



# **BASELINE MONITORING DOCUMENT AND AS-BUILT BASELINE REPORT**

Final

## **BIG HARRIS CREEK MITIGATION SITE**

Cleveland County, NC  
DEQ Contract No. 6256  
DMS Project No. 739  
USACE Action ID No. SAW-2009-0475  
DWR No. 10-0811  
Broad River Basin  
HUC 03050105

Data Collection Period: September 2017 – May 2018  
Submission Date: August 21, 2018

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### **PREPARED FOR:**



**NC Department of Environment Quality  
Division of Mitigation Services**  
1652 Mail Service Center  
Raleigh, NC 27699-1652



RECEIVED AUG 22 2018

August 21, 2018

Mr. Paul Wiesner  
Western Regional Supervisor  
NC Department of Environmental Quality  
Division of Mitigation Services  
5 Ravenscroft Dr., Suite 102  
Asheville, NC 28801

RE: Big Harris Creek Mitigation Site – Baseline Monitoring Document and As-Built Report  
Final Submittal for DMS  
DMS ID 739  
DEQ Contract Number 006256  
Broad River Basin – CU# 03050105; Cleveland County, NC

Dear Mr. Wiesner:

Wildlands Engineering, Inc. (Wildlands) has reviewed the Division of Mitigation Services (DMS) comments and observations from the Big Harris Creek Mitigation Site Draft Baseline Monitoring Document and As-Built Report. The following are Wildlands responses to your comments and observations from the report noted in italics lettering.

**DMS; General and Table 1 – Mitigation Credits: The Big Harris project credit totals in Table 1 need to be updated so they match the DMS accounting system:**

- Total R stream mitigation credits should be reported in the table as 25,228.121
- Total RE stream mitigation credits should be reported in the table as 101.795
- The project will yield a total 25,329.916 stream mitigation credits.

Please note that these totals do not include the potential 2% based on a statistical improvement in water quality. RE credits are for preservation only. Based on Table 1, the project will yield 65 credits for stream preservation. Additional credits are awarded based on linear footage. 5.5% of 669 = 36.795. Accordingly, the RE credit total will be 101.795. Please also update the report text accordingly. MYO invoicing and subsequent invoicing should be based on 25,330 credits.

*Wildlands Response; Wildlands has updated Table 1 as noted above. Wildlands will revise Table 1 credits to include the 2% credit increase following IRT approval of the proposed water quality plan.*

**DMS; General – Janet Whisnant Property: DMS understands that Wildlands has made numerous attempts to have Janet Whisnant sign a revised conservation easement and plat so the current driveway stream crossing is not located within the existing conservation easement. DMS also understands that Mrs. Whisnant has been unresponsive to date. The Draft Baseline Monitoring**



**Document and As-built Baseline Report (MY0) shows the revised CE plat and reports the mitigation assets based on finalizing the Whisnant property transaction. DMS recommends finalizing the MY0 report as presented and continued pursuit of a revised conservation easement and plat on the Whisnant property. If Mrs. Whisnant is unwilling to sign the revised conservation easement and associated plat prior to project closeout, mitigation assets and the associated contract invoices will need to be revised accordingly.**

*Wildlands Response; Wildlands will continue to contact Mrs. Whisnant in attempt to revise the conservation easement and plat.*

**DMS; Cover Page: Please include the DWR project number on the report cover.**

*Wildlands Response; The DWR number has been added to the report cover.*

**DMS; Executive Summary: Consider introducing the BMP repair made during construction since it was a significant effort and is referenced later in the document.**

*Wildlands Response; The BMP repairs have been included in the last paragraph of the executive summary.*

**DMS; Section 2 – Performance Standards; 1st paragraph, second to last sentence: Typo – missing MY4.**

*Wildlands Response; This error has been fixed.*

**DMS; Section 2.1.4 – Hydrology Documentation: In the revised document, please describe how baseflow for the reaches indicated will be monitored.**

*Wildlands Response; Section 2.1.4 Hydrology Documentation has been revised as follows:*

*The occurrence of bankfull events and geomorphically significant events will be documented throughout the five-year monitoring period. Streamflow stage will be monitored using a continuous stage recorder (pressure transducer). The streamflow stage recorders will be installed within a surveyed riffle cross-section of the restoration and EI channels and will be downloaded quarterly to determine if a bankfull event has occurred. Photographs will also be used to document the occurrence of debris lines and sediment deposition observed during field visits.*

*In addition, the presence of baseflow will be documented along Scott Creek, Bridges Creek, and Royster Creek Reach 1 constructed with a Priority 1 Restoration approach. Baseflow is expected to be present for at least 30 days (most likely in the winter/early spring) during each monitoring year with normal rainfall conditions. These low flow channels will have a stream gage pressure transducer installed mid-reach to document 30 consecutive days of baseflow. Pressure transducers will be set to record stage once every 2-3 hours. The transducer will be inspected and downloaded semi-annually.*

**DMS; Section 2.5 – Schedule and Reporting: Please indicate that the digital deliverables will be provided as part of reporting as per the monitoring template.**



*Wildlands Response; The inclusion of digital files has been added to Section 2.5.*

**DMS; Section 3.2: Vegetation: Please include a description of how volunteers will be handled.**

*Wildlands Response; Wildlands added the following to Section 3.2:  
Volunteer stems will be recorded by species and height. In addition, these stems will be included in the annual stem density calculations, but will not amount to more than 10% of the planted stems within the plot.*

**DMS; Section 3.3 – Additional Monitoring – See suggested revisions to the WEI-DMS water quality and biology monitoring memo. This section should be replaced with the narrative from that memo or the IRT approved memo should be referenced as an addendum to this report at a later date. Please discuss/note the proposed future IRT approved addendum in the revised report.**

*Wildlands Response; Wildlands has included a few paragraphs to discuss the status of the proposed water quality plan in Section 3.3 as follows:*

*As stated in the final mitigation plan, a 4% credit allowance based on the entire linear footage of the project will be granted for the water quality, benthic, and fish monitoring presented in below and in Section 12.7 of the Mitigation Plan. Also based on the mitigation plan, an additional 2% (507 SMUs) credit allowance will be granted if post-construction water quality monitoring demonstrates improvement in selected water quality parameters (Table 1).*

*A Technical memorandum, dated August 10, 2018, was presented to the IRT proposing a revised version of the water quality, benthic, and fish monitoring program that has been refined based on an analysis of the pre-construction data and a set of criteria to support statistically reliable detection of change. Pending approval, the revised monitoring program would supersede the program described in the final mitigation plan and Sections 3.3.1 – 3.3.3 below and define success criteria for the water quality monitoring program. An addendum will be prepared if the revised monitoring program is approved by the IRT.*

**DMS; Section 3.3.1 – Physiochemical: Can WEI confirm that the 3 additional >Qgs will measure the same parameters as the annual XS measurements?**

*Wildlands Response; Yes, the Qgs cross-section measurements will capture the same morphological features as the permanent cross-sections.*

**DMS; 5.1.1 – BMPs: Please provide narratives for the design changes made to the BMPs at a level of detail equivalent to the descriptions provided in the Mitigation Plan.**

*Wildlands Response; The text describing design changes made during construction on the BMPs has been updated to provide more detailed descriptions on the design changes in Section 5.*



**DMS; Asset Map and Monitoring Map –**

- Can be consolidated as a single map given inclusion of reach breaks and restoration levels in the MPV.

*Wildlands Response; Figure 2 has been consolidated to a single map.*

- Inclusion of the alignment diversions from design is an excellent, innovative addition to this map.

*Wildlands Response; Wildlands appreciates the feedback and we are happy to hear these additions were useful.*

- Upon completion of the water quality and biological monitoring section these features need to be included in the addendum and subsequent monitoring reports.

*Wildlands Response; These monitoring features will be added once the final plan is approved.*

- Please symbolize structures with more detectable color.

*Wildlands Response; The color of the structures in Figures 3.0-3.15 has been revised.*

**DMS; Stream Plan and Profile Record Drawings:**

- Culvert crossings shown on the as-built profiles should include the pipes, bed and the overlying ground surface (as-built and design grades).
- Please include an updated set of structure details for the BMPs that depict representative changes from the design for the basic features such as filter fabric positioning, structure backfill, footers, changes on how structures are keyed in to the bank or any other important design improvements.
- Please label all stream crossings on the sheets that were part of the project construction in a manner consistent with the design sheets. Labeling the individual road uses such as "graveled farm road" would also be beneficial.

*Wildlands Response; The above changes have been made to the record drawing.*

- Sections of UT4 to Upper Stick Elliot road, UT4A to Upper Stick Elliot road, and UT5 to Upper Stick Elliot road are located outside of the conservation easement. Please confirm that these sections are not generating mitigation credit. Based on Table 1, this appears to be the case but please confirm.

*Wildlands Response; UT4, UT4A, and UT5 are not included in credit calculations presented in Table 1.*

**DMS; Appendix 1. General Figures and Tables: Please add the thermal regime to Table 4.**

*Wildlands Response; The thermal regime has been included in Table 4.*



**DMS; Appendix 2. Morphological Summary Data and Plots: Thank you for the detailed geomorphic survey of the facet slopes shown on the profiles and sections. The line weights and color scheme are excellent and the axes were appropriately incremented.**

*Wildlands Response; Thank you for the positive feedback, we appreciate it!*

Enclosed please find three (3) hard copies of the Final Baseline Document and As-Built Monitoring Report and one (1) CD with all electronic files for DMS distribution. Please contact me at 704-332-7754 x100 if you have any questions.

Sincerely,

A handwritten signature in black ink that reads "Shawn Wilkerson". The signature is fluid and cursive, with a long horizontal stroke at the end.

Shawn Wilkerson  
swilkerson@wildlandseng.com

**PREPARED BY:**

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Charlotte, NC 28203

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Fax: 704.332.3306

## EXECUTIVE SUMMARY

Wildlands Engineering, Inc. (Wildlands) implemented a design-build project for the North Carolina Department of Environmental Quality (DEQ) Division of Mitigation Services (DMS) to restore 10,071 linear feet (LF) of streams, enhance 23,421 LF of streams, preserve 669 LF of streams, and provide water quality treatment for 171 acres of drainage area in Cleveland County, NC. The streams proposed for mitigation credit include Big Harris Creek and 25 tributaries. Buffer restoration also occurred but is not proposed for buffer mitigation credit. The project is expected to provide 25,330 stream mitigation units (SMUs) in the Broad River Basin.

The Big Harris Creek Mitigation Site (Site) is located within the DMS targeted watershed for the Broad River Basin Hydrologic Unit Code (HUC) 03050105080060 and the North Carolina Division of Water Resources (NCDWR) Subbasin 03-08-04. The Big Harris Creek and Magness Creek HUC 03050105080060 was identified as a Targeted Local Watershed (TLW) in DMS's 2009 Broad River Basin Restoration Priority (RBRP) Plan. The Cleveland County Natural Resources Conservation Service has also identified this watershed as a priority area.

The watershed has a long history of agricultural activity and most of the stressors to stream functions are related to this historic and current land use practices. The major stream stressors for the project were cattle access, erosion from lateral instability, and gully headcutting in the headwater ephemeral reaches. The effects of these stressors resulted in degraded water quality and habitat throughout the watershed when compared to reference conditions. The project approach for the Site focused on evaluating the Site's existing functional condition and evaluating its potential for recovery and need for intervention.

The major goals of the project; which align with the overall goals of the Broad River Basin RBRP, are to reduce sediment and nutrient inputs, reduce fecal coliform inputs through cattle exclusion, and reestablish native riparian corridors while preserving existing headwater aquatic habitats and riparian corridors.

The following specific project goals were established in the mitigation plan (Wildlands, 2016).

- Improve stream stability and reduce stream bed and bank erosion;
- Restore hydrologic connection between bankfull channels and floodplains, wetlands, and vernal pools;
- Improve instream habitat and instream habitat connectivity;
- Reduce agricultural pollutant loading to project streams; and
- Create and improve forested riparian buffers.

The Site construction and as-built surveys were completed between April 2017 and May 2018. Planting and baseline vegetation data collection occurred between March and May 2018. During construction, storm repairs were completed along a few BMPs (Carroll and Scott). Adjustments were based on field conditions and lessons learned on previous BMP installations during construction. Other than the BMP repairs, minimal adjustments were made during construction. Specific changes are detailed in Section 5.1. Baseline (MY0) profiles and cross-section dimensions closely match the design parameters with some variation. Cross section widths occasionally exceed design parameters within a normal range of variability for natural streams. The Site has been built as designed and is expected to meet the upcoming monitoring year's success criteria.





**BIG HARRIS CREEK MITIGATION SITE**  
 Baseline Monitoring Document and As-Built Baseline Report

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Vegetation Photographs

### **Appendix 4      Record Drawings**

## LIST OF ACRONYMS

Department of Environmental Quality (DEQ)  
Division of Mitigation Services (DMS)  
Interagency Review Team (IRT)  
United States Army Corps of Engineers (USACE)  
North Carolina Division of Water Resources (NCDWR)  
Environmental Resources and Technical Report (ERTR)  
Targeted Local Watershed (TLW)  
Unnamed Tributary (UT)  
Monitoring Year (MY)  
Current Condition Plan View (CCPV)  
Best Management Practice (BMP)  
Step Pool Stormwater Conveyance (SPSC)  
Lower Stick Elliott Creek (LSEC)  
Upper Big Harris Creek (UBHC)  
Upper Stick Elliott Creek (USEC)  
Upper Fletcher Creek (UFC)  
Lower Fletcher Creek (LFC)  
Lower Big Harris Creek (LBHC)



## Section 1: PROJECT GOALS, BACKGROUND, AND ATTRIBUTES

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### 1.1 Project Location and Setting

The Site is located in western Cleveland County, approximately 2.5 miles west of the Town of Lawndale in the Broad River Basin HUC 03050105080060 and NCDWR Subbasin 03-08-04 and is being submitted for mitigation credit in the Broad River Basin HUC 03050105. (Figure 1). Located in the Inner Piedmont geologic belt within the Piedmont physiographic province (NCGS, 1985), the project watershed is dominated by agricultural and forested land. Big Harris Creek drains 3.9 square miles of rural land.

The development of the mitigation project for this Site has a long history. The Site was first identified in 2008 by DMS staff as a watershed-scale mitigation opportunity. The Site is located in a HUC that was designated as a high priority agricultural TLW and as a “focus area” for DMS in the 2009 Broad River Basin Restoration Priority (RBRP) Plan. The initial ETRR for the Site was completed in March 2009. Easement acquisition on 12 parcels, totaling 144.7 acres, was completed on the project area by the end of 2009. The IRT originally walked the Site in 2010 and requested a “light touch” approach to much of the Site. Water quality, benthic, fish, and storm water sampling has been collected for the project by multiple agencies and organizations between 2009 and 2013.

The availability of the pre-construction monitoring led to more precise management recommendations for the Site. The project approach incorporated previous and recent IRT feedback and minimized construction phase impacts to existing channels and riparian areas while providing the targeted uplifts to the system. Project components include intermittent and perennial stream restoration, enhancement, and preservation, as well as water quality treatment on ephemeral drainages. Stream restoration, enhancement, and preservation components include Big Harris Creek and 25 unnamed tributaries.

The watershed has a long history of agricultural activity and most of the stressors to stream functions are related to this historic and current land use. The major stream stressors for the project were cattle access, erosion from lateral instability, and gully headcutting in the headwater ephemeral reaches. The effects of these stressors resulted in degraded water quality and habitat throughout the watershed when compared to reference conditions.

Table 4 in Appendix 1 and Tables 6 in Appendix 2 present the pre-restoration conditions in more detail.

### 1.2 Project Goals and Objectives

The Site was identified by DMS to address major agricultural stressors within the watershed with specific focus on gully erosion, streambank erosion, and livestock access to streams. Restoration and enhancement of streams and buffers on the Site will address those identified stressors and thereby improve water quality in the Big Harris Creek watershed.

The major goals of this stream mitigation project are to reduce sediment and nutrient sources, reduce fecal coliform sources through cattle exclusion, and reestablish healthy riparian corridors while preserving existing, high quality headwater aquatic habitats. These goals will primarily be achieved by creating functional and stable stream channels by: 1) increasing and improving the interaction of stream hydrology with the riparian zone, 2) improving in-stream habitat and bed form diversity, 3) introducing large woody debris, and beginning the establishment of a native, forested riparian corridor along the stream reaches. These activities are known to support higher order functions like the processing of organic matter, nutrient cycling, and temperature regulation.

The project includes the majority of the headwater tributaries to Big Harris Creek and 35% of the 11-square mile Big Harris Creek watershed before it flows into the First Broad River. Within the project



limits, approximately 34,161 LF of stream channel were restored, enhanced or preserved. Water quality BMPs were also implemented to stabilize eroding ephemeral channels and provide water quality treatment on 171 acres of headwater drainage systems during the period after construction until the riparian buffer vegetation becomes established. A total of 5,536 LF of ephemeral drainages were buffered and conserved, enhancing the overall watershed water quality and function.

The following specific goals and objectives address the identified stressors in the Big Harris Creek and Magness Creek TLW.

Goals	Objectives
Improve stream stability and reduce stream bed and bank erosion.	Grade back eroding stream and headwater gully slopes and/or install bioengineering. Add bank revetments and in-stream structures to protect enhanced streams.
	Construct new stream channels that will maintain a stable pattern and profile considering the hydrologic and sediment inputs to the system, the landscape setting, and the watershed conditions.
Restore hydrologic connection between bankfull channels and floodplains, wetlands, and vernal pools.	Construct new stream channels with appropriate dimension and depth relative to their functioning floodplain elevation.
Improve instream habitat and instream habitat connectivity.	Install habitat features such as constructed riffles and brush toes into restored/enhanced streams, adding woody materials to channel beds and constructing pools of varying depth.
	Replace existing culverts with bottomless arch culverts, partially buried culverts, or ford crossings and enhance profile by removing vertical steps at culvert outlets.
Reduce agricultural pollutant loading to project streams.	Install BMPs at concentrated flow locations in the watershed headwaters to treat agricultural runoff until riparian buffer vegetation becomes established and reduce gully erosion. Plant riparian buffers that will uptake runoff and reduce pollutants once established.
	Construct new stream channels with floodplain connectivity, allowing flood flows to filter through a vegetated floodplain.
	Install fencing around conservation easements adjacent to cattle pastures to exclude cattle from the easement.
Create and improve forested riparian buffers.	Plant native tree and understory species in riparian zone.

### 1.3 Project Structure, Restoration Type and Approach

The final mitigation plan was submitted and accepted by the DMS in November of 2016. Construction activities were completed in May 2018 by Land Mechanic Designs, Inc. and Fluvial Solutions, Inc. Key Mapping and Surveying, P.A. completed the as-built survey activities in May 2018 and planting was completed by Bruton Natural Systems, Inc. between February and March 2018. Minimal adjustments

occurred during construction and are described in further detail in section 5.1. Please refer to Appendix 1 for detailed project activity, history, contact information, and watershed/site background information.

### **1.3.1 Project Structure**

Please refer to Figures 2.0 – 2.3 for the project component/asset map for the stream feature exhibits and Table 1 for the project components and mitigation credits information for the Site.

### **1.3.2 Restoration Type and Approach**

The degree of degradation varies widely throughout the watershed. Restoration activities chosen were based on the existing state of the stream, its watershed, and the potential for functional uplift. Wildlands' design approach focused on evaluating the key stressors affecting the system's hydrology, hydraulics, geomorphology, physicochemistry, and biology. The conceptual approach was driven by this information and took a "lighter touch" approach to semi-stable, moderately functioning reaches where large-scale construction would negatively impact existing functions. Design and construction resources were also invested to address headwater conveyances that deliver large volumes of sediment and agricultural pollutants to the system.

#### Stream Restoration, Enhancement, and Preservation

As detailed in Section 1.2, the major goals and objectives focused on improving the ecological health of the Site, including a reduction in sedimentation and nutrient concentrations. Prior to restoration, the majority of the reaches were incised with actively eroding banks. Enhancement was implemented on reaches that had established at least one functional stream feature, such as bedform diversity, stable banks, or low bank height. Representative enhancement activities included fencing out livestock, vegetating the streambanks, repairing eroded banks, and/or adding instream habitat features. Restoration was not proposed for these enhancement reaches in order to preserve the functional feature(s) while avoiding large scale tree loss. Reaches without these functioning features were restored utilizing a combination of Priority Levels 1 and 2 to establish a stable plan, profile, and dimension. Restoration also included installation of in-stream structures including constructed riffles, log vanes, j-hooks, and angled rock and log sills. EI implementation included targeted use of bank stabilization practices and channel realignment to address areas of instability, particularly on the outside of meander bends. Constructed riffles and other grade control structures were also incorporated in key locations to prevent further downcutting. Throughout the Site, fencing and dedicated crossings were installed to reduce stressors to the riparian buffer and corridor. Preservation reaches along stable tributaries will provide additional protection.

#### Headwater BMPs

Throughout the Site and its surrounding watershed, gullies were prominent in headwater drainages at locations where flow was concentrated in ephemeral channels or as a result of past terracing practices. While these locations were not appropriate for restoration of aquatic habitat due to lack of sustained baseflows, they offered opportunities for water quality enhancement throughout the watershed through the installation of headwater BMPs. BMPs at these locations are intended to capture runoff from pastures and provide some treatment of nutrient and other pollutant loads during the initial post-construction period until the riparian buffer vegetation becomes established. The BMPs stabilized severely eroding channel beds and gullies which will significantly reduce sources of sediment to receiving streams. Many of these BMPs will retain stormwater, promote infiltration, and thereby serve to improve hydrology within the watershed and reduce peak stormflows in the perennial streams. The types of BMPs implemented on Site included SPSC, Boulder Cascades, Vegetated Swales, and Detention Basins. Table 1 and Figures 3.0-3.15 further specify the BMP chosen for each area to provide the appropriate treatment for each headwater drainage.



## 1.4 Project History, Contacts and Attribute Data

The Site was restored by Wildlands through a design-build contract with DMS. Tables 2, 3, and 4 in Appendix 1 provide detailed information regarding the project activity and reporting history, project contacts, and project baseline information and attributes.



## Section 2: PERFORMANCE STANDARDS

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The stream and vegetation performance criteria for the Site was outlined in the Mitigation Plan and is based on performance criteria presented in the DMS Mitigation Plan Template (Version 2.3, 12/18/2014), the Annual Monitoring and Closeout Reporting Template (February 2014), and the Stream Mitigation Guidelines issued in April 2003 by the USACE and NCDWR. Semi-annual site visits will be conducted to assess the condition of the finished project. The stream restoration and EI reaches of the project are assigned specific performance criteria components for stream geomorphology, hydrology, and vegetation. Performance criteria components for EI reaches only include vegetation. The preservation reaches and water quality BMPs are not assigned specific performance criteria. Performance criteria will be evaluated throughout the five-year post-construction monitoring program. In addition to the five-year monitoring program, water quality and benthic macroinvertebrate sampling will be conducted during MY3, MY4, and MY5. Fish sampling will take place in year five. These additional parameters are intended to provide information to complement the pre-restoration data that have already been collected by DMS and others, but mitigation success criteria will not be based on the results.

### 2.1 Streams

#### 2.1.1 Dimension

Riffle cross-sections on the restoration and EI reaches should be stable and should show little change in bankfull area, maximum depth ratio, and width-to-depth ratio over time after geomorphically significant flow events (defined in Section 11.1.4 of the mitigation plan). Per DMS guidance, bank height ratios shall not exceed 1.2 and entrenchment ratios shall be at least 2.2 for restored E- and C-type channels and within 1.4-2.2 for B-type channels to be considered stable. All riffle cross-sections should fall within the parameters defined for channels of the appropriate stream type. If any changes do occur, these changes will be evaluated to assess whether the stream channel is showing signs of instability. Changes in the channel that indicate a movement toward stability or enhanced habitat include a decrease in the width-to-depth ratio in meandering channels or an increase in pool depth. Remedial action would not be taken if channel changes indicate a movement toward stability or enhanced function.

#### 2.1.2 Pattern and Profile

Restoration and EI reaches must remain vertically stable throughout the monitoring period with little indication of downcutting or significant aggradation to the extent of obscuring habitat and/or generating lateral instability. Deposition of sediments at certain locations (such as the inside of meander bends) is expected and acceptable. Changes in pool depth are not an indication of vertical instability. Restoration and EI reaches must remain laterally stable and major changes in pattern dimensions and sinuosity should not occur. However, migration of meanders on alluvial channels is not an indication of instability if cross-sectional dimensions continue to meet the requirements described in Section 2.1.1.

#### 2.1.3 Substrate

Substrate materials in the restoration reaches should indicate a progression towards or the maintenance of coarser materials in the riffle features and finer particles in the pool features.

#### 2.1.4 Hydrology Documentation

The occurrence of bankfull events and geomorphically significant events will be documented throughout the five-year monitoring period. Streamflow stage will be monitored using a continuous stage recorder



(pressure transducer). The streamflow stage recorders will be installed within a surveyed riffle cross-section of the restoration and EI channels and will be downloaded quarterly to determine if a bankfull event has occurred. Photographs will also be used to document the occurrence of debris lines and sediment deposition observed during field visits.

In addition, the presence of baseflow must be documented along Scott Creek, Bridges Creek, and Royster Creek Reach 1 constructed with a Priority 1 Restoration approach. Baseflow must be present for at least 30 days (most likely in the winter/early spring) during each monitoring year with normal rainfall conditions. These low flow channels will have a stream gage pressure transducer installed midreach to document 30 consecutive days of baseflow. Pressure transducers will be set to record stage once every 2-3 hours. The transducer will be inspected and downloaded semi-annually.

## 2.2 Photo Documentation

Photographs should illustrate the Site's morphological stability on an annual basis. Cross-section photos should demonstrate a lack of excessive erosion or degradation of the banks. Longitudinal photos should indicate the absence of persistent bars within the channel or vertical incision. Grade control structures should remain stable. Deposition of sediment on the bank side of vane arms is preferable. Maintenance of scour pools on the channel side of vane arms is expected.

## 2.3 Visual Assessments

Visual assessments will be performed on a semi-annual basis in order to check for and document areas of concern. The monitoring team will note problem areas such as channel instability (i.e. lateral and/or vertical instability, in-stream structure failure/instability and/or piping, headcuts), vegetated buffer health (i.e. low stem density, vegetation mortality, invasive species or encroachment), beaver activity, or livestock access. Areas of concern will be mapped and photographed accompanied by a written description in the annual report. Problem areas will be re-evaluated during each subsequent visual assessment. Should remedial actions be required, recommendations will be provided in the next annual monitoring report.

## 2.4 Vegetation

The final vegetative success criteria will be the survival of 260 planted stems per acre in the riparian corridor at the end of the required monitoring period (MY5). The interim measure of vegetative success for the Site will be the survival of at least 320 planted stems per acre at the end of MY3. The extent of invasive species coverage will also be monitored and treated as necessary throughout the required monitoring period (five years).

## 2.5 Schedule and Reporting

Monitoring reports will be prepared in the fall of each year of monitoring and submitted to DMS. Annual monitoring data will be reported using the DMS Annual Monitoring Report Format, Data Requirements, and Content Guidance (February 2014). The monitoring report will provide project data chronology that will facilitate an understanding of project status and trends, population of DMS databases for analysis, research purposes, and assist in decision making regarding close-out.

Monitoring reports and digital files will be prepared in the fall of each year of monitoring and submitted to DMS. The monitoring reports at a minimum will include the following:

- Project background which includes project objectives, project structure, restoration type and approach, location and setting, history and background;
- Topographic plans of major project elements including such items as grade control structures, vegetation plots, permanent cross-sections, and pressure transducers;





- Photographs showing views of the restored Site taken from fixed point stations;
- Assessment of the stability of the stream based on the cross-sections;
- Vegetative data as described above including the identification of any invasion by undesirable plant species;
- A description of damage by animals or vandalism;
- Maintenance issues and recommended remediation measures will be detailed and documented;  
and
- Wildlife observations.



## Section 3: MONITORING PLAN & METHODOLOGY

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Monitoring will consist of collecting morphological, vegetative, and hydrological data to assess the project success based on the restoration goals and objectives as described below. The success of the project will be assessed using measurements of the stream channel's dimension, substrate composition, permanent photographs, vegetation, and surface water hydrology. Any areas with identified high priority problems, such as streambank instability, aggradation/degradation, insufficient groundwater hydroperiod, or lack of vegetation establishment will be evaluated on a case-by-case basis. The problem areas will be visually noted and remedial actions will be discussed with DMS staff to determine a plan of action. Refer to Table 5 in Appendix 1 for monitoring component summary.

In addition to the required five-year monitoring program, based on the 2014 guidance and in response to IRT concerns about quantitative uplift evaluations, water quality and benthic macroinvertebrate data will be collected during MY3, MY4, and MY5. Monitoring of fish will be completed in MY5. These additional parameters are intended to provide information only to complement the pre-restoration data that have already been collected by DMS and others and is not part of the project success criteria. No monitoring is proposed on the individual BMPs. The performance standards for the project will be based on those specified above in Section 2.

The monitoring period will extend five years beyond completion of construction since the Big Harris Creek Mitigation Site was instituted by DMS on September 25, 2007. Though the RFP for the project specified five years of post-construction monitoring, it also referenced utilizing the most recent monitoring templates for reporting. Wildlands, DMS, and IRT members agreed to establish a five-year monitoring plan for the Site that will follow the latest 2014 guidance for monitoring programs, while adhering as close as possible to the 2003 guidance requirements (with the exclusion of longitudinal profile surveys).

Components of the monitoring plan are summarized in Tables 5 a-e. Project monitoring locations are shown on Figures 3.0-3.15. All surveys will be tied to NC State Plane.

### 3.1 Streams

Geomorphic assessments follow guidelines outlined in the Stream Channel Reference Sites: An Illustrated Guide to Field Techniques (Harrelson et al., 1994), methodologies utilized in the Rosgen stream assessment and classification documents (Rosgen, 1994 and 1996), and in the Stream Restoration: A Natural Channel Design Handbook (Doll et al, 2003). Please refer to Figures 3.0-3.15 in Appendix 1 for monitoring locations discussed below.

#### 3.1.1 Dimension

In order to assess channel dimension success, 44 permanent cross-sections were installed along stream restoration and EI reaches, with the percentage of riffle and pool sections in accordance with DMS guidance and as defined in Table 19 of the Mitigation Plan. Each cross-section is permanently marked with rebar to establish its location. Cross-section surveys included points measured at all breaks in slope, including top of bank, bankfull, edge of water, and thalweg. If moderate bank erosion is observed within permanent pool cross-sections during the monitoring period, an array of bank pins will be installed in the permanent cross-section where erosion is occurring for reaches with a bankfull width of greater than three feet. Bank pins will be installed on the outside bend of the cross-section in at least three locations (one in upper third of the pool, one at the permanent cross-section, and one in the lower third of the pool). Bank pins will be monitored by measuring exposed rebar and maintaining pins flush to bank



to capture bank erosion progression. Cross-section surveys will be conducted annually and bank pin surveys (if applicable) will be conducted in MY1, MY2, MY3, and MY5.

In addition to the above geomorphic surveys, at least three sets of hydraulic geometry measurements will be conducted within each distinct design reach following a geomorphically significant discharge (Qgs) event as described in the DMS Stream and Wetland Monitoring Guidelines (February 2014). Within each reach, a representative wavelength will be assessed using hydraulic measurements within riffle and pool cross-sections and along water surface slopes. These measurements can occur at any time during the five-year monitoring period.

### **3.1.2 Pattern and Profile**

Longitudinal profile surveys will not be conducted during the five-year monitoring period unless other indicators during the annual monitoring indicate a trend toward vertical and lateral instability. If a longitudinal profile is deemed necessary, monitoring will follow standards as described in the DMS Annual Monitoring and Closeout Reporting Template (February 2014), and the Stream Mitigation Guidelines issued in April 2003 by the USACE and NCDWR for the necessary reaches. Stream pattern and profile will be assessed visually as described below in Section 3.1.6.

### **3.1.3 Substrate**

An annual reach-wide pebble count will be performed in each restoration and EI reach for classification purposes. A Wolman pebble count will also be performed annually at each surveyed riffle to characterize the pavement.

### **3.1.4 Photo Reference Points**

A total of 107 permanent photograph reference points were established along the stream reaches after construction. Photographs will be taken once a year to visually document stability for the five-year monitoring period. Permanent markers were established and located with GPS equipment so that the same locations and view directions on the site are photographed each year. Photos will be used to monitor all restoration, enhancement, and preservation stream reaches as well as vegetation plots.

Longitudinal reference photos were established at the tail of riffles approximately every 300-500 LF along the channel by taking a photo looking upstream and downstream. Cross-sectional photos will be taken of each permanent cross-section looking upstream and downstream.

### **3.1.5 Hydrology Documentation**

The occurrence of bankfull events and geomorphically significant events will be documented throughout the five-year monitoring period using pressure transducers, photographs, and visual assessments such as debris lines. Streamflow stage will be monitored using a continuous stage recorder (pressure transducer). A total of 14 stage recorders were installed within surveyed riffle cross-sections of the restoration and EI channels. In addition, flow gage pressure transducers were installed on Scott Creek, Royster Creek Reach 1, and Bridges Creek to document stream flow. The stream gages will be downloaded quarterly to determine if a bankfull event has occurred. Photographs will be used to document the occurrence of debris lines and sediment deposition observed during field visits. The transducer data will be plotted and included in the annual monitoring reports.

### **3.1.6 Visual Assessment**

Visual assessments will be performed along stream reaches on a semi-annual basis during the five-year monitoring period. Areas of concern, such as channel instability (i.e. lateral and/or vertical instability, in-



stream structure failure/instability and/or piping, headcuts), vegetation health (i.e. low stem density, mortality, invasive species or encroachment), beaver activity, or livestock access; will be mapped, photographed, and described in the annual monitoring reports. Problem areas will be re-evaluated during each subsequent visual assessment. Should remedial actions be required, recommendations will be provided in the annual monitoring report.

## 3.2 Vegetation

Planted woody vegetation will be monitored in accordance with the guidelines and procedures developed by the Carolina Vegetation Survey-EEP Level 2 Protocol (Lee et al., 2006) to monitor and assess the planted woody vegetation. A total of 56 vegetation plots were established within the project easement area. All of the plots were established as either a standard 10 meter by 10 meter square plot or a 5 meter by 20 meter plot. Please refer to Figures 3.0-3.15 in Appendix 1 for the vegetation monitoring locations.

Vegetation plots were randomly established within the planted stream restoration areas to capture the heterogeneity of the designed vegetative communities. The vegetation plot corners have been marked and are recoverable either through field identification or with the use of a GPS unit. Reference photographs at the origin looking diagonally across the plot to the opposite corner were taken during the MY0 in April 2018. Subsequent annual assessments following baseline survey will capture the same reference photograph locations. Species composition, density and survival rates will be evaluated on an annual basis by plot and for the entire Site. Individual plot data will be provided and will include diameter, height, density, vigor, damage (if any), and percent survival. Planted woody stems will be marked annually as needed based off of a known origin so they can be found in succeeding monitoring years. Mortality will be determined from the difference between the baseline year's living planted stems and the current year's living planted stems. Volunteer stems will also be recorded by species and height in each plot. Annual stem densities reported will include recorded volunteer stems, but will not amount to more than 10% of the planted stems within the plot.

## 3.3 Additional Monitoring

As stated in the final mitigation plan, a 4% credit allowance based on the entire linear footage of the project will be granted for the water quality, benthic, and fish monitoring presented in below and in Section 12.7 of the Mitigation Plan. Also based on the mitigation plan, an additional 2% (507 SMUs) credit allowance will be granted if post-construction water quality monitoring demonstrates improvement in selected water quality parameters (Table 1).

A Technical memorandum, dated August 10, 2018, was presented to the IRT proposing a revised version of the water quality, benthic, and fish monitoring program that has been refined based on an analysis of the pre-construction data and a set of criteria to support statistically reliable detection of change. Pending approval, the revised monitoring program would supersede the program described in the final mitigation plan and Sections 3.3.1 – 3.3.3 below and define success criteria for the water quality monitoring program. An addendum will be prepared if the revised monitoring program is approved by the IRT.

### 3.3.1 Physiochemical

Pre-construction water quality data collected by NCDWR (2013b and c) indicated that the primary stressors in the project streams were elevated fecal coliform counts and elevated Total Suspended Solids (TSS) during storm events. In order to assess improvements in water quality over time, the following sampling protocol will be used in MY3, MY4, and MY5. These monitoring tasks will include collecting water quality at eight locations throughout project area and at one reference location. The



monitoring will include four baseflow water quality sampling events and four stormflow water quality sampling events per each of the three monitoring years at each location. Water quality parameters will include:

- a. Total Nitrogen (NH<sub>3</sub>, NO<sub>2</sub>, TKN)
- b. Total Phosphorus
- c. Fecal Coliform
- d. TSS
- e. Turbidity
- f. Temperature
- g. pH
- h. Dissolved Oxygen
- i. Conductivity

Parameters a through d above will be collected as grab samples and analyzed by a State-certified water quality lab. Additional items e through i (field parameters) will be measured with calibrated water quality meters in the field.

As previously mentioned the primary stressors of concern are fecal coliform and TSS. Cattle have been fenced out of the entire easement as part of project construction. This activity should remove the major source of elevated fecal coliform counts. Large headcuts on the project have been stabilized and should remove the primary source of fine sediment entering project streams. In addition, the treatment of agricultural runoff in ephemeral conveyances should further reduce fecal coliform and fine sediment inputs. Due to the inability to control the entire watershed, Wildlands water quality data will not be tied to specific performance criteria.

### **3.3.2 Benthic Macroinvertebrates and Habitat Assessment Physiochemical**

Post-construction benthic macroinvertebrate and habitat assessments will be conducted in MY3, MY4, and MY5 to assess changes as a result of the restoration and BMPs. Sample site locations will be based on those utilized during the pre-construction data collection efforts (eight project site locations and one reference location). The benthic macroinvertebrate communities will be collected following the Qual-4 method as described in the Standard Operating Procedures for Collection and Analysis of Benthic Macroinvertebrates (NCDWR, 2016). No specific performance criteria are proposed based on benthic macroinvertebrate surveys or habitat assessments.

### **3.3.3 Fisheries Survey**

Post-construction fisheries surveys will be conducted during year five of the monitoring period to assess the response of the fish communities to the restoration activities. Sample site locations and collection methodologies will be based on those utilized during the pre-construction data collection efforts (NCDWR, 2013). The fisheries surveys will be located at eight sites within the project area plus the reference watershed location on Little Harris Creek which was sampled during the pre-construction data collection efforts. No specific performance criteria are proposed based on fisheries.



## Section 4: ADAPTIVE MANAGEMENT AND CONTINGENCY PLAN

### 4.1 Adaptive Management Plan

Wildlands will perform maintenance as needed on the mitigation project. A physical inspection of the Site shall be conducted a minimum of twice per year throughout the post-construction monitoring period or until performance standards are met. These site inspections may identify site components and features that require routine maintenance. Routine maintenance for stream features should be expected most often in the first two years following site construction. Wildlands will perform maintenance of BMPs and ephemeral reach areas as necessary during the five-year monitoring period. The need for maintenance will be evaluated annually during monitoring activities. Maintenance activities may include the following.

Component/ Feature	Maintenance through project close-out
Stream	Routine channel maintenance and repair activities may include chinking of in-stream structures to prevent piping, securing of loose coir matting, and supplemental installations of live stakes and other target vegetation along the channel. Areas where storm water and floodplain flows intercept the channel may also require maintenance to prevent bank failures and head-cutting.
Water Quality BMPs	Routine BMP maintenance may include removal of accumulated sediment from the bottom of the BMP. Sediment and vegetation shall be removed from the stone weir or outlet channel to ensure a positive drainage pattern. Stone and boulders may need to be adjusted or re-installed to prevent scour. Wildlands will maintain the BMPs during the five-year monitoring period until close-out. Wildlands will evaluate whether sediment removal is necessary based on available sediment storage volume and post-construction stabilized watershed conditions. The dry detention ponds were designed with extra volume to allow significant accumulations to occur before maintenance would be needed. After close out, the newly established riparian buffer is expected to replace BMP treatment functions.
Vegetation	Vegetation shall be maintained to ensure the health and vigor of the desired community type. Routine vegetation maintenance and repair activities may include supplemental planting, pruning, mulching, and fertilizing. Exotic invasive plant species shall be treated by mechanical and/or chemical methods. Any vegetation control requiring herbicide application will be performed in accordance with NC Department of Agriculture (NCDA) rules and regulations.
Site Boundary	Site boundaries shall be identified in the field to ensure clear distinction between the mitigation site and adjacent properties. Boundaries may be identified by fence, marker, bollard, post, tree-blazing, or other means as allowed by site conditions and/or conservation easement. Boundary markers disturbed, damaged, or destroyed will be repaired and/or replaced on an as-needed basis.
Ford and Culvert Crossings	Ford and culvert crossings within the Site may be maintained only as allowed by Conservation Easement or existing easement, deed restrictions, rights of way, or corridor agreements.

The Wildlands Team will develop necessary adaptive measures or implement appropriate remedial actions in the event that the Site or a specific component of the Site fails to achieve the success criteria outlined above. The project-specific monitoring plan developed during the design phase identifies an appropriate threshold for maintenance intervention based on the monitored items. Any actions implemented will be designed to achieve the success criteria specified previously and will include a work schedule and updated monitoring criteria.



## Section 5: AS-BUILT CONDITION (BASELINE)

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The Site construction was completed in May 2018 and the as-built surveys were between September 2017 and May 2018. The survey included developing an as-built topographic surface, locating the channel boundaries, structures, and cross-sections. For comparison purposes, during the baseline assessments, reaches were divided into assessment reaches in the same way that they were established for design parameters: Area A, Area B, and Area C.

### 5.1 Record Drawings

A sealed half-size record drawing is located in Appendix 4 that includes redlines for any significant field adjustments made during construction that were different from the design plans. Specific changes by each project area are detailed below:

#### 5.1.1 Area A

##### Cornwell Creek

- Proposed ford crossing at Station 419+52 was changed to a culvert crossing based on landowner needs and best practices for the overall design.
- The proposed alignment and profile from Station 424+50 to 428+27 was altered in the field to raise the channel bed and become more of a Priority 1 restoration approach. This change was made to save the existing mature canopy and ensure adequate stream and floodplain connection to achieve a stable system. Structures along the reach were raised as necessary and additional structures were added upstream as part of the adjusted design.

##### Eaker Creek BMP

- Rock cascades proposed at Station 503+91 and 504+90 were not installed. Alternatively, grading was performed to re-align sections of the existing swale to the low point of the existing valley, a grass swale was installed, and banks were graded and planted as site conditions allowed. All disturbed banks were matted, seeded, and strawed and all floodplain areas were seeded and strawed with native riparian mix.

##### Scism Creek

- Riffle at Station 608+50 was not installed due to field conditions. Bank grading along Scism was re-evaluated during construction and revised to best meet the goals of the project.

##### Royster Creek

- The profile for Royster Creek Reach 1 was updated based on the upstream topography. The pre-project survey was incorrect and as a result, the profile for Royster Creek Reach 1 was lowered to accommodate the tie in to the off-site conditions and the downstream reach.
- Brush toe structures were replaced with rock toe due to concern over the channel being dry for seasonal portions of the year.
- The riffle located at Station 808+03 was moved downstream due to field conditions and the rock sill was determined to be unnecessary.



### Royster BMP2

- Alignment of the BMP at approximate station 854+25 was straightened based on field conditions.

### Royster BMP3

- The overall design and alignment of BMP3 was altered based on previous BMP installations and lessons learned during construction.

### Royster BMP4

- The design of BMP4 was altered based on previous BMP installations and lessons learned during construction and high flow events.

### Royster BMP5

- At the downstream end of BMP5, two cascades instead of four were installed to drop valley grade and tie BMP5 to Royster Creek using shallower sloped, longer cascades to increase stability.

### Lower Stick Elliott

- The proposed J-Hook at Station 1113+85 was moved upstream by approximately 15 feet to accommodate the installed brush toe.
- The proposed riffle at station 1114+58 was shortened to create a more natural confluence. A rock sill was added at the tail of riffle for increased stability of the shortened riffle.

### Scott Creek

- Locations and elevations of the step structures on Scott Creek were altered in the field based on site conditions and available materials.
- A rock sill was added for stability at Station 1215+95.
- The rock cascade at Station 1216+12 was not installed to preserve habitat.

### Carroll Creek

- Concentrated flow stabilization from the left terrace was moved upstream based on field conditions.
- Concentrated flow stabilization was added on the right terrace based on field conditions.

### Upper Big Harris

- Items within the enhancement sections were field adjusted to ensure proper installation.
- Riffles were added to enhance habitat at Station 130+00.
- Concentrated flow stabilization was added on the left terrace at Station 169+10.
- Concentrated flow stabilization on the right terrace was moved upstream due to field conditions at station 168+70.
- Boulder toe was moved to preserve habitat at Station 174+00.
- As-built alignment was revised to adjust to field conditions at Station 175+60.





## 5.1.2 Area B

### Elliott Creek

- The alignment of Elliott Creek was slightly altered from the design in multiple areas to accommodate the existing condition of the channel and preserve mature trees. Many locations had to be revised due to the age and incomplete nature of the culvert provided pre-project survey.
- Log vane at Station 1402+00 was removed to save mature tree in the field.
- Log vane at Station 1402+28 was moved downstream based on field conditions.
- Brush toe from 1403+25 to 1404+50 was adjusted in the field to accommodate field conditions.
- A mix of rip rap and native rock was used to construct a floodplain outlet that ties the terrace slope down to the newly excavated floodplain at station 1405+00. Brush toe originally slated for this location was removed to accommodate the floodplain outlet.
- The two riffles at Station 1410+16 and 1410+44 were combined to one long riffle and the log sill proposed for station 1410+35 was moved downstream to Station 14110+71. These changes were made to create a better pool to pool spacing based on field observation.

### Upper Stick Elliott Creek

- Cascade structures installed between 1002+89 and 1004+50 were altered based on field conditions.
- The proposed alignment from Station 1006+34 to 1007+24 was altered to remain within the existing channel alignment. Structures proposed for this section of channel were installed within the existing stable channel alignment. A brush toe was added at the downstream tie in based on field conditions.
- Concentrated flow stabilization on the left bank at Station 1050+15 was not installed due to field conditions.
- The left floodplain at approximate station 1069+00 was narrowed to save mature trees along Lower Fletcher Creek. The right floodplain in this section was widened to ensure an adequate entrenchment ratio.

### Upper Fletcher Creek

- Double log vanes proposed at Station 1606+50 were removed based on field conditions.
- Double log vanes proposed at Station 1611+50 were replaced with right bank grading including one installed geolift.
- Double log vanes proposed at Station 1614+15 were swapped in the field for an extension of the brush toe installed along the right bank.
- Double log vanes proposed at station 1615+15 were moved upstream, a riffle was installed downstream of the log vanes, and the proposed double log vane just upstream from the culvert was changed to a single log vane. All of these changes were made in the field to accommodate the existing channel and the installation of the proposed culvert crossing.
- Outlet from the right floodplain just downstream of the installed culvert crossing was stabilized using native rock. One log sill was installed within the outlet, but the two upstream log sills were removed to save existing mature trees.

### Lower Fletcher Creek

- Proposed log vanes at Stations 1643+60, 1644+25, and 1646+35 were relocated in the field based on field conditions.



- The brush toe at station 1648+00 was moved downstream to save existing mature trees.

### 5.1.3 Area C

#### Lower Big Harris Creek

- Bedrock was encountered at Station 317+30. Bed elevations and structure placement was altered, and a log sill was installed to accommodate the field conditions.
- Log vane at Station 320+60 was changed to a Log-J-Hook due to field conditions.

### 5.1.4 Headwaters Drainage BMP Design

Headwater BMPs were installed on the Site to address the gullies that had formed in headwater drainages from past terracing practices. As noted during the design, these locations are not appropriate for restoration of aquatic habitat due to lack of sustained baseflows, but they did offer opportunities for water quality enhancement through the installation of headwater BMPs. BMPs at these locations were constructed to stabilize gullies and eroding channel beds while providing treatment of nutrient and other pollutant loads. Updated details for the Rock Cascade and Step-Pool Stormwater Conveyance (SPSC) structures are included with the as-built record drawing to provide an overview of general sitewide changes made to these proposed structures. Changes to these structures were done based on lessons learned during construction and observation of the project structures during high flow events. Design changes to the BMPs during construction were carefully considered and discussed with designers to ensure they were supporting or enhancing the ability of the BMPs to meet project goals.

#### Eaker Creek BMP

The upper reach of Eaker Creek is an ephemeral channel that drains 26 acres of cattle pasture. This channel was not as deeply incised as other ephemeral drainage ways but there were multiple knickpoints and steep slopes that needed to be stabilized to reduce further headcutting and sediment production. The objectives for the reach were to stabilize the eroding bed to reduce sediment loads in specific locations, provide stormwater treatment to reduce pollutants in the agricultural runoff, and retain stormflows to help restore more natural hydrology and reduce peak flows in receiving streams. The original design called for two rock cascades to be installed near the upstream extent followed by the installation of a step pool stormwater conveyance (SPSC). The rock cascades proposed at the upstream end of the reach were replaced during construction with a stabilized grass swale at the low point of the existing valley. The grass swale was installed, and banks were graded and planted as site conditions allowed. All disturbed banks were matted, seeded, and strawed and all floodplain areas were seeded and strawed with native riparian mix. A native rock riffle and rock sill were added during construction at the upstream end of the SPSC to stabilize an existing headcut. The SPSC was installed at the designed stations and included filter media as originally planned in the design. The curvature profile along the sills of the SPSC were increased during construction to promote stability and boulders were extended further into the banks to decrease potential flow around the structures. Beyond these changes, the Eaker Creek BMP was installed to plan.

#### Scism Creek BMP

The upper reach of Scism Creek is an ephemeral drainage way that drains 16 acres of pasture. The primary objectives for this site included stabilization of severely eroding channel bed, treatment of stormwater runoff, and invasive species treatment. The original design called for the installation of a vegetated swale at the upstream extent and a step-pool sequence downstream of the vegetated swale. During construction it was deemed necessary to install grade control at the upstream end of the swale to prevent headcut migration. Banks along the swale were also graded, matted with erosion control



matting, and planted to promote stabilization. The width of the step-pool sequence was increased during construction to ensure adequate capacity, but otherwise the structure was installed per plan.

#### Tributary to UBHC Reach 5 BMP

This small ephemeral channel with an 8-acre drainage was stabilized using a series of BMP rock sills. The banks of the ephemeral drainage were graded, matted, and planted with native riparian seed mix to promote stabilization. The original design called for the installation of six rock sills. The most upstream rock sill was removed during construction to prevent the removal of a large tree providing grade control with a stable root mat.

#### Royster Creek BMP2

The drainage area to this site is approximately 9 acres and is bisected by an easement break with an existing culvert crossing. The objectives for this site included stabilization of the eroding channel bed, treatment of runoff from pasture, and retention of stormflows. The existing farm road and culvert crossing were stabilized as part of the BMP installation. Upstream of the culvert crossing, an existing headcut was stabilized with a series of BMP rock sills. During construction, rock sills were shifted slightly downstream based on the existing valley topography. Downstream from the rock sills, a vegetated swale was installed along with a small detention basin and rock outlet to further promote sediment removal. The height of the rock outlet was decreased based on field conditions of the culvert and smaller stone was added to the rock outlet to increase retention times within the basin. Downstream of the culvert crossing, natural rock sills were added to the vegetative swale during construction to increase the bed stability. The series of step-pools proposed downstream of the culvert were re-aligned during construction based on the natural valley topography. Aside from the minor changes listed above, BMP2 was installed per plan.

#### Royster Creek BMP3

This reach was another small ephemeral channel that drains 14 acres. Like the other ephemeral drainage ways that discharge to Royster Creek, this channel had an unstable bed with a 16% slope and multiple knickpoints. The design of BMP3 was altered during construction based on lessons learned from previous BMP installations. The alignment was straightened, and the valley was graded to promote a wider flow path during storm events. Treatment cells with filter media originally proposed midway along the BMP were moved upstream to the flatter portions of the valley to increase retention times and promote stability of the upstream section. The profile was adjusted to flatten the upstream slopes, before using rock cascade structures to stably tie the ephemeral channel to Royster Creek. While many aspects of BMP3 were altered during construction, the design goals of stabilizing the existing knickpoints and providing treatment of upstream agricultural runoff were under constant consideration during the installation. The changes made during construction improved the overall design while maintaining the original project goals. The area was stabilized with grass and understory species in shaded areas. Additionally, the area was fenced and planted with native tree species per the original design.

#### Royster Creek BMP4

This reach drains 28 acres. The objectives for this reach were to stabilize existing headcuts, provide a stabilized culvert crossing, and promote the treatment of agricultural runoff while stably connecting the drainage to Royster Creek. The proposed culvert crossing upstream of the BMP was installed per plan. Additional grading was performed around the installed crossing to ensure flow from the adjacent terraced cattle pastures enters the BMP drainage at stable locations to prevent rill erosion along graded slopes. The plan and profile for the SPSC proposed downstream of the culvert was altered during construction to reduce the slope over the BMP rock sills with media, reduce the overall depth of the drainage, and promote a wider flow path during high flow events. Two cascade structures originally



proposed were replaced with one long cascade structure built with larger rock material to transition the upstream end of the BMP to the low elevation of the existing drainage. Downstream of the cascade, the BMP was generally installed per plan with minor grade adjustments to ensure a stable tie to Royster Creek. A small floodplain outlet was added to the downstream end of the BMP to prevent rill erosion along steeper bank slopes within the BMP. Alterations to the design BMP4 during construction were based on lessons learned from previous BMP installation and the observations of high flows during storm events. The design of the Rock Cascades was altered to include a mixed rock backfill of railroad ballast, No 57 stone, Class A, Class B, and Class I material to increase stability. Additionally, a wider footprint of boulders with an increased curvature profile to promote a wider flow path at high flows was implemented. The intent of the structures was not altered by these changes and an increased stability during high flow events has been observed since the completion of construction.

#### Royster Creek BMP5

The watershed for this ephemeral reach is 7 acres. There is an easement break with an existing farm road and three small culverts (12 to 18 inches) across this reach. Upstream of the existing crossing, the short reach of defined channel which was previously headcutting was stabilized with an SPSC generally installed per plan. One additional step structure was added at the downstream end of the SPSC during construction based on the existing topography. Downstream of the SPSC, the sediment basin and rock outlet were installed with minor changes. Similar to BMP2, the elevation of the rock outlet was lowered slightly, and the outlet was capped with smaller rock material to decrease flow through times within the basin. The existing series of three culverts was stabilized per plan with a rock outlet added to the downstream end of the main culvert. The profile of BMP5 was lowered slightly based on the field conditions and native rock material was added to sections of the proposed vegetated swales to ensure bed stability through these sections. Downstream of the vegetated swales, the proposed rock cascade design was altered as outlined above and shown in the Rock Cascade detail. The profile was flattened where possible and two rock steps were added to the downstream portion of the BMP to increase bed stability along the BMP. Changes made to BMP5 during construction were based on lessons learned during high flow events and during previous BMP installations.

#### Scott Creek Upstream BMP

The upper reach of Scott Creek is an ephemeral channel draining 34 acres. Like the other ephemeral reaches described, the bed was very steep through this reach and there were previously multiple headcuts. Very minor adjustments were made to the Scott Creek BMP. Installed filter media was capped with native rock material for stabilization and minor grading changes were incorporated based on the existing field condition. Otherwise, the Scott Creek BMP was installed per plan.

#### USEC BMP (School Site)

The beginning of USEC is an ephemeral drainage way that drains 29 acres of cropland and the Union Elementary School campus. There was a very significant, migrating headcut at station 1002+74 prior to the project construction. The SPSC at the upstream end of USEC was shifted upstream during construction based on the existing topography. The series of rock steps used to stabilize the large existing headcut were lowered during construction to prevent building the highest points of the rock steps out of unconsolidated fill material. Rock backfill was added to step structures installed within the steepest portion of the BMP to promote bed stability and prevent any further headcutting. Generally, design changes during construction along the USEC BMP were minor.

## **5.2 Baseline Data Assessment**

MYO was conducted between January and May 2018 with the vegetation data collection occurring between March and May 2018, immediately following planting. The first annual monitoring assessment



(MY1) will be completed in the fall of 2018. The streams will be monitored for a total of five years, with the final monitoring activities to be conducted in 2022.

### **5.2.1 Morphological State of the Channel**

As-built morphological data was collected between September 2017 and April 2018. Please refer to Appendix 2 for summary data tables, morphological plots, and stream photographs.

#### Profile

The MY0 profiles generally match the profile design parameters. On the design profiles, riffles were depicted as straight lines with consistent slopes. Variations from the design profile reflect field changes during construction as a result of field conditions as well as deviations between the provided existing conditions survey and actual field conditions. For example, grading was minimized in areas to preserve existing stable channel sections and/or mature trees. Variations in channel profile do not constitute a problem or indicate a need for remedial actions and will be assessed visually during the CCPV Site walks.

#### Dimension

The MY0 dimension numbers closely match the design parameters with minor variations in a few reaches. These occasional variations are primarily due to a wider as-built bankfull width constructed on Royster Creek Reach 1, Upper Big Harris Creek Reach 2A, Bridges Creek Reach 1, and Upper Stick Elliott Creek UT3 where bank slopes were made less steep as reflected in the cross sections. We expect that over time as vegetation is established, the channels may narrow more toward design dimensions. This narrowing over time would not be seen as an indicator of instability in and of itself.

#### Pattern

The MY0 pattern metrics fell within acceptable ranges of the design parameters. Pattern data will be evaluated in MY5 if there are any indicators through the profile or dimension assessments that significant geomorphic adjustments have occurred.

#### Sediment Transport

As-built shear stresses and velocities are expected to be similar to design calculations and should reduce the risk of further erosion along the reaches. Based on the grade control structures implemented during construction, stream channel degradation is not expected.

Visual assessments will be conducted during the annual monitoring efforts and areas of aggradation and/or degradation will be reported in the annual monitoring reports.

#### Bankfull Events

Bankfull events recorded following completion of construction will be reported in the Year 1 monitoring report.

### **5.2.2 Vegetation**

The MY0 planted density is 628 stems/acre, which exceeds the interim measure of vegetative success of at least 320 planted stems per acre at the end of the third monitoring year. Summary data and photographs of each plot can be found in Appendix 3.



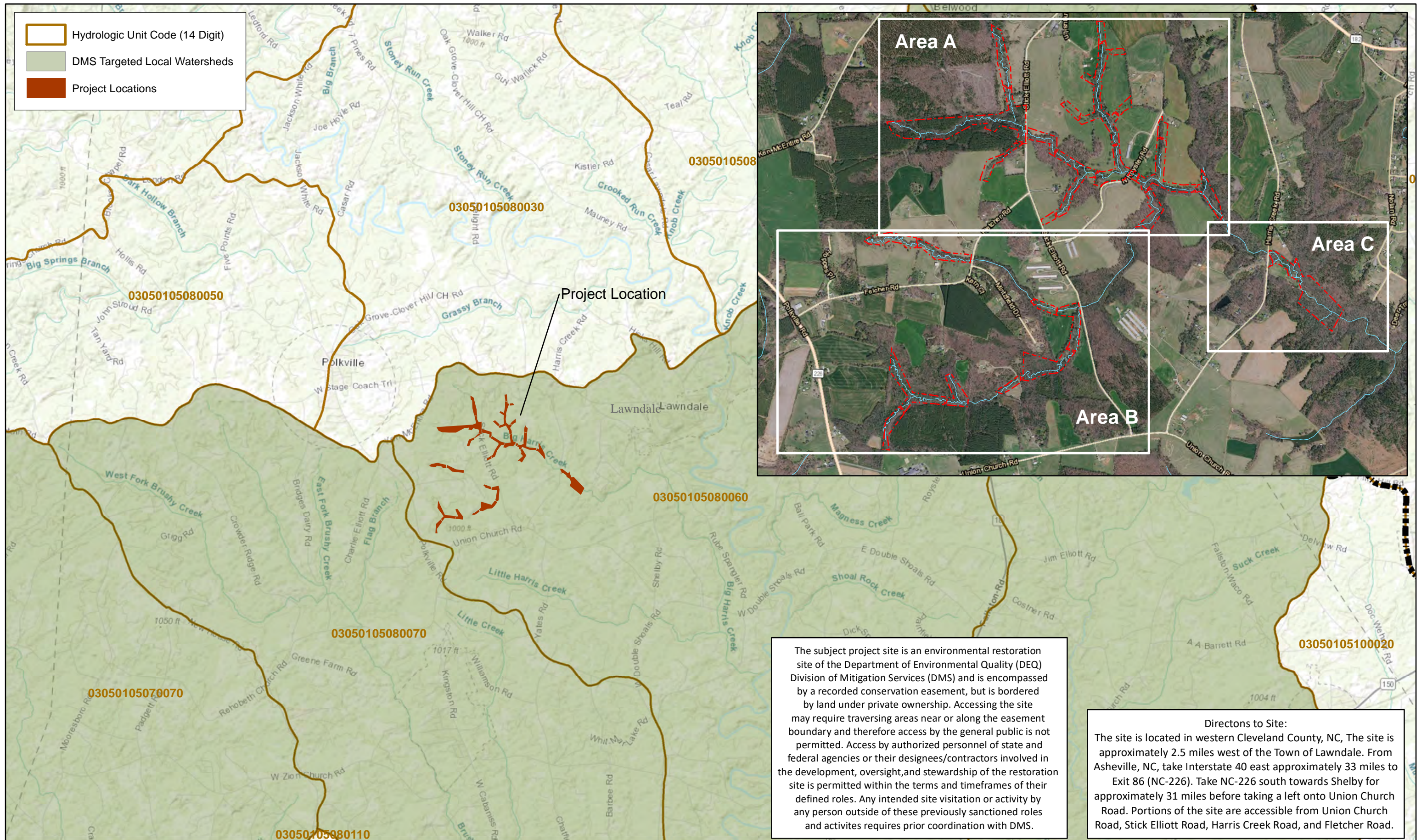
## Section 6: REFERENCES

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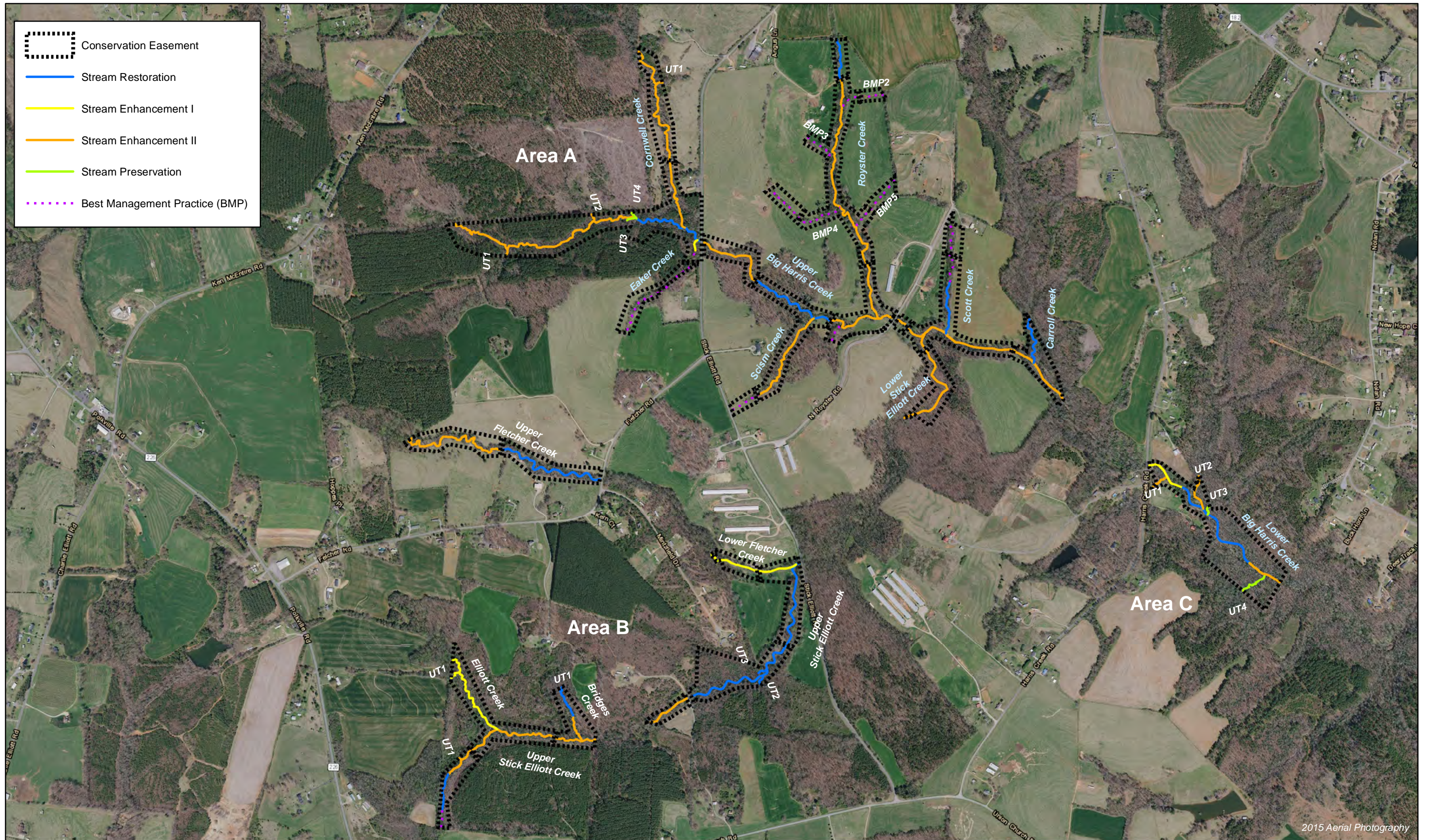
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## **APPENDIX 1. General Figures and Tables**







-  Conservation Easement
-  Stream Restoration
-  Stream Enhancement I
-  Stream Enhancement II
-  Stream Preservation
-  Best Management Practice (BMP)

2015 Aerial Photography

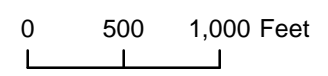
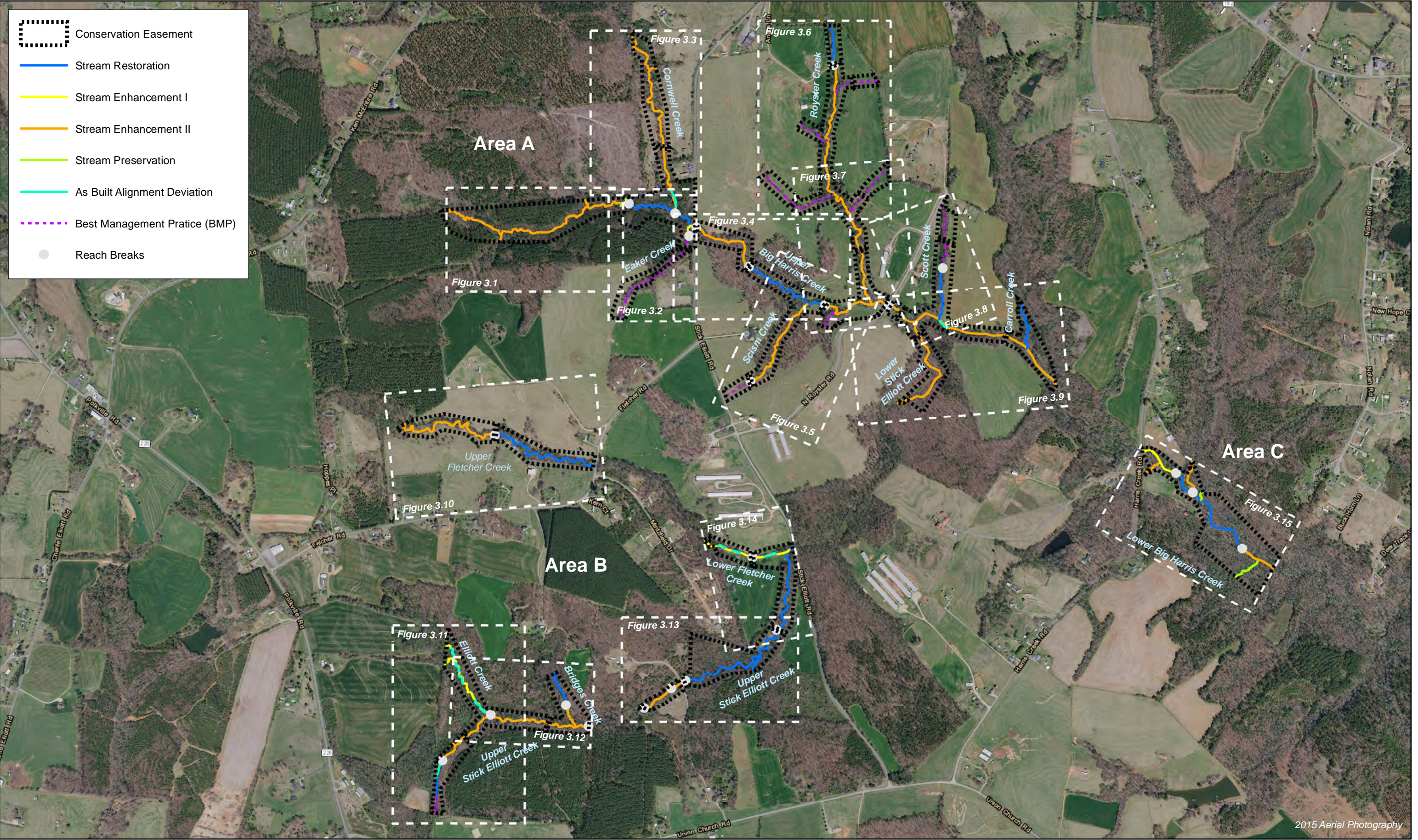


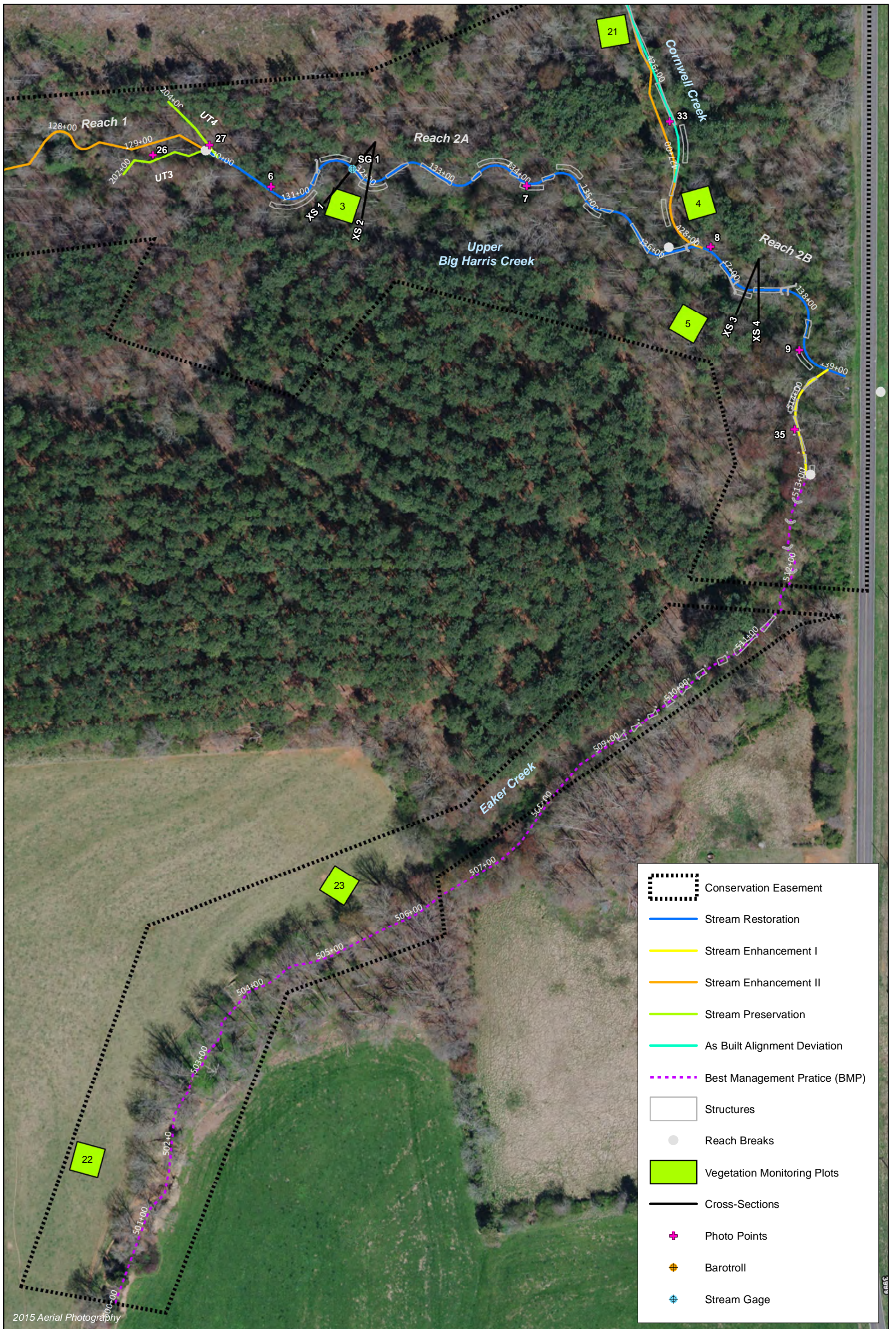
Figure 2.0 Project Component/Asset Map  
 Big Harris Creek Mitigation Site  
 DMS Project No. 739  
 Monitoring Year 0 - 2018  
 Cleveland County, NC

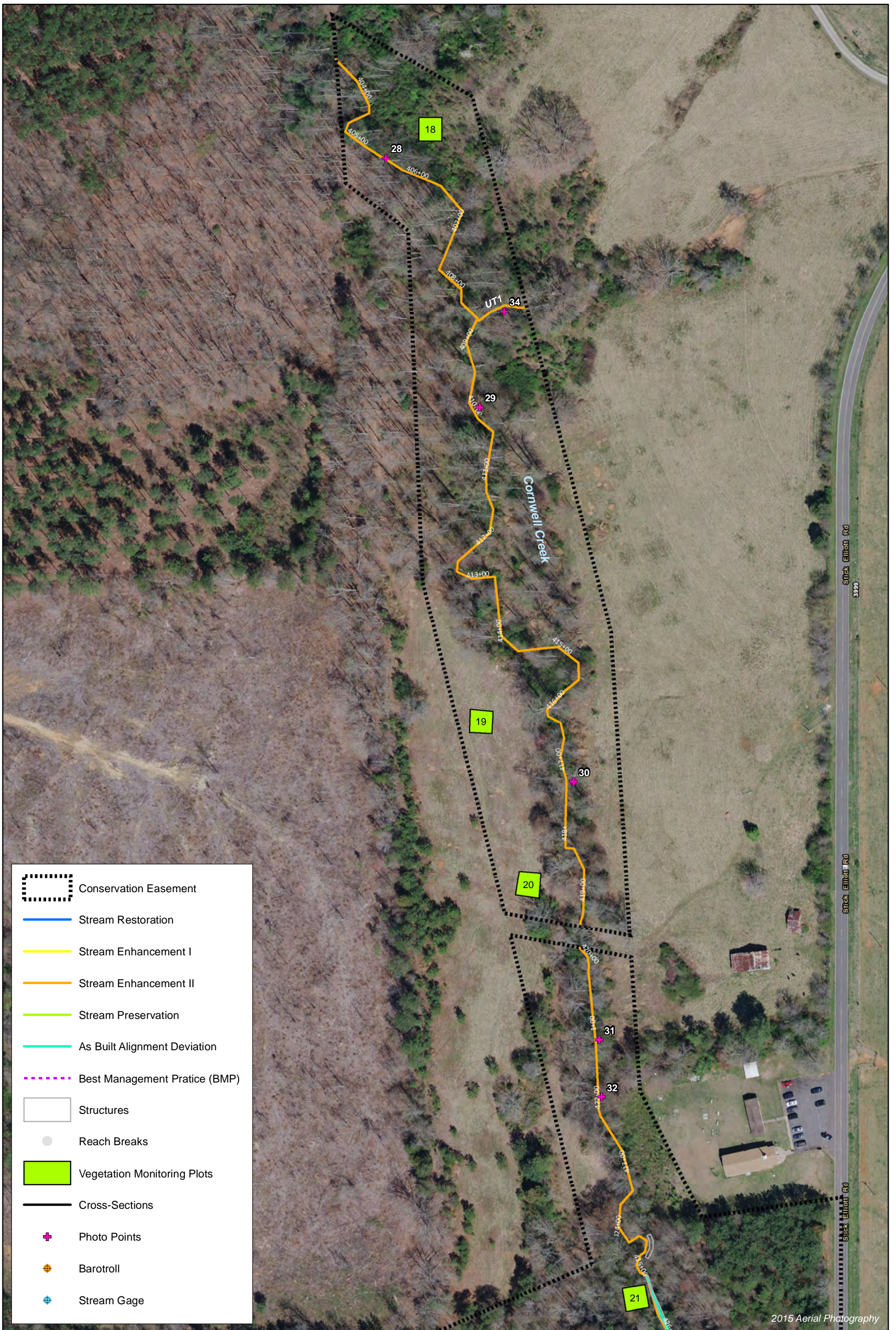


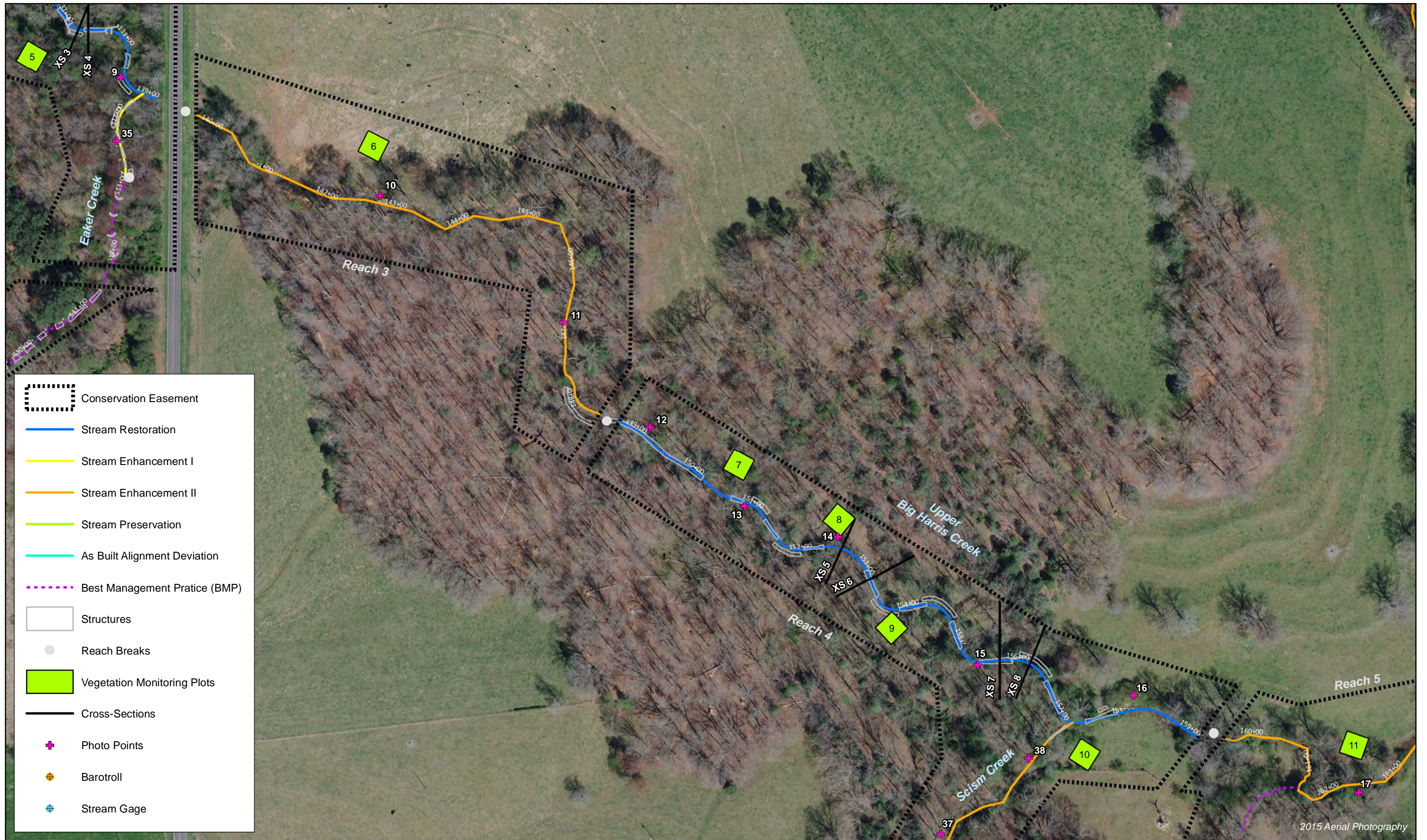
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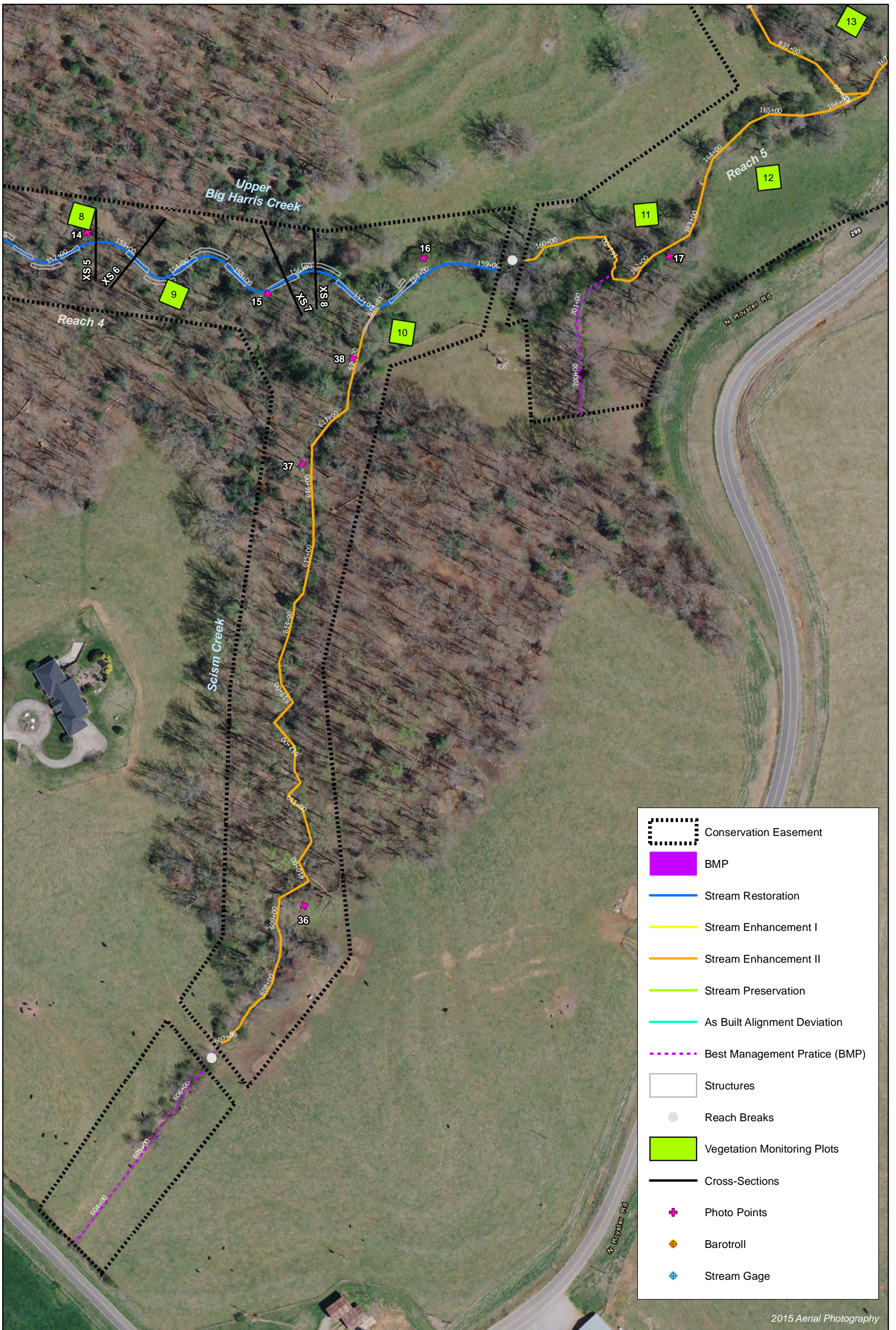


2015 Aerial Photography









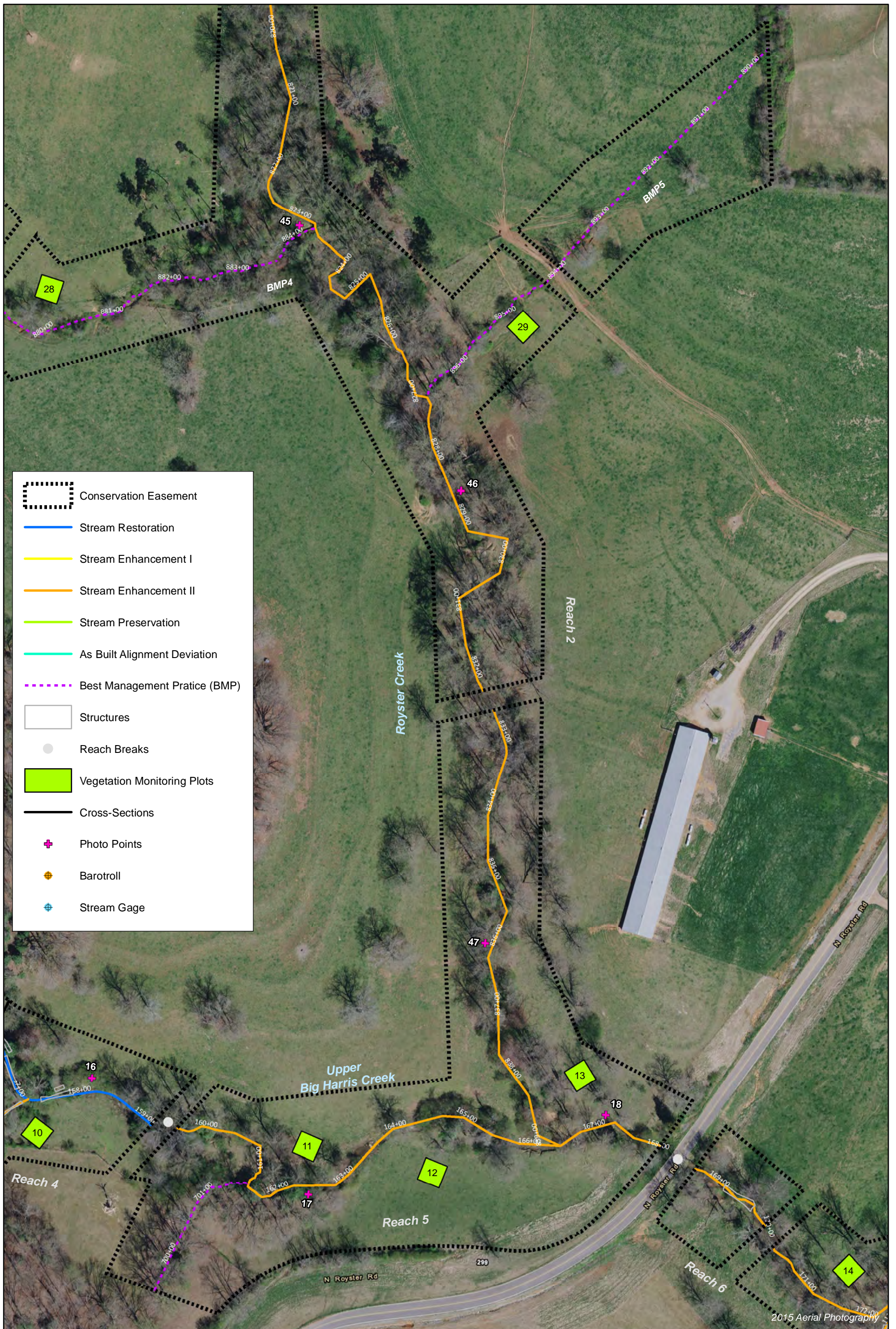
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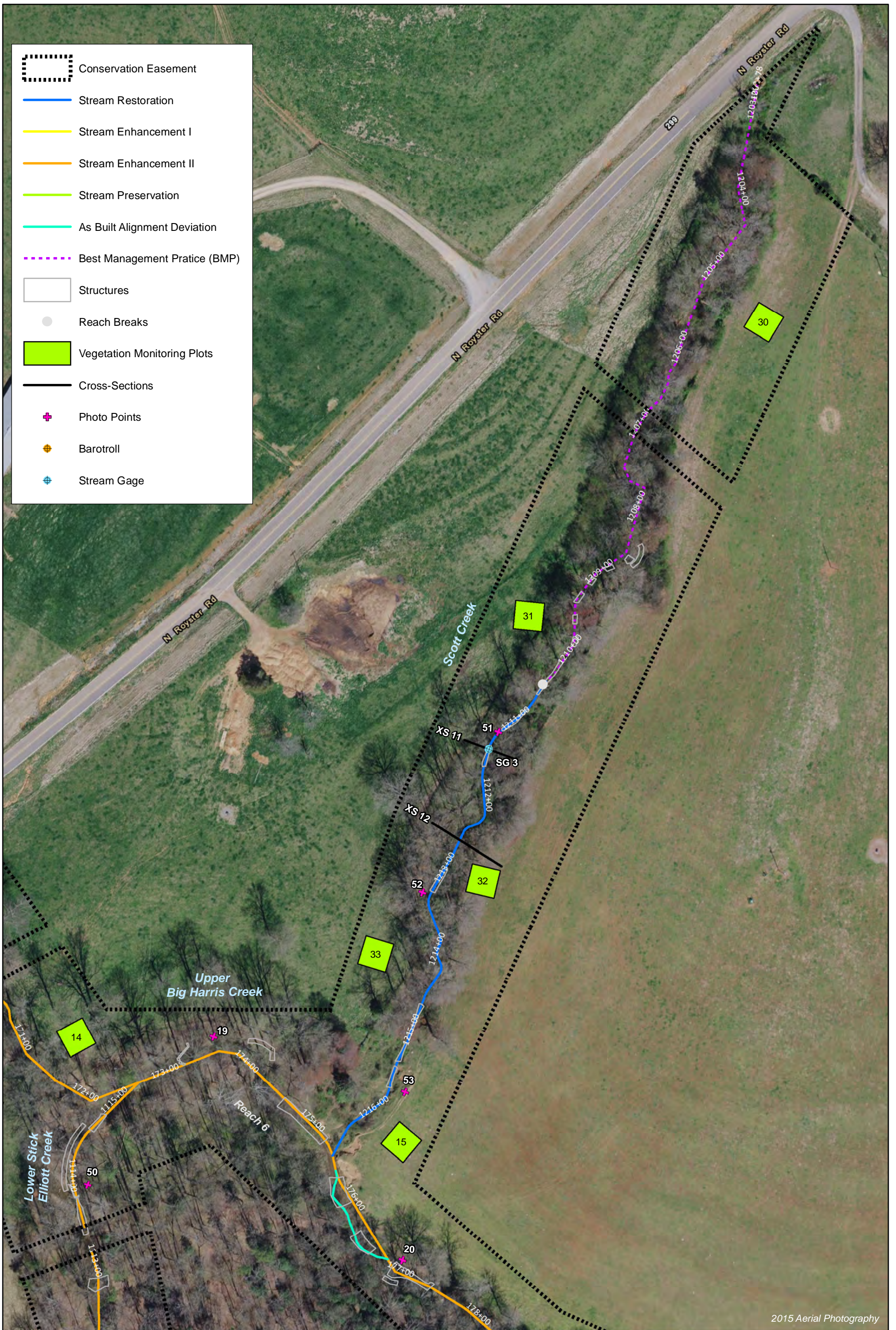




2015 Aerial Photography



















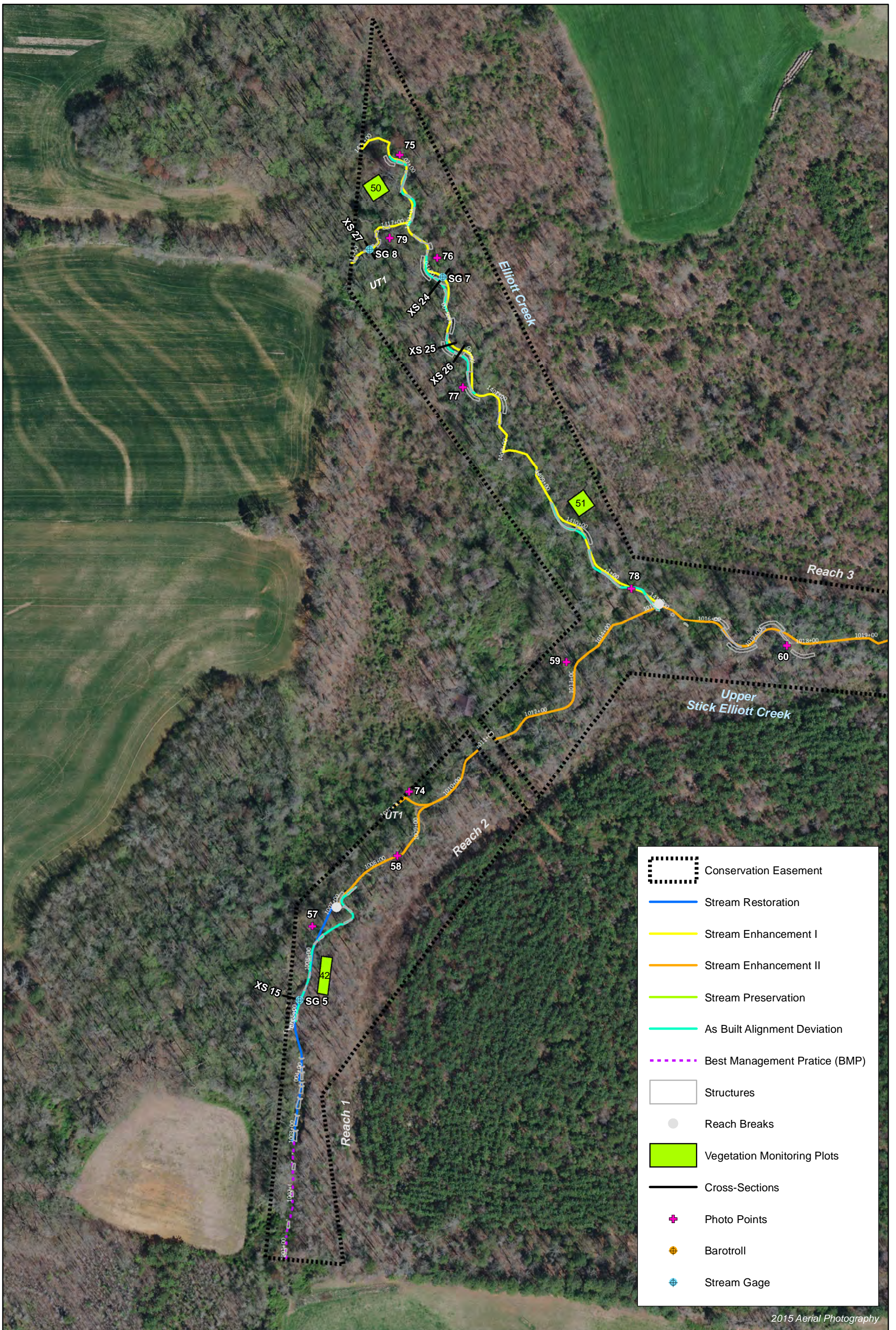




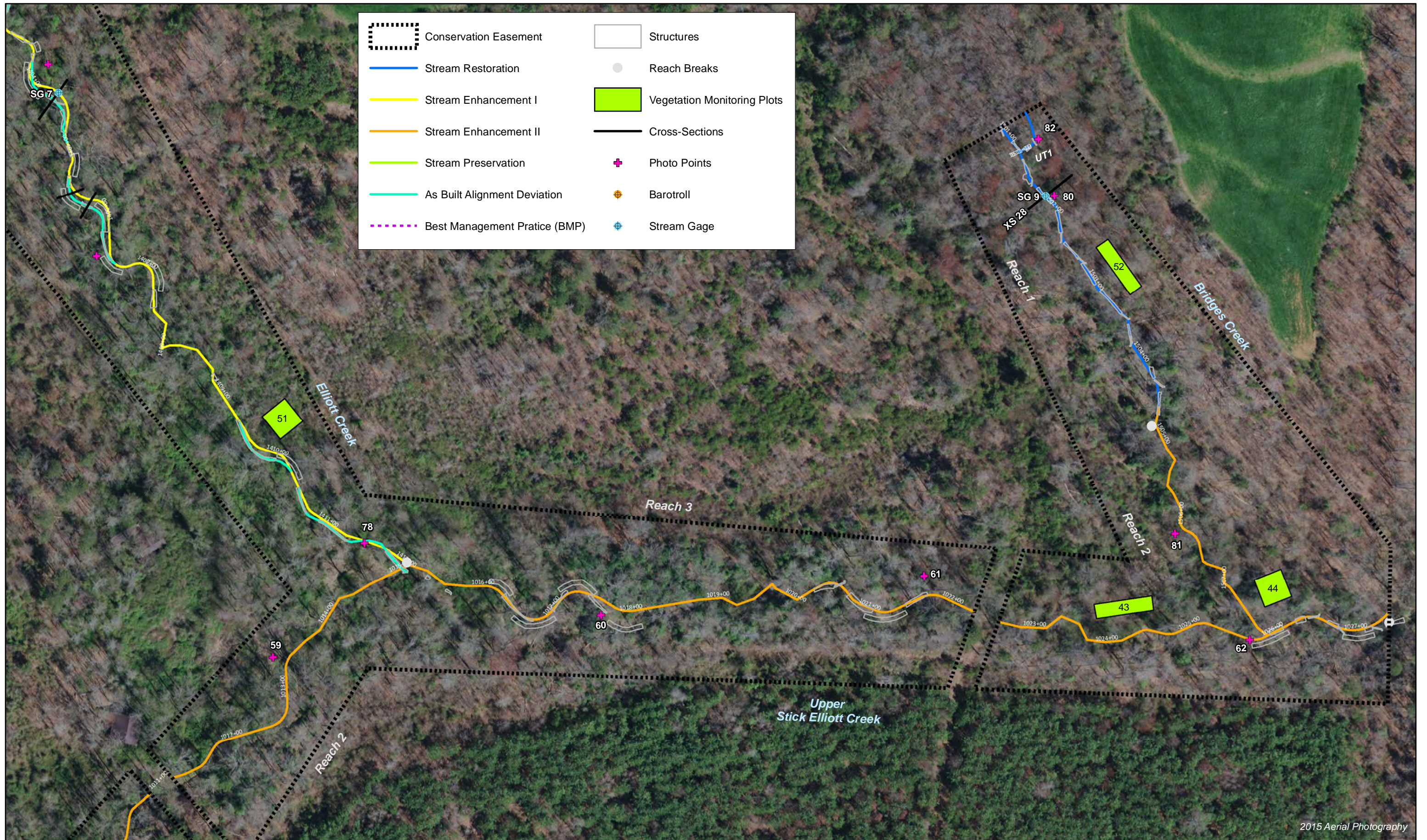
2015 Aerial Photography



-  Conservation Easement
-  Stream Restoration
-  Stream Enhancement I
-  Stream Enhancement II
-  Stream Preservation
-  As Built Alignment Deviation
-  Best Management Practice (BMP)
-  Structures
-  Reach Breaks
-  Vegetation Monitoring Plots
-  Cross-Sections
-  Photo Points
-  Barotroll
-  Stream Gage



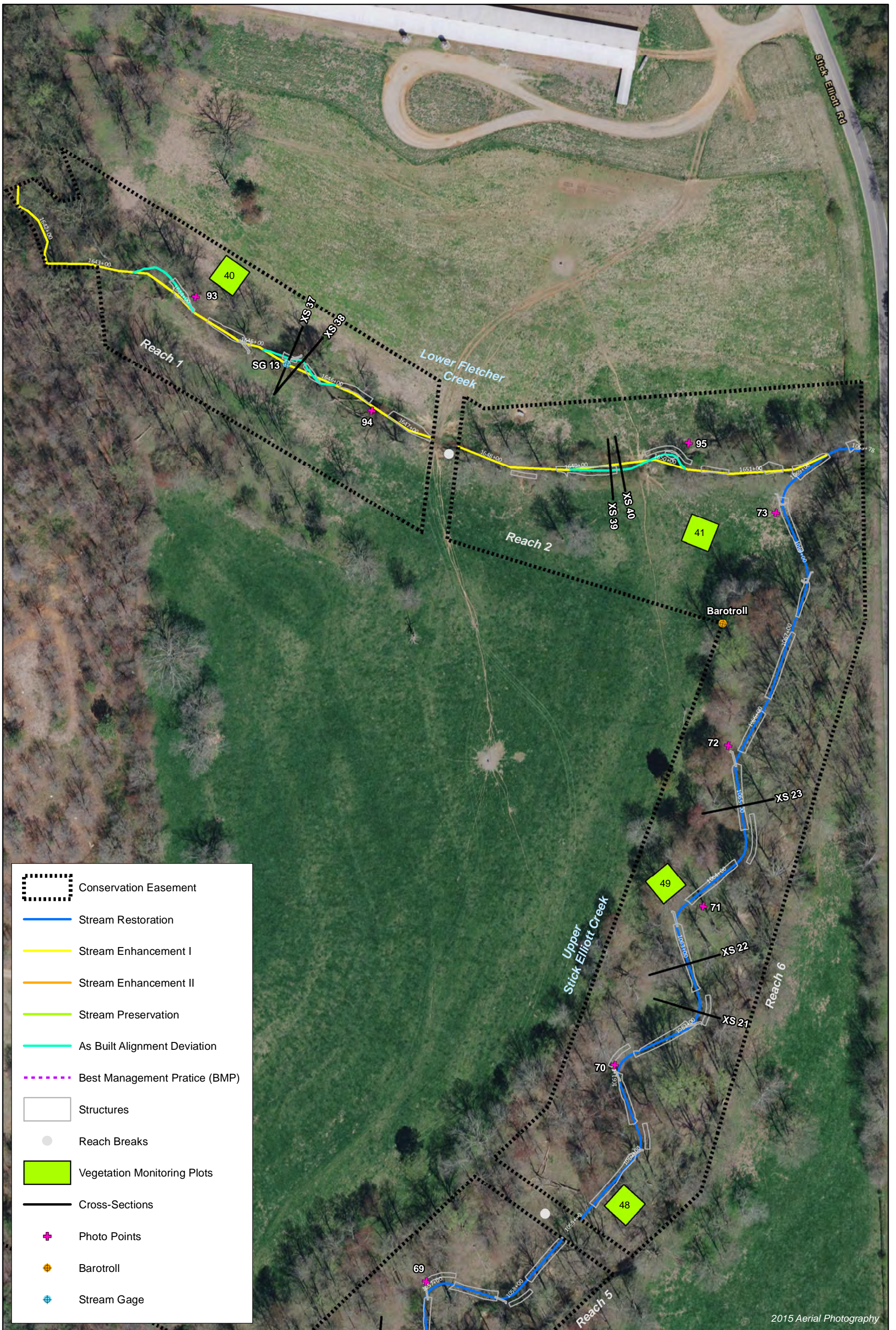
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2015 Aerial Photography







2015 Aerial Photography

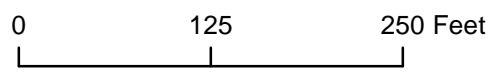


Figure 3.15 Monitoring Plan View  
 Big Harris Creek Mitigation Site - Area C  
 DMS Project No. 739  
 Monitoring Year 0 - 2018  
 Cleveland County, NC

**Table 1. Project Components and Mitigation Credits**

Big Harris Creek Mitigation Site  
 DMS Project No. 739  
 Monitoring Year 0 - 2018

Mitigation Credits										
	Stream		Riparian Wetland		Non-riparian Wetland		Buffer	Nitrogen Nutrient Offset	Phosphorus Nutrient Offset	
Type	R	RE	R	RE	R	RE				
Totals	25,228.121	101.795	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
Project Components										
Project Area	Project Reach	Existing Footage (LF) <sup>1</sup>	Proposed Stationing/Location		Approach	Restoration (R) or Restoration Equivalent (RE)	Restoration Footage (LF) <sup>1</sup>	Mitigation Ratio	Total Buffer Width Adjustments	Proposed Credit <sup>2,3,4</sup>
					(P1, P2, etc.)					
A	Cornwell Creek R1	2,144	403+44	425+20	cattle fencing; buffer planting	EII	2,144	2.5	25	883.000
	Cornwell Creek R2	286	425+20	428+27	Full restoration with structures	EII	307	2.5	0	123.000
	UT1 to Cornwell Creek	78	430+27	431+05	cattle fencing; buffer planting	EII	78	2.5	0	31.000
	Eaker Creek	135	513+11	514+45	cattle fencing, bank grading and in-stream structures	EI	134	1	0	134.000
	Eaker Creek SPSC BMP	N/A	N/A	N/A	headwater BMP	N/A	1309	N/A	N/A	N/A
	Scism Creek	1,189	606+92	618+81	BMP, bank grading and in-stream structures	EII	1,189	1.5	12	805.000
	Scism Creek EC	N/A	N/A	N/A	headwater BMP	N/A	358	N/A	N/A	N/A
	Royster Creek R1	438	802+54	807+13	Priority 2 Restoration	R	459	1	-5	454.000
	Royster Creek R2	3,185	807+40	839+40	cattle fencing; buffer planting	EII	3,170	2	21	1606.000
	Royster BMP2	N/A	N/A	N/A	headwater BMP	N/A	539	N/A	N/A	N/A
	Royster BMP3	N/A	N/A	N/A	headwater BMP	N/A	399	N/A	N/A	N/A
	Royster BMP4	N/A	N/A	N/A	headwater BMP	N/A	1022	N/A	N/A	N/A
	Royster BMP5	N/A	N/A	N/A	headwater BMP	N/A	669	N/A	N/A	N/A
	Lower Stick Elliott Creek	1,422	1101+13	1115+34	cattle fencing; buffer planting	EII	1,389	2.5	-29	527.000
	Scott Creek	630	1210+12	1216+74	Priority 1 Restoration	R	662	1	19	681.000
	Scott Creek SPSC BMP	N/A	N/A	N/A	headwater BMP	N/A	734	N/A	N/A	N/A
	Carroll Creek	553	1301+68	1307+63	Priority 2 Restoration	R	595	1	-56	539.000
	Upper Big Harris Creek R1	2,615	104+25	129+81	bank grading and in-stream structures; pine removal and buffer planting	EII	2,556	2.5	119	1141.000
	Upper Big Harris Creek R2	990	129+81	139+15	Priority 2 Restoration	R	934	1	126	1060.000
	Upper Big Harris Creek R3	880	139+75	148+45	cattle fencing; bank grading and in-stream structures	EII	870	2	75	510.000
Upper Big Harris Creek R4	1,203	148+76	159+15	Priority 2 Restoration	R	1,039	1	11	1050.000	
Upper Big Harris Creek R5	845	159+58	168+03	cattle fencing; bank grading and in-stream structures	EII	845	1.5	41	604.000	
Upper Big Harris Creek R6A	824	168+63	177+50	cattle fencing; benching; bank grading and in-stream structures	EII	855	1.5	1	571.000	

**Table 1. Project Components and Mitigation Credits**

Big Harris Creek Mitigation Site  
 DMS Project No. 739  
 Monitoring Year 0 - 2018

Mitigation Credits										
	Stream		Riparian Wetland		Non-riparian Wetland		Buffer	Nitrogen Nutrient Offset	Phosphorus Nutrient Offset	
Type	R	RE	R	RE	R	RE				
Totals	25,228.121	101.795	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
Project Components										
Project Area	Project Reach	Existing Footage (LF) <sup>1</sup>	Proposed Stationing/Location		Approach	Restoration (R) or Restoration Equivalent (RE)	Restoration Footage (LF) <sup>1</sup>	Mitigation Ratio	Total Buffer Width Adjustments	Proposed Credit <sup>2,3,4</sup>
					(P1, P2, etc.)					
A	Upper Big Harris Creek R6B	1,434	177+50	191+84	cattle fencing; benching; bank grading and bank structures	EII	1,403	1.5	-10	925.000
	Upper Big Harris BMP	N/A	N/A	N/A	headwater BMP into Upper Big Harris Reach 5	N/A	166	N/A	N/A	N/A
	UT1 to Upper Big Harris Creek	84	197+13	197+97	bank grading and in-stream structures; pine removal and buffer planting	EII	84	2.5	-8	26.000
	UT2 to Upper Big Harris Creek	97	200+42	201+39	bank grading and in-stream structures; pine removal and buffer planting	EII	97	2.5	-4	35.000
	UT3 to Upper Big Harris Creek	105	202+00	203+05	preservation	P	105	10	0	11.000
	UT4 to Upper Big Harris Creek	84	204+00	204+84	preservation	P	84	10	-1	7.000
B	Elliott Creek	1,389	1400+85	1412+06	bank grading, segments of profile and bench restoration, in-stream structures	EI	1,121	1	42	1163.000
	UT1 to Elliott Creek	141	1415+87	1417+28	bank grading, segments of profile and bench restoration, in-stream structures	EI	141	1	-19	122.000
	Bridges Creek R1	445	1500+91	1504+67	Priority 1 Restoration	R	376	1	15	391.000
	Bridges Creek R2	366	1504+67	1507+84	bank grading and in-stream structures	EII	317	2	9	168.000
	UT1 to Bridges Creek	58	1510+46	1511+01	Priority 1 Restoration	R	55	1	-28	27.000
	Upper Stick Elliott Creek SPSC BMP	N/A	N/A	N/A	headwater BMP into USEC	N/A	206	N/A	N/A	N/A
	Upper Stick Elliott Creek R1	352	1002+89	1006+98	Priority 1 Restoration	R	409	1	-55	354.000
	Upper Stick Elliott Creek R2A	535	1006+98	1012+00	bank grading and in-stream structures	EII	471	2	4	240.000
	Upper Stick Elliott Creek R2B	334	1012+00	1015+10	bank grading and in-stream structures	EII	310	2	0	155.000
	Upper Stick Elliott Creek R3A	209	1015+10	1018+25	bank grading and benching	EII	315	2	17	175.000
	Upper Stick Elliott Creek R3B	1,336	1018+25	1027+44	bank grading, benching, and in-stream structures	EII	889	2	21	465.000
	Upper Stick Elliott Creek R4A	428	1038+11	1042+08	cattle fencing, bank grading and in-stream structures	EII	397	2	-17	182.000
	Upper Stick Elliott Creek R4B	113	1042+28	1043+21	in-stream structures	EII	113	1.5	-6	69.000
	Upper Stick Elliott Creek R5	1,909	1043+77	1058+84	Priority 2 -> Priority 1 Restoration	R	1,507	1	89	1596.000
	Upper Stick Elliott Creek R6	1,036	1059+14	1069+83	Priority 1 -> Priority 2 Restoration	R	1,069	1	0	1069.000
	UT1 to Upper Stick Elliott Creek	50	1078+08	1078+80	bank grading and in-stream structures	EII	72	1.5	-9	39.000
	UT2 to Upper Stick Elliott Creek	56	1080+00	1081+54	reconnection; Priority 1 Restoration	R	154	1	-10	144.000
UT3 to Upper Stick Elliott Creek	107	1082+00	1083+18	reconnection; Priority 1 Restoration	R	118	1	0	118.000	

**Table 1. Project Components and Mitigation Credits**

Big Harris Creek Mitigation Site  
 DMS Project No. 739  
 Monitoring Year 0 - 2018

Mitigation Credits											
		Stream		Riparian Wetland		Non-riparian Wetland		Buffer	Nitrogen Nutrient Offset	Phosphorus Nutrient Offset	
Type	R	RE	R	RE	R	RE	R	RE	N/A	N/A	N/A
Totals	25,228.121	101.795	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Project Components											
Project Area	Project Reach	Existing Footage (LF) <sup>1</sup>	Proposed Stationing/Location		Approach	Restoration (R) or Restoration Equivalent (RE)	Restoration Footage (LF) <sup>1</sup>	Mitigation Ratio	Total Buffer Width Adjustments	Proposed Credit <sup>2,3,4</sup>	
					(P1, P2, etc.)						
B	Upper Fletcher Creek R1	1,493	1600+00	1615+71	isolated bank grading and in-stream structures, livestock fencing, invasives treatment	EII	1,571	2.5	16	644.000	
	Upper Fletcher Creek R2	1,465	1616+02	1630+09	Priority 2 Restoration	R	1,407	1	33	1440.000	
	Lower Fletcher Creek R1	574	1641+28	1647+02	bank grading, benching, and in-stream structures	EI	574	1	-81	493.000	
	Lower Fletcher Creek R2	467	1647+33	1651+60	bank grading, benching, and in-stream structures	EI	427	1	37	464.000	
C	Lower Big Harris Creek R1A	509	300+13	305+13	bank grading, segments of profile and bench restoration, in-stream structures	EI	500	1.5	-29	304.000	
	Lower Big Harris Creek R1B	385	305+13	308+33	Priority 2 Restoration	R	320	1	13	333.000	
	Lower Big Harris Creek R2	987	308+33	318+00	Priority 2 Restoration	R	967	1	125	1092.000	
	Lower Big Harris Creek R3	414	318+00	322+14	isolated bank grading and in-stream structures, invasives treatment	EII	414	2.5	32	198.000	
	UT1 to Lower Big Harris Creek	229	330+68	332+96	isolated bank grading and in-stream structures, invasives treatment	EII	228	2.5	-39	53.000	
	UT2 to Lower Big Harris Creek	511	334+20	338+60	heavy enhancement with in-stream structures, invasives treatment	EII	440	2	-37	183.000	
	UT3 to Lower Big Harris Creek	99	341+69	342+87	preservation	P	118	10	-1	11.000	
	UT4 to Lower Big Harris Creek	362	343+12	346+74	preservation	P	362	10	0	36.000	
Total Intermittent/Perennial (I/P) Streams							39,563			23,451.000	
Additional 4% Credit Based on I/P Stream Length for Extra Project Monitoring										1,366.000	
Additional 1.5% Credit Based on I/P Stream Length for Watershed Nature of Project										512.000	
Additional 2% Credit Based on Total SMUs for Statistical Improvement in Water Quality <sup>5</sup>										507.000	
Potential Total Credits <sup>5</sup>										25,329.916	
Component Summation											
Restoration Level		Stream (linear feet)		Riparian Wetland (acres)		Non-Riparian Wetland (acres)		Buffer (square feet)		Upland (acres)	
Restoration		10,071									
Enhancement		N/A									
Enhancement I		2,897									
Enhancement II		20,524									
Creation		N/A									
Wetland Rehabilitation		N/A									
Wetland Re-Establishment		N/A									
Preservation		669									
High Quality Preservation		N/A									
Notes:											
1. Existing and proposed lengths include only reach length located within the conservation easement. No direct credit for BMPs. BMP lengths not included in proposed footage.											
2. Credits reported have been adjusted based on buffer width deviations from standard 50-foot buffer width. Detailed calculations included in Appendix I of the Mitigation Plan (Wildlands, 2016).											
3. The lengths of Royster Reach 2 and Scott Creek that are located underneath the existing overhead electric power line corridor have credits reduced by 100%.											
4. The SMUs reported in this table were determined in the mitigation plan utilizing the design center line.											
5. The potential SMU total does not include the 2% increase for statistical improvement in water quality. If revised monitoring plan is approved, an addendum will be prepared and submitted.											

**Table 2. Project Activity and Reporting History**

Big Harris Creek Mitigation Site  
 DMS Project No. 739  
**Monitoring Year 0 - 2018**

Activity or Report	Data Collection Complete	Completion or Scheduled Delivery
Mitigation Plan	February - July 2015	November 2016
Final Design - Construction Plans	May 2018	June 2018
Construction	April 2017 - May 2018	April 2017 - May 2018
Temporary S&E mix applied to entire project area <sup>1</sup>	April 2017 - May 2018	April 2017 - May 2018
Permanent seed mix applied to reach/segments	April 2017 - May 2018	April 2017 - May 2018
Bare root and live stake plantings for reach/segments	February 2018 - March 2018	February 2018 - March 2018
Baseline Monitoring Document (Year 0)	January - May 2018	June 2018
Year 1 Monitoring	2018	November 2018
Year 2 Monitoring	2019	November 2019
Year 3 Monitoring	2020	November 2020
Year 4 Monitoring	2021	November 2021
Year 5 Monitoring	2022	November 2022

<sup>1</sup>Seed and mulch is added as each section of construction is completed.

**Table 3. Project Contact Table**

Big Harris Creek Mitigation Site  
 DMS Project No. 739  
**Monitoring Year 0 - 2018**

<b>Designers</b> Emily Reinicker, PE, CFM Angela Allen, PE - Area A Jake McLean, PE, CFM - Area C	<b>Wildlands Engineering, Inc.</b> 1430 South Mint Street, Suite 104 Charlotte, NC 28203 704.332.7754
	<b>Ecosystem Planning &amp; Restoration</b> 559 Jones Franklin Road, Suite 150 Raleigh, NC 27606
Kevin Tweedy, PE - Area B	
<b>Construction Contractors</b>	<b>Land Mechanics Designs Incorporated</b> 780 Landmark Road Willow Springs, NC 27611
	<b>Fluvial Solutions Incorporated</b> P.O. Box 28749 Raleigh, NC 27611
<b>Planting Contractor</b>	<b>Bruton Natural Systems, Inc.</b> 150 Old Black Creek Rd Freemont, NC 27830
<b>Seeding Contractor</b>	<b>Land Mechanics Designs Incorporated</b>
	<b>Fluvial Solutions Incorporated</b>
<b>Seed Mix Sources</b>	<b>Green Resource, LLC</b> 5204 Highgreen Court Colfax, NC 27235
	<b>ACF Environmental</b> 3313 Durham Drive Raleigh, NC 27603
<b>Nursery Stock Suppliers</b> <b>Bare Roots</b>  <b>Live Stakes</b>  <b>Herbaceous Plugs</b>	<b>Dykes &amp; Son Nursery</b> 825 Maude Etter Rd. McMinnville, TN 37110
	<b>Foggy Mountain Nursery</b> 797 Helton Creek Road Lansing, NC 28643
	<b>Bruton Natural Systems, Inc.</b> <b>Wetland Plants Incorporated</b> 812 Drummonds Point Road Edenton, NC 27932
<b>Monitoring Performers</b>	<b>Wildlands Engineering, Inc.</b>
Monitoring, POC	Ruby Davis 704.332.7754, ext. 119

**Table 4. Project Information and Attributes**

Big Harris Creek Mitigation Site  
 DMS Project No. 739  
 Monitoring Year 0 - 2018

**AREA A**

Project Information																				
Project Name	Big Harris Creek Mitigation Site																			
County	Cleveland County																			
Project Area (acres)	145																			
Project Coordinates (latitude and longitude)	34° 24' 32.70"N, 81° 36' 41.55"W																			
Project Watershed Summary Information																				
Physiographic Province	Piedmont Physiographic Province																			
River Basin	Broad																			
Temperature Regime	Warm																			
USGS Hydrologic Unit 8-digit	03050105																			
USGS Hydrologic Unit 14-digit	03050105080060																			
DWR Sub-basin	03-08-04																			
Project Drainage Area (acres)	2,509																			
Project Drainage Area Percentage of Impervious Area	<10%																			
CGIA Land Use Classification	Pasture (46%); Deciduous Forest (22%); Evergreen Forest (14%); Developed (10%); Herbaceous (2%); Shrub/Scrub (2%); Cultivated Crops (2%); Mixed Forest (1%); and Woody Wetlands (1%)																			
Reach Summary Information																				
Parameters	Area A																			
	Carroll Creek	Cornwell Creek	Cornwell Creek UT1	Eaker Creek	LSEC	Royster Creek		Sciam Creek	Scott Creek	UBHC						UBHC UT1	UBHC UT2	UBHC UT3	UBHC UT4	
		R 1 & 2		R1	R1	R1	R2				R1	R2a	R2b	R3	R4	R5	R6			
Length of reach (linear feet) - Post-Restoration	595	2,451	78	134	1,389	459	3,170	1,189	662	2,556	934		870	1,039	845	2,258	84	97	105	84
Drainage area (acres)	203	211		27	943	149		40	42	1,969										
NCDWR stream identification score	38	-	30	31.5/20.5	-	22.5	32	34/22.5	28.5	25 (I only)	-	-	-	-	-	-	-	-	-	24
NCDWR Water Quality Classification	WS-IV	WS-IV	WS-IV	WS-IV	WS-IV	WS-IV	WS-IV	WS-IV	WS-IV	WS-IV	WS-IV	WS-IV	WS-IV	WS-IV	WS-IV	WS-IV	WS-IV	WS-IV	WS-IV	WS-IV
Morphological Description (stream type)	P	P	P	P/I	P	I	P	P/I	I	P/I	P	P	P	P	P	P	P	P	I	I
Evolutionary trend (Simon's Model) - Pre- Restoration	IV/V	VI		IIIa	V	III/IV	V/VI	III, IV, V	III	III	III	IV	IV	III	III	III	III	III	III	III
Underlying mapped soils	Pacolet-Saw complex (PtD)	Chewacla loam (ChA)		Pacolet-Bethlehem complex (PbC2)	Toccoa loam (ToA)	Chewacla loam (ChA)		Pacolet-Saw complex (PtD)		Chewacla loam (ChA)										
Drainage class	Well drained	Somewhat poorly drained		Well drained	Well drained and moderately well drained	Somewhat poorly drained		Well drained		Somewhat poorly drained										
Soil hydric status	No	Yes		No	No	Yes		No		Yes										
Slope	15-25%	0-2%		8-15%	0-2%	0-2%		15-25%		0-2%										
FEMA classification	LBHC Reaches 1a, 1b, and 2 are a mapped Zone AE floodplain with defined base flood elevations.																			
Native vegetation community	Piedmont Alluvial Forest, Mesic Mixed Hardwood Forest, and Timber Forest (applies to UBHC - Reach 1, Reach 2, UT1, UT2, UT3 only)																			
Percent composition exotic invasive vegetation -Post-Restoration	0%																			

**Table 4. Project Information and Attributes**

Big Harris Creek Mitigation Site

DMS Project No. 739

Monitoring Year 0 - 2018

**AREA A**

Regulatory Considerations			
Regulation	Applicable?	Resolved?	Supporting Documentation
Waters of the United States - Section 404	Yes	Yes	USACE Nationwide Permit No.27 and DWQ 401 Water Quality Certification No. 4087. USACE Action ID #SAW-2009-0045
Waters of the United States - Section 401	Yes	Yes	
Division of Land Quality (Erosion and Sediment Control)	Yes	Yes	NPDES Construction Stormwater General Permit NCG010000
Endangered Species Act	Yes	Yes	Big Harris Creek Mitigation Plan; Wildlands determined "no effect" on Cleveland County listed endangered species. USFWS indicates project will have no impact on possible endangered plants and the possibility of incidental take of the northern long-eared bat is exempt under the 4(d) rule at this location (email correspondence from 12/18/2008 and 05/09/2016).
Historic Preservation Act	Yes	Yes	No historic resources were found to be impacted (letter from SHPO dated 6/25/2008).
Coastal Zone Management Act (CZMA)/Coastal Area Management Act (CAMA)	No	N/A	N/A
FEMA Floodplain Compliance	Yes	Yes	LBHC Reaches 1a, 1b, and 2 are a mapped Zone AE floodplain with defined base flood elevations. (FEMA Zone AE, FIRM panels 2620 and 2621). Cleveland County Floodplain Development Permit #153715.
Essential Fisheries Habitat	No	N/A	N/A

**Table 4. Project Information and Attributes**

Big Harris Creek Mitigation Site

DMS Project No. 739

Monitoring Year 0 - 2018

**AREA B**

Project Information																					
Project Name	Big Harris Creek Mitigation Site																				
County	Cleveland County																				
Project Area (acres)	145.00																				
Project Coordinates (latitude and longitude)	34° 24' 32.70"N, 81° 36' 41.55"W																				
Project Watershed Summary Information																					
Physiographic Province	Piedmont Physiographic Province																				
River Basin	Broad																				
Temperature Regime	Warm																				
USGS Hydrologic Unit 8-digit	03050105																				
USGS Hydrologic Unit 14-digit	03050105080060																				
DWR Sub-basin	03-08-04																				
Project Drainage Area (acres)	2509																				
Project Drainage Area Percentage of Impervious Area	<10%																				
CGIA Land Use Classification	Pasture (46%); Deciduous Forest (22%); Evergreen Forest (14%); Developed (10%); Herbaceous (2%); Shrub/Scrub (2%); Cultivated Crops (2%); Mixed Forest (1%); and Woody Wetlands (1%)																				
Reach Summary Information																					
Parameters	Area B																				
	Elliott Creek		Elliott Creek UT1		Bridges Creek		Bridges Creek UT1		LFC		USEC						USEC UT1	USEC UT2	USEC UT3	UFC	
	R1		R1	R2			R1	R2	R1	R2	R3	R4a	R4b	R5	R6				R1	R2	
Length of reach (linear feet) - Post-Restoration	1,121	141	376	317	55	574	427	409	781	1,204	397	113	1,507	1,069	72	154	118	1,571	1,407		
Drainage area (acres)	82		38		266		487						185								
NCDWR stream identification score	33.5	33.5	33/25.5	-	24	38	-	33.5	-	-	-	-	-	-	25.5	33	25.5	-	-		
NCDWR Water Quality Classification	WS-IV	WS-IV	WS-IV	WS-IV	WS-IV	WS-IV	WS-IV	WS-IV	WS-IV	WS-IV	WS-IV	WS-IV	WS-IV	WS-IV	WS-IV	WS-IV	WS-IV	WS-IV	WS-IV		
Morphological Description (stream type)	P	P	P/I	P	I	P	P	P	P	P	P	P	P	P	P	I	P	I	P	P	
Evolutionary trend (Simon's Model) - Pre- Restoration	IV/V	III	III/IV/V/VI			IV/V	III/IV	III/IV	IV/V	V	III/V/VI	IV	IV/V	-	-	-		VI			
Underlying mapped soils	Chewacla loam (ChA)		Pacolet sandy clay loam (PaC2)		Chewacla loam (ChA)																
Drainage class	Somewhat poorly drained		Well drained		Somewhat poorly drained																
Soil hydric status	Yes		No		Yes																
Slope	0-2%		8-15%		0-2%																
FEMA classification	no regulated floodplain																				
Native vegetation community	Piedmont Alluvial Forest and Mesic Mixed Hardwood Forest																				
Percent composition exotic invasive vegetation -Post-Restoration	0%																				



**Table 4. Project Information and Attributes**

Big Harris Creek Mitigation Site

DMS Project No. 739

Monitoring Year 0 - 2018

**AREA B**

Regulatory Considerations			
Regulation	Applicable?	Resolved?	Supporting Documentation
Waters of the United States - Section 404	Yes	Yes	USACE Nationwide Permit No.27 and DWQ 401 Water Quality Certification No. 4087. USACE Action ID #SAW-2009-0045
Waters of the United States - Section 401	Yes	Yes	
Division of Land Quality (Erosion and Sediment Control)	Yes	Yes	NPDES Construction Stormwater General Permit NCG010000
Endangered Species Act	Yes	Yes	Big Harris Creek Mitigation Plan; Wildlands determined "no effect" on Cleveland County listed endangered species. USFWS indicates project will have no impact on possible endangered plants and the possibility of incidental take of the northern long-eared bat is exempt under the 4(d) rule at this location (email correspondence from 12/18/2008 and 05/09/2016).
Historic Preservation Act	Yes	Yes	No historic resources were found to be impacted (letter from SHPO dated 6/25/2008).
Coastal Zone Management Act (CZMA)/Coastal Area Management Act (CAMA)	No	N/A	N/A
FEMA Floodplain Compliance	Yes	Yes	LBHC Reaches 1a, 1b, and 2 are a mapped Zone AE floodplain with defined base flood elevations. (FEMA Zone AE, FIRM panels 2620 and 2621). Cleveland County Floodplain Development Permit #153715.
Essential Fisheries Habitat	No	N/A	N/A

**Table 4. Project Information and Attributes**

Big Harris Creek Mitigation Site

DMS Project No. 739

Monitoring Year 0 - 2018

**AREA C**

Project Information								
Project Name	Big Harris Creek Mitigation Site							
County	Cleveland County							
Project Area (acres)	145.00							
Project Coordinates (latitude and longitude)	34° 24' 32.70"N, 81° 36' 41.55"W							
Project Watershed Summary Information								
Physiographic Province	Piedmont Physiographic Province							
River Basin	Broad							
Temperature Regime	Warm							
USGS Hydrologic Unit 8-digit	03050105							
USGS Hydrologic Unit 14-digit	03050105080060							
DWR Sub-basin	03-08-04							
Project Drainage Area (acres)	2509							
Project Drainage Area Percentage of Impervious Area	<10%							
CGIA Land Use Classification	Pasture (46%); Deciduous Forest (22%); Evergreen Forest (14%); Developed (10%); Herbaceous (2%); Shrub/Scrub (2%); Cultivated Crops (2%); Mixed Forest							
Reach Summary Information								
Parameters	Area C							
	LBHC				LBHC UT1	LBHC UT2	LBHC UT3	LBHC UT4
	R1a	R1b	R2	R3				
Length of reach (linear feet) - Post-Restoration	500	320	967	414	228	440	118	362
Drainage area (acres)	2,509							
NCDWR stream identification score	-	-	-	-	-	35.5	32	35.5
NCDWR Water Quality Classification	WS-IV	WS-IV	WS-IV	WS-IV	WS-IV	WS-IV	WS-IV	WS-IV
Morphological Description (stream type)	P	P	P	P	P	P	P	P
Evolutionary trend (Simon's Model) - Pre- Restoration	IV/V						VI	
Underlying mapped soils	Toccoa loam (ToA)							
Drainage class	Well drained and moderately well drained							
Soil hydric status	No							
Slope	0-2%							
FEMA classification	Zone AE				no regulated floodplain			
Native vegetation community	Piedmont Alluvial Forest and Mesic Mixed Hardwood Forest							
Percent composition exotic invasive vegetation -Post-Restoration	0%							

**Table 4. Project Information and Attributes**

Big Harris Creek Mitigation Site

DMS Project No. 739

Monitoring Year 0 - 2018

**AREA C**

Regulatory Considerations			
Regulation	Applicable?	Resolved?	Supporting Documentation
Waters of the United States - Section 404	Yes	Yes	USACE Nationwide Permit No.27 and DWQ 401 Water Quality Certification No. 4087. USACE Action ID #SAW-2009-0045.
Waters of the United States - Section 401	Yes	Yes	
Division of Land Quality (Erosion and Sediment Control)	Yes	Yes	NPDES Construction Stormwater General Permit NCG010000
Endangered Species Act	Yes	Yes	Big Harris Creek Mitigation Plan; Wildlands determined "no effect" on Cleveland County listed endangered species. USFWS indicates project will have no impact on possible endangered plants and the possibility of incidental take of the northern long-eared bat is exempt under the 4(d) rule at this location (email correspondence from 12/18/2008 and 05/09/2016).
Historic Preservation Act	Yes	Yes	No historic resources were found to be impacted (letter from SHPO dated 6/25/2008).
Coastal Zone Management Act (CZMA)/Coastal Area Management Act (CAMA)	No	N/A	N/A
FEMA Floodplain Compliance	Yes	Yes	LBHC Reaches 1a, 1b, and 2 are a mapped Zone AE floodplain with defined base flood elevations. (FEMA Zone AE, FIRM panels 2620 and 2621). Cleveland County Floodplain Development Permit #153715.
Essential Fisheries Habitat	No	N/A	N/A

**Table 5. Monitoring Component Summary**

Big Harris Creek Mitigation Site

DMS Project No. 739

Monitoring Year 0 - 2018

**Area A - Restoration and Enhancement I Reaches**

Parameter	Monitoring Feature	Quantity / Length by Reach						Frequency	Notes
		Carroll Creek	Royster Creek R1	Scott Creek	UBHC R2	UBHC R4	Eaker Creek		
Dimension	Riffle Cross-Section	1	1	1	2	2	N/A	Annual	
	Pool Cross-Section	1	1	1	2	2	N/A		
Pattern	Pattern	N/A	N/A	N/A	N/A	N/A	N/A	N/A	1
Profile	Longitudinal Profile	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
Substrate	Reach Wide (RW) / Riffle (RF) 100 Pebble Count	1 RW, 1 RF	1 RW, 1 RF	1 RW, 1 RF	1 RW, 2RF	1 RW, 2RF	N/A	Annual	
Hydrology	Crest Gage/Transducer	1	1	1	1		N/A	Quarterly	2
Vegetation	CVS Level 2	16					N/A	Annual	3
Water Quality	4 baseflow, 4 stormflow grab samples	up to 10 locations throughout project areas A, B, & C and 1 reference location					N/A	Years 3, 4, and 5	
Benthic Macroinvertebrates	NCDWR Qual 4						N/A	Years 3, 4, and 5	
Fisheries	NCDWR SOP						N/A	Year 5	
Exotic and Nuisance Vegetation								Semi-Annual	4
Project Boundary								Semi-Annual	5
Reference Photos	Photographs	18						Annual	

Notes:

1. Pattern and profile will be assessed visually during semi-annual site visits. Longitudinal profile will be collected during as-built baseline monitoring survey only, unless observations indicate lack of stability and profile survey is warranted in additional years.
2. Crest gages and/or transducers will be inspected quarterly or semi-annually, evidence of bankfull events will be documented with a photo when possible. Transducers will be set to record stage once every hour. Device will be inspected and downloaded semi-annually. In addition, Scott Creek and Royster Creek Reach 1 will be monitored for baseflow presence (minimum of 30 consecutive days).
3. The total number of vegetation monitoring plots represents 2% of the open planted area. This is a reduction from the number of vegetation plots proposed in the Mitigation Plan, which was based on 2% of the entire planted area that included supplemental planting areas. IRT and DMS approved of this change in January 2018.
4. Locations of exotic and nuisance vegetation will be mapped
5. Locations of vegetation damage, boundary encroachments, etc. will be mapped

**Table 5. Monitoring Component Summary**

Big Harris Creek Mitigation Site

DMS Project No. 739

Monitoring Year 0 - 2018

**Area A - Enhancement II Reaches**

Parameter	Monitoring Feature	Quantity / Length by Reach										Frequency	Notes
		Cornwell Creek	Cornwell Creek UT1	LSEC	Royster Creek R2	Scism Creek	UBHC R1	UBHC R3	UBHC R5	UBHC R6	UBHC UT1 & UT2		
Dimension	Riffle Cross-Section	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Annual	
	Pool Cross-Section	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A		
Pattern	Pattern	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Annual	
Profile	Longitudinal Profile	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Annual	
Substrate	Reach Wide (RW) / Riffle (RF) 100 Pebble Count	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Annual	
Hydrology	Crest Gage/Transducer	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Quarterly	
Vegetation	CVS Level 2	18										Annual	1
Exotic and Nuisance Vegetation												Semi-Annual	2
Project Boundary												Semi-Annual	3
Reference Photos	Photographs	38										Annual	4

Notes:

1. The total number of vegetation monitoring plots represents 2% of the open planted area. This is a reduction from the number of vegetation plots proposed in the Mitigation Plan, which was based on 2% of the entire planted area that included supplemental planting areas. IRT and DMS approved of this change in January 2018.
2. Locations of exotic and nuisance vegetation will be mapped.
3. Locations of vegetation damage, boundary encroachments, etc. will be mapped.
4. Photographs will be taken along preservation reaches not noted above on each reach (3 photographs total).

**Table 5. Monitoring Component Summary**

Big Harris Creek Mitigation Site

DMS Project No. 739

Monitoring Year 0 - 2018

**Area B - Restoration and Enhancement I Reaches**

Parameter	Monitoring Feature	Quantity / Length by Reach												Frequency	Notes
		Elliott Creek	Elliott Creek UT1	Bridges Creek R1	Bridges Creek UT1	LFC R1	LFC R2	Upper Stick Elliott Creek R1	USEC R5	USEC R6	USEC UT2	USEC UT3	UFC R2		
Dimension	Rifle Cross-Section	2	1	1	N/A	1	1	1	3	2	1	1	3	Annual	
	Pool Cross-Section	1	0	0	N/A	1	1	0	2	1	0	0	3		
Pattern	Pattern	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Annual	1
Profile	Longitudinal Profile	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Annual	
Substrate	Reach Wide (RW) / Rifle (RF) 100 Pebble Count	1 RW, 2 RF	1 RW, 1 RF	1 RW, 1 RF	N/A	1 RW, 1 RF	1 RW, 1 RF	1 RW, 1 RF	1 RW, 3 RF	1 RW, 2 RF	1 RW, 1 RF	1 RW, 1 RF	1 RW, 3RF	Annual	
Hydrology	Crest Gage/Transducer	1	1	1	N/A	1	1	1	1	1	1	1	1	Quarterly	2
Vegetation	CVS Level 2	13												Annual	3
Water Quality	4 baseflow, 4 stormflow grab samples	up to 10 locations throughout project areas A, B, & C and 1 reference location												Years 3, 4, and 5	
Benthic Macroinvertebrates	NCDWR Qual 4													Years 3, 4, and 5	
Fisheries	NCDWR SOP													Year 5	
Exotic and Nuisance Vegetation														Semi-Annual	4
Project Boundary														Semi-Annual	5
Reference Photos	Photographs	27												Annual	

Notes:

1. Pattern and profile will be assessed visually during semi-annual site visits. Longitudinal profile will be collected during as-built baseline monitoring survey only, unless observations indicate lack of stability and profile survey is warranted in additional years.
2. Crest gages and/or transducers will be inspected quarterly or semi-annually, evidence of bankfull events will be documented with a photo when possible. Transducers will be set to record stage once every hour. Device will be inspected and downloaded semi-annually. In addition, Bridges Creek will be monitored for baseflow presence (minimum of 30 consecutive days).
3. The total number of vegetation monitoring plots represents 2% of the open planted area. This is a reduction from the number of vegetation plots proposed in the Mitigation Plan, which was based on 2% of the entire planted area that included supplemental planting areas. IRT and DMS approved of this change in January 2018.
4. Locations of exotic and nuisance vegetation will be mapped
5. Locations of vegetation damage, boundary encroachments, etc. will be mapped

**Table 5. Monitoring Component Summary**

Big Harris Creek Mitigation Site  
 DMS Project No. 739  
 Monitoring Year 0 - 2018

**Area B - Enhancement II Reaches**

Parameter	Monitoring Feature	Quantity / Length by Reach						Frequency	Notes
		Bridges Creek R2	USEC R2	USEC R3	USEC R4a/4b	USEC UT1	UFC R1		
Dimension	Riffle Cross-Section	N/A	N/A	N/A	N/A	N/A	N/A	Annual	
	Pool Cross-Section	N/A	N/A	N/A	N/A	N/A	N/A		
Pattern	Pattern	N/A	N/A	N/A	N/A	N/A	N/A	Annual	
Profile	Longitudinal Profile	N/A	N/A	N/A	N/A	N/A	N/A	Annual	
Substrate	Reach Wide (RW) / Riffle (RF) 100 Pebble Count	N/A	N/A	N/A	N/A	N/A	N/A	Annual	
Hydrology	Crest Gage/Transducer	N/A	N/A	N/A	N/A	N/A	N/A	Quarterly	
Vegetation	CVS Level 2	5						Annual	1
Exotic and Nuisance Vegetation								Semi-Annual	2
Project Boundary								Semi-Annual	3
Reference Photos	Photographs	12						Annual	

Notes:

1. The total number of vegetation monitoring plots represents 2% of the open planted area. This is a reduction from the number of vegetation plots proposed in the Mitigation Plan, which was based on 2% of the entire planted area that included supplemental planting areas. IRT and DMS approved of this change in January 2018.
2. Locations of exotic and nuisance vegetation will be mapped
3. Locations of vegetation damage, boundary encroachments, etc. will be mapped.

**Table 5. Monitoring Component Summary**

Big Harris Creek Mitigation Site  
 DMS Project No. 739  
 Monitoring Year 0 - 2018

**Area C - Restoration, Enhancement I, and II Reaches**

Parameter	Monitoring Feature	Quantity / Length by Reach				Frequency	Notes
		LBHC Reach 1a	LBHC Reaches 1b & 2	LBHC UT1	LBHC UT2		
Dimension	Riffle Cross-Section	1	1	N/A	N/A	Annual	
	Pool Cross-Section	1	1	N/A	N/A		
Pattern	Pattern	N/A	N/A	N/A	N/A	Annual	1
Profile	Longitudinal Profile	N/A	N/A	N/A	N/A	Annual	
Substrate	Reach Wide (RW) / Riffle (RF) 100 Pebble Count	1 RW, 1 RF	1 RW, 1 RF	N/A	N/A	Annual	
Hydrology	Crest Gage/Transducer	1	1	N/A	N/A	Quarterly	2
Vegetation	CVS Level 2	4				Annual	3
Water Quality	4 baseflow, 4 stormflow grab samples	up to 10 locations throughout project areas A, B, & C and 1 reference location				Years 3, 4, and 5	
Benthic Macroinvertebrates	NCDWR Qual 4					Years 3, 4, and 5	
Fisheries	NCDWR SOP					Year 5	
Exotic and Nuisance Vegetation						Semi-Annual	4
Project Boundary						Semi-Annual	5
Reference Photos	Photographs	12				Annual	6

Notes:

1. Pattern and profile will be assessed visually during semi-annual site visits. Longitudinal profile will be collected during as-built baseline monitoring survey only unless observations indicate lack of stability and profile survey is warranted in additional years.
2. Crest gages and/or transducers will be inspected quarterly or semi-annually, evidence of bankfull events will be documented with a photo when possible. Transducers will be set to record stage once every hour. Device will be inspected and downloaded semi-annually.
3. The total number of vegetation monitoring plots represents 2% of the open planted area. This is a reduction from the number of vegetation plots proposed in the Mitigation Plan, which was based on 2% of the entire planted area that included supplemental planting areas. IRT and DMS approved of this change in January 2018.
4. Locations of exotic and nuisance vegetation will be mapped
5. Locations of vegetation damage, boundary encroachments, etc. will be mapped
6. Photographs will be taken along preservation reaches not noted above on each reach (2 photographs total)



## **APPENDIX 2. Morphological Summary Data and Plots**

Table 6. Baseline Stream Data Summary

Area A  
 Big Harris Creek Mitigation Site  
 DMS Project No. 739  
 Monitoring Year 0 - 2018

Parameter	Gage	Pre-Restoration Condition														Design										As-Built/Baseline																					
		Carroll Creek Reach 1		Eaker Creek Reach 1		Royster Creek Reach 1		Scott Creek		UBHC Reach 2A		UBHC Reach 2B		UBHC Reach 4		Carroll Creek Reach 1		Royster Creek Reach 1		Scott Creek		UBHC Reach 2A		UBHC Reach 2B		UBHC Reach 4		Carroll Creek Reach 1		Eaker Creek Reach 1		Royster Creek Reach 1		Scott Creek		UBHC Reach 2A		UBHC Reach 2B		UBHC Reach 4							
		Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max								
<b>Dimension and Substrate - Riffle</b>																																															
Bankfull Width (ft)		9.4	10.8	3.5	3.6	3.6	6.1	4.4	10.3	7.0	8.2	11.3	12.0	18.7	26.8	10.40	8.30	6.50	10.20	12.80	13.80	11.4	N/A	10.0	6.8	16.0	11.3	15.5	16.0																		
Floodprone Width (ft)		13.1	14.2	6.7	7.1	6.0	7.0	5.2	12.4	9.5	10.0	15.5	16.5	22.0	34.6	---	---	---	---	---	---	82.0	N/A	46.7	67.1	108.7	170.3	118.0	190.0																		
Bankfull Mean Depth		0.9	1.4	0.5	0.5	0.6		0.3	0.6	0.7	0.8	0.9	1.0	0.8	1.1	0.8	0.6	0.5	0.8	1.0	1.0	0.7	N/A	0.4	0.5	0.7	1.6	0.8	1.1																		
Bankfull Max Depth		1.0	1.8	1.0	1.1	0.8	1.4	0.8	0.9	0.8	1.0	1.3	1.7	1.3	1.7	1.2	1.0	0.7	1.2	1.5	1.6	1.3	N/A	0.8	0.9	1.5	3.0	1.4	2.0																		
Bankfull Cross-sectional Area (ft <sup>2</sup> )	N/A	11.4		1.9		3.7		2.9		5.6		11.3		20.4		8.2	5.3	3.1	7.9	12.5	14.4	7.9	N/A	3.6	3.6	11.6	17.7	13.1	17.6																		
Width/Depth Ratio		6.6	12.5	6.6	6.9	6.1	10.2	7.4	30.8	9.1	11.5	11.4	12.7	17.6	30.3	13.2	13.0	13.6	13.2	13.1	13.2	16.4	N/A	27.6	12.7	22.0	7.3	14.5	18.3																		
Entrenchment Ratio		1.2	1.5	1.9	2.0	1.2	1.5	1.2	1.4	1.2	1.4	1.3	1.5	1.1	1.8	2.2+	2.2+	1.4	2.2	2.2+	2.2+	2.2+	7.2	N/A	4.7	9.9	6.8	15.0	7.6	11.9																	
Bank Height Ratio		3.4	5.0	3.1	3.5	6.6	7.3	3.8	10.6	3.1	4.6	3.4	4.4	1.6	2.9	1.0	1.2	1.0	1.2	1.0	1.2	1.0	1.2	N/A	1.0	1.0	1.0	1.0	1.0	1.0																	
D <sub>50</sub> (mm)		---	---	---	---	---	---	---	---	---	---	---	---	---	---	N/A	N/A	N/A	N/A	N/A	N/A	51.00	N/A	43.50	51.60	44.20	83.80	46.20	85.60																		
<b>Profile</b>																																															
Riffle Length (ft)																						14	65	10	19	7	42	22	47	11	40	8	39	19	56												
Riffle Slope (ft/ft)																						0.0084	0.0359	0.0093	0.0406	0.0068	0.0569	0.0164	0.0416	0.0006	0.0515	0.0215	0.0627	0.0119	0.0521												
Pool Length (ft)																						18	50	4	13	7	71	6	138	10	59	10	47	33	73												
Pool Max Depth (ft)	N/A	---	---	---	---			0.9	1.2	2.2	2.2	1.9	1.9	2.9	3.2	1.3	2.4	1.1	2.0	1.0	1.7	1.2	2.3	1.5	2.9	1.6	3.1	1.9	2.8	1.3	2.1	1.6	2.5	1.9	5.2	1.9	3.3	2.6	3.4	2.4	3.8						
Pool Spacing (ft)																						45	67	20	22	38	70	17	69	29	75	21	62	62	125												
Pool Volume (ft <sup>3</sup> )																																															
<b>Pattern</b>																																															
Channel Beltwidth (ft)		---	---	---	---	---	---	---	---	---	---	---	---	---	---	31	47	25	37	7	26	26	51	28	64	41	69	26	45	N/A	9	18	25	45	13	31	20	35	19	67							
Radius of Curvature (ft)		---	---	---	---	---	---	---	---	---	---	---	---	---	---	19	47	15	37	16	29	18	41	23	51	25	62	15	29	46	62	21	41	11	28	18	26	30	34	27	60						
Rc:Bankfull Width (ft/ft)	N/A	---	---	---	---	---	---	---	---	---	---	---	---	---	---	1.8	4.5	1.8	4.5	2.5	4.5	1.8	4.0	1.8	4.0	1.8	4.5	1.3	2.5	N/A	2.1	4.1	1.6	4.1	1.1	1.6	2.7	3.0	1.7	3.8							
Meander Length (ft)		---	---	---	---	---	---	---	---	---	---	---	---	---	---	31	104	25	83	20	52	36	97	45	122	48	193	89	139	N/A	95	125	30	59	74	102	108	125	122	178							
Meander Width Ratio		---	---	---	---	---	---	---	---	---	---	---	---	---	---	3.0	4.5	3.0	4.5	3.0	8.0	3.5	9.5	3.5	9.5	3.5	14.0	2.2	3.9	N/A	0.9	1.8	3.7	6.6	0.8	1.9	1.8	3.1	1.2	4.2							
<b>Additional Reach Parameters</b>																																															
Drainage Area (SM)		0.32		0.04		0.23		0.07		0.36		0.74		0.83		0.32		0.23		0.07		0.36		0.74		0.83		0.32		0.04		0.23		0.07		0.36		0.74		0.83							
Watershed Impervious Cover Estimate (%)		<10%																																													
Rosgen Classification		E4-G4c		A4		B4		A4		G4c		F4		F4		C4		B4		B4a		C4		C4		C4		C4		N/A		B/C4		B/C4		C4		C4									
Bankfull Velocity (fps)		5.4		4.9		3.8		4.5		4.1		4.4		3.7		3.9		4.4		3.9		4.2		4.2		3.8		3.8		N/A		4.0		4.6		3.5		5.4		3.6		4.5					
Bankfull Discharge (cfs)		30		9.5		14		9		32		47		53		32		23		12		33		53		55		30.3		N/A		14.5		16.5		41.2		94.9		47.2		78.4					
Q-NFF regression (2-yr)		---																																													
Q-USGS extrapolation (1.2-yr)		18.0		---		26.0		6.6		24.8		44.0		51.0																																	
Q-Mannings		---																																													
Valley Slope (ft/ft)		0.0150		N/A		0.0325		0.0444		0.0152		0.0163		0.0129		0.0150		0.0325		0.0444		0.0152		0.0163		0.0129		0.0150		N/A		0.0325		0.0444		0.0152		0.0163		0.0129							
Channel Thalweg Length (ft)		553		135		438		630		990		1203		1903		595		459		662		934		1039		590		135		459		644		930		1296											
Sinuosity		1.16		1.01		1.01		1.08		1.22		1.22		1.28		1.15		1.10		1.05		1.10		1.18		1.15		1.10		1.2		N/A		1.1		1.1		1.1		1.4							
Bankfull/Channel Slope (ft/ft)		0.0180		0.0482		0.0153		0.0405		0.0163		0.0186		0.0118		0.0131		0.0295		0.0411		0.0130		0.0140		0.0105		0.0171		0.0555		0.0395		0.0382		0.0146		0.0126									

SC: Silt/Clay <0.062 mm diameter particles  
 (---): Data was not provided  
 N/A: Not Applicable

Table 6. Baseline Stream Data Summary  
Area B - Pre-Restoration Condition  
Big Harris Creek Mitigation Site  
DMS Project No. 739  
Monitoring Year 0 - 2018

Area B		Pre-Restoration Condition																								
Parameter	Gage	Elliott Creek Reach 1		Elliott Creek UT1		Bridges Creek Reach 1		UT1 to Bridges Creek		Lower Fletcher Creek Reach 1		Lower Fletcher Creek Reach 2		Upper Stick Elliott Creek Reach 1		Upper Stick Elliott Creek Reach 5		Upper Stick Elliott Creek Reach 6		Upper Stick Elliott Creek UT2		Upper Stick Elliott Creek UT3		Upper Fletcher Creek Reach 2		
		Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	
<b>Dimension and Substrate - Shallow</b>																										
Bankfull Width (ft)	N/A	7.7		3.4		2.9	5.3		3.4		16.4		9.2		4.9		15.2	15.7	24.7		4.4		4.2		9.2	
Floodprone Width (ft)		18.0		6.0		6.0	17.0		4.0		21.0		11.0		6.0		14.0	19.0	58.0		7.0		5.0		19.0	
Bankfull Mean Depth		0.5		0.4		0.4	1.0		0.2		0.8		1.0		0.4		1.2	0.7	1.2		0.7		0.8		1.1	
Bankfull Max Depth		0.9		0.2		0.7	1.2		0.3		1.1		1.3		0.6		1.7	1.5	1.7		0.9		1.1		1.7	
Bankfull Cross-sectional Area (ft <sup>2</sup> )		4.0		3.9		3.8			0.6		12.4		9.1		1.9		18.4	18.4			2.9		3.6		10.3	
Width/Depth Ratio		14.9		26.3		3.0	9.8		18.6		21.6		9.2		12.3		12.6	13.5	34.4		6.8		5.0		8.3	
Entrenchment Ratio		2.3		1.1		2.2	4.7		1.2		1.3		1.2		1.3		1.5	1.2	2.3		1.6		1.3		2.0	
Bank Height Ratio		1.9		17.3		1.9	2.3		6.2		5.1		2.3		20.7		1.7	1.4	3.5		4.0		4.1		3.2	
D <sub>50</sub> (mm)		---		---		---		---		---		---		---		---		---		---		---		---		---
<b>Profile</b>																										
Riffle Length (ft)	N/A	0.0179		0.0250		0.0208		0.0812		0.0204		0.0198		0.0320		0.0150		0.0175		0.0200		---		0.0270	0.0458	
Riffle Slope (ft/ft)																										
Pool Length (ft)																										
Pool Max Depth (ft)		1.0	1.4	0.5	0.5	1.2	1.5	0.5	0.5	1.1	1.4	1.3	1.7	1.3	2.0	1.7	2.1	0.8	1.0	1.0	1.2	1.3	1.4	2.2		
Pool Spacing (ft)		15.0	100.0	22.5	27.9	22.1	51.2	3.8	4.1	65.0	80.0	6.0	80.0	14.1	68.1	15.0	90.0	15.0	90.0	29.5	49.3	21.5	21.5	77.0	259.0	
Pool Volume (ft <sup>3</sup> )																										
<b>Pattern</b>																										
Channel Beltwidth (ft)	N/A	3	40	4	20	11	26	9	13	21	43	39	43	4	37	21	97	20	49	7	38	17	17	48	143	
Radius of Curvature (ft)		7	74	5	23	6	25	6	25	53	98	100	130	2	23	11	76	15	69	12	26	21	33	10	90	
Rc:Bankfull Width (ft/ft)		0.9	9.6	1.4	6.9	2.0	4.8	1.7	7.5	3.2	6.0	10.9	14.1	0.5	4.6	0.8	5.0	0.9	2.8	2.8	6.0	5.0	7.9	1.1	9.8	
Meander Length (ft)		54	166	45	56	44	102	44	102	249	336	318	336	28	136	72	134	142	304	59	99	43	43	200	295	
Meander Width Ratio		0.3	5.1	0.7	3.6	3.8	8.9	3.8	8.9	4.2	4.7	4.2	4.7	5.8	27.8	1.4	6.4	0.8	2.0	1.5	8.7	4.0	4.0	5.2	15.5	
<b>Substrate, Bed and Transport Parameters</b>																										
Ri%/Ru%/P%/G%/S%	N/A																									
SC%/Sa%/G%/C%/B%/Be%																										
d16/d35/d50/d84/d95/d100		---																					---			
Reach Shear Stress (Competency) lb/ft <sup>2</sup>		---																					---			
Max part size (mm) mobilized at bankfull																										
Stream Power (Capacity) W/m <sup>2</sup>																										
<b>Additional Reach Parameters</b>																										
Drainage Area (SM)	N/A	0.13		0.02		0.07		0.01		0.41		0.42		0.05		0.72		0.76		0.07		0.10		0.42		
Watershed Impervious Cover Estimate (%)		<10%																								
Rosgen Classification		Incised C5	F4	Incised E4	F5b	F4	F4	F4	F4	F4	F4	F4	F4	F4	F4	F4	B4c	Incised C4 / F4	G4	G4	G4	G4	G4	F4		
Bankfull Velocity (fps)		4.2		5.2		3.8		3.9		4.8		4.1		4.8		2.8		2.9		4.2		4.2		3.6		
Bankfull Discharge (cfs)		17		3		12		3		35		37		9		52		54		12		15		21		
Q-NFF regression (2-yr)		---		---		---		---		---		---		---		---		---		---		---		---		
Q-USGS extrapolation (1.2-yr)		11		2		7		1		144		162		---		43		45		7		9		21		
Q-Mannings		15		9		12		2.4		46		44		---		73		53		11		20		40	60	
Valley Slope (ft/ft)		0.0179		0.0135		0.0208		0.0812		0.0125		0.0198		0.0638		0.0143		0.0087		0.0208		0.0353		0.0160		
Channel Thalweg Length (ft)		1,389		141		445		58		574		467		352		1,909		1,036		56		107		1,465		
Sinuosity	1.30		1.17		1.06		1.16		1.10		1.03		1.04		1.53		1.09		1.22		1.22		1.23			
Bankfull/Channel Slope (ft/ft)	0.0138		0.0113		0.0196		0.0700		0.0113		0.0192		0.0613		0.0093		0.0080		0.0200		0.0289		0.0130			

SC: Silt/Clay <0.062 mm diameter particles  
(---): Data was not provided  
N/A: Not Applicable

Table 6. Baseline Stream Data Summary

Area B - Design Parameters  
 Big Harris Creek Mitigation Site  
 DMS Project No. 739  
 Monitoring Year 0 - 2018

Area B

Parameter	Design																					
	Elliott Creek Reach 1		Elliott Creek UT1		Bridges Creek Reach 1		UT1 to Bridges Creek		Lower Fletcher Creek Reach 1		Lower Fletcher Creek Reach 2		Upper Stick Elliott Creek Reach 5		Upper Stick Elliott Creek Reach 6		Upper Stick Elliott Creek UT2		Upper Stick Elliott Creek UT3		Upper Fletcher Creek Reach 2	
	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
<b>Dimension and Substrate - Shallow</b>																						
Bankfull Width (ft)	7.5		4.9		6.9		4.9		11.8		12.4		16.0		16.0		6.7		7.2		10.5	
Floodprone Width (ft)	16.5	---	10.8	---	9.7	15.3	10.8	---	26.0	---	27.3	---	22.5	35.3	35.3	---	14.8	---	15.9	---	50.0	100.0
Bankfull Mean Depth	0.5		0.4		0.5		0.4		0.8		0.9		1.1		1.1		0.5		0.6		0.9	
Bankfull Max Depth	1.1	1.9	0.8	1.4	1.1	1.9	0.8	1.4	1.7	3.0	1.8	3.1	2.3	4.0	2.3	4.0	1.0	1.8	1.1	1.9	2.2+	
Bankfull Cross-sectional Area (ft <sup>2</sup> )	4.0		2.0		3.7		2.0		10.0		11.0		18.4		18.4		3.5		4.0		9.0	
Width/Depth Ratio	14.0		12.0		13.0		12.0		14.0		14.0		14.0		14.0		13.0		13.0		12.2	
Entrenchment Ratio	2.2+		2.2+		1.4	2.2	2.2+		2.2+		2.2+		1.4	2.2	2.2+		2.2+		2.2+		4.8	9.5
Bank Height Ratio	1.0		1.0		1.0		1.0		1.0		1.0		1.0		1.0		1.0		1.0		1.0	
D <sub>50</sub> (mm)	---		---		---		---		---		---		---		---		---		---		---	
<b>Profile</b>																						
Riffle Length (ft)	---		---		---		---		---		---		---		---		---		---		---	
Riffle Slope (ft/ft)	0.020	0.030	0.030	0.050	0.025	0.047	0.074	0.098	0.013	0.018	0.022	0.029	0.009	0.014	0.015	0.020	0.005	0.007	0.020	0.026	0.021	0.032
Pool Length (ft)	---		---		---		---		---		---		---		---		---		---		---	
Pool Max Depth (ft)	1.1	1.9	0.8	1.4	1.1	1.9	0.8	1.4	1.7	3.0	1.8	3.1	2.3	4.0	2.3	4.0	1.0	1.8	1.1	1.9	2.2+	
Pool Spacing (ft)	26	45	17	29	24	55	17	29	41	71	43	74	88	119	63	109	24	45	25	43	40	100
Pool Volume (ft <sup>3</sup> )	---		---		---		---		---		---		---		---		---		---		---	
<b>Pattern</b>																						
Channel Beltwidth (ft)	19	60	17	39	---	---	17	39	41	95	43	99	61	81	62	78	24	54	25	58	25	95
Radius of Curvature (ft)	15	26	10	17	---	---	10	17	24	41	25	43	33	56	32	43	13	24	14	25	23	50
Rc:Bankfull Width (ft/ft)	2.0	3.5	2.0	3.5	---	---	2.0	3.5	2.0	3.5	2.0	3.5	2.1	3.5	2.0	2.7	1.9	3.6	1.9	3.5	2.2	4.8
Meander Length (ft)	52	90	34	59	---	---	34	59	83	142	87	149	139	192	166	191	47	81	50	87	100	200
Meander Width Ratio	2.5	8.0	3.5	8.0	---	---	3.5	8.0	3.5	8.0	3.5	8.0	3.8	5.0	3.8	4.8	3.5	8.0	3.5	8.0	2.4	9.0
<b>Substrate, Bed and Transport Parameters</b>																						
Ri%/Ru%/P%/G%/S%																						
SC%/Sa%/G%/C%/B%/Be%																						
d16/d35/d50/d84/d95/d100																						
Reach Shear Stress (Competency) lb/ft <sup>2</sup>	0.47	---		0.65		---		0.73		0.45		0.55		0.69		---		---		---		
Max part size (mm) mobilized at bankfull																						
Stream Power (Capacity) W/m <sup>2</sup>																						
<b>Additional Reach Parameters</b>																						
Drainage Area (SM)	0.13	0.02		0.07		0.01		0.41		0.42		0.72		0.76		0.07		0.10		0.29		
Watershed Impervious Cover Estimate (%)	<10%																					
Rosgen Classification	C5	C4		B4		C4		C4		C4		C4		C4		C4		C4		C		
Bankfull Velocity (fps)	4.3	3		3.2		1.5		3.5		3.4		2.8		2.9		3.4		3.8		3.3		
Bankfull Discharge (cfs)	17	6		12		3		35		37		52		54		12		15		30		
Q-NFF regression (2-yr)																						
Q-USGS extrapolation (1.2-yr)																						
Q-Mannings																						
Valley Slope (ft/ft)	0.0174	0.0302		0.0290		0.0580		0.0089		0.0150		0.0110		0.0115		0.0045		0.0150		0.0158		
Channel Thalweg Length (ft)	1,121	141		376		55		574		427		1,507		1,069		154		118		1,407		
Sinuosity	1.19	1.19		1.03		1.20		1.02		1.03		1.34		1.13		1.27		1.09		1.21		
Bankfull/Channel Slope (ft/ft)	0.0149	0.0255		0.028		0.049		0.0088		0.0088		0.0088		0.0101		0.0035		0.0130		0.0128		

SC: Silt/Clay <0.062 mm diameter particles

(---): Data not provided

N/A: Not Applicable

Table 6. Baseline Stream Data Summary  
 Area B - As-Built/Baseline Parameters  
 Big Harris Creek Mitigation Site  
 DMS Project No. 739  
 Monitoring Year 0 - 2018

Area B

Parameter	As-Built/Baseline																																																							
	Elliott Creek Reach 1		Elliott Creek UT1		Bridges Creek Reach 1		UT1 to Bridges Creek		Lower Fletcher Creek Reach 1		Lower Fletcher Creek Reach 2		Upper Stick Elliot Creek Reach 1		Upper Stick Elliott Creek Reach 5		Upper Stick Elliott Creek Reach 6		Upper Stick Elliott Creek UT2		Upper Stick Elliott Creek UT3		Upper Fletcher Creek Reach 2																																	
	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max																														
<b>Dimension and Substrate - Shallow</b>																																																								
Bankfull Width (ft)	6.4	8.2	5.2		9.3		N/A		12.3		9.9		6.7		15.9		18.4		16.7		18.3		7.9		12.4		11.4		13.2																											
Floodprone Width (ft)	19.0	19.6	14.0		23.6		N/A		26.4		28.1		37.2		150.0		178.4		148.5		192.7		25.0		63.8		72.0		150.0																											
Bankfull Mean Depth	0.6	0.7	0.5		0.4		N/A		0.8		0.6		0.7		1.0		1.2		1.1		1.2		0.5		0.4		0.7		0.8																											
Bankfull Max Depth	0.9	0.9	0.8		0.7		N/A		1.1		0.8		0.9		1.7		1.8		2.0		2.2		0.9		0.9		1.1		1.5																											
Bankfull Cross-sectional Area (ft <sup>2</sup> )	4.1	5.6	2.5		3.3		N/A		9.7		6.3		4.7		18.9		19.2		19.1		22.4		3.8		4.8		8.2		10.3																											
Width/Depth Ratio	10.1	11.9	10.7		26.5		N/A		15.7		15.4		9.6		13.3		17.8		14.6		14.9		16.5		32.3		15.6		16.9																											
Entrenchment Ratio	2.4	2.9	2.7		2.5		N/A		2.1		2.9		5.5		8.1		10.9		8.9		10.5		3.2		5.2		6.0		11.3																											
Bank Height Ratio	1.0	1.0	1.0		1.0		N/A		1.0		1.0		1.0		1.0		1.0		1.0		1.0		1.0		1.0		1.0		1.0																											
D <sub>50</sub> (mm)	32	42	31		53.7		N/A		35.3		11.0		32.0		35.0		39.8		41.1		46.1		14.9		14.4		39.1		54.8																											
<b>Profile</b>																																																								
Riffle Length (ft)	7	64	11	21	11	32	6	6	11	55	14	36	6	18	39	74	13	80	14	37	18	19	16	69																																
Riffle Slope (ft/ft)	0.0076	0.0712	0.0018	0.0429	0.0129	0.0576	0.0686	0.0862	0.0008	0.0466	0.0050	0.0396	0.0028	0.1323	0.0068	0.0218	0.0038	0.0653	0.0065	0.0167	0.0092	0.0257	0.0078	0.0631																																
Pool Length (ft)	10.98	73.26	12.42	18.46	6.36	34.19	8.56	8.56	10.61	44	17.92	53.39	3.72	55.52	14.68	66.89	14.35	79.03	18.84	51.34	8.77	14.02	13.89	63.47																																
Pool Max Depth (ft)	1.1	2.3	1.1	1.4	1.6	2.4	1.0	2.0	1.4	1.6	1.8	2.2	1.7	2.2	1.9	4.1	2.0	4.6	1.0	1.7	1.5	1.7	2.5	4.5																																
Pool Spacing (ft)	20	132	18	45	29	49	11	11	36	92	42	90	22	102	48	128	43	127	62	62	26	34	45	162																																
Pool Volume (ft <sup>3</sup> )																																																								
<b>Pattern</b>																																																								
Channel Beltwidth (ft)	14	38	8	17	9	15	23	23	20	73	44		N/A	N/A	37	64	27	57	24	24	16	16	8	71																																
Radius of Curvature (ft)	8	42	15	20	10	19	19	19	12	50	53	79	N/A	N/A	25	48	24	39	20	17	9	12	23	50																																
Rc:Bankfull Width (ft/ft)	1.3	5.1	2.9	3.8	1.1	2.0	N/A		1.0	4.1	5.4	8.0	N/A	N/A	1.6	2.6	1.4	2.2	2.5	2.2	0.7	1.0	2.0	3.8																																
Meander Length (ft)	46	156	48	69	68	80	51	51	73	138	201	201	N/A	N/A	128	200	160	193	54	54	32	32	92	195																																
Meander Width Ratio	2.2	4.6	1.4	3.3	1.0	1.6	N/A		1.6	5.9	4.4	0.0	N/A	N/A	2.3	3.5	1.6	3.1	3.1	3.1	1.3	1.3	0.7	5.4																																
<b>Substrate, Bed and Transport Parameters</b>																																																								
R%/Ru%/P%/G%/S%																																																								
SC%/Sa%/G%/C%/B%/Be%																																																								
d16/d35/d50/d84/d95/d100	0.59/1.78/6/101.2/151.8/180		SC/1/5.9/47/101.2/180		SC/0.16/1/90/135.5/180		N/A		0.36/0.69/1.8/57.9/110.1/180		0.27/0.69/4.4/40.5/128.7/362		SC/3.15/20.7/68.5/137/256		0.15/2.18/23.6/64/103.6/10		SC/0.61/3.3/60.4/113.8/180		SC/0.14/0.2/26.1/48/64		SC/SC/0.2/20.5/35.9/ 180		SC/0.63/10.4/55.9/104/180																																	
Reach Shear Stress (Competency) lb/ft <sup>2</sup>	0.66		1.08		1.35		N/A		0.40		0.71		3.66		0.35		0.41		0.44		0.46		0.55																																	
Max part size (mm) mobilized at bankfull																																																								
Stream Power (Capacity) W/m <sup>2</sup>																																																								
<b>Additional Reach Parameters</b>																																																								
Drainage Area (SM)	0.13		0.02		0.07		0.01		0.41		0.42		0.05		0.72		0.76		0.07		0.10		0.29																																	
Watershed Impervious Cover Estimate (%)	<10%																																																							
Rosgen Classification	C/E4		C/E4		C5		N/A		C5		C4		E4		C4		C4		C5		C5		C4																																	
Bankfull Velocity (fps)	3.2		3.7		2.9		N/A		3.1		3.4		8.5		3.4		3.8		3.8		4.1		2.4		3.3		3.6																													
Bankfull Discharge (cfs)	13.3		9.2		9.7		N/A		29.9		21.3		39.9		63.4		72.8		73.1		90.9		9.0		9.9		26.9		37.0																											
Q-NFF regression (2-yr)																																																								
Q-USGS extrapolation (1.2-yr)																																																								
Q-Mannings																																																								
Valley Slope (ft/ft)	0.0174		0.0302		0.0290		0.0580		0.0089		0.0150		N/A		0.0110		0.0115		0.0045		0.0150		N/A																																	
Channel Thalweg Length (ft)	1,121		141		376		55		574		427		409		1,228		1,070		154		118		1,407																																	
Sinuosity	1.1		1.1		1.0		1.0		1.1		1.0		1.0		1.2		1.1		1.4		1.3		1.2																																	
Bankfull/Channel Slope (ft/ft)	0.0150		0.0247		0.0308		0.0598		0.0092		0.0162		0.0837		0.0081		0.0093		0.0101		0.0105		0.0125																																	

SC: Silt/Clay <0.062 mm diameter particles  
 (---): Data was not provided  
 N/A: Not Applicable

Table 6. Baseline Stream Data Summary

Area C

Big Harris Creek Mitigation Site

DMS Project No. 739

Monitoring Year 0 - 2018

Area C

Parameter	Gage	Pre-Restoration Condition				Design				As-Built/Baseline			
		Lower Big Harris Creek Reach 1a/1b		Lower Big Harris Creek Reach 2		Lower Big Harris Creek Reach 1a/1b		Lower Big Harris Creek Reach 2		Lower Big Harris Creek Reach 1a/1b		Lower Big Harris Creek Reach 2	
		Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
<b>Dimension and Substrate - Shallow</b>													
Bankfull Width (ft)	N/A	25.2		25.2		26.0		27.0		30.20		26.70	
Floodprone Width (ft)		120.0		120.0		75.0	115.0	100.0	200.0	169		200	
Bankfull Mean Depth		2.4		2.4		2.1		2.2		2.0		1.7	
Bankfull Max Depth		3.6		3.6		2.9		3.0		3.3		2.8	
Bankfull Cross-sectional Area (ft <sup>2</sup> )		60.5		60.5		54.4		58.5		59.8		46.0	
Width/Depth Ratio		10.5		10.5		12.4		12.5		15.2		15.5	
Entrenchment Ratio		4.8		4.8		2.9	4.4	3.7	7.4	5.6		7.5	
Bank Height Ratio		2.0		2.0		1.0		1.0		1.0		1.0	
D <sub>50</sub> (mm)		---		---		---		---		32.0		87.4	
<b>Profile</b>													
Riffle Length (ft)	N/A					---		---		15	142	21	146
Riffle Slope (ft/ft)		0.0133	0.0512	0.0063	0.0177	---	0.0054	0.0054	0.0086	0.0055	0.0792	0.0019	0.0651
Pool Length (ft)						---		---		54.2		94.3	
Pool Max Depth (ft)		4.1		3.2		6.0		6.2		3.9		6.2	
Pool Spacing (ft)		200.0	250.0	410.0	480.0	185	240	150	250	116	218	37	291
Pool Volume (ft <sup>3</sup> )													
<b>Pattern</b>													
Channel Beltwidth (ft)	N/A	75	120	85	125	53	112	110	145	58	105	80	117
Radius of Curvature (ft)		70	165	120	190	60	80	75	90	60	80	65	90
Rc:Bankfull Width (ft/ft)		2.8	6.5	4.8	7.5	2.3	3.1	2.8	3.3	2.0	2.6	2.4	3.4
Meander Length (ft)		350	450	250	300	290	440	344	420	157	419	236	396
Meander Width Ratio		3.0	4.8	3.4	5.0	2.0	4.3	4.1	5.4	1.9	3.5	3.0	4.4
<b>Substrate, Bed and Transport Parameters</b>													
Ri%/Ru%/P%/G%/S%	N/A												
SC%/Sa%/G%/C%/B%/Be%													
d16/d35/d50/d84/d95/d100		1.9/16/29/83/130/2048		1.9/16/29/83/130/2048						0.4/0.8/1.7/94/256/2048		0.2/0.3/5.6/94/256/2048	
Reach Shear Stress (Competency) lb/ft <sup>2</sup>		---		---		---		---		---		---	
Max part size (mm) mobilized at bankfull													
Stream Power (Capacity) W/m <sup>2</sup>													
<b>Additional Reach Parameters</b>													
Drainage Area (SM)	N/A	3.19	3.36	3.50	3.88	3.36		3.88		3.36		3.88	
Watershed Impervious Cover Estimate (%)		<10%											
Rosgen Classification		E4	G4c	E4	G4c	C		C		C5		C4	
Bankfull Velocity (fps)		2.9		3.2		3.3		3.4		3.6		3.0	
Bankfull Discharge (cfs)		176		194		176		194		213		137	
Q-NFF regression (2-yr)		---		---									
Q-USGS extrapolation (1.2-yr)		190		211									
Q-Mannings		182	255	205	350								
Valley Slope (ft/ft)		0.0053		0.0053		0.0053		0.0053		0.0053		0.0053	
Channel Thalweg Length (ft)		894		987		820		967		820		967	
Sinuosity		1.0		1.0		1.1		1.1		1.1		1.1	
Bankfull/Channel Slope (ft/ft)		0.0050		0.0050		0.0048		0.0048		0.0039		0.0032	

SC: Silt/Clay <0.062 mm diameter particles

(---): Data was not provided

N/A: Not Applicable

Table 7. Reference Reach Data Summary

Big Harris Creek Mitigation Site  
 DMS Project No.739  
 Monitoring Year 0 - 2018

Parameter	Gage	Reference Reach Data																							
		Group Camp Tributary		UT to South Crowders		UT to Cane Creek		Boyd Branch		Spencer Creek		Box Creek		Hall Creek		Meadow Fork		UT to Gap Branch		UT to Kelly Branch		UT to Sandy Run		UT to Little Pine Trib 1	
		Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
<b>Dimension and Substrate - Shallow</b>																									
Bankfull Width (ft)	N/A	4.2	4.4	6.1	8.4	11.5	12.3	13.5		10.7	11.2	23.5		20.7	27.0	21.4		6.2	7.9		7.3	7.8	12.2		
Floodprone Width (ft)	N/A	8.6	10.6	26.0	31.0	31.0		37.0		60.0	114.0	76.0		34.0	39.0	---		20.9	9.1		12.2	15.6	72.0		
Bankfull Mean Depth	N/A	0.8	0.8	1.0	1.1	0.8	1.0	1.1		1.6	1.8	1.2		1.4	1.8	2.1		0.6	0.7		0.7	0.8	1.3		
Bankfull Max Depth	N/A	1.0	1.2	1.4		1.2	1.6	1.9		2.1	2.6	1.9		3.1		3.1	1.0	1.1		1.1	1.4	1.8			
Bankfull Cross-sectional Area (ft <sup>2</sup> )	N/A	3.4	3.6	6.4	8.7	8.9	12.2	15.4		17.8	19.7	28.9		36.9		44.0	3.8	5.7		5.7	6.2	16.3			
Width/Depth Ratio	N/A	5.2	55.0	5.8	8.0	12.3	14.4	11.8		5.8	7.1	19.1		11.6	19.7	10.4		10.1	10.9		6.6	9.8	9.1		
Entrenchment Ratio	N/A	1.9	2.5	3.7	4.3	2.5	2.7	2.8		5.5	10.2+	3.3		1.4	1.6	>2.2		3.4	1.2		1.6	2.1	6.0		
Bank Height Ratio	N/A	1.0	1.0	1.4	2.1	---		1.0		1.0		1.5		2.1	2.2	1.1		1.0	2.5		1.7	2.6	1.0		
D50 (mm)	N/A																								
<b>Pattern</b>																									
Riffle Length (ft)	N/A	---		---		---		---		---		---		---		---		---		---		---		---	
Riffle Slope (ft/ft)	N/A	0.0105	0.1218	0.0202	0.0664	0.0188	0.0704	0.015	0.028	0.013		0.0100	0.0770	0.008	0.02	0.2390		0.01	0.14	---		0.004	0.04	0.0600	0.0892
Pool Length (ft)	N/A	---		---		---		---		---		---		---		---		---		---		---		---	
Pool Max Depth (ft)	N/A	1.8	2.8	1.3	3	1.8	2.3	2.6		3.3	---	4.4		2.7	3.5	---		15.0		---		1.3	1.5	2.2	
Pool Spacing (ft)	N/A	9	58	28	63	27	73	260	345	71	---	29	88	35	108	---		3	4	---		9	55	26	81
Pool Volume (ft <sup>3</sup> )	N/A	---		---		---		---		---		---		---		---		---		---		---		---	
<b>Substrate, Bed and Transport Parameters</b>																									
Channel Beltwidth (ft)	N/A	16	17	81		102		230.0		38	41	62	88	35	41	---		---		18	34	24	60	---	
Radius of Curvature (ft)	N/A	8	12	9	20	23	38	50	180	1.3	1.4	1	2	1	4	---		---		8	26	14	29	---	
Rc:Bankfull Width (ft/ft)	N/A	---		---		---		---		---		---		---		---		---		---		---		---	
Meander Length (ft)	N/A	31	34	45	72	45	81	600	623	46	48	39	76	78	200	---		---		27	94	63	72	---	
Meander Width Ratio	N/A	3.6	3.8	9.6	13.3	8.3	8.9	17.0		3.4	3.6	2.6	3.7	1.5	1.7	---		---		2.3	4.3	3.3	7.6	---	
<b>Additional Reach Parameters</b>																									
Drainage Area (SM)	N/A	0.10		0.22		0.29		0.90		0.96		2.13		4.09		4.37		0.04		0.08		0.15		1.10	
Watershed Impervious Cover Estimate (%)	N/A	---		---		---		---		---		---		---		---		---		---		---		---	
Rosgen Classification	N/A	ESb		E4		E4		E4		E4		C4		B4c		E4		B4a		A4		E4		E4b	
Bankfull Velocity (fps)	N/A	3.4	3.6	4		3.8		3.2		4.9	5.4	3.3		4.3		5.1		5		6.2		3.2		5.5	
Bankfull Discharge (cfs)	N/A	12		30		40		51		97		94.9		159		224		18.7		23.2		19		85	
Q-NFF regression (2-yr)	N/A	---		---		---		---		---		---		---		---		---		---		---		---	
Q-USGS extrapolation (1.2-yr)	N/A	---		---		---		---		---		---		---		---		---		---		---		---	
Q-Mannings	N/A	---		---		---		---		---		---		---		---		---		---		---		---	
Valley Length (ft)	N/A	---		---		---		---		---		---		---		---		---		---		---		---	
Channel Thalweg Length (ft)	N/A	---		---		---		---		---		---		---		---		---		---		---		---	
Sinuosity	N/A	1.60		2.20		1.40		1.40		1.30		1.30		1.04		---		1.12		1.19		1.60		1.10	
Water Surface Slope (ft/ft) <sup>2</sup>	N/A	---		---		---		---		---		---		---		---		---		---		---		---	
Bankfull Slope (ft/ft)	N/A	---		---		---		---		---		---		---		---		---		---		---		---	

SC: Silt/Clay <0.062 mm diameter particles

(---): Data was not provided

N/A: Not Applicable

Table 8. Morphology and Hydraulic Summary (Dimensional Parameters - Cross-Section)

Big Harris Creek Mitigation Site  
DMS Project No. 739  
Monitoring Year 0 - 2018

AREA A

Dimension and Substrate	Cross-Section 1, UBHC R2a (Riffle)						Cross-Section 2, UBHC R2a (Pool)						Cross-Section 3, UBHC R2b (Pool)						Cross-Section 4, UBHC R2b (Riffle)						Cross-Section 5, UBHC R4 (Pool)					
	Base (3/2018)	MY1	MY2	MY3	MY4	MY5	Base (3/2018)	MY1	MY2	MY3	MY4	MY5	Base (3/2018)	MY1	MY2	MY3	MY4	MY5	Base (3/2018)	MY1	MY2	MY3	MY4	MY5	Base (4/2018)	MY1	MY2	MY3	MY4	MY5
<i>based on fixed bankfull elevation</i>	929.17						928.69						920.99						920.83						900.30					
Bankfull Width (ft)	16.0						13.5						12.0						11.3						30.3					
Floodprone Width (ft)	108.7						N/A						N/A						170.3						N/A					
Bankfull Mean Depth (ft)	0.7						1.4						1.2						1.6						1.0					
Bankfull Max Depth (ft)	1.5						3.1						1.9						3.0						2.9					
Bankfull Cross-Sectional Area (ft²)	11.6						19.3						14.0						17.7						28.8					
Bankfull Width/Depth Ratio	22.0						N/A						N/A						7.3						N/A					
Bankfull Entrenchment Ratio	6.8						N/A						N/A						15.0						N/A					
Bankfull Bank Height Ratio	1.0						N/A						N/A						1.0						N/A					
Dimension and Substrate	Cross-Section 6, UBHC R4 (Riffle)						Cross-Section 7, UBHC R4 (Riffle)						Cross-Section 8, UBHC R4 (Pool)						Cross-Section 9, Royster Cr R1 (Riffle)						Cross-Section 10, Royster Cr R1 (Pool)					
	Base (4/2018)	MY1	MY2	MY3	MY4	MY5	Base (4/2018)	MY1	MY2	MY3	MY4	MY5	Base (4/2018)	MY1	MY2	MY3	MY4	MY5	Base (4/2018)	MY1	MY2	MY3	MY4	MY5	Base (4/2018)	MY1	MY2	MY3	MY4	MY5
<i>based on fixed bankfull elevation</i>	899.74						896.53						896.03						964.98						961.48					
Bankfull Width (ft)	15.5						16.0						20.9						10.0						12.3					
Floodprone Width (ft)	118.0						190.0						N/A						46.7						N/A					
Bankfull Mean Depth (ft)	0.8						1.1						1.5						0.4						0.9					
Bankfull Max Depth (ft)	1.4						2.0						3.3						0.8						1.9					
Bankfull Cross-Sectional Area (ft²)	13.1						17.6						31.6						3.6						11.0					
Bankfull Width/Depth Ratio	18.3						14.5						N/A						27.6						N/A					
Bankfull Entrenchment Ratio	7.6						11.9						N/A						4.7						N/A					
Bankfull Bank Height Ratio	1.0						1.0						N/A						1.0						N/A					
Dimension and Substrate	Cross-Section 11, Scott Cr (Riffle)						Cross-Section 12, Scott Cr (Pool)						Cross-Section 13, Carroll Cr R1 (Riffle)						Cross-Section 14, Carroll Cr R1 (Pool)											
	Base (4/2018)	MY1	MY2	MY3	MY4	MY5	Base (4/2018)	MY1	MY2	MY3	MY4	MY5	Base (4/2018)	MY1	MY2	MY3	MY4	MY5	Base (4/2018)	MY1	MY2	MY3	MY4	MY5	Base (4/2018)	MY1	MY2	MY3	MY4	MY5
<i>based on fixed bankfull elevation</i>	894.77						890.09						862.20						861.58											
Bankfull Width (ft)	6.8						13.7						11.4						12.7											
Floodprone Width (ft)	67.1						N/A						82.0						N/A											
Bankfull Mean Depth (ft)	0.5						1.1						0.7						1.1											
Bankfull Max Depth (ft)	0.9						2.1						1.3						2.0											
Bankfull Cross-Sectional Area (ft²)	3.6						14.9						7.9						13.4											
Bankfull Width/Depth Ratio	12.7						N/A						16.4						N/A											
Bankfull Entrenchment Ratio	9.9						N/A						7.2						N/A											
Bankfull Bank Height Ratio	1.0						N/A						1.0						N/A											

AREA B

Dimension and Substrate	Cross-Section 15, USEC R1 (Riffle)						Cross-Section 16, USEC R5 (Pool)						Cross-Section 17, USEC R5 (Riffle)						Cross-Section 18, USEC R5 (Riffle)						Cross-Section 19, USEC R5 (Pool)						Cross-Section 20, USEC R5 (Riffle)					
	Base (4/2018)	MY1	MY2	MY3	MY4	MY5	Base (3/2018)	MY1	MY2	MY3	MY4	MY5	Base (3/2018)	MY1	MY2	MY3	MY4	MY5	Base (3/2018)	MY1	MY2	MY3	MY4	MY5	Base (3/2018)	MY1	MY2	MY3	MY4	MY5	Base (3/2018)	MY1	MY2	MY3	MY4	MY5
<i>based on fixed bankfull elevation</i>	979.10						933.97						932.08						930.87						928.94						925.67					
Bankfull Width (ft)	6.7						17.4						18.4						18.1						20.8						15.9					
Floodprone Width (ft)	37.2						N/A						150.0						178.4						N/A						173.2					
Bankfull Mean Depth (ft)	0.7						1.5						1.0						1.1						1.9						1.2					
Bankfull Max Depth (ft)	0.9						2.3						1.7						1.7						3.5						1.8					
Bankfull Cross-Sectional Area (ft²)	4.7						26.3						19.2						19.1						39.3						18.9					
Bankfull Width/Depth Ratio	9.6						N/A						17.8						17.2						N/A						13.3					
Bankfull Entrenchment Ratio	5.5						N/A						8.1						9.8						N/A						10.9					
Bankfull Bank Height Ratio	1.0						N/A						1.0						1.0						N/A						1.0					
Dimension and Substrate	Cross-Section 21, USEC R6 (Pool)						Cross-Section 22, USEC R6 (Riffle)						Cross-Section 23, USEC R6 (Riffle)						Cross-Section 24, Elliott Cr (Riffle)						Cross-Section 25, Elliott Cr (Pool)						Cross-Section 26, Elliott Cr (Riffle)					
	Base (3/2018)	MY1	MY2	MY3	MY4	MY5	Base (3/2018)	MY1	MY2	MY3	MY4	MY5	Base (3/2018)	MY1	MY2	MY3	MY4	MY5	Base (4/2018)	MY1	MY2	MY3	MY4	MY5	Base (4/2018)	MY1	MY2	MY3	MY4	MY5	Base (4/2018)	MY1	MY2	MY3	MY4	MY5
<i>based on fixed bankfull elevation</i>	919.78						919.40						917.54						972.13						970.48						970.30					
Bankfull Width (ft)	21.8						18.3						16.7						6.4						7.6						8.2					
Floodprone Width (ft)	N/A						192.7						148.5						19.0						N/A						19.6					
Bankfull Mean Depth (ft)	2.1						1.2						1.1						0.6						1.5						0.7					
Bankfull Max Depth (ft)	5.2						2.2						2.0						0.9						1.9						0.9					
Bankfull Cross-Sectional Area (ft²)	45.1						22.4						19.1						4.1						11.2						5.6					
Bankfull Width/Depth Ratio	N/A						N/A						14.6						10.1						N/A						11.9					
Bankfull Entrenchment Ratio	N/A						10.5						8.9						2.9						N/A						2.4					
Bankfull Bank Height Ratio	N/A						1.0						1.0						1.0						N/A						1.0					



**Table 8. Morphology and Hydraulic Summary (Dimensional Parameters - Cross-Section)**

Big Harris Creek Mitigation Site  
 DMS Project No. 739  
 Monitoring Year 0 - 2018

<b>AREA B</b>																																					
<b>Dimension and Substrate</b>	Cross-Section 27, UT to Elliott Cr (Riffle)					Cross-Section 28, Bridges Cr (Riffle)					Cross-Section 29, USEC UT2 (Riffle)					Cross-Section 30, USEC UT3 (Riffle)					Cross-Section 31, UFC R2 (Riffle)					Cross-Section 32, UFC R2 (Pool)											
	Base (4/2018)	MY1	MY2	MY3	MY4	MY5	Base (4/2018)	MY1	MY2	MY3	MY4	MY5	Base (3/2018)	MY1	MY2	MY3	MY4	MY5	Base (3/2018)	MY1	MY2	MY3	MY4	MY5	Base (10/2017)	MY1	MY2	MY3	MY4	MY5	Base (10/2017)	MY1	MY2	MY3	MY4	MY5	
<i>based on fixed bankfull elevation</i>	976.75						966.77						926.92						927.03							969.53						969.11					
Bankfull Width (ft)	5.2						9.3						7.9						12.4							11.4						12.3					
Floodprone Width (ft)	14.0						23.6						25.0						63.8							91.8						N/A					
Bankfull Mean Depth (ft)	0.5						0.4						0.5						0.4							0.7						1.4					
Bankfull Max Depth (ft)	0.8						0.7						0.9						0.9							1.1						2.6					
Bankfull Cross-Sectional Area (ft <sup>2</sup> )	2.5						3.3						3.8						4.8							8.2						17.1					
Bankfull Width/Depth Ratio	10.7						26.5						16.5						32.3							15.7						N/A					
Bankfull Entrenchment Ratio	2.7						2.5						3.2						5.2							8.1						N/A					
Bankfull Bank Height Ratio	1.0						1.0						1.0						1.0							1.0						N/A					
<b>Dimension and Substrate</b>	Cross-Section 33, UFC R2 (Pool)					Cross-Section 34, UFC R2 (Riffle)					Cross-Section 35, UFC R2 (Riffle)					Cross-Section 36, UFC R2 (Pool)					Cross-Section 37, LFC R1 (Riffle)					Cross-Section 38, LFC R1 (Pool)											
	Base (10/2017)	MY1	MY2	MY3	MY4	MY5	Base (10/2017)	MY1	MY2	MY3	MY4	MY5	Base (10/2017)	MY1	MY2	MY3	MY4	MY5	Base (10/2017)	MY1	MY2	MY3	MY4	MY5	Base (3/2018)	MY1	MY2	MY3	MY4	MY5	Base (3/2018)	MY1	MY2	MY3	MY4	MY5	
<i>based on fixed bankfull elevation</i>	965.86						965.49						960.57						960.15							919.39						919.17					
Bankfull Width (ft)	13.2						12.0						13.2						14.7							12.3						15.3					
Floodprone Width (ft)	N/A						N/A						150.0						N/A							26.4						N/A					
Bankfull Mean Depth (ft)	1.2						0.8						0.8						1.5							0.8						0.8					
Bankfull Max Depth (ft)	2.3						1.4						1.5						2.8							1.1						1.4					
Bankfull Cross-Sectional Area (ft <sup>2</sup> )	16.1						9.2						10.3						21.5							9.7						11.6					
Bankfull Width/Depth Ratio	N/A						15.6						16.9						N/A							15.7						N/A					
Bankfull Entrenchment Ratio	N/A						6.0						11.3						N/A							2.1						N/A					
Bankfull Bank Height Ratio	N/A						1.0						1.0						N/A							1.0						N/A					
<b>Dimension and Substrate</b>	Cross-Section 39, LFC R2 (Riffle)					Cross-Section 40, LFC R2 (Pool)																															
	Base (3/2018)	MY1	MY2	MY3	MY4	MY5	Base (3/2018)	MY1	MY2	MY3	MY4	MY5																									
<i>based on fixed bankfull elevation</i>	915.90						915.95																														
Bankfull Width (ft)	9.9						11.5																														
Floodprone Width (ft)	28.1						N/A																														
Bankfull Mean Depth (ft)	0.6						1.0																														
Bankfull Max Depth (ft)	0.8						1.5																														
Bankfull Cross-Sectional Area (ft <sup>2</sup> )	6.3						11.8																														
Bankfull Width/Depth Ratio	15.4						N/A																														
Bankfull Entrenchment Ratio	2.9						N/A																														
Bankfull Bank Height Ratio	1.0						N/A																														
<b>AREA C</b>																																					
<b>Dimension and Substrate</b>	Cross-Section 41, LBHC R1a (Pool)					Cross-Section 42, LBHC R1a (Riffle)					Cross-Section 43, LBHC R1b/2 (Riffle)					Cross-Section 44, LBHC R1b/2 (Pool)																					
	Base (9/2017)	MY1	MY2	MY3	MY4	MY5	Base (9/2017)	MY1	MY2	MY3	MY4	MY5	Base (9/2017)	MY1	MY2	MY3	MY4	MY5	Base (9/2017)	MY1	MY2	MY3	MY4	MY5	Base (9/2017)	MY1	MY2	MY3	MY4	MY5							
<i>based on fixed bankfull elevation</i>	848.00						847.93						844.23						843.50																		
Bankfull Width (ft)	41.6						30.2						26.7						26.8																		
Floodprone Width (ft)	N/A						169.0						200.0						N/A																		
Bankfull Mean Depth (ft)	2.5						2.0						1.7						2.8																		
Bankfull Max Depth (ft)	5.8						3.3						2.8						5.5																		
Bankfull Cross-Sectional Area (ft <sup>2</sup> )	104.7						59.8						46.0						75.4																		
Bankfull Width/Depth Ratio	N/A						15.2						15.5						N/A																		
Bankfull Entrenchment Ratio	N/A						5.6						7.5						N/A																		
Bankfull Bank Height Ratio	N/A						1.0						1.0						N/A																		

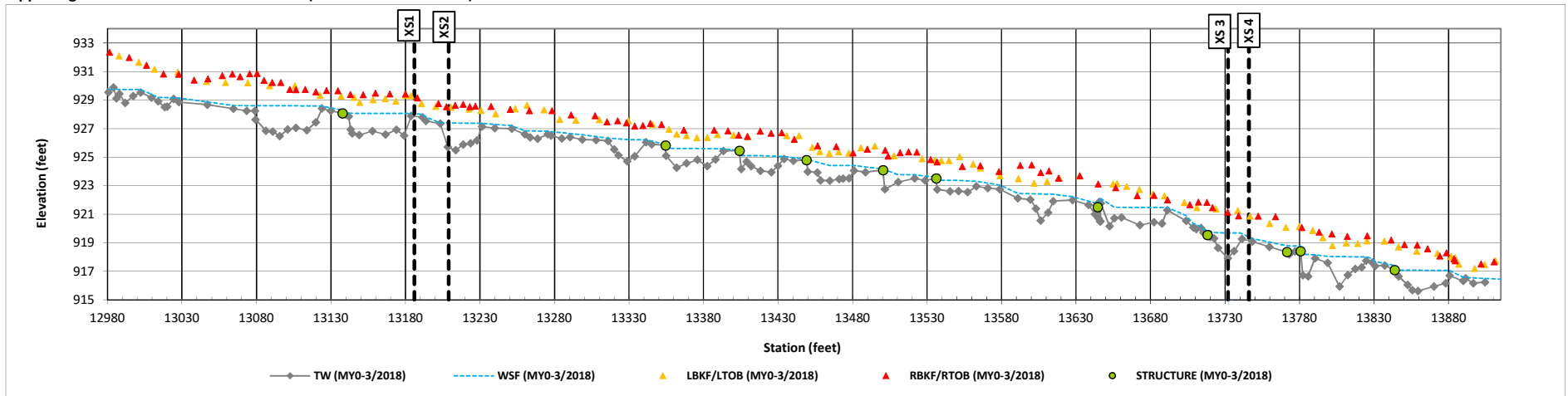
### Longitudinal Profile Plots

Big Harris Creek Mitigation Site - Area A

DMS Project No. 739

Monitoring Year 0 - 2018

#### Upper Big Harris Creek Reaches 2A and 2B (STA 129+81 to 139+15)



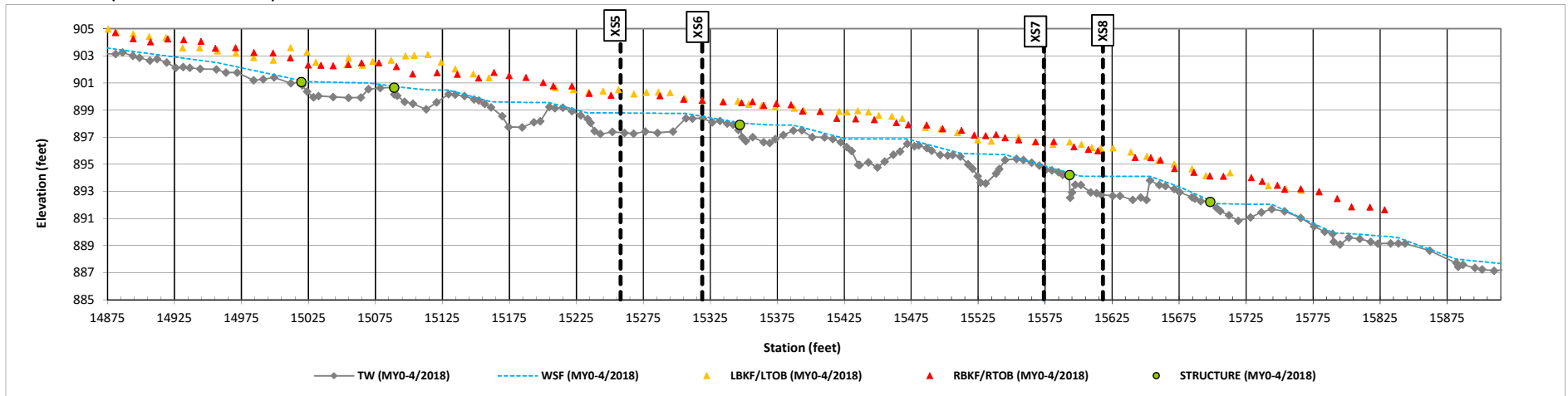
### Longitudinal Profile Plots

Big Harris Creek Mitigation Site - Area A

DMS Project No. 739

Monitoring Year 0 - 2018

#### UBHC Reach 4 (STA 148+76 to 159+15)



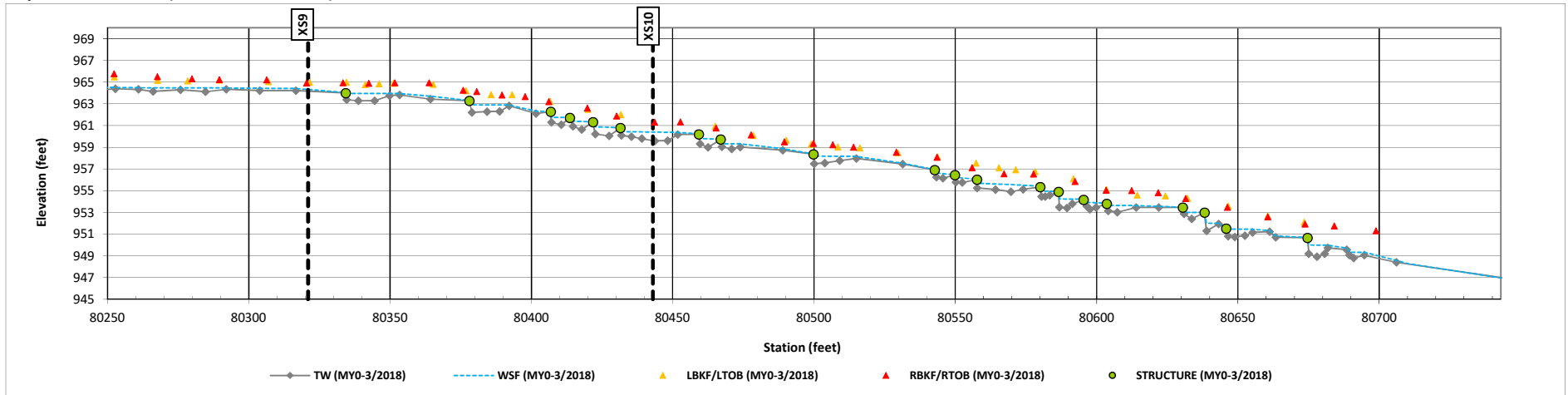
### Longitudinal Profile Plots

Big Harris Creek Mitigation Site - Area A

DMS Project No. 739

Monitoring Year 0 - 2018

#### Royster Creek Reach 1 (STA 802+54 to 807+13)



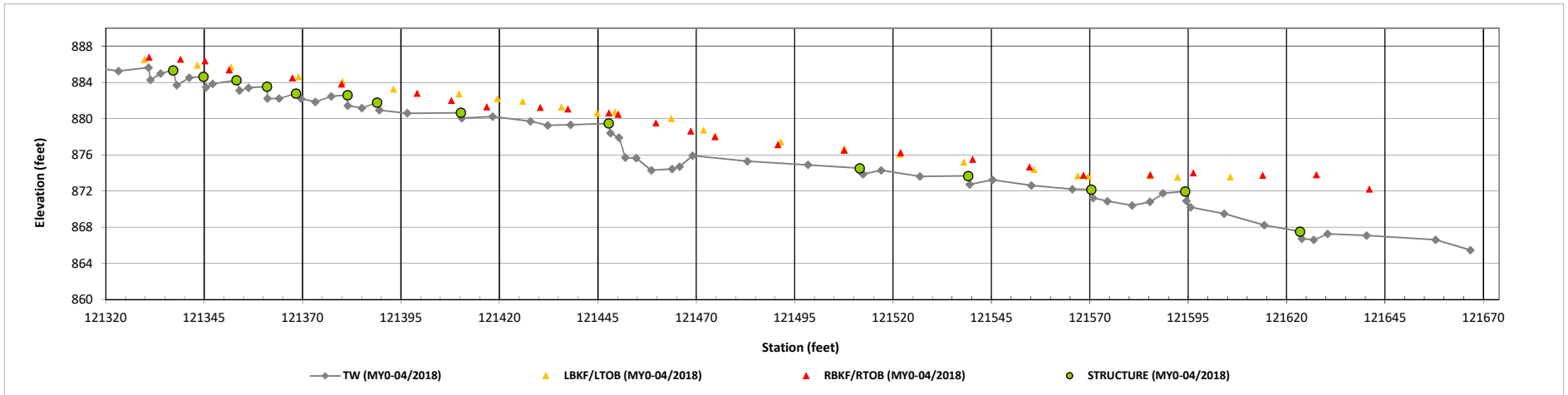
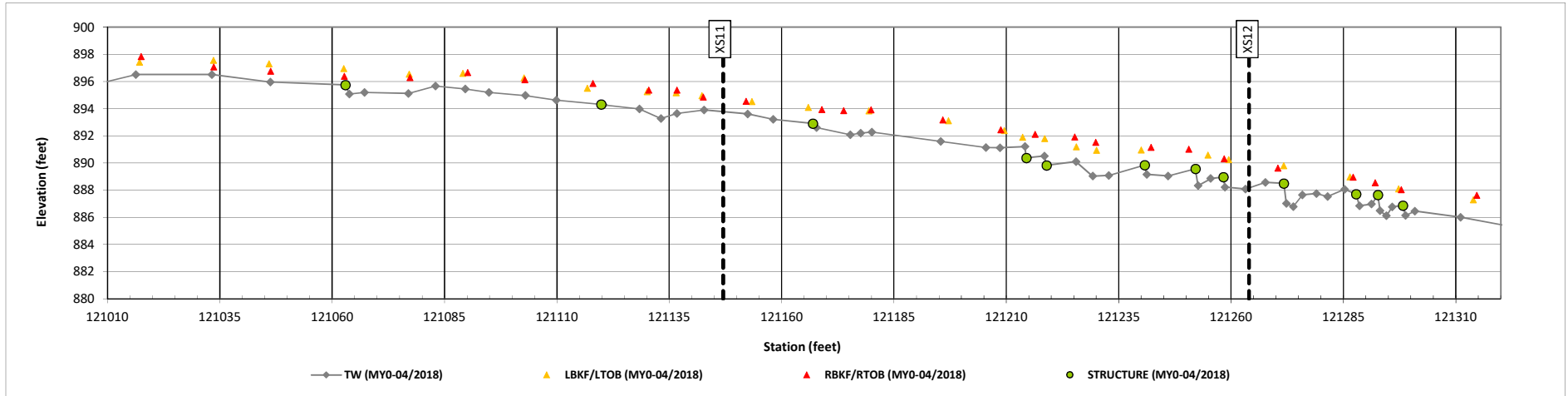
### Longitudinal Profile Plots

Big Harris Creek Mitigation Site - Area A

DMS Project No. 739

Monitoring Year 0 - 2018

#### Scott Creek (STA 1210+12 - STA 1216+74)

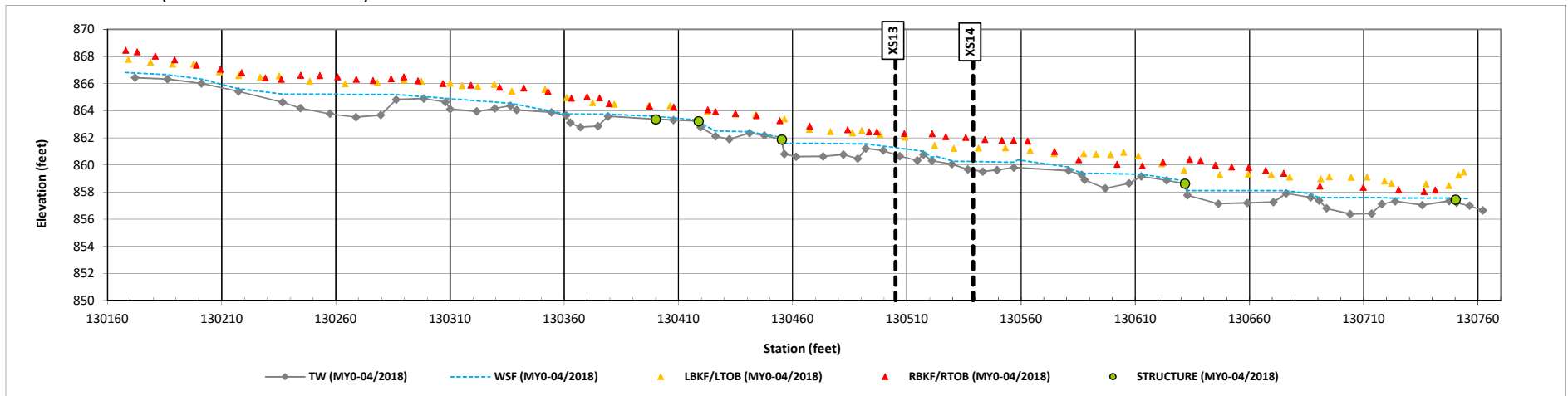


### Longitudinal Profile Plots

Big Harris Creek Mitigation Site - Area A  
DMS Project No. 739

Monitoring Year 0 - 2018

#### Carroll Creek Reach 1 (STA 1301+68 - STA 1307+63)

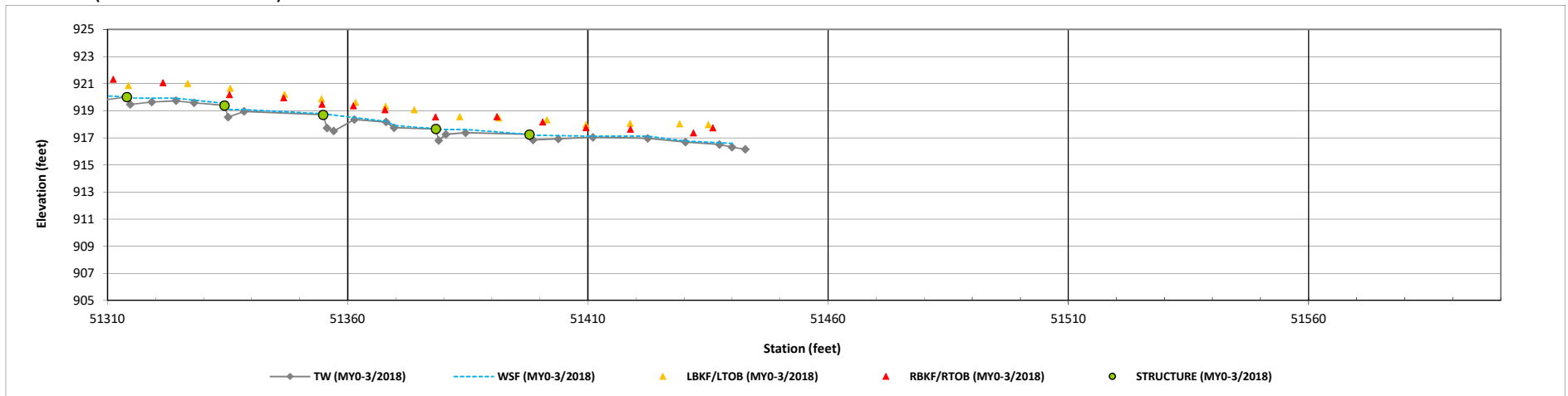


### Longitudinal Profile Plots

Big Harris Creek Mitigation Site - Area A  
DMS Project No. 739

Monitoring Year 0 - 2018

#### Eaker Creek (STA 513+11 - STA 514+45)



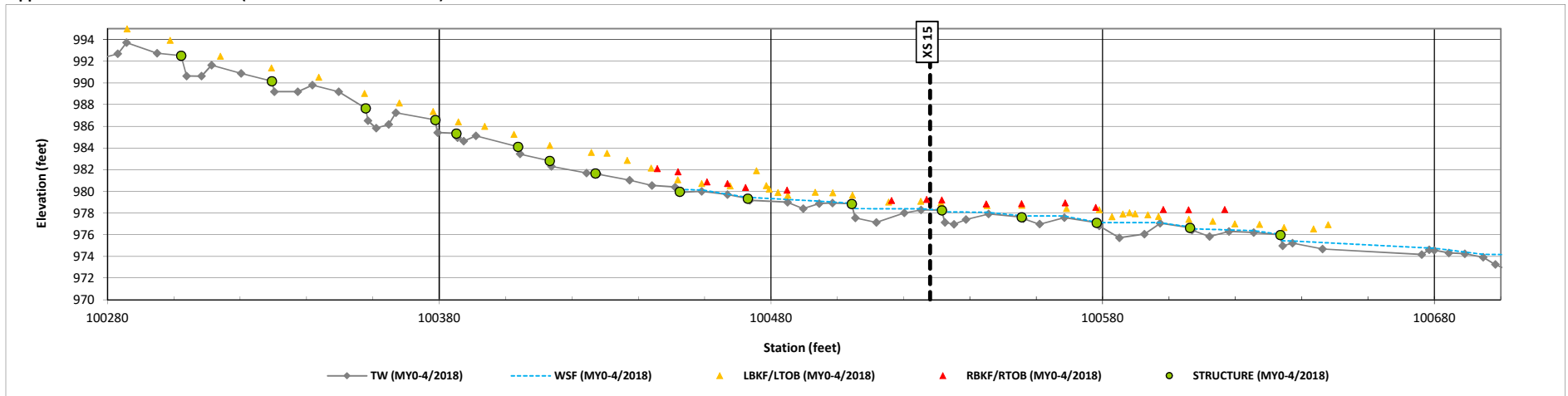
### Longitudinal Profile Plots

Big Harris Creek Mitigation Site - Area B

DMS Project No. 739

Monitoring Year 0 - 2018

#### Upper Stick Elliott Creek Reach 1 (STA 1002+89 - STA 1006+98)





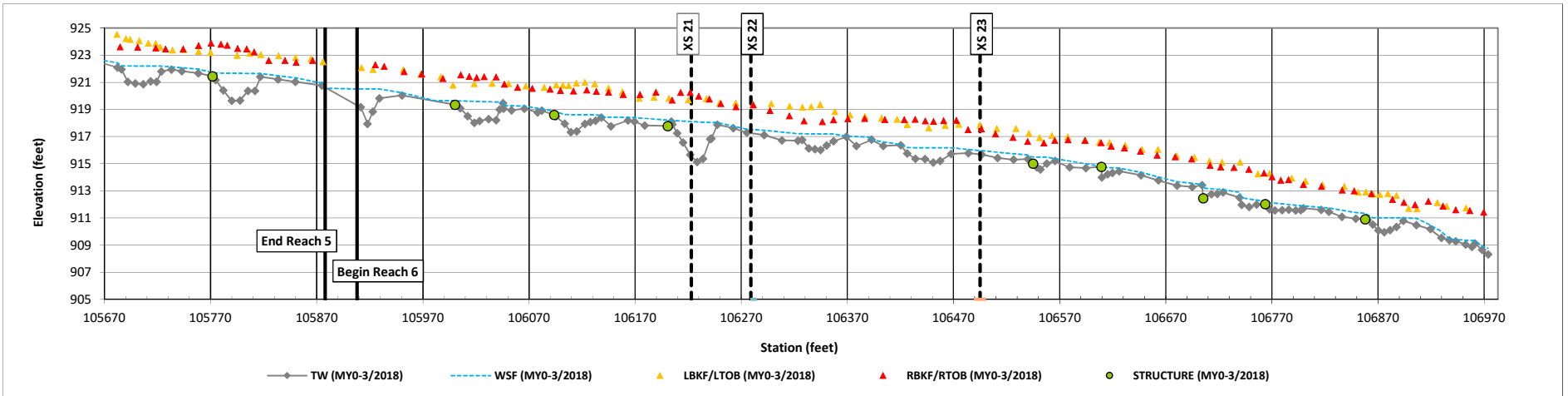
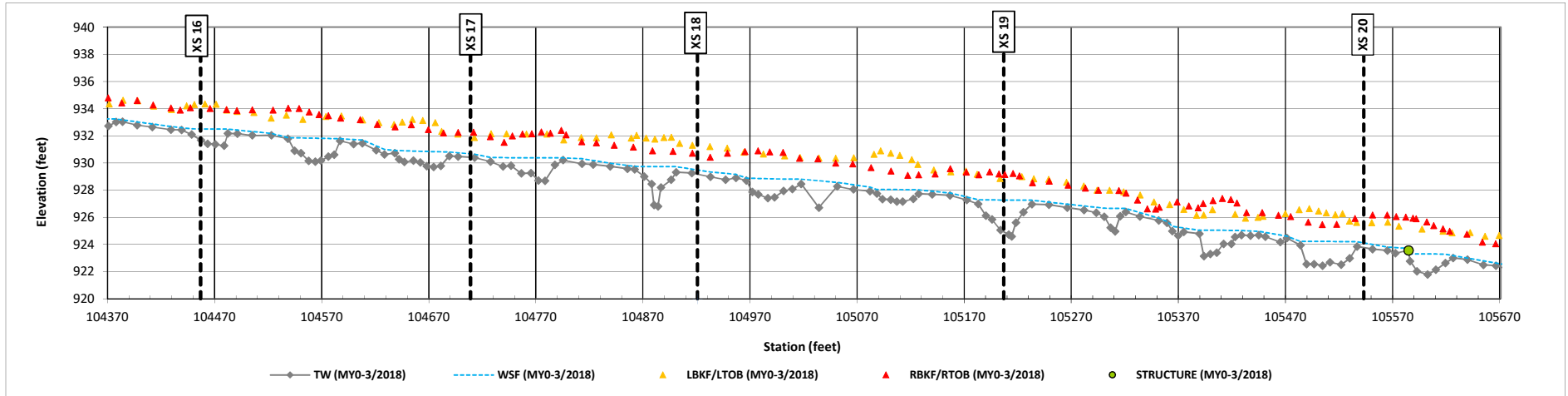
### Longitudinal Profile Plots

Big Harris Creek Mitigation Site - Area B

DMS Project No. 739

Monitoring Year 0 - 2018

#### Upper Stick Elliott Creek Reaches 5 & 6 (STA 1043+77 - STA 1069+83)



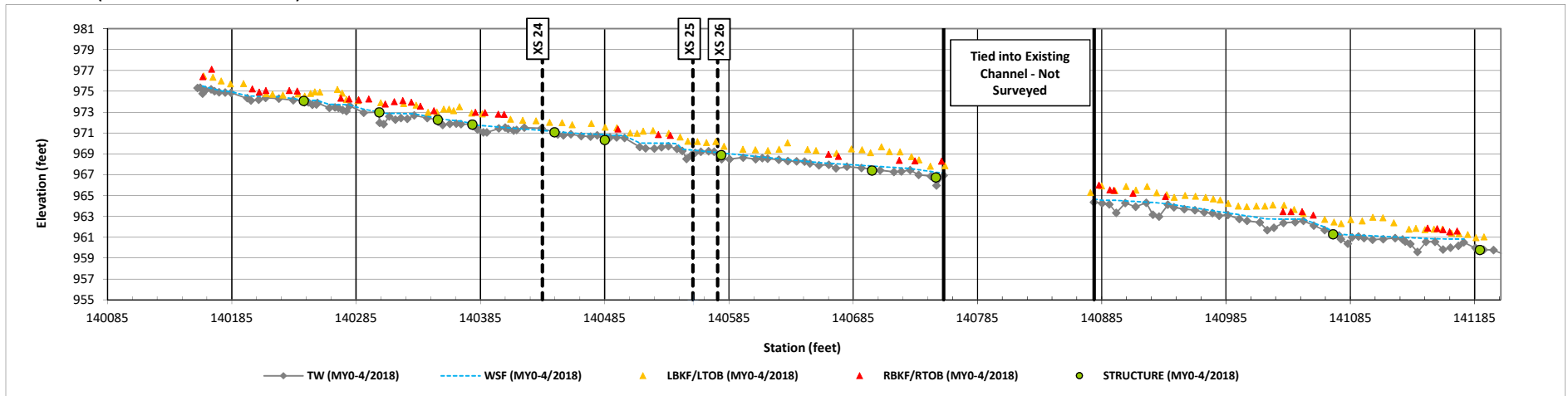
### Longitudinal Profile Plots

Big Harris Creek Mitigation Site - Area B

DMS Project No. 739

Monitoring Year 0 - 2018

#### Elliott Creek (STA 1400+85 - STA 1412+06)



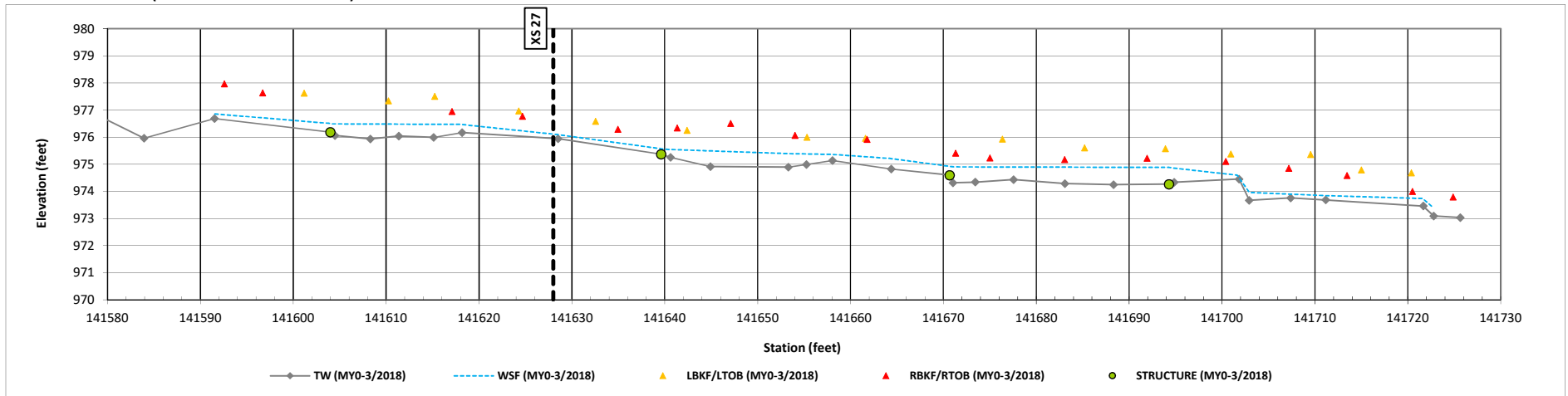
### Longitudinal Profile Plots

Big Harris Creek Mitigation Site - Area B

DMS Project No. 739

Monitoring Year 0 - 2018

#### UT1 to Elliott Creek (STA 1415+87 - STA 1417+28)



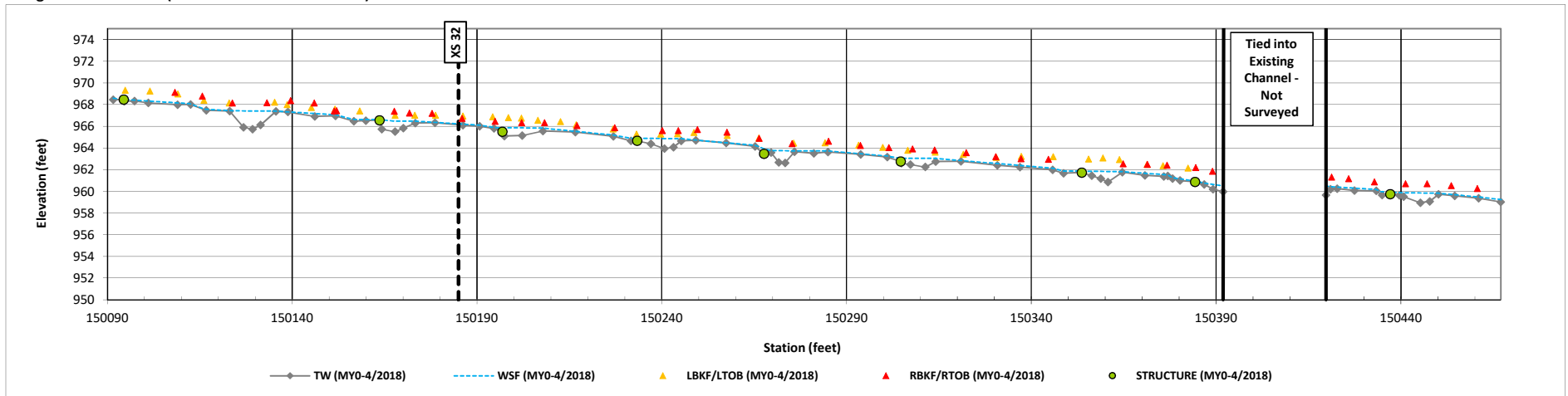
### Longitudinal Profile Plots

Big Harris Creek Mitigation Site - Area B

DMS Project No. 739

Monitoring Year 0 - 2018

#### Bridges Creek Reach 1 (STA 1500+91 - STA 1504+67)



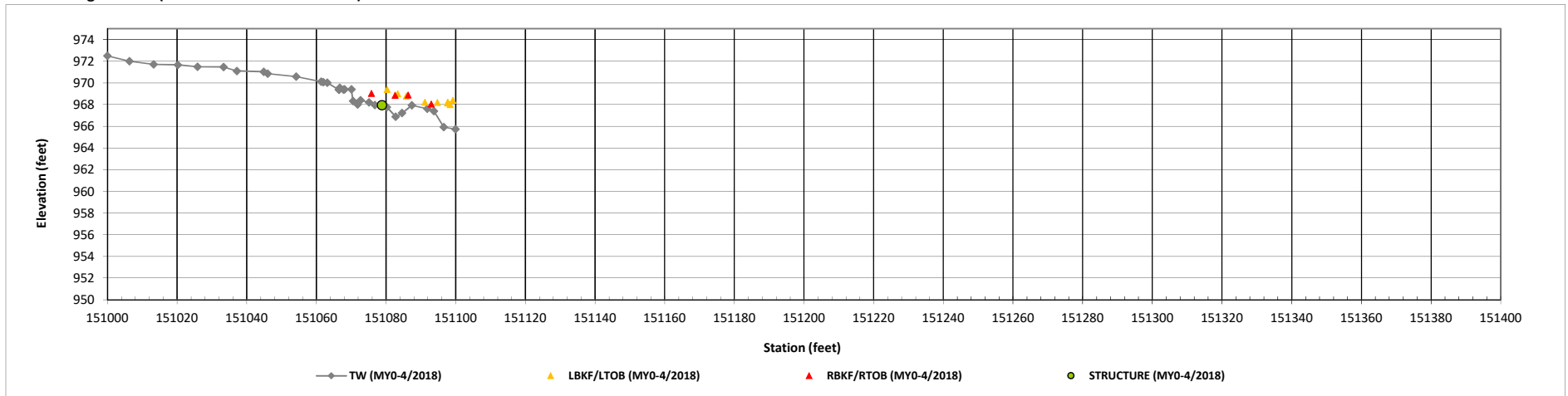
### Longitudinal Profile Plots

Big Harris Creek Mitigation Site - Area B

DMS Project No. 739

Monitoring Year 0 - 2018

#### UT1 to Bridges Creek (STA 1510+46 - STA 1511+01)



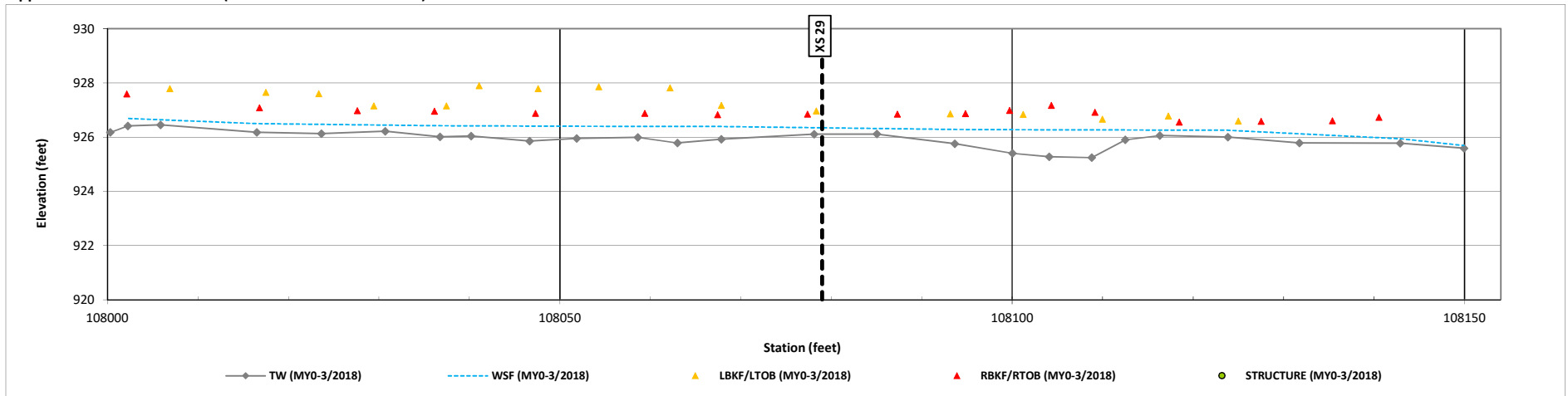
### Longitudinal Profile Plots

Big Harris Creek Mitigation Site - Area B

DMS Project No. 739

Monitoring Year 0 - 2018

#### Upper Stick Elliott Creek - UT2 (STA 1080+00 - STA 1081+54)



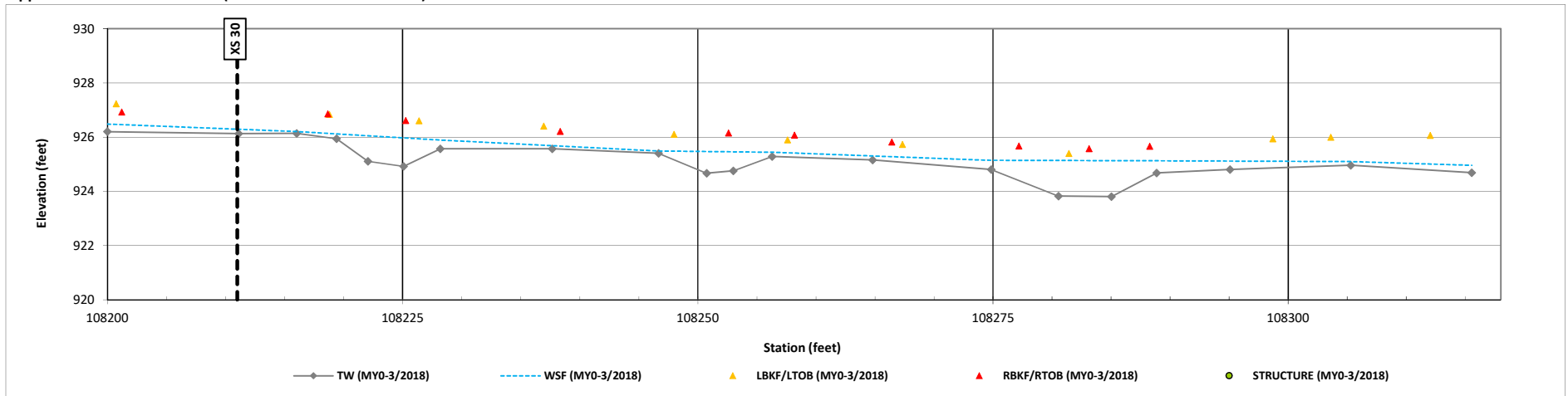
### Longitudinal Profile Plots

Big Harris Creek Mitigation Site - Area B

DMS Project No. 739

Monitoring Year 0 - 2018

#### Upper Stick Elliott Creek - UT3 (STA 1082+00 - STA 1083+18)



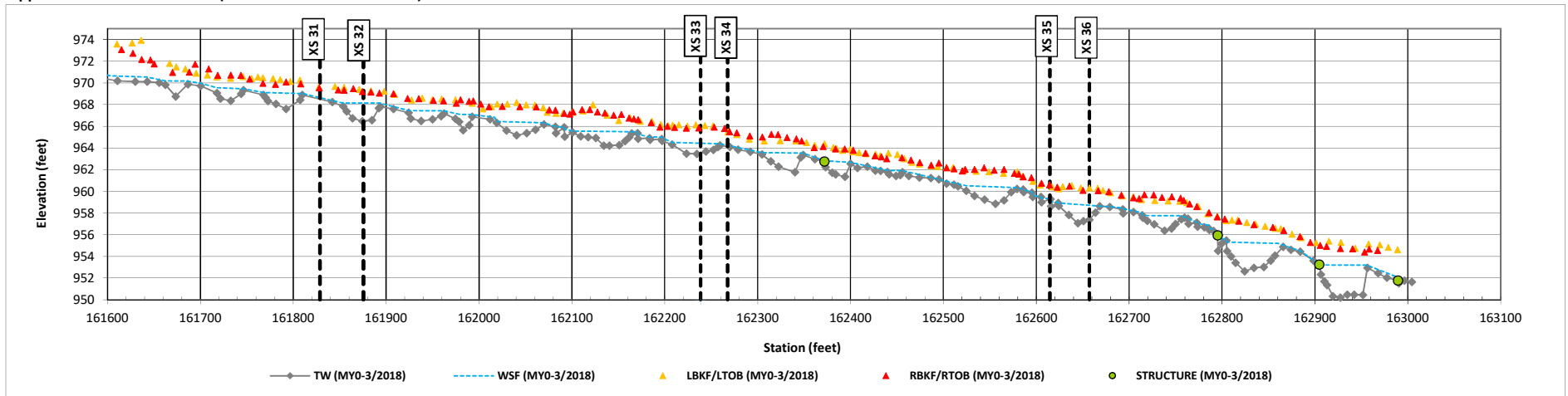
### Longitudinal Profile Plots

Big Harris Creek Mitigation Site - Area B

DMS Project No. 739

Monitoring Year 0 - 2018

#### Upper Fletcher Creek Reach 2 (STA 1616+02 - STA 1630+09)





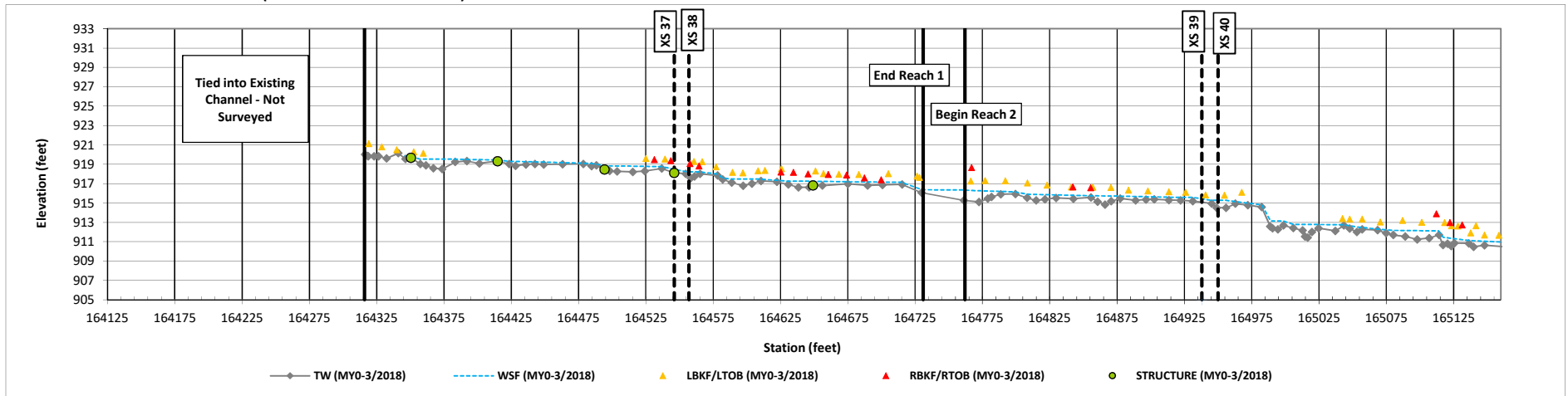
### Longitudinal Profile Plots

Big Harris Creek Mitigation Site - Area B

DMS Project No. 739

Monitoring Year 0 - 2018

#### Lower Fletcher Creek Reaches 1 & 2 (STA 1641+28 - STA 1651+60)



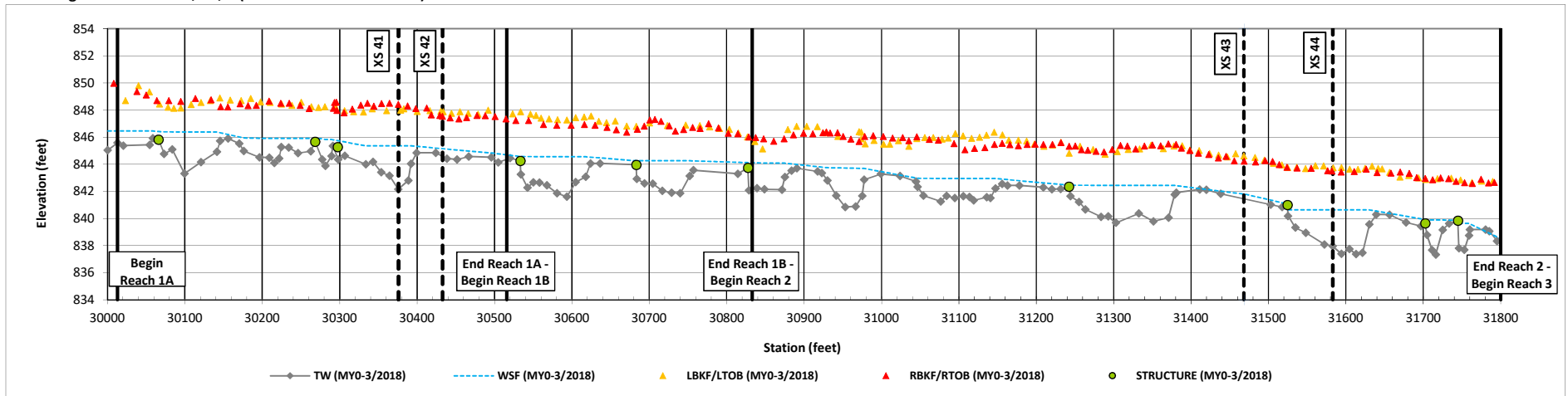
### Longitudinal Profile Plots

Big Harris Creek Mitigation Site - Area C

DMS Project No. 739

Monitoring Year 0 - 2018

#### Lower Big Harris Reach 1A, 1B, 2 (STA 300+13 - STA 318+00)



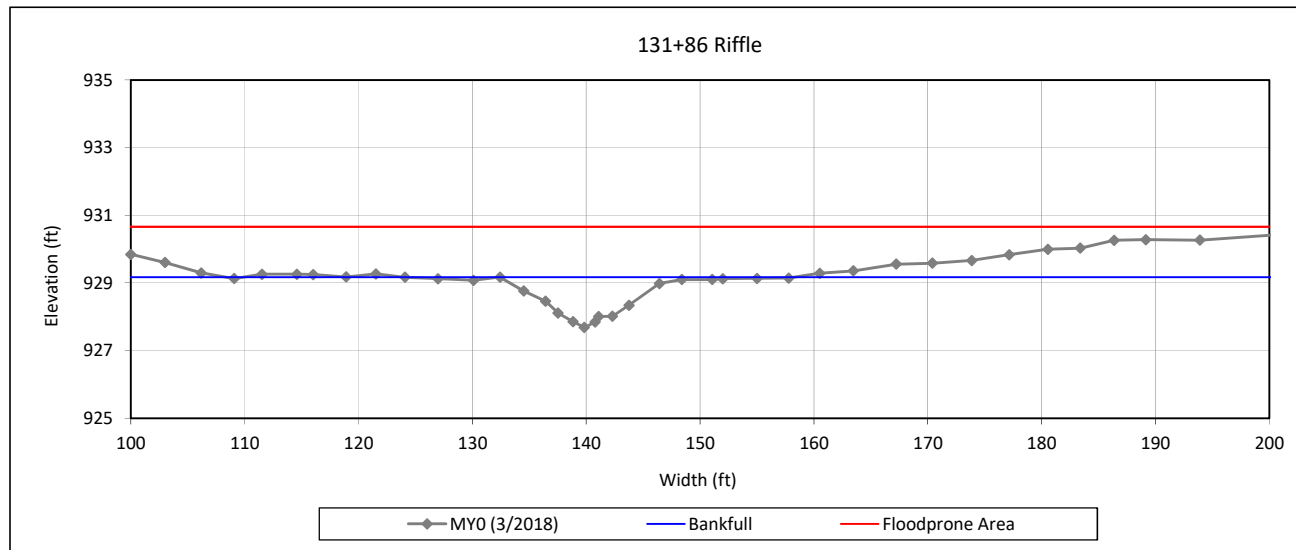
### Cross-Section Plots

Big Harris Creek Mitigation Site - Area A

NCDMS Project No. 739

Monitoring Year 0 - 2018

#### UBHC Reach 2A: Cross-Section 1



#### Bankfull Dimensions

11.6	x-section area (ft.sq.)
16.0	width (ft)
0.7	mean depth (ft)
1.5	max depth (ft)
16.3	wetted perimeter (ft)
0.7	hydraulic radius (ft)
22.0	width-depth ratio
108.7	W flood prone area (ft)
6.8	entrenchment ratio
1.0	low bank height ratio

Survey Date: 3/2018

Field Crew: Kee Mapping & Surveying



View Downstream

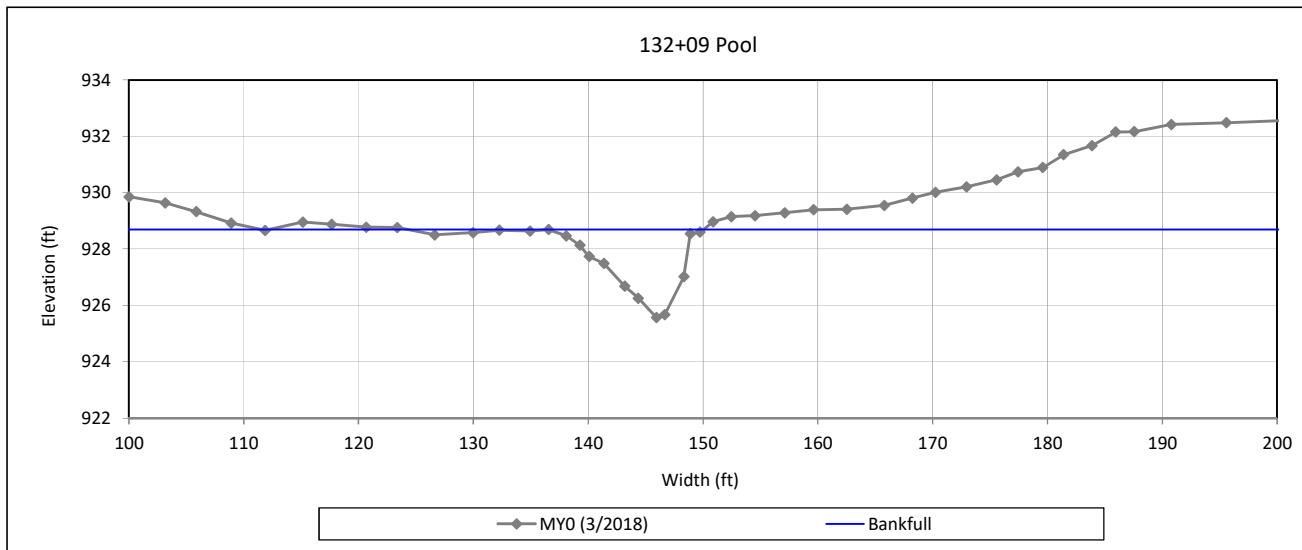
### Cross-Section Plots

Big Harris Creek Mitigation Site - Area A

NCDMS Project No. 739

Monitoring Year 0 - 2018

#### UBHC Reach 2A: Cross-Section 2



#### Bankfull Dimensions

19.3	x-section area (ft.sq.)
13.5	width (ft)
1.4	mean depth (ft)
3.1	max depth (ft)
15.6	wetted perimeter (ft)
1.2	hydraulic radius (ft)
9.4	width-depth ratio

Survey Date: 3/2018

Field Crew: Kee Mapping & Surveying



View Downstream

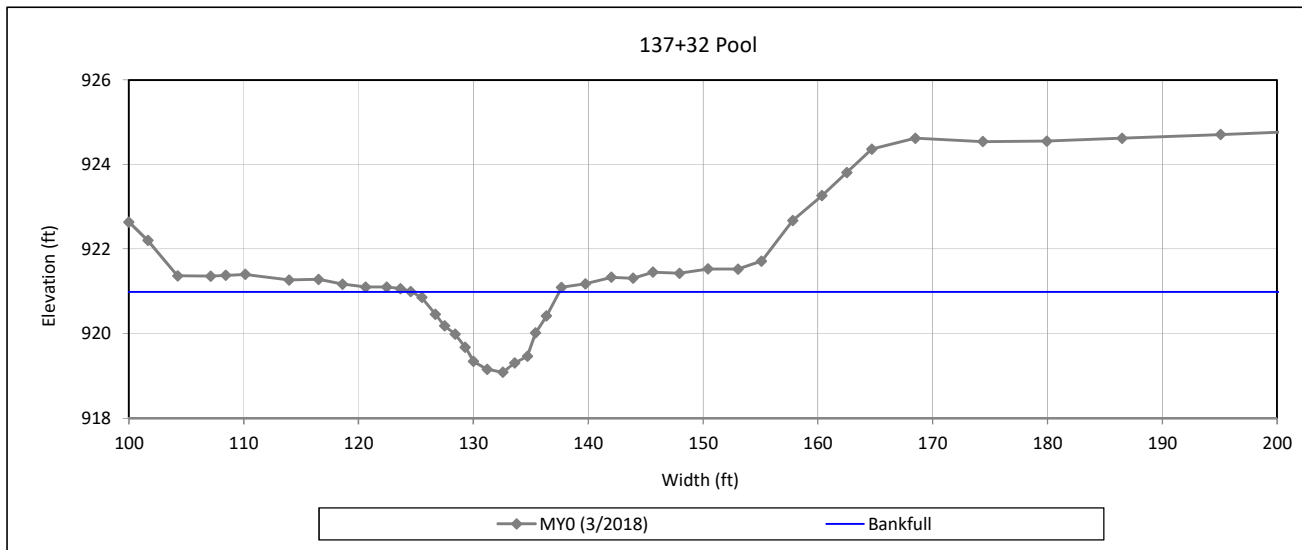
### Cross-Section Plots

Big Harris Creek Mitigation Site - Area A

NCDMS Project No. 739

Monitoring Year 0 - 2018

#### UBHC Reach 2B: Cross-Section 3



#### Bankfull Dimensions

14.0	x-section area (ft.sq.)
12.0	width (ft)
1.2	mean depth (ft)
1.9	max depth (ft)
12.7	wetted perimeter (ft)
1.1	hydraulic radius (ft)
10.2	width-depth ratio

Survey Date: 3/2018

Field Crew: Kee Mapping & Surveying



View Downstream

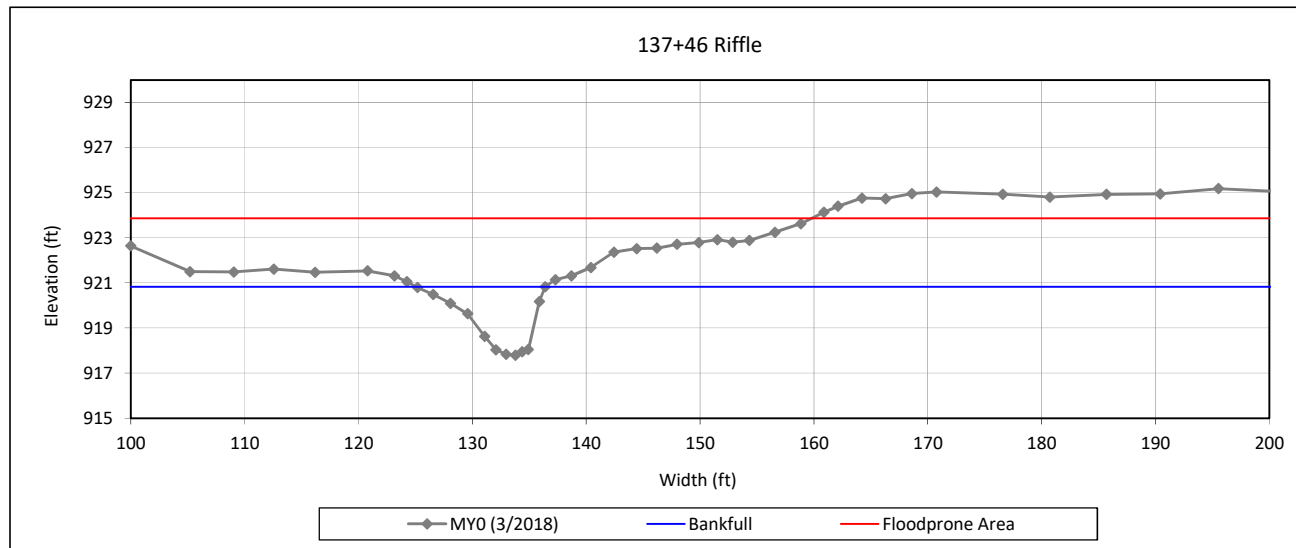
### Cross-Section Plots

Big Harris Creek Mitigation Site - Area A

NCDMS Project No. 739

Monitoring Year 0 - 2018

#### UBHC Reach 2B: Cross-Section 4



#### Bankfull Dimensions

17.7	x-section area (ft.sq.)
11.3	width (ft)
1.6	mean depth (ft)
3.0	max depth (ft)
13.7	wetted perimeter (ft)
1.3	hydraulic radius (ft)
7.3	width-depth ratio
170.3	W flood prone area (ft)
15.0	entrenchment ratio
1.0	low bank height ratio

Survey Date: 3/2018

Field Crew: Kee Mapping & Surveying



View Downstream

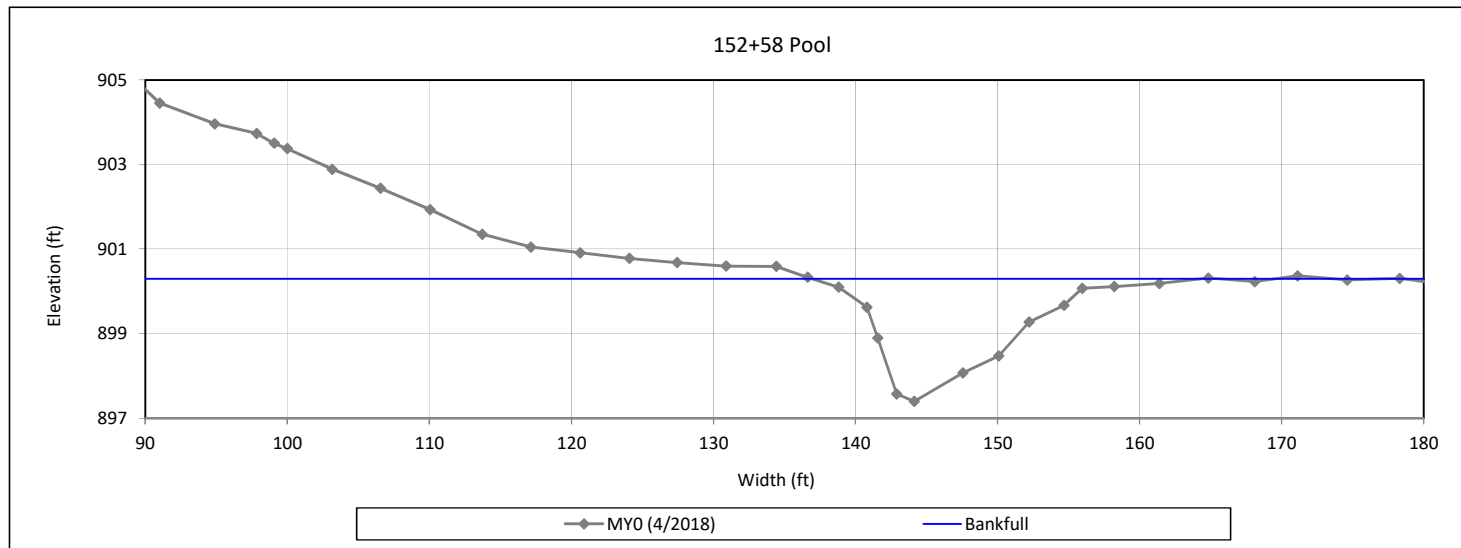
### Cross-Section Plots

Big Harris Creek Mitigation Site

NCDMS Project No. 739

Monitoring Year 0 - 2018

#### UBHC Reach 4: Cross-Section 5



#### Bankfull Dimensions

28.8	x-section area (ft.sq.)
30.3	width (ft)
1.0	mean depth (ft)
2.9	max depth (ft)
31.6	wetted perimeter (ft)
0.9	hydraulic radius (ft)
31.9	width-depth ratio

Survey Date: 4/2018

Field Crew: Kee Mapping & Surveying



View Downstream

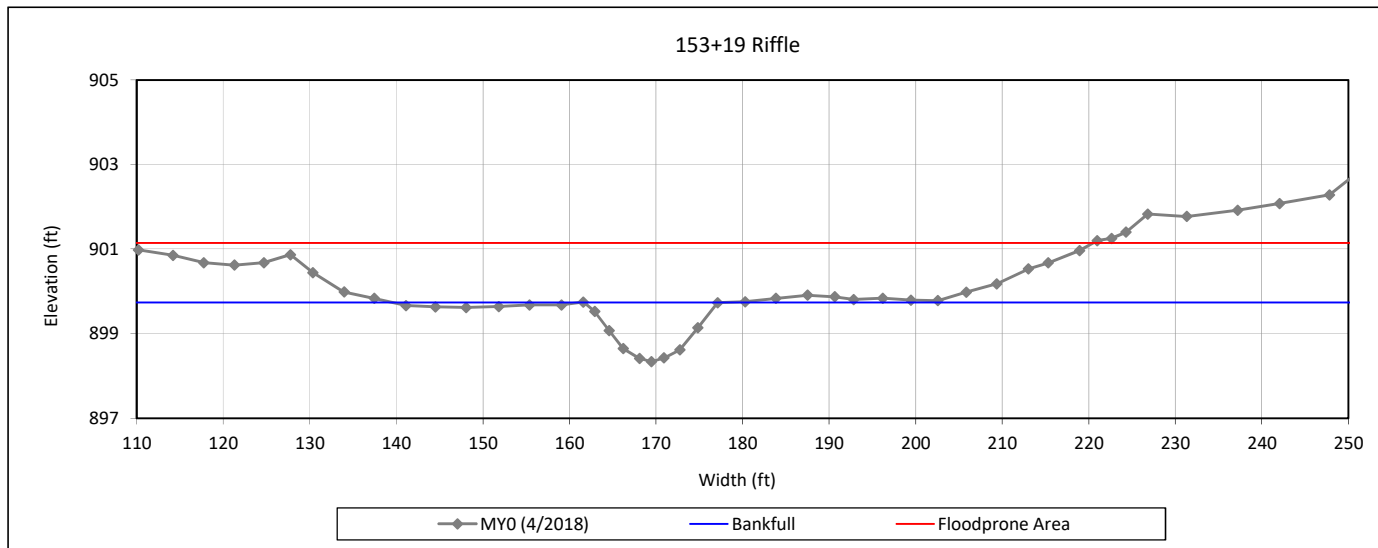
### Cross-Section Plots

Big Harris Creek Mitigation Site

NCDMS Project No. 739

Monitoring Year 0 - 2018

#### UBHC Reach 4: Cross-Section 6



#### Bankfull Dimensions

13.1	x-section area (ft.sq.)
15.5	width (ft)
0.8	mean depth (ft)
1.4	max depth (ft)
15.8	wetted perimeter (ft)
0.8	hydraulic radius (ft)
18.3	width-depth ratio
118.0	W flood prone area (ft)
7.6	entrenchment ratio
1.0	low bank height ratio

Survey Date: 4/2018

Field Crew: Kee Mapping & Surveying



View Downstream



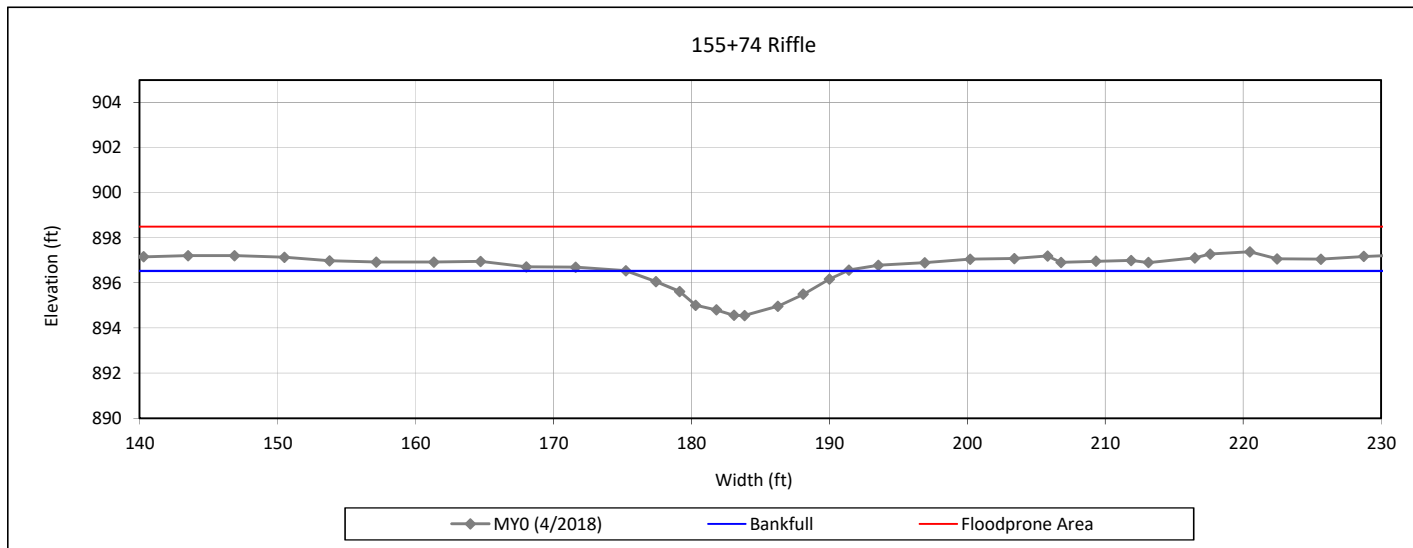
### Cross-Section Plots

Big Harris Creek Mitigation Site

NCDMS Project No. 739

Monitoring Year 0 - 2018

#### UBHC Reach 4: Cross-Section 7



#### Bankfull Dimensions

17.6	x-section area (ft.sq.)
16.0	width (ft)
1.1	mean depth (ft)
2.0	max depth (ft)
16.6	wetted perimeter (ft)
1.1	hydraulic radius (ft)
14.5	width-depth ratio
190.0	W flood prone area (ft)
11.9	entrenchment ratio
1.0	low bank height ratio

Survey Date: 4/2018

Field Crew: Kee Mapping & Surveying



View Downstream

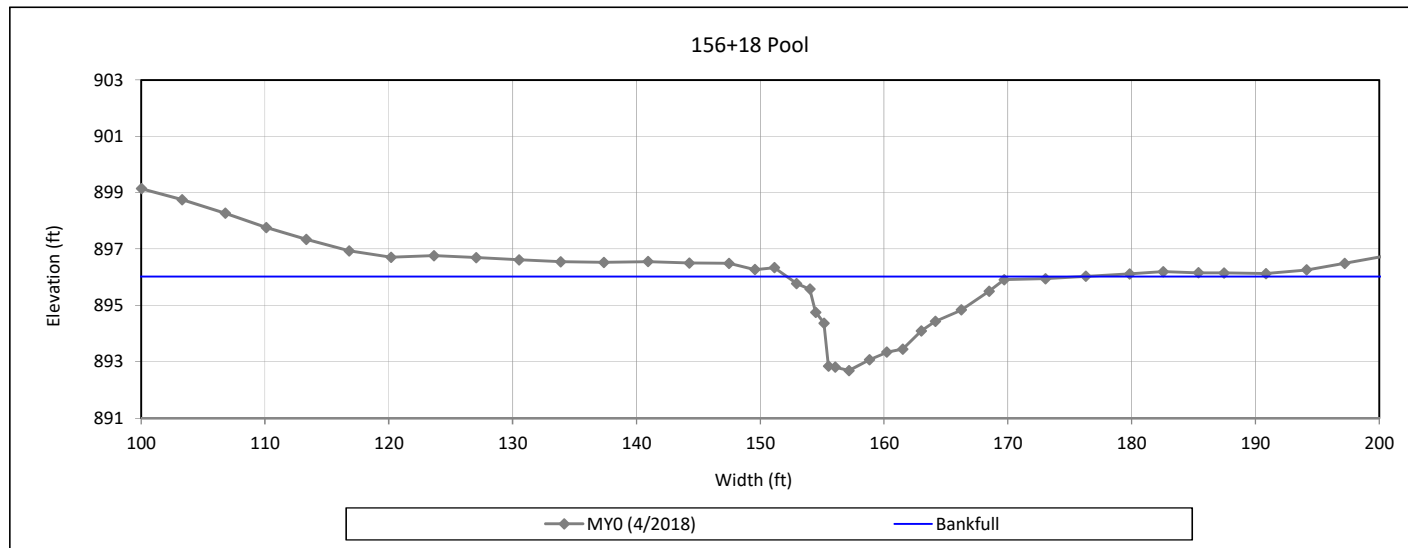
### Cross-Section Plots

Big Harris Creek Mitigation Site

NCDMS Project No. 739

Monitoring Year 0 - 2018

#### UBHC Reach 4: Cross-Section 8



#### Bankfull Dimensions

31.6	x-section area (ft.sq.)
20.9	width (ft)
1.5	mean depth (ft)
3.3	max depth (ft)
23.2	wetted perimeter (ft)
1.4	hydraulic radius (ft)
13.8	width-depth ratio

Survey Date: 4/2018

Field Crew: Kee Mapping & Surveying



View Downstream

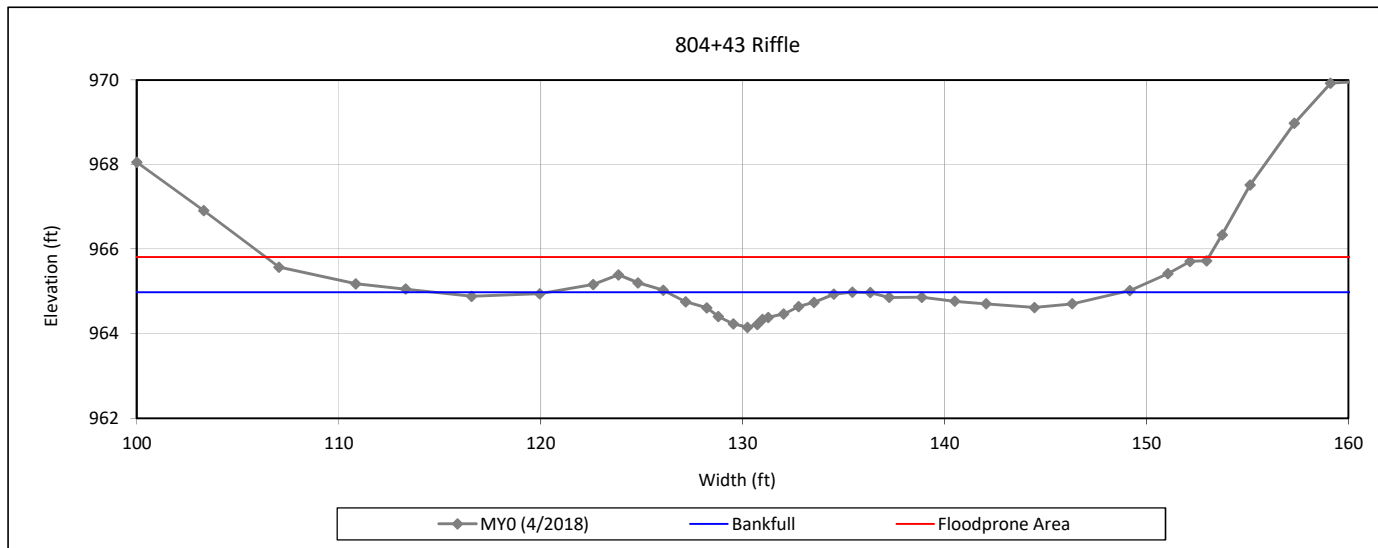
### Cross-Section Plots

Big Harris Creek Mitigation Site

NCDMS Project No. 739

Monitoring Year 0 - 2018

#### Royster Creek Reach 1: Cross-Section 9



#### Bankfull Dimensions

3.6	x-section area (ft.sq.)
10.0	width (ft)
0.4	mean depth (ft)
0.8	max depth (ft)
10.2	wetted perimeter (ft)
0.4	hydraulic radius (ft)
27.6	width-depth ratio
46.7	W flood prone area (ft)
4.7	entrenchment ratio
1.0	low bank height ratio

Survey Date: (4/2018)

Field Crew: Kee Mapping & Surveying



View Downstream

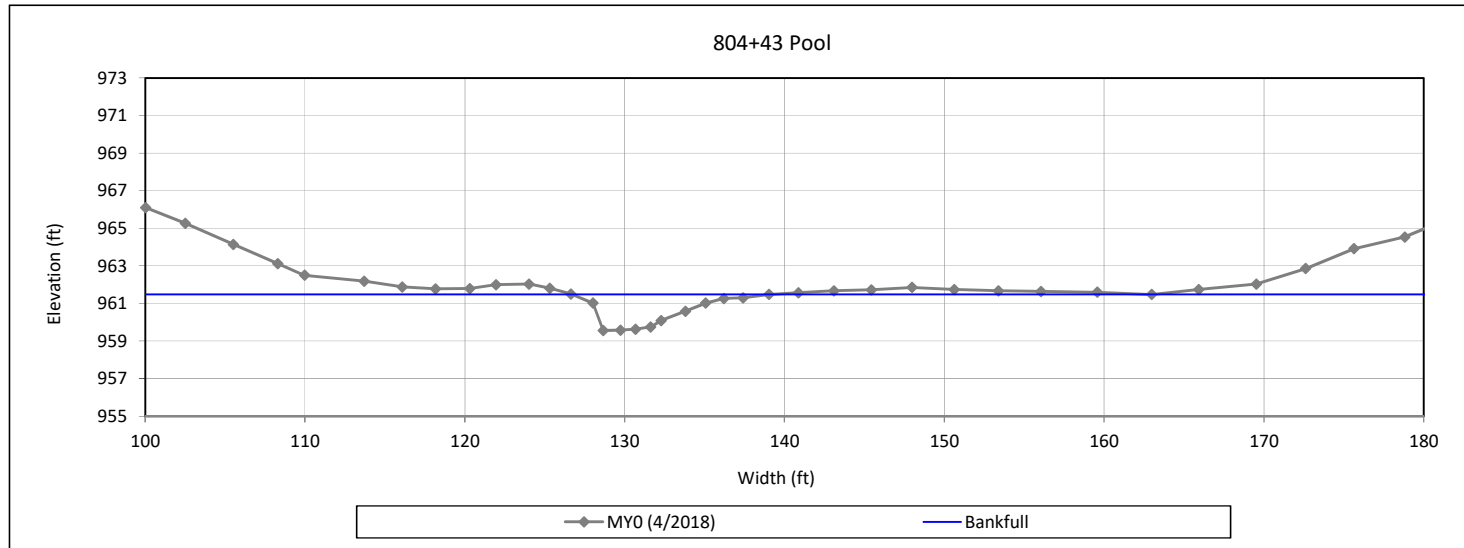
### Cross-Section Plots

Big Harris Creek Mitigation Site

NCDMS Project No. 739

Monitoring Year 0 - 2018

#### Royster Creek Reach 1: Cross-Section 10



#### Bankfull Dimensions

11.0	x-section area (ft.sq.)
12.3	width (ft)
0.9	mean depth (ft)
1.9	max depth (ft)
13.6	wetted perimeter (ft)
0.8	hydraulic radius (ft)
13.9	width-depth ratio

Survey Date: 4/2018

Field Crew: Kee Mapping & Surveying



View Downstream

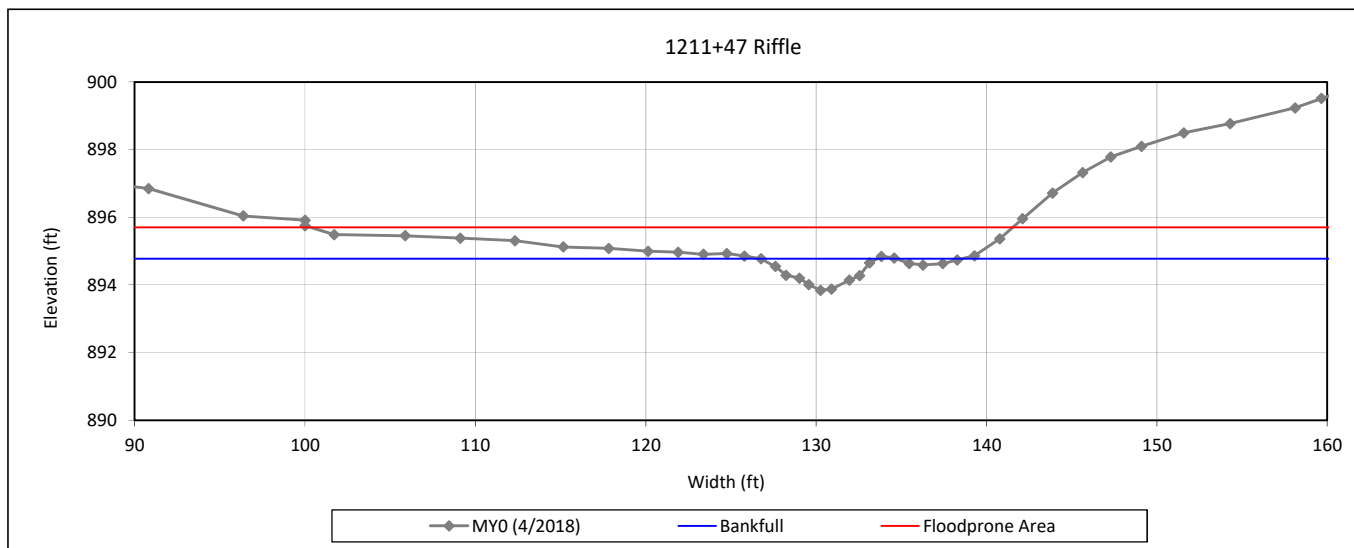
### Cross-Section Plots

Big Harris Creek Mitigation Site

NCDMS Project No. 739

Monitoring Year 0 - 2018

#### Scott Creek: Cross-Section 11



#### Bankfull Dimensions

3.6	x-section area (ft.sq.)
6.8	width (ft)
0.5	mean depth (ft)
0.9	max depth (ft)
7.1	wetted perimeter (ft)
0.5	hydraulic radius (ft)
12.7	width-depth ratio
67.1	W flood prone area (ft)
9.9	entrenchment ratio
1.0	low bank height ratio

Survey Date: 4/2018

Field Crew: Kee Mapping and Surveying



View Downstream

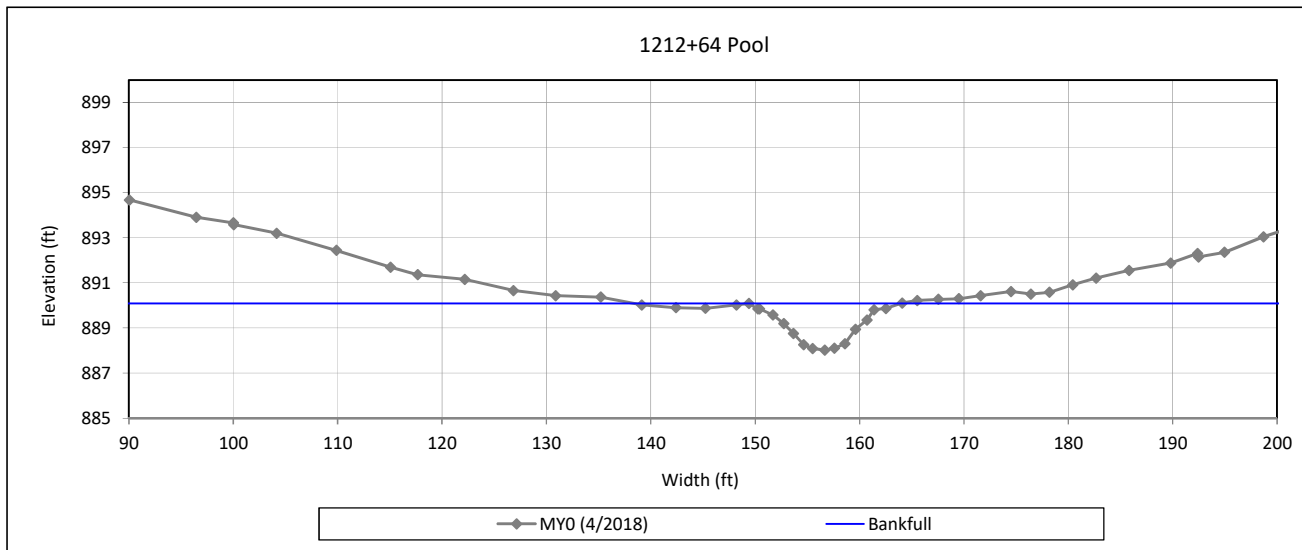
### Cross-Section Plots

Big Harris Creek Mitigation Site

NCDMS Project No. 739

Monitoring Year 0 - 2018

#### Scott Creek: Cross-Section 12



#### Bankfull Dimensions

14.9	x-section area (ft.sq.)
13.7	width (ft)
1.1	mean depth (ft)
2.1	max depth (ft)
14.5	wetted perimeter (ft)
1.0	hydraulic radius (ft)
12.6	width-depth ratio

Survey Date: 4/2018

Field Crew: Kee Mapping & Surveying



View Downstream

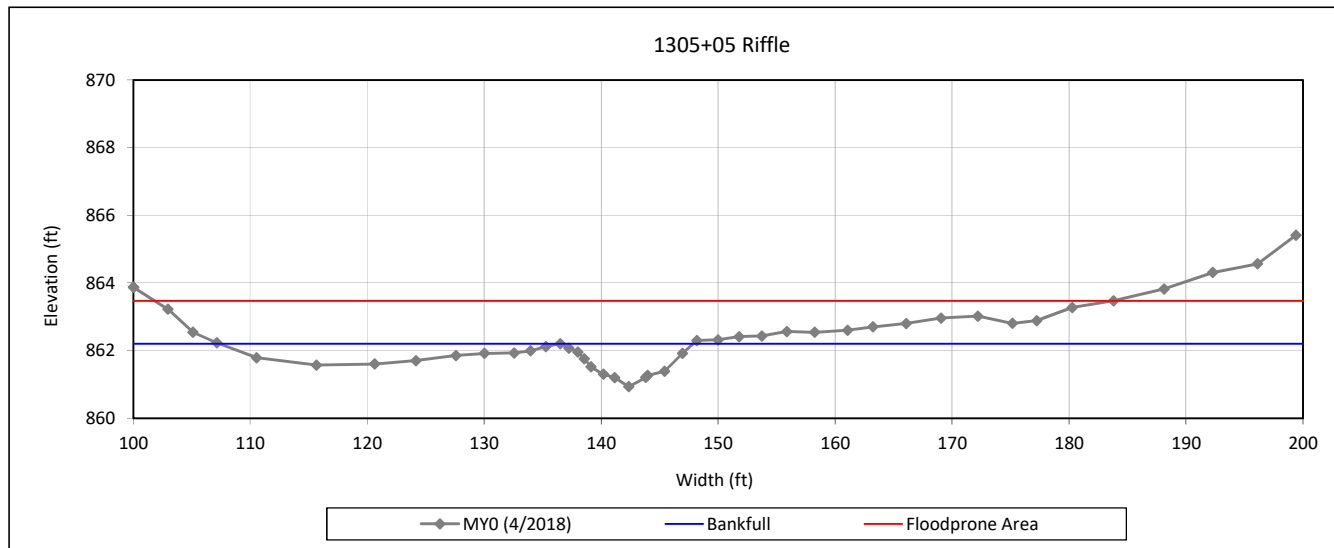
### Cross-Section Plots

Big Harris Creek Mitigation Site

NCDMS Project No. 739

Monitoring Year 0 - 2018

#### Carroll Creek Reach 1: Cross-Section 13



#### Bankfull Dimensions

7.9	x-section area (ft.sq.)
11.4	width (ft)
0.7	mean depth (ft)
1.3	max depth (ft)
11.7	wetted perimeter (ft)
0.7	hydraulic radius (ft)
16.4	width-depth ratio
82.0	W flood prone area (ft)
7.2	entrenchment ratio
1.0	low bank height ratio

Survey Date: 4/2018

Field Crew: Kee Mapping & Surveying



View Downstream

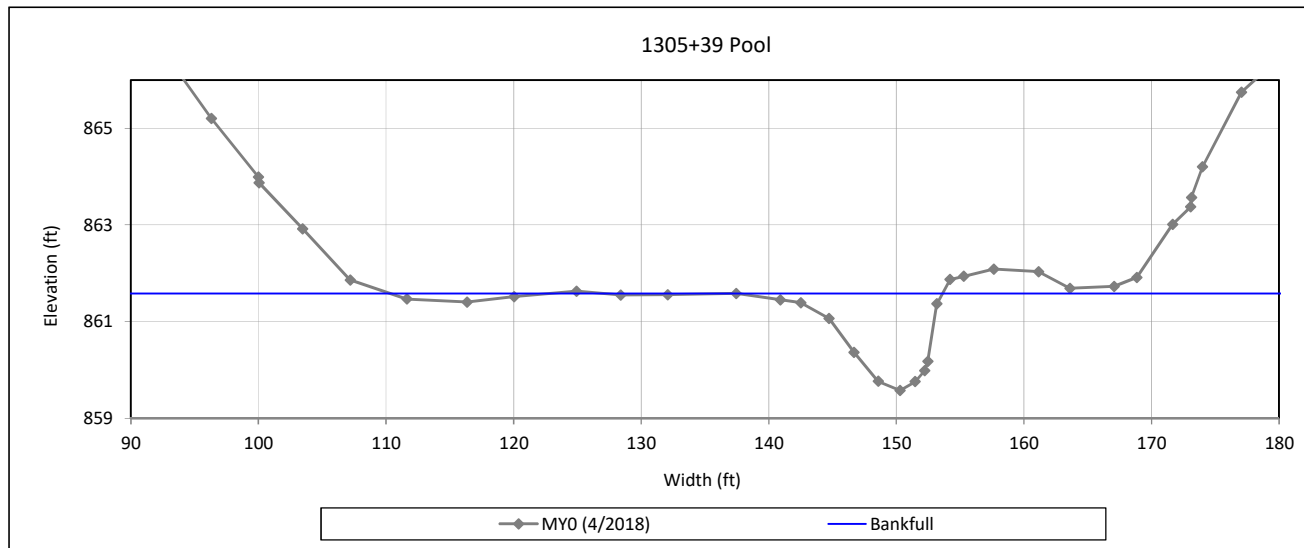
### Cross-Section Plots

Big Harris Creek Mitigation Site

NCDMS Project No. 739

Monitoring Year 0 - 2018

#### Carroll Creek Reach 1: Cross-Section 14



#### Bankfull Dimensions

13.4	x-section area (ft.sq.)
12.7	width (ft)
1.1	mean depth (ft)
2.0	max depth (ft)
13.8	wetted perimeter (ft)
1.0	hydraulic radius (ft)
12.0	width-depth ratio

Survey Date: 4/2018

Field Crew: Kee Mapping & Surveying



View Downstream



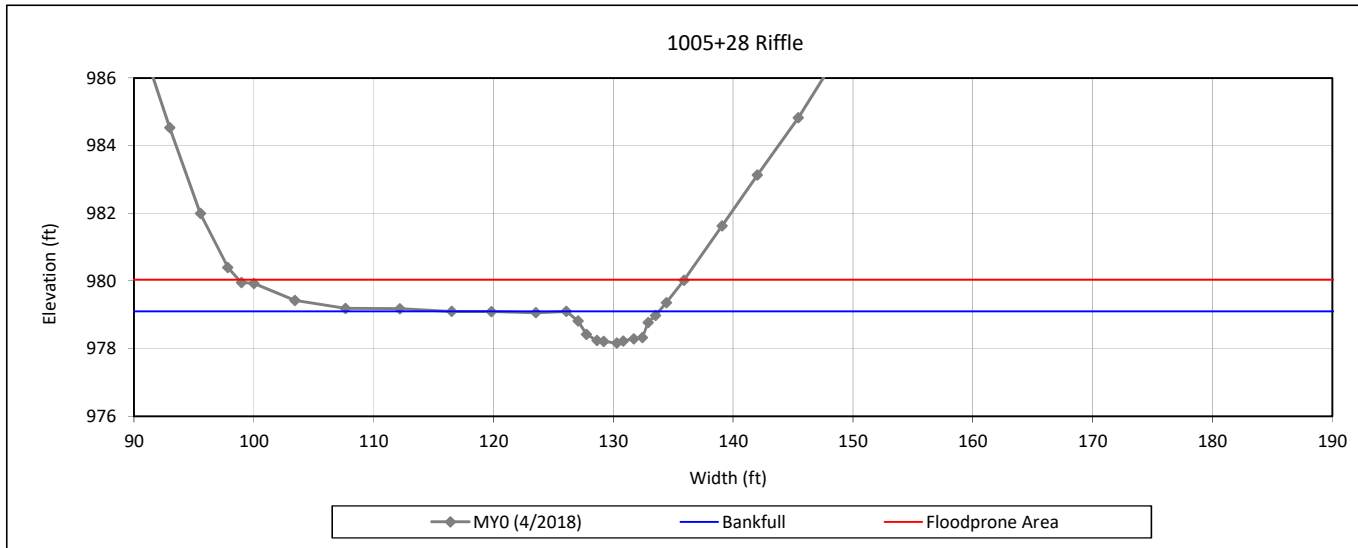
### Cross-Section Plots

Big Harris Creek Mitigation Site

NCDMS Project No. 739

Monitoring Year 0 - 2018

#### USEC Reach 1: Cross-Section 15



#### Bankfull Dimensions

4.7	x-section area (ft.sq.)
6.7	width (ft)
0.7	mean depth (ft)
0.9	max depth (ft)
7.1	wetted perimeter (ft)
0.7	hydraulic radius (ft)
9.6	width-depth ratio
37.2	W flood prone area (ft)
5.5	entrenchment ratio
1.0	low bank height ratio

Survey Date: 4/2018

Field Crew: Kee Mapping & Surveying



View Downstream

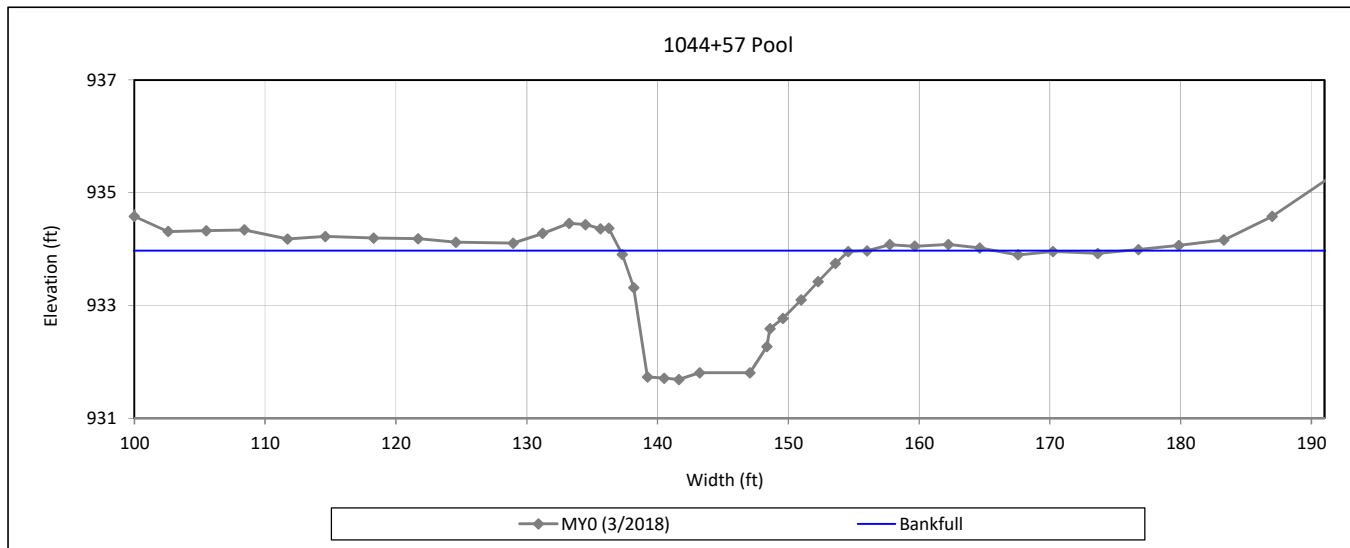
### Cross-Section Plots

Big Harris Creek Mitigation Site

NCDMS Project No. 739

Monitoring Year 0 - 2018

#### USEC Reach 5: Cross-Section 16



#### Bankfull Dimensions

26.3	x-section area (ft.sq.)
17.4	width (ft)
1.5	mean depth (ft)
2.3	max depth (ft)
18.9	wetted perimeter (ft)
1.4	hydraulic radius (ft)
11.5	width-depth ratio

Survey Date: 3/2018

Field Crew: Kee Mapping & Surveying



View Downstream

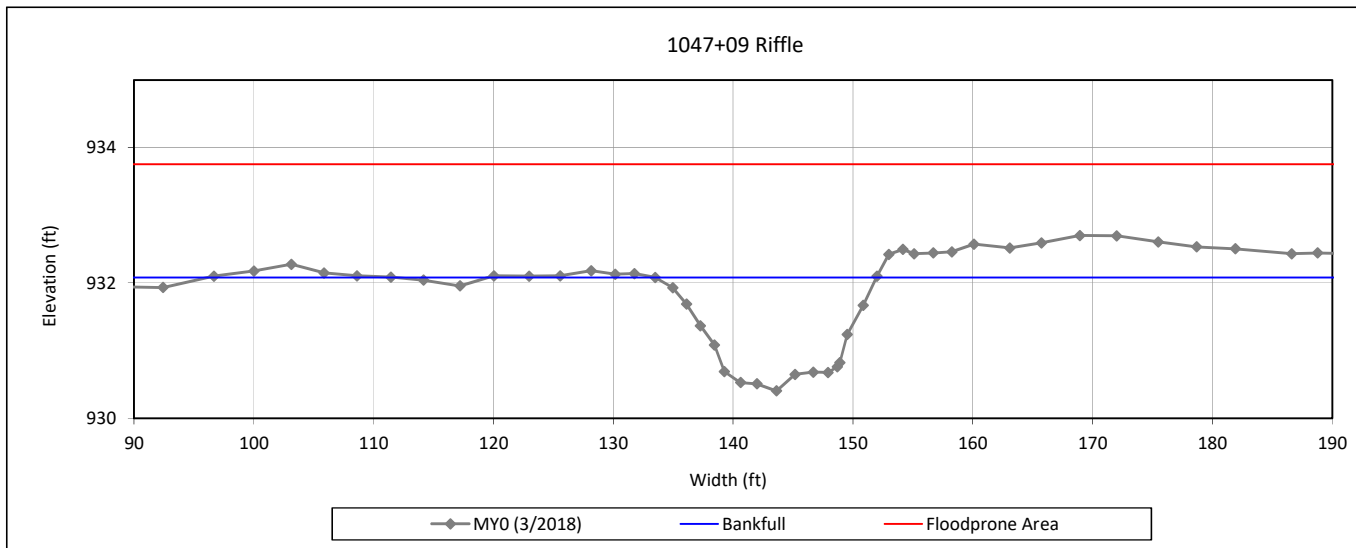
### Cross-Section Plots

Big Harris Creek Mitigation Site

NCDMS Project No. 739

Monitoring Year 0 - 2018

#### USEC Reach 5: Cross-Section 17



#### Bankfull Dimensions

19.2	x-section area (ft.sq.)
18.4	width (ft)
1.0	mean depth (ft)
1.7	max depth (ft)
19.0	wetted perimeter (ft)
1.0	hydraulic radius (ft)
17.8	width-depth ratio
150.0	W flood prone area (ft)
8.1	entrenchment ratio
1.0	low bank height ratio

Survey Date: 3/2018

Field Crew: Kee Mapping & Surveying



View Downstream

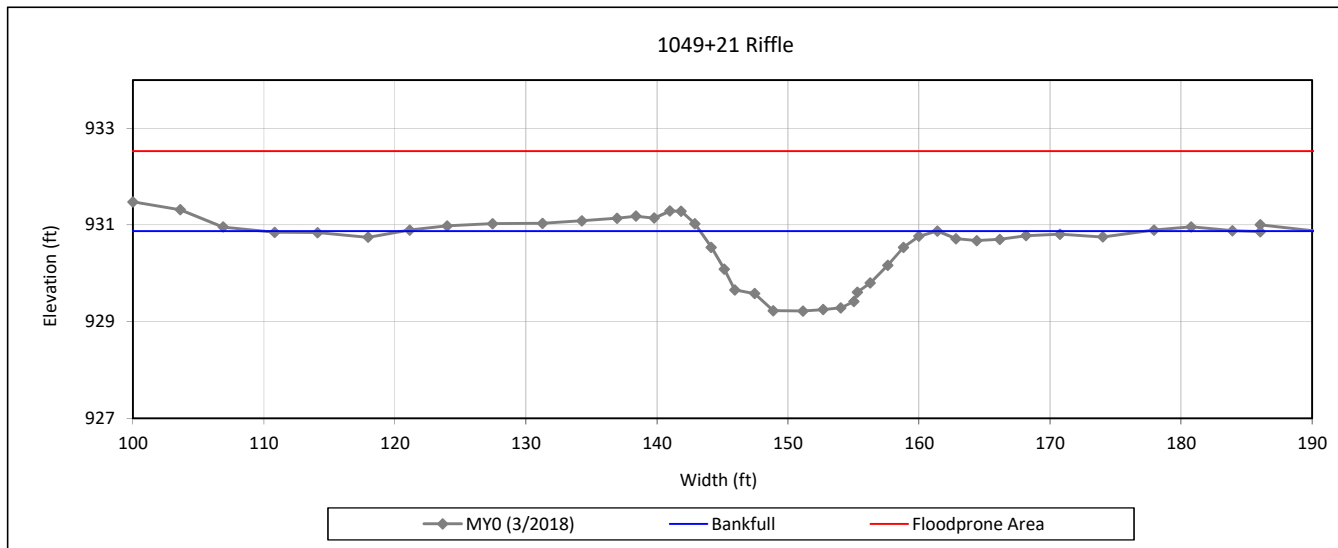
### Cross-Section Plots

Big Harris Creek Mitigation Site

NCDMS Project No. 739

Monitoring Year 0 - 2018

#### USEC Reach 5: Cross-Section 18



#### Bankfull Dimensions

19.1	x-section area (ft.sq.)
18.1	width (ft)
1.1	mean depth (ft)
1.7	max depth (ft)
18.6	wetted perimeter (ft)
1.0	hydraulic radius (ft)
17.2	width-depth ratio
178.4	W flood prone area (ft)
9.8	entrenchment ratio
1.0	low bank height ratio

Survey Date: 3/2018

Field Crew: Kee Mapping & Surveying



View Downstream

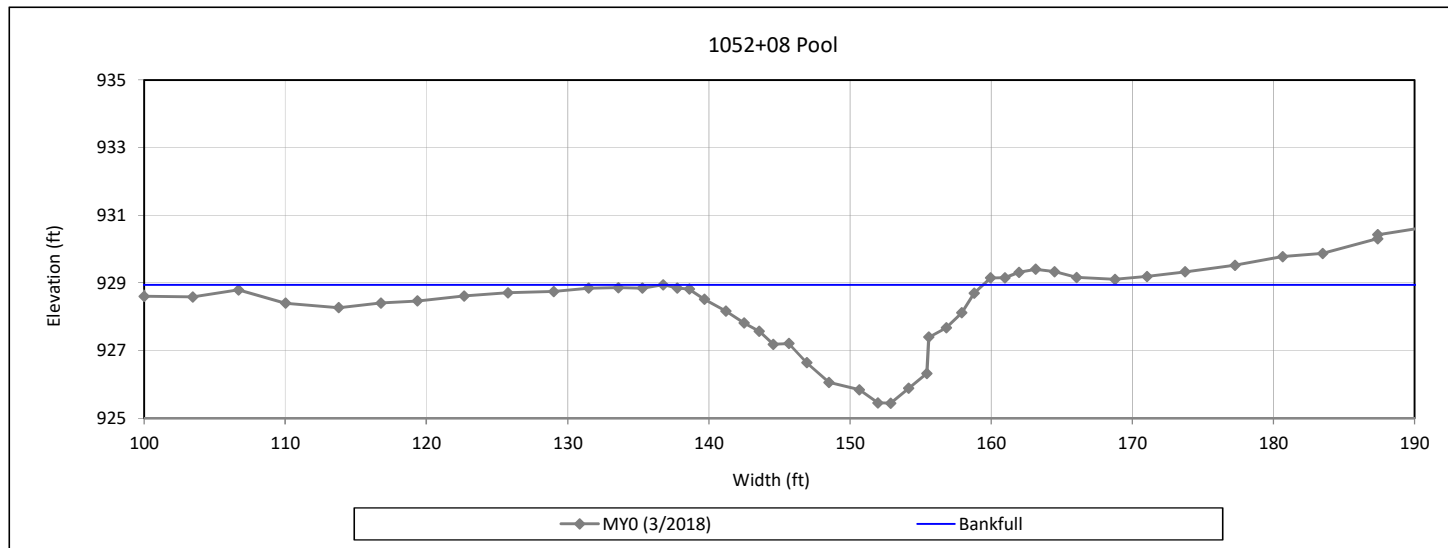
### Cross-Section Plots

Big Harris Creek Mitigation Site

NCDMS Project No. 739

Monitoring Year 0 - 2018

### USEC Reach 5: Cross-Section 19



#### Bankfull Dimensions

39.3	x-section area (ft.sq.)
20.8	width (ft)
1.9	mean depth (ft)
3.5	max depth (ft)
22.8	wetted perimeter (ft)
1.7	hydraulic radius (ft)
11.0	width-depth ratio

Survey Date: 3/2018

Field Crew: Kee Mapping & Surveying



View Downstream

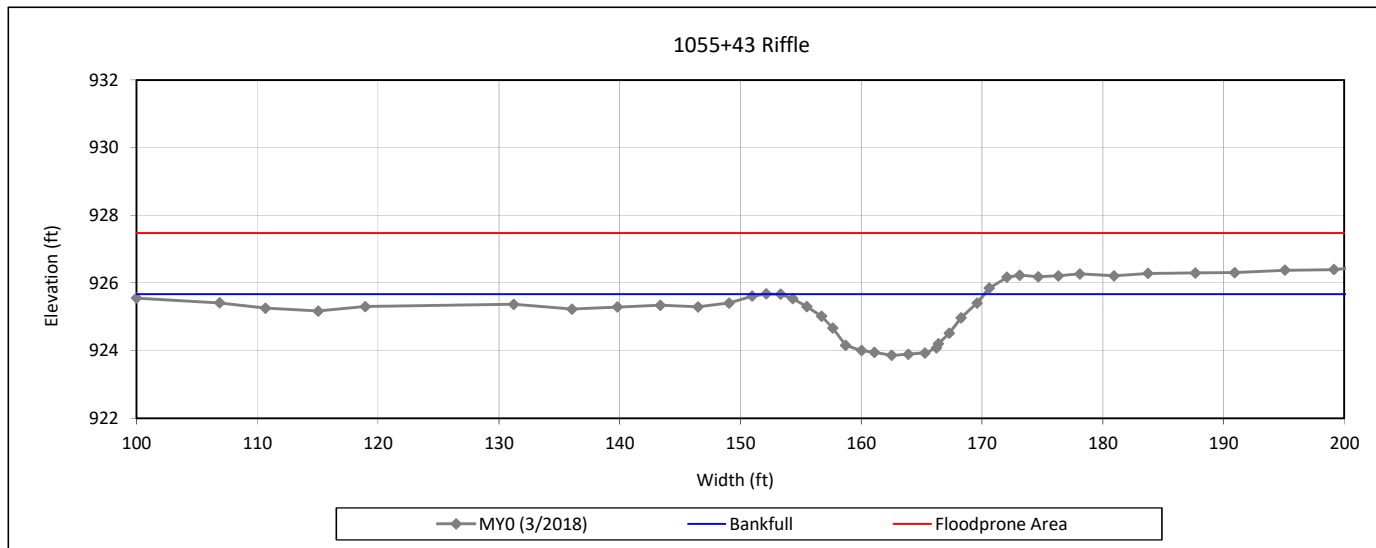
### Cross-Section Plots

Big Harris Creek Mitigation Site

NCDMS Project No. 739

Monitoring Year 0 - 2018

#### USEC Reach 5: Cross-Section 20



#### Bankfull Dimensions

18.9	x-section area (ft.sq.)
15.9	width (ft)
1.2	mean depth (ft)
1.8	max depth (ft)
16.4	wetted perimeter (ft)
1.2	hydraulic radius (ft)
13.3	width-depth ratio
173.2	W flood prone area (ft)
10.9	entrenchment ratio
1.0	low bank height ratio

Survey Date: 3/2018

Field Crew: Kee Mapping & Surveying



View Downstream

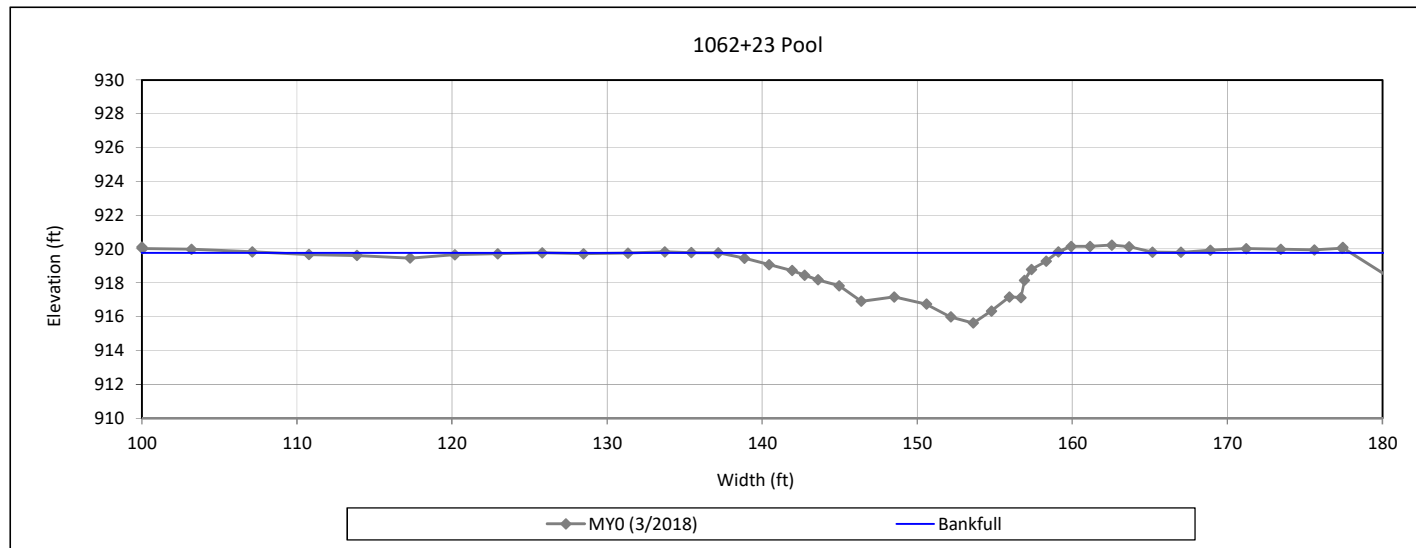
### Cross-Section Plots

Big Harris Creek Mitigation Site

NCDMS Project No. 739

Monitoring Year 0 - 2018

#### USEC Reach 6: Cross-Section 21



#### Bankfull Dimensions

45.1	x-section area (ft.sq.)
21.8	width (ft)
2.1	mean depth (ft)
5.2	max depth (ft)
24.5	wetted perimeter (ft)
1.8	hydraulic radius (ft)
10.6	width-depth ratio

Survey Date: 3/2018

Field Crew: Kee Mapping & Surveying



View Downstream

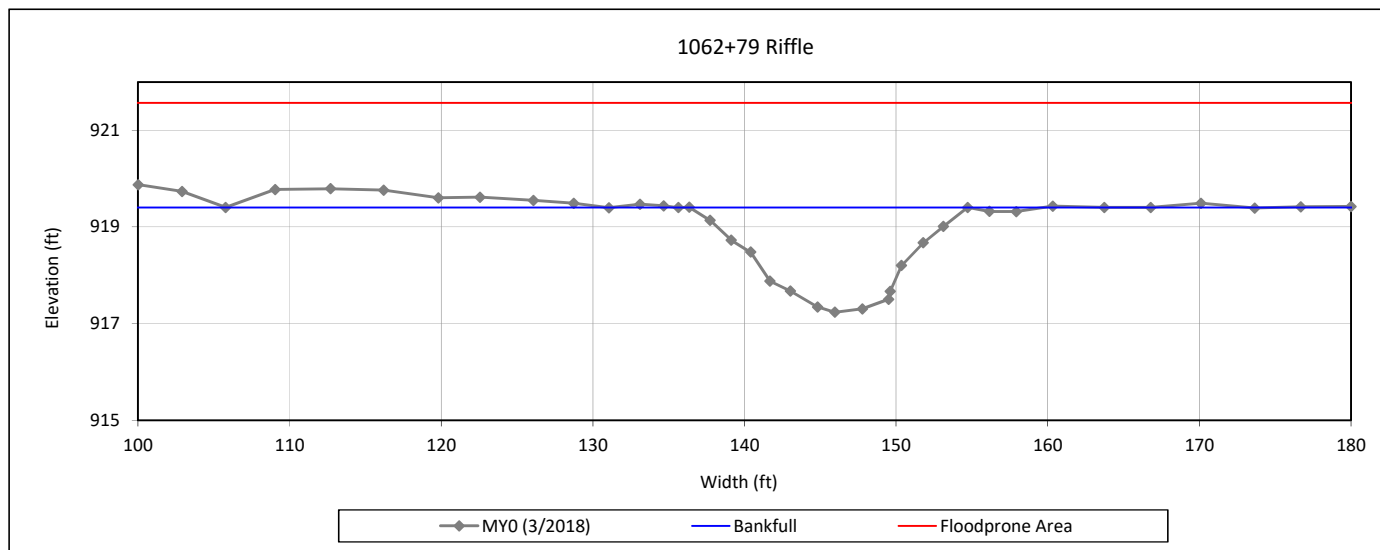
### Cross-Section Plots

Big Harris Creek Mitigation Site

NCDMS Project No. 739

Monitoring Year 0 - 2018

#### USEC Reach 6: Cross-Section 22



#### Bankfull Dimensions

22.4	x-section area (ft.sq.)
18.3	width (ft)
1.2	mean depth (ft)
2.2	max depth (ft)
19.0	wetted perimeter (ft)
1.2	hydraulic radius (ft)
14.9	width-depth ratio
192.7	W flood prone area (ft)
10.5	entrenchment ratio
1.0	low bank height ratio

Survey Date: 3/2018

Field Crew: Kee Mapping & Surveying



View Downstream



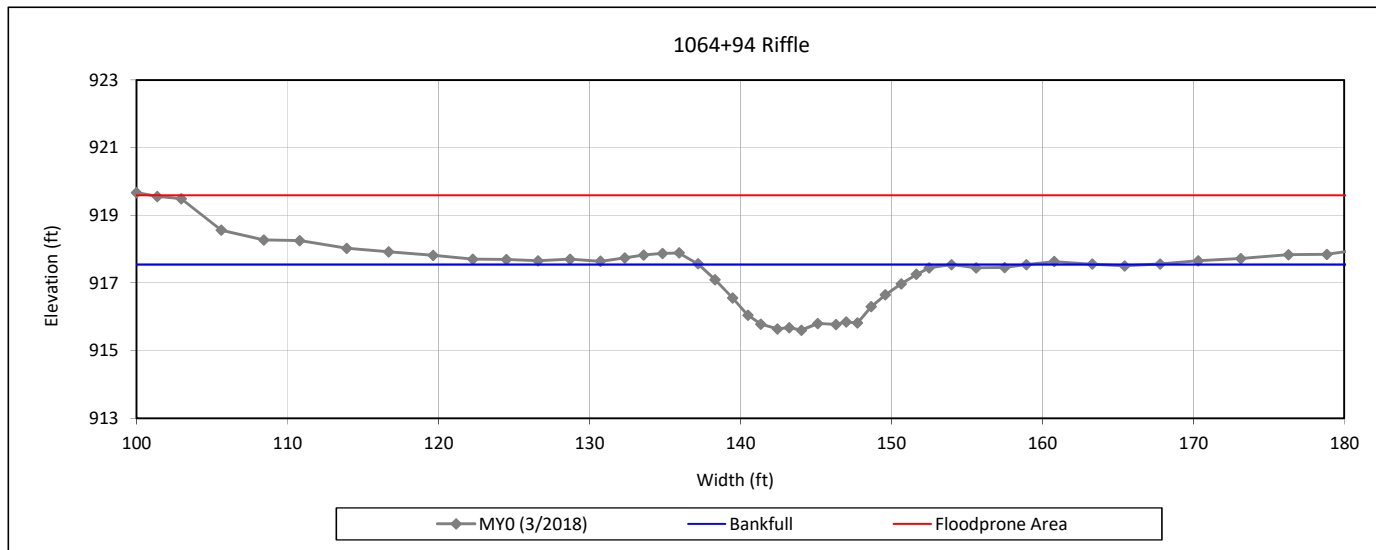
### Cross-Section Plots

Big Harris Creek Mitigation Site

NCDMS Project No. 739

Monitoring Year 0 - 2018

#### USEC Reach 6: Cross-Section 23



#### Bankfull Dimensions

19.1	x-section area (ft.sq.)
16.7	width (ft)
1.1	mean depth (ft)
2.0	max depth (ft)
17.4	wetted perimeter (ft)
1.1	hydraulic radius (ft)
14.6	width-depth ratio
148.5	W flood prone area (ft)
8.9	entrenchment ratio
1.0	low bank height ratio

Survey Date: 3/2018

Field Crew: Kee Mapping & Surveying



View Downstream

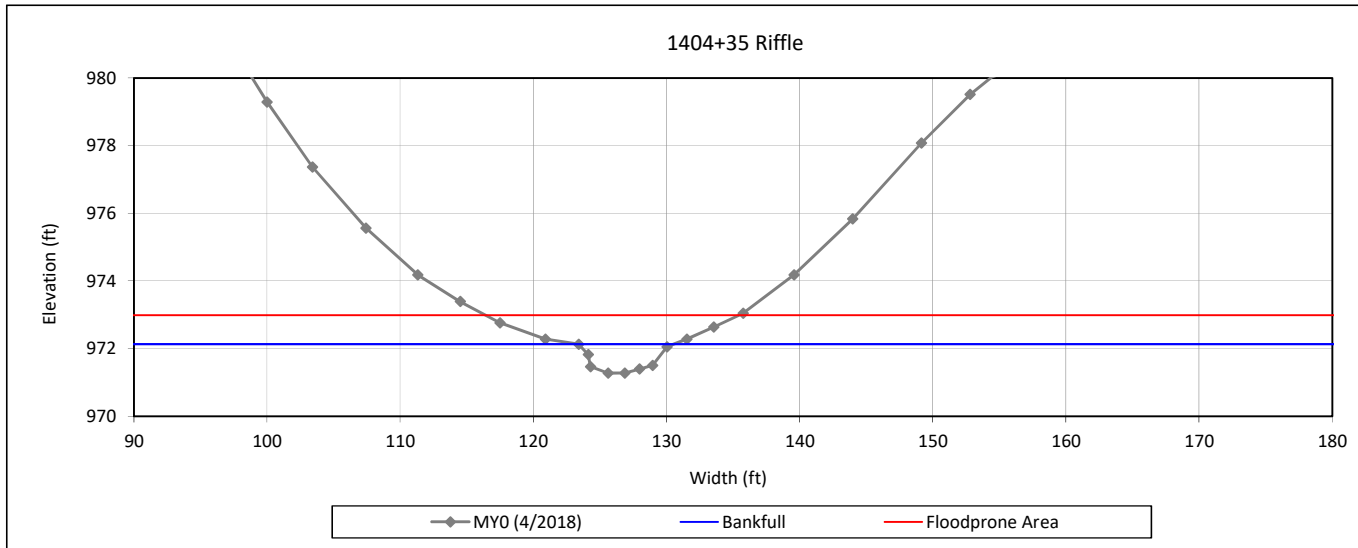
### Cross-Section Plots

Big Harris Creek Mitigation Site

NCDMS Project No. 739

Monitoring Year 0 - 2018

#### Elliott Creek: Cross-Section 24



#### Bankfull Dimensions

4.1	x-section area (ft.sq.)
6.4	width (ft)
0.6	mean depth (ft)
0.9	max depth (ft)
6.8	wetted perimeter (ft)
0.6	hydraulic radius (ft)
10.1	width-depth ratio
19.0	W flood prone area (ft)
2.9	entrenchment ratio
1.0	low bank height ratio

Survey Date: 4/2018

Field Crew: Kee Mapping & Surveying



View Downstream

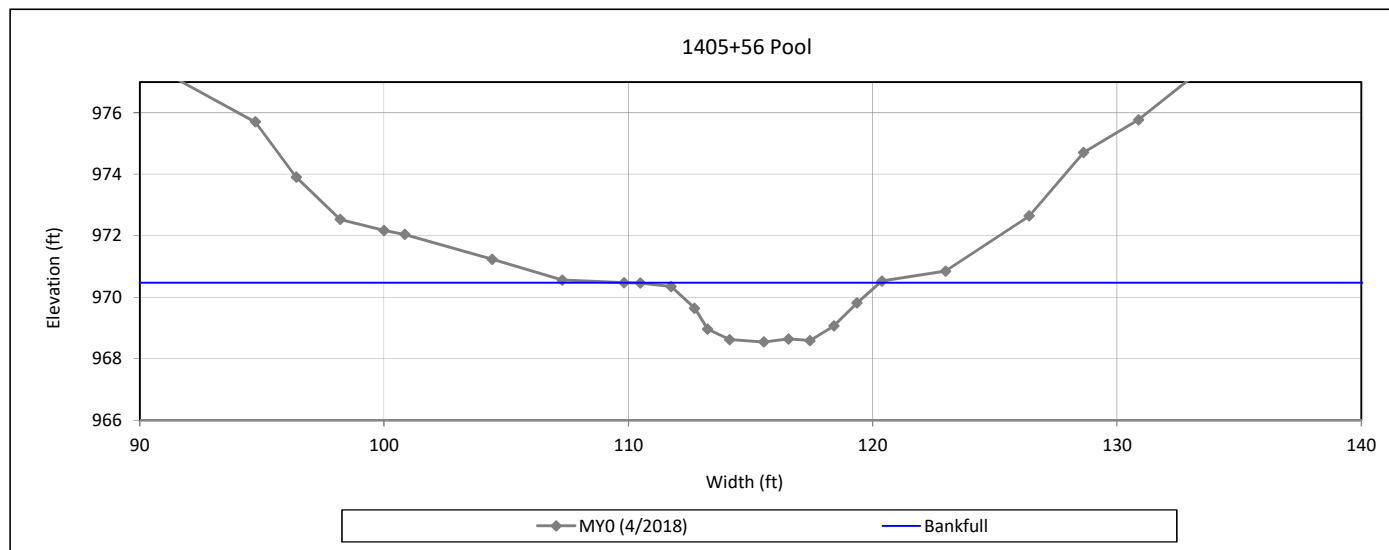
### Cross-Section Plots

Big Harris Creek Mitigation Site

NCDMS Project No. 739

Monitoring Year 0 - 2018

### Elliott Creek: Cross-Section 25



#### Bankfull Dimensions

11.2	x-section area (ft.sq.)
7.6	width (ft)
1.5	mean depth (ft)
1.9	max depth (ft)
8.6	wetted perimeter (ft)
1.3	hydraulic radius (ft)
5.1	width-depth ratio

Survey Date: 4/2018

Field Crew: Kee Mapping & Surveying



View Downstream

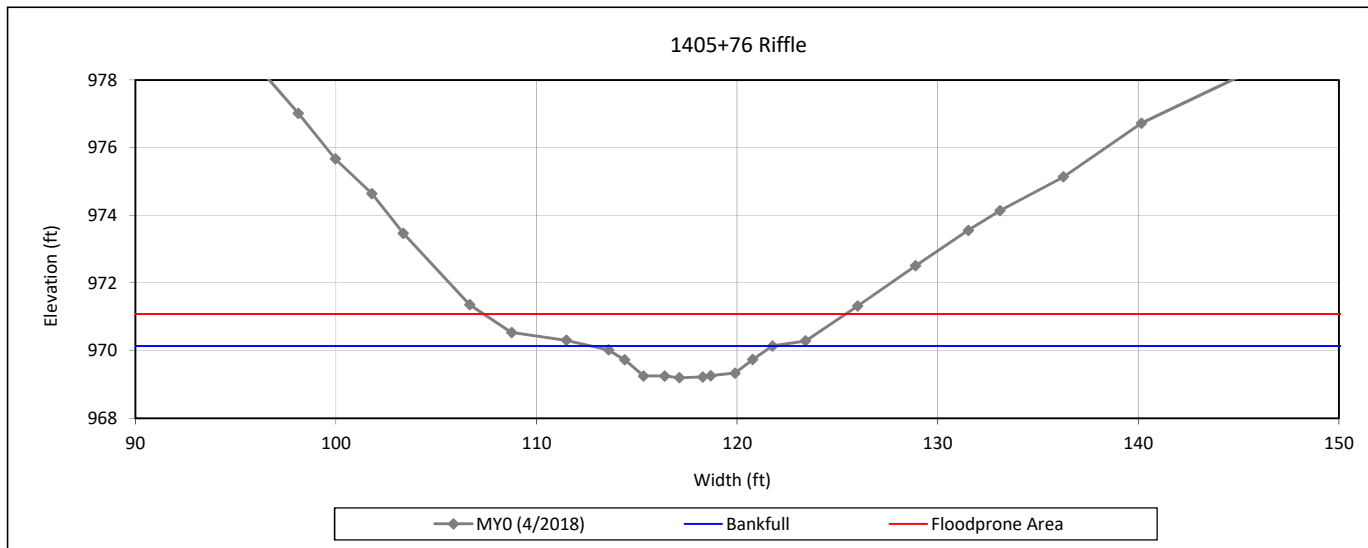
### Cross-Section Plots

Big Harris Creek Mitigation Site

NCDMS Project No. 739

Monitoring Year 0 - 2018

#### Elliott Creek: Cross-Section 26



#### Bankfull Dimensions

5.6	x-section area (ft.sq.)
8.2	width (ft)
0.7	mean depth (ft)
0.9	max depth (ft)
8.5	wetted perimeter (ft)
0.7	hydraulic radius (ft)
11.9	width-depth ratio
19.6	W flood prone area (ft)
2.4	entrenchment ratio
1.0	low bank height ratio

Survey Date: 4/2018

Field Crew: Kee Mapping & Surveying



View Downstream

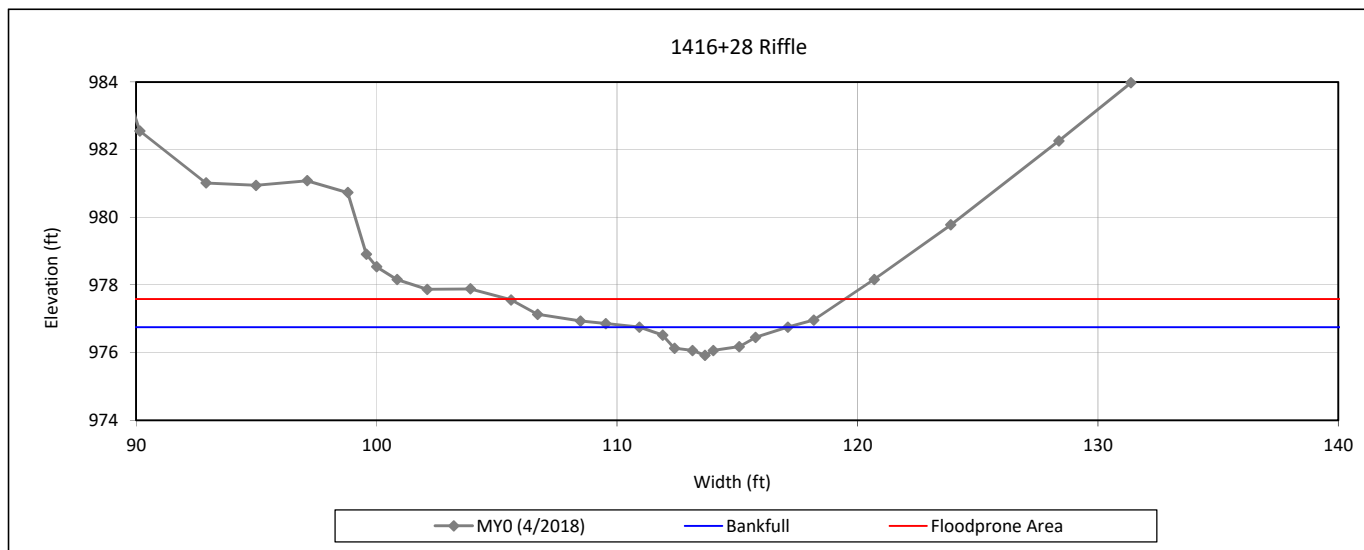
### Cross-Section Plots

Big Harris Creek Mitigation Site

NCDMS Project No. 739

Monitoring Year 0 - 2018

#### UT1 to Elliott Creek: Cross-Section 27



#### Bankfull Dimensions

2.5	x-section area (ft.sq.)
5.2	width (ft)
0.5	mean depth (ft)
0.8	max depth (ft)
5.5	wetted perimeter (ft)
0.5	hydraulic radius (ft)
10.7	width-depth ratio
14.0	W flood prone area (ft)
2.7	entrenchment ratio
1.0	low bank height ratio

Survey Date: 4/2018

Field Crew: Kee Mapping & Surveying



View Downstream

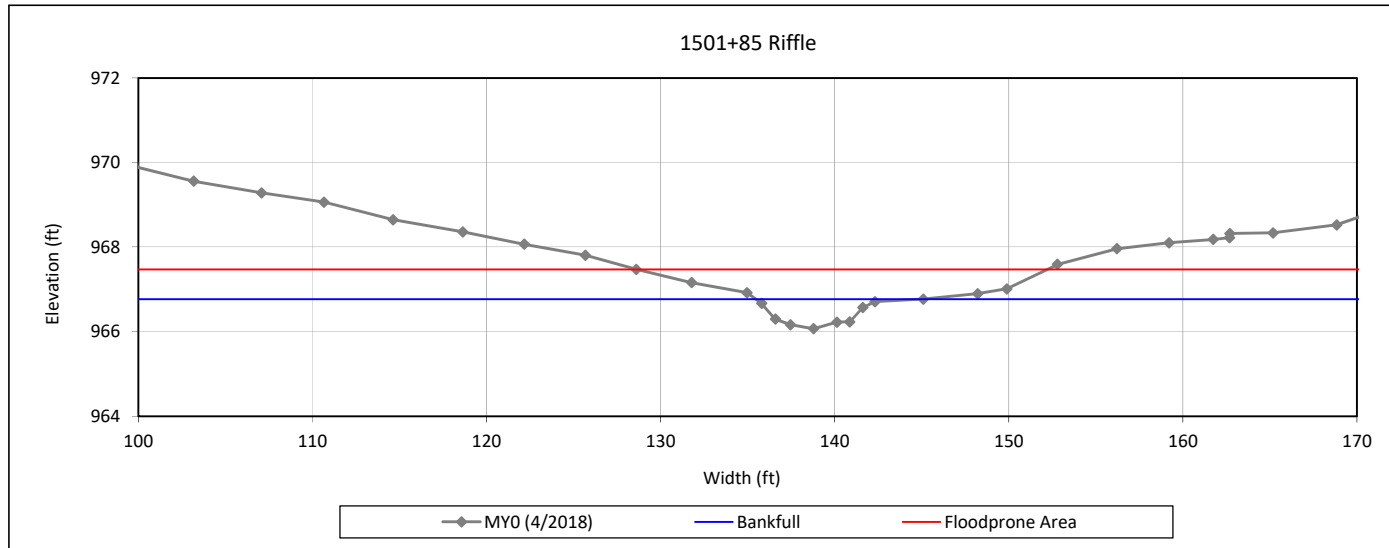
### Cross-Section Plots

Big Harris Creek Mitigation Site

NCDMS Project No. 739

Monitoring Year 0 - 2018

### Bridges Creek: Cross-Section 28



#### Bankfull Dimensions

3.3	x-section area (ft.sq.)
9.3	width (ft)
0.4	mean depth (ft)
0.7	max depth (ft)
9.5	wetted perimeter (ft)
0.3	hydraulic radius (ft)
26.5	width-depth ratio
23.6	W flood prone area (ft)
2.5	entrenchment ratio
1.0	low bank height ratio

Survey Date: 4/2018

Field Crew: Kee Mapping & Surveying



View Downstream

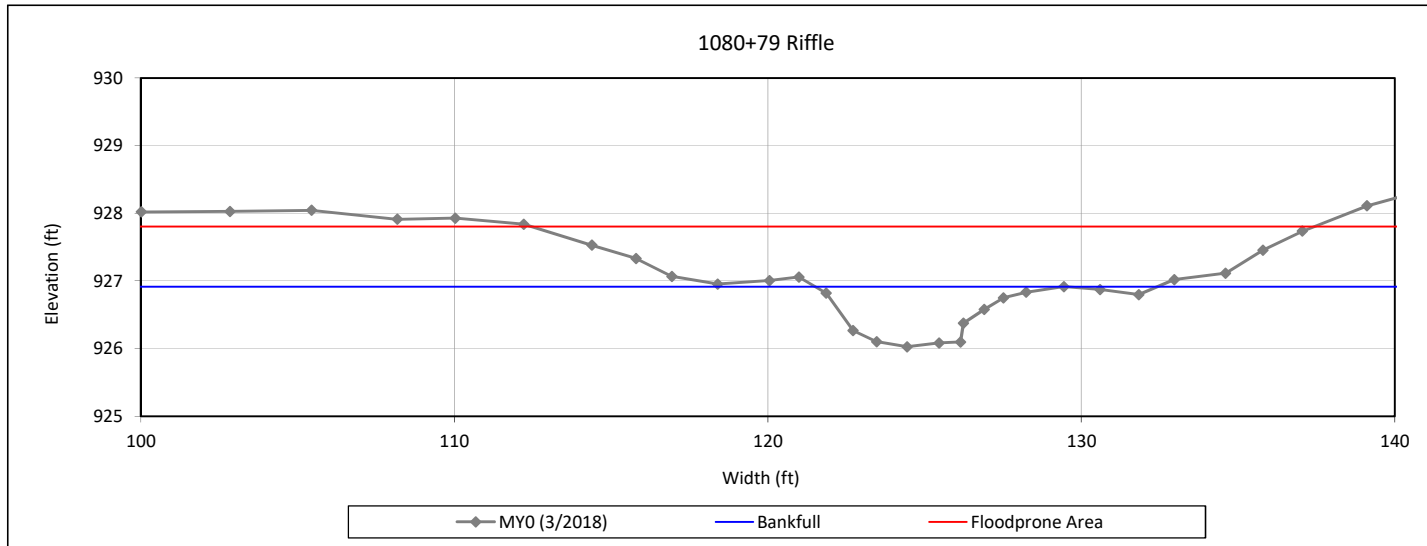
### Cross-Section Plots

Big Harris Creek Mitigation Site

NCDMS Project No. 739

Monitoring Year 0 - 2018

#### USEC UT2: Cross-Section 29



#### Bankfull Dimensions

3.8	x-section area (ft.sq.)
7.9	width (ft)
0.5	mean depth (ft)
0.9	max depth (ft)
8.4	wetted perimeter (ft)
0.5	hydraulic radius (ft)
16.5	width-depth ratio
25.0	W flood prone area (ft)
3.2	entrenchment ratio
1.0	low bank height ratio

Survey Date: 3/2018

Field Crew: Kee Mapping & Surveying



View Downstream

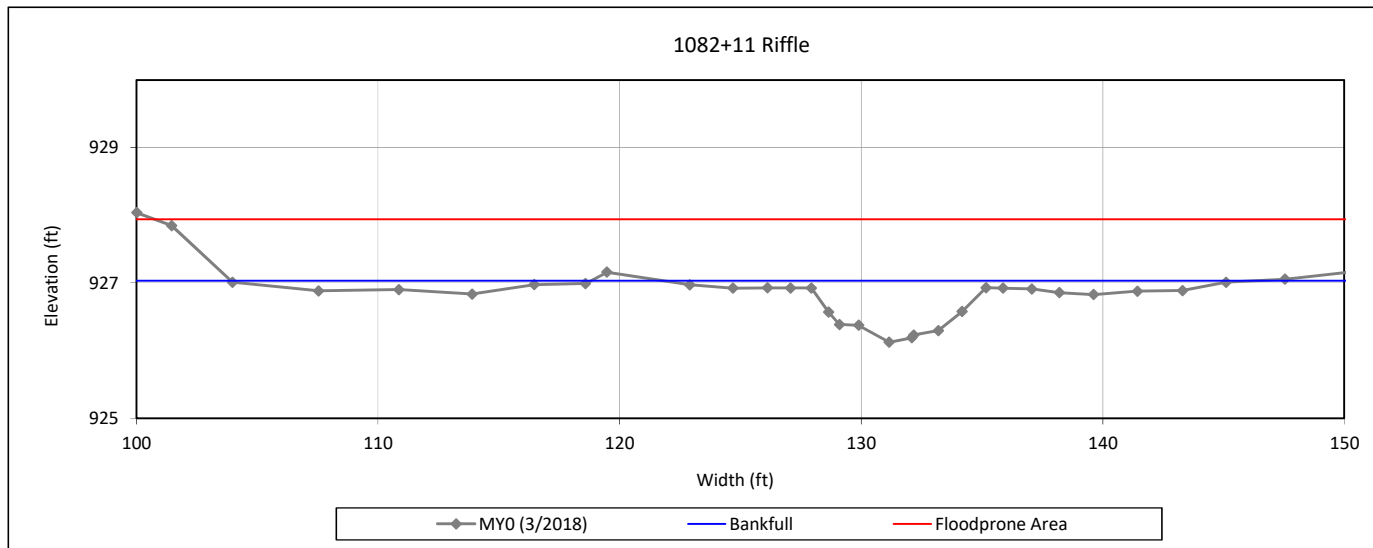
### Cross-Section Plots

Big Harris Creek Mitigation Site

NCDMS Project No. 739

Monitoring Year 0 - 2018

#### USEC Reach UT3: Cross-Section 30



#### Bankfull Dimensions

4.8	x-section area (ft.sq.)
12.4	width (ft)
0.4	mean depth (ft)
0.9	max depth (ft)
12.6	wetted perimeter (ft)
0.4	hydraulic radius (ft)
32.3	width-depth ratio
63.8	W flood prone area (ft)
5.2	entrenchment ratio
1.0	low bank height ratio

Survey Date: 3/2018

Field Crew: Kee Mapping & Surveying



View Downstream



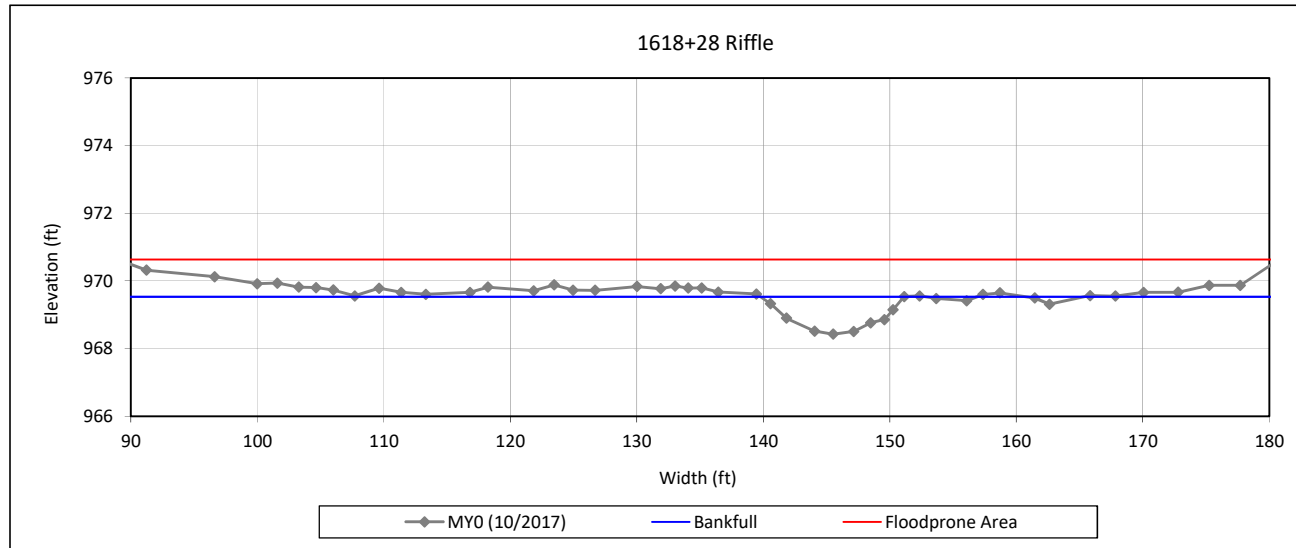
### Cross-Section Plots

Big Harris Creek Mitigation Site

NCDMS Project No. 739

Monitoring Year 0 - 2018

#### UFC Reach 2: Cross-Section 31



#### Bankfull Dimensions

8.2	x-section area (ft.sq.)
11.4	width (ft)
0.7	mean depth (ft)
1.1	max depth (ft)
11.7	wetted perimeter (ft)
0.7	hydraulic radius (ft)
15.7	width-depth ratio
91.8	W flood prone area (ft)
8.1	entrenchment ratio
1.0	low bank height ratio

Survey Date: 10/2017

Field Crew: Kee Mapping & Surveying



View Downstream

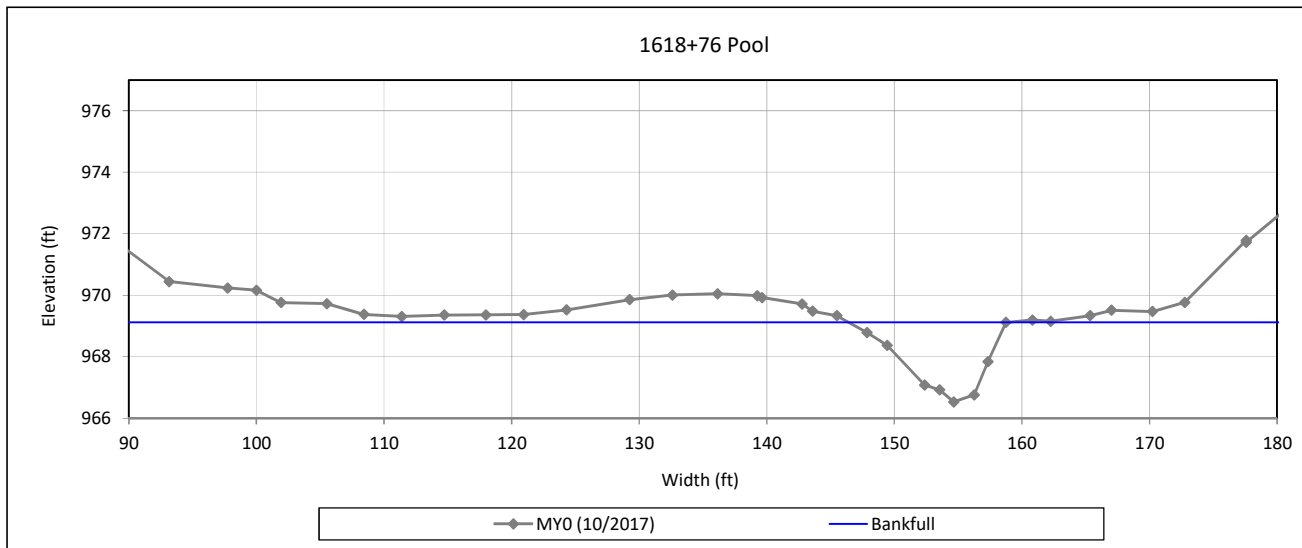
### Cross-Section Plots

Big Harris Creek Mitigation Site

NCDMS Project No. 739

Monitoring Year 0 - 2018

#### UFC Reach 2: Cross-Section 32



#### Bankfull Dimensions

17.1	x-section area (ft.sq.)
12.3	width (ft)
1.4	mean depth (ft)
2.6	max depth (ft)
13.7	wetted perimeter (ft)
1.3	hydraulic radius (ft)
8.8	width-depth ratio

Survey Date: 10/2017  
Field Crew: Kee Mapping & Surveying



View Downstream

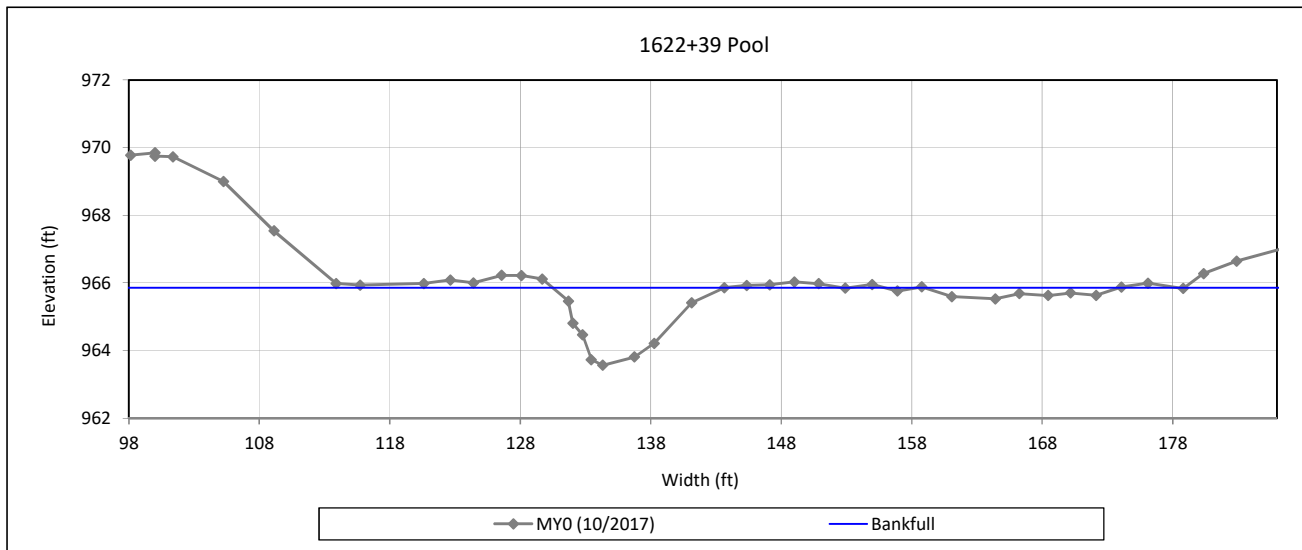
### Cross-Section Plots

Big Harris Creek Mitigation Site

NCDMS Project No. 739

Monitoring Year 0 - 2018

#### UFC Reach 2: Cross-Section 33



#### Bankfull Dimensions

16.1	x-section area (ft.sq.)
13.2	width (ft)
1.2	mean depth (ft)
2.3	max depth (ft)
14.4	wetted perimeter (ft)
1.1	hydraulic radius (ft)
10.8	width-depth ratio

Survey Date: 10/2017  
Field Crew: Kee Mapping & Surveying



View Downstream

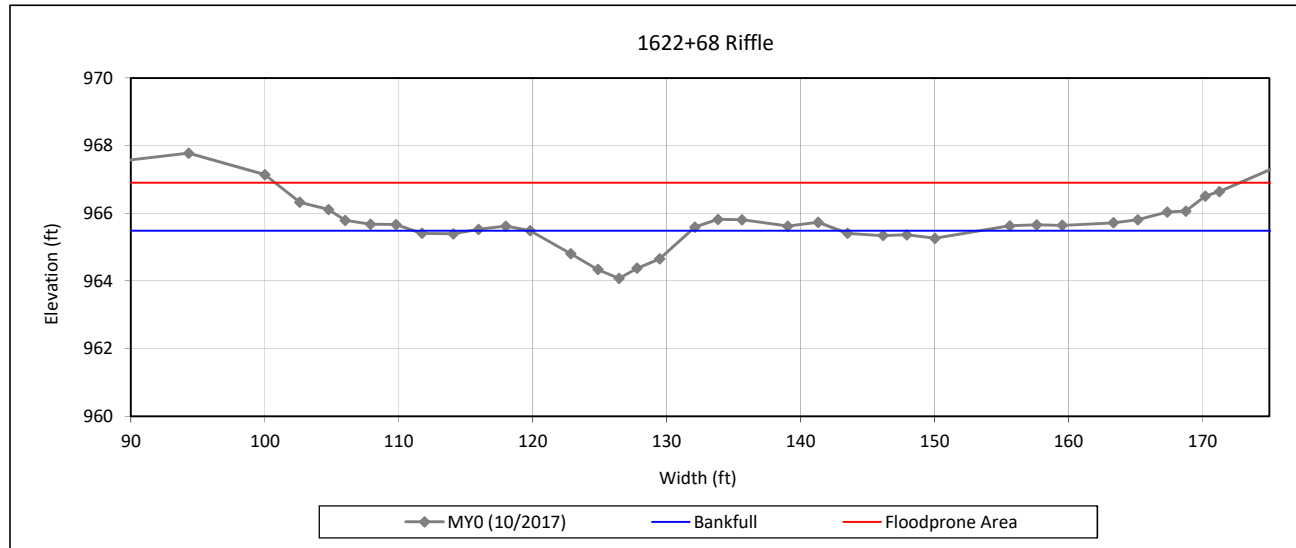
### Cross-Section Plots

Big Harris Creek Mitigation Site

NCDMS Project No. 739

Monitoring Year 0 - 2018

#### UFC Reach 2: Cross-Section 34



#### Bankfull Dimensions

9.2	x-section area (ft.sq.)
12.0	width (ft)
0.8	mean depth (ft)
1.4	max depth (ft)
12.4	wetted perimeter (ft)
0.7	hydraulic radius (ft)
15.6	width-depth ratio
72.0	W flood prone area (ft)
6.0	entrenchment ratio
1.0	low bank height ratio

Survey Date: 10/2017

Field Crew: Kee Mapping & Surveying



View Downstream

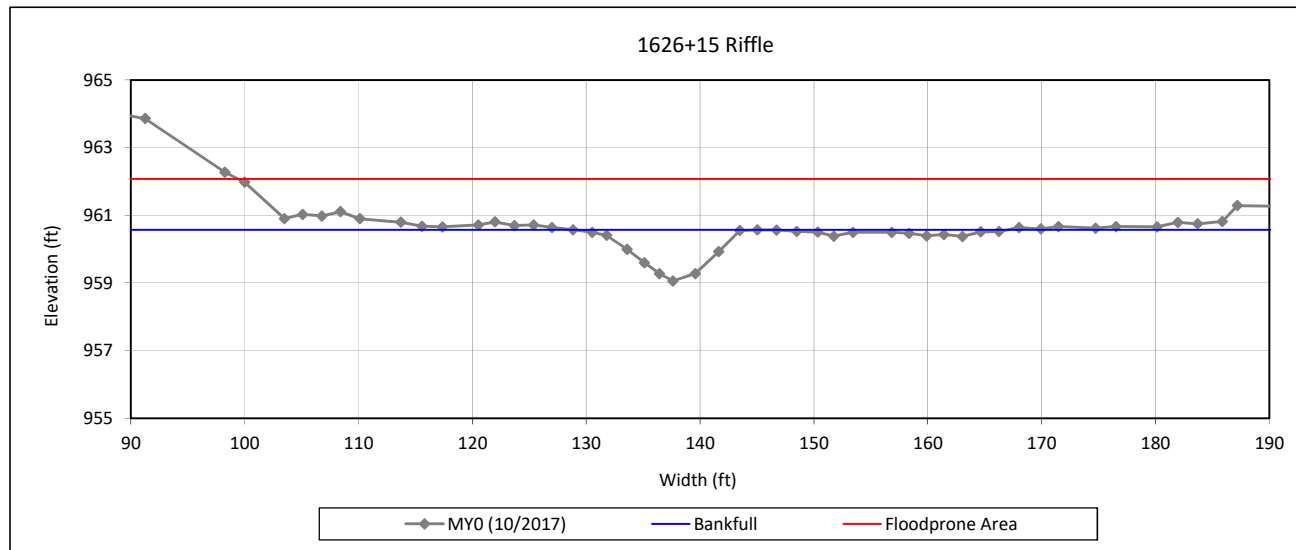
### Cross-Section Plots

Big Harris Creek Mitigation Site

NCDMS Project No. 739

Monitoring Year 0 - 2018

#### UFC Reach 2: Cross-Section 35



#### Bankfull Dimensions

10.3	x-section area (ft.sq.)
13.2	width (ft)
0.8	mean depth (ft)
1.5	max depth (ft)
13.6	wetted perimeter (ft)
0.8	hydraulic radius (ft)
16.9	width-depth ratio
150.0	W flood prone area (ft)
11.3	entrenchment ratio
1.0	low bank height ratio

Survey Date: 10/2017

Field Crew: Kee Mapping & Surveying



View Downstream

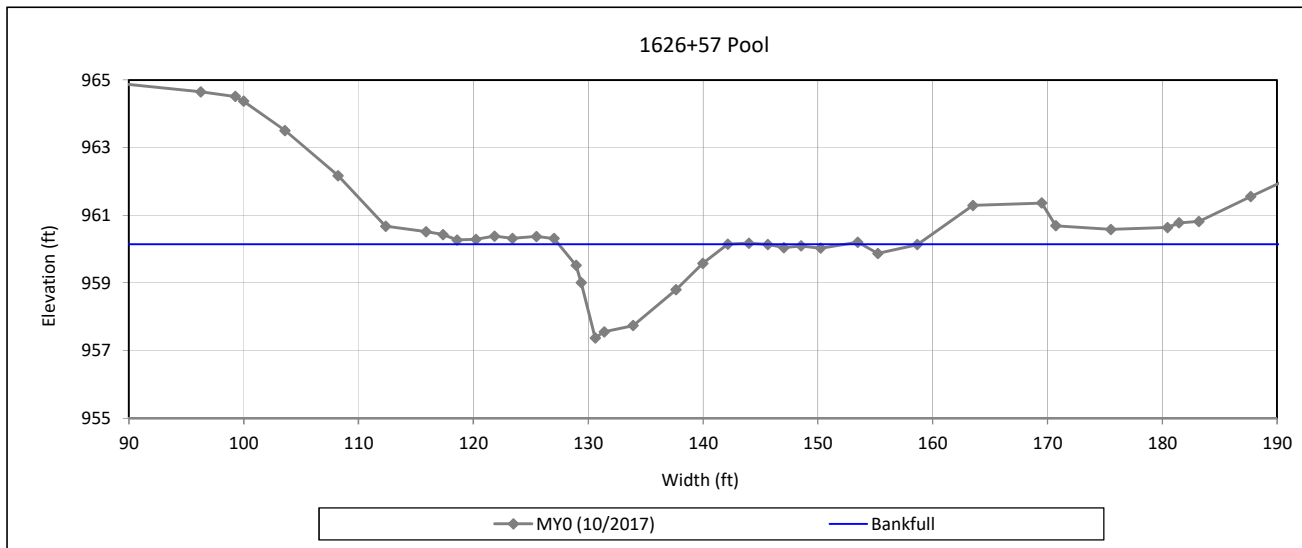
### Cross-Section Plots

Big Harris Creek Mitigation Site

NCDMS Project No. 739

Monitoring Year 0 - 2018

#### UFC Reach 2: Cross-Section 36



#### Bankfull Dimensions

21.5	x-section area (ft.sq.)
14.7	width (ft)
1.5	mean depth (ft)
2.8	max depth (ft)
16.3	wetted perimeter (ft)
1.3	hydraulic radius (ft)
10.1	width-depth ratio

Survey Date: 10/2017

Field Crew: Kee Mapping & Surveying



View Downstream

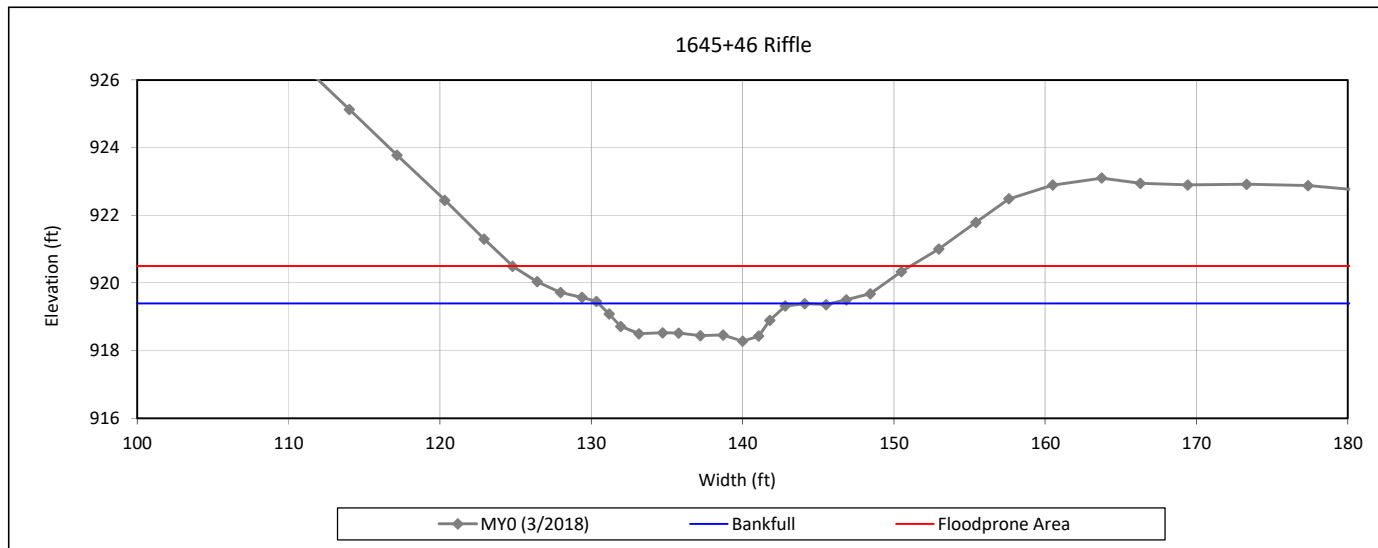
### Cross-Section Plots

Big Harris Creek Mitigation Site

NCDMS Project No. 739

Monitoring Year 0 - 2018

#### LFC Reach 1: Cross-Section 37



#### Bankfull Dimensions

9.7	x-section area (ft.sq.)
12.3	width (ft)
0.8	mean depth (ft)
1.1	max depth (ft)
12.7	wetted perimeter (ft)
0.8	hydraulic radius (ft)
15.7	width-depth ratio
26.4	W flood prone area (ft)
2.1	entrenchment ratio
1.0	low bank height ratio

Survey Date: 3/2018

Field Crew: Kee Mapping & Surveying



View Downstream

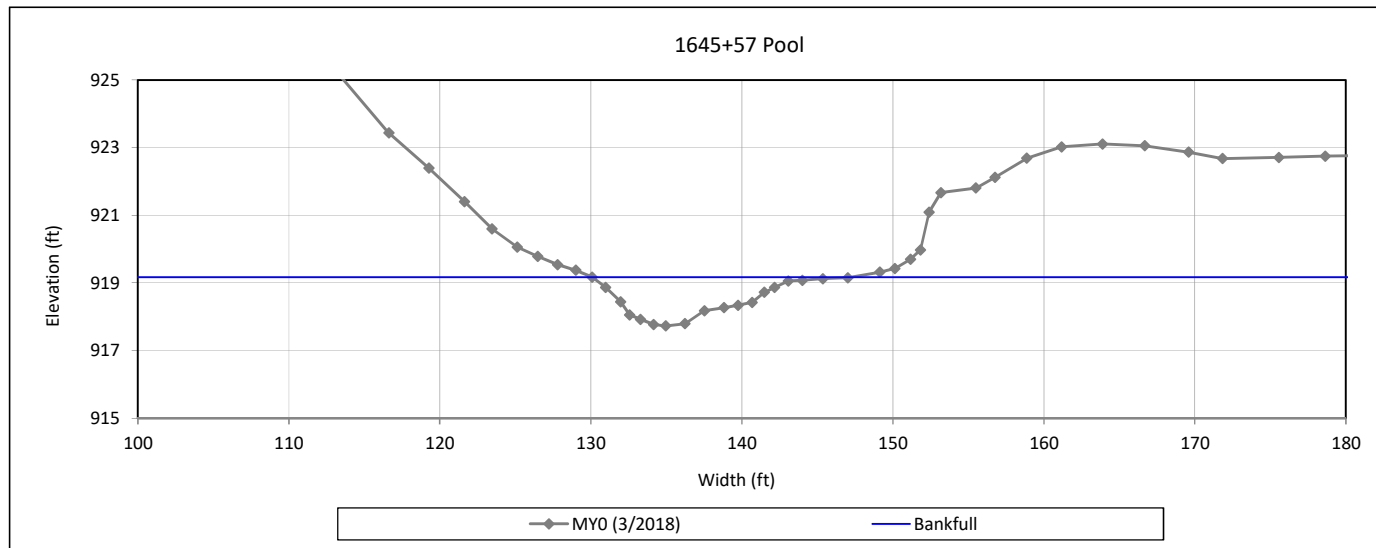
### Cross-Section Plots

Big Harris Creek Mitigation Site

NCDMS Project No. 739

Monitoring Year 0 - 2018

#### LFC Reach 1: Cross-Section 38



#### Bankfull Dimensions

11.6	x-section area (ft.sq.)
15.3	width (ft)
0.8	mean depth (ft)
1.4	max depth (ft)
15.7	wetted perimeter (ft)
0.7	hydraulic radius (ft)
20.2	width-depth ratio

Survey Date: 3/2018

Field Crew: Kee Mapping & Surveying



View Downstream



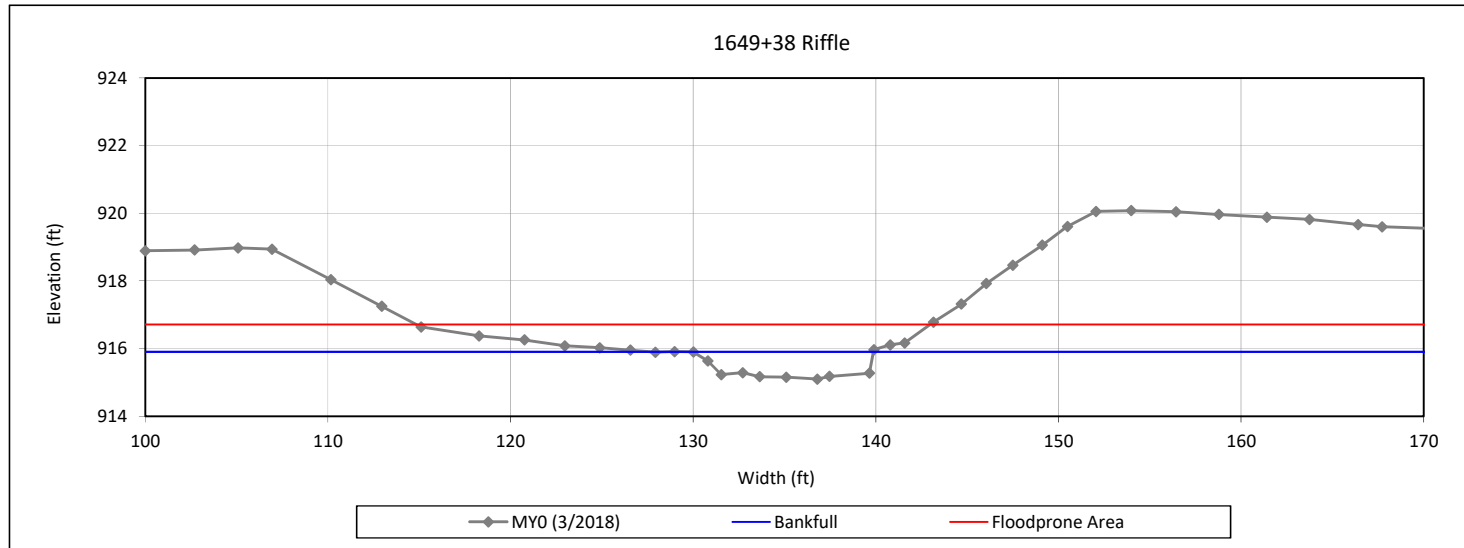
### Cross-Section Plots

Big Harris Creek Mitigation Site

NCDMS Project No. 739

Monitoring Year 0 - 2018

#### LFC Reach 2: Cross-Section 39



#### Bankfull Dimensions

6.3	x-section area (ft.sq.)
9.9	width (ft)
0.6	mean depth (ft)
0.8	max depth (ft)
10.5	wetted perimeter (ft)
0.6	hydraulic radius (ft)
15.4	width-depth ratio
28.1	W flood prone area (ft)
2.9	entrenchment ratio
1.0	low bank height ratio

Survey Date: 3/2018

Field Crew: Kee Mapping & Surveying



View Downstream

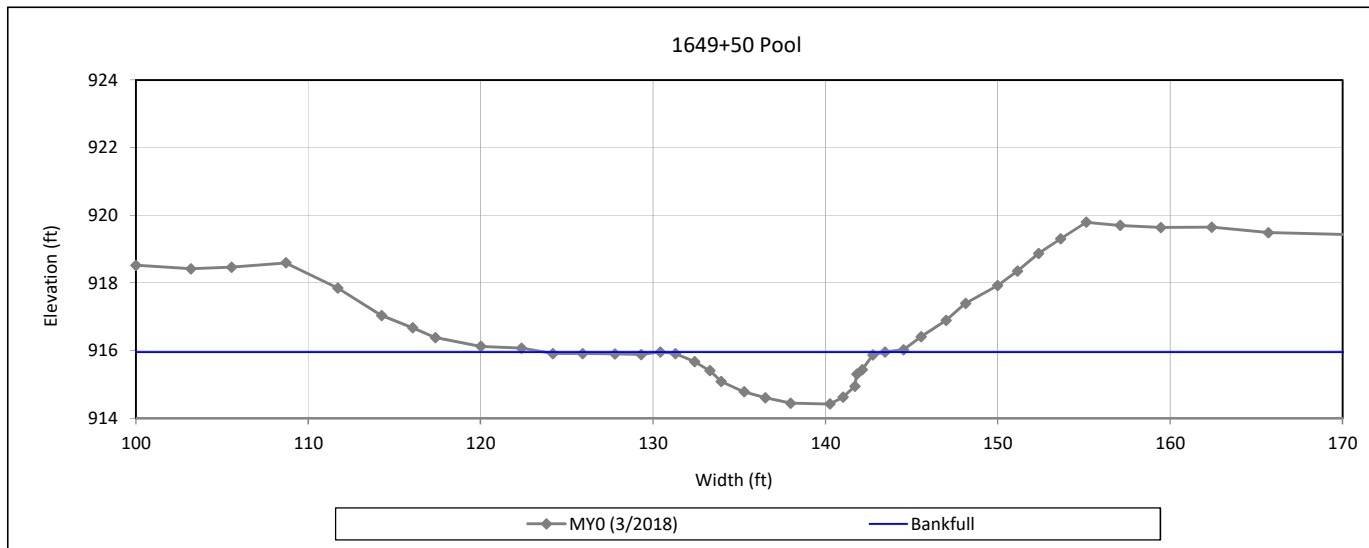
### Cross-Section Plots

Big Harris Creek Mitigation Site

NCDMS Project No. 739

Monitoring Year 0 - 2018

#### LFC Reach 2: Cross-Section 40



#### Bankfull Dimensions

11.8	x-section area (ft.sq.)
11.5	width (ft)
1.0	mean depth (ft)
1.5	max depth (ft)
12.2	wetted perimeter (ft)
1.0	hydraulic radius (ft)
11.1	width-depth ratio



View Downstream

Survey Date: 3/2018

Field Crew: Kee Mapping & Surveying

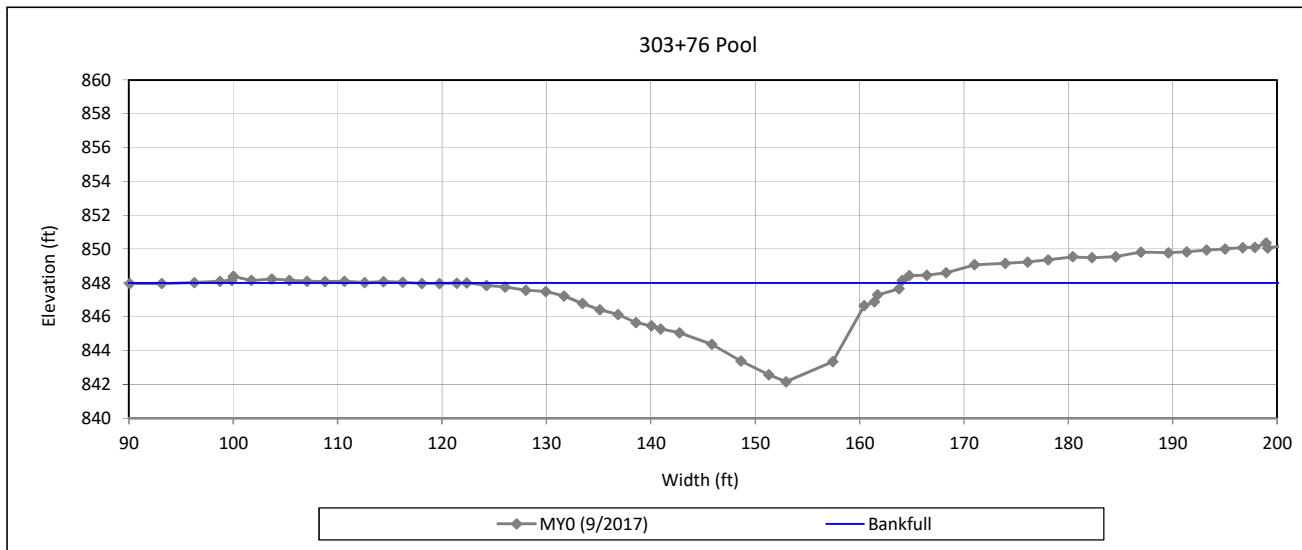
### Cross-Section Plots

Big Harris Creek Mitigation Site - Area C

NCDMS Project No. 739

Monitoring Year 0 - 2018

#### LBHC Reach 1A: Cross-Section 41



#### Bankfull Dimensions

104.7	x-section area (ft.sq.)
41.6	width (ft)
2.5	mean depth (ft)
5.8	max depth (ft)
44.4	wetted perimeter (ft)
2.4	hydraulic radius (ft)
16.5	width-depth ratio

Survey Date: 9/2017

Field Crew: Kee Mapping & Surveying



View Downstream

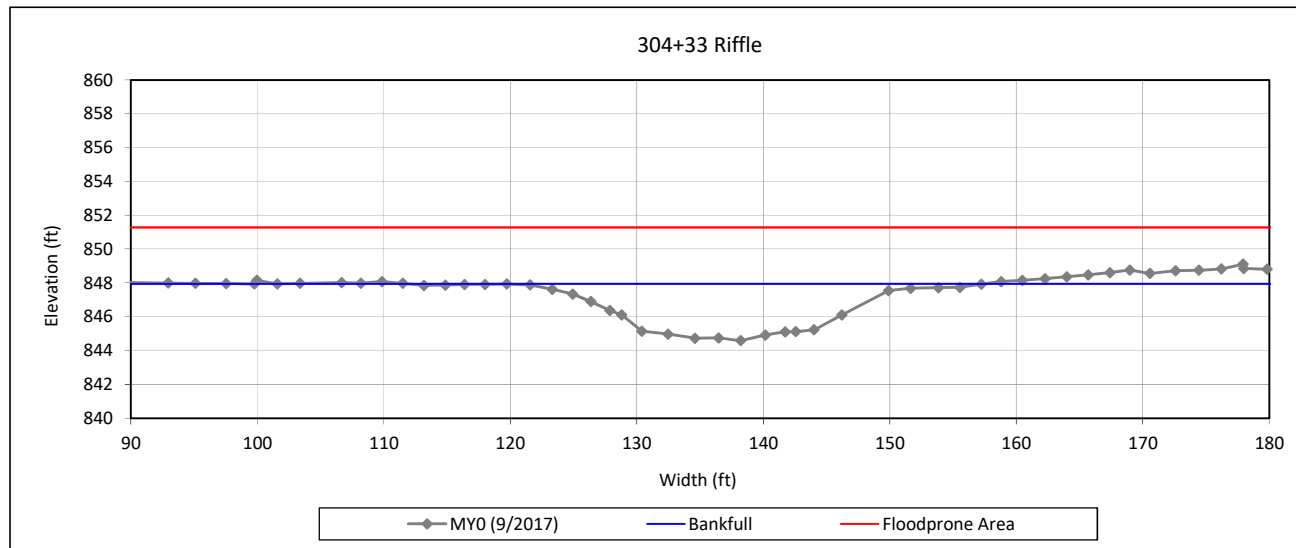
### Cross-Section Plots

Big Harris Creek Mitigation Site - Area C

NCDMS Project No. 739

Monitoring Year 0 - 2018

#### LBHC Reach 1A: Cross-Section 42



#### Bankfull Dimensions

59.8	x-section area (ft.sq.)
30.2	width (ft)
2.0	mean depth (ft)
3.3	max depth (ft)
31.2	wetted perimeter (ft)
1.9	hydraulic radius (ft)
15.2	width-depth ratio
169.0	W flood prone area (ft)
5.6	entrenchment ratio
1.0	low bank height ratio

Survey Date: 9/2017

Field Crew: Kee Mapping & Surveying



View Downstream

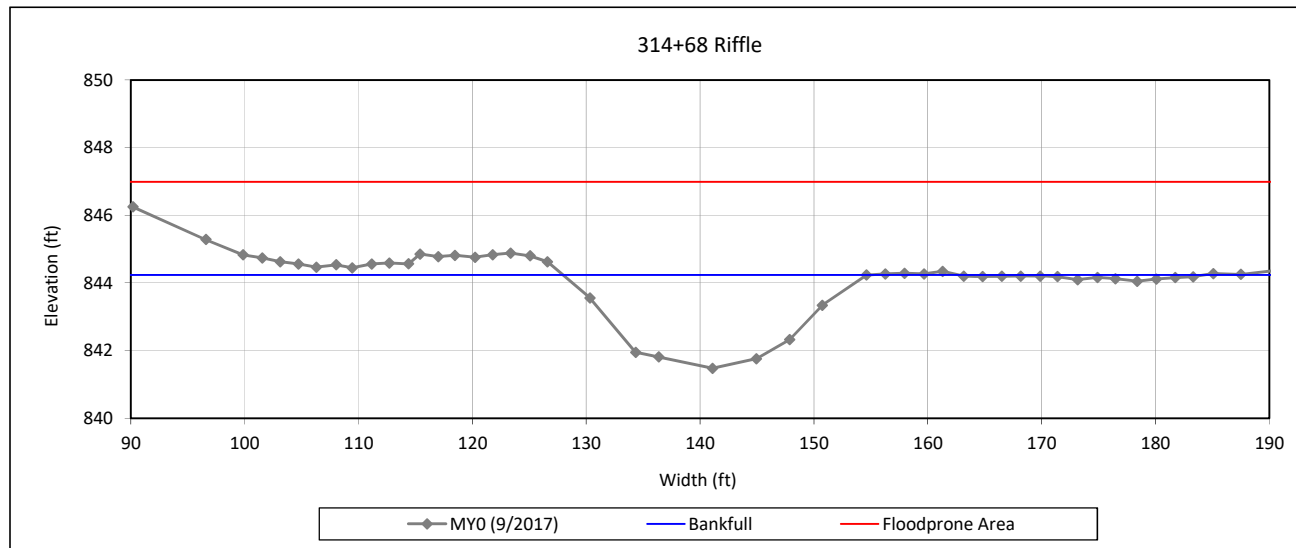
### Cross-Section Plots

Big Harris Creek Mitigation Site - Area C

NCDMS Project No. 739

Monitoring Year 0 - 2018

#### LBHC Reach 1B/2: Cross-Section 43



#### Bankfull Dimensions

46.0	x-section area (ft.sq.)
26.7	width (ft)
1.7	mean depth (ft)
2.8	max depth (ft)
27.4	wetted perimeter (ft)
1.7	hydraulic radius (ft)
15.5	width-depth ratio
200.0	W flood prone area (ft)
7.5	entrenchment ratio
1.0	low bank height ratio

Survey Date: 9/2017

Field Crew: Kee Mapping & Surveying



View Downstream

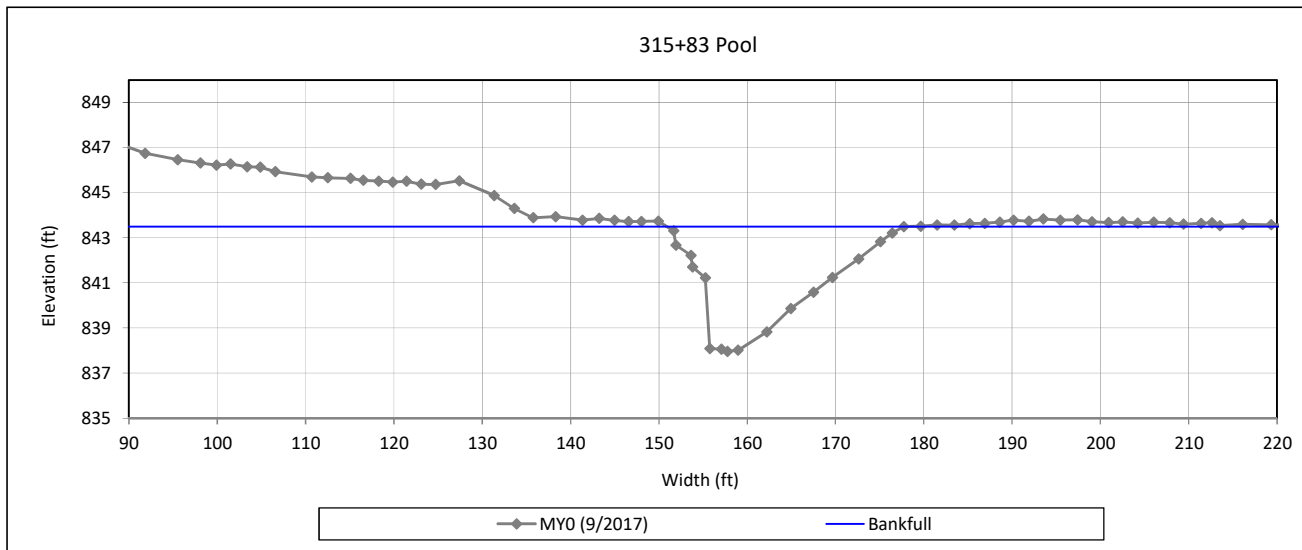
### Cross-Section Plots

Big Harris Creek Mitigation Site - Area C

NCDMS Project No. 739

Monitoring Year 0 - 2018

#### LBHC Reach 1B/2: Cross-Section 44



#### Bankfull Dimensions

75.4	x-section area (ft.sq.)
26.8	width (ft)
2.8	mean depth (ft)
5.5	max depth (ft)
31.2	wetted perimeter (ft)
2.4	hydraulic radius (ft)
9.5	width-depth ratio

Survey Date: 9/2017

Field Crew: Kee Mapping & Surveying



View Downstream

**Reachwide and Cross-Section Pebble Count Plots**

Big Harris Creek Mitigation Site - Area A

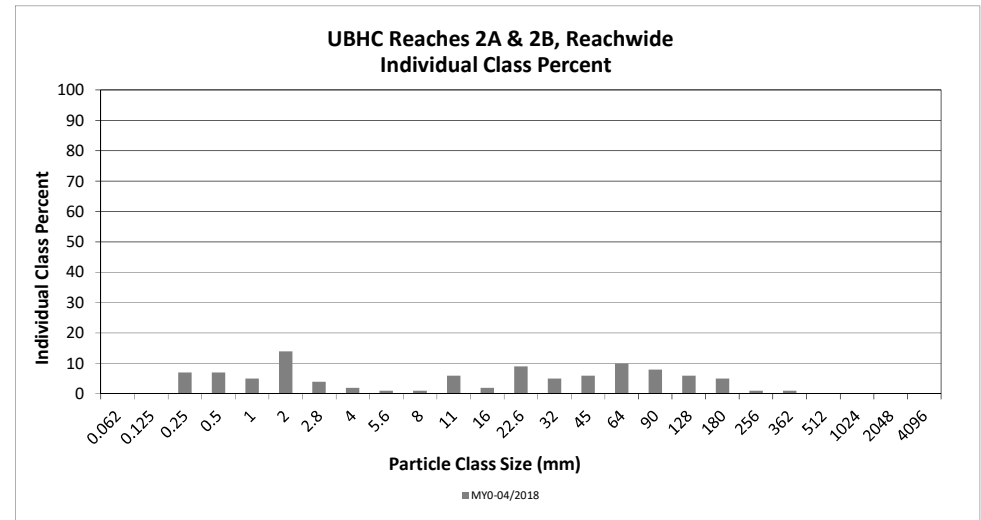
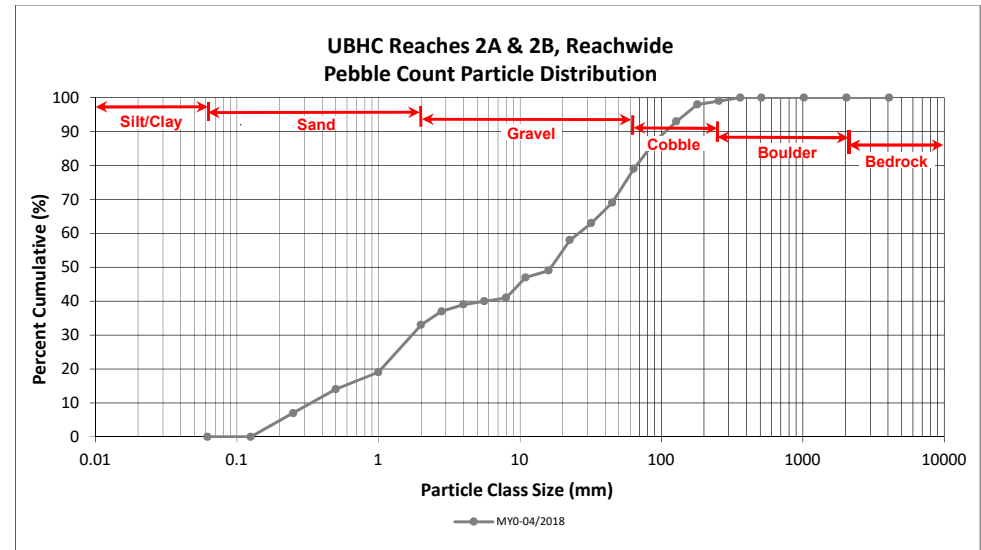
DMS Project No. 739

Monitoring Year 0 - 2018

UBHC Reaches 2A & 2B, Reachwide

Particle Class		Diameter (mm)		Particle Count			Reach Summary	
		min	max	Riffle	Pool	Total	Class Percentage	Percent Cumulative
<b>SILT/CLAY</b>	Silt/Clay	0.000	0.062					0
<b>SAND</b>	Very fine	0.062	0.125					0
	Fine	0.125	0.250		7	7	7	7
	Medium	0.25	0.50		7	7	7	14
	Coarse	0.5	1.0		5	5	5	19
	Very Coarse	1.0	2.0	1	13	14	14	33
<b>GRAVEL</b>	Very Fine	2.0	2.8		4	4	4	37
	Very Fine	2.8	4.0	1	1	2	2	39
	Fine	4.0	5.6		1	1	1	40
	Fine	5.6	8.0		1	1	1	41
	Medium	8.0	11.0		6	6	6	47
	Medium	11.0	16.0		2	2	2	49
	Coarse	16.0	22.6	6	3	9	9	58
	Coarse	22.6	32	5		5	5	63
	Very Coarse	32	45	6		6	6	69
	Very Coarse	45	64	10		10	10	79
<b>COBBLE</b>	Small	64	90	8		8	8	87
	Small	90	128	6		6	6	93
	Large	128	180	5		5	5	98
	Large	180	256	1		1	1	99
<b>BOULDER</b>	Small	256	362	1		1	1	100
	Small	362	512					100
	Medium	512	1024					100
	Large/Very Large	1024	2048					100
<b>BEDROCK</b>	Bedrock	2048	>2048					100
<b>Total</b>				<b>50</b>	<b>50</b>	<b>100</b>	<b>100</b>	<b>100</b>

Reachwide Channel materials (mm)	
D <sub>16</sub> =	0.66
D <sub>35</sub> =	2.37
D <sub>50</sub> =	16.6
D <sub>84</sub> =	79.2
D <sub>95</sub> =	146.7
D <sub>100</sub> =	362.0



**Reachwide and Cross-Section Pebble Count Plots**

Big Harris Creek Mitigation Site - Area A

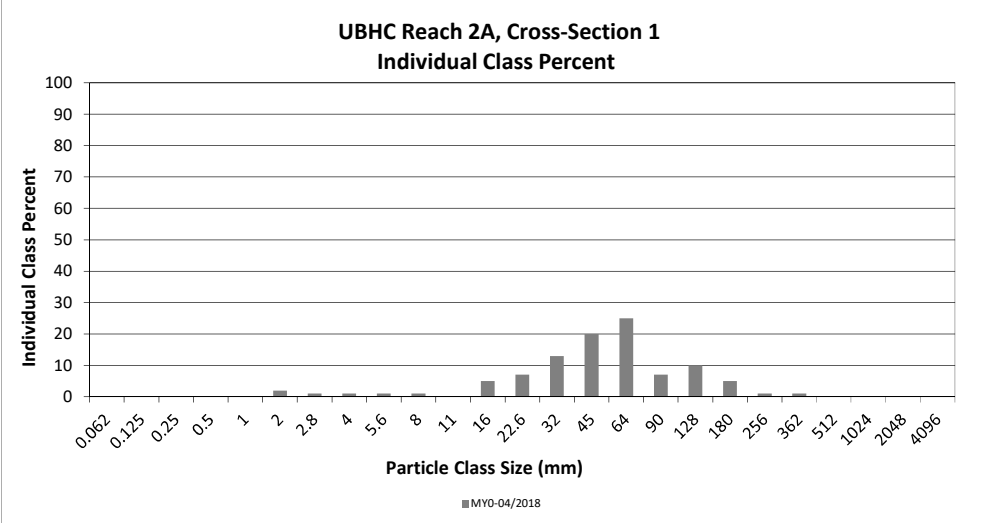
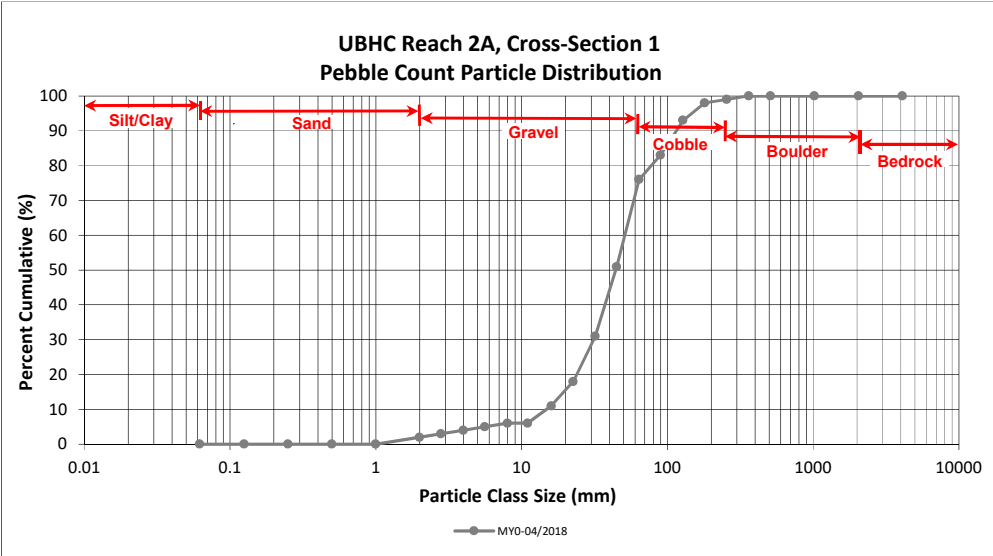
DMS Project No. 739

**Monitoring Year 0 - 2018**

UBHC Reach 2A, Cross-Section 1

Particle Class		Diameter (mm)		Riffle 100-Count	Summary	
		min	max		Class Percentage	Percent Cumulative
<b>SILT/CLAY</b>	Silt/Clay	0.000	0.062			0
<b>SAND</b>	Very fine	0.062	0.125			0
	Fine	0.125	0.250			0
	Medium	0.25	0.50			0
	Coarse	0.5	1.0			0
	Very Coarse	1.0	2.0	2	2	2
<b>GRAVEL</b>	Very Fine	2.0	2.8	1	1	3
	Very Fine	2.8	4.0	1	1	4
	Fine	4.0	5.6	1	1	5
	Fine	5.6	8.0	1	1	6
	Medium	8.0	11.0			6
	Medium	11.0	16.0	5	5	11
	Coarse	16.0	22.6	7	7	18
	Coarse	22.6	32	13	13	31
	Very Coarse	32	45	20	20	51
<b>COBBLE</b>	Very Coarse	45	64	25	25	76
	Small	64	90	7	7	83
	Small	90	128	10	10	93
	Large	128	180	5	5	98
<b>BOULDER</b>	Large	180	256	1	1	99
	Small	256	362	1	1	100
	Small	362	512			100
	Medium	512	1024			100
<b>BEDROCK</b>	Large/Very Large	1024	2048			100
	Bedrock	2048	>2048			100
<b>Total</b>				<b>100</b>	<b>100</b>	<b>100</b>

Cross-Section 1 Channel materials (mm)	
D <sub>16</sub> =	20.48
D <sub>35</sub> =	34.26
D <sub>50</sub> =	44.2
D <sub>84</sub> =	93.2
D <sub>95</sub> =	146.7
D <sub>100</sub> =	362.0





**Reachwide and Cross-Section Pebble Count Plots**

Big Harris Creek Mitigation Site - Area A

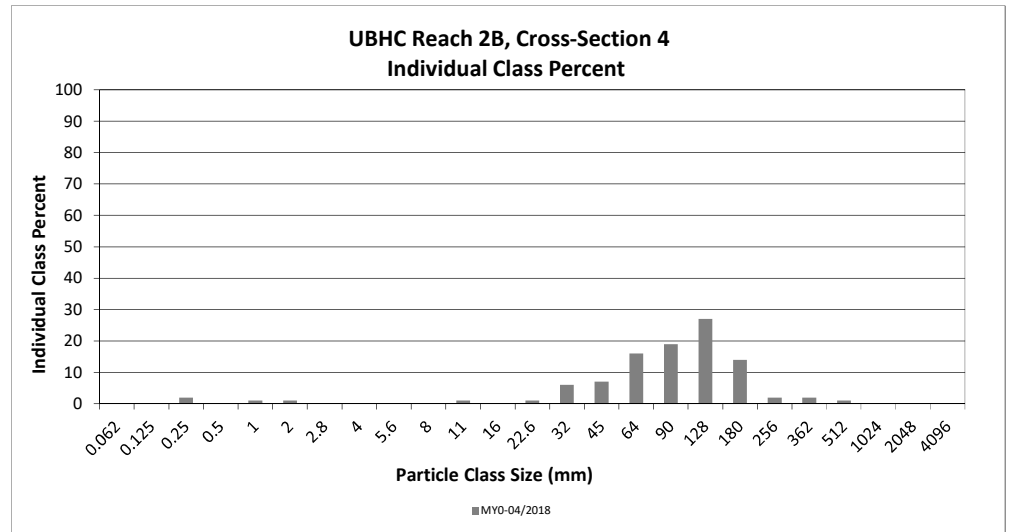
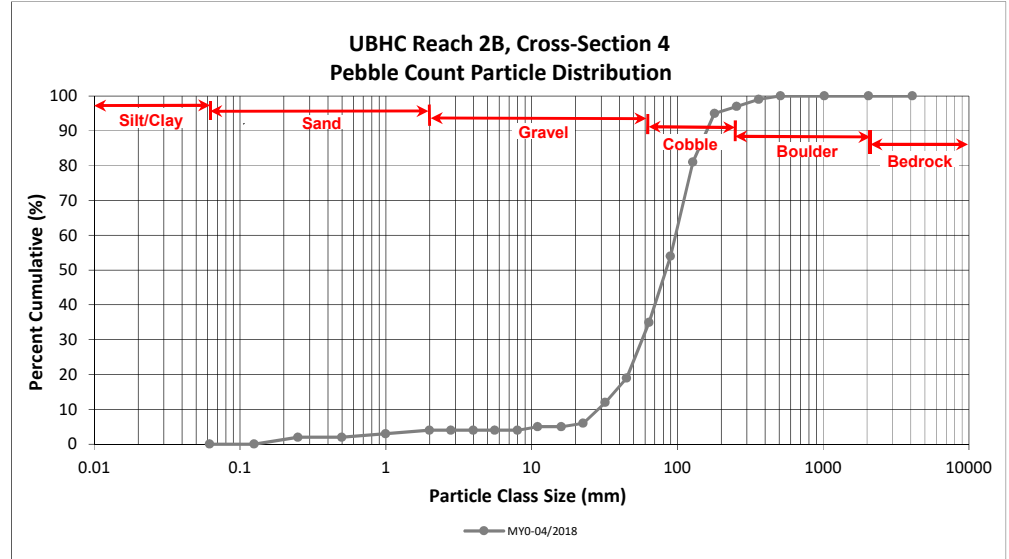
DMS Project No. 739

**Monitoring Year 0 - 2018**

UBHC Reach 2B, Cross-Section 4

Particle Class		Diameter (mm)		Riffle 100-Count	Summary	
		min	max		Class Percentage	Percent Cumulative
<b>SILT/CLAY</b>	Silt/Clay	0.000	0.062			0
<b>SAND</b>	Very fine	0.062	0.125			0
	Fine	0.125	0.250	2	2	2
	Medium	0.25	0.50			2
	Coarse	0.5	1.0	1	1	3
	Very Coarse	1.0	2.0	1	1	4
<b>GRAVEL</b>	Very Fine	2.0	2.8			4
	Very Fine	2.8	4.0			4
	Fine	4.0	5.6			4
	Fine	5.6	8.0			4
	Medium	8.0	11.0	1	1	5
	Medium	11.0	16.0			5
	Coarse	16.0	22.6	1	1	6
	Coarse	22.6	32	6	6	12
	Very Coarse	32	45	7	7	19
	Very Coarse	45	64	16	16	35
<b>COBBLE</b>	Small	64	90	19	19	54
	Small	90	128	27	27	81
	Large	128	180	14	14	95
	Large	180	256	2	2	97
<b>BOULDER</b>	Small	256	362	2	2	99
	Small	362	512	1	1	100
	Medium	512	1024			100
	Large/Very Large	1024	2048			100
<b>BEDROCK</b>	Bedrock	2048	>2048			100
<b>Total</b>				<b>100</b>	<b>100</b>	<b>100</b>

Cross-Section 4 Channel materials (mm)	
D <sub>16</sub> =	38.88
D <sub>35</sub> =	64.00
D <sub>50</sub> =	83.8
D <sub>84</sub> =	137.7
D <sub>95</sub> =	180.0
D <sub>100</sub> =	512.0



**Reachwide and Cross-Section Pebble Count Plots**

Big Harris Creek Mitigation Site - Area A

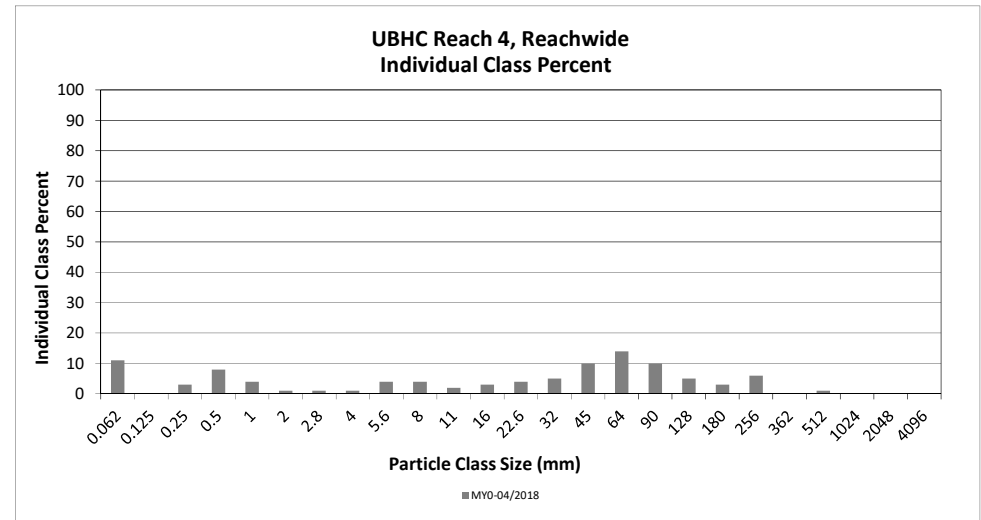
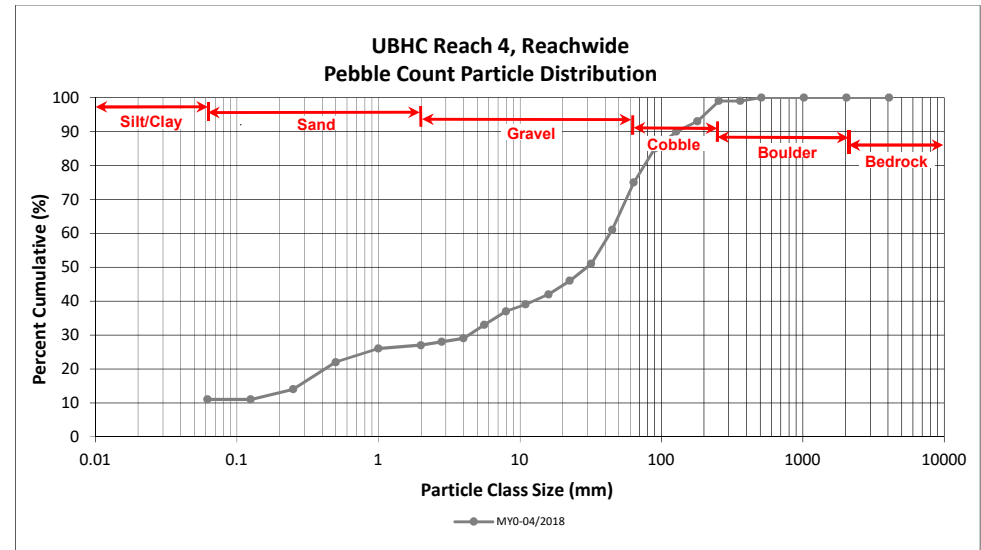
DMS Project No. 739

Monitoring Year 0 - 2018

UBHC Reach 4, Reachwide

Particle Class		Diameter (mm)		Particle Count			Reach Summary	
		min	max	Riffle	Pool	Total	Class Percentage	Percent Cumulative
<b>SILT/CLAY</b>	Silt/Clay	0.000	0.062	1	10	11	11	11
<b>SAND</b>	Very fine	0.062	0.125					11
	Fine	0.125	0.250		3	3	3	14
	Medium	0.25	0.50		8	8	8	22
	Coarse	0.5	1.0		4	4	4	26
	Very Coarse	1.0	2.0		1	1	1	27
<b>GRAVEL</b>	Very Fine	2.0	2.8		1	1	1	28
	Very Fine	2.8	4.0		1	1	1	29
	Fine	4.0	5.6		4	4	4	33
	Fine	5.6	8.0	1	3	4	4	37
	Medium	8.0	11.0		2	2	2	39
	Medium	11.0	16.0	1	2	3	3	42
	Coarse	16.0	22.6	2	2	4	4	46
	Coarse	22.6	32	3	2	5	5	51
	Very Coarse	32	45	8	2	10	10	61
	Very Coarse	45	64	11	3	14	14	75
<b>COBBLE</b>	Small	64	90	9	1	10	10	85
	Small	90	128	5		5	5	90
	Large	128	180	3		3	3	93
	Large	180	256	5	1	6	6	99
<b>BOULDER</b>	Small	256	362					99
	Small	362	512	1		1	1	100
	Medium	512	1024					100
	Large/Very Large	1024	2048					100
<b>BEDROCK</b>	Bedrock	2048	>2048					100
<b>Total</b>				<b>50</b>	<b>50</b>	<b>100</b>	<b>100</b>	<b>100</b>

Reachwide Channel materials (mm)	
D <sub>16</sub> =	0.30
D <sub>35</sub> =	6.69
D <sub>50</sub> =	29.8
D <sub>84</sub> =	87.0
D <sub>95</sub> =	202.4
D <sub>100</sub> =	512.0



**Reachwide and Cross-Section Pebble Count Plots**

Big Harris Creek Mitigation Site - Area A

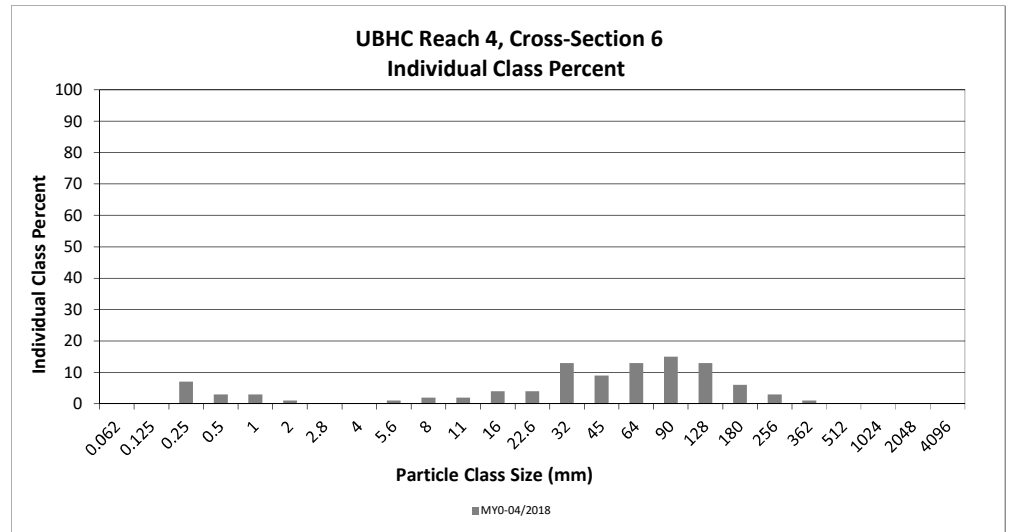
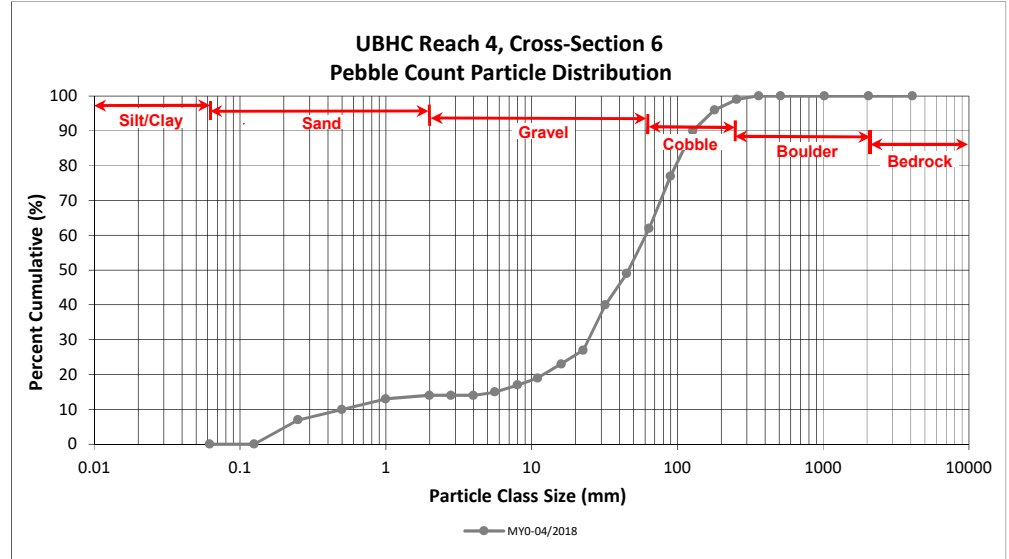
DMS Project No. 739

**Monitoring Year 0 - 2018**

UBHC Reach 4, Cross-Section 6

Particle Class		Diameter (mm)		Riffle 100-Count	Summary	
		min	max		Class Percentage	Percent Cumulative
<b>SILT/CLAY</b>	Silt/Clay	0.000	0.062			0
<b>SAND</b>	Very fine	0.062	0.125			0
	Fine	0.125	0.250	7	7	7
	Medium	0.25	0.50	3	3	10
	Coarse	0.5	1.0	3	3	13
	Very Coarse	1.0	2.0	1	1	14
<b>GRAVEL</b>	Very Fine	2.0	2.8			14
	Very Fine	2.8	4.0			14
	Fine	4.0	5.6	1	1	15
	Fine	5.6	8.0	2	2	17
	Medium	8.0	11.0	2	2	19
	Medium	11.0	16.0	4	4	23
	Coarse	16.0	22.6	4	4	27
	Coarse	22.6	32	13	13	40
	Very Coarse	32	45	9	9	49
<b>COBBLE</b>	Very Coarse	45	64	13	13	62
	Small	64	90	15	15	77
	Small	90	128	13	13	90
	Large	128	180	6	6	96
<b>BOULDER</b>	Large	180	256	3	3	99
	Small	256	362	1	1	100
	Small	362	512			100
<b>BOULDER</b>	Medium	512	1024			100
	Large/Very Large	1024	2048			100
<b>BEDROCK</b>	Bedrock	2048	>2048			100
<b>Total</b>				<b>100</b>	<b>100</b>	<b>100</b>

Cross-Section 6 Channel materials (mm)	
D <sub>16</sub> =	6.69
D <sub>35</sub> =	27.99
D <sub>50</sub> =	46.2
D <sub>84</sub> =	108.8
D <sub>95</sub> =	170.1
D <sub>100</sub> =	362.0



**Reachwide and Cross-Section Pebble Count Plots**

Big Harris Creek Mitigation Site - Area A

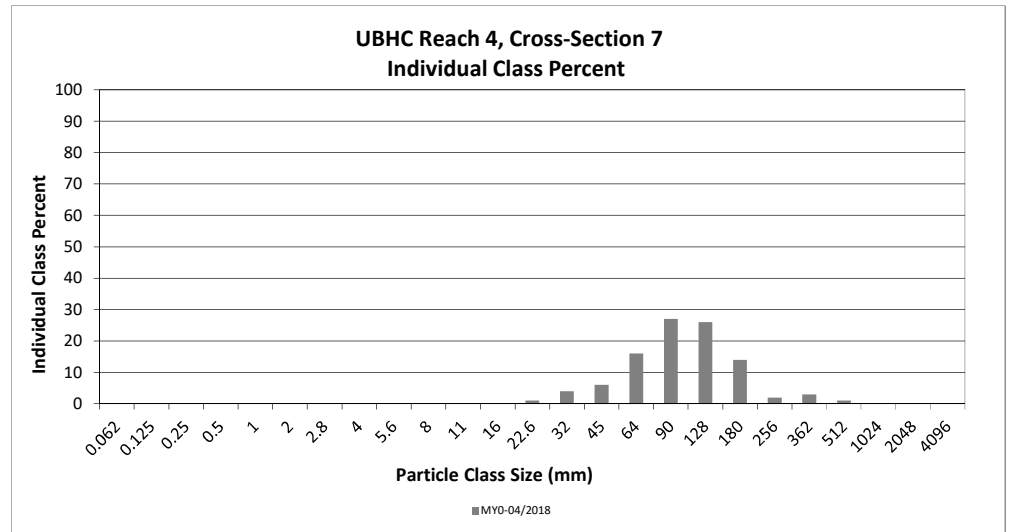
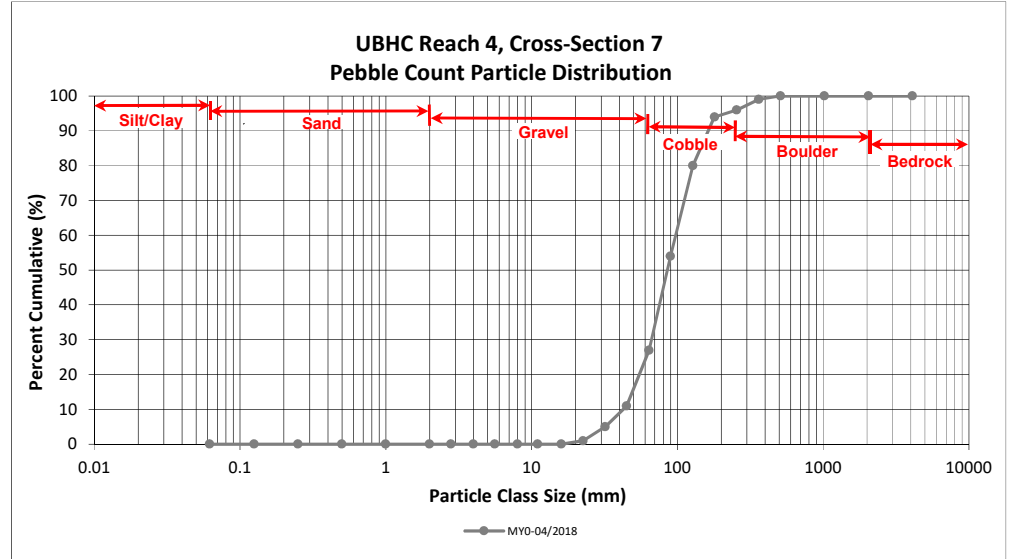
DMS Project No. 739

**Monitoring Year 0 - 2018**

UBHC Reach 4, Cross-Section 7

Particle Class		Diameter (mm)		Riffle 100-Count	Summary	
		min	max		Class Percentage	Percent Cumulative
<i>SILT/CLAY</i>	Silt/Clay	0.000	0.062			0
<i>SAND</i>	Very fine	0.062	0.125			0
	Fine	0.125	0.250			0
	Medium	0.25	0.50			0
	Coarse	0.5	1.0			0
	Very Coarse	1.0	2.0			0
<i>GRAVEL</i>	Very Fine	2.0	2.8			0
	Very Fine	2.8	4.0			0
	Fine	4.0	5.6			0
	Fine	5.6	8.0			0
	Medium	8.0	11.0			0
	Medium	11.0	16.0			0
	Coarse	16.0	22.6	1	1	1
	Coarse	22.6	32	4	4	5
	Very Coarse	32	45	6	6	11
<i>COBBLE</i>	Very Coarse	45	64	16	16	27
	Small	64	90	27	27	54
	Small	90	128	26	26	80
	Large	128	180	14	14	94
<i>BOULDER</i>	Large	180	256	2	2	96
	Small	256	362	3	3	99
<i>BOULDER</i>	Small	362	512	1	1	100
	Medium	512	1024			100
	Large/Very Large	1024	2048			100
<i>BEDROCK</i>	Bedrock	2048	>2048			100
<b>Total</b>				<b>100</b>	<b>100</b>	<b>100</b>

Cross-Section 7 Channel materials (mm)	
D <sub>16</sub> =	50.24
D <sub>35</sub> =	70.80
D <sub>50</sub> =	85.6
D <sub>84</sub> =	141.1
D <sub>95</sub> =	214.7
D <sub>100</sub> =	512.0



**Reachwide and Cross-Section Pebble Count Plots**

Big Harris Creek Mitigation Site - Area A

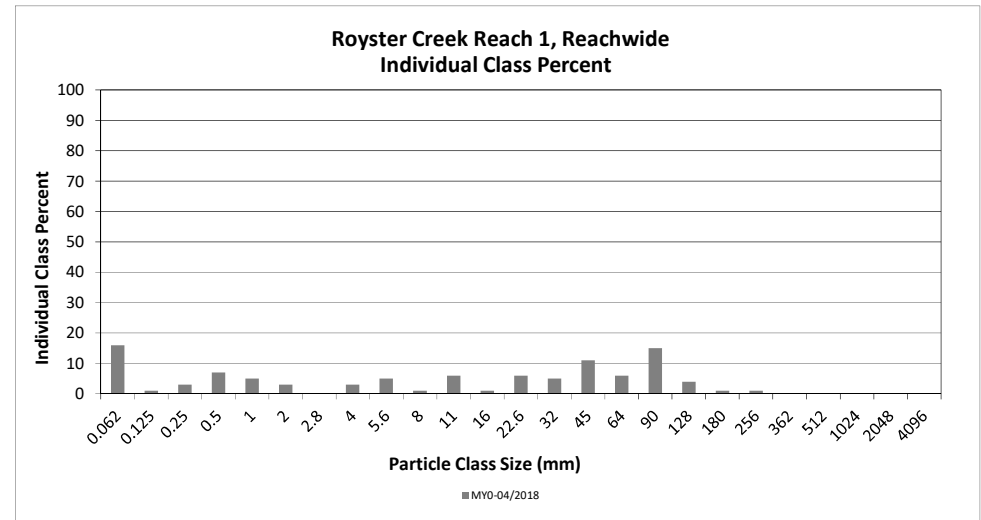
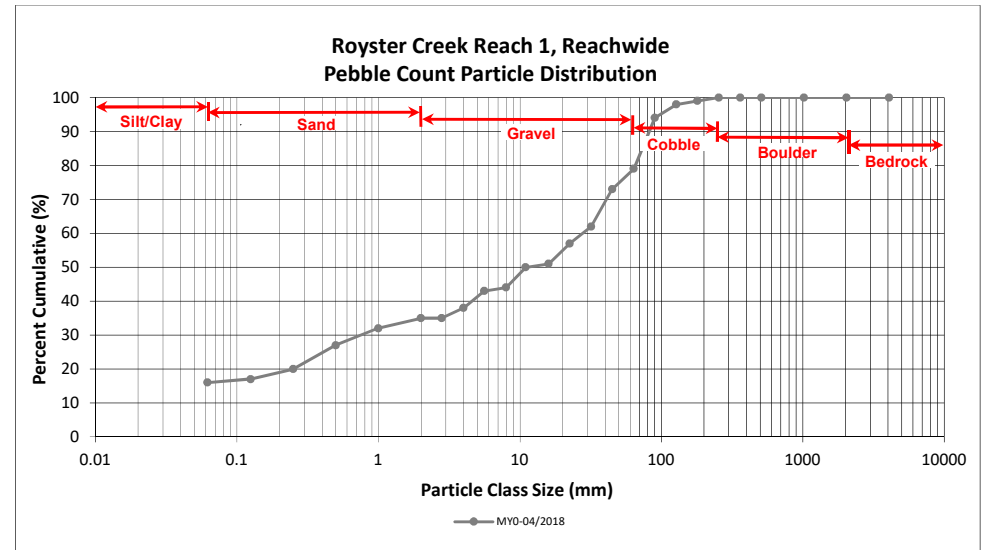
DMS Project No. 739

**Monitoring Year 0 - 2018**

Royster Creek Reach 1, Reachwide

Particle Class		Diameter (mm)		Particle Count			Reach Summary	
		min	max	Riffle	Pool	Total	Class Percentage	Percent Cumulative
<b>SILT/CLAY</b>	Silt/Clay	0.000	0.062			16	16	16
<b>SAND</b>	Very fine	0.062	0.125			1	1	17
	Fine	0.125	0.250			3	3	20
	Medium	0.25	0.50			7	7	27
	Coarse	0.5	1.0	1	4	5	5	32
	Very Coarse	1.0	2.0	1	2	3	3	35
<b>GRAVEL</b>	Very Fine	2.0	2.8					35
	Very Fine	2.8	4.0	1	2	3	3	38
	Fine	4.0	5.6	1	4	5	5	43
	Fine	5.6	8.0			1	1	44
	Medium	8.0	11.0	3	3	6	6	50
	Medium	11.0	16.0			1	1	51
	Coarse	16.0	22.6	5	1	6	6	57
	Coarse	22.6	32	5		5	5	62
	Very Coarse	32	45	10	1	11	11	73
	Very Coarse	45	64	4	2	6	6	79
<b>COBBLE</b>	Small	64	90	14	1	15	15	94
	Small	90	128	3	1	4	4	98
	Large	128	180	1		1	1	99
	Large	180	256	1		1	1	100
<b>BOULDER</b>	Small	256	362					100
	Small	362	512					100
	Medium	512	1024					100
	Large/Very Large	1024	2048					100
<b>BEDROCK</b>	Bedrock	2048	>2048					100
<b>Total</b>				<b>50</b>	<b>50</b>	<b>100</b>	<b>100</b>	<b>100</b>

Reachwide Channel materials (mm)	
D <sub>16</sub> =	Silt/Clay
D <sub>35</sub> =	2.00
D <sub>50</sub> =	11.0
D <sub>84</sub> =	71.7
D <sub>95</sub> =	98.3
D <sub>100</sub> =	256.0



## Reachwide and Cross-Section Pebble Count Plots

Big Harris Creek Mitigation Site - Area A

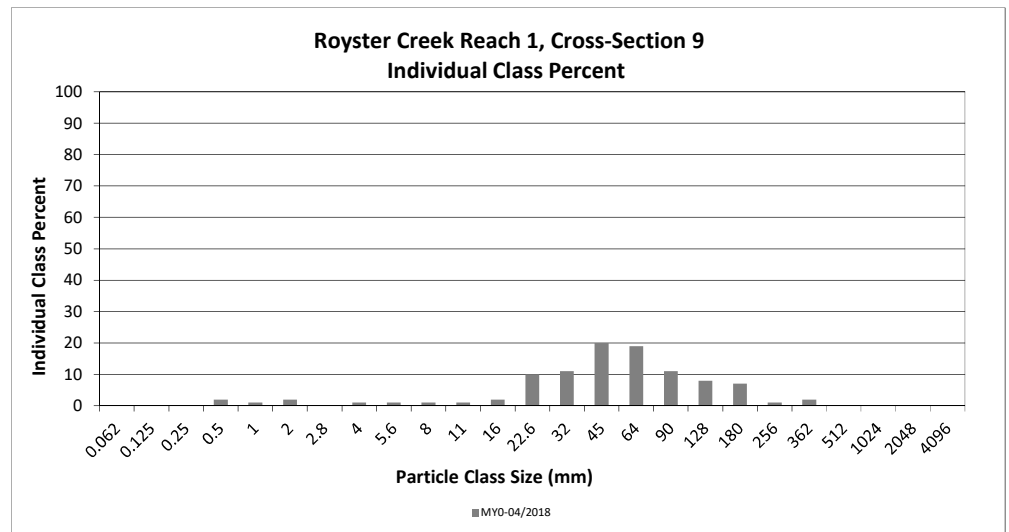
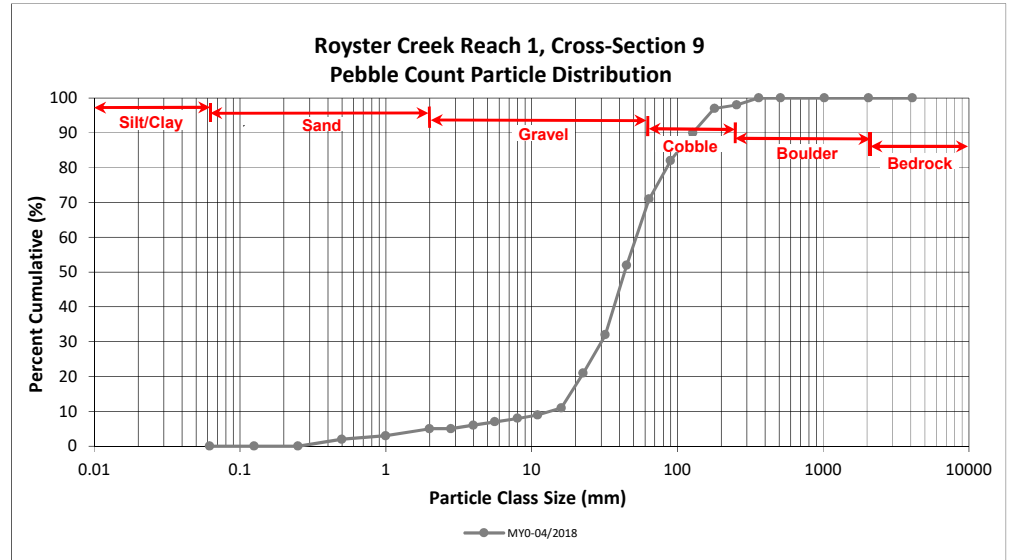
DMS Project No. 739

Monitoring Year 0 - 2018

Royster Creek Reach 1, Cross-Section 9

Particle Class		Diameter (mm)		Riffle 100-Count	Summary	
		min	max		Class Percentage	Percent Cumulative
<b>SILT/CLAY</b>	Silt/Clay	0.000	0.062			0
<b>SAND</b>	Very fine	0.062	0.125			0
	Fine	0.125	0.250			0
	Medium	0.25	0.50	2	2	2
	Coarse	0.5	1.0	1	1	3
	Very Coarse	1.0	2.0	2	2	5
<b>GRAVEL</b>	Very Fine	2.0	2.8			5
	Very Fine	2.8	4.0	1	1	6
	Fine	4.0	5.6	1	1	7
	Fine	5.6	8.0	1	1	8
	Medium	8.0	11.0	1	1	9
	Medium	11.0	16.0	2	2	11
	Coarse	16.0	22.6	10	10	21
	Coarse	22.6	32	11	11	32
	Very Coarse	32	45	20	20	52
	Very Coarse	45	64	19	19	71
<b>COBBLE</b>	Small	64	90	11	11	82
	Small	90	128	8	8	90
	Large	128	180	7	7	97
	Large	180	256	1	1	98
<b>BOULDER</b>	Small	256	362	2	2	100
	Small	362	512			100
	Medium	512	1024			100
	Large/Very Large	1024	2048			100
<b>BEDROCK</b>	Bedrock	2048	>2048			100
<b>Total</b>				<b>100</b>	<b>100</b>	<b>100</b>

Cross-Section 9 Channel materials (mm)	
D <sub>16</sub> =	19.02
D <sub>35</sub> =	33.68
D <sub>50</sub> =	43.5
D <sub>84</sub> =	98.3
D <sub>95</sub> =	163.3
D <sub>100</sub> =	362.0



**Reachwide and Cross-Section Pebble Count Plots**

Big Harris Creek Mitigation Site - Area A

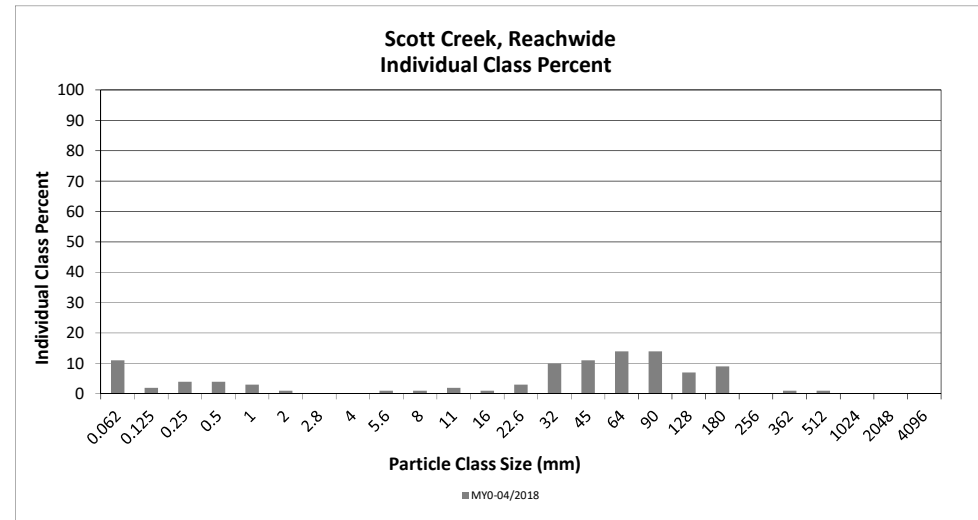
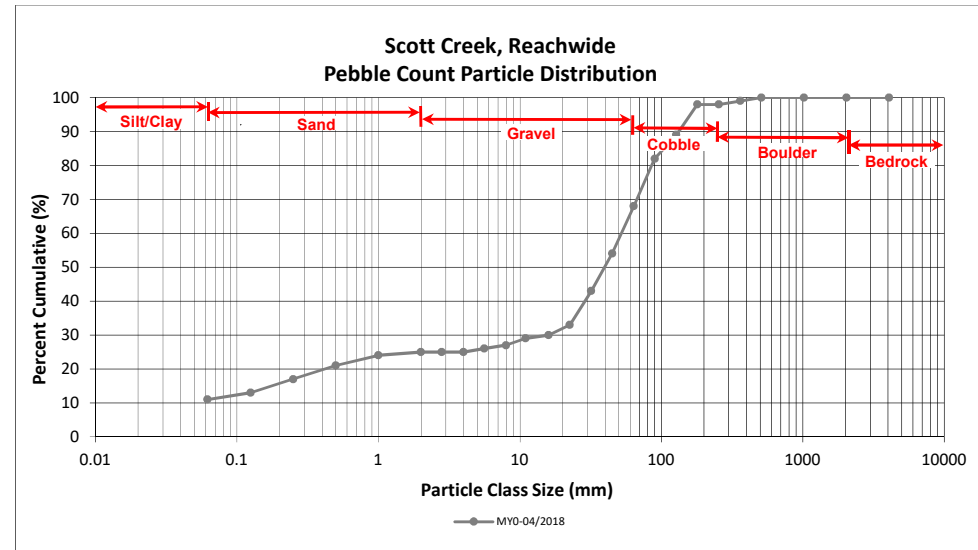
DMS Project No. 739

**Monitoring Year 0 - 2018**

Scott Creek, Reachwide

Particle Class		Diameter (mm)		Particle Count			Reach Summary	
		min	max	Riffle	Pool	Total	Class Percentage	Percent Cumulative
<b>SILT/CLAY</b>	Silt/Clay	0.000	0.062			11	11	11
<b>SAND</b>	Very fine	0.062	0.125			2	2	13
	Fine	0.125	0.250			4	4	17
	Medium	0.25	0.50			4	4	21
	Coarse	0.5	1.0			3	3	24
	Very Coarse	1.0	2.0			1	1	25
<b>GRAVEL</b>	Very Fine	2.0	2.8					25
	Very Fine	2.8	4.0					25
	Fine	4.0	5.6			1	1	26
	Fine	5.6	8.0			1	1	27
	Medium	8.0	11.0			2	2	29
	Medium	11.0	16.0			1	1	30
	Coarse	16.0	22.6	1	2	3	3	33
	Coarse	22.6	32	5	5	10	10	43
	Very Coarse	32	45	5	6	11	11	54
	Very Coarse	45	64	13	1	14	14	68
<b>COBBLE</b>	Small	64	90	10	4	14	14	82
	Small	90	128	5	2	7	7	89
	Large	128	180	9		9	9	98
	Large	180	256					98
<b>BOULDER</b>	Small	256	362	1		1	1	99
	Small	362	512	1		1	1	100
	Medium	512	1024					100
	Large/Very Large	1024	2048					100
<b>BEDROCK</b>	Bedrock	2048	>2048					100
<b>Total</b>				<b>50</b>	<b>50</b>	<b>100</b>	<b>100</b>	<b>100</b>

Reachwide Channel materials (mm)	
D <sub>16</sub> =	0.21
D <sub>35</sub> =	24.23
D <sub>50</sub> =	39.8
D <sub>84</sub> =	99.5
D <sub>95</sub> =	160.7
D <sub>100</sub> =	512.0



## Reachwide and Cross-Section Pebble Count Plots

Big Harris Creek Mitigation Site - Area A

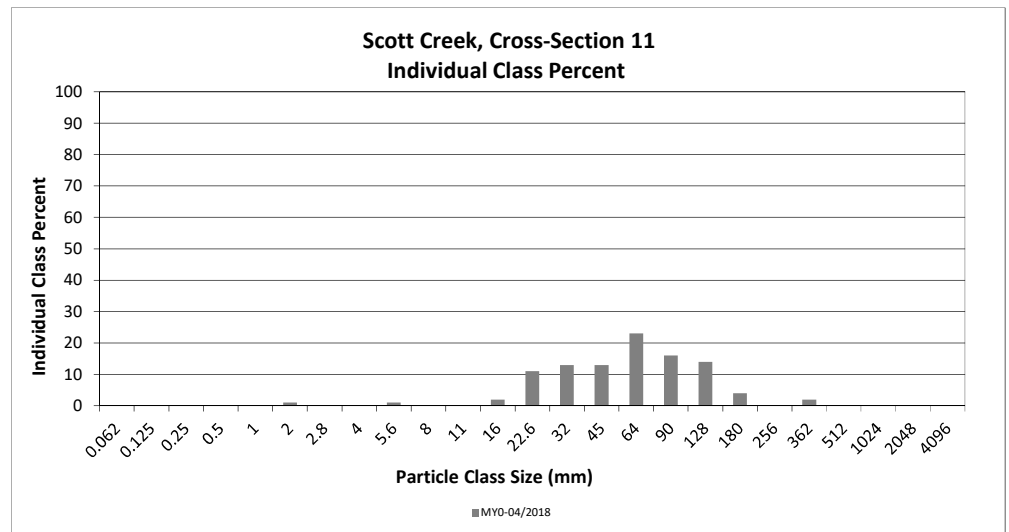
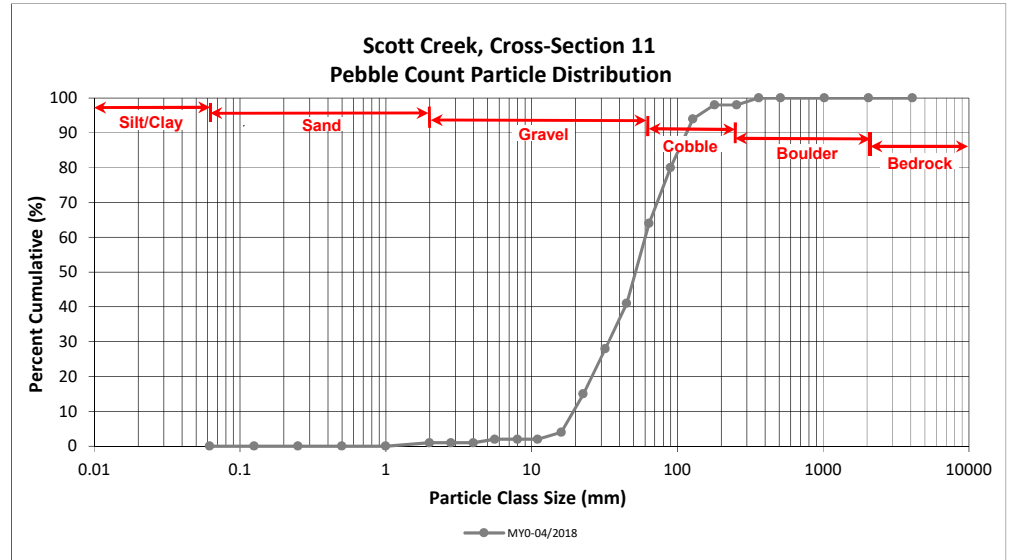
DMS Project No. 739

Monitoring Year 0 - 2018

Scott Creek, Cross-Section 11

Particle Class		Diameter (mm)		Riffle 100-Count	Summary	
		min	max		Class Percentage	Percent Cumulative
<b>SILT/CLAY</b>	Silt/Clay	0.000	0.062			0
<b>SAND</b>	Very fine	0.062	0.125			0
	Fine	0.125	0.250			0
	Medium	0.25	0.50			0
	Coarse	0.5	1.0			0
	Very Coarse	1.0	2.0	1	1	1
<b>GRAVEL</b>	Very Fine	2.0	2.8			1
	Very Fine	2.8	4.0			1
	Fine	4.0	5.6	1	1	2
	Fine	5.6	8.0			2
	Medium	8.0	11.0			2
	Medium	11.0	16.0	2	2	4
	Coarse	16.0	22.6	11	11	15
	Coarse	22.6	32	13	13	28
	Very Coarse	32	45	13	13	41
<b>COBBLE</b>	Very Coarse	45	64	23	23	64
	Small	64	90	16	16	80
	Small	90	128	14	14	94
	Large	128	180	4	4	98
<b>BOULDER</b>	Large	180	256			98
	Small	256	362	2	2	100
<b>BOULDER</b>	Small	362	512			100
	Medium	512	1024			100
	Large/Very Large	1024	2048			100
<b>BEDROCK</b>	Bedrock	2048	>2048			100
<b>Total</b>				<b>100</b>	<b>100</b>	<b>100</b>

Cross-Section 11 Channel materials (mm)	
D <sub>16</sub> =	23.21
D <sub>35</sub> =	38.45
D <sub>50</sub> =	51.6
D <sub>84</sub> =	99.5
D <sub>95</sub> =	139.4
D <sub>100</sub> =	362.0





**Reachwide and Cross-Section Pebble Count Plots**

Big Harris Creek Mitigation Site - Area A

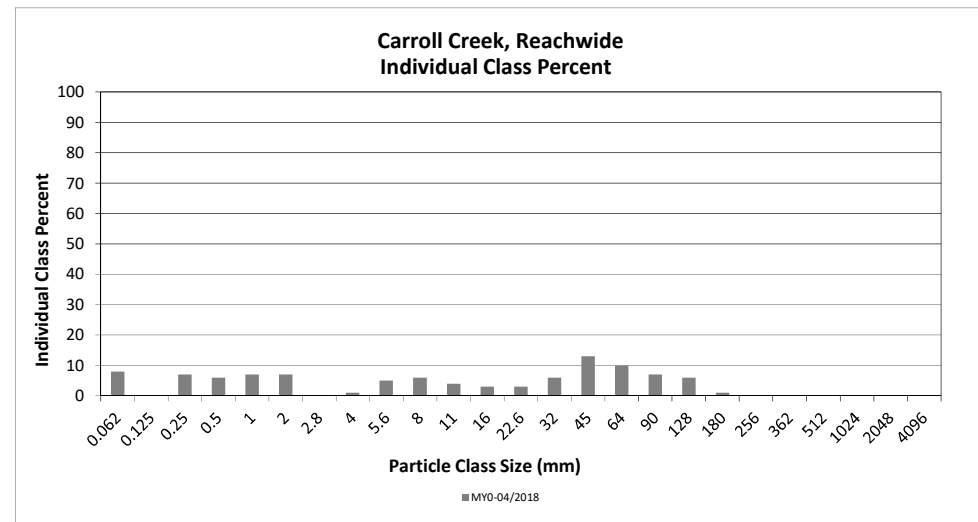
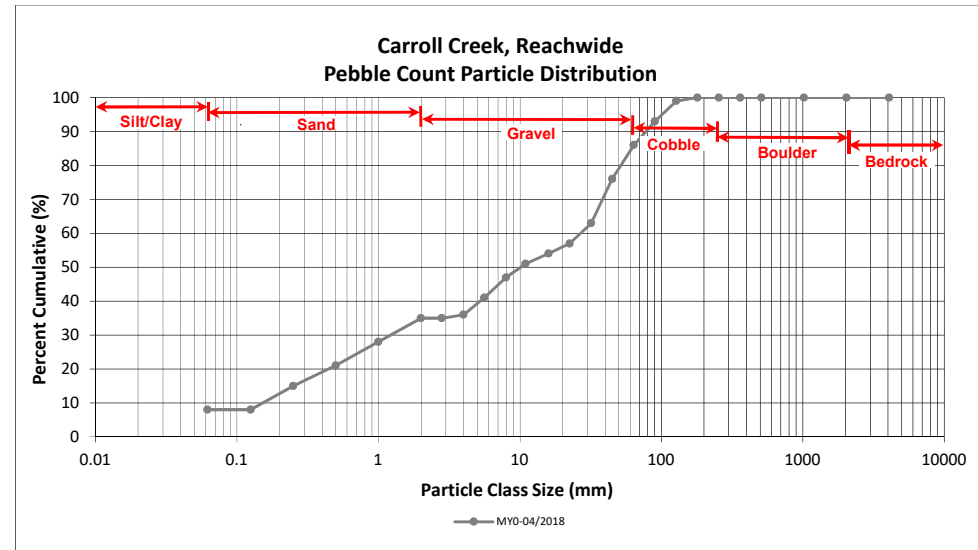
DMS Project No. 739

**Monitoring Year 0 - 2018**

Carroll Creek, Reachwide

Particle Class		Diameter (mm)		Particle Count			Reach Summary	
		min	max	Riffle	Pool	Total	Class Percentage	Percent Cumulative
<b>SILT/CLAY</b>	Silt/Clay	0.000	0.062			8	8	8
<b>SAND</b>	Very fine	0.062	0.125					8
	Fine	0.125	0.250	4	3	7	7	15
	Medium	0.25	0.50	1	5	6	6	21
	Coarse	0.5	1.0	1	6	7	7	28
	Very Coarse	1.0	2.0	1	6	7	7	35
<b>GRAVEL</b>	Very Fine	2.0	2.8					35
	Very Fine	2.8	4.0		1	1	1	36
	Fine	4.0	5.6	1	4	5	5	41
	Fine	5.6	8.0		6	6	6	47
	Medium	8.0	11.0		4	4	4	51
	Medium	11.0	16.0		3	3	3	54
	Coarse	16.0	22.6	1	2	3	3	57
	Coarse	22.6	32	5	1	6	6	63
	Very Coarse	32	45	12	1	13	13	76
	Very Coarse	45	64	10		10	10	86
<b>COBBLE</b>	Small	64	90	7		7	7	93
	Small	90	128	6		6	6	99
	Large	128	180	1		1	1	100
	Large	180	256					100
<b>BOULDER</b>	Small	256	362					100
	Small	362	512					100
	Medium	512	1024					100
	Large/Very Large	1024	2048					100
<b>BEDROCK</b>	Bedrock	2048	>2048					100
<b>Total</b>				<b>50</b>	<b>50</b>	<b>100</b>	<b>100</b>	<b>100</b>

Reachwide Channel materials (mm)	
D <sub>16</sub> =	0.28
D <sub>35</sub> =	2.00
D <sub>50</sub> =	10.2
D <sub>84</sub> =	59.6
D <sub>95</sub> =	101.2
D <sub>100</sub> =	180.0



## Reachwide and Cross-Section Pebble Count Plots

Big Harris Creek Mitigation Site - Area A

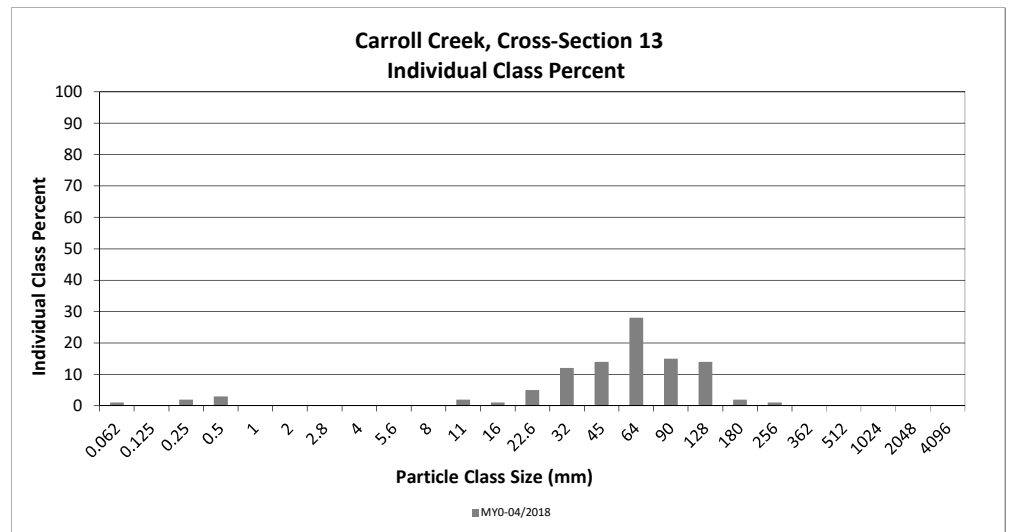
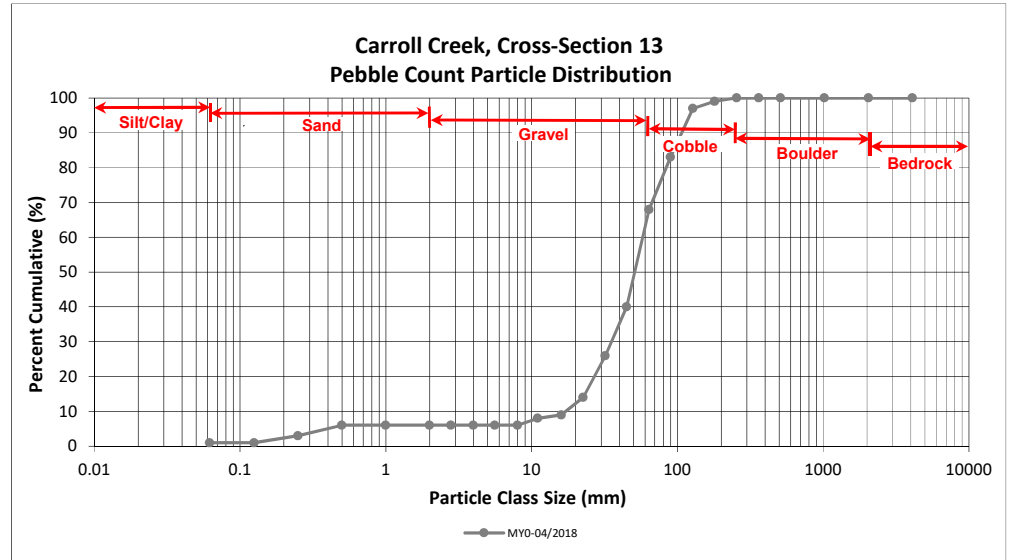
DMS Project No. 739

Monitoring Year 0 - 2018

Carroll Creek, Cross-Section 13

Particle Class		Diameter (mm)		Riffle 100-Count	Summary	
		min	max		Class Percentage	Percent Cumulative
<b>SILT/CLAY</b>	Silt/Clay	0.000	0.062	1	1	1
<b>SAND</b>	Very fine	0.062	0.125			1
	Fine	0.125	0.250	2	2	3
	Medium	0.25	0.50	3	3	6
	Coarse	0.5	1.0			6
	Very Coarse	1.0	2.0			6
<b>GRAVEL</b>	Very Fine	2.0	2.8			6
	Very Fine	2.8	4.0			6
	Fine	4.0	5.6			6
	Fine	5.6	8.0			6
	Medium	8.0	11.0	2	2	8
	Medium	11.0	16.0	1	1	9
	Coarse	16.0	22.6	5	5	14
	Coarse	22.6	32	12	12	26
	Very Coarse	32	45	14	14	40
	Very Coarse	45	64	28	28	68
<b>COBBLE</b>	Small	64	90	15	15	83
	Small	90	128	14	14	97
	Large	128	180	2	2	99
	Large	180	256	1	1	100
<b>BOULDER</b>	Small	256	362			100
	Small	362	512			100
	Medium	512	1024			100
	Large/Very Large	1024	2048			100
<b>BEDROCK</b>	Bedrock	2048	>2048			100
<b>Total</b>				<b>100</b>	<b>100</b>	<b>100</b>

Cross-Section 13 Channel materials (mm)	
D <sub>16</sub> =	23.95
D <sub>35</sub> =	39.84
D <sub>50</sub> =	51.0
D <sub>84</sub> =	92.3
D <sub>95</sub> =	121.7
D <sub>100</sub> =	256.0



**Reachwide and Cross-Section Pebble Count Plots**

Big Harris Creek Mitigation Site - Area B

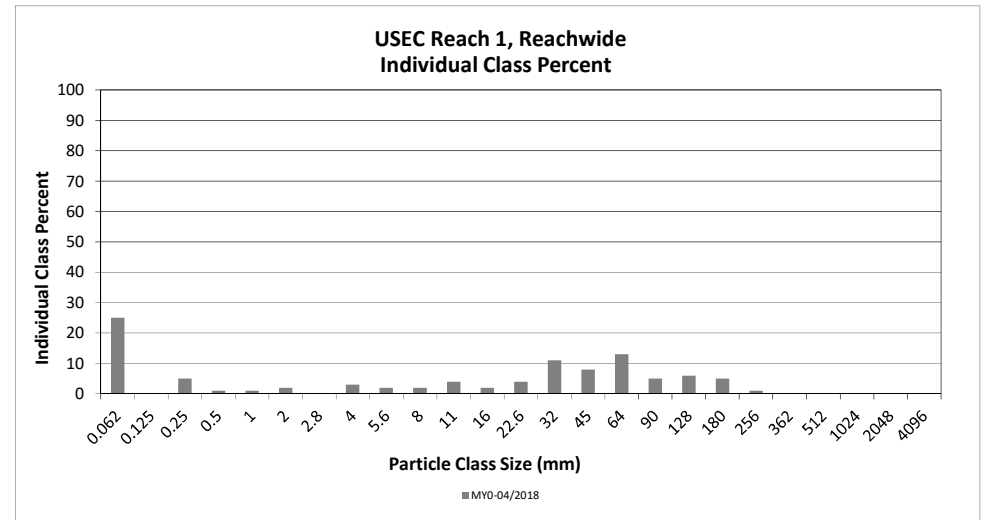
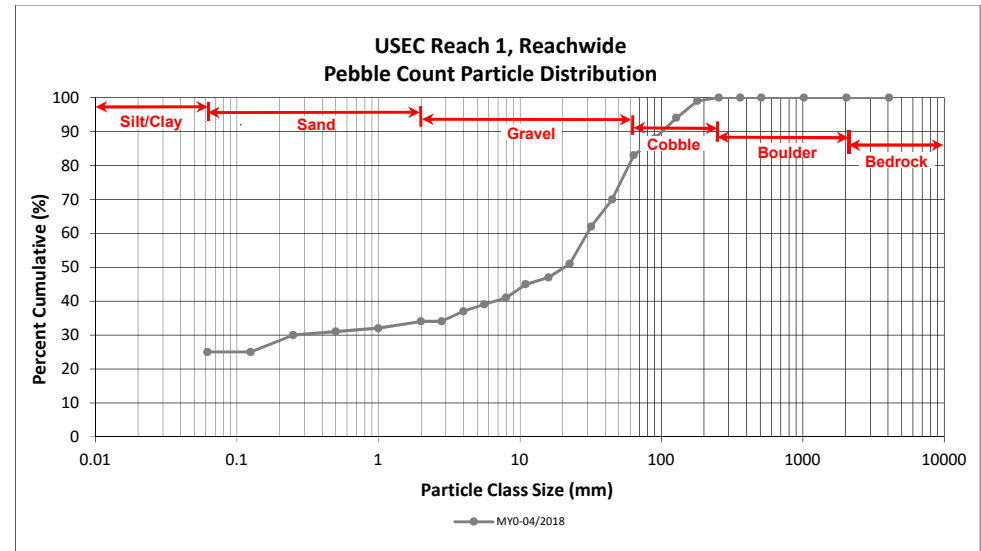
DMS Project No. 739

Monitoring Year 0 - 2018

USEC Reach 1, Reachwide

Particle Class		Diameter (mm)		Particle Count			Reach Summary	
		min	max	Riffle	Pool	Total	Class Percentage	Percent Cumulative
<b>SILT/CLAY</b>	Silt/Clay	0.000	0.062	1	24	25	25	25
<b>SAND</b>	Very fine	0.062	0.125					25
	Fine	0.125	0.250		5	5	5	30
	Medium	0.25	0.50		1	1	1	31
	Coarse	0.5	1.0		1	1	1	32
	Very Coarse	1.0	2.0		2	2	2	34
<b>GRAVEL</b>	Very Fine	2.0	2.8					34
	Very Fine	2.8	4.0	1	2	3	3	37
	Fine	4.0	5.6		2	2	2	39
	Fine	5.6	8.0		2	2	2	41
	Medium	8.0	11.0		4	4	4	45
	Medium	11.0	16.0	2		2	2	47
	Coarse	16.0	22.6	1	3	4	4	51
	Coarse	22.6	32	10	1	11	11	62
	Very Coarse	32	45	8		8	8	70
	Very Coarse	45	64	13		13	13	83
<b>COBBLE</b>	Small	64	90	4	1	5	5	88
	Small	90	128	6		6	6	94
	Large	128	180	3	2	5	5	99
	Large	180	256	1		1	1	100
<b>BOULDER</b>	Small	256	362					100
	Small	362	512					100
	Medium	512	1024					100
<b>BEDROCK</b>	Large/Very Large	1024	2048					100
	Bedrock	2048	>2048					100
<b>Total</b>				<b>50</b>	<b>50</b>	<b>100</b>	<b>100</b>	<b>100</b>

Reachwide	
Channel materials (mm)	
D <sub>16</sub> =	Silt/Clay
D <sub>35</sub> =	3.15
D <sub>50</sub> =	20.7
D <sub>84</sub> =	68.5
D <sub>95</sub> =	137.0
D <sub>100</sub> =	256.0



**Reachwide and Cross-Section Pebble Count Plots**

Big Harris Creek Mitigation Site - Area B

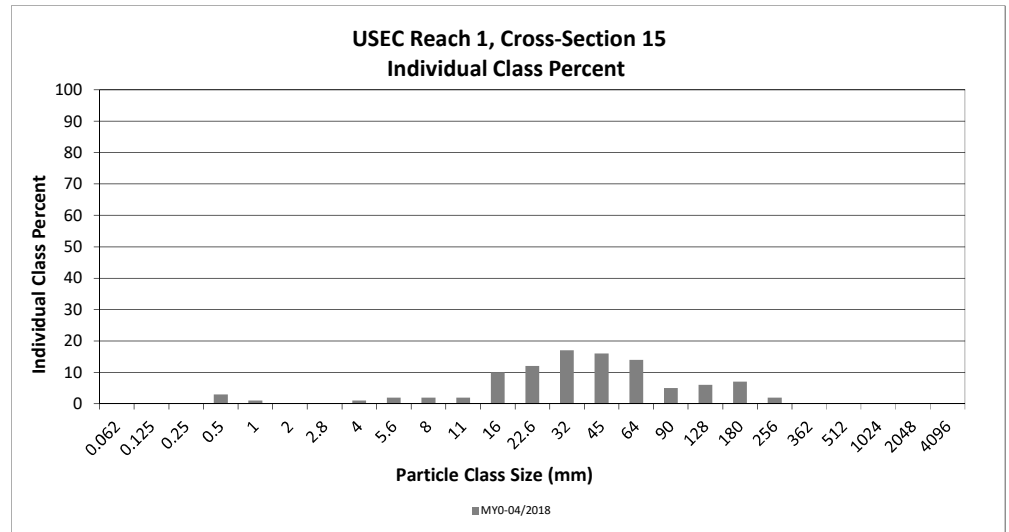
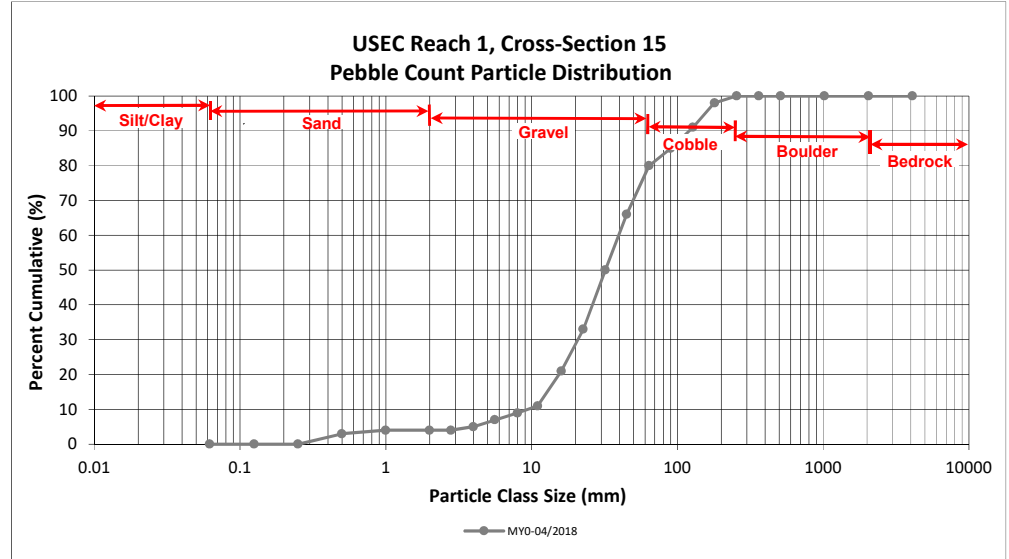
DMS Project No. 739

**Monitoring Year 0 - 2018**

USEC Reach 1, Cross-Section 15

Particle Class		Diameter (mm)		Riffle 100-Count	Summary	
		min	max		Class Percentage	Percent Cumulative
<i>SILT/CLAY</i>	Silt/Clay	0.000	0.062			0
<i>SAND</i>	Very fine	0.062	0.125			0
	Fine	0.125	0.250			0
	Medium	0.25	0.50	3	3	3
	Coarse	0.5	1.0	1	1	4
	Very Coarse	1.0	2.0			4
<i>GRAVEL</i>	Very Fine	2.0	2.8			4
	Very Fine	2.8	4.0	1	1	5
	Fine	4.0	5.6	2	2	7
	Fine	5.6	8.0	2	2	9
	Medium	8.0	11.0	2	2	11
	Medium	11.0	16.0	10	10	21
	Coarse	16.0	22.6	12	12	33
	Coarse	22.6	32	17	17	50
	Very Coarse	32	45	16	16	66
	Very Coarse	45	64	14	14	80
<i>COBBLE</i>	Small	64	90	5	5	85
	Small	90	128	6	6	91
	Large	128	180	7	7	98
	Large	180	256	2	2	100
<i>BOULDER</i>	Small	256	362			100
	Small	362	512			100
	Medium	512	1024			100
	Large/Very Large	1024	2048			100
<i>BEDROCK</i>	Bedrock	2048	>2048			100
<b>Total</b>				<b>100</b>	<b>100</b>	<b>100</b>

Cross-Section 15 Channel materials (mm)	
D <sub>16</sub> =	13.27
D <sub>35</sub> =	23.54
D <sub>50</sub> =	32.0
D <sub>84</sub> =	84.1
D <sub>95</sub> =	155.5
D <sub>100</sub> =	256.0



**Reachwide and Cross-Section Pebble Count Plots**

Big Harris Creek Mitigation Site - Area B

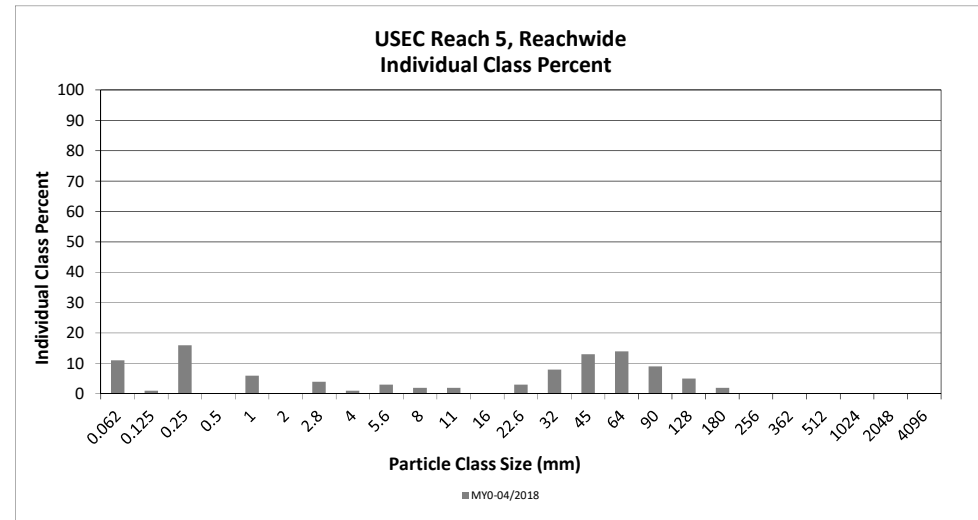
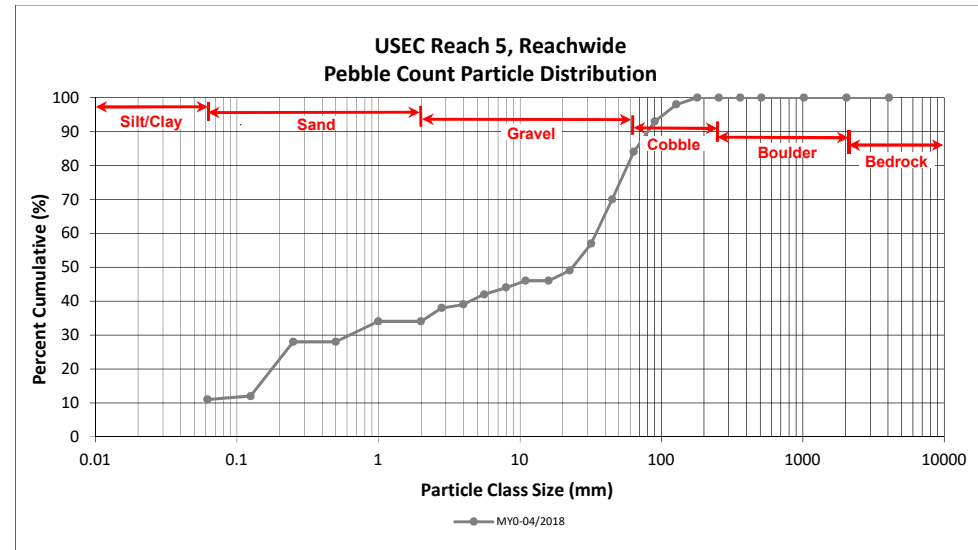
DMS Project No. 739

Monitoring Year 0 - 2018

USEC Reach 5, Reachwide

Particle Class		Diameter (mm)		Particle Count			Reach Summary	
		min	max	Riffle	Pool	Total	Class Percentage	Percent Cumulative
<b>SILT/CLAY</b>	Silt/Clay	0.000	0.062	4	7	11	11	11
<b>SAND</b>	Very fine	0.062	0.125		1	1	1	12
	Fine	0.125	0.250		16	16	16	28
	Medium	0.25	0.50					28
	Coarse	0.5	1.0	1	5	6	6	34
	Very Coarse	1.0	2.0					34
<b>GRAVEL</b>	Very Fine	2.0	2.8	1	3	4	4	38
	Very Fine	2.8	4.0		1	1	1	39
	Fine	4.0	5.6		3	3	3	42
	Fine	5.6	8.0	1	1	2	2	44
	Medium	8.0	11.0		2	2	2	46
	Medium	11.0	16.0					46
	Coarse	16.0	22.6	3		3	3	49
	Coarse	22.6	32	4	4	8	8	57
	Very Coarse	32	45	9	4	13	13	70
	Very Coarse	45	64	13	1	14	14	84
<b>COBBLE</b>	Small	64	90	7	2	9	9	93
	Small	90	128	5		5	5	98
	Large	128	180	2		2	2	100
	Large	180	256					100
<b>BOULDER</b>	Small	256	362					100
	Small	362	512					100
	Medium	512	1024					100
	Large/Very Large	1024	2048					100
<b>BEDROCK</b>	Bedrock	2048	>2048					100
<b>Total</b>				<b>50</b>	<b>50</b>	<b>100</b>	<b>100</b>	<b>100</b>

Reachwide Channel materials (mm)	
D <sub>16</sub> =	0.15
D <sub>35</sub> =	2.18
D <sub>50</sub> =	23.6
D <sub>84</sub> =	64.0
D <sub>95</sub> =	103.6
D <sub>100</sub> =	180.0



**Reachwide and Cross-Section Pebble Count Plots**

Big Harris Creek Mitigation Site - Area B

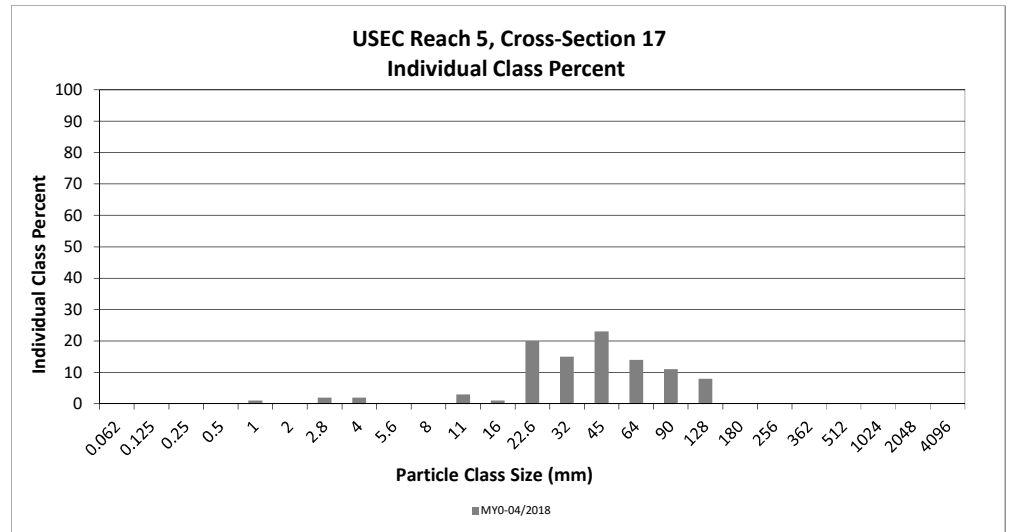
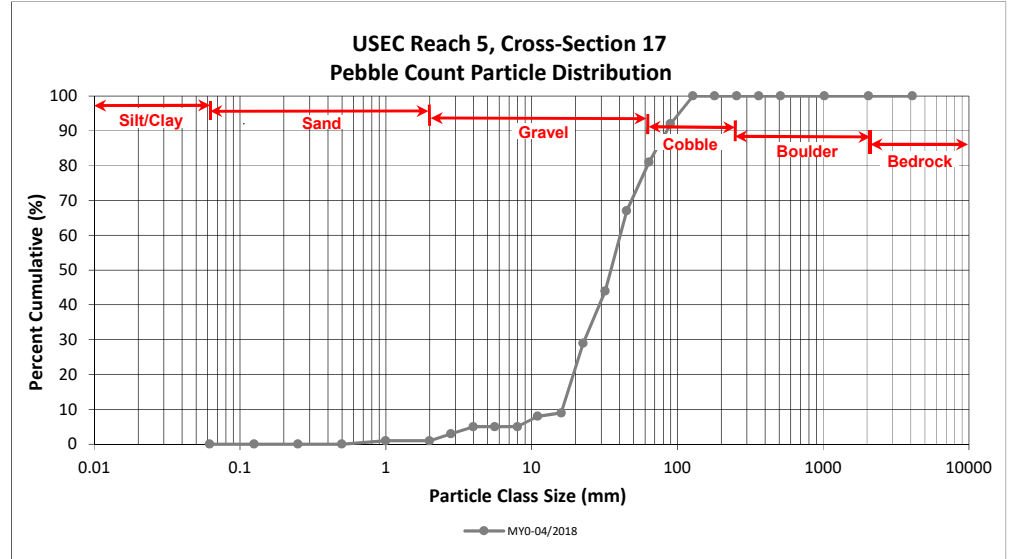
DMS Project No. 739

**Monitoring Year 0 - 2018**

USEC Reach 5, Cross-Section 17

Particle Class		Diameter (mm)		Riffle 100-Count	Summary	
		min	max		Class Percentage	Percent Cumulative
<b>SILT/CLAY</b>	Silt/Clay	0.000	0.062			0
<b>SAND</b>	Very fine	0.062	0.125			0
	Fine	0.125	0.250			0
	Medium	0.25	0.50			0
	Coarse	0.5	1.0	1	1	1
	Very Coarse	1.0	2.0			1
<b>GRAVEL</b>	Very Fine	2.0	2.8	2	2	3
	Very Fine	2.8	4.0	2	2	5
	Fine	4.0	5.6			5
	Fine	5.6	8.0			5
	Medium	8.0	11.0	3	3	8
	Medium	11.0	16.0	1	1	9
	Coarse	16.0	22.6	20	20	29
	Coarse	22.6	32	15	15	44
	Very Coarse	32	45	23	23	67
<b>COBBLE</b>	Very Coarse	45	64	14	14	81
	Small	64	90	11	11	92
	Small	90	128	8	8	100
	Large	128	180			100
<b>BOULDER</b>	Large	180	256			100
	Small	256	362			100
	Small	362	512			100
	Medium	512	1024			100
<b>BEDROCK</b>	Large/Very Large	1024	2048			100
	Bedrock	2048	>2048			100
<b>Total</b>				<b>100</b>	<b>100</b>	<b>100</b>

Cross-Section 17 Channel materials (mm)	
D <sub>16</sub> =	18.06
D <sub>35</sub> =	25.97
D <sub>50</sub> =	35.0
D <sub>84</sub> =	70.2
D <sub>95</sub> =	102.7
D <sub>100</sub> =	128.0



**Reachwide and Cross-Section Pebble Count Plots**

Big Harris Creek Mitigation Site - Area B

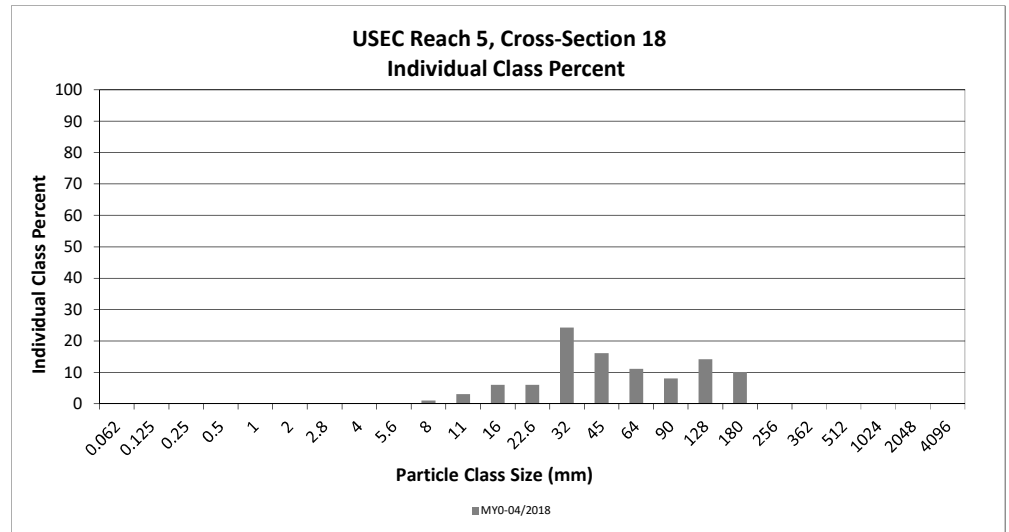
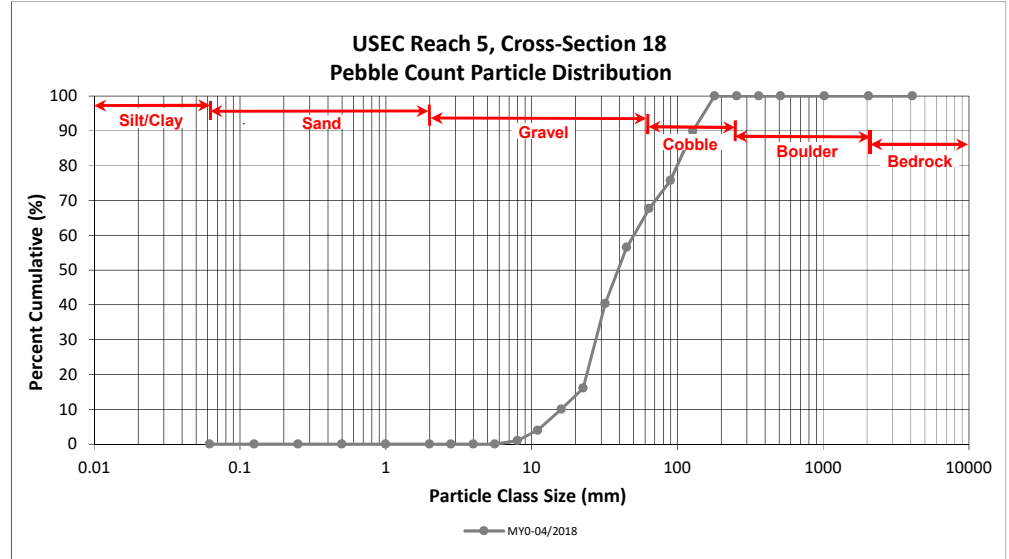
DMS Project No. 739

**Monitoring Year 0 - 2018**

USEC Reach 5, Cross-Section 18

Particle Class		Diameter (mm)		Riffle 100-Count	Summary	
		min	max		Class Percentage	Percent Cumulative
<b>SILT/CLAY</b>	Silt/Clay	0.000	0.062			0
<b>SAND</b>	Very fine	0.062	0.125			0
	Fine	0.125	0.250			0
	Medium	0.25	0.50			0
	Coarse	0.5	1.0			0
	Very Coarse	1.0	2.0			0
<b>GRAVEL</b>	Very Fine	2.0	2.8			0
	Very Fine	2.8	4.0			0
	Fine	4.0	5.6			0
	Fine	5.6	8.0	1	1	1
	Medium	8.0	11.0	3	3	4
	Medium	11.0	16.0	6	6	10
	Coarse	16.0	22.6	6	6	16
	Coarse	22.6	32	24	24	40
Very Coarse	32	45	16	16	57	
<b>Very Coarse</b>		45	64	11	11	68
<b>COBBLE</b>	Small	64	90	8	8	76
	Small	90	128	14	14	90
	Large	128	180	10	10	100
	Large	180	256			100
<b>BOULDER</b>	Small	256	362			100
	Small	362	512			100
	Medium	512	1024			100
	Large/Very Large	1024	2048			100
<b>BEDROCK</b>	Bedrock	2048	>2048			100
<b>Total</b>				<b>99</b>	<b>100</b>	<b>100</b>

Cross-Section 18 Channel materials (mm)	
D <sub>16</sub> =	22.39
D <sub>35</sub> =	29.61
D <sub>50</sub> =	39.2
D <sub>84</sub> =	110.5
D <sub>95</sub> =	152.0
D <sub>100</sub> =	180.0



## Reachwide and Cross-Section Pebble Count Plots

Big Harris Creek Mitigation Site - Area B

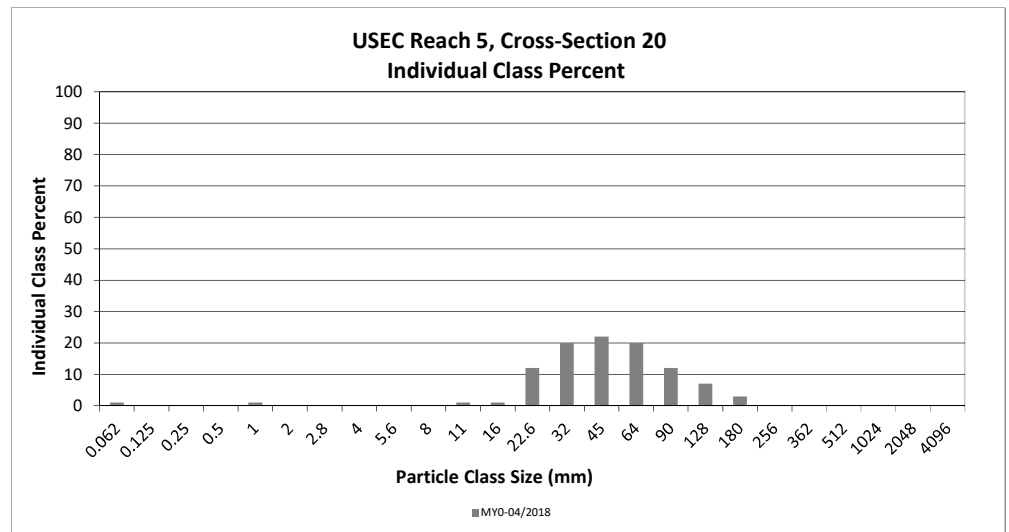
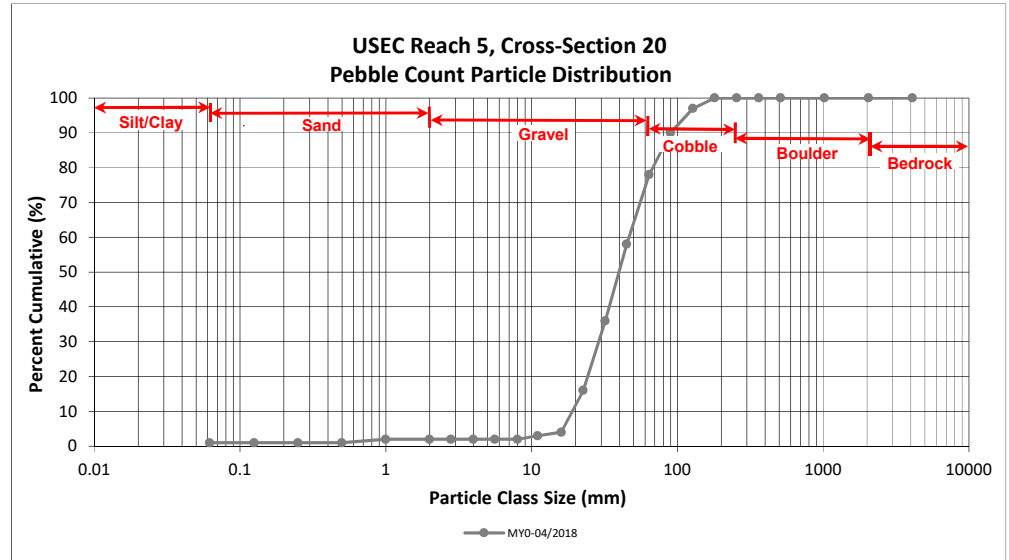
DMS Project No. 739

Monitoring Year 0 - 2018

USEC Reach 5, Cross-Section 20

Particle Class		Diameter (mm)		Riffle 100-Count	Summary	
		min	max		Class Percentage	Percent Cumulative
<i>SILT/CLAY</i>	Silt/Clay	0.000	0.062	1	1	1
<i>SAND</i>	Very fine	0.062	0.125			1
	Fine	0.125	0.250			1
	Medium	0.25	0.50			1
	Coarse	0.5	1.0	1	1	2
	Very Coarse	1.0	2.0			2
<i>GRAVEL</i>	Very Fine	2.0	2.8			2
	Very Fine	2.8	4.0			2
	Fine	4.0	5.6			2
	Fine	5.6	8.0			2
	Medium	8.0	11.0	1	1	3
	Medium	11.0	16.0	1	1	4
	Coarse	16.0	22.6	12	12	16
	Coarse	22.6	32	20	20	36
	Very Coarse	32	45	22	22	58
<i>COBBLE</i>	Very Coarse	45	64	20	20	78
	Small	64	90	12	12	90
	Small	90	128	7	7	97
	Large	128	180	3	3	100
<i>BOULDER</i>	Large	180	256			100
	Small	256	362			100
	Small	362	512			100
	Medium	512	1024			100
<i>BEDROCK</i>	Large/Very Large	1024	2048			100
	Bedrock	2048	>2048			100
<b>Total</b>				<b>100</b>	<b>100</b>	<b>100</b>

Cross-Section 20 Channel materials (mm)	
D <sub>16</sub> =	22.60
D <sub>35</sub> =	31.45
D <sub>50</sub> =	39.8
D <sub>84</sub> =	75.9
D <sub>95</sub> =	115.7
D <sub>100</sub> =	180.0





**Reachwide and Cross-Section Pebble Count Plots**

Big Harris Creek Mitigation Site - Area B

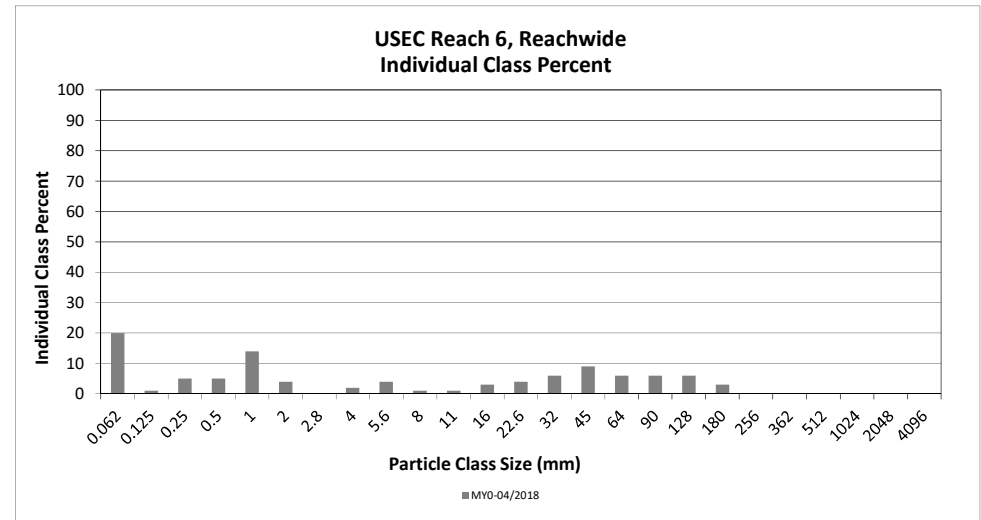
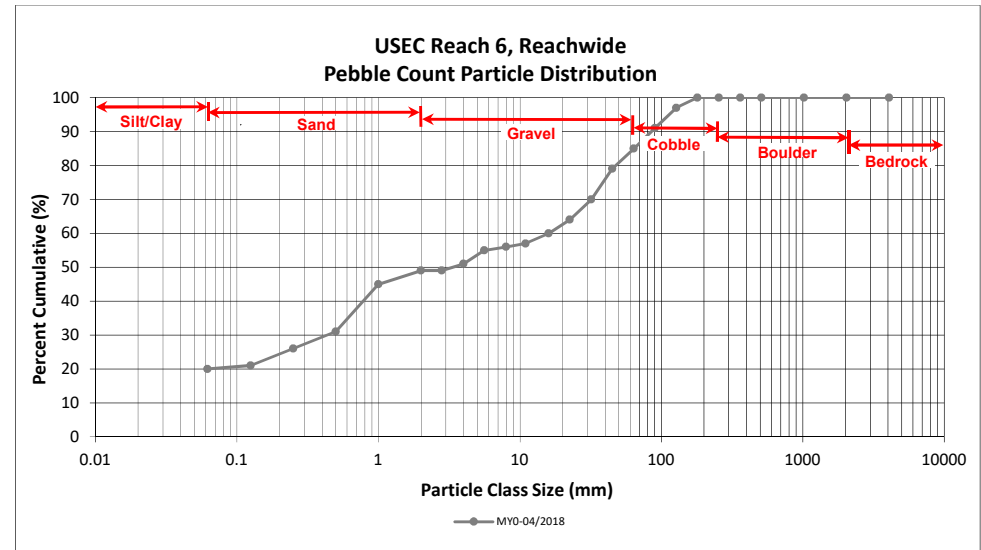
DMS Project No. 739

**Monitoring Year 0 - 2018**

USEC Reach 6, Reachwide

Particle Class		Diameter (mm)		Particle Count			Reach Summary	
		min	max	Riffle	Pool	Total	Class Percentage	Percent Cumulative
<b>SILT/CLAY</b>	Silt/Clay	0.000	0.062	8	12	20	20	20
<b>SAND</b>	Very fine	0.062	0.125	1		1	1	21
	Fine	0.125	0.250	1	4	5	5	26
	Medium	0.25	0.50	1	4	5	5	31
	Coarse	0.5	1.0	1	13	14	14	45
	Very Coarse	1.0	2.0	1	3	4	4	49
<b>GRAVEL</b>	Very Fine	2.0	2.8					49
	Very Fine	2.8	4.0	1	1	2	2	51
	Fine	4.0	5.6	1	3	4	4	55
	Fine	5.6	8.0	1		1	1	56
	Medium	8.0	11.0	1		1	1	57
	Medium	11.0	16.0	1	2	3	3	60
	Coarse	16.0	22.6	2	2	4	4	64
	Coarse	22.6	32	3	3	6	6	70
	Very Coarse	32	45	6	3	9	9	79
	Very Coarse	45	64	6		6	6	85
<b>COBBLE</b>	Small	64	90	6		6	6	91
	Small	90	128	6		6	6	97
	Large	128	180	3		3	3	100
	Large	180	256					100
<b>BOULDER</b>	Small	256	362					100
	Small	362	512					100
	Medium	512	1024					100
	Large/Very Large	1024	2048					100
<b>BEDROCK</b>	Bedrock	2048	>2048					100
<b>Total</b>				<b>50</b>	<b>50</b>	<b>100</b>	<b>100</b>	<b>100</b>

Reachwide Channel materials (mm)	
D <sub>16</sub> =	Silt/Clay
D <sub>35</sub> =	0.61
D <sub>50</sub> =	3.3
D <sub>84</sub> =	60.4
D <sub>95</sub> =	113.8
D <sub>100</sub> =	180.0



## Reachwide and Cross-Section Pebble Count Plots

Big Harris Creek Mitigation Site - Area B

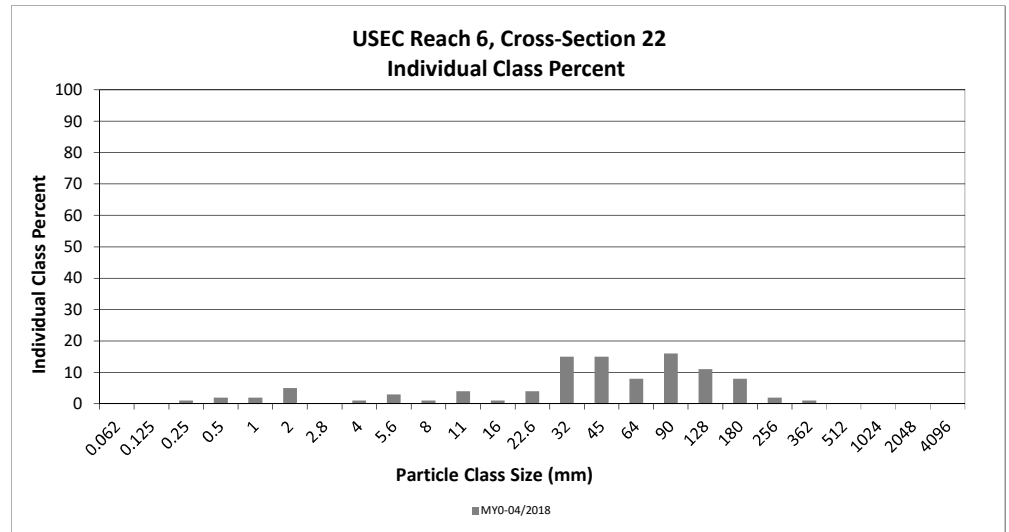
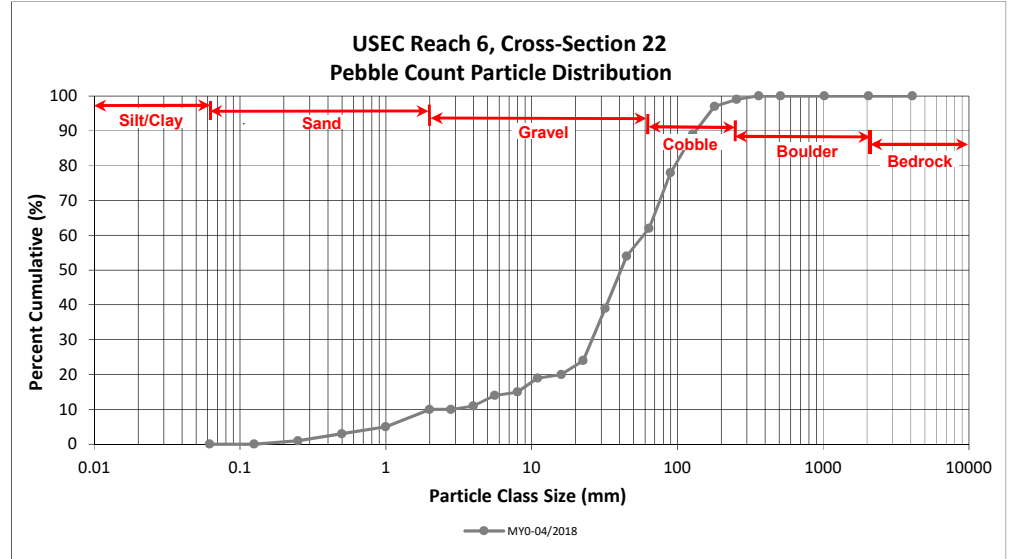
DMS Project No. 739

Monitoring Year 0 - 2018

USEC Reach 6, Cross-Section 22

Particle Class		Diameter (mm)		Riffle 100-Count	Summary	
		min	max		Class Percentage	Percent Cumulative
<b>SILT/CLAY</b>	Silt/Clay	0.000	0.062			0
<b>SAND</b>	Very fine	0.062	0.125			0
	Fine	0.125	0.250	1	1	1
	Medium	0.25	0.50	2	2	3
	Coarse	0.5	1.0	2	2	5
	Very Coarse	1.0	2.0	5	5	10
<b>GRAVEL</b>	Very Fine	2.0	2.8			10
	Very Fine	2.8	4.0	1	1	11
	Fine	4.0	5.6	3	3	14
	Fine	5.6	8.0	1	1	15
	Medium	8.0	11.0	4	4	19
	Medium	11.0	16.0	1	1	20
	Coarse	16.0	22.6	4	4	24
	Coarse	22.6	32	15	15	39
	Very Coarse	32	45	15	15	54
	Very Coarse	45	64	8	8	62
<b>COBBLE</b>	Small	64	90	16	16	78
	Small	90	128	11	11	89
	Large	128	180	8	8	97
	Large	180	256	2	2	99
<b>BOULDER</b>	Small	256	362	1	1	100
	Small	362	512			100
	Medium	512	1024			100
	Large/Very Large	1024	2048			100
<b>BEDROCK</b>	Bedrock	2048	>2048			100
<b>Total</b>				<b>100</b>	<b>100</b>	<b>100</b>

Cross-Section 22 Channel materials (mm)	
D <sub>16</sub> =	8.66
D <sub>35</sub> =	29.17
D <sub>50</sub> =	41.1
D <sub>84</sub> =	109.1
D <sub>95</sub> =	165.3
D <sub>100</sub> =	362.0



## Reachwide and Cross-Section Pebble Count Plots

Big Harris Creek Mitigation Site - Area B

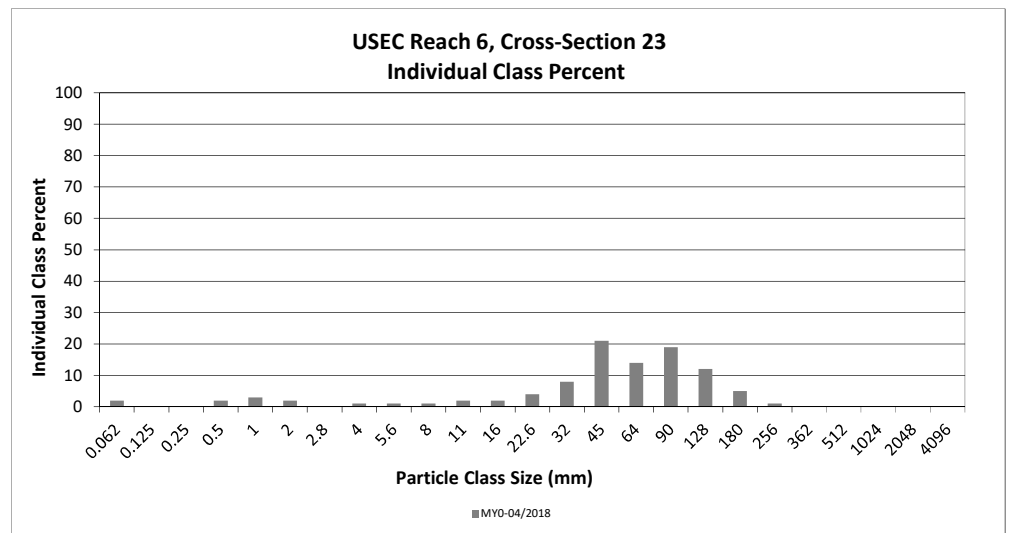
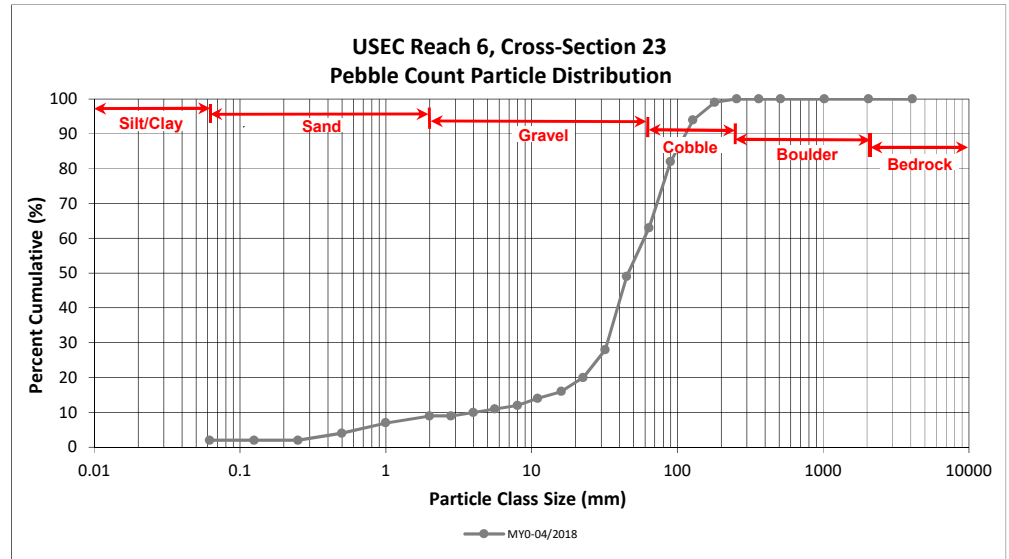
DMS Project No. 739

Monitoring Year 0 - 2018

USEC Reach 6, Cross-Section 23

Particle Class		Diameter (mm)		Riffle 100-Count	Summary	
		min	max		Class Percentage	Percent Cumulative
<b>SILT/CLAY</b>	Silt/Clay	0.000	0.062	2	2	2
<b>SAND</b>	Very fine	0.062	0.125			2
	Fine	0.125	0.250			2
	Medium	0.25	0.50	2	2	4
	Coarse	0.5	1.0	3	3	7
	Very Coarse	1.0	2.0	2	2	9
<b>GRAVEL</b>	Very Fine	2.0	2.8			9
	Very Fine	2.8	4.0	1	1	10
	Fine	4.0	5.6	1	1	11
	Fine	5.6	8.0	1	1	12
	Medium	8.0	11.0	2	2	14
	Medium	11.0	16.0	2	2	16
	Coarse	16.0	22.6	4	4	20
	Coarse	22.6	32	8	8	28
	Very Coarse	32	45	21	21	49
<b>COBBLE</b>	Very Coarse	45	64	14	14	63
	Small	64	90	19	19	82
	Small	90	128	12	12	94
	Large	128	180	5	5	99
<b>BOULDER</b>	Large	180	256	1	1	100
	Small	256	362			100
<b>BOULDER</b>	Small	362	512			100
	Medium	512	1024			100
	Large/Very Large	1024	2048			100
<b>BEDROCK</b>	Bedrock	2048	>2048			100
<b>Total</b>				<b>100</b>	<b>100</b>	<b>100</b>

Cross-Section 23 Channel materials (mm)	
D <sub>16</sub> =	16.00
D <sub>35</sub> =	35.85
D <sub>50</sub> =	46.1
D <sub>84</sub> =	95.4
D <sub>95</sub> =	137.0
D <sub>100</sub> =	256.0



**Reachwide and Cross-Section Pebble Count Plots**

Big Harris Creek Mitigation Site - Area B

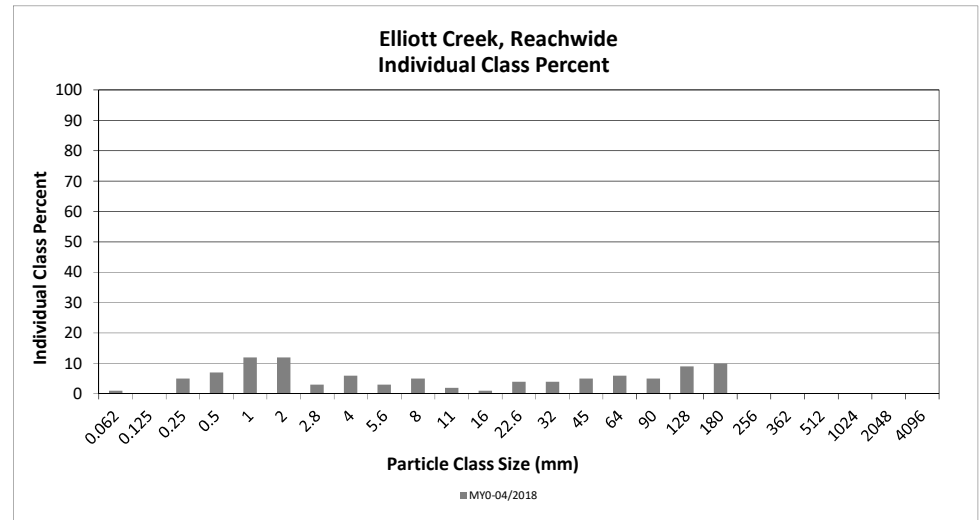
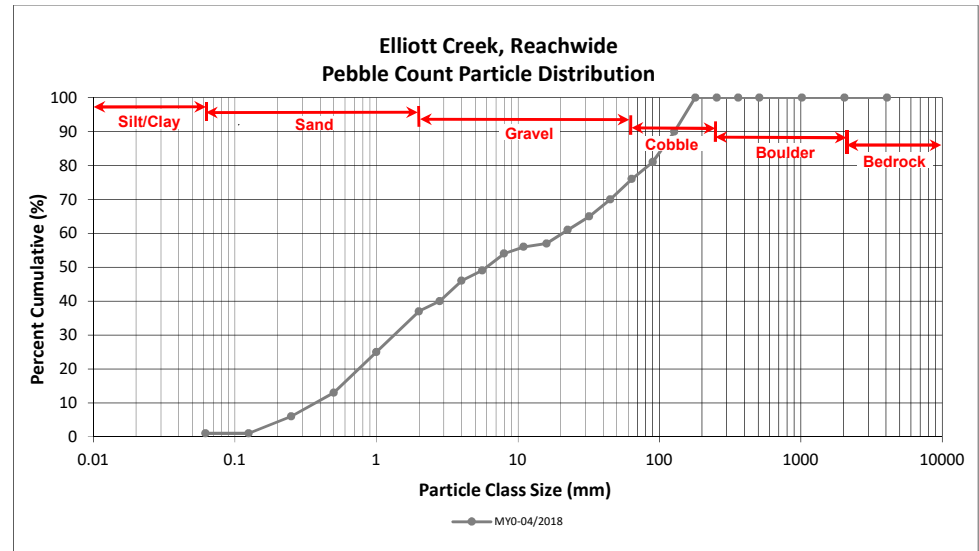
DMS Project No. 739

**Monitoring Year 0 - 2018**

Elliott Creek, Reachwide

Particle Class		Diameter (mm)		Particle Count			Reach Summary	
		min	max	Riffle	Pool	Total	Class Percentage	Percent Cumulative
<b>SILT/CLAY</b>	Silt/Clay	0.000	0.062		1	1	1	1
<b>SAND</b>	Very fine	0.062	0.125					1
	Fine	0.125	0.250	1	4	5	5	6
	Medium	0.25	0.50		7	7	7	13
	Coarse	0.5	1.0	6	6	12	12	25
	Very Coarse	1.0	2.0	3	9	12	12	37
<b>GRAVEL</b>	Very Fine	2.0	2.8		3	3	3	40
	Very Fine	2.8	4.0		6	6	6	46
	Fine	4.0	5.6	1	2	3	3	49
	Fine	5.6	8.0		5	5	5	54
	Medium	8.0	11.0		2	2	2	56
	Medium	11.0	16.0		1	1	1	57
	Coarse	16.0	22.6	2	2	4	4	61
	Coarse	22.6	32	4		4	4	65
	Very Coarse	32	45	5		5	5	70
	Very Coarse	45	64	6		6	6	76
	<b>COBBLE</b>	Small	64	90	5		5	5
Small		90	128	9		9	9	90
Large		128	180	8	2	10	10	100
Large		180	256					100
<b>BOULDER</b>	Small	256	362					100
	Small	362	512					100
	Medium	512	1024					100
	Large/Very Large	1024	2048					100
<b>BEDROCK</b>	Bedrock	2048	>2048					100
<b>Total</b>				<b>50</b>	<b>50</b>	<b>100</b>	<b>100</b>	<b>100</b>

Reachwide Channel materials (mm)	
D <sub>16</sub> =	0.59
D <sub>35</sub> =	1.78
D <sub>50</sub> =	6.0
D <sub>84</sub> =	101.2
D <sub>95</sub> =	151.8
D <sub>100</sub> =	180.0



**Reachwide and Cross-Section Pebble Count Plots**

Big Harris Creek Mitigation Site - Area B

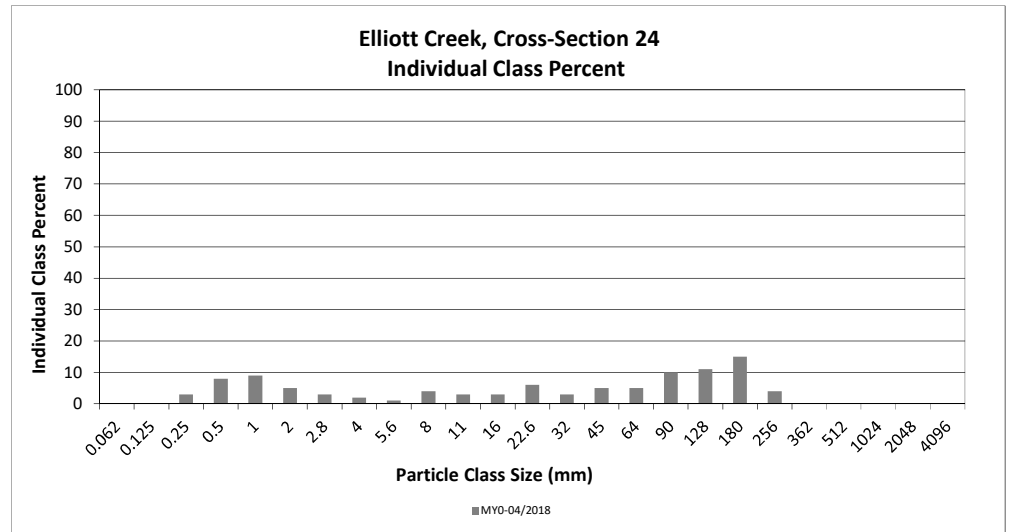
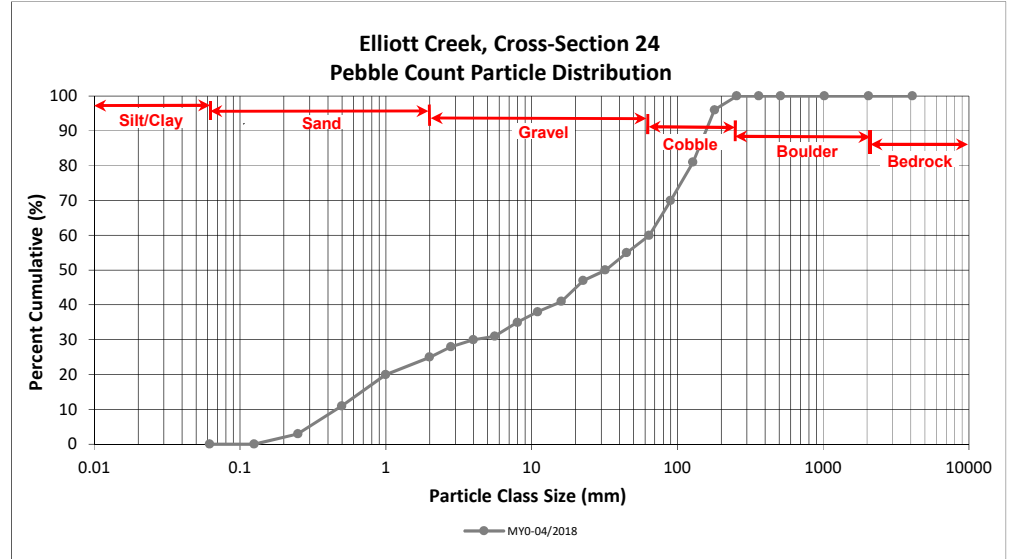
DMS Project No. 739

**Monitoring Year 0 - 2018**

Elliott Creek, Cross-Section 24

Particle Class		Diameter (mm)		Riffle 100-Count	Summary	
		min	max		Class Percentage	Percent Cumulative
<b>SILT/CLAY</b>	Silt/Clay	0.000	0.062			0
<b>SAND</b>	Very fine	0.062	0.125			0
	Fine	0.125	0.250	3	3	3
	Medium	0.25	0.50	8	8	11
	Coarse	0.5	1.0	9	9	20
	Very Coarse	1.0	2.0	5	5	25
<b>GRAVEL</b>	Very Fine	2.0	2.8	3	3	28
	Very Fine	2.8	4.0	2	2	30
	Fine	4.0	5.6	1	1	31
	Fine	5.6	8.0	4	4	35
	Medium	8.0	11.0	3	3	38
	Medium	11.0	16.0	3	3	41
	Coarse	16.0	22.6	6	6	47
	Coarse	22.6	32	3	3	50
	Very Coarse	32	45	5	5	55
	Very Coarse	45	64	5	5	60
<b>COBBLE</b>	Small	64	90	10	10	70
	Small	90	128	11	11	81
	Large	128	180	15	15	96
	Large	180	256	4	4	100
<b>BOULDER</b>	Small	256	362			100
	Small	362	512			100
	Medium	512	1024			100
	Large/Very Large	1024	2048			100
<b>BEDROCK</b>	Bedrock	2048	>2048			100
<b>Total</b>				<b>100</b>	<b>100</b>	<b>100</b>

Cross-Section 24 Channel materials (mm)	
D <sub>16</sub> =	0.73
D <sub>35</sub> =	8.00
D <sub>50</sub> =	32.0
D <sub>84</sub> =	137.0
D <sub>95</sub> =	176.0
D <sub>100</sub> =	256.0



## Reachwide and Cross-Section Pebble Count Plots

Big Harris Creek Mitigation Site - Area B

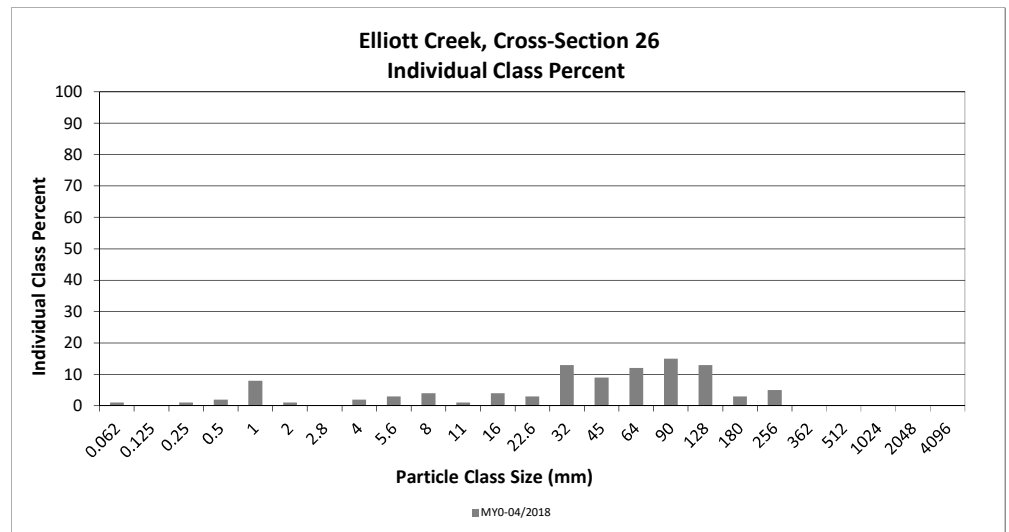
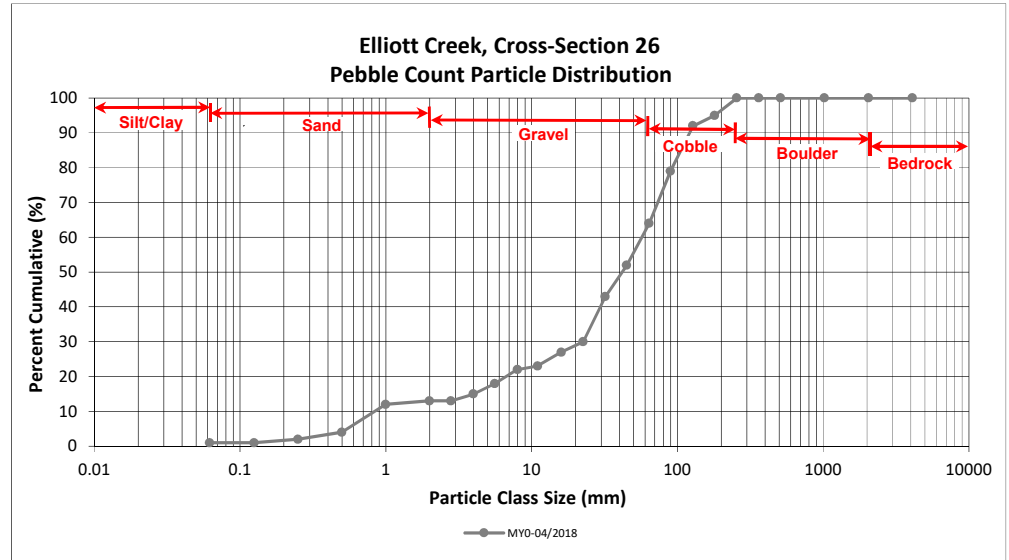
DMS Project No. 739

Monitoring Year 0 - 2018

Elliott Creek, Cross-Section 26

Particle Class		Diameter (mm)		Riffle 100-Count	Summary	
		min	max		Class Percentage	Percent Cumulative
<b>SILT/CLAY</b>	Silt/Clay	0.000	0.062	1	1	1
<b>SAND</b>	Very fine	0.062	0.125			1
	Fine	0.125	0.250	1	1	2
	Medium	0.25	0.50	2	2	4
	Coarse	0.5	1.0	8	8	12
	Very Coarse	1.0	2.0	1	1	13
<b>GRAVEL</b>	Very Fine	2.0	2.8			13
	Very Fine	2.8	4.0	2	2	15
	Fine	4.0	5.6	3	3	18
	Fine	5.6	8.0	4	4	22
	Medium	8.0	11.0	1	1	23
	Medium	11.0	16.0	4	4	27
	Coarse	16.0	22.6	3	3	30
	Coarse	22.6	32	13	13	43
	Very Coarse	32	45	9	9	52
	Very Coarse	45	64	12	12	64
<b>COBBLE</b>	Small	64	90	15	15	79
	Small	90	128	13	13	92
	Large	128	180	3	3	95
	Large	180	256	5	5	100
<b>BOULDER</b>	Small	256	362			100
	Small	362	512			100
	Medium	512	1024			100
	Large/Very Large	1024	2048			100
<b>BEDROCK</b>	Bedrock	2048	>2048			100
<b>Total</b>				<b>100</b>	<b>100</b>	<b>100</b>

Cross-Section 26 Channel materials (mm)	
D <sub>16</sub> =	4.47
D <sub>35</sub> =	25.83
D <sub>50</sub> =	41.7
D <sub>84</sub> =	103.1
D <sub>95</sub> =	180.0
D <sub>100</sub> =	256.0



**Reachwide and Cross-Section Pebble Count Plots**

Big Harris Creek Mitigation Site - Area B

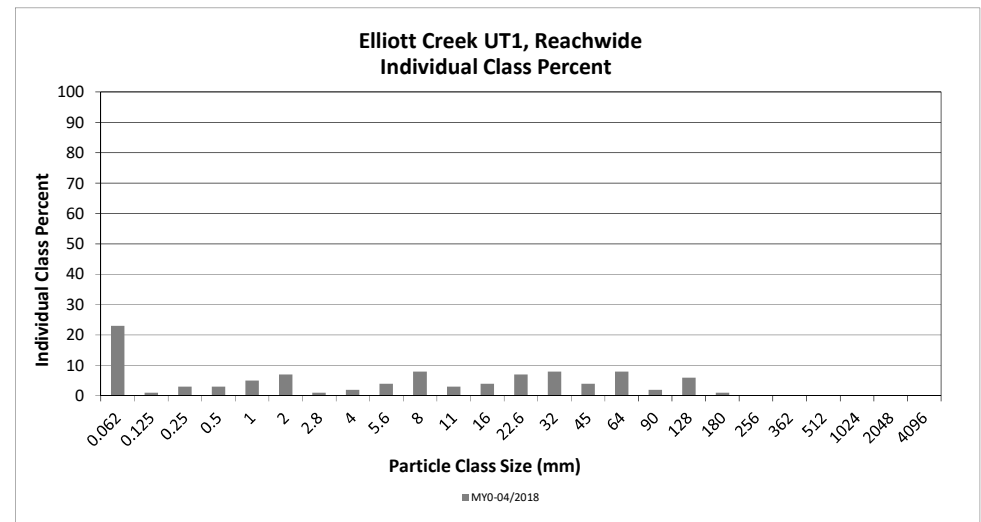
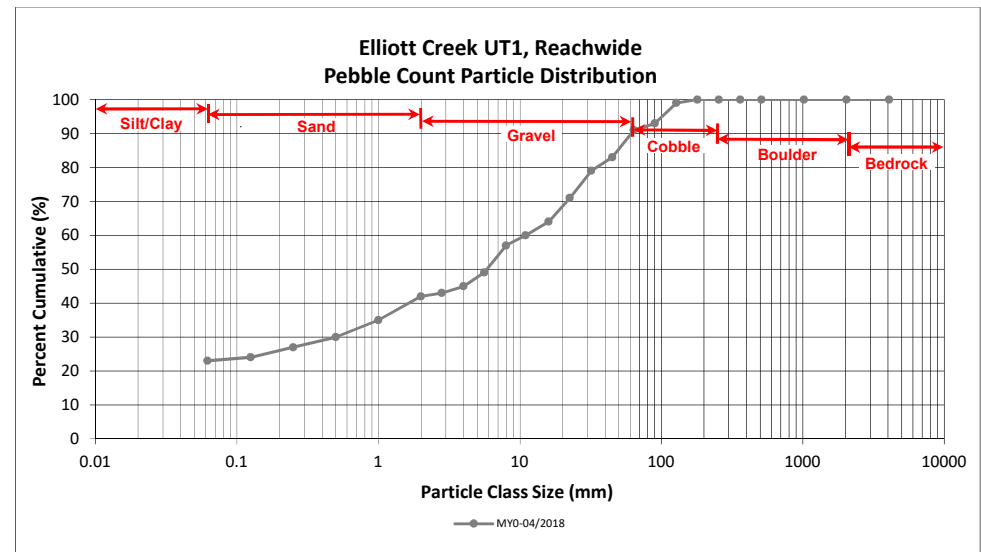
DMS Project No. 739

**Monitoring Year 0 - 2018**

Elliott Creek UT1, Reachwide

Particle Class		Diameter (mm)		Particle Count			Reach Summary	
		min	max	Riffle	Pool	Total	Class Percentage	Percent Cumulative
<b>SILT/CLAY</b>	Silt/Clay	0.000	0.062	1	22	23	23	23
<b>SAND</b>	Very fine	0.062	0.125		1	1	1	24
	Fine	0.125	0.250		3	3	3	27
	Medium	0.25	0.50		3	3	3	30
	Coarse	0.5	1.0	2	3	5	5	35
	Very Coarse	1.0	2.0	2	5	7	7	42
<b>GRAVEL</b>	Very Fine	2.0	2.8		1	1	1	43
	Very Fine	2.8	4.0		2	2	2	45
	Fine	4.0	5.6	1	3	4	4	49
	Fine	5.6	8.0	4	4	8	8	57
	Medium	8.0	11.0	2	1	3	3	60
	Medium	11.0	16.0	3	1	4	4	64
	Coarse	16.0	22.6	6	1	7	7	71
	Coarse	22.6	32	8		8	8	79
	Very Coarse	32	45	4		4	4	83
	Very Coarse	45	64	8		8	8	91
<b>COBBLE</b>	Small	64	90	2		2	2	93
	Small	90	128	6		6	6	99
	Large	128	180	1		1	1	100
	Large	180	256					100
<b>BOULDER</b>	Small	256	362					100
	Small	362	512					100
	Medium	512	1024					100
	Large/Very Large	1024	2048					100
<b>BEDROCK</b>	Bedrock	2048	>2048					100
<b>Total</b>				<b>50</b>	<b>50</b>	<b>100</b>	<b>100</b>	<b>100</b>

Reachwide Channel materials (mm)	
D <sub>16</sub> =	Silt/Clay
D <sub>35</sub> =	1.00
D <sub>50</sub> =	5.9
D <sub>84</sub> =	47.0
D <sub>95</sub> =	101.2
D <sub>100</sub> =	180.0



**Reachwide and Cross-Section Pebble Count Plots**

Big Harris Creek Mitigation Site - Area B

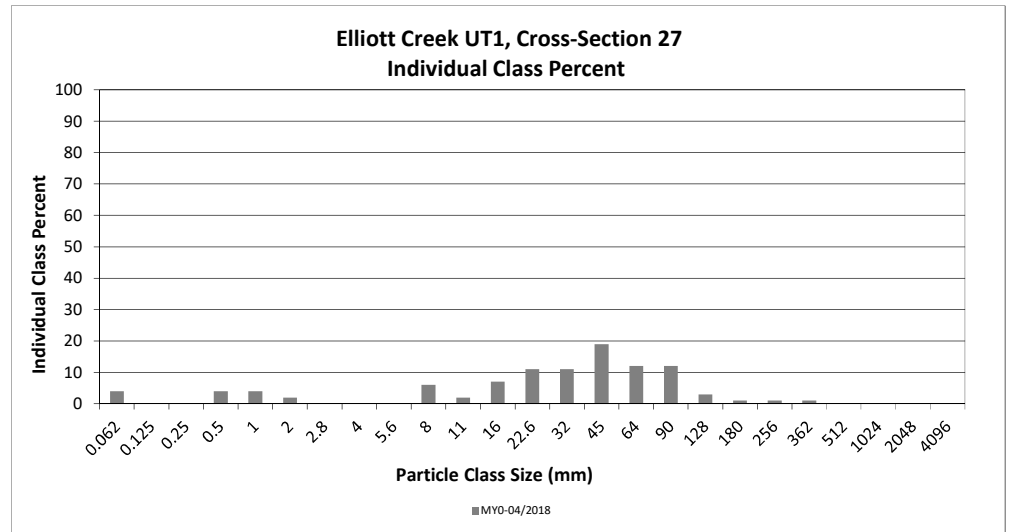
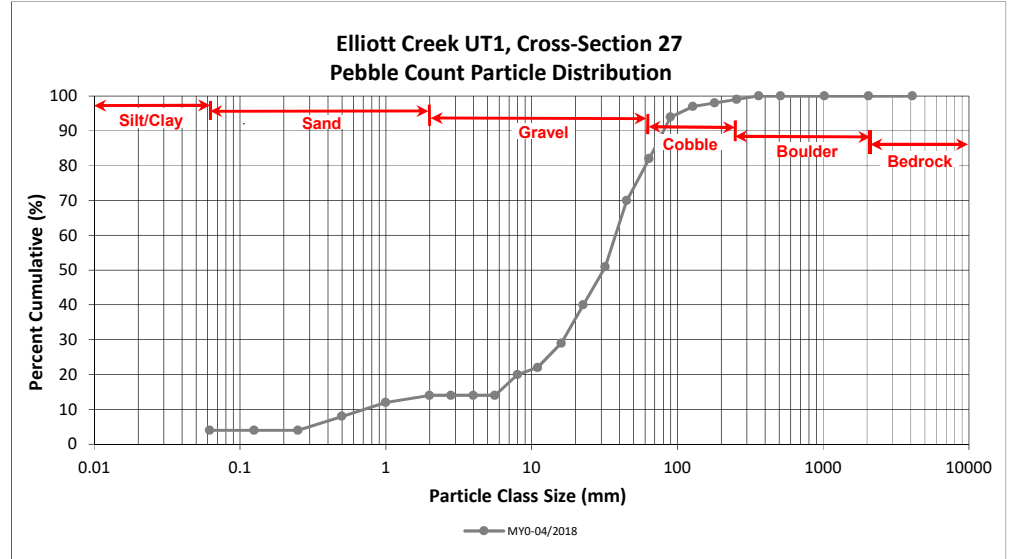
DMS Project No. 739

**Monitoring Year 0 - 2018**

Elliott Creek UT1, Cross-Section 27

Particle Class		Diameter (mm)		Riffle 100-Count	Summary	
		min	max		Class Percentage	Percent Cumulative
<i>SILT/CLAY</i>	Silt/Clay	0.000	0.062	4	4	4
<i>SAND</i>	Very fine	0.062	0.125			4
	Fine	0.125	0.250			4
	Medium	0.25	0.50	4	4	8
	Coarse	0.5	1.0	4	4	12
	Very Coarse	1.0	2.0	2	2	14
<i>GRAVEL</i>	Very Fine	2.0	2.8			14
	Very Fine	2.8	4.0			14
	Fine	4.0	5.6			14
	Fine	5.6	8.0	6	6	20
	Medium	8.0	11.0	2	2	22
	Medium	11.0	16.0	7	7	29
	Coarse	16.0	22.6	11	11	40
	Coarse	22.6	32	11	11	51
	Very Coarse	32	45	19	19	70
	Very Coarse	45	64	12	12	82
<i>COBBLE</i>	Small	64	90	12	12	94
	Small	90	128	3	3	97
	Large	128	180	1	1	98
	Large	180	256	1	1	99
<i>BOULDER</i>	Small	256	362	1	1	100
	Small	362	512			100
	Medium	512	1024			100
	Large/Very Large	1024	2048			100
<i>BEDROCK</i>	Bedrock	2048	>2048			100
<b>Total</b>				<b>100</b>	<b>100</b>	<b>100</b>

Cross-Section 27 Channel materials (mm)	
D <sub>16</sub> =	6.31
D <sub>35</sub> =	19.32
D <sub>50</sub> =	31.0
D <sub>84</sub> =	67.7
D <sub>95</sub> =	101.2
D <sub>100</sub> =	362.0





**Reachwide and Cross-Section Pebble Count Plots**

Big Harris Creek Mitigation Site - Area B

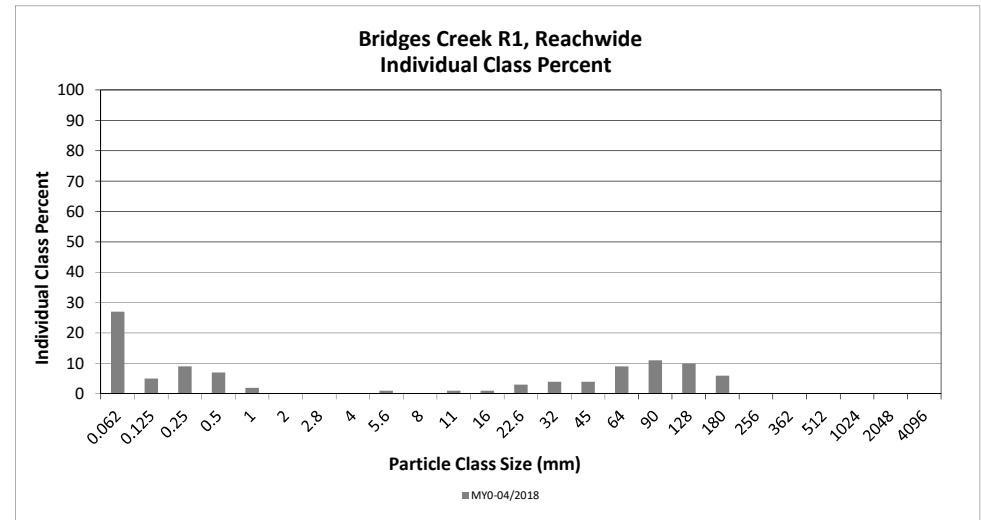
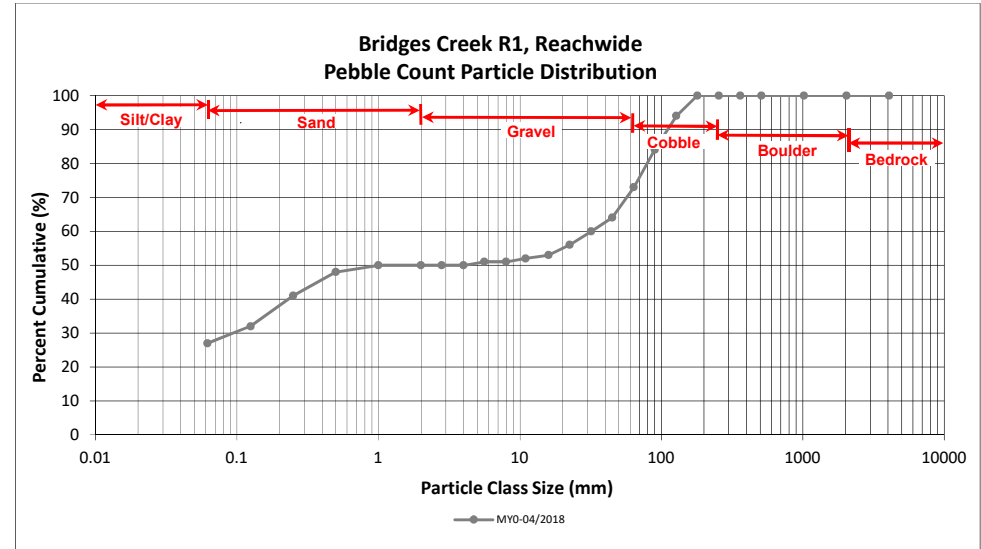
DMS Project No. 739

**Monitoring Year 0 - 2018**

Bridges Creek R1, Reachwide

Particle Class		Diameter (mm)		Particle Count			Reach Summary	
		min	max	Riffle	Pool	Total	Class Percentage	Percent Cumulative
<b>SILT/CLAY</b>	Silt/Clay	0.000	0.062	1	26	27	27	27
<b>SAND</b>	Very fine	0.062	0.125		5	5	5	32
	Fine	0.125	0.250	1	8	9	9	41
	Medium	0.25	0.50	2	5	7	7	48
	Coarse	0.5	1.0		2	2	2	50
	Very Coarse	1.0	2.0					50
<b>GRAVEL</b>	Very Fine	2.0	2.8					50
	Very Fine	2.8	4.0					50
	Fine	4.0	5.6		1	1	1	51
	Fine	5.6	8.0					51
	Medium	8.0	11.0	1		1	1	52
	Medium	11.0	16.0	1		1	1	53
	Coarse	16.0	22.6	2	1	3	3	56
	Coarse	22.6	32	4		4	4	60
	Very Coarse	32	45	4		4	4	64
	Very Coarse	45	64	9		9	9	73
<b>COBBLE</b>	Small	64	90	9	2	11	11	84
	Small	90	128	10		10	10	94
	Large	128	180	6		6	6	100
	Large	180	256					100
<b>BOULDER</b>	Small	256	362					100
	Small	362	512					100
	Medium	512	1024					100
	Large/Very Large	1024	2048					100
<b>BEDROCK</b>	Bedrock	2048	>2048					100
<b>Total</b>				<b>50</b>	<b>50</b>	<b>100</b>	<b>100</b>	<b>100</b>

Reachwide Channel materials (mm)	
D <sub>16</sub> =	Silt/Clay
D <sub>35</sub> =	0.16
D <sub>50</sub> =	1.0
D <sub>84</sub> =	90.0
D <sub>95</sub> =	135.5
D <sub>100</sub> =	180.0



## Reachwide and Cross-Section Pebble Count Plots

Big Harris Creek Mitigation Site - Area B

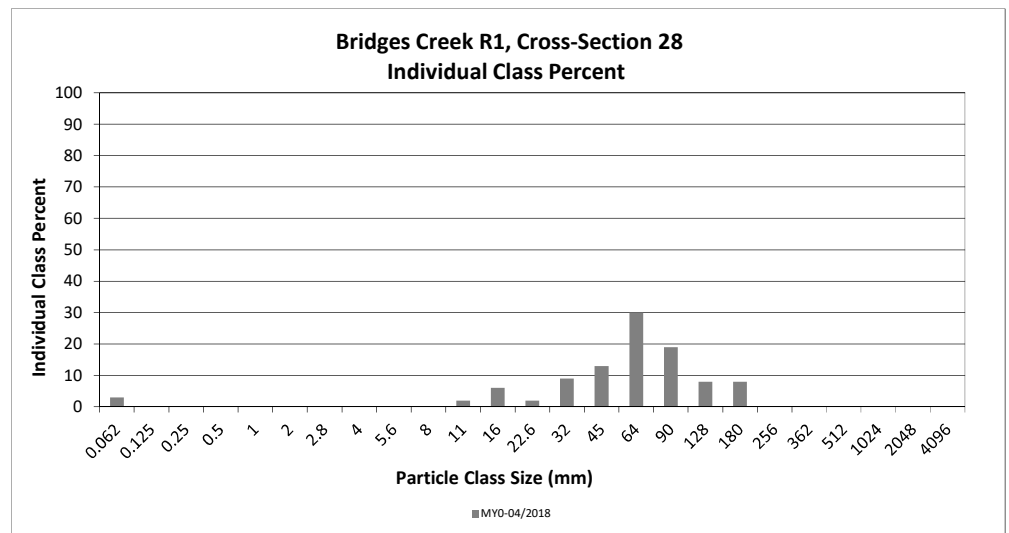
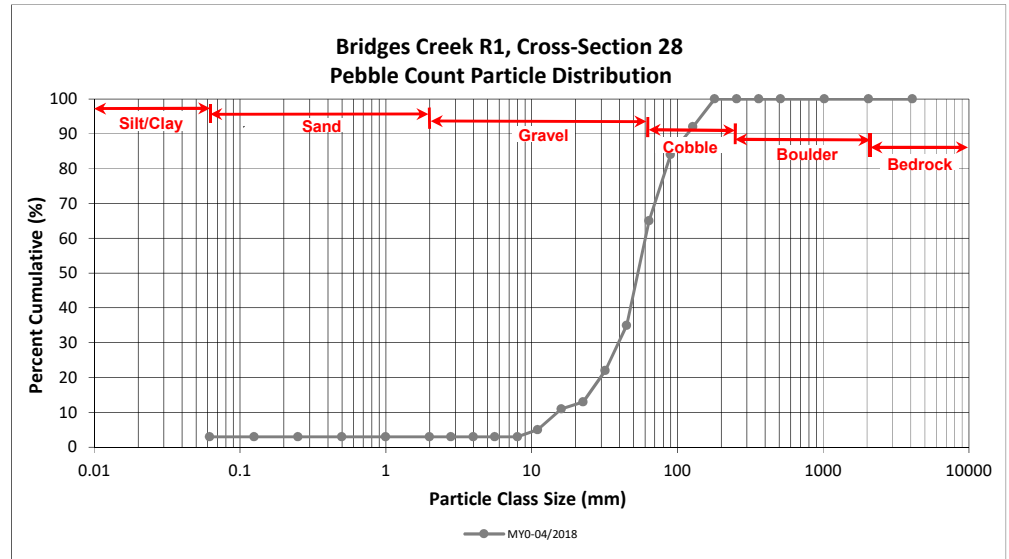
DMS Project No. 739

Monitoring Year 0 - 2018

Bridges Creek R1, Cross-Section 28

Particle Class		Diameter (mm)		Riffle 100-Count	Summary	
		min	max		Class Percentage	Percent Cumulative
<b>SILT/CLAY</b>	Silt/Clay	0.000	0.062	3	3	3
<b>SAND</b>	Very fine	0.062	0.125			3
	Fine	0.125	0.250			3
	Medium	0.25	0.50			3
	Coarse	0.5	1.0			3
	Very Coarse	1.0	2.0			3
<b>GRAVEL</b>	Very Fine	2.0	2.8			3
	Very Fine	2.8	4.0			3
	Fine	4.0	5.6			3
	Fine	5.6	8.0			3
	Medium	8.0	11.0	2	2	5
	Medium	11.0	16.0	6	6	11
	Coarse	16.0	22.6	2	2	13
	Coarse	22.6	32	9	9	22
	Very Coarse	32	45	13	13	35
<b>COBBLE</b>	Very Coarse	45	64	30	30	65
	Small	64	90	19	19	84
	Small	90	128	8	8	92
	Large	128	180	8	8	100
<b>BOULDER</b>	Large	180	256			100
	Small	256	362			100
	Small	362	512			100
<b>BOULDER</b>	Medium	512	1024			100
	Large/Very Large	1024	2048			100
<b>BEDROCK</b>	Bedrock	2048	>2048			100
<b>Total</b>				<b>100</b>	<b>100</b>	<b>100</b>

Cross-Section 28 Channel materials (mm)	
D <sub>16</sub> =	25.38
D <sub>35</sub> =	45.00
D <sub>50</sub> =	53.7
D <sub>84</sub> =	90.0
D <sub>95</sub> =	145.5
D <sub>100</sub> =	180.0



**Reachwide and Cross-Section Pebble Count Plots**

Big Harris Creek Mitigation Site - Area B

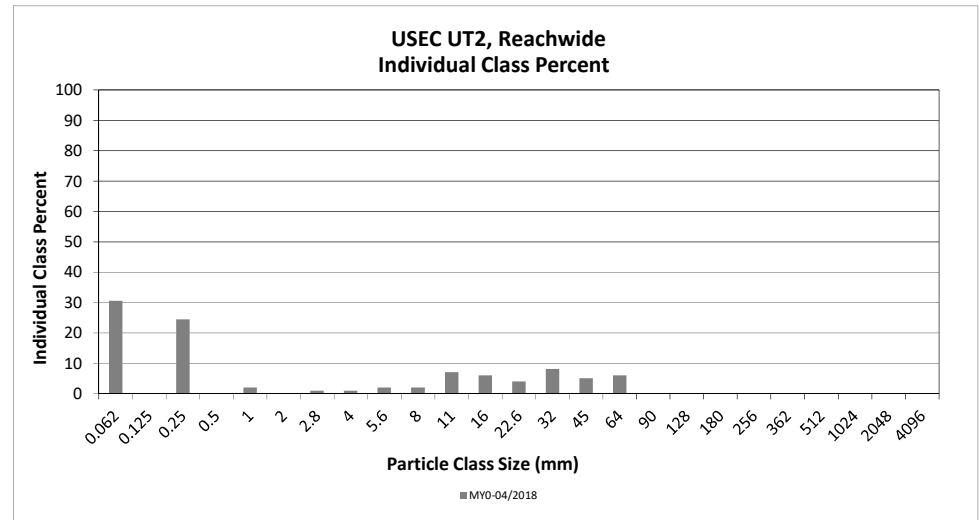
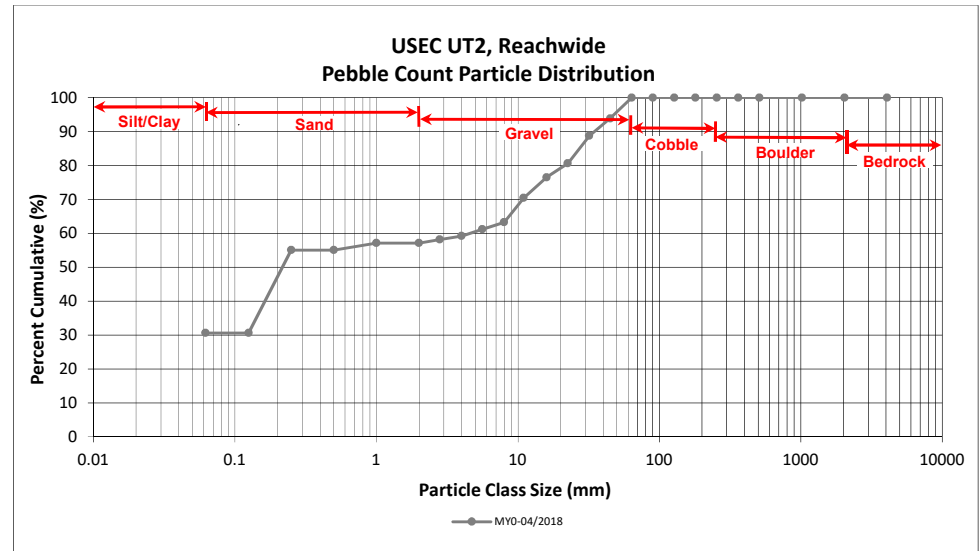
DMS Project No. 739

**Monitoring Year 0 - 2018**

USEC UT2, Reachwide

Particle Class		Diameter (mm)		Particle Count			Reach Summary	
		min	max	Riffle	Pool	Total	Class Percentage	Percent Cumulative
<b>SILT/CLAY</b>	Silt/Clay	0.000	0.062	9	21	30	31	31
<b>SAND</b>	Very fine	0.062	0.125					31
	Fine	0.125	0.250	4	21	24	24	55
	Medium	0.25	0.50					55
	Coarse	0.5	1.0	2		2	2	57
	Very Coarse	1.0	2.0					57
<b>GRAVEL</b>	Very Fine	2.0	2.8		1	1	1	58
	Very Fine	2.8	4.0	2		1	1	59
	Fine	4.0	5.6	2		2	2	61
	Fine	5.6	8.0	2		2	2	63
	Medium	8.0	11.0	7		7	7	70
	Medium	11.0	16.0	5	1	6	6	77
	Coarse	16.0	22.6	2	2	4	4	81
	Coarse	22.6	32	5	3	8	8	89
	Very Coarse	32	45	4	1	5	5	94
	Very Coarse	45	64	6		6	6	100
<b>COBBLE</b>	Small	64	90					100
	Small	90	128					100
	Large	128	180					100
	Large	180	256					100
<b>BOULDER</b>	Small	256	362					100
	Small	362	512					100
	Medium	512	1024					100
	Large/Very Large	1024	2048					100
<b>BEDROCK</b>	Bedrock	2048	>2048					100
<b>Total</b>				<b>50</b>	<b>50</b>	<b>98</b>	<b>100</b>	<b>100</b>

Reachwide Channel materials (mm)	
D <sub>16</sub> =	Silt/Clay
D <sub>35</sub> =	0.14
D <sub>50</sub> =	0.2
D <sub>84</sub> =	26.1
D <sub>95</sub> =	48.0
D <sub>100</sub> =	64.0



**Reachwide and Cross-Section Pebble Count Plots**

Big Harris Creek Mitigation Site - Area B

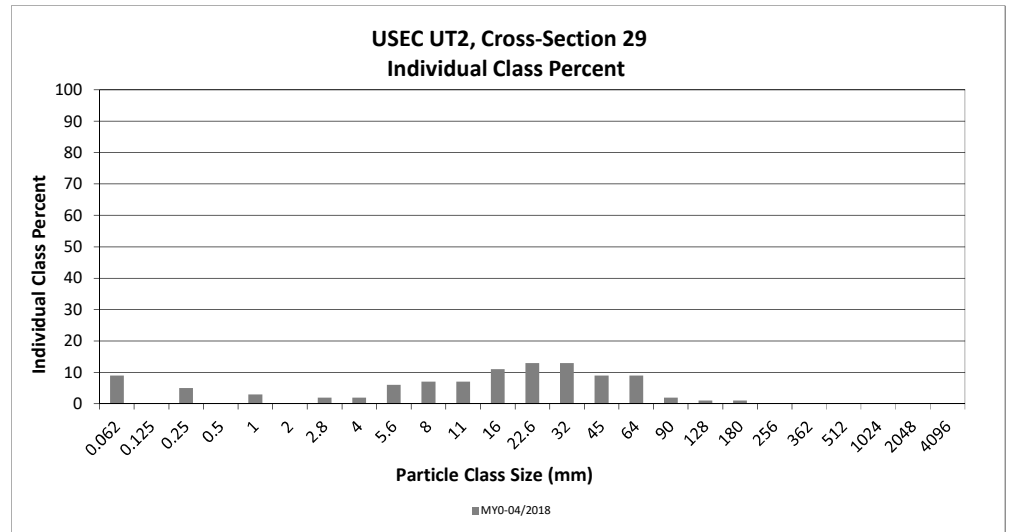
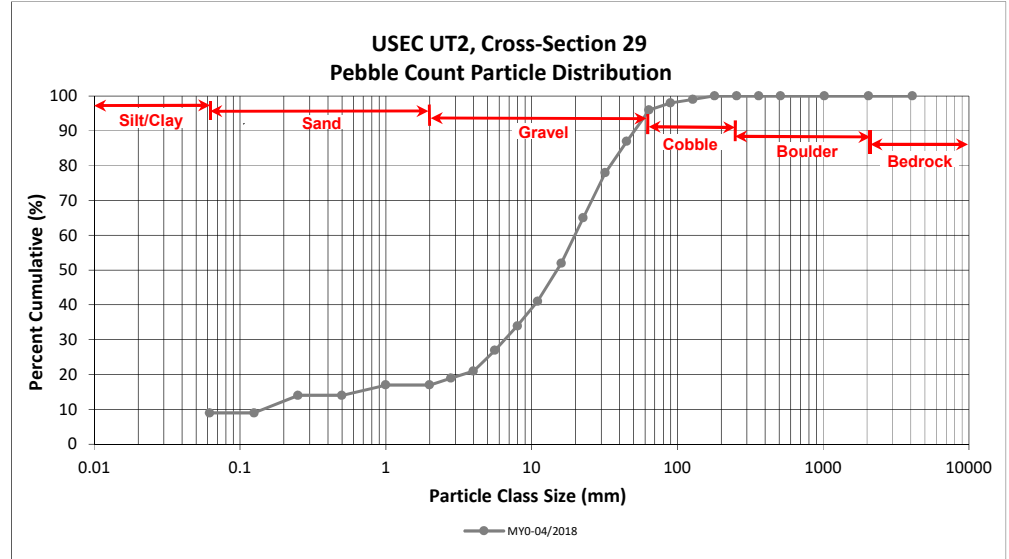
DMS Project No. 739

**Monitoring Year 0 - 2018**

USEC UT2, Cross-Section 29

Particle Class		Diameter (mm)		Riffle 100-Count	Summary	
		min	max		Class Percentage	Percent Cumulative
<i>SILT/CLAY</i>	Silt/Clay	0.000	0.062	9	9	9
<i>SAND</i>	Very fine	0.062	0.125			9
	Fine	0.125	0.250	5	5	14
	Medium	0.25	0.50			14
	Coarse	0.5	1.0	3	3	17
	Very Coarse	1.0	2.0			17
<i>GRAVEL</i>	Very Fine	2.0	2.8	2	2	19
	Very Fine	2.8	4.0	2	2	21
	Fine	4.0	5.6	6	6	27
	Fine	5.6	8.0	7	7	34
	Medium	8.0	11.0	7	7	41
	Medium	11.0	16.0	11	11	52
	Coarse	16.0	22.6	13	13	65
	Coarse	22.6	32	13	13	78
	Very Coarse	32	45	9	9	87
	Very Coarse	45	64	9	9	96
<i>COBBLE</i>	Small	64	90	2	2	98
	Small	90	128	1	1	99
	Large	128	180	1	1	100
	Large	180	256			100
<i>BOULDER</i>	Small	256	362			100
	Small	362	512			100
	Medium	512	1024			100
	Large/Very Large	1024	2048			100
<i>BEDROCK</i>	Bedrock	2048	>2048			100
<b>Total</b>				<b>100</b>	<b>100</b>	<b>100</b>

Cross-Section 29 Channel materials (mm)	
D <sub>16</sub> =	0.79
D <sub>35</sub> =	8.37
D <sub>50</sub> =	14.9
D <sub>84</sub> =	40.2
D <sub>95</sub> =	61.5
D <sub>100</sub> =	180.0



**Reachwide and Cross-Section Pebble Count Plots**

Big Harris Creek Mitigation Site - Area B

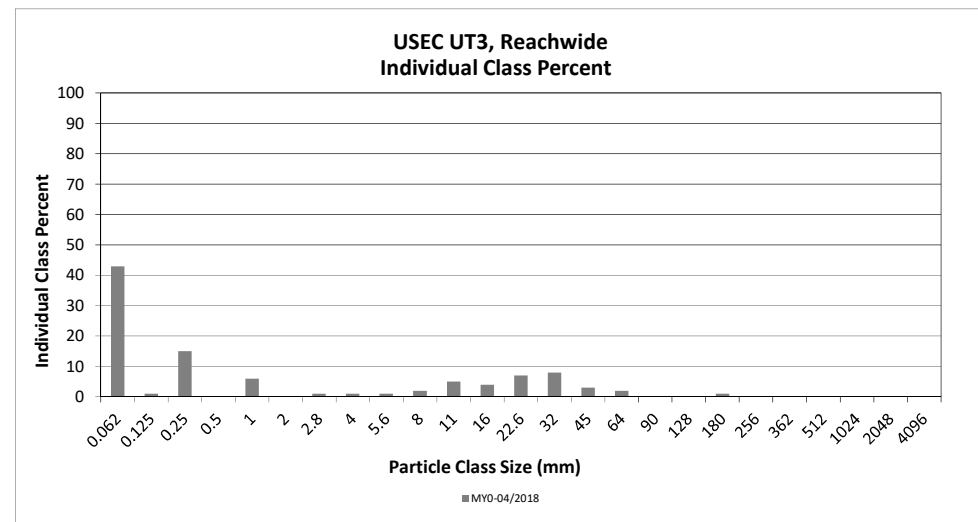
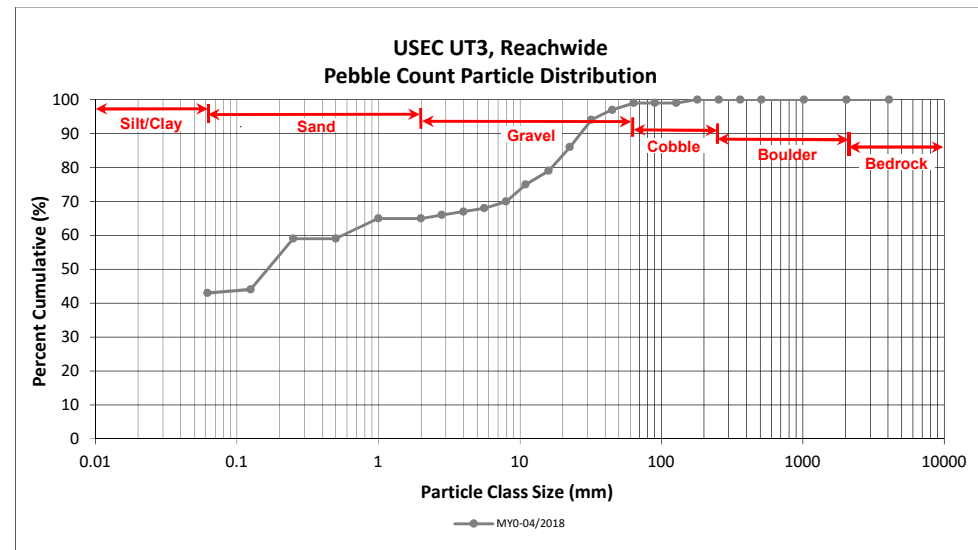
DMS Project No. 739

**Monitoring Year 0 - 2018**

USEC UT3, Reachwide

Particle Class		Diameter (mm)		Particle Count			Reach Summary	
		min	max	Riffle	Pool	Total	Class Percentage	Percent Cumulative
<b>SILT/CLAY</b>	Silt/Clay	0.000	0.062	11	32	43	43	43
<b>SAND</b>	Very fine	0.062	0.125		1	1	1	44
	Fine	0.125	0.250		15	15	15	59
	Medium	0.25	0.50					59
	Coarse	0.5	1.0	4	2	6	6	65
	Very Coarse	1.0	2.0					65
<b>GRAVEL</b>	Very Fine	2.0	2.8	1		1	1	66
	Very Fine	2.8	4.0	1		1	1	67
	Fine	4.0	5.6	1		1	1	68
	Fine	5.6	8.0	2		2	2	70
	Medium	8.0	11.0	5		5	5	75
	Medium	11.0	16.0	4		4	4	79
	Coarse	16.0	22.6	7		7	7	86
	Coarse	22.6	32	8		8	8	94
	Very Coarse	32	45	3		3	3	97
	Very Coarse	45	64	2		2	2	99
<b>COBBLE</b>	Small	64	90					99
	Small	90	128					99
	Large	128	180	1		1	1	100
	Large	180	256					100
<b>BOULDER</b>	Small	256	362					100
	Small	362	512					100
	Medium	512	1024					100
	Large/Very Large	1024	2048					100
<b>BEDROCK</b>	Bedrock	2048	>2048					100
<b>Total</b>				<b>50</b>	<b>50</b>	<b>100</b>	<b>100</b>	<b>100</b>

Reachwide Channel materials (mm)	
D <sub>16</sub> =	Silt/Clay
D <sub>35</sub> =	Silt/Clay
D <sub>50</sub> =	0.2
D <sub>84</sub> =	20.5
D <sub>95</sub> =	35.9
D <sub>100</sub> =	180.0



**Reachwide and Cross-Section Pebble Count Plots**

Big Harris Creek Mitigation Site - Area B

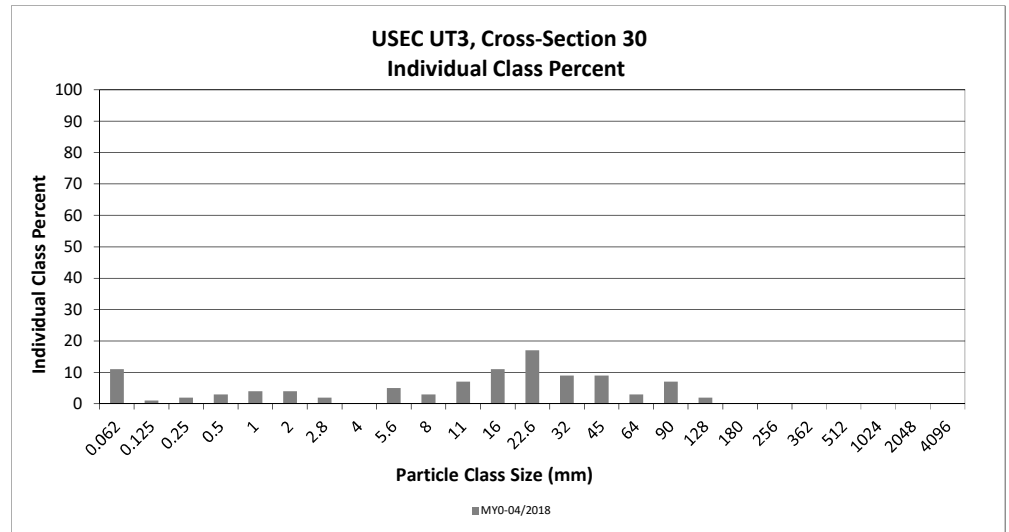
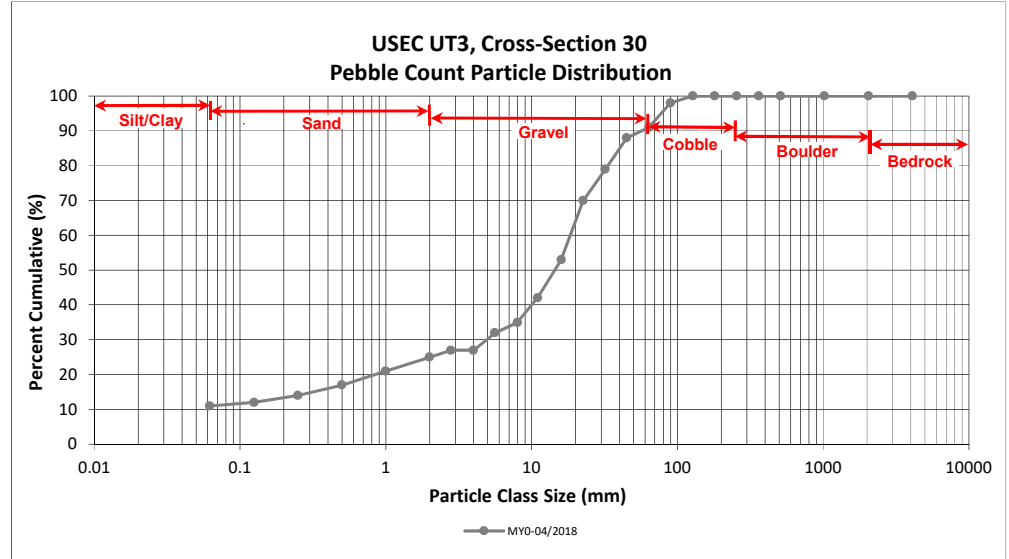
DMS Project No. 739

**Monitoring Year 0 - 2018**

USEC UT3, Cross-Section 30

Particle Class		Diameter (mm)		Riffle 100-Count	Summary	
		min	max		Class Percentage	Percent Cumulative
<i>SILT/CLAY</i>	Silt/Clay	0.000	0.062	11	11	11
<i>SAND</i>	Very fine	0.062	0.125	1	1	12
	Fine	0.125	0.250	2	2	14
	Medium	0.25	0.50	3	3	17
	Coarse	0.5	1.0	4	4	21
	Very Coarse	1.0	2.0	4	4	25
<i>GRAVEL</i>	Very Fine	2.0	2.8	2	2	27
	Very Fine	2.8	4.0			27
	Fine	4.0	5.6	5	5	32
	Fine	5.6	8.0	3	3	35
	Medium	8.0	11.0	7	7	42
	Medium	11.0	16.0	11	11	53
	Coarse	16.0	22.6	17	17	70
	Coarse	22.6	32	9	9	79
	Very Coarse	32	45	9	9	88
<i>COBBLE</i>	Very Coarse	45	64	3	3	91
	Small	64	90	7	7	98
	Small	90	128	2	2	100
	Large	128	180			100
<i>BOULDER</i>	Large	180	256			100
	Small	256	362			100
	Small	362	512			100
	Medium	512	1024			100
<i>BEDROCK</i>	Large/Very Large	1024	2048			100
	Bedrock	2048	>2048			100
<b>Total</b>				<b>100</b>	<b>100</b>	<b>100</b>

Cross-Section 30 Channel materials (mm)	
D <sub>16</sub> =	0.40
D <sub>35</sub> =	8.00
D <sub>50</sub> =	14.4
D <sub>84</sub> =	38.7
D <sub>95</sub> =	77.8
D <sub>100</sub> =	128.0



**Reachwide and Cross-Section Pebble Count Plots**

Big Harris Creek Mitigation Site - Area B

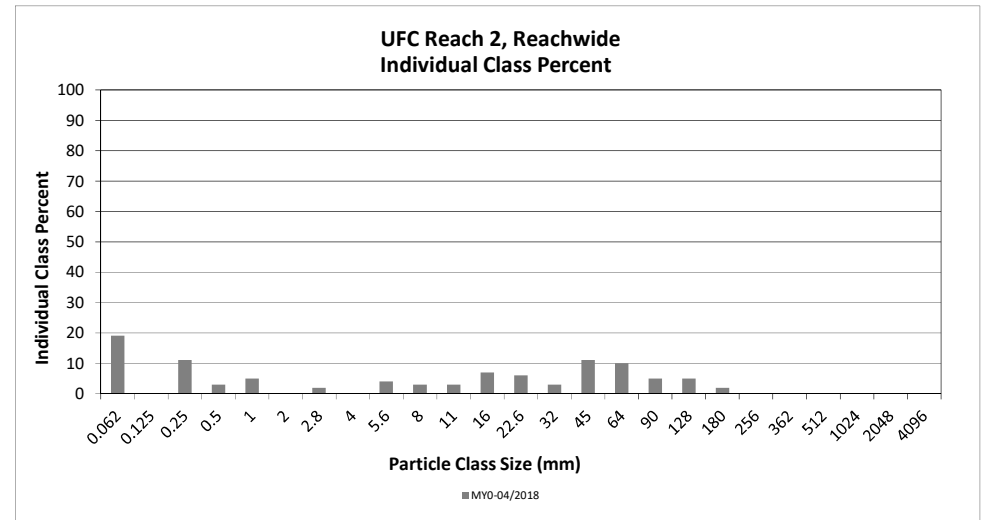
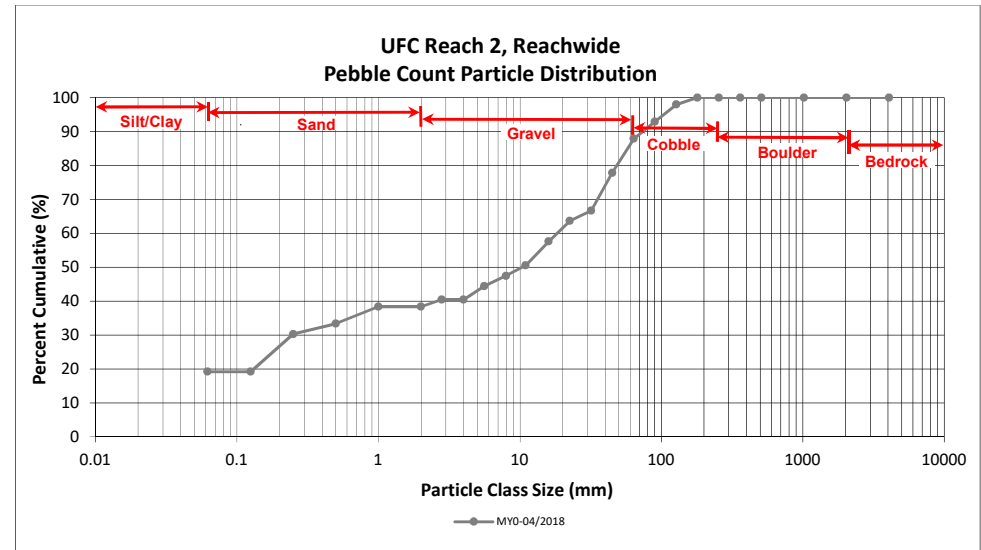
DMS Project No. 739

Monitoring Year 0 - 2018

UFC Reach 2, Reachwide

Particle Class		Diameter (mm)		Particle Count			Reach Summary	
		min	max	Riffle	Pool	Total	Class Percentage	Percent Cumulative
<b>SILT/CLAY</b>	Silt/Clay	0.000	0.062	1	18	19	19	19
<b>SAND</b>	Very fine	0.062	0.125					19
	Fine	0.125	0.250	1	10	11	11	30
	Medium	0.25	0.50	1	2	3	3	33
	Coarse	0.5	1.0		5	5	5	38
	Very Coarse	1.0	2.0					38
<b>GRAVEL</b>	Very Fine	2.0	2.8	1	1	2	2	40
	Very Fine	2.8	4.0					40
	Fine	4.0	5.6	3	1	4	4	44
	Fine	5.6	8.0	1	2	3	3	47
	Medium	8.0	11.0		3	3	3	51
	Medium	11.0	16.0	5	2	7	7	58
	Coarse	16.0	22.6	2	4	6	6	64
	Coarse	22.6	32	3		3	3	67
	Very Coarse	32	45	9	2	11	11	78
	Very Coarse	45	64	10		10	10	88
<b>COBBLE</b>	Small	64	90	6		5	5	93
	Small	90	128	5		5	5	98
	Large	128	180	2		2	2	100
	Large	180	256					100
<b>BOULDER</b>	Small	256	362					100
	Small	362	512					100
	Medium	512	1024					100
	Large/Very Large	1024	2048					100
<b>BEDROCK</b>	Bedrock	2048	>2048					100
<b>Total</b>				<b>50</b>	<b>50</b>	<b>99</b>	<b>100</b>	<b>100</b>

Reachwide	
Channel materials (mm)	
D <sub>16</sub> =	Silt/Clay
D <sub>35</sub> =	0.63
D <sub>50</sub> =	10.4
D <sub>84</sub> =	55.9
D <sub>95</sub> =	104.0
D <sub>100</sub> =	180.0



## Reachwide and Cross-Section Pebble Count Plots

Big Harris Creek Mitigation Site - Area B

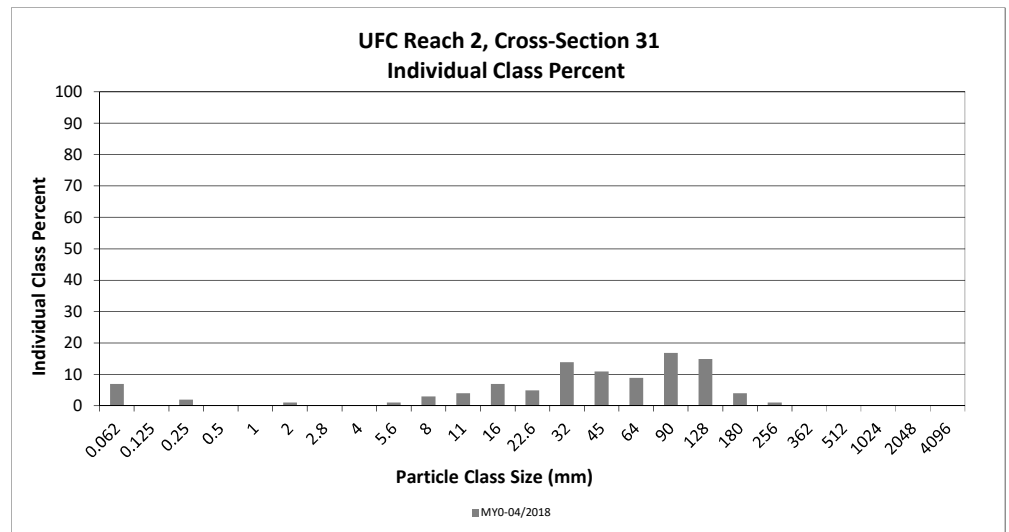
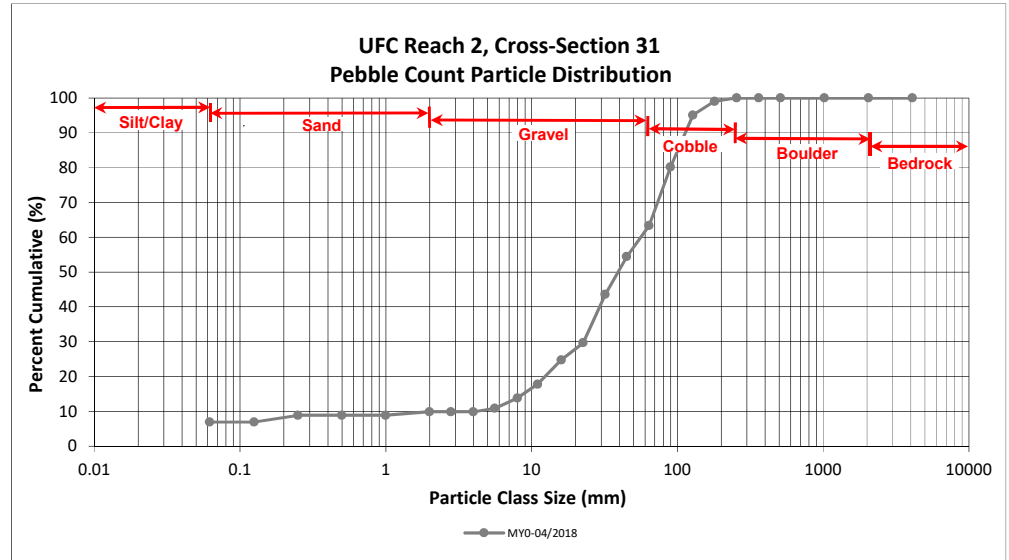
DMS Project No. 739

Monitoring Year 0 - 2018

UFC Reach 2, Cross-Section 31

Particle Class		Diameter (mm)		Riffle 100-Count	Summary	
		min	max		Class Percentage	Percent Cumulative
<b>SILT/CLAY</b>	Silt/Clay	0.000	0.062	7	7	7
<b>SAND</b>	Very fine	0.062	0.125			7
	Fine	0.125	0.250	2	2	9
	Medium	0.25	0.50			9
	Coarse	0.5	1.0			9
	Very Coarse	1.0	2.0	1	1	10
<b>GRAVEL</b>	Very Fine	2.0	2.8			10
	Very Fine	2.8	4.0			10
	Fine	4.0	5.6	1	1	11
	Fine	5.6	8.0	3	3	14
	Medium	8.0	11.0	4	4	18
	Medium	11.0	16.0	7	7	25
	Coarse	16.0	22.6	5	5	30
	Coarse	22.6	32	14	14	44
	Very Coarse	32	45	11	11	54
<b>COBBLE</b>	Very Coarse	45	64	9	9	63
	Small	64	90	17	17	80
	Small	90	128	15	15	95
	Large	128	180	4	4	99
<b>BOULDER</b>	Large	180	256	1	1	100
	Small	256	362			100
<b>BOULDER</b>	Small	362	512			100
	Medium	512	1024			100
	Large/Very Large	1024	2048			100
<b>BEDROCK</b>	Bedrock	2048	>2048			100
<b>Total</b>				<b>101</b>	<b>100</b>	<b>100</b>

Cross-Section 31 Channel materials (mm)	
D <sub>16</sub> =	9.50
D <sub>35</sub> =	25.81
D <sub>50</sub> =	39.1
D <sub>84</sub> =	98.5
D <sub>95</sub> =	127.8
D <sub>100</sub> =	256.0





**Reachwide and Cross-Section Pebble Count Plots**

Big Harris Creek Mitigation Site - Area B

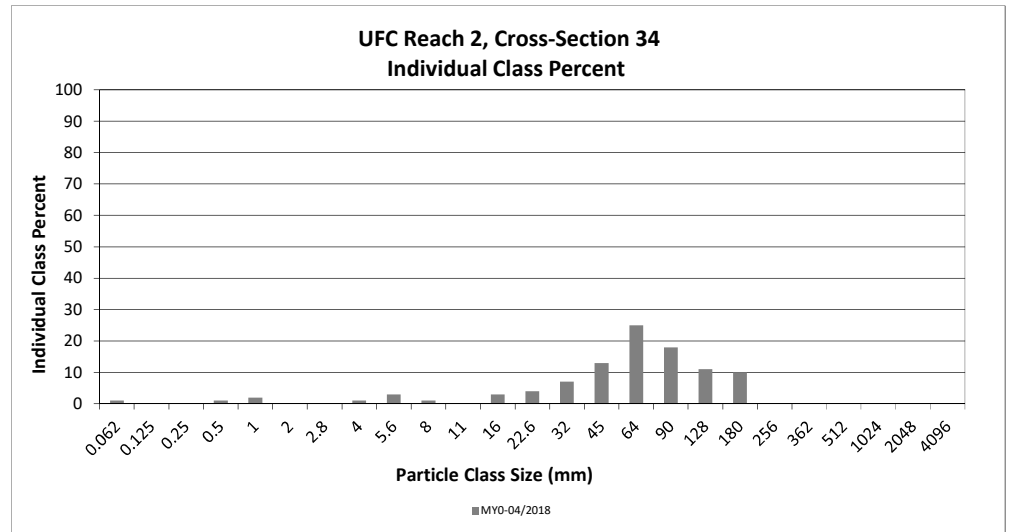
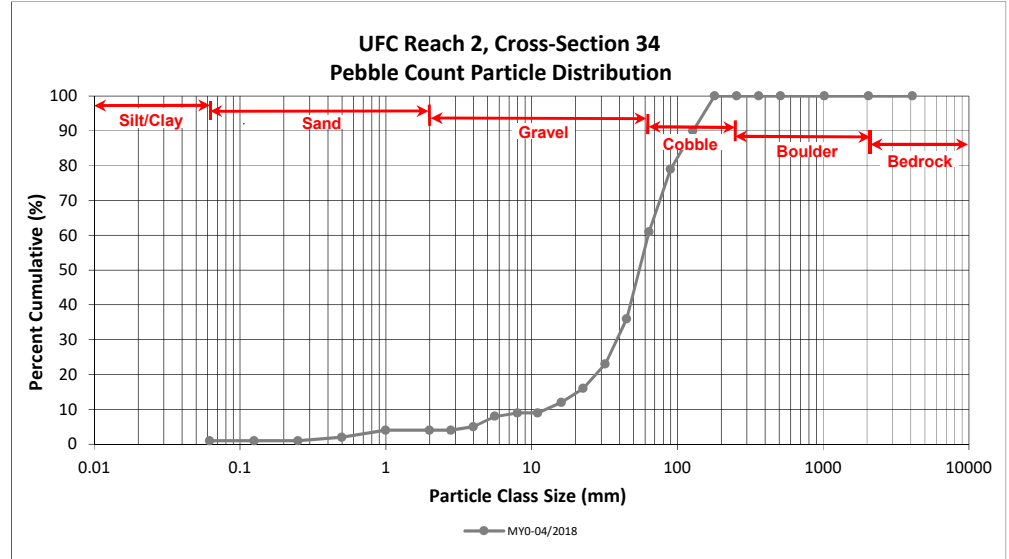
DMS Project No. 739

**Monitoring Year 0 - 2018**

UFC Reach 2, Cross-Section 34

Particle Class		Diameter (mm)		Riffle 100-Count	Summary	
		min	max		Class Percentage	Percent Cumulative
<i>SILT/CLAY</i>	Silt/Clay	0.000	0.062	1	1	1
<i>SAND</i>	Very fine	0.062	0.125			1
	Fine	0.125	0.250			1
	Medium	0.25	0.50	1	1	2
	Coarse	0.5	1.0	2	2	4
	Very Coarse	1.0	2.0			4
<i>GRAVEL</i>	Very Fine	2.0	2.8			4
	Very Fine	2.8	4.0	1	1	5
	Fine	4.0	5.6	3	3	8
	Fine	5.6	8.0	1	1	9
	Medium	8.0	11.0			9
	Medium	11.0	16.0	3	3	12
	Coarse	16.0	22.6	4	4	16
	Coarse	22.6	32	7	7	23
	Very Coarse	32	45	13	13	36
<i>COBBLE</i>	Very Coarse	45	64	25	25	61
	Small	64	90	18	18	79
	Small	90	128	11	11	90
	Large	128	180	10	10	100
<i>BOULDER</i>	Large	180	256			100
	Small	256	362			100
<i>BOULDER</i>	Small	362	512			100
	Medium	512	1024			100
	Large/Very Large	1024	2048			100
<i>BEDROCK</i>	Bedrock	2048	>2048			100
<b>Total</b>				<b>100</b>	<b>100</b>	<b>100</b>

Cross-Section 34	
Channel materials (mm)	
D <sub>16</sub> =	22.60
D <sub>35</sub> =	43.84
D <sub>50</sub> =	54.8
D <sub>84</sub> =	105.6
D <sub>95</sub> =	151.8
D <sub>100</sub> =	180.0



## Reachwide and Cross-Section Pebble Count Plots

Big Harris Creek Mitigation Site - Area B

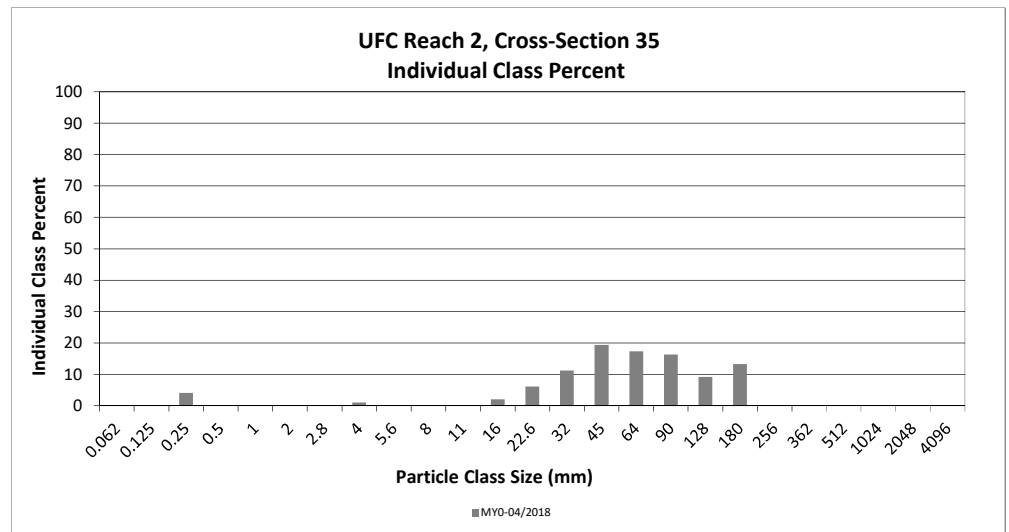
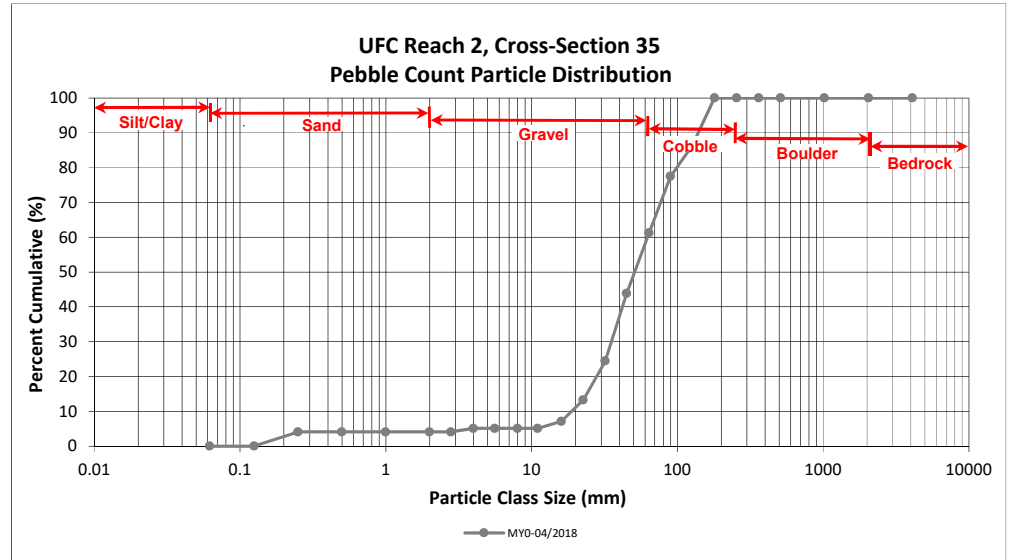
DMS Project No. 739

Monitoring Year 0 - 2018

UFC Reach 2, Cross-Section 35

Particle Class		Diameter (mm)		Riffle 100-Count	Summary	
		min	max		Class Percentage	Percent Cumulative
<b>SILT/CLAY</b>	Silt/Clay	0.000	0.062			0
<b>SAND</b>	Very fine	0.062	0.125			0
	Fine	0.125	0.250	4	4	4
	Medium	0.25	0.50			4
	Coarse	0.5	1.0			4
	Very Coarse	1.0	2.0			4
<b>GRAVEL</b>	Very Fine	2.0	2.8			4
	Very Fine	2.8	4.0	1	1	5
	Fine	4.0	5.6			5
	Fine	5.6	8.0			5
	Medium	8.0	11.0			5
	Medium	11.0	16.0	2	2	7
	Coarse	16.0	22.6	6	6	13
	Coarse	22.6	32	11	11	24
	Very Coarse	32	45	19	19	44
<b>COBBLE</b>	Very Coarse	45	64	17	17	61
	Small	64	90	16	16	78
	Small	90	128	9	9	87
	Large	128	180	13	13	100
	Large	180	256			100
<b>BOULDER</b>	Small	256	362			100
	Small	362	512			100
	Medium	512	1024			100
	Large/Very Large	1024	2048			100
<b>BEDROCK</b>	Bedrock	2048	>2048			100
<b>Total</b>				<b>98</b>	<b>100</b>	<b>100</b>

Cross-Section 35 Channel materials (mm)	
D <sub>16</sub> =	24.60
D <sub>35</sub> =	38.50
D <sub>50</sub> =	51.0
D <sub>84</sub> =	115.3
D <sub>95</sub> =	158.3
D <sub>100</sub> =	180.0



**Reachwide and Cross-Section Pebble Count Plots**

Big Harris Creek Mitigation Site - Area B

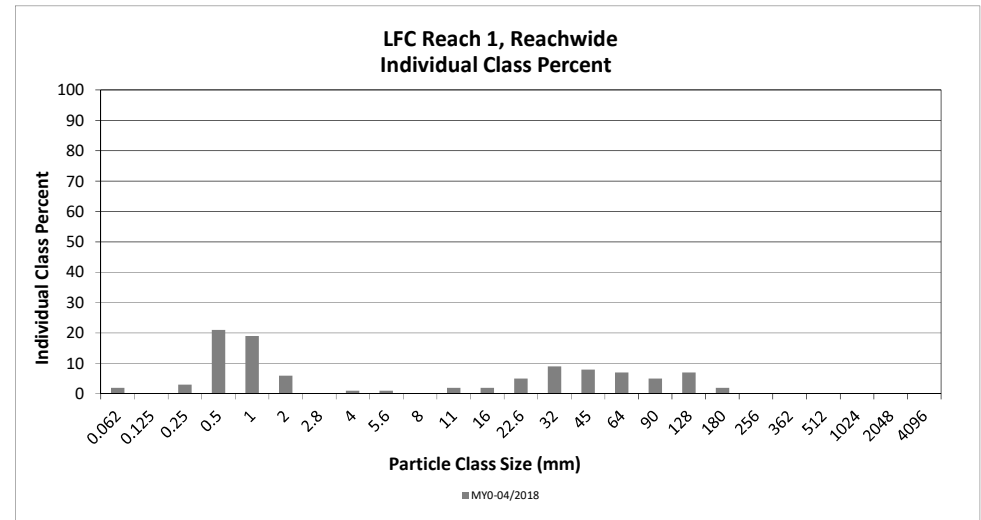
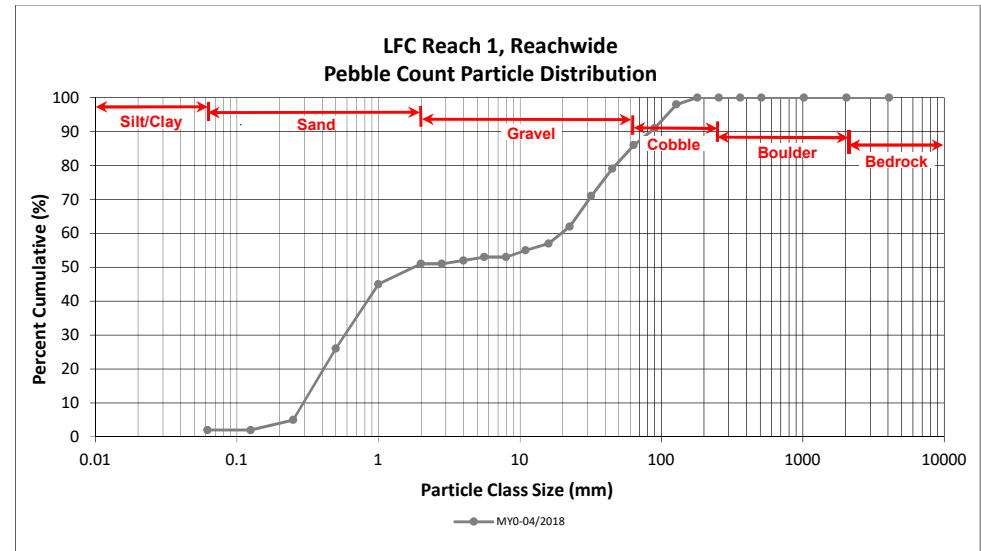
DMS Project No. 739

**Monitoring Year 0 - 2018**

LFC Reach 1, Reachwide

Particle Class		Diameter (mm)		Particle Count			Reach Summary	
		min	max	Riffle	Pool	Total	Class Percentage	Percent Cumulative
<b>SILT/CLAY</b>	Silt/Clay	0.000	0.062	2		2	2	2
<b>SAND</b>	Very fine	0.062	0.125					2
	Fine	0.125	0.250	1	2	3	3	5
	Medium	0.25	0.50	3	18	21	21	26
	Coarse	0.5	1.0	3	16	19	19	45
	Very Coarse	1.0	2.0	1	5	6	6	51
<b>GRAVEL</b>	Very Fine	2.0	2.8					51
	Very Fine	2.8	4.0		1	1	1	52
	Fine	4.0	5.6		1	1	1	53
	Fine	5.6	8.0					53
	Medium	8.0	11.0	2		2	2	55
	Medium	11.0	16.0	2		2	2	57
	Coarse	16.0	22.6	5		5	5	62
	Coarse	22.6	32	7	2	9	9	71
	Very Coarse	32	45	6	2	8	8	79
	Very Coarse	45	64	7		7	7	86
<b>COBBLE</b>	Small	64	90	4	1	5	5	91
	Small	90	128	5	2	7	7	98
	Large	128	180	2		2	2	100
	Large	180	256					100
<b>BOULDER</b>	Small	256	362					100
	Small	362	512					100
	Medium	512	1024					100
	Large/Very Large	1024	2048					100
<b>BEDROCK</b>	Bedrock	2048	>2048					100
<b>Total</b>				<b>50</b>	<b>50</b>	<b>100</b>	<b>100</b>	<b>100</b>

Reachwide Channel materials (mm)	
D <sub>16</sub> =	0.36
D <sub>35</sub> =	0.69
D <sub>50</sub> =	1.8
D <sub>84</sub> =	57.9
D <sub>95</sub> =	110.1
D <sub>100</sub> =	180.0



## Reachwide and Cross-Section Pebble Count Plots

Big Harris Creek Mitigation Site - Area B

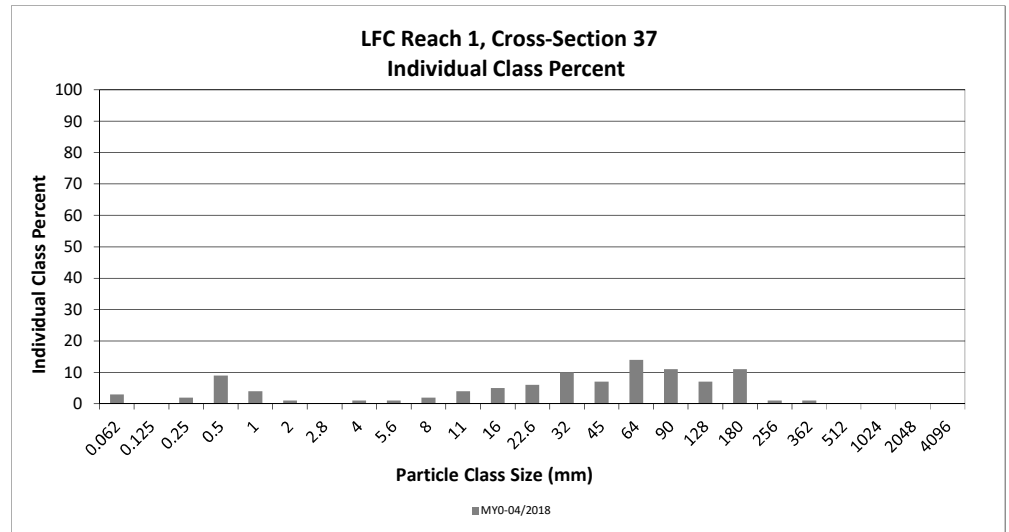
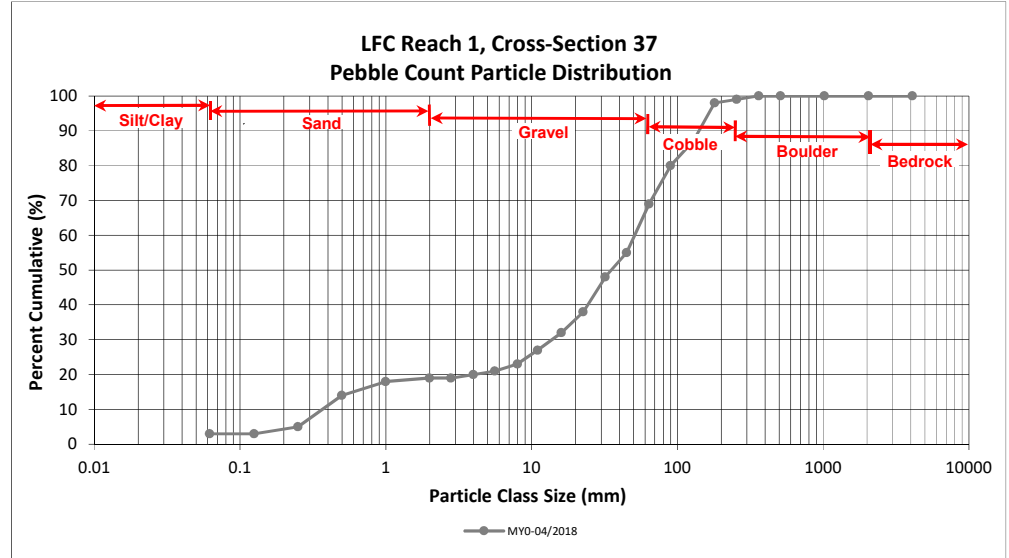
DMS Project No. 739

Monitoring Year 0 - 2018

LFC Reach 1, Cross-Section 37

Particle Class		Diameter (mm)		Riffle 100-Count	Summary	
		min	max		Class Percentage	Percent Cumulative
<b>SILT/CLAY</b>	Silt/Clay	0.000	0.062	3	3	3
<b>SAND</b>	Very fine	0.062	0.125			3
	Fine	0.125	0.250	2	2	5
	Medium	0.25	0.50	9	9	14
	Coarse	0.5	1.0	4	4	18
	Very Coarse	1.0	2.0	1	1	19
<b>GRAVEL</b>	Very Fine	2.0	2.8			19
	Very Fine	2.8	4.0	1	1	20
	Fine	4.0	5.6	1	1	21
	Fine	5.6	8.0	2	2	23
	Medium	8.0	11.0	4	4	27
	Medium	11.0	16.0	5	5	32
	Coarse	16.0	22.6	6	6	38
	Coarse	22.6	32	10	10	48
	Very Coarse	32	45	7	7	55
<b>COBBLE</b>	Very Coarse	45	64	14	14	69
	Small	64	90	11	11	80
	Small	90	128	7	7	87
	Large	128	180	11	11	98
<b>BOULDER</b>	Large	180	256	1	1	99
	Small	256	362	1	1	100
	Small	362	512			100
<b>BOULDER</b>	Medium	512	1024			100
	Large/Very Large	1024	2048			100
<b>BEDROCK</b>	Bedrock	2048	>2048			100
<b>Total</b>				<b>100</b>	<b>100</b>	<b>100</b>

Cross-Section 37 Channel materials (mm)	
D <sub>16</sub> =	0.71
D <sub>35</sub> =	19.02
D <sub>50</sub> =	35.3
D <sub>84</sub> =	110.1
D <sub>95</sub> =	164.0
D <sub>100</sub> =	362.0



**Reachwide and Cross-Section Pebble Count Plots**

Big Harris Creek Mitigation Site - Area B

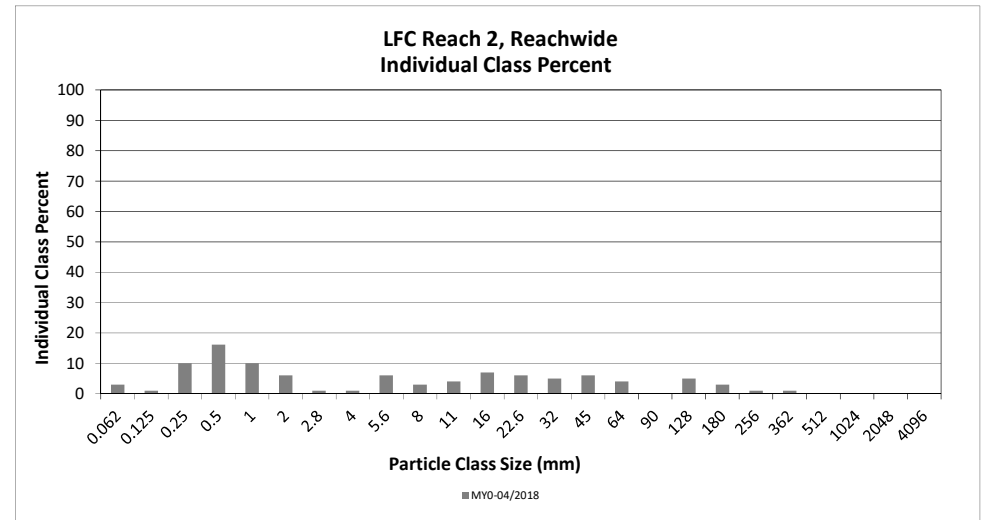
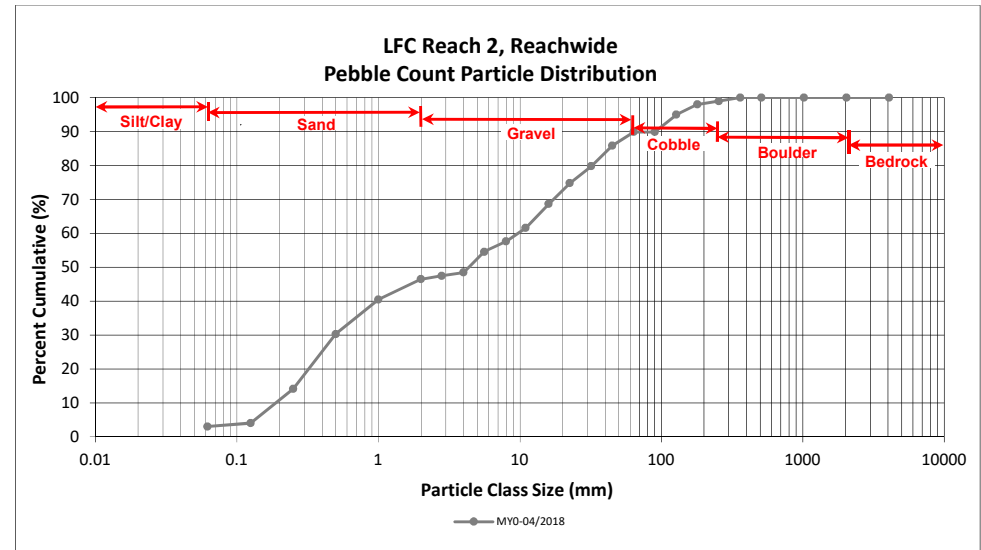
DMS Project No. 739

**Monitoring Year 0 - 2018**

LFC Reach 2, Reachwide

Particle Class		Diameter (mm)		Particle Count			Reach Summary	
		min	max	Riffle	Pool	Total	Class Percentage	Percent Cumulative
<b>SILT/CLAY</b>	Silt/Clay	0.000	0.062	3		3	3	3
<b>SAND</b>	Very fine	0.062	0.125		1	1	1	4
	Fine	0.125	0.250	1	9	10	10	14
	Medium	0.25	0.50	5	11	16	16	30
	Coarse	0.5	1.0	1	9	10	10	40
	Very Coarse	1.0	2.0	1	5	6	6	46
<b>GRAVEL</b>	Very Fine	2.0	2.8		1	1	1	47
	Very Fine	2.8	4.0	1		1	1	48
	Fine	4.0	5.6	1	5	6	6	55
	Fine	5.6	8.0	1	2	3	3	58
	Medium	8.0	11.0	2	2	4	4	62
	Medium	11.0	16.0	7		7	7	69
	Coarse	16.0	22.6	6		6	6	75
	Coarse	22.6	32	4	1	5	5	80
	Very Coarse	32	45	5	1	6	6	86
	Very Coarse	45	64	4		4	4	90
<b>COBBLE</b>	Small	64	90					90
	Small	90	128	3	2	5	5	95
	Large	128	180	3		3	3	98
	Large	180	256		1	1	1	99
<b>BOULDER</b>	Small	256	362	1		1	1	100
	Small	362	512					100
	Medium	512	1024					100
	Large/Very Large	1024	2048					100
<b>BEDROCK</b>	Bedrock	2048	>2048					100
<b>Total</b>				<b>49</b>	<b>50</b>	<b>99</b>	<b>100</b>	<b>100</b>

Reachwide Channel materials (mm)	
D <sub>16</sub> =	0.27
D <sub>35</sub> =	0.69
D <sub>50</sub> =	4.4
D <sub>84</sub> =	40.5
D <sub>95</sub> =	128.7
D <sub>100</sub> =	362.0



## Reachwide and Cross-Section Pebble Count Plots

Big Harris Creek Mitigation Site - Area B

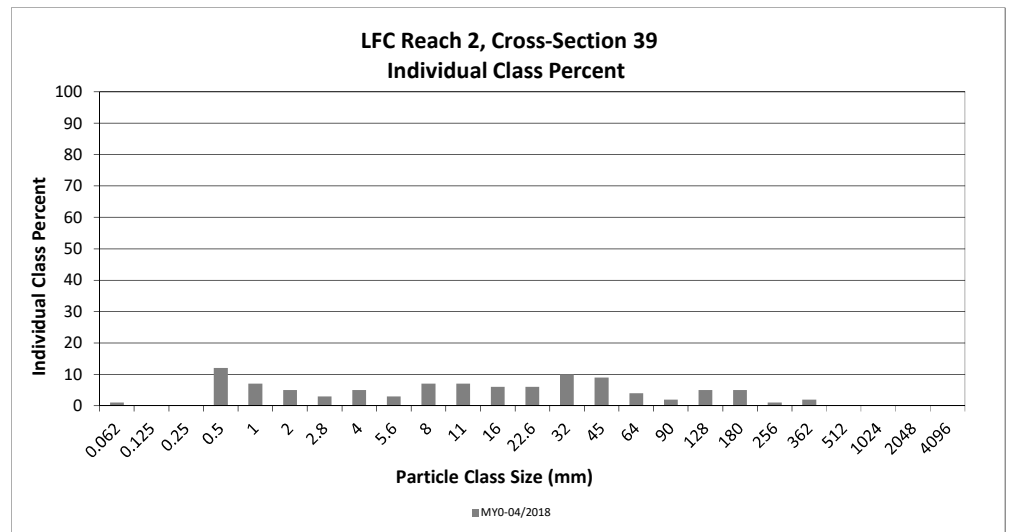
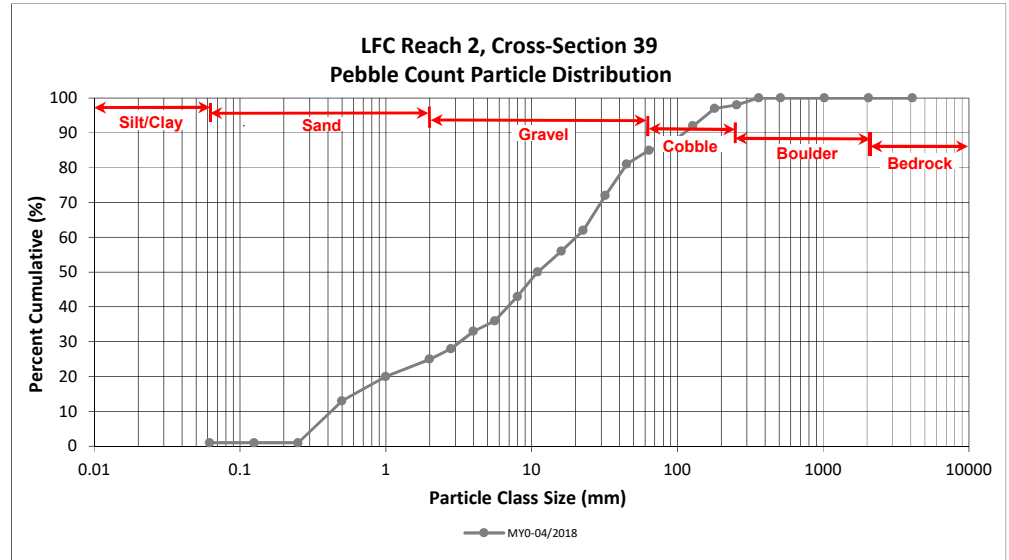
DMS Project No. 739

Monitoring Year 0 - 2018

LFC Reach 2, Cross-Section 39

Particle Class		Diameter (mm)		Riffle 100-Count	Summary	
		min	max		Class Percentage	Percent Cumulative
<b>SILT/CLAY</b>	Silt/Clay	0.000	0.062	1	1	1
<b>SAND</b>	Very fine	0.062	0.125			1
	Fine	0.125	0.250			1
	Medium	0.25	0.50	12	12	13
	Coarse	0.5	1.0	7	7	20
	Very Coarse	1.0	2.0	5	5	25
<b>GRAVEL</b>	Very Fine	2.0	2.8	3	3	28
	Very Fine	2.8	4.0	5	5	33
	Fine	4.0	5.6	3	3	36
	Fine	5.6	8.0	7	7	43
	Medium	8.0	11.0	7	7	50
	Medium	11.0	16.0	6	6	56
	Coarse	16.0	22.6	6	6	62
	Coarse	22.6	32	10	10	72
	Very Coarse	32	45	9	9	81
<b>COBBLE</b>	Very Coarse	45	64	4	4	85
	Small	64	90	2	2	87
	Small	90	128	5	5	92
	Large	128	180	5	5	97
<b>BOULDER</b>	Large	180	256	1	1	98
	Small	256	362	2	2	100
	Small	362	512			100
<b>BOULDER</b>	Medium	512	1024			100
	Large/Very Large	1024	2048			100
<b>BEDROCK</b>	Bedrock	2048	>2048			100
<b>Total</b>				<b>100</b>	<b>100</b>	<b>100</b>

Cross-Section 39 Channel materials (mm)	
D <sub>16</sub> =	0.67
D <sub>35</sub> =	5.01
D <sub>50</sub> =	11.0
D <sub>84</sub> =	58.6
D <sub>95</sub> =	157.1
D <sub>100</sub> =	362.0



**Reachwide and Cross-Section Pebble Count Plots**

Big Harris Creek Mitigation Site - Area C

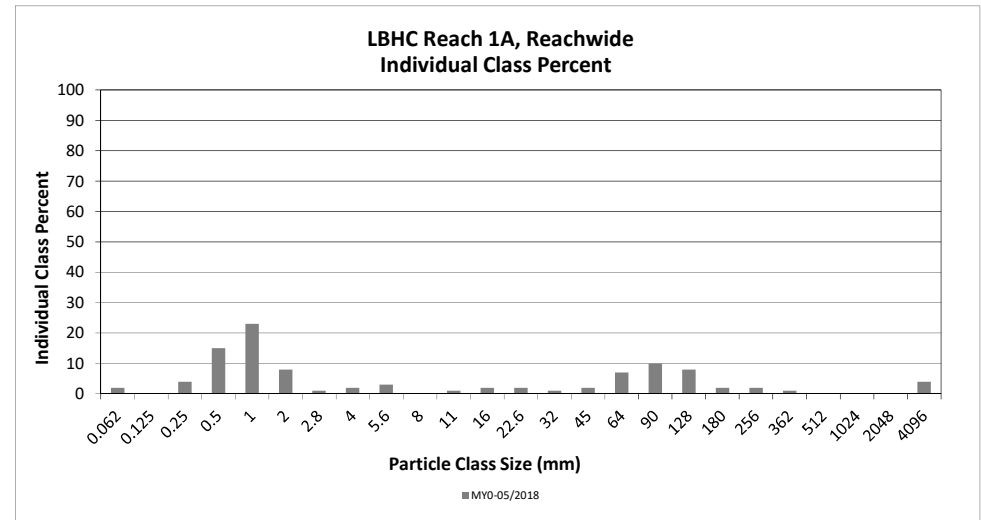
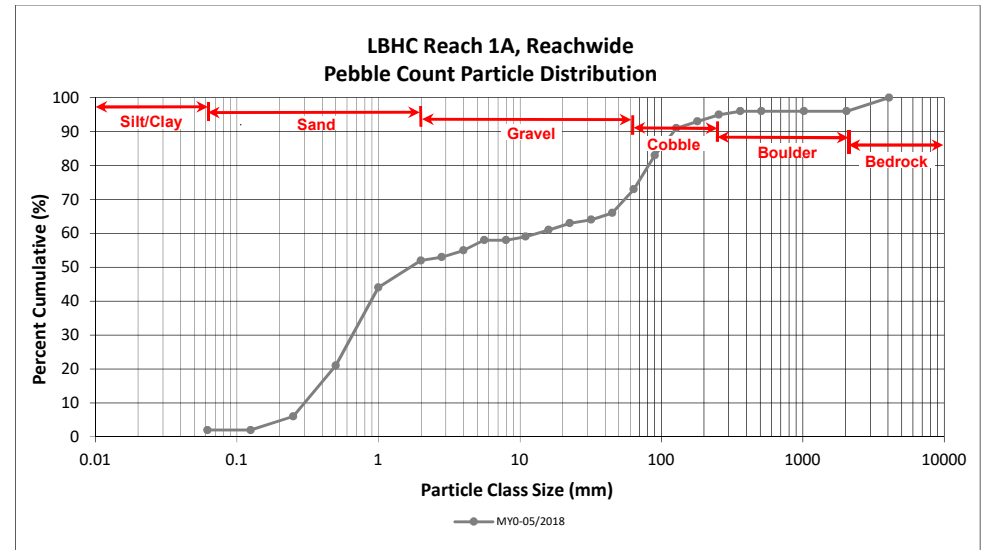
DMS Project No. 739

**Monitoring Year 0 - 2018**

LBHC Reach 1A, Reachwide

Particle Class		Diameter (mm)		Particle Count			Reach Summary	
		min	max	Riffle	Pool	Total	Class Percentage	Percent Cumulative
<b>SILT/CLAY</b>	Silt/Clay	0.000	0.062		2	2	2	2
<b>SAND</b>	Very fine	0.062	0.125					2
	Fine	0.125	0.250	1	3	4	4	6
	Medium	0.25	0.50	4	11	15	15	21
	Coarse	0.5	1.0	1	22	23	23	44
	Very Coarse	1.0	2.0	2	6	8	8	52
<b>GRAVEL</b>	Very Fine	2.0	2.8		1	1	1	53
	Very Fine	2.8	4.0		2	2	2	55
	Fine	4.0	5.6	2	1	3	3	58
	Fine	5.6	8.0					58
	Medium	8.0	11.0		1	1	1	59
	Medium	11.0	16.0	2		2	2	61
	Coarse	16.0	22.6	2		2	2	63
	Coarse	22.6	32	1		1	1	64
	Very Coarse	32	45	2		2	2	66
	Very Coarse	45	64	7		7	7	73
<b>COBBLE</b>	Small	64	90	10		10	10	83
	Small	90	128	7	1	8	8	91
	Large	128	180	2		2	2	93
	Large	180	256	2		2	2	95
<b>BOULDER</b>	Small	256	362	1		1	1	96
	Small	362	512					96
	Medium	512	1024					96
	Large/Very Large	1024	2048					96
<b>BEDROCK</b>	Bedrock	2048	>2048	4		4	4	100
<b>Total</b>				<b>50</b>	<b>50</b>	<b>100</b>	<b>100</b>	<b>100</b>

Reachwide Channel materials (mm)	
D <sub>16</sub> =	0.40
D <sub>35</sub> =	0.76
D <sub>50</sub> =	1.7
D <sub>84</sub> =	94.1
D <sub>95</sub> =	256.0
D <sub>100</sub> =	>2048



## Reachwide and Cross-Section Pebble Count Plots

Big Harris Creek Mitigation Site - Area C

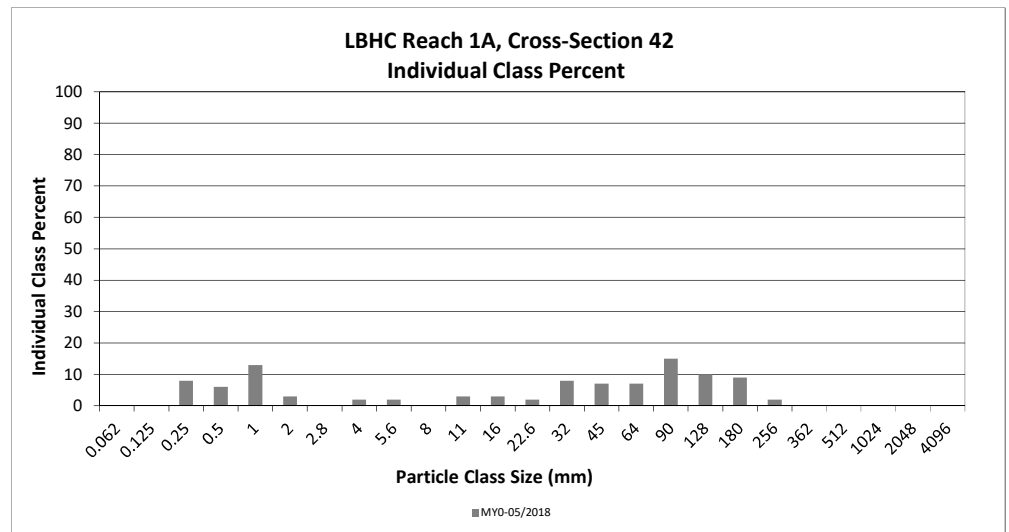
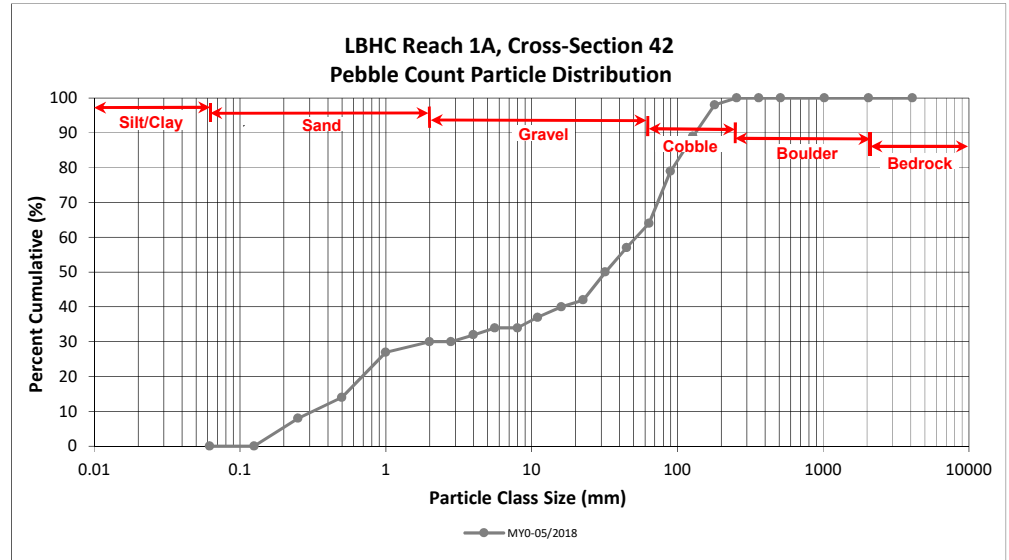
DMS Project No. 739

Monitoring Year 0 - 2018

LBHC Reach 1A, Cross-Section 42

Particle Class		Diameter (mm)		Riffle 100-Count	Summary	
		min	max		Class Percentage	Percent Cumulative
<b>SILT/CLAY</b>	Silt/Clay	0.000	0.062			0
<b>SAND</b>	Very fine	0.062	0.125			0
	Fine	0.125	0.250	8	8	8
	Medium	0.25	0.50	6	6	14
	Coarse	0.5	1.0	13	13	27
	Very Coarse	1.0	2.0	3	3	30
<b>GRAVEL</b>	Very Fine	2.0	2.8			30
	Very Fine	2.8	4.0	2	2	32
	Fine	4.0	5.6	2	2	34
	Fine	5.6	8.0			34
	Medium	8.0	11.0	3	3	37
	Medium	11.0	16.0	3	3	40
	Coarse	16.0	22.6	2	2	42
	Coarse	22.6	32	8	8	50
	Very Coarse	32	45	7	7	57
<b>COBBLE</b>	Very Coarse	45	64	7	7	64
	Small	64	90	15	15	79
	Small	90	128	10	10	89
	Large	128	180	9	9	98
<b>BOULDER</b>	Large	180	256	2	2	100
	Small	256	362			100
<b>BOULDER</b>	Small	362	512			100
	Medium	512	1024			100
	Large/Very Large	1024	2048			100
<b>BEDROCK</b>	Bedrock	2048	>2048			100
<b>Total</b>				<b>100</b>	<b>100</b>	<b>100</b>

Cross-Section 42 Channel materials (mm)	
D <sub>16</sub> =	0.56
D <sub>35</sub> =	8.90
D <sub>50</sub> =	32.0
D <sub>84</sub> =	107.3
D <sub>95</sub> =	160.7
D <sub>100</sub> =	256.0





**Reachwide and Cross-Section Pebble Count Plots**

Big Harris Creek Mitigation Site - Area C

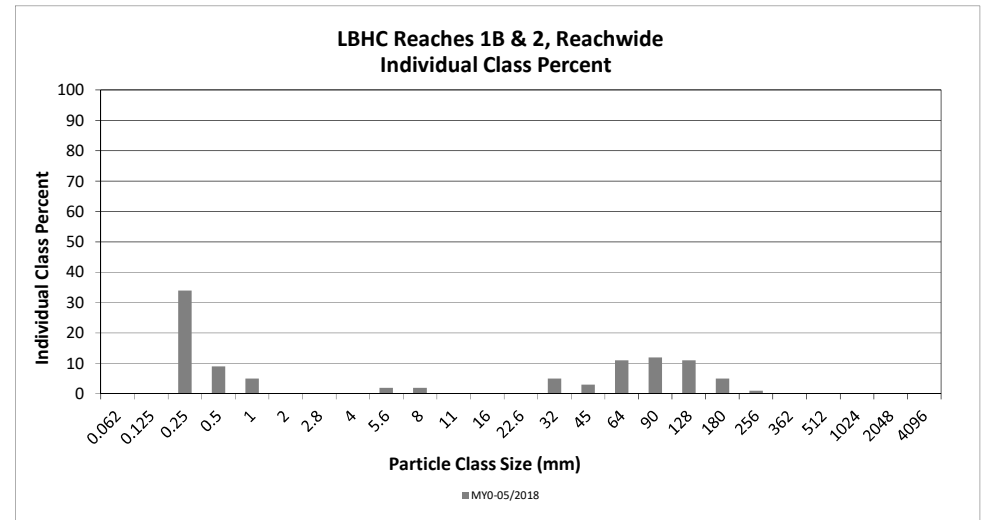
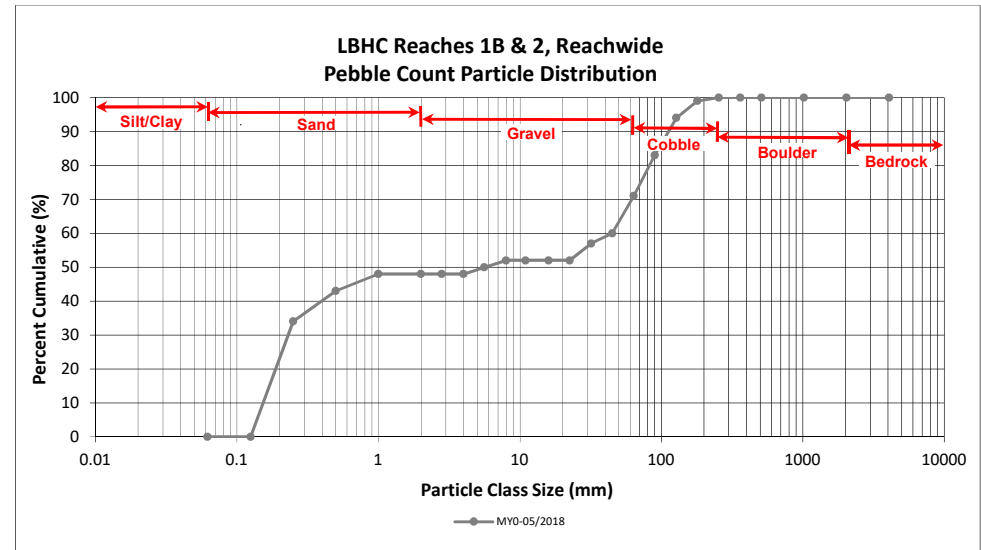
DMS Project No. 739

Monitoring Year 0 - 2018

LBHC Reaches 1B & 2, Reachwide

Particle Class		Diameter (mm)		Particle Count			Reach Summary	
		min	max	Riffle	Pool	Total	Class Percentage	Percent Cumulative
<b>SILT/CLAY</b>	Silt/Clay	0.000	0.062					0
<b>SAND</b>	Very fine	0.062	0.125					0
	Fine	0.125	0.250	5	29	34	34	34
	Medium	0.25	0.50		9	9	9	43
	Coarse	0.5	1.0		5	5	5	48
	Very Coarse	1.0	2.0					48
<b>GRAVEL</b>	Very Fine	2.0	2.8					48
	Very Fine	2.8	4.0					48
	Fine	4.0	5.6	1	1	2	2	50
	Fine	5.6	8.0	2		2	2	52
	Medium	8.0	11.0					52
	Medium	11.0	16.0					52
	Coarse	16.0	22.6					52
	Coarse	22.6	32	5		5	5	57
	Very Coarse	32	45	3		3	3	60
	Very Coarse	45	64	7	4	11	11	71
<b>COBBLE</b>	Small	64	90	11	1	12	12	83
	Small	90	128	11		11	11	94
	Large	128	180	4	1	5	5	99
	Large	180	256	1		1	1	100
<b>BOULDER</b>	Small	256	362					100
	Small	362	512					100
	Medium	512	1024					100
Large/Very Large	1024	2048					100	
<b>BEDROCK</b>	Bedrock	2048	>2048					100
<b>Total</b>				<b>50</b>	<b>50</b>	<b>100</b>	<b>100</b>	<b>100</b>

Reachwide Channel materials (mm)	
D <sub>16</sub> =	0.17
D <sub>35</sub> =	0.27
D <sub>50</sub> =	5.6
D <sub>84</sub> =	92.9
D <sub>95</sub> =	137.0
D <sub>100</sub> =	256.0



**Reachwide and Cross-Section Pebble Count Plots**

Big Harris Creek Mitigation Site - Area C

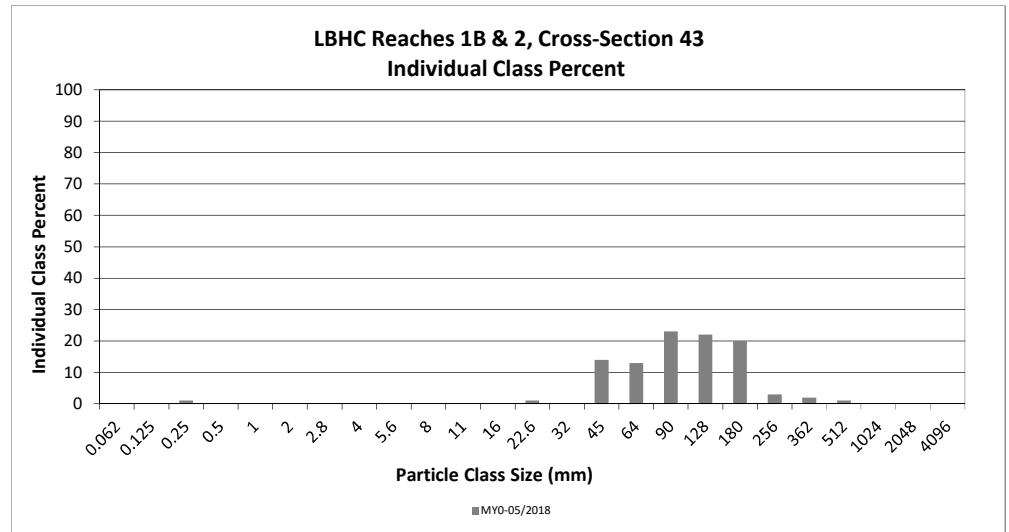
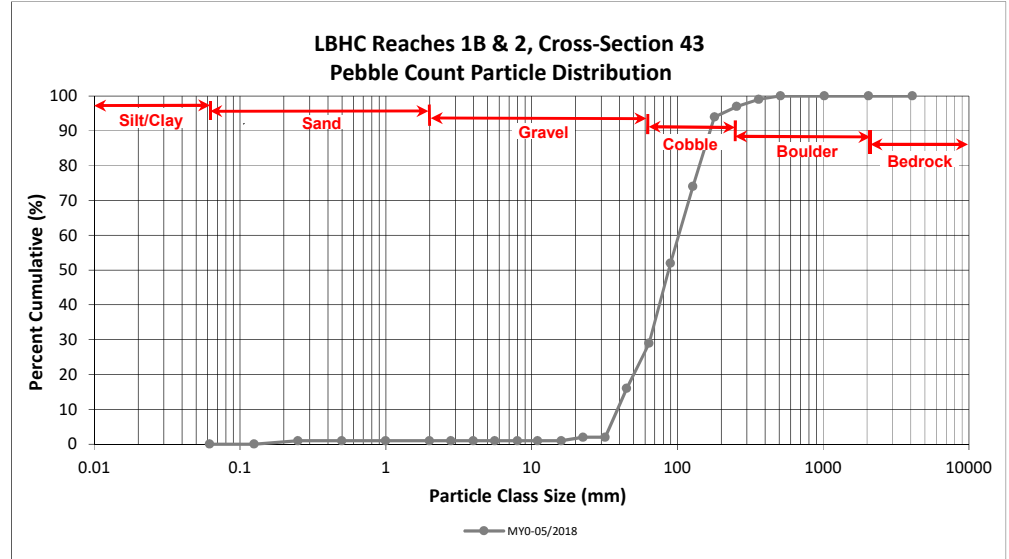
DMS Project No. 739

**Monitoring Year 0 - 2018**

LBHC Reaches 1B & 2, Cross-Section 43

Particle Class		Diameter (mm)		Riffle 100-Count	Summary	
		min	max		Class Percentage	Percent Cumulative
<b>SILT/CLAY</b>	Silt/Clay	0.000	0.062			0
<b>SAND</b>	Very fine	0.062	0.125			0
	Fine	0.125	0.250	1	1	1
	Medium	0.25	0.50			1
	Coarse	0.5	1.0			1
	Very Coarse	1.0	2.0			1
<b>GRAVEL</b>	Very Fine	2.0	2.8			1
	Very Fine	2.8	4.0			1
	Fine	4.0	5.6			1
	Fine	5.6	8.0			1
	Medium	8.0	11.0			1
	Medium	11.0	16.0			1
	Coarse	16.0	22.6	1	1	2
	Coarse	22.6	32			2
	Very Coarse	32	45	14	14	16
	Very Coarse	45	64	13	13	29
<b>COBBLE</b>	Small	64	90	23	23	52
	Small	90	128	22	22	74
	Large	128	180	20	20	94
	Large	180	256	3	3	97
<b>BOULDER</b>	Small	256	362	2	2	99
	Small	362	512	1	1	100
	Medium	512	1024			100
	Large/Very Large	1024	2048			100
<b>BEDROCK</b>	Bedrock	2048	>2048			100
<b>Total</b>				<b>100</b>	<b>100</b>	<b>100</b>

Cross-Section 43 Channel materials (mm)	
D <sub>16</sub> =	45.00
D <sub>35</sub> =	69.95
D <sub>50</sub> =	87.4
D <sub>84</sub> =	151.8
D <sub>95</sub> =	202.4
D <sub>100</sub> =	512.0



## **STREAM PHOTOGRAPHS**

Big Harris Creek - Area A  
Monitoring Year 0



**UBHC R1 Photo Point 1 – view upstream (05/14/2018)**



**UBHC R1 Photo Point 1 – view downstream (05/14/2018)**



**UBHC R1 Photo Point 2 – view upstream (05/14/2018)**



**UBHC R1 Photo Point 2 – view downstream (05/14/2018)**



**UBHC R1 Photo Point 3 – view upstream (05/14/2018)**



**UBHC R1 Photo Point 3 – view downstream (05/14/2018)**



**UBHC R1 Photo Point 4 – view upstream (05/14/2018)**



**UBHC R1 Photo Point 4 – view downstream (05/14/2018)**



**UBHC R1 Photo Point 5 – view upstream (05/14/2018)**



**UBHC R1 Photo Point 5 – view downstream (05/14/2018)**



**UBHC R2A Photo Point 6 – view upstream (05/14/2018)**



**UBHC R2A Photo Point 6 – view downstream (05/14/2018)**



**UBHC R2A Photo Point 7 – view upstream (05/14/2018)**



**UBHC R2A Photo Point 7 – view downstream (05/14/2018)**



**UBHC R2B Photo Point 8 – view upstream (05/14/2018)**



**UBHC R2B Photo Point 8 – view downstream (05/14/2018)**



**UBHC R2B Photo Point 9 – view upstream (05/14/2018)**



**UBHC R2B Photo Point 9 – view downstream (05/14/2018)**



**UBHC R3 Photo Point 10 – view upstream (04/27/2018)**



**UBHC R3 Photo Point 10 – view downstream (04/27/2018)**



**UBHC R3 Photo Point 11 – view upstream (04/27/2018)**



**UBHC R3 Photo Point 11 – view downstream (04/27/2018)**



**UBHC R4 Photo Point 12 – view upstream (04/27/2018)**



**UBHC R4 Photo Point 12 – view downstream (04/27/2018)**



**UBHC R4 Photo Point 13 – view upstream (04/27/2018)**



**UBHC R4 Photo Point 13 – view downstream (04/27/2018)**



**UBHC R4 Photo Point 14 – view upstream (04/27/2018)**



**UBHC R4 Photo Point 14 – view downstream (04/27/2018)**



**UBHC R4 Photo Point 15 – view upstream (04/27/2018)**



**UBHC R4 Photo Point 15 – view downstream (04/27/2018)**





**UBHC R4 Photo Point 16 – view upstream (04/27/2018)**



**UBHC R4 Photo Point 16 – view downstream (04/27/2018)**



**UBHC R5 Photo Point 17 – view upstream (04/27/2018)**



**UBHC R5 Photo Point 17 – view downstream (04/27/2018)**



**UBHC R5 Photo Point 18 – view upstream (04/27/2018)**



**UBHC R5 Photo Point 18 – view downstream (04/27/2018)**



**UBHC R6 Photo Point 19 – view upstream (04/27/2018)**



**UBHC R6 Photo Point 19 – view downstream (04/27/2018)**



**UBHC R6 Photo Point 20 – view upstream (04/27/2018)**



**UBHC R6 Photo Point 20 – view downstream (04/27/2018)**



**UBHC R6 Photo Point 21 – view upstream (04/27/2018)**



**UBHC R6 Photo Point 21 – view downstream (04/27/2018)**



**UBHC R6 Photo Point 22 – view upstream (04/27/2018)**



**UBHC R6 Photo Point 22 – view downstream (04/27/2018)**



**UBHC R6 Photo Point 23 – view upstream (04/27/2018)**



**UBHC R6 Photo Point 23 – view downstream (04/27/2018)**



**UBHC UT1 Photo Point 24 – view upstream (05/14/2018)**



**UBHC UT1 Photo Point 24 – view downstream (05/14/2018)**



**UBHC UT2 Photo Point 25 – view upstream (05/14/2018)**



**UBHC UT2 Photo Point 25 – view downstream (05/14/2018)**



**UBHC UT3 Photo Point 26 – view upstream (05/14/2018)**



**UBHC UT3 Photo Point 26 – view downstream (05/14/2018)**



**UBHC UT4 Photo Point 27 – view upstream (05/14/2018)**



**UBHC UT4 Photo Point 27 – view downstream (05/14/2018)**



**Cornwell Creek Photo Point 28 – view upstream (05/03/2018)**



**Cornwell Creek Photo Point 28 – view downstream (05/03/2018)**



**Cornwell Creek Photo Point 29 – view upstream (05/03/2018)**



**Cornwell Creek Photo Point 29 – view downstream (05/03/2018)**



**Cornwell Creek Photo Point 30 – view upstream (05/03/2018)**



**Cornwell Creek Photo Point 30 – view downstream (05/03/2018)**



**Cornwell Creek Photo Point 31 – view upstream (05/03/2018)**



**Cornwell Creek Photo Point 31 – view downstream (05/03/2018)**



**Cornwell Creek Photo Point 32 – view upstream (05/03/2018)**



**Cornwell Creek Photo Point 32 – view downstream (05/03/2018)**



**Cornwell Creek Photo Point 33 – view upstream (05/03/2018)**



**Cornwell Creek Photo Point 33 – view downstream (05/03/2018)**



**Cornwell Creek UT1 Photo Point 34 – view upstream**



**Cornwell Creek UT1 Photo Point 34 – view downstream**



**Eaker Creek Photo Point 35 – view upstream (05/14/2018)**



**Eaker Creek Photo Point 35 – view downstream (05/14/2018)**



**Scism Creek Photo Point 36 – view upstream (04/27/2018)**



**Scism Creek Photo Point 36 – view downstream (04/27/2018)**



**Scism Creek Photo Point 37 – view upstream (04/27/2018)**



**Scism Creek Photo Point 37 – view downstream (04/27/2018)**



**Scism Creek Photo Point 38 – view upstream (04/27/2018)**



**Scism Creek Photo Point 38 – view downstream (04/27/2018)**



**Royster Creek Photo Point 39 – view upstream (05/14/2018)**



**Royster Creek Photo Point 39 – view downstream (05/14/2018)**





**Royster Creek Photo Point 40 – view upstream (05/14/2018)**



**Royster Creek Photo Point 40 – view downstream (05/14/2018)**



**Royster Creek Photo Point 41 – view upstream (05/14/2018)**



**Royster Creek Photo Point 41 – view downstream (05/14/2018)**



**Royster Creek Photo Point 42 – view upstream (05/14/2018)**



**Royster Creek Photo Point 42 – view downstream (05/14/2018)**



**Royster Creek Photo Point 43 – view upstream (05/14/2018)**



**Royster Creek Photo Point 43 – view downstream (05/14/2018)**



**Royster Creek Photo Point 44 – view upstream (05/14/2018)**



**Royster Creek Photo Point 44 – view downstream (05/14/2018)**



**Royster Creek Photo Point 45 – view upstream (05/14/2018)**



**Royster Creek Photo Point 45 – view downstream (05/14/2018)**



**Royster Creek Photo Point 46 – view upstream (05/14/2018)**



**Royster Creek Photo Point 46 – view downstream (05/14/2018)**



**Royster Creek Photo Point 47 – view upstream (04/27/2018)**



**Royster Creek Photo Point 47 – view downstream (04/27/2018)**



**LSEC Photo Point 48 – view upstream (04/26/2018)**



**LSEC Photo Point 48 – view downstream (04/26/2018)**



**LSEC Photo Point 49 – view upstream (04/26/2018)**



**LSEC Photo Point 49 – view downstream (04/26/2018)**



**LSEC Photo Point 50 – view upstream (04/26/2018)**



**LSEC Photo Point 50 – view downstream (04/26/2018)**



**Scott Creek Photo Point 51 – view upstream (04/27/2018)**



**Scott Creek Photo Point 51 – view downstream (04/27/2018)**



**Scott Creek Photo Point 52 – view upstream (04/27/2018)**



**Scott Creek Photo Point 52 – view downstream (04/27/2018)**



**Scott Creek Photo Point 53 – view upstream (04/27/2018)**



**Scott Creek Photo Point 53 – view downstream (04/27/2018)**



**Carroll Creek Photo Point 54 – view upstream (04/27/2018)**



**Carroll Creek Photo Point 54 – view downstream (04/27/2018)**



**Carroll Creek Photo Point 55 – view upstream (04/27/2018)**



**Carroll Creek Photo Point 55 – view downstream (04/27/2018)**



**Carroll Creek Photo Point 56 – view upstream (04/27/2018)**



**Carroll Creek Photo Point 56 – view downstream (04/27/2018)**

## **STREAM PHOTOGRAPHS**

Big Harris Creek - Area B  
Monitoring Year 0



**USEC R1 Photo Point 57 – view upstream (04/25/2018)**



**USEC R1 Photo Point 57 – view downstream (04/25/2018)**



**USEC R2 Photo Point 58 – view upstream (04/25/2018)**



**USEC R2 Photo Point 58 – view downstream (04/25/2018)**



**USEC R2 Photo Point 59 – view upstream (04/25/2018)**



**USEC R2 Photo Point 59 – view downstream (04/25/2018)**





**USEC R3 Photo Point 60 – view upstream (04/25/2018)**



**USEC R3 Photo Point 60 – view downstream (04/25/2018)**



**USEC R3 Photo Point 61 – view upstream (04/25/2018)**



**USEC R3 Photo Point 61 – view downstream (04/25/2018)**



**USEC R3 Photo Point 62 – view upstream (04/25/2018)**



**USEC R3 Photo Point 62 – view downstream (04/25/2018)**



**USEC R4A Photo Point 63 – view upstream (04/25/2018)**



**USEC R4A Photo Point 63 – view downstream (04/25/2018)**



**USEC R4B Photo Point 64 – view upstream (04/25/2018)**



**USEC R4B Photo Point 64 – view downstream (04/25/2018)**



**USEC R5 Photo Point 65 – view upstream (04/25/2018)**



**USEC R5 Photo Point 65 – view downstream (04/25/2018)**



**USEC R5 Photo Point 66 – view upstream (04/25/2018)**



**USEC R5 Photo Point 66 – view downstream (04/25/2018)**



**USEC R5 Photo Point 67 – view upstream (04/25/2018)**



**USEC R5 Photo Point 67 – view downstream (04/25/2018)**



**USEC R5 Photo Point 68 – view upstream (04/25/2018)**



**USEC R5 Photo Point 68 – view downstream (04/25/2018)**



**USEC R5 Photo Point 69 – view upstream (04/25/2018)**



**USEC R5 Photo Point 69 – view downstream (04/25/2018)**



**USEC R6 Photo Point 70 – view upstream (04/25/2018)**



**USEC R6 Photo Point 70 – view downstream (04/25/2018)**



**USEC R6 Photo Point 71 – view upstream (04/25/2018)**



**USEC R6 Photo Point 71 – view downstream (04/25/2018)**



**USEC R6 Photo Point 72 – view upstream (04/25/2018)**



**USEC R6 Photo Point 72 – view downstream (04/25/2018)**



**USEC R6 Photo Point 73 – view upstream (04/25/2018)**



**USEC R6 Photo Point 73 – view downstream (04/25/2018)**



**USEC UT1 Photo Point 74 – view upstream (04/26/2018)**



**USEC UT1 Photo Point 74 – view downstream (04/26/2018)**



**Elliott Creek Photo Point 75 – view upstream (04/25/2018)**



**Elliott Creek Photo Point 75 – view downstream (04/25/2018)**



**Elliott Creek Photo Point 76 – view upstream (04/25/2018)**



**Elliott Creek Photo Point 76 – view downstream (04/25/2018)**



**Elliott Creek Photo Point 77 – view upstream (05/15/2018)**



**Elliott Creek Photo Point 77 – view downstream (05/15/2018)**



**Elliott Creek Photo Point 78 – view upstream (04/25/2018)**



**Elliott Creek Photo Point 78 – view downstream (04/25/2018)**



**Elliott Creek UT1 Photo Point 79 – view upstream (04/25/2018)**



**Elliott Creek UT1 Photo Point 79 – view downstream**



**Bridges Creek R1 Photo Point 80 – view upstream (04/26/2018)**



**Bridges Creek R1 Photo Point 80 – view downstream**



**Bridges Creek R2 Photo Point 81 – view upstream (04/26/2018)**



**Bridges Crk R2 Photo Point 81 – view downstream (04/26/2018)**



**Bridges Creek UT1 Photo Point 82 – view upstream (04/25/2018)**



**Bridges Crk UT1 Photo Point 82 – view downstream (04/25/2018)**



**USEC UT2 Photo Point 83 – view upstream (04/25/2018)**



**USEC UT2 Photo Point 83 – view downstream (04/25/2018)**





**USEC UT3 Photo Point 84 – view upstream (04/25/2018)**



**USEC UT3 Photo Point 84 – view downstream (04/25/2018)**



**UFC R1 Photo Point 85 – view upstream (04/25/2018)**



**UFC R1 Photo Point 85 – view downstream (04/25/2018)**



**UFC R1 Photo Point 86 – view upstream (04/25/2018)**



**UFC R1 Photo Point 86 – view downstream (04/25/2018)**



**UFC R1 Photo Point 87 – view upstream (04/25/2018)**



**UFC R1 Photo Point 87 – view downstream (04/25/2018)**



**UFC R2 Photo Point 88 – view upstream (04/25/2018)**



**UFC R2 Photo Point 88 – view downstream (04/25/2018)**



**UFC R2 Photo Point 89 – view upstream (04/25/2018)**



**UFC R2 Photo Point 89 – view downstream (04/25/2018)**



**UFC R2 Photo Point 90 – view upstream (04/25/2018)**



**UFC R2 Photo Point 90 – view downstream (04/25/2018)**



**UFC R2 Photo Point 91 – view upstream (04/25/2018)**



**UFC R2 Photo Point 91 – view downstream (04/25/2018)**



**UFC R2 Photo Point 92 – view upstream (04/25/2018)**



**UFC R2 Photo Point 92 – view downstream (04/25/2018)**



**LFC R1 Photo Point 93 – view upstream (04/26/2018)**



**LFC R1 Photo Point 93 – view downstream (04/26/2018)**



**LFC R1 Photo Point 94 – view upstream (04/26/2018)**



**LFC R1 Photo Point 94 – view downstream (04/26/2018)**



**LFC R2 Photo Point 95 – view upstream (04/26/2018)**



**LFC R2 Photo Point 95 – view downstream (04/26/2018)**

## **STREAM PHOTOGRAPHS**

Big Harris Creek - Area C  
Monitoring Year 0



**LBHC R1A Photo Point 96 – view upstream (05/14/2018)**



**LBHC R1A Photo Point 96 – view downstream (05/14/2018)**



**LBHC R1A Photo Point 97 – view upstream (05/14/2018)**



**LBHC R1A Photo Point 97 – view downstream (05/14/2018)**



**LBHC R1B Photo Point 98 – view upstream (05/14/2018)**



**LBHC R1B Photo Point 98 – view downstream (05/14/2018)**



**LBHC R2 Photo Point 99 – view upstream (05/14/2018)**



**LBHC R2 Photo Point 99 – view downstream (05/14/2018)**



**LBHC R2 Photo Point 100 – view upstream (05/14/2018)**



**LBHC R2 Photo Point 100 – view downstream (05/14/2018)**



**LBHC R2 Photo Point 101 – view upstream (05/14/2018)**



**LBHC R2 Photo Point 101 – view downstream (05/14/2018)**



**LBHC R3 Photo Point 102 – view upstream (05/14/2018)**



**LBHC R3 Photo Point 102 – view downstream (05/14/2018)**



**LBHC R3 Photo Point 103 – view upstream (05/14/2018)**



**LBHC R3 Photo Point 103 – view downstream (05/14/2018)**



**LBHC UT1 Photo Point 104 – view upstream (05/14/2018)**



**LBHC UT1 Photo Point 104 – view downstream (05/14/2018)**





**LBHC UT2 Photo Point 105** – view upstream (05/14/2018)



**LBHC UT2 Photo Point 105** – view downstream (05/14/2018)



**LBHC UT3 Photo Point 106** – view upstream (05/14/2018)



**LBHC UT3 Photo Point 106** – view downstream (05/14/2018)



**LBHC UT4 Photo Point 107** – view upstream (05/14/2018)



**LBHC UT4 Photo Point 107** – view downstream (05/14/2018)

### **APPENDIX 3. Vegetation Plot Data**

Table 9. Planted and Total Stems

Big Harris Creek Mitigation Site  
DMS Project No. 739

Monitoring Year 0 - 2018

Current Plot Data (MY0 2018) - Area A																							
Scientific Name	Common Name	Species Type	Vegetation Plot 1			Vegetation Plot 2			Vegetation Plot 3			Vegetation Plot 4			Vegetation Plot 5			Vegetation Plot 6			Vegetation Plot 7		
			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
<i>Acer rubrum</i>	Red maple	Tree	5	5	5	4	4	4	3	3	3	4	4	4	5	5	5	3	3	3	3	3	3
<i>Betula nigra</i>	River birch	Tree	1	1	1	1	1	1	1	1	1	1	1	1	3	3	3	1	1	1	3	3	3
<i>Fraxinus pennsylvanica</i>	Green ash	Tree	3	3	3	1	1	1	4	4	4	2	2	2	3	3	3	5	5	5	2	2	2
<i>Nyssa sylvatica</i>	Blackgum	Tree	1	1	1	1	1	1	2	2	2	1	1	1				2	2	2	2	2	2
<i>Platanus occidentalis</i>	American sycamore	Tree	4	4	4	6	6	6	1	1	1	4	4	4	5	5	5						
<i>Quercus sp.</i>	Oak	Tree																					
<i>Quercus pagoda</i>	Cherrybark oak	Tree	1	1	1	2	2	2	1	1	1	2	2	2				1	1	1	1	1	1
<i>Quercus phellos</i>	Willow oak	Tree	1	1	1				2	2	2	1	1	1				3	3	3			
<i>Quercus rubra</i>	Red oak	Tree				1	1	1	2	2	2	1	1	1				1	1	1	1	1	1
Stem count			16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16
Size (ares)			1			1			1			1			1			1			1		
Size (ACRES)			0.02			0.02			0.02			0.02			0.02			0.02			0.02		
Species count			7	7	7	7	7	7	8	8	8	8	8	8	4	4	4	7	7	7	7	7	7
Stems per ACRE			647	647	647	647	647	647	647	647	647	647	647	647	647	647	647	647	647	647	647	647	647

Current Plot Data (MY0 2018) - Area A																							
Scientific Name	Common Name	Species Type	Vegetation Plot 8			Vegetation Plot 9			Vegetation Plot 10			Vegetation Plot 11			Vegetation Plot 12			Vegetation Plot 13			Vegetation Plot 14		
			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
<i>Acer rubrum</i>	Red maple	Tree	3	3	3	4	4	4	5	5	5	3	3	3	4	4	4	5	5	5	3	3	3
<i>Betula nigra</i>	River birch	Tree	1	1	1							1	1	1	3	3	3	3	3	3	1	1	1
<i>Fraxinus pennsylvanica</i>	Green ash	Tree	5	5	5	4	4	4	3	3	3	4	4	4	2	2	2	2	2	2	3	3	3
<i>Nyssa sylvatica</i>	Blackgum	Tree										1	1	1				1	1	1	1	1	1
<i>Platanus occidentalis</i>	American sycamore	Tree	4	4	4	7	7	7	7	7	7	5	5	5	5	5	5	2	2	2	6	6	6
<i>Quercus sp.</i>	Oak	Tree																					
<i>Quercus pagoda</i>	Cherrybark oak	Tree	1	1	1				1	1	1				1	1	1	2	2	2	1	1	1
<i>Quercus phellos</i>	Willow oak	Tree	1	1	1	1	1	1							1	1	1	1	1	1	1	1	1
<i>Quercus rubra</i>	Red oak	Tree	1	1	1							2	2	2	1	1	1	1	1	1	1	1	1
Stem count			16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16
Size (ares)			1			1			1			1			1			1			1		
Size (ACRES)			0.02			0.02			0.02			0.02			0.02			0.02			0.02		
Species count			7	7	7	4	4	4	4	4	4	6	6	6	6	6	6	7	7	7	7	7	7
Stems per ACRE			647	647	647	647	647	647	647	647	647	647	647	647	647	647	647	647	647	647	647	647	647

Current Plot Data (MY0 2018) - Area A																							
Scientific Name	Common Name	Species Type	Vegetation Plot 15			Vegetation Plot 16			Vegetation Plot 17			Vegetation Plot 18			Vegetation Plot 19			Vegetation Plot 20			Vegetation Plot 21		
			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
<i>Acer rubrum</i>	Red maple	Tree	1	1	1	1	1	1	5	5	5				4	4	4	1	1	1	3	3	3
<i>Betula nigra</i>	River birch	Tree	4	4	4	1	1	1	1	1	1	2	2	2				3	3	3	2	2	2
<i>Fraxinus pennsylvanica</i>	Green ash	Tree	2	2	2	6	6	6	3	3	3	5	5	5	1	1	1	2	2	2	2	2	2
<i>Nyssa sylvatica</i>	Blackgum	Tree							2	2	2	1	1	1	3	3	3				2	2	2
<i>Platanus occidentalis</i>	American sycamore	Tree	2	2	2	5	5	5	3	3	3				4	4	4	5	5	5	5	5	5
<i>Quercus sp.</i>	Oak	Tree																					
<i>Quercus pagoda</i>	Cherrybark oak	Tree	2	2	2							2	2	2				1	1	1	1	1	1
<i>Quercus phellos</i>	Willow oak	Tree							2	2	2	2	2	2				1	1	1	3	3	3
<i>Quercus rubra</i>	Red oak	Tree										1	1	1	1	1	1	1	1	1	1	1	1
Stem count			11	11	11	13	13	13	16	16	16	13	13	13	13	13	13	13	13	13	16	16	16
Size (ares)			1			1			1			1			1			1			1		
Size (ACRES)			0.02			0.02			0.02			0.02			0.02			0.02			0.02		
Species count			5	5	5	4	4	4	6	6	6	6	6	6	5	5	5	6	6	6	8	8	8
Stems per ACRE			445	445	445	526	526	526	647	647	647	526	526	526	526	526	526	526	526	526	647	647	647

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%  
Volunteers included

PnoLS: Number of planted stems excluding live stakes  
P-All: Number of planted stems including live stakes  
T: Total stems

**Table 9. Planted and Total Stems**

Big Harris Creek Mitigation Site  
 DMS Project No. 739  
 Monitoring Year 0 - 2018

		Current Plot Data (MYO 2018) - Area A																						
Scientific Name	Common Name	Species Type	Vegetation Plot 22			Vegetation Plot 23			Vegetation Plot 24			Vegetation Plot 25			Vegetation Plot 26			Vegetation Plot 27			Vegetation Plot 28			
			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	
<i>Acer rubrum</i>	Red maple	Tree	3	3	3	5	5	5	5	5	5	5	5	5	5	1	1	1	4	4	4	2	2	2
<i>Betula nigra</i>	River birch	Tree	1	1	1	2	2	2	2	2	2	3	3	3				2	2	2	1	1	1	
<i>Fraxinus pennsylvanica</i>	Green ash	Tree	3	3	3	2	2	2	1	1	1	1	1	1	4	4	4	1	1	1	3	3	3	
<i>Nyssa sylvatica</i>	Blackgum	Tree	1	1	1				2	2	2	1	1	1				2	2	2	2	2	2	
<i>Platanus occidentalis</i>	American sycamore	Tree	6	6	6	3	3	3	3	3	3	2	2	2	7	7	7				5	5	5	
<i>Quercus sp.</i>	Oak	Tree																						
<i>Quercus pagoda</i>	Cherrybark oak	Tree				1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
<i>Quercus phellos</i>	Willow oak	Tree	1	1	1	1	1	1				1	1	1	2	2	2				2	2	2	
<i>Quercus rubra</i>	Red oak	Tree				1	1	1	2	2	2	2	2	2	1	1	1	2	2	2	1	1	1	
<b>Stem count</b>			15	15	15	15	15	15	16	16	16	16	16	16	16	16	16	16	12	12	12	16	16	16
<b>Size (ares)</b>			1			1			1			1			1			1			1			
<b>Size (ACRES)</b>			0.02			0.02			0.02			0.02			0.02			0.02			0.02			
<b>Species count</b>			6	6	6	7	7	7	7	7	7	8	8	8	6	6	6	6	6	6	7	7	7	
<b>Stems per ACRE</b>			607	607	607	607	607	607	647	647	647	647	647	647	647	647	647	486	486	486	647	647	647	

		Current Plot Data (MYO 2018) - Area A																		
Scientific Name	Common Name	Species Type	Vegetation Plot 29			Vegetation Plot 30			Vegetation Plot 31			Vegetation Plot 32			Vegetation Plot 33			Vegetation Plot 34		
			PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T
<i>Acer rubrum</i>	Red maple	Tree				5	5	5	2	2	2	1	1	1	5	5	5	1	1	1
<i>Betula nigra</i>	River birch	Tree	5	5	5	1	1	1	2	2	2	3	3	3	2	2	2	1	1	1
<i>Fraxinus pennsylvanica</i>	Green ash	Tree				3	3	3	4	4	4	2	2	2	3	3	3	3	3	3
<i>Nyssa sylvatica</i>	Blackgum	Tree	3	3	3				1	1	1	3	3	3				5	5	5
<i>Platanus occidentalis</i>	American sycamore	Tree	4	4	4	6	6	6	1	1	1	3	3	3	2	2	2	1	1	1
<i>Quercus sp.</i>	Oak	Tree																		
<i>Quercus pagoda</i>	Cherrybark oak	Tree				1	1	1	2	2	2	1	1	1	1	1	1	1	1	1
<i>Quercus phellos</i>	Willow oak	Tree	2	2	2				3	3	3	1	1	1	1	1	1	1	1	1
<i>Quercus rubra</i>	Red oak	Tree	1	1	1				1	1	1	2	2	2	2	2	2	1	1	1
<b>Stem count</b>			15	15	15	16	16	16	16	16	16	16	16	16	16	16	16	13	13	13
<b>Size (ares)</b>			1			1			1			1			1			1		
<b>Size (ACRES)</b>			0.02			0.02			0.02			0.02			0.02			0.02		
<b>Species count</b>			5	5	5	5	5	5	8	8	8	8	8	8	7	7	7	7	7	7
<b>Stems per ACRE</b>			607	607	607	647	647	647	647	647	647	647	647	647	647	647	647	526	526	526

		Current Plot Data (MYO 2018) - Area B																						
Scientific Name	Common Name	Species Type	Vegetation Plot 35			Vegetation Plot 36			Vegetation Plot 37			Vegetation Plot 38			Vegetation Plot 39			Vegetation Plot 40			Vegetation Plot 41			
			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	
<i>Acer rubrum</i>	Red maple	Tree	2	2	2	6	6	6	5	5	5	2	2	2	3	3	3	3	3	3	5	5	5	
<i>Betula nigra</i>	River birch	Tree	2	2	2				1	1	1	1	1	1				1	1	1	1	1	1	
<i>Fraxinus pennsylvanica</i>	Green ash	Tree	2	2	2	3	3	3	3	3	3	5	5	5	3	3	3	2	2	2	4	4	4	
<i>Nyssa sylvatica</i>	Blackgum	Tree	2	2	2										1	1	1	1	1	1	2	2	2	
<i>Platanus occidentalis</i>	American sycamore	Tree	3	3	3	7	7	7	3	3	3	5	5	5	6	6	6	6	6	6	1	1	1	
<i>Quercus sp.</i>	Oak	Tree																						
<i>Quercus pagoda</i>	Cherrybark oak	Tree	1	1	1				2	2	2				2	2	2	3	3	3				
<i>Quercus phellos</i>	Willow oak	Tree	1	1	1				2	2	2	2	2	2							2	2	2	
<i>Quercus rubra</i>	Red oak	Tree	3	3	3				1	1	1	1	1	1	1	1	1				1	1	1	
<b>Stem count</b>			16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16
<b>Size (ares)</b>			1			1			1			1			1			1			1			
<b>Size (ACRES)</b>			0.02			0.02			0.02			0.02			0.02			0.02			0.02			
<b>Species count</b>			8	8	8	3	3	3	6	6	6	6	6	6	6	6	6	6	6	6	7	7	7	
<b>Stems per ACRE</b>			647	647	647	647	647	647	647	647	647	647	647	647	647	647	647	647	647	647	647	647	647	

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%  
 Volunteers included

PnoLS: Number of planted stems excluding live stakes  
 P-All: Number of planted stems including live stakes  
 T: Total stems

Table 9. Planted and Total Stems

Big Harris Creek Mitigation Site

DMS Project No. 739

Monitoring Year 0 - 2018

Current Plot Data (MYO 2018) - Area B																							
Scientific Name	Common Name	Species Type	Vegetation Plot 42			Vegetation Plot 43			Vegetation Plot 44			Vegetation Plot 45			Vegetation Plot 46			Vegetation Plot 47			Vegetation Plot 48		
			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
<i>Acer rubrum</i>	Red maple	Tree	1	1	1	2	2	2	3	3	3	2	2	2	2	2	2	5	5	5	3	3	3
<i>Betula nigra</i>	River birch	Tree				5	5	5	2	2	2	4	4	4	2	2	2	2	2	2	1	1	1
<i>Fraxinus pennsylvanica</i>	Green ash	Tree	6	6	6	4	4	4	2	2	2	2	2	2	6	6	6	3	3	3	3	3	3
<i>Nyssa sylvatica</i>	Blackgum	Tree	2	2	2				1	1	1	1	1	1	1	1	1				1	1	1
<i>Platanus occidentalis</i>	American sycamore	Tree	3	3	3	3	3	3	4	4	4	5	5	5	4	4	4	6	6	6	3	3	3
<i>Quercus sp.</i>	Oak	Tree																					
<i>Quercus pagoda</i>	Cherrybark oak	Tree	2	2	2							1	1	1	1	1	1				2	2	2
<i>Quercus phellos</i>	Willow oak	Tree										1	1	1	1	1	1				1	1	1
<i>Quercus rubra</i>	Red oak	Tree				2	2	2	4	4	4										2	2	2
Stem count			14	14	14	16	16	16	16	16	16	16	16	16	17	17	17	16	16	16	16	16	16
Size (ares)			1			1			1			1			1			1			1		
Size (ACRES)			0.02			0.02			0.02			0.02			0.02			0.02			0.02		
Species count			5	5	5	5	5	5	6	6	6	7	7	7	7	7	7	4	4	4	8	8	8
Stems per ACRE			567	567	567	647	647	647	647	647	647	647	647	647	688	688	688	647	647	647	647	647	647

Current Plot Data (MYO 2018) - Area B														
Scientific Name	Common Name	Species Type	Vegetation Plot 49			Vegetation Plot 50			Vegetation Plot 51			Vegetation Plot 52		
			PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T
<i>Acer rubrum</i>	Red maple	Tree	3	3	3	2	2	2	2	2	2	1	1	1
<i>Betula nigra</i>	River birch	Tree	4	4	4	2	2	2	3	3	3	2	2	2
<i>Fraxinus pennsylvanica</i>	Green ash	Tree	2	2	2	4	4	4	3	3	3	5	5	5
<i>Nyssa sylvatica</i>	Blackgum	Tree	2	2	2				2	2	2			
<i>Platanus occidentalis</i>	American sycamore	Tree	2	2	2	4	4	4	2	2	2	4	4	4
<i>Quercus sp.</i>	Oak	Tree												
<i>Quercus pagoda</i>	Cherrybark oak	Tree	1	1	1	2	2	2				1	1	1
<i>Quercus phellos</i>	Willow oak	Tree	1	1	1	1	1	1	2	2	2	3	3	3
<i>Quercus rubra</i>	Red oak	Tree	1	1	1	1	1	1	2	2	2	3	3	3
Stem count			16	16	16	16	16	16	16	16	16	16	16	16
Size (ares)			1			1			1			1		
Size (ACRES)			0.02			0.02			0.02			0.02		
Species count			8	8	8	7	7	7	7	7	7	6	6	6
Stems per ACRE			647	647	647	647	647	647	647	647	647	647	647	647

Current Plot Data (MYO 2018) - Area C														Annual Summaries			
Scientific Name	Common Name	Species Type	Vegetation Plot 53			Vegetation Plot 54			Vegetation Plot 55			Vegetation Plot 56			MYO (3/2017)		
			PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T
<i>Acer rubrum</i>	Red maple	Tree	1	1	1	2	2	2	4	4	4	4	4	4	171	171	171
<i>Betula nigra</i>	River birch	Tree	4	4	4	1	1	1	3	3	3				99	99	99
<i>Fraxinus pennsylvanica</i>	Green ash	Tree	5	5	5	1	1	1	3	3	3	2	2	2	167	167	167
<i>Nyssa sylvatica</i>	Blackgum	Tree				1	1	1				2	2	2	59	59	59
<i>Platanus occidentalis</i>	American sycamore	Tree	6	6	6	5	5	5	4	4	4	2	2	2	212	212	212
<i>Quercus sp.</i>	Oak	Tree	3	3	3										3	3	3
<i>Quercus pagoda</i>	Cherrybark oak	Tree				3	3	3	2	2	2	1	1	1	55	55	55
<i>Quercus phellos</i>	Willow oak	Tree										2	2	2	46	46	46
<i>Quercus rubra</i>	Red oak	Tree				1	1	1				3	3	3	57	57	57
Stem count			19	19	19	14	14	14	16	16	16	16	16	16	869	869	869
Size (ares)			1			1			1			1			56		
Size (ACRES)			0.02			0.02			0.02			0.02			1.38		
Species count			5	5	5	7	7	7	5	5	5	7	7	7	9	9	9
Stems per ACRE			769	769	769	567	567	567	647	647	647	647	647	647	628	628	628

- 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%
- Volunteers included

PnoLS: Number of planted stems excluding live stakes  
 P-All: Number of planted stems including live stakes  
 T: Total stems

# **VEGETATION PHOTOGRAPHS**

Monitoring Year 0



**Vegetation Plot 1 (03/27/2018)**



**Vegetation Plot 2 (03/27/2018)**



**Vegetation Plot 3 (03/27/2018)**



**Vegetation Plot 4 (03/27/2018)**



**Vegetation Plot 5 (03/27/2018)**



**Vegetation Plot 6 (03/27/2018)**



**Vegetation Plot 7 (03/27/2018)**



**Vegetation Plot 8 (03/27/2018)**



**Vegetation Plot 9 (03/27/2018)**



**Vegetation Plot 10 (03/27/2018)**



**Vegetation Plot 11 (03/27/2018)**



**Vegetation Plot 12 (05/03/2018)**





**Vegetation Plot 13 (03/27/2018)**



**Vegetation Plot 14 (03/28/2018)**



**Vegetation Plot 15 (04/27/2018)**



**Vegetation Plot 16 (04/27/2018)**



**Vegetation Plot 17 (03/28/2018)**



**Vegetation Plot 18 (03/30/2018)**



**Vegetation Plot 19 (05/03/2018)**



**Vegetation Plot 20 (05/03/2018)**



**Vegetation Plot 21 (03/27/2018)**



**Vegetation Plot 22 (03/27/2018)**



**Vegetation Plot 23 (03/27/2018)**



**Vegetation Plot 24 (03/28/2018)**



**Vegetation Plot 25 (03/28/2018)**



**Vegetation Plot 26 (03/28/2018)**



**Vegetation Plot 27 (03/29/2018)**



**Vegetation Plot 28 (03/29/2018)**



**Vegetation Plot 29 (03/29/2018)**



**Vegetation Plot 30 (03/28/2018)**



**Vegetation Plot 31 (03/28/2018)**



**Vegetation Plot 32 (03/28/2018)**



**Vegetation Plot 33 (03/28/2018)**



**Vegetation Plot 34 (04/27/2018)**



**Vegetation Plot 35 (03/30/2018)**



**Vegetation Plot 36 (03/30/2018)**



**Vegetation Plot 37 (03/30/2018)**



**Vegetation Plot 38 (03/30/2018)**



**Vegetation Plot 39 (03/30/2018)**



**Vegetation Plot 40 (03/29/2018)**



**Vegetation Plot 41 (03/29/2018)**



**Vegetation Plot 42 (05/03/2018)**



**Vegetation Plot 43 (04/26/2018)**



**Vegetation Plot 44 (04/26/2018)**



**Vegetation Plot 45 (03/29/2018)**



**Vegetation Plot 46 (03/29/2018)**



**Vegetation Plot 47 (03/29/2018)**



**Vegetation Plot 48 (03/29/2018)**



**Vegetation Plot 49 (03/29/2018)**



**Vegetation Plot 50 (04/26/2018)**



**Vegetation Plot 51 (04/26/2018)**



**Vegetation Plot 52 (04/26/2018)**



**Vegetation Plot 53 (05/03/2018)**



**Vegetation Plot 54 (05/03/2018)**



**Vegetation Plot 55 (03/27/2018)**



**Vegetation Plot 56 (03/27/2018)**



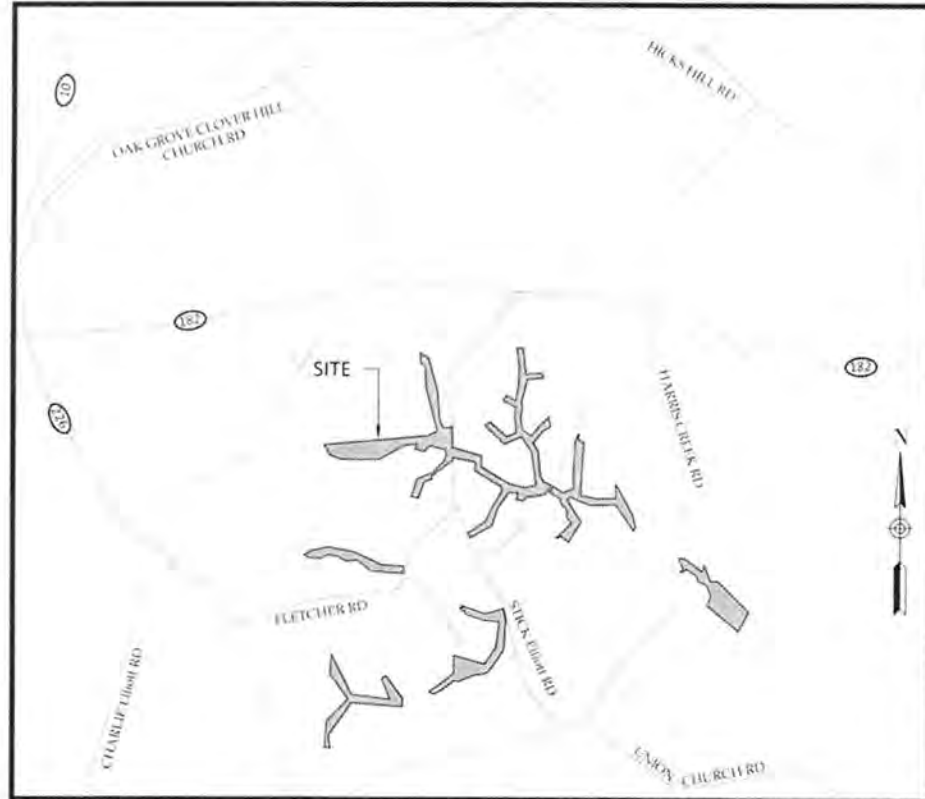
## **APPENDIX 4. Record Drawings**

# Big Harris Creek Mitigation Site

## Cleveland County, North Carolina

for  
NC DEQ

Division of Mitigation Services




Vicinity Map  
Not to Scale



ISSUED AUGUST 21, 2018  
RECORD DRAWINGS

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Scism Creek - BMP	2.3.1-2.3.4
Royster Creek	2.4.1-2.4.9
Royster Creek - BMP 2	2.4.10-2.4.11
Royster Creek - BMP 3	2.4.12
Royster Creek - BMP 4	2.4.13-2.4.15
Royster Creek - BMP 5	2.4.16-2.4.17
Lower Stick Elliott Creek	2.5.1-2.5.4
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Bridges Creek	2.10.1-2.10.2
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UT2 & UT3 to Upper Stick Elliott Creek	2.11.15
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UT5 to Upper Stick Elliott Creek	2.11.17
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Lower Fletcher Creek	2.13.1-2.13.3
Lower Big Harris Creek	2.14.1-2.14.8
Planting Sheets	3.0-3.11
Details	4.1

Project Directory	
<p><b>Engineering:</b> Wildlands Engineering, Inc. License No. F-0831 1430 South Mint Street Suite 104 Charlotte, NC 28203 Emily G. Reinicker, PE 704-332-7754</p>	<p><b>Owner:</b> NC DEQ Division of Mitigation Services 5 Ravenscroft Dr, Suite 102 Asheville, NC 28801 DMS Project Manager: Paul Wiesner 828-273-1673</p>
<p><b>Surveying:</b> Kee Mapping and Surveying 88 Central Avenue Asheville, NC 28801 Nolan Carmack, PLS 828-575-9021</p>	<p>DEQ Contract No. 6256 DMS ID No. 739</p>
 <p>BEFORE YOU DIG! CALL 1-800-632-4949 N.C. ONE-CALL CENTER IT'S THE LAW!</p>	

**CERTIFICATE OF SURVEY AND ACCURACY**

I, **NOLAN R. CARMACK**, CERTIFY THAT THE GROUND TOPOGRAPHIC SURVEY PORTION OF THIS PROJECT WAS COMPLETED UNDER MY DIRECT SUPERVISION FROM AN ACTUAL SURVEY MADE UNDER MY DIRECT SUPERVISION, THAT THE RECORD DRAWINGS WERE PREPARED BY WILDLANDS ENGINEERING, INC FROM DIGITAL FILES PROVIDED BY KEE MAPPING AND SURVEYING, PA AS SHOWN ON SURVEYS FOR "THE STATE OF NC, DIVISION OF MITIGATION SERVICES" DATED:

10/11/17, 12/5/17, 4/20/18, 5/16/18, 5/22/18, 5/24/18, & 6/11/18, THAT THESE SURVEYS WERE PERFORMED AT THE 95% CONFIDENCE LEVEL TO MEET THE FEDERAL GEOGRAPHIC DATA COMMITTEE STANDARDS, THAT THIS SURVEY WAS PERFORMED TO MEET THE REQUIREMENTS FOR A TOPOGRAPHIC SURVEY TO THE ACCURACY OF CLASS A HORIZONTAL AND CLASS C VERTICAL WHERE APPLICABLE, THAT THE ORIGINAL DATA WAS OBTAINED BETWEEN THE DATES OF 09/18/17-05/16/18, THAT THE CONTOURS SHOWN AS BROKEN LINES MAY NOT MEET THE STATED STANDARD AND ALL COORDINATES ARE BASED ON NAD 83 (NARS 2011) AND ALL ELEVATIONS ARE BASE ON NAVD 88; THAT THIS MAP MEETS THE SPECIFICATIONS FOR TOPOGRAPHIC SURVEYS AS STATED IN TITLE 21, CHAPTER 56, SECTION 1606; THAT THIS MAP WAS NOT PREPARED IN ACCORDANCE WITH G.S. 47-30, AS AMENDED AND DOES NOT REPRESENT AN OFFICIAL BOUNDARY SURVEY.

WITNESS MY ORIGINAL SIGNATURE, REGISTRATION NUMBER, AND SEAL THIS THE 20th DAY OF August, 2018

OFFICIAL SEAL



NOLAN R. CARMACK, PLS | 5078

**WILDLANDS ENGINEERING, INC.**  
1430 S. Mint Street, Ste 104  
Charlotte, NC 28203  
Tel: 704.332.7754  
Fax: 704.332.5306  
Firm License No. F-0831



Big Harris Creek Mitigation Site  
Cleveland County, North Carolina

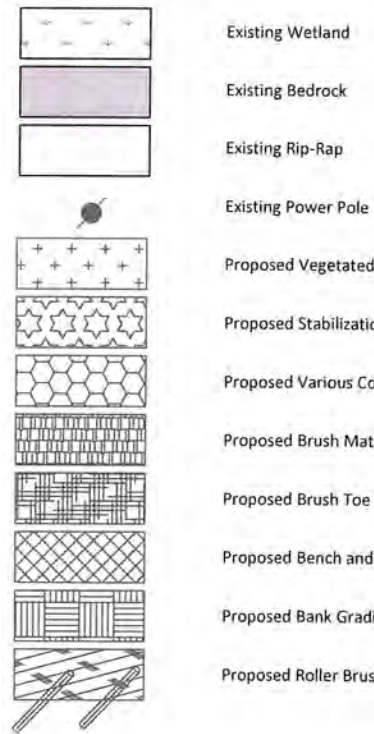
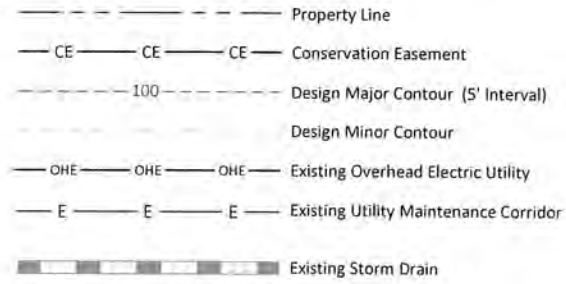
Title Sheet

August 21, 2018  
104-60123  
FCR-AA  
FS  
ICK

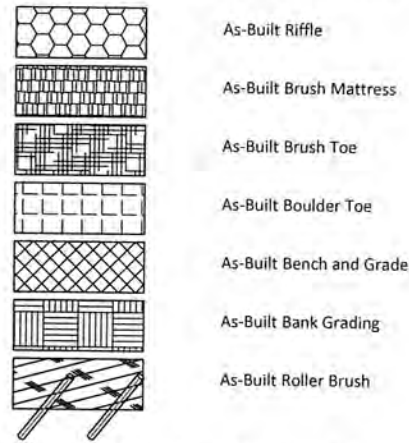
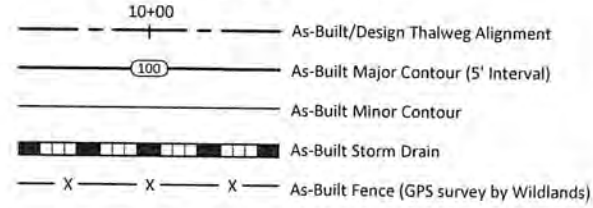
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AS-BUILT DRAWINGS  
 Deviations from the design will be shown in red

### Existing/Design Features



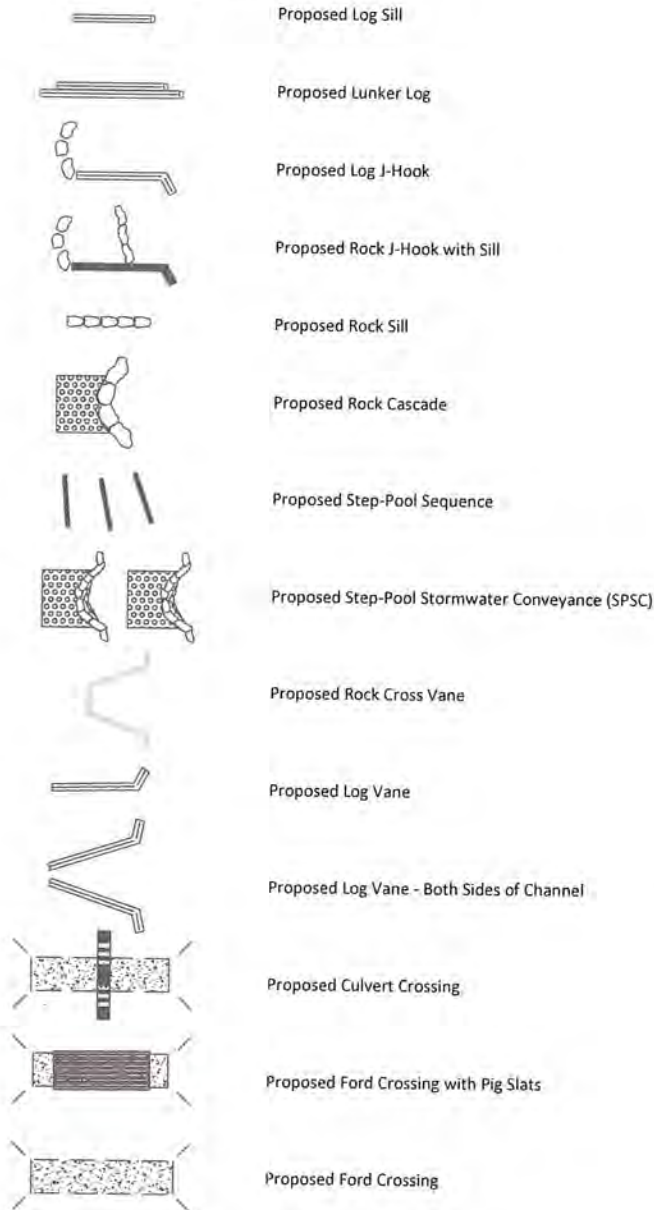
### As-Built Features



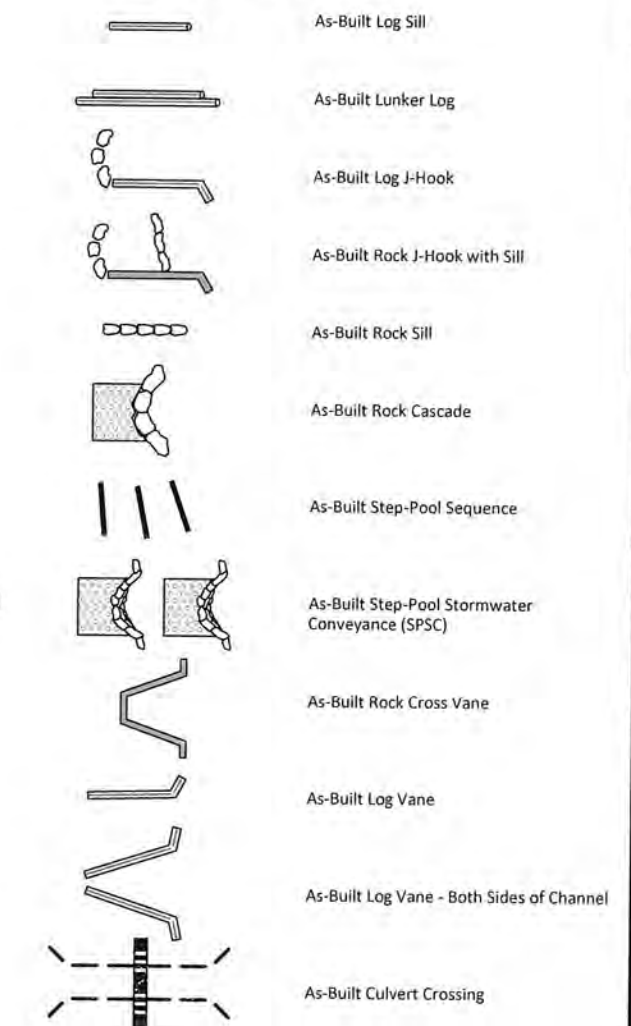
### Monitoring Features



### Design Structures



### As-Built Structures



#### PROJECT NOTES:

- As-Built survey was completed by Kee Mapping and Survey in May 2018. Topographic data was collected for restoration reaches and channel re-alignment sections only. Areas of isolated enhancement work (bank grading, structures, and BMPs) have been indicated by the engineer on the record drawings from construction phase notation.
- Topographic survey was completed by Stantec Engineering in 2008. Supplemental topographic survey completed by Kee Mapping and Survey in August 2015.
- A Conservation Easement has been recorded for the project. The easement is shown throughout the plan set.

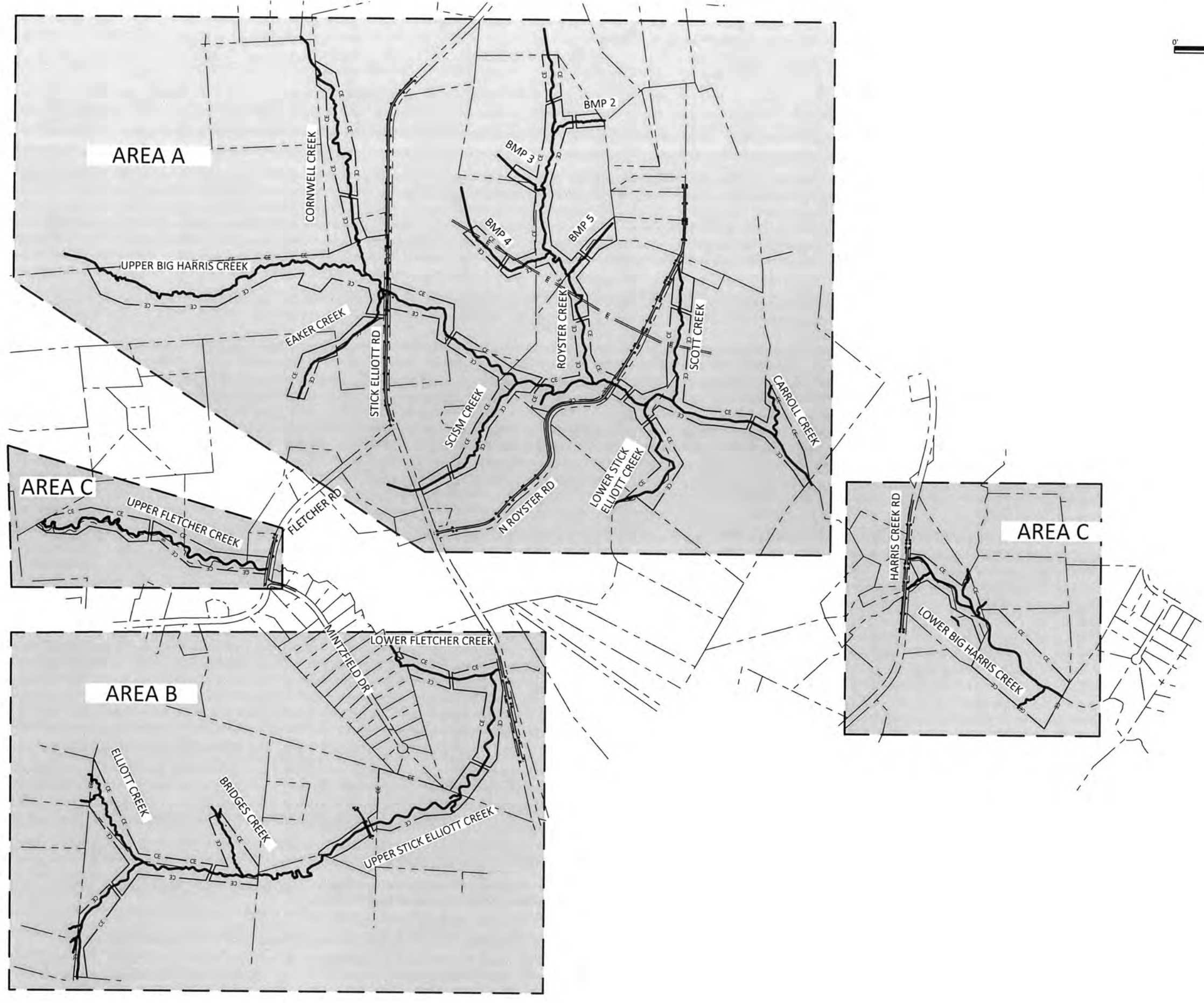


Revision	Date	By	Check

Date: August 21, 2018  
 Job Number: 00547123  
 Designed By: EGR, AA  
 Drawn By: JS  
 Checked By: JCK

0.2

C:\Users\jshubbs\OneDrive\Documents\Big Harris Creek Mitigation\Drawings\11.1 Overview.dwg August 21, 2018



Date:	August 21, 2018
Job Number:	005-07123
Designed By:	EGE, A.A.
Drawn By:	JS
Checked By:	JCK

Revision

1.1

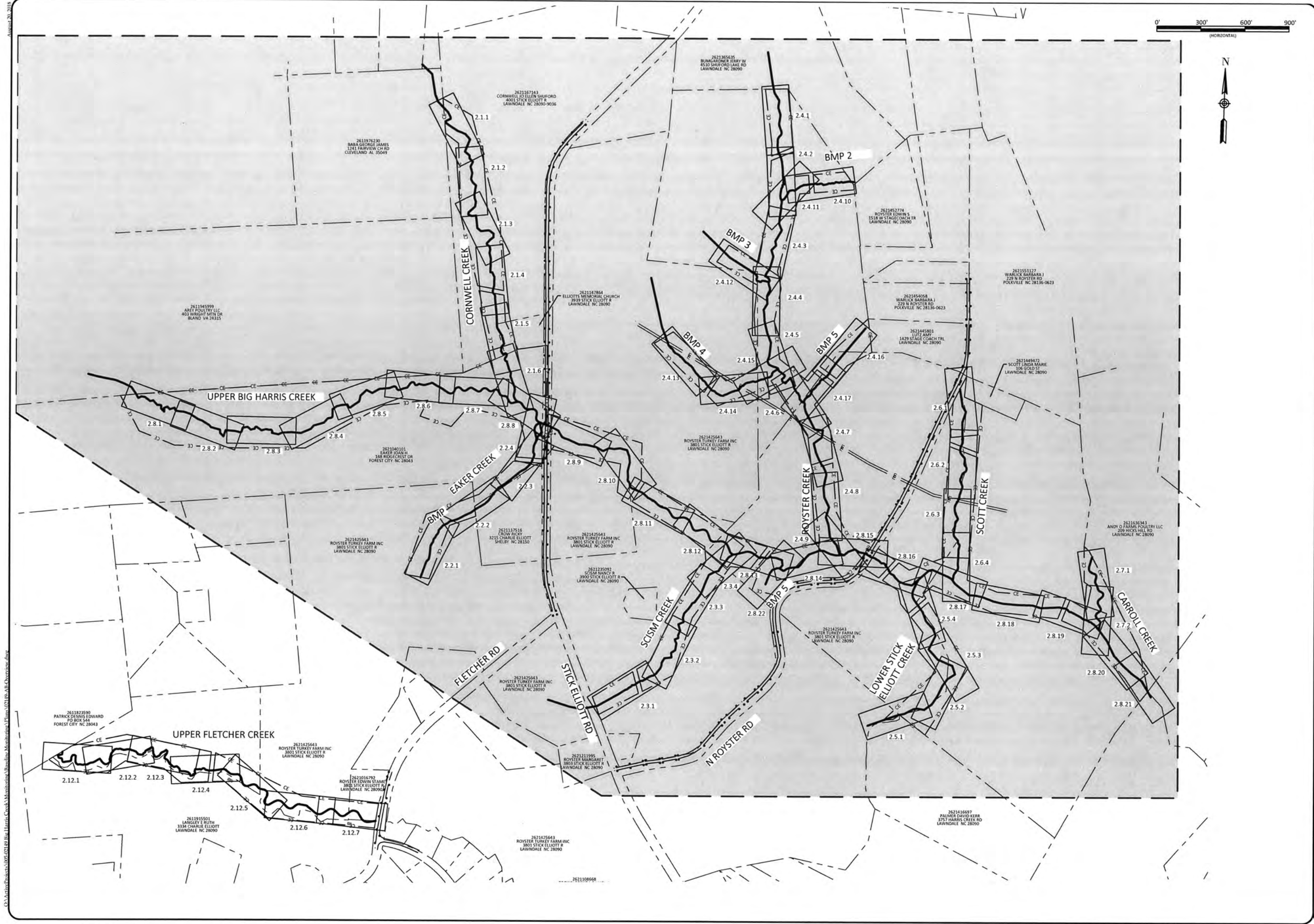
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**Big Harris Creek Mitigation Site**  
**Cleveland County, North Carolina**

Project Overview

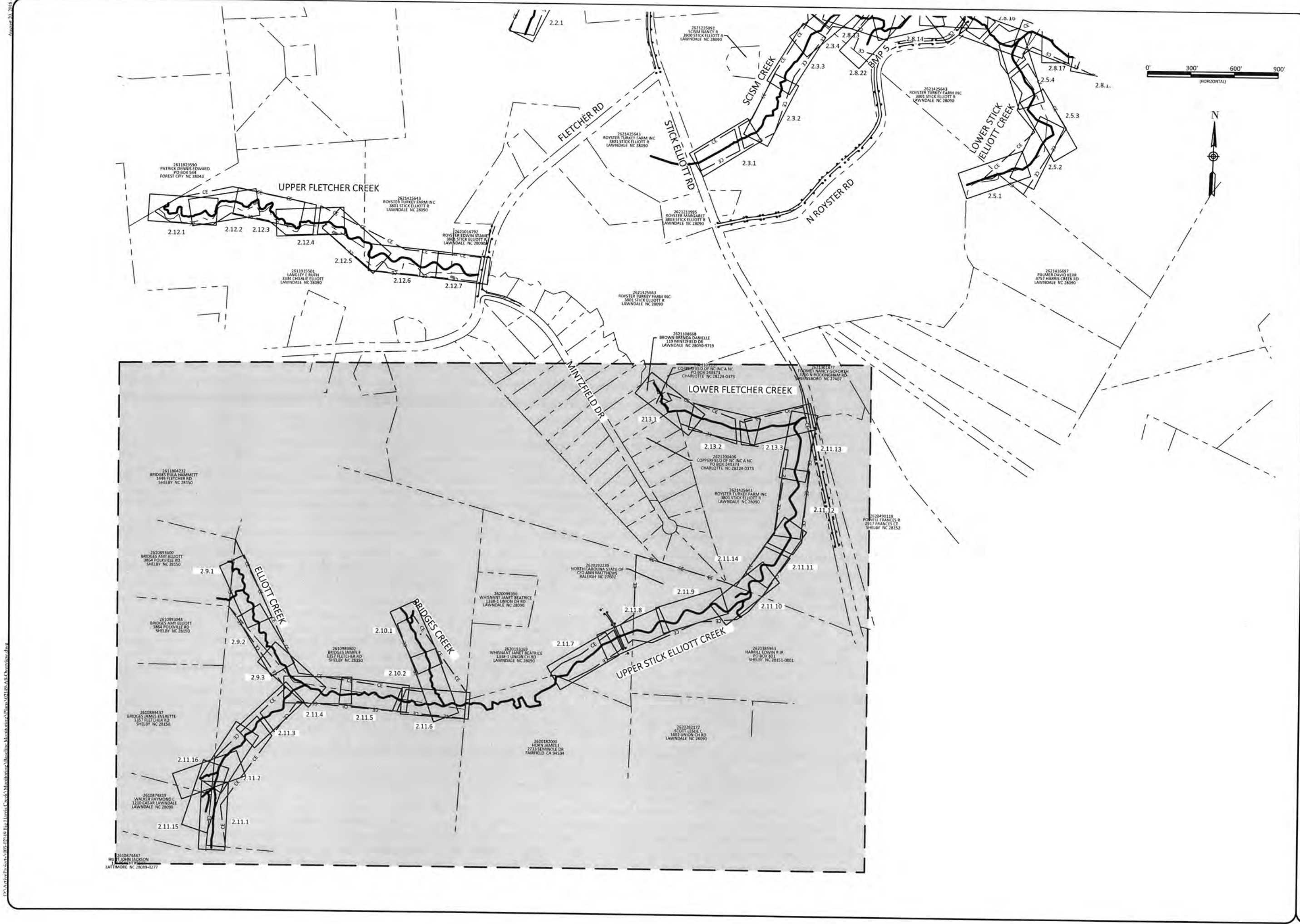


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**Big Harris Creek Mitigation Site**  
**Cleveland County, North Carolina**  
 Project Overview - Area A

Date:	August 21, 2018
Job Number:	005-02123
Designed By:	EGR, AA
Drawn By:	JS
Checked By:	JCK
Scale:	1.2



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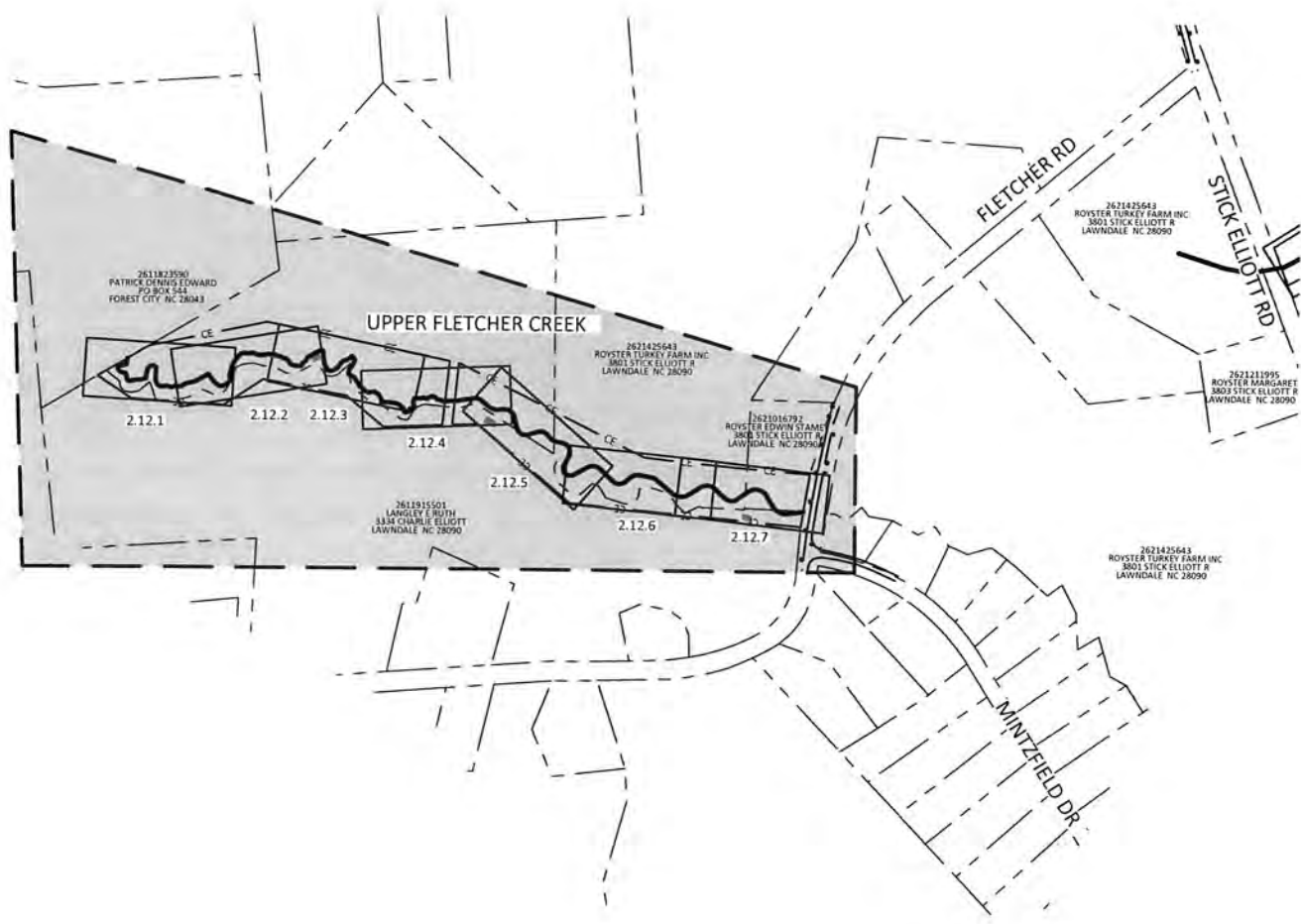


**Big Harris Creek Mitigation Site**  
 Cleveland County, North Carolina  
 Project Overview - Area B


Date: August 21, 2018  
 Job Number: 005-02123  
 Designed By: EGR, AIA  
 Drawn By: JS  
 Checked By: JCK

**1.3**

Sheet



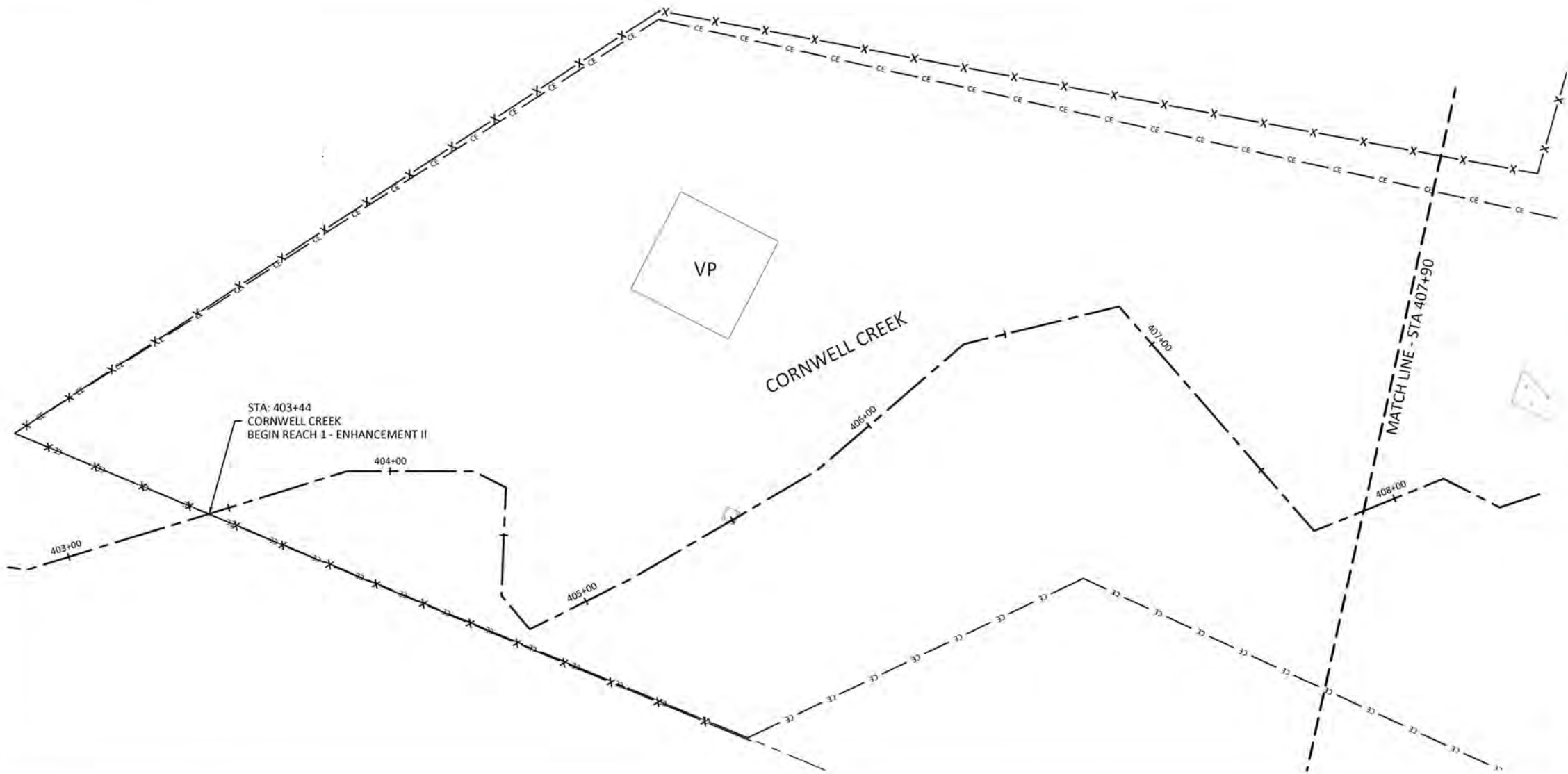
Big Harris Creek Mitigation Site  
Cleveland County, North Carolina  
Project Overview - Area C

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Charlotte, NC 28203  
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Date:	August 21, 2018
Job Number:	005-02123
Designed By:	EGR, AA
Drawn By:	JS
Checked By:	JCK

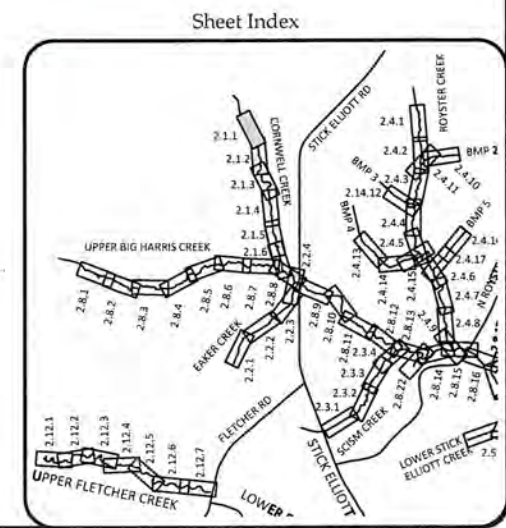
1.4



STA: 403+44  
 CORNWELL CREEK  
 BEGIN REACH 1 - ENHANCEMENT II

- REACH TREATMENT:
1. FENCE OUT CATTLE - REFER TO FENCING PLAN SHEETS
  2. TREAT INVASIVE SPECIES - REFER TO PLANTING PLAN SHEETS.
  3. REPLANT ALONG ENTIRE REACH - REFER TO PLANTING PLAN SHEETS.

NOTE:  
 SURVEY WAS NOT CONDUCTED IN ENHANCEMENT II REACHES. REACHES WERE BUILT PER DESIGN UNLESS OTHERWISE NOTED.



Big Harris Creek Mitigation Site  
 Cleveland County, North Carolina  
 Cornwell Creek  
 Stream Plan and Profile Record Drawings

Date:	August 21, 2018
Job Number:	005-02123
Designed By:	EGR, A.A.
Drawn By:	JS
Checked By:	JCK

2.1.1

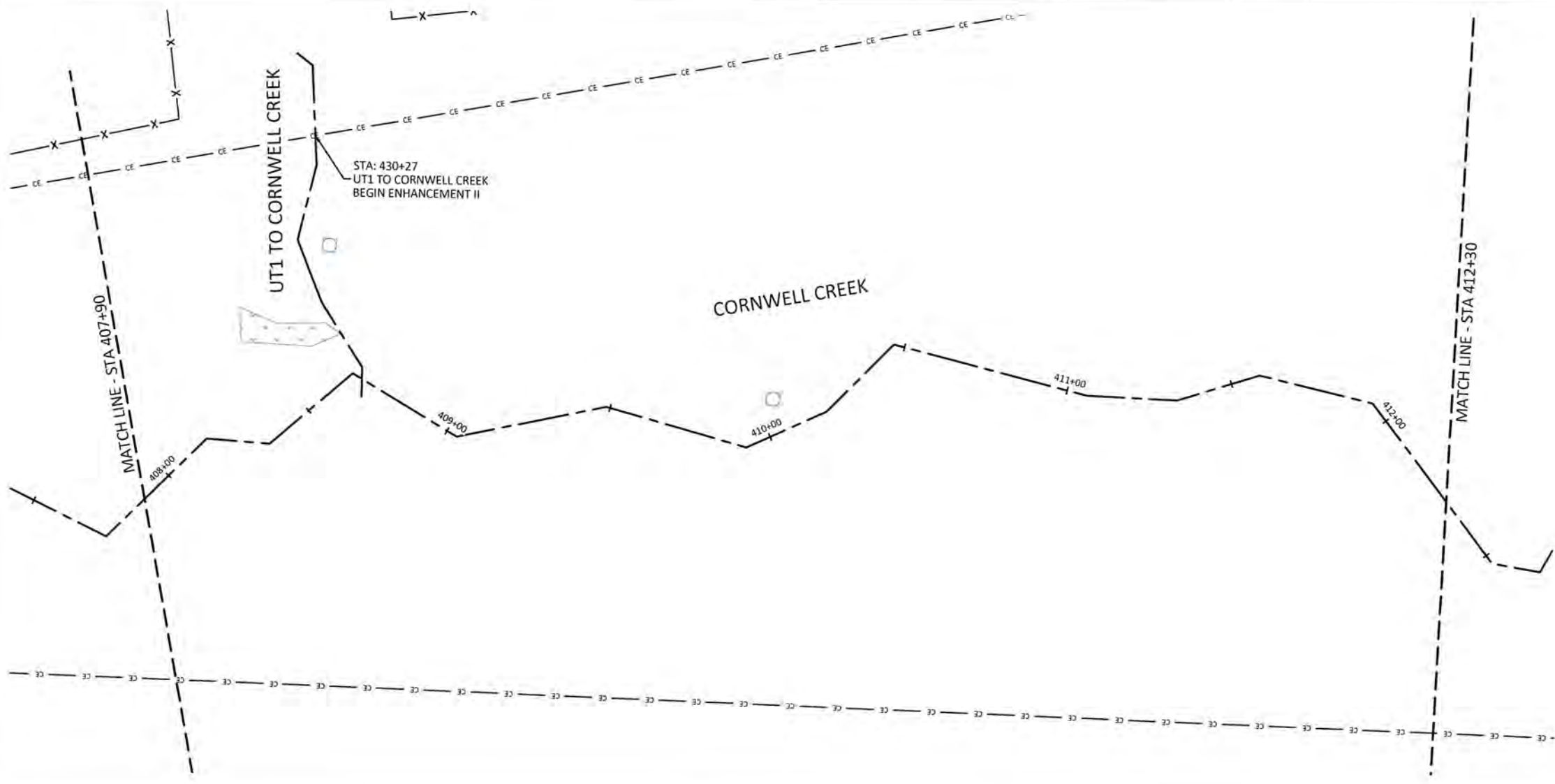
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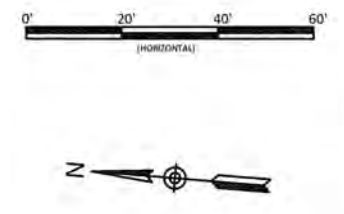
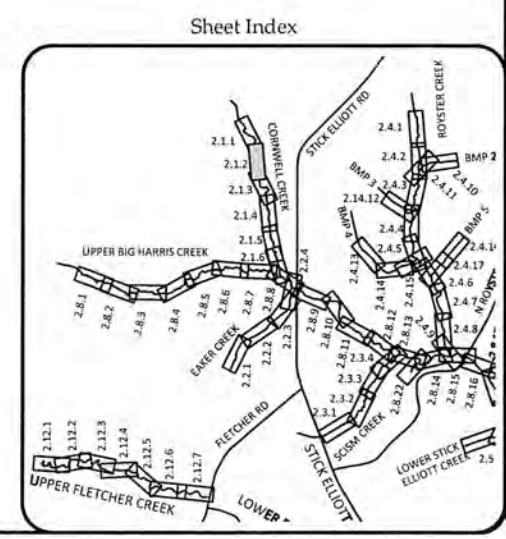


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- REACH TREATMENT:
1. FENCE OUT CATTLE - REFER TO FENCING PLAN SHEETS
  2. TREAT INVASIVE SPECIES - REFER TO PLANTING PLAN SHEETS.
  3. REPLANT ALONG ENTIRE REACH - REFER TO PLANTING PLAN SHEETS.

NOTE:  
SURVEY WAS NOT CONDUCTED IN ENHANCEMENT II REACHES. REACHES WERE BUILT PER DESIGN UNLESS OTHERWISE NOTED.



Date	Revisions
August 21, 2018	
Job Number: 05-02123	
Designed By: ECR, AA	
Drawn By: JS	
Checked By: JCK	

Big Harris Creek Mitigation Site  
Cleveland County, North Carolina

Cornwell Creek  
Stream Plan and Profile Record Drawings

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Charlotte, NC 28205  
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2.1.2

Sheet

















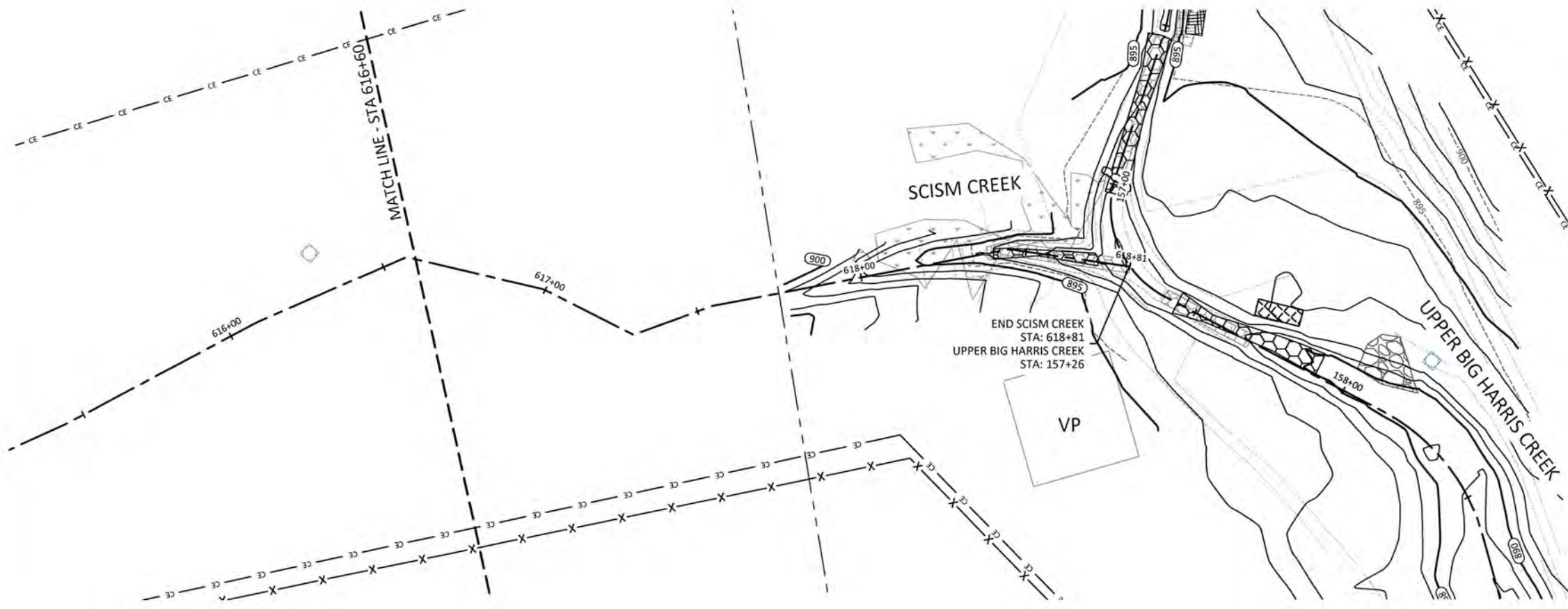
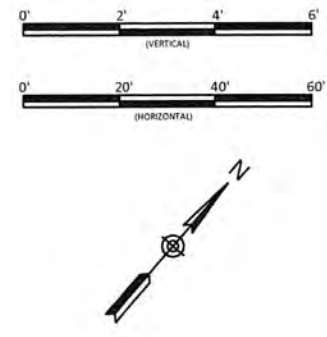
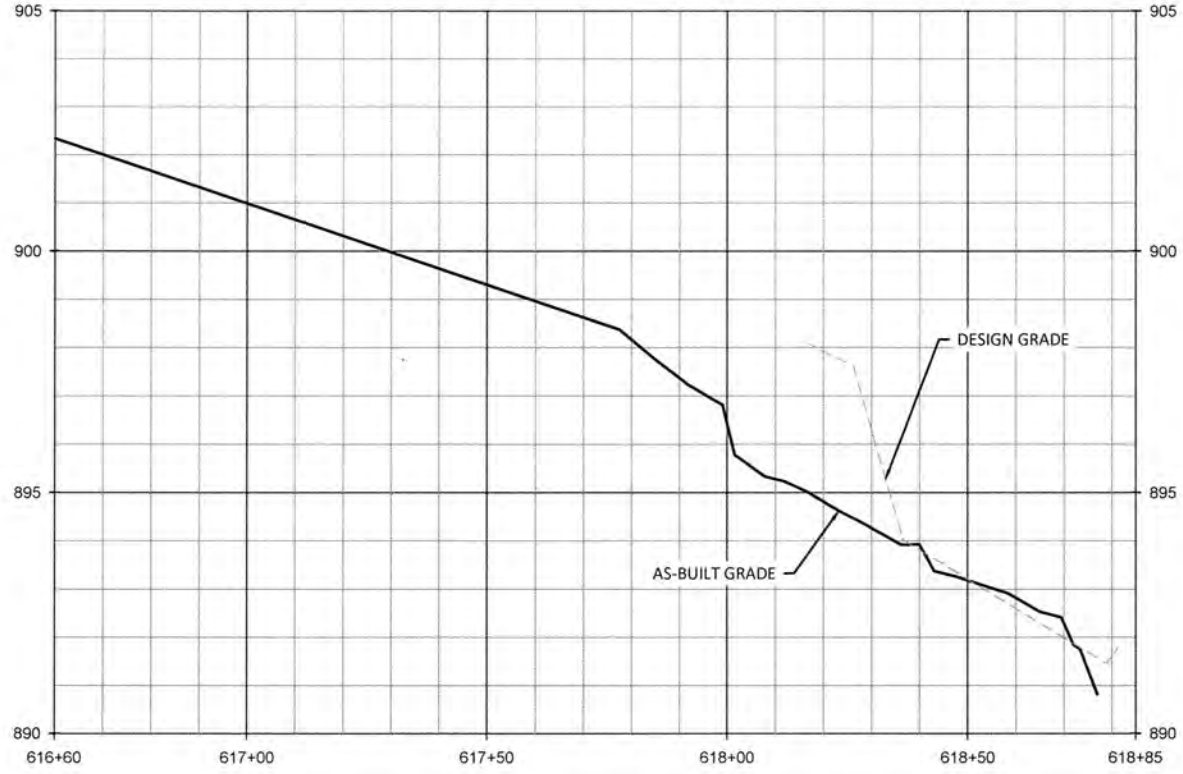






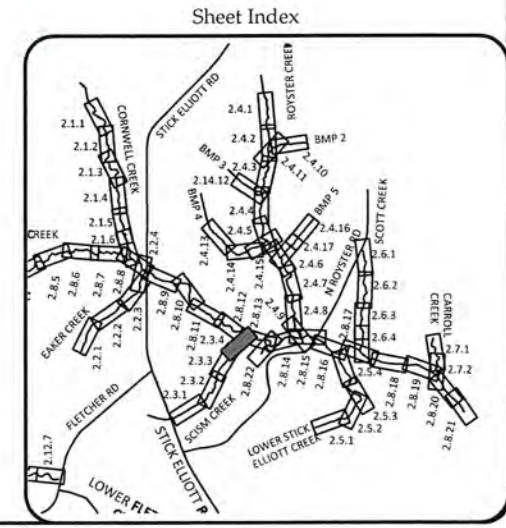


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- REACH TREATMENT:**
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**Big Harris Creek Mitigation Site**  
 Cleveland County, North Carolina

Scism Creek  
 Stream Plan and Profile Record Drawings

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Date: August 21, 2018  
 Job Number: 005-02123  
 Designed By: ECR, AA  
 Drawn By: JS  
 Checked By: JCK

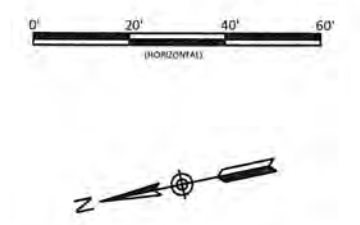
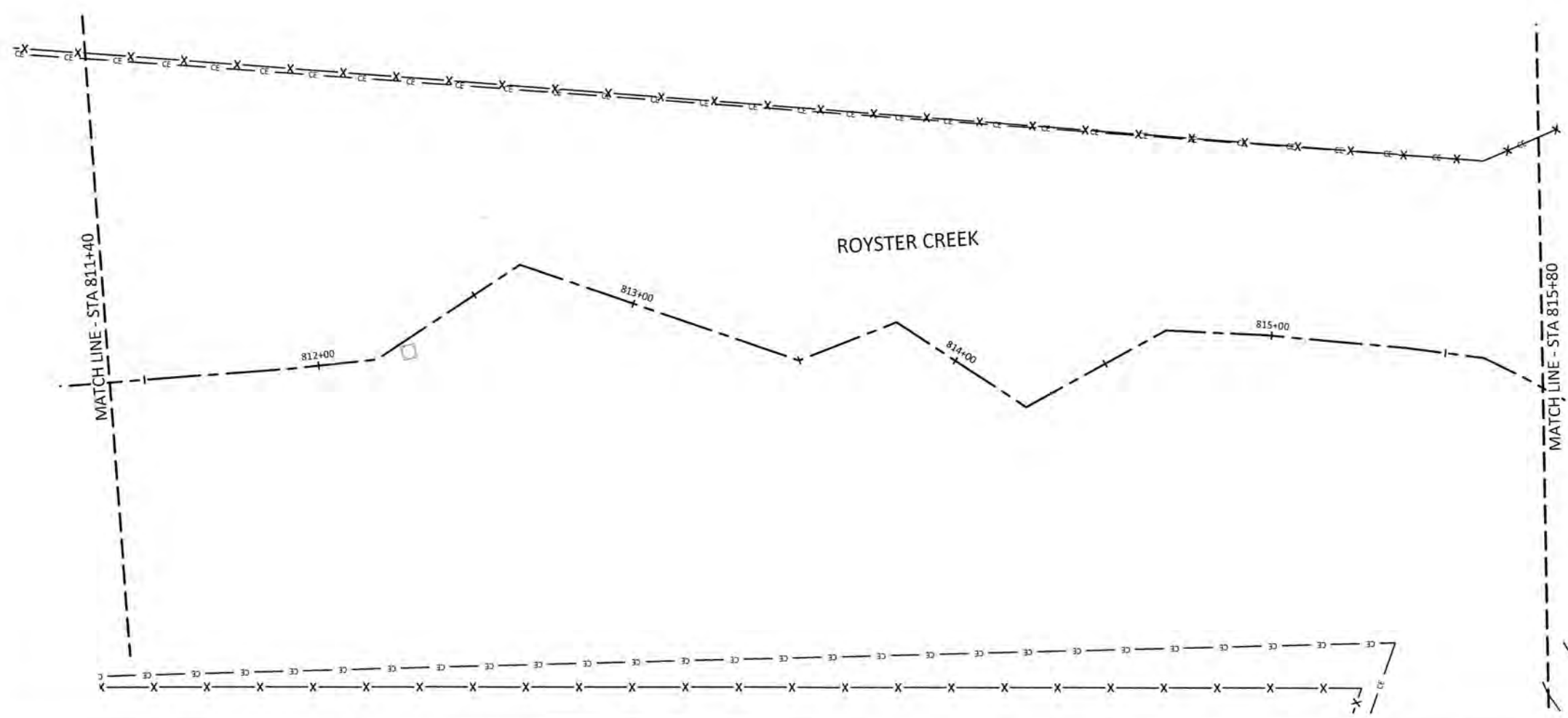
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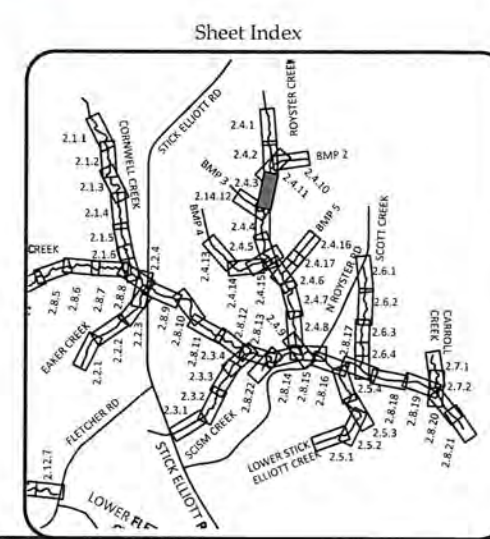


August 21, 2018  
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 User: jck



- REACH TREATMENT:**
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**Big Harris Creek Mitigation Site**  
**Cleveland County, North Carolina**  
 Royster Creek  
 Stream Plan and Profile Record Drawings

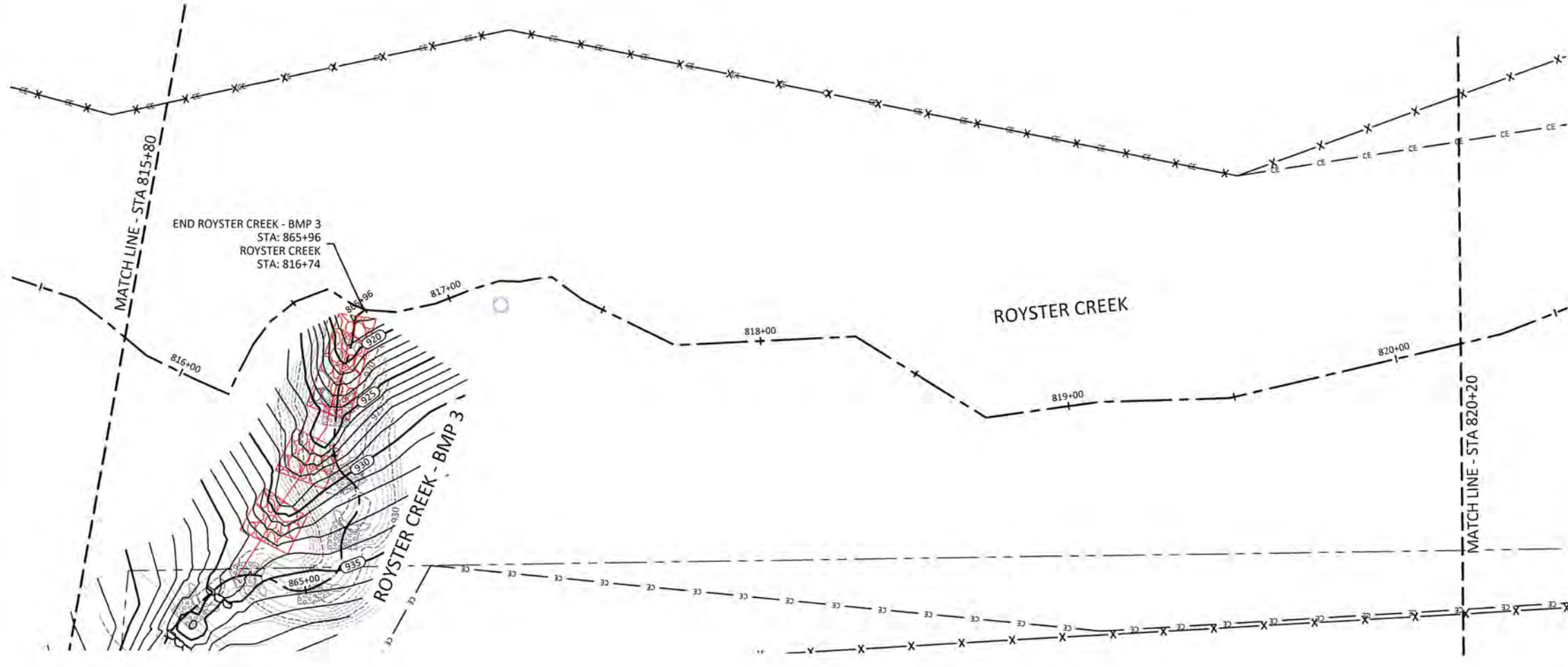
Revisions:


Date: August 21, 2018  
 Job Number: 005-02123  
 Designed By: EGR, AA  
 Drawn By: JS  
 Checked By: JCK

2.4.3

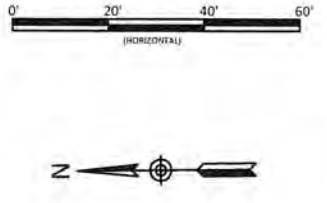
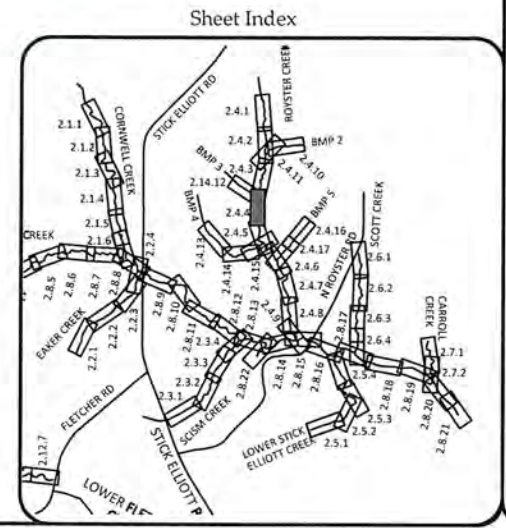
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- REACH TREATMENT:
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Big Harris Creek Mitigation Site  
Cleveland County, North Carolina  
Royster Creek  
Stream Plan and Profile Record Drawings

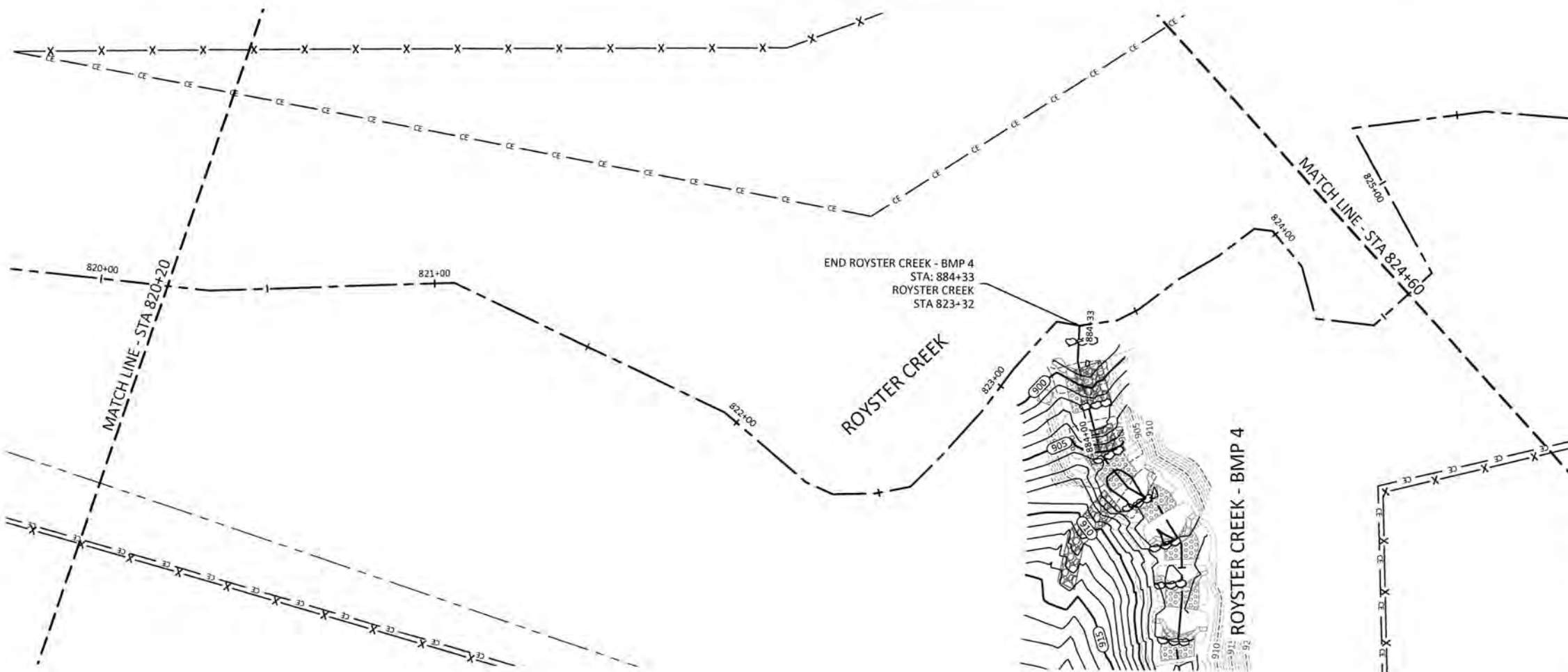
Date:	August 21, 2018
Job Number:	005-02123
Designed By:	EGR, AA
Drawn By:	JS
Checked By:	JCK
Revisions:	

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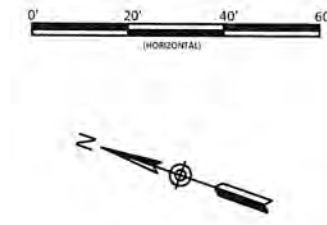
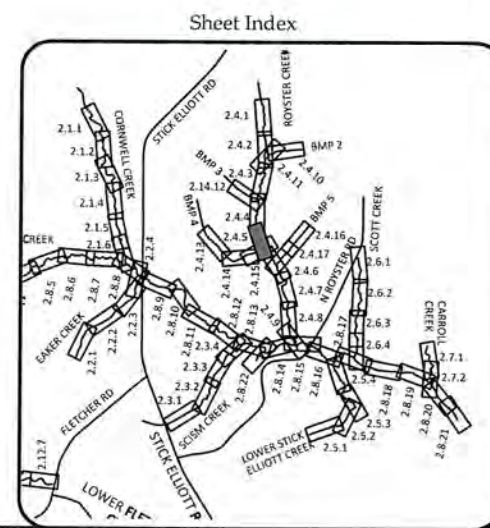
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August 21, 2018



- REACH TREATMENT:**
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**Big Harris Creek Mitigation Site**  
**Cleveland County, North Carolina**  
 Royster Creek  
 Stream Plan and Profile Record Drawings

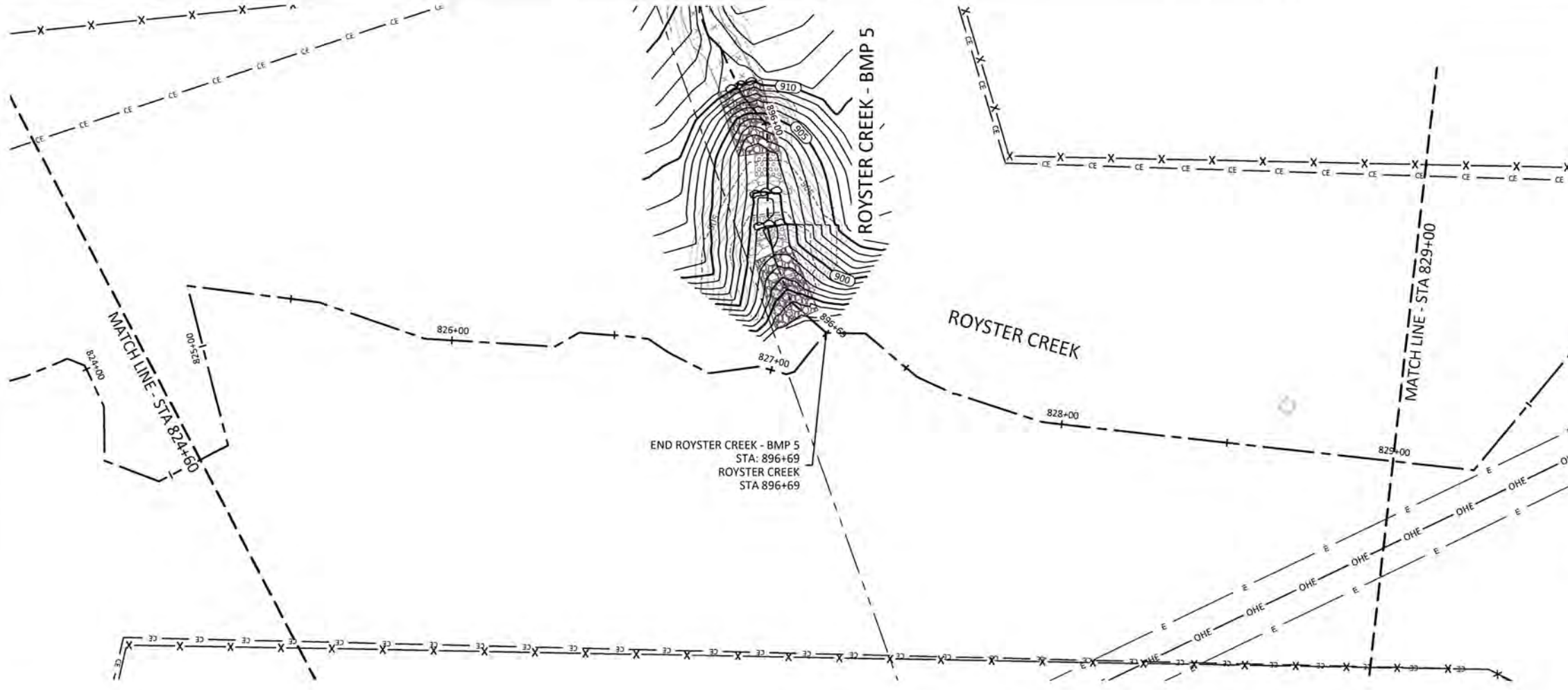
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Title: August 21, 2018 Job Number: 005-02123 Designed By: EGR, AA Drawn By: JS Checked By: JCK	<h1 style="margin: 0;">2.4.5</h1>
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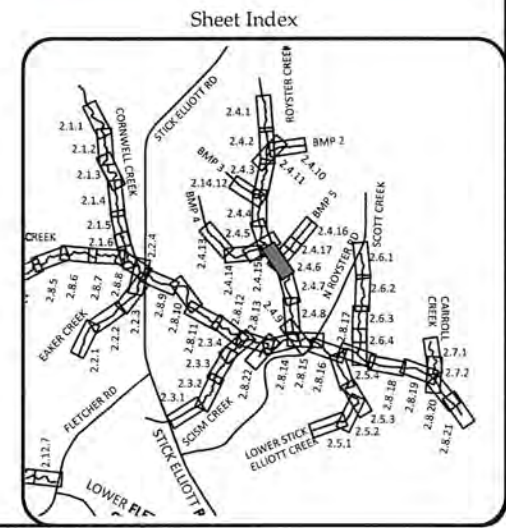
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- REACH TREATMENT:**
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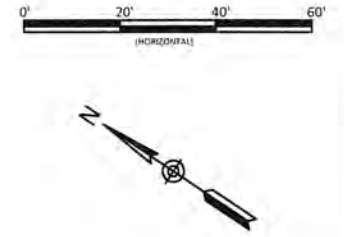
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Date:	August 21, 2018
Job Number:	005-02123
Designed By:	EGR, AA
Drawn By:	JS
Checked By:	JCK

2.4.6

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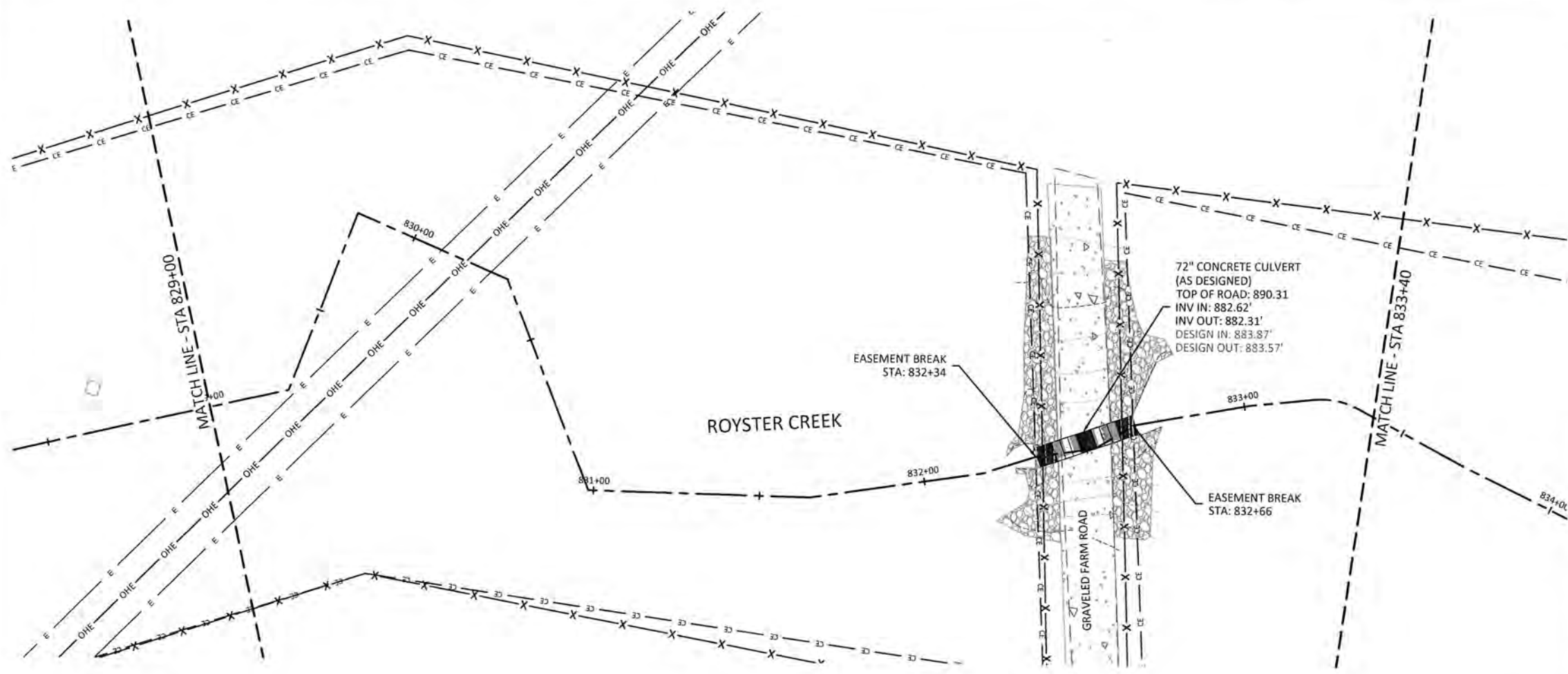


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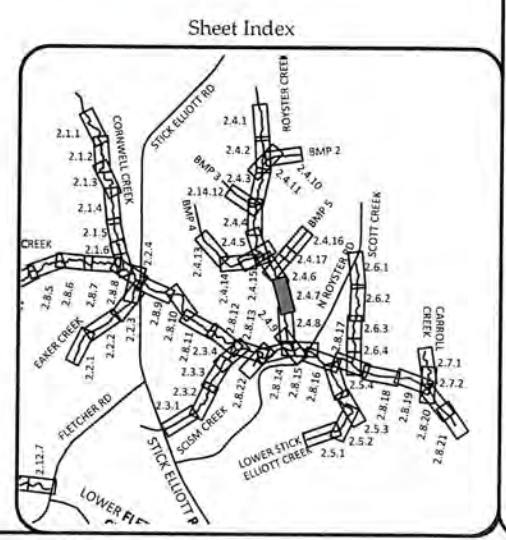
**Big Harris Creek Mitigation Site**  
**Cleveland County, North Carolina**  
 Royster Creek  
 Stream Plan and Profile Record Drawings

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- REACH TREATMENT:
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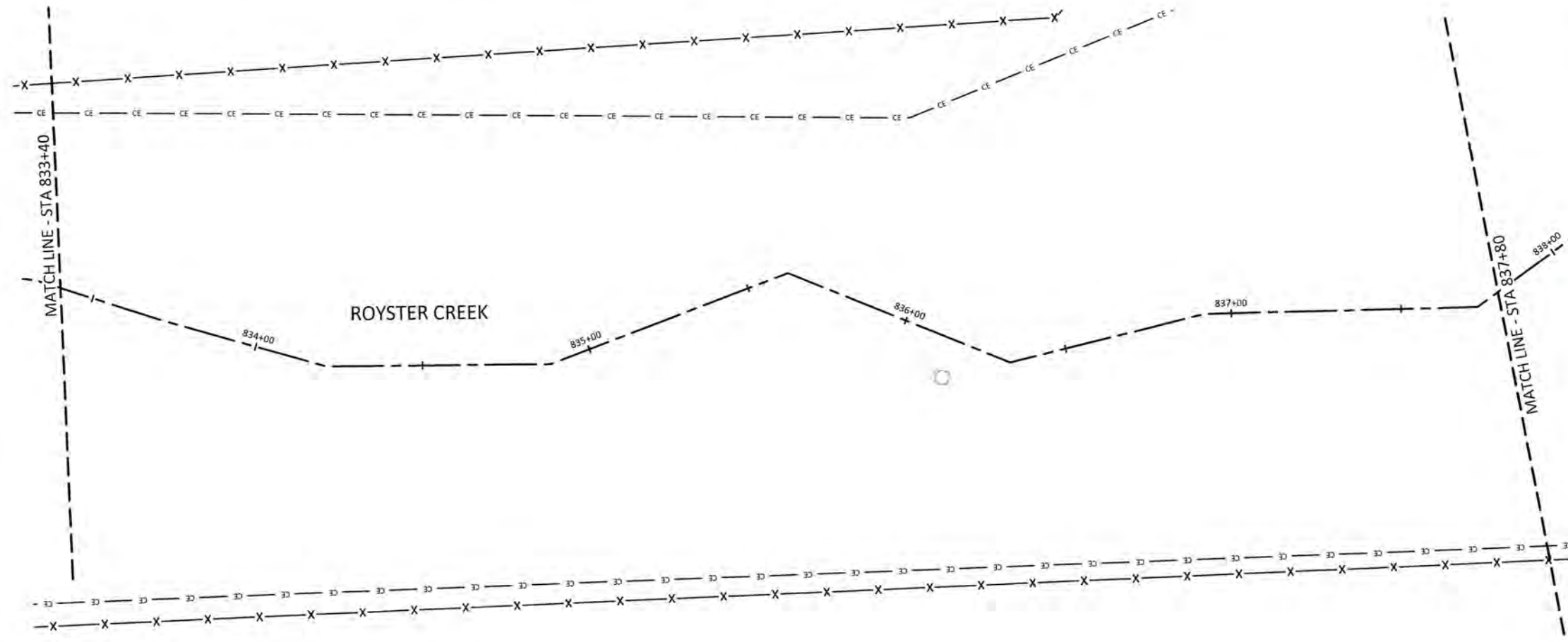
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Big Harris Creek Mitigation Site  
 Cleveland County, North Carolina  
 Royster Creek  
 Stream Plan and Profile Record Drawings

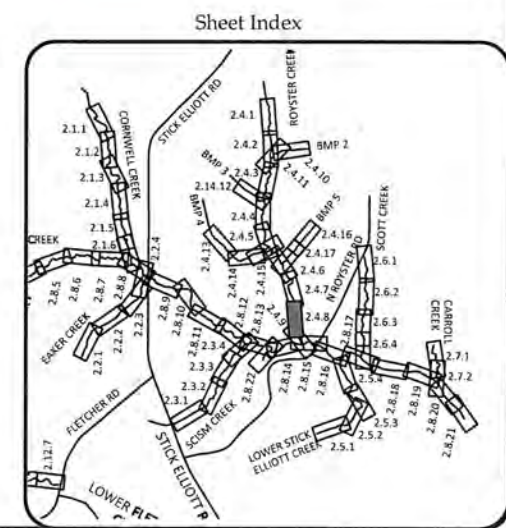
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Drawn By:	JS
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August 21, 2018  
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- REACH TREATMENT:
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Big Harris Creek Mitigation Site  
Cleveland County, North Carolina  
Royster Creek  
Stream Plan and Profile Record Drawings

Revisions:	

Date:	August 21, 2018
Job Number:	005-02123
Designed by:	EGR, AA
Drawn by:	JS
Checked by:	JCK

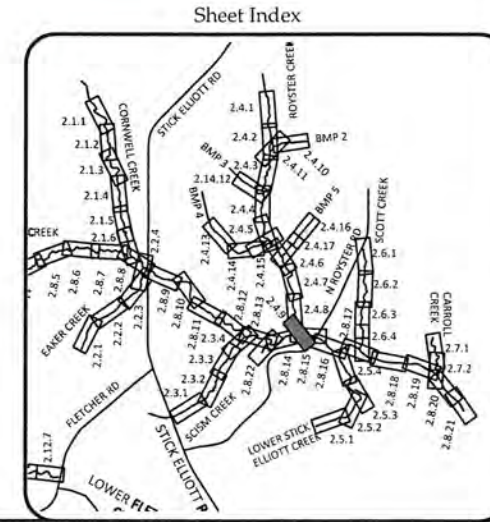
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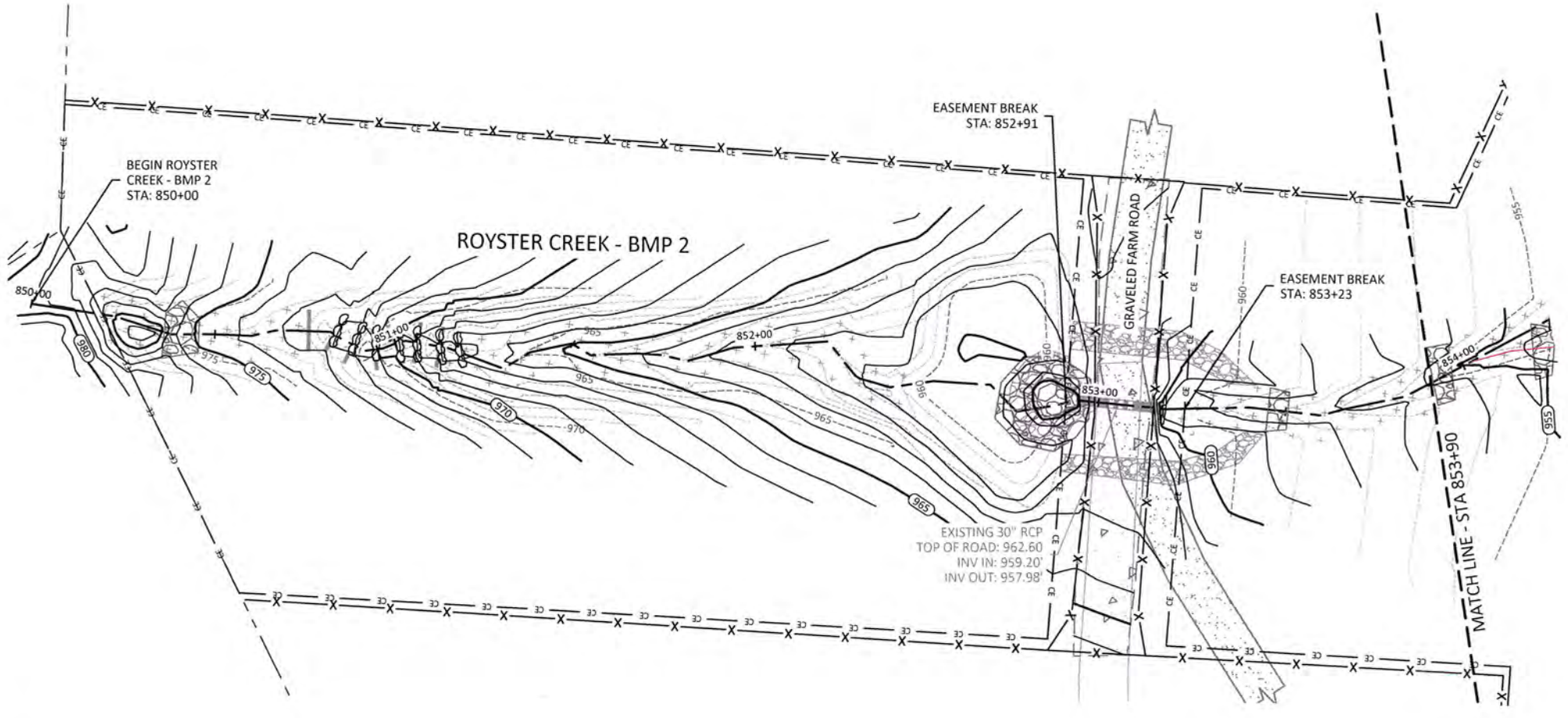
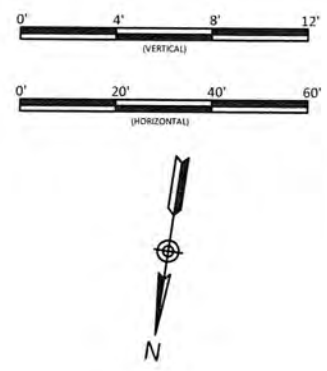
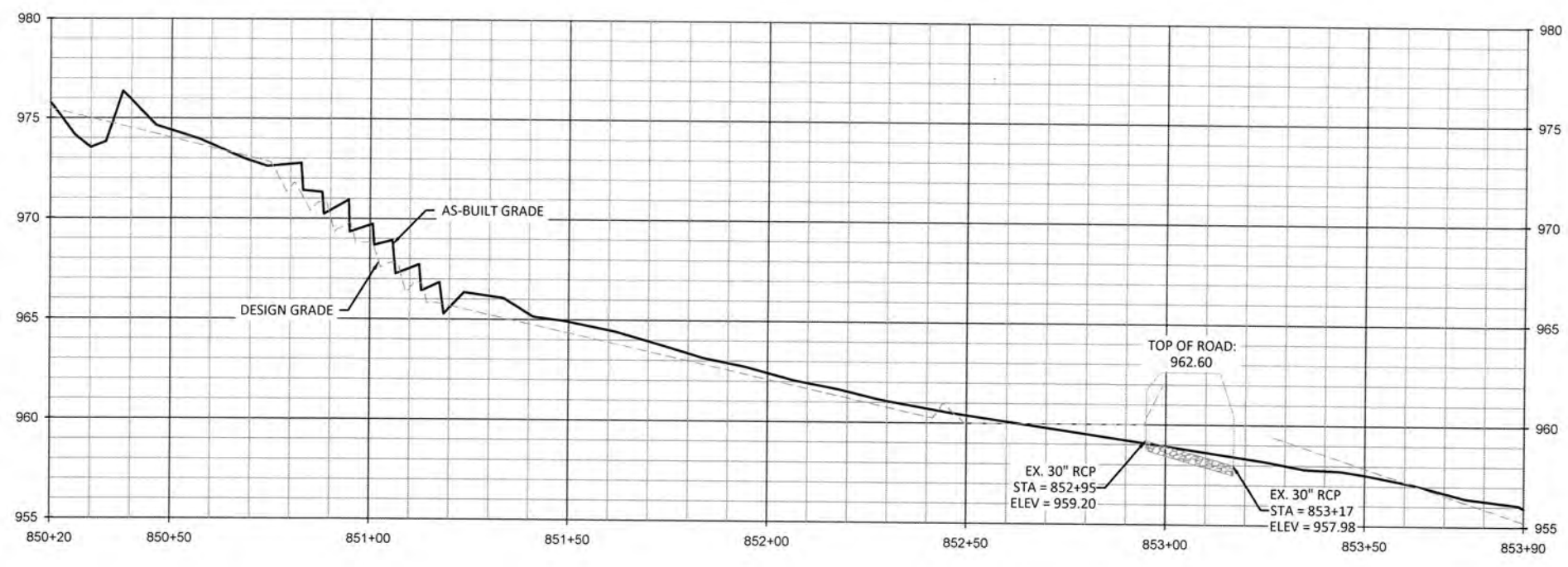
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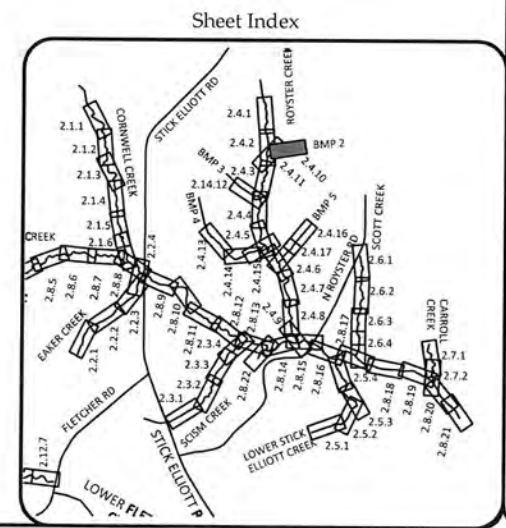
Big Harris Creek Mitigation Site  
 Cleveland County, North Carolina  
 Royster Creek  
 Stream Plan and Profile Record Drawings

Date:	August 21, 2018
Job Number:	005-02123
Designed By:	EGR, A.A.
Drawn By:	JS
Checked By:	JCK
Revisions:	

August 21, 2018  
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- REACH TREATMENT:**
1. FENCE OUT CATTLE - REFER TO FENCING PLAN SHEETS.
  2. TREAT INVASIVE SPECIES - REFER TO PLANTING PLAN SHEETS.
  3. REPLANT ALONG ENTIRE REACH - REFER TO PLANTING PLAN SHEETS.
  4. STABILIZE EPHEMERAL CHANNEL WITH STEP-POOLS AND ROCK CASCADES.
  5. TREAT STORMWATER WITH HEADWATERS DETENTION.



**Big Harris Creek Mitigation Site**  
 Cleveland County, North Carolina

Royster Creek - BMP 2  
 Stream Plan and Profile Record Drawings

Revisions:

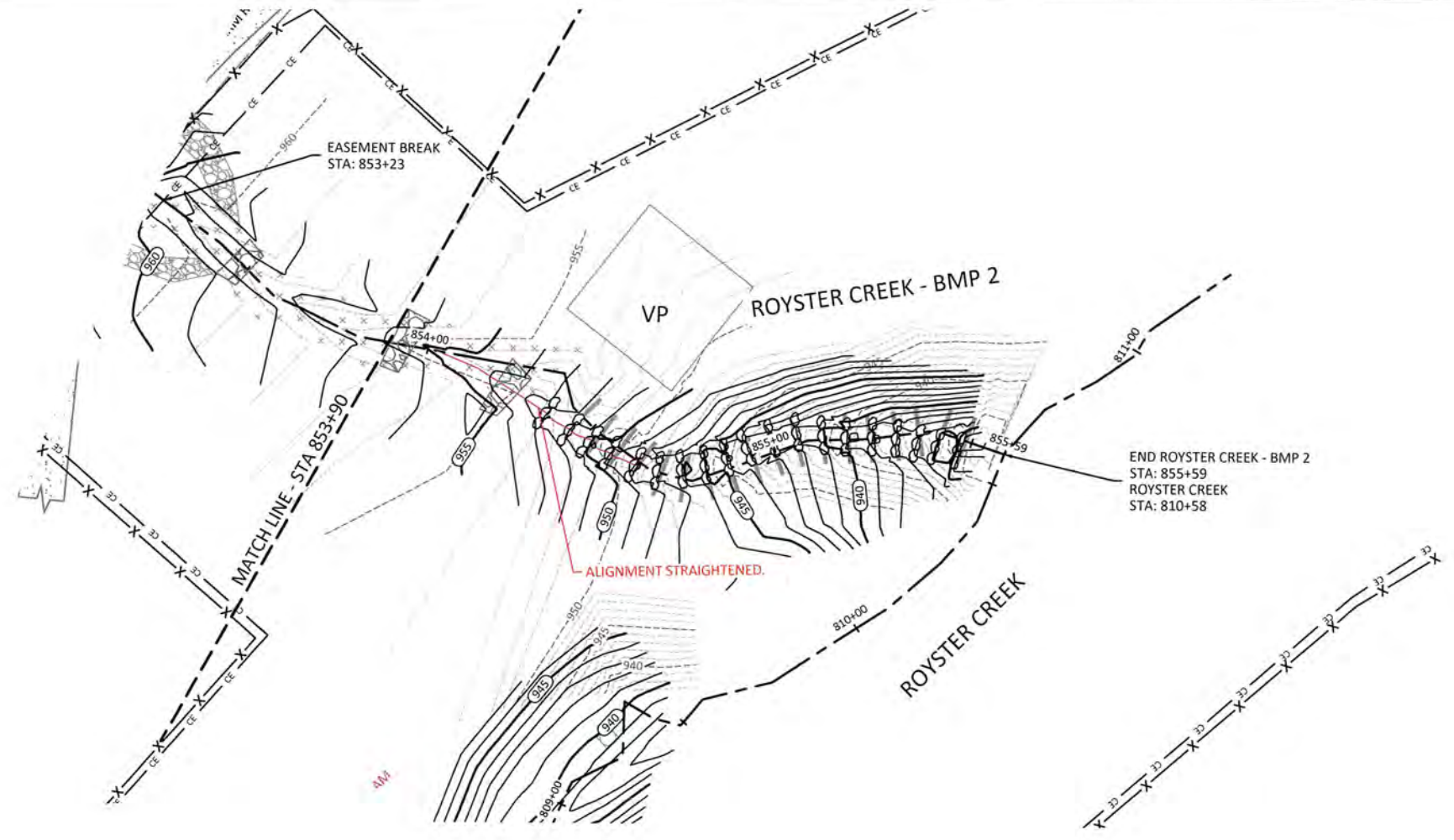
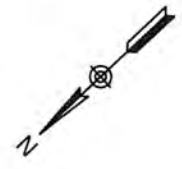
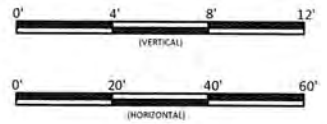
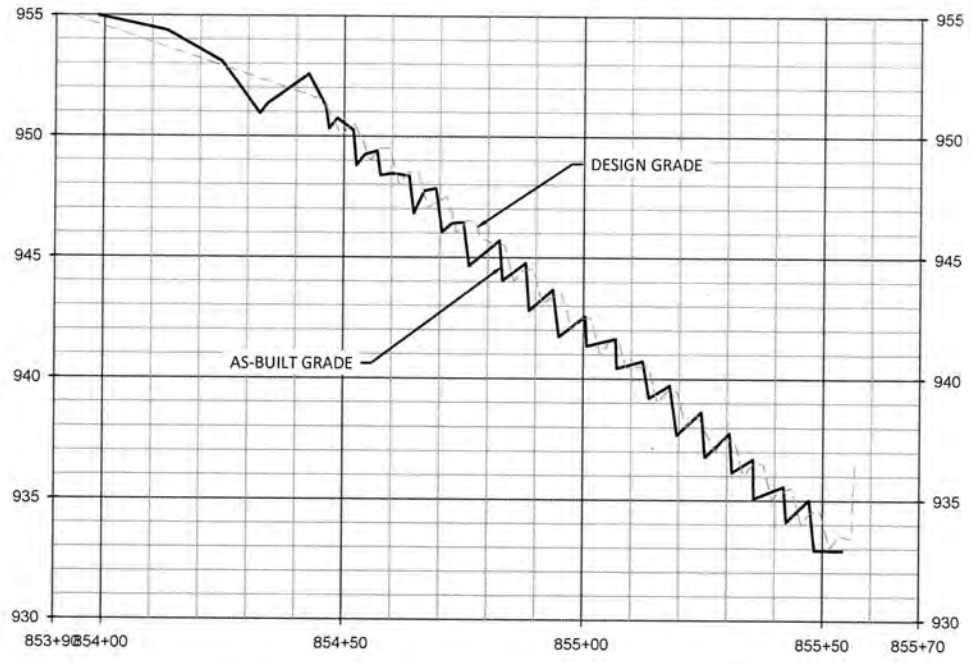

Date: August 21, 2018  
 Job Number: 005-02123  
 Designed By: ECR, AA  
 Drawn By: JS  
 Checked By: JCK

**2.4.10**

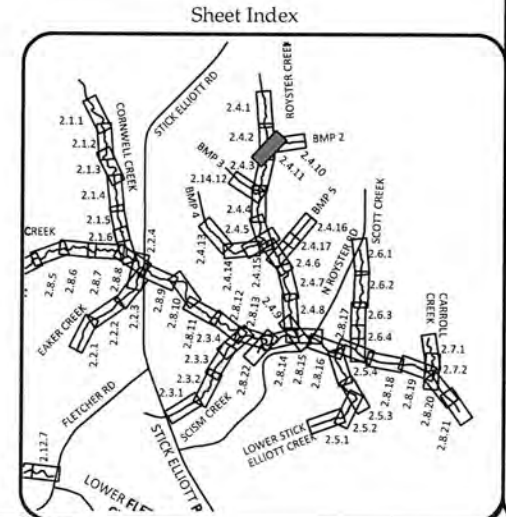
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  3. REPLANT ALONG ENTIRE REACH - REFER TO PLANTING PLAN SHEETS.
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Big Harris Creek Mitigation Site  
 Cleveland County, North Carolina  
 Royster Creek - BMP 2  
 Stream Plan and Profile Record Drawings

Date:	August 21, 2018
Job Number:	005-02123
Designed By:	ECR, AA
Drawn By:	JS
Checked By:	JCK

2.4.11

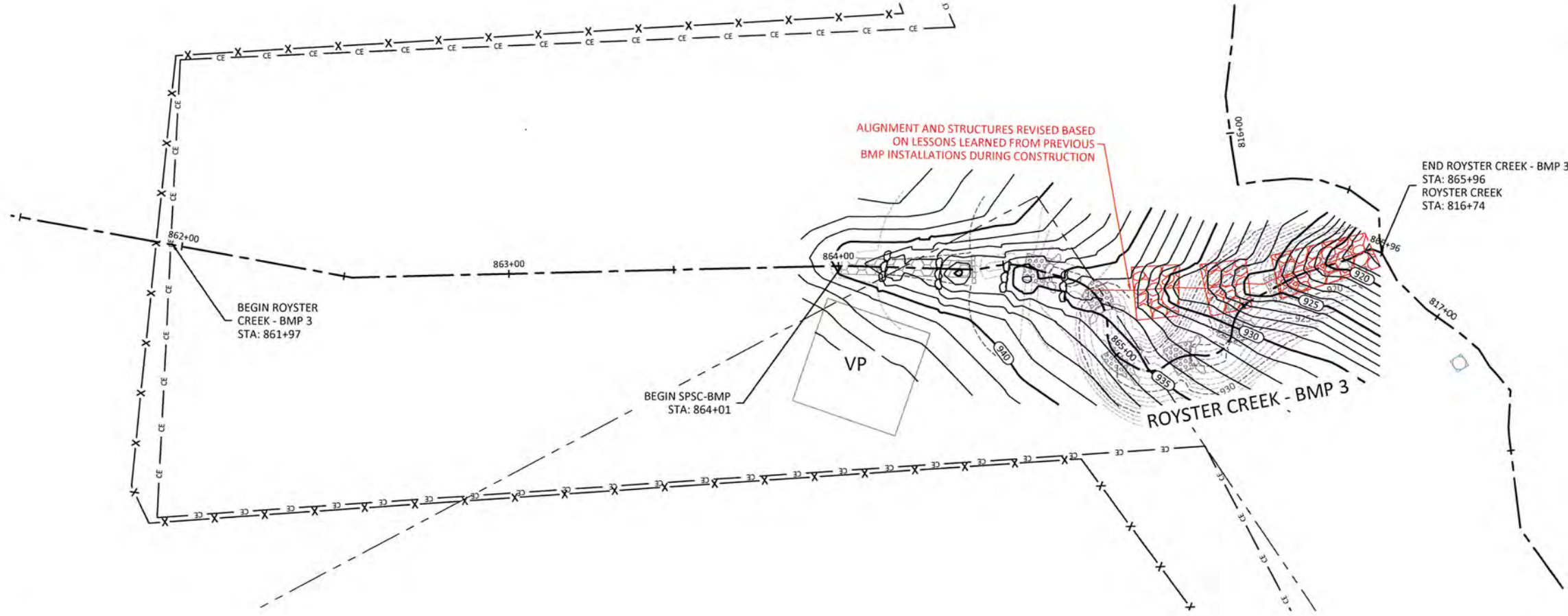
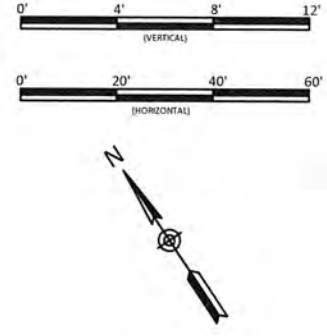
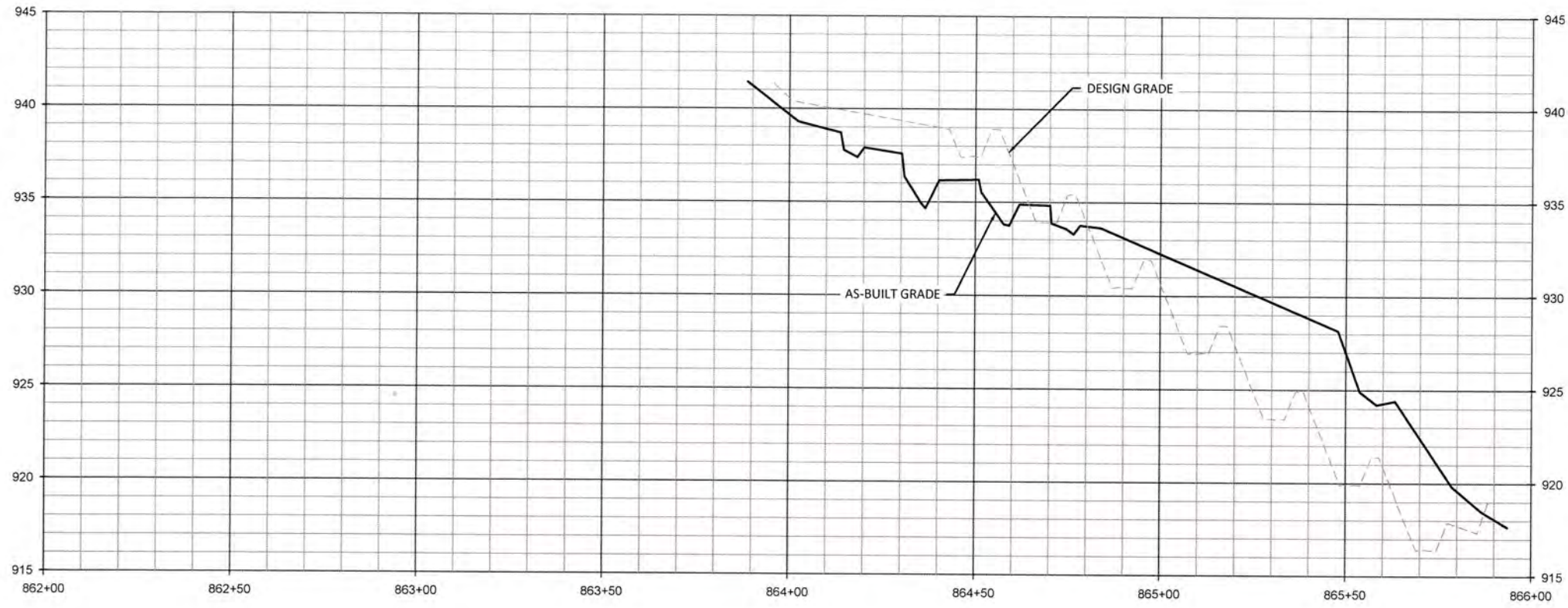
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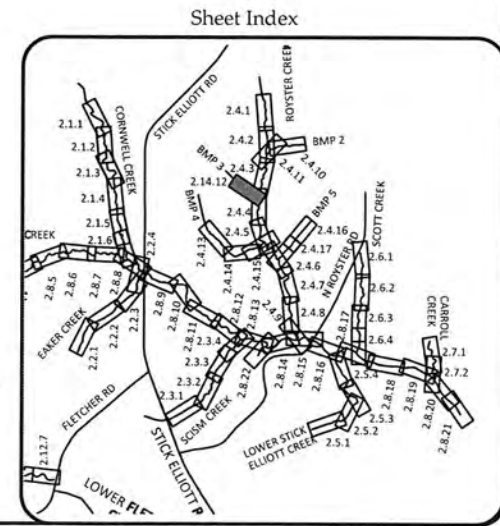




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**Big Harris Creek Mitigation Site**  
Cleveland County, North Carolina

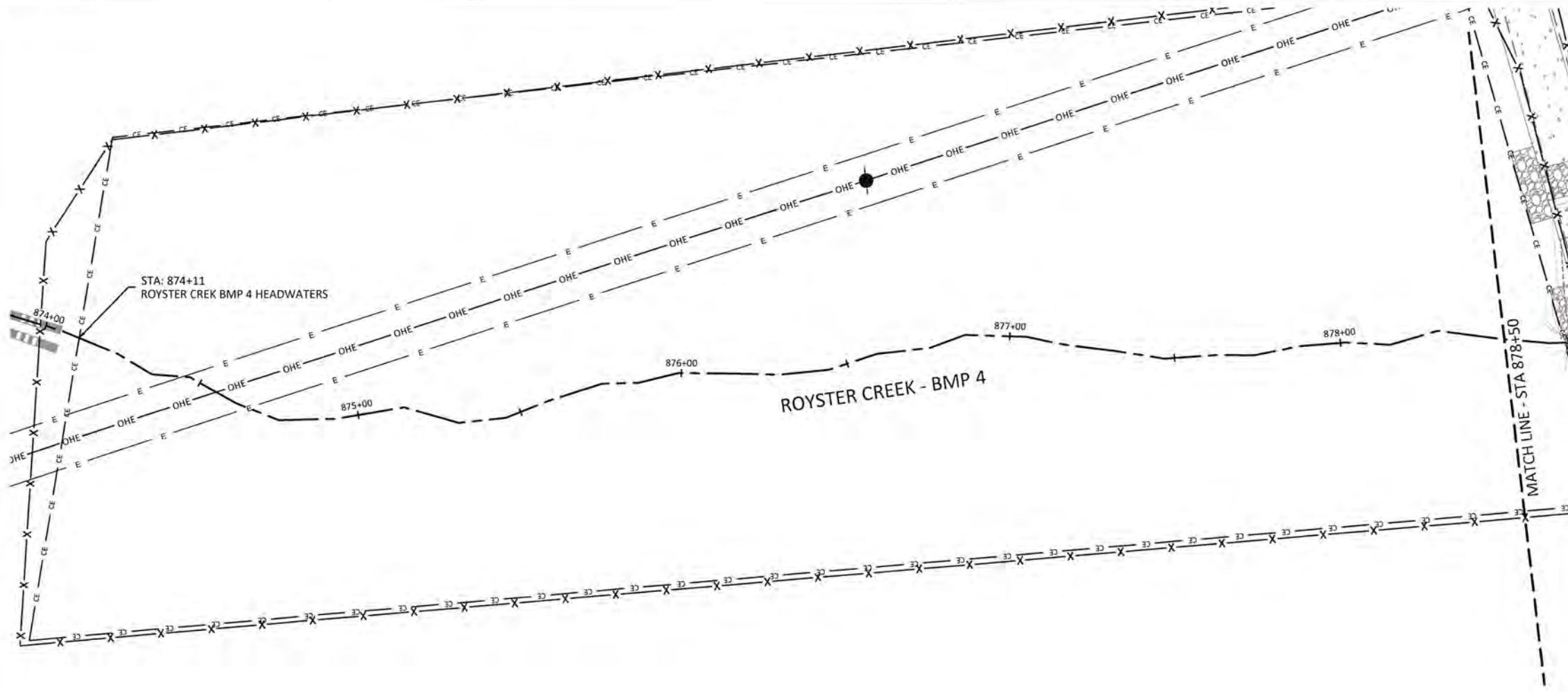
Royster Creek - BMP 3  
Stream Plan and Profile Record Drawings

Date:	August 21, 2018
Job Number:	005-02123
Designed By:	EGR, A.A.
Drawn By:	JS
Checked By:	JCK
Revisions:	

**2.4.12**

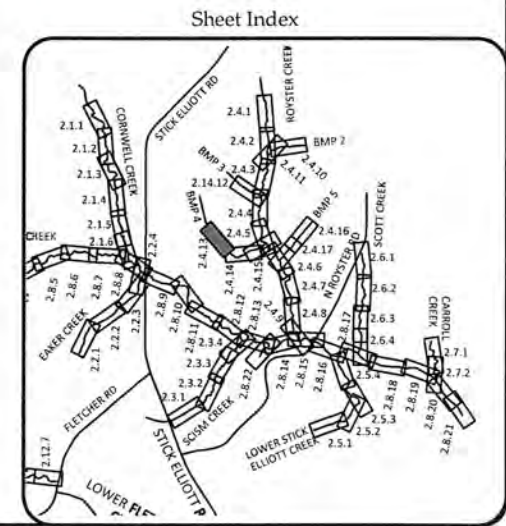
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- REACH TREATMENT:
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**Big Harris Creek Mitigation Site**  
 Cleveland County, North Carolina

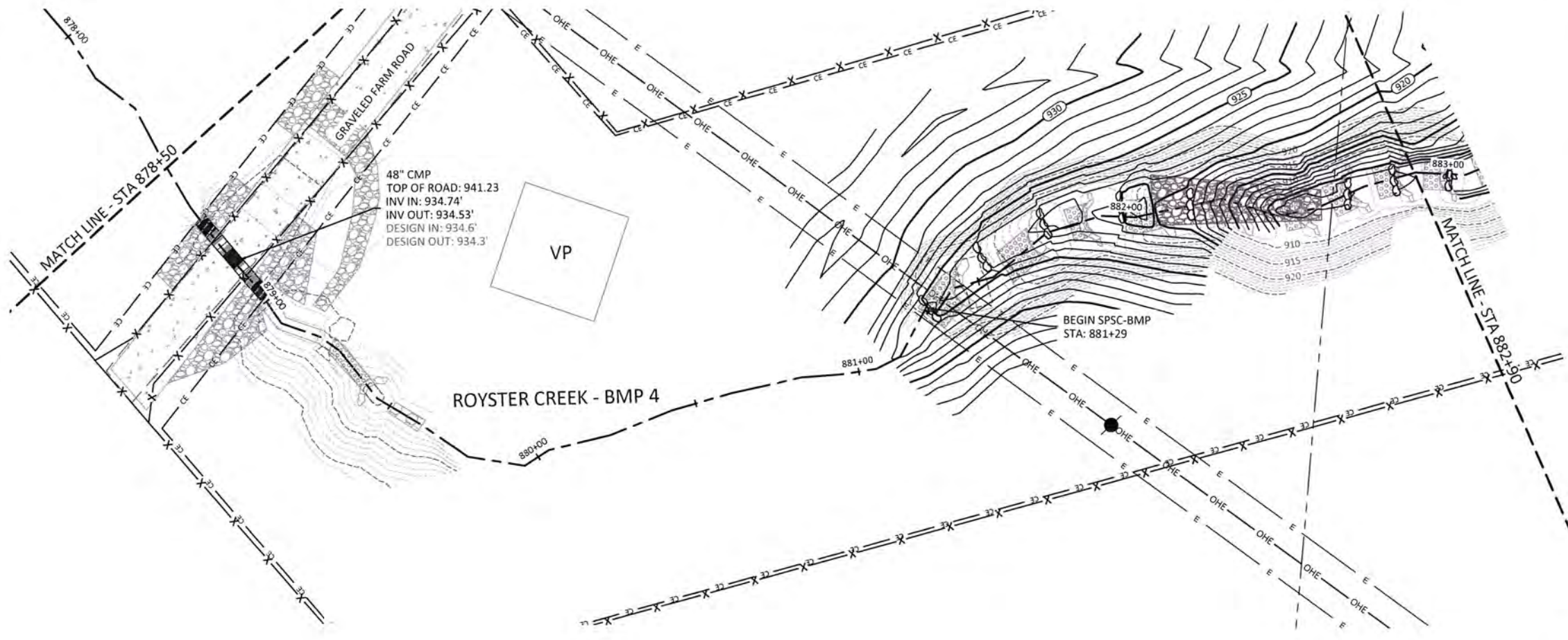
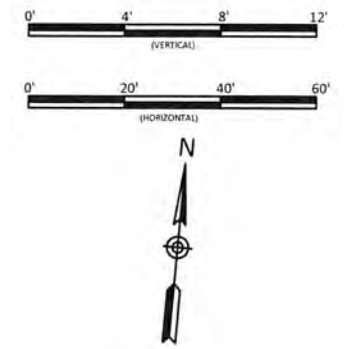
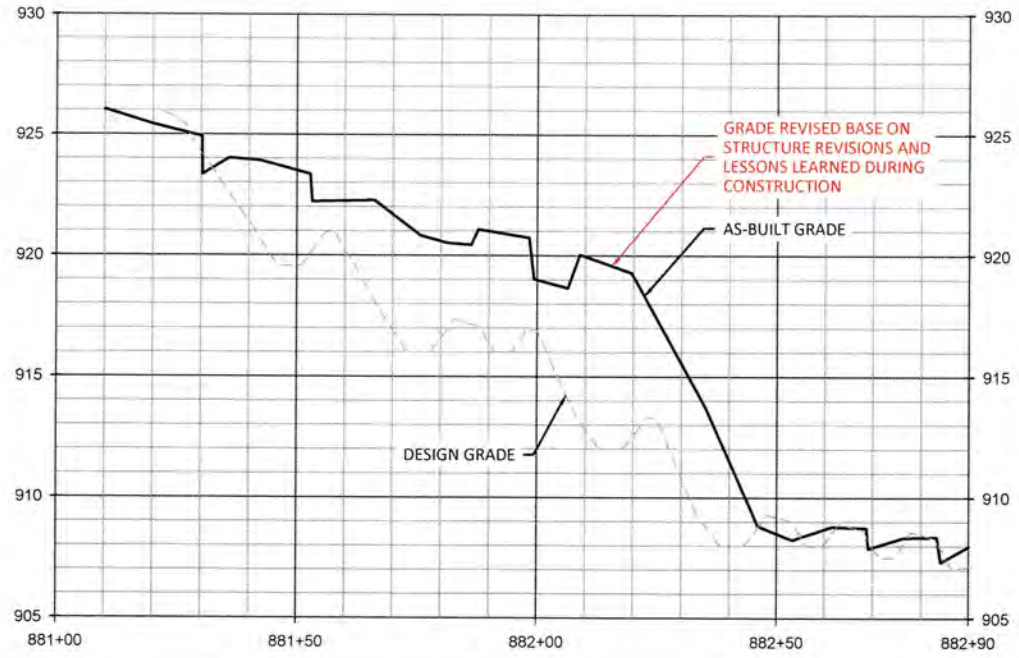
Royster Creek - BMP 4  
 Stream Plan and Profile Record Drawings

Date: August 21, 2018	Revision:
Job Number: 005-02123	
Designed By: EGR, AA	
Drawn By: JS	
Checked By: JCK	

# 2.4.13

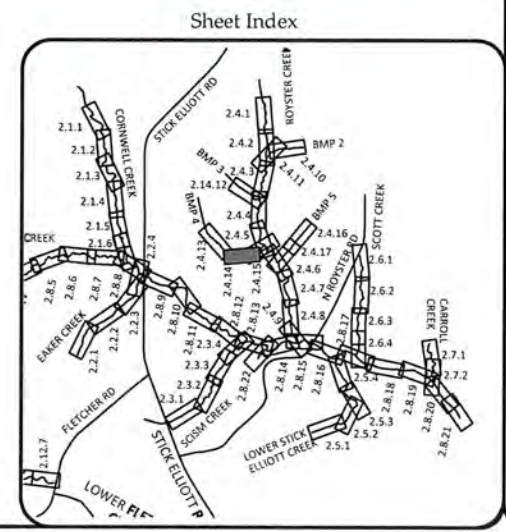
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- REACH TREATMENT:**
1. FENCE OUT CATTLE - REFER TO FENCING PLAN SHEETS.
  2. TREAT INVASIVE SPECIES - REFER TO PLANTING PLAN SHEETS.
  3. REPLANT ALONG ENTIRE REACH - REFER TO PLANTING PLAN SHEETS.
  4. STABILIZE HEADCUT WITH ROCK CASCADE.
  5. TREAT STORMWATER WITH SPSC.

**NOTE:**  
STRUCTURES REVISED BASED ON LESSONS LEARNED FROM PREVIOUS BMP INSTALLATIONS DURING CONSTRUCTION



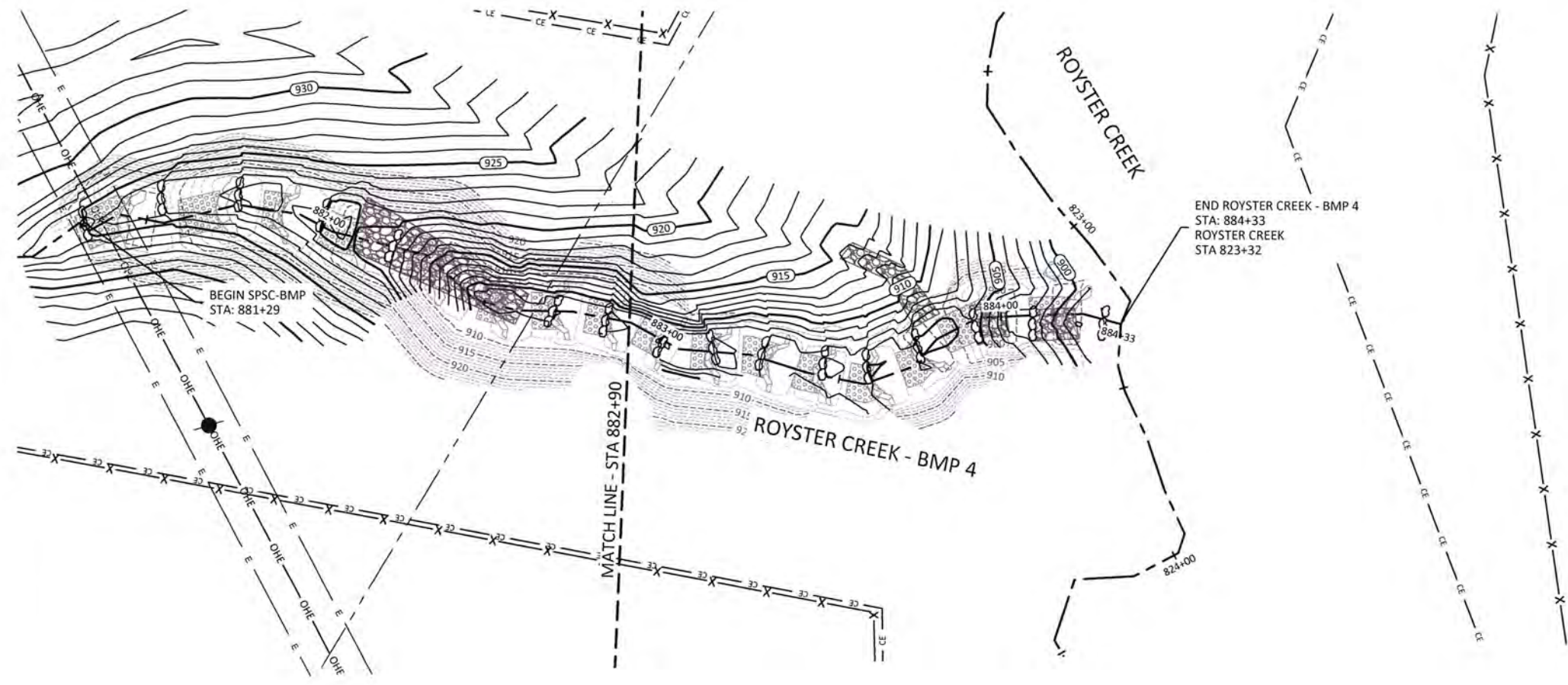
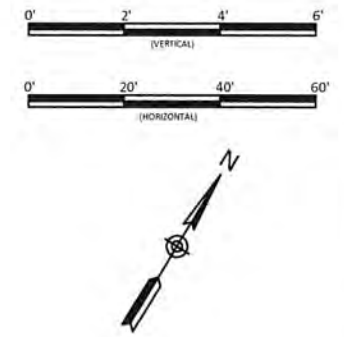
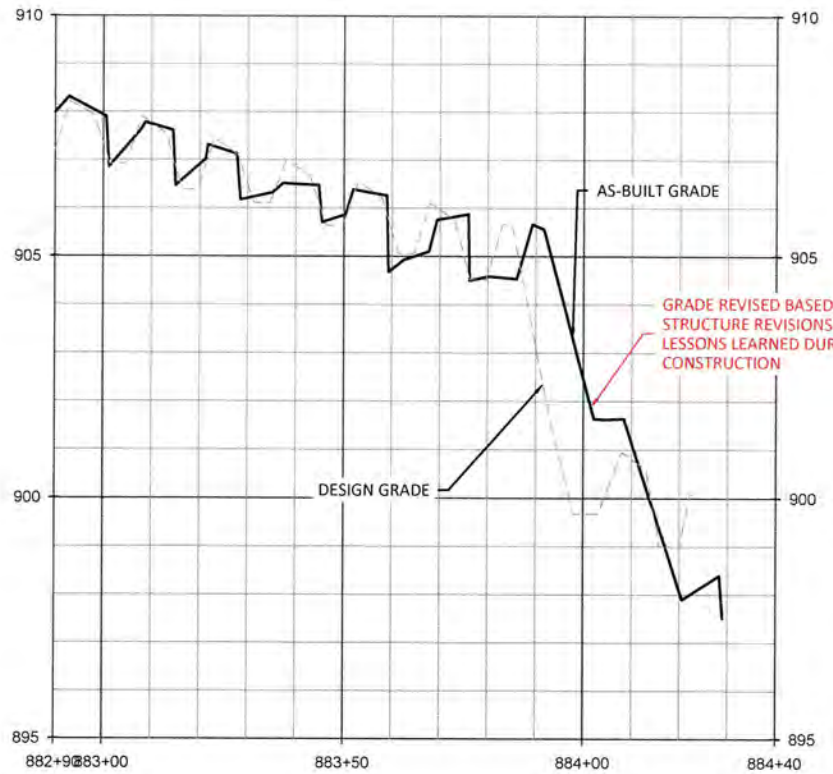
Big Harris Creek Mitigation Site  
Cleveland County, North Carolina  
Royster Creek - BMP 4  
Stream Plan and Profile Record Drawings

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ENGINEERING  
1450 S. Mint Street, Ste 104  
Charlotte, NC 28209  
Tel: 704.332.7000  
Fax: 704.332.7005  
Firm License No. F-0831



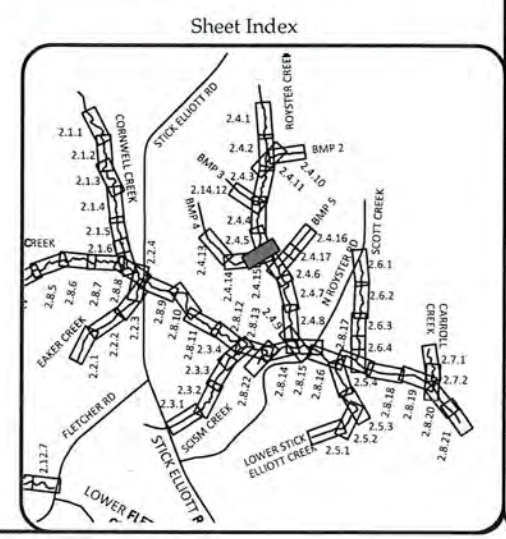
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Job Number:	005-02123
Designed By:	EGR, AA
Drawn By:	JS
Checked By:	JCK
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August 21, 2018  
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- REACH TREATMENT:**
1. FENCE OUT CATTLE - REFER TO FENCING PLAN SHEETS.
  2. TREAT INVASIVE SPECIES - REFER TO PLANTING PLAN SHEETS.
  3. REPLANT ALONG ENTIRE REACH - REFER TO PLANTING PLAN SHEETS.
  4. TREAT STORMWATER WITH SPSC.

**NOTE:**  
 STRUCTURES REVISED BASED ON LESSONS LEARNED FROM PREVIOUS BMP INSTALLATIONS DURING CONSTRUCTION



Date:	August 21, 2018
Job Number:	005-02123
Designed By:	EGR, AA
Drawn By:	JS
Checked By:	JCK

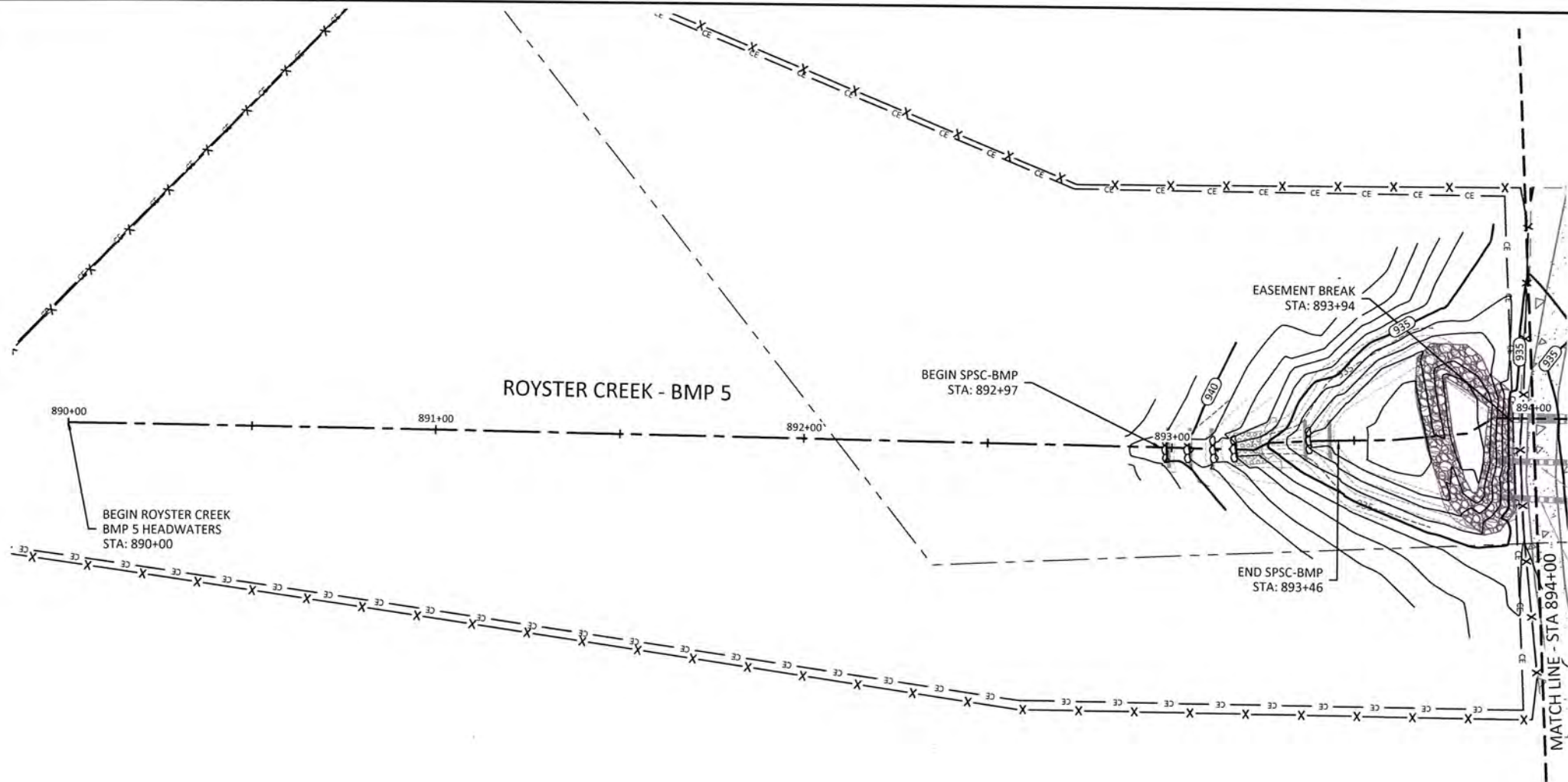
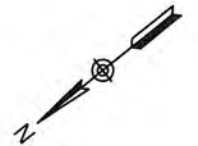
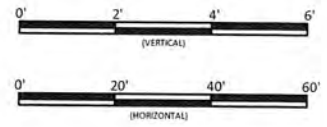
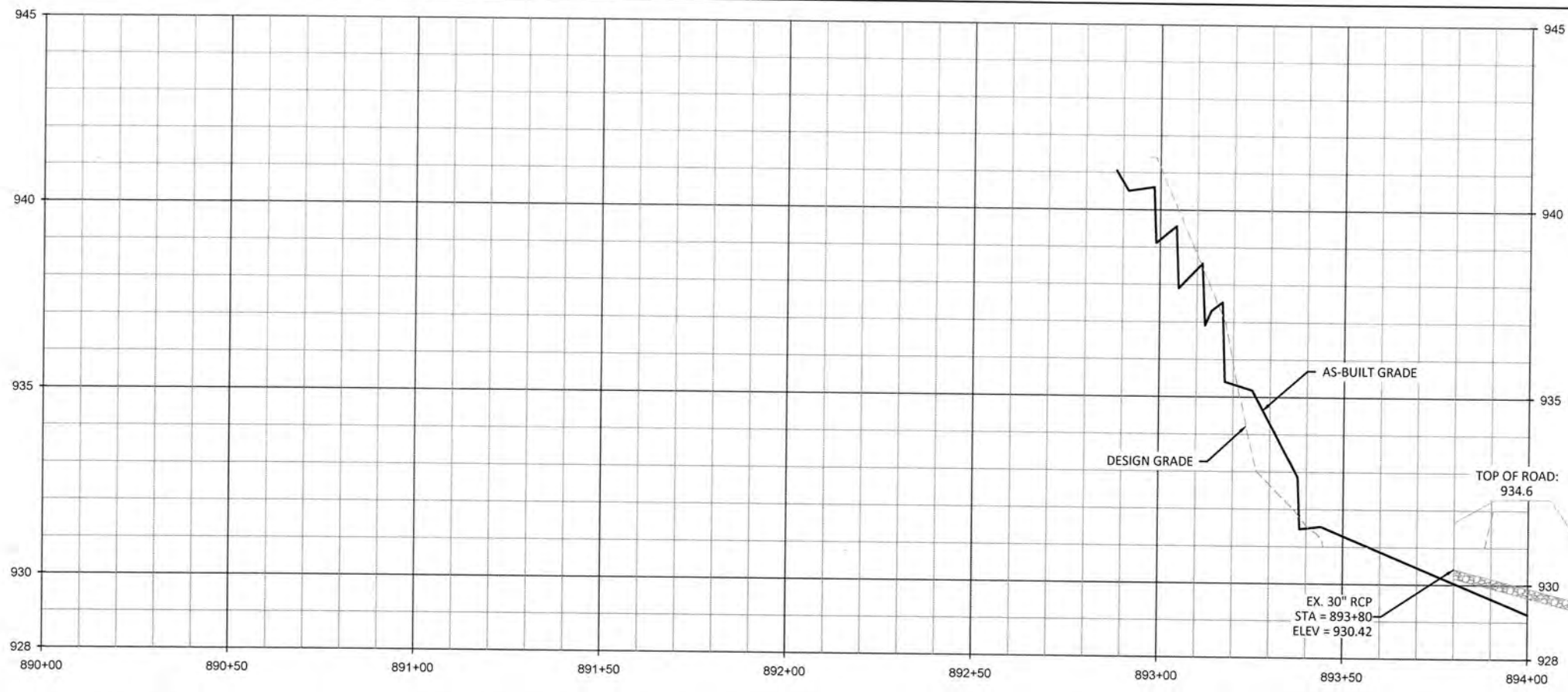
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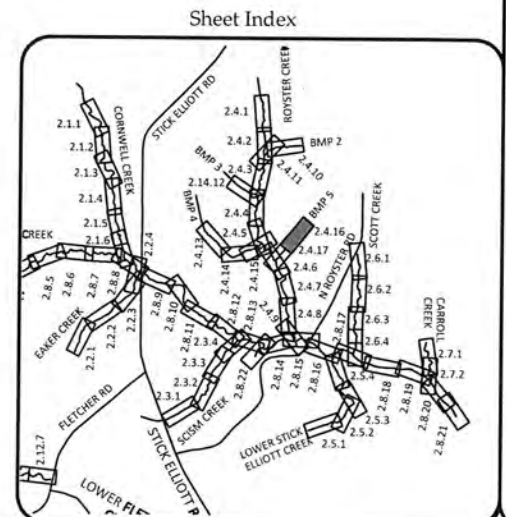
**Big Harris Creek Mitigation Site**  
**Cleveland County, North Carolina**  
 Royster Creek - BMP 4  
 Stream Plan and Profile Record Drawings



August 20, 2018  
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- REACH TREATMENT:**
1. FENCE OUT CATTLE - REFER TO FENCING PLAN SHEETS.
  2. TREAT INVASIVE SPECIES - REFER TO PLANTING PLAN SHEETS.
  3. REPLANT ALONG ENTIRE REACH - REFER TO PLANTING PLAN SHEETS.
  4. STABILIZE EPHEMERAL CHANNEL WITH STEP-POOLS AND ROCK CASCADES.
  5. TREAT STORMWATER WITH HEADWATER DETENTION.



**Big Harris Creek Mitigation Site**  
**Cleveland County, North Carolina**  
 Royster Creek - BMP 5  
 Stream Plan and Profile Record Drawings

Date:	August 21, 2018
Job Number:	005-02123
Designed By:	EGR, AA
Drawn By:	JS
Checked By:	JCK
Revisions:	

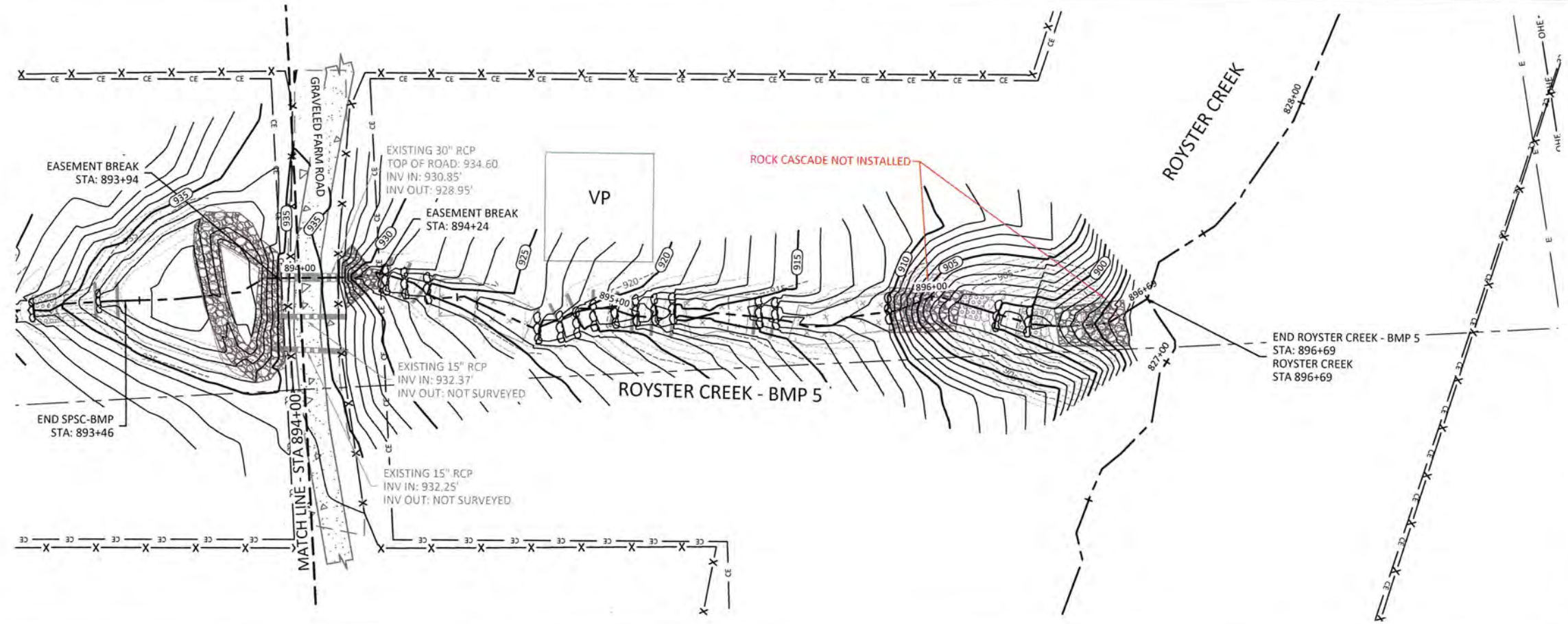
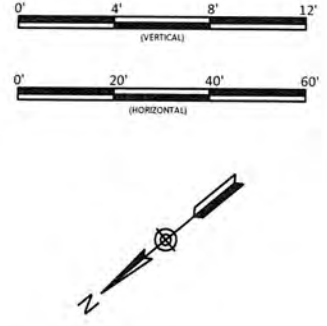
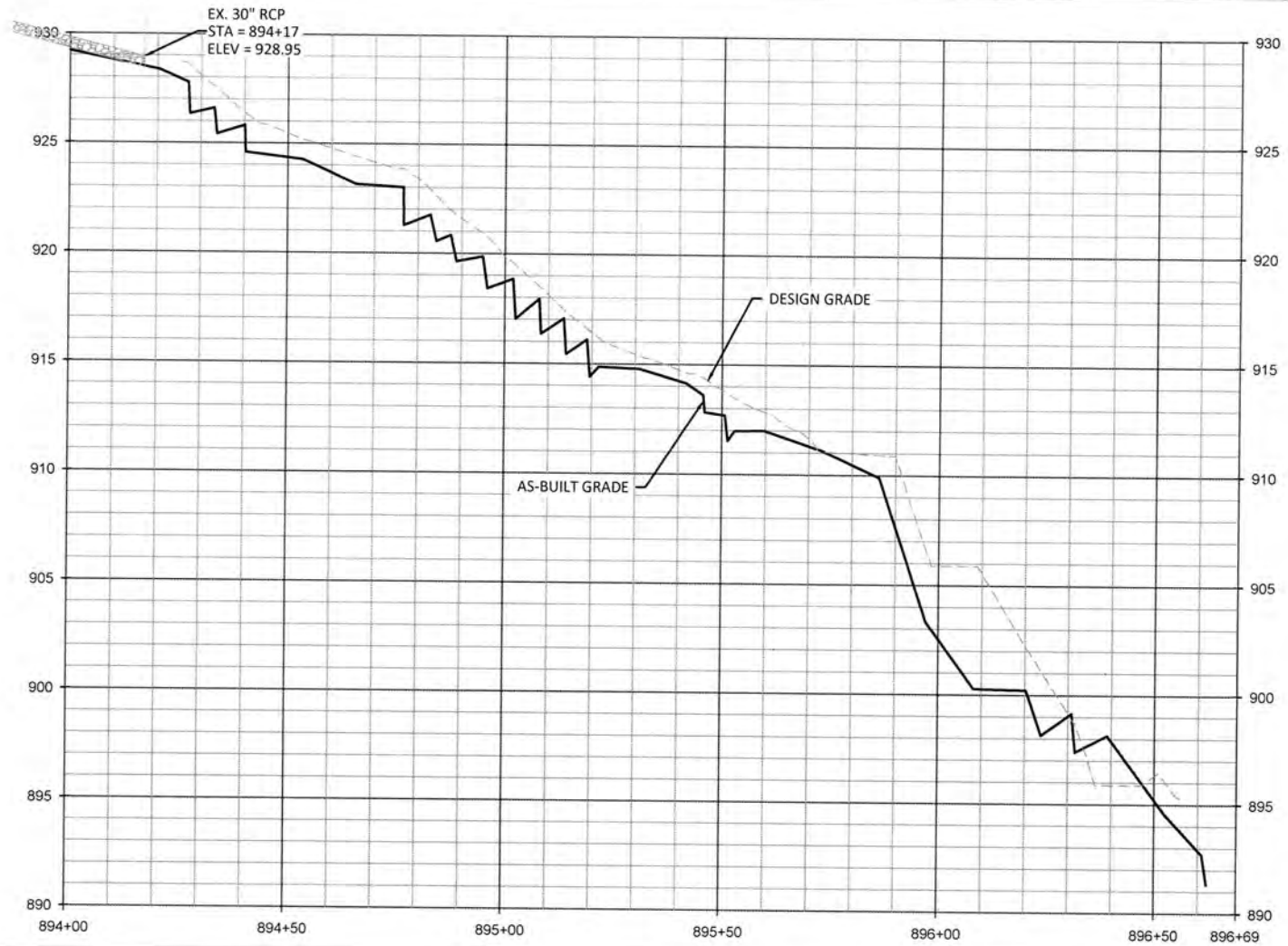
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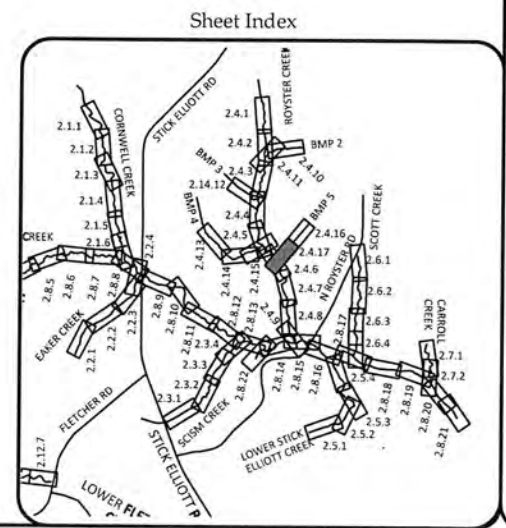
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August 21, 2018  
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- REACH TREATMENT:**
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  2. TREAT INVASIVE SPECIES - REFER TO PLANTING PLAN SHEETS.
  3. REPLANT ALONG ENTIRE REACH - REFER TO PLANTING PLAN SHEETS.
  4. STABILIZE EPHEMERAL CHANNEL WITH STEP-POOLS AND ROCK CASCADES.



Big Harris Creek Mitigation Site  
 Cleveland County, North Carolina

Royster Creek - BMP 5  
 Stream Plan and Profile Record Drawings

Revisions	

Date: August 21, 2018  
 Job Number: 005-02123  
 Designed By: ECR, AA  
 Drawn By: JS  
 Checked By: JCK

**2.4.17**

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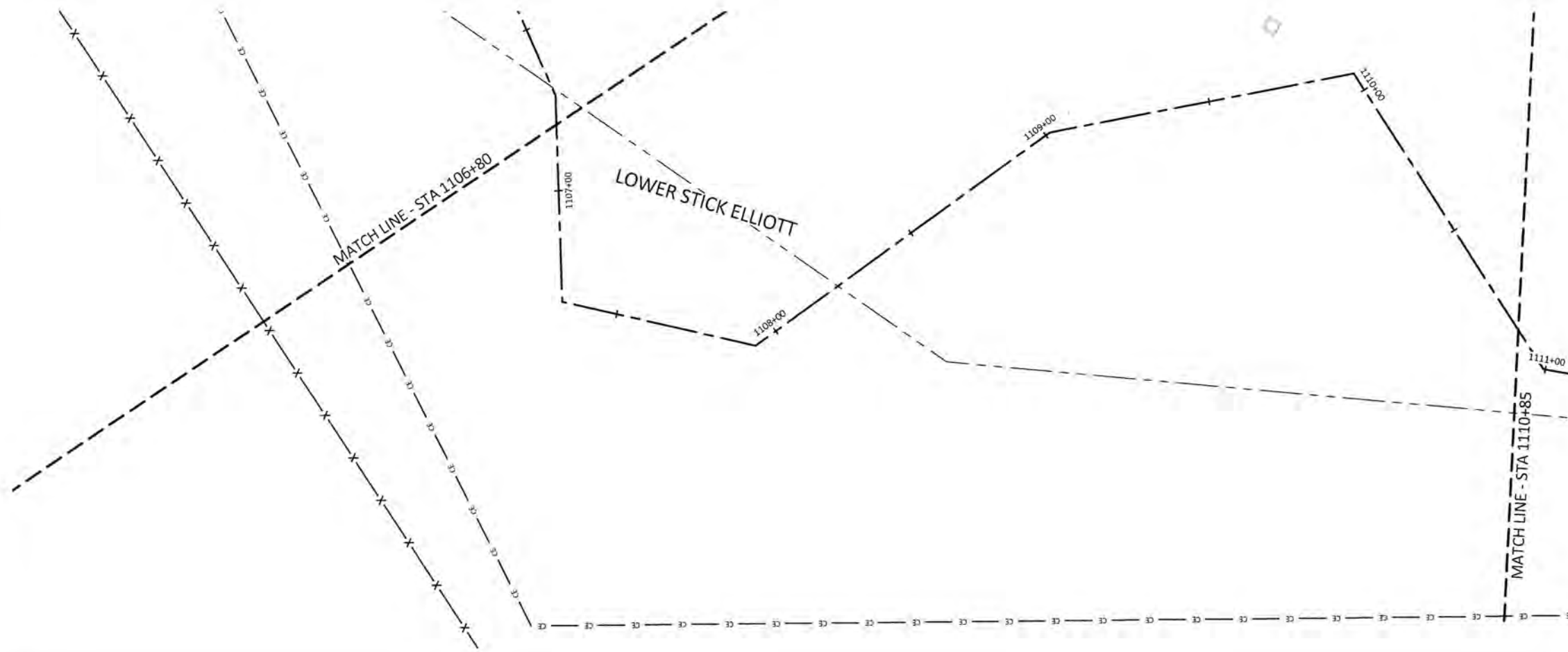
**WILDLANDS**  
 ENGINEERS & ARCHITECTS  
 1430 S. Mint Street, Ste 104  
 Charlotte, NC 28203  
 Tel: 704.332.7754  
 Fax: 704.332.3006  
 Firm License No. F-0831





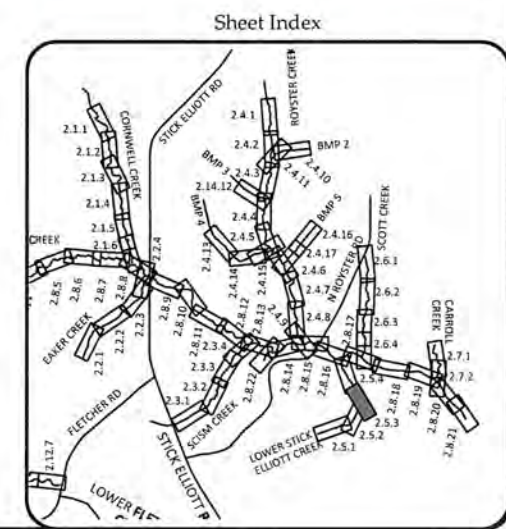






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  2. TREAT INVASIVE SPECIES - REFER TO PLANTING PLAN SHEETS.
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NOTE:  
 SURVEY WAS NOT CONDUCTED IN ENHANCEMENT II REACHES. REACHES WERE BUILT PER DESIGN UNLESS OTHERWISE NOTED.



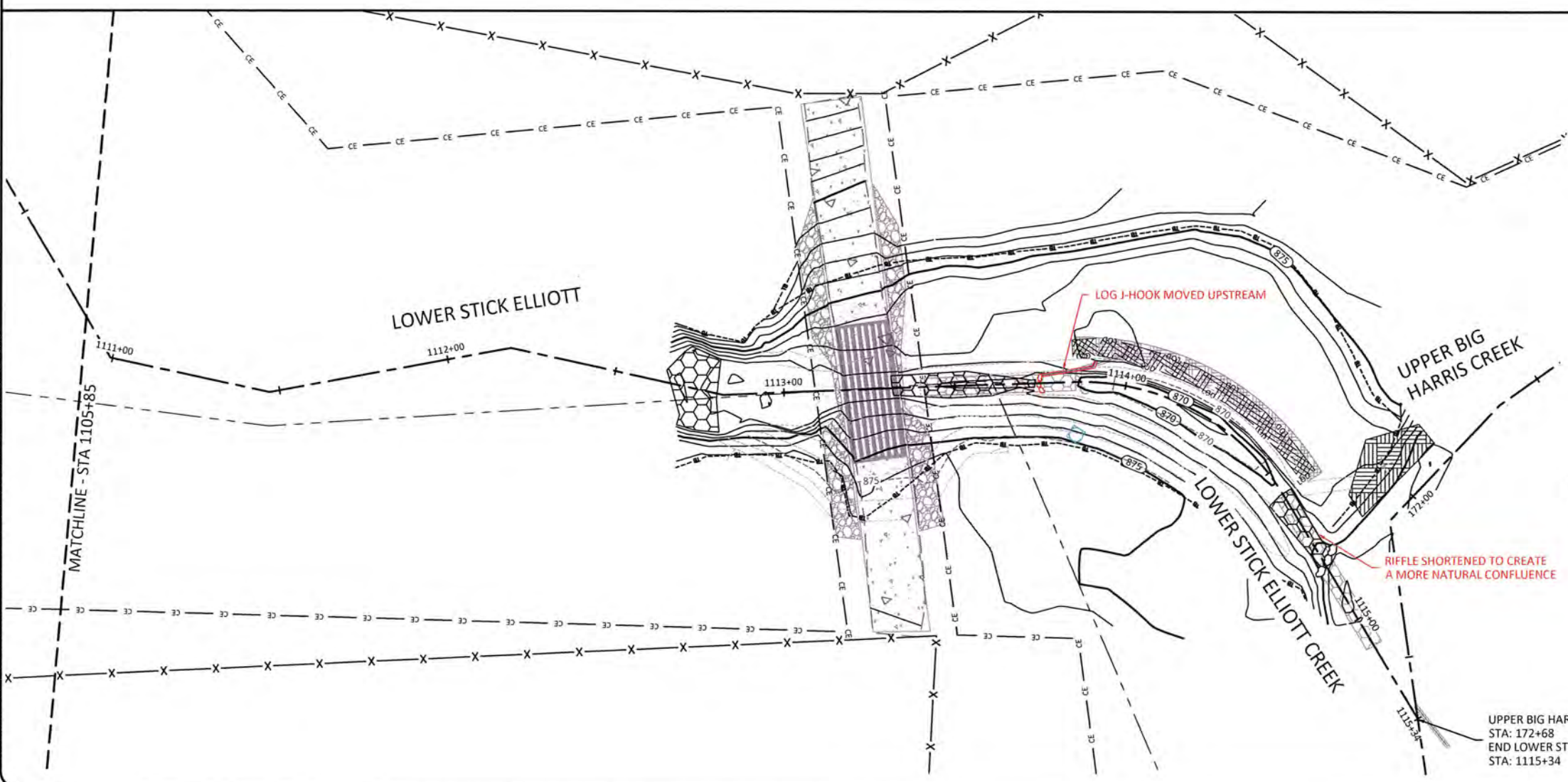
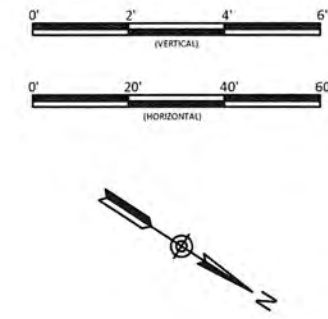
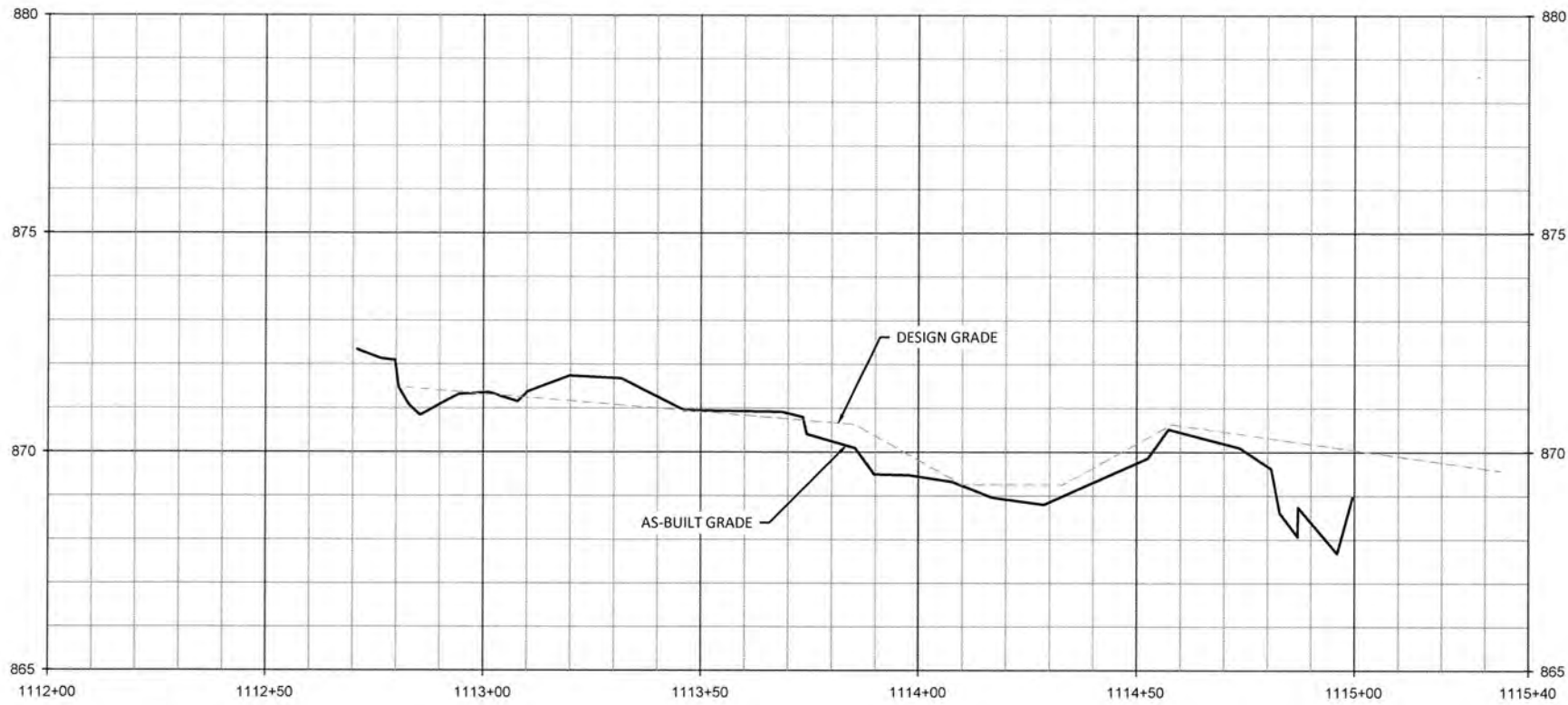
**WILDLANDS**  
 ENGINEERING  
 1490 S. HARRIS CREEK RD  
 CLEVELAND, NC 28003  
 Tel: 704.332.7754  
 Fax: 704.332.3306  
 Firm License No. F-0831



**Big Harris Creek Mitigation Site**  
 Cleveland County, North Carolina  
 Lower Stick Elliott Creek  
 Stream Plan and Profile Record Drawings

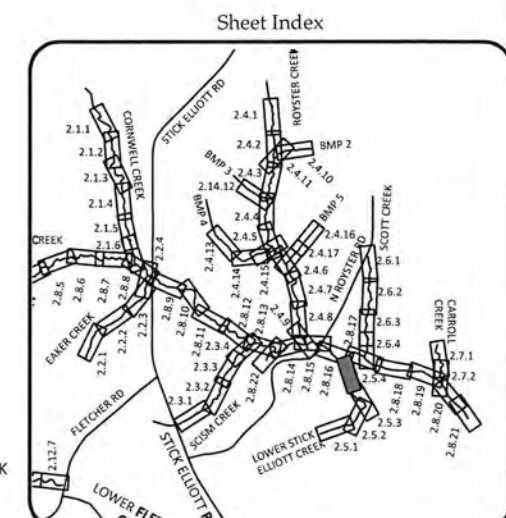
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Job Number:	005-02123
Designed By:	ECR, AA
Drawn By:	JS
Checked By:	JCK
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August 20, 2018  
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- REACH TREATMENT:**
1. FENCE OUT CATTLE - REFER TO FENCING PLAN SHEETS.
  2. TREAT INVASIVE SPECIES - REFER TO PLANTING PLAN SHEETS.
  3. REPLANT ALONG ENTIRE REACH - REFER TO PLANTING PLAN SHEETS.

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UPPER BIG HARRIS CREEK  
 STA: 172+68  
 END LOWER STICK ELLIOTT CREEK  
 STA: 1115+34

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**Big Harris Creek Mitigation Site**  
**Cleveland County, North Carolina**  
 Lower Stick Elliott Creek  
 Stream Plan and Profile Record Drawings

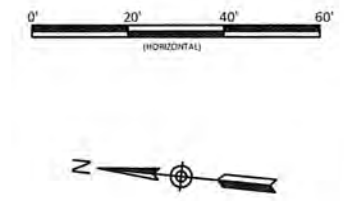
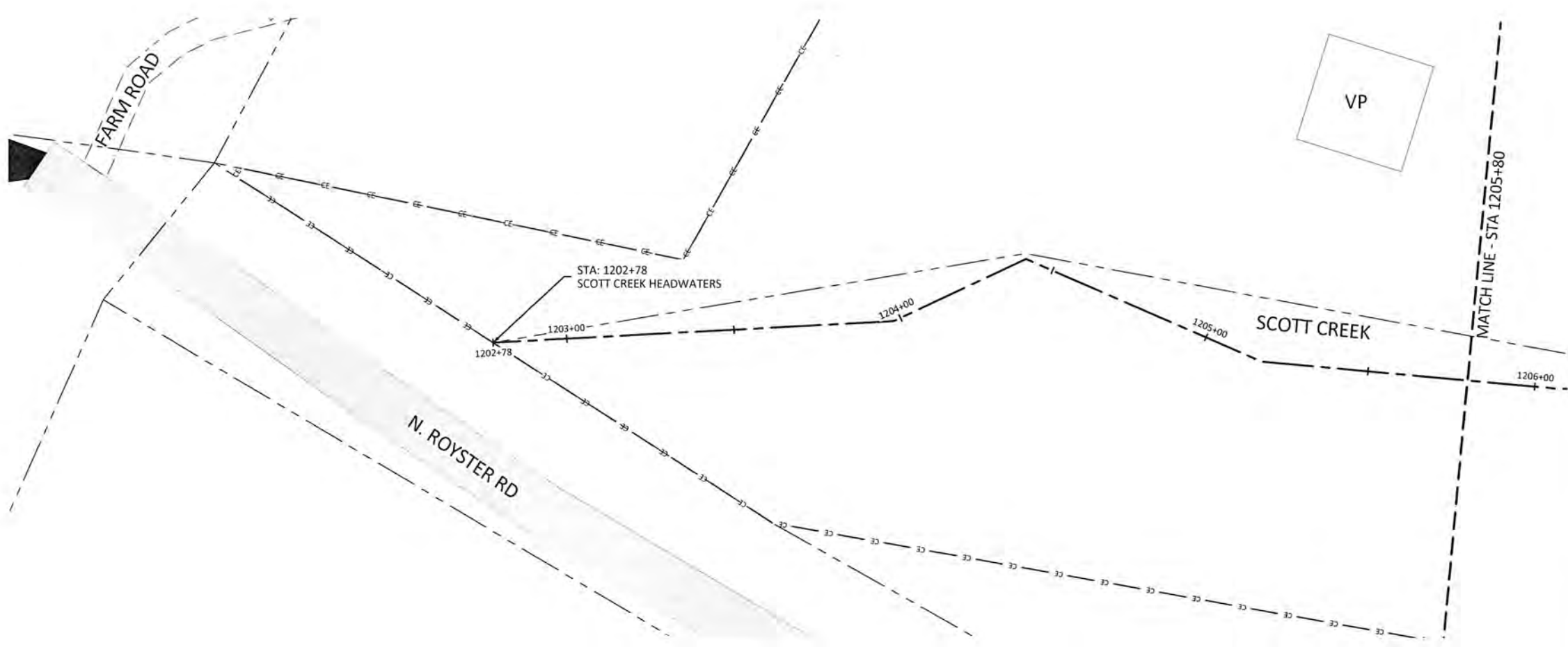
Revisions	
No.	Description

Date:	August 21, 2018
Job Number:	005-02123
Designed By:	EGR, AA
Drawn By:	JS
Checked By:	JCK

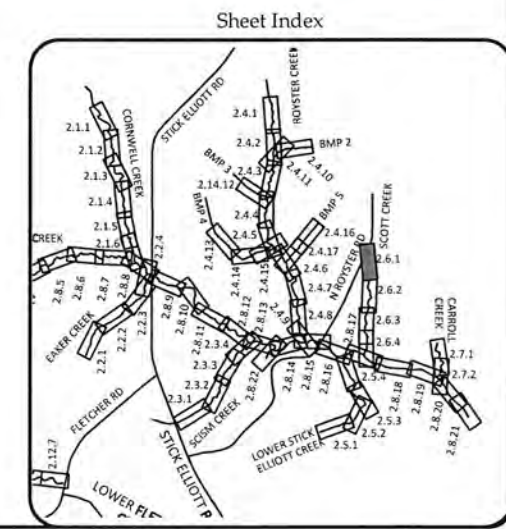
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- REACH TREATMENT:
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  2. TREAT INVASIVE SPECIES - REFER TO PLANTING PLAN SHEETS.
  3. REPLANT ALONG ENTIRE REACH - REFER TO PLANTING PLAN SHEETS.

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Big Harris Creek Mitigation Site  
 Cleveland County, North Carolina  
 Stream Plan and Profile Record Drawings



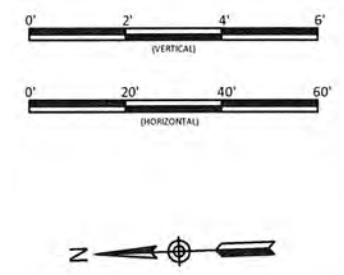
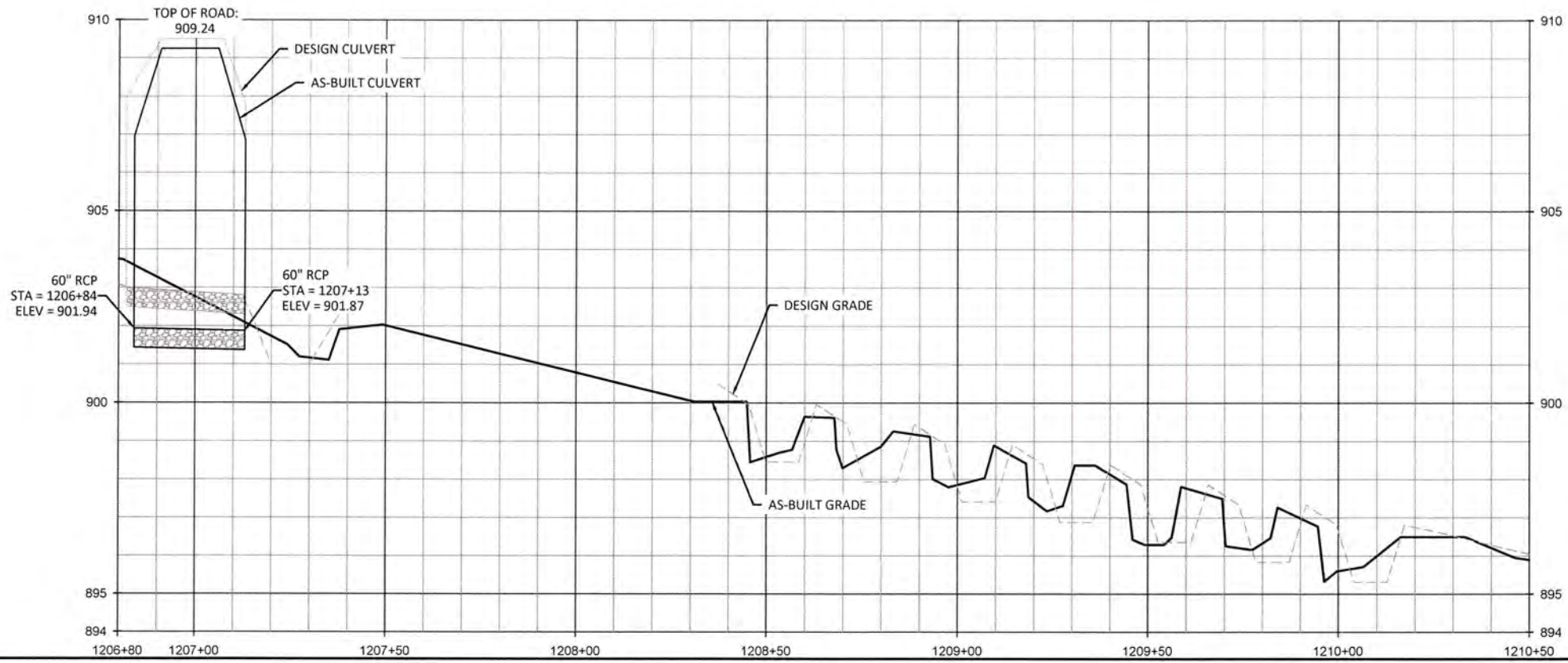
**WILDLANDS**  
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 Charlotte, NC 28205  
 Tel: 704.332.3306  
 Fax: 704.332.3306  
 Firm License No. F-08931

Revision

Date: August 21, 2018  
 Job Number: 005-02123  
 Designed By: ECR, A.A.  
 Drawn By: JS  
 Checked By: JCK

**2.6.1**

August 21, 2018  
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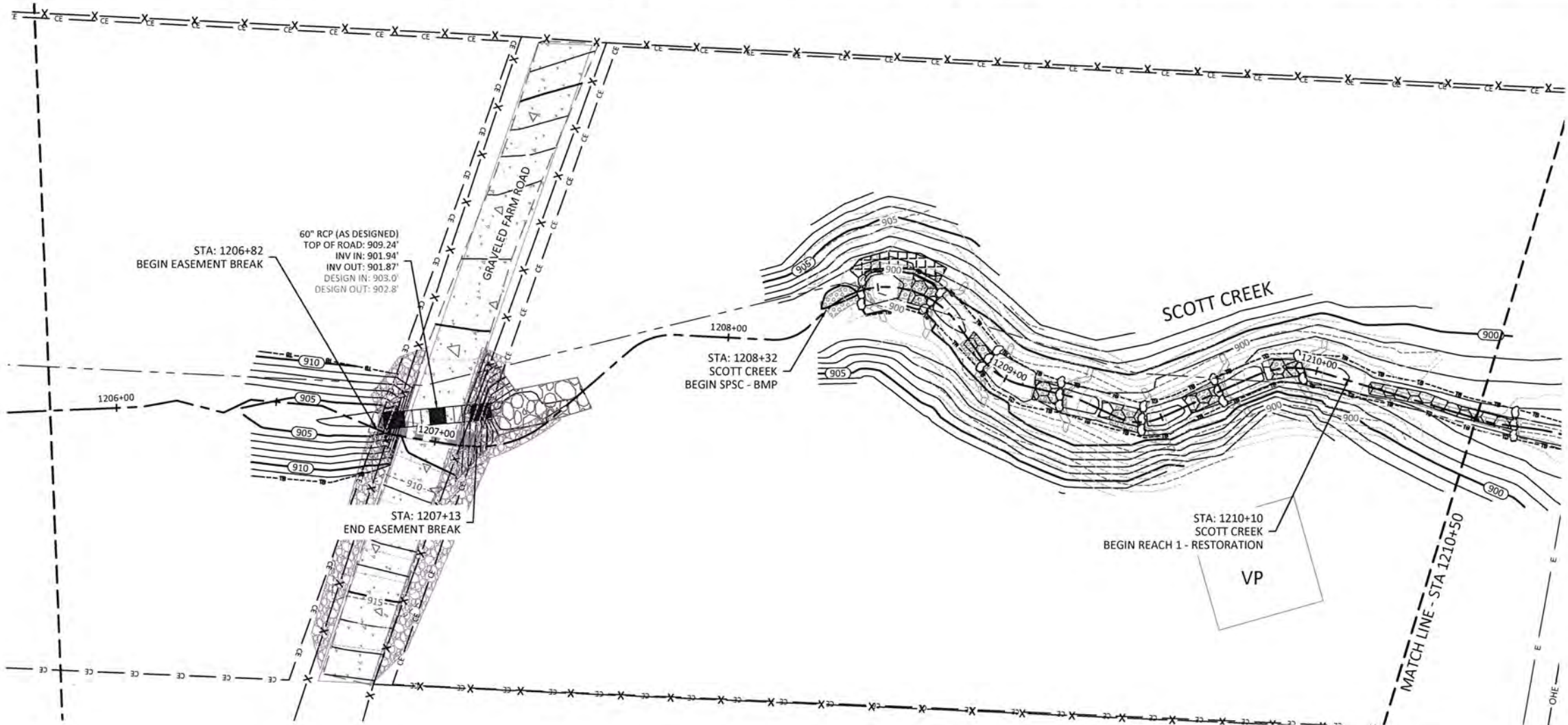


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 1480 S. WILKINSON BLVD.  
 CLEVELAND, OH 44115  
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 Firm License No. F-0831

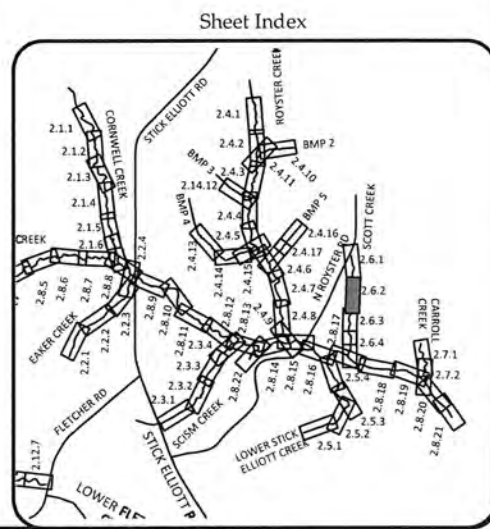


**Big Harris Creek Mitigation Site**  
**Cleveland County, North Carolina**  
 Stream Plan and Profile Record Drawings

Scott Creek



- REACH TREATMENT:**
1. FENCE OUT CATTLE - REFER TO FENCING PLAN SHEETS.
  2. TREAT INVASIVE SPECIES - REFER TO PLANTING PLAN SHEETS.
  3. REPLANT ALONG ENTIRE REACH - REFER TO PLANTING PLAN SHEETS.
  4. TREAT STORMWATER RUNOFF WITH SPSC.



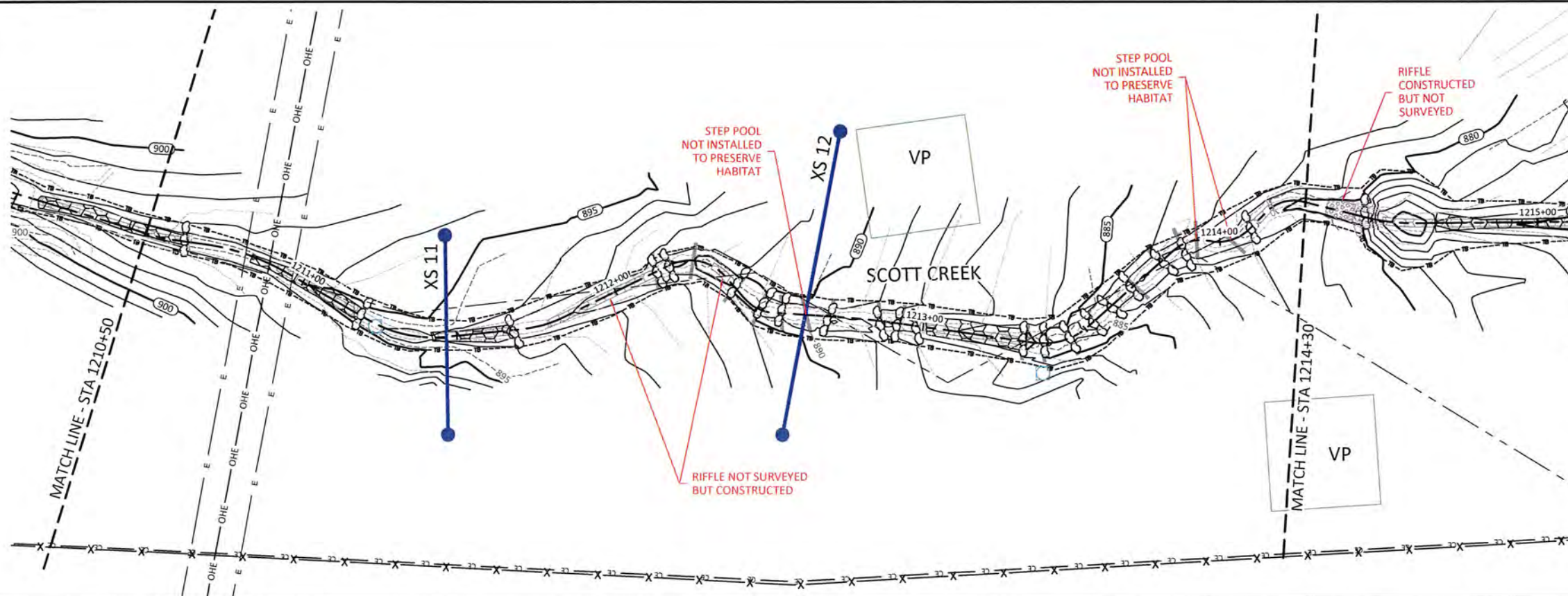
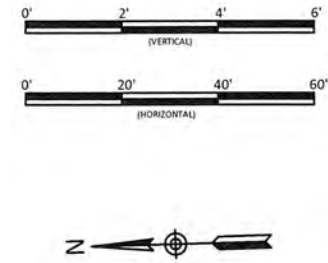
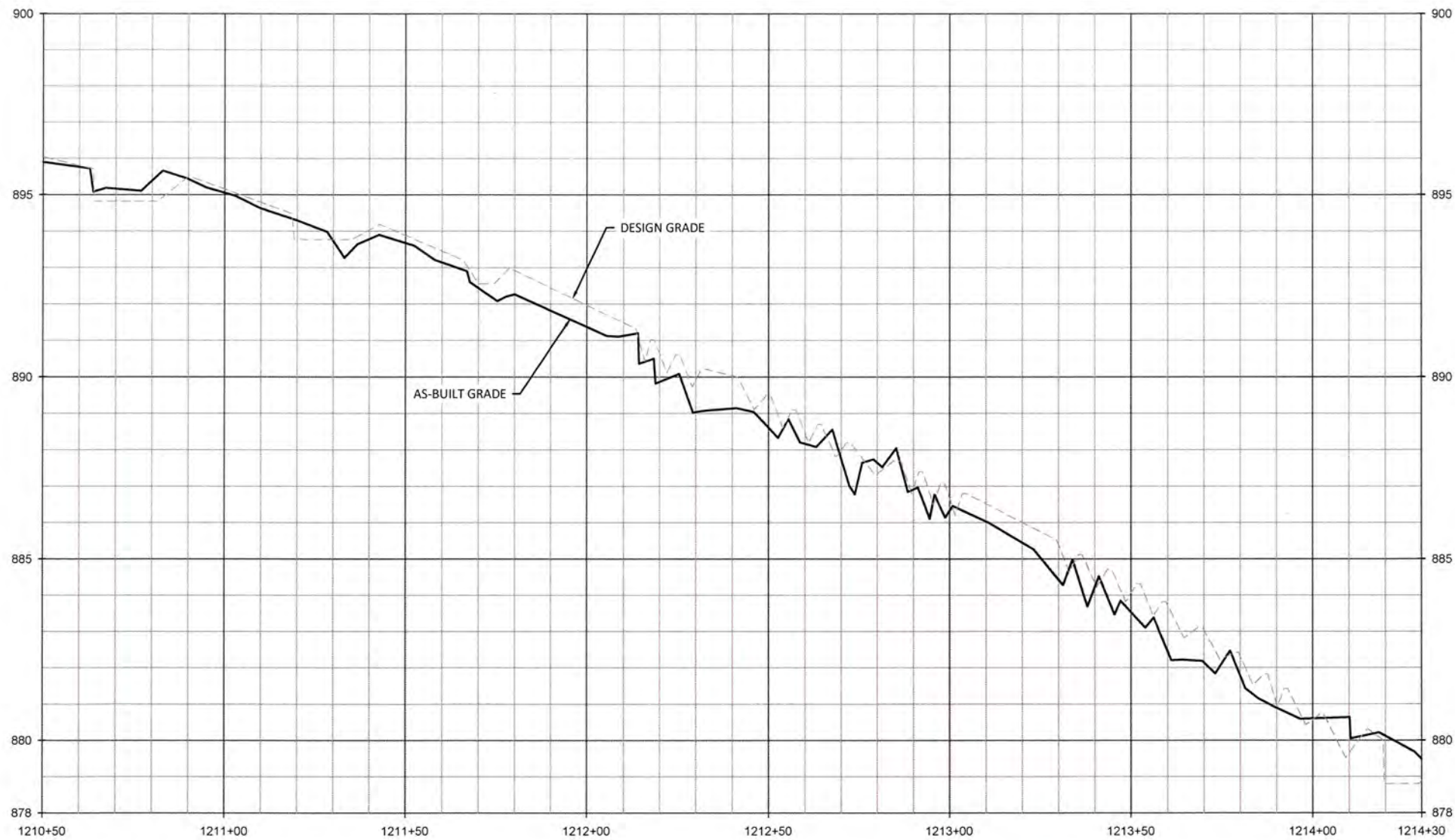
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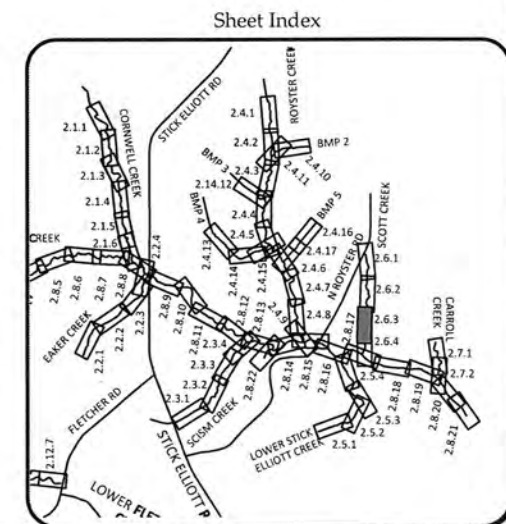
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Job Number:	005-02123
Designed By:	ECR, AA
Drawn By:	JS
Checked By:	JCK

**2.6.2**

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- REACH TREATMENT:**
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  3. REPLANT ALONG ENTIRE REACH - REFER TO PLANTING PLAN SHEETS.



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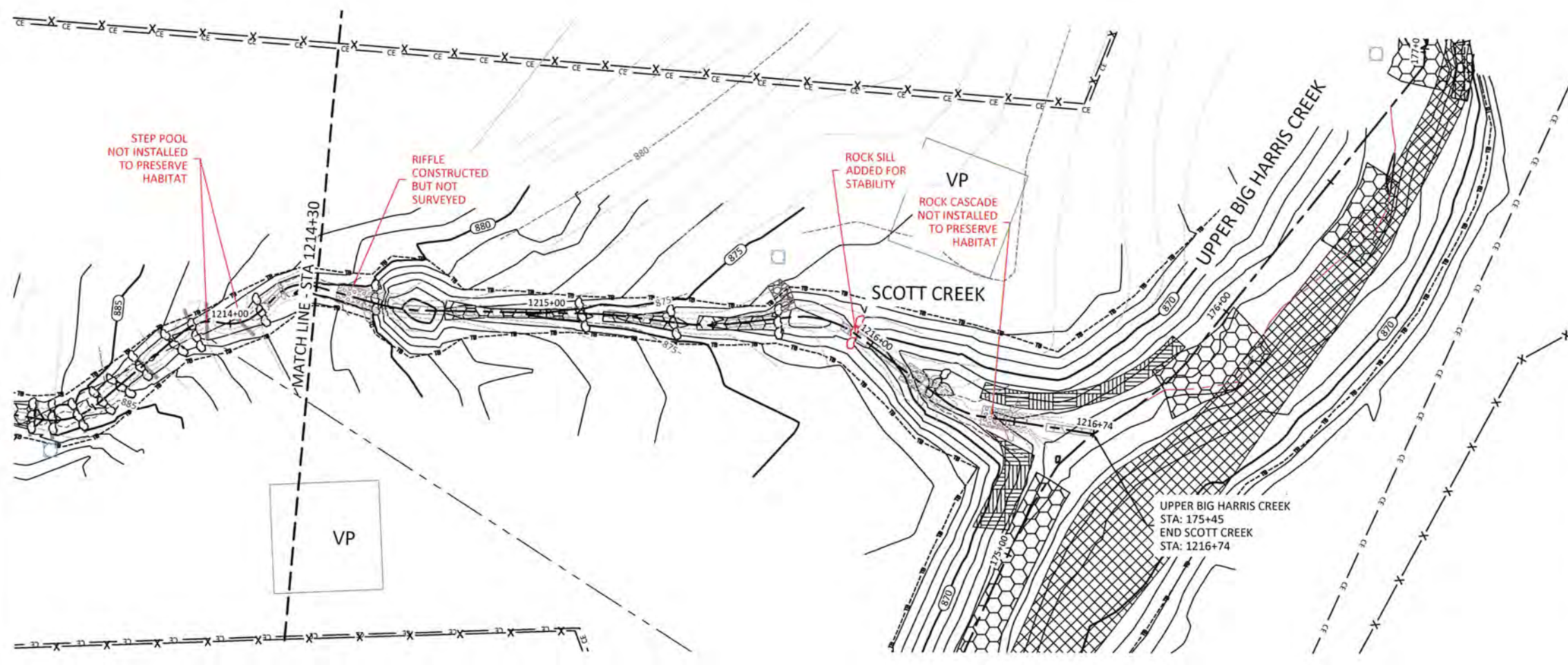
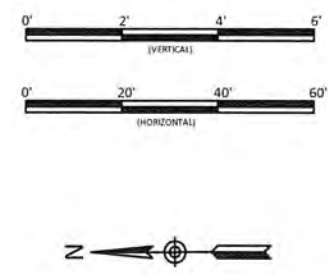
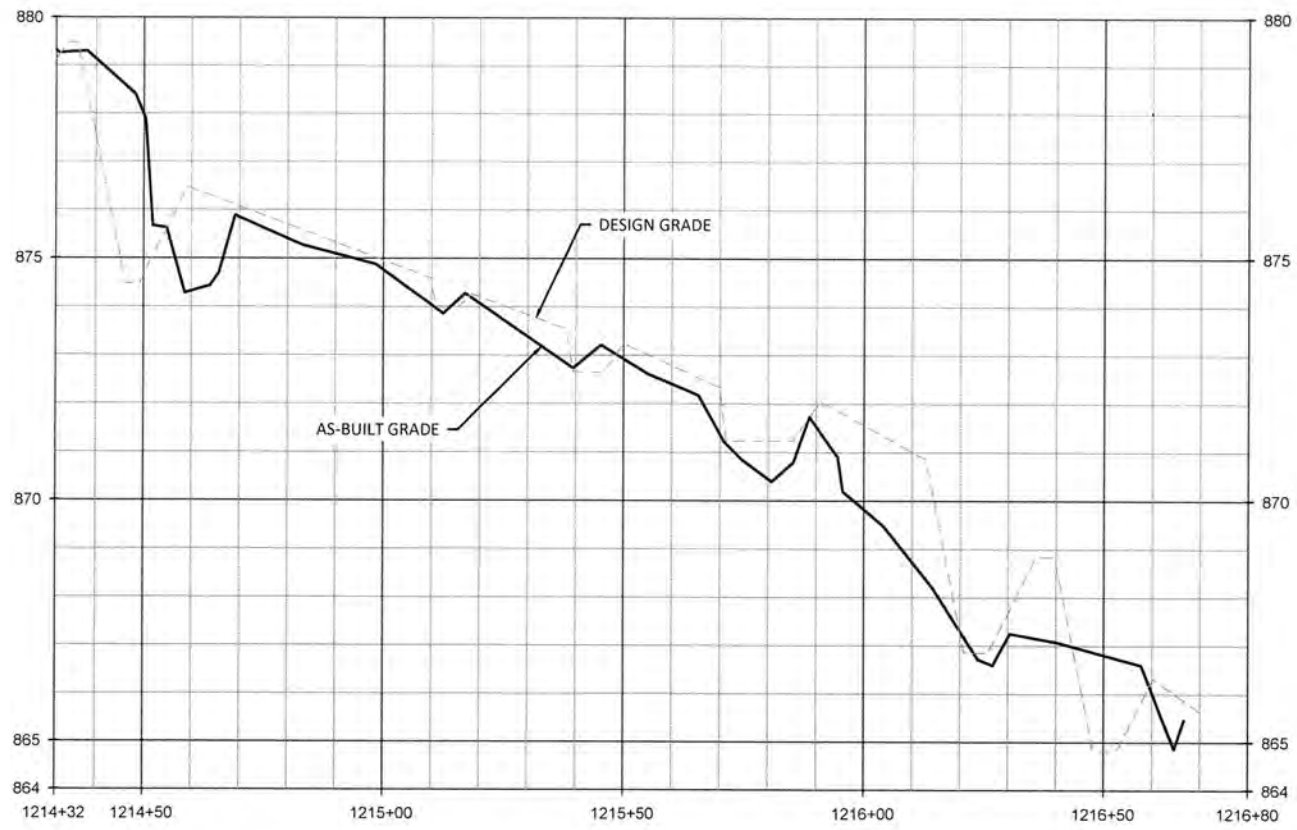


**Big Harris Creek Mitigation Site**  
**Cleveland County, North Carolina**  
 Scott Creek  
 Stream Plan and Profile Record Drawings

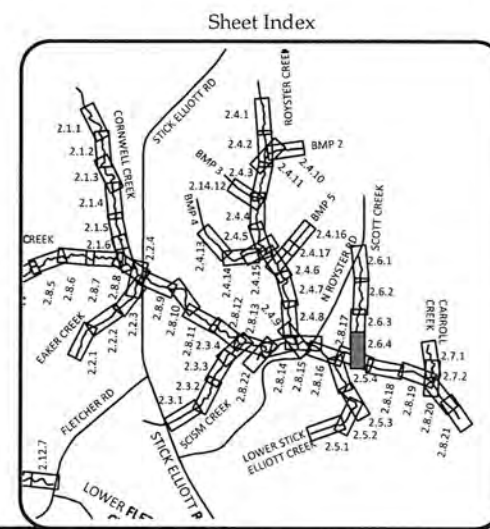
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Job Number:	005-02123
Designed By:	EGCR, A.A.
Drawn By:	JS
Checked By:	JCK

**2.6.3**

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- REACH TREATMENT:**
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  2. TREAT INVASIVE SPECIES - REFER TO PLANTING PLAN SHEETS.
  3. REPLANT ALONG ENTIRE REACH - REFER TO PLANTING PLAN SHEETS.



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 Charlotte, NC 28203  
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**Big Harris Creek Mitigation Site**  
 Cleveland County, North Carolina

Scott Creek  
 Stream Plan and Profile Record Drawings

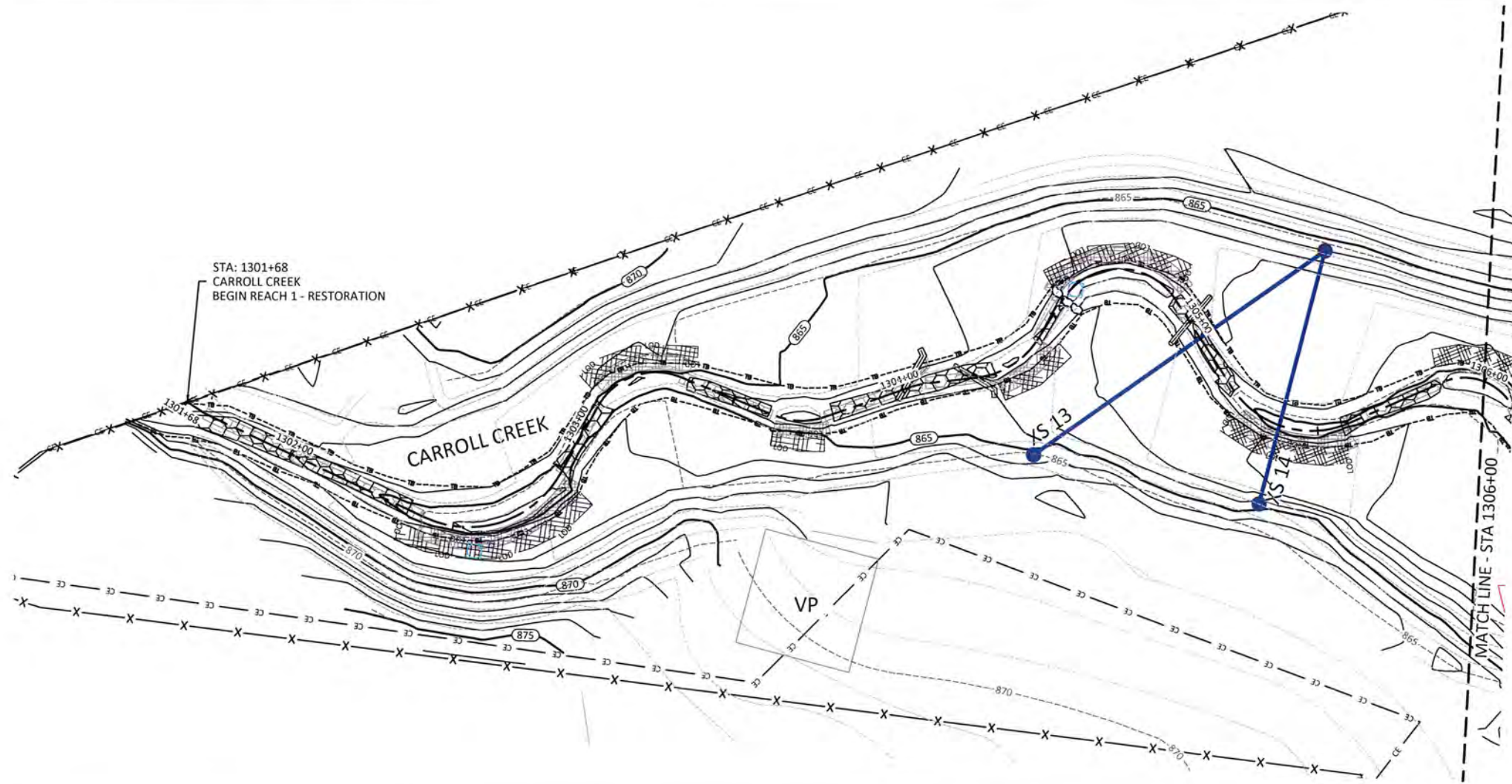
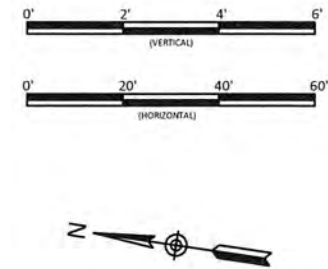
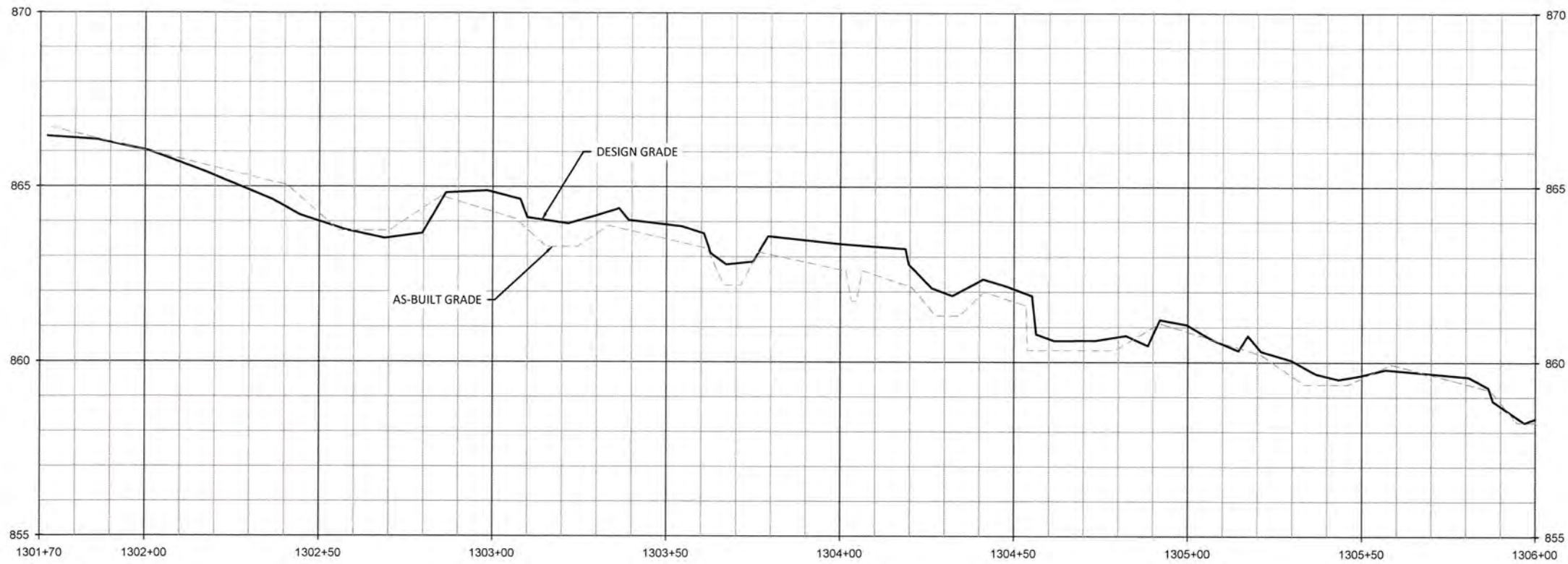
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Date: August 21, 2018  
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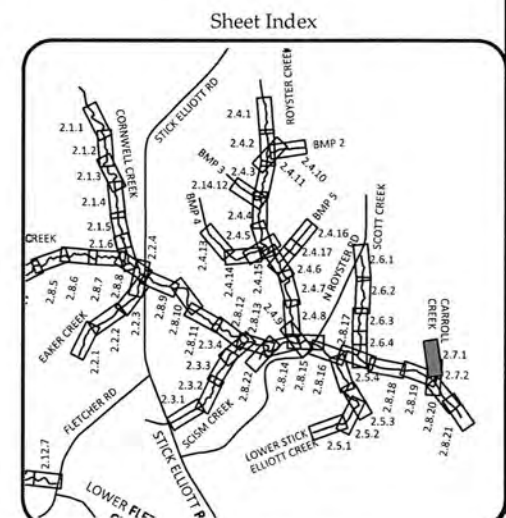
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- REACH TREATMENT:**
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  2. TREAT INVASIVE SPECIES - REFER TO PLANTING PLAN SHEETS.
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**Big Harris Creek Mitigation Site**  
**Cleveland County, North Carolina**  
 Stream Plan and Profile Record Drawings

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Revisions	

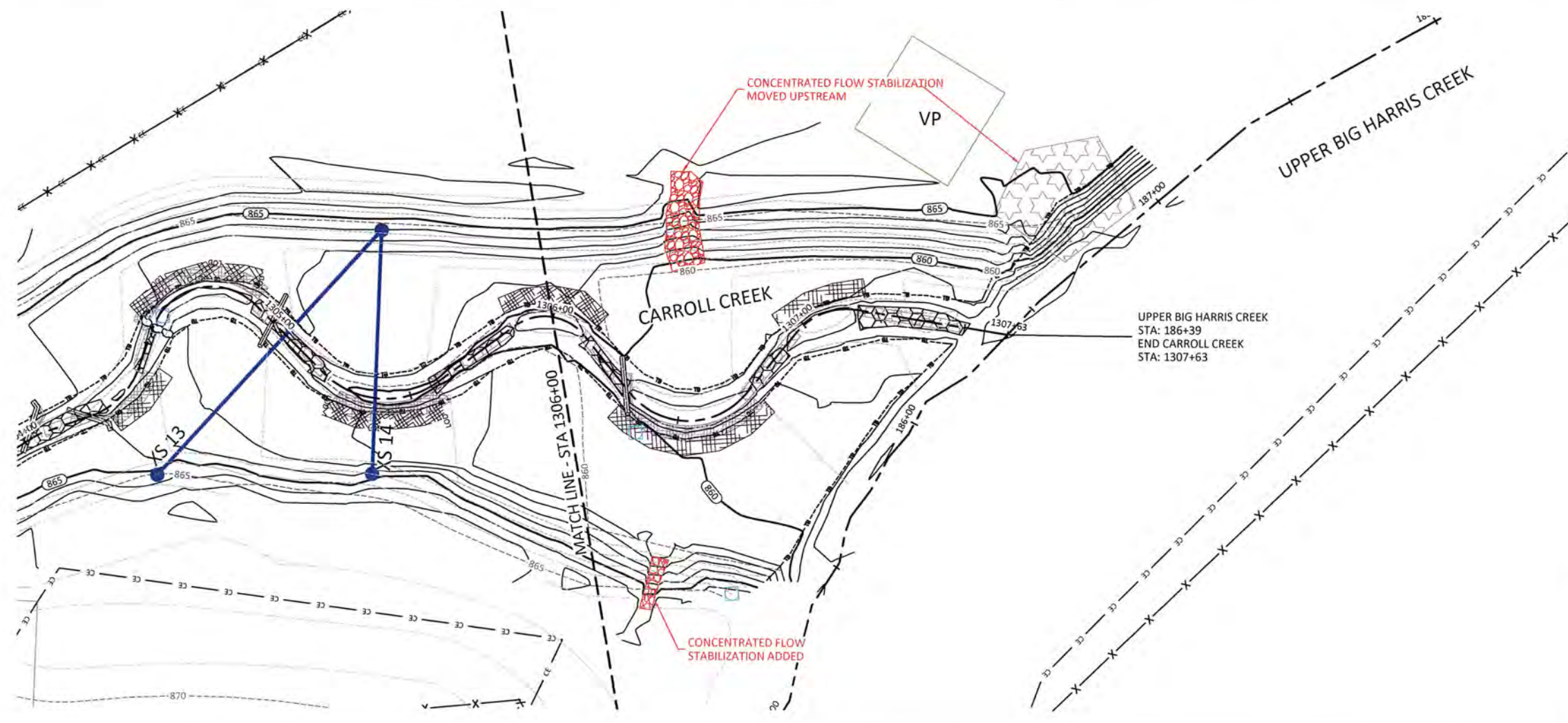
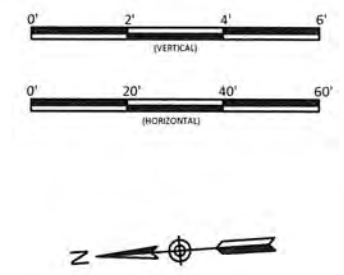
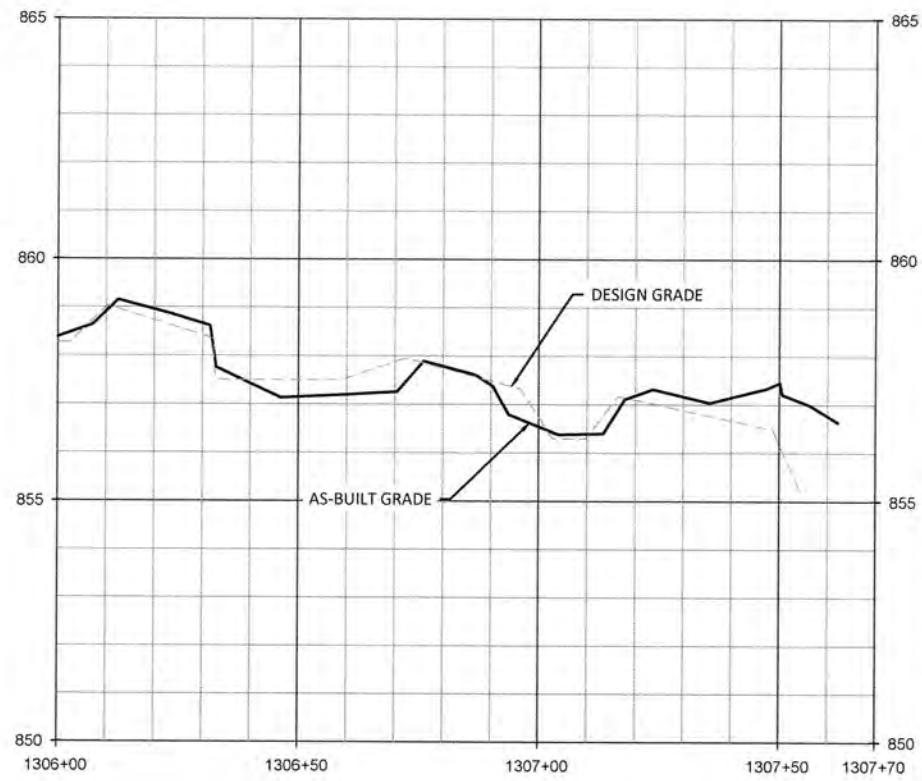
  

Date:	August 21, 2018
Job Number:	005-02123
Designed By:	EGR, AIA
Drawn By:	JCK
Checked By:	JCK

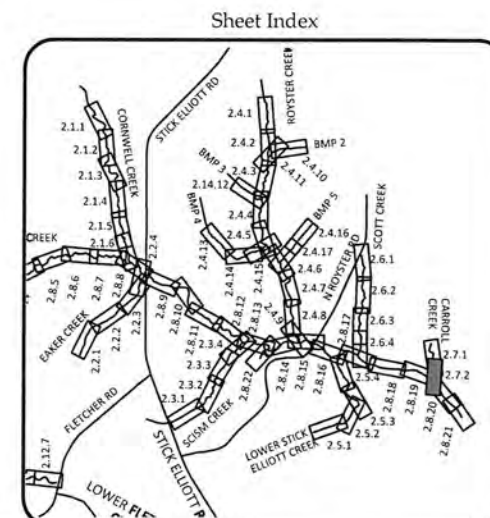
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August 21, 2018  
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- 1. FENCE OUT CATTLE - REFER TO FENCING PLAN SHEETS.
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  - 3. REPLANT ALONG ENTIRE REACH - REFER TO PLANTING PLAN SHEETS.



**Big Harris Creek Mitigation Site**  
Cleveland County, North Carolina

Carroll Creek  
Stream Plan and Profile Record Drawings

Revisions	

Date:	August 21, 2018
Job Number:	005-07123
Designed By:	EGR, AIA
Drawn By:	JIS
Checked By:	JCK

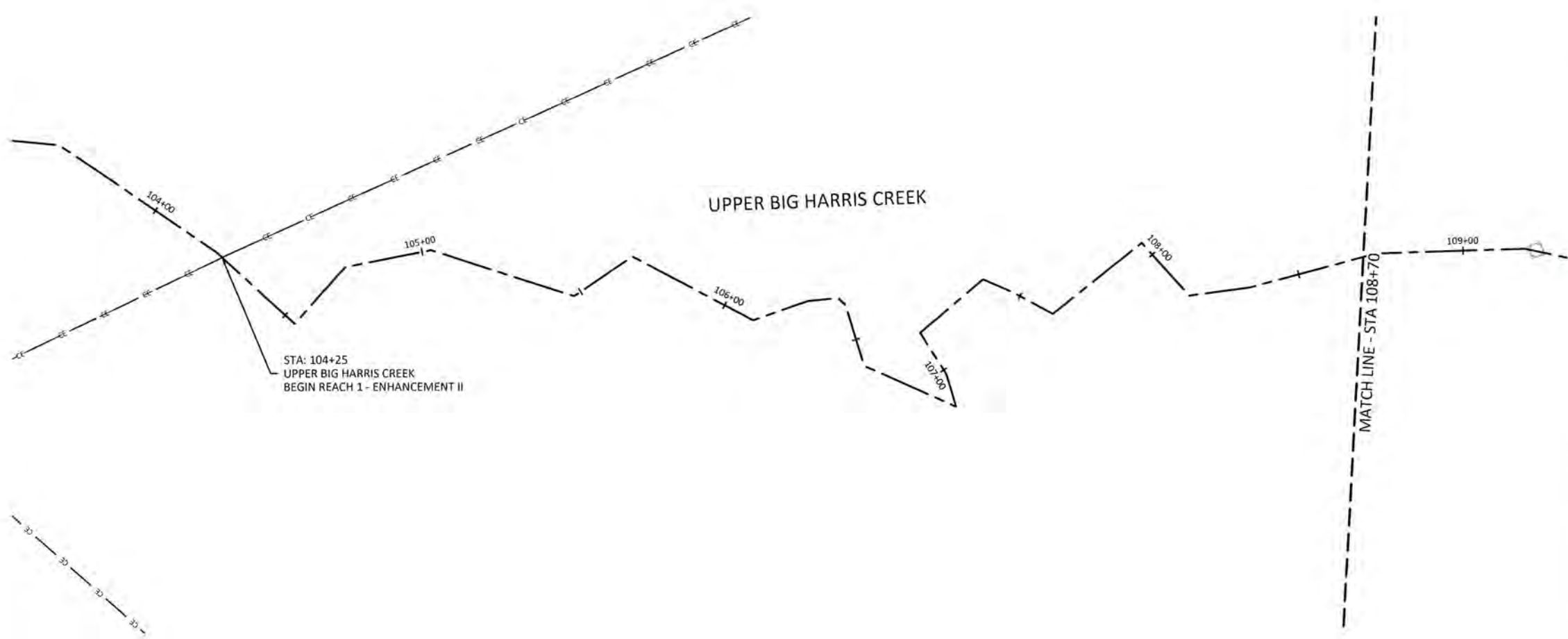
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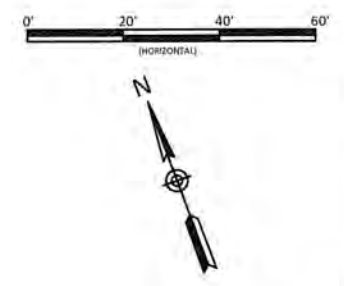
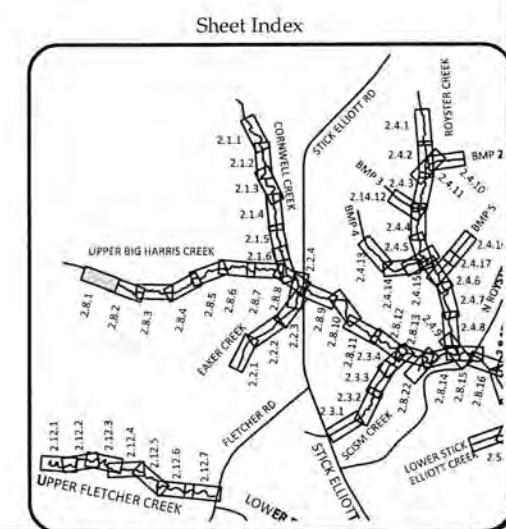


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 August 21, 2018



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  3. REPLANT ALONG ENTIRE REACH - REFER TO PLANTING PLAN SHEETS.

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 1436 N. WILSON ST.  
 CHARLOTTE, NC 28203  
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 Firm License No. F-0831



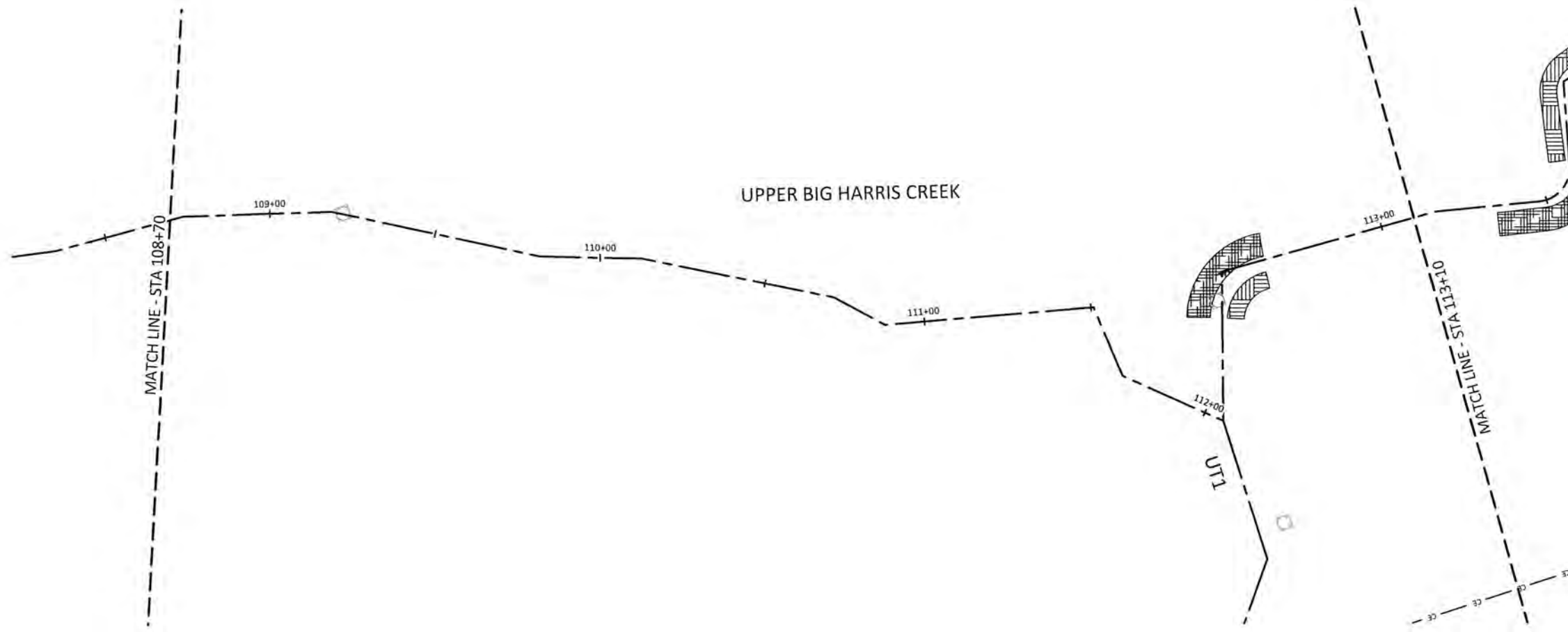
**Big Harris Creek Mitigation Site**  
**Cleveland County, North Carolina**  
 Upper Big Harris Creek Reach 1  
 Stream Plan and Profile Record Drawings

Revisions:	

Date: August 21, 2018  
 Job Number: 005-02123  
 Designed By: EGR, A.A.  
 Drawn By: JS  
 Checked By: JCK

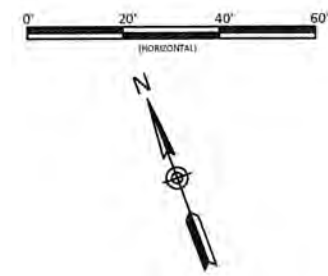
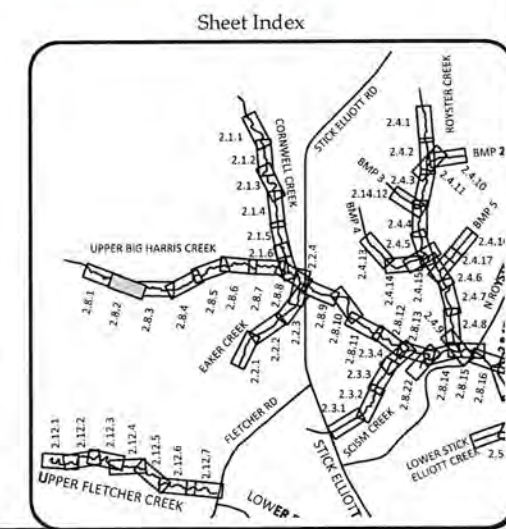
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- REACH TREATMENT:
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 1486 S. GARDNER STREET, SUITE 104  
 CHARLOTTE, NC 28203  
 TEL: 704.332.7754  
 FAX: 704.332.3306  
 FIRM LICENSE NO. F-08831

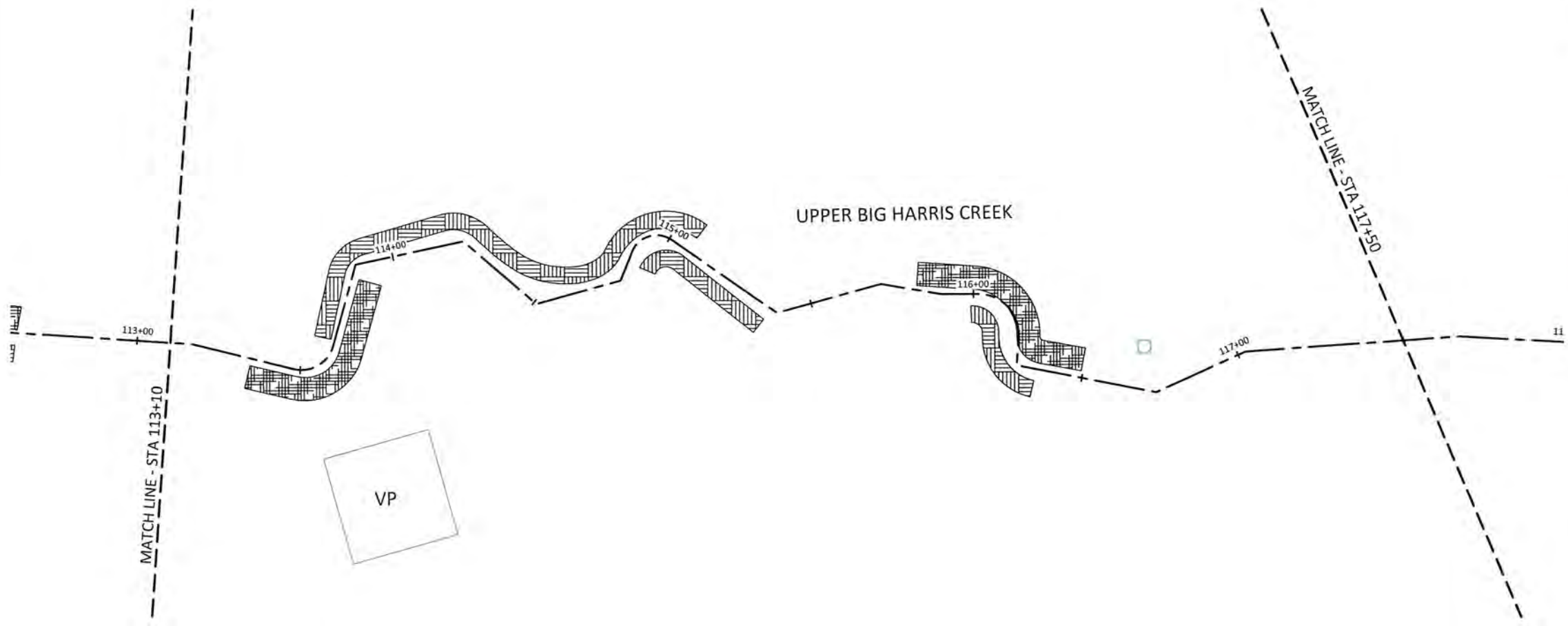


**Big Harris Creek Mitigation Site**  
**Cleveland County, North Carolina**  
 Upper Big Harris Creek Reach 1  
 Stream Plan and Profile Record Drawings

Revisions	

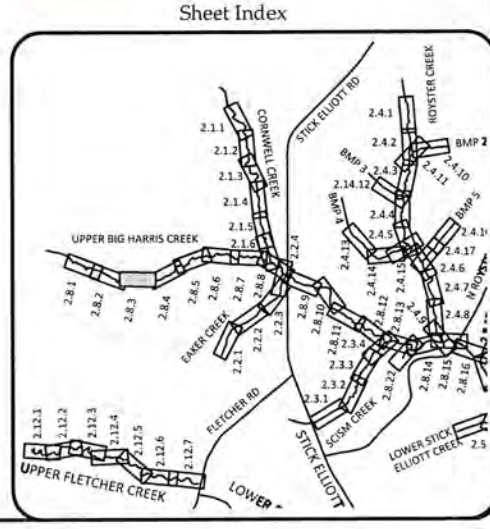
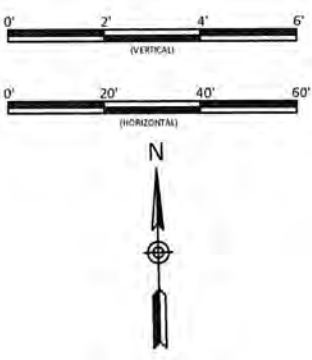
Date: August 21, 2018  
 Job Number: 005-02123  
 Designed By: ECR, AA  
 Drawn By: JS  
 Checked By: JCK

**2.8.2**



- REACH TREATMENT:
1. FENCE OUT CATTLE - REFER TO FENCING PLAN SHEETS.
  2. TREAT INVASIVE SPECIES - REFER TO PLANTING PLAN SHEETS.
  3. REPLANT ALONG ENTIRE REACH - REFER TO PLANTING PLAN SHEETS.

**NOTE:**  
 SURVEY WAS NOT CONDUCTED IN ENHANCEMENT II REACHES. REACHES WERE BUILT PER DESIGN UNLESS OTHERWISE NOTED.  
 BANK GRADING WAS RE-EVALUATED DURING CONSTRUCTION AND REVISED ACCORDINGLY.



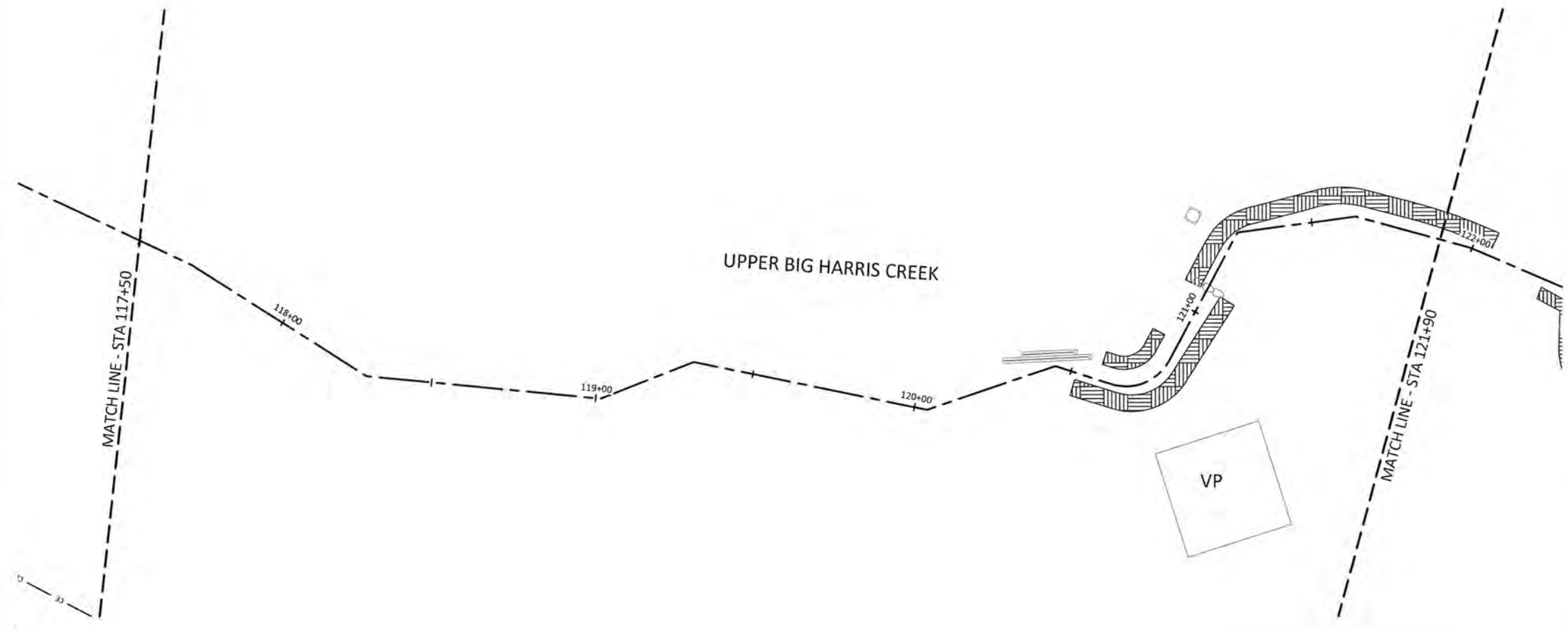
Date:	August 21, 2018
JOB Number:	005-02123
Designed By:	EGR, AA
Drawn By:	JS
Checked By:	JCS

2.8.3

Big Harris Creek Mitigation Site  
 Cleveland County, North Carolina  
 Upper Big Harris Creek Reach 1  
 Stream Plan and Profile Record Drawings

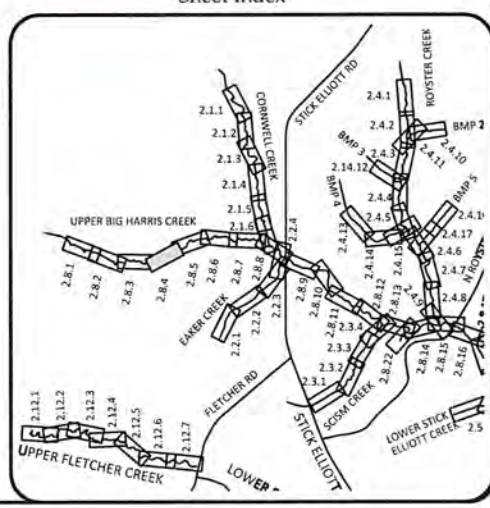
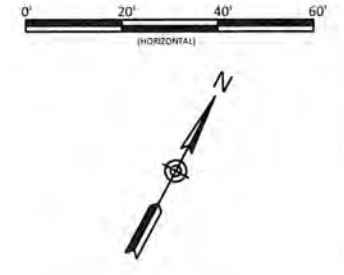


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- REACH TREATMENT:
1. TREAT INVASIVE SPECIES - REFER TO PLANTING PLAN SHEETS.
  2. REPLANT ALONG ENTIRE REACH - REFER TO PLANTING PLAN SHEETS.

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Date:	August 21, 2018
Job Number:	005-02123
Designed By:	EGR, AA
Drawn By:	JS
Checked By:	JCK

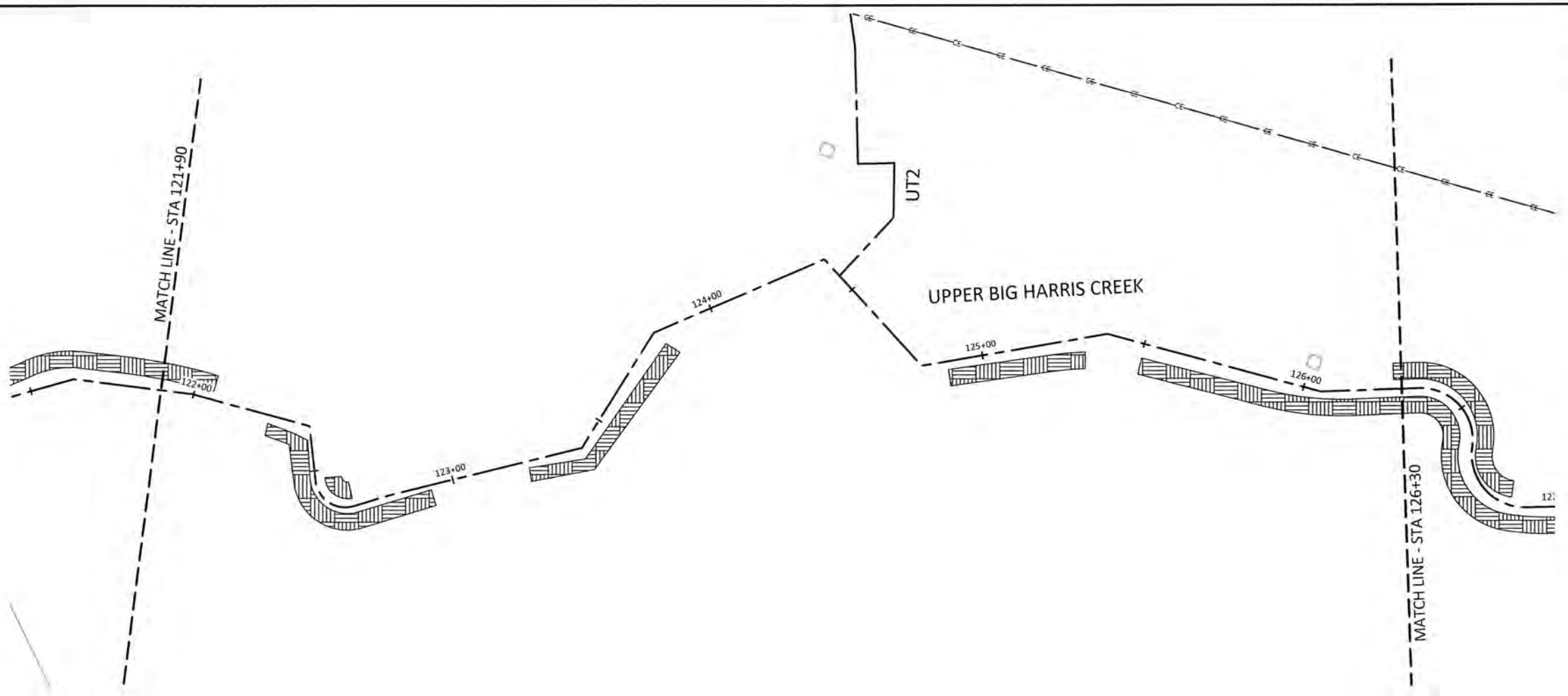
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Big Harris Creek Mitigation Site  
 Cleveland County, North Carolina  
 Upper Big Harris Creek Reach 1  
 Stream Plan and Profile Record Drawings



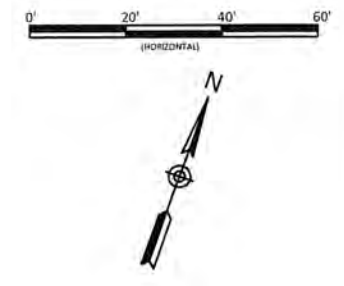
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- REACH TREATMENT:**
1. TREAT INVASIVE SPECIES - REFER TO PLANTING PLAN SHEETS.
  2. REPLANT ALONG ENTIRE REACH - REFER TO PLANTING PLAN SHEETS.

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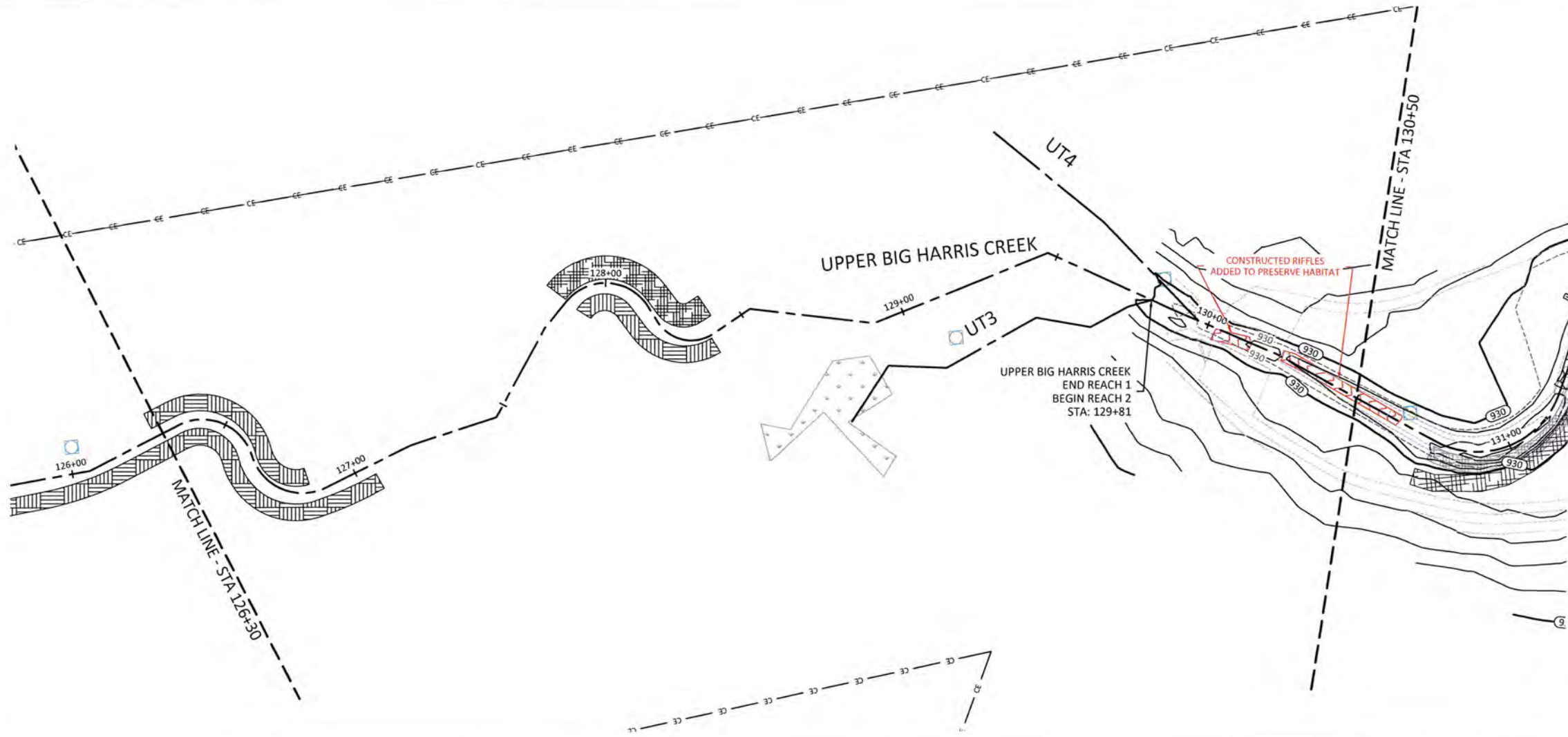
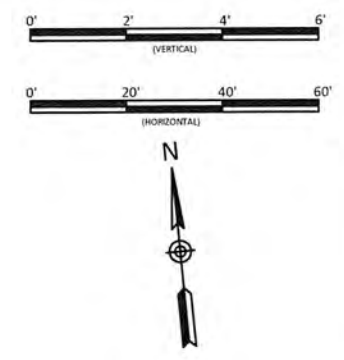
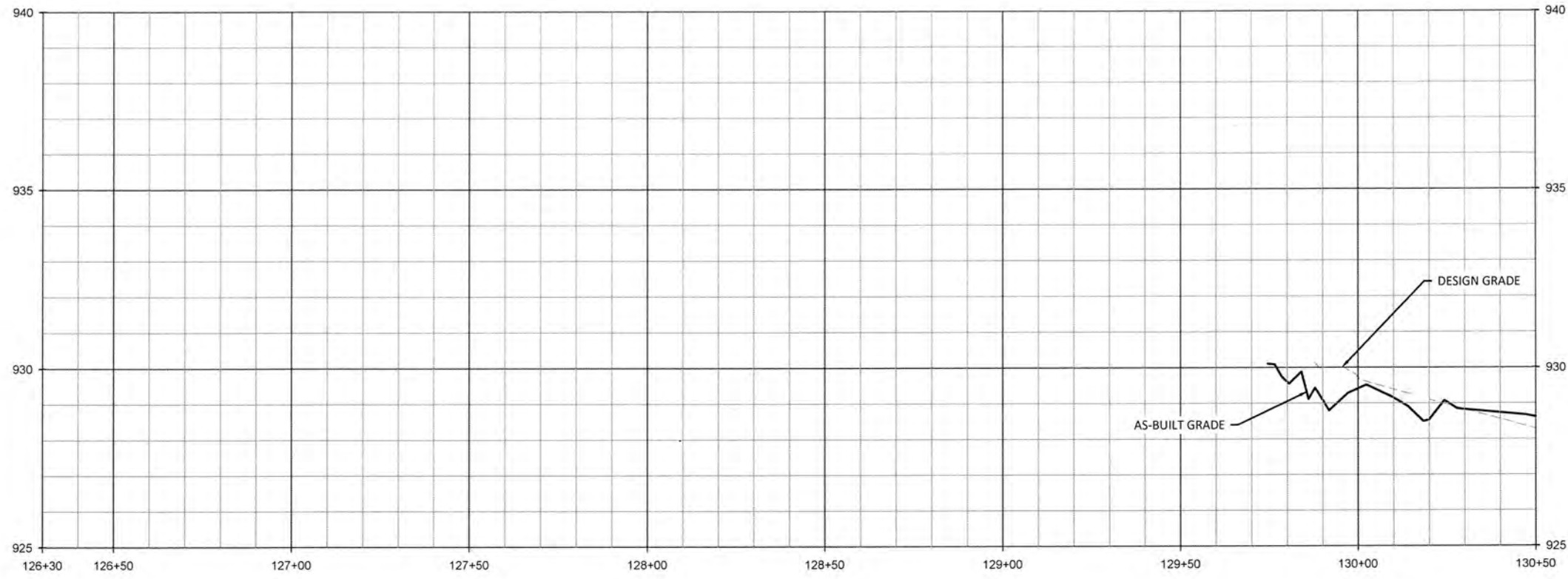


**Big Harris Creek Mitigation Site**  
 Cleveland County, North Carolina  
 Upper Big Harris Creek Reach 1  
 Stream Plan and Profile Record Drawings

Date:	August 21, 2018
Job Number:	005-02123
Designed By:	EGR, AA
Drawn By:	JS
Checked By:	JCS
<b>2.8.5</b>	
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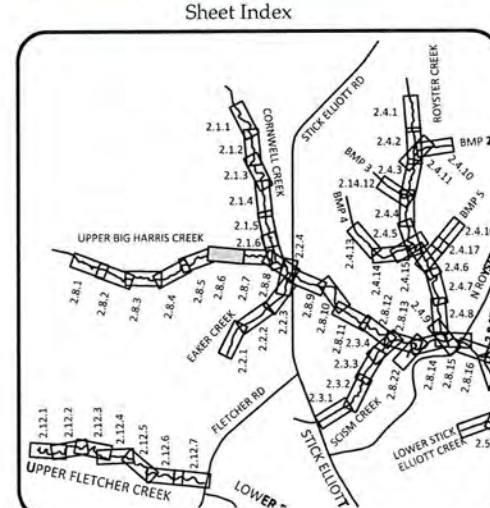
**WILDLANDS**  
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- REACH TREATMENT:**
1. TREAT INVASIVE SPECIES - REFER TO PLANTING PLAN SHEETS.
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**Big Harris Creek Mitigation Site**  
**Cleveland County, North Carolina**  
 Upper Big Harris Creek Reach 1 & 2  
 Stream Plan and Profile Record Drawings

Revisions	

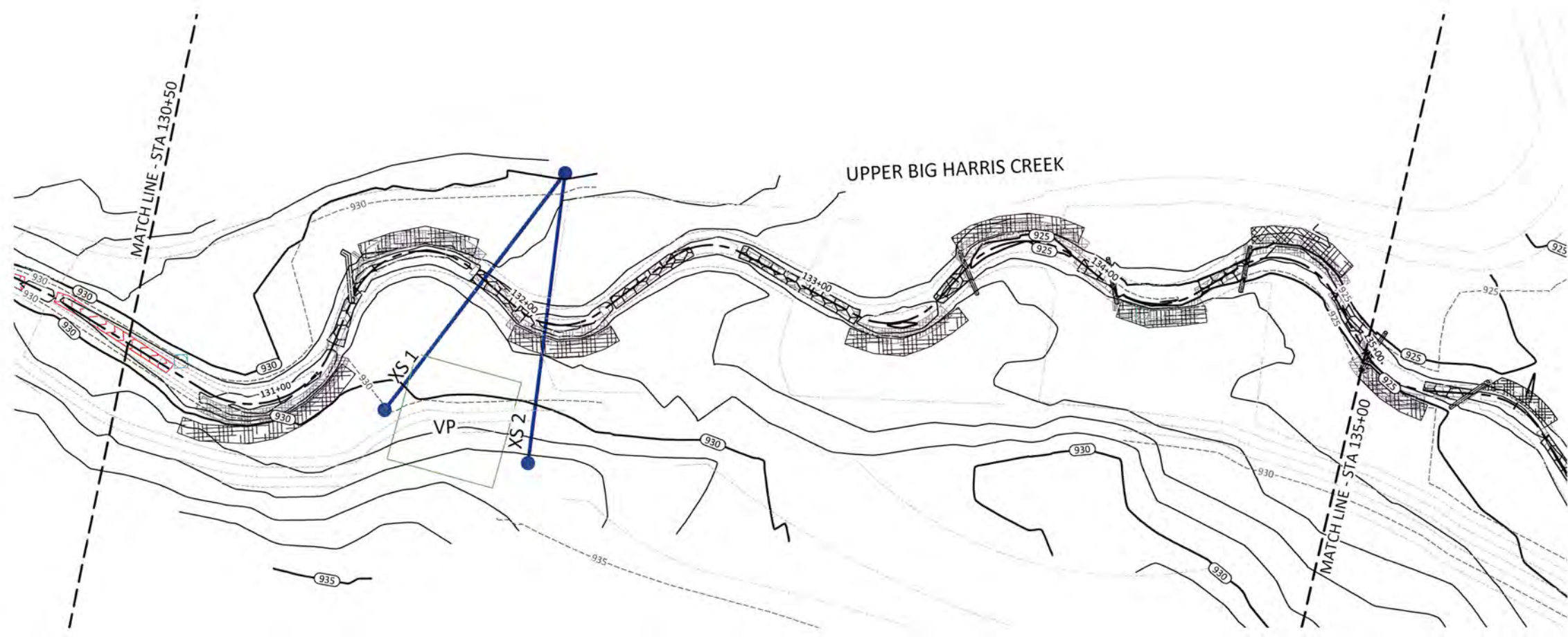
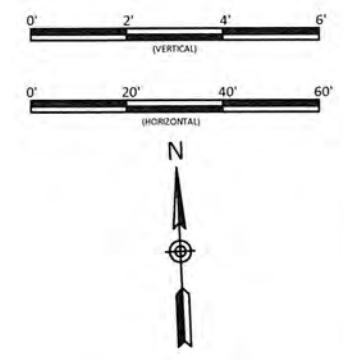
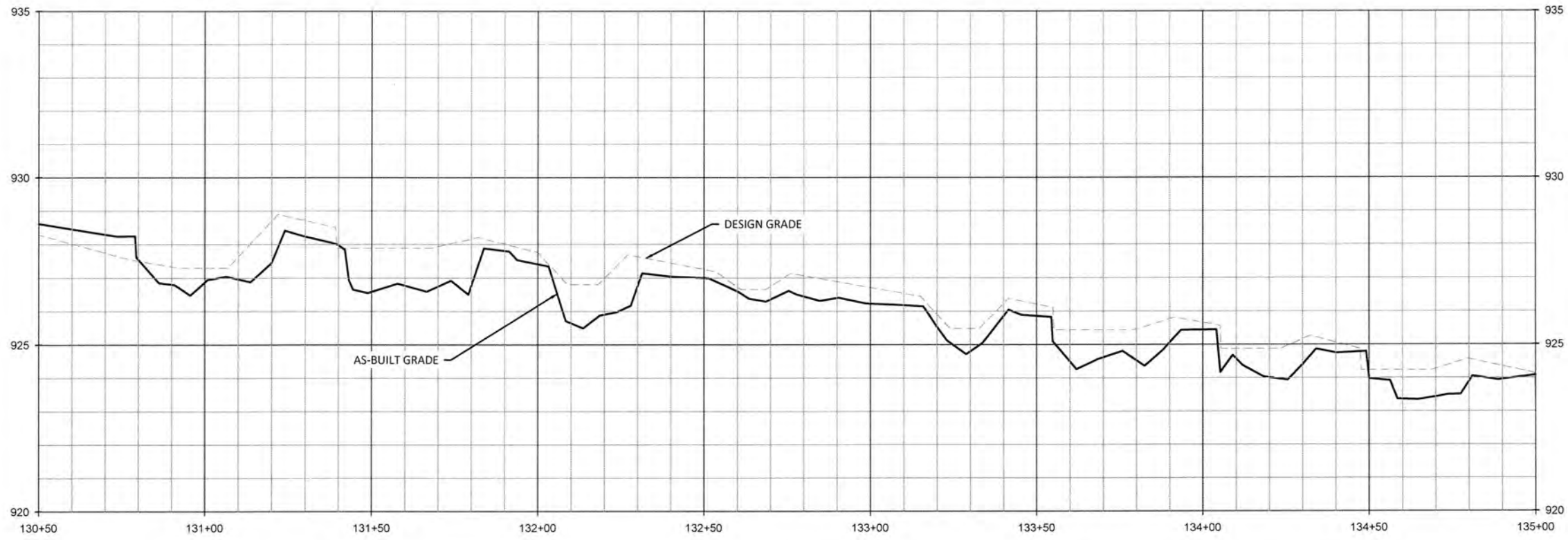
Date:	August 21, 2018
Job Number:	005-02123
Assigned By:	EGR, AA
Drawn By:	JS
Checked By:	JCK

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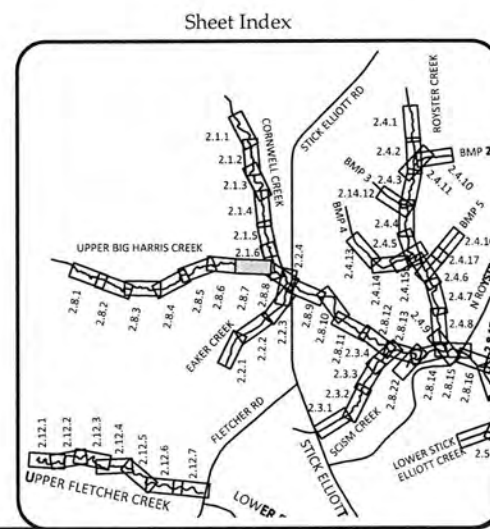


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- REACH TREATMENT:
1. TREAT INVASIVE SPECIES - REFER TO PLANTING PLAN SHEETS.
  2. REPLANT ALONG ENTIRE REACH - REFER TO PLANTING PLAN SHEETS.



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Big Harris Creek Mitigation Site  
Cleveland County, North Carolina  
Upper Big Harris Creek Reach 2  
Stream Plan and Profile Record Drawings

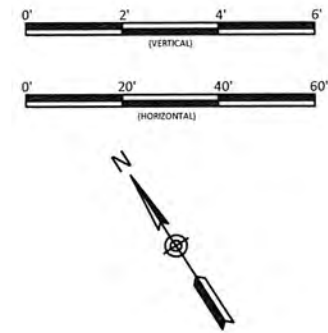
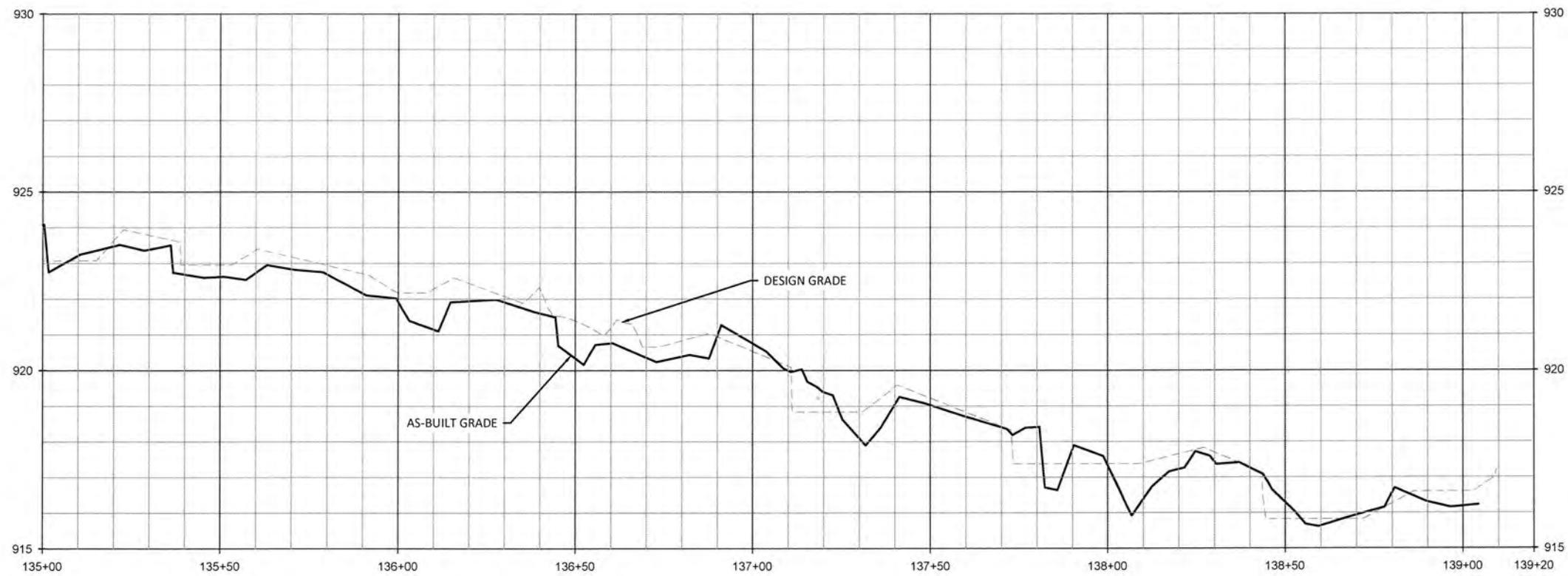
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Date: August 21, 2018  
Job Number: 005-02123  
Assigned By: EGR, AA  
Drawn By: JS  
Checked By: JCK

**2.8.7**

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August 21, 2018

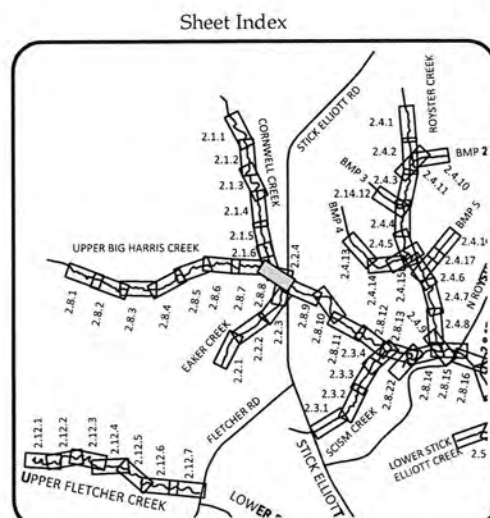
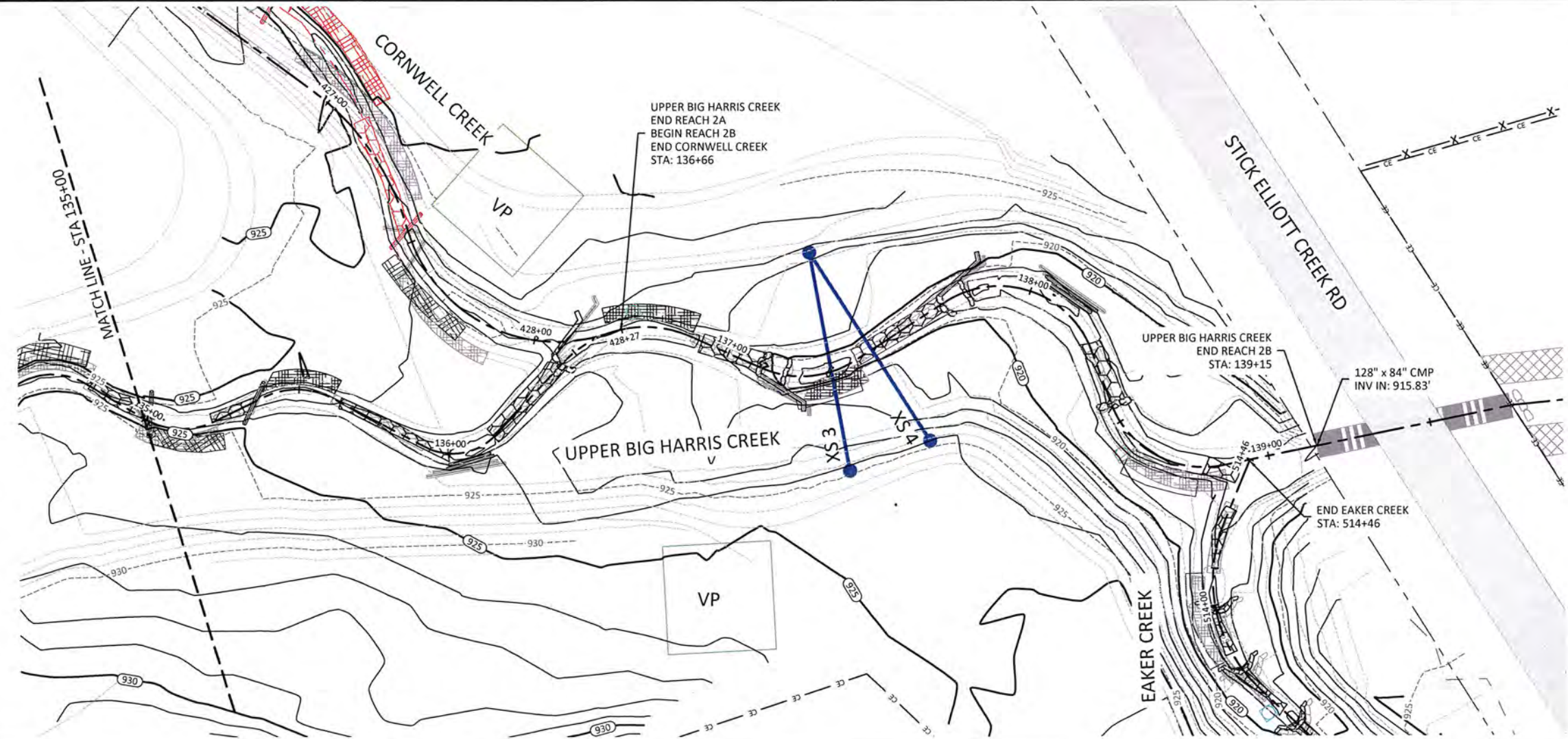


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**Big Harris Creek Mitigation Site**  
**Cleveland County, North Carolina**  
 Upper Big Harris Creek Reach 2  
 Stream Plan and Profile Record Drawings

- REACH TREATMENT:**
1. TREAT INVASIVE SPECIES - REFER TO PLANTING PLAN SHEETS.
  2. REPLANT ALONG ENTIRE REACH - REFER TO PLANTING PLAN SHEETS.



Revisions	

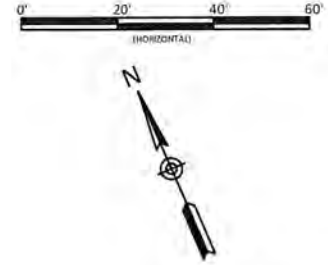
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 Designed By: ECR, AA  
 Drawn By: JS  
 Checked By: JCK

**2.8.8**

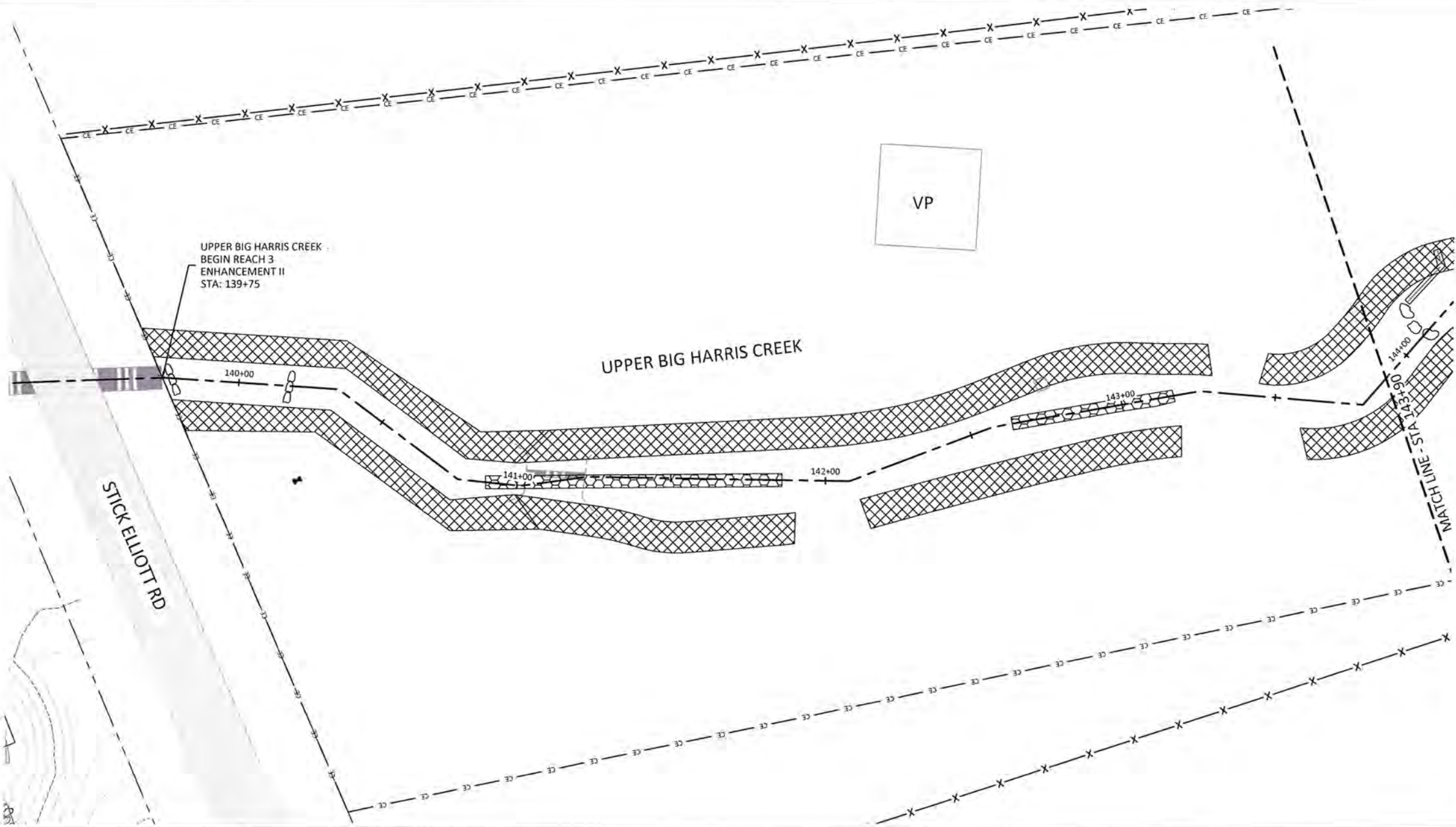
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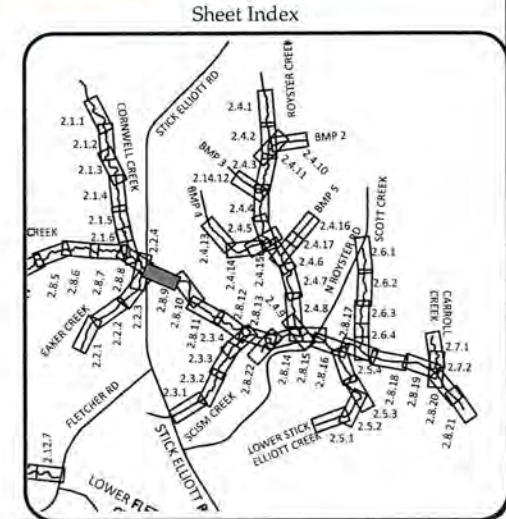


Big Harris Creek Mitigation Site  
Cleveland County, North Carolina  
Upper Big Harris Creek Reach 3  
Stream Plan and Profile Record Drawings



- REACH TREATMENT:
- 1. FENCE OUT CATTLE - REFER TO FENCING PLAN SHEETS.
  - 2. TREAT INVASIVE SPECIES - REFER TO PLANTING PLAN SHEETS.

NOTE:  
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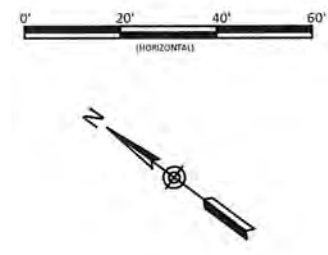
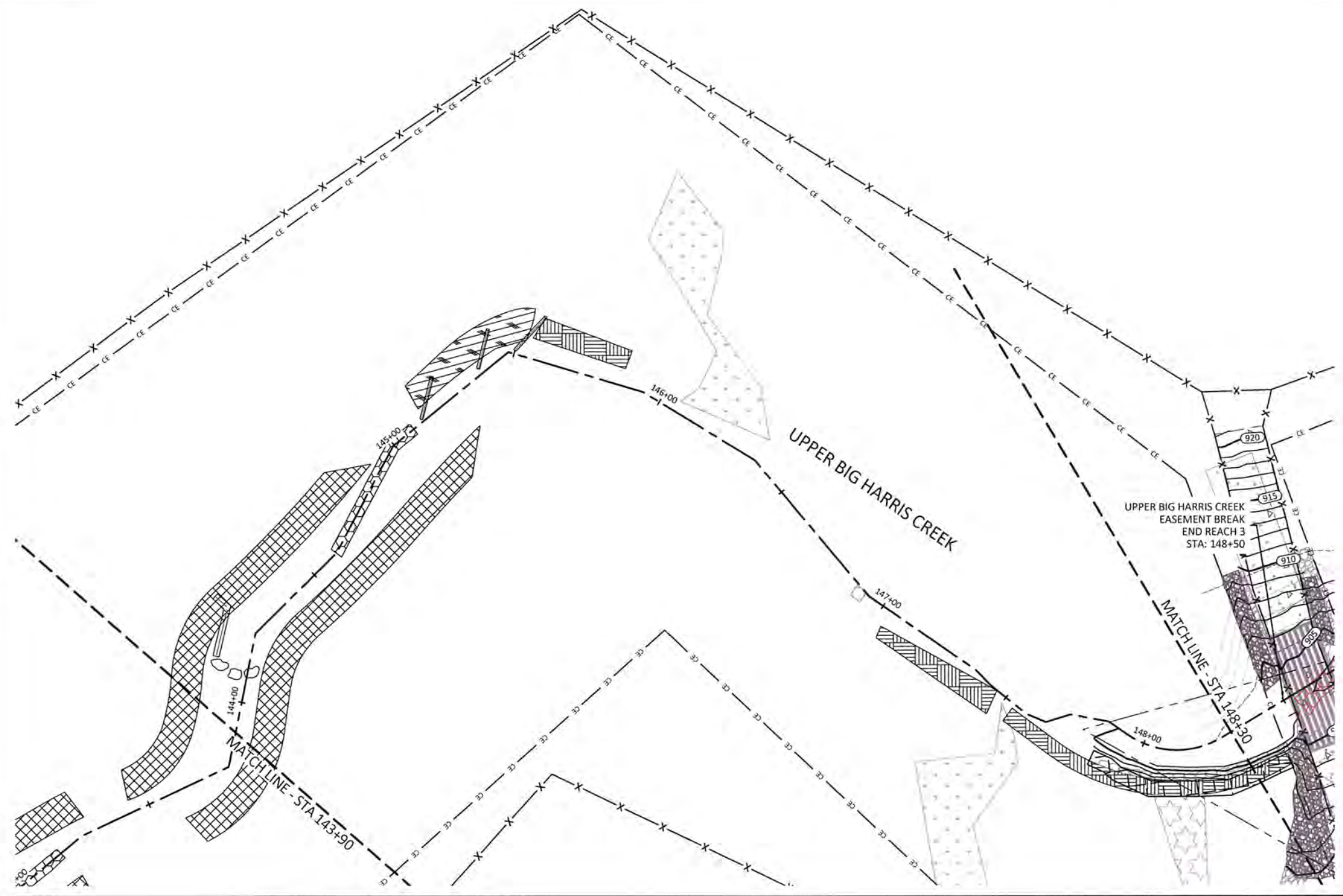


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Date: August 21, 2018  
Job Number: 005-02123  
Designed By: EGR, AA  
Drawn By: JS  
Checked By: JCK

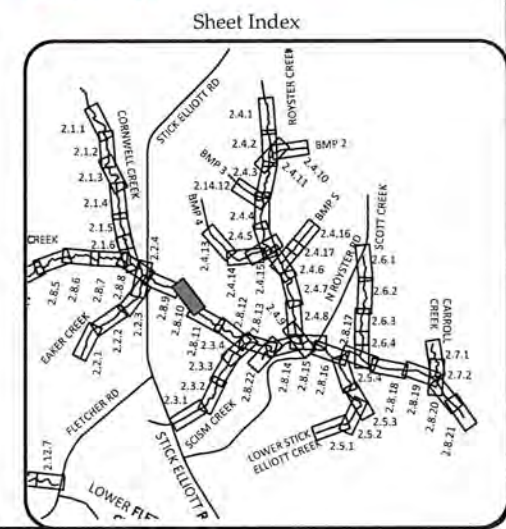
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- REACH TREATMENT:
1. FENCE OUT CATTLE - REFER TO FENCING PLAN SHEETS.
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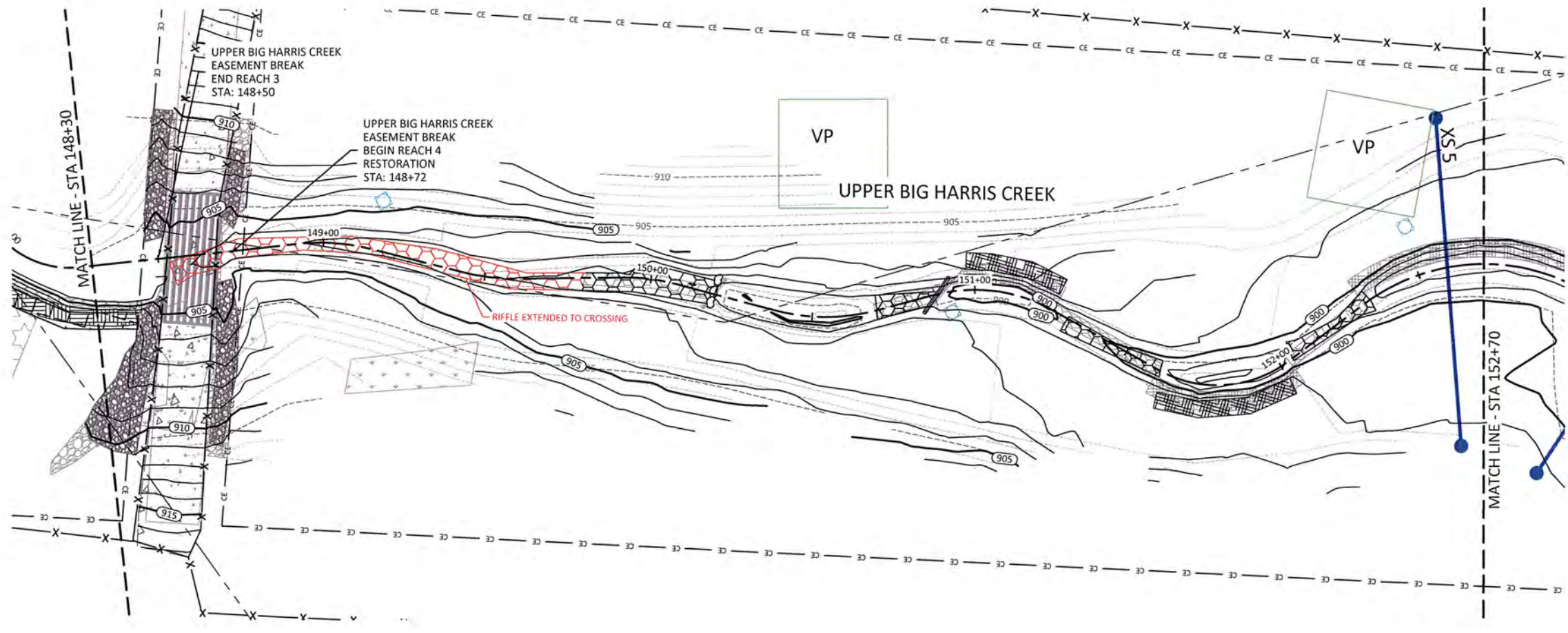
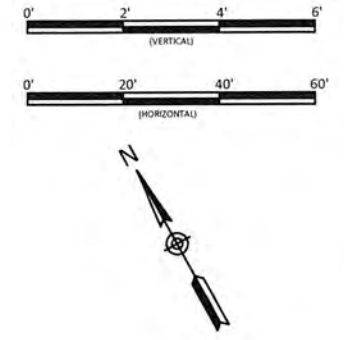
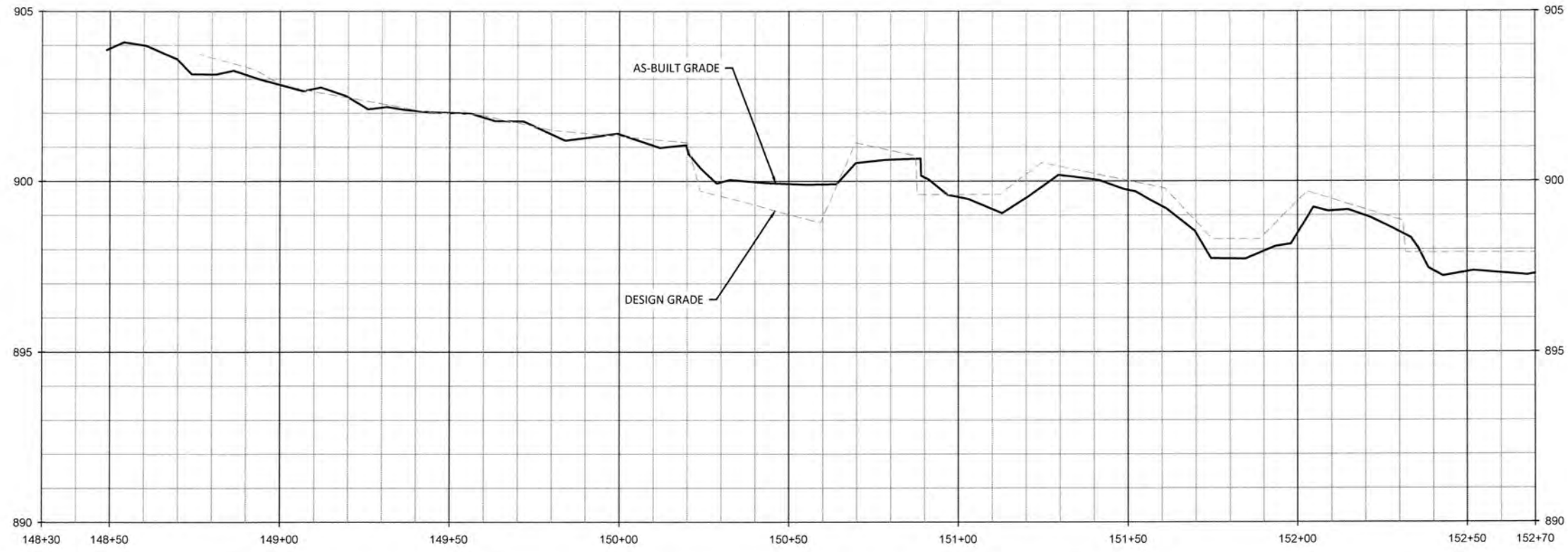
Big Harris Creek Mitigation Site  
 Cleveland County, North Carolina  
 Upper Big Harris Creek Reach 3  
 Stream Plan and Profile Record Drawings

Date:	August 21, 2018
Job Number:	05-02123
Designed By:	ECR, AA
Drawn By:	JCK
Checked By:	JCK
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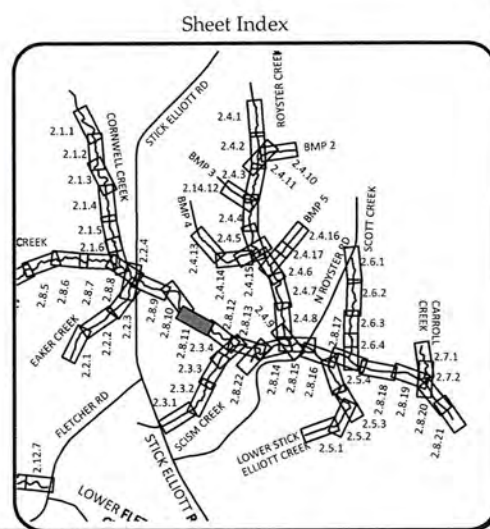
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- REACH TREATMENT:
1. FENCE OUT CATTLE - REFER TO FENCING PLAN SHEETS.
  2. TREAT INVASIVE SPECIES - REFER TO PLANTING PLAN SHEETS.
  3. REPLANT ALONG ENTIRE REACH - REFER TO PLANTING PLAN SHEETS.





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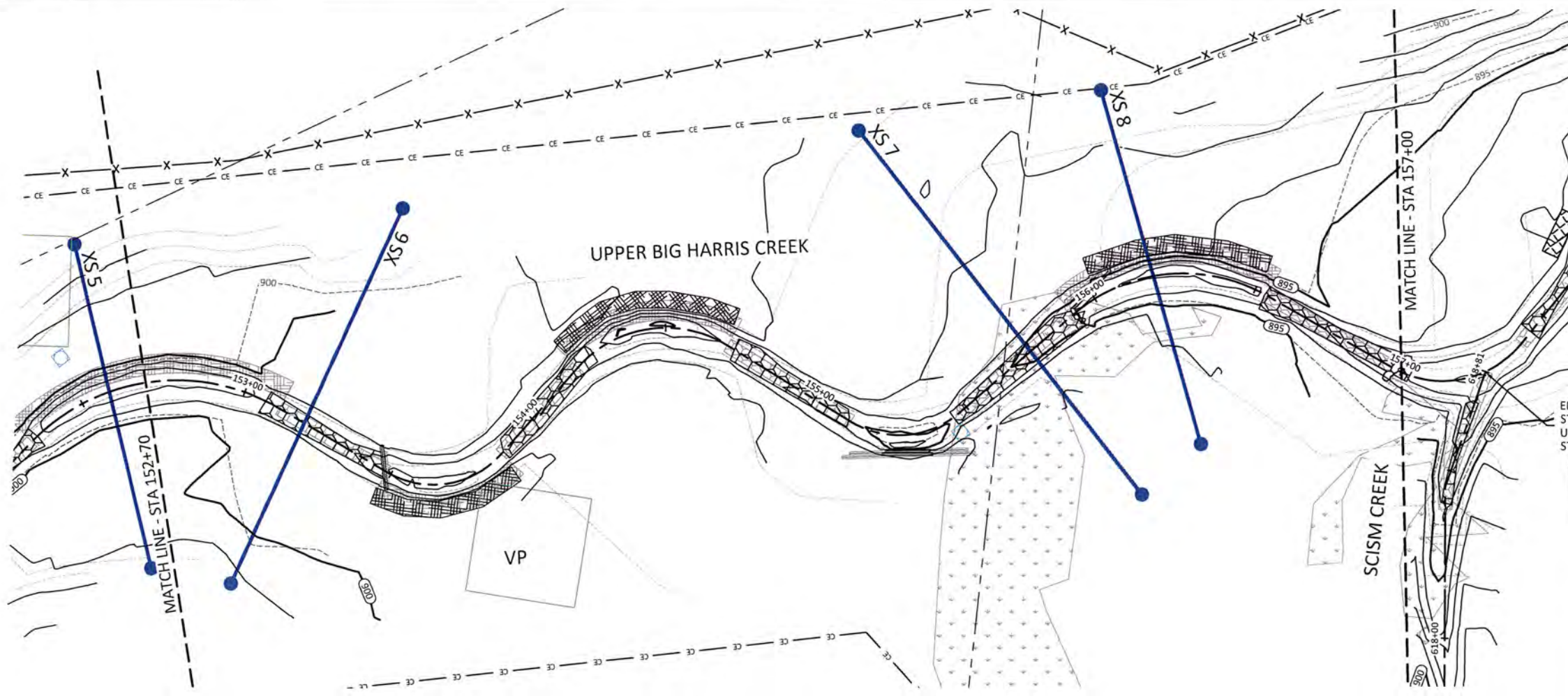
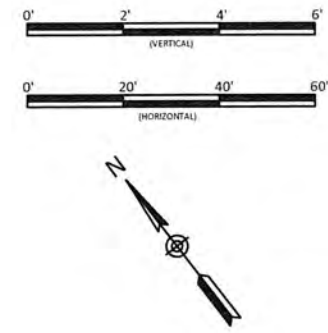
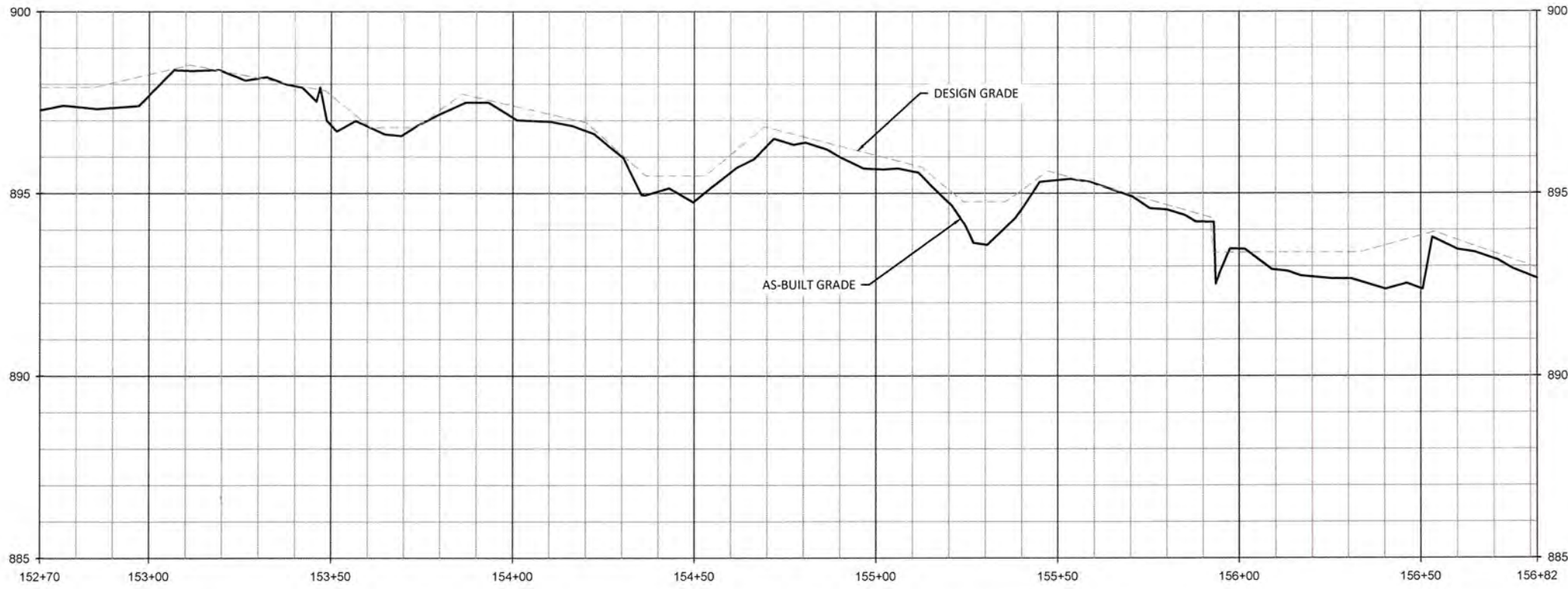
**Big Harris Creek Mitigation Site**  
Cleveland County, North Carolina

Upper Big Harris Creek Reach 4  
Stream Plan and Profile Record Drawings

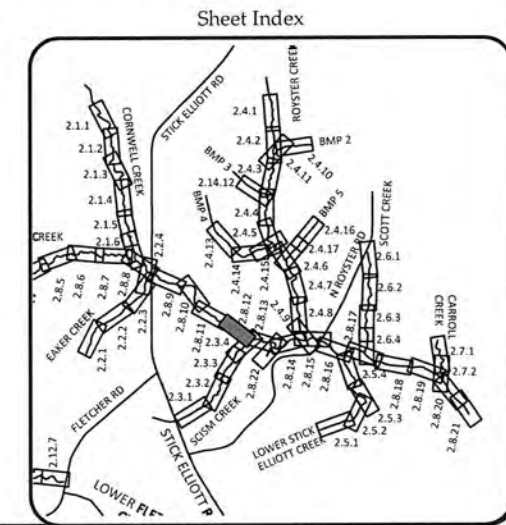
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Job Number:	005-02123
Designed By:	ECR, AA
Drawn By:	JS
Checked By:	JCK

2.8.11

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- REACH TREATMENT:**
1. FENCE OUT CATTLE - REFER TO FENCING PLAN SHEETS.
  2. TREAT INVASIVE SPECIES - REFER TO PLANTING PLAN SHEETS.
  3. REPLANT ALONG ENTIRE REACH - REFER TO PLANTING PLAN SHEETS.



Date:	August 21, 2018
Job Number:	005-02123
Designed By:	ECR, AA
Drawn By:	JS
Checked By:	JCK

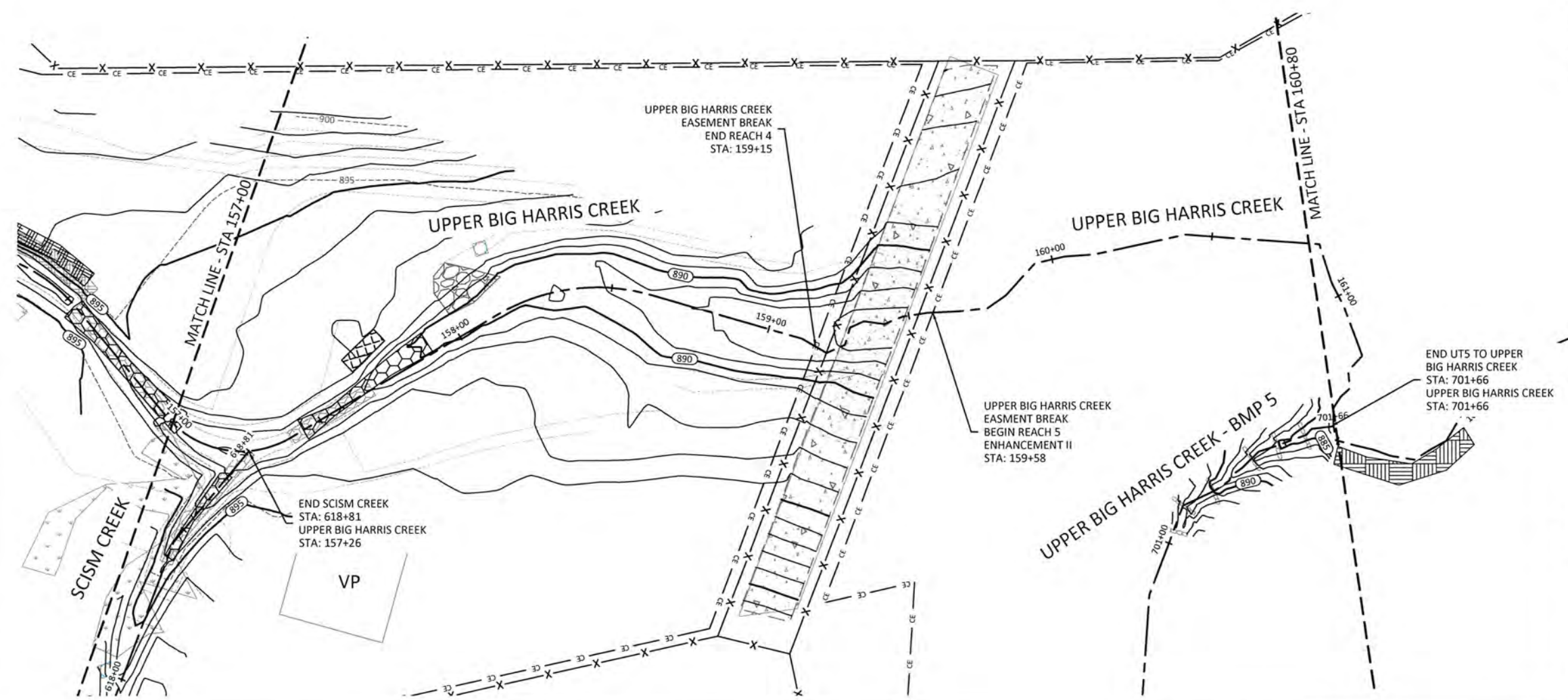
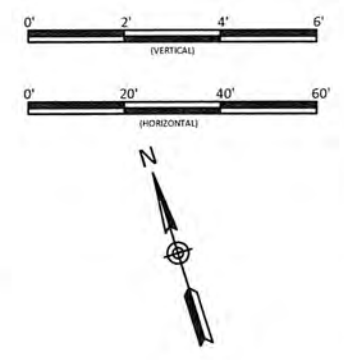
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**Big Harris Creek Mitigation Site**  
**Cleveland County, North Carolina**  
 Upper Big Harris Creek Reach 4  
 Stream Plan and Profile Record Drawings

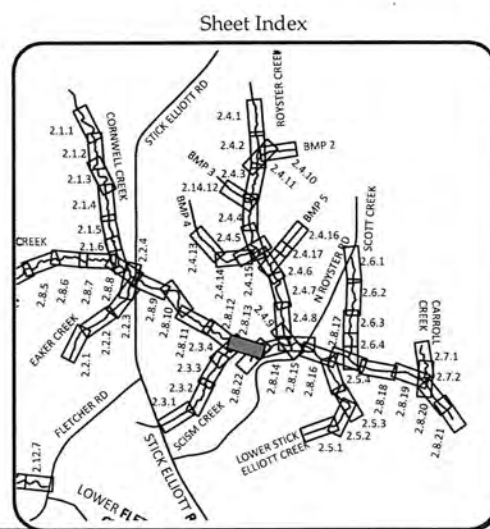
**WILDLANDS**  
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 CHARLOTTE, NC 28203  
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- REACH TREATMENT:
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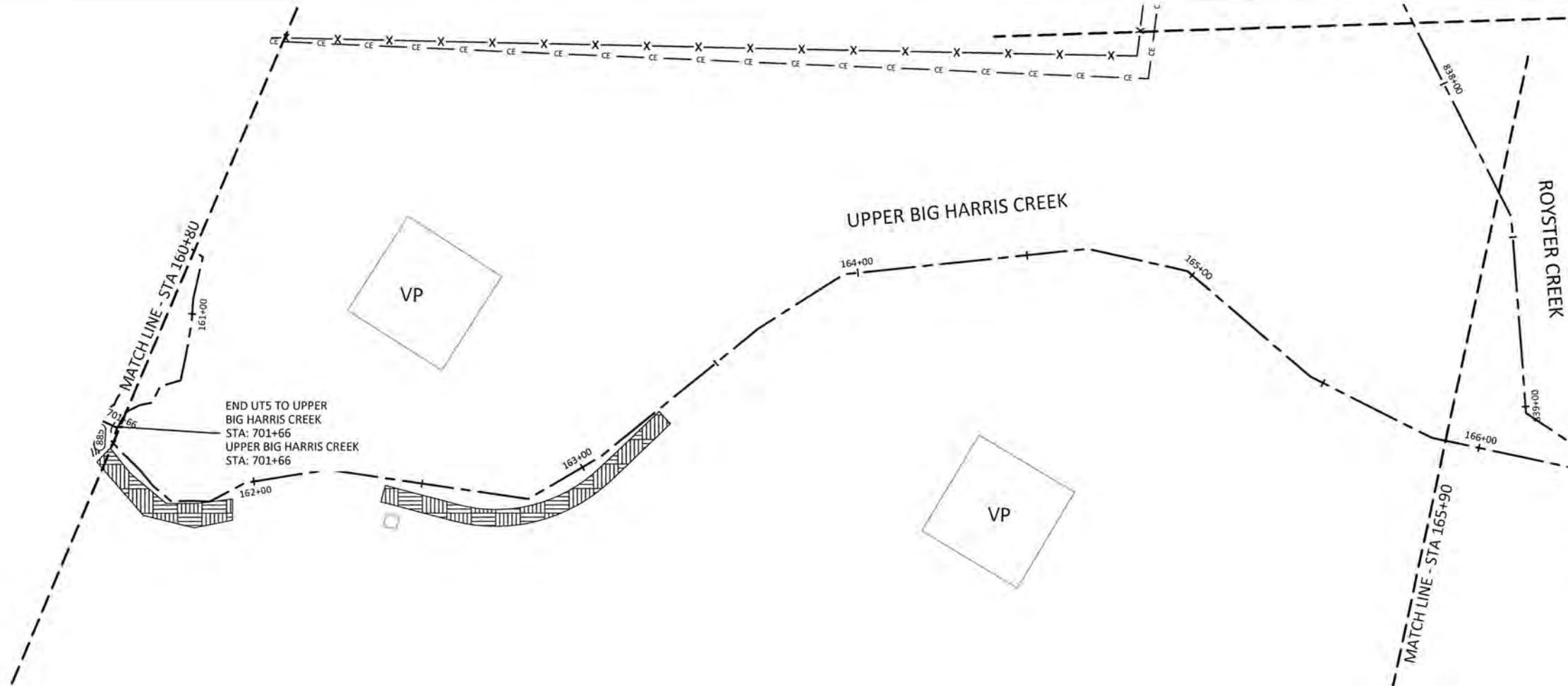
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 Charlotte, NC 28203  
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Big Harris Creek Mitigation Site  
 Cleveland County, North Carolina  
 Upper Big Harris Reach Creek 4 & 5  
 Stream Plan and Profile Record Drawings

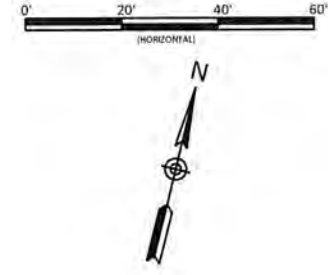
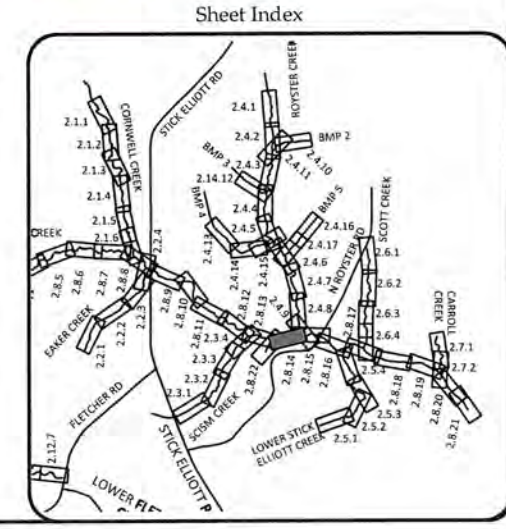
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Designed By:	EGR, AA
Drawn By:	JS
Checked By:	JCK
Sheet Number:	<b>2.8.13</b>

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 August 20, 2018



- REACH TREATMENT:**
1. FENCE OUT CATTLE - REFER TO FENCING PLAN SHEETS.
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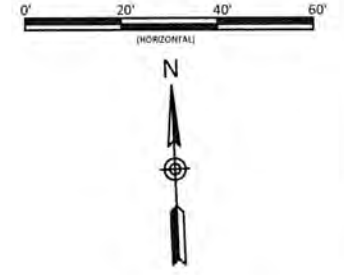
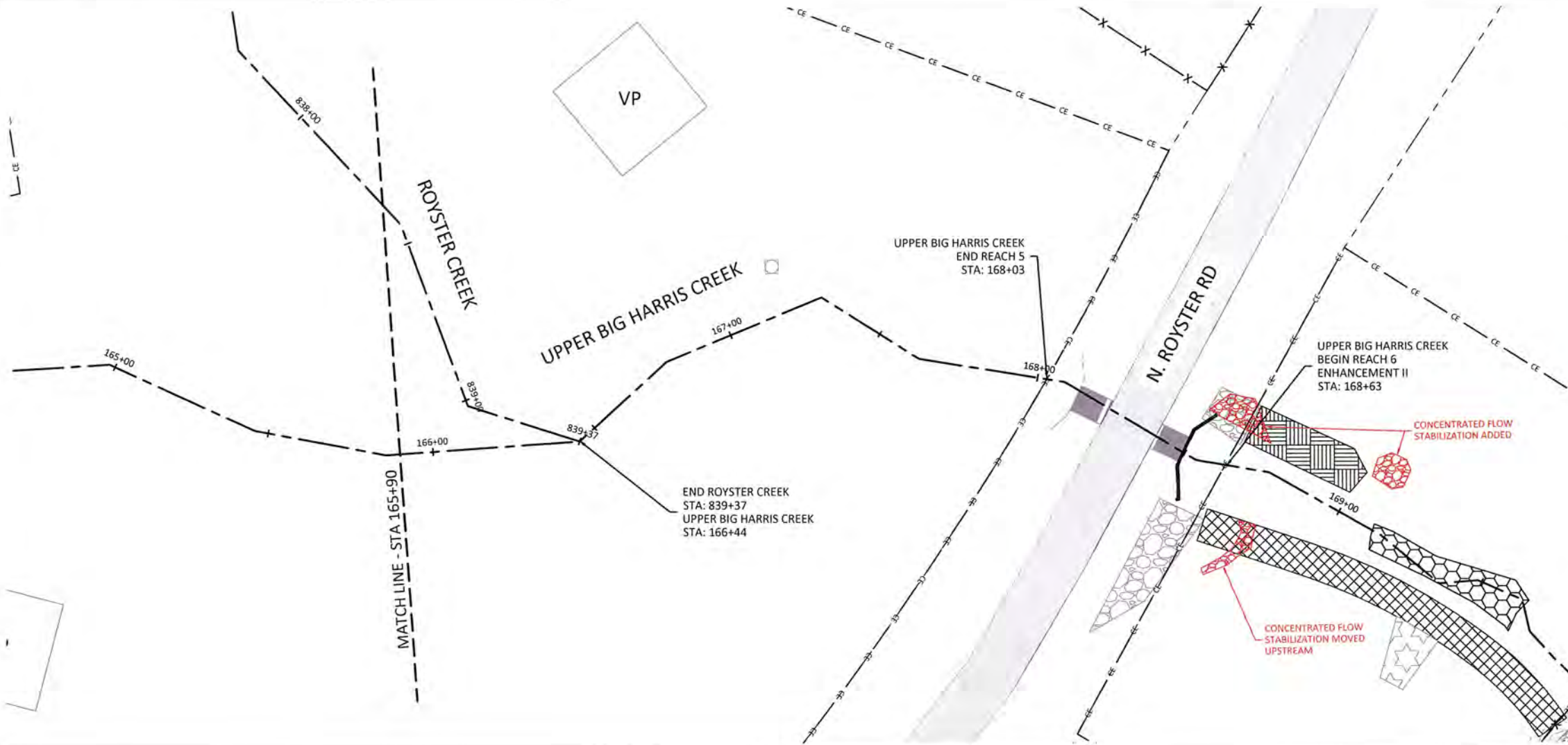
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**Big Harris Creek Mitigation Site**  
 Cleveland County, North Carolina  
 Upper Big Harris Creek Reach 5  
 Stream Plan and Profile Record Drawings

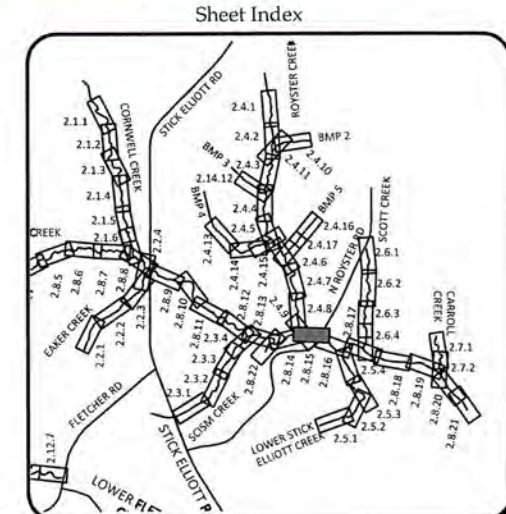
Date	Revision
August 21, 2018	
005-02123	
EGR, AA	
JS	
JCK	

**2.8.14**



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**Big Harris Creek Mitigation Site**  
**Cleveland County, North Carolina**  
 Upper Big Harris Creek Reach 5  
 Stream Plan and Profile Record Drawings

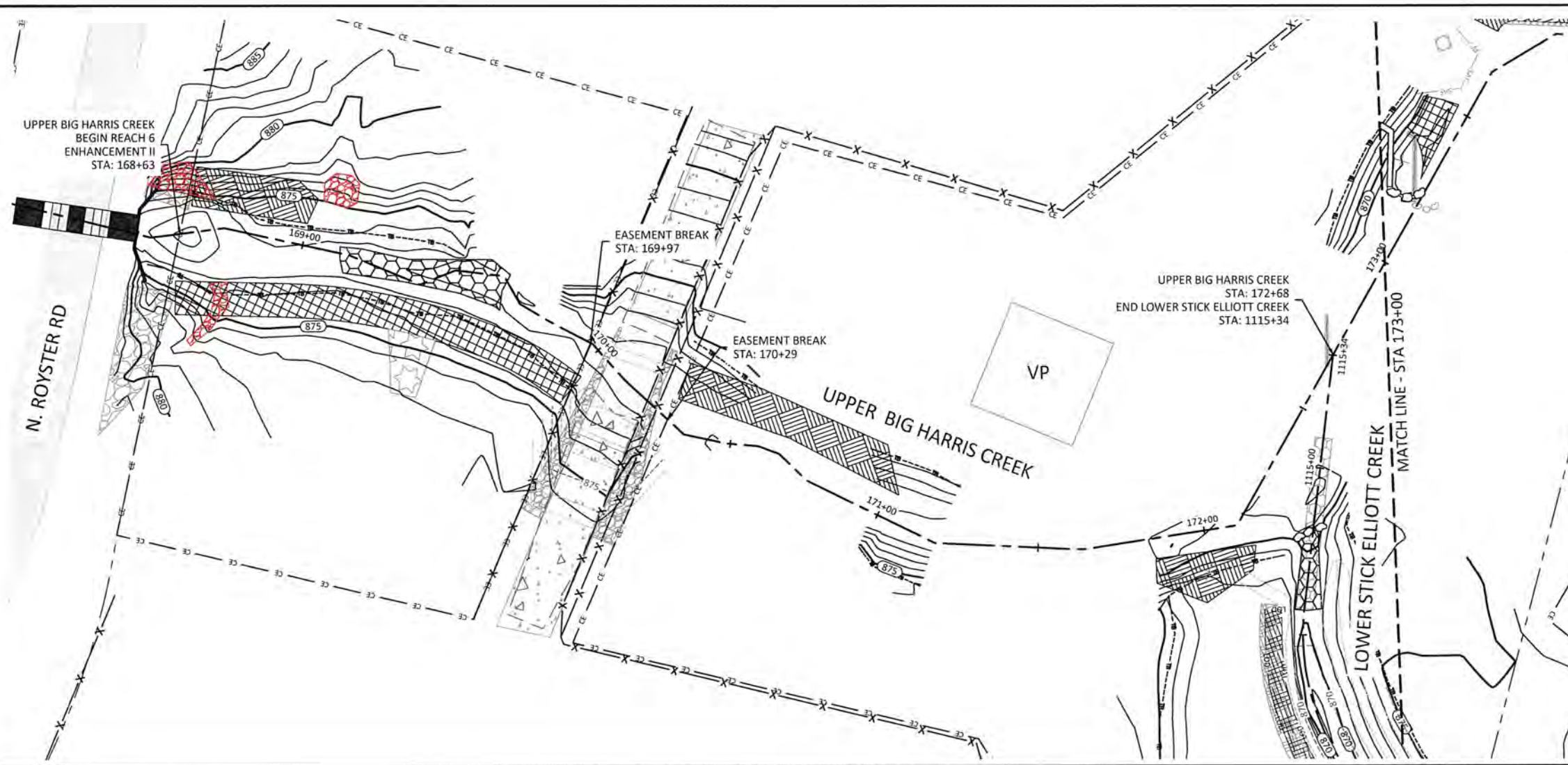
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Date:	August 21, 2018
Job Number:	005-02123
Designed By:	EGR, AA
Drawn By:	JIS
Checked By:	JCK

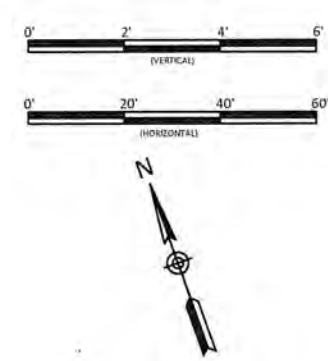
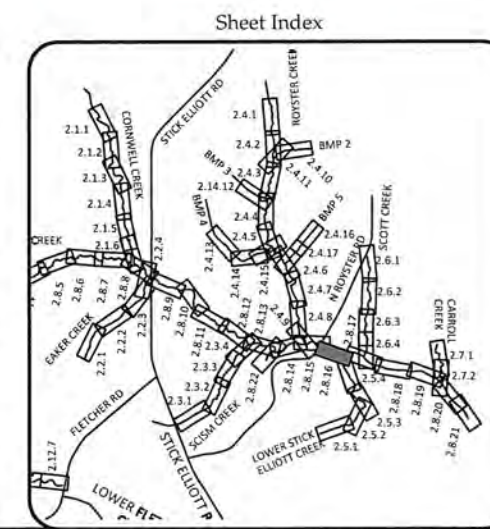
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- REACH TREATMENT:**
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  2. TREAT INVASIVE SPECIES - REFER TO PLANTING PLAN SHEETS.
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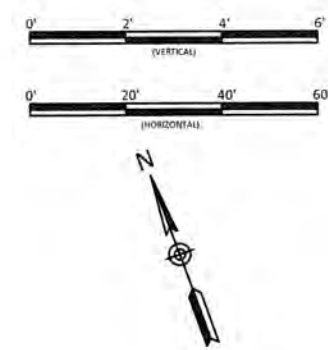
**Big Harris Creek Mitigation Site**  
**Cleveland County, North Carolina**  
 Upper Big Harris Creek Reach 6  
 Stream Plan and Profile Record Drawings

Date:	August 21, 2018
Job Number:	005-02123
Designed By:	ECR, AA
Drawn By:	JS
Checked By:	JCK
2.8.16	
Sheet	

  
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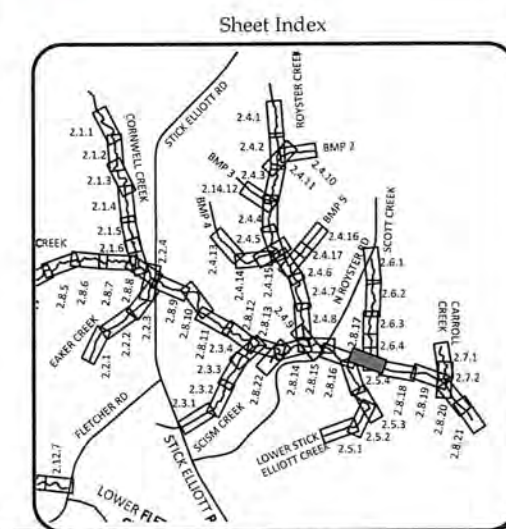






- REACH TREATMENT:**
1. FENCE OUT CATTLE - REFER TO FENCING PLAN SHEETS.
  2. TREAT INVASIVE SPECIES - REFER TO PLANTING PLAN SHEETS.
  3. REPLANT ALONG ENTIRE REACH - REFER TO PLANTING PLAN SHEETS.

**NOTE:**  
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Firm License No. F-0831

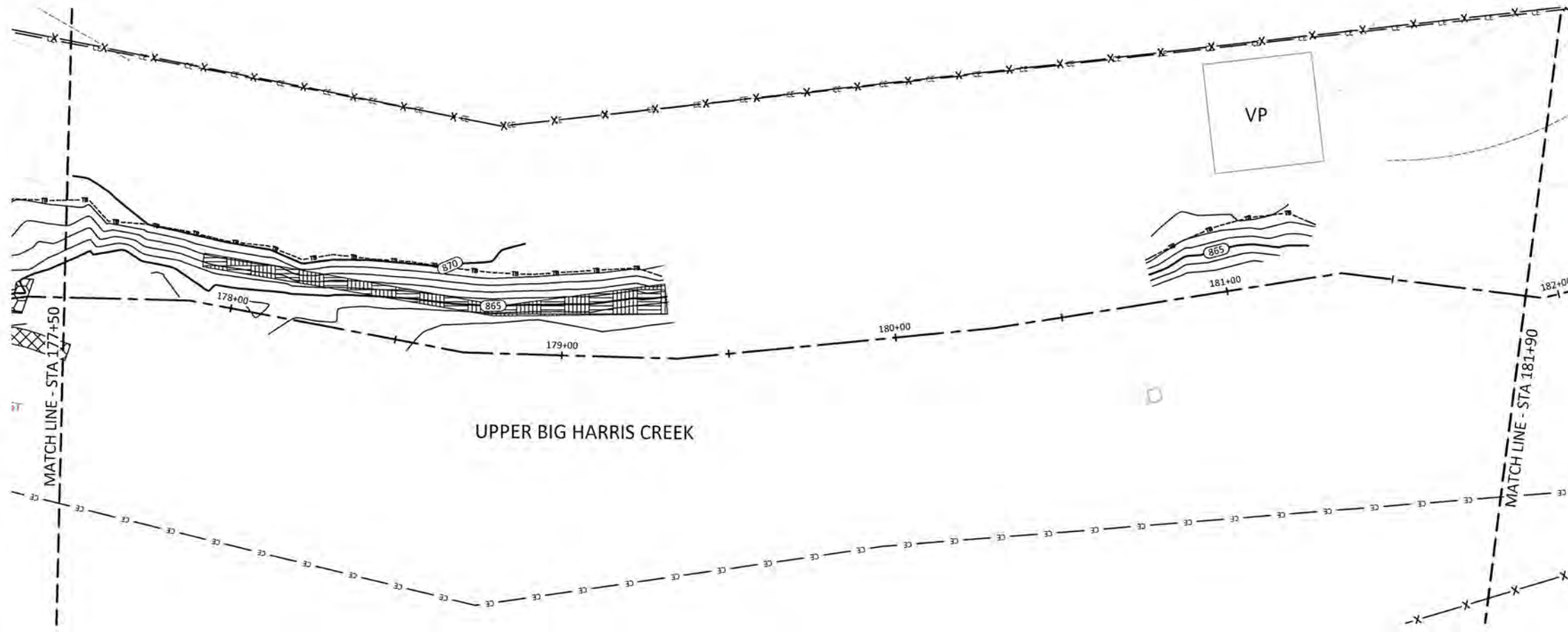


**Big Harris Creek Mitigation Site**  
Cleveland County, North Carolina  
Upper Big Harris Creek Reach 6  
Stream Plan and Profile Record Drawings

Date:	August 21, 2018
Job Number:	005-02123
Designed By:	EGR, AA
Drawn By:	JS
Checked By:	JCK
Revisions:	

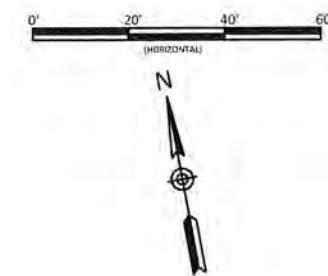
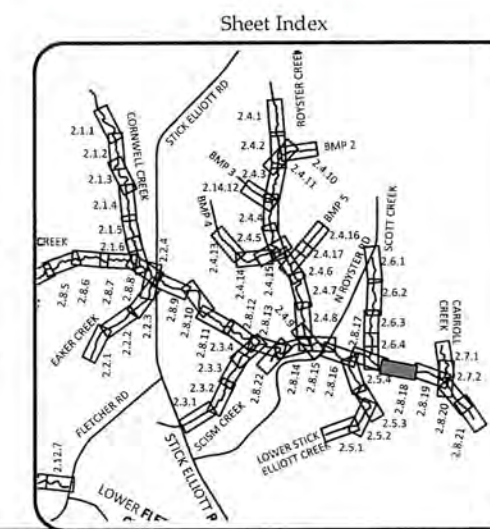
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August 21, 2018  
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- REACH TREATMENT:
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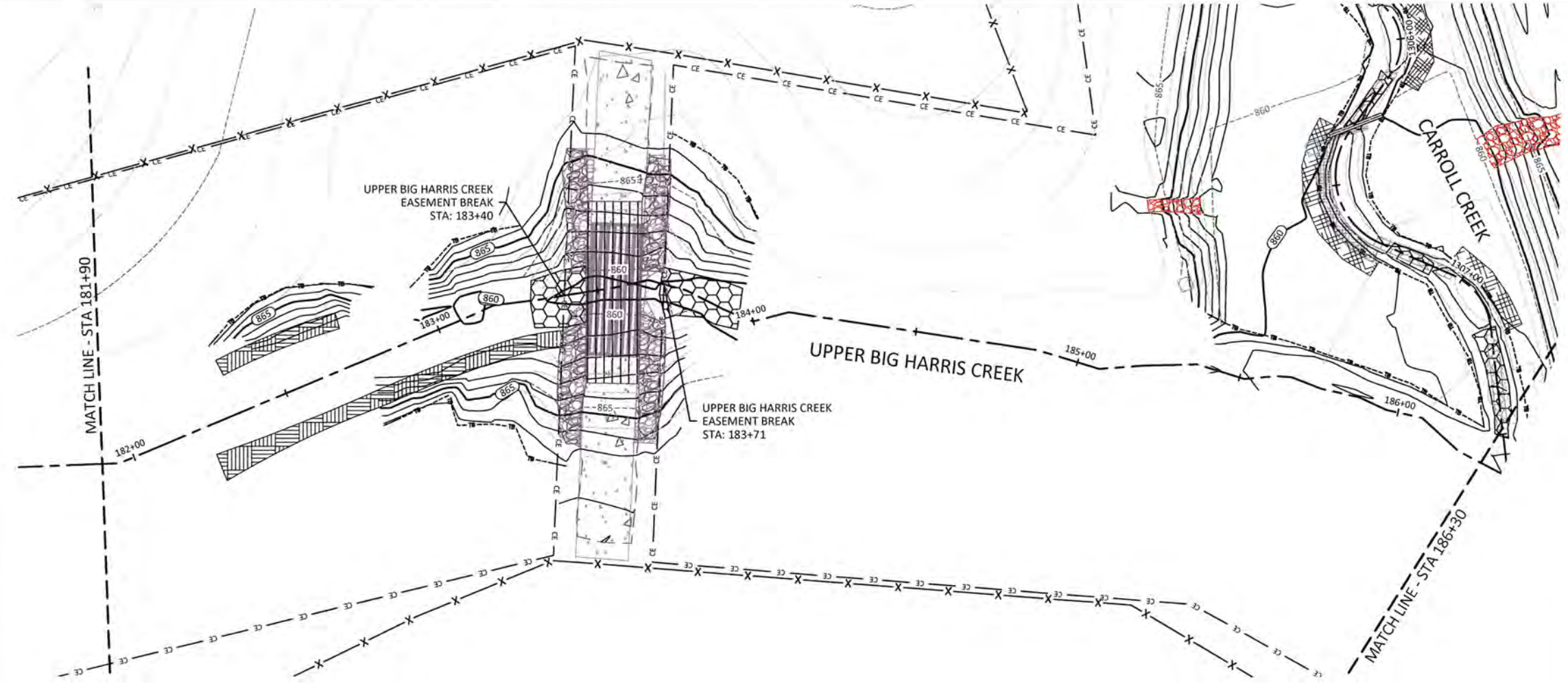
Big Harris Creek Mitigation Site  
Cleveland County, North Carolina  
Upper Big Harris Creek Reach 6  
Stream Plan and Profile Record Drawings

Date:	August 21, 2018
Job Number:	005-02123
Designed By:	EGR:AA
Drawn By:	JS
Checked By:	JCK

2.8.18

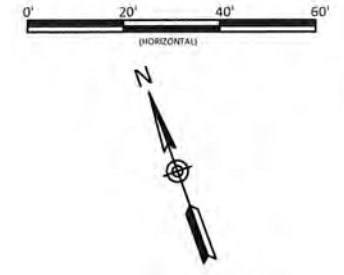
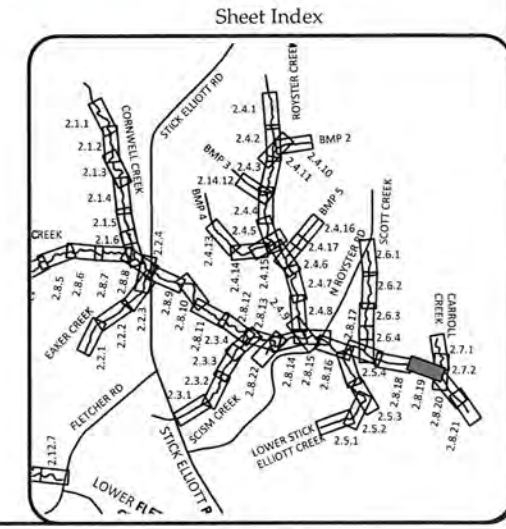
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1490 S. Mint Street, Ste 104  
Charlotte, NC 28203  
Tel: 704.332.3306  
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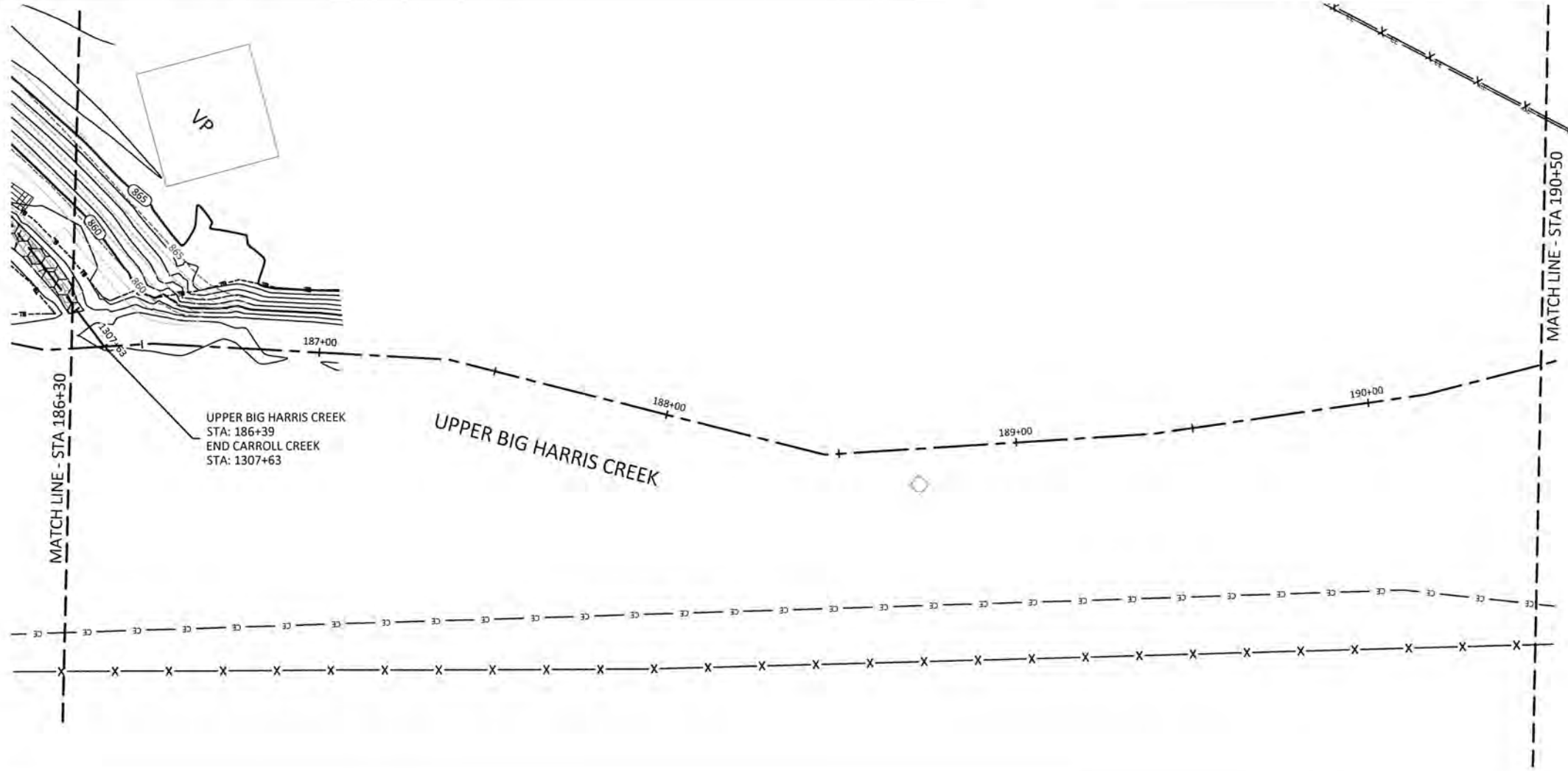
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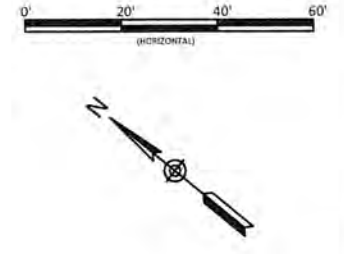


**Big Harris Creek Mitigation Site**  
**Cleveland County, North Carolina**  
 Upper Big Harris Creek Reach 6  
 Stream Plan and Profile Record Drawings

Date:	August 21, 2018
Job Number:	005-02123
Designed By:	ECR, AA
Drawn By:	JS
Checked By:	JCK
<b>2.8.19</b>	
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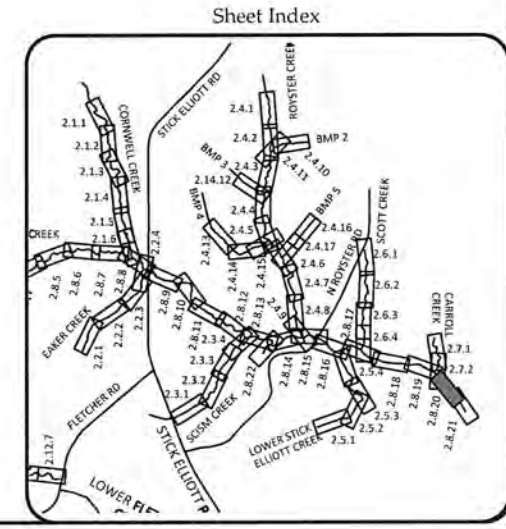


UPPER BIG HARRIS CREEK  
 STA: 186+39  
 END CARROLL CREEK  
 STA: 1307+63



- REACH TREATMENT:**
1. FENCE OUT CATTLE - REFER TO FENCING PLAN SHEETS.
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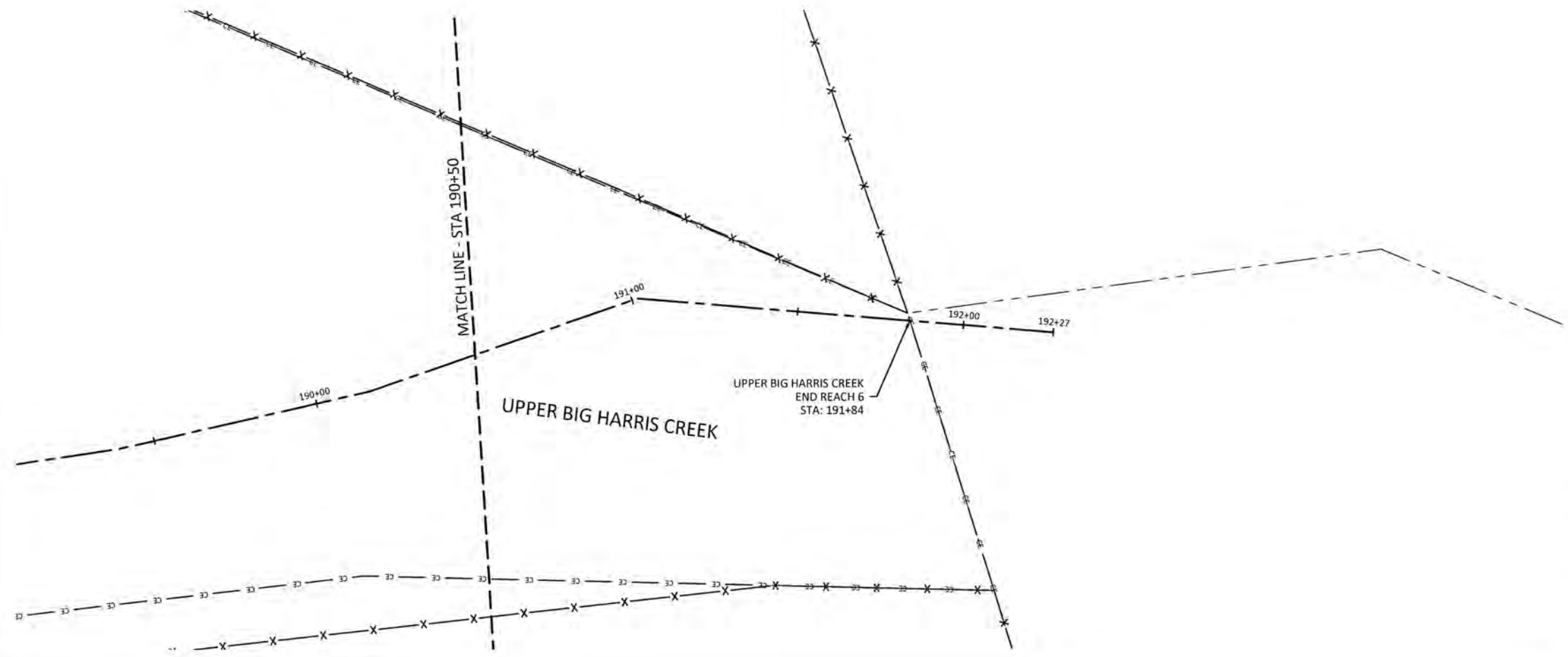
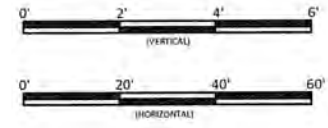


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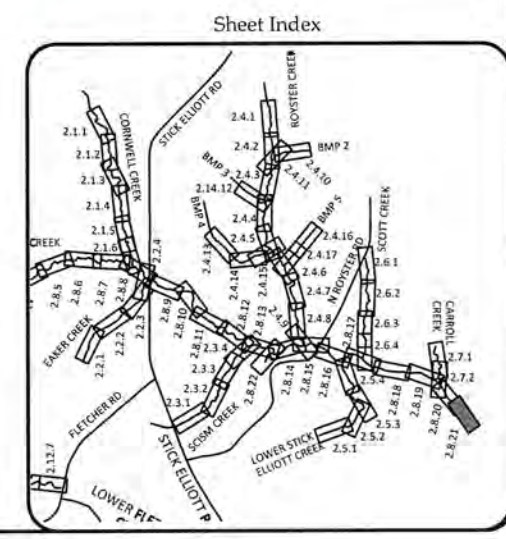
**Big Harris Creek Mitigation Site**  
**Cleveland County, North Carolina**  
 Upper Big Harris Creek Reach 6  
 Stream Plan and Profile Record Drawings

Date:	August 21, 2018
Job Number:	005-02123
Designed By:	EGE, AA
Drawn By:	JS
Checked By:	JCK
Sheet:	<b>2.8.20</b>



- REACH TREATMENT:
1. FENCE OUT CATTLE - REFER TO FENCING PLAN SHEETS.
  2. TREAT INVASIVE SPECIES - REFER TO PLANTING PLAN SHEETS.
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NOTE:  
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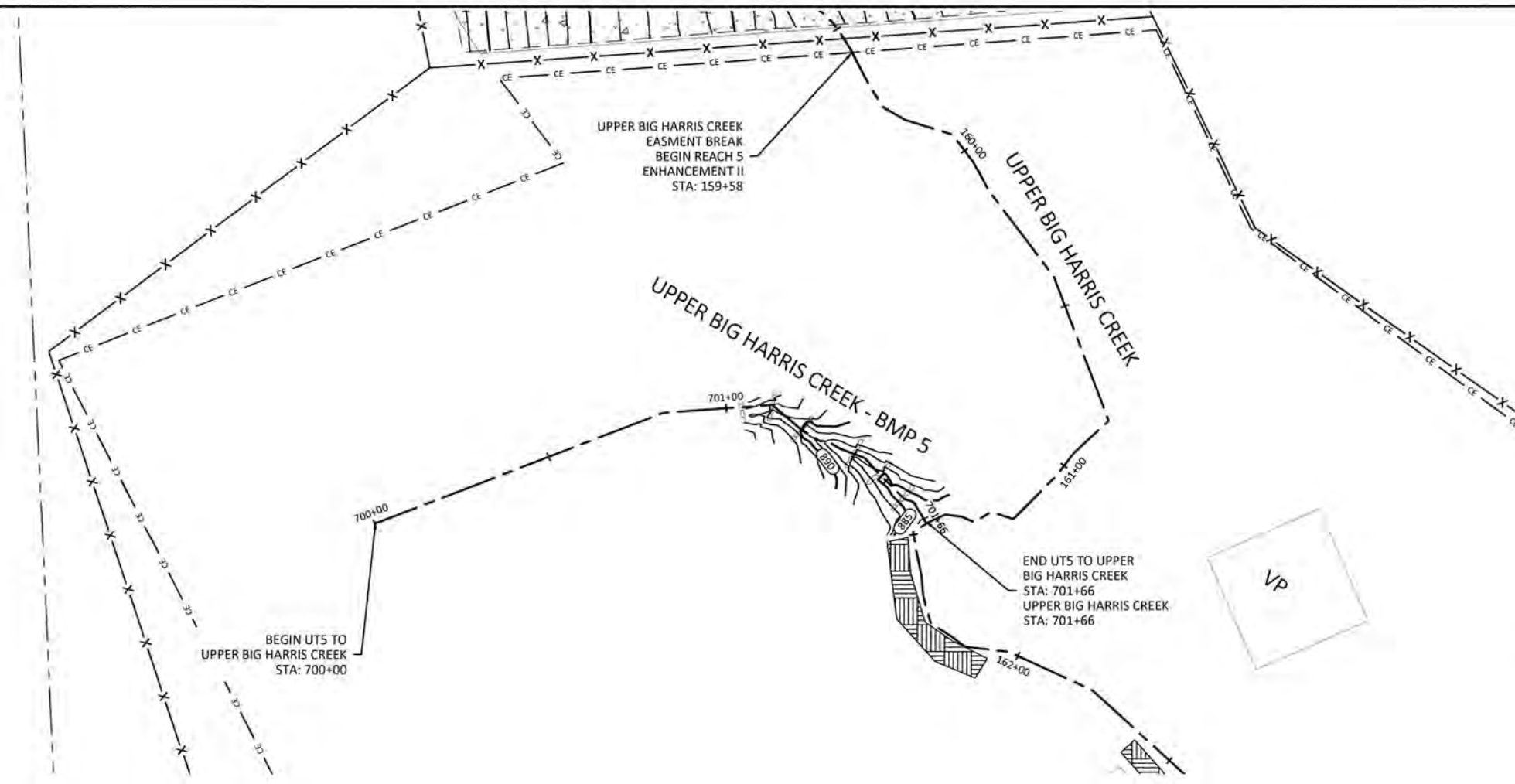
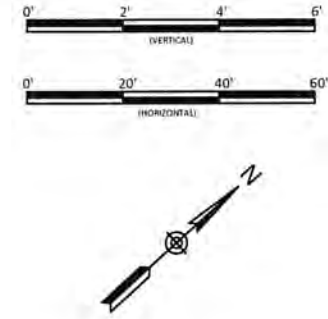
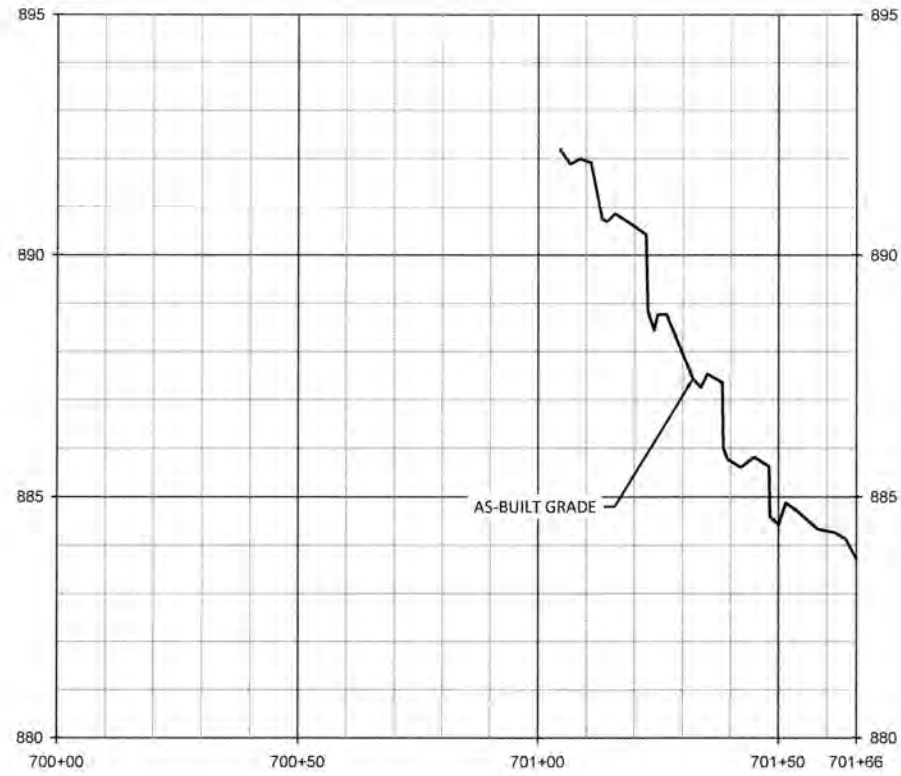
Big Harris Creek Mitigation Site  
Cleveland County, North Carolina  
Upper Big Harris Creek Reach 6  
Stream Plan and Profile Record Drawings

Date:	August 21, 2018
Job Number:	005-02123
Designed By:	ECR, AA
Drawn By:	JS
Checked By:	JCK
Revision:	

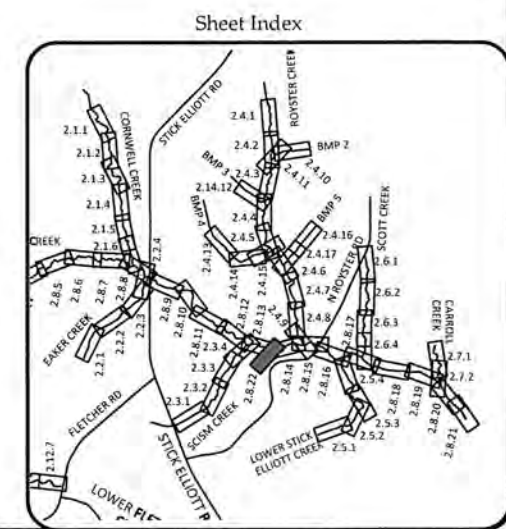
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- REACH TREATMENT:**
1. FENCE OUT CATTLE - REFER TO FENCING PLAN SHEETS.
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  3. REPLANT ALONG ENTIRE REACH - REFER TO PLANTING PLAN SHEETS.



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 Fax: 704.332.3306  
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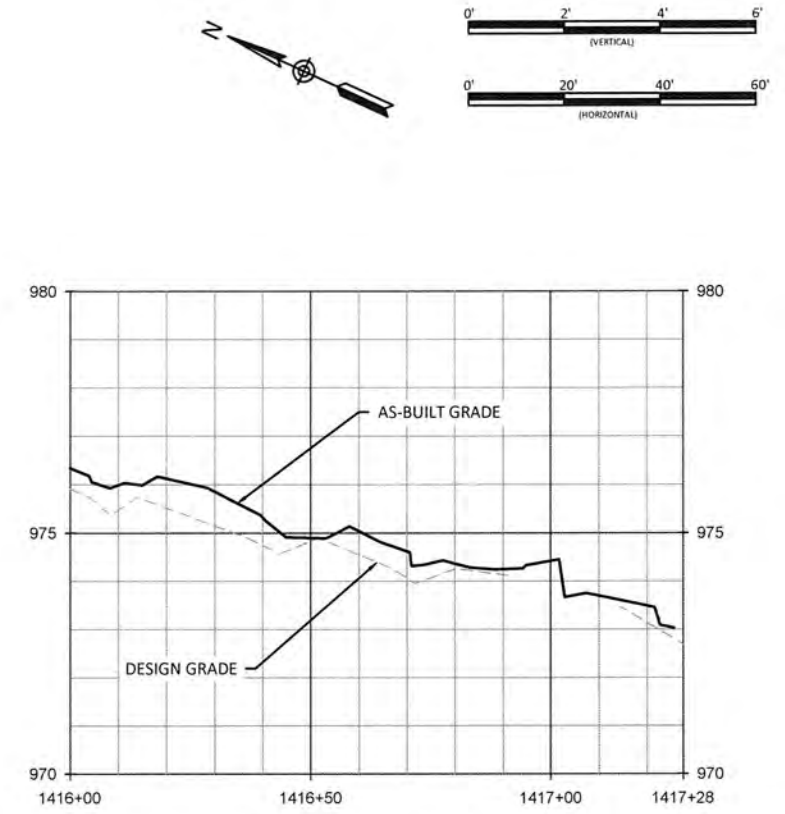
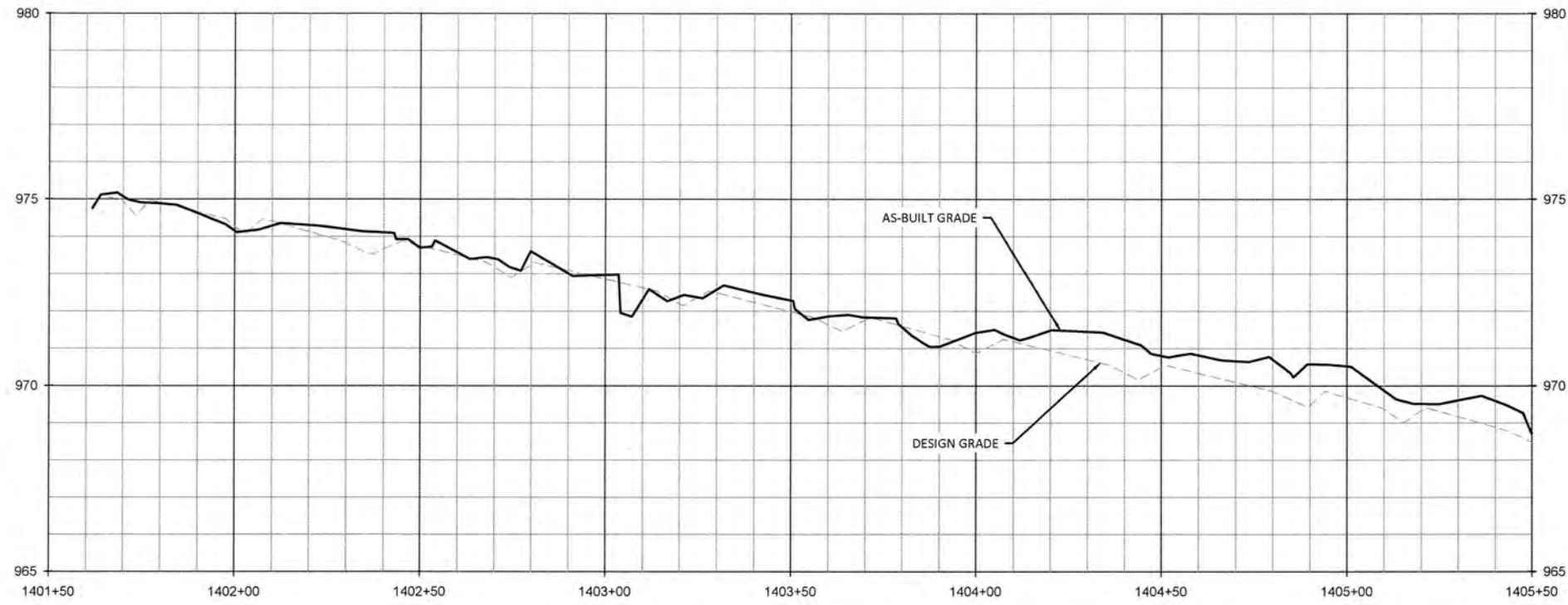
**Big Harris Creek Mitigation Site**  
**Cleveland County, North Carolina**  
 Upper Big Harris Creek - UT5  
 Stream Plan and Profile Record Drawings

Revisions	

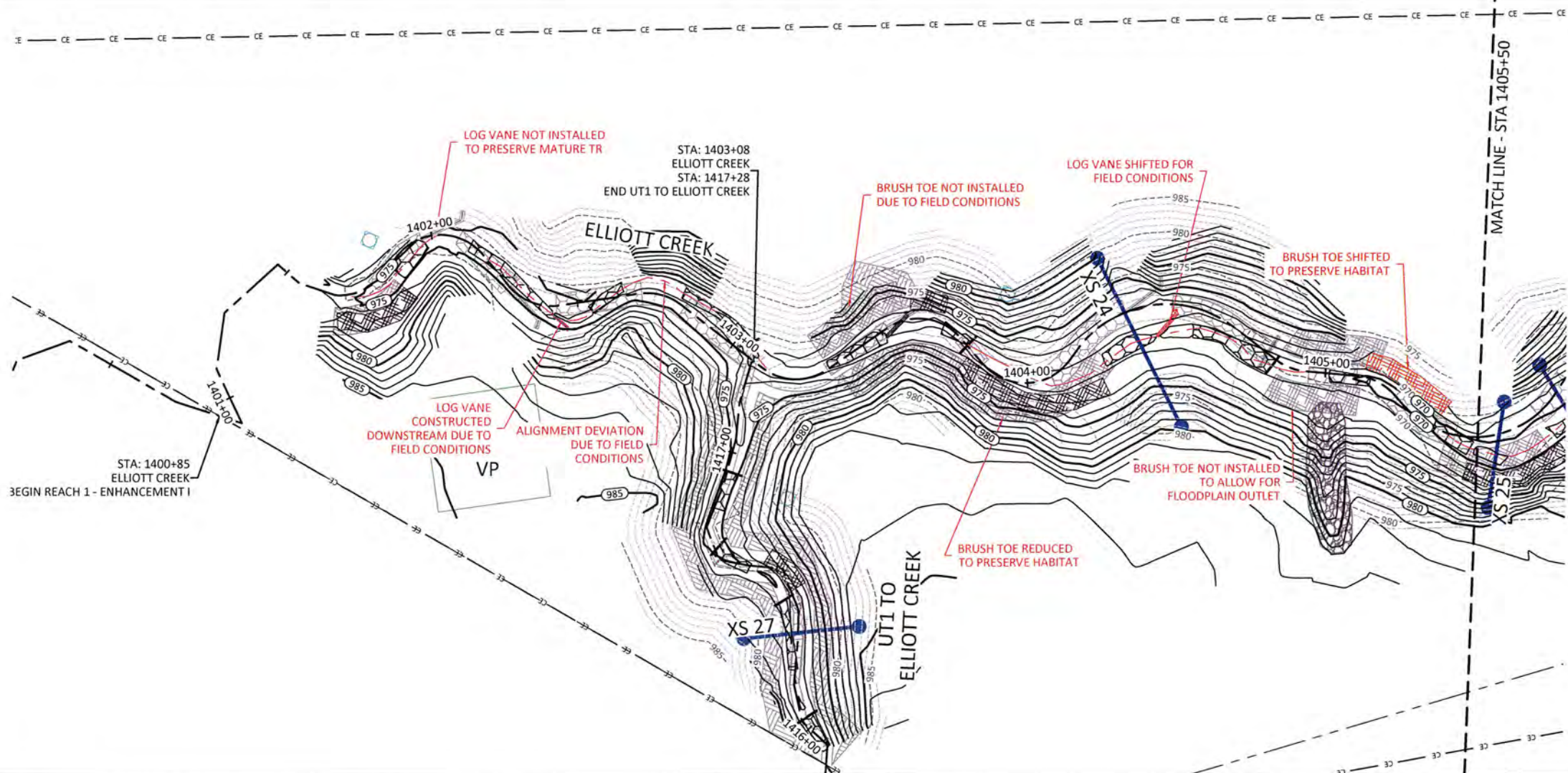
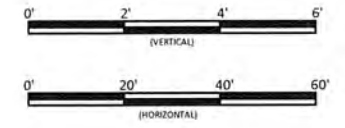
  

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Job Number:	005-02123
Designed By:	ECR, AA
Drawn By:	JS
Checked By:	JCK
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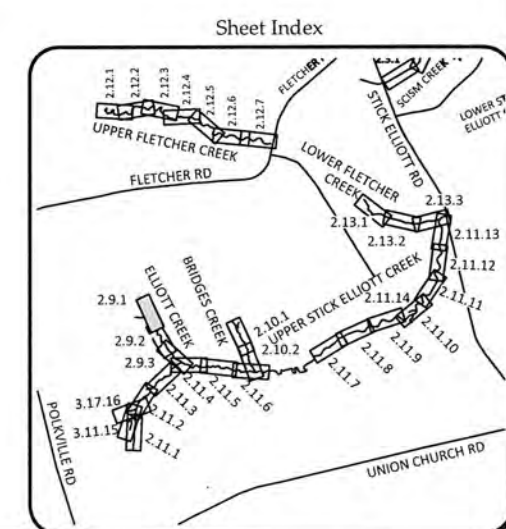
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UT1 TO ELLIOTT CREEK



- REACH TREATMENT:
1. FENCE OUT CATTLE - REFER TO FENCING PLAN SHEETS.
  2. TREAT INVASIVE SPECIES - REFER TO PLANTING PLAN SHEETS.
  3. REPLANT ALONG ENTIRE REACH - REFER TO PLANTING PLAN SHEETS.
  4. CONSTRUCT BED FORMS IN EXISTING CHANNEL (ENHANCEMENT 1)



Big Harris Creek Mitigation Site  
 Cleveland County, North Carolina  
 Elliott Creek  
 Stream Plan and Profile Record Drawings

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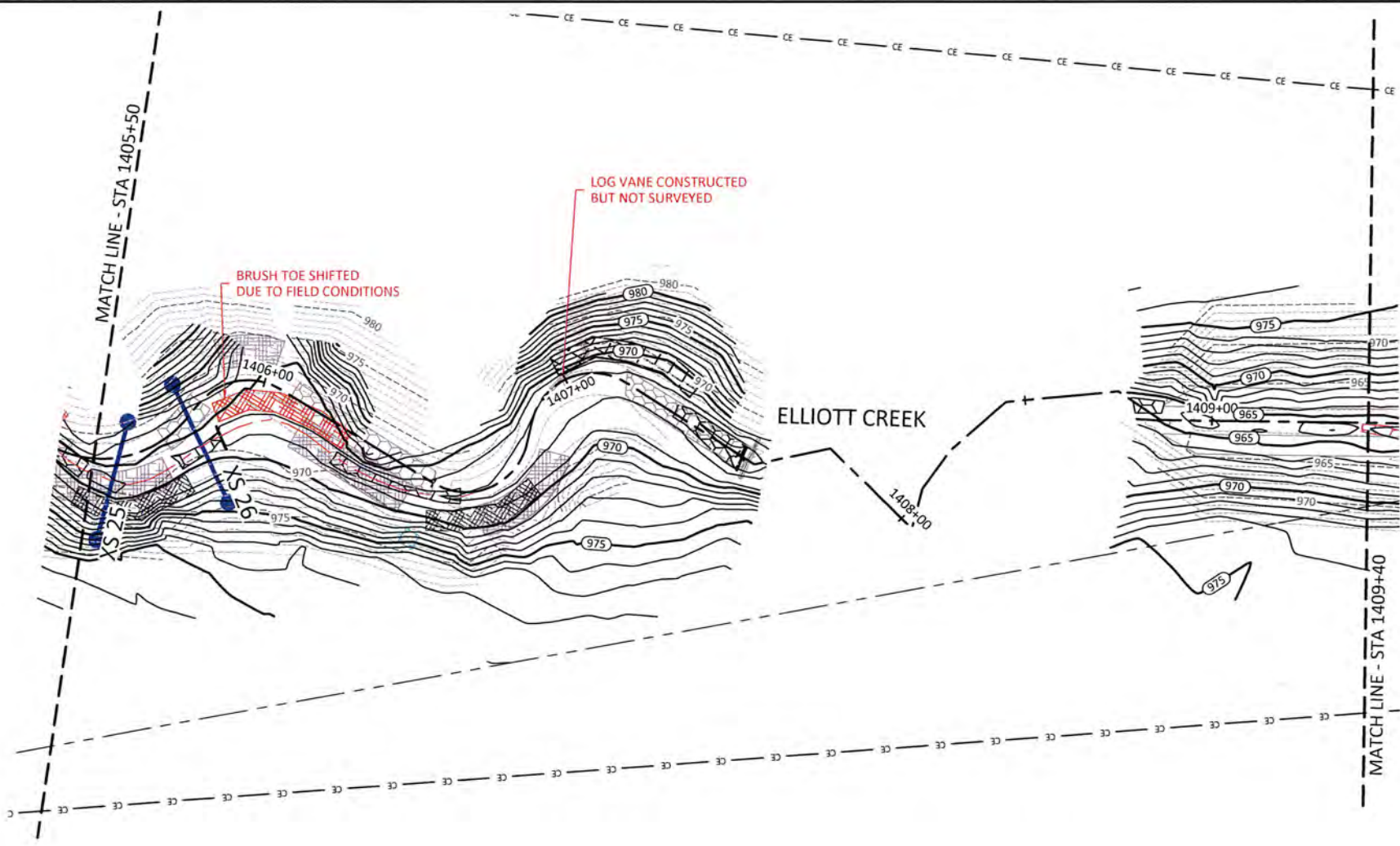
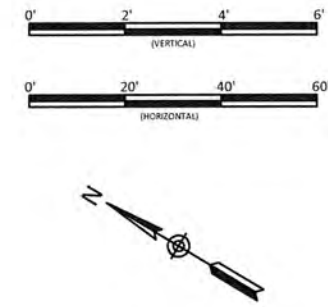
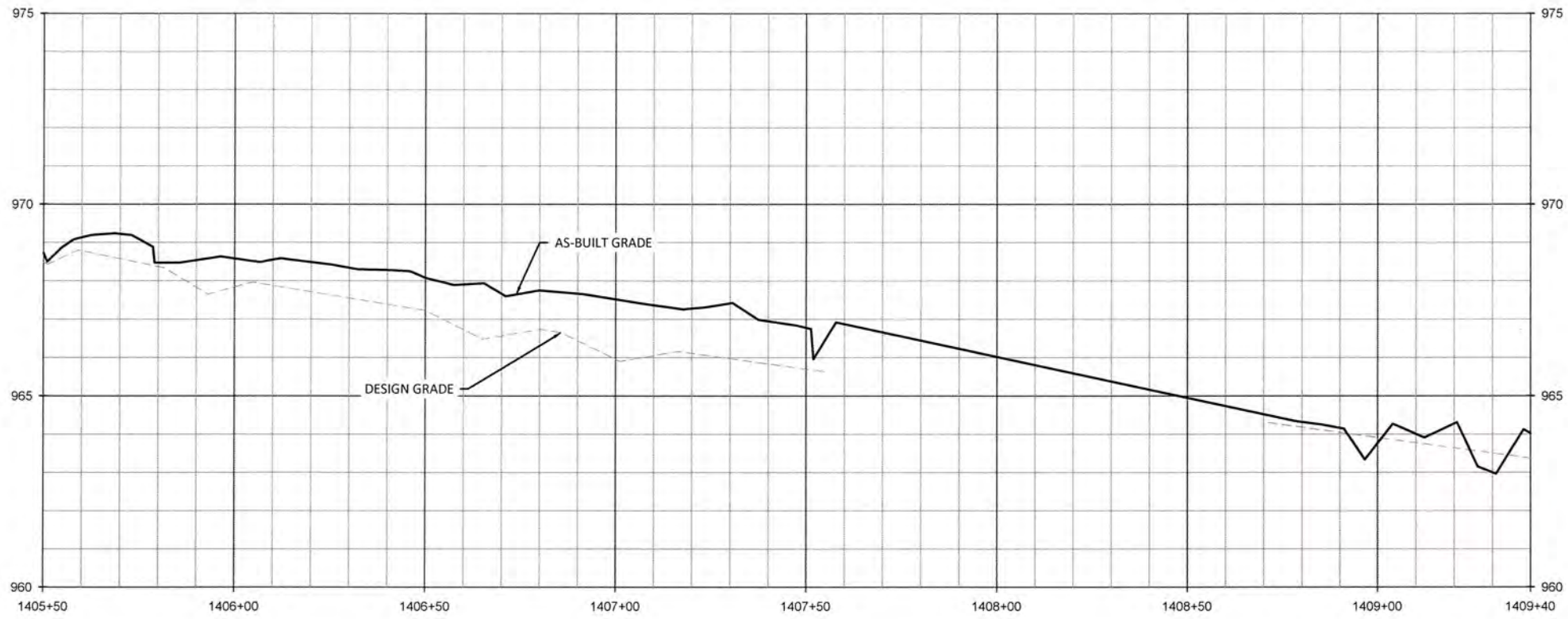


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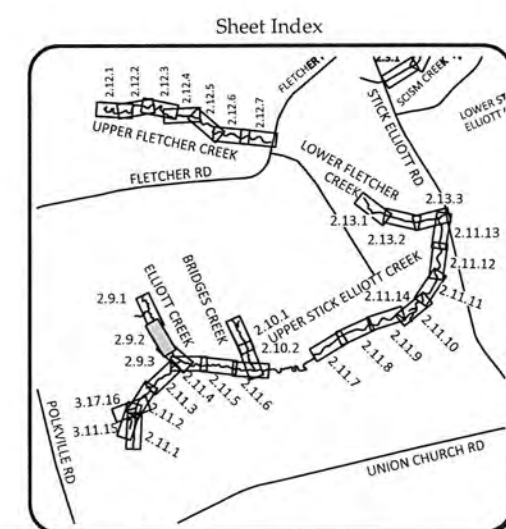
Date: August 21, 2018  
 Job Number: 005-02123  
 Designed By: ECR, AA  
 Drawn By: JS  
 Checked By: JCK

2.9.1

Sheet



- REACH TREATMENT:
1. FENCE OUT CATTLE - REFER TO FENCING PLAN SHEETS.
  2. TREAT INVASIVE SPECIES - REFER TO PLANTING PLAN SHEETS.
  3. REPLANT ALONG ENTIRE REACH - REFER TO PLANTING PLAN SHEETS.
  4. CONSTRUCT BED FORMS IN EXISTING CHANNEL (ENHANCEMENT 1)



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Big Harris Creek Mitigation Site  
Cleveland County, North Carolina  
Elliott Creek  
Stream Plan and Profile Record Drawings

Revisions	

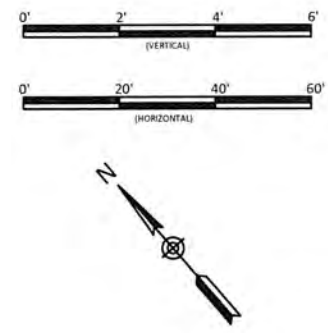
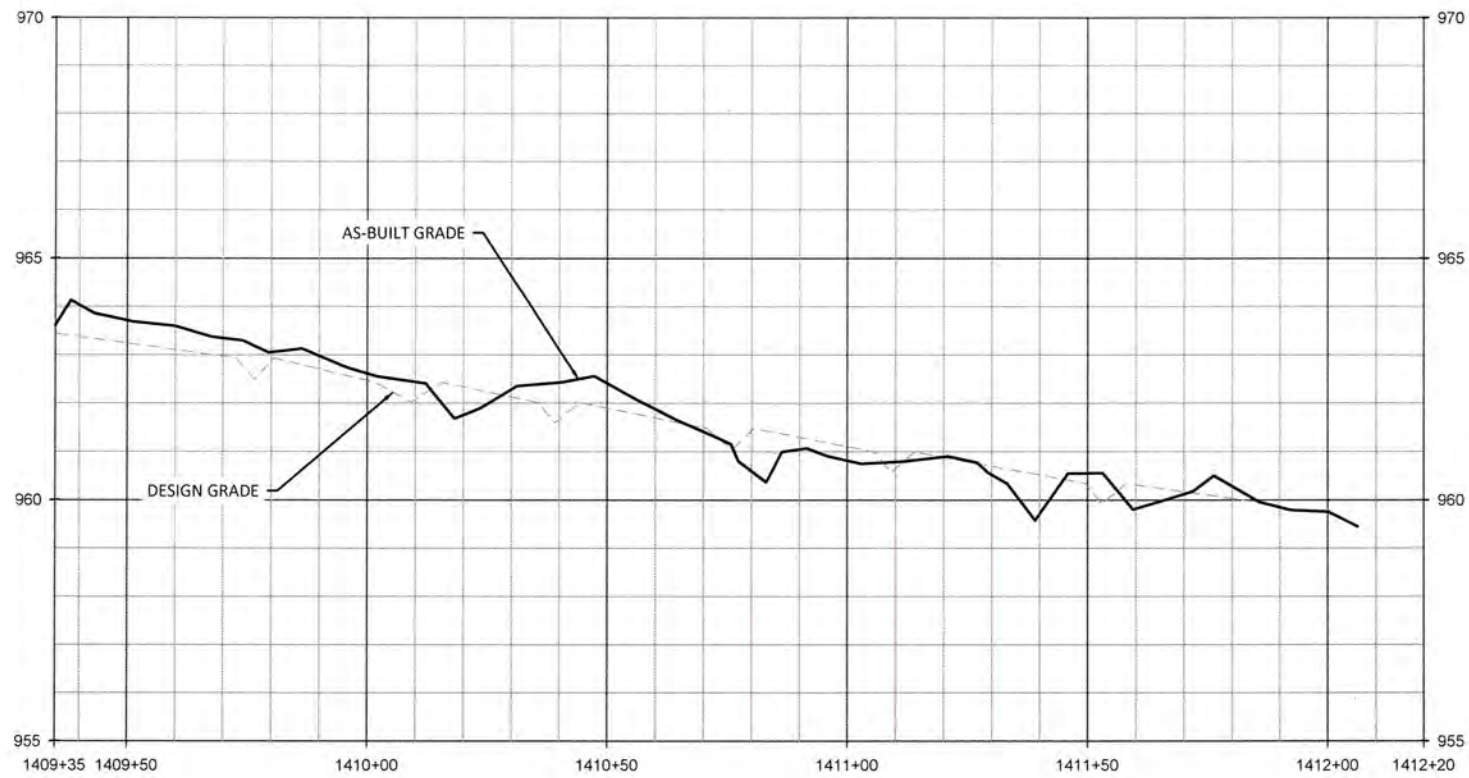
Date: August 21, 2018  
 Job Number: 005-02123  
 Designed By: EGR, AA  
 Drawn By: JS  
 Checked By: JCK

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August 21, 2018

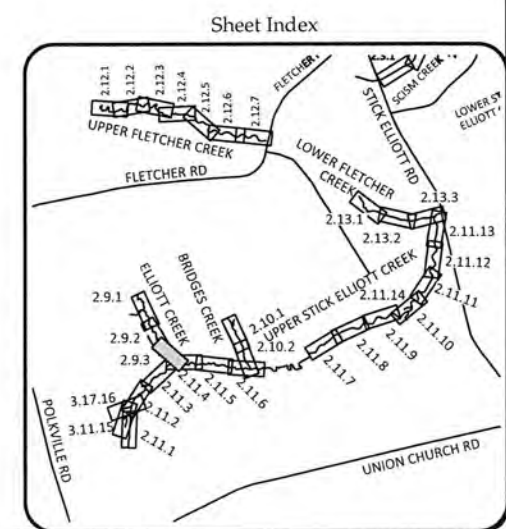
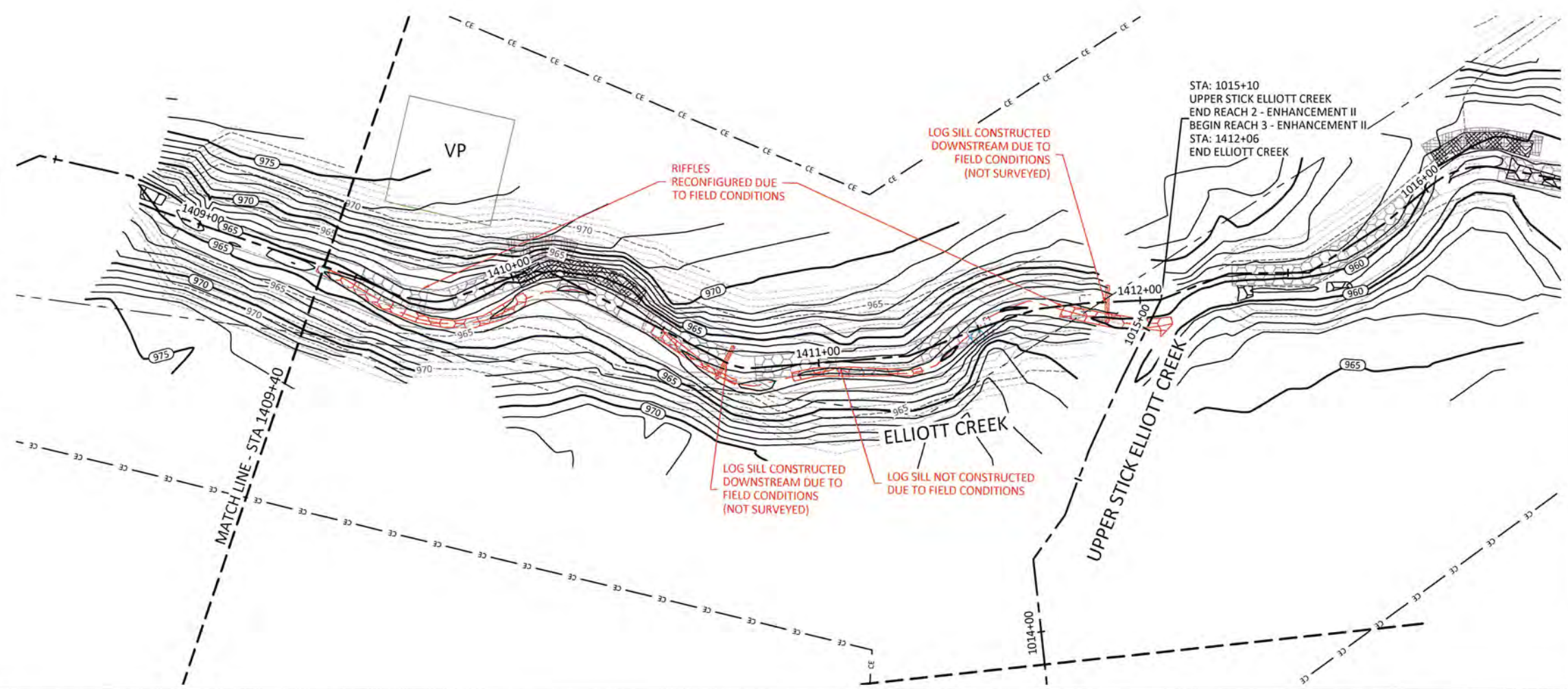


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**Big Harris Creek Mitigation Site**  
 Cleveland County, North Carolina  
 Elliott Creek  
 Stream Plan and Profile Record Drawings

- REACH TREATMENT:**
1. FENCE OUT CATTLE - REFER TO FENCING PLAN SHEETS.
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  4. CONSTRUCT BED FORMS IN EXISTING CHANNEL (ENHANCEMENT 1)



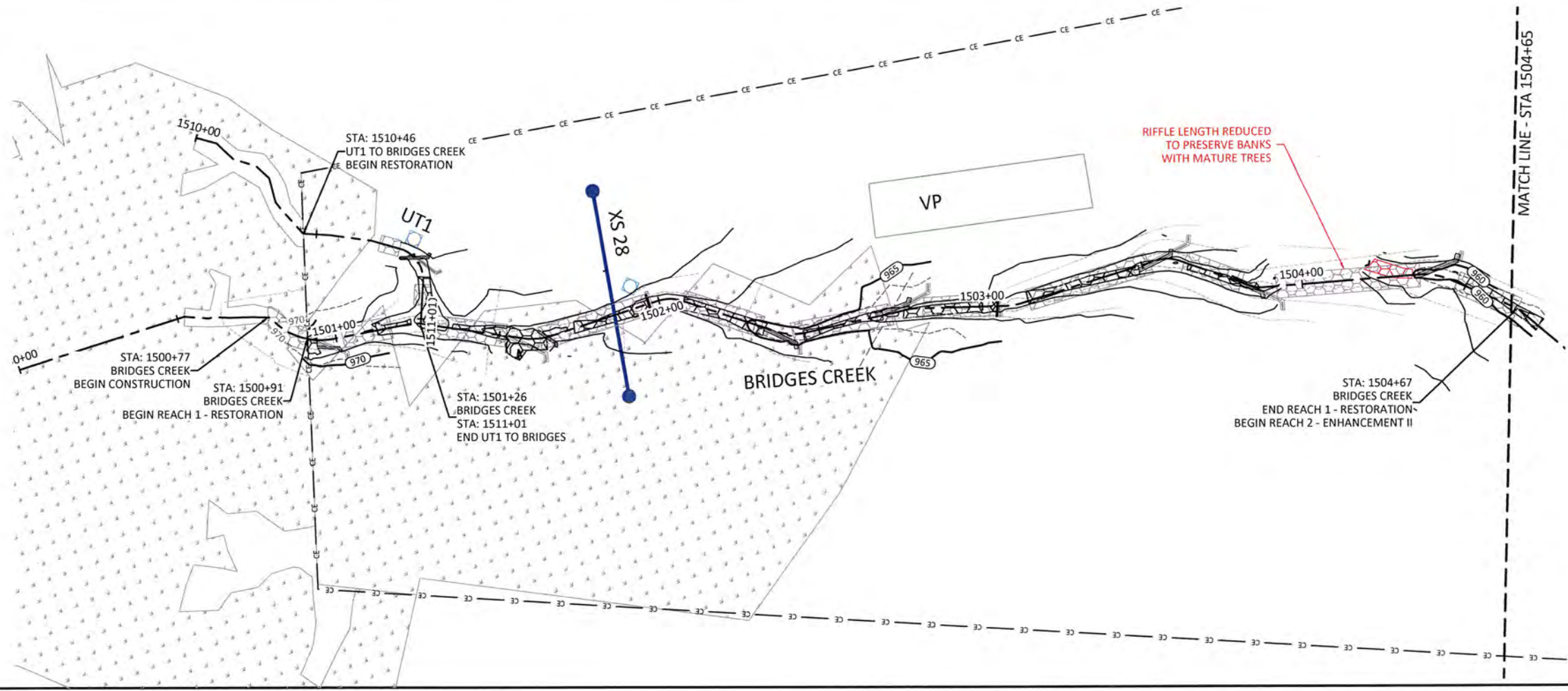
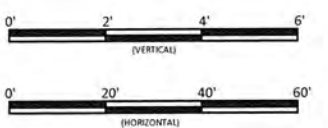
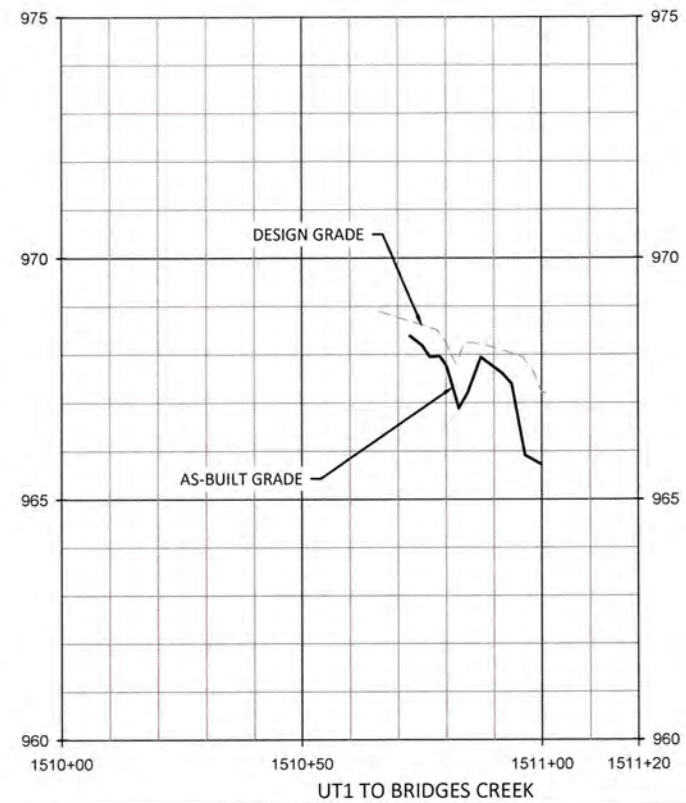
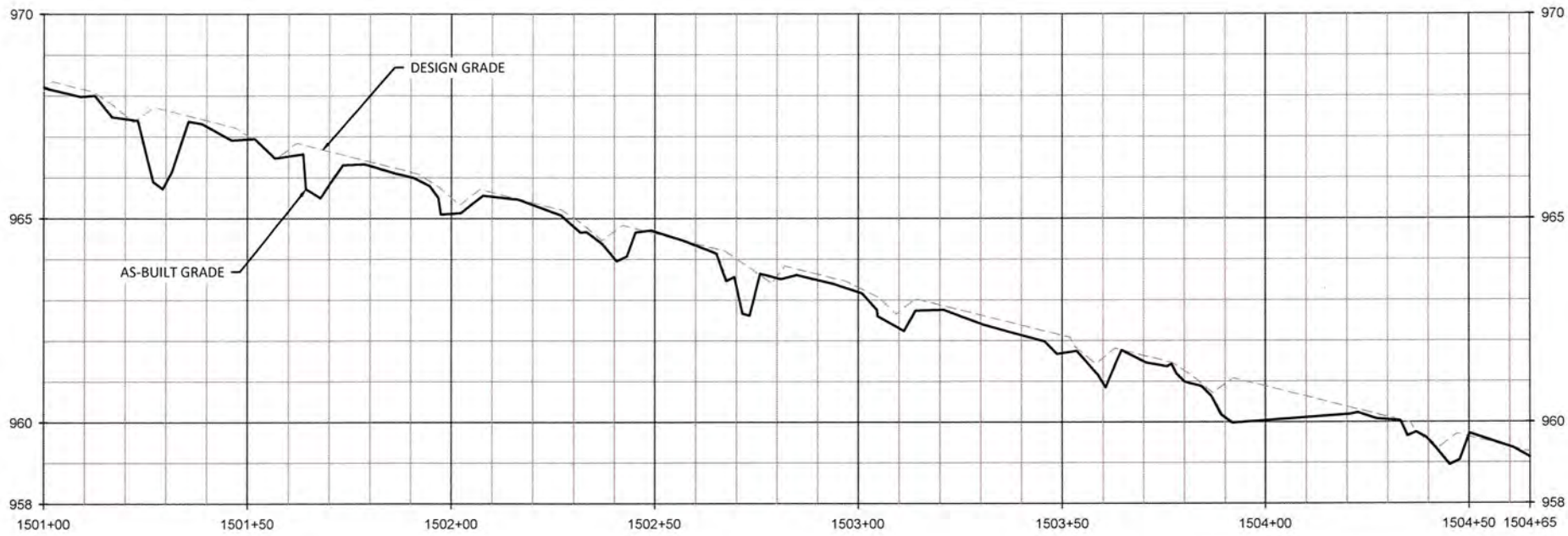
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Date: August 21, 2018  
 Job Number: 005-02123  
 Designed By: EGK, AA  
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 Checked By: JCK

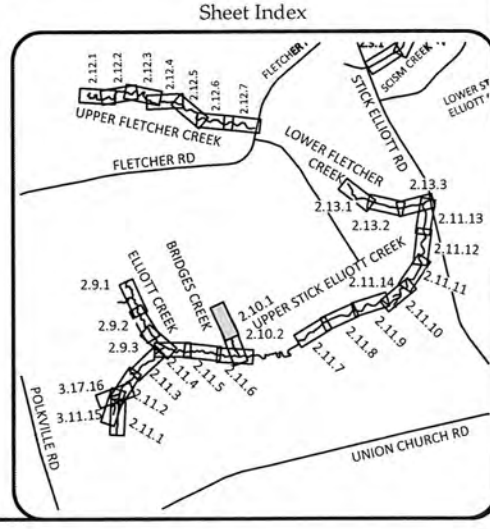
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- REACH TREATMENT:**
1. FENCE OUT CATTLE - REFER TO FENCING PLAN SHEETS.
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  3. REPLANT ALONG ENTIRE REACH - REFER TO PLANTING PLAN SHEETS.



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**Big Harris Creek Mitigation Site**  
**Cleveland County, North Carolina**  
 Bridges Creek Reach 1  
 Stream Plan and Profile Record Drawings

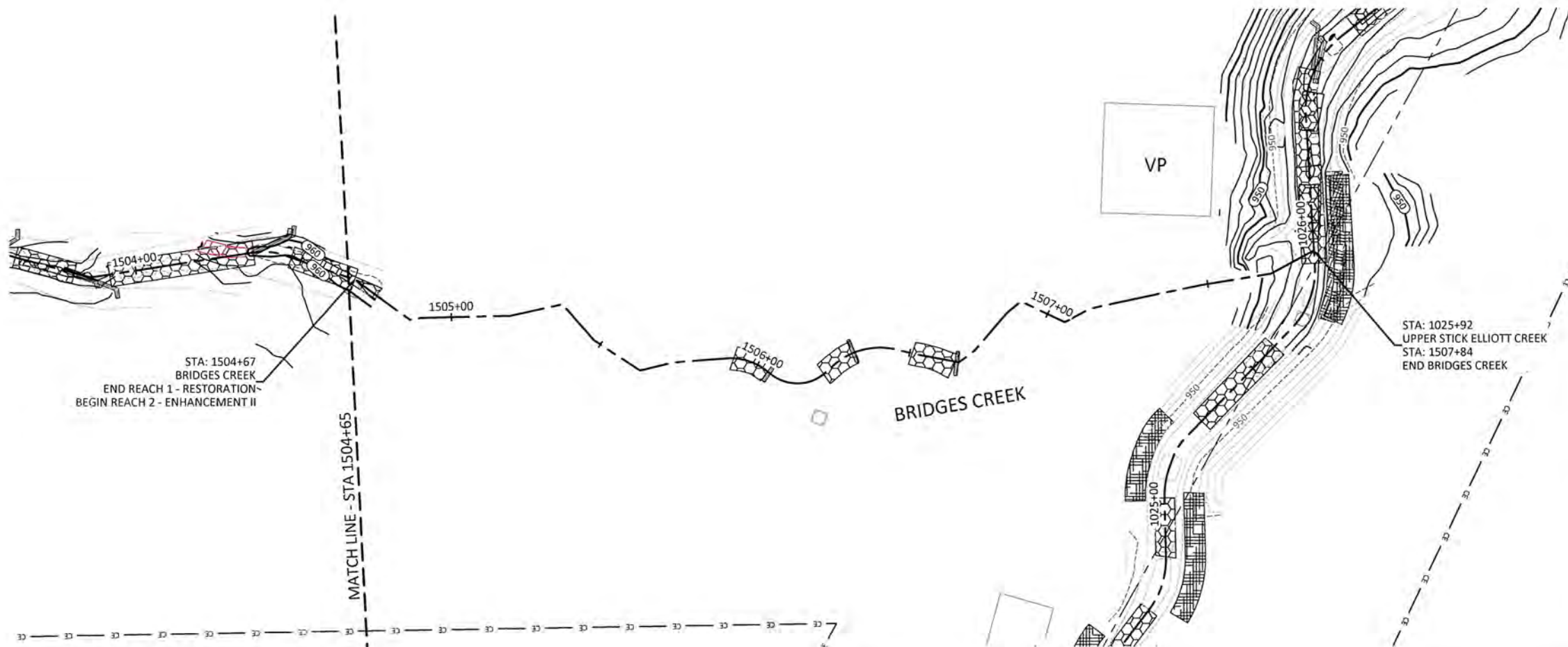
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Date: August 21, 2018  
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 Designed By: ECR, AA  
 Drawn By: JS  
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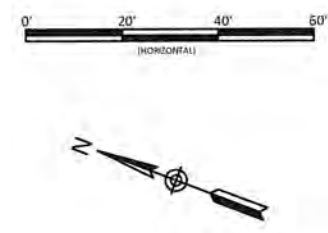
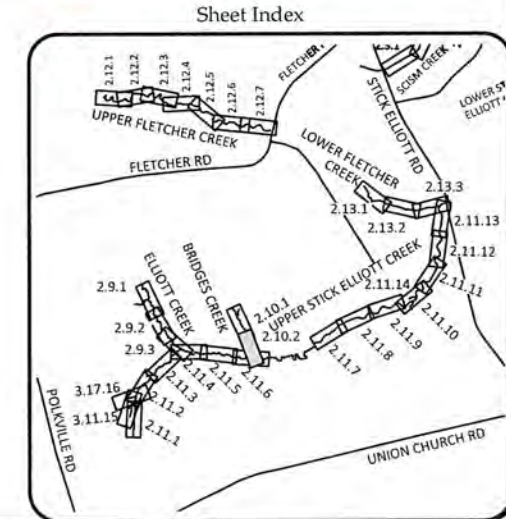
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 August 20, 2018



- REACH TREATMENT:**
1. FENCE OUT CATTLE - REFER TO FENCING PLAN SHEETS.
  2. TREAT INVASIVE SPECIES - REFER TO PLANTING PLAN SHEETS.
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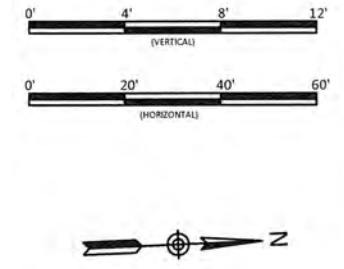
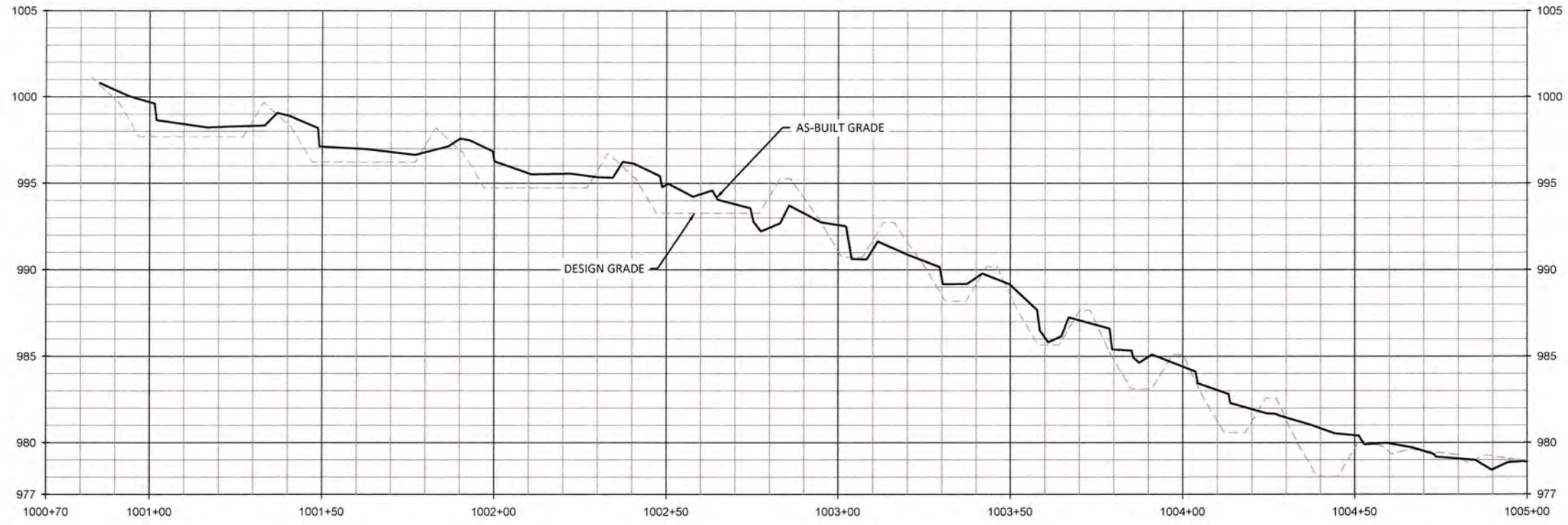


**Big Harris Creek Mitigation Site**  
**Cleveland County, North Carolina**  
 Bridges Creek Reach 2  
 Stream Plan and Profile Record Drawings

Revisions:	

Date:	August 21, 2018
Job Number:	005-02123
Designed By:	EGER, AA
Drawn By:	JS
Checked By:	JCK

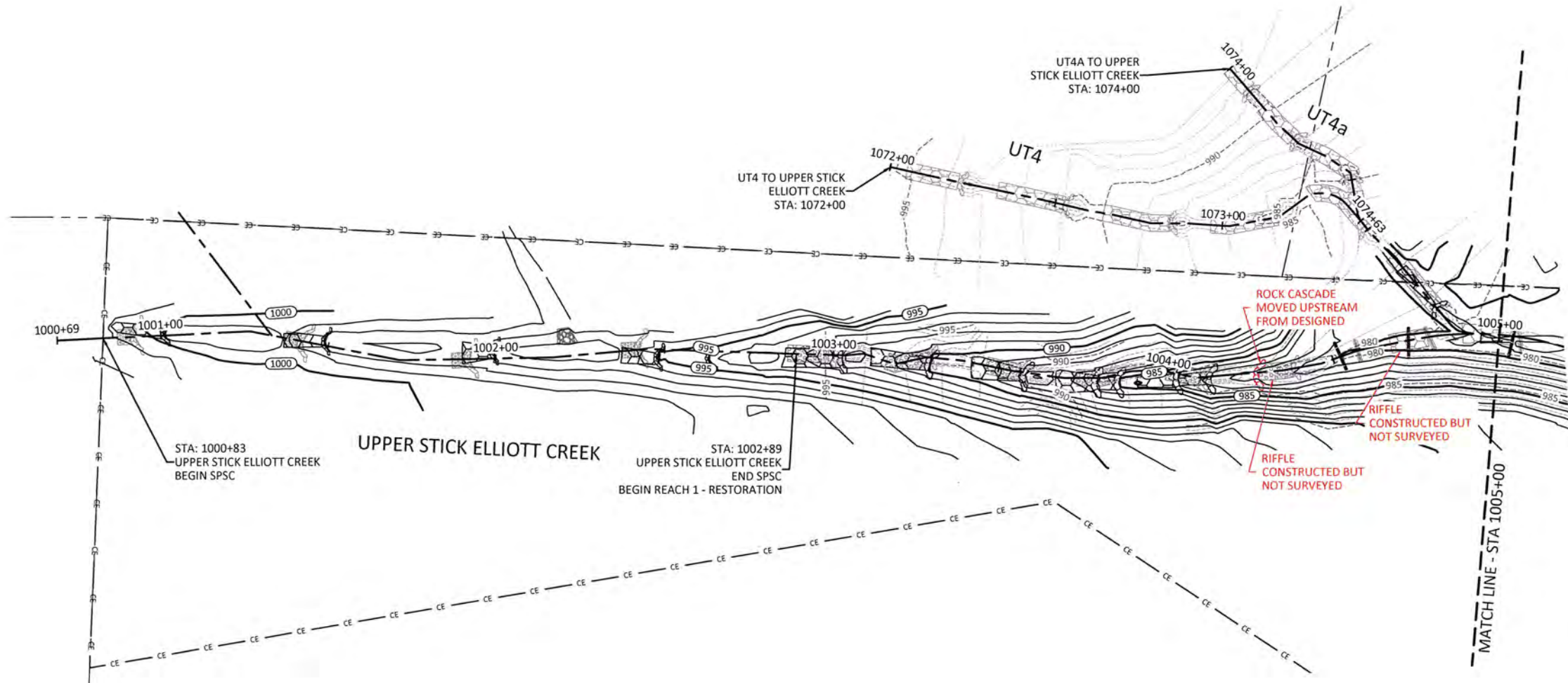
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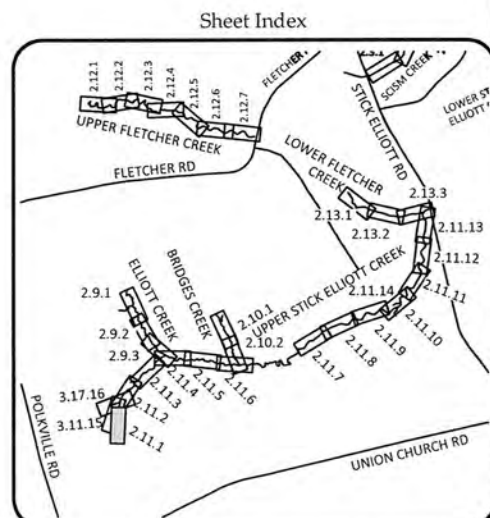
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**Big Harris Creek Mitigation Site**  
Cleveland County, North Carolina  
Upper Stick Elliott Creek Reach 1  
Stream Plan and Profile Record Drawings



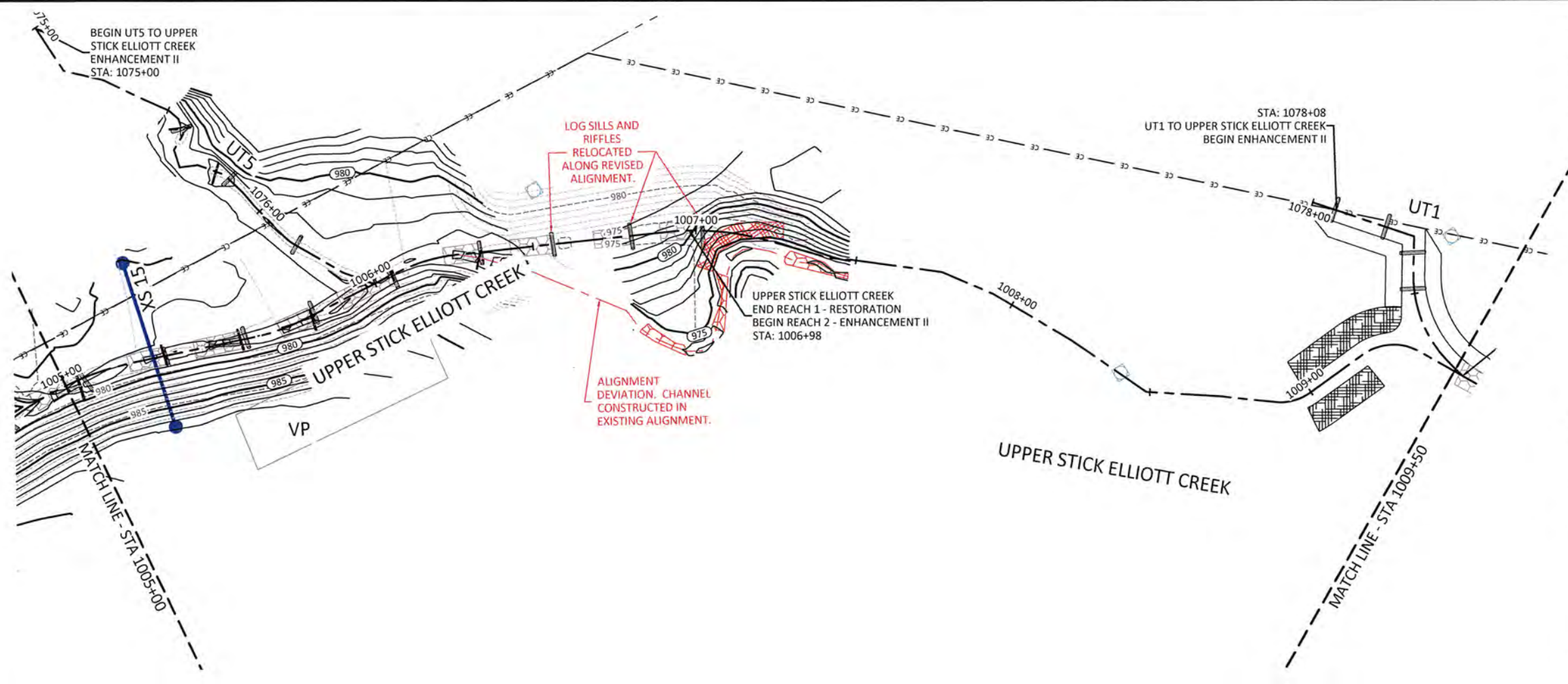
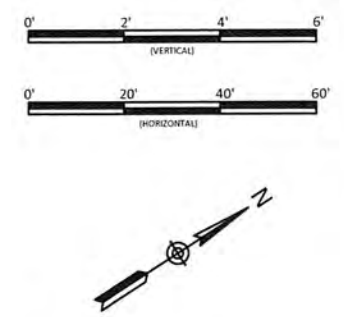
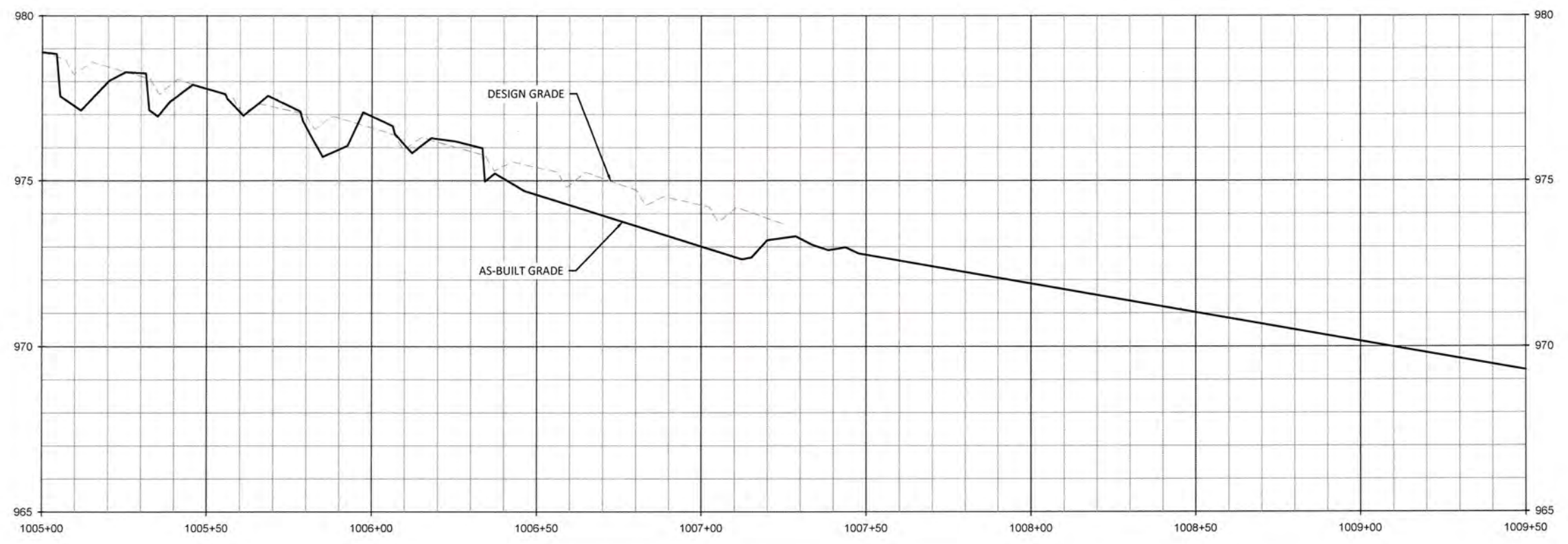
- REACH TREATMENT:**
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  2. TREAT INVASIVE SPECIES - REFER TO PLANTING PLAN SHEETS.
  3. REPLANT ALONG ENTIRE REACH - REFER TO PLANTING PLAN SHEETS.
  4. TREAT STORMWATER RUNOFF WITH SPSC.
  5. SEE SHEETS 3.11.16-3.11.17 FOR UT4, UT4A, AND UT5 PROFILES.



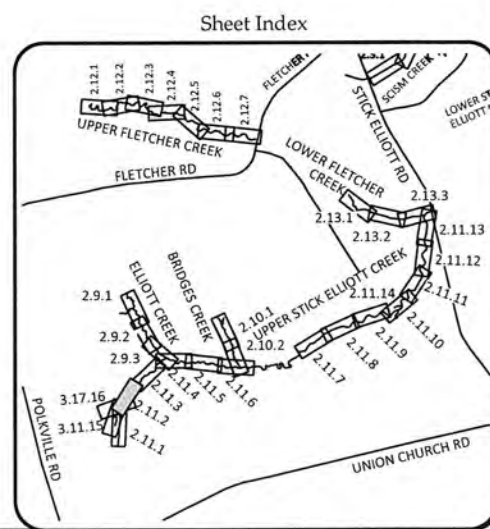
Date: August 21, 2018  
Job Number: 005-02123  
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Drawn By: JS  
Checked By: JCK

**2.11.1**

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- REACH TREATMENT:**
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  4. TREAT STORMWATER RUNOFF WITH SPSC.



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**Big Harris Creek Mitigation Site**  
 Cleveland County, North Carolina  
 Upper Stick Elliott Creek Reach 1 & 2  
 Stream Plan and Profile Record Drawings

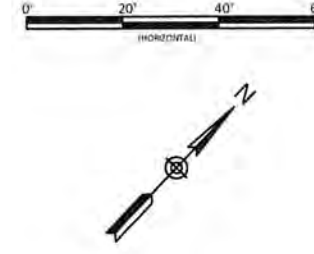
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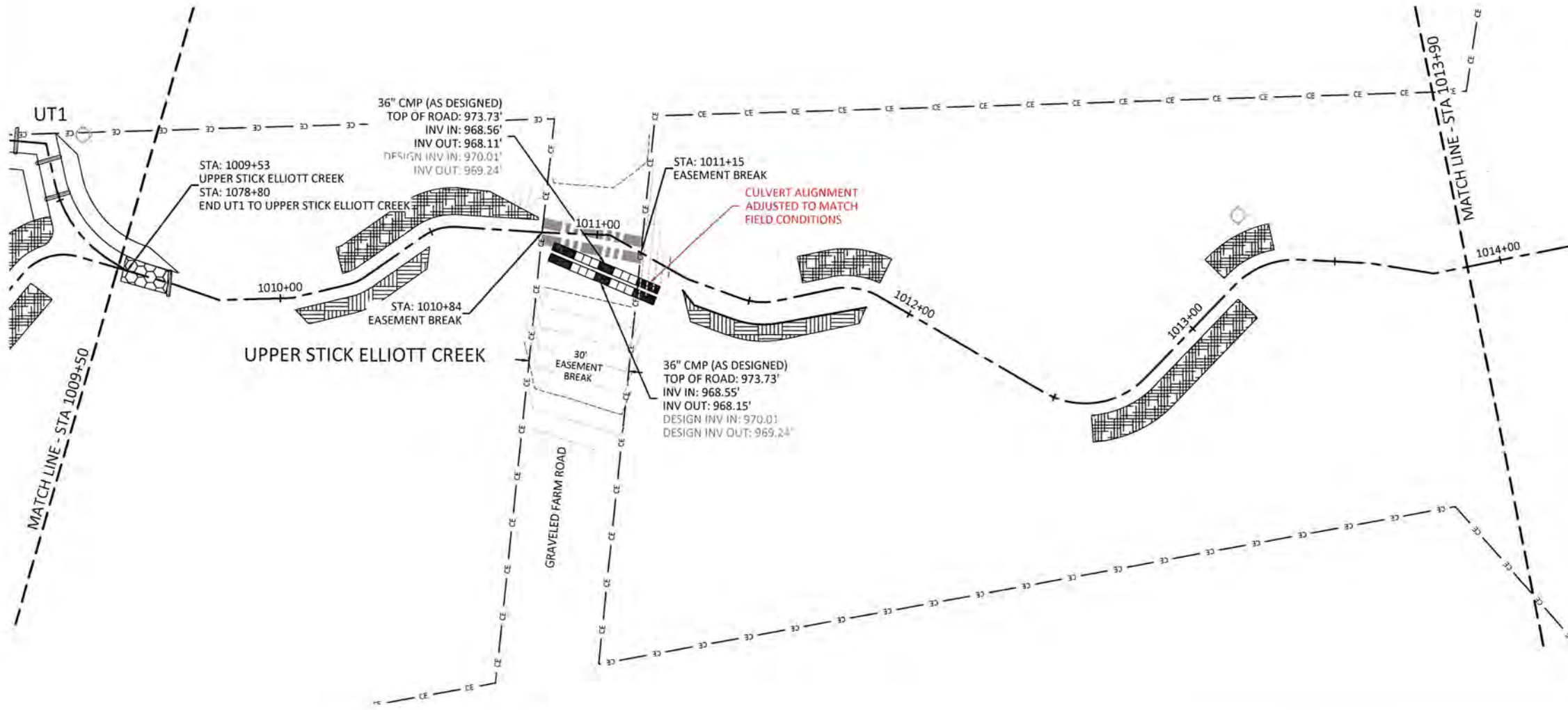
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Job Number:	005-02123
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Drawn By:	JS
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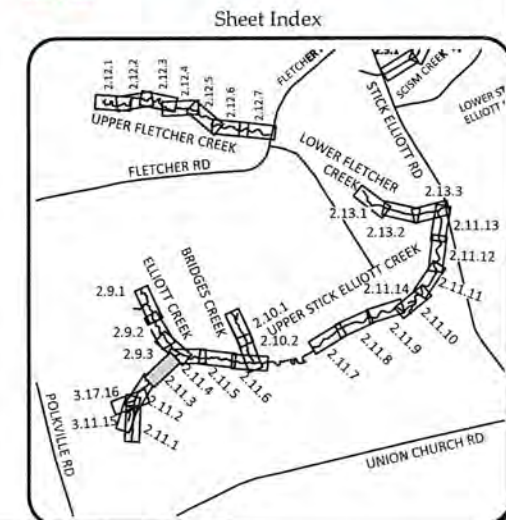


Big Harris Creek Mitigation Site  
Cleveland County, North Carolina  
Upper Stick Elliott Creek Reach 2  
Stream Plan and Profile Record Drawings



- REACH TREATMENT:
1. FENCE OUT CATTLE - REFER TO FENCING PLAN SHEETS.
  2. TREAT INVASIVE SPECIES - REFER TO PLANTING PLAN SHEETS.
  3. REPLANT ALONG ENTIRE REACH - REFER TO PLANTING PLAN SHEETS.

NOTE:  
SURVEY WAS NOT CONDUCTED IN ENHANCEMENT II REACHES. REACHES WERE BUILT PER DESIGN UNLESS OTHERWISE NOTED.



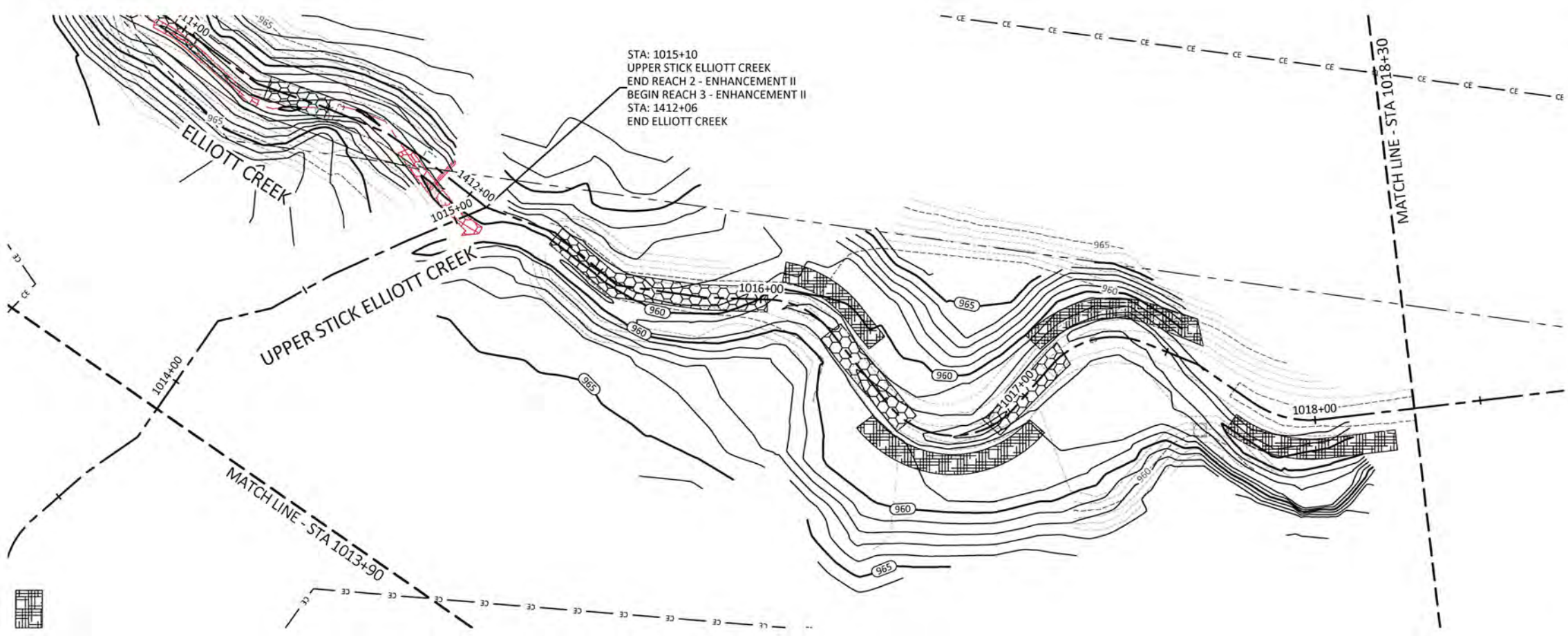
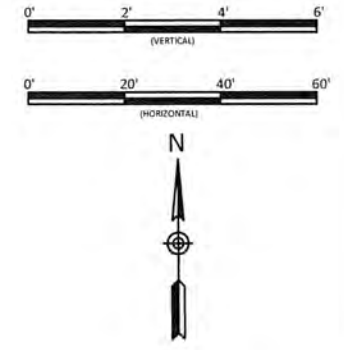
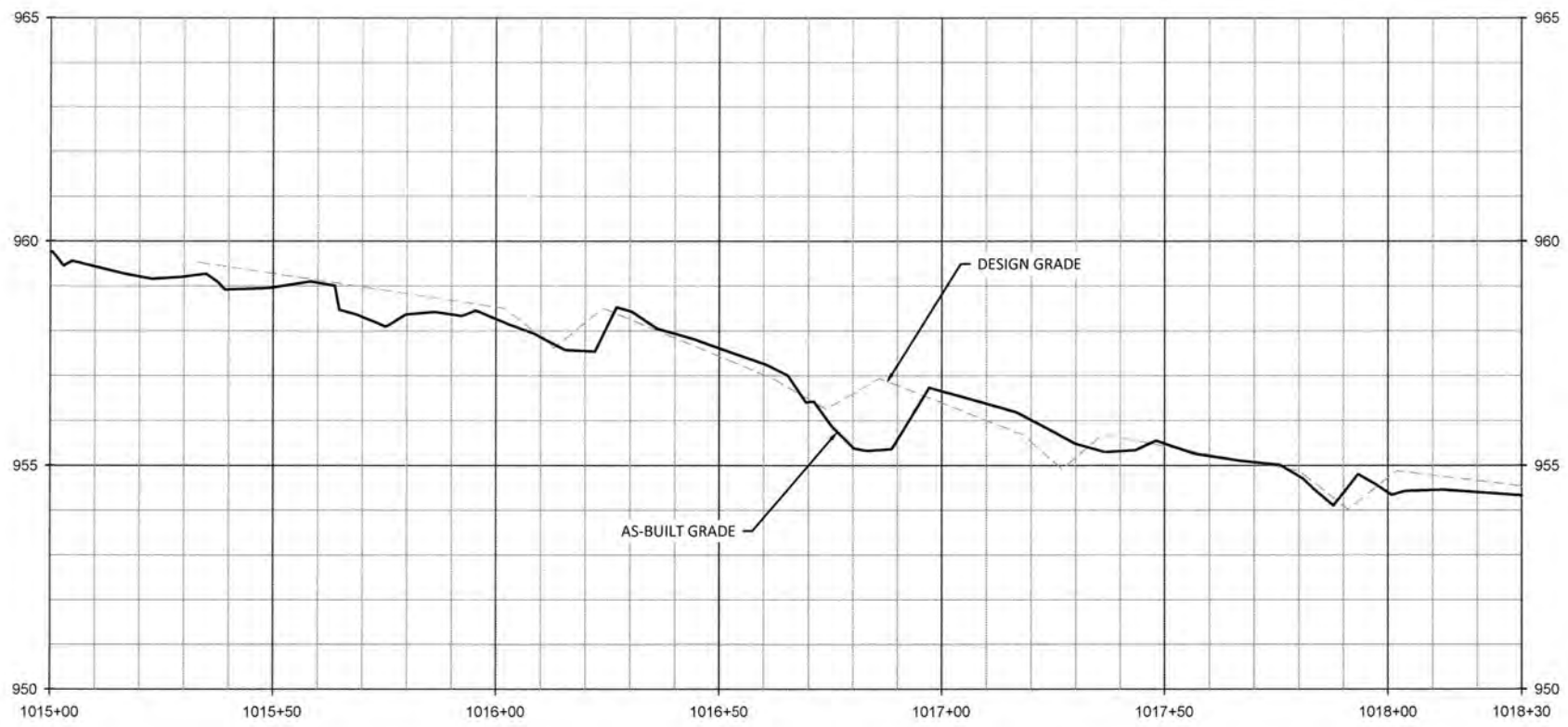
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Date:	August 21, 2018
Job Number:	005-02123
Designed By:	EGR, AA
Drawn By:	JS
Checked By:	JCK

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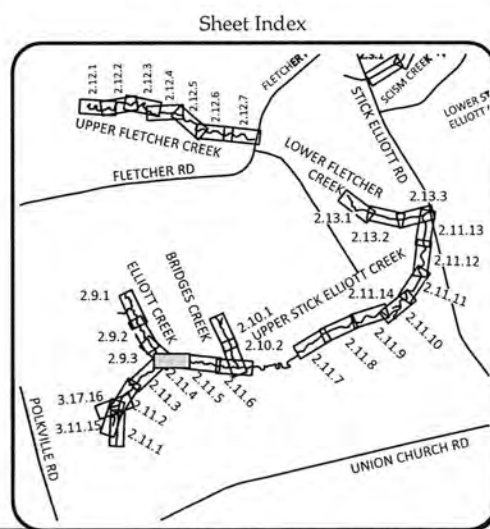
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STA: 1015+10  
 UPPER STICK ELLIOTT CREEK  
 END REACH 2 - ENHANCEMENT II  
 BEGIN REACH 3 - ENHANCEMENT II  
 STA: 1412+06  
 END ELLIOTT CREEK

- REACH TREATMENT:**
1. FENCE OUT CATTLE - REFER TO FENCING PLAN SHEETS.
  2. TREAT INVASIVE SPECIES - REFER TO PLANTING PLAN SHEETS.
  3. REPLANT ALONG ENTIRE REACH - REFER TO PLANTING PLAN SHEETS.
  4. TREAT STORMWATER RUNOFF WITH SPSC.



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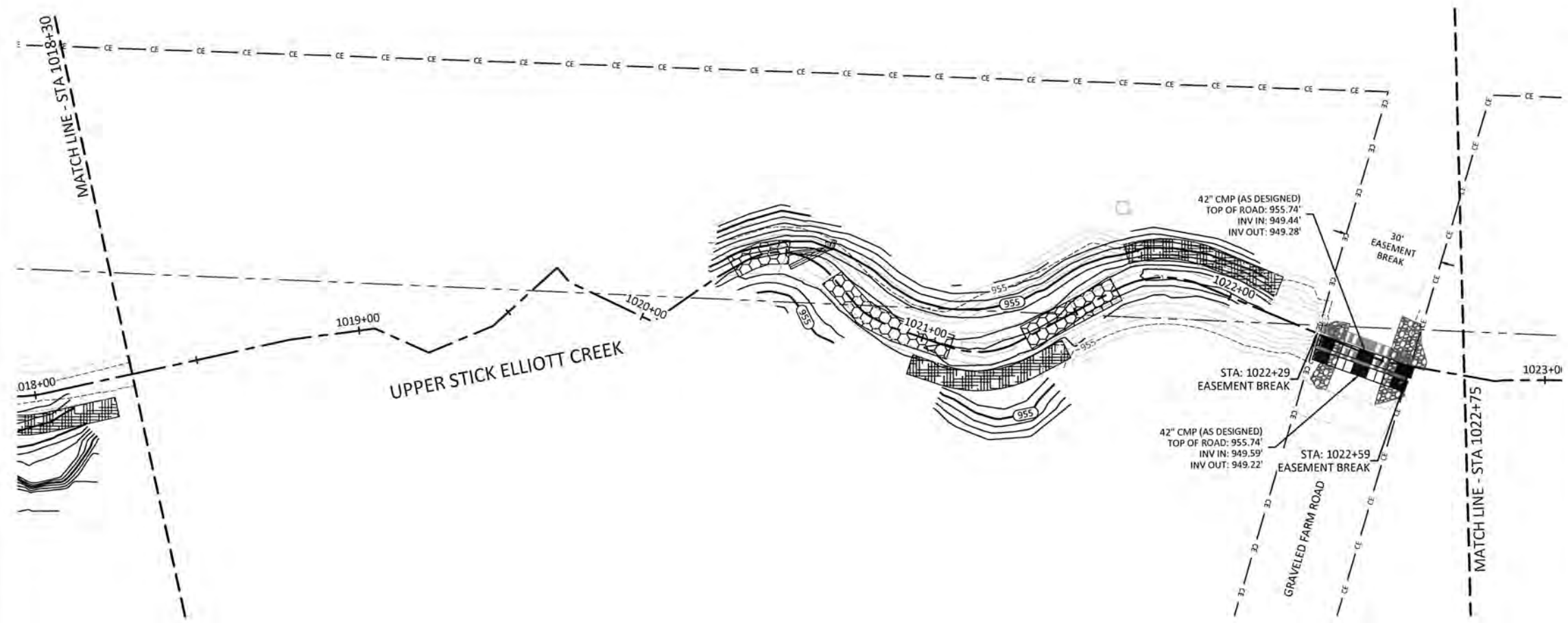
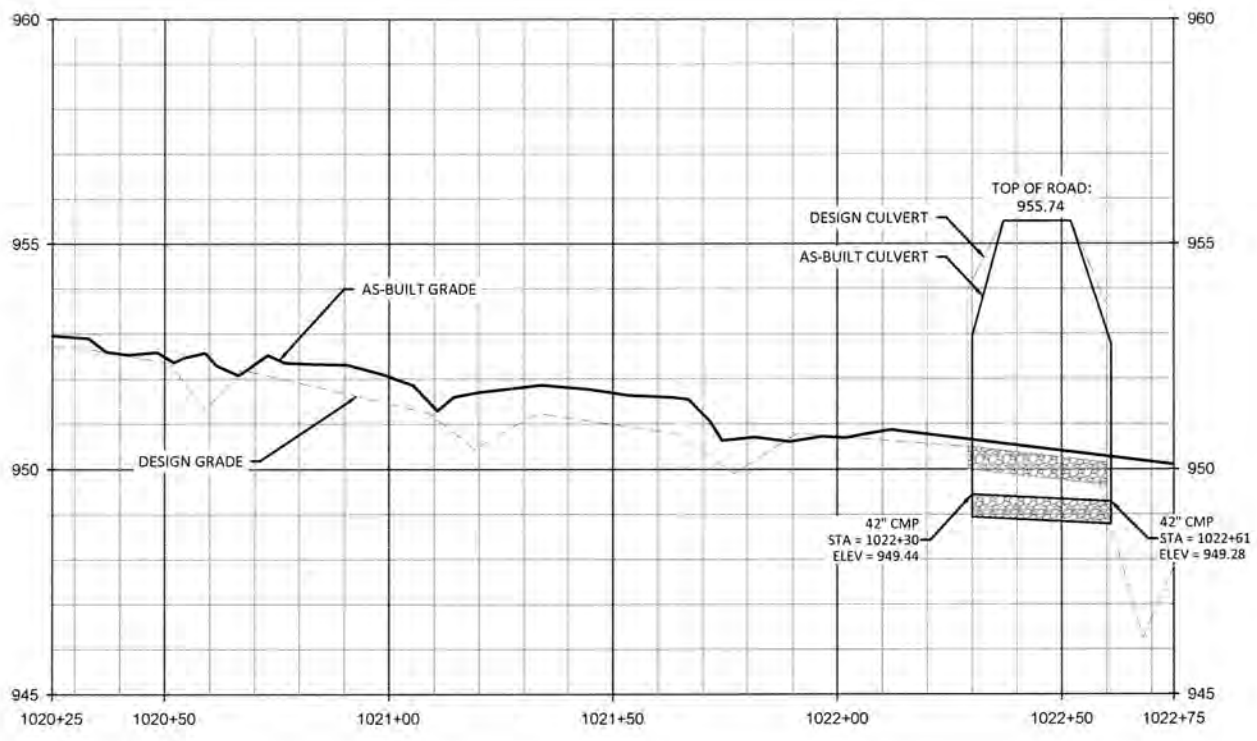
**Big Harris Creek Mitigation Site**  
**Cleveland County, North Carolina**  
 Upper Stick Elliott Creek Reach 3  
 Stream Plan and Profile Record Drawings

Revisions	

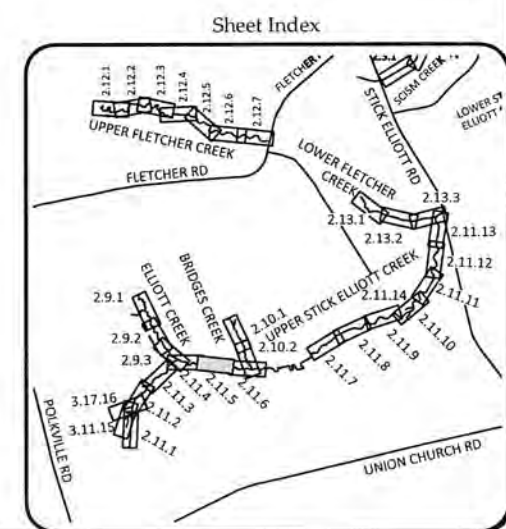
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 Job Number: 005-02123  
 Designed By: EGER, AA  
 Drawn By: JS  
 Checked By: JCK

**2.11.4**

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- REACH TREATMENT:
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Big Harris Creek Mitigation Site  
 Cleveland County, North Carolina  
 Upper Stick Elliott Creek Reach 3  
 Stream Plan and Profile Record Drawings

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Date:	August 21, 2018
Job Number:	005-07123
Designed By:	EGK, AA
Drawn By:	JS
Checked By:	JCK
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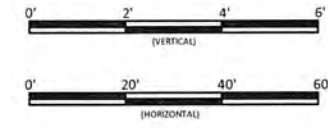
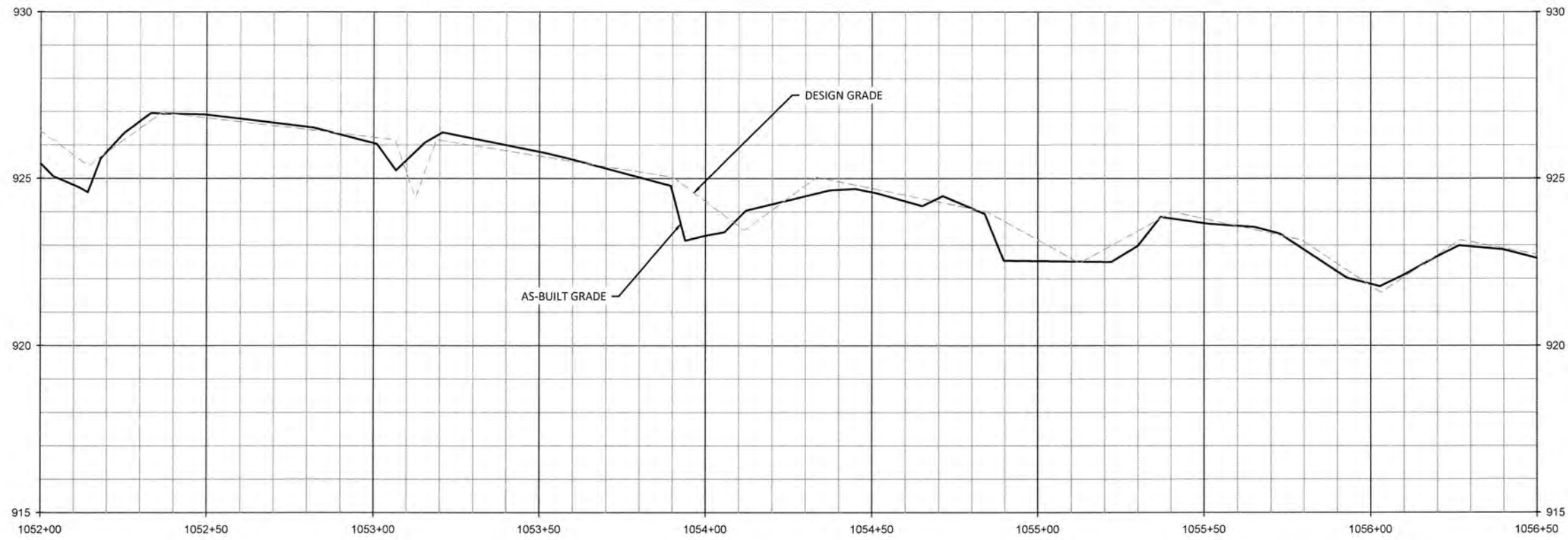








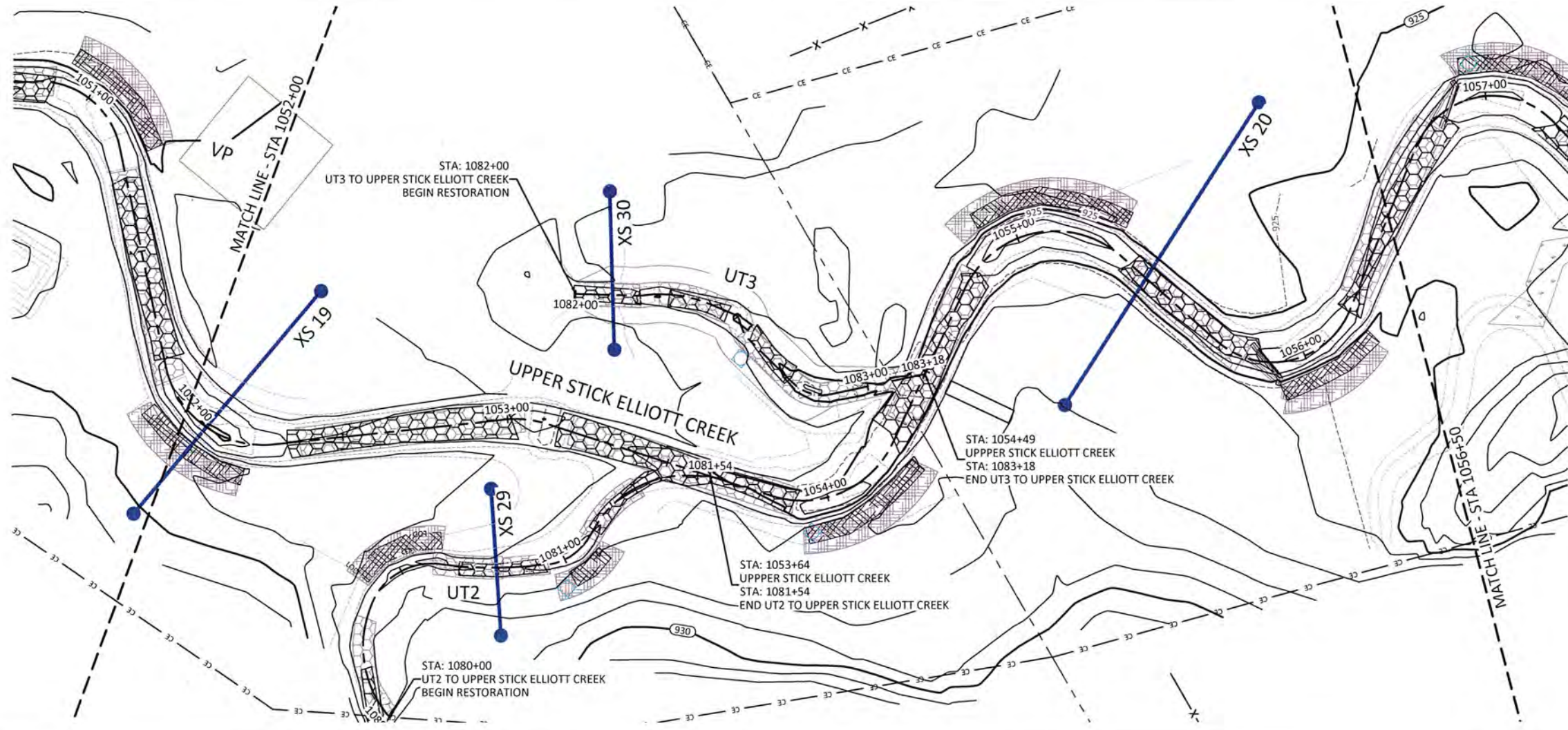




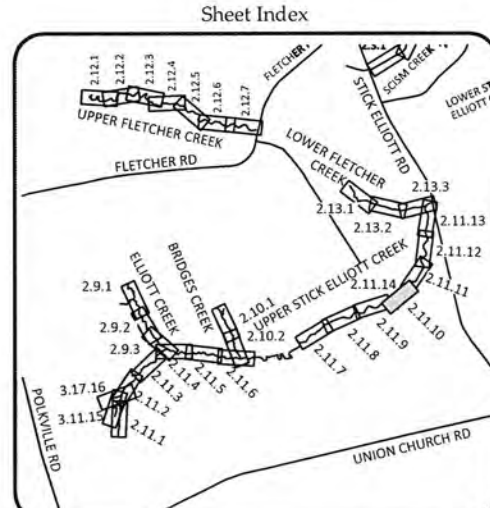
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**Big Harris Creek Mitigation Site**  
Cleveland County, North Carolina  
Upper Stick Elliott Creek Reach 5  
Stream Plan and Profile Record Drawings



- REACH TREATMENT:**
1. FENCE OUT CATTLE - REFER TO FENCING PLAN SHEETS.
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  3. REPLANT ALONG ENTIRE REACH - REFER TO PLANTING PLAN SHEETS.



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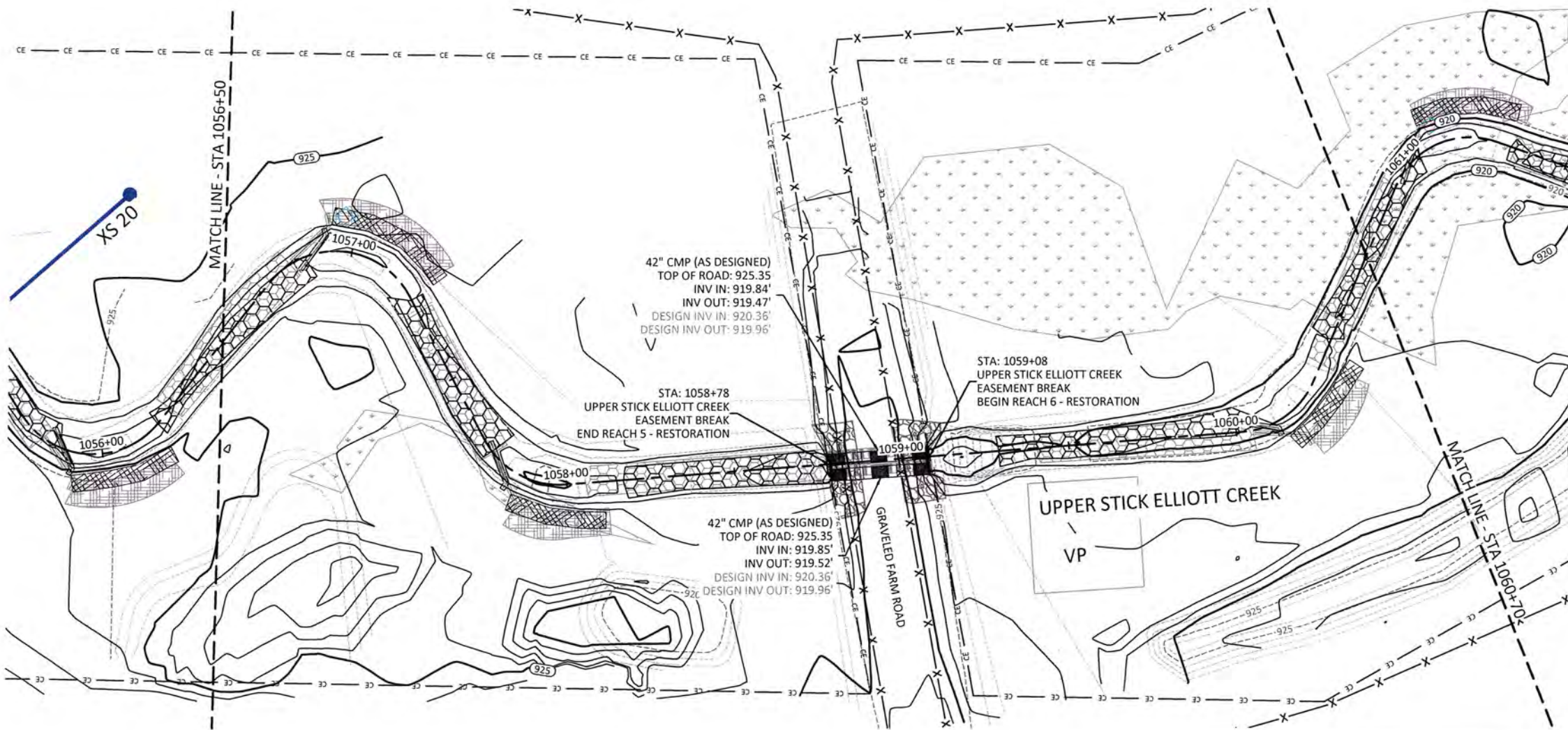
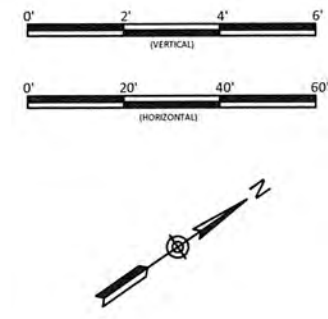
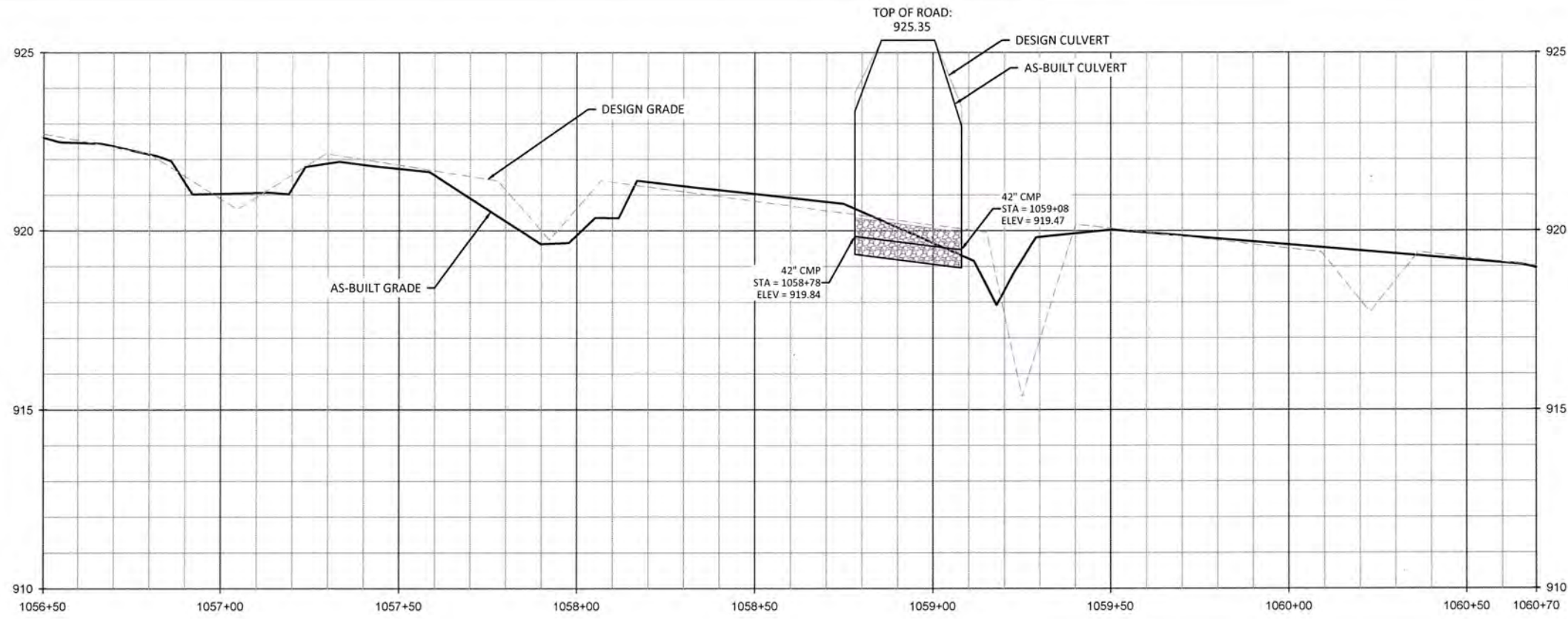
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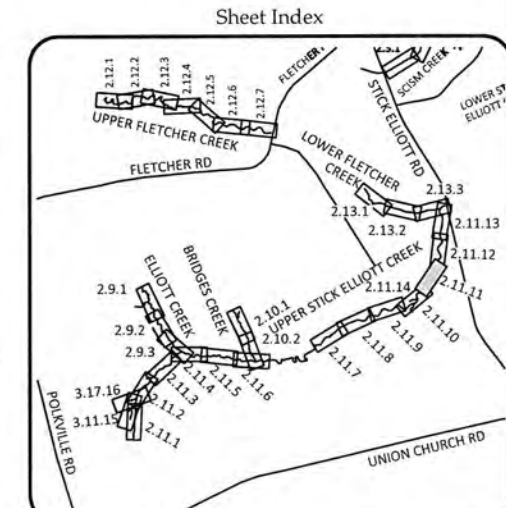
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August 20, 2018  
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- REACH TREATMENT:**
1. FENCE OUT CATTLE - REFER TO FENCING PLAN SHEETS.
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  3. REPLANT ALONG ENTIRE REACH - REFER TO PLANTING PLAN SHEETS.



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**G. REINICKER**  
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 STATE OF NORTH CAROLINA  
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Big Harris Creek Mitigation Site

Cleveland County, North Carolina

Upper Stick Elliott Creek Reach 5 & 6

Stream Plan and Profile Record Drawings

No.	Description	Date

Date: August 21, 2018

Job Number: 005-02123

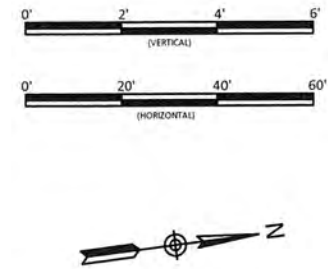
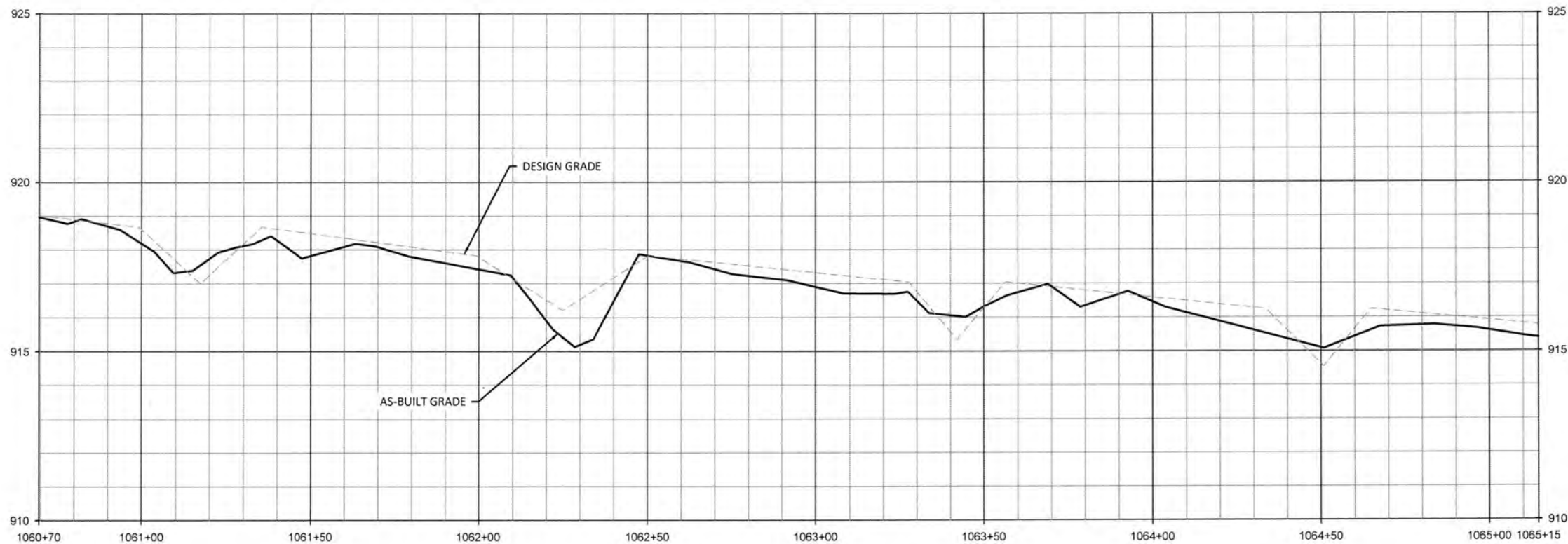
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Drawn By: JS

Checked By: JCK

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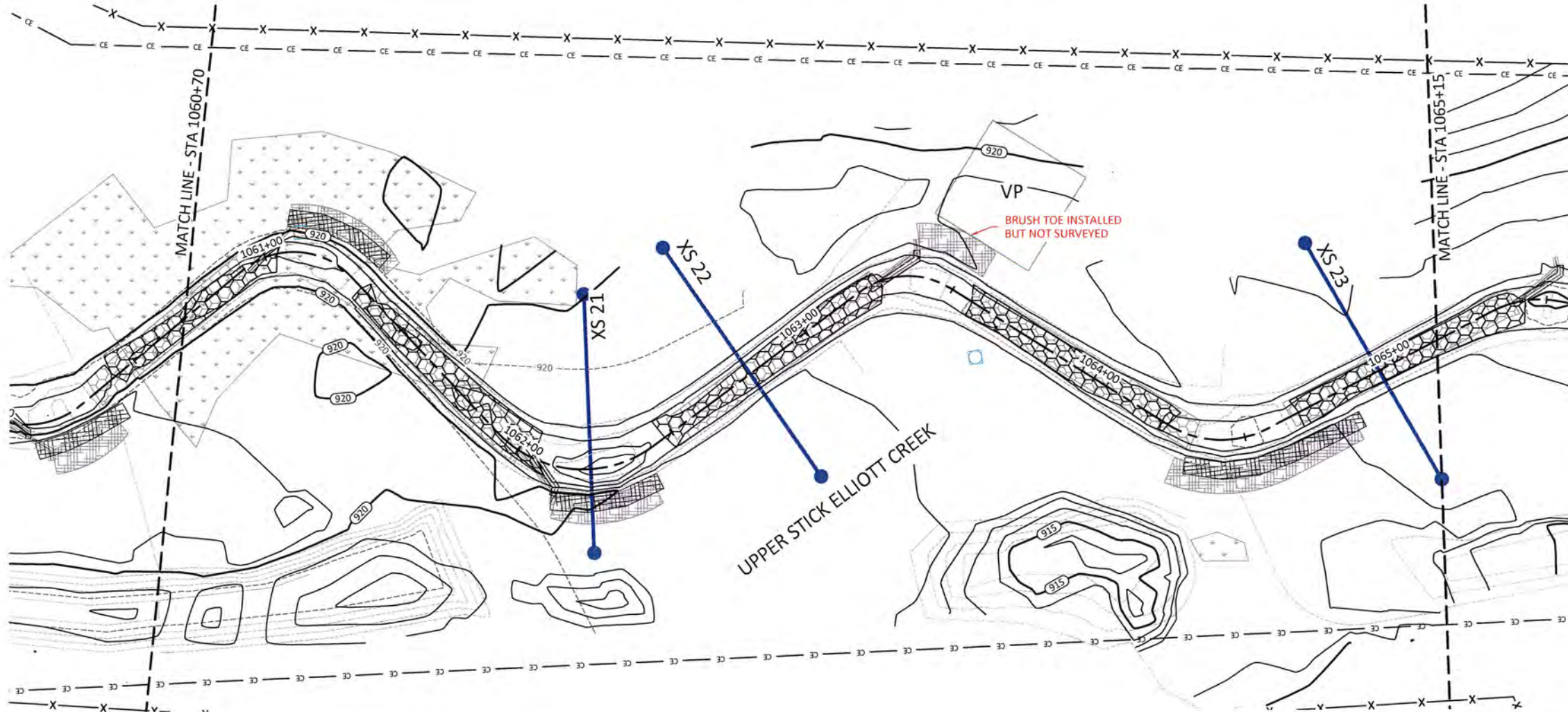
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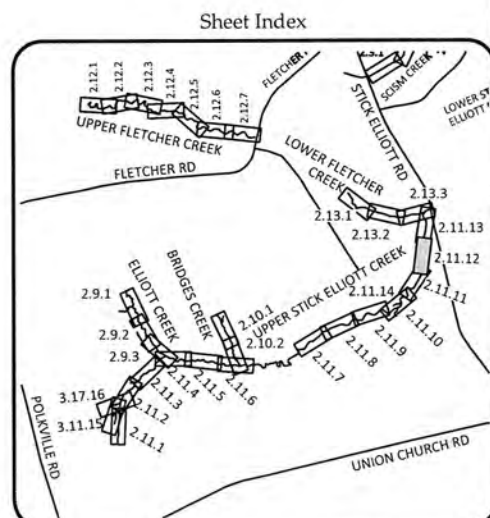
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**Big Harris Creek Mitigation Site**  
 Cleveland County, North Carolina  
 Upper Stick Elliott Creek Reach 6  
 Stream Plan and Profile Record Drawings



- REACH TREATMENT:**
1. FENCE OUT CATTLE - REFER TO FENCING PLAN SHEETS.
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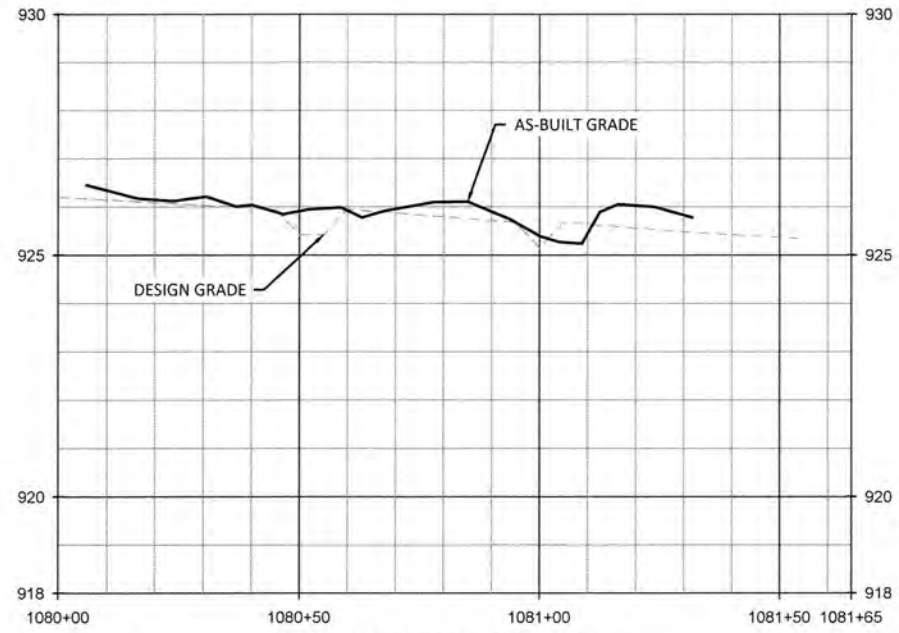
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 Job Number: 005-02123  
 Designed By: ECR, A.A.  
 Drawn By: JS  
 Checked By: JCK

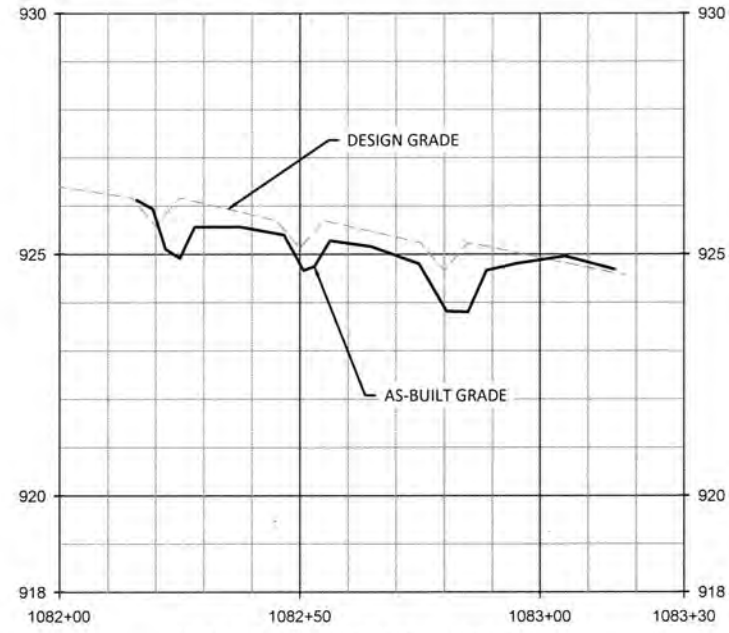
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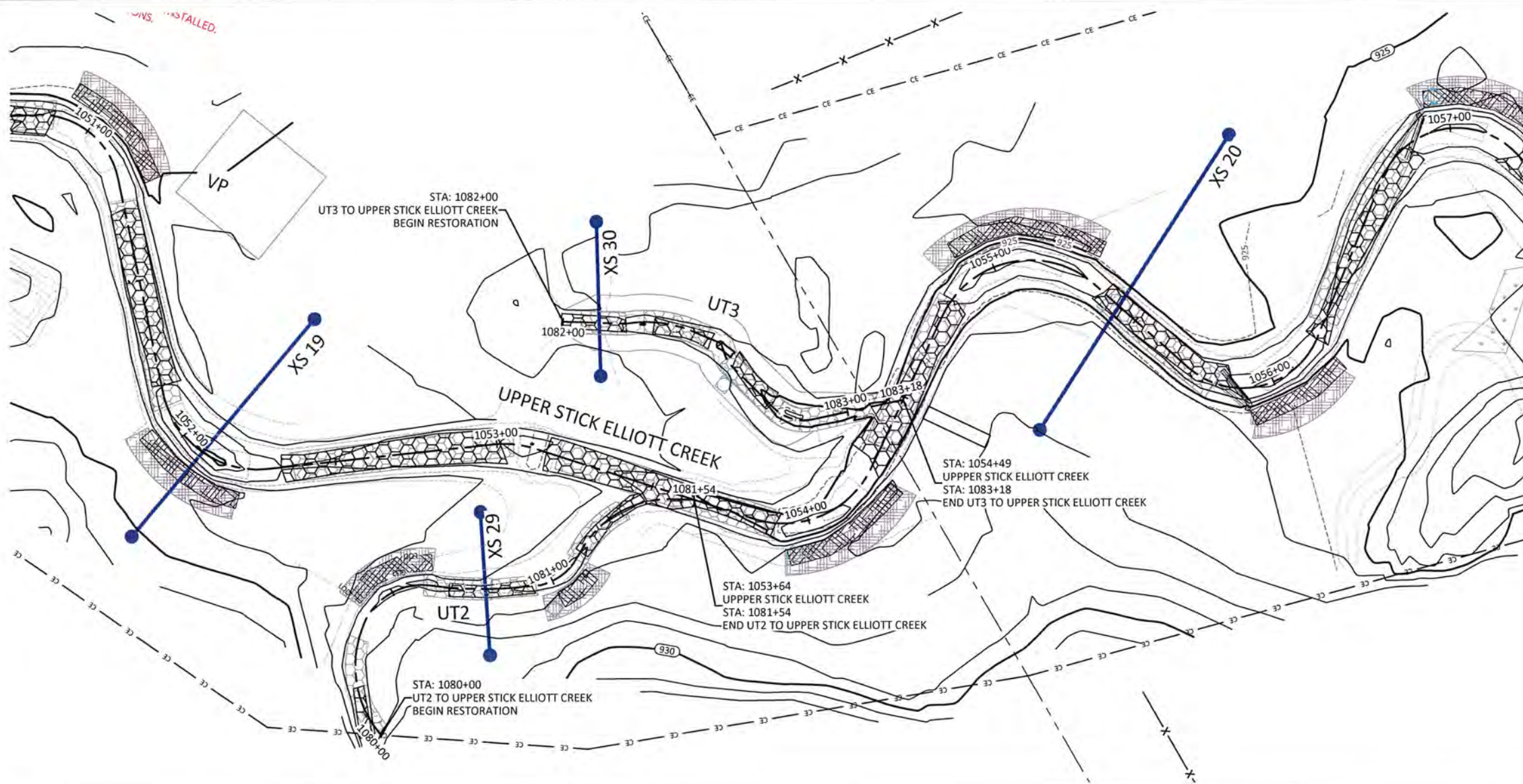
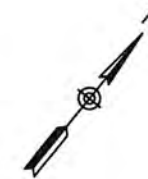
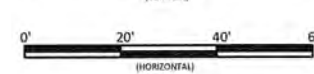




UT2 TO UPPER STICK ELLIOTT CREEK



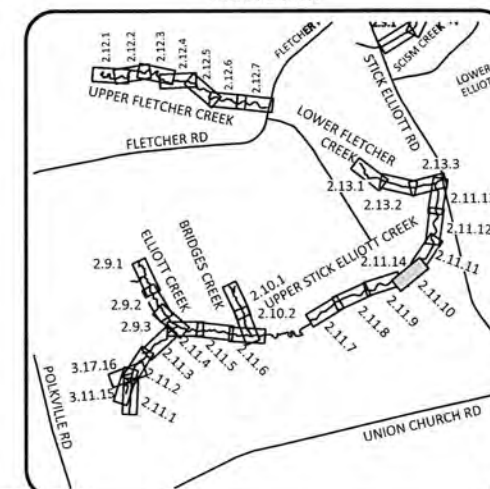
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REACH TREATMENT:

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2. TREAT INVASIVE SPECIES - REFER TO PLANTING PLAN SHEETS.
3. REPLANT ALONG ENTIRE REACH - REFER TO PLANTING PLAN SHEETS.

Sheet Index



Big Harris Creek Mitigation Site  
 Cleveland County, North Carolina  
 UT2 & UT3 to Upper Stick Elliott Creek  
 As-Built Plans

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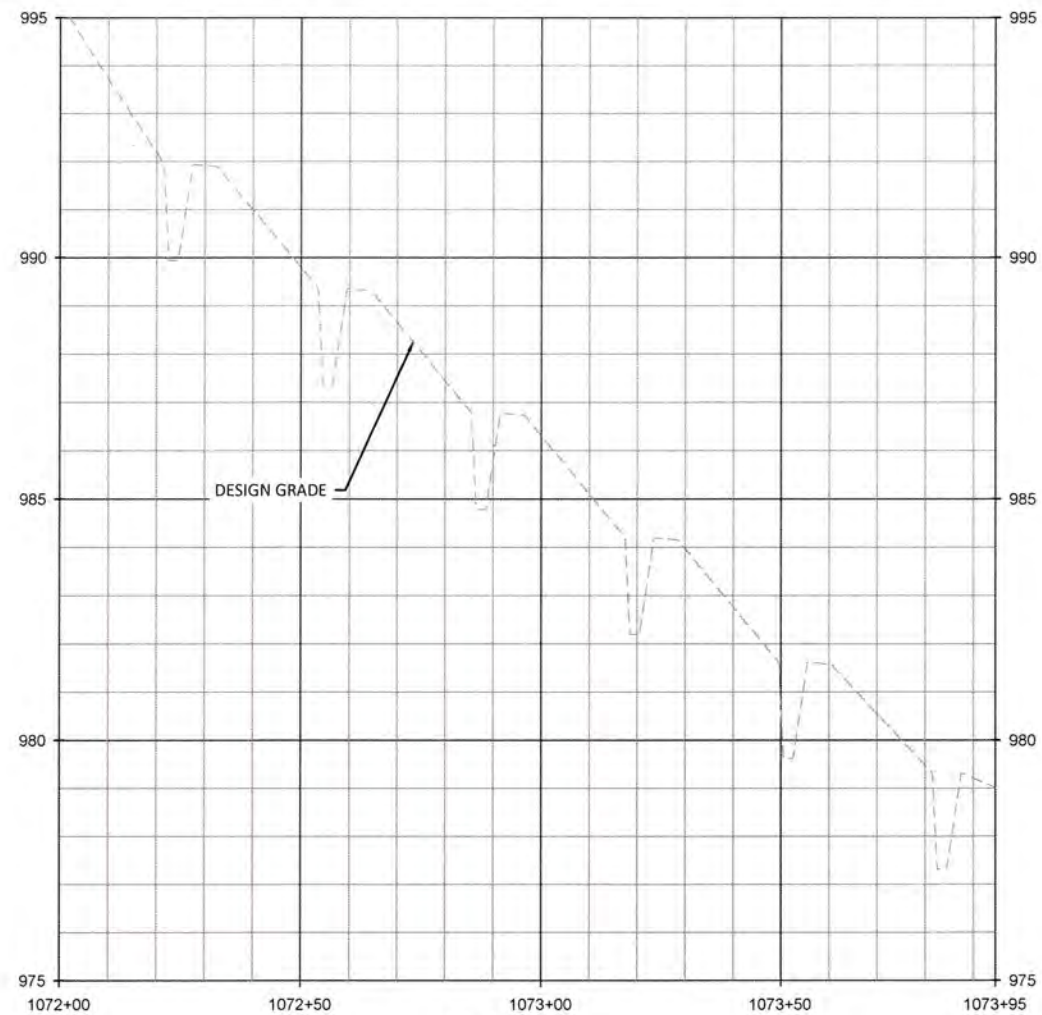


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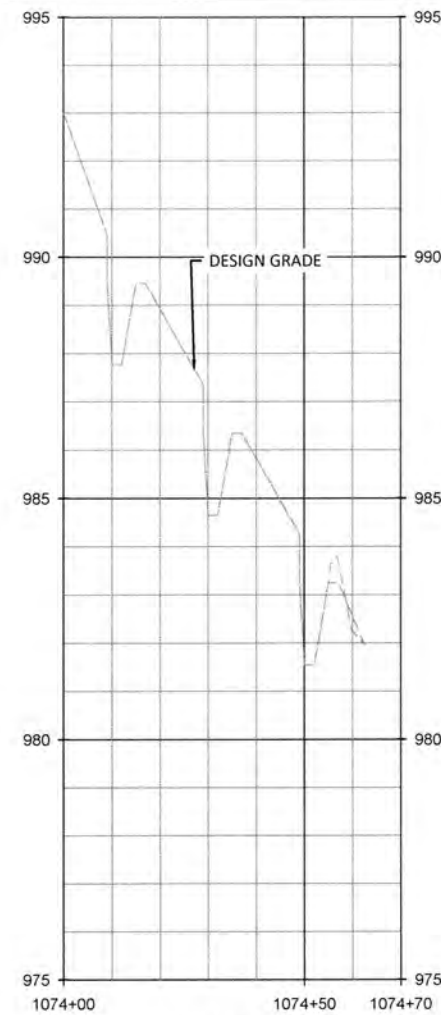
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Job Number:	005-02123
Designed By:	KT
Drawn By:	JS
Checked By:	JCK

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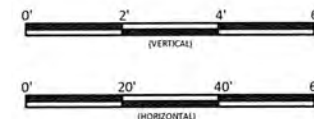
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UT4



UT4A



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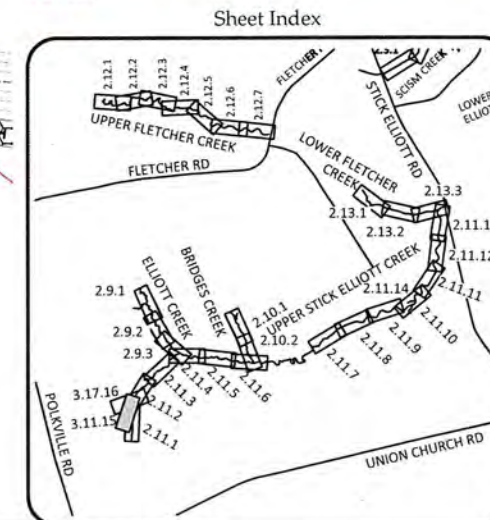
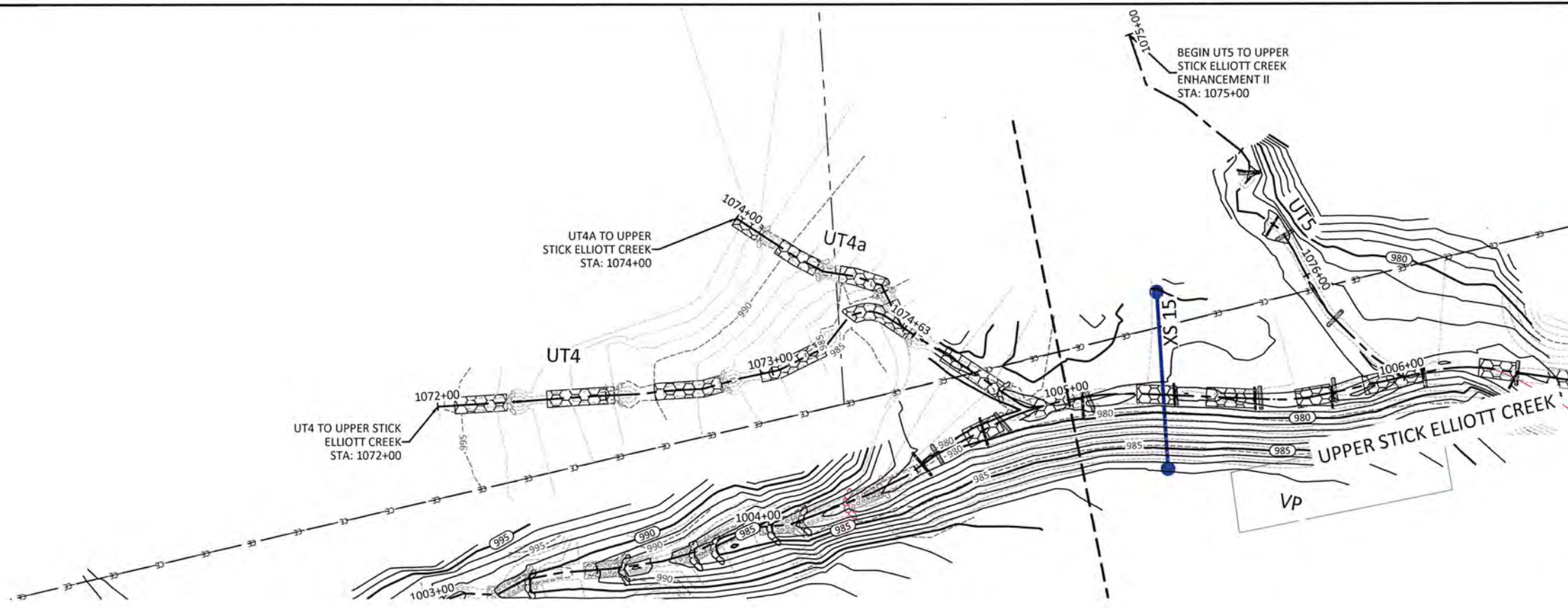


**Big Harris Creek Mitigation Site**  
**Cleveland County, North Carolina**  
 UT4 & UT4a to Upper Stick Elliott Creek  
 Stream Plan and Profile Record Drawings

**REACH TREATMENT:**

1. FENCE OUT CATTLE - REFER TO FENCING PLAN SHEETS.
2. TREAT INVASIVE SPECIES - REFER TO PLANTING PLAN SHEETS.
3. REPLANT ALONG ENTIRE REACH - REFER TO PLANTING PLAN SHEETS.

**NOTE:**  
 SURVEY WAS NOT CONDUCTED OUTSIDE CONSERVATION EASEMENT. REACHES WERE BUILT PER DESIGN UNLESS OTHERWISE NOTED.



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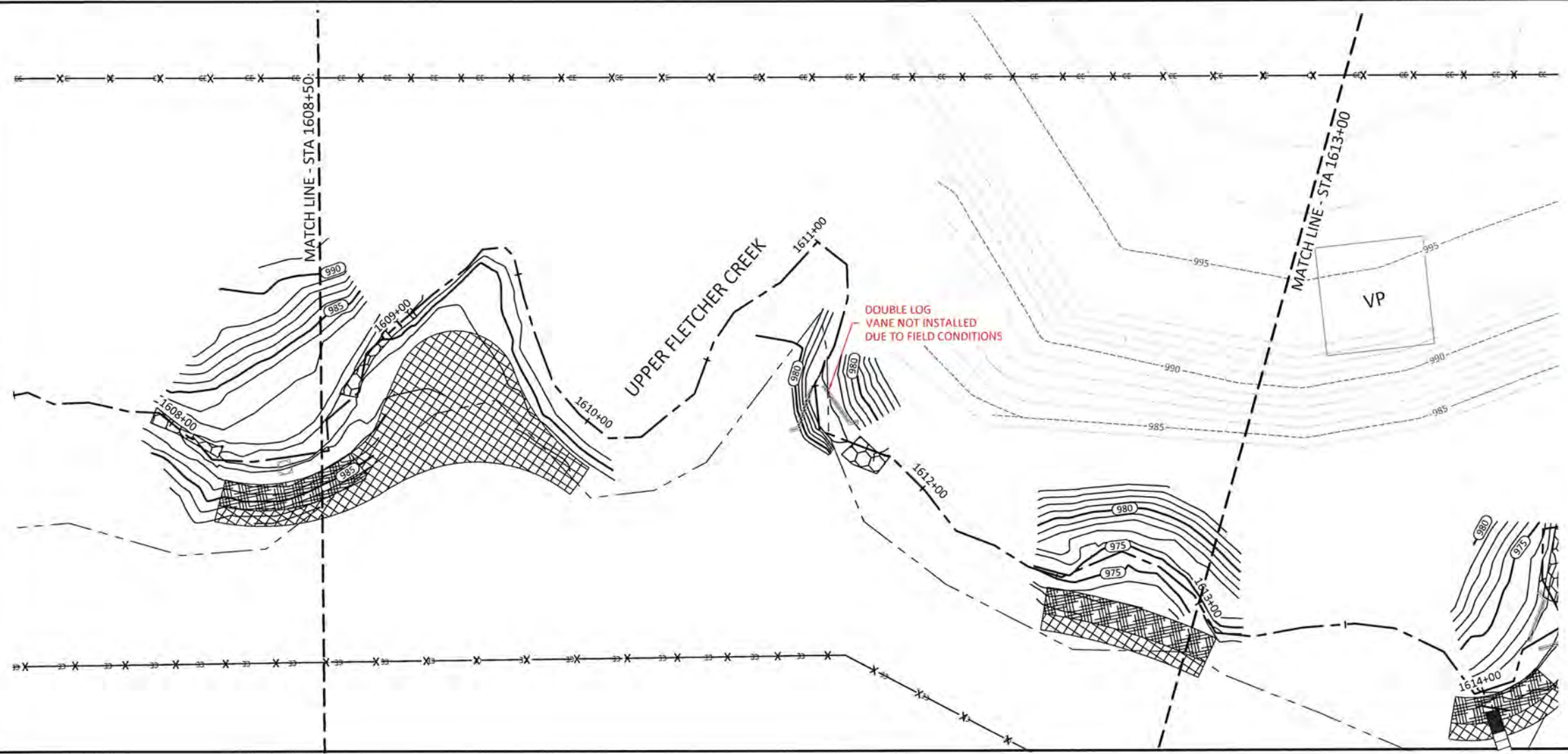
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 Designed By: EGER, AA  
 Drawn By: JS  
 Checked By: JCK

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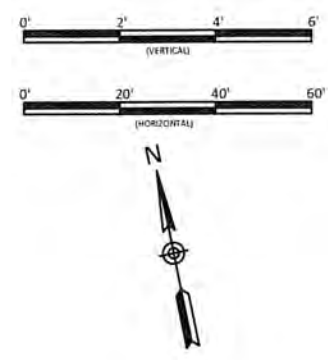
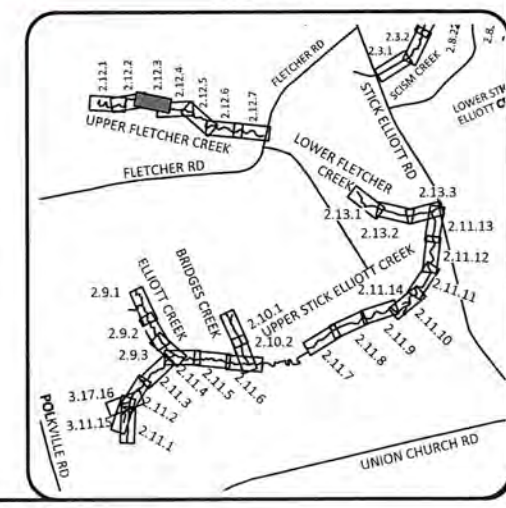






- REACH TREATMENT:**
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**Big Harris Creek Mitigation Site**  
**Cleveland County, North Carolina**  
 Upper Fletcher Creek Reach 1  
 Stream Plan and Profile Record Drawings

Date:	August 21, 2018
Job Number:	005-02123
Designed By:	ECR, AA
Drawn By:	JS
Checked By:	JCK

**2.12.3**

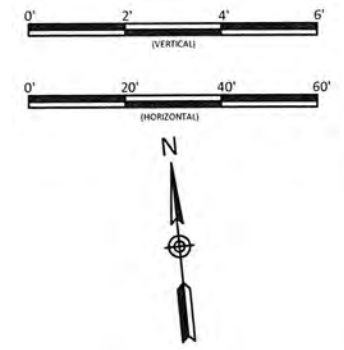
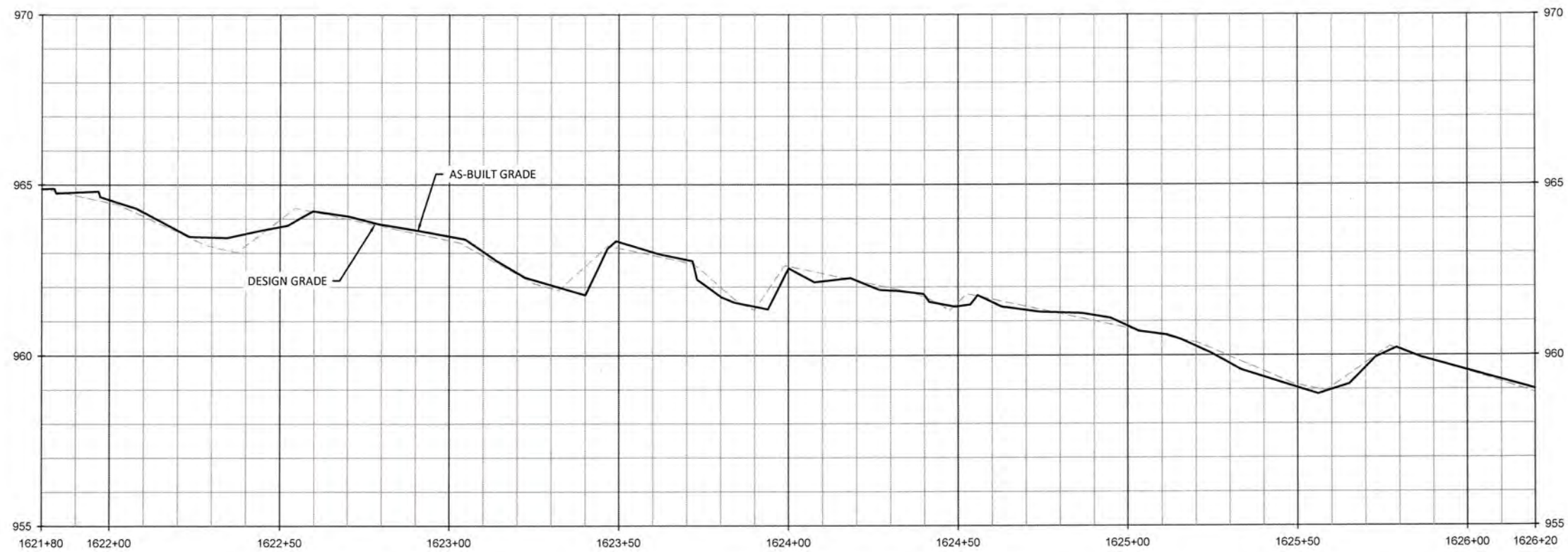








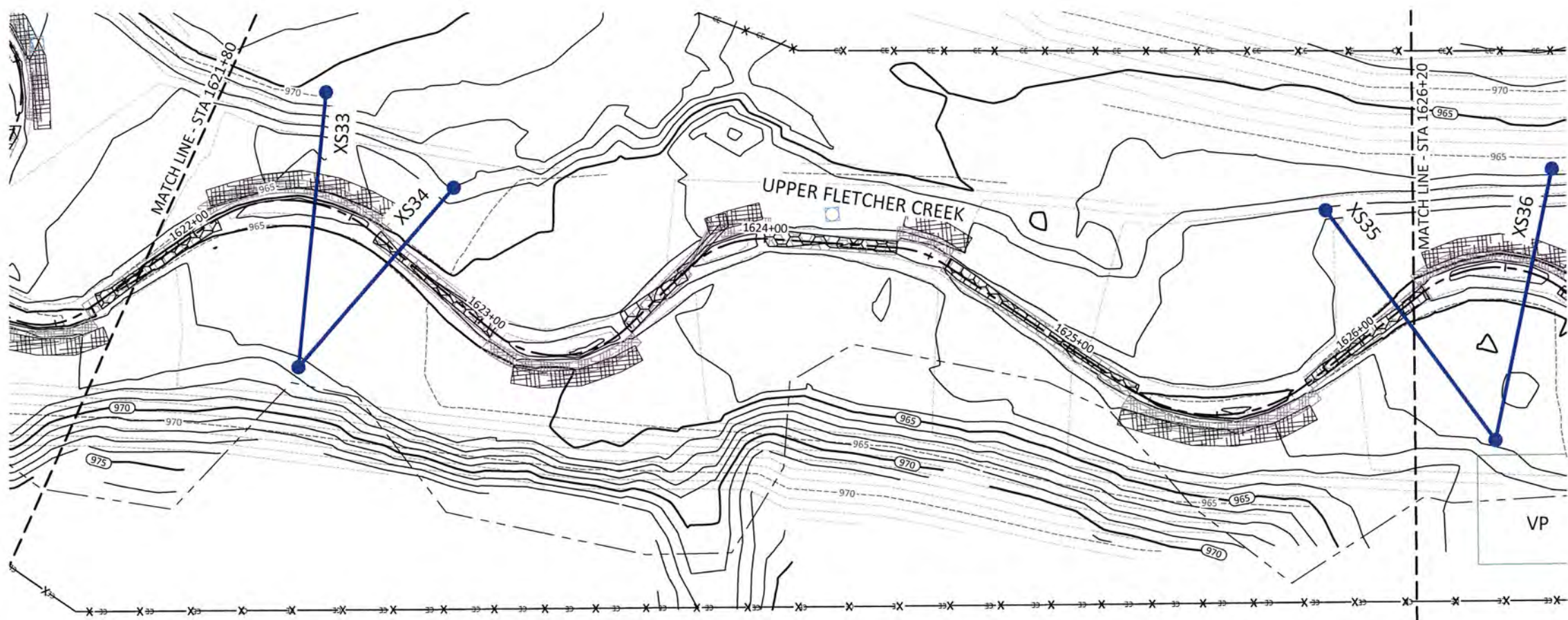
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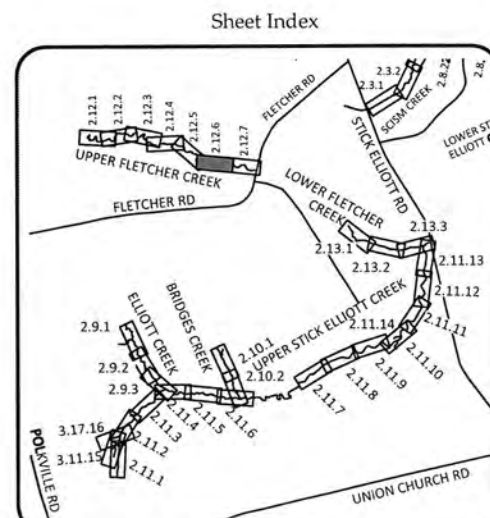
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Big Harris Creek Mitigation Site  
Cleveland County, North Carolina  
Upper Fletcher Creek Reach 2  
Stream Plan and Profile Record Drawings



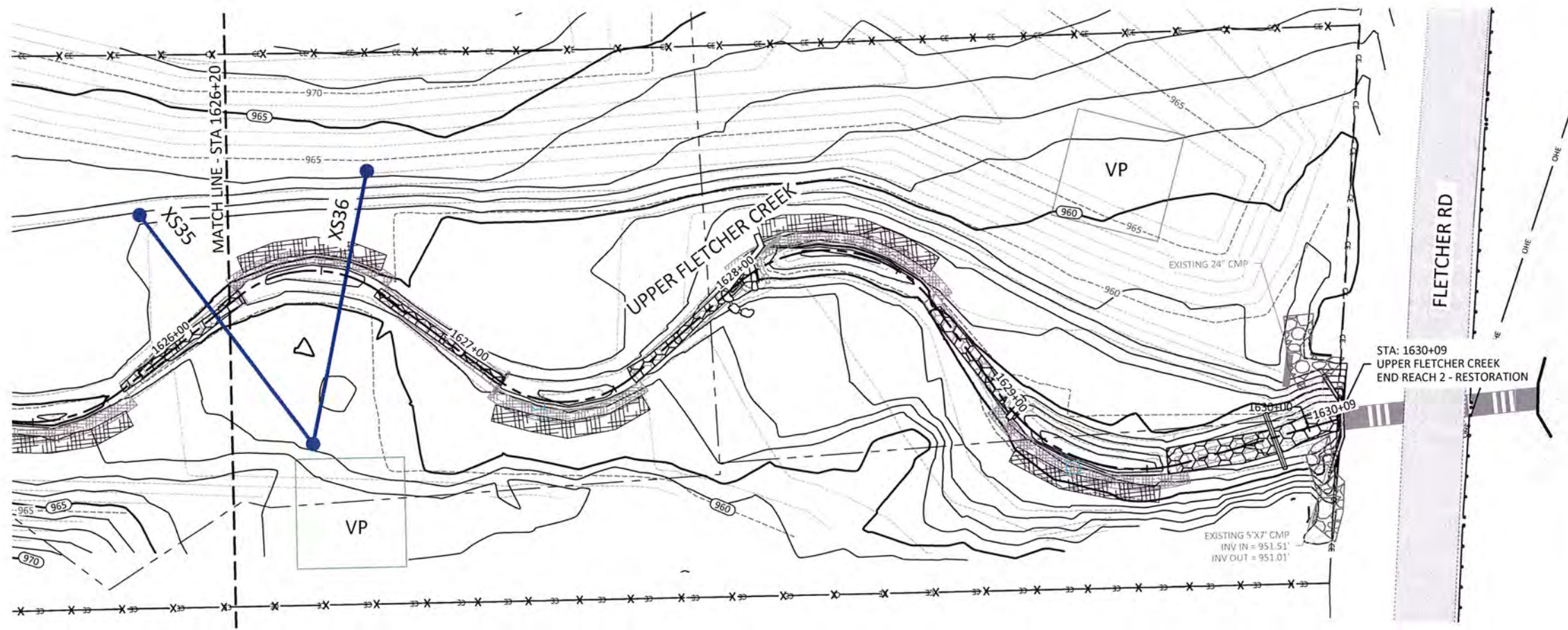
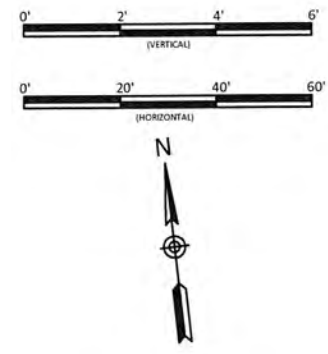
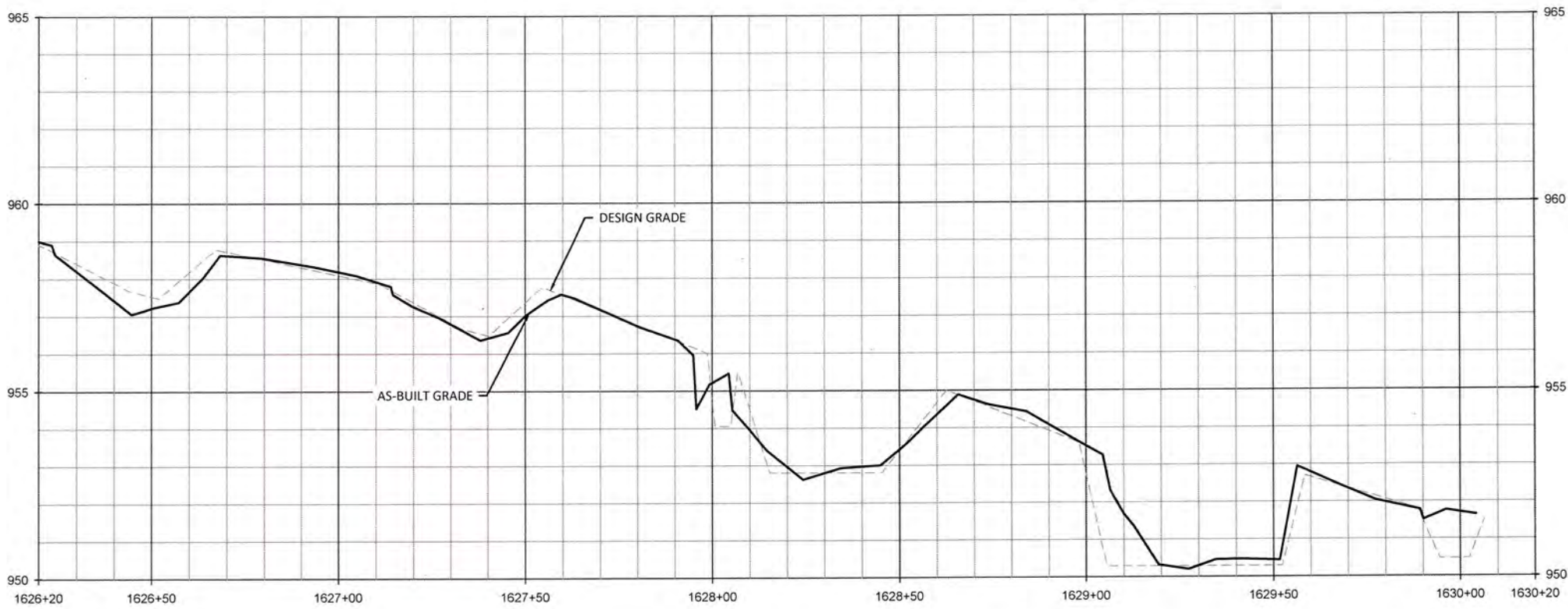
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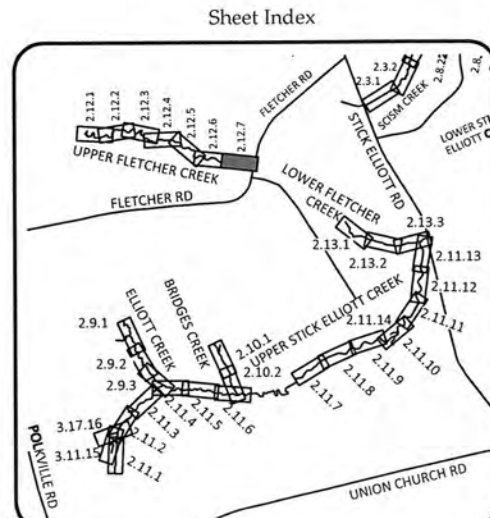
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August 21, 2018	005-02123	EGR, AA	JIS	JCK

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- REACH TREATMENT:
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Big Harris Creek Mitigation Site  
 Cleveland County, North Carolina  
 Upper Fletcher Creek Reach 2  
 Stream Plan and Profile Record Drawings

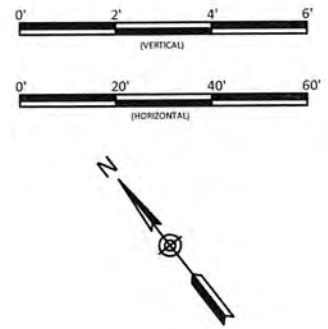
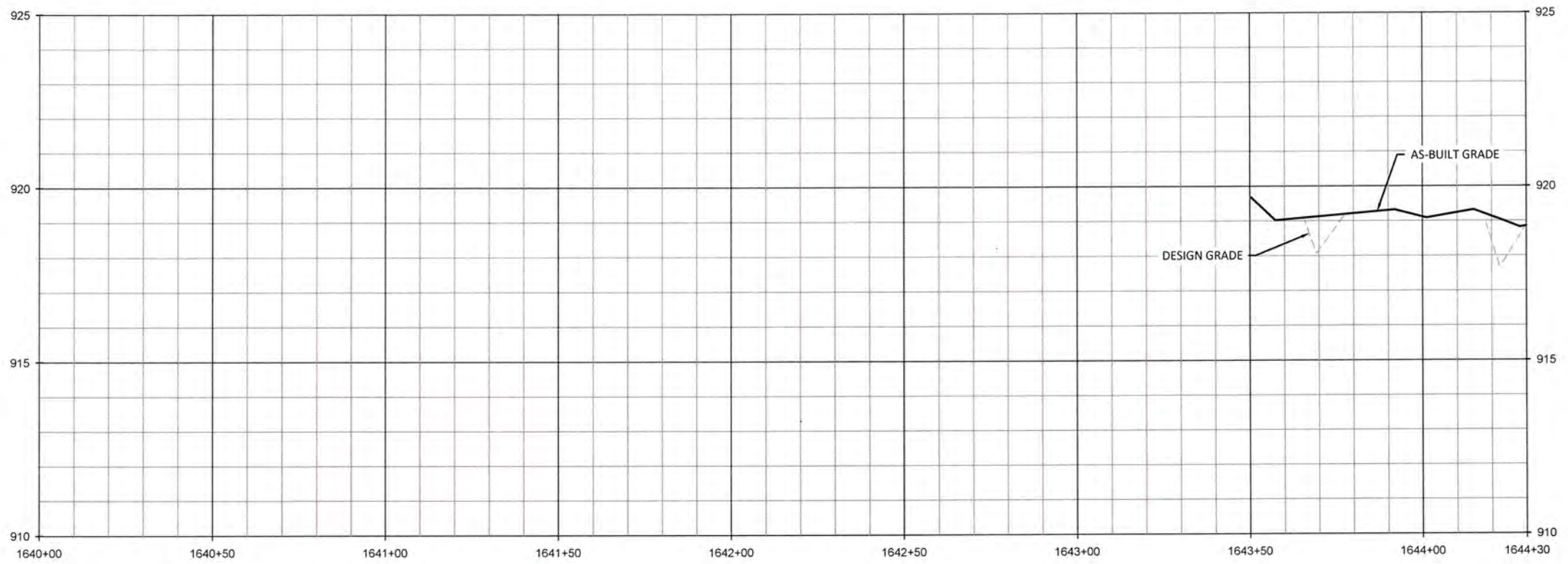
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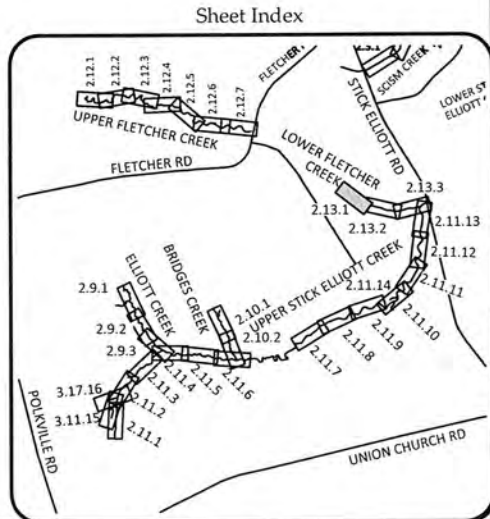
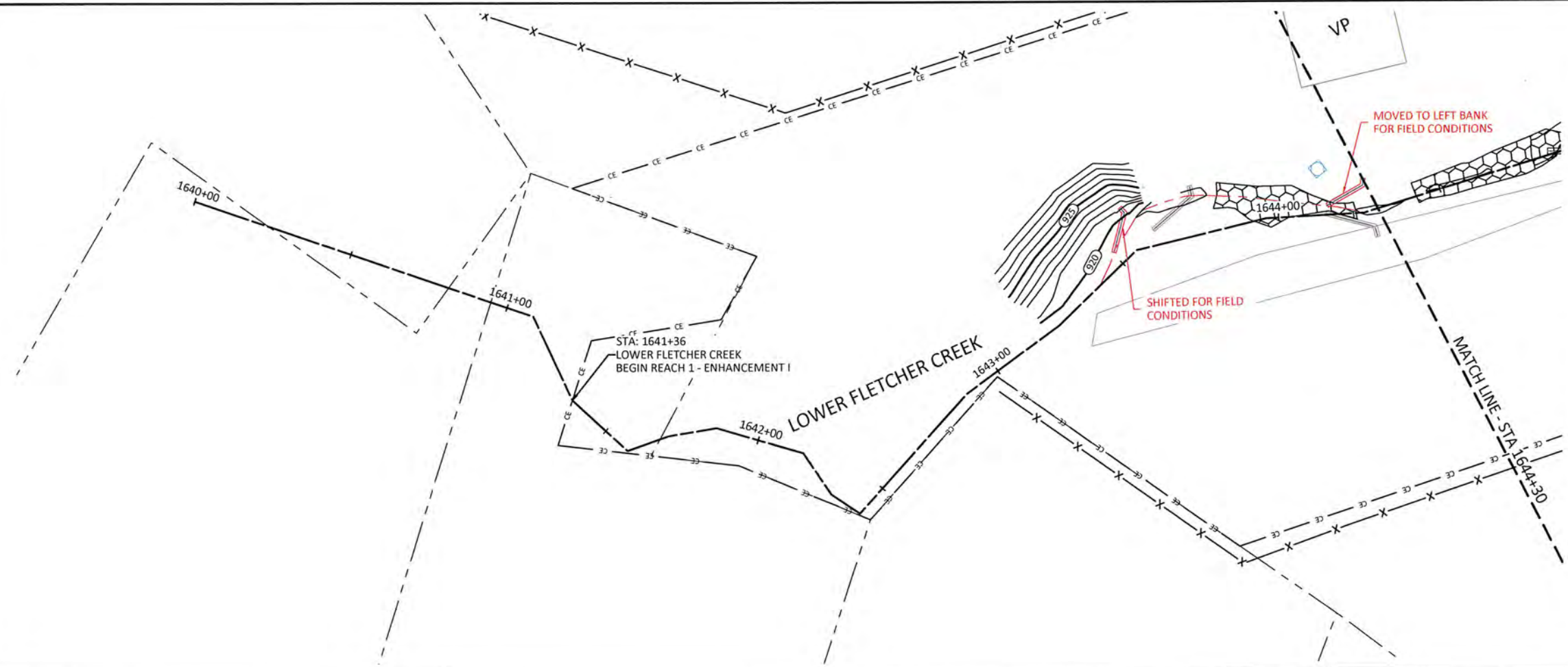


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Big Harris Creek Mitigation Site  
Cleveland County, North Carolina  
Lower Fletcher Creek Reach 1  
As-Built Plans

- REACH TREATMENT:
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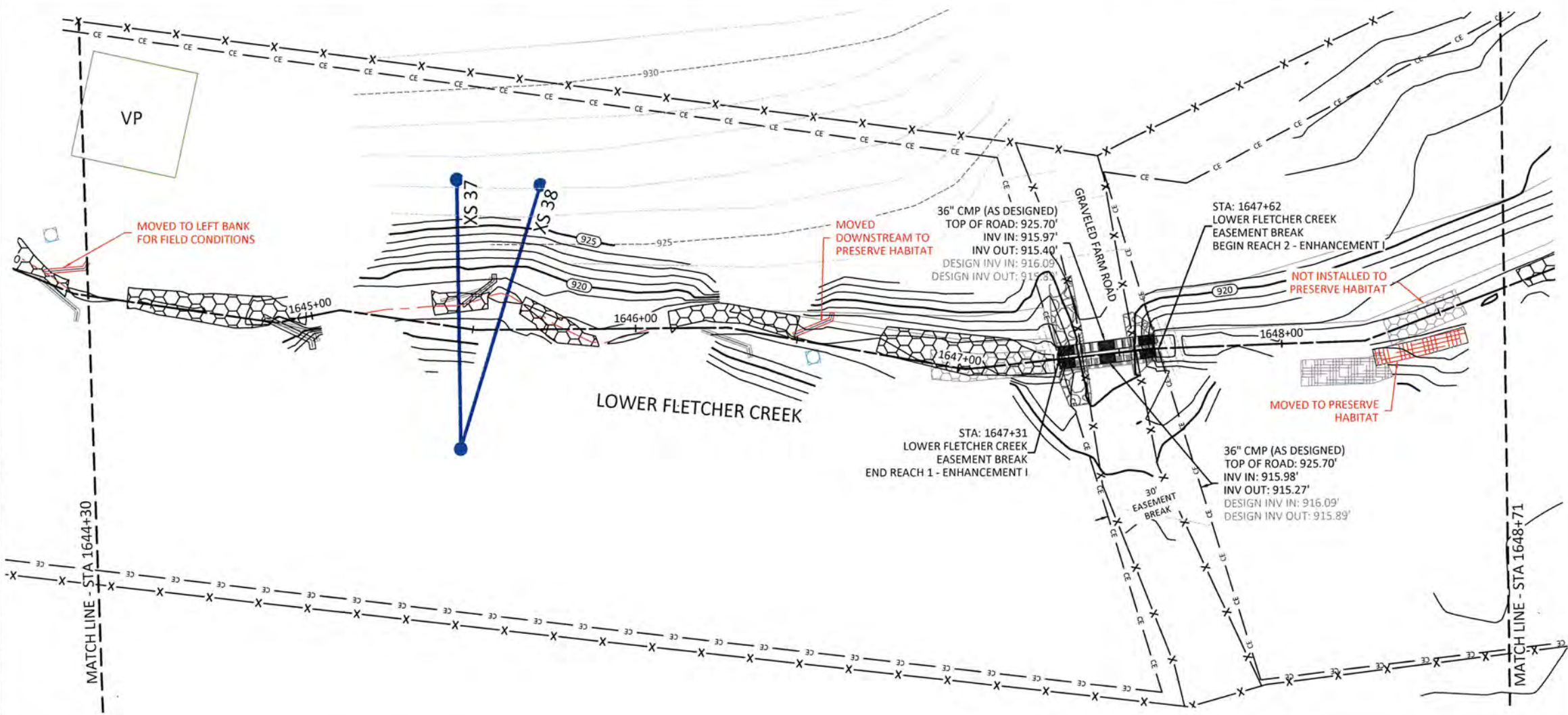
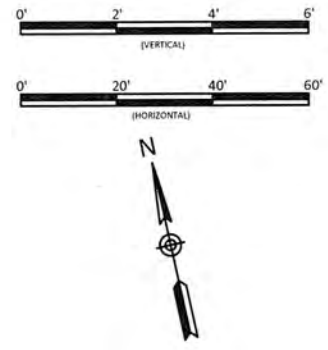
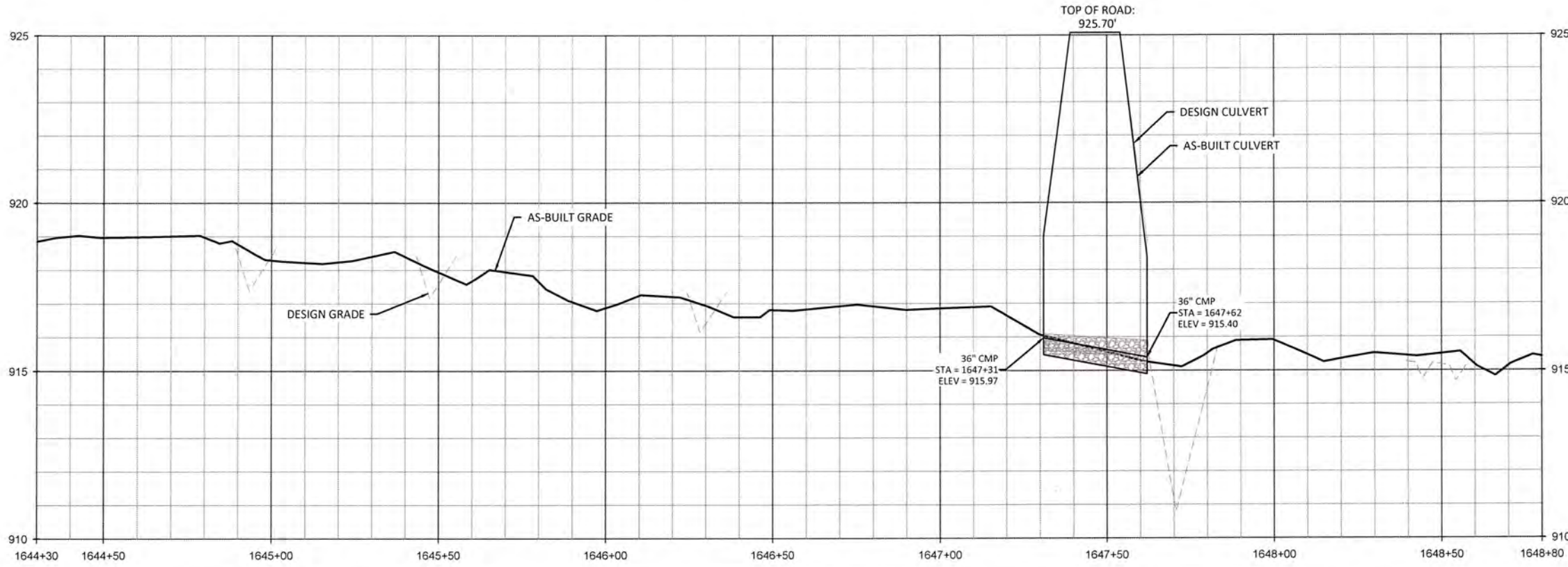
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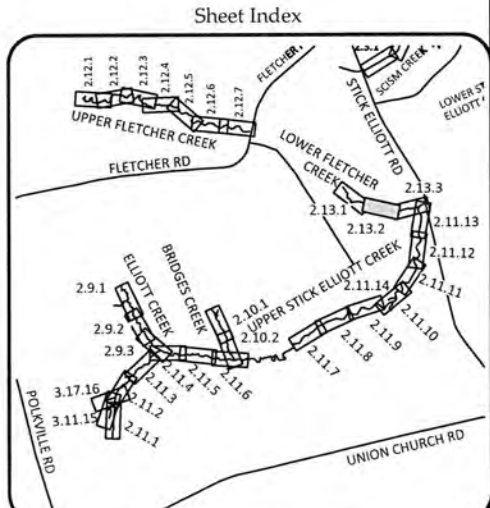
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August 21, 2018



- REACH TREATMENT:
1. FENCE OUT CATTLE - REFER TO FENCING PLAN SHEETS.
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Big Harris Creek Mitigation Site  
 Cleveland County, North Carolina  
 Lower Fletcher Creek Reach 1 & 2  
 As-Built Plans

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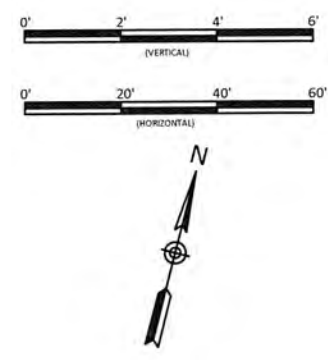
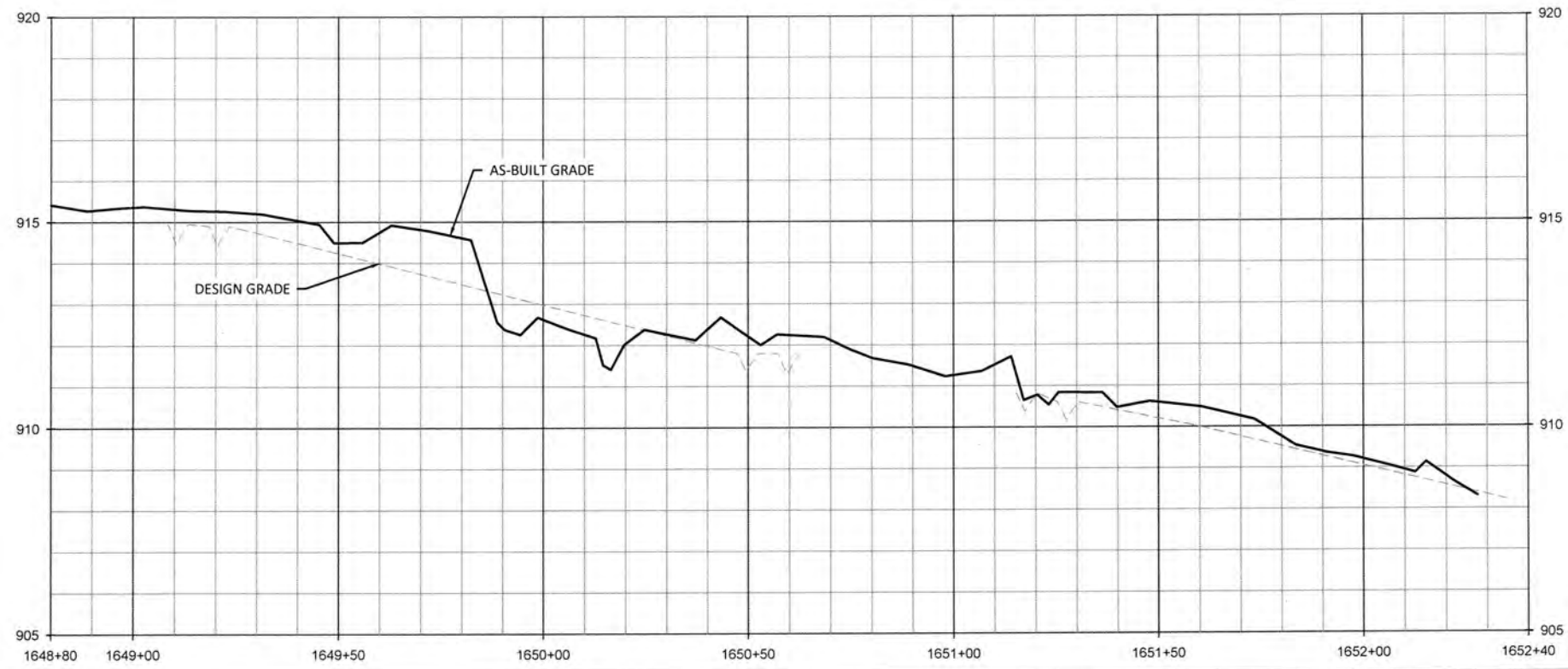


Date:	August 21, 2018
Job Number:	005-02123
Designed By:	KT
Drawn By:	JS
Checked By:	JCK

**2.13.2**

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August 21, 2018

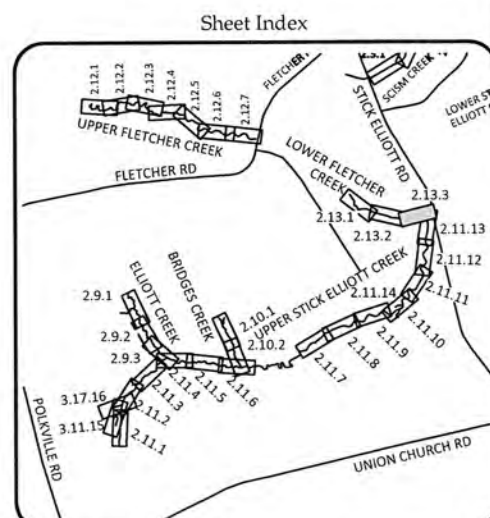
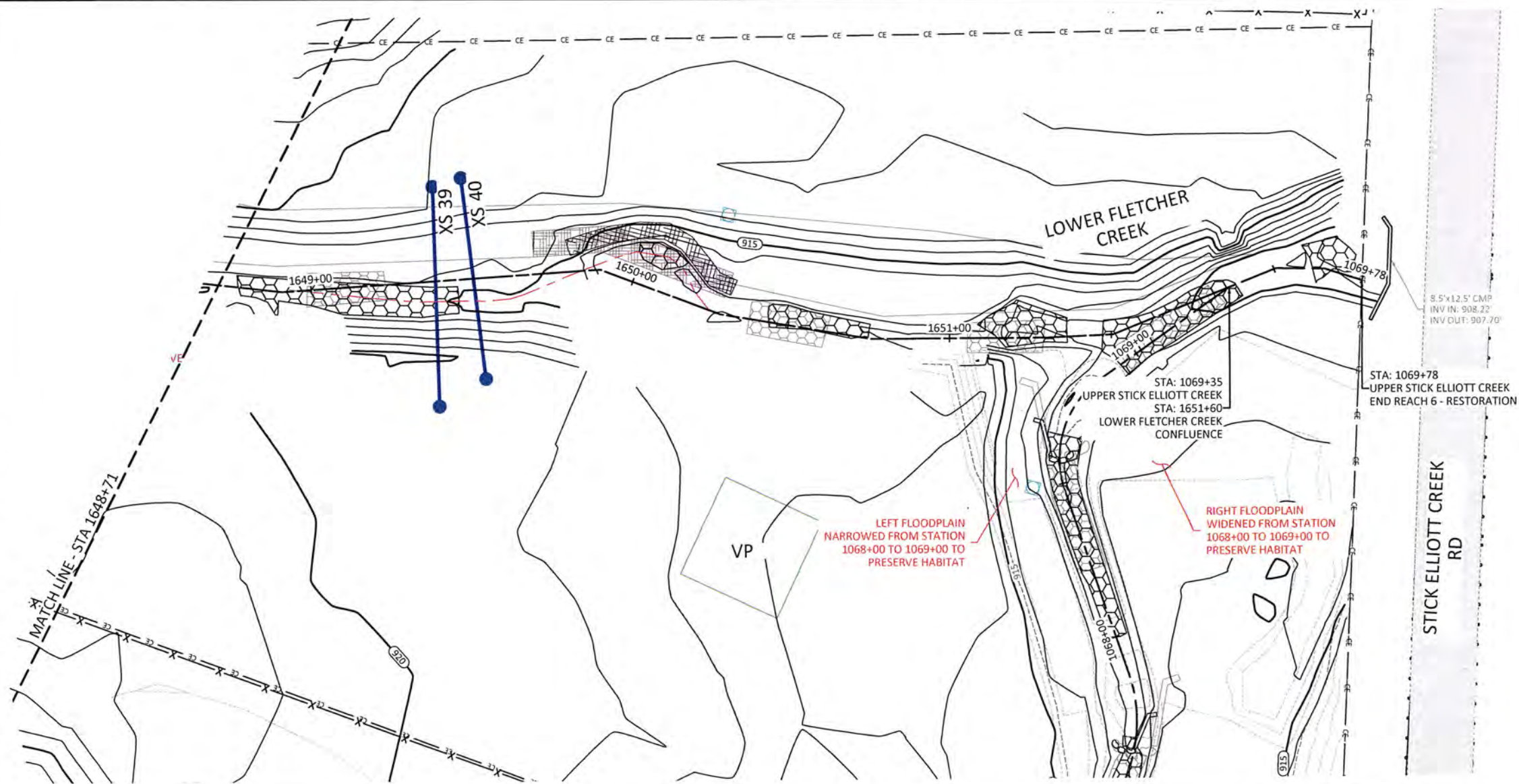


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**Big Harris Creek Mitigation Site**  
 Cleveland County, North Carolina  
 Lower Fletcher Creek Reach 2  
 As-Built Plans

- REACH TREATMENT:**
1. FENCE OUT CATTLE - REFER TO FENCING PLAN SHEETS.
  2. TREAT INVASIVE SPECIES - REFER TO PLANTING PLAN SHEETS.
  3. REPLANT ALONG ENTIRE REACH - REFER TO PLANTING PLAN SHEETS.



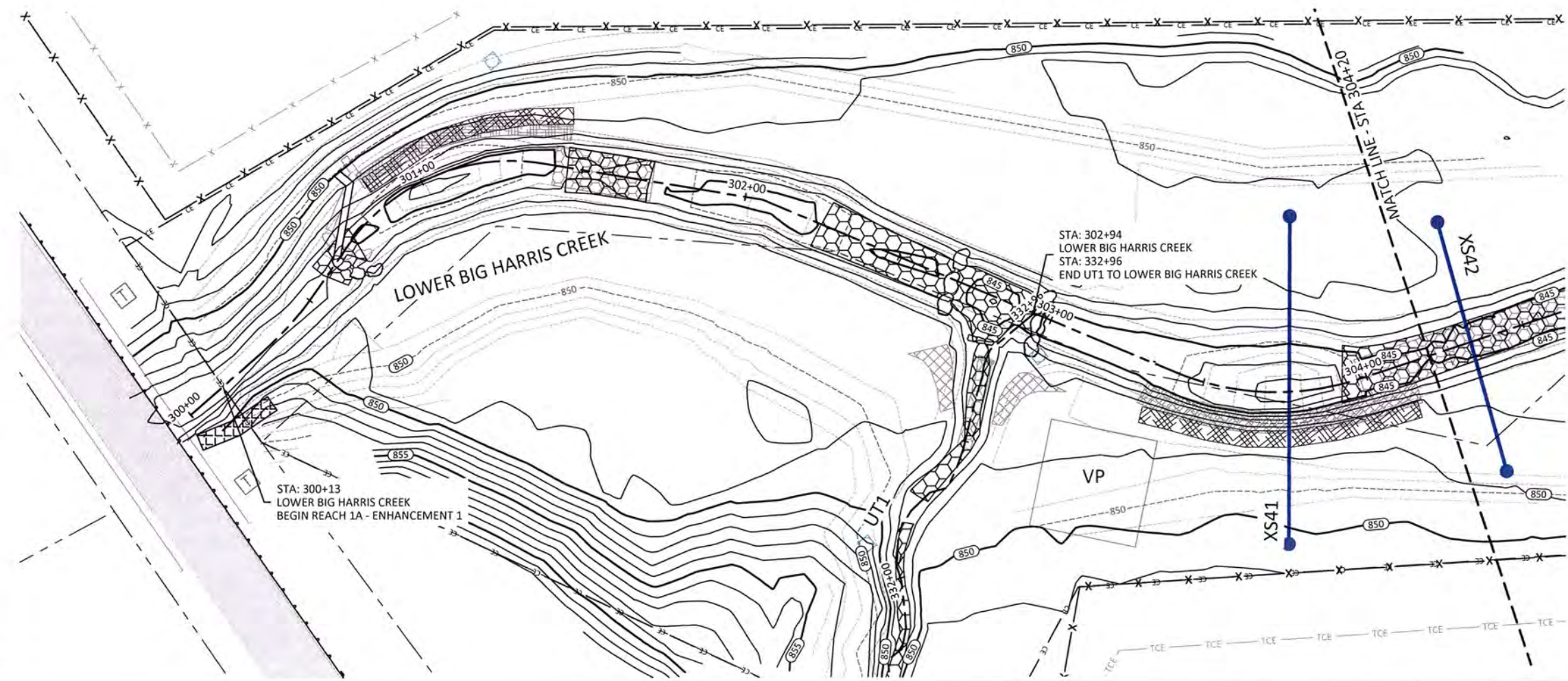
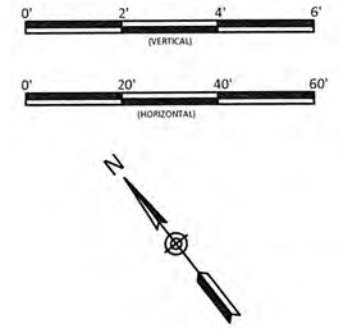
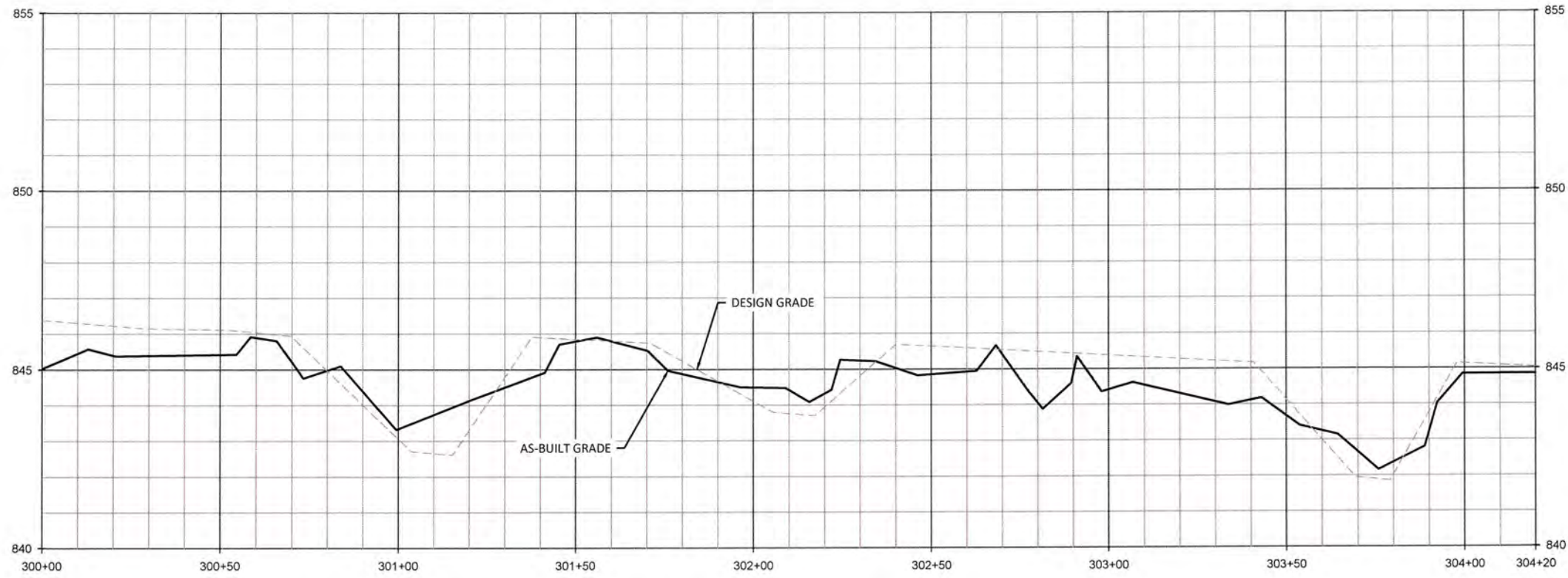
Date		August 21, 2018	
Job Number:	005-02123	Designed By:	KT
Drawn By:	JS	Checked By:	JCK
Revision:			

**2.13.3**

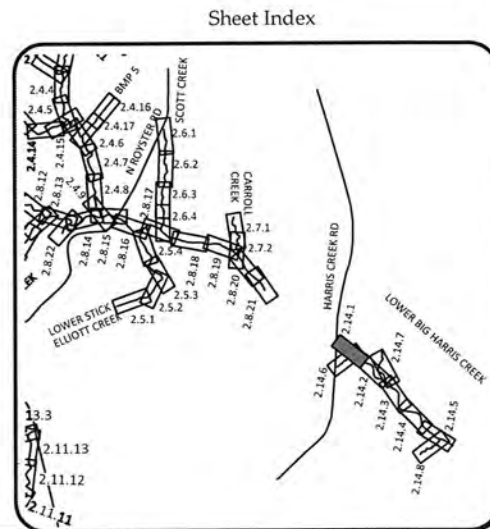
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August 21, 2018  
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- REACH TREATMENT:
1. FENCE OUT CATTLE - REFER TO FENCING PLAN SHEETS.
  2. TREAT INVASIVE SPECIES - REFER TO PLANTING PLAN SHEETS.



Revisions:	

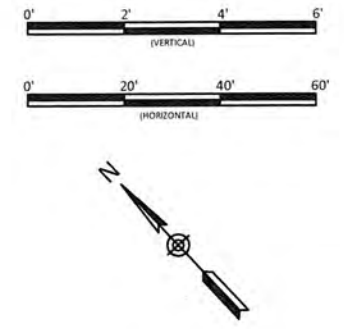
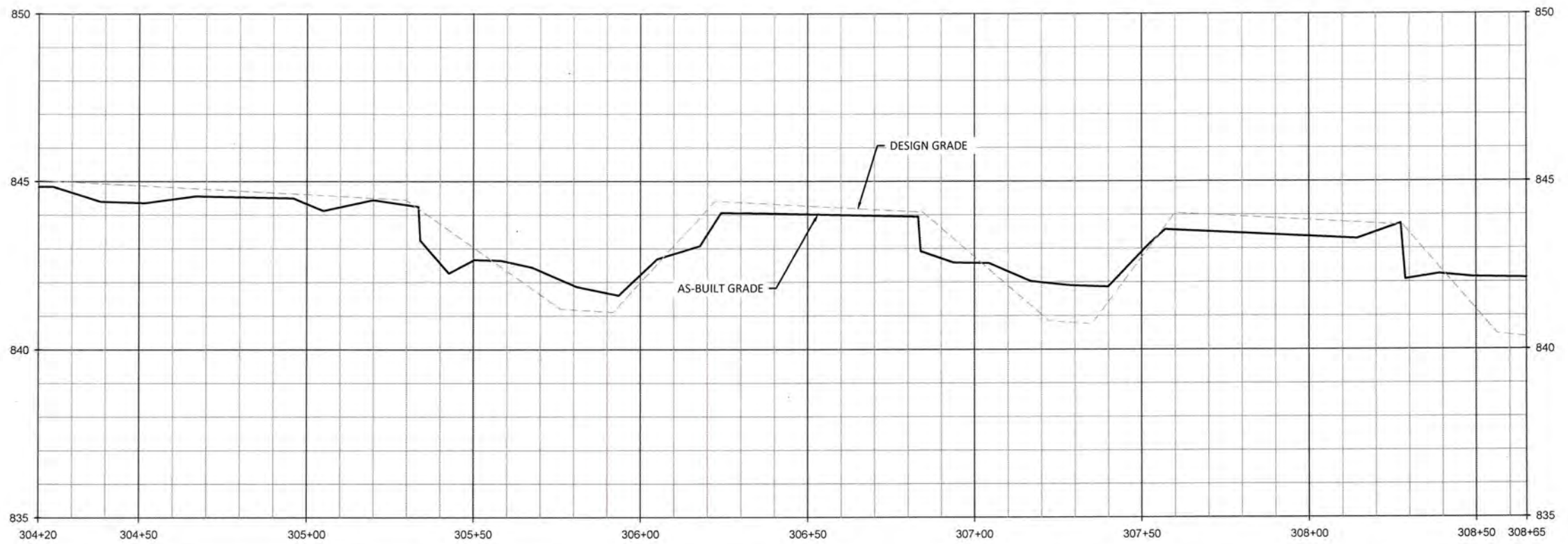
Date: August 21, 2018  
 Job Number: 005-02123  
 Designed By: EGR, AA  
 Drawn By: JS  
 Checked By: JCK

**2.14.1**

Big Harris Creek Mitigation Site  
 Cleveland County, North Carolina  
 Lower Big Harris Creek Reach 1A  
 As-Built Plans

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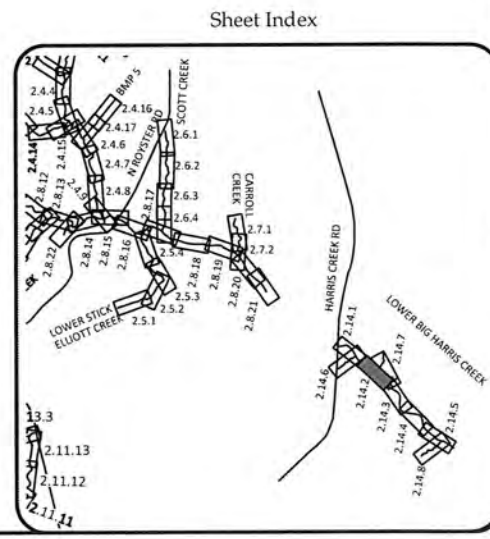
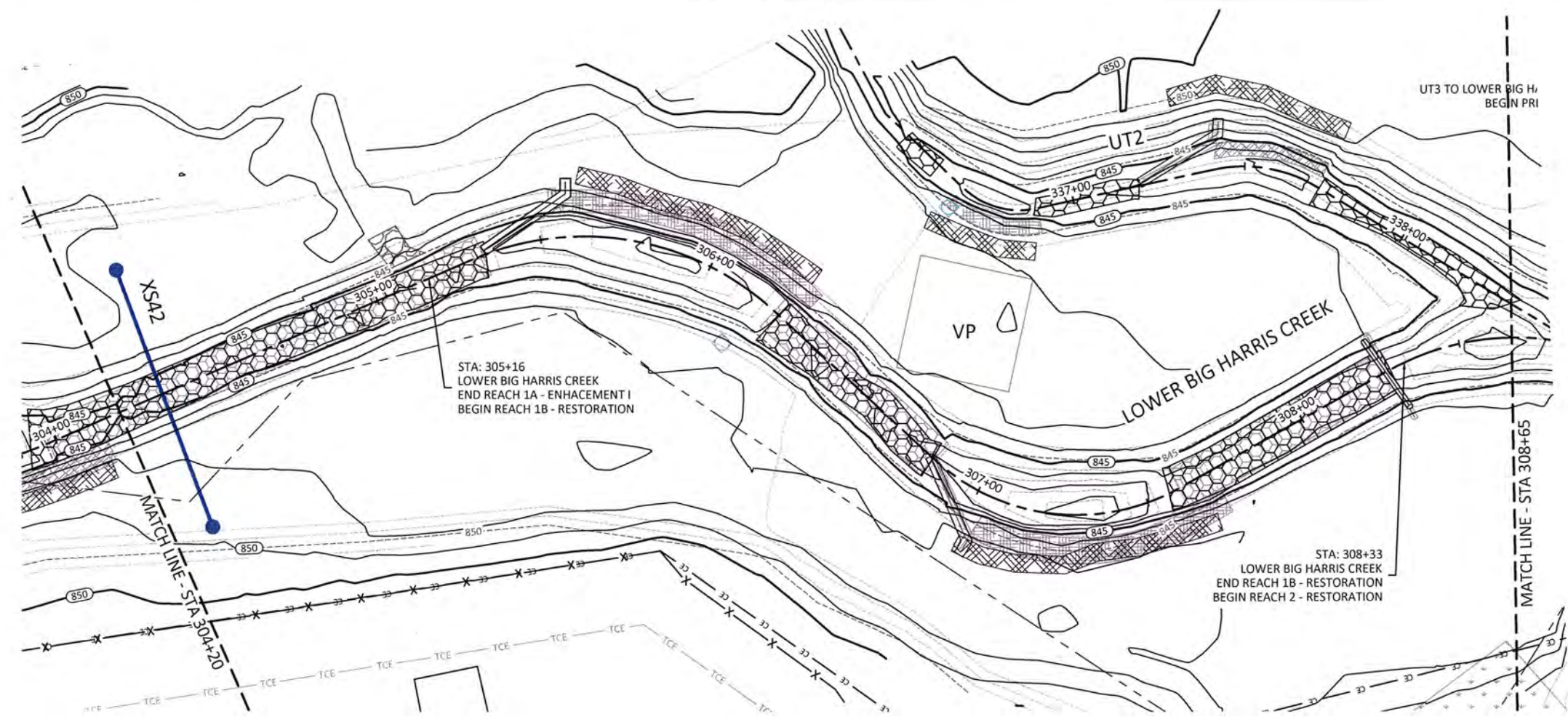


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**Big Harris Creek Mitigation Site**  
 Cleveland County, North Carolina  
 Lower Big Harris Creek Reach 1A & 1B  
 Stream Plan and Profile Record Drawings

- REACH TREATMENT:**
1. FENCE OUT CATTLE - REFER TO FENCING PLAN SHEETS.
  2. TREAT INVASIVE SPECIES - REFER TO PLANTING PLAN SHEETS.

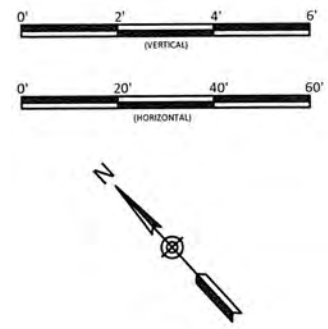
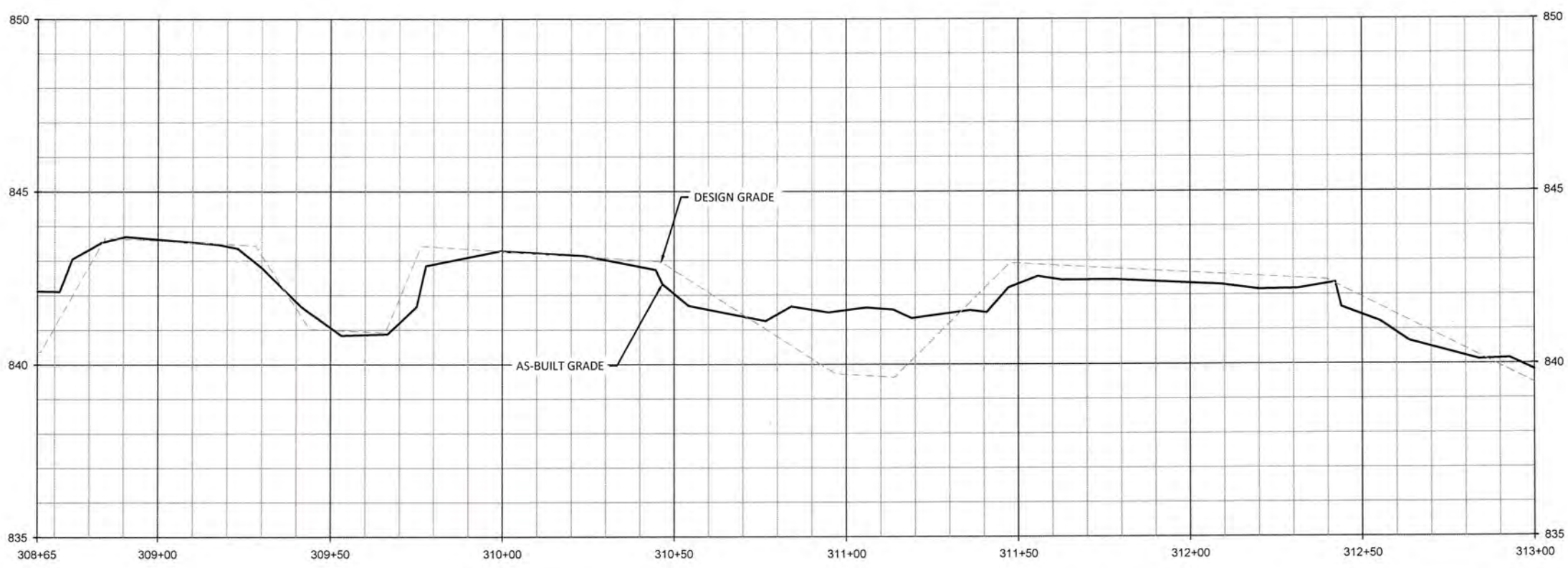


Revisions:

Date: August 21, 2018  
 Job Number: 005-02123  
 Designed By: EGR, AA  
 Drawn By: JS  
 Checked By: JCK

**2.14.2**

August 21, 2018

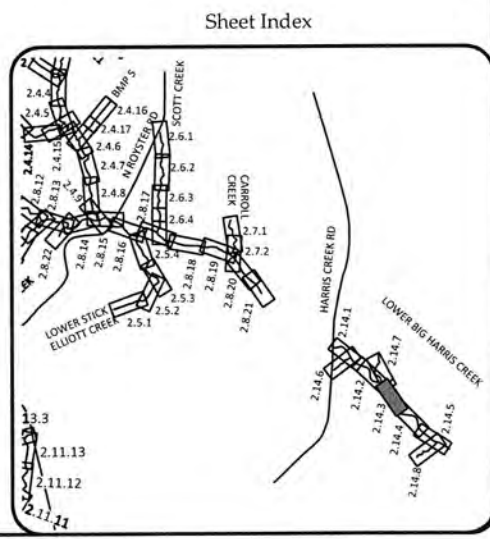
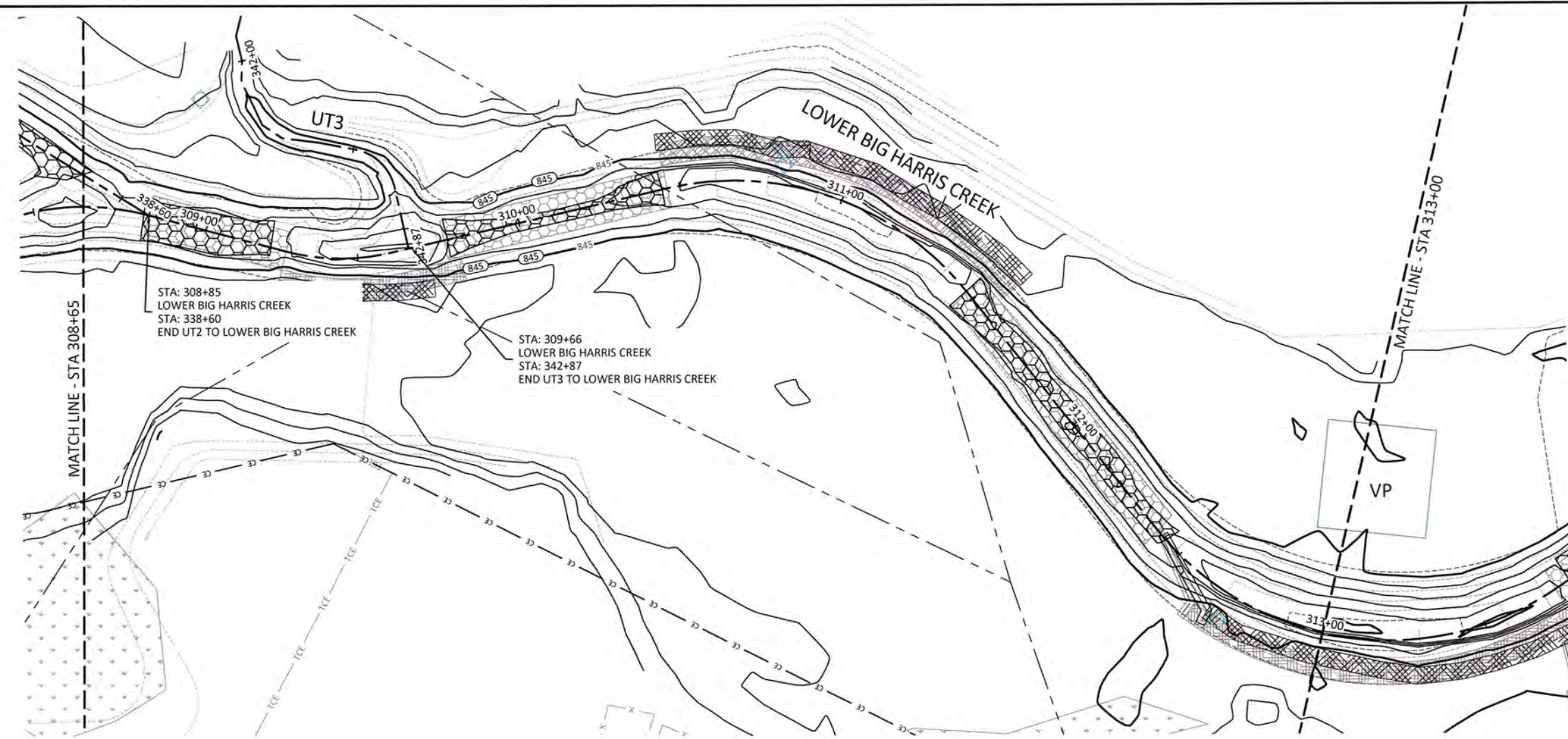


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**Big Harris Creek Mitigation Site**  
 Cleveland County, North Carolina  
 Lower Big Harris Creek Reach 2  
 Stream Plan and Profile Record Drawings

- REACH TREATMENT:
1. FENCE OUT CATTLE - REFER TO FENCING PLAN SHEETS.
  2. TREAT INVASIVE SPECIES - REFER TO PLANTING PLAN SHEETS.



Revisions:

Date: August 21, 2018  
 Job Number: 005-02123  
 Designed By: EGR, AA  
 Drawn By: JS  
 Checked By: JCK

**2.14.3**

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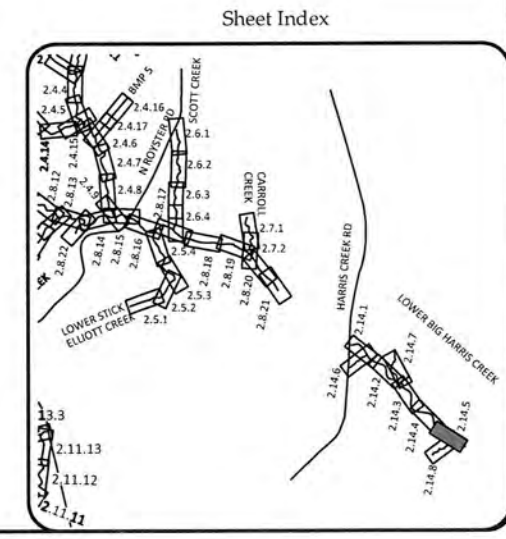
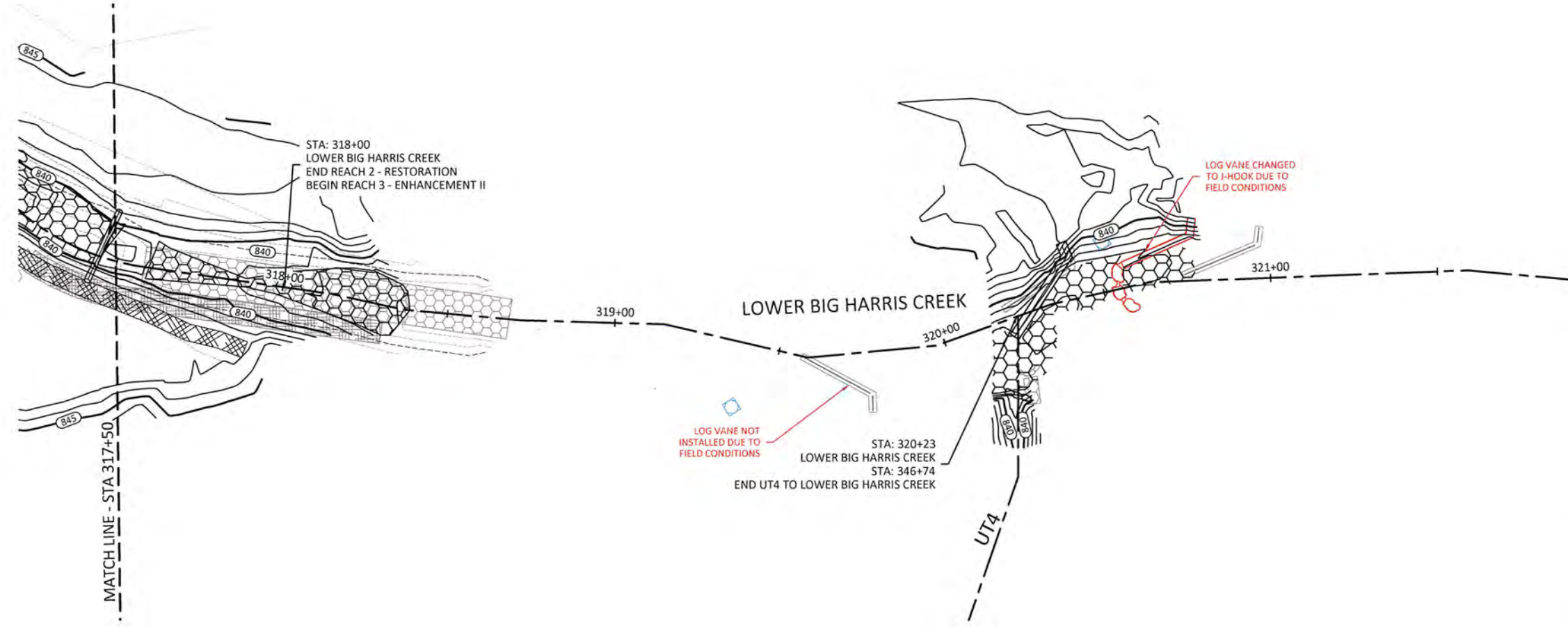
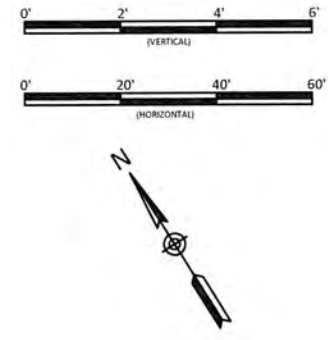
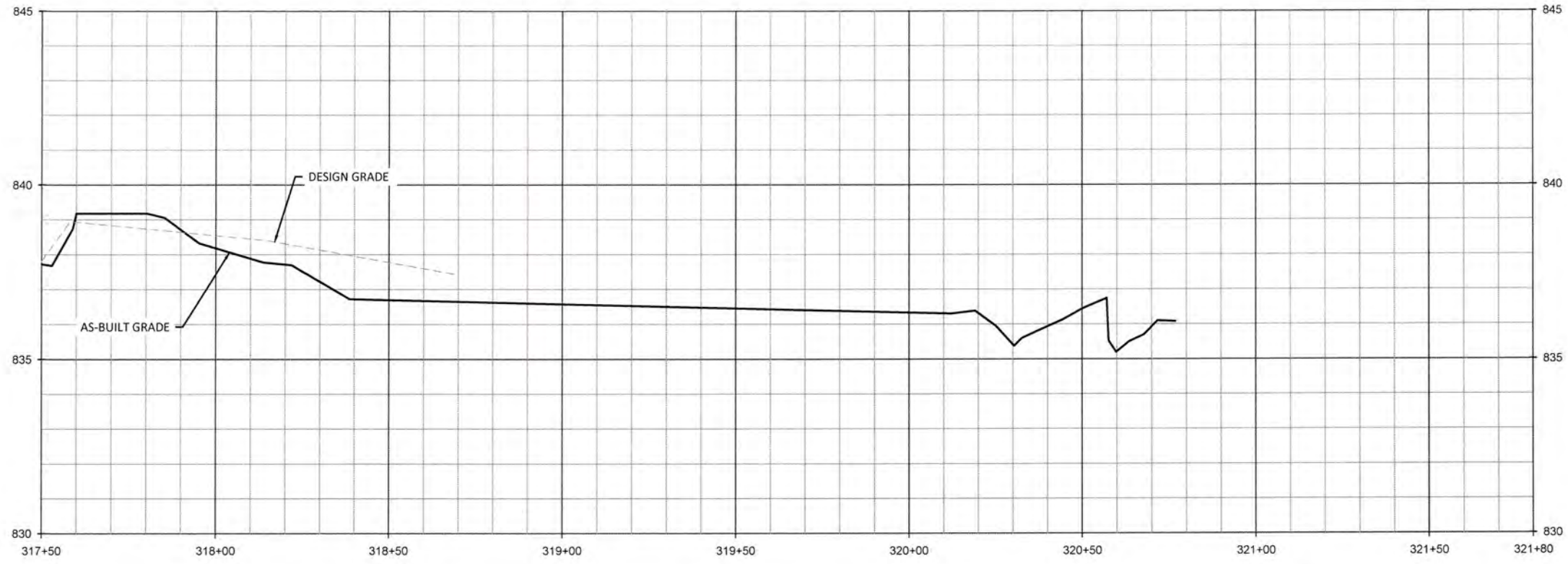
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August 21, 2018

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Big Harris Creek Mitigation Site  
 Cleveland County, North Carolina  
 Lower Big Harris Creek Reach 3  
 Stream Plan and Profile Record Drawings

Date	Revision
August 21, 2018	005-02123
EGR, AA	JCK
EGR, AA	JCK
JCK	JCK
JCK	JCK

2.14.5

Sheet

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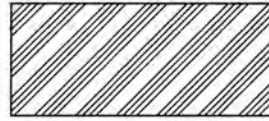




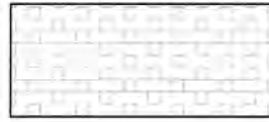
## Proposed Invasive Species Control



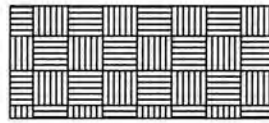
Proposed Intensive Invasive Treatment



Proposed Fescue Treatment



Proposed Pine Removal



Proposed Kudzu Removal

## Proposed Planting

**Note:**

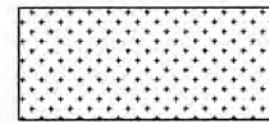
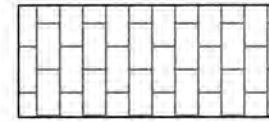
1. See Detail 1, Sheet 6.6 for Live Staking
2. All bank grading shall have live staking
3. For Area A: Only plant *Juncus effusus* and *Carex alata* on Upper Big Harris Creek

Streambank Planting Zone						
Live Stakes and Herbaceous Plugs						
Species	Common Name	Max Spacing	Indiv. Spacing	Min. Size	Stratum	# of Stems
<i>Physocarpus opulifolius</i>	Ninebark	8 ft.	2-8 ft.	0.5"-1.5" cal.	Shrub	15%
<i>Cephalanthus occidentalis</i>	Buttonbush	8 ft.	2-8 ft.	0.5"-1.5" cal.	Shrub	15%
<i>Cornus amomum</i>	Silky Dogwood	8 ft.	2-8 ft.	0.5"-1.5" cal.	Shrub	35%
<i>Salix sericea</i>	Silky Willow	8 ft.	2-8 ft.	0.5"-1.5" cal.	Shrub	35%
<i>Juncus effusus</i>	Common Rush	5 ft.	3-5 ft.	1.0"- 2.0" plug	Herb	N/A
<i>Carex alata</i>	Broadwing Sedge	5 ft.	3-5 ft.	1.0"- 2.0" plug	Herb	N/A
						100%

Temporary Seeding				
Pure Live Seed (20 lbs/ acre)				
Approved Date	Species Name	Common Name	Stratum	Density (lbs/acre)
Aug 15 - May 1	<i>Secale cereale</i>	Rye Grain	Herb	140
May 1 - Aug 15	<i>Setaria italica</i>	German Millet	Herb	50

Pasture Seeding In Disturbed Areas Outside Easement				
Approved Date	Species Name	Stratum	Common Name	Density (lbs/acre)
All Year	<i>Festuca arundinacea</i>	Herb	Tall Fescue	80
All Year	<i>Trifolium repens</i>	Herb	White Clover	8

Power Easement Planting						
Species	Common Name	Max Spacing	Indiv. Spacing	Min. Size	Stratum	# of Stems
<i>Cornus amomum</i>	Silky Dogwood	12 ft.	6-12 ft.	0.25"-1.0"	Canopy	20%
<i>Ilex verticillata</i>	Winterberry	12 ft.	6-12 ft.	0.25"-1.0"	Canopy	20%
<i>Itea virginica</i>	Virginia Sweetspire	12 ft.	6-12 ft.	0.25"-1.0"	Canopy	20%
<i>Physocarpus opulifolius</i>	Ninebark	12 ft.	6-12 ft.	0.25"-1.0"	Canopy	20%
<i>Aronia melanocarpa</i>	Black Chokeberry	12 ft.	6-12 ft.	0.25"-1.0"	Canopy	20%
						100%



**Note:**  
Permanent Riparian seeding in all disturbed areas within Conservation Easement

## Proposed Planting

Open/Graded Areas Bare Roots				
Species	Common name	Max spacing	Individ. Spacing	# of stems
<i>Platanus occidentalis</i>	Sycamore	12 ft.	6-12 ft.	20%
<i>Fraxinus pennsylvanicum</i>	Green Ash	12 ft.	6-12 ft.	20%
<i>Betula nigra</i>	River Birch	12 ft.	6-12 ft.	15%
<i>Acer rubrum</i>	Red Maple	12 ft.	6-12 ft.	15%
<i>Alnus serrulata</i>	Tag Alder	12 ft.	6-12 ft.	10%
<i>Nyssa sylvatica</i>	Black Tupelo	12 ft.	6-12 ft.	5%
<i>Quercus rubra</i>	Red Oak	12 ft.	6-12 ft.	5%
<i>Quercus phellos</i>	Willow Oak	12 ft.	6-12 ft.	5%
<i>Quercus pagoda</i>	Cherrybark Oak	12 ft.	6-12 ft.	5%
				100%
Permanent Riparian Seeding Within Conservation Easement- Open Canopy				
Pure Live Seed (20 lbs/ acre)				
Approved Date	Species Name	Common Name	Stratum	Density
All Year	<i>Panicum rigidulum</i>	Redtop Panicgrass	herb	1.5
All Year	<i>Agrostis hyemalis</i>	Winter Bentgrass	herb	4
All Year	<i>Chasmanthium latifolium</i>	River Oats	herb	2
All Year	<i>Rudbeckia hirta</i>	Blackeyed Susan	herb	1
All Year	<i>Coreopsis lanceolata</i>	Lanceleaf Coreopsis	herb	1
All Year	<i>Carex vulpinoidea</i>	Fox Sedge	herb	3
All Year	<i>Panicum clandestinum</i>	Deertongue	herb	3.5
All Year	<i>Elymus virginicus</i>	Virginia Wild Rye	herb	2
All Year	<i>Asclepias syrica</i>	Common Milkweed	herb	0.2
All Year	<i>Baptisia australis</i>	Blue False Indigo	herb	0.2
All Year	<i>Gaillardia pulchella</i>	Annual Gaillardia	herb	1
All Year	<i>Echinacea purpurea</i>	Pale Purple Coneflower	herb	0.6

Permanent Riparian Seeding for Cut/Low pH soils				
Pure Live Seed (20 lbs/ acre)				
Approved Date	Species Name	Common Name	Stratum	Density
All Year	<i>Panicum virgatum</i>	Switchgrass	herb	5
All Year	<i>Panicum clandestinum</i>	Deertongue	herb	4
All Year	<i>Sorghastrum nutans</i>	Indian Grass	herb	3
All Year	<i>Tridens flavus</i>	Purple top	herb	3
All Year	<i>Elymus virginicus</i>	Virginia Wild Rye	herb	3
All Year	<i>Rudbeckia hirta</i>	Blackeyed Susan	herb	2

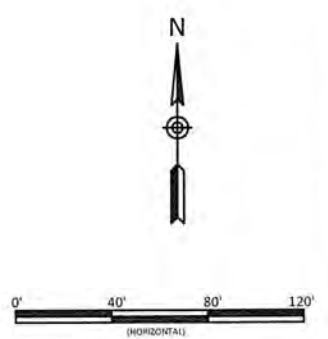
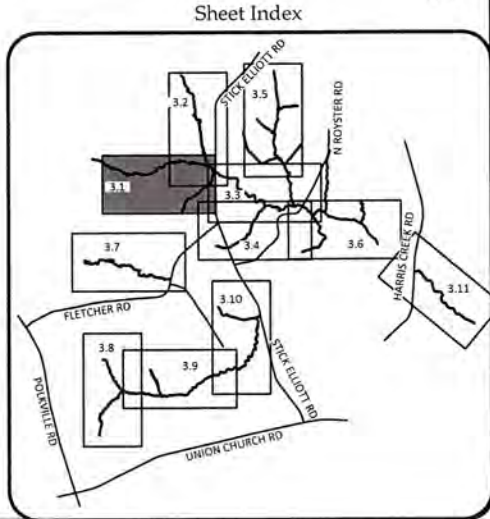
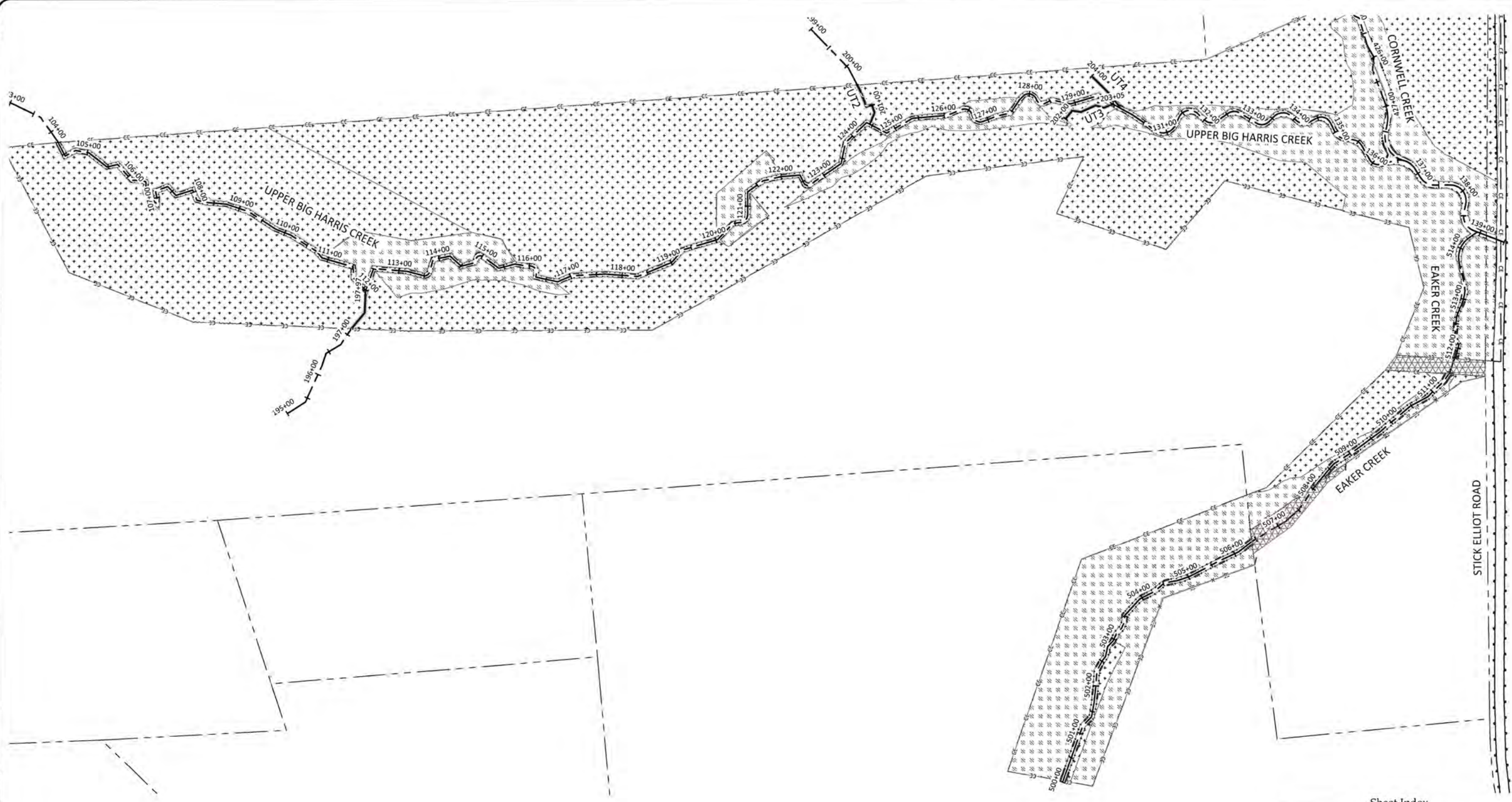
Shaded Areas Bare Roots - Buffer Planting As Needed to Increase Density		
Species	Common name	# of stems
<i>Platanus occidentalis</i>	Sycamore	15%
<i>Fraxinus pennsylvanicum</i>	Green Ash	15%
<i>Betula nigra</i>	River Birch	10%
<del><i>Liriodendron tulipifera</i></del>	<del>Tulip Poplar</del>	<del>10%</del>
<del><i>Quercus michauxii</i></del>	<del>Swamp Chestnut-Oak</del>	<del>10%</del>
<del><i>Carpinus caroliniana</i></del>	<del>Ironwood</del>	<del>5%</del>
<del><i>Diospyros virginiana</i></del>	<del>Persimmon</del>	<del>5%</del>
<i>Quercus pagoda</i>	Cherrybark Oak	5%-10%
<del><i>Acer saccharinum</i></del>	<del>Silver Maple</del>	<del>5%-10%</del>
<i>Nyssa sylvatica</i>	Black Gum	5%-10%
<del><i>Gallicarpa americana</i></del>	<del>Beautyberry</del>	<del>5%</del>
<del><i>Cornus alternifolia</i></del>	<del>Pagoda-Dogwood</del>	<del>5%</del>
<del><i>Euonymus americanus</i></del>	<del>American Strawberry-Bush</del>	<del>1%</del>
<del><i>Calyanthus floridus</i></del>	<del>Sweetshrub</del>	<del>1%</del>
<del><i>Magnolia virginiana</i></del>	<del>Sweetbay Magnolia</del>	<del>1%</del>
<del><i>Hamamelis virginiana</i></del>	<del>Witch-Hazel</del>	<del>1%</del>
<del><i>Clethra alnifolia</i></del>	<del>Sweet Pepperbush</del>	<del>1%</del>
<i>Acer rubrum</i>	Red Maple	10%
<i>Quercus rubra</i>	Red Oak	10%
<i>Quercus phellos</i>	Willow Oak	10%
		100%

PLANTING LIST REVISED BASED ON LOCALLY AVAILABLE PLANT STOCK AT TIME OF PLANTING.



August 21, 2018

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FINAL PLANTED SHADED/OPEN RIPARIAN AREA DETERMINED AFTER CONSTRUCTION SHOWN ON PLAN SHEETS

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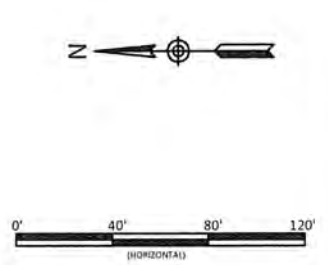
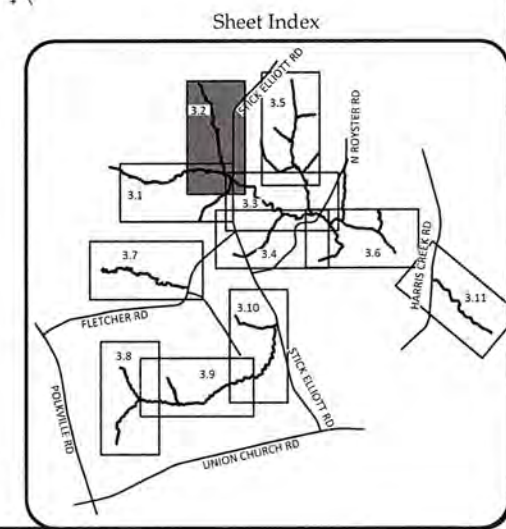
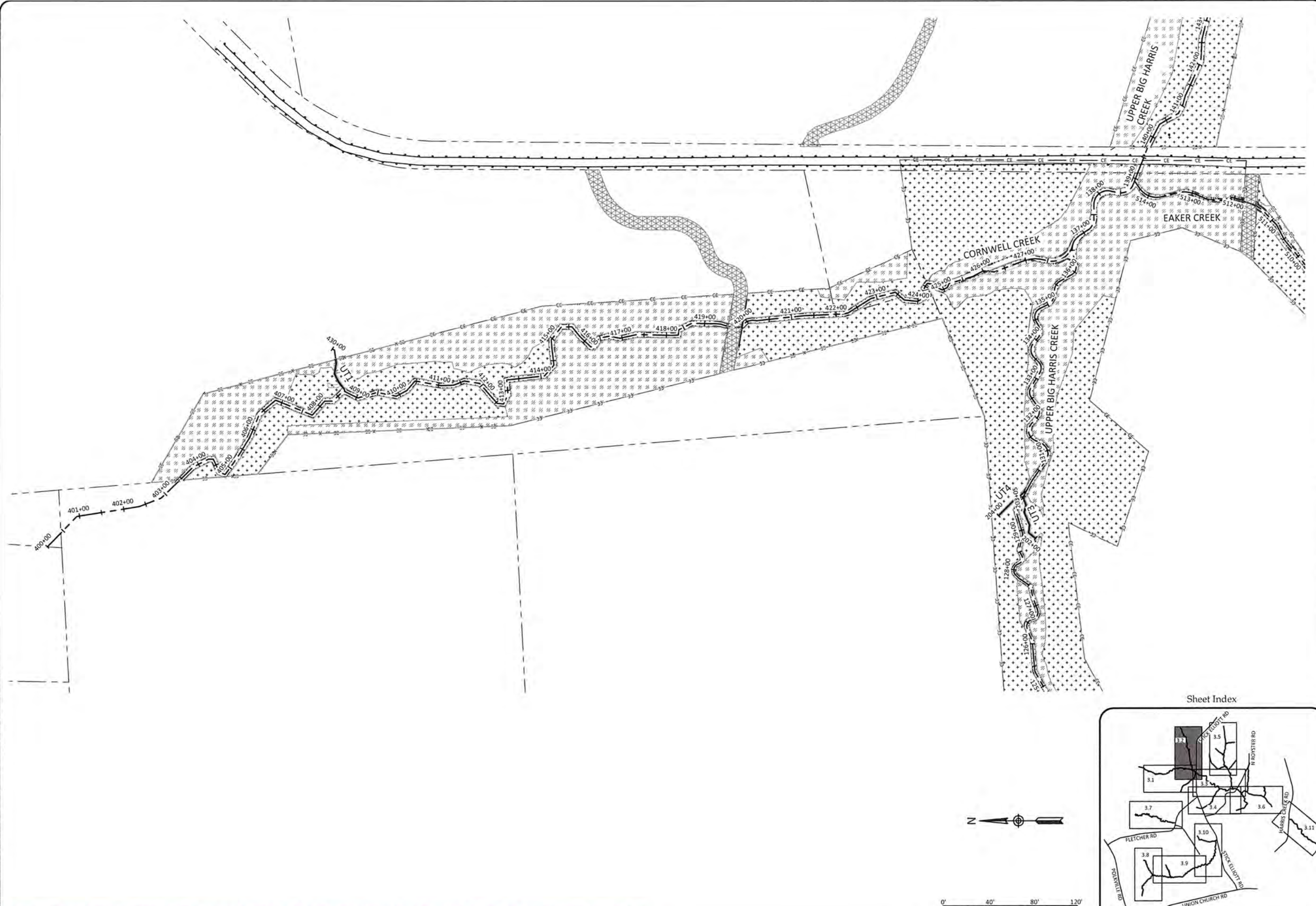


**Big Harris Creek Mitigation Site**  
**Cleveland County, North Carolina**  
 Upper Big Harris Creek & Eaker Creek  
 Planting Sheets

Date:	August 21, 2018
Job Number:	005-02123
Designed By:	EGR, AIA
Drawn By:	JS
Checked By:	JCK

3.1

Sheet



FINAL PLANTED SHADED/OPEN RIPARIAN AREA DETERMINED AFTER CONSTRUCTION SHOWN ON PLAN SHEETS.

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Big Harris Creek Mitigation Site  
 Cleveland County, North Carolina

Cornwell Creek  
 Planting Sheets

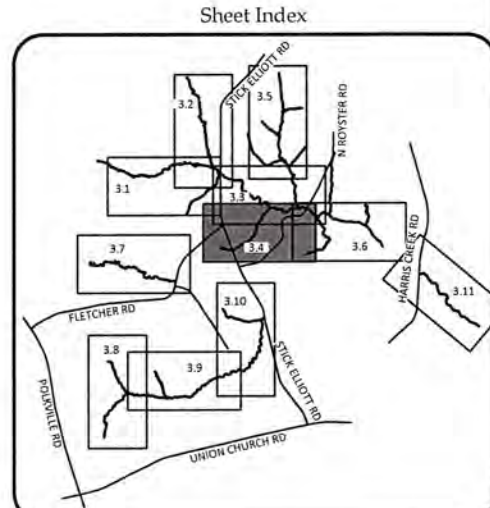
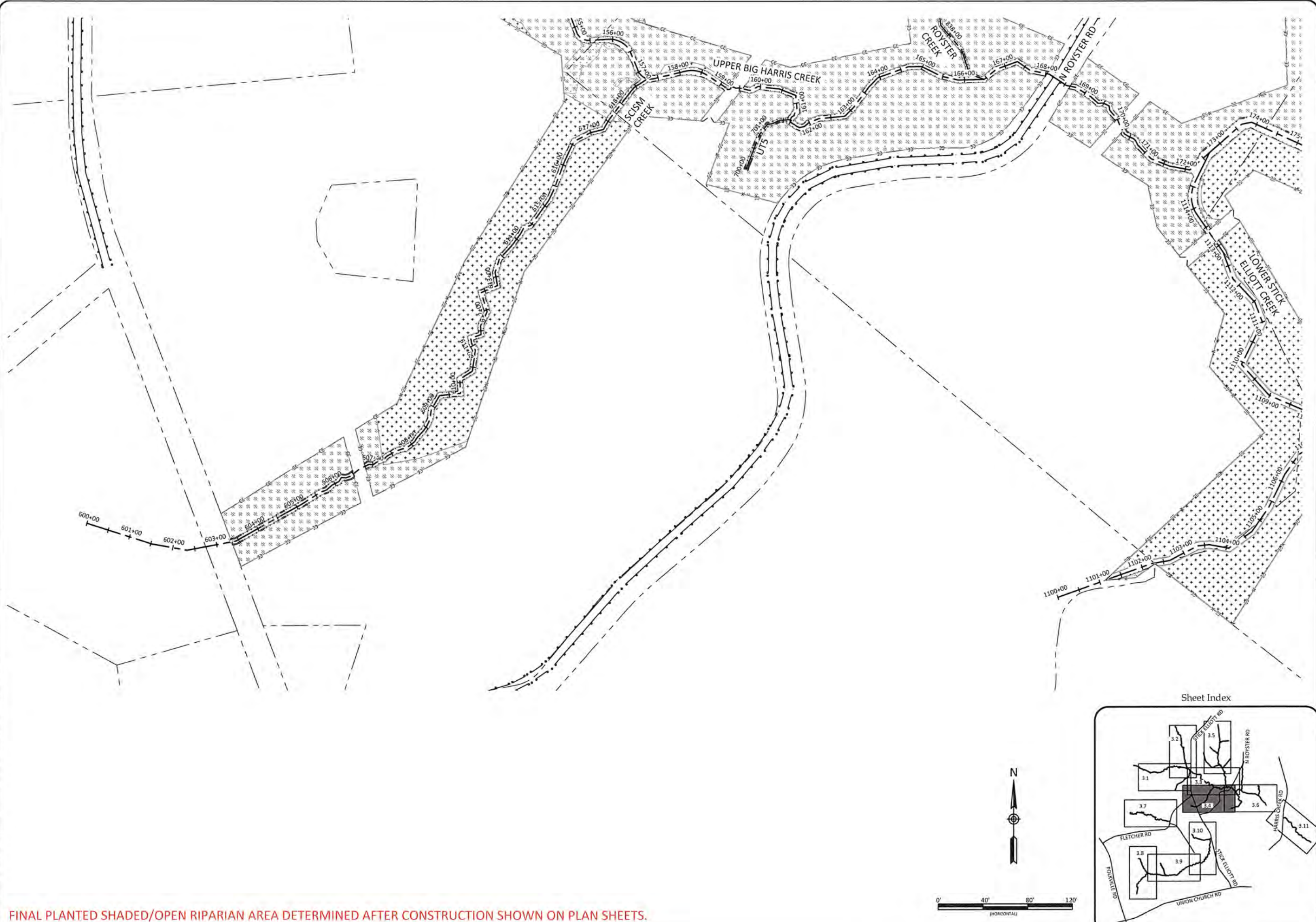
Revision	Date	By	Check

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August 21, 2018  
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**Big Harris Creek Mitigation Site**  
**Cleveland County, North Carolina**  
Scism Creek Upper Big Harris & Lower Stick Elliott  
Planting Sheets

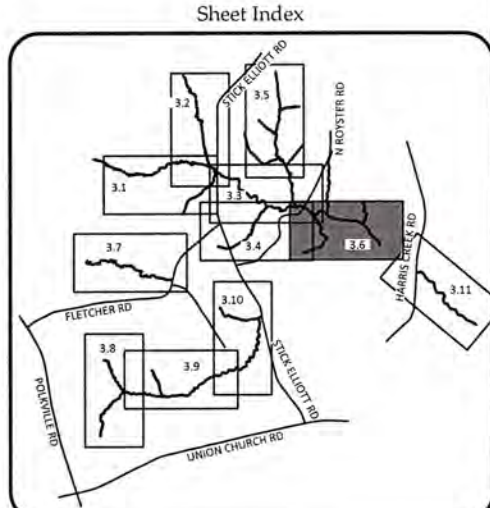
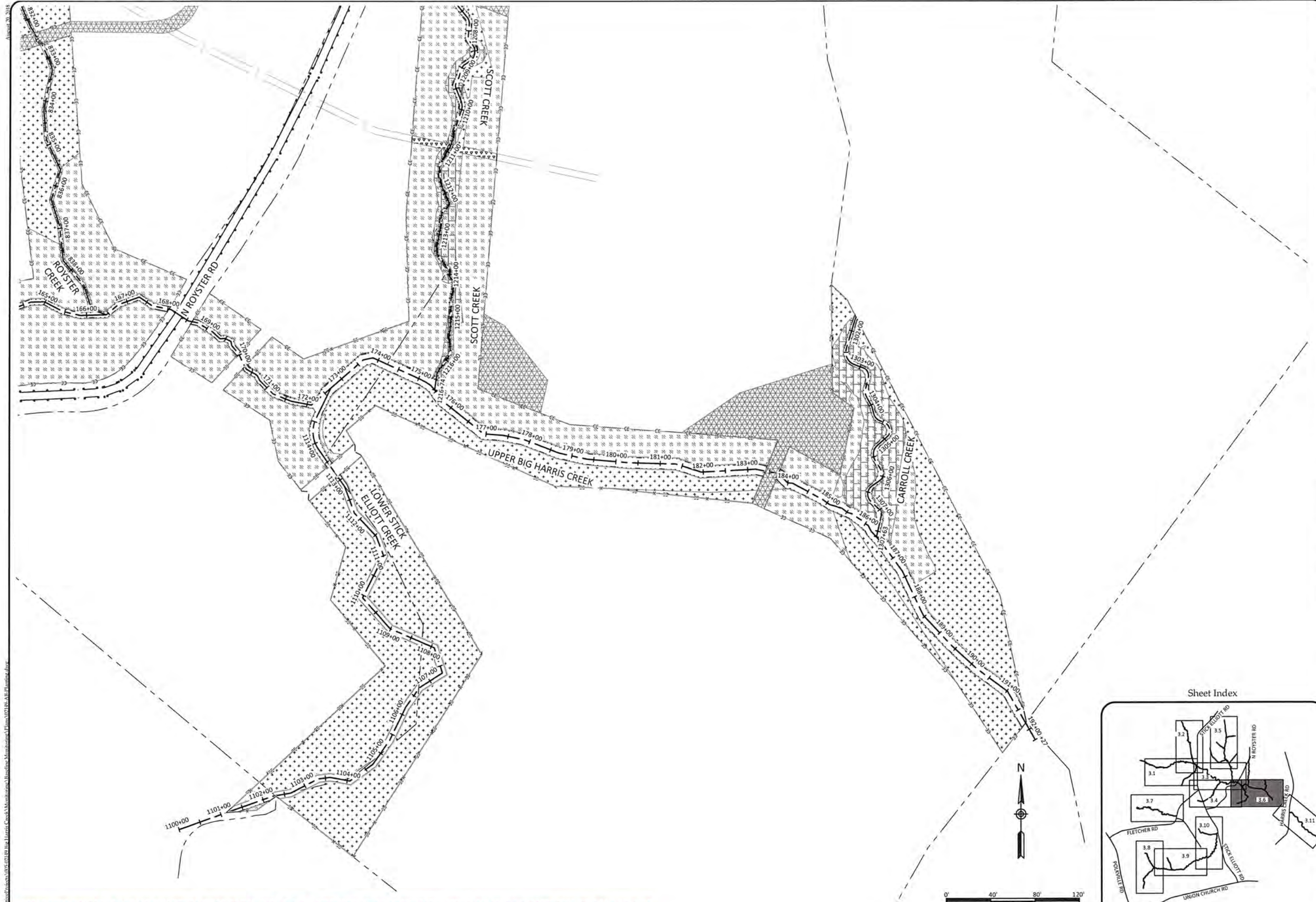
Revisions:	

Date: August 21, 2018  
Job Number: 005-02123  
Designed By: EGR, A.A.  
Drawn By: JS  
Checked By: JCK

**3.4**

Sheet





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**Big Harris Creek Mitigation Site**  
**Cleveland County, North Carolina**  
 Upper Big Harris Scott Carroll & Lower Stick Elliott  
 Planting Sheets

Date:	August 21, 2018
Job Number:	005-02123
Designed By:	EGR, AA
Drawn By:	JS
Checked By:	JCK
Revisions:	

**3.6**

Sheet

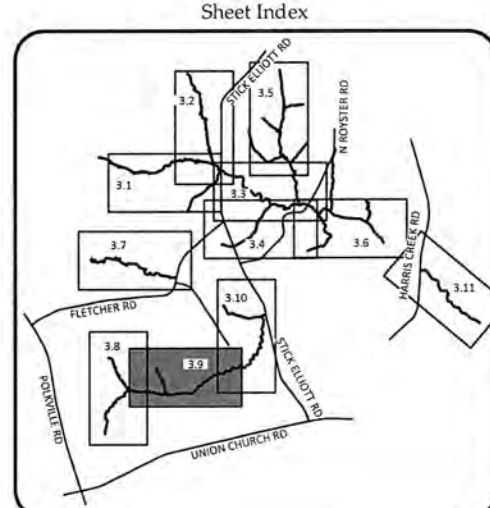




August 21, 2018  
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Job Number: 005-02123  
Designed By: ECR, AA  
Drawn By: JS  
Checked By: JCN

Revisions:


3.9

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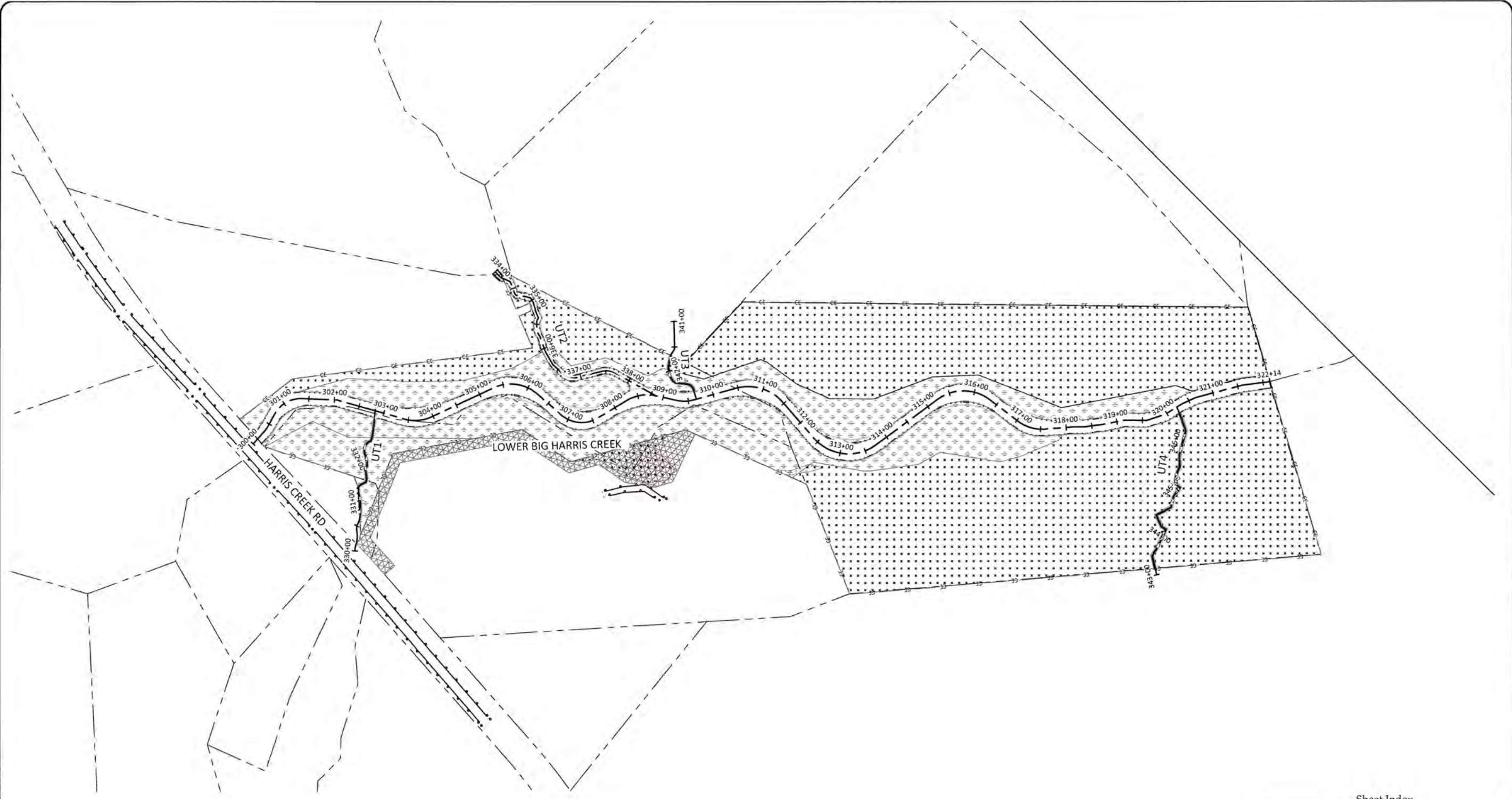
Big Harris Creek Mitigation Site  
Cleveland County, North Carolina  
Upper Stick Elliott and Bridges Creek  
Planting Sheets

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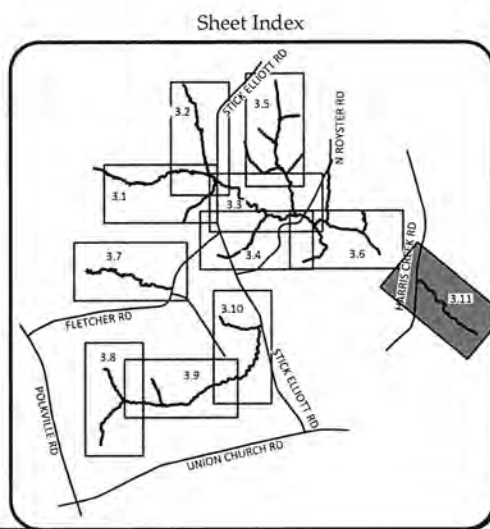
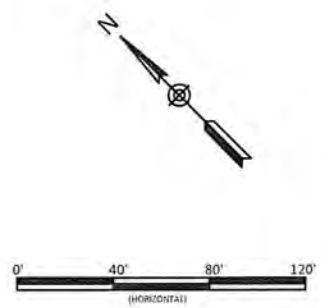






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**Big Harris Creek Mitigation Site**  
**Cleveland County, North Carolina**  
 Lower Big Harris Creek  
 Planting Sheets

Date:	August 21, 2018
Job Number:	005-02123
Designed By:	ECR, AA
Drawn By:	JS
Checked By:	JCK

3.11

Sheet

