BASELINE MONITORING DOCUMENT AND AS-BUILT BASELINE REPORT

FINAL

CATFISH POND MITIGATION SITE

Durham County, NC
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PREPARED FOR:

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

PREPARED BY:

Wildlands Engineering, Inc.
312 West Millbrook Road, Suite 225
Raleigh, NC 27609

Jason Lorch
jlorch@wildlandseng.com
Phone: (919) 851-9986

EXECUTIVE SUMMARY

Wildlands Engineering, Inc. (Wildlands) implemented a full delivery project at the Catfish Pond Mitigation Site (Site) for the North Carolina Department of Environmental Quality Division of Mitigation Services (DMS). A total of 7,140 linear feet (LF) of perennial and intermittent streams were restored and enhanced in Durham County, NC. The Site is expected to generate 3,748.800 stream mitigation units (SMUs) when calculated along stream centerlines. The Site is located approximately 12 miles north of the City of Durham and approximately 3 miles east of the Orange/Durham County border (Figure 1). It is in the Neuse River Basin 8-Digit Hydrologic Unit Code (HUC) 03020201 and within a DMS targeted watershed for the Neuse River Basin Hydrologic Unit Code (HUC) 03020201020040 and NC Division of Water Resources (DWR) Subbasin 03-04-01. The Site contains Catfish Creek and 3 unnamed tributaries. The streams drain to Mountain Creek, which flows into Little River, the Eno River, and then Falls Lake. Falls Lake is classified as Water Supply Waters (WS-IV) and Nutrient Sensitive Waters (NSW). The 20.73-acre Site is protected with a permanent conservation easement.

The Site is located within the Targeted Local Watershed (TLW) as discussed in the 2010 Neuse River Basin Restoration Priorities (RBRP), which highlights the importance of riparian buffers for stream restoration projects (Breeding, 2010). Current and past degradation at the Site includes an in-line pond, extensive logging, farm road crossings, stream channelization, and livestock access to streams and buffers.

The project goals established in the Mitigation Plan (Wildlands, 2019) were completed with careful consideration of goals and objectives described in the Neuse River RBRP plan. The project goals established include:

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

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

Site construction and planting were completed in March and April 2020. As-built surveys were conducted in April 2020. The Site has been built as designed, with a few exceptions due to field conditions, and is expected to meet the upcoming monitoring year's performance criteria. 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, except where channel alignments were adjusted due to bedrock in a section of Catfish Creek Reach 6 and UT1 Reach 3. Cross-section widths and pool depths occasionally deviate from the design parameters but fall within a normal range of variability for natural streams.

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Section 1: PROJECT GOALS, BACKGROUND, AND ATTRIBUTES

1.1 Project Location and Setting

The Catfish Pond Mitigation Site (Site) is located in Durham County approximately 12 miles north of the City of Durham and approximately 3 miles east of the Orange/Durham County border (Figure 1). From Raleigh, NC, take I-40 West towards Durham. Take exit 279B for NC-147 N towards Durham/Downtown. Travel approximately 8 miles and exit onto Duke Street. Merge onto South Duke Street and continue 4.3 miles until South Duke Street merges with US-501 N/N Roxboro Street. Travel north on US-501 N/N Roxboro Street for 7.5 miles. Make a U-turn and travel south on N Roxboro Street for 0.2 miles, turn right on the first gravel road. Drive approximately 0.2 miles and take the first right onto another gravel road. The Site is located at the end of the gravel road. A conservation easement was recorded on 20.73 acres.

The Site is located within the Falls Lake Water Supply Watershed, which is within the Neuse River Basin. Both the Neuse River and Falls Lake have been designated as Nutrient Sensitive Water (NSW). The Site is within Hydrologic Unit Code (HUC) 03020201020040 and is located within the Neuse River Targeted Local Watershed (TLW) (Figure 1) as identified in the 2010 Neuse River Basin Restoration Priorities (RBRP) (Breeding, 2010). This document highlights the importance of riparian buffers for stream restoration projects. Riparian buffers immobilize and retain nutrients and suspended sediment. The RBRP also supports the Falls Lake watershed plan. Falls Lake is the receiving water supply water body downstream of the Site and is classified as WS-IV and NSW.

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

Prior to construction activities, one of the primary causes of degradation on the Site was the creation of an in-line pond on Catfish Creek Reach 6 sometime between 1940 and 1955. In that time period extensive logging and farm road construction also took place at the Site. Aerial photographs from 1972 suggest that portions of UT1 had been straightened for agricultural purposes. Catfish Creek above and below the pond, UT2, and Mountain Tributary showed few signs of channel manipulation. Table 4 in Appendix 1 and Tables 7a-b in Appendix 4 present additional information on pre-restoration conditions.

1.2 Project Goals and Objectives

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

Table 1: Mitigation Goals and Objectives – *Catfish Pond Mitigation Site*

Goal	Objective	Expected Outcomes	Function(s) Supported
Exclude cattle from project streams.	Install fencing around conservation easements adjacent to cattle pastures to remove livestock.	Reduce and control sediment inputs; reduce and manage nutrient inputs; reduce and manage fecal coliform inputs. Contribute to protection of or improvement to a Water Supply Waterbody.	Geomorphology, Physicochemical
Reconnect channels with floodplains and riparian wetlands to allow a natural flooding regime.	Reconstruct stream channels for bankfull dimensions and depth relative to the existing floodplain. Remove existing berms to re-connect channel with adjacent wetlands.	Raise water table and hydrate riparian wetlands. Allow more frequent flood flows to disperse on the floodplain. Support geomorphology and higher-level functions.	Hydraulic
Improve the stability of stream channels.	Construct stream channels that will maintain stable cross-sections, patterns, and profiles over time.	Significantly reduce sediment inputs from bank erosion. Reduce shear stress on channel boundary. Support all stream functions above hydrology.	Geomorphology
Improve instream habitat.	Install habitat features such as constructed riffles, cover/lunker logs, and brush toes into restored/enhanced streams. Add woody materials to channel beds. Construct pools of varying depth.	Increase and diversify available habitats for macroinvertebrates, fish, and amphibians leading to colonization and increase in biodiversity over time. Add complexity including LWD to streams.	Geomorphology (supporting Biology)
Restore and enhance native floodplain and streambank vegetation.	Plant native tree and understory species in riparian zone and plant appropriate species on streambank.	Reduce sediment inputs from bank erosion and runoff. Increase nutrient cycling and storage in floodplain. Provide riparian habitat. Add a source of LWD and organic material to stream. Support all stream functions.	Hydrology (local), Hydraulic, Geomorphology, Physicochemical, Biology
Permanently protect the project Site from harmful uses.	Establish conservation easements on the Site.	Protect Site from encroachment on the riparian corridor and direct impact to streams and wetlands. Support all stream functions.	Hydrology (local), Hydraulic, Geomorphology, Physicochemical, Biology

1.3 Project Structure, Restoration Type, and Approach

The Mitigation Plan was approved in July 2019. Construction activities were completed by Main Stream Earthwork, Inc. in March 2020. Kee Mapping and Surveying completed the baseline as-built survey and Bruton Natural Systems, Inc. completed planting in April 2020. Refer to Appendix 1 for detailed project activity, history, contact information, and watershed/Site background information.

1.3.1 Project Structure

The project will provide 3,748.800 stream mitigation units (SMUs). Changes in stream alignment on Catfish Creek Reach 6 due to bedrock in the floodplain reduced overall reach length by 10 lf. Refer to Figure 2, the Project Component/Asset Map for the stream restoration feature exhibits, and Table 1 in Appendix 1 for the project component and mitigation credit information for the Site.

1.3.2 Restoration Type and Approach

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

Table 2: Restoration Type and Approach Per Reach – *Catfish Pond Mitigation Site*

Stream	Reach	Primary Stressors/Impairments	Treatment Approach	Restoration Activity
Catfish Creek	R1	Livestock Access	Enhancement Level II	Bank Stabilization, Fencing
	R2	Livestock Access, Headcut, Lack of Riparian Vegetation	Enhancement Level II	Bank Stabilization, Fencing
	R3	Bank Erosion, Livestock Access	Enhancement Level II	Bank Stabilization, Fencing
	R4	Stream Channelization, Livestock Access	Restoration – Priority 1	Plan, Pattern, Profile, Replace Culvert, Fencing
	R5	Livestock Access, Incision Near Culvert at Upper End	Enhancement Level II	Step-pool Transition from Reach 4 to Existing Elevation
	R6	Farm Pond, Lack of Riparian Vegetation, Livestock Access	Restoration – Priority 1	Farm Pond Removal, Plan, Pattern, Profile, Fencing
	R7	Livestock Access, Bank Erosion, Lack of Riparian Vegetation	Enhancement Level II	Bank Stabilization, Constructed Riffle, Toe Protection
UT1	R1	Livestock Access, Bank Erosion, Lack of Riparian Vegetation	Enhancement Level II	Fencing, Bank Stabilization, Constructed Riffles
	R2	Livestock Access, Aggradation	Restoration – Priority 1	Plan, Pattern, Profile, Fencing
	R3	Livestock Access, Culvert, Rock Retaining Wall	Restoration – Priority 2	Plan, Pattern, Profile, Fencing
	R4	Livestock Access	Enhancement Level II	Bank Stabilization, Fencing
UT2		Livestock Access, Incision	Enhancement Level II	Fencing, Constructed Riffles
Mountain Tributary		Livestock Access, Bank Erosion, Lack of Habitat	Enhancement Level II	Fencing, Raise Streambed

The design approach for this Site employed a combination of analog and analytical approaches for stream restoration. Reference reaches were identified to serve as an acceptable range for design parameters. Channels were sized based on design discharge hydrologic analysis. Designs were then verified and/or modified based on a sediment transport analysis. This approach has been used on many successful Piedmont and Slate Belt restoration projects (e.g., Underwood, Foust, Holman Mill, Maney Farm, and Agony Acres Mitigation Sites) and is appropriate for the goals and objectives for this Site.

The morphologic design parameters are shown in Appendix 4, Tables 7a and 7b for the restoration reaches, and fall within the ranges specified for C4 and B4a streams (Rosgen, 1996). The specific values for the design parameters were selected based on designer experience and judgment and were verified with morphologic data form reference reach data sets.

1.4 Project History, Contacts, and Attribute Data

The Site was restored by Wildlands through a full delivery contract with DMS. Tables 2, 3, and 4 in Appendix 1 provide detailed information regarding the Project Activity and Reporting History, Project Contacts, and Project Information and Attributes.

Section 2: PERFORMANCE STANDARDS

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

2.1 Stream

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. Per DMS guidance, bank height ratios shall not exceed 1.2 and entrenchment ratios shall be at least 2.2 for restored C channels and no less than 1.4 for B channels to be considered stable. All riffle cross-sections should fall within the parameters defined for channels of the design 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. Changes in the channel that indicate a movement toward stability or enhanced habitat include a decrease in the width-to-depth ratio in meandering channels or an increase in pool depth. Remedial action would not be taken if channel changes indicate a movement toward stability.

2.1.2 Pattern and Profile

Longitudinal profile surveys will not be conducted 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 NCIRT Wilmington District Stream and Wetland Compensatory Mitigation Update (2016) and the 2003 USACE and NCDWR Stream Mitigation Guidance for the necessary reaches. Visual assessments and photo documentation should indicate that streams are remaining stable and do not indicate a trend toward vertical or lateral instability. 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.

2.1.3 Substrate

Channel substrate materials will be sampled in the four restoration reaches (Catfish Creek Reach 4 and 6 and UT1 Reach 2 and 3) using the reach-wide pebble count method. Reaches should show maintenance of coarser substrate in the riffles than in the pools. Riffle cross-section pebble counts were conducted during as-built baseline monitoring and will not be conducted during annual monitoring unless observations indicate a trend toward finer substrate and a comparison is needed.

2.1.4 Photo Documentation

Photographs should illustrate the Site's vegetation and morphological stability on an annual basis. Cross-section photos should demonstrate no excessive erosion or degradation of the banks. Longitudinal photos should indicate the absence of persistent 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 seven-year monitoring period. Stream monitoring will continue until performance standards in the form of four bankfull events in separate years have been documented.

2.2 Wetlands

Wildlands installed four groundwater wells at locations requested by the NCIRT in comments made on June 26, 2019. One is along Catfish Creek Reach 4 and three are along UT1 Reach 2. Although there is no pre-construction wetland data for comparison, the purpose of the data from these groundwater wells is to assess potential impacts to existing wetland hydrology from the project. Results are not tied to success criteria nor stream crediting. It is expected that the project will result in a net increase in wetland quality.

2.3 Vegetation

Vegetative performance for riparian buffers associated with the stream restoration component of the project (buffer widths 0 – 50 feet) will be in accordance with the Stream Mitigation Guidelines issued October 2016 by the NCIRT. The success criteria are an interim survival rate of 320 planted stems per acre at the end of monitoring year three (MY3), 260 stems per acre at the end of monitoring year 5 (MY5), and a final vegetation survival rate of 210 stems per acre at the end of monitoring year 7 (MY7). Trees should also average 7 feet in height at MY5 and 10 feet in height at MY7. No one species shall account for more than 50% of the required number of stems within any vegetation plot at the end of MY7.

The extent of invasive species coverage will be monitored and treated as necessary throughout the required monitoring period.

2.4 Visual Assessment

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

2.5 Schedule and Reporting

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

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

Section 3: MONITORING PLAN

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

3.1 Stream

Geomorphic assessments will follow guidelines outlined in the Stream Channel Reference Sites: An Illustrated Guide to Field Techniques (Harrelson et al., 1994), methodologies utilized in the Rosgen stream assessment and classification document (Rosgen, 1994 and 1996), and in the Stream Restoration: A Natural Channel Design Handbook (Doll et al, 2003). Refer to Figure 3 in Appendix 2 and Record Drawings in Appendix 5 for monitoring locations discussed below.

3.1.1 Dimension

A total of seven cross-sections were installed along the stream restoration reaches. Two cross-sections were installed per 1,000 linear feet of stream restoration work. Each cross-section was permanently marked with pins to establish its location. Cross-section surveys include points measured at all breaks in slope; including top of bank, bankfull, edge of water, and thalweg to monitor any deviations in dimension. If moderate bank erosion is observed along a stream reach during the monitoring period, a series of bank pins will be installed in representative areas where erosion is occurring for reaches with a bankfull width of greater than five feet. Bank pins will be installed in at least three locations (one in upper third of the pool, one at the mid-point of the pool, and one in the lower third of the pool). If bank pins are required, exposure will be documented during each bank assessment and bank pins will be re-set flush with the bank. Cumulative measurements will be assessed annually to document the severity of bank erosion. Annual cross-section surveys will be conducted in MY1, MY2, MY3, MY5, and MY7. Photographs will be taken annually of the cross-sections looking upstream and downstream.

3.1.2 Pattern and Profile

Longitudinal profile surveys will not be conducted during the seven-year monitoring period unless other indicators during the annual monitoring show a trend toward vertical and lateral instability. If a longitudinal profile is deemed necessary, monitoring will follow standards as described in the NCIRT Wilmington District Stream and Wetland Compensatory Mitigation Update (2016) and the 2003 USACE and NCDWR Stream Mitigation Guidance for the necessary reaches. Stream pattern and profile will be assessed visually as described below in section 3.4.

3.1.3 Substrate

A reach-wide pebble count will be performed in the four restoration reaches (Catfish Creek Reach 4 and 6 and UT1 Reach 2 and 3) during monitoring years 1, 2, 3, 5, and 7 for classification purposes and to show that riffles remain coarser than pools. Riffle cross-section pebble counts were conducted during as-built baseline monitoring only unless observations indicate a trend toward finer substrate and a comparison is needed.

3.1.4 Photo Documentation

A total of 20 permanent photograph reference points were established along the stream reaches after construction. Permanent markers were established so that the same locations and view directions on the Site are photographed each year. Longitudinal stream photographs will be taken looking upstream and downstream once a year to visually document stability. Cross-sectional photos will be taken at each permanent cross-section looking upstream and downstream. The photographer will make every effort to consistently maintain the same area in each photo over time.

3.1.5 Hydrology Documentation

Two automated crest gauges were installed on Site. The crest gauges were installed in surveyed riffle cross-sections on Catfish Creek Reach 6 and UT1 Reach 2 (cross-sections 3 and 6). Crest gauge data will be downloaded quarterly to determine if a bankfull event has occurred.

3.2 Wetlands

Four groundwater monitoring wells equipped with pressure transducers were installed to assess hydrology in wetland areas. Pressure transducers will record groundwater pressure at least twice daily. Data from the wells will be downloaded at regular intervals and included in annual monitoring reports for informational purposes only. Results are not tied to success criteria nor stream crediting. It is expected that the project will result in a net increase in wetland quality. Groundwater well locations are shown in Appendix 2 Figure 3.

3.3 Vegetation

Planted woody vegetation will be monitored in accordance with the guidelines and procedures developed by the Carolina Vegetation Survey-EEP Level 2 Protocol (Lee et al., 2008) to monitor and assess the planted woody vegetation. A total of eight standard 10-meter by 10-meter vegetation plots and one 5-meter by 20-meter vegetation plot were established within the project easement area, seven fixed and two random.

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

A new center point will arbitrarily be chosen each year within the conservation easement planted areas for the two random vegetation plots. Trees within a 100 square meter area will be measured and assessed as described below.

Species composition, density, and survival rates will be evaluated on an annual basis by plot and for the entire Site. Individual plot data will be provided and will include height, density, vigor, damage (if any), and survival. Mortality will be determined from the difference between the baseline year's living planted stems and the current year's living planted stems. Vegetation surveys will be conducted during monitoring years 1, 2, 3, 5, and 7.

3.4 Visual Assessment

Visual assessments will be performed along all stream restoration and enhancement areas on a semi-annual basis during the seven-year monitoring period. Problem areas will be noted such as channel

instability (i.e. lateral and/or vertical instability, in-stream structure failure/instability and/or piping, or headcuts), vegetation health (i.e. low stem density, vegetation mortality, invasive species or encroachment), beaver activity, or livestock access. Areas of concern will be mapped and accompanied by a written description in the annual report. Problem areas will be re-evaluated during each subsequent visual assessment. Should remedial actions be required, recommendations will be provided in the annual monitoring report.

Section 4: MAINTENANCE AND CONTINGENCY PLAN

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

4.1 Stream

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

4.2 Vegetation

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

4.3 Site Boundary

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

Section 5: AS-BUILT CONDITION (BASELINE)

The Site construction was completed in March 2020 and as-built surveys were completed in April 2020. The survey included developing an as-built topographic surface; as well as surveying the as-built channel centerlines, top of banks, structures, and cross-sections. For comparison purposes, baseline monitoring divided the reach assessments in the same way they were established for design parameters: Catfish Creek Reaches 1-7, UT1 Reaches 1-4, UT2, and Mountain Tributary.

5.1 As-Built/Record Drawings

A sealed half-size set of record drawings are in Appendix 5 which includes the post-construction survey, alignments, structures, and monitoring features. These include redlines for any significant field adjustments made during construction that differ from the design plans. Where needed, adjustments were made during construction based on field evaluation and are listed below.

5.1.1 Catfish Creek Reach 4

- Station 113+00 culvert installed based on dimensions listed in details of construction plan sheets.

5.1.2 Catfish Creek Reach 6

- Station 118+30 log sill removed due to stability at head of riffle and stream banks during construction;
- Station 119+76 rock sill removed due to bedrock in channel;
- Station 119+81 through 121+90 deviation of alignment due to bedrock in floodplain; and
- Station 122+54 reach break moved upstream from 122+71 due to bedrock in channel and to minimize tree clearing during construction.

5.1.3 UT1 Reach 2

- No significant changes made.

5.1.4 UT1 Reach 3

- Station 217+10 riffle and rock sill not constructed due to bedrock in field; and
- Station 217+38 riffle and rock sill shifted upstream 10 LF due to bedrock in field.

5.2 Baseline Data Assessment

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

5.2.1 Morphological State of the Channel

Morphological data for the as-built profile was collected in March and April 2020. Refer to Appendix 2 for stream photographs and Appendix 4 for summary data tables and morphological plots.

Profile

The MY0 longitudinal profiles closely match the design profile on Catfish Creek Reach 4 and UT1 Reach 2. Bedrock within the floodplain resulted in a section of Catfish Creek Reach 6 to be realigned and some adjustments to be made on UT1 Reach 3 but the overall slope is consistent with design. The bedrock would not allow for as many pools as were designed, this resulted in a predominantly riffle section on Catfish Creek Reach 6. On the design profiles, pools and riffles were depicted as straight lines with

consistent slopes. The as-built surveyed profiles are not as consistent in slope due to natural deposition, scour, and bedrock. Pool and riffle depths and slopes are expected to be maintained near design parameter values. The variations in slope and depth do not constitute a problem or indicate a need for remedial actions and will be assessed visually during site walks.

Dimension

The MY0 channel dimensions are within an acceptable range of the design parameters. The channels are expected to maintain dimensions of C4 or B4a Rosgen type channels. Summary data and cross-section plots of each project reach are included in Appendix 4.

Pattern

The MY0 pattern metrics fall within an acceptable range of the design parameters. No major changes to design alignments were made during construction on Catfish Creek Reach 4 and UT1 Reach 2 and 3. Catfish Creek Reach 6 had to be re-aligned between station 119+81 and 121+90 due to bedrock in the floodplain. Pattern data will be evaluated in monitoring year five if channel dimensions or profile indicate that significant geomorphic changes have occurred.

Sediment Transport

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

5.2.2 Hydrology

Bankfull events recorded following completion of construction will be reported in the MY1 report.

5.2.3 Wetlands

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

5.2.4 Vegetation

The MY0 vegetation survey was completed in April 2020. The MY0 planted density is 553 stems per acre which exceeds the MY3 interim stem density requirement of 320 planted stems per acre. Vegetation plot photographs are included in Appendix 2 and summary data for each plot are included in Tables 6a and 6b in Appendix 3.

Section 6: REFERENCES

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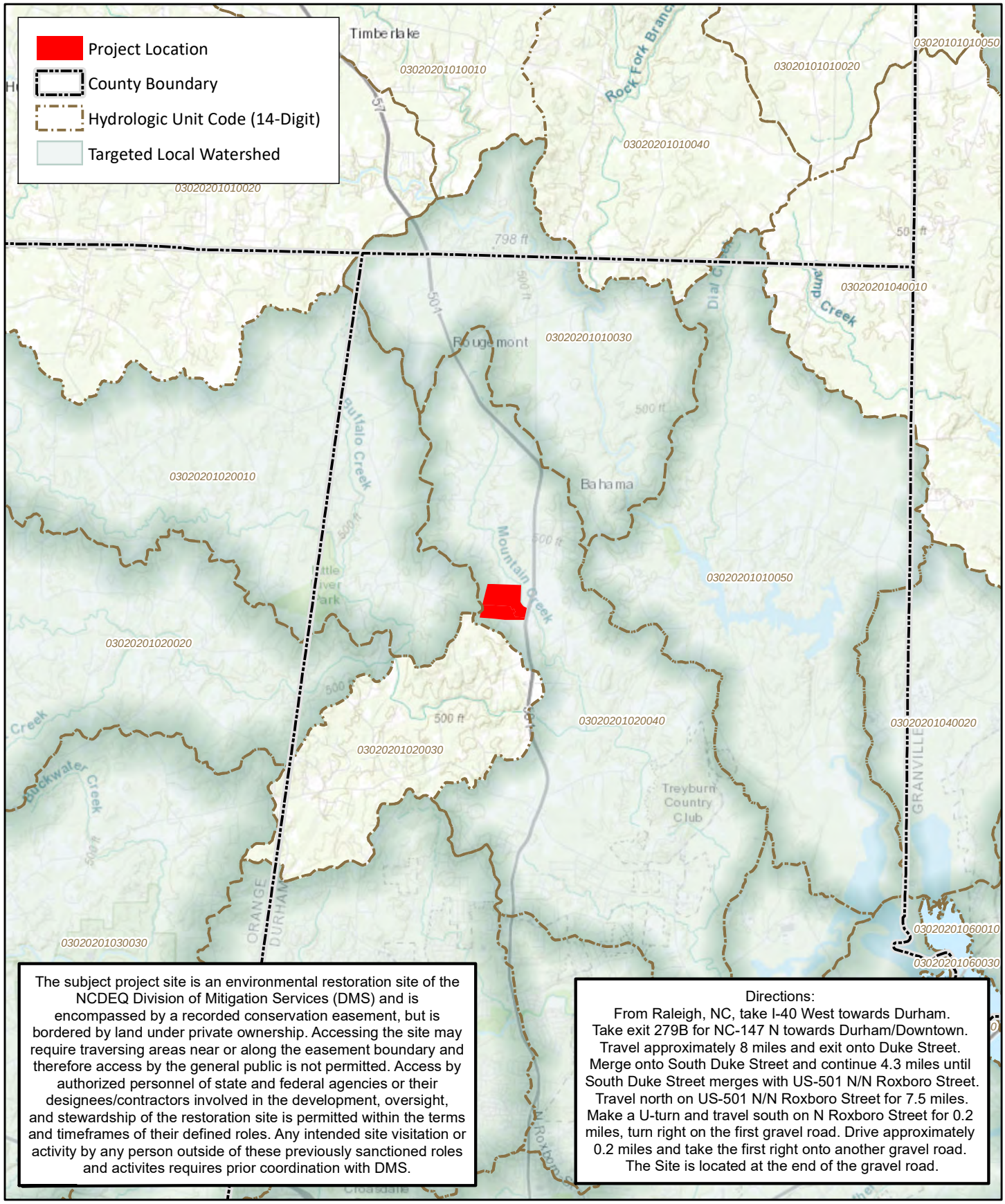
APPENDIX 1. General Figures and Tables



The subject project site is an environmental restoration site of the NCDEQ 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.

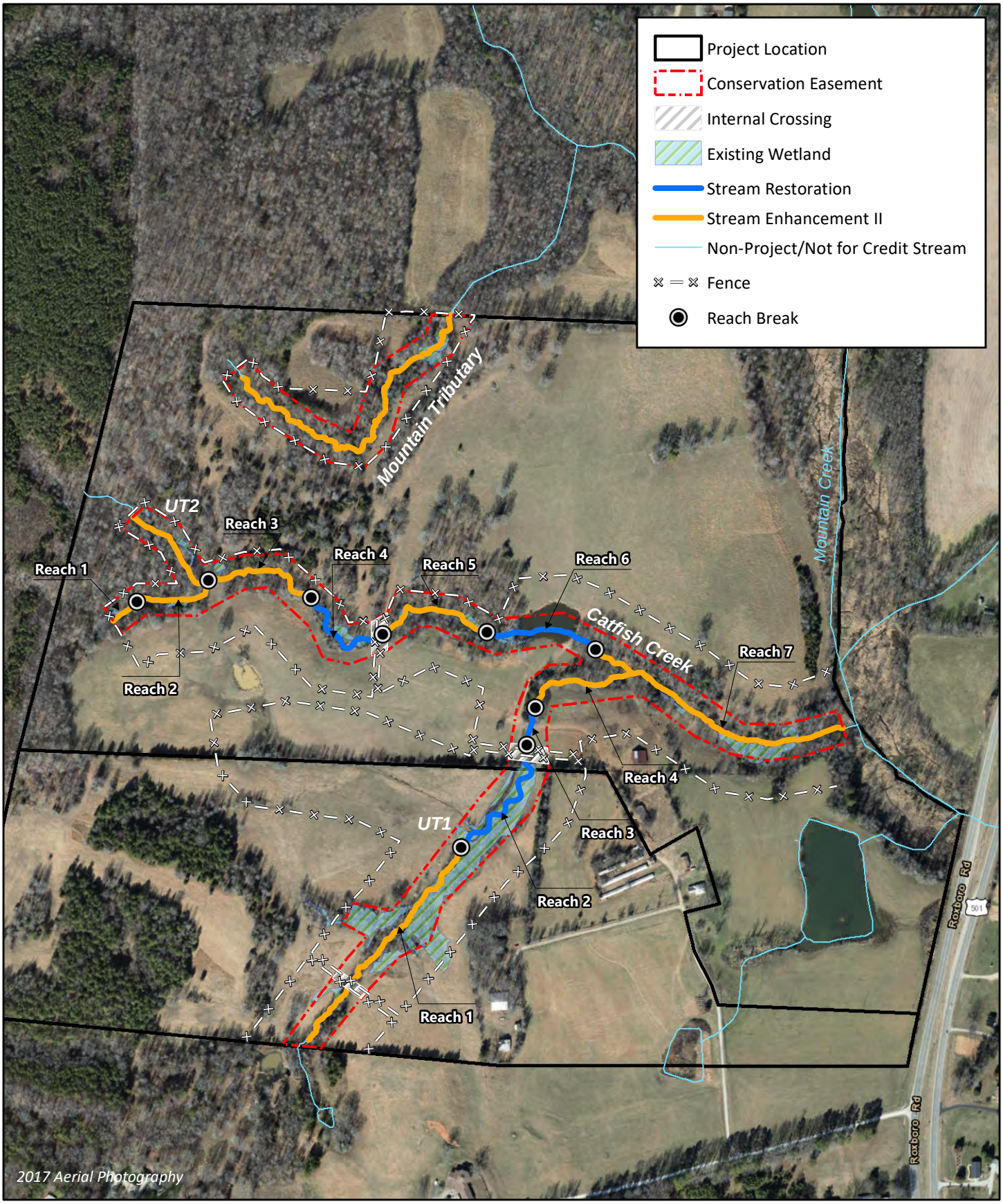
Directions:
From Raleigh, NC, take I-40 West towards Durham. Take exit 279B for NC-147 N towards Durham/Downtown. Travel approximately 8 miles and exit onto Duke Street. Merge onto South Duke Street and continue 4.3 miles until South Duke Street merges with US-501 N/N Roxboro Street. Travel north on US-501 N/N Roxboro Street for 7.5 miles. Make a U-turn and travel south on N Roxboro Street for 0.2 miles, turn right on the first gravel road. Drive approximately 0.2 miles and take the first right onto another gravel road. The Site is located at the end of the gravel road.

WILDLANDS ENGINEERING

0 1 2 Miles

N

Figure 1. Project Vicinity Map
Catfish Pond Mitigation Site
DMS Project No. 100039
Monitoring Year 0 – 2020
Durham County, NC



WILDLANDS ENGINEERING

0 250 500 Feet

N

Figure 2. Project Component/Asset Map
Catfish Pond Mitigation Site
DMS Project No. 100039
Monitoring Year 0 – 2020

Durham County, NC

Table 1. Mitigation Assets and Components
Catfish Pond Mitigation Site
DMS Project No. 100039
Monitoring Year 0 - 2020

PROJECT COMPONENTS								
Reach ID	**Existing Footage**	**Mitigation Plan Footage**	**Mitigation Category**	**Restoration Level**	**Priority Level**	**Mitigation Ratio (X:1)**	**As-Built Footage**	**Comments**
STREAMS								
Catfish Creek Reach 1	115	115	Warm	EII	N/A	2.5	115	Invasive Control, Conservation Easement
Catfish Creek Reach 2	323	323	Warm	EII	N/A	2.5	323	Invasive Control, Grade Control Structures, Planted Buffer, Livestock Exclusion
Catfish Creek Reach 3	474	473	Warm	EII	N/A	2.5	474	Invasive Control, Grade Control Structures, Planted Buffer, Livestock Exclusion
Catfish Creek Reach 4	369	374	Warm	R	P1	1.0	373	Full Channel Restoration, Planted Buffer, Livestock Exclusion
	65	72	N/A	N/A	N/A	0.0	72	Culvert Crossing
Catfish Creek Reach 5	459	460	Warm	EII	N/A	2.5	460	Grade Control Structures, Planted Buffer, Livestock Exclusion, Conservation Easement
Catfish Creek Reach 6	466	454	Warm	R	P1	1.0	444	Full Channel Restoration, Planted Buffer, Livestock Exclusion, Farm Pond Drained
Catfish Creek Reach 7	1,087	1,071	Warm	EII	N/A	2.5	1,087	Invasive Control, Grade Control Structures, Planted Buffer, Livestock Exclusion
UT1 Reach 1	307	263	Warm	EII	N/A	2.5	263	Invasive Control, Planted Buffer, Livestock Exclusion
	42	42	N/A	N/A	N/A	0.0	42	Culvert Crossing
	717	717	Warm	EII	N/A	2.5	711	Invasive Control, Planted Buffer, Livestock Exclusion
UT1 Reach 2	430	515	Warm	R	P1	1.0	520	Full Channel Restoration, Planted Buffer, Livestock Exclusion
	60	60	N/A	N/A	N/A	0.0	61	Culvert Crossing
UT1 Reach 3	154	149	Warm	R	P2	1.0	149	Full Channel Restoration, Planted Buffer, Livestock Exclusion
UT1 Reach 4	447	446	Warm	EII	N/A	2.5	446	Invasive Control, Planted Buffer, Livestock Exclusion
UT2	412	412	Warm	EII	N/A	2.5	412	Invasive Control, Grade Control Structures, Livestock Exclusion
Mountain Tributary	1,362	1,362	Warm	EII	N/A	2.5	1,362	Invasive Control, Grade Control Structures, Planted Buffer, Livestock Exclusion

PROJECT CREDITS							
Restoration Level	**Stream**			**Riparian Wetland**		**Non-Riparian**	**Coastal Marsh**
	Warm	**Cool**	**Cold**	**Riverine**	**Non-Riverine**		
Restoration	1,482.000						
Enhancement I							
Enhancement II	2,263.200						
Preservation							
Re-Establishment							
Rehabilitation							
Enhancement							
Creation							
Total*	**3,748.800**						

*Credits have been adjusted to include changes in stream alignment on Catfish Creek Reach 6 due to bedrock in the floodplain.

Table 2. Project Activity and Reporting History
Catfish Pond Mitigation Site
DMS Project No. 100039
Monitoring Year 0 - 2020

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

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

Table 3. Project Contact Table
Catfish Pond Mitigation Site
DMS Project No. 100039
Monitoring Year 0 - 2020

Designer Daniel Johnson, PE	**Wildlands Engineering, Inc.** 497 Bramson Ct, Suite 104 Mt. Pleasant, SC 29464 843.277.6221
Construction Crew	**Main Stream Earthwork, Inc.** 631 Camp Dan Valley Rd Reidsville, NC 27320
Planting Contractor	**Bruton Natural Systems, Inc** P.O. Box 1197 Fremont, NC 27830
Seeding Contractor	**Canady's Landscaping & Erosion** 256 Fairview Acres Rd Lexington, NC 27295
Seed Mix Sources	**Garrett Wildflower Seed Farm** 1591 Cleveland Rd Smithfield, NC 27577
	Ernst Conservation Seeds, Inc. 8884 Mercer Pike Meadville, PA 16335
Nursery Stock Suppliers **Bare Roots**	**Dykes and Sons Nursery and Greenhouse** 825 Maude Etter Rd McMinnville, TN 37110
Live Stakes	**Bruton Natural Systems, Inc**
	Foggy Mountain Nursery 797 Helton Creek Rd Lansing, NC 28643
Monitoring Performers	**Wildlands Engineering, Inc.**
Monitoring, POC	Jason Lorch 919.851.9986

Table 4. Project Information and Attributes
Catfish Pond Mitigation Site
DMS Project No.100039
Monitoring Year 0 - 2020

PROJECT INFORMATION	
Project Name	Catfish Pond Mitigation Site
County	Durham County
Project Coordinates (latitude and longitude)	36° 9' 48.03" N, 78° 54' 37.66" W
Project Area (acres)	20.73
Planted Acerage (acres of woody stems planted)	8.00

PROJECT WATERSHED SUMMARY INFORMATION	
Physiographic Province	Carolina Slate Belt of the Piedmont Physiographic Province
River Basin	Neuse River
USGS Hydrologic Unit 8-digit	03020201
USGS Hydrologic Unit 14-digit	03020201020040
DWR Sub-basin	03-04-01
Project Drainiage Area (acres)	227 (Catfish Creek - 197, Mountain Tributary - 30)
Project Drainage Area Percentage of Impervious Area	0.0%
CGIA Land Use Classification	45.6% forested, 54.2% cultivated, 0.2% wetland

REACH SUMMARY INFORMATION

Parameters	Catfish Creek						
	R1	R2	R3	R4	R5	R6	R7
Length of Reach (linear feet) - Post-Restoration	115	323	474	373	460	444	1,087
Valley Confinement (confined, moderately confined, unconfined)	Confined	Confined	Confined	Unconfined	Moderately Confined	Moderately Confined	Moderately Confined
Drainage Area (acres)	17	17	53	56	61	70	197
Perennial, Intermittent, Ephemeral	I	P	P	P	P	P	P
NCDWR Stream Identification Score	35.00	---	30.00	45.25	---	---	---
NCDWR Water Quality Classification	WS-II/HQW/NSW						
Morphological Description (stream type) - Pre-Restoration	E5b/E4b	E5b/E4b	E4	Incised E6	C4b	N/A	C4b
Morphological Description (stream type) - Post-Restoration	E5b/E4b	E5b/E4b	E4	C4	C4b	B4a	C4b
Evolutionary Trend (Simon's Model) - Pre-Restoration	IV	IV	IV	IV	IV	N/A	V
FEMA Classification	None						Zone AE

Parameters	UT1				UT2	Mountain Tributary
	R1	R2	R3	R4		
Length of Reach (linear feet) - Post-Restoration	974	520	149	446	412	1,362
Valley Confinement (confined, moderately confined, unconfined)	Unconfined	Moderately Confined	Moderately Confined	Confined	Confined	Moderately Confined
Drainage Area (acres)	75	105	107	108	32	30
Perennial, Intermittent, Ephemeral	P	P	P	P	I	I
NCDWR Stream Identification Score	31.50				26.00	26.00
NCDWR Water Quality Classification	WS-II/HQW/NSW					
Morphological Description (stream type) - Pre-Restoration	E4	C6	E4b	E4b	C3b/C4b	E4b
Morphological Description (stream type) - Post-Restoration	E4	C4	B4a	E4b	C3b/C4b	E4b
Evolutionary Trend (Simon's Model) - Pre-Restoration	IV	V	IV	IV	IV	IV
FEMA Classification	None					

REGULATORY CONSIDERATIONS

Regulation	Applicable	Resolved	Supporting Documentation
Waters of the United States - Section 404	Yes	Yes	USACE Nationwide Permit No. 27 and DWQ 401 Water Quality Certification No. 4134.
Waters of the United States - Section 401	Yes	Yes	
Division of Land Quality (Dam Safety)	N/A	N/A	N/A
Endangered Species Act	Yes	Yes	Catfish Pond Mitigation Plan; per the Categorical Exclusion research and response by US Fish and Wildlife Service the "proposed action [in this project] is not likely to adversely affect any federally listed endangered or threatened species, their formally designated critical habitat, or species currently proposed for listing under the Act."
Historic Preservation Act	Yes	Yes	Correspondence from SHPO on March 5, 2018 stated they were aware of "no historic resources which would be affected by the project."
Coastal Zone Management Act (CZMA)/Coastal Area Management Act (CAMA)	N/A	N/A	N/A
FEMA Floodplain Compliance	Yes	Yes	Durham County Floodplain Development Permit No. 19800041 was obtained on October 7, 2019.
Essential Fisheries Habitat	N/A	N/A	N/A

(---): Data was not provided

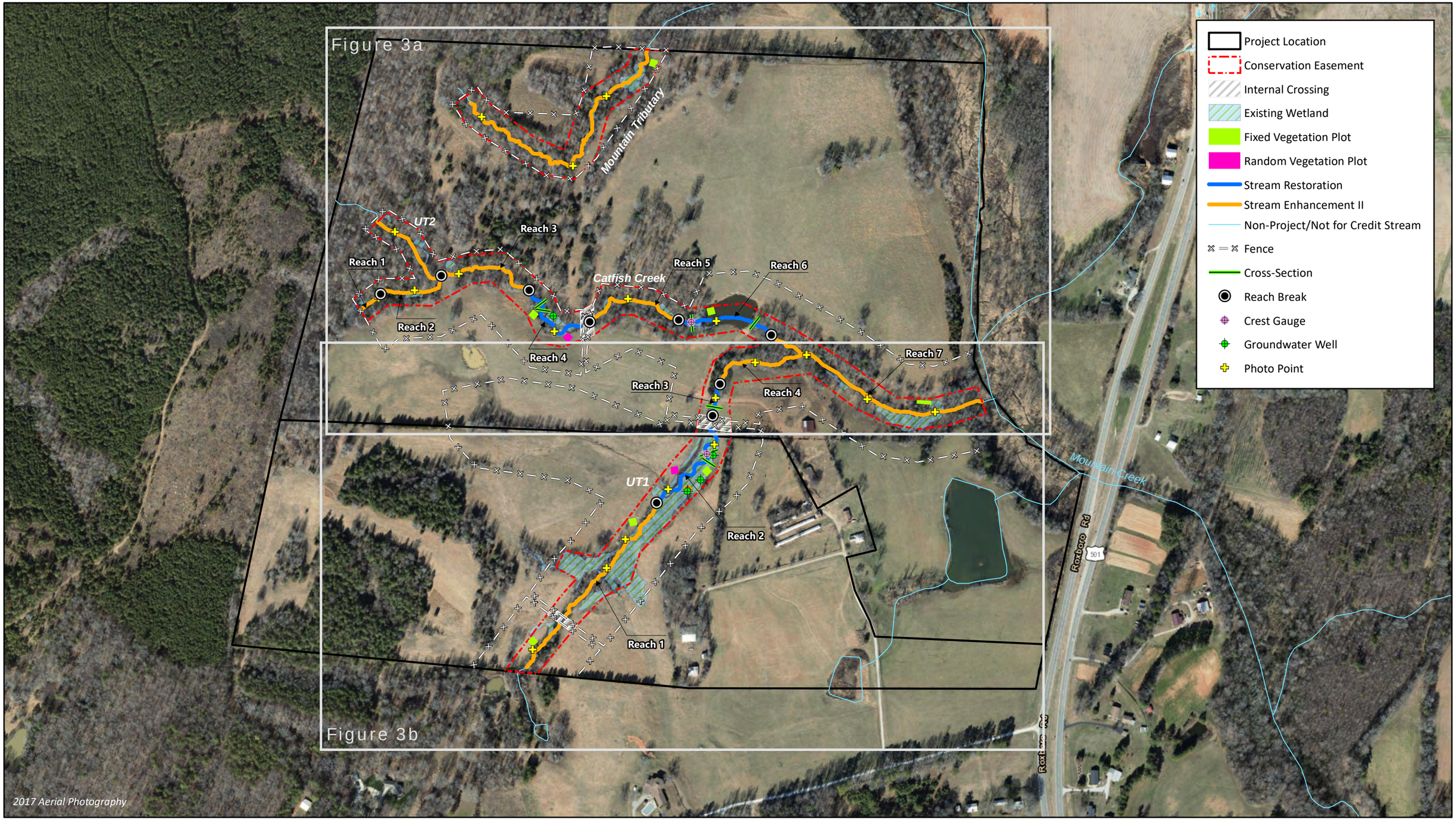
Table 5. Monitoring Component Summary

Catfish Pond Mitigation Site
DMS Project No. 100039
Monitoring Year 0 - 2020

Parameter	Monitoring Feature	Quantity / Length by Reach				Frequency
		Catfish Creek Reach 4	Catfish Creek Reach 6	UT1 Reach 2	UT1 Reach 3	
Dimension	Riffle Cross-Sections	1	2*	1	1	Year 1, 2, 3, 5, and 7
	Pool Cross-Sections	1	0	1	0	Year 1, 2, 3, 5, and 7
Pattern	Pattern	N/A				N/A
Profile	Longitudinal Profile	N/A				Year 0 (Unless Required)
Substrate	Reachwide Pebble Count	1	1	1	1	Year 1, 2, 3, 5, and 7
Hydrology	Crest Gauge (Continuous Overbank Flow Recorder)	N/A	1	1	N/A	Quarterly
Wetlands[1]	Groundwater Wells	4				Quarterly
Vegetation	CVS Level 2 Vegetation Plots	7 Fixed, 2 Random				Year 1, 2, 3, 5, and 7
Visual Assessment		Yes				Semi-Annual
Exotic and Nuisance Vegetation						Semi-Annual
Project Boundary						Semi- Annual
Reference Photos	Photographs	20				Annual

[1]Groundwater well data will be collected for informational purposes only, no success criteria is associated with the wetland areas.
*Construction changes along Catfish Creek Reach 6 resulted in a riffle dominant system. Both cross-sections are riffles to be representative.

APPENDIX 2. Visual Assessment Data



WILDLANDS ENGINEERING

0 400 800 Feet

N

Figure 3. Monitoring Plan View Map Key
Catfish Pond Mitigation Site
DMS Project No. 100039
Monitoring Year 0 – 2020
Durham County, NC

Project Location
Conservation Easement
Internal Crossing
Existing Wetland
Fixed Vegetation Plot
Random Vegetation Plot
Stream Restoration
Stream Enhancement II
Non-Project/Not for Credit Stream
Fence
Top of Bank
Structure
Cross-Section (XS)
Reach Break
Crest Gauge
Groundwater Well (GW)
Photo Point (PP)

UT2
Mountain Tributary
Catfish Creek
UT1
Mountain Creek
Reach 1
Reach 2
Reach 3
Reach 4
Reach 5
Reach 6
Reach 7
PP 1
PP 2
PP 3
PP 4
PP 5
PP 6
PP 7
PP 8
PP 9
PP 15
PP 16
PP 17
PP 18
PP 19
PP 20
XS 1
XS 2
XS 3
XS 4
XS 7
GW 1
100+00
102+00
104+00
106+00
108+00
110+00
112+00
114+00
116+00
118+00
120+00
122+00
124+00
126+00
128+00
130+00
132+00
218+00
220+00
222+00
302+00
304+00
306+00
402+00
404+00
406+00
408+00
410+00
412+00
414+00
1
2
3
7
8

2017 Aerial Photography

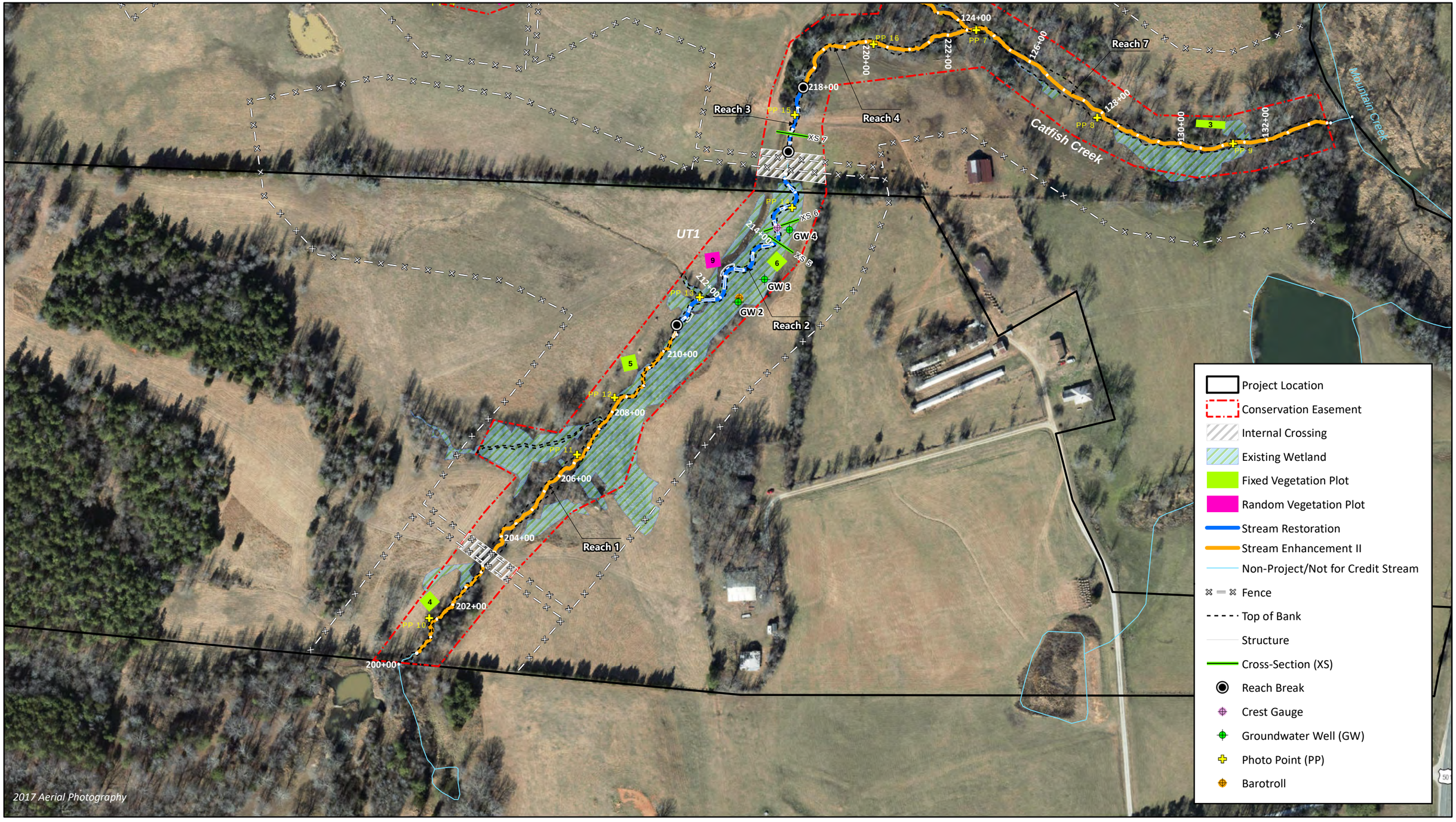
WILDLANDS ENGINEERING

0 200 400 Feet

N

Figure 3a. Monitoring Plan View Map
Catfish Pond Mitigation Site
DMS Project No. 100039
Monitoring Year 0 – 2020

Durham County, NC



WILDLANDS ENGINEERING

0 200 400 Feet

N

Figure 3b. Monitoring Plan View Map
Catfish Pond Mitigation Site
DMS Project No. 100039
Monitoring Year 0 – 2020

Durham County, NC

STREAM PHOTOGRAPHS

PHOTO POINT 1 Catfish Creek R1 – upstream *(04/28/2020)*

PHOTO POINT 1 Catfish Creek R1 – downstream *(04/28/2020)*

PHOTO POINT 2 Catfish Creek R2 – upstream *(04/28/2020)*

PHOTO POINT 2 Catfish Creek R2 – downstream *(04/28/2020)*

PHOTO POINT 3 Catfish Creek R3 – upstream *(04/28/2020)*

PHOTO POINT 3 Catfish Creek R3 – downstream *(04/28/2020)*

	
PHOTO POINT 4 Catfish Creek R4 – upstream *(04/28/2020)*	**PHOTO POINT 4 Catfish Creek R4 – downstream *(04/28/2020)***
	
PHOTO POINT 5 Catfish Creek R5 – upstream *(04/28/2020)*	**PHOTO POINT 5 Catfish Creek R5 – downstream *(04/28/2020)***
	
PHOTO POINT 6 Catfish Creek R6 – upstream *(04/28/2020)*	**PHOTO POINT 6 Catfish Creek R6 – downstream *(04/28/2020)***

PHOTO POINT 7 Catfish Creek R7 – upstream *(04/28/2020)*

PHOTO POINT 7 Catfish Creek R7 – downstream *(04/28/2020)*

PHOTO POINT 8 Catfish Creek R7 – upstream *(04/28/2020)*

PHOTO POINT 8 Catfish Creek R7 – downstream *(04/28/2020)*

PHOTO POINT 9 Catfish Creek R7 – upstream *(04/28/2020)*

PHOTO POINT 9 Catfish Creek R7 – downstream *(04/28/2020)*

	
PHOTO POINT 10 UT1 R1 – upstream *(04/28/2020)*	**PHOTO POINT 10 UT1 R1 – downstream *(04/28/2020)***
	
PHOTO POINT 11 UT1 R1 – upstream *(04/28/2020)*	**PHOTO POINT 11 UT1 R1 – downstream *(04/28/2020)***
	
PHOTO POINT 12 UT1 R1 – upstream *(04/28/2020)*	**PHOTO POINT 12 UT1 R1 – downstream *(04/28/2020)***

	
PHOTO POINT 13 UT1 R2 – upstream *(04/28/2020)*	**PHOTO POINT 13 UT1 R2 – downstream *(04/28/2020)***
	
PHOTO POINT 14 UT1 R2 – upstream *(04/28/2020)*	**PHOTO POINT 14 UT1 R2 – downstream *(04/28/2020)***
	
PHOTO POINT 15 UT1 R3 – upstream *(04/28/2020)*	**PHOTO POINT 15 UT1 R3 – downstream *(04/28/2020)***

	
PHOTO POINT 16 UT1 R4 – upstream *(04/28/2020)*	**PHOTO POINT 16 UT1 R4 – downstream *(04/28/2020)***
	
PHOTO POINT 17 UT2 – upstream *(04/28/2020)*	**PHOTO POINT 17 UT2 – downstream *(04/28/2020)***
	
PHOTO POINT 18 Mountain Trib – upstream *(04/28/2020)*	**PHOTO POINT 18 Mountain Trib – downstream *(04/28/2020)***

	
PHOTO POINT 19 Mountain Trib – upstream *(04/28/2020)*	**PHOTO POINT 19 Mountain Trib – downstream *(04/28/2020)***
	
PHOTO POINT 20 Mountain Trib – upstream *(04/28/2020)*	**PHOTO POINT 20 Mountain Trib – downstream *(04/28/2020)***

VEGETATION PLOT PHOTOGRAPHS

FIXED VEG PLOT 1 *(03/26/2020)*

FIXED VEG PLOT 2 *(03/26/2020)*

FIXED VEG PLOT 3 *(03/26/2020)*

FIXED VEG PLOT 4 *(03/26/2020)*

FIXED VEG PLOT 5 *(03/26/2020)*

FIXED VEG PLOT 6 *(03/26/2020)*

FIXED VEG PLOT 7 *(04/09/2020)*

RANDOM VEG PLOT 8 *(03/26/2020)*

RANDOM VEG PLOT 9 *(03/26/2020)*

APPENDIX 3. Vegetation Plot Data

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

Catfish Pond Mitigation Site

DMS Project No. 100039

Monitoring Year 0 - 2020

			Current Plot Data (MY0 2020)														
			VP 1			VP 2			VP 3			VP 4			VP 5		
Scientific Name	**Common Name**	**Species Type**	**PnoLS**	**P-all**	**T**	**PnoLS**	**P-all**	**T**	**PnoLS**	**P-all**	**T**	**PnoLS**	**P-all**	**T**	**PnoLS**	**P-all**	**T**
Aesculus sylvatica	Painted Buckeye	Shrub Tree	1	1	1												
Betula nigra	River Birch	Tree				1	1	1	1	1	1						
Fraxinus pennsylvanica	Green Ash	Tree				2	2	2							3	3	3
Platanus occidentalis	Sycamore	Tree	4	4	4	7	7	7	3	3	3	8	8	8	2	2	2
Quercus alba	White Oak	Tree	1	1	1	1	1	1				1	1	1	2	2	2
Quercus lyrata	Overcup Oak	Tree				1	1	1	3	3	3	1	1	1	2	2	2
Quercus michauxii	Swamp Chestnut Oak	Tree	2	2	2										1	1	1
Quercus phellos	Willow Oak	Tree	5	5	5				3	3	3	1	1	1	3	3	3
Quercus shumardii	Shumard Oak	Tree	1	1	1	3	3	3	2	2	2	1	1	1			
		Stem count	14	14	14	15	15	15	12	12	12	12	12	12	13	13	13
		size (ares)	1			1			1			1			1		
		size (ACRES)	0.02			0.02			0.02			0.02			0.02		
		Species count	6	6	6	6	6	6	5	5	5	5	5	5	6	6	6
		Stems per ACRE	567	567	567	607	607	607	486	486	486	486	486	486	526	526	526

Color for Density

Exceeds requirements by 10%

Exceeds requirements, but by less than 10%

Fails to meet requirements, by less than 10%

Fails to meet requirements by more than 10%

PnoLS - Planted Stems Excluding Live Stakes

P-all - All Planted Stems

T - All Woody Stems

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

Catfish Pond Mitigation Site

DMS Project No. 100039

Monitoring Year 0 - 2020

			Current Plot Data (MY0 2020)						Annual Means		
			VP 6			VP 7			MY0 (2020)		
Scientific Name	**Common Name**	**Species Type**	**PnoLS**	**P-all**	**T**	**PnoLS**	**P-all**	**T**	**PnoLS**	**P-all**	**T**
Aesculus sylvatica	Painted Buckeye	Shrub Tree							1	1	1
Betula nigra	River Birch	Tree				7	7	7	9	9	9
Fraxinus pennsylvanica	Green Ash	Tree	2	2	2	2	2	2	9	9	9
Platanus occidentalis	Sycamore	Tree	6	6	6	6	6	6	36	36	36
Quercus alba	White Oak	Tree	1	1	1	1	1	1	7	7	7
Quercus lyrata	Overcup Oak	Tree	1	1	1				8	8	8
Quercus michauxii	Swamp Chestnut Oak	Tree	1	1	1				4	4	4
Quercus phellos	Willow Oak	Tree	4	4	4				16	16	16
Quercus shumardii	Shumard Oak	Tree							7	7	7
		Stem count	15	15	15	16	16	16	97	97	97
		size (ares)		1			1			7	
		size (ACRES)		0.02			0.02			0.17	
		Species count	6	6	6	4	4	4	9	9	9
		Stems per ACRE	607	607	607	647	647	647	561	561	561

Color for Density

Exceeds requirements by 10%

Exceeds requirements, but by less than 10%

Fails to meet requirements, by less than 10%

Fails to meet requirements by more than 10%

PnoLS - Planted Stems Excluding Live Stakes

P-all - All Planted Stems

T - All Woody Stems

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

Catfish Pond Mitigation Site

DMS Project No. 100039

Monitoring Year 0 - 2020

			Current Plot Data (MY0 2020)				Annual Means	
			VP 8		VP 9		MY0 (2020)	
Scientific Name	Common Name	Species Type	Te	Total	Te	Total	Te	Total
Aesculus sylvatica	Painted Buckeye	Shrub Tree	1	1	2	2	3	3
Betula nigra	River Birch	Tree	3	3	1	1	4	4
Fraxinus pennsylvanica	Green Ash	Tree			1	1	1	1
Platanus occidentalis	Sycamore	Tree	3	3	4	4	7	7
Quercus alba	White Oak	Tree			1	1	1	1
Quercus lyrata	Overcup Oak	Tree	1	1			1	1
Quercus michauxii	Swamp Chestnut Oak	Tree	1	1	1	1	2	2
Quercus phellos	Willow Oak	Tree	2	2	2	2	4	4
Quescus shumardii	Shumard Oak	Tree	1	1	1	1	2	2
Viburnum dentatum	Arrowwood Viburnum	Shrub Tree	1	1			1	1
		Stem count	13	13	13	13	26	26
		size (ares)	1		1		2	
		size (ACRES)	0.02		0.02		0.05	
		Species count	8	8	8	8	10	10
		Stems per ACRE	526	526	526	526	526	526

Color for Density

Exceeds requirements by 10%

Exceeds requirements, but by less than 10%

Fails to meet requirements, by less than 10%

Fails to meet requirements by more than 10%

Te - Number of stems including exotic species

Total - Number of stems excluding exotic species

APPENDIX 4. Morphological Summary Data and Plots

Table 7a. Baseline Stream Data Summary
Catfish Pond Mitigation Site
DMS Project No. 100039
Monitoring Year 0 - 2020

Catfish Creek Reach 4 & UT1 Reach 2

		PRE-RESTORATION CONDITION				REFERENCE REACH DATA						DESIGN				AS-BUILT/BASELINE			
Parameter	Gage	Catfish Creek Reach 4		UT1 Reach 2		UT4 (UT to Cedar Creek)		UT to Wells Creek		UT to Varnals Creek		Catfish Creek Reach 4		UT1 Reach 2		Catfish Creek Reach 4		UT1 Reach 2	
		Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
Dimension and Substrate - Riffle																			
Bankfull Width (ft)	N/A	7.0		16.7		7.3		6.2	8.6	9.3	10.5	8.5		11.5		8.1		10.0	
Floodprone Width (ft)[1]		12.0		22.0		20.1		16.0	22.0	60.0	100.0	19.0		25.0	58.0	200.0		200.0	
Bankfull Mean Depth		0.9		0.4		0.6		0.6	1.0	1.5	1.7	0.7		0.9		0.8		0.8	
Bankfull Max Depth		1.3		0.9		1.1		0.9	1.4	1.5	1.7	0.9	1.2	1.0	1.3	1.2		1.5	
Bankfull Cross Sectional Area (ft^2)		6.4		7.1		4.2		3.9	6.3	10.3	12.3	5.8		9.9		6.4		8.0	
Width/Depth Ratio		7.7		39.5		12.6		6.1	12.6	8.1	9.3	12.6		13.4		10.2		12.4	
Entrenchment Ratio[1]		1.7		1.3		2.7		1.9	4.1	5.7	10.0	>2.2		2.2	5.0	24.6		20.1	
Bank Height Ratio		2.2		2.4		1.0		1.0	1.8	1.0		1.0		1.0		1.0		1.0	
D50 (mm)		---		---		---		---		---		---		---		28.5		37.5	
Profile																			
Riffle Length (ft)	N/A																		
Riffle Slope (ft/ft)		---		---		0.006	0.049	0.017	0.078	0.024	0.057	0.016	0.026	0.007	0.012	0.011	0.042	0.004	0.027
Pool Length (ft)																			
Pool Max Depth (ft)		1.4		---		1.4	1.5	1.6	1.9	2.5	2.6	2.3		2.6		1.9	2.2	2.1	2.8
Pool Spacing (ft)		---		---		17.6	24.1	17.0	63.0	7.8	82.0	48.0	61.0	36.0	64.0	35.0	78.0	30.0	71.0
Pool Volume (ft^3)																			
Pattern																			
Channel Beltwidth (ft)	N/A	---		---		3.2	5.7	10.0	35.0	15.0	45.0	21.0	38.0	33.0	48.0	21.0	38.0	33.0	48.0
Radius of Curvature (ft)		---		---		5.3	12.6	2.3	32.0	8.3	47.3	21.0	35.0	18.0	26.0	21.0	35.0	18.0	26.0
Rc:Bankfull Width (ft/ft)		---		---		0.7	1.7	0.3	4.0	0.6	3.2	2.5	4.1	1.6	2.3	2.5	4.1	1.6	2.3
Meander Length (ft)		---		---		10.2	17.0	---		---		109.0	120.0	93.0	125.0	109.0	120.0	93.0	125.0
Meander Width Ratio		---		---		0.4	0.8	1.3	4.4	1.0	3.0	2.5	4.5	2.9	4.2	2.5	4.5	2.9	4.2
Substrate, Bed and Transport Parameters																			
Ri%/Ru%/P%/G%/S%	N/A																		
SC%/Sa%/G%/C%/B%/Be%																			
d16/d35/d50/d84/d95/d100		---		---		---		0.1/0.6/4.5/53/ 96/x		2.9/9.2/15.0/56.0/ 88.0		---		---		sc/6.69/16.0/ 60.9/107.3/>2048		sc/sc/0.5/ 56.9/107.3/256	
Reach Shear Stress (Competency) lb/ft^2		0.56		0.26		---		---		---		---		---		0.65		0.13	
Max part size (mm) mobilized at bankfull																			
Stream Power (Capacity) W/m^2																			
Additional Reach Parameters																			
Drainage Area (SM)	N/A	0.09		0.16		0.11		0.13		0.41		0.09		0.16		0.09		0.16	
Watershed Impervious Cover Estimate (%)		0.0%				---		---		---		0.0%				0.0%			
Rosgen Classification		E6		C6		C4		C4		C4/E4		C4		C4		C4		C4	
Bankfull Velocity (fps)		2.8		3.0		5.2	6.1	3.8		4.4	5.2	3.0		2.1		3.2		1.1	
Bankfull Discharge (cfs)		18.0		21.0		21.7	25.8	15.0		54.0		17.0		20.6		20.6		9.6	
Q-NFF regression																			
Q-USGS extrapolation																			
Q-Mannings																			
Valley Length (ft)		---		---		---		---		---		---		---		---		---	
Channel Thalweg Length (ft)		369 (65 crossing)		430 (60 crossing)		---		---		---		374 (72 crossing)		515 (60 crossing)		373 (72 crossing)		520 (61 crossing)	
Sinuosity		1.07		1.06		1.05		1.41		1.20		1.18		1.23		1.18		1.23	
Bankfull Slope (ft/ft)		0.016		0.020		0.016		0.020		0.020		0.014		0.005		0.014		0.005	

[1] Differences between Design and As-Built/Baseline calculations are due to the ranges used in Design and field surveyed measurements used in As-Built/Baseline.
(---): Data was not provided

Table 7b. Baseline Stream Data Summary
Catfish Pond Mitigation Site
DMS Project No. 100039
Monitoring Year 0 - 2020

Catfish Reach 6 & UT1 Reach 3

		PRE-RESTORATION CONDITION				REFERENCE REACH DATA				DESIGN				AS-BUILT/BASELINE			
Parameter	Gage	Catfish Creek Reach 6		UT1 Reach 3 (Reach 4 XS)		UT to Henry Fork		Agony Acres		Catfish Creek Reach 6		UT1 Reach 3		Catfish Creek Reach 6		UT1 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	N/A[1]		6.2	8.1	3.2	7.7	11.1		8.5		8.0		7.7	9.0	6.5	
Floodprone Width (ft)[2]		N/A[1]		22.0		6.3	13.3	25.2		12.0	21.0	11.0	20.0	30.0	100.0	60.0	
Bankfull Mean Depth		N/A[1]		0.7	0.8	0.5	0.6	0.7		0.6		0.6		0.7	0.8	0.8	
Bankfull Max Depth		N/A[1]		0.9	1.1	0.8	0.7	1.0		0.9	1.1	0.9	1.1	1.2	1.3	1.5	
Bankfull Cross Sectional Area (ft^2)		N/A[1]		4.2	6.2	1.3	3.6	7.4		5.3		4.9		5.7	7.0	5.4	
Width/Depth Ratio		N/A[1]		9.2	10.5	5.2	16.4	16.6		13.8		13.0		10.2	11.6	7.8	
Entrenchment Ratio[2]		N/A[1]		2.8	3.6	1.7	2.0	2.3		1.4	2.5	1.4	2.5	3.3	13.1	9.3	
Bank Height Ratio		N/A[1]		1.2	1.5	1.0	1.3	1.0		1.0		1.0		1.0		1.0	
D50 (mm)		N/A[1]		---		34.0		50.6		---		---		34.4	40.6	34.1	
Profile																	
Riffle Length (ft)	N/A																
Riffle Slope (ft/ft)		N/A[1]		---		0.050	0.070	---		0.031	0.045	0.049	0.055	0.005	0.059	0.040	0.093
Pool Length (ft)																	
Pool Max Depth (ft)		N/A[1]		---		---		1.6		2.3		3.0		1.5	2.4	1.8	2.6
Pool Spacing (ft)		N/A[1]		---		14.1	24.9	---		13.0	51.0	11.0	28.0	7.9	142.1	19.0	32.0
Pool Volume (ft^3)																	
Pattern																	
Channel Beltwidth (ft)	N/A	N/A[3]		---		N/A[3]		N/A[3]		N/A[3]		N/A[3]		N/A[3]		N/A[3]	
Radius of Curvature (ft)		N/A[3]		---		N/A[3]		N/A[3]		N/A[3]		N/A[3]		N/A[3]		N/A[3]	
Rc:Bankfull Width (ft/ft)		N/A[3]		---		N/A[3]		N/A[3]		N/A[3]		N/A[3]		N/A[3]		N/A[3]	
Meander Length (ft)		N/A[3]		---		N/A[3]		N/A[3]		N/A[3]		N/A[3]		N/A[3]		N/A[3]	
Meander Width Ratio		N/A[3]		---		N/A[3]		N/A[3]		N/A[3]		N/A[3]		N/A[3]		N/A[3]	
Substrate, Bed and Transport Parameters																	
Ri%/Ru%/P%/G%/S%	N/A																
SC%/Sa%/G%/C%/B%/Be%																	
d16/d35/d50/d84/d95/d100		---		---		---		2.0/12.9/50.6/ 168.1/>2048.1		---		---		16.56/32.92/50.6/ 2580.3/3545.2/>2048		sc/7.10/23.2/ 71.7/120.7/>2048	
Reach Shear Stress (Competency) lb/ft^2		1.52		1.89		---		---		---		---		1.86		1.89	
Max part size (mm) mobilized at bankfull																	
Stream Power (Capacity) W/m^2																	
Additional Reach Parameters																	
Drainage Area (SM)	N/A	0.11		0.16		0.05		0.15		0.11		0.16		0.11		0.16	
Watershed Impervious Cover Estimate (%)		0.0%				---		---		0.0%				0.0%			
Rosgen Classification		---		E4b		B4a		B3		B4a		B4a		B4a		B4a	
Bankfull Velocity (fps)		---		5.1		3.8	5.4	4.9		4.0		4.4		4.9		3.5	
Bankfull Discharge (cfs)		---		21.0		12.0		37.0		20.9		21.8		28.4		20.1	
Q-NFF regression																	
Q-USGS extrapolation																	
Q-Mannings																	
Valley Length (ft)		---		---		---		---		---		---		---		---	
Channel Thalweg Length (ft)		466		154		---		---		454		149		444		149	
Sinuosity		---		1.10		1.10		1.04		1.04		1.02		1.05		1.02	
Bankfull Slope (ft/ft)		---		0.038		0.042		0.050		0.043		0.054		0.043		0.061	

[1] Catfish Creek Reach 6 was an embankment pond and thus had no existing channel characteristics.

[2] Differences between Design and As-Built/Baseline calculations are due to the ranges used in Design and field surveyed measurements used in As-Built/Baseline.

[3] Pattern data is not applicable for B-type channels.

(---): Data was not provided

N/A: Not Applicable

Table 8. Morphology and Hydraulic Summary (Dimensional Parameters - Cross-Section)
Catfish Pond Mitigation Site
DMS Project No. 100039
Monitoring Year 0 - 2020

	Catfish Creek Reach 4												Catfish Creek Reach 6					
	Cross-Section 1 (Pool)						Cross-Section 2 (Riffle)						Cross-Section 3 (Riffle)					
Dimension and Substrate	**Base**	**MY1**	**MY2**	**MY3**	**MY5**	**MY7**	**Base**	**MY1**	**MY2**	**MY3**	**MY5**	**MY7**	**Base**	**MY1**	**MY2**	**MY3**	**MY5**	**MY7**
Bankfull Elevation (ft)	467.55						466.93						444.72					
Low Bank Elevation (ft)	467.55						466.93						444.72					
Bankfull Width (ft)	11.0						8.1						7.7					
Floodprone Width (ft)	N/A						200						100					
Bankfull Mean Depth (ft)	1.3						0.8						0.7					
Bankfull Max Depth (ft)	2.2						1.2						1.3					
Bankfull Cross-Sectional Area (ft^2)	14.4						6.4						5.7					
Bankfull Width/Depth Ratio	8.4						10.2						10.2					
Entrenchment Ratio[1]	N/A						24.6						13.1					
Bankfull Bank Height Ratio[2]	N/A						1.0						1.0					

	Catfish Creek Reach 6						UT1 Reach 2											
	Cross-Section 4 (Riffle)						Cross-Section 5 (Pool)						Cross-Section 6 (Riffle)					
Dimension and Substrate	**Base**	**MY1**	**MY2**	**MY3**	**MY5**	**MY7**	**Base**	**MY1**	**MY2**	**MY3**	**MY5**	**MY7**	**Base**	**MY1**	**MY2**	**MY3**	**MY5**	**MY7**
Bankfull Elevation (ft)	432.39						446.13						445.98					
Low Bank Elevation (ft)	432.39						446.13						445.98					
Bankfull Width (ft)	9.0						12.7						10.0					
Floodprone Width (ft)	30						N/A						200					
Bankfull Mean Depth (ft)	0.8						1.6						0.8					
Bankfull Max Depth (ft)	1.2						2.7						1.5					
Bankfull Cross-Sectional Area (ft^2)	7.0						20.1						8.0					
Bankfull Width/Depth Ratio	11.6						8.0						12.4					
Entrenchment Ratio[1]	3.3						N/A						20.1					
Bankfull Bank Height Ratio[2]	1.0						N/A						1.0					

	UT1 Reach 3					
	Cross-Section 7 (Riffle)					
Dimension and Substrate	**Base**	**MY1**	**MY2**	**MY3**	**MY5**	**MY7**
Bankfull Elevation (ft)	442.36					
Low Bank Elevation (ft)	442.36					
Bankfull Width (ft)	6.5					
Floodprone Width (ft)	60					
Bankfull Mean Depth (ft)	0.8					
Bankfull Max Depth (ft)	1.5					
Bankfull Cross-Sectional Area (ft^2)	5.4					
Bankfull Width/Depth Ratio	7.8					
Entrenchment Ratio[1]	9.3					
Bankfull Bank Height Ratio[2]	1.0					

[1]Entrenchment Ratio is calculated using the method specified in the Industry Technical Work Group Memorandum.
[2]Bank Height Ratio is calculated using the method specified in the Industry Technical Work Group Memorandum.
*Morphological survey and analysis not required for MY4 and MY6.

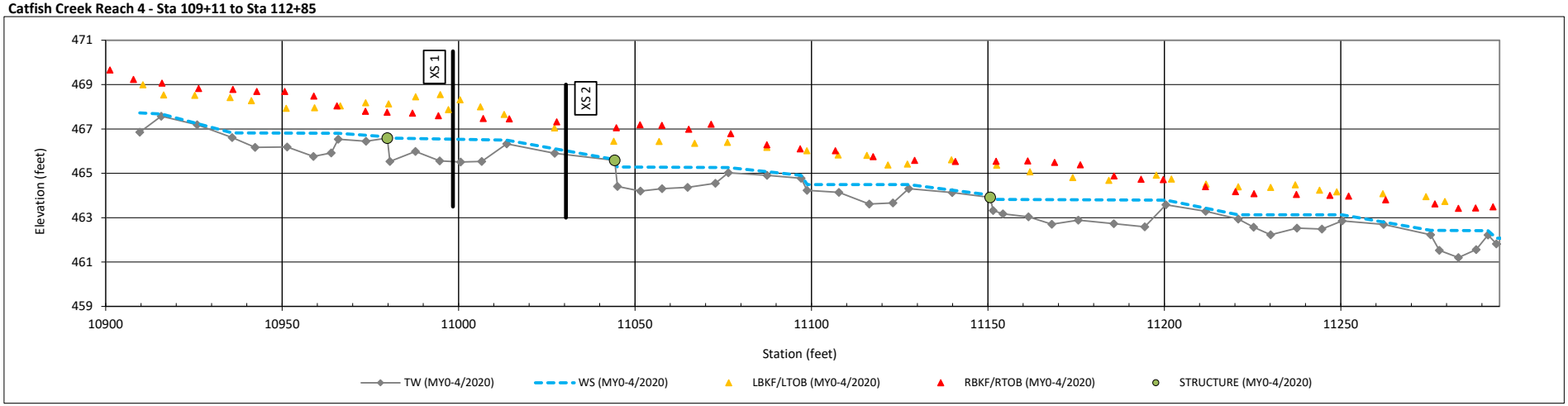
Longitudinal Profile Plots

Catfish Pond Mitigation Site

DMS Project No. 100039

Monitoring Year 0 - 2020

Catfish Creek Reach 4 - Sta 109+11 to Sta 112+85



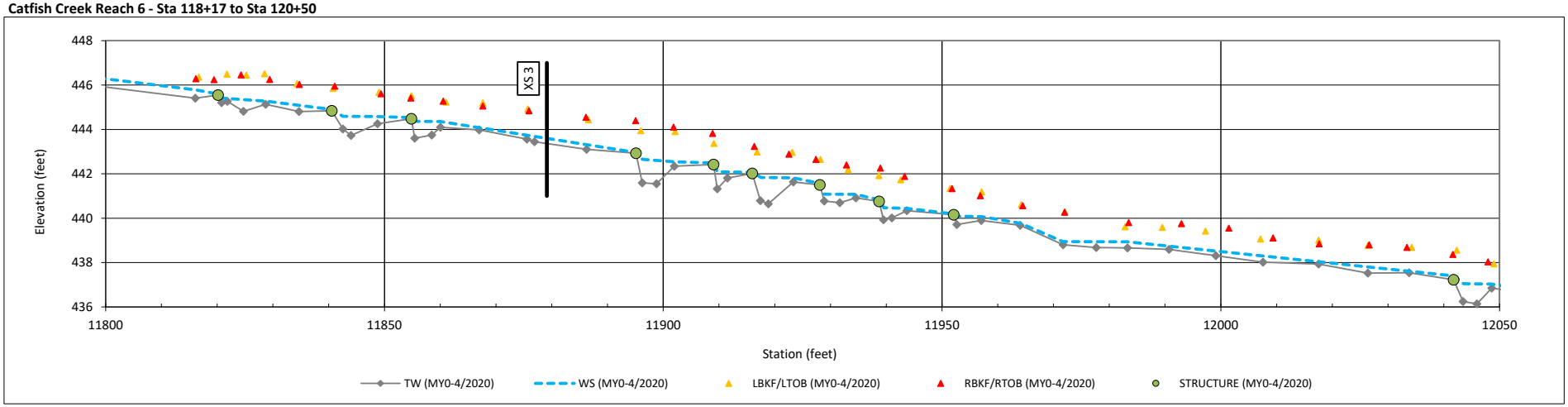
Longitudinal Profile Plots

Catfish Pond Mitigation Site

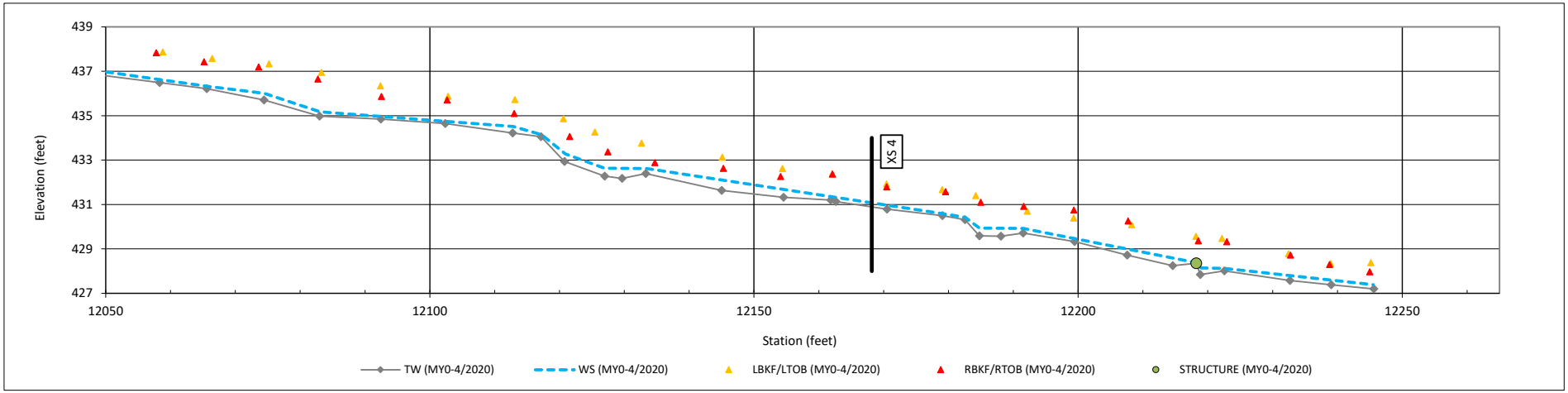
DMS Project No. 100039

Monitoring Year 0 - 2020

Catfish Creek Reach 6 - Sta 118+17 to Sta 120+50



Catfish Creek Reach 6 - Sta 120+50 to Sta 122+54



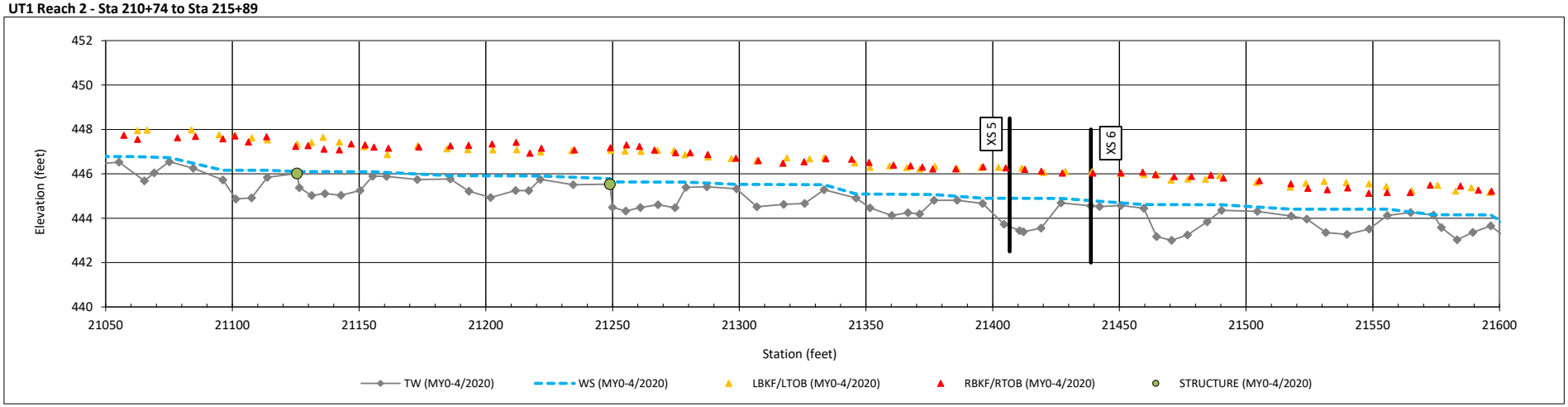
Longitudinal Profile Plots

Catfish Pond Mitigation Site

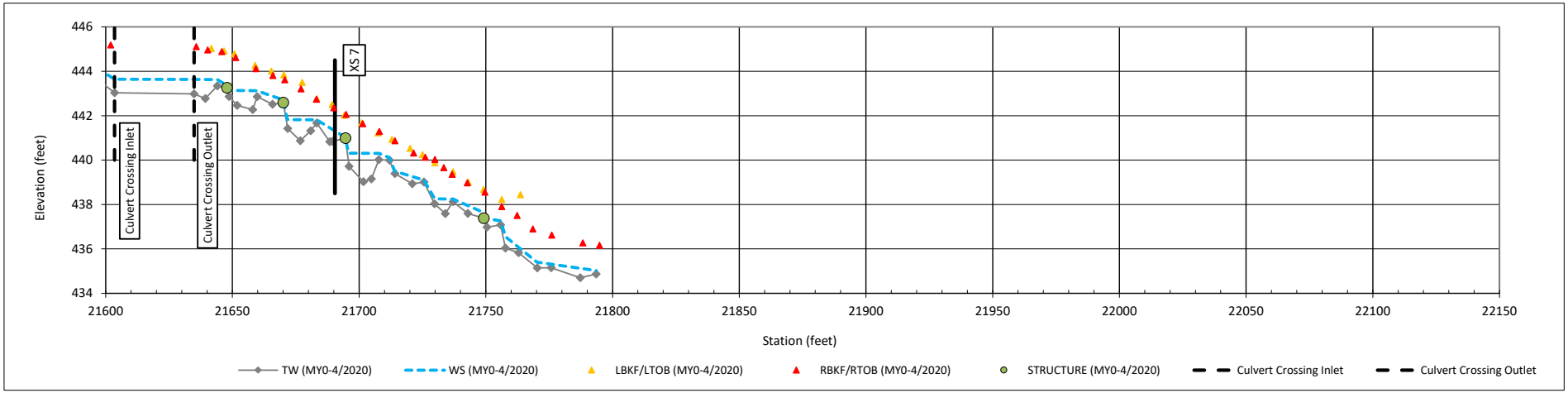
DMS Project No. 100039

Monitoring Year 0 - 2020

UT1 Reach 2 - Sta 210+74 to Sta 215+89



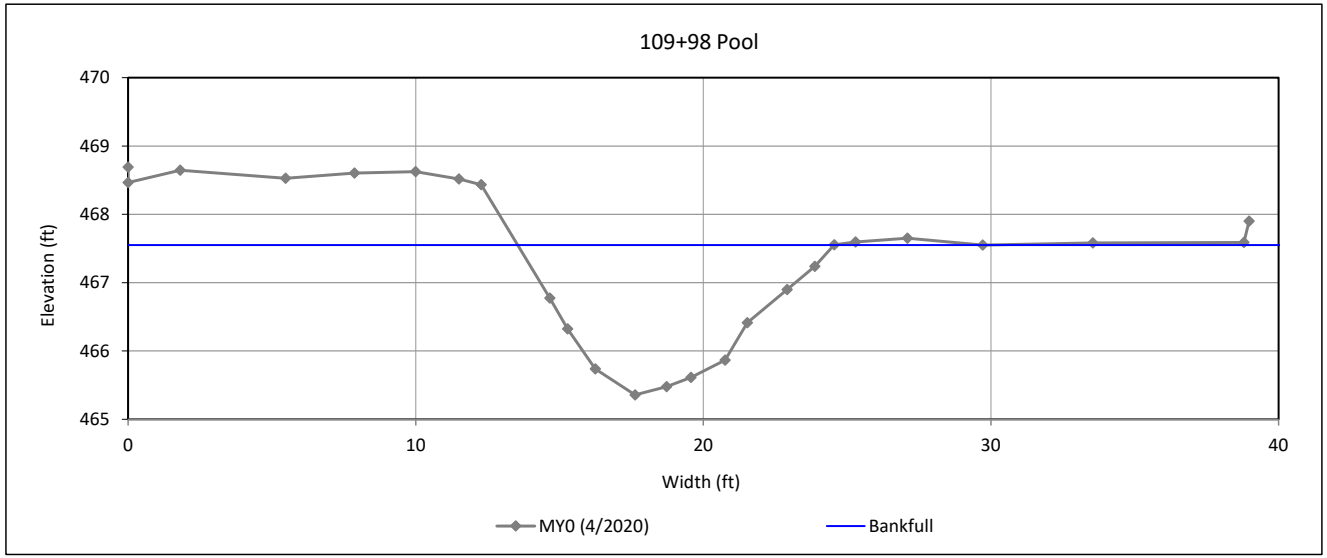
UT1 Reach 3 - Sta 216+49 to Sta 217+98



Cross-Section Plots

Catfish Pond Mitigation Site
DMS Project No. 100039
Monitoring Year 0 - 2020

Cross-Section 1 - Catfish Creek Reach 4



Bankfull Dimensions	
14.4	x-section area (ft.sq.)
11.0	width (ft)
1.3	mean depth (ft)
2.2	max depth (ft)
12.0	wetted perimeter (ft)
1.2	hydraulic radius (ft)
8.4	width-depth ratio

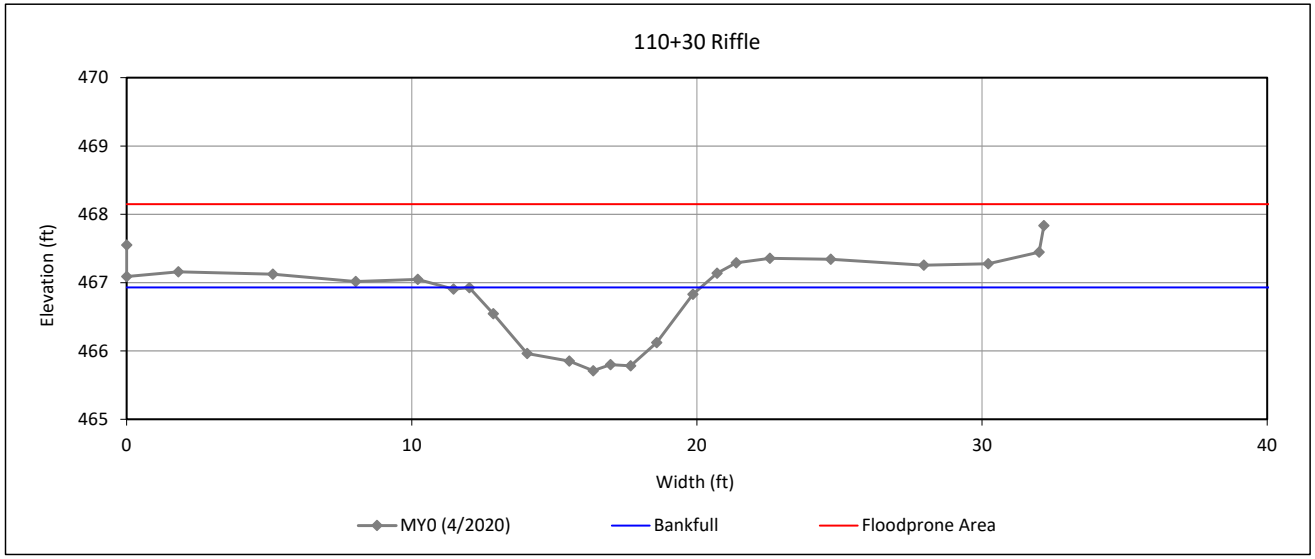
Survey Date: 4/2020
Field Crew: Kee Mapping & Surveying

View Downstream

Cross-Section Plots

Catfish Pond Mitigation Site
DMS Project No. 100039
Monitoring Year 0 - 2020

Cross-Section 2 - Catfish Creek Reach 4



Bankfull Dimensions	
6.4	x-section area (ft.sq.)
8.1	width (ft)
0.8	mean depth (ft)
1.2	max depth (ft)
8.6	wetted perimeter (ft)
0.7	hydraulic radius (ft)
10.2	width-depth ratio
200.0	W flood prone area (ft)
24.6	entrenchment ratio
1.0	low bank height ratio

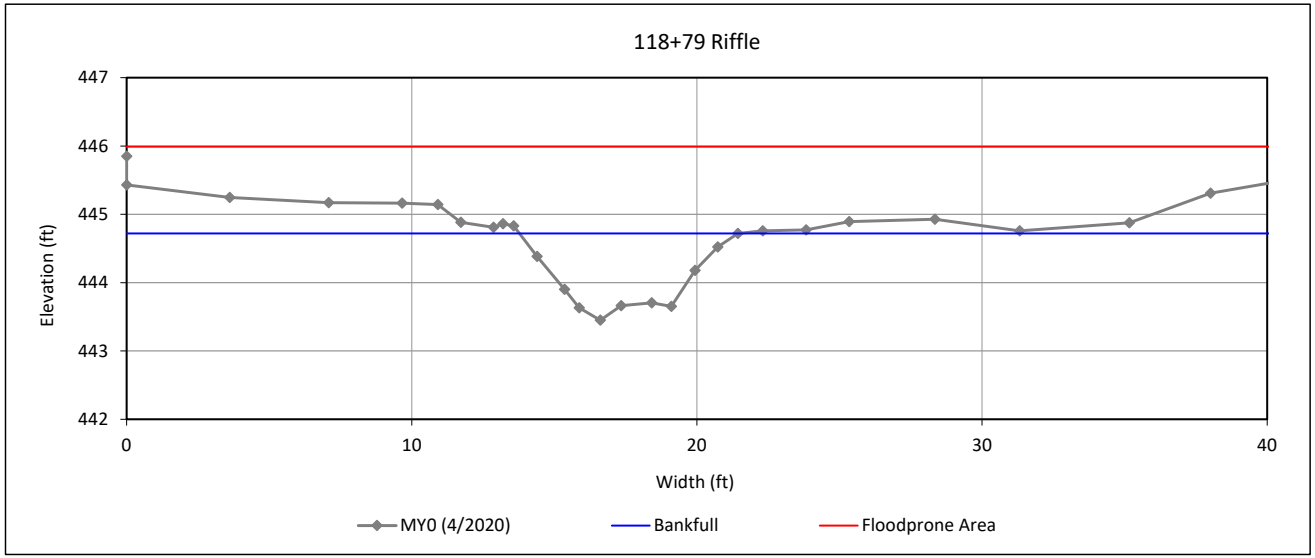
Survey Date: 4/2020
Field Crew: Kee Mapping & Surveying

View Downstream

Cross-Section Plots

Catfish Pond Mitigation Site
DMS Project No. 100039
Monitoring Year 0 - 2020

Cross-Section 3 - Catfish Creek Reach 6



Bankfull Dimensions	
5.7	x-section area (ft.sq.)
7.7	width (ft)
0.7	mean depth (ft)
1.3	max depth (ft)
8.2	wetted perimeter (ft)
0.7	hydraulic radius (ft)
10.2	width-depth ratio
100.0	W flood prone area (ft)
13.1	entrenchment ratio
1.0	low bank height ratio

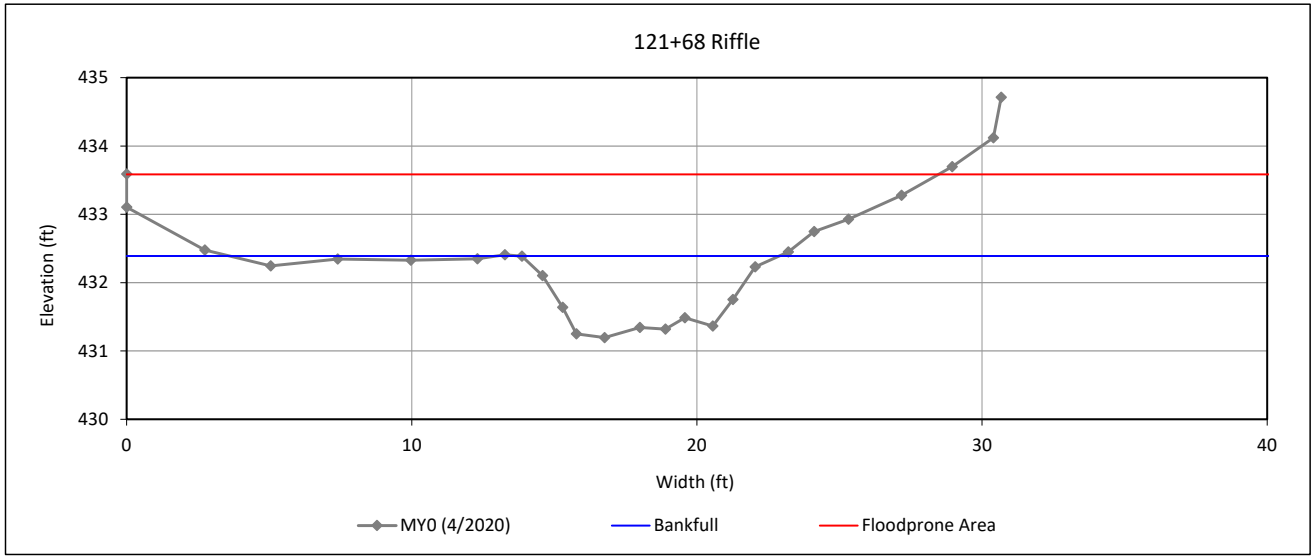
Survey Date: 4/2020
Field Crew: Kee Mapping & Surveying

View Downstream

Cross-Section Plots

Catfish Pond Mitigation Site
DMS Project No. 100039
Monitoring Year 0 - 2020

Cross-Section 4 - Catfish Creek Reach 6



Bankfull Dimensions	
7.0	x-section area (ft.sq.)
9.0	width (ft)
0.8	mean depth (ft)
1.2	max depth (ft)
9.6	wetted perimeter (ft)
0.7	hydraulic radius (ft)
11.6	width-depth ratio
30.0	W flood prone area (ft)
3.3	entrenchment ratio
1.0	low bank height ratio

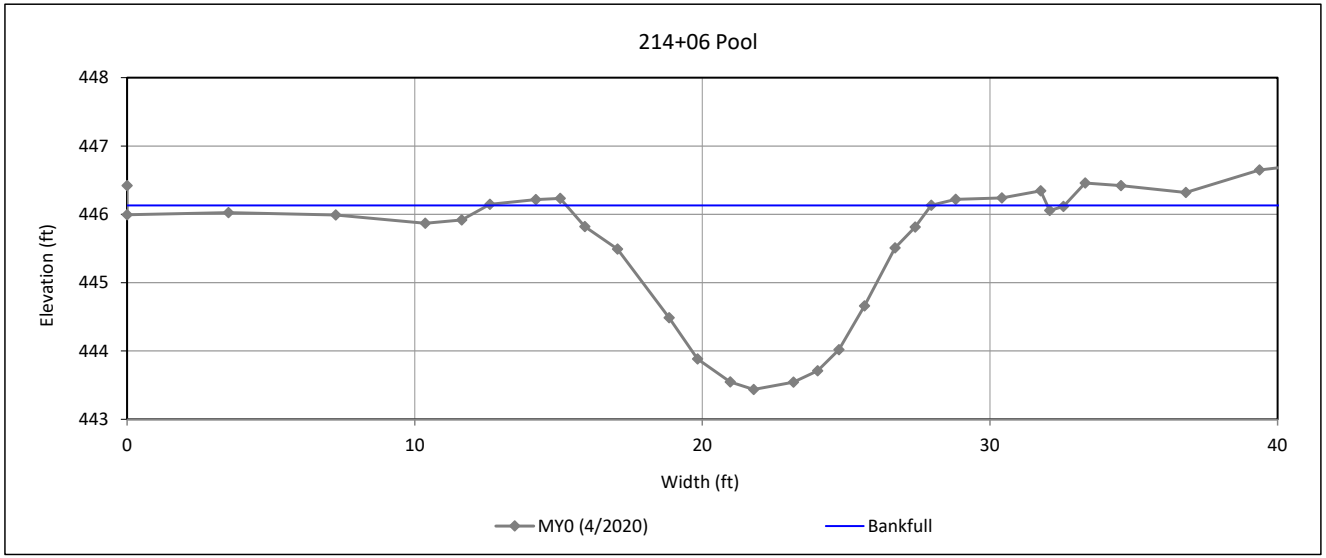
Survey Date: 4/2020
Field Crew: Kee Mapping & Surveying

View Downstream

Cross-Section Plots

Catfish Pond Mitigation Site
DMS Project No. 100039
Monitoring Year 0 - 2020

Cross-Section 5 - UT1 Reach 2



Bankfull Dimensions	
20.1	x-section area (ft.sq.)
12.7	width (ft)
1.6	mean depth (ft)
2.7	max depth (ft)
14.0	wetted perimeter (ft)
1.4	hydraulic radius (ft)
8.0	width-depth ratio

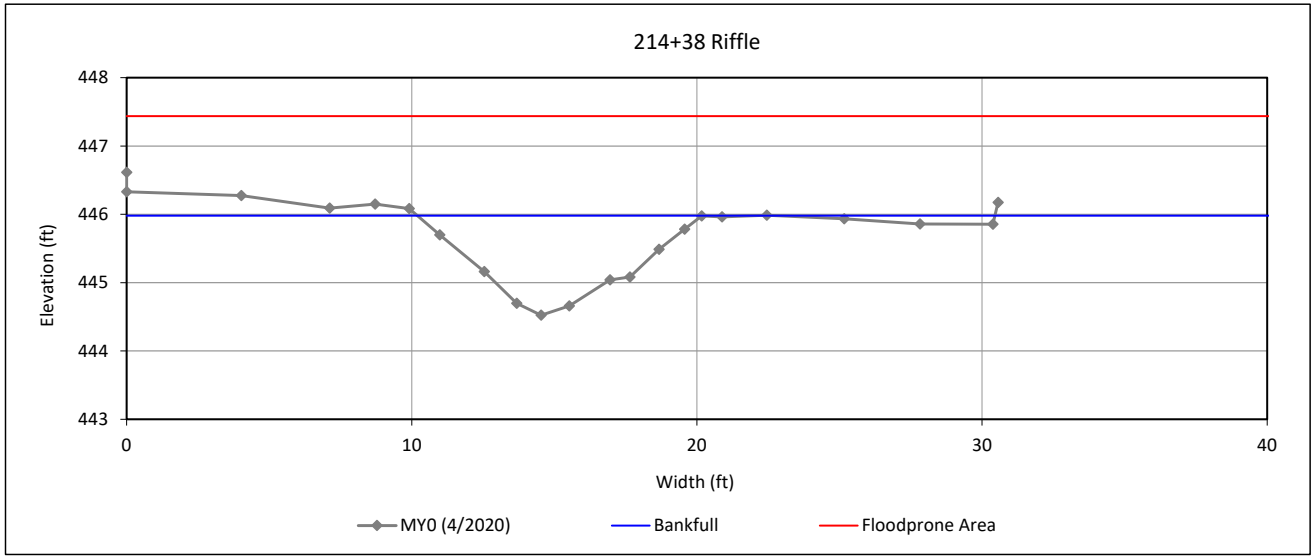
Survey Date: 4/2020
Field Crew: Kee Mapping & Surveying

View Downstream

Cross-Section Plots

Catfish Pond Mitigation Site
DMS Project No. 100039
Monitoring Year 0 - 2020

Cross-Section 6 - UT1 Reach 2



Bankfull Dimensions	
8.0	x-section area (ft.sq.)
10.0	width (ft)
0.8	mean depth (ft)
1.5	max depth (ft)
10.4	wetted perimeter (ft)
0.8	hydraulic radius (ft)
12.4	width-depth ratio
200.0	W flood prone area (ft)
20.1	entrenchment ratio
1.0	low bank height ratio

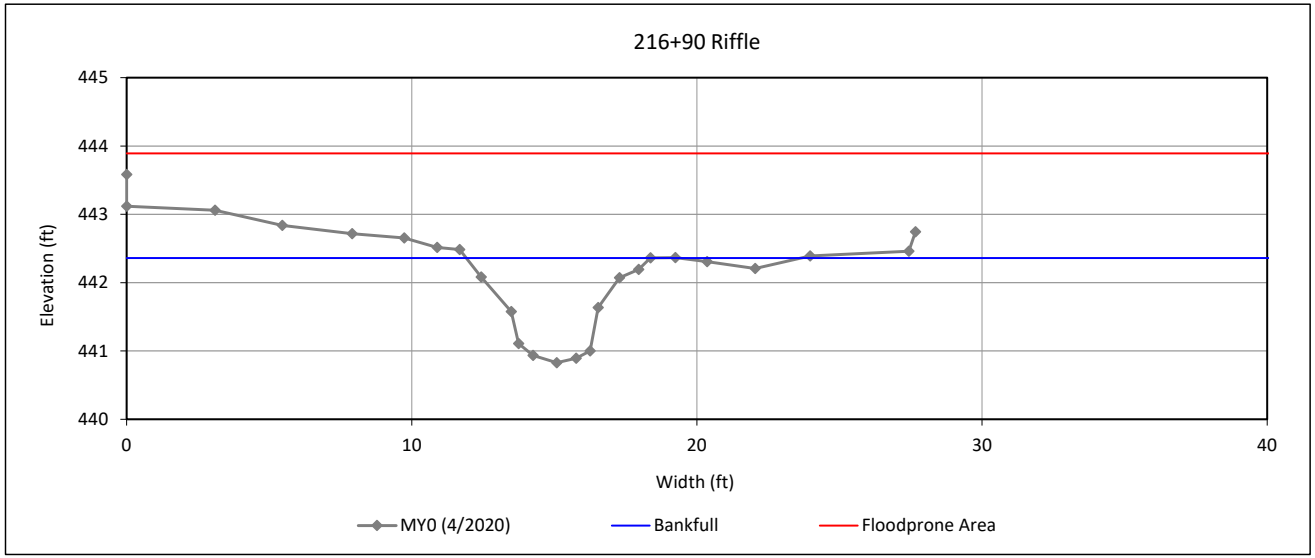
Survey Date: 4/2020
Field Crew: Kee Mapping & Surveying

View Downstream

Cross-Section Plots

Catfish Pond Mitigation Site
DMS Project No. 100039
Monitoring Year 0 - 2020

Cross-Section 7 - UT1 Reach 3



Bankfull Dimensions	
5.4	x-section area (ft.sq.)
6.5	width (ft)
0.8	mean depth (ft)
1.5	max depth (ft)
7.5	wetted perimeter (ft)
0.7	hydraulic radius (ft)
7.8	width-depth ratio
60.0	W flood prone area (ft)
9.3	entrenchment ratio
1.0	low bank height ratio

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

View Downstream

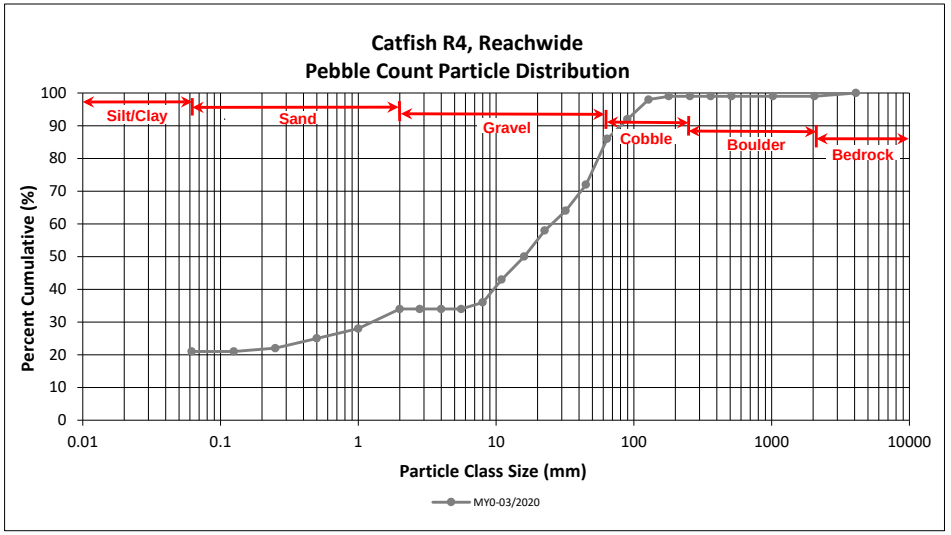
Reachwide and Cross-Section Pebble Count Plots

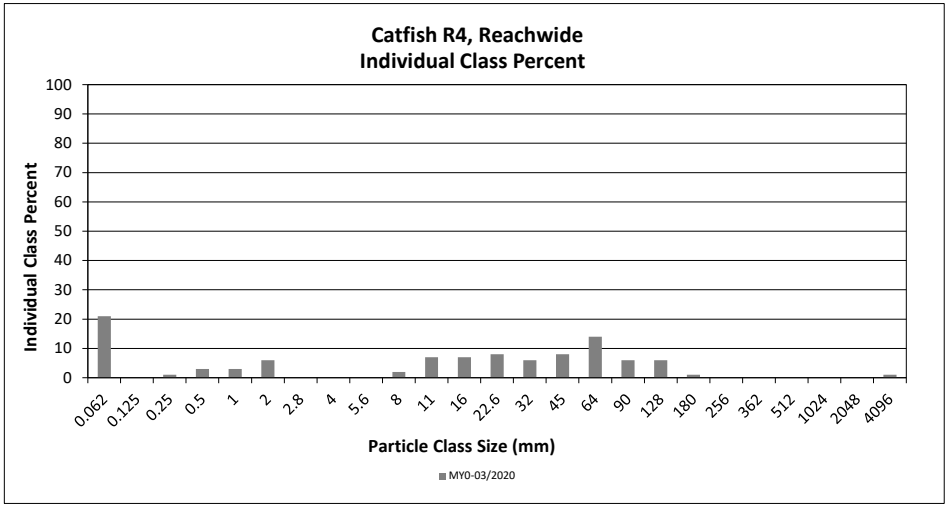
Catfish Pond Mitigation Site
DMS Project No. 100039
Monitoring Year 0 - 2020

Catfish R4, Reachwide

Particle Class		Diameter (mm)		Particle Count			Reach Summary	
		min	max	Riffle	Pool	Total	Class Percentage	Percent Cumulative
SILT/CLAY	Silt/Clay	0.000	0.062	5	16	21	21	21
SAND	Very fine	0.062	0.125					21
	Fine	0.125	0.250		1	1	1	22
	Medium	0.25	0.50	1	2	3	3	25
	Coarse	0.5	1.0	2	1	3	3	28
	Very Coarse	1.0	2.0	6		6	6	34
GRAVEL	Very Fine	2.0	2.8					34
	Very Fine	2.8	4.0					34
	Fine	4.0	5.6					34
	Fine	5.6	8.0		2	2	2	36
	Medium	8.0	11.0	5	2	7	7	43
	Medium	11.0	16.0	6	1	7	7	50
	Coarse	16.0	22.6	4	4	8	8	58
	Coarse	22.6	32	3	3	6	6	64
	Very Coarse	32	45	5	3	8	8	72
	Very Coarse	45	64	12	2	14	14	86
COBBLE	Small	64	90	5	1	6	6	92
	Small	90	128	4	2	6	6	98
	Large	128	180	1		1	1	99
	Large	180	256					99
BOULDER	Small	256	362					99
	Small	362	512					99
	Medium	512	1024					99
	Large/Very Large	1024	2048					99
BEDROCK	Bedrock	2048	>2048	1		1	1	100
			Total	**60**	**40**	**100**	**100**	**100**

Reachwide	
Channel materials (mm)	
D_{16} =	Silt/Clay
D_{35} =	6.69
D_{50} =	16.0
D_{84} =	60.9
D_{95} =	107.3
D_{100} =	>2048





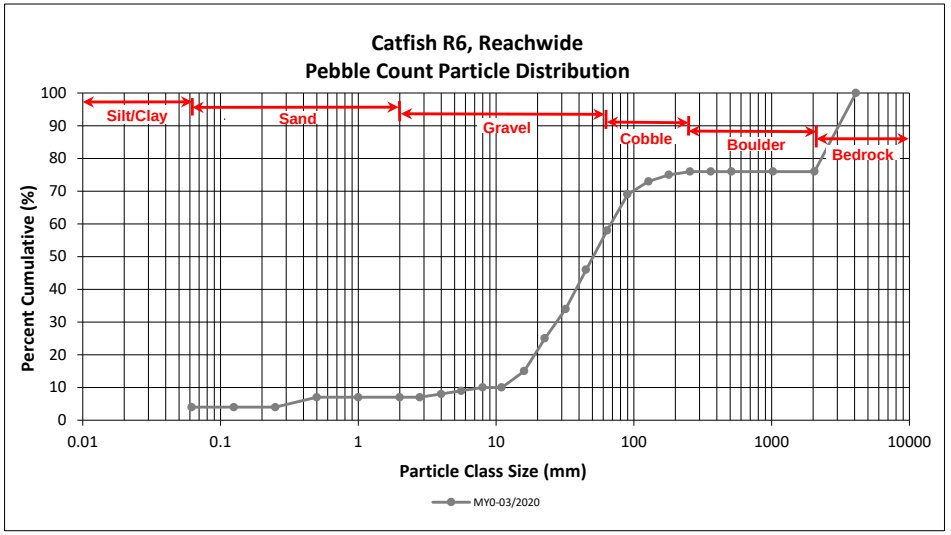
Reachwide and Cross-Section Pebble Count Plots

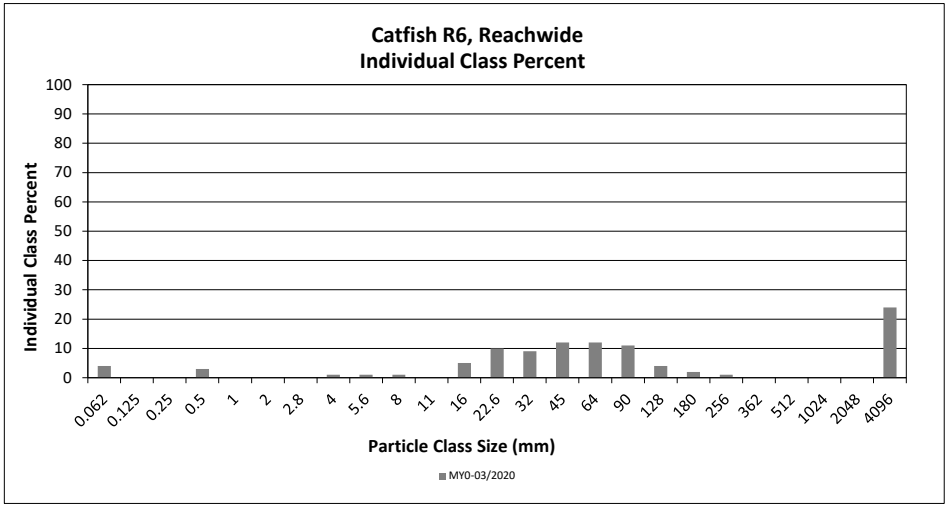
Catfish Pond Mitigation Site
DMS Project No. 100039
Monitoring Year 0 - 2020

Catfish R6, 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		4	4	4	4
SAND	Very fine	0.062	0.125					4
	Fine	0.125	0.250					4
	Medium	0.25	0.50		3	3	3	7
	Coarse	0.5	1.0					7
	Very Coarse	1.0	2.0					7
GRAVEL	Very Fine	2.0	2.8					7
	Very Fine	2.8	4.0	1		1	1	8
	Fine	4.0	5.6	1		1	1	9
	Fine	5.6	8.0	1		1	1	10
	Medium	8.0	11.0					10
	Medium	11.0	16.0	5		5	5	15
	Coarse	16.0	22.6	10		10	10	25
	Coarse	22.6	32	9		9	9	34
	Very Coarse	32	45	11	1	12	12	46
	Very Coarse	45	64	12		12	12	58
COBBLE	Small	64	90	9	2	11	11	69
	Small	90	128	4		4	4	73
	Large	128	180	2		2	2	75
	Large	180	256	1		1	1	76
BOULDER	Small	256	362					76
	Small	362	512					76
	Medium	512	1024					76
	Large/Very Large	1024	2048					76
BEDROCK	Bedrock	2048	>2048	14	10	24	24	100
			Total	**80**	**20**	**100**	**100**	**100**

Reachwide	
Channel materials (mm)	
D_{16} =	16.56
D_{35} =	32.92
D_{50} =	50.6
D_{84} =	2580.3
D_{95} =	3545.2
D_{100} =	>2048





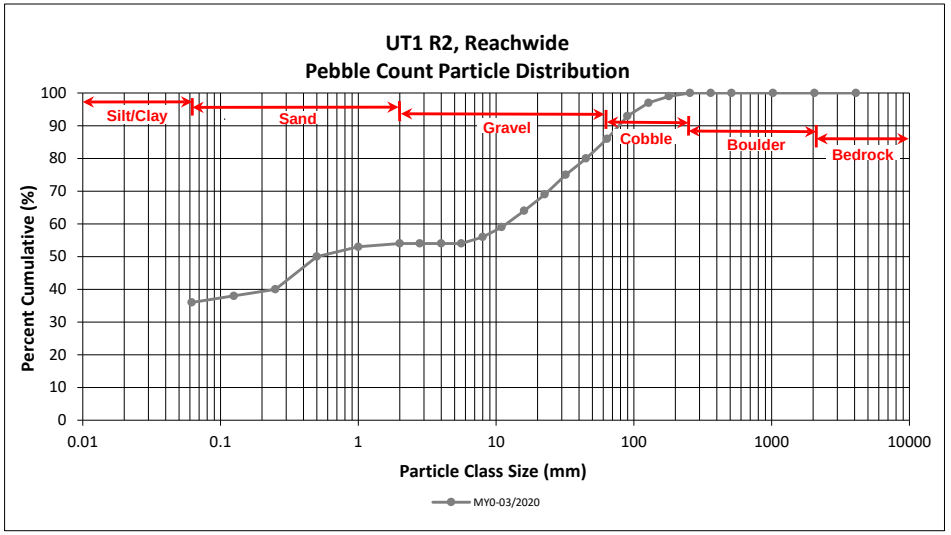
Reachwide and Cross-Section Pebble Count Plots

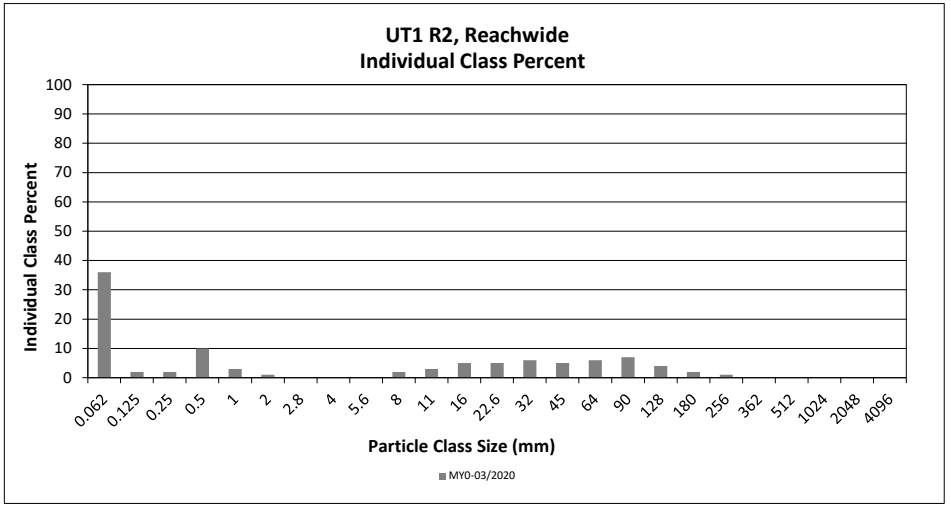
Catfish Pond Mitigation Site
DMS Project No. 100039
Monitoring Year 0 - 2020

UT1 R2, Reachwide

Particle Class		Diameter (mm)		Particle Count			Reach Summary	
		min	max	Riffle	Pool	Total	Class Percentage	Percent Cumulative
SILT/CLAY	Silt/Clay	0.000	0.062	5	31	36	36	36
SAND	Very fine	0.062	0.125		2	2	2	38
	Fine	0.125	0.250		2	2	2	40
	Medium	0.25	0.50	1	9	10	10	50
	Coarse	0.5	1.0	2	1	3	3	53
	Very Coarse	1.0	2.0	1		1	1	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	2	2	56
	Medium	8.0	11.0	1	2	3	3	59
	Medium	11.0	16.0	5		5	5	64
	Coarse	16.0	22.6	4	1	5	5	69
	Coarse	22.6	32	6		6	6	75
	Very Coarse	32	45	4	1	5	5	80
	Very Coarse	45	64	6		6	6	86
COBBLE	Small	64	90	7		7	7	93
	Small	90	128	4		4	4	97
	Large	128	180	2		2	2	99
	Large	180	256	1		1	1	100
BOULDER	Small	256	362					100
	Small	362	512					100
	Medium	512	1024					100
	Large/Very Large	1024	2048					100
BEDROCK	Bedrock	2048	>2048					100
			Total	50	50	100	100	100

Reachwide	
Channel materials (mm)	
D_{16} =	Silt/Clay
D_{35} =	Silt/Clay
D_{50} =	0.5
D_{84} =	56.9
D_{95} =	107.3
D_{100} =	256.0





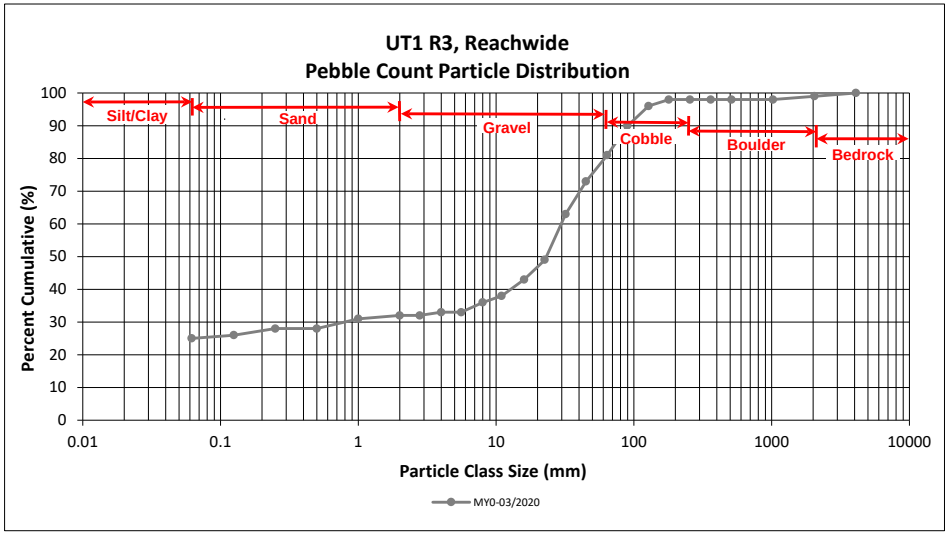
Reachwide and Cross-Section Pebble Count Plots

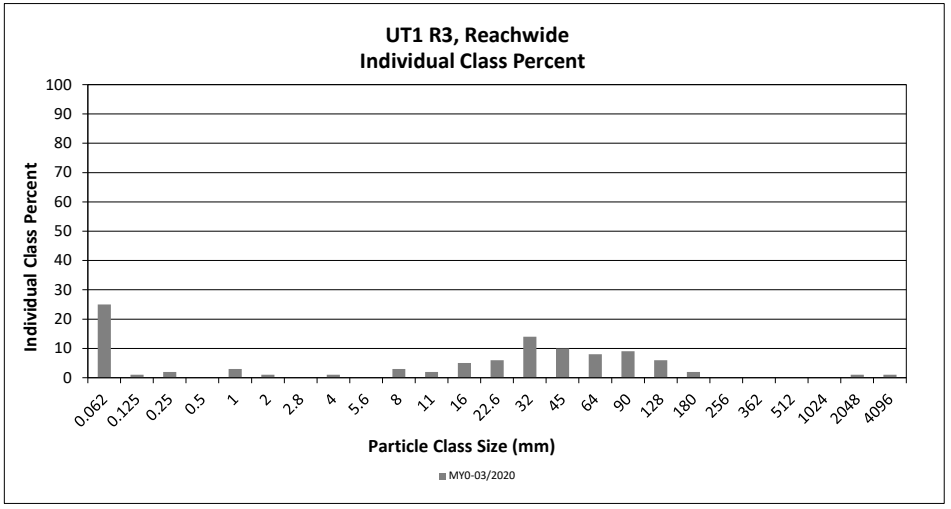
Catfish Pond Mitigation Site
DMS Project No. 100039
Monitoring Year 0 - 2020

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	3	22	25	25	25
SAND	Very fine	0.062	0.125		1	1	1	26
	Fine	0.125	0.250		2	2	2	28
	Medium	0.25	0.50					28
	Coarse	0.5	1.0	2	1	3	3	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	1		1	1	33
	Fine	4.0	5.6					33
	Fine	5.6	8.0	2	1	3	3	36
	Medium	8.0	11.0	1	1	2	2	38
	Medium	11.0	16.0	3	2	5	5	43
	Coarse	16.0	22.6	5	1	6	6	49
	Coarse	22.6	32	9	5	14	14	63
	Very Coarse	32	45	8	2	10	10	73
	Very Coarse	45	64	8		8	8	81
COBBLE	Small	64	90	8	1	9	9	90
	Small	90	128	5	1	6	6	96
	Large	128	180	2		2	2	98
	Large	180	256					98
BOULDER	Small	256	362					98
	Small	362	512					98
	Medium	512	1024					98
	Large/Very Large	1024	2048	1		1	1	99
BEDROCK	Bedrock	2048	>2048	1		1	1	100
			Total	**60**	**40**	**100**	**100**	**100**

Reachwide	
Channel materials (mm)	
D_{16} =	Silt/Clay
D_{35} =	7.10
D_{50} =	23.2
D_{84} =	71.7
D_{95} =	120.7
D_{100} =	>2048





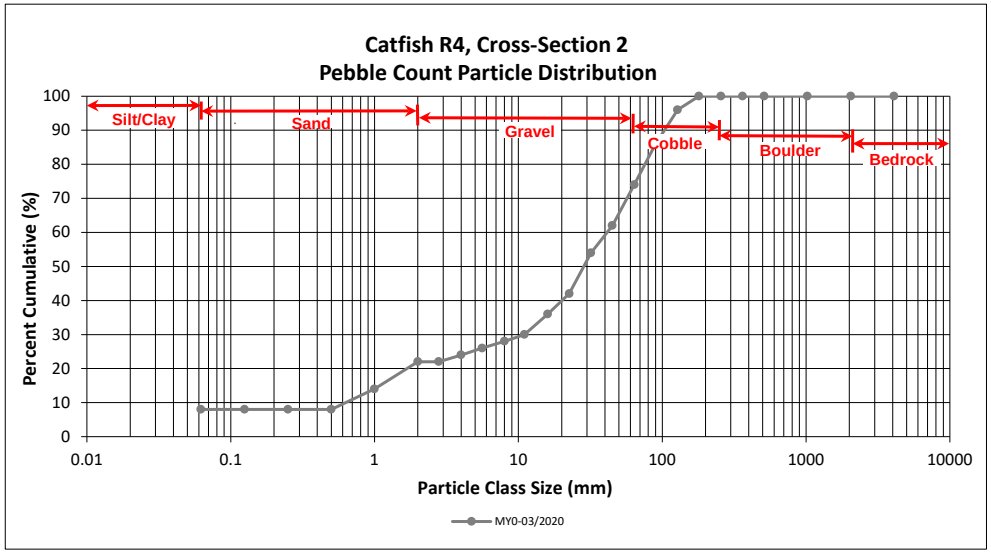
Reachwide and Cross-Section Pebble Count Plots

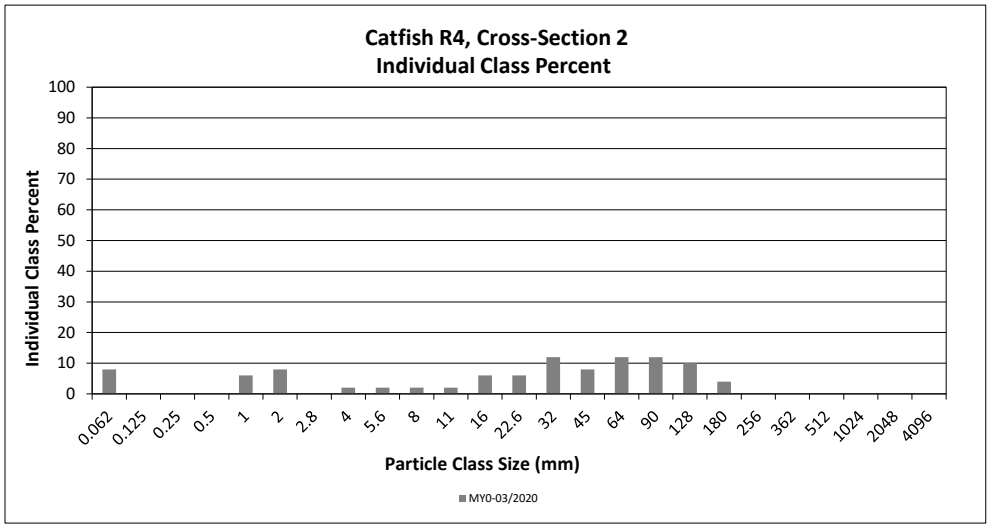
Catfish Pond Mitigation Site
DMS Project No. 100039
Monitoring Year 0 - 2020

Catfish R4, 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	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	6	6	14
	Very Coarse	1.0	2.0	8	8	22
GRAVEL	Very Fine	2.0	2.8			22
	Very Fine	2.8	4.0	2	2	24
	Fine	4.0	5.6	2	2	26
	Fine	5.6	8.0	2	2	28
	Medium	8.0	11.0	2	2	30
	Medium	11.0	16.0	6	6	36
	Coarse	16.0	22.6	6	6	42
	Coarse	22.6	32	12	12	54
	Very Coarse	32	45	8	8	62
	Very Coarse	45	64	12	12	74
COBBLE	Small	64	90	12	12	86
	Small	90	128	10	10	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 2	
Channel materials (mm)	
D_{16} =	1.19
D_{35} =	15.03
D_{50} =	28.5
D_{84} =	85.0
D_{95} =	123.6
D_{100} =	180.0





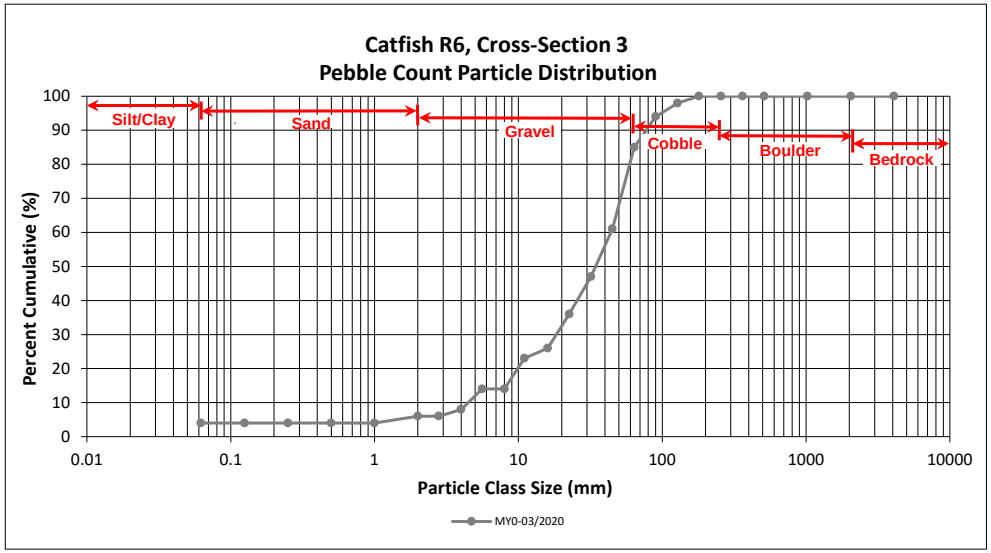
Reachwide and Cross-Section Pebble Count Plots

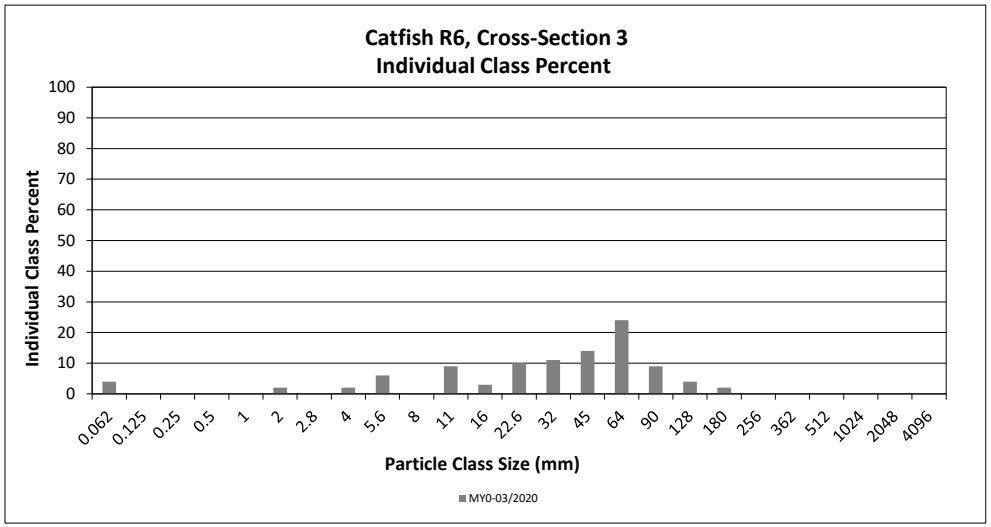
Catfish Pond Mitigation Site
DMS Project No. 100039
Monitoring Year 0 - 2020

Catfish R6, Cross-Section 3

Particle Class		Diameter (mm)		Riffle 100-Count	Summary	
		min	max		Class Percentage	Percent Cumulative
SILT/CLAY	Silt/Clay	0.000	0.062	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	2	2	6
GRAVEL	Very Fine	2.0	2.8			6
	Very Fine	2.8	4.0	2	2	8
	Fine	4.0	5.6	6	6	14
	Fine	5.6	8.0			14
	Medium	8.0	11.0	9	9	23
	Medium	11.0	16.0	3	3	26
	Coarse	16.0	22.6	10	10	36
	Coarse	22.6	32	11	11	47
	Very Coarse	32	45	14	14	61
	Very Coarse	45	64	24	24	85
COBBLE	Small	64	90	9	9	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 3	
Channel materials (mm)	
D_{16} =	8.59
D_{35} =	21.83
D_{50} =	34.4
D_{84} =	63.1
D_{95} =	98.3
D_{100} =	180.0





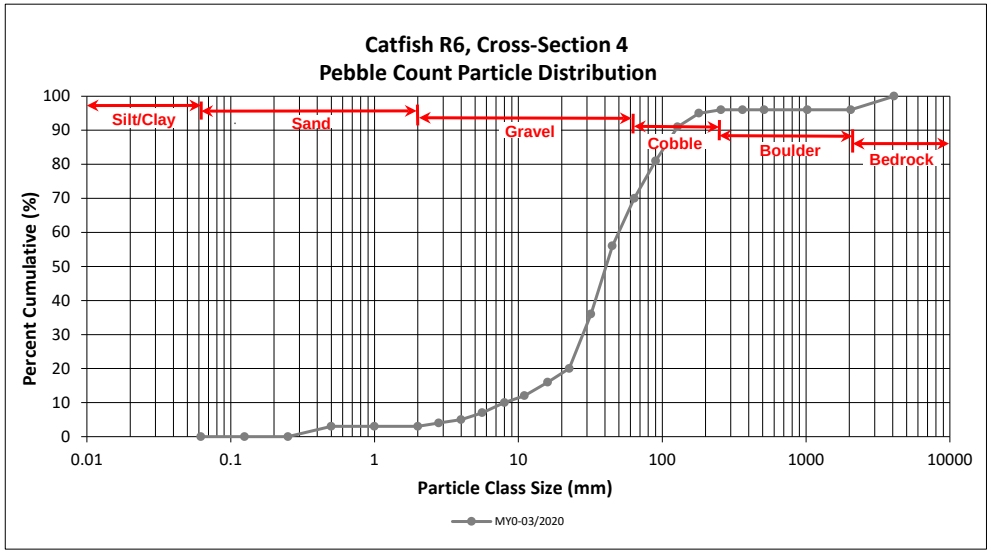
Reachwide and Cross-Section Pebble Count Plots

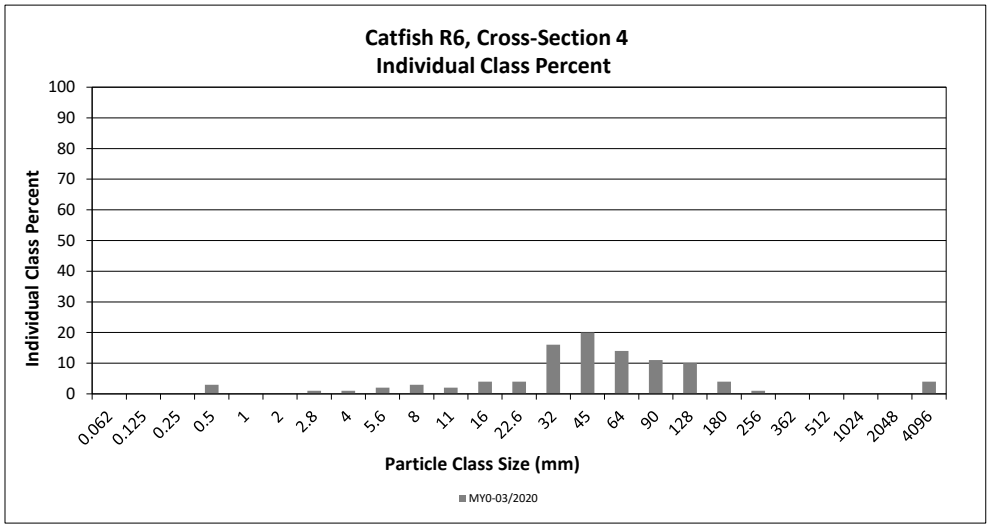
Catfish Pond Mitigation Site
DMS Project No. 100039
Monitoring Year 0 - 2020

Catfish R6, 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	3	3	3
	Coarse	0.5	1.0			3
	Very Coarse	1.0	2.0			3
GRAVEL	Very Fine	2.0	2.8	1	1	4
	Very Fine	2.8	4.0	1	1	5
	Fine	4.0	5.6	2	2	7
	Fine	5.6	8.0	3	3	10
	Medium	8.0	11.0	2	2	12
	Medium	11.0	16.0	4	4	16
	Coarse	16.0	22.6	4	4	20
	Coarse	22.6	32	16	16	36
	Very Coarse	32	45	20	20	56
	Very Coarse	45	64	14	14	70
COBBLE	Small	64	90	11	11	81
	Small	90	128	10	10	91
	Large	128	180	4	4	95
	Large	180	256	1	1	96
BOULDER	Small	256	362			96
	Small	362	512			96
	Medium	512	1024			96
	Large/Very Large	1024	2048			96
BEDROCK	Bedrock	2048	>2048	4	4	100
			Total	**100**	**100**	**100**

Cross-Section 4	
Channel materials (mm)	
D_{16} =	16.00
D_{35} =	31.31
D_{50} =	40.6
D_{84} =	100.0
D_{95} =	180.0
D_{100} =	>2048





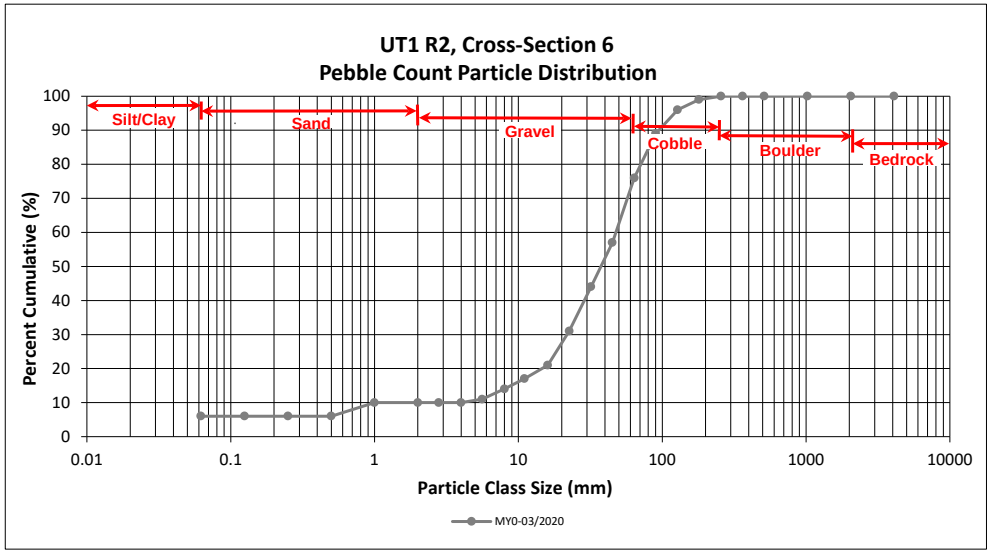
Reachwide and Cross-Section Pebble Count Plots

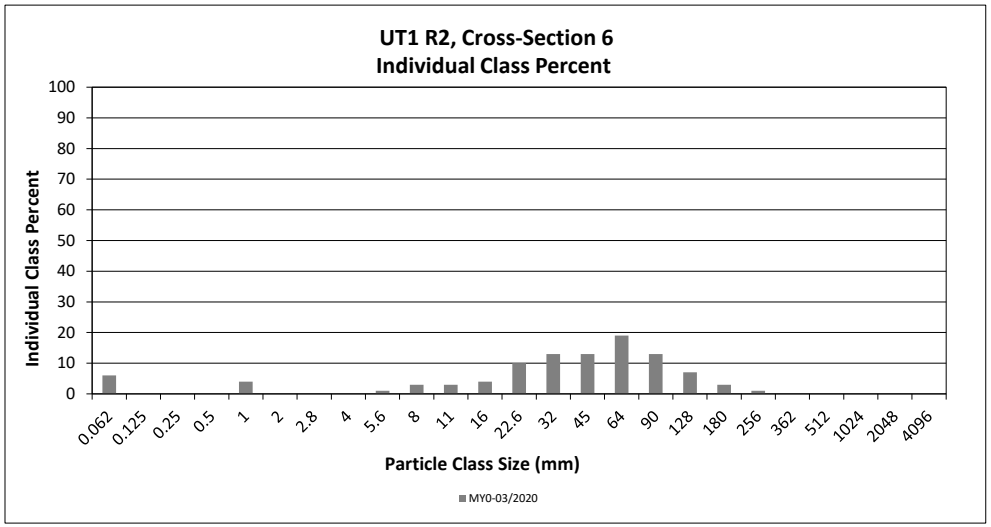
Catfish Pond Mitigation Site
DMS Project No. 100039
Monitoring Year 0 - 2020

UT1 R2, Cross-Section 6

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	6	6	6
SAND	Very fine	0.062	0.125			6
	Fine	0.125	0.250			6
	Medium	0.25	0.50			6
	Coarse	0.5	1.0	4	4	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	1	1	11
	Fine	5.6	8.0	3	3	14
	Medium	8.0	11.0	3	3	17
	Medium	11.0	16.0	4	4	21
	Coarse	16.0	22.6	10	10	31
	Coarse	22.6	32	13	13	44
	Very Coarse	32	45	13	13	57
	Very Coarse	45	64	19	19	76
COBBLE	Small	64	90	13	13	89
	Small	90	128	7	7	96
	Large	128	180	3	3	99
	Large	180	256	1	1	100
BOULDER	Small	256	362			100
	Small	362	512			100
	Medium	512	1024			100
	Large/Very Large	1024	2048			100
BEDROCK	Bedrock	2048	>2048			100
			Total	**100**	**100**	**100**

Cross-Section 6	
Channel materials (mm)	
D_{16} =	9.89
D_{35} =	25.15
D_{50} =	37.5
D_{84} =	78.9
D_{95} =	121.7
D_{100} =	256.0





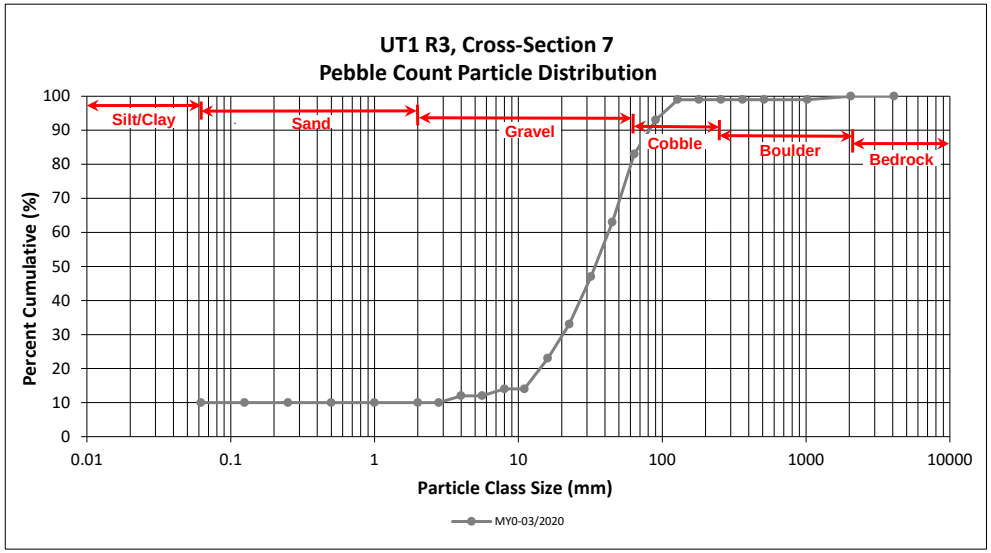
Reachwide and Cross-Section Pebble Count Plots

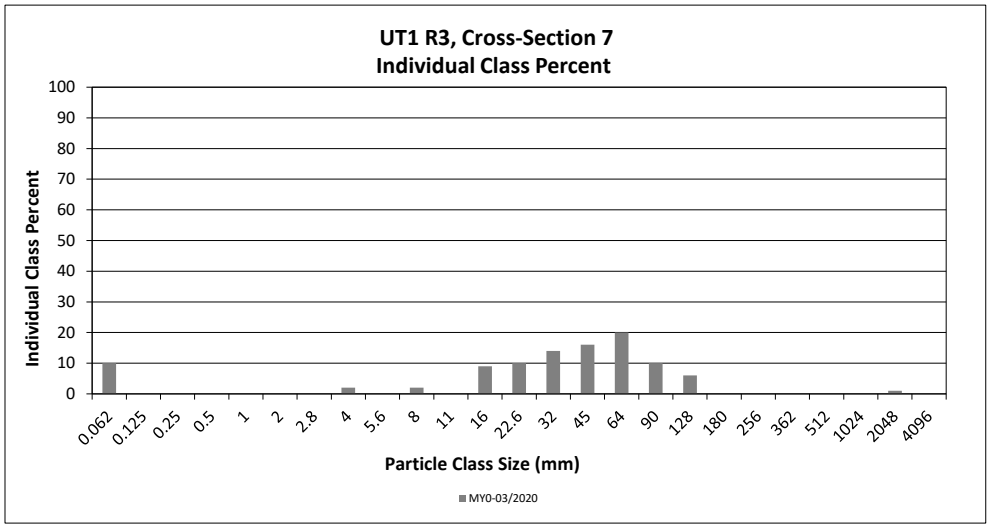
Catfish Pond Mitigation Site
DMS Project No. 100039
Monitoring Year 0 - 2020

UT1 R3, 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	10	10	10
SAND	Very fine	0.062	0.125			10
	Fine	0.125	0.250			10
	Medium	0.25	0.50			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	2	2	12
	Fine	4.0	5.6			12
	Fine	5.6	8.0	2	2	14
	Medium	8.0	11.0			14
	Medium	11.0	16.0	9	9	23
	Coarse	16.0	22.6	10	10	33
	Coarse	22.6	32	14	14	47
	Very Coarse	32	45	16	16	63
	Very Coarse	45	64	20	20	83
COBBLE	Small	64	90	10	10	93
	Small	90	128	6	6	99
	Large	128	180			99
	Large	180	256			99
BOULDER	Small	256	362			99
	Small	362	512			99
	Medium	512	1024			99
	Large/Very Large	1024	2048	1	1	100
BEDROCK	Bedrock	2048	>2048			100
			Total	**100**	**100**	**100**

Cross-Section 7	
Channel materials (mm)	
D_{16} =	11.96
D_{35} =	23.75
D_{50} =	34.1
D_{84} =	66.2
D_{95} =	101.2
D_{100} =	2048.0





APPENDIX 5. Record Drawings

Catfish Pond Mitigation Site - Record Drawings

Durham County, North Carolina
for
NCDEQ
Division of Mitigation Services

Durham County, NC

Vicinity Map
Not to Scale

Environmental Quality

As-Built and Record Drawings - Issued
June 18, 2020

Sheet Index

Site Coordinates

Latitude	Longitude
36.163342	-78.910461

BEFORE YOU DIG!
CALL 1-800-632-4949
N.C. ONE-CALL CENTER
IT'S THE LAW!

CERTIFICATE OF SURVEY AND ACCURACY

I, PHILLIP B. KEE, CERTIFY THAT THE GROUND TOPOGRAPHIC SURVEY PORTION OF THIS PROJECT WAS COMPLETED UNDER MY DIRECT SUPERVISION FROM AN ACTUAL SURVEY MADE UNDER MY DIRECT SUPERVISION; THAT THE RECORD DRAWINGS WERE PREPARED BY WILDLANDS ENGINEERING, INC. FROM DIGITAL FILES PROVIDED BY KEE MAPPING AND SURVEYING, PA AS SHOWN ON AN AS-BUILT SURVEY FOR "WILDLANDS ENGINEERING, INC.", JOB #1909105-AB, DATED JUNE 05, 2020; THAT THIS SURVEY WAS PERFORMED AT THE 95% CONFIDENCE LEVEL TO MEET THE FEDERAL GEOGRAPHIC DATA COMMITTEE STANDARDS AND TO MEET THE REQUIREMENTS OF A TOPOGRAPHIC SURVEY TO THE ACCURACY OF CLASS A HORIZONTAL AND CLASS C VERTICAL WHERE APPLICABLE; THAT THE ORIGINAL DATA WAS OBTAINED BETWEEN THE DATES OF 03/31/20-04/02/20; THAT THE CONTOURS SHOWN AS BROKEN LINES MAY NOT MEET THE STATED STANDARD; THAT ALL COORDINATES ARE BASED ON NAD 83 (NSRS 2011) AND ALL ELEVATIONS ARE BASED ON NAVD 88; THAT THIS MAP MEETS THE SPECIFICATIONS FOR TOPOGRAPHIC SURVEYS AS STATED IN TITLE 21, CHAPTER 56, SECTION .1606.

WITNESS MY ORIGINAL SIGNATURE, LICENSE NUMBER, AND SEAL THIS 8TH DAY OF JUNE, 2020, A.D.

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

DocuSigned by:
Phillip B. Kee
D965004A7692407...

PHILLIP B. KEE, PLS L-4647

Project Directory

Engineering:
Wildlands Engineering, Inc
License No. F-0831
312 W. Millbrook Rd., Suite 225
Raleigh, NC 27609
Chris Roessler
919-851-9986

Surveying:
Kee Mapping & Surveying
Box P.O. 2566
Asheville, NC 28802
Phillip B. Kee, PLS
828-575-9021

Owner:
NCDEQ
Division of Mitigation Services
217 West Jones St. Suite 3000A
Raleigh, NC 27603
Jeremiah Dow
919-707-8280

DMS Project No. 100039

Neuse River Basin HUC 03020201

USACE Action ID: SAW-2018-00424

WILDLANDS ENGINEERING
497 Bramson Ct, Suite 104
Mount Pleasant, SC 29464
Tel: 843.277.6221

NORTH CAROLINA PROFESSIONAL SEAL 048920 ENGINEER GRANT REYL SMITH

Catfish Pond Mitigation Site - Record Drawings
Durham County, North Carolina

Title Sheet

Revisions:

Date:	06-18-2020
Job Number:	005-02168
Project Engineer:	GLS
Drawn By:	JTC
Checked By:	JCK

Sheet 0.1

Design Features

- Design Stream Alignment (10+00)
- Design Bankfull
- Design 5' Major Contour (540)
- Design 1' Minor Contour
- Design Riffle
- Design Brush Toe
- Design Boulder Toe
- Design Brush Mattress
- Design Log Sill
- Design Rock Sill
- Design Culvert
- Design Permanent Fencing (X-P-X)
- Design Road over Culvert
- Existing Wetland
- Existing Bedrock

As-Built Features

- Conservation Easement (CE)
- Conservation Easement Crossing (CE-XS)
- As-Built Fence (GPS survey by Wildlands)
- As-Built Stream Alignment - Restoration
- As-Built Stream Alignment - Enhancement II
- As-Built Stream Alignment - No Credit
- As-Built Bankfull
- As-Built 5' Major Contour (540)
- As-Built 1' Minor Contour
- As-Built Riffle
- As-Built Brush Toe
- As-Built Boulder Toe
- As-Built Brush Mattress
- As-Built Log Sill
- As-Built Rock Sill
- As-Built Culvert
- As-Built Road over Culvert
- As-Built Riprap Apron
- As-Built Bedrock

Monitoring Features

- Permanent Cross Section (XS)
- Vegetation Plot (VP, VEG)
- Groundwater Well (GW)
- Crest Gauge (CG)
- Photo Point (PP)

Notes:

1. Both the As-Built surveyed thalweg alignment and Design Centerline are depicted in this plan set.
2. The Design Centerline stationing is used for the profiles as well as project credit stationing.

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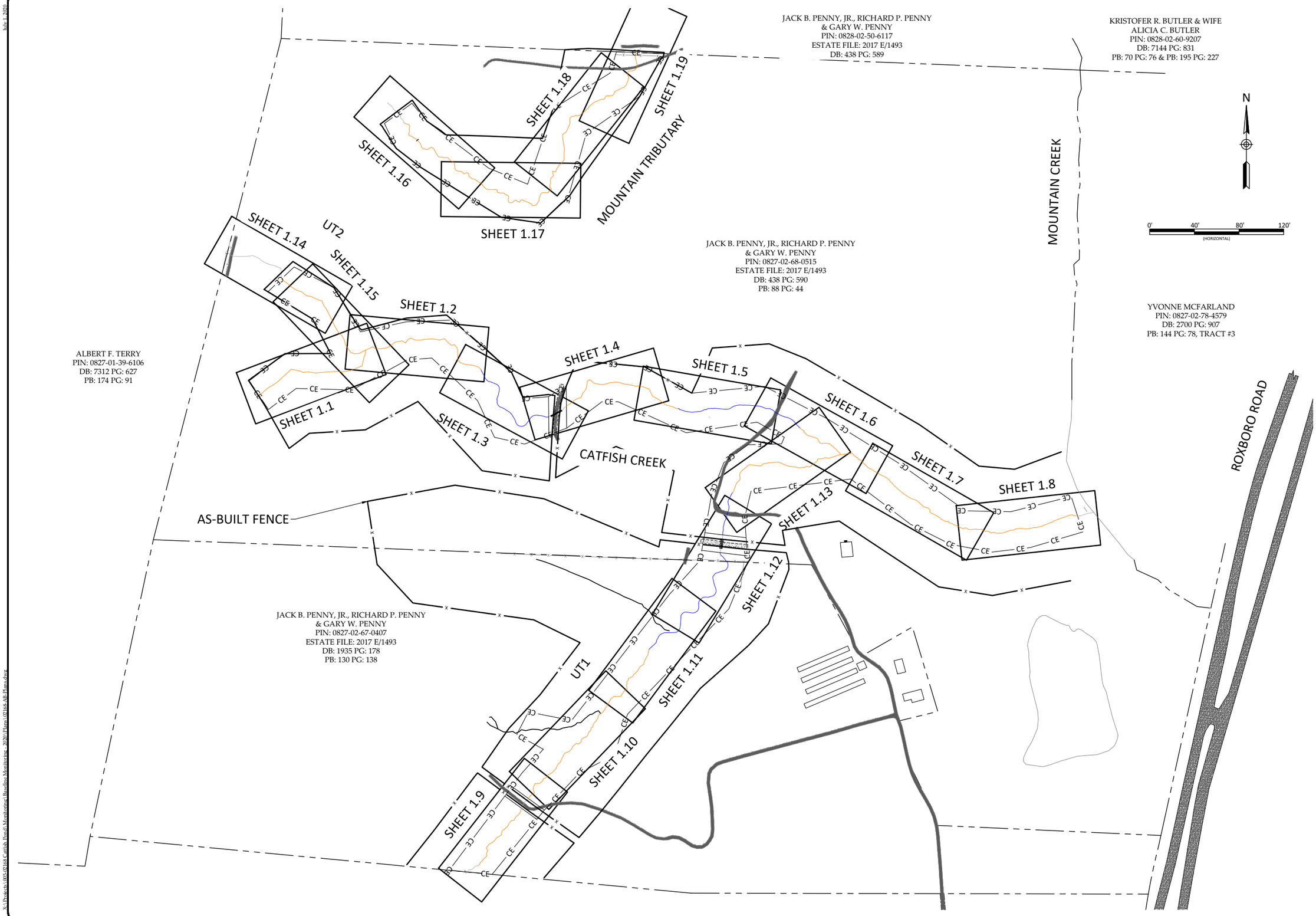
Catfish Pond Mitigation Site - Record Drawings
Durham County, North Carolina
General Notes and Legend

Revisions

Date:	06-18-2020
Job Number:	005-02168
Project Engineer:	GLS
Drawn By:	JTC
Checked By:	JCK

Sheet 0.2



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NORTH CAROLINA
SEAL
048920
GEOFFREY L. SMITH
ENGINEER

Catfish Pond Mitigation Site - Record Drawings
Durham County, North Carolina

Project Overview

Date:	06-18-2020
Job Number:	005-02168
Project Engineer:	GLS
Drawn By:	JTC
Checked By:	JCK

Revisions

Sheet 0.3

July 1, 2020

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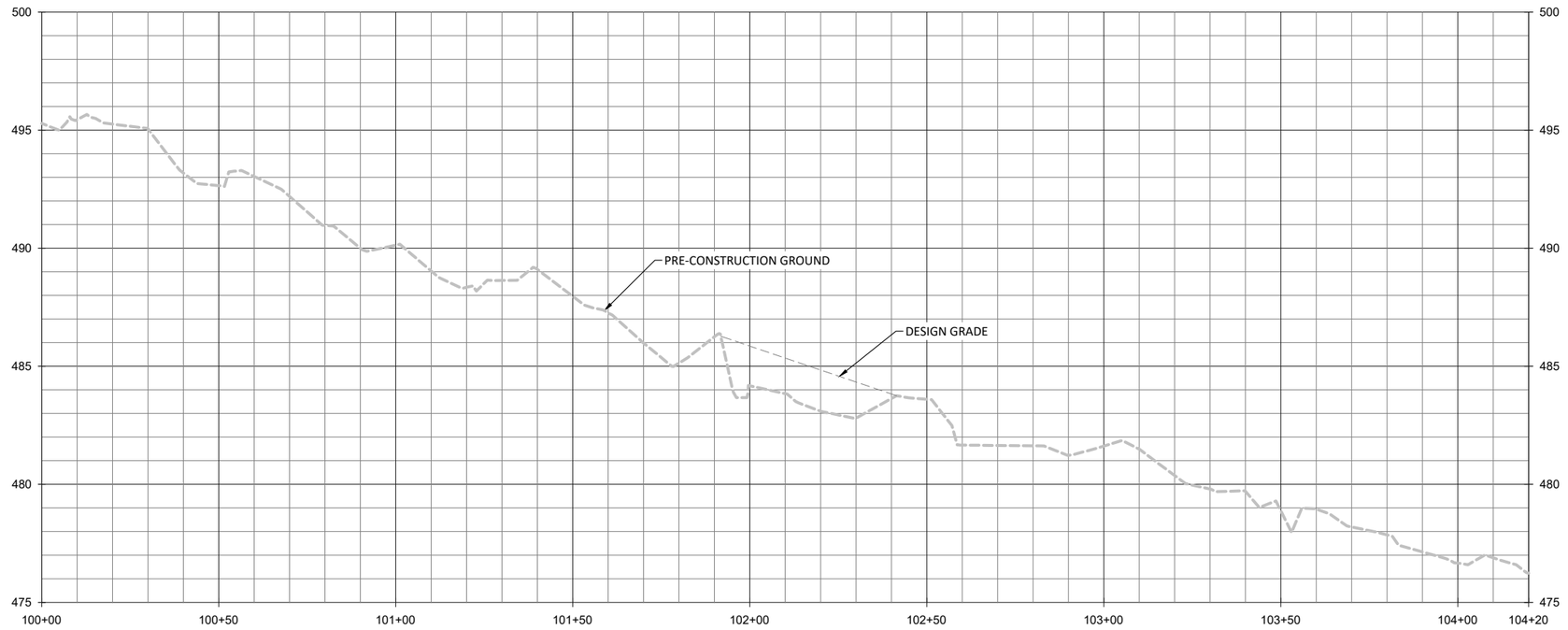

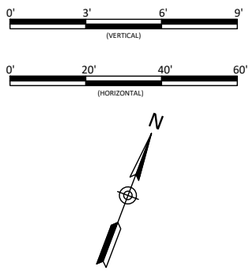

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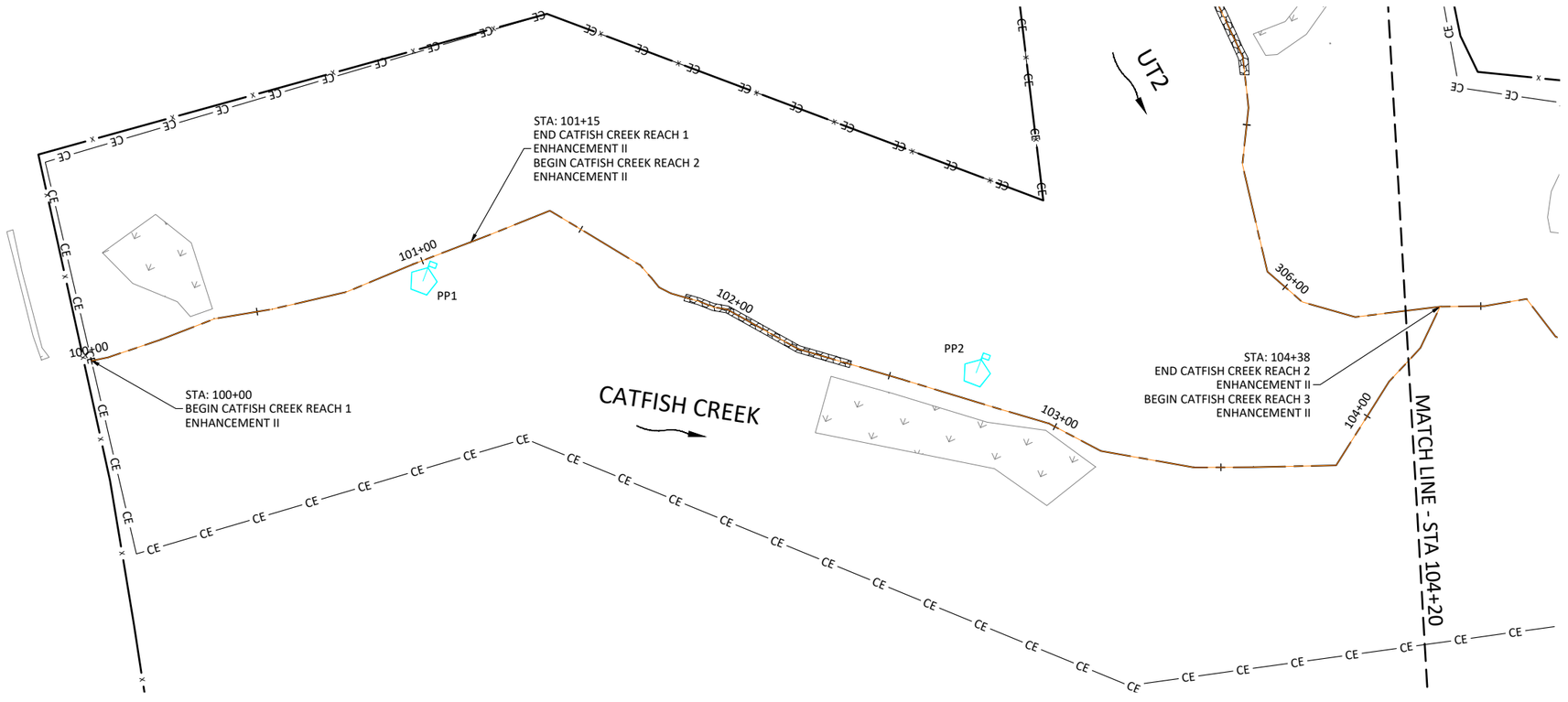

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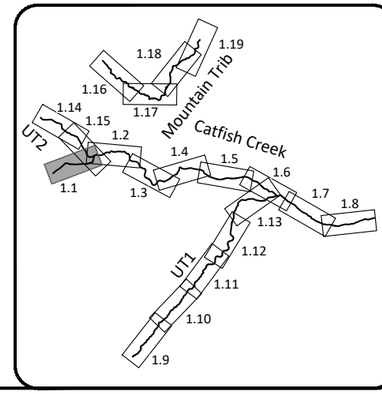

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Tel: 843.277.6221

NORTH CAROLINA SEAL 048920 ENGINEER GREGORY L. SMITH

Catfish Pond Mitigation Site - Record Drawings
Durham County, North Carolina

Catfish Creek
Stream Plan and Profile

Revisions:

Date:	06-18-2020
Job Number:	085-02168
Project Engineer:	GLS
Drawn By:	JTC
Checked By:	JCK

Sheet 1.1

July 1, 2020

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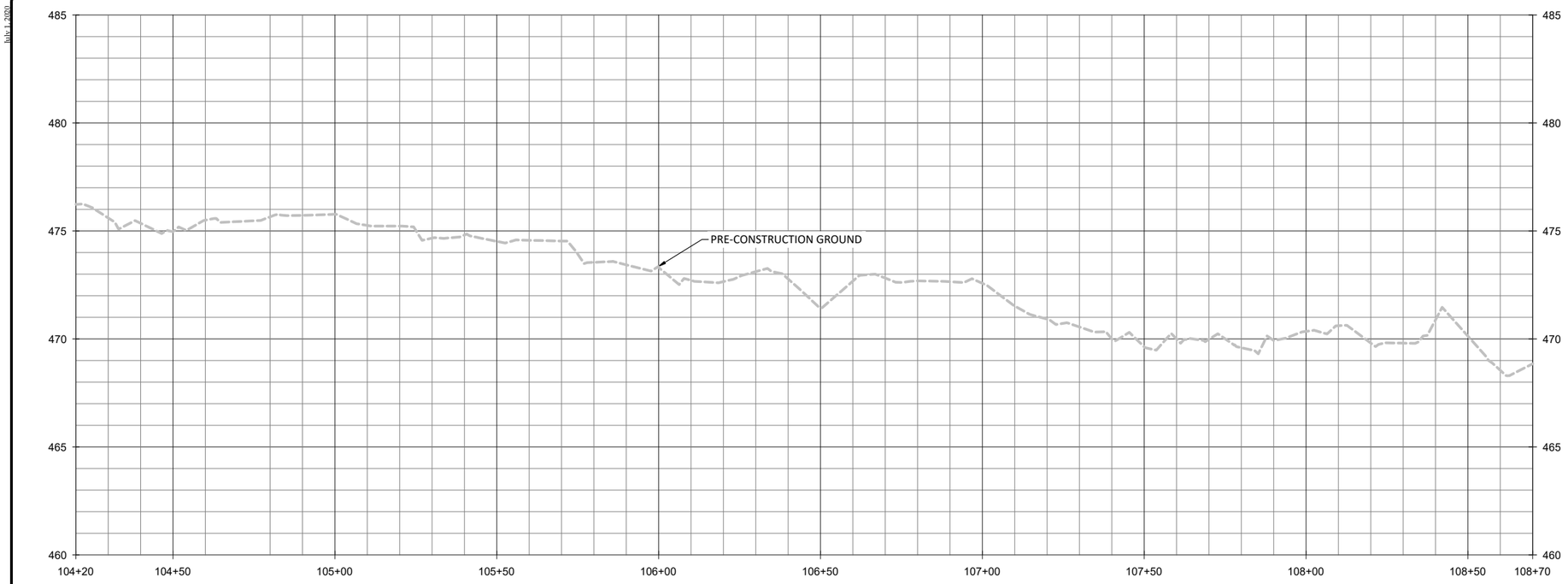

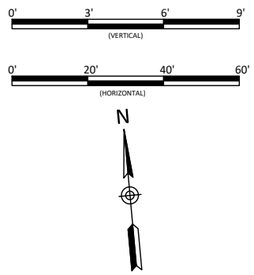

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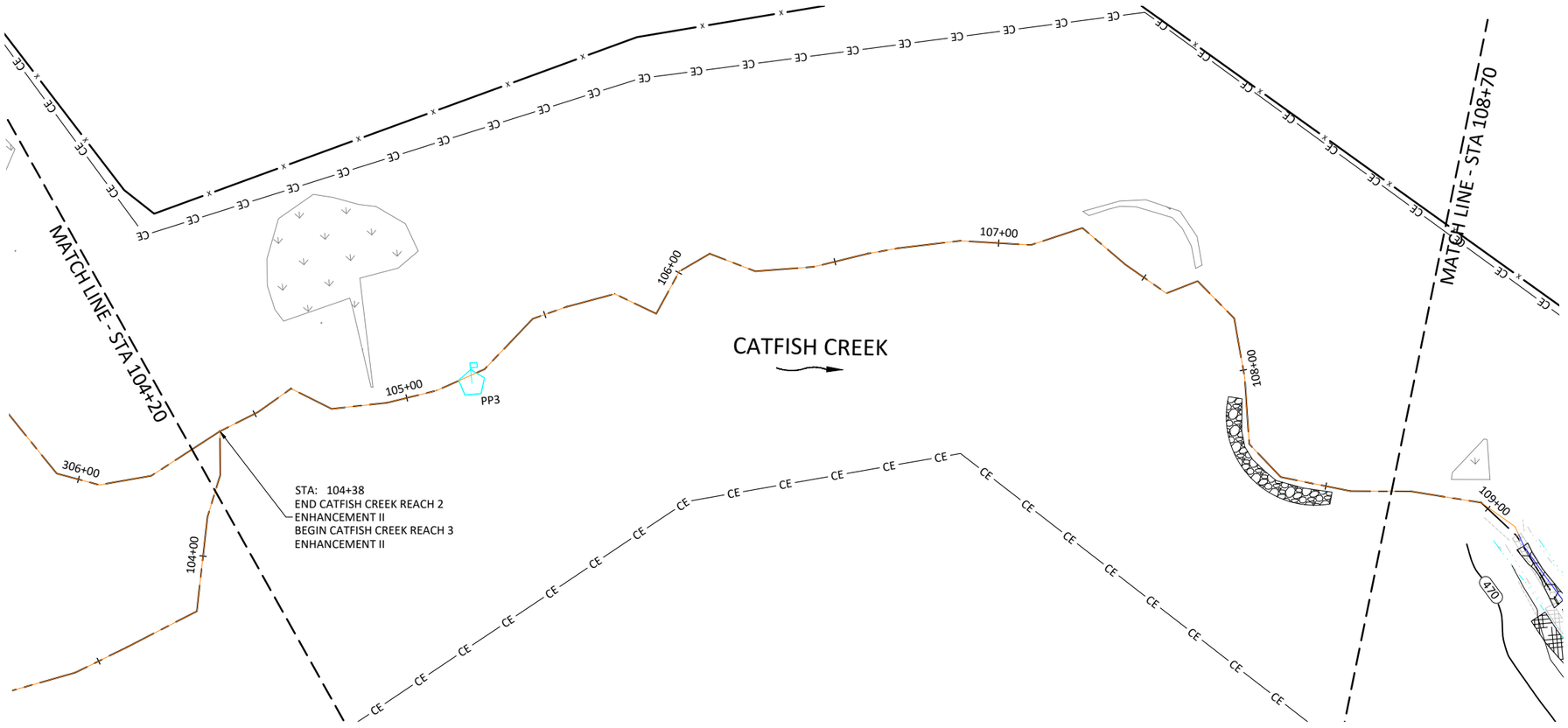

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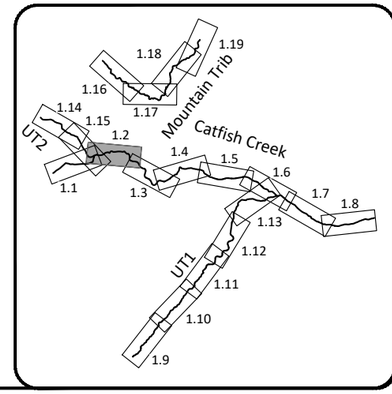

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Mount Pleasant, SC 29464
Tel: 843.277.6221

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5/21/20
GREGORY L. SMITH

Catfish Pond Mitigation Site - Record Drawings
Durham County, North Carolina

Catfish Creek
Stream Plan and Profile

Revisions:

Date:	06-18-2020
Job Number:	005-02168
Project Engineer:	GLS
Drawn By:	JTC
Checked By:	JCK

Sheet 1.2

July 1, 2020

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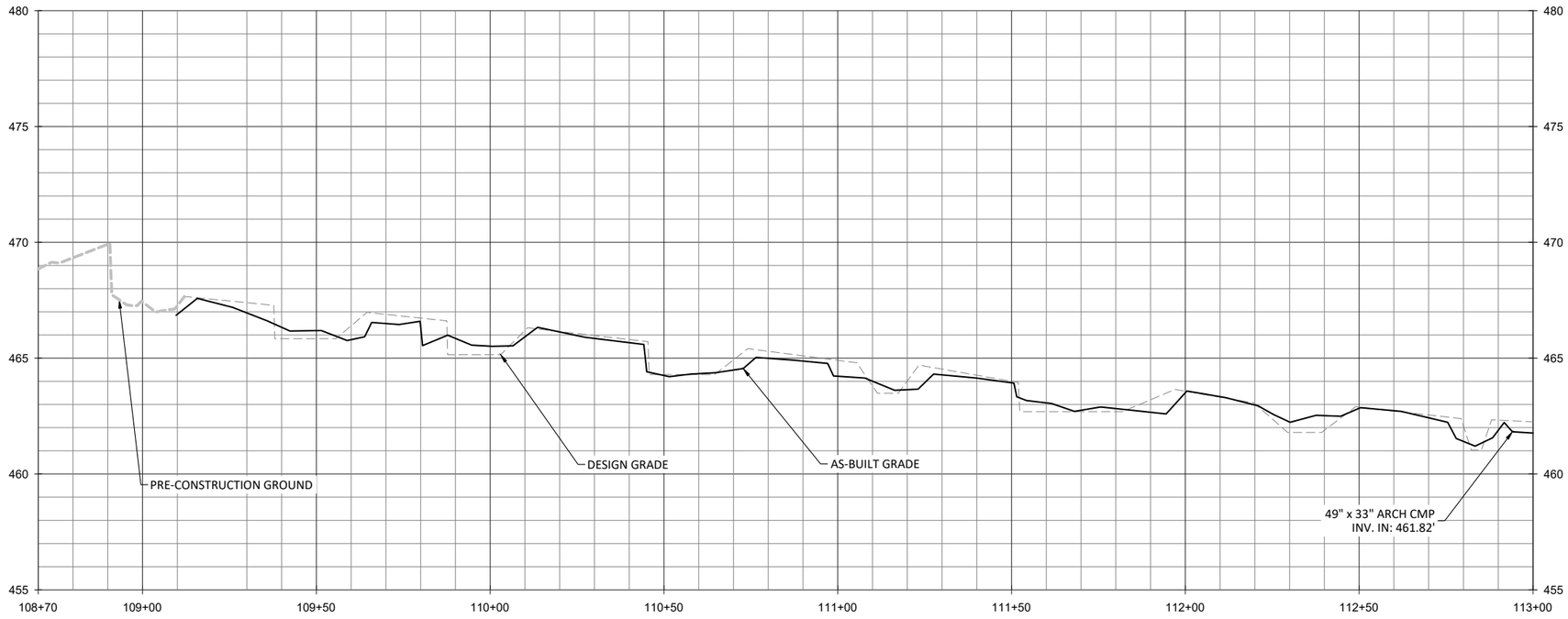

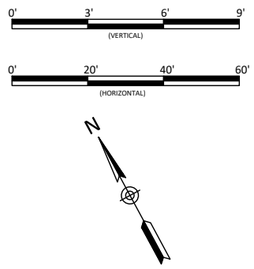

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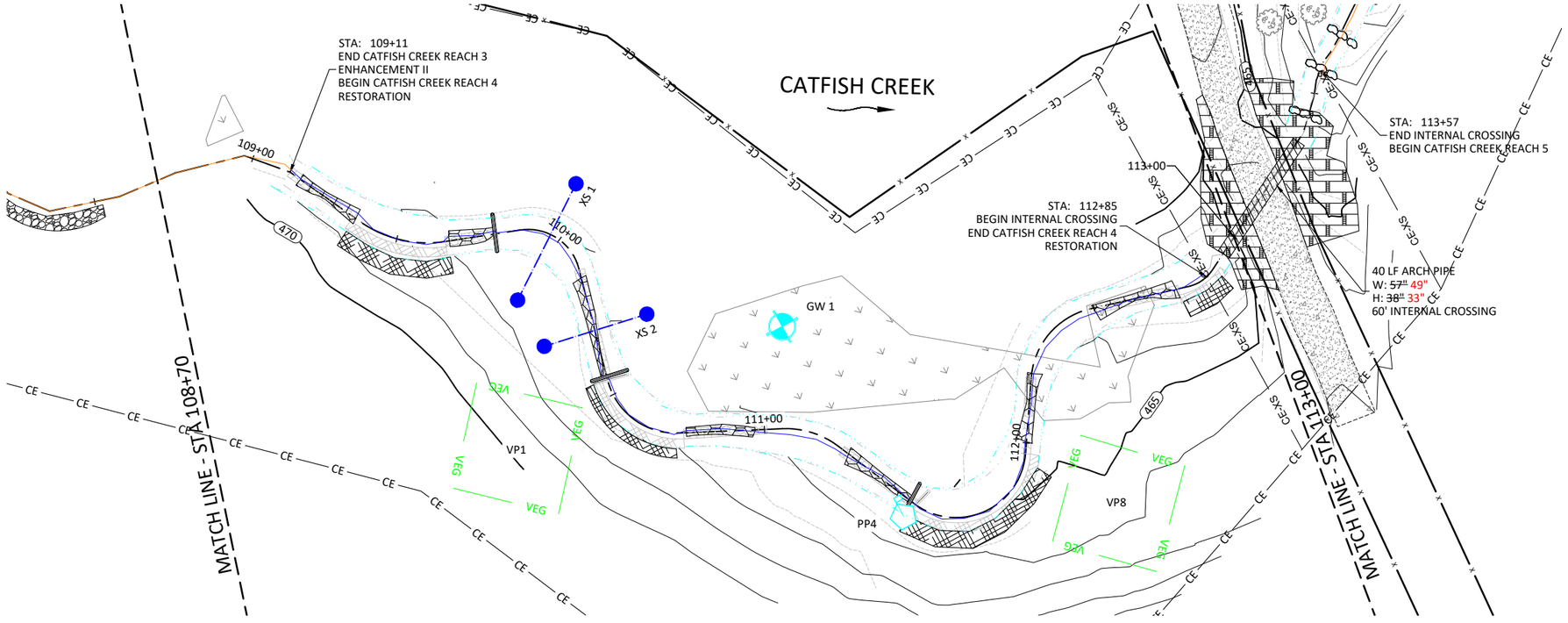

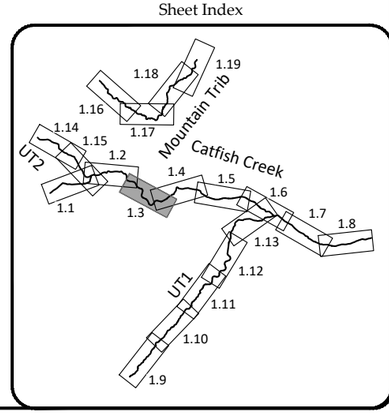

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Catfish Pond Mitigation Site - Record Drawings
Durham County, North Carolina

Catfish Creek
Stream Plan and Profile

Revisions:

Date:	06-18-2020
Job Number:	085-02168
Project Engineer:	GLS
Drawn By:	JTC
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Sheet 1.3

July 1, 2020

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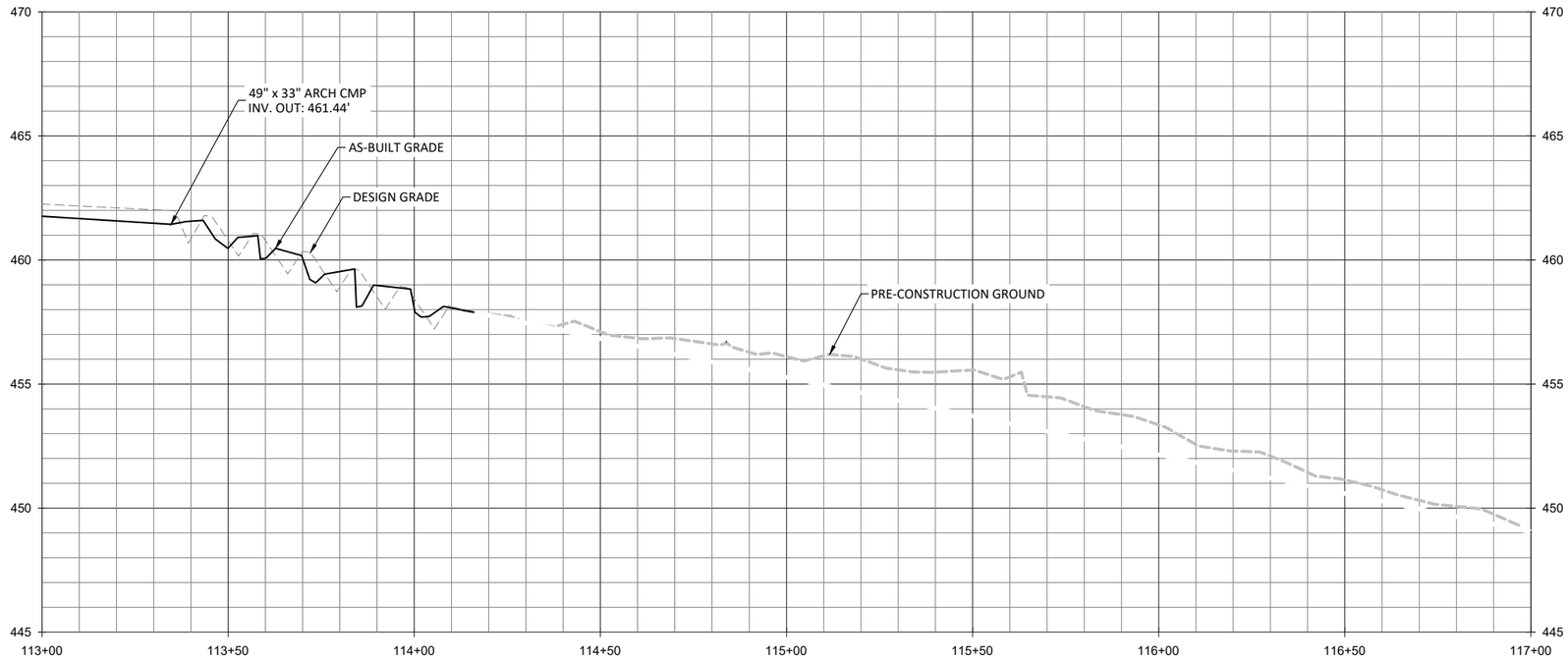

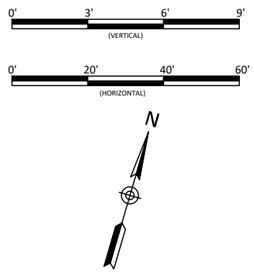

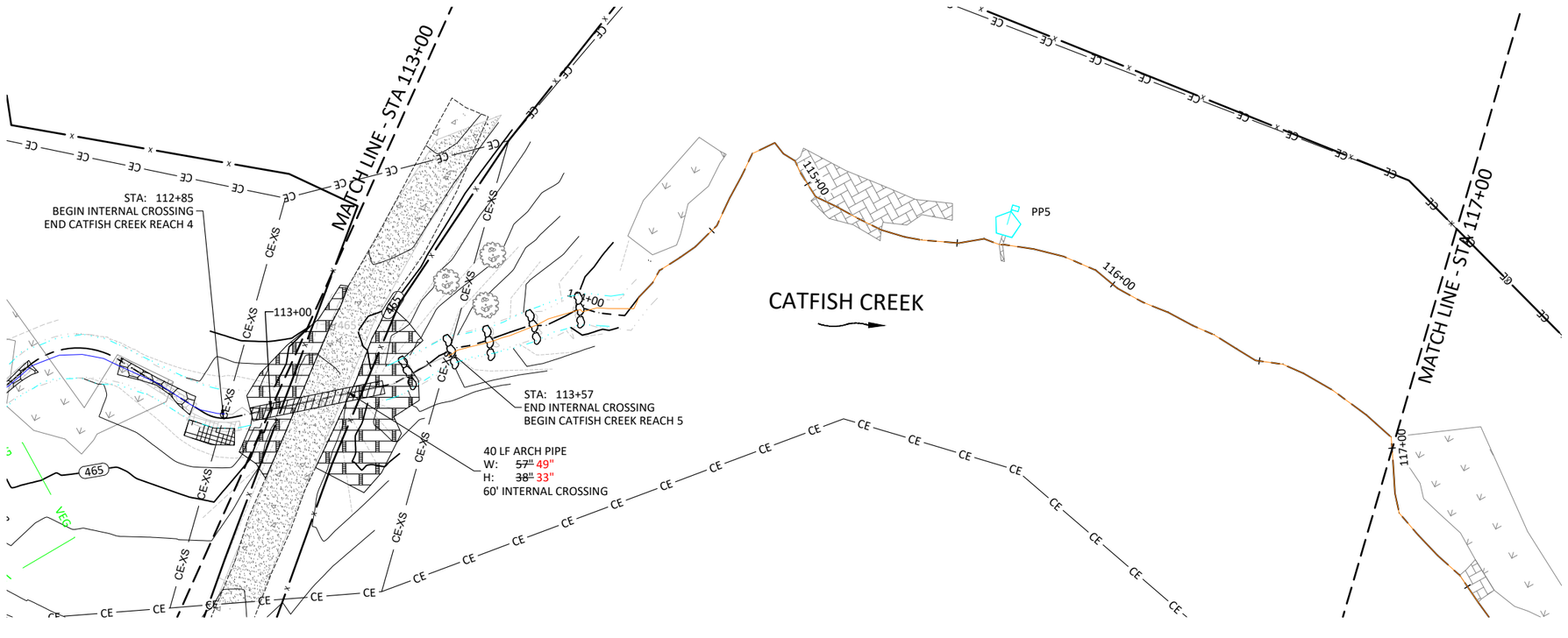

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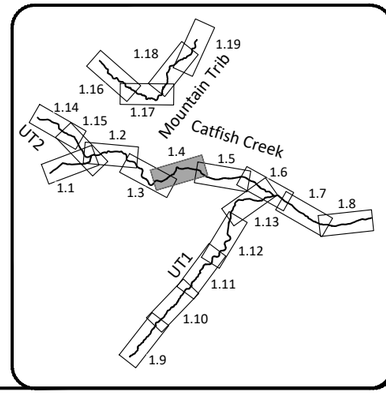

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Mount Pleasant, SC 29464
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NORTH CAROLINA PROFESSIONAL ENGINEER SEAL 048920 5/21/20 GEOFFREY L. SMITH

Catfish Pond Mitigation Site - Record Drawings
Durham County, North Carolina

Catfish Creek
Stream Plan and Profile

Revisions

Date:	06-18-2020
Job Number:	005-02168
Project Engineer:	GLS
Drawn By:	JTC
Checked By:	JCK

Sheet 1.4

July 1, 2020

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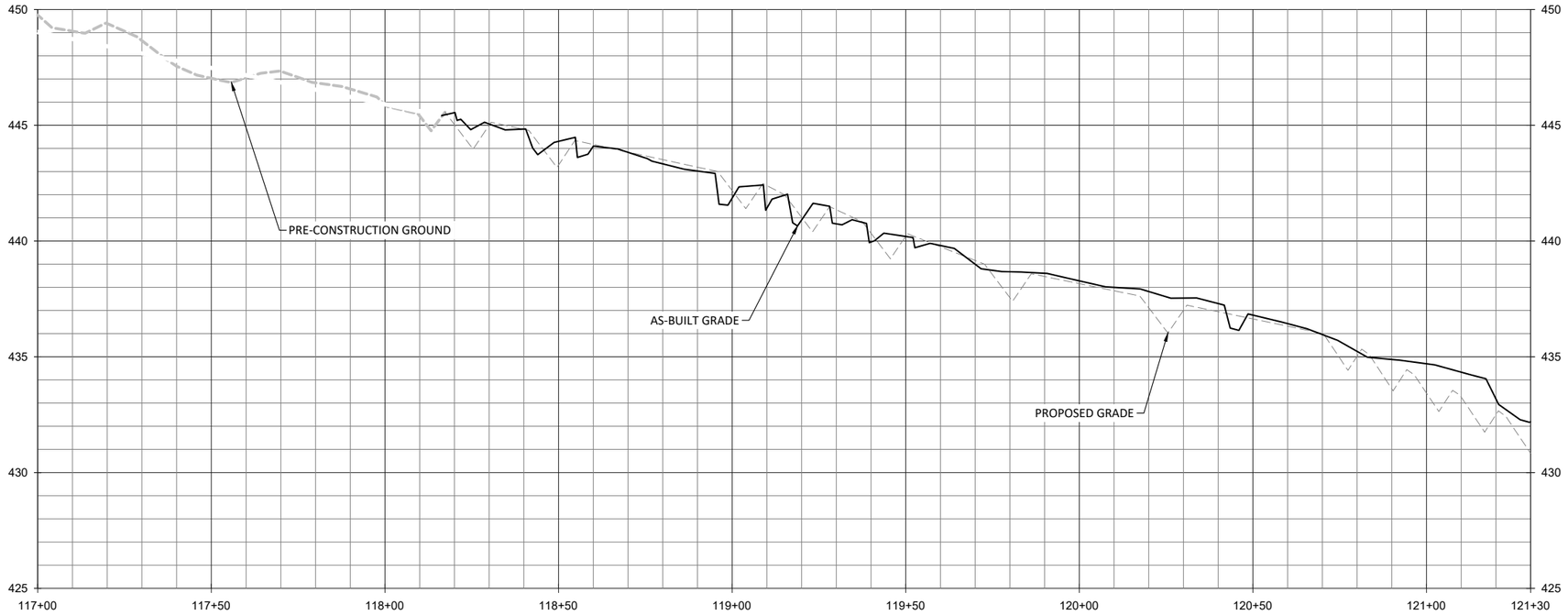
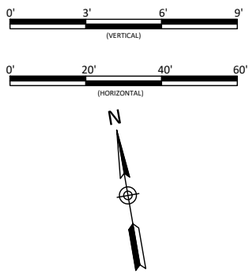
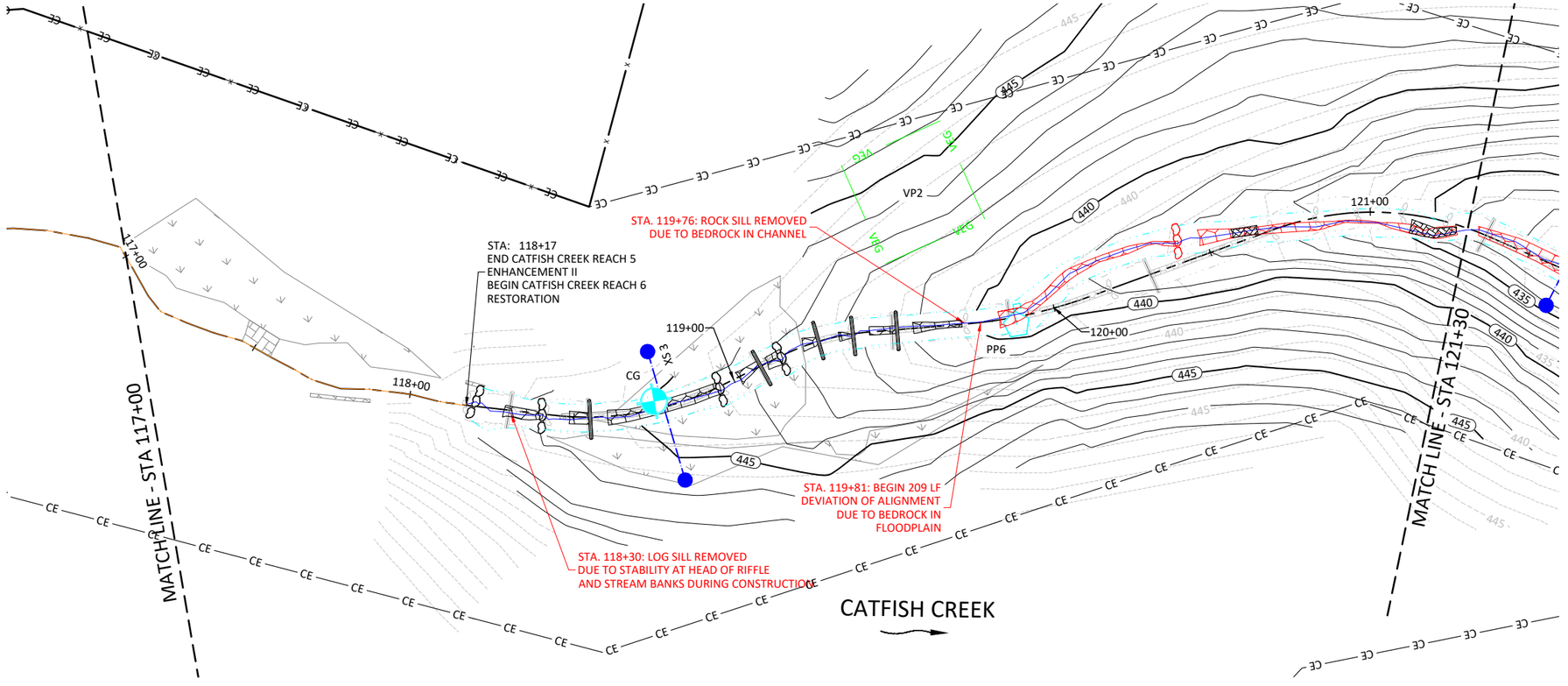




NOTES:
1. STA. 119+81 - 121+90: THE CHANNEL DESIGN WAS ALTERED AND REALIGNED DUE TO BEDROCK THAT WAS PRESENT IN THE FLOODPLAIN. THE REALIGNMENT RESULTED IN 209 LF OF CONSTRUCTED CHANNEL COMPARED TO 207 LF IN THE ORIGINAL DESIGN.



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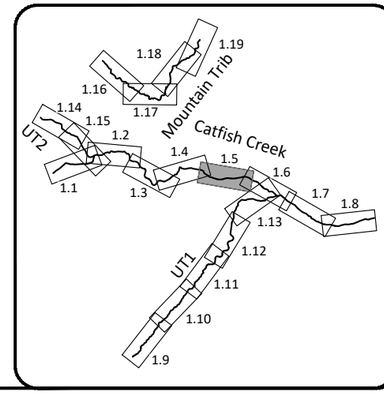

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497 Bramson Ct, Suite 104
Mount Pleasant, SC 29464
Tel: 843.277.6221

NORTH CAROLINA PROFESSIONAL ENGINEER SEAL 048920 5/21/20 GEOFFREY L. SMITH

Catfish Pond Mitigation Site - Record Drawings
Durham County, North Carolina

Catfish Creek
Stream Plan and Profile

Revisions:

Date:	06-18-2020
Job Number:	085-02168
Project Engineer:	GLS
Drawn By:	JTC
Checked By:	JCK

1.5
Sheet

July 1, 2020

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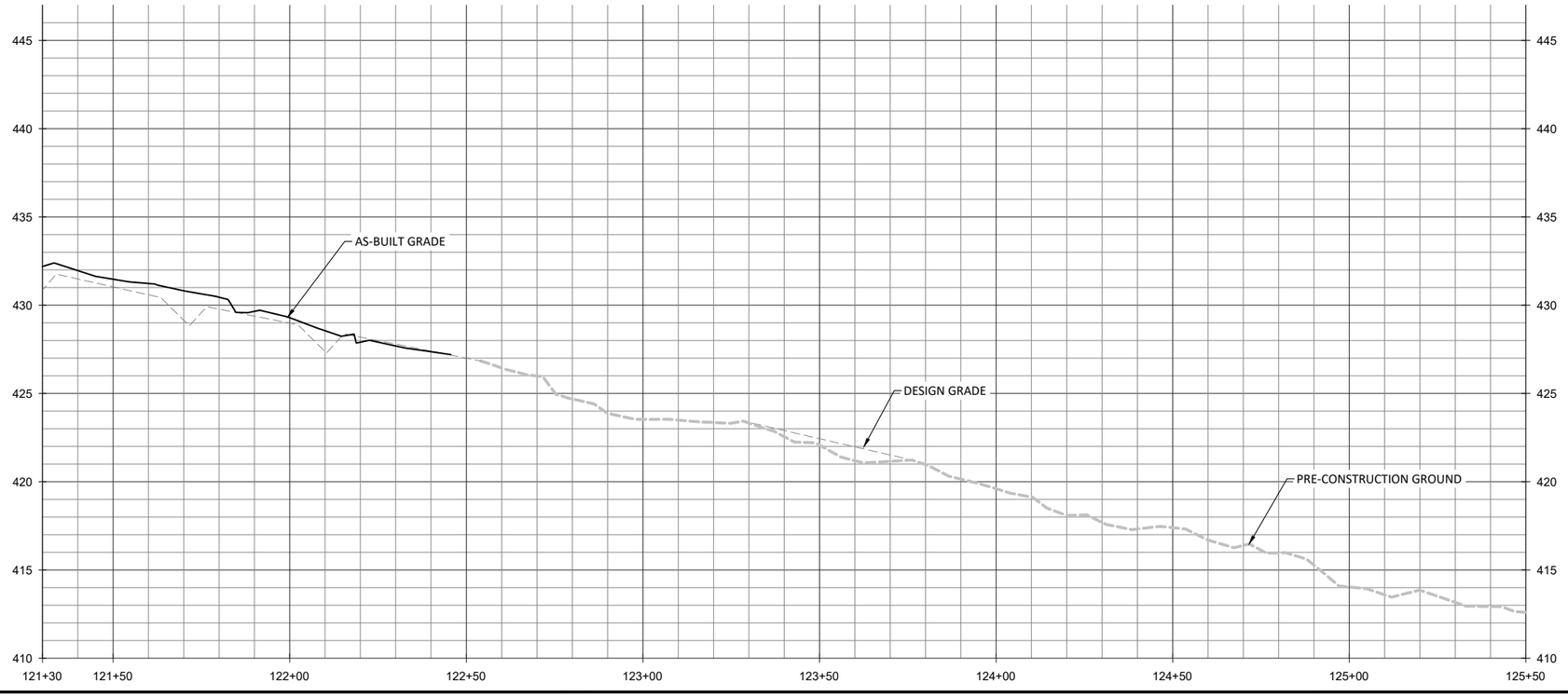
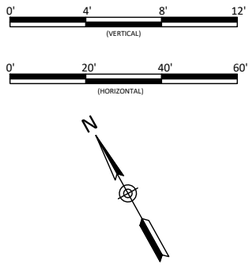
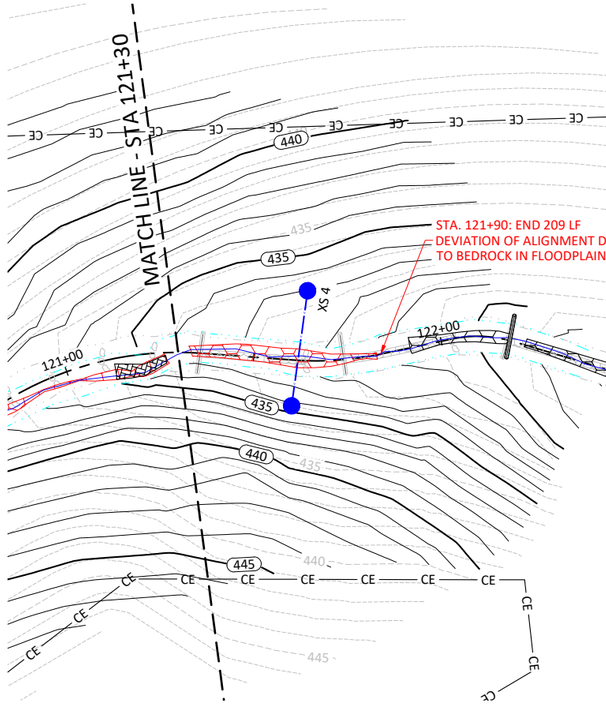
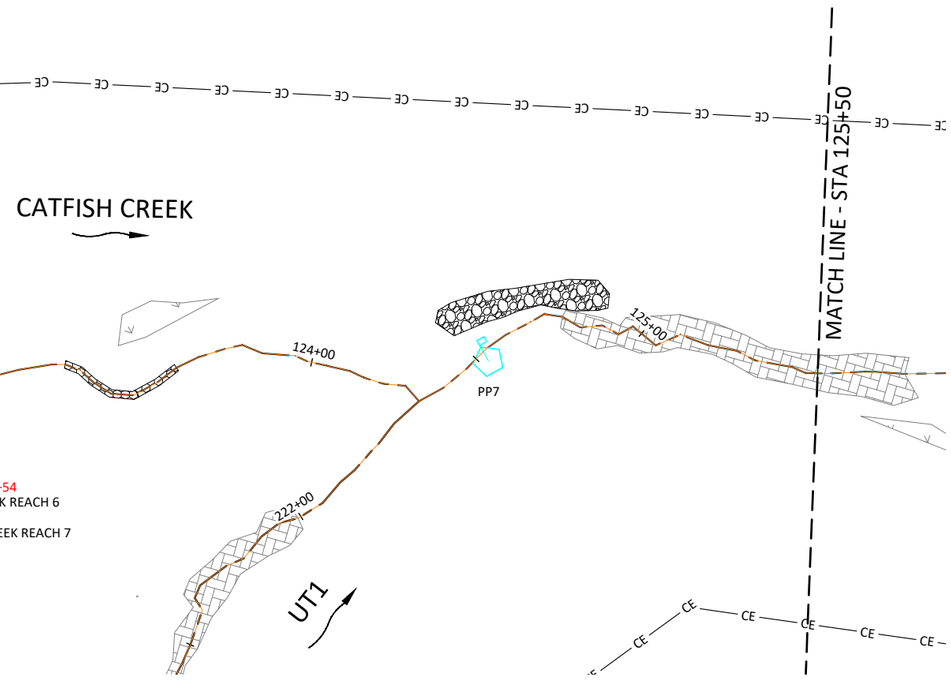


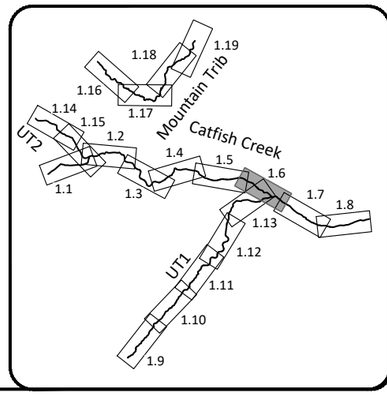






NOTES:
1. CATFISH CREEK REACH 6 END MOVED UPSTREAM FROM STATION 122+71 to 122+54 DUE TO BEDROCK IN CHANNEL AND TO MINIMIZE TREE CLEARING DURING CONSTRUCTION.
2. SURVEY WAS NOT CONDUCTED IN ENHANCEMENT II REACHES. REACHES WERE BUILT PER DESIGN UNLESS OTHERWISE NOTED.

Sheet Index



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Mount Pleasant, SC 29464
Tel: 843.277.6221

NORTH CAROLINA
SEAL
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5/21/20
GREGORY L. SMITH
ENGINEER

Catfish Pond Mitigation Site - Record Drawings
Durham County, North Carolina
Catfish Creek
Stream Plan and Profile

Revisions:

Date:	06-18-2020
Job Number	006-02168
Project Engineer:	GLS
Drawn By:	JTC
Checked By:	JCK

Sheet 1.6

July 1, 2020

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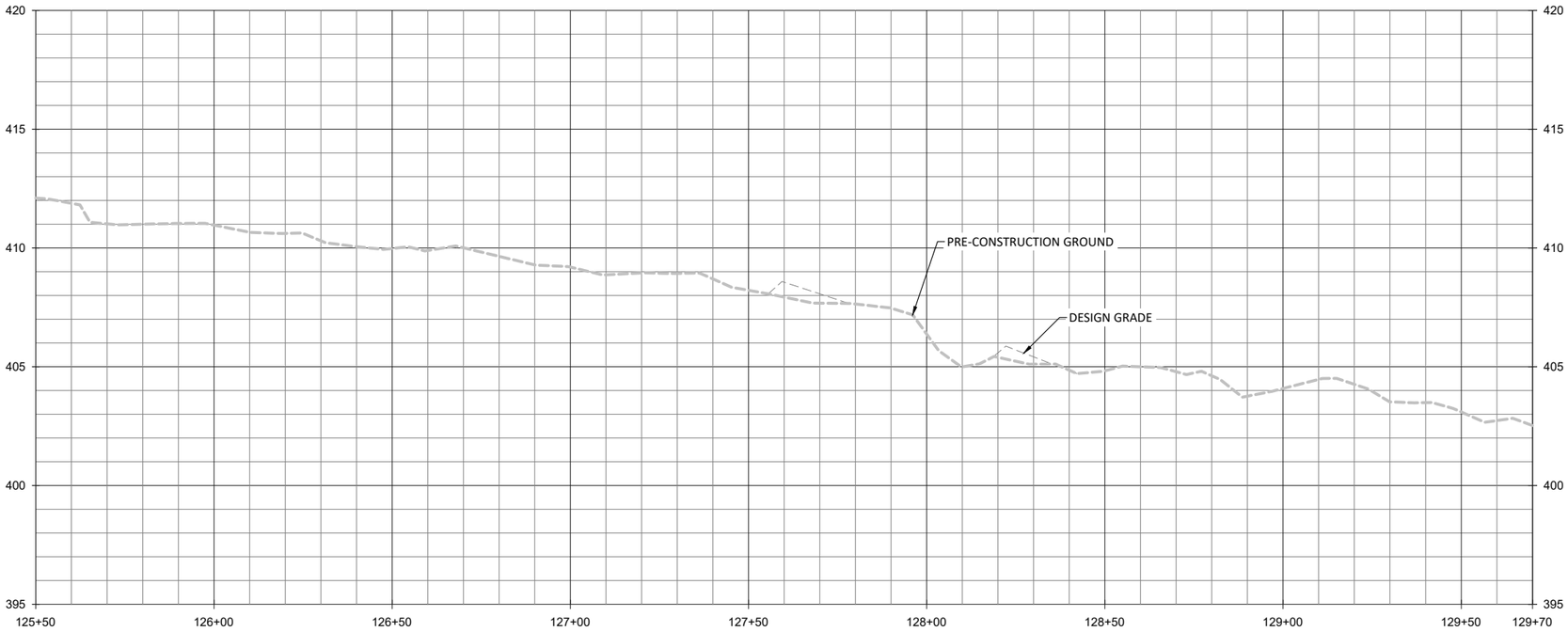

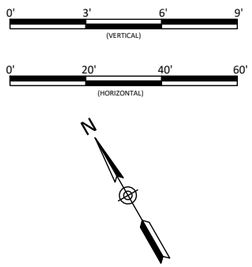

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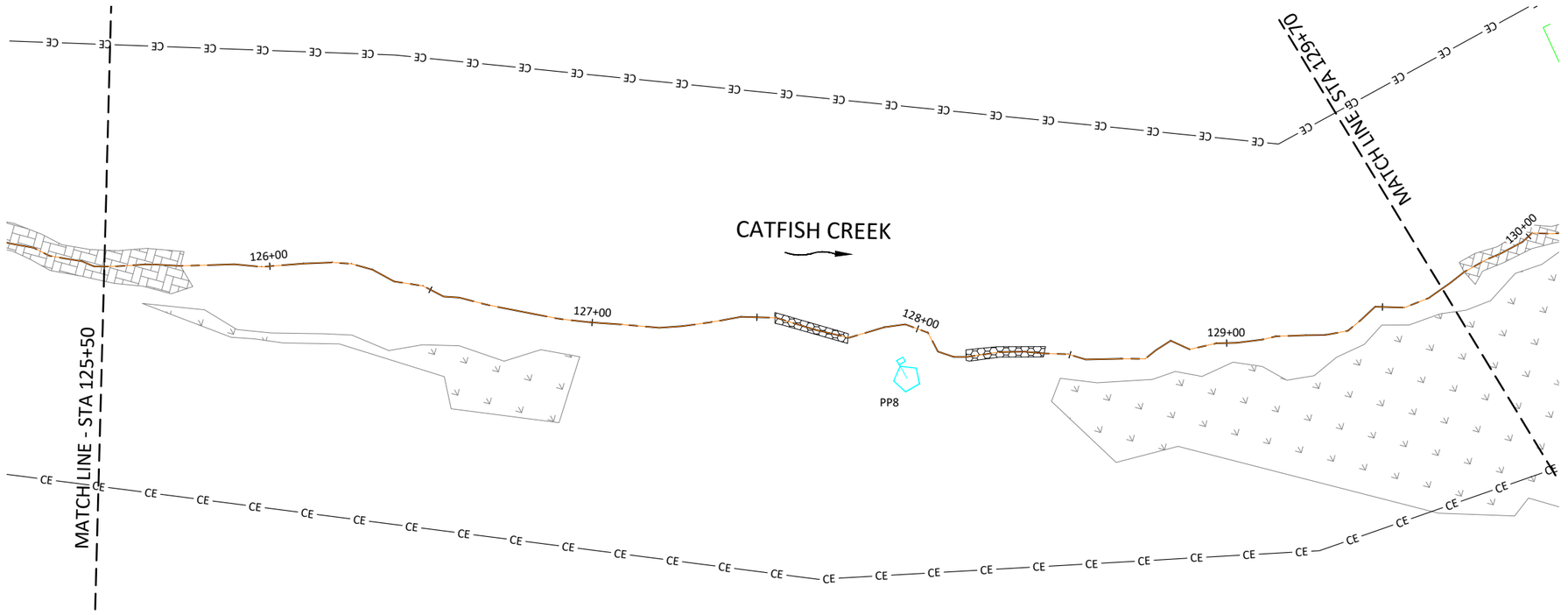

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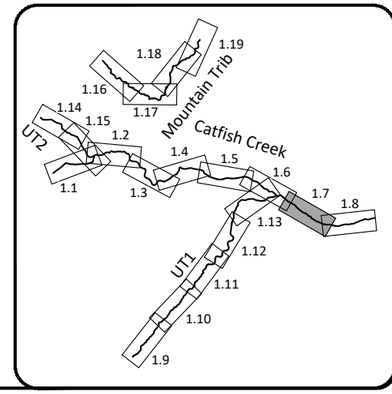

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Mount Pleasant, SC 29464
Tel: 843.277.6221

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SEAL
048920
5/21/20
ENGINEER
GEOFFREY L. SMITH

Catfish Pond Mitigation Site - Record Drawings
Durham County, North Carolina

Catfish Creek
Stream Plan and Profile

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Date:	06-18-2020
Job Number:	085-02168
Project Engineer:	GLS
Drawn By:	JTC
Checked By:	JCK

1.7
Sheet

July 1, 2020

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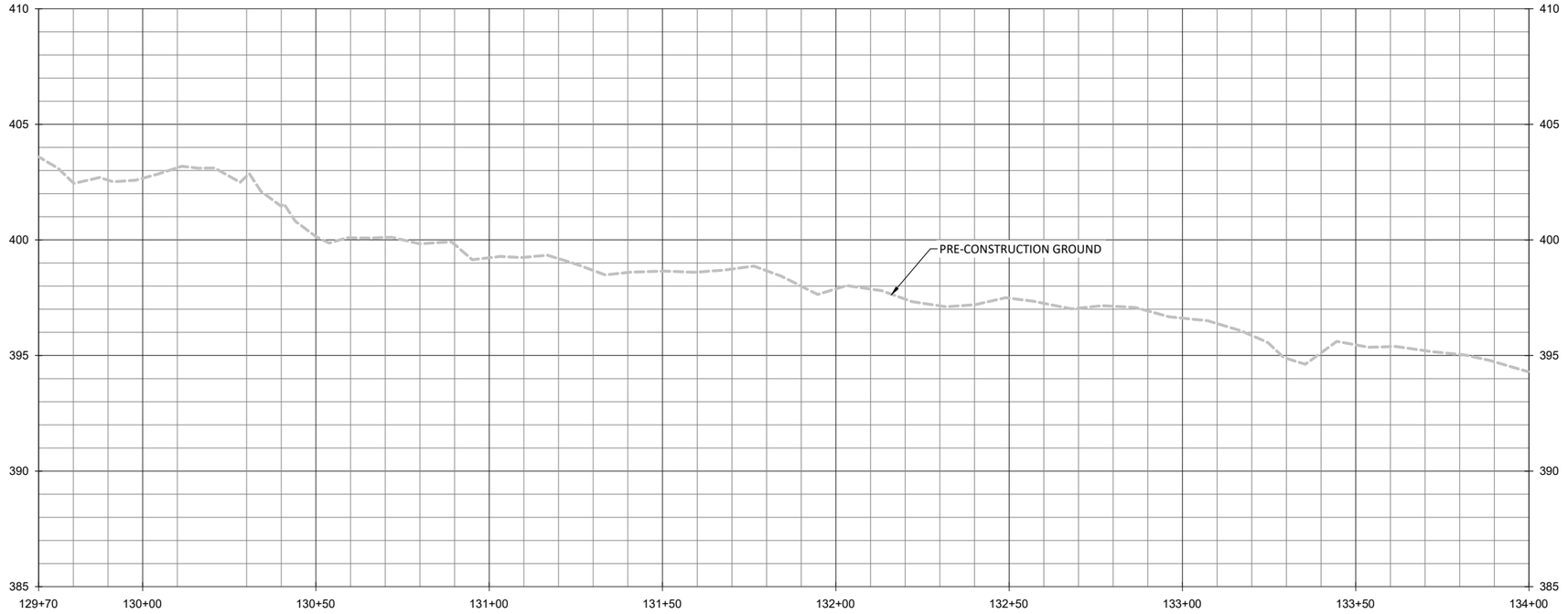

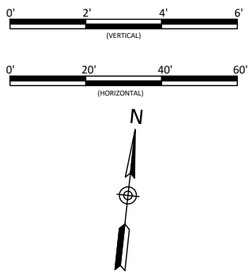

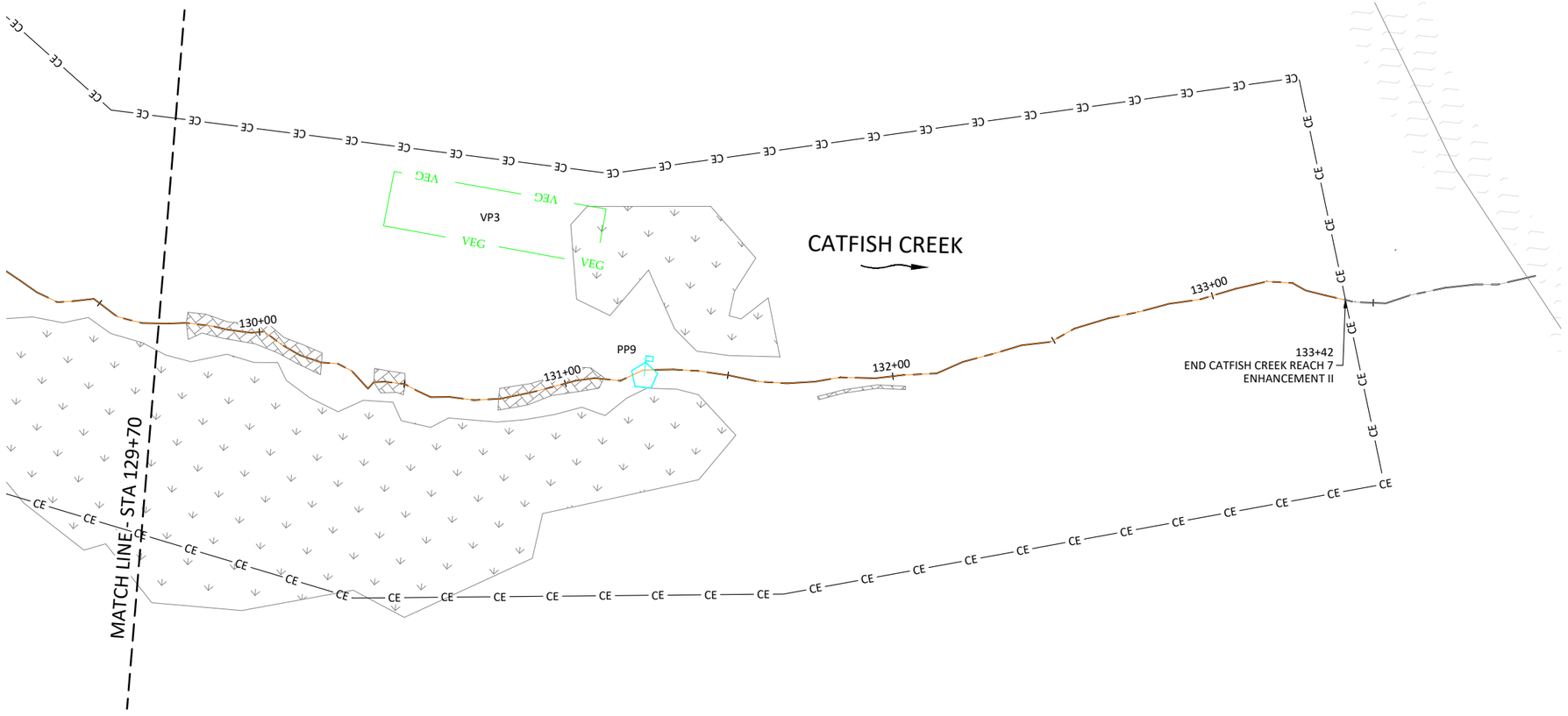

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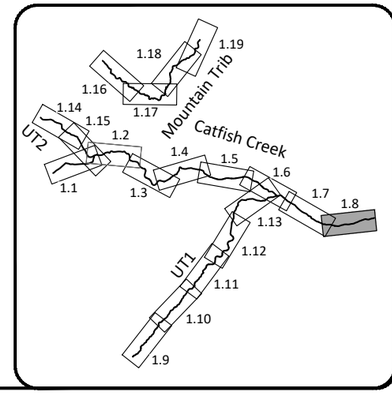

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497 Bramson Ct, Suite 104
Mount Pleasant, SC 29464
Tel: 843.277.6221

NORTH CAROLINA
SEAL
048920
5/21/20
GEOFFREY L. SMITH
ENGINEER

Catfish Pond Mitigation Site - Record Drawings
Durham County, North Carolina

Catfish Creek
Stream Plan and Profile

Revisions:

Date:	06-18-2020
Job Number:	085-02168
Project Engineer:	GLS
Drawn By:	JTC
Checked By:	JCK

Sheet 1.8

July 1, 2020

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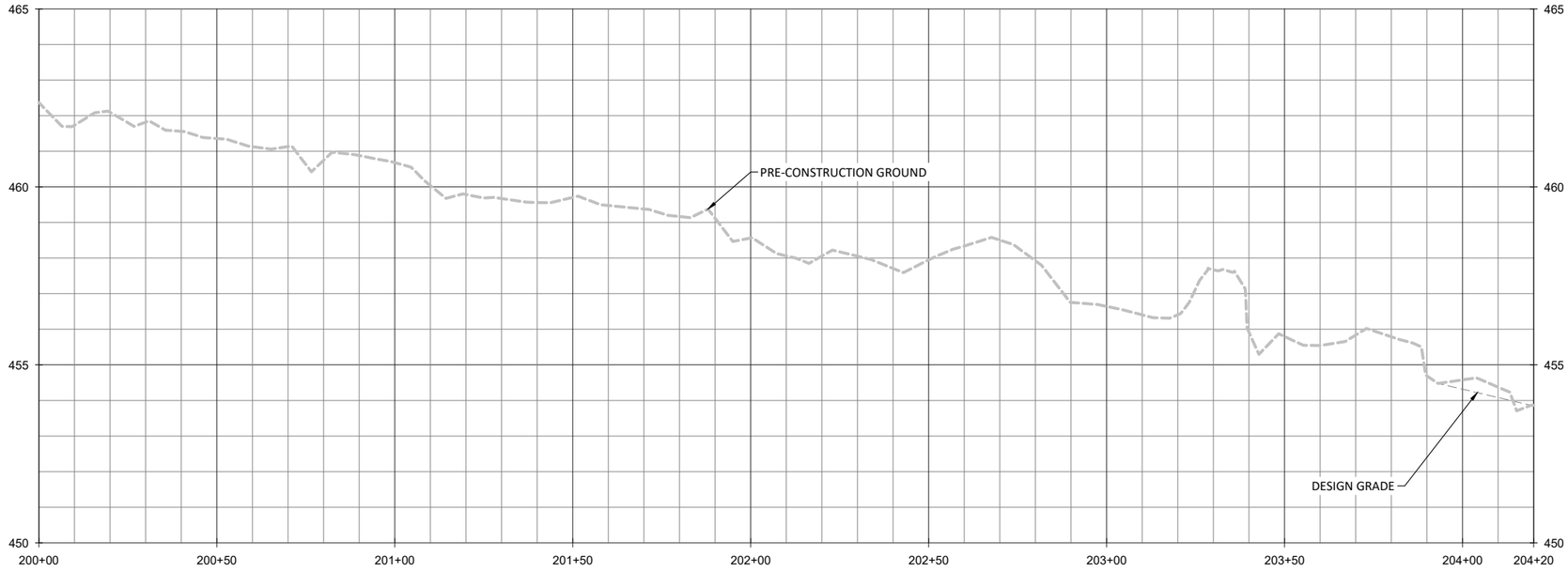

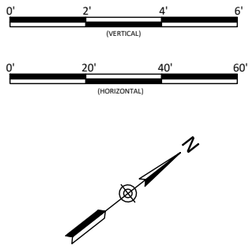

NOTES:
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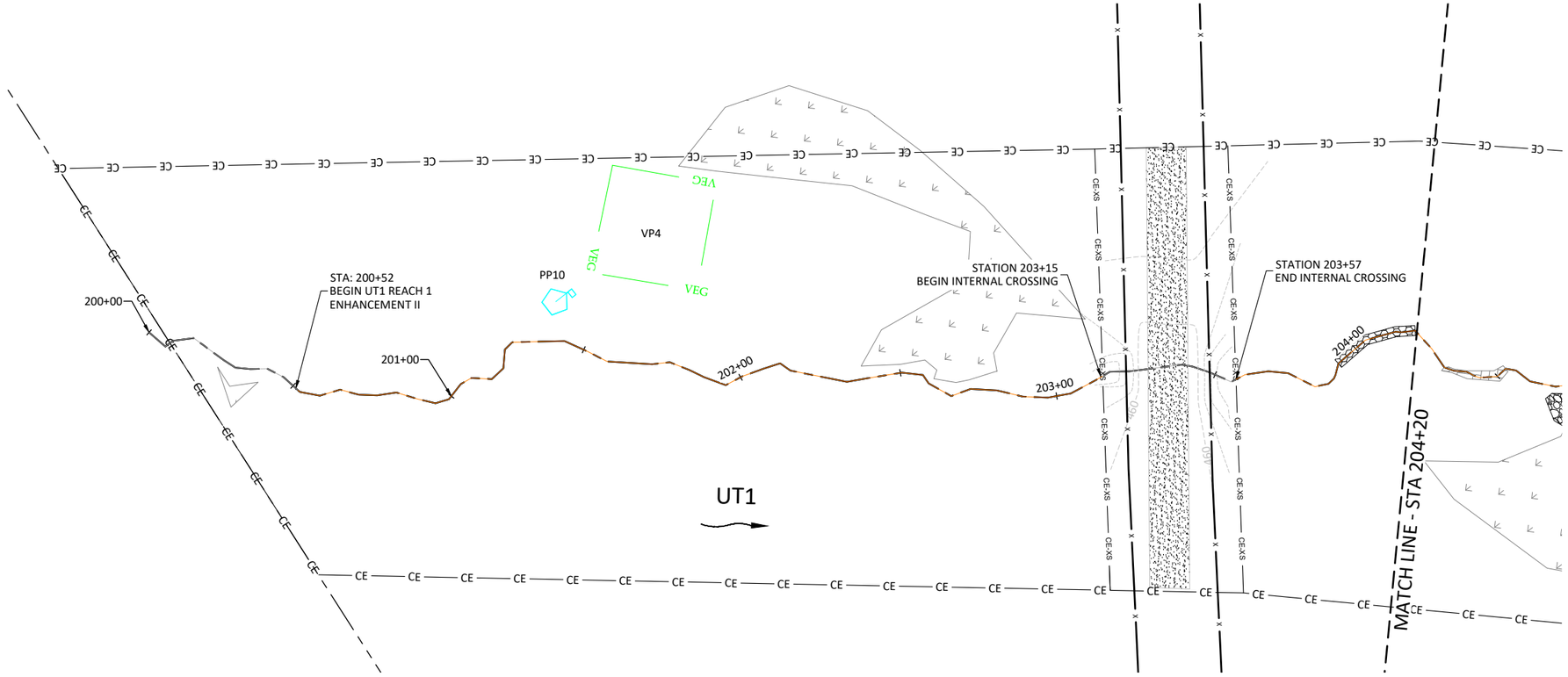

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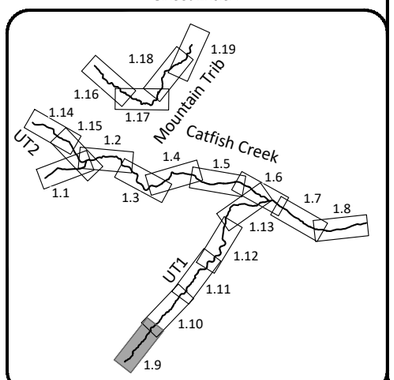

WILDLANDS ENGINEERING
497 Bramson Ct, Suite 104
Mount Pleasant, SC 29464
Tel: 843.277.6221

NORTH CAROLINA
SEAL
048920
5/21/20
GEOFFREY L. SMITH
ENGINEER

Catfish Pond Mitigation Site - Record Drawings
Durham County, North Carolina
UT1
Stream Plan and Profile

Date:	06-18-2020
Job Number:	085-02168
Project Engineer:	GLS
Drawn By:	JTC
Checked By:	JCK

Revisions:

Sheet 1.9

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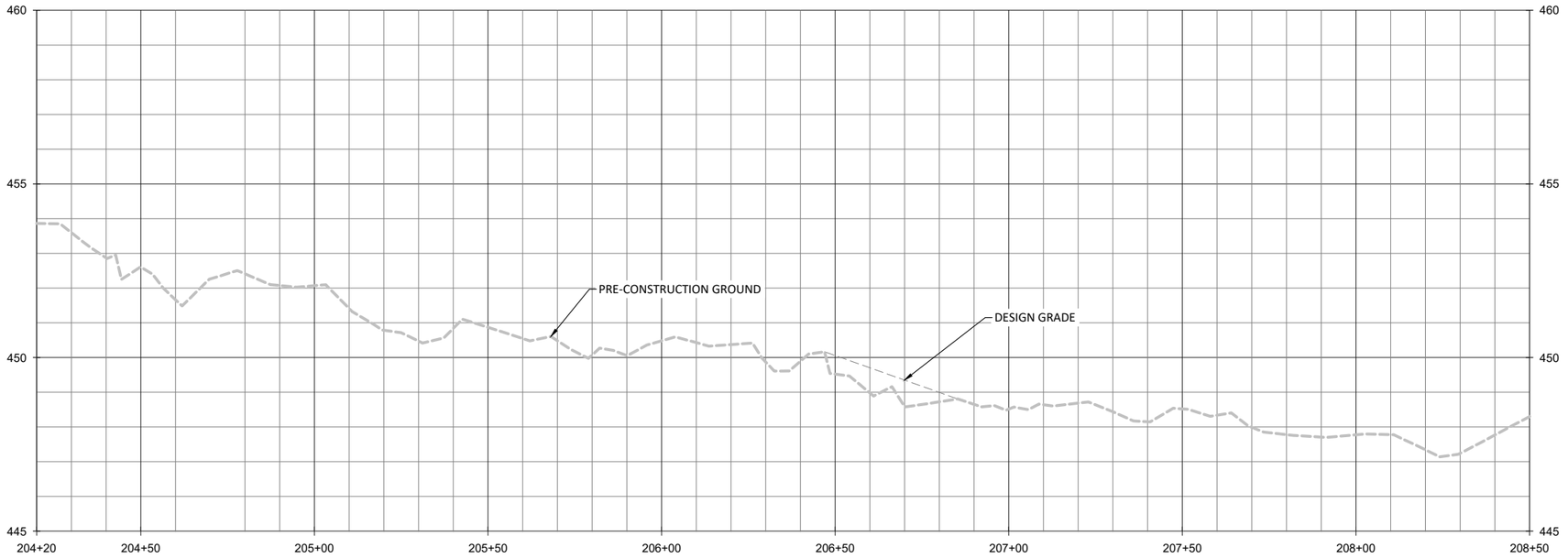
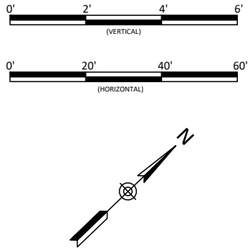
July 1, 2020





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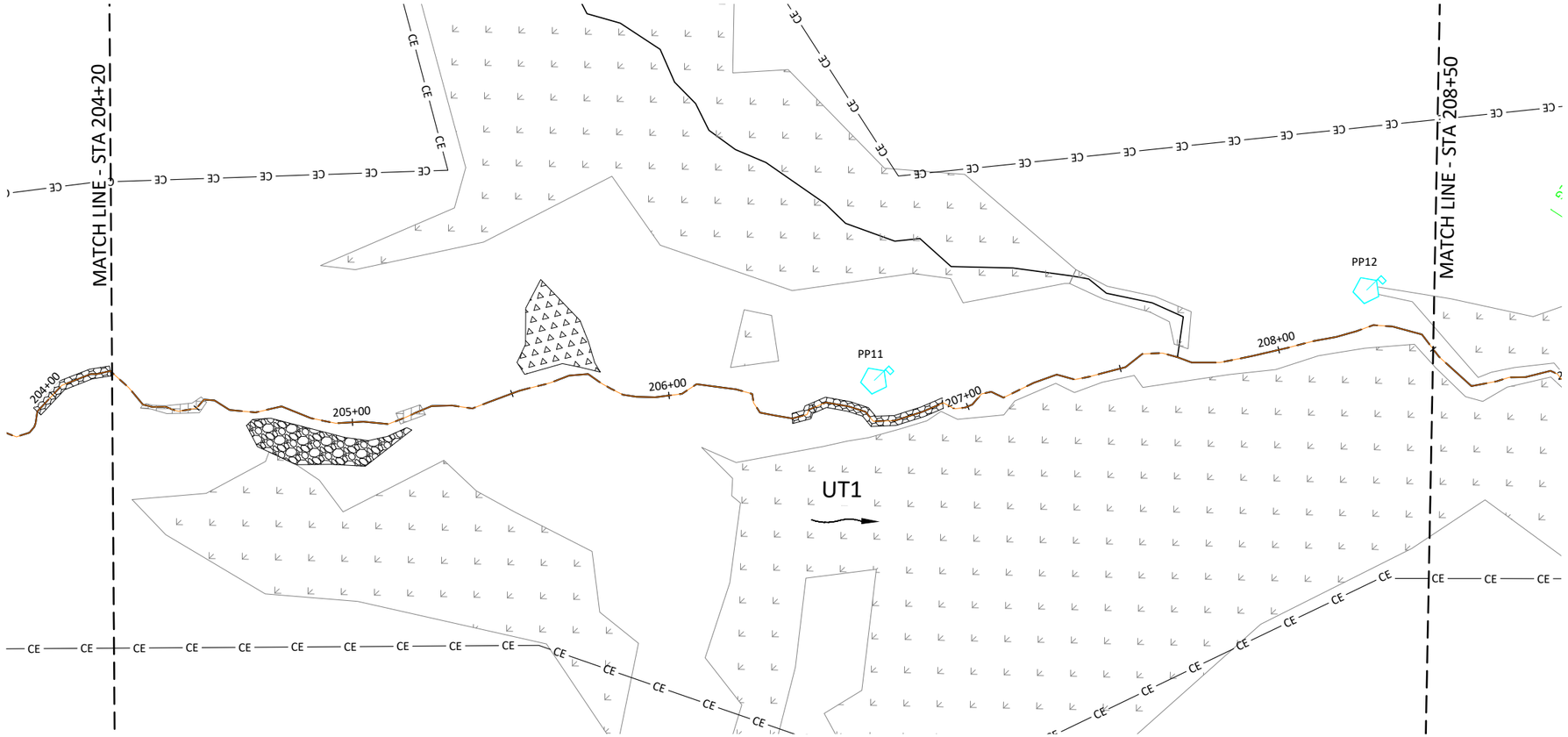

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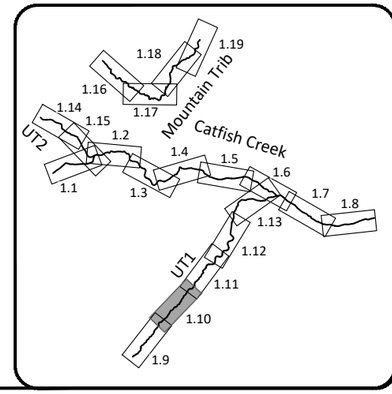

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497 Bramson Ct, Suite 104
Mount Pleasant, SC 29464
Tel: 843.277.6221

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GEOFFREY L. SMITH

Catfish Pond Mitigation Site - Record Drawings
Durham County, North Carolina

UT1
Stream Plan and Profile

Revisions:

Date:	06-18-2020
Job Number:	068-02168
Project Engineer:	GLS
Drawn By:	JTC
Checked By:	JCK

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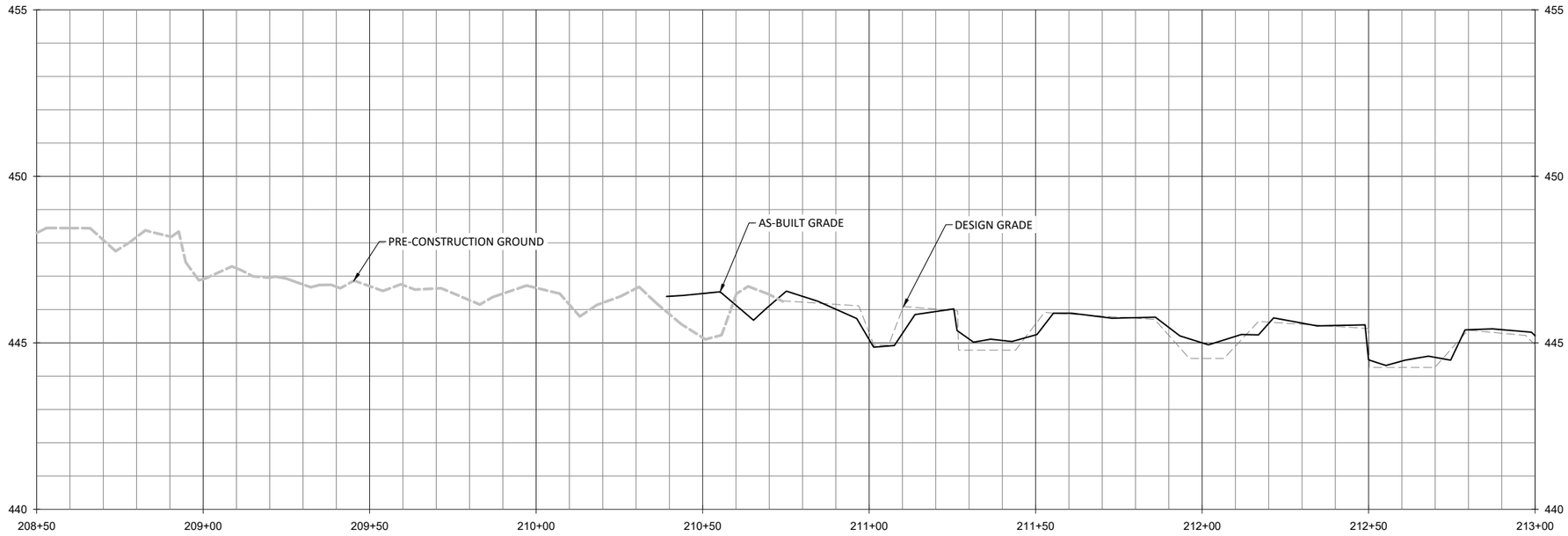

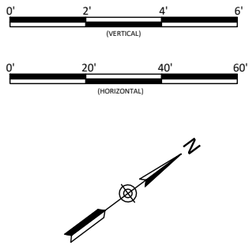

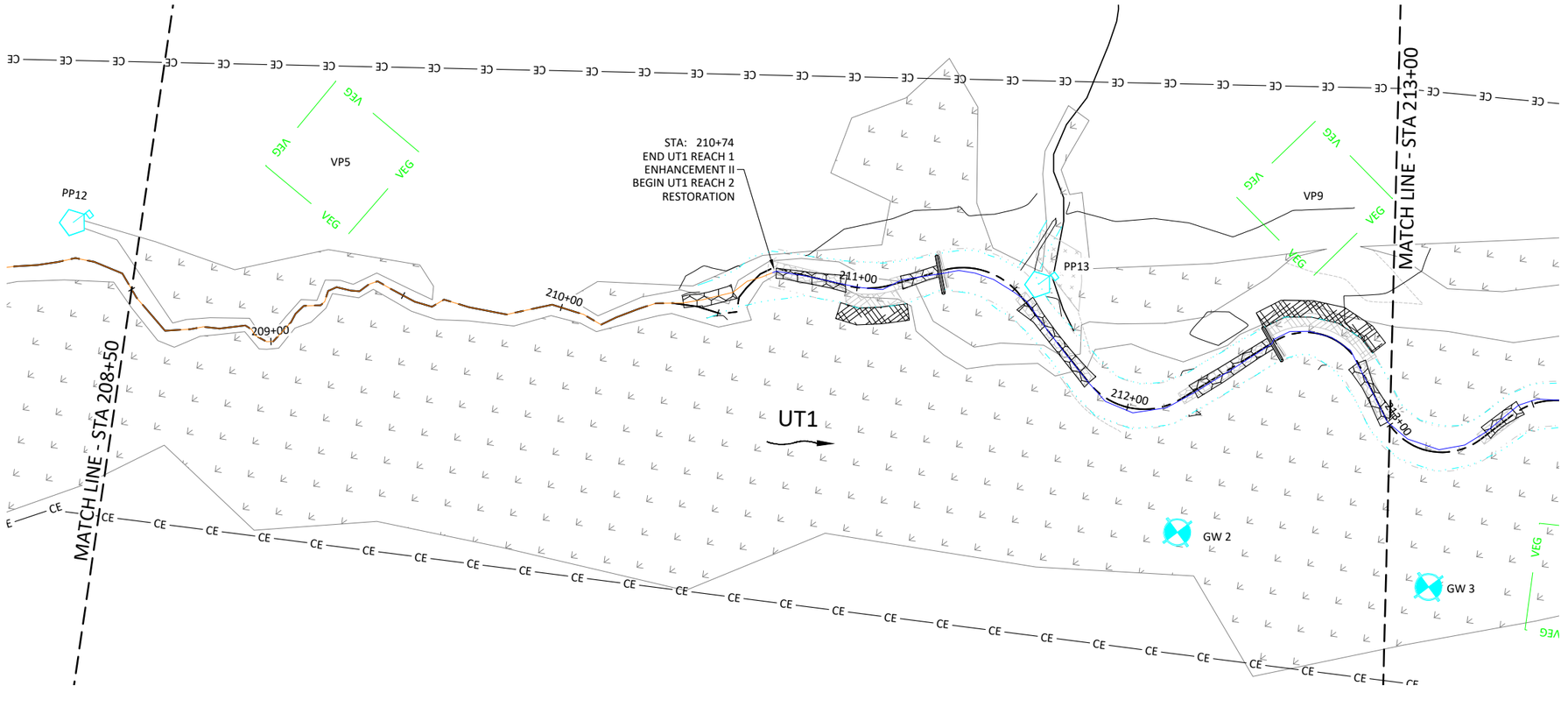

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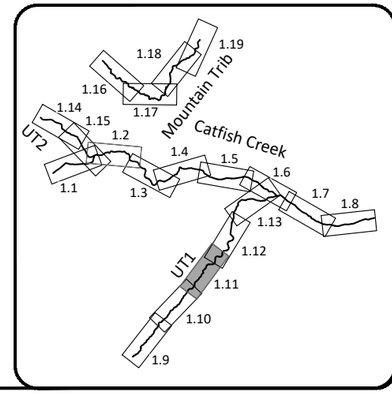

WILDLANDS ENGINEERING
497 Bramson Ct, Suite 104
Mount Pleasant, SC 29464
Tel: 843.277.6221

NORTH CAROLINA ENGINEERING SEAL 048920 GEOFFREY L. SMITH

Catfish Pond Mitigation Site - Record Drawings
Durham County, North Carolina

UT1
Stream Plan and Profile

Date:	06-18-2020
Job Number:	005-02168
Project Engineer:	GLS
Drawn By:	JTC
Checked By:	JCK

Revisions

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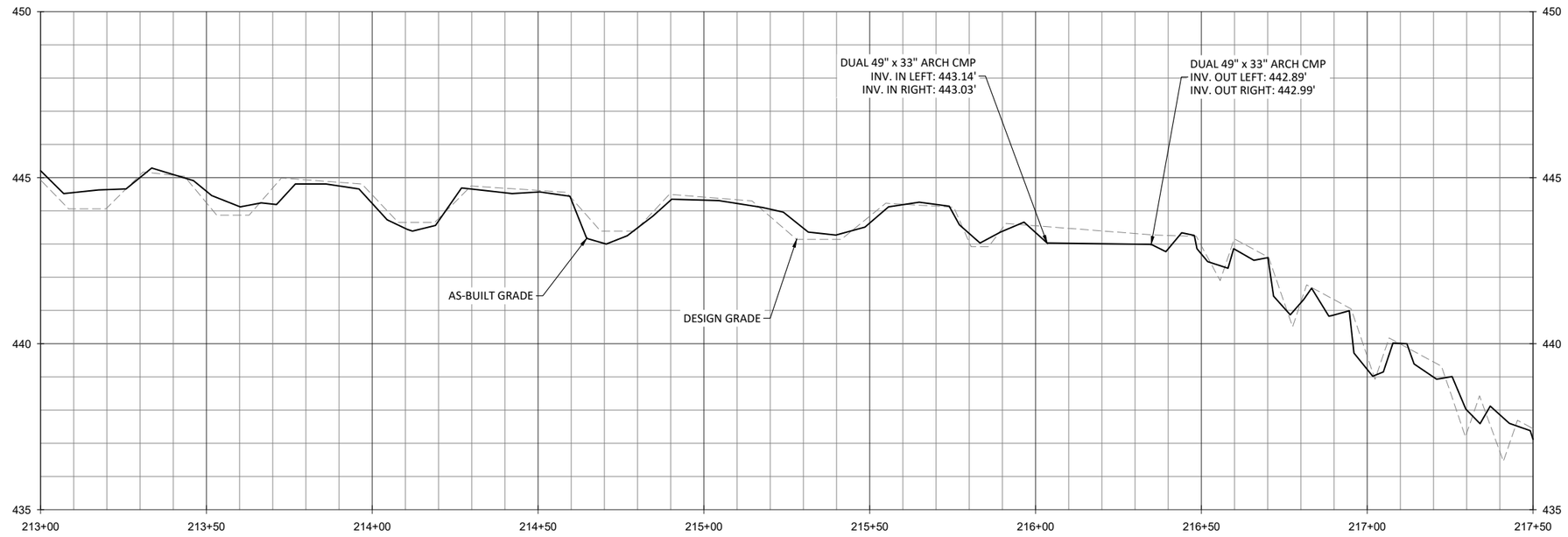

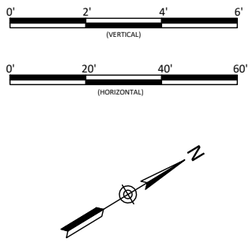

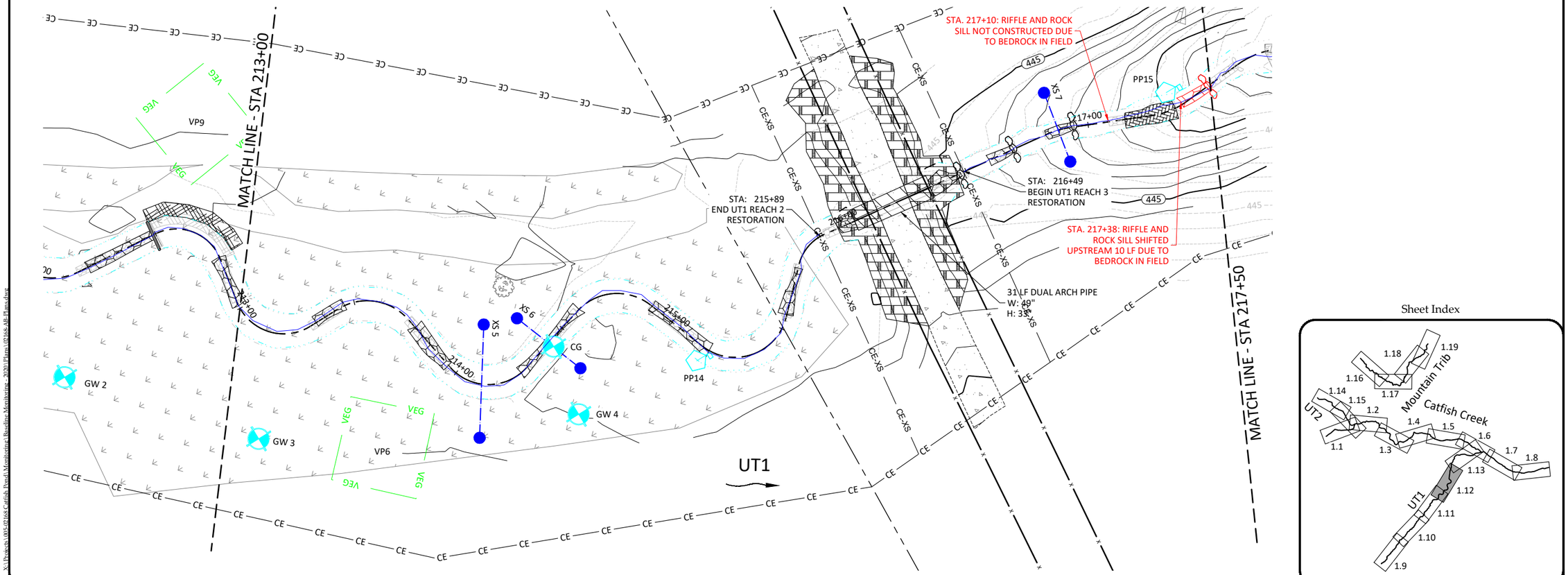

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WILDLANDS ENGINEERING
497 Bramson Ct, Suite 104
Mount Pleasant, SC 29464
Tel: 843.277.6221

NORTH CAROLINA PROFESSIONAL ENGINEER SEAL 048920 GEOFFREY L. SMITH

Catfish Pond Mitigation Site - Record Drawings
Durham County, North Carolina

UT1
Stream Plan and Profile

Revisions:	
Date:	06-18-2020
Job Number:	085-02168
Project Engineer:	GLS
Drawn By:	JTC
Checked By:	JCK

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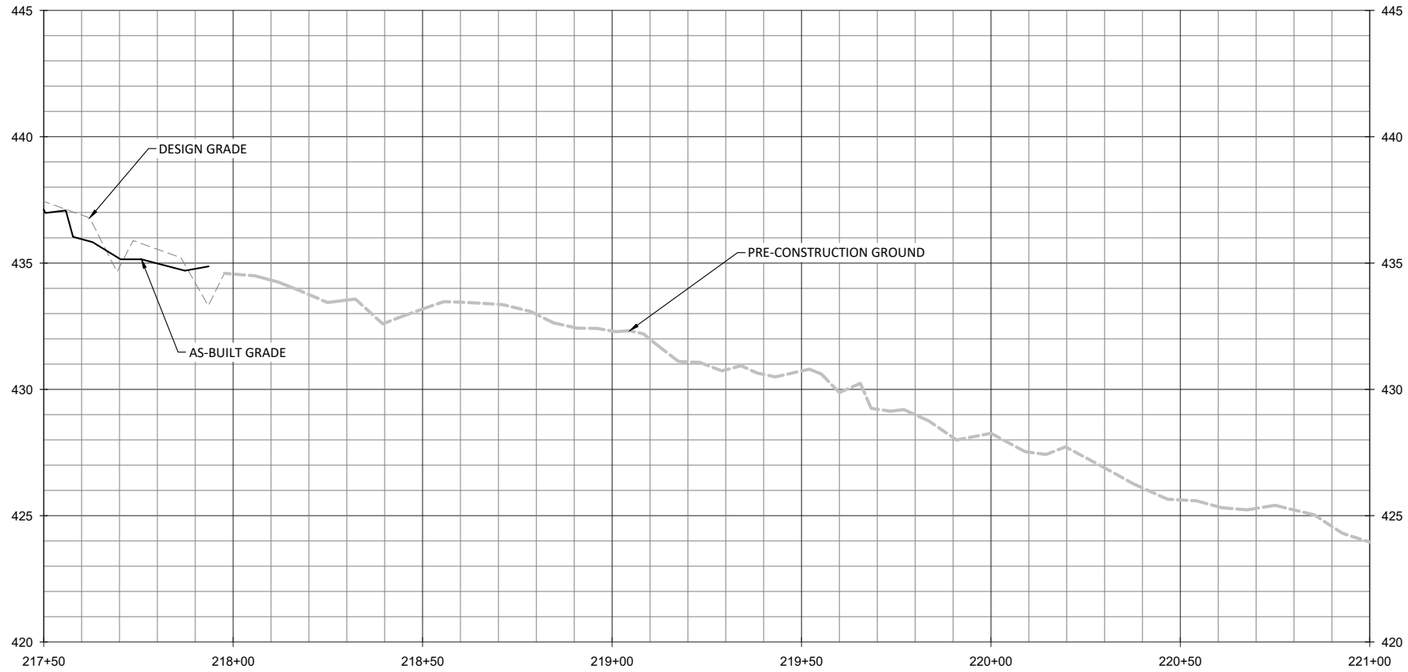

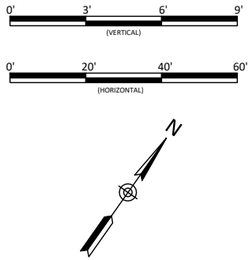

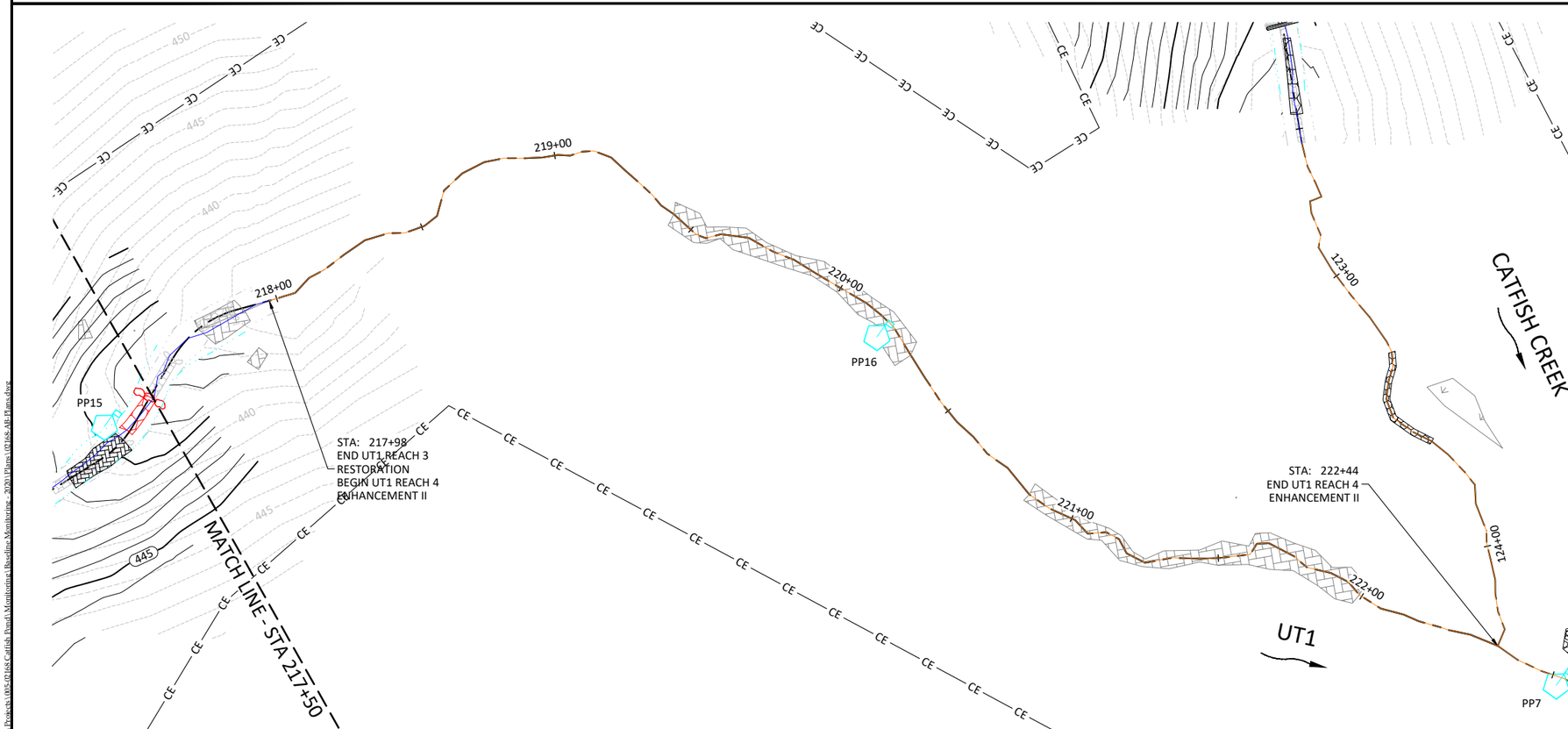

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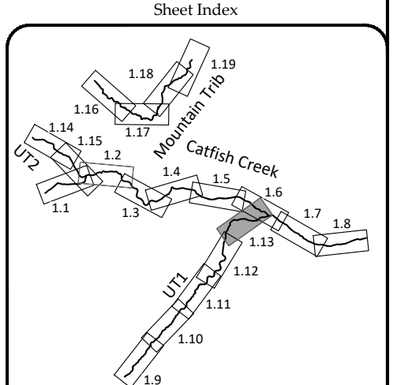

WILDLANDS ENGINEERING
497 Bramson Ct, Suite 104
Mount Pleasant, SC 29464
Tel: 843.277.6221

NORTH CAROLINA
SEAL
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5/21/20
GREGORY L. SMITH

Catfish Pond Mitigation Site - Record Drawings
Durham County, North Carolina

UT1
Stream Plan and Profile

Revisions:

Date:	06-18-2020
Job Number:	005-02168
Project Engineer:	GLS
Drawn By:	JTC
Checked By:	JCK

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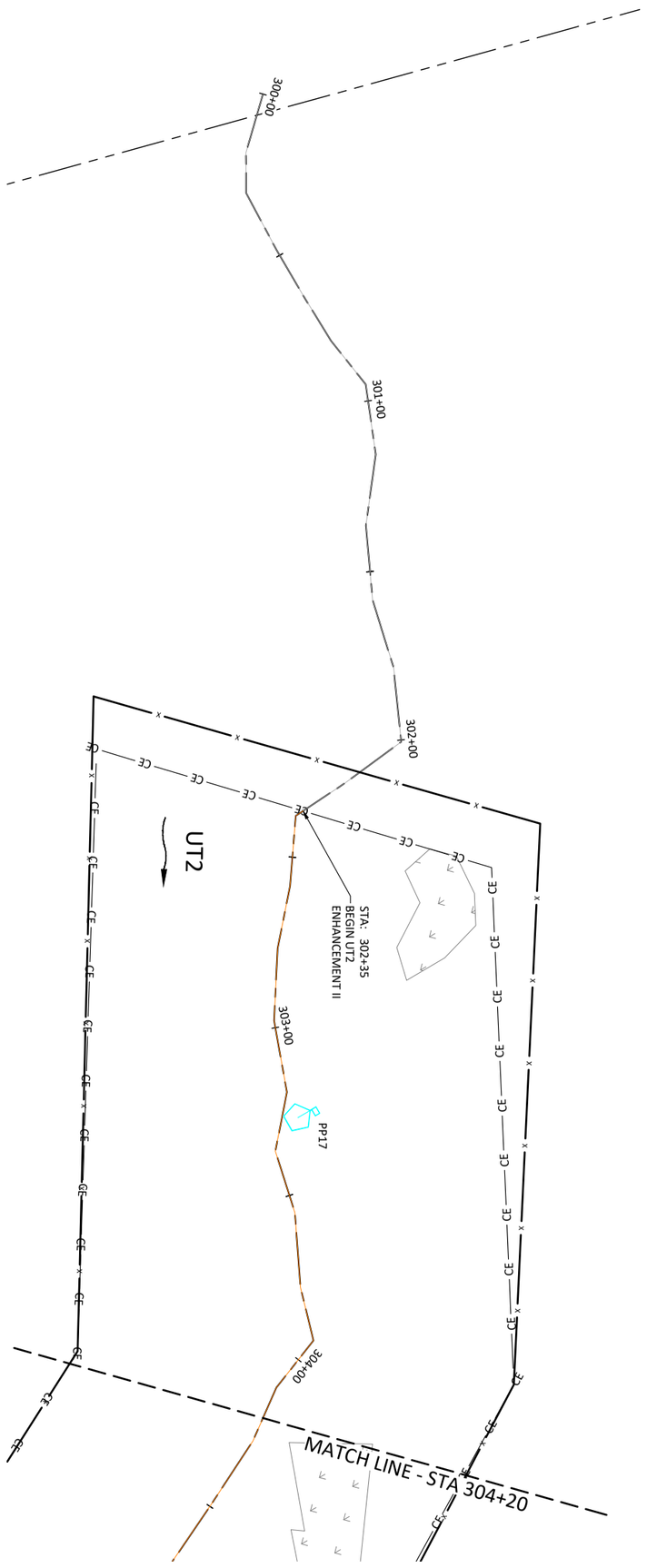

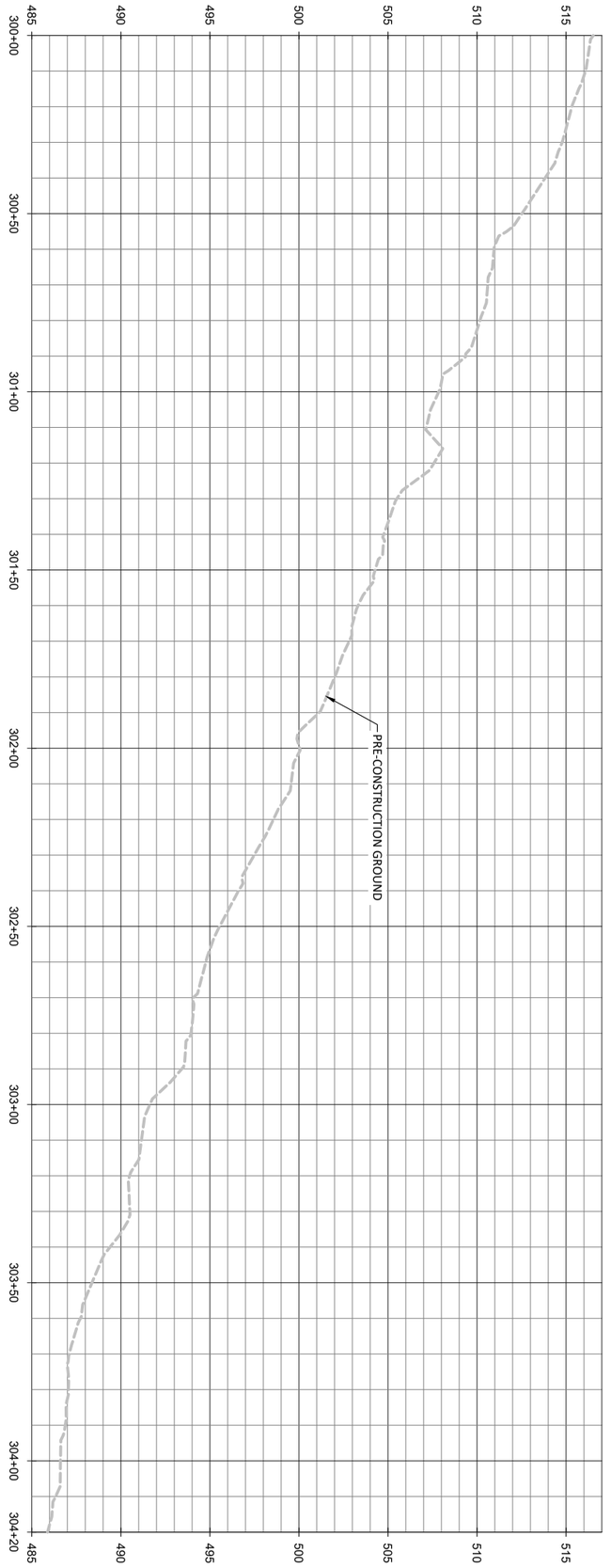

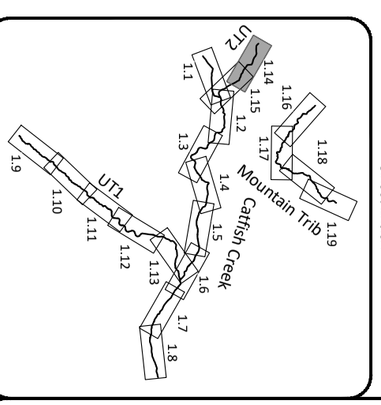

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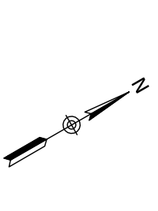

Date:	06-18-2020
Job Number:	005-02168
Project Engineer:	GLS
Drawn By:	JTC
Checked By:	JCK

Revisions:

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Catfish Pond Mitigation Site - Record Drawings
Durham County, North Carolina

UT2
Stream Plan and Profile

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ENGINEERING
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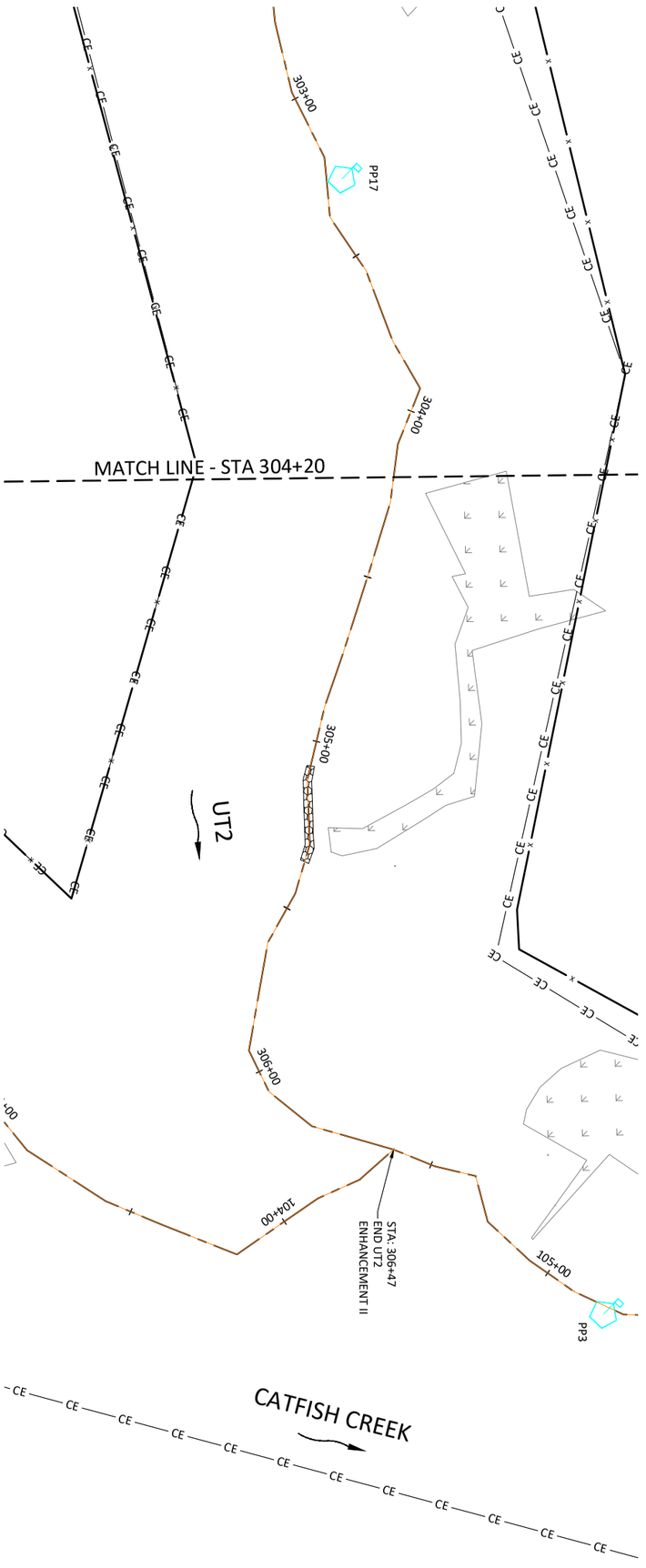
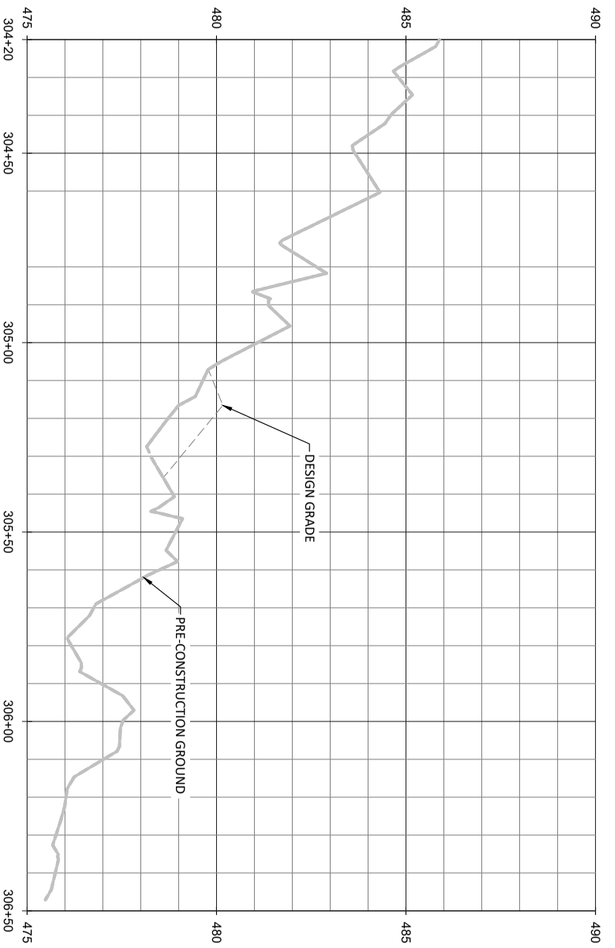
Mount Pleasant, SC 29464
Tel: 843.277.6221





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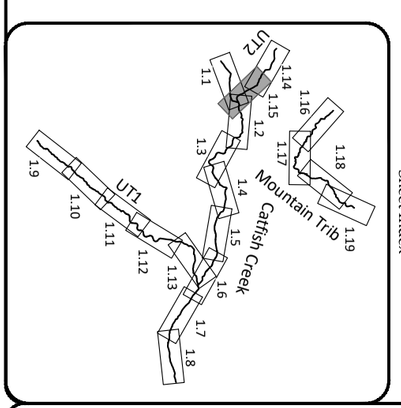

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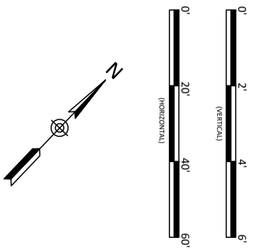

Date:	06-18-2020
Job Number:	005-02168
Project Engineer:	GLS
Drawn By:	JTC
Checked By:	JCK

1.15
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Revisions:

Catfish Pond Mitigation Site - Record Drawings
Durham County, North Carolina

UT2
Stream Plan and Profile

WILDLANDS
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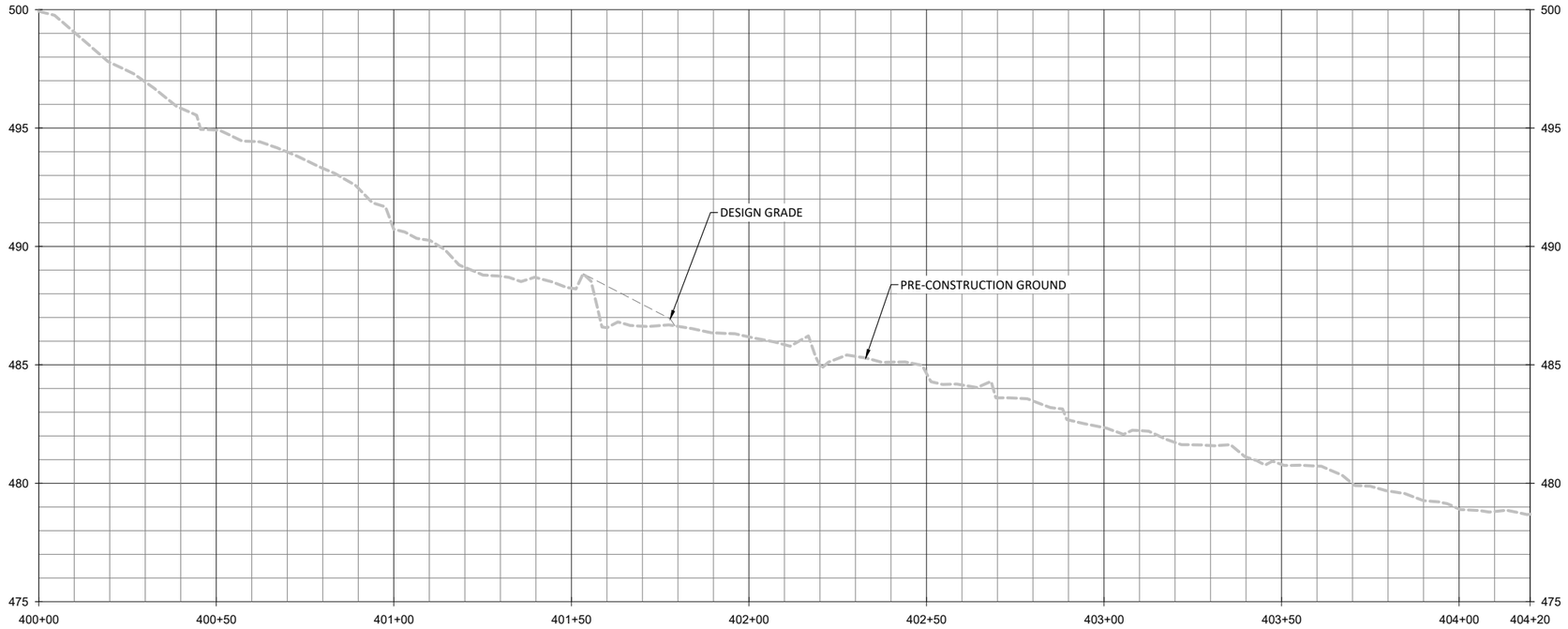
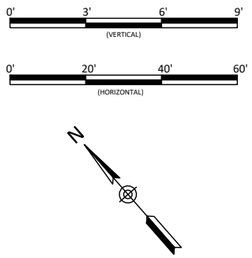
Mount Pleasant, SC 29464
Tel: 843.277.6221





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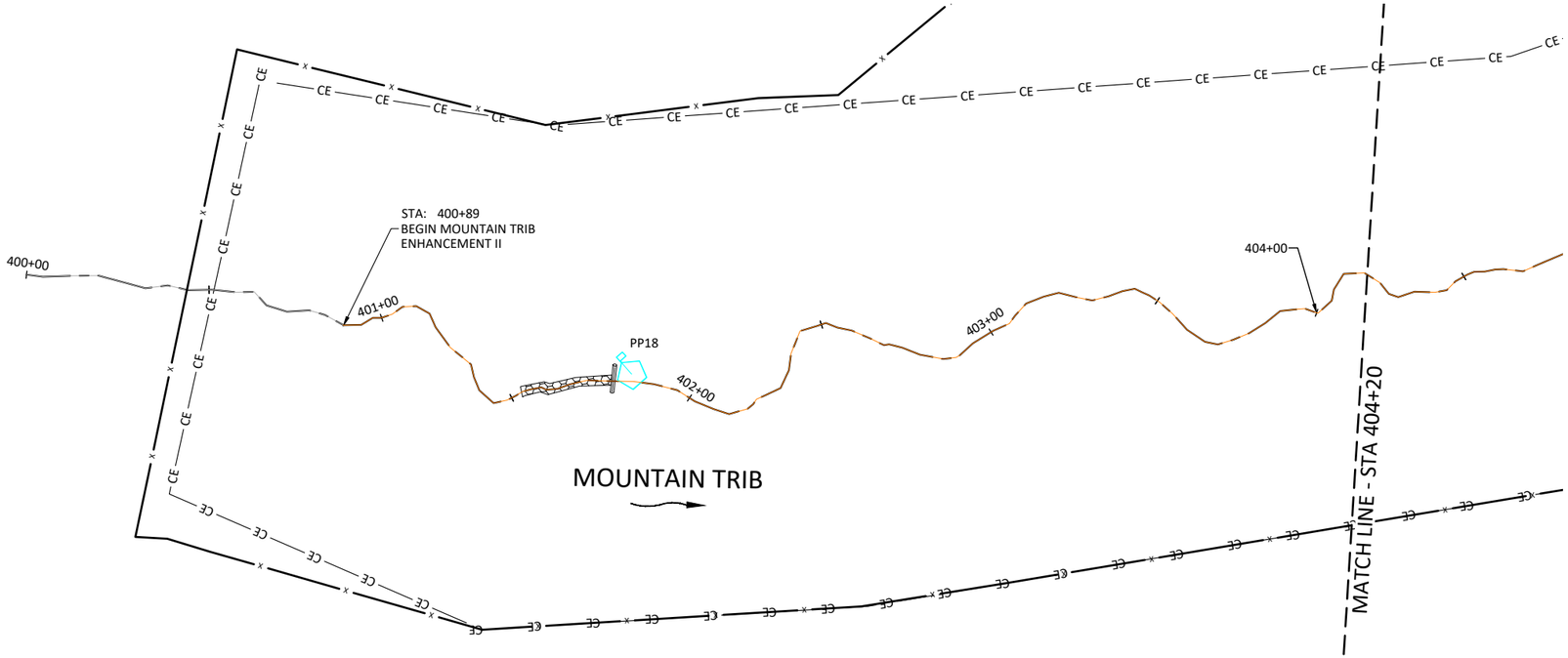

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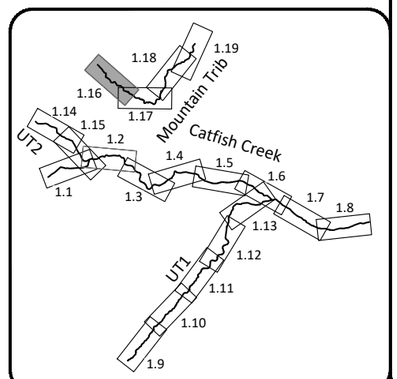

WILDLANDS ENGINEERING
497 Bramson Ct, Suite 104
Mount Pleasant, SC 29464
Tel: 843.277.6221

NORTH CAROLINA
SEAL
048920
GEOMORPHOLOGIST
JEFFREY L. SMITH

Catfish Pond Mitigation Site - Record Drawings
Durham County, North Carolina

Mountain Trib
Stream Plan and Profile

Revisions:

Date:	06-18-2020
Job Number:	006-02168
Project Engineer:	GLS
Drawn By:	JTC
Checked By:	JCK

Sheet 1.16

July 1, 2020

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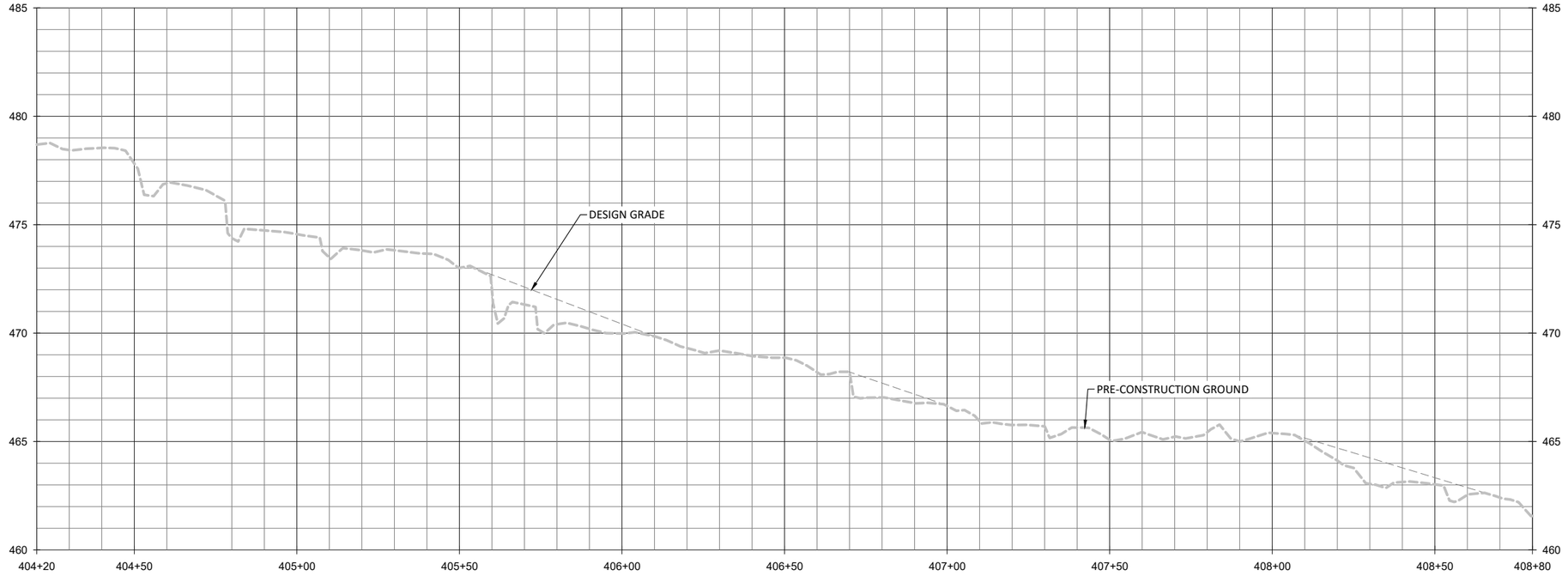

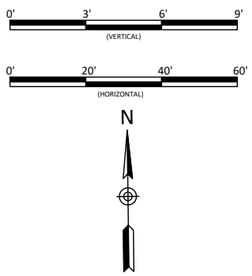

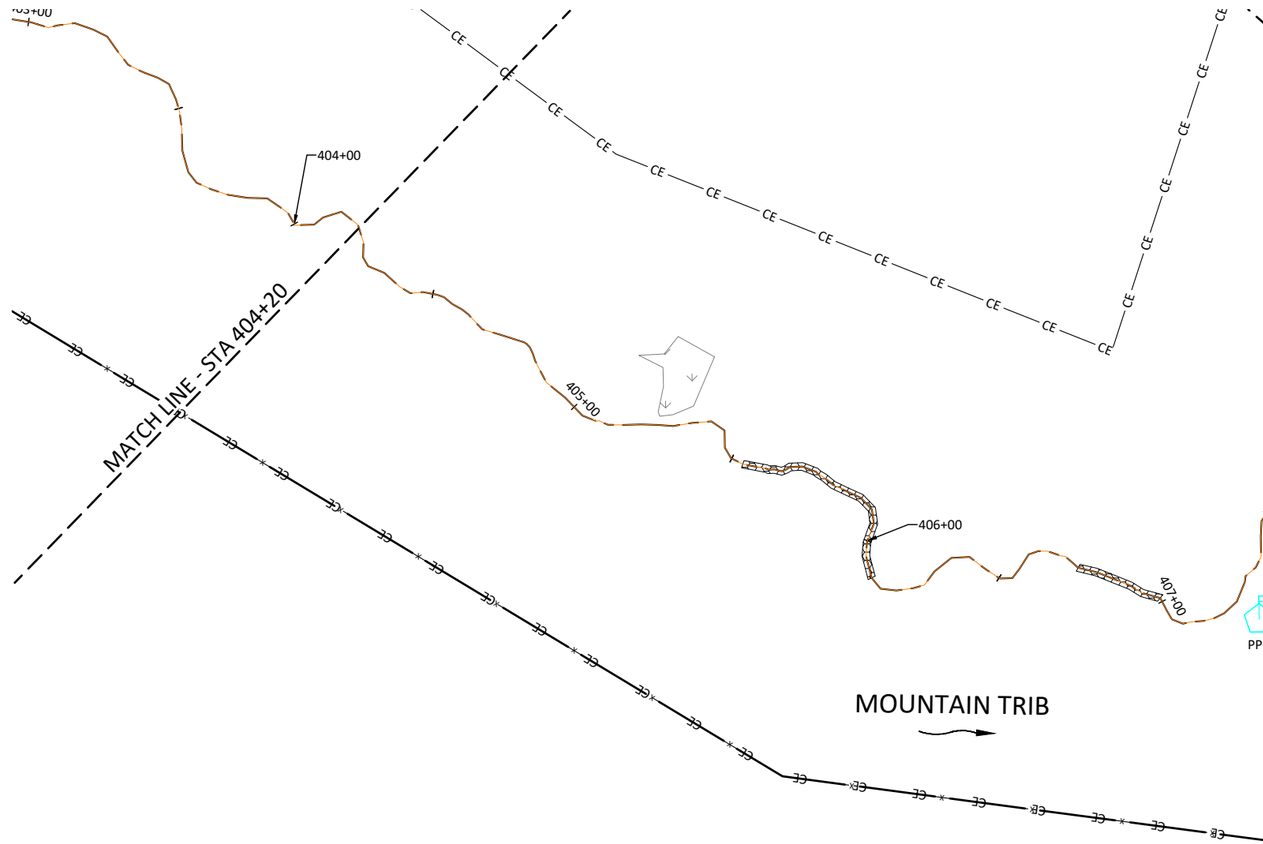

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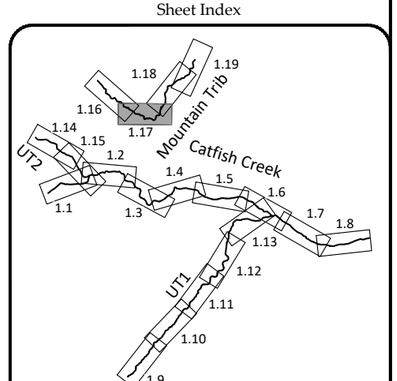

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497 Bramson Ct, Suite 104
Mount Pleasant, SC 29464
Tel: 843.277.6221

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SEAL
048920
5/21/20
GRADY L. SMITH

Catfish Pond Mitigation Site - Record Drawings
Durham County, North Carolina

Mountain Trib
Stream Plan and Profile

Revisions:

Date:	06-18-2020
Job Number:	005-02168
Project Engineer:	GLS
Drawn By:	JTC
Checked By:	JCK

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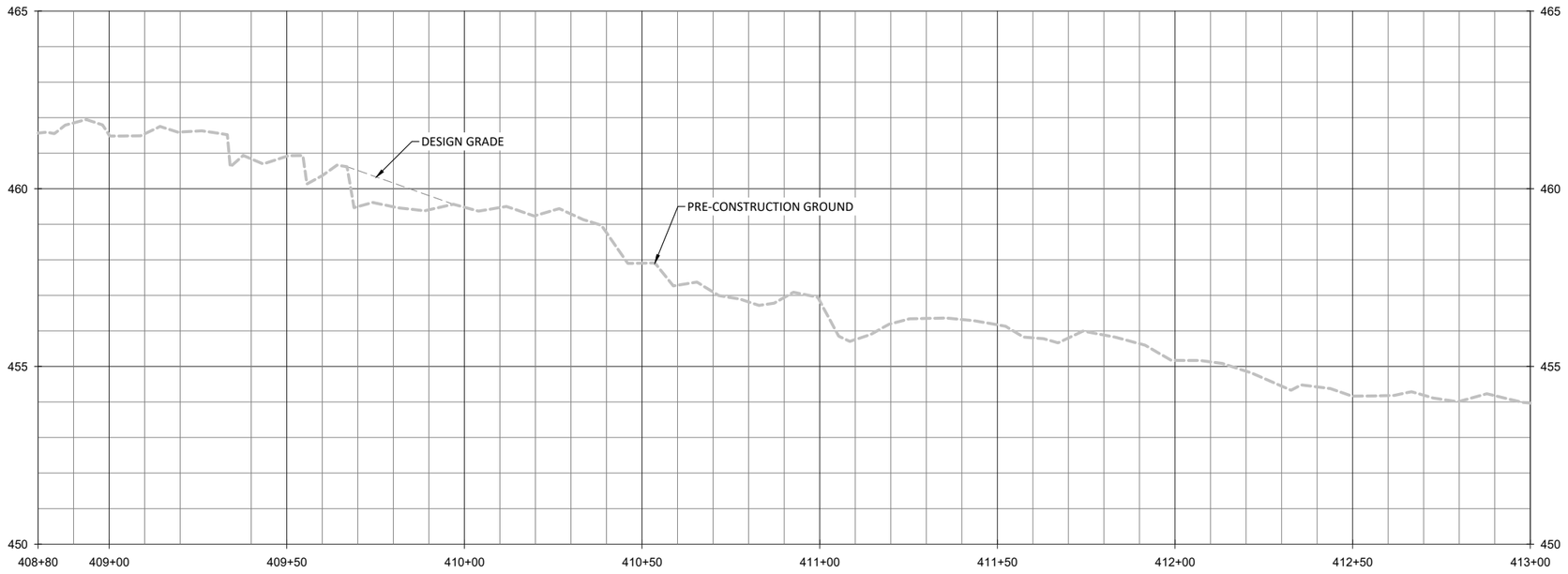

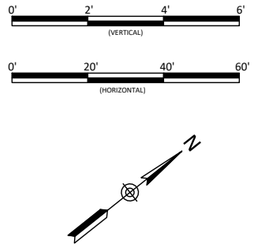

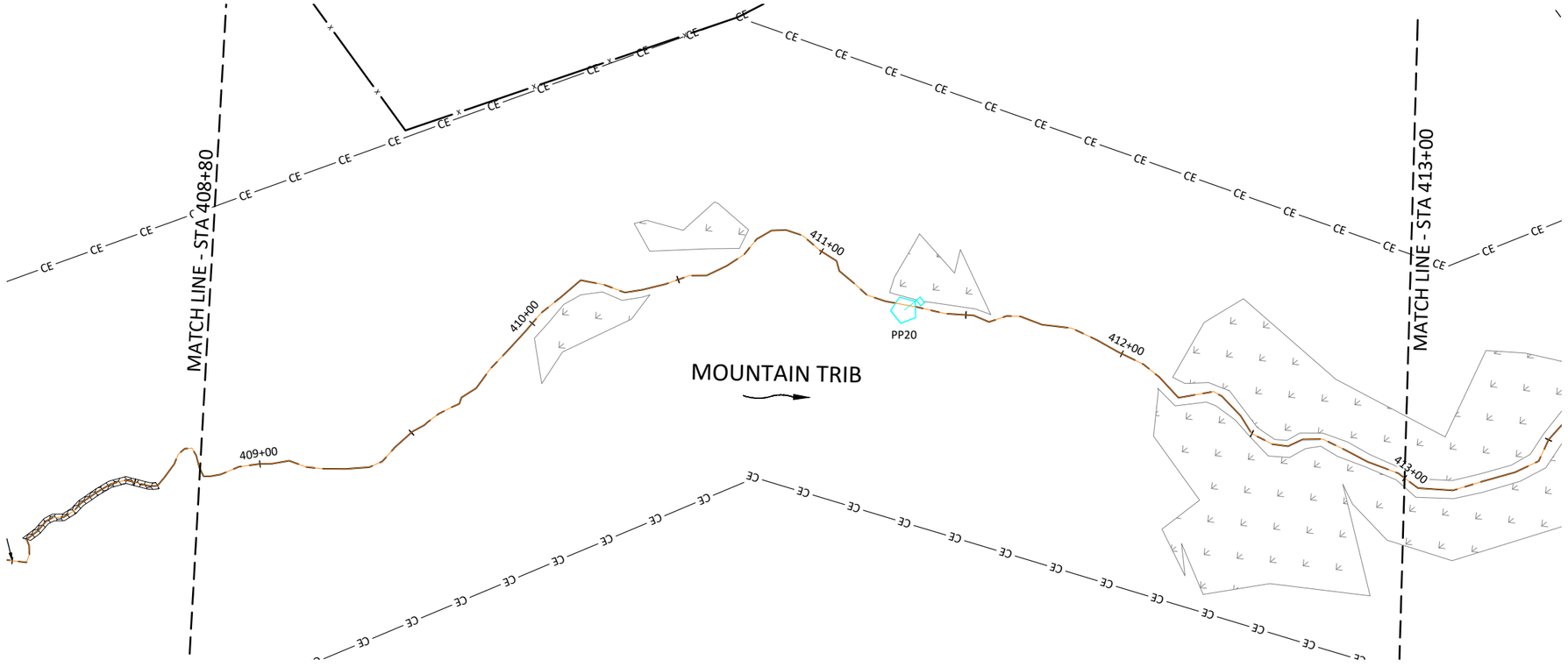

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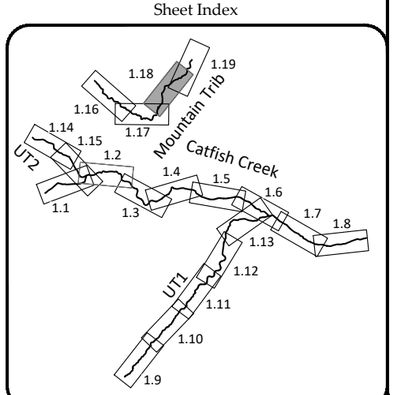

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497 Bramson Ct, Suite 104
Mount Pleasant, SC 29464
Tel: 843.277.6221

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SEAL
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5/21/20
GEOFFREY L. SMITH
ENGINEER

Catfish Pond Mitigation Site - Record Drawings
Durham County, North Carolina

Mountain Trib
Stream Plan and Profile

Date:	06-18-2020
Job Number:	005-02168
Project Engineer:	GLS
Drawn By:	JTC
Checked By:	JCK

Revisions:

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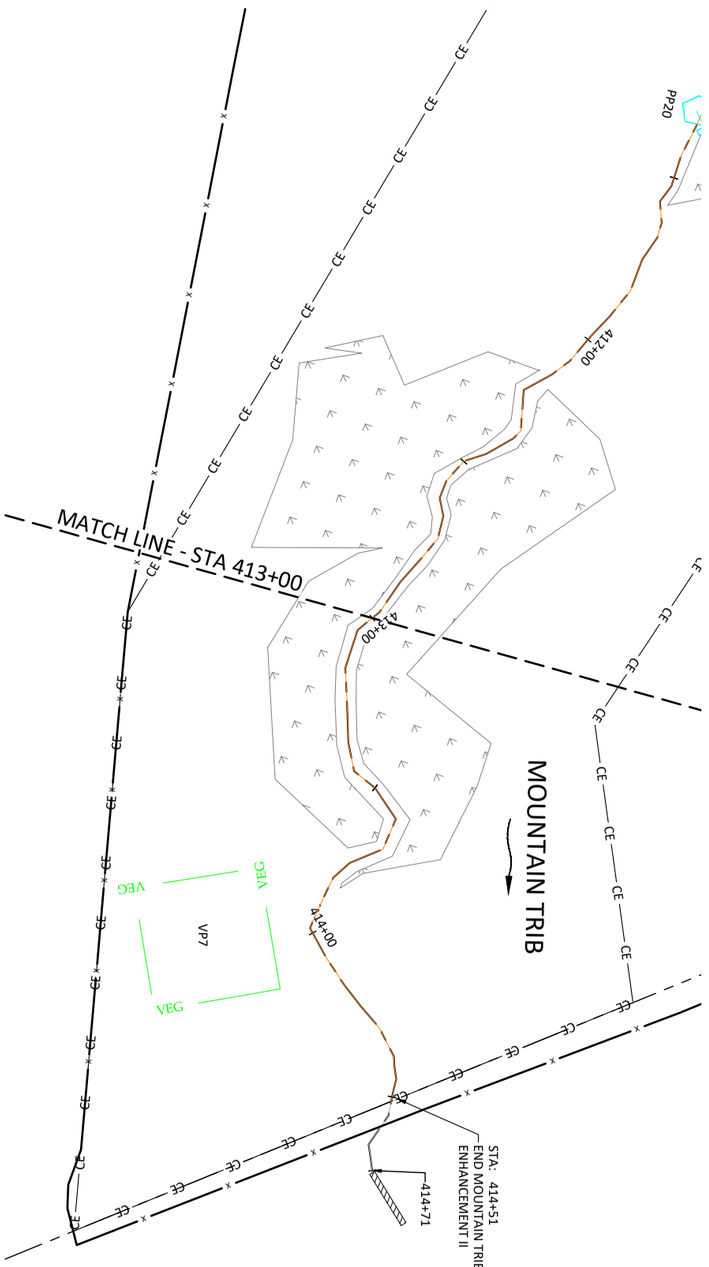

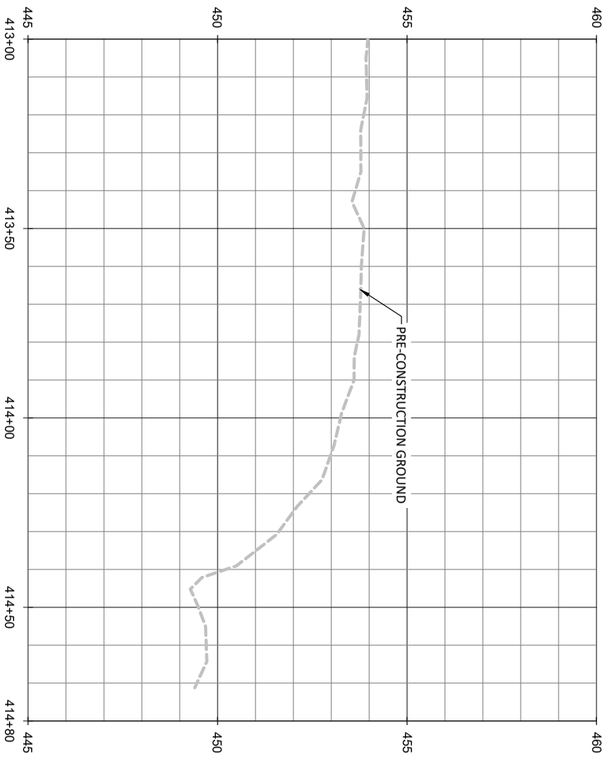

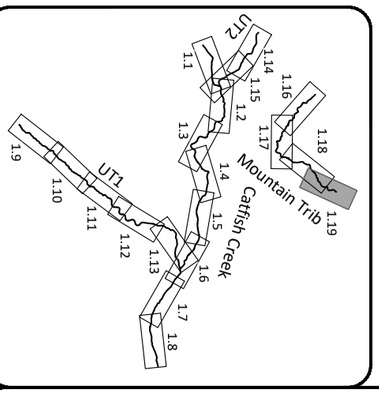

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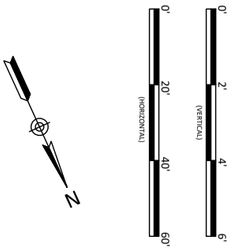

Date:	06-18-2020
Job Number:	005-02168
Project Engineer:	GLS
Drawn By:	JTC
Checked By:	JCK

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Revisions:

Catfish Pond Mitigation Site - Record Drawings
Durham County, North Carolina

Mountain Trib
Stream Plan and Profile

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Tel: 843.277.6221

Note:
1. Percent of stems altered due to availability of plant species.

Zone 1* - Streambank Planting Zone

Streambank Planting Zone

Live Stakes

Species	Common Name	Indiv. Spacing	Min. Size	Stratum	% of Stems
Sambucus canadensis	Elderberry	3-6 ft.	0.5"-1.5" cal.	Shrub	~~15%~~ 12%
Cornus ammomum	Silky Dogwood	3-6 ft.	0.5"-1.5" cal.	Shrub	~~45%~~ 44%
Salix sericea	Silky Willow	3-6 ft.	0.5"-1.5" cal.	Shrub	~~40%~~ 44%
					100%
Herbaceous Plugs					
Juncus effusus	Common Rush	4 ft.	1.0"- 2.0" plug	Herb	40%
Scirpus cyperinus	Woolgrass	4 ft.	1.0"- 2.0" plug	Herb	30%
Carex lurida	Lurid Sedge	4 ft.	1.0"- 2.0" plug	Herb	15%
Carex alata	Broadwing Sedge	4 ft.	1.0"- 2.0" plug	Herb	15%
					100%

Zone 2 - Buffer Planting Zone (Upland)

Zone 2 - Buffer Planting Zone (Wetland)

No Planting Zone (No planting within existing forested area)

Buffer Planting Zone

Bare Root

Species	Common Name	Max Spacing	Indiv. Spacing	Min. Caliper Size	Stratum	Zone	# of Stems
Quercus phellos	Willow Oak	12 ft.	6-12 ft.	0.25"-1.0"	Canopy	Throughout	~~10%~~ 12%
Platanus occidentalis	Sycamore	12 ft.	6-12 ft.	0.25"-1.0"	Canopy	Throughout	~~20%~~ 22%
Betula nigra	River Birch	12 ft.	6-12 ft.	0.25"-1.0"	Canopy	Throughout	~~15%~~ 17%
Quercus michauxii	Swamp Chestnut Oak	12 ft.	6-12 ft.	0.25"-1.0"	Canopy	Throughout	~~10%~~ 12%
Populus deltoides	Eastern Cottonwood	12 ft.	6-12 ft.	0.25"-1.0"	Canopy	Throughout	~~12%~~ 0%
****Quercus alba*	White Oak	12 ft.	6-12 ft.	0.25"-1.0"	Canopy	Zone 2 Upland Only	~~5%~~ 6%
****Quercus lyrata*	Overcup Oak	12 ft.	6-12 ft.	0.25"-1.0"	Canopy	Zone 2 Wetland Only	~~5%~~ 6%
Quercus shumardii	Shumard Oak	12 ft.	6-12 ft.	0.25"-1.0"	Canopy	Throughout	~~10%~~ 11%
Fraxinus pennsylvanica	Green Ash	12 ft.	6-12 ft.	0.25"-1.0"	Canopy	Throughout	~~10%~~ 11%
~~*Viburnum nudum~~ *Viburnum dentatum*	~~Possumhaw Viburnum~~ Arrowwood Viburnum	24 ft.	12-24 ft.	0.25"-1.0"	Understory	Throughout	1%
~~*Amelanchier canadensis~~ *Amelanchier laevis*	~~Shadbush Serviceberry~~ Smooth Serviceberry	24 ft.	12-24 t.	0.25"-1.0"	Understory	Throughout	1%
~~*Aesculus sylvatica~~ *Aesculus flava*	~~Painted Buckeye~~ Yellow Buckeye	24 ft.	12-24 ft.	0.25"-1.0"	Understory	Throughout	1%
* These species should be used for supplemental planting in areas with existing canopy but limited understory							100%
** *Q. alba* should only be planted in true upland areas and *Q. lyrata* should only be planted in true wetland areas							

Zones 1* and 2

Permanent Riparian Seeding

Pure Live Seed (20 lbs / acre)

Approved Date	Species Name	Common Name	Stratum	Density (lbs/acre)	pH	Percentage
All Year	*Panicum rigidulum*	Redtop Panicgrass	Herb	1.6	5.0-7.5	8%
All Year	*Agrostis hyemalis*	Winter Bentgrass	Herb	1.8	5.0-7.5	9%
All Year	*Rudbeckia hirta*	Blackeyed Susan	Herb	1.0	6.0-7.0	5%
All Year	*Coreopsis lanceolata*	Lanceleaf Coreopsis	Herb	1.0	6.0-7.0	5%
All Year	*Carex vulpinoidea*	Fox Sedge	Herb	3.0	6.8-8.9	15%
All Year	*Panicum clandestinum*	Deertongue	Herb	3.0	4.0-7.5	15%
All Year	*Elymus virginicus*	Virginia Wild Rye	Herb	3.0	5.0-7.4	15%
All Year	*Bidens anstosa*	Bur-Marigold	Herb	1.4	5.0-7.0	7%
All Year	*Helianthus angustifolius*	Swamp Sunflower	Herb	0.6	4.0-7.0	3%
All Year	*Panicum virgatum*	Switchgrass	Herb	1.0	4.5-8.0	5%
All Year	*Poa palustris*	Fowl Bluegrass	Herb	1.0	4.9-7.5	5%
All Year	*Elymus riparius*	Riverbank Wildrye	Herb	0.6	4.5-7.2	3%
All Year	*Panicum dichotoiflorum*	Smooth Panicgrass	Herb	1.0	4.8-7.0	5%
						100%

Permanent Seeding Outside Easement

Approved Date	Species Name	Common Name	Stratum	Density (lbs/acre)	Percentage
All Year	*Festuca arundinacea*	Tall Fescue	Herb	80	50%
All Year	*Festuca rubra*	Creeping Red Fescue	Herb	80	50%
					100%

Temporary Seeding

Pure Live Seed

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

*Zone 1 is from top of bank to top of bank but is not depicted on the plans.

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Tel: 843.277.6221

NORTH CAROLINA SEAL 048920 GREGORY L. SMITH 5/21/20

Catfish Pond Mitigation Site - Record Drawings
Durham County, North Carolina

Planting Tables
Planting Plan

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Project Engineer: GLS
Drawn By: JTC
Checked By: JCK

Sheet 2.1

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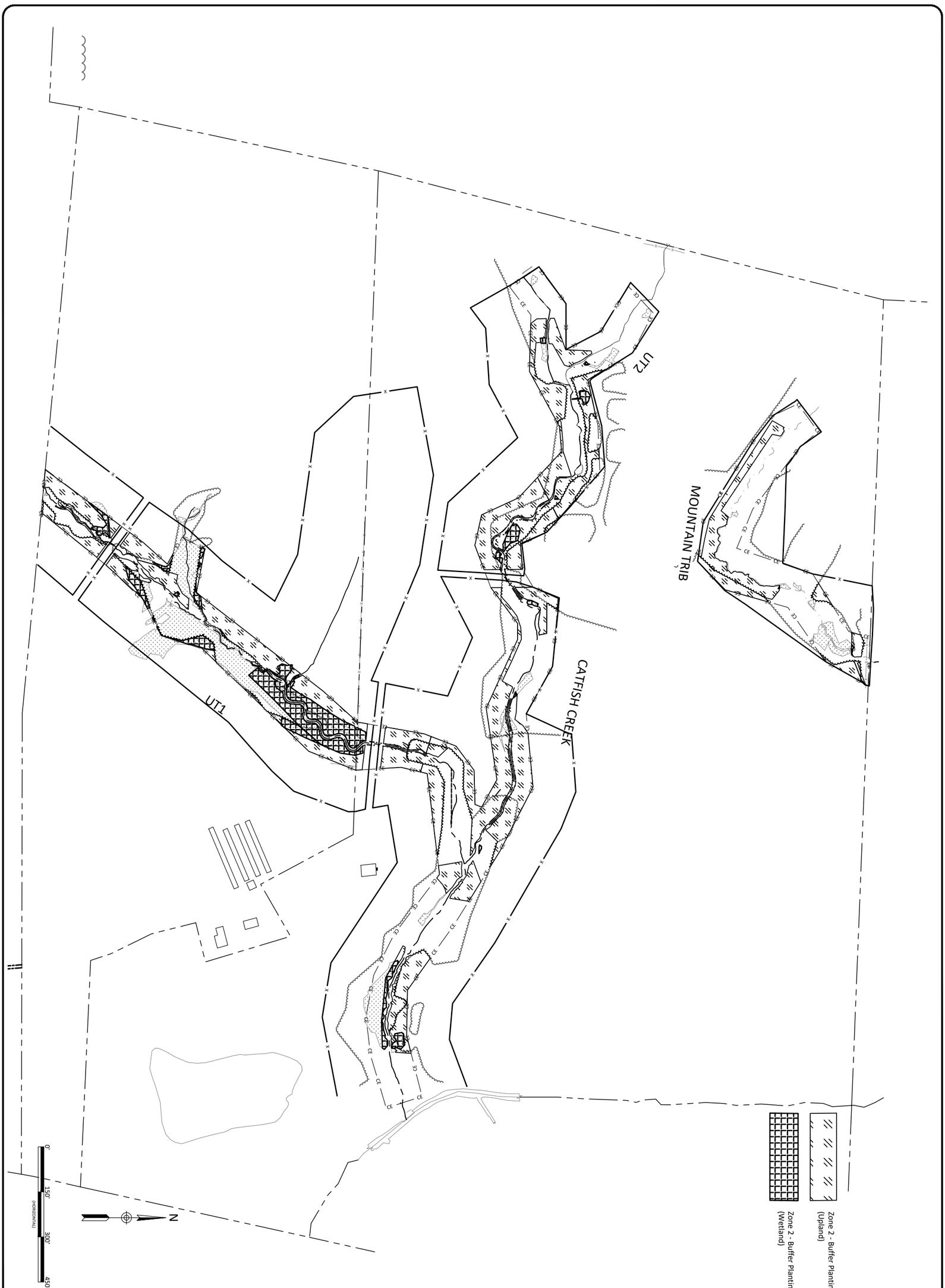

Date:	06-18-2020
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Project Engineer:	LAD
Drawn By:	JTC
Checked By:	JCK

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Sheet

Revisions:

Catfish Pond Mitigation Site - Record Drawings
Durham County, North Carolina

Planting Overview
Planting Plan

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Mount Pleasant, SC 29464
Tel: 843.277.6221

APPENDIX 6. Buffer Baseline Monitoring Report

Buffer Baseline Monitoring Report

July 2020

CATFISH POND MITIGATION SITE

Durham County, NC
NCDEQ Contract No. 007424
DMS ID No. 100039
DWR Project Number 2018-0196

Neuse River Basin
HUC 03020201

RFP #: 16-007279

PREPARED FOR:

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

BUFFER BASELINE MONITORING REPORT

CATFISH POND MITIGATION SITE

Durham County, NC
NCDEQ Contract No. 007424
DMS ID No. 100039

Neuse River Basin
HUC 03020201

PREPARED FOR:

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

PREPARED BY:

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

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

- 15A NCAC 02B .0295 Mitigation Program Requirements for Protection and Maintenance of Riparian Buffers.
- NCDEQ Division of Mitigation Services In-Lieu Fee Instrument signed and dated July 28, 2010.

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

Contributing Staff:

Chris Roessler, *Project Manager*
John Hutton, *Principal in Charge*
Jason Lorch, *Baseline Monitoring Plan*
Daniel Taylor, *Construction Administrator*
Tasha King, *Monitoring Lead*
Andrea Eckardt, *Lead Quality Assurance*

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APPENDICES

1.0 Mitigation Project Summary

The Catfish Pond Buffer Mitigation Site (Site) is a riparian restoration project located in Durham County approximately 12 miles north of the City of Durham and approximately 3 miles east of the Orange County/Durham County border (Figure 1). Figure 2 depicts the service area of the Site which includes the Falls Lake watershed in the Neuse river basin. A conservation easement comprised of 20.73 acres along Catfish Creek and three unnamed tributaries was recorded on the Site (Figure 3). Before construction, the majority of the Site was used as cattle pasture, with some forested riparian areas. In addition, Catfish Pond was a significant source of degradation on Catfish Creek. The project is expected to generate 523,358.865 riparian buffer credits.

The Site is within Hydrologic Unit Code (HUC) 03020201020040 and North Carolina Department of Water Resources (NCDWR) Sub-basin 03-04-01. Two unnamed tributaries (UT1 and UT2) drain to Catfish Creek, which drains to Mountain Creek, and one unnamed tributary (Mountain Tributary) drains directly to Mountain Creek. Mountain Creek flows into Little River, the Eno River, and then Falls Lake. Falls Lake is classified as water supply waters (WS-IV) and nutrient sensitive waters (NSW).

1.1 Project Goals

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

- Exclude cattle from project streams – Fencing has been installed around project areas adjacent to cattle pastures.
- Decrease nutrient levels – Filtering runoff from the agricultural fields through restored native riparian zones. The off-site nutrient input is absorbed on-site by filtering flood flows through restored floodplain areas, where flood flows can disperse through native vegetation.
- Decrease water temperature and increase dissolved oxygen concentrations – Riparian areas will create additional long-term shading of the channel flow to reduce thermal pollution.
- Restore and enhance native floodplain vegetation – Planted native tree species in riparian zone where tree growth was insufficient.
- Permanently protect the project Site from harmful uses – Established a conservation easement on the site.

1.2 Pre-construction Site Conditions

The riparian restoration project includes 20.73 acres of cattle pasture and riparian forest along Catfish Creek and the three unnamed tributaries that drain into the Neuse River Basin. Prior to construction, the primary degradation of Catfish Creek was the creation of Catfish Pond sometime between 1940 and 1955. In that same time period extensive logging and farm road construction also took place. Aerial photographs from 1972 suggest that UT1 had been straightened for agricultural purposes. Catfish Creek above and below the pond, UT2, and Mountain Tributary showed few signs of channel manipulation.

Two unnamed tributaries (UT1 and UT2) drain to Catfish Creek, which drains to Mountain Creek, and one unnamed tributary (Mountain Tributary) drains directly to Mountain Creek. Catfish Creek, UT1, UT2, and Mountain Tributary are all jurisdictional streams. The buffer project attributes are listed in Table 1, located in Appendix 1.

On May 13, 2018, NCDWR conducted on-site determinations to review features and land use within the project boundary. The resulting NCDWR site viability letter and map confirming the Site as suitable for riparian buffer and nutrient offset mitigation is located in Appendix 2. Catfish Creek and the three unnamed tributaries are appropriate for buffer and nutrient offset mitigation as related to the rules set forth in the Neuse Buffer Mitigation Rules: Mitigation Program Requirements for Protection and Maintenance of Riparian Buffers (15A NCAC 02B .0295) and Neuse River Basin: Nutrient Sensitive Waters Management Strategy: Protection and Maintenance of Existing Riparian Buffers (15A NCAC 02B .0233).

2.0 Determination of Credits

The project is expected to generate 523,358.865 riparian buffer credits, through buffer restoration and buffer enhancement via cattle exclusion, per the Consolidated Buffer Mitigation Rules (15A NCAC 02B 0.0295 (o)). There is also potential to convert some buffer credits to nutrient offset credits, dependent on the need. Mitigation credits are presented in Table 2 and illustrated in Figure 3 (Appendix 1). Calculations are based upon the as-built survey included in Appendix 3.

In the Mitigation Plan, 0.1 acres of buffer restoration credits were removed around Ditch D because it did not meet the requirement to maintain diffuse flow throughout the buffer. With the addition of Catfish Pond II Mitigation Bank Parcel (DWR Project Number 2018-0196v2), this deduction is no longer necessary. The Catfish Pond II conservation easement completely encompasses Ditch D allowing for diffuse flow. Fencing has been installed around Catfish Pond II (Appendix 1, Figure 4).

3.0 Baseline Summary

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

3.1 Parcel Preparation

Prior to stream construction, the Site was cattle pasture, with livestock having access to all streams causing streambank erosion. UT1 was also channelized to maximize land use. Catfish Pond was removed during stream construction and the four streams were restored and/or enhanced. The approved permits are included in Appendix 5. During stream construction, invasive plants were targeted and removed to reduce native competition. Soil amendments were added to certain graded areas after construction as directed by soil test results. Amendments included agricultural lime, slow release fertilizer, and soil conditioners (humic acid, organic material, soil biota stimulants). Haul roads and other high trafficked areas were also ripped to a depth of 18” where possible to reduce soil compaction.

3.2 Riparian Area Restoration Activities

The revegetation plan for the riparian restoration area included permanent seeding and planting bare root trees. These revegetation efforts were coupled with the select treatment of invasive species to control their population. The species composition planted was selected based on the desired community

type, occurrence of species in riparian areas adjacent to the Site, and best professional judgement. The total number of tree species planted across the buffer areas are as follows: sycamore (*Platanus occidentalis*) 1,207 stems, river birch (*Betula nigra*) 927 stems, green ash (*Fraxinus pennsylvanica*) 646 stems, Shumard oak (*Quercus shumardii*) 646 stems, swamp chestnut oak (*Quercus michauxii*) 646 stems, willow oak (*Quercus phellos*) 646 stems, white oak (*Quercus alba*) 365 stems, overcup oak (*Quercus lyrata*) 365 stems, and 55 stems each of arrowwood viburnum (*Viburnum dentatum*), smooth serviceberry (*Amelanchier laevis*), and yellow buckeye (*Aesculus flava*). Additionally, 350 stems each of silky dogwood (*Cornus ammomum*) and silky willow (*Salix sericea*) and 100 stems of elderberry (*Sambucus canadensis*) were planted along streambanks. In total, 6,413 stems were planted across the site.

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

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

3.3 Riparian Area Enhancement Activities

Fencing was used to exclude cattle throughout the entire project as allowed by 15A NCAC 02B .0295(o) and minimal work was done on the streams through the enhancement areas. Fencing was built to incorporate the conservation easement for Catfish Pond II Mitigation Bank Parcel as shown in Figure 4. The enhancement area has been protected in perpetuity under a conservation easement.

4.0 Annual Monitoring and Performance Criteria

The performance criteria for the Site follows approved performance criteria presented in the guidance documents outlined in Request for Proposal (RFP) 16-007279 and the Consolidated Buffer Rule (15A NCAC 02B .0295). Annual monitoring and semi-annual site visits will be conducted to assess the condition of the finished project. The riparian restoration project has been assigned specific performance criteria components for vegetation that will be evaluated throughout the five-year post-construction monitoring. An outline of the performance criteria and monitoring components follows. Monitoring components are included in Table 3 and vegetation plots are depicted in Figure 5 (Appendix 1).

4.1 Vegetation

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

Seven fixed 100 square meter vegetation monitoring quadrants were installed across the Site to measure the survival of the planted stems (Figure 5) with a mean of 561 stems per acre (Table 4). Vegetation monitoring follows the CVS-EEP Level 2 Protocol for Recording Vegetation (2008). All planted stems were marked with flagging tape and a reference photograph was taken from the southwestern

corner of each vegetation plot during vegetation assessments. Each year, trees will be re-marked and plot photos will be taken along with overview photographs of the Site. Appendix 6 includes the baseline (MY0) vegetation plot planted and total stem counts, as well as plot photographs.

4.2 Overview Photographs

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

4.3 Visual Assessments

Visual assessments should support the performance standards for each metric as described above. Visual assessments will be performed within the Site on a semi-annual basis during the five-year monitoring period. Problem areas with vegetative health will be noted (e.g. low stem density, vegetation mortality, invasive species, or encroachment). Areas of concern will be mapped and photographed accompanied by a written description in the annual report. Problem areas will be re-evaluated during each subsequent visual assessment.

4.4 Annual Reporting Performance Criteria

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

4.5 Maintenance and Contingency Plans

The conservation easement has been properly and accurately marked by adding witness posts with easement placards along the easement boundary and at every corner. Adaptive management will be performed during the monitoring years to address minor issues as necessary. If during annual monitoring it is determined the project's ability to achieve performance standards are jeopardized, Wildlands will notify and work with the DMS/NCDWR to develop contingency plans and remedial actions. Any actions implemented will be designed to achieve the success criteria specified previously and will include a work schedule and updated monitoring criteria (if applicable).

5.0 References

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APPENDIX 1. General Figures and Tables

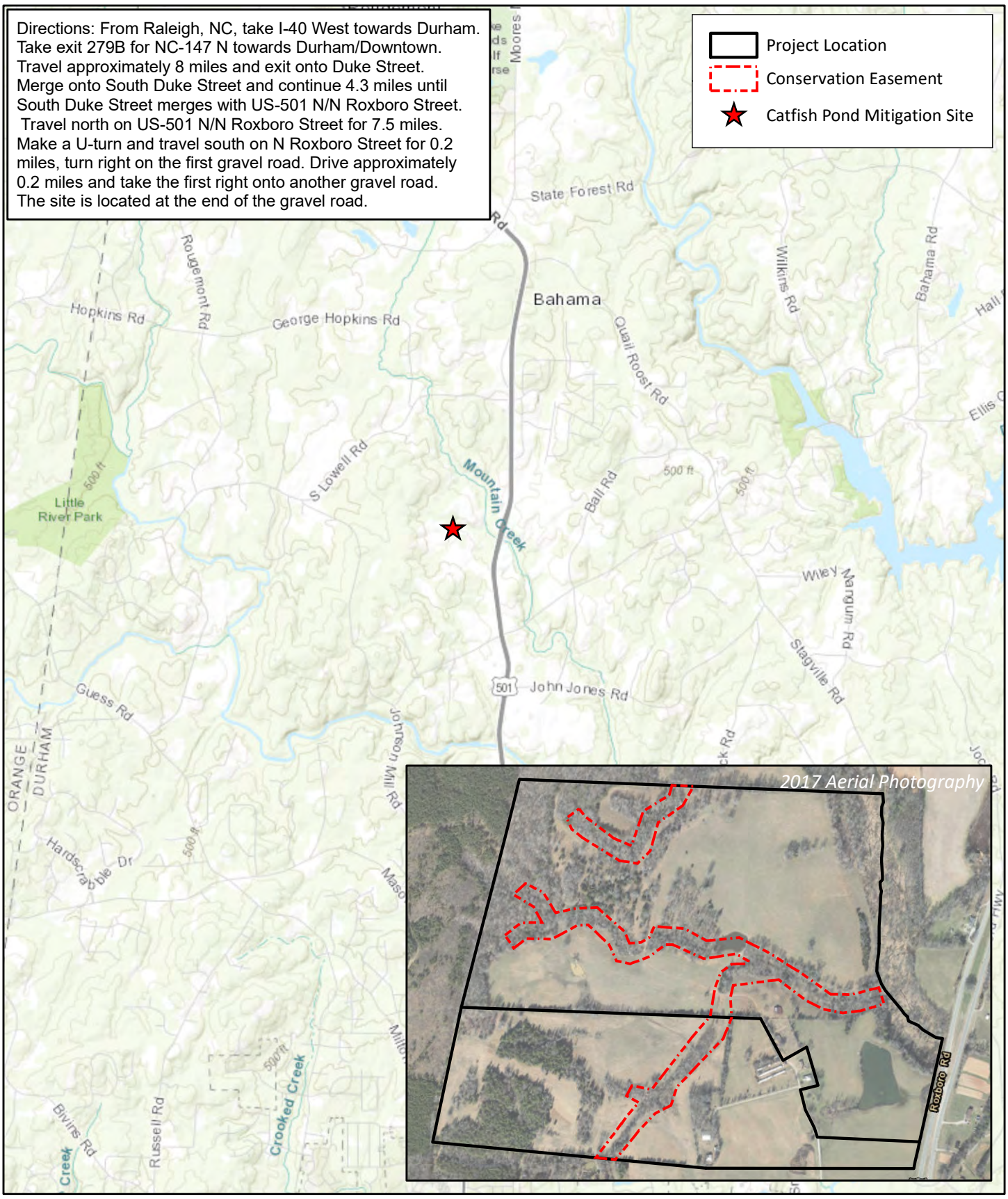

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Figure 1. Project Vicinity Map
Catfish Pond Mitigation Site
Baseline Monitoring Report (MY0)
Neuse River Basin (03020201)

Durham County, NC

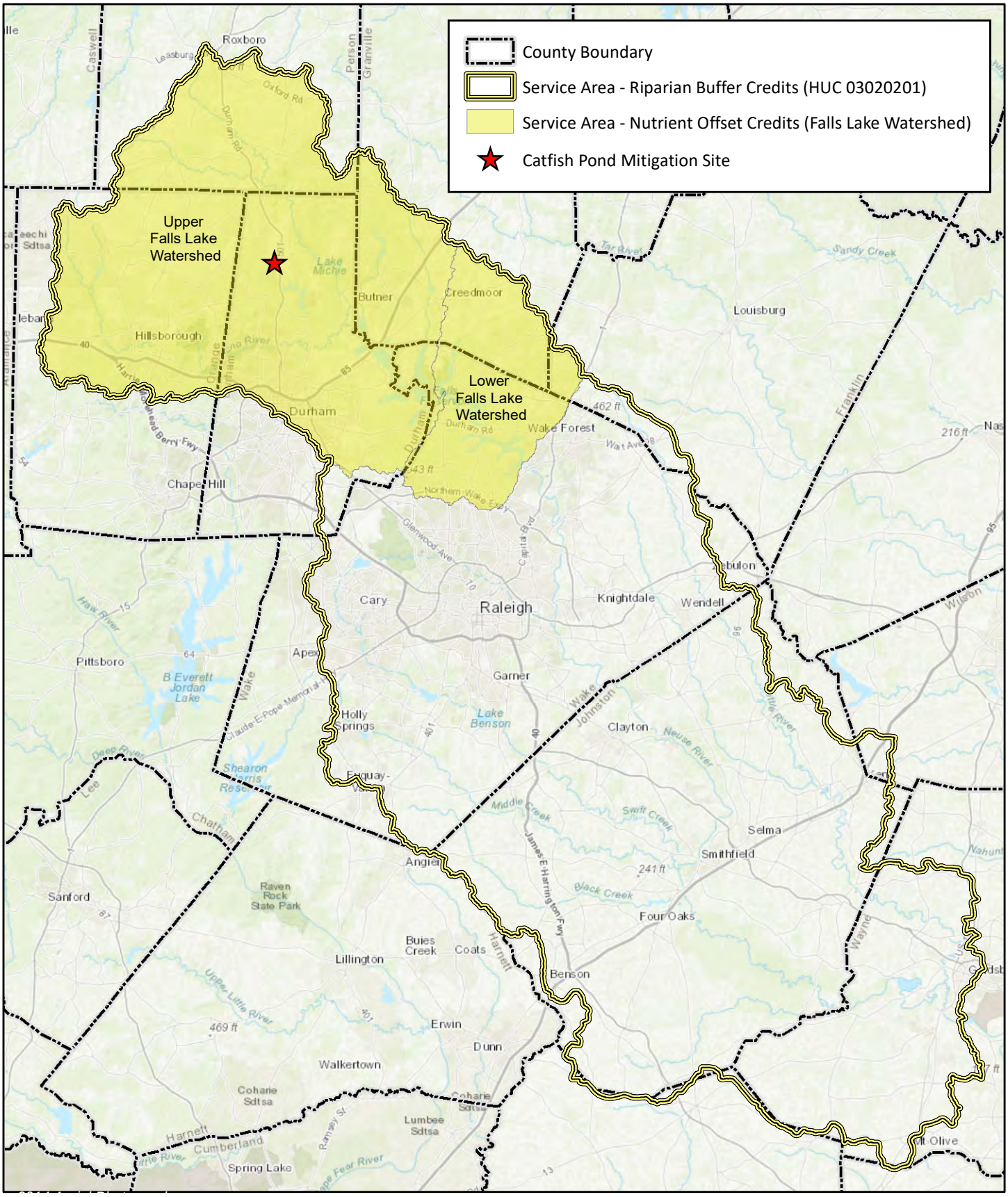

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Figure 2. Service Area Map
Catfish Pond Mitigation Site
Baseline Monitoring Report (MY0)
Neuse River Basin (03020201)
Durham County, NC

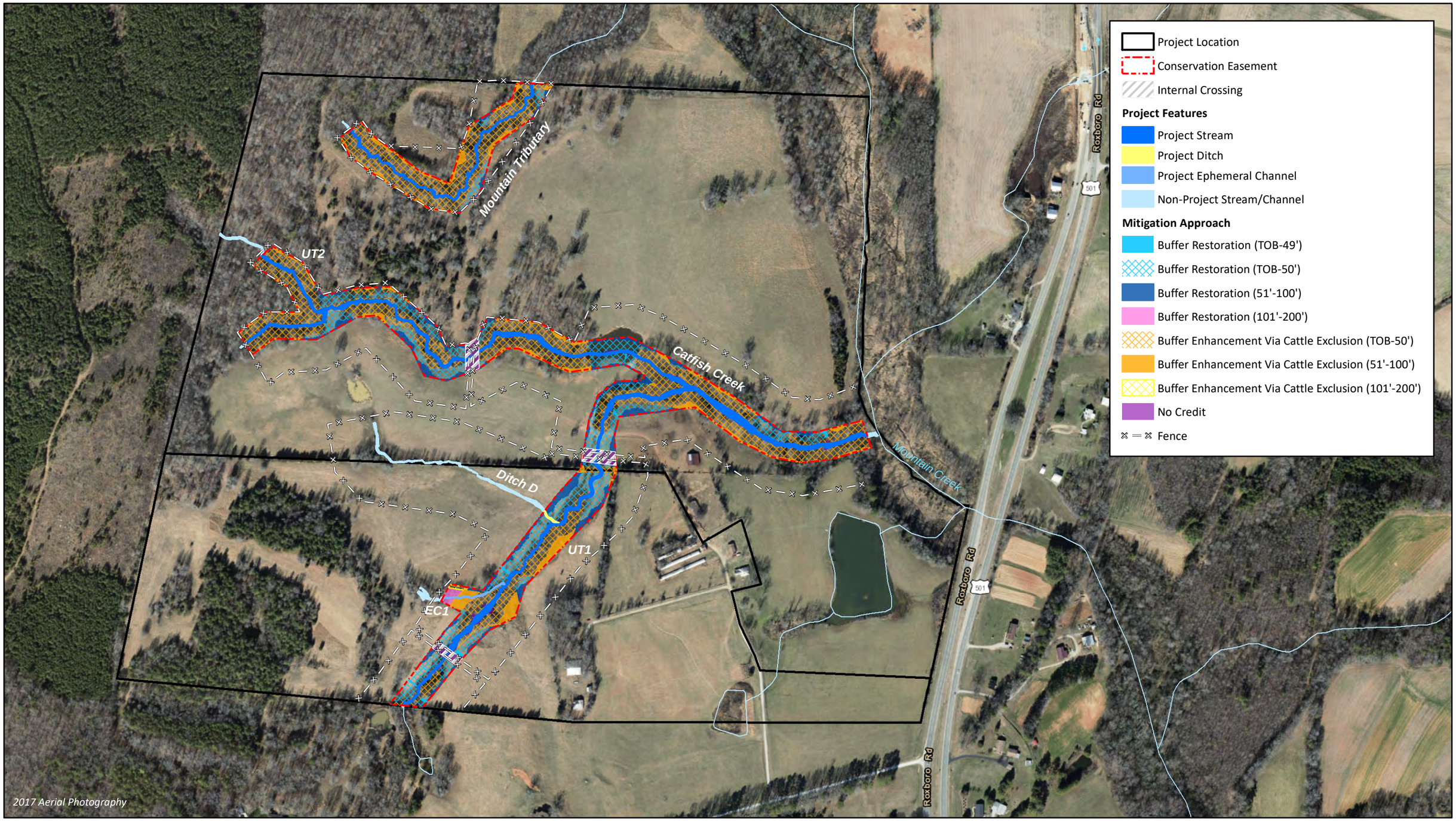

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Figure 3. Project Component/Asset Map
Catfish Pond Mitigation Site
Baseline Monitoring Report (MY0)
Neuse River Basin (03020201)
Durham County, NC

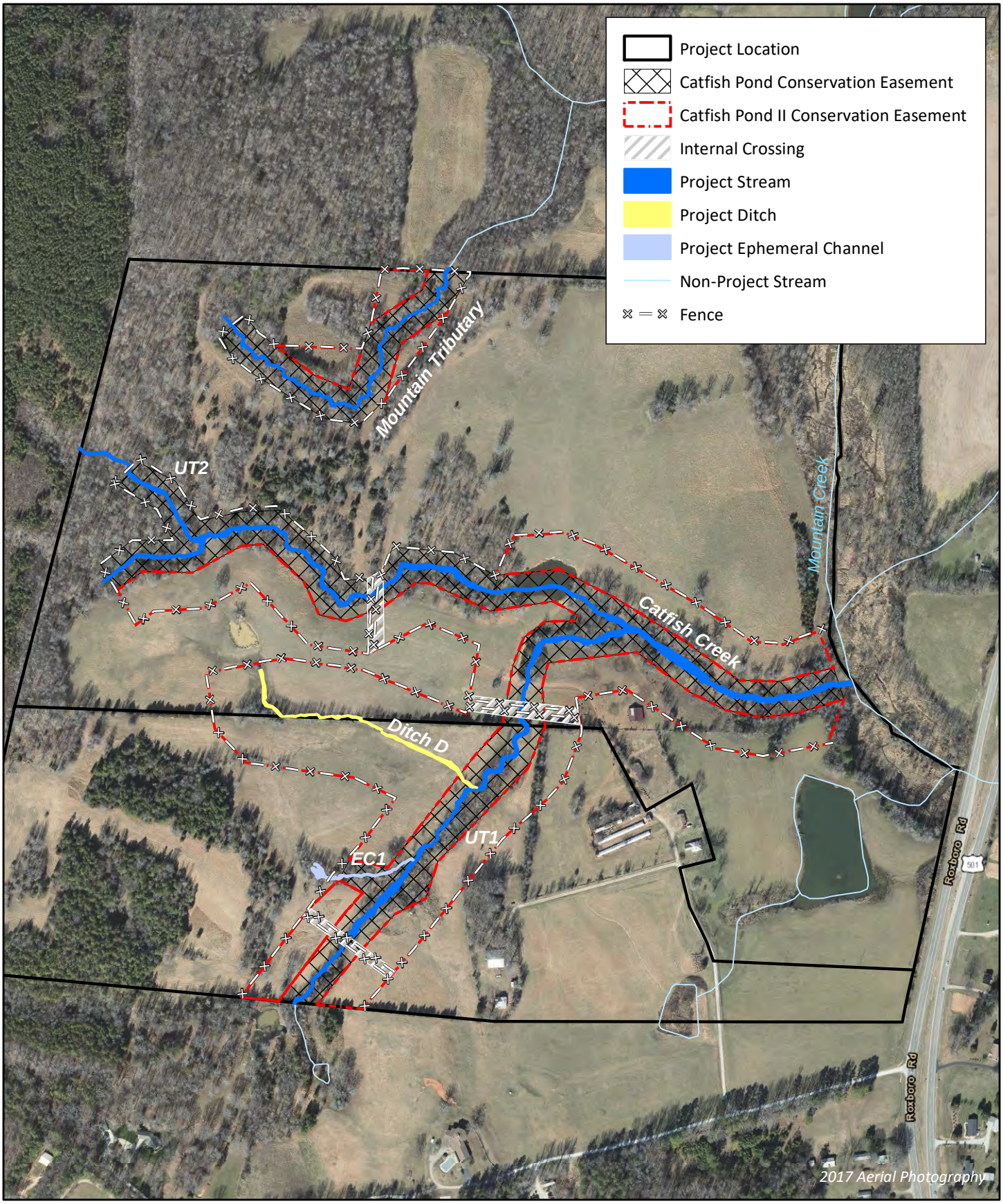

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Figure 4. Catfish Pond II Mitigation Bank Parcel Site Map
Catfish Pond Mitigation Site
Baseline Monitoring Report (MY0)
Neuse River Basin (03020201)
Durham County, NC

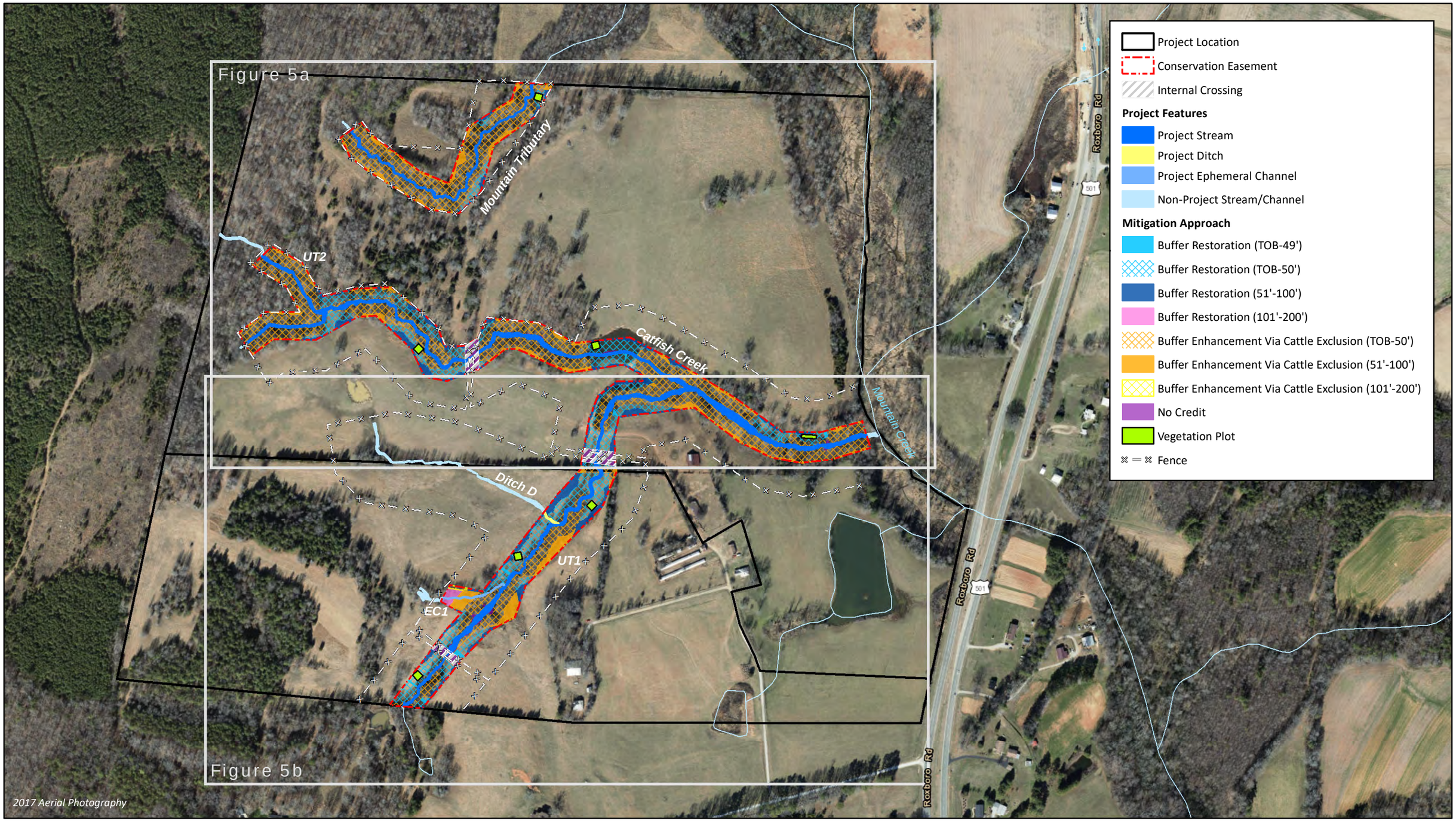

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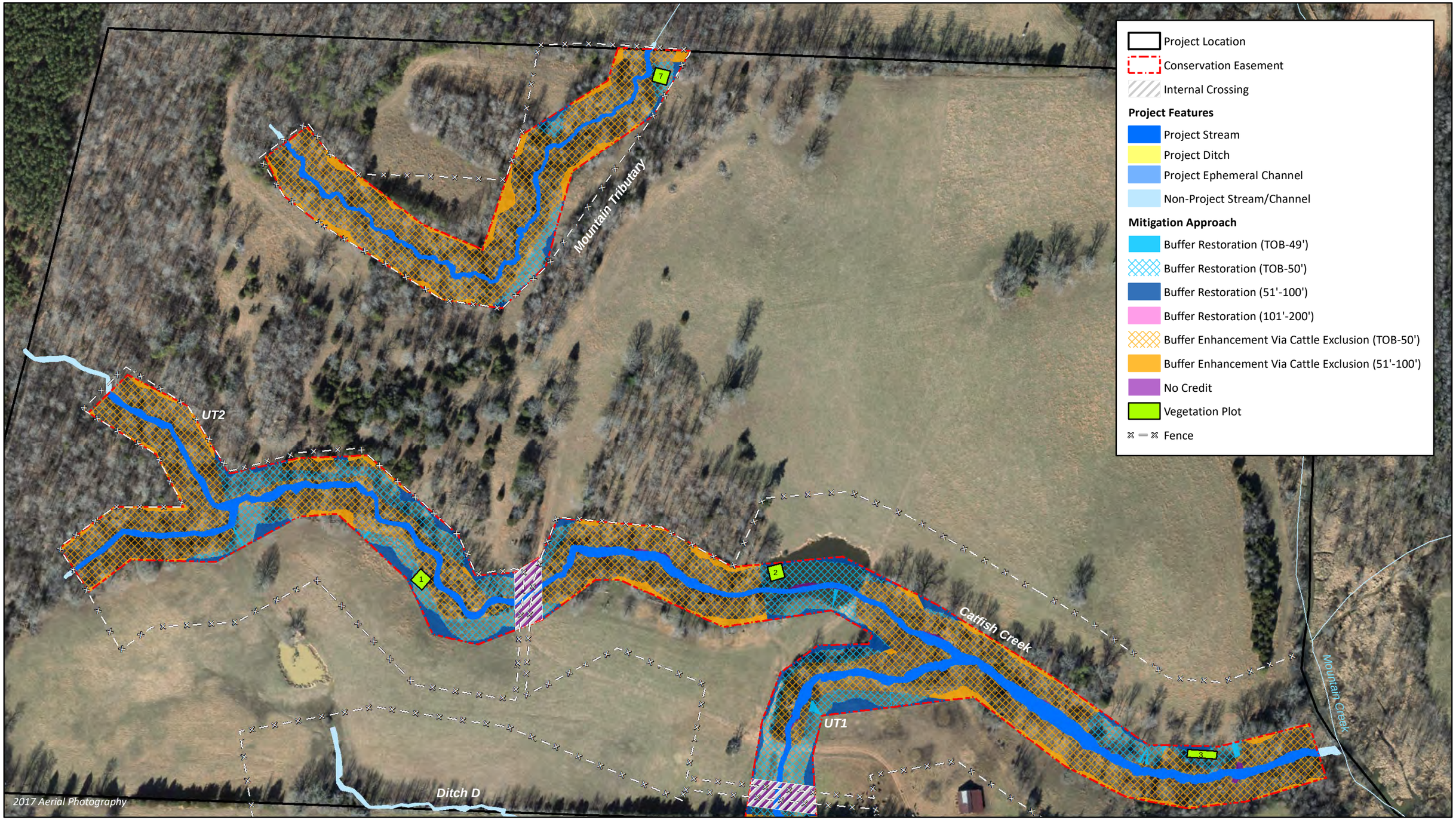
Figure 5. Monitoring Plan View Map Key
Catfish Pond Mitigation Site
Baseline Monitoring Report (MY0)
Neuse River Basin (03020201)
Durham County, NC



WILDLANDS ENGINEERING

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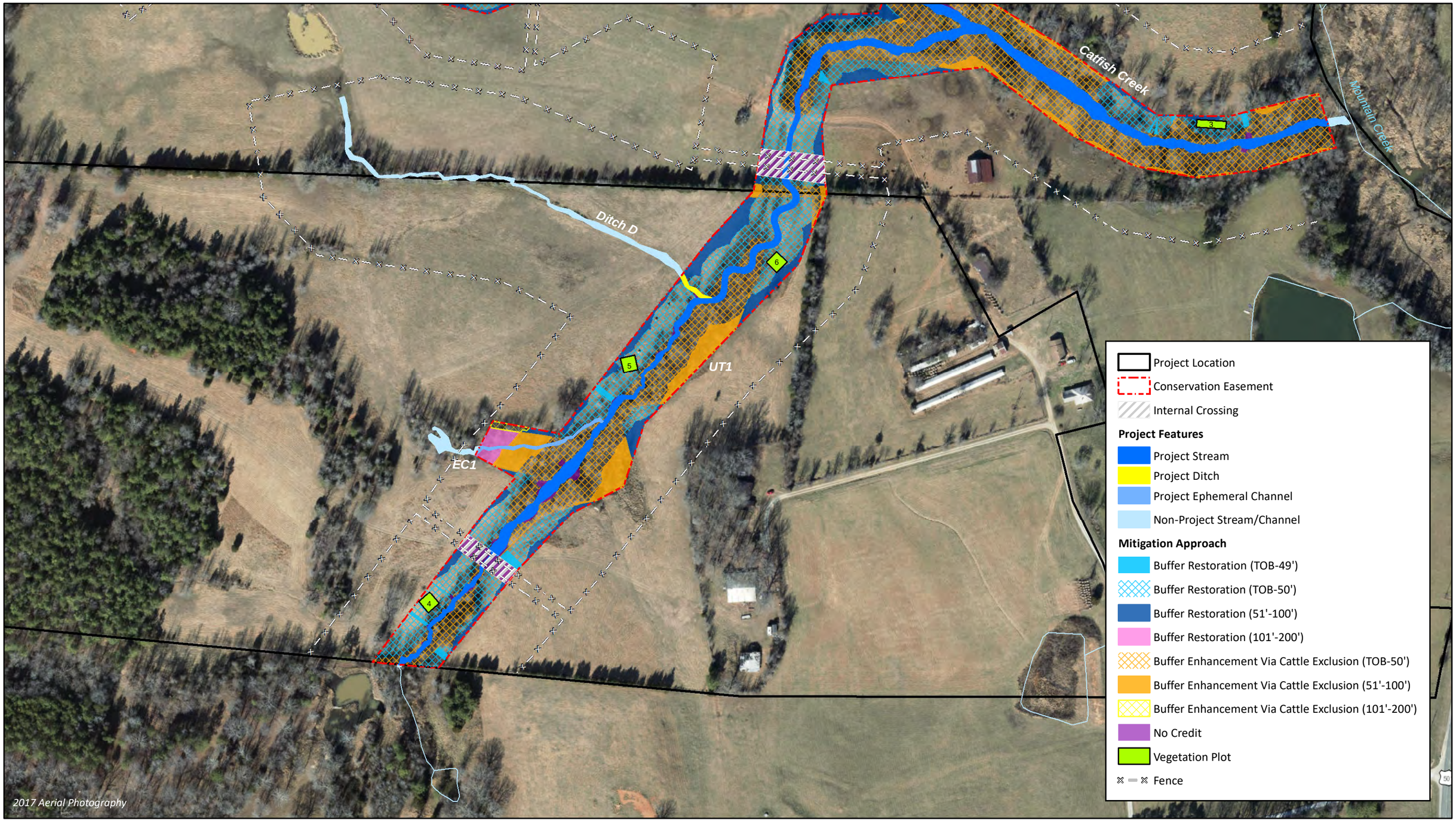
Figure 5a. Monitoring Plan View Map
Catfish Pond Mitigation Site
Baseline Monitoring Report (MY0)
Neuse River Basin (03020201)
Durham County, NC



WILDLANDS ENGINEERING

0 200 400 Feet

N

Figure 5b. Monitoring Plan View Map
Catfish Pond Mitigation Site
Baseline Monitoring Report (MY0)
Neuse River Basin (03020201)
Durham County, NC

Table 1. Buffer Project Attributes

Catfish Pond Mitigation Site

Monitoring Year 0 - 2020

Project Name	Catfish Pond Mitigation Site
Hydrologic Unit Code	03020201020040
River Basin	Neuse
Geographic Location (Lat, Long)	36° 9’ 48.03” N, 78° 54’ 37.66” W
Site Protection Instrument (DB/PG)	DB8235/776-780
Total Credits (BMU)	523,358.865
Types of Credits	Riparian Buffer
Mitigation Plan Date	July 2019
Initial Planting Date	March 2020
Baseline Report Date	June 2020
MY1 Report Date	December 2020
MY2 Report Date	December 2021
MY3 Report Date	December 2022
MY4 Report Date	December 2023
MY5 Report Date	December 2024

Table 2. Buffer Project Areas and Assets

Catfish Pond Mitigation Site

Monitoring Year 0 - 2020

Neuse 03020201 - Upper Falls Lake	**Project Area**
19.16394	**N Credit Conversion Ratio (ft^2/pound)**
297.54099	**P Credit Conversion Ratio (ft^2/pound)**

Credit Type	Location	Subject? (enter NO if ephemeral or ditch [1])	Feature Type	Mitigation Activity	Min-Max Buffer Width (ft)	Feature Name	Total Area (ft^2)	Total (Creditable) Area of Buffer Mitigation (ft^2)	Initial Credit Ratio (x:1)	% Full Credit	Final Credit Ratio (x:1)	Convertible to Riparian Buffer?	Riparian Buffer Credits	Convertible to Nutrient Offset?	Delivered Nutrient Offset: N (lbs)	Delivered Nutrient Offset: P (lbs)
Buffer	Rural	Yes	I / P	Restoration	0-50	Catfish Creek, UT1	4,369	4,369	1	100%	1.00000	Yes	4,369.000	No	—	—
Buffer	Rural	Yes	I / P	Restoration	51-100	Catfish Creek, UT1, UT2, Mountain Trib	252,086	252,086	1	100%	1.00000	Yes	252,086.000	Yes	13,154.184	847.231
Buffer	Rural	Yes	I / P	Restoration	101-200	UT1	1,063	1,063	1	33%	3.03030	Yes	350.790	Yes	55.469	3.573
Buffer	Rural	Yes	I / P	Enhancement via Cattle Exclusion	0-100	Catfish Creek, UT1, UT2, Mountain Trib	531,834	531,834	2	100%	2.00000	Yes	265,917.000	No	—	—
Buffer	Rural	Yes	I / P	Enhancement via Cattle Exclusion	101-200	UT1	3,855	3,855	2	33%	6.06061	Yes	636.075	No	—	—
													—		—	—
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													—		—	—
													—		—	—
													—		—	—
						Totals:	793,207	793,207								

Enter Preservation Credits Below

Eligible for Preservation (ft^2): 264,402

Credit Type	Location	Subject?	Feature Type	Mitigation Activity	Min-Max Buffer Width (ft)	Feature Name	Total Area (sf)	Total (Creditable) Area for Buffer Mitigation (ft^2)	Initial Credit Ratio (x:1)	% Full Credit	Final Credit Ratio (x:1)	Riparian Buffer Credits
Buffer				Preservation								—
												—
												—
												—
												—
												—
												—
												—
												—
												—
												—
												—
						Preservation Area Subtotal (ft^2):		0				
						Preservation as % Total Area of Buffer Mitigation:		0.0%				
						Ephemeral Reaches as % Total Area of Buffer Mitigation:		0.0%				

TOTAL AREA OF BUFFER MITIGATION (TABM)		
Mitigation Totals	**Square Feet**	**Credits**
Restoration:	257,518	256,805.790
Enhancement:	535,689	266,553.075
Preservation:	0	0.000
Total Riparian Buffer:	793,207	523,358.865
TOTAL NUTRIENT OFFSET MITIGATION		
Mitigation Totals	**Square Feet**	**Credits**
Nutrient Offset: Nitrogen:	0	0.000
Nutrient Offset: Phosphorus:		0.000

1. The Randleman Lake buffer rules allow some ditches to be classified as subject according to 15A NCAC 02B .0250 (5)(a).

last updated 01/17/2020

Table 3. Monitoring Components

Catfish Pond Mitigation Site

Monitoring Year 0 - 2020

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

APPENDIX 2. DWR Correspondence

Water Resources
ENVIRONMENTAL QUALITY

ROY COOPER
Governor
MICHAEL S. REGAN
Secretary
LINDA CULPEPPER
Interim Director

March 13, 2018

DWR ID# 2018-0196
Johnston County

Wildlands Engineering, Inc.
Attn: John Hutton
312 West Millbrook Rd, Suite 225
Raleigh, NC 27609
(via electronic mail: scott@waterlandsolutions.com)

Re: Site Viability for Buffer Mitigation & Nutrient Offset – Catfish Pond Site
Off US-501 (36.158391, -78.907343)
Neuse 03020201 (Falls Lake WS)
Durham County

Dear Mr. Hutton,

On February 23, 2018, Katie Merritt, with the Division of Water Resources (DWR), assisted you and others from Wildlands Engineering, Inc. at the proposed Catfish Pond Mitigation Site (Site) in Bahama, NC. The Site is located in the Falls Lake WS of the Neuse River Basin within the 8-digit Hydrologic Unit Code 03020201. The Site is being proposed as part of a full-delivery stream restoration project for the Division of Mitigation Services (RFP #16-007279). Members of the Interagency Review Team (IRT) and Division of Mitigation Services were also present onsite. At your request, on February 23, 2018, Ms. Merritt performed an onsite assessment of riparian land uses adjacent to streams and ditches onsite, which are shown on the attached map labeled "Figure 6A Concept Map".

Ms. Merritt's evaluation of the features onsite and their associated mitigation determination for the riparian areas are provided in the table below. This evaluation was made from Top of Bank (TOB) out to 200' from each feature for buffer mitigation pursuant to 15A NCAC 02B .0295 (effective November 1, 2015) and for nutrient offset credits pursuant to 15A NCAC 02B .0240.

Feature	Classification	[1]Subject to Buffer Rule	Riparian Land uses adjacent to Feature (0-200')	Buffer Credit Viable	[2]Nutrient Offset Viable at 2,273 lbs/acre	Mitigation Type Determination w/in riparian areas
UT1	Stream & Wetland complex *Proposed for stream restoration*	Yes (where stream is restored)	Combination of forested and non/forested pasture grazed by cattle	Yes[4]	Yes *(non-forested fields only)*	**Fields** - Restoration Site per 15A NCAC 02B .0295 (n) **Forested Areas** - Enhancement Site per 15A NCAC 02B .0295 (o) (6) *Crossing 1 has impeded flow and Crossing 2 is severely perched with impeded flow. Both crossings need be repaired/replaced.*

Feature	Classification	[1]Subject to Buffer Rule	Riparian Land uses adjacent to Feature (0-200')	Buffer Credit Viable	[2]Nutrient Offset Viable at 2,273 lbs/acre	Mitigation Type Determination w/in riparian areas
D	Ditch	No	Non-forested pasture grazed by cattle	*See Note	Yes	**Fields** - Restoration Site per 15A NCAC 02B .0295 (n) *The ditch meets 15A NCAC 02B .0295 (o)(8) (A, B, C & E). More information is needed for complete assessment.
Catfish Creek	Stream	Yes	Combination of forested and non/forested pasture grazed by cattle	Yes[4]	Yes *(non-forested fields only)*	**Fields** - Restoration Site per 15A NCAC 02B .0295 (n) **Forested Areas** - Enhancement Site per 15A NCAC 02B .0295 (o) (6) *Crossing 3 has impeded flow and needs to be repaired/replaced*
Catfish Pond	In-line pond *(proposed for stream Restoration)*	Yes	Combination of forested and non/forested pasture grazed by cattle	*Yes[4]	Yes *(non-forested fields only)*	**Fields** - Restoration Site per 15A NCAC 02B .0295 (n) **Forested Areas** - Enhancement Site per 15A NCAC 02B .0295 (o) (6) *If stream channel is created & restored through the pond, the new riparian areas will be viable as a Restoration Site
UT2	Stream	Yes	Mostly forested pasture with some open canopy areas and grazed by cattle	Yes[4]	Yes *(non-forested fields only)*	**Fields** - Restoration Site per 15A NCAC 02B .0295 (n) **Forested Areas** - Enhancement Site per 15A NCAC 02B .0295 (o) (6)
Mountain Tributary	Stream	Yes	Mostly forested pasture with some open canopy areas and grazed by cattle	Yes[4]	Yes *(non-forested fields only)*	**Fields** - Restoration Site per 15A NCAC 02B .0295 (n) **Forested Areas** - Enhancement Site per 15A NCAC 02B .0295 (o) (6)

[1]Subjectivity calls for the features were determined by DWR in correspondence dated March 12, 2018 using the 1:24,000 scale quadrangle topographic map prepared by USGS and the most recent printed version of the soil survey map prepared by the NRCS

[2] *NC Division of Water Resources - Methodology and Calculations for determining Nutrient Reductions associated with Riparian Buffer Establishment*

[3]The area of preservation credit within a buffer mitigation site shall comprise of no more than 25 percent (25%) of the total area of buffer mitigation per 15A NCAC 0295 (o)(5) and 15A NCAC 0295 (o)(4). Site cannot be a Preservation only site to comply with this rule.

[4]The area described as an Enhancement Site was assessed and determined to comply with all of 15A NCAC 02B .0295(o)(6).

Catfish Pond Full-Delivery Site
Wildlands
March 13, 2018

The attached map (Figure 6A Concept Map) showing the project site and features was provided by Wildlands Engineering and was initialed by Ms. Merritt on March 13, 2018. ***There were at least 3 crossings that need to be repaired or replaced to allow for aquatic passage and continuous hydrologic connectively throughout the stream/s.*** This letter should be provided in any future stream, wetland, buffer and/or nutrient offset mitigation plans for this Site.

This letter does not constitute an approval of this site to generate mitigation credits. Pursuant to 15A NCAC 02B .0295, a mitigation proposal and a mitigation plan shall be submitted to DWR for written approval **prior** to conducting any mitigation activities in riparian areas and/or surface waters for buffer mitigation credit. Pursuant to 15A NCAC 02B .0240, a proposal regarding a proposed nutrient load-reducing measure for nutrient offset credit shall be submitted to DWR for approval prior to any mitigation activities in riparian areas and/or surface waters.

All vegetative plantings, performance criteria and other mitigation requirements for riparian restoration, enhancement and preservation must follow the requirements in 15A NCAC 02B .0295 to be eligible for buffer and/or nutrient offset mitigation credits. For any areas depicted as not being viable for nutrient offset credit above, one could propose a different measure, along with supporting calculations and sufficient detail to support estimates of load reduction, for review by the DWR to determine viability for nutrient offset in accordance with 15A NCAC 02B .0240. For any areas generating wetland mitigation credit, no buffer or nutrient offset credit can be generated.

This viability assessment will expire on March 13, 2020 or upon the submittal of an As-Built Report to the DWR, whichever comes first. Please contact Katie Merritt at (919)-807-6371 if you have any questions regarding this correspondence.

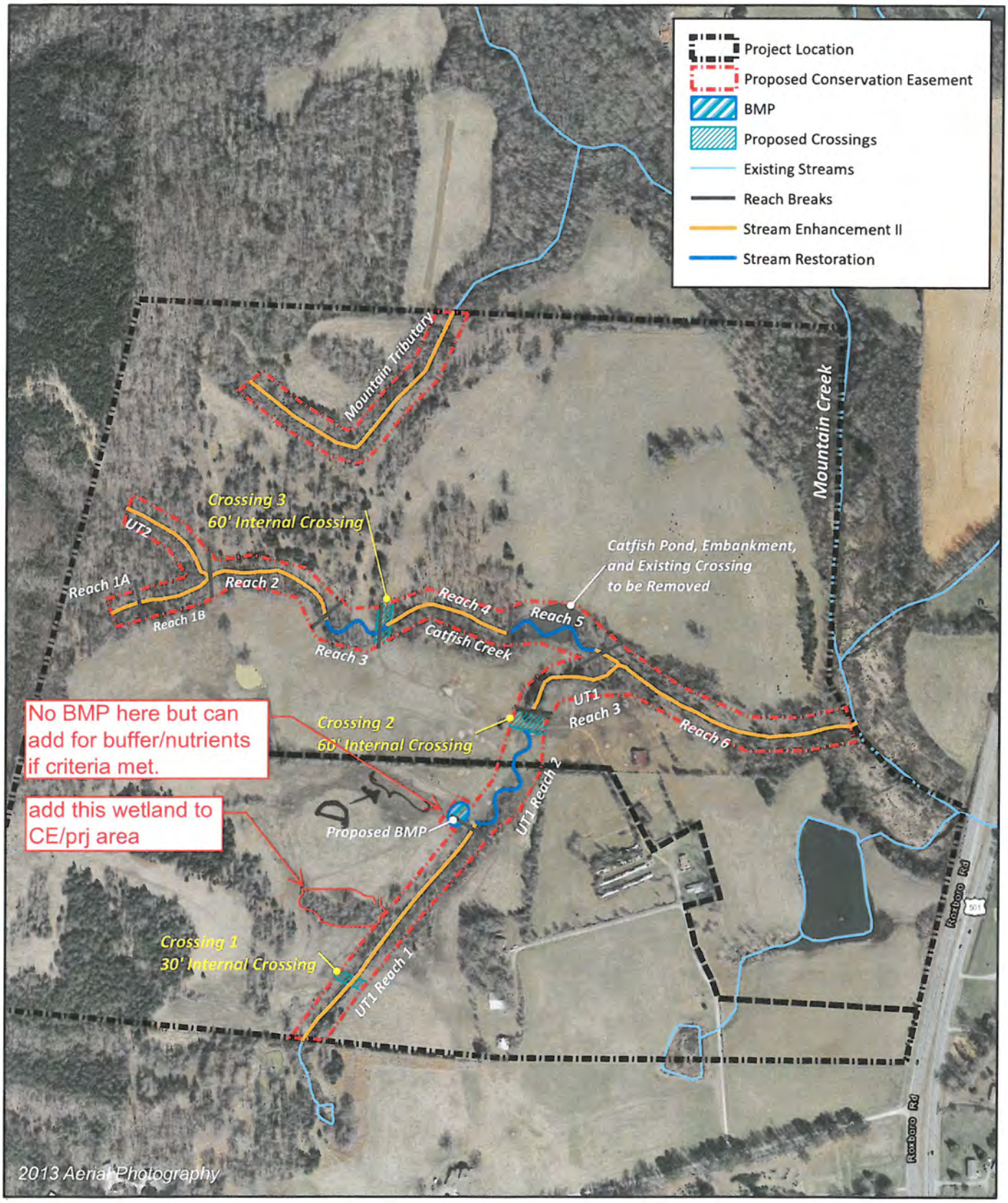
Sincerely,

Karen Higgins

Karen Higgins, Supervisor
401 and Buffer Permitting Branch

KAH/*km*
Attachments: Figure 6A Concept Map

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



WILDLANDS ENGINEERING

0 500 Feet

N

3/13/18
DWR# 2018-0194

Figure 6A Concept Map (Option 1)
Catfish Pond Mitigation Site
Neuse River Basin 03020201

Durham County, NC

APPENDIX 3. As-Built Survey

CERTIFICATE OF SURVEY AND ACCURACY

I, PHILLIP B. KEE, CERTIFY THAT THIS BUFFER MAP WAS DRAWN UNDER MY SUPERVISION, IS AN ACCURATE CALCULATION OF THE BUFFER AREAS AND IS BASED ON THE DIGITAL AS-BUILT CONDITIONS DATA DATED APRIL 14, 2020 BY KEE MAPPING AND SURVEYING, THE EXISTING CONDITIONS DATA DATED SEPTEMBER 26, 2018 BY KEE MAPPING AND SURVEYING, THE EASEMENT BOUNDARY AS RECORDED IN PB 201 PGS 153 & 154 OF THE DURHAM COUNTY REGISTER OF DEEDS OFFICE AND INFORMATION PROVIDED BY WILDLANDS ENGINEERING INC; THAT THE BOUNDARIES NOT SURVEYED ARE INDICATED AS DRAWN FROM INFORMATION AS REFERENCED; AND THAT THIS PLAT DOES NOT REPRESENT AN OFFICIAL BOUNDARY SURVEY AND IS ONLY FOR THE PURPOSE OF DEPICTING THE RIPARIAN BUFFER AREAS.

WITNESS MY ORIGINAL SIGNATURE, LICENSE NUMBER, AND SEAL THIS 1ST DAY OF JUNE, 2020, A.D.

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

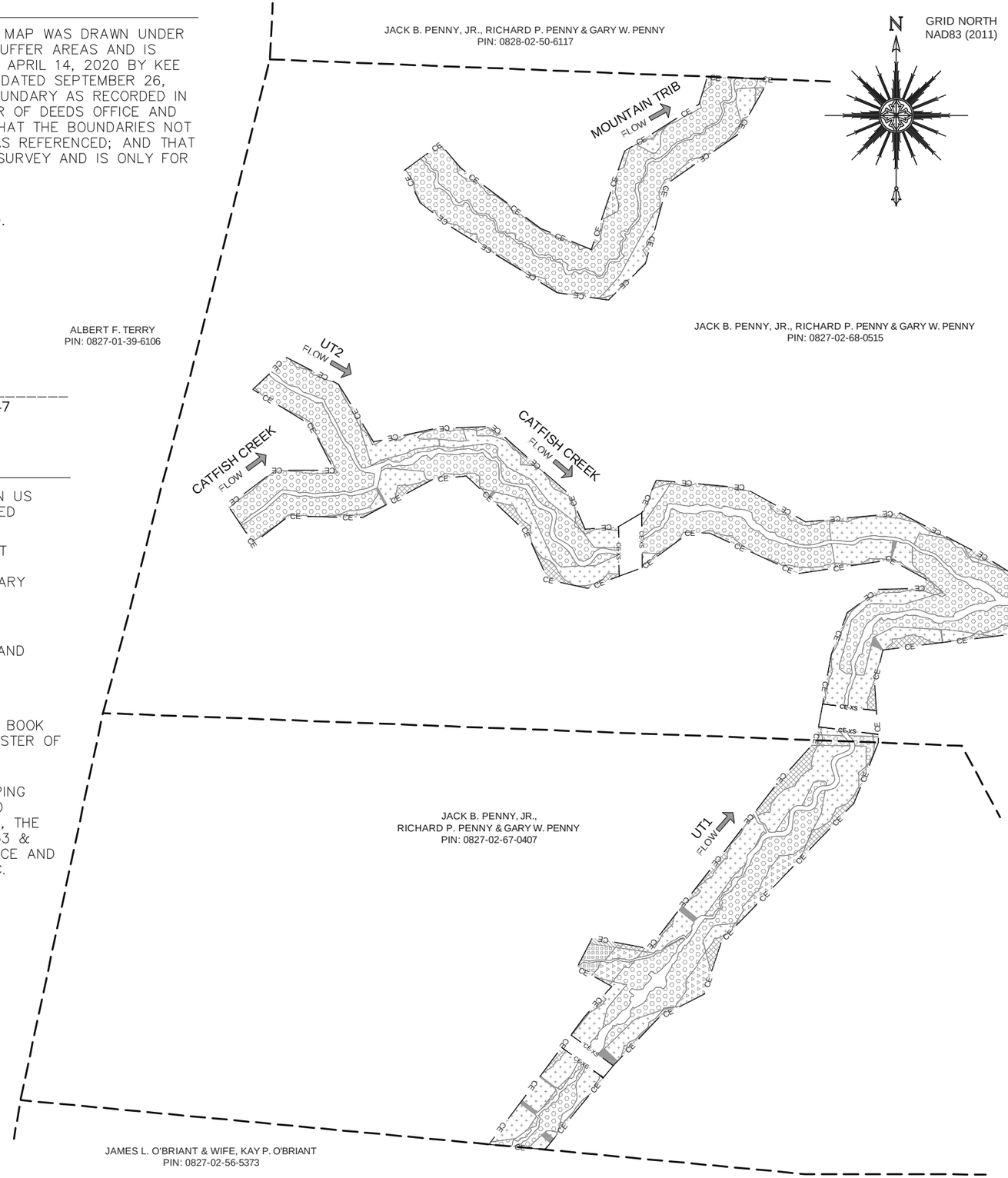
DocuSigned by:
Phillip B. Kee
D965004A7692407...

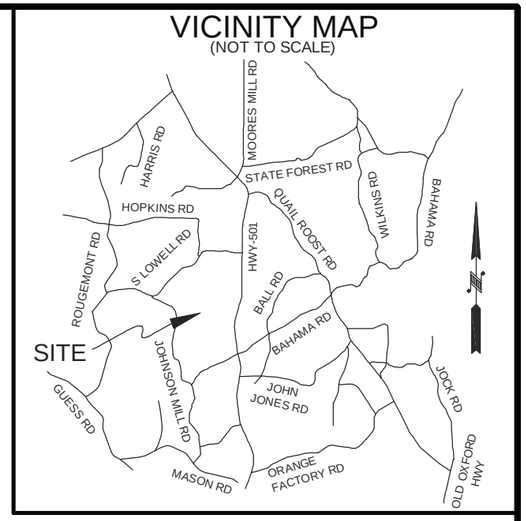
PHILLIP B. KEE, PLS L-4647

SURVEYOR NOTES

1. ALL DISTANCES ARE HORIZONTAL GROUND DISTANCES IN US SURVEY FEET. THE AREA SHOWN HEREON WAS COMPUTED USING THE COORDINATE COMPUTATION METHOD.
2. THE PURPOSE OF THIS PLAT IS TO SHOW THE AS-BUILT AREAS FOR RIPARIAN BUFFER CREDITS WITHIN THE CONSERVATION EASEMENT. THIS PLAT IS NOT A BOUNDARY SURVEY. THE LAND PARCELS AND THEIR BOUNDARIES AFFECTED BY THIS CONSERVATION EASEMENT ARE NOT CHANGED BY THIS PLAT.
3. LINES NOT SURVEYED ARE SHOWN AS A DASHED LINE AND WERE TAKEN FROM INFORMATION REFERENCED HEREON.
4. SUBJECT TO ALL EASEMENTS, RIGHT OF WAYS, AND/OR ENCUMBRANCES THAT MAY AFFECT THE PROPERTY(S).
5. SEE CONSERVATION EASEMENT MAP RECORDED IN PLAT BOOK 201 PAGES 153-154 IN THE DURHAM COUNTY, NC REGISTER OF DEEDS OFFICE.
6. BUFFER AREAS ARE BASED ON THE DIGITAL AS-BUILT CONDITIONS DATA DATED APRIL 14, 2020 BY KEE MAPPING AND SURVEYING, THE EXISTING CONDITIONS DATA DATED SEPTEMBER 26, 2018 BY KEE MAPPING AND SURVEYING, THE EASEMENT BOUNDARY AS RECORDED IN PB 201 PGS 153 & 154 OF THE DURHAM COUNTY REGISTER OF DEEDS OFFICE AND INFORMATION PROVIDED BY WILDLANDS ENGINEERING INC.

RIPARIAN BUFFER:	SQ. FT.	ACRES
BUFFER RESTORATION 0'-49' (MIN 30')	4,369	0.10
BUFFER RESTORATION 0'-50' (MIN 30')	203,644	4.68
BUFFER RESTORATION 50'-100'	48,442	1.11
BUFFER RESTORATION 100'-200'	1,063	0.03
CATTLE EXCLUSION 0'-50'	481,652	11.06
CATTLE EXCLUSION 50'-100'	50,182	1.15
CATTLE EXCLUSION 100'-200'	3,855	0.09
NO CREDIT AREA	109,428	2.51
TOTAL CE AREA	902,635	20.73





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

LEGEND

- CE — CONSERVATION EASEMENT
- CE-XS — CONSERVATION EASEMENT CROSSINGS
- PROPERTY LINE

AS-BUILT SURVEY OF BUFFER AREAS FOR WILDLANDS ENGINEERING INC. CATFISH POND MITIGATION SITE

DMS #100039	SPO FILE #32-FO	NEUSE RIVER BASIN
SITE ADDRESS: 9021 NORTH ROXBORO STREET (US 501), BAHAMA, NC 27503		
MANGUM TOWNSHIP,	DURHAM COUNTY,	NORTH CAROLINA
DRAWN BY: LDP, AB	CHECKED BY: PBK	JOB #1909105
REVISION:		DATE:
SHEET SIZE: 11"X17"	SHEET #: 1 OF 1	SCALE: 1"=300'

0' 300' 600' 900'

ONE INCH = THREE HUNDRED FEET

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

APPENDIX 4. Overview Photographs

APPENDIX 5. Permit Approvals

ROY COOPER
Governor
MICHAEL S. REGAN
Secretary
LINDA CULPEPPER
Director

NORTH CAROLINA
Environmental Quality

October 1, 2019

DWR # 18-0196
Durham County

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

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

Subject: APPROVAL OF 401 WATER QUALITY CERTIFICATION WITH ADDITIONAL CONDITIONS

Catfish Pond Mitigation Site

Dear Mr. Xu and Mr. Roessler:

You have our approval for the impacts listed below for the purpose described in your application dated August 27, 2019, received by the Division of Water Resources (Division) August 28, 2019. These impacts are covered by the attached Water Quality General Certification Number 4134 and the conditions listed below. This certification is associated with the use of Nationwide Permit Number 27 once it is issued to you by the U.S. Army Corps of Engineers. Please note that you should get any other federal, state or local permits before proceeding with your project, including those required by (but not limited to) Sediment and Erosion Control, Non-Discharge, and Water Supply Watershed regulations.

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

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

Type of Impact	Amount Approved (units) Permanent	Amount Approved (units) Temporary
Stream		
S1	0 (linear feet)	52 (linear feet)
S2	0	112
S3	378	0
S4	0	72
S5	0	51
S6	99	0
S7	97	0
S8	0	35
S9	0	122
S10	0	88
S11	0	69
S12	0	134
S13	0	300
S14	444	0
S15	168	0
S16	0	28
S17	0	27
S18	0	411
S19	0	13
Total	1,186	1,514
404/401 Wetlands		
W1	0.0086 (acres)	0.0691 (acres)
W2	0.0564	0
W3	0	0.0032
W4	0.0156	0
W5	0.0046	0
W6	0.1327	0.3357
W7	0	0.0032
Total	0.2179	0.4112
Open Waters		
O1	0.597 (acres)	0 (acres)
Total	0.597	0

2. This approval is for the purpose and design described in your application. The plans and specifications for this project are incorporated by reference as part of the Certification. If you change your project, you must notify the Division and you may be required to submit a new application package with the appropriate fee. If the property is sold, the new owner must be given a copy of this approval letter and

General Certification(s)/Permit/Authorization and is responsible for complying with all conditions. [15A NCAC 02H .0507(d)(2)]

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

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

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

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

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

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

Mailing address for the OAH:

If sending via US Postal Service:

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

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

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

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

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

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

Sincerely,

Mac Haupt, Acting Supervisor
401 & Buffer Permitting Branch

Enclosures: GC 4134

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

Filename: 180196CatfishPond(Durham)_401_ approval ltr.October 1, 2019.docx

U.S. ARMY CORPS OF ENGINEERS
WILMINGTON DISTRICT

Action Id. **SAW-2018-00424** County: **Durham** U.S.G.S. Quad: **Rougemont**

GENERAL PERMIT (REGIONAL AND NATIONWIDE) VERIFICATION

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

Permittee: **Wildlands Engineering, Inc.**
Attn: Chris Roessler
Address: **321 West Millbrook Road, Suite 225**
Raleigh, NC 27609
Telephone: **919-851-9986 x111**

Size (acres) **20.73 acres**
Nearest Waterway **Mountain Creek**
USGS HUC **03020201**

Nearest Town **Bahama**
River Basin **Neuse**
Coordinates Latitude: **36.162562 °N** Longitude: **-78.910068°W**

Location description: **The NCDMS 20.73-acre Catfish Pond Mitigation Site includes Catfish Creek and three of its tributaries. All drain to Mountain Creek. The site is located in Durham County, North Carolina, approximately 12 miles north of the city of Durham and 3 miles east of the Orange County/Durham County border. PIN: 0827-02-67-0407, 0827-02-58-9864, 0828-04-50-5560.**

Description of projects area and activity: **The co-applicants, NCDMS and Wildlands Engineering, Inc, have requested a Department of the Army permit authorization to discharge dredged and/or fill material into waters of the United States associated with the NCDMS Catfish Pond Mitigation Site. Implementation of the proposed restoration and enhancement activities will result in the discharge of fill material into 2,700 linear feet of stream channel and 0.6291 acres of wetlands associated with mechanized land clearing, excavation, placement of fill material, and stream relocation activities for the mitigation site. Compensatory mitigation is NOT required in conjunction with the aforementioned activities. Refer to the enclosed Table 1 for a detailed summary of impacts**

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

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

Your work is authorized by the above referenced permit provided it is accomplished in strict accordance with the attached conditions and your submitted application and attached information dated August 27, 2019. Any violation of the attached conditions or deviation from your submitted plans may subject the permittee to a stop work order, a restoration order, a Class I administrative penalty, and/or appropriate legal action.

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

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

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

SAW-2018-00424

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

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

Corps Regulatory Official: _____ Date: **October 3, 2019**
Expiration Date of Verification: **March 18, 2022**

Table 1. Authorized discharge of fill material into waters of the United States in association with the NCDMS Catfish Pond Mitigation Site (SAW-2018-00424).

Table 1 Proposed Impacts Inventory

1

1a. Which sections were completed below for your project (check all that apply):

☒ Wetlands ☒ Streams - tributaries ☐ Buffers

☒ Open Waters ☐ Pond Construction

Table 1 Wetland Impacts

If there are wetland impacts proposed on the site, then complete this question for each wetland area impacted.

1a. Wetland impact number – Permanent (P) or Temporary (T)	1b. Type of impact	1c. Type of wetland (if known)	1d. Forested	1e. Type of jurisdiction (Corps - 404, 10 DWQ – non-404, other)	1f. Area of impact (acres)
W1 – Wetland M ☒ P ☐ T	Excavation	Headwater Forest	☒ Yes ☐ No	☒ Corps ☒ DWQ	0.0086
W1 – Wetland M ☐ P ☒ T	Floodplain Grading	Headwater Forest	☒ Yes ☐ No	☒ Corps ☒ DWQ	0.0691
W2 – Wetland J ☒ P ☐ T	Excavation	Non-Tidal Freshwater Marsh	☒ Yes ☐ No	☒ Corps ☒ DWQ	0.0564
W3 – Wetland Y ☐ P ☒ T	Floodplain Grading	Headwater Forest	☒ Yes ☐ No	☒ Corps ☒ DWQ	0.0032
W4 – Wetland W ☒ P ☐ T	Floodplain Grading	Headwater Forest	☒ Yes ☐ No	☒ Corps ☒ DWQ	0.0156
W5 – Wetland D ☒ P ☐ T	Temporary Crossing	Headwater Forest	☒ Yes ☐ No	☒ Corps ☒ DWQ	0.0046
W6 – Wetland A ☐ P ☒ T	Floodplain Grading	Headwater Forest (Emergent)	☐ Yes ☒ No	☒ Corps ☒ DWQ	0.3357
W6 – Wetland A ☒ P ☐ T	Excavation	Headwater Forest (Emergent)	☐ Yes ☒ No	☒ Corps ☒ DWQ	0.1327
W7 – Wetland DD ☐ P ☒ T	Ford Crossing Decommission	Headwater Forest	☒ Yes ☐ No	☒ Corps ☒ DWQ	0.0032
				2g. **Total wetland impacts**	0.6291

1h. Comments:

Wetlands within the work area will be flagged with safety fence during construction to prevent unintended impacts.

Stream Impacts

If there are perennial or intermittent stream impacts (including temporary impacts) proposed on the site, then complete this question for all stream sites impacted.

3. Stream impact number Permanent (P) or Temporary (T)	b. Type of impact	c. Stream name	d. Perennial (PER) or intermittent (INT)?	e. Type of jurisdiction (Corps - 404, 10 DWQ – non-404, other)	f. Average stream width (feet)	g. Impact length (linear feet)
S1 ☐ P ☒ T	Stabilization	Catfish Creek	☒ PER ☐ INT	☒ Corps ☒ DWQ	3.3	52
S2 ☐ P ☒ T	Stabilization	Catfish Creek	☒ PER ☐ INT	☒ Corps ☒ DWQ	5.8	112
S3 ☒ P ☐ T	Relocation	Catfish Creek	☒ PER ☐ INT	☒ Corps ☒ DWQ	7.0	378
S4 ☐ P ☒ T	Stabilization	Catfish Creek	☒ PER ☐ INT	☒ Corps ☒ DWQ	9.4	72
S5 ☐ P ☒ T	Stabilization	Catfish Creek	☒ PER ☐ INT	☒ Corps ☒ DWQ	9.4	51

Stream Impacts Continued

S6 ☒ P ☐ T	Relocation	Catfish Creek	☒ PER ☐ INT	☒ Corps ☒ DWQ	10.9	99
S7 ☒ P ☐ T	Relocation	Catfish Creek	☒ PER ☐ INT	☒ Corps ☒ DWQ	7.5	97
S8 ☐ P ☒ T	Stabilization	Catfish Creek	☒ PER ☐ INT	☒ Corps ☒ DWQ	7.5	35
S9 ☐ P ☒ T	Stabilization	Catfish Creek	☒ PER ☐ INT	☒ Corps ☒ DWQ	7.9	122
S10 ☐ P ☒ T	Stabilization	Catfish Creek	☒ PER ☐ INT	☒ Corps ☒ DWQ	7.9	88
S11 ☐ P ☒ T	Stabilization	Catfish Creek	☒ PER ☐ INT	☒ Corps ☒ DWQ	7.9	69
S12 ☐ P ☒ T	Stabilization	UT1	☒ PER ☐ INT	☒ Corps ☒ DWQ	7	134
S13 ☐ P ☒ T	Stabilization	UT1	☒ PER ☐ INT	☒ Corps ☒ DWQ	7	300
S14 ☒ P ☐ T	Relocation	UT1	☒ PER ☐ INT	☒ Corps ☒ DWQ	16.7	444
S15 ☒ P ☐ T	Relocation	UT1	☒ PER ☐ INT	☒ Corps ☒ DWQ	7.1	168
S16 ☐ P ☒ T	Stabilization	UT2	☐ PER ☒ INT	☒ Corps ☒ DWQ	4.6	28
S17 ☐ P ☒ T	Stabilization	Mountain Trib	☐ PER ☒ INT	☒ Corps ☒ DWQ	7.5	27
S18 ☐ P ☒ T	Stabilization	Mountain Trib	☐ PER ☒ INT	☒ Corps ☒ DWQ	7.5	411
S19 ☐ P ☒ T	Stabilization	Mountain Trib	☐ PER ☒ INT	☒ Corps ☒ DWQ	7.5	13
				h. **Total stream and tributary impacts**		2,700
I Comments: Stream names per Figure 3 Site Map in PJD.						

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

SPECIAL CONDITIONS

1. **The permittee understands and agrees that the document entitled "Final Mitigation Plan – Catfish Pond Mitigation Site" dated July 18, 2019 is incorporated and made part of this permit. Execution of the work and terms given in the approved mitigation plan are a condition of this permit.**

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

COMPLIANCE CERTIFICATION

Action ID Number: SAW-2018-00424 **County: Durham**

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

Wildlands Engineering, Inc.
Attn: Mr. Chris Roessler

Project Name: NCDMS Catfish Pond Site

Date Verification Issued: October 3, 2019

Project Manager: Kim Browning

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

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

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

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

_____ _____

Signature of Permittee **Date**

APPENDIX 6. Vegetation Plot Data

Table 4. Planted and Total Stem Counts

Catfish Pond Mitigation Site

Monitoring Year 0 - 2020

			Current Plot Data (MY0 2020)														
			VP 1			VP 2			VP 3			VP 4			VP 5		
Scientific Name	**Common Name**	**Species Type**	**PnoLS**	**P-all**	**T**	**PnoLS**	**P-all**	**T**	**PnoLS**	**P-all**	**T**	**PnoLS**	**P-all**	**T**	**PnoLS**	**P-all**	**T**
Aesculus sylvatica	Painted Buckeye	Shrub Tree	1	1	1												
Betula nigra	River Birch	Tree				1	1	1	1	1	1						
Fraxinus pennsylvanica	Green Ash	Tree				2	2	2							3	3	3
Platanus occidentalis	Sycamore	Tree	4	4	4	7	7	7	3	3	3	8	8	8	2	2	2
Quercus alba	White Oak	Tree	1	1	1	1	1	1				1	1	1	2	2	2
Quercus lyrata	Overcup Oak	Tree				1	1	1	3	3	3	1	1	1	2	2	2
Quercus michauxii	Swamp Chestnut Oak	Tree	2	2	2										1	1	1
Quercus phellos	Willow Oak	Tree	5	5	5				3	3	3	1	1	1	3	3	3
Quercus shumardii	Shumard Oak	Tree	1	1	1	3	3	3	2	2	2	1	1	1			
		Stem count	14	14	14	15	15	15	12	12	12	12	12	12	13	13	13
		size (ares)		1			1			1			1			1	
		size (ACRES)		0.02			0.02			0.02			0.02			0.02	
		Species count	6	6	6	6	6	6	5	5	5	5	5	5	6	6	6
		Stems per ACRE	567	567	567	607	607	607	486	486	486	486	486	486	526	526	526

Color for Density

Exceeds requirements by 10%

Exceeds requirements, but by less than 10%

Fails to meet requirements, by less than 10%

Fails to meet requirements by more than 10%

PnoLS - Planted Stems Excluding Live Stakes

P-all - All Planted Stems

T - All Woody Stems

Table 4. Planted and Total Stem Counts

Catfish Pond Mitigation Site

Monitoring Year 0 - 2020

			Current Plot Data (MY0 2020)						Annual Means		
			VP 6			VP 7			MY0 (2020)		
Scientific Name	**Common Name**	**Species Type**	**PnoLS**	**P-all**	**T**	**PnoLS**	**P-all**	**T**	**PnoLS**	**P-all**	**T**
Aesculus sylvatica	Painted Buckeye	Shrub Tree							1	1	1
Betula nigra	River Birch	Tree				7	7	7	9	9	9
Fraxinus pennsylvanica	Green Ash	Tree	2	2	2	2	2	2	9	9	9
Platanus occidentalis	Sycamore	Tree	6	6	6	6	6	6	36	36	36
Quercus alba	White Oak	Tree	1	1	1	1	1	1	7	7	7
Quercus lyrata	Overcup Oak	Tree	1	1	1				8	8	8
Quercus michauxii	Swamp Chestnut Oak	Tree	1	1	1				4	4	4
Quercus phellos	Willow Oak	Tree	4	4	4				16	16	16
Quercus shumardii	Shumard Oak	Tree							7	7	7
		Stem count	15	15	15	16	16	16	97	97	97
		size (ares)		1			1			7	
		size (ACRES)		0.02			0.02			0.17	
		Species count	6	6	6	4	4	4	9	9	9
		Stems per ACRE	607	607	607	647	647	647	561	561	561

Color for Density

Exceeds requirements by 10%

Exceeds requirements, but by less than 10%

Fails to meet requirements, by less than 10%

Fails to meet requirements by more than 10%

PnoLS - Planted Stems Excluding Live Stakes

P-all - All Planted Stems

T - All Woody Stems

VEGETATION PLOT PHOTOGRAPHS

VEG PLOT 1 *(03/26/2020)*

VEG PLOT 2 *(03/26/2020)*

VEG PLOT 3 *(03/26/2020)*

VEG PLOT 4 *(03/26/2020)*

VEG PLOT 5 *(03/26/2020)*

VEG PLOT 6 *(03/26/2020)*

VEG PLOT 7 *(04/09/2020)*