BASELINE MONITORING DOCUMENT AND AS-BUILT BASELINE REPORT

FINAL

DRY CREEK MITIGATION SITE

Durham County, NC
NCDEQ Contract No. 6827
DMS Project Number 97082
USACE Action ID Number SAW-2016-00880
NCDWR Project Number 2016-0369

Data Collection Period: March - April 2020
Draft Submission Date: August 7, 2020
Final Submission Date: August 28, 2020

PREPARED FOR:

NC Department of Environmental Quality
Division of Mitigation Services
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August 28, 2020

Lindsay Crocker
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217 W. Jones Street, Suite 3000
Raleigh, NC 27609-1652

Subject: DMS Comments on the Draft Baseline Report and Record Drawings Review
Dry Creek, Project ID #97082, DMS Contract #0006827

Dear Ms. Crocker,

We have reviewed the comments on the As-Built Baseline Report for the above referenced project dated August 18, 2020 and have revised the report based on these comments. The revised documents are submitted with this letter. Below are responses to each of your comments. For your convenience, the comments are reprinted with our response in italics.

Baseline Report:

1. Section 5.1, There were many rock structures replaced by wood. This may be concerning to the IRT. Please briefly describe why these substitutions were made in the As-Built text and justify if and how they are appropriate for this slate belt system (i.e. explain what changed from Mitigation Plan to 'no rock available.')
   An explanation was added to Section 5.1 explaining the substitution of wood for rock on many of the structures.

2. Table 2. Throughout the document, it is stated that construction, planting, and as-built survey occurred in "April 2020." Provide specific date (day and month) of each of these items in table 2. Please also differentiate the between the actual completed and the future completed deliverables (through shading, italics, etc.).
   Specific dates are now provided for construction, planting, and as-built survey in table 2 and future completed deliverable dates are greyed out.

3. Table 1. Per recent IRT request, add a column between "Mitigation Ratio" and "As-built footage" called "Project credits.' The project credit should match the Mitigation Plan numbers. Credits should not change without an appendix to the Mitigation Plan.
   A new column called "Project Credits" has been added to Table 1.

4. Table 1. Break out the powerline crossing length in this table to show how it was reduced or increased in length based on the slight modification to alignment (Zero credit segment, see digital comment below). Please also ensure that the zero-credit portion of the stream under this powerline right of way is included in that as-built crossing length for clarity.
   The powerline crossing in now broken out in Table 1.

Record Drawings:

5. As-Built drawings sheet 2. There were some notes that sod was not available, indicating that plugs may not have been installed per vegetation planting specs shown on this page. Verify that there were no changes to the percentages, shrubs, trees, other species shown on this page. Suggest adding table to show the number and species of planted trees with total plants (these were listed in the Riparian Buffer Appendix but not stream and wetland portion).

   Wildlands confirmed that there were no deviations from the vegetation planting specs, and the number of each tree species planted was added to the planting table.

Riparian Buffer Appendix:

1. Cover page, remove reference to DMS/IRT ILF instrument as this is not relevant to riparian buffer mitigation.

   The DMS/IRT ILF instrument reference has been removed.

2. Page 2, Determination of Credits. Please describe changes in square feet (second paragraph) rather than acres.

   Any mention of acres that describes the changes of credits has been updated to square feet.

3. Table 1. Update planting date to include day of the month.

   Day of the month has been added.

Digital Deliverables:

- While the stream features accurately represent creditable versus non-creditable stream segments, the asset table does not exclude those 0 credit segments. For example, Dry Creek Reach 2 has an As-Built Footage in the asset table reported as 1918 ft, whereas the creditable feature length is 1814 ft, and the 0-credit feature length is 103 ft. Please update asset table to exclude the zero credit lengths and update the project credits table.

  The project asset table (Table 1) lengths were updated to breakout zero credit reaches, and the project credit table was updated to match the Mitigation Plan stream credits.

- Please specify the creditable versus non-creditable preservation features in the "Crediting Zones" shapefile. This can be done by creating creditable and non-creditable multipart features.

  Creditable versus non-creditable preservation is now distinguished in the Crediting Zones shapefile.

If you have any questions, please contact me by phone (919) 851-9986, or by email (jlorch@wildlandseng.com).

Sincerely,

Jason Lorch, *Monitoring Coordinator*

PREPARED BY:

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EXECUTIVE SUMMARY

Wildlands Engineering, Inc. (Wildlands) implemented a full delivery project at the Dry Creek Mitigation Site (Site) for the North Carolina Department of Environmental Quality Division of Mitigation Services (DMS) to restore, enhance, and preserve a total of 9,454 linear feet (LF) of perennial and intermittent streams in Durham County, NC. The Site will generate 8,457.734 stream mitigation units (SMUs). All stream lengths were measured along the stream centerline for SMU calculations. UT1 Reach 2 had a minor change due a revised break in the conservation easement associated with a utility line relocation. This occurred after the Mitigation Plan was approved and resulted in a loss of 4 linear feet of stream but did not affect the total stream credits. The Site is located approximately three miles northwest of Butner, NC and approximately 2 miles west of the Granville County/Durham County line (Figure 1) in the Neuse River Basin 8-Digit Hydrologic Unit Code (HUC) 03020201. The Site is located within the Neuse River Targeted Local Watershed (TLW) as presented in the 2010 Neuse River Basin Restoration Priorities (RBRP) which highlights the importance of riparian buffers for stream restoration projects (Breeding, 2010). The Site is located in the Neuse River Basin Hydrologic Unit Code (HUC) 03020201010050 and NC Division of Water Resources (NCDWR) Subbasin 03-04-01. Dry Creek and eight unnamed tributaries (UT1-UT7; UT1a) are located on the Site. The downstream drainage area of the Site is 807 acres. The Site contains tributaries to Lake Michie on the Flat River, which flows directly into Falls Lake. In the 2011 NCDWR Lake & Reservoir Assessments Report for the Neuse River Basin, Lake Michie was determined to be eutrophic (NCDWR, 2011). Flat River is classified as water supply waters (WS-III), nutrient sensitive waters (NSW) and was rated in the 2012 North Carolina Integrated Reports for 305(b) and 303(d) listings as impaired for aquatic life due to low dissolved oxygen concentrations. The 29.764 acre Site is protected with a permanent conservation easement.

The project goals established in the Mitigation Plan (Wildlands, 2018) were completed with careful consideration of goals and objectives described in the Neuse River RBRP plan. The project goals include:

- Exclude cattle from project streams;
- Stabilize eroding stream banks;
- Reconnect channels with floodplains and riparian wetlands to allow a natural flooding regime;
- Improve the stability of stream channels;
- Restore and enhance native floodplain and streambank vegetation;
- Improve instream habitat; and
- Permanently protect the Site from harmful land uses.

The project will contribute to achieving the goals for the watershed listed in the Neuse River RBRP and provide ecological benefits within the Neuse River Basin. While benefits such as habitat improvement and geomorphic stability are limited to the Site, others, such as reduced pollutant and sediment loading, have farther reaching effects.

Site construction and planting were completed in April 2020. As-built surveys were conducted between March and April 2020. No major adjustments were made during construction. Baseline (MY0) profiles and cross-section dimensions closely match the design parameters. Cross-section widths and pool depths occasionally deviate from the design parameters but fall 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 performance criteria.

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APPENDICES

Section 1: PROJECT GOALS, BACKGROUND, AND ATTRIBUTES

1.1 Project Location and Setting

The Dry Creek Mitigation Site (Site) is located in central Durham County, approximately three miles northwest of Butner, NC and approximately 2 miles west of the Granville County/Durham County line (Figure 1). From Raleigh, NC, take U.S. 70 W/NC-50 N/Glenwood Avenue. Turn right in 3.9 miles onto NC-50 N/Creedmoor Rd. Stay on Creedmoor Rd for 15.9 miles. Turn left onto Old Weaver Trail. Turn right onto Cash Rd in 1.3 miles. Cash Rd turns into Gate 2 Rd, which turns into Central Ave. Turn left onto 33rd St and then take and immediate left onto Old NC 75. In 0.4 miles, turn right onto Range Rd. Turn left onto Hampton Road in 4.0 miles. The Site will be located on the left in 0.3 miles. A conservation easement was recorded on 29.764 acres of the Site.

The Site contains tributaries to Lake Michie on the Flat River, which flows directly into Falls Lake. Flat River is classified as water supply waters (WS-III) and nutrient sensitive waters (NSW). In the 2011 NCDWR Lake & Reservoir Assessments Report for the Neuse River Basin, Lake Michie was determined to be eutrophic. Eutrophic waters are rich in nutrients resulting in dense algal blooms that deplete dissolved oxygen concentrations when they decompose. Flat River below Lake Michie was rated in the 2012 North Carolina Integrated Report for 305(b) and 303(d) listings as impaired for aquatic life due to low dissolved oxygen concentrations. The Site is within Hydrologic Unit Code (HUC) 03020201010050, Subbasin 03-04-01 and is located within the Neuse River Targeted Local Watershed (TLW) (Figure 1). The 2009 Neuse River Basinwide Water Quality Plan lists major stressors in Subbasin 03-04-01 to be total suspended solids, nutrients, and chlorophyll α (NCDWR, 2009). The Neuse River TLW is identified in the 2010 Neuse River Basin Restoration Priorities (RBRP) (Breeding, 2010). This document highlights the importance of riparian buffers for stream restoration projects. Riparian buffers immobilize and retain nutrients and suspended sediment.

The Site is located in the Carolina Slate Belt of the Piedmont Physiographic Province. The Piedmont Province is characterized by gently rolling, well rounded hills with long low ridges and elevations ranging from 300-1500 feet above sea level. The Site topography and relief are typical for the region. The Carolina Slate Belt consists of heated and deformed volcanic and sedimentary rocks. The area is called "Slate Belt" because of the slatey cleavage of many of the surficial rocks. The region's geology also includes coarse-grained intrusive granites.

Prior to construction activities, cattle were rotationally grazed along UT1, UT1a, and Dry Creek to the UT3 confluence. Cattle access to these streams resulted in significant ecological impacts. Table 4 in Appendix 1 and Tables 7a-d in Appendix 4 present additional information on pre-restoration conditions.

1.2 Project Goals and Objectives

The project is intended to provide numerous ecological benefits within the Neuse River Basin. While benefits such as habitat improvement and geomorphic stability are limited to the Site, reduced nutrient and sediment loading have farther reaching effects. Table 1 below describes expected outcomes to water quality and ecological processes associated with the project goals and objectives. These goals were established and completed with careful consideration of goals and objectives described in the RBRP and to meet the DMS mitigation needs while maximizing the ecological and water quality uplift within the watershed.

Table 1: Mitigation Goals and Objectives – *Dry Creek Mitigation Site*

Goal	Objective	Expected Outcomes
Exclude cattle from project streams.	Install fencing around project areas adjacent to cattle pastures or remove cattle from the Site.	Reduce and control sediment inputs. Reduce and manage nutrient inputs. Contribute to protection of or improvement to a Water Supply Waterbody.
Stabilize eroding stream banks.	Reconstruct stream channels slated for Restoration with stable dimensions. Create stable tie-ins for tributaries joining restored channels. Add bank revetments and in-stream structures to reaches to protect restored/enhanced streams.	Reduce sediment inputs. Contribute to protection of or improvement to a Water Supply Waterbody.
Improve the stability of stream channels.	Construct 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.	Reduce and control sediment inputs. Contribute to protection of or improvement to a Water Supply Waterbody.
Improve instream habitat.	Install habitat features such as constructed riffles, cover logs, and brush toes into restored/enhanced streams. Add woody materials to channel beds. Construct pools of varying depth.	Improve aquatic communities in project streams.
Reconnect channels with floodplains.	Reconstruct stream channels with appropriate bankfull dimensions and depth relative to the existing floodplain.	Reduce and control sediment inputs. Reduce and manage nutrient inputs. Contribute to protection of or improvement to a Water Supply Waterbody. Enhance hydration of riparian wetlands.
Restore and enhance native floodplain vegetation.	Plant native tree species in riparian zone where currently insufficient.	Reduce and control sediment inputs. Reduce and manage nutrient inputs. Provide a canopy to shade streams and reduce thermal loadings. Contribute to protection of or improvement to a Water Supply Waterbody.
Permanently protect the project Site from harmful uses.	Establish conservation easements on the Site.	Ensure that development and agricultural uses that would damage the site or reduce the benefits of project are prevented.

1.3 Project Structure, Restoration Type, and Approach

The final Mitigation Plan was approved in October 2018. Construction activities were completed by Land Mechanic Designs, Inc in April 2020. The baseline as-built survey was completed by Kee Mapping and Surveying in April 2020. The planting was completed by Bruton Natural Systems, Inc. in April 2020. Refer to Appendix 1 for detailed project activity, history, contact information, and watershed/Site background information.

1.3.1 Project Structure

The project provides 8,457.734 stream mitigation units (SMUs). Refer to Figure 2 for the Project Component / Asset Map for the stream restoration feature exhibits and Table 1 in Appendix 1 for the project components and mitigation credits for the Site.

1.3.2 Restoration Type and Approach

The design streams were restored to the appropriate type based on the surrounding landscape, climate, and natural vegetation communities but also with strong consideration to existing watershed conditions. The project consists of the stream restoration, enhancement, and preservation activities as described below (Table 2) and illustrated in Figure 2.

Table 2: Restoration Type and Approach Per Reach – *Dry Creek Mitigation Site*

Stream	Reach	Primary Stressors/Impairments	Treatment Approach	Restoration Activity
Dry Creek	R1	Channelized, lack of riparian vegetation, manmade dam	Restoration – Priority 1	Plan, Pattern, Profile, Pond Removal, Fencing, Planting
	R2	Incision, erosion, livestock access, lack of habitat	Restoration – Priority 1	Plan, Pattern, Profile, Fencing, Planting
	R3	Incision, erosion	Restoration – Priority 1	Plan, Pattern, Profile, Invasive Removal
	R4	Incision, erosion, lack of habitat	Restoration – Priority 1	Plan, Pattern, Profile, Fencing, Invasive Removal
UT1	R1	Incision, erosion	Enhancement Level II	Fencing, Bank Repairs, Utility Relocation, Planting
	R2	Incision, erosion, lack of riparian vegetation	Restoration – Priority 1	Plan, Pattern, Profile, Fencing, Pond Removal, Utility Relocation, Planting
UT1A		Incision, erosion, lack of habitat	Enhancement Level I	Grade Control Structures, Fencing
UT2		Incision, erosion	Enhancement Level II	Bank Repairs, Fencing
UT3		Incision, erosion, lack of habitat	Enhancement Level II	Bank Repairs, Fencing
UT4		N/A	Preservation	Conservation Easement
UT5	R1	Lack of riparian vegetation	Enhancement Level I	Grade Control Structures, Invasive Removal, Planting
	R2	Incision, erosion	Restoration – Priority 1	Plan, Pattern, Profile
UT6	R1	Incision, erosion	Restoration – Priority 1	Plan, Pattern, Profile, Invasive Removal
	R2	N/A	Preservation	Conservation Easement
	R3	Incision, erosion	Restoration – Priority 1	Plan, Pattern, Profile, Invasive Removal
UT7		Incision, erosion	Enhancement Level II	Bank Repairs

The design approach for this Site utilized a combination of analog and analytical approaches for stream restoration. Reference reaches were identified to serve as the basis for design parameters. Channels were sized based on design discharge hydrologic analysis. Designs were then verified and/or modified based on a sediment transport analysis. This approach has been used on many successful Piedmont and

Slate Belt restoration projects (Underwood, Foust, Holman Mill, Maney Farm, and Agony Acres Mitigation Sites) and is appropriate for the goals and objectives for this Site.

The morphologic design parameters are shown in Appendix 4, Tables 7a - 7d for the restoration reaches, and fall within the ranges specified for C4/C4b streams (Rosgen, 1996). The specific values for the design parameters were selected based on designer experience and judgment and were verified with morphologic data form reference reach data sets.

1.4 Project History, Contacts, and Attribute Data

The Site was restored by Wildlands Engineering through a full delivery 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 Information and Attributes.

Section 2: PERFORMANCE STANDARDS

The stream performance standards for the project will follow approved standards presented in the Wilmington District Stream and Wetland Compensatory Mitigation Updated in October 2016 by the North Carolina Interagency Review Team (NCIRT). Annual monitoring and semi-annual site visits will be conducted by qualified personnel to assess the condition of the project. Specific performance standard components are proposed for stream morphology, hydrology, and vegetation. Performance standards will be evaluated throughout the seven-year post-construction monitoring.

2.1 Streams

2.1.1 Dimension

Riffle cross-sections on the restoration reaches should be largely stable and should only show minor changes in bankfull area, maximum depth ratio, and width-to-depth ratio. Per guidance, bank height ratios shall not exceed 1.2 and entrenchment ratios shall be at least 2.2 for restored channels to be considered stable. Riffle cross-sections should largely fall within the parameters defined for channels of that stream classification. If any changes do occur, these changes will be evaluated to assess whether the stream channel is showing signs of instability. Indicators of instability include a vertically incising thalweg or eroding channel banks. 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.

2.1.2 Pattern and Profile

Visual assessments and photo documentation should indicate that streams are remaining stable and do not indicate a trend toward vertical or lateral instability.

2.1.3 Substrate

Channel substrate materials will be sampled in restoration and enhancement I reaches using the reach-wide pebble count method. Reaches should show maintenance of coarser substrate in the riffles than in the pools. Riffle cross-section pebble counts were conducted during as-built baseline monitoring and will not be conducted during annual monitoring unless observations indicate a trend toward finer substrate and a comparison is needed.

2.1.4 Photo Documentation

Photographs should illustrate the Site's vegetation and morphological stability on an annual basis. Cross-section photos should demonstrate no 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.

2.1.5 Hydrology Documentation

The occurrence of bankfull events will be documented throughout the monitoring period. Four bankfull flow events must be documented within the seven-year monitoring period and individual events must occur in separate years. Stream monitoring will continue until performance standards in the form of four bankfull events in separate years have been documented.

All intermittent streams must demonstrate a minimum of 30 days of continuous flow on an annual basis during the monitoring period. A minimum of 30 days of continuous flow is targeted for UT1A, UT2 and UT5.

2.2 Wetlands

Wildlands installed one groundwater monitoring gauge at a location identified by NCDWR. The purpose of this gauge is to assess potential impacts to existing wetland hydrology from the project. Results are not tied to success criteria nor stream crediting. It is expected that the project will result in a net increase in wetland quality.

2.3 Vegetation

Vegetative performance for riparian buffers associated with the stream restoration component of the project (buffer widths 0 – 50ft) will be in accordance with the Stream Mitigation Guidelines issued October 2016 by the USACE and NCIRT. The success criteria is an interim survival rate of 320 planted stems per acre at the end of monitoring year three (MY3), 260 stems per acre at the end of MY5, and a final vegetation survival rate of 210 stems per acre at the end of MY7. Planted vegetation must average 10 feet in height in each plot at the end of the seventh year of monitoring. Vegetation monitoring will be conducted between July 1st and the end of the of the growing season. Individual plot data will be provided and will include height, density, vigor, damage (if any), and survival. In fixed vegetation plots, planted woody stems will be marked annually as needed and given a coordinate, based off a known origin so they can be found in succeeding monitoring years. Mortality will be determined from the difference between the previous year's living planted stems and the current year's living planted stems.

The extent of invasive species coverage will be monitored and controlled as necessary throughout the required monitoring period (MY7).

2.4 Visual Assessment

Visual assessments should support the specific performance standards for each metric as described above.

2.5 Schedule and Reporting

Monitoring reports will be prepared in the fall of each year of monitoring and submitted to DMS. Based on the DMS Annual Monitoring Report Template (June, 2017), the monitoring reports will include the following:

- Project background which includes project objectives, project structure, restoration type and approach, location and setting, history and background;
- Monitoring Current Condition Plan View (CCPV) maps with major project elements noted such as grade control structures, vegetation plots, permanent cross-sections, and crest/flow gauges;
- Photographs showing views of the restored Site taken from fixed point stations;
- Assessment of the stability of the Site based on the cross-sections;
- Vegetative data as described above including the establishment of any undesirable plant species;
- A description of damage by animals or vandalism; and
- Maintenance issues and recommended remediation measures will be detailed and documented.

Section 3: MONITORING PLAN

Monitoring will consist of collecting morphological, hydrologic, and vegetative data to assess the project performance based on the restoration goals and objectives on an annual basis until performance criteria have been met. The performance of the project will be assessed using measurements of the stream channel's dimension, substrate composition, permanent photographs, surface water hydrology, and vegetation. Any areas identified as high priority problems, such as streambank instability, aggradation/degradation, 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. A remedial action plan will be submitted if maintenance is required. The monitoring period will extend seven years beyond completion of construction or until performance criteria have been met.

3.1 Stream

Geomorphic assessments will 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 document (Rosgen, 1994 and 1996), and in the Stream Restoration: A Natural Channel Design Handbook (Doll et al, 2003). Refer to Figure 3 in Appendix 2 and Record Drawings in Appendix 5 for monitoring locations discussed below.

3.1.1 Dimension

A total of nineteen cross-sections were installed along the stream restoration reaches. Two cross-sections were installed per 1,000 linear feet of stream restoration work, with riffle and pool sections in proportion to DMS guidance. Each cross-section was permanently marked with pins to establish its location. Cross-section surveys include points measured at all breaks in slope; including top of bank, bankfull, edge of water, and thalweg to monitor any deviations in dimension. If moderate bank erosion is observed along a stream reach during the monitoring period, a series of bank pins will be installed in representative areas where erosion is occurring for reaches with a bankfull width of greater than five feet. If required, bank pins will be installed in at least three locations (one in upper third of the pool, one at the mid-point of the pool, and one in the lower third of the pool). If bank pins are required, they will be monitored by measuring exposed rebar and maintaining pins flush to bank to capture bank erosion progression. Annual cross-section surveys will be conducted in monitoring years MY1, MY2, MY3, MY5, and MY7. Photographs will be taken annually of the cross-sections looking upstream and downstream.

3.1.2 Pattern and Profile

Longitudinal profile surveys will not be conducted during the seven year monitoring period unless other indicators during the annual monitoring show a trend toward vertical and lateral instability. If a longitudinal profile is deemed necessary, monitoring will follow standards as described in the DMS Monitoring Requirements and Performance Standards for Stream and/or Wetland Mitigation (DMS, 2011) and the 2003 USACE and NCDWR Stream Mitigation Guidance for the necessary reaches. Stream pattern and profile will be assessed visually as described below in section 3.1.6.

3.1.3 Substrate

A reach-wide pebble count will be performed in eight reaches (Dry Creek Reach 1-4, UT1 Reach 2, UT1A, UT5 Reach 1, and UT6 Reach 1) during monitoring years 1, 2, 3, 5, and 7 for classification purposes and to show that riffles remain coarser than pools. Riffle cross-section pebble counts were conducted during as-built baseline monitoring only unless observations indicate a trend toward finer substrate and a comparison is needed.

3.1.4 Photo Reference Points

A total of 32 permanent photograph reference points were established along the stream reaches after construction. Permanent markers were established so that the same locations and view directions on the Site are photographed each year. Longitudinal stream photographs will be taken looking upstream and downstream once a year to visually document stability. Cross-sectional photos will be taken at each permanent cross-section looking upstream and downstream. Representative digital photos of each permanent photo point will be taken on the same day the stream assessments are conducted.

3.1.5 Hydrology Documentation

Six automated crest gauges were installed on Site. Crest gauges were installed in surveyed riffle cross-sections on Dry Creek Reach 2 and 3 (XS 5 and 10), UT1 Reach 2 (XS 13), UT1A (XS 15) and UT6 Reach 1 (XS 18). The crest gauge on UT5 Reach 1 was not installed in a surveyed riffle cross-section. Crest gauge data will be downloaded during site visits to determine if a bankfull event has occurred since the last visit. Additionally, photographs will be collected to document the occurrence of debris lines and sediment deposition as evidence of bankfull events.

Three automated flow gauges were installed in intermittent reaches on Site. The flow gauges were installed in riffles on UT1A, UT2, and UT5 Reach 1. Flow gauge data will be downloaded during site visits to determine if each reach has 30 days of continuous flow.

3.1.6 Visual Assessment

Visual assessments will be performed at the Site on a semi-annual basis during the seven year monitoring period. Problem areas will be noted such as channel instability (i.e. lateral and/or vertical instability, in-stream structure failure/instability and/or piping, or headcuts), vegetated health (i.e. low stem density, vegetation mortality, invasive species or encroachment), beaver activity, or livestock access. Areas of concern will be mapped and 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 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 twelve standard 10 meter by 10 meter and 5 meter by 20 meter vegetation plots were established within the project easement area. Four of the twelve vegetation plots will be relocated randomly on an annual basis to monitor vegetation health across the Site.

Vegetation plots were randomly established between the conservation easement boundaries and five feet from the top of stream banks. Fixed vegetation plot corners have been marked and are recoverable either through field identification or with the use of a GPS unit. Reference photographs were taken at the origin looking diagonally across the plot to the opposite corner during the baseline monitoring in March and April 2020. Subsequent annual assessments following the baseline survey will capture the same reference photograph locations. Planted woody stems will be marked annually, as needed, based off a known origin so they can be found in subsequent monitoring years.

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 height, density, vigor, damage (if any), and survival. Mortality will be determined from the difference between the baseline year's living planted stems and the current year's living planted stems. Vegetation surveys will be conducted during monitoring years 1, 2, 3, 5, and 7.

Section 4: LAND MANAGEMENT AND CONTINGENCY PLAN

Wildlands will perform maintenance as needed at the Site. A physical inspection of the Site shall be conducted a minimum of once per year throughout the post-construction monitoring period until performance standards are met. These site inspections may identify components and features that require routine maintenance. Routine maintenance should be expected most often in the first two years following construction and may include one or more of the following components.

4.1 Stream

Stream problem areas will be mapped and included in the CCPV as part of the annual stream assessment. Stream problems areas may include bank erosion, structure failure, beaver dams, aggradation/degradation, etc. Routine channel maintenance and repair activities may include chinking of in-stream structures to prevent piping, securing loose coir matting, and supplemental installations of live stakes and other target vegetation along the channel. Areas where storm water runoff flows into the channel may also require maintenance to prevent bank failures and head-cutting.

4.2 Vegetation

Vegetation shall be maintained to ensure the health and vigor of the targeted community. Vegetative problem areas will be mapped and included in the CCPV as part of the annual vegetation assessment. Vegetation problem areas may include planted vegetation not meeting performance criteria, persistent invasive species, barren areas with little to no herbaceous cover, or grass suffocation/crowding of planted stems. Routine vegetation maintenance and repair activities may include supplemental planting, pruning, mulching, and fertilizing. Exotic invasive plant species shall be controlled by mechanical and/or chemical methods. Any vegetation control requiring herbicide application will be performed in accordance with NC Department of Agriculture rules and regulations.

4.3 Site Boundary

Site boundary issues will be mapped and included in the CCPV as part of the annual visual assessment. Site boundaries shall be identified in the field to ensure clear distinction between the Site and adjacent properties. Boundaries are marked with conservation easement signs attached to metal posts. Boundary markers disturbed, damaged, or destroyed will be repaired and/or replaced on an as needed basis.

Section 5: AS-BUILT CONDITION (BASELINE)

The Site construction and as-built surveys were completed in April 2020. The survey included developing an as-built topographic surface; as well as, surveying the as-built channel centerlines, top of banks, structures, and cross-sections.

5.1 As-Built/Record Drawings

A sealed half-size set of record drawings are in Appendix 5 which includes the post-construction survey, alignments, structures, and monitoring features. No significant field adjustments were made during construction that differ from the design plans. Most of the rock J-Hooks were substituted with log J-Hooks due to the availability of onsite materials. An abundance of mature trees on the site provided numerous large logs for structures, but the contractor was not able to locate boulder size rock on the site. There are additional benefits to using wood in the stream instead of rock. Wood creates additional instream habitat for aquatic species, and it also is better at maintaining the stream bed grade due to the absence of voids in between large rocks. Minimal adjustments were made during construction, where needed, based on field evaluation, and are listed below.

5.1.1 Dry Creek Reach 1

- Station 102+61 rock J-hook changed to log J-hook due to no rock available.
- Station 102+77 – Station 103+54 revetment changed to brush toe for stability.
- Station 104+14 rock J-hook changed to log J-hook due to no rock available.
- Station 104+74 – Station 105+25 brush tow revetment not installed due to bedrock.
- Station 106+38 – Station 107+14 brush toe revetment added for stability.
- Station 109+25 – Station 109+64 brush toe revetment not installed due to bedrock.
- Station 112+47 rock J-hook changed to log J-hook due to no rock available.

5.1.2 Dry Creek Reach 2

- Station 115+80 – Station 116+19 brush toe revetment not installed to preserve existing trees.
- Station 116+69 – Station 117+08 brush toe revetment installed due to curve being too long for cover log.
- Station 121+95 rock J-hook changed to log J-hook due to no rock available.
- Station 122+20 – Station 122+42 brush toe revetment added for stability.
- Station 123+41 rock J-hook changed to log J-hook due to no rock available.
- Station 124+56 – Station 125+17 brush toe revetment installed due to curve being too long for cover log.
- Station 128+08 rock J-hook changed to log sill due to no rock available.
- Station 128+07 – Station 128+76 brush toe revetment installed for increased stability.

5.1.3 Dry Creek Reach 3

- Station 136+00 – Station 136+44 brush toe revetment installed to increase stability.
- Station 137+15 – Station 137+73 brush toe revetment installed due to curve being too long for cover log.
- Station 142+27 – Station 142+88 brush toe revetment installed due to curve being too long for cover log.
- Station 146+13 – Station 146+66 brush toe revetment installed to increase stability.

5.1.4 Dry Creek Reach 4

- Station 152+07 utility conduit installed.
- Station 153+59 – Station 154+22 brush toe revetment installed due to curve being too long for cover log.
- Station 159+72 – Station 159+98 boulder toe revetment installed for stability.

5.1.5 UT1 Reach 1

- No changes were made.

5.1.6 UT1 Reach 2

- Station 210+67 rock sill not installed due to no boulders available. Proceeding riffle armored with large riffle material.
- Station 210+71 – Station 210+77 Sod mat added to revetment.
- Station 211+76 rock J-hook changed to log J-hook due to no rock available.
- Station 213+56 – Station 213+86 brush toe installed due to stream not deep enough for soil lift.
- Station 214+14 – Station 214+35 brush toe not installed due to presence of stable bedrock.
- Station 214+58 – Station 214+79 brush toe installed due to stream not deep enough for soil lift.
- Station 214+99 log sill added to accommodate profile drop.
- Station 214+99 – Station 215+37 brush toe installed due to stream not deep enough for soil lift.

5.1.7 UT1A

- Station 301+22 rock sill changed to log sill due to no rock available.

5.1.8 UT2

- Station 400+09 rock sill not installed due to no rock available.
- Station 400+79 – Station 401+00 brush toe installed due to stream not deep enough for soil lift.

5.1.9 UT3

- Station 500+88 – Station 501+14 constructed riffle was shifted upstream to preserve mature trees, and a stable section of stream.

5.1.10 UT4

- Station 600+69 – Station 600+80 brush toe installed due to stream not deep enough for soil lift.

5.1.11 UT5 Reach 1

- Station 702+60 rock sill changed to log sill due to no rock available.

5.1.12 UT5 Reach 2

- Station 705+65 rock sill changed to log sill due to no rock available.
- Station 706+01 rock sill changed to log sill due to no rock available.
- Station 706+01 – Station 706+14 brush toe installed due to stream not deep enough for soil lift.

5.1.13 UT6 Reach 1

- Station 801+33 log sill removed due to grade drop over pool was reduced.
- Station 801+51 log sill removed due to grade drop over pool was reduced.
- Station 801+51 – Station 801+57 no sod available on site.
- Station 802+59 – Station 802+67 no sod available on site.
- Station 804+33 – Station 804+38 no sod available on site.

- Station 804+68 – Station 804+74 no sod available on site.
- Station 804+81 – Station 804+87 no sod available on site.
- Station 805+15 – Station 805+24 no sod available on site.
- Station 805+67 – Station 805+74 no sod available on site.
- Station 805+79 – Station 805+87 no sod available on site.

5.1.14 UT6 Reach 2

- No changes were made.

5.1.15 UT6 Reach 3

- No changes were made.

5.1.16 UT7

- No changes were made.

5.2 Baseline Data Assessment

Baseline monitoring (MY0) was conducted between March and April 2020. The first annual monitoring assessment (MY1) will be completed in late 2020. The streams will be monitored for a total of seven years, with the final monitoring activities concluding in 2026. The close-out for the Site will be conducted in 2027 given the performance criteria have been met.

5.2.1 Morphological State of the Channel

Refer to Appendix 2 for stream photographs and Appendix 4 for summary data tables and morphological plots.

Profile

The MY0 longitudinal profiles closely match the design profile. On the design profiles, pools and riffles were depicted as straight lines with consistent slopes. The as-built surveyed profiles are not as consistent in slope due to natural deposition and scour. Pool and riffle depths and slopes are expected to be maintained near design parameter values. The variations in slope and depth do not constitute a problem or indicate a need for remedial actions and will be assessed visually during the site walks.

Dimension

The MY0 channel dimensions fall within specified design parameter ranges. The channels are expected to maintain dimensions of C4/C4b Rosgen type channels. Summary data and cross-section plots of each project reach are included in Appendix 4.

Pattern

The MY0 pattern metrics fall within the design parameter ranges for all reaches. No major changes to design alignments were made during construction. Pattern data will be evaluated in MY5 if channel dimensions or profile indicate that significant geomorphic changes have occurred.

Sediment Transport

As-built shear stress and velocities are similar to design calculations and should reduce the risk of further erosion along the reaches. The as-built condition for each of these reaches indicates an overall increase in substrate particle size (Appendix 4). The substrate data for each constructed reach was compared to the design shear stress parameters from the mitigation plan to assess the potential for bed degradation. The shear stresses calculated for the constructed channels are within the allowable range, which indicates the channel is not at risk to trend toward channel degradation.

5.2.2 Hydrology
Bankful events recorded following completion of construction will be reported in the MY1 report.

5.2.3 Wetlands
Wetland data recorded following completion of construction will be reported in the MY1 report for informational purposes only.

5.2.4 Vegetation
The MY0 vegetation survey was completed in April 2020. The MY0 planted density is 533 stems per acre which exceeds the MY3 interim stem density requirement of 320 planted stems per acre. Vegetation Plot photographs are included in Appendix 2 and summary data for each plot are included in Tables 6a and 6b in Appendix 3.

Section 6: REFERENCES

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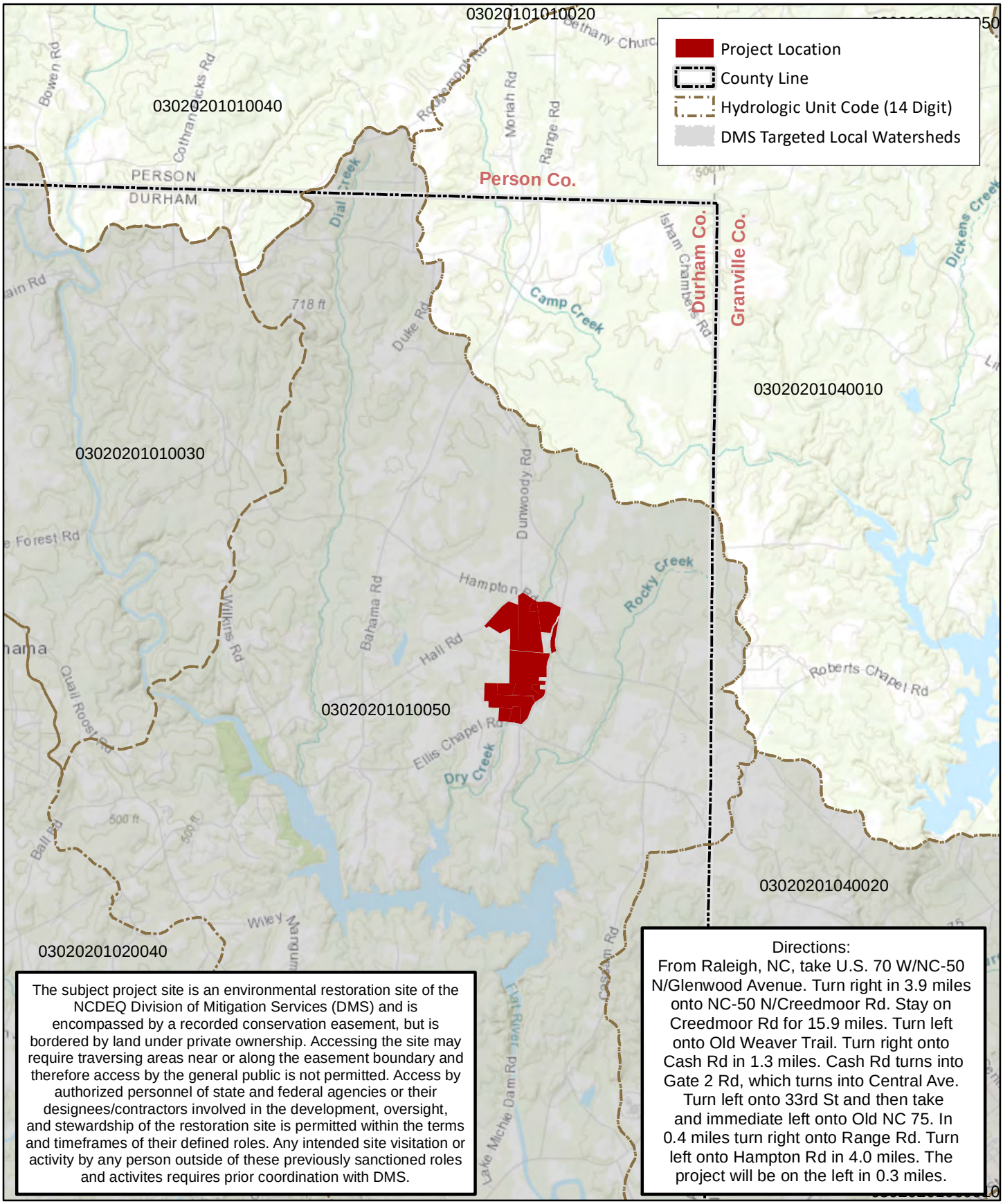
APPENDIX 1. General Figures and Tables



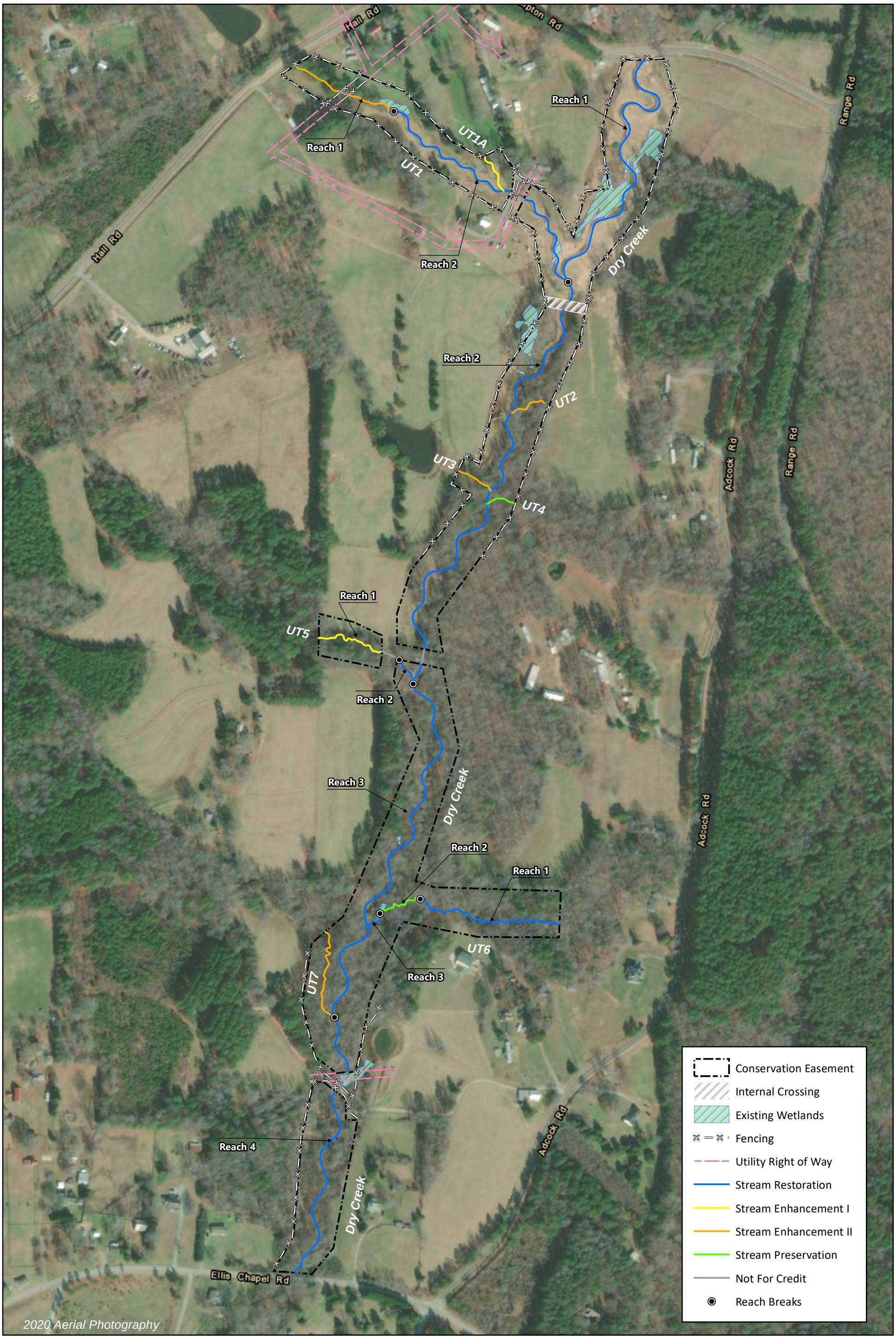
WILDLANDS ENGINEERING

0 0.5 1 Miles

N

Figure 1. Project Vicinity Map
Dry Creek Mitigation Site
DMS Project No. 97082
Monitoring Year 0 - 2020

Durham County, NC



WILDLANDS ENGINEERING

Figure 2. Project Component / Asset Map
Dry Creek Mitigation Site
DMS Project No. 97082
Monitoring Year 0 - 2020
Durham County, NC

Table 1. Project Components and Mitigation Credits
Dry Creek Mitigation Site
DMS Project No. 97082
Monitoring Year 0 - 2020

PROJECT COMPONENTS									
Reach ID	**Existing Footage**	**Mitigation Plan Footage**	**Mitigation Category**	**Restoration Level**	**Priority Level**	**Mitigation Ratio (X:1)**	**Project Credits**	**As-Built Footage**	**Comments**
STREAMS									
Dry Creek Reach 1	999	1,278	Warm	R	P1	1	1,278.000	1,247	Pond Removal, Full Channel Restoration, Planted Buffer, Fencing Out Livestock
Dry Creek Reach 2	2,104	81	Warm	R	P1	1	81.000	84	Full Channel Restoration, Planted Buffer, Fencing Out Livestock
		44	Warm	N/A	N/A	N/A	N/A	43	Internal Easement Culvert Crossing
		1,681	Warm	R		1	1,681.000	1,656	Full Channel Restoration, Planted Buffer, Fencing Out Livestock
		60	Warm	N/A	N/A	N/A	N/A	60	Bridge Crossing, Easement Break
		85	Warm	R	P1	1	85.000	75	Full Channel Restoration, Planted Buffer, Fencing Out Livestock
Dry Creek Reach 3	1,955	1,603	Warm	R	P1	1	1,603.000	1,583	Full Channel Restoration, Invasive Removal
Dry Creek Reach 4	1,495	241	Warm	R	P1	1	241.000	243	Full Channel Restoration, Invasive Removal
		85	Warm	N/A	N/A	N/A	N/A	85	Culvert Crossing, Easement Break
		813	Warm	R	P1	1	813.000	807	Full Channel Restoration, Invasive Removal
UT1 Reach 1	456	216	Warm	EII	N/A	2.5	86.200	215	Bank Repairs, Fencing Out Livestock, Planted Buffer
		35	Warm	N/A	N/A	N/A	N/A	36	Utility Crossing
		205	Warm	EII	N/A	2.5	82.000	202	Bank Repairs, Fencing Out Livestock, Planted Buffer
UT1 Reach 2	945	631	Warm	R	P1	1	631.000	627	Pond Removal, Full Channel Restoration, Planted Buffer, Fencing Out Livestock
		52	Warm	N/A	N/A	N/A	N/A	53	Culvert Crossing, Utility Relocation, Easement Break
		436	Warm	R	P1	1	436.000	426	Full Channel Restoration, Planted Buffer, Fencing Out Livestock
UT1A	90	166	Warm	EI	N/A	1.5	110.667	165	Grade Control Structures, Fencing
UT2	72	151	Warm	EII	N/A	2.5	60.400	135	Bank Repairs, Fencing Out Livestock
UT3	153	156	Warm	EII	N/A	2.5	62.400	160	Bank Repairs, Fencing Out Livestock
UT4	110	115	Warm	P	N/A	10	11.500	114	Conservation Easement
UT5 Reach 1	371	298	Warm	EI	N/A	1.5	198.667	285	Grade Control Structures, Invasive Removal, Planted Buffer
		80	Warm	N/A	N/A	N/A	N/A	79	Culvert Crossing, Easement Break
UT5 Reach 2[1]	135	119	Warm	R	P1	1	104.000	112	Full Channel Restoration
UT6 Reach 1	582	617	Warm	R	P1	1	617.000	612	Full Channel Restoration, Invasive Removal
UT6 Reach 2	209	209	Warm	P	N/A	10	20.900	209	Conservation Easement
UT6 Reach 3	58	89	Warm	R	P1	1	89.000	89	Full Channel Restoration, Invasive Removal
UT7	367	415	Warm	EII	N/A	2.5	166.000	408	Bank Repairs

1. No credit proposed for UT5 Reach 2 Station 705+61 to 705+76 due to easement width being less than 15 feet wide.

PROJECT CREDITS							
Restoration Level	**Stream**			**Riparian Wetland**		**Non-Riparian Wetland**	**Coastal Marsh**
	Warm	**Cool**	**Cold**	**Riverine**	**Non-Riverine**		
Restoration	7,659.000						
Enhancement I	309.334						
Enhancement II	457.000						
Preservation	32.400						
Re-Establishment							
Rehabilitation							
Enhancement							
Creation							
Totals	**8,457.734**						

Table 2. Project Activity and Reporting History

Dry Creek Mitigation Site
DMS Project No. 97082
Monitoring Year 0 - 2020

Activity or Report		Data Collection Complete	Completion or Scheduled Delivery
Mitigation Plan		October 2018	October 2018
Final Design - Construction Plans		November 2019	November 2019
Construction		October 2019 - April 2020	April 20, 2020
Temporary S&E mix applied to entire project area [1]		October 2019 - April 2020	April 20, 2020
Permanent seed mix applied to reach/segments [1]		October 2019 - April 2020	April 20, 2020
Bare root and live stake plantings for reach/segments		April 2020	April 24, 2020
Baseline Monitoring Document (Year 0)	Stream Survey	April 30, 2020	August 2020
	Vegetation Survey	April 27, 2020	
Year 1 Monitoring	Stream Survey	2020	December 2020
	Vegetation Survey	2020	
Year 2 Monitoring	Stream Survey	2021	December 2021
	Vegetation Survey	2021	
Year 3 Monitoring	Stream Survey	2022	December 2022
	Vegetation Survey	2022	
Year 4 Monitoring			December 2023
Year 5 Monitoring	Stream Survey	2024	December 2024
	Vegetation Survey	2024	
Year 6 Monitoring			December 2025
Year 7 Monitoring	Stream Survey	2026	December 2026
	Vegetation Survey	2026	

[1]Seed and mulch is added as each section of construction is completed.

Table 3. Project Contact Table

Dry Creek Mitigation Site
DMS Project No. 97082
Monitoring Year 0 - 2020

Designer Nicole Macaluso Millns, PE	**Wildlands Engineering, Inc.** 312 West Millbrook Road, Suite 225 Raleigh, NC 27609 919.851.9986
Construction Contractor	**Land Mechanic Designs, Inc.** 126 Circle G Lane Willow Spring, NC 27592
Planting Contractor	**Bruton Natural Systems, Inc** P.O. Box 1197 Fremont, NC 27830
Seeding Contractor	**Land Mechanic Designs, Inc.** 126 Circle G Lane Willow Spring, NC 27592
Seed Mix Sources	**Garrett Wildflower Seed Company**
Nursery Stock Suppliers Bare Roots	**Dykes and Sons Nursery and Greenhouse**
Live Stakes	**Bruton Natural Systems, Inc**
Monitoring Performers Monitoring, POC	**Wildlands Engineering, Inc.** Jason Lorch 919.851.9986

Table 4. Project Information and Attributes

Dry Creek Mitigation Site

DMS Project No. 97082

Monitoring Year 0 - 2020

PROJECT INFORMATION									
Project Name	Dry Creek Mitigation Site								
County	Durham County								
Project Area (acres)	29.764								
Planted (acres)	14.040								
Project Coordinates (latitude and longitude)	36° 11′ 07.92″ N, 78° 49′ 39.00″ W								
PROJECT WATERSHED SUMMARY INFORMATION									
Physiographic Province	Carolina Slate Belt of the Piedmont Physiographic Province								
River Basin	Neuse River								
USGS Hydrologic Unit 8-digit	03020201								
USGS Hydrologic Unit 14-digit	03020201010050								
DWR Sub-basin	03-04-01								
Project Drainiage Area (acres)	807								
Project Drainage Area Percentage of Impervious Area	<1%								
CGIA Land Use Classification	50% Forested, 40% Cultivated, 9% Residential Area								
REACH SUMMARY INFORMATION									
Parameters	**Dry Creek**	**UT1**	**UT1a**	**UT2**	**UT3**	**UT4**	**UT5**	**UT6**	**UT7**
Length of Reach (linear feet) - Post-Restoration	5,883	1,559	165	135	160	114	477	910	408
Drainage Area (acres)	807	85	22	4	17	33	40	17	64
NCDWR Stream Identification Score	50.5	32.25	27.5	24.5	26	24	25.5	36	35.5
NCDWR Water Quality Classification	WS-III (NSW)								
Morphological Desription (stream type)	Perennial		Intermittent					Perennial	
Evolutionary Trend (Simon's Model) - Pre-Restoration	IV: Degradation and Widening				III Channelized	I Premodified	IV Degradation and Widening		
Underlying Mapped Soils	Chewacla loam, Herndon silt loam, Tatum silt loam								
Drainage Class	-								
Soil Hydric Status	-								
Slope	-								
FEMA Classification	Zone X								
Native Vegetation Community	Piedmont Bottomland Forest								
Percent Composition Exotic Invasive Vegetation - Post-Restoration	0%								

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. 4134.
Waters of the United States - Section 401	Yes	Yes	
Division of Land Quality (Dam Safety)	N/A	N/A	N/A
Endangered Species Act	Yes	Yes	Dry Creek Mitigation Plan; Wildlands determined "no effect" on Orange County listed endangered species. The USFWS responded on May 5, 2016 and concurred with NCWRC stating that "the proposed action is not likely to adversely affect any federally-listed endangered or threatened species, their formally designated critical habitat, or species currently proposed for listing under the Act."
Historic Preservation Act	Yes	Yes	Correspondence from SHPO on April 26, 2016 indicating they were not aware of any historic resources that would be affected by the project.
Coastal Zone Management Act (CZMA)/Coastal Area Management Act (CAMA)	N/A	N/A	N/A
FEMA Floodplain Compliance	Yes	Yes	Durham County Floodplain Development Permit No. 19800028 was obtained on August 1, 2019
Essential Fisheries Habitat	N/A	N/A	N/A

Table 5. Monitoring Component Summary
Dry Creek Mitigation Site
DMS Project No. 97082
Monitoring Year 0 - 2020

Parameter	Monitoring Feature	Quantity / Length by Reach						Frequency
		Dry Creek	UT1	UT1A	UT2	UT5	UT6	
Dimension	Riffle Cross-Sections	7	1	1	N/A	1	1	Year 1, 2, 3, 5, and 7
	Pool Cross-Sections	5	1	0	N/A	1	1	Year 1, 2, 3, 5, and 7
Pattern	Pattern	N/A						N/A
Profile	Longitudinal Profile	N/A						Year 0 (Unless Required)
Substrate	Reach Wide Pebble Count	4 RW	1 RW	1 RW	N/A	1 RW	1 RW	Year 1, 2, 3, 5, and 7
Hydrology	Transducer: Crest Gauge (CG) or Flow Gauge (FG)	2 CG	1 CG	1 CG, 1 FG	1 FG	1 CG, 1 FG	1 CG	Semi- Annual
Vegetation	CVS Level 2 Vegetation Plots	8 Fixed; 4 Random						Year 1, 2, 3, 5, and 7
Wetlands	Groundwater Well	1						Semi-Annual
Visual Assessment		Yes						Semi-Annual
Exotic and Nuisance Vegetation								Semi-Annual
Project Boundary								Semi- Annual
Reference Photos	Photographs	32						Annual

APPENDIX 2. Visual Assessment Data

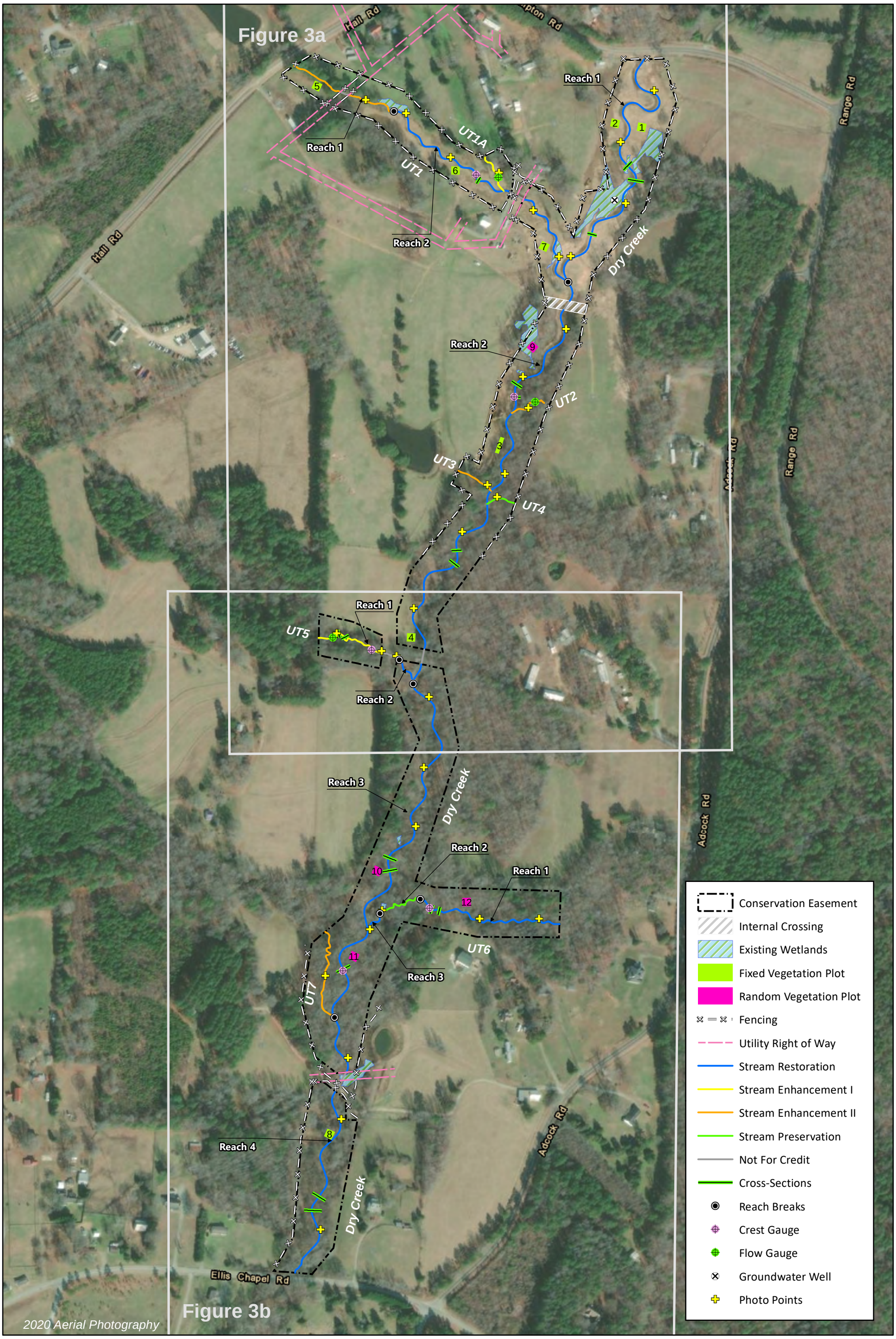


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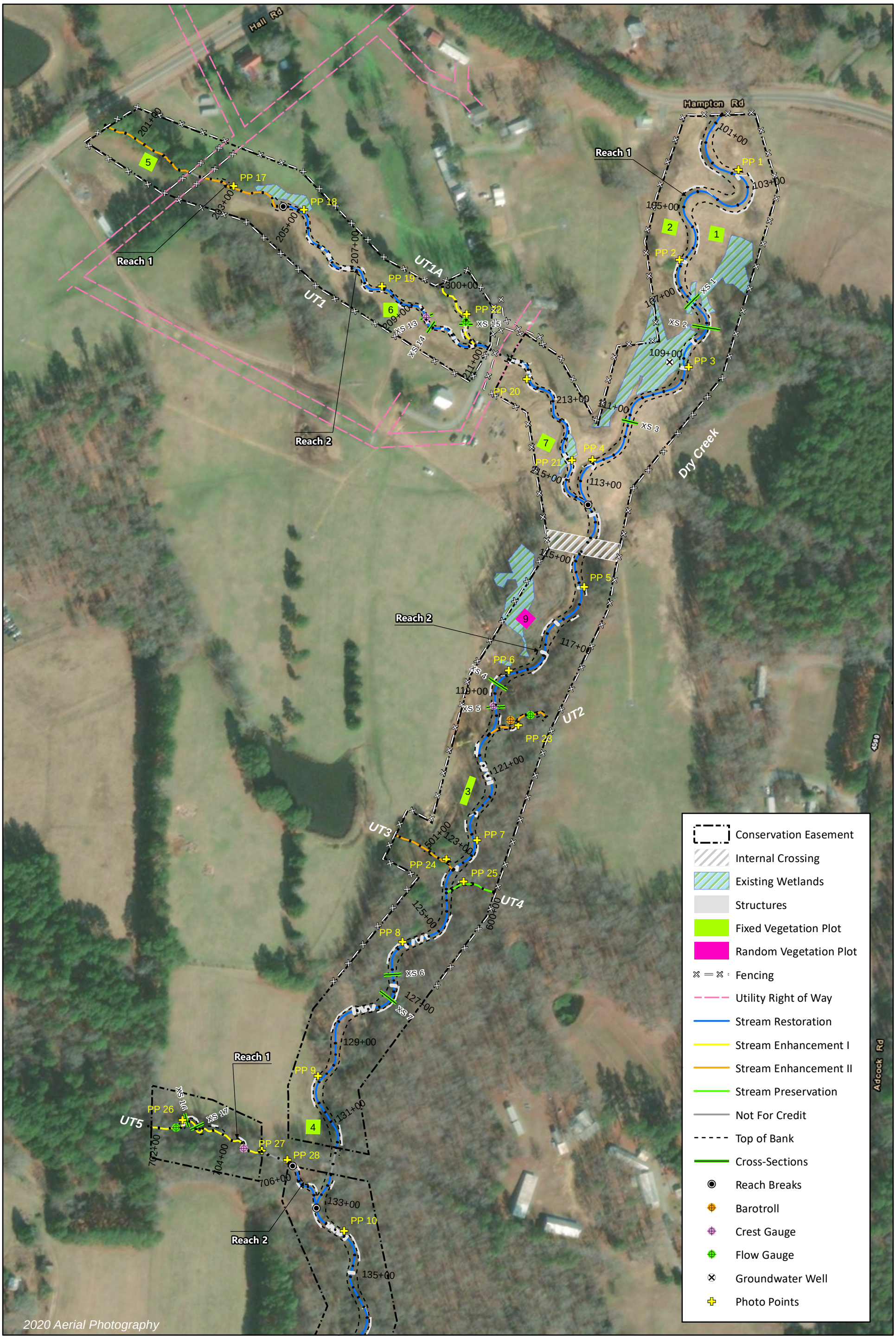
Figure 3. Monitoring Plan View Key
Dry Creek Mitigation Site
DMS Project No. 97082
Monitoring Year 0 - 2020
Durham County, NC

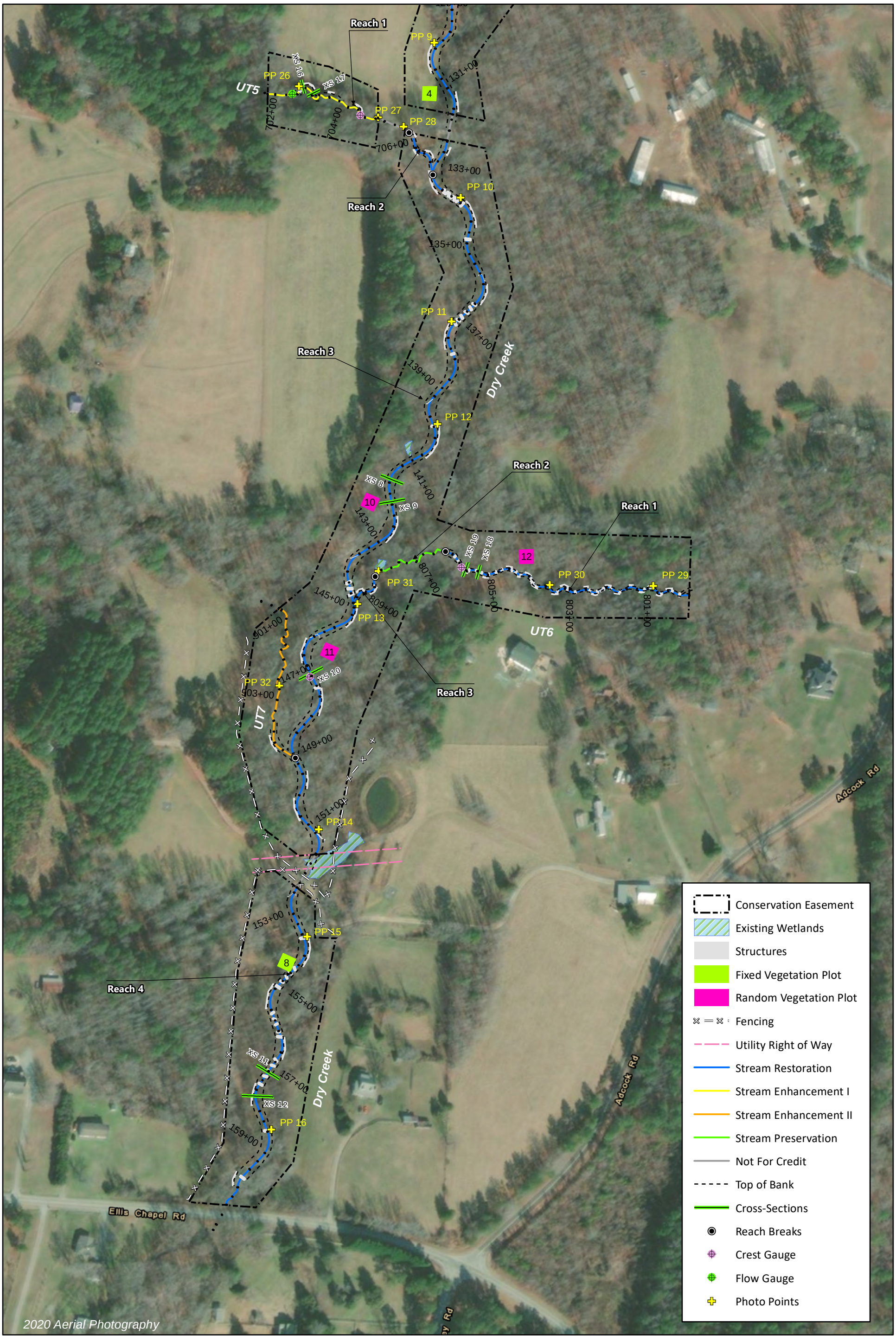


WILDLANDS ENGINEERING

0 200 400 Feet

N

Figure 3a. Monitoring Plan View
Dry Creek Mitigation Site
DMS Project No. 97082
Monitoring Year 0 - 2020
Durham County, NC



WILDLANDS ENGINEERING

0 200 400 Feet

N

Figure 3b. Monitoring Plan View
Dry Creek Mitigation Site
DMS Project No. 97082
Monitoring Year 0 - 2020
Durham County, NC

STREAM PHOTOGRAPHS

PHOTO POINT 1 Dry Creek R1 – upstream *(04/27/2020)*

PHOTO POINT 1 Dry Creek R1 – downstream *(04/27/2020)*

PHOTO POINT 2 Dry Creek R1 – upstream *(04/27/2020)*

PHOTO POINT 2 Dry Creek R1 – downstream *(04/27/2020)*

PHOTO POINT 3 Dry Creek R1 – upstream *(04/27/2020)*

PHOTO POINT 3 Dry Creek R1 – downstream *(04/27/2020)*

PHOTO POINT 4 Dry Creek R1 – upstream *(04/27/2020)*

PHOTO POINT 4 Dry Creek R1 – downstream *(04/27/2020)*

PHOTO POINT 5 Dry Creek R2 – upstream *(04/27/2020)*

PHOTO POINT 5 Dry Creek R2 – downstream *(04/27/2020)*

PHOTO POINT 6 Dry Creek R2 – upstream *(04/27/2020)*

PHOTO POINT 6 Dry Creek R2 – downstream *(04/27/2020)*

PHOTO POINT 7 Dry Creek R2 – upstream *(04/27/2020)*

PHOTO POINT 7 Dry Creek R2 – downstream *(04/27/2020)*

PHOTO POINT 8 Dry Creek R2 – upstream *(04/27/2020)*

PHOTO POINT 8 Dry Creek R2 – downstream *(04/27/2020)*

PHOTO POINT 9 Dry Creek R2 – upstream *(04/27/2020)*

PHOTO POINT 9 Dry Creek R2 – downstream *(04/27/2020)*

PHOTO POINT 10 Dry Creek R3 – upstream *(04/27/2020)*

PHOTO POINT 10 Dry Creek R3 – downstream *(04/27/2020)*

PHOTO POINT 11 Dry Creek R3 – upstream *(04/27/2020)*

PHOTO POINT 11 Dry Creek R3 – downstream *(04/27/2020)*

PHOTO POINT 12 Dry Creek R3 – upstream *(04/27/2020)*

PHOTO POINT 12 Dry Creek R3 – downstream *(04/27/2020)*

PHOTO POINT 13 Dry Creek R3 – upstream *(04/27/2020)*

PHOTO POINT 13 Dry Creek R3 – downstream *(04/27/2020)*

PHOTO POINT 14 Dry Creek R3 – upstream *(04/27/2020)*

PHOTO POINT 14 Dry Creek R3 – downstream *(04/27/2020)*

PHOTO POINT 15 Dry Creek R4 – upstream *(04/27/2020)*

PHOTO POINT 15 Dry Creek R4 – downstream *(04/27/2020)*

PHOTO POINT 16 Dry Creek R4 – upstream *(04/27/2020)*

PHOTO POINT 16 Dry Creek R4 – downstream *(04/27/2020)*

PHOTO POINT 17 UT1 R1 – upstream *(04/27/2020)*

PHOTO POINT 17 UT1 R1 – downstream *(04/27/2020)*

PHOTO POINT 18 UT1 R2 – upstream *(04/27/2020)*

PHOTO POINT 18 UT1 R2 – downstream *(04/27/2020)*

	
PHOTO POINT 19 UT1 R2 – upstream *(04/27/2020)*	**PHOTO POINT 19 UT1 R2 – downstream *(04/27/2020)***
	
PHOTO POINT 20 UT1 R2 – upstream *(04/27/2020)*	**PHOTO POINT 20 UT1 R2 – downstream *(04/27/2020)***
	
PHOTO POINT 21 UT1 R2 – upstream *(04/27/2020)*	**PHOTO POINT 21 UT1 R2 – downstream *(04/27/2020)***

	
PHOTO POINT 22 UT1a – upstream *(04/27/2020)*	**PHOTO POINT 22 UT1a – downstream *(04/27/2020)***
	
PHOTO POINT 23 UT2 – upstream *(04/27/2020)*	**PHOTO POINT 23 UT2 – downstream *(04/27/2020)***
	
PHOTO POINT 24 UT3 – upstream *(04/27/2020)*	**PHOTO POINT 24 UT3 – downstream *(04/27/2020)***

PHOTO POINT 25 UT4 – upstream *(04/27/2020)*

PHOTO POINT 25 UT4 – downstream *(04/27/2020)*

PHOTO POINT 26 UT5 R1 – upstream *(04/27/2020)*

PHOTO POINT 26 UT5 R1 – downstream *(04/27/2020)*

PHOTO POINT 27 UT5 R1 – upstream *(07/14/2020)*

PHOTO POINT 28 UT5 R2 – downstream *(04/27/2020)*

	
PHOTO POINT 29 UT6 R1 – upstream *(04/27/2020)*	**PHOTO POINT 29 UT6 R1 – downstream *(04/27/2020)***
	
PHOTO POINT 30 UT6 R1 – upstream *(04/27/2020)*	**PHOTO POINT 30 UT6 R1 – downstream *(04/27/2020)***
	
PHOTO POINT 31 UT6 R2 – upstream *(07/14/2020)*	**PHOTO POINT 31 UT6 R2 – downstream *(07/14/2020)***

	
PHOTO POINT 32 UT7 – upstream *(04/27/2020)*	**PHOTO POINT 32 UT7 – downstream *(04/27/2020)***

VEGETATION PLOT PHOTOGRAPHS

FIXED VEG PLOT 1 *(4/27/2020)*

FIXED VEG PLOT 2 *(4/15/2020)*

FIXED VEG PLOT 3 *(4/27/2020)*

FIXED VEG PLOT 4 *(4/27/2020)*

FIXED VEG PLOT 5 *(4/15/2020)*

FIXED VEG PLOT 6 *(4/15/2020)*

FIXED VEG PLOT 7 *(4/15/2020)*

FIXED VEG PLOT 8 *(4/27/2020)*

RANDOM VEG PLOT 9 *(4/27/2020)*

RANDOM VEG PLOT 10 *(4/27/2020)*

RANDOM VEG PLOT 11 *(4/27/2020)*

RANDOM VEG PLOT 12 *(4/27/2020)*

APPENDIX 3. Vegetation Plot Data

Table 6a. Fixed Plots: Planted and Total Stem Counts

Dry Creek Mitigation Site
DMS Project No. 97082
Monitoring Year 0 - 2020

			Current Plot Data (MY0 2020)														
			VP 1			VP 2			VP 3			VP 4			VP 5		
Scientific Name	Common Name	Species Type	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T
Betula nigra	River Birch	Tree	8	8	8	2	2	2				2	2	2	7	7	7
Fraxinus pennsylvanica	Green Ash	Tree							3	3	3	1	1	1	1	1	1
Liriodendron tulipifera	Tulip Poplar	Tree	1	1	1				1	1	1	2	2	2	1	1	1
Platanus occidentalis	Sycamore	Tree	2	2	2	6	6	6	6	6	6	2	2	2			
Populus deltoides	Eastern Cottonwood	Tree	2	2	2				1	1	1				1	1	1
Quercus pagoda	Cherrybark Oak	Tree				2	2	2	3	3	3	1	1	1	2	2	2
Quercus michauxii	Swamp Chestnut Oak	Tree	1	1	1				1	1	1	5	5	5			
Quercus phellos	Willow Oak	Tree				2	2	2	1	1	1	1	1	1	1	1	1
		Stem count	14	14	14	12	12	12	16	16	16	14	14	14	13	13	13
		size (ares)		1			1			1			1			1	
		size (ACRES)		0.02			0.02			0.02			0.02			0.02	
		Species count	5	5	5	4	4	4	7	7	7	7	7	7	6	6	6
		Stems per ACRE	567	567	567	486	486	486	647	647	647	567	567	567	526	526	526

Color for Density

Exceeds requirements by 10%
Exceeds requirements, but by less than 10%
Fails to meet requirements, by less than 10%
Fails to meet requirements by more than 10%
Volunteer species included in total

PnLS: Number of planted stems excluding live stakes
P-all: Number of planted stems including live stakes
T: Total stems

Table 6a. Fixed Plots: Planted and Total Stem Counts

Dry Creek Mitigation Site
DMS Project No. 97082
Monitoring Year 0 - 2020

			Current Plot Data (MY0 2020)									Annual Means		
			VP 6			VP 7			VP 8			MY0 (2020)		
Scientific Name	Common Name	Species Type	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T
Betula nigra	River Birch	Tree	2	2	2	2	2	2	3	3	3	26	26	26
Fraxinus pennsylvanica	Green Ash	Tree	1	1	1				1	1	1	7	7	7
Liriodendron tulipifera	Tulip Poplar	Tree	3	3	3	2	2	2				10	10	10
Platanus occidentalis	Sycamore	Tree	2	2	2	4	4	4	4	4	4	26	26	26
Populus deltoides	Eastern Cottonwood	Tree	4	4	4	1	1	1				9	9	9
Quercus pagoda	Cherrybark Oak	Tree							1	1	1	9	9	9
Quercus michauxii	Swamp Chestnut Oak	Tree				2	2	2	1	1	1	10	10	10
Quercus phellos	Willow Oak	Tree				1	1	1	4	4	4	10	10	10
		Stem count	12	12	12	12	12	12	14	14	14	107	107	107
		size (ares)		1			1			1			8	
		size (ACRES)		0.02			0.02			0.02			0.20	
		Species count	5	5	5	6	6	6	6	6	6	8	8	8
		Stems per ACRE	486	486	486	486	486	486	567	567	567	541	541	541

Color for Density

Exceeds requirements by 10%
Exceeds requirements, but by less than 10%
Fails to meet requirements, by less than 10%
Fails to meet requirements by more than 10%
Volunteer species included in total

PnLS: Number of planted stems excluding live stakes
P-all: Number of planted stems including live stakes
T: Total stems

Table 6b. Random Plots: Planted and Total Stem Counts

Dry Creek Mitigation Site
DMS Project No. 97082
Monitoring Year 0 - 2020

Scientific Name	Common Name	Species Type	Current Plot Data (MY0 2020)								Annual Means	
			VP 9		VP 10		VP 11		VP 12		MY0 (2020)	
			Te	Total	Te	Total	Te	Total	Te	Total	Te	Total
Betula nigra	River Birch	Tree	6	6	2	2	6	6	2	2	16	16
Fraxinus pennsylvanica	Green Ash	Tree			1	1	1	1	1	1	3	3
Liriodendron tulipifera	Tulip Poplar	Tree	3	3	2	2	1	1			6	6
Platanus occidentalis	Sycamore	Tree			2	2	1	1	7	7	10	10
Populus deltoides	Eastern Cottonwood	Tree	1	1			1	1			2	2
Quercus pagoda	Cherrybark Oak	Tree	2	2					1	1	3	3
Quercus michauxii	Swamp Chestnut Oak	Tree			2	2	2	2	1	1	5	5
Quercus phellos	Willow Oak	Tree	3	3	1	1			2	2	6	6
		Stem count	15	15	10	10	12	12	14	14	51	51
		size (ares)	1		1		1		1		2	
		size (ACRES)	0.02		0.02		0.02		0.02		0.10	
		Species count	5	5	6	6	6	6	6	6	8	8
		Stems per ACRE	607	607	405	405	486	486	567	567	516	516

Color for Density

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

Te - Number of stems including exotic species

Total - Number of stems excluding exotic species

APPENDIX 4. Morphological Summary Data and Plots

Table 7a. Baseline Stream Data Summary
Dry Creek Mitigation Site
DMS Project No. 97082
Monitoring Year 0 - 2020

Dry Creek Reach 1 & 2

		PRE-RESTORATION CONDITION				REFERENCE REACH DATA						DESIGN				AS-BUILT/BASELINE			
Parameter	Gage	Dry Creek Reach 1		Dry Creek Reach 2		Long Branch		Spencer Creek 2		UT to Varnals		Dry Creek Reach 1		Dry Creek Reach 2		Dry Creek Reach 1		Dry Creek Reach 2	
		Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
Dimension and Substrate - Riffle																			
Bankfull Width (ft)	N/A	16		13.5		14.8	18.6	10.7	11.2	9.3	10.5	17.8		17.8		14.6	18.2	15.9	18.2
Floodprone Width (ft)		140		15		50		60	114	60	100	39	89	39	89	70	152	126	155
Bankfull Mean Depth		0.7		0.9		1.3	2.1	1.6	1.8	1.1	1.2	1.3		1.3		1.0	1.1	1.0	1.2
Bankfull Max Depth		2.5		1.3		1.9	2.9	2.1	2.6	1.5	1.7	1.6	2.0	1.6	2.0	1.6	1.8	1.8	2.1
Bankfull Cross Sectional Area (ft^2)		11.0		12.8		25.0	34.6	17.8	19.7	10.3	12.3	23.6		23.6		14.2	19.4	16.5	22.4
Width/Depth Ratio		23.0		14.2		7.9	13.8	5.8	7.1	8.1	9.3	13.0		13.0		14.9	17.1	14.7	15.3
Entrenchment Ratio		8.9		1.1		3.4		5.5	10.2	5.7	10.0	2.2	5.0	2.2	5.0	3.9	10.4	7.9	8.5
Bank Height Ratio		1.3		2.6		1.2	1.5	1.0		1.0		1.0		1.0		1.0		1.0	
D50 (mm)						---		---		---		---		---		33.9	36.7	30.0	47.7
Profile																			
Riffle Length (ft)	N/A																		
Riffle Slope (ft/ft)		---		---		0.0130	0.0120	0.0130		0.0240	0.0570	0.0056	0.0214	0.0087	0.0328	0.0034	0.0126	0.0056	0.0262
Pool Length (ft)																			
Pool Max Depth (ft)		---		---		2.2		3.3		2.5	2.6	4.0	5.3	4.0	5.3	3.3	5.4	3.4	4.8
Pool Spacing (ft)		---		---		50	105	71		8	82	28	126	28	126	67	137	46	121
Pool Volume (ft^3)																			
Pattern																			
Channel Beltwidth (ft)	N/A	27	57	41	89	60		38	41	15	45	45	142	36	117	45	142	36	117
Radius of Curvature (ft)		16	33	19	69	16	87	11	15	8.3	47	36	89	36	53	36	89	36	53
Rc:Bankfull Width (ft/ft)		1	2.1	1.4	5	1.1	4.7	1.3	1.4	0.57	3.2	2.0	5.0	2.0	3.0	2.0	5.0	2.0	3.0
Meander Length (ft)		5.7	13	98	346	66.0	191	46.0	48.0	---		53	303	134	267	53	303	134	267
Meander Width Ratio		1.7	3.6	3.1	7.0	3.2	4.1	3.4	3.6	---		2.5	8.0	2.0	6.6	2.5	8.0	2.0	6.6
Substrate, Bed and Transport Parameters																			
Ri%/Ru%/P%/G%/S%	N/A																		
SC%/Sa%/G%/C%/B%/Be%																			
d16/d35/d50/d84/d95/d100		---		1.1, 4.5, 11.3, 47.3, 126.9, -,-		8.1, 26.6, 41.6, 124.8, 225.5, -, -,		<0.062, 3, 8.8 42,90,-,-		---		---		---		SC, 0.63, 3.8, 46.3, 64.0, 128		SC, 9.38, 20.4, 78.1, 128, 362	
Reach Shear Stress (Competency) lb/ft^2		---		0.47								---		---		0.26	0.29	0.42	0.50
Max part size (mm) mobilized at bankfull																			
Stream Power (Capacity) W/m^2																			
Additional Reach Parameters																			
Drainage Area (SM)	N/A	0.67		0.95		1.49		0.96		0.41		0.67		0.95		0.67		0.95	
Watershed Impervious Cover Estimate (%)		0.8%		0.7%		---		---		---		0.8%		0.7%		0.8%		0.7%	
Rosgen Classification		C4		F4		C4/E4		E4		C4/E4		C4		C4		C4		C4	
Bankfull Velocity (fps)		3.4		4		3.6	4	4.9	5.4	4.5	5.4	2.5		3.4		2.4	2.5	3.1	3.4
Bankfull Discharge (cfs)		58		75		101	124	97		54		58		75		34	49	50	77
Q-NFF regression																			
Q-USGS extrapolation																			
Q-Mannings																			
Valley Length (ft)		---		---		---		---		---		---		---		---		---	
Channel Thalweg Length (ft)		999		2,014		---		---		---		1,278		1,950		1,247		1,918	
Sinuosity		1.19		1.07		1.30		2.30		1.20		1.20	1.30	1.20	1.30	1.30		1.20	
Water Surface Slope $(ft/ft)^2$		0.006		0.005		0.004		0.0047		0.0017		0.0059		0.0059		0.0034		0.0069	
Bankfull Slope (ft/ft)		---		---		---		---		---		0.0059		0.0059		0.0044		0.0067	

(---): Data was not provided

Table 7b. Baseline Stream Data Summary

Dry Creek Mitigation Site

DMS Project No. 97082

Monitoring Year 0 - 2020

Dry Creek Reach 3 & 4

		PRE-RESTORATION CONDITION				REFERENCE REACH DATA						DESIGN				AS-BUILT/BASELINE			
Parameter	Gage	Dry Creek Reach 3		Dry Creek Reach 4		Long Branch		Spencer Creek 2		UT to Varnals		Dry Creek Reach 3		Dry Creek Reach 4		Dry Creek Reach 3		Dry Creek Reach 4	
		Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
Dimension and Substrate - Riffle																			
Bankfull Width (ft)	N/A	1.9	1.4	1.9	1.4	14.8	18.6	10.7	11.2	9.3	10.5	17.8		17.8		16.9	17.6	16.7	
Floodprone Width (ft)		18	26	18	26	50		60	114	60	100	39	89	39	89	175	219	190	
Bankfull Mean Depth		1.2	1.5	1.2	1.5	1.3	2.1	1.6	1.8	1.1	1.2	1.3		1.3		1.1	1.3	1.2	
Bankfull Max Depth		1.6	2.5	1.6	2.5	1.9	2.9	2.1	2.6	1.5	1.7	1.5		1.5		2.0		2.1	
Bankfull Cross Sectional Area (ft^2)		15.0	27.9	15.0	27.9	25.0	34.6	17.8	19.7	10.3	12.3	23.6		23.6		18.1	22.4	20.5	
Width/Depth Ratio		11.2	12.7	11.2	12.7	7.9	13.8	5.8	7.1	8.1	9.3	13.0		13.0		13.9	15.9	13.5	
Entrenchment Ratio		1.4		1.4		3		5.5	10.2	5.7	10.0	2.2	5.0	2.2	5.0	9.9	12.9	11.4	
Bank Height Ratio		2.1		2.1		1.2	1.5	1.0		1.0		1.0		1.0		1.0		1.0	
D50 (mm)						---		---		---		---		---		30.4	32.0	42.6	
Profile																			
Riffle Length (ft)	N/A																		
Riffle Slope (ft/ft)		---		---		0.0130	0.0120	0.0130		0.0240	0.0570	0.0071	0.0268	0.0045	0.0050	0.0070	0.0166	0.0096	0.0236
Pool Length (ft)																			
Pool Max Depth (ft)		2.2	2.4	2.2	2.4	2.2		3.3		2.5	2.6	4.0	5.3	4.0	5.3	3.4	5.2	4.6	6.0
Pool Spacing (ft)		22	127	22	127	50	105	71		8	82	28	126	28	126	75	128	61	119
Pool Volume (ft^3)																			
Pattern																			
Channel Beltwidth (ft)	N/A	45	107	45	107	60		38	41	15	45	36	117	36	117	36	117	36	117
Radius of Curvature (ft)		24	78	24	78	16	87	11	15	8.3	47	36	53	36	53	36	53	36	53
Rc:Bankfull Width (ft/ft)		1.87	6	1.87	6	1.1	4.7	1.3	1.4	0.6	3.2	2.0	3.0	2.0	3.0	2.0	3.0	2.0	3.0
Meander Length (ft)		108	422	108	422	66.0	191	46.0	48.0	---		134	267	134	267	134	267	134	267
Meander Width Ratio		2.4	8.3	2.4	8.3	3.2	4.1	3.4	3.6	---		2.0	6.6	2.0	6.6	2.0	6.6	2.0	6.6
Substrate, Bed and Transport Parameters																			
Ri%/Ru%/P%/G%/S%	N/A																		
SC%/Sa%/G%/C%/B%/Be%																			
d16/d35/d50/d84/d95/d100		0.9, 5.0, 9.5, 27.2, 55.4, -, -		---		---		---		---		---		---		0.28, 2.24, 21.5, 68.5, 256, 512		0.28, 2.80, 16.8, 78.5, 168.1, 512	
Reach Shear Stress (Competency) lb/ft^2		0.43		---								---		---		0.32	0.37	0.39	
Max part size (mm) mobilized at bankfull																			
Stream Power (Capacity) W/m^2																			
Additional Reach Parameters																			
Drainage Area (SM)	N/A	1.09		1.26		1.49		0.96		0.41		1.09		1.26		1.09		1.26	
Watershed Impervious Cover Estimate (%)		0.8%		0.8%		---		---		---		0.8%		0.8%		0.8%		0.8%	
Rosgen Classification		F4		F4		C4/E4		E4		C4/E4		C4		C4		C4		C4	
Bankfull Velocity (fps)		1.9	4.1	1.9	4.1	3.6	4	4.9	5.4	4.5	5.4	3.2		3.8		2.7	3.0	3.0	
Bankfull Discharge (cfs)		83		92		101	124	97		54		83		92		48	67	62	
Q-NFF regression																			
Q-USGS extrapolation																			
Q-Mannings																			
Valley Length (ft)		---		---		---		---		---		---		---		---		---	
Channel Thalweg Length (ft)		1,955		1,495		---		---		---		1,603		1,140		1,593		1,135	
Sinuosity		1.39		1.39		1.30		2.30		1.20		1.20		1.20		1.20		1.20	
Water Surface Slope (ft/ft)[2]		0.0040		0.0040		---		---		0.0017		0.0054		0.0075		0.0049		0.0087	
Bankfull Slope (ft/ft)		---		---		0.004		0.005		---		0.0054		0.0075		0.0049		0.0053	

(---): Data was not provided

Table 7c. Baseline Stream Data Summary
Dry Creek Mitigation Site
DMS Project No. 97082
Monitoring Year 0 - 2020

UT1 Reach 2 & UT1A

		PRE-RESTORATION CONDITION				REFERENCE REACH DATA						DESIGN				AS-BUILT/BASELINE			
Parameter	**Gage**	**UT1 Reach 2**		**UT1A**		**UT to Wells**		**UT to Cane Creek**		**UT4 (UT to Cedar)**		**UT1 Reach 2**		**UT1A**		**UT1 Reach 2**		**UT1A**	
		Min	**Max**	**Min**	**Max**	**Min**	**Max**	**Min**	**Max**	**Min**	**Max**	**Min**	**Max**	**Min**	**Max**	**Min**	**Max**	**Min**	**Max**
Dimension and Substrate - Riffle																			
Bankfull Width (ft)	N/A	14		---		6.2	8.6	9.3		7.3		8.4		7.5		9.1		10.6	
Floodprone Width (ft)		18		---		15	25	>30		20		18	42	17	38	116		78	
Bankfull Mean Depth		0.4		---		0.6	1	0.9		0.6		0.6		0.7		0.4		0.8	
Bankfull Max Depth		1		---		0.6	1.4	1.5		1.1		1.0		1.0		0.8		1.4	
Bankfull Cross Sectional Area (ft^2)		5.1		---		3.9	6.3	8.6		4.2		5.4		5.2		3.6		8.3	
Width/Depth Ratio		38		---		6.1	12.6	10.1		12.6		13.0		11.0		23.0		13.5	
Entrenchment Ratio		1.3		---		1.9	4.1	>3.2		2.7		2.2	5.0	2.2	5.0	12.8		7.4	
Bank Height Ratio		2.7		---		1.0	1.8	1.0		1.0		1.0		1.0		1.0		1.0	
D50 (mm)				---		---		---		---		---		---		36.9		30.8	
Profile																			
Riffle Length (ft)	N/A																		
Riffle Slope (ft/ft)		---		---		0.0280		0.0057		0.0173		0.0148	0.0573	0.0102	0.0394	0.0107	0.0519	0.0198	0.0230
Pool Length (ft)																			
Pool Max Depth (ft)		---		1.1		---		2.2		1.4	1.5	1.9	2.6	2.1	2.8	1.4	2.9	2.0	2.7
Pool Spacing (ft)		48	112	23		17	63	14.8	87	18	24	13	52	12	47	33	58	28	42
Pool Volume (ft^3)																			
Pattern																			
Channel Beltwidth (ft)	N/A	23	25	---		10	35	15	50	3	6	17	45	15	41	17	45	15	41
Radius of Curvature (ft)		6	13	---		2	32	9	26	5	13	17	25	15	23	17	25	15	23
Rc:Bankfull Width (ft/ft)		0.4	1	---		0.3	4.5	0.9	2.8	0.7	1.7	2.0	3.0	2.0	3.0	2.0	3.0	2.0	3.0
Meander Length (ft)		93	145	---		---		---		---		63	126	56	113	63	126	56	113
Meander Width Ratio		1.6	1.8	---		---		---		---		2.0	5.4	2.0	5.4	2.0	5.4	2.0	5.4
Substrate, Bed and Transport Parameters																			
Ri%/Ru%/P%/G%/S%	N/A																		
SC%/Sa%/G%/C%/B%/Be%																			
d16/d35/d50/d84/d95/d100		---		---		---		---		---		---		---		SC, 5.94, 12.7, 58.1, 90, 362		0.11, 4.0, 7.1, 60.4, 11.2, 256	
Reach Shear Stress (Competency) lb/ft^2		0.69		---		---		---		---						0.40		1.08	
Max part size (mm) mobilized at bankfull																			
Stream Power (Capacity) W/m^2																			
Additional Reach Parameters																			
Drainage Area (SM)	N/A	0.14		0.03		0.13		0.28		0.11		0.14		0.03		0.14		0.03	
Watershed Impervious Cover Estimate (%)		1.4%		2.2%		---		---		---		1.4%		2.2%		1.4%		2.2%	
Rosgen Classification		---		---		C4/1		C4/E4		C4		C4		C4		C4		C4	
Bankfull Velocity (fps)		2.7		---		3.8		2.2		5.2	6.1	3.6		4.1		2.6		4.7	
Bankfull Discharge (cfs)		20		---		15		19		22	26	20		8		9		39	
Q-NFF regression																			
Q-USGS extrapolation																			
Q-Mannings																			
Valley Length (ft)		---		---		---		---		---		---		---		---		---	
Channel Thalweg Length (ft)		945		90		---		---		---		1,118		166		1,106		165	
Sinuosity		1.1		1.1		1.4		1.2		1.1		1.2		1.2		1.2		1.2	
Water Surface Slope $(ft/ft)^2$		0.0160		0.0100		0.0199		0.0046		0.0156		0.0180		0.0210		0.0179		0.0119	
Bankfull Slope (ft/ft)		---		---		0.0199		0.0046		0.0156		0.0180		0.0210		0.0168		0.0230	

(---): Data was not provided

Table 7d. Baseline Stream Data Summary
Dry Creek Mitigation Site
DMS Project No. 97082
Monitoring Year 0 - 2020

UT5 Reach 1 & UT6 Reach 1

		PRE-RESTORATION CONDITION				REFERENCE REACH DATA						DESIGN				AS-BUILT/BASELINE			
Parameter	Gage	UT5 Reach 1		UT6 Reach 1		UT to Wells		UT to Cane Creek		UT4 (UT to Cedar)		UT5 Reach 1		UT6 Reach 1		UT5 Reach 1		UT6 Reach 1	
		Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
Dimension and Substrate - Riffle																			
Bankfull Width (ft)	N/A	3.4		3	4.6	6.2	8.6	9.3		7.3		6.8		5.2		8.3		5.5	
Floodprone Width (ft)		5		4	150	15	25	>30		20		15	34	11	25	20		55	
Bankfull Mean Depth		0.6		0.4	0.5	0.6	1	0.9		0.6		0.5		0.4		0.8		0.5	
Bankfull Max Depth		0.9		0.6		0.6	1.4	1.5		1.1		0.8		0.6		1.3		1.0	
Bankfull Cross Sectional Area (ft^2)		1.9		1.4	1.9	3.9	6.3	8.6		4.2		3.7		2.0		7.0		2.9	
Width/Depth Ratio		5.9		6.3	11.5	6.1	12.6	10.1		12.6		13.0		13.0		9.8		10.4	
Entrenchment Ratio		1.4		1.2	32.4	1.9	4.1	>3.2		2.7		2.2	5.0	2.2	5.0	2.4		10.0	
Bank Height Ratio		3.0		1.2	6.9	1.0	1.8	1.0		1.0		1.0		1.0		1.0		1.0	
D50 (mm)						---		---		---		---		---		16.0		25.4	
Profile																			
Riffle Length (ft)	N/A																		
Riffle Slope (ft/ft)		---		---		0.0280		0.0057		0.0173		0.0309	0.1201	0.0310	0.1205	0.0110	0.0670	0.0175	0.1073
Pool Length (ft)																			
Pool Max Depth (ft)		---		0.4	0.8	---		2.2		1.4	1.5	1.6	2.1	1.2	1.5	2.4	3.2	0.8	2.3
Pool Spacing (ft)		23	116	17	283	17	63	14.8	87	18	24	11	42	8	31	19	74	10	25
Pool Volume (ft^3)																			
Pattern																			
Channel Beltwidth (ft)	N/A	22	33	13	30	10	35	15	50	3	6	14	37	10	27	14	37	10	27
Radius of Curvature (ft)		9	25	5	47	2	32	9	26	5	13	14	20	10	15	14	20	10	15
Rc:Bankfull Width (ft/ft)		2.5	7	0.4	15.7	0.3	4.5	0.9	2.8	0.7	1.7	2.0	3.0	2.0	3.0	2.0	3.0	2.0	3.0
Meander Length (ft)		47	175	25	141	---		---		---		51	102	38	75	51	102	38	75
Meander Width Ratio		14.0	51.0	2.8	10.0	---		---		---		2.0	5.4	2.0	5.4	2.0	5.4	2.0	5.4
Substrate, Bed and Transport Parameters																			
Ri%/Ru%/P%/G%/S%	N/A																		
SC%/Sa%/G%/C%/B%/Be%																			
d16/d35/d50/d84/d95/d100		---		1.2, 6.2, 10.6, 64, 119.3, -, -		---		---		---		---		---		0.16, 4.0, 11.0, 41.3, 90.0, 180		1.0, 1.87, 8.7, 55.6, 120.7, 180	
Reach Shear Stress (Competency) lb/ft^2		---		0.62		---		---		---						1.14		0.96	
Max part size (mm) mobilized at bankfull																			
Stream Power (Capacity) W/m^2																			
Additional Reach Parameters																			
Drainage Area (SM)	N/A	0.06		0.03		0.13		0.28		0.11		0.06		0.03		0.06		0.03	
Watershed Impervious Cover Estimate (%)		0.0%		0.0%		---		---		---		0.0%		0.0%		0.0%		0.0%	
Rosgen Classification		---		E4		C4/1		C4/E4		C4		C4b		C4b		C4b		C4b	
Bankfull Velocity (fps)		3.7		1.9	2.4	3.8		2.2		5.2	6.1	3.2		3.2		4.8		4.1	
Bankfull Discharge (cfs)		11.5		6.4		15.0		19.4		21.7	25.8	11.5		6.4		33.7		12.0	
Q-NFF regression																			
Q-USGS extrapolation																			
Q-Mannings																			
Valley Length (ft)		---		---		---		---		---		---		---		---		---	
Channel Thalweg Length (ft)		137		582		---		---		---		378		617		365		612	
Sinuosity		1.2		1.2		1.4		1.2		1.1		1.2		1.2		1.2		1.2	
Water Surface Slope $(ft/ft)^2$		0.0330		0.0260		0.0199		0.0046		0.0156		0.0180		0.0270		0.0268		0.0324	
Bankfull Slope (ft/ft)		---		---		0.0199		0.0046		0.0156		0.0180		0.0270		0.0236		0.0310	

(---): Data was not provided

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

Dry Creek Mitigation Site

DMS Project No. 97082

Monitoring Year 0 - 2020

	Dry Creek Reach 1																		Dry Creek Reach 2					
	Cross-Section 1 (Riffle)						Cross-Section 2 (Pool)						Cross-Section 3 (Riffle)						Cross-Section 4 (Pool)					
Dimension and Substrate	**Base**	**MY1**	**MY2**	**MY3**	**MY5**	**MY7**	**Base**	**MY1**	**MY2**	**MY3**	**MY5**	**MY7**	**Base**	**MY1**	**MY2**	**MY3**	**MY5**	**MY7**	**Base**	**MY1**	**MY2**	**MY3**	**MY5**	**MY7**
Bankfull Elevation (ft)	424.23						424.30							422.77					418.19					
Low Bank Elevation (ft)	424.23						424.30							422.77					418.19					
Bankfull Width (ft)	14.6						21.8							18.2					24.1					
Floodprone Width (ft)	152						N/A							70					N/A					
Bankfull Mean Depth (ft)	1.0						2.1							1.1					2.7					
Bankfull Max Depth (ft)	1.6						3.9							1.8					4.4					
Bankfull Cross-Sectional Area (ft^2)	14.2						46.4							19.4					65.4					
Bankfull Width/Depth Ratio	14.9						10.2							17.1					8.9					
Entrenchment Ratio[1]	10.4						N/A							3.9					N/A					
Bankfull Bank Height Ratio[2]	1.0						N/A							1.0					N/A					

	Dry Creek Reach 2																		Dry Creek Reach 3					
	Cross-Section 5 (Riffle)						Cross-Section 6 (Riffle)						Cross-Section 7 (Pool)						Cross-Section 8 (Pool)					
Dimension and Substrate	**Base**	**MY1**	**MY2**	**MY3**	**MY5**	**MY7**	**Base**	**MY1**	**MY2**	**MY3**	**MY5**	**MY7**	**Base**	**MY1**	**MY2**	**MY3**	**MY5**	**MY7**	**Base**	**MY1**	**MY2**	**MY3**	**MY5**	**MY7**
Bankfull Elevation (ft)	418.18						413.29						412.88						405.36					
Low Bank Elevation (ft)	418.18						413.29						412.88						405.36					
Bankfull Width (ft)	18.2						15.9						22.1						22.3					
Floodprone Width (ft)	155						126						N/A						N/A					
Bankfull Mean Depth (ft)	1.2						1.0						2.5						2.3					
Bankfull Max Depth (ft)	2.1						1.8						5.2						4.1					
Bankfull Cross-Sectional Area (ft^2)	22.4						16.5						55.2						52.3					
Bankfull Width/Depth Ratio	14.7						15.3						8.9						9.5					
Entrenchment Ratio[1]	8.5						7.9						N/A						N/A					
Bankfull Bank Height Ratio[2]	1.0						1.0						N/A						N/A					

	Dry Creek Reach 3												Dry Creek Reach 4											
	Cross-Section 9 (Riffle)						Cross-Section 10 (Riffle)						Cross-Section 11 (Riffle)						Cross-Section 12 (Pool)					
Dimension and Substrate	**Base**	**MY1**	**MY2**	**MY3**	**MY5**	**MY7**	**Base**	**MY1**	**MY2**	**MY3**	**MY5**	**MY7**	**Base**	**MY1**	**MY2**	**MY3**	**MY5**	**MY7**	**Base**	**MY1**	**MY2**	**MY3**	**MY5**	**MY7**
Bankfull Elevation (ft)	405.37						402.52						396.59						396.54					
Low Bank Elevation (ft)	405.37						402.52						396.59						396.54					
Bankfull Width (ft)	17.6						16.9						16.7						20.3					
Floodprone Width (ft)	175						219						190						N/A					
Bankfull Mean Depth (ft)	1.3						1.1						1.2						2.3					
Bankfull Max Depth (ft)	2.0						2.0						2.1						5.0					
Bankfull Cross-Sectional Area (ft^2)	22.4						18.1						20.5						46.8					
Bankfull Width/Depth Ratio	13.9						15.9						13.5						8.8					
Entrenchment Ratio[1]	9.9						12.9						11.4						N/A					
Bankfull Bank Height Ratio[2]	1.0						1.0						1.0						N/A					

[1]Entrenchment Ratio is calculated using the method specified in the Industry Technical Workgroup Memorandum

[2]Bank Height Ratio is calculated using the method specified in the Industry Technical Workgroup Memorandum

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

Dry Creek Mitigation Site

DMS Project No. 97082

Monitoring Year 0 - 2020

	UT1 Reach 2												UT1A						UT5 Reach 1					
	Cross-Section 13 (Riffle)						Cross-Section 14 (Pool)						Cross-Section 15 (Riffle)						Cross-Section 16 (Pool)					
Dimension and Substrate	**Base**	**MY1**	**MY2**	**MY3**	**MY5**	**MY7**	**Base**	**MY1**	**MY2**	**MY3**	**MY5**	**MY7**	**Base**	**MY1**	**MY2**	**MY3**	**MY5**	**MY7**	**Base**	**MY1**	**MY2**	**MY3**	**MY5**	**MY7**
Bankfull Elevation (ft)	433.07						432.64						431.67						417.85					
Low Bank Elevation (ft)	433.07						432.64						431.67						417.85					
Bankfull Width (ft)	9.1						11.4						10.6						6.8					
Floodprone Width (ft)	116						N/A						78						N/A					
Bankfull Mean Depth (ft)	0.4						0.9						0.8						1.4					
Bankfull Max Depth (ft)	0.8						1.8						1.4						2.0					
Bankfull Cross-Sectional Area (ft^2)	3.6						10.7						8.3						9.4					
Bankfull Width/Depth Ratio	23.0						12.1						13.5						5.0					
Entrenchment Ratio[1]	12.8						N/A						7.4						N/A					
Bankfull Bank Height Ratio[2]	1.0						N/A						1.0						N/A					

	UT5 Reach 1						UT6 Reach 1											
	Cross-Section 17 (Riffle)						Cross-Section 18 (Riffle)						Cross-Section 19 (Pool)					
Dimension and Substrate	**Base**	**MY1**	**MY2**	**MY3**	**MY5**	**MY7**	**Base**	**MY1**	**MY2**	**MY3**	**MY5**	**MY7**	**Base**	**MY1**	**MY2**	**MY3**	**MY5**	**MY7**
Bankfull Elevation (ft)	417.15						410.70						409.60					
Low Bank Elevation (ft)	417.15						410.70						409.60					
Bankfull Width (ft)	8.3						5.5						6.7					
Floodprone Width (ft)	20						55						N/A					
Bankfull Mean Depth (ft)	0.8						0.5						0.8					
Bankfull Max Depth (ft)	1.3						1.0						1.9					
Bankfull Cross-Sectional Area (ft^2)	7.0						2.9						5.2					
Bankfull Width/Depth Ratio	9.8						10.4						8.6					
Entrenchment Ratio[1]	2.4						10.0						N/A					
Bankfull Bank Height Ratio[2]	1.0						1.0						N/A					

[1]Entrenchment Ratio is calculated using the method specified in the Industry Technical Workgroup Memorandum

[2]Bank Height Ratio is calculated using the method specified in the Industry Technical Workgroup Memorandum

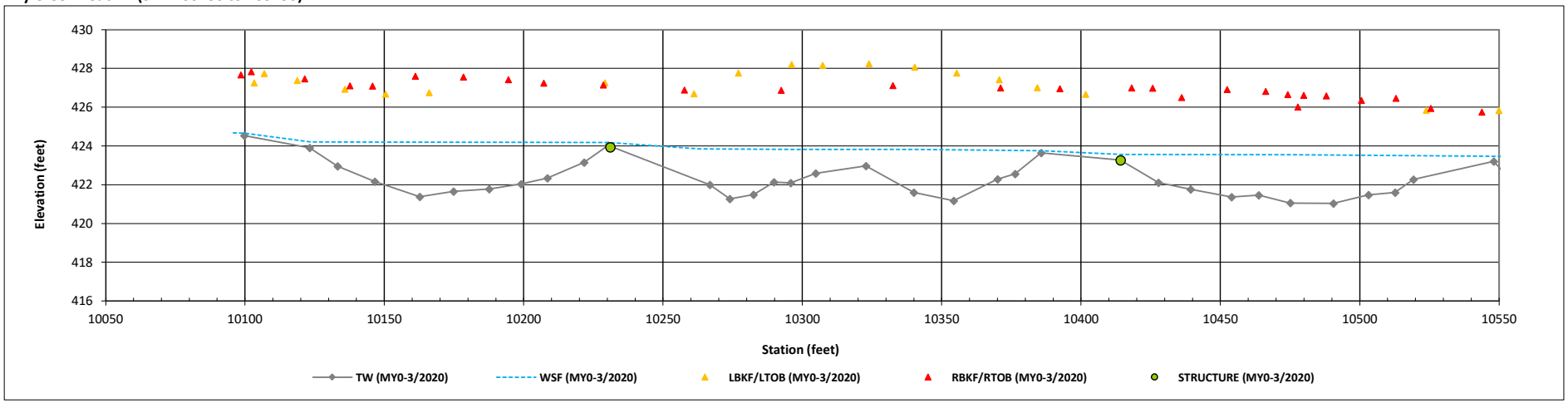
Longitudinal Profile Plots

Dry Creek Mitigation Site

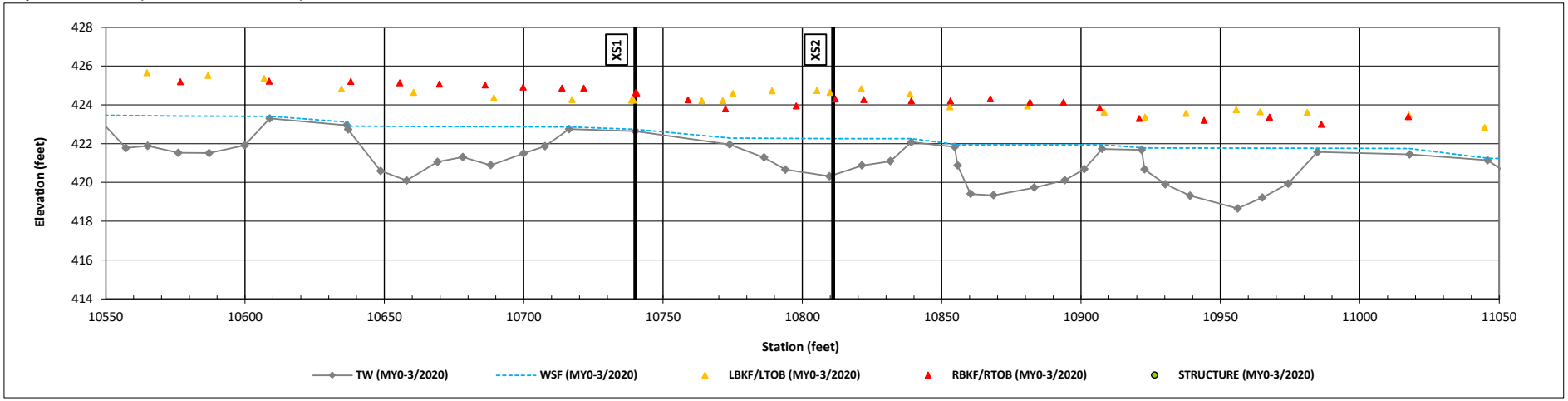
DMS Project No. 97082

Monitoring Year 0 - 2020

Dry Creek Reach 1 (STA 100+80 to 105+50)



Dry Creek Reach 1 (STA 105+50 to 110+50)



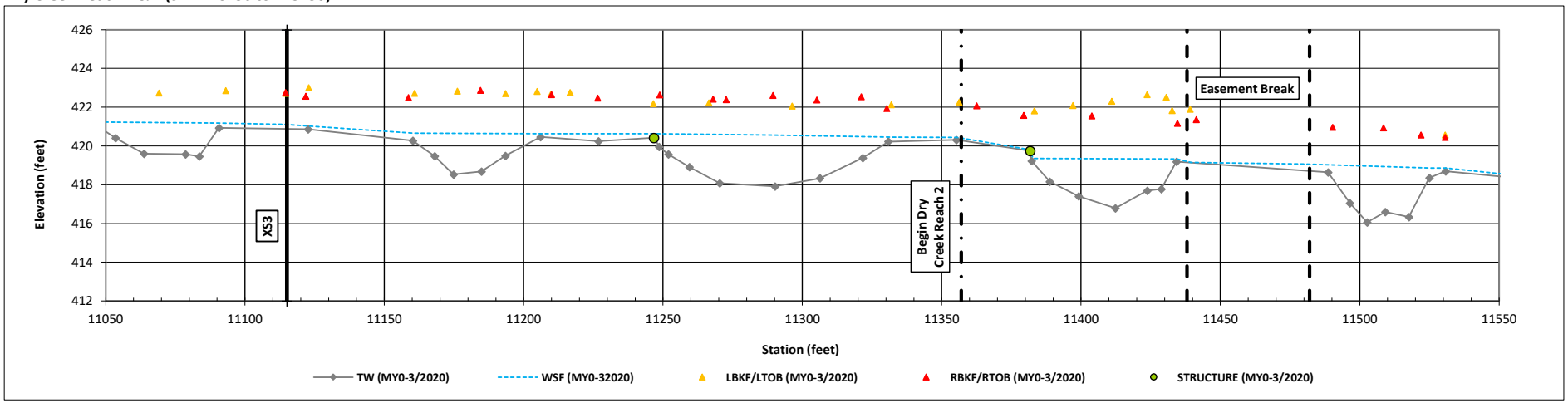
Longitudinal Profile Plots

Dry Creek Mitigation Site

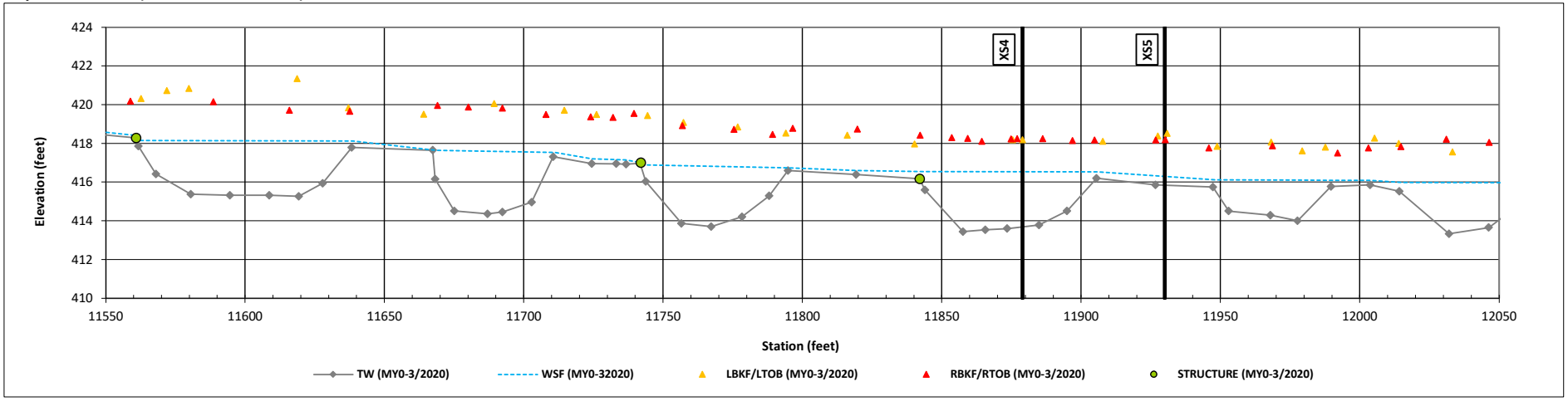
DMS Project No. 97082

Monitoring Year 0 - 2020

Dry Creek Reach 1 & 2 (STA 110+50 to 115+50)



Dry Creek Reach 2 (STA 115+50 to 120+50)



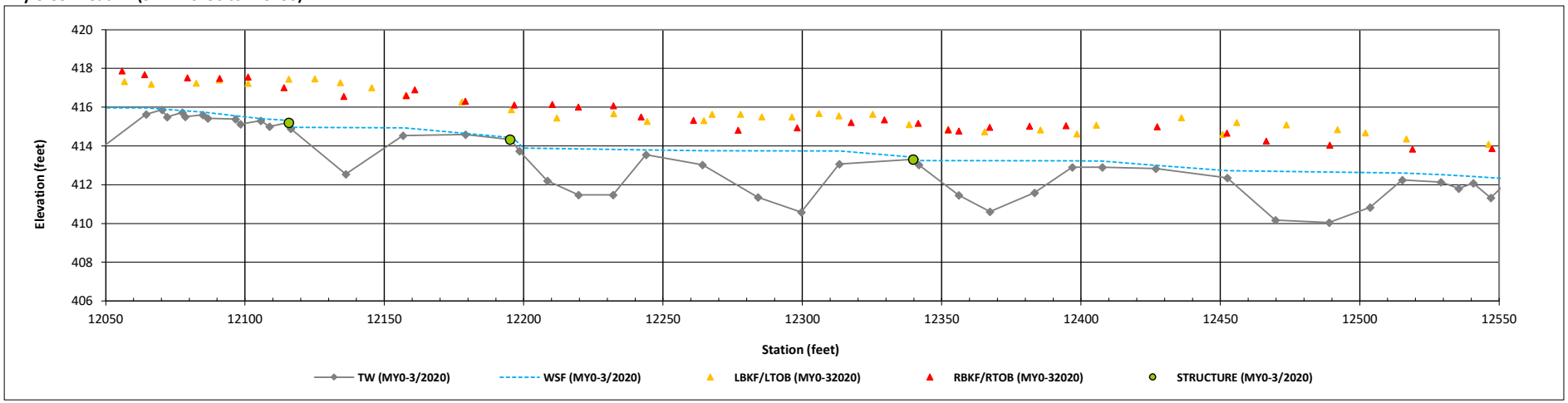
Longitudinal Profile Plots

Dry Creek Mitigation Site

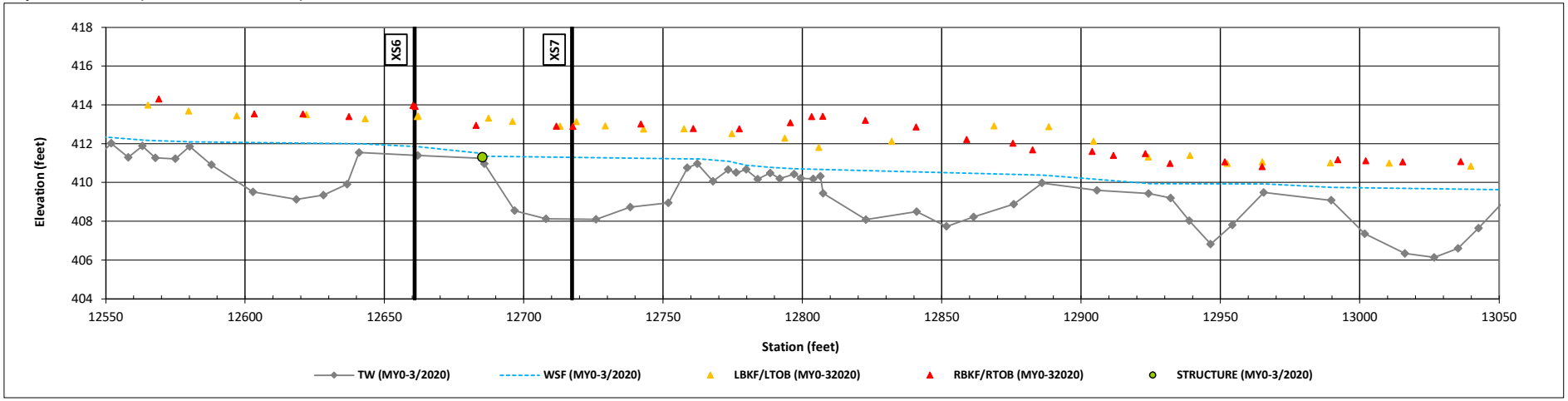
DMS Project No. 97082

Monitoring Year 0 - 2020

Dry Creek Reach 2 (STA 120+50 to 125+50)



Dry Creek Reach 2 (STA 125+50 to 130+50)



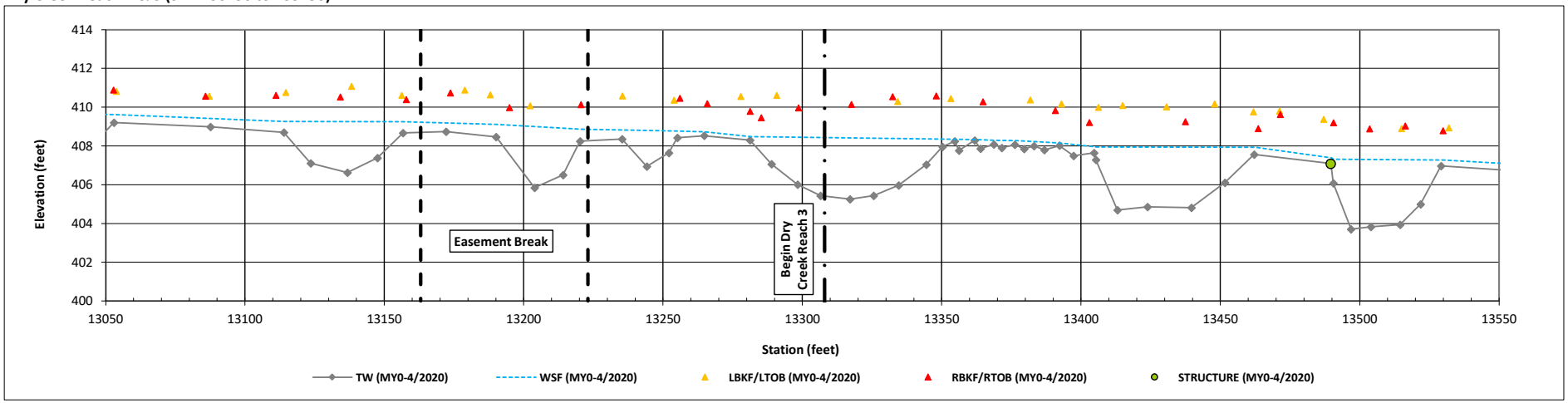
Longitudinal Profile Plots

Dry Creek Mitigation Site

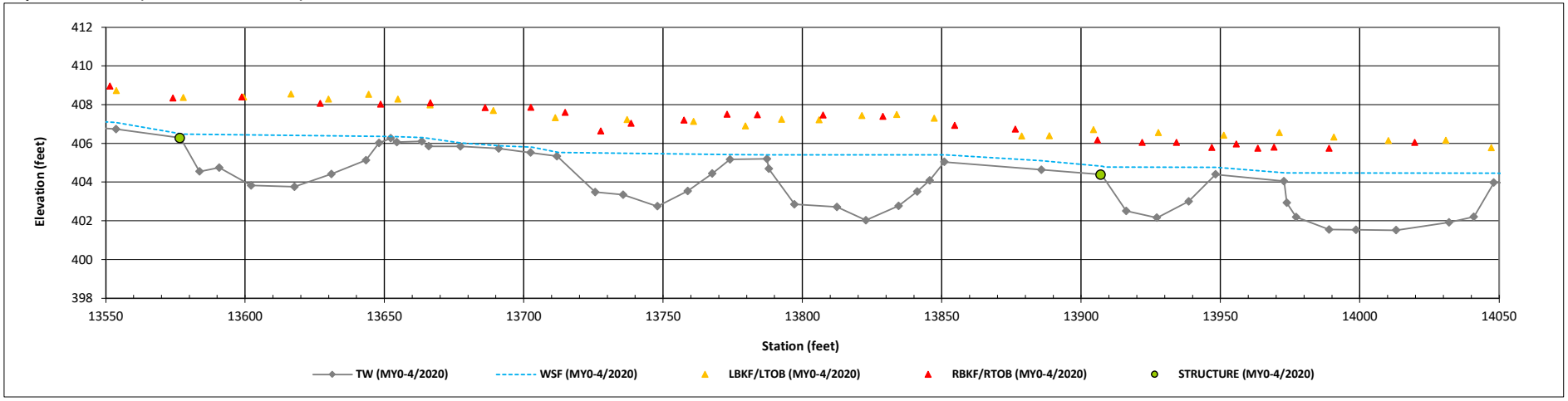
DMS Project No. 97082

Monitoring Year 0 - 2020

Dry Creek Reach 2 & 3 (STA 130+50 to 135+50)



Dry Creek Reach 3 (STA 135+50 to 140+50)



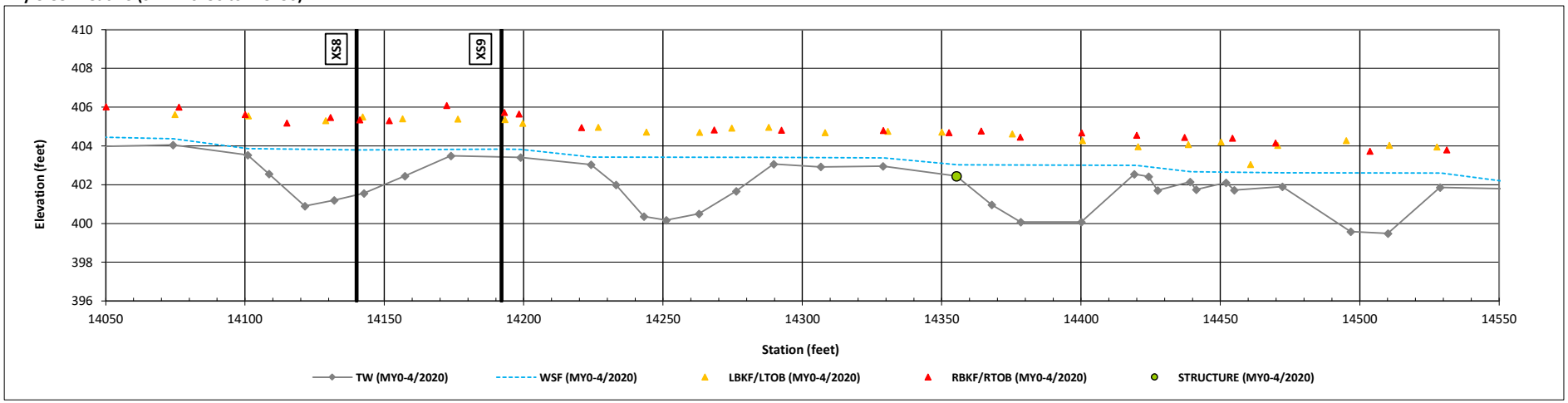
Longitudinal Profile Plots

Dry Creek Mitigation Site

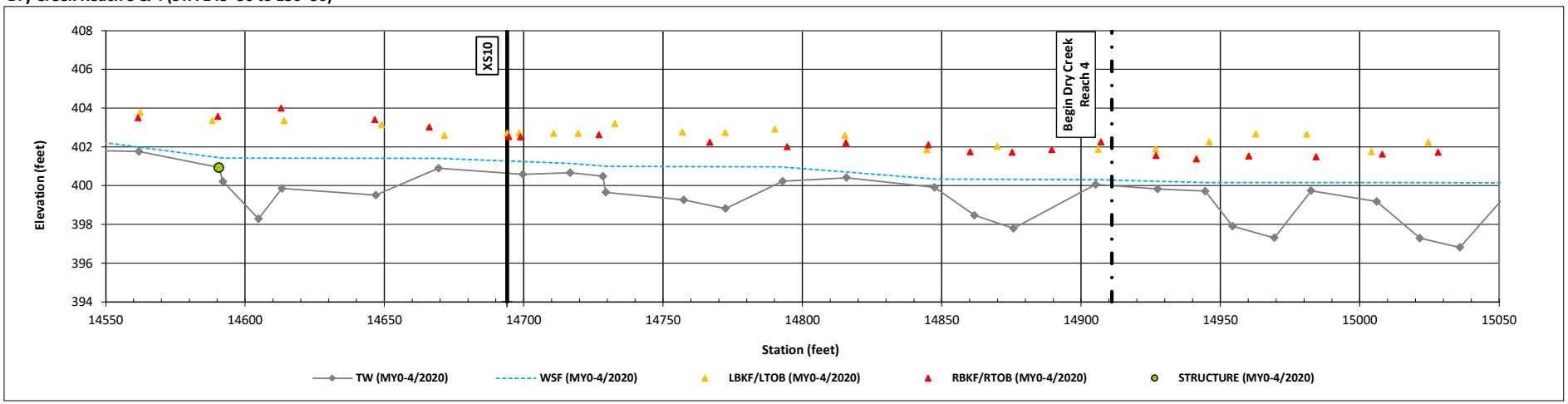
DMS Project No. 97082

Monitoring Year 0 - 2020

Dry Creek Reach 3 (STA 140+50 to 145+50)



Dry Creek Reach 3 & 4 (STA 145+50 to 150+50)



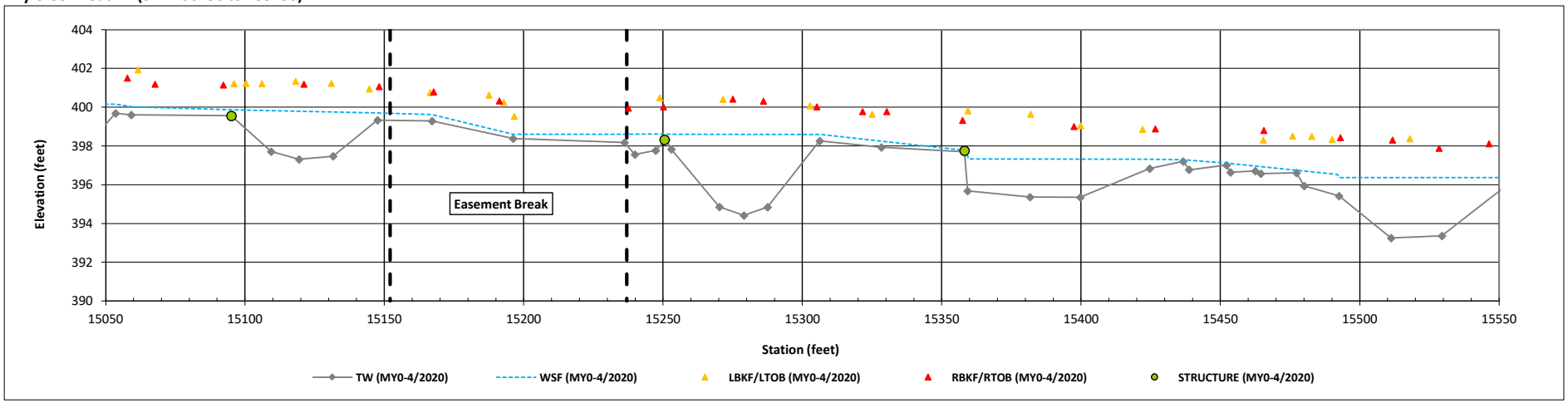
Longitudinal Profile Plots

Dry Creek Mitigation Site

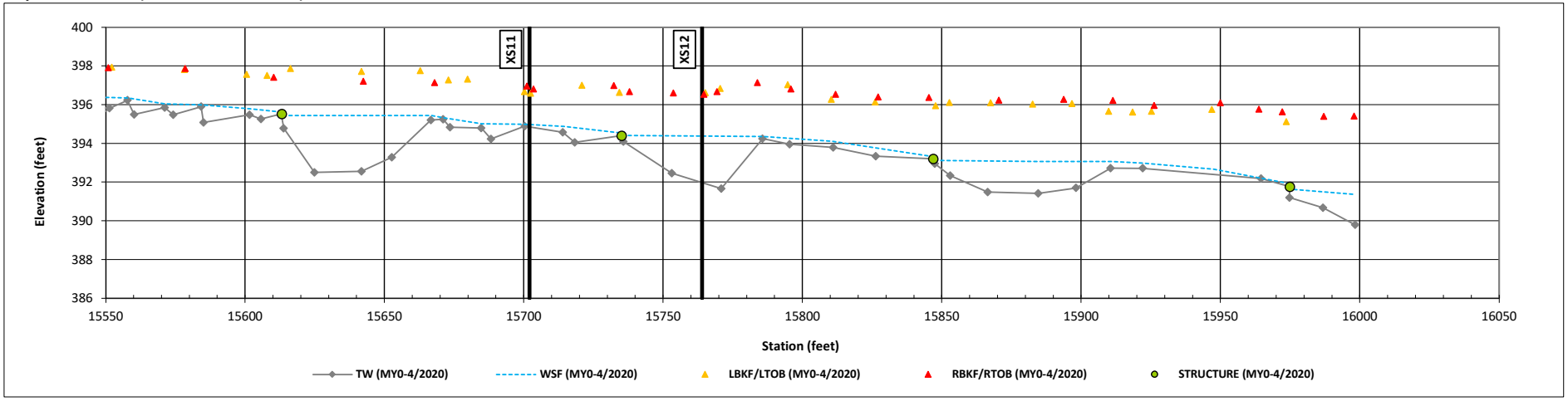
DMS Project No. 97082

Monitoring Year 0 - 2020

Dry Creek Reach 4 (STA 150+50 to 155+50)



Dry Creek Reach 4 (STA 155+50 to 160+50)



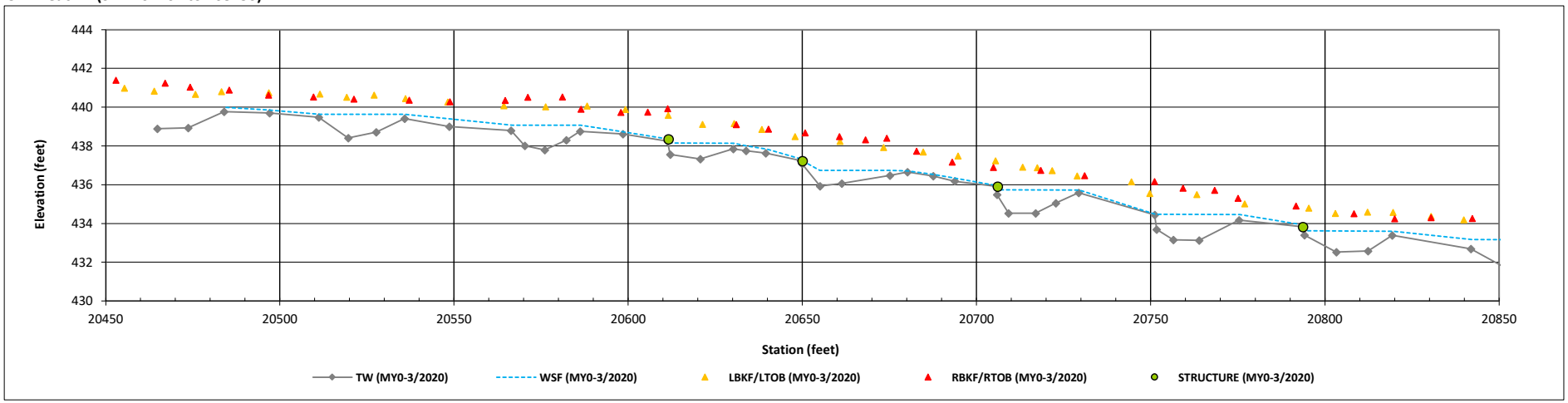
Longitudinal Profile Plots

Dry Creek Mitigation Site

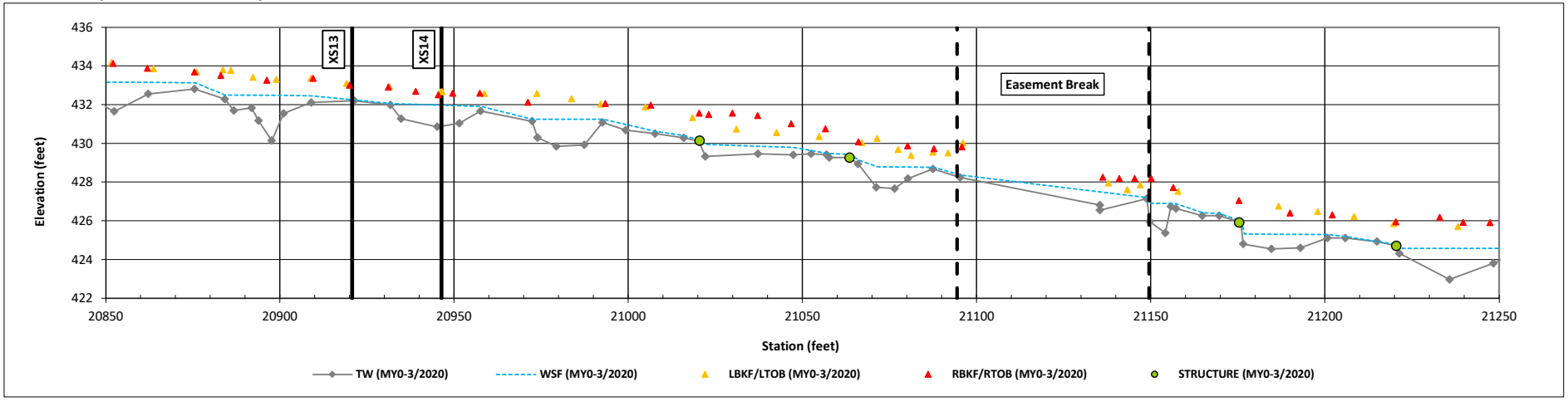
DMS Project No. 97082

Monitoring Year 0 - 2020

UT1 Reach 2 (STA 204+64 to 208+50)



UT1 Reach 2 (STA 208+50 to 212+50)



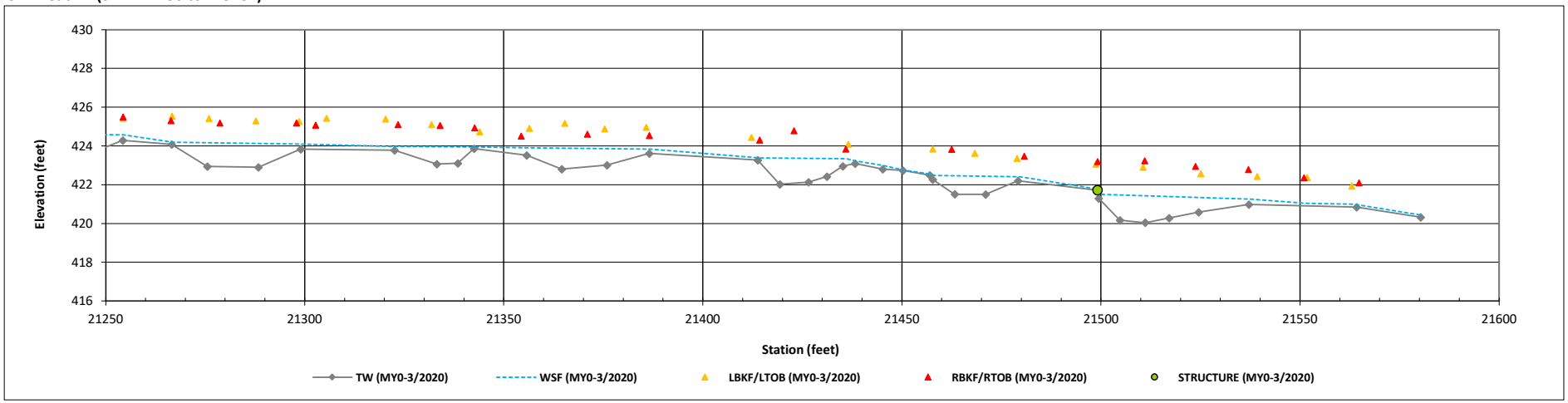
Longitudinal Profile Plots

Dry Creek Mitigation Site

DMS Project No. 97082

Monitoring Year 0 - 2020

UT1 Reach 2 (STA 212+50 to 215+82)



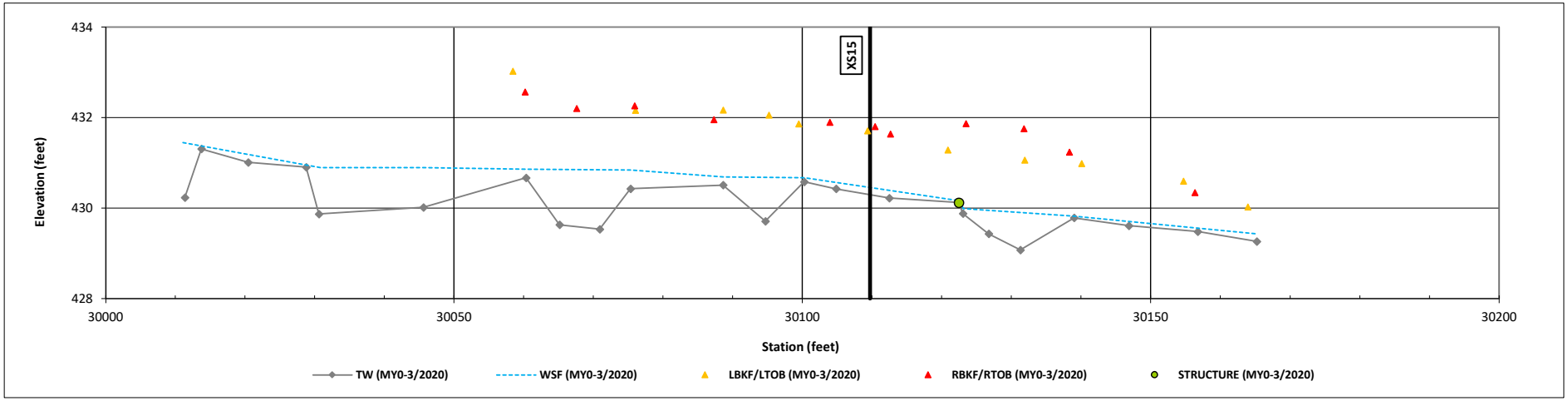
Longitudinal Profile Plots

Dry Creek Mitigation Site

DMS Project No. 97082

Monitoring Year 0 - 2020

UT1A (STA 300+00 to 301+66)



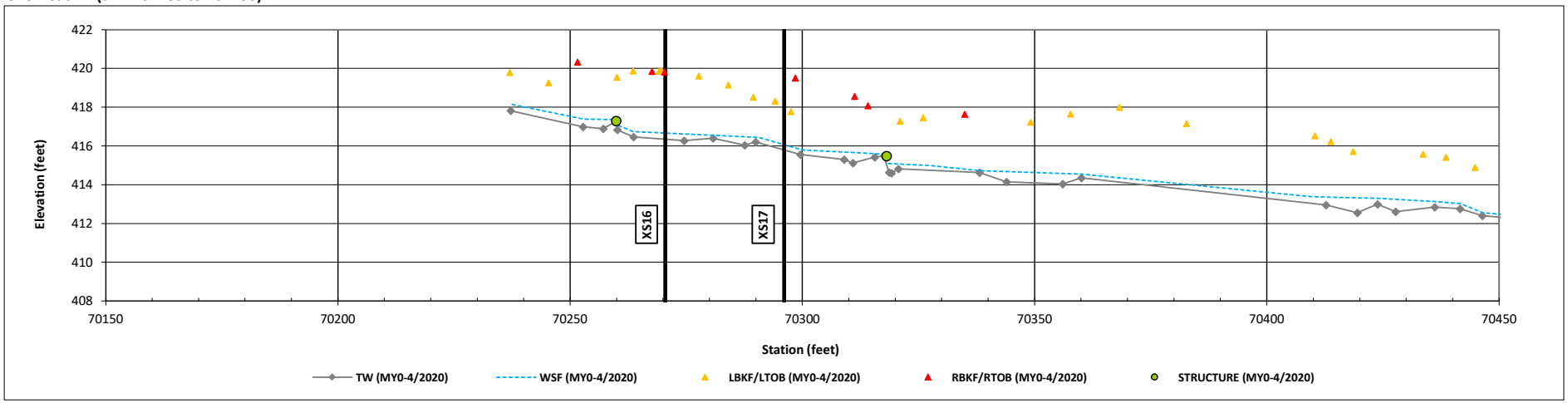
Longitudinal Profile Plots

Dry Creek Mitigation Site

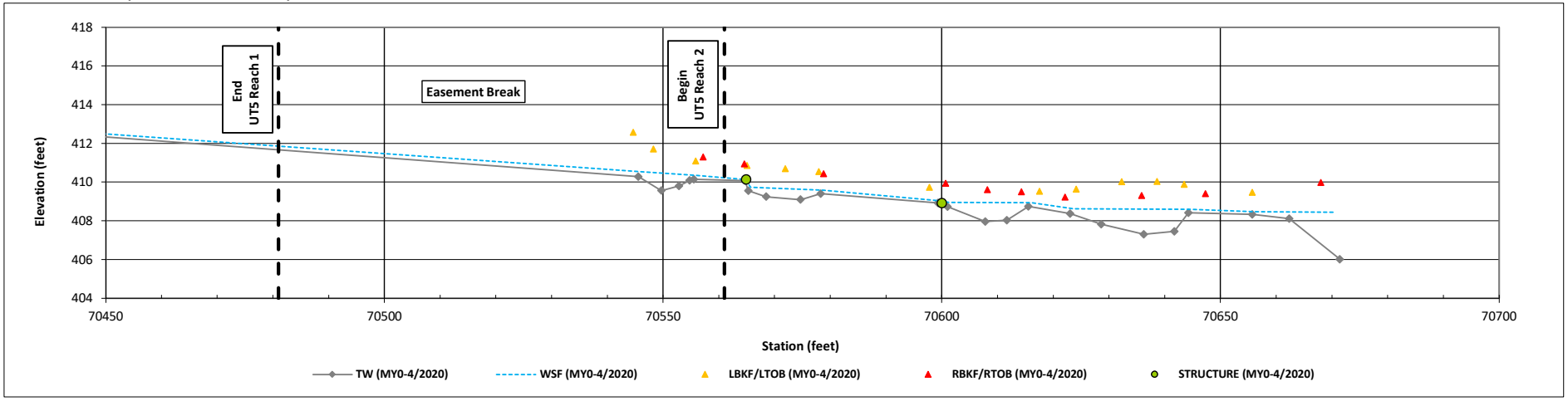
DMS Project No. 97082

Monitoring Year 0 - 2020

UT5 Reach 1 (STA 701+83 to 704+50)



UT5 Reach 1 & 2 (STA 704+50 to 706+80)



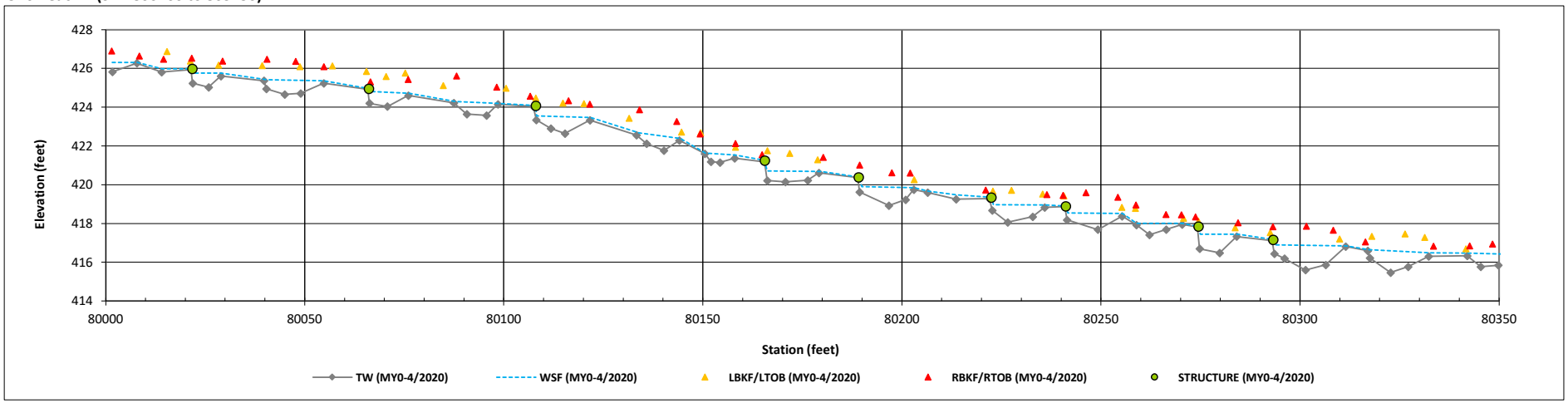
Longitudinal Profile Plots

Dry Creek Mitigation Site

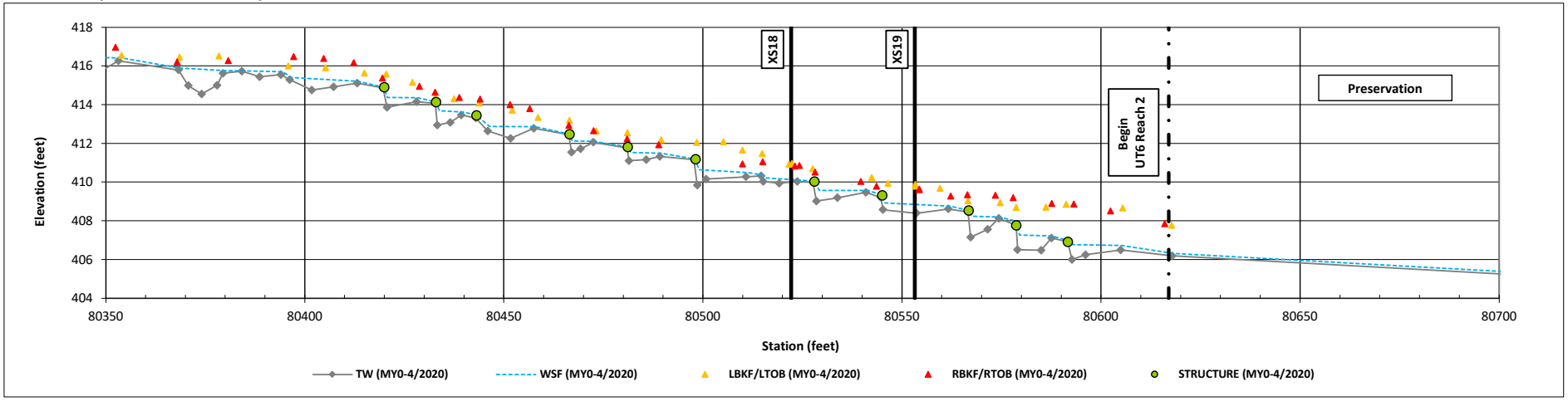
DMS Project No. 97082

Monitoring Year 0 - 2020

UT6 Reach 1 (STA 800+00 to 803+50)



UT6 Reach 1 (STA 803+50 to 806+17)



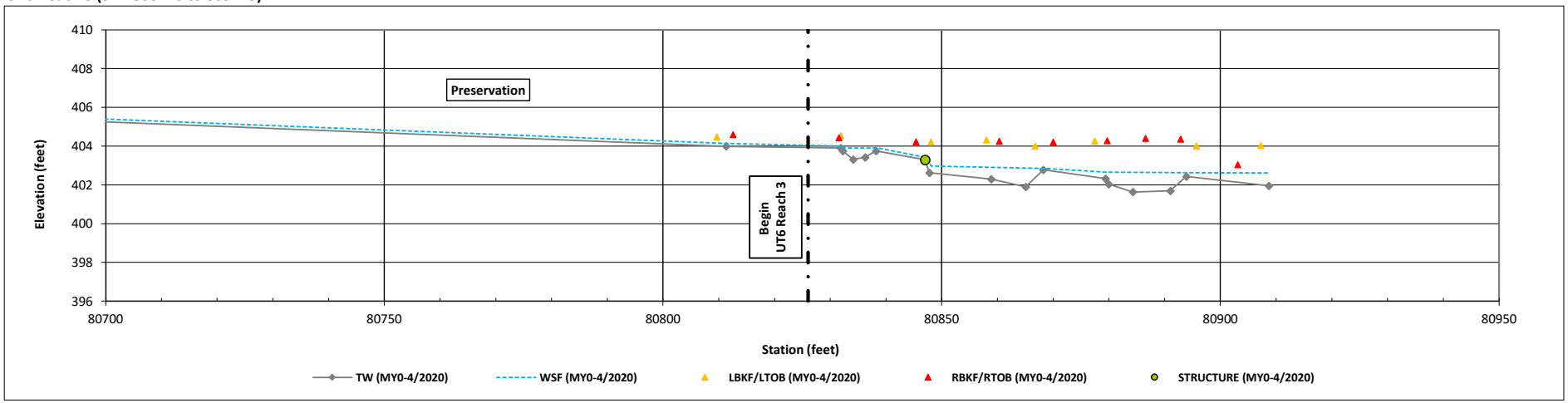
Longitudinal Profile Plots

Dry Creek Mitigation Site

DMS Project No. 97082

Monitoring Year 0 - 2020

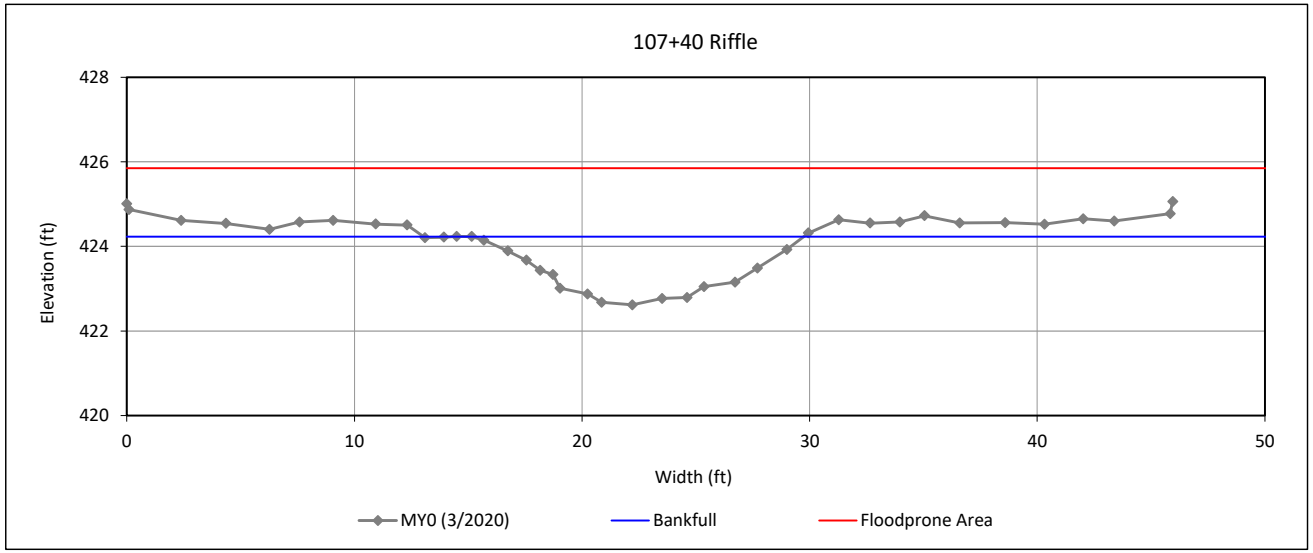
UT6 Reach 3 (STA 808+26 to 809+15)



Cross-Section Plots

Dry Creek Mitigation Site
DMS Project No. 97082
Monitoring Year 0 - 2020

Cross-Section 1 - Dry Creek Reach 1



Bankfull Dimensions

14.2	x-section area (ft.sq.)
14.6	width (ft)
1.0	mean depth (ft)
1.6	max depth (ft)
15.1	wetted perimeter (ft)
0.9	hydraulic radius (ft)
14.9	width-depth ratio
152.0	W flood prone area (ft)
10.4	entrenchment ratio
1.0	low bank height ratio

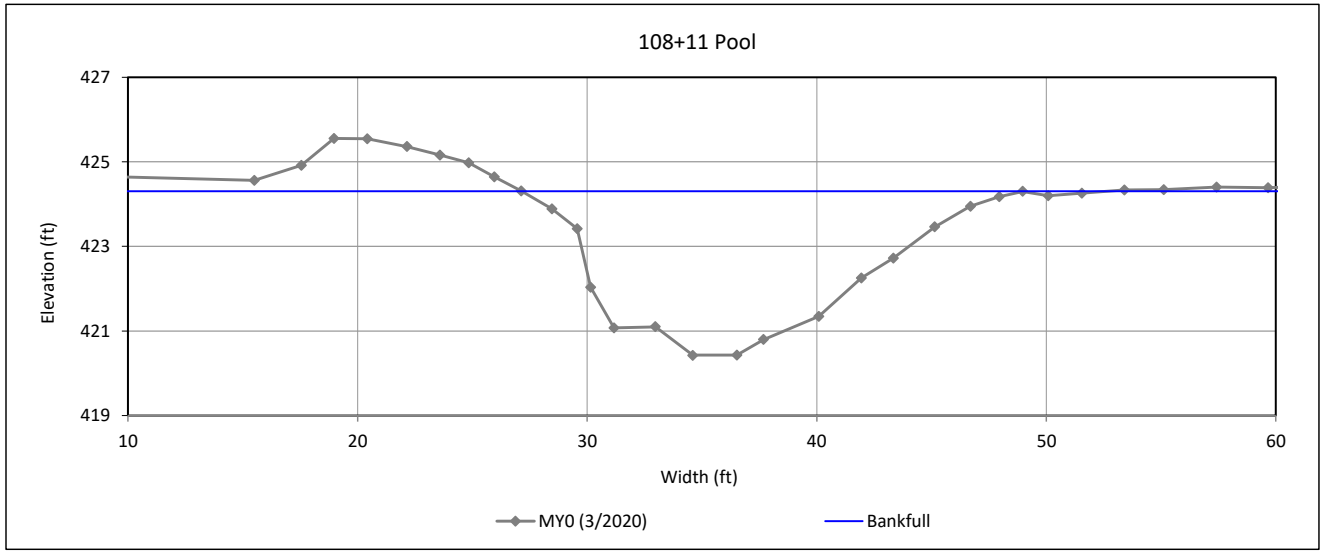
Survey Date: 3/2020
Field Crew: Kee Mapping & Surveying

View Downstream

Cross-Section Plots

Dry Creek Mitigation Site
DMS Project No. 97082
Monitoring Year 0 - 2020

Cross-Section 2 - Dry Creek Reach 1



Bankfull Dimensions	
46.4	x-section area (ft.sq.)
21.8	width (ft)
2.1	mean depth (ft)
3.9	max depth (ft)
24.0	wetted perimeter (ft)
1.9	hydraulic radius (ft)
10.2	width-depth ratio

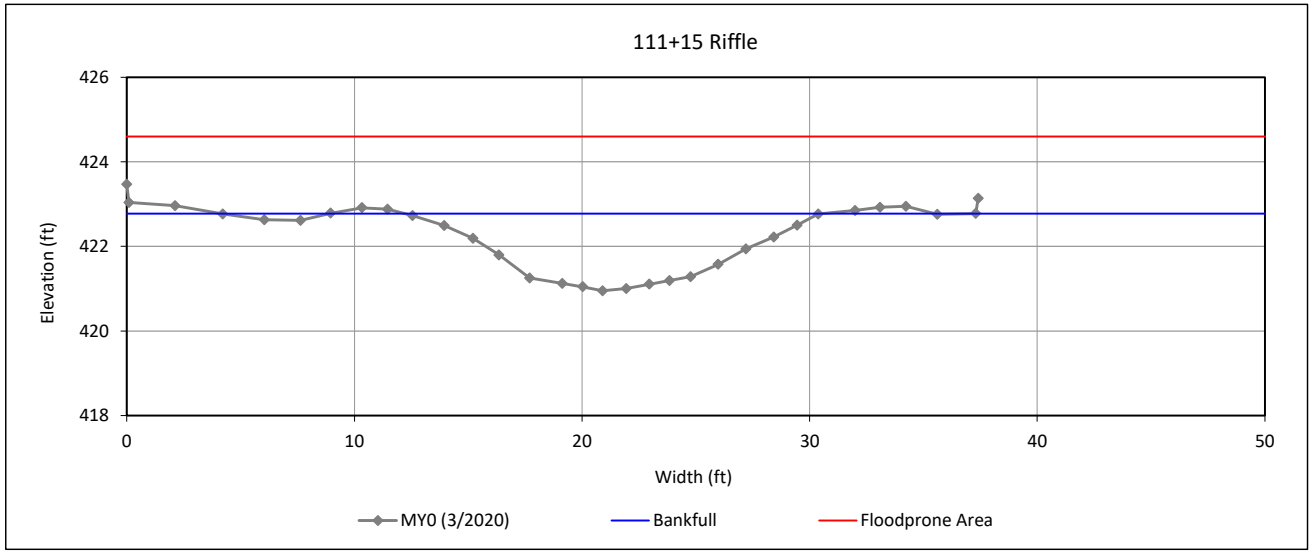
Survey Date: 3/2020
Field Crew: Kee Mapping & Surveying

View Downstream

Cross-Section Plots

Dry Creek Mitigation Site
DMS Project No. 97082
Monitoring Year 0 - 2020

Cross-Section 3 - Dry Creek Reach 1



Bankfull Dimensions

19.4	x-section area (ft.sq.)
18.2	width (ft)
1.1	mean depth (ft)
1.8	max depth (ft)
18.6	wetted perimeter (ft)
1.0	hydraulic radius (ft)
17.1	width-depth ratio
70.0	W flood prone area (ft)
3.9	entrenchment ratio
1.0	low bank height ratio

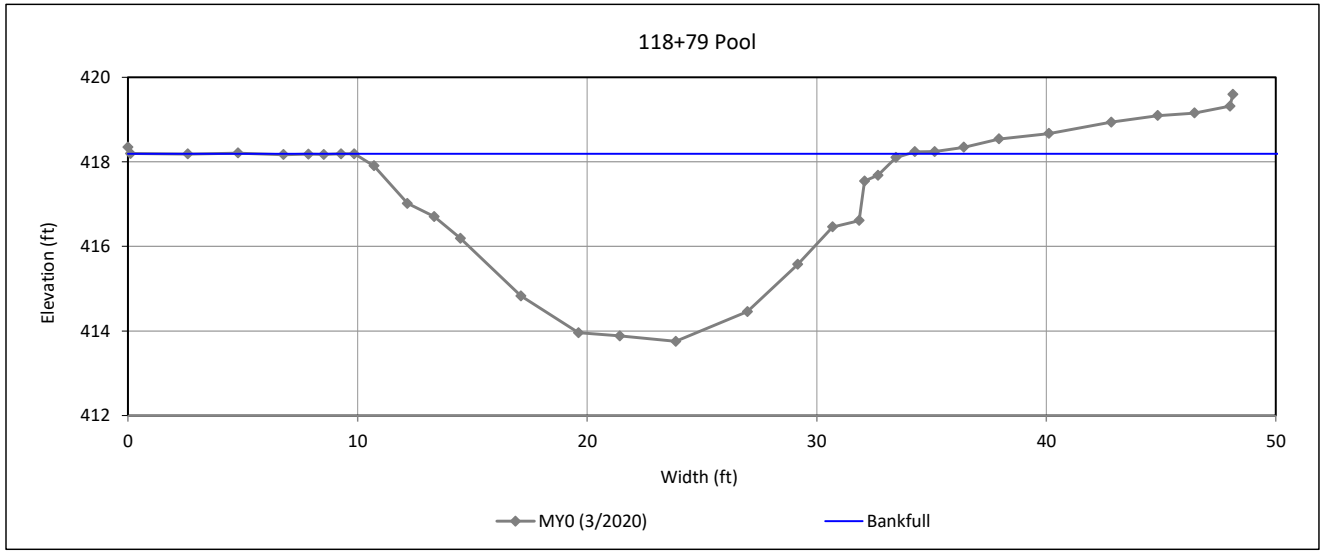
Survey Date: 3/2020
Field Crew: Kee Mapping & Surveying

View Downstream

Cross-Section Plots

Dry Creek Mitigation Site
DMS Project No. 97082
Monitoring Year 0 - 2020

Cross-Section 4 - Dry Creek Reach 2



Bankfull Dimensions	
65.4	x-section area (ft.sq.)
24.1	width (ft)
2.7	mean depth (ft)
4.4	max depth (ft)
26.5	wetted perimeter (ft)
2.5	hydraulic radius (ft)
8.9	width-depth ratio

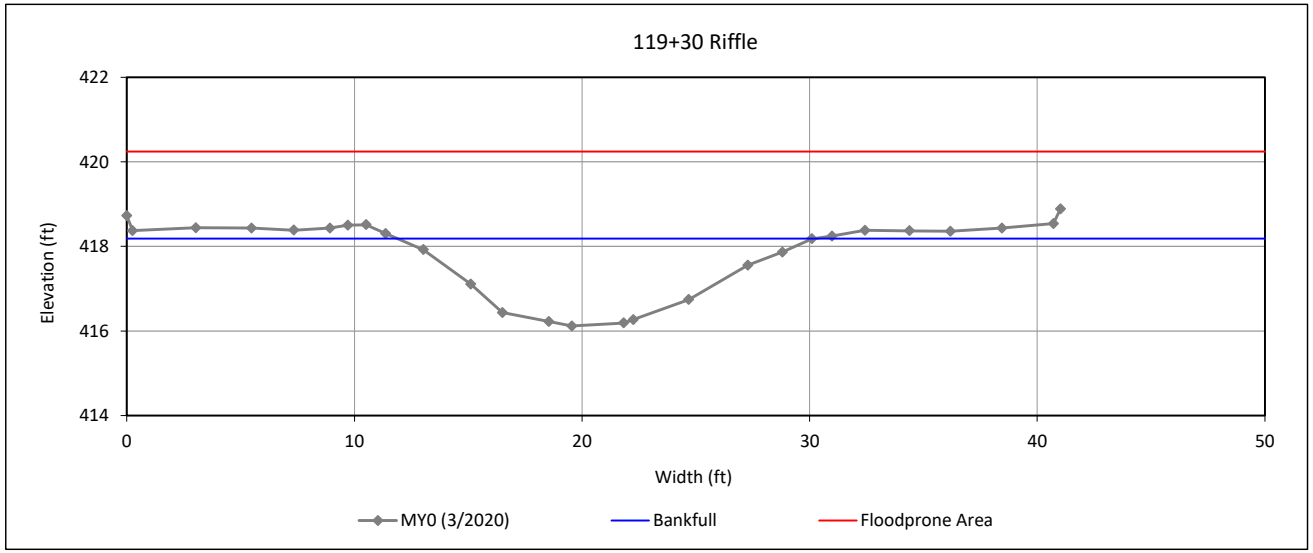
Survey Date: 3/2020
Field Crew: Kee Mapping & Surveying

View Downstream

Cross-Section Plots

Dry Creek Mitigation Site
DMS Project No. 97082
Monitoring Year 0 - 2020

Cross-Section 5 - Dry Creek Reach 2



Bankfull Dimensions

22.4	x-section area (ft.sq.)
18.2	width (ft)
1.2	mean depth (ft)
2.1	max depth (ft)
18.8	wetted perimeter (ft)
1.2	hydraulic radius (ft)
14.7	width-depth ratio
155.0	W flood prone area (ft)
8.5	entrenchment ratio
1.0	low bank height ratio

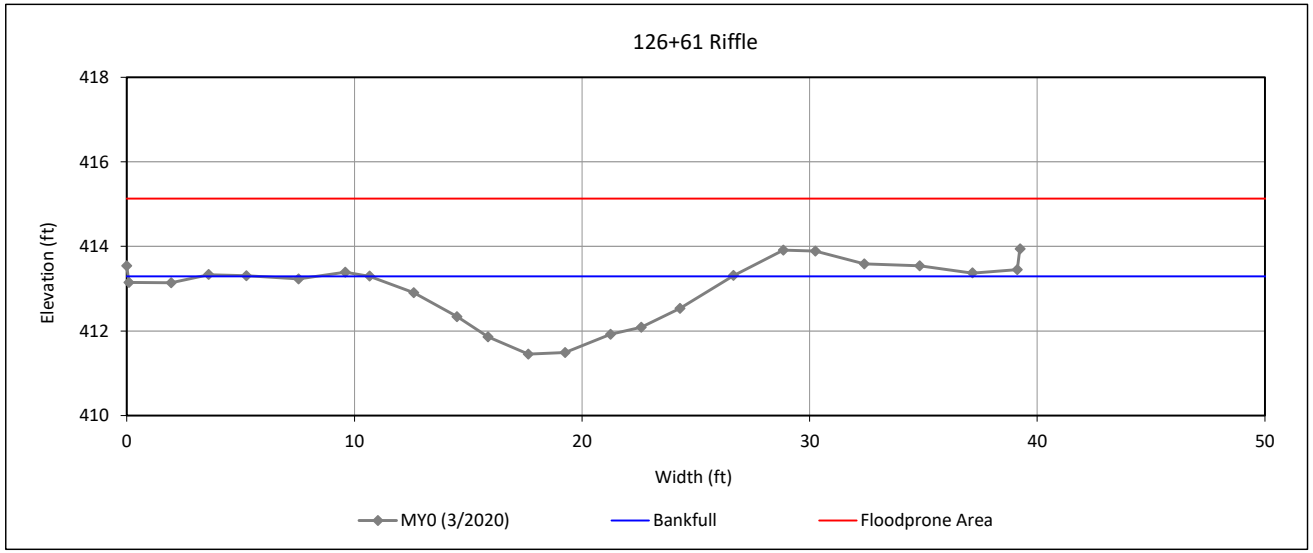
Survey Date: 3/2020
Field Crew: Kee Mapping & Surveying

View Downstream

Cross-Section Plots

Dry Creek Mitigation Site
DMS Project No. 97082
Monitoring Year 0 - 2020

Cross-Section 6 - Dry Creek Reach 2



Bankfull Dimensions

16.5	x-section area (ft.sq.)
15.9	width (ft)
1.0	mean depth (ft)
1.8	max depth (ft)
16.4	wetted perimeter (ft)
1.0	hydraulic radius (ft)
15.3	width-depth ratio
126.0	W flood prone area (ft)
7.9	entrenchment ratio
1.0	low bank height ratio

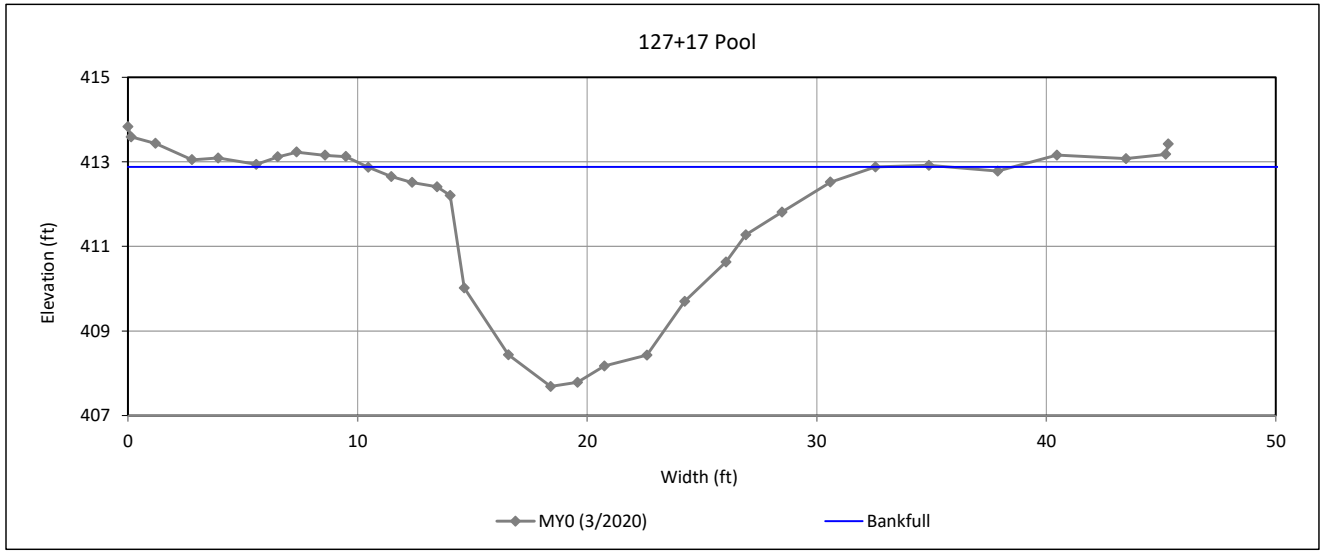
Survey Date: 3/2020
Field Crew: Kee Mapping & Surveying

View Downstream

Cross-Section Plots

Dry Creek Mitigation Site
DMS Project No. 97082
Monitoring Year 0 - 2020

Cross-Section 7 - Dry Creek Reach 2



Bankfull Dimensions	
55.2	x-section area (ft.sq.)
22.1	width (ft)
2.5	mean depth (ft)
5.2	max depth (ft)
25.8	wetted perimeter (ft)
2.1	hydraulic radius (ft)
8.9	width-depth ratio

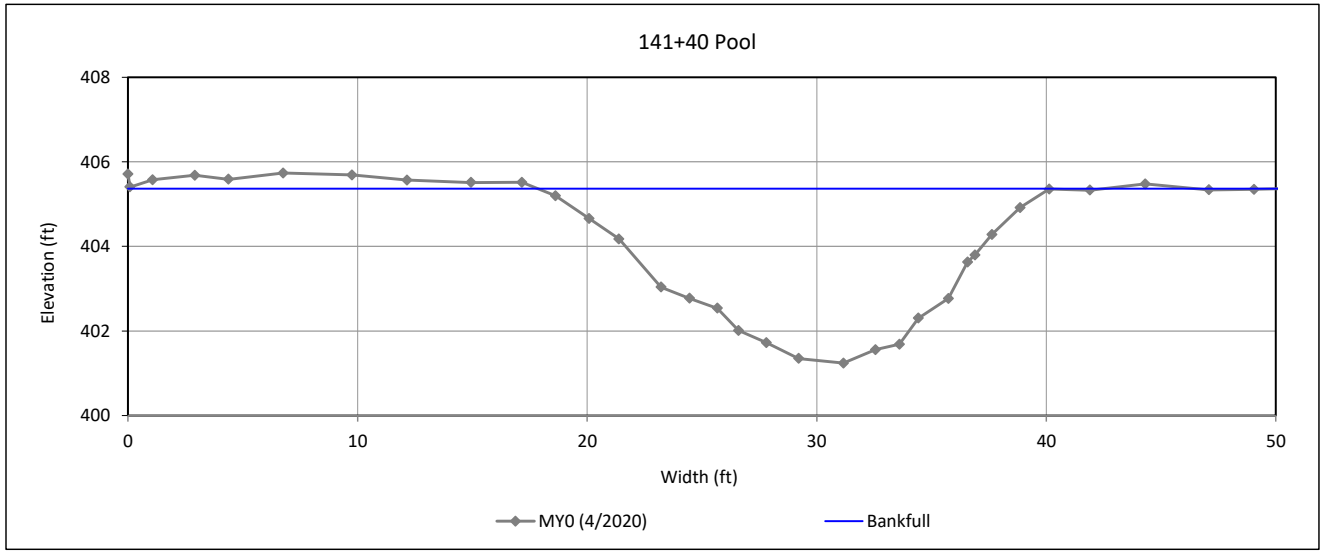
Survey Date: 3/2020
Field Crew: Kee Mapping & Surveying

View Downstream

Cross-Section Plots

Dry Creek Mitigation Site
DMS Project No. 97082
Monitoring Year 0 - 2020

Cross-Section 8 - Dry Creek Reach 3



Bankfull Dimensions	
52.3	x-section area (ft.sq.)
22.3	width (ft)
2.3	mean depth (ft)
4.1	max depth (ft)
24.2	wetted perimeter (ft)
2.2	hydraulic radius (ft)
9.5	width-depth ratio

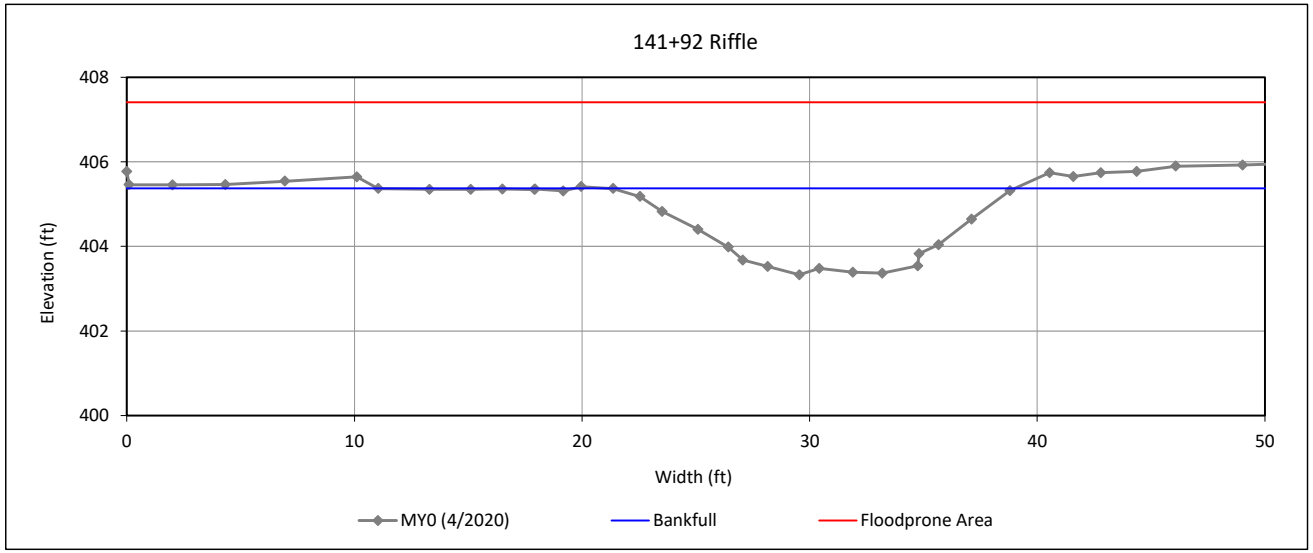
Survey Date: 4/2020
Field Crew: Kee Mapping & Surveying

View Downstream

Cross-Section Plots

Dry Creek Mitigation Site
DMS Project No. 97082
Monitoring Year 0 - 2020

Cross-Section 9 - Dry Creek Reach 3



Bankfull Dimensions

22.4	x-section area (ft.sq.)
17.6	width (ft)
1.3	mean depth (ft)
2.0	max depth (ft)
18.5	wetted perimeter (ft)
1.2	hydraulic radius (ft)
13.9	width-depth ratio
175.0	W flood prone area (ft)
9.9	entrenchment ratio
1.0	low bank height ratio

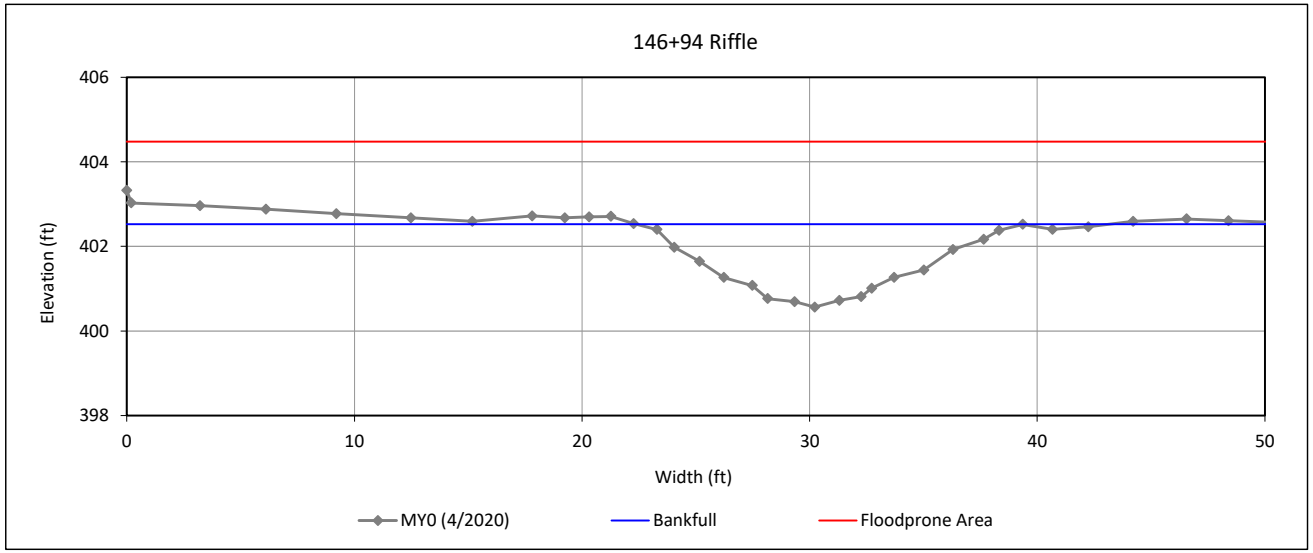
Survey Date: 4/2020
Field Crew: Kee Mapping & Surveying

View Downstream

Cross-Section Plots

Dry Creek Mitigation Site
DMS Project No. 97082
Monitoring Year 0 - 2020

Cross-Section 10 - Dry Creek Reach 3



Bankfull Dimensions

18.1	x-section area (ft.sq.)
16.9	width (ft)
1.1	mean depth (ft)
2.0	max depth (ft)
17.5	wetted perimeter (ft)
1.0	hydraulic radius (ft)
15.9	width-depth ratio
219.0	W flood prone area (ft)
12.9	entrenchment ratio
1.0	low bank height ratio

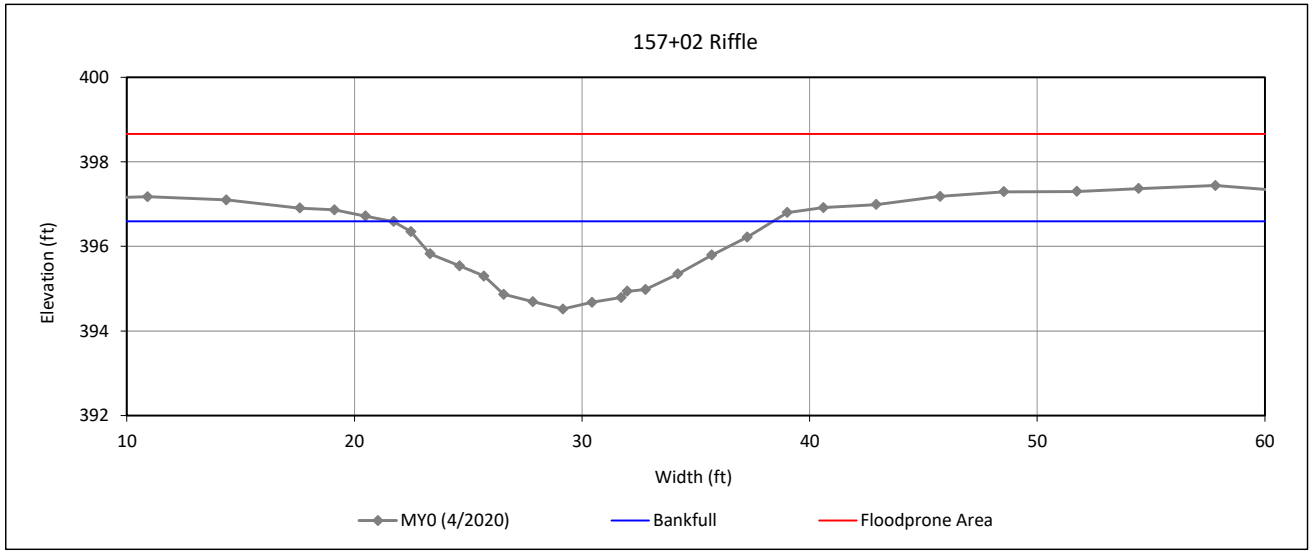
Survey Date: 4/2020
Field Crew: Kee Mapping & Surveying

View Downstream

Cross-Section Plots

Dry Creek Mitigation Site
DMS Project No. 97082
Monitoring Year 0 - 2020

Cross-Section 11 - Dry Creek Reach 4



Bankfull Dimensions

20.5	x-section area (ft.sq.)
16.7	width (ft)
1.2	mean depth (ft)
2.1	max depth (ft)
17.3	wetted perimeter (ft)
1.2	hydraulic radius (ft)
13.5	width-depth ratio
190.0	W flood prone area (ft)
11.4	entrenchment ratio
1.0	low bank height ratio

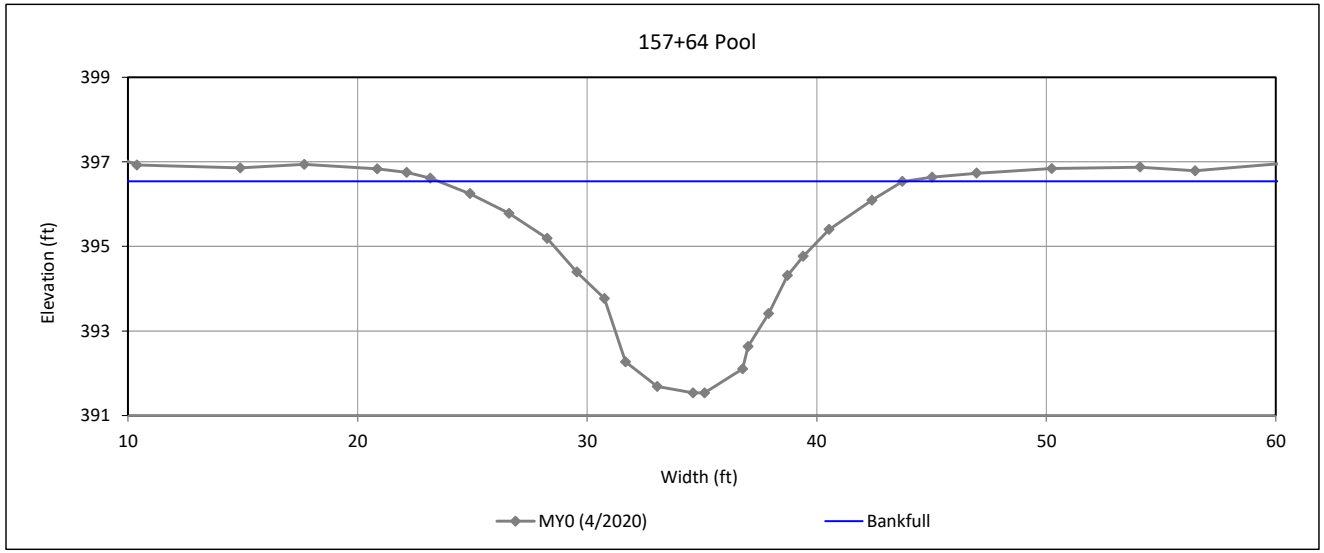
Survey Date: 4/2020
Field Crew: Kee Mapping & Surveying

View Downstream

Cross-Section Plots

Dry Creek Mitigation Site
DMS Project No. 97082
Monitoring Year 0 - 2020

Cross-Section 12 - Dry Creek Reach 4



Bankfull Dimensions	
46.8	x-section area (ft.sq.)
20.3	width (ft)
2.3	mean depth (ft)
5.0	max depth (ft)
23.4	wetted perimeter (ft)
2.0	hydraulic radius (ft)
8.8	width-depth ratio

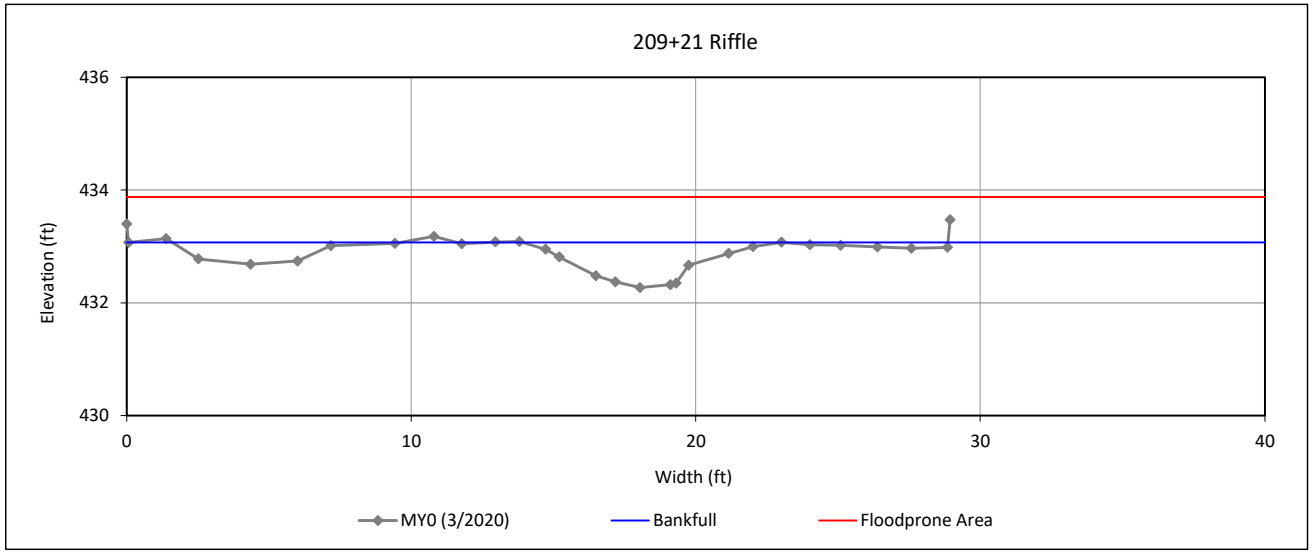
Survey Date: 4/2020
Field Crew: Kee Mapping & Surveying

View Downstream

Cross-Section Plots

Dry Creek Mitigation Site
DMS Project No. 97082
Monitoring Year 0 - 2020

Cross-Section 13 - UT1 Reach 2



Bankfull Dimensions

3.6	x-section area (ft.sq.)
9.1	width (ft)
0.4	mean depth (ft)
0.8	max depth (ft)
9.3	wetted perimeter (ft)
0.4	hydraulic radius (ft)
23.0	width-depth ratio
116.0	W flood prone area (ft)
12.8	entrenchment ratio
1.0	low bank height ratio

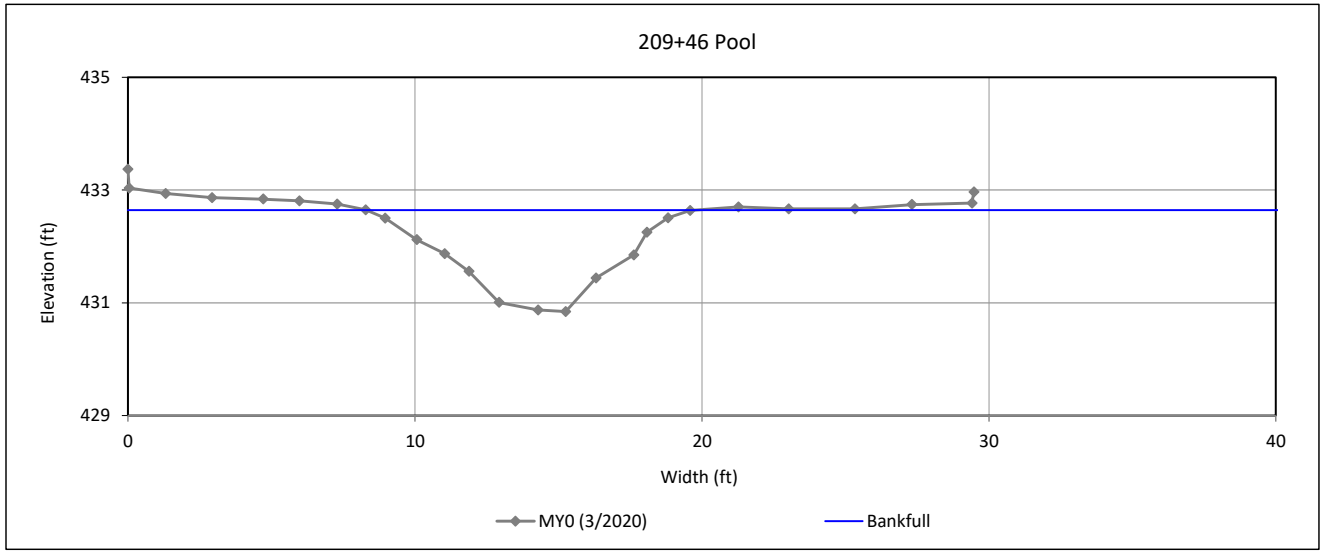
Survey Date: 3/2020
Field Crew: Kee Mapping & Surveying

View Downstream

Cross-Section Plots

Dry Creek Mitigation Site
DMS Project No. 97082
Monitoring Year 0 - 2020

Cross-Section 14 - UT1 Reach 2



Bankfull Dimensions	
10.7	x-section area (ft.sq.)
11.4	width (ft)
0.9	mean depth (ft)
1.8	max depth (ft)
12.1	wetted perimeter (ft)
0.9	hydraulic radius (ft)
12.1	width-depth ratio

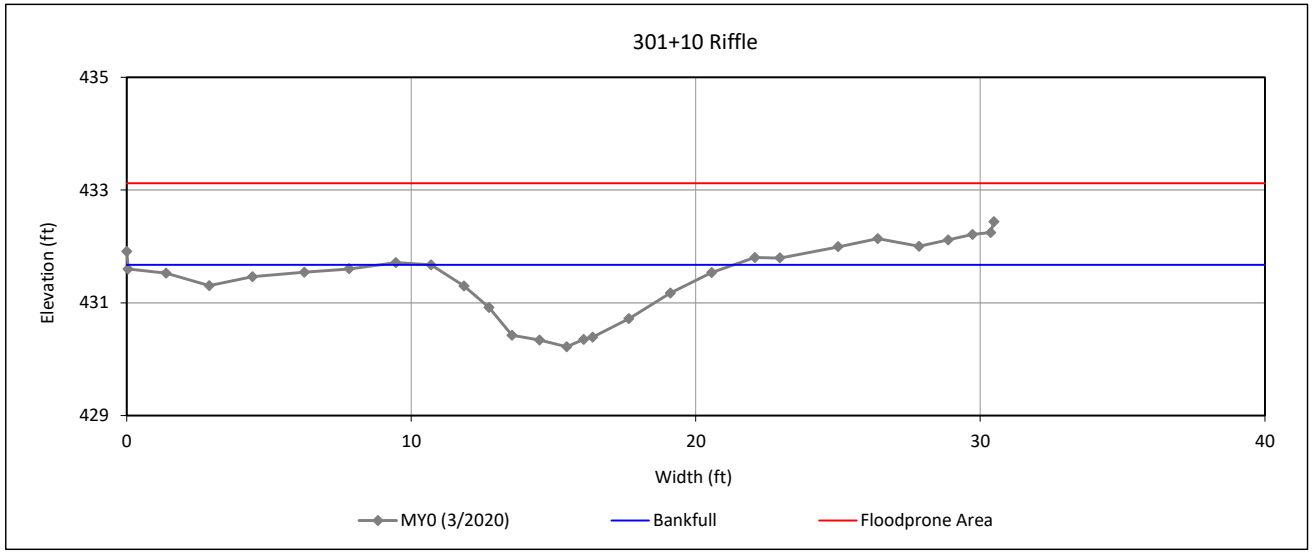
Survey Date: 3/2020
Field Crew: Kee Mapping & Surveying

View Downstream

Cross-Section Plots

Dry Creek Mitigation Site
DMS Project No. 97082
Monitoring Year 0 - 2020

Cross-Section 15 - UT1A



Bankfull Dimensions

8.3	x-section area (ft.sq.)
10.6	width (ft)
0.8	mean depth (ft)
1.4	max depth (ft)
11.1	wetted perimeter (ft)
0.8	hydraulic radius (ft)
13.5	width-depth ratio
78.0	W flood prone area (ft)
7.4	entrenchment ratio
1.0	low bank height ratio

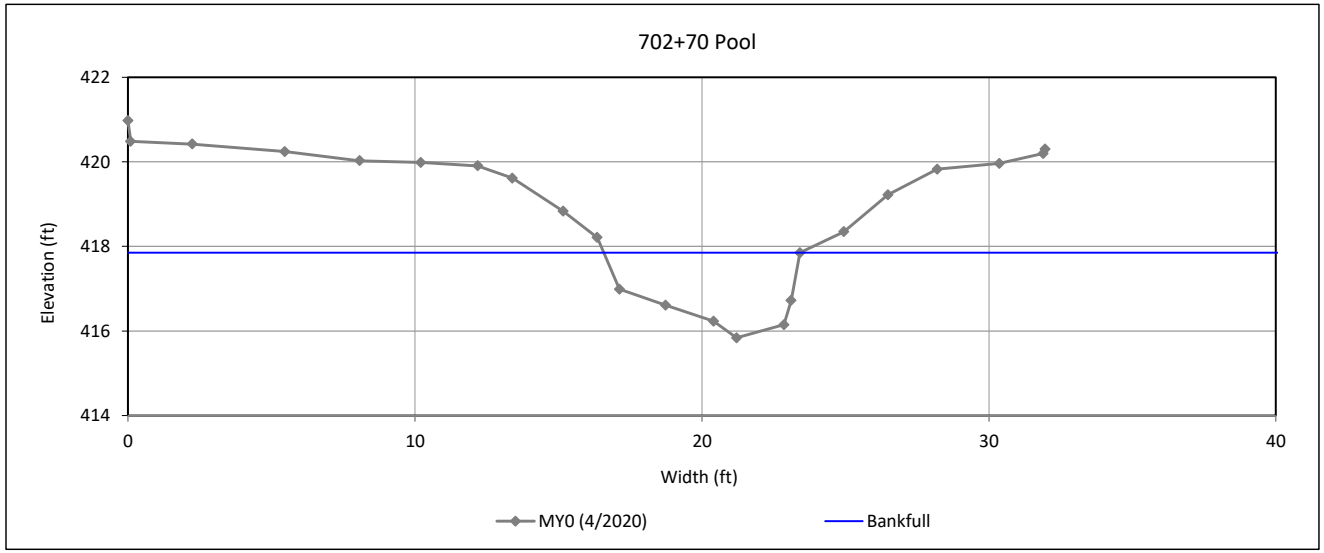
Survey Date: 3/2020
Field Crew: Kee Mapping & Surveying

View Downstream

Cross-Section Plots

Dry Creek Mitigation Site
DMS Project No. 97082
Monitoring Year 0 - 2020

Cross-Section 16 - UT5 Reach 1



Bankfull Dimensions	
9.4	x-section area (ft.sq.)
6.8	width (ft)
1.4	mean depth (ft)
2.0	max depth (ft)
8.8	wetted perimeter (ft)
1.1	hydraulic radius (ft)
5.0	width-depth ratio

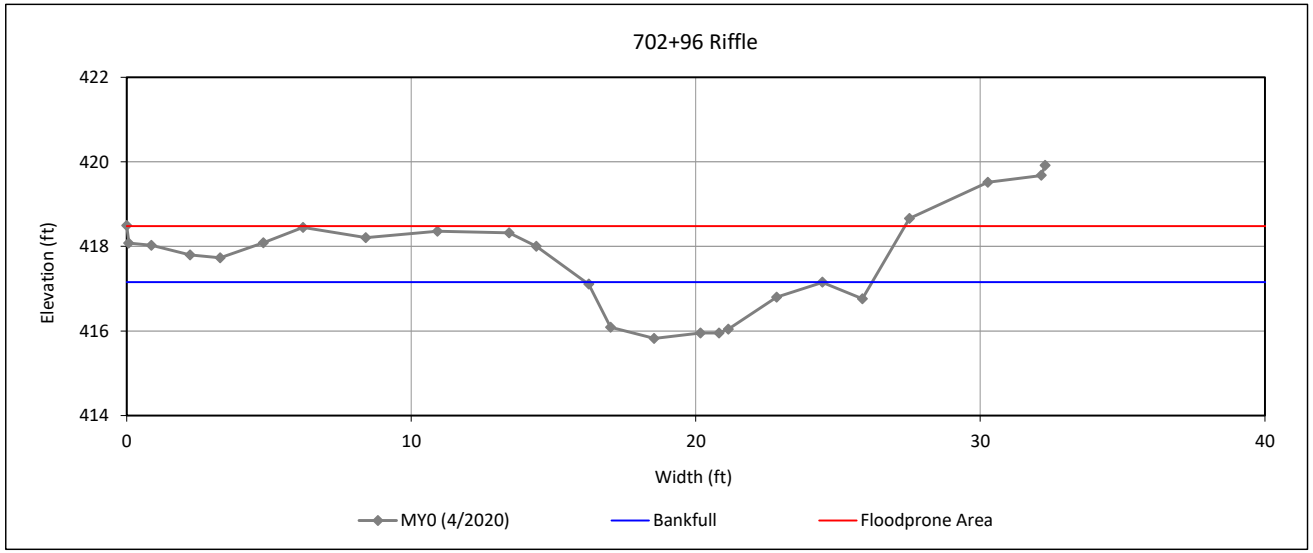
Survey Date: 4/2020
Field Crew: Kee Mapping & Surveying

View Downstream

Cross-Section Plots

Dry Creek Mitigation Site
DMS Project No. 97082
Monitoring Year 0 - 2020

Cross-Section 17 - UT5 Reach 1



Bankfull Dimensions

7.0	x-section area (ft.sq.)
8.3	width (ft)
0.8	mean depth (ft)
1.3	max depth (ft)
9.0	wetted perimeter (ft)
0.8	hydraulic radius (ft)
9.8	width-depth ratio
20.0	W flood prone area (ft)
2.4	entrenchment ratio
1.0	low bank height ratio

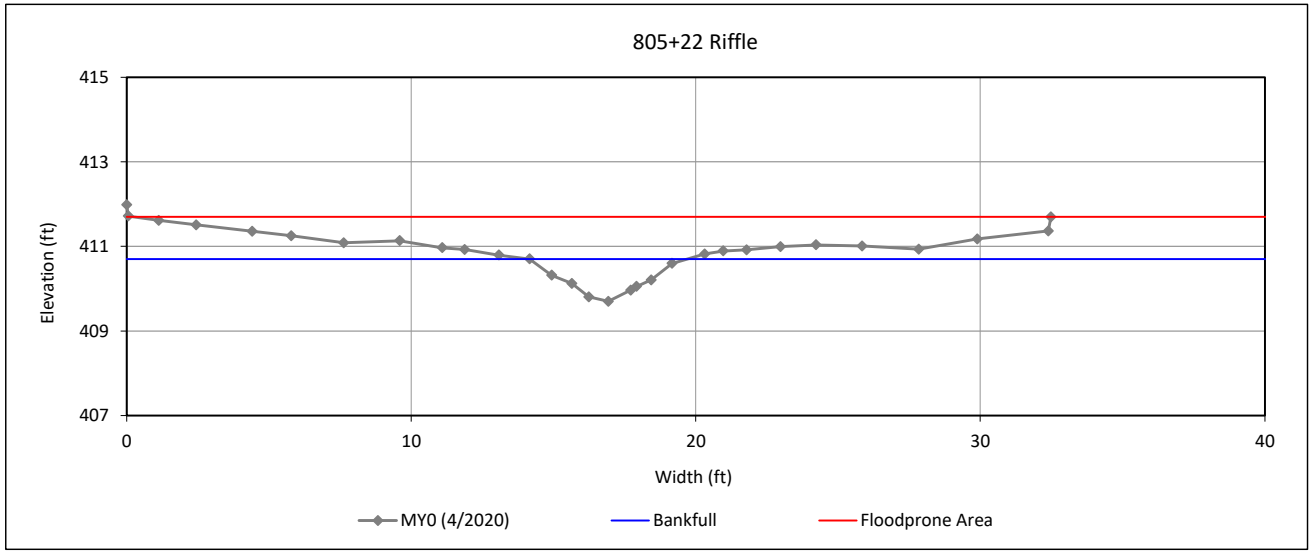
Survey Date: 4/2020
Field Crew: Kee Mapping & Surveying

View Downstream

Cross-Section Plots

Dry Creek Mitigation Site
DMS Project No. 97082
Monitoring Year 0 - 2020

Cross-Section 18 - UT6 Reach 1



Bankfull Dimensions

2.9	x-section area (ft.sq.)
5.5	width (ft)
0.5	mean depth (ft)
1.0	max depth (ft)
5.9	wetted perimeter (ft)
0.5	hydraulic radius (ft)
10.4	width-depth ratio
55.0	W flood prone area (ft)
10.0	entrenchment ratio
1.0	low bank height ratio

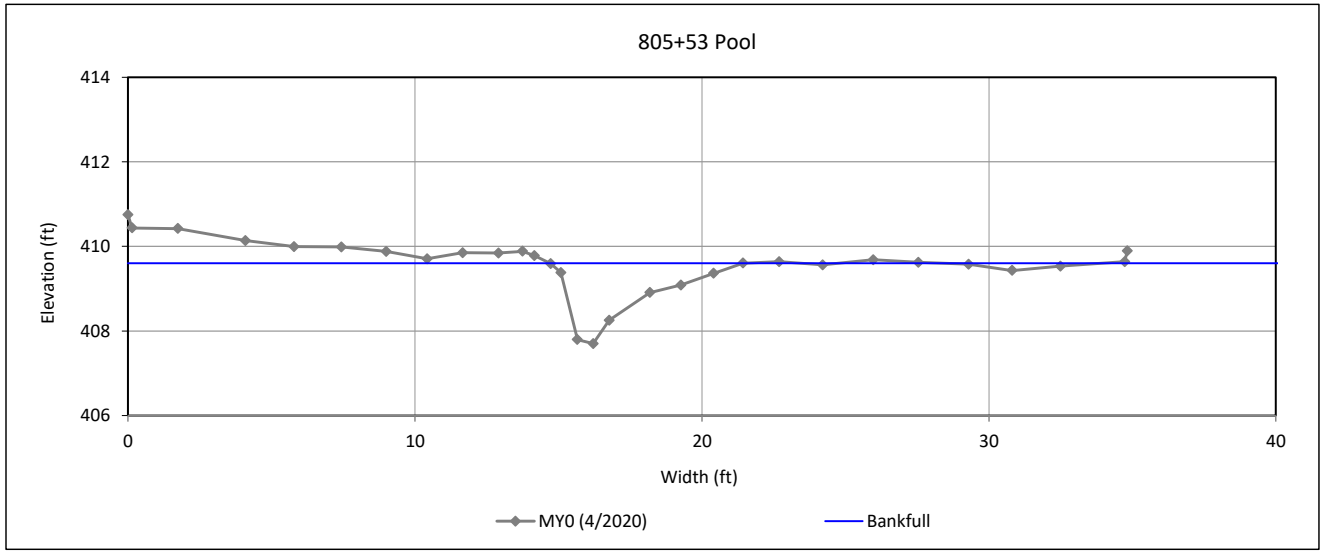
Survey Date: 4/2020
Field Crew: Kee Mapping & Surveying

View Downstream

Cross-Section Plots

Dry Creek Mitigation Site
DMS Project No. 97082
Monitoring Year 0 - 2020

Cross-Section 19 - UT6 Reach 1



Bankfull Dimensions	
5.2	x-section area (ft.sq.)
6.7	width (ft)
0.8	mean depth (ft)
1.9	max depth (ft)
8.3	wetted perimeter (ft)
0.6	hydraulic radius (ft)
8.6	width-depth ratio

Survey Date: 4/2020
Field Crew: Kee Mapping & Surveying

View Downstream

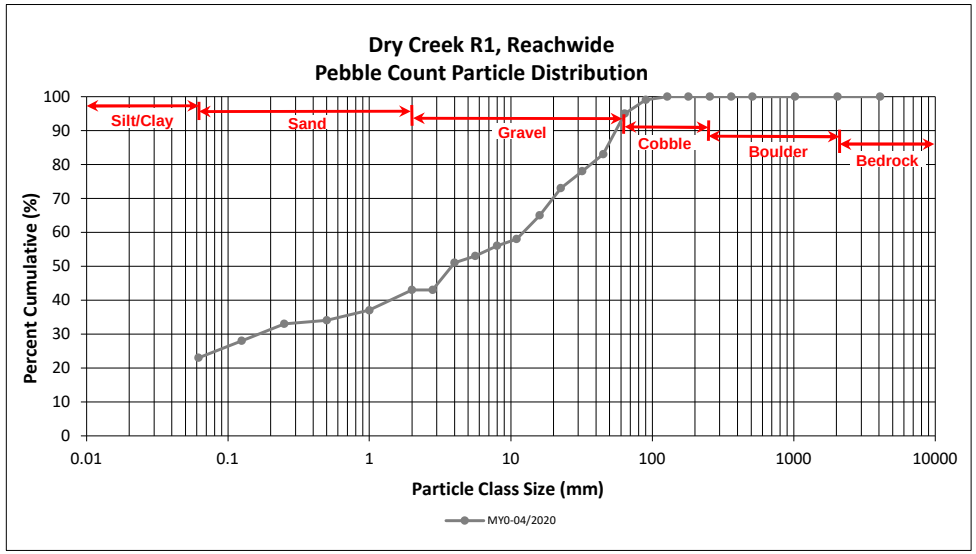
Reachwide and Cross-Section Pebble Count Plots

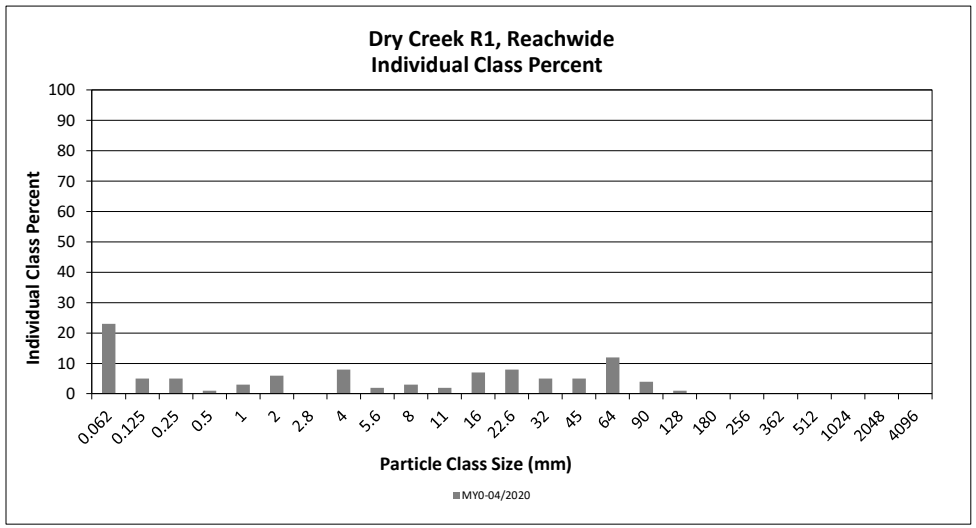
Dry Creek Mitigation Site
DMS Project No. 97082
Monitoring Year 0 - 2020

Dry Creek R1, Reachwide

Particle Class		Diameter (mm)		Particle Count			Reach Summary	
		min	max	Riffle	Pool	Total	Class Percentage	Percent Cumulative
SILT/CLAY	Silt/Clay	0.000	0.062		23	23	23	23
SAND	Very fine	0.062	0.125		5	5	5	28
	Fine	0.125	0.250		5	5	5	33
	Medium	0.25	0.50		1	1	1	34
	Coarse	0.5	1.0	1	2	3	3	37
	Very Coarse	1.0	2.0	1	5	6	6	43
GRAVEL	Very Fine	2.0	2.8					43
	Very Fine	2.8	4.0		8	8	8	51
	Fine	4.0	5.6	1	1	2	2	53
	Fine	5.6	8.0	2	1	3	3	56
	Medium	8.0	11.0	1	1	2	2	58
	Medium	11.0	16.0	3	4	7	7	65
	Coarse	16.0	22.6	6	2	8	8	73
	Coarse	22.6	32	5		5	5	78
	Very Coarse	32	45	5		5	5	83
	Very Coarse	45	64	10	2	12	12	95
COBBLE	Small	64	90	4		4	4	99
	Small	90	128	1		1	1	100
	Large	128	180					100
	Large	180	256					100
BOULDER	Small	256	362					100
	Small	362	512					100
	Medium	512	1024					100
	Large/Very Large	1024	2048					100
BEDROCK	Bedrock	2048	>2048					100
			Total	**40**	**60**	**100**	**100**	**100**

Reachwide	
Channel materials (mm)	
D_{16} =	Silt/Clay
D_{35} =	0.63
D_{50} =	3.8
D_{84} =	46.3
D_{95} =	64.0
D_{100} =	128.0





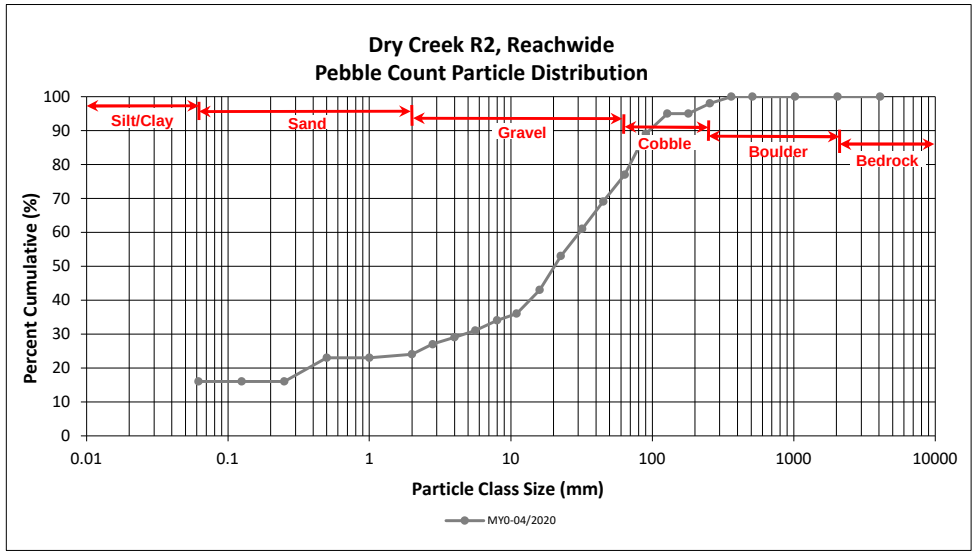
Reachwide and Cross-Section Pebble Count Plots

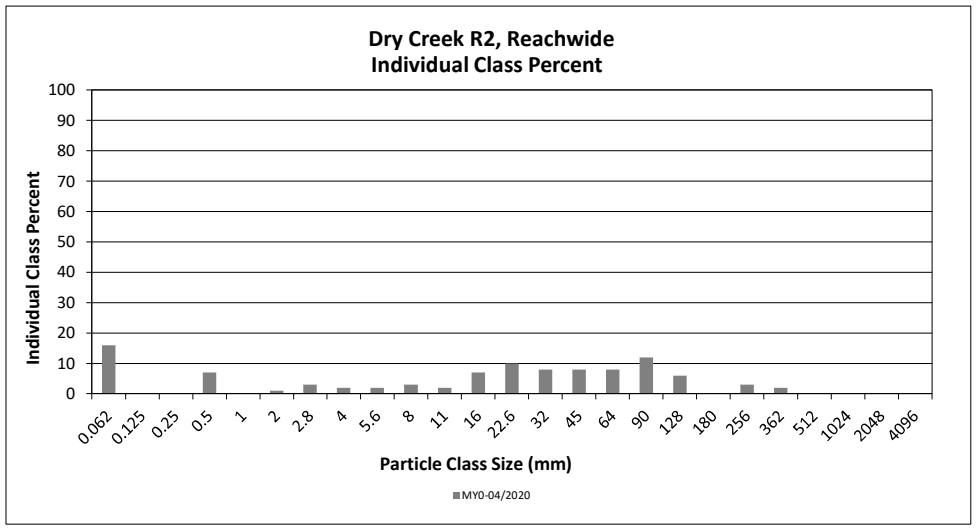
Dry Creek Mitigation Site
DMS Project No. 97082
Monitoring Year 0 - 2020

Dry Creek R2, Reachwide

Particle Class		Diameter (mm)		Particle Count			Reach Summary	
		min	max	Riffle	Pool	Total	Class Percentage	Percent Cumulative
SILT/CLAY	Silt/Clay	0.000	0.062		16	16	16	16
SAND	Very fine	0.062	0.125					16
	Fine	0.125	0.250					16
	Medium	0.25	0.50		7	7	7	23
	Coarse	0.5	1.0					23
	Very Coarse	1.0	2.0		1	1	1	24
GRAVEL	Very Fine	2.0	2.8	1	2	3	3	27
	Very Fine	2.8	4.0		2	2	2	29
	Fine	4.0	5.6		2	2	2	31
	Fine	5.6	8.0		3	3	3	34
	Medium	8.0	11.0		2	2	2	36
	Medium	11.0	16.0	3	4	7	7	43
	Coarse	16.0	22.6	4	6	10	10	53
	Coarse	22.6	32	4	4	8	8	61
	Very Coarse	32	45	8		8	8	69
	Very Coarse	45	64	7	1	8	8	77
COBBLE	Small	64	90	12		12	12	89
	Small	90	128	6		6	6	95
	Large	128	180					95
	Large	180	256	3		3	3	98
BOULDER	Small	256	362	2		2	2	100
	Small	362	512					100
	Medium	512	1024					100
	Large/Very Large	1024	2048					100
BEDROCK	Bedrock	2048	>2048					100
			Total	**50**	**50**	**100**	**100**	**100**

Reachwide	
Channel materials (mm)	
D_{16} =	Silt/Clay
D_{35} =	9.38
D_{50} =	20.4
D_{84} =	78.1
D_{95} =	128.0
D_{100} =	362.0





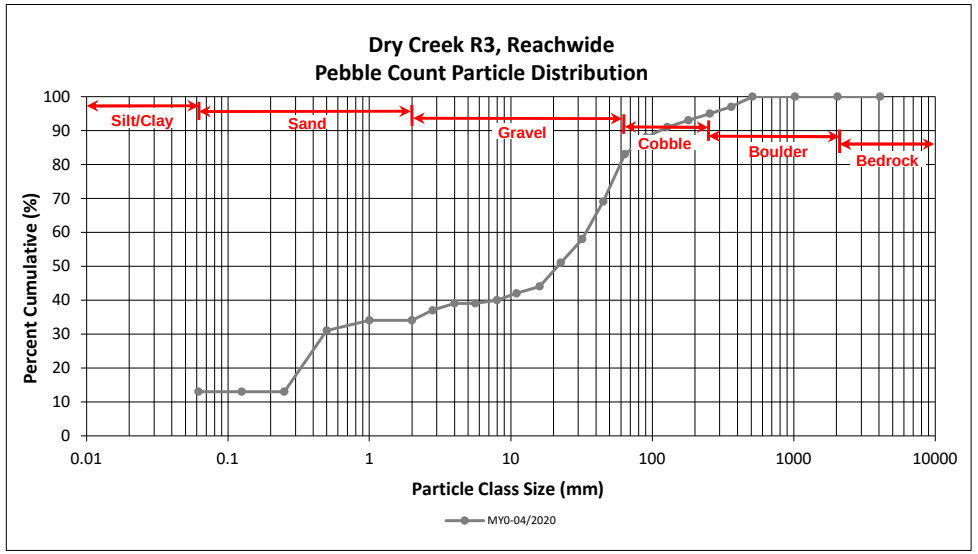
Reachwide and Cross-Section Pebble Count Plots

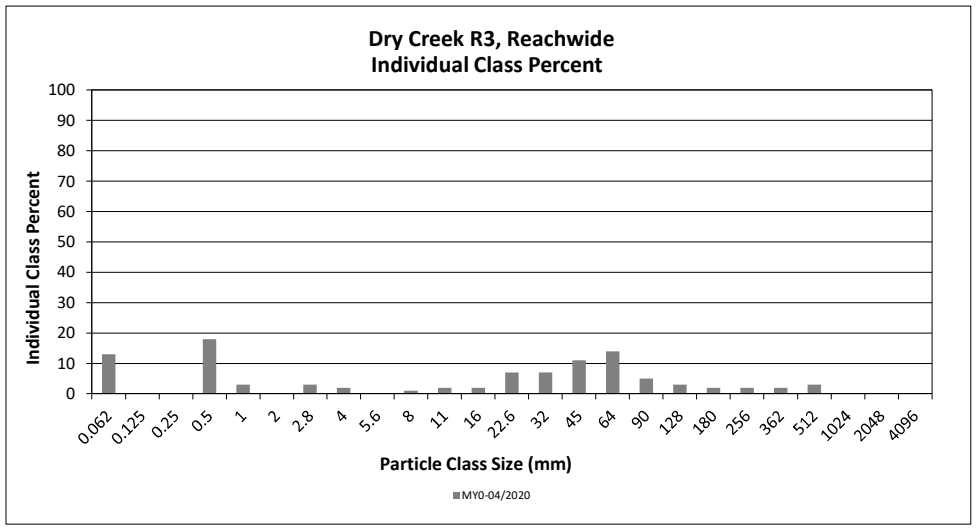
Dry Creek Mitigation Site
DMS Project No. 97082
Monitoring Year 0 - 2020

Dry Creek R3, Reachwide

Particle Class		Diameter (mm)		Particle Count			Reach Summary	
		min	max	Riffle	Pool	Total	Class Percentage	Percent Cumulative
SILT/CLAY	Silt/Clay	0.000	0.062	3	10	13	13	13
SAND	Very fine	0.062	0.125					13
	Fine	0.125	0.250					13
	Medium	0.25	0.50		18	18	18	31
	Coarse	0.5	1.0		3	3	3	34
	Very Coarse	1.0	2.0					34
GRAVEL	Very Fine	2.0	2.8	2	1	3	3	37
	Very Fine	2.8	4.0		2	2	2	39
	Fine	4.0	5.6					39
	Fine	5.6	8.0	1		1	1	40
	Medium	8.0	11.0		2	2	2	42
	Medium	11.0	16.0	1	1	2	2	44
	Coarse	16.0	22.6	3	4	7	7	51
	Coarse	22.6	32	3	4	7	7	58
	Very Coarse	32	45	10	1	11	11	69
	Very Coarse	45	64	11	3	14	14	83
COBBLE	Small	64	90	4	1	5	5	88
	Small	90	128	3		3	3	91
	Large	128	180	2		2	2	93
	Large	180	256	2		2	2	95
BOULDER	Small	256	362	2		2	2	97
	Small	362	512	3		3	3	100
	Medium	512	1024					100
	Large/Very Large	1024	2048					100
BEDROCK	Bedrock	2048	>2048					100
			Total	**50**	**50**	**100**	**100**	**100**

Reachwide	
Channel materials (mm)	
D_{16} =	0.28
D_{35} =	2.24
D_{50} =	21.5
D_{84} =	68.5
D_{95} =	256.0
D_{100} =	512.0





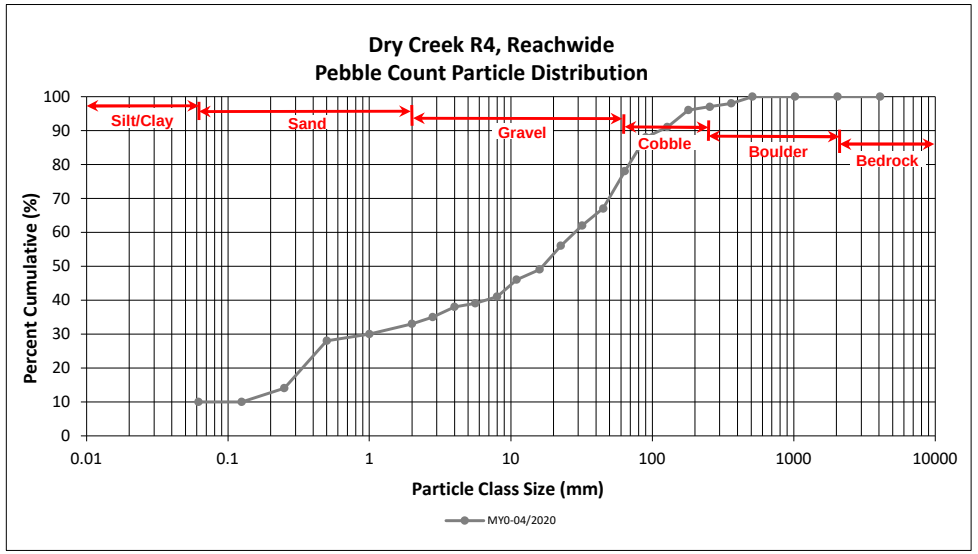
Reachwide and Cross-Section Pebble Count Plots

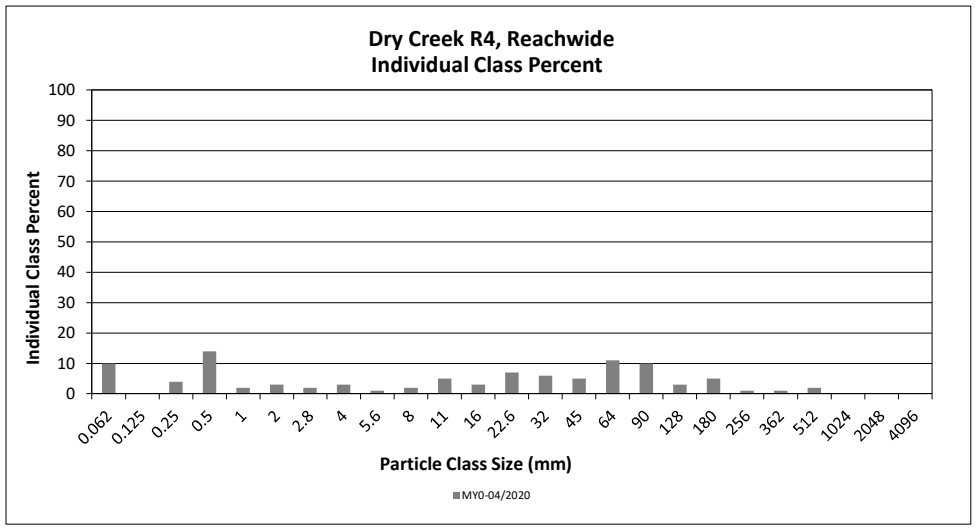
Dry Creek Mitigation Site
DMS Project No. 97082
Monitoring Year 0 - 2020

Dry Creek R4, Reachwide

Particle Class		Diameter (mm)		Particle Count			Reach Summary	
		min	max	Riffle	Pool	Total	Class Percentage	Percent Cumulative
SILT/CLAY	Silt/Clay	0.000	0.062		10	10	10	10
SAND	Very fine	0.062	0.125					10
	Fine	0.125	0.250		4	4	4	14
	Medium	0.25	0.50		14	14	14	28
	Coarse	0.5	1.0		2	2	2	30
	Very Coarse	1.0	2.0		3	3	3	33
GRAVEL	Very Fine	2.0	2.8		2	2	2	35
	Very Fine	2.8	4.0		3	3	3	38
	Fine	4.0	5.6		1	1	1	39
	Fine	5.6	8.0		2	2	2	41
	Medium	8.0	11.0	1	4	5	5	46
	Medium	11.0	16.0	2	1	3	3	49
	Coarse	16.0	22.6	4	3	7	7	56
	Coarse	22.6	32	6		6	6	62
	Very Coarse	32	45	5		5	5	67
	Very Coarse	45	64	11		11	11	78
COBBLE	Small	64	90	9	1	10	10	88
	Small	90	128	3		3	3	91
	Large	128	180	5		5	5	96
	Large	180	256	1		1	1	97
BOULDER	Small	256	362	1		1	1	98
	Small	362	512	2		2	2	100
	Medium	512	1024					100
	Large/Very Large	1024	2048					100
BEDROCK	Bedrock	2048	>2048					100
			Total	**50**	**50**	**100**	**100**	**100**

Reachwide	
Channel materials (mm)	
D_{16} =	0.28
D_{35} =	2.80
D_{50} =	16.8
D_{84} =	78.5
D_{95} =	168.1
D_{100} =	512.0





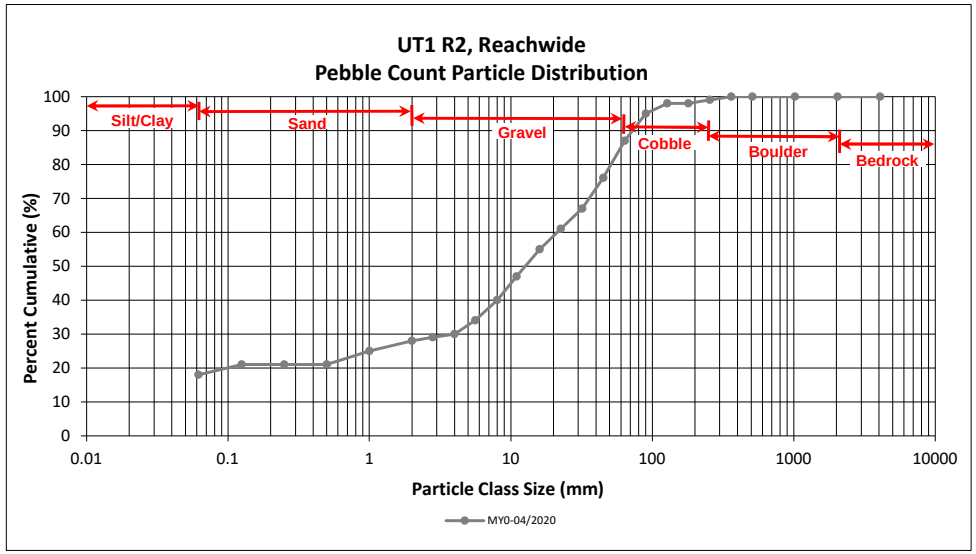
Reachwide and Cross-Section Pebble Count Plots

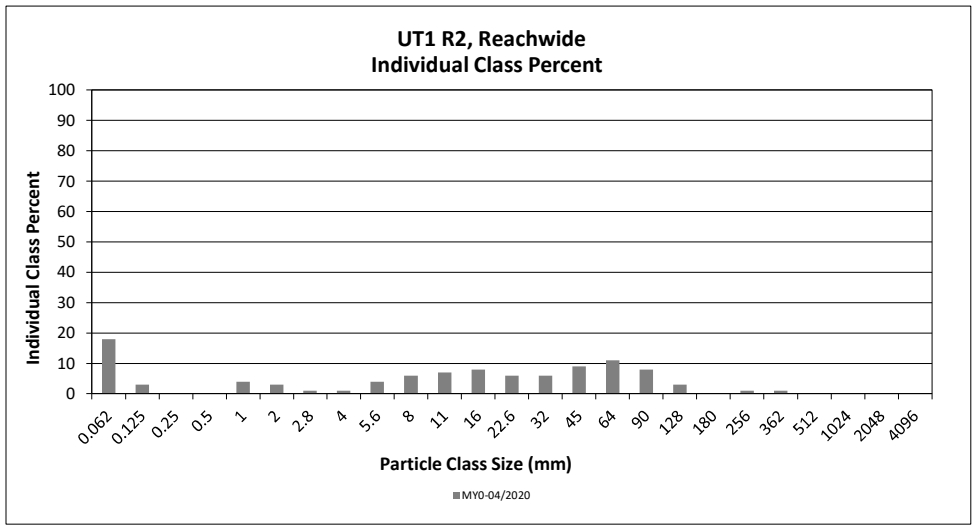
Dry Creek Mitigation Site
DMS Project No. 97082
Monitoring Year 0 - 2020

UT1 R2, Reachwide

Particle Class		Diameter (mm)		Particle Count			Reach Summary	
		min	max	Riffle	Pool	Total	Class Percentage	Percent Cumulative
SILT/CLAY	Silt/Clay	0.000	0.062	3	15	18	18	18
SAND	Very fine	0.062	0.125		3	3	3	21
	Fine	0.125	0.250					21
	Medium	0.25	0.50					21
	Coarse	0.5	1.0		4	4	4	25
	Very Coarse	1.0	2.0		3	3	3	28
GRAVEL	Very Fine	2.0	2.8	1		1	1	29
	Very Fine	2.8	4.0	1		1	1	30
	Fine	4.0	5.6		4	4	4	34
	Fine	5.6	8.0		6	6	6	40
	Medium	8.0	11.0	1	6	7	7	47
	Medium	11.0	16.0	2	6	8	8	55
	Coarse	16.0	22.6	6		6	6	61
	Coarse	22.6	32	4	2	6	6	67
	Very Coarse	32	45	8	1	9	9	76
	Very Coarse	45	64	11		11	11	87
COBBLE	Small	64	90	8		8	8	95
	Small	90	128	3		3	3	98
	Large	128	180					98
	Large	180	256	1		1	1	99
BOULDER	Small	256	362	1		1	1	100
	Small	362	512					100
	Medium	512	1024					100
	Large/Very Large	1024	2048					100
BEDROCK	Bedrock	2048	>2048					100
			Total	**50**	**50**	**100**	**100**	**100**

Reachwide	
Channel materials (mm)	
D_{16} =	Silt/Clay
D_{35} =	5.94
D_{50} =	12.7
D_{84} =	58.1
D_{95} =	90.0
D_{100} =	362.0





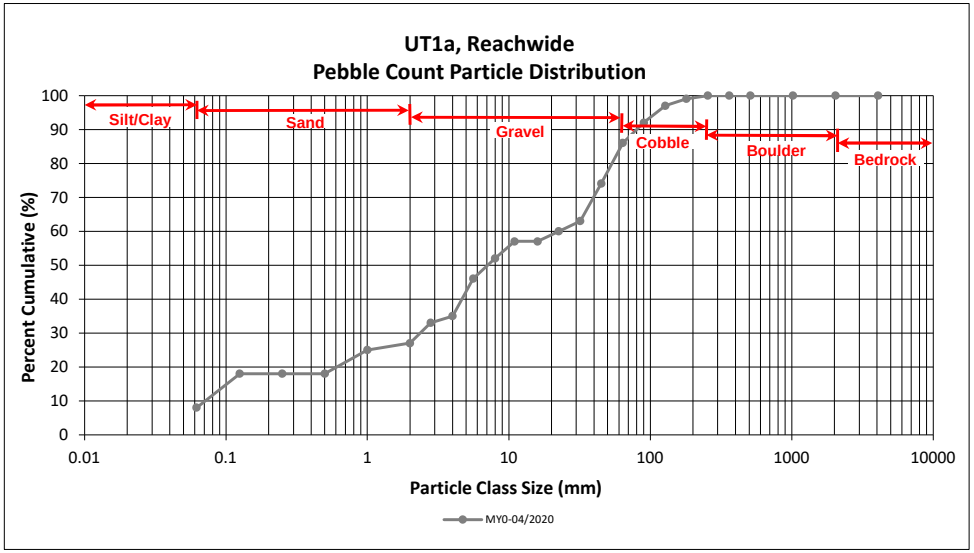
Reachwide and Cross-Section Pebble Count Plots

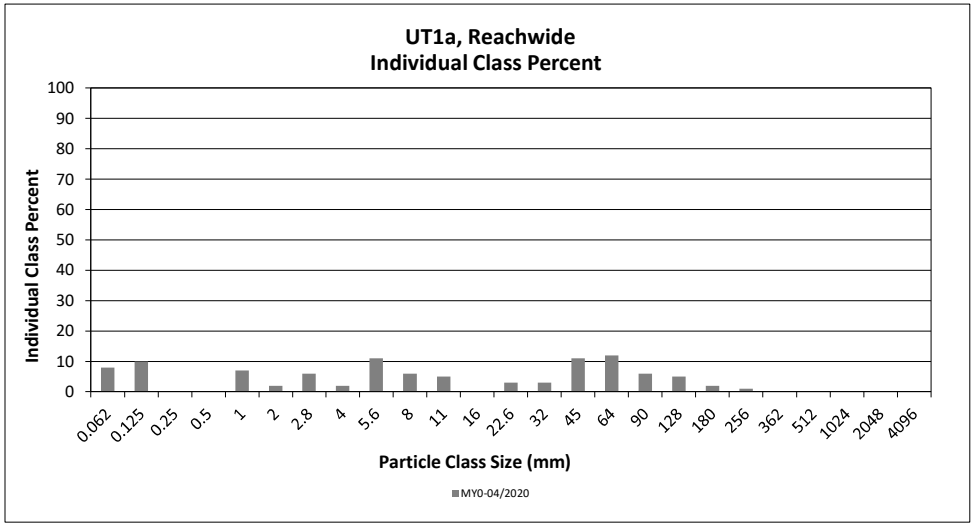
Dry Creek Mitigation Site
DMS Project No. 97082
Monitoring Year 0 - 2020

UT1a, Reachwide

Particle Class		Diameter (mm)		Particle Count			Reach Summary	
		min	max	Riffle	Pool	Total	Class Percentage	Percent Cumulative
SILT/CLAY	Silt/Clay	0.000	0.062	2	6	8	8	8
SAND	Very fine	0.062	0.125		10	10	10	18
	Fine	0.125	0.250					18
	Medium	0.25	0.50					18
	Coarse	0.5	1.0	3	4	7	7	25
	Very Coarse	1.0	2.0		2	2	2	27
GRAVEL	Very Fine	2.0	2.8		6	6	6	33
	Very Fine	2.8	4.0	1	1	2	2	35
	Fine	4.0	5.6	1	10	11	11	46
	Fine	5.6	8.0	1	5	6	6	52
	Medium	8.0	11.0		5	5	5	57
	Medium	11.0	16.0					57
	Coarse	16.0	22.6	2	1	3	3	60
	Coarse	22.6	32	3		3	3	63
	Very Coarse	32	45	11		11	11	74
	Very Coarse	45	64	12		12	12	86
COBBLE	Small	64	90	6		6	6	92
	Small	90	128	5		5	5	97
	Large	128	180	2		2	2	99
	Large	180	256	1		1	1	100
BOULDER	Small	256	362					100
	Small	362	512					100
	Medium	512	1024					100
	Large/Very Large	1024	2048					100
BEDROCK	Bedrock	2048	>2048					100
			Total	**50**	**50**	**100**	**100**	**100**

Reachwide	
Channel materials (mm)	
D_{16} =	0.11
D_{35} =	4.00
D_{50} =	7.1
D_{84} =	60.4
D_{95} =	111.2
D_{100} =	256.0





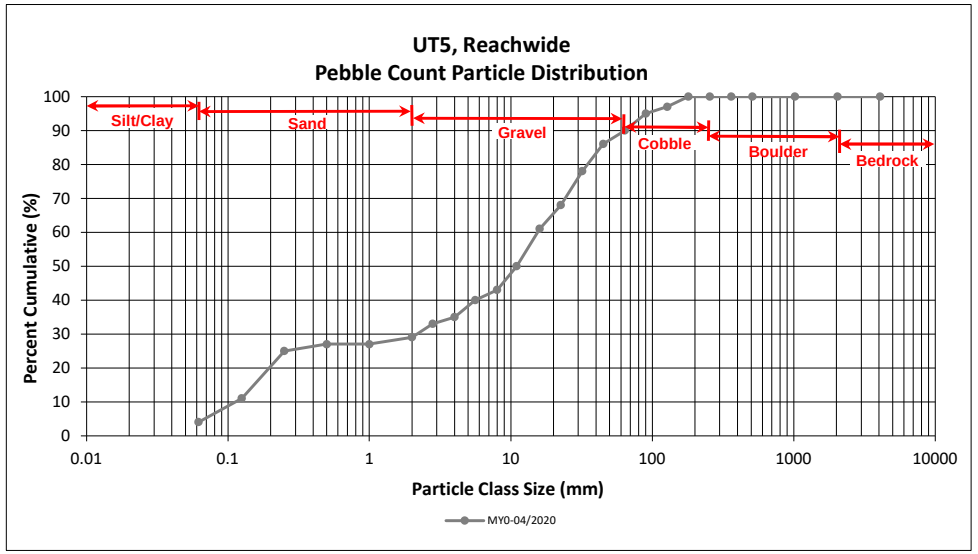
Reachwide and Cross-Section Pebble Count Plots

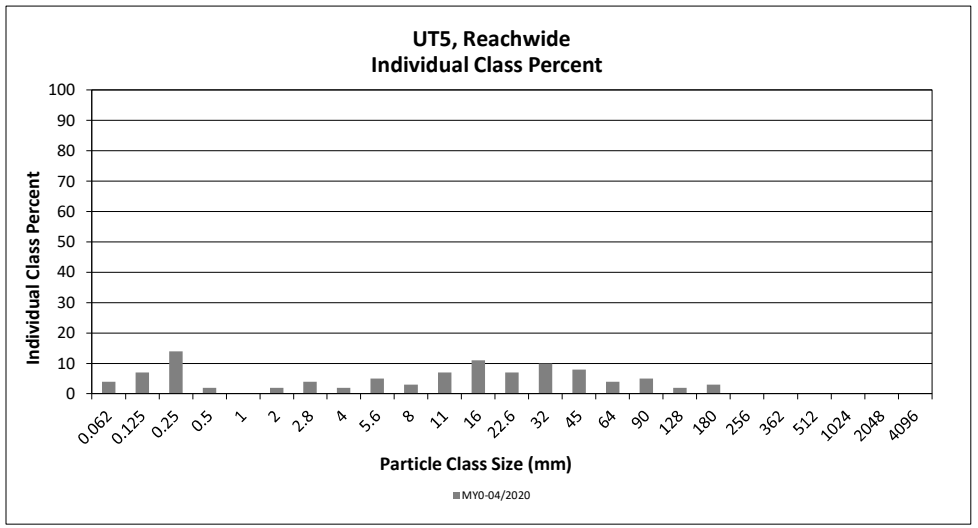
Dry Creek Mitigation Site
DMS Project No. 97082
Monitoring Year 0 - 2020

UT5, Reachwide

Particle Class		Diameter (mm)		Particle Count			Reach Summary	
		min	max	Riffle	Pool	Total	Class Percentage	Percent Cumulative
SILT/CLAY	Silt/Clay	0.000	0.062	1	3	4	4	4
SAND	Very fine	0.062	0.125	1	6	7	7	11
	Fine	0.125	0.250	3	11	14	14	25
	Medium	0.25	0.50	1	1	2	2	27
	Coarse	0.5	1.0					27
	Very Coarse	1.0	2.0	1	1	2	2	29
GRAVEL	Very Fine	2.0	2.8		4	4	4	33
	Very Fine	2.8	4.0		2	2	2	35
	Fine	4.0	5.6		5	5	5	40
	Fine	5.6	8.0	2	1	3	3	43
	Medium	8.0	11.0	6	1	7	7	50
	Medium	11.0	16.0	6	5	11	11	61
	Coarse	16.0	22.6	6	1	7	7	68
	Coarse	22.6	32	7	3	10	10	78
	Very Coarse	32	45	5	3	8	8	86
	Very Coarse	45	64	3	1	4	4	90
COBBLE	Small	64	90	3	2	5	5	95
	Small	90	128	2		2	2	97
	Large	128	180	3		3	3	100
	Large	180	256					100
BOULDER	Small	256	362					100
	Small	362	512					100
	Medium	512	1024					100
	Large/Very Large	1024	2048					100
BEDROCK	Bedrock	2048	>2048					100
			Total	**50**	**50**	**100**	**100**	**100**

Reachwide	
Channel materials (mm)	
D_{16} =	0.16
D_{35} =	4.00
D_{50} =	11.0
D_{84} =	41.3
D_{95} =	90.0
D_{100} =	180.0





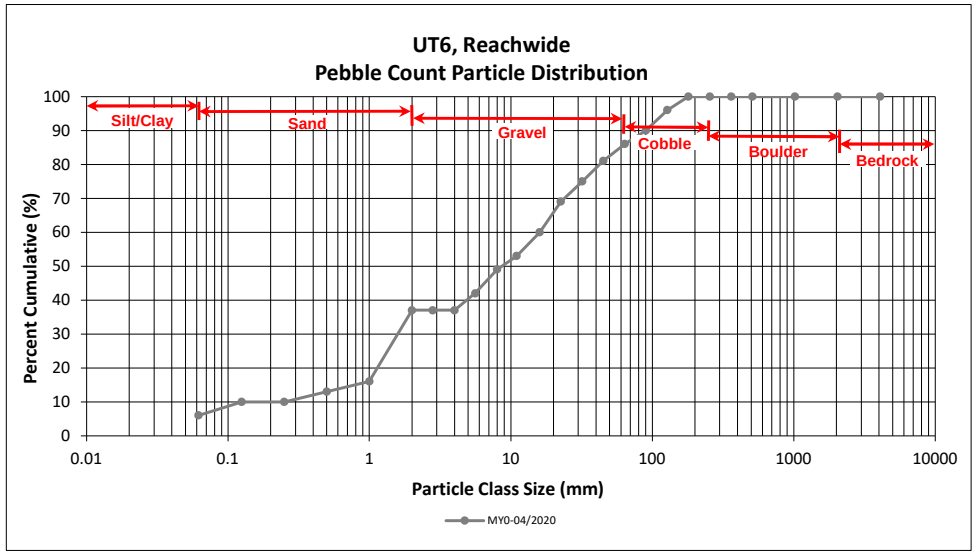
Reachwide and Cross-Section Pebble Count Plots

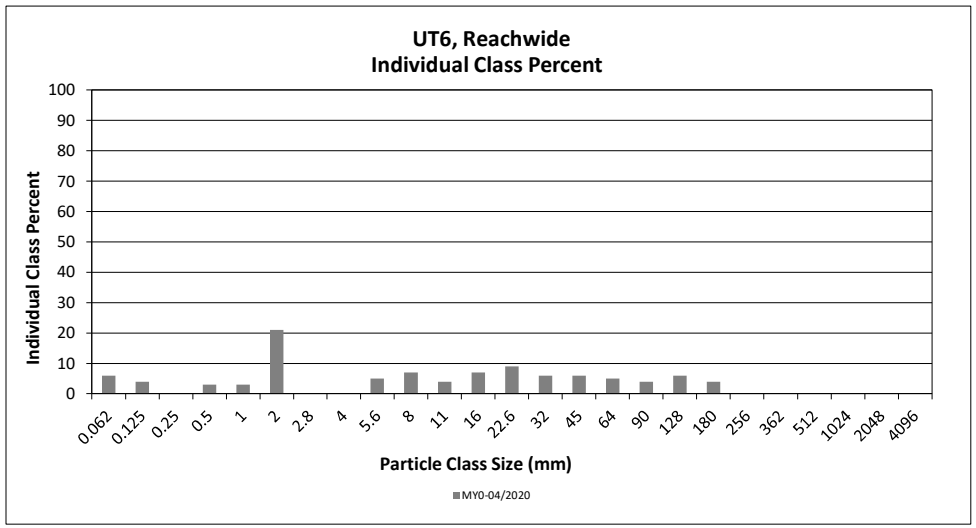
Dry Creek Mitigation Site
DMS Project No. 97082
Monitoring Year 0 - 2020

UT6, Reachwide

Particle Class		Diameter (mm)		Particle Count			Reach Summary	
		min	max	Riffle	Pool	Total	Class Percentage	Percent Cumulative
SILT/CLAY	Silt/Clay	0.000	0.062	1	5	6	6	6
SAND	Very fine	0.062	0.125		4	4	4	10
	Fine	0.125	0.250					10
	Medium	0.25	0.50		3	3	3	13
	Coarse	0.5	1.0	2	1	3	3	16
	Very Coarse	1.0	2.0	14	7	21	21	37
GRAVEL	Very Fine	2.0	2.8					37
	Very Fine	2.8	4.0					37
	Fine	4.0	5.6	4	1	5	5	42
	Fine	5.6	8.0	3	4	7	7	49
	Medium	8.0	11.0		4	4	4	53
	Medium	11.0	16.0	1	6	7	7	60
	Coarse	16.0	22.6	2	7	9	9	69
	Coarse	22.6	32	4	2	6	6	75
	Very Coarse	32	45	4	2	6	6	81
	Very Coarse	45	64	4	1	5	5	86
COBBLE	Small	64	90	4		4	4	90
	Small	90	128	5	1	6	6	96
	Large	128	180	2	2	4	4	100
	Large	180	256					100
BOULDER	Small	256	362					100
	Small	362	512					100
	Medium	512	1024					100
	Large/Very Large	1024	2048					100
BEDROCK	Bedrock	2048	>2048					100
			Total	**50**	**50**	**100**	**100**	**100**

Reachwide	
Channel materials (mm)	
D_{16} =	1.00
D_{35} =	1.87
D_{50} =	8.7
D_{84} =	55.6
D_{95} =	120.7
D_{100} =	180.0





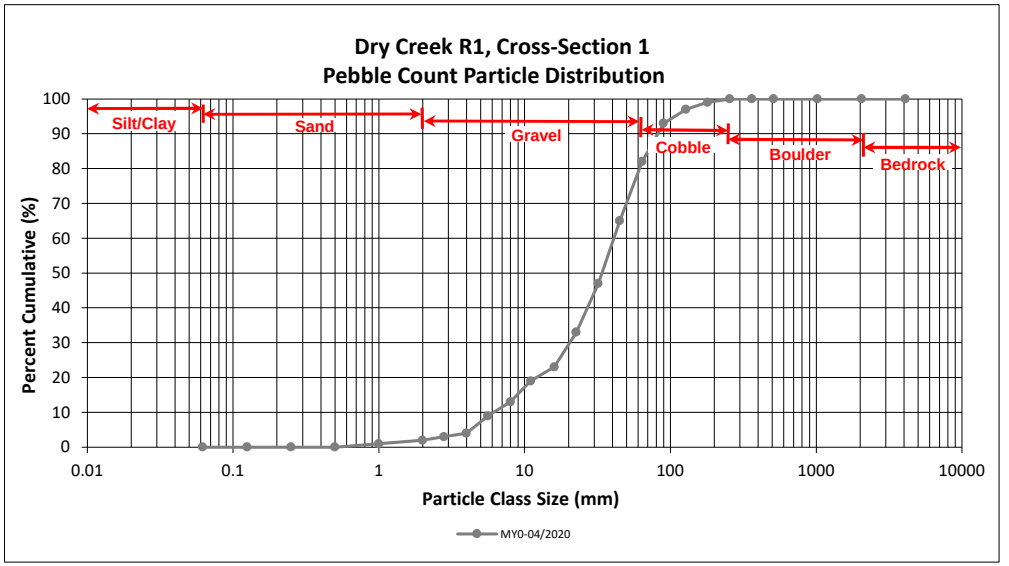
Reachwide and Cross-Section Pebble Count Plots

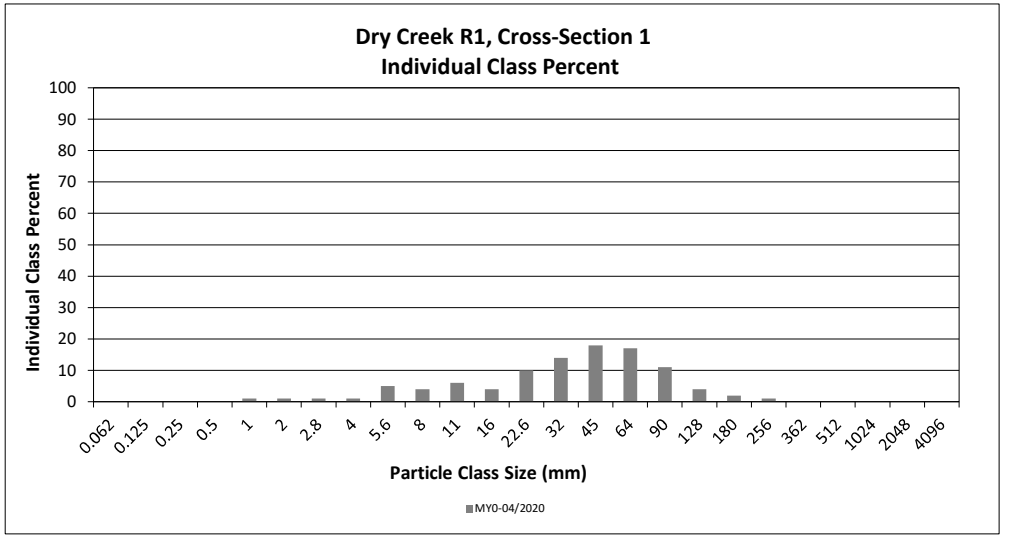
Dry Creek Mitigation Site
DMS Project No. 97082
Monitoring Year 0 - 2020

Dry Creek R1, Cross-Section 1

Particle Class		Diameter (mm)		Riffle 100-Count	Summary	
		min	max		Class Percentage	Percent Cumulative
SILT/CLAY	Silt/Clay	0.000	0.062			0
SAND	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	1	2
GRAVEL	Very Fine	2.0	2.8	1	1	3
	Very Fine	2.8	4.0	1	1	4
	Fine	4.0	5.6	5	5	9
	Fine	5.6	8.0	4	4	13
	Medium	8.0	11.0	6	6	19
	Medium	11.0	16.0	4	4	23
	Coarse	16.0	22.6	10	10	33
	Coarse	22.6	32	14	14	47
	Very Coarse	32	45	18	18	65
	Very Coarse	45	64	17	17	82
COBBLE	Small	64	90	11	11	93
	Small	90	128	4	4	97
	Large	128	180	2	2	99
	Large	180	256	1	1	100
BOULDER	Small	256	362			100
	Small	362	512			100
	Medium	512	1024			100
	Large/Very Large	1024	2048			100
BEDROCK	Bedrock	2048	>2048			100
			Total	**100**	**100**	**100**

Cross-Section 1	
Channel materials (mm)	
D_{16} =	9.38
D_{35} =	23.75
D_{50} =	33.9
D_{84} =	68.1
D_{95} =	107.3
D_{100} =	256.0





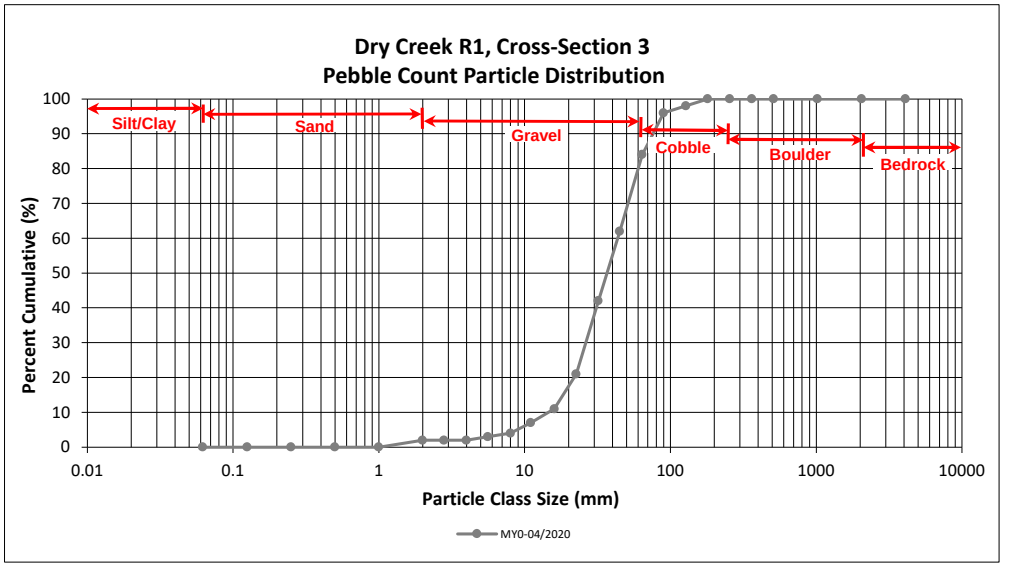
Reachwide and Cross-Section Pebble Count Plots

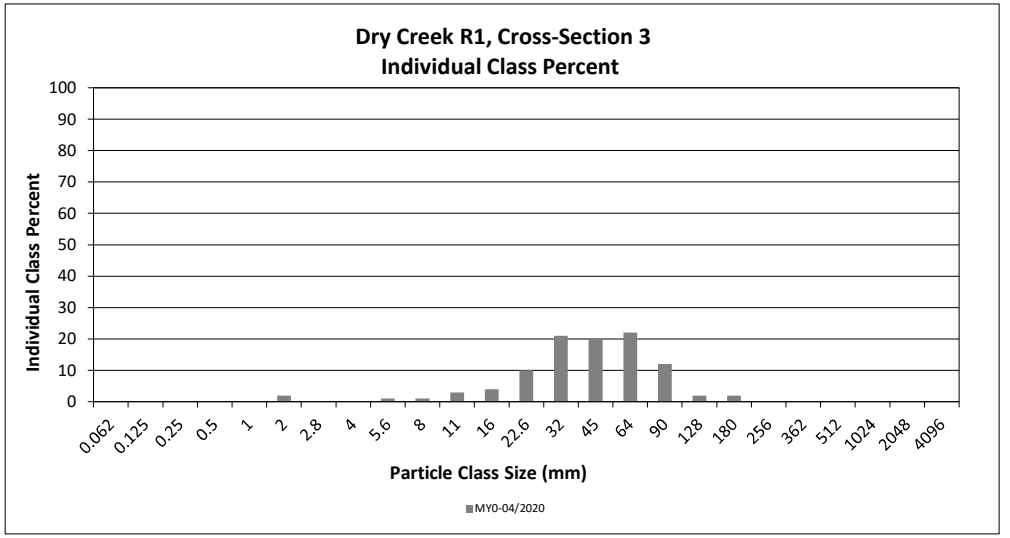
Dry Creek Mitigation Site
DMS Project No. 97082
Monitoring Year 0 - 2020

Dry Creek R1, Cross-Section 3

Particle Class		Diameter (mm)		Riffle 100-Count	Summary	
		min	max		Class Percentage	Percent Cumulative
SILT/CLAY	Silt/Clay	0.000	0.062			0
SAND	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
GRAVEL	Very Fine	2.0	2.8			2
	Very Fine	2.8	4.0			2
	Fine	4.0	5.6	1	1	3
	Fine	5.6	8.0	1	1	4
	Medium	8.0	11.0	3	3	7
	Medium	11.0	16.0	4	4	11
	Coarse	16.0	22.6	10	10	21
	Coarse	22.6	32	21	21	42
	Very Coarse	32	45	20	20	62
	Very Coarse	45	64	22	22	84
COBBLE	Small	64	90	12	12	96
	Small	90	128	2	2	98
	Large	128	180	2	2	100
	Large	180	256			100
BOULDER	Small	256	362			100
	Small	362	512			100
	Medium	512	1024			100
	Large/Very Large	1024	2048			100
BEDROCK	Bedrock	2048	>2048			100
			Total	**100**	**100**	**100**

Cross-Section 3	
Channel materials (mm)	
D_{16} =	19.02
D_{35} =	28.50
D_{50} =	36.7
D_{84} =	64.0
D_{95} =	87.5
D_{100} =	180.0





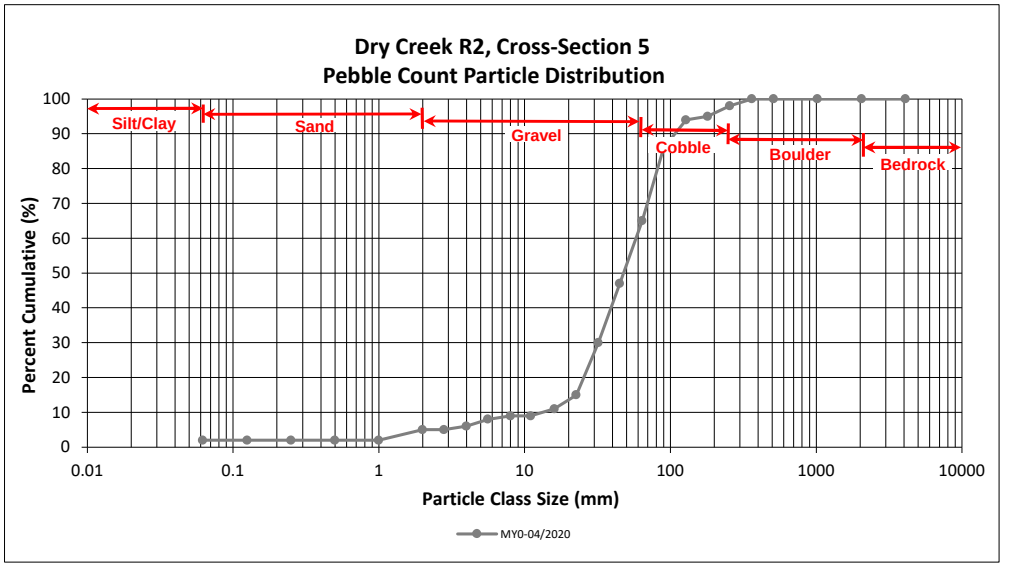
Reachwide and Cross-Section Pebble Count Plots

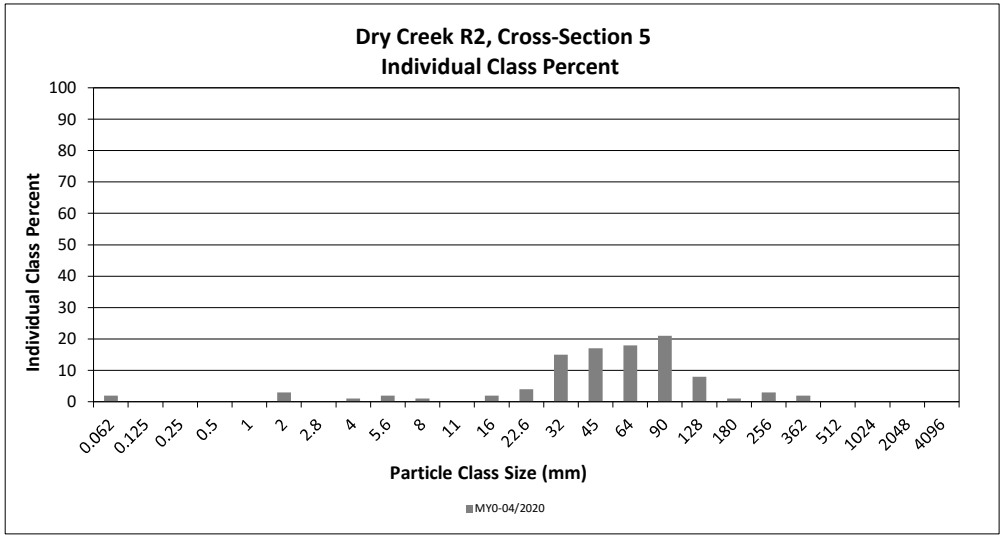
Dry Creek Mitigation Site
DMS Project No. 97082
Monitoring Year 0 - 2020

Dry Creek R2, Cross-Section 5

Particle Class		Diameter (mm)		Riffle 100-Count	Summary	
		min	max		Class Percentage	Percent Cumulative
SILT/CLAY	Silt/Clay	0.000	0.062	2	2	2
SAND	Very fine	0.062	0.125			2
	Fine	0.125	0.250			2
	Medium	0.25	0.50			2
	Coarse	0.5	1.0			2
	Very Coarse	1.0	2.0	3	3	5
GRAVEL	Very Fine	2.0	2.8			5
	Very Fine	2.8	4.0	1	1	6
	Fine	4.0	5.6	2	2	8
	Fine	5.6	8.0	1	1	9
	Medium	8.0	11.0			9
	Medium	11.0	16.0	2	2	11
	Coarse	16.0	22.6	4	4	15
	Coarse	22.6	32	15	15	30
	Very Coarse	32	45	17	17	47
	Very Coarse	45	64	18	18	65
COBBLE	Small	64	90	21	21	86
	Small	90	128	8	8	94
	Large	128	180	1	1	95
	Large	180	256	3	3	98
BOULDER	Small	256	362	2	2	100
	Small	362	512			100
	Medium	512	1024			100
	Large/Very Large	1024	2048			100
BEDROCK	Bedrock	2048	>2048			100
			Total	**100**	**100**	**100**

Cross-Section 5	
Channel materials (mm)	
D_{16} =	23.13
D_{35} =	35.38
D_{50} =	47.7
D_{84} =	87.1
D_{95} =	180.0
D_{100} =	362.0





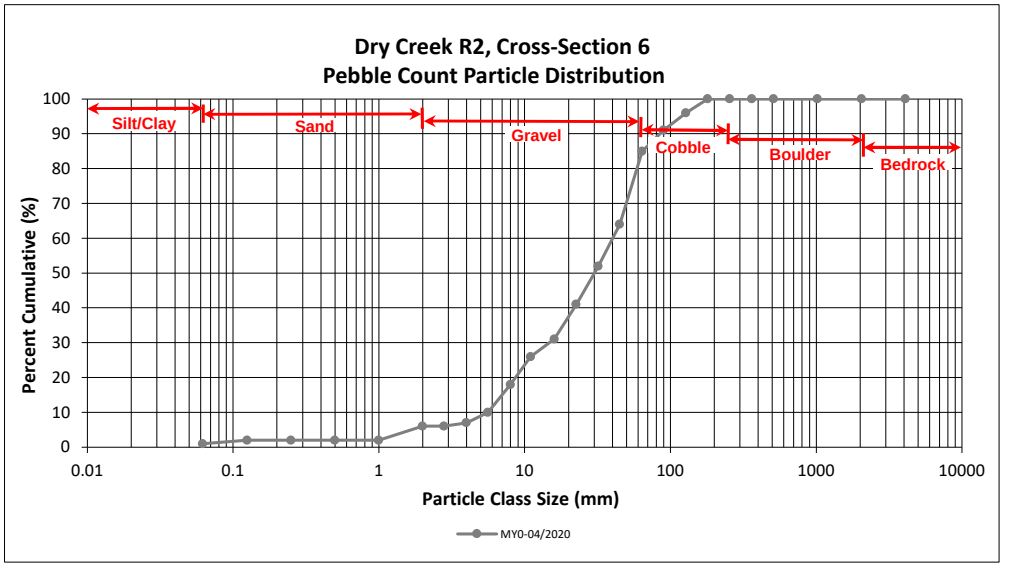
Reachwide and Cross-Section Pebble Count Plots

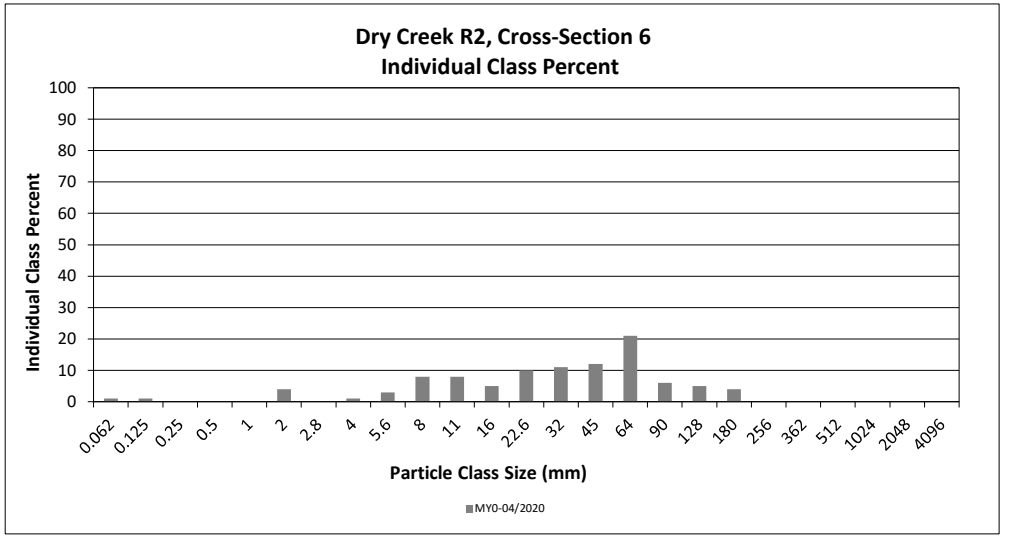
Dry Creek Mitigation Site
DMS Project No. 97082
Monitoring Year 0 - 2020

Dry Creek R2, Cross-Section 6

Particle Class		Diameter (mm)		Riffle 100-Count	Summary	
		min	max		Class Percentage	Percent Cumulative
SILT/CLAY	Silt/Clay	0.000	0.062	1	1	1
SAND	Very fine	0.062	0.125	1	1	2
	Fine	0.125	0.250			2
	Medium	0.25	0.50			2
	Coarse	0.5	1.0			2
	Very Coarse	1.0	2.0	4	4	6
GRAVEL	Very Fine	2.0	2.8			6
	Very Fine	2.8	4.0	1	1	7
	Fine	4.0	5.6	3	3	10
	Fine	5.6	8.0	8	8	18
	Medium	8.0	11.0	8	8	26
	Medium	11.0	16.0	5	5	31
	Coarse	16.0	22.6	10	10	41
	Coarse	22.6	32	11	11	52
	Very Coarse	32	45	12	12	64
	Very Coarse	45	64	21	21	85
COBBLE	Small	64	90	6	6	91
	Small	90	128	5	5	96
	Large	128	180	4	4	100
	Large	180	256			100
BOULDER	Small	256	362			100
	Small	362	512			100
	Medium	512	1024			100
	Large/Very Large	1024	2048			100
BEDROCK	Bedrock	2048	>2048			100
			Total	**100**	**100**	**100**

Cross-Section 6	
Channel materials (mm)	
D_{16} =	7.32
D_{35} =	18.37
D_{50} =	30.0
D_{84} =	62.9
D_{95} =	119.3
D_{100} =	180.0





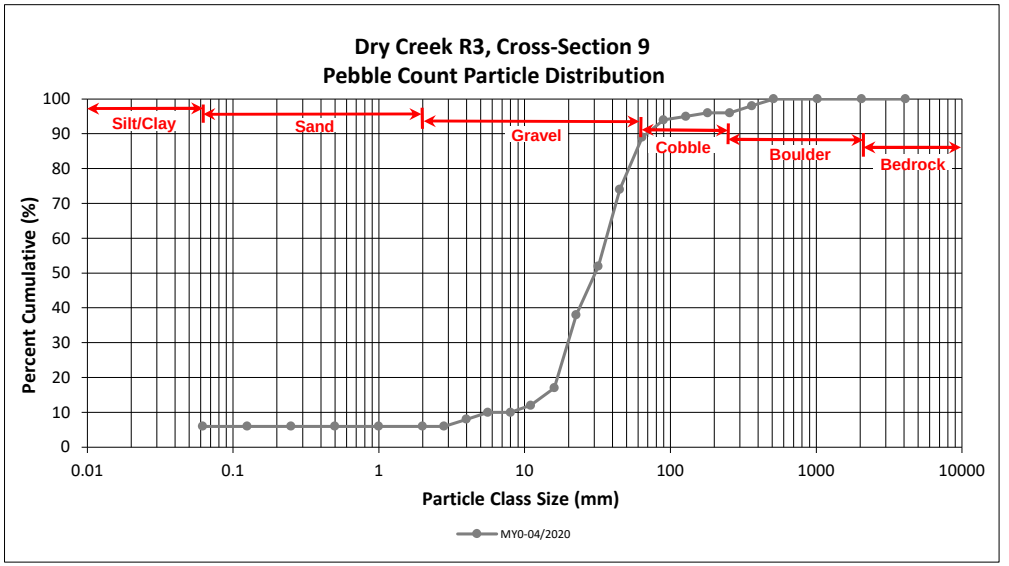
Reachwide and Cross-Section Pebble Count Plots

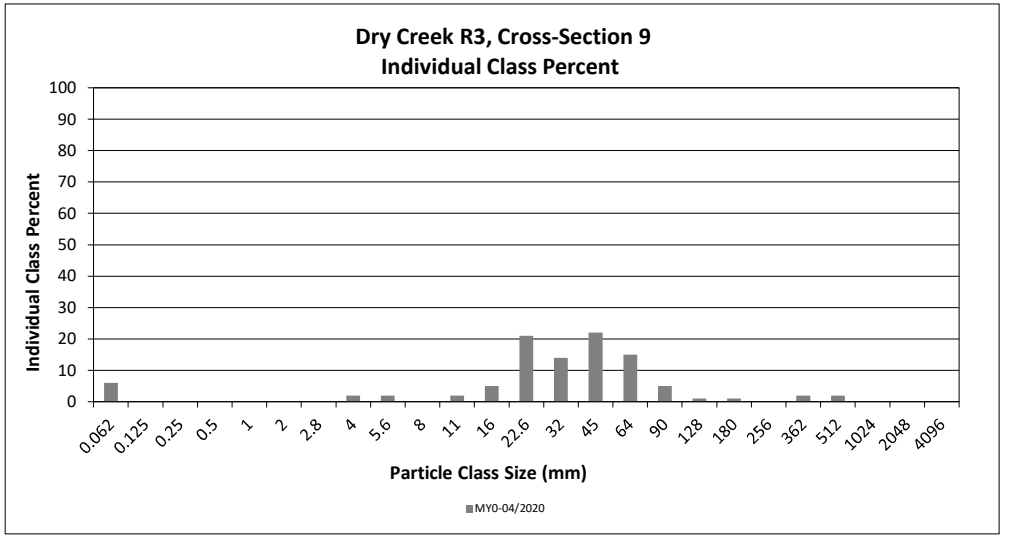
Dry Creek Mitigation Site
DMS Project No. 97082
Monitoring Year 0 - 2020

Dry Creek R3, Cross-Section 9

Particle Class		Diameter (mm)		Riffle 100-Count	Summary	
		min	max		Class Percentage	Percent Cumulative
SILT/CLAY	Silt/Clay	0.000	0.062	6	6	6
SAND	Very fine	0.062	0.125			6
	Fine	0.125	0.250			6
	Medium	0.25	0.50			6
	Coarse	0.5	1.0			6
	Very Coarse	1.0	2.0			6
GRAVEL	Very Fine	2.0	2.8			6
	Very Fine	2.8	4.0	2	2	8
	Fine	4.0	5.6	2	2	10
	Fine	5.6	8.0			10
	Medium	8.0	11.0	2	2	12
	Medium	11.0	16.0	5	5	17
	Coarse	16.0	22.6	21	21	38
	Coarse	22.6	32	14	14	52
	Very Coarse	32	45	22	22	74
	Very Coarse	45	64	15	15	89
COBBLE	Small	64	90	5	5	94
	Small	90	128	1	1	95
	Large	128	180	1	1	96
	Large	180	256			96
BOULDER	Small	256	362	2	2	98
	Small	362	512	2	2	100
	Medium	512	1024			100
	Large/Very Large	1024	2048			100
BEDROCK	Bedrock	2048	>2048			100
			Total	**100**	**100**	**100**

Cross-Section 9	
Channel materials (mm)	
D_{16} =	14.84
D_{35} =	21.51
D_{50} =	30.4
D_{84} =	56.9
D_{95} =	128.0
D_{100} =	512.0





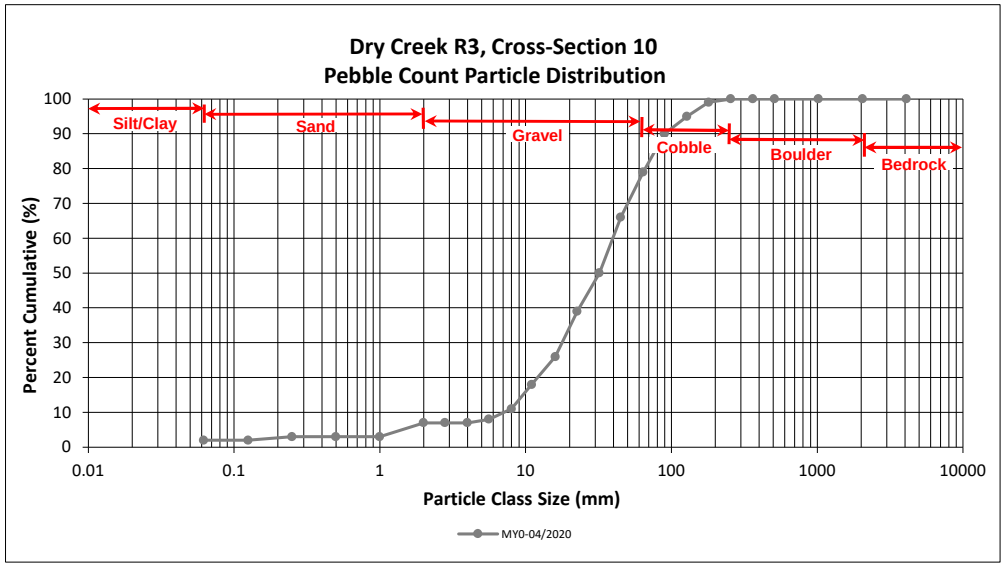
Reachwide and Cross-Section Pebble Count Plots

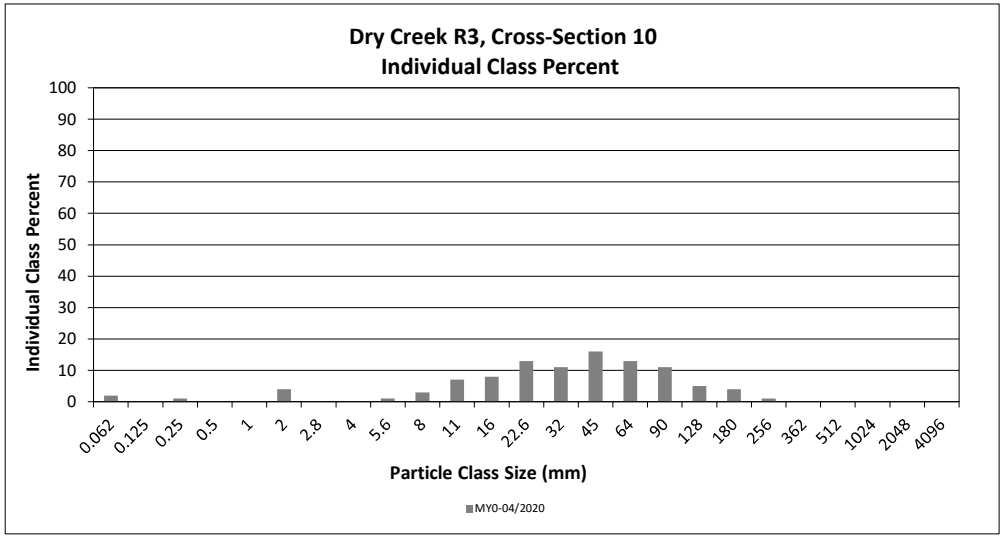
Dry Creek Mitigation Site
DMS Project No. 97082
Monitoring Year 0 - 2020

Dry Creek R3, Cross-Section 10

Particle Class		Diameter (mm)		Riffle 100-Count	Summary	
		min	max		Class Percentage	Percent Cumulative
SILT/CLAY	Silt/Clay	0.000	0.062	2	2	2
SAND	Very fine	0.062	0.125			2
	Fine	0.125	0.250	1	1	3
	Medium	0.25	0.50			3
	Coarse	0.5	1.0			3
	Very Coarse	1.0	2.0	4	4	7
GRAVEL	Very Fine	2.0	2.8			7
	Very Fine	2.8	4.0			7
	Fine	4.0	5.6	1	1	8
	Fine	5.6	8.0	3	3	11
	Medium	8.0	11.0	7	7	18
	Medium	11.0	16.0	8	8	26
	Coarse	16.0	22.6	13	13	39
	Coarse	22.6	32	11	11	50
	Very Coarse	32	45	16	16	66
	Very Coarse	45	64	13	13	79
COBBLE	Small	64	90	11	11	90
	Small	90	128	5	5	95
	Large	128	180	4	4	99
	Large	180	256	1	1	100
BOULDER	Small	256	362			100
	Small	362	512			100
	Medium	512	1024			100
	Large/Very Large	1024	2048			100
BEDROCK	Bedrock	2048	>2048			100
			Total	**100**	**100**	**100**

Cross-Section 10	
Channel materials (mm)	
D_{16} =	10.04
D_{35} =	20.32
D_{50} =	32.0
D_{84} =	74.7
D_{95} =	128.0
D_{100} =	256.0





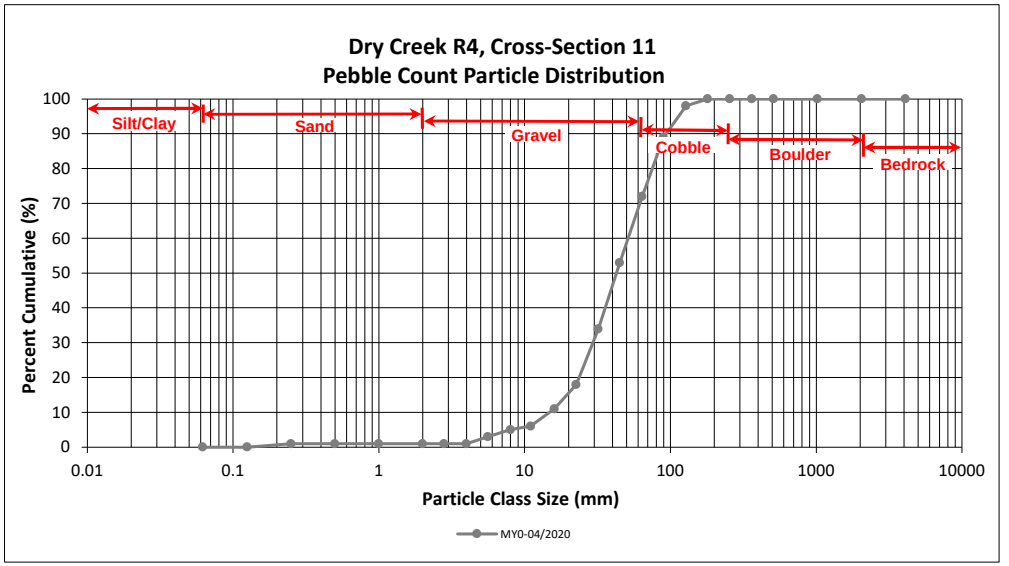
Reachwide and Cross-Section Pebble Count Plots

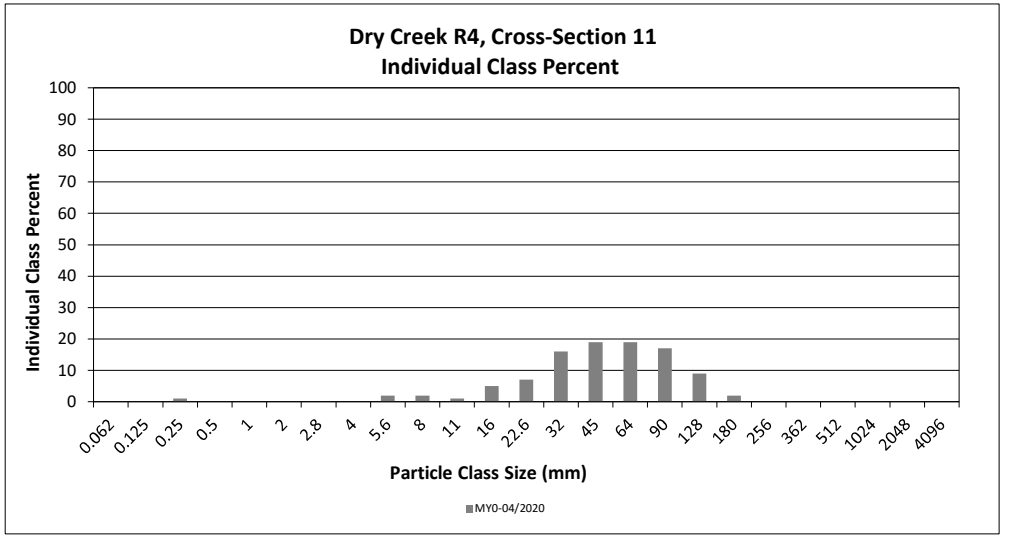
Dry Creek Mitigation Site
DMS Project No. 97082
Monitoring Year 0 - 2020

Dry Creek R4, Cross-Section 11

Particle Class		Diameter (mm)		Riffle 100-Count	Summary	
		min	max		Class Percentage	Percent Cumulative
SILT/CLAY	Silt/Clay	0.000	0.062			0
SAND	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
GRAVEL	Very Fine	2.0	2.8			1
	Very Fine	2.8	4.0			1
	Fine	4.0	5.6	2	2	3
	Fine	5.6	8.0	2	2	5
	Medium	8.0	11.0	1	1	6
	Medium	11.0	16.0	5	5	11
	Coarse	16.0	22.6	7	7	18
	Coarse	22.6	32	16	16	34
	Very Coarse	32	45	19	19	53
	Very Coarse	45	64	19	19	72
COBBLE	Small	64	90	17	17	89
	Small	90	128	9	9	98
	Large	128	180	2	2	100
	Large	180	256			100
BOULDER	Small	256	362			100
	Small	362	512			100
	Medium	512	1024			100
	Large/Very Large	1024	2048			100
BEDROCK	Bedrock	2048	>2048			100
			Total	**100**	**100**	**100**

Cross-Section 11	
Channel materials (mm)	
D_{16} =	20.48
D_{35} =	32.58
D_{50} =	42.6
D_{84} =	81.4
D_{95} =	113.8
D_{100} =	180.0





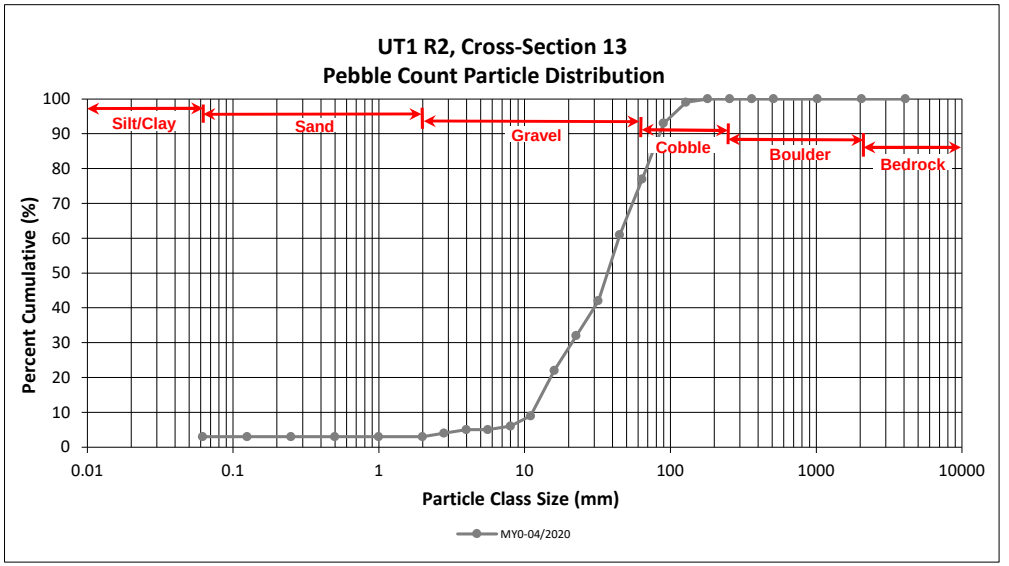
Reachwide and Cross-Section Pebble Count Plots

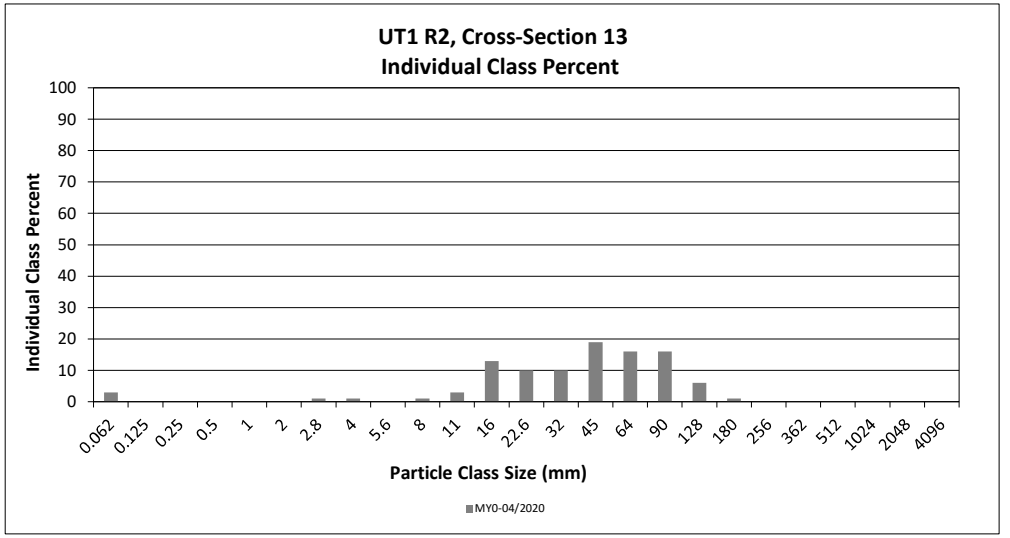
Dry Creek Mitigation Site
DMS Project No. 97082
Monitoring Year 0 - 2020

UT1 R2, Cross-Section 13

Particle Class		Diameter (mm)		Riffle 100-Count	Summary	
		min	max		Class Percentage	Percent Cumulative
SILT/CLAY	Silt/Clay	0.000	0.062	3	3	3
SAND	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
GRAVEL	Very Fine	2.0	2.8	1	1	4
	Very Fine	2.8	4.0	1	1	5
	Fine	4.0	5.6			5
	Fine	5.6	8.0	1	1	6
	Medium	8.0	11.0	3	3	9
	Medium	11.0	16.0	13	13	22
	Coarse	16.0	22.6	10	10	32
	Coarse	22.6	32	10	10	42
	Very Coarse	32	45	19	19	61
	Very Coarse	45	64	16	16	77
COBBLE	Small	64	90	16	16	93
	Small	90	128	6	6	99
	Large	128	180	1	1	100
	Large	180	256			100
BOULDER	Small	256	362			100
	Small	362	512			100
	Medium	512	1024			100
	Large/Very Large	1024	2048			100
BEDROCK	Bedrock	2048	>2048			100
			Total	**100**	**100**	**100**

Cross-Section 13	
Channel materials (mm)	
D_{16} =	13.46
D_{35} =	25.09
D_{50} =	36.9
D_{84} =	74.3
D_{95} =	101.2
D_{100} =	180.0





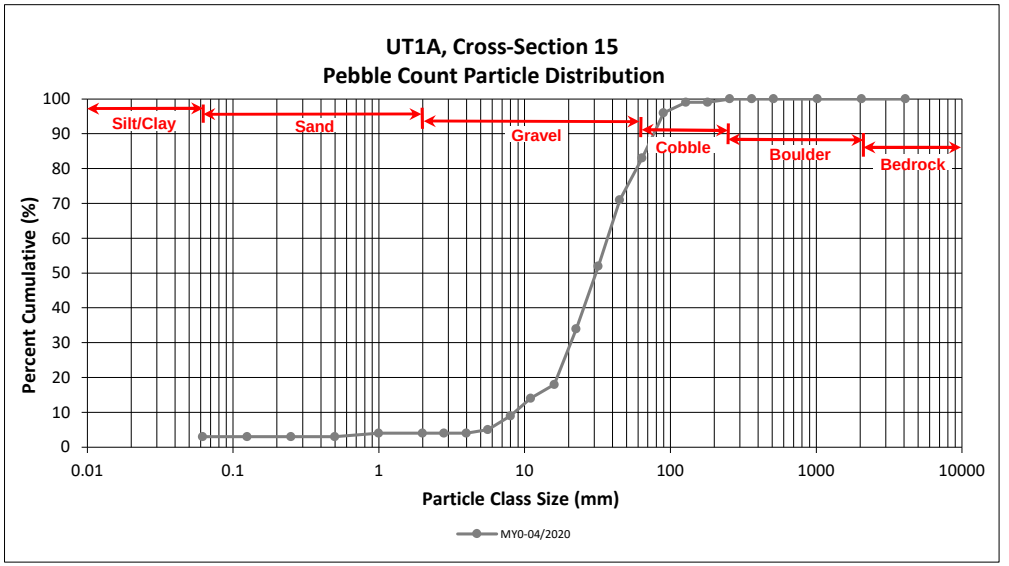
Reachwide and Cross-Section Pebble Count Plots

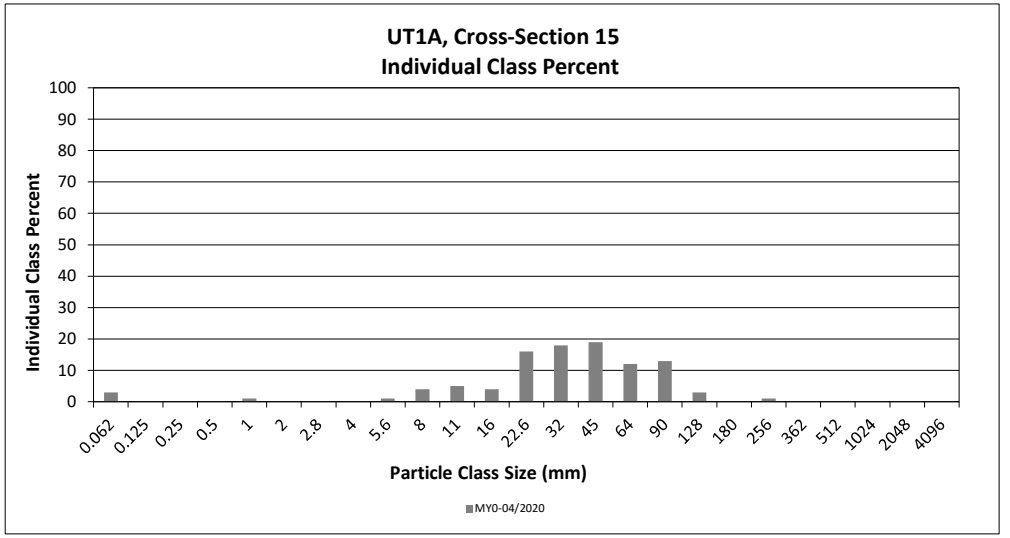
Dry Creek Mitigation Site
DMS Project No. 97082
Monitoring Year 0 - 2020

UT1A, Cross-Section 15

Particle Class		Diameter (mm)		Riffle 100-Count	Summary	
		min	max		Class Percentage	Percent Cumulative
SILT/CLAY	Silt/Clay	0.000	0.062	3	3	3
SAND	Very fine	0.062	0.125			3
	Fine	0.125	0.250			3
	Medium	0.25	0.50			3
	Coarse	0.5	1.0	1	1	4
	Very Coarse	1.0	2.0			4
GRAVEL	Very Fine	2.0	2.8			4
	Very Fine	2.8	4.0			4
	Fine	4.0	5.6	1	1	5
	Fine	5.6	8.0	4	4	9
	Medium	8.0	11.0	5	5	14
	Medium	11.0	16.0	4	4	18
	Coarse	16.0	22.6	16	16	34
	Coarse	22.6	32	18	18	52
	Very Coarse	32	45	19	19	71
	Very Coarse	45	64	12	12	83
COBBLE	Small	64	90	13	13	96
	Small	90	128	3	3	99
	Large	128	180			99
	Large	180	256	1	1	100
BOULDER	Small	256	362			100
	Small	362	512			100
	Medium	512	1024			100
	Large/Very Large	1024	2048			100
BEDROCK	Bedrock	2048	>2048			100
			Total	**100**	**100**	**100**

Cross-Section 15	
Channel materials (mm)	
D_{16} =	13.27
D_{35} =	23.04
D_{50} =	30.8
D_{84} =	65.7
D_{95} =	87.7
D_{100} =	256.0





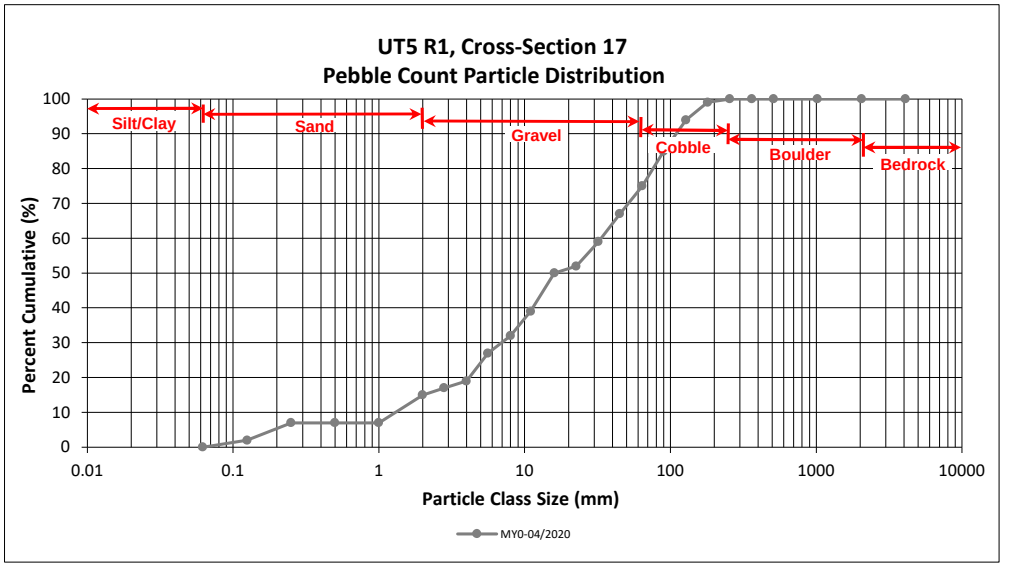
Reachwide and Cross-Section Pebble Count Plots

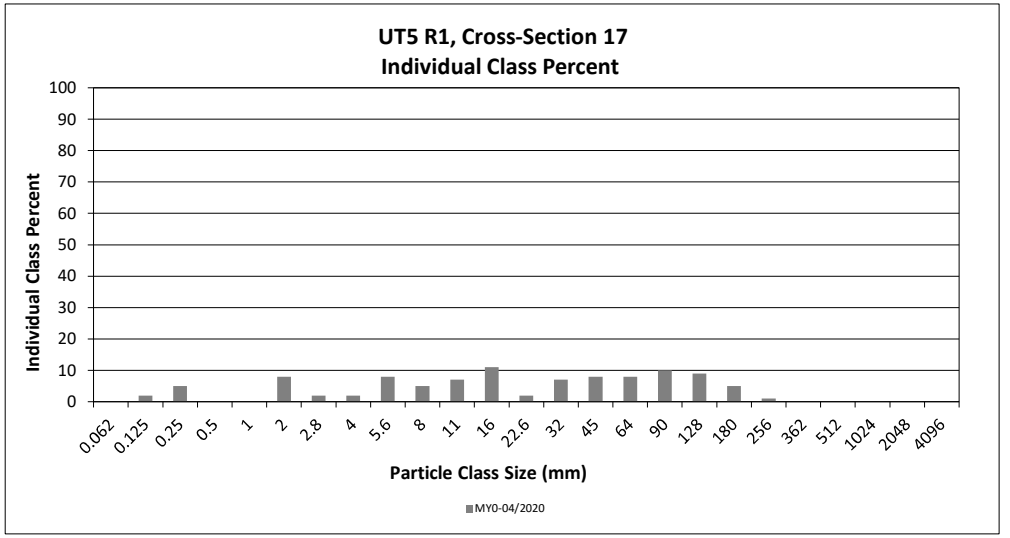
Dry Creek Mitigation Site
DMS Project No. 97082
Monitoring Year 0 - 2020

UT5 R1, Cross-Section 17

Particle Class		Diameter (mm)		Riffle 100-Count	Summary	
		min	max		Class Percentage	Percent Cumulative
SILT/CLAY	Silt/Clay	0.000	0.062			0
SAND	Very fine	0.062	0.125	2	2	2
	Fine	0.125	0.250	5	5	7
	Medium	0.25	0.50			7
	Coarse	0.5	1.0			7
	Very Coarse	1.0	2.0	8	8	15
GRAVEL	Very Fine	2.0	2.8	2	2	17
	Very Fine	2.8	4.0	2	2	19
	Fine	4.0	5.6	8	8	27
	Fine	5.6	8.0	5	5	32
	Medium	8.0	11.0	7	7	39
	Medium	11.0	16.0	11	11	50
	Coarse	16.0	22.6	2	2	52
	Coarse	22.6	32	7	7	59
	Very Coarse	32	45	8	8	67
	Very Coarse	45	64	8	8	75
COBBLE	Small	64	90	10	10	85
	Small	90	128	9	9	94
	Large	128	180	5	5	99
	Large	180	256	1	1	100
BOULDER	Small	256	362			100
	Small	362	512			100
	Medium	512	1024			100
	Large/Very Large	1024	2048			100
BEDROCK	Bedrock	2048	>2048			100
			Total	**100**	**100**	**100**

Cross-Section 17	
Channel materials (mm)	
D_{16} =	2.37
D_{35} =	9.17
D_{50} =	16.0
D_{84} =	87.0
D_{95} =	137.0
D_{100} =	256.0





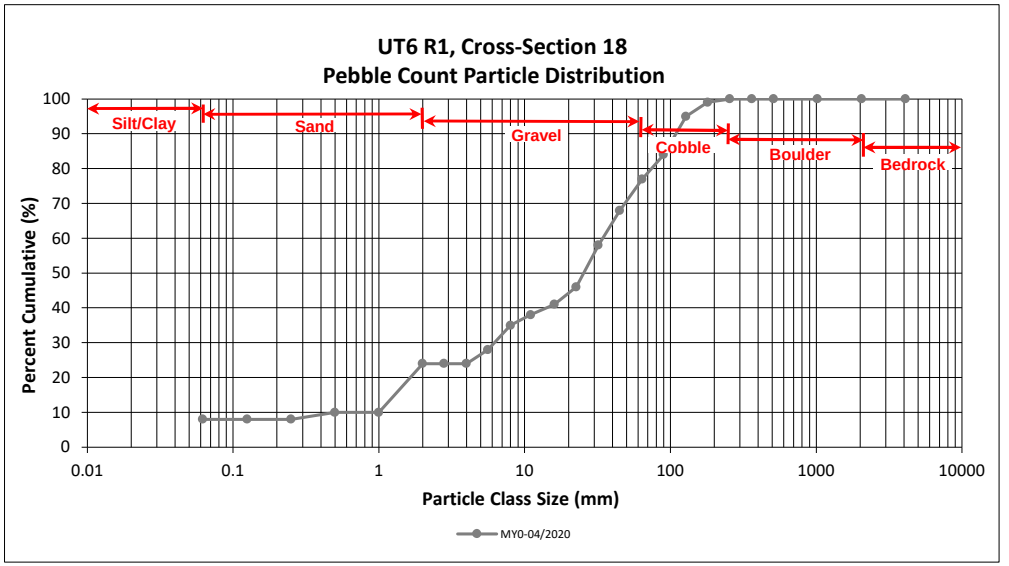
Reachwide and Cross-Section Pebble Count Plots

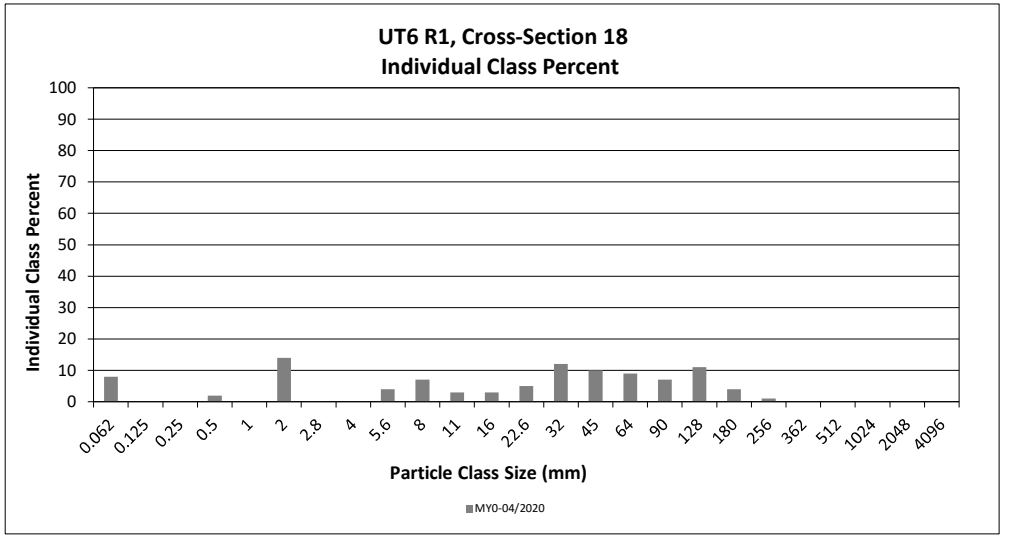
Dry Creek Mitigation Site
DMS Project No. 97082
Monitoring Year 0 - 2020

UT6 R1, Cross-Section 18

Particle Class		Diameter (mm) min	Diameter (mm) max	Riffle 100-Count	Summary: Class Percentage	Summary: Percent Cumulative
SILT/CLAY	Silt/Clay	0.000	0.062	8	8	8
SAND	Very fine	0.062	0.125			8
	Fine	0.125	0.250			8
	Medium	0.25	0.50	2	2	10
	Coarse	0.5	1.0			10
	Very Coarse	1.0	2.0	14	14	24
GRAVEL	Very Fine	2.0	2.8			24
	Very Fine	2.8	4.0			24
	Fine	4.0	5.6	4	4	28
	Fine	5.6	8.0	7	7	35
	Medium	8.0	11.0	3	3	38
	Medium	11.0	16.0	3	3	41
	Coarse	16.0	22.6	5	5	46
	Coarse	22.6	32	12	12	58
	Very Coarse	32	45	10	10	68
	Very Coarse	45	64	9	9	77
COBBLE	Small	64	90	7	7	84
	Small	90	128	11	11	95
	Large	128	180	4	4	99
	Large	180	256	1	1	100
BOULDER	Small	256	362			100
	Small	362	512			100
	Medium	512	1024			100
	Large/Very Large	1024	2048			100
BEDROCK	Bedrock	2048	>2048			100
			Total	**100**	**100**	**100**

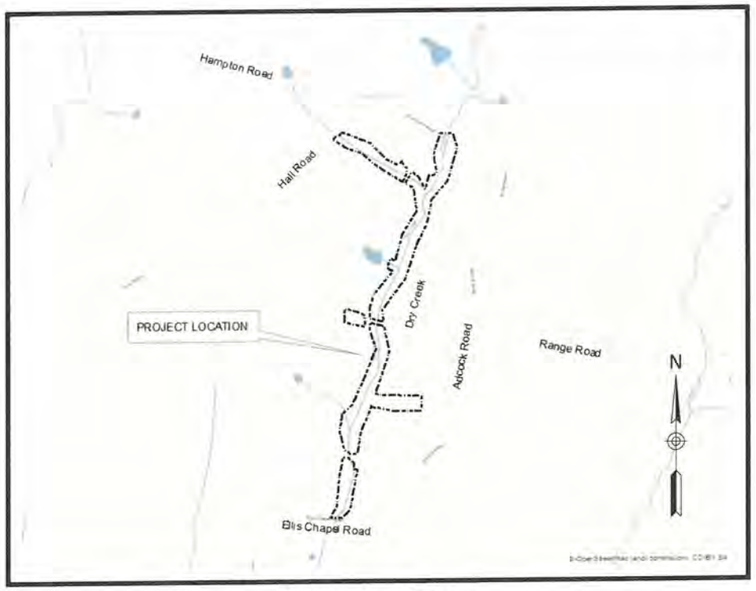
Cross-Section 18	
Channel materials (mm)	
D_{16} =	1.35
D_{35} =	8.00
D_{50} =	25.4
D_{84} =	90.0
D_{95} =	128.0
D_{100} =	256.0





APPENDIX 5. Record Drawings

Dry Creek Mitigation Site
Durham County, North Carolina
for NCDEQ



Vicinity Map
Not to Scale

Environmental Quality

As-Built and Record Drawings
08.05.2020

Stream Origins

Stream	Latitude	Longitude
DRY CREEK	N 36º 11' 32.98"	W 78º 49' 32.29"
UT1	N 36º 11' 32.79"	W 78º 49' 49.04"
UT1A	N 36º 11' 29.29"	W 78º 49' 39.91"
UT2	N 36º 11' 19.68"	W 78º 49' 37.08"
UT3	N 36º 11' 17.14"	W 78º 49' 41.14"
UT4	N 36º 11' 15.79"	W 78º 49' 38.52"
UT5	N 36º 11' 10.57"	W 78º 49' 47.90"
UT6	N 36º 10' 59.43"	W 78º 49' 36.38"
UT7	N 36º 10' 59.15"	W 78º 49' 47.62"

CERTIFICATE OF SURVEY AND ACCURACY

I, DREW V. DUINKERKEN, 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 AN AS-BUILT SURVEY FOR "WILDLANDS ENGINEERING, INC.", JOB #2003022-AB, DATED JULY 23, 2020; THAT THIS SURVEY WAS PERFORMED AT THE 95% CONFIDENCE LEVEL TO MEET THE FEDERAL GEOGRAPHIC DATA COMMITTEE STANDARDS AND TO MEET THE REQUIREMENTS OF 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 03/17/20-06/02/20; THAT THE CONTOURS SHOWN AS BROKEN LINES MAY NOT MEET THE STATED STANDARD; THAT ALL COORDINATES ARE BASED ON NAD 83 (NSRS 2011) AND ALL ELEVATIONS ARE BASED ON NAVD 88; THAT THIS MAP MEETS THE SPECIFICATIONS FOR TOPOGRAPHIC SURVEYS AS STATED IN TITLE 21, CHAPTER 56, SECTION .1606.

WITNESS MY ORIGINAL SIGNATURE, LICENSE NUMBER, AND SEAL THIS 7TH DAY OF AUGUST 2020, A.D.

NORTH CAROLINA PROFESSIONAL SEAL L-5010 LAND SURVEYOR DREW VAN DUINKERKEN

DREW V. DUINKERKEN, PLS L-5010

Sheet Index

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Nicole Macaluso Millns, PE, Project Engineer
919-851-9986

Surveying:
Kee Mapping & Surveying, PA
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Asheville, NC 28801
Drew Duinkerken, PLS
828-575-9021

Owner:
NCDEQ
Division of Mitigation Services
217 West Jones St. Suite 3000A
Raleigh, NC 27603
Lindsay Crocker
919-594-3910

DMS Project No. 97082

Neuse River Basin 03020201

USACE Action ID No. 2016-00880

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NORTH CAROLINA PROFESSIONAL SEAL 031027 ENGINEER JEFFREY T. KEATON

Dry Creek Mitigation Site
Durham County, NC

Title Sheet

Revisions:

Date: 08.05.2020
Job Number: 005-02159
Project Engineer: NMM
Drawn By: CAW
Checked By: JTL

Sheet 0.1

August 7, 2020

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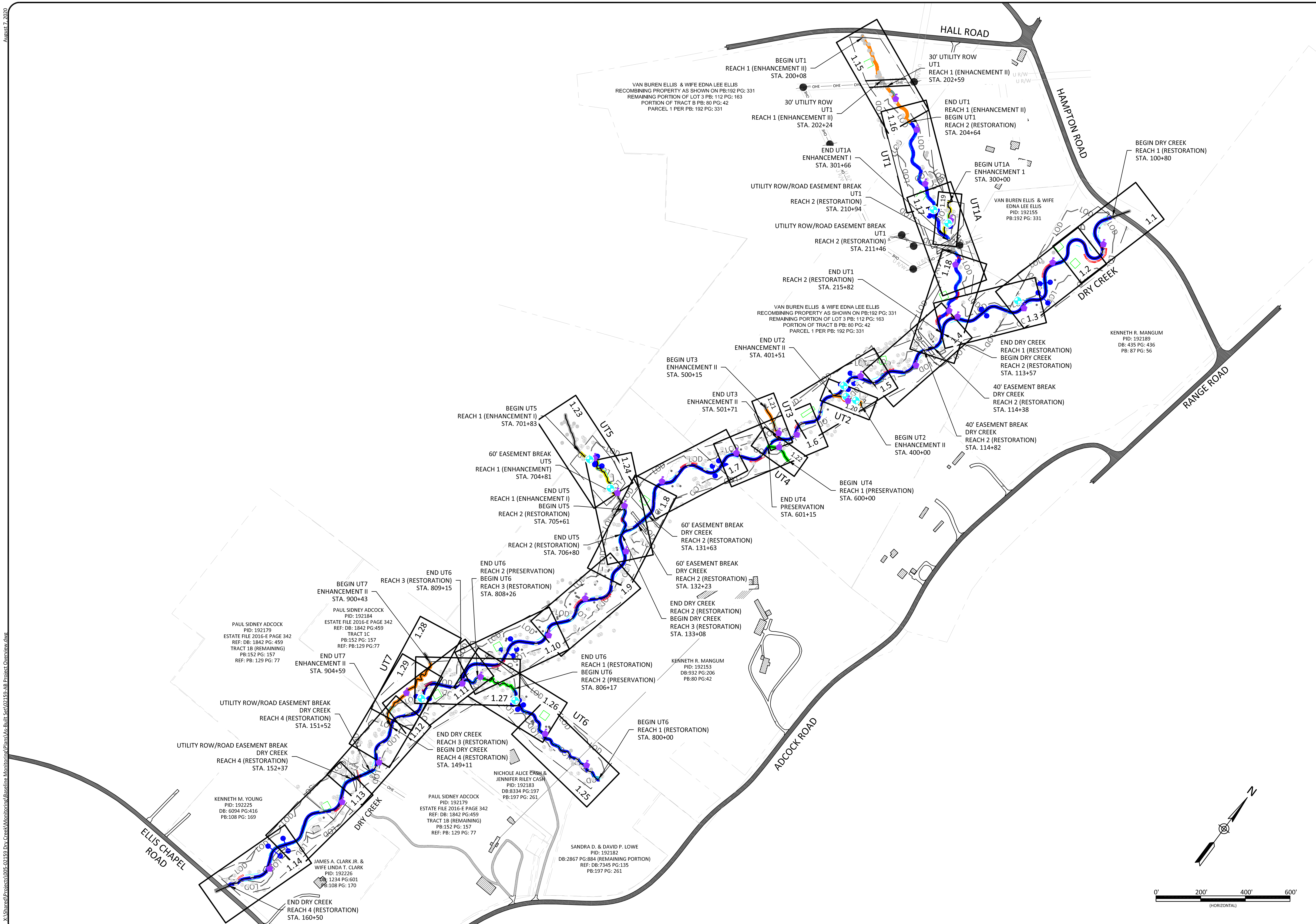

August 7, 2020

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NORTH CAROLINA PROFESSIONAL ENGINEER SEAL 031027 JEFFERSON ... 8-7-20

Dry Creek Mitigation Site
Durham County, NC

Project Overview

Revisions:

Date:	08.05.2020
Job Number:	005-02159
Project Engineer:	NMM
Drawn By:	CAW
Checked By:	JTL

0.2

Sheet

August 7, 2020

Pre Construction Features

- Existing Property Boundary
- R/W — Existing NCDOT Right-of-way
- U R/W — Existing Utility Right-of-way
- Existing Wetlands
- Existing Treeline
- Existing Tree
- Existing Bedrock

Design Features

- CE CE CE — Conservation Easement
- 10+00 — Design Stream Alignment - No Credit
- 10+00 — Design Stream Alignment - Restoration
- 10+00 — Design Stream Alignment - Enhancement I
- 10+00 — Design Stream Alignment - Enhancement II
- 10+00 — Design Stream Alignment - Preservation
- Designed Bankfull
- 540 — Designed 5' Major Contour
- Designed 1' Minor Contour
- CR-NM — Designed Riffle
- Designed Lunker Log
- Designed Angled Log Sill
- Designed Boulder Sill
- Designed Log Vane
- Designed Log J-Hook
- Designed Vernal Pool
- Designed Boulder Sill with Boulder Toe Protection
- Designed Brush Toe
- Designed Vegetated Soil Lift
- Designed Transplanted Sod Mat
- Designed Rock Floodplain Outlet
- Designed Channel Plug
- Designed Culvert
- Designed Woven Wire Fence
- Designed 4 Strand High Tensile Fence
- Designed 2" Tube Steel Gate
- Designed 2x2" Tube Steel Gate
- Designed Cattle Grate

As-Built Features

- 10+00 — As-Built Stream Alignment
- As-Built Stream Bankfull
- 100 — As-Built Major Contour
- As-Built Minor Contour
- LOD LOD — As-Built Limits of Disturbance
- Designed Boulder Sill
- As-Built Woven Wire Fence
- As-Built High Tensile Fence
- As-Built Culvert
- As-Built Cattle Grate
- As-Built Gate
- As-Built Gate
- As-Built Riffle
- As-Built Rock Structure
- As-Built Road
- As-Built Brush Toe
- As-Built Vegetated Soil Lift
- As-Built Transplanted Sod Mat
- As-Built Boulder Toe
- As-Built Log J-Hook
- As-Built Log J-Hook
- As-Built Log Vane
- As-Built Cover Log
- As-Built Rock Sill
- As-Built Log Sill
- As-Built Vernal Pool
- Photo Point
- CG — Crest Gauge
- FG — Flow Gauge
- GW — Ground Water Gauge
- BAROTROLL — Barotroll Data Logger
- VEG / VP 6 — Vegetation Plot

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Dry Creek Mitigation Site
Durham County, NC

General Notes and Symbols

Revisions:

Date: 08.05.2020
Job Number: 005-02159
Project Engineer: NMM
Drawn By: CAW
Checked By: JTL

Sheet 0.3

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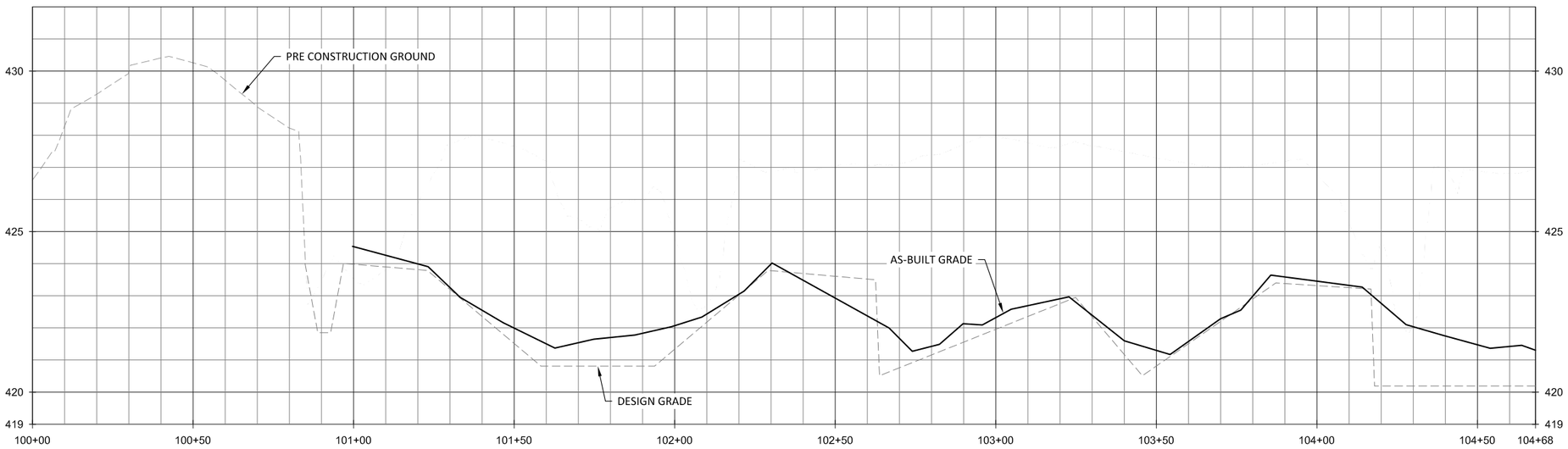
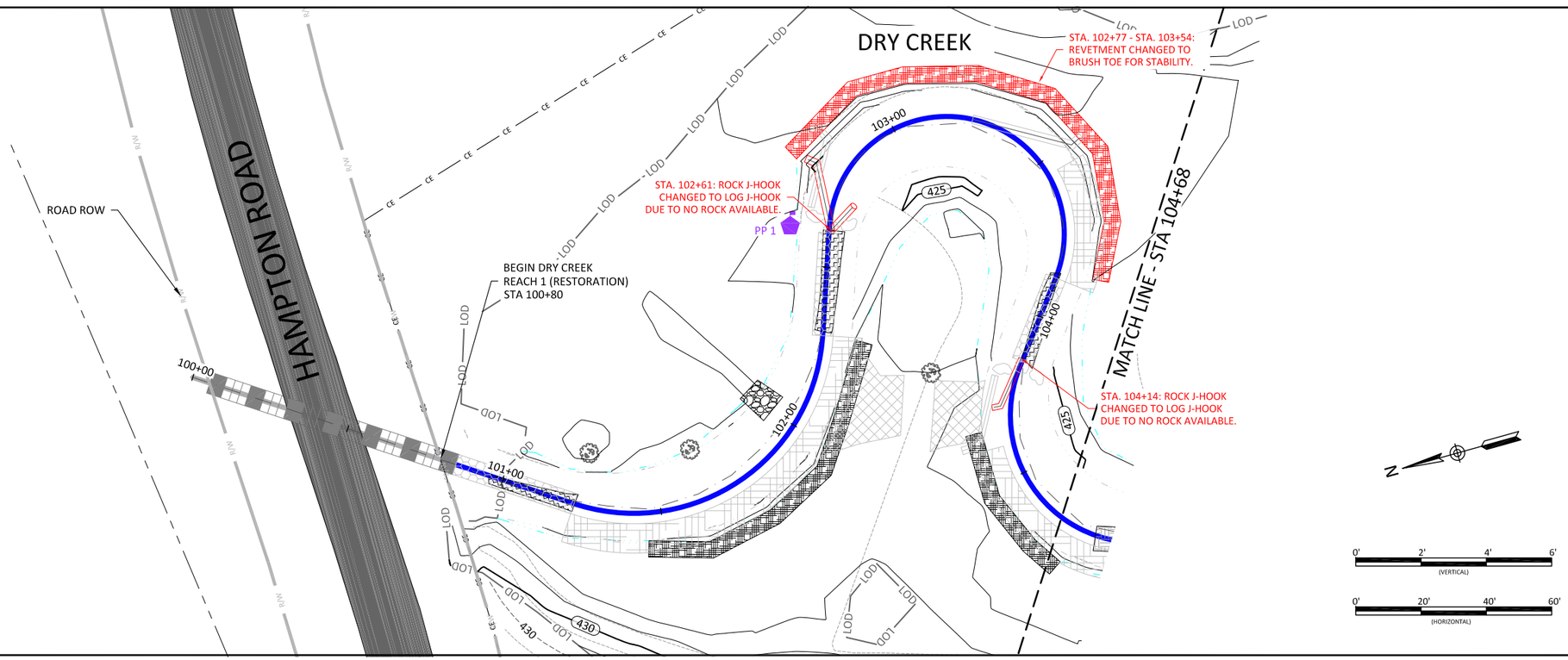
August 7, 2020





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NORTH CAROLINA PROFESSIONAL SEAL 031027 ENGINEER JEREMY T. LITTLE

Dry Creek Mitigation Site
Durham County, NC

Dry Creek Reach 1
Stream Plan and Profile

Revisions:

Date: 08.05.2020
Job Number: 005-02159
Project Engineer: NMM
Drawn By: CAW
Checked By: JTL

Sheet 1.1

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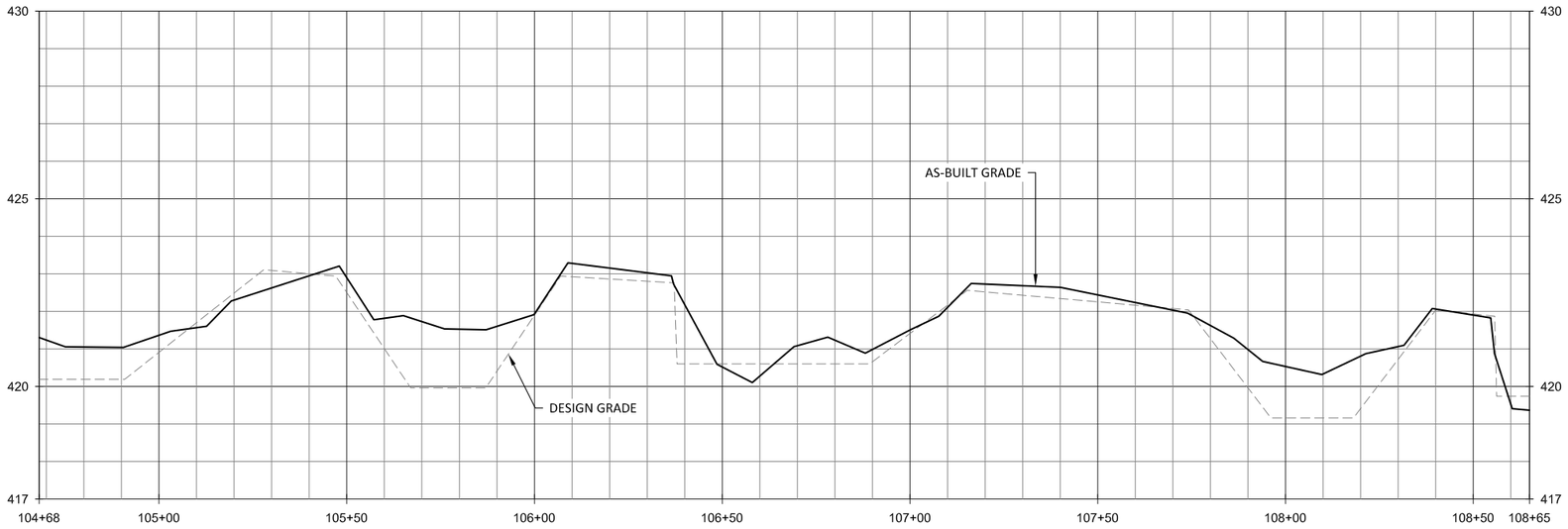
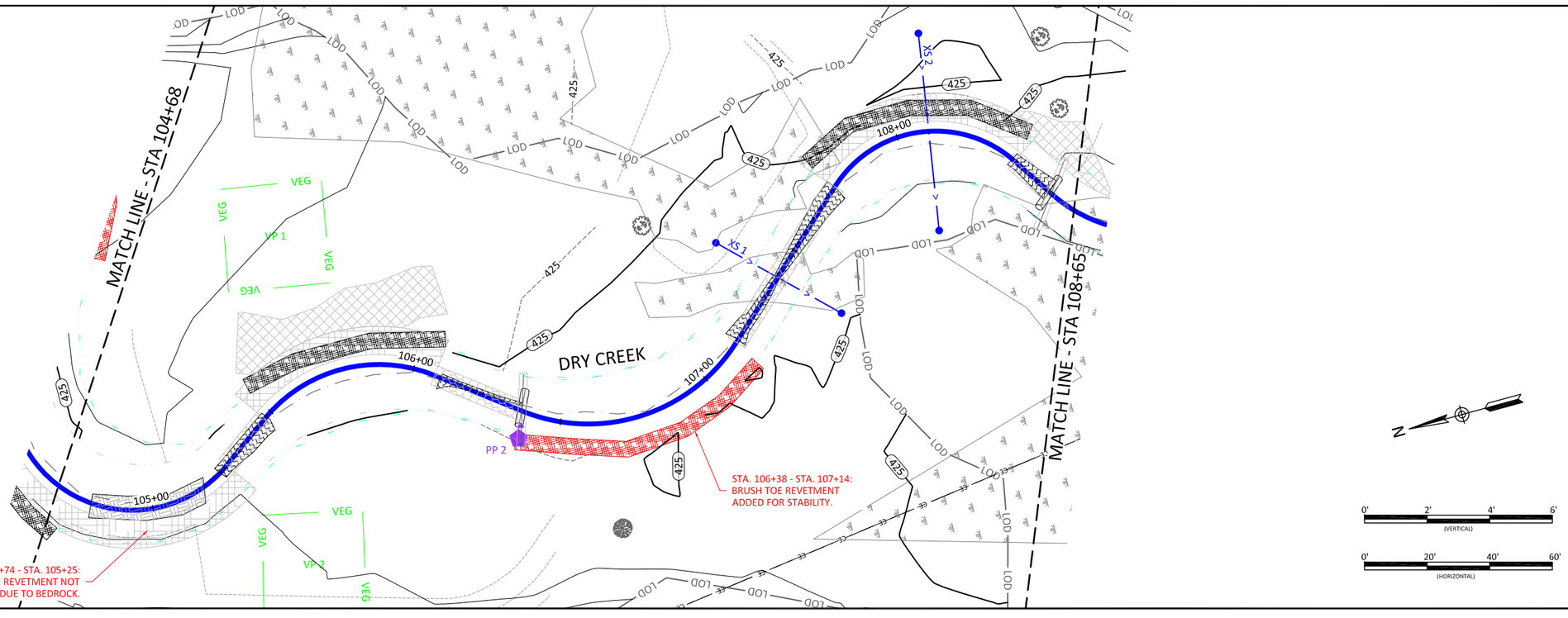
August 7, 2020





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NORTH CAROLINA PROFESSIONAL SEAL 031027 ENGINEER JEFFREY T. LEWIS

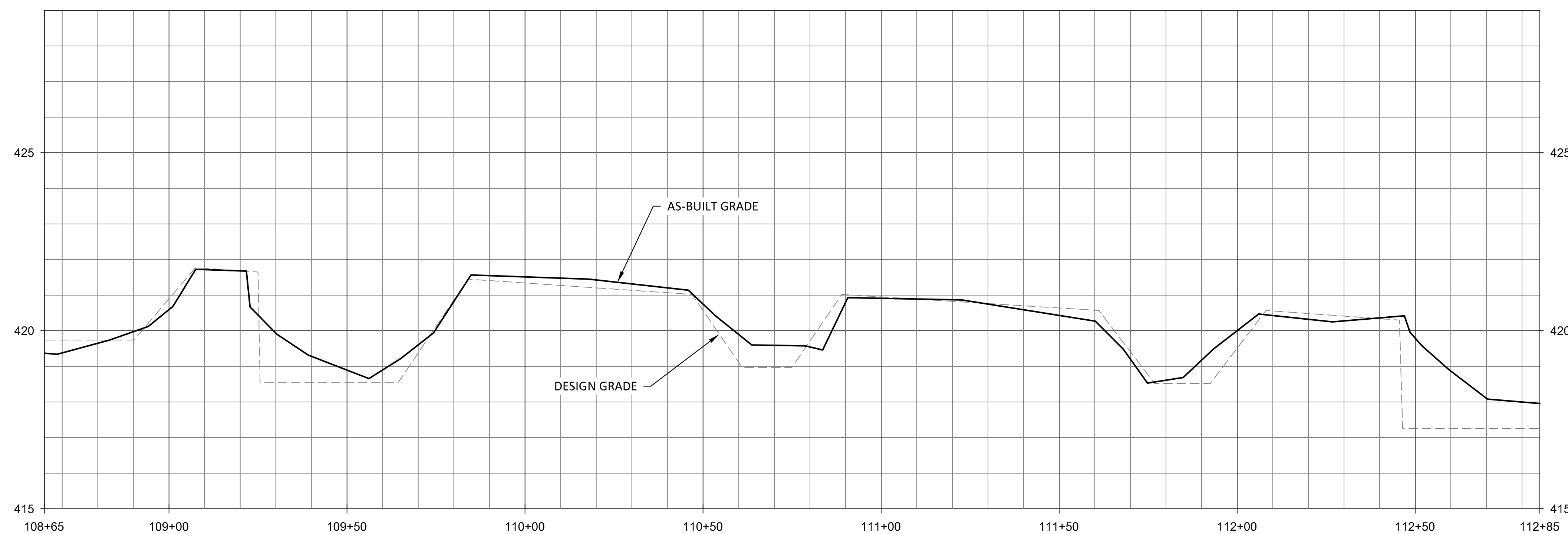
Dry Creek Mitigation Site
Durham County, NC

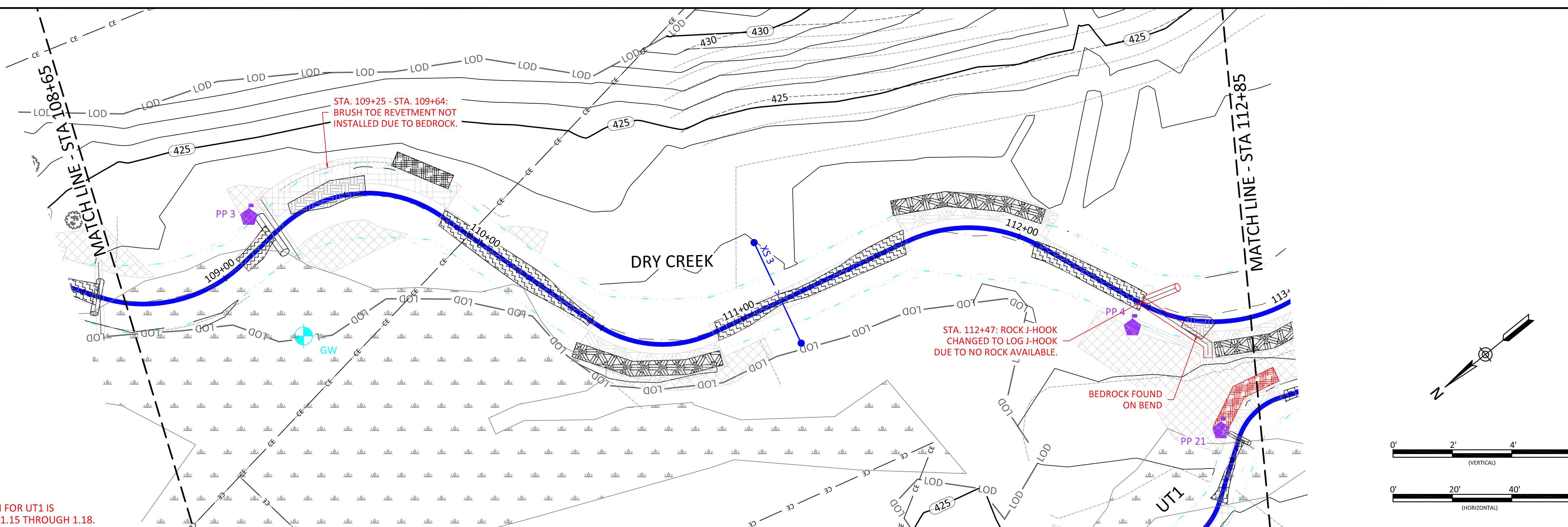
Dry Creek Reach 1
Stream Plan and Profile

Revisions:

Date: 08.05.2020
Job Number: 095-02159
Project Engineer: NMM
Drawn By: CAW
Checked By: JTL

Sheet 1.2





NOTES:
1. AS-BUILT INFORMATION FOR UT1 IS ADDRESSED ON SHEETS 1.15 THROUGH 1.18.

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Dry Creek Mitigation Site
Durham County, NC

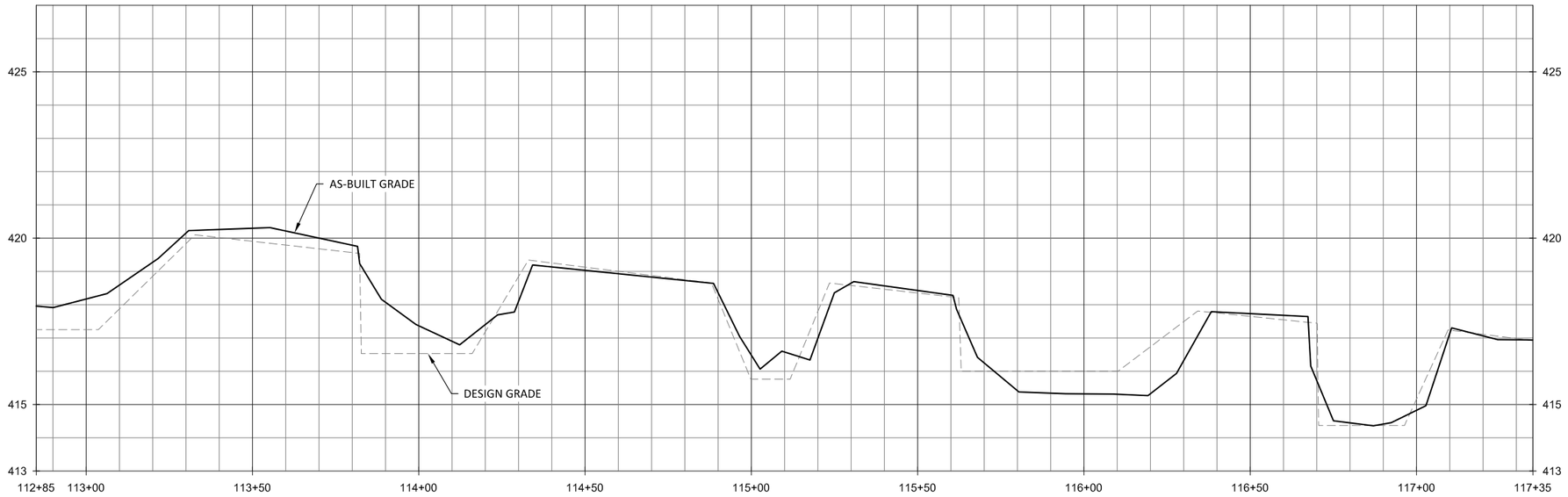
Dry Creek Reach 1
Stream Plan and Profile

Revisions:

Date:	08.05.2020
Job Number:	005-02159
Project Engineer:	NMM
Drawn By:	CAW
Checked By:	JTL

Sheet 1.3

August 7, 2020



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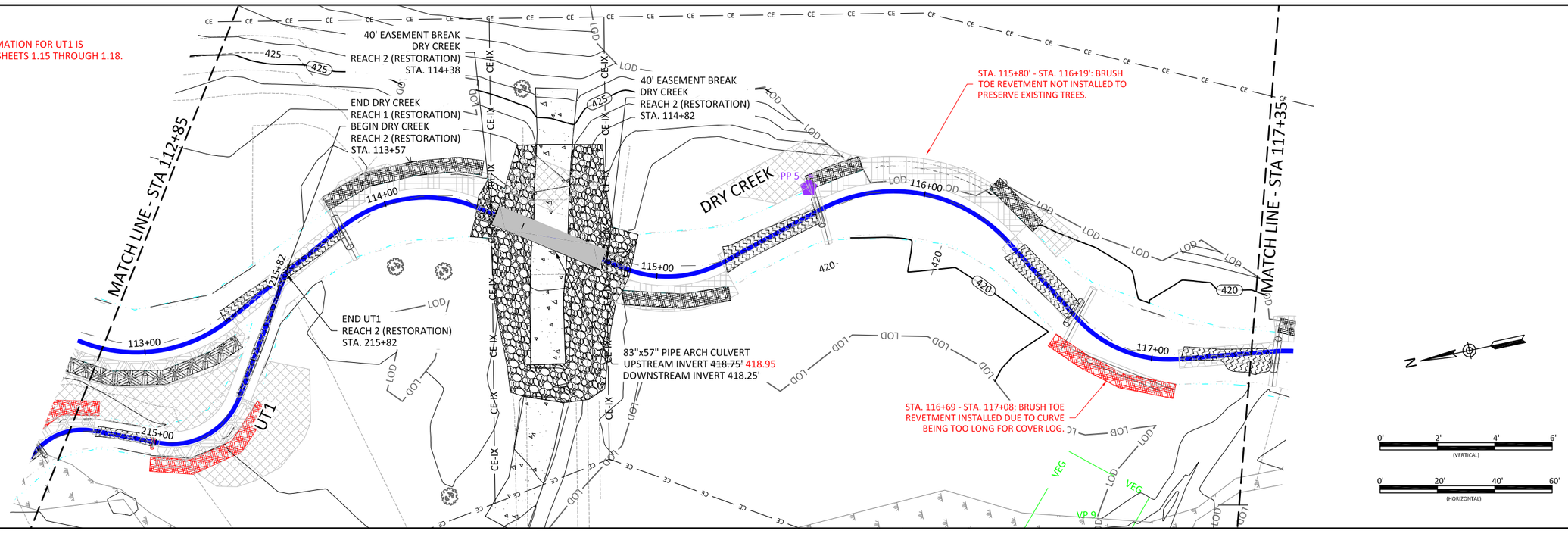

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NORTH CAROLINA PROFESSIONAL SEAL 031027 ENGINEER JEFFREY T. FLEMING

Dry Creek Mitigation Site
Durham County, NC

Dry Creek Reaches 1 & 2
Stream Plan and Profile

Revisions:

Date: 08.05.2020
Job Number: 005-02159
Project Engineer: NMM
Drawn By: CAW
Checked By: JTL

Sheet 1.4

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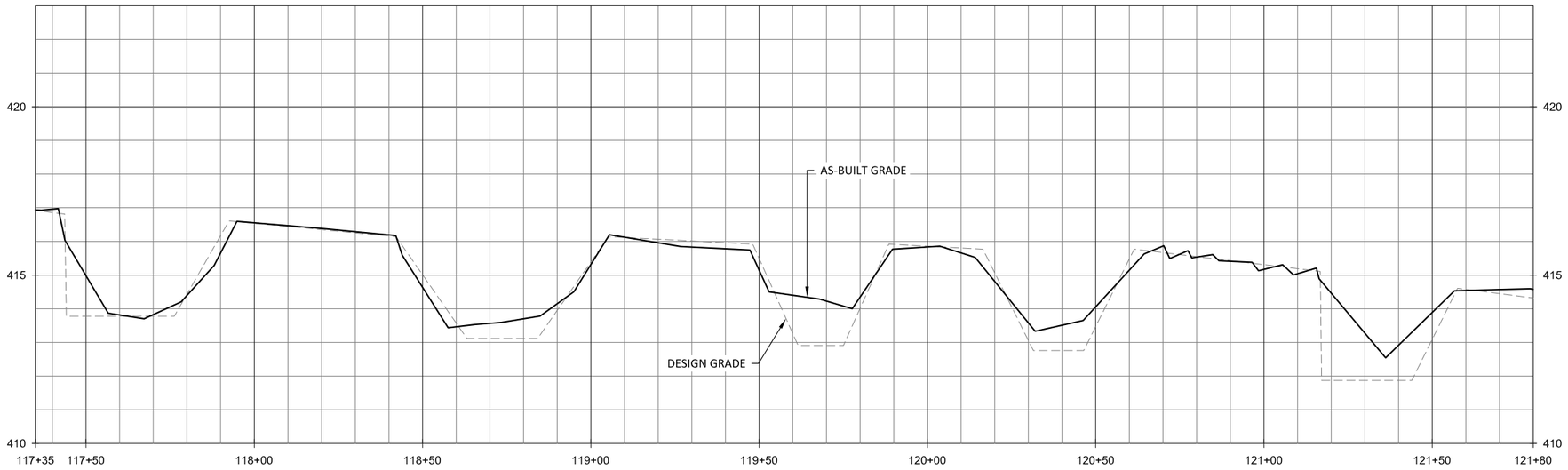
August 7, 2020



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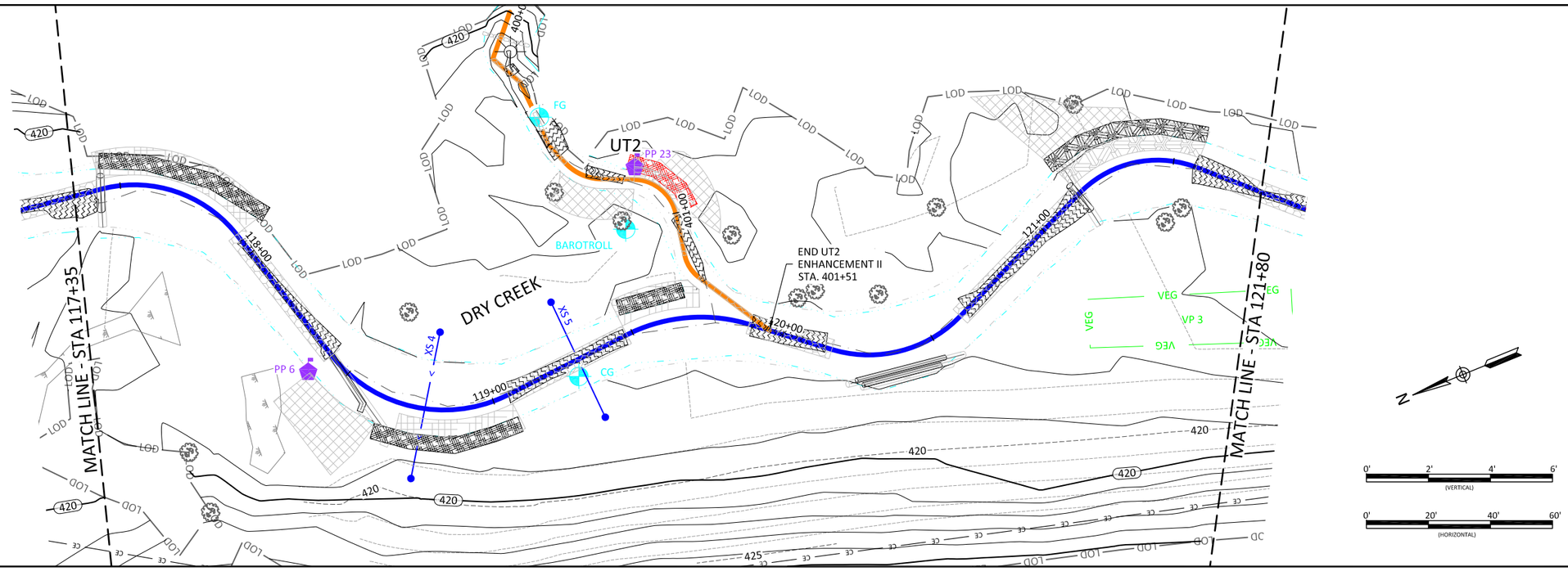

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NORTH CAROLINA PROFESSIONAL SEAL 031027 ENGINEER JEFFREY T. FLETCHER

Dry Creek Mitigation Site
Durham County, NC

Dry Creek Reach 2
Stream Plan and Profile

Revisions:

Date: 08.05.2020
Job Number: 005-02159
Project Engineer: NMM
Drawn By: CAW
Checked By: JTL

Sheet 1.5

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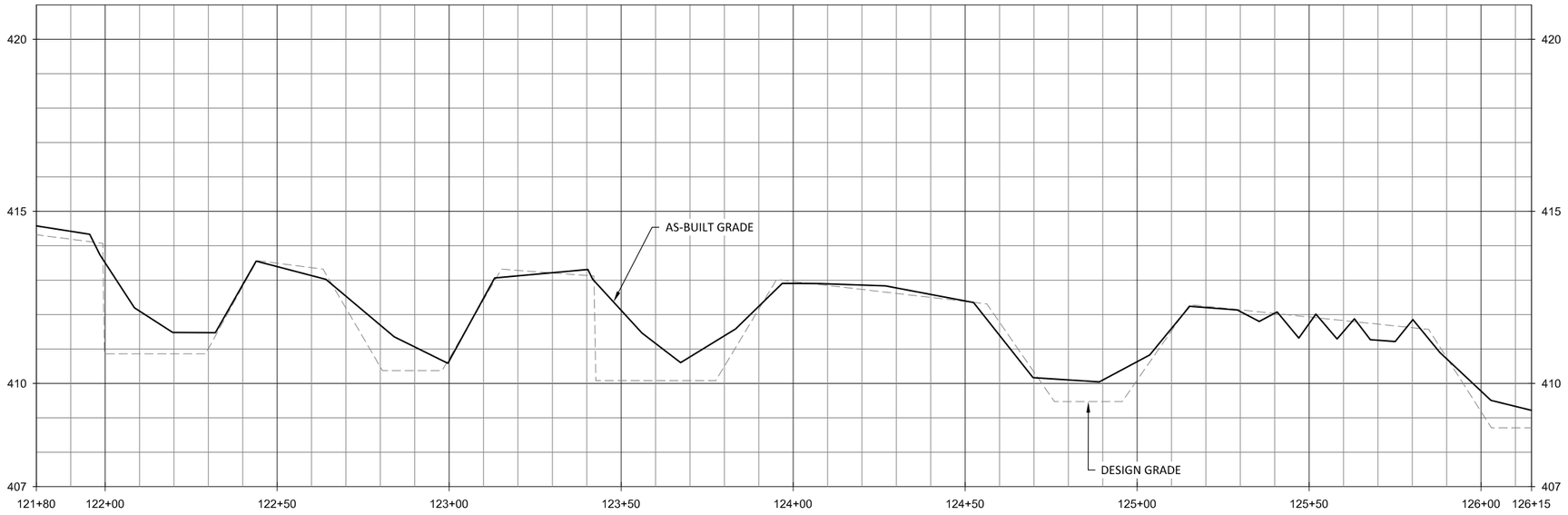
August 7, 2020



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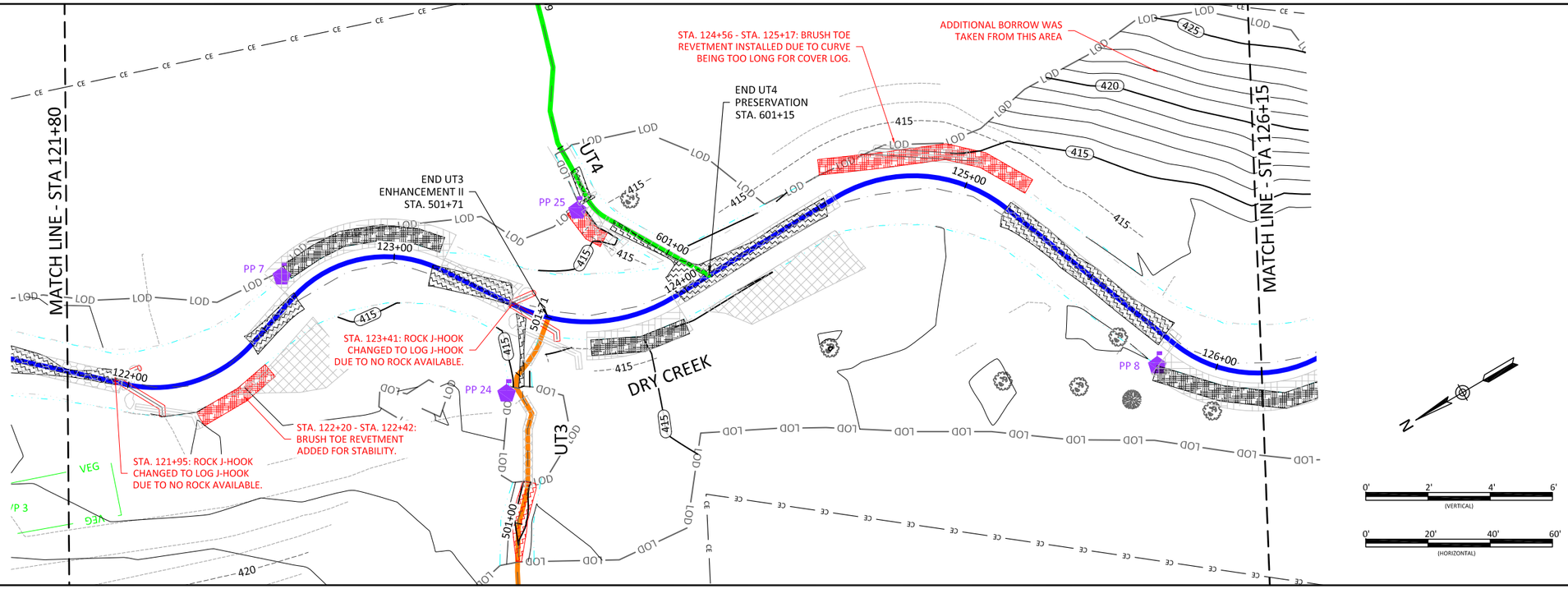
2. AS-BUILT INFORMATION FOR UT4 IS ADDRESSED ON SHEET 1.22.



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NORTH CAROLINA PROFESSIONAL SEAL 031027 ENGINEER JEFFREY T. LITTLETON
8-7-20

Dry Creek Mitigation Site
Durham County, NC
Dry Creek Reach 2
Stream Plan and Profile

Revisions:

Date:	08.05.2020
Job Number:	005-02159
Project Engineer:	NMM
Drawn By:	CAW
Checked By:	JTL

Sheet 1.6

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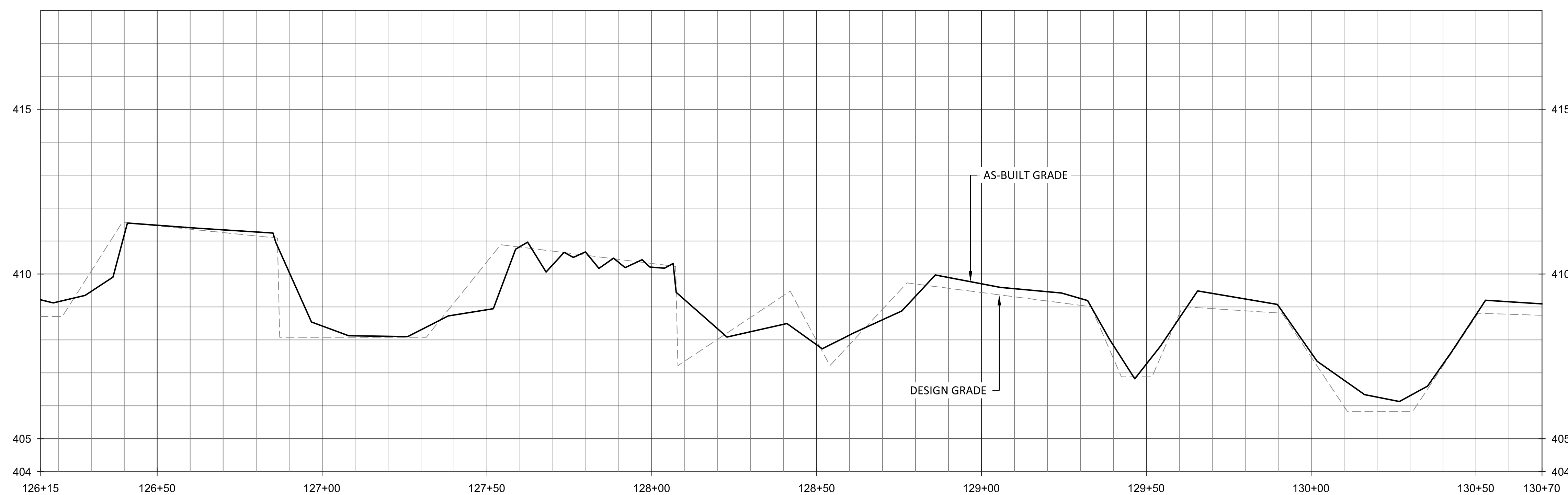

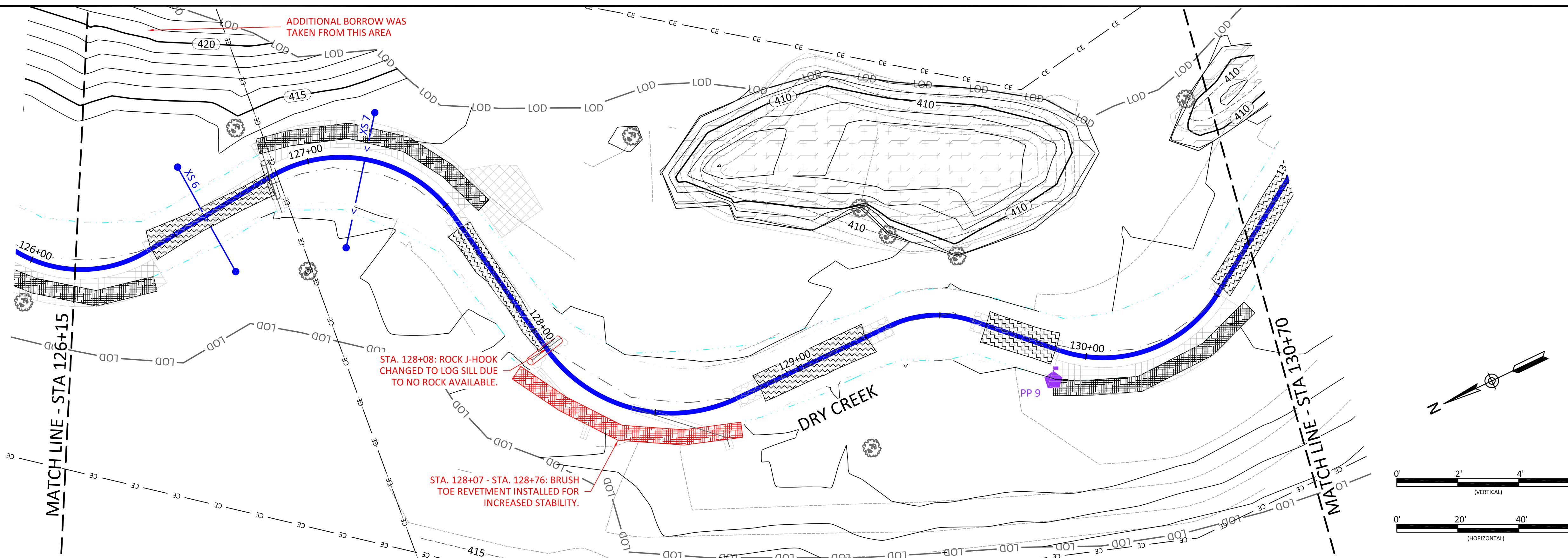

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NORTH CAROLINA PROFESSIONAL ENGINEER SEAL 031027 JEFFERSON

Dry Creek Mitigation Site
Durham County, NC

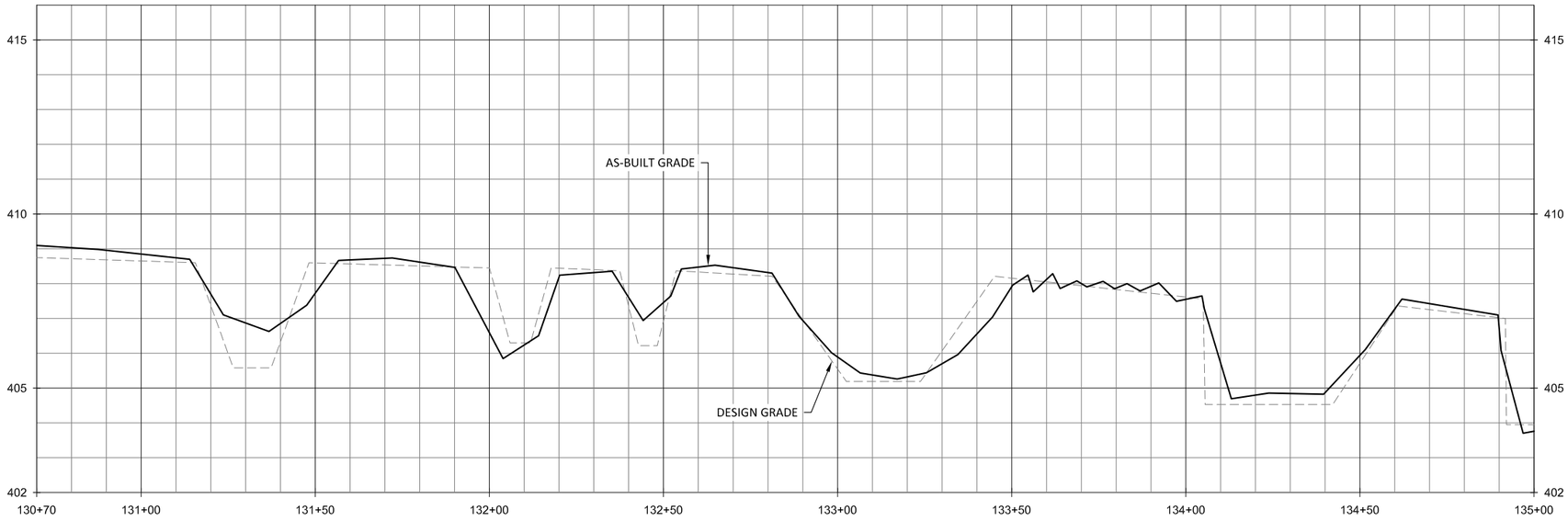
Dry Creek Reach 2
Stream Plan and Profile

Revisions:

Date:	08.05.2020
Job Number:	005-02159
Project Engineer:	NMM
Drawn By:	CAW
Checked By:	JTL

Sheet 1.7

August 7, 2020



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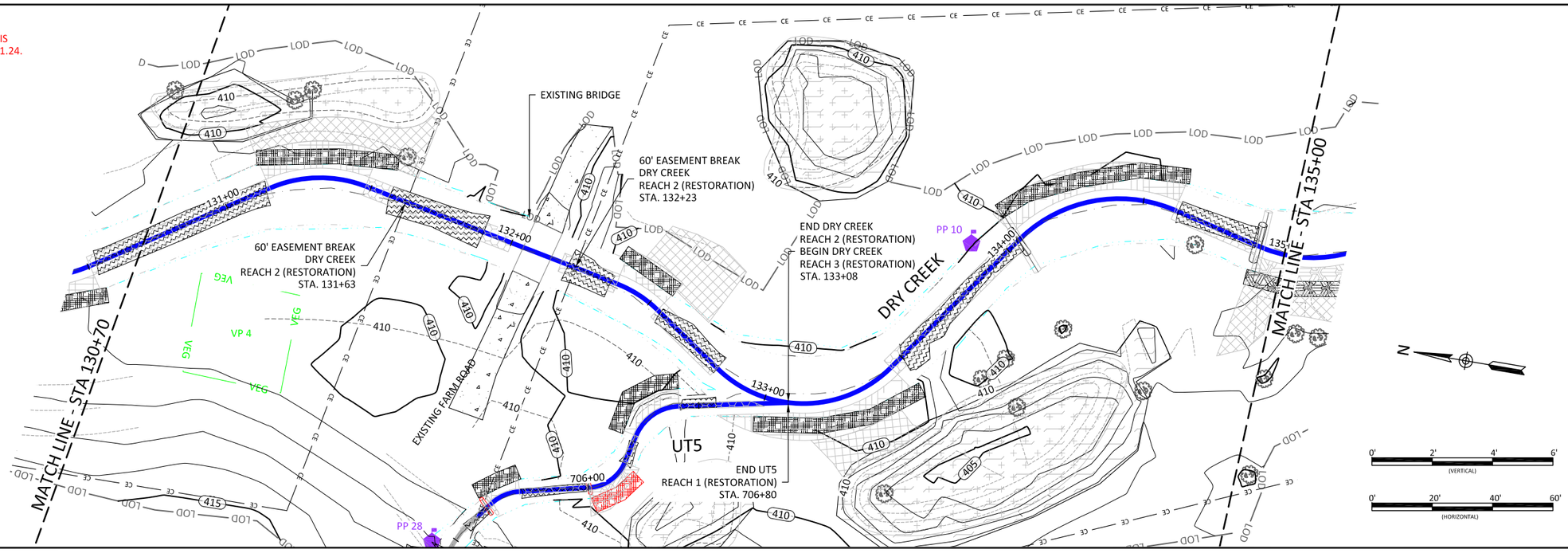

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NORTH CAROLINA PROFESSIONAL SEAL 031027 ENGINEER JEFFREY T. LITTLETON 8-7-20

Dry Creek Mitigation Site
Durham County, NC

Dry Creek Reaches 2 & 3
Stream Plan and Profile

Revisions:

Date:	08.05.2020
Job Number:	005-02159
Project Engineer:	NMM
Drawn By:	CAW
Checked By:	JTL

Sheet 1.8

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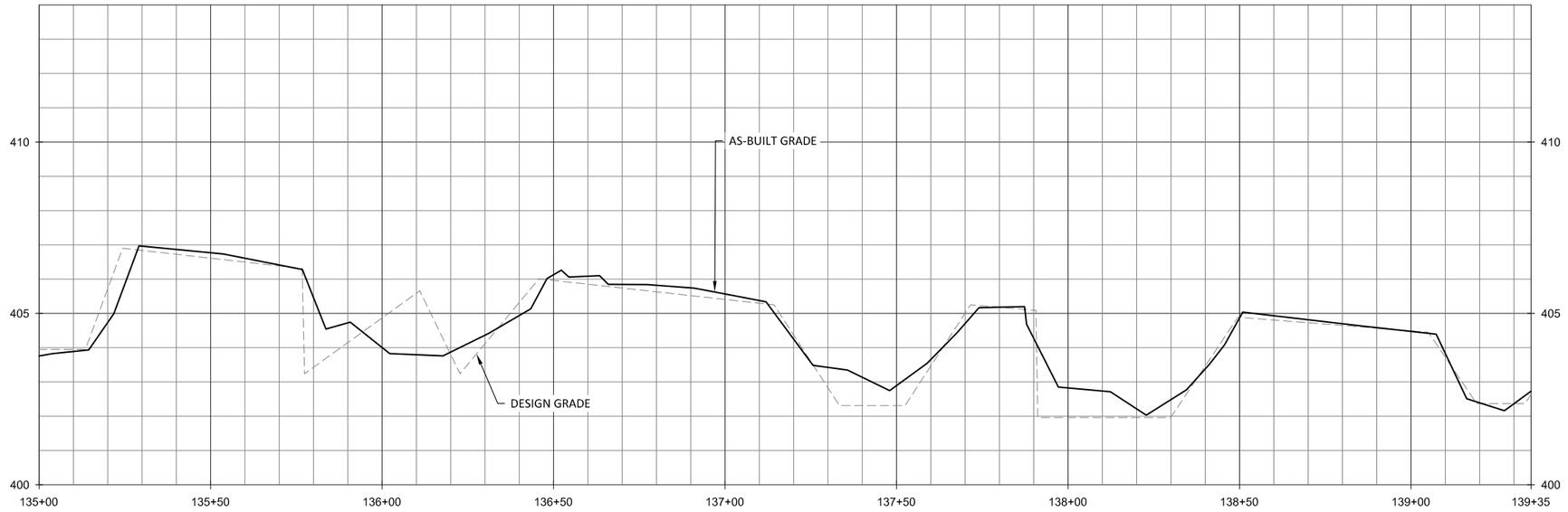
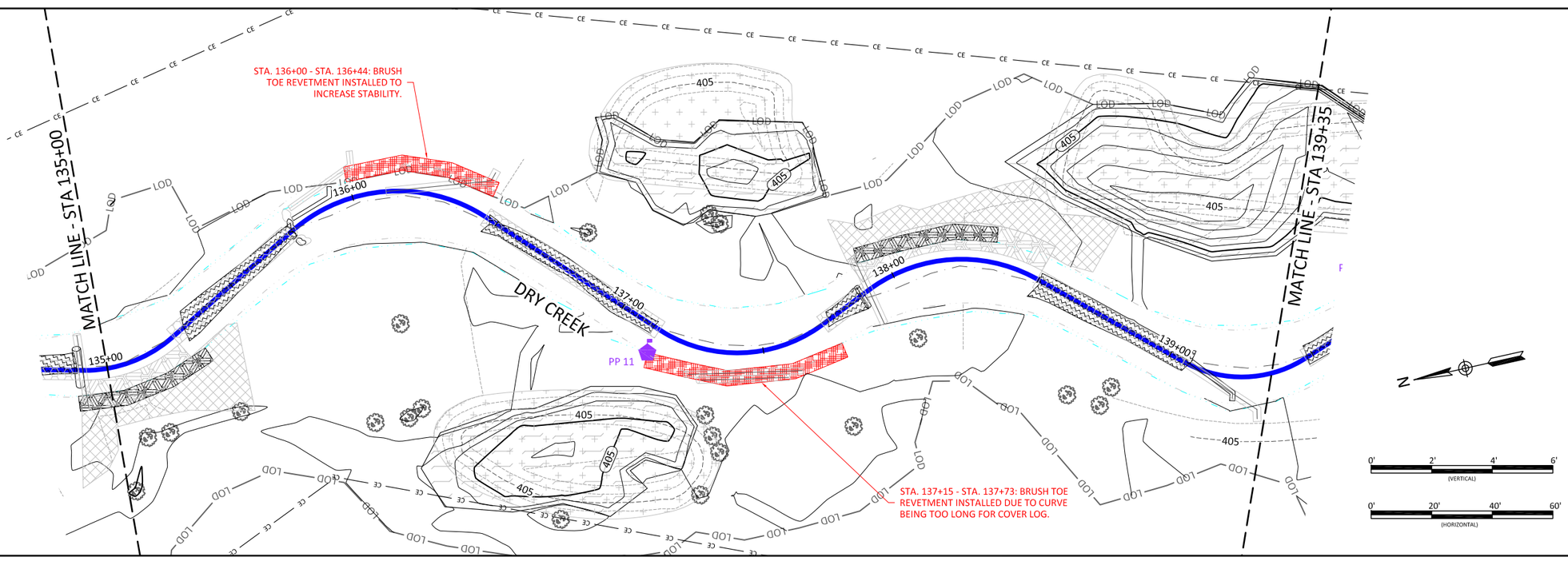
August 7, 2020





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NORTH CAROLINA PROFESSIONAL SEAL 031027 ENGINEER JEFFREY T. LEWIS

Dry Creek Mitigation Site
Durham County, NC

Dry Creek Reach 3
Stream Plan and Profile

Revisions:

Date: 08.05.2020
Job Number: 005-02159
Project Engineer: NMM
Drawn By: CAW
Checked By: JTL

Sheet 1.9

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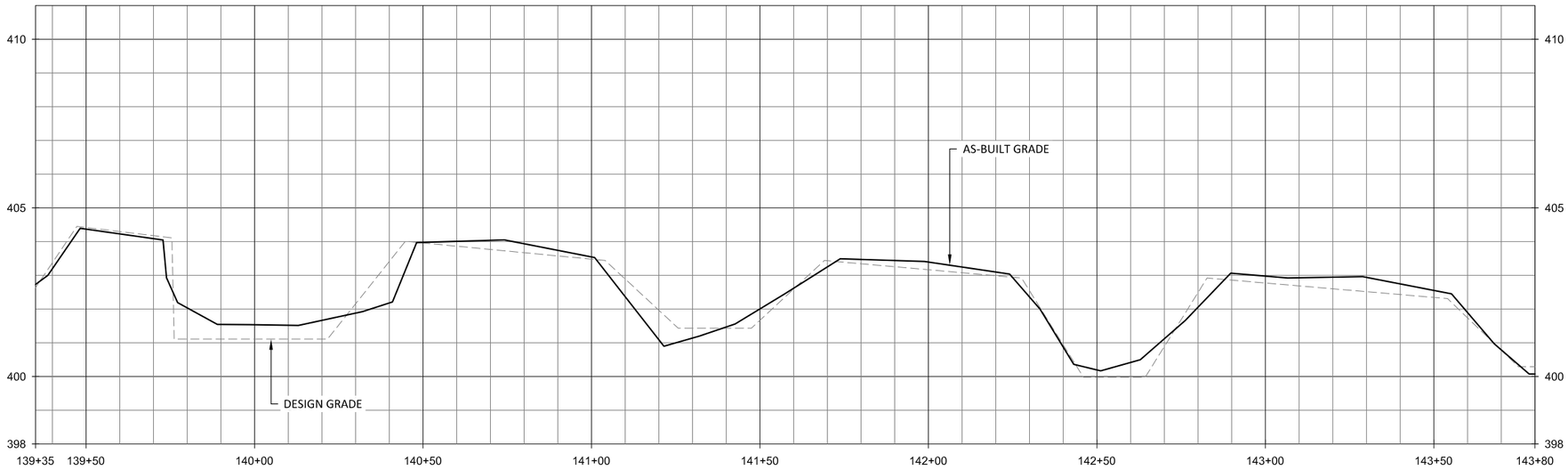
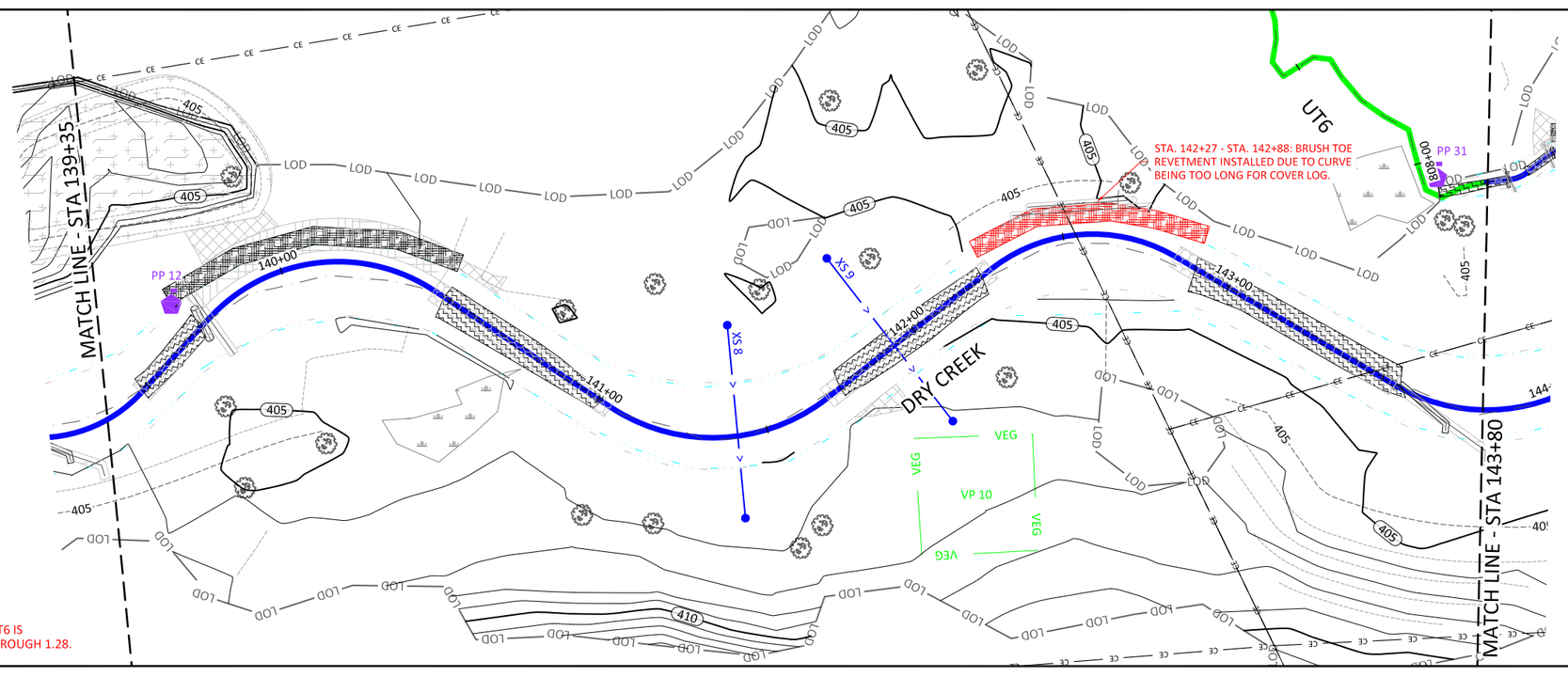
August 7, 2020





NOTES:
1. AS-BUILT INFORMATION FOR UT6 IS ADDRESSED ON SHEETS 1.25 THROUGH 1.28.

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NORTH CAROLINA PROFESSIONAL SEAL 031027 ENGINEER JEFFREY T. LITTON

Dry Creek Mitigation Site
Durham County, NC

Dry Creek Reach 3
Stream Plan and Profile

Revisions:

Date: 08.05.2020
Job Number: 005-02159
Project Engineer: NMM
Drawn By: CAW
Checked By: JTL

Sheet 1.10

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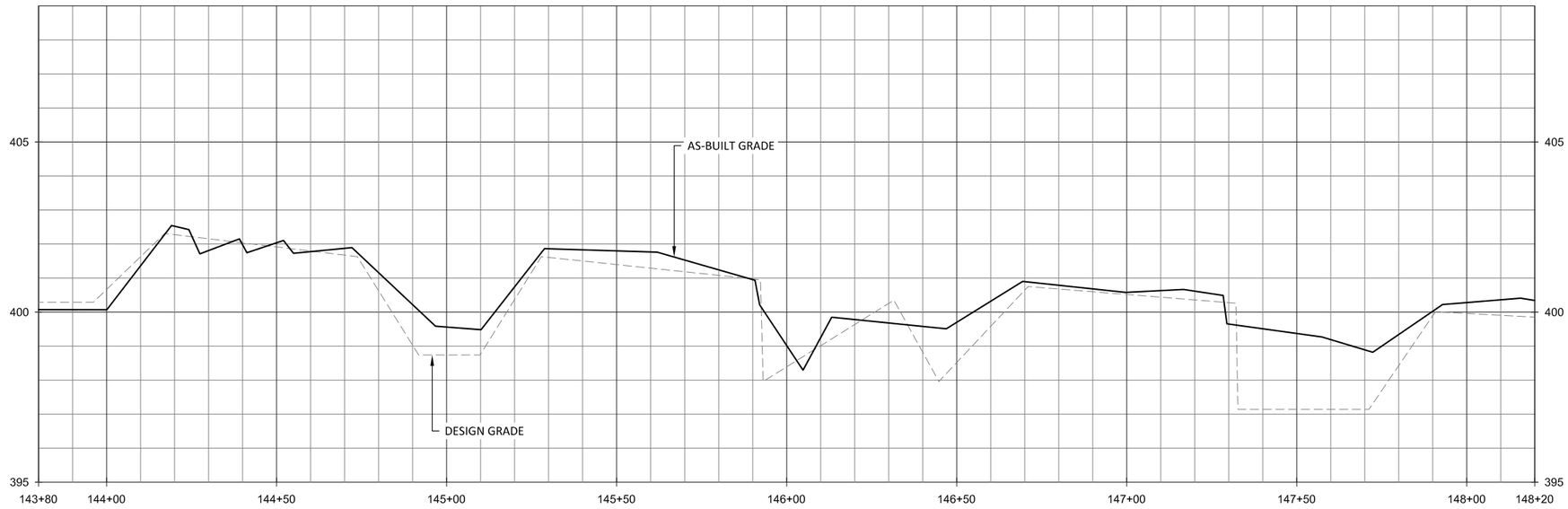
August 7, 2020



NOTES:
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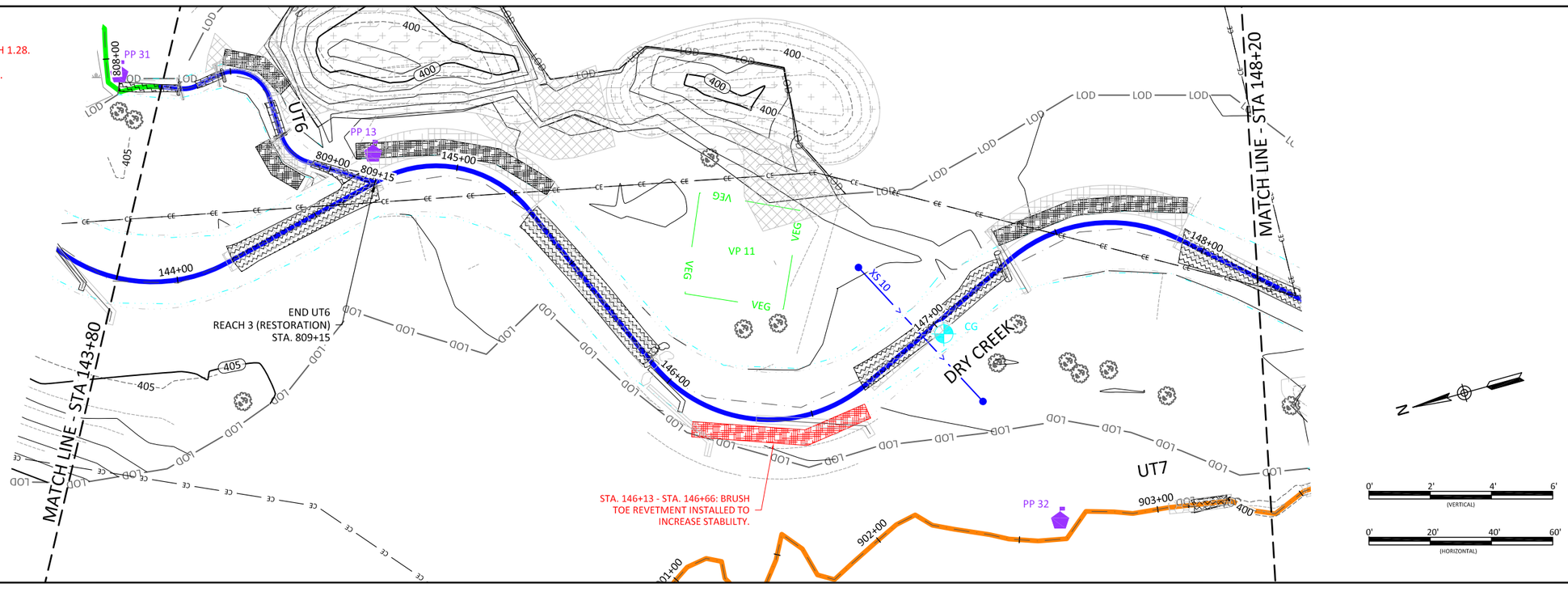
2. AS-BUILT INFORMATION FOR UT7 IS ADDRESSED ON SHEETS 1.29 AND 1.30.



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NORTH CAROLINA PROFESSIONAL SEAL 031027 ENGINEER JEFFREY T. LITTLETON 8-7-20

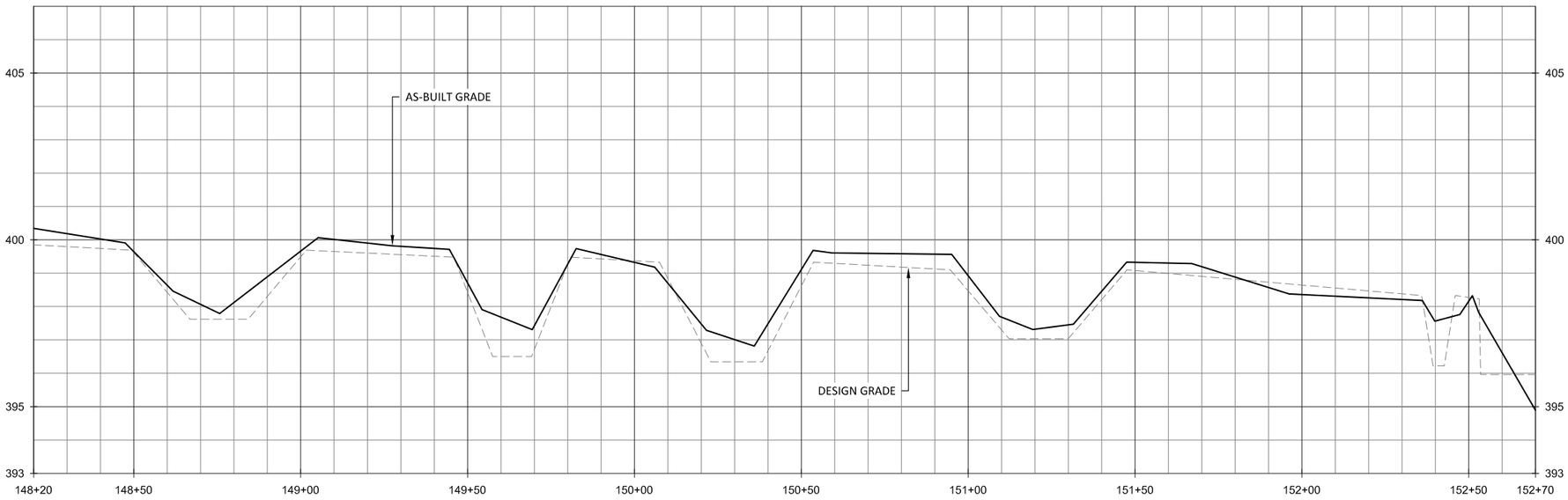
Dry Creek Mitigation Site
Durham County, NC

Dry Creek Reach 3
Stream Plan and Profile

Revisions:

Date: 08.05.2020
Job Number: 005-02159
Project Engineer: NMM
Drawn By: CAW
Checked By: JTL

Sheet 1.11



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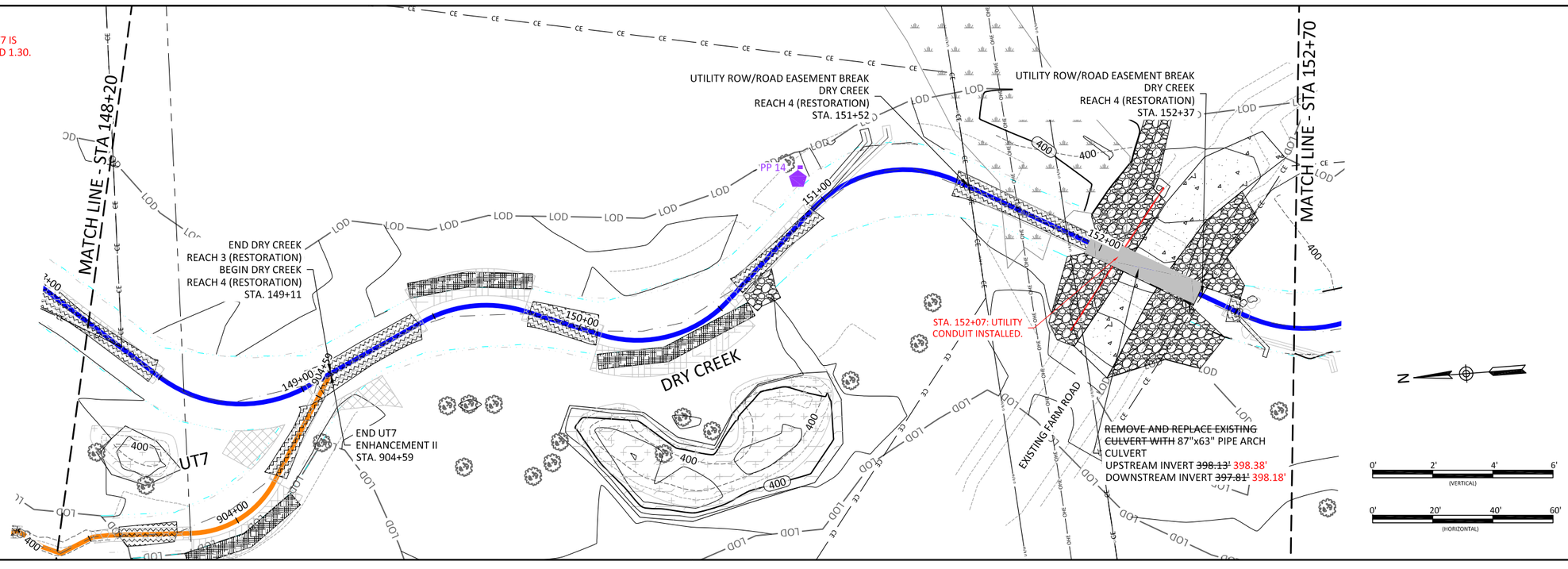

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NORTH CAROLINA PROFESSIONAL SEAL 031027 ENGINEER JEFFREY T. FLEMING

Dry Creek Mitigation Site
Durham County, NC

Dry Creek Reaches 3 & 4
Stream Plan and Profile

Revisions:

Date:	08.05.2020
Job Number:	005-02159
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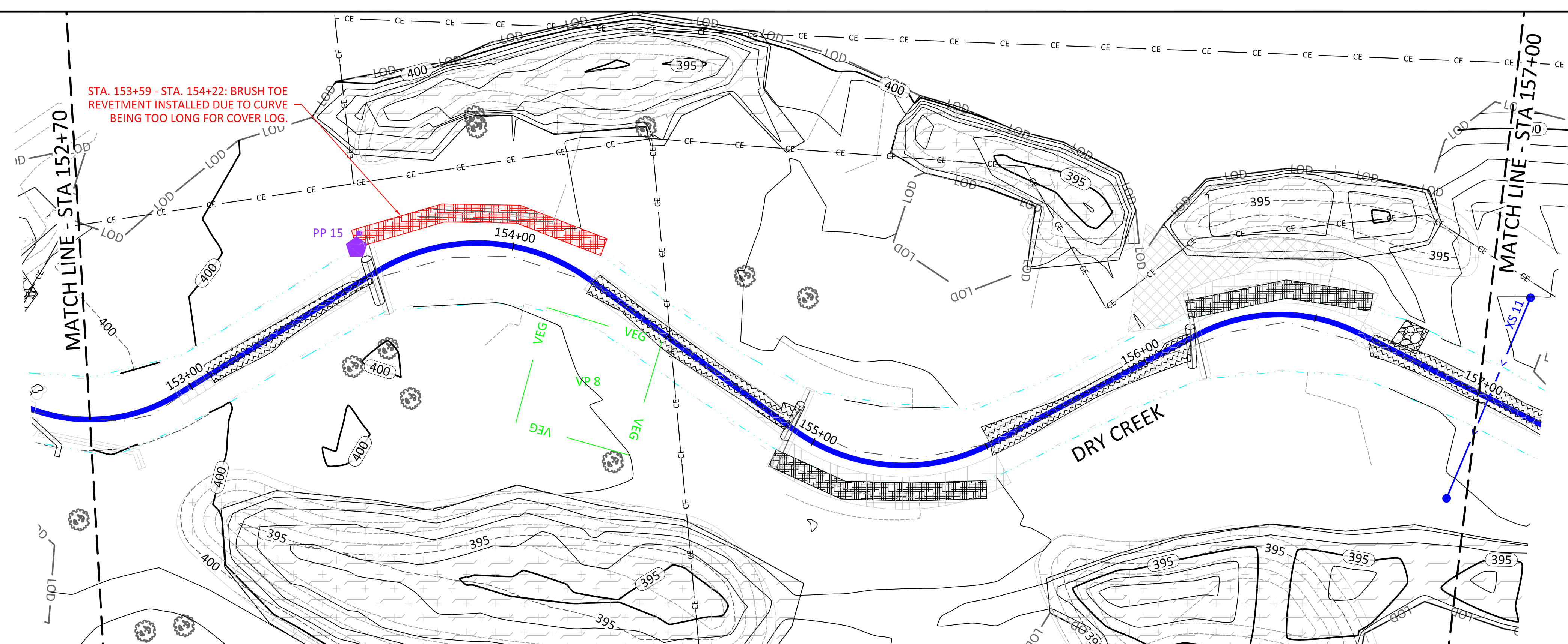
Drawn By:	CAW
Checked By:	JTL

Sheet 1.12



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NORTH CAROLINA PROFESSIONAL ENGINEER SEAL 031027 JEFFERSON

Dry Creek Mitigation Site
Durham County, NC

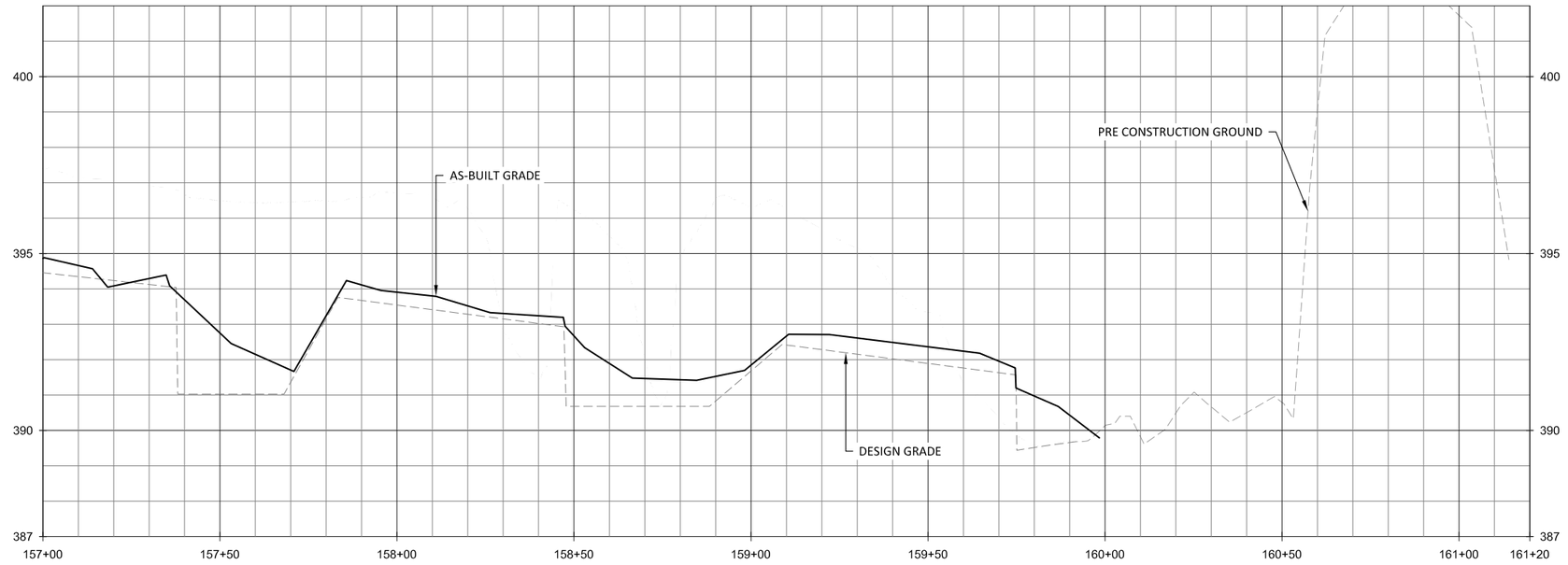
Dry Creek Reach 4
Stream Plan and Profile

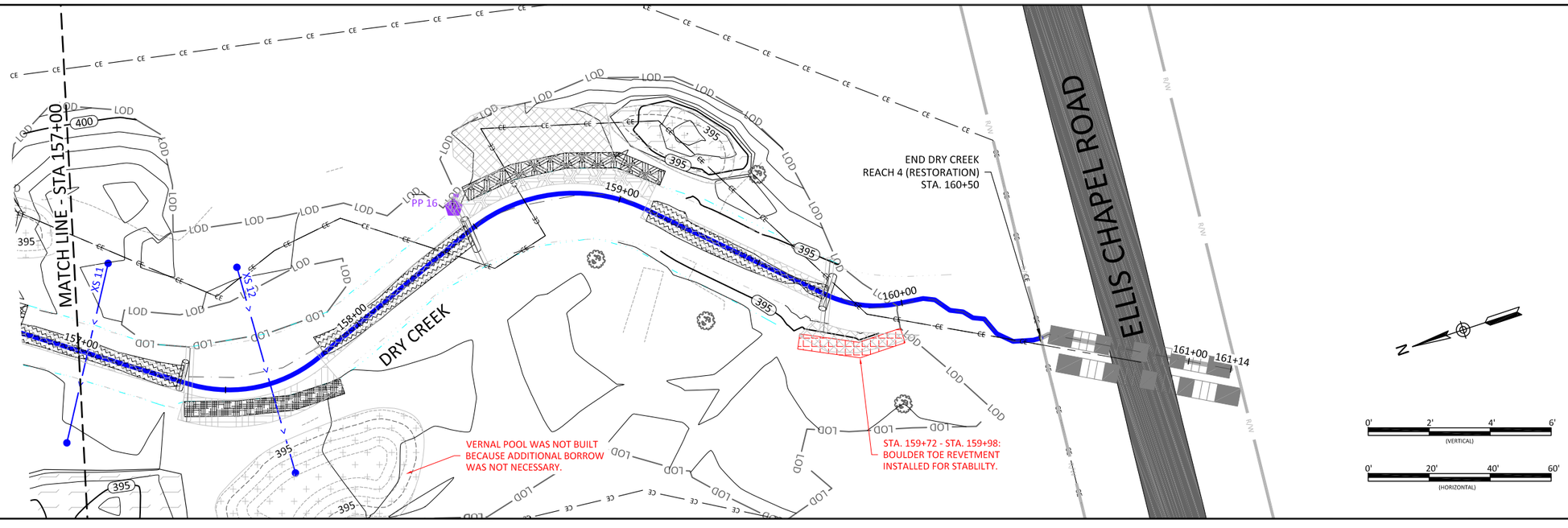
Revisions:

Date:	08.05.2020
Job Number:	005-02159
Project Engineer:	NMM
Drawn By:	CAW
Checked By:	JTL

Sheet 1.13

August 7, 2020





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NORTH CAROLINA PROFESSIONAL SEAL 031027 ENGINEER JEFFREY T. LEWIS

Dry Creek Mitigation Site
Durham County, NC

Dry Creek Reach 4
Stream Plan and Profile

Revisions:

Date:	08.05.2020
Job Number:	005-02159
Project Engineer:	NMM
Drawn By:	CAW
Checked By:	JTL

Sheet 1.14

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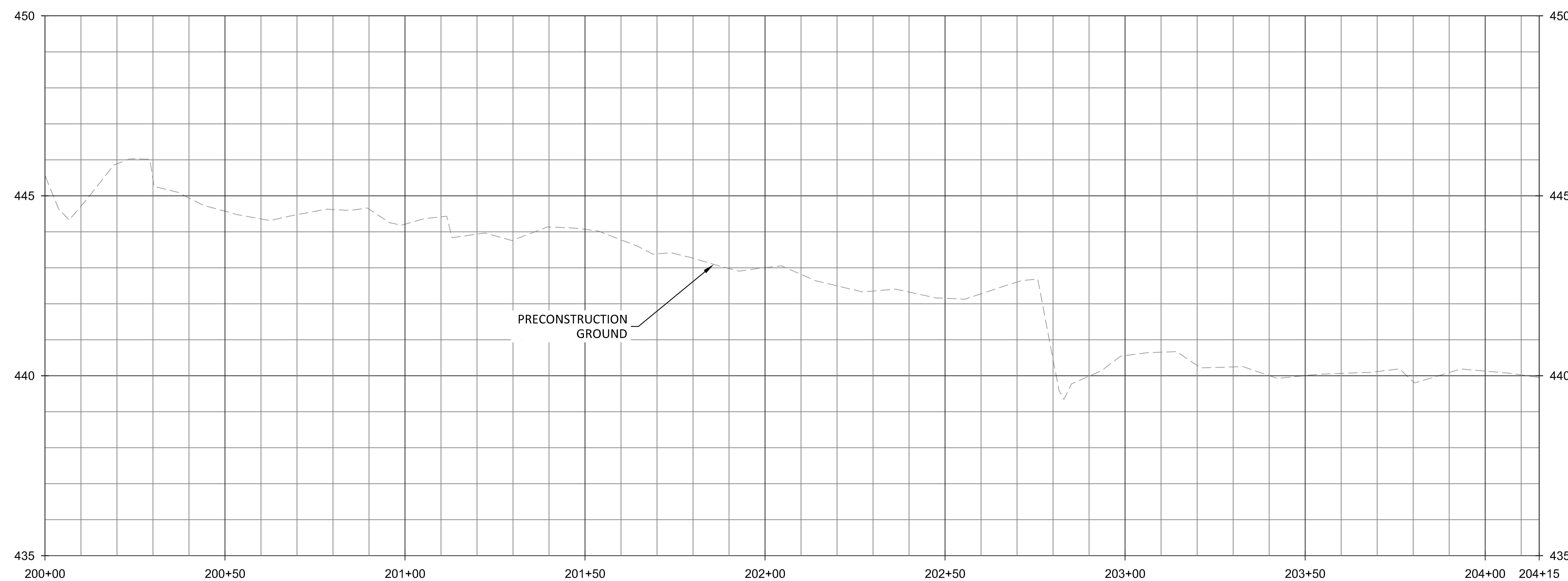

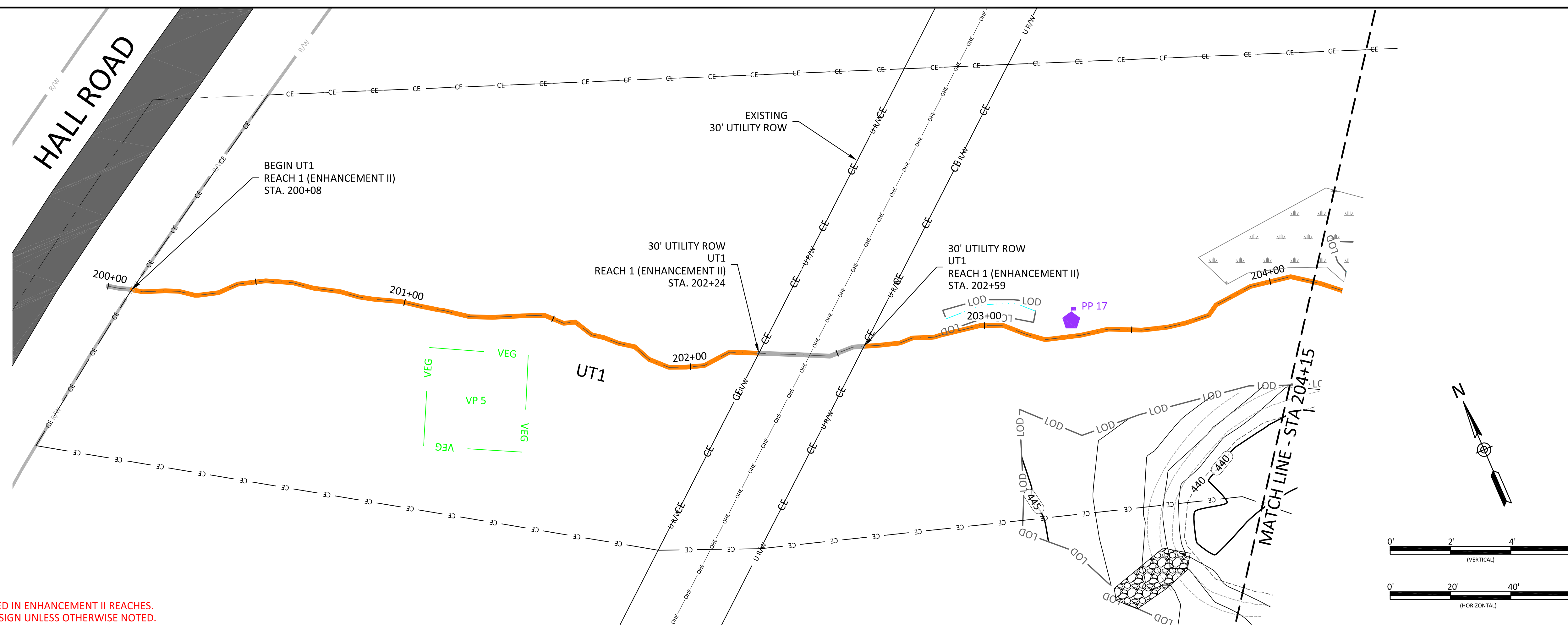

NOTES:
1. SURVEY WAS NOT CONDUCTED IN ENHANCEMENT II REACHES. REACHES WERE BUILT PER DESIGN UNLESS OTHERWISE NOTED.

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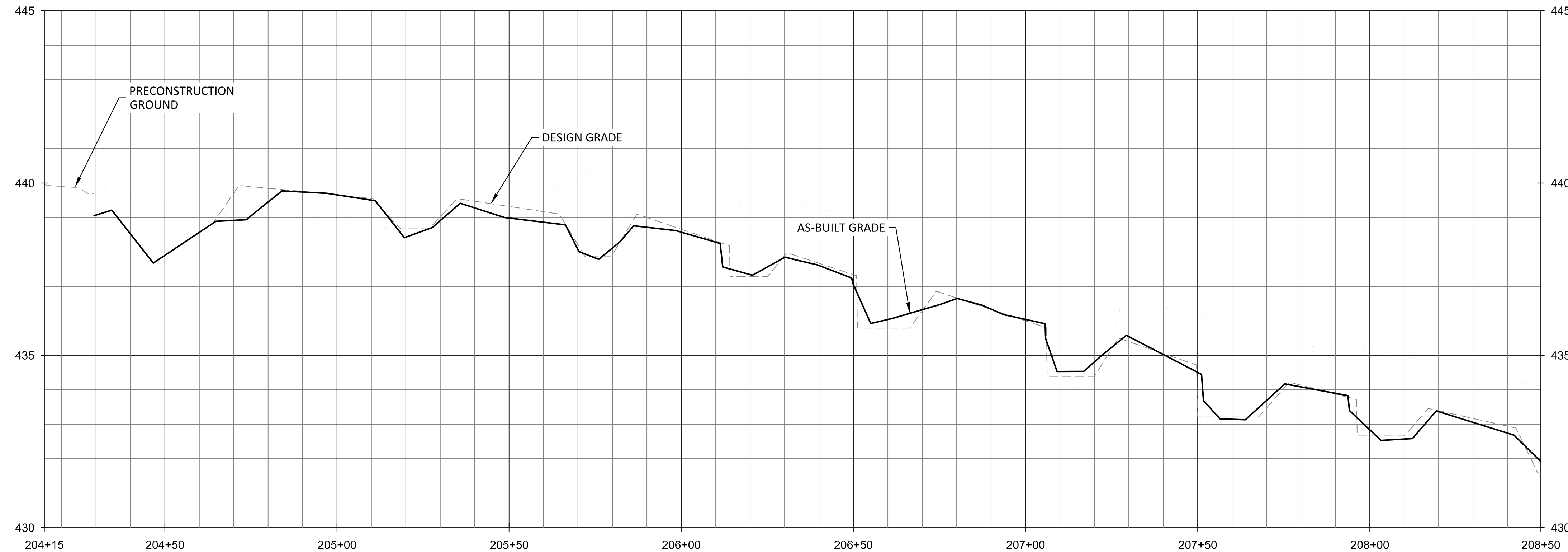
Dry Creek Mitigation Site
Durham County, NC

UT1 Reach 1
Stream Plan and Profile

Date:	08.05.2020
Job Number:	005-02159
Project Engineer:	NMM
Drawn By:	CAW
Checked By:	JTL

Revisions:

Sheet 1.15



NOTES:

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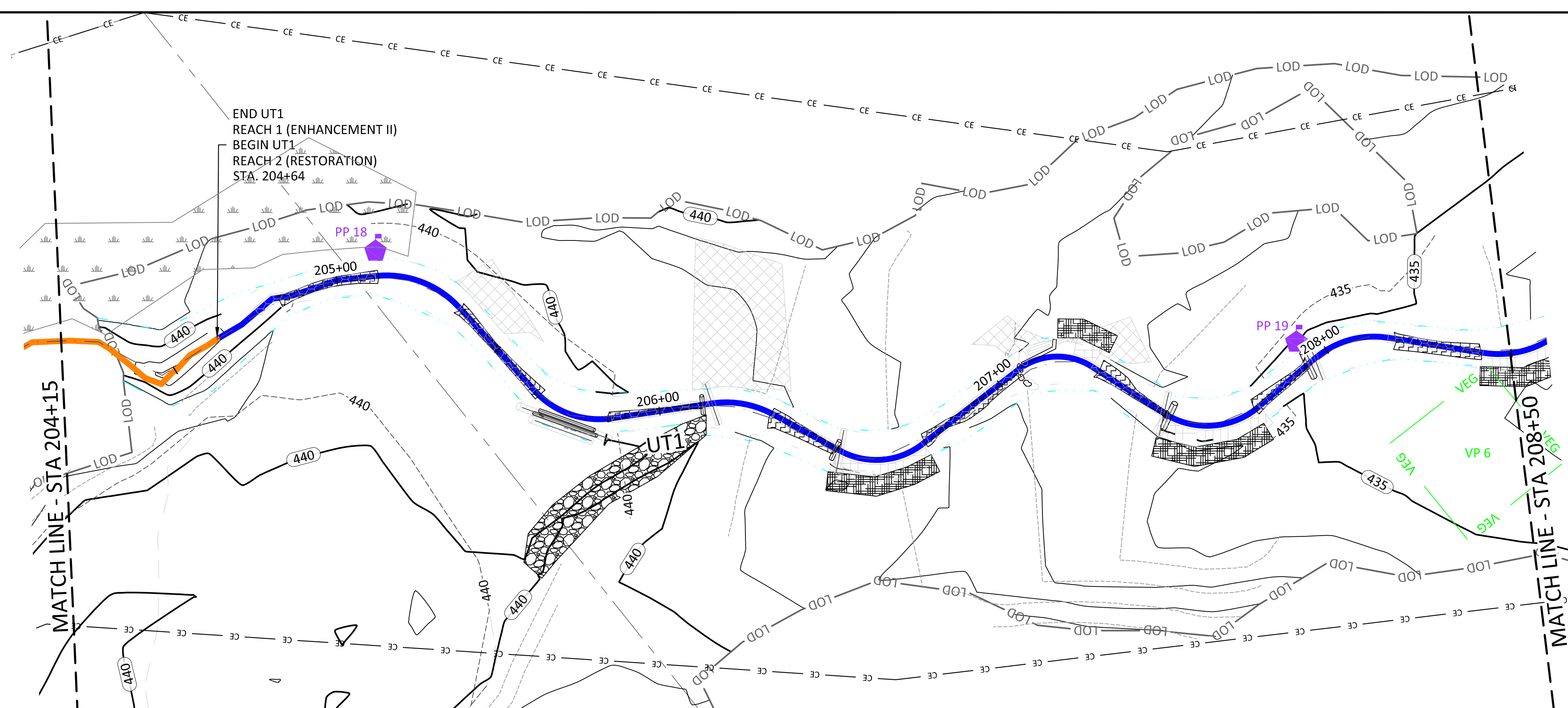

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Dry Creek Mitigation Site
Durham County, NC

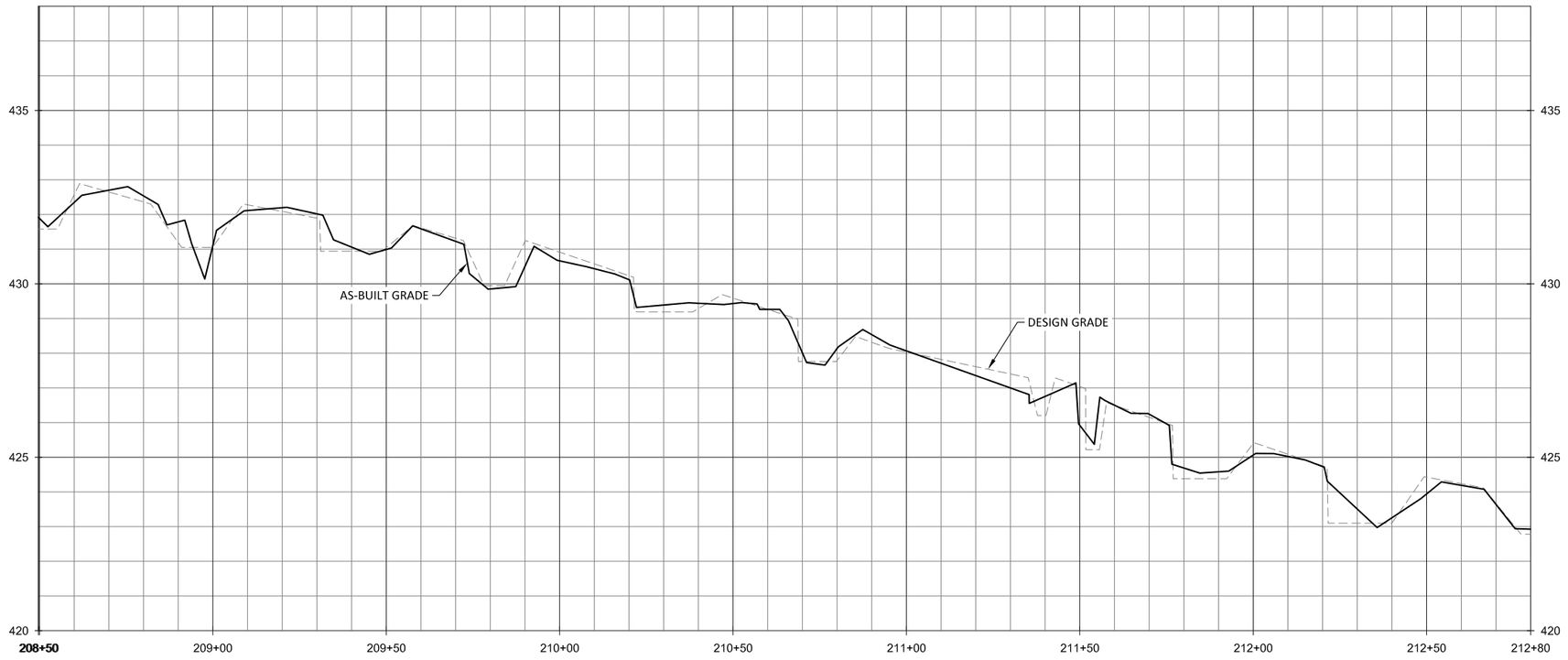
UT1 Reaches 1 & 2
Stream Plan and Profile

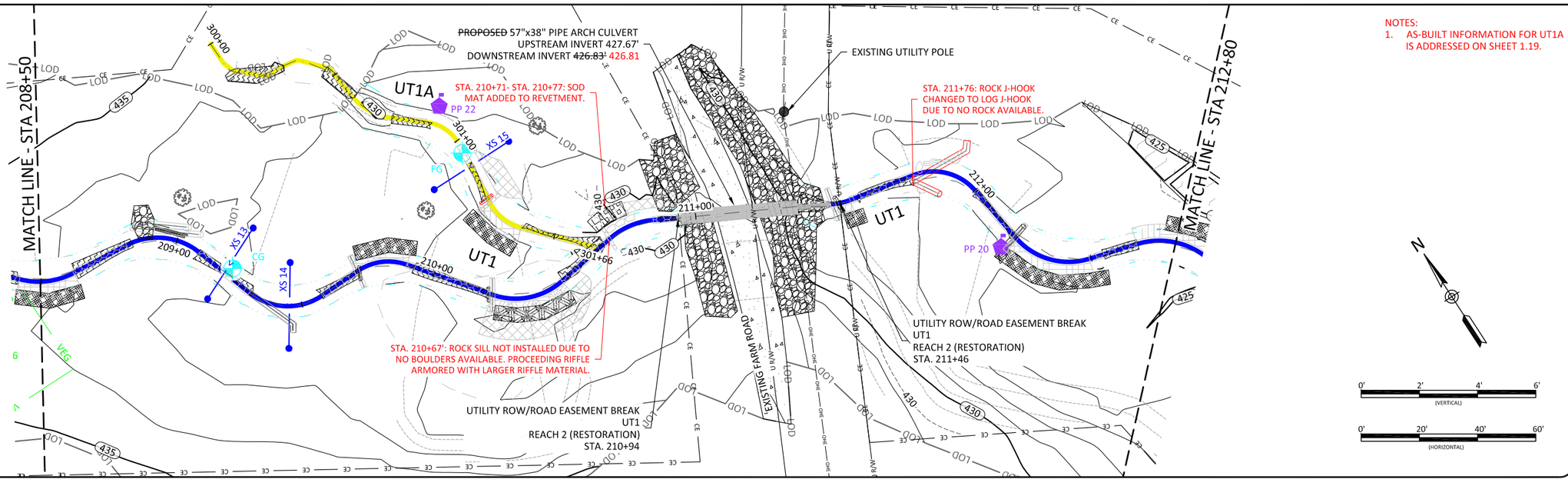
Revisions:

Date: 08.05.2020
Job Number: 005-02159
Project Engineer: NMM
Drawn By: CAW
Checked By: JTL

Sheet 1.16

August 7, 2020





NOTES:
1. AS-BUILT INFORMATION FOR UT1A IS ADDRESSED ON SHEET 1.19.

0' 2' 4' 6' (VERTICAL)

0' 20' 40' 60' (HORIZONTAL)

X:\Shared\Projects\005-02159 Dry Creek\Monitoring\Baseline Monitoring\Plans\As-Built set\005-02159-AB Profiles-Tributaries.dwg

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Dry Creek Mitigation Site
Durham County, NC

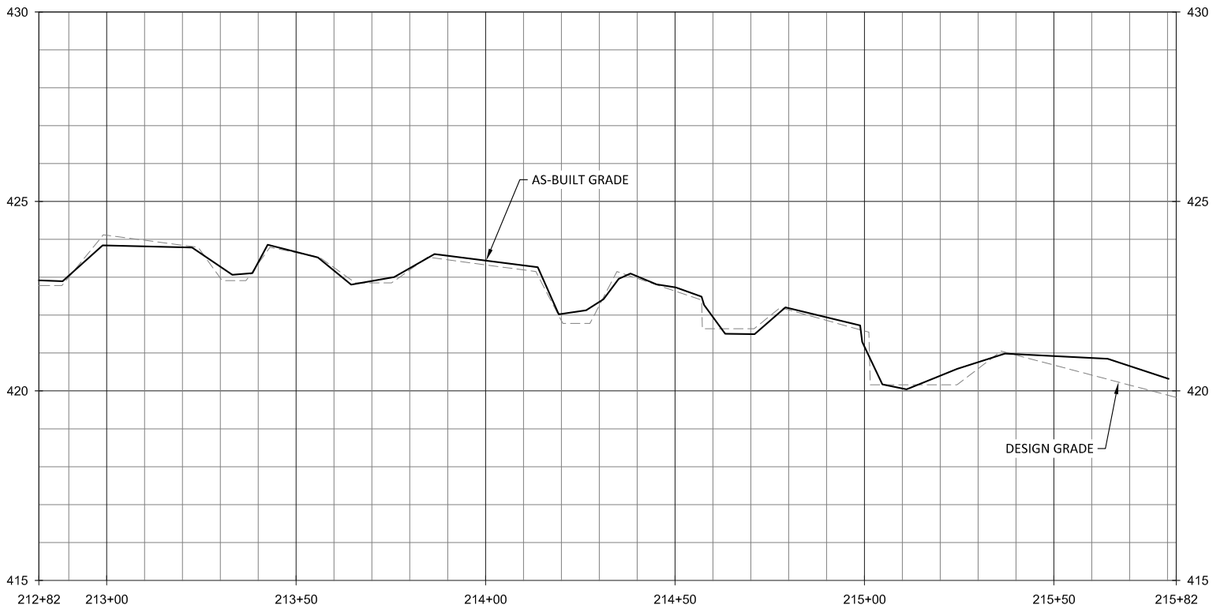
UT1 Reach 2
Stream Plan and Profile

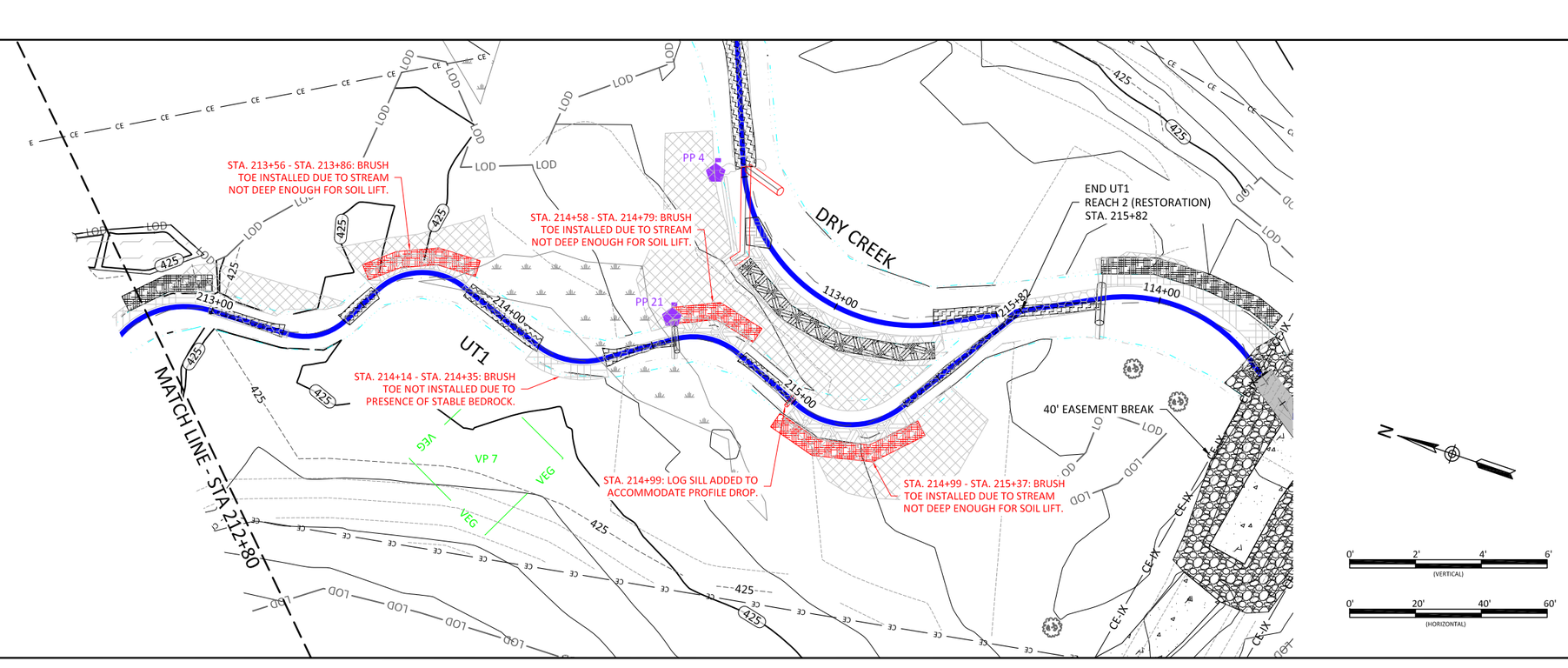
Revisions:

Date: 08.05.2020
Job Number: 005-02159
Project Engineer: NMM
Drawn By: CAW
Checked By: JTL

Sheet 1.17

August 7, 2020





NOTES:
1. AS-BUILT INFORMATION FOR DRY CREEK IS ADDRESSED ON SHEETS 1.1 THROUGH 1.14.

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Dry Creek Mitigation Site
Durham County, NC

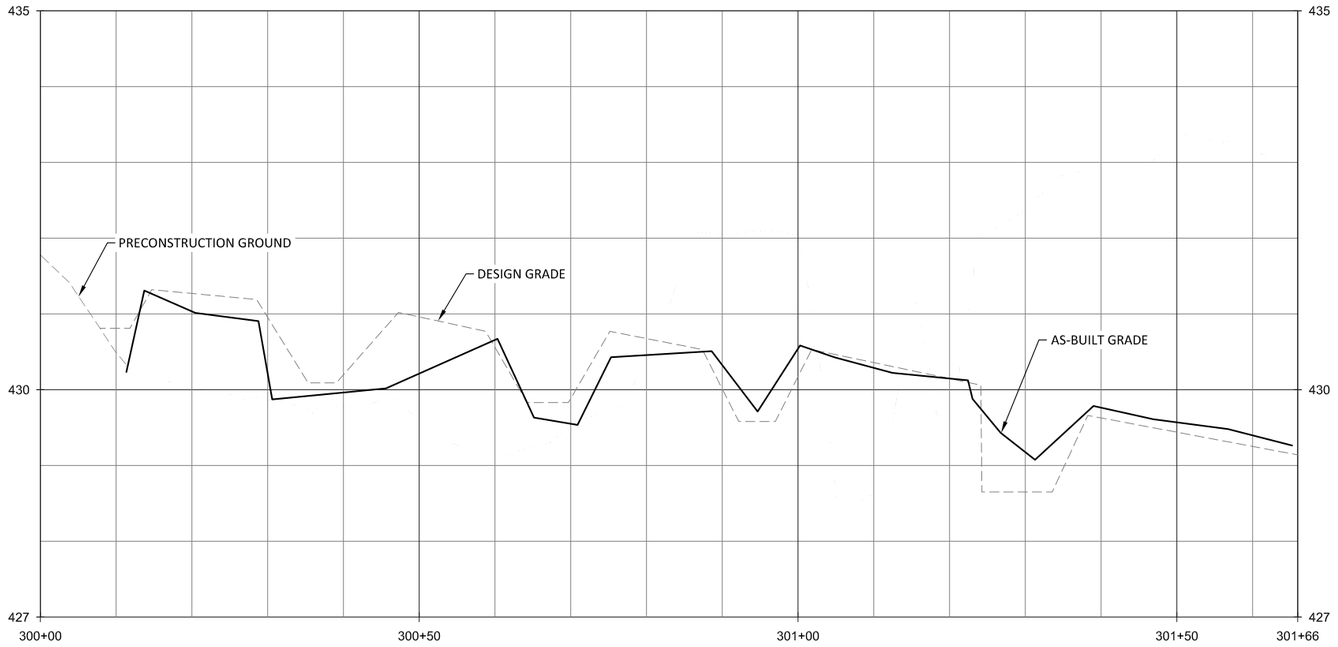
UT1 Reach 2
Stream Plan and Profile

Revisions:

Date: 08.05.2020
Job Number: 005-02159
Project Engineer: NMM
Drawn By: CAW
Checked By: JTL

Sheet 1.18

August 7, 2020



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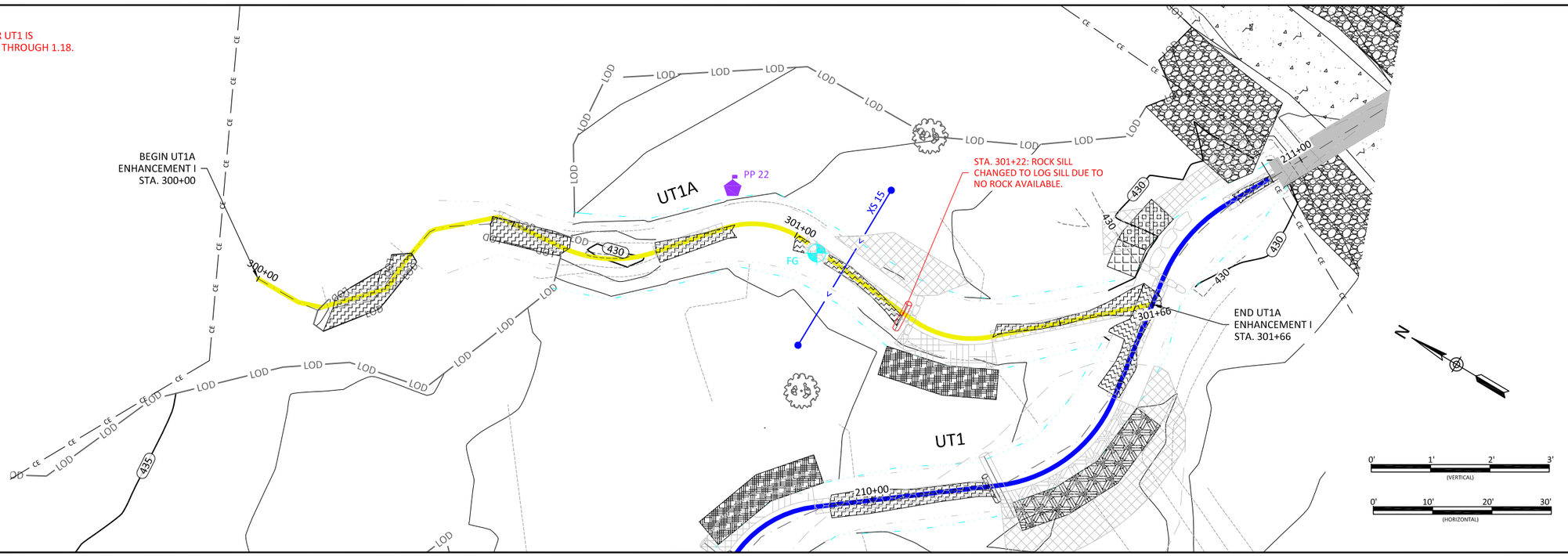

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Dry Creek Mitigation Site
Durham County, NC

UT1A
Stream Plan and Profile

Revisions:

Date: 08.05.2020
Job Number: 005-02159
Project Engineer: NMM
Drawn By: CAW
Checked By: JTL

Sheet 1.19

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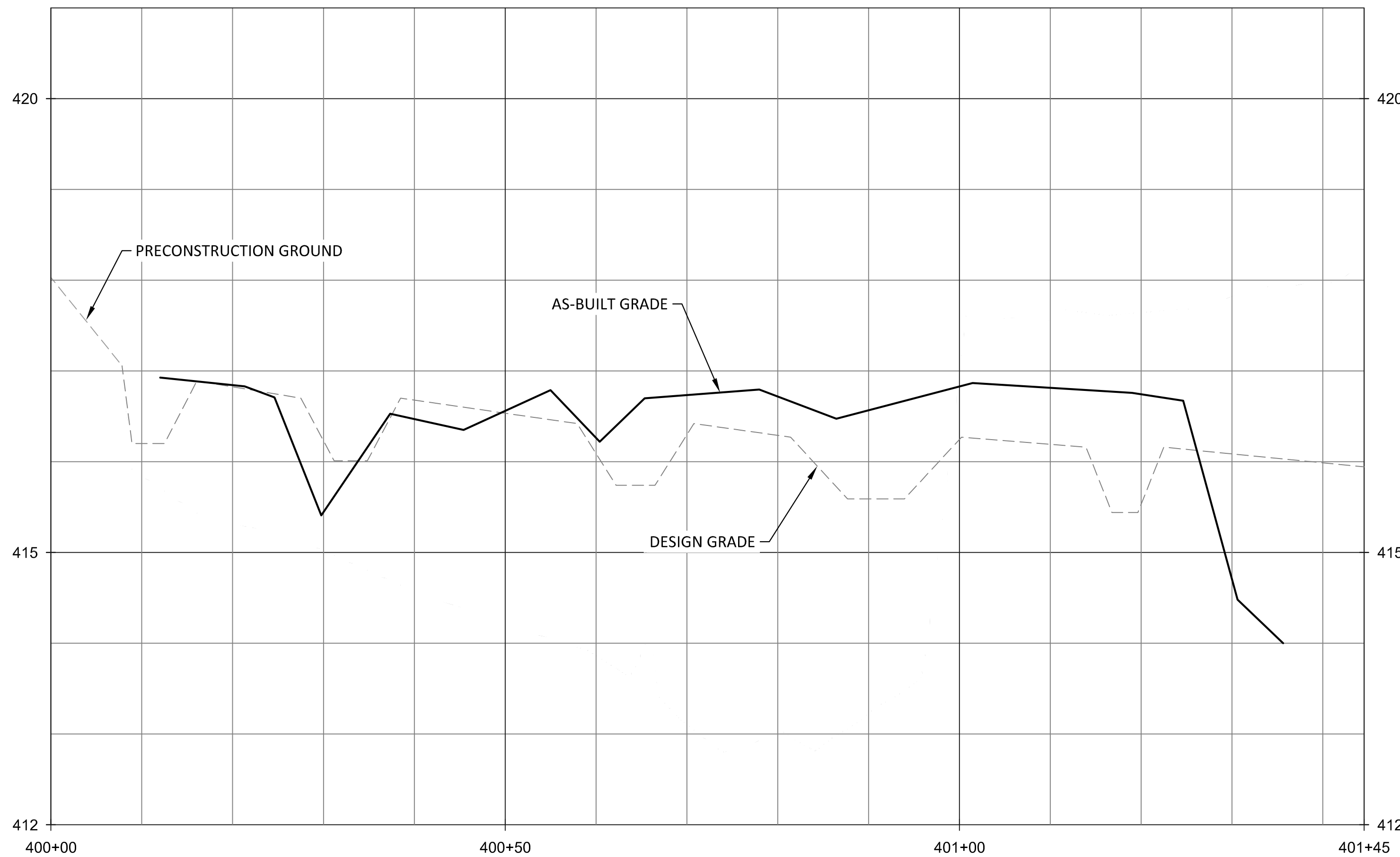

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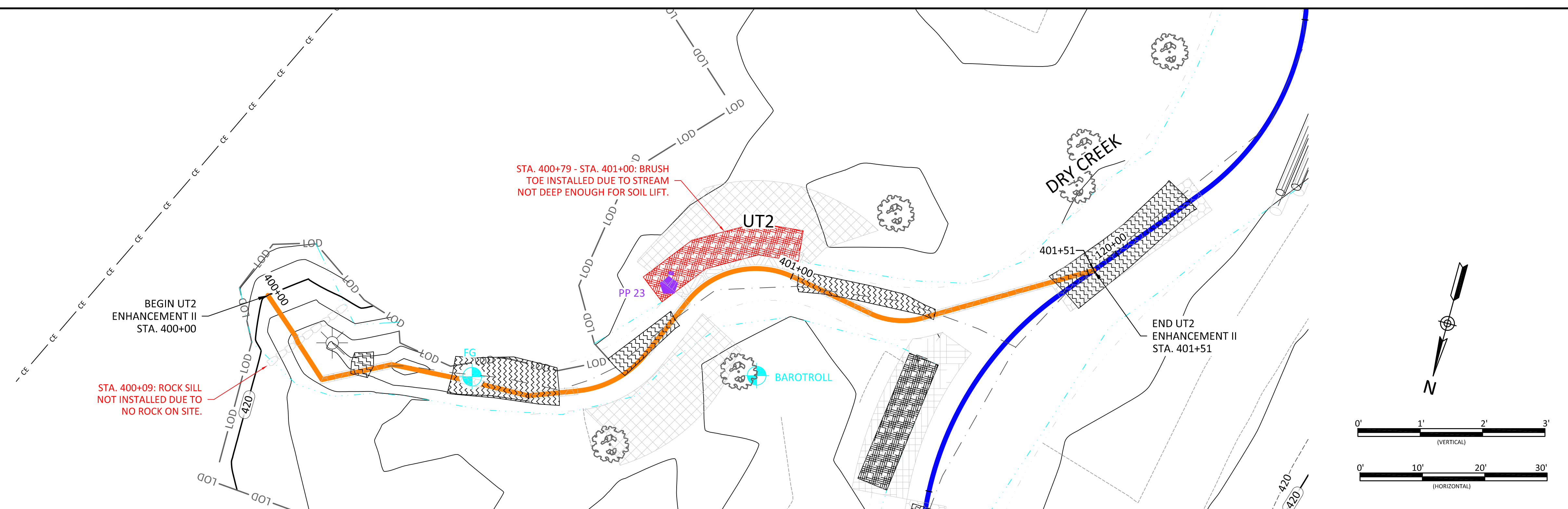

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NORTH CAROLINA PROFESSIONAL ENGINEER SEAL 031027

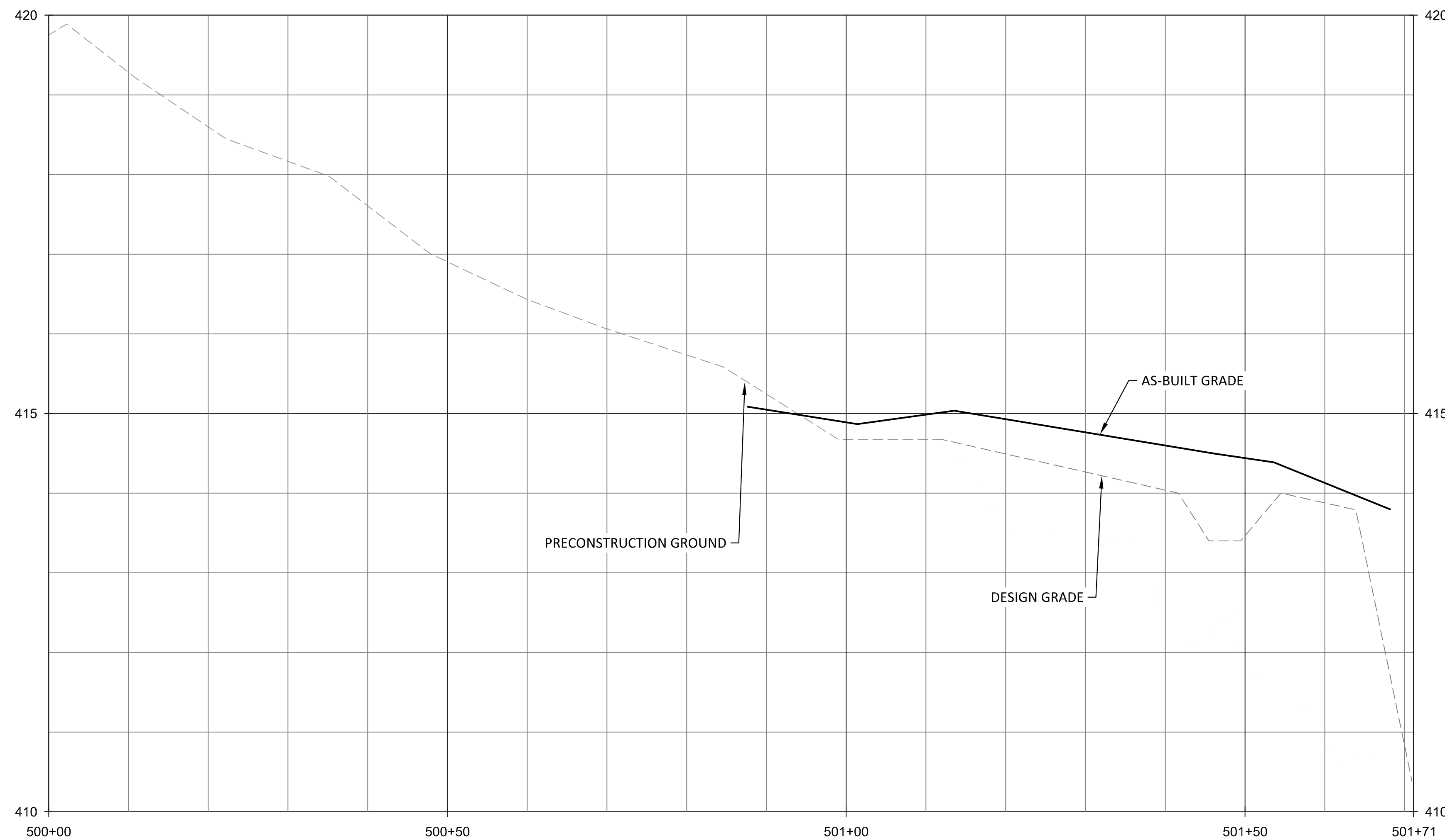
Dry Creek Mitigation Site
Durham County, NC

UT2
Stream Plan and Profile

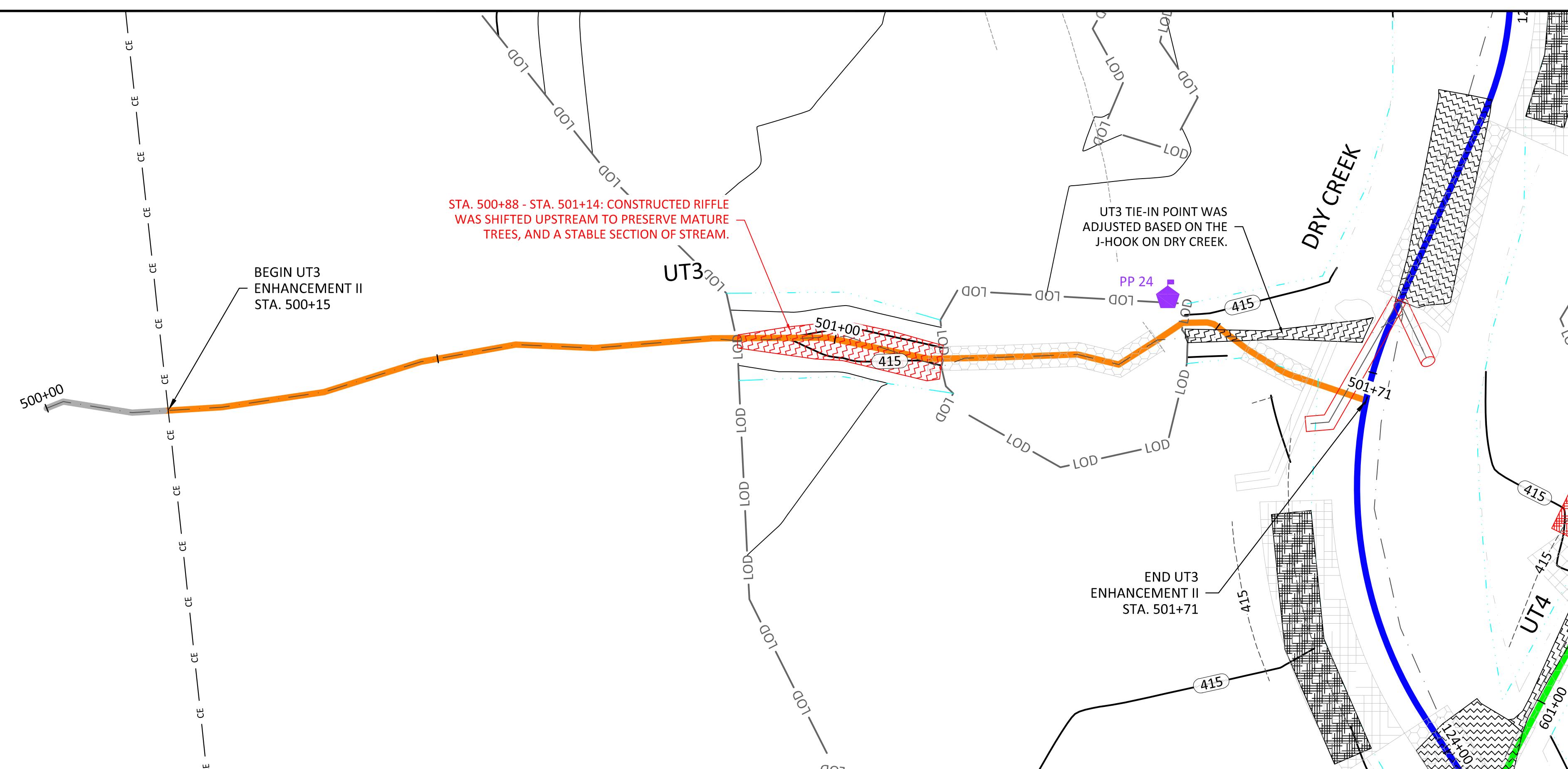
Revisions:

Date:	08.05.2020
Job Number:	005-02159
Project Engineer:	NMM
Drawn By:	CAW
Checked By:	JTL

Sheet 1.20



NOTES:
1. SURVEY WAS NOT CONDUCTED IN ENHANCEMENT II REACHES. REACHES WERE BUILT PER DESIGN UNLESS OTHERWISE NOTED.
2. AS-BUILT INFORMATION FOR DRY CREEK IS ADDRESSED ON SHEETS 1.1 THROUGH 1.14.
3. AS-BUILT INFORMATION FOR UT4 IS ADDRESSED ON SHEET 1.22.



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NORTH CAROLINA PROFESSIONAL ENGINEER SEAL 031027

Dry Creek Mitigation Site
Durham County, NC

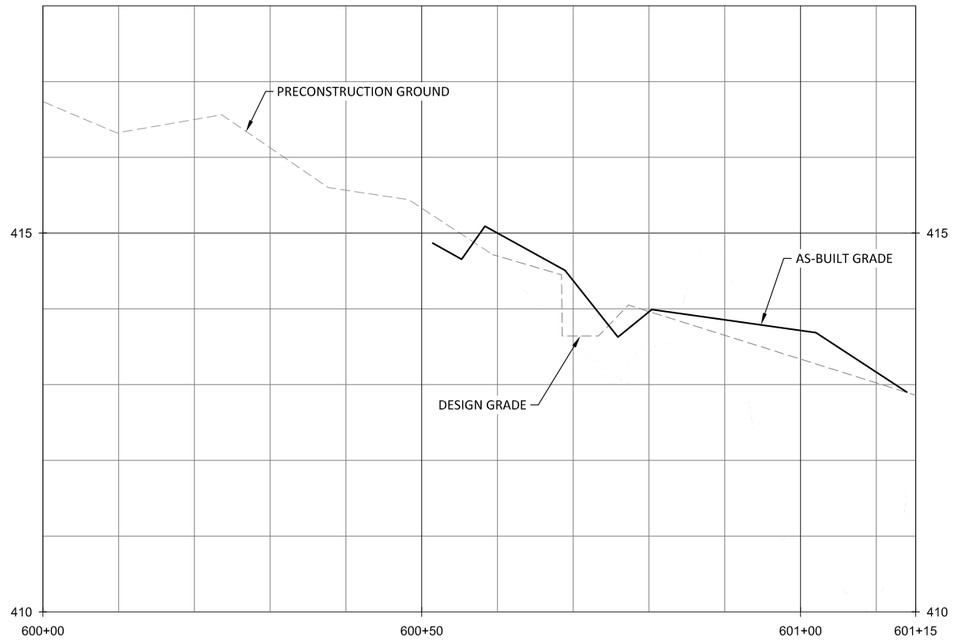
UT3
Stream Plan and Profile

Date:	08.05.2020
Job Number:	005-02159
Project Engineer:	NMM
Drawn By:	CAW
Checked By:	JTL

Revisions:

Sheet 1.21

August 7, 2020



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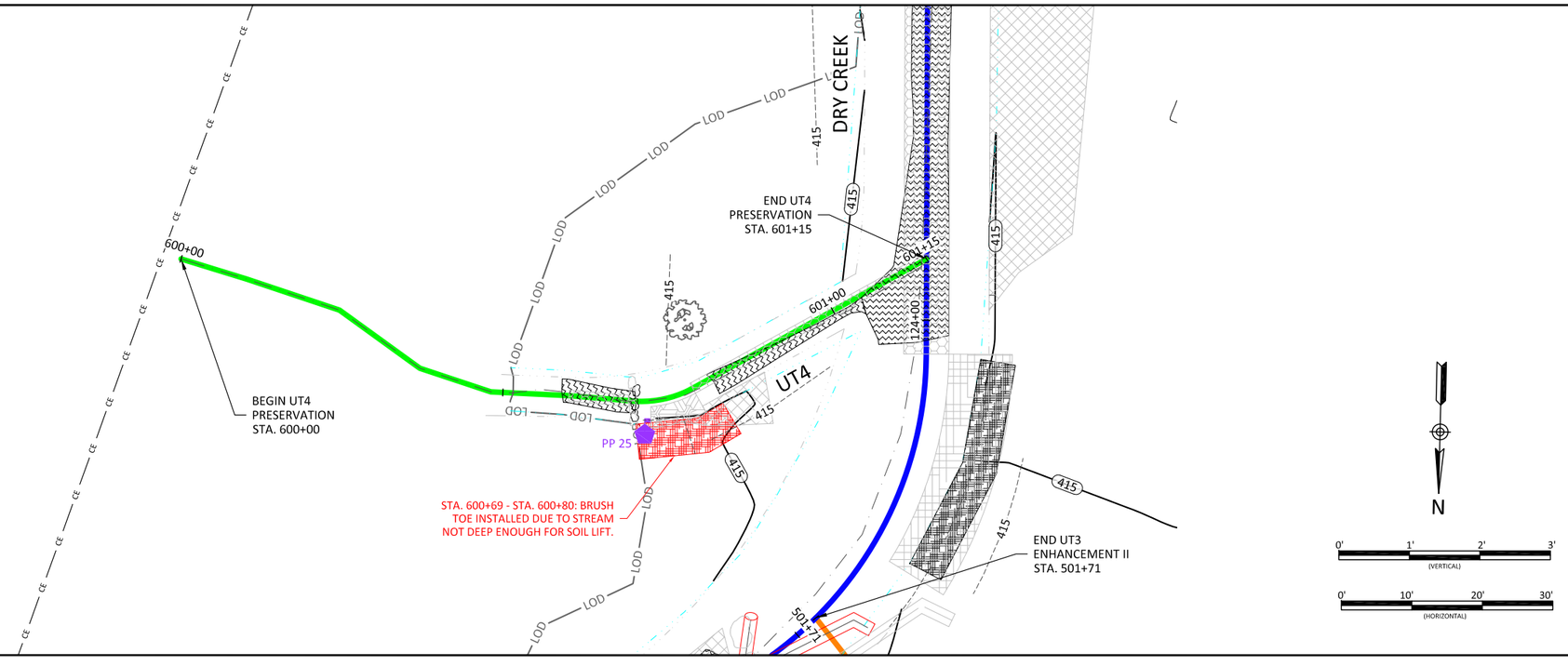

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Dry Creek Mitigation Site
Durham County, NC

UT4
Stream Plan and Profile

Revisions:

Date: 08.05.2020
Job Number: 005-02159
Project Engineer: NMM
Drawn By: CAW
Checked By: JTL

Sheet 1.22

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NORTH CAROLINA PROFESSIONAL SEAL 031027 ENGINEER JEFFREY T. FLEMING

Dry Creek Mitigation Site
Durham County, NC

UT5
Stream Plan and Profile

Revisions:

Date:	08.05.2020
Job Number:	005-02159
Project Engineer:	NMM
Drawn By:	CAW
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1.23
Sheet

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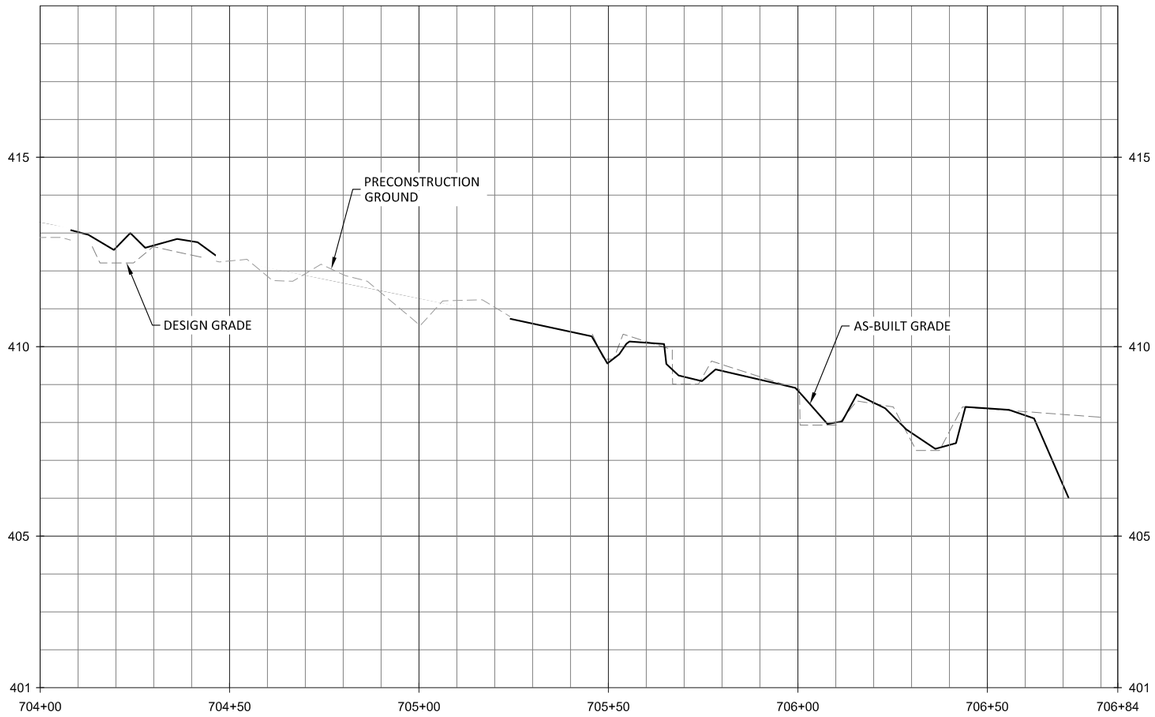

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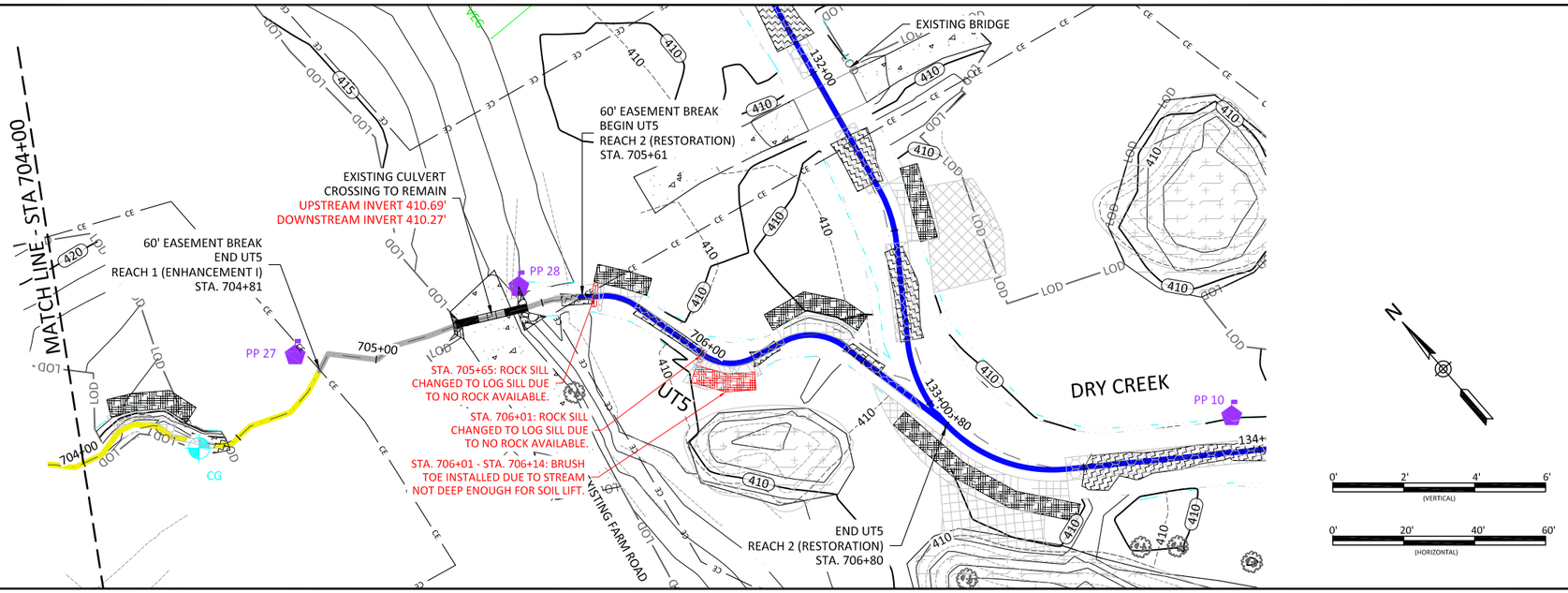

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Dry Creek Mitigation Site
Durham County, NC

UT5
Stream Plan and Profile

Revisions:

Date: 08.05.2020
Job Number: 005-02159
Project Engineer: NMM
Drawn By: CAW
Checked By: JTL

Sheet 1.24

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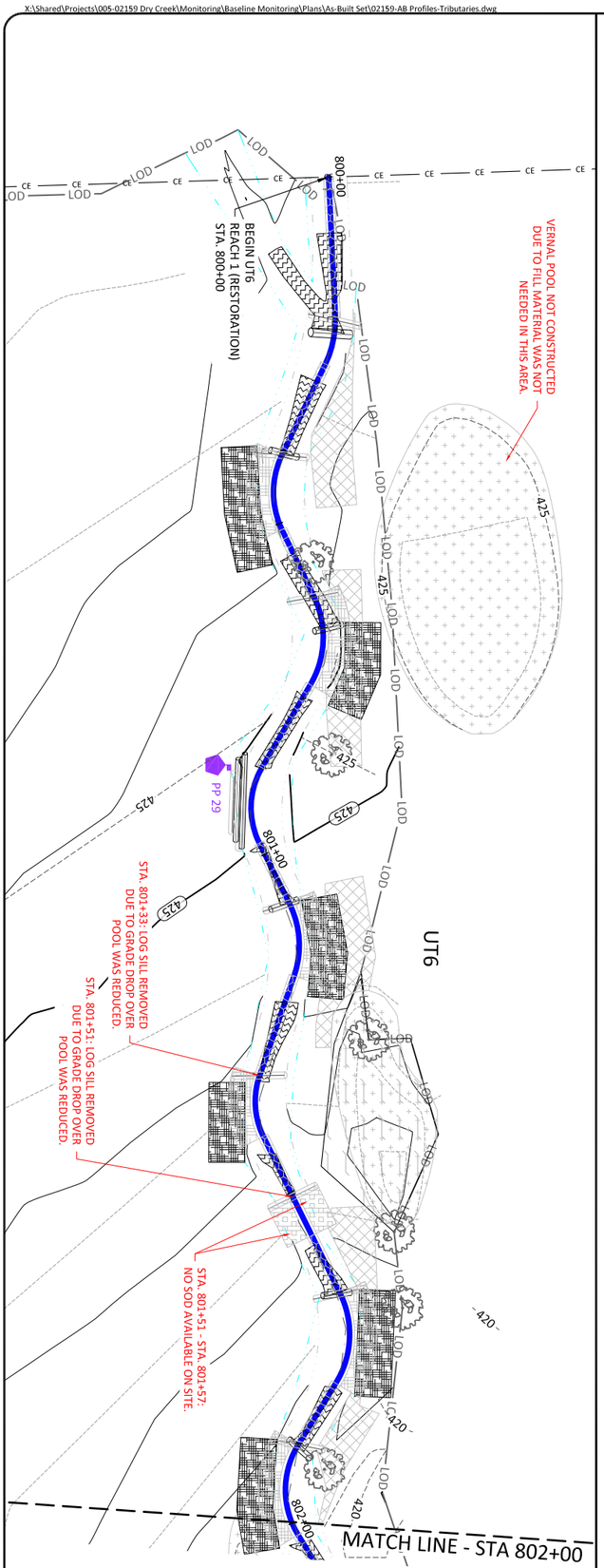

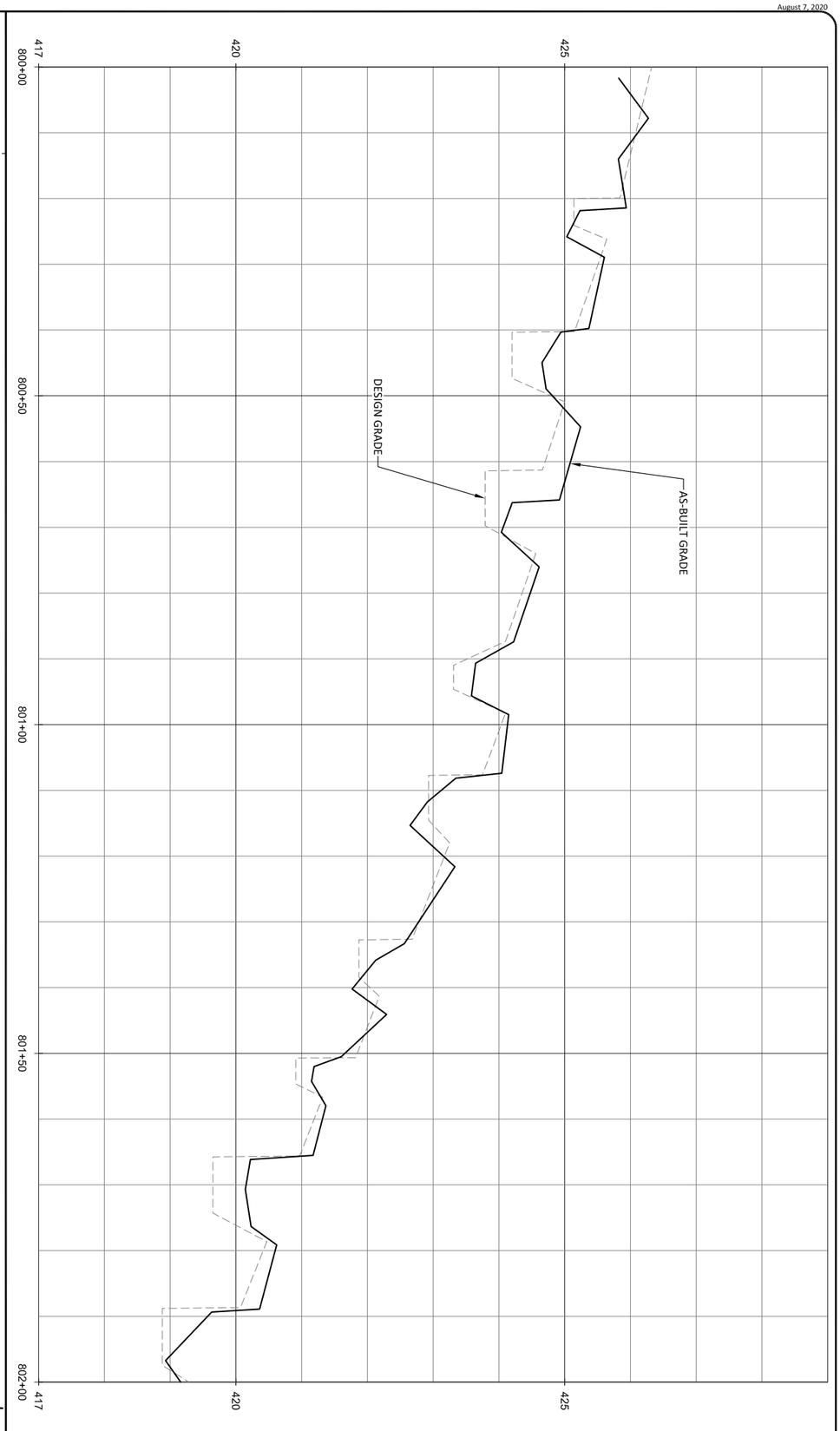

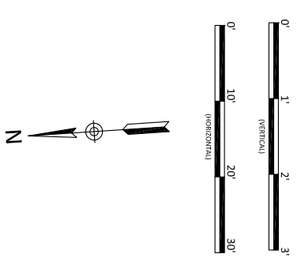

Date:	08.05.2020
Job Number:	005-02159
Project Engineer:	NMM
Drawn By:	CAW
Checked By:	JTL

1.25
Sheet

Revisions:

Dry Creek Mitigation Site
Durham County, NC

UT6 Reach 1
Stream Plan and Profile

NORTH CAROLINA PROFESSIONAL SEAL 031027 ENGINEER JOHN T. LEATHERMAN
8-7-20

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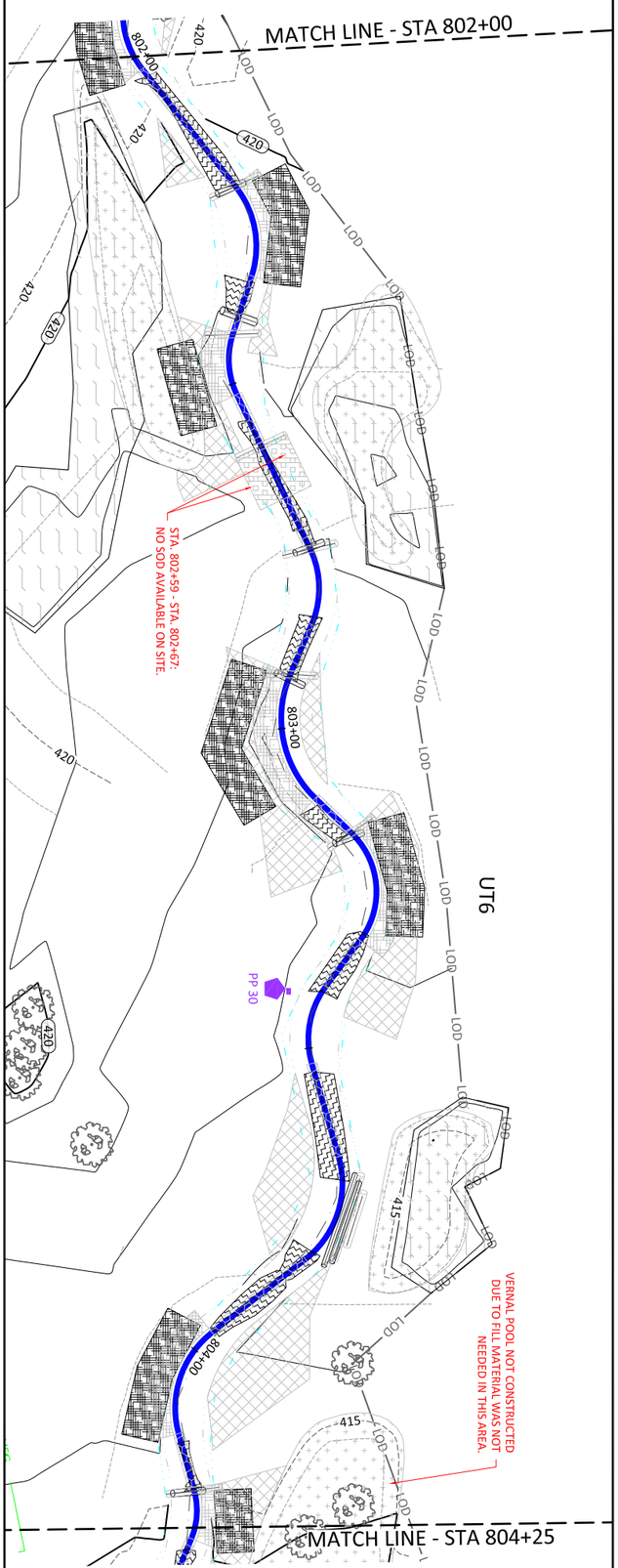

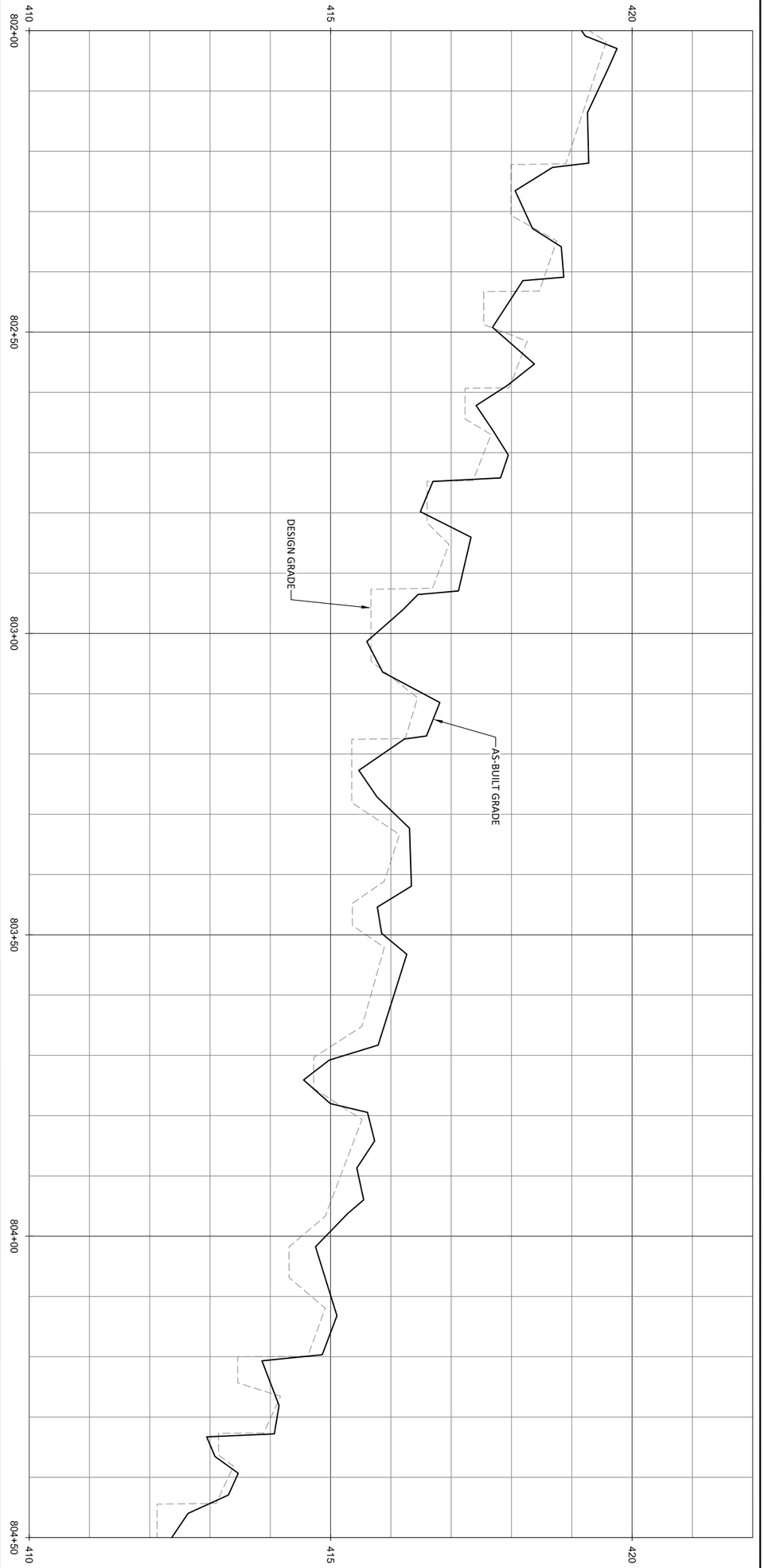

Date:	08.05.2020
Job Number:	005-02159
Project Engineer:	NMM
Drawn By:	CAW
Checked By:	JTL

1.26
Sheet

Revisions:

Dry Creek Mitigation Site
Durham County, NC

UT6 Reach 1
Stream Plan and Profile

NORTH CAROLINA PROFESSIONAL SEAL 031027 ENGINEER JEREMY T. LEATHERMAN
8-7-20

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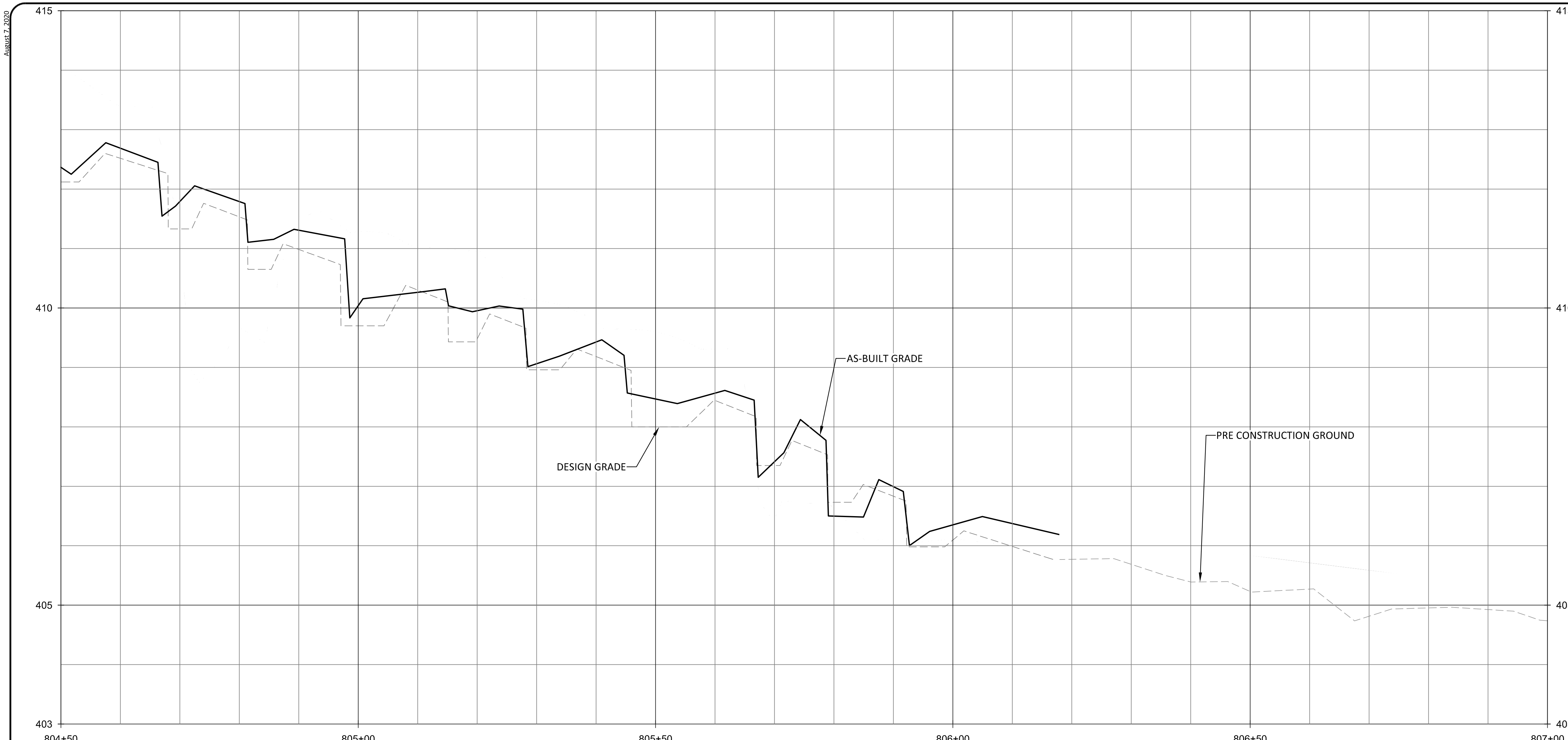

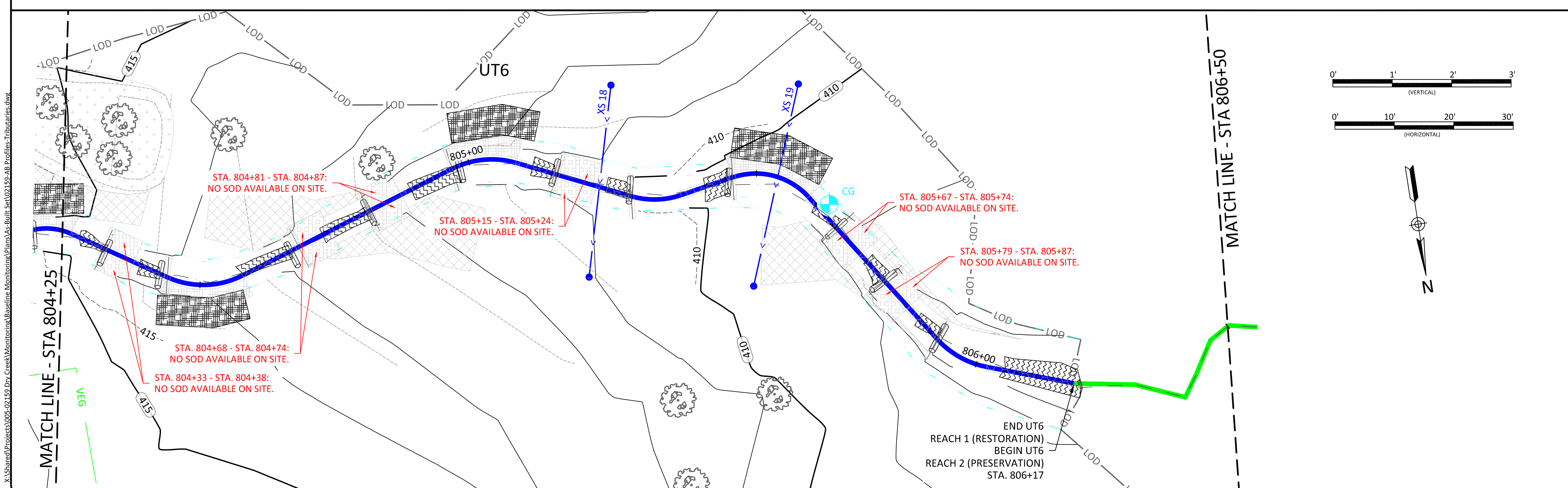

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SEAL 031027

Dry Creek Mitigation Site
Durham County, NC

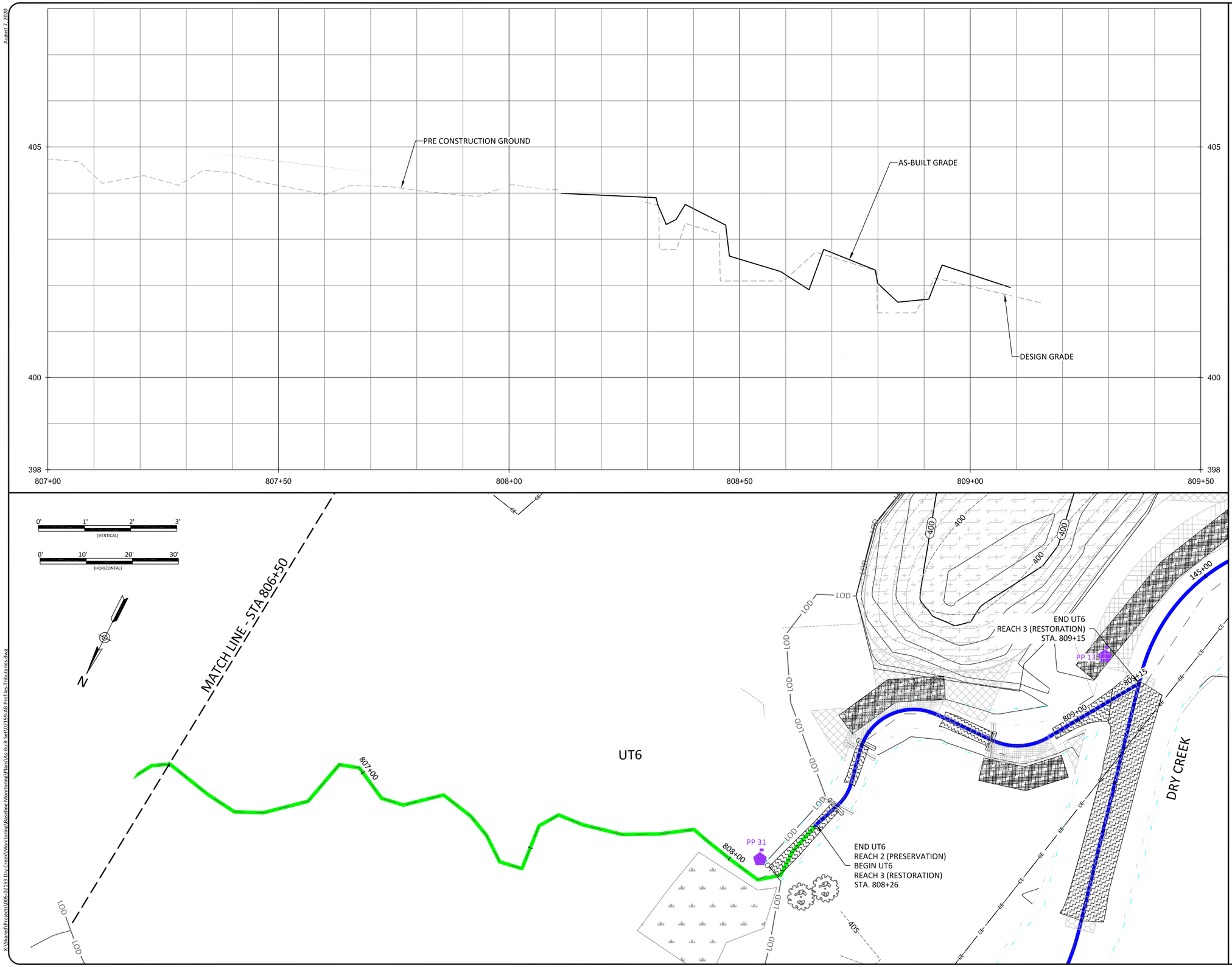
UT6 Reaches 1 & 2
Stream Plan and Profile

Revisions:

Date:	08.05.2020
Job Number:	005-02159
Project Engineer:	NMM
Drawn By:	CAW
Checked By:	JTL

Sheet 1.27

August 7, 2020



NOTES:
1. AS-BUILT INFORMATION FOR DRY CREEK IS ADDRESSED ON SHEETS 1.1 THROUGH 1.14.

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Dry Creek Mitigation Site
Durham County, NC

UT6 Reaches 2 & 3
Stream Plan and Profile

Revisions:

Date:	08.05.2020
Job Number:	005-02159
Project Engineer:	NMM
Drawn By:	CAW
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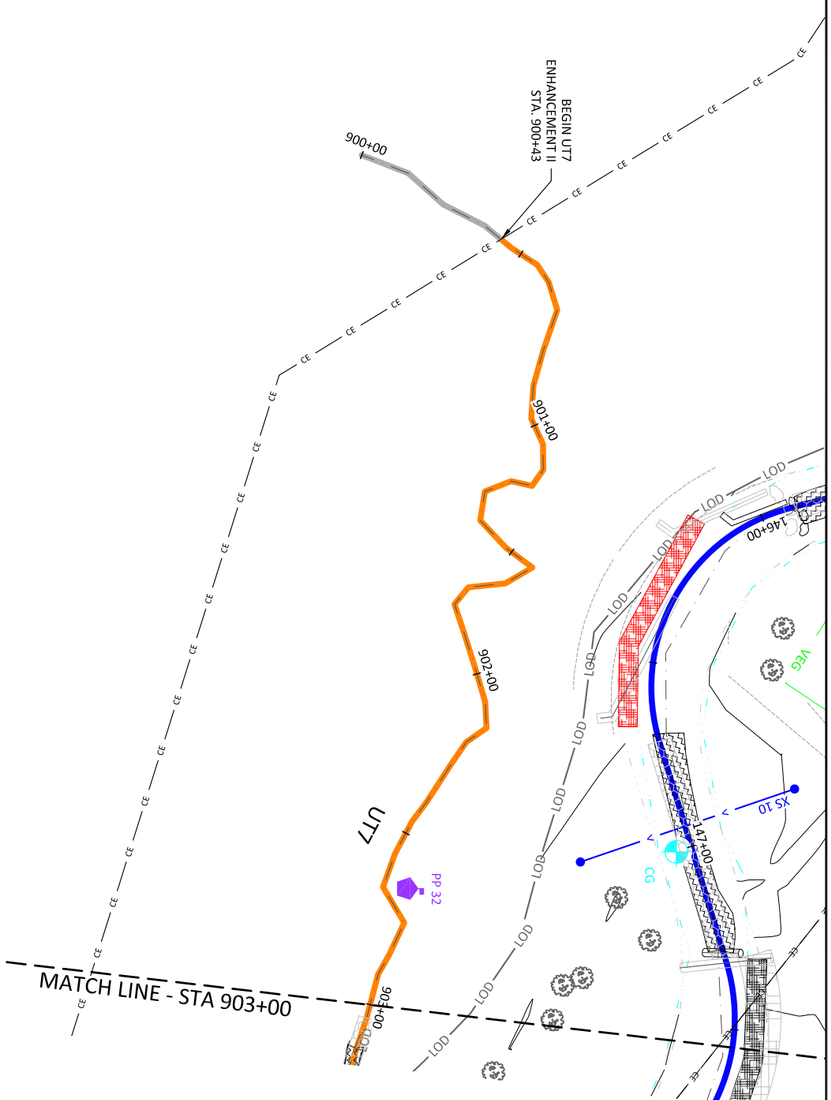
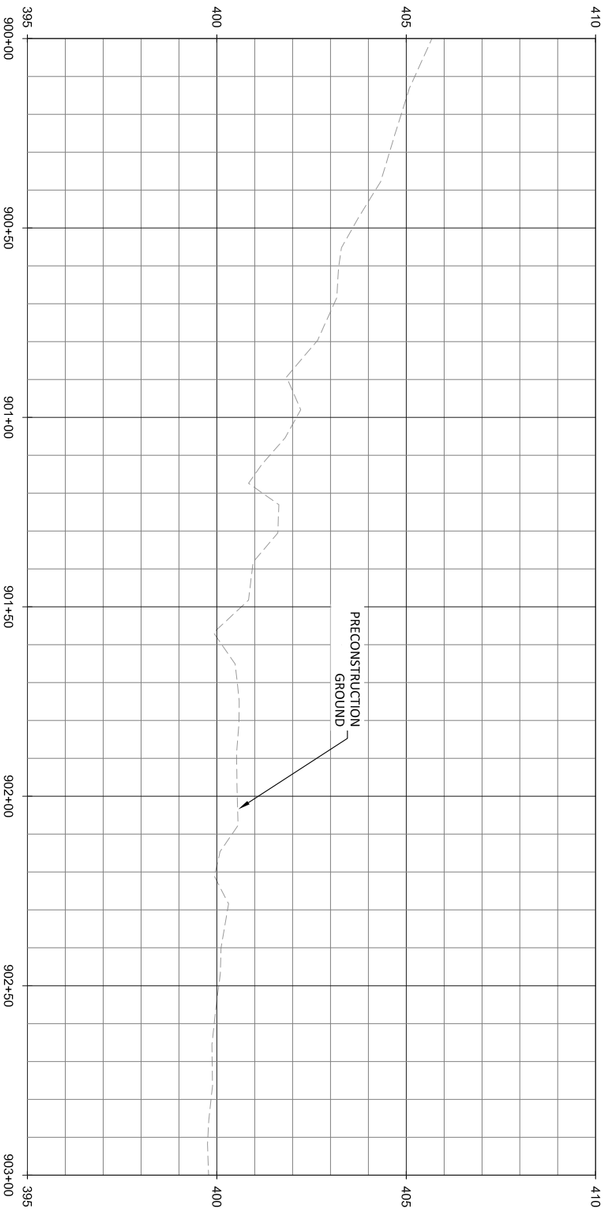
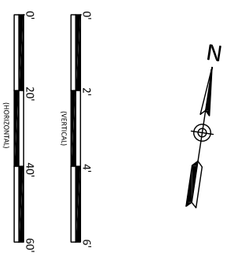
Sheet 1.28

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







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Drawn By:	CAW
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1.29
Sheet

Revisions:

Dry Creek Mitigation Site
Durham County, NC

UT7
Stream Plan and Profile

NORTH CAROLINA PROFESSIONAL SEAL 031027 ENGINEER JEFFREY T. LEATHERMAN
8-7-20

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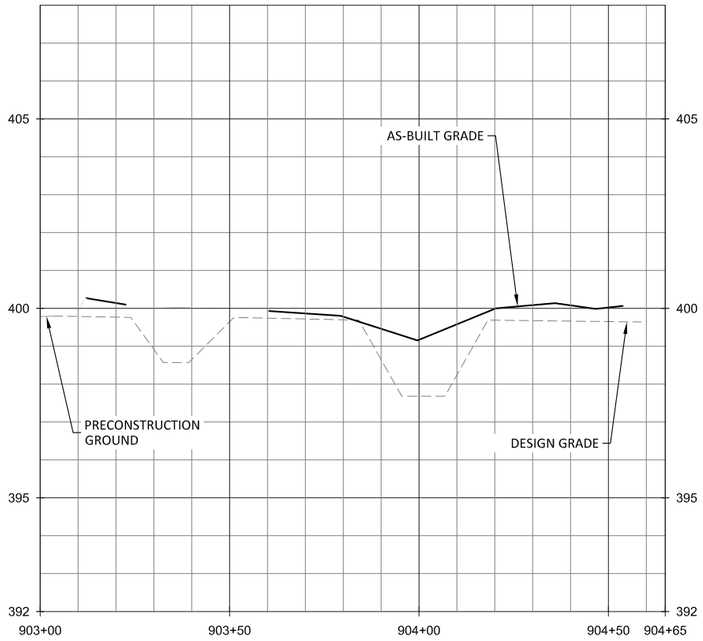

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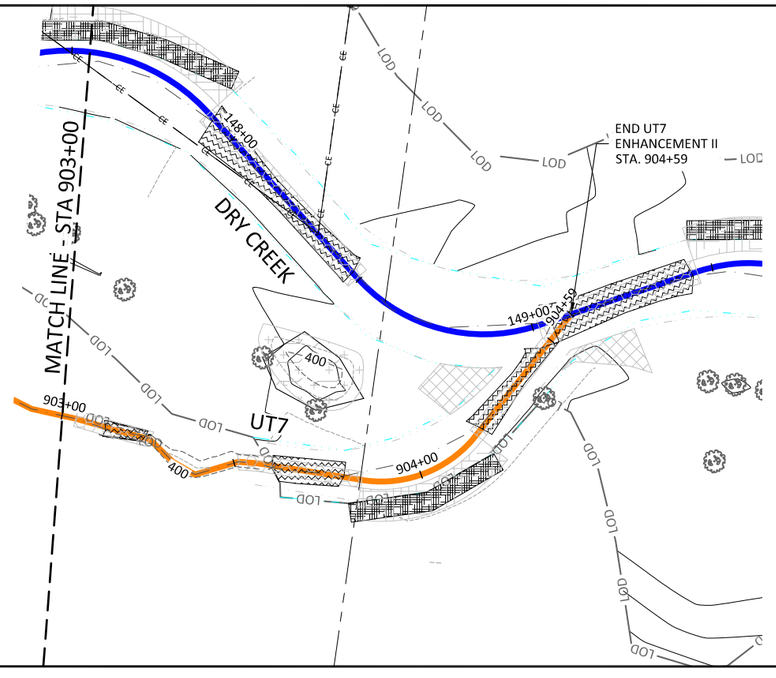

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Dry Creek Mitigation Site
Durham County, NC

UT7
Stream Plan and Profile

Revisions:

Date: 08.05.2020
Job Number: 005-02159
Project Engineer: NMM
Drawn By: CAW
Checked By: JTL

Sheet 1.30

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August 28, 2020

Zone 1 (Dry Creek) - Streambank Planting Zone 1
~~(See Detail 2, Sheet 5.6)~~

Zone 2 (UT1 - UT7) - Streambank Planting Zone 2
~~(See Detail 2, Sheet 5.6)~~

Zone 3 - Buffer Planting Zone
~~(See Detail 1, Sheet 5.6)~~

Permanent Seeding Outside Easement

Note: Non-hatched areas within easement are currently vegetated but were planted as needed to achieve target density.

Buffer Planting Zone

Bare Root

Species	Common Name	Max Spacing	Indiv. Spacing	Min. Caliper Size	Stratum	# of Stems	Qty Specified
Quercus pagoda	Cherrybark Oak	12 ft.	6-12 ft.	0.25"-1.0"	Canopy	10%	1049
Populus deltoides	Eastern Cottonwood	13 ft.	6-12 ft.	0.25"-1.0"	Canopy	6%	630
Quercus phellos	Willow Oak	12 ft.	6-12 ft.	0.25"-1.0"	Canopy	10%	1049
Platanus occidentalis	Sycamore	12 ft.	6-12 ft.	0.25"-1.0"	Canopy	20%	2098
Betula nigra	River Birch	12 ft.	6-12 ft.	0.25"-1.0"	Canopy	20%	2098
Salix nigra	Black Willow	12 ft.	6-12 ft.	0.25"-1.0"	Canopy	7%	735
Liriodendron tulipifera	Tulip Poplar	12 ft.	6-12 ft.	0.25"-1.0"	Canopy	10%	1049
Quercus michauxii	Swamp Chestnut Oak	12 ft.	6-12 ft.	0.25"-1.0"	Canopy	10%	1049
Fraxinus pennsylvanica	Green Ash	12 ft.	6-12 ft.	0.25"-1.0"	Canopy	7%	735
						100%	

NOTE: 10 Paw Paw (Asimina triloba) and 10 Persimmon (Diospyros virginiana) trees were to be planted randomly along the easement boundaries of the Ellis property.

Streambank Planting Zone 1

Live Stakes

Species	Common Name	Max Spacing	Indiv. Spacing	Min. Size	Stratum	% of Stems
Salix nigra	Black Willow	8 ft.	2-8 ft.	0.5"-1.5" cal.	Shrub	25%
Cornus ammomum	Silky Dogwood	8 ft.	2-8 ft.	0.5"-1.5" cal.	Shrub	40%
Salix sericea	Silky Willow	8 ft.	2-8 ft.	0.5"-1.5" cal.	Shrub	35%
						100%
Herbaceous Plugs						
Juncus effusus	Common Rush	5 ft.	3-5 ft.	1.0"- 2.0" plug	Herb	50%
Carex alata	Broadwing Sedge	5 ft.	3-5 ft.	1.0"- 2.0" plug	Herb	50%
						100%

Streambank Planting Zone 2

Live Stakes

Species	Common Name	Max Spacing	Indiv. Spacing	Min. Size	Stratum	% of Stems
Cornus ammomum	Silky Dogwood	8 ft.	2-8 ft.	0.5"-1.5" cal.	Shrub	50%
Salix sericea	Silky Willow	8 ft.	2-8 ft.	0.5"-1.5" cal.	Shrub	50%
						100%
Herbaceous Plugs						
Juncus effusus	Common Rush	5 ft.	3-5 ft.	1.0"- 2.0" plug	Herb	50%
Carex alata	Broadwing Sedge	5 ft.	3-5 ft.	1.0"- 2.0" plug	Herb	50%
						100%

Zones 1 - 3

Permanent Riparian Seeding

Pure Live Seed (20 lbs/acre)

Approved Date	Species Name	Common Name	Stratum	Density (lbs/acre)	pH	Percentage
All Year	*Panicum rigidulum*	Redtop Panicgrass	Herb	1.5	5.0-7.5	10%
All Year	*Agrostis hyemalis*	Winter Bentgrass	Herb	4.0	5.0-7.5	15%
All Year	*Chasmanthium latifolium*	River Oats	Herb	2.0	5.0-7.0	10%
All Year	*Rudbeckia hirta*	Blackeyed Susan	Herb	1.0	6.0-7.0	10%
All Year	*Coreopsis lanceolata*	Lanceleaf Coreopsis	Herb	1.0	6.0-7.0	10%
All Year	*Carex vulpinoidea*	Fox Sedge	Herb	3.0	6.8-8.9	15%
All Year	*Panicum clandestinum*	Deertongue	Herb	3.5	4.0-7.5	20%
All Year	*Elymus virginicus*	Virginia Wild Rye	Herb	2.0	5.0-7.4	10%
						100%

Temporary Seeding

Pure Live Seed

Approved Date	Species Name	Common Name	Stratum	Density (lbs/acre)
Aug 15 - May 1	*Secale cereale*	Rye Grain	Herb	140
May 1 - Aug 15	*Pennisetum glaucum*	Pearl Millet	Herb	50

Permanent Seeding Outside Easement

Approved Date	Species Name	Common Name	Stratum	Density (lbs/acre)
All Year	*Festuca arundinacea*	Tall Fescue	Herb	40

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Dry Creek Mitigation Site
Durham County, NC

Planting Tables

Revisions:
1) BUFFER TABLE UPDATED

Date: 08.05.2020
Job Number: 005-02159
Project Engineer: NMM
Drawn By: CAW
Checked By: JTL

Sheet 2.0

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August 7, 2020

Zone 1 (Dry Creek) - Streambank Planting Zone 1
~~(See Detail 2, Sheet 5.6)~~

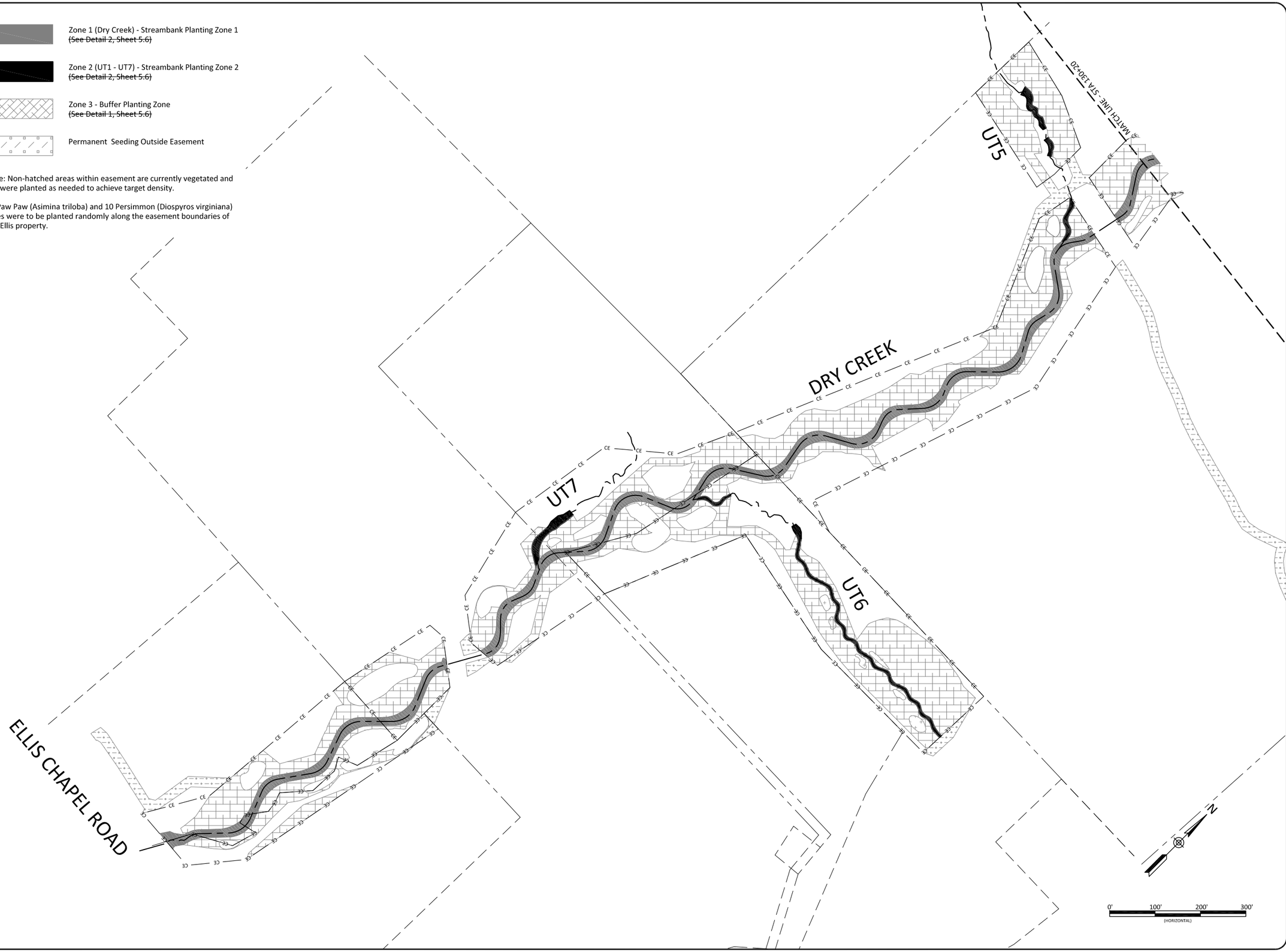
Zone 2 (UT1 - UT7) - Streambank Planting Zone 2
~~(See Detail 2, Sheet 5.6)~~

Zone 3 - Buffer Planting Zone
~~(See Detail 1, Sheet 5.6)~~

Permanent Seeding Outside Easement

Notes:

1. Note: Non-hatched areas within easement are currently vegetated and but were planted as needed to achieve target density.
2. 10 Paw Paw (Asimina triloba) and 10 Persimmon (Diospyros virginiana) trees were to be planted randomly along the easement boundaries of the Ellis property.



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Durham County, NC

Planting Plan

Revisions:

Date: 08.05.2020
Job Number: 005-02159
Project Engineer: NMM
Drawn By: CAW
Checked By: JTL

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August 7, 2020

Zone 1 (Dry Creek) - Streambank Planting Zone 1
~~(See Detail 2, Sheet 5.6)~~

Zone 2 (UT1 - UT7) - Streambank Planting Zone 2
~~(See Detail 2, Sheet 5.6)~~

Zone 3 - Buffer Planting Zone
~~(See Detail 1, Sheet 5.6)~~

Permanent Seeding Outside Easement

Notes:
1. Note: Non-hatched areas within easement are currently vegetated and but were planted as needed to achieve target density.
2. 10 Paw Paw (Asimina triloba) and 10 Persimmon (Diospyros virginiana) trees were to be planted randomly along the easement boundaries of the Ellis property.

AREA WAS SEEDED WITH FESCUE AFTER CLEARING AND GRUBBING

HALL ROAD

HAMPTON ROAD

UT1

UT1A

UT2

UT3

UT4

DRY CREEK

MATCH LINE - STA 130+20

N

0' 100' 200' 300'
(HORIZONTAL)

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Dry Creek Mitigation Site
Durham County, NC

Planting Plan

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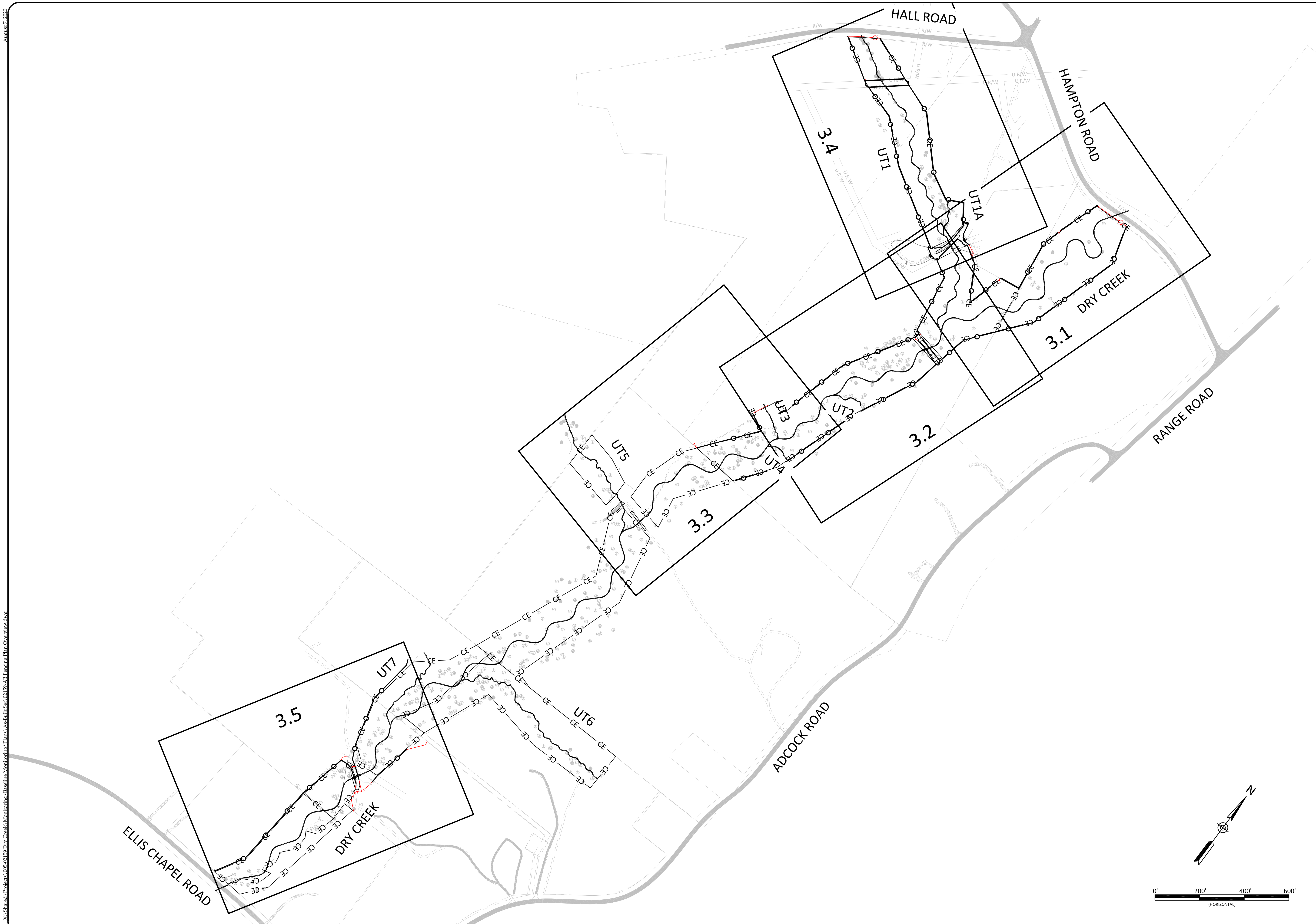

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Dry Creek Mitigation Site
Durham County, NC

Fencing Plan Overview

Revisions:

Date:	08.05.2020
Job Number:	005-02159
Project Engineer:	NMM
Drawn By:	CAW
Checked By:	JTL

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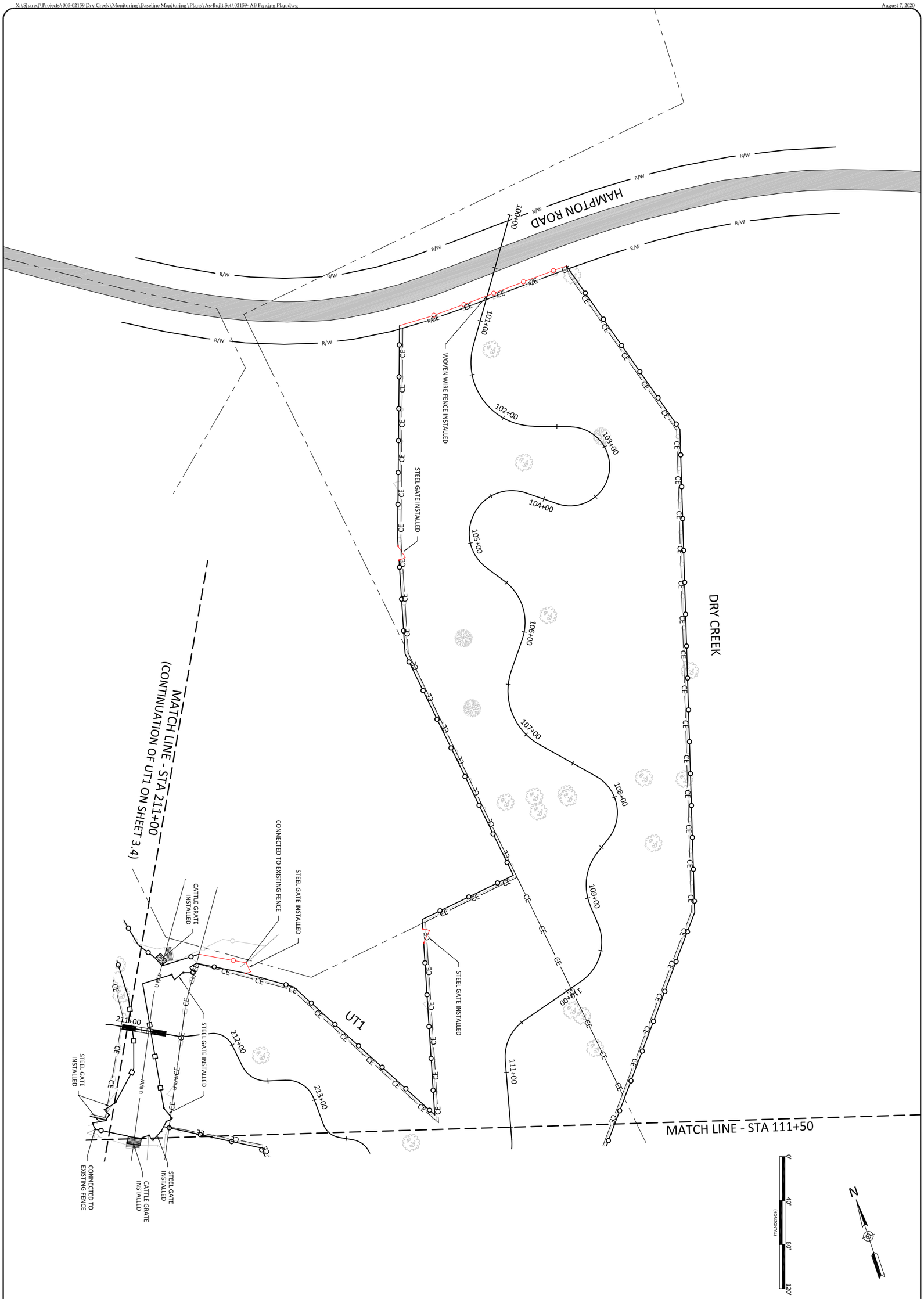

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Job Number:	005-02159
Project Engineer:	NMM
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Fencing Plan

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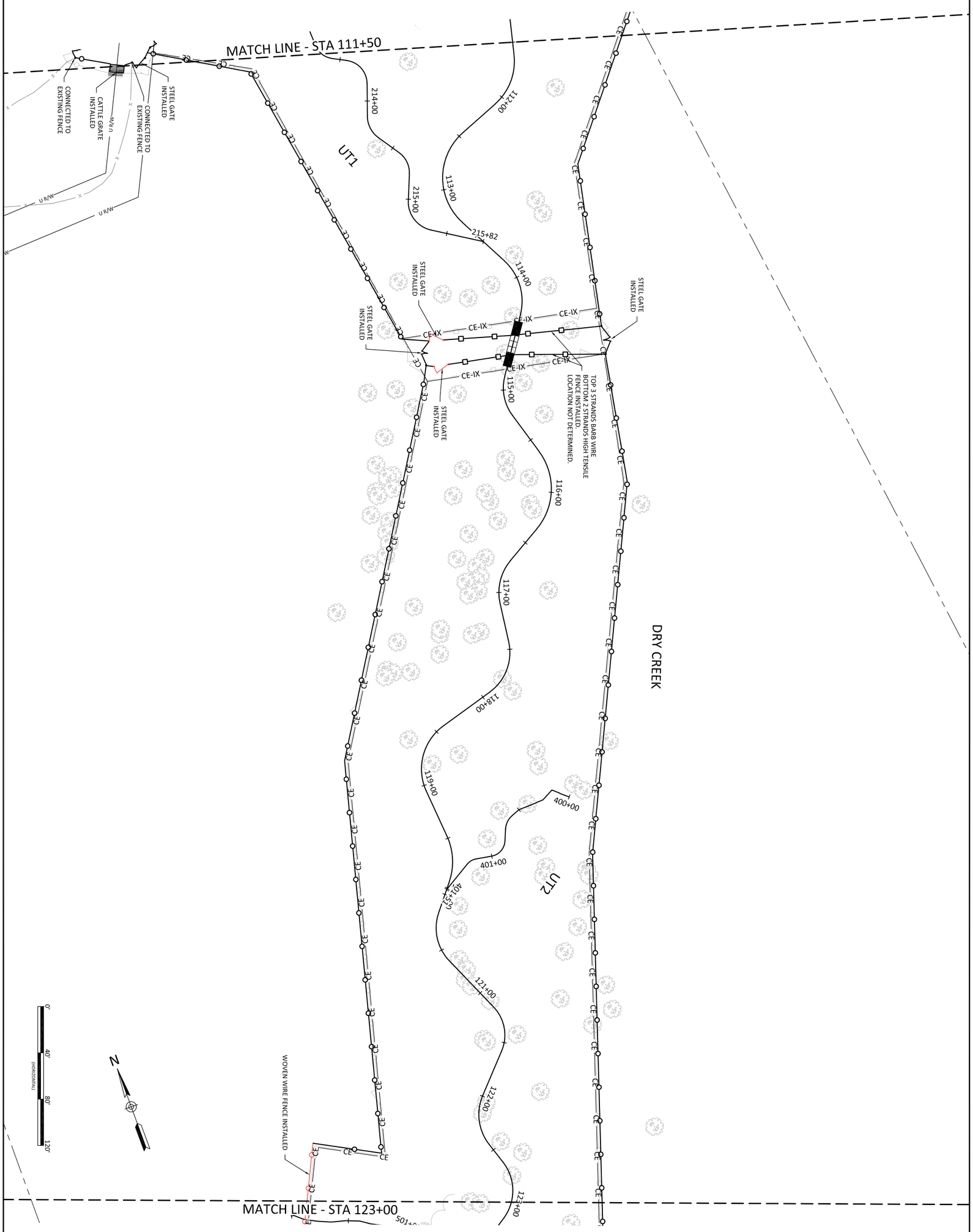

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Job Number:	005-02159
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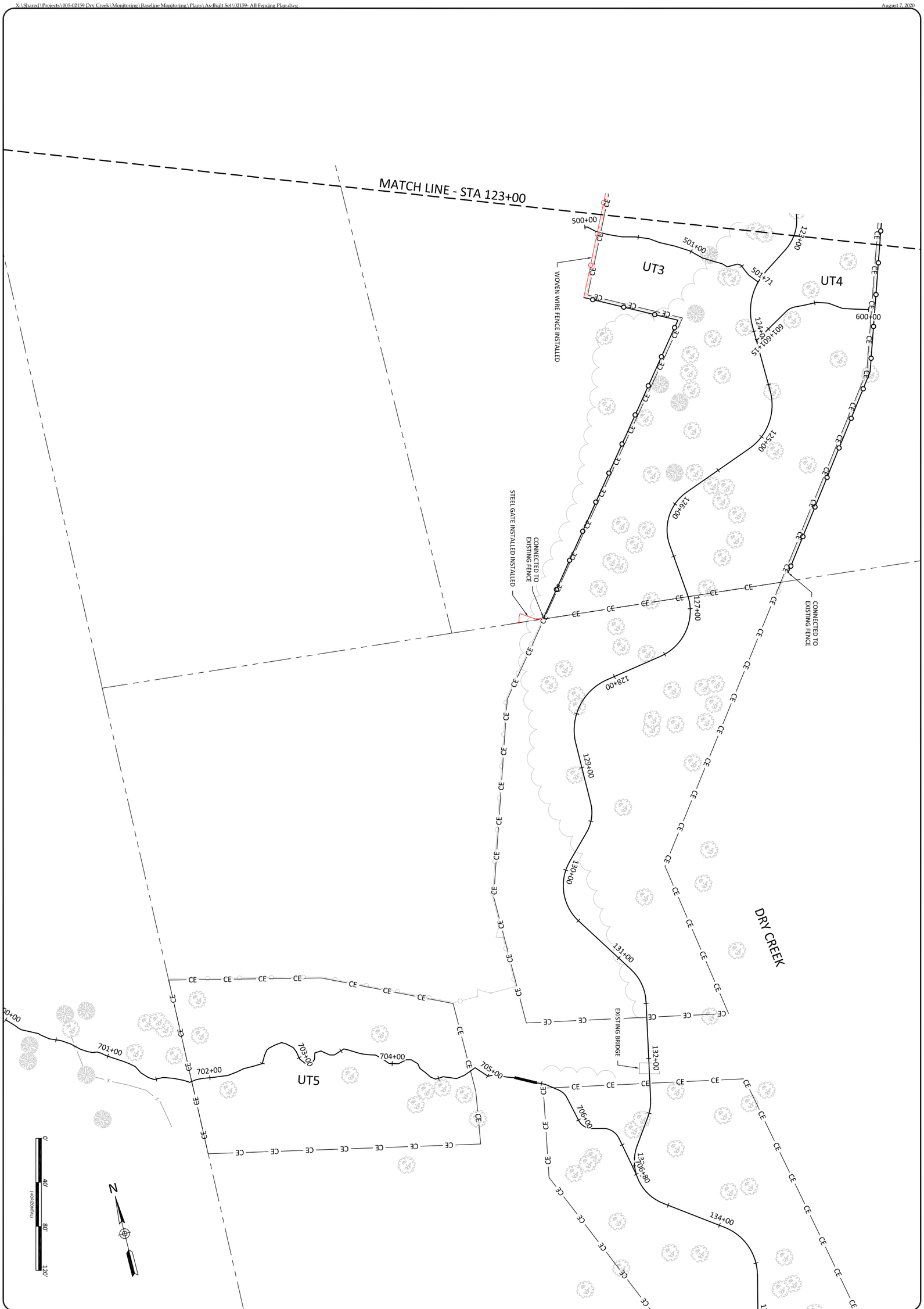

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Durham County, NC

Fencing Plan

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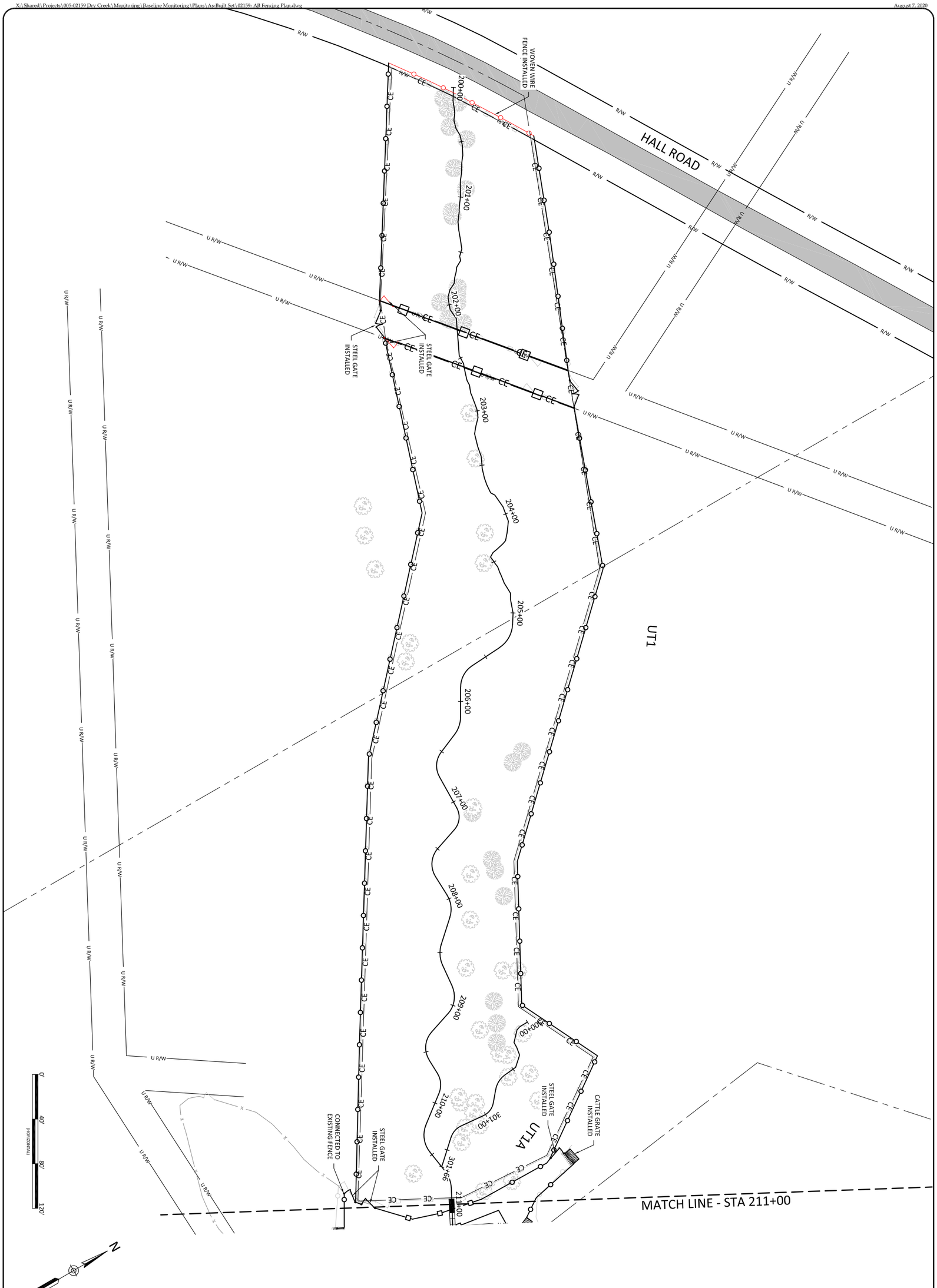

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Job Number:	005-02159
Project Engineer:	NMM
Drawn By:	CAW
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Durham County, NC

Fencing Plan

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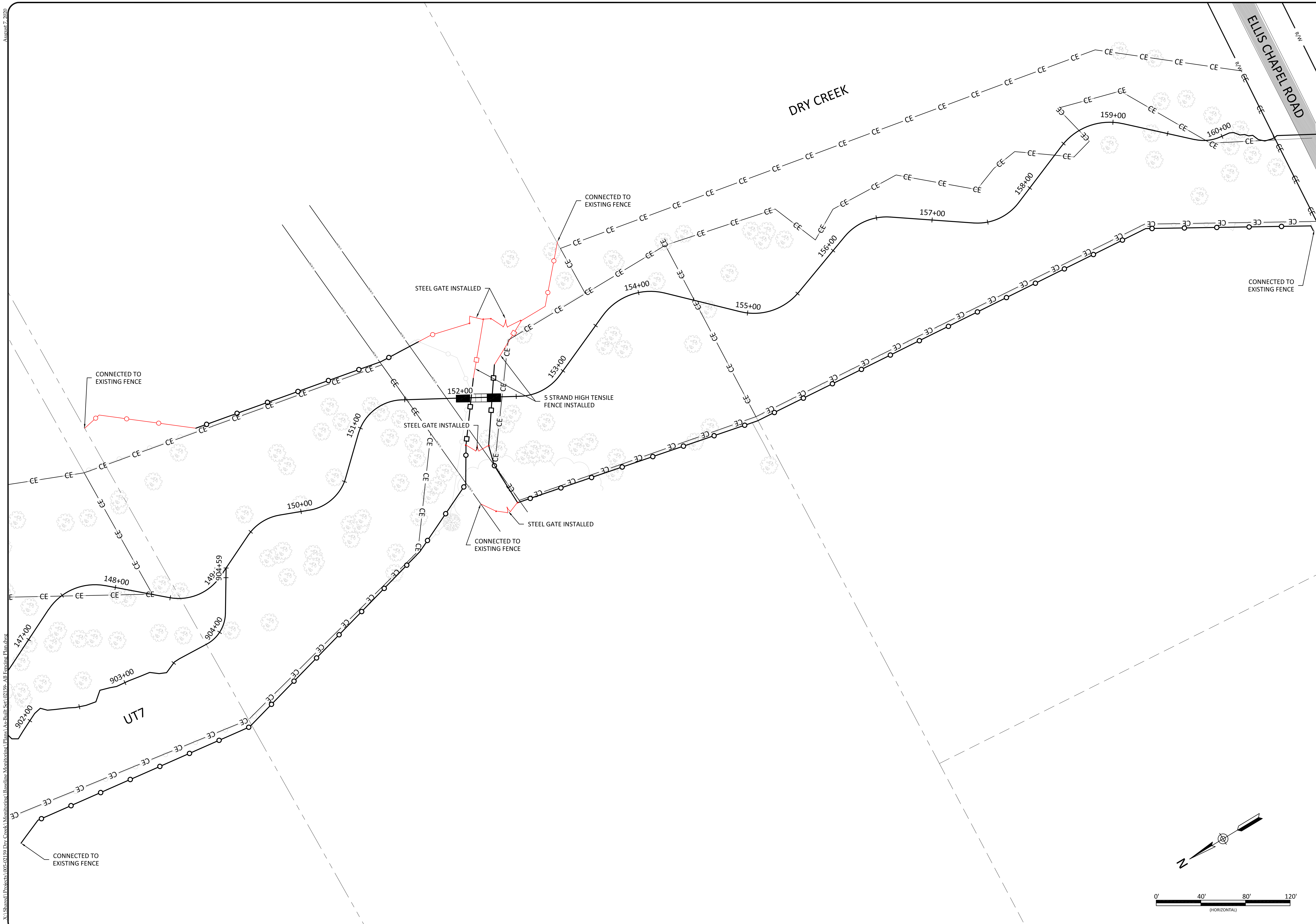

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Job Number: 005-02159
Project Engineer: NMM
Drawn By: CAW
Checked By: JTL

Sheet 3.5

APPENDIX 6. Buffer Baseline Monitoring Report

Buffer Baseline Monitoring Report

August 2020

DRY CREEK MITIGATION SITE

Durham County, NC
NCDEQ Contract No. 6827
DMS ID No. 97082
DWR Project Number 2016-0369

Neuse River Basin
HUC 03020201

RFP #: 16-006477

PREPARED FOR:

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

BUFFER BASELINE MONITORING REPORT

DRY CREEK MITIGATION SITE

Durham County, NC
NCDEQ Contract No. 6827
DMS ID No. 97082

Neuse River Basin
HUC 03020201

PREPARED FOR:

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

PREPARED BY:

Wildlands Engineering, Inc.
312 West Millbrook Road, Suite 225
Raleigh, NC 27609
Phone: (919) 851-9986

This Baseline Monitoring Plan has been written in conformance with the requirements of the following:

- 15A NCAC 02B .0295 Mitigation Program Requirements for Protection and Maintenance of Riparian Buffers.

These documents govern DMS operations and procedures for the delivery of compensatory mitigation.

Contributing Staff:

Jeff Keaton, *Project Manager*
John Hutton, *Principal in Charge*
Jason Lorch, *Baseline Monitoring Plan*
Daniel Taylor, *Construction Administrator*
Carolyn Lanza, *Monitoring Lead*
Andrea Eckardt, *Lead Quality Assurance*

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APPENDICES

1.0 Mitigation Project Summary

The Dry Creek Mitigation Site (Site) is a riparian restoration project located in Durham County approximately three miles northwest of Butner, NC and approximately 2 miles west of the Granville County/Durham County line (Figure 1). Figure 2 depicts the service area of the Site which includes the Falls Lake watershed in the Neuse river basin. A conservation easement comprised of 29.764 acres along Dry Creek and eight unnamed tributaries was recorded on the Site (Figure 3). Before construction, the Site was characterized by a mix of active pastures, fields, and woodlands. The project is expected to generate 441,874.94 riparian buffer credits.

The Site is within Hydrologic Unit Code (HUC) 03020201010050 and North Carolina Department of Water Resources (NCDWR) Sub-basin 03-04-01. The eight unnamed tributaries (UT1 – UT7; UT1A) drain to Dry Creek, which flow into Lake Michie on the Flat River, which flows directly into Falls Lake. Flat River is classified as water supply waters (WS-III) and nutrient sensitive waters (NSW).

1.1 Project Goals

The major goals of the riparian restoration project are to provide ecological and water quality enhancements to the Neuse River Watershed within the Falls Lake Water Supply Watershed by creating a functional riparian corridor and restoring the riparian area. The project supports specific goals identified in the 2010 Neuse River Basin Restoration Priorities Plan (RBRP) for the Neuse River Targeted Local Watershed (TLW). This document highlights the importance of riparian buffers for stream restoration projects. Forested riparian areas immobilize and retain nutrients and suspended sediment. The RBRP also supports the Falls Lake watershed plan. Falls Lake is the receiving water supply water body downstream of the Site and is classified as WS-IV and NSW. Specific enhancements to water quality and ecological processes are outlined below:

- Decrease nutrient levels - Nutrient input will be decreased by filtering runoff from the agricultural fields through restored native buffer zones. The off-site nutrient input will also be absorbed on-site by dispersing flood flows through native vegetation, thereby reducing nutrient inputs to waters of the Neuse River Basin.
- Exclude cattle from project streams. - Install fencing around project areas adjacent to cattle pastures.
- Decrease water temperature and increase dissolved oxygen concentrations - Establishment and maintenance of riparian buffers will create additional long-term shading of the channel flow to reduce thermal pollution.
- Restore and enhance native floodplain vegetation - Plant native tree species in riparian zone where currently insufficient.
- Permanently protect the Site from harmful uses - Establish a conservation easement on the Site. Protect aquatic habitat; protecting water supply waters.

1.2 Pre-construction Site Conditions

The riparian restoration project includes 29.764 acres of a mix of active pastures, fields, and woodlands along Dry Creek and eight unnamed tributaries that drain into the Falls Lake watershed, which is part of the Neuse River Basin. The Site includes four perennial streams: Dry Creek, UT1, UT6, and UT7. It also includes four intermittent streams: UT2, UT3, UT4, UT5, and one ephemeral stream: UT1a. The Buffer project attributes are listed in Table 1, located in Appendix 1.

Dry Creek enters the project area from a culvert under Hampton Road on the north end of the project. A narrow, sparse buffer existed on both stream banks and beyond the buffer on both sides of the retired

pasture, was a maintained fescue lawn. Approximately 600 linear feet (LF) downstream of the Hampton Road culvert, the stream was impounded by a manmade dam located just downstream of Dry Creek's confluence with UT1. This area was once wooded, but the riparian trees died due to root inundation. The manmade dam was frequently utilized as a vehicular stream crossing by the landowner. The floodplain along Dry Creek – Reach 2 was forested with young trees, with larger, more mature trees interspersed along the stream banks. A portion of the right floodplain had been deforested. Pasture was present beyond the forested area. Cattle were grazed in these pastures and often wallowed in Dry Creek and would seek shade in the adjacent buffer. Dry Creek – Reach 3 was completely forested within the buffer zone. The landowner indicated that tobacco was grown in the floodplain of Dry Creek Reach – 4 in the late 1800's and early 1900's. The reach was no longer in argicultural production and was wooded.

UT1 and UT1a flowed through an active cattle pasture and had a single row of mature Virginia pines (*Pinus virginiana*) or eastern red cedar (*Juniperus virginiana*) on each bank.

UT2, UT4, UT6, and UT7 were contained entirely within the Dry Creek forested buffer and very little understory existed in the vicinity of this channel but had cattle throughout the reach. Groundcover was limited to patches of Japanese stiltgrass (*Microstegium vimineum*) and moss species along the streambank.

UT3 originates outside the project limits at the outlet of a farm pond. It flowed through an open pasture before entering the deciduous forest of Dry Creek's floodplain.

Upstream of the culvert, UT5 had a sparse left buffer consisting of a very narrow strip of deciduous forest with pasture beyond. The right buffer of UT5 was similar in species composition to the deciduous forest described along Dry Creek but was much less mature. Downstream of the culvert, UT5 was entirely contained within the Dry Creek riparian buffer.

On April 6, 2016, NCDWR conducted on-site determinations to review features and land use within the project boundary. The resulting NCDWR site viability letter and map confirming the Site as suitable for riparian buffer and nutrient offset mitigation is located in Appendix 2. Dry Creek and the eight unnamed tributaries are appropriate for buffer and nutrient offset mitigation as related to the rules set forth in the Neuse Buffer Mitigation Rules: Mitigation Program Requirements for Protection and Maintenance of Riparian Buffers (15A NCAC 02B .0295) and Neuse River Basin: Nutrient Sensitive Waters Management Strategy: Protection and Maintenance of Existing Riparian Buffers (15A NCAC 02B .0233).

2.0 Determination of Credits

The project is expected to generate 441874.94 riparian buffer credits, through buffer restoration, buffer restoration on ephemeral channels, buffer enhancement via cattle exclusion, and buffer preservation per the Consolidated Buffer Mitigation Rules (15A NCAC 02B 0.0295 (o)). There is also potential to convert some buffer credits to nutrient offset credits, dependent on the need. Mitigation credits are presented in Table 2a and Table 2b and illustrated in Figure 3 (Appendix 1). Calculations are based upon the as-built survey included in Appendix 3.

Since approval of the Mitigation Plan, there have been some minor changes to credits. The Mitigation Plan did not consider the utility easement along UT1 for no credits resulting in a 5,227 square feet subtraction to restoration credits being claimed. Due to the reduction in restoration credits, preservation credits are also reduced. Accuracy of survey and final conservation easement account for a 13,068 square feet subtraction.

3.0 Baseline Summary

The Wildlands Team restored high quality riparian areas along Dry Creek and eight unnamed tributaries on the Site. The buffer and nutrient offset mitigation took place in conjunction with Dry Creek Stream Mitigation. The project design ensured that no adverse impacts to existing riparian areas occurred. Figure 3 illustrates the as-built conditions for the Site. Detailed descriptions of the restoration activity follow in Sections 3.1 through 3.4. Overview site photographs are included in Appendix 4.

3.1 Parcel Preparation

Prior to stream construction, the Site was a mix of active pastures, fields, and woodlands. Two in-line ponds were removed as part of the stream restoration, one on UT1 Reach 2 and one on Dry Creek Reach 1, and two other off-line ponds near UT1 were removed. The approved permits are included in Appendix 5. During stream construction, invasive plants were targeted and removed to reduce native competition. Soil amendments were added to certain graded areas after construction as directed by soil test results. Amendments included agricultural lime, slow release fertilizer, and soil conditioners (humic acid, organic material, soil biota stimulants). Haul roads and other high trafficked areas were also ripped to a depth of 18" where possible to reduce soil compaction.

3.2 Riparian Area Restoration Activities

The revegetation plan for the riparian restoration area included permanent seeding and planting bare root trees. These revegetation efforts were coupled with the select treatment of invasive species to control their population. The species composition planted was selected based on the desired community type, occurrence of species in riparian areas adjacent to the Site, and best professional judgement. The total number of tree species planted across the buffer areas are as follows: tulip poplar (*Liriodendron tulipifera*) 1,049 stems, willow oak (*Quercus phellos*) 1,049 stems, American sycamore (*Platanus occidentalis*) 2,098 stems, river birch (*Betula nigra*) 2,098 stems, green ash (*Fraxinus pennsylvanica*) 735 stems, swamp chestnut oak (*Quercus michauxii*) 1,049 stems, cherrybark oak (*Quercus pagoda*) 1,049 stems, eastern cottonwood (*Populus deltoides*) 630 stems, and black willow (*Salix nigra*) 735 stems. In total, 10,492 stems were planted across the site.

Trees were planted at a density sufficient to meet the performance standards outlined in the Rule 15A NCAC 02B .0295 of 260 trees per acre at the end of five years. An appropriate seed mix was applied as necessary to provide temporary ground cover for soil stabilization and reduction of sediment loss during rain events in disturbed areas. This was followed by an appropriate permanent seed mixture. Tree planting was completed in April 2020.

Vegetation management and herbicide applications are being implemented as needed during tree establishment in the restoration areas to prevent establishment of invasive species that could compete with the planted native species.

3.3 Riparian Area Enhancement Activities

Fencing was used to exclude cattle throughout the project as allowed by 15A NCAC 02B .0295(o) and minimal work was done on the streams through the enhancement areas. The enhancement areas have been protected in perpetuity under a conservation easement.

3.4 Riparian Area Preservation Activities

No work was done in the buffer preservation areas, as allowed under 15A NCAC 02B .0295(o). The preservation area will be protected in perpetuity under a conservation easement.

4.0 Annual Monitoring and Performance Criteria

The performance criteria for the Site follows approved performance criteria presented in the guidance documents outlined in Request for Proposal (RFP) 16-006477 and the Consolidated Buffer Rule (15A NCAC 02B .0295). Annual monitoring and semi-annual site visits will be conducted to assess the condition of the finished project. The riparian restoration project has been assigned specific performance criteria components for vegetation that will be evaluated throughout the five-year post-construction monitoring. An outline of the performance criteria and monitoring components follows. Monitoring components are included in Table 3 and vegetation plots are depicted in Figure 4 (Appendix 1).

4.1 Vegetation

Performance Standards for the Site will be based on the health and survival of a minimum density of 260 trees per acre after five years of monitoring, with a minimum of four native hardwood tree or shrub species composition and no one species comprising more than 50 percent of stems. Height, visual assessment of damage, and vigor will be used as indicators of overall health. Desirable volunteer species may be included to meet the success criteria upon DWR approval. The extent of invasive species coverage will also be monitored and treated as necessary throughout the required five-year monitoring period.

Seven fixed 100 square meter vegetation monitoring quadrants were installed across the Site to measure the survival of the planted stems (Figure 4) with a mean of 538 stems per acre (Table 4). Vegetation monitoring follows the CVS-EEP Level 2 Protocol for Recording Vegetation (2008). All planted stems were marked with flagging tape and a reference photograph was taken from the southwestern corner of each vegetation plot during vegetation assessments. Each year, trees will be re-marked and plot photos will be taken along with overview photographs of the Site. Appendix 6 includes the baseline (MY0) vegetation plot planted and total stem counts, as well as plot photographs.

4.2 Overview Photographs

Photographs will be taken within the project area once a year to visually document stability for five years following construction. Baseline overview photographs are included in Appendix 4.

4.3 Visual Assessments

Visual assessments should support the performance standards for each metric as described above. Visual assessments will be performed within the Site on a semi-annual basis during the five-year monitoring period. Problem areas with vegetative health will be noted (e.g. low stem density, vegetation mortality, invasive species, or encroachment). 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.

4.4 Annual Reporting Performance Criteria

Using the Division of Mitigation Services (DMS) Riparian Buffer and Nutrient Offset Buffer Baseline and Annual Monitoring Report Template version 2.0 (2017), monitoring reports will be prepared in the fall of each monitoring year and submitted to DMS. The monitoring period will extend five years beyond completion of construction or until performance criteria have been met.

4.5 Maintenance and Contingency Plans

The conservation easement has been properly and accurately marked by adding witness posts with easement placards along the easement boundary and at every corner. Adaptive management will be performed during the monitoring years to address minor issues as necessary. If during annual monitoring it is determined the project's ability to achieve performance standards are jeopardized,

Wildlands will notify and work with the DMS/NCDWR to develop contingency plans and remedial actions. Any actions implemented will be designed to achieve the success criteria specified previously and will include a work schedule and updated monitoring criteria (if applicable).

5.0 References

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APPENDIX 1. General Figures and Tables

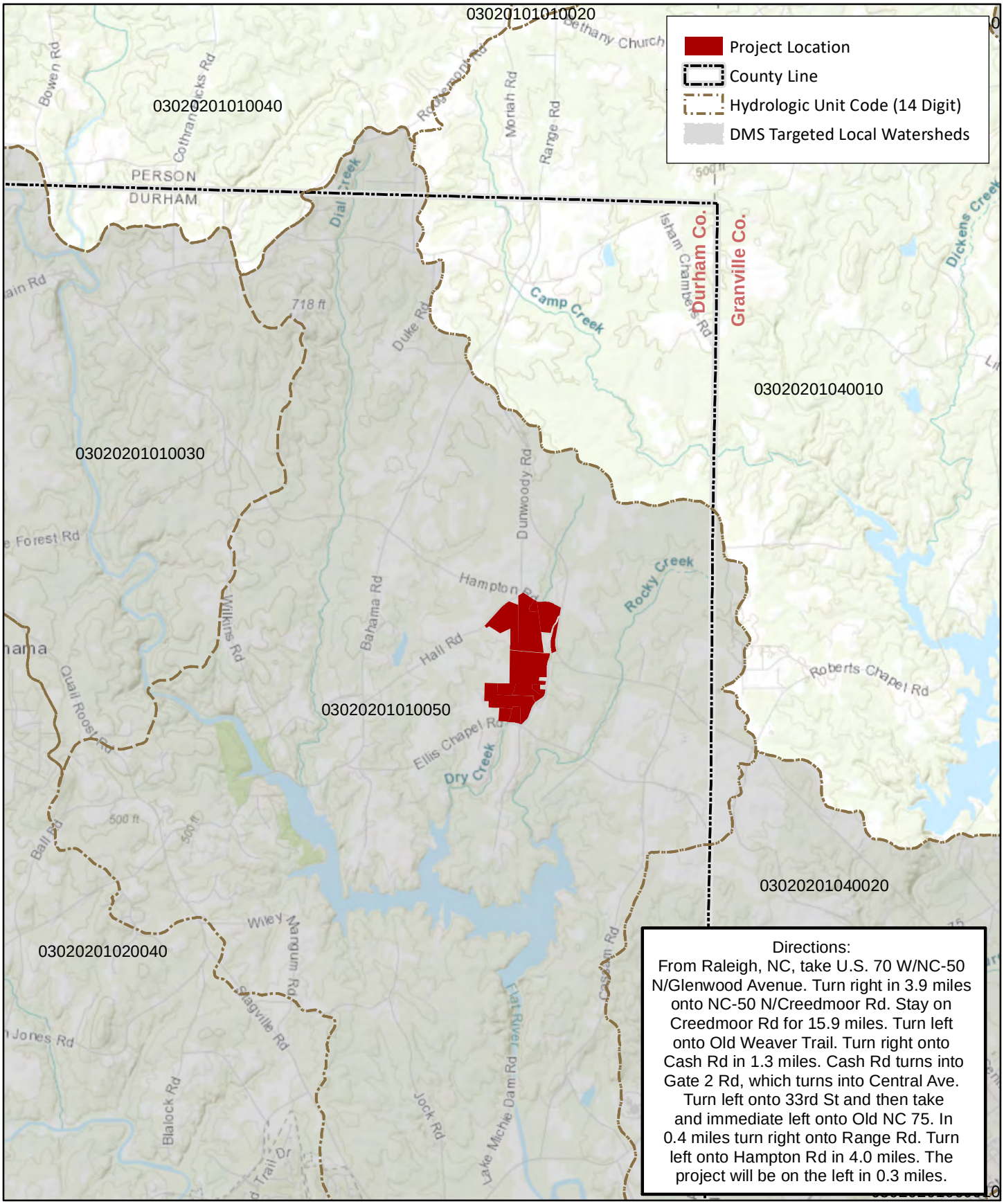

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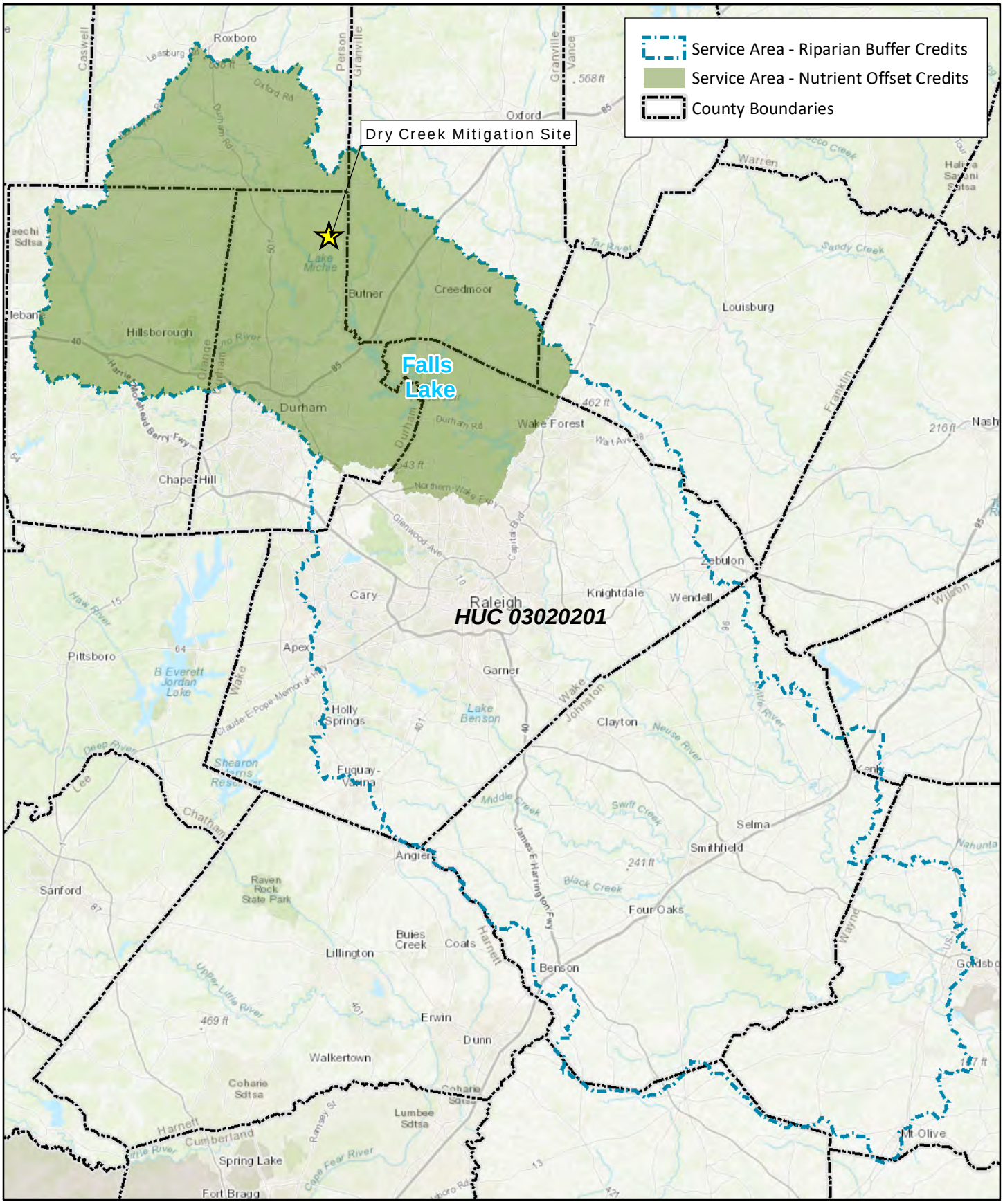
Figure 1. Project Vicinity Map
Dry Creek Mitigation Site
Baseline Monitoring Report (MY0)
Neuse River Basin (03020201)

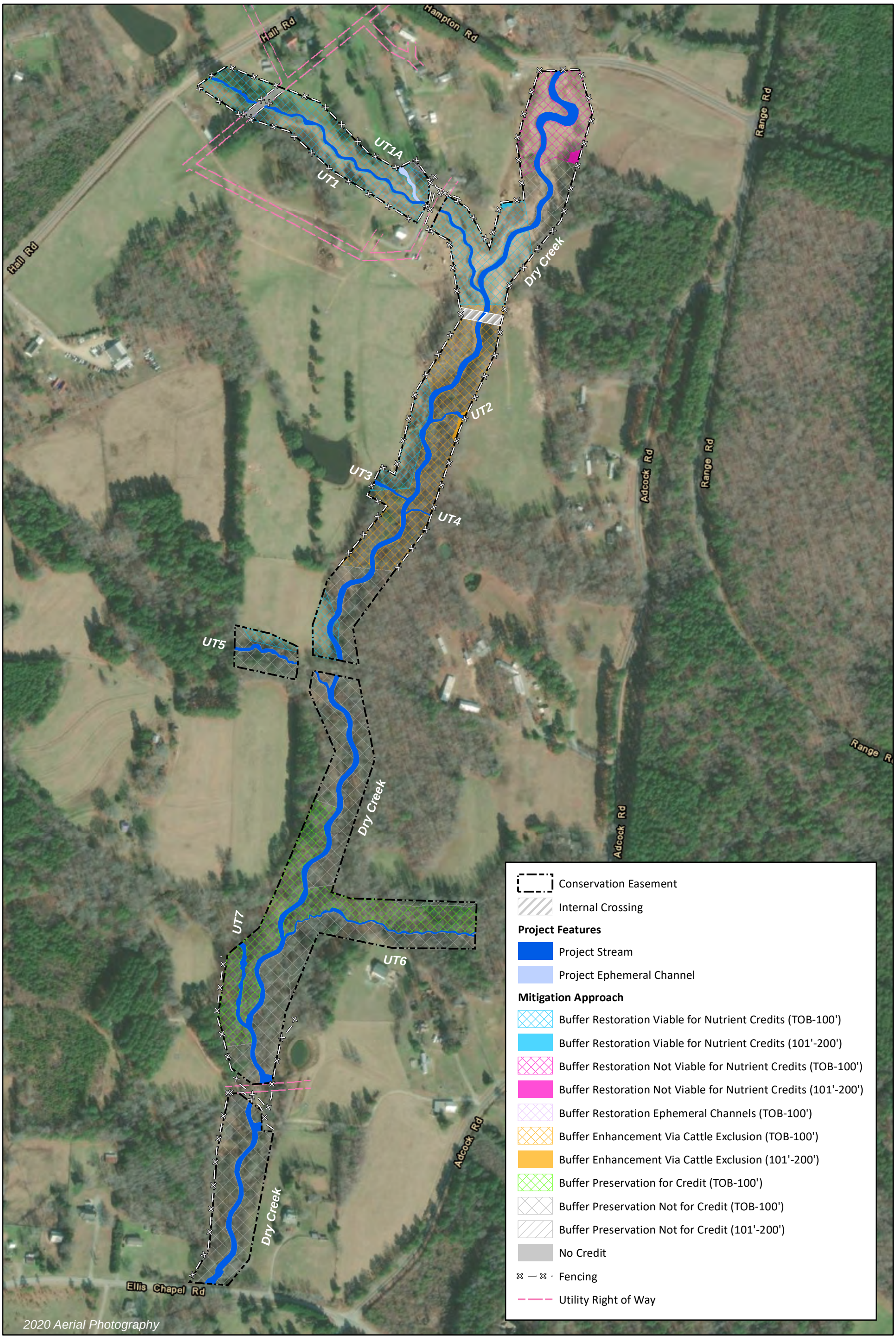
Durham County, NC



WILDLANDS ENGINEERING

Figure 2. Service Area Map
Dry Creek Mitigation Site
Baseline Monitoring Report (MY0)
Neuse River Basin (03020201)

Durham County, NC

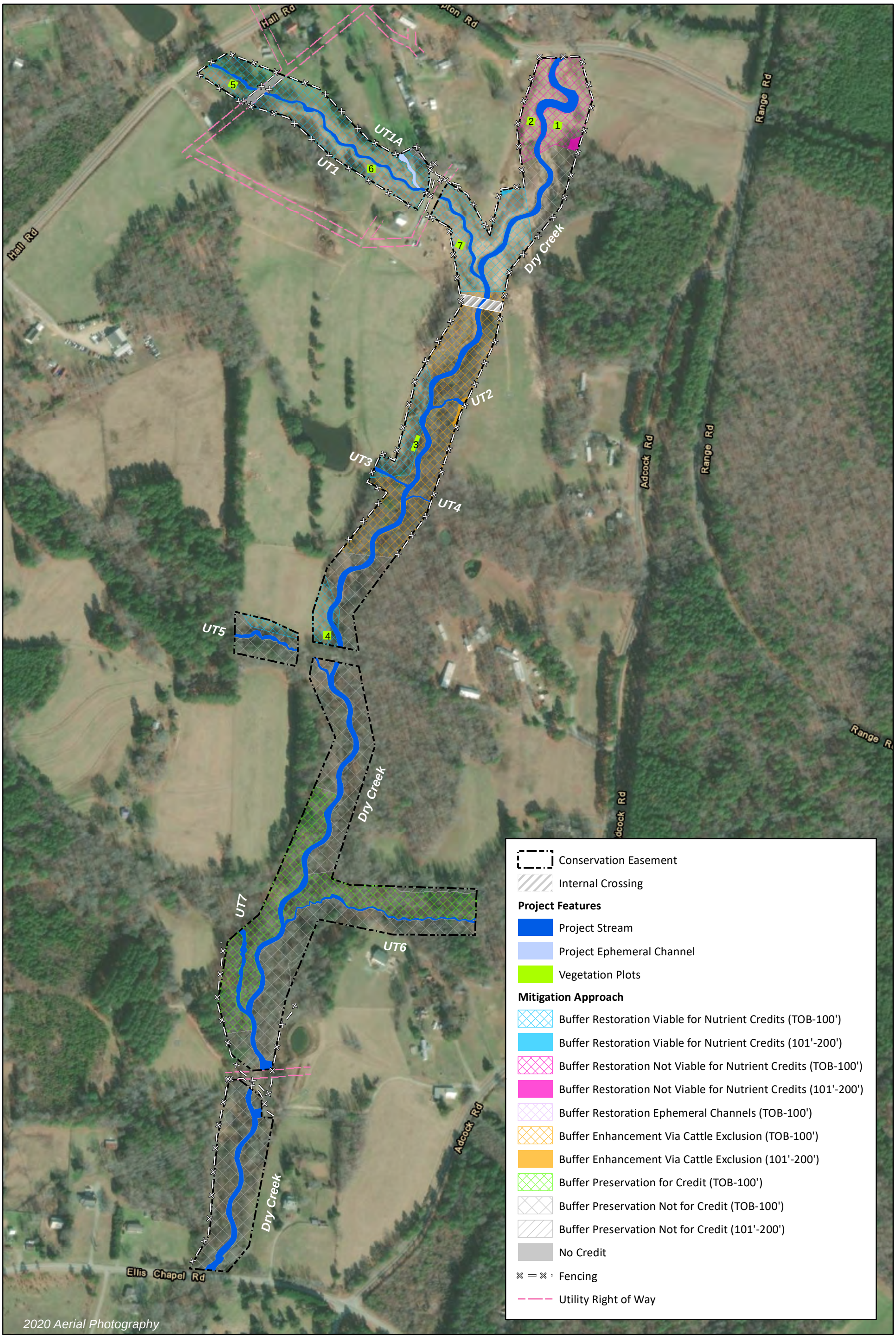


WILDLANDS ENGINEERING

0 350 700 Feet

N

Figure 3. Project Component / Asset Map
Dry Creek Mitigation Site
Baseline Monitoring Report (MY0)
Neuse River Basin (03020201)
Durham County, NC



WILDLANDS ENGINEERING

Figure 4. Monitoring Plan View Map
Dry Creek Mitigation Site
Baseline Monitoring Report (MY0)
Neuse River Basin (03020201)
Durham County, NC

Table 1. Buffer Project Attributes

Dry Creek Mitigation Site

Monitoring Year 0 - 2020

Project Name	Dry Creek Mitigation Site
Hydrologic Unit Code	03020201010050
River Basin	Neuse
Geographic Location (Lat, Long)	36° 11’ 07.92” N, 78° 49’ 39.00” W
Site Protection Instrument (DB/PG)	DB7806/PG657-662 DB779/PG477-482 DB7811/PG274-279 DB7811/PG268-273 DB7811/PG280-285 DB7811/PG263-267
Total Credits (BMU)	441,874.861
Types of Credits	Riparian Buffer
Mitigation Plan Date	October 2018
Initial Planting Date	April 24, 2020
Baseline Report Date	August 2020
MY1 Report Date	December 2020
MY2 Report Date	December 2021
MY3 Report Date	December 2022
MY4 Report Date	December 2023
MY5 Report Date	December 2024

Table 2a. Buffer Project Area and Assets: Riparian Buffer Credits

Dry Creek Mitigation Site

Monitoring Year 0 - 2020

Location	Jurisdictional Streams	Restoration Type	Feature Type	Reach ID / Component	Buffer Width (ft)	Creditable Area (ac)*	Creditable Area (sf)*	Eligible Credit Area (ac)**	Initial Credit Ratio (x:1)	% Full Credit	Final Credit Ratio (x:1)	Riparian Buffer Credits (BMU)	Riparian Buffer Credits (ac)
Rural or Urban	Subject or Nonsubject	Restoration	Stream Type	Dry Creek, UT1, UT3, UT5	0-100	7.93	345,454.00	7.93	1	1	1	345,454.00	7.93
			Stream Type	Dry Creek, UT1, UT3, UT5	101-200	0.06	2,516.00	0.06	1	0.33	3.03	830.36	0.02
			Ephemeral Channel	UT1a	0-100	0.03	1,489.00	0.03	1	1	1	1,489.00	0.03
			Ephemeral Channel	UT1a	101-201	0	0.00	0.00	1	0.33	3.03	0.00	0.00
Rural or Urban	Subject or Nonsubject	Enhancement via Cattle Exclusion	Stream Type	Dry Creek, UT3, UT4	0-100	3.53	153,970.00	3.53	2	0.75	2	76,985.00	1.77
				Dry Creek, UT3, UT4	101-200	0.04	1,692.00	0.04	2	0.33	6.06	279.21	0.01
Rural	Subject	Preservation	Stream Type	Dry Creek	0-100	14.04	611,691.00	3.87	10	1	10	16,837.37	0.39
Rural	Subject	Preservation		Dry Creek	101-200	0.024	10,342.00	0.00	10	0.33	30.3	0.00	0.00
											Total:	**441,874.94**	10.15

* Preservation creditable area is over 25% of the total mitigation area, therefore the eligible creditable area has been reduced to 25% of the total creditable mitigation area. With that adjustment, the Site is in compliance with 15A NCAC 02B 0.0295(o)(5) which limits preservation mitigation area to no more than 25% of total mitigated area.

** Creditable area on ephemeral channels is <1% of the total eligible mitigation area and is therefore in compliance with 15A NCAC 02B 0.0295(o)(7) without any adjustments.

Table 2b. Buffer Project Area and Assets: Nutrient Offset Credits

Dry Creek Mitigation Site

Monitoring Year 0 - 2020

Location	Jurisdictional Streams	Restoration Type	Reach ID / Component	Buffer Width (ft)	Creditable Area (ac)*	Creditable Area (sf)*	Eligible Credit Area (ac)**	Convertible to Nutrient offset (Yes or No)	Nutrient Offset: N (lbs)	Nutrient Offset: P (lbs)
Rural or Urban	Subject or Nonsubject	Restoration	Dry Creek, UT1, UT3, UT5	0-100	6.36	277,068.00	6.36	Yes	14460.75	932.89
				101-200	0.01	647.00	0.01	Yes	33.77	2.18
			Dry Creek Fescue Lawn	0-100	1.57	68,386.00	1.57	No	0.00	0.00
				101-200	0.04	1,869.00	0.04	No	0.00	0.00
			UT1a	0-100	0.03	1,489.00	0.03	Yes	93.37	5.01
				101-200	0	0.00	0	Yes	0.00	0.00
Rural or Urban	Subject or Nonsubject	Enhancement via Cattle Exclusion	Dry Creek, UT3, UT4	0-100	3.53	153,970.00	3.53	No	0.00	0.00
				101-200	0.04	1,692.00	0.04	No	0.00	0.00
Rural	Subject	Preservation	Dry Creek	0-100	14.04	611,691.00	3.87	No	0.00	0.00
				101-200	0.024	10,342.00	0	No	0.00	0.00
								Total:	**14,587.89**	**940.08**

*The above creditable areas all meet the 50-foot minimum width for buffer or nutrient credit sales.

** Impacts that occur in the watershed of Falls Lake in the upper Neuse River Basin may be offset only by load reductions in the same watershed; 15A NCAC 02B .0282 (2) (Figure 10)

Table 3. Monitoring Components

Dry Creek Mitigation Site

Monitoring Year 0 - 2020

Parameter	Monitoring Feature	Quantity	Frequency
Vegetation	CVS Level 2	7 Plots	Year 1-5
Visual Assessment	Photographs and Mapping		Semi-Annual
Exotic and Nuisance Vegetation	Photographs and Mapping		Semi-Annual
Project Boundary	Photographs and Mapping		Semi-Annual
Overview Photos	Photographs		Year 1-5

APPENDIX 2. DWR Correspondence

Water Resources
ENVIRONMENTAL QUALITY

PAT MCCRORY
Governor
DONALD R. VAN DER VAART
Secretary
S. JAY ZIMMERMAN
Director

April 28, 2016

John Hutton
Wildlands Holdings II, LLC
312 West Millbrook Rd, Suite 225
Raleigh, NC 27609
(via electronic mail)

DWR Project #: 2016-0369

Re: Site Viability for Buffer Mitigation & Nutrient Offset – Dry Creek Mitigation Site
9507 Hampton Rd, Rougemont, NC
Durham County

Dear John,

On April 6, 2016, Katie Merritt, with the Division of Water Resources (DWR), assisted staff with Wildlands Engineering Inc. at the proposed Dry Creek Mitigation Site (Site) in Rougemont, NC. The Site is located in the Upper Falls Watershed of the Neuse River Basin within the 8-digit Hydrologic Unit Code 03020201. The Site is being proposed as part of a full-delivery stream restoration project for the Division of Mitigation Services (RFP #16-006477). The Interagency Review Team (IRT) was also present onsite. At your request, Ms. Merritt, performed a site assessment of features onsite to determine suitability for buffer and nutrient offset mitigation. Features are more accurately shown in the attached maps signed by Ms. Merritt on April 15, 2016. If approved, mitigating this site could provide stream mitigation credits, riparian buffer credits and/or nutrient offset credits.

Ms. Merritt's evaluation of the features from Top of Bank (TOB) out to 200' for buffer and nutrient offset mitigation pursuant to Rule 15A NCAC 02B .0295 (effective November 1, 2015) and Rule 15A NCAC 02B .0240 is provided in the table below:

Feature	Classification	[1]Subject to Buffer Rule	Adjacent Land uses	Buffer Credit Viable	[2]Nutrient Offset Viable at 2,273 lbs/acre	Mitigation Type
Dry Creek - (Hampton Rd to UT1 confluence)	stream	Yes	Managed fescue lawn; Native hardwood forest w/ canopy downstream	Yes	No	Forested areas = Preservation per 15A NCAC 02B .0295 (o)(5) Fescue Lawn = Restoration
In-line impoundment (to be drained)	Wetland (according to IRT onsite)	No	Pasture actively grazed by cattle	No	Yes	Restoration *(if impoundment is drained, a stream determination by DWR must be performed if proposing buffer credit)*

Dry Creek - Below Impoundment to Ellis/Mangum Property Boundary)	Stream	Yes	Pasture actively grazed by cattle and narrow closed canopy of native hardwoods	Yes	Yes *(outside of forested area only)*	Narrow closed canopy of hardwoods = Enhancement per 15A NCAC 02B .0295 (o)(6); Outside of forested areas = Restoration
Dry Creek - Ellis/Mangum property boundary to Ellis Chapel Rd	Stream	Yes	Native hardwood forest w/ closed canopy	Yes	No	Preservation per 15A NCAC 02B .0295 (o)(5)
UT3 & UT6	Streams	Yes	Native hardwood forest w/ closed canopy	Yes	No	Preservation per 15A NCAC 02B .0295 (o)(5)
UT1	Stream	Yes	Pasture actively grazed by cattle w/ narrow forest fringe of pines and sparse mature hardwoods	Yes	Yes	Restoration
UT1a	ephemeral channel	No	Pasture actively grazed by cattle	Yes	Yes	Restoration per 15A NCAC 02B .0295 (o)(7)
UT2 (upstream)	Stream	Yes	Pasture actively grazed by cattle	Yes	Yes	Restoration
UT2 (confluence w/ Dry Creek)	Stream	Yes	Pasture actively grazed by cattle w/ closed canopy of native hardwoods	Yes	No	Enhancement per 15A NCAC 02B .0295 (o)(6)
UT3	Stream	Yes	Pasture actively grazed by cattle w/ closed canopy of native hardwoods	Yes	No	Enhancement per 15A NCAC 02B .0295 (o)(6)
UT4	Stream	Yes	Left Bank= closed canopy of native hardwoods adjacent to active pasture Right Bank= closed canopy of native hardwoods	Yes	Yes *(left bank in pasture only)*	Forested Areas= Preservation per 15A NCAC 02B .0295 (o)(5) Pasture/field= Restoration
UT5	Stream	No	Native hardwood forest w/ closed canopy	Yes	No	Preservation per 15A NCAC 02B .0295 (o)(4)

[1]Subjectivity calls were determined using the 1:24,000 scale quadrangle topographic map prepared by USGS and the most recent printed version of the soil survey map prepared by the NRCS

[2]For nutrient offset viability to be determined, the landowner must provide proof in writing that the land is being used for agriculture or has been used for agriculture previously (prior to rule baseline). Dates, supported by photos or other written records, must be included to confirm that the uses of the open fields onsite are/were for hay crop cultivation/row crop/cattle.

Maps showing the project site and the features are provided and are signed by Ms. Merritt on April 15, 2016. This letter should be provided in all future mitigation plans for this Site. In addition, all vegetative plantings, performance criteria and other mitigation requirements for riparian restoration, enhancement and preservation must follow the requirements in 15A NCAC 02B .0295 to be eligible for buffer and/or nutrient offset credits. Where buffer and nutrient offset credits are viable in the same area, only one credit type is allowed to be generated for credit, not both.

For any areas depicted as not being viable for nutrient offset credit, one could propose a different measure other than riparian restoration/enhancement, along with supporting calculations and sufficient detail to support estimates of load reduction, for review by the DWR to determine viability for nutrient offset according to 15A NCAC 02B .0240.

Please contact Katie Merritt at (919)-807-6371 if you have any questions regarding this correspondence.

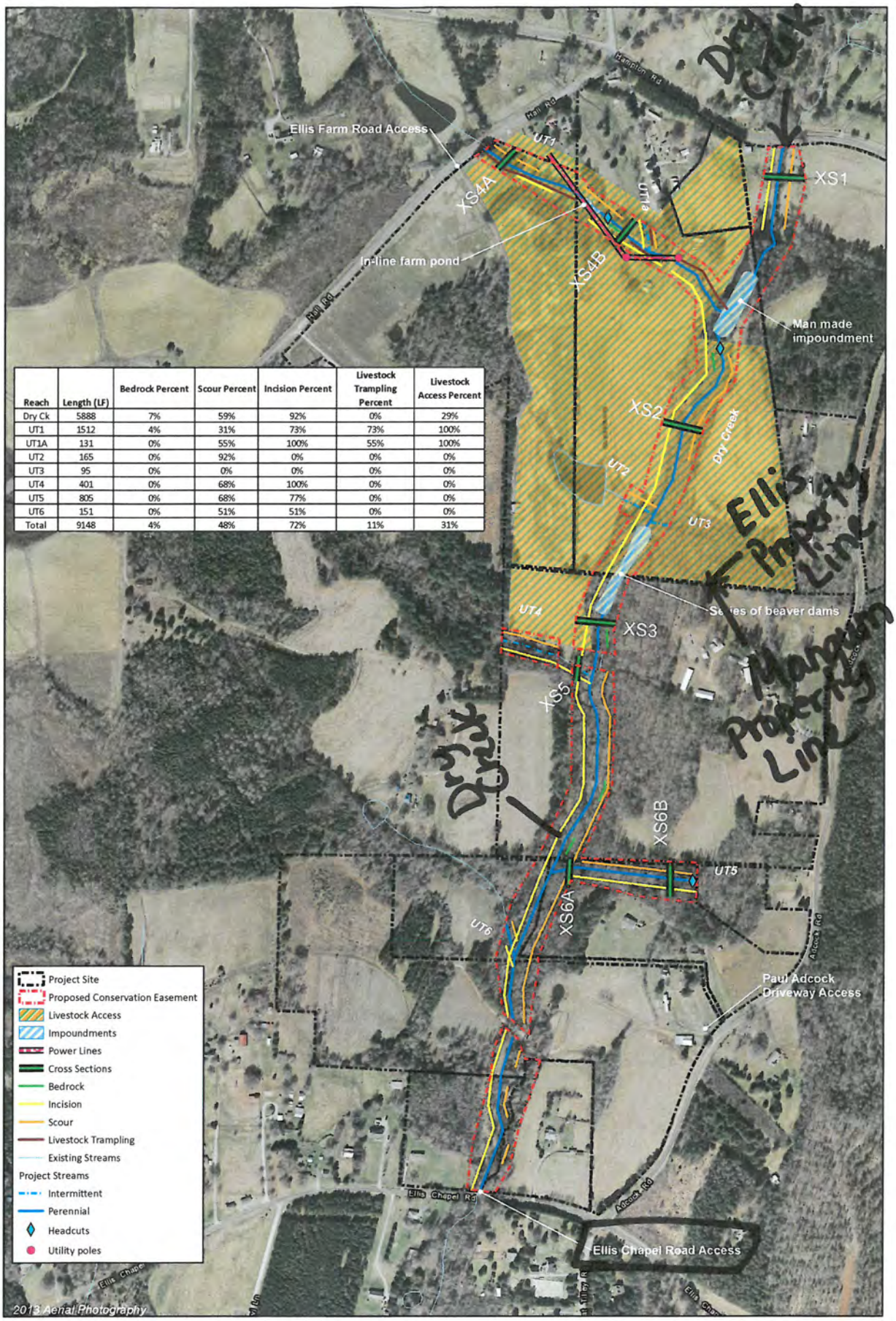
Sincerely,

Karen Higgins

Karen Higgins, Supervisor
401 and Buffer Permitting Branch

KAH/*km*
Attachments: Site Aerial Map, Topographic Map, Durham County Soil Survey

cc:File Copy (Katie Merritt)
DMS – Jeff Schaffer (via electronic mail)



Reach	Length (LF)	Bedrock Percent	Scour Percent	Incision Percent	Livestock Trampling Percent	Livestock Access Percent
Dry Ck	5888	7%	59%	92%	0%	29%
UT1	1512	4%	31%	73%	73%	100%
UT1A	131	0%	55%	100%	55%	100%
UT2	165	0%	92%	0%	0%	0%
UT3	95	0%	0%	0%	0%	0%
UT4	401	0%	68%	100%	0%	0%
UT5	805	0%	68%	77%	0%	0%
UT6	151	0%	51%	51%	0%	0%
Total	9148	4%	48%	72%	11%	31%

WILDLANDS ENGINEERING

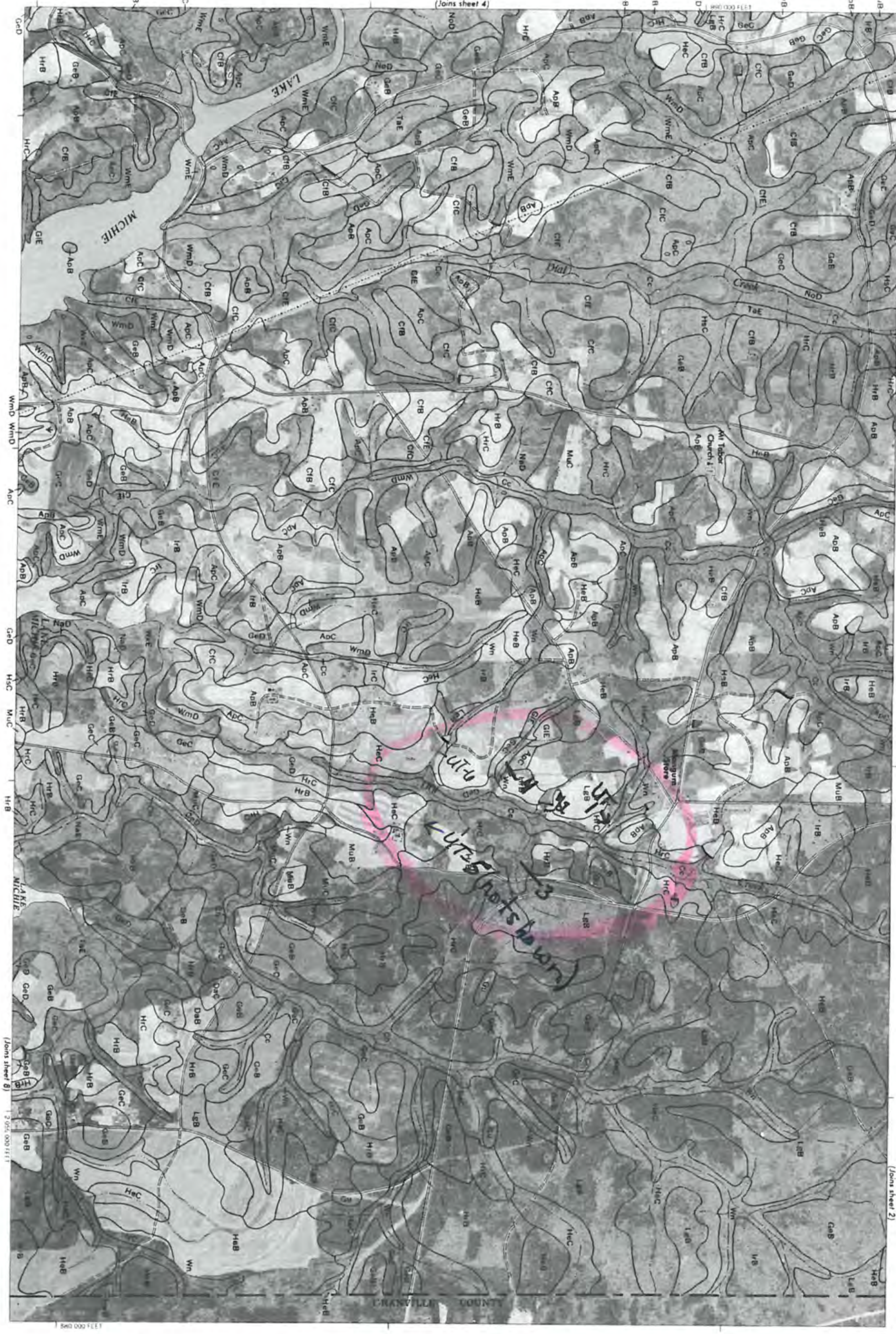
0 400 Feet

Figure 2 Site Map and Channel Stability Map
Dry Creek Mitigation Site
New River Basin 03020201
Durham County, NC

kpm 2/15/16
DWR# 2016-0369

This map is compiled on 1977 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

DURHAM COUNTY, NORTH CAROLINA NO. 5



DURHAM COUNTY, NORTH CAROLINA — SHEET NUMBER 5

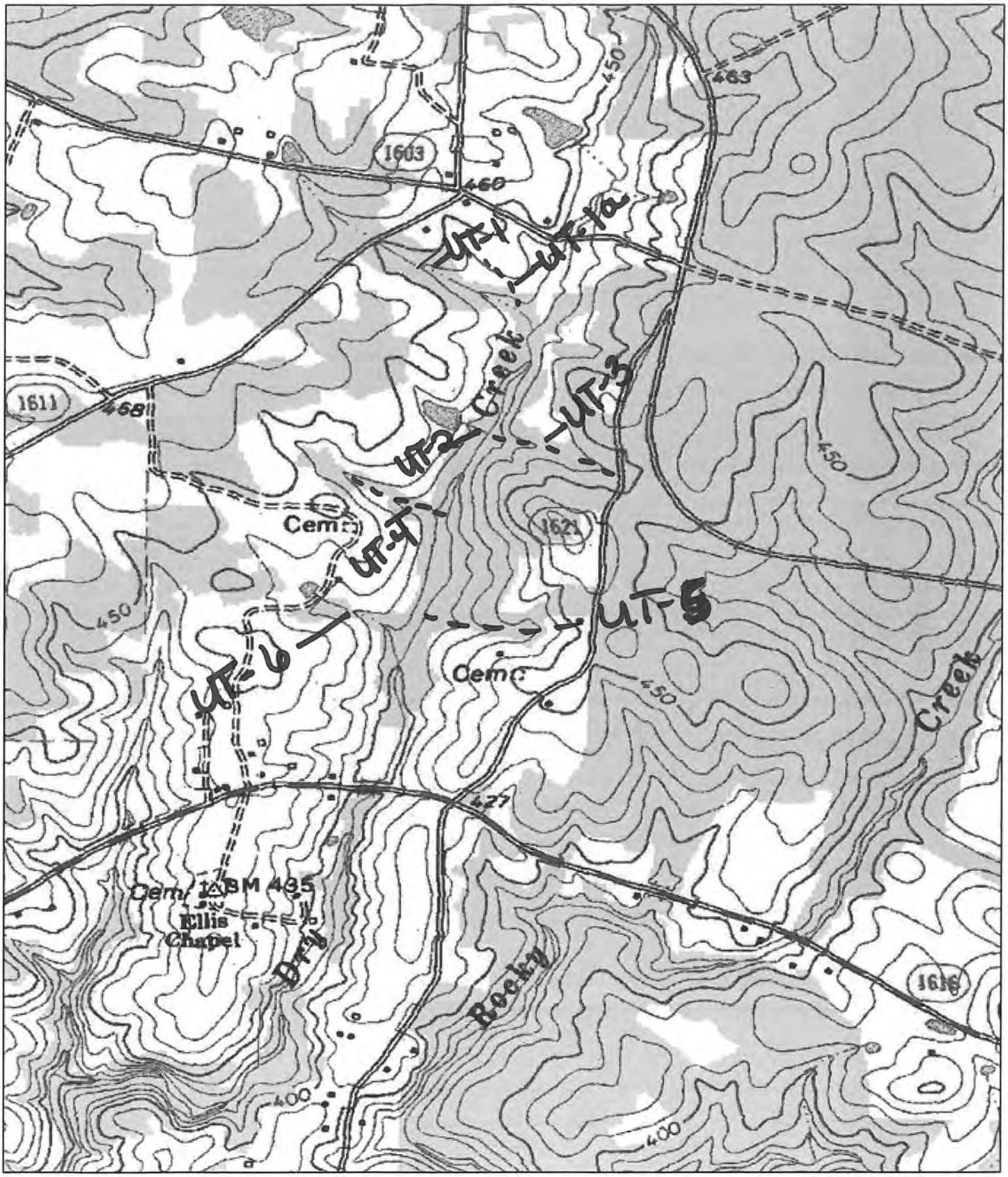
KYM 4/15/16
DWR# 2016-0369
"Dry Creek Site"

1 ¾ ½ ¼ 0 1 Mile
5 000 4 000 3 000 2 000 1 000 0 5 000 Feet
Scale 1:15 840

N

5

NC USGS Topo & Parcels Map



April 15, 2016

1:14,048

0 0.1 0.2 0.4 mi

0 0.175 0.35 0.7 km

4/15/16

DWR # 2016-0369

"Dry Creek Site"

Participating NC Counties, NCCGIA, NC OneMap, US EPA

APPENDIX 3. As-Built Survey

CERTIFICATE OF SURVEY AND ACCURACY

I, PHILLIP B. KEE, CERTIFY THAT THIS BUFFER MAP WAS DRAWN UNDER MY SUPERVISION, IS AN ACCURATE CALCULATION OF THE BUFFER AREAS AND IS BASED ON THE AS-BUILT SURVEY DATED JULY 23RD, 2020 BY KEE MAPPING AND SURVEYING, THE EXISTING CONDITIONS TOPOGRAPHIC SURVEY DATED NOVEMBER 3RD, 2017 BY KEE MAPPING AND SURVEYING, THE CONSERVATION EASEMENT SURVEY AS RECORDED IN PB:199 PG:345, PB:201 PG:132, PB:201 PG:362, PB:201 PG:131, PB:201 PG: 129, PB:201 PG:130 & PB:201 PG:134 IN THE DURHAM COUNTY REGISTER OF DEEDS OFFICE AND INFORMATION PROVIDED BY WILDLANDS ENGINEERING INC.; THAT THE BOUNDARIES NOT SURVEYED ARE INDICATED AS DRAWN FROM INFORMATION AS REFERENCED; AND THAT THIS MAP DOES NOT REPRESENT AN OFFICIAL BOUNDARY SURVEY AND IS ONLY FOR THE PURPOSE OF DEPICTING THE RIPARIAN BUFFER AREAS.

WITNESS MY ORIGINAL SIGNATURE, LICENCE NUMBER, AND SEAL THIS 24TH DAY OF JULY, 2020, A.D.

NORTH CAROLINA PROFESSIONAL SEAL L-4647 LAND SURVEYOR PHILLIP B. KEE

DocuSigned by:
Phillip B. Kee
D965004A7692407...

PHILLIP B. KEE, PLS L-4647

SURVEYOR NOTES

1. ALL DISTANCES ARE HORIZONTAL GROUND DISTANCES IN US SURVEY FEET. THE AREAS SHOWN HEREON WERE COMPUTED USING THE COORDINATE COMPUTATION METHOD.
2. THE PURPOSE OF THIS MAP IS TO SHOW THE AS-BUILT AREAS FOR RIPARIAN BUFFER CREDITS WITHIN THE CONSERVATION EASEMENT. THIS MAP IS NOT A BOUNDARY SURVEY. THE LAND PARCELS AND THEIR BOUNDARIES AFFECTED BY THIS CONSERVATION EASEMENT ARE NOT CHANGED BY THIS MAP.
3. LINES NOT SURVEYED ARE SHOWN AS DASHED LINES AND WERE TAKEN FROM INFORMATION REFERENCED HEREON.
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5. SEE CONSERVATION EASEMENT SURVEY AS RECORDED IN PB:199 PG:345, PB:201 PG:132, PB:201 PG:362, PB:201 PG:131, PB:201 PG: 129, PB:201 PG:130 & PB:201 PG:134 IN THE DURHAM COUNTY REGISTER OF DEEDS.
6. BUFFER AREAS ARE BASED ON THE THE AS-BUILT SURVEY DATED JULY 23RD, 2020 BY KEE MAPPING AND SURVEYING, THE EXISTING CONDITIONS TOPOGRAPHIC SURVEY DATED NOVEMBER 3RD, 2017 BY KEE MAPPING AND SURVEYING, THE CONSERVATION EASEMENT SURVEY AS RECORDED IN PB:199 PG:345, PB:201 PG:132, PB:201 PG:362, PB:201 PG:131, PB:201 PG:129, PB:201 PG:130 & PB:201 PG:134 IN THE DURHAM COUNTY REGISTER OF DEEDS OFFICE AND INFORMATION PROVIDED BY WILDLANDS ENGINEERING INC.
7. DURHAM COUNTY GIS WEBSITE USED TO IDENTIFY ADOINING PROPERTY OWNERS

Riparian Buffer:	SQ. FT. (Total)	Acres (Total)
Buffer Preservation 0'-100'	611,691	14.04
Buffer Preservation 100'-200'	10,342	0.24
Buffer Enhancement Via Cattle Exclusion 0'-100'	153,970	3.54
Buffer Enhancement Via Cattle Exclusion 100'-200'	1,692	0.04
Buffer Restoration Ephemeral Channels 0'-100'	1,489	0.03
Buffer Restoration Stream - Not Viable Nutrients 0'-100'	68,386	1.57
Buffer Restoration Stream - Not Viable Nutrients 100'-200'	1,869	0.04
Buffer Restoration Stream - Viable Nutrients 0'-100'	277,068	6.36
Buffer Restoration Stream - Viable Nutrients 100'-200'	647	0.01
NO CREDIT AREA	169,395	3.89
Total CE Area	**1,296,549**	**29.76**

THIS MAP IS NOT FOR RECORDATION, SALES, OR CONVEYANCES AND DOES NOT COMPLY WITH G.S. 47-30 MAPPING REQUIREMENTS.

AS-BUILT SURVEY OF BUFFER AREAS FOR
WILDLANDS ENGINEERING INC.
DRY CREEK MITIGATION SITE

SPO FILE #32-FC, 32-FD, 32-FE, 32-FF, 32-FG & 32-FH *DMS SITE ID #97082*

SITE ADDRESS: ELLIS ROAD, BAHAMA NC 27503

MANGUM TOWNSHIP, *DURHAM COUNTY,* *NORTH CAROLINA*

DRAWN BY: LDP, AB *CHECKED BY: PBK* *JOB #2003022*

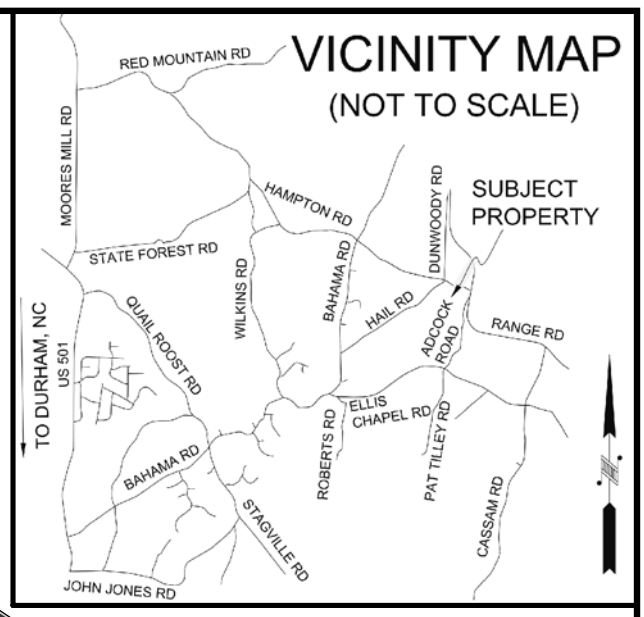
REVISION: *DATE:*

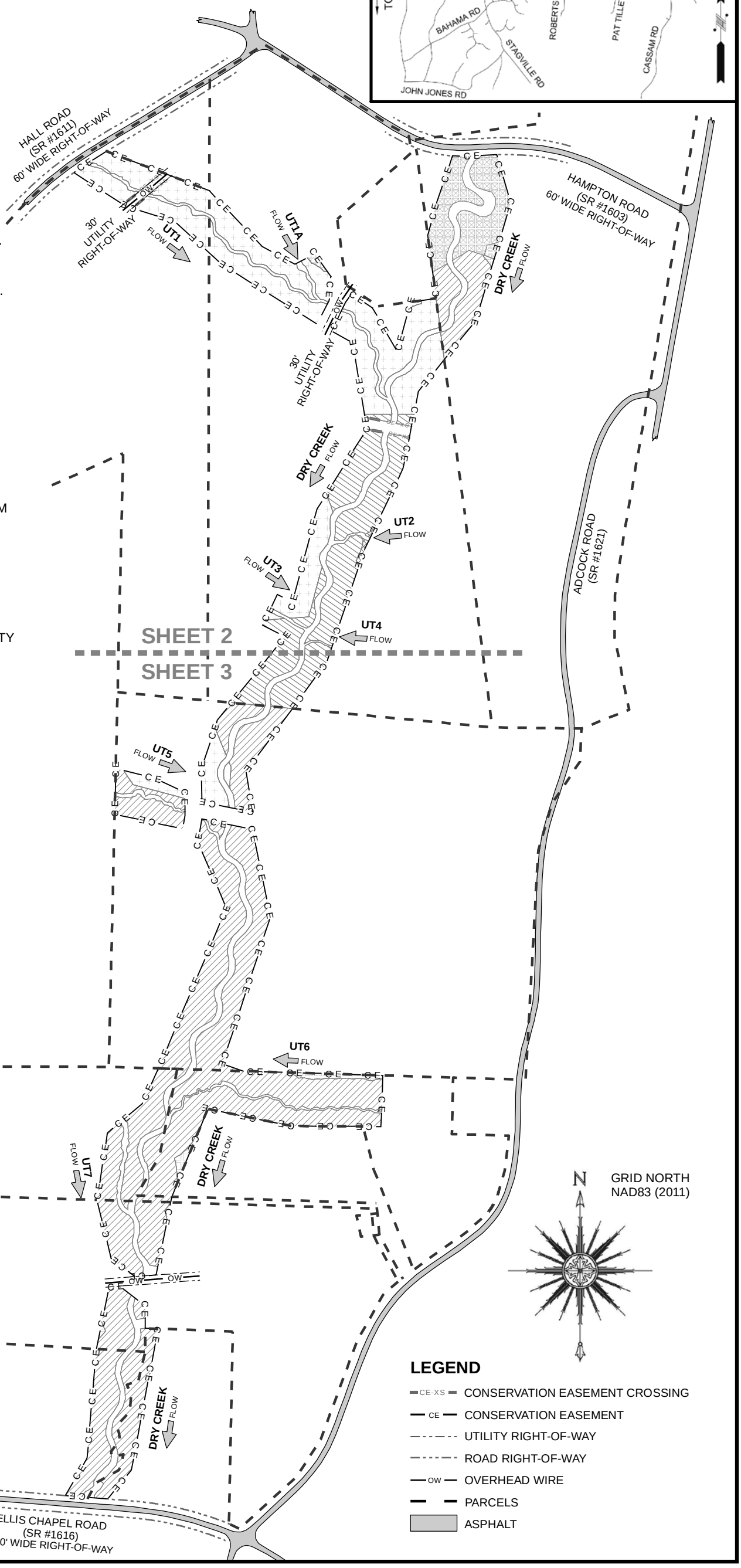
SHEET SIZE: 11"x17" *SHEET #: 1 OF 3* *SCALE: 1"=400'*

0' 400' 800' 1,200'

ONE INCH = FOUR HUNDRED FEET

Kee MAPPING & SURVEYING
P.O. Box 2566
Asheville, NC 28802
(828) 575-9021
www.keemap.com
License # C-3039





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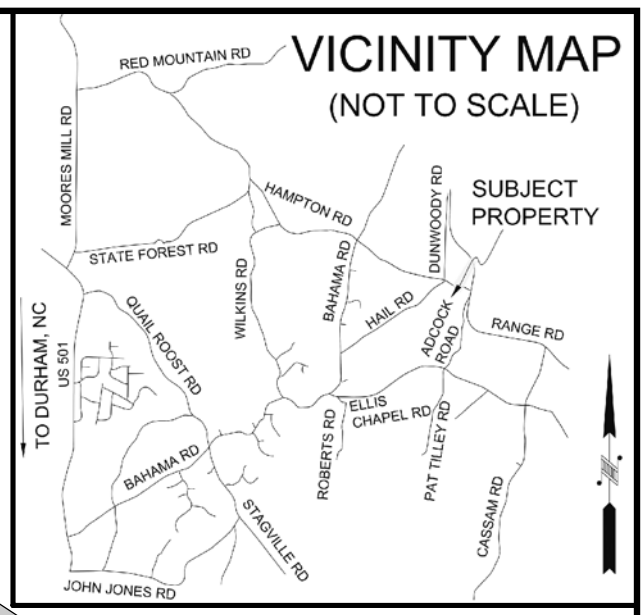
DocuSigned by: Phillip B. Kee D965004A7692407...

PHILLIP B. KEE, PLS L-4647

N GRID NORTH NAD83 (2011)



HALL ROAD (SR #1611) 60' WIDE RIGHT-OF-WAY

HAMPTON ROAD (SR #1603) 60' WIDE RIGHT-OF-WAY

THEODORE BERNHARD BARILA & ANITA GAYE BARILA PID: 192157

VAN BUREN ELLIS & WIFE EDNA LEE ELLIS PID: 192155

VAN BUREN ELLIS & WIFE EDNA LEE ELLIS PID: 192152

VAN BUREN ELLIS & WIFE EDNA LEE ELLIS PID: 192152

KENNETH R. MANGUM PID: 192189

KENNETH R. MANGUM PID: 192153

30' UTILITY RIGHT-OF-WAY

UT1 FLOW

UT1A FLOW

UT2 FLOW

UT3 FLOW

UT4 FLOW

UT5 FLOW

DRY CREEK FLOW

LEGEND

- CE-XS — CONSERVATION EASEMENT CROSSING
- CE — CONSERVATION EASEMENT
- UTILITY RIGHT-OF-WAY
- ROAD RIGHT-OF-WAY
- OW — OVERHEAD WIRE
- PARCELS
- ASPHALT

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SHEET 2
SHEET 3

Riparian Buffer:	SQ. FT. (Total)	(Total)
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WILDLANDS ENGINEERING INC.
DRY CREEK MITIGATION SITE

SPO FILE #32-FC, 32-FD, 32-FE, 32-FF, 32-FG & 32-FH		*DMS SITE ID #97082*
SITE ADDRESS:	ELLIS ROAD, BAHAMA NC 27503	
MANGUM TOWNSHIP,	*DURHAM COUNTY,*	*NORTH CAROLINA*
DRAWN BY: LDP, AB	*CHECKED BY: PBK*	*JOB #2003022*
REVISION:		*DATE:*
SHEET SIZE: 11"x17"	*SHEET #: 2 OF 3*	*SCALE: 1"=200'*

0' 200' 400' 600'

ONE INCH = TWO HUNDRED FEET

Kee MAPPING & SURVEYING
P.O. Box 2566
Asheville, NC 28802
(828) 575-9021
www.keemap.com
License # C-3039

CERTIFICATE OF SURVEY AND ACCURACY

I, PHILLIP B. KEE, CERTIFY THAT THIS BUFFER MAP WAS DRAWN UNDER MY SUPERVISION, IS AN ACCURATE CALCULATION OF THE BUFFER AREAS AND IS BASED ON THE AS-BUILT SURVEY DATED JULY 23RD, 2020 BY KEE MAPPING AND SURVEYING, THE EXISTING CONDITIONS TOPOGRAPHIC SURVEY DATED NOVEMBER 3RD, 2017 BY KEE MAPPING AND SURVEYING, THE CONSERVATION EASEMENT SURVEY AS RECORDED IN PB:199 PG:345, PB:201 PG:132, PB:201 PG:362, PB:201 PG:131, PB:201 PG: 129, PB:201 PG:130 & PB:201 PG:134 IN THE DURHAM COUNTY REGISTER OF DEEDS OFFICE AND INFORMATION PROVIDED BY WILDLANDS ENGINEERING INC.; THAT THE BOUNDARIES NOT SURVEYED ARE INDICATED AS DRAWN FROM INFORMATION AS REFERENCED; AND THAT THIS MAP DOES NOT REPRESENT AN OFFICIAL BOUNDARY SURVEY AND IS ONLY FOR THE PURPOSE OF DEPICTING THE RIPARIAN BUFFER AREAS.

WITNESS MY ORIGINAL SIGNATURE, LICENCE NUMBER, AND SEAL THIS 24TH DAY OF JULY, 2020, A.D.

NORTH CAROLINA PROFESSIONAL SEAL L-4647 LAND SURVEYOR PHILLIP B. KEE

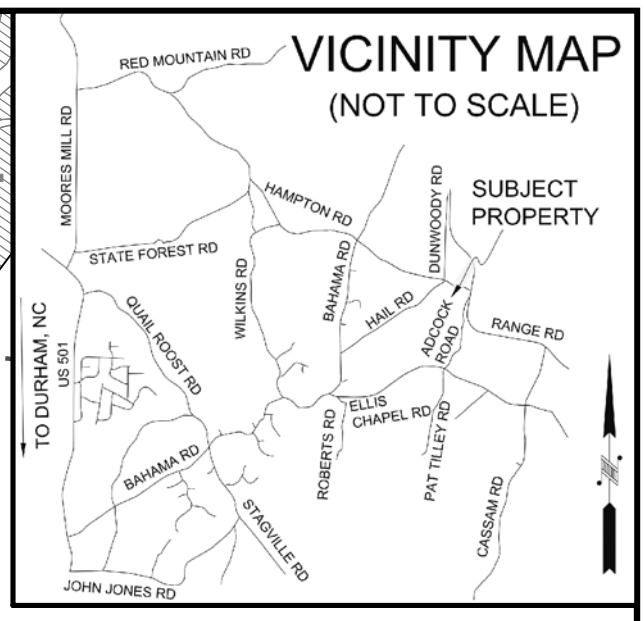
DocuSigned by: Phillip B. Kee D965004A7692407...

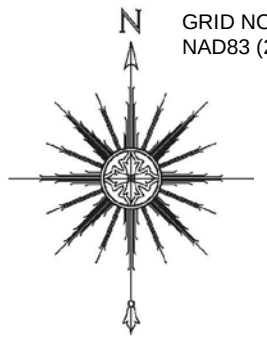
PHILLIP B. KEE. PLS L-4647

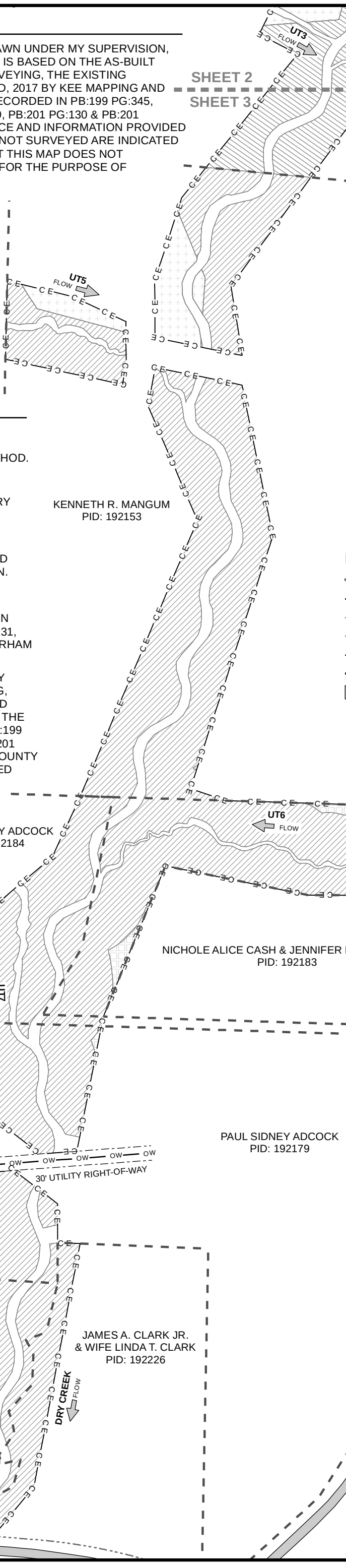
SURVEYOR NOTES

1. ALL DISTANCES ARE HORIZONTAL GROUND DISTANCES IN US SURVEY FEET. THE AREAS SHOWN HEREON WERE COMPUTED USING THE COORDINATE COMPUTATION METHOD.
2. THE PURPOSE OF THIS MAP IS TO SHOW THE AS-BUILT AREAS FOR RIPARIAN BUFFER CREDITS WITHIN THE CONSERVATION EASEMENT. THIS MAP IS NOT A BOUNDARY SURVEY. THE LAND PARCELS AND THEIR BOUNDARIES AFFECTED BY THIS CONSERVATION EASEMENT ARE NOT CHANGED BY THIS MAP.
3. LINES NOT SURVEYED ARE SHOWN AS DASHED LINES AND WERE TAKEN FROM INFORMATION REFERENCED HEREON.
4. PROPERTIES ARE SUBJECT TO ALL EASEMENTS, RIGHT OF WAYS, AND/OR ENCUMBRANCES AFFECTING THEM.
5. SEE CONSERVATION EASEMENT SURVEY AS RECORDED IN PB:199 PG:345, PB:201 PG:132, PB:201 PG:362, PB:201 PG:131, PB:201 PG: 129, PB:201 PG:130 & PB:201 PG:134 IN THE DURHAM COUNTY REGISTER OF DEEDS.
6. BUFFER AREAS ARE BASED ON THE THE AS-BUILT SURVEY DATED JULY 23RD, 2020 BY KEE MAPPING AND SURVEYING, THE EXISTING CONDITIONS TOPOGRAPHIC SURVEY DATED NOVEMBER 3RD, 2017 BY KEE MAPPING AND SURVEYING, THE CONSERVATION EASEMENT SURVEY AS RECORDED IN PB:199 PG:345, PB:201 PG:132, PB:201 PG:362, PB:201 PG:131, PB:201 PG:129, PB:201 PG:130 & PB:201 PG:134 IN THE DURHAM COUNTY REGISTER OF DEEDS OFFICE AND INFORMATION PROVIDED BY WILDLANDS ENGINEERING INC.
7. DURHAM COUNTY GIS WEBSITE USED TO IDENTIFY ADOINING PROPERTY OWNERS

Riparian Buffer:	SQ. FT. (Total)	Acres (Total)
Buffer Preservation 0'-100'	611,691	14.04
Buffer Preservation 100'-200'	10,342	0.24
Buffer Enhancement Via Cattle Exclusion 0'-100'	153,970	3.54
Buffer Enhancement Via Cattle Exclusion 100'-200'	1,692	0.04
Buffer Restoration Ephemeral Channels 0'-100'	1,489	0.03
Buffer Restoration Stream - Not Viable Nutrients 0'-100'	68,386	1.57
Buffer Restoration Stream - Not Viable Nutrients 100'-200'	1,869	0.04
Buffer Restoration Stream - Viable Nutrients 0'-100'	277,068	6.36
Buffer Restoration Stream - Viable Nutrients 100'-200'	647	0.01
NO CREDIT AREA	169,395	3.89
Total CE Area	**1,296,549**	**29.76**







LEGEND

- CE-XS — CONSERVATION EASEMENT CROSSING
- CE — CONSERVATION EASEMENT
- UTILITY RIGHT-OF-WAY
- ROAD RIGHT-OF-WAY
- OW — OVERHEAD WIRE
- PARCELS
- ASPHALT

THIS MAP IS NOT FOR RECORDATION, SALES, OR CONVEYANCES AND DOES NOT COMPLY WITH G.S. 47-30 MAPPING REQUIREMENTS.

AS-BUILT SURVEY OF BUFFER AREAS FOR

WILDLANDS ENGINEERING INC.
DRY CREEK MITIGATION SITE

SPO FILE #32-FC, 32-FD, 32-FE, 32-FF, 32-FG & 32-FH		*DMS SITE ID #97082*
SITE ADDRESS:		ELLIS ROAD, BAHAMA NC 27503
MANGUM TOWNSHIP,	*DURHAM COUNTY,*	*NORTH CAROLINA*
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APPENDIX 4. Overview Photographs

APPENDIX 5. Permit Approvals

ROY COOPER
Governor
MICHAEL S. REGAN
Secretary
LINDA CULPEPPER
Director

NORTH CAROLINA
Environmental Quality

October 1, 2019

DWR # 16-0369
Durham County

NC Division of Mitigation Services
Attn: Lin Xu
217 West Jones Street
Raleigh, North Carolina 27699

Wildlands Engineering, Inc.
Attn: Jeff Keaton
312 West Millbrook Road, Suite 225
Raleigh, North Carolina 27609

Subject: APPROVAL OF 401 WATER QUALITY CERTIFICATION WITH ADDITIONAL CONDITIONS

Dry Creek Mitigation Site

Dear Mr. Xu and Mr. Keaton:

You have our approval for the impacts listed below for the purpose described in your application dated August 29, 2019, received by the Division of Water Resources (Division) August 29, 2019. These impacts are covered by the attached Water Quality General Certification Number 4134 and the conditions listed below. This certification is associated with the use of Nationwide Permit Number 27 once it is issued to you by the U.S. Army Corps of Engineers. Please note that you should get any other federal, state or local permits before proceeding with your project, including those required by (but not limited to) Sediment and Erosion Control, Non-Discharge, and Water Supply Watershed regulations.

This approval requires you to follow the conditions listed in the enclosed certification(s) or general permit and the following additional conditions:

1. The following impacts are hereby approved provided that all of the other specific and general conditions of the Certification are met. No other impacts are approved, including incidental impacts. [15A NCAC 02H .0506(b) and/or (c)]

Type of Impact	Amount Approved (units) Permanent	Amount Approved (units) Temporary
Stream		
S1	692.75 (linear feet)	0 (linear feet)
S2	2002.44	0
S3	106.50	0
S4	1957.52	0
S5	1440.78	0
S6	822.37	0
S7	89.93	0
S8	3.00	0
S9	12.00	0
S10	25.00	0
S11	11.50	0
S12	33.50	0
S13	10.70	0
S14	47.66	0
S15	298.17	0
S16	140.68	0
S17	581.34	0
S18	57.86	0
S19	22.94	0
S20	58.22	0
Total	8414.86	0
404/401 Wetlands		
W1	0 (acres)	0.006 (acres)
W2	0.029	0
W3	0.004	0
W4	0	0.158
W5	0.040	0
W6	0.021	0
W7	0.004	0
W8	0	0.019
W9	0	0.005
W10	0	0.007
W11	0	0.003
W12	0.034	0
Total	0.132	0.198
Open Waters		

01	0.162 (acres)	0 (acres)
02	0.062	0
03	0.055	0
04	0.653	0
05	0.041	0
Total	0.973	0

2. This approval is for the purpose and design described in your application. The plans and specifications for this project are incorporated by reference as part of the Certification. If you change your project, you must notify the Division and you may be required to submit a new application package with the appropriate fee. If the property is sold, the new owner must be given a copy of this approval letter and General Certification(s)/Permit/Authorization and is responsible for complying with all conditions. [15A NCAC 02H .0507(d)(2)]

3. The issuance of the 401 Water Quality Certification for the restoration/enhancement project does not represent an approval of credit yield for the project. [15A NCAC 02H .0500(h)]

4. You have our approval for your proposed final stream enhancements/restorations plan. The stream restorations/enhancements must be constructed, maintained, and monitored according to the plans approved by this Office and this Certificate of Coverage. Any repairs or adjustments to the site must be made according to the approved plans or must receive written approval from this Office to make the repairs or adjustments. [15A NCAC 02H .0506(h)]

This approval and its conditions are final and binding unless contested. [G.S. 143-215.5]

This Certification can be contested as provided in Articles 3 and 4 of General Statute 150B by filing a written petition for an administrative hearing to the Office of Administrative Hearings (hereby known as OAH) **within sixty (60) calendar days**.

A petition form may be obtained from the OAH at http://www.ncoah.com/ or by calling the OAH Clerk's Office at (919) 431-3000 for information. A petition is considered filed when the original and one (1) copy along with any applicable OAH filing fee is received in the OAH during normal office hours (Monday through Friday between 8:00am and 5:00pm, excluding official state holidays).

The petition may be faxed to the OAH at (919) 431-3100, provided the original and one copy of the petition along with any applicable OAH filing fee is received by the OAH within five (5) business days following the faxed transmission.

Mailing address for the OAH:

If sending via US Postal Service:

Office of Administrative Hearings
6714 Mail Service Center
Raleigh, NC 27699-6714

If sending via delivery service (UPS, FedEx, etc):

Office of Administrative Hearings
1711 New Hope Church Road
Raleigh, NC 27609-6285

One (1) copy of the petition must also be served to Department of Environmental Quality:

William F. Lane, General Counsel
Department of Environmental Quality
1601 Mail Service Center
Raleigh, NC 27699-1601

This letter completes the review of the Division under section 401 of the Clean Water Act. Please contact Mac Haupt at 919-707-3632 or mac.haupt@ncdenr.gov if you have any questions or concerns.

Sincerely,

Mac Haupt, Acting Supervisor
401 & Buffer Permitting Branch

Enclosures: GC 4134

cc: Todd Tugwell, Kim Browning, USACE Raleigh Regulatory Field Office
DWR 401 & Buffer Permitting Branch file

Filename: 160369DryCreek(Durham)_401_ approval ltr.October 1, 2019.docx

STATE OF NORTH CAROLINA
DEPARTMENT OF ENVIRONMENTAL QUALITY
DIVISION OF WATER RESOURCES

WATER QUALITY GENERAL CERTIFICATION NO. 4134

GENERAL CERTIFICATION FOR PROJECTS ELIGIBLE FOR US ARMY CORPS OF ENGINEERS

- **NATIONWIDE PERMIT NUMBER 13 (BANK STABILIZATION),**
- **NATIONWIDE PERMIT NUMBER 27 (AQUATIC HABITAT RESTORATION, ESTABLISHMENT AND ENHANCEMENT ACTIVITIES), AND**
- **REGIONAL GENERAL PERMIT 197800080 (BULKHEADS AND RIP-RAP)**

Water Quality Certification Number 4134 is issued in conformity with the requirements of Section 401, Public Laws 92-500 and 95-217 of the United States and subject to the North Carolina Regulations in 15A NCAC 02H .0500 and 15A NCAC 02B .0200 for the discharge of fill material to surface waters and wetland areas as described in 33 CFR 330 Appendix A (B) (13 and 27) of the US Army Corps of Engineers regulations and Regional General Permit 197800080.

The State of North Carolina certifies that the specified category of activity will not violate applicable portions of Sections 301, 302, 303, 306 and 307 of the Public Laws 92-500 and 95-217 if conducted in accordance with the conditions hereinafter set forth.

Effective date: December 1, 2017

Signed this day: December 1, 2017

By

for Linda Culpepper
Interim Director

Activities meeting any one (1) of the following thresholds or circumstances require *written approval* for a 401 Water Quality Certification from the Division of Water Resources (DWR):

a) If any of the conditions of this Certification (listed below) cannot be met; or
b) Any permanent fill into or modification of wetlands and/or waters except for single and independent stream stabilization or enhancement projects involving in-stream structures that meet the following criteria:
    i. Designed based on current natural channel techniques; and
    ii. In-stream structures do not exceed a spacing of three structures per 100 feet of stream length up to a total of 500 feet of streambank stabilization; or
c) Any stream relocation; or
d) Complete dewatering and drawdowns to a sediment layer related to pond/dam maintenance or removal; or
e) Total temporary and permanent impacts to streambanks of greater than 150 feet for bank stabilization projects when non-natural armoring techniques (e.g. rip-rap, gabion baskets, deflection walls) are utilized; or
f) Total temporary and permanent impacts to streambanks of greater than 500 feet for bank stabilization projects when natural techniques (e.g. sloping, vegetation, geolifts) are used; or
g) Any permanent impacts to waters, or to wetlands adjacent to waters, designated as: ORW (including SAV), HQW (including PNA), SA, WS-I, WS-II, or North Carolina or National Wild and Scenic River.
h) Any permanent impacts to waters, or to wetlands adjacent to waters, designated as Trout except for bank stabilization projects that qualify for a Nationwide Permit #13 provided that:
    i. The total impacts are less than 100 feet in length;
    ii. The project is not adjacent to any other existing stabilization structures;
    iii. All conditions of this General Certification can be met, including adherence to any moratoriums as stated in Condition #10; and
    iv. A *Notification of Work in Trout Watersheds Form* is submitted to the Division at least 60 days prior to commencement of work; or
i) Any permanent impacts to coastal wetlands [15A NCAC 07H .0205], or Unique Wetlands (UWL); or
j) Any impact associated with a Notice of Violation or an enforcement action for violation(s) of NC Wetland Rules (15A NCAC 02H .0500), NC Isolated Wetland Rules (15A NCAC 02H .1300), NC Surface Water or Wetland Standards (15A NCAC 02B .0200), or State Regulated Riparian Buffer Rules (15A NCAC 02B .0200); or
k) Any impacts to subject water bodies and/or state regulated riparian buffers along subject water bodies in the Neuse, Tar-Pamlico, or Catawba River Basins or in the Randleman Lake, Jordan Lake or Goose Creek Watersheds (or any other basin or watershed with State Regulated Riparian Area Protection Rules [Buffer Rules] in effect at the time of application) *unless:*
    i. The activities are listed as "EXEMPT" from these rules; or

ii. A Buffer Authorization Certificate is issued by the NC Division of Coastal Management (DCM); or

iii. A Buffer Authorization Certificate or a Minor Variance is issued by a delegated or designated local government implementing a state riparian buffer program pursuant to 143-215.23.

Activities included in this General Certification that do not meet one of the thresholds listed above do not require written approval.

I. ACTIVITY SPECIFIC CONDITIONS:

1. Any repairs or adjustments to the site shall be made according to the approved plans. Repairs that result in a change from the approved plans must receive written approval from DWR prior to commencement of the repairs. [15A NCAC 02H .0501 and .0502]

2. Written authorization for a compensatory mitigation project does not represent an approval of credit yield for the project. [15A NCAC 02H .0500(h)]

3. For all dam removal projects meeting the definition under G.S. 143-215.25 and requirements under G.S. 143-215.27 of a professionally supervised dam removal, the applicant shall provide documentation that any sediment that may be released has similar or lower level of contamination than sediment sampled from downstream of the dam in accordance with Session Law 2017-145.

II. GENERAL CONDITIONS:

1. When written authorization is required, the plans and specifications for the project are incorporated into the authorization by reference and are an enforceable part of the Certification. Any modifications to the project require notification to DWR and may require an application submittal to DWR with the appropriate fee. [15A NCAC 02H .0501 and .0502]

2. No waste, spoil, solids, or fill of any kind shall occur in wetlands or waters beyond the footprint of the impacts (including temporary impacts) as authorized in the written approval from DWR; or beyond the thresholds established for use of this Certification without written authorization. [15A NCAC 02H .0501 and .0502]

   No removal of vegetation or other impacts of any kind shall occur to state regulated riparian buffers beyond the footprint of impacts approved in a Buffer Authorization or Variance or as listed as an exempt activity in the applicable riparian buffer rules. [15A NCAC 02B .0200]

3. In accordance with 15A NCAC 02H .0506(h) and Session Law 2017-10, compensatory mitigation may be required for losses of greater than 300 linear feet of perennial streams and/or greater than one (1) acre of wetlands. Impacts associated with the removal of a dam shall not require mitigation when the removal complies with the requirements of Part 3 of Article 21 in Chapter 143 of the North Carolina General Statutes. Impacts to isolated and other non-404 jurisdictional wetlands shall not be combined with 404 jurisdictional wetlands for the purpose of determining when impact thresholds trigger a mitigation requirement. For linear publicly owned and maintained transportation projects that are not determined to be part of a larger common plan of development by the US Army Corps of Engineers, compensatory mitigation may be required for losses of greater than 300 linear feet per perennial stream.

   Compensatory stream and/or wetland mitigation shall be proposed and completed in compliance with G.S. 143-214.11. For applicants proposing to conduct mitigation within a project site, a complete mitigation proposal developed in accordance with the most recent guidance issued by the US Army Corps of Engineers Wilmington District shall be submitted for review and approval with the application for impacts.

4. All activities shall be in compliance with any applicable State Regulated Riparian Buffer Rules in Chapter 2 of Title 15A.

5. When applicable, all construction activities shall be performed and maintained in full compliance with G.S. Chapter 113A Article 4 (Sediment and Pollution Control Act of 1973). Regardless of applicability of the Sediment and Pollution Control Act, all projects shall incorporate appropriate Best Management Practices for the control of sediment and erosion so that no violations of state water quality standards, statutes, or rules occur. [15A NCAC 02H .0506(b)(3) and (c)(3) and 15A NCAC 02B .0200].

   Design, installation, operation, and maintenance of all sediment and erosion control measures shall be equal to or exceed the requirements specified in the most recent version of the *North Carolina Sediment and Erosion Control Manual*, or for linear transportation projects, the *NCDOT Sediment and Erosion Control Manual*.

   All devices shall be maintained on all construction sites, borrow sites, and waste pile (spoil) sites, including contractor-owned or leased borrow pits associated with the project. Sufficient materials required for stabilization and/or repair of erosion control measures and stormwater routing and treatment shall be on site at all times.

   For borrow pit sites, the erosion and sediment control measures shall be designed, installed, operated, and maintained in accordance with the most recent version of the *North Carolina Surface Mining Manual*. Reclamation measures and implementation shall comply with the reclamation in accordance with the requirements of the Sedimentation Pollution Control Act and the Mining Act of 1971.

If the project occurs in waters or watersheds classified as Primary Nursery Areas (PNAs), SA, WS-I, WS-II, High Quality Waters (HQW), or Outstanding Resource Waters (ORW), then the sedimentation and erosion control designs shall comply with the requirements set forth in 15A NCAC 04B .0124, *Design Standards in Sensitive Watersheds.*

6. Sediment and erosion control measures shall not be placed in wetlands or waters except within the footprint of temporary or permanent impacts authorized under this Certification. Exceptions to this condition require application to and written approval from DWR. [15A NCAC 02H .0501 and .0502]

7. Erosion control matting that incorporates plastic mesh and/or plastic twine shall not be used along streambanks or within wetlands. Exceptions to this condition require application to and written approval from DWR. [15A NCAC 02B .0201]

8. An NPDES Construction Stormwater Permit (NCG010000) is required for construction projects that disturb one (1) or more acres of land. The NCG010000 Permit allows stormwater to be discharged during land disturbing construction activities as stipulated in the conditions of the permit. If the project is covered by this permit, full compliance with permit conditions including the erosion & sedimentation control plan, inspections and maintenance, self-monitoring, record keeping and reporting requirements is required. [15A NCAC 02H .0506(b)(5) and (c)(5)]

   The North Carolina Department of Transportation (NCDOT) shall be required to be in full compliance with the conditions related to construction activities within the most recent version of their individual NPDES (NCS000250) stormwater permit. [15A NCAC 02H .0506(b)(5) and (c)(5)]

9. All work in or adjacent to streams shall be conducted so that the flowing stream does not come in contact with the disturbed area. Approved best management practices from the most current version of the *NC Sediment and Erosion Control Manual*, or the *NC DOT Construction and Maintenance Activities Manual*, such as sandbags, rock berms, cofferdams, and other diversion structures shall be used to minimize excavation in flowing water. Exceptions to this condition require application to and written approval from DWR. [15A NCAC 02H .0506(b)(3) and (c)(3)]

10. If activities must occur during periods of high biological activity (e.g. sea turtle nesting, fish spawning, or bird nesting), then biological monitoring may be required at the request of other state or federal agencies and coordinated with these activities. [15A NCAC 02H .0506(b)(2) and 15A NCAC 04B .0125]

    All moratoriums on construction activities established by the NC Wildlife Resources Commission (WRC), US Fish and Wildlife Service (USFWS), NC Division of Marine Fisheries (DMF), or National Marine Fisheries Service (NMFS) shall be implemented. Exceptions to this condition require written approval by the resource agency responsible for the given moratorium. A copy of the approval from the resource agency shall be forwarded to DWR.

Work within a designated trout watershed of North Carolina (as identified by the Wilmington District of the US Army Corps of Engineers), or identified state or federal endangered or threatened species habitat, shall be coordinated with the appropriate WRC, USFWS, NMFS, and/or DMF personnel.

11. Culverts shall be designed and installed in such a manner that the original stream profiles are not altered and allow for aquatic life movement during low flows. The dimension, pattern, and profile of the stream above and below a pipe or culvert shall not be modified by widening the stream channel or by reducing the depth of the stream in connection with the construction activity. The width, height, and gradient of a proposed culvert shall be such as to pass the average historical low flow and spring flow without adversely altering flow velocity. [15A NCAC 02H .0506(b)(2) and (c)(2)]

    Placement of culverts and other structures in streams shall be below the elevation of the streambed by one foot for all culverts with a diameter greater than 48 inches, and 20% of the culvert diameter for culverts having a diameter less than or equal to 48 inches, to allow low flow passage of water and aquatic life.

    If multiple pipes or barrels are required, they shall be designed to the mimic the existing stream cross section as closely as possible including pipes or barrels at flood plain elevation and/or sills where appropriate. Widening the stream channel shall be avoided.

    When topographic constraints indicate culvert slopes of greater than 5%, culvert burial is not required, provided that all alternative options for flattening the slope have been investigated and aquatic life movement/connectivity has been provided when possible (e.g. rock ladders, cross vanes, etc.). Notification, including supporting documentation to include a location map of the culvert, culvert profile drawings, and slope calculations, shall be provided to DWR 60 calendar days prior to the installation of the culvert.

    When bedrock is present in culvert locations, culvert burial is not required provided that there is sufficient documentation of the presence of bedrock. Notification, including supporting documentation such as a location map of the culvert, geotechnical reports, photographs, etc. shall be provided to DWR a minimum of 60 calendar days prior to the installation of the culvert. If bedrock is discovered during construction, then DWR shall be notified by phone or email within 24 hours of discovery.

    If other site-specific topographic constraints preclude the ability to bury the culverts as described above and/or it can be demonstrated that burying the culvert would result in destabilization of the channel, then exceptions to this condition require application to and written approval from DWR.

Installation of culverts in wetlands shall ensure continuity of water movement and be designed to adequately accommodate high water or flood conditions. When roadways, causeways, or other fill projects are constructed across FEMA-designated floodways or wetlands, openings such as culverts or bridges shall be provided to maintain the natural hydrology of the system as well as prevent constriction of the floodway that may result in destabilization of streams or wetlands.

The establishment of native woody vegetation and other soft stream bank stabilization techniques shall be used where practicable instead of rip-rap or other bank hardening methods.

12. Bridge deck drains shall not discharge directly into the stream. Stormwater shall be directed across the bridge and pre-treated through site-appropriate means to the maximum extent practicable (e.g. grassed swales, pre-formed scour holes, vegetated buffers, etc.) before entering the stream. Exceptions to this condition require application to and written approval from DWR. [15A NCAC 02H .0506(b)(5)]

13. Application of fertilizer to establish planted/seeded vegetation within disturbed riparian areas and/or wetlands shall be conducted at agronomic rates and shall comply with all other Federal, State and Local regulations. Fertilizer application shall be accomplished in a manner that minimizes the risk of contact between the fertilizer and surface waters. [15A NCAC 02B .0200 and 15A NCAC 02B .0231]

14. If concrete is used during construction, then all necessary measures shall be taken to prevent direct contact between uncured or curing concrete and waters of the state. Water that inadvertently contacts uncured concrete shall not be discharged to waters of the state. [15A NCAC 02B .0200]

15. All proposed and approved temporary fill and culverts shall be removed and the impacted area shall be returned to natural conditions within 60 calendar days after the temporary impact is no longer necessary. The impacted areas shall be restored to original grade, including each stream's original cross sectional dimensions, planform pattern, and longitudinal bed profile. For projects that receive written approval, no temporary impacts are allowed beyond those included in the application and authorization. All temporarily impacted sites shall be restored-and stabilized with native vegetation. [15A NCAC 02H .0506(b)(2) and (c)(2)]

16. All proposed and approved temporary pipes/culverts/rip-rap pads etc. in streams shall be installed as outlined in the most recent edition of the *North Carolina Sediment and Erosion Control Planning and Design Manual* or the *North Carolina Surface Mining Manual* or the *North Carolina Department of Transportation Best Management Practices for Construction and Maintenance Activities* so as not to restrict stream flow or cause dis-equilibrium during use of this Certification. [15A NCAC 02H .0506(b)(2) and (c)(2)]

17. Any rip-rap required for proper culvert placement, stream stabilization, or restoration of temporarily disturbed areas shall be restricted to the area directly impacted by the approved construction activity. All rip-rap shall be placed such that the original stream elevation and streambank contours are restored and maintained. Placement of rip-rap or other approved materials shall not result in de-stabilization of the stream bed or banks upstream or downstream of the area or in a manner that precludes aquatic life passage. [15A NCAC 02H .0506(b)(2)]

18. Any rip-rap used for stream or shoreline stabilization shall be of a size and density to prevent movement by wave, current action, or stream flows and shall consist of clean rock or masonry material free of debris or toxic pollutants. Rip-rap shall not be installed in the streambed except in specific areas required for velocity control and to ensure structural integrity of bank stabilization measures. [15A NCAC 02H .0506(b)(2)]

19. Applications for rip-rap groins proposed in accordance with 15A NCAC 07H .1401 (NC Division of Coastal Management General Permit for construction of Wooden and Rip-rap Groins in Estuarine and Public Trust Waters) shall meet all the specific conditions for design and construction specified in 15A NCAC 07H .1405.

20. All mechanized equipment operated near surface waters shall be inspected and maintained regularly to prevent contamination of surface waters from fuels, lubricants, hydraulic fluids, or other toxic materials. Construction shall be staged in order to minimize the exposure of equipment to surface waters to the maximum extent practicable. Fueling, lubrication and general equipment maintenance shall be performed in a manner to prevent, to the maximum extent practicable, contamination of surface waters by fuels and oils. [15A NCAC 02H .0506(b)(3) and (c)(3) and 15A NCAC 02B .0211 (12)]

21. Heavy equipment working in wetlands shall be placed on mats or other measures shall be taken to minimize soil disturbance. [15A NCAC 02H .0506 (b)(3) and (c)(3)]

22. In accordance with 143-215.85(b), the applicant shall report any petroleum spill of 25 gallons or more; any spill regardless of amount that causes a sheen on surface waters; any petroleum spill regardless of amount occurring within 100 feet of surface waters; and any petroleum spill less than 25 gallons that cannot be cleaned up within 24 hours.

23. If an environmental document is required under the State Environmental Policy Act (SEPA), then this General Certification is not valid until a Finding of No Significant Impact (FONSI) or Record of Decision (ROD) is issued by the State Clearinghouse. If an environmental document is required under the National Environmental Policy Act (NEPA), then this General Certification is not valid until a Categorical Exclusion, the Final Environmental Assessment, or Final Environmental Impact Statement is published by the lead agency. [15A NCAC 01C .0107(a)]

24. This General Certification does not relieve the applicant of the responsibility to obtain all other required Federal, State, or Local approvals before proceeding with the project, including those required by, but not limited to, Sediment and Erosion Control, Non-Discharge, Water Supply Watershed, and Trout Buffer regulations.

25. The applicant and their authorized agents shall conduct all activities in a manner consistent with State water quality standards (including any requirements resulting from compliance with §303(d) of the Clean Water Act), and any other appropriate requirements of State and Federal Law. If DWR determines that such standards or laws are not being met, including failure to sustain a designated or achieved use, or that State or Federal law is being violated, or that further conditions are necessary to assure compliance, then DWR may revoke or modify a written authorization associated with this General Water Quality Certification. [15A NCAC 02H .0507(d)]

26. The permittee shall require its contractors and/or agents to comply with the terms and conditions of this permit in the construction and maintenance of this project, and shall provide each of its contractors and/or agents associated with the construction or maintenance of this project with a copy of this Certification. A copy of this Certification, including all conditions shall be available at the project site during the construction and maintenance of this project. [15A NCAC 02H .0507 (c) and 15A NCAC 02H .0506 (b)(2) and (c)(2)]

27. When written authorization is required for use of this Certification, upon completion of all permitted impacts included within the approval and any subsequent modifications, the applicant shall be required to return a certificate of completion (available on the DWR website: https://edocs.deq.nc.gov/Forms/Certificate-of-Completion). [15A NCAC 02H .0502(f)]

28. Additional site-specific conditions, including monitoring and/or modeling requirements, may be added to the written approval letter for projects proposed under this Water Quality Certification in order to ensure compliance with all applicable water quality and effluent standards. [15A NCAC 02H .0507(c)]

29. If the property or project is sold or transferred, the new permittee shall be given a copy of this Certification (and written authorization if applicable) and is responsible for complying with all conditions. [15A NCAC 02H .0501 and .0502]

III. GENERAL CERTIFICATION ADMINISTRATION:

1. In accordance with North Carolina General Statute 143-215.3D(e), written approval for a 401 Water Quality General Certification must include the appropriate fee. An applicant for a CAMA permit under Article 7 of Chapter 113A of the General Statutes for which a water quality Certification is required shall only make one payment to satisfy both agencies; the fee shall be as established by the Secretary in accordance with 143-215.3D(e)(7).

2. This Certification neither grants nor affirms any property right, license, or privilege in any waters, or any right of use in any waters. This Certification does not authorize any person to interfere with the riparian rights, littoral rights, or water use rights of any other person and this Certification does not create any prescriptive right or any right of priority regarding any usage of water. This Certification shall not be interposed as a defense in any action respecting the determination of riparian or littoral rights or other rights to water use. No consumptive user is deemed by virtue of this Certification to possess any prescriptive or other right of priority with respect to any other consumptive user regardless of the quantity of the withdrawal or the date on which the withdrawal was initiated or expanded.

3. This Certification grants permission to the Director, an authorized representative of the Director, or DWR staff, upon the presentation of proper credentials, to enter the property during normal business hours. [15A NCAC 02H .0502(e)]

4. This General Certification shall expire on the same day as the expiration date of the corresponding Nationwide Permit and/or Regional General Permit. The conditions in effect on the date of issuance of Certification for a specific project shall remain in effect for the life of the project, regardless of the expiration date of this Certification. This General Certification is rescinded when the US Army Corps of Engineers reauthorizes any of the corresponding Nationwide Permits and/or Regional General Permits or when deemed appropriate by the Director of the Division of Water Resources.

5. Non-compliance with or violation of the conditions herein set forth by a specific project may result in revocation of this General Certification for the project and may also result in criminal and/or civil penalties.

6. The Director of the North Carolina Division of Water Resources may require submission of a formal application for Individual Certification for any project in this category of activity if it is deemed in the public's best interested or determined that the project is likely to have a significant adverse effect upon water quality, including state or federally listed endangered or threatened aquatic species, or degrade the waters so that existing uses of the water or downstream waters are precluded.

History Note: *Water Quality Certification (WQC) Number 4134 issued December 1, 2017 replaces WQC March 3, 2017; WQC 3885 issued March 19, 2012; WQC Number 3689 issued November 1, 2007; WQC Number 3626 issued March 19, 2007; WQC Number 3495 issued December 31, 2004; and WQC Number 3399 issued March 2003.*

U.S. ARMY CORPS OF ENGINEERS
WILMINGTON DISTRICT

Action Id. **SAW-2016-00880** County: **Durham** U.S.G.S. Quad:**Lake Michie**

GENERAL PERMIT (REGIONAL AND NATIONWIDE) VERIFICATION

Permittee: **NC Division of Mitigation Services**
Attn: Mr. Tim Baumgartner
Address: **217 West Jones Street, Suite 3000A**
Raleigh, North Carolina 27603
Telephone: **919-707-8319**

Permittee: **Wildlands Engineering, Inc.**
Attn: Jeff Keaton
Address: **321 West Millbrook Road, Suite 225**
Raleigh, NC 27609
Telephone: **919-851-9986**

Size (acres) **29.66 acres**
Nearest Waterway **Dry Creek**
USGS HUC **03020201**

Nearest Town **Bahama**
River Basin **Neuse**
Coordinates Latitude: **36.190677 °N** Longitude: **-78.826550°W**

Location description: **The NCDMS 29.66-acre Dry Creek Mitigation Site includes Dry Creek and eight of its unnamed tributaries. All drain to the Neuse River Basin. The site is located in Durham County, North Carolina, approximately 3 miles northwest of Butner, NC. PIN: 0848-03-95-9272; 0858-03-04-3591; 0858-01-08-5170; 0858-01-15-0542; 0855-01-06-8492; 0858-01-18-7320; 0848-03-94-9564.**

Description of projects area and activity: **The co-applicants, NCDMS and Wildlands Engineering, Inc, have requested a Department of the Army permit authorization to discharge dredged and/or fill material into waters of the United States associated with the NCDMS Dry Creek Mitigation Site. Implementation of the proposed restoration and enhancement activities will result in the discharge of fill material into8,414.86 linear feet of stream channel and 0.33 acres of wetlands associated with mechanized land clearing, excavation, placement of fill material, and stream relocation activities for the mitigation site. Compensatory mitigation is NOT required in conjunction with the aforementioned activities. Refer to the enclosed Table 1 for a detailed summary of impacts**

Applicable Law: ☒ Section 404 (Clean Water Act, 33 USC 1344)
☐ Section 10 (Rivers and Harbors Act, 33 USC 403)

Authorization: Regional General Permit Number and/or Nationwide Permit Number: **NWP 27 – Aquatic Habitat Restoration, Enhancement, and Establishment Activities**
SEE ATTACHED RGP or NWP GENERAL, REGIONAL AND SPECIAL CONDITIONS

Your work is authorized by the above referenced permit provided it is accomplished in strict accordance with the attached conditions and your submitted application and attached information dated August 29, 2019. Any violation of the attached conditions or deviation from your submitted plans may subject the permittee to a stop work order, a restoration order, a Class I administrative penalty, and/or appropriate legal action.

This verification will remain valid until the expiration date identified below unless the nationwide and/or regional general permit authorization is modified, suspended or revoked. If, prior to the expiration date identified below, the nationwide and/or regional general permit authorization is reissued and/or modified, this verification will remain valid until the expiration date identified below, provided it complies with all requirements of the modified nationwide permit. If the nationwide and/or regional general permit authorization expires or is suspended, revoked, or is modified, such that the activity would no longer comply with the terms and conditions of the nationwide permit, activities which have commenced (i.e., are under construction) or are under contract to commence in reliance upon the nationwide and/or regional general permit, will remain authorized provided the activity is completed within twelve months of the date of the nationwide and/or regional general permit's expiration, modification or revocation, unless discretionary authority has been exercised on a case-by-case basis to modify, suspend or revoke the authorization.

Activities subject to Section 404 (as indicated above) may also require an individual Section 401 Water Quality Certification. You should contact the NC Division of Water Resources (telephone 919-807-6300) to determine Section 401 requirements.

For activities occurring within the twenty coastal counties subject to regulation under the Coastal Area Management Act (CAMA), prior to beginning work you must contact the N.C. Division of Coastal Management in Morehead City, NC, at (252) 808-2808.

SAW-2016-00880

This Department of the Army verification does not relieve the permittee of the responsibility to obtain any other required Federal, State or local approvals/permits.

If there are any questions regarding this verification, any of the conditions of the Permit, or the Corps of Engineers regulatory program, please contact **Kimberly Browning, 919.554.4884 x60.**

Corps Regulatory Official: _____ Date: **October 11, 2019**
Expiration Date of Verification: **March 18, 2022**

Table 1. Authorized discharge of fill material into waters of the United States in association with the NCDMS Dry Creek Mitigation Site (SAW-2016-00880).

Stream Impact Number	Temporary or Permanent	Type of Impact	Stream Name	Perennial or Intermittent	Type of Jurisdiction	Average Stream Width (Feet)	Impact Length (linear feet)
S1	Permanent	Fill - Stream Restoration	Dry Creek Reach 1	Perennial	Corps/DWR	16.0	692.75
S2	Permanent	Fill - Stream Restoration	Dry Creek Reach 2	Perennial	Corps/DWR	13.5	2002.44
S3	Permanent	Fill - Stream Restoration	Dry Creek Reach 2 (side channel)	Perennial	Corps/DWR	12.0	108.50
S4	Permanent	Fill - Stream Restoration	Dry Creek Reach 3	Perennial	Corps/DWR	12.9	1957.52
S5	Permanent	Fill - Stream Restoration	Dry Creek Reach 4	Perennial	Corps/DWR	12.9	1440.78
S6	Permanent	Fill - Stream Restoration	UT1 Reach 2	Perennial	Corps/DWR	14.0	822.37
S7	Permanent	Fill - Enhancement I	UT1a	Intermittent	Corps/DWR	6.0	89.93
S8	Permanent	Fill - Boulder Sill	UT2	Intermittent	Corps/DWR	6.0	3.00
S9	Permanent	Fill - Constructed Riffle	UT2	Intermittent	Corps/DWR	8.0	12.00
S10	Permanent	Fill - Constructed Riffle	UT2	Intermittent	Corps/DWR	6.0	25.00
S11	Permanent	Fill - Relocation	UT2	Intermittent	Corps/DWR	6.0	11.50
S12	Permanent	Fill - Constructed Riffle/Temporary Crossing	UT3	Intermittent	Corps/DWR	10.0	33.50
S13	Permanent	Fill - Constructed Riffle	UT3	Intermittent	Corps/DWR	10.0	10.70
S14	Permanent	Fill - Constructed Riffle/Relocation	UT4	Intermittent	Corps/DWR	8.0	47.66
S15	Permanent	Fill - Enhancement I	UT5 Reach 1	Intermittent	Corps/DWR	3.4	298.17
S16	Permanent	Fill - Stream Restoration	UT5 Reach 2	Intermittent	Corps/DWR	3.4	140.68
S17	Permanent	Fill - Stream Restoration	UT6 Reach 1	Perennial	Corps/DWR	3.8	581.34
S18	Permanent	Fill - Stream Restoration	UT6 Reach 3	Perennial	Corps/DWR	3.8	57.86
S19	Permanent	Fill - Constructed Riffle	UT7	Perennial	Corps/DWR	16.0	22.94
S20	Permanent	Fill - Relocation	UT7	Perennial	Corps/DWR	16.0	58.22
				Total Stream and Tributary Impacts			8414.86

Wetland Impact Number	Temporary or Permanent	Type of Impact	Type of Wetland	Forested	Type of Jurisdiction	Area of Impact (acres)
W1	Temporary	Floodplain Grading	Seep	No	Corps/DWR	0.006
W2	Permanent	Stream Channel Excavation	Headwater Forest	No	Corps/DWR	0.029
W3	Permanent	Stream Channel Excavation	Headwater Forest	No	Corps/DWR	0.004
W4	Temporary	Floodplain Grading	Headwater Forest	No	Corps/DWR	0.158
W5	Permanent	Stream Channel Excavation	Headwater Forest	No	Corps/DWR	0.040
W6	Permanent	Stream Channel Excavation	Headwater Forest	No	Corps/DWR	0.021
W7	Permanent	Stream Channel Excavation	Seep	Yes	Corps/DWR	0.004
W8	Temporary	Floodplain Grading	Seep	Yes	Corps/DWR	0.019
W9	Temporary	Floodplain Grading/Temporary Crossing	Seep	Yes	Corps/DWR	0.005
W10	Temporary	Floodplain Grading/Temporary Crossing	Headwater Forest	Yes	Corps/DWR	0.007
W11	Temporary	Floodplain Grading	Seep	Yes	Corps/DWR	0.003
W12	Permanent	Stream Channel Excavation	Seep	Yes	Corps/DWR	0.034
				Total Wetland Impacts		0.330

*****Impacts are associated with aquatic resource restoration and enhancement activities and are expected to result in a net gain in Waters of the US.

SPECIAL CONDITIONS

1. **The permittee understands and agrees that the document entitled "Final Mitigation Plan –Dry Creek Mitigation Plan" dated November 2018 is incorporated and made part of this permit. Execution of the work and terms given in the approved mitigation plan are a condition of this permit.**

2. **This Nationwide Permit verification does not imply suitability of this property for compensatory mitigation for any particular project. The use of any portion of this site as compensatory mitigation for a particular project will be determined during the permit review process for that project.**

SAW-2016-00880

COMPLIANCE CERTIFICATION

Action ID Number: SAW-2016-00880 **County: Durham**

Permittee: NC Division of Mitigation Services
Attn: Mr. Tim Baumgartner

Wildlands Engineering, Inc.
Attn: Mr. Jeff Keaton

Project Name: NCDMS Dry Creek Site

Date Verification Issued: October 11, 2019

Project Manager: Kim Browning

Upon completion of the activity authorized by this permit and any mitigation required by the permit, sign this certification and return it to the following address:

US ARMY CORPS OF ENGINEERS
WILMINGTON DISTRICT
Regulatory Division Mitigation Office
Attn: Kim Browning
3331 Heritage Trade Drive, Suite 105
Raleigh, NC 27587

Please note that your permitted activity is subject to a compliance inspection by a U. S. Army Corps of Engineers representative. Failure to comply with any terms or conditions of this authorization may result in the Corps suspending, modifying or revoking the authorization and/or issuing a Class I administrative penalty, or initiating other appropriate legal action.

I hereby certify that the work authorized by the above referenced permit has been completed in accordance with the terms and condition of the said permit, and required mitigation was completed in accordance with the permit conditions.

_____ _____

Signature of Permittee **Date**

ROY COOPER
Governor
MICHAEL S. REGAN
Secretary
S. DANIEL SMITH
Director

NORTH CAROLINA
Environmental Quality

November 1, 2019

Letter of Approval

Wildlands Engineering, Inc.
ATTN: John Hutton, Vice President
312 W Millbrook Road, Suite 225
Raleigh, NC 27609

RE: Project Name: Dry Creek Mitigation Site
Project ID: DURHA-2019-013
Acres Approved: 38.78
County: DURHAM, City: Butner, Address: Hall Rd. & Hampton Rd.
River Basin: Neuse Stream Classification: Falls Lake Watershed
Submitted By: Wildlands Engineering, Inc.
Date Received by LQS: March 28, 2019
Plan Type: Revised

Dear Mr. Hutton:

This office has reviewed the subject erosion and sedimentation control plan. We find the plan to be acceptable and hereby issue this Letter of Approval. The enclosed Certificate of Approval must be posted at the job site. This plan approval shall expire three (3) years following the date of approval, if no land-disturbing activity has been undertaken, as is required by Title 15A NCAC 4B .0129.

As of April 1, 2019, all new construction activities are required to complete and submit an electronic Notice of Intent (NOI) form requesting a Certificate of Coverage (COC) under the NCG010000 Construction Stormwater General Permit. This form MUST be submitted prior to the commencement of any land disturbing activity on the above named project. The NOI form may be accessed at deq.nc.gov/NCG01. Please direct questions about the NOI form to Annette Lucas at Annette.lucas@ncdenr.gov or Paul Clark at Paul.clark@ncdenr.gov. After you submit a complete and correct NOI form, a CPOC will be emailed to you within **three business days.** Initially, DEMLR will not charge a fee for the coverage under the NCG01 permit. However, on or after June 1, 2019, a $100 fee will be charged annually. This fee is to be sent to the DEMLR Stormwater Central Office staff in Raleigh.

Title 15A NCAC 4B .0118(a) and the NCG01 permit require that the following documentation be kept on file at the job site:

1. The approved E&SC plan as well as any approved deviation.
2. The NCG01 permit and the COC, once it is received.
3. Records of inspection made during the previous 30 days.

Also, this letter gives the notice required by G.S. 113A-61.1(a) of our right of periodic inspection to insure compliance with the approved plan.

North Carolina's Sedimentation Pollution Control Act is performance-oriented, requiring protection of existing natural resources and adjoining properties. If, following the commencement of this project, the erosion and sedimentation control plan is inadequate to meet the requirements of the Sedimentation Pollution Control Act of 1973 (North Carolina General Statute 113A-51 through 66), this office may require revisions to the plan and implementation of the revisions to insure compliance with the Act.

Acceptance and approval of this plan is conditioned upon your compliance with Federal and State water quality laws, regulations, and rules. In addition, local city or county ordinances or rules may also apply to this land-disturbing activity. This approval does not supersede any other permit or approval.

Please note that this approval is based in part on the accuracy of the information provided in the Financial Responsibility Form, which you provided. You are requested to file an amended form if there is any change in the information included on the form. In addition, it would be helpful if you notify this office of the proposed starting date for this project. Please notify us if you plan to have a preconstruction conference.

Your cooperation is appreciated.

Sincerely,

Sally Castle, EI
Regional Engineering Associate
DEMLR

Enclosures: Certificate of Approval
NCG01 Fact Sheet

cc: Jeff Keaton (jkeaton@wildlandseng.com) – Electronic Copy
DEMLR – Raleigh Regional Office File

APPENDIX 6. Vegetation Plot Data

Table 4. Planted and Total Stem Counts

Dry Creek Mitigation Site
DMS Project No. 97082
Monitoring Year 0 - 2020

Scientific Name	Common Name	Species Type	Current Plot Data (MY0 2020)														
			VP 1			VP 2			VP 3			VP 4			VP 5		
			PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T
Betula nigra	River Birch	Tree	8	8	8	2	2	2				2	2	2	7	7	7
Fraxinus pennsylvanica	Green Ash	Tree							3	3	3	1	1	1	1	1	1
Liriodendron tulipifera	Tulip Poplar	Tree	1	1	1				1	1	1	2	2	2	1	1	1
Platanus occidentalis	Sycamore	Tree	2	2	2	6	6	6	6	6	6	2	2	2			
Populus deltoides	Eastern Cottonwood	Tree	2	2	2				1	1	1				1	1	1
Quercus pagoda	Cherrybark Oak	Tree				2	2	2	3	3	3	1	1	1	2	2	2
Quercus michauxii	Swamp Chestnut Oak	Tree	1	1	1				1	1	1	5	5	5			
Quercus phellos	Willow Oak	Tree				2	2	2	1	1	1	1	1	1	1	1	1
		Stem count	14	14	14	12	12	12	16	16	16	14	14	14	13	13	13
		size (ares)	1			1			1			1			1		
		size (ACRES)	0.02			0.02			0.02			0.02			0.02		
		Species count	5	5	5	4	4	4	7	7	7	7	7	7	6	6	6
		Stems per ACRE	567	567	567	486	486	486	647	647	647	567	567	567	526	526	526

Color for Density

Exceeds requirements by 10%
Exceeds requirements, but by less than 10%
Fails to meet requirements, by less than 10%
Fails to meet requirements by more than 10%
Volunteer species included in total

PnLS: Number of planted stems excluding live stakes
P-all: Number of planted stems including live stakes
T: Total stems

Table 4. Planted and Total Stem Counts

Dry Creek Mitigation Site
DMS Project No. 97082
Monitoring Year 0 - 2020

Scientific Name	Common Name	Species Type	Current Plot Data (MY0 2020)						Annual Means		
			VP 6			VP 7			MY0 (2020)		
			PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T
Betula nigra	River Birch	Tree	2	2	2	2	2	2	23	23	23
Fraxinus pennsylvanica	Green Ash	Tree	1	1	1				6	6	6
Liriodendron tulipifera	Tulip Poplar	Tree	3	3	3	2	2	2	10	10	10
Platanus occidentalis	Sycamore	Tree	2	2	2	4	4	4	22	22	22
Populus deltoides	Eastern Cottonwood	Tree	4	4	4	1	1	1	9	9	9
Quercus pagoda	Cherrybark Oak	Tree							8	8	8
Quercus michauxii	Swamp Chestnut Oak	Tree				2	2	2	9	9	9
Quercus phellos	Willow Oak	Tree				1	1	1	6	6	6
		Stem count	12	12	12	12	12	12	93	93	93
		size (ares)	1			1			7		
		size (ACRES)	0.02			0.02			0.17		
		Species count	5	5	5	6	6	6	8	8	8
		Stems per ACRE	486	486	486	486	486	486	538	538	538

Color for Density

Exceeds requirements by 10%
Exceeds requirements, but by less than 10%
Fails to meet requirements, by less than 10%
Fails to meet requirements by more than 10%
Volunteer species included in total

PnLS: Number of planted stems excluding live stakes
P-all: Number of planted stems including live stakes
T: Total stems

VEGETATION PLOT PHOTOGRAPHS

VEG PLOT 1 *(4/27/2020)*

VEG PLOT 2 *(4/15/2020)*

VEG PLOT 3 *(4/27/2020)*

VEG PLOT 4 *(4/27/2020)*

VEG PLOT 5 *(4/15/2020)*

VEG PLOT 6 *(4/15/2020)*

VEG PLOT 7 *(4/15/2020)*