AS-BUILT BASELINE MONITORING REPORT

Final

LONE HICKORY MITIGATION SITE

Yadkin County, NC
DEQ Contract No. 6897
DMS Project No. 97135
USACE Action ID No. SAW-2017-00100
Yadkin River Basin
HUC 03040101

Data Collection Period: January 2019 – April 2019
Submission Date: July 10, 2019

PREPARED FOR:

NC Department of Environmental Quality
Division of Mitigation Services
217 West Jones Street; 3rd Floor
Raleigh, NC 27603

July 10, 2019

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

RE: Final As-built Baseline Monitoring Document and Record Drawings for the Lone Hickory Mitigation Site
Yadkin River Basin – CU# 03040101 – Yadkin County
DMS Project ID No. 97135
Contract # 006897

Dear Mr. Wiesner:

Wildlands Engineering, Inc. (Wildlands) has reviewed the Division of Mitigation Services (DMS) comments from the Draft As-built Baseline Monitoring report for the Lone Hickory Mitigation Site. The report has been updated to reflect those comments. The Final As-built Baseline Monitoring Document and Record Drawings are included. Wildlands' responses to DMS' report comments are noted below in *italics*.

DMS comment; Cover page: Please include the DEQ – DMS Raleigh address on the cover page.
NCDEQ – Division of Mitigation Services
217 West Jones Street; 3rd Floor
Raleigh, NC 27603

Wildlands response; The DEQ – DMS Raleigh address has been included on the cover page of the report.

DMS comment; Section 3 – Monitoring Plan and Methodology: Please briefly discuss any updated locations of monitoring devices/plot locations from the IRT approved mitigation plan.

Wildlands response; Text has been added in Sections 3.0, 3.1.1, 3.2, and 3.3 to clarify any updated locations of monitoring devices/plot locations from the Mitigation Plan.

DMS comment; Table 2: Please add "Activity or Report", "Data Collection Complete" and "Completion or Delivery" titles to the table columns.

Wildlands response; In Table 2, the appropriate titles have been added to the table columns.

DMS comment; Electronic Support Files: Please provide the Turner as-built .dwg file with the final electronic submittal.

Wildlands response; The Turner as-built .dwg file has been provided with the final electronic support files.

DMS comment; Electronic Support Files: Please provide the WEI design .dwg file with the final electronic submittal.

Wildlands response; The WEI design .dwg file has been provided with the final electronic support files.

DMS comment; Electronic Support Files: Please confirm that all CCPV GIS shapefiles have been included in the final electronic submittal.

Wildlands response; All CCPV GIS shapefiles have been included in the final electronic support files.

DMS comment; Electronic Support Files: Please include the FEMA Floodplain Compliance permit (#2017-4) and any supporting documentation in the final electronic submittal.

Wildlands response; The FEMA Floodplain Compliance permit (#2017-4) and supporting documentation have been included in the final electronic support files.

Two (2) hard copies of the Final Monitoring Report and a full electronic submittal has been mailed to the DMS western field office. Please contact me at 704-332-7754 x110 if you have any questions.

Sincerely,

Emily Reinicker, PE, CFM
Project Manager

PREPARED BY:

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Charlotte, NC 28203

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EXECUTIVE SUMMARY

Wildlands Engineering, Inc. (Wildlands) implemented a full-delivery stream and wetland mitigation project at the Lone Hickory Mitigation Site (Site) for the North Carolina Department of Environmental Quality (DEQ) Division of Mitigation Services (DMS). The project restored and preserved a total of 12,630 linear feet (LF) of perennial and intermittent stream and restored 9.5 acres of riparian wetland in Yadkin County, NC. The Site is located within the DMS targeted watershed for the Yadkin River Basin HUC 03040101130020 and the NC Division of Water Resources (NCDWR) Subbasin 03-07-02. The project is providing 13,164 stream mitigation units (SMUs) and 9.5 wetland mitigation units (WMUs) for the Yadkin River Basin Hydrologic Unit Code (HUC) 03040101 (Yadkin 01).

The watershed has a long history of agricultural activity and most of the stressors to stream functions are related to this historic and current land use practices. The major stream stressors for the Site were concentrated agricultural runoff inputs, active stream incision and head cutting, lack of stabilizing streamside vegetation, extensive agricultural manipulation through ditching, and the lack of bedform diversity. The effects of these stressors resulted in degraded water quality and habitat throughout the Site's watershed when compared to reference conditions. The project approach for the Site focused on evaluating the Site's existing functional condition and evaluating its potential for recovery and need for intervention.

The project goals defined in the mitigation plan (Wildlands, 2017) were established with careful consideration of 2009 Upper Yadkin Pee Dee River Basin Restoration Priorities (RBRP) goals and objectives to address stressors identified in the watershed. The established project goals include:

- Improve stream channel stability;
- Reconnect channels with historic floodplains and re-establish wetland hydrology and function in relic wetland areas;
- Improve instream habitat;
- Reduce sediment and nutrient input from adjacent farm fields;
- Restore and enhance native floodplain and wetland vegetation; and
- Permanently protect the project site from harmful uses.

The Site construction and as-built surveys were completed between October 2018 and April 2019. Planting and baseline vegetation data collection occurred between February and April 2019. Minimal adjustments were made during construction and specific changes are detailed in Section 5.1. Baseline (MY0) profiles and cross-section dimensions closely match the design parameters with little variation. The Site has been built as designed and is expected to meet the upcoming monitoring year's success criteria.

LONE HICKORY MITIGATION SITE

As-Built Baseline Monitoring Report

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Section 1: PROJECT GOALS, BACKGROUND, AND ATTRIBUTES

1.1 Project Location and Setting

The Lone Hickory Mitigation Site (Site) is located in Yadkin County approximately 3.5 miles south of the town of Yadkinville, NC in the Yadkin River Basin HUC 03040101130020 and NCDWR Subbasin 03-07-02 (Figure 1). Located in the Inner Piedmont lithotectonic belt within the Piedmont physiographic province (NCGS, 1985), the project watershed is dominated by agricultural and forested land.

The Site contains two valleys, separated by a ridge that runs north to south through the project limits. South Deep Creek flows along the northern boundary of the project. On the east side of the ridge (herein referenced as the East Side), UT1 flows through a steep, narrow valley that gradually widens and flattens in slope as it flows downstream to the South Deep Creek floodplain. UT1 is joined by UT1A and UT1B within the Site limits before flowing offsite to join South Deep Creek. On the west side of the ridge (herein referenced as the West Side), UT2 and UT3 flow out of steep, narrow valleys into the broad, flat floodplain of South Deep Creek. UT2A and UT2B join UT2 before the stream's confluence with South Deep Creek. The East Side of the Site drains 0.44 square miles and the West Side of the Site drains 0.87 square miles of rural land.

Prior to construction activities, the Site has a history of use for both crop production and as a dairy farm resulting in degraded in-stream habitat and sediment erosion. Within the East Side of the Site, the streams were manipulated through ditching, impoundments, and land use changes. The West Side streams were ditched and re-routed with the adjacent floodplain previously altered for agricultural uses. The riparian buffers on both sides exhibited a lack of stabilizing streamside vegetation due to agricultural practices.

Pre-construction conditions are outlined in Table 4 of Appendix 1 and Table 6 of Appendix 2.

1.2 Project Goals and Objectives

The Site is providing numerous ecological benefits within the Yadkin Valley Basin. The project goals were established with careful consideration to address stressors that were identified in the NCDWR 2008 Yadkin River Basinwide Plan (NCDWR, 2008) and the RBRP (EEP, 2009). Improvements to water quality and ecological processes are outlined below as project goals and objectives.

Goals	Objectives
Improve stream channel stability.	Restore 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. Create stable tie-ins for tributaries joining restored channels. Add bank revetments and in-stream structures to protect restored streams.
Reconnect channels with historic floodplains and re-establish wetland hydrology and function in relic wetland areas.	Remove man-made impoundments, remove culvert crossings, and restore historic valley profile. Remove historic overburden from farm fields. Reconstruct stream channels with bankfull dimensions relative to the floodplain. Restore stream plan form to promote development of mutually beneficial stream/wetland complex.
Improve instream habitat.	Remove man-made impoundments and culvert crossings within easement. 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.
Reduce sediment and nutrient input from adjacent farm fields.	Construct two step pool stormwater conveyance and three dry detention BMPs to slow and treat runoff from farm fields before entering Site streams.
Restore and enhance native floodplain and wetland vegetation.	Plant native tree and understory species in riparian zone where currently insufficient.
Permanently protect the project site from harmful uses.	Establish a conservation easement on the Site.

1.3 Project Structure, Restoration Type and Approach

The final mitigation plan was submitted and accepted by DMS in October of 2017 and the IRT in December of 2017. Construction activities were completed in April 2019 by KBS Earthworks, Inc. Turner Land Surveying, PLLC. completed the as-built survey in April 2019. Planting was completed following construction in the spring of 2019 by Bruton Natural Systems, Inc. Field adjustments made during construction are described in further detail in section 5.1 and depicted in the Record Drawings in Appendix 4. Please refer to Appendix 1 for detailed project activity, history, contact information, and watershed/site background information.

1.3.1 Project Structure

Project mitigation components are outlined in the Project Components and Mitigation Credits Table (Table 1) and depicted in the Current Conditions Plan View Maps (Figures 3.0-3.5) that are located in Appendix 1.

1.3.2 Restoration Type and Approach

The design approach for this Site was chosen based on the surrounding landscape, climate, natural vegetation communities but also with thorough consideration to existing watershed conditions and trajectory. The project includes stream restoration and preservation, as well as wetland restoration. The specific proposed stream and wetland mitigation types are illustrated in Figure 2 and detailed below. The Site vegetative planting plan is depicted on sheet 3.0 through 3.10 of the record drawings located in Appendix 4.

East Side

At the beginning of UT1, upstream of the jurisdictional stream call, BMP1 was installed to treat concentrated agricultural runoff and was constructed as a Step Pool Conveyance System (SPSC). At the downstream extend of BMP1, UT1 becomes intermittent and the channel was reconnected to the valley bottom using Priority 1 restoration. As UT1 transitions to a perennial channel, its valley slope is over 6%; therefore, it was designed as a Ba-type stream with energy dissipating vertical steps. This approach continued throughout Reach 1. BMP2 was installed in the left floodplain of Reach 1 to capture and treat concentrated agricultural runoff. BMP2 discharges into Reach 1 near station 103+00 via a stabilized outlet channel.

UT1 Reach 2A begins at station 111+05 where the valley slope flattens to 3.1% and the design transitions to a Rosgen B-type stream. The stream was re-aligned to the center of the valley, and rock steps and long constructed riffles were used to dissipate energy. Reach 2A continues downslope to the confluence of UT1A at station 128+51 where Reach 2B begins. Here, the valley slope flattens to 2.3%, and the design transitions to a meandering Rosgen C-type stream.

UT1 Reach 3 begins at station 142+19 slightly downstream of where UT1B enters from the right floodplain. Reach 3 continues downstream as a Rosgen C-type stream with slightly larger dimensions to accommodate the increased watershed size. To treat the agricultural runoff and ditch erosion, a SPSC BMP (BMP3) was installed within an ephemeral ditch that enters Reach 3 from the right floodplain. Reach 4 starts at station 158+60 where the design approach changes to preservation with some minor enhancement features, such as bank stabilization and the addition of a few habitat structures. The two project tributaries to UT1 (UT1A and UT1B) were extended to tie into the new UT1 alignment and credited as preservation streams.

Native riparian vegetation was planted along UT1 and its tributaries in non-forested areas within the conservation easement. Open areas were planted at density of 605 stems. Disturbed areas outside of the easement were re-established with permanent grass.

West Side

The focus on this side of the Site was to holistically restore the bottom land by removing drainage ditches and overburden material and restoring the streams and wetlands to their natural position within the South Deep Creek floodplain. To accomplish these goals, a ditch that ran along the property boundary was filled up to the wetland area and UT3's hydrology was restored using Priority 1 restoration. UT3 flows northeasterly through the broad floodplain to connect with UT2A and UT2 before discharging into Deep South Creek. The downstream extent of UT3 Reach 3 was designed using a Priority 2 approach with a floodplain bench as it drops to meet the invert of South Deep Creek; however, the step height was limited to no more than 0.5 feet to allow aquatic species from South Deep Creek to navigate upstream into the newly restored design reaches.

UT2A was restored as a Rosgen C-type stream using Priority 1 restoration and flows northwesterly to connect with UT3 at station 309+82. A series of farm ditches that previously diverted UT2B's drainage

area from the channel were filled, and UT2B was restored as a Rosgen Cb-type stream within the center of its valley using Priority 1 restoration. UT2B flows westerly to join UT2 at station 215+19. A dry detention basin BMP (BMP4) was installed upstream of UT2B's inception point to treat agricultural drainage.

Native riparian vegetation was planted throughout the open floodplain areas of UT2A, UT2B, UT2, and UT3 to the extent of the conservation easement. Open areas were planted at density of 605 stems per acre. Disturbed areas outside of the easement were re-established with permanent grass.

The West Side of the Site includes the re-establishment of the stream wetland complex through the floodplain bottom to South Deep Creek. To improve wetland hydrology, grading was performed within the wetland zone to remove overburden, bring hydric soils within the top 12 inches of the soil, and restore the natural topography of the floodplain. Additionally, the wetland areas were disked and planted with native wetland plants.

1.4 Project History, Contacts and Attribute Data

The Site was restored by Wildlands 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 baseline information and attributes.

Section 2: PERFORMANCE STANDARDS

The stream and wetland performance criteria for the Site follow approved performance criteria presented in the Lone Hickory Mitigation Site Mitigation Plan (2017) and is based on performance criteria presented in the DMS Mitigation Plan Template (October 2015), the Annual Monitoring and Closeout Reporting Template (April 2015), and the Stream and Wetland Mitigation Guidance issued in October 2016 by the USACE. Annual monitoring and semi-annual site visits will be conducted to assess the condition of the finished project. Specific performance standard components are proposed for stream morphology, hydrology, vegetation, and wetland hydrology. Performance criteria will be evaluated throughout the seven-year post-construction monitoring period. The monitoring program designed to verify that performance standards are met is described in Section 3.

2.1 Streams

2.1.1 Dimension

Riffle cross-sections on the restoration reaches should be stable and should show little change in bankfull area, maximum depth ratio, and width-to-depth ratio. All riffle cross-sections should fall within the parameters defined for the designated stream type. 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. Remedial action would not be taken if channel changes indicate a movement toward stability. Please note that the downstream extent of UT3 Reach 3 was designed to deepen relative to its floodplain as it transitions to meet the invert of South Deep Creek and this reach is expected to have a bank height ratio greater than 1.0 and an entrenchment ratio less than 2.2.

2.1.2 Pattern and Profile

A longitudinal profile was conducted as part of the as-built survey to provide a baseline for comparison should it become necessary to perform longitudinal profile surveys later during monitoring and to insure accordance with design plans. Annual longitudinal profile surveys are not required during the seven-year monitoring period unless other indicators during the annual monitoring indicate a trend toward vertical and lateral instability. If a longitudinal profile is deemed necessary, monitoring will follow standards as described in the 2016 USACE Stream and Wetland Mitigation Guidance for the necessary reaches.

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

2.1.3 Substrate

A pebble count was conducted at each surveyed riffle to characterize the pavement during the baseline monitoring only. A reach-wide pebble count will be performed in each restoration reach for monitoring years 1, 2, 3, 5 and 7. Reach-wide counts will be conducted for classification purposes. Restoration reaches should show maintenance of coarser materials in the riffle features and finer particles in the pool features. Riffles may fine over the course of monitoring due to the stabilization of contributing watershed sediment sources.

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 of mid-channel bars 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. The four bankfull events must occur in separate years. In addition, restored intermittent channels (UT1 Reach 1, UT2A, and UT2B) will each have a stream gage pressure transducer installed midreach to document 30 consecutive days of flow.

2.2 Vegetation

The final vegetative performance standard will be the survival of 210 planted stems per acre in the planted riparian areas at the end of the required seven-year monitoring period. The interim measure of vegetative success for the Site will be the survival of at least 320 planted stems per acre at the end of MY3 and at least 260 stems per acre at the end of MY5. The extent of invasive species coverage will also be monitored and controlled as necessary throughout the required monitoring period.

2.3 Wetlands

The final performance standard for wetland hydrology will be a free groundwater surface within 12 inches of the ground surface for 19 consecutive days (9.2 percent) of the defined growing season for Yadkin County (April 4 through October 27) under typical precipitation conditions. This performance standard was determined through model simulations of post restoration conditions and comparison to reference wetland systems. If a gage does not meet the performance standard for a given monitoring year, rainfall patterns will be analyzed, and the hydrograph will be compared to that of the reference wetlands to assess whether atypical weather conditions occurred during the monitoring period. In addition, on-site soil temperatures corroborated with vegetative indicators, including bud burst and leaf drop, may be used as documentation to extend the growing season.

2.4 Visual Assessments

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 Template (April 2015), 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;
- Project Asset Map of major project elements;
- Photographs showing views of the restored Site taken from fixed point stations;
- Current Condition Plan View Map with monitoring features and current problem areas noted such as stability and easement encroachment based on the cross-section surveys and annual visual assessments;
- Assessment of the stability of the stream based on the cross-sections;

- Vegetative data as described above including the identification of any invasion by undesirable plant species;
- Groundwater gage plots;
- A description of damage by animals or vandalism;
- Maintenance issues and recommended remediation measures will be detailed and documented; and
- Wildlife observations.

Section 3: MONITORING PLAN & METHODOLOGY

Annual monitoring will consist of collecting morphologic, vegetative, and hydrologic data to assess the project success based on the restoration goals, as outlined in the Lone Hickory Mitigation Site Mitigation Plan (2017). Monitoring requirements will follow guidelines outlined in the DMS Annual Monitoring and Closeout Reporting Template (April 2015) and the USACE Stream and Wetland Mitigation Guidance (October 2016). Installed monitoring device and plot locations closely mimic the locations of those proposed in the Site's Mitigation Plan. Deviations from these locations were made when professional judgement deemed them necessary to better represent as-built field conditions or when installation of the device in the proposed location was not physically feasible. Project success will be assessed by measuring channel dimension, substrate composition, vegetation, surface water hydrology, groundwater hydrology and by analyzing photographs and performing visual assessments. Any high priority problem areas identified, such as unstable stream banks, bed instability, aggradation/degradation, or poor vegetation establishment will be evaluated on a case-by-case basis. The problem areas will be visually noted and reported to DMS staff in the annual report. Refer to Table 5 in Appendix 1 for the monitoring component summary.

3.1 Streams

Geomorphic assessments follow guidelines outlined in the Stream Channel Reference Sites: An Illustrated Guide to Field Techniques (Harrelson et al., 1994), methodologies utilized in the Rosgen stream assessment and classification documents (Rosgen, 1994 and 1996), and in the Stream Restoration: A Natural Channel Design Handbook (Doll et al., 2003). Please refer to Figures 3.0 through 3.5 in Appendix 1 for monitoring locations discussed below.

3.1.1 Dimension

To assess channel dimension performance, 32 permanent cross-sections were installed along stream restoration reaches to represent approximately 50% riffles and 50% pools and as defined in Table 23 and Table 24 of the Mitigation Plan. Cross-section locations were chosen in the field to be representative of the typical dimensions for each project reach. Each cross-section is permanently marked with rebar installed in concrete and ½ inch PVC pipes. Cross-section surveys will include points measured at all breaks in slope, including top of bank, bankfull, edge of water, and thalweg. Cross-section surveys will be conducted in monitoring years one, two, three, five, and seven. Photographs will be taken of the cross-sections looking upstream and downstream during the survey assessment.

3.1.2 Pattern and Profile

Longitudinal profile surveys will not be conducted during the seven-year post-construction monitoring period unless other indicators during the annual monitoring indicate a trend toward vertical and lateral instability. If a longitudinal profile is deemed necessary, monitoring will follow standards as described in the DMS Annual Monitoring and Closeout Reporting Template (April 2015), and the Stream Mitigation Guidelines issued in October 2016 by the USACE for the necessary reaches. Stream pattern and profile will be assessed visually as described below in Section 3.1.6.

3.1.3 Substrate

Reach-wide pebble count will be performed in each restoration reach for classification purposes and will be conducted in monitoring years one, two, three, five, and seven. Riffle 100-count substrate sampling will be collected during the baseline monitoring only to characterize pavement at as-built.

3.1.4 Photo Reference Points

A total of 44 permanent photograph reference points were established along the stream reaches after construction. Photographs will be taken once a year to visually document stability for the seven-year monitoring period. Permanent markers were established and located with GPS equipment so that the same locations and view directions on the site are photographed each year. Photos will be used to monitor all restoration and preservation stream reaches.

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

3.1.5 Hydrology Documentation

The occurrence of bankfull events will be documented throughout the seven-year monitoring period using pressure transducers, photographs, and visual assessments such as debris lines. Streamflow stage will be monitored using a continuous stage recorder (pressure transducer). A total of 6 stream gages were installed along restoration reaches. The stream gage pressure transducers installed on UT1 Reach 1, UT2A, and UT2B are to document 30 days of continuous flow. The stream gages will be downloaded semi-annually to determine if a bankfull event has occurred. Photographs will be used to document the occurrence of debris lines and sediment deposition observed during field visits. The transducer data will be plotted and included in the annual monitoring reports.

3.1.6 Visual Assessment

Visual assessments will be performed along stream reaches on a semi-annual basis during the seven-year monitoring period. Areas of concern, such as channel instability (i.e. lateral and/or vertical instability, in-stream structure failure/instability and/or piping, headcuts), vegetation health (i.e. low stem density, mortality, invasive species, and/or encroachment), beaver activity, or livestock trespass; will be mapped, photographed, and described in the annual monitoring reports. Problem areas will be re-evaluated during each subsequent visual assessment. Should remedial actions be required, recommendations will be provided in the annual monitoring report.

3.2 Vegetation

Vegetative plot monitoring will be conducted in post-construction monitoring years 1, 2, 3, 5, and 7. Permanent plots will be monitored in accordance with the guidelines and procedures developed by the Carolina Vegetation Survey-EEP Level 2 Protocol (Lee et al., 2006) and the 2016 USACE Stream and Wetland Mitigation Guidance to assess the vegetation success. For both permanent and random plots, all woody stems, including exotic and invasive species, should be counted. Supplemental plantings and volunteer plants must be present for at least two growing seasons before counting toward performance standards for monitoring years five and seven. Exotic/invasive species will not count toward success of performance standards.

A total of 25 permanent vegetation plots were established within the project easement area. Permanent vegetation plots were randomly established within the planted stream riparian buffer areas to capture the heterogeneity of the designed vegetative communities. The locations of permanent vegetation plots were chosen in the field using the same distribution throughout the planting areas, as shown in the Site's Mitigation Plan, and to best represent the planted areas within the easement. All of the plots were established as either a standard 10 meter by 10 meter square plot or a 5 meter by 20 meter plot. The vegetation plot corners have been marked and are recoverable either through field identification or with the use of a GPS unit. Reference photographs at the origin looking diagonally across the plot to the opposite corner were taken during the MY0 in April 2019. Subsequent assessments in monitoring years

one, two, three, five, and seven following baseline survey will capture the same reference photograph locations.

Individual permanent plot data will be provided and will include diameter, height, density, vigor, damage (if any), and percent survival. Planted woody stems will be marked during assessment as needed based on a known origin so they can be found in succeeding monitoring years. Mortality will be determined from the difference between the baseline year's living planted stems and the current year's living planted stems.

In addition, 15 mobile vegetation plots will be established in different locations throughout the planted conservation easement to evaluate the random vegetation performance for the Site. Mobile vegetation monitoring plot assessments will document stems, species, and height using a circular or 100 m^2 square/rectangular plot.

Please refer to Figures 3.0 through 3.5 in Appendix 1 for the permanent vegetation monitoring locations.

3.3 Wetlands

To monitor the wetland re-establishment area, nine groundwater monitoring gages were installed in March of 2019 per USACE recommended procedures within the wetland areas using In-situ Level TROLL® 100 pressure transducers. The locations of the installed gages closely mimic those of the Site's Mitigation Plan. Minor adjustments in these locations were made to best represent wetland topography or when installation of a gage met ground refusal. An additional gage was established in a nearby reference wetland and will be utilized to compare the hydrologic response within the restored wetland areas at the Site. The gages are set to record the groundwater level two times per day. The groundwater gages will be downloaded quarterly during site visits. The locations of the groundwater gages are denoted in Figures 3.0 through 3.5.

Section 4: ADAPTIVE MANAGEMENT AND CONTINGENCY PLAN

4.1 Adaptive Management Plan

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

Component/ Feature	Maintenance through project close-out
Stream	Routine channel maintenance and repair activities may include chinking of in-stream structures to prevent piping, securing of loose coir matting, and supplemental installations of live stakes and other target vegetation along the channel – these shall be conducted where success criteria are threatened or at the discretion of the Designer. Areas where storm water and floodplain flows intercept the channel may also require maintenance to prevent bank failures and head-cutting. Beaver activity will be monitored and beaver dams on project streams will typically be removed, at the discretion of the Designer, during the monitoring period to allow for bank stabilization and stream development outside of this type of influence.
Wetlands	Routine wetland maintenance and repair activities may include supplemental installations of target vegetation within the wetland. Areas where storm water and floodplain flows intercept the wetland may also require maintenance to prevent scour that adversely and persistently threatens wetland habitat or function.
Vegetation	Vegetation shall be maintained to ensure the health and vigor of the targeted community. Routine vegetation maintenance and repair activities may include supplemental planting, pruning, mulching, and fertilizing. Exotic invasive plant species requiring treatment per the Invasive Species Treatment Plan (Appendix 9) shall be treated in accordance with that plan and with NC Department of Agriculture (NCDA) rules and regulations.
Site Boundary	Site boundaries shall be identified in the field to ensure clear distinction between the mitigation site and adjacent properties. Boundaries may be identified by fence, marker, bollard, post, tree-blazing, or other means as allowed by site conditions and/or conservation easement. Boundary markers disturbed, damaged, or destroyed will be repaired and/or replaced on an as-needed basis.

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

Section 5: AS-BUILT CONDITION (BASELINE)

The Site construction and as-built surveys were completed in April 2019. The survey included developing an as-built topographic surface, locating the channel boundaries, structures, and cross-sections. For comparison purposes, during the baseline assessments, reaches were divided into assessment reaches in the same way that they were established for design parameters: UT1 Reach 1, UT1 Reach 2A, UT1 Reach 2B, UT1 Reach 3, UT1 Reach 4, UT1A, UT1B, UT2 Reach 1, UT2 Reach 2, UT2A, UT2B, UT3 Reach 1, UT3 Reach 2, and UT3 Reach 3.

5.1 Record Drawings

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

5.1.1 UT1

- Station 108+10 – 110+00: Valley grading was revised to reduce wetland impacts;
- Station 110+80 – 113+10: Alignment revised from the 230 LF in original design to 239 LF constructed in the field to save trees;
- Station 160+00: Brush toe was not installed due to field conditions;
- Station 160+00 – 160+70: Riffle material was added due to field conditions;
- Station 161+05 – 161+28: Boulder toe was added due to field conditions;
- Station 161+28: Boulder sill was not installed due to field conditions;
- Station 161+70 – 161+85: Brush toe was added due to field conditions; and
- Station 162+37 – 162+60: Brush toe was added due to field conditions.

5.1.2 UT2A

- Station 400+50 – 400+65: Brush toe was not installed due to field conditions;
- Station 400+86 – 400+96: Brush toe was not installed due to field conditions; and
- Station 401+11 – 401+22: Brush toe was not installed due to field conditions.

5.1.3 BMPs

- BMP2: Rock was added to the outlet for stability;
- BMP3: A detention basin with rock inlets and outlets was added; and
- BMP4: 4 Boulder sills were added to the overflow channel for stability.

5.1.4 Vegetation Planting Plan

- *Alnus serrulata* (tag alder) was not planted in the open area buffer planting zone.
- Shaded planting areas shown on the mitigation planting plan were evaluated based on the field conditions. Areas that warranted additional stems were supplemented with bare root plantings. Approximately 2 acres of the site required supplemental bare root plantings.

- *Quercus pagoda* (cherrybark oak) and *Quercus lyrata* (overcup oak) were planted in addition to *Quercus michauxii* (swamp chestnut oak) as alternatives in the open buffer planting areas. *Quercus pagoda* (cherrybark oak) was planted instead of *Quercus michauxii* (swamp chestnut oak) in the wetland planting area.

5.2 Baseline Data Assessment

MY0 was conducted between February and April 2019 with the vegetation data collection occurring between March and April 2019, immediately following planting. The first annual monitoring assessment (MY1) will be completed in the fall of 2019. The streams will be monitored for a total of seven years, with the final monitoring activities scheduled for 2025.

5.2.1 Morphological State of the Channel

As-built morphological data was collected between February 2019 and April 2019. Please refer to Appendix 2 for summary data tables, morphological plots, and stream photographs.

Profile

The MY0 profiles generally match the profile design parameters. On the design profiles, riffles were depicted as straight lines with consistent slopes. Variations from the design profile reflect field changes during construction as a result of field conditions. Additionally, as-built maximum bankfull depths slightly exceed design parameters for UT1 Reach 1, UT1 Reach 2A, and UT2. Variations in channel profile do not constitute a problem or indicate a need for remedial actions and will be assessed visually during the CCPV Site walks.

Dimension

The MY0 dimension numbers closely match the design parameters with minor variations. Over time as vegetation is established, the channels may narrow. This narrowing over time would not be seen as an indicator of instability in and of itself.

Pattern

The MY0 pattern metrics fell within acceptable ranges of the design parameters.

Bankfull Events

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

5.2.2 Vegetation

The overall MY0 planted density is 597 stems/acre, which exceeds the interim measure of vegetative success of at least 320 planted stems per acre at the end of the third monitoring year. Summary data and photographs of each plot can be found in Appendix 3.

5.2.3 Wetlands

Groundwater gage data will be reported in the annual MY1 report.

Section 6: REFERENCES

Doll, B.A., Grabow, G.L., Hall, K.A., Halley, J., Harman, W.A., Jennings, G.D., and Wise, D.E. 2003. Stream Restoration A Natural Channel Design Handbook.

Ecosystem Enhancement Program (EEP), February 2009. Upper Yadkin Pee-Dee River Basin Restoration Priorities.

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Lee, Michael T., Peet, Robert K., Steven D., Wentworth, Thomas R. 2006. CVS-EEP Protocol for Recording Vegetation Version 4.0. Retrieved from http://www.nceep.net/business/monitoring/veg/datasheets.htm

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Rosgen, D. L. 1994. A classification of natural rivers. *Catena* 22:169-199.

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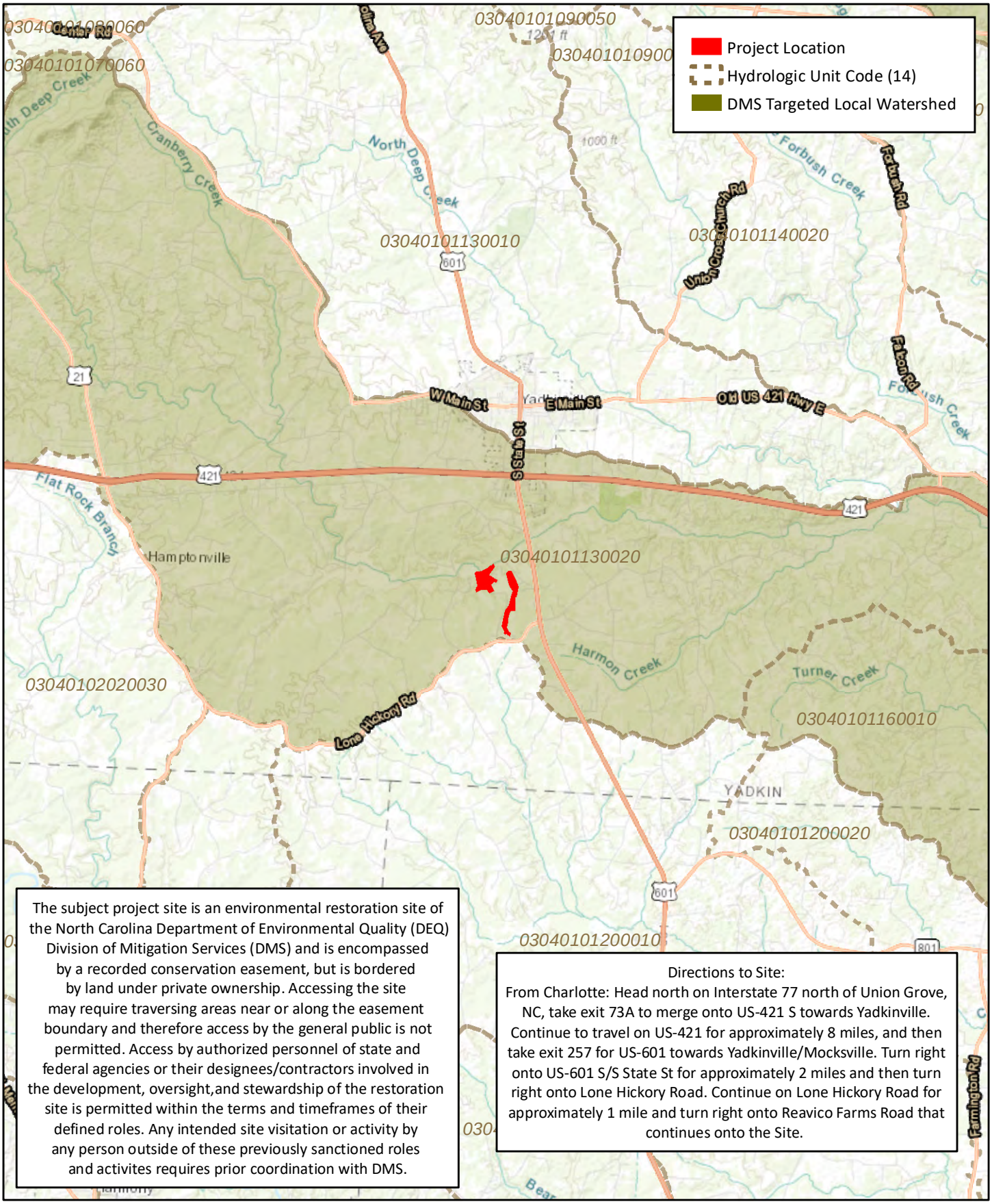
APPENDIX 1. General Figures and Tables



The subject project site is an environmental restoration site of the North Carolina Department of Environmental Quality (DEQ) Division of Mitigation Services (DMS) and is encompassed by a recorded conservation easement, but is bordered by land under private ownership. Accessing the site may require traversing areas near or along the easement boundary and therefore access by the general public is not permitted. Access by authorized personnel of state and federal agencies or their designees/contractors involved in the development, oversight,and stewardship of the restoration site is permitted within the terms and timeframes of their defined roles. Any intended site visitation or activity by any person outside of these previously sanctioned roles and activites requires prior coordination with DMS.

Directions to Site:
From Charlotte: Head north on Interstate 77 north of Union Grove, NC, take exit 73A to merge onto US-421 S towards Yadkinville. Continue to travel on US-421 for approximately 8 miles, and then take exit 257 for US-601 towards Yadkinville/Mocksville. Turn right onto US-601 S/S State St for approximately 2 miles and then turn right onto Lone Hickory Road. Continue on Lone Hickory Road for approximately 1 mile and turn right onto Reavico Farms Road that continues onto the Site.

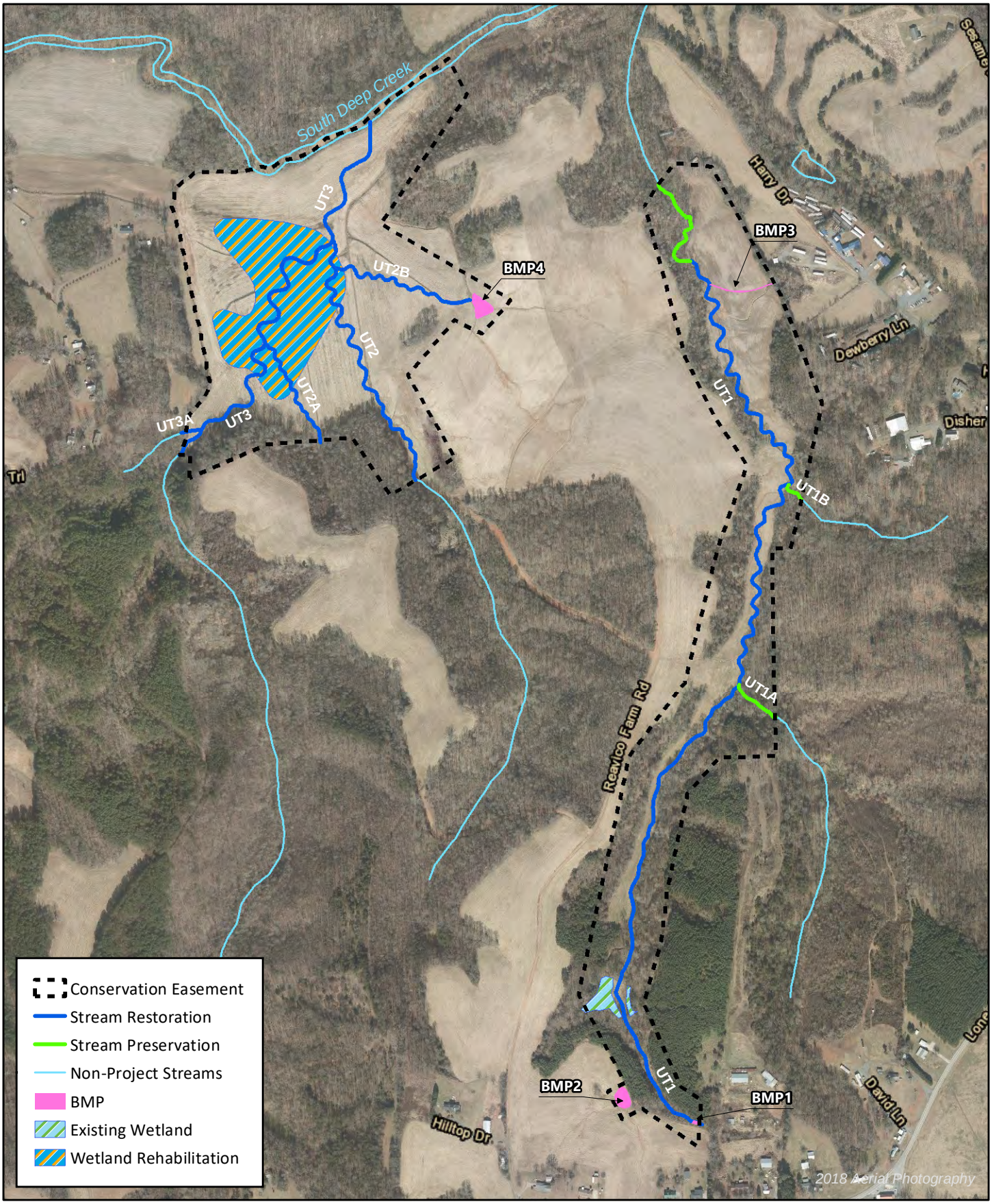
WILDLANDS ENGINEERING

0 1 2 Mile

N

Figure 1 Project Vicinity Map
Lone Hickory Mitigation Site
DMS Project No. 97135
Monitoring Year 0 - 2019

Yadkin County, NC



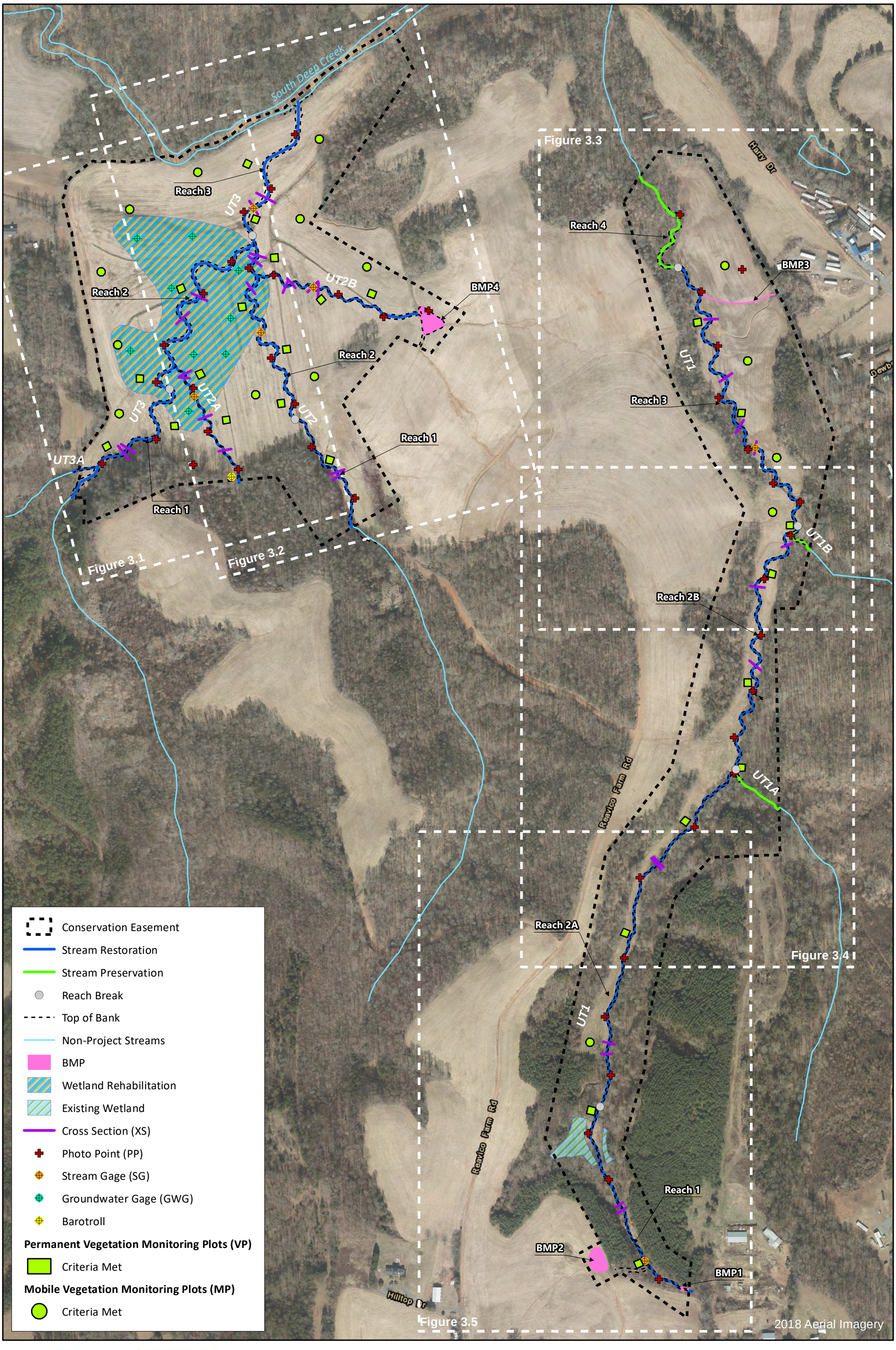
WILDLANDS ENGINEERING

0 350 700 Feet

N

Figure 2 Project Component/Asset Map
Lone Hickory Mitigation Site
DMS Project No. 97135
Monitoring Year 0 - 2019

Yadkin County, NC



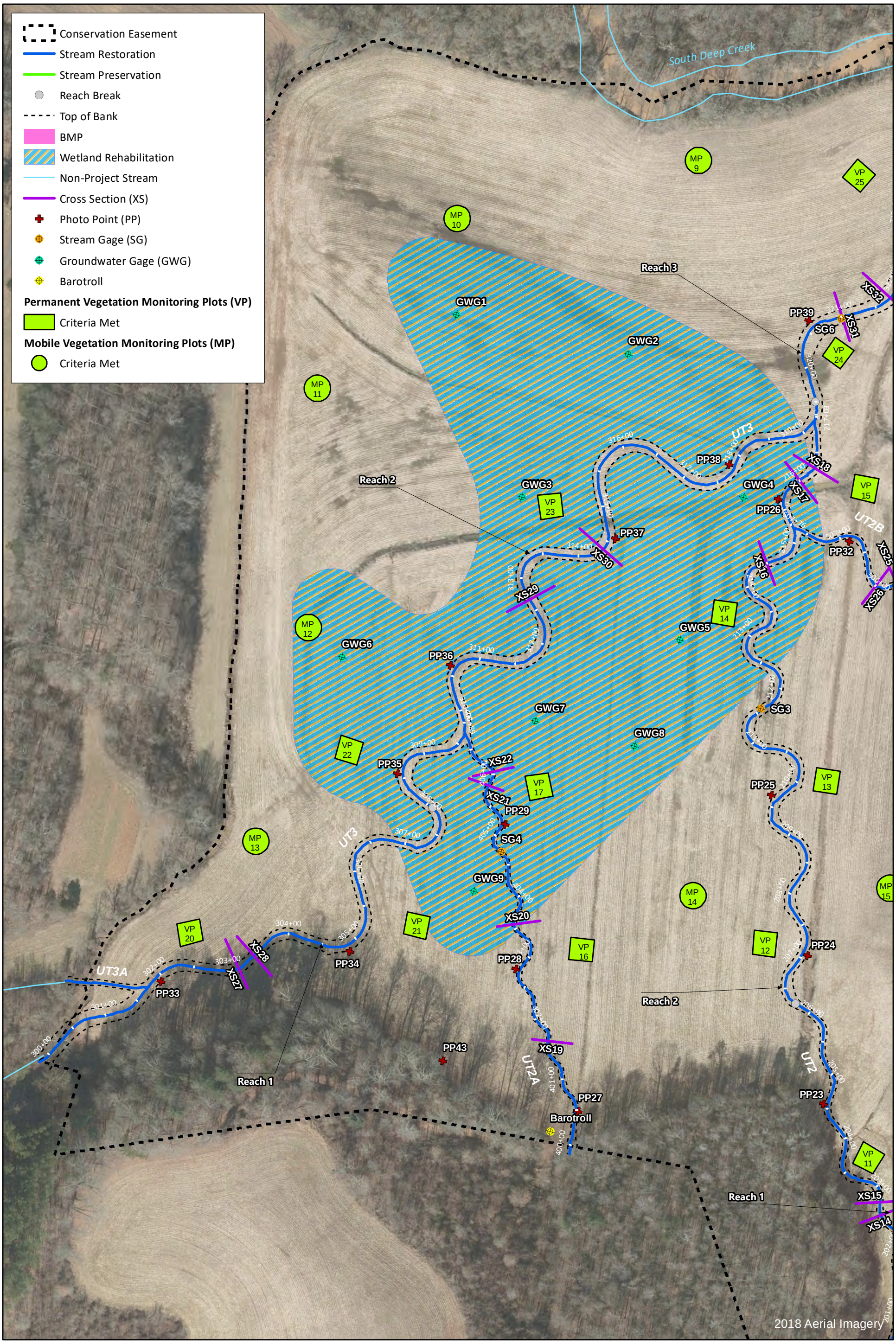
WILDLANDS ENGINEERING

0 400 800 Feet

N

Figure 3.0 Monitoring Plan View Map (Key)
Lone Hickory Mitigation Site
DMS Project No. 97135
Monitoring Year 0 - 2019

Yadkin County, NC

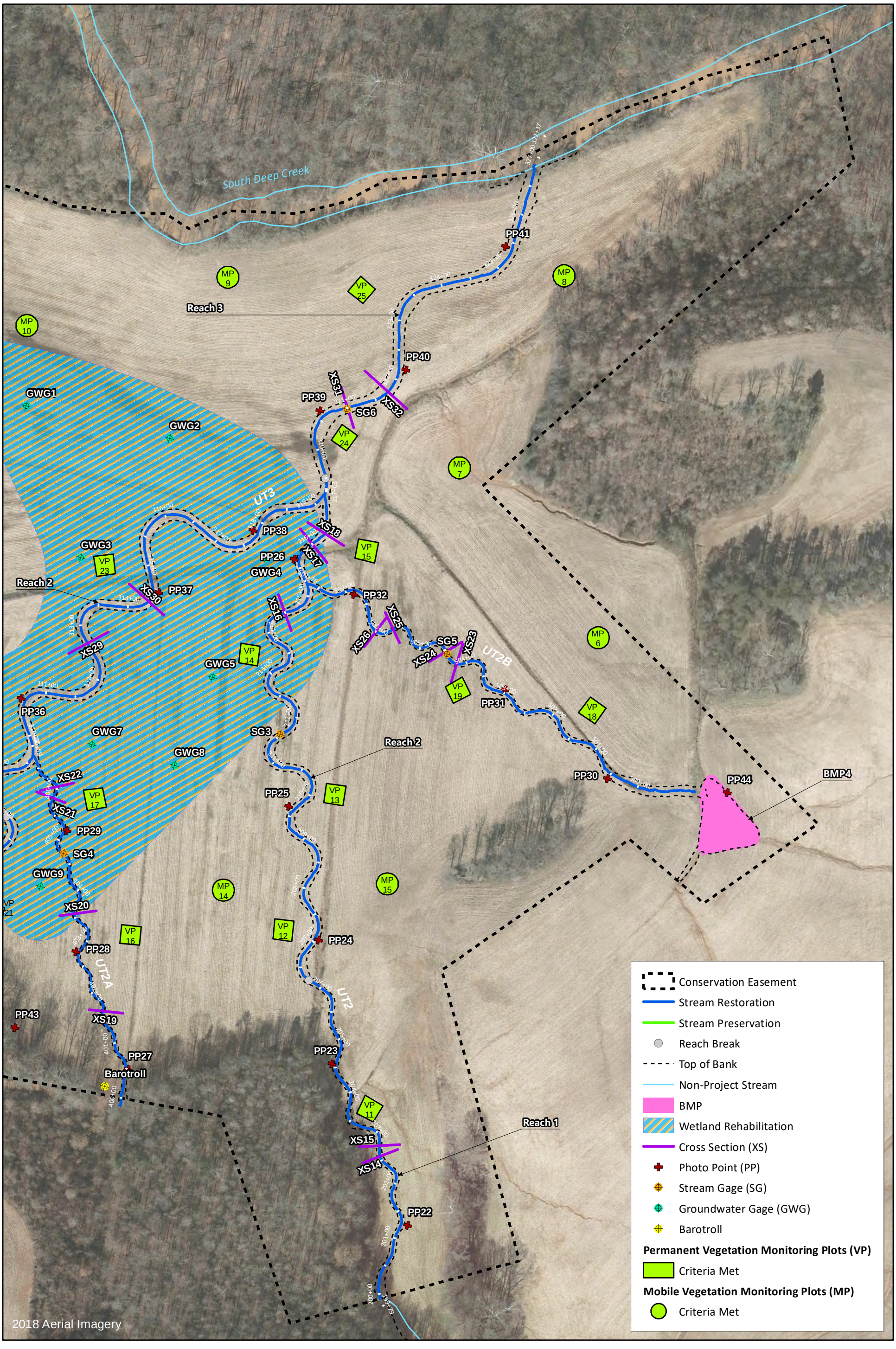


WILDLANDS ENGINEERING

0 125 250 Feet

Figure 3.1 Monitoring Plan View Map (Sheet 1)
Lone Hickory Mitigation Site
DMS Project No. 97135
Monitoring Year 0 - 2019

Yadkin County, NC

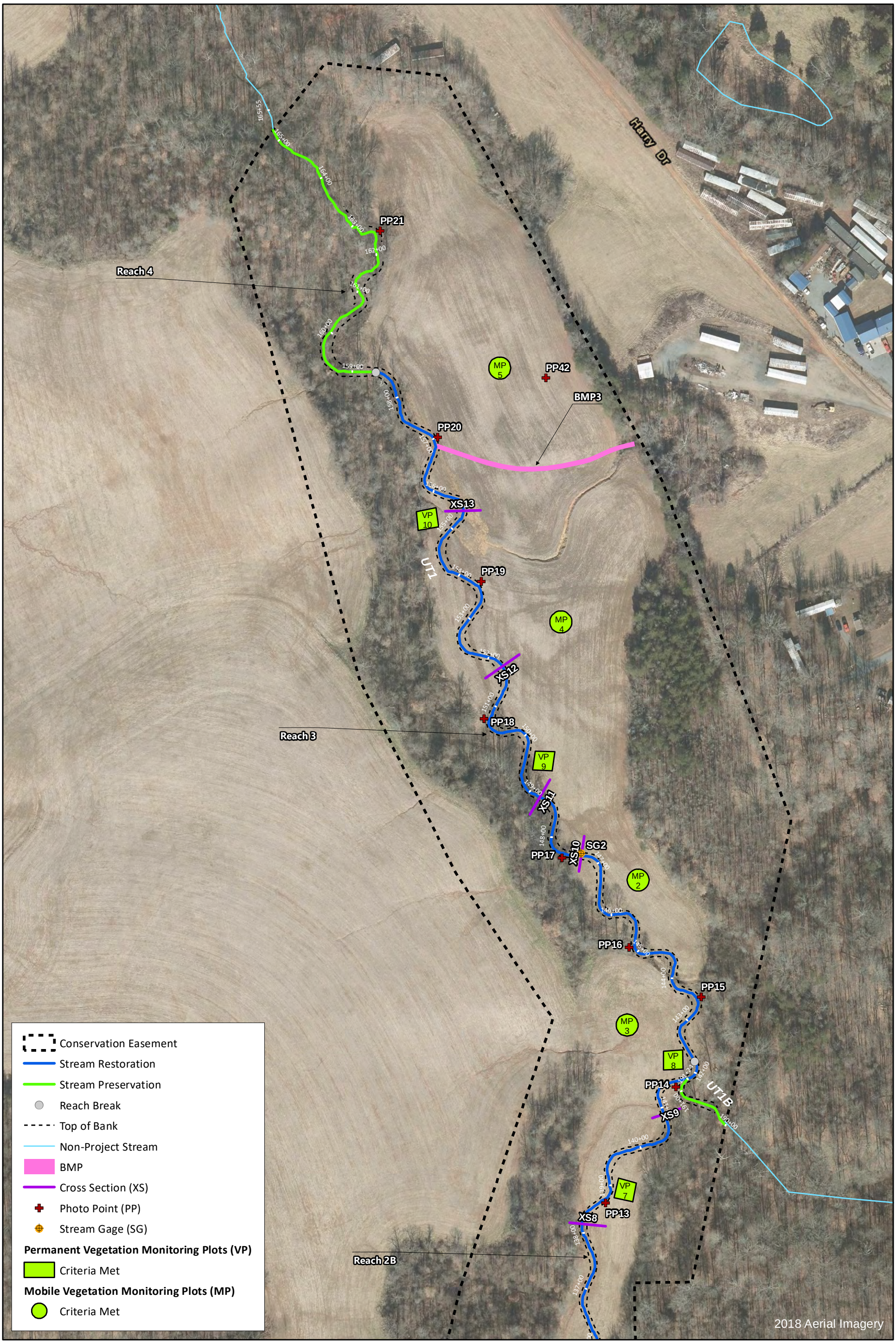


WILDLANDS ENGINEERING

0 150 300 Feet

Figure 3.2 Monitoring Plan View Map (Sheet 2)
Lone Hickory Mitigation Site
DMS Project No. 97135
Monitoring Year 0 - 2019

Yadkin County, NC



WILDLANDS ENGINEERING

0 150 300 Feet

N

Figure 3.3 Monitoring Plan View Map (Sheet 3)
Lone Hickory Mitigation Site
DMS Project No. 97135
Monitoring Year 0 - 2019

Yadkin County, NC

Conservation Easement
Stream Restoration
Stream Preservation
Reach Break
Top of Bank
Non-Project Stream
BMP
Cross Section (XS)
Photo Point (PP)
Stream Gage (SG)

Permanent Vegetation Monitoring Plots (VP)

Criteria Met

Mobile Vegetation Monitoring Plots (MP)

Criteria Met

PP16
PP15
PP14
PP13
PP12
PP11
PP10
PP9
PP8
PP7
PP6
XS9
XS8
XS7
XS6
XS5
MP 3
VP 8
VP 7
VP 6
VP 5
VP 4
VP 3
UT1B
UT1A
UT1
Reach 3
Reach 2B
Reach 2A
Reavico Farm Rd
2018 Aerial Imagery

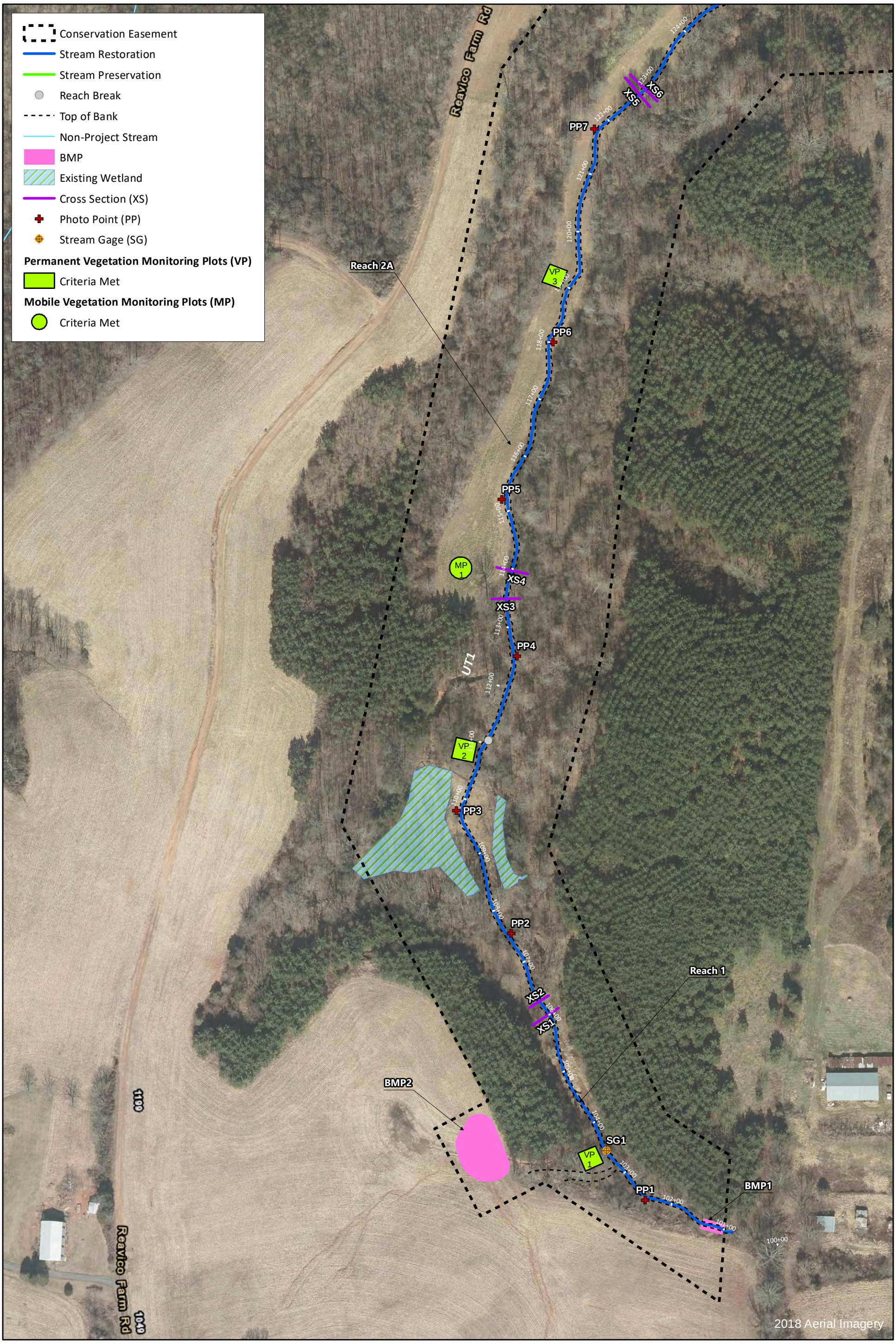
WILDLANDS ENGINEERING

0 150 300 Feet

N

Figure 3.4 Monitoring Plan View Map (Sheet 4)
Lone Hickory Mitigation Site
DMS Project No. 97135
Monitoring Year 0 - 2019

Yadkin County, NC



WILDLANDS ENGINEERING

0 150 300 Feet

N

Figure 3.5 Monitoring Plan View Map (Sheet 5)
Lone Hickory Mitigation Site
DMS Project No. 97135
Monitoring Year 0 - 2019

Yadkin County, NC

Table 1. Mitigation Assets and Components

Lone Hickory Mitigation Site
DMS Project No. 97135
Monitoring Year 0 - 2019

Project Components								
Project Area/Reach	**Existing Footage (LF) or Acreage**	**Mitigation Plan Footage/ Acreage**	**Mitigation Category**	**Restoration Level**	**Priority Level**	**Mitigation Ratio (X:1)**	**As-Built Footage/ Acreage**	**Project Credit [1 2]**
UT1, R1, R2a, R2b, R3	6,015	5,721	Warm	Restoration	P1, P2	1.000	5,721	6,698
UT1 R4	659	659	Warm	Preservation	P4	10.000	659	66
UT1A	230	282	Warm	Preservation	N/A	10.000	282	28
UT1B	48	124	Warm	Preservation	N/A	10.000	123	12
UT2 R1, R2	2,527	1,703	Warm	Restoration	P1, P2	1.000	1,703	1,933
UT2A	1,184	655	Warm	Restoration	P1	1.000	655	699
UT2B	699	784	Warm	Restoration	P1, P2	1.000	776	893
UT3 R1, R2, R3	2,008	2,702	Warm	Restoration	P1, P2	1.000	2,702	2,835
West Side Wetlands	N/A	9.5	Warm	Re-establishment		1.000	9.5	9.5

Project Credits							
Restoration Level	**Stream**			**Riparian Wetland**		**Non-Riparian Wetland**	**Coastal Marsh**
	Warm	**Cool**	**Cold**	**Riverine**	**Non-Riv**		
Restoration	13,058.000	N/A	N/A	9.500	N/A	N/A	N/A
Re-establishment				N/A	N/A	N/A	N/A
Rehabilitation				N/A	N/A	N/A	N/A
Enhancement				N/A	N/A	N/A	N/A
Enhancement I	N/A	N/A	N/A				
Enhancement II	N/A	N/A	N/A				
Creation				N/A	N/A	N/A	N/A
Preservation	106.000	N/A	N/A	N/A	N/A	N/A	
Totals	**13,164.000**	**N/A**	**N/A**	**9.500**	**N/A**	**N/A**	**N/A**

Notes:

1. No direct credit for BMPs.

2. Credits reported have been adjusted based on buffer width deviations from standard 50-foot buffer width.

Table 2. Project Activity and Reporting History

Lone Hickory Mitigation Site
DMS Project No. 97135
Monitoring Year 0 - 2019

Activity or Report		Data Collection Complete	Completion or Delivery
404 Permit		April 2018	April 2018
Mitigation Plan		July - December 2016	December 2017
Final Design - Construction Plans		June 2018	June 2018
Construction		Oct 2018 - April 2019	Oct 2018 - April 2019
Temporary S&E mix applied to entire project area[1]		Oct 2018 - April 2019	Oct 2018 - April 2019
Permanent seed mix applied to reach/segments		Oct 2018 - April 2019	Oct 2018 - April 2019
Bare root and live stake plantings for reach/segments		February 2019 - April 2019	April 2019
Baseline Monitoring Document (Year 0)		February 2019 - May 2019	June 2019
Year 1 Monitoring	Stream Survey	2019	November 2019
	Vegetation Survey	2019	
Year 2 Monitoring	Stream Survey	2020	November 2020
	Vegetation Survey	2020	
Year 3 Monitoring	Stream Survey	2021	November 2021
	Vegetation Survey	2021	
Year 4 Monitoring	Stream Survey	2022	November 2022
	Vegetation Survey	2022	
Year 5 Monitoring	Stream Survey	2023	November 2023
	Vegetation Survey	2023	
Year 6 Monitoring	Stream Survey	2024	November 2024
	Vegetation Survey	2024	
Year 7 Monitoring	Stream Survey	2025	November 2025
	Vegetation Survey	2025	

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

Table 3. Project Contact Table

Lone Hickory Mitigation Site
DMS Project No. 97135
Monitoring Year 0 - 2019

Designers Emily Reinicker, PE, CFM	**Wildlands Engineering, Inc.** 1430 South Mint Street, Suite 104 Charlotte, NC 28203 704.332.7754
Construction Contractors	**KBS Earthworks, Inc.** 5616 Coble Church Road Julian, NC 27283
Planting Contractor	**Bruton Natural Systems, Inc.** PO Box 1197 Freemont, NC 27830
Seeding Contractor	**KBS Earthworks, Inc.**
Seed Mix Sources	**KBS Earthworks, Inc.**
Nursery Stock Suppliers **Bare Roots** **Live Stakes** **Herbaceous Plugs**	**Bruton Natural Systems, Inc.**
Monitoring Performers	**Wildlands Engineering, Inc.**

Table 4. Project Information and Attributes
Lone Hickory Mitigation Site
DMS Project No. 97135
Monitoring Year 0 - 2019

Project Information	
Project Name	Lone Hickory Mitigation Site Yadkin County
Project Area (acres)	103.000
Project Coordinates (latitude and longitude)	36° 5' 39.16"N 80° 40' 2.14"W
Planted Acreage (Acre of Woody Stems Planted)	99.000

Project Watershed Summary Information	
Physiographic Province	Piedmont Physiographic Province
River Basin	Yadkin River
USGS Hydrologic Unit 8-digit	03040101
USGS Hydrologic Unit 14-digit	03040101130020
DWR Sub-basin	03-07-02
Project Drainage Area (acres)	286 (East Side), 170 (UT2 - West Side), 392 (UT3 – West Side)
Project Drainage Area Percentage of Impervious Area	3% (UT1 - East Side), 1% (UT2 – West Side), 2% (UT3 – West Side)
2011 NLCD Land Use Classification	UT1 - East Side: Forest (39%), Cultivated (42%), Grassland (4%), Shrubland (7%), Urban (8%), Open Water (0%) UT2 - West Side: Forest (31%), Cultivated (40%), Grassland (9%), Shrubland (10%), Urban (0%), Open Water (10%) UT3 - West Side: Forest (57%), Cultivated (22%), Grassland (5%), Shrubland (10%), Urban (3%), Open Water (3%)

Reach Summary Information

Parameters	UT1				UT1A	UT1B	UT2		UT2A	UT2B	UT3		
	R1	R2A/R2B	R3	R4			R1	R2			R1	R2	R3
Length of reach (linear feet) - Post-Restoration	966	3,114	1,641	659	282	123	623	1,080	655	776	779	1,159	764
Valley confinement (Confined, moderately confined, unconfined)	Confined	Confined to moderately confined			Confined	Confined	Moderately confined to unconfined		Unconfined	Unconfined	Moderately confined to unconfined		
Drainage area (acres)	286				92	31	170		27	6	392		
Perennial, Intermittent, Ephemeral	I/P	P	P	P	P	P	P		I/P	P	P		
NCDWR Water Quality Classification	WS-III				WS-III	WS-III	WS-III		WS-III	WS-III	WS-III		
Morphological Description (stream type) - Pre-Restoration	G, Straigthened E/G				-	-	G	G	G	G	G	G	G
Morphological Description (stream type) - Post-Restoration	A	B	C	-	-	-	B	C	C	C/Cb	Bc	C	C
Evolutionary trend (Simon's Model) - Pre- Restoration	III/IV/V				VI	VI	III/IV/V		III/IV/V	IV/V	IV/V		
FEMA classification	Last 400LF in Zone AE backwater from South Deep Creek				None	None	Zone AE backwater from South Deep Creek						

Wetland Summary Information

Parameters	West Side Wetlands
Size of Wetland (acres)	9.5
Wetland Type	Riparian Riverine
Mapped Soil Series	Codorus loam/Dan River and Comus soils
Drainage class	Somewhat poorly drainage/well drained
Soil Hydric Status	Yes/No
Source of Hydrology	Groundwater
Restoration or enhancement method (hydrologic, vegetative etc.)	Re-establishment

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	USACE Action ID #SAW-2017-00100
Division of Land Quality (Erosion and Sediment Control)	Yes	Yes	NPDES Construction Stormwater General Permit NCG010000
Endangered Species Act	Yes	Yes	Categorical Exclusion Document in Mitigation Plan
Historic Preservation Act	Yes	Yes	Categorical Exclusion Document in Mitigation Plan
Coastal Zone Management Act (CZMA)/Coastal Area Management Act (CAMA)	No	N/A	N/A
FEMA Floodplain Compliance	Yes	Yes	Yadkin County Floodplain Development Permit #2017-4.
Essential Fisheries Habitat	No	N/A	N/A

Table 5a. Monitoring Component Summary

Lone Hickory Mitigation Site
DMS Project No. 97135
Monitoring Year 0 - 2019

East Side

Parameter	Monitoring Feature	Quantity / Length by Reach						Frequency	Notes
		UT1 Reach 1	UT1 Reach 2	UT1 Reach 3	UT1 Reach 4	UT1A	UT1B		
Dimension	Riffle Cross-Section	1	4	2	N/A	N/A	N/A	Year 1, 2, 3, 5, and 7	1
	Pool Cross-Section	1	3	2	N/A	N/A	N/A		
Pattern	Pattern	N/A	N/A	N/A	N/A	N/A	N/A	N/A	2
Profile	Longitudinal Profile	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
Substrate	Reach Wide (RW) Pebble Count	1 RW	1 RW	1 RW	N/A	N/A	N/A	Year 1, 2, 3, 5, and 7	3
Hydrology	Crest Gage (CG) and or/Transducer (SG)	1 SG	1 CG & SG					Semi-Annual	4
Vegetation	CVS Level 2/Mobile plots	15 (10 permanent, 5 mobile)						Year 1, 2, 3, 5, and 7	5
Visual Assessment		Yes						Semi-Annual	
Exotic and Nuisance Vegetation								Semi-Annual	6
Project Boundary								Semi-Annual	7
Reference Photos	Photographs	22						Annual	

Notes:

1. Cross-sections were permanently marked with rebar to establish location. Surveys include points measured at all breaks in slope, including top of bank, bankfull, edge of water, and thalweg.
2. Pattern and profile will be assessed visually during semi-annual site visits. Longitudinal profile was collected during as-built baseline monitoring survey only, unless observations indicate widespread lack of vertical stability (greater than 10% of reach is affected) and profile survey is warranted in additional years to monitor adjustments or survey repair work.
3. Riffle 100-count substrate sampling were collected during the baseline monitoring only.
4. Crest gages and/or transducers will be inspected quarterly or semi-annually, evidence of bankfull events will be documented with a photo when possible. Transducers, if used, will be set to record stage once every 2 hours. The transducer will be inspected and downloaded semi-annually. A transducer will be installed on the intermittent portion of UT1 Reach 1 and in UT2A to document 30 days of continuous flow.
5. Permanent vegetation monitoring plot assessments will follow CVS Level 2 protocols. Mobile vegetation monitoring plot assessments will document number of planted stems, height, and species using a circular or 100 m2 square/rectangular plot. 2% of the non-shaded planted acreage will be monitored with permanent plots within the 50' stream buffer, and 1% of the non-shaded planted acreage will be monitored with mobile plots beyond the 50' stream buffer. Planted shaded areas will be visually assessed.
6. Locations of exotic and nuisance vegetation will be mapped.
7. Locations of vegetation damage, boundary encroachments, etc. will be mapped.

Table 5b. Monitoring Component Summary

Lone Hickory Mitigation Site
DMS Project No. 97135
Monitoring Year 0 - 2019

West Side

Parameter	Monitoring Feature	Quantity / Length by Reach								Frequency	Notes
		UT2 Reach 1	UT2 Reach 2	UT2A	UT2B	UT3 Reach 1	UT3 Reach 2	UT3 Reach 3	Wetland Re-establishment		
Dimension	Riffle Cross-Section	1	2	2	2.000	1	1	1	N/A	Year 1, 2, 3, 5, and 7	1
	Pool Cross-Section	1	1	2	2.000	1	1	1	N/A		
Pattern	Pattern	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	2
Profile	Longitudinal Profile	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
Substrate	Reach Wide (RW) Pebble Count	1 RW	1 RW	1 RW	1 RW	1 RW	1 RW	1 RW	N/A	Year 1, 2, 3, 5, and 7	3
Stream Hydrology	Crest Gage (CG) and/or Transducer (SG)	1 CG & SG		1 CG & SG	1 CG & SG	1 CG & SG			N/A	Semi-Annual	4
Wetland Hydrology	Groundwater Gages								9	Quarterly	
Vegetation	CVS Level 2/Mobile Plots	25 (15 permanent, 10 mobile)								Year 1, 2, 3, 5, and 7	5
Visual Assessment		Yes								Semi-Annual	
Exotic and Nuisance Vegetation										Semi-Annual	6
Project Boundary										Semi-Annual	7
Reference Photos	Photographs	22								Annual	

Notes:

1. Cross-sections were permanently marked with rebar to establish location. Surveys include points measured at all breaks in slope, including top of bank, bankfull, edge of water, and thalweg.

2. Pattern and profile will be assessed visually during semi-annual site visits. Longitudinal profile was collected during as-built baseline monitoring survey only, unless observations indicate widespread lack of vertical stability (greater than 10% of reach is affected) and profile survey is warranted in additional years to monitor adjustments or survey repair work.

3. Riffle 100-count substrate sampling was collected during the baseline monitoring only.

4. Crest gages and/or transducers will be inspected quarterly or semi-annually, evidence of bankfull events will be documented with a photo when possible. Transducers, if used, will be set to record stage once every 2 hours. The transducer will be inspected and downloaded semi-annually. A transducer will be installed on the intermittent portion of UT2A to document 30 days of continuous flow.

5. Permanent vegetation monitoring plot assessments will follow CVS Level 2 protocols. Mobile vegetation monitoring plot assessments will document number of planted stems, height, and species using a circular or 100 m2 square/rectangular plot. 2% of the non-shaded planted acreage will be monitored with permanent plots within the 50’ stream buffer, and 1% of the non-shaded planted acreage will be monitored with mobile plots beyond the 50’ stream buffer. Planted shaded areas will be visually assessed.

6. Locations of exotic and nuisance vegetation will be mapped.
7. Locations of vegetation damage, boundary encroachments, etc. will be mapped.

APPENDIX 2. Morphological Summary Data and Plots

Table 6a. Baseline Stream Data Summary
Lone Hickory Mitigation Site
DMS Project No. 97135
Monitoring Year 0 - 2019

East Side

Parameter	Gage	Pre-Restoration Condition						Design								As-Built/Baseline							
		UT1 Reach 1		UT1 Reach 2		UT1 Reach 3		UT1 Reach 1		UT1 Reach 2A		UT1 Reach 2B		UT1 Reach 3		UT1 Reach 1		UT1 Reach 2A		UT1 Reach 2B		UT1 Reach 3	
		Min	Max	Min	Max	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)		4.8		8.9		10.0		6.5		7.8		10.7		11.8		6.9		7.3		10.3	10.5	11.3	12.5
Floodprone Width (ft)		13.1		13.2		31.1		15	50	15	50	25	100	25	100	29		46	65+	49+	68+	60+	68+
Bankfull Mean Depth (ft)		0.8		0.8		1.3		0.5		0.5		0.8		0.8		0.6		0.6		0.8		0.7	
Bankfull Max Depth (ft)		1.4		1.3		1.9		0.6		0.7		1.0		1.0		1.0		0.9	1.0	1.2	1.3	1.1	
Bankfull Cross-sectional Area (ft^2)	N/A	3.8		7.2		13.4		3.0		4.2		8.1		9.5		4.2		4.5	4.6	7.9	8.5	8.3	8.7
Width/Depth Ratio		6.2		11.0		7.5		14.2		14.6		14.3		14.6		11.5		11.5	11.8	12.9	13.3	15.5	18.0
Entrenchment Ratio		2.7		1.5		3.1		2.2+		2.2+		2.2+		2.2+		4.2		6.3	9.0+	4.7+	6.6+	5.3+	5.4+
Bank Height Ratio		3.8		2.6		1.7		1.0		1.0		1.0		1.0		1.0		1.0		1.0		1.0	
D_{50} (mm)		15.1		41.0		19.6		---		---		---		---		59.6		37.0	37.9	35.6	45.0	41.6	47.4
Profile																							
Riffle Length (ft)																							
Riffle Slope (ft/ft)								0.020	0.041	0.011	0.055	0.018	0.045	0.016	0.048	N/A[1]	N/A[1]	0.003	0.068	0.013	0.072	0.013	0.055
Pool Length (ft)	N/A																						
Pool Max Depth (ft)		1.4		1.4		1.7		1.7		1.8		3.2		2.9		1.1	3.0	1.3	2.8	1.8	3.1	1.8	3.7
Pool Spacing (ft)		5	20	29	42	18	32	14	26	16	39	34	109	48	113	5	76	6	51	18	145	41	129
Pool Volume (ft^3)																							
Pattern																							
Channel Beltwidth (ft)		6	12	---		12	14	N/A[2]		N/A[2]		31	67	35	71	N/A[2]		N/A[2]		31	67	35	71
Radius of Curvature (ft)		3	8	---		5	12	N/A[2]		N/A[2]		20	38	19	38	N/A[2]		N/A[2]		20	38	19	38
Rc/Bankfull Width (ft/ft)	N/A	0.6	1.7	---		5	12	N/A[2]		N/A[2]		1.9	3.6	1.6	3.2	N/A[2]		N/A[2]		1.9	3.6	1.7	3.0
Meander Length (ft)		9	19	---		14	43	N/A[2]		N/A[2]		102	190	102	196	N/A[2]		N/A[2]		102	190	102	196
Meander Width Ratio		1.3	2.5	---		1.2	1.4	N/A[2]		N/A[2]		2.9	6.3	3.0	6.0	N/A[2]		N/A[2]		3.0	6.4	3.1	5.7
Substrate, Bed and Transport Parameters																							
Ri%/Ru%/P%/G%/S%																							
SC%/Sa%/G%/C%/B%/Be%																							
$D_{16}/D_{35}/D_{50}/D_{84}/D_{95}/D_{100}$	N/A	SC/0.37/3.7/54.2/75.9/128		1.35/11.0/38/90/193.1/2048		0.19/0.39/0.73/26.3/52.5/90										0.4/1.8/33.9/108/156.5/256		0.3/14.1/21.6/67.2/137/362		0.3/0.4/22.6/59.2/104.7/362		0.3/16/25.6/62.4/113.8/180	
Reach Shear Stress (Competency) lb/ft^2		---		---		---		1.74		0.95		0.75		0.76		1.97		1.06	1.08	0.85	0.88	0.65	0.68
Max part size (mm) mobilized at bankfull								228		146		123		125		97		52	53	42	43	32	33
Stream Power (Capacity) W/m^2																							
Additional Reach Parameters																							
Drainage Area (SM)		0.07		0.37		0.45		0.07		0.12		0.32		0.44		0.07		0.12		0.32		0.44	
Watershed Impervious Cover Estimate (%)		3%						3%								3%							
Rosgen Classification		E5b		G4		E4		A4		B4		C4		C4		A4		E4b		C4		C4	
Bankfull Velocity (fps)		2.9		4.8		4.1		4.1		3.7		3.8		4.0		4.8		3.9	4.0	4.1	4.2	3.7	3.8
Bankfull Discharge (cfs)		11		35		55		11		15		30		38		20.2		17.7	18.3	32.7	36.2	30.4	31.0
Q-NFF regression (2-yr)	N/A	---		---		---																	
Q-USGS extrapolation (1.2-yr)		---		---		---		11		16		34		42									
Max Q-Mannings		---		---		---		601		304		304		218									
Valley Slope (ft/ft)		0.0411		0.0454		0.0049		0.0648		0.0313		0.0225		0.0203		---		---		---		---	
Channel Thalweg Length (ft)		6,015						966		1,746		1,368		1,641		966		1,746		1,368		1,641	
Sinuosity		1.08		1.04		1.13						1.25		1.30						1.25		1.30	
Bankfull/Channel Slope (ft/ft)		0.0295		0.0256		0.0101		0.0622		0.0290		0.0180		0.0156		0.0555		0.0292		0.0182		0.0153	

1. UT1 Reach 1 riffle slopes were not calculated because this reach is comprised of a series of rock steps and cascades.

2. Pattern data is not applicable for A-type and B-type channels

SC: Silt/Clay <0.062 mm diameter particles

(---): Data was not provided

N/A: Not Applicable

Table 6b. Baseline Stream Data Summary
Lone Hickory Mitigation Site
DMS Project No. 97135
Monitoring Year 0 - 2019

West Side - UT2, UT2A, UT2B

		Pre-Restoration Condition										Design								As-built/Baseline							
Parameter	Gage	UT2 Reach 1		UT2 Reach 2		UT2 Reach 3		UT2A		UT2B		UT2 Reach 1		UT2 Reach 2		UT2A		UT2B		UT2 Reach 1		UT2 Reach 2		UT2A		UT2B	
		Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
Dimension and Substrate - Riffle																											
Bankfull Width (ft)	N/A	8.7		7.7		8.4		3.4	4.7	3.9	4.1	6.5		11.0		5.5		7.5		8.3		11.8	11.9	5.4	5.7	7.2	9.6
Floodprone Width (ft)		12.3		10.7		13.0		5.4	11.4	5.1	6.4	130+		250+		100+		100+		69+		65+	72+	51+	57+	56+	66+
Bankfull Mean Depth (ft)		0.7		0.8		0.7		0.5	0.7	0.3		0.5		0.7		0.4		0.5		0.7		0.8	0.9	0.4	0.4	0.5	0.5
Bankfull Max Depth (ft)		0.9		1.2		1.1		0.9		0.5	0.6	0.8		1.0		0.6		0.9		1.2		1.2	1.3	0.5	0.7	0.8	0.8
Bankfull Cross-sectional Area (ft^2)		5.7		6.1		5.7		2.2	2.3	1.3	1.4	3.9		7.8		2.1		4.1		6.1		9.1	10.2	1.9	2.4	3.9	4.3
Width/Depth Ratio		13.1		9.8		12.3		5.1	9.5	11.4	13.0	14.0		16.0		14.0		14.0		11.3		13.6	15.6	13.6	15.2	13.4	21.1
Entrenchment Ratio		1.4		1.1		1.5		1.6	2.4	1.2	1.6	2.2+		2.2+		2.2+		1.4	2.2+	8.3+		5.5+	6.1+	9.0+	10.5+	6.9+	7.8+
Bank Height Ratio		4.4		2.3		3.1		2.7	3.1	6.5	7.2	1.0		1.0		1.0		1.0		1.0		1.0		1.0		1.0	
D_{50} (mm)		34.4		11.4		---		---		---		---		---		---		---		26.9		25.4	33.4	21.0	28.1	25.1	30.6
Profile																											
Riffle Length (ft)	N/A																										
Riffle Slope (ft/ft)												0.020	0.034	0.003	0.025	0.006	0.045	0.004	0.056	0.006	0.034	0.004	0.035	0.001	0.046	0.001	0.037
Pool Length (ft)																											
Pool Max Depth (ft)		1.2		1.5		1.5		---		---		1.1	1.8	1.1	2.5	0.6	1.4	0.8	1.9	1.2	2.5	2.1	3.2	0.9	1.3	1.5	2.7
Pool Spacing (ft)		24	30	22	44	23	68	---		---		8	45	39	77	19	39	26	53	15	78	45	127	18	58	7	58
Pool Volume (ft^3)																											
Pattern																											
Channel Beltwidth (ft)	N/A	---		---		---		---		---		N/A[1]		39	88	19	44	26	60	N/A[1]		39	88	19	44	26	60
Radius of Curvature (ft)		---		---		---		---		---		N/A[1]		20	39	10	19	14	23	N/A[1]		20	39	10	19	14	23
Rc/Bankfull Width (ft/ft)		---		---		---		---		---		N/A[1]		1.8	3.5	1.8	3.5	1.8	3.0	N/A[1]		1.7	3.3	1.9	3.3	1.9	2.4
Meander Length (ft)		---		---		---		---		---		N/A[1]		72	154	36	77	49	105	N/A[1]		72	154	36	77	49	105
Meander Width Ratio		---		---		---		---		---		N/A[1]		3.5	8.0	3.5	8.0	3.5	8.0	N/A[1]		3.3	7.4	3.5	7.7	3.6	6.3
Substrate, Bed and Transport Parameters																											
Ri%/Ru%/P%/G%/S%	N/A																										
SC%/Sa%/G%/C%/B%/Be%																											
$D_{16}/D_{35}/D_{50}/D_{84}/D_{95}/D_{100}$		0.37/1.38/7.1/49.5/75.9/128		0.25/0.59/1.1/17.9/35.9/90				---		---		---		---		---		---		SC/SC/0.5/47.3/90/128		SC/SC/SC/42/71.7/180		SC/SC/0.5/42.5/90/180		SC/SC/0.4/43.3/82.6/256	
Reach Shear Stress (Competency) lb/ft^2		---		---		---		---		---		0.66		1.66		---		---		0.79		0.33	0.38	---		---	
Max part size (mm) mobilized at bankfull		---		---		---		---		---		112		221		---		---		39		16	19	---		---	
Stream Power (Capacity) W/m^2																											
Additional Reach Parameters																											
Drainage Area (SM)	N/A	0.14		0.26		0.27		0.02		0.04		0.14		0.26		0.02		0.05		0.14		0.26		0.02		0.05	
Watershed Impervious Cover Estimate (%)		1%						---		---		1%				---		---		1%				---		---	
Rosgen Classification		G4		G5		G5		G5		G5		B4		C4		C4		C/Cb4		E4		C4		C4		C4	
Bankfull Velocity (fps)		3.4		2.3		1.8		1.6	1.8	1.7	1.8	3.4		2.6		1.9		2.0		3.9		2.6	2.8	1.9	2.1	2.3	2.6
Bankfull Discharge (cfs)		19		14		10		4		2	3	14		20		4		8		24.0		23.6	28.9	3.7	5.1	10.1	10.1
Q-NFF regression (2-yr)		---		---		---		---		---																	
Q-USGS extrapolation (1.2-yr)		---		---		---		---		---		18		29		4		9									
Max Q-Mannings		---		---		---		---		---		331		75		52		124									
Valley Slope (ft/ft)		0.0205		0.0123		0.0086		0.0028		0.0027		0.0280		0.0045	0.0130	0.0057	0.0170	0.0060	0.0400	---		---		---		---	
Channel Thalweg Length (ft)		2,527						1,184		699		623		1080		655		776		623		1,080		655		776	
Sinuosity		1.01		1.02		1.05		1.00		1.00		1.10		1.30		1.20		1.20		1.10		1.30		1.20		1.20	
Bankfull/Channel Slope (ft/ft)		0.0154		0.0062		0.0043		0.0052		0.0107		0.0200		0.0030	0.0120	0.0050	0.0140	0.0040	0.0280	0.0180		0.0072		0.0110		0.0115	

1. Pattern data is not applicable for B-type channels
SC: Silt/Clay <0.062 mm diameter particles
(---): Data was not provided
N/A: Not Applicable

Table 6c. Baseline Stream Data Summary
Lone Hickory Mitigation Site
DMS Project No. 97135
Monitoring Year 0 - 2019

West Side - UT3

		Pre- Restoration				Design						As-Built/Baseline					
Parameter	**Gage**	**UT3 Reach 1**		**UT3 Reach 2**		**UT3 Reach 1**		**UT3 Reach 2**		**UT3 Reach 3**		**UT3 Reach 1**		**UT3 Reach 2**		**UT3 Reach 3**	
		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	11.2		10.0		13.0		16.2		19.0		13.7		16.7		19.2	
Floodprone Width (ft)		17.4		150+		75		100+		42	219	73+		76+		71+	
Bankfull Mean Depth (ft)		1.2		1.0		0.9		1.0		1.1		0.9		1.0		1.0	
Bankfull Max Depth (ft)		1.8		2.1		1.4		1.7		2.0		1.5		1.9		1.9	
Bankfull Cross-sectional Area (ft^2)		13.7		10.2		12.1		16.2		21.1		12.8		16.5		19.5	
Width/Depth Ratio		9.1		9.9		14.4		16.2		17.1		14.7		17.0		19.0	
Entrenchment Ratio		1.3		14.9+		1.4	2.2+	2.2+		2.2+		5.3+		4.5+		3.7+	
Bank Height Ratio		2.6		1.4		1.0		1.0		1.0		1.0		1.0		1.0	
D_{50} (mm)		12.5		0.9		---		---		---		50.0		31.2		47.0	
Profile																	
Riffle Length (ft)	N/A																
Riffle Slope (ft/ft)						0.012	0.017	0.002	0.022	0.002	0.008	0.001	0.023	0.002	0.012	0.0002	0.005
Pool Length (ft)																	
Pool Max Depth (ft)		1.9		2.7		1.9	3.3	1.5	3.5	1.7	3.9	2.8	3.9	2.5	4.1	3.3	3.9
Pool Spacing (ft)		12	87	48	185	169	1014	57	113	67	133	64	163	53	186	83	180
Pool Volume (ft^3)																	
Pattern																	
Channel Beltwidth (ft)	N/A	4	10	---		N/A[1]		57	130	67	152	N/A[1]		57	130	67	152
Radius of Curvature (ft)		4	8	---		N/A[1]		29	57	34	67	N/A[1]		29	57	34	67
Rc/Bankfull Width (ft/ft)		0.4	0.7	---		N/A[1]		1.8	3.5	1.8	3.5	N/A[1]		1.7	3.4	1.8	3.5
Meander Length (ft)		15	28	---		N/A[1]		105	227	124	266	N/A[1]		105	227	124	266
Meander Width Ratio		0.4	0.9	---		N/A[1]		3.5	8.0	3.5	8.0	N/A[1]		3.4	7.8	3.5	7.9
Substrate, Bed and Transport Parameters																	
Ri%/Ru%/P%/G%/S%	N/A																
SC%/Sa%/G%/C%/B%/Be%																	
$D_{16}/D_{35}/D_{50}/D_{84}/D_{95}/D_{100}$		0.22/0.87/2.5/22.6/47.7/64		SC/0.12/0.24/4.63/7.7/16		---		---		---		SC/0.2/0.4/59.2/107.3/180		SC/SC/0.2/41.6/61.5/180		SC/SC/SC/64/151.8/362	
Reach Shear Stress (Competency) lb/ft^2		---		---		0.61		---		---		0.42		---		---	
Max part size (mm) mobilized at bankfull		---		---		106		---		---		21		---		---	
Stream Power (Capacity) W/m^2																	
Additional Reach Parameters																	
Drainage Area (SM)	N/A	0.59		0.65		0.63		0.63		0.88		0.63		0.63		0.88	
Watershed Impervious Cover Estimate (%)		2%				2%						2%					
Rosgen Classification		G4		G5		B4c		C4		C4		C4		C4		C4	
Bankfull Velocity (fps)		4.0		2.0		3.6		2.7		1.8		3.0		1.9		0.8	
Bankfull Discharge (cfs)		54.8		20.4		45		45		55		38.6		31.1		16.0	
Q-NFF regression (2-yr)		---		---		---		---		---							
Q-USGS extrapolation (1.2-yr)		---		---		53		56		71							
Max Q-Mannings		---		---		370		39		N/A[2]							
Valley Slope (ft/ft)		0.0145		0.0050		0.0120		0.0030	0.0140	0.0022		---		---		---	
Channel Thalweg Length (ft)		2,008				779		1159		764		779		1,159		764	
Sinuosity		1.06		1.01		1.10		1.40		1.20		1.10		1.40		1.20	
Bankfull/Channel Slope (ft/ft)		0.0107		0.0034		0.0110		0.0020	0.0110	0.0020		0.0075		0.0027		0.0005	

1. Pattern data is not applicable for B-type channels

2. UT3 Reach 3 post-restoration combines flow from the existing conditions UT2 Reach 3 and UT3.

SC: Silt/Clay <0.062 mm diameter particles

(---): Data was not provided

N/A: Not Applicable

Table 7. Reference Reach Data Summary
Lone Hickory Mitigation Site
DMS Project No. 97135
Monitoring Year 0 - 2019

Parameter	Gage	Reference Reach Data															
		UT to Kelly Branch		Pilot Mountain Trib		Lone Hickory UT3 - Onsite Reference		UT to South Crowders		UT to S. Fork Catawba - Vile Preserve		UT to Lyle Creek		Deep Creek Mitigation		Cooleemee Plantation	
		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	6.4		8.6		6.7		6.1	8.4	6.1	6.2	7.0	8.6	12.9		14.7	18.1
Floodprone Width (ft)		9.1		13.3		20.0		26.0	31.0	200+		45.0	49.0	135.0		140+	
Bankfull Mean Depth		0.7		0.7		0.5		1.0	1.1	0.7	0.8	0.5		1.4		0.8	1.0
Bankfull Max Depth		0.9		1.0		0.8		1.4		1.3	1.4	1.0	1.1	2.3		1.6	
Bankfull Cross-sectional Area (ft^2)		4.5		6.0		3.6		6.4	8.7	4.5	5.3	3.5	4.1	17.1		13.6	14.9
Width/Depth Ratio		9.2		12.5		13.4		5.8	8.0	7.4	8.3	14.9	18.3	9.6		14.6	24.1
Entrenchment Ratio		1.4		1.5		3.0		3.7	4.3	30+		5.7	6.4	10.5		8.8+	
Bank Height Ratio		1.0		1.0		1.0		1.4	2.1	1.0		1.0		1.0		1.0	
D50 (mm)		9.4		---		---		---		---		---		---		---	
Profile																	
Riffle Length (ft)	N/A	---		---		---		---		---		---		---		---	
Riffle Slope (ft/ft)		---		0.0150	0.1200	0.0229	0.0615	0.0202	0.0664	0.0260		0.0055	0.0597	0.0019	0.009	0.0027	0.0130
Pool Length (ft)		---		---		---		---		---		---		---		---	
Pool Max Depth (ft)		---		1.6		2.0		1.3	3	1.4		1.3		3.2		2.0	
Pool Spacing (ft)		---		7	52	13	77	28	63	45		15	28	29	103	19	35
Pool Volume (ft^3)																	
Pattern																	
Channel Beltwidth (ft)	N/A	18	34	---		12	31	81		---		21		45	71	22	30
Radius of Curvature (ft)		8	26	---		---		9	20	---		19	32	18	33	14	38
Rc/Bankfull Width (ft/ft)		1.2	4.1	---		---		1.5	2.4	---		2.7	3.7	1.4	2.6	0.9	2.3
Meander Length (ft)		27	94	---		55		45	72	---		39	44	95	130	58	70
Meander Width Ratio		2.8	5.3	---		1.8	4.6	9.6	13.3	---		2.4	3.0	3.5	5.5	1.3	1.8
Substrate, Bed and Transport Parameters																	
Ri%/Ru%/P%/G%/S%	N/A																
SC%/Sa%/G%/C%/B%/Be%																	
d16/d35/d50/d84/d95/d100		0.25/3.2/9.4/45/140/---		SC/5.6/20.1/128/322.5/>2048		0.2/1.5/16.8/69.7/115.7/180		0.8/12.1/19.7/49.5/75.9/180		---		NA/0.07/0.17/0.54/4.0/8.0		SC/0.2/0.2/1.1/8.9/22.6		---	
Reach Shear Stress (Competency) lb/ft^2																	
Max part size (mm) mobilized at bankfull																	
Stream Power (Capacity) W/m^2																	
Additional Reach Parameters																	
Drainage Area (SM)	N/A	0.08		0.27		0.17		0.22		0.94		0.25		0.67		0.68	
Watershed Impervious Cover Estimate (%)		---		---		---		---		---		---		---		---	
Rosgen Classification		A4		B4		C4		E4		E5		C5		C5		C5	
Bankfull Velocity (fps)		4.4		5.3		3.2		2.9		11		4.7		2.4		1.8	
Bankfull Discharge (cfs)		19		32		12		22		54		18		41		26	
Q-NFF regression (2-yr)																	
Q-USGS extrapolation (1.2-yr)																	
Q-Mannings																	
Valley Length (ft)		---		---		---		---		---		---		---		---	
Channel Thalweg Length (ft)		---		---		---		---		---		---		---		---	
Sinuosity		1.2		1.05		1.32		2.20		1.03		1.10		1.60		1.10	
Water Surface Slope (ft/ft)		---		---		---		---		---		---		---		---	
Bankfull/Channel Slope (ft/ft)		0.03 - 0.065		0.0378		0.0185		0.0091		0.0068		0.0057		0.0028		0.0027	

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

Table 8a. Morphology and Hydraulic Summary (Dimensional Parameters - Cross-Section)
Lone Hickory Mitigation Site
DMS Project No. 97135
Monitoring Year 0 - 2019

East Side

	UT1 Reach 1 Cross-Section 1, Pool								UT1 Reach 1 Cross-Section 2, Riffle								UT1 Reach 2A Cross-Section 3, Pool								UT1 Reach 2A Cross-Section 4, Riffle								UT1 Reach 2A Cross-Section 5, Riffle							
Dimension and Substrate	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**MY6**	**MY7**	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**MY6**	**MY7**	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**MY6**	**MY7**	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**MY6**	**MY7**	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**MY6**	**MY7**
bankfull elevation	918.84								918.21								870.19								868.46								844.23							
Bankfull Width (ft)	8.2								6.9								9.2								7.3								7.3							
Floodprone Width (ft)	---								29								---								46								65+							
Bankfull Mean Depth (ft)	1.0								0.6								1.2								0.6								0.6							
Bankfull Max Depth (ft)	1.8								1.0								2.1								0.9								1.0							
Bankfull Cross-Sectional Area (ft^2)	8.5								4.2								11.4								4.5								4.6							
Bankfull Width/Depth Ratio	7.8								11.5								7.4								11.8								11.5							
Bankfull Entrenchment Ratio	---								4.2								---								6.3								9.0+							
Bankfull Bank Height Ratio	---								1.0								---								1.0								1.0							

	UT1 Reach 2A Cross-Section 6, Pool								UT1 Reach 2B Cross-Section 7, Riffle								UT1 Reach 2B Cross-Section 8, Pool								UT1 Reach 2B Cross-Section 9, Riffle								UT1 Reach 3 Cross-Section 10, Riffle							
Dimension and Substrate	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**MY6**	**MY7**	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**MY6**	**MY7**	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**MY6**	**MY7**	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**MY6**	**MY7**	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**MY6**	**MY7**
bankfull elevation	843.72								817.28								809.31								804.58								794.10							
Bankfull Width (ft)	9.1								10.3								12.6								10.5								11.3							
Floodprone Width (ft)	---								68+								---								49+								60+							
Bankfull Mean Depth (ft)	1.2								0.8								1.2								0.8								0.7							
Bankfull Max Depth (ft)	1.9								1.2								2.6								1.3								1.1							
Bankfull Cross-Sectional Area (ft^2)	10.5								7.9								15.4								8.5								8.3							
Bankfull Width/Depth Ratio	7.9								13.3								10.3								12.9								15.5							
Bankfull Entrenchment Ratio	---								6.6+								---								4.7+								5.3+							
Bankfull Bank Height Ratio	---								1.0								---								1.0								1.0							

	UT1 Reach 3 Cross-Section 11, Riffle								UT1 Reach 3 Cross-Section 12, Pool								UT1 Reach 3 Cross-Section 13, Pool							
Dimension and Substrate	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**MY6**	**MY7**	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**MY6**	**MY7**	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**MY6**	**MY7**
bankfull elevation	791.15								787.94								783.88							
Bankfull Width (ft)	12.5								16.7								15.6							
Floodprone Width (ft)	68+								---								---							
Bankfull Mean Depth (ft)	0.7								1.1								1.4							
Bankfull Max Depth (ft)	1.1								2.4								2.6							
Bankfull Cross-Sectional Area (ft^2)	8.7								18.7								22.4							
Bankfull Width/Depth Ratio	18.0								14.8								10.9							
Bankfull Entrenchment Ratio	5.4+								---								---							
Bankfull Bank Height Ratio	1.0								---								---							

Table 8b. Morphology and Hydraulic Summary (Dimensional Parameters - Cross-Section)
Lone Hickory Mitigation Site
DMS Project No. 97135
Monitoring Year 0 - 2019

West Side

	UT2 Reach 1 Cross-Section 14, Pool								UT2 Reach 1 Cross-Section 15, Riffle								UT2 Reach 2 Cross-Section 16, Riffle								UT2 Reach 2 Cross-Section 17, Riffle								UT2 Reach 2 Cross-Section 18, Pool							
Dimension and Substrate	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**MY6**	**MY7**	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**MY6**	**MY7**	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**MY6**	**MY7**	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**MY6**	**MY7**	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**MY6**	**MY7**
bankfull elevation	772.71								772.61								759.49								758.87								758.62							
Bankfull Width (ft)	9.3								8.3								11.8								11.9								15.2							
Floodprone Width (ft)	---								69+								65+								72+								---							
Bankfull Mean Depth (ft)	0.8								0.7								0.9								0.8								1.4							
Bankfull Max Depth (ft)	1.5								1.2								1.3								1.2								2.5							
Bankfull Cross-Sectional Area (ft^2)	7.6								6.1								10.2								9.1								21.8							
Bankfull Width/Depth Ratio	11.4								11.3								13.6								15.6								10.6							
Bankfull Entrenchment Ratio	---								8.3+								5.5+								6.1+								---							
Bankfull Bank Height Ratio	---								1.0								1.0								1.0								---							

	UT2A Cross-Section 19, Riffle								UT2A Cross-Section 20, Pool								UT2A Cross-Section 21, Riffle								UT2A Cross-Section 22, Pool								UT2B Cross-Section 23, Pool							
Dimension and Substrate	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**MY6**	**MY7**	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**MY6**	**MY7**	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**MY6**	**MY7**	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**MY6**	**MY7**	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**MY6**	**MY7**
bankfull elevation	763.99								761.60								760.53								760.53								761.34							
Bankfull Width (ft)	5.4								6.9								5.7								7.2								9.9							
Floodprone Width (ft)	57+								---								51+								---								---							
Bankfull Mean Depth (ft)	0.4								0.6								0.4								0.6								0.9							
Bankfull Max Depth (ft)	0.5								1.2								0.7								1.1								1.6							
Bankfull Cross-Sectional Area (ft^2)	1.9								4.1								2.4								4.3								8.8							
Bankfull Width/Depth Ratio	15.2								11.6								13.6								12.1								11.2							
Bankfull Entrenchment Ratio	10.5+								---								9.0+								---								---							
Bankfull Bank Height Ratio	1.0								---								1.0								---								---							

	UT2B Cross-Section 24, Riffle								UT2B Cross-Section 25, Riffle								UT2B Cross-Section 26, Pool								UT3 Reach 1 Cross-Section 27, Pool								UT3 Reach 1 Cross-Section 28, Riffle							
Dimension and Substrate	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**MY6**	**MY7**	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**MY6**	**MY7**	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**MY6**	**MY7**	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**MY6**	**MY7**	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**MY6**	**MY7**
bankfull elevation	761.16								760.67								760.71								766.07								765.76							
Bankfull Width (ft)	9.6								7.2								12.2								16.0								13.7							
Floodprone Width (ft)	66+								56+								---								---								73+							
Bankfull Mean Depth (ft)	0.5								0.5								1.3								1.4								0.9							
Bankfull Max Depth (ft)	0.8								0.8								2.6								2.6								1.5							
Bankfull Cross-Sectional Area (ft^2)	4.3								3.9								15.8								21.7								12.8							
Bankfull Width/Depth Ratio	21.1								13.4								9.4								11.9								14.7							
Bankfull Entrenchment Ratio	6.9+								7.8+								---								---								5.3+							
Bankfull Bank Height Ratio	1.0								1.0								---								---								1.0							

	UT3 Reach 2 Cross-Section 29, Riffle								UT3 Reach 2 Cross-Section 30, Pool								UT3 Reach 3 Cross-Section 31, Riffle								UT3 Reach 3 Cross-Section 32, Pool							
Dimension and Substrate	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**MY6**	**MY7**	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**MY6**	**MY7**	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**MY6**	**MY7**	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**MY6**	**MY7**
bankfull elevation	759.75								759.40								758.39								758.36							
Bankfull Width (ft)	16.7								18.7								19.2								25.8							
Floodprone Width (ft)	76+								---								71+								---							
Bankfull Mean Depth (ft)	1.0								1.4								1.0								1.8							
Bankfull Max Depth (ft)	1.9								2.6								1.9								3.8							
Bankfull Cross-Sectional Area (ft^2)	16.5								26.3								19.5								45.8							
Bankfull Width/Depth Ratio	17.0								13.3								19.0								14.5							
Bankfull Entrenchment Ratio	4.5+								---								3.7+								---							
Bankfull Bank Height Ratio	1.0								---								1.0								---							

Longitudinal Profile Plots

Lone Hickory Mitigation Site

DMS Project No. 97135

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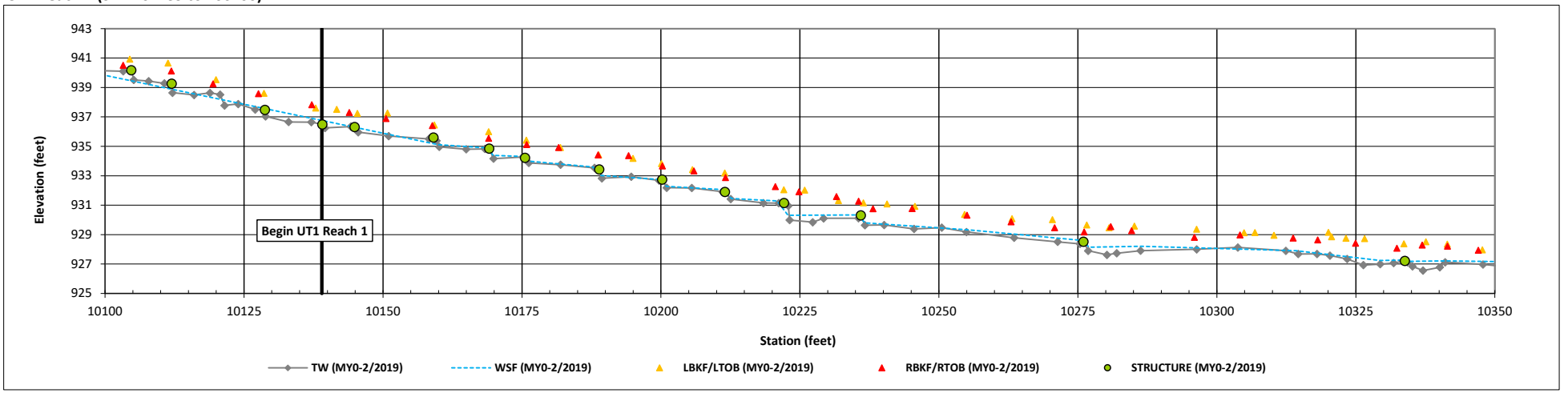
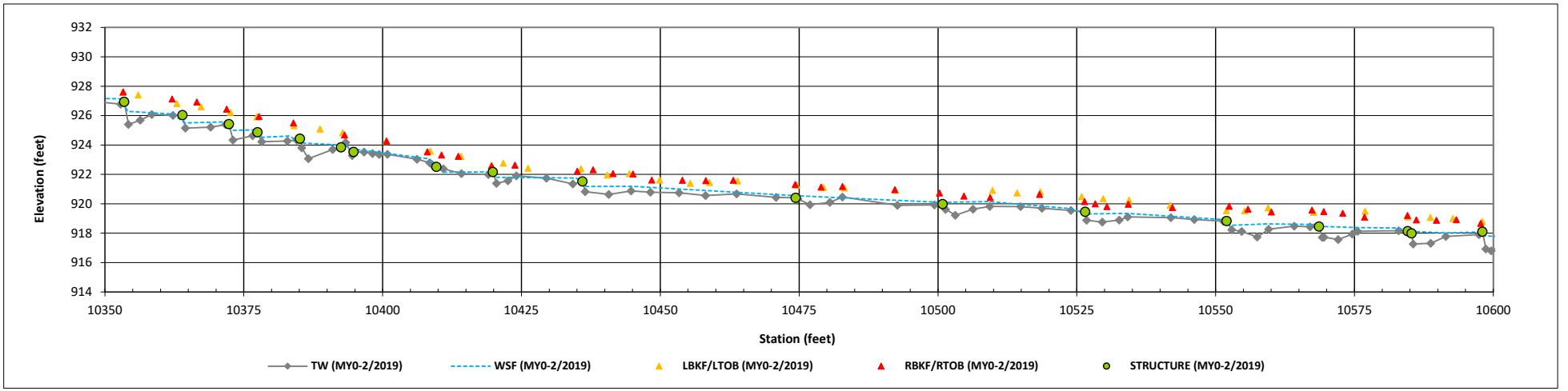
UT1 Reach 1 (STA 101+39 to 106+00)





Longitudinal Profile Plots

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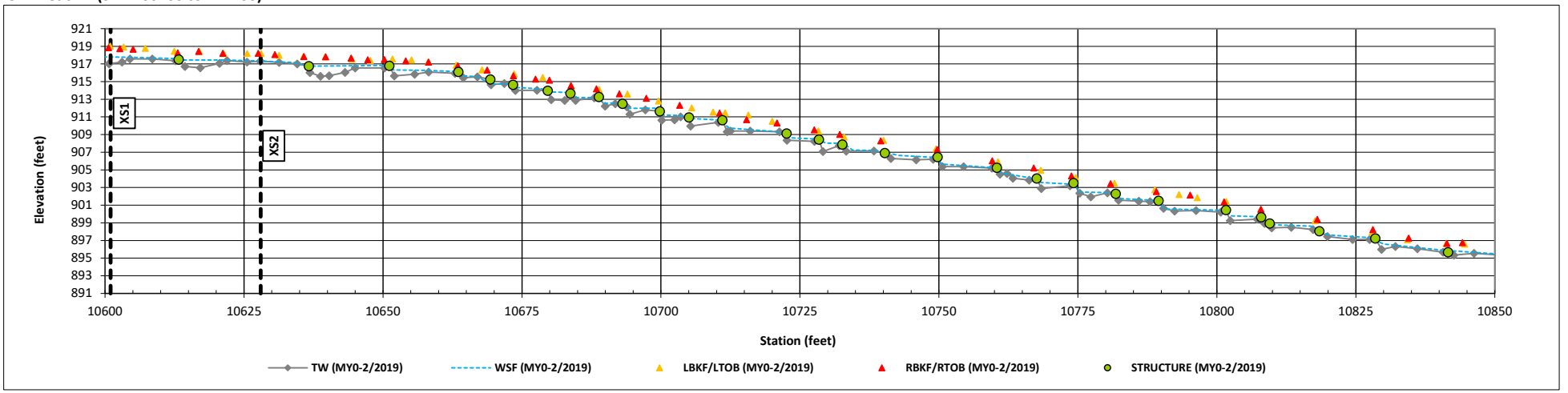
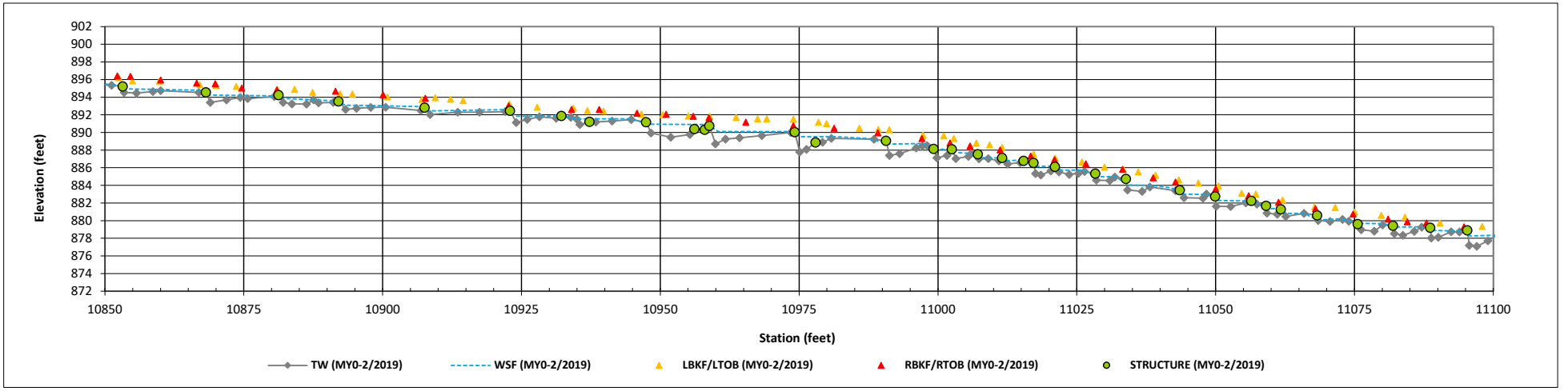
UT1 Reach 1 (STA 106+00 to 111+00)





Longitudinal Profile Plots

Lone Hickory Mitigation Site

DMS Project No. 97135

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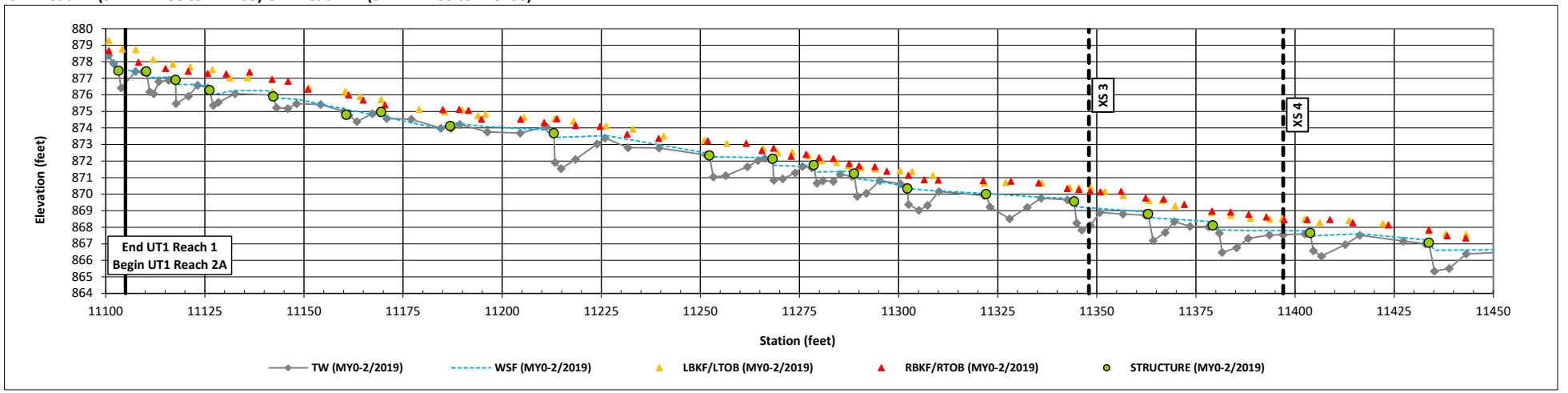
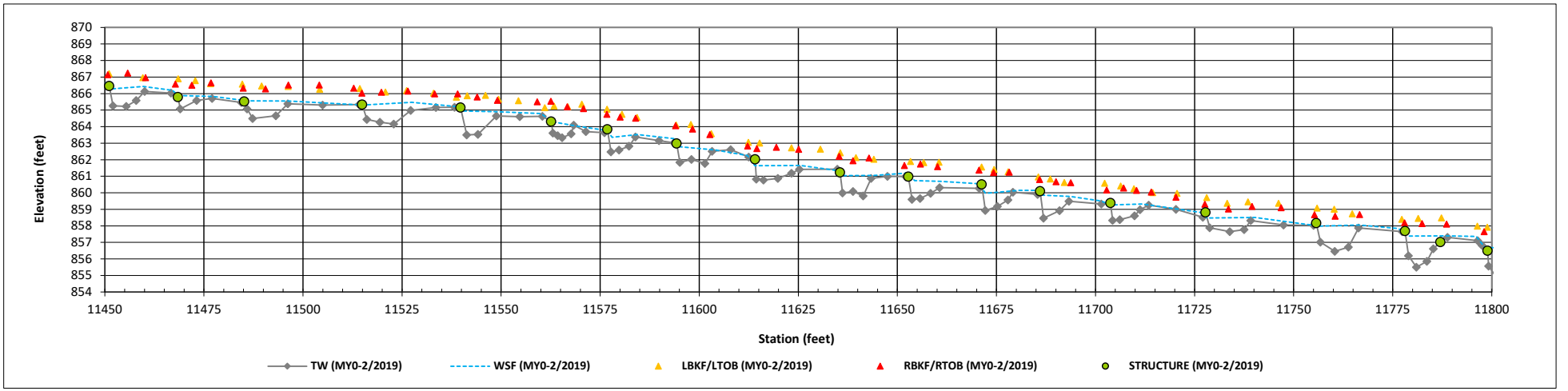
UT1 Reach 1 (STA 111+00 to 111+05) UT1 Reach 2A (STA 111+05 to 118+00)





Longitudinal Profile Plots

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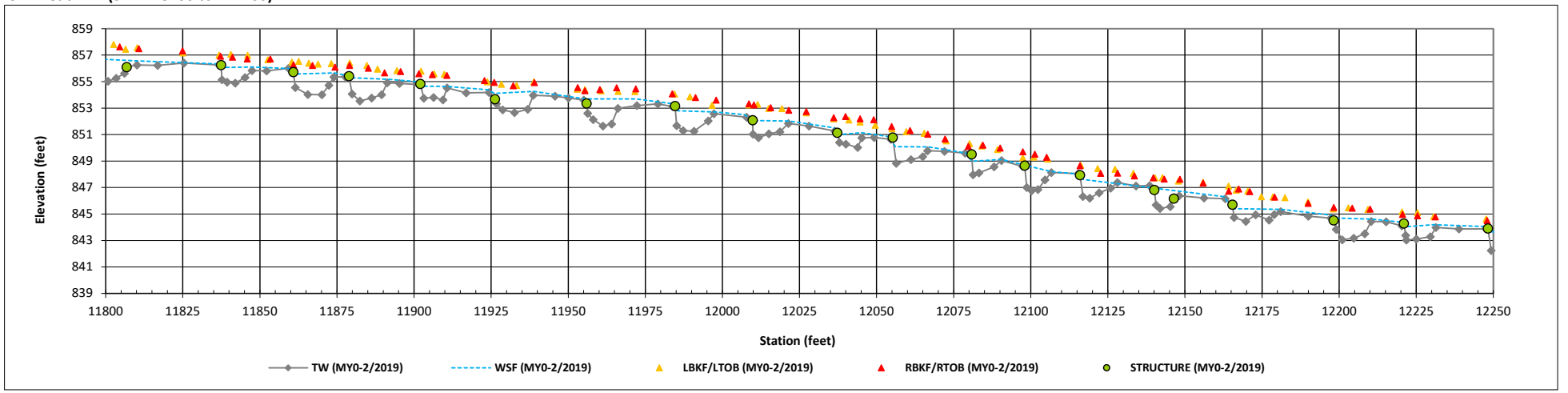
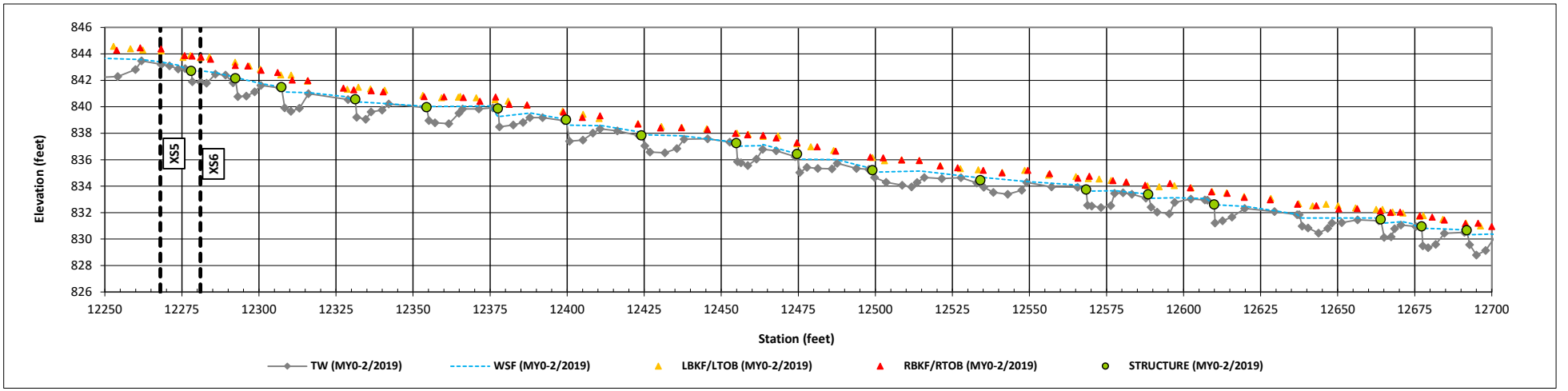
UT1 Reach 2A (STA 118+00 to 127+00)





Longitudinal Profile Plots

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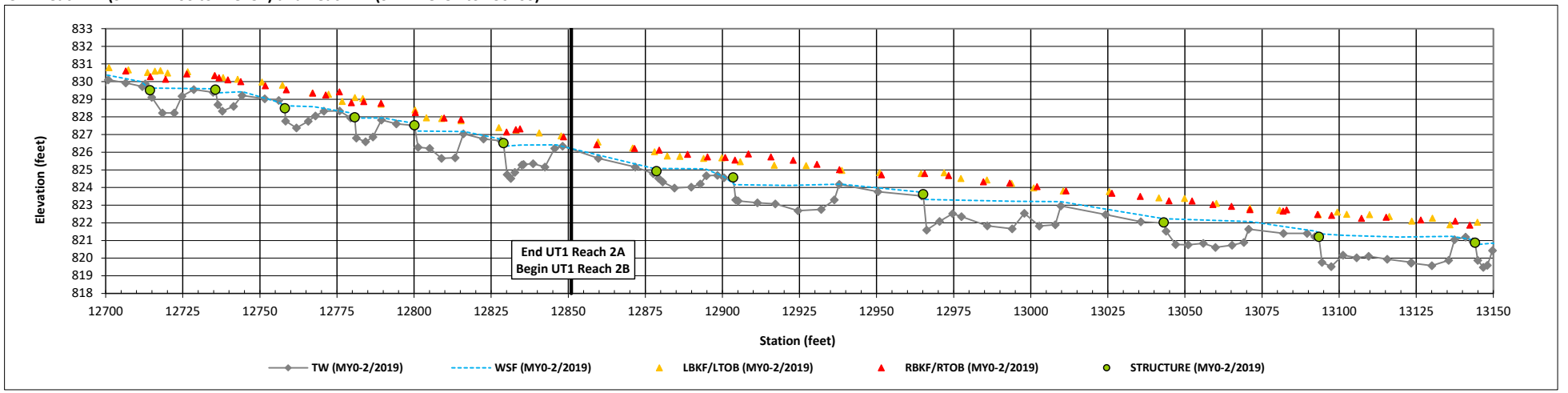
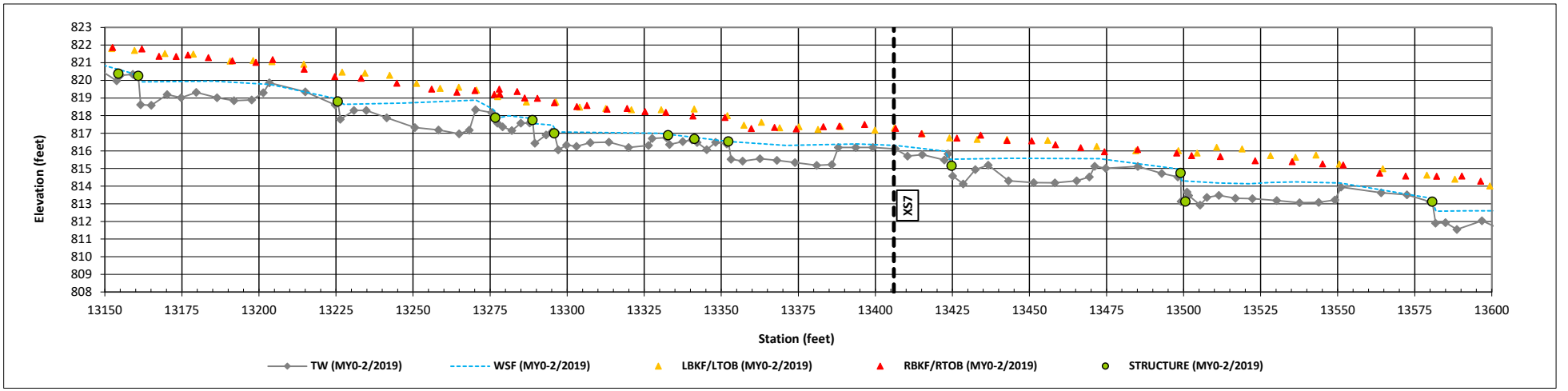
UT1 Reach 2A (STA 127+00 to 128+51) and Reach 2B (STA 128+51 to 136+00)





Longitudinal Profile Plots

Lone Hickory Mitigation Site

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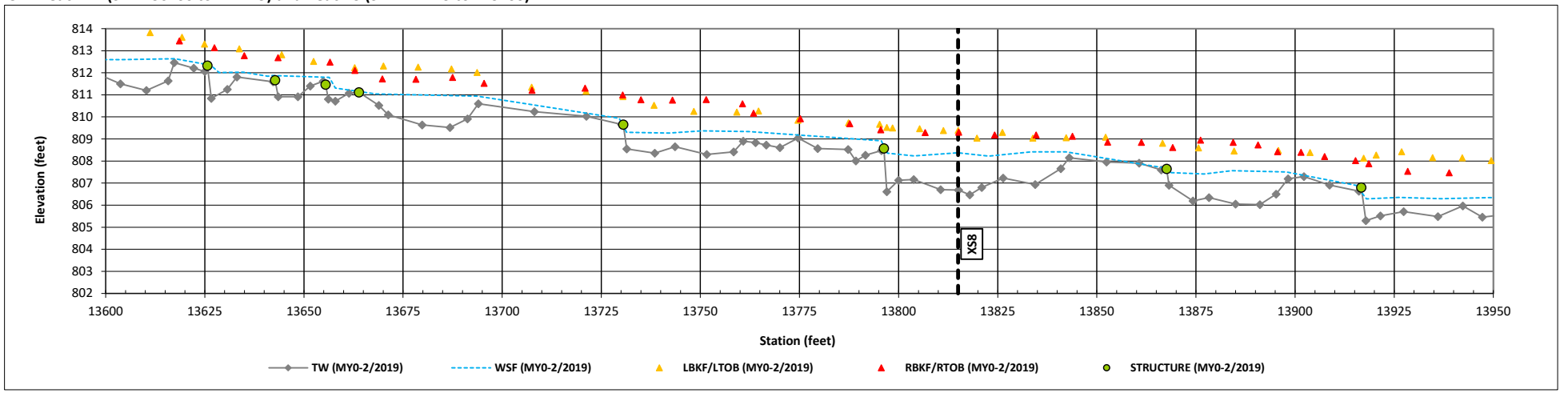
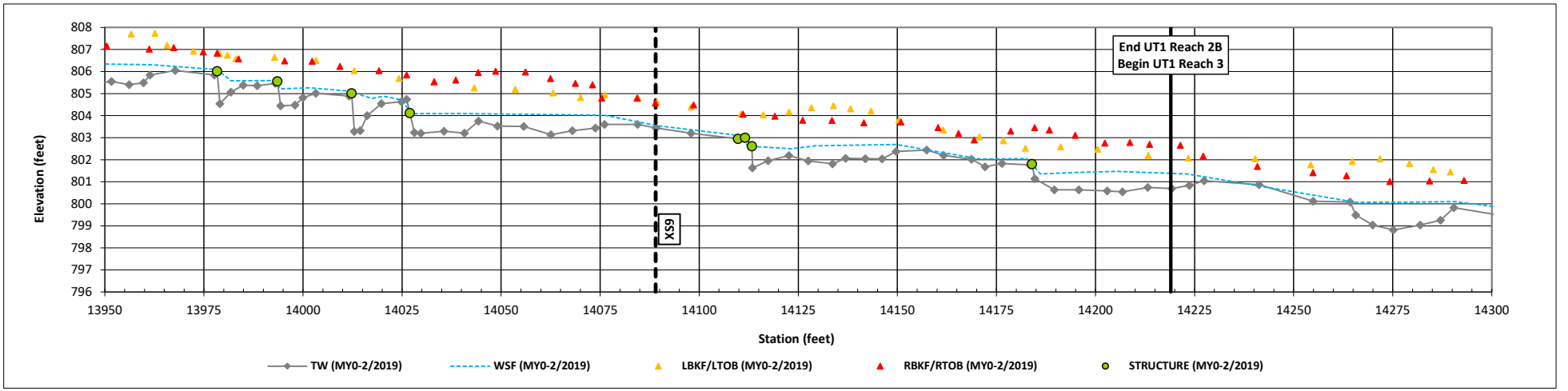
UT1 Reach 2B (STA 136+00 to 142+19) and Reach 3 (STA 142+19 to 143+00)





Longitudinal Profile Plots

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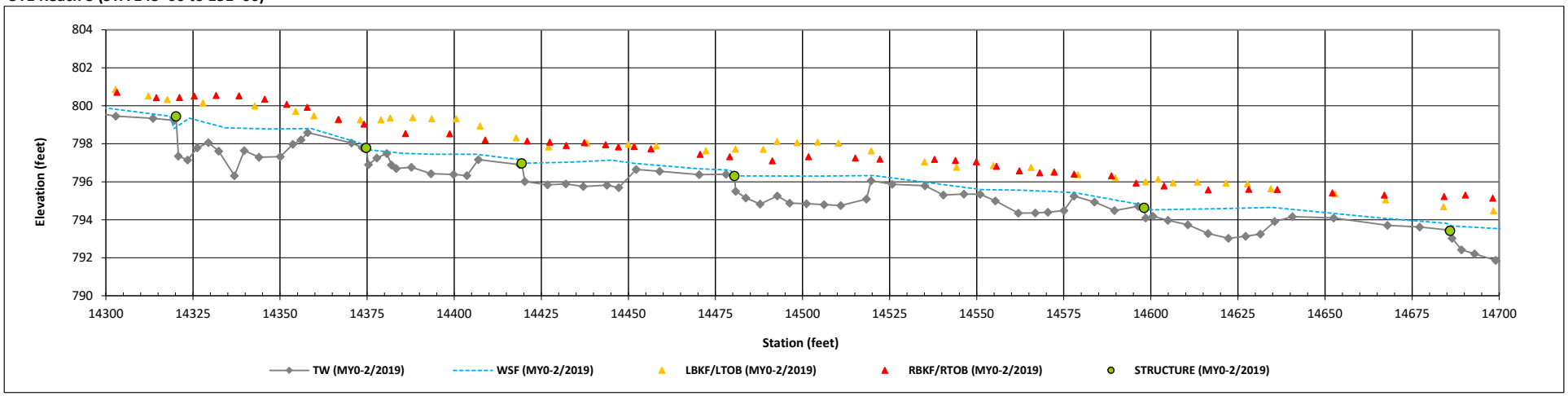
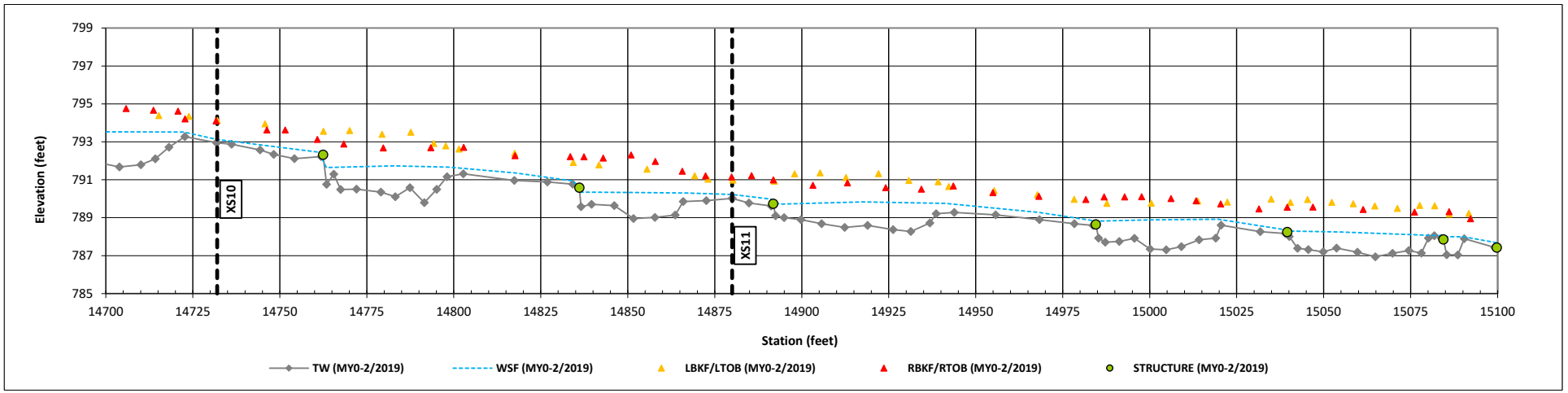
UT1 Reach 3 (STA 143+00 to 151+00)





Longitudinal Profile Plots

Lone Hickory Mitigation Site
DMS Project No. 97135
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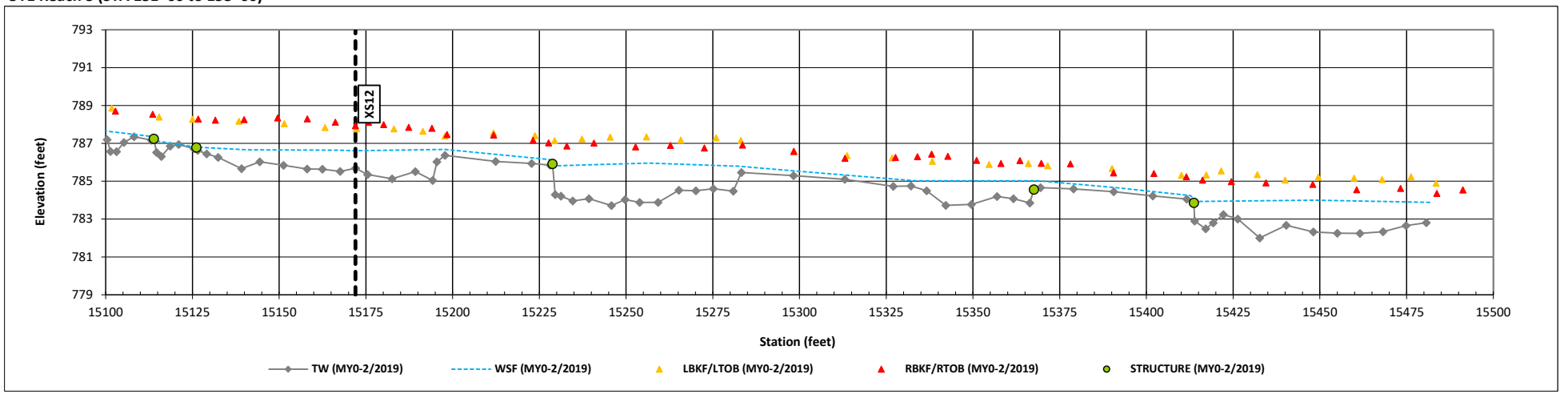
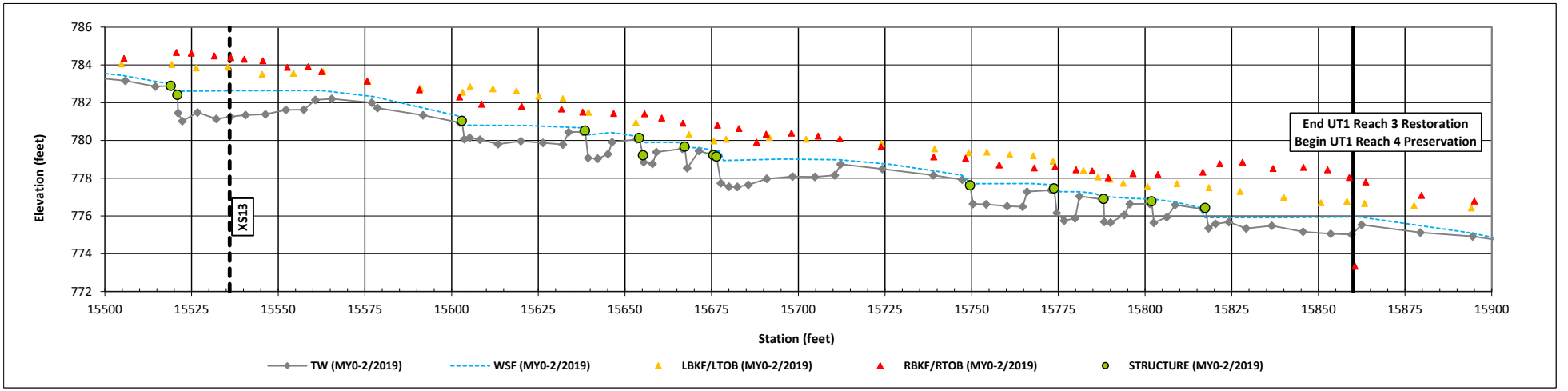
UT1 Reach 3 (STA 151+00 to 158+60)





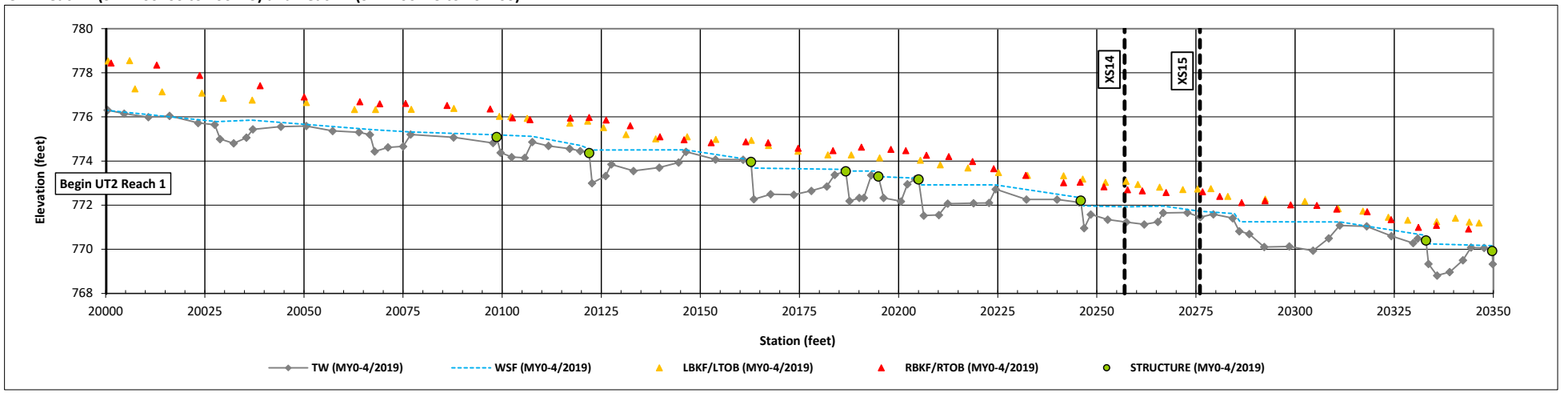
Longitudinal Profile Plots

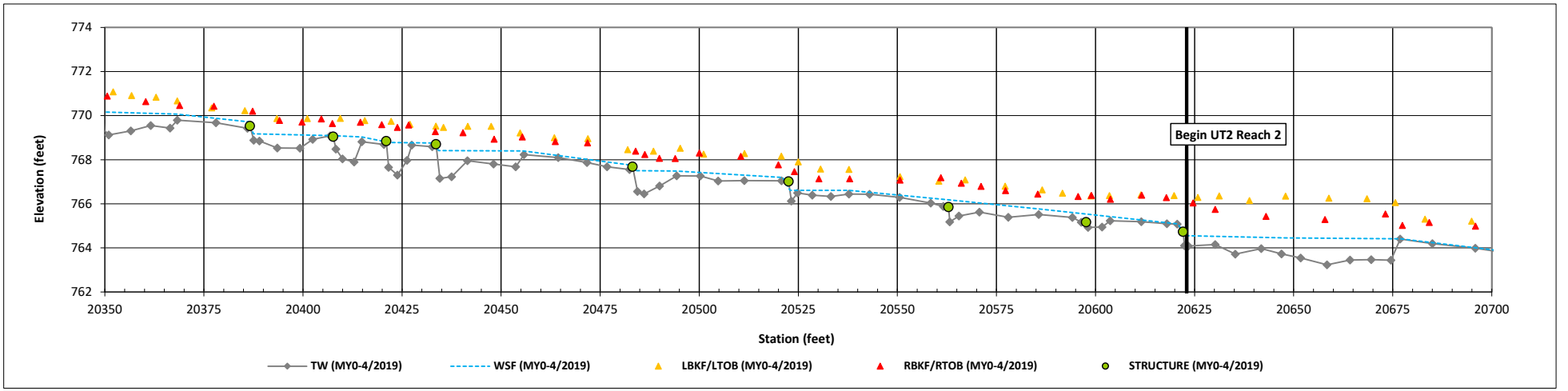
Lone Hickory Mitigation Site

DMS Project No. 97135

Monitoring Year 0 - 2019

UT2 Reach 1 (STA 200+00 to 206+23) and Reach 2 (STA 206+23 to 207+00)





Longitudinal Profile Plots

Lone Hickory Mitigation Site

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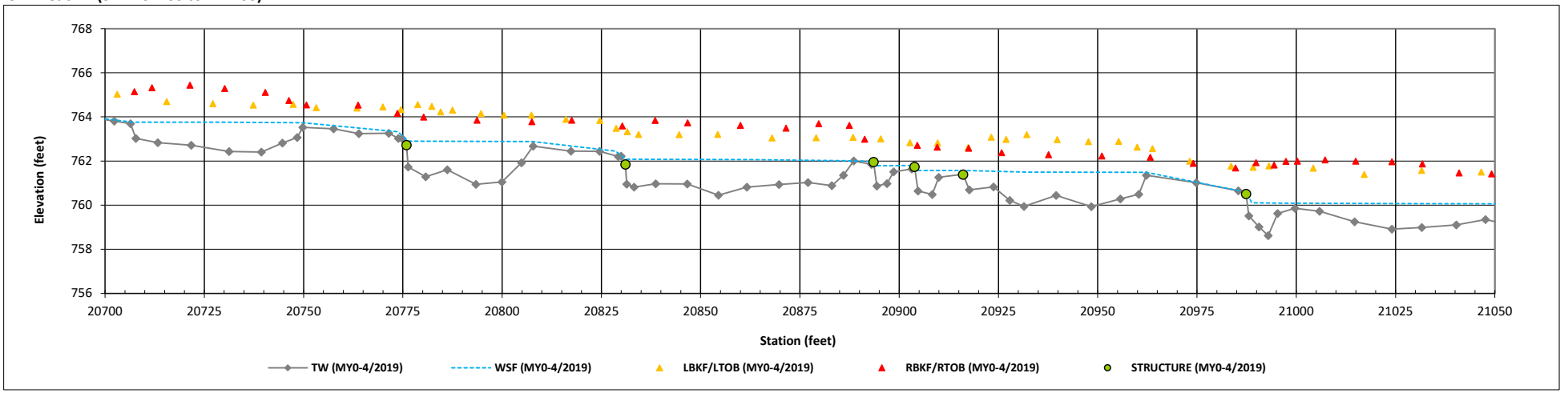
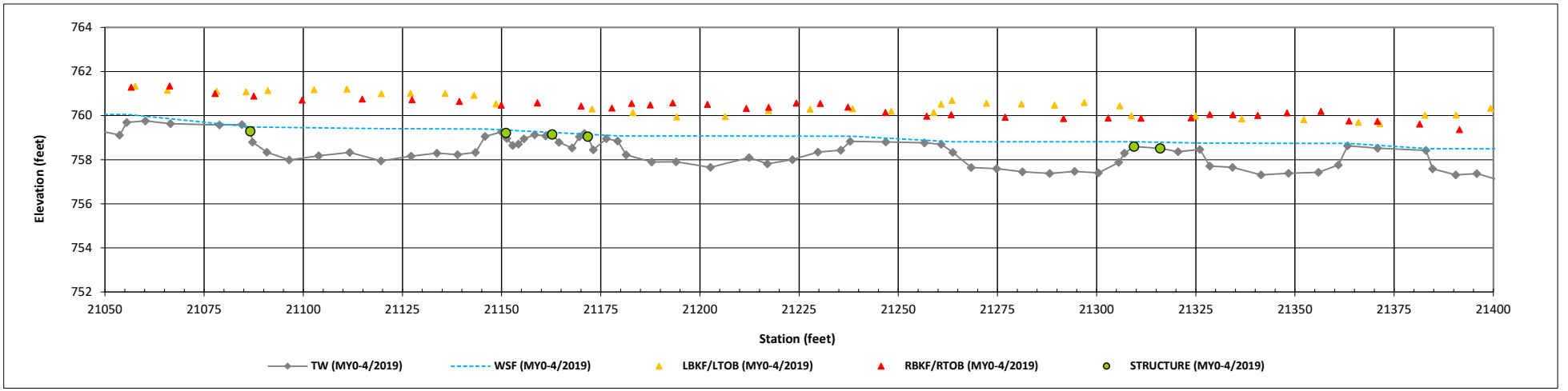
UT2 Reach 2 (STA 207+00 to 214+00)

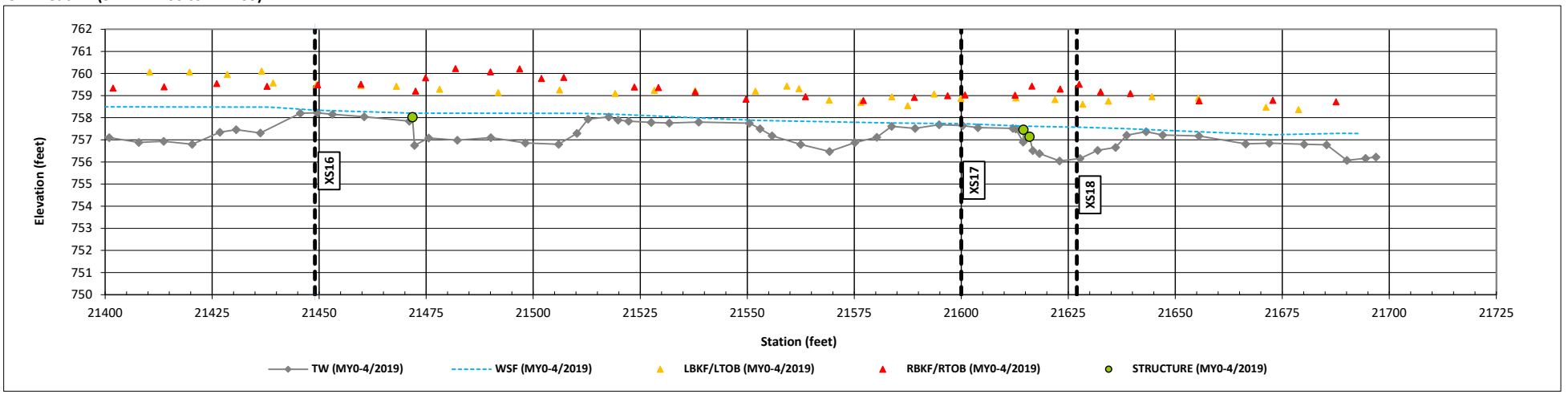




Longitudinal Profile Plots

Lone Hickory Mitigation Site
DMS Project No. 97135
Monitoring Year 0 - 2019

UT2 Reach 2 (STA 214+00 to 217+03)



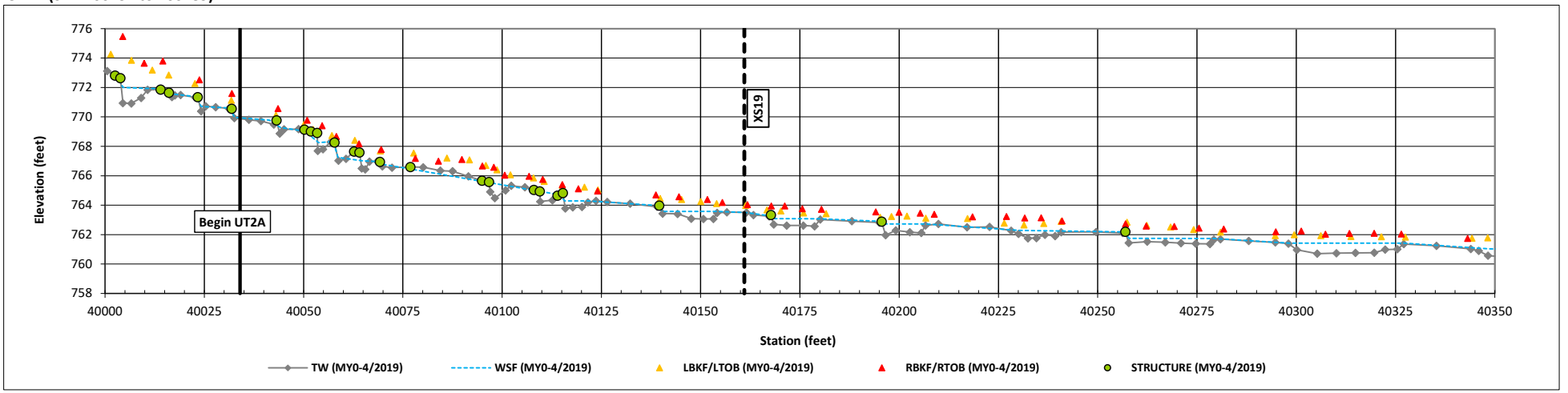
Longitudinal Profile Plots

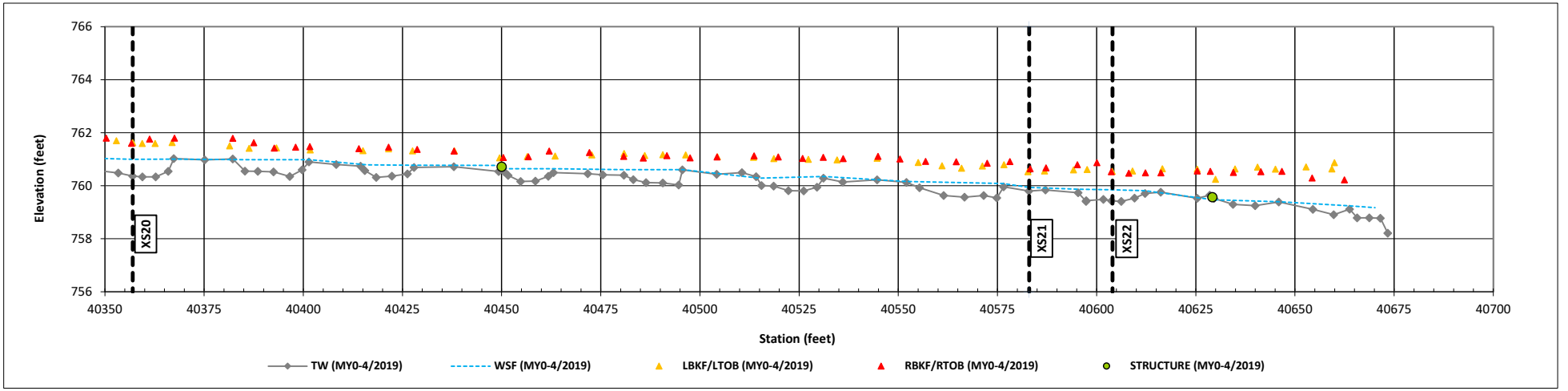
Lone Hickory Mitigation Site

DMS Project No. 97135

Monitoring Year 0 - 2019

UT2A (STA 400+34 to 406+89)

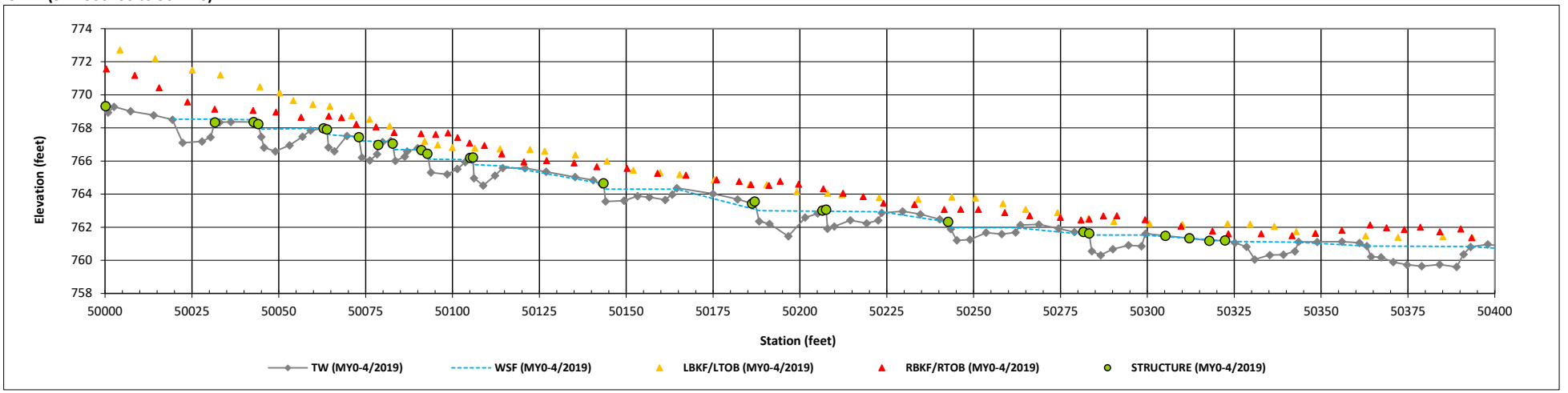


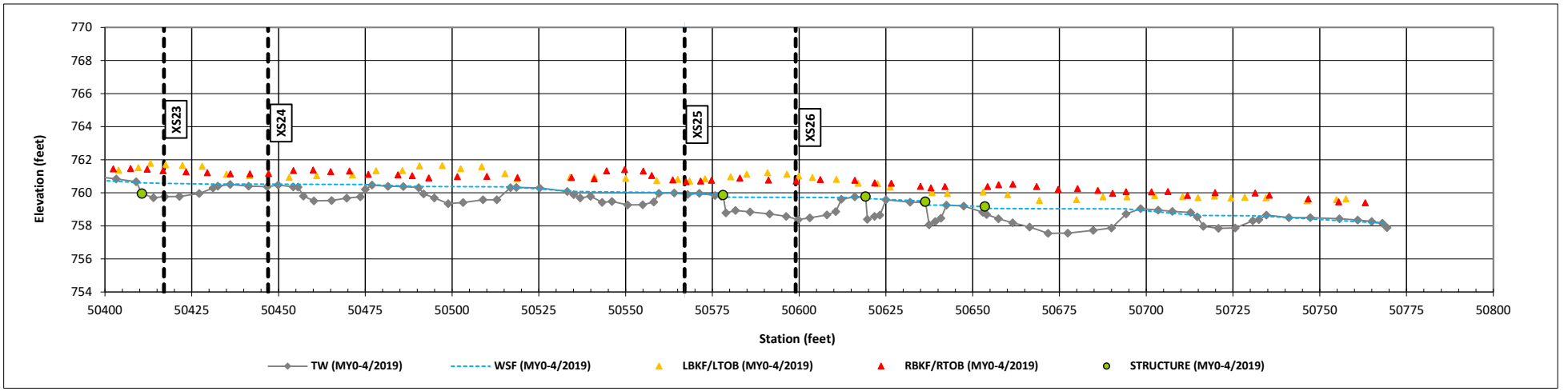


Longitudinal Profile Plots

Lone Hickory Mitigation Site
DMS Project No. 97135
Monitoring Year 0 - 2019

UT2B (STA 500+00 to 507+76)





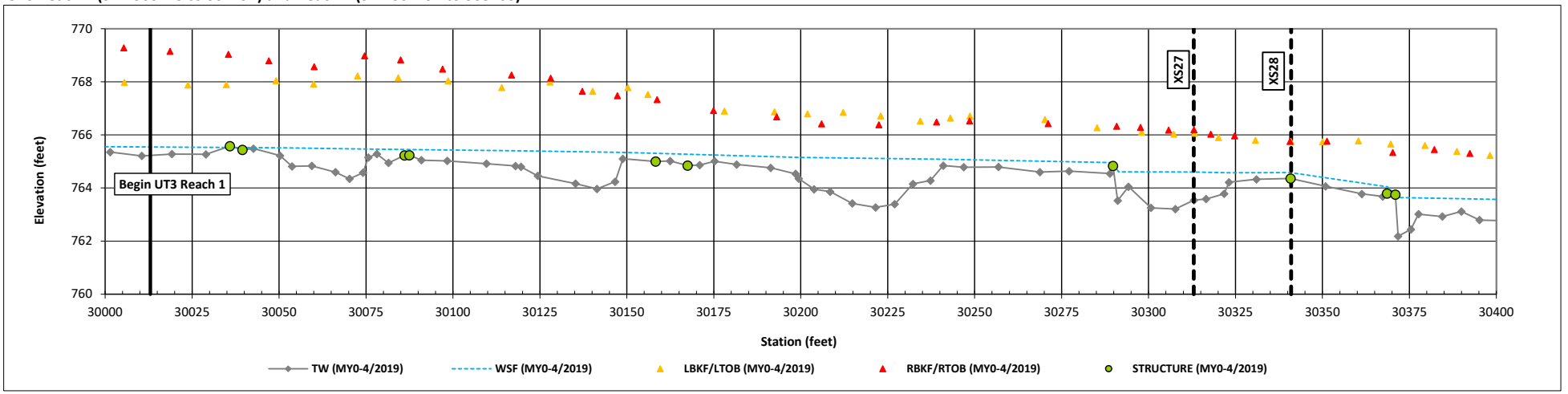
Longitudinal Profile Plots

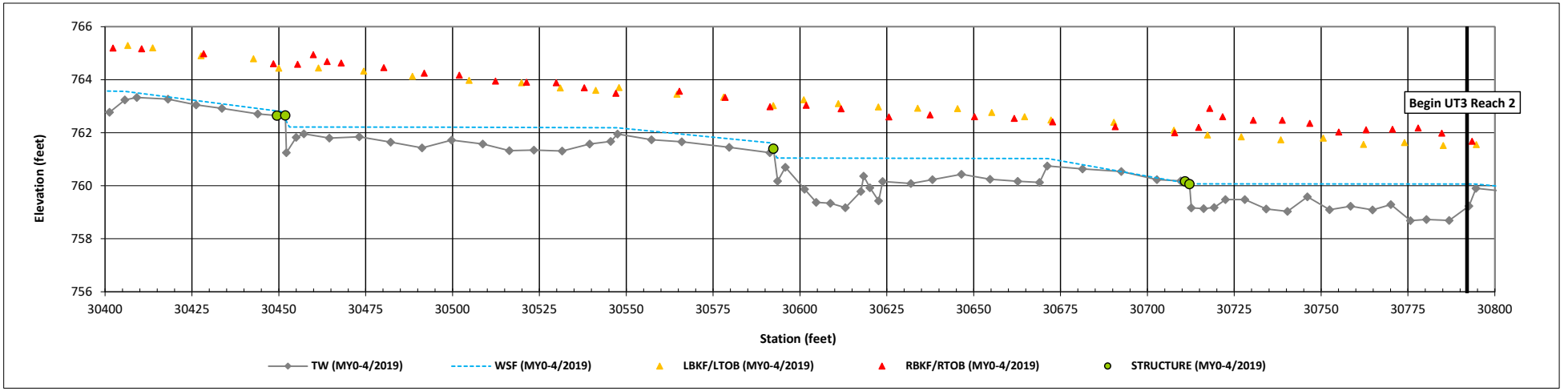
Lone Hickory Mitigation Site

DMS Project No. 97135

Monitoring Year 0 - 2019

UT3 Reach 1 (STA 300+13 to 307+92) and Reach 2 (STA 307+92 to 308+00)

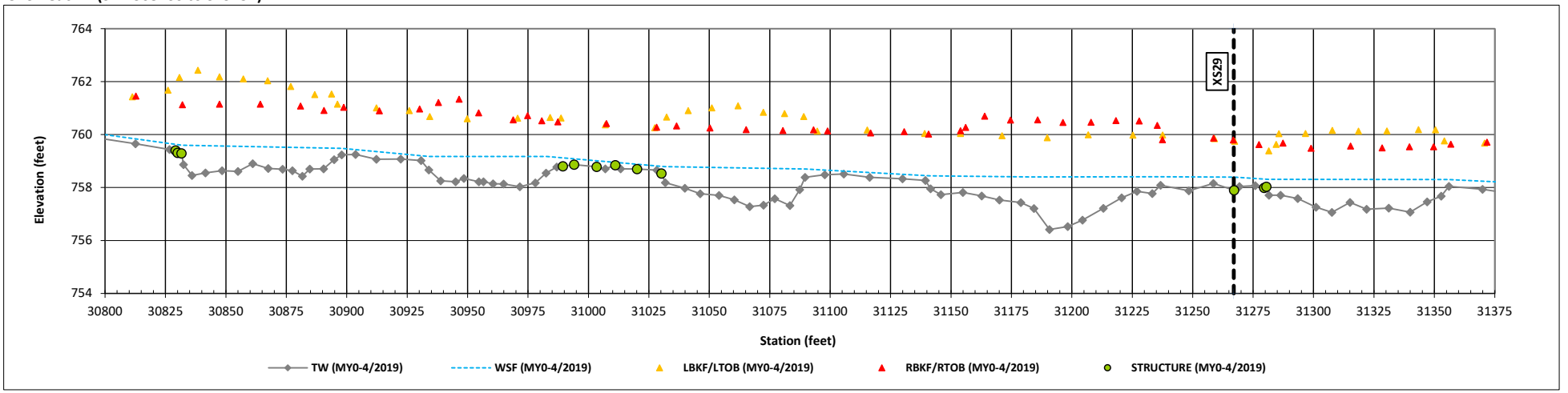


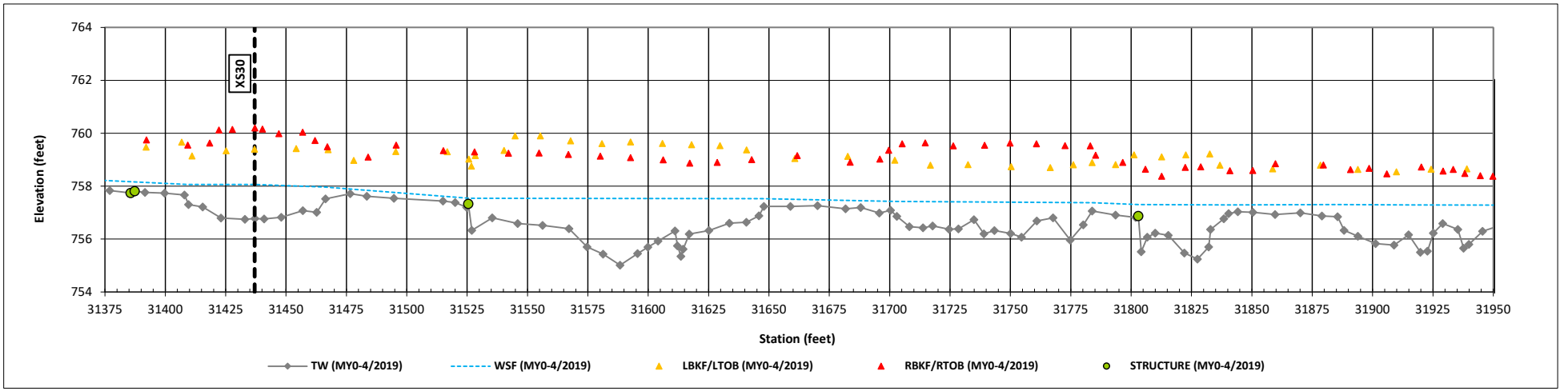


Longitudinal Profile Plots

Lone Hickory Mitigation Site
DMS Project No. 97135
Monitoring Year 0 - 2019

UT3 Reach 2 (STA 308+00 to 319+51)

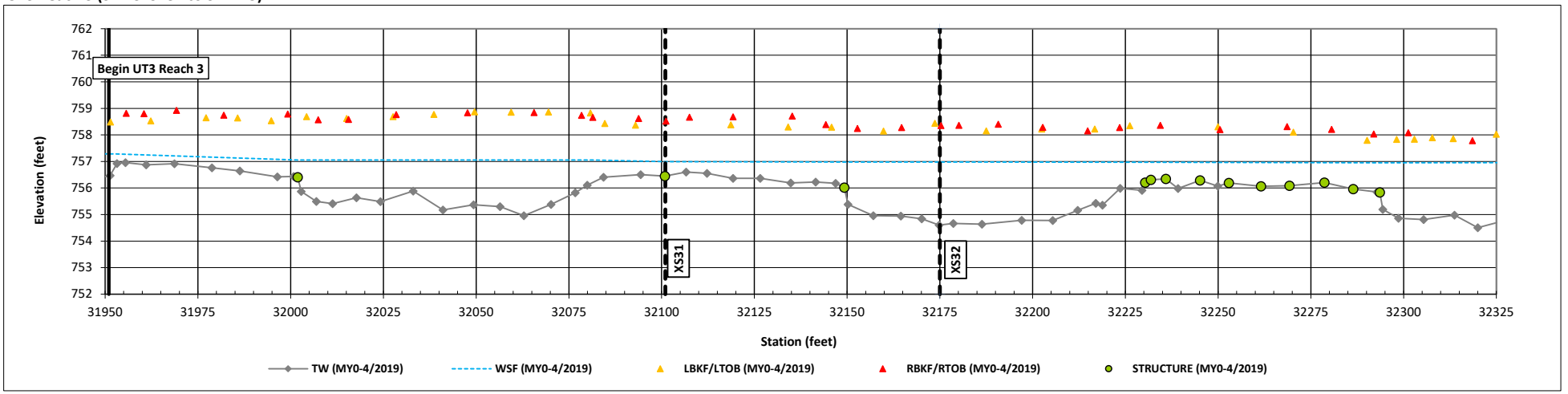


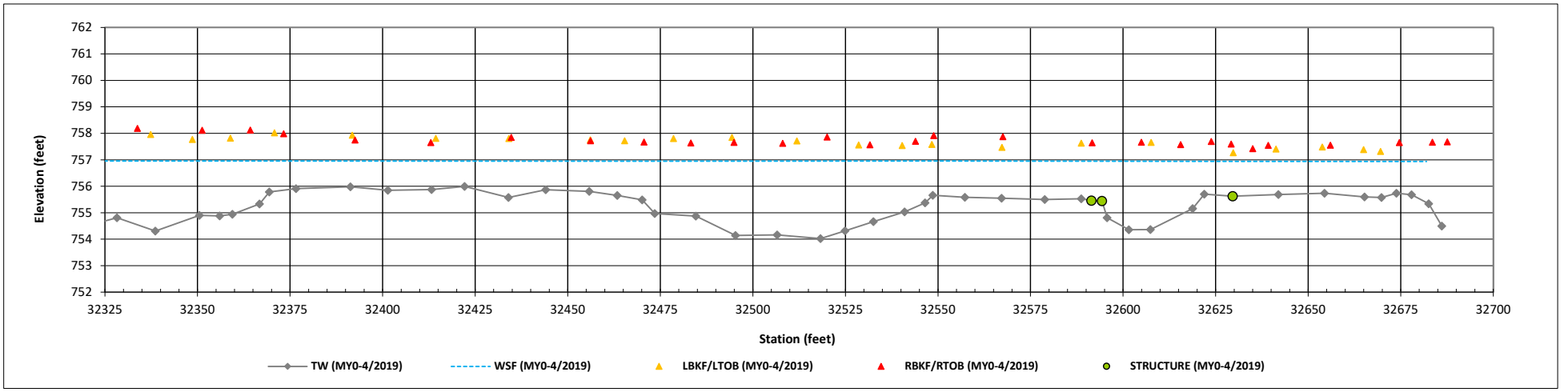


Longitudinal Profile Plots

Lone Hickory Mitigation Site
DMS Project No. 97135
Monitoring Year 0 - 2019

UT3 Reach 3 (STA 319+51 to 327+15)

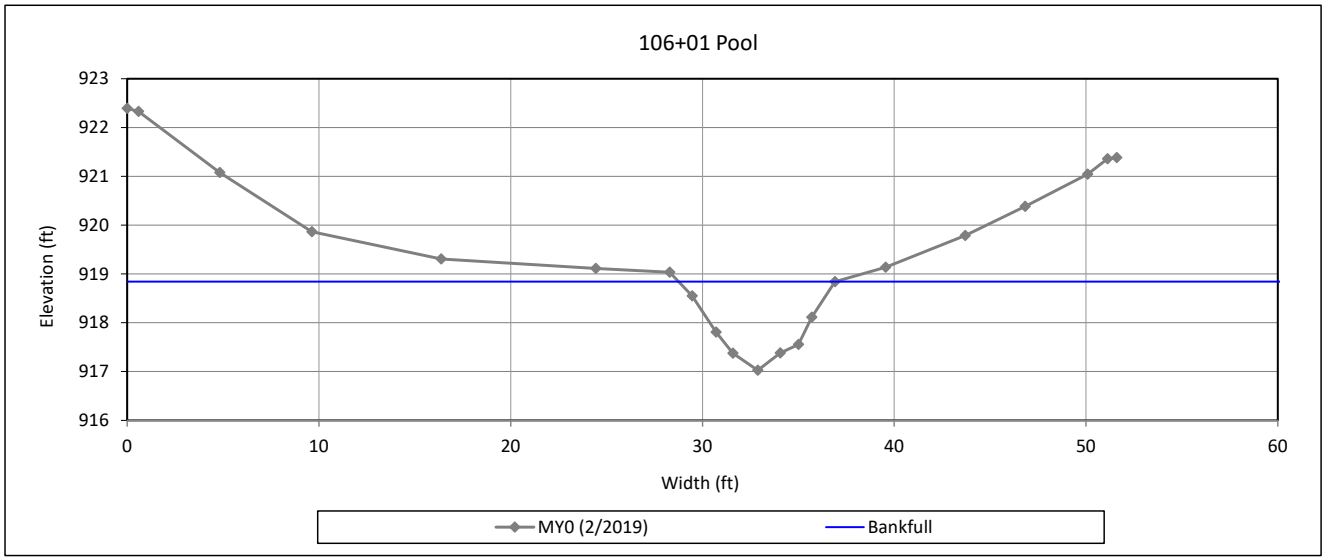




Cross-Section Plots

Lone Hickory Mitigation Site
NCDMS Project No. 97135
Monitoring Year 0 - 2019

Cross-Section 1-UT1 Reach 1



Bankfull Dimensions	
8.5	x-section area (ft.sq.)
8.2	width (ft)
1.0	mean depth (ft)
1.8	max depth (ft)
9.0	wetted perimeter (ft)
0.9	hydraulic radius (ft)
7.8	width-depth ratio

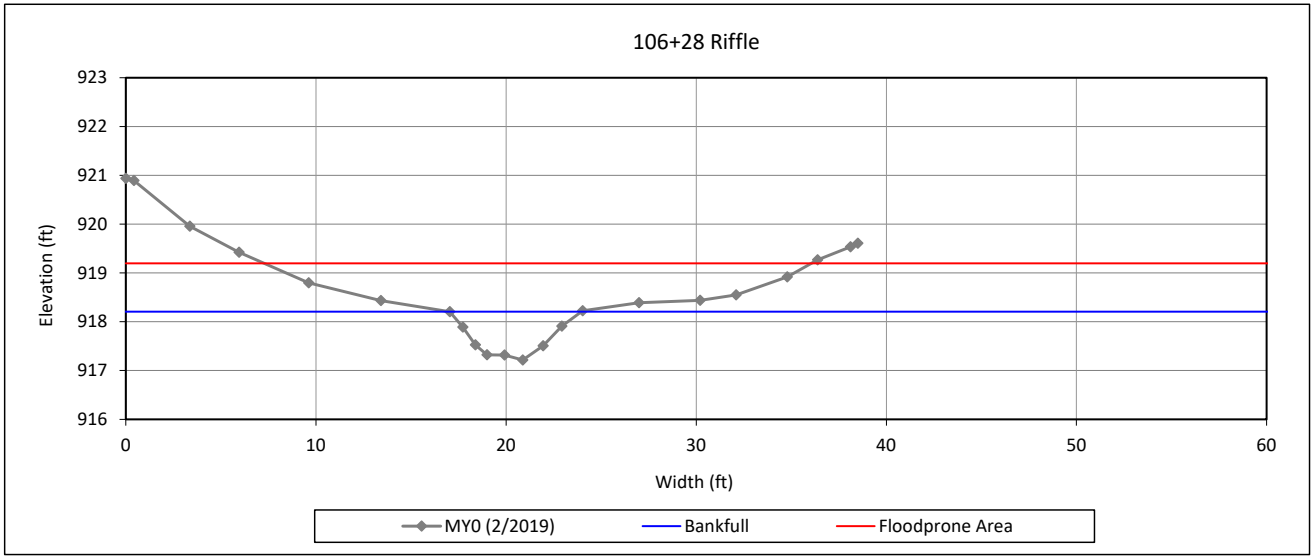
Survey Date: 2/2019
Field Crew: Turner Land Surveying

View Downstream

Cross-Section Plots

Lone Hickory Mitigation Site
NCDMS Project No. 97135
Monitoring Year 0 - 2019

Cross-Section 2-UT1 Reach 1



Bankfull Dimensions	
4.2	x-section area (ft.sq.)
6.9	width (ft)
0.6	mean depth (ft)
1.0	max depth (ft)
7.3	wetted perimeter (ft)
0.6	hydraulic radius (ft)
11.5	width-depth ratio
28.8	W flood prone area (ft)
4.2	entrenchment ratio
1.0	low bank height ratio

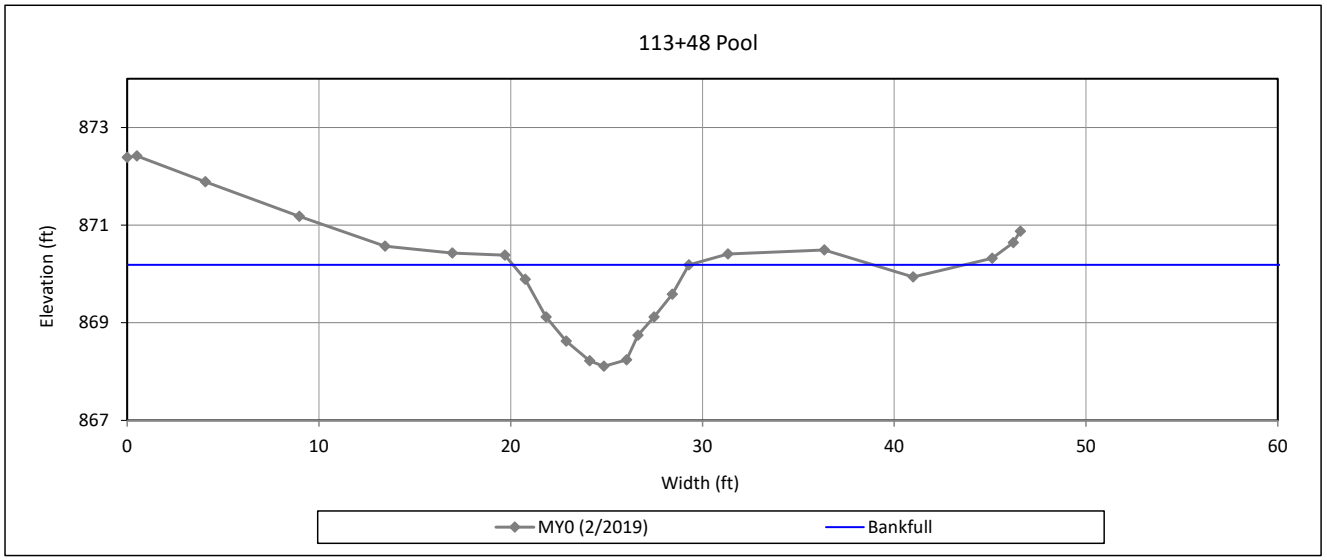
Survey Date: 2/2019
Field Crew: Turner Land Surveying

View Downstream

Cross-Section Plots

Lone Hickory Mitigation Site
NCDMS Project No. 97135
Monitoring Year 0 - 2019

Cross-Section 3-UT1 Reach 2A



Bankfull Dimensions	
11.4	x-section area (ft.sq.)
9.2	width (ft)
1.2	mean depth (ft)
2.1	max depth (ft)
10.2	wetted perimeter (ft)
1.1	hydraulic radius (ft)
7.4	width-depth ratio

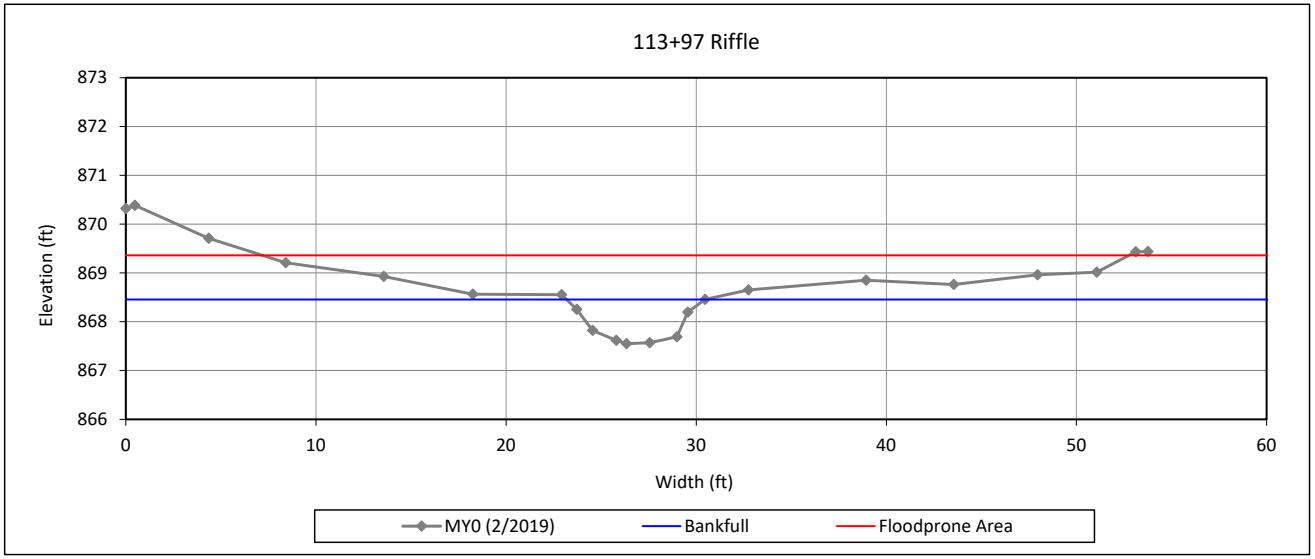
Survey Date: 2/2019
Field Crew: Turner Land Surveying

View Downstream

Cross-Section Plots

Lone Hickory Mitigation Site
NCDMS Project No. 97135
Monitoring Year 0 - 2019

Cross-Section 4-UT1 Reach 2A



Bankfull Dimensions	
4.5	x-section area (ft.sq.)
7.3	width (ft)
0.6	mean depth (ft)
0.9	max depth (ft)
7.7	wetted perimeter (ft)
0.6	hydraulic radius (ft)
11.8	width-depth ratio
45.6	W flood prone area (ft)
6.3	entrenchment ratio
1.0	low bank height ratio

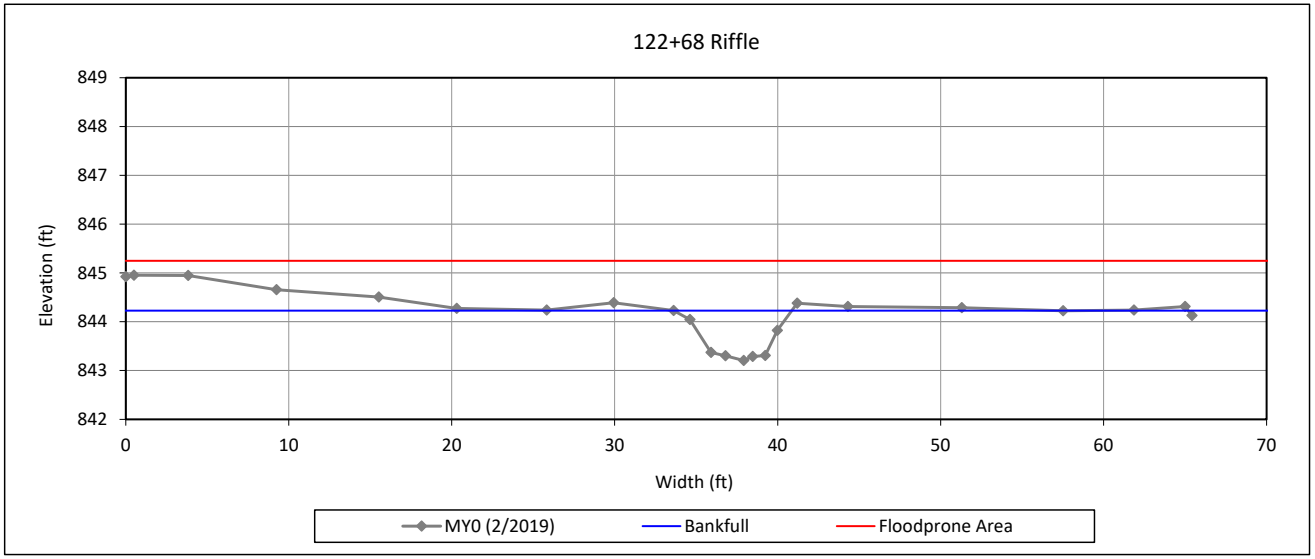
Survey Date: 2/2019
Field Crew: Turner Land Surveying

View Downstream

Cross-Section Plots

Lone Hickory Mitigation Site
NCDMS Project No. 97135
Monitoring Year 0 - 2019

Cross-Section 5-UT1 Reach 2A



Bankfull Dimensions	
4.6	x-section area (ft.sq.)
7.3	width (ft)
0.6	mean depth (ft)
1.0	max depth (ft)
7.7	wetted perimeter (ft)
0.6	hydraulic radius (ft)
11.5	width-depth ratio
65.4	W flood prone area (ft)
9.0	entrenchment ratio
1.0	low bank height ratio

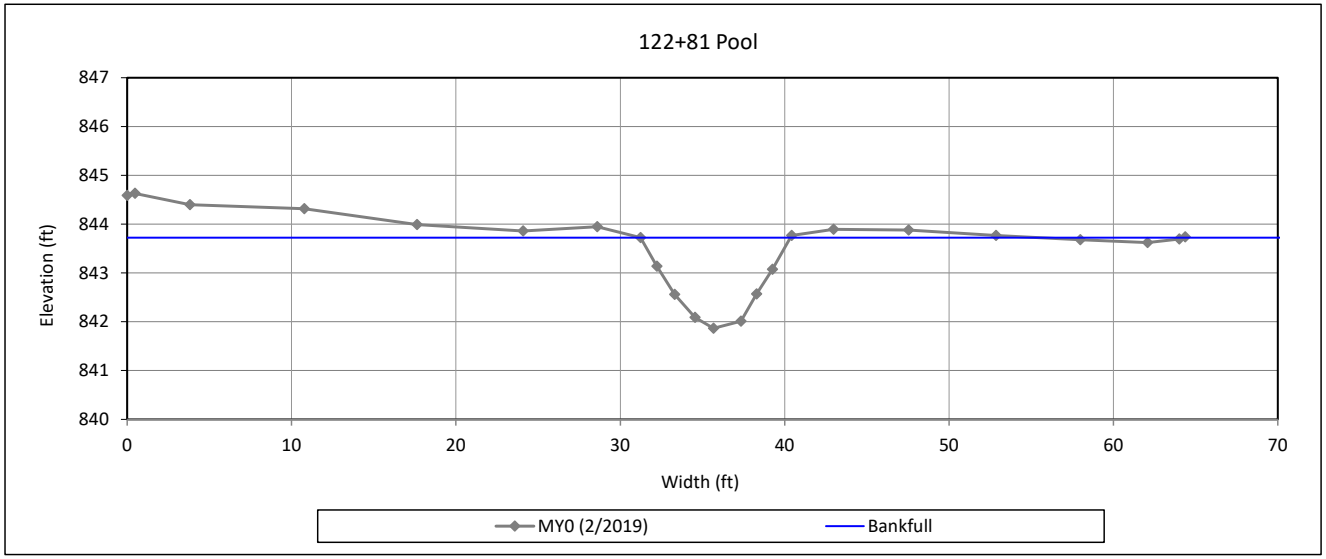
Survey Date: 2/2019
Field Crew: Turner Land Surveying

View Downstream

Cross-Section Plots

Lone Hickory Mitigation Site
NCDMS Project No. 97135
Monitoring Year 0 - 2019

Cross-Section 6-UT1 Reach 2A



Bankfull Dimensions	
10.5	x-section area (ft.sq.)
9.1	width (ft)
1.2	mean depth (ft)
1.9	max depth (ft)
10.0	wetted perimeter (ft)
1.1	hydraulic radius (ft)
7.9	width-depth ratio

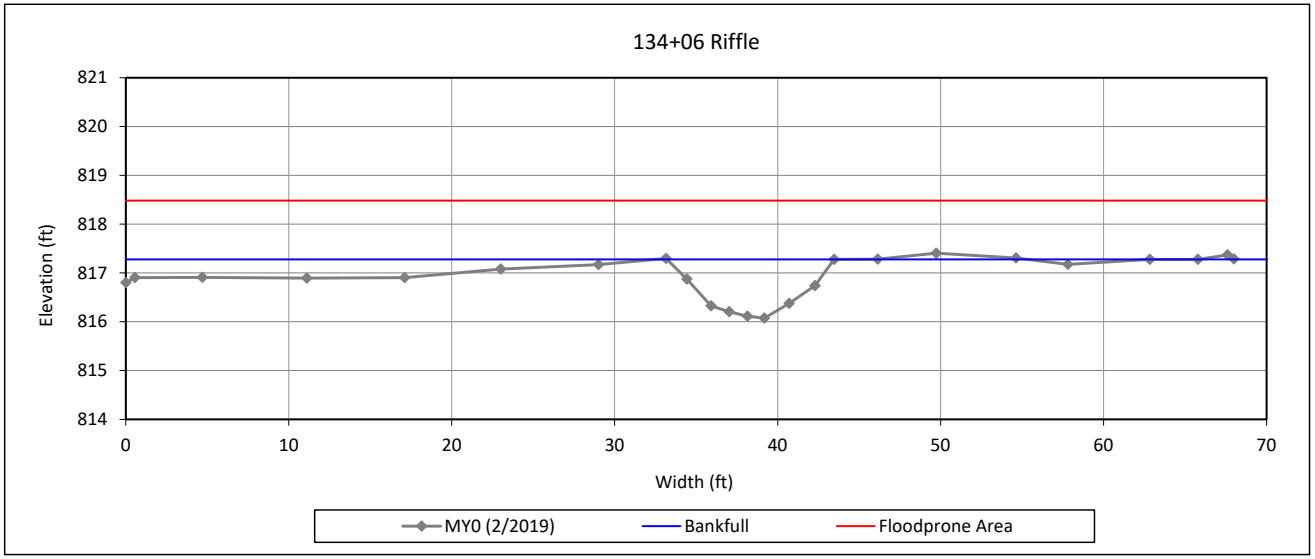
Survey Date: 2/2019
Field Crew: Turner Land Surveying

View Downstream

Cross-Section Plots

Lone Hickory Mitigation Site
NCDMS Project No. 97135
Monitoring Year 0 - 2019

Cross-Section 7-UT1 Reach 2B



Bankfull Dimensions	
7.9	x-section area (ft.sq.)
10.3	width (ft)
0.8	mean depth (ft)
1.2	max depth (ft)
10.6	wetted perimeter (ft)
0.7	hydraulic radius (ft)
13.3	width-depth ratio
68.0	W flood prone area (ft)
6.6	entrenchment ratio
1.0	low bank height ratio

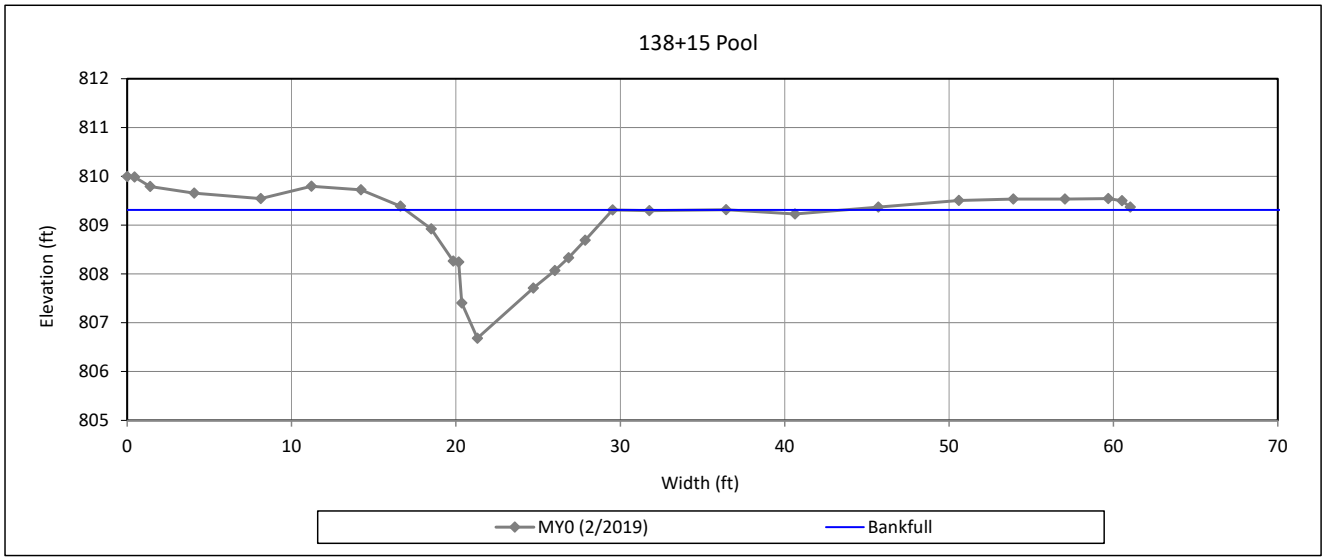
Survey Date: 2/2019
Field Crew: Turner Land Surveying

View Downstream

Cross-Section Plots

Lone Hickory Mitigation Site
NCDMS Project No. 97135
Monitoring Year 0 - 2019

Cross-Section 8-UT1 Reach 2B



Bankfull Dimensions	
15.4	x-section area (ft.sq.)
12.6	width (ft)
1.2	mean depth (ft)
2.6	max depth (ft)
14.1	wetted perimeter (ft)
1.1	hydraulic radius (ft)
10.3	width-depth ratio

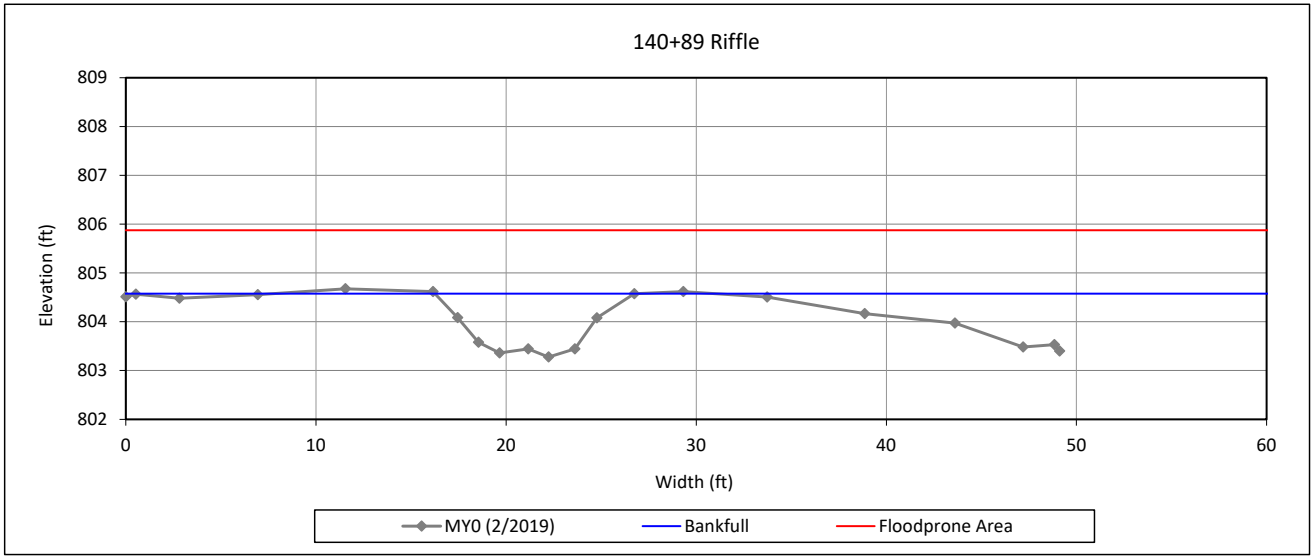
Survey Date: 2/2019
Field Crew: Turner Land Surveying

View Downstream

Cross-Section Plots

Lone Hickory Mitigation Site
NCDMS Project No. 97135
Monitoring Year 0 - 2019

Cross-Section 9-UT1 Reach 2B



Bankfull Dimensions	
8.5	x-section area (ft.sq.)
10.5	width (ft)
0.8	mean depth (ft)
1.3	max depth (ft)
11.0	wetted perimeter (ft)
0.8	hydraulic radius (ft)
12.9	width-depth ratio
49.1	W flood prone area (ft)
4.7	entrenchment ratio
1.0	low bank height ratio

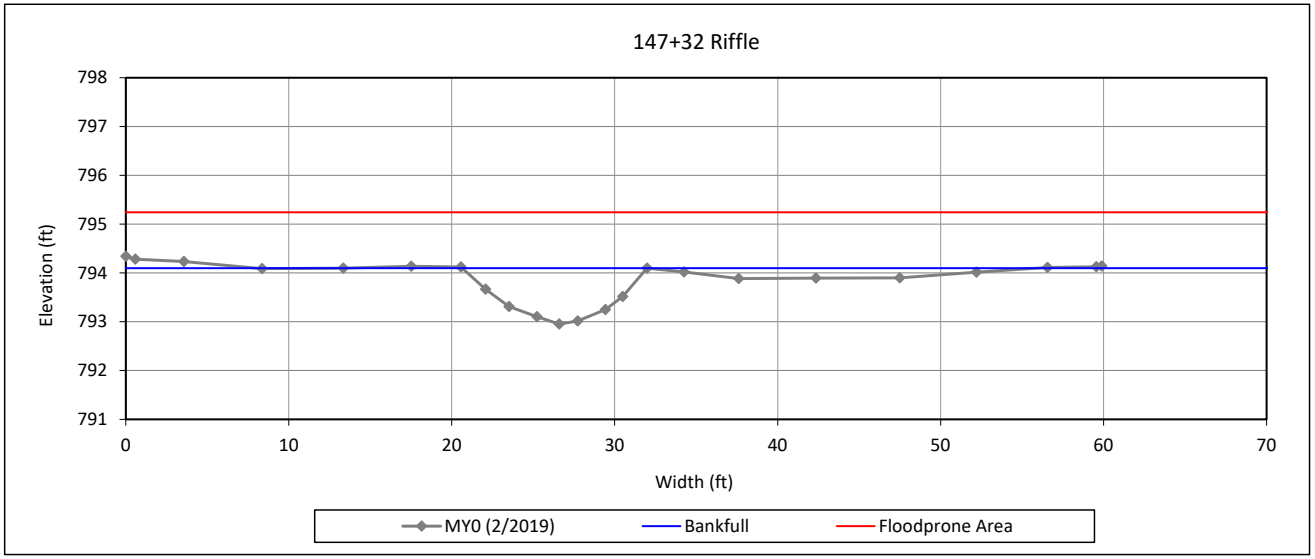
Survey Date: 2/2019
Field Crew: Turner Land Surveying

View Downstream

Cross-Section Plots

Lone Hickory Mitigation Site
NCDMS Project No. 97135
Monitoring Year 0 - 2019

Cross-Section 10-UT1 Reach 3



Bankfull Dimensions	
8.3	x-section area (ft.sq.)
11.3	width (ft)
0.7	mean depth (ft)
1.1	max depth (ft)
11.6	wetted perimeter (ft)
0.7	hydraulic radius (ft)
15.5	width-depth ratio
59.9	W flood prone area (ft)
5.3	entrenchment ratio
1.0	low bank height ratio

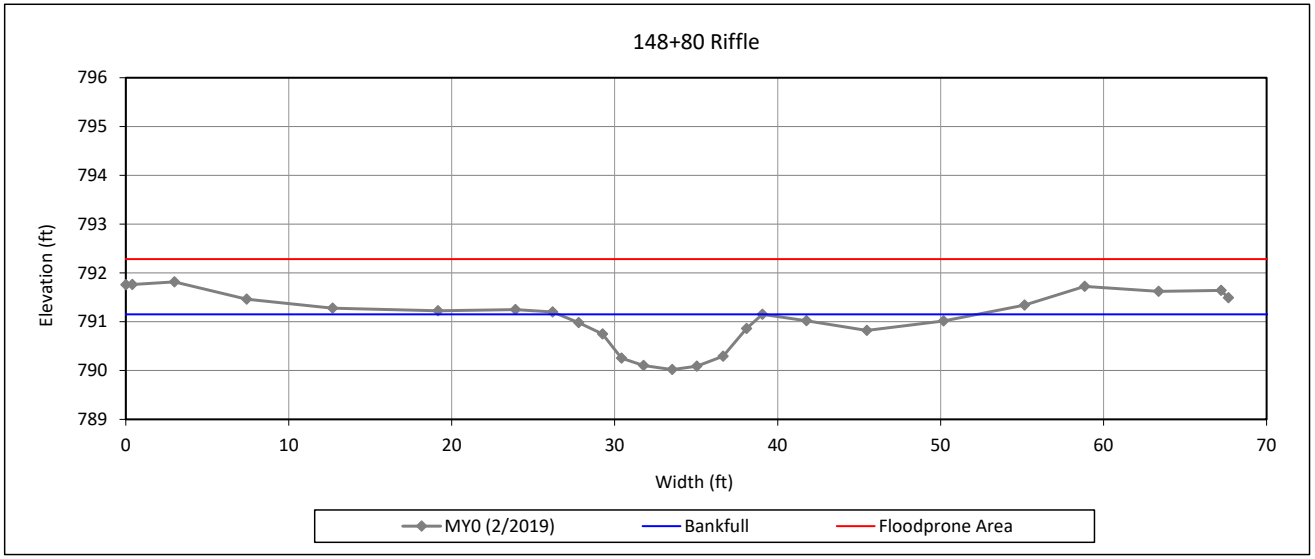
Survey Date: 2/2019
Field Crew: Turner Land Surveying

View Downstream

Cross-Section Plots

Lone Hickory Mitigation Site
NCDMS Project No. 97135
Monitoring Year 0 - 2019

Cross-Section 11-UT1 Reach 3



Bankfull Dimensions	
8.7	x-section area (ft.sq.)
12.5	width (ft)
0.7	mean depth (ft)
1.1	max depth (ft)
12.8	wetted perimeter (ft)
0.7	hydraulic radius (ft)
18.0	width-depth ratio
67.7	W flood prone area (ft)
5.4	entrenchment ratio
1.0	low bank height ratio

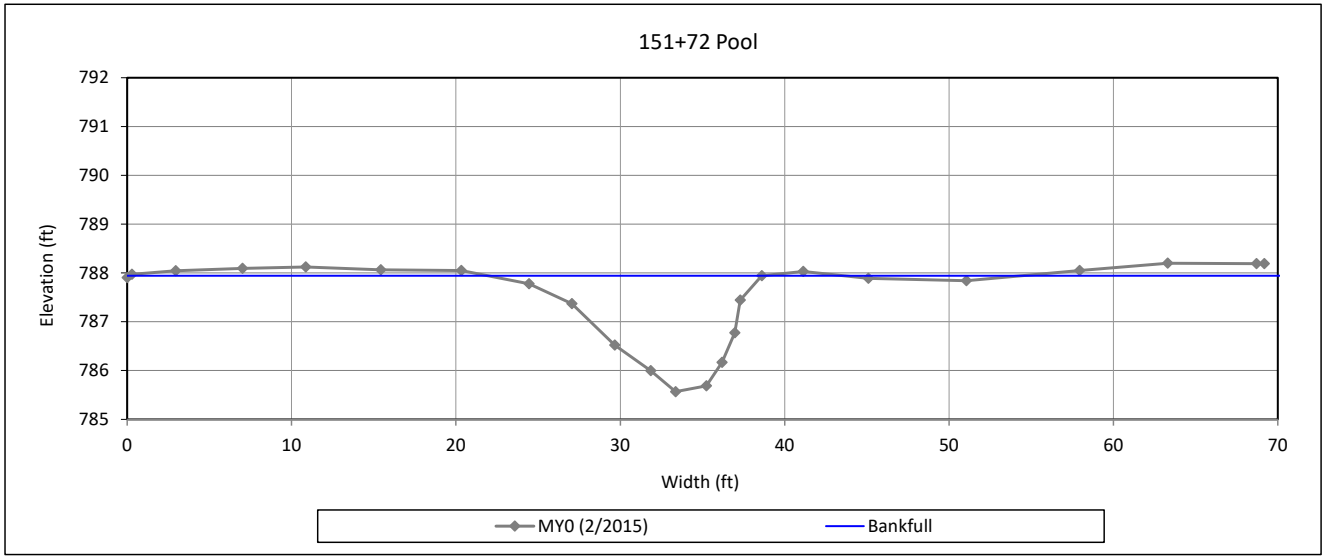
Survey Date: 2/2019
Field Crew: Turner Land Surveying

View Downstream

Cross-Section Plots

Lone Hickory Mitigation Site
NCDMS Project No. 97135
Monitoring Year 0 - 2019

Cross-Section 12-UT1 Reach 3



Bankfull Dimensions	
18.7	x-section area (ft.sq.)
16.7	width (ft)
1.1	mean depth (ft)
2.4	max depth (ft)
17.8	wetted perimeter (ft)
1.1	hydraulic radius (ft)
14.8	width-depth ratio

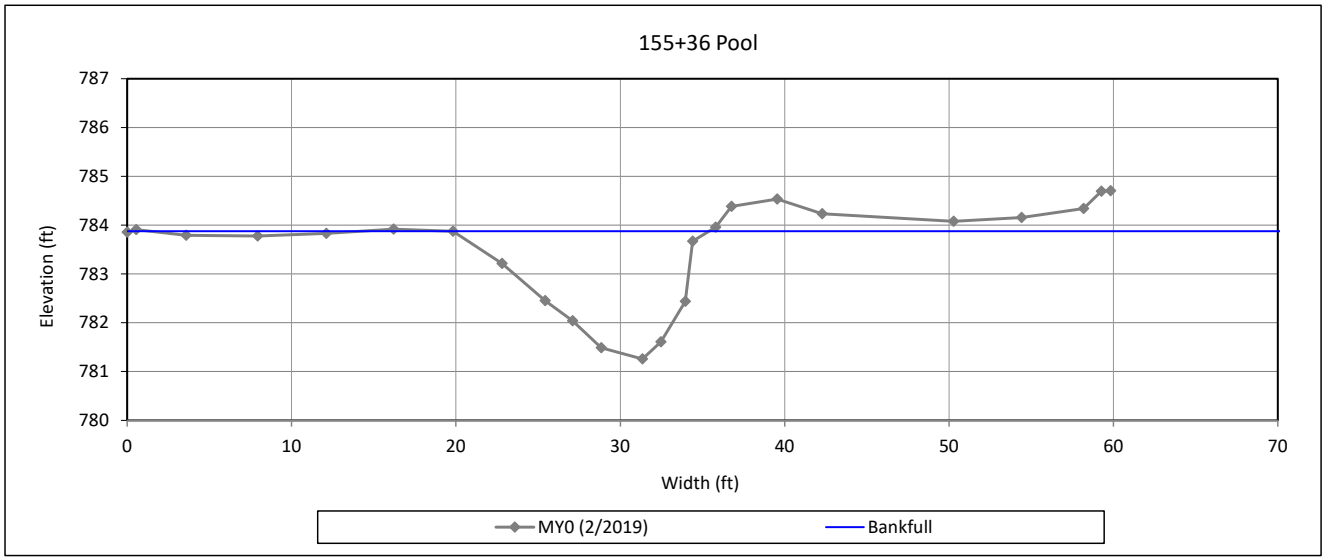
Survey Date: 2/2014
Field Crew: Turner Land Surveying

View Downstream

Cross-Section Plots

Lone Hickory Mitigation Site
NCDMS Project No. 97135
Monitoring Year 0 - 2019

Cross-Section 13-UT1 Reach 3



Bankfull Dimensions	
22.4	x-section area (ft.sq.)
15.6	width (ft)
1.4	mean depth (ft)
2.6	max depth (ft)
17.1	wetted perimeter (ft)
1.3	hydraulic radius (ft)
10.9	width-depth ratio

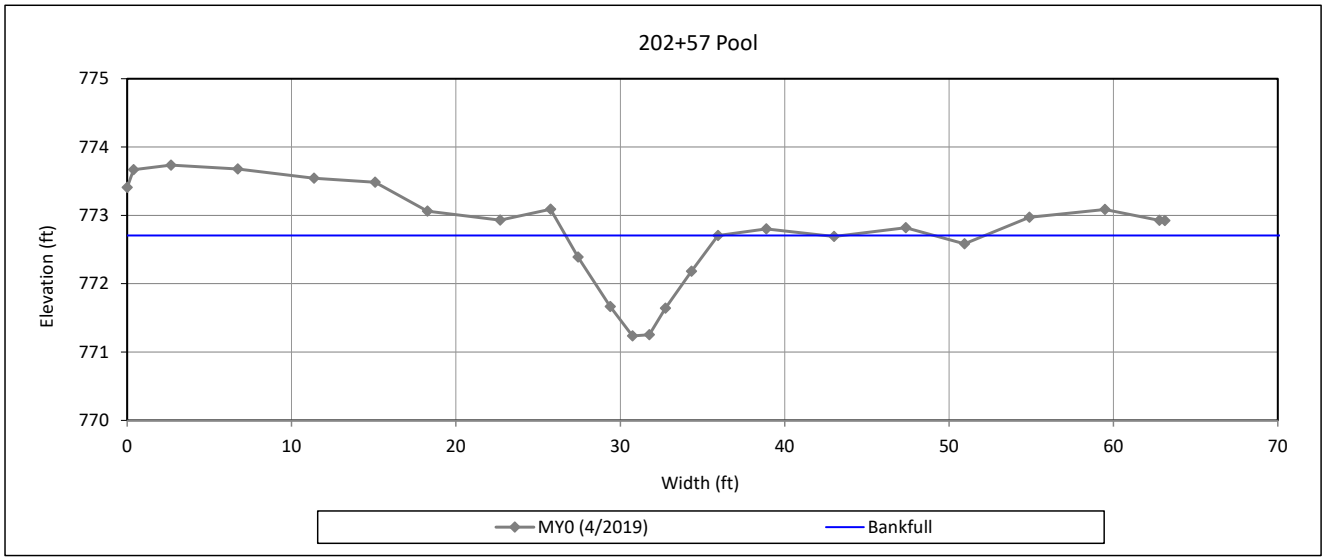
Survey Date: 2/2019
Field Crew: Turner Land Surveying

View Downstream

Cross-Section Plots

Lone Hickory Mitigation Site
NCDMS Project No. 97135
Monitoring Year 0 - 2019

Cross-Section 14-UT2 Reach 1



Bankfull Dimensions	
7.6	x-section area (ft.sq.)
9.3	width (ft)
0.8	mean depth (ft)
1.5	max depth (ft)
9.8	wetted perimeter (ft)
0.8	hydraulic radius (ft)
11.4	width-depth ratio

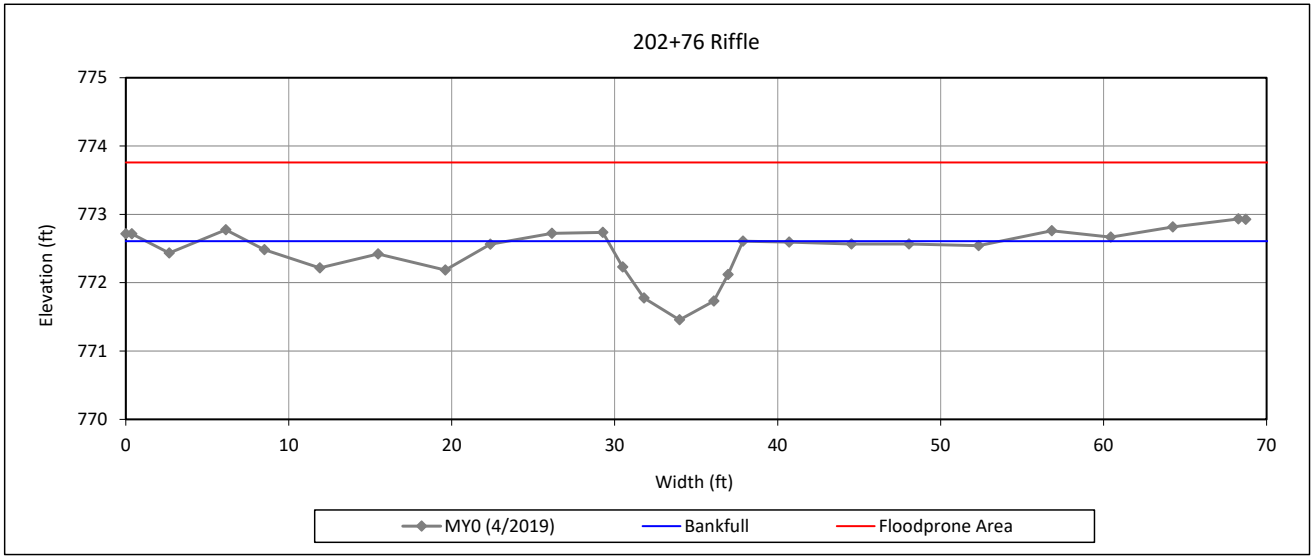
Survey Date: 4/2019
Field Crew: Turner Land Surveying

View Downstream

Cross-Section Plots

Lone Hickory Mitigation Site
NCDMS Project No. 97135
Monitoring Year 0 - 2019

Cross-Section 15-UT2 Reach 1



Bankfull Dimensions	
6.1	x-section area (ft.sq.)
8.3	width (ft)
0.7	mean depth (ft)
1.2	max depth (ft)
8.7	wetted perimeter (ft)
0.7	hydraulic radius (ft)
11.3	width-depth ratio
68.7	W flood prone area (ft)
8.3	entrenchment ratio
1.0	low bank height ratio

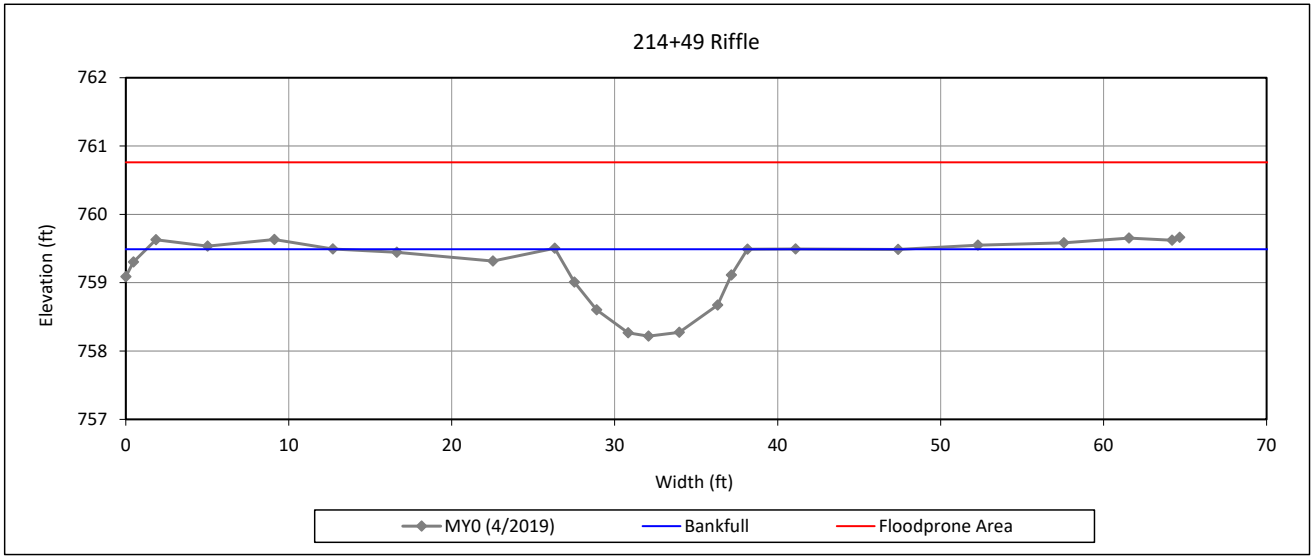
Survey Date: 4/2019
Field Crew: Turner Land Surveying

View Downstream

Cross-Section Plots

Lone Hickory Mitigation Site
NCDMS Project No. 97135
Monitoring Year 0 - 2019

Cross-Section 16-UT2 Reach 2



Bankfull Dimensions	
10.2	x-section area (ft.sq.)
11.8	width (ft)
0.9	mean depth (ft)
1.3	max depth (ft)
12.2	wetted perimeter (ft)
0.8	hydraulic radius (ft)
13.6	width-depth ratio
64.7	W flood prone area (ft)
5.5	entrenchment ratio
1.0	low bank height ratio

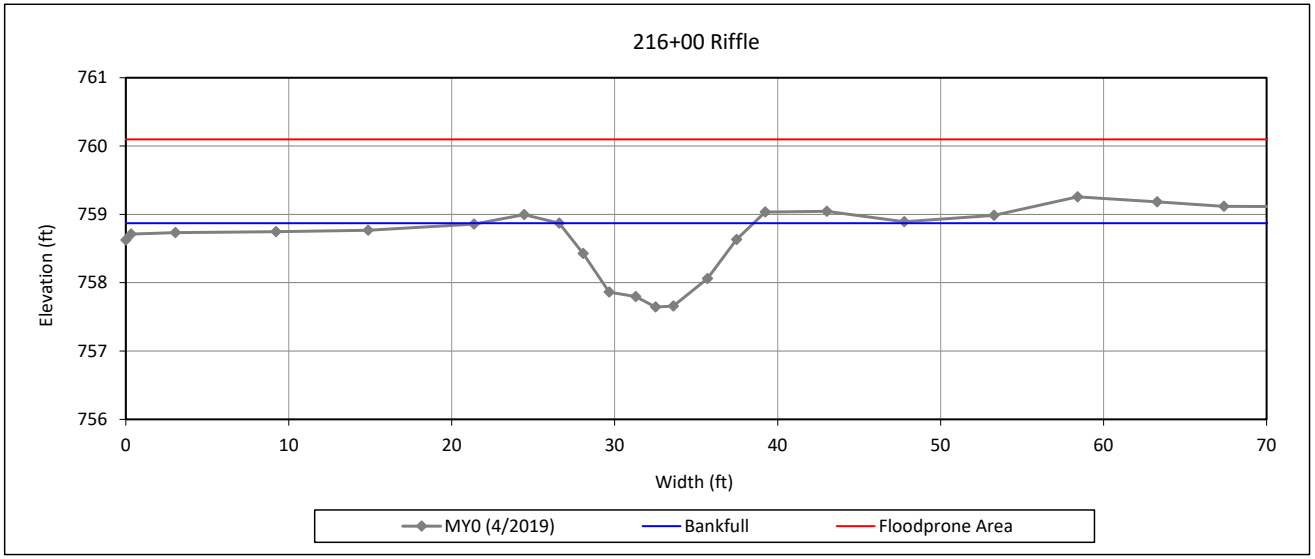
Survey Date: 4/2019
Field Crew: Turner Land Surveying

View Downstream

Cross-Section Plots

Lone Hickory Mitigation Site
NCDMS Project No. 97135
Monitoring Year 0 - 2019

Cross-Section 17-UT2 Reach 2



Bankfull Dimensions	
9.1	x-section area (ft.sq.)
11.9	width (ft)
0.8	mean depth (ft)
1.2	max depth (ft)
12.2	wetted perimeter (ft)
0.7	hydraulic radius (ft)
15.6	width-depth ratio
72.2	W flood prone area (ft)
6.1	entrenchment ratio
1.0	low bank height ratio

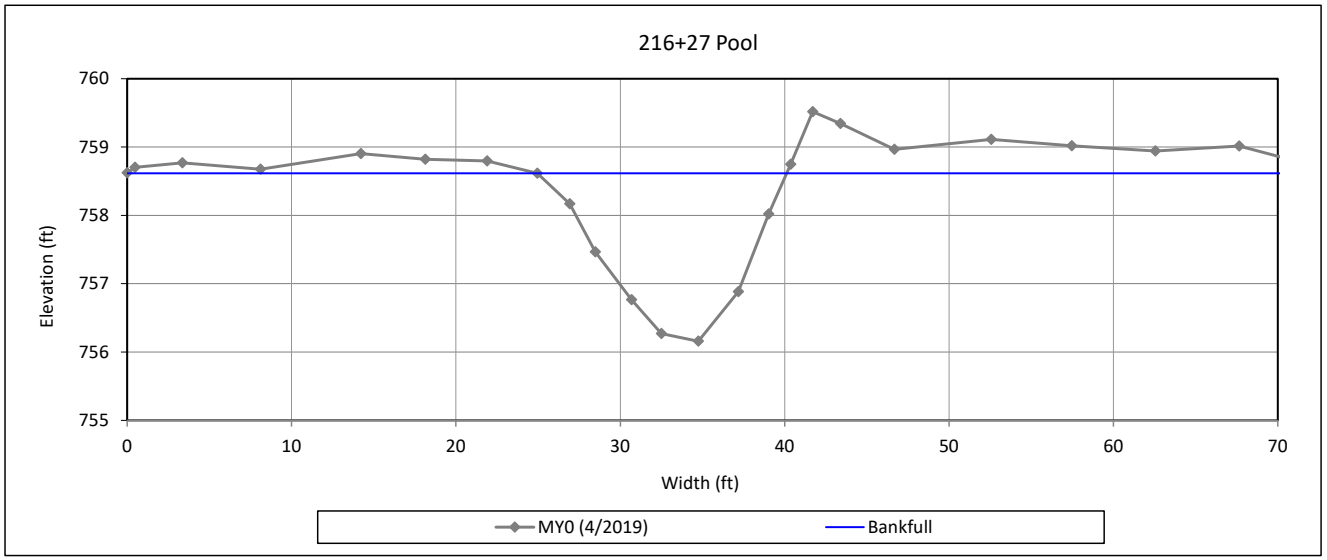
Survey Date: 4/2019
Field Crew: Turner Land Surveying

View Downstream

Cross-Section Plots

Lone Hickory Mitigation Site
NCDMS Project No. 97135
Monitoring Year 0 - 2019

Cross-Section 18-UT2 Reach 2



Bankfull Dimensions	
21.8	x-section area (ft.sq.)
15.2	width (ft)
1.4	mean depth (ft)
2.5	max depth (ft)
16.1	wetted perimeter (ft)
1.3	hydraulic radius (ft)
10.6	width-depth ratio

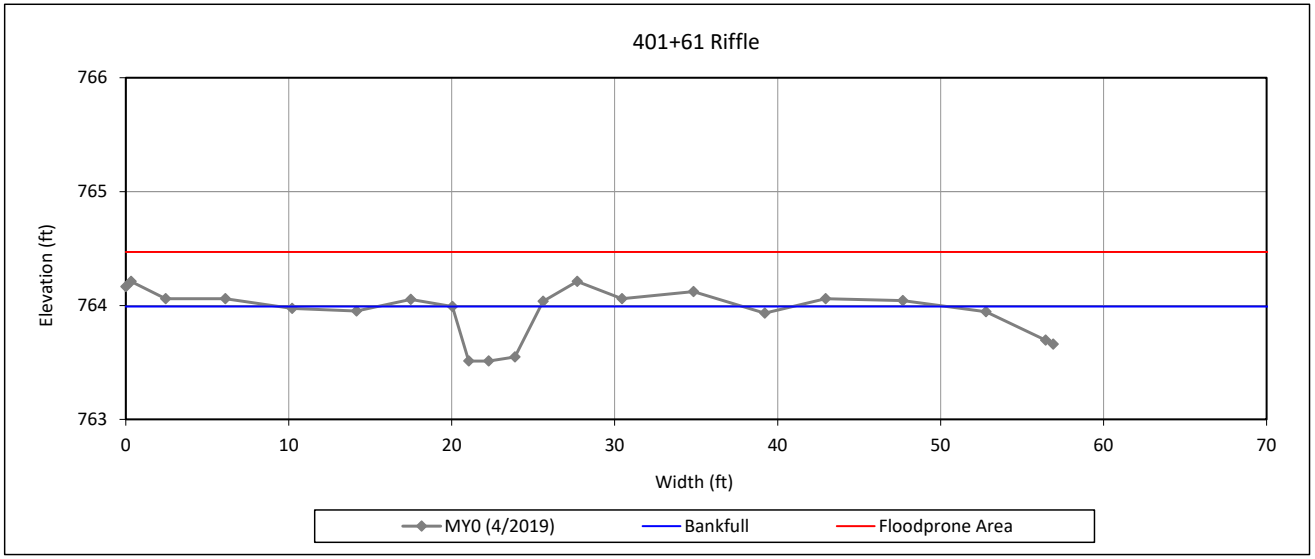
Survey Date: 4/2019
Field Crew: Turner Land Surveying

View Downstream

Cross-Section Plots

Lone Hickory Mitigation Site
NCDMS Project No. 97135
Monitoring Year 0 - 2019

Cross-Section 19-UT2A



Bankfull Dimensions	
1.9	x-section area (ft.sq.)
5.4	width (ft)
0.4	mean depth (ft)
0.5	max depth (ft)
5.6	wetted perimeter (ft)
0.3	hydraulic radius (ft)
15.2	width-depth ratio
56.9	W flood prone area (ft)
10.5	entrenchment ratio
1.0	low bank height ratio

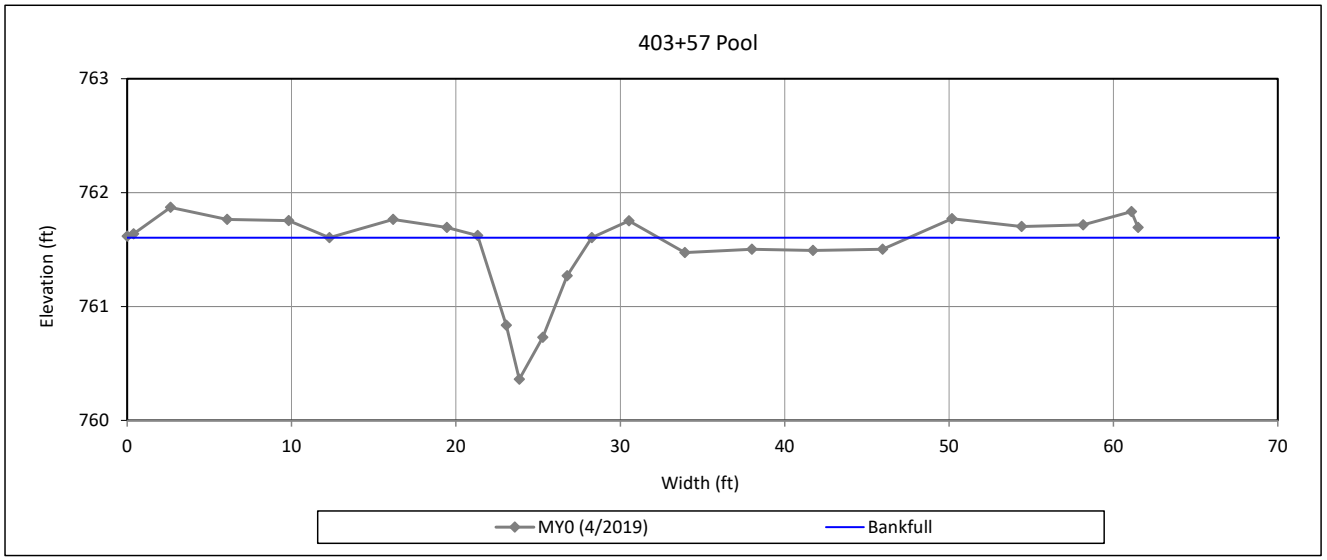
Survey Date: 4/2019
Field Crew: Turner Land Surveying

View Downstream

Cross-Section Plots

Lone Hickory Mitigation Site
NCDMS Project No. 97135
Monitoring Year 0 - 2019

Cross-Section 20-UT2A



Bankfull Dimensions	
4.1	x-section area (ft.sq.)
6.9	width (ft)
0.6	mean depth (ft)
1.2	max depth (ft)
7.4	wetted perimeter (ft)
0.6	hydraulic radius (ft)
11.6	width-depth ratio

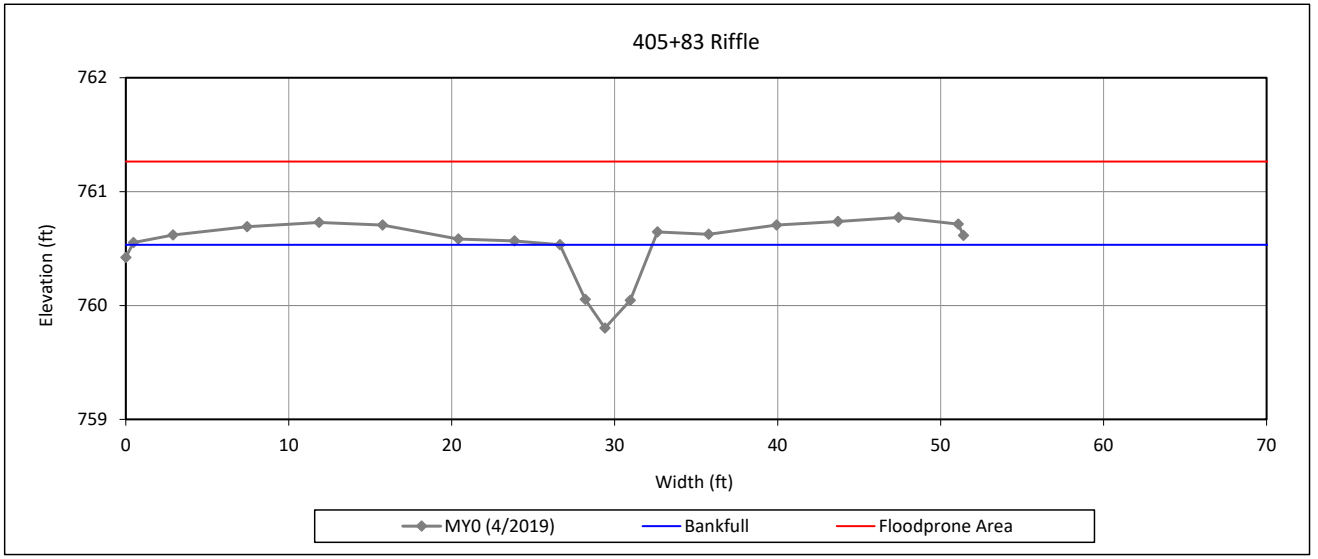
Survey Date: 4/2019
Field Crew: Turner Land Surveying

View Downstream

Cross-Section Plots

Lone Hickory Mitigation Site
NCDMS Project No. 97135
Monitoring Year 0 - 2019

Cross-Section 21-UT2A



Bankfull Dimensions	
2.4	x-section area (ft.sq.)
5.7	width (ft)
0.4	mean depth (ft)
0.7	max depth (ft)
5.9	wetted perimeter (ft)
0.4	hydraulic radius (ft)
13.6	width-depth ratio
51.4	W flood prone area (ft)
9.0	entrenchment ratio
1.0	low bank height ratio

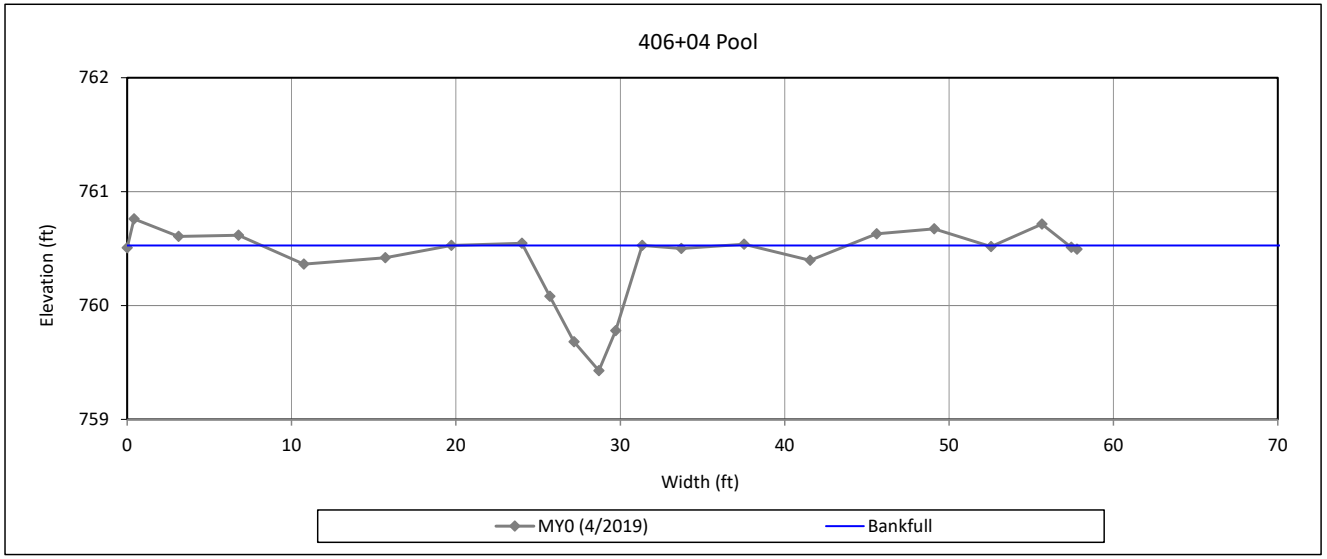
Survey Date: 4/2019
Field Crew: Turner Land Surveying

View Downstream

Cross-Section Plots

Lone Hickory Mitigation Site
NCDMS Project No. 97135
Monitoring Year 0 - 2019

Cross-Section 22-UT2A



Bankfull Dimensions	
4.3	x-section area (ft.sq.)
7.2	width (ft)
0.6	mean depth (ft)
1.1	max depth (ft)
7.6	wetted perimeter (ft)
0.6	hydraulic radius (ft)
12.1	width-depth ratio

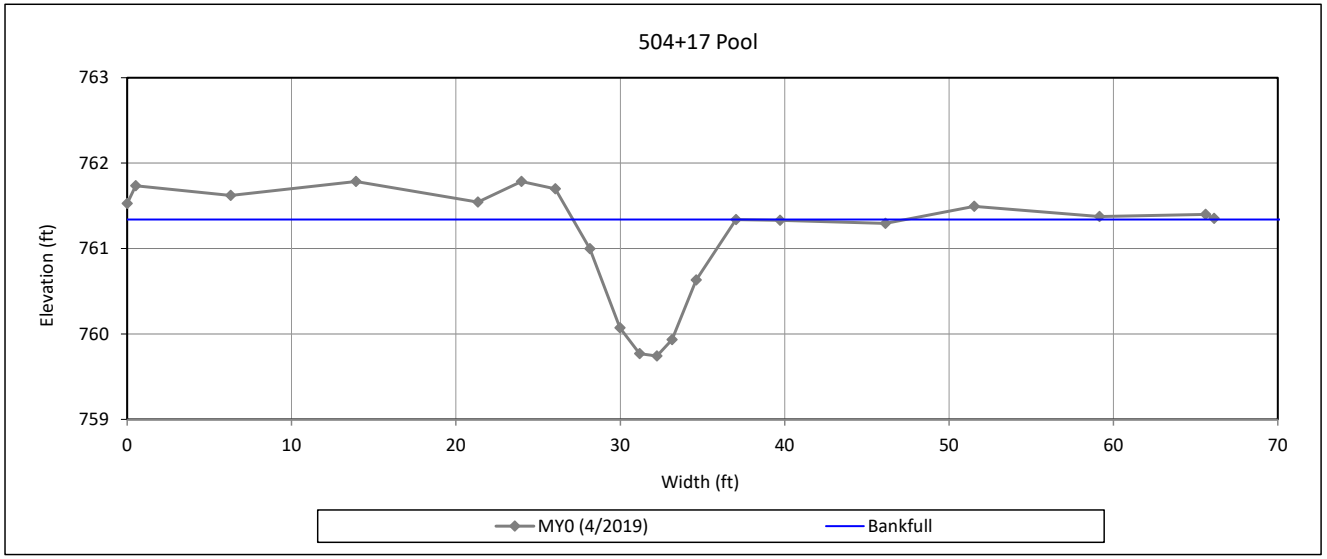
Survey Date: 4/2019
Field Crew: Turner Land Surveying

View Downstream

Cross-Section Plots

Lone Hickory Mitigation Site
NCDMS Project No. 97135
Monitoring Year 0 - 2019

Cross-Section 23-UT2B



Bankfull Dimensions	
8.8	x-section area (ft.sq.)
9.9	width (ft)
0.9	mean depth (ft)
1.6	max depth (ft)
10.5	wetted perimeter (ft)
0.8	hydraulic radius (ft)
11.2	width-depth ratio

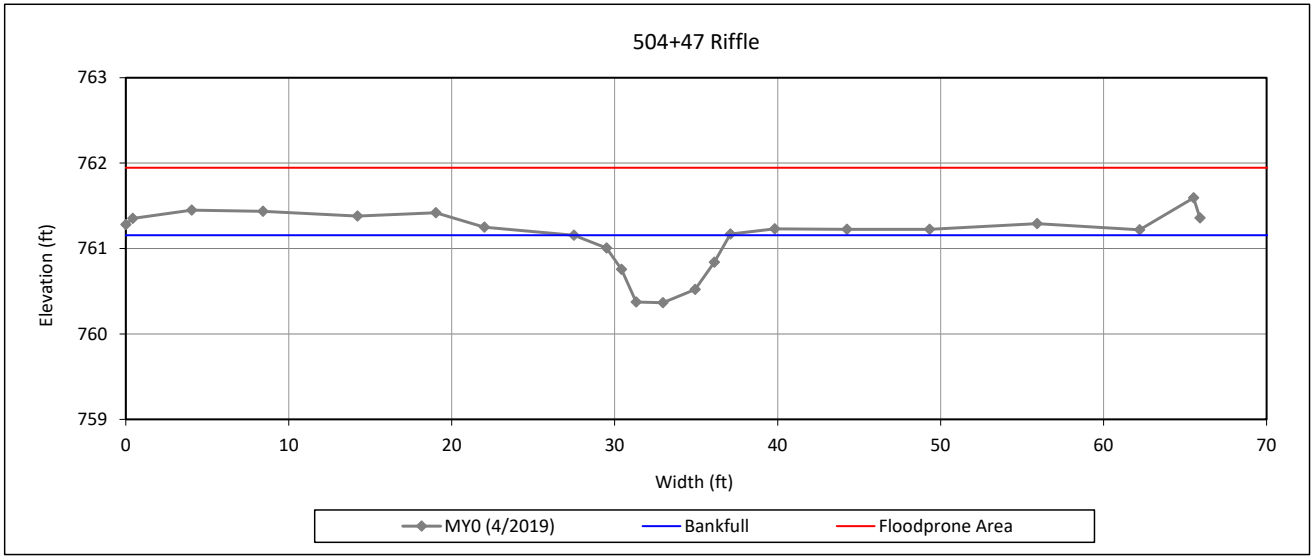
Survey Date: 4/2019
Field Crew: Turner Land Surveying

View Downstream

Cross-Section Plots

Lone Hickory Mitigation Site
NCDMS Project No. 97135
Monitoring Year 0 - 2019

Cross-Section 24-UT2B



Bankfull Dimensions	
4.3	x-section area (ft.sq.)
9.6	width (ft)
0.5	mean depth (ft)
0.8	max depth (ft)
9.8	wetted perimeter (ft)
0.4	hydraulic radius (ft)
21.1	width-depth ratio
65.9	W flood prone area (ft)
6.9	entrenchment ratio
1.0	low bank height ratio

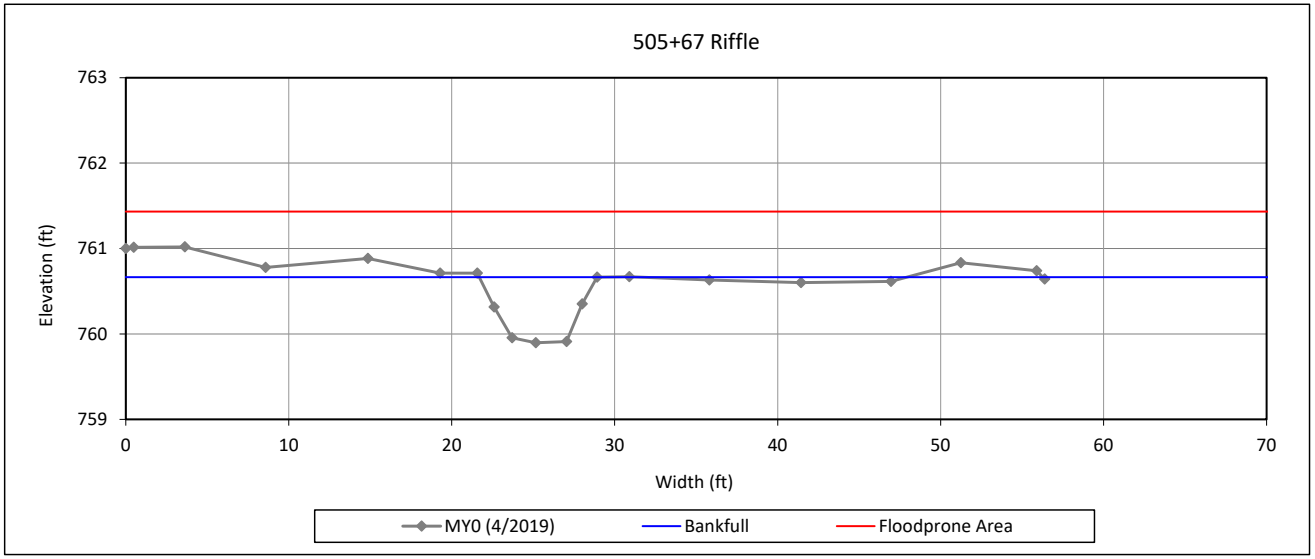
Survey Date: 4/2019
Field Crew: Turner Land Surveying

View Downstream

Cross-Section Plots

Lone Hickory Mitigation Site
NCDMS Project No. 97135
Monitoring Year 0 - 2019

Cross-Section 25-UT2B



Bankfull Dimensions	
3.9	x-section area (ft.sq.)
7.2	width (ft)
0.5	mean depth (ft)
0.8	max depth (ft)
7.5	wetted perimeter (ft)
0.5	hydraulic radius (ft)
13.4	width-depth ratio
56.4	W flood prone area (ft)
7.8	entrenchment ratio
1.0	low bank height ratio

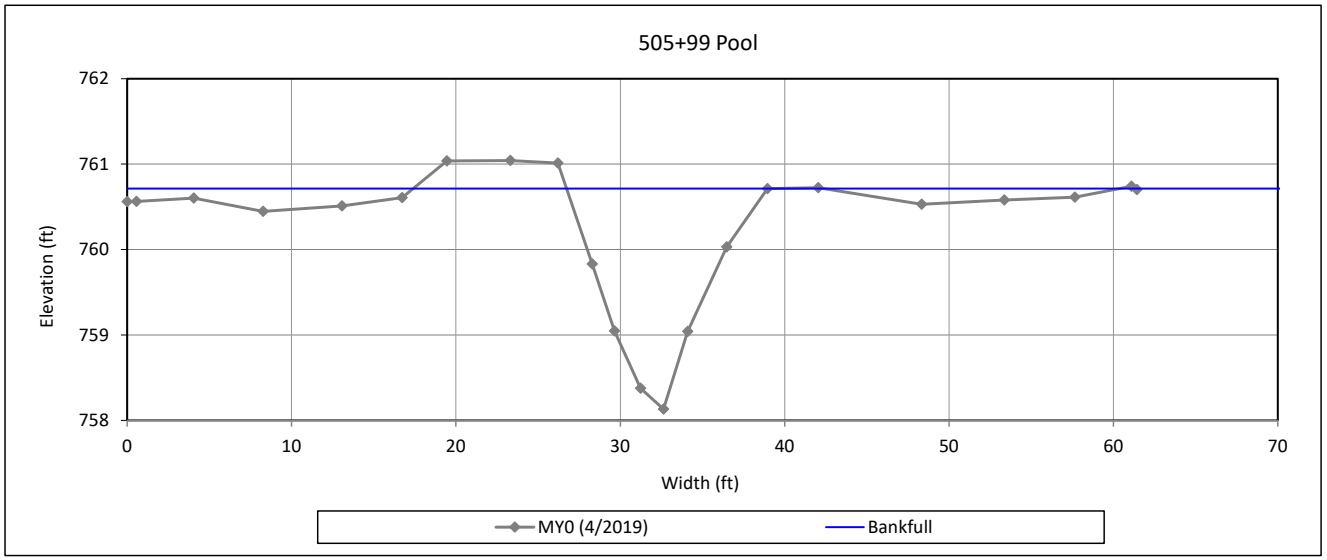
Survey Date: 4/2019
Field Crew: Turner Land Surveying

View Downstream

Cross-Section Plots

Lone Hickory Mitigation Site
NCDMS Project No. 97135
Monitoring Year 0 - 2019

Cross-Section 26-UT2B



Bankfull Dimensions	
15.8	x-section area (ft.sq.)
12.2	width (ft)
1.3	mean depth (ft)
2.6	max depth (ft)
13.4	wetted perimeter (ft)
1.2	hydraulic radius (ft)
9.4	width-depth ratio

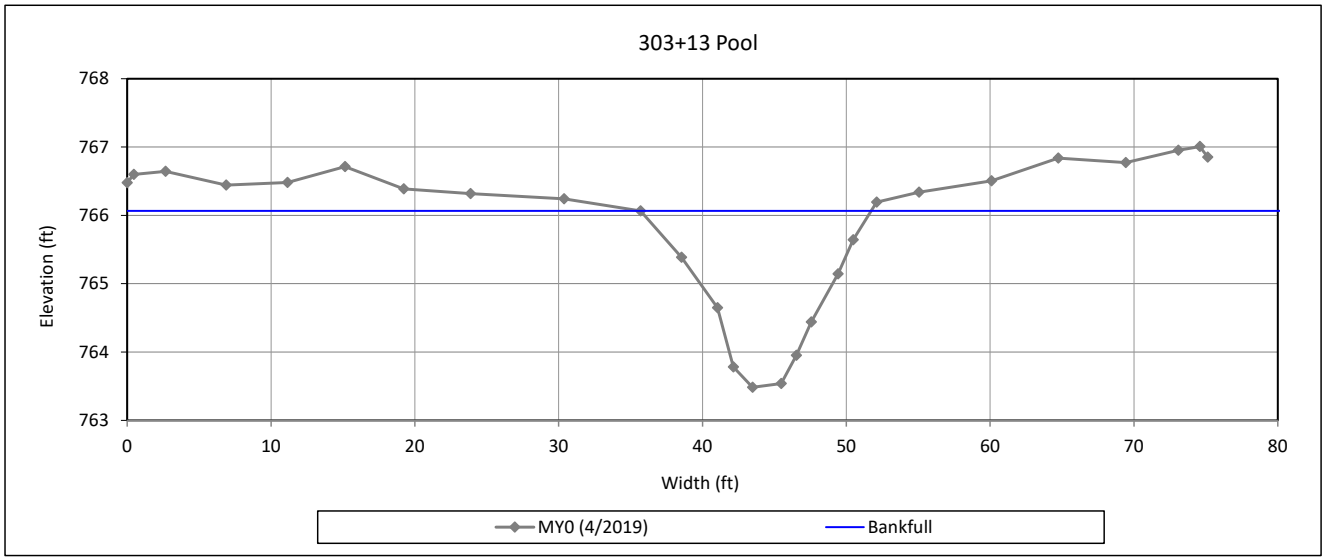
Survey Date: 4/2019
Field Crew: Turner Land Surveying

View Downstream

Cross-Section Plots

Lone Hickory Mitigation Site
NCDMS Project No. 97135
Monitoring Year 0 - 2019

Cross-Section 27-UT3 Reach 1



Bankfull Dimensions	
21.7	x-section area (ft.sq.)
16.0	width (ft)
1.4	mean depth (ft)
2.6	max depth (ft)
17.1	wetted perimeter (ft)
1.3	hydraulic radius (ft)
11.9	width-depth ratio

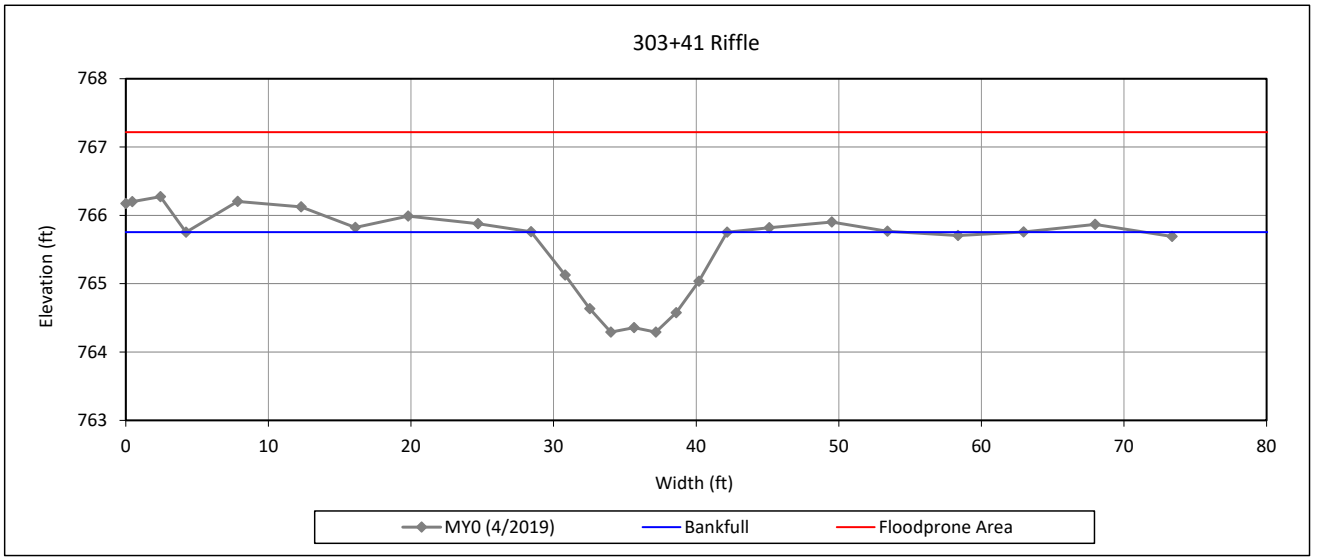
Survey Date: 4/2019
Field Crew: Turner Land Surveying

View Downstream

Cross-Section Plots

Lone Hickory Mitigation Site
NCDMS Project No. 97135
Monitoring Year 0 - 2019

Cross-Section 28-UT3 Reach 1



Bankfull Dimensions	
12.8	x-section area (ft.sq.)
13.7	width (ft)
0.9	mean depth (ft)
1.5	max depth (ft)
14.1	wetted perimeter (ft)
0.9	hydraulic radius (ft)
14.7	width-depth ratio
73.4	W flood prone area (ft)
5.3	entrenchment ratio
1.0	low bank height ratio

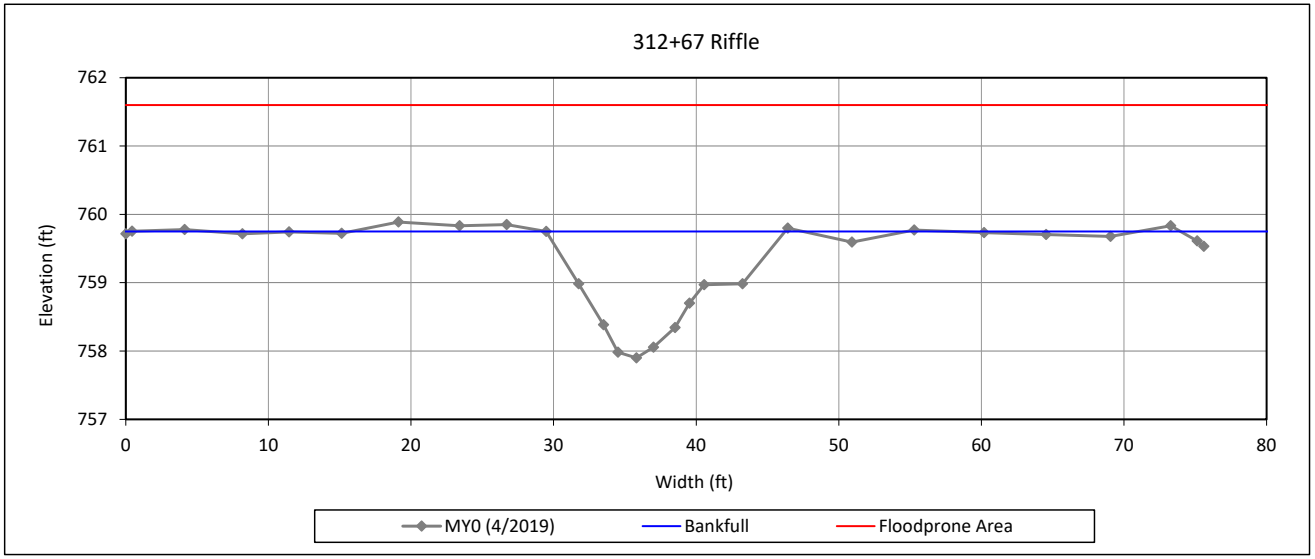
Survey Date: 4/2019
Field Crew: Turner Land Surveying

View Downstream

Cross-Section Plots

Lone Hickory Mitigation Site
NCDMS Project No. 97135
Monitoring Year 0 - 2019

Cross-Section 29-UT3 Reach 2



Bankfull Dimensions	
16.5	x-section area (ft.sq.)
16.7	width (ft)
1.0	mean depth (ft)
1.9	max depth (ft)
17.3	wetted perimeter (ft)
1.0	hydraulic radius (ft)
17.0	width-depth ratio
75.6	W flood prone area (ft)
4.5	entrenchment ratio
1.0	low bank height ratio

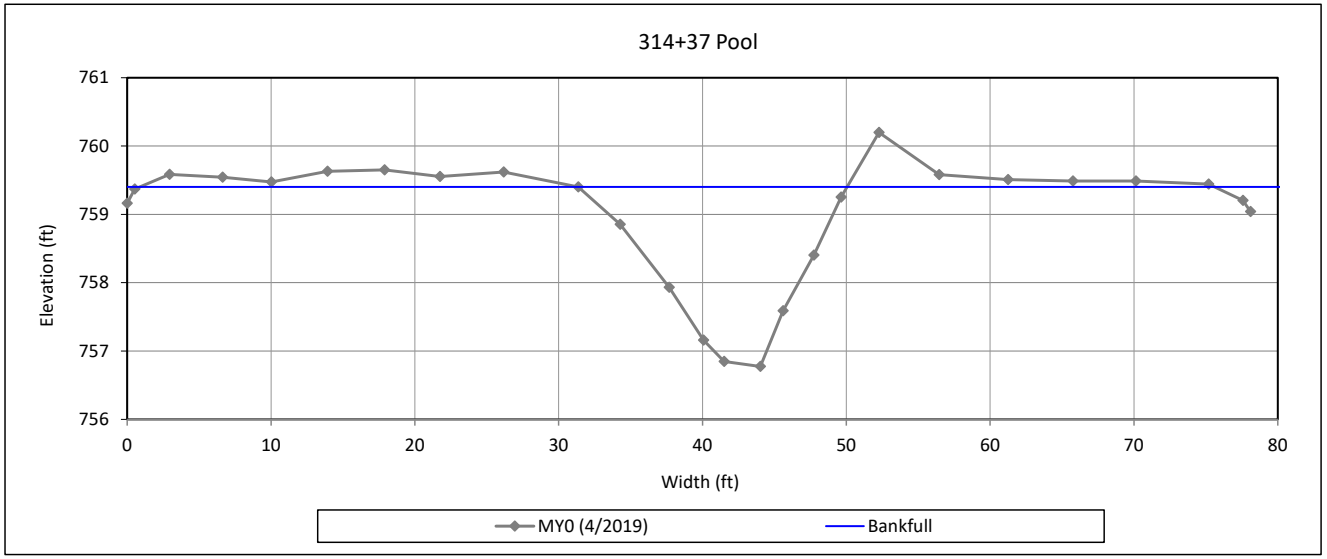
Survey Date: 4/2019
Field Crew: Turner Land Surveying

View Downstream

Cross-Section Plots

Lone Hickory Mitigation Site
NCDMS Project No. 97135
Monitoring Year 0 - 2019

Cross-Section 30-UT3 Reach 2



Bankfull Dimensions	
26.3	x-section area (ft.sq.)
18.7	width (ft)
1.4	mean depth (ft)
2.6	max depth (ft)
19.6	wetted perimeter (ft)
1.3	hydraulic radius (ft)
13.3	width-depth ratio

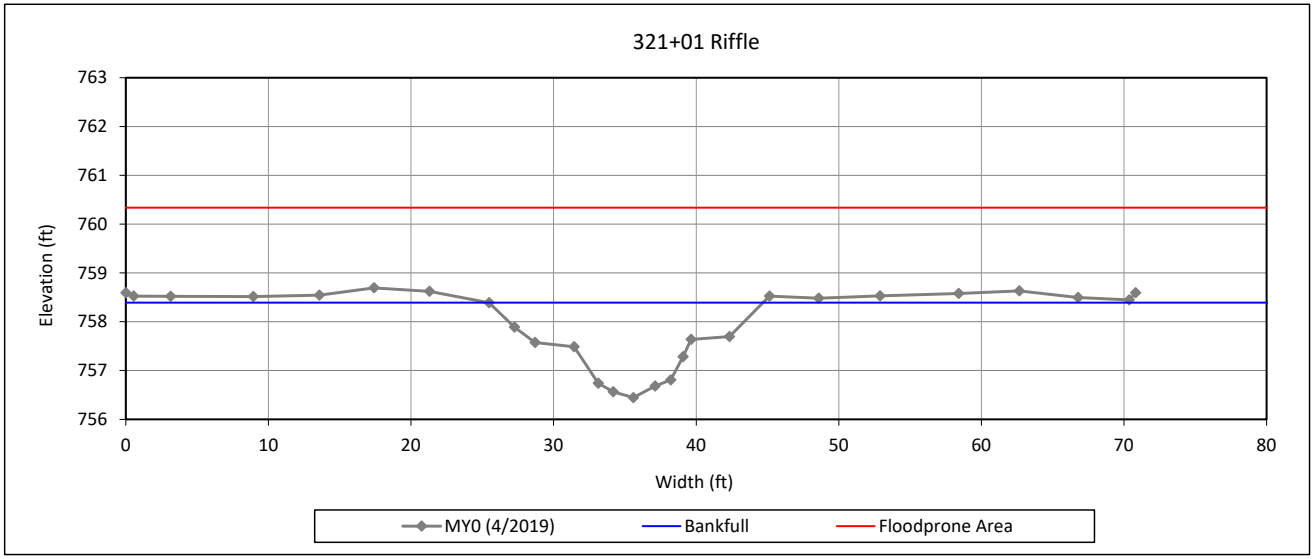
Survey Date: 4/2019
Field Crew: Turner Land Surveying

View Downstream

Cross-Section Plots

Lone Hickory Mitigation Site
NCDMS Project No. 97135
Monitoring Year 0 - 2019

Cross-Section 31-UT3 Reach 3



Bankfull Dimensions	
19.5	x-section area (ft.sq.)
19.2	width (ft)
1.0	mean depth (ft)
1.9	max depth (ft)
19.8	wetted perimeter (ft)
1.0	hydraulic radius (ft)
19.0	width-depth ratio
70.8	W flood prone area (ft)
3.7	entrenchment ratio
1.0	low bank height ratio

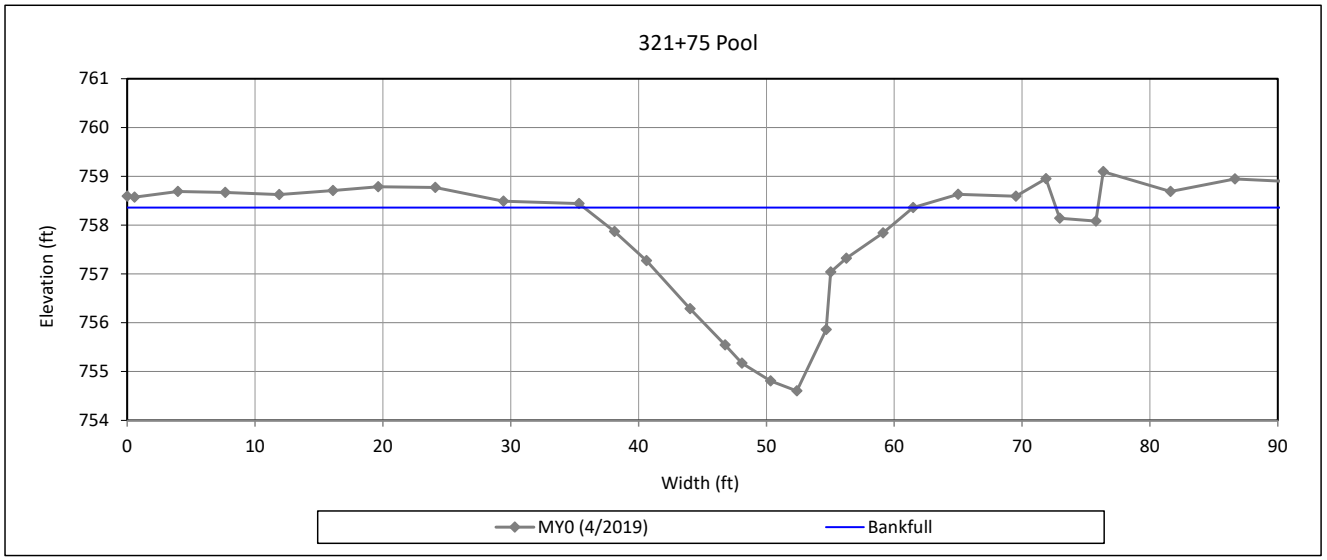
Survey Date: 4/2019
Field Crew: Turner Land Surveying

View Downstream

Cross-Section Plots

Lone Hickory Mitigation Site
NCDMS Project No. 97135
Monitoring Year 0 - 2019

Cross-Section 32-UT3 Reach 3



Bankfull Dimensions	
45.8	x-section area (ft.sq.)
25.8	width (ft)
1.8	mean depth (ft)
3.8	max depth (ft)
27.5	wetted perimeter (ft)
1.7	hydraulic radius (ft)
14.5	width-depth ratio

Survey Date: 4/2019
Field Crew: Turner Land Surveying

View Downstream

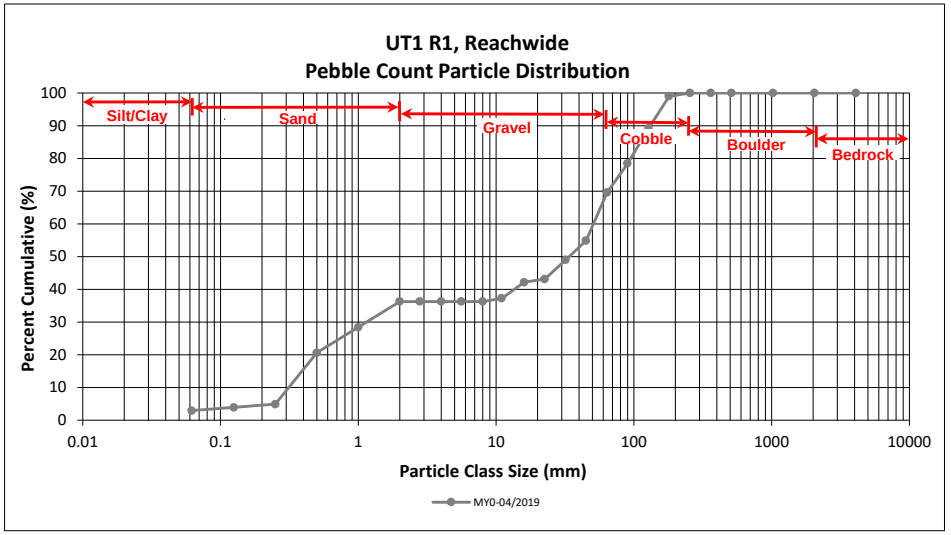
Reachwide Pebble Count Plots

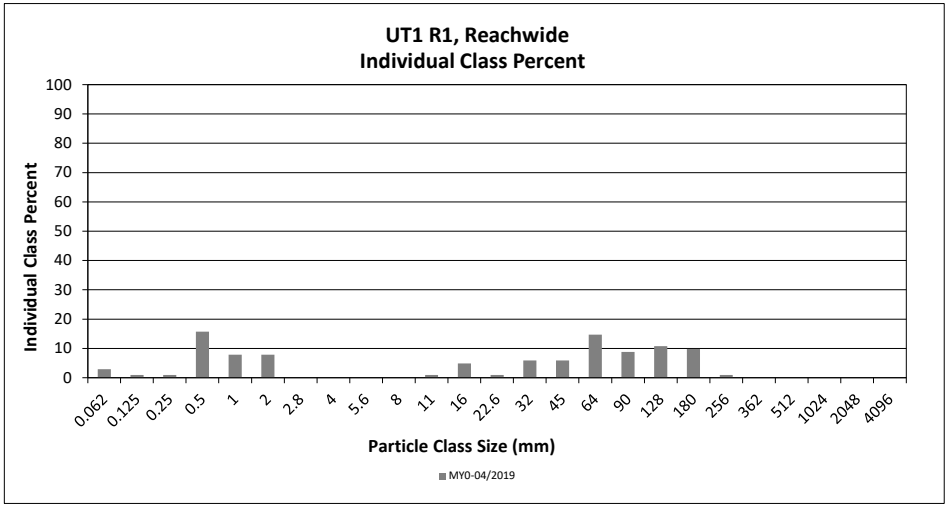
Lone Hickory Mitigation Site
DMS Project No. 97135
Monitoring Year 0 - 2019

UT1 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	1	2	3	3	3
SAND	Very fine	0.062	0.125		1	1	1	4
	Fine	0.125	0.250		1	1	1	5
	Medium	0.25	0.50	1	15	16	16	21
	Coarse	0.5	1.0	1	7	8	8	28
	Very Coarse	1.0	2.0	1	7	8	8	36
GRAVEL	Very Fine	2.0	2.8					36
	Very Fine	2.8	4.0					36
	Fine	4.0	5.6					36
	Fine	5.6	8.0					36
	Medium	8.0	11.0		1	1	1	37
	Medium	11.0	16.0	3	2	5	5	42
	Coarse	16.0	22.6	1		1	1	43
	Coarse	22.6	32	3	3	6	6	49
	Very Coarse	32	45	4	2	6	6	55
	Very Coarse	45	64	13	2	15	15	70
COBBLE	Small	64	90	8	1	9	9	78
	Small	90	128	7	4	11	11	89
	Large	128	180	8	2	10	10	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	**51**	**51**	**102**	**100**	**100**

Reachwide	
Channel materials (mm)	
D_{16} =	0.4
D_{35} =	1.8
D_{50} =	33.9
D_{84} =	108.0
D_{95} =	156.5
D_{100} =	256.0





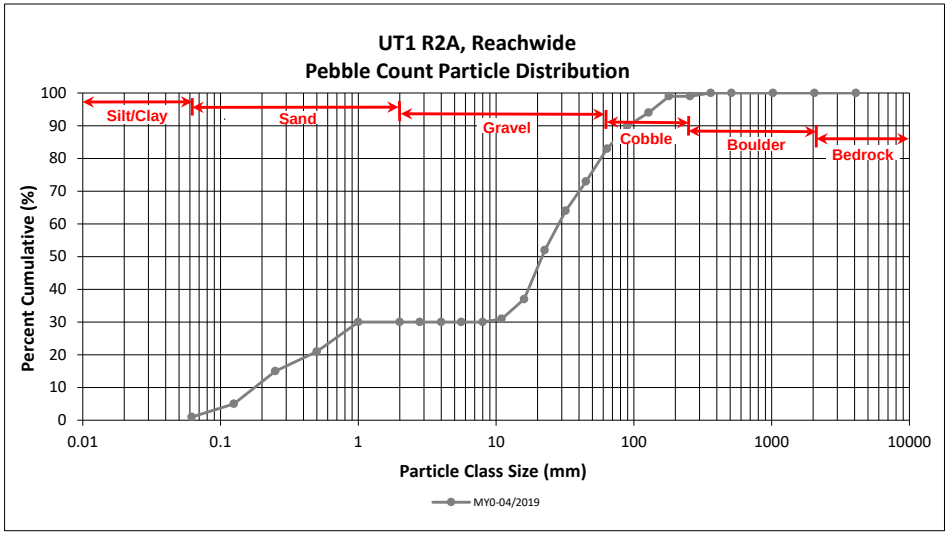
Reachwide Pebble Count Plots

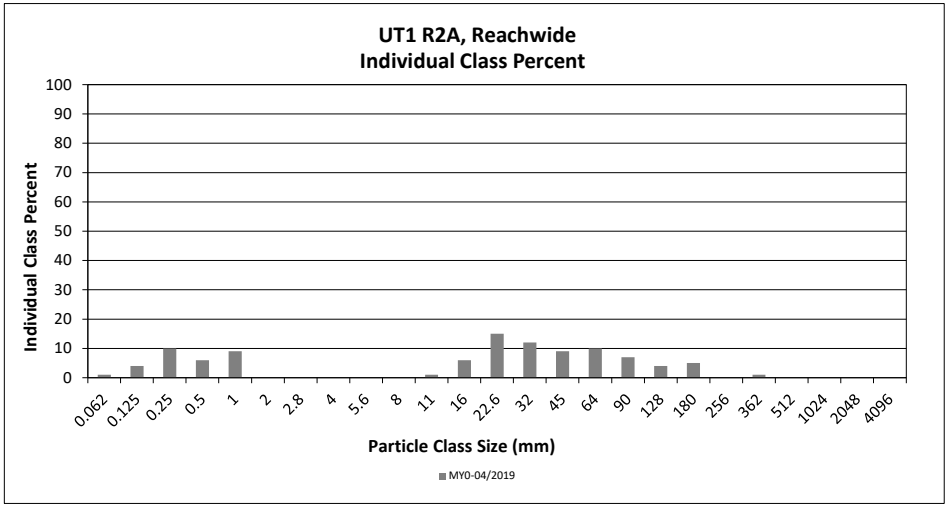
Lone Hickory Mitigation Site
DMS Project No. 97135
Monitoring Year 0 - 2019

UT1 R2A, 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	1	1	1
SAND	Very fine	0.062	0.125		4	4	4	5
	Fine	0.125	0.250		10	10	10	15
	Medium	0.25	0.50		6	6	6	21
	Coarse	0.5	1.0		9	9	9	30
	Very Coarse	1.0	2.0					30
GRAVEL	Very Fine	2.0	2.8					30
	Very Fine	2.8	4.0					30
	Fine	4.0	5.6					30
	Fine	5.6	8.0					30
	Medium	8.0	11.0	1		1	1	31
	Medium	11.0	16.0	3	3	6	6	37
	Coarse	16.0	22.6	11	4	15	15	52
	Coarse	22.6	32	9	3	12	12	64
	Very Coarse	32	45	6	3	9	9	73
	Very Coarse	45	64	8	2	10	10	83
COBBLE	Small	64	90	6	1	7	7	90
	Small	90	128	3	1	4	4	94
	Large	128	180	2	3	5	5	99
	Large	180	256					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} =	0.3
D_{35} =	14.1
D_{50} =	21.6
D_{84} =	67.2
D_{95} =	137.0
D_{100} =	362.0





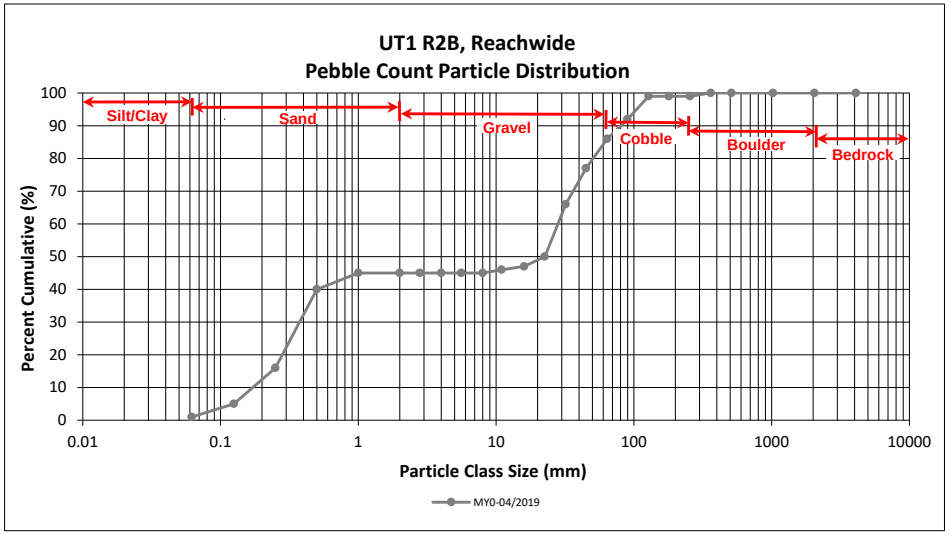
Reachwide Pebble Count Plots

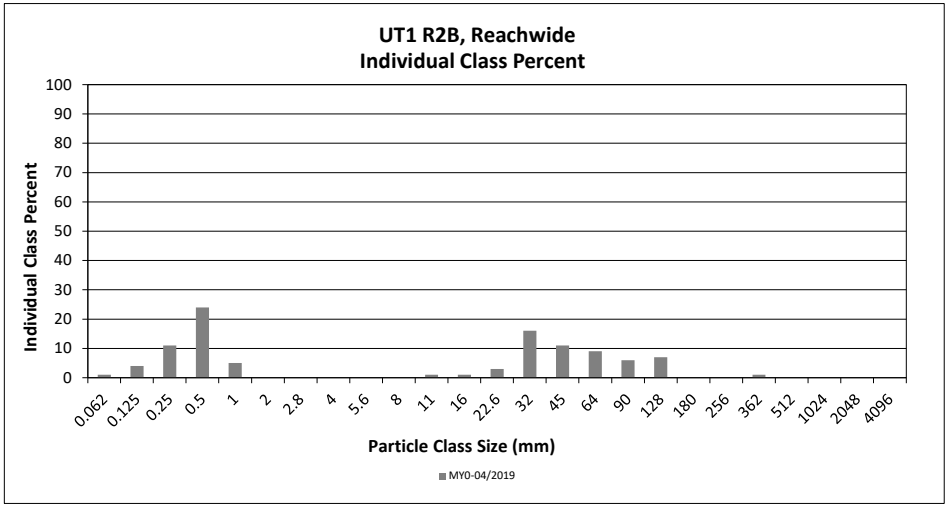
Lone Hickory Mitigation Site
DMS Project No. 97135
Monitoring Year 0 - 2019

UT1 R2B, 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	1	1	1
SAND	Very fine	0.062	0.125		4	4	4	5
	Fine	0.125	0.250		11	11	11	16
	Medium	0.25	0.50		24	24	24	40
	Coarse	0.5	1.0		5	5	5	45
	Very Coarse	1.0	2.0					45
GRAVEL	Very Fine	2.0	2.8					45
	Very Fine	2.8	4.0					45
	Fine	4.0	5.6					45
	Fine	5.6	8.0					45
	Medium	8.0	11.0		1	1	1	46
	Medium	11.0	16.0	1		1	1	47
	Coarse	16.0	22.6	3		3	3	50
	Coarse	22.6	32	13	3	16	16	66
	Very Coarse	32	45	10	1	11	11	77
	Very Coarse	45	64	9		9	9	86
COBBLE	Small	64	90	6		6	6	92
	Small	90	128	7		7	7	99
	Large	128	180					99
	Large	180	256					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} =	0.3
D_{35} =	0.4
D_{50} =	22.6
D_{84} =	59.2
D_{95} =	104.7
D_{100} =	362.0





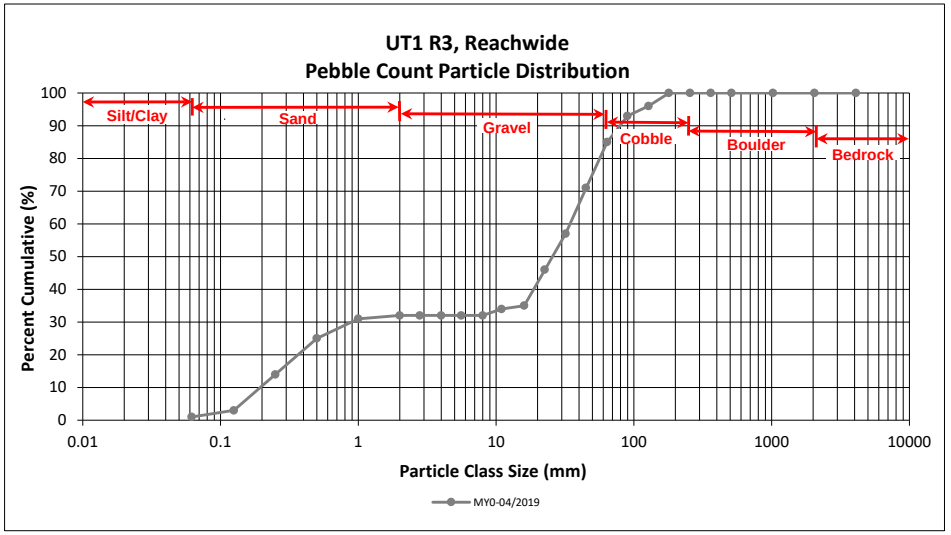
Reachwide Pebble Count Plots

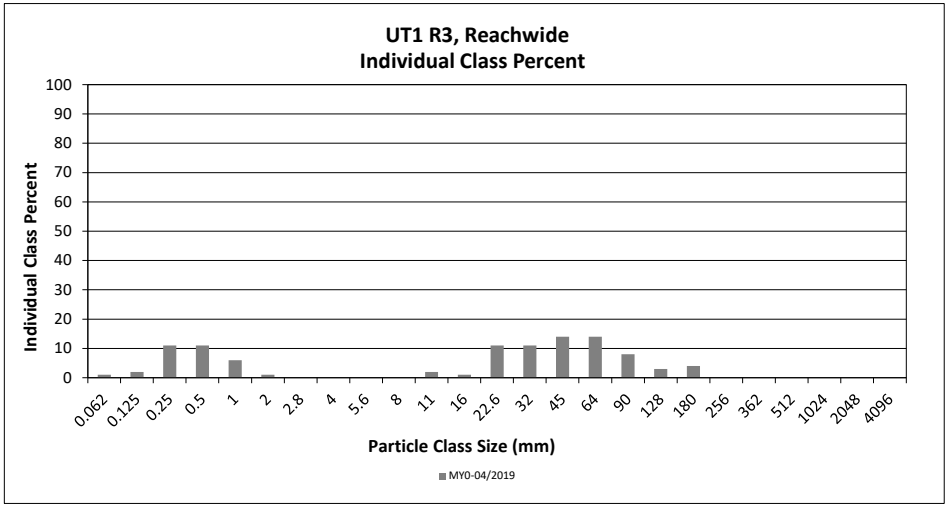
Lone Hickory Mitigation Site
DMS Project No. 97135
Monitoring Year 0 - 2019

UT1 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		1	1	1	1
SAND	Very fine	0.062	0.125		2	2	2	3
	Fine	0.125	0.250		11	11	11	14
	Medium	0.25	0.50		11	11	11	25
	Coarse	0.5	1.0		6	6	6	31
	Very Coarse	1.0	2.0		1	1	1	32
GRAVEL	Very Fine	2.0	2.8					32
	Very Fine	2.8	4.0					32
	Fine	4.0	5.6					32
	Fine	5.6	8.0					32
	Medium	8.0	11.0	1	1	2	2	34
	Medium	11.0	16.0		1	1	1	35
	Coarse	16.0	22.6	5	6	11	11	46
	Coarse	22.6	32	4	7	11	11	57
	Very Coarse	32	45	12	2	14	14	71
	Very Coarse	45	64	13	1	14	14	85
COBBLE	Small	64	90	8		8	8	93
	Small	90	128	3		3	3	96
	Large	128	180	4		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} =	0.3
D_{35} =	16.0
D_{50} =	25.6
D_{84} =	62.4
D_{95} =	113.8
D_{100} =	180.0





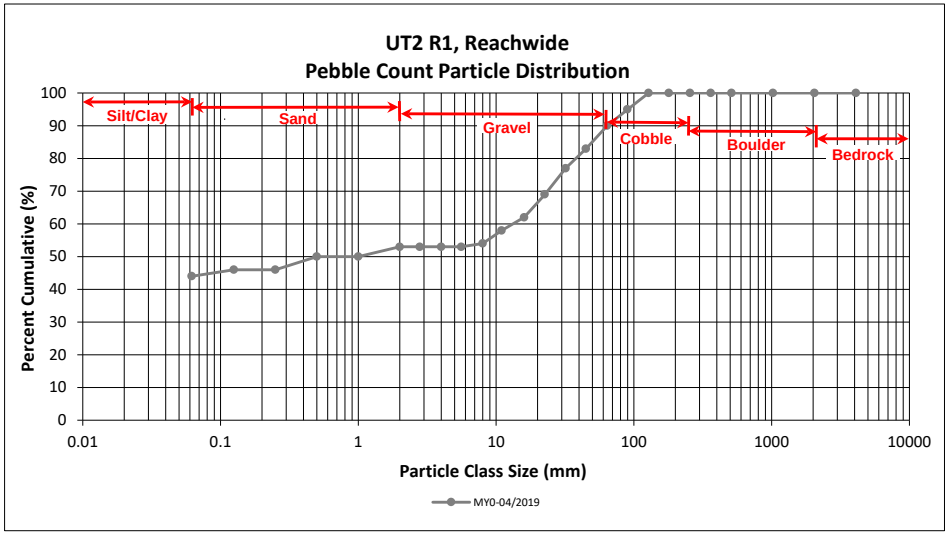
Reachwide Pebble Count Plots

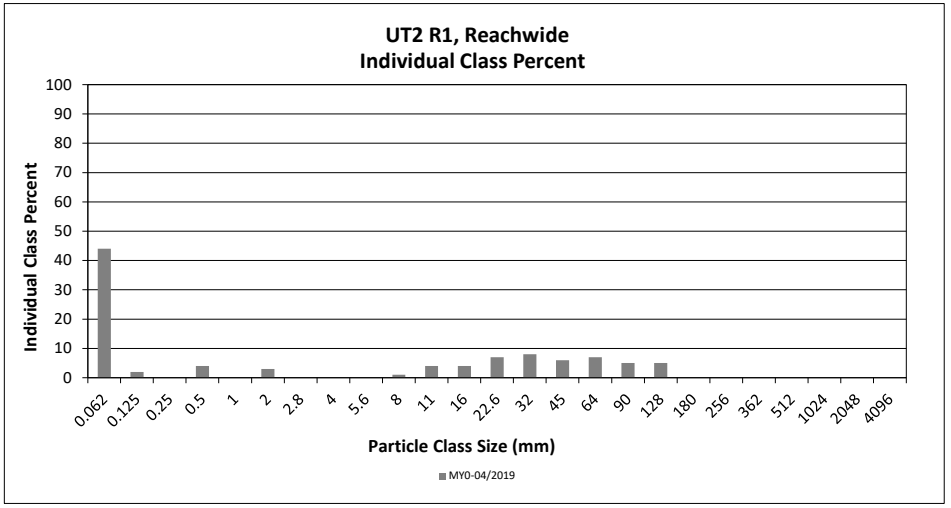
Lone Hickory Mitigation Site
DMS Project No. 97135
Monitoring Year 0 - 2019

UT2 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		44	44	44	44
SAND	Very fine	0.062	0.125		2	2	2	46
	Fine	0.125	0.250					46
	Medium	0.25	0.50		4	4	4	50
	Coarse	0.5	1.0					50
	Very Coarse	1.0	2.0	3		3	3	53
GRAVEL	Very Fine	2.0	2.8					53
	Very Fine	2.8	4.0					53
	Fine	4.0	5.6					53
	Fine	5.6	8.0	1		1	1	54
	Medium	8.0	11.0	4		4	4	58
	Medium	11.0	16.0	4		4	4	62
	Coarse	16.0	22.6	7		7	7	69
	Coarse	22.6	32	8		8	8	77
	Very Coarse	32	45	6		6	6	83
	Very Coarse	45	64	7		7	7	90
COBBLE	Small	64	90	5		5	5	95
	Small	90	128	5		5	5	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	**50**	**50**	**100**	**100**	**100**

Reachwide	
Channel materials (mm)	
D_{16} =	Silt/Clay
D_{35} =	Silt/Clay
D_{50} =	0.5
D_{84} =	47.3
D_{95} =	90.0
D_{100} =	128.0





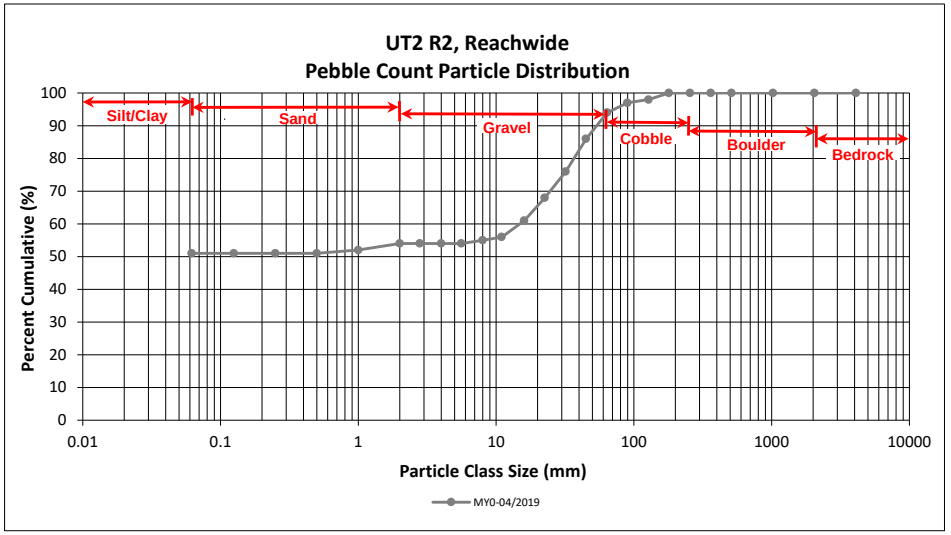
Reachwide Pebble Count Plots

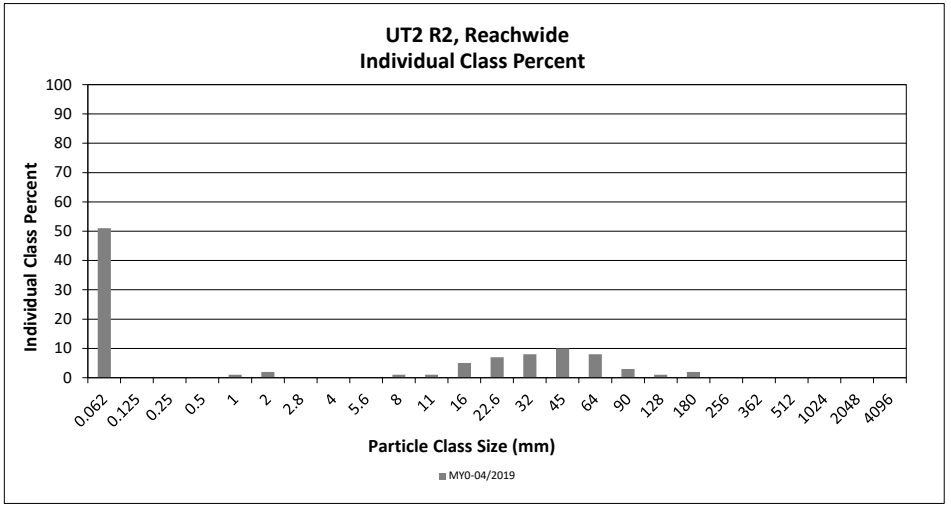
Lone Hickory Mitigation Site
DMS Project No. 97135
Monitoring Year 0 - 2019

UT2 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	1	50	51	51	51
SAND	Very fine	0.062	0.125					51
	Fine	0.125	0.250					51
	Medium	0.25	0.50					51
	Coarse	0.5	1.0	1		1	1	52
	Very Coarse	1.0	2.0	2		2	2	54
GRAVEL	Very Fine	2.0	2.8					54
	Very Fine	2.8	4.0					54
	Fine	4.0	5.6					54
	Fine	5.6	8.0	1		1	1	55
	Medium	8.0	11.0	1		1	1	56
	Medium	11.0	16.0	5		5	5	61
	Coarse	16.0	22.6	7		7	7	68
	Coarse	22.6	32	8		8	8	76
	Very Coarse	32	45	10		10	10	86
	Very Coarse	45	64	8		8	8	94
COBBLE	Small	64	90	3		3	3	97
	Small	90	128	1		1	1	98
	Large	128	180	2		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	**50**	**50**	**100**	**100**	**100**

Reachwide	
Channel materials (mm)	
D_{16} =	Silt/Clay
D_{35} =	Silt/Clay
D_{50} =	Silt/Clay
D_{84} =	42.0
D_{95} =	71.7
D_{100} =	180.0





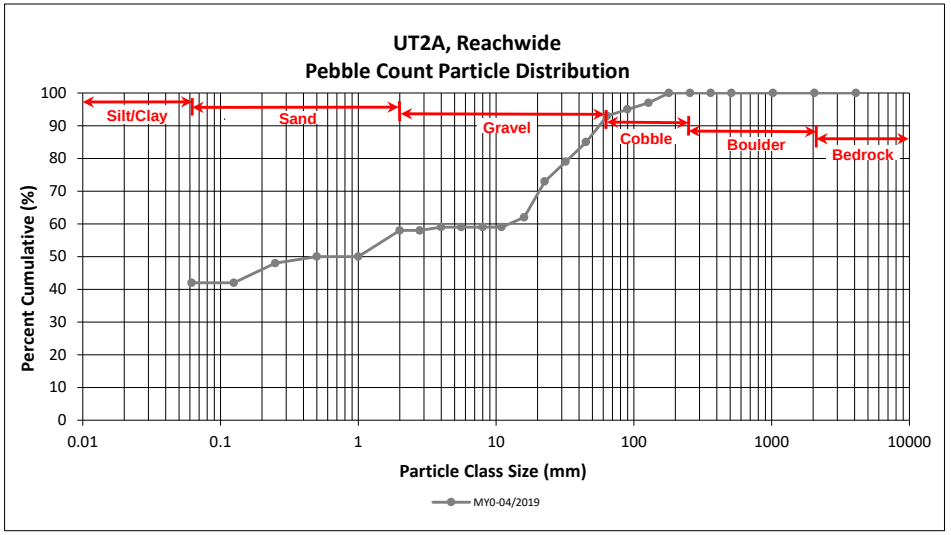
Reachwide Pebble Count Plots

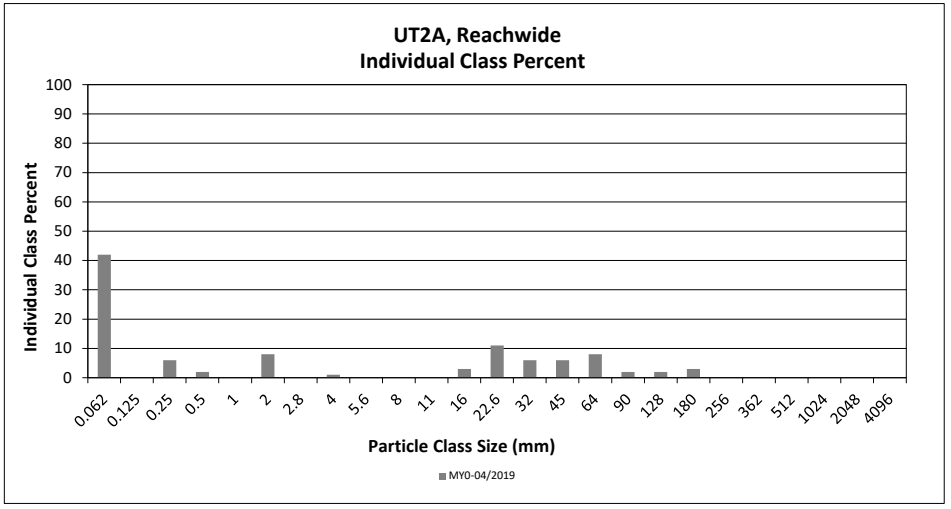
Lone Hickory Mitigation Site
DMS Project No. 97135
Monitoring Year 0 - 2019

UT2A, 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		42	42	42	42
SAND	Very fine	0.062	0.125					42
	Fine	0.125	0.250		6	6	6	48
	Medium	0.25	0.50		2	2	2	50
	Coarse	0.5	1.0					50
	Very Coarse	1.0	2.0	8		8	8	58
GRAVEL	Very Fine	2.0	2.8					58
	Very Fine	2.8	4.0	1		1	1	59
	Fine	4.0	5.6					59
	Fine	5.6	8.0					59
	Medium	8.0	11.0					59
	Medium	11.0	16.0	3		3	3	62
	Coarse	16.0	22.6	11		11	11	73
	Coarse	22.6	32	6		6	6	79
	Very Coarse	32	45	6		6	6	85
	Very Coarse	45	64	8		8	8	93
COBBLE	Small	64	90	2		2	2	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} =	Silt/Clay
D_{35} =	Silt/Clay
D_{50} =	0.5
D_{84} =	42.5
D_{95} =	90.0
D_{100} =	180.0





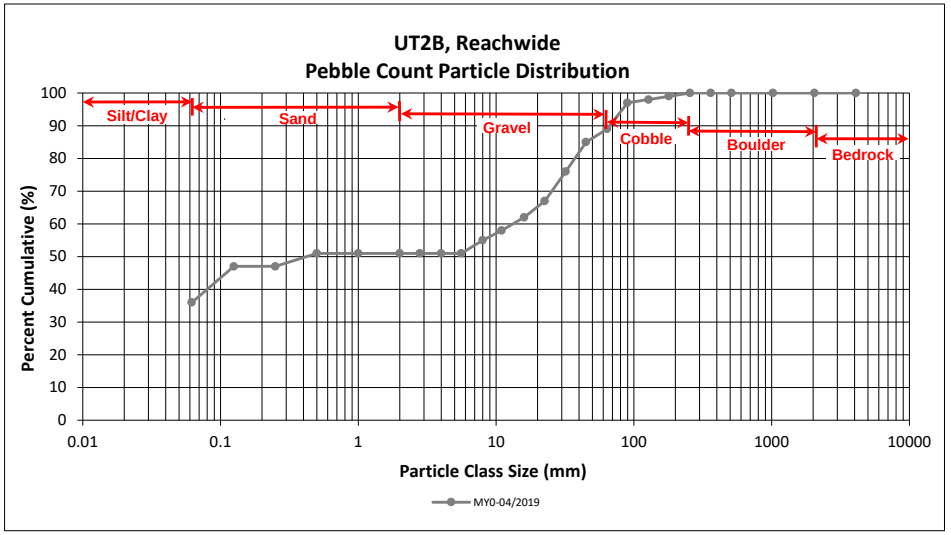
Reachwide Pebble Count Plots

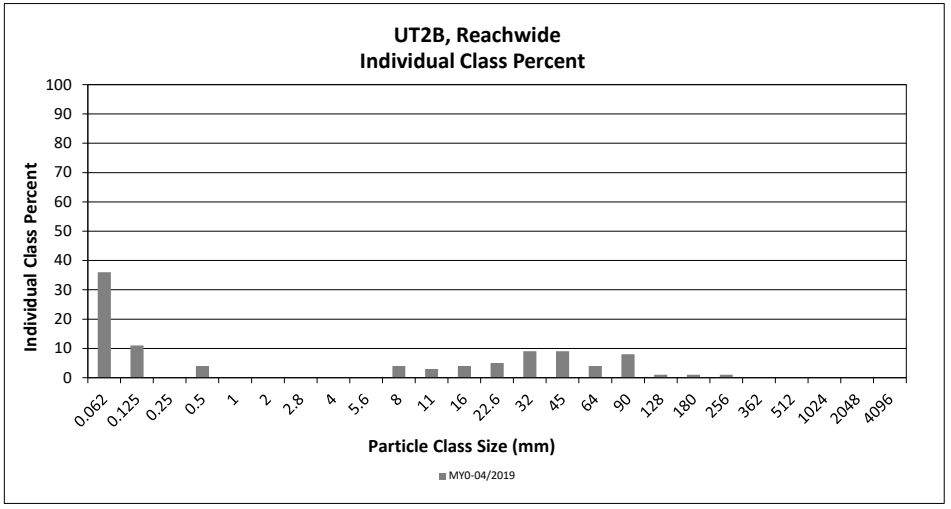
Lone Hickory Mitigation Site
DMS Project No. 97135
Monitoring Year 0 - 2019

UT2B, 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	35	36	36	36
SAND	Very fine	0.062	0.125		11	11	11	47
	Fine	0.125	0.250					47
	Medium	0.25	0.50		4	4	4	51
	Coarse	0.5	1.0					51
	Very Coarse	1.0	2.0					51
GRAVEL	Very Fine	2.0	2.8					51
	Very Fine	2.8	4.0					51
	Fine	4.0	5.6					51
	Fine	5.6	8.0	4		4	4	55
	Medium	8.0	11.0	3		3	3	58
	Medium	11.0	16.0	4		4	4	62
	Coarse	16.0	22.6	5		5	5	67
	Coarse	22.6	32	9		9	9	76
	Very Coarse	32	45	9		9	9	85
	Very Coarse	45	64	4		4	4	89
COBBLE	Small	64	90	8		8	8	97
	Small	90	128	1		1	1	98
	Large	128	180	1		1	1	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} =	Silt/Clay
D_{35} =	Silt/Clay
D_{50} =	0.4
D_{84} =	43.3
D_{95} =	82.6
D_{100} =	256.0





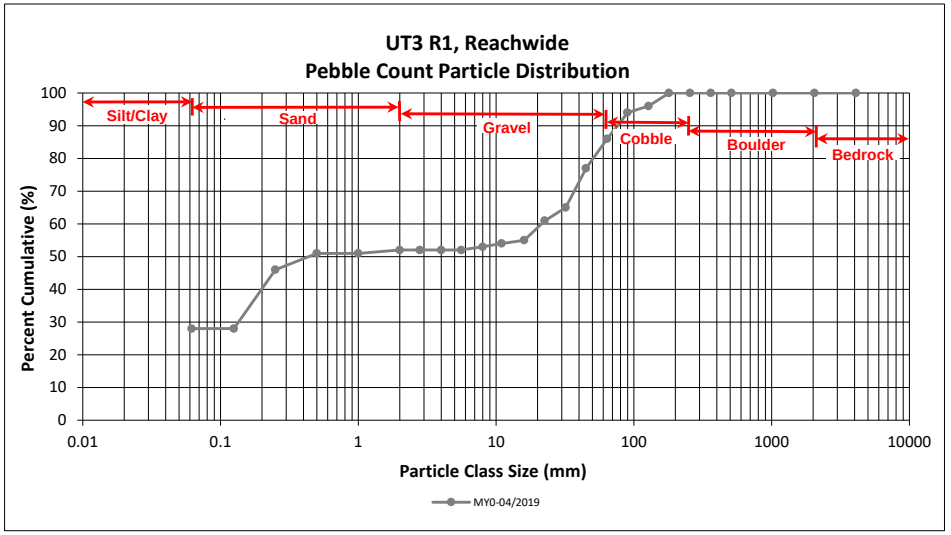
Reachwide Pebble Count Plots

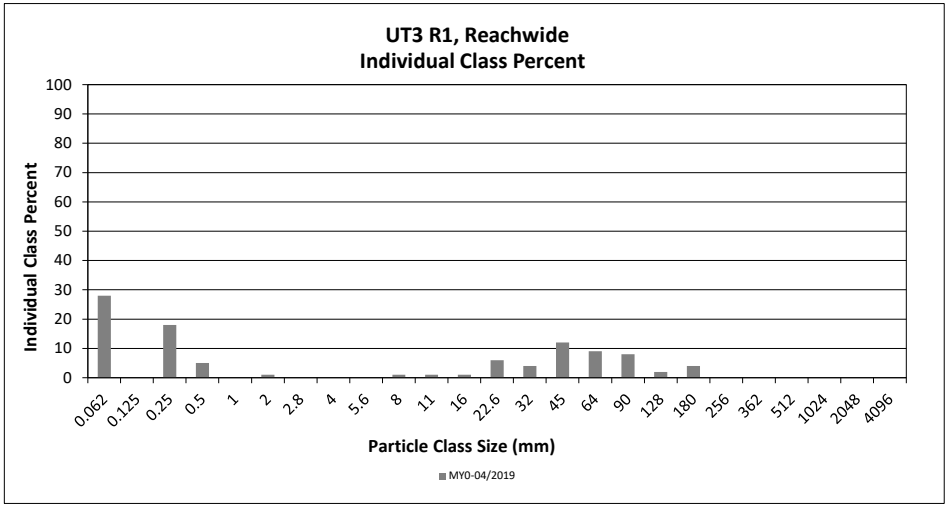
Lone Hickory Mitigation Site
DMS Project No. 97135
Monitoring Year 0 - 2019

UT3 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	2	26	28	28	28
SAND	Very fine	0.062	0.125					28
	Fine	0.125	0.250		18	18	18	46
	Medium	0.25	0.50		5	5	5	51
	Coarse	0.5	1.0					51
	Very Coarse	1.0	2.0	1		1	1	52
GRAVEL	Very Fine	2.0	2.8					52
	Very Fine	2.8	4.0					52
	Fine	4.0	5.6					52
	Fine	5.6	8.0		1	1	1	53
	Medium	8.0	11.0	1		1	1	54
	Medium	11.0	16.0	1		1	1	55
	Coarse	16.0	22.6	6		6	6	61
	Coarse	22.6	32	4		4	4	65
	Very Coarse	32	45	12		12	12	77
	Very Coarse	45	64	9		9	9	86
COBBLE	Small	64	90	8		8	8	94
	Small	90	128	2		2	2	96
	Large	128	180	4		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} =	Silt/Clay
D_{35} =	0.2
D_{50} =	0.4
D_{84} =	59.2
D_{95} =	107.3
D_{100} =	180.0





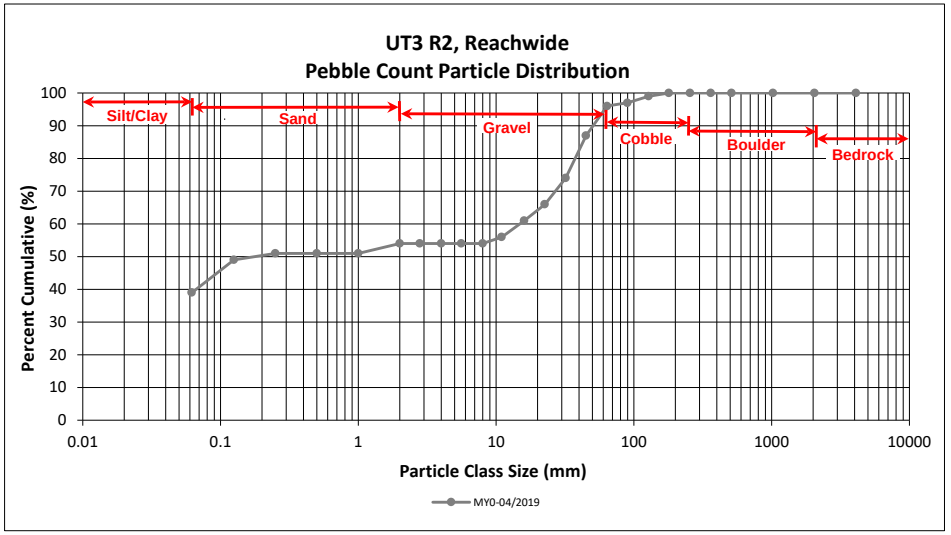
Reachwide Pebble Count Plots

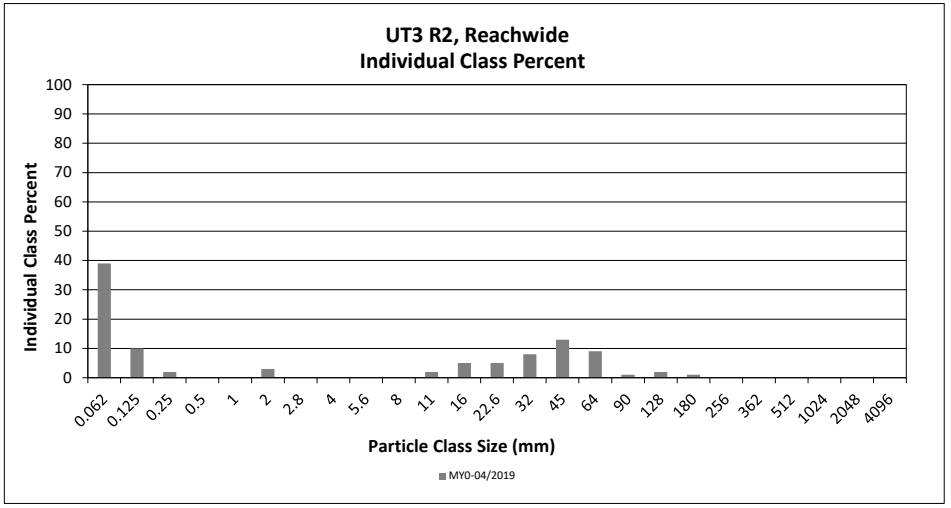
Lone Hickory Mitigation Site
DMS Project No. 97135
Monitoring Year 0 - 2019

UT3 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	1	38	39	39	39
SAND	Very fine	0.062	0.125		10	10	10	49
	Fine	0.125	0.250		2	2	2	51
	Medium	0.25	0.50					51
	Coarse	0.5	1.0					51
	Very Coarse	1.0	2.0	3		3	3	54
GRAVEL	Very Fine	2.0	2.8					54
	Very Fine	2.8	4.0					54
	Fine	4.0	5.6					54
	Fine	5.6	8.0					54
	Medium	8.0	11.0	2		2	2	56
	Medium	11.0	16.0	5		5	5	61
	Coarse	16.0	22.6	5		5	5	66
	Coarse	22.6	32	8		8	8	74
	Very Coarse	32	45	13		13	13	87
	Very Coarse	45	64	9		9	9	96
COBBLE	Small	64	90	1		1	1	97
	Small	90	128	2		2	2	99
	Large	128	180	1		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	**50**	**50**	**100**	**100**	**100**

Reachwide	
Channel materials (mm)	
D_{16} =	Silt/Clay
D_{35} =	Silt/Clay
D_{50} =	0.2
D_{84} =	41.6
D_{95} =	61.5
D_{100} =	180.0





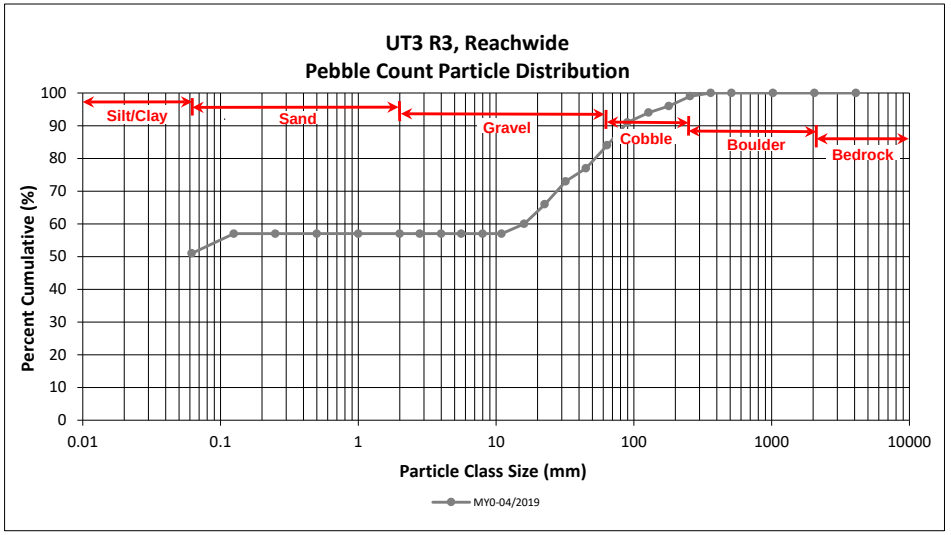
Reachwide Pebble Count Plots

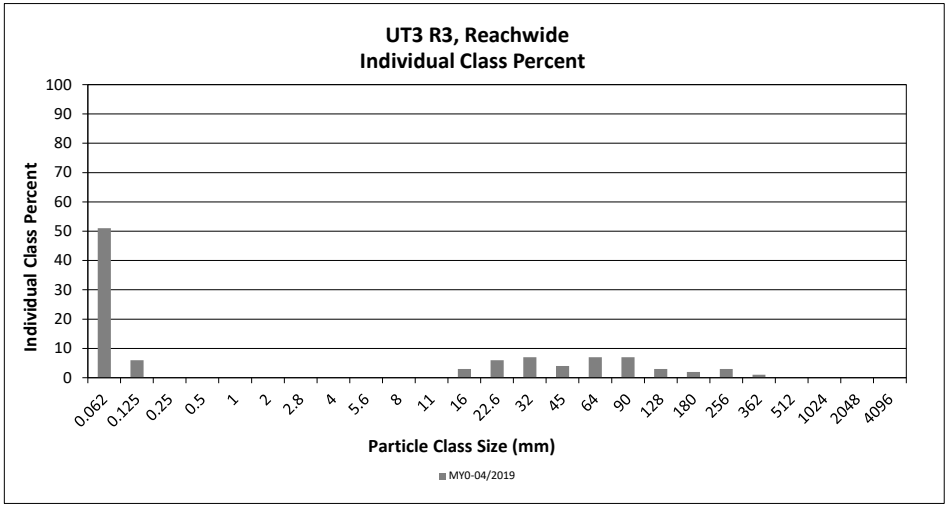
Lone Hickory Mitigation Site
DMS Project No. 97135
Monitoring Year 0 - 2019

UT3 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	7	44	51	51	51
SAND	Very fine	0.062	0.125		6	6	6	57
	Fine	0.125	0.250					57
	Medium	0.25	0.50					57
	Coarse	0.5	1.0					57
	Very Coarse	1.0	2.0					57
GRAVEL	Very Fine	2.0	2.8					57
	Very Fine	2.8	4.0					57
	Fine	4.0	5.6					57
	Fine	5.6	8.0					57
	Medium	8.0	11.0					57
	Medium	11.0	16.0	3		3	3	60
	Coarse	16.0	22.6	6		6	6	66
	Coarse	22.6	32	7		7	7	73
	Very Coarse	32	45	4		4	4	77
	Very Coarse	45	64	7		7	7	84
COBBLE	Small	64	90	7		7	7	91
	Small	90	128	3		3	3	94
	Large	128	180	2		2	2	96
	Large	180	256	3		3	3	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} =	Silt/Clay
D_{50} =	Silt/Clay
D_{84} =	64.0
D_{95} =	151.8
D_{100} =	362.0





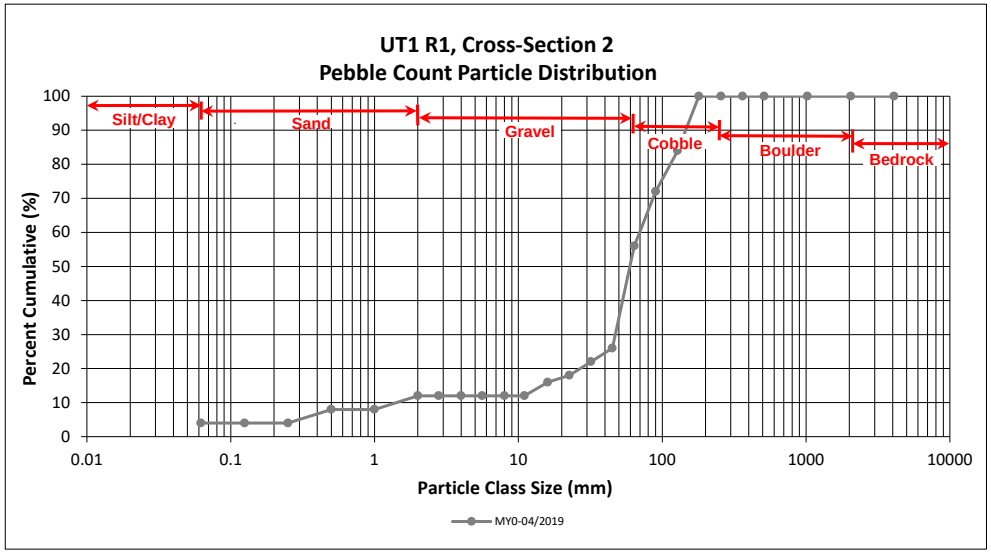
Cross-Section Pebble Count Plots

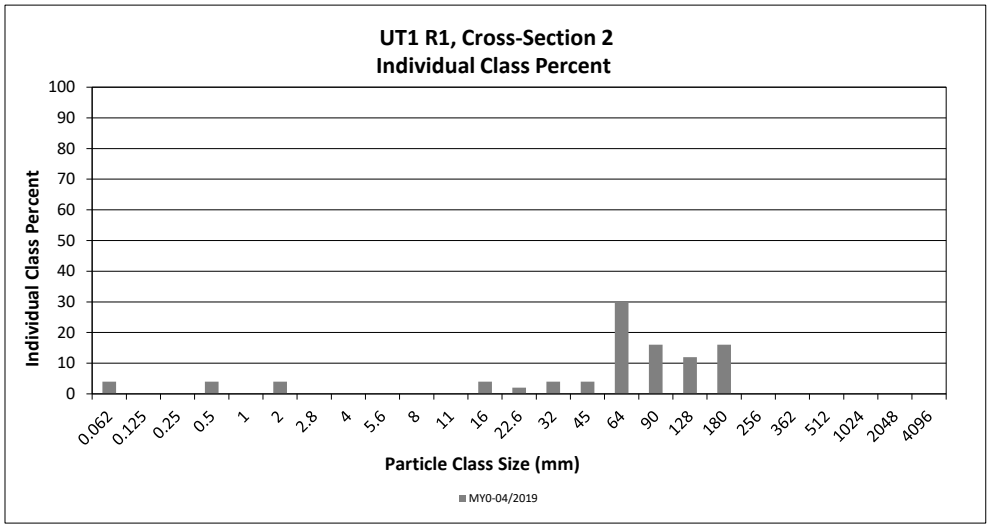
Lone Hickory Mitigation Site
DMS Project No. 97135
Monitoring Year 0 - 2019

UT1 R1, Cross-Section 2

Particle Class		Diameter (mm)		Riffle 100-Count	Summary	
		min	max		Class Percentage	Percent Cumulative
SILT/CLAY	Silt/Clay	0.000	0.062	4	4	4
SAND	Very fine	0.062	0.125			4
	Fine	0.125	0.250			4
	Medium	0.25	0.50	4	4	8
	Coarse	0.5	1.0			8
	Very Coarse	1.0	2.0	4	4	12
GRAVEL	Very Fine	2.0	2.8			12
	Very Fine	2.8	4.0			12
	Fine	4.0	5.6			12
	Fine	5.6	8.0			12
	Medium	8.0	11.0			12
	Medium	11.0	16.0	4	4	16
	Coarse	16.0	22.6	2	2	18
	Coarse	22.6	32	4	4	22
	Very Coarse	32	45	4	4	26
	Very Coarse	45	64	30	30	56
COBBLE	Small	64	90	16	16	72
	Small	90	128	12	12	84
	Large	128	180	16	16	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 2	
Channel materials (mm)	
D_{16} =	16.0
D_{35} =	50.0
D_{50} =	59.6
D_{84} =	128.0
D_{95} =	161.8
D_{100} =	180.0





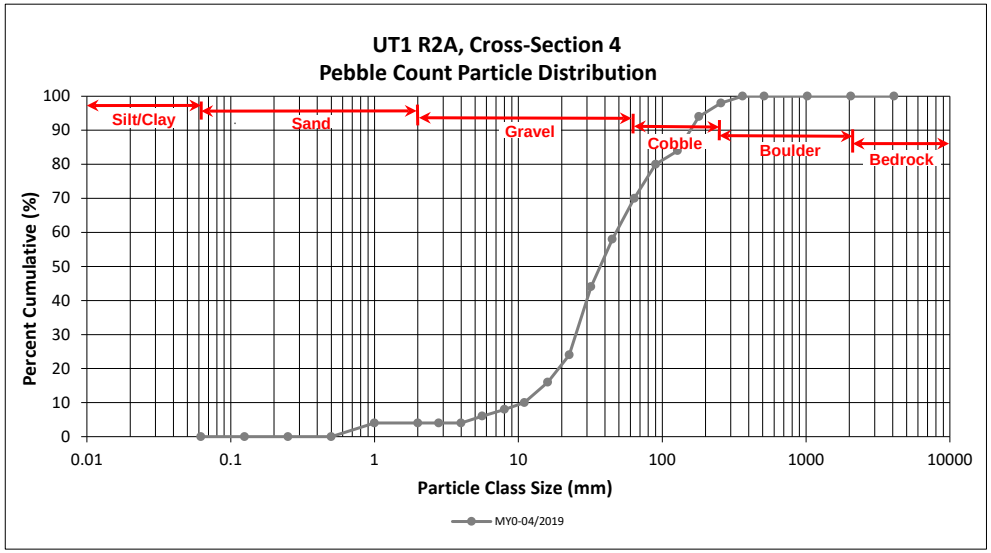
Cross-Section Pebble Count Plots

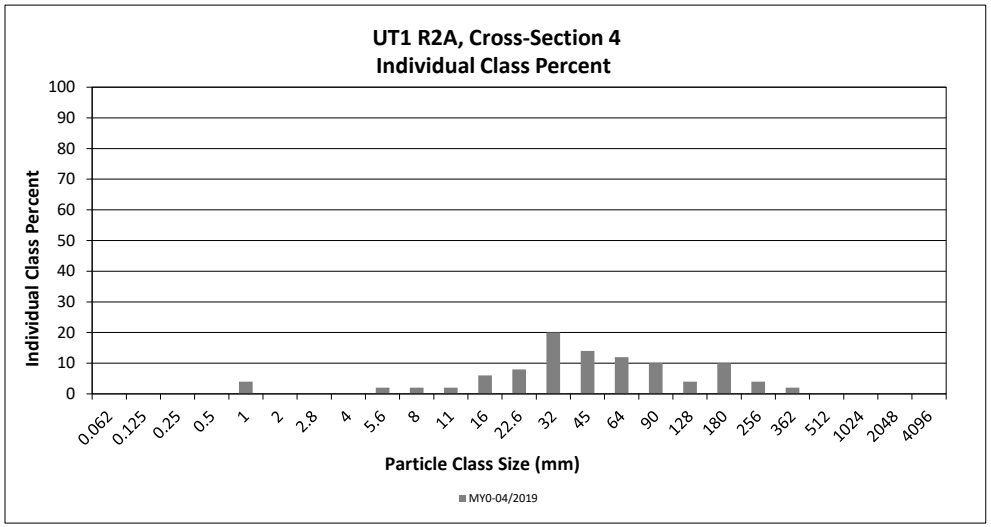
Lone Hickory Mitigation Site
DMS Project No. 97135
Monitoring Year 0 - 2019

UT1 R2A, Cross-Section 4

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	4	4	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	2	2	6
	Fine	5.6	8.0	2	2	8
	Medium	8.0	11.0	2	2	10
	Medium	11.0	16.0	6	6	16
	Coarse	16.0	22.6	8	8	24
	Coarse	22.6	32	20	20	44
	Very Coarse	32	45	14	14	58
	Very Coarse	45	64	12	12	70
COBBLE	Small	64	90	10	10	80
	Small	90	128	4	4	84
	Large	128	180	10	10	94
	Large	180	256	4	4	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 4	
Channel materials (mm)	
D_{16} =	16.0
D_{35} =	27.4
D_{50} =	37.0
D_{84} =	128.0
D_{95} =	196.6
D_{100} =	362.0





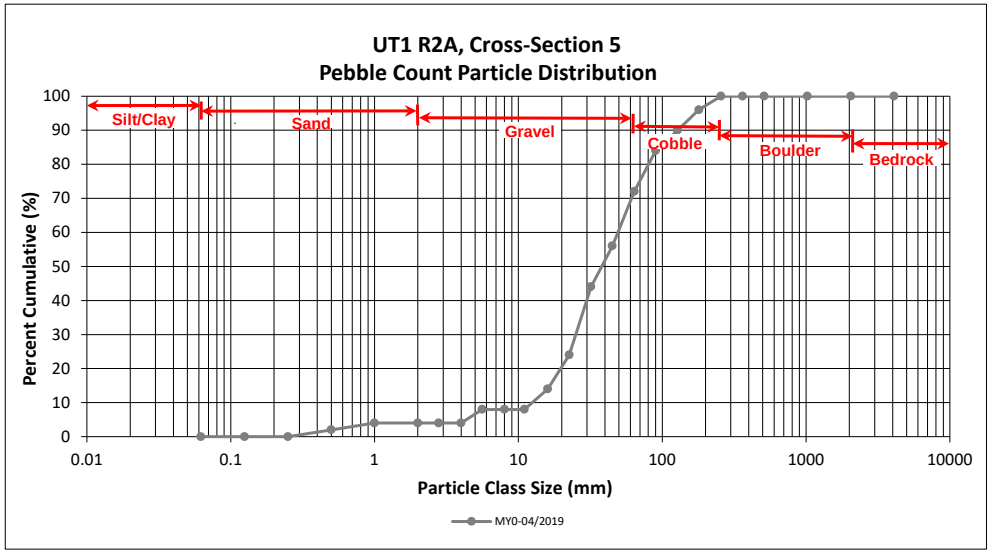
Cross-Section Pebble Count Plots

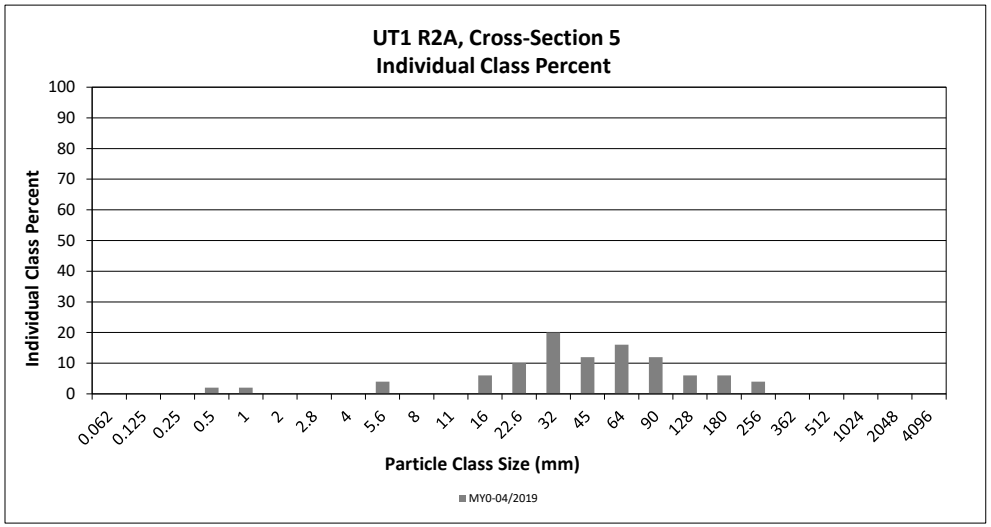
Lone Hickory Mitigation Site
DMS Project No. 97135
Monitoring Year 0 - 2019

UT1 R2A, 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			0
SAND	Very fine	0.062	0.125			0
	Fine	0.125	0.250			0
	Medium	0.25	0.50	2	2	2
	Coarse	0.5	1.0	2	2	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	4	4	8
	Fine	5.6	8.0			8
	Medium	8.0	11.0			8
	Medium	11.0	16.0	6	6	14
	Coarse	16.0	22.6	10	10	24
	Coarse	22.6	32	20	20	44
	Very Coarse	32	45	12	12	56
	Very Coarse	45	64	16	16	72
COBBLE	Small	64	90	12	12	84
	Small	90	128	6	6	90
	Large	128	180	6	6	96
	Large	180	256	4	4	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 5	
Channel materials (mm)	
D_{16} =	17.1
D_{35} =	27.4
D_{50} =	37.9
D_{84} =	90.0
D_{95} =	170.1
D_{100} =	256.0





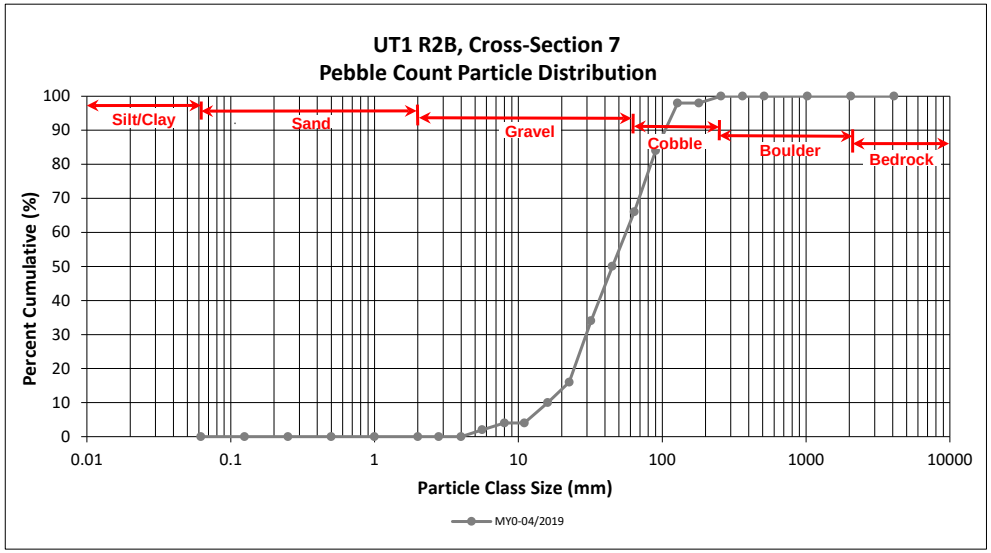
Cross-Section Pebble Count Plots

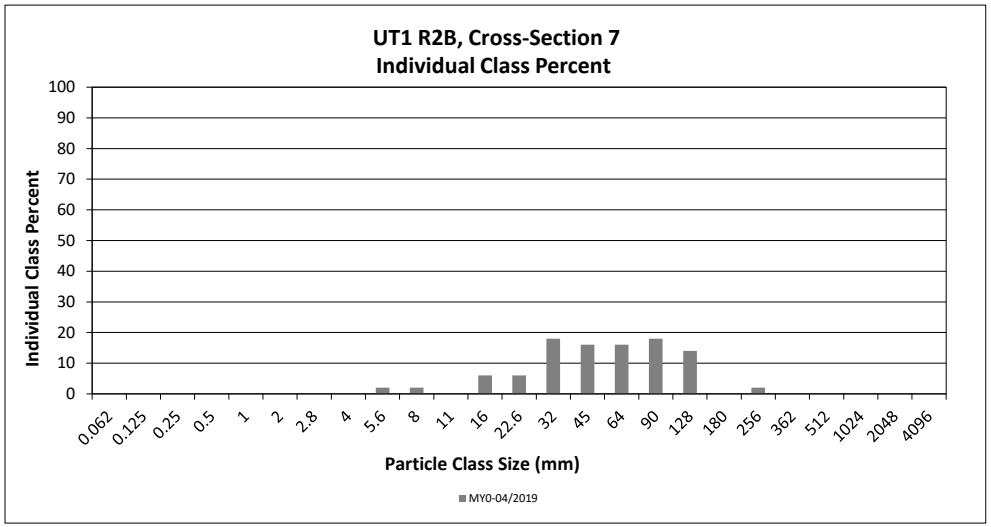
Lone Hickory Mitigation Site
DMS Project No. 97135
Monitoring Year 0 - 2019

UT1 R2B, Cross-Section 7

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			0
GRAVEL	Very Fine	2.0	2.8			0
	Very Fine	2.8	4.0			0
	Fine	4.0	5.6	2	2	2
	Fine	5.6	8.0	2	2	4
	Medium	8.0	11.0			4
	Medium	11.0	16.0	6	6	10
	Coarse	16.0	22.6	6	6	16
	Coarse	22.6	32	18	18	34
	Very Coarse	32	45	16	16	50
	Very Coarse	45	64	16	16	66
COBBLE	Small	64	90	18	18	84
	Small	90	128	14	14	98
	Large	128	180			98
	Large	180	256	2	2	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 7	
Channel materials (mm)	
D_{16} =	22.6
D_{35} =	32.7
D_{50} =	45.0
D_{84} =	90.0
D_{95} =	118.7
D_{100} =	256.0





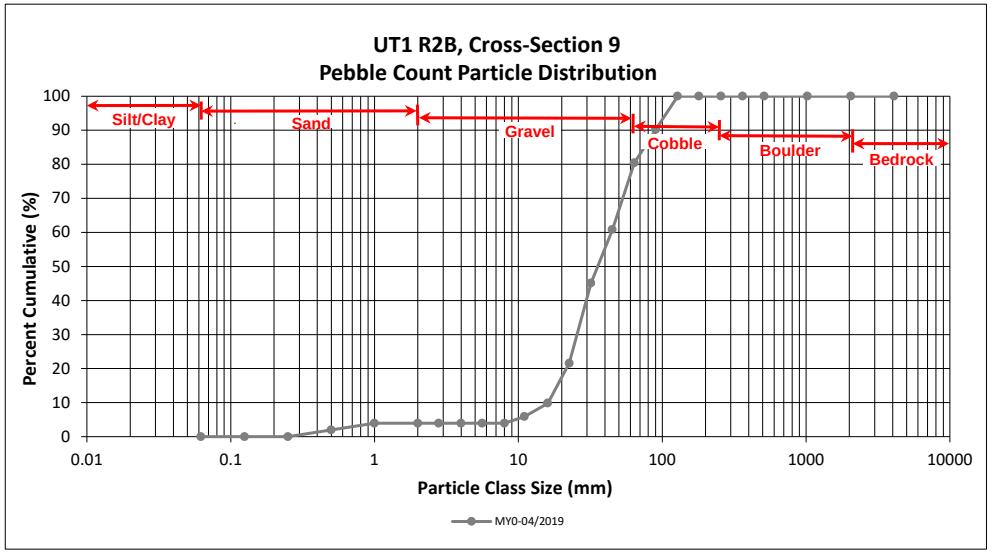
Cross-Section Pebble Count Plots

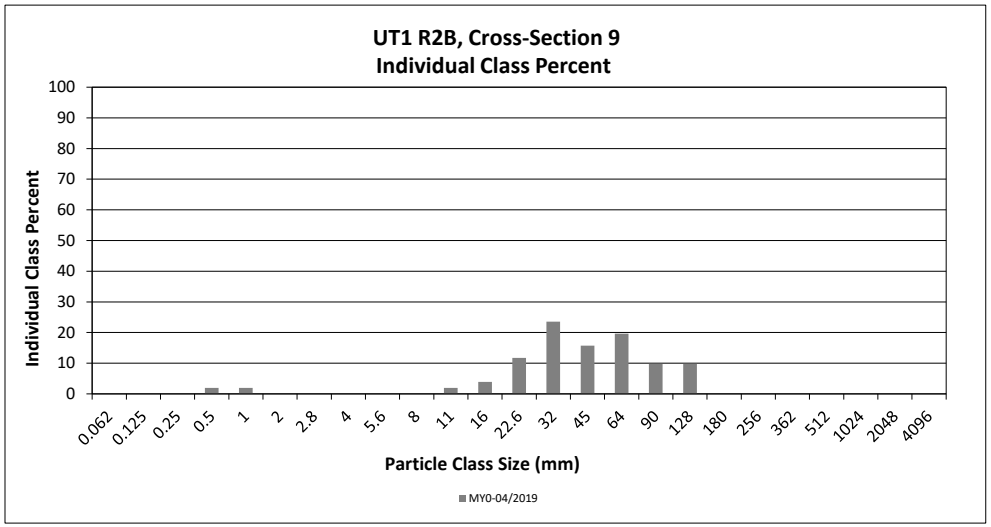
Lone Hickory Mitigation Site
DMS Project No. 97135
Monitoring Year 0 - 2019

UT1 R2B, 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			0
SAND	Very fine	0.062	0.125			0
	Fine	0.125	0.250			0
	Medium	0.25	0.50	2	2	2
	Coarse	0.5	1.0	2	2	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			4
	Fine	5.6	8.0			4
	Medium	8.0	11.0	2	2	6
	Medium	11.0	16.0	4	4	10
	Coarse	16.0	22.6	12	12	22
	Coarse	22.6	32	24	24	45
	Very Coarse	32	45	16	16	61
	Very Coarse	45	64	20	20	80
COBBLE	Small	64	90	10	10	90
	Small	90	128	10	10	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	**102**	**100**	**100**

Cross-Section 9	
Channel materials (mm)	
D_{16} =	19.2
D_{35} =	27.6
D_{50} =	35.6
D_{84} =	72.6
D_{95} =	107.0
D_{100} =	128.0





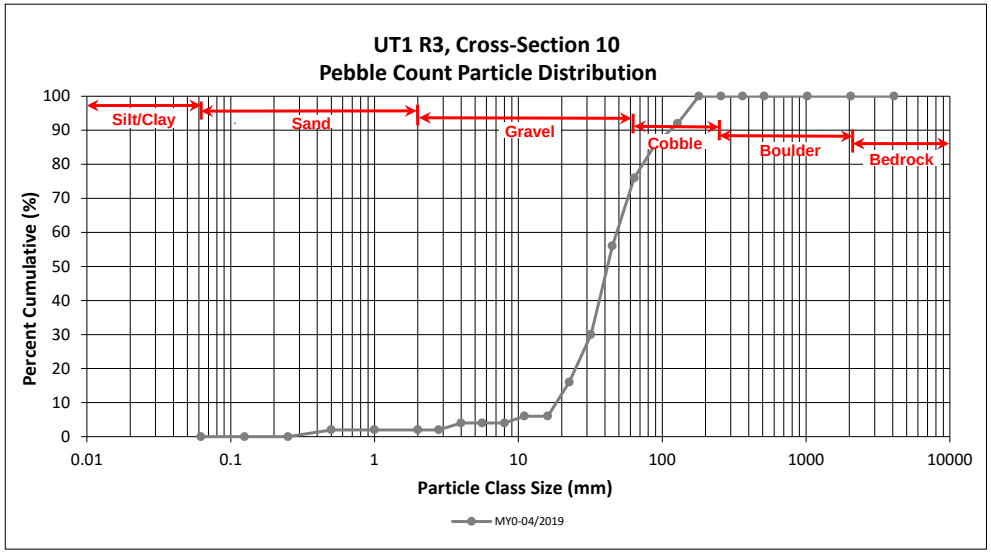
Cross-Section Pebble Count Plots

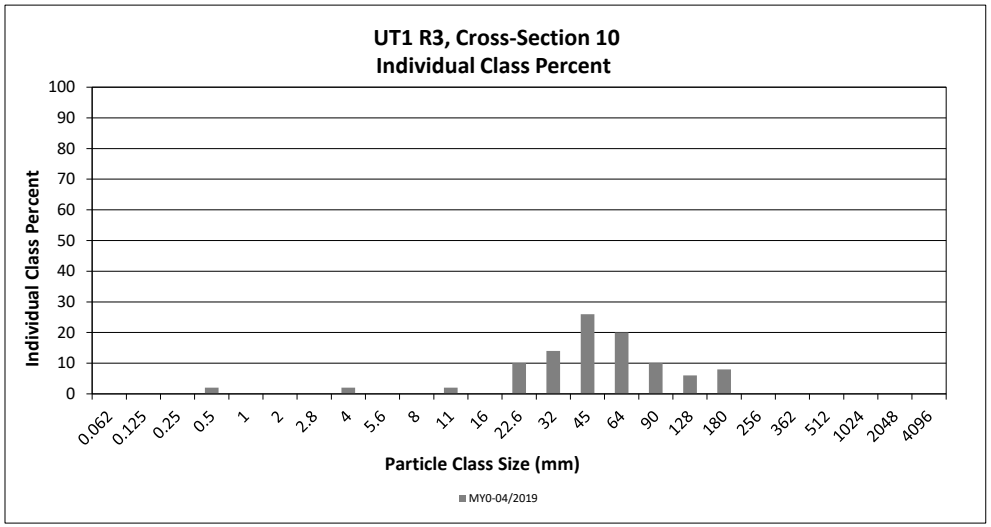
Lone Hickory Mitigation Site
DMS Project No. 97135
Monitoring Year 0 - 2019

UT1 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			0
SAND	Very fine	0.062	0.125			0
	Fine	0.125	0.250			0
	Medium	0.25	0.50	2	2	2
	Coarse	0.5	1.0			2
	Very Coarse	1.0	2.0			2
GRAVEL	Very Fine	2.0	2.8			2
	Very Fine	2.8	4.0	2	2	4
	Fine	4.0	5.6			4
	Fine	5.6	8.0			4
	Medium	8.0	11.0	2	2	6
	Medium	11.0	16.0			6
	Coarse	16.0	22.6	10	10	16
	Coarse	22.6	32	14	14	30
	Very Coarse	32	45	26	26	56
	Very Coarse	45	64	20	20	76
COBBLE	Small	64	90	10	10	86
	Small	90	128	6	6	92
	Large	128	180	8	8	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 10	
Channel materials (mm)	
D_{16} =	22.6
D_{35} =	34.2
D_{50} =	41.6
D_{84} =	84.1
D_{95} =	145.5
D_{100} =	180.0





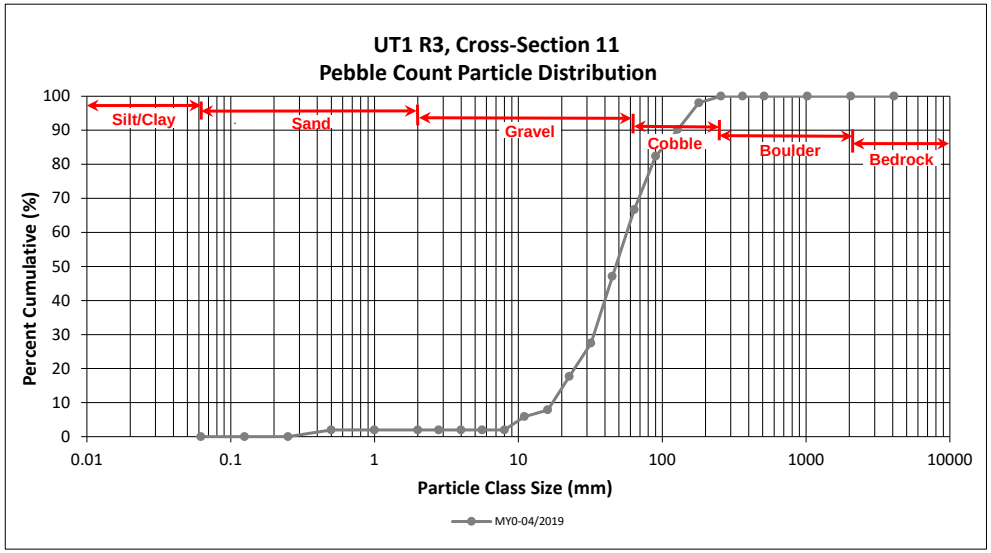
Cross-Section Pebble Count Plots

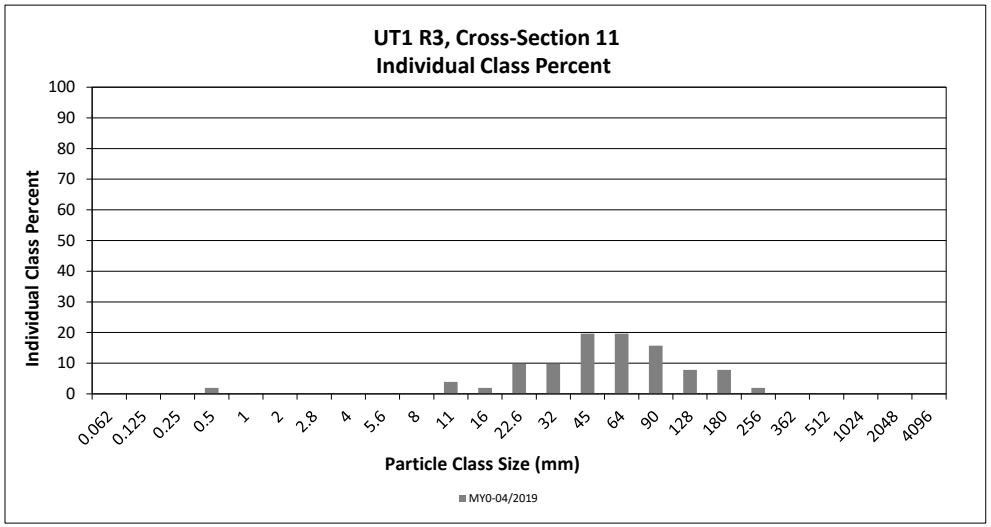
Lone Hickory Mitigation Site
DMS Project No. 97135
Monitoring Year 0 - 2019

UT1 R3, 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			0
	Medium	0.25	0.50	2	2	2
	Coarse	0.5	1.0			2
	Very Coarse	1.0	2.0			2
GRAVEL	Very Fine	2.0	2.8			2
	Very Fine	2.8	4.0			2
	Fine	4.0	5.6			2
	Fine	5.6	8.0			2
	Medium	8.0	11.0	4	4	6
	Medium	11.0	16.0	2	2	8
	Coarse	16.0	22.6	10	10	18
	Coarse	22.6	32	10	10	27
	Very Coarse	32	45	20	20	47
	Very Coarse	45	64	20	20	67
COBBLE	Small	64	90	16	16	82
	Small	90	128	8	8	90
	Large	128	180	8	8	98
	Large	180	256	2	2	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	**102**	**100**	**100**

Cross-Section 11	
Channel materials (mm)	
D_{16} =	21.3
D_{35} =	36.5
D_{50} =	47.4
D_{84} =	96.9
D_{95} =	157.7
D_{100} =	256.0





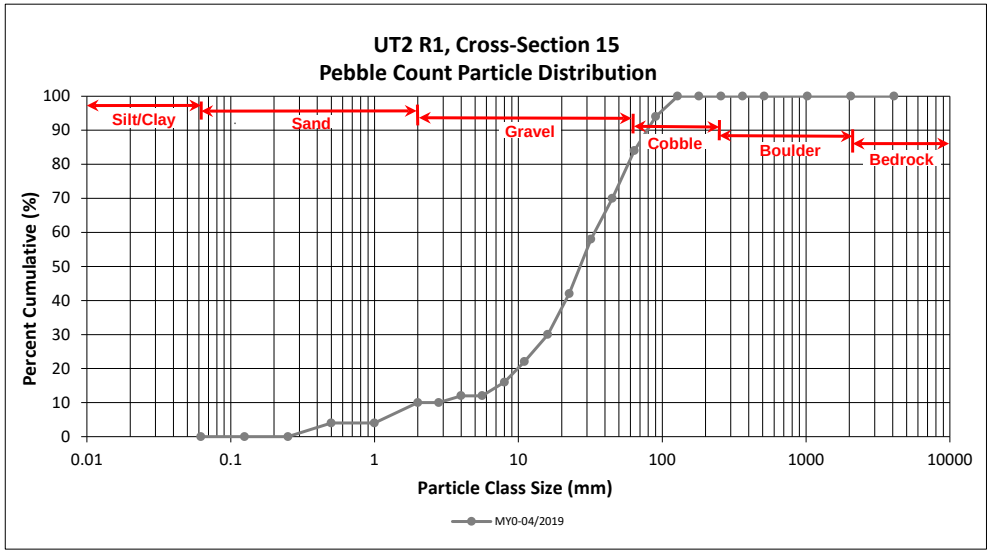
Cross-Section Pebble Count Plots

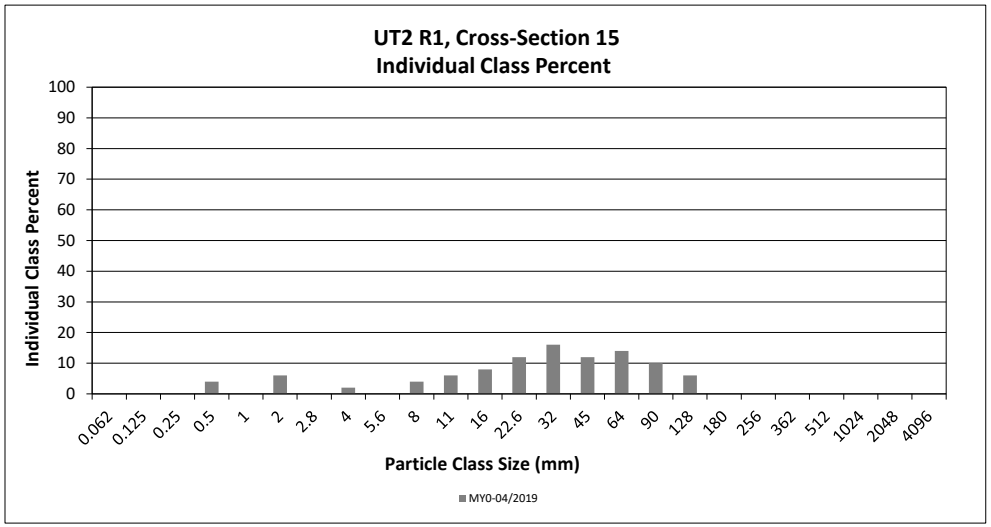
Lone Hickory Mitigation Site
DMS Project No. 97135
Monitoring Year 0 - 2019

UT2 R1, 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			0
SAND	Very fine	0.062	0.125			0
	Fine	0.125	0.250			0
	Medium	0.25	0.50	4	4	4
	Coarse	0.5	1.0			4
	Very Coarse	1.0	2.0	6	6	10
GRAVEL	Very Fine	2.0	2.8			10
	Very Fine	2.8	4.0	2	2	12
	Fine	4.0	5.6			12
	Fine	5.6	8.0	4	4	16
	Medium	8.0	11.0	6	6	22
	Medium	11.0	16.0	8	8	30
	Coarse	16.0	22.6	12	12	42
	Coarse	22.6	32	16	16	58
	Very Coarse	32	45	12	12	70
	Very Coarse	45	64	14	14	84
COBBLE	Small	64	90	10	10	94
	Small	90	128	6	6	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	**100**	**100**	**100**

Cross-Section 15	
Channel materials (mm)	
D_{16} =	8.0
D_{35} =	18.5
D_{50} =	26.9
D_{84} =	64.0
D_{95} =	95.4
D_{100} =	128.0





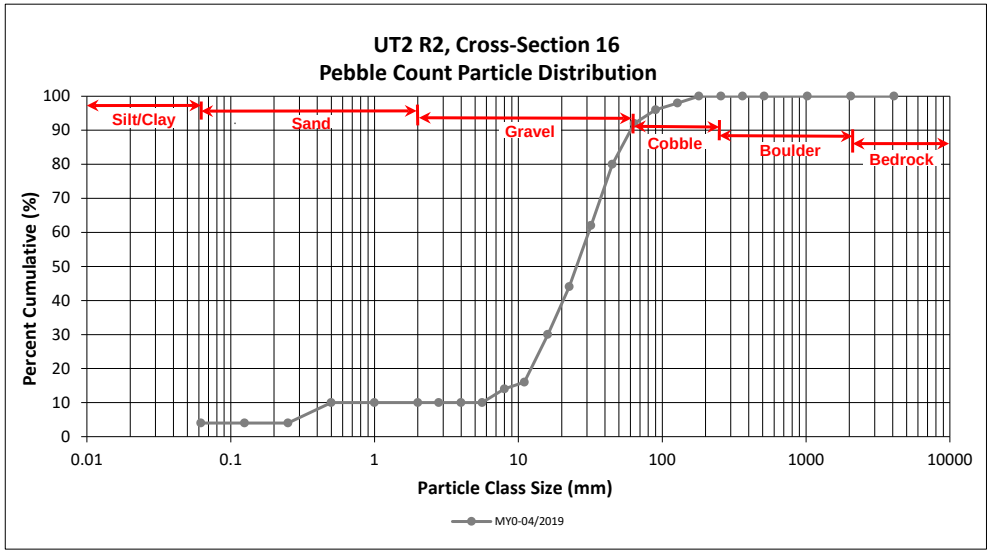
Cross-Section Pebble Count Plots

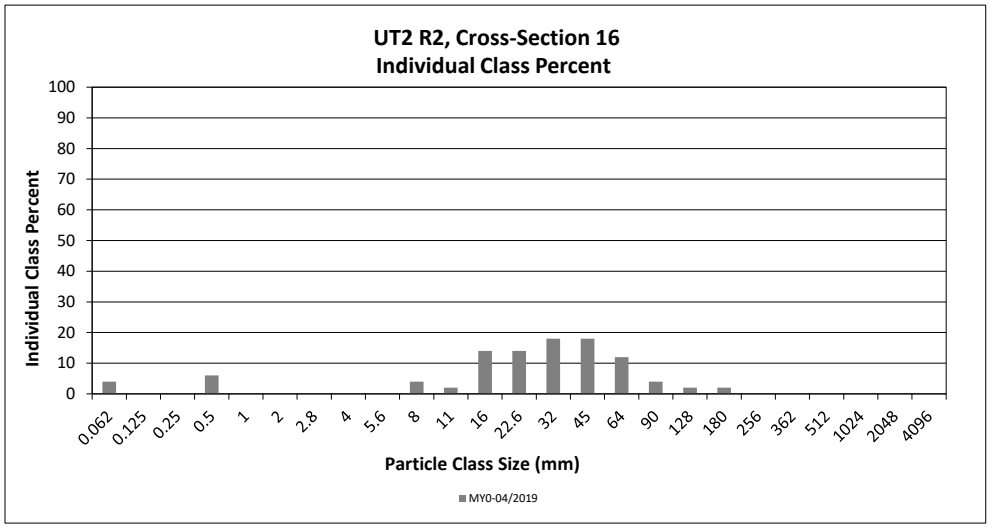
Lone Hickory Mitigation Site
DMS Project No. 97135
Monitoring Year 0 - 2019

UT2 R2, Cross-Section 16

Particle Class		Diameter (mm)		Riffle 100-Count	Summary	
		min	max		Class Percentage	Percent Cumulative
SILT/CLAY	Silt/Clay	0.000	0.062	4	4	4
SAND	Very fine	0.062	0.125			4
	Fine	0.125	0.250			4
	Medium	0.25	0.50	6	6	10
	Coarse	0.5	1.0			10
	Very Coarse	1.0	2.0			10
GRAVEL	Very Fine	2.0	2.8			10
	Very Fine	2.8	4.0			10
	Fine	4.0	5.6			10
	Fine	5.6	8.0	4	4	14
	Medium	8.0	11.0	2	2	16
	Medium	11.0	16.0	14	14	30
	Coarse	16.0	22.6	14	14	44
	Coarse	22.6	32	18	18	62
	Very Coarse	32	45	18	18	80
	Very Coarse	45	64	12	12	92
COBBLE	Small	64	90	4	4	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 16	
Channel materials (mm)	
D_{16} =	11.0
D_{35} =	18.1
D_{50} =	25.4
D_{84} =	50.6
D_{95} =	82.6
D_{100} =	180.0





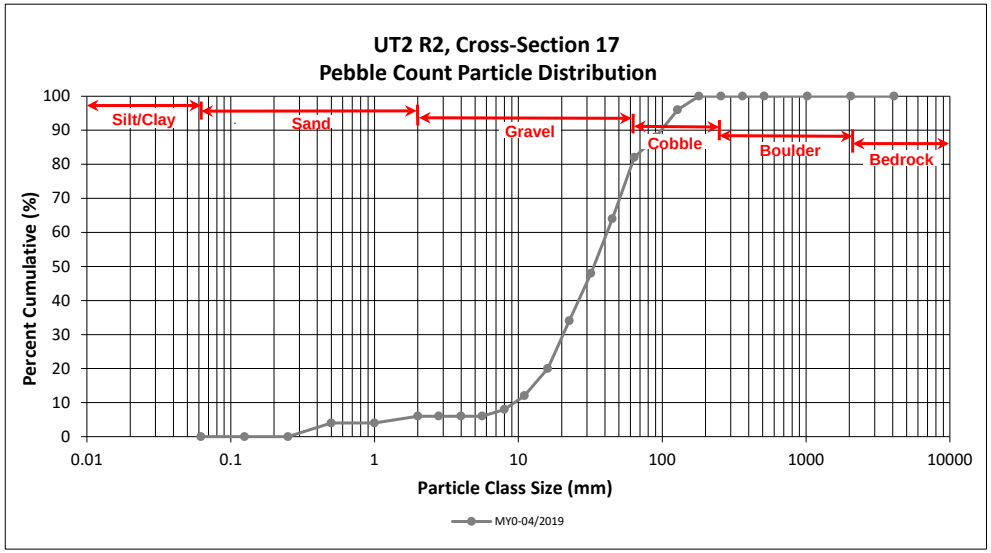
Cross-Section Pebble Count Plots

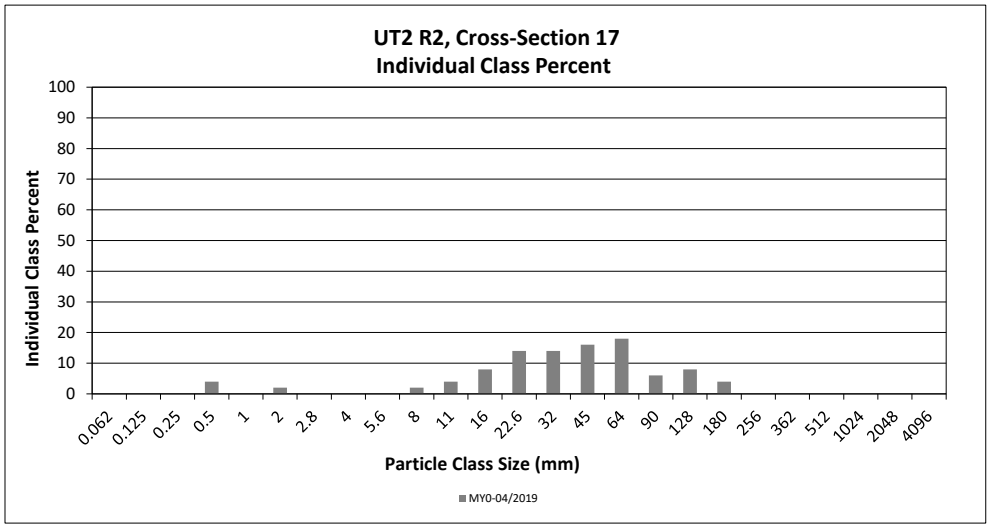
Lone Hickory Mitigation Site
DMS Project No. 97135
Monitoring Year 0 - 2019

UT2 R2, 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			0
	Fine	0.125	0.250			0
	Medium	0.25	0.50	4	4	4
	Coarse	0.5	1.0			4
	Very Coarse	1.0	2.0	2	2	6
GRAVEL	Very Fine	2.0	2.8			6
	Very Fine	2.8	4.0			6
	Fine	4.0	5.6			6
	Fine	5.6	8.0	2	2	8
	Medium	8.0	11.0	4	4	12
	Medium	11.0	16.0	8	8	20
	Coarse	16.0	22.6	14	14	34
	Coarse	22.6	32	14	14	48
	Very Coarse	32	45	16	16	64
	Very Coarse	45	64	18	18	82
COBBLE	Small	64	90	6	6	88
	Small	90	128	8	8	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 17	
Channel materials (mm)	
D_{16} =	13.3
D_{35} =	23.2
D_{50} =	33.4
D_{84} =	71.7
D_{95} =	122.5
D_{100} =	180.0





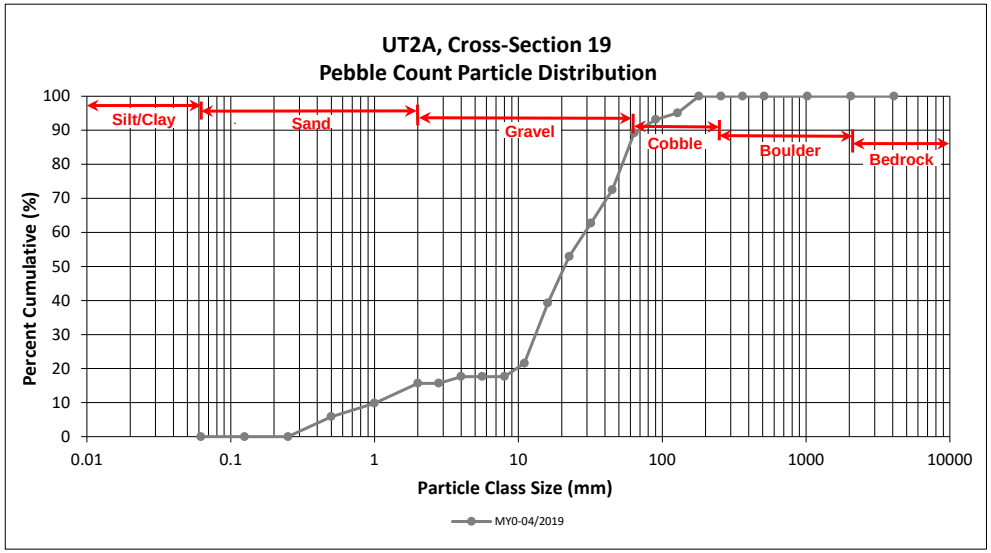
Cross-Section Pebble Count Plots

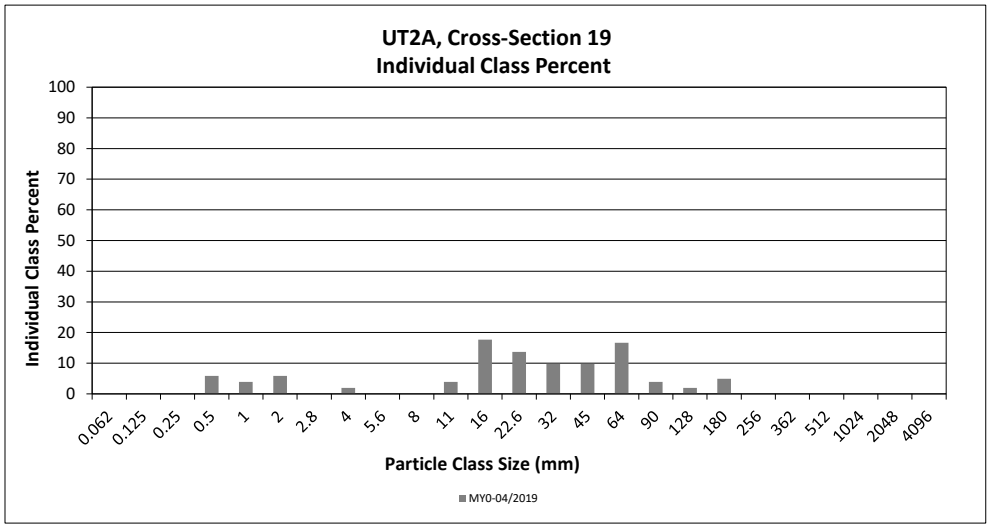
Lone Hickory Mitigation Site
DMS Project No. 97135
Monitoring Year 0 - 2019

UT2A, Cross-Section 19

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			0
SAND	Very fine	0.062	0.125			0
	Fine	0.125	0.250			0
	Medium	0.25	0.50	6	6	6
	Coarse	0.5	1.0	4	4	10
	Very Coarse	1.0	2.0	6	6	16
GRAVEL	Very Fine	2.0	2.8			16
	Very Fine	2.8	4.0	2	2	18
	Fine	4.0	5.6			18
	Fine	5.6	8.0			18
	Medium	8.0	11.0	4	4	22
	Medium	11.0	16.0	18	18	39
	Coarse	16.0	22.6	14	14	53
	Coarse	22.6	32	10	10	63
	Very Coarse	32	45	10	10	73
	Very Coarse	45	64	17	17	89
COBBLE	Small	64	90	4	4	93
	Small	90	128	2	2	95
	Large	128	180	5	5	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	**102**	**100**	**100**

Cross-Section 19	
Channel materials (mm)	
D_{16} =	3.0
D_{35} =	14.6
D_{50} =	21.0
D_{84} =	57.3
D_{95} =	125.8
D_{100} =	180.0





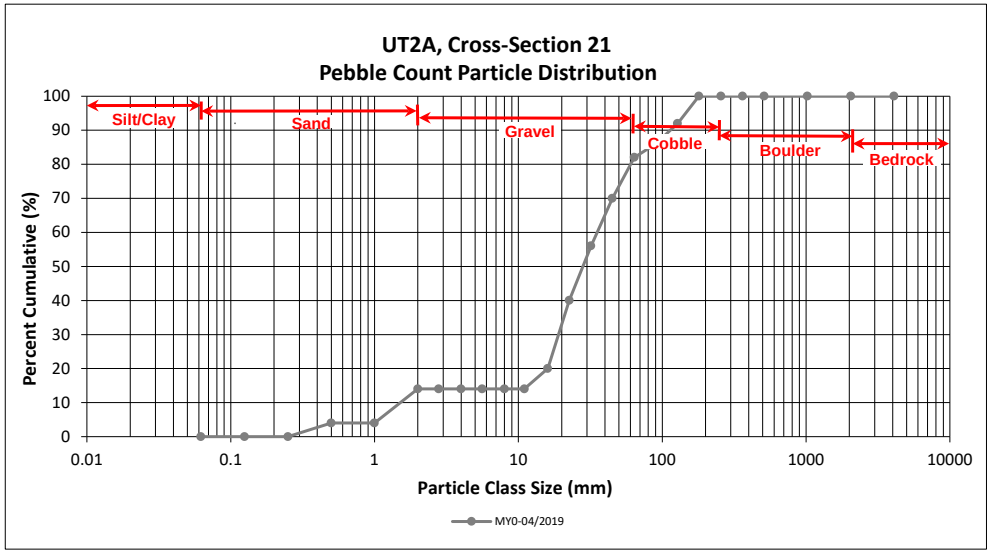
Cross-Section Pebble Count Plots

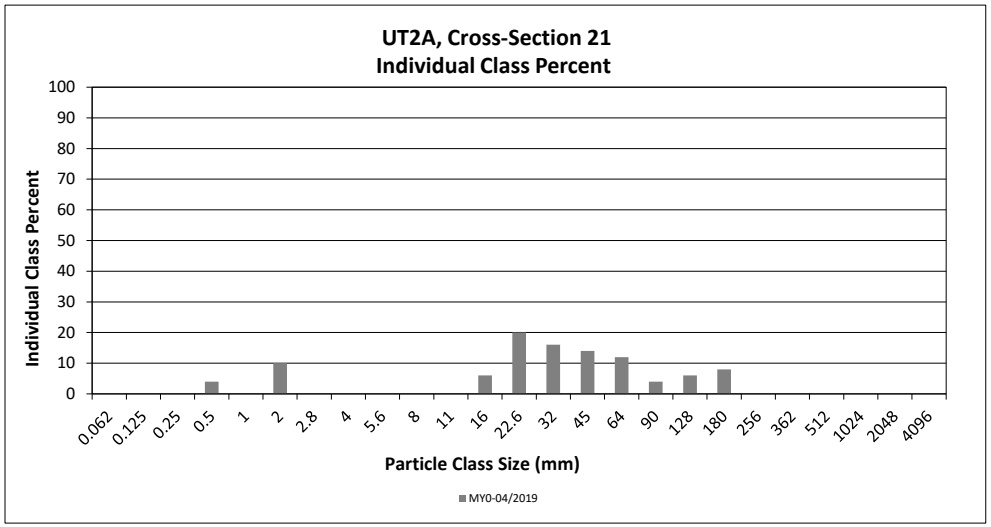
Lone Hickory Mitigation Site
DMS Project No. 97135
Monitoring Year 0 - 2019

UT2A, Cross-Section 21

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	4	4	4
	Coarse	0.5	1.0			4
	Very Coarse	1.0	2.0	10	10	14
GRAVEL	Very Fine	2.0	2.8			14
	Very Fine	2.8	4.0			14
	Fine	4.0	5.6			14
	Fine	5.6	8.0			14
	Medium	8.0	11.0			14
	Medium	11.0	16.0	6	6	20
	Coarse	16.0	22.6	20	20	40
	Coarse	22.6	32	16	16	56
	Very Coarse	32	45	14	14	70
	Very Coarse	45	64	12	12	82
COBBLE	Small	64	90	4	4	86
	Small	90	128	6	6	92
	Large	128	180	8	8	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 21	
Channel materials (mm)	
D_{16} =	12.5
D_{35} =	20.7
D_{50} =	28.1
D_{84} =	75.9
D_{95} =	145.5
D_{100} =	180.0





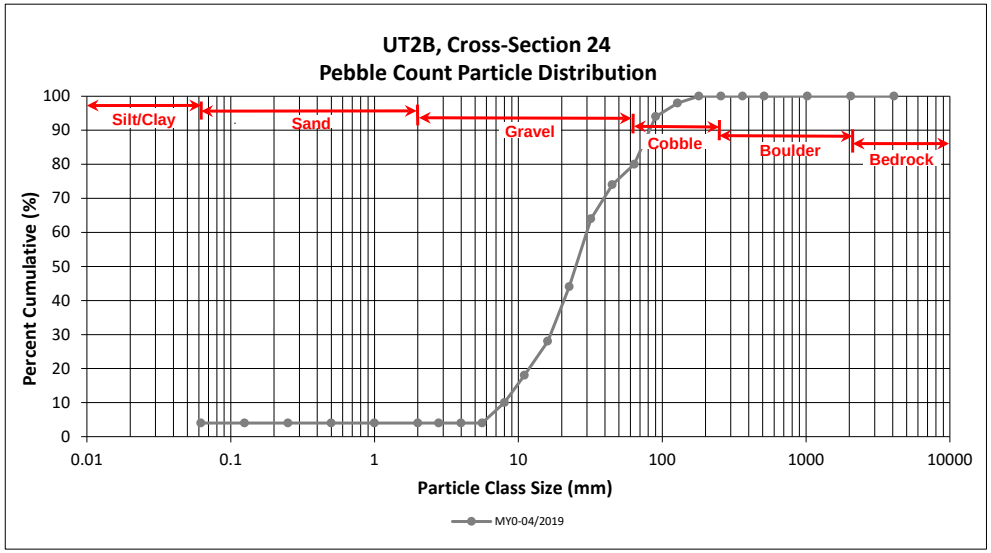
Cross-Section Pebble Count Plots

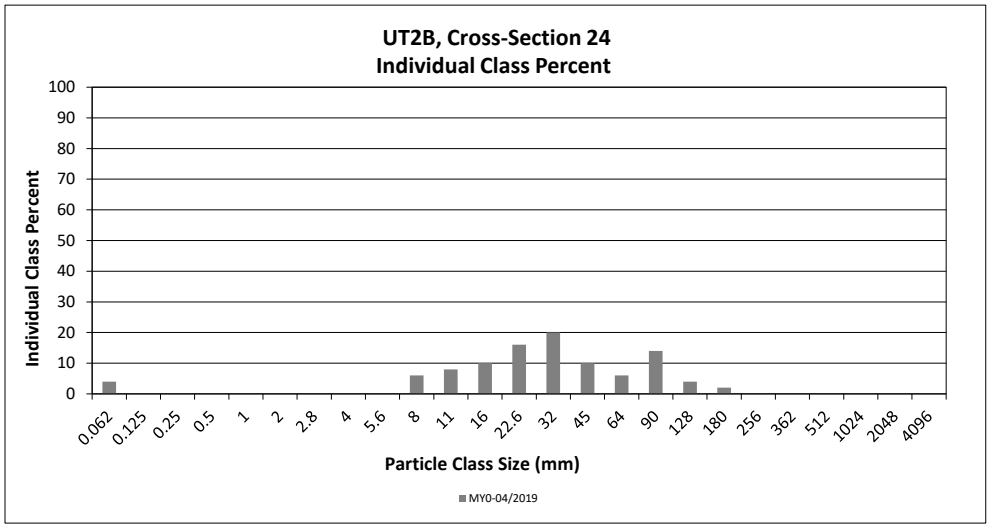
Lone Hickory Mitigation Site
DMS Project No. 97135
Monitoring Year 0 - 2019

UT2B, Cross-Section 24

Particle Class		Diameter (mm)		Riffle 100-Count	Summary	
		min	max		Class Percentage	Percent Cumulative
SILT/CLAY	Silt/Clay	0.000	0.062	4	4	4
SAND	Very fine	0.062	0.125			4
	Fine	0.125	0.250			4
	Medium	0.25	0.50			4
	Coarse	0.5	1.0			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			4
	Fine	5.6	8.0	6	6	10
	Medium	8.0	11.0	8	8	18
	Medium	11.0	16.0	10	10	28
	Coarse	16.0	22.6	16	16	44
	Coarse	22.6	32	20	20	64
	Very Coarse	32	45	10	10	74
	Very Coarse	45	64	6	6	80
COBBLE	Small	64	90	14	14	94
	Small	90	128	4	4	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 24	
Channel materials (mm)	
D_{16} =	10.2
D_{35} =	18.6
D_{50} =	25.1
D_{84} =	70.5
D_{95} =	98.3
D_{100} =	180.0





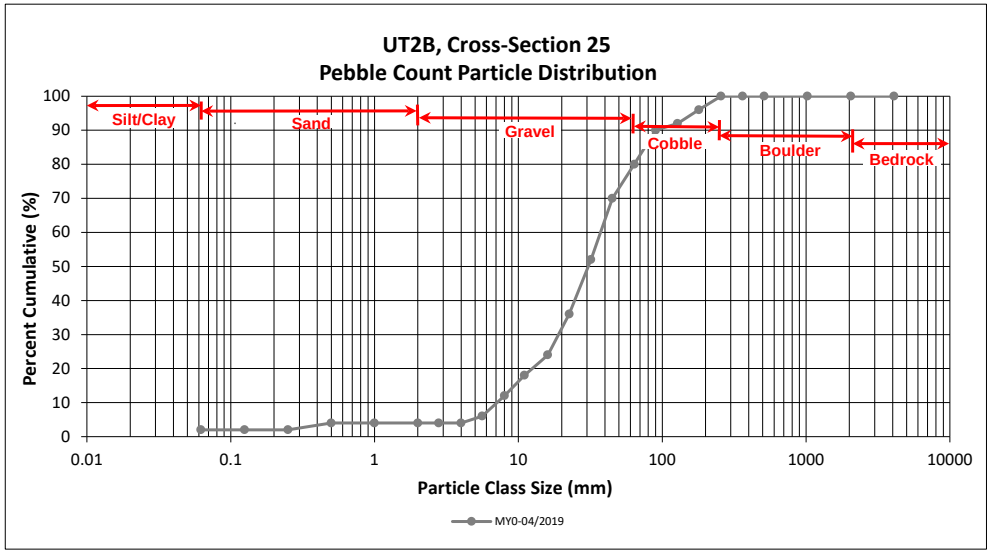
Cross-Section Pebble Count Plots

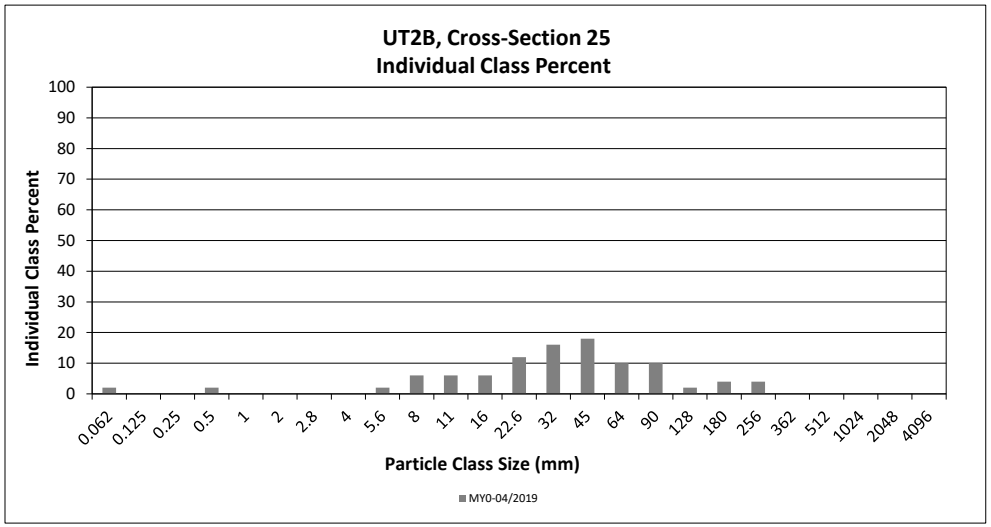
Lone Hickory Mitigation Site
DMS Project No. 97135
Monitoring Year 0 - 2019

UT2B, Cross-Section 25

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	2	4
	Coarse	0.5	1.0			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	2	2	6
	Fine	5.6	8.0	6	6	12
	Medium	8.0	11.0	6	6	18
	Medium	11.0	16.0	6	6	24
	Coarse	16.0	22.6	12	12	36
	Coarse	22.6	32	16	16	52
	Very Coarse	32	45	18	18	70
	Very Coarse	45	64	10	10	80
COBBLE	Small	64	90	10	10	90
	Small	90	128	2	2	92
	Large	128	180	4	4	96
	Large	180	256	4	4	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 25	
Channel materials (mm)	
D_{16} =	9.9
D_{35} =	22.0
D_{50} =	30.6
D_{84} =	73.4
D_{95} =	165.3
D_{100} =	256.0





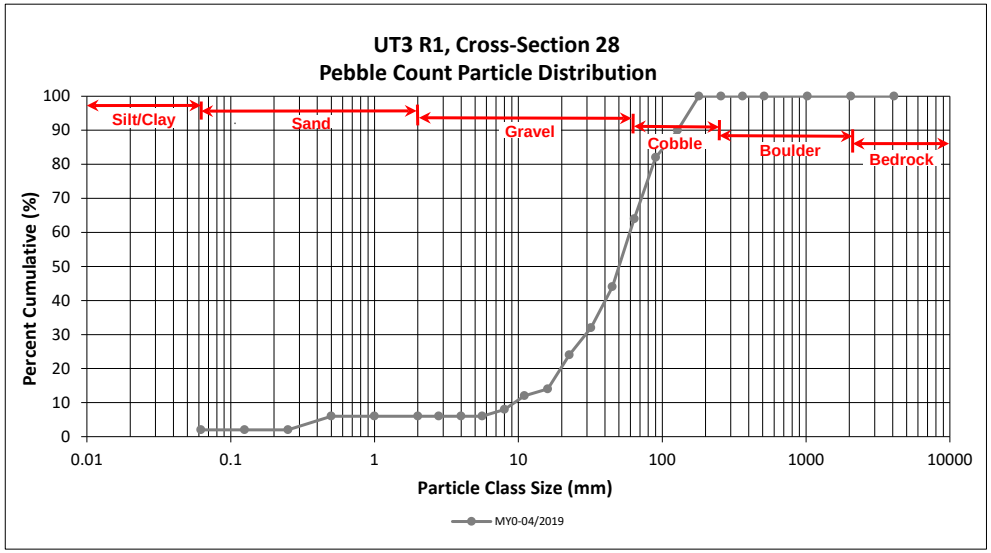
Cross-Section Pebble Count Plots

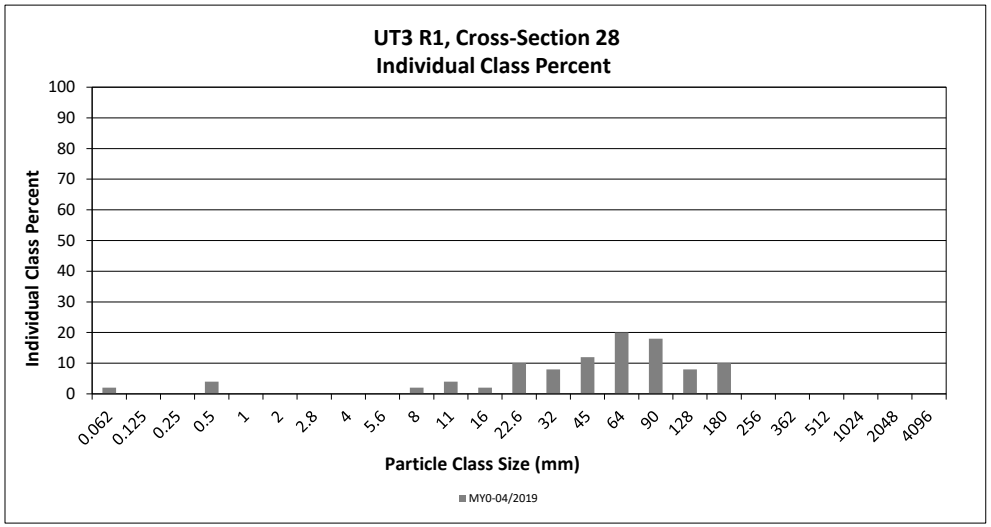
Lone Hickory Mitigation Site
DMS Project No. 97135
Monitoring Year 0 - 2019

UT3 R1, Cross-Section 28

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	4	4	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			6
	Fine	4.0	5.6			6
	Fine	5.6	8.0	2	2	8
	Medium	8.0	11.0	4	4	12
	Medium	11.0	16.0	2	2	14
	Coarse	16.0	22.6	10	10	24
	Coarse	22.6	32	8	8	32
	Very Coarse	32	45	12	12	44
	Very Coarse	45	64	20	20	64
COBBLE	Small	64	90	18	18	82
	Small	90	128	8	8	90
	Large	128	180	10	10	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 28	
Channel materials (mm)	
D_{16} =	17.1
D_{35} =	34.8
D_{50} =	50.0
D_{84} =	98.3
D_{95} =	151.8
D_{100} =	180.0





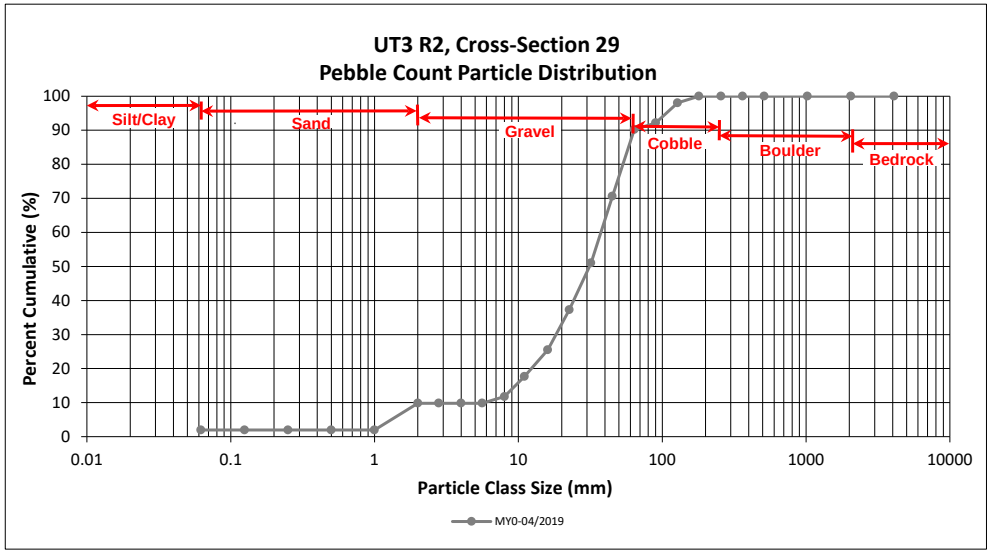
Cross-Section Pebble Count Plots

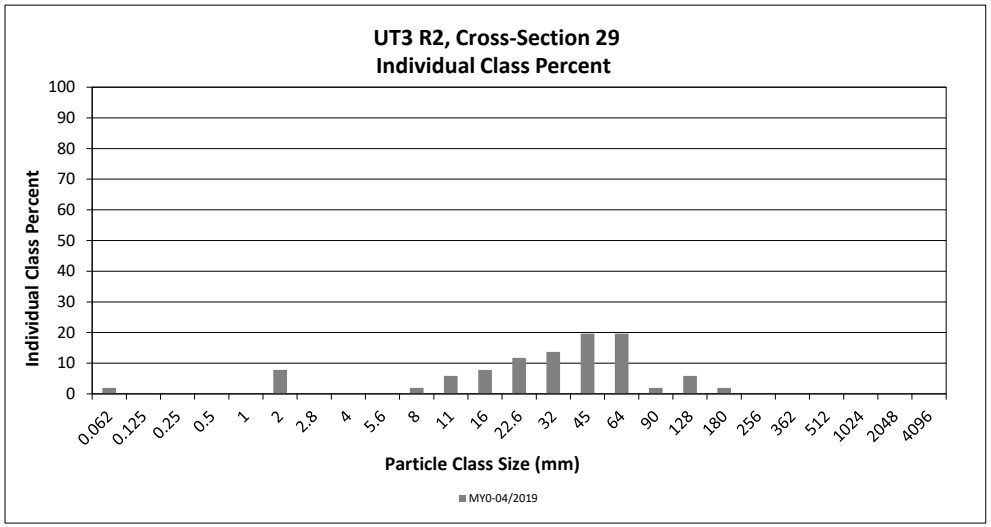
Lone Hickory Mitigation Site
DMS Project No. 97135
Monitoring Year 0 - 2019

UT3 R2, Cross-Section 29

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	8	8	10
GRAVEL	Very Fine	2.0	2.8			10
	Very Fine	2.8	4.0			10
	Fine	4.0	5.6			10
	Fine	5.6	8.0	2	2	12
	Medium	8.0	11.0	6	6	18
	Medium	11.0	16.0	8	8	25
	Coarse	16.0	22.6	12	12	37
	Coarse	22.6	32	14	14	51
	Very Coarse	32	45	20	20	71
	Very Coarse	45	64	20	20	90
COBBLE	Small	64	90	2	2	92
	Small	90	128	6	6	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	**102**	**100**	**100**

Cross-Section 29	
Channel materials (mm)	
D_{16} =	10.1
D_{35} =	21.2
D_{50} =	31.2
D_{84} =	57.3
D_{95} =	106.7
D_{100} =	180.0





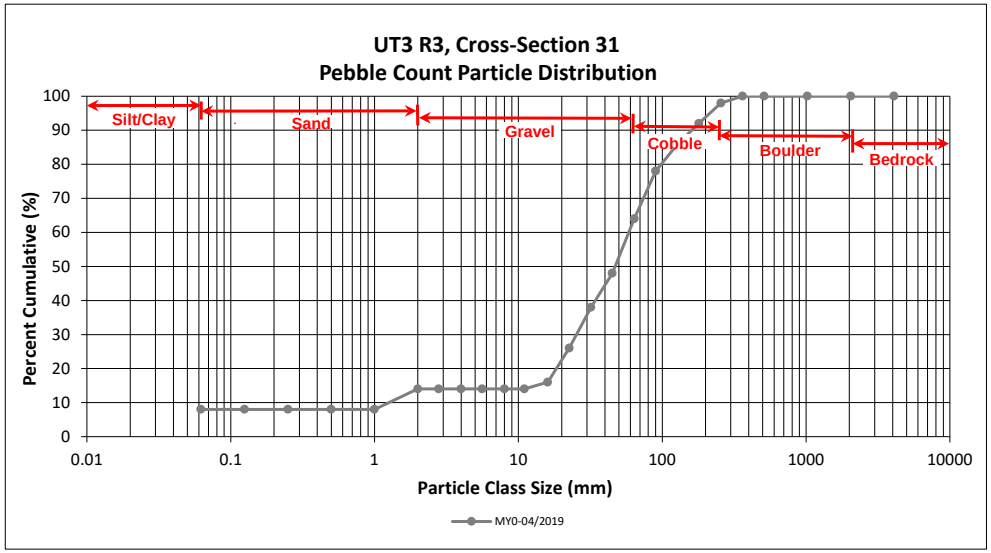
Cross-Section Pebble Count Plots

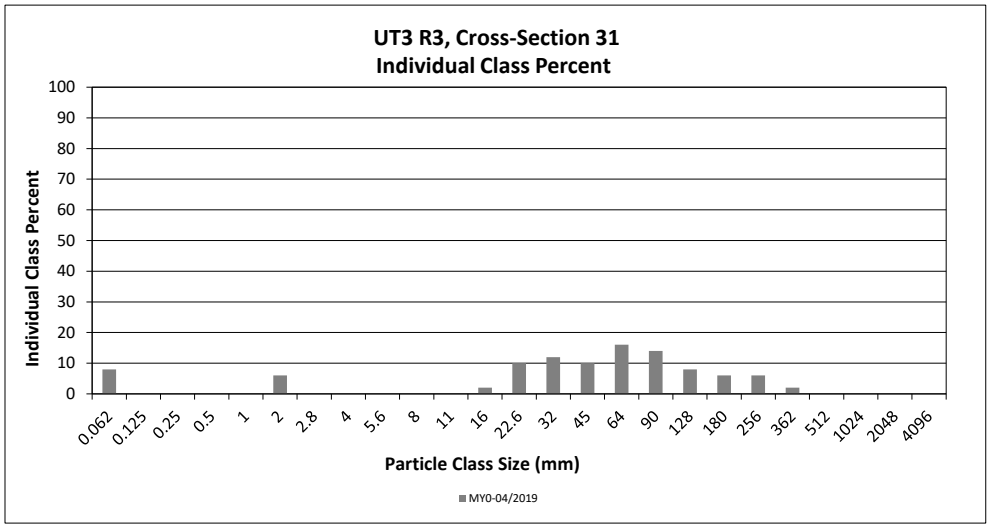
Lone Hickory Mitigation Site
DMS Project No. 97135
Monitoring Year 0 - 2019

UT3 R3, Cross-Section 31

Particle Class		Diameter (mm)		Riffle 100-Count	Summary	
		min	max		Class Percentage	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			8
	Coarse	0.5	1.0			8
	Very Coarse	1.0	2.0	6	6	14
GRAVEL	Very Fine	2.0	2.8			14
	Very Fine	2.8	4.0			14
	Fine	4.0	5.6			14
	Fine	5.6	8.0			14
	Medium	8.0	11.0			14
	Medium	11.0	16.0	2	2	16
	Coarse	16.0	22.6	10	10	26
	Coarse	22.6	32	12	12	38
	Very Coarse	32	45	10	10	48
	Very Coarse	45	64	16	16	64
COBBLE	Small	64	90	14	14	78
	Small	90	128	8	8	86
	Large	128	180	6	6	92
	Large	180	256	6	6	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 31	
Channel materials (mm)	
D_{16} =	16.0
D_{35} =	29.3
D_{50} =	47.0
D_{84} =	117.2
D_{95} =	214.7
D_{100} =	362.0





Stream Photographs

	
Photo Point 1 – UT1 Reach 1, view upstream *(04/04/2019)*	**Photo Point 1** – UT1 Reach 1, view downstream *(04/04/2019)*
	
Photo Point 2 – UT1 Reach 1, view upstream *(04/04/2019)*	**Photo Point 2** – UT1 Reach 1, view downstream *(04/04/2019)*
	
Photo Point 3 – UT1 Reach 1, view upstream *(04/04/2019)*	**Photo Point 3** – UT1 Reach 1, view downstream *(04/04/2019)*

	
Photo Point 4 – UT1 Reach 2A, view upstream *(04/04/2019)*	**Photo Point 4** – UT1 Reach 2A, view downstream *(04/04/2019)*
	
Photo Point 5 – UT1 Reach 2A, view upstream *(04/04/2019)*	**Photo Point 5** – UT1 Reach 2A, view downstream *(04/04/2019)*
	
Photo Point 6 – UT1 Reach 2A, view upstream *(04/04/2019)*	**Photo Point 6** – UT1 Reach 2A, view downstream *(04/04/2019)*

	
Photo Point 7 – UT1 Reach 2A, view upstream *(04/04/2019)*	**Photo Point 7** – UT1 Reach 2A, view downstream *(04/04/2019)*
	
Photo Point 8 – UT1 Reach 2A, view upstream *(04/04/2019)*	**Photo Point 8** – UT1 Reach 2A, view downstream *(04/04/2019)*
	
Photo Point 9 – UT1 Reach 2A, view upstream *(04/04/2019)*	**Photo Point 9** – UT1 Reach 2A, view downstream *(04/04/2019)*

Photo Point 9 – UT1A, view upstream *(04/04/2019)*

Photo Point 10 – UT1 Reach 2B, view upstream *(04/04/2019)*

Photo Point 10 – UT1 Reach 2B, view downstream *(04/04/2019)*

Photo Point 11 – UT1 Reach 2B, view upstream *(04/04/2019)*

Photo Point 11 – UT1 Reach 2B, view downstream *(04/04/2019)*

	
Photo Point 12 – UT1 Reach 2B, view upstream *(04/04/2019)*	**Photo Point 12** – UT1 Reach 2B, view downstream *(04/04/2019)*
	
Photo Point 13 – UT1 Reach 2B, view upstream *(04/04/2019)*	**Photo Point 13** – UT1 Reach 2B, view downstream *(04/04/2019)*
	
Photo Point 14 – UT1 Reach 2B, view upstream *(04/04/2019)*	**Photo Point 14** – UT1 Reach 2B, view downstream *(04/04/2019)*

Photo Point 14 – UT1B, view upstream *(04/04/2019)*

Photo Point 15 – UT1 Reach 3, view upstream *(04/04/2019)*

Photo Point 15 – UT1 Reach 3, view downstream *(04/04/2019)*

Photo Point 16 – UT1 Reach 3, view upstream *(04/04/2019)*

Photo Point 16 – UT1 Reach 3, view downstream *(04/04/2019)*

	
Photo Point 17 – UT1 Reach 3, view upstream *(04/04/2019)*	**Photo Point 17** – UT1 Reach 3, view downstream *(04/04/2019)*
	
Photo Point 18 – UT1 Reach 3, view upstream *(04/04/2019)*	**Photo Point 18** – UT1 Reach 3, view downstream *(04/04/2019)*
	
Photo Point 19 – UT1 Reach 3, view upstream *(04/04/2019)*	**Photo Point 19** – UT1 Reach 3, view downstream *(04/04/2019)*

Photo Point 20 – UT1 Reach 3, view upstream *(04/04/2019)*

Photo Point 20 – UT1 Reach 3, view downstream *(04/04/2019)*

Photo Point 20 – UT1 Reach 3 BMP 3, view upstream *(04/04/2019)*

Photo Point 21 – UT1 Reach 4, view upstream *(04/04/2019)*

Photo Point 21 – UT1 Reach 4, view downstream *(04/04/2019)*

	
Photo Point 22 – UT2 Reach 1, view upstream *(04/04/2019)*	**Photo Point 22** – UT2 Reach 1, view downstream *(04/04/2019)*
	
Photo Point 23 – UT2 Reach 1, view upstream *(04/04/2019)*	**Photo Point 23** – UT2 Reach 1, view downstream *(04/04/2019)*
	
Photo Point 24 – UT2 Reach 2, view upstream *(04/04/2019)*	**Photo Point 24** – UT2 Reach 2, view downstream *(04/04/2019)*

Photo Point 25 – UT2 Reach 2, view upstream *(04/04/2019)*

Photo Point 25 – UT2 Reach 2, view downstream *(04/04/2019)*

Photo Point 26 – UT2 Reach 2, view upstream *(04/04/2019)*

Photo Point 26 – UT2 Reach 2, view downstream *(04/04/2019)*

Photo Point 27 – UT2A, view upstream *(04/17/2019)*

Photo Point 27 – UT2A, view downstream *(04/17/2019)*

	
Photo Point 28 – UT2A, view upstream *(04/17/2019)*	**Photo Point 28** – UT2A, view downstream *(04/17/2019)*
	
Photo Point 29 – UT2A, view upstream *(04/17/2019)*	**Photo Point 29** – UT2A, view downstream *(04/17/2019)*
	
Photo Point 30 – UT2B, view upstream *(04/17/2019)*	**Photo Point 30** – UT2B, view downstream *(04/17/2019)*

	
Photo Point 31 – UT2B, view upstream *(04/17/2019)*	**Photo Point 31** – UT2B, view downstream *(04/17/2019)*
	
Photo Point 32 – UT2B, view upstream *(04/17/2019)*	**Photo Point 32** – UT2B, view downstream *(04/17/2019)*
	
Photo Point 33 – UT3 Reach 1, view upstream *(04/17/2019)*	**Photo Point 33** – UT3 Reach 1, view downstream *(04/17/2019)*

	
Photo Point 34 – UT3 Reach 1, view upstream *(04/17/2019)*	**Photo Point 34** – UT3 Reach 1, view downstream *(04/17/2019)*
	
Photo Point 35 – UT3 Reach 1, view upstream *(04/17/2019)*	**Photo Point 35** – UT3 Reach 1, view downstream *(04/17/2019)*
	
Photo Point 36 – UT3 Reach 2, view upstream *(04/17/2019)*	**Photo Point 36** – UT3 Reach 2, view downstream *(04/17/2019)*

Photo Point 37 – UT3 Reach 2, view upstream *(04/17/2019)*

Photo Point 37 – UT3 Reach 2, view downstream *(04/17/2019)*

Photo Point 38 – UT3 Reach 2, view upstream *(04/17/2019)*

Photo Point 38 – UT3 Reach 2, view downstream *(04/17/2019)*

Photo Point 39 – UT3 Reach 3, view upstream *(04/17/2019)*

Photo Point 39 – UT3 Reach 3, view downstream *(04/17/2019)*

	
Photo Point 40 – UT3 Reach 3, view upstream *(04/17/2019)*	**Photo Point 40** – UT3 Reach 3, view downstream *(04/17/2019)*
	
Photo Point 41 – UT3 Reach 3, view upstream *(04/17/2019)*	**Photo Point 41** – UT3 Reach 3, view downstream *(04/17/2019)*
	
Photo Point 42 – UT1 Reach 3, up valley *(04/04/2019)*	**Photo Point 42** – UT1 Reach 4, down valley *(04/04/2019)*

Photo Point 43 – UT2A, northeast view *(04/17/2019)*

Photo Point 43 – UT2A, north view *(04/17/2019)*

Photo Point 43 – UT3 Reach 3, northwest view *(04/17/2019)*

Photo Point 44 – BMP 4 above UT2B, inlet view *(04/24/2019)*

Photo Point 44 – BMP 4 above UT2B, outlet view *(04/24/2019)*

APPENDIX 3. Vegetation Plot Data

Table 9a. Planted and Total Stem Counts
Lone Hickory Mitigation Site
DMS Project No. 97135
Monitoring Year 0 - 2019

Permanent Vegetation Monitoring Plots

			Current Permanent Vegetation Plot Data (MY0 2019)																														
			97135-WEI-0001			97135-WEI-0002			97135-WEI-0003			97135-WEI-0004			97135-WEI-0005			97135-WEI-0006			97135-WEI-0007			97135-WEI-0008			97135-WEI-0009			97135-WEI-0010		
Scientific Name	**Common Name**	**Species Type**	**PnoLS**	**P-all**	**T**	**PnoLS**	**P-all**	**T**	**PnoLS**	**P-all**	**T**	**PnoLS**	**P-all**	**T**	**PnoLS**	**P-all**	**T**	**PnoLS**	**P-all**	**T**	**PnoLS**	**P-all**	**T**	**PnoLS**	**P-all**	**T**	**PnoLS**	**P-all**	**T**	**PnoLS**	**P-all**	**T**
Acer rubrum	Red Maple	Tree																															
Betula nigra	River Birch	Tree	3	3	3				2	2	2	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	2	2	2	2	2	2
Diospyros virginiana	American Persimmon	Tree																															
Fraxinus pennsylvanica	Green Ash	Tree													3	3	3													2	2	2
Liriodendron tulipifera	Tulip Poplar	Tree	3	3	3	5	5	5				2	2	2	3	3	3	2	2	2	5	5	5	3	3	3	4	4	4	3	3	3
Platanus occidentalis	Sycamore	Tree	3	3	3	4	4	4	3	3	3	4	4	4	3	3	3	3	3	3	5	5	5	2	2	2	5	5	5			
Populus deltoides	Eastern Cottonwood	Tree																															
Quercus lyrata	Overcup Oak	Tree																															
Quercus michauxii	Swamp Chestnut Oak	Tree	2	2	2	2	2	2	5	5	5	3	3	3	1	1	1	4	4	4	2	2	2	1	1	1				3	3	3
Quercus pagoda	Cherrybark Oak	Tree	4	4	4	3	3	3	3	3	3	2	2	2	1	1	1							5	5	5	1	1	1	2	2	2
Quercus phellos	Willow Oak	Tree				1	1	1	2	2	2	1	1	1	1	1	1	2	2	2				1	1	1	3	3	3	3	3	3
		Stem count	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	14	14	14	15	15	15	15	15	15	15	15	15	15	15	15
		size (ares)	1			1			1			1			1			1			1			1			1			1		
		size (ACRES)	0.02			0.02			0.02			0.02			0.02			0.02			0.02			0.02			0.02			0.02		
		Species count	5	5	5	5	5	5	5	5	5	6	6	6	7	7	7	5	5	5	4	4	4	6	6	6	5	5	5	6	6	6
		Stems per ACRE	607	607	607	607	607	607	607	607	607	607	607	607	607	607	607	567	567	567	607	607	607	607	607	607	607	607	607	607	607	607

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

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

Table 9b. Planted and Total Stem Counts
Lone Hickory Mitigation Site
DMS Project No. 97135
Monitoring Year 0 - 2019

Permanent Vegetation Monitoring Plots

			Current Permanent Vegetation Plot Data (MY0 2019)																														
			97135-WEI-0011			97135-WEI-0012			97135-WEI-0013			97135-WEI-0014			97135-WEI-0015			97135-WEI-0016			97135-WEI-0017			97135-WEI-0018			97135-WEI-0019			97135-WEI-0020		
Scientific Name	**Common Name**	**Species Type**	**PnoLS**	**P-all**	**T**	**PnoLS**	**P-all**	**T**	**PnoLS**	**P-all**	**T**	**PnoLS**	**P-all**	**T**	**PnoLS**	**P-all**	**T**	**PnoLS**	**P-all**	**T**	**PnoLS**	**P-all**	**T**	**PnoLS**	**P-all**	**T**	**PnoLS**	**P-all**	**T**	**PnoLS**	**P-all**	**T**
Acer rubrum	Red Maple	Tree																			1	1	1									
Betula nigra	River Birch	Tree	3	3	3	3	3	3	2	2	2	3	3	3	1	1	1				1	1	1	1	1	1	3	3	3	3	3	3
Diospyros virginiana	American Persimmon	Tree																			1	1	1									
Fraxinus pennsylvanica	Green Ash	Tree	1	1	1				2	2	2	1	1	1	1	1	1	1	1	1	2	2	2	1	1	1	1	1	1	3	3	3
Liriodendron tulipifera	Tulip Poplar	Tree	2	2	2	8	8	8	2	2	2				1	1	1							2	2	2	3	3	3	3	3	3
Platanus occidentalis	Sycamore	Tree	3	3	3	1	1	1	3	3	3	4	4	4	4	4	4	5	5	5	5	5	5	6	6	6	3	3	3	3	3	3
Populus deltoides	Eastern Cottonwood	Tree										3	3	3							2	2	2									
Quercus lyrata	Overcup Oak	Tree	2	2	2	1	1	1	2	2	2	2	2	2	2	2	2	2	2	2	3	3	3	5	5	5	2	2	2	1	1	1
Quercus michauxii	Swamp Chestnut Oak	Tree																														
Quercus pagoda	Cherrybark Oak	Tree	2	2	2	2	2	2	3	3	3				4	4	4	1	1	1				1	1	1						
Quercus phellos	Willow Oak	Tree	2	2	2				1	1	1	2	2	2	2	2	2	6	6	6							3	3	3	2	2	2
		Stem count	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	16	16	16	15	15	15	15	15	15
		size (ares)	1			1			1			1			1			1			1			1			1			1		
		size (ACRES)	0.02			0.02			0.02			0.02			0.02			0.02			0.02			0.02			0.02			0.02		
		Species count	7	7	7	5	5	5	7	7	7	6	6	6	7	7	7	5	5	5	7	7	7	6	6	6	6	6	6	6	6	6
		Stems per ACRE	607	607	607	607	607	607	607	607	607	607	607	607	607	607	607	607	607	607	607	607	607	647	647	647	607	607	607	607	607	607

			Current Permanent Vegetation Plot Data (MY0 2019)															Annual Mean		
			97135-WEI-0021			97135-WEI-0022			97135-WEI-0023			97135-WEI-0024			97135-WEI-0025			MY0 (2019)		
Scientific Name	**Common Name**	**Species Type**	**PnoLS**	**P-all**	**T**	**PnoLS**	**P-all**	**T**	**PnoLS**	**P-all**	**T**	**PnoLS**	**P-all**	**T**	**PnoLS**	**P-all**	**T**	**PnoLS**	**P-all**	**T**
Acer rubrum	Red Maple	Tree				1	1	1	1	1	1							3	3	3
Betula nigra	River Birch	Tree	2	2	2	2	2	2	2	2	2	3	3	3	2	2	2	55	55	55
Diospyros virginiana	American Persimmon	Tree				2	2	2	3	3	3							6	6	6
Fraxinus pennsylvanica	Green Ash	Tree				2	2	2	2	2	2	1	1	1				23	23	23
Liriodendron tulipifera	Tulip Poplar	Tree	2	2	2							2	2	2	3	3	3	58	58	58
Platanus occidentalis	Sycamore	Tree	3	3	3	3	3	3				1	1	1	1	1	1	77	77	77
Populus deltoides	Eastern Cottonwood	Tree				2	2	2	1	1	1							8	8	8
Quercus lyrata	Overcup Oak	Tree	3	3	3	1	1	1	2	2	2	3	3	3	2	2	2	33	33	33
Quercus michauxii	Swamp Chestnut Oak	Tree																23	23	23
Quercus pagoda	Cherrybark Oak	Tree	2	2	2							2	2	2	4	4	4	42	42	42
Quercus phellos	Willow Oak	Tree	3	3	3	2	2	2	3	3	3	3	3	3	3	3	3	46	46	46
		Stem count	15	15	15	15	15	15	14	14	14	15	15	15	15	15	15	374	374	374
		size (ares)	1			1			1			1			1			25		
		size (ACRES)	0.02			0.02			0.02			0.02			0.02			0.62		
		Species count	6	6	6	8	8	8	7	7	7	7	7	7	6	6	6	11	11	11
		Stems per ACRE	607	607	607	607	607	607	567	567	567	607	607	607	607	607	607	605	605	605

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

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

Table 9c. Planted and Total Stem Counts
Lone Hickory Mitigation Site
DMS Project No. 97135
Monitoring Year 0 - 2019

Mobile Vegetation Monitoring Plots

			Current Mobile Vegetation Plot Data (MY0 2019)									
			MP1	MP2	MP3	MP4	MP5	MP6	MP7	MP8	MP9	MP10
Scientific Name	Common Name	Species Type	PnoLS	PnoLS	PnoLS	PnoLS	PnoLS	PnoLS	PnoLS	PnoLS	PnoLS	PnoLS
Acer rubrum	Red Maple	Tree										
Betula nigra	River Birch	Tree	5	2		1		2		1	3	1
Diospyros virginiana	American Persimmon	Tree										
Fraxinus pennsylvanica	Green Ash	Tree	1	1	2	1	3	1		1	2	
Liriodendron tulipifera	Tulip Poplar	Tree	5	6		4	1	4	4	6	1	2
Platanus occidentalis	Sycamore	Tree	4	5	5		1		3	3	4	5
Populus deltoides	Eastern Cottonwood	Tree										
Quercus lyrata	Overcup Oak	Tree						2	1			2
Quercus michauxii	Swamp Chestnut Oak	Tree	3	2								
Quercus pagoda	Cherrybark Oak	Tree	1	3	8	5	5	4	4	3	3	3
Quercus phellos	Willow Oak	Tree		1	2	1	2		1			
		Stem count	19	20	17	12	12	13	13	14	13	13
		size (ares)	1	1	1	1	1	1	1	1	1	1
		size (ACRES)	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02
		Species count	6	7	4	5	5	5	5	5	5	5
		Stems per ACRE	769	809	688	486	486	526	526	567	526	526

			Current Mobile Vegetation Plot Data (MY0 2019)					Annual Mean	Overall Site Annual Mean
			MP11	MP12	MP13	MP14	MP15	MY0 (2019)	MY0 (2019)
Scientific Name	Common Name	Species Type	PnoLS	PnoLS	PnoLS	PnoLS	PnoLS	PnoLS	PnoLS
Acer rubrum	Red Maple	Tree							3
Betula nigra	River Birch	Tree	4	2	1	3	2	27	82
Diospyros virginiana	American Persimmon	Tree							6
Fraxinus pennsylvanica	Green Ash	Tree	2	1	1	1	1	18	41
Liriodendron tulipifera	Tulip Poplar	Tree	1	2	6	2	3	47	105
Platanus occidentalis	Sycamore	Tree	4	3	2	2	2	43	120
Populus deltoides	Eastern Cottonwood	Tree							8
Quercus lyrata	Overcup Oak	Tree			1	1		7	40
Quercus michauxii	Swamp Chestnut Oak	Tree						5	28
Quercus pagoda	Cherrybark Oak	Tree	1	4	3	4	5	56	98
Quercus phellos	Willow Oak	Tree	1	3			2	13	59
		Stem count	13	15	14	13	15	216	590
		size (ares)	1	1	1	1	1	15	40
		size (ACRES)	0.02	0.02	0.02	0.02	0.02	0.37	0.99
		Species count	6	6	6	6	6	8	11
		Stems per ACRE	526	607	567	526	607	583	597

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

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

Vegetation Photographs

	
Vegetation Plot 1 – *(03/28/2019)*	**Vegetation Plot 2** – *(03/28/2019)*
	
Vegetation Plot 3 – *(03/28/2019)*	**Vegetation Plot 4** – *(03/28/2019)*
	
Vegetation Plot 5 – *(03/28/2019)*	**Vegetation Plot 6** – *(03/28/2019)*

Vegetation Plot 7 – *(03/28/2019)*

Vegetation Plot 8 – *(03/28/2019)*

Vegetation Plot 9 – *(03/28/2019)*

Vegetation Plot 10 – *(03/28/2019)*

Vegetation Plot 11 – *(04/17/2019)*

Vegetation Plot 12 – *(04/17/2019)*

Vegetation Plot 13 – *(04/17/2019)*

Vegetation Plot 14 – *(04/17/2019)*

Vegetation Plot 15 – *(04/17/2019)*

Vegetation Plot 16 – *(04/17/2019)*

Vegetation Plot 17 – *(04/17/2019)*

Vegetation Plot 18 – *(04/17/2019)*

Vegetation Plot 19 – *(04/17/2019)*

Vegetation Plot 20 – *(04/17/2019)*

Vegetation Plot 21 – *(04/17/2019)*

Vegetation Plot 22 – *(04/17/2019)*

Vegetation Plot 23 – *(04/17/2019)*

Vegetation Plot 24 – *(04/17/2019)*

Vegetation Plot 25 – *(04/17/2019)*

APPENDIX 4. Record Drawings

Lone Hickory Mitigation Site

Yadkin County, North Carolina

for

NCDEQ

Division of Mitigation Services

Yadkinville, NC

Vicinity Map
Not to Scale

Environmental Quality

RECORD DRAWINGS
ISSUED JULY 10, 2019

CERTIFICATE OF SURVEY AND ACCURACY

I, DAVID S. TURNER, 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 TURNER LAND SURVEYING, PLLC AS SHOWN ON AN AS-BUILT SURVEY FOR "THE STATE OF NC, DIVISION OF MITIGATION SERVICES" DATED MAY 30, 2019 ; THAT THIS SURVEY WAS PERFORMED AT THE 95% CONFIDENCE LEVEL TO MEET THE FEDERAL GEOGRAPHIC DATA COMMITTEE STANDARDS; THAT THIS SURVEY WAS PERFORMED TO MEET THE REQUIREMENTS FOR A TOPOGRAPHIC SURVEY TO THE ACCURACY OF CLASS A HORIZONTAL AND CLASS C VERTICAL WHERE APPLICABLE; THAT THE ORIGINAL DATA WAS OBTAIN BETWEEN THE DATES OF JAN 16 & MAY 15 2019 ; THAT THE CONTOURS SHOWN AS BROKEN LINES MAY NOT MEET THE STATED STANDARD AND ALL COORDINATES ARE BASED ON NAD 83 (NSRS 2011) AND ALL ELEVATIONS ARE BASE ON NAVD 88; THAT THIS MAP MEETS THE SPECIFICATIONS FOR TOPOGRAPHIC SURVEYS AS STATED IN TITLE 21, CHAPTER 56, SECTION .1606; THAT THIS MAP WAS NOT PREPARED IN ACCORDANCE WITH G.S. 47-30, AS AMENDED AND DOES NOT REPRESENT AN OFFICIAL BOUNDARY SURVEY.

WITNESS MY ORIGINAL SIGNATURE, REGISTRATION NUMBER, AND SEAL THIS THE 8th DAY OF July, 20 19.

OFFICIAL SEAL

NORTH CAROLINA PROFESSIONAL SEAL L-4551 LAND SURVEYOR DAVID S. TURNER

DAVID S. TURNER, PLS L-4551

Sheet Index

Project Directory

Engineering:
Wildlands Engineering, Inc.
License No. F-0831
1430 South Mint Street, Ste 104
Charlotte, NC 28203
Emily G. Reinicker, PE
704-332-7754

As-Built Survey:
Turner Land Surveying, PLLC
P.O. Box 148
Swannanoa, NC 28778
Telephone: (919) 827-0745

Initial Topographic Survey:
Kee Mapping and Surveying, PA
88 Central Avenue
Asheville, NC 28801
Nolan Carmack, PLS
828-575-9021

Owner:
NCDEQ - Division of Mitigation Services
217 West Jones Street, 3rd floor
Raleigh, NC 27603

DMS Project No. 97135

Yadkin River Basin HUC 03040101

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1430 S. Mint Street, Ste 104
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NORTH CAROLINA PROFESSIONAL SEAL 29923 ENGINEER EMILY G. REINICKER

Lone Hickory Mitigation Site Record Drawings
Yadkin County, North Carolina

Title Sheet

Revisions:

Date:	July 10, 2019
Job Number:	005-02163
Project Engineer:	EGR
Drawn By:	JCK
Checked By:	EGR/JCK

Sheet 0.1

As-Built Features

- As-Built Thalweg Alignment
- As-Built Bankfull
- As-Built Major Contour (100)
- As-Built Minor Contour
- As-Built Monitoring Cross Section
- VP — Permanent Vegetation Monitoring Plots
- SG1 — Stream Gage
- GWG1 — Groundwater Gage

As-Built Structures

- As-Built Constructed Riffle
- As-Built Brush Toe
- As-Built Bank Grading in Stream Preservation Reach
- As-Built Channel Stabilization

As-Built Structures

- As-Built Log Sill
- As-Built Lunker Log
- As-Built Log J-Hook
- As-Built Boulder J-Hook
- As-Built Boulder J-Hook with Sill
- As-Built Log Vane
- As-Built Rock Sill
- Wetland Re-establishment

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

Pre-construction Features

- Recorded Conservation Easement (CE)
- Pre-construction Property Line
- Pre-construction Overhead Electric
- Pre-construction Power Pole
- Pre-construction Storm Pipe
- Pre-construction Farm Road
- Pre-project Wetland Delineation
- Pre-construction Tree
- Pre-construction Bedrock
- Pre-construction Road
- Pre-construction Treeline

Design Features

- Design Thalweg Alignment (10+00)
- Design Bankfull
- Design Major Contour (100)
- Design Minor Contour
- Design Safety Fence (SAF)
- Design Silt Fence
- Design Limits of Disturbance

Design Structures

- Design Constructed Riffle
- Design Brush Toe
- Design Bank Grading in Preservation Areas
- Design Channel Stabilization
- Design Log Sill
- Design Lunker Log
- Design Log J-Hook
- Design Boulder J-Hook
- Design Boulder J-Hook with Sill
- Design Log Vane
- Design Rock Sill

PROJECT NOTES:

Topographic survey was completed by Kee Mapping and Surveying in February 2017.
Parcel boundary survey completed by Kee Mapping and Surveying in July 2017.

Topographic data outside Design conservation easement supplemented with Lidar data from September 2015.

As-Built survey completed April 2019 by Turner Land Surveying.

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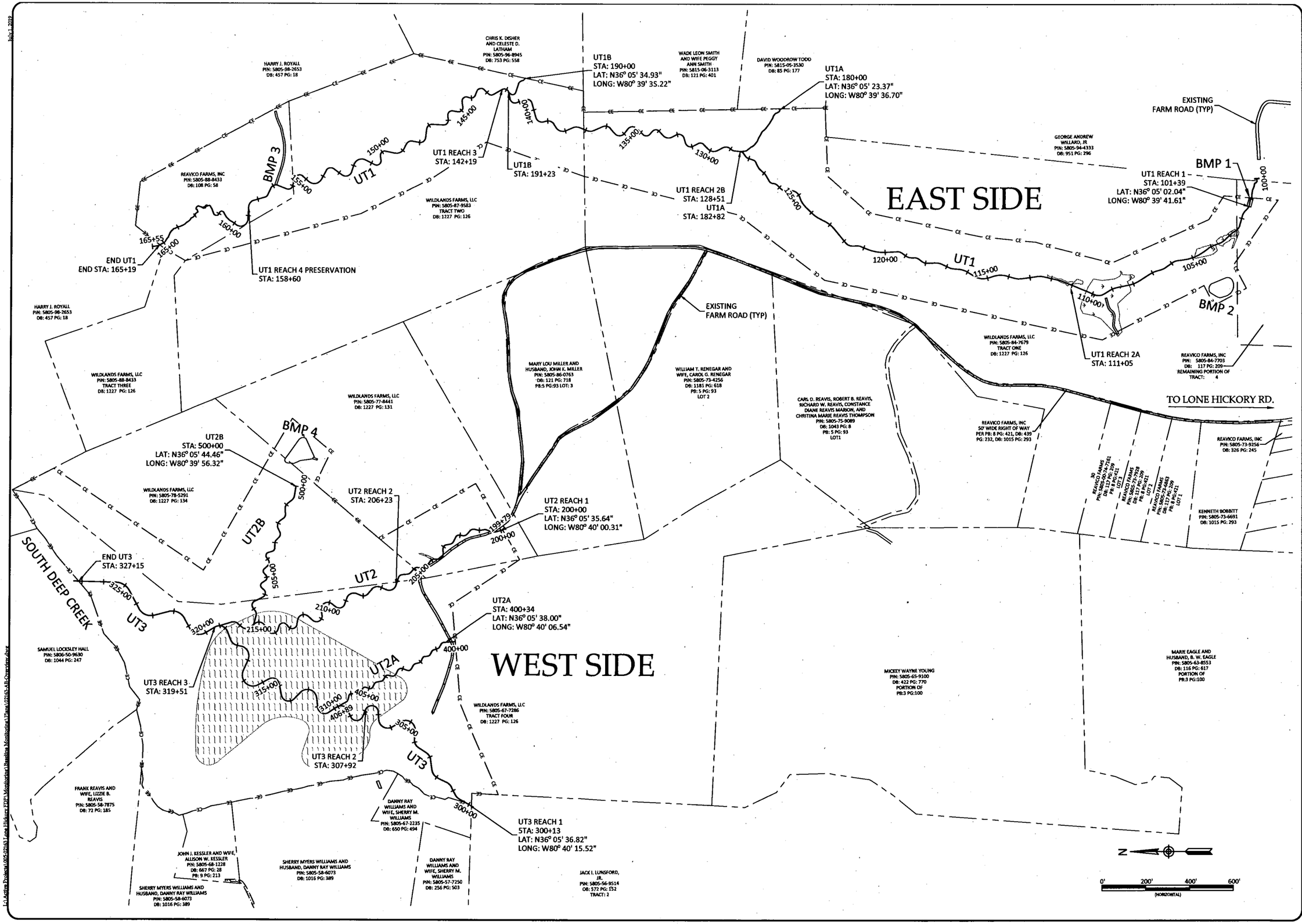
Lone Hickory Mitigation Site Record Drawings
Yadkin County, North Carolina

General Notes and Symbols

Revisions:

Date:	July 10, 2019
Job Number:	005-02163
Project Engineer:	EGR
Drawn By:	JCK
Checked By:	EGR/JCK

Sheet 0.2



July 1, 2019

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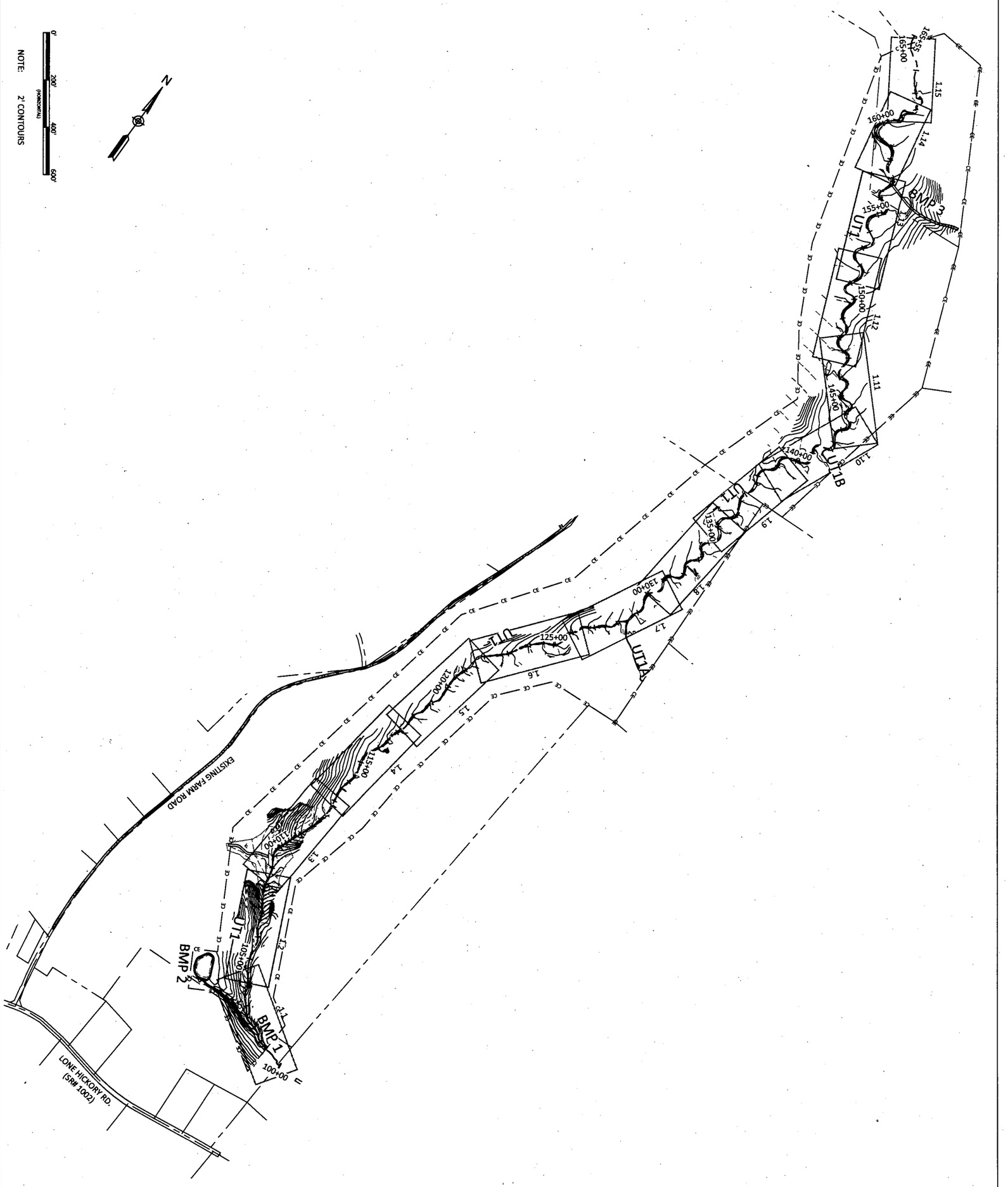
NORTH CAROLINA PROFESSIONAL ENGINEER SEAL 38913 ERIN C. REINICKER

Lone Hickory Mitigation Site Record Drawings
Yadkin County, North Carolina
Project Overview

Date:	July 10, 2019
Job Number:	005-02163
Project Engineer:	EGR
Drawn By:	JCK
Checked By:	EGR/CK

Revisions:

Sheet 0.3



Date:	July 10, 2019
Job Number:	005-02163
Project Engineer:	EGR
Drawn By:	JCK
Checked By:	EGR/JCK

Revisions:

0.4

Sheet

Lone Hickory Mitigation Site Record Drawings
Yadkin County, North Carolina

Project Overview - East

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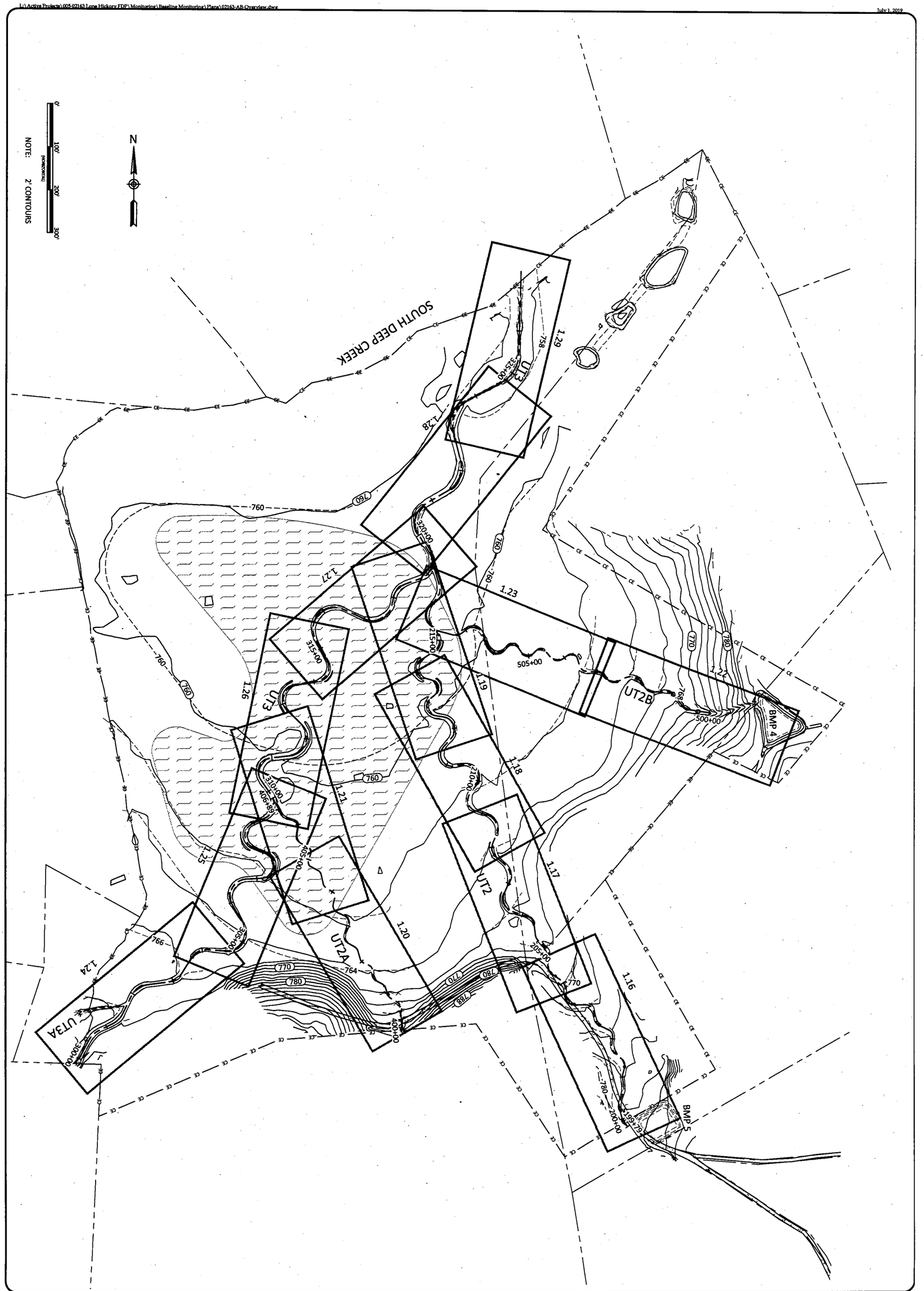

Date:	July 10, 2019
Job Number:	005-02163
Project Engineer:	EGR
Drawn By:	JCK
Checked By:	EGR/JCK

Revisions:

Lone Hickory Mitigation Site Record Drawings
Yadkin County, North Carolina

Project Overview - West

0.5

Sheet

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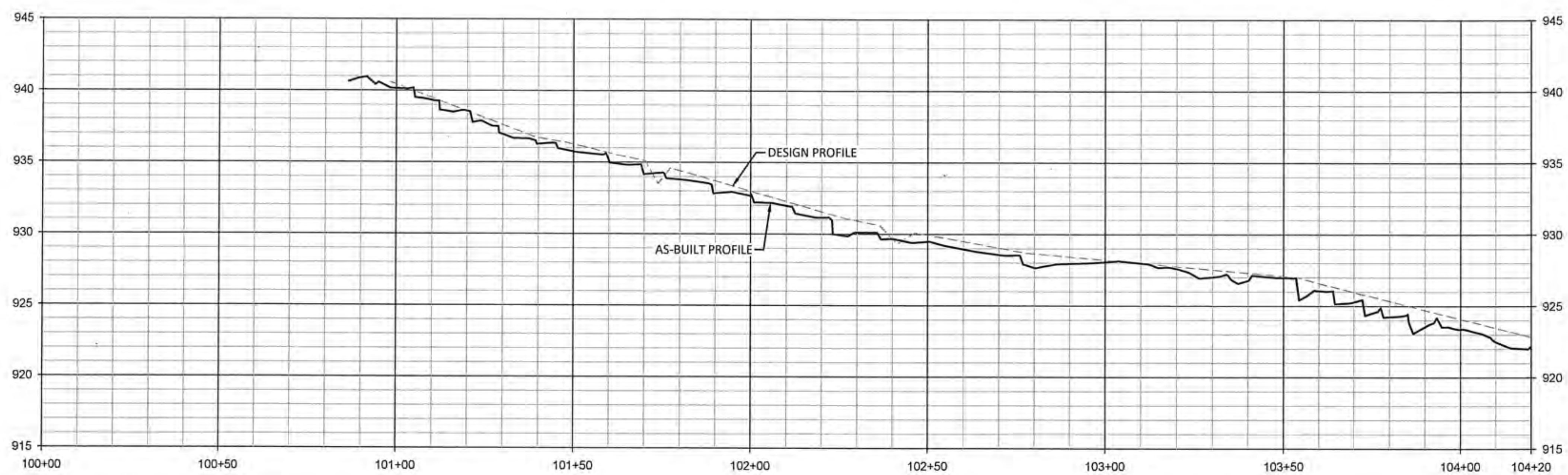

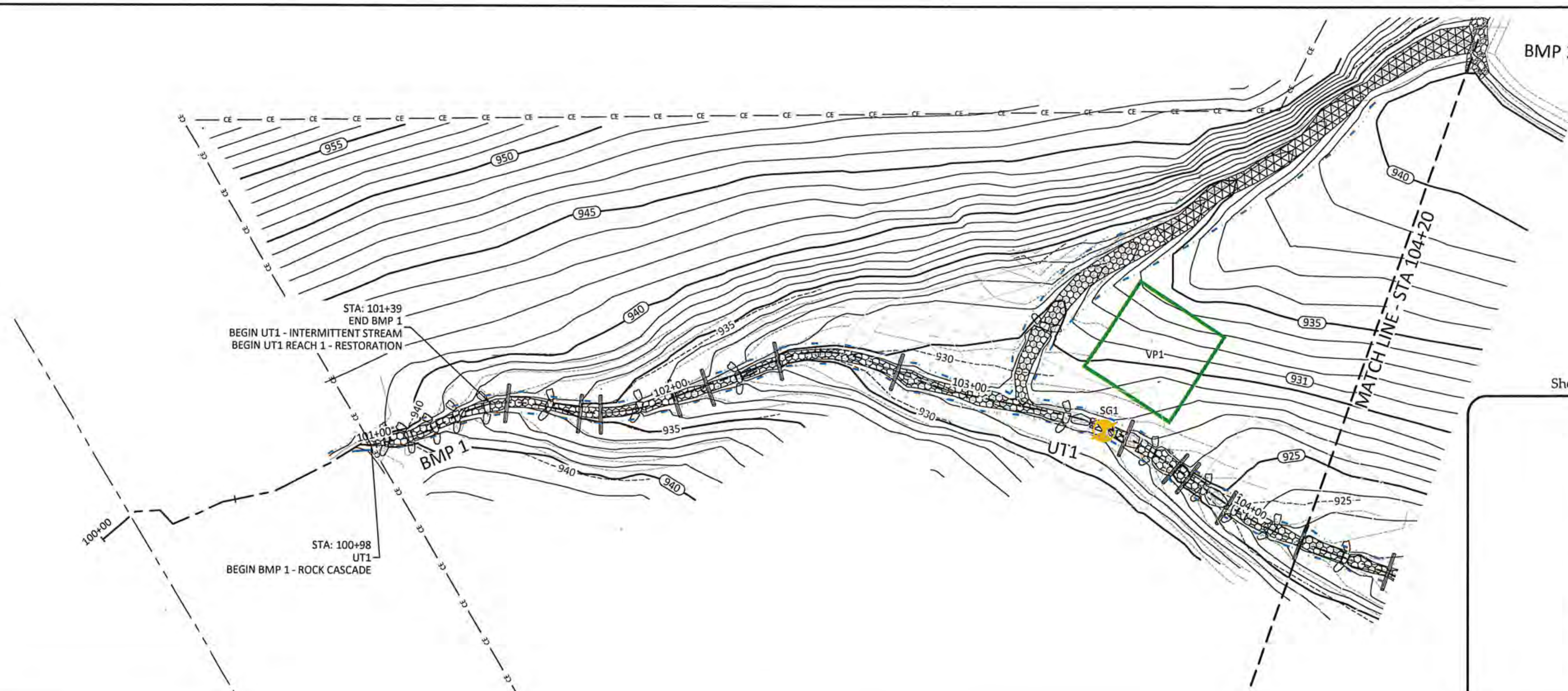

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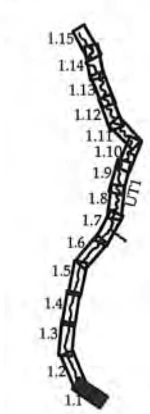

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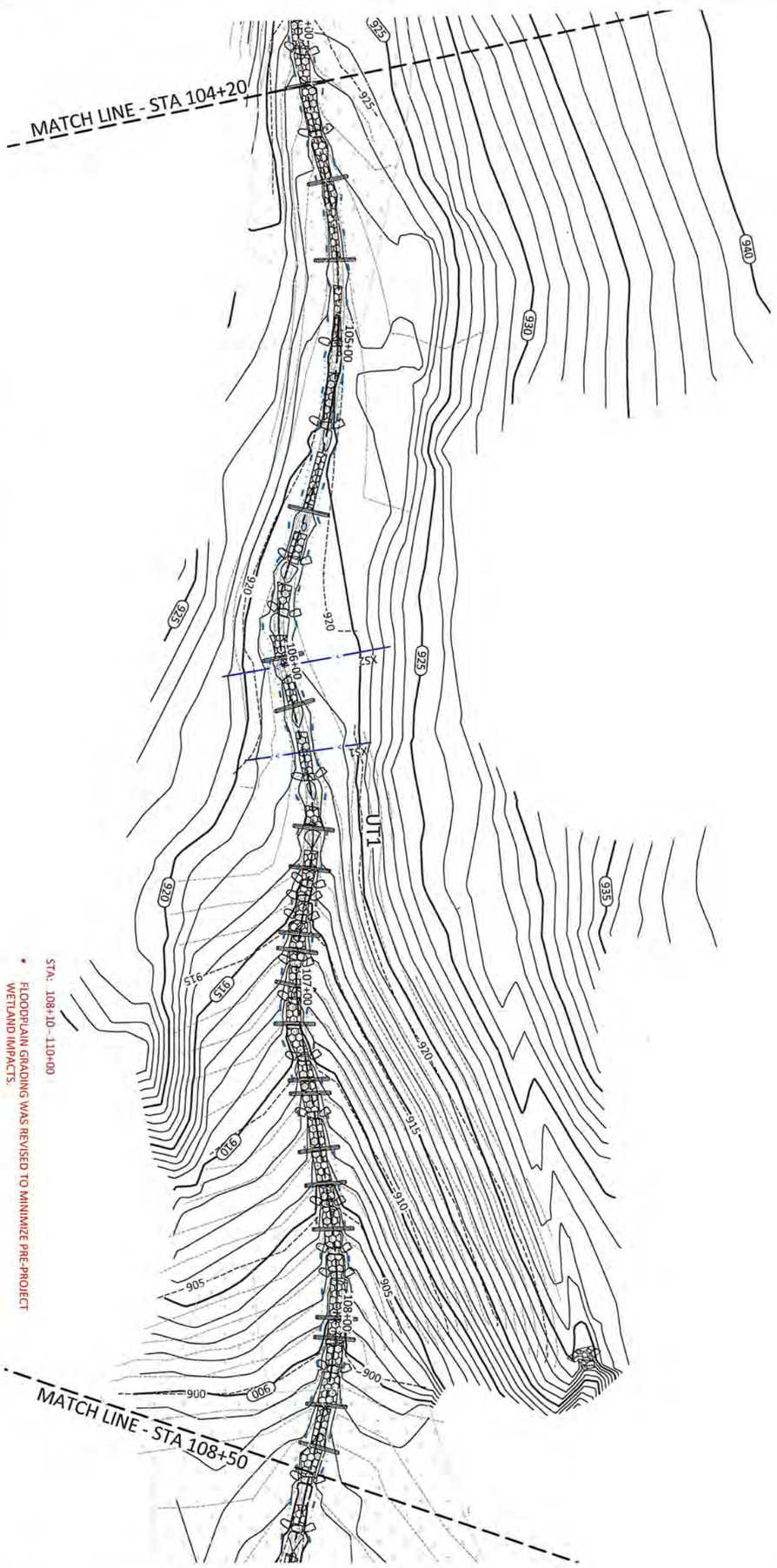
Lone Hickory Mitigation Site Record Drawings
Yadkin County, North Carolina

UT1
Stream Plan and Profile

Date:	July 10, 2019
Job Number:	005-02163
Project Engineer:	EGR
Drawn By:	JCK
Checked By:	EGR/JCK

Revisions:

Sheet 1.1



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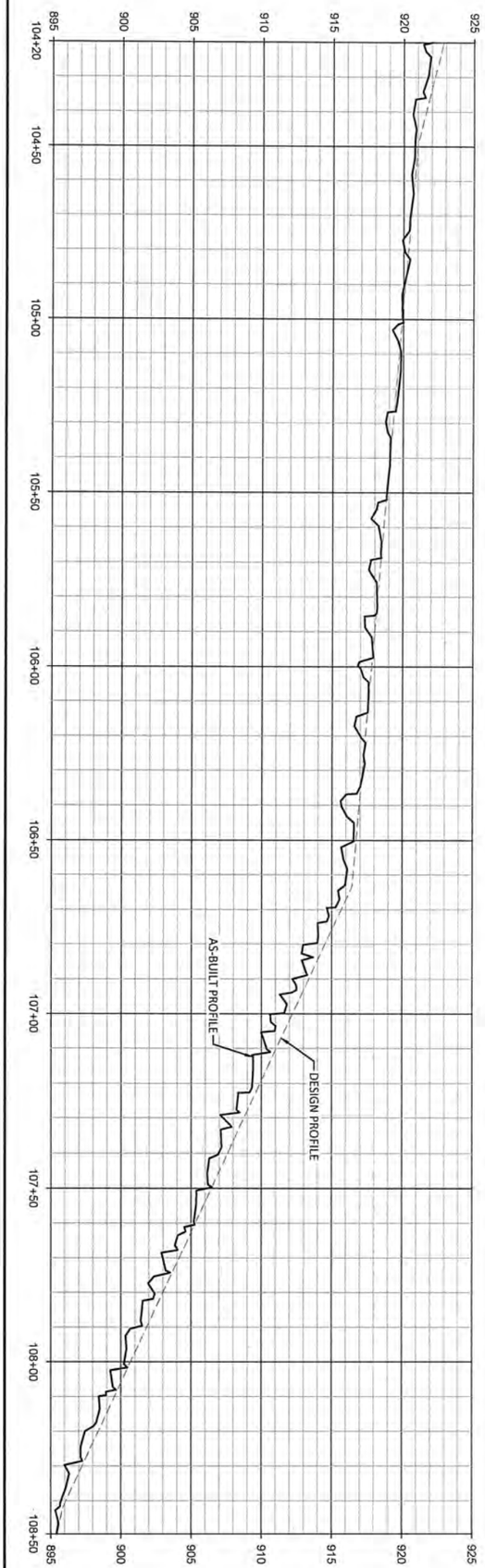

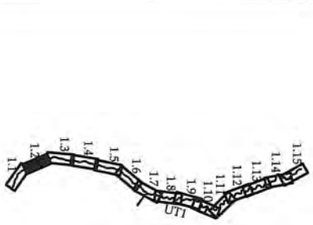

Sheet Index - East

Date:	July 10, 2019
Job Number:	005-02163
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Sheet

Lone Hickory Mitigation Site Record Drawings
Yadkin County, North Carolina

UT1
Stream Plan and Profile

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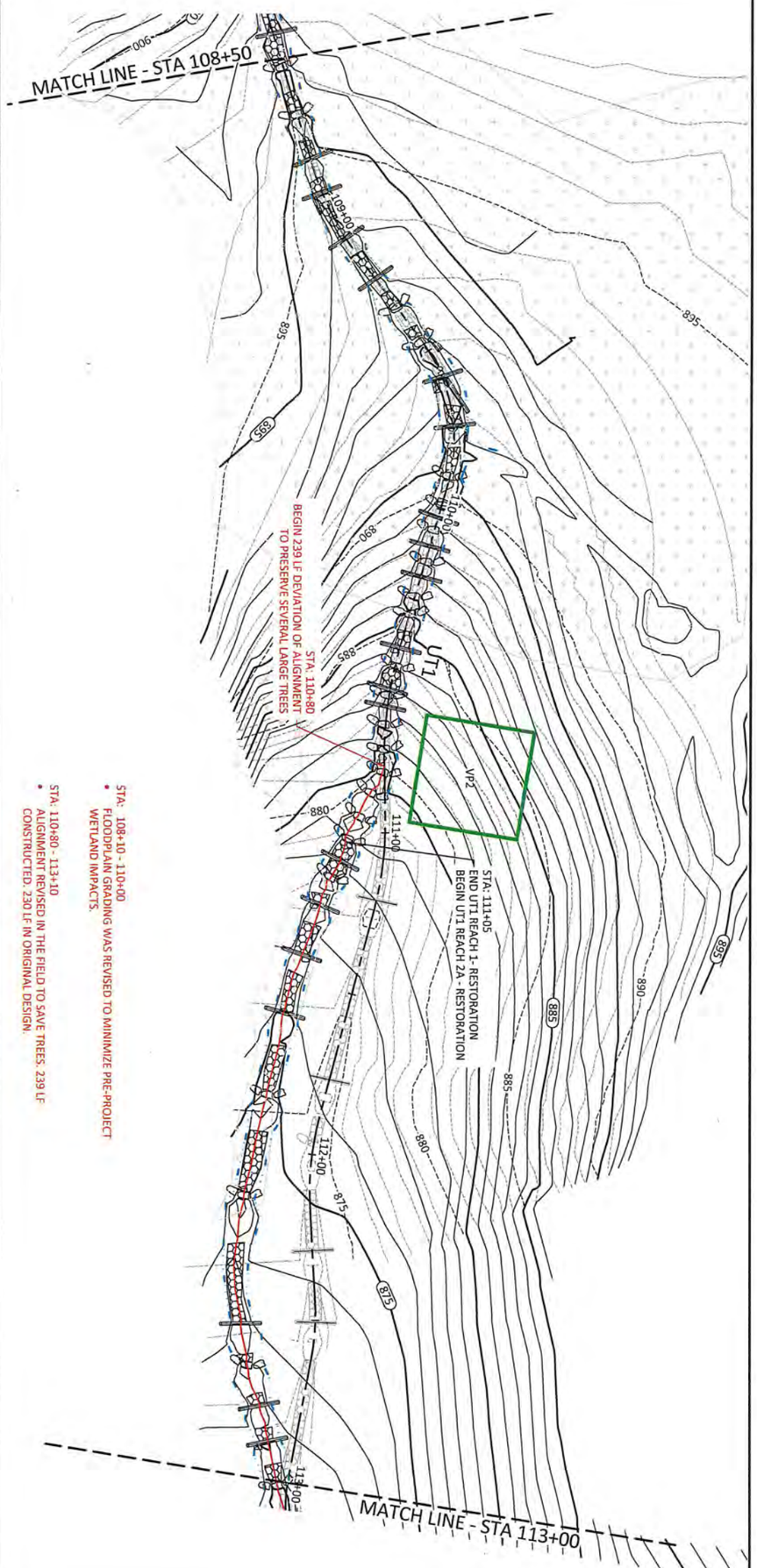

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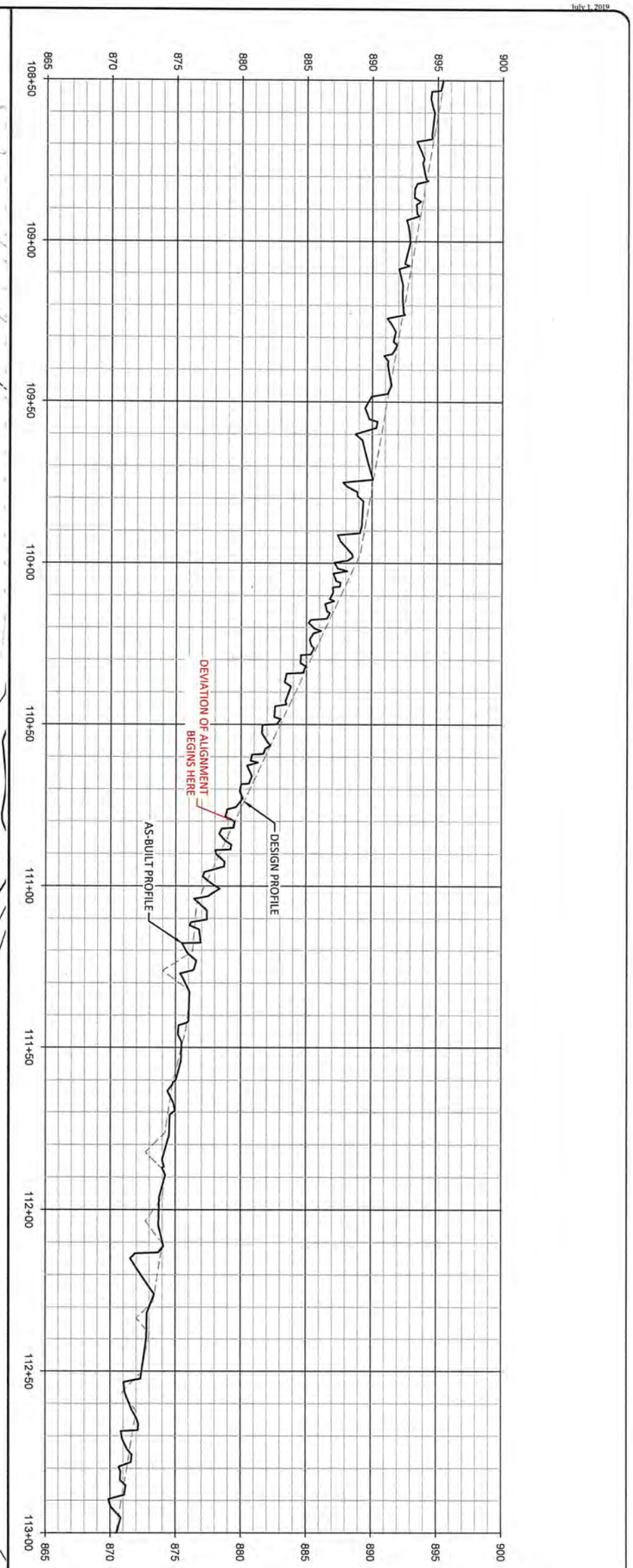

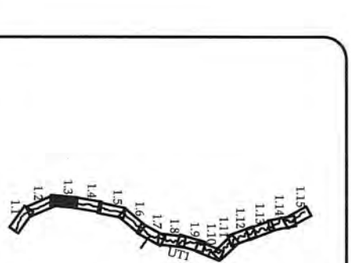

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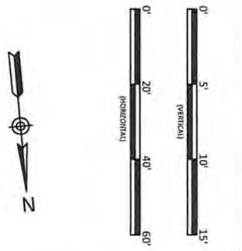

Date:	July 10, 2019
Job Number:	005-02163
Project Engineer:	EGR
Drawn By:	JCK
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Revisions:

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Lone Hickory Mitigation Site Record Drawings
Yadkin County, North Carolina

UT1
Stream Plan and Profile

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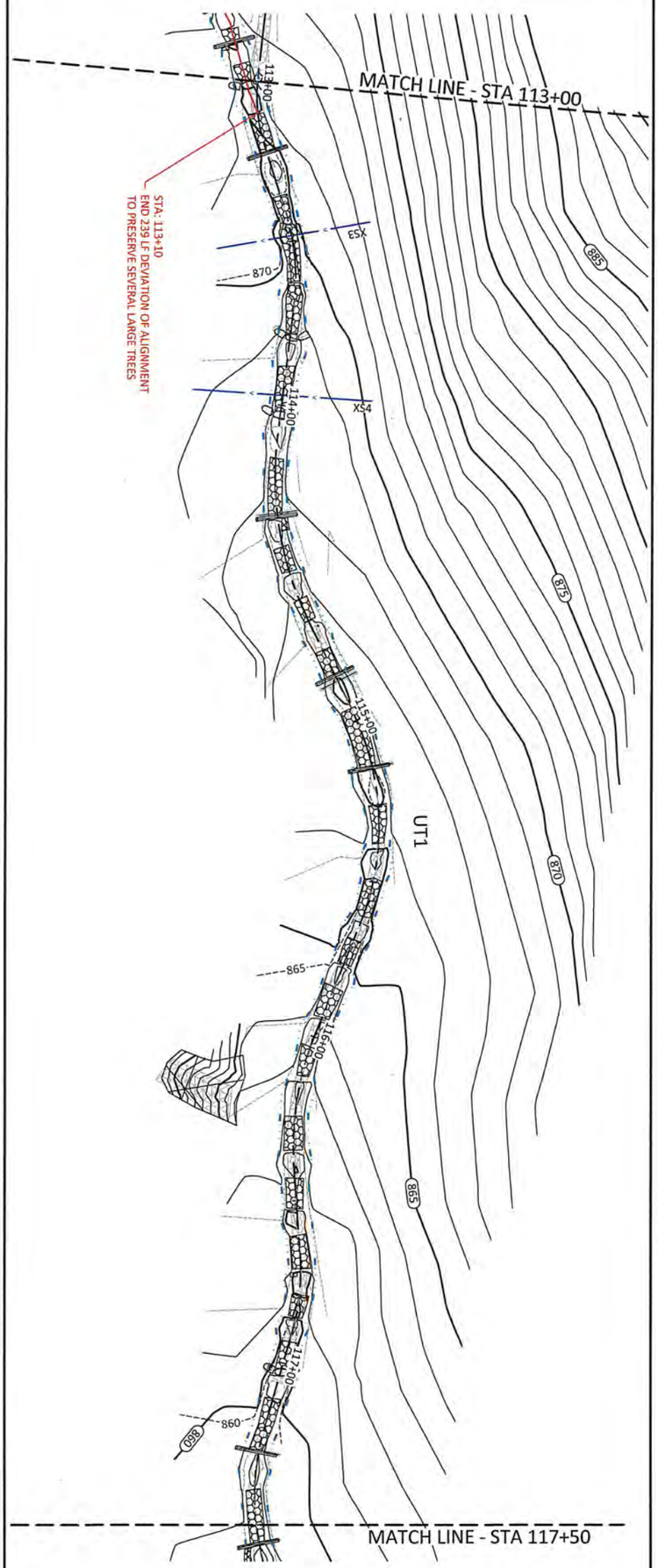

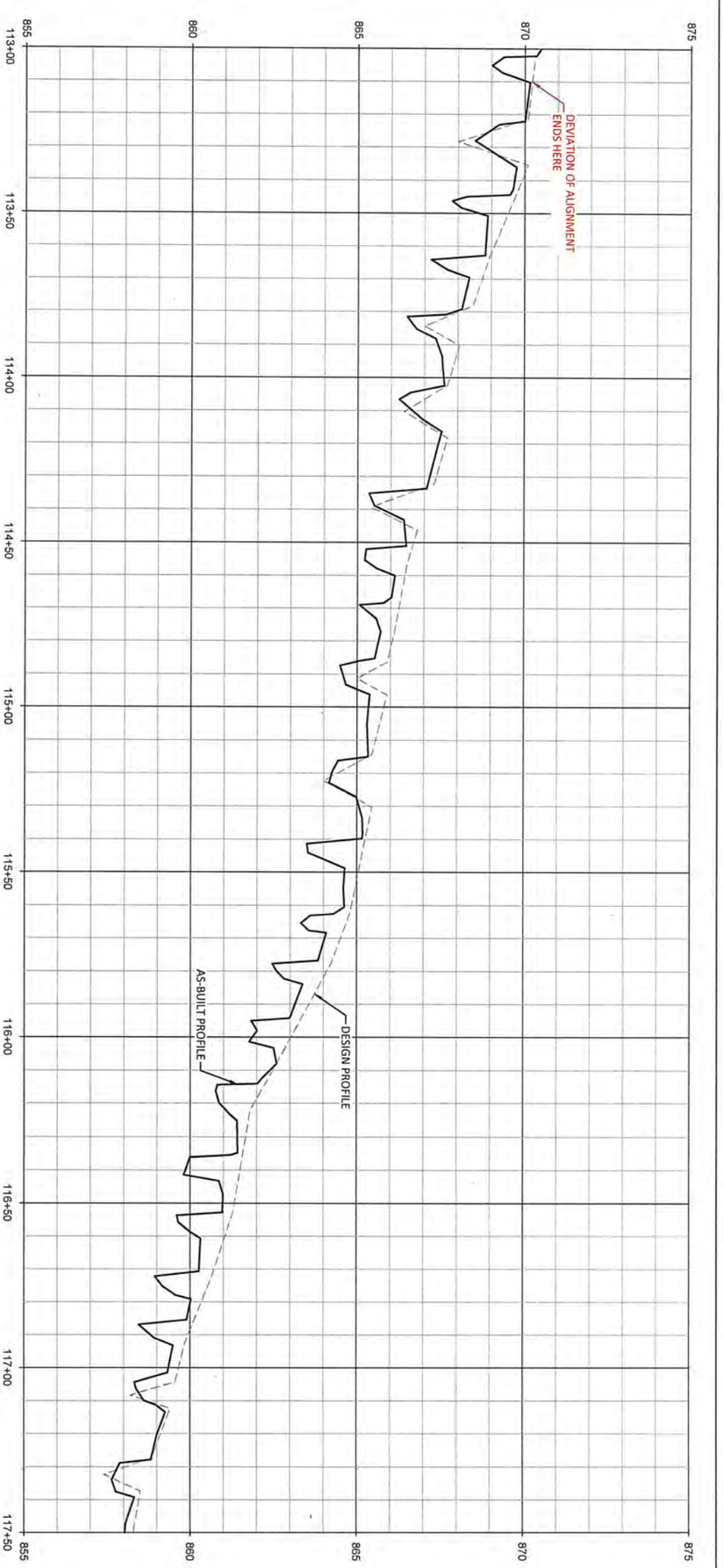

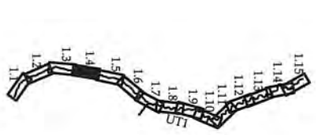

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Job Number:	005-02163
Project Engineer:	EGR
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Lone Hickory Mitigation Site Record Drawings
Yadkin County, North Carolina

UT1
Stream Plan and Profile

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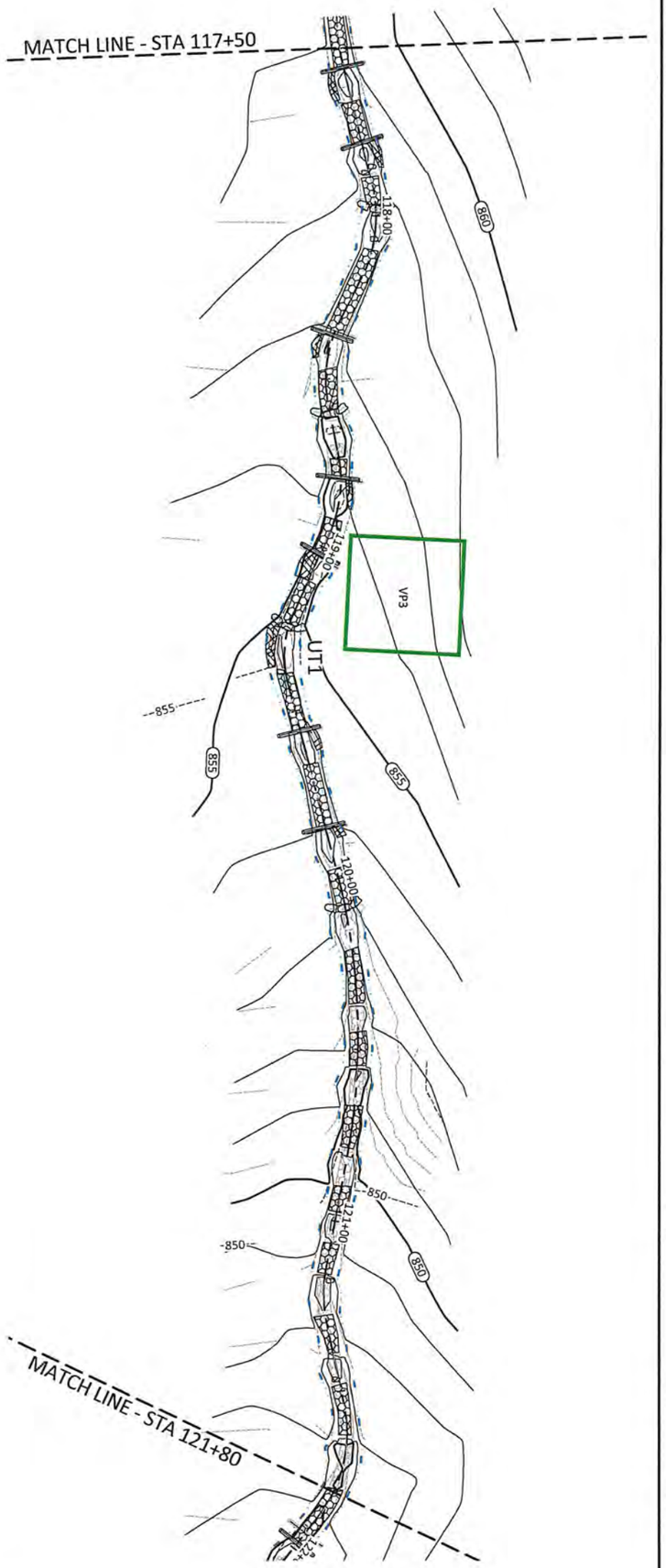

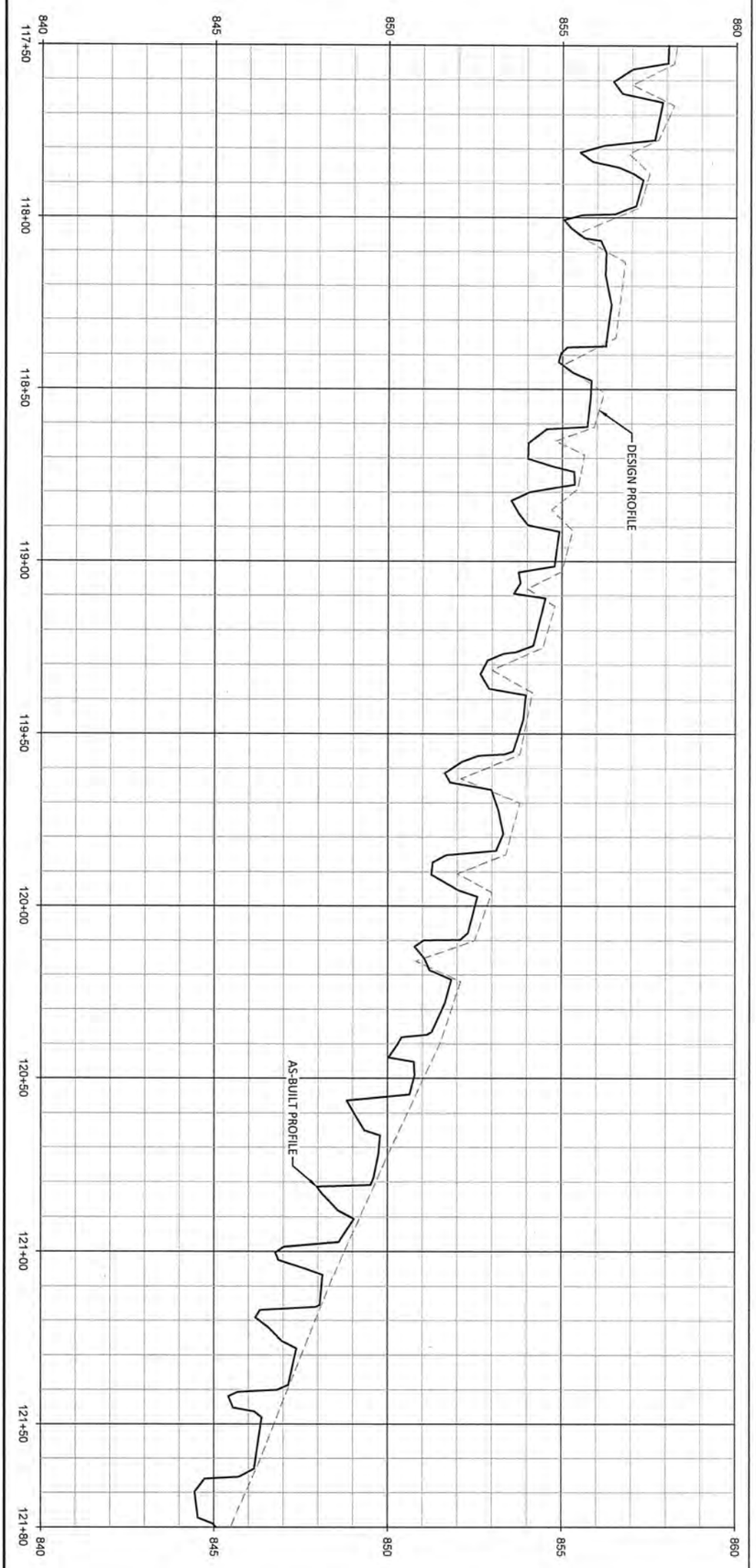

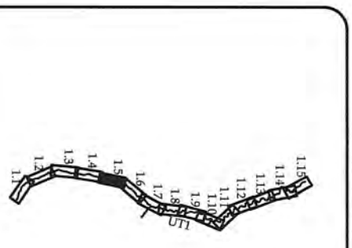

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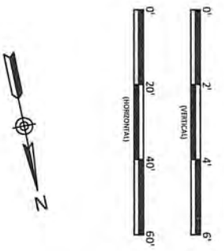

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Checked By:	EGR/JCK

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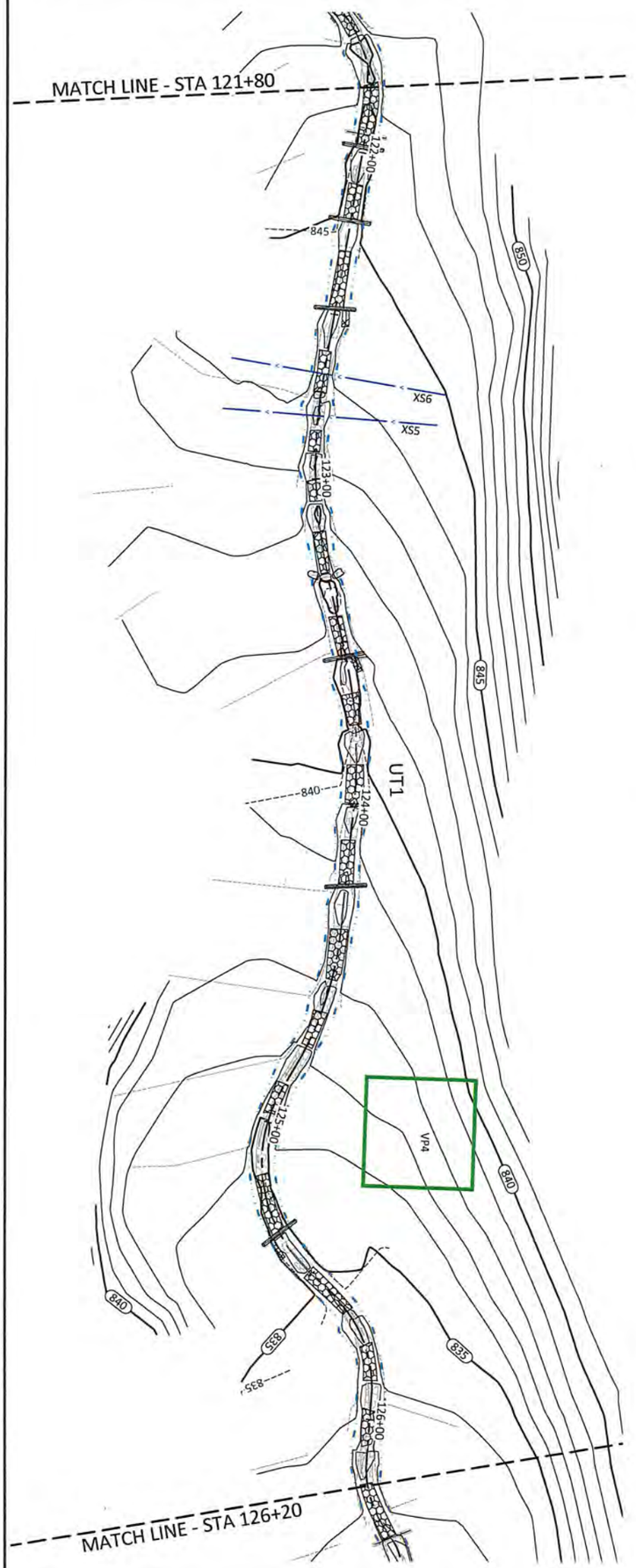

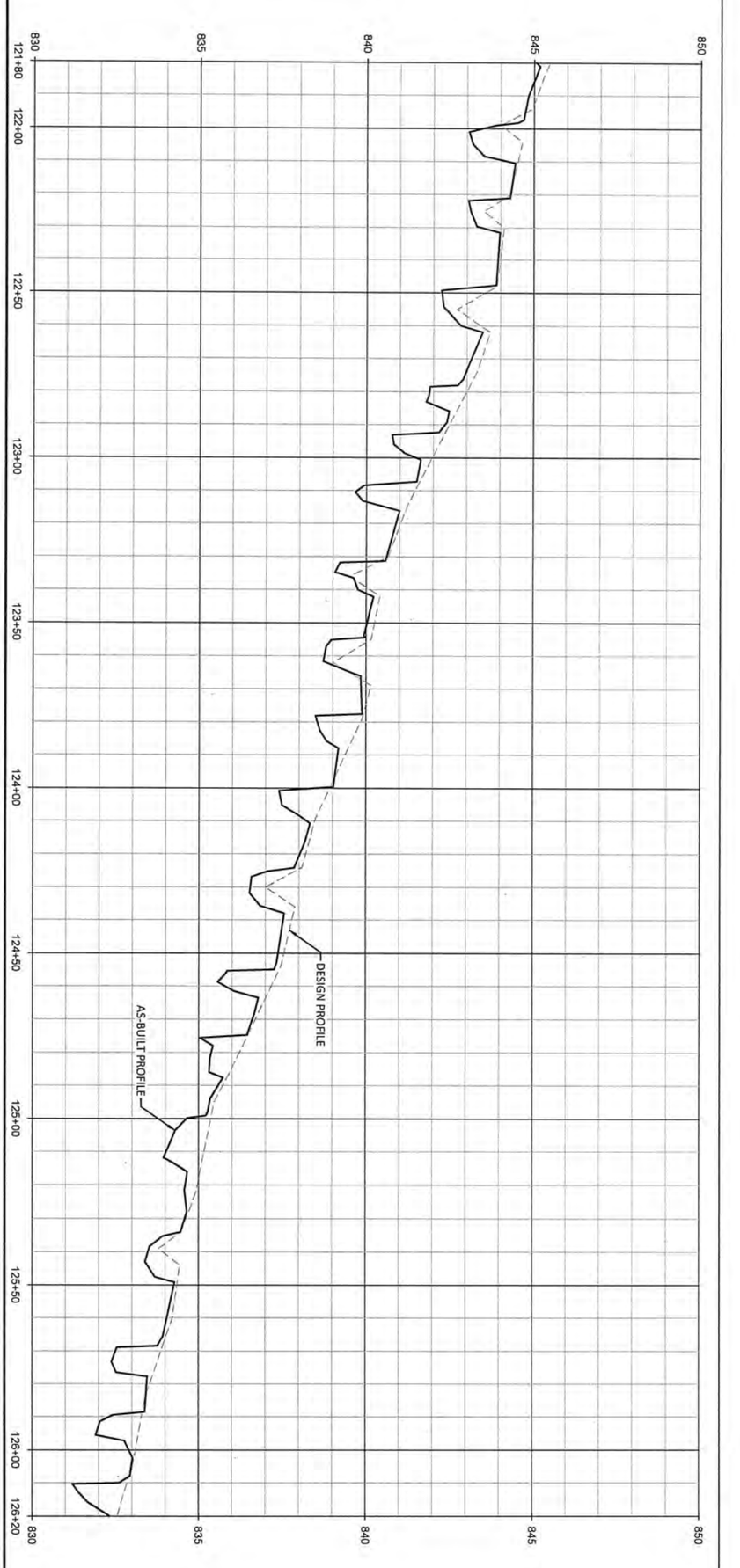

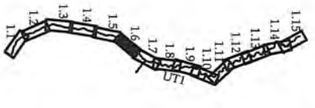

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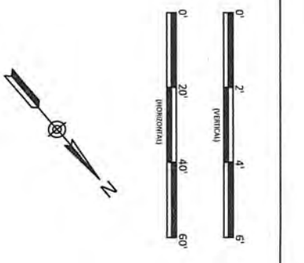

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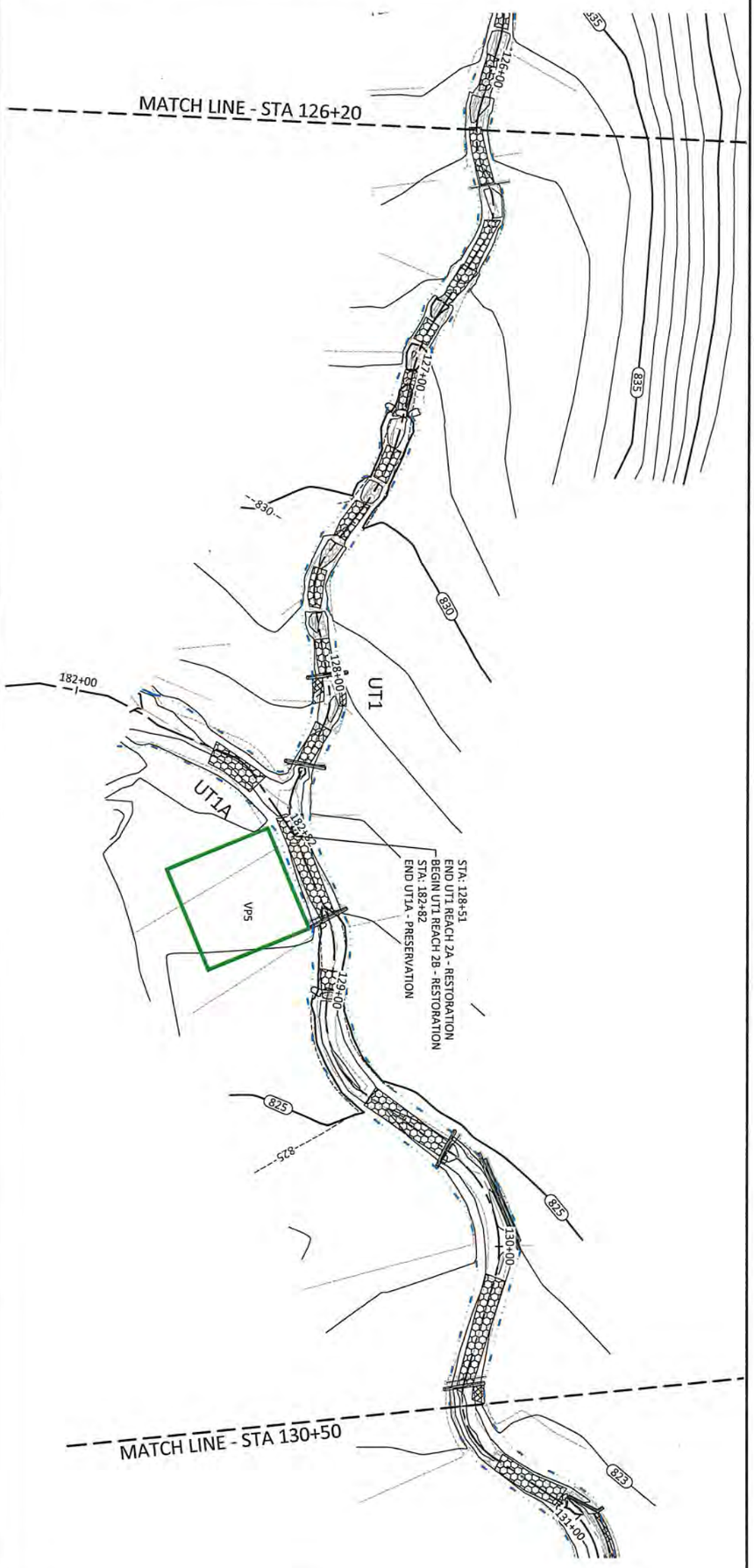

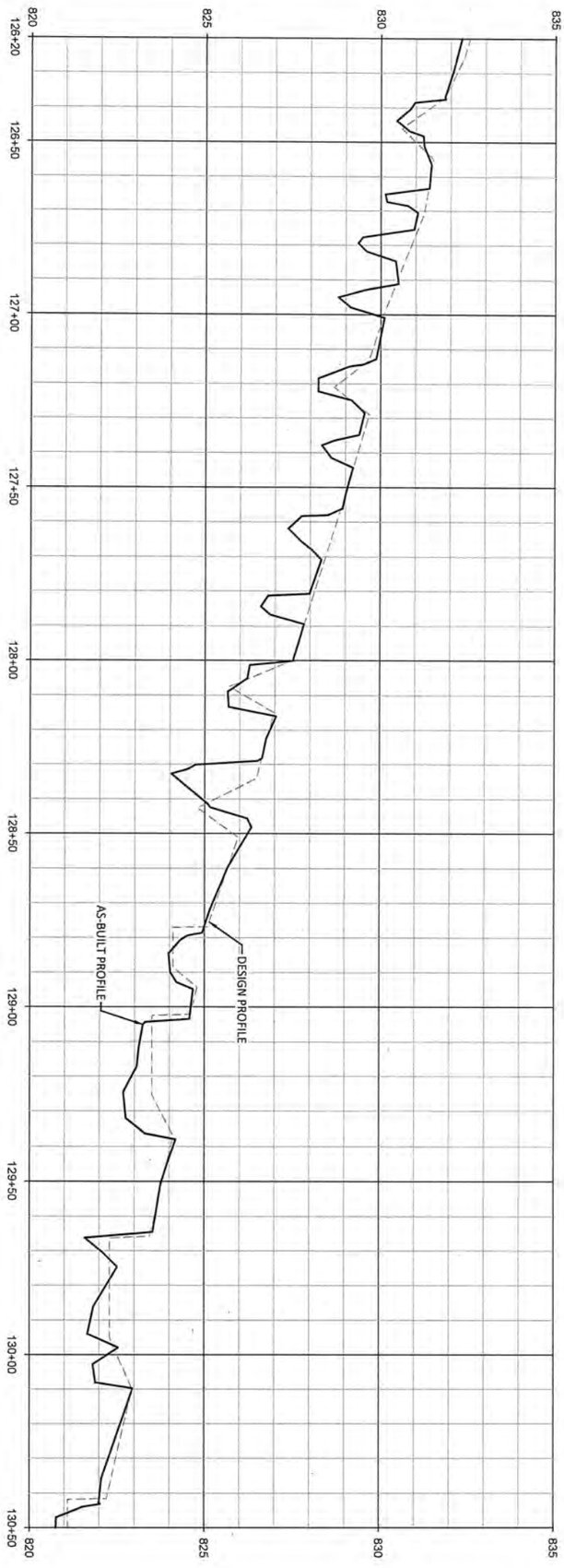

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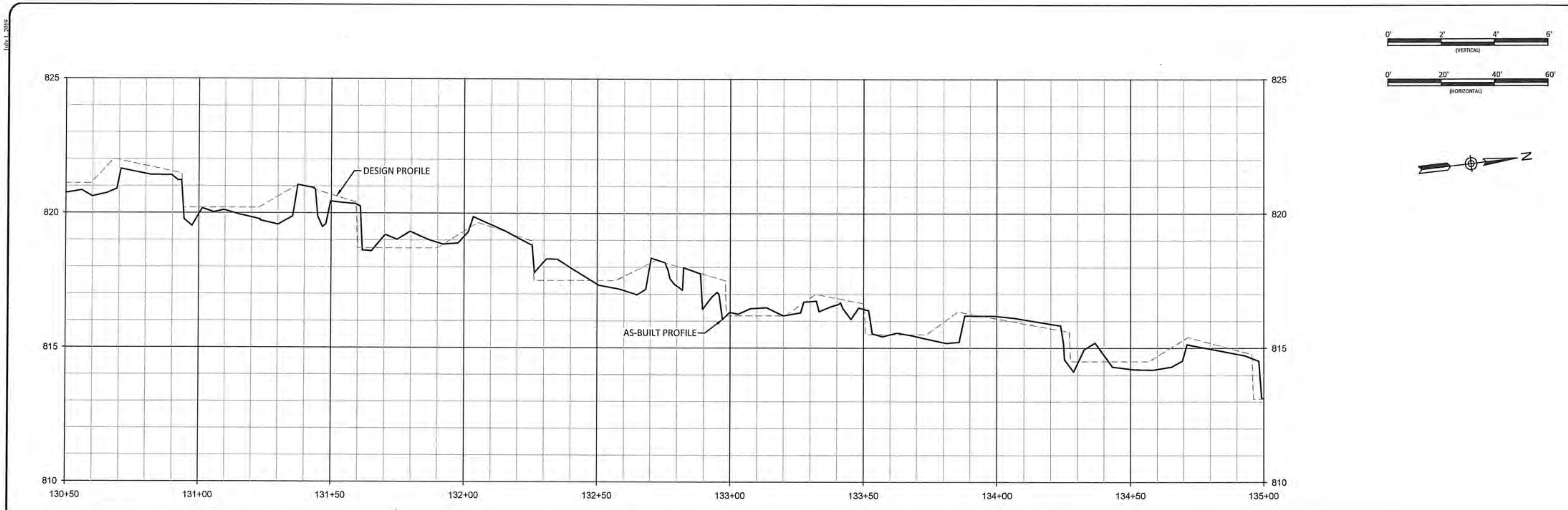

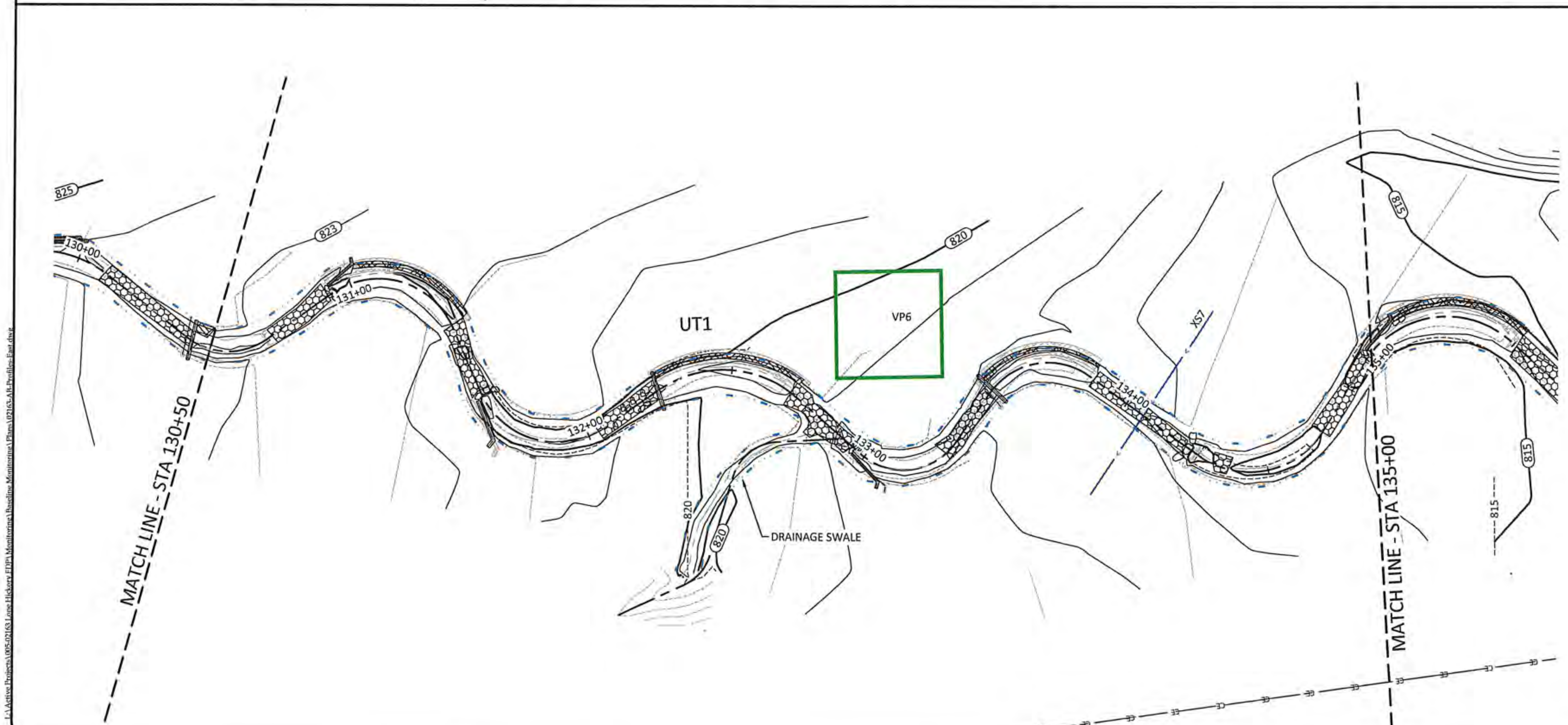

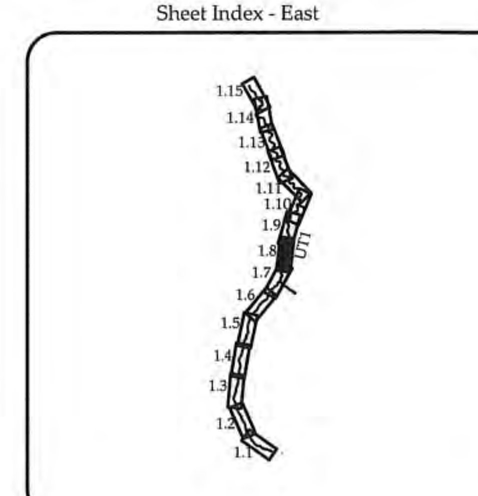

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EMILY G. REINICKER

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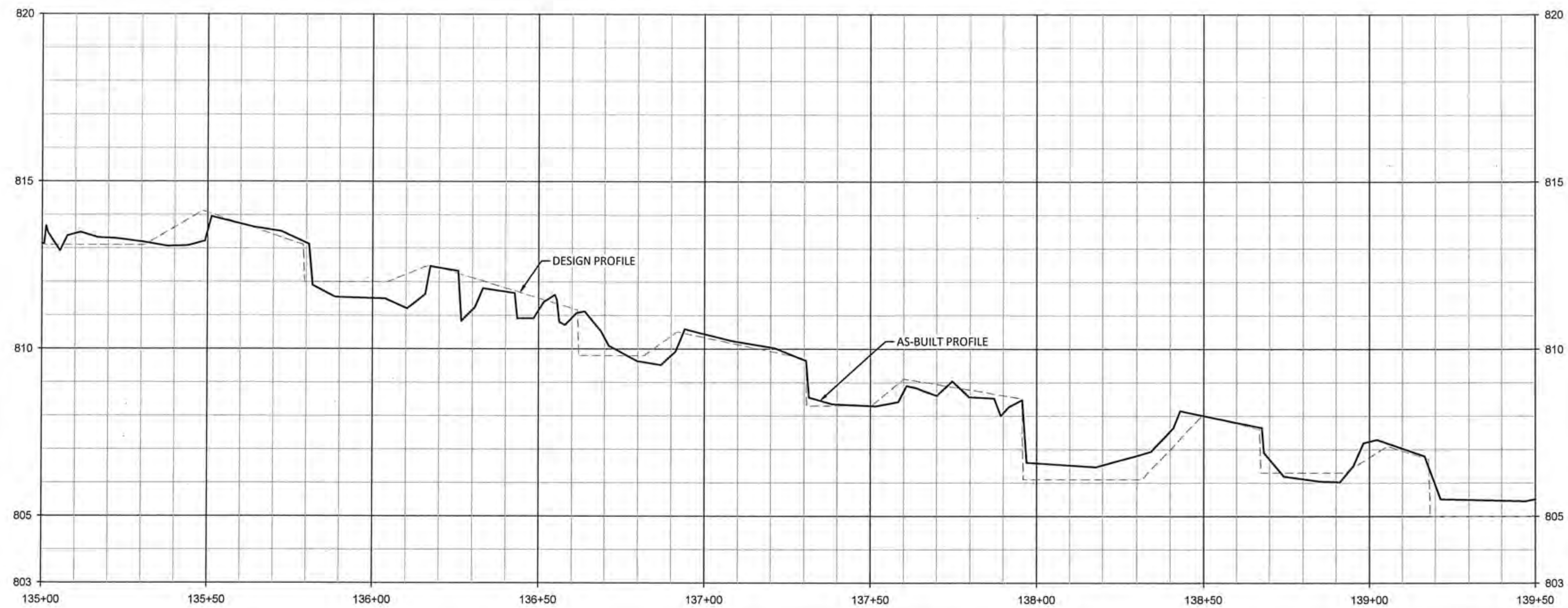

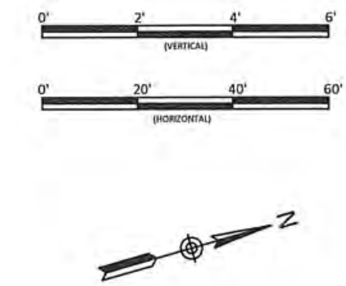

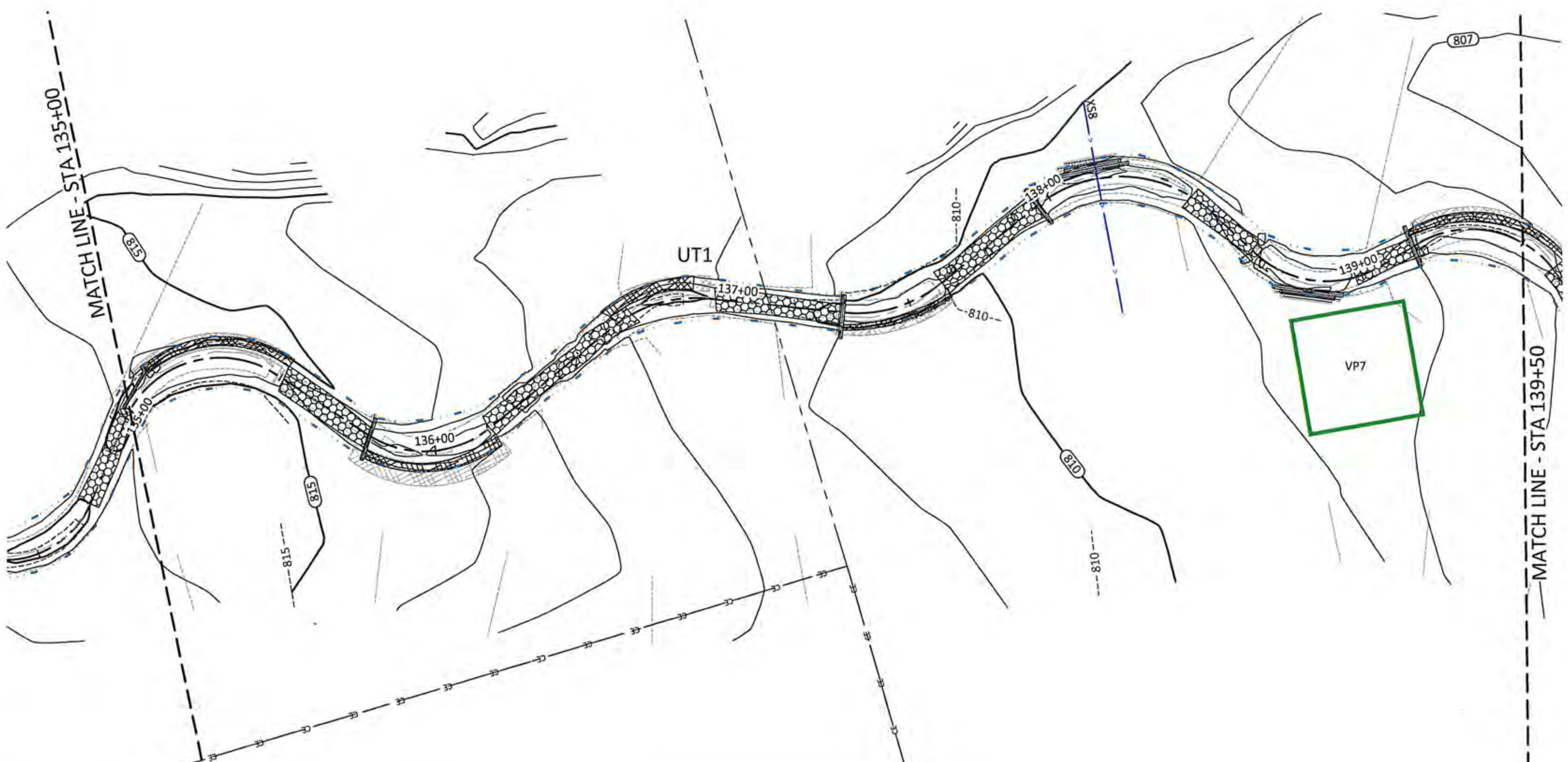

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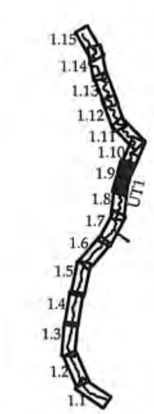

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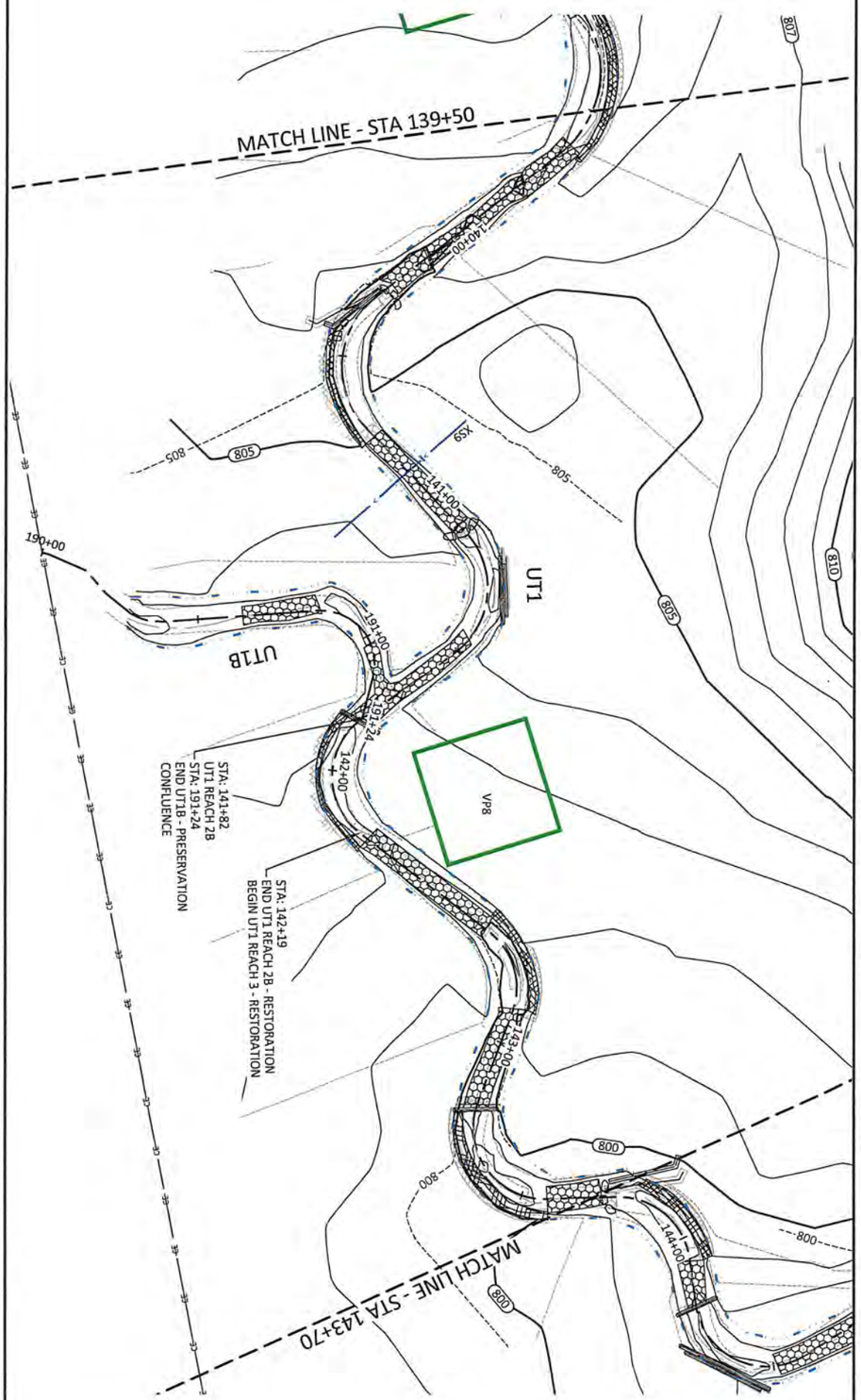

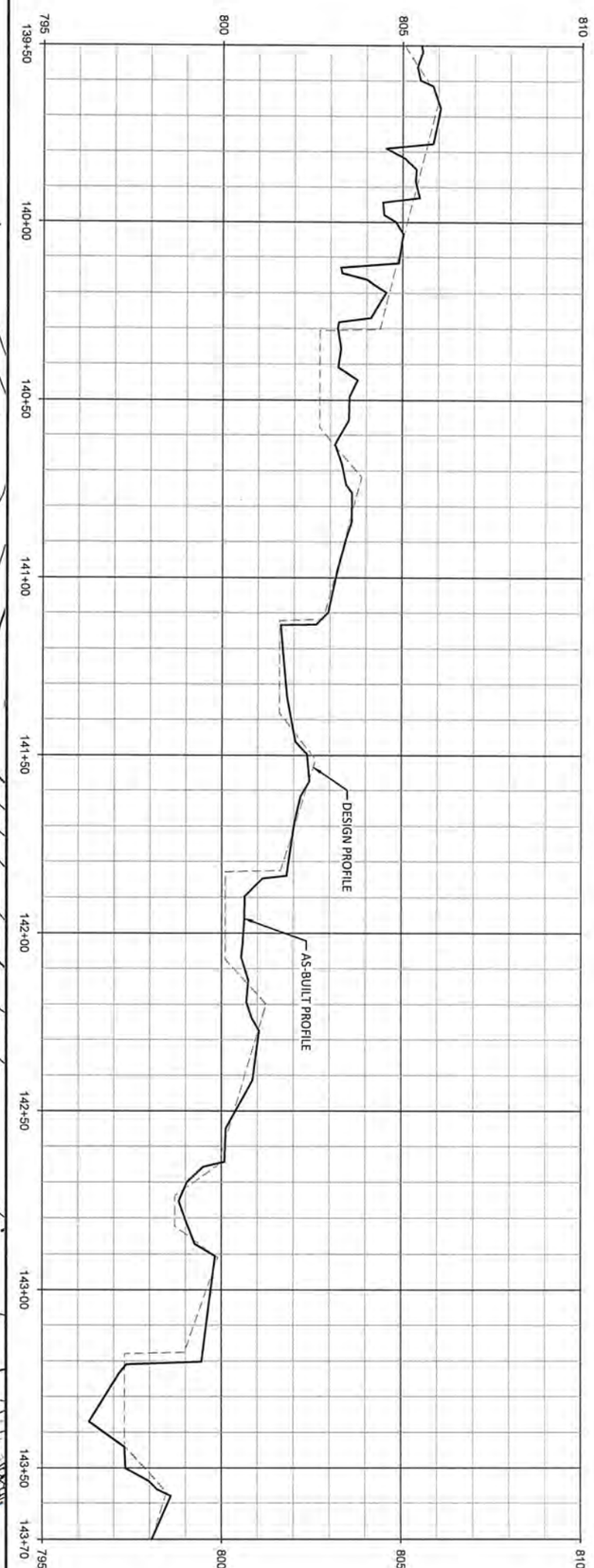

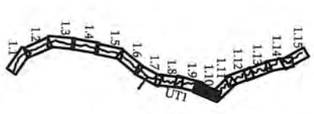

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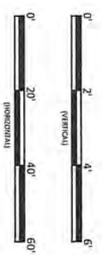

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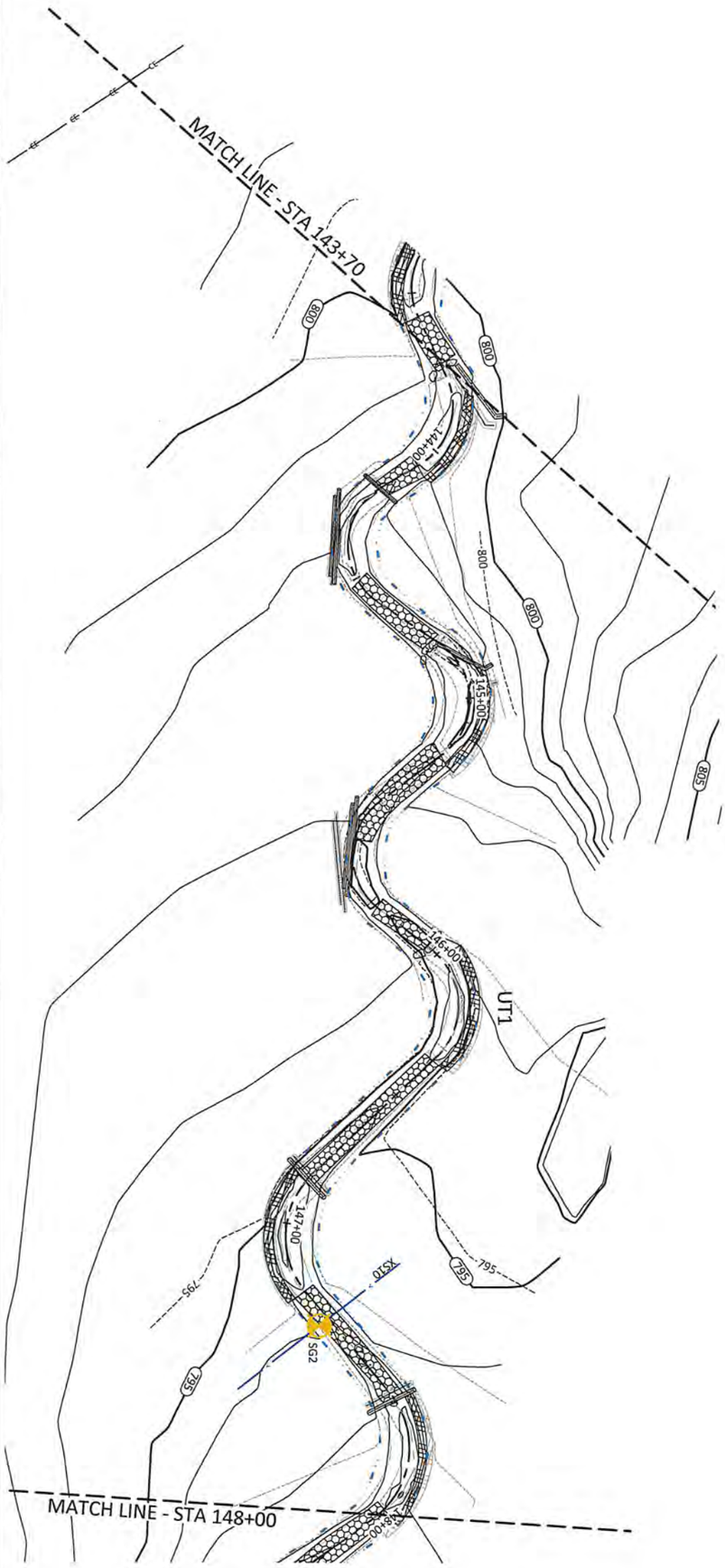

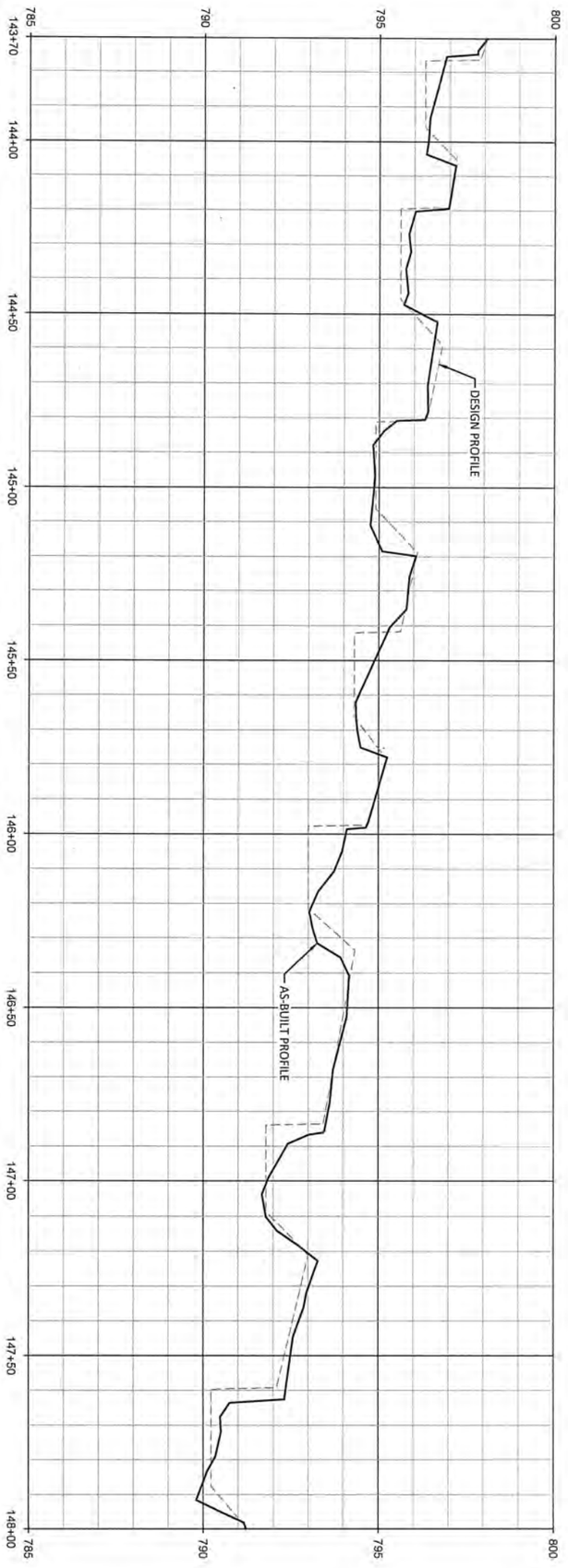

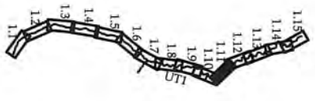

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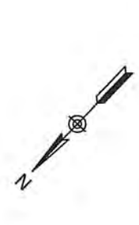

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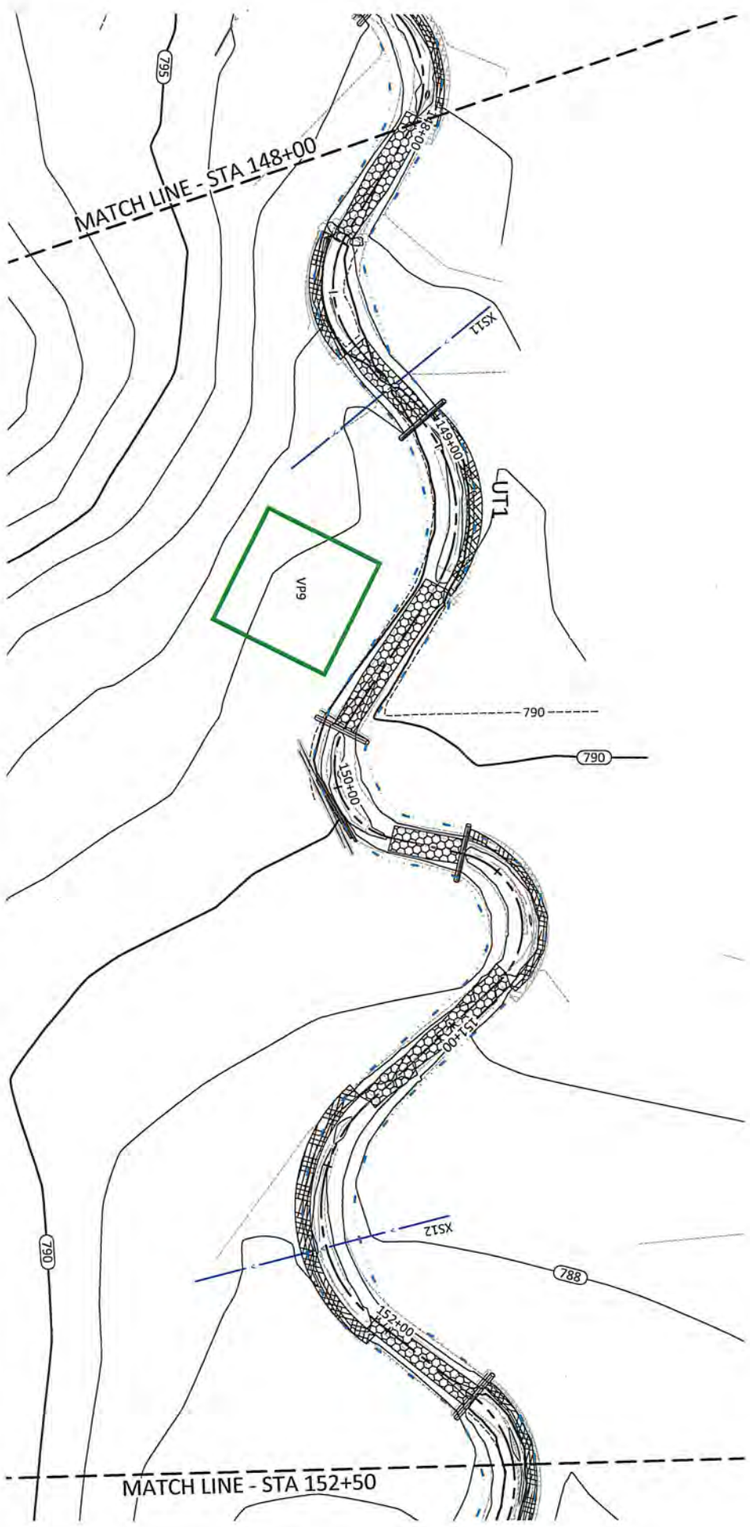

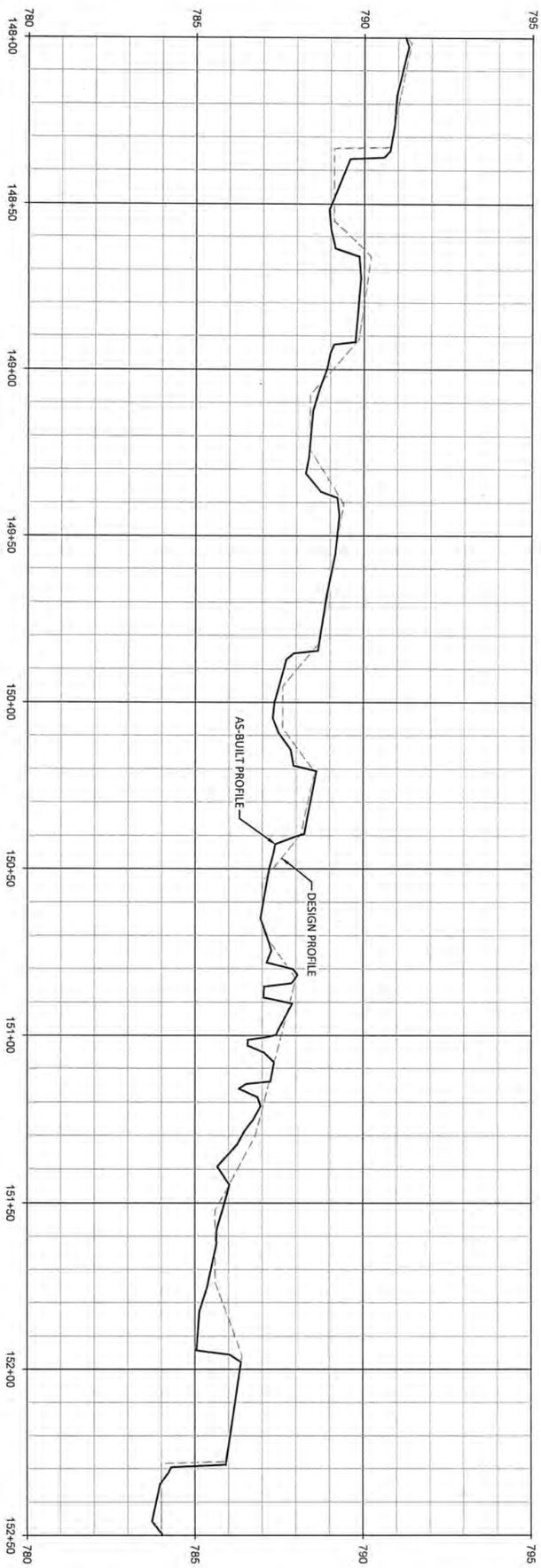

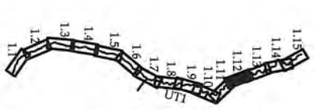

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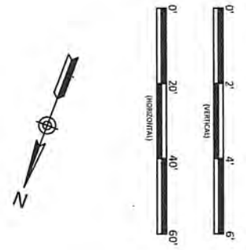

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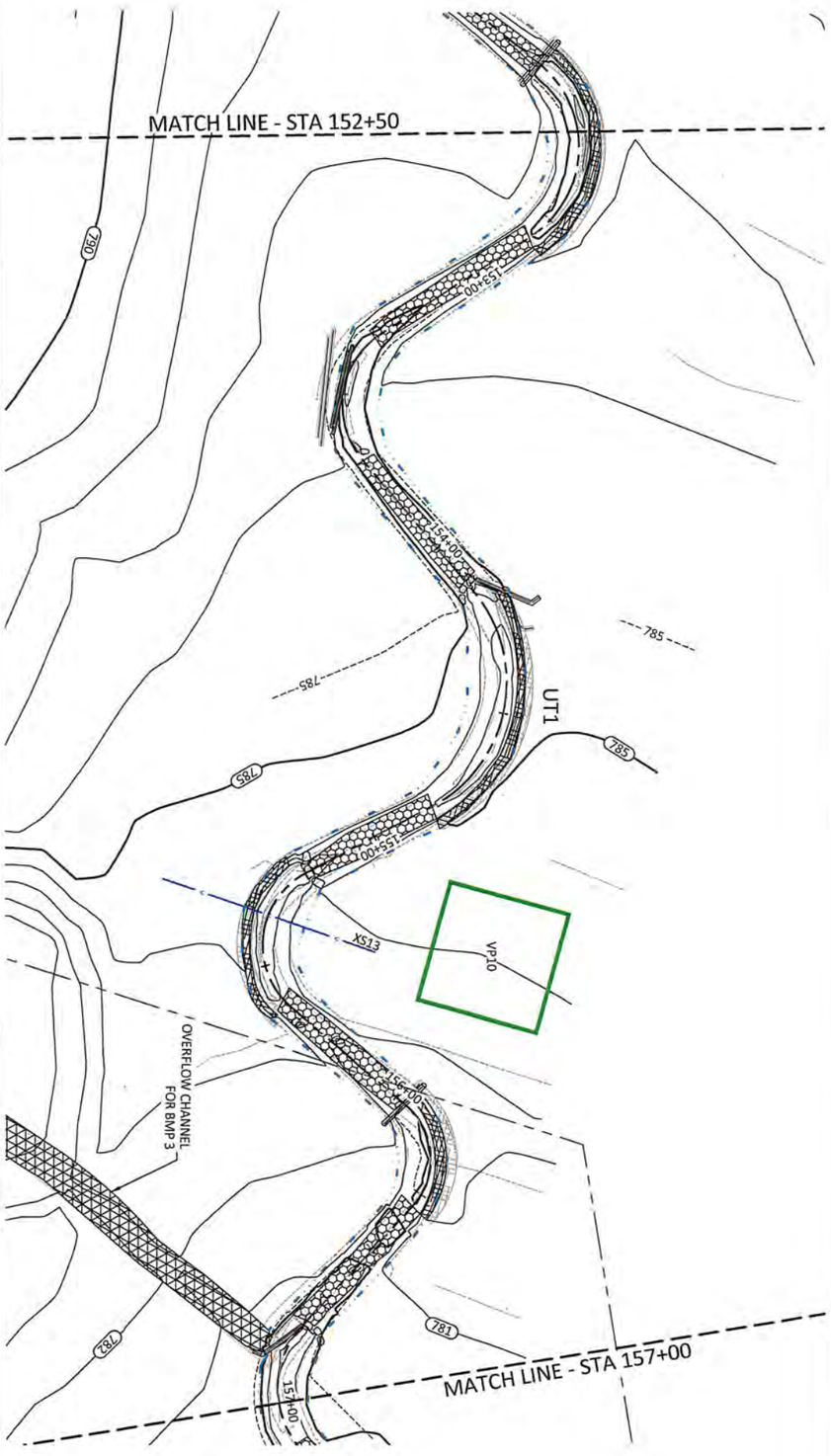

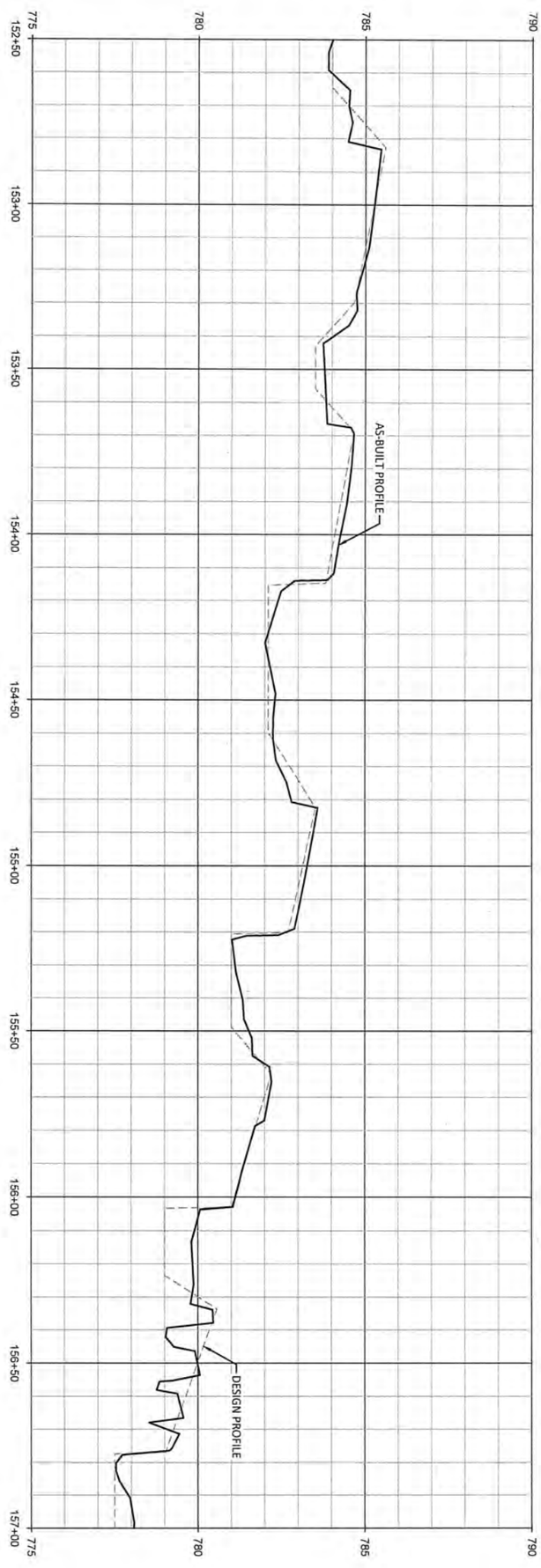

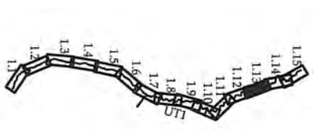

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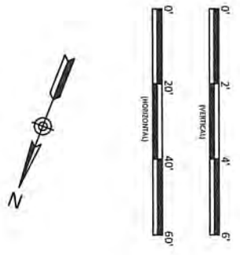

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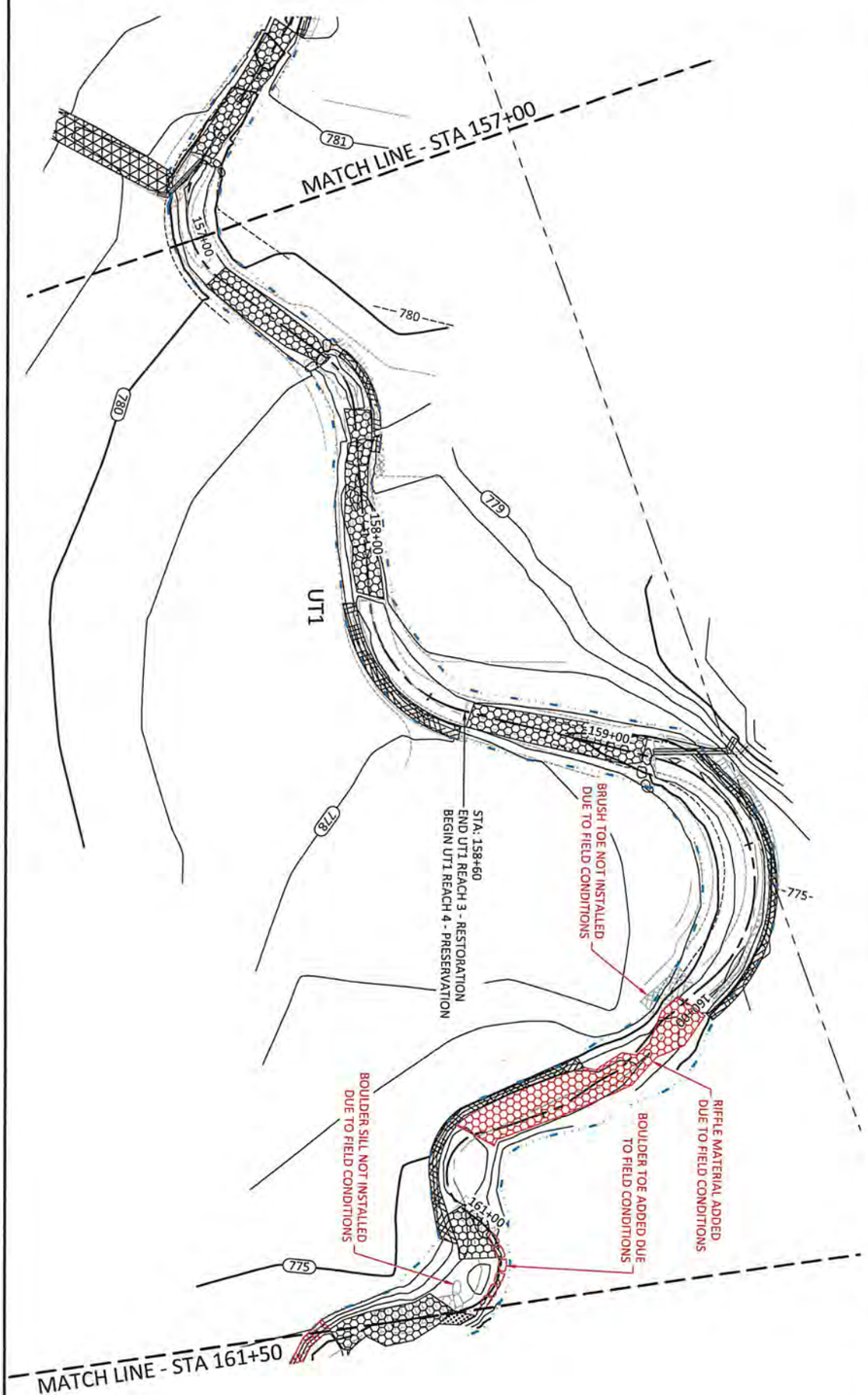

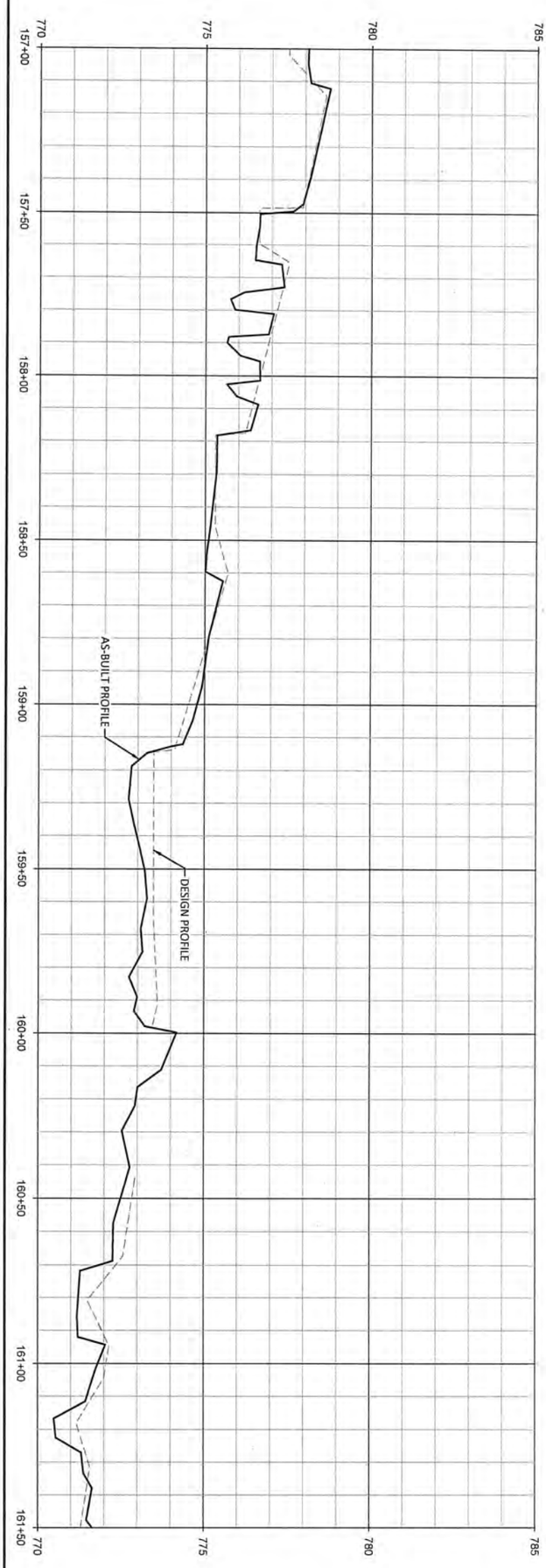

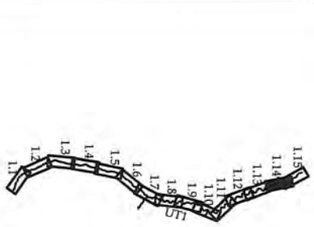

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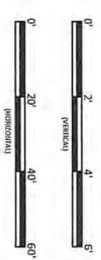

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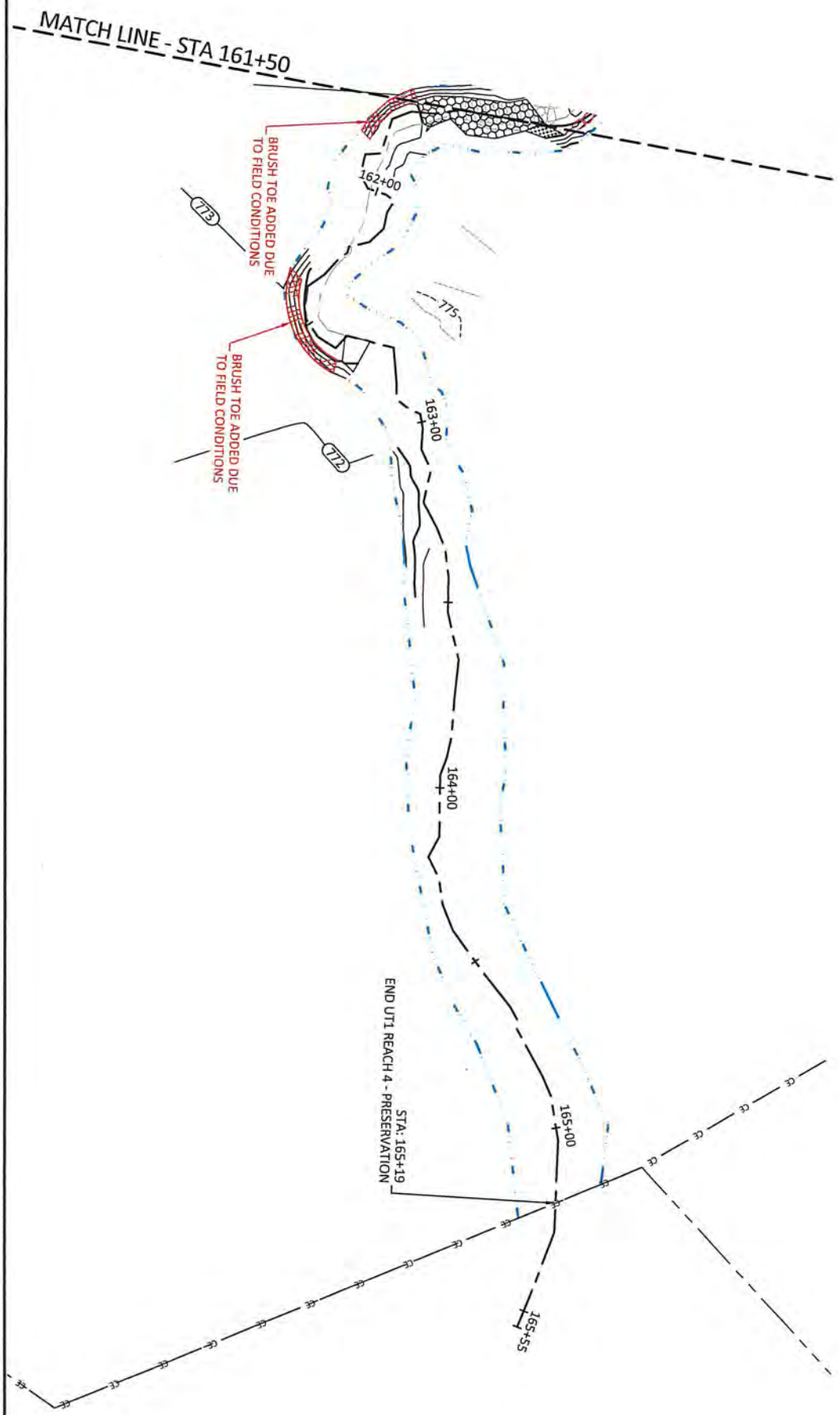

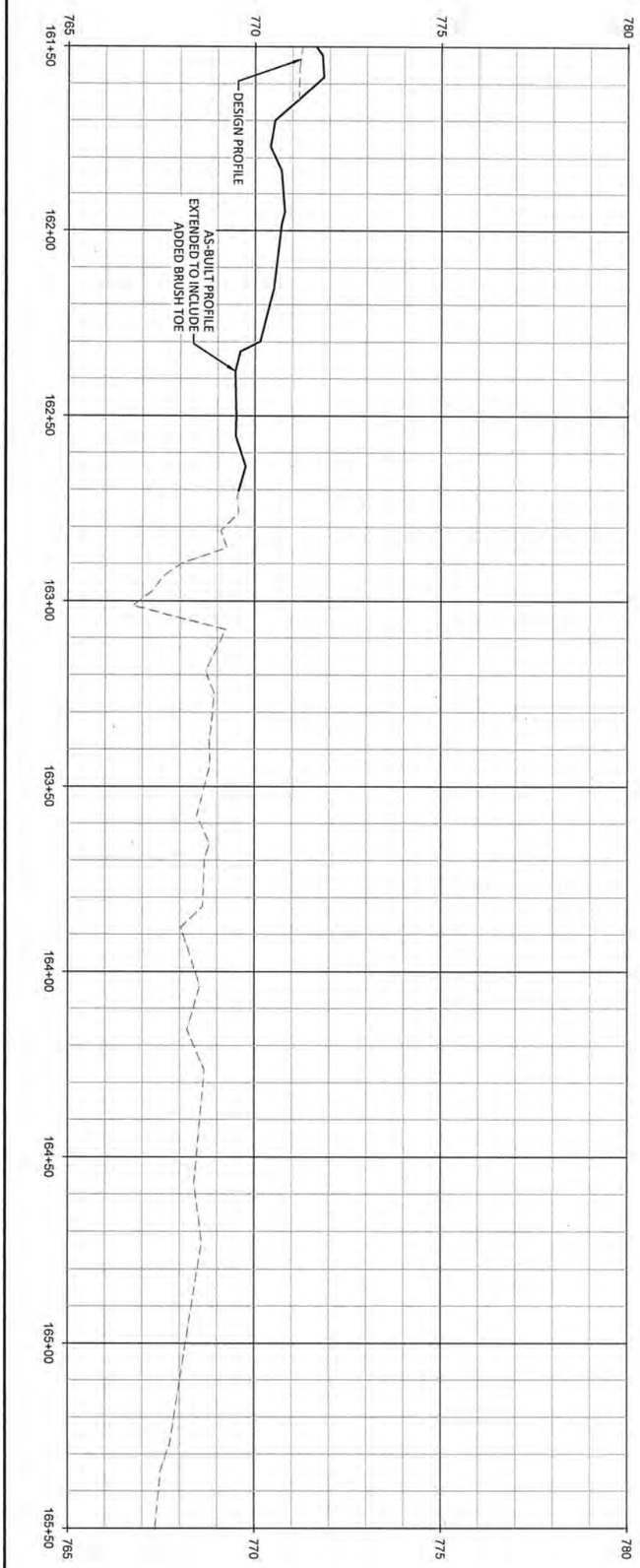

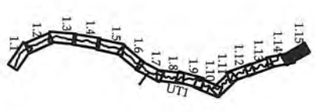

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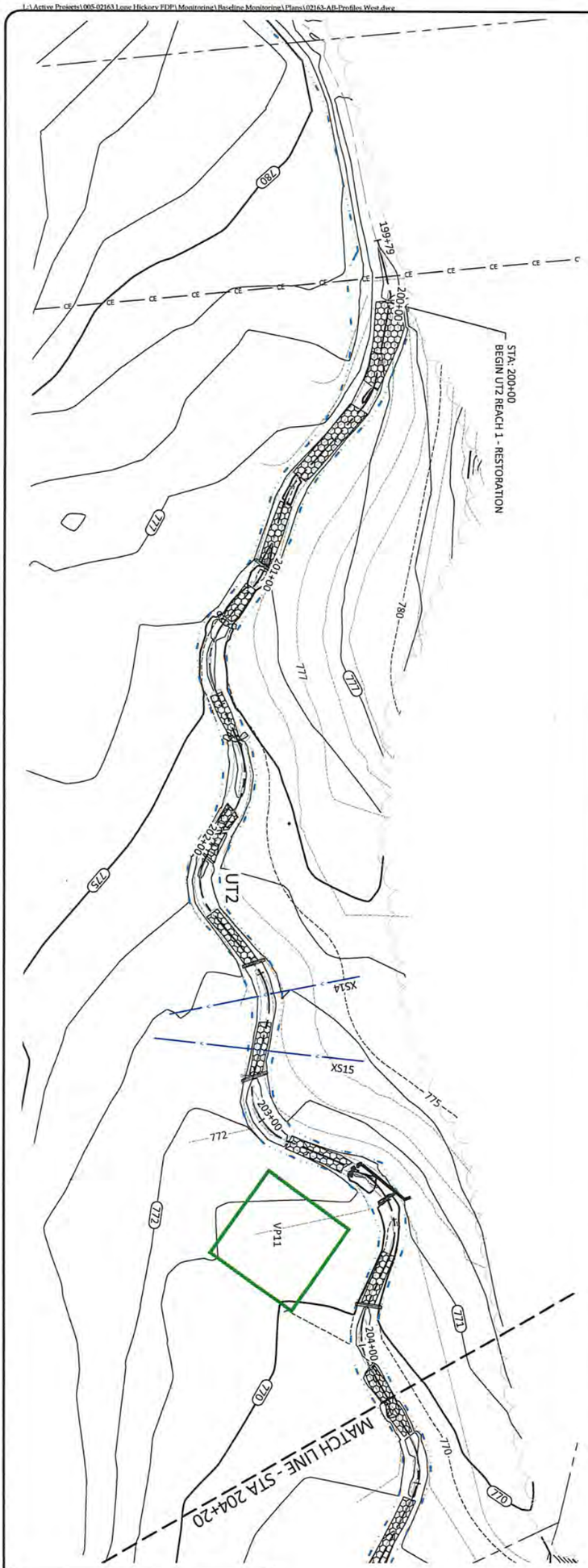

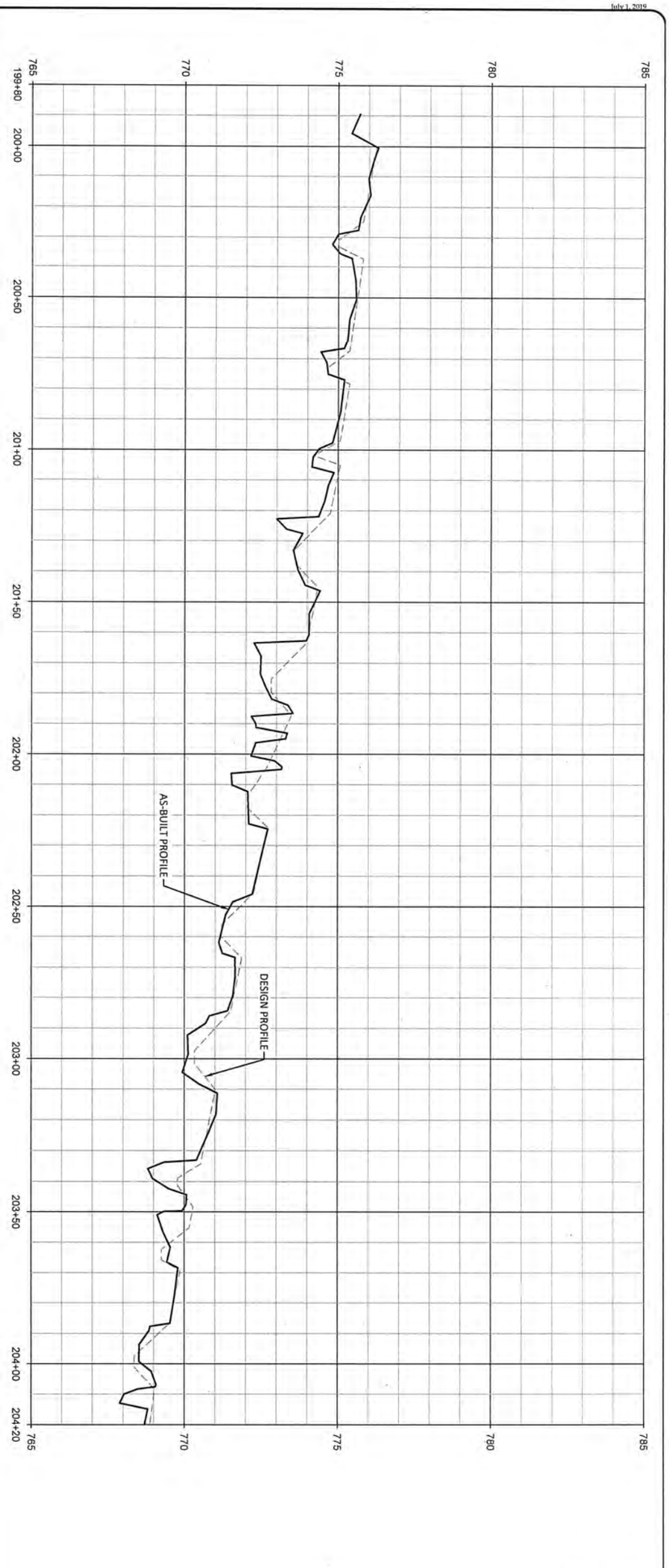

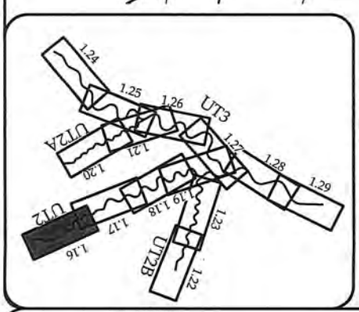

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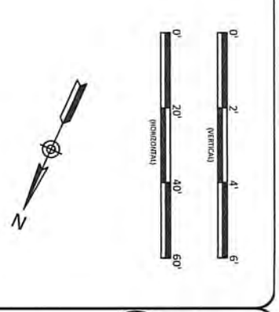

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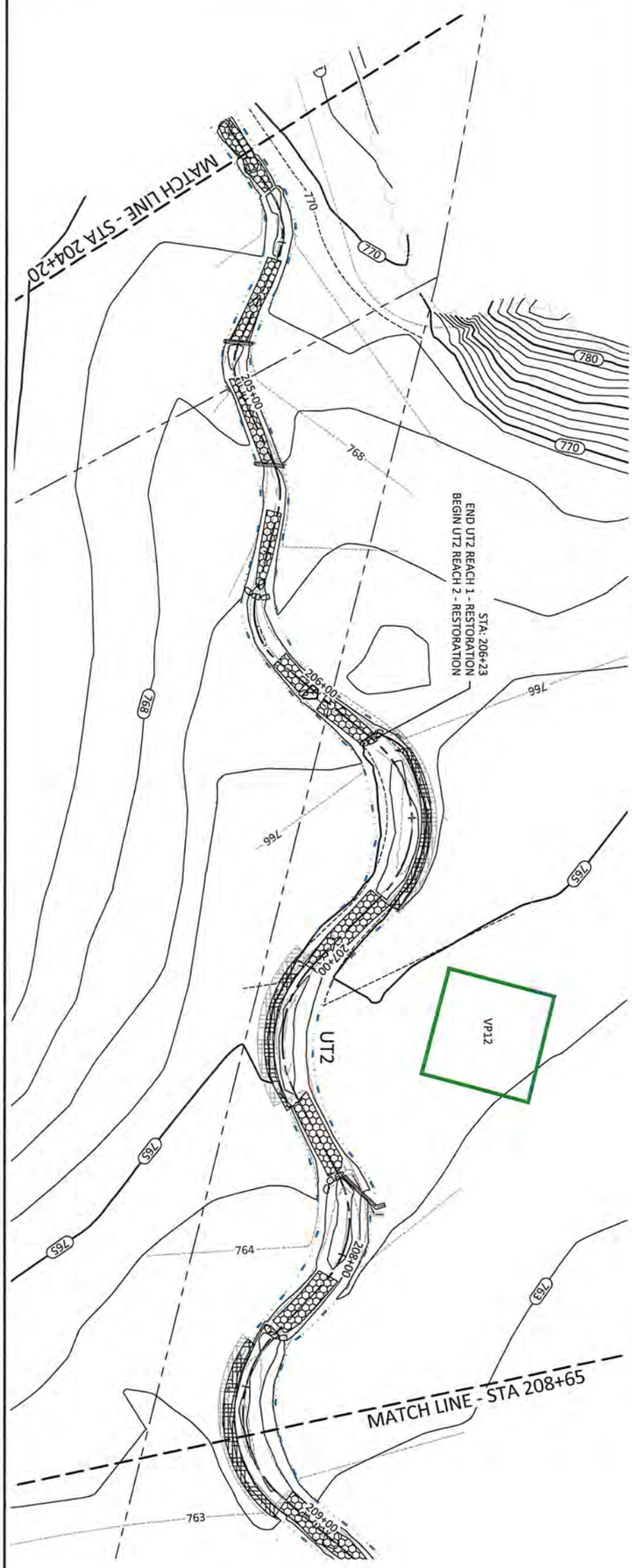

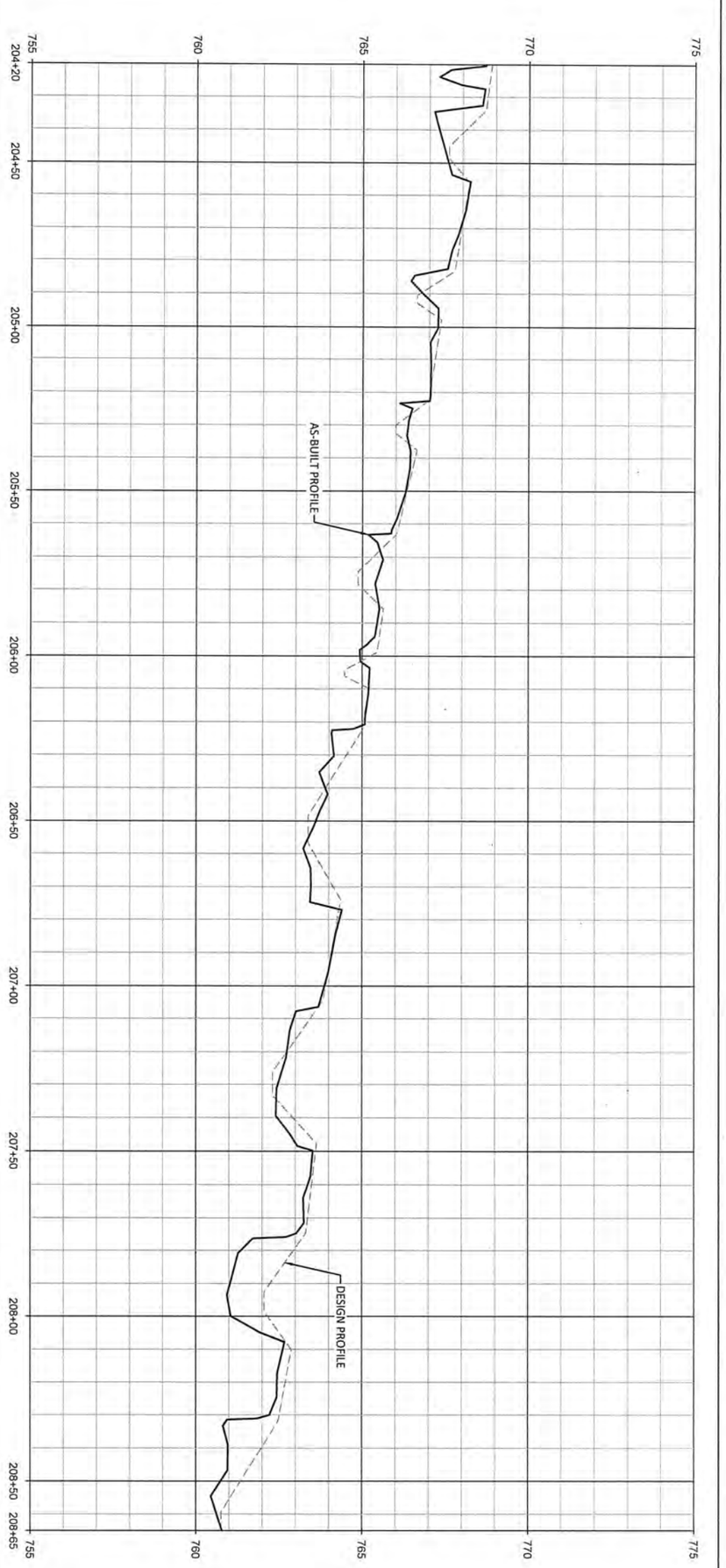

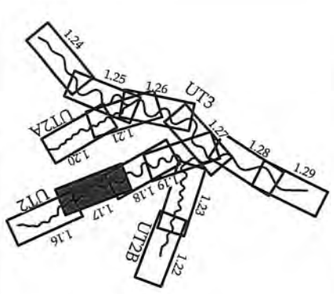

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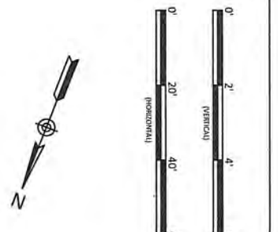

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Drawn By:	JCK
Checked By:	EGR/JCK

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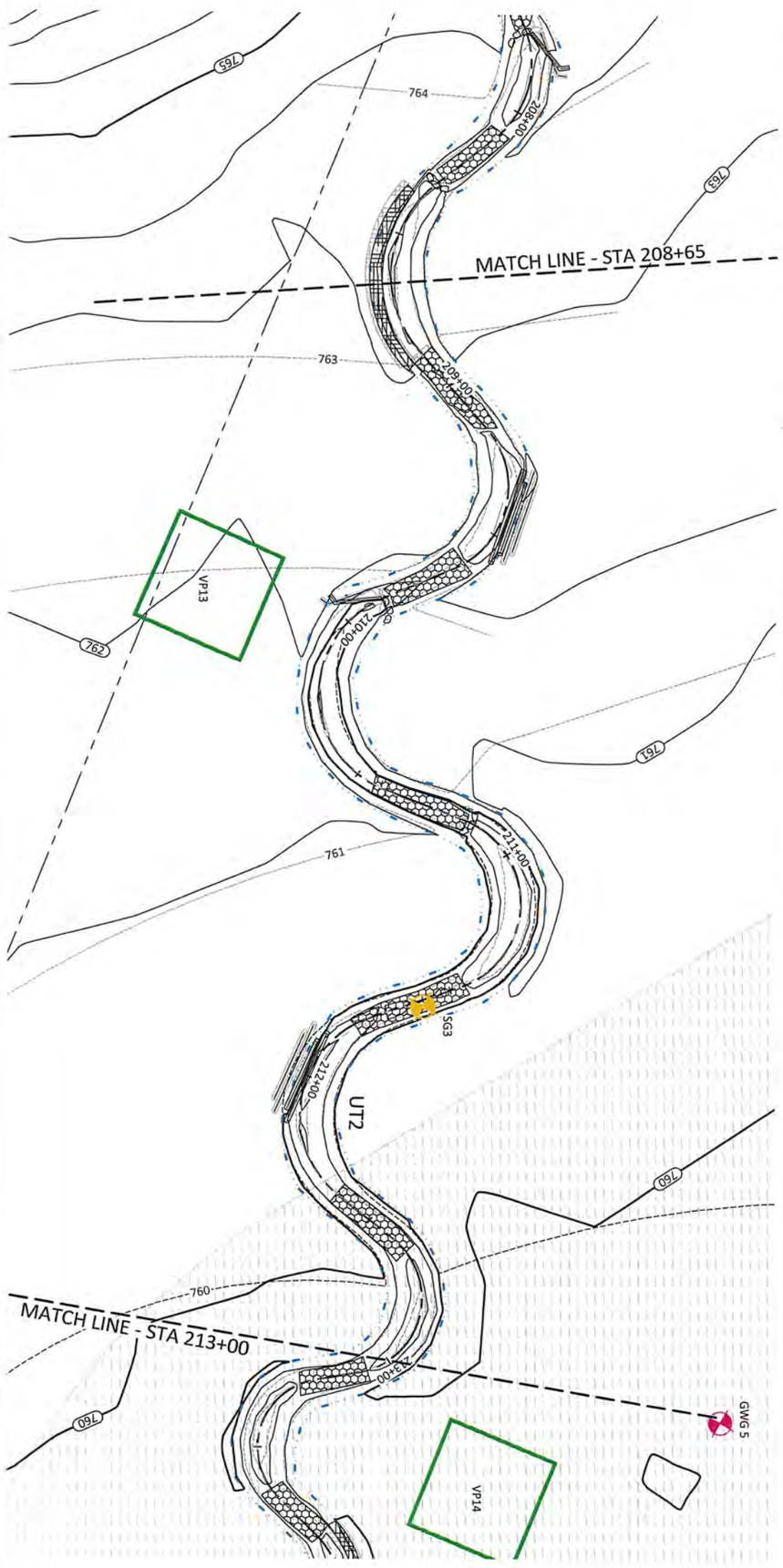

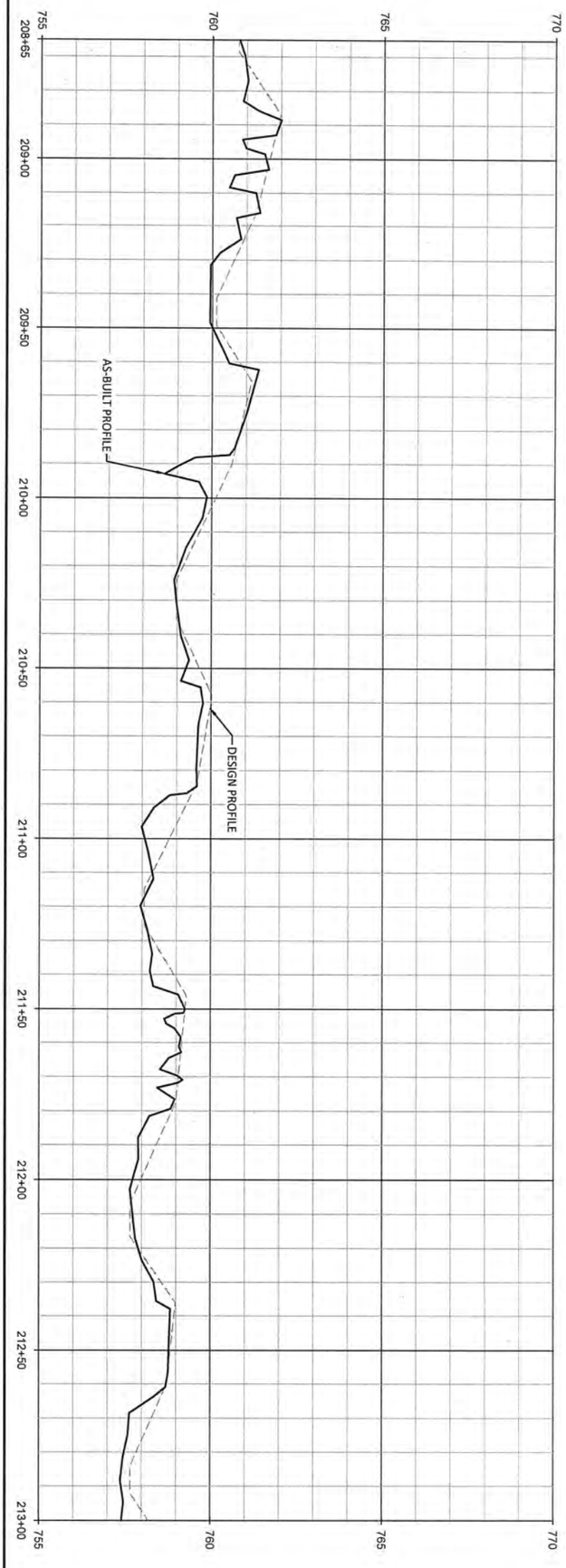

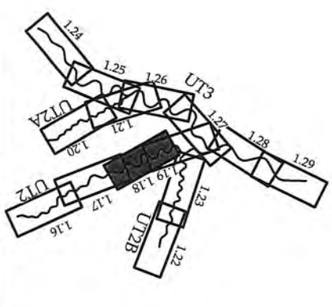

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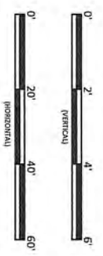

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Job Number:	005-02163
Project Engineer:	EGR
Drawn By:	JCK
Checked By:	EGR/JCK

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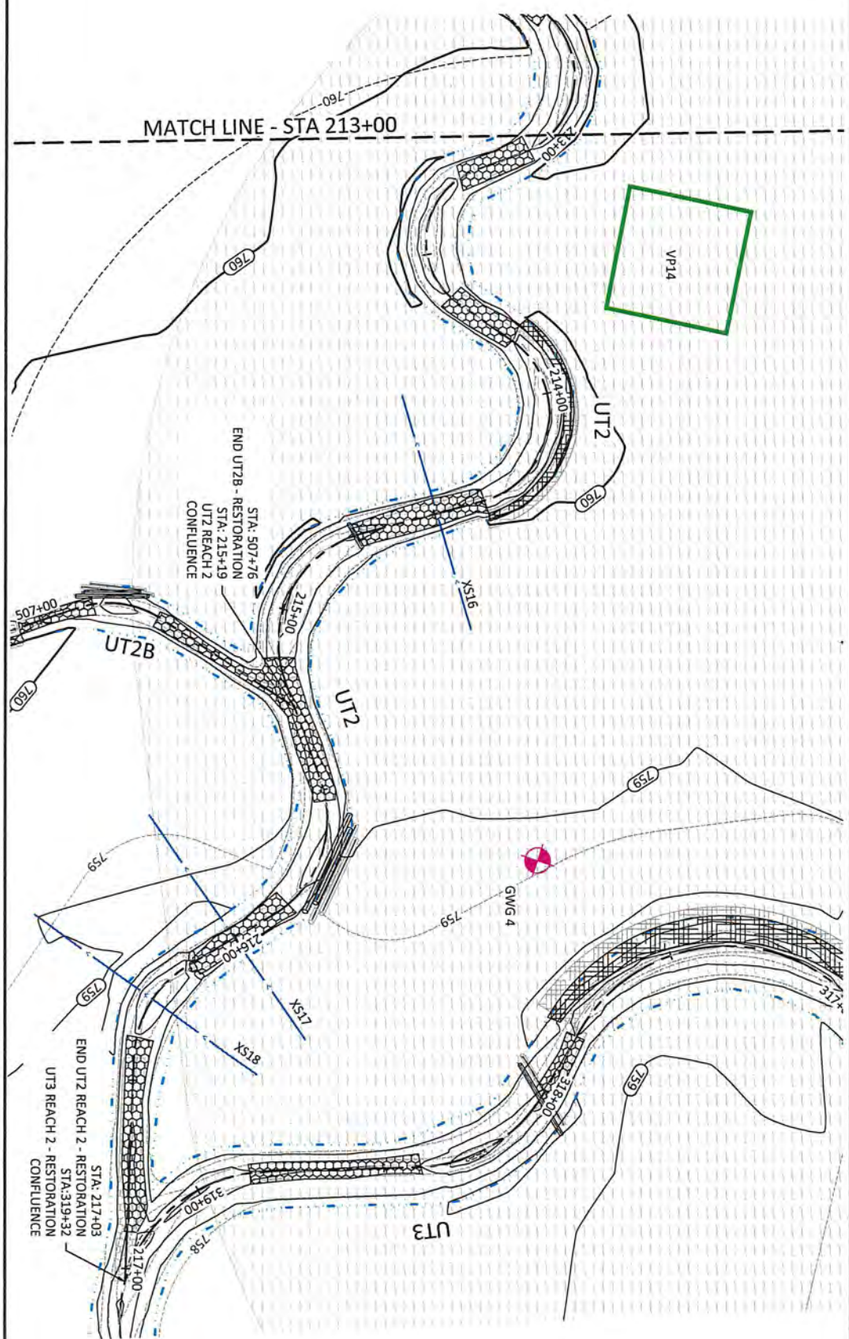

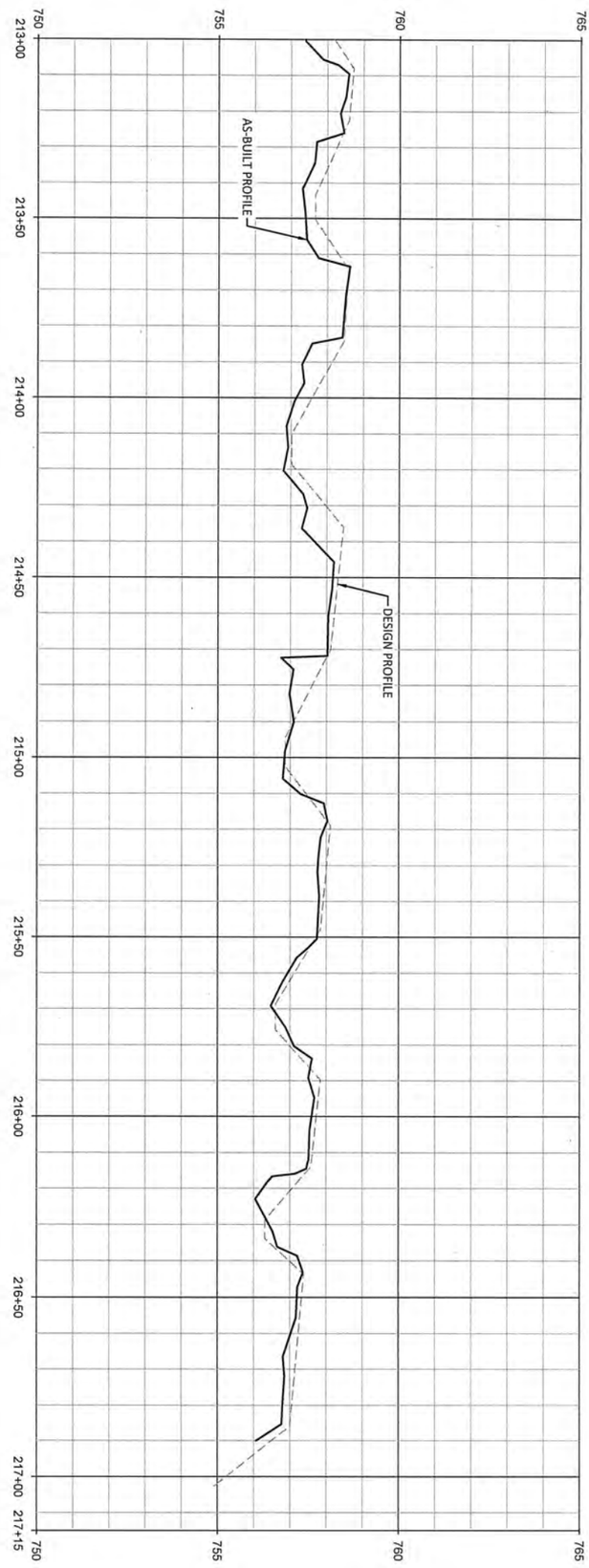

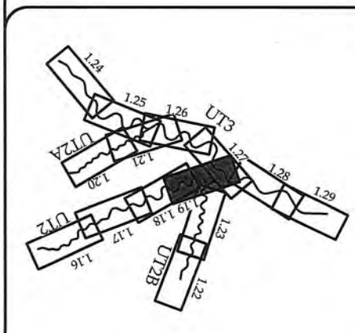

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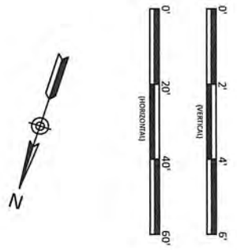

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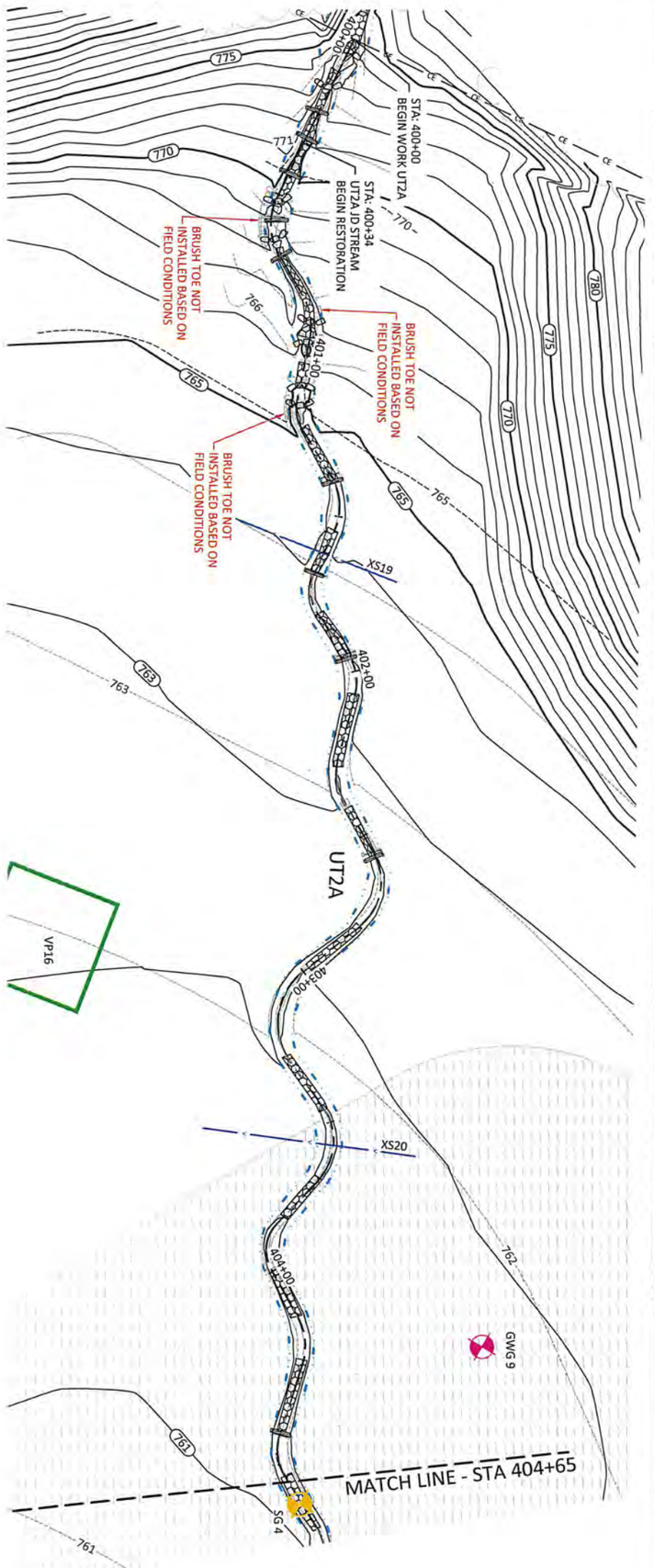

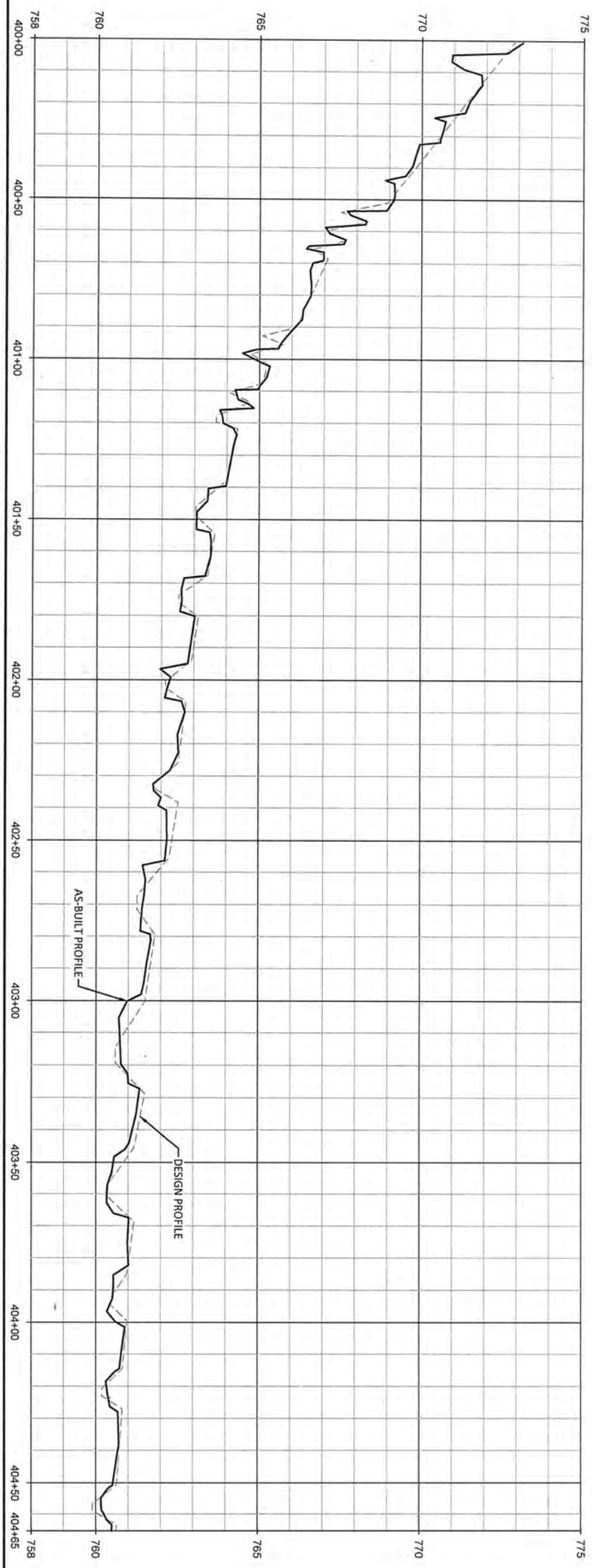

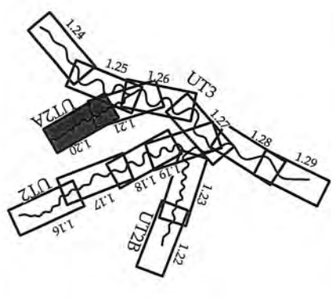

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Drawn By:	JCK
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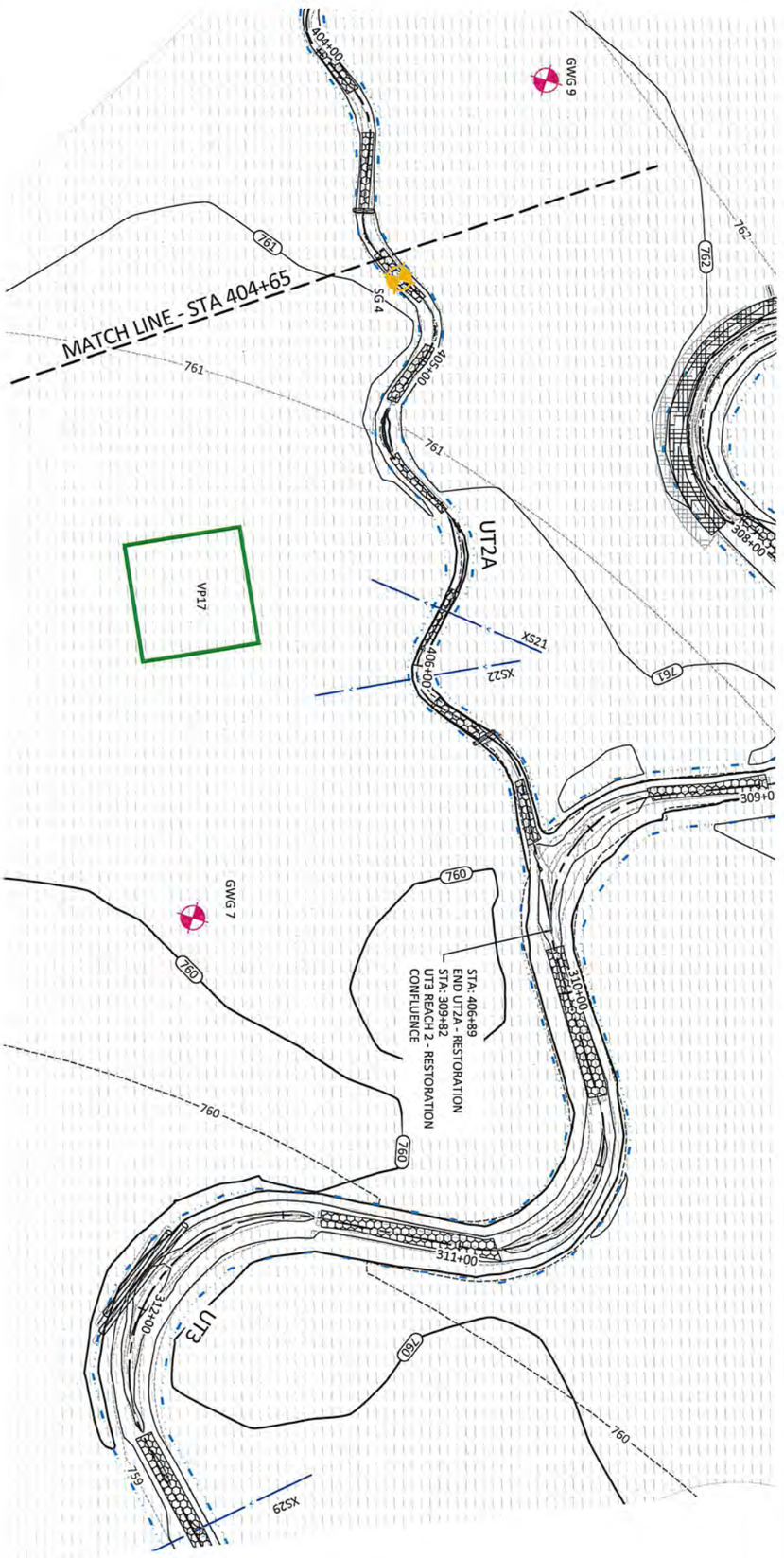

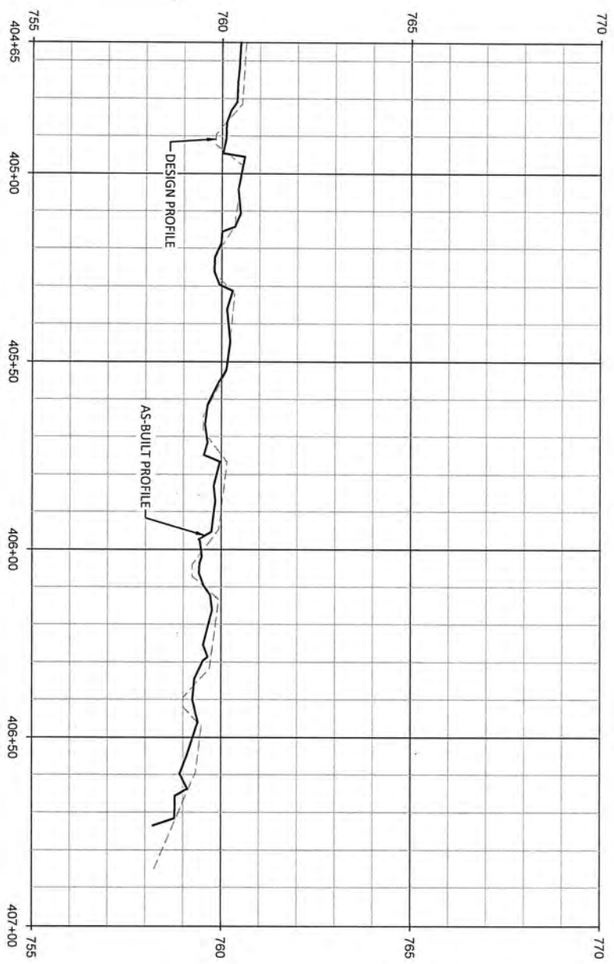

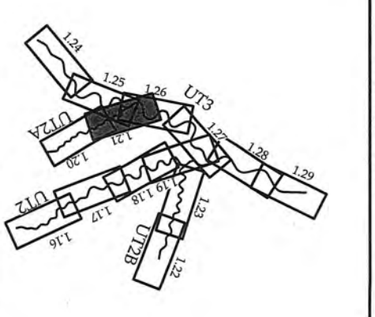

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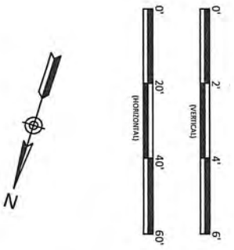

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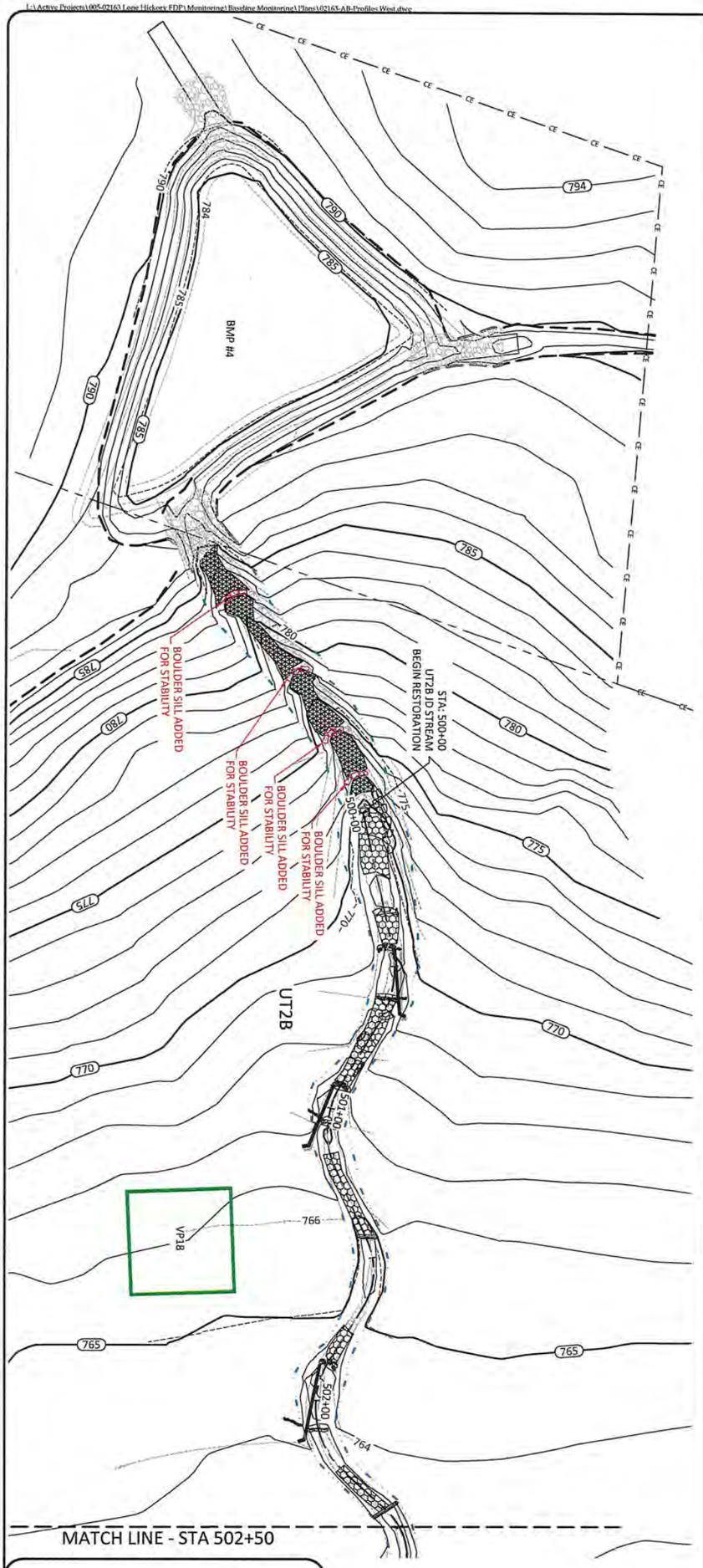

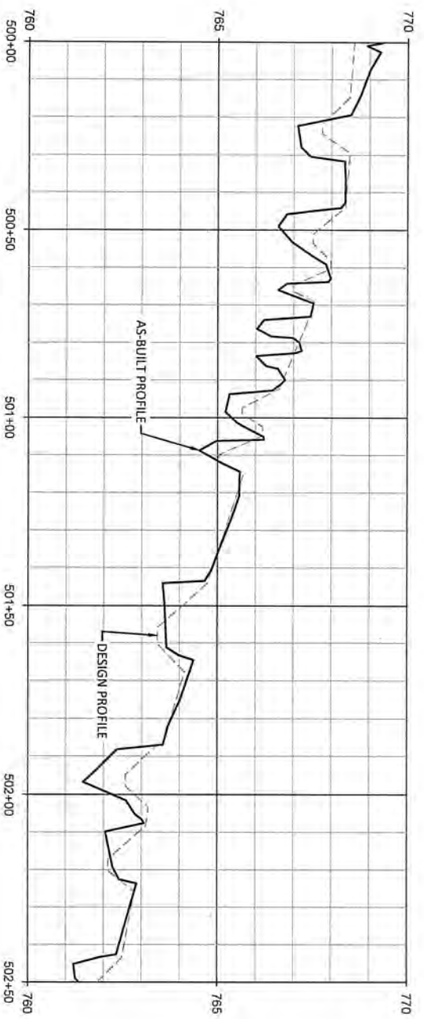

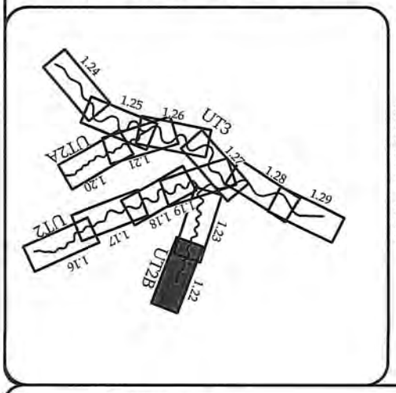

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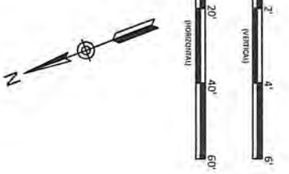

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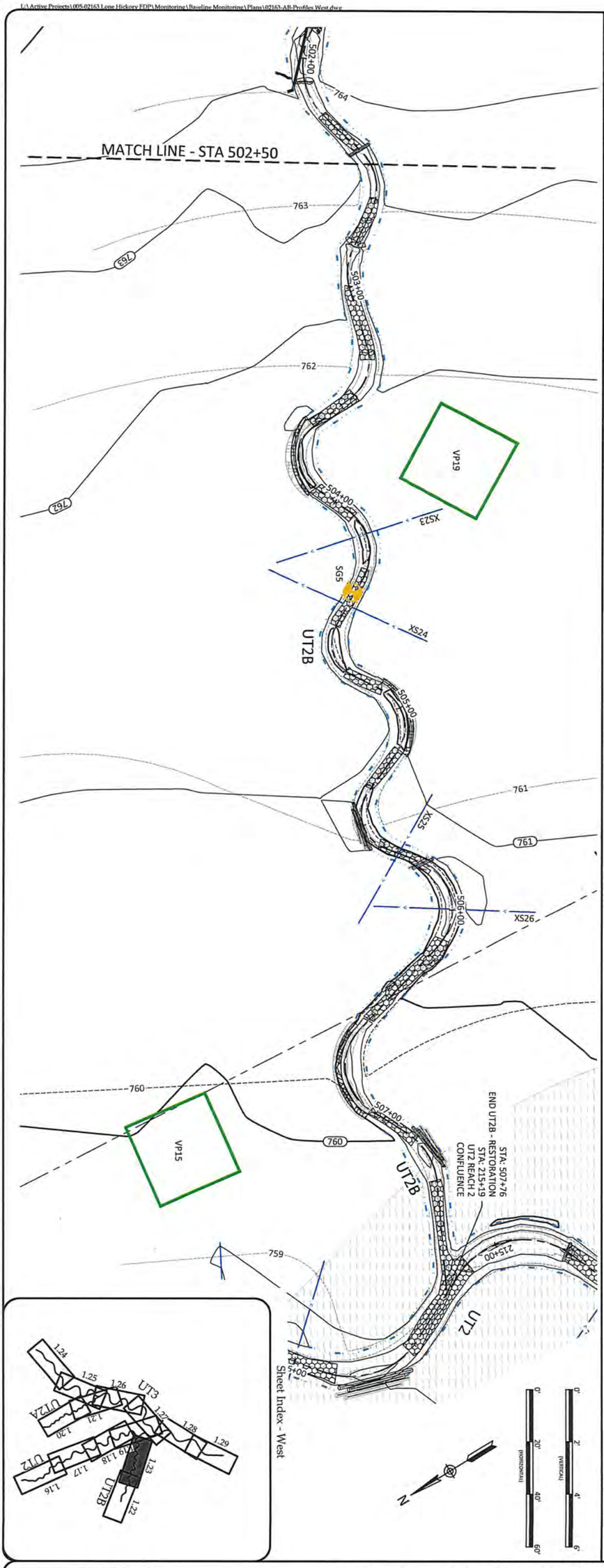

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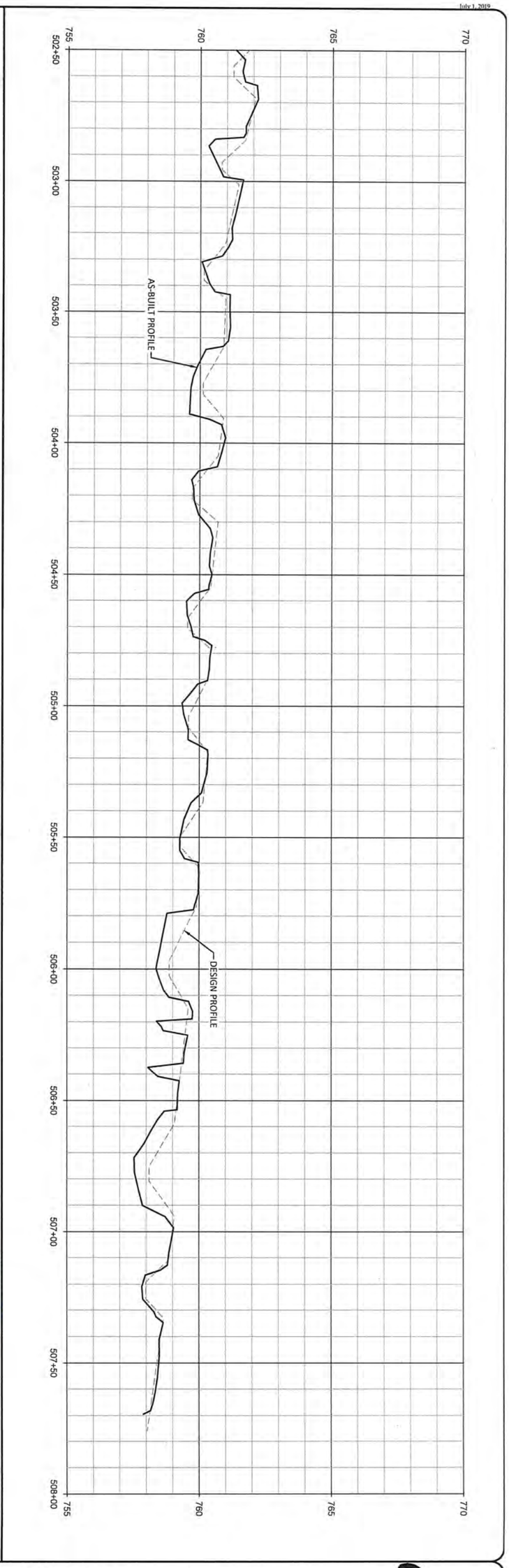

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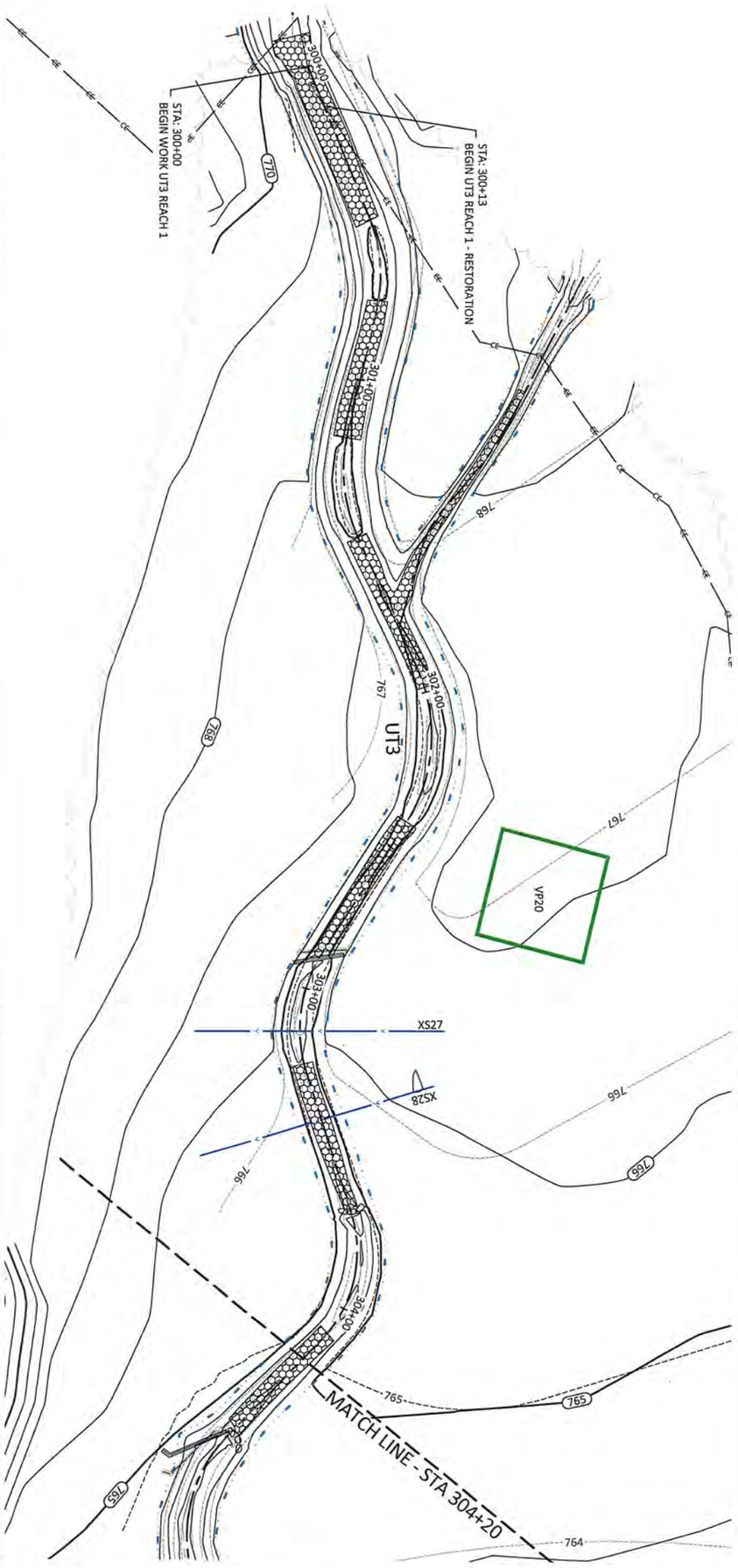

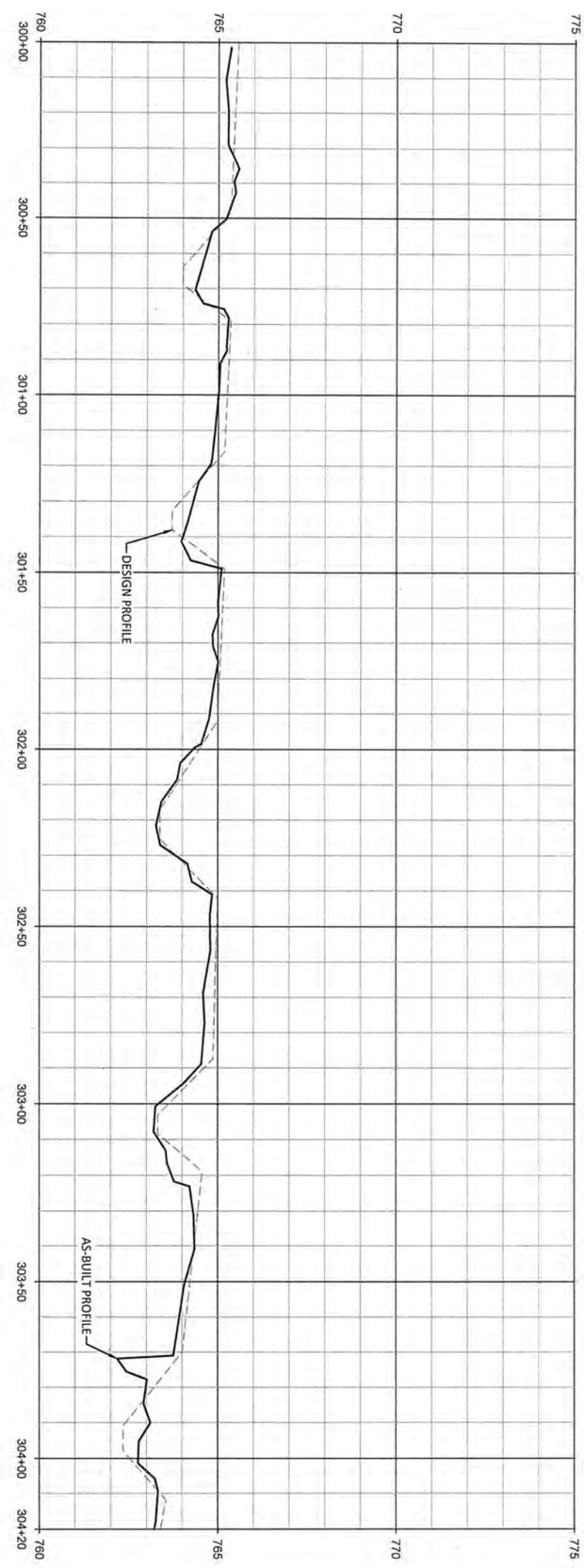

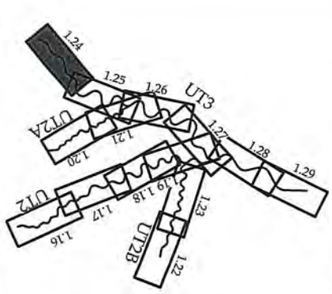

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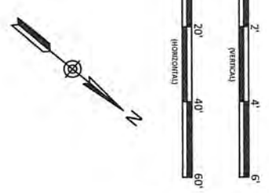

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Drawn By:	JCK
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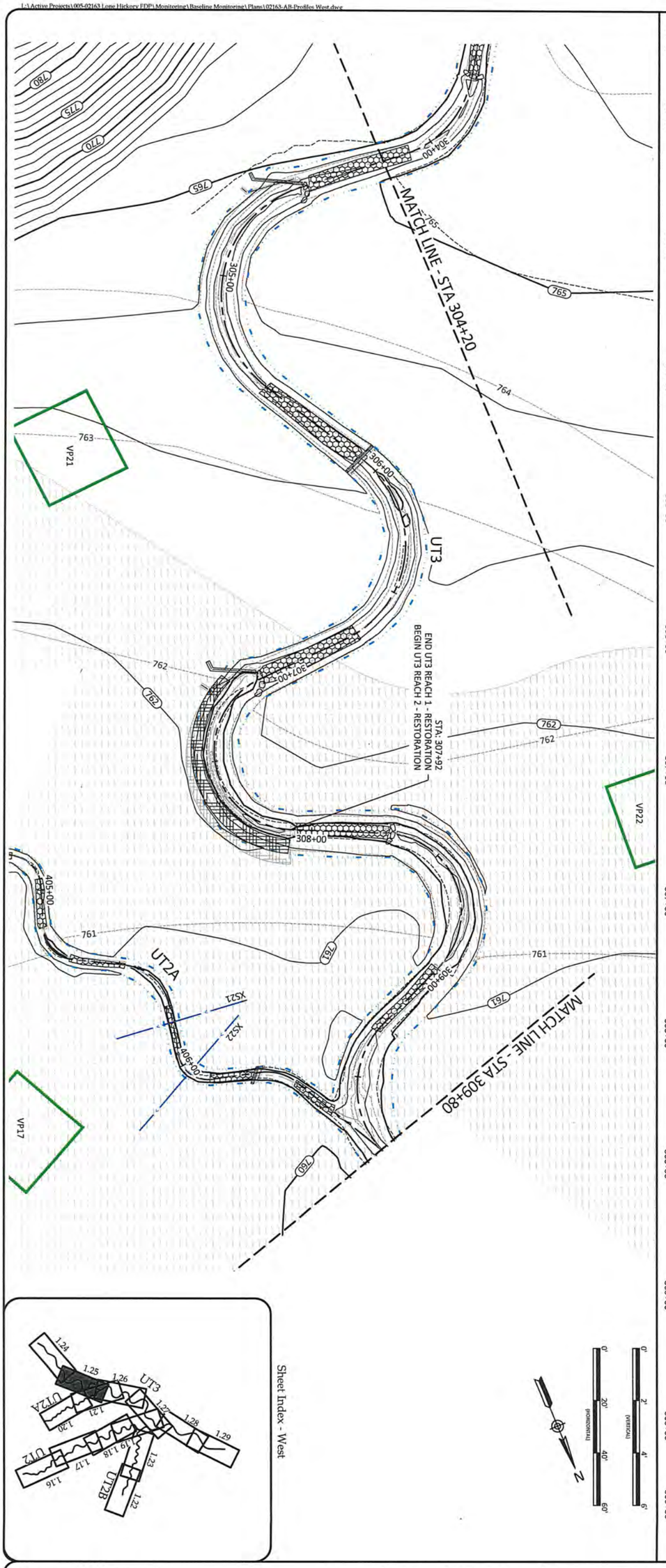

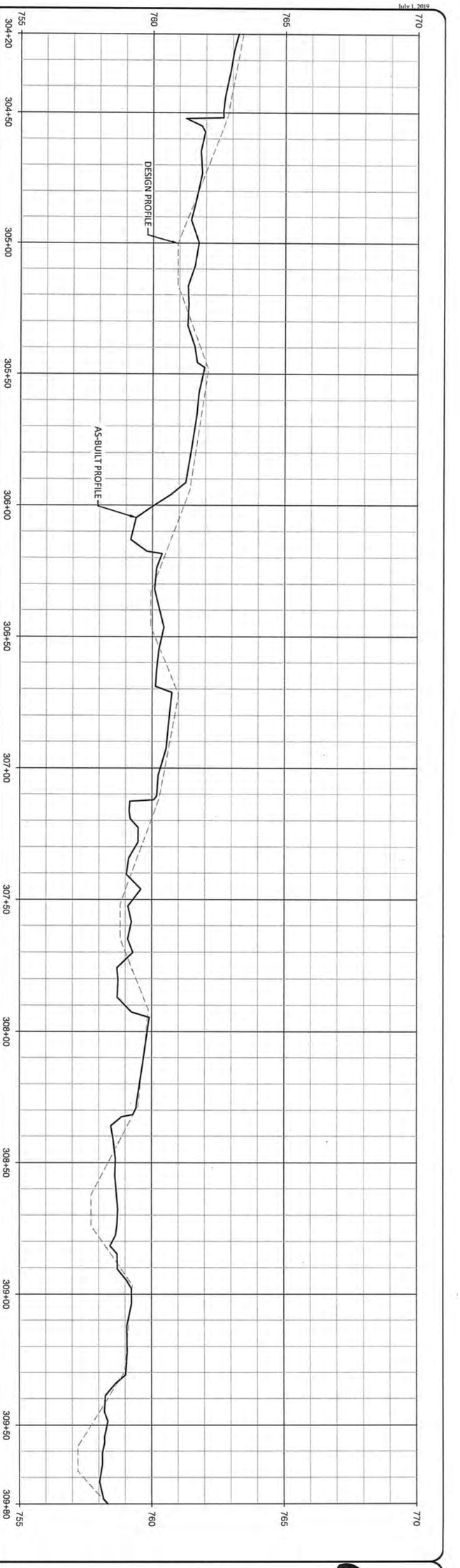

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N

0' 20' 40' 60' (HORIZONTAL)

0' 2' 4' 6' (VERTICAL)

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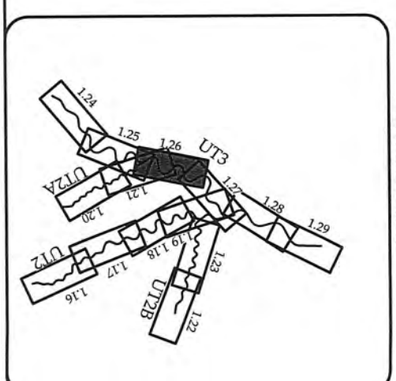

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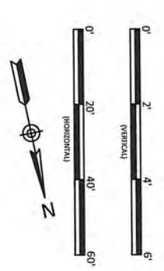

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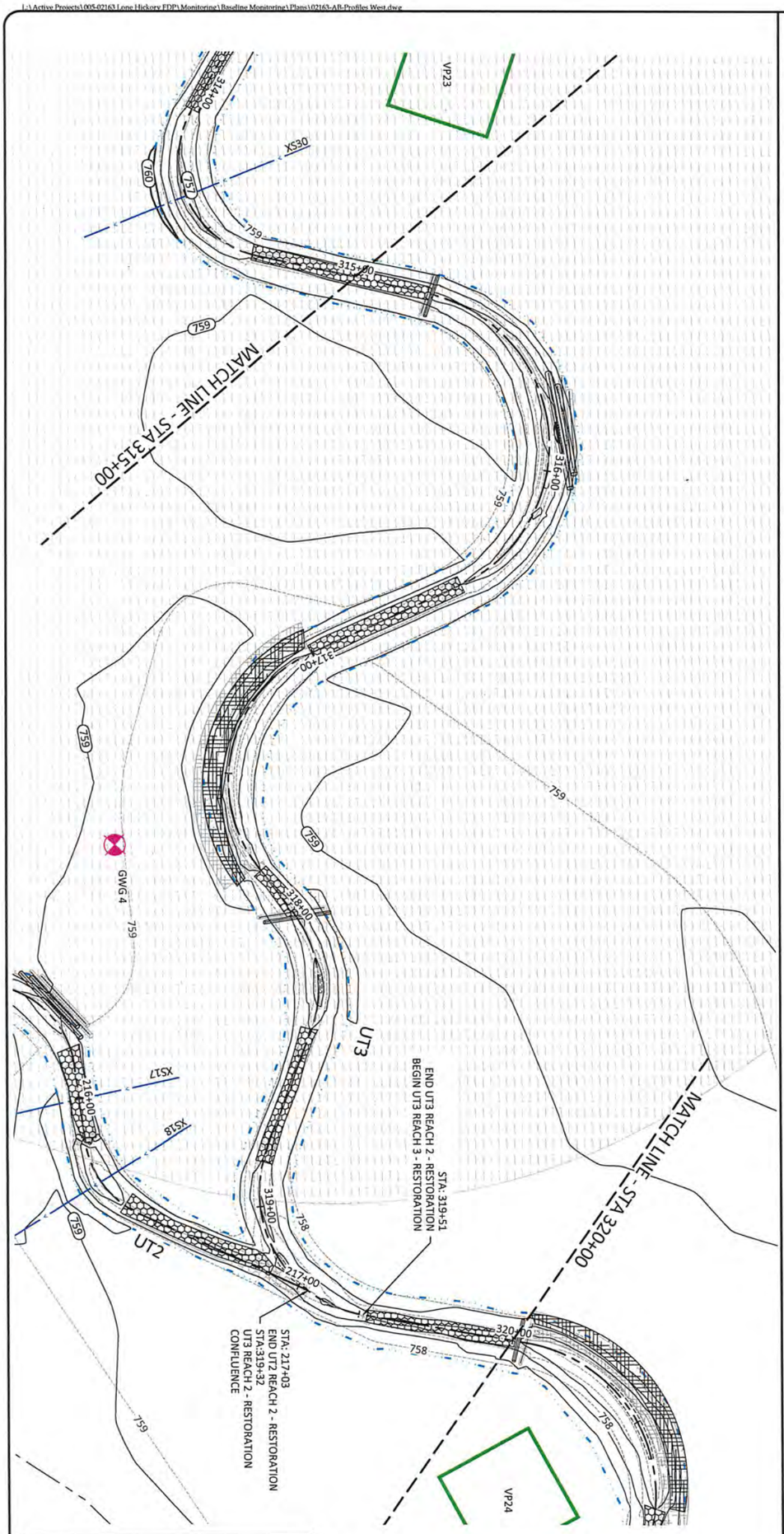

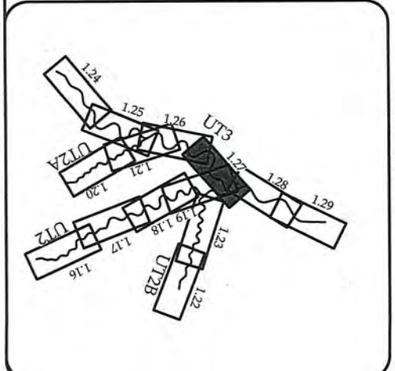

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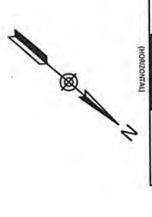

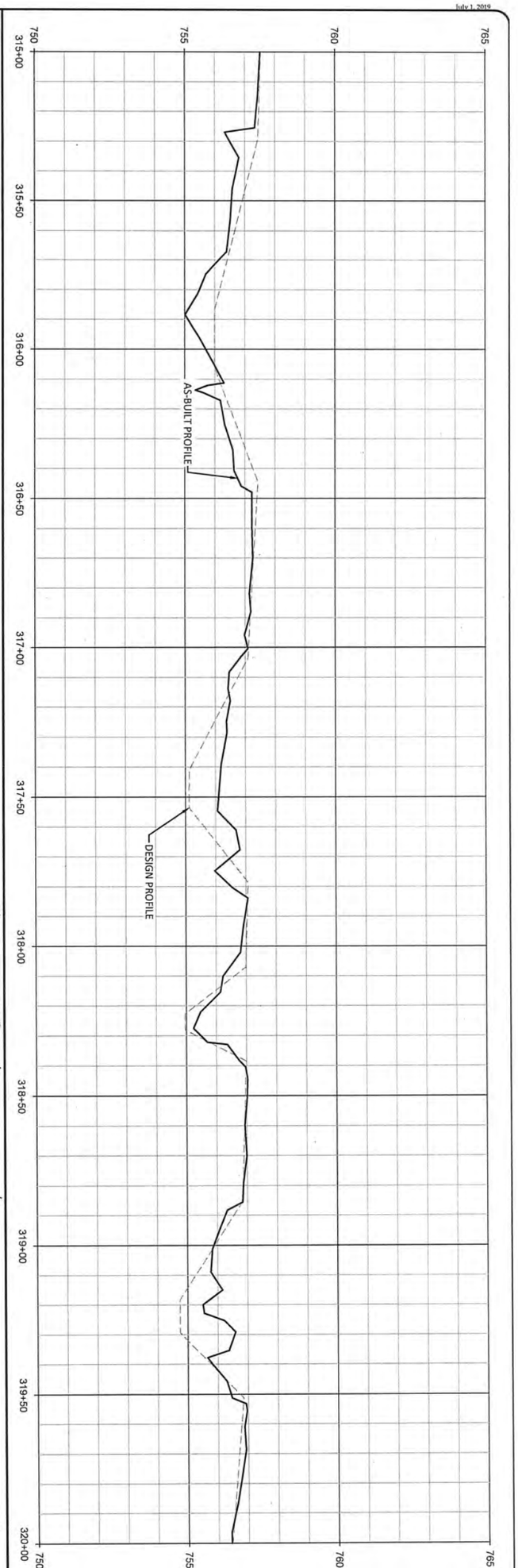

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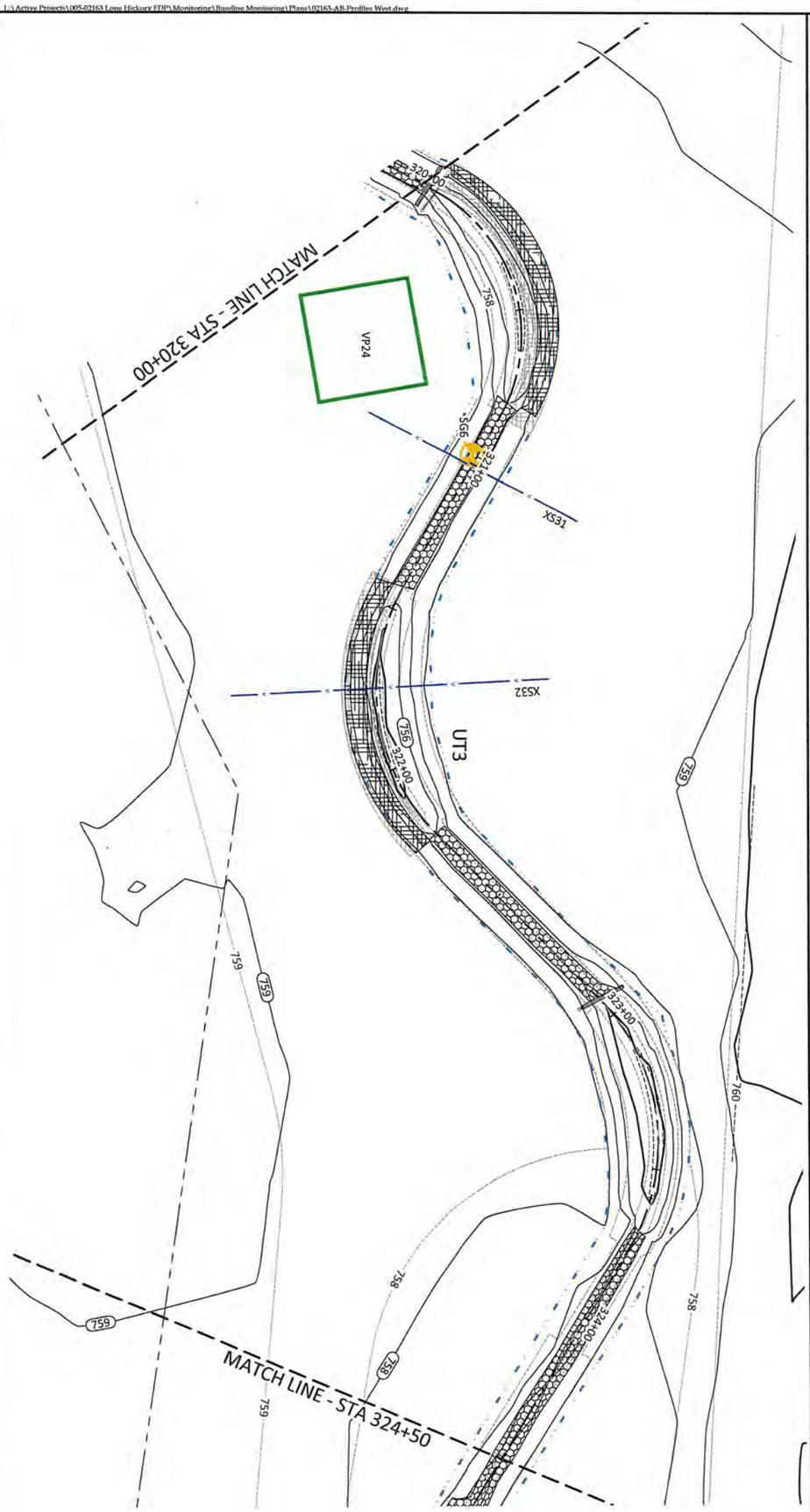

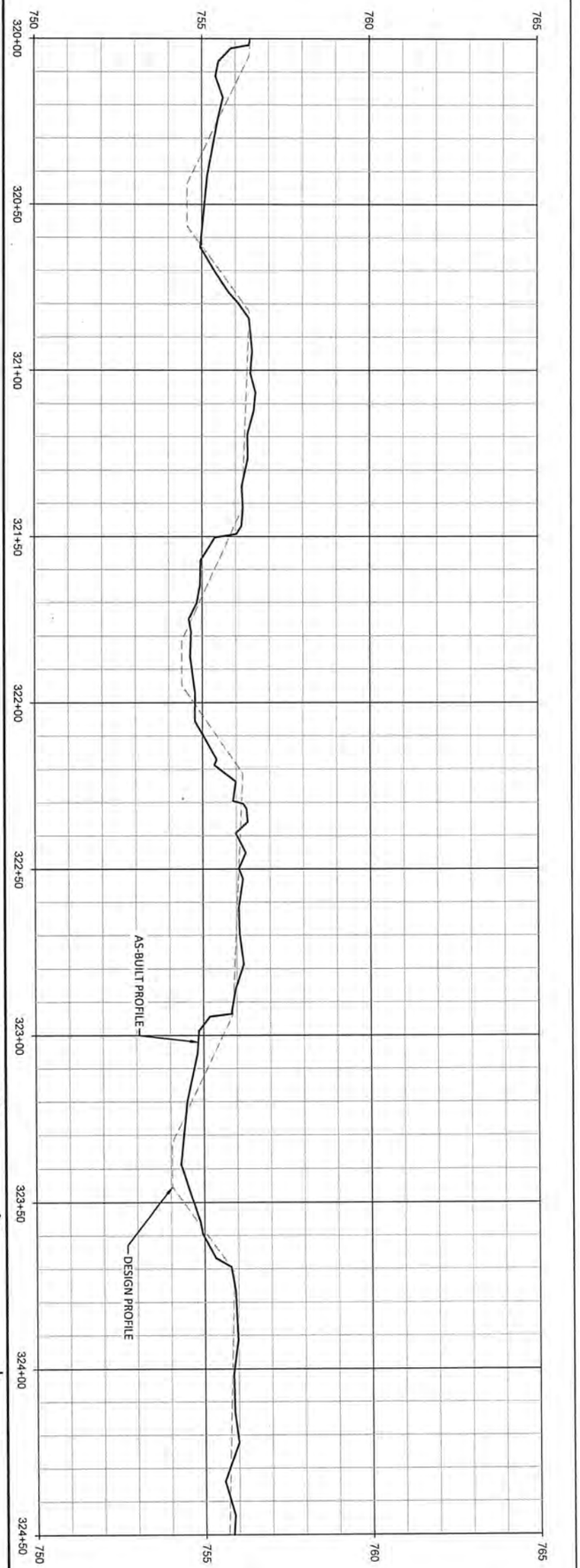

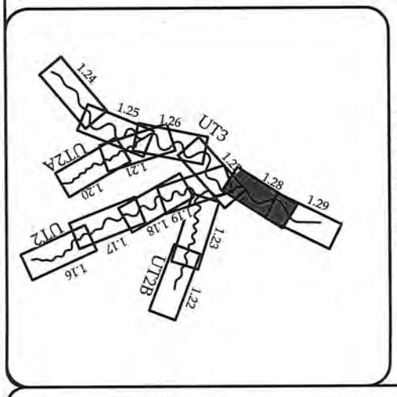

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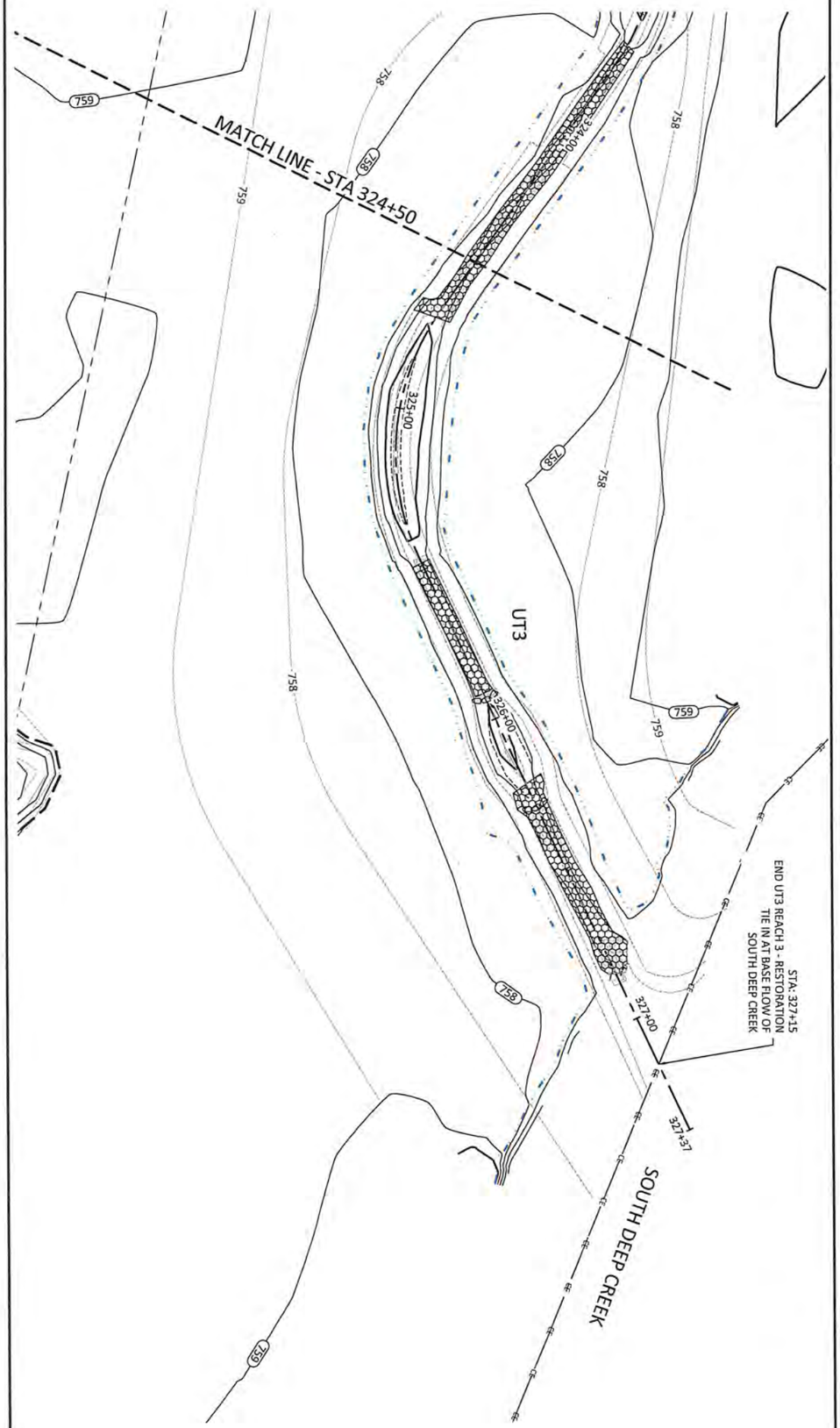

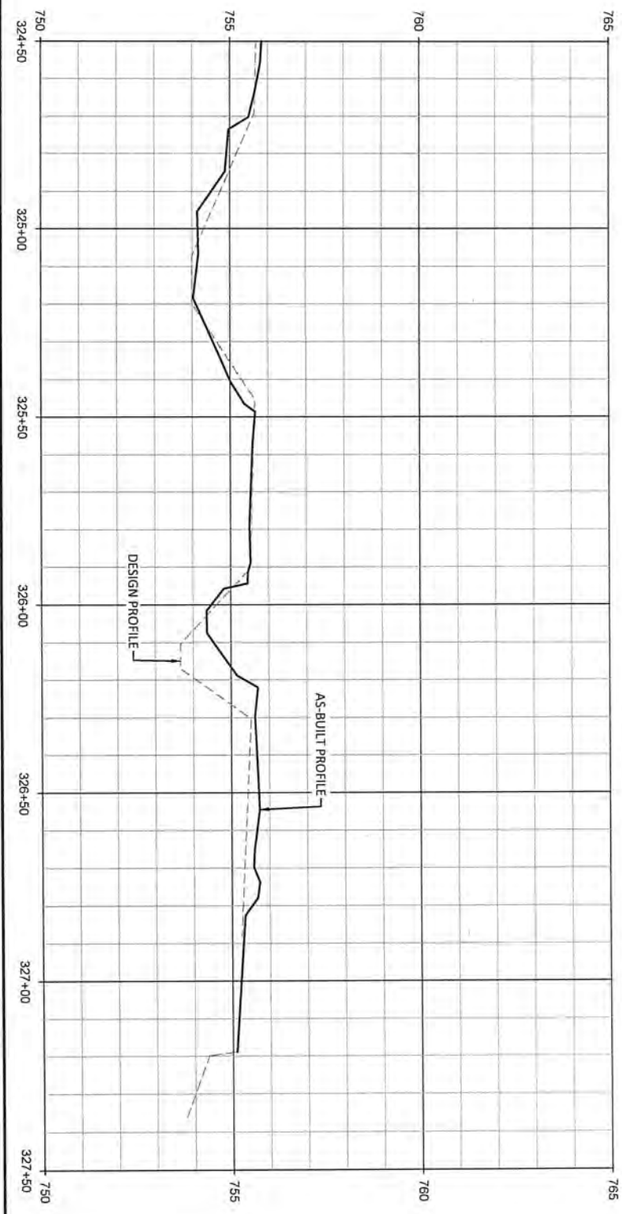

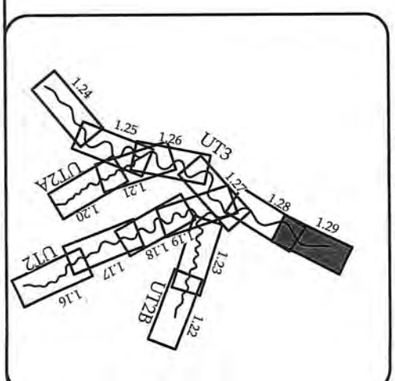

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N

0' 20' 40' 60' (HORIZONTAL)

0' 2' 4' 6' (VERTICAL)

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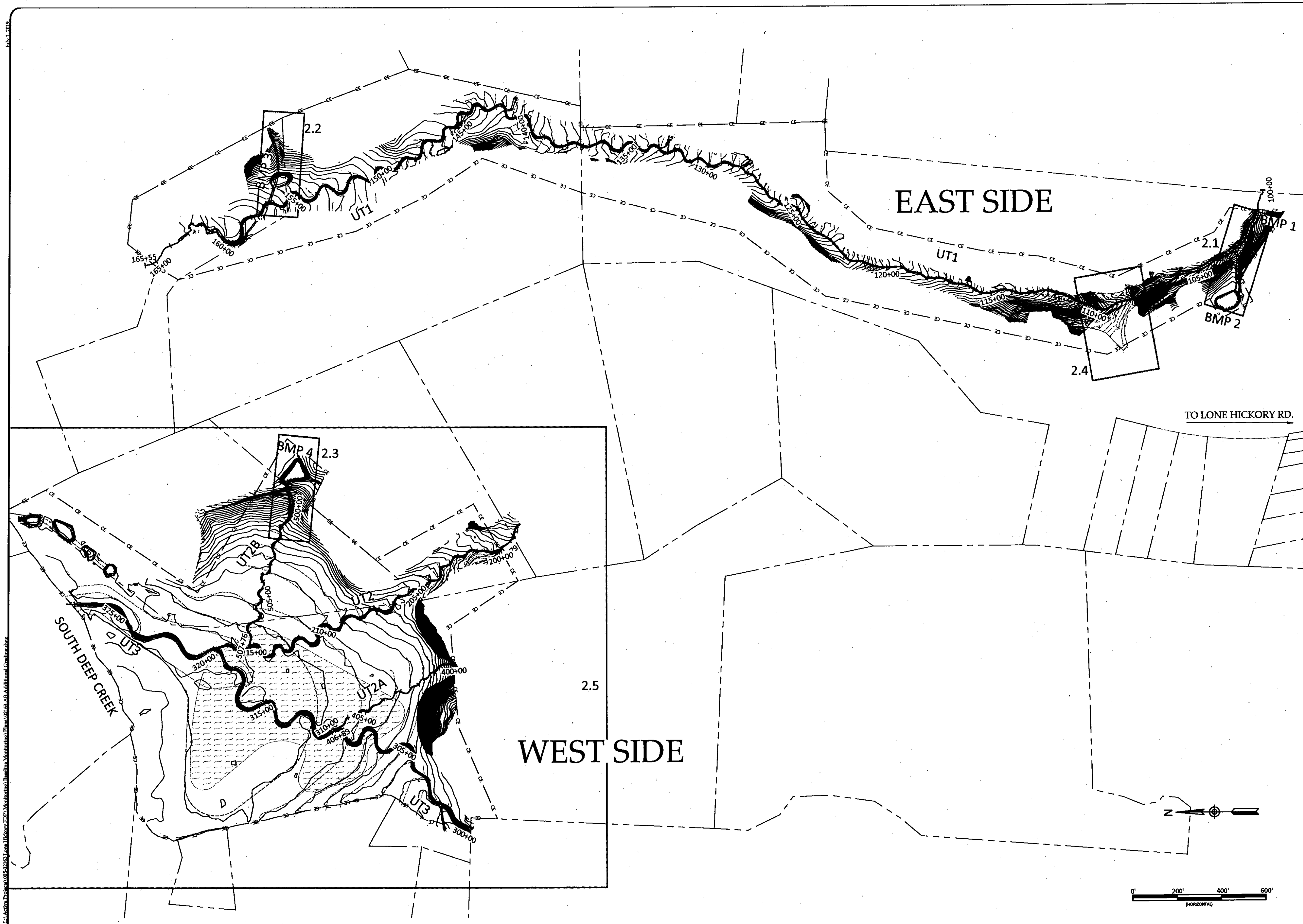

Lone Hickory Mitigation Site Record Drawings

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Additional Grading Overview

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NORTH CAROLINA PROFESSIONAL SEAL 29928 ENGINEER EMILY G. REINICKER

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Drawn By:	JCK
Checked By:	EGR/JCK

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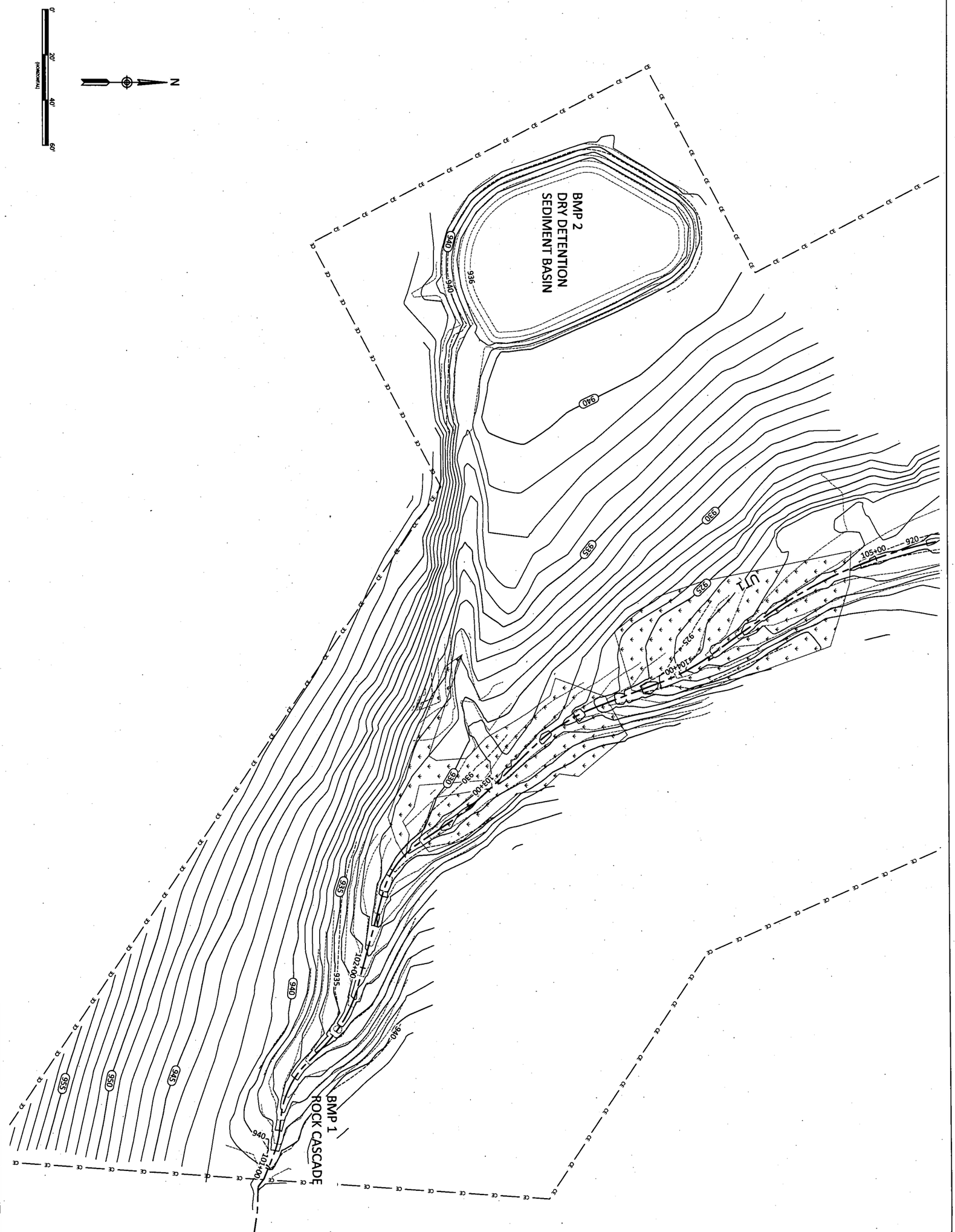

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BMP #1 & BMP #2
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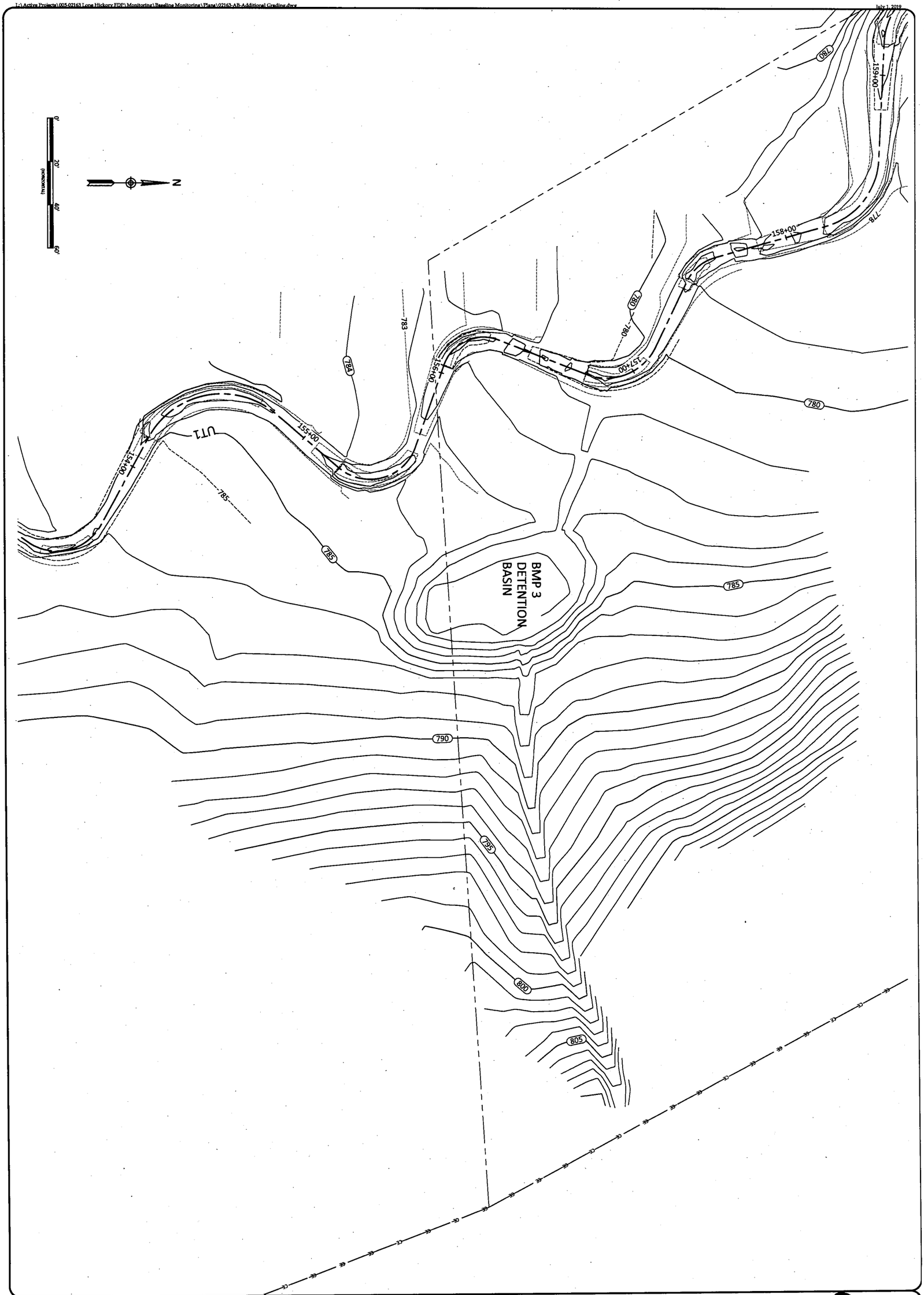

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Project Engineer:	EGR
Drawn By:	JCK
Checked By:	EGR/JCK

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Lone Hickory Mitigation Site Record Drawings
Yadkin County, North Carolina

BMP #3
Additional Grading

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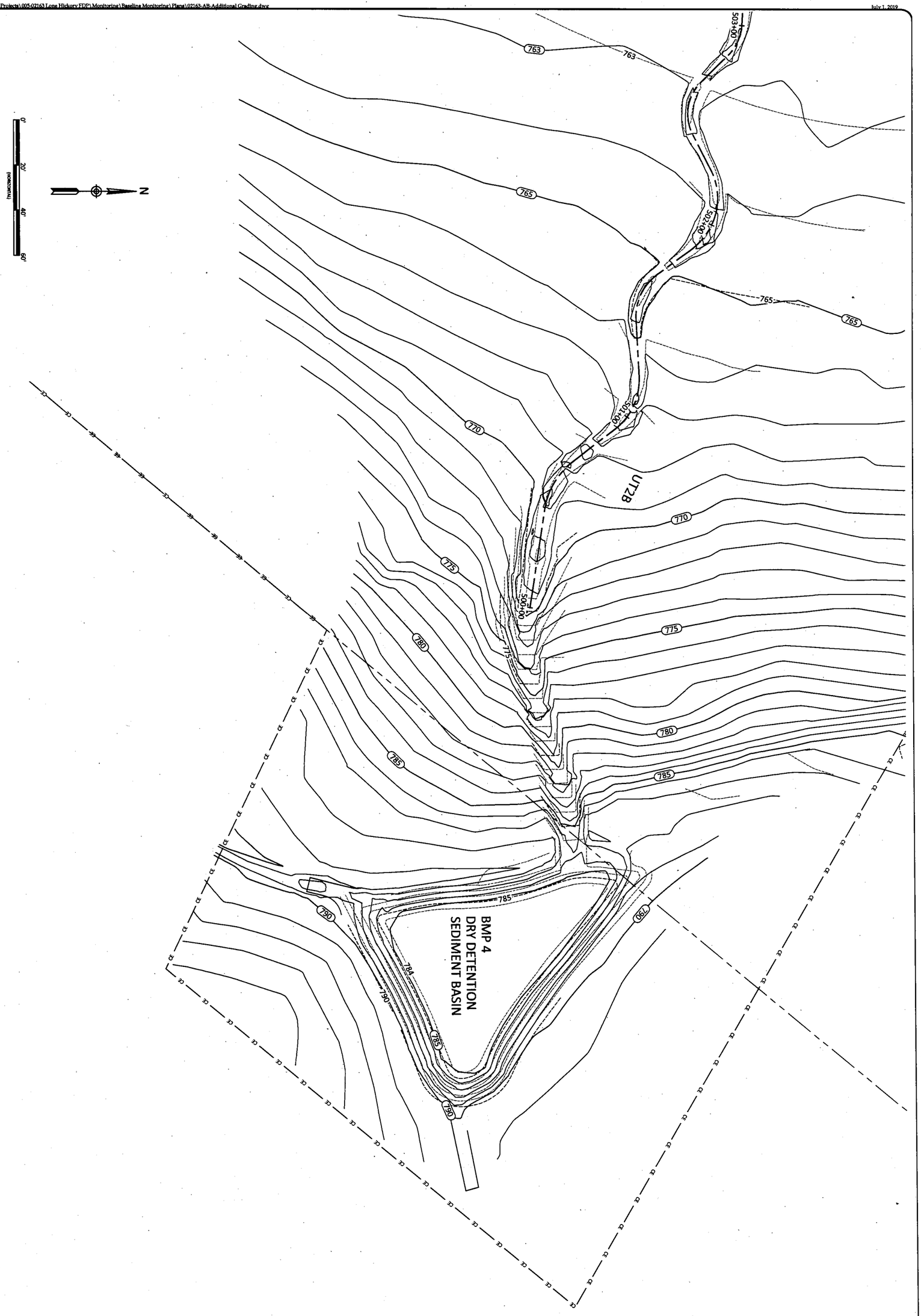

Date:	July 10, 2019
Job Number:	005-02163
Project Engineer:	EGR
Drawn By:	JCK
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Revisions:

Lone Hickory Mitigation Site Record Drawings
Yadkin County, North Carolina

BMP #4
Additional Grading

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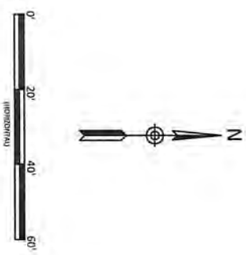
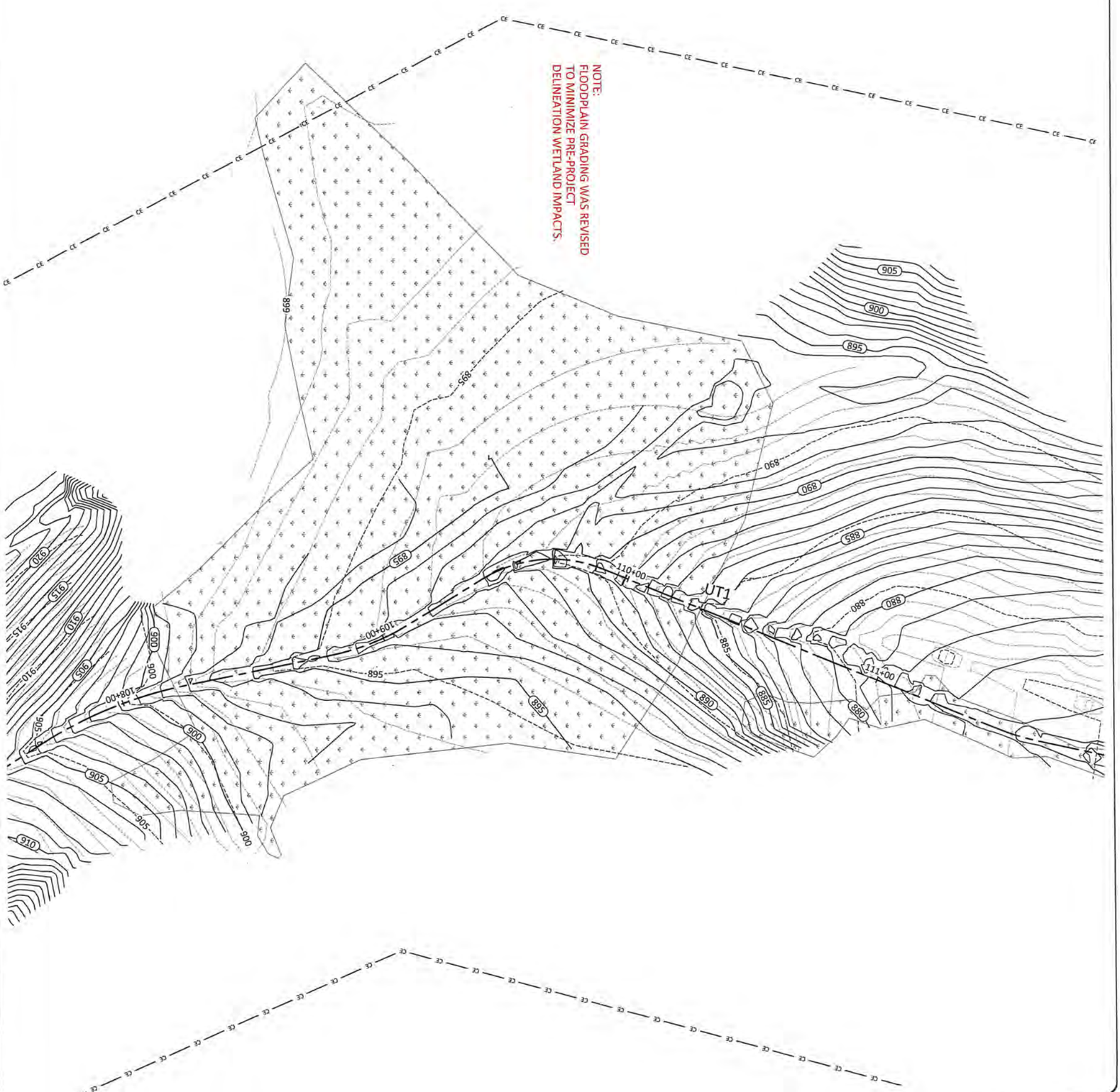


NOTE:
FLOODPLAIN GRADING WAS REVISED TO MINIMIZE PRE-PROJECT DELINEATION WETLAND IMPACTS.



Date:	July 10, 2019
Job Number:	005-02163
Project Engineer:	EGR
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Lone Hickory Mitigation Site Record Drawings
Yadkin County, North Carolina

Wetland Grading

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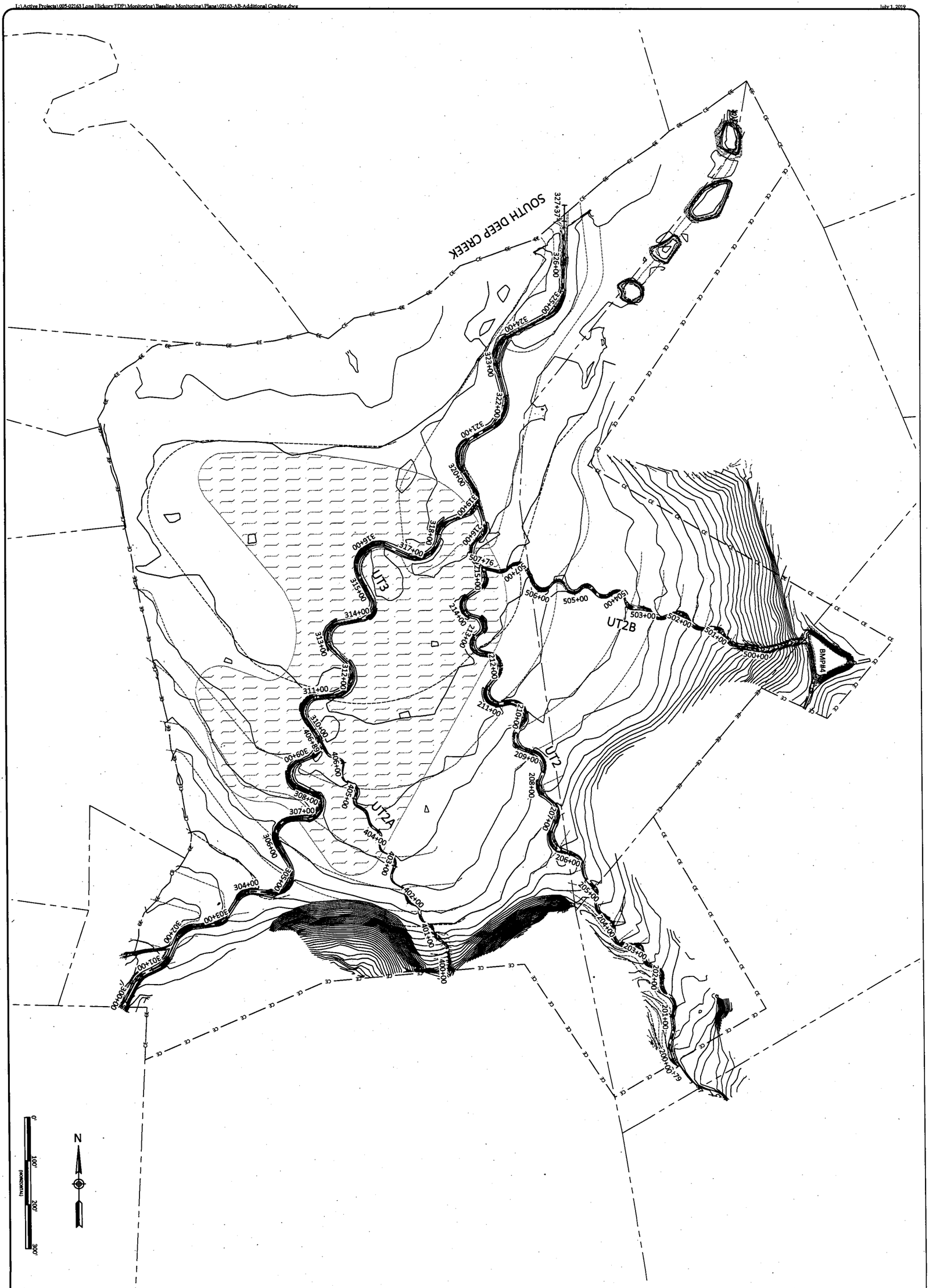

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Revisions:

Lone Hickory Mitigation Site Record Drawings
Yadkin County, North Carolina

Wetland Grading

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Buffer Planting Zone						
Open/Graded Bare Roots (605 stems / acre)						
Species	Common Name	Max Spacing	Indiv. Spacing	Min. Caliper Size	Stratum	% of Stems
Quercus phellos	Willow Oak	12 ft.	6-12 ft.	0.25"-1.0"	Canopy	10%
Platanus occidentalis	Sycamore	12 ft.	6-12 ft.	0.25"-1.0"	Canopy	20%
Betula nigra	River Birch	12 ft.	6-12 ft.	0.25"-1.0"	Canopy	15%
Liriodendron tulipifera	Tulip Poplar	12 ft.	6-12 ft.	0.25"-1.0"	Canopy	20%
Fraxinus pennsylvanica	Green Ash	12 ft.	6-12 ft.	0.25"-1.0"	Canopy	5%
						70%
Alternatives						
~~*Alnus serrulata*~~	~~Tag Alder~~	~~12 ft.~~	~~6-12 ft.~~	~~0.25"-1.0"~~	~~Canopy~~	~~10%~~
Quercus pagoda	Cherrybark Oak	12 ft.	6-12 ft.	0.25"-1.0"	Canopy	~~10%~~ 15 %
Quercus michauxii	Swamp Chestnut Oak	12 ft.	6-12 ft.	0.25"-1.0"	Canopy	~~10%~~ 5 %
Quercus lyrata	Overcup Oak	12 ft.	6-12 ft.	0.25"-1.0"	Canopy	10%
					Total	100%

Permanent Riparian Seeding - Open Canopy				
Pure Live Seed (20 lbs/ acre)				
Approved Date	Species Name	Common Name	Stratum	Density (lbs/acre)
All Year	*Panicum rigidulum*	Redtop Panicgrass	Herb	1.5
All Year	*Agrostis hyemalis*	Winter Bentgrass	Herb	4.0
All Year	*Chasmanthium latifolium*	River Oats	Herb	2.0
All Year	*Rudbeckia hirta*	Blackeyed Susan	Herb	1.0
All Year	*Coreopsis lanceolata*	Lanceleaf Coreopsis	Herb	1.0
All Year	*Carex vulpinoidea*	Fox Sedge	Herb	3.0
All Year	*Panicum clandestinum*	Deertongue	Herb	3.5
All Year	*Elymus virginicus*	Virginia Wild Rye	Herb	2.0
All Year	*Asclepias syrica*	Common Milkweed	Herb	0.2
All Year	*Baptisia australis*	Blue False Indigo	Herb	0.2
All Year	*Gaillardia pulchella*	Annual Gaillardia	Herb	1.0
All Year	*Echinacea purpurea*	Pale Purple Coneflower	Herb	0.6

Streambank Planting Zone						
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	10%
Cornus amomum	Silky Dogwood	8 ft.	2-8 ft.	0.5"-1.5" cal.	Shrub	35%
Salix sericea	Silky Willow	8 ft.	2-8 ft.	0.5"-1.5" cal.	Shrub	40%
Physocarpos opulifolius	Ninebark	8 ft.	2-8 ft.	0.5"-1.5" cal.	Shrub	15%
						100%
Herbaceous Plugs						
Juncus effusus	Common Rush	5 ft.	3-5 ft.	1.0"- 2.0" plug	Herb	~~45%~~ 50%
Carex alata	Broadwing Sedge	5 ft.	3-5 ft.	1.0"- 2.0" plug	Herb	~~45%~~ 50%
~~*Panicum virgatum*~~	~~Switchgrass~~	~~5 ft.~~	~~3-5 ft.~~	~~1.0"- 2.0" plug~~	~~Herb~~	~~10%~~
						100%

NOTE:
HERBACEOUS PLUGS TO BE PLANTED DURING APPROPRIATE PLANTING WINDOW

Wetland Bare Root Planting (60 stems / acre)		
Scientific Name	Common Name	% of stems
Platanus occidentalis	Sycamore	15%
Quercus phellos	Willow Oak	15%
Betula nigra	River Birch	15%
Fraxinus pennsylvanica	Green Ash	15%
~~*Quercus michauxii*~~ *Quercus pagoda*	~~Swamp Chestnut Oak~~ Cherrybark Oak	15%
Acer rubrum	Red Maple	5%
Diospyros virginiana	Persimmon	10%
Populus deltoides	Eastern Cottonwood	10%
	Total	100%

NOTE:
SUPPLEMENTAL PLANTING MODIFIED BASED ON FIELD CONDITIONS.

Shaded Areas Bare Roots - Buffer Planting	
Species	Common name
Platanus occidentalis	Sycamore
Fraxinus pennsylvanicum	Green Ash
Betula nigra	River Birch
Liriodendron tulipifera	Tulip Poplar
Quercus michauxii	Swamp Chestnut Oak
Carpinus caroliniana	Ironwood
Diospyros virginiana	Persimmon
Quercus pagoda	Cherrybark Oak
Acer saccharinum	Silver Maple
Nyssa sylvatica	Black Gum
Quercus phellos	Willow Oak
~~*Callicarpa americana*~~	~~Beautyberry~~
~~*Cornus alternifolia*~~	~~Pagoda Dogwood~~
~~*Euonymus americanus*~~	~~American Strawberry Bush~~
~~*Calycanthus floridus*~~	~~Sweetshrub~~
~~*Magnolia virginiana*~~	~~Sweetbay Magnolia~~
~~*Hamamelis virginiana*~~	~~Witch-Hazel~~
~~*Clethra alnifolia*~~	~~Sweet Pepperbush~~

Pasture areas outside easement.

Pasture Seeding				
Approved Date	Species Name	Stratum	Common Name	Density (lbs/acre)
All Year	*Festuca arundinacea*	Herb	Tall Fescue	80
All Year	*Trifolium repens*	Herb	White Clover	8

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Lone Hickory Mitigation Site Record Drawings
Yadkin County, North Carolina

Planting List
Planting

Date: July 10, 2019
Job Number: 005-02163
Project Engineer: EGR
Drawn By: JCK
Checked By: EGR/JCK

Revisions:

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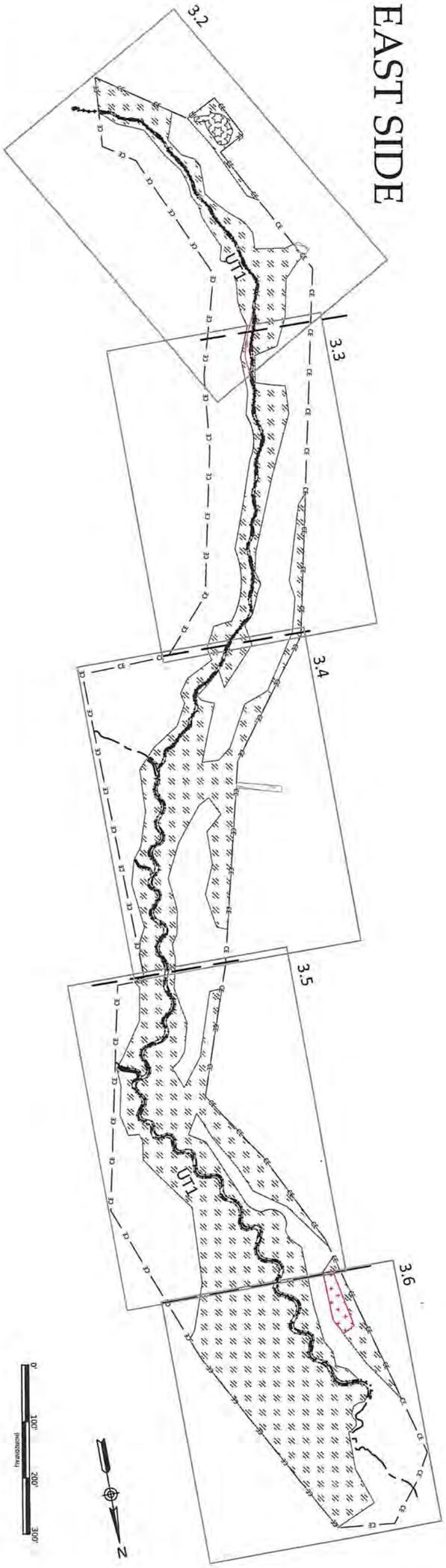
EAST SIDE



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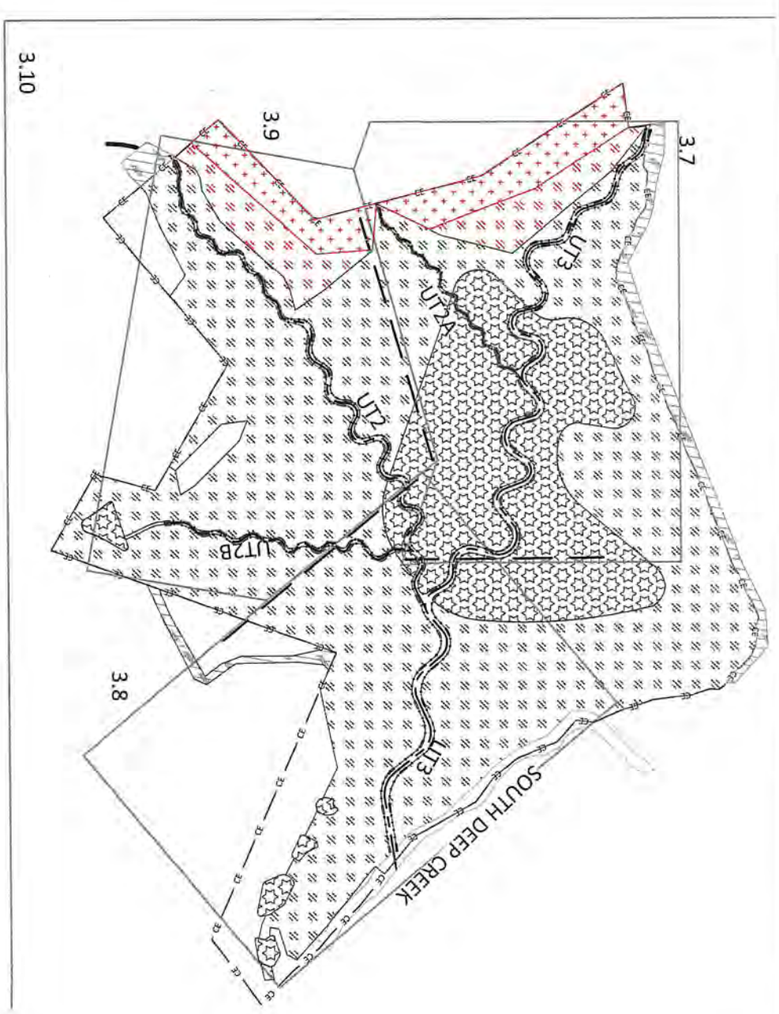

Date:	July 10, 2019
Job Number:	005-02163
Project Engineer:	EGR
Drawn By:	JCK
Checked By:	EGR/JCK

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Lone Hickory Mitigation Site Record Drawings
Yadkin County, North Carolina

Overall Planting Plan
Planting

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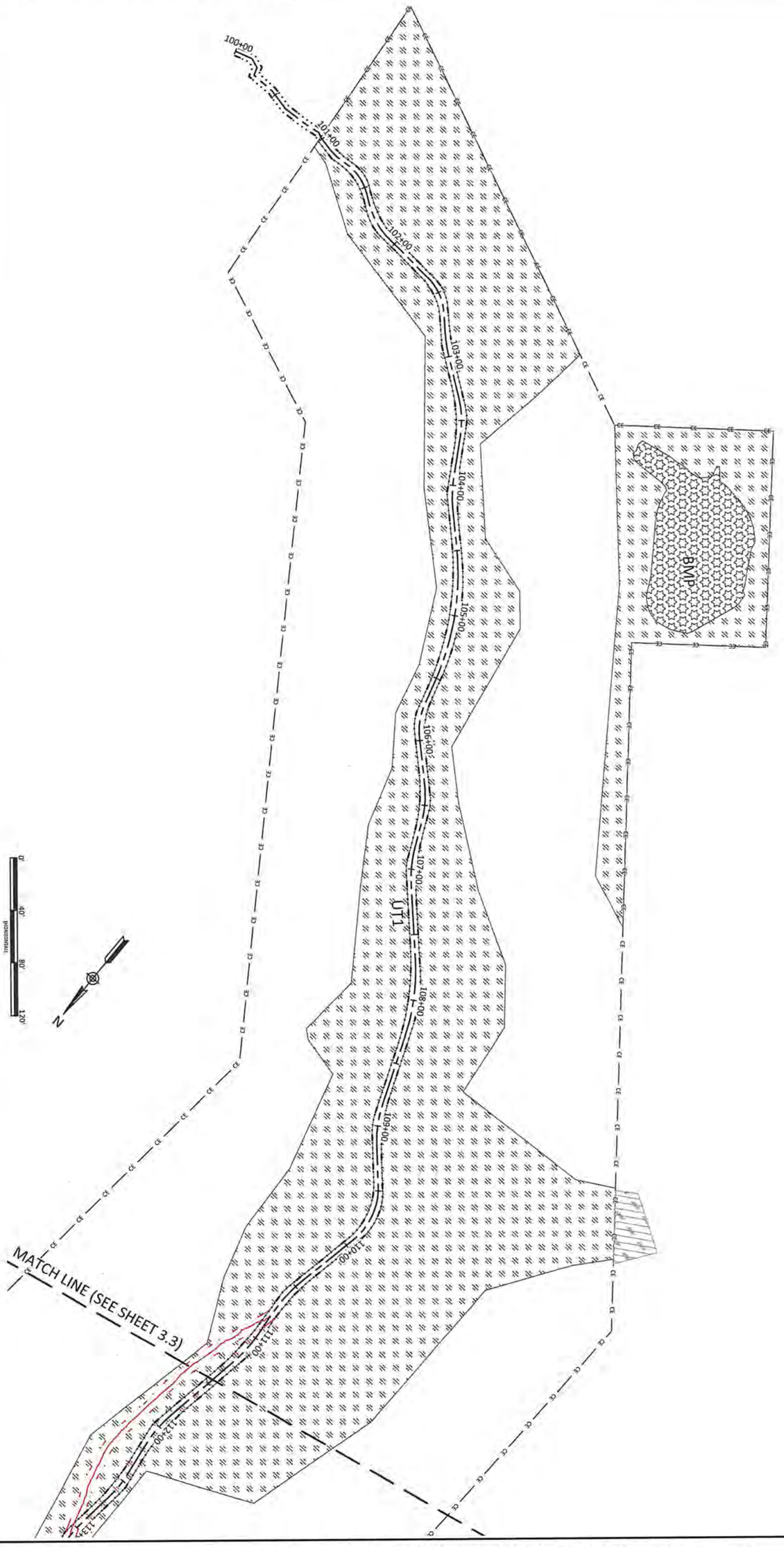

Date:	July 10, 2019
Job Number:	005-02163
Project Engineer:	EGR
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Yadkin County, North Carolina

UT1
Planting

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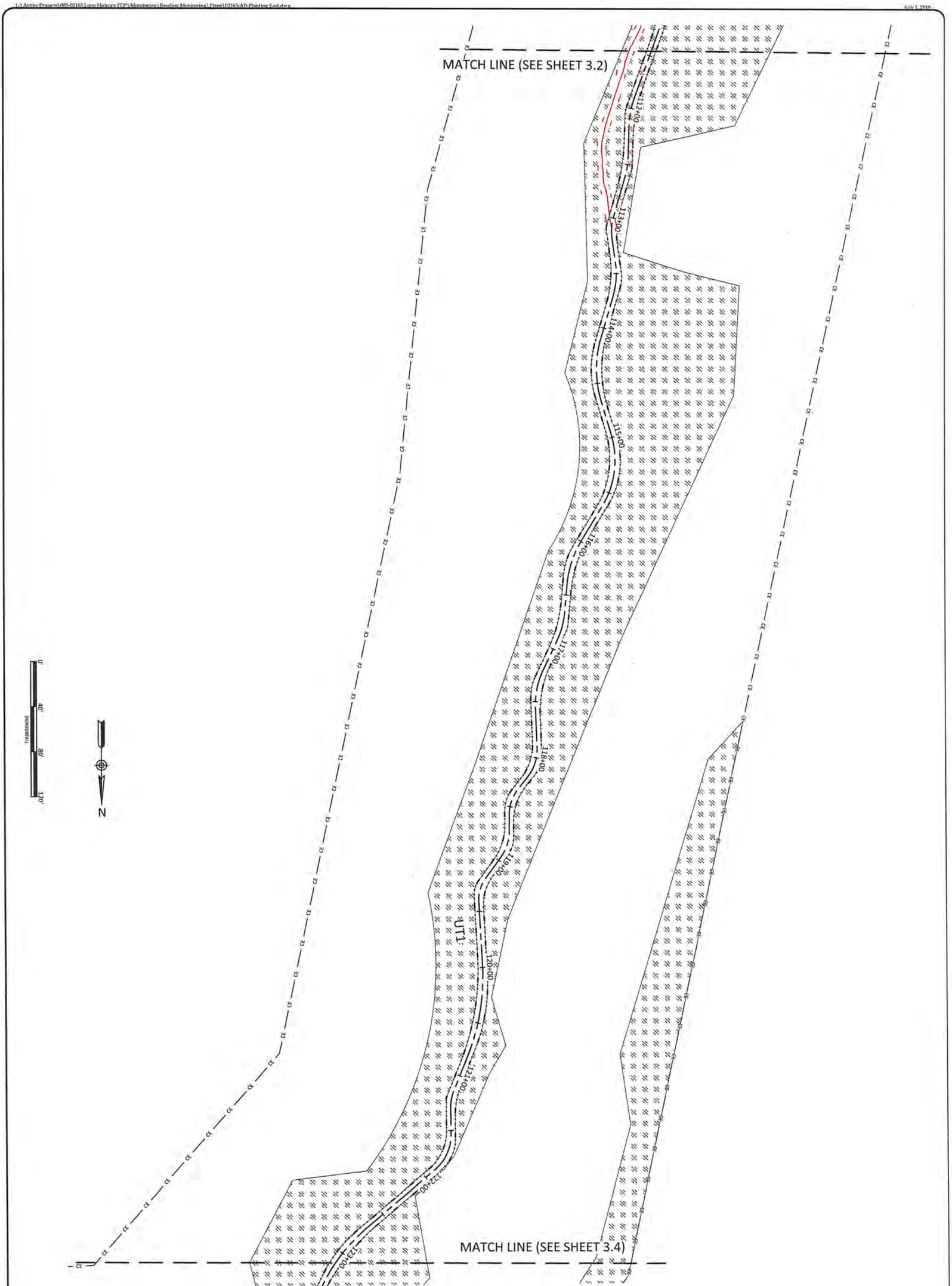

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Job Number:	005-02163
Project Engineer:	EGR
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Lone Hickory Mitigation Site Record Drawings
Yadkin County, North Carolina

UT1
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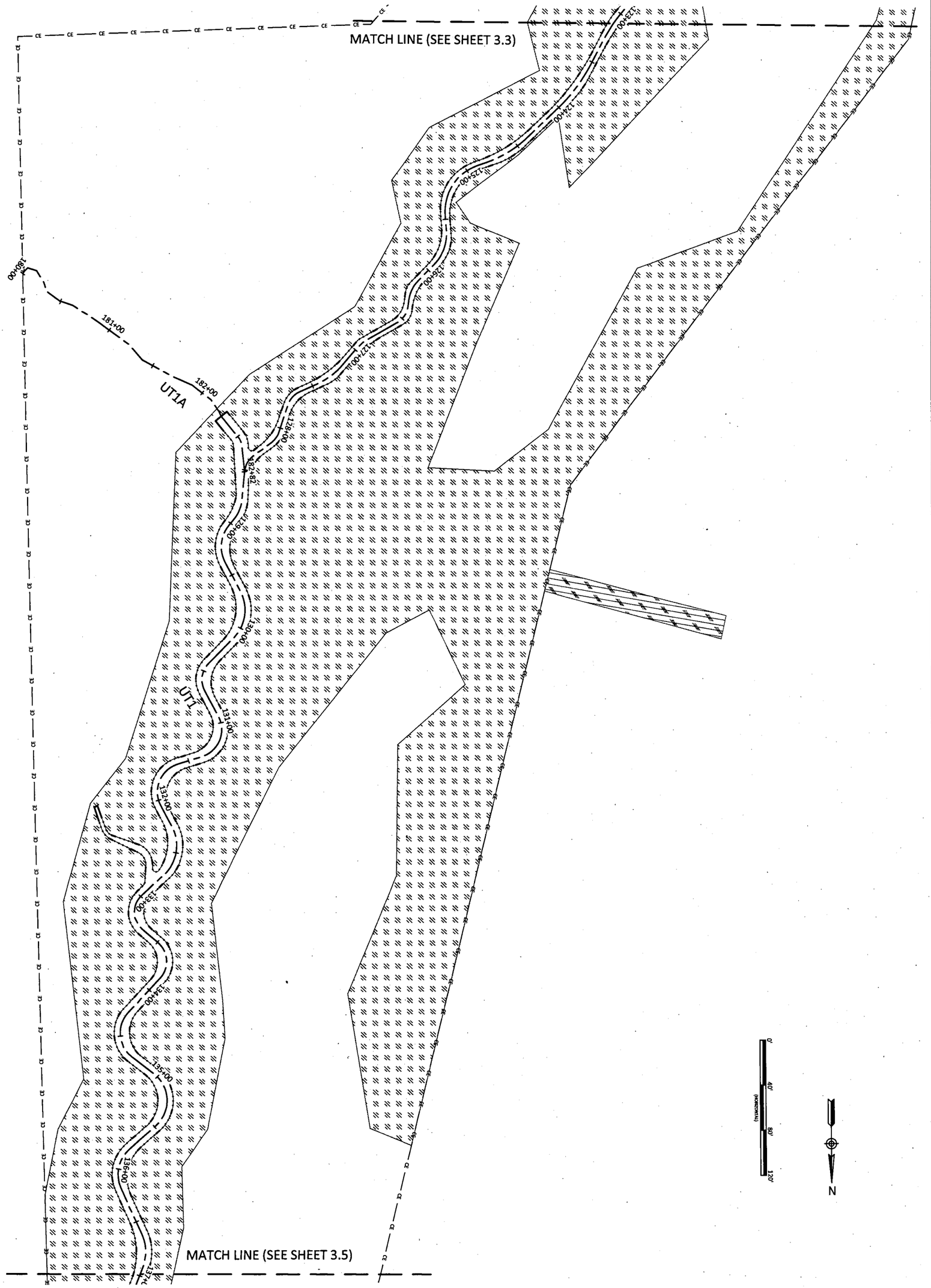

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Job Number:	005-02163
Project Engineer:	EGR
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Lone Hickory Mitigation Site Record Drawings
Yadkin County, North Carolina

UT1
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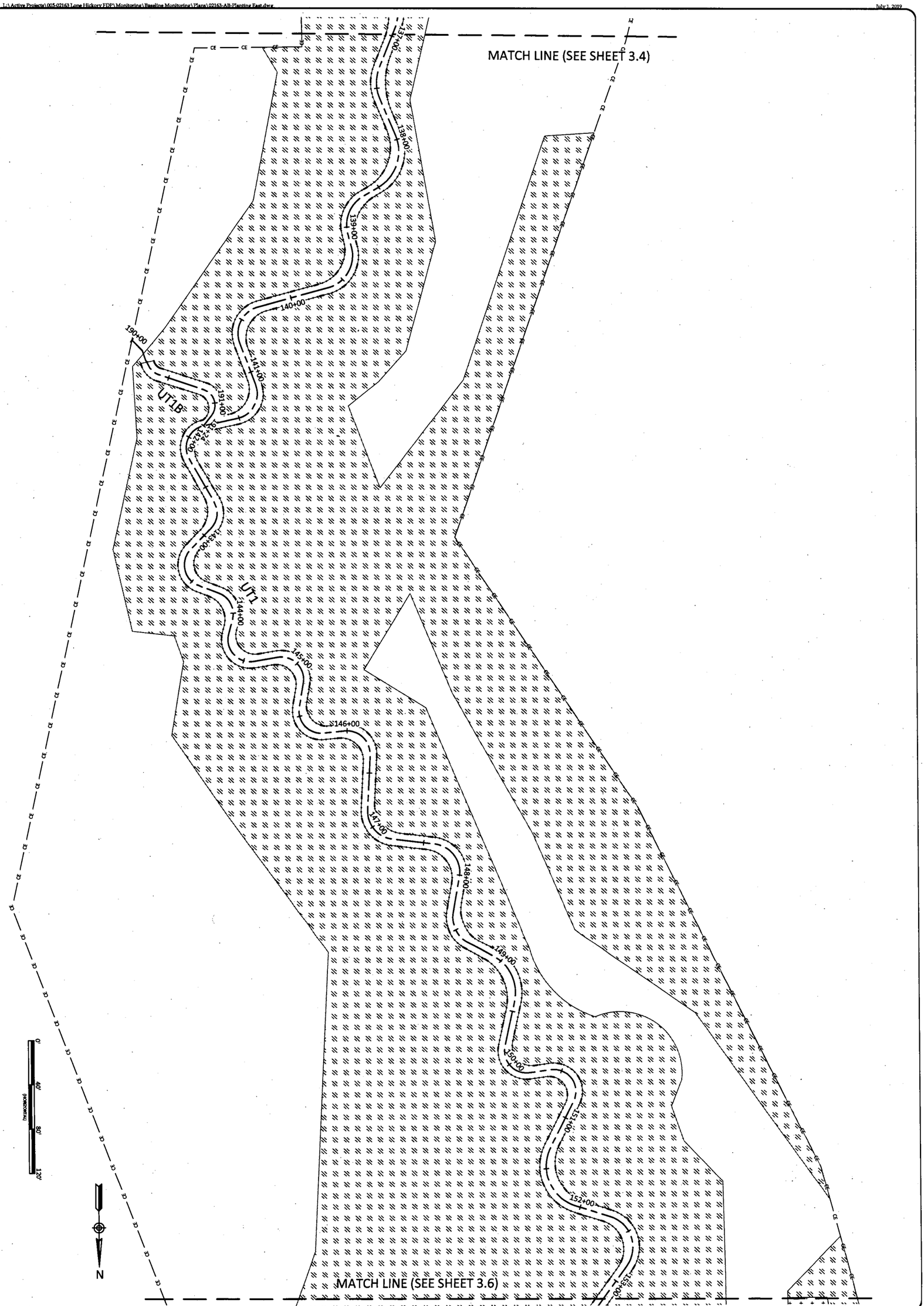

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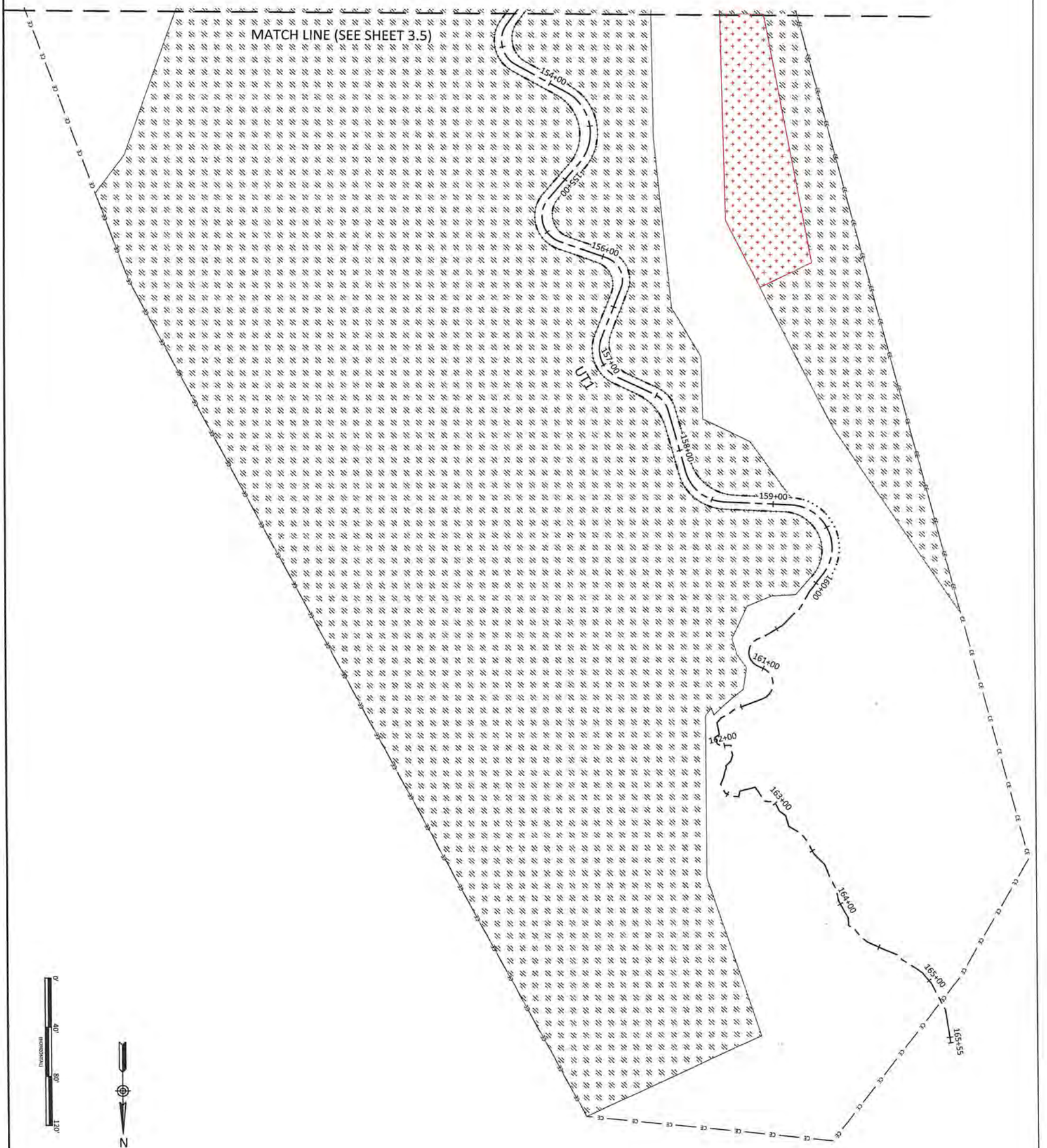

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Lone Hickory Mitigation Site Record Drawings
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UT1
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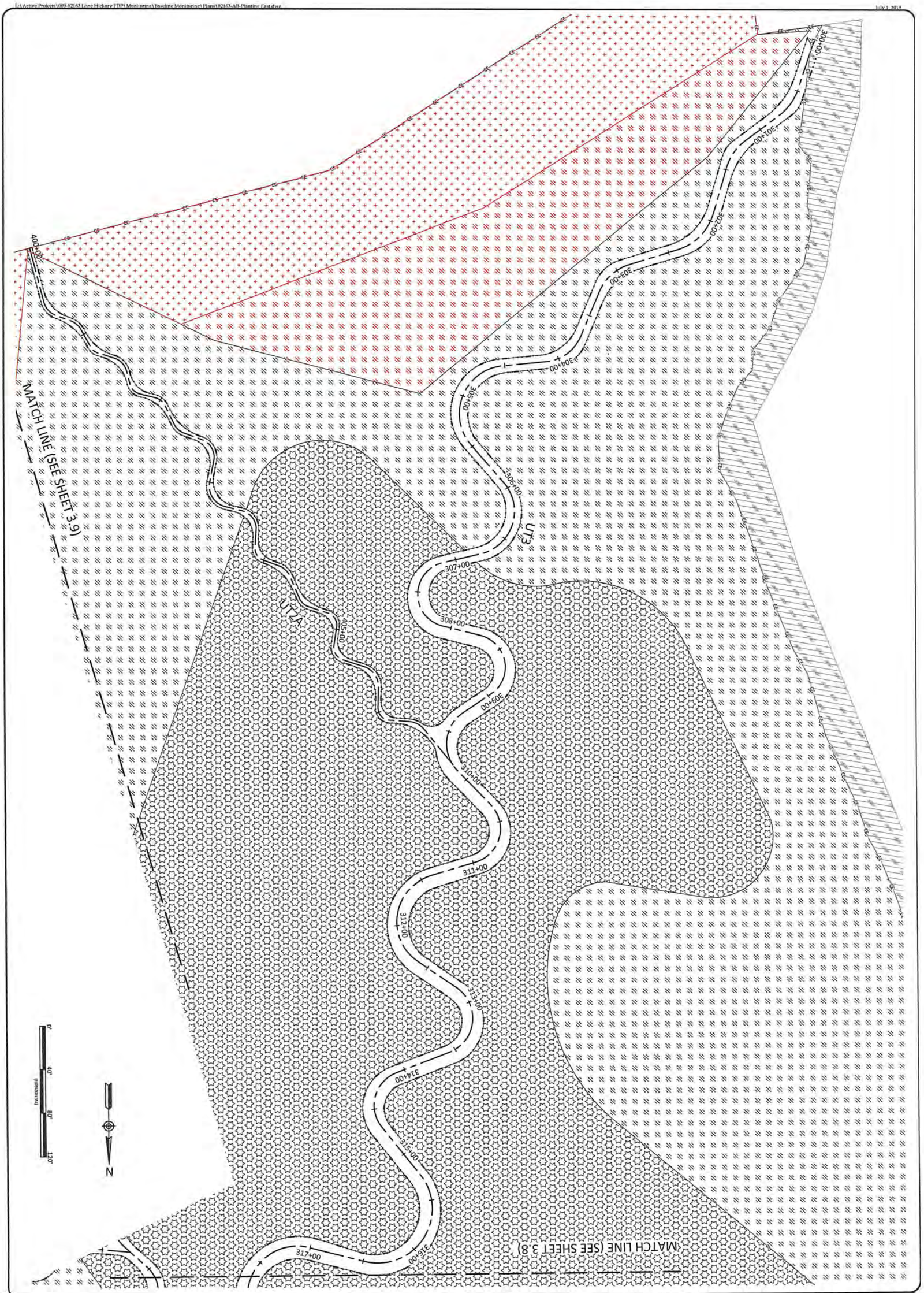

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UT3 and UT2A
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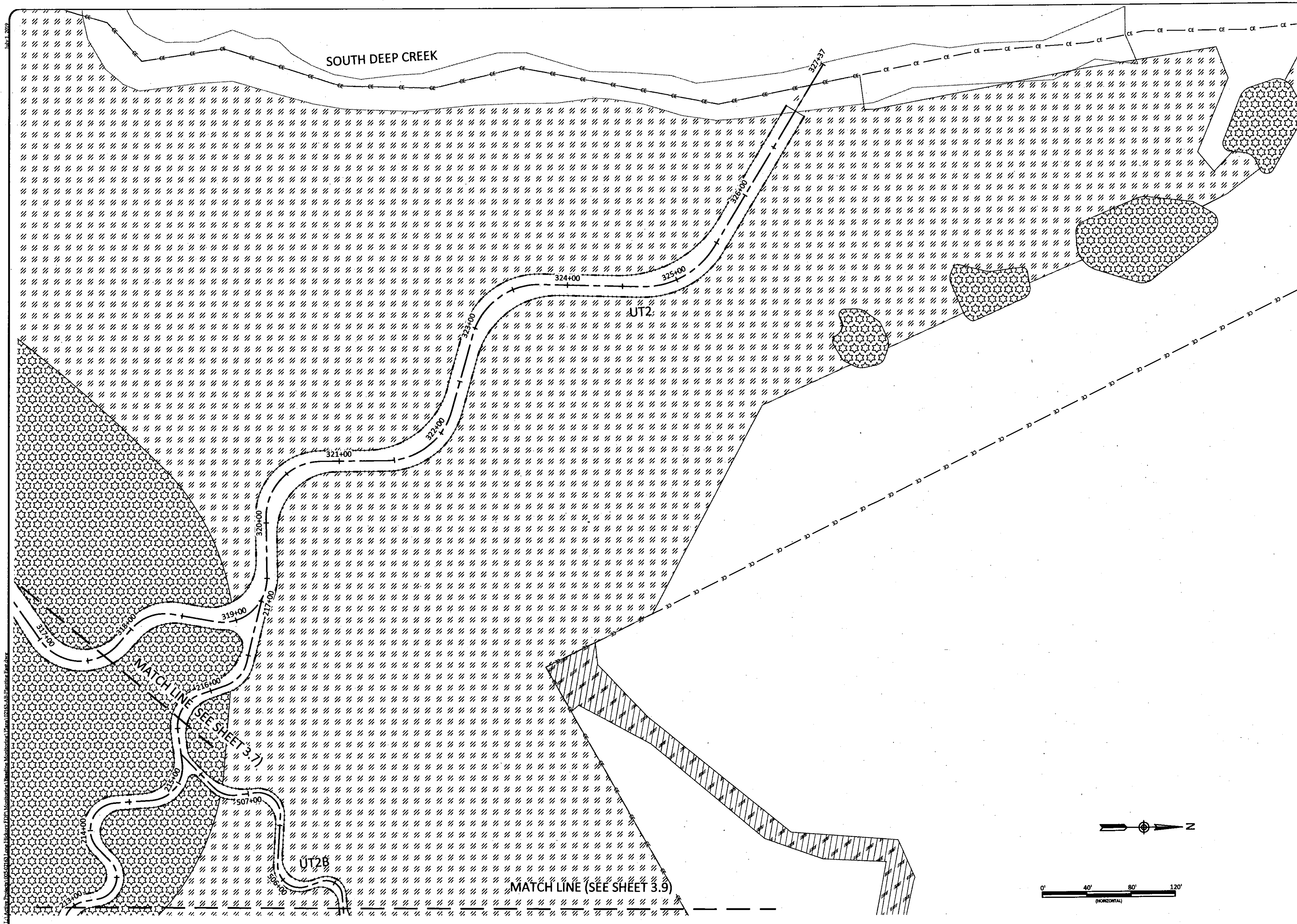

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Lone Hickory Mitigation Site Record Drawings
Yadkin County, North Carolina

UT3 and UT2B
Planting

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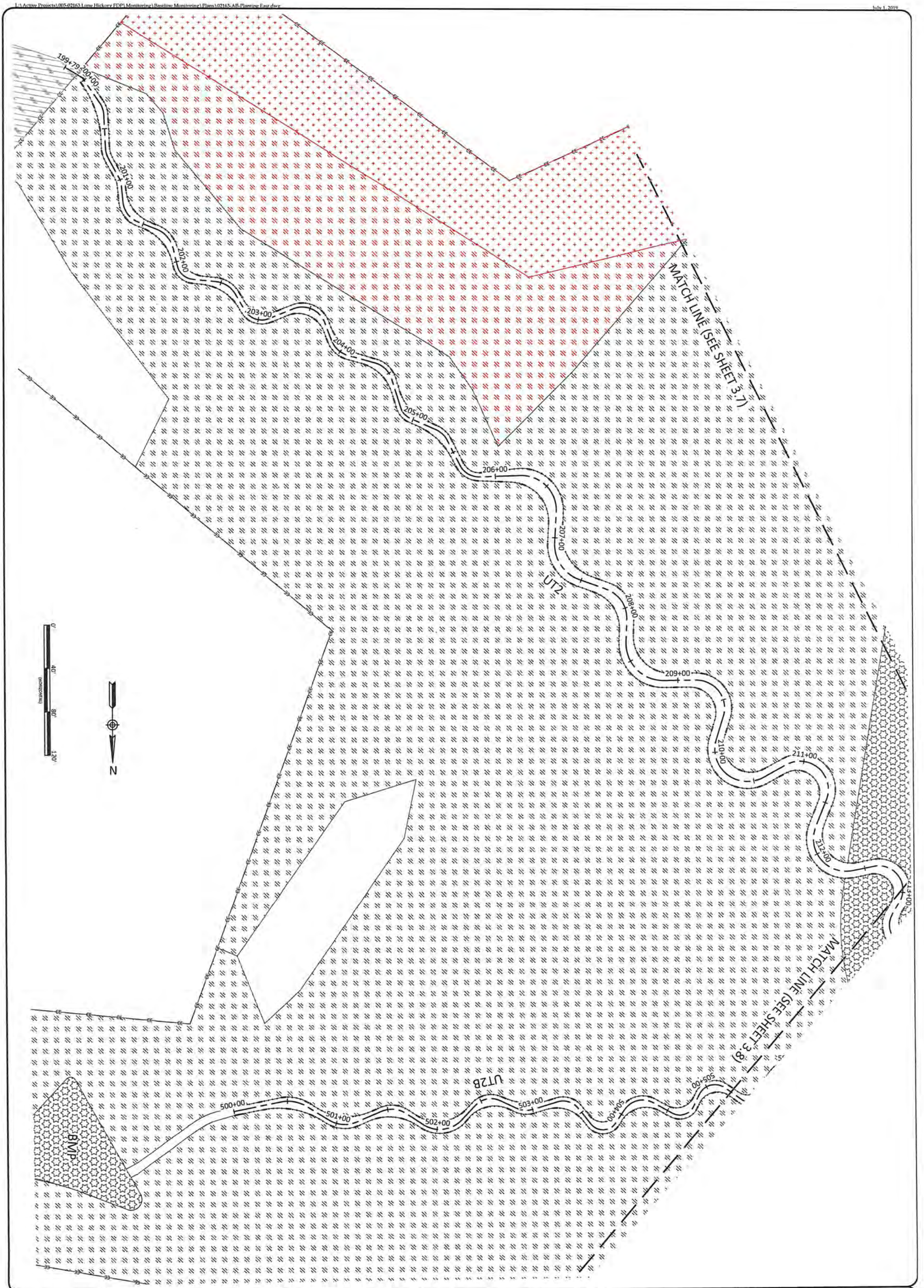

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Lone Hickory Mitigation Site Record Drawings
Yadkin County, North Carolina

UT2 and UT2B
Planting

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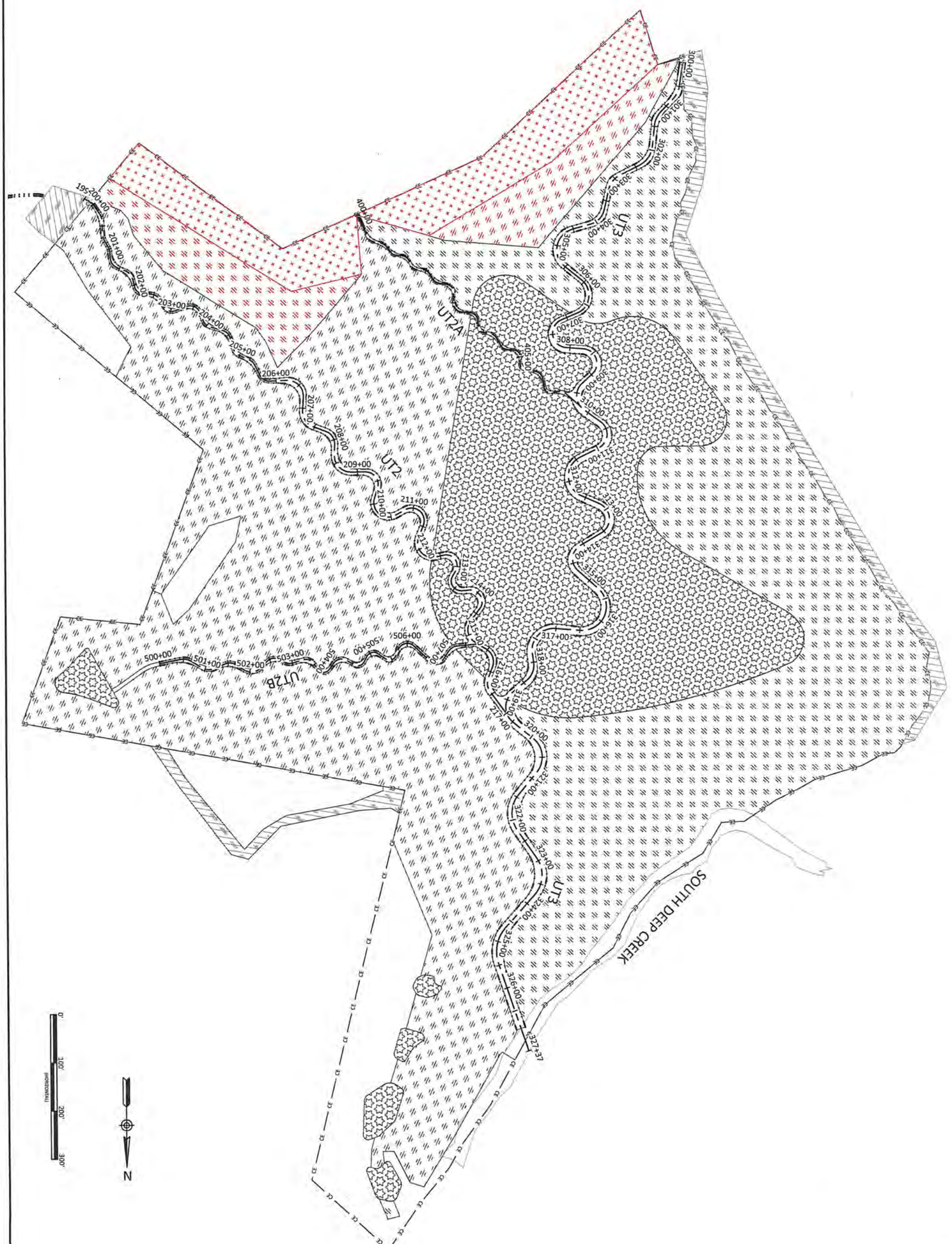

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Lone Hickory Mitigation Site Record Drawings
Yadkin County, North Carolina

West Side Overall Planting Plan
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