AS-BUILT BASELINE MONITORING REPORT

Final

VILE CREEK MITIGATION SITE
Alleghany County, NC
DEQ Contract No. 5999
DMS Project No. 96582
DWR No. 14-0869
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EXECUTIVE SUMMARY

Wildlands Engineering, Inc. (Wildlands) completed a full-delivery stream and wetland mitigation project at the Vile Creek Mitigation Site (Site) for the North Carolina Division of Mitigation Services (DMS) to restore and enhance a total of 8,056 linear feet (LF) of perennial and intermittent stream, and to restore 6.40 acres of riparian wetlands in Alleghany County, NC. The Site is expected to generate 5,053 stream mitigation units (SMUs), and 5.70 riparian wetland mitigation units (WMUs), for the New River Basin (Table 1). The Site is located approximately one mile northeast of the Town of Sparta, NC in the New River Basin; eight-digit Cataloging Unit (CU) 05050001 and the 14-digit Hydrologic Unit Code (HUC) 05050001030020 (Figure 1). The Site streams consist of Vile Creek and five unnamed tributaries (UT) to Vile Creek including UT1, UT1b, UT1c, UT2, UT3, and a portion of the Little River (Figure 2). Vile Creek flows into the Little River at the downstream Site boundary. The land adjacent to the streams and wetlands is primarily maintained cattle pasture and forest.

The Site is within a Targeted Local Watershed (TLW) identified in the New River Basin Restoration Priority (RBRP) plan (NCDENR, 2009). The Site is also located within the Little River & Brush Creek Local Watershed Plan (LWP). The LWP identified the following stressors to watershed function: deforested buffers that are heavily grazed, livestock access to the streams, heavily eroded stream banks, land-disturbing activities on steep slopes, and non-point source pollution from the Town of Sparta and surrounding areas, and drained and deforested wetland areas (NCDENR, 2007).

The project goals defined in the mitigation plan (Wildlands, 2016) were established with careful consideration of RBRP goals and objectives to address stressors identified in the LWP. The established project goals include:

- Reduce pollutant inputs to streams including fecal coliform, nitrogen, and phosphorous;
- Reduce inputs of sediment into streams from eroding stream banks;
- Return a network of streams to a stable form that is capable of supporting hydrologic, biologic, and water quality functions;
- Improve aquatic communities in project streams and provide improved habitat for trout migrating from Little River into Vile Creek. Note: Presence of aquatic organisms and trout will not be tied to project success criteria;
- Raise local groundwater elevations and allow for more frequent overbank flows to provide a source of hydration for floodplain wetlands. Reduce shear stress on channels during larger flow events;
- Restore wetland hydrology, soils, and plant communities;
- Improve and expand Southern Appalachian bog habitat to support bog species such as bog turtles. Note: Presence of bog turtles will not be tied to project success criteria;
- Create and improve riparian and wetland habitats by planting native vegetation. Provide a canopy to shade streams and reduce thermal loadings. Create a source of woody inputs for streams. Reduce flood flow velocities on floodplain and improve long-term lateral stability of streams. Improve bog habitat by planting herbaceous wetland plants; and
- Ensure that development and agricultural uses that would damage the site or reduce the benefits of project are prevented.

The Site construction and as-built survey were completed in March 2017. Planting and baseline (MY0) monitoring activities occurred between February and April 2017. Adjustments were made to the alignments and materials used during construction and these are detailed in Section 4.1. Longitudinal profiles and cross-section dimensions closely match the design parameters. Cross-section widths and pool depths occasionally exceed design parameters within a normal range of variability for natural streams. The Site is expected to meet the upcoming monitoring year's success criteria.

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Section 1: PROJECT GOALS, BACKGROUND, AND ATTRIBUTES

1.1 Project Location and Setting

The Site is located in eastern Alleghany County, NC, approximately one mile northeast of the Town of Sparta (Figure 1). The land required for construction, management, and stewardship of the mitigation project included portions of 5 parcels resulting in 25.04 acres of conservation easement.

The Site is located in the New River Basin; eight-digit Cataloging Unit (CU) 05050001 and the 14-digit Hydrologic Unit Code (HUC) 05050001030020 (Figure 1). Located in the Blue Ridge Belt of the Blue Ridge Province (USGS, 1998), the project watershed includes primarily managed herbaceous, mixed upland hardwoods, and other forested land. The drainage area for the project streams range from 0.01 square miles to 2.69 square miles.

The North Carolina Division of Water Resources (DWR) assigns best usage classifications to State Waters that reflect water quality conditions and potential resource usage. The Little River (DWR Index No. 10-9-(6)) and Vile Creek (DWR Index No. 10-9-8) are the main tributaries of the project and are classified as Class C waters within the project area. Class C waters are protected for secondary recreation, fishing, wildlife, fish and aquatic life propagation and survival, agriculture, and other uses. The Site is located within a TLW in the New River RBRP plan (NCDENR, 2009), and is within the planning area for the Little River and Brush Creek Local Watershed Plan (LWP) (2007).

Prior to construction activities, livestock (cattle) had frequent access to most of the Site streams resulting in degraded in-stream habitat and sediment erosion. Deposition of fine sediment, severe bank erosion, and trampling of banks degraded the in-stream habitat. Channel widening and incision indicated instability. The riparian buffers in areas proposed for restoration were primarily herbaceous with a few sparse trees. Adjacent floodplain areas consist of ditched wetlands, previously altered for agricultural practices. Floodplain wetlands are actively grazed with evidence of active cattle wallows. Table 4 in Appendix 1 and Table 6 in Appendix 2 present the pre-restoration conditions.

1.2 Project Goals and Objectives

This Site is intended to provide numerous ecological benefits within the New River Basin. While many of these benefits are limited to the Vile Creek project area, others, such as pollutant removal, reduced sediment loading, and improved aquatic and terrestrial habitat, have farther-reaching effects. Expected improvements to water quality and ecological processes are outlined below as project goals and objectives. These project goals were established with careful consideration of goals and objectives that were described in the RBRP and to address stressors identified in the LWP.

The project specific goals of the Site address stressors identified in the LWP and include the following:

Goals	Objectives
Reduce pollutant inputs to streams including fecal coliform, nitrogen, and phosphorous.	Exclude cattle from streams and buffers by installing fencing around conservation easements adjacent to cattle pastures. Install wells and drinkers to provide alternative water sources for cattle.
Reduce inputs of sediment into streams from eroding stream banks.	Reconstruct stream channels with stable dimensions. Add bank revetments and in-stream structures to protect restored/enhanced streams.

Goals	Objectives
Return a network of streams to a stable form that is capable of supporting hydrologic, biologic, and water quality functions.	Construct stream channels that will maintain a stable pattern and profile considering the hydrologic and sediment inputs to the system, the landscape setting, and the watershed conditions.
Improve aquatic communities in project streams and provide improved habitat for trout migrating from Little River into Vile Creek. *Note: Presence of aquatic organisms and trout will not be tied to project success criteria.*	Install habitat features such as constructed riffles, cover logs, and brush toes into restored/enhanced streams. Add woody materials to channel beds. Construct pools of varying depth.
Raise local groundwater elevations and allow for more frequent overbank flows to provide a source of hydration for floodplain wetlands. Reduce shear stress on channels during larger flow events.	Reconstruct stream channels with appropriate bankfull dimensions and depth relative to the existing floodplain.
Restore wetland hydrology, soils, and plant communities.	Restore riparian wetlands by raising stream beds, plugging existing ditches, removing fill material over relict hydric soils, and planting native wetland species.
Improve and expand Southern Appalachian bog habitat to support bog species such as bog turtles. *Note: Presence of bog turtles will not be tied to project success criteria.*	Widen low lying ditched areas that represent bog conditions.
Create and improve riparian and wetland habitats by planting native vegetation. Provide a canopy to shade streams and reduce thermal loadings. Create a source of woody inputs for streams. Reduce flood flow velocities on floodplain and improve long-term lateral stability of streams. Improve bog habitat by planting herbaceous wetland plants.	Plant native tree and shrub species in riparian zone and wetland areas other than bog areas. Bog areas will be planted with herbaceous species.
Ensure that development and agricultural uses that would damage the site or reduce the benefits of project are prevented.	Establish conservation easements on the site.

1.3 Project Structure, Restoration Type and Approach

The final mitigation plan was submitted and accepted by DMS in June of 2016. Construction activities were completed in February 2017 by Land Mechanic Designs, Inc. Kee Surveying Inc. completed the as-built survey in March 2017 and Wildlands completed the baseline monitoring activities between February and April 2017. Planting was completed following construction in the spring of 2017 by Bruton Environmental, Inc. Final monitoring activities and close out will commence in December 2023. Adjustments were made to the alignments and materials used during construction and field adjustments made during construction are described in further detail in section 4.1. Please refer to Appendix 1 for detailed project activity, history, contact information, and watershed/site background information.

1.3.1 Project Structure

The Site is expected to provide 5,053 SMUs, and 5.70 WMUs. These Site components and mitigation credits reflect assets developed in the final Interagency Review Team (IRT)-approved project mitigation plan with minimal adjustments. Please refer to the Project Component/Asset Map (Figure 2) for the stream and wetland features and to Table 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 thorough consideration to existing watershed conditions and trajectory. The project includes stream restoration, stream enhancement I (EI), and stream enhancement II (EII) as well as wetland rehabilitation and re-establishment. The specific proposed stream and wetland types are illustrated in figure 2 and detailed below.

UT1 Reach 1 was designed as EI. Treatments for this reach included raising the stream bed by adding constructed riffles and establishing a riffle cross section sized appropriately for the bankfull discharge. UT1 Reach 2 was designed as restoration. The channel was reconstructed mostly offline to alter the profile, planview pattern, and cross-sectional dimensions so that they are similar to a natural stream in this setting. Vile Creek Reaches 1 and 2 were also constructed as restoration. These reaches were constructed offline to meander through riparian wetlands. Reach 3 of Vile Creek was more stable and less incised than the upstream reaches and were enhanced through fencing out cattle and planting riparian buffers (EII). The remaining project reaches include UT1B, UT1C, UT2, UT3, and a short reach of Little River. All of the reaches are EII reaches and all except UT2 were improved through techniques similar to Vile Creek Reach 3. The treatment of UT2 included grading back banks to a stable slope and/or cutting benches, repairing areas of banks damaged by cattle access or erosion, matting the banks, planting, and fencing out livestock.

The wetland portion of the Site includes wetland re-establishment and rehabilitation to increase the acreage of wetlands on site and improve the existing wetlands. The re-establishment zones are areas that, prior to construction, were no-longer wetland because they had been effectively drained and/or filled. The rehabilitation zones are areas that were considered jurisdictional prior to construction but functioned poorly. In addition, the design includes expansion of Southern Appalachian Bog habitat within the wetland zones. Improvements to the wetland areas included raising the bed elevation of Vile Creek to restore the natural water table elevation and flooding regime. The wetland re-establishment areas were graded to remove fill material over the relict hydric soils and lower floodplain elevations to be like those of the rehabilitation zones. Grading was performed in the wetland rehabilitation areas only to facilitate the expansion of bogs. This involved modifying the ditches previously cutting through the wetland areas to be widened and plugged in multiple locations to promote a higher water table.

A small headwater stormwater BMP was also constructed on an ephemeral drainage that discharges to UT2. This feature was designed to retain and treat water draining from 17 acres of active cattle pasture for a 1 inch rainfall event. No mitigation credits are sought for this project asset.

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 schedule, project contacts, and project baseline information and attributes.

1.5 Credit Release Schedule

All credit releases will be based on the total credit generated as reported in the as-built survey of the mitigation site (Table 1). Under no circumstances shall any mitigation project be debited until the necessary DA authorization has been received for its construction or the District Engineer (DE) has otherwise provided written approval for the project in the case where no DA authorization is required for construction of the mitigation project. The DE, in consultation with the Interagency Review Team (IRT), will determine if performance standards have been satisfied sufficiently to meet the requirements of the release schedules below. In cases where some performance standards have not been met, credits

may still be released depending on the specifics of the case. Monitoring may be required to restart or be extended, depending on the extent to which the site fails to meet the specified performance standard. The release of project credits will be subject to the criteria described as follows:

Credit Release Schedule – Wetlands Credits

Monitoring Year	Credit Release Activity	Interim Release	Total Released
0	Initial Allocation – see requirements below	30%	30%
1	First year monitoring report demonstrates performance standards are being met	10%	40%
2	Second year monitoring report demonstrates performance standards are being met	10%	50%
3	Third year monitoring report demonstrates performance standards are being met	10%	60%
4	Fourth year monitoring report demonstrates performance standards are being met	10%	70%
5	Fifth year monitoring report demonstrates performance standards are being met; Provided that all performance standards are met, the IRT may allow the DMS to discontinue hydrologic monitoring after the fifth year, but vegetation monitoring must continue for an additional two years after the fifth year for a total of seven years.	10%	80%
6	Sixth year monitoring report demonstrates performance standards are being met	10%	90%
7	Seventh year monitoring report demonstrates performance standards are being met, and project has received close-out approval	10%	100%

Credit Release Schedule – Stream Credits

Monitoring Year	Credit Release Activity	Interim Release	Total Released
0	Initial Allocation – see requirements below	30%	30%
1	First year monitoring report demonstrates performance standards are being met	10%	40%
2	Second year monitoring report demonstrates performance standards are being met	10%	50% (60%*)
3	Third year monitoring report demonstrates performance standards are being met	10%	60% (70%*)
4	Fourth year monitoring report demonstrates performance standards are being met	5%	65% (75%*)
5	Fifth year monitoring report demonstrates performance standards are being met	10%	75% (85%*)
6	Sixth year monitoring report demonstrates performance standards are being met	5%	80% (90%)
7	Seventh year monitoring report demonstrates performance standards are being met and the project has received closeout approval	10%	90% (100%)

1.5.1 Initial Allocation of Released Credits

The initial allocation of released credits, as specified in the mitigation plan can be released by the NCEEP without prior written approval of the DE upon satisfactory completion of the following activities:

a. Approval of the final Mitigation Plan;
b. Recordation of the preservation mechanism, as well as a title opinion acceptable to the USACE covering the property;
c. Completion of project construction (the initial physical and biological improvements to the mitigation site) pursuant to the mitigation plan; Per the DMS Instrument, construction means that a mitigation site has been constructed in its entirety, to include planting, and an as-built report has been produced. As-built reports must be sealed by an engineer prior to project closeout, if appropriate but not prior to the initial allocation of released credits; and
d. Receipt of necessary DA permit authorization or written DA approval for projects where DA permit issuance is not required.

1.5.2 Subsequent Credit Releases

All subsequent credit releases must be approved by the DE, in consultation with the IRT, based on a determination that required performance standards have been achieved. For stream projects a reserve of 10% of a site's total stream credits shall be released after two bank-full events have occurred, in separate years, provided the channel is stable and all other performance standards are met. In the event that less than two bank-full events occur during the monitoring period, release of these reserve credits shall be at the discretion of the IRT. As projects approach milestones associated with credit release, the DMS will submit a request for credit release to the DE along with documentation substantiating achievement of criteria required for release to occur. This documentation will be included with the annual monitoring report.

Section 2: PERFORMANCE STANDARDS

The stream and wetland performance criteria for the Site follow approved performance criteria presented in the Vile Creek Mitigation Site Mitigation Plan (2016). Semi-annual site visits will be conducted to assess the condition of the finished project. The stream restoration and enhancement reaches and wetland re-establishment and rehabilitation zones of the project have been assigned specific performance criteria components for stream geomorphology, hydrology, and vegetation. Performance criteria will be evaluated throughout the (up to) seven-year post-construction monitoring. The following Table summarizes the performance standards for each project goal. Further explanation of certain performance criteria components is necessary and is included below in this section. The monitoring program designed to verify that performance standards are met is described in Section 3.

Goal	Objective	Performance Standard	Monitoring Approach
Reduce pollutant inputs to streams including fecal coliform, nitrogen, and phosphorous.	Exclude cattle from streams and buffers by installing fencing around conservation easements adjacent to cattle pastures. Install wells and drinkers to provide alternative water sources for cattle.	Fencing remains intact throughout the monitoring period and no signs of livestock access to streams or wetlands are observed	Visual assessment
Reduce inputs of sediment into streams from eroding stream banks.	Reconstruct stream channels with stable dimensions. Add bank revetments and in-stream structures to protect restored/enhanced streams.	Riffle cross sections will remain stable over time (note description of stability in Section 2.1.1)	Visual assessment and surveying of riffle cross sections
Return a network of streams to a stable form that is capable of supporting hydrologic, biologic, and water quality functions.	Construct stream channels that will maintain a stable pattern and profile considering the hydrologic and sediment inputs to the system, the landscape setting, and the watershed conditions.	Stream profile and pattern must remain stable (note description of stability in Section 2.1.2)	Visual assessment. Surveying of longitudinal profiles and/or planview pattern if visual assessment indicates potential instability
Improve aquatic communities in project streams and provide improved habitat for trout migrating from Little River into Vile Creek. *Note: Presence of aquatic organisms and trout will not be tied to project success criteria.*	Install habitat features such as constructed riffles, cover logs, and brush toes into restored/enhanced streams. Add woody materials to channel beds. Construct pools of varying depth.	Habitat features such as constructed riffles, cover logs, and other habitat features described in Section 9.3.1 of the Mitigation Plan (2016) will remain intact	Visual assessment

Goal	Objective	Performance Standard	Monitoring Approach
Raise local groundwater elevations and allow for more frequent overbank flows to provide a source of hydration for floodplain wetlands. Reduce shear stress on channels during larger flow events.	Reconstruct stream channels with appropriate bankfull dimensions and depth relative to the existing floodplain.	Two bankfull or greater flow events will be documented during the monitoring period	Crest gauges and continuous stage recorders
Restore wetland hydrology, soils, and plant communities.	Restore riparian wetlands by raising stream beds, plugging existing ditches, removing fill material over relict hydric soils, and planting native wetland species.	Free groundwater surface within 12 inches of the ground surface for 8.5 % of the growing season for wetland areas other than bogs. *Note: Bog hydrologic performance standard and vegetation performance standard described below.*	Groundwater monitoring gauges
Improve and expand Southern Appalachian bog habitat to support bog species such as bog turtles. *Note: Presence of bog turtles will not be tied to project success criteria.*	Widen low lying ditched areas that represent bog conditions.	Free groundwater surface within 12 inches of the ground surface for 12% of the growing season for bog areas.	Groundwater monitoring gauges
Create and improve riparian and wetland habitats by planting native vegetation. Provide a canopy to shade streams and reduce thermal loadings. Create a source of woody inputs for streams. Reduce flood flow velocities on floodplain and improve long-term lateral stability of streams. Improve bog habitat by planting herbaceous wetland plants.	Plant native tree and shrub species in riparian zone and wetland areas other than bog areas. Bog areas will be planted with herbaceous species.	Trees: Survival of 210 planted stems per acre at MY7. Survival of at least 320 planted stems at MY3 and at least 260 stems per acre at MY5. Shrubs: 160 surviving plants at year 3, 130 at year 5, and 105 at year 7. Herbaceous: 80% coverage of the vegetation plots with planted or volunteer vegetation at year 7.	Vegetation plot monitoring
Ensure that development and agricultural uses that would damage the site or reduce the benefits of project are prevented.	Establish conservation easements on the site.	Record and close conservation easement prior to implementation	None

2.1 Stream

2.1.1 Dimension

Riffle cross-sections on the restoration and EI reaches should be stable and should show little change in bankfull area, maximum depth ratio, and width-to-depth ratio over time after geomorphically significant flow events (defined in Section 2.1.5). Per DMS guidance, bank height ratios shall not exceed 1.2 and entrenchment ratios shall be at least 2.2 (C stream type reaches only) for restored channels to be considered stable. All riffle cross-sections should fall within the parameters defined for channels of the appropriate stream type. If any changes do occur, these changes will be evaluated to assess whether the stream channel is showing signs of instability. Changes in the channel that indicate 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

Annual 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 NCDMS Monitoring Requirements and Performance Standards for Stream and/or Wetland Mitigation (11/7/2011) and the 2003 USACE and NCDWR Stream Mitigation Guidance for the necessary reaches. 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. Restoration and EI reaches must remain vertically stable throughout the monitoring period with little indication of downcutting or significant aggradation. Deposition of sediments at certain locations (such as the inside of meander bends) is expected and acceptable. Changes in pool depth are not an indication of vertical instability. Restoration and EI reaches must remain laterally stable and major changes planform pattern dimensions and sinuosity should not occur. However, migration of meanders on alluvial channels is not an indication of instability if cross-sectional dimensions continue to meet the requirements.

2.1.3 Photo Documentation

Photographs should illustrate the Site's vegetation and morphological stability on an annual basis. Cross-section photos should demonstrate no excessive erosion or degradation of the banks. Longitudinal photos should indicate the absence of persistent bars within the channel or vertical incision. Grade control structures should remain stable. Deposition of sediment on the bank side of vane arms is preferable. Maintenance of scour pools on the channel side of vane arms is expected.

2.1.4 Substrate

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

2.1.5 Bankfull Documentation

Two bankfull flow events, occurring in separate years, must be documented on the restoration and enhancement reaches within the seven-year monitoring period. In addition, two other geomorphically significant events must be documented. For these purposes, a geomorphically significant event is a flow event that is between 60% of the bankfull flow and the bankfull flow. The confirmation that such an event has occurred will be based on measurements of stage converted to discharge with a stage-discharge relation developed with a hydraulic model. Stream monitoring will continue until success

criteria in the form of two bankfull events in separate years and two additional geomorphically significant events have been documented.

2.1.6 Visual Assessments

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

2.2 Vegetation

The final vegetation success criteria for planted trees will be the survival of 210 planted stems per acre in the riparian corridor at the end of the required monitoring period (year seven). The interim measure of vegetation success for the trees on the site will be the survival of at least 320 planted stems per acre at the end of the third monitoring year and at least 260 stems per acre at the end of the fifth year of monitoring. Planted trees must average 10 feet in height in each plot at the end of the seventh year of monitoring. The success criteria for shrubs will be 160 surviving plants at year 3, 130 at year 5, and 105 at year 7. There will be no height criteria for shrubs. The success criteria for herbaceous plants will be 80% coverage of the vegetation plots with planted or volunteer vegetation at year 7. If these performance standards are met by year five and stem density is trending towards success (i.e., no less than 260 five-year-old trees/acre, no less than 130 five-year-old shrubs/acre, and 80% coverage of herbaceous veg plots), monitoring of vegetation on the site may be terminated with written approval by the USACE in consultation with the NC Interagency Review Team (IRT). The extent of invasive species coverage will also be monitored and controlled as necessary throughout the required monitoring period.

2.3 Wetlands

The final performance standard for wetland hydrology will be a free groundwater surface within 12 inches of the ground surface for 8.5% of the growing season for wetland for all wetland zones other than bog areas which is measured on consecutive days under typical precipitation conditions. The final performance stand for bog areas will be a free groundwater surface within 12 inches of the ground surface for 12 % of the growing season. If a gauge does not meet the performance standard for a given monitoring year, rainfall patterns will be analyzed and the hydrograph will be compared to that of the reference wetlands to assess whether atypical weather conditions occurred during the monitoring period. A soil temperature probe will be installed onsite to collect additional information to define the start and end of the growing season.

2.4 Schedule and Reporting

Monitoring reports will be prepared in the fall of each year of monitoring and submitted to DMS. Based on the DMS Annual Monitoring Template (April 2015), the monitoring reports will include the following:

- Project background which includes project objectives, project structure, restoration type and approach, location and setting, history and background;
- Project Asset Map of major project elements;
- Photographs showing views of the restored Site taken from fixed point stations;
- Current Condition Plan View Map with monitoring features and current problem areas noted such as stability and easement encroachment based on the cross-section surveys and annual visual assessments;
- Vegetation data as described above including the identification of any invasion by undesirable plant species;
- Groundwater gage plots;
- A description of damage by animals or vandalism;

- Maintenance issues and recommended remediation measures will be detailed and documented; and
- Wildlife observations.

Section 3: MONITORING PLAN

Annual monitoring will consist of collecting morphologic, vegetative, and hydrologic data to assess the project success based on the restoration goals. Project success will be assessed by measuring channel dimension, substrate composition, vegetation, surface water hydrology, groundwater hydrology and by analyzing photographs and performing visual assessments. Any high priority problem areas identified, such as unstable stream banks, bed instability, aggradation/degradation, or poor vegetation establishment will be evaluated on a case-by-case basis. The problem areas will be visually noted and reported to DMS staff in the annual report. Refer to Table 5 in Appendix 1 for the monitoring component summary.

3.1 Stream

Geomorphic assessments follow guidelines outlined in the *Stream Channel Reference Sites: An Illustrated Guide to Field Techniques* (Harrelson et al., 1994), methodologies utilized in the Rosgen stream assessment and classification documents (Rosgen, 1994 and 1996), and in the *Stream Restoration: A Natural Channel Design Handbook* (Doll et al., 2003). Please refer to Figure 3 in Appendix 1 for monitoring locations discussed below.

3.1.1 Dimension

To assess channel dimension performance, 11 permanent cross-sections were installed per DMS Stream and Wetland Monitoring Guidelines (February 2014). Each cross-section is permanently marked with rebar installed in concrete and 1/2 inch PVC pipes. Cross-section surveys will include points measured at all breaks in slope, including top of bank, bankfull, edge of water, and thalweg. Cross-section surveys will be conducted in monitoring years one, two, three, five, and seven. In addition, at least two sets of cross-sectional surveys will be conducted within each design reach after a geomorphically significant discharge event as described in the DMS Stream and Wetland Monitoring Guidelines (February 2014). These measurements may occur at any time during the seven-year monitoring period. 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 indicate a trend toward vertical and lateral instability. If a longitudinal profile is deemed necessary, monitoring will follow standards as described in the NCDMS Monitoring Requirements and Performance Standards for Stream and/or Wetland Mitigation (11/7/2011) and the 2003 USACE and NCDWR Stream Mitigation Guidance for the necessary reaches. Stream pattern and profile will be assessed visually as described below in Section 3.1.6.

3.1.3 Substrate

Reachwide pebble counts will be conducted for classification purposes on each of the restoration and EI reaches (Vile Creek Reaches 1 and 2, UT1 Reaches 1 and 2). Wetted riffle pebble counts will also conducted at permanent riffle cross-sections on Vile Creek Reach 1 (XS2, XS3), Vile Creek Reach 2 (XS4, XS5), UT1 Reach 1 (XS7, XS9) and UT1 Reach 2 (XS11); the pebble counts will be conducted annually for seven years following construction and compared with data from previous years.

3.1.4 Photo Reference Points

Photos will be used to monitor restoration and enhancement stream reaches as well as vegetation plots and wetland areas and demonstrate that performance criteria are being met. A total of 36 permanent photographic reference points were established after construction. These longitudinal reference photos are established at regular intervals along the channel by taking a photo looking upstream and

downstream (usually at tail of riffle feature). Photographs will be taken once a year with a handheld camera to visually document stability throughout the monitoring period. Permanent markers are established and located with GPS equipment so that the same locations and view directions on the site are photographed each year.

Cross-sectional photos will be taken of each permanent cross-section looking upstream and downstream. Reference photos will also be taken for each of the vegetation plots, within wetland areas, and depicting the stormwater BMP. Representative digital photos of each permanent photo point, cross-section, and vegetation plot will be taken on the same day of the stream and vegetation assessments are conducted. The photographer will make every effort to consistently maintain the same area in each photo over time.

3.1.5 Hydrology Documentation

The occurrence of bankfull events and geomorphically significant events will be documented throughout the monitoring period. Streamflow stage will be monitored using a stage monitoring station which will consist of a crest gage and a continuous stage recorder at the same location. Two stage monitoring locations were installed within surveyed riffle cross-sections; one on Vile Creek (XS5) and one on UT1 (XS11). The stage data will be downloaded at each site visit to determine if a bankfull event has occurred. Crest gauges will be read at each visit as well to verify the continuous stage data. In addition, time lapse photographs will be taken with a mounted trail camera at an interval of one hour between photos. The camera will be mounted on a metal or wooden post installed on the floodplain adjacent to a riffle cross-section. Photographs taken with a handheld camera will be used to document the occurrence of debris lines and sediment deposition observed during field visits.

3.1.6 Visual Assessment

Visual assessments will be performed along all stream and wetland 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 or habitat feature failure/instability, and/or headcuts), vegetation health (i.e. low stem density, vegetation mortality, invasive species or encroachment), or problems with fencing/livestock access. Areas of concern will be mapped, photographed, and accompanied by a written description in the annual monitoring report. Problem areas will be re-evaluated during each subsequent visual assessment. Should remedial actions be required, recommendations will be provided in the annual monitoring report.

3.2 Vegetation

Vegetation monitoring plots were installed and evaluated throughout the easement to measure the survival of the planted trees, shrubs, and herbaceous vegetation. A total of 25 vegetation plots were established within planted areas on the Site including tree and shrub plots and herbaceous vegetation plots. The size of individual quadrants are 100 square meters (10m x 10m or 5m x 20m) for woody tree species and shrub assessment plots. Tree and shrub assessments will be conducted on 17 vegetation plots following the Carolina Vegetation Survey (CVS) Level 2 Protocol for Recording Vegetation (Lee et al., 2006). The size of the herbaceous vegetation plots will be 20 square meters (5m x 4m). The herbaceous vegetation assessments will be conducted on 8 vegetation plots within bog cells by visually estimating the percent coverage within each plot.

The initial baseline survey was conducted within 21 days from completion of site planting and used for subsequent monitoring year comparisons. The first annual vegetation monitoring activities will commence at the end of the first growing season. The Site will then be evaluated each subsequent year between June 1 and September 31. 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. Planted woody stems will be marked annually as needed and given a coordinate, based on a known origin, so they can be found in succeeding monitoring years. Mortality will be determined from the difference between the previous year's living planted stems and the current year's living planted stems. Please refer to Figure 3 in Appendix 1 for the vegetation monitoring locations.

3.3 Wetlands

To monitor the wetland rehabilitation and re-establishment areas, wetland hydrology groundwater monitoring gages were installed per USACE recommended procedures. Ten groundwater monitoring gages were within the wetland areas using In-situ Level TROLL® 100 pressure transducers. An additional gage was established in a nearby reference wetland and will be utilized to compare the hydrologic response within the restored wetland areas at the Site. The gages are set to record the ground water level two times per day. An onsite rain gage is installed to record daily rainfall, and will be utilized to assess whether typical weather conditions occur during the monitoring period. If a groundwater gage does not meet the performance standard for a given monitoring year, rainfall patterns will be analyzed and the hydrograph will be compared to that of the reference wetland to assess whether atypical weather conditions occurred during the monitoring period. The groundwater gages and the onsite rain gage will be downloaded during quarterly site visits. The locations of the groundwater gages are denoted in Figure 3.

Section 4: MAINTENANCE AND CONTINGENCY PLAN

Wildlands will perform maintenance as needed on the mitigation project. A physical inspection of the Site shall be conducted a minimum of once per year throughout the post-construction monitoring period 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 items listed in the Maintenance Plan Table below. Problem areas will be mapped and included in the CCPV as part of the annual stream assessment.

Component/Feature	Maintenance through project close-out
Stream	Routine channel maintenance and repair activities may include minor repairs to in-stream structures to prevent piping of flows, securing loose coir matting, and supplemental installations of live stakes and other target vegetation along the channel. Areas where storm water and floodplain flows intercept the channel may also require maintenance to prevent bank failures and head-cutting.
Wetlands	Routine site walks will be conducted to identify and document potential areas of concern, such as, but not limited to areas of low stem density or poor plant vigor, invasive species, encroachments, and livestock access. Maintenance will follow procedures as described below under the vegetation and site boundary components.
Vegetation	Vegetation shall be maintained to ensure the health and vigor of the targeted communities. 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.
Site boundary	Site boundaries shall be identified in the field to ensure clear distinction between the mitigation site and adjacent properties. Boundaries may be identified by fence, marker, bollard, post, tree-blazing, or other means as allowed by site conditions and/or conservation easement. Boundary markers disturbed, damaged, or destroyed will be repaired and/or replaced on an as-needed basis.
Ford and Culvert Crossings	Ford crossings within the site may be maintained only as allowed by Conservation Easement or existing easement, deed restrictions, rights of way, or corridor agreements.
Beaver/Wildlife Management	If beaver dams are observed on site, Wildlands will remove the dams and attempt to remove the beavers from the site. If wildlife herbivory becomes a problem for the plantings, Wildlands will take measures to manage wildlife on the site.

Section 5: AS-BUILT CONDITION (BASELINE)

The Site construction and as-built surveys were completed in April 2017. The survey included developing an as-built topographic surface, locating the stream channel and wetland boundaries and in-stream structures as well as easements and other relevant project components. For comparison purposes, during the baseline assessment, reaches were divided into assessment reaches in the same way that they were established for design parameters: Vile Creek Reach 1, Vile Creek Reach 2, Vile Creek Reach 3, UT1 Reach 1, UT1 Reach 2, UT1b, UT1c, UT2 and UT3.

5.1 Record Drawings

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

5.1.1 Vile Creek Reach 1

- Station 109+62 – 110+85 Alignment deviation;
- Station 110+05 – 110+23 Riffle added; and
- Station 110+21 Rock J-Hook.

5.1.2 Vile Creek Reach 2

- Station 111+45 No defined wetland outlet installed;
- Station 112+62 Rock sill replaces log sill;
- Station 114+25 – 114+51 Replaced lunker log with brush toe;
- Station 115+11 – 115+25 Boulder toe added;
- Station 115+19 – 115+47 Lunker log moved upstream from sod mat and brush toe;
- Station 115+47 – 115+75 Brush toe added;
- Station 116+35 J-hook replaces log sill
- Station 116+72 Vane removed, brush toe all;
- Station 117+70 No defined outlet installed;
- Station 118+96 Outlet moved downstream to log vane;
- Station 119+03 – 119+47 Brush toe replaces lunker log;
- Station 120+29 – 120+59 Brush toe replaces lunker log;
- Station 120+35 – 120+70 Boulder toe replaces lunker log and brush toe;
- Station 121+09 – 121+52 Brush toe removed;
- Station 121+28 Rock J-Hook added;
- Station 121+71 Vane removed; and
- Station 123+32 Rock sill replaces log sill.

5.1.3 Vile Creek Reach 3

- Station 125+06 Rock sill replaces log sill, rock toe on left bank;
- Station 126+00 – 127+50 Bank work performed on left bank; and
- Station 130+00 No bank protection installed on right bank.

5.1.4 UT1 Reach 1

- Station 202+25 – 202+67 Alignment deviation;
- Station 202+31 – 202+70 Brush toe added;
- Station 204+03 – 204+15 Riffle shifted toward left bank;
- Station 207+50 Rock sill replaces log sill;

- Station 208+53 – 208+72 Alignment deviation;
- Station 209+63 Wetland outlet here;
- Station 212+40 Rock sill replaces log sill;
- Station 215+71 – 215+95 Boulder toe added; and
- Station 215+80 Rock sill replaces log sill.

5.1.5 UT1 Reach 2

- Station 220+39 – 220+64 Boulder toe added;
- Station 220+69 – 221+28 UT1 realigned in field to work with bedrock;
- Station 220+39 - 221+28 On right bank - boulder toe with sod mat cover;
- Station 220+78 – 221+13 Boulder cascade added; and
- Station 220+96 – 221+04 On left bank – Boulder toe added.

5.1.6 UT2

- Station 303+00 - 304+00 Bank work and light coir fiber matting on left bank;
- Station 304+00 - 304+75 Bank work and light coir fiber matting on right bank;
- Station 305+25 - 306+75 Bank work and light coir fiber matting on right bank;
- Station 306+50 Rock toe;
- Station 307+50 - 307+50 Bank work and light coir fiber matting on both banks;
- Station 308+50 Rock toe;
- Station 309+50 Rock toe;
- Station 309+75 - 309+85; Bank work and light coir fiber matting on left bank;
- Station 310+50 - 311+00 Bank work and light coir fiber matting on both banks; and
- Station 312+25 - 312-62 Bank work and light coir fiber matting on both banks.

5.2 Baseline Data Assessment

Baseline monitoring (MY0) was conducted between February and April 2017. The first annual monitoring assessment (MY1) will be completed in the fall of 2017. The streams and wetlands will be monitored for a total of seven years, with the final monitoring activities to be conducted in 2023. The mitigation close-out for the Site is planned for 2024.

5.2.1 Morphological State of the Channel

Morphological data for the as-built profile was collected in March 2017. Please refer to Appendix 2 for summary data tables, morphological plots, and stream photographs.

Profile

With the exception of Vile Creek and UT1 alignment adjustments, the MY0 profiles closely match the profile design parameters. On the design profiles, riffles were depicted as straight lines with consistent slopes. However, at some locations the riffle profiles within the as-built survey are not consistent in slope due to the installation of structures such as logs within the streambed. Maximum riffle and bankfull slopes vary from design parameters as a result of channel realignment made during construction to work with existing bedrock. Additionally, maximum pool depths typically exceed design parameters. These variations in riffle slope and pool depths do not constitute a problem or indicate a need for remedial actions and will be assessed visually during the annual assessments.

Dimension

The MY0 dimension numbers closely match the design parameters within acceptable ranges of variation. Deviation from design dimensions in baseline parameters include wider bankfull widths, deeper bankfull mean and max depths, and larger cross-sectional areas. We anticipate that over time,

sediment and organic matter will accumulate as vegetation becomes established, resulting in a trend toward design dimensions. Accumulation of sediment within pools is not considered an indicator of instability, and occasional depth exceedance within riffles will not impact the stability of the channel.

Pattern

The MY0 pattern metrics fell within acceptable ranges of the design parameters for all three reaches.

Bankfull Events

Bankfull events recorded following completion of construction will be reported in the Monitoring Year 1 (MY1) report.

5.2.2 Vegetation

The MY0 average planted density is 686 planted stems per acre. Wetland bogs were planted with an 8 ft spacing and evaluated using a percent cover estimate. Summary data and photographs of each plot can be found in Appendix 3.

5.2.3 Wetlands

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

Section 6: REFERENCES

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

Harrelson, Cheryl C; Rawlins, C.L.; Potyondy, John P. 1994. *Stream Channel Reference Sites: An Illustrated Guide to Field Technique.* Gen. Tech. Rep. RM-245. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Forest and Range Experiment Station. 61 p.

Lee, Michael T., Peet, Robert K., Steven D., Wentworth, Thomas R. 2006. CVS-EEP Protocol for Recording Vegetation Version 4.0. Retrieved from http://deq.nc.gov/document/cvs-eep-protocol-v42-lev1-2

North Carolina Division of Water Resources (NCDWR). 2016. Surface Water Classifications. Retrieved from http://deq.nc.gov/about/divisions/water-resources/planning/classification-standards/classifications

NCDENR. 2009. New River Basin Restoration Priorities. Retrieved from http://deq.nc.gov/about/divisions/mitigation-services/dms-planning/watershed-planning-documents/new-river-basin

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

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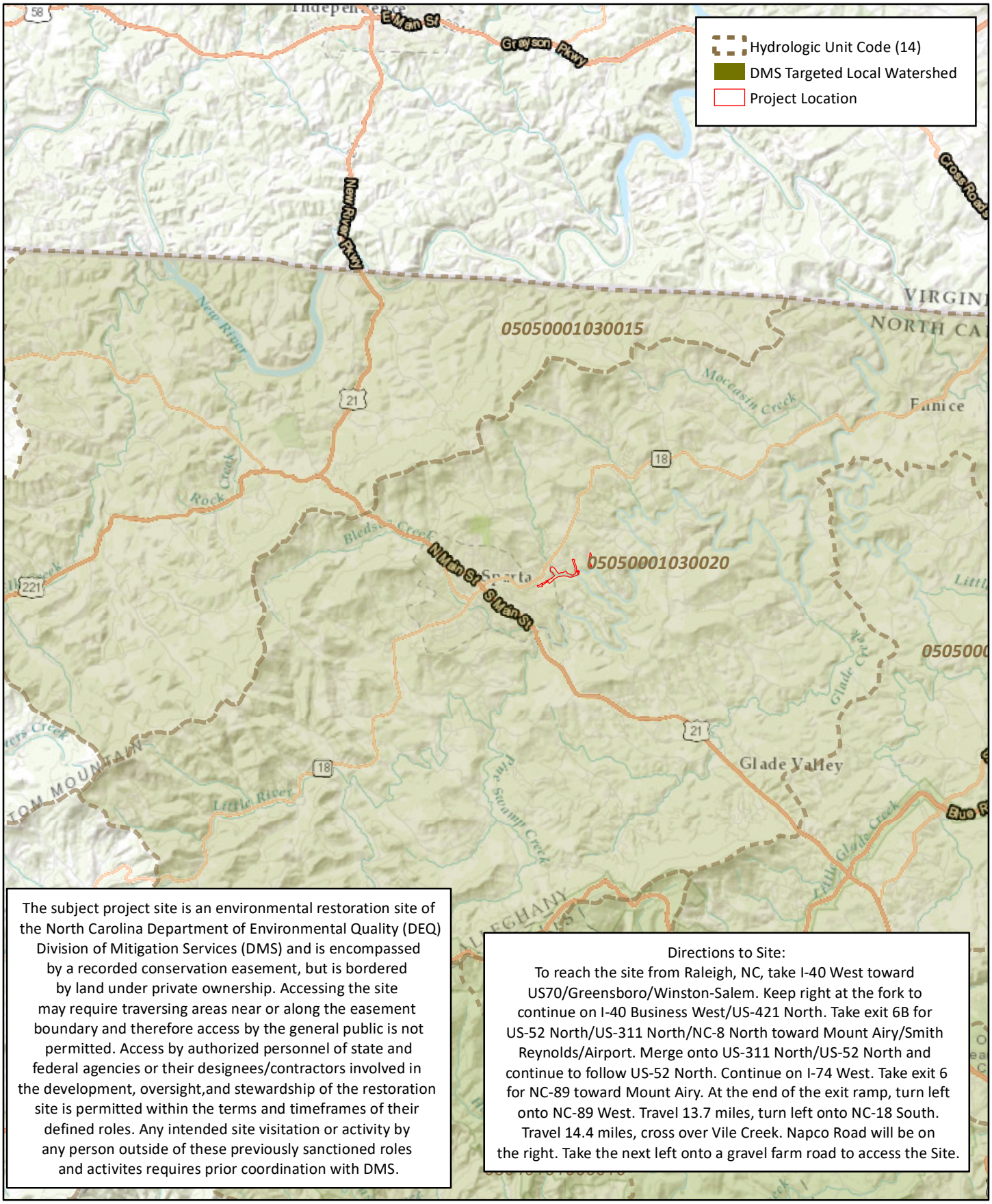
United States Army Corps of Engineers (USACE), 2003. Stream Mitigation Guidelines. USACE, NCDENR-DWQ, USEPA, NCWRC.

United States Geological Survey (USGS), 1998. North Carolina Geology. https://deq.nc.gov/about/divisions/energy-mineral-land-resources/north-carolina-geological-survey/

Wildlands Engineering, Inc. (2016). Vile Creek Mitigation Site Final Mitigation Plan. NCDMS, Raleigh, NC.

APPENDIX 1. General Tables and Figures



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

Directions to Site:
To reach the site from Raleigh, NC, take I-40 West toward US70/Greensboro/Winston-Salem. Keep right at the fork to continue on I-40 Business West/US-421 North. Take exit 6B for US-52 North/US-311 North/NC-8 North toward Mount Airy/Smith Reynolds/Airport. Merge onto US-311 North/US-52 North and continue to follow US-52 North. Continue on I-74 West. Take exit 6 for NC-89 toward Mount Airy. At the end of the exit ramp, turn left onto NC-89 West. Travel 13.7 miles, turn left onto NC-18 South. Travel 14.4 miles, cross over Vile Creek. Napco Road will be on the right. Take the next left onto a gravel farm road to access the Site.

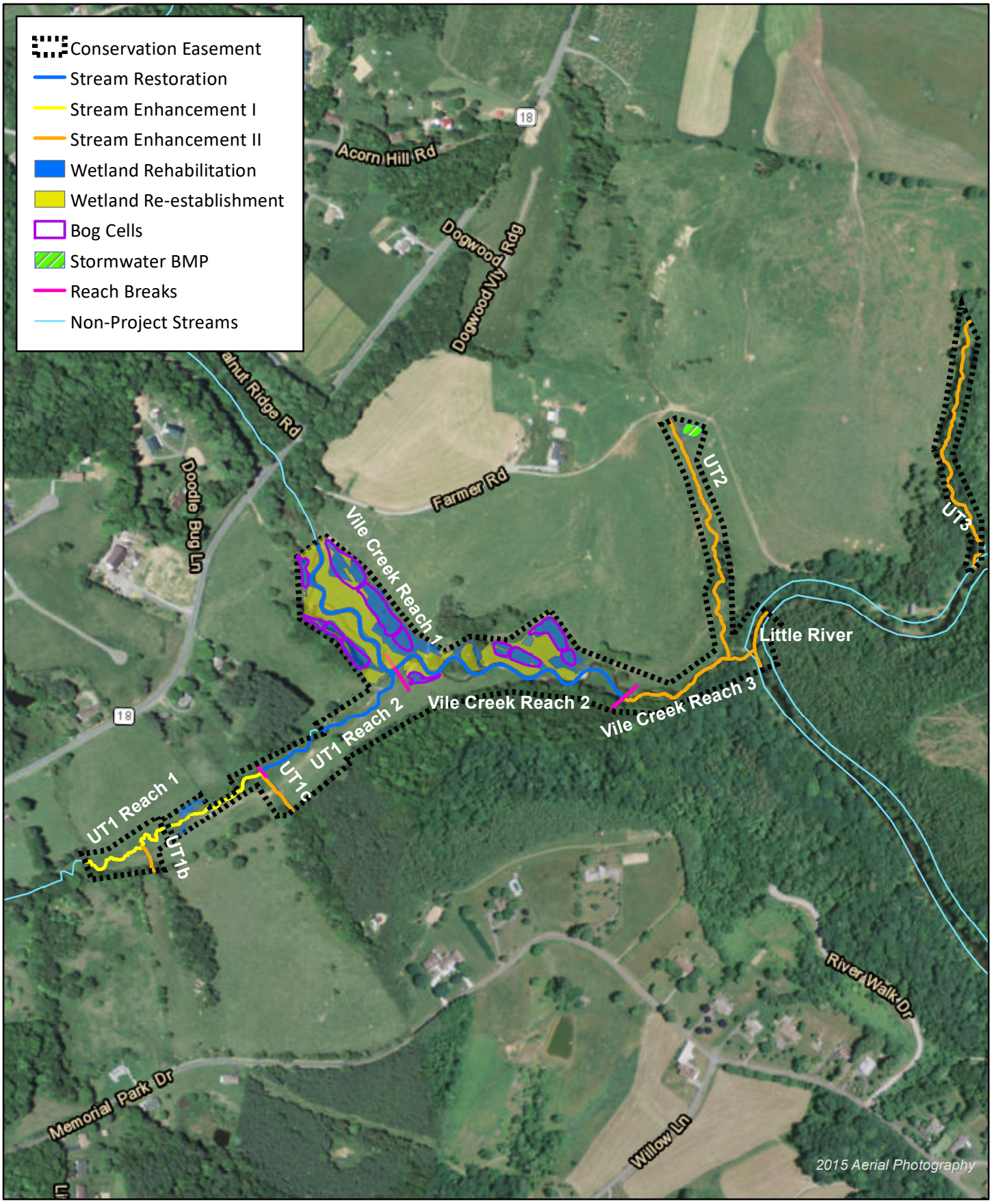
WILDLANDS ENGINEERING

0 0.5 1 Mile

N

Figure 1 Project Vicinity Map
Vile Creek Mitigation Site
DMS Project No. 96582
Monitoring Year 0 - 2017

Alleghany County, NC

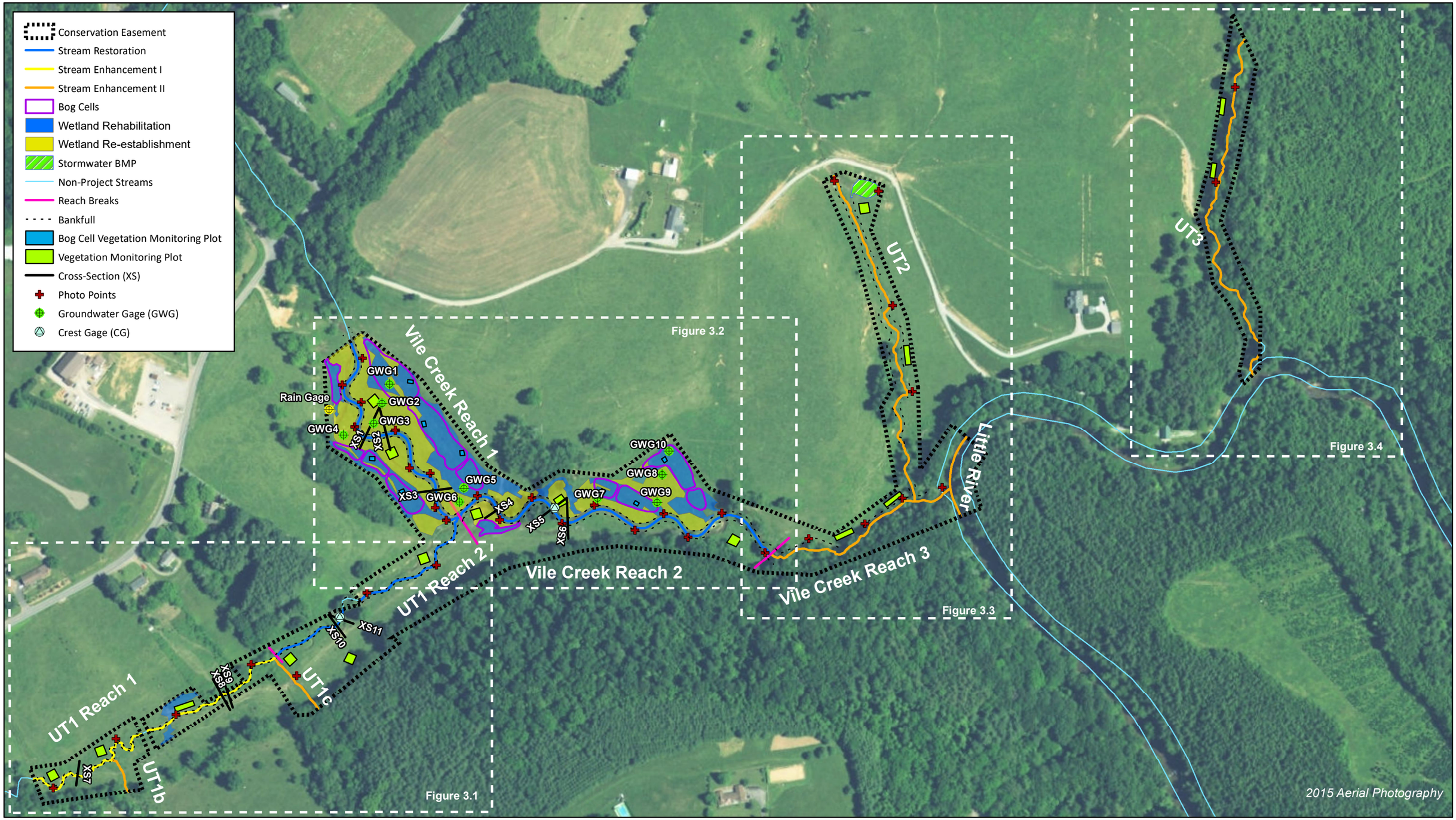


WILDLANDS ENGINEERING

0 700 Feet N

Figure 2 Project Component/Asset Map
Vile Creek Mitigation Site
DMS Project No. 96582
Monitoring Year 0 - 2017

Alleghany County, NC



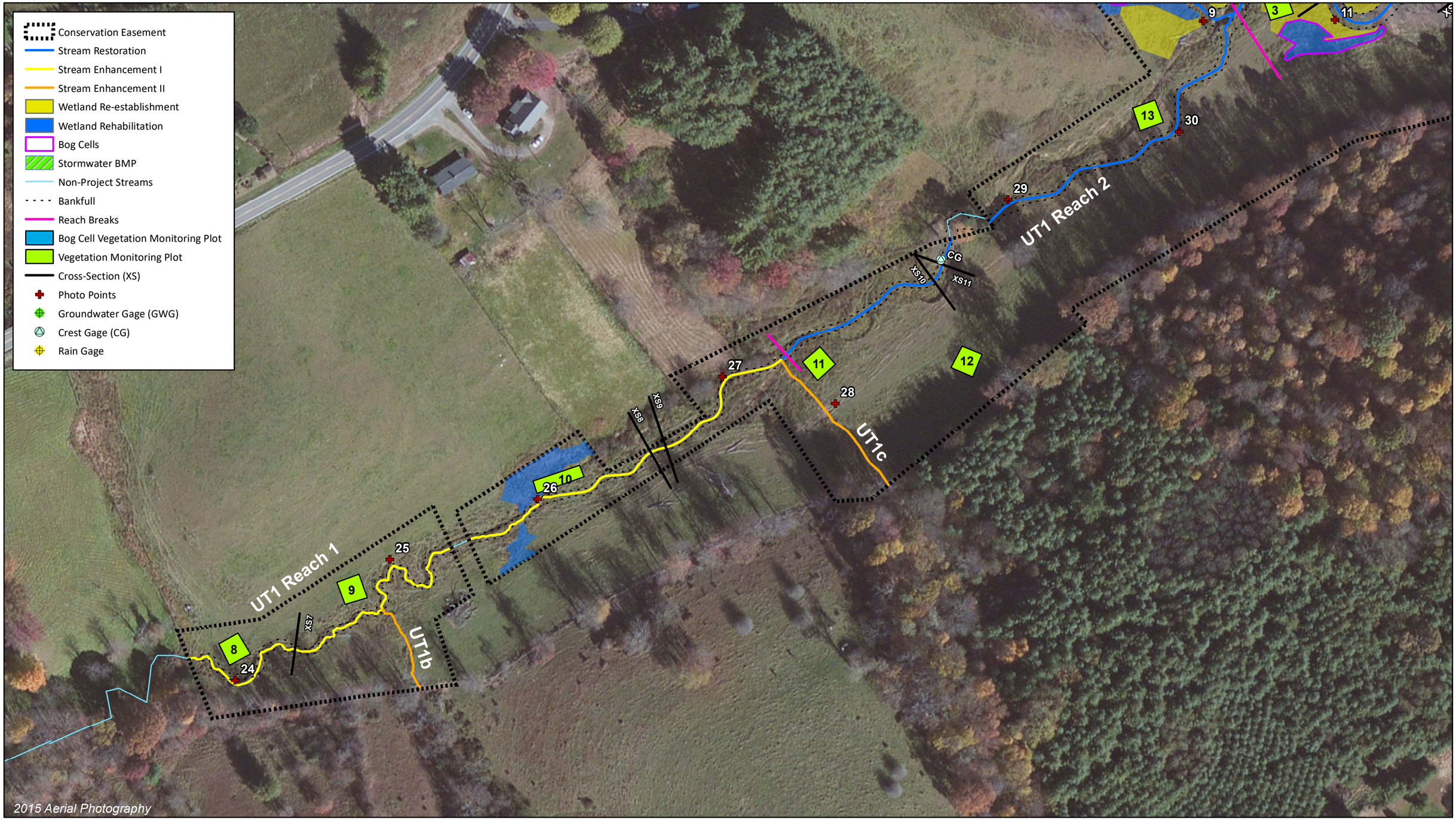
WILDLANDS ENGINEERING

0 100 200 Feet

N

Figure 3.0 Monitoring Plan View Map (Key)
Vile Creek Mitigation Site
DMS Project No. 96582
Monitoring Year 0 - 2017

Alleghany County, NC



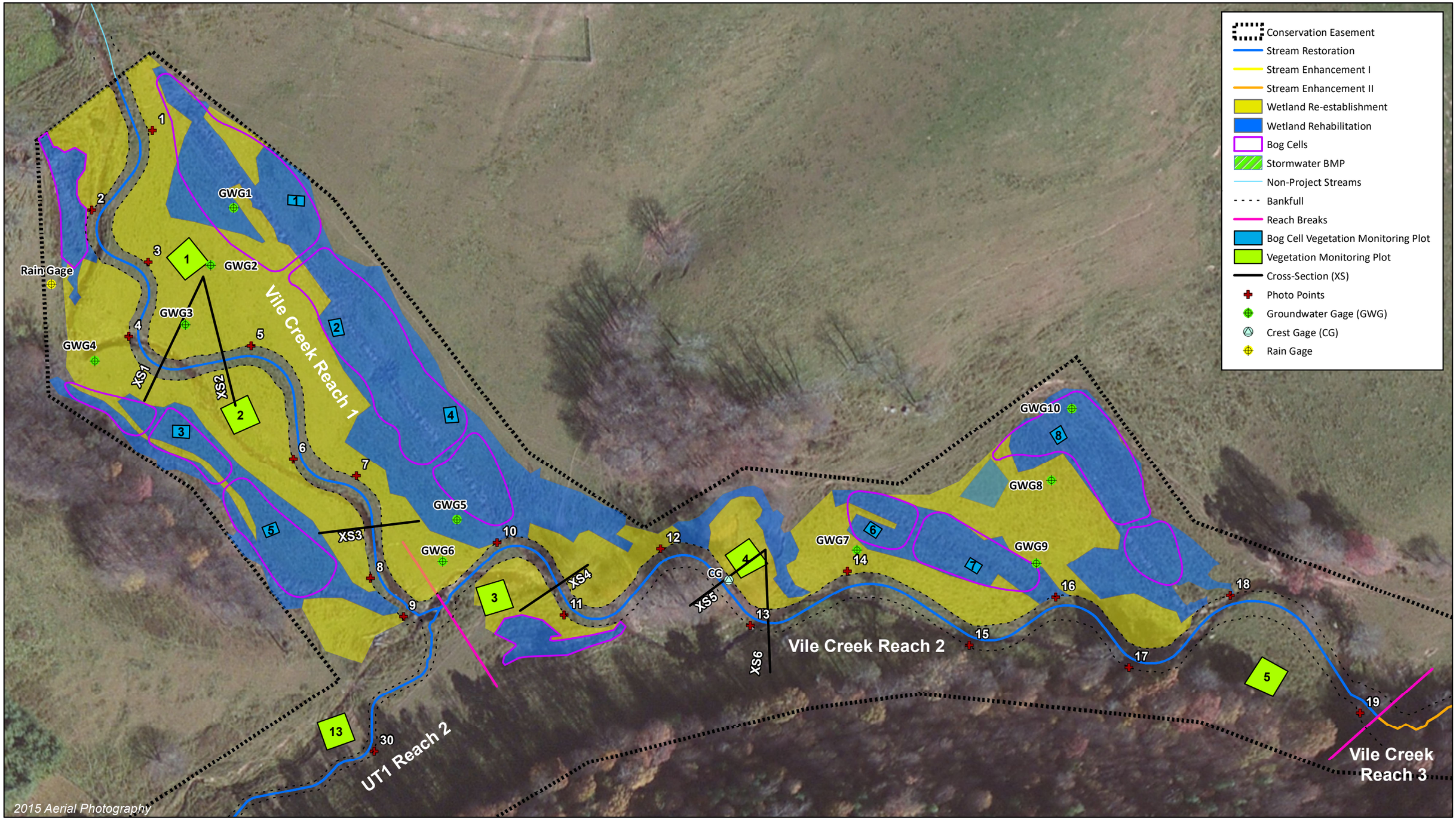
WILDLANDS ENGINEERING

0 100 200 Feet

N

Figure 3.1 Monitoring Plan View Map (Sheet 1 of 4)
Vile Creek Mitigation Site
DMS Project No. 96582
Monitoring Year 0 - 2017

Alleghany County, NC



WILDLANDS ENGINEERING

0 100 200 Feet

N

Figure 3.2 Monitoring Plan View Map (Sheet 2 of 4)
Vile Creek Mitigation Site
DMS Project No. 96582
Monitoring Year 0 - 2017

Alleghany County, NC

WILDLANDS ENGINEERING

0 100 200 Feet

Figure 3.3 Monitoring Plan View Map (Sheet 3 of 4)
Vile Creek Mitigation Site
DMS Project No. 96582
Monitoring Year 0 - 2017

Alleghany County, NC

WILDLANDS ENGINEERING

0 100 200 Feet

Figure 3.4 Monitoring Plan View Map (Sheet 4 of 4)
Vile Creek Mitigation Site
DMS Project No. 96582
Monitoring Year 0 - 2017

Alleghany County, NC

Table 1. Project Components and Mitigation Credits
Vile Creek Mitigation Site
DMS Project No.96582
Monitoring Year 0 - 2017

MITIGATION CREDITS									
	Stream		Riparian Wetland		Non-Riparian Wetland		Buffer	Nitrogen Nutrient Offset	Phosphorous Nutrient
Type	R	RE	R	RE	R	RE			
Totals	5,053	N/A	5.70	N/A	N/A	N/A	N/A	N/A	N/A

PROJECT COMPONENTS											
Reach ID	Existing Footage/ Acreage	Design Footage/ Acreage	Approach	Restoration (R) or Restoration Equivalent (RE)	As-Built Stationing/ Location[3]	As Built Footage/ Acreage[3]	Creditable As Built Footage/ Acreage[1,3]	Mitigation Ratio	Buffer Width Credit Reduction[2]	As-Built Credits (SMU/WMU)[2,3]	Notes
STREAMS											
Vile Creek Reach 1	962	920	P1	Restoration (R)	101+81 - 110+63	882	882	1:1	N/A	882	Alignment changed from mitigation plan/final design due to bedrock obstruction.
Vile Creek Reach 2	1,247	1,260	P1	Restoration (R)	110+63 -123+74	1,311	1,311	1:1	N/A	1,311	Alignment changed from mitigation plan/final design due to bedrock obstruction.
Vile Creek Reach 3	714	714	Bank Grading/Fencing/Planting	Enhancement II (R)	123+74 - 130+87	713	713	2.5:1	6	279	As-Built credits were reduced for areas where easement is restricted and the full buffer width is not possible.
UT1 Reach 1	1,143	1,107	Reconstructing channel to correct profile & cross section	Enhancement I (R)	201+60 - 207+16 & 207+42 - 212+74	1,114	1,088	1.5:1	95	630	Excludes one 25 foot easement crossing break from 207+13 - 207+38. As-Built credits were reduced for areas where easement is restricted and the full buffer width is not possible.
UT1 Reach 2	989	825	P1	Restoration (R)	212+74 - 215+68 & 216+45 - 221+28	854	777	1:1	27	750	Excludes 77 feet of stream outside of conservation easement from 215+68 - 216+45. Alignment changed from design due to bedrock obstruction. As-Built credits were reduced for areas where easement is restricted and the full buffer width is not possible.
UT1B	128	128	Fencing/Planting	Enhancement II (R)	250+36 - 251+64	128	128	2.5:1	3	48	As-Built credits were reduced for areas where easement is restricted and the full buffer width is not possible.
UT1C	234	228	Fencing/Planting	Enhancement II (R)	270+53 - 272+81	228	228	2.5:1	2	89	As-Built credits were reduced for areas where easement is restricted and the full buffer width is not possible.
UT2	1,226	1,226	Fencing/Planting	Enhancement II (R)	300+36 - 312+62	1,226	1,226	2.5:1	N/A	490	
UT3	1,316	1,236	Fencing/Planting	Enhancement II (R)	401+10 - 412+94 & 413+29 - 414+26	1,316	1,236	2.5:1	33	461	Creditable length reduced by 45 LF to account for 45 LF of alignment that does not have the full bankfull width within the CE.
Little River	284	284	Fencing/Planting	Enhancement II (R)	502+33 - 505+17	284	284	2.5:1	N/A	114	
WETLANDS											
Wetland Rehabilitation	3.02	3.02	Planting / Minor grading	Restoration (R)	N/A	3.02	3.02	1.3:1	N/A	2.32	
Wetland Re-establishment	0	3.50	Grading / Planting	Restoration (R)	N/A	3.38	3.38	1:1	N/A	3.38	The reduction in wetland re-establishment acreage from design to as-built stages was mainly due to Vile Creek Reaches 1 and 2 having wider top widths in the as-built survey than in the design wetland area calculations. Thus, Vile Creek cut more into the wetland area in the as-built plans than it did in the design calculations, resulting in lower as-built wetland acreage.

[1] Creditable As-Built footage excludes conservation easement breaks and a section along UT3 that exists outside of conservation easement.
[2] As-Built credits (SMUs) have been adjusted where the easement is restricted and the full buffer width and/or bankfull width is not fully contained within the conservation easement. The reductions are greater in the as-built compared to the mitigation plan. The as-built credit reductions follows the updated 2016 USACE Wilmington District Stream and Wetland Compensatory Mitigation update.
[3] Stream mitigation credits and stationg noted above are based on the as-built stream centerline.

COMPONENT SUMMATION					
Restoration Level	Stream (LF)	Riparian Wetland (acres)	Non-Riparian Wetland (acres)	Buffer (square feet)	Upland (acres)
Restoration	3047				
Enhancement I	1114				
Enhancement II	3895				
Wetland Rehabilitation		3.02			
Wetland Re-establishment		3.38			

Table 2. Project Activity and Reporting History

Vile Creek Mitigation Site
DMS Project No.96582
Monitoring Year 0 - 2017

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

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

Table 3. Project Contact Table

Vile Creek Mitigation Site
DMS Project No.96582
Monitoring Year 0 - 2017

Designer **Jeff Keaton, PE**	**Wildlands Engineering, Inc.** 1430 South Mint Street, Ste 104 Charlotte, NC 28205 704.332.7754
Construction Contractor	**Land Mechanics Design, Inc.** 126 Circle G Lane Willow Spring, NC 27592
Planting Contractor	**Bruton Natural Systems, Inc** P.O. Box 1197 Fremont, NC 27830
Seeding Contractor	**Land Mechanics Design, Inc.** 126 Circle G Lane Willow Spring, NC 27592
Seed Mix Sources	**Green Resource, LLC**
Nursery Stock Suppliers **Bare Roots** **Live Stakes** **Plugs**	 **Dykes and Son Nursery** **Bruton Natural Systems, Inc.; Foggy Mountain Nursery, LLC** **Wetland Plants Inc.**
Monitoring Performers	**Wildlands Engineering, Inc.**
Monitoring, POC	Kirsten Gimbert 704.332.7754, ext. 110

Table 4. Project Information and Attributes
Vile Creek Mitigation Site
DMS Project No.96582
Monitoring Year 0 - 2017

PROJECT INFORMATION	
Project Name	Vile Creek Mitigation Site
County	Alleghany County
Project Area (acres)	25.04
Project Coordinates (latitude and longitude)	36.510530° N, -80.104092° W
PROJECT WATERSHED SUMMARY INFORMATION	
Physiographic Province	Blue Ridge Belt of the Blue Ridge Province
River Basin	New
USGS Hydrologic Unit 8-digit	05050001
USGS Hydrologic Unit 14-digit	05050001030020
DWR Sub-basin	05-07-03
Project Drainiage Area (acres)	22,912
Project Drainage Area Percentage of Impervious Area	2%
CGIA Land Use Classification	Managed Herbaceous (50%), Forested (45%), Mountain Conifers (3%), Impervious (2%)

REACH SUMMARY INFORMATION										
Parameters	**Vile Creek Reach 1**	**Vile Creek Reach 2**	**Vile Creek Reach 3**	**UT1 Reach 1**	**UT1 Reach 2**	**UT1B**	**UT1C**	**UT2**	**Little River**	**UT3**
Length of Reach (linear feet) - Post-Restoration	882	1,311	713	1,114	854	128	228	1,226	284	1,316
Drainage Area (acres)	1,375	1,639	1,720	190	218	8	8	80	22,912	38
NCDWR Stream Identification Score - Pre-Restoration	45.5	45.5	45.5	43	43	28.25	26	27, 42.5	49.5	33.5
NCDWR Water Quality Classification	C									
Morphological Desription (stream type) - Pre-Restoration	C3	C4	C4	E4b	F4b	E4b	E4b	B4	C4	B4a
Evolutionary Trend (Simon's Model) - Pre-Restoration	IV	IV	IV	III	IV	III	III	II	I	III
Underlying Mapped Soils	Alluvial land, wet (Nikwasi); Chandler silt loam; Chandler stony silt loam; Chester loam; Chester stony loam; Clifton loam; Fannin silt loam; Stony Steep Land; Tate loam; Tusquitee loam; Watauga loam									
Drainage Class	Very poorly drained (Alluvial land, wet (Nikwasi); Well Drained (Chester loam, Chester stony loam, Clifton loam, Fannin silt loam, Tate loam, Tusquitee loam, Watauga loam); Somewhat excessively drained (Chandler silt loam, Chandlery stony silt loam); Excessively drained (Stony steep land).									
Soil Hydric Status	A/D (Nikwasi); A (Chandler silt loam, Chandler stony silt loam, Tusquitee loam, Stony steep land); B (Chester silt loam, Chester stony loam, Clifton loam, Fannin silt loam, Tate loam, Watauga loam)									
Valley Slope - Pre-Restoration	0.017	0.016	0.015	0.032	0.033	0.071	0.067	0.048	N/A	0.070
FEMA Classification	AE									
Native Vegetation Community	Montane Alluvial Forest, Southern Appalachian Bog									
Percent Composition Exotic Invasive Vegetation -Post-	<1%									

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. 3885. Action ID# SAW-2014-01585
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	Vile Creek Mitigation Site Categorical Exclusion (CE) Approved 9/15/2014
Historic Preservation Act	Yes	Yes	No historic resources were found to be impacted (letter from SHPO dated 7/25/2014)
Coastal Zone Management Act (CZMA)/Coastal Area Management Act (CAMA)	No	N/A	N/A
FEMA Floodplain Compliance	Yes	No impact application was prepared for local review. No post-project activities required.	LPIII Final Mitigation Plan (June 2016) and LPIII Categorical Exclusion (CE) Approved 9/15/2014
Essential Fisheries Habitat	No	No	LPIII Final Mitigation Plan (June 2016) and LPIII Categorical Exclusion (CE) Approved 9/15/2014

Table 5. Monitoring Component Summary
Vile Creek Mitigation Site
DMS Project No.96582
Monitoring Year 0 - 2017

Parameter	Monitoring Feature	Quantity/ Length by Reach										Frequency	Notes
		Vile Creek Reach 1	Vile Creek Reach 2	Vile Creek Reach 3	UT1 Reach 1	UT1 Reach 2	UT1a	UT1b	UT3	UT4	Wetlands		
Dimension	Riffle Cross Section	2	2	N/A	2	1	N/A	N/A	N/A	N/A	N/A	Years 1, 2, 3, 5 and 7	1
	Pool Cross Section	1	1	N/A	1	1	N/A	N/A	N/A	N/A	N/A		
Pattern	Pattern	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Year 0	2
Profile	Longitudinal Profile	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Year 0	
Substrate	Reach Wide (RW) / Riffle (RF) 100 Pebble Count	RW-1, RF-2	RW-1, RF-2	N/A	RW-1, RF-2	RW-1, RF-1	N/A	N/A	N/A	N/A	N/A	Years 1, 2, 3, 5 and 7	
Stream Hydrology	Crest Gage	N/A	1	N/A	N/A	1	N/A	N/A	N/A	N/A	N/A	Quarterly	3
Wetland Hydrology	Groundwater Gages	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	10		
Vegetation- Trees and shrubs	CVS Level 2	17										Annual	4
Vegetation- Herbaceous	Visual	8										Annual	
Visual Assessment	All Streams	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Semi - Annual	
Exotic and nuisance vegetation												Semi - Annual	5
Project Boundary												Semi - Annual	6
Reference Photos	Photographs	36										Annual	7

[1]Cross-sections were permanently marked with rebar to establish location. Surveys included points measured at all breaks in slope, including top of bank, bankfull, edge of water, and thalweg
[2]Pattern and profile will be assessed visually during bi-annual site visits.
[3]Device to be inspected quarterly or semi-annually.
[4]Vegetation monitoring follow CVS protocols.
[5]Locations of exotic and nuisance vegetation to be mapped
[6]Locations of fence damage, vegetation damage, boundary encroachments, etc. to be mapped.
[7]Permanent markers were established so that the same locations and view directions can be captured.

APPENDIX 2. Morphological Summary Data and Plots

Table 6a. Baseline Stream Data Summary
Vile Creek Mitigation Site
DMS Project No.96582
Monitoring Year 0 - 2017

Vile Creek Reach 1, Reach 2

	PRE-RESTORATION CONDITION				REFERENCE REACH DATA								DESIGN				AS-BUILT/BASELINE			
Parameter	**Vile Creek Reach 1**		**Vile Creek Reach 2**		**Meadow Creek**		**West Fork of Chestnut Creek**		**Brush Creek**		**Little Glade Creek**		**Vile Creek Reach 1**		**Vile Creek Reach 2**		**Vile Creek Reach 1**		**Vile Creek Reach 2**	
	Min	**Max**	**Min**	**Max**	**Min**	**Max**	**Min**	**Max**	**Min**	**Max**	**Min**	**Max**	**Min**	**Max**	**Min**	**Max**	**Min**	**Max**	**Min**	**Max**
Dimension and Substrate - Riffle																				
Bankfull Width (ft)	19.3		22.4		26.0		18.3	20.3	22.8		34.7		17.0		19.0		17.1	18.8	18.7	19.2
Floodprone Width (ft)	333		119		52.0		---		---		---		37	85	42	95	>200		156	188
Bankfull Mean Depth	1.6		0.9		2.4		1.8	2.2	1.7		2.2		1.2		1.2		1.1	1.2	1.2	1.5
Bankfull Max Depth	2.7		1.6		3.3		2.2	2.8	2.3		2.4		1.4	1.7	1.5	1.9	1.9	2.1	2.0	2.3
Bankfull Cross-sectional Area (ft^2)	30.4	31.7	20.1	48.0	62.2		35.8	40.0	37.9		76.5		19.6		23.7		19.8	21.2	22.5	28.6
Width/Depth Ratio	12.2		25.1		10.9		8.3	11.5	13.4		15.8		14.7		15.2		13.7	17.8	12.9	15.5
Entrenchment Ratio	17.2		5.3		>2.2		>2.2		>2.2		>2.2		2.2	5.0	2.2	5.0	>2.2		>2.2	
Bank Height Ratio	1.4		1.8		---		1.3	1.4	1.1		1.5		1.0		1.0		1.0	1.1	1.0	
D50 (mm)	112.0		56.3		---		---		---		---		---		---		60.4	69.3	58.6	61.5
Riffle Length (ft)	---		---		---		---		---		---		---		---		19.7	74.1	18.3	94.1
Riffle Slope (ft/ft)	0.021	0.050	0.0190	0.063	---		0.0110	0.0280	0.0040		0.0140		0.0148	0.0333	0.016	0.0360	0.0164	0.0420	0.0187	0.0385
Pool Length (ft)	---		---		---		---		---		---		---		---		38.8	149.3	47.1	123.7
Pool Max Depth (ft)	2.9		3.1		---		3.8	4.1	---		---		1.4	2.9	1.5	3.1	3.1	4.4	3.4	5.5
Pool Spacing (ft)	36	69	33	88	---		31	124	---		---		34	119	38	133	55	161	87	172
Pool Volume (ft^3)	---		---		---		---		---		---		---		---		---		---	
Pattern																				
Channel Beltwidth (ft)	38	90	42	93	---		64	71	---		---		51	119	57	133	34	127	48	88
Radius of Curvature (ft)	22	80	55	125	---		26	40	---		---		34	68	38	76	34	50	38	76
Rc:Bankfull Width (ft/ft)	1.1	4.1	2.4	5.6	---		1.3	2.0	---		---		2.0	4.0	2.0	4.0	1.8	2.9	2.0	4.1
Meander Wavelength (ft)	160	190	100	330	---		---		---		---		119	238	133	266	125	214	177	235
Meander Width Ratio	2.0	4.7	1.9	4.2	---		---		---		---		3	7	3	7	2	7	3	5
Substrate, Bed and Transport Parameters																				
Ri%/Ru%/P%/G%/S%																				
SC%/Sa%/G%/C%/B%/Be%																				
d16/d35/d50/d84/d95/d100	8.7/30.2/99.4/180/243/>2048		0.16/6.1/38/95/139/>2048		---		---		---		---		---		---		0.15/0.39/25.7/90.0/163.3/362.0		0.19/0.53/9.6/69.2/120.3/362.0	
Reach Shear Stress (Competency) lb/ft^2	1.20		0.80		---		---		---		---		1.1		1.2		0.86	1.09	0.69	0.74
Max part size (mm) mobilized at bankfull	175		130		---		---		---		---		165		175		42	54	43	53
Stream Power (Capacity) W/m^2																	3.8	5.9	4.1	5.8
Additional Reach Parameters																				
Drainage Area (SM)	2.2		2.6		2.70		1.60		1.67		3.30		2.2		2.6		2.2		2.6	
Watershed Impervious Cover Estimate (%)	3%				---		---		---		---		3%				3%			
Rosgen Classification	C3		C4		C		E4		C4		C4		C		C		C		C	
Bankfull Velocity (fps)	3.3	3.2	6.0	2.5	---		4.6	5.3	4.4		5.5		4.7		5.0		4.4	5.2	5.5	5.2
Design Bankfull Discharge (cfs)	100		120		---		164	210	168		424		100		120		87	133	103	144
Q- Little River LWP Regional 1.25-yr(cfs)	107		124																	
Q- Little River LWP Regional 1.5-yr (cfs)	122		141																	
Q- Rural Mountain Regional Curve (cfs)	180		206																	
Q-Revised Piedmont/Mountain Regional Curve (cfs)	102		117																	
Q- Basin Ration Method 1.1-yr (cfs)	101		121																	
Q- Basin Ration Method 1.25-yr (cfs)	122		146																	
Valley Length (ft)	---		---		---		---		---		---		---		---		729		1042	
Channel Thalweg Length (ft)	962		1,247		---		---		---		---		920		1260		882		1,311	
Sinuosity	1.3		1.3		---		---		---		---		1.20	1.30	1.20	1.30	1.21		1.26	
Water Surface Slope (ft/ft)	0.014		0.011		---		0.010		0.012		0.010		0.0123	0.0133	0.0131	0.0142	0.0135		0.0122	
Bankfull Slope (ft/ft)	0.017		0.016		---		---		---		---		0.016		0.017		0.0145		0.0122	

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

Table 6b. Baseline Stream Data Summary
Vile Creek Mitigation Site
DMS Project No.96582
Monitoring Year 0 - 2017

UT1 Reach 1, UT1 Reach 2

	PRE-RESTORATION CONDITION				REFERENCE REACH DATA								DESIGN				AS-BUILT/BASELINE			
Parameter	UT1 Reach 1		UT1 Reach 2		Little Pine III UT2A		Henry Fork UT Upstream		UT to Gap Branch		Group Camp Tributary		UT1 Reach 1		UT1 Reach 2		UT1 Reach 1		UT1 Reach 2	
	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
Dimension and Substrate - Riffle																				
Bankfull Width (ft)	7.9		19.2		12.6		3.2	7.7	6.2		4.2	4.4	8.0		9.0		7.7	8.6	9.0	
Floodprone Width (ft)	203.0		28.0		31.0		6	13	21		9	11	14	18	15	20	63	91	96	
Bankfull Mean Depth	0.9		0.4		1.4		0.5	0.6	0.6		0.8		0.5		0.6		0.5	0.7	0.8	
Bankfull Max Depth	1.7		0.9		2.0		0.7	0.8	1.0		1.0	1.2	0.7	0.8	0.7	0.9	1.1	1.1	1.3	
Bankfull Cross-sectional Area (ft^2)	7.3	10.3	8.4	11.8	18.1		1.9	3.6	3.8		3.4	3.6	4.3		5.2		4.1	5.9	7.8	
Width/Depth Ratio	8.6		43.9		8.7		5.2	16.4	10.1		5.2	5.5	14.9		15.6		12.4	14.7	11.4	
Entrenchment Ratio	25.6		1.5		2.4		1.7	2.0	3.4		1.9	2.5	1.8	2.3	1.7	2.2	>2.2		>2.2	
Bank Height Ratio	1.3		3.8		1.0		1.0	1.3	1.0		1.0		1.0		1.0		1.0	1.0	1.0	
D50 (mm)	32		28.5		---		---		---		---		---		---		22.6	34.3	28.1	
Profile																				
Riffle Length (ft)	---		---		---		---		---		---		---		---		11.0	53.1	13.5	60.7
Riffle Slope (ft/ft)	0.022	0.11	0.0280	0.071	0.0404	0.0517	0.0500	0.0700	0.0110	0.1400	0.0110	0.1220	0.0291	0.0640	0.0282	0.6200	0.0149	0.0410	0.0176	0.0897
Pool Length (ft)	---		---		---		---		---		---		---		---		13.0	36.9	8.6	42.5
Pool Max Depth (ft)	2.3		1.6		2.2	2.5	---		6.1		1.8	2.8	1.1	1.9	1.2	2	0.8	2.6	1.1	2.5
Pool Spacing (ft)	15	39	14	58	78		14	25	18	27	5	58	16	48	162	486	7	59	38	88
Pool Volume (ft^3)	---		---		---		---		---		---		---		---		---		---	
Pattern																				
Channel Beltwidth (ft)	40	55	60	80	---		---		---		16	17	N/A[1]		13	32	N/A[1]		6	66
Radius of Curvature (ft)	12	40	15	65	---		---		---		8	11.8	N/A[1]		20	59	N/A[1]		18	59
Rc:Bankfull Width (ft/ft)	1.5	5.1	0.8	3.4	---		---		---		1.9	2.7	N/A[1]		2.2	6.6	N/A[1]		2.0	6.5
Meander Length (ft)	57	100	115	140	---		---		---		31	34	N/A[1]		64	110	N/A[1]		56	152
Meander Width Ratio	5.1	7.0	3.1	4.2	---		---		---		3.6	3.8	N/A[1]		1.5	3.6	N/A[1]		1	7
Substrate, Bed and Transport Parameters																				
Ri%/Ru%/P%/G%/S%																				
SC%/Sa%/G%/C%/B%/Be%																				
d16/d35/d50/d84/d95/d100	0.4/1.7/25.9/137/203/256		0.17/0.55/26.9/133/205/256		---		---		---		---						0.21/0.79/8.6/51.0/126.9/256.0		0.25/4.47/12.1/70.5/101.2/180.0	
Reach Shear Stress (Competency) lb/ft^2	0.7		0.4		---		---		---		---		0.5		0.6		0.53	0.84	1.39	
Max part size (mm) mobilized at bankfull	115		75		---		---		---		---		95		100		26	41	68	
Stream Power (Capacity) W/m^2																	1.54	3.4	8.2	
Additional Reach Parameters																				
Drainage Area (SM)	0.30		0.34		0.12		0.20		0.04		0.10		0.30		0.34		0.30		0.34	
Watershed Impervious Cover Estimate (%)	1%				---		---		---		---		1%				1%			
Rosgen Classification	E4b		F4b		A/B		B4a		B4a/A4		E5b		B		B		B		B	
Bankfull Velocity (fps)	1.7	2.3	1.7	2.4	0.5		3.8	5.4	5.0		3.4	3.6	3.8		3.9		2.8	3.9	5.3	
Design Bankfull Discharge (cfs)	17		20		9		12		19		12		17		20		8	16	42	
Q- Little River LWP Regional 1.25-yr(cfs)	21		23																	
Q- Little River LWP Regional 1.5-yr (cfs)	24		26																	
Q- Rural Mountain Regional Curve (cfs)	40		44																	
Q-Revised Piedmont/Mountain Regional Curve (cfs)	21		24																	
Q- Basin Ration Method 1.1-yr (cfs)	16		16																	
Q- Basin Ration Method 1.25-yr (cfs)	17		19										---		---					
Valley Length (ft)	---		---		---		---		---		---		---		---		903		755	
Channel Thalweg Length (ft)	1,143		989		---		---		---		---		1,132		863		1,114		854	
Sinuosity	1.26		1.3		---		1.1		---		1.6		1.0 - 1.1		1.0 - 1.1		1.2		1.1	
Water Surface Slope (ft/ft^2)	0.022		0.028		0.0433		0.0420		0.0680		0.0167		0.0291	0.0320	0.0282	0.0310	0.0264		0.0288	
Bankfull Slope (ft/ft)	0.032		0.033		---		0.0460		---		0.0229		0.0320		0.0310		0.0261		0.0284	

SC: Silt/Clay <0.062 mm diameter particles
FS: Fine Sand 0.125-0.250mm diameter particles
(---): Data was not provided
N/A: Not Applicable

[1] Design parameters for pattern features are not reported for UT1 Reach 1 because the channel was designed as Enhancement I.

Table 7. Morphology and Hydraulic Summary (Dimensional Parameters - Cross-Section)

Vile Creek Mitigation Site

DMS Project No.96582

Monitoring Year 0 - 2017

	Cross-Section 1, Vile Creek Reach 1 (Pool)						Cross-Section 2, Vile Creek Reach 1 (Riffle)						Cross-Section 3, Vile Creek Reach 1 (Riffle)					
Dimension and Substrate	**Base**	**MY1**	**MY2**	**MY3**	**MY5**	**MY7**	**Base**	**MY1**	**MY2**	**MY3**	**MY5**	**MY7**	**Base**	**MY1**	**MY2**	**MY3**	**MY5**	**MY7**
based on fixed bankfull elevation	2700.8						2700.0						2695.7					
Bankfull Width (ft)	25.1						17.1						18.8					
Floodprone Width (ft)	---						>200						>200					
Bankfull Mean Depth (ft)	1.2						1.2						1.1					
Bankfull Max Depth (ft)	3.0						2.1						1.9					
Bankfull Cross-Sectional Area (ft^2)	29.2						21.2						19.8					
Bankfull Width/Depth Ratio	---						13.7						17.8					
Bankfull Entrenchment Ratio	---						>10.6						>10.7					
Bankfull Bank Height Ratio	---						1.0						1.0					
	Cross-Section 4, Vile Creek Reach 2 (Riffle)						**Cross-Section 5, Vile Creek Reach 2 (Riffle)**						**Cross-Section 6, Vile Creek Reach 2 (Pool)**					
Dimension and Substrate	**Base**	**MY1**	**MY2**	**MY3**	**MY5**	**MY7**	**Base**	**MY1**	**MY2**	**MY3**	**MY5**	**MY7**	**Base**	**MY1**	**MY2**	**MY3**	**MY5**	**MY7**
based on fixed bankfull elevation	2691.7						2688.9						2687.9					
Bankfull Width (ft)	18.7						19.2						24.1					
Floodprone Width (ft)	188.0						156.0						---					
Bankfull Mean Depth (ft)	1.2						1.5						1.8					
Bankfull Max Depth (ft)	2.0						2.3						3.6					
Bankfull Cross-Sectional Area (ft^2)	22.5						28.6						44.3					
Bankfull Width/Depth Ratio	15.5						12.9						---					
Bankfull Entrenchment Ratio	10.1						8.1						---					
Bankfull Bank Height Ratio	1.0						1.0						---					
	Cross-Section 7, UT1 Reach 1 (Riffle)						**Cross-Section 8, UT1 Reach 1 (Pool)**						**Cross-Section 9, UT1 Reach 1 (Riffle)**					
Dimension and Substrate	**Base**	**MY1**	**MY2**	**MY3**	**MY5**	**MY7**	**Base**	**MY1**	**MY2**	**MY3**	**MY5**	**MY7**	**Base**	**MY1**	**MY2**	**MY3**	**MY5**	**MY7**
based on fixed bankfull elevation	2743.9						2725.7						2725.3					
Bankfull Width (ft)	8.6						11.3						7.7					
Floodprone Width (ft)	63.0						---						97.0					
Bankfull Mean Depth (ft)	0.7						0.6						0.5					
Bankfull Max Depth (ft)	1.1						1.4						1.1					
Bankfull Cross-Sectional Area (ft^2)	5.9						7.1						4.1					
Bankfull Width/Depth Ratio	12.4						---						14.7					
Bankfull Entrenchment Ratio	7.3						---						12.5					
Bankfull Bank Height Ratio	1.0						---						1.0					
	Cross-Section 10, UT1 Reach 2 (Pool)						**Cross-Section 11, UT1 Reach 2 (Riffle)**											
Dimension and Substrate	**Base**	**MY1**	**MY2**	**MY3**	**MY5**	**MY7**	**Base**	**MY1**	**MY2**	**MY3**	**MY5**	**MY7**						
based on fixed bankfull elevation	2713.5						2712.9											
Bankfull Width (ft)	13.3						9.0											
Floodprone Width (ft)	---						96.0											
Bankfull Mean Depth (ft)	0.9						0.8											
Bankfull Max Depth (ft)	1.9						1.3											
Bankfull Cross-Sectional Area (ft^2)	12.6						7.8											
Bankfull Width/Depth Ratio	---						11.4											
Bankfull Entrenchment Ratio	---						10.7											
Bankfull Bank Height Ratio	---						1.0											

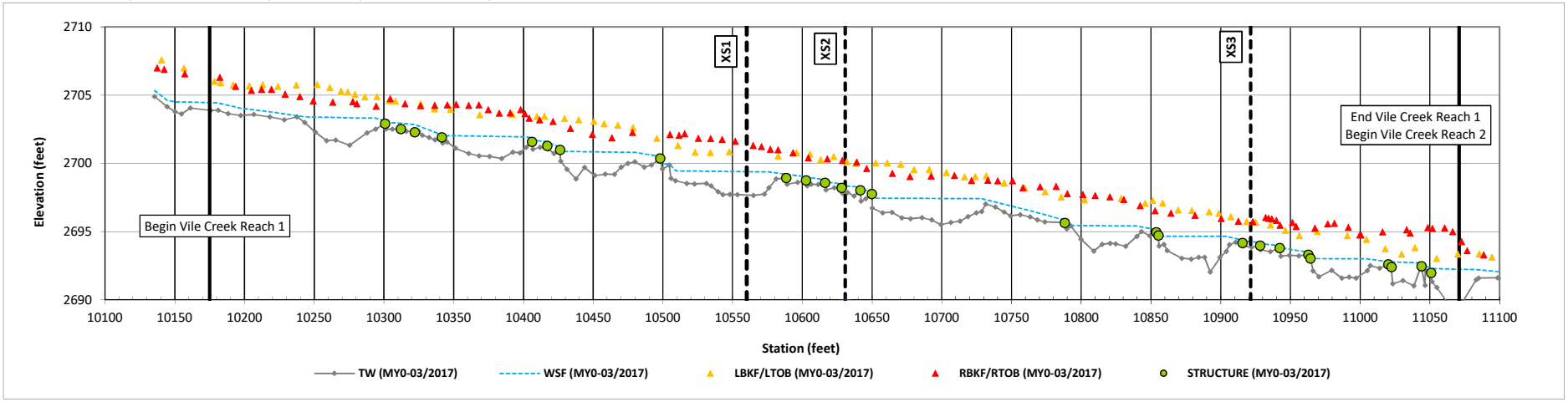
Longitudinal Profile Plots

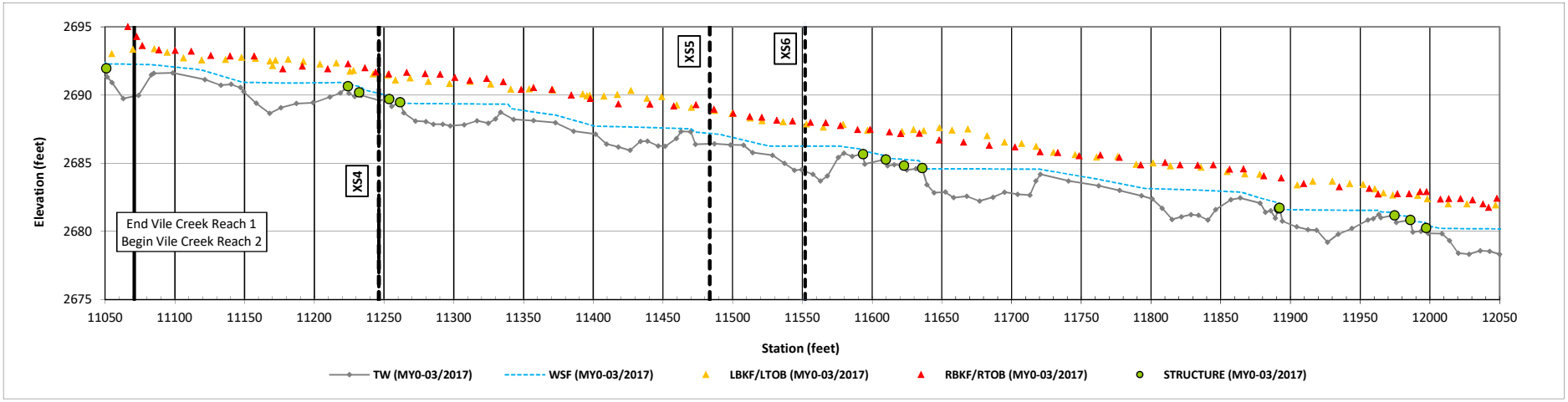
Vile Creek Mitigation Site

DMS Project No. 96582

Monitoring Year 0 - 2017

Vile Creek Reach 1 (STA 101+75 – 110+71) and Reach 2 (STA 110+71-123+54)





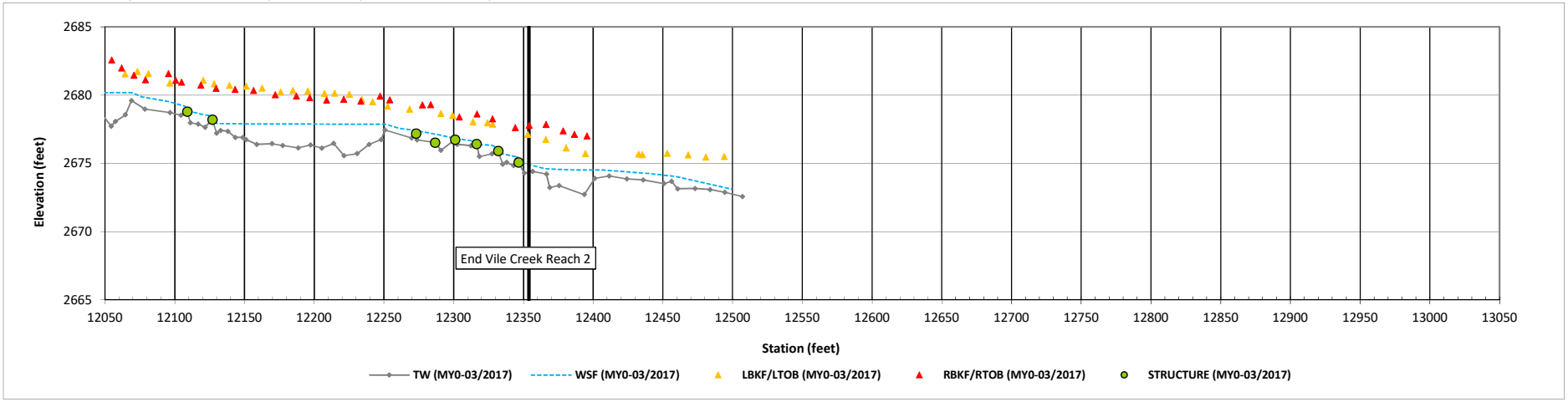
Longitudinal Profile Plots

Vile Creek Mitigation Site

DMS Project No. 96582

Monitoring Year 0 - 2017

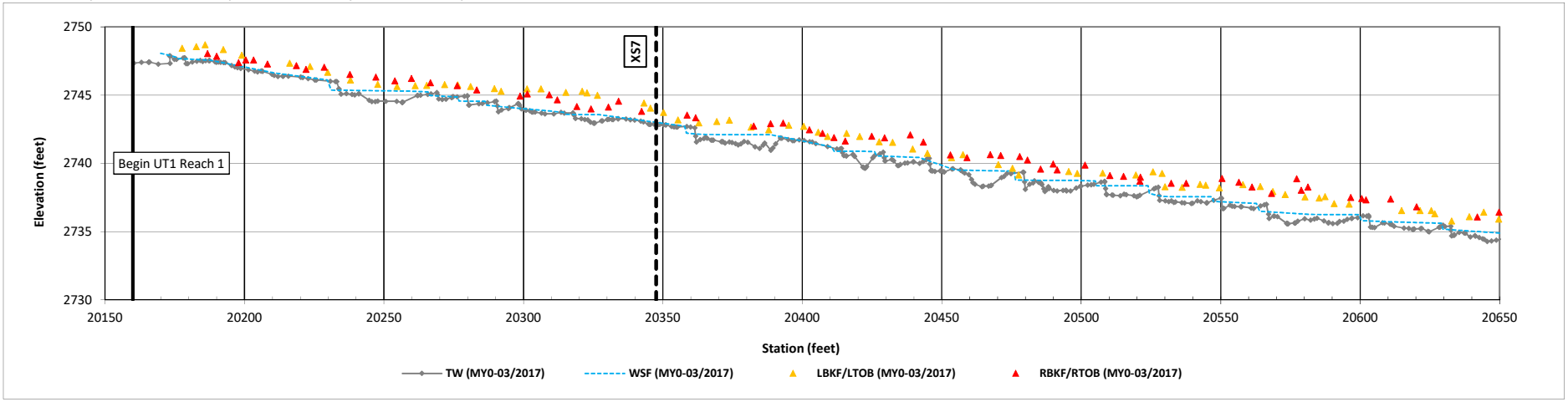
Vile Creek Reach 1 (STA 101+75 – 110+71) and Reach 2 (STA 110+71-123+54)

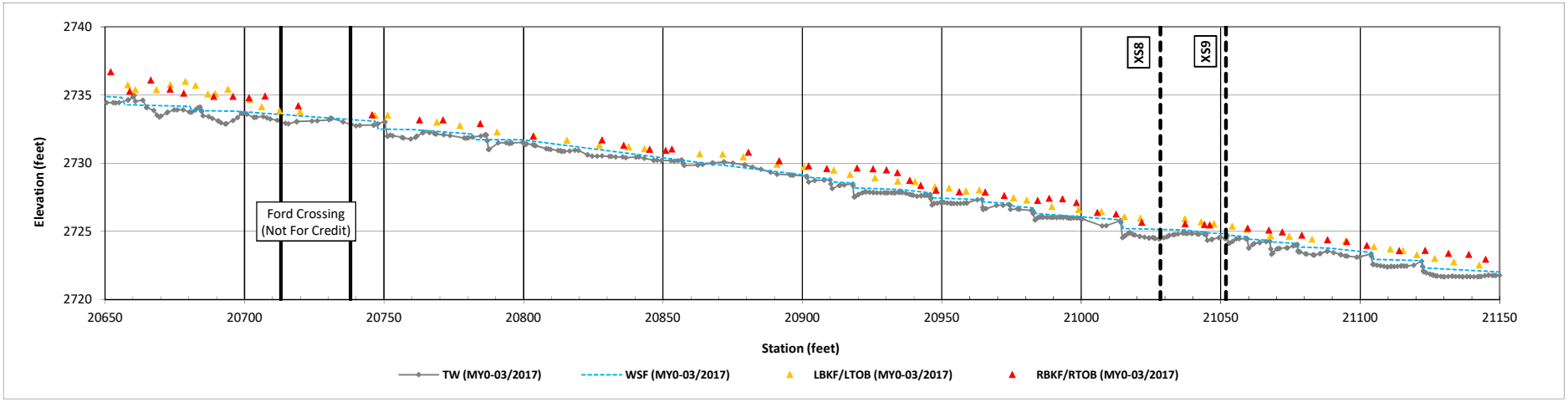


Longitudinal Profile Plots

Vile Creek Mitigation Site
DMS Project No. 96582
Monitoring Year 0 - 2017

UT1 Reach 1 (STA 201+57 – 212+89) and UT1 Reach 2 (212+89 – 221+23)





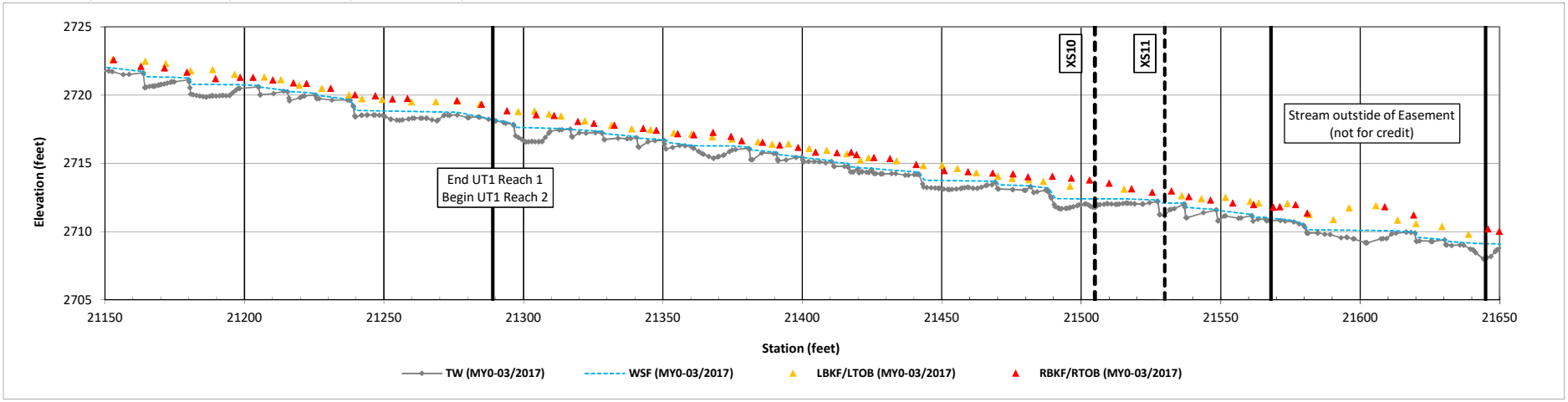
Longitudinal Profile Plots

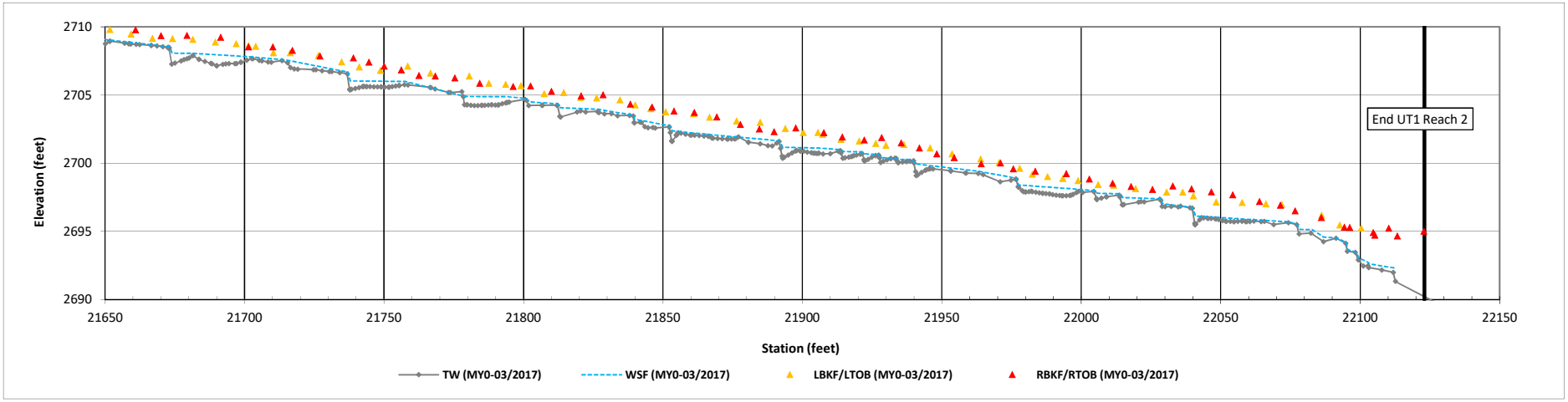
Vile Creek Mitigation Site

DMS Project No. 96582

Monitoring Year 0 - 2017

UT1 Reach 1 (STA 201+57 – 212+73) and UT1 Reach 2 (212+73 – 221+28)

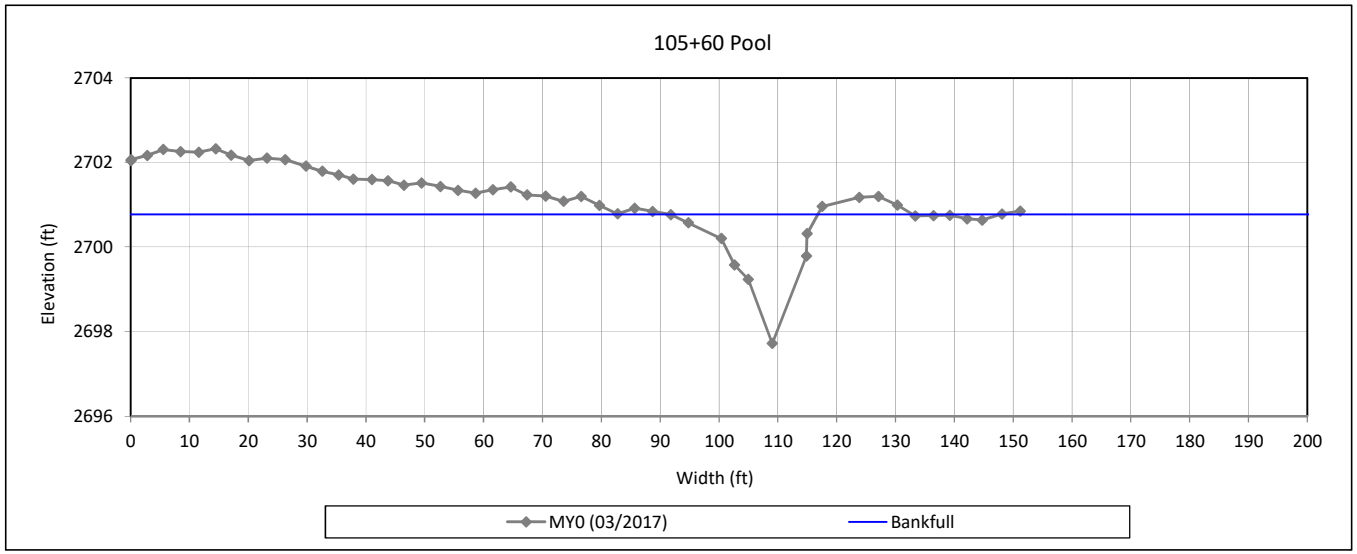




Cross-section Plots

Vile Creek Mitigation Site
DMS Project No. 96582
Monitoring Year 0 - 2017

Cross-section 1 - Vile Creek Reach 1



Bankfull Dimensions	
29.2	x-section area (ft.sq.)
25.1	width (ft)
1.2	mean depth (ft)
3.0	max depth (ft)
26.4	wetted perimeter (ft)
1.1	hydraulic radius (ft)
21.6	width-depth ratio

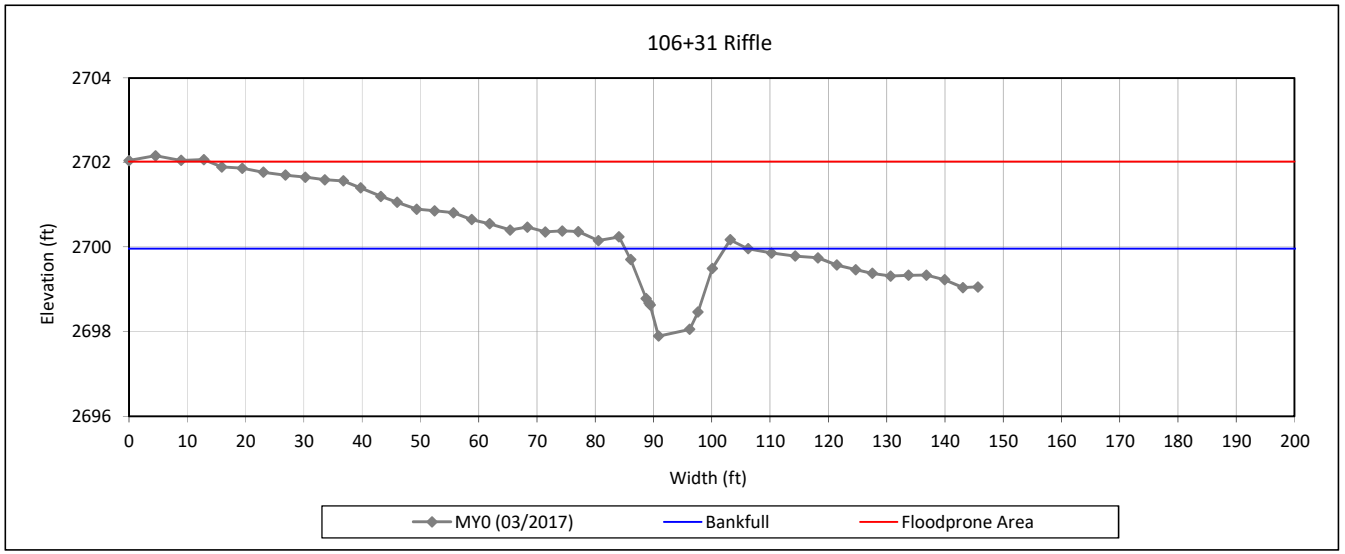
Survey Date: 03/2017
Field Crew: Kee Mapping and Surveying

View Downstream

Cross-section Plots

Vile Creek Mitigation Site
DMS Project No. 96582
Monitoring Year 0 - 2017

Cross-section 2 - Vile Creek Reach 1



Bankfull Dimensions	
21.2	x-section area (ft.sq.)
17.1	width (ft)
1.2	mean depth (ft)
2.1	max depth (ft)
17.8	wetted perimeter (ft)
1.2	hydraulic radius (ft)
13.7	width-depth ratio
>200	W flood prone area (ft)
>10.6	entrenchment ratio
1.1	low bank height ratio

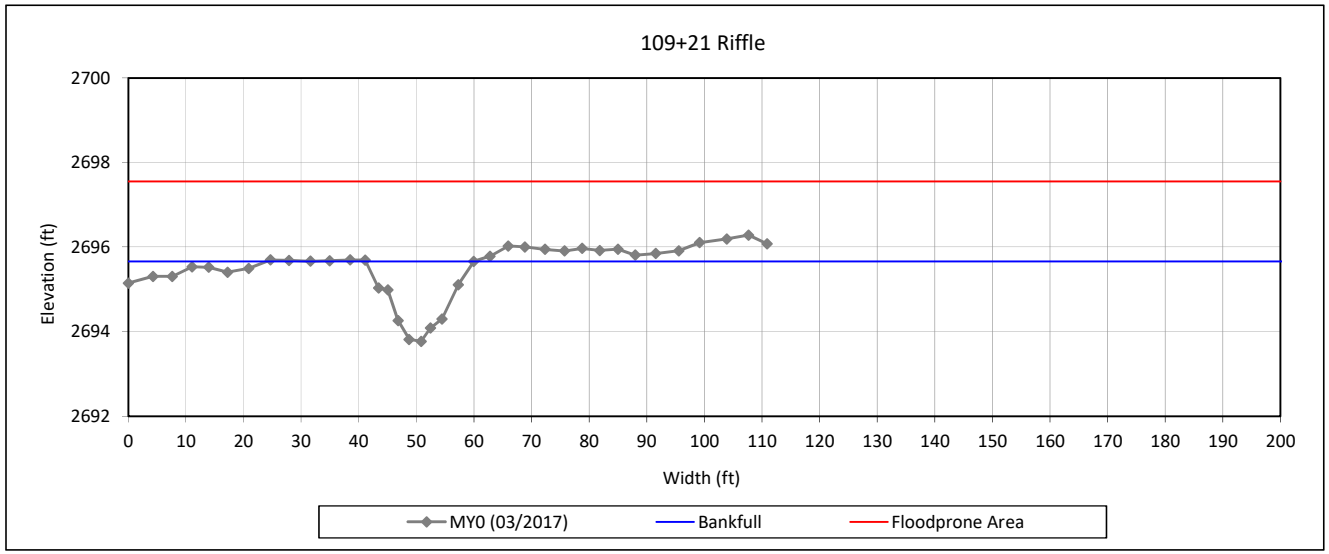
Survey Date: 03/2017
Field Crew: Kee Mapping and Surveying

View Downstream

Cross-section Plots

Vile Creek Mitigation Site
DMS Project No. 96582
Monitoring Year 0 - 2017

Cross-section 3 - Vile Creek Reach 1



Bankfull Dimensions	
19.8	x-section area (ft.sq.)
18.8	width (ft)
1.1	mean depth (ft)
1.9	max depth (ft)
19.3	wetted perimeter (ft)
1.0	hydraulic radius (ft)
17.8	width-depth ratio
>200	W flood prone area (ft)
>10.7	entrenchment ratio
1.0	low bank height ratio

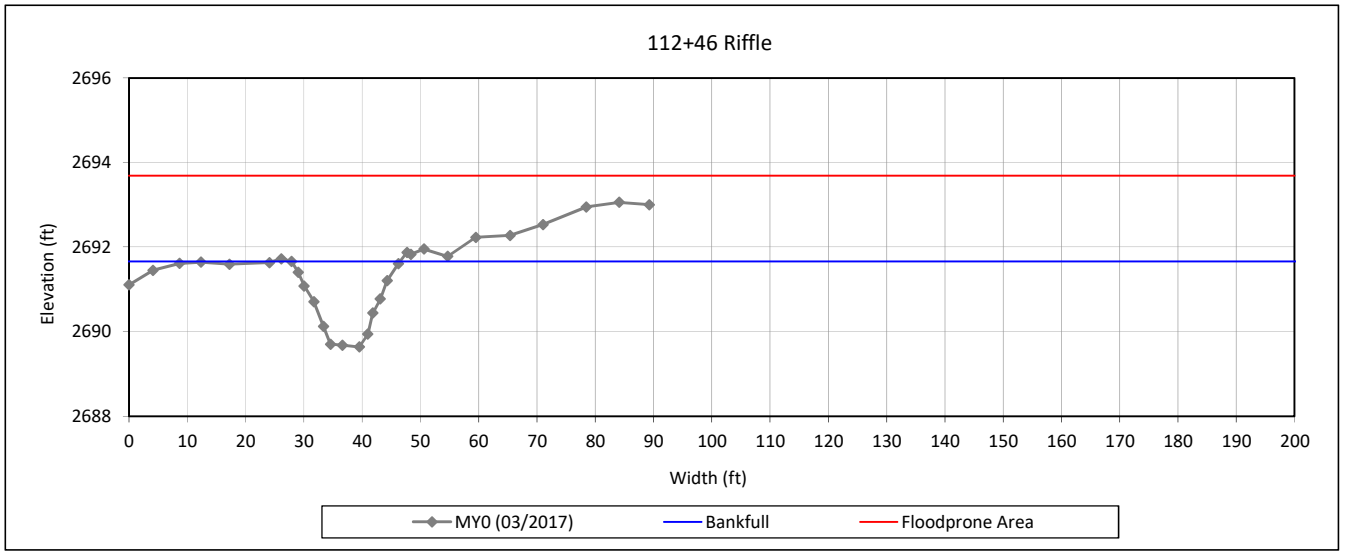
Survey Date: 03/2017
Field Crew: Kee Mapping and Surveying

View Downstream

Cross-section Plots

Vile Creek Mitigation Site
DMS Project No. 96582
Monitoring Year 0 - 2017

Cross-section 4 - Vile Creek Reach 2



Bankfull Dimensions	
22.5	x-section area (ft.sq.)
18.7	width (ft)
1.2	mean depth (ft)
2.0	max depth (ft)
19.3	wetted perimeter (ft)
1.2	hydraulic radius (ft)
15.5	width-depth ratio
188.0	W flood prone area (ft)
10.1	entrenchment ratio
1.0	low bank height ratio

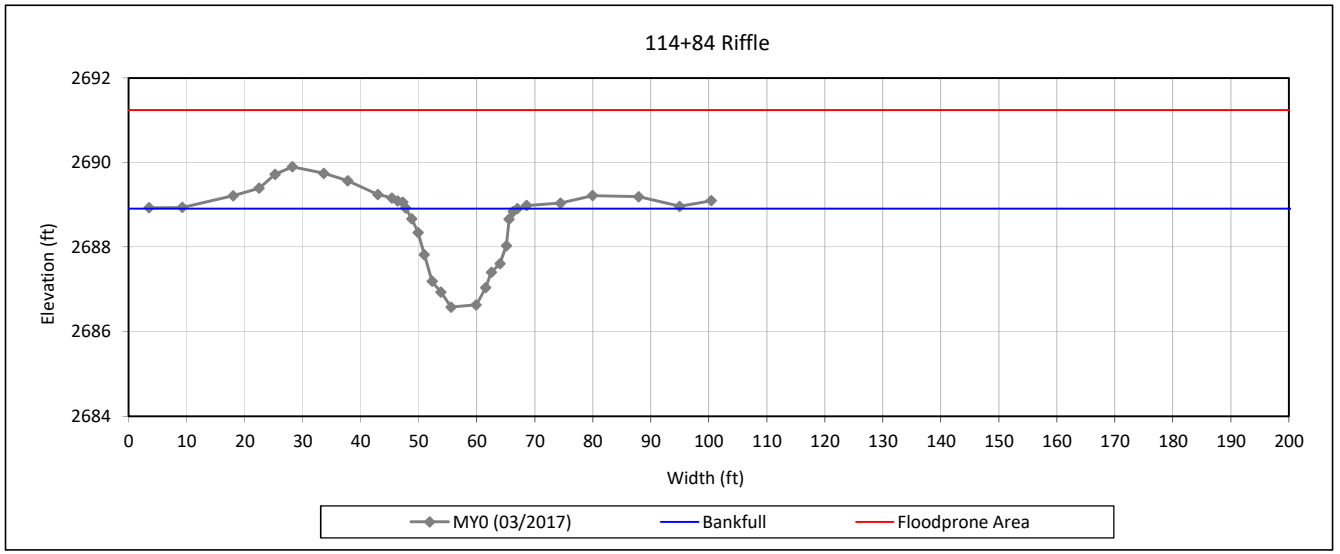
Survey Date: 03/2017
Field Crew: Kee Mapping and Surveying

View Downstream

Cross-section Plots

Vile Creek Mitigation Site
DMS Project No. 96582
Monitoring Year 0 - 2017

Cross-section 5 - Vile Creek Reach 2



Bankfull Dimensions	
28.6	x-section area (ft.sq.)
19.2	width (ft)
1.5	mean depth (ft)
2.3	max depth (ft)
20.2	wetted perimeter (ft)
1.4	hydraulic radius (ft)
12.9	width-depth ratio
156.0	W flood prone area (ft)
8.1	entrenchment ratio
1.0	low bank height ratio

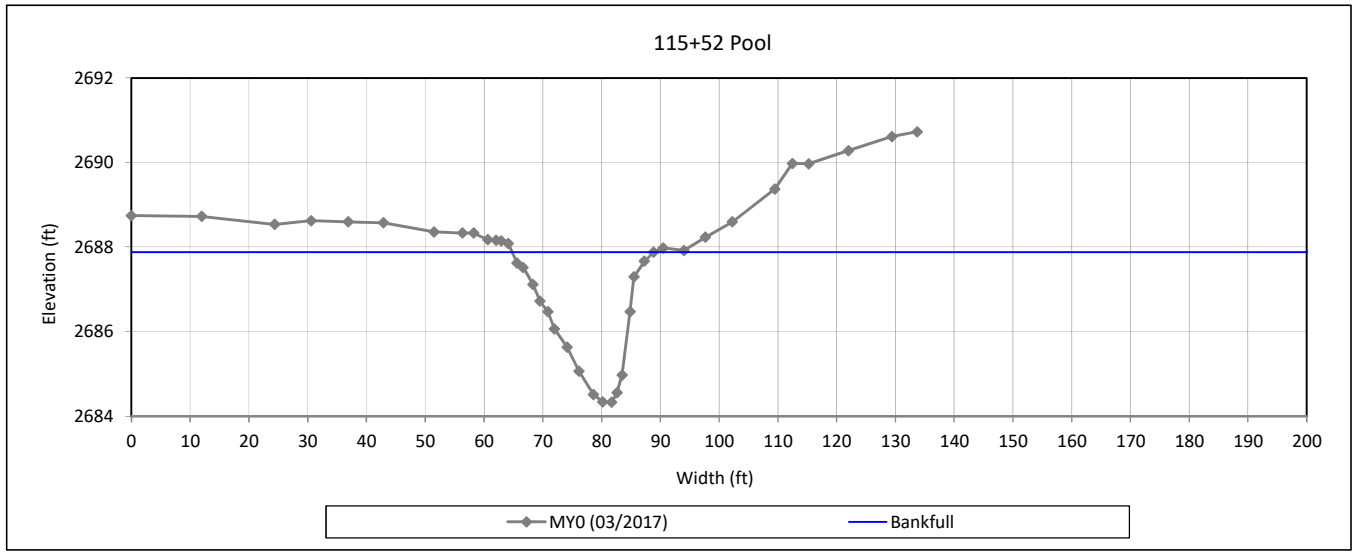
Survey Date: 03/2017
Field Crew: Kee Mapping and Surveying

View Downstream

Cross-section Plots

Vile Creek Mitigation Site
DMS Project No. 96582
Monitoring Year 0 - 2017

Cross-section 6 - Vile Creek Reach 2



Bankfull Dimensions	
44.3	x-section area (ft.sq.)
24.1	width (ft)
1.8	mean depth (ft)
3.6	max depth (ft)
25.8	wetted perimeter (ft)
1.7	hydraulic radius (ft)
13.1	width-depth ratio

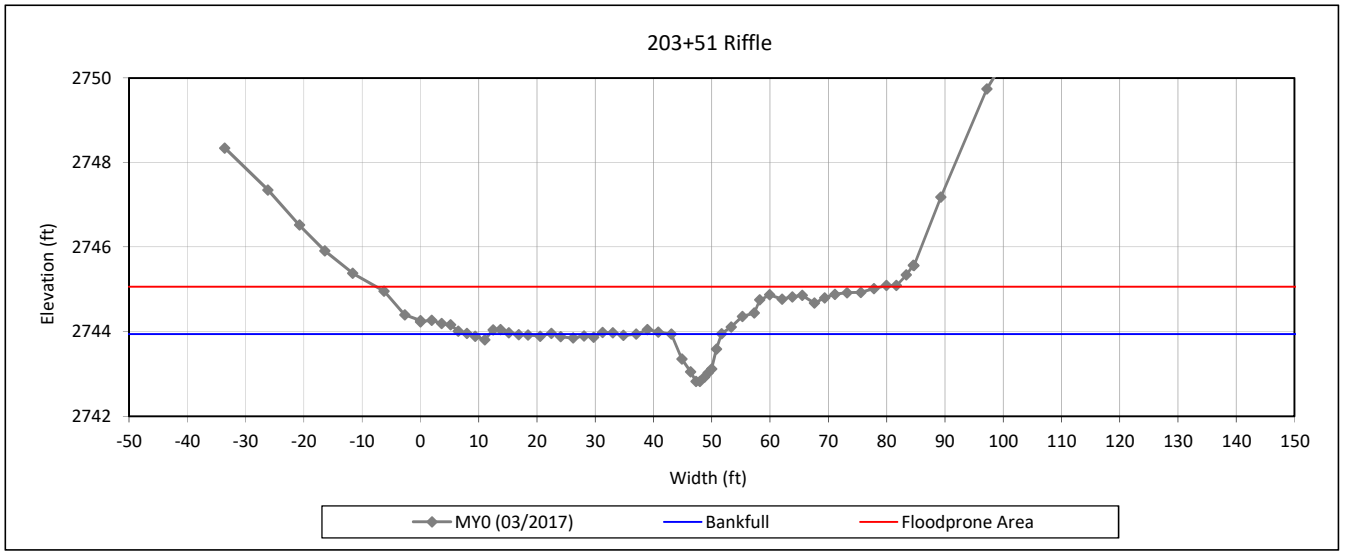
Survey Date: 03/2017
Field Crew: Kee Mapping and Surveying

View Downstream

Cross-section Plots

Vile Creek Mitigation Site
DMS Project No. 96582
Monitoring Year 0 - 2017

Cross-section 7 - UT1 Reach 1



Bankfull Dimensions	
5.9	x-section area (ft.sq.)
8.6	width (ft)
0.7	mean depth (ft)
1.1	max depth (ft)
8.9	wetted perimeter (ft)
0.7	hydraulic radius (ft)
12.4	width-depth ratio
63.0	W flood prone area (ft)*
7.3	entrenchment ratio
1.0	low bank height ratio

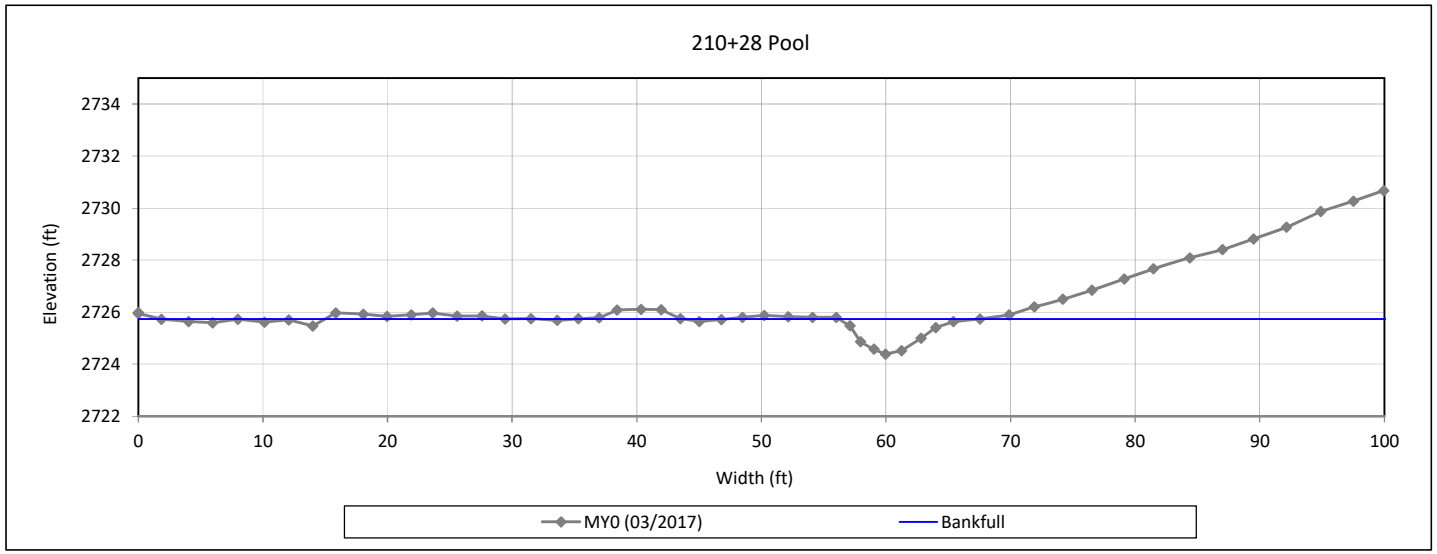
Survey Date: 03/2017
Field Crew: Kee Mapping and Surveying
*Wfpa measured in CAD

View Downstream

Cross-section Plots

Vile Creek Mitigation Site
DMS Project No. 96582
Monitoring Year 0 - 2017

Cross-section 8 - UT1 Reach 1



Bankfull Dimensions	
7.1	x-section area (ft.sq.)
11.3	width (ft)
0.6	mean depth (ft)
1.4	max depth (ft)
11.8	wetted perimeter (ft)
0.6	hydraulic radius (ft)
18.0	width-depth ratio

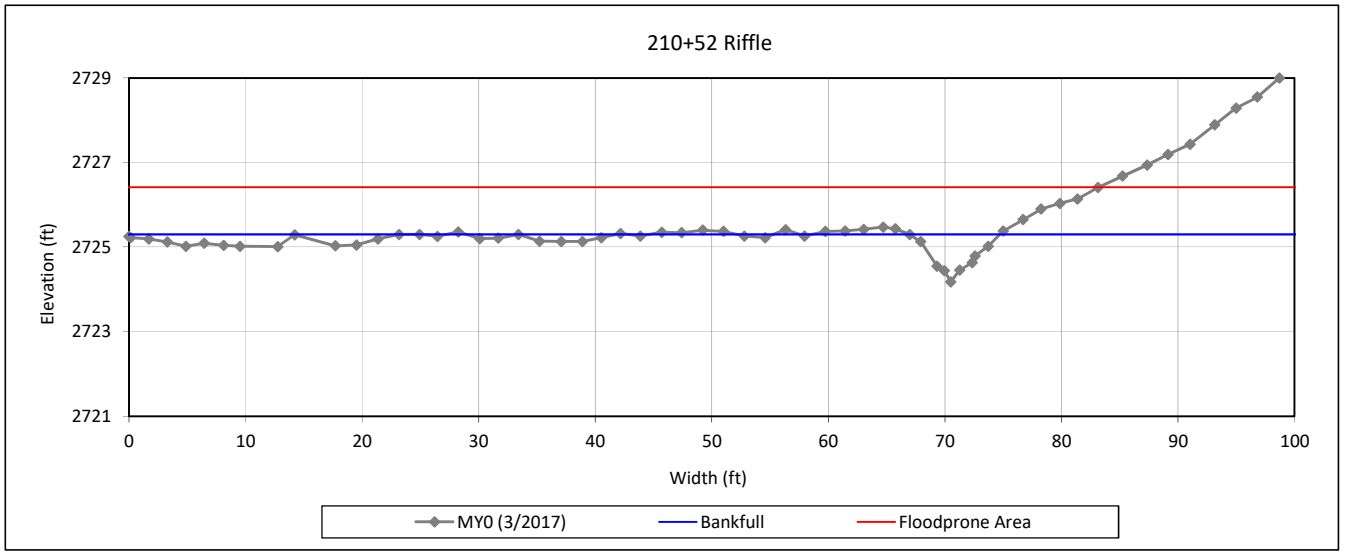
Survey Date: 03/2017
Field Crew: Kee Mapping and Surveying

View Downstream

Cross-section Plots

Vile Creek Mitigation Site
DMS Project No. 96582
Monitoring Year 0 - 2017

Cross-section 9 - UT1 Reach 1



Bankfull Dimensions	
4.1	x-section area (ft.sq.)
7.7	width (ft)
0.5	mean depth (ft)
1.1	max depth (ft)
8.1	wetted perimeter (ft)
0.5	hydraulic radius (ft)
14.7	width-depth ratio
97.0	W flood prone area (ft)
12.5	entrenchment ratio
1.0	low bank height ratio

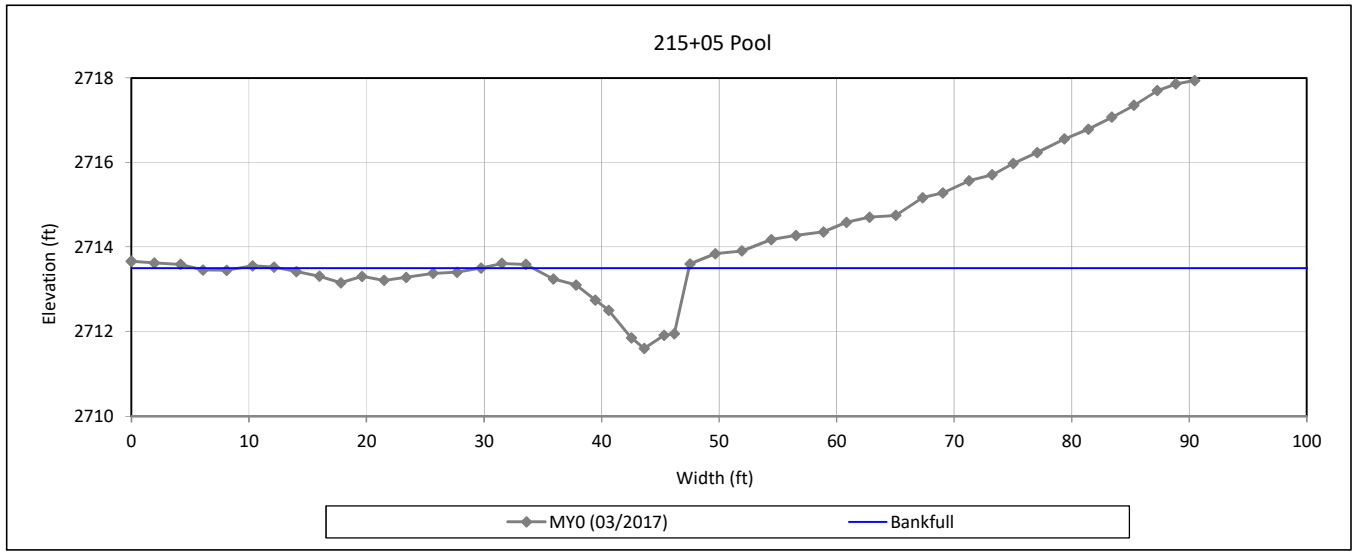
Survey Date: 03/2017
Field Crew: Kee Mapping and Surveying

View Downstream

Cross-section Plots

Vile Creek Mitigation Site
DMS Project No. 96582
Monitoring Year 0 - 2017

Cross-section 10 - UT1 Reach 2



Bankfull Dimensions	
12.6	x-section area (ft.sq.)
13.3	width (ft)
0.9	mean depth (ft)
1.9	max depth (ft)
14.3	wetted perimeter (ft)
0.9	hydraulic radius (ft)
14.0	width-depth ratio

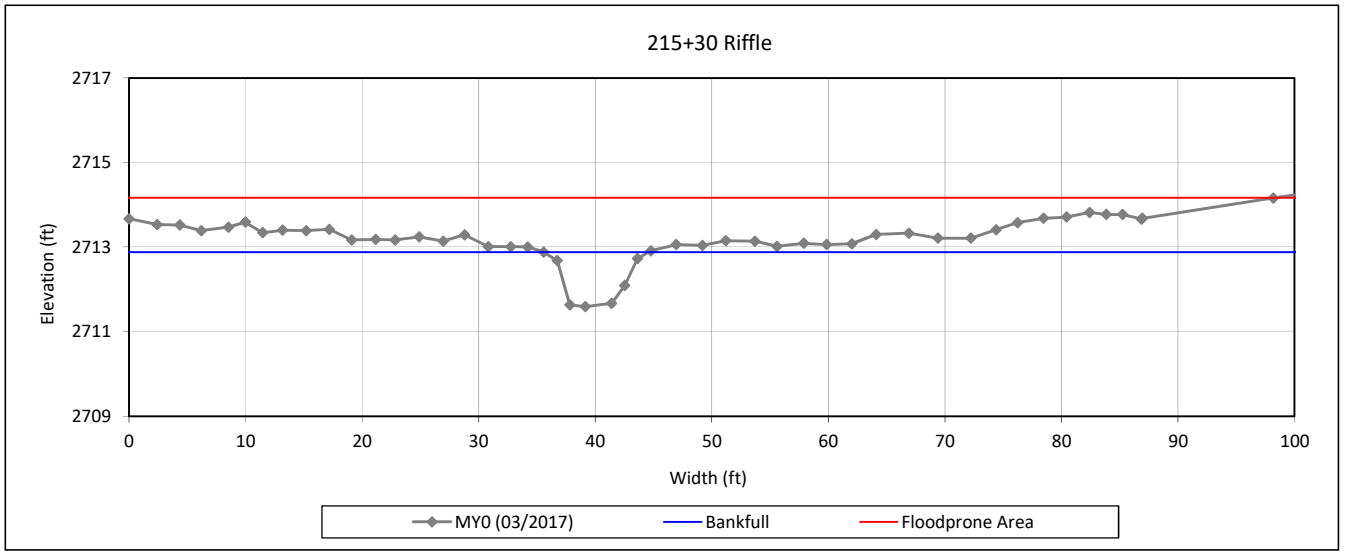
Survey Date: 03/2017
Field Crew: Kee Mapping and Surveying

View Downstream

Cross-section Plots

Vile Creek Mitigation Site
DMS Project No. 96582
Monitoring Year 0 - 2017

Cross-section 11 - UT1 Reach 2



Bankfull Dimensions	
7.1	x-section area (ft.sq.)
9.0	width (ft)
0.8	mean depth (ft)
1.3	max depth (ft)
9.7	wetted perimeter (ft)
0.7	hydraulic radius (ft)
11.4	width-depth ratio
96.0	W flood prone area (ft)
10.7	entrenchment ratio
1.0	low bank height ratio

Survey Date: 03/2017
Field Crew: Kee Mapping and Surveying

View Downstream

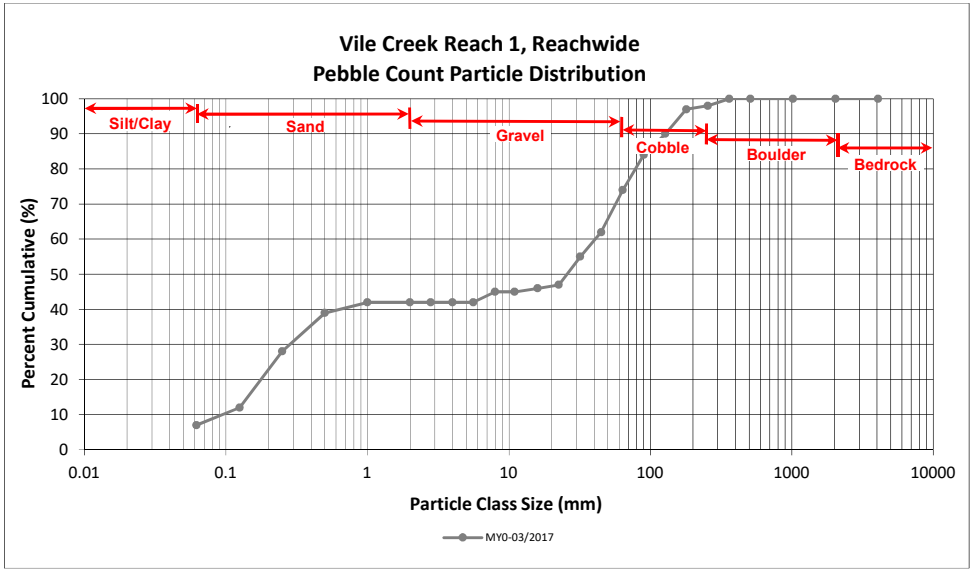
Reachwide and Cross-section Pebble Count Plots

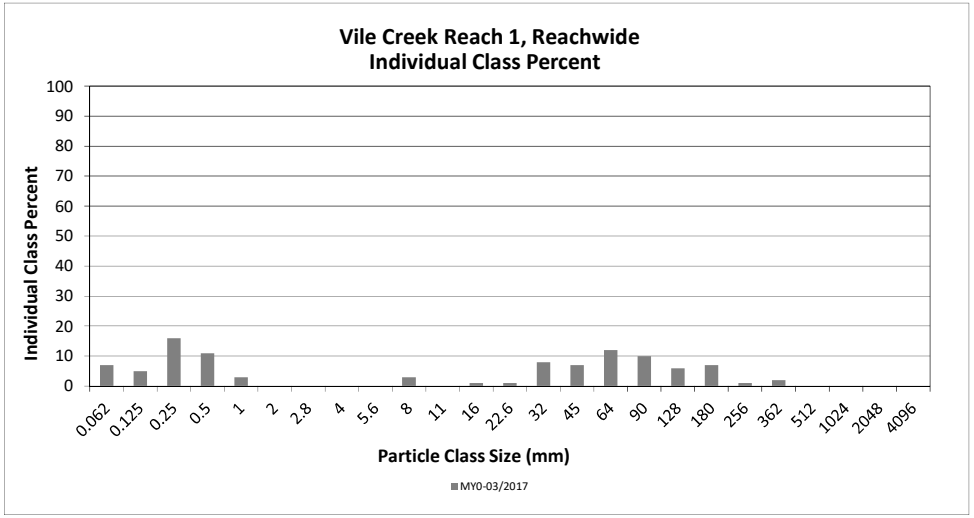
Vile Creek Restoration Site
DMS Project No. 96582
Monitoring Year 0 - 2017

Vile Creek Reach 1, 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	3	7	7	7
SAND	Very fine	0.062	0.125		5	5	5	12
	Fine	0.125	0.250		16	16	16	28
	Medium	0.25	0.50	1	10	11	11	39
	Coarse	0.5	1.0	1	2	3	3	42
	Very Coarse	1.0	2.0					42
GRAVEL	Very Fine	2.0	2.8					42
	Very Fine	2.8	4.0					42
	Fine	4.0	5.6					42
	Fine	5.6	8.0	2	1	3	3	45
	Medium	8.0	11.0					45
	Medium	11.0	16.0		1	1	1	46
	Coarse	16.0	22.6	1		1	1	47
	Coarse	22.6	32	6	2	8	8	55
	Very Coarse	32	45	4	3	7	7	62
	Very Coarse	45	64	11	1	12	12	74
COBBLE	Small	64	90	7	3	10	10	84
	Small	90	128	6		6	6	90
	Large	128	180	4	3	7	7	97
	Large	180	256	1		1	1	98
BOULDER	Small	256	362	2		2	2	100
	Small	362	512					100
	Medium	512	1024					100
	Large/Very Large	1024	2048					100
BEDROCK	Bedrock	2048	>2048					100
			Total	**50**	**50**	**100**	**100**	**100**

Reachwide	
Channel materials (mm)	
D_{16} =	0.15
D_{35} =	0.39
D_{50} =	25.7
D_{84} =	90.0
D_{95} =	163.3
D_{100} =	362.0





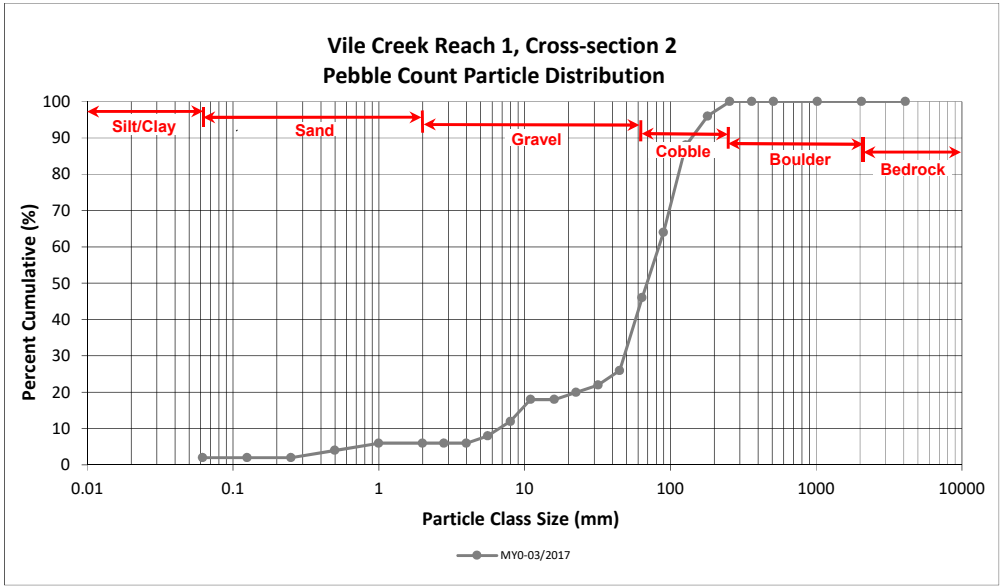
Reachwide and Cross-section Pebble Count Plots

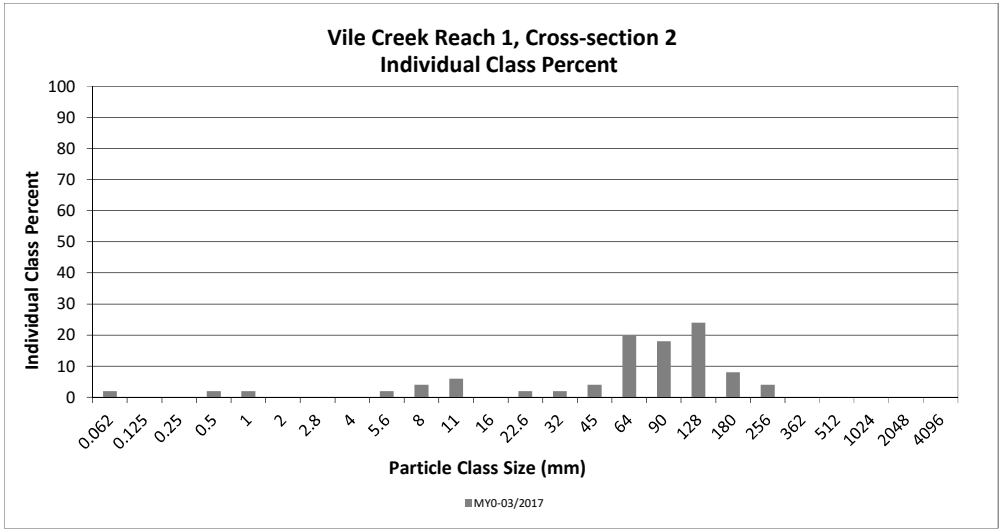
Vile Creek Restoration Site
DMS Project No. 96582
Monitoring Year 0 - 2017

Vile Creek Reach 1, 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	1	2	2
SAND	Very fine	0.062	0.125			2
	Fine	0.125	0.250			2
	Medium	0.25	0.50	1	2	4
	Coarse	0.5	1.0	1	2	6
	Very Coarse	1.0	2.0			6
GRAVEL	Very Fine	2.0	2.8			6
	Very Fine	2.8	4.0			6
	Fine	4.0	5.6	1	2	8
	Fine	5.6	8.0	2	4	12
	Medium	8.0	11.0	3	6	18
	Medium	11.0	16.0			18
	Coarse	16.0	22.6	1	2	20
	Coarse	22.6	32	1	2	22
	Very Coarse	32	45	2	4	26
	Very Coarse	45	64	10	20	46
COBBLE	Small	64	90	9	18	64
	Small	90	128	12	24	88
	Large	128	180	4	8	96
	Large	180	256	2	4	100
BOULDER	Small	256	362			100
	Small	362	512			100
	Medium	512	1024			100
	Large/Very Large	1024	2048			100
BEDROCK	Bedrock	2048	>2048			100
			Total	**50**	**100**	**100**

Cross-section 2	
Channel materials (mm)	
D_{16} =	9.89
D_{35} =	52.73
D_{50} =	69.0
D_{84} =	120.7
D_{95} =	172.5
D_{100} =	256.0





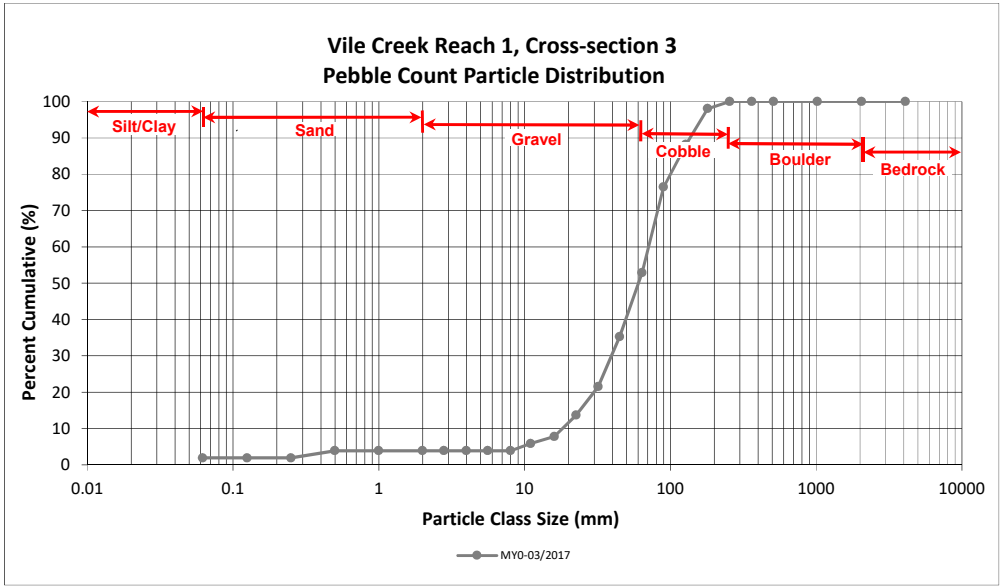
Reachwide and Cross-section Pebble Count Plots

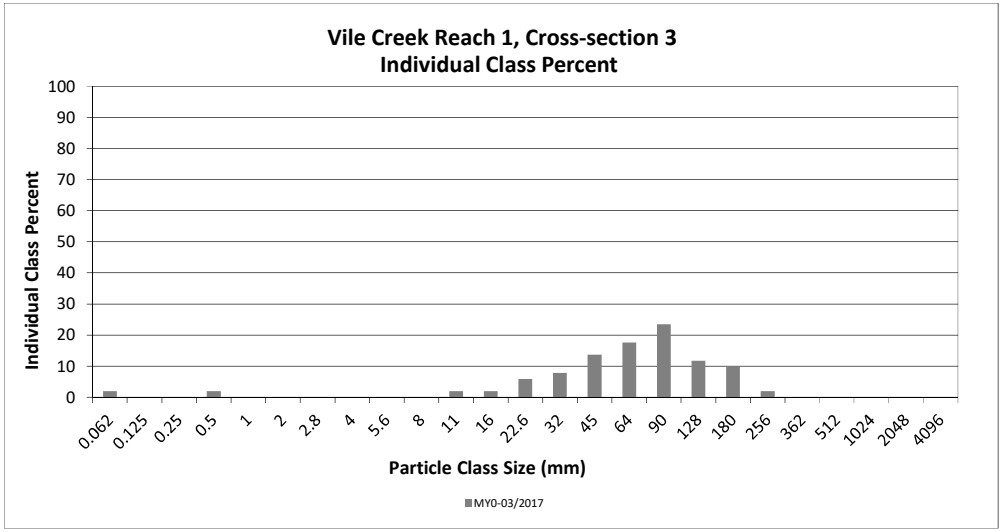
Vile Creek Restoration Site
DMS Project No. 96582
Monitoring Year 0 - 2017

Vile Creek Reach 1, 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	1	2	2
SAND	Very fine	0.062	0.125			2
	Fine	0.125	0.250			2
	Medium	0.25	0.50	1	2	4
	Coarse	0.5	1.0			4
	Very Coarse	1.0	2.0			4
GRAVEL	Very Fine	2.0	2.8			4
	Very Fine	2.8	4.0			4
	Fine	4.0	5.6			4
	Fine	5.6	8.0			4
	Medium	8.0	11.0	1	2	6
	Medium	11.0	16.0	1	2	8
	Coarse	16.0	22.6	3	6	14
	Coarse	22.6	32	4	8	22
	Very Coarse	32	45	7	14	35
	Very Coarse	45	64	9	18	53
COBBLE	Small	64	90	12	24	76
	Small	90	128	6	12	88
	Large	128	180	5	10	98
	Large	180	256	1	2	100
BOULDER	Small	256	362			100
	Small	362	512			100
	Medium	512	1024			100
	Large/Very Large	1024	2048			100
BEDROCK	Bedrock	2048	>2048			100
			Total	**51**	**100**	**100**

Cross-section 3	
Channel materials (mm)	
D_{16} =	25.00
D_{35} =	44.67
D_{50} =	60.4
D_{84} =	112.8
D_{95} =	161.9
D_{100} =	256.0





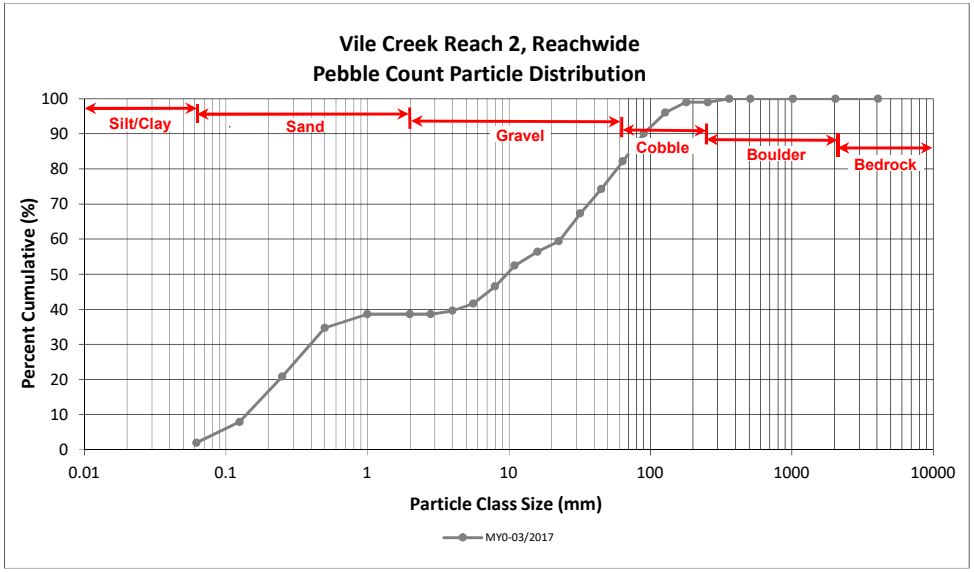
Reachwide and Cross-section Pebble Count Plots

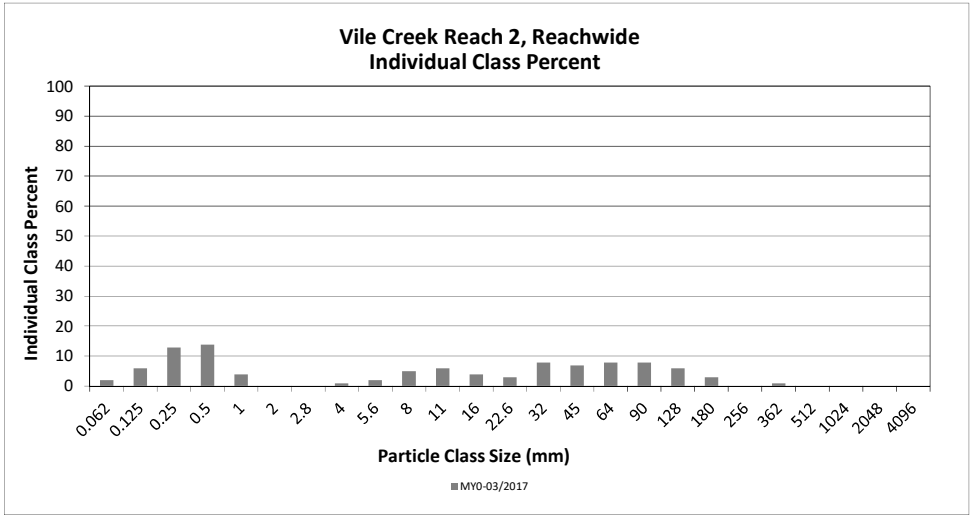
Vile Creek Restoration Site
DMS Project No. 96582
Monitoring Year 0 - 2017

Vile Creek Reach 2, Reachwide

Particle Class		Diameter (mm)		Particle Count			Reach Summary	
		min	max	Riffle	Pool	Total	Class Percentage	Percent Cumulative
SILT/CLAY	Silt/Clay	0.000	0.062	2		2	2	2
SAND	Very fine	0.062	0.125		6	6	6	8
	Fine	0.125	0.250		13	13	13	21
	Medium	0.25	0.50		14	14	14	35
	Coarse	0.5	1.0	2	2	4	4	39
	Very Coarse	1.0	2.0					39
GRAVEL	Very Fine	2.0	2.8					39
	Very Fine	2.8	4.0	1		1	1	40
	Fine	4.0	5.6	2		2	2	42
	Fine	5.6	8.0	2	3	5	5	47
	Medium	8.0	11.0	2	4	6	6	52
	Medium	11.0	16.0	2	2	4	4	56
	Coarse	16.0	22.6	2	1	3	3	59
	Coarse	22.6	32	8		8	8	67
	Very Coarse	32	45	5	2	7	7	74
	Very Coarse	45	64	7	1	8	8	82
COBBLE	Small	64	90	6	2	8	8	90
	Small	90	128	6		6	6	96
	Large	128	180	3		3	3	99
	Large	180	256					99
BOULDER	Small	256	362	1		1	1	100
	Small	362	512					100
	Medium	512	1024					100
	Large/Very Large	1024	2048					100
BEDROCK	Bedrock	2048	>2048					100
			Total	**51**	**50**	**101**	**100**	**100**

Reachwide	
Channel materials (mm)	
D_{16} =	0.19
D_{35} =	0.53
D_{50} =	9.6
D_{84} =	69.2
D_{95} =	120.3
D_{100} =	362.0





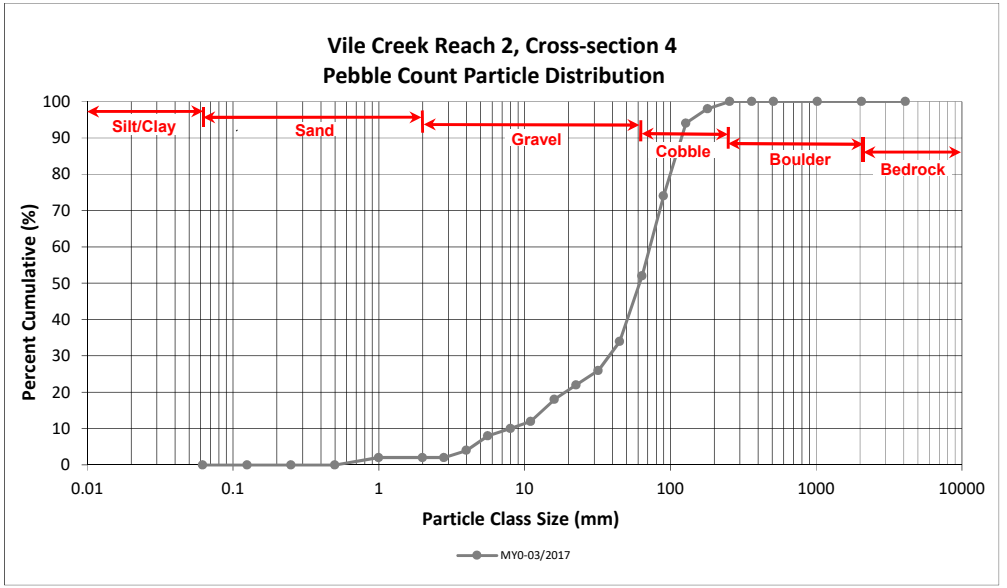
Reachwide and Cross-section Pebble Count Plots

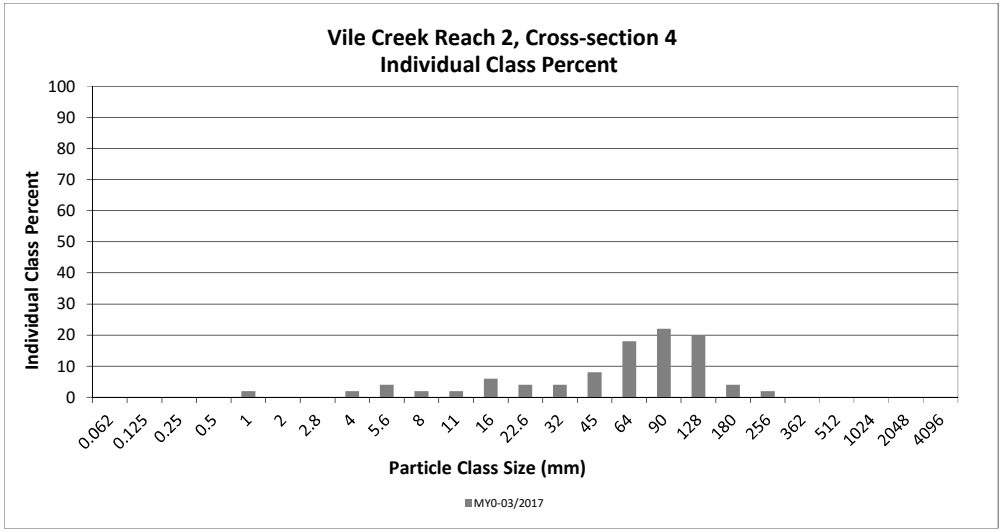
Vile Creek Restoration Site
DMS Project No. 96582
Monitoring Year 0 - 2017

Vile Creek Reach 2, Cross-section 4

Particle Class		Diameter (mm)		Riffle 100-Count	Summary	
		min	max		Class Percentage	Percent Cumulative
SILT/CLAY	Silt/Clay	0.000	0.062			0
SAND	Very fine	0.062	0.125			0
	Fine	0.125	0.250			0
	Medium	0.25	0.50			0
	Coarse	0.5	1.0	1	2	2
	Very Coarse	1.0	2.0			2
GRAVEL	Very Fine	2.0	2.8			2
	Very Fine	2.8	4.0	1	2	4
	Fine	4.0	5.6	2	4	8
	Fine	5.6	8.0	1	2	10
	Medium	8.0	11.0	1	2	12
	Medium	11.0	16.0	3	6	18
	Coarse	16.0	22.6	2	4	22
	Coarse	22.6	32	2	4	26
	Very Coarse	32	45	4	8	34
	Very Coarse	45	64	9	18	52
COBBLE	Small	64	90	11	22	74
	Small	90	128	10	20	94
	Large	128	180	2	4	98
	Large	180	256	1	2	100
BOULDER	Small	256	362			100
	Small	362	512			100
	Medium	512	1024			100
	Large/Very Large	1024	2048			100
BEDROCK	Bedrock	2048	>2048			100
			Total	**50**	**100**	**100**

Cross-section 4	
Channel materials (mm)	
D_{16} =	14.12
D_{35} =	45.89
D_{50} =	61.5
D_{84} =	107.3
D_{95} =	139.4
D_{100} =	256.0





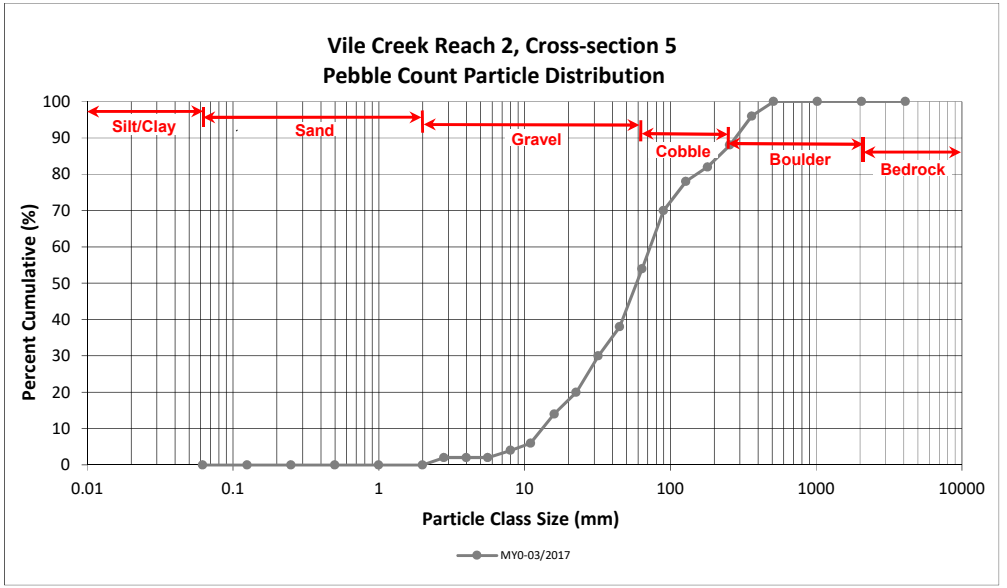
Reachwide and Cross-section Pebble Count Plots

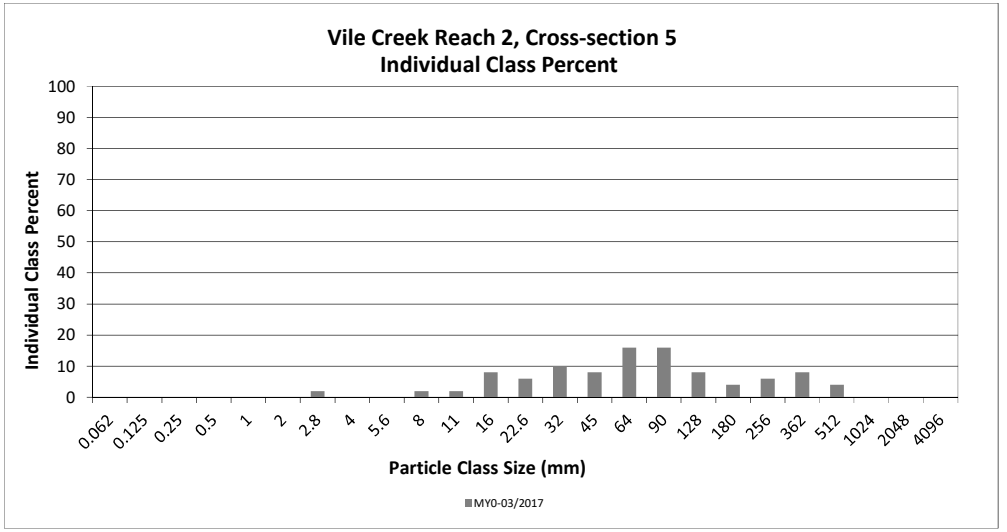
Vile Creek Restoration Site
DMS Project No. 96582
Monitoring Year 0 - 2017

Vile Creek Reach 2, Cross-section 5

Particle Class		Diameter (mm)		Riffle 100-Count	Summary	
		min	max		Class Percentage	Percent Cumulative
SILT/CLAY	Silt/Clay	0.000	0.062			0
SAND	Very fine	0.062	0.125			0
	Fine	0.125	0.250			0
	Medium	0.25	0.50			0
	Coarse	0.5	1.0			0
	Very Coarse	1.0	2.0			0
GRAVEL	Very Fine	2.0	2.8	1	2	2
	Very Fine	2.8	4.0			2
	Fine	4.0	5.6			2
	Fine	5.6	8.0	1	2	4
	Medium	8.0	11.0	1	2	6
	Medium	11.0	16.0	4	8	14
	Coarse	16.0	22.6	3	6	20
	Coarse	22.6	32	5	10	30
	Very Coarse	32	45	4	8	38
	Very Coarse	45	64	8	16	54
COBBLE	Small	64	90	8	16	70
	Small	90	128	4	8	78
	Large	128	180	2	4	82
	Large	180	256	3	6	88
BOULDER	Small	256	362	4	8	96
	Small	362	512	2	4	100
	Medium	512	1024			100
	Large/Very Large	1024	2048			100
BEDROCK	Bedrock	2048	>2048			100
			Total	**50**	**100**	**100**

Cross-section 5	
Channel materials (mm)	
D_{16} =	17.95
D_{35} =	39.60
D_{50} =	58.6
D_{84} =	202.4
D_{95} =	346.7
D_{100} =	512.0





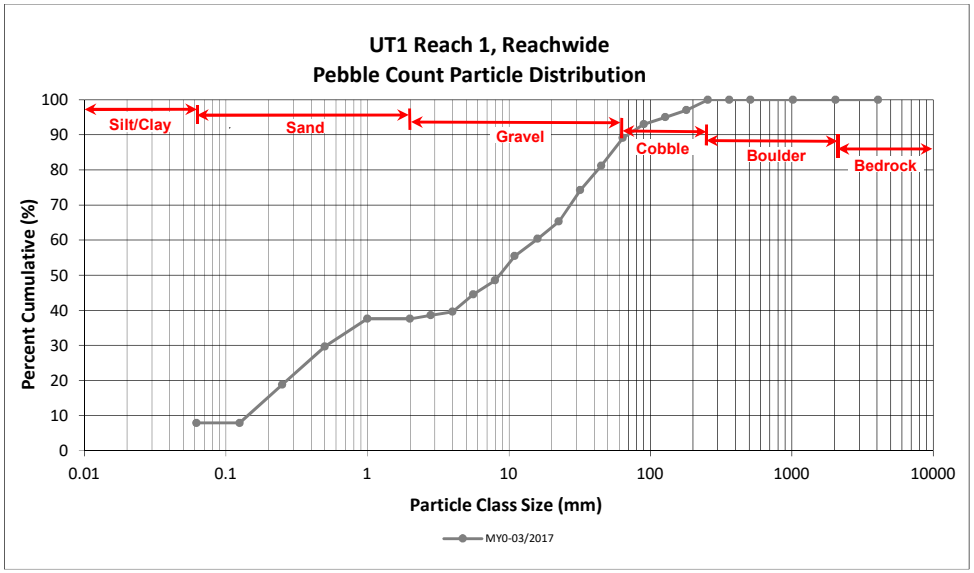
Reachwide and Cross-section Pebble Count Plots

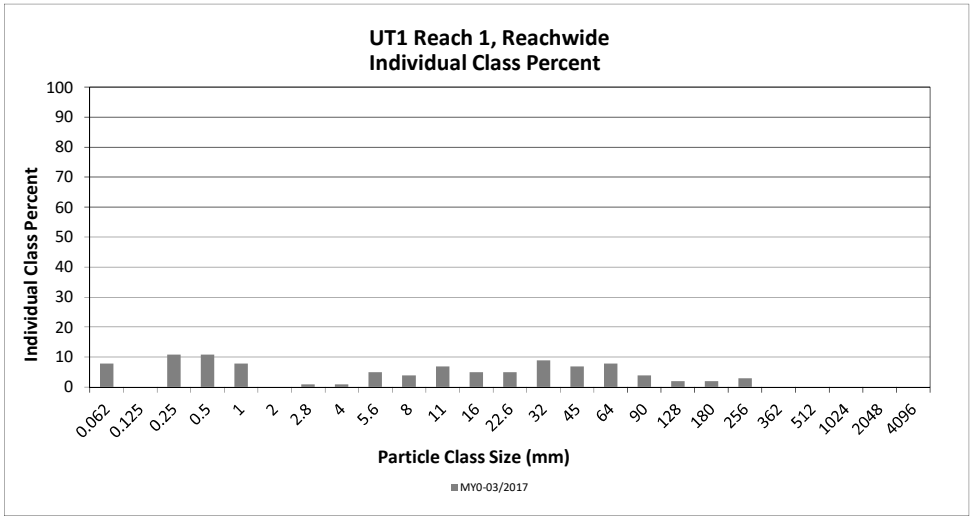
Vile Creek Restoration Site
DMS Project No. 96582
Monitoring Year 0 - 2017

UT1 Reach 1, Reachwide

Particle Class		Diameter (mm)		Particle Count			Reach Summary	
		min	max	Riffle	Pool	Total	Class Percentage	Percent Cumulative
SILT/CLAY	Silt/Clay	0.000	0.062	2	6	8	8	8
SAND	Very fine	0.062	0.125					8
	Fine	0.125	0.250	3	8	11	11	19
	Medium	0.25	0.50	1	10	11	11	30
	Coarse	0.5	1.0		8	8	8	38
	Very Coarse	1.0	2.0					38
GRAVEL	Very Fine	2.0	2.8	1		1	1	39
	Very Fine	2.8	4.0		1	1	1	40
	Fine	4.0	5.6	1	4	5	5	45
	Fine	5.6	8.0	1	3	4	4	49
	Medium	8.0	11.0	5	2	7	7	55
	Medium	11.0	16.0	1	4	5	5	60
	Coarse	16.0	22.6	4	1	5	5	65
	Coarse	22.6	32	9		9	9	74
	Very Coarse	32	45	7		7	7	81
	Very Coarse	45	64	7	1	8	8	89
COBBLE	Small	64	90	4		4	4	93
	Small	90	128	2		2	2	95
	Large	128	180	2		2	2	97
	Large	180	256	1	2	3	3	100
BOULDER	Small	256	362					100
	Small	362	512					100
	Medium	512	1024					100
	Large/Very Large	1024	2048					100
BEDROCK	Bedrock	2048	>2048					100
			Total	**51**	**50**	**101**	**100**	**100**

Reachwide	
Channel materials (mm)	
D_{16} =	0.21
D_{35} =	0.79
D_{50} =	8.6
D_{84} =	51.0
D_{95} =	126.9
D_{100} =	256.0





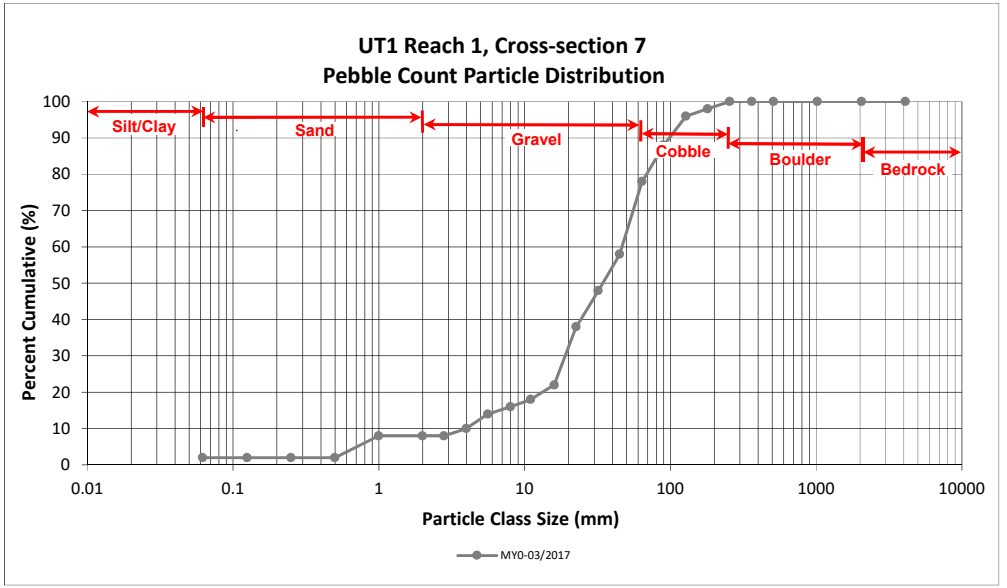
Reachwide and Cross-section Pebble Count Plots

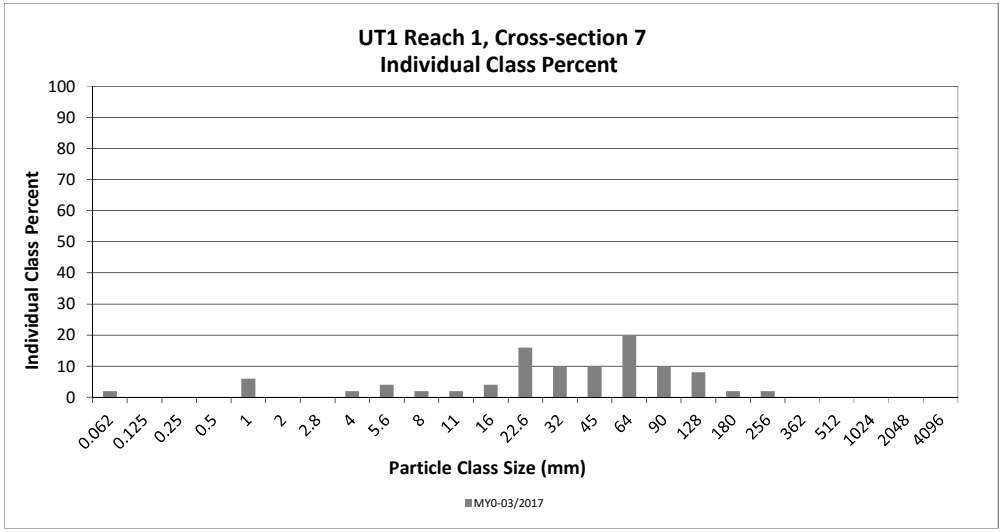
Vile Creek Restoration Site
DMS Project No. 96582
Monitoring Year 0 - 2017

UT1 Reach 1, 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	1	2	2
SAND	Very fine	0.062	0.125			2
	Fine	0.125	0.250			2
	Medium	0.25	0.50			2
	Coarse	0.5	1.0	3	6	8
	Very Coarse	1.0	2.0			8
GRAVEL	Very Fine	2.0	2.8			8
	Very Fine	2.8	4.0	1	2	10
	Fine	4.0	5.6	2	4	14
	Fine	5.6	8.0	1	2	16
	Medium	8.0	11.0	1	2	18
	Medium	11.0	16.0	2	4	22
	Coarse	16.0	22.6	8	16	38
	Coarse	22.6	32	5	10	48
	Very Coarse	32	45	5	10	58
	Very Coarse	45	64	10	20	78
COBBLE	Small	64	90	5	10	88
	Small	90	128	4	8	96
	Large	128	180	1	2	98
	Large	180	256	1	2	100
BOULDER	Small	256	362			100
	Small	362	512			100
	Medium	512	1024			100
	Large/Very Large	1024	2048			100
BEDROCK	Bedrock	2048	>2048			100
			Total	**50**	**100**	**100**

Cross-section 7	
Channel materials (mm)	
D_{16} =	8.00
D_{35} =	21.18
D_{50} =	34.3
D_{84} =	78.5
D_{95} =	122.5
D_{100} =	256.0





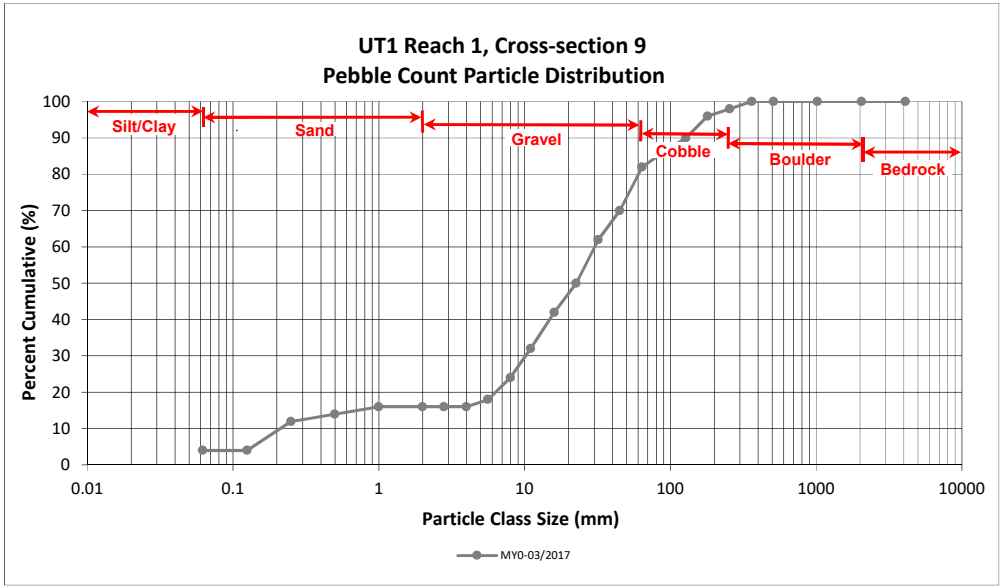
Reachwide and Cross-section Pebble Count Plots

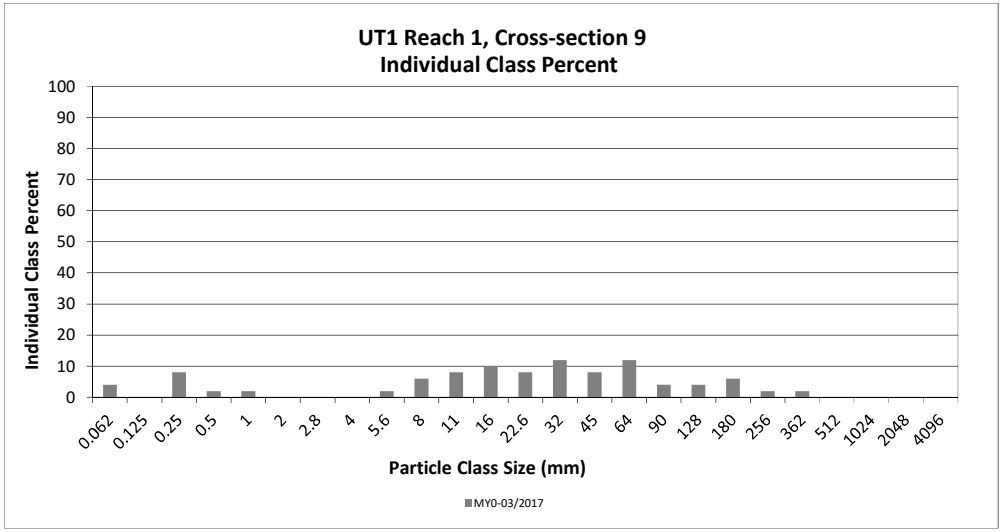
Vile Creek Restoration Site
DMS Project No. 96582
Monitoring Year 0 - 2017

UT1 Reach 1, Cross-section 9

Particle Class		Diameter (mm)		Riffle 100-Count	Summary	
		min	max		Class Percentage	Percent Cumulative
SILT/CLAY	Silt/Clay	0.000	0.062	2	4	4
SAND	Very fine	0.062	0.125			4
	Fine	0.125	0.250	4	8	12
	Medium	0.25	0.50	1	2	14
	Coarse	0.5	1.0	1	2	16
	Very Coarse	1.0	2.0			16
GRAVEL	Very Fine	2.0	2.8			16
	Very Fine	2.8	4.0			16
	Fine	4.0	5.6	1	2	18
	Fine	5.6	8.0	3	6	24
	Medium	8.0	11.0	4	8	32
	Medium	11.0	16.0	5	10	42
	Coarse	16.0	22.6	4	8	50
	Coarse	22.6	32	6	12	62
	Very Coarse	32	45	4	8	70
	Very Coarse	45	64	6	12	82
COBBLE	Small	64	90	2	4	86
	Small	90	128	2	4	90
	Large	128	180	3	6	96
	Large	180	256	1	2	98
BOULDER	Small	256	362	1	2	100
	Small	362	512			100
	Medium	512	1024			100
	Large/Very Large	1024	2048			100
BEDROCK	Bedrock	2048	>2048			100
			Total	**50**	**100**	**100**

Cross-section 9	
Channel materials (mm)	
D_{16} =	1.00
D_{35} =	12.31
D_{50} =	22.6
D_{84} =	75.9
D_{95} =	170.1
D_{100} =	362.0





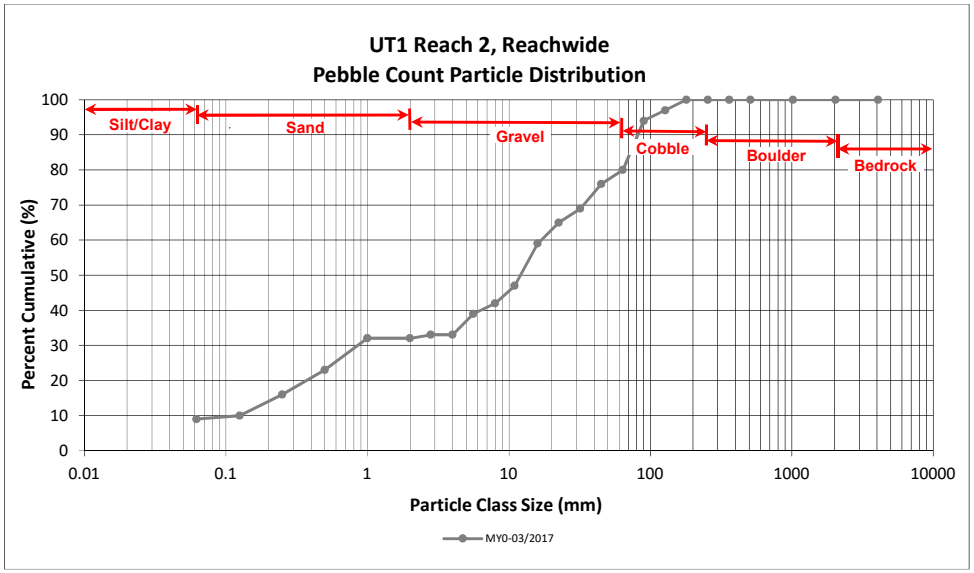
Reachwide and Cross-section Pebble Count Plots

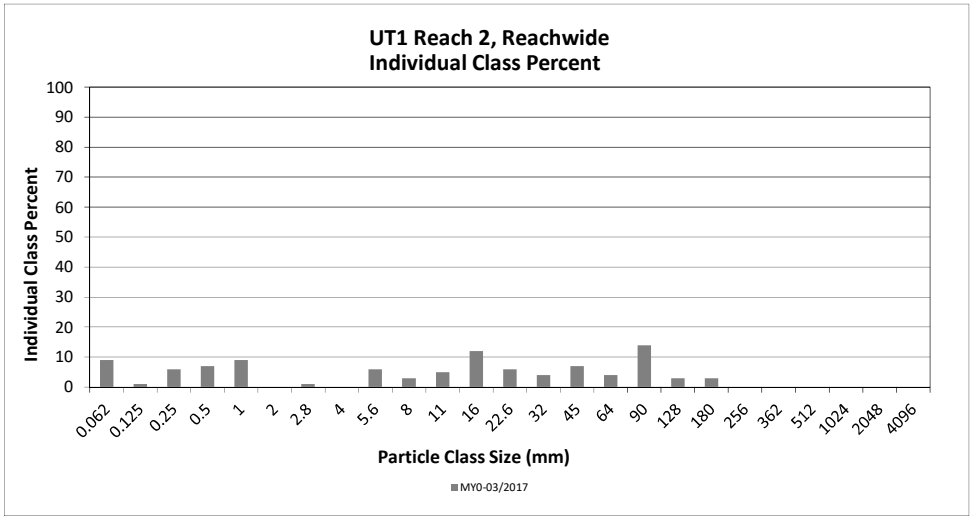
Vile Creek Restoration Site
DMS Project No. 96582
Monitoring Year 0 - 2017

UT1 Reach 2, Reachwide

Particle Class		Diameter (mm)		Particle Count			Reach Summary	
		min	max	Riffle	Pool	Total	Class Percentage	Percent Cumulative
SILT/CLAY	Silt/Clay	0.000	0.062	2	7	9	9	9
SAND	Very fine	0.062	0.125		1	1	1	10
	Fine	0.125	0.250	3	3	6	6	16
	Medium	0.25	0.50	1	6	7	7	23
	Coarse	0.5	1.0	1	8	9	9	32
	Very Coarse	1.0	2.0					32
GRAVEL	Very Fine	2.0	2.8	1		1	1	33
	Very Fine	2.8	4.0					33
	Fine	4.0	5.6	1	5	6	6	39
	Fine	5.6	8.0	2	1	3	3	42
	Medium	8.0	11.0	2	3	5	5	47
	Medium	11.0	16.0	4	8	12	12	59
	Coarse	16.0	22.6	2	4	6	6	65
	Coarse	22.6	32	4		4	4	69
	Very Coarse	32	45	6	1	7	7	76
	Very Coarse	45	64	3	1	4	4	80
COBBLE	Small	64	90	12	2	14	14	94
	Small	90	128	3		3	3	97
	Large	128	180	3		3	3	100
	Large	180	256					100
BOULDER	Small	256	362					100
	Small	362	512					100
	Medium	512	1024					100
	Large/Very Large	1024	2048					100
BEDROCK	Bedrock	2048	>2048					100
			Total	**50**	**50**	**100**	**100**	**100**

Reachwide	
Channel materials (mm)	
D_{16} =	0.25
D_{35} =	4.47
D_{50} =	12.1
D_{84} =	70.5
D_{95} =	101.2
D_{100} =	180.0





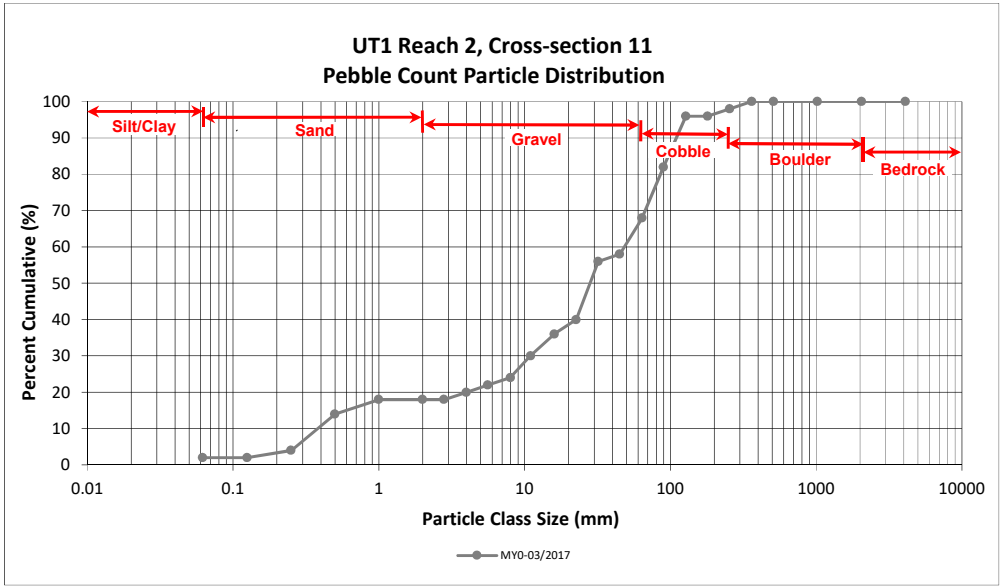
Reachwide and Cross-section Pebble Count Plots

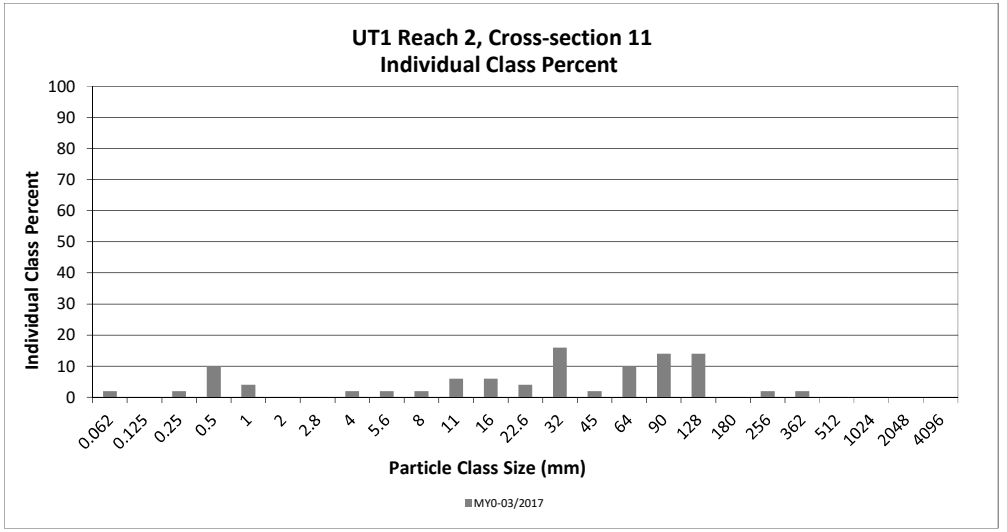
Vile Creek Restoration Site
DMS Project No. 96582
Monitoring Year 0 - 2017

UT1 Reach 2, Cross-section 11

Particle Class		Diameter (mm)		Riffle 100-Count	Summary	
		min	max		Class Percentage	Percent Cumulative
SILT/CLAY	Silt/Clay	0.000	0.062	1	2	2
SAND	Very fine	0.062	0.125			2
	Fine	0.125	0.250	1	2	4
	Medium	0.25	0.50	5	10	14
	Coarse	0.5	1.0	2	4	18
	Very Coarse	1.0	2.0			18
GRAVEL	Very Fine	2.0	2.8			18
	Very Fine	2.8	4.0	1	2	20
	Fine	4.0	5.6	1	2	22
	Fine	5.6	8.0	1	2	24
	Medium	8.0	11.0	3	6	30
	Medium	11.0	16.0	3	6	36
	Coarse	16.0	22.6	2	4	40
	Coarse	22.6	32	8	16	56
	Very Coarse	32	45	1	2	58
	Very Coarse	45	64	5	10	68
COBBLE	Small	64	90	7	14	82
	Small	90	128	7	14	96
	Large	128	180			96
	Large	180	256	1	2	98
BOULDER	Small	256	362	1	2	100
	Small	362	512			100
	Medium	512	1024			100
	Large/Very Large	1024	2048			100
BEDROCK	Bedrock	2048	>2048			100
			Total	**50**	**100**	**100**

Cross-section 11	
Channel materials (mm)	
D_{16} =	0.71
D_{35} =	15.03
D_{50} =	28.1
D_{84} =	94.6
D_{95} =	124.8
D_{100} =	362.0





Stream Photographs

	
Photo Point 1 – view upstream Vile Creek R1 *(3/6/2017)*	**Photo Point 1** – view downstream Vile Creek R1 *(3/6/2017)*
	
Photo Point 2 – view upstream Vile Creek R1 *(3/6/2017)*	**Photo Point 2** – view downstream Vile Creek R1 *(3/6/2017)*
	
Photo Point 3 – view upstream Vile Creek R1 *(3/6/2017)*	**Photo Point 3** – view downstream Vile Creek R1 (*3/6/2017)*

	
Photo Point 4 – view upstream Vile Creek R1 *(3/6/2017)*	**Photo Point 4** – view downstream Vile Creek R1 *(3/6/2017)*
	
Photo Point 5 – view upstream Vile Creek R1 *(3/6/2017)*	**Photo Point 5** – view downstream Vile Creek R1 *(3/6/2017)*
	
Photo Point 6 – view upstream Vile Creek R1 *(3/6/2017)*	**Photo Point 6** – view downstream Vile Creek R1 *(3/6/2017)*

	
Photo Point 7 – view upstream Vile Creek R1 *(3/6/2017)*	**Photo Point 7** – view downstream Vile Creek R1 *(3/6/2017)*
	
Photo Point 8 – view upstream Vile Creek R1 *(3/6/2017)*	**Photo Point 8** – view downstream Vile Creek R1 *(3/6/2017)*
	
Photo Point 9 – view upstream Vile Creek R1 *(3/6/2017)*	**Photo Point 9** – view downstream Vile Creek R1 *(3/6/2017)*

	
Photo Point 10 – view upstream Vile Creek R2 *(3/6/2017)*	**Photo Point 10** –view downstream Vile Creek R2 *(3/6/2017)*
	
Photo Point 11 – view upstream Vile Creek R2 *(3/6/2017)*	**Photo Point 11** –view downstream Vile Creek R2 *(3/6/2017)*
	
Photo Point 12 – view upstream Vile Creek R2 *(3/6/2017)*	**Photo Point 12** –view downstream Vile Creek R2 *(3/6/2017)*

	
Photo Point 13 – view upstream Vile Creek R2 *(3/6/2017)*	**Photo Point 13** –view downstream Vile Creek R2 *(3/6/2017)*
	
Photo Point 14 – view upstream Vile Creek R2 *(3/6/2017)*	**Photo Point 14** – view downstream Vile Creek R2 *(3/6/2017)*
	
Photo Point 15 – view upstream Vile Creek R2 *(3/6/2017)*	**Photo Point 15** – view downstream Vile Creek R2 *(3/6/2017)*

	
Photo Point 16 – view upstream Vile Creek R2 *(3/6/2017)*	**Photo Point 16** – view downstream Vile Creek R2 *(3/6/2017)*
	
Photo Point 17 – view upstream Vile Creek R2 *(3/6/2017)*	**Photo Point 17** – view downstream Vile Creek R2 *(3/6/2017)*
	
Photo Point 18 – view upstream Vile Creek R2 *(3/6/2017)*	**Photo Point 18** – view downstream Vile Creek R2 *(3/6/2017)*

	
Photo Point 19 – view upstream Vile Creek R3 *(3/6/2017)*	**Photo Point 19** – view downstream Vile Creek R3 *(3/6/2017)*
	
Photo Point 20 – view upstream Vile Creek R3 *(3/6/2017)*	**Photo Point 20** – view downstream Vile Creek R3 *(3/6/2017)*
	
Photo Point 21 – view upstream Vile Creek R3 *(3/6/2017)*	**Photo Point 21** – view downstream Vile Creek R3 *(3/6/2017)*

	
Photo Point 22 – view upstream Vile Creek R3 *(3/6/2017)*	**Photo Point 22** – view downstream Vile Creek R3 *(3/6/2017)*
	
Photo Point 23 – view upstream Little River *(3/6/2017)*	**Photo Point 23** – view downstream Little River *(3/6/2017)*
	
Photo Point 24 – view upstream UT1 R1 *(3/7/2017)*	**Photo Point 24** – view downstream UT1 R1 *(3/7/2017)*

	
Photo Point 25 – view upstream UT1 R1 (3/7/2017)	**Photo Point 25** – view downstream UT1 R1 (3/7/2017)
	
Photo Point 26 – view upstream UT1 R1 (3/7/2017)	**Photo Point 26** – view downstream UT1 R1 (3/7/2017)
	
Photo Point 27 – view upstream UT1 R1 (3/7/2017)	**Photo Point 27** – view downstream UT1 R1 (3/7/2017)

	
Photo Point 28 – view upstream UT1 R2 *(3/7/2017)*	**Photo Point 28** – view downstream UT1 R2 *(3/7/2017)*
	
Photo Point 29 – view upstream UT1 R2 *(3/7/2017)*	**Photo Point 29** – view downstream UT1 R2 *(3/7/2017)*
	
Photo Point 30 – view upstream UT1 R2 *(3/7/2017)*	**Photo Point 30** – view downstream UT1 R2 *(3/7/2017)*

Photo Point 31 – view upstream UT2 *(3/6/2017)*

Photo Point 31 – view downstream UT2 *(3/6/2017)*

Photo Point 31 – view of UT2 BMP *(3/6/2017)*

Photo Point 32 – view upstream UT2 *(3/6/2017)*

Photo Point 32 – view downstream UT2 *(3/6/2017)*

	
Photo Point 33 – view upstream UT2 *(3/6/2017)*	**Photo Point 33** – view downstream UT2 *(3/6/2017)*
	
Photo Point 34 – view upstream UT3 *(3/6/2017)*	**Photo Point 34** – view downstream UT3 *(3/6/2017)*
	
Photo Point 35 – view upstream UT3 *(3/6/2017)*	**Photo Point 35** – view downstream UT3 *(3/6/2017)*

Photo Point 36 –stormwater wetland *(5/3/2017)*

APPENDIX 3. Vegetation Plot Data

Table 8. Planted and Total Stem Counts

Vile Creek Mitigation Site
DMS Project No.96582
Monitoring Year 0 - 2017

			Current Plot Data (MY0 2017)																				
			Vegetation Plot 1			Vegetation Plot 2			Vegetation Plot 3			Vegetation Plot 4			Vegetation Plot 5			Vegetation Plot 6			Vegetation Plot 7		
Scientific Name	Common Name	Species Type	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T
Aronia arbutifolia	Red chokeberry	Shrub Tree	1	1	1																		
Betula nigra	River birch	Tree										3	3	3	1	1	1	4	4	4	1	1	1
Carpinus caroliniana	Ironwood	Shrub Tree										1	1	1	1	1	1	2	2	2	1	1	1
Cephalanthus occidentalis	Buttonbush	Shrub Tree	6	6	6	7	7	7	1	1	1												
Cornus amomum	Silky dogwood	Tree	1	1	1	3	3	3	14	14	14	1	1	1									
Diospyros virginiana	American persimmon	Tree													1	1	1				2	2	2
Fraxinus pennsylvanica	Green ash	Tree										3	3	3	4	4	4	2	2	2	7	7	7
Lindera benzoin	Northern spicebush	Shrub Tree	7	7	7	7	7	7															
Liriodendron tulipifera	Tulip poplar	Tree										2	2	2	3	3	3	4	4	4	2	2	2
Platanus occidentalis	Sycamore	Tree										4	4	4	2	2	2	3	3	3	2	2	2
Quercus pagoda	Cherrybark Oak	Tree										2	2	2	3	3	3	3	3	3	3	3	3
Stem count			15	15	15	17	17	17	15	15	15	16	16	16	15	15	15	18	18	18	18	18	18
size (ares)			1			1			1			1			1			1			1		
size (ACRES)			0.02			0.02			0.02			0.02			0.02			0.02			0.02		
Species count			4	4	4	3	3	3	2	2	2	7	7	7	7	7	7	6	6	6	7	7	7
Stems per ACRE			607	607	607	688	688	688	607	607	607	647	647	647	607	607	607	728	728	728	728	728	728

			Current Plot Data (MY0 2017)																				
			Vegetation Plot 8			Vegetation Plot 9			Vegetation Plot 10			Vegetation Plot 11			Vegetation Plot 12			Vegetation Plot 13			Vegetation Plot 14		
Scientific Name	Common Name	Species Type	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T
Aronia arbutifolia	Red chokeberry	Shrub Tree																					
Betula nigra	River birch	Tree				5	5	5	4	4	4	4	4	4	2	2	2	2	2	2	6	6	6
Carpinus caroliniana	Ironwood	Shrub Tree				3	3	3				3	3	3	1	1	1				1	1	1
Cephalanthus occidentalis	Buttonbush	Shrub Tree																					
Cornus amomum	Silky dogwood	Tree																					
Diospyros virginiana	American persimmon	Tree	1	1	1										2	2	2	3	3	3			
Fraxinus pennsylvanica	Green ash	Tree	6	6	6	1	1	1	7	7	7	1	1	1	3	3	3	1	1	1			
Lindera benzoin	Northern spicebush	Shrub Tree																					
Liriodendron tulipifera	Tulip poplar	Tree	2	2	2	3	3	3	5	5	5	4	4	4	2	2	2	2	2	2	2	2	2
Platanus occidentalis	Sycamore	Tree	2	2	2	3	3	3	5	5	5	2	2	2	1	1	1	4	4	4	2	2	2
Quercus pagoda	Cherrybark Oak	Tree	4	4	4				4	4	4	1	1	1	4	4	4	3	3	3	3	3	3
Stem count			15	15	15	15	15	15	25	25	25	15	15	15	15	15	15	15	15	15	14	14	14
size (ares)			1			1			1			1			1			1			1		
size (ACRES)			0.02			0.02			0.02			0.02			0.02			0.02			0.02		
Species count			5	5	5	5	5	5	5	5	5	6	6	6	7	7	7	6	6	6	5	5	5
Stems per ACRE			607	607	607	607	607	607	1012	1012	1012	607	607	607	607	607	607	607	607	607	567	567	567

			Current Plot Data (MY0 2017)									Annual Summary		
			Vegetation Plot 15			Vegetation Plot 16			Vegetation Plot 17			MY0 (2017)		
Scientific Name	Common Name	Species Type	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T
Aronia arbutifolia	Red chokeberry	Shrub Tree										1	1	1
Betula nigra	River birch	Tree	6	6	6	13	13	13	4	4	4	55	55	55
Carpinus caroliniana	Ironwood	Shrub Tree	5	5	5				3	3	3	21	21	21
Cephalanthus occidentalis	Buttonbush	Shrub Tree										14	14	14
Cornus amomum	Silky dogwood	Tree										19	19	19
Diospyros virginiana	American persimmon	Tree	2	2	2				1	1	1	12	12	12
Fraxinus pennsylvanica	Green ash	Tree										35	35	35
Lindera benzoin	Northern spicebush	Shrub Tree										14	14	14
Liriodendron tulipifera	Tulip poplar	Tree	3	3	3				4	4	4	38	38	38
Platanus occidentalis	Sycamore	Tree	7	7	7				3	3	3	40	40	40
Quercus pagoda	Cherrybark Oak	Tree	1	1	1	5	5	5	3	3	3	39	39	39
Stem count			24	24	24	18	18	18	18	18	18	288	288	288
size (ares)			1			1			1			17		
size (ACRES)			0.02			0.02			0.02			0.42		
Species count			6	6	6	2	2	2	6	6	6	11	11	11
Stems per ACRE			971	971	971	728	728	728	728	728	728	686	686	686

Color For Density

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

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

Table 9. Planted Herbaceous Cover (Bog Cells)
Vile Creek Mitigation Site
DMS Project No.96582
Monitoring Year 0 - 2017

	Percent Cover %							
Plot ID	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**MY6**	**MY7**
1	<5							
2	10							
3	<5							
4	<5							
5	<5							
6	<5							
7	<5							
8	50							

Vegetation Photographs

Vegetation Plot 1 - *(3/6/2017)*

Vegetation Plot 2 - *(3/6/2017)*

Vegetation Plot 3 - *(3/6/2017)*

Vegetation Plot 4 - *(3/6/2017)*

Vegetation Plot 5 - *(3/6/2017)*

Vegetation Plot 6 - *(3/6/2017)*

Vegetation Plot 7 - *(3/6/2017)*

Vegetation Plot 8 - *(3/7/2017)*

Vegetation Plot 9 - *(3/7/2017)*

Vegetation Plot 10 - *(3/7/2017)*

Vegetation Plot 11 - *(3/7/2017)*

Vegetation Plot 12 - *(3/7/2017)*

Vegetation Plot 13 - *(3/7/2017)*

Vegetation Plot 14 - *(3/6/2017)*

Vegetation Plot 15 - *(3/6/2017)*

Vegetation Plot 16 – (3/6/2017)

Vegetation Plot 17 - *(3/6/2017)*

Bog Vegetation Photographs

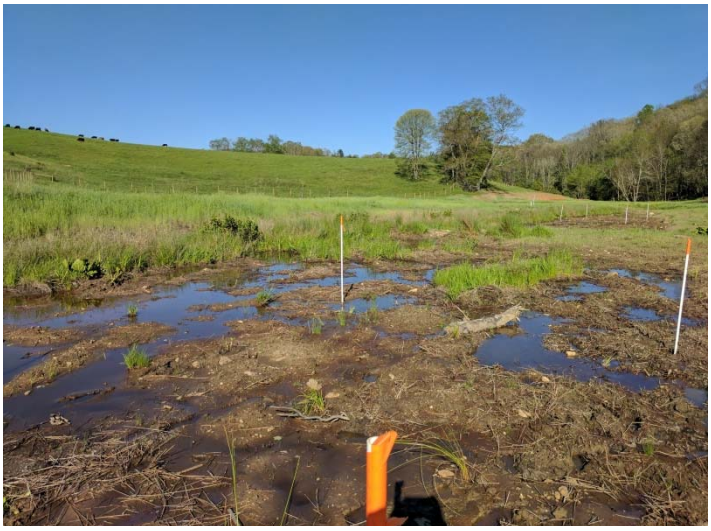
Bog Vegetation Plot 1 - *(5/4/2017)*

Bog Vegetation Plot 2 - *(5/4/2017)*

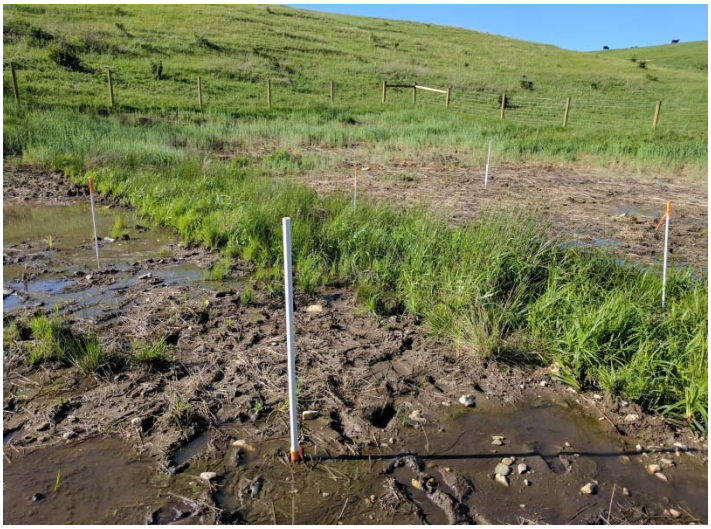
Bog Vegetation Plot 3 - *(5/4/2017)*

Bog Vegetation Plot 4 - *(5/4/2017)*

Bog Vegetation Plot 5 - *(5/4/2017)*



Bog Vegetation Plot 6 - *(5/4/2017)*

	
Bog Vegetation Plot 7 - *(5/4/2017)*	**Bog Vegetation Plot 8** - *(5/4/2017)*

APPENDIX 4. Record Drawings

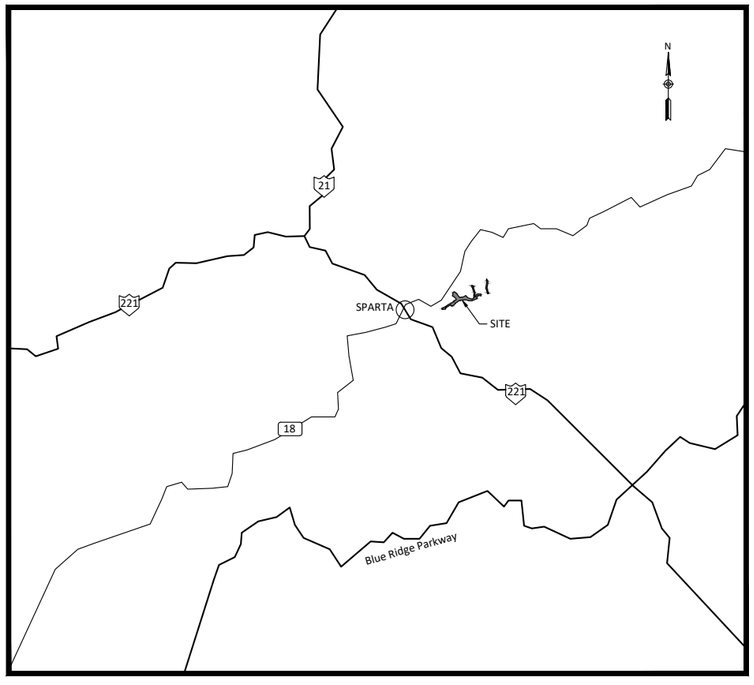
Vile Creek Mitigation Site Record Drawings

Alleghany County, North Carolina

for

NCDEQ

Division of Mitigation Services



Vicinity Map
Not to Scale

RECORD DRAWINGS
ISSUED JUNE 13, 2017

CERTIFICATE OF SURVEY
AND
ACCURACY

I, NOLAN R. CARMACK , CERTIFY THAT THE GROUND TOPOGRAPHIC SURVEY PORTION OF THIS PROJECT WAS COMPLETED UNDER MY DIRECT SUPERVISION FROM AN ACTUAL SURVEY MADE UNDER MY DIRECT SUPERVISION, THAT THE RECORD DRAWINGS WERE PREPARED BY WILDLANDS ENGINEERING, INC FROM DIGITAL FILES PROVIDED BY KEE MAPPING AND SURVEYING, PA AS SHOWN ON AN AS-BUILT SURVEY FOR "THE STATE OF NC, DIVISION OF MITIGATION SERVICES" DATED APRIL 24, 2017; THAT THIS SURVEY WAS PERFORMED AT THE 95% CONFIDENCE LEVEL TO MEET THE FEDERAL GEOGRAPHIC DATA COMMITTEE STANDARDS; THAT THIS SURVEY WAS PERFORMED TO MEET THE REQUIREMENTS FOR A TOPOGRAPHIC SURVEY TO THE ACCURACY OF CLASS A HORIZONTAL AND CLASS C VERTICAL WHERE APPLICABLE; THAT THE ORIGINAL DATA WAS OBTAINED BETWEEN THE DATES OF 3/01/17 - 4/20/17 ; THAT THE CONTOURS SHOWN AS BROKEN LINES MAY NOT MEET THE STATED STANDARD AND ALL COORDINATES ARE BASED ON NAD 83 (NSRS 2011) AND ALL ELEVATIONS ARE BASE ON NAVD 88; THAT THIS MAP MEETS THE SPECIFICATIONS FOR TOPOGRAPHIC SURVEYS AS STATED IN TITLE 21, CHAPTER 56, SECTION .1606; THAT THIS MAP WAS NOT PREPARED IN ACCORDANCE WITH G.S. 47-30, AS AMENDED AND DOES NOT REPRESENT AN OFFICIAL BOUNDARY SURVEY.

WITNESS MY ORIGINAL SIGNATURE, REGISTRATION NUMBER, AND SEAL THIS THE _____DAY OF _____, 20____.

OFFICIAL SEAL

Sheet Index

Project Directory

Engineering:
Wildlands Engineering, Inc
License No. F-0831
312 West Millbrook Rd., Ste. 225
Raleigh, NC 27609
Jeff Keaton, PE
919-851-9986

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

Owner:
NCDEQ
Division of Mitigation Services
217 West Jones St., Ste. 3000A
Raleigh, NC 27603
Harry Tsomides
828-545-7057

DMS Project #: 96582

DEQ Contract #: 5999

WILDLANDS ENGINEERING
312 West Millbrook Rd., Ste.225
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Tel: 919.851.9986
Fax: 919.851.9985
Firm License No. F-0831

NORTH CAROLINA PROFESSIONAL SEAL 031027 ENGINEER JEFFERSON KEATON

Date: 6/13/17

Vile Creek Mitigation Site Record Drawings
Alleghany County, North Carolina

Title Sheet

Revisions:

Date: June 13, 2017
Job Number: 005-02147
Project Engineer: JNK
Drawn By: JCK
Checked By: KG

Sheet 0.1

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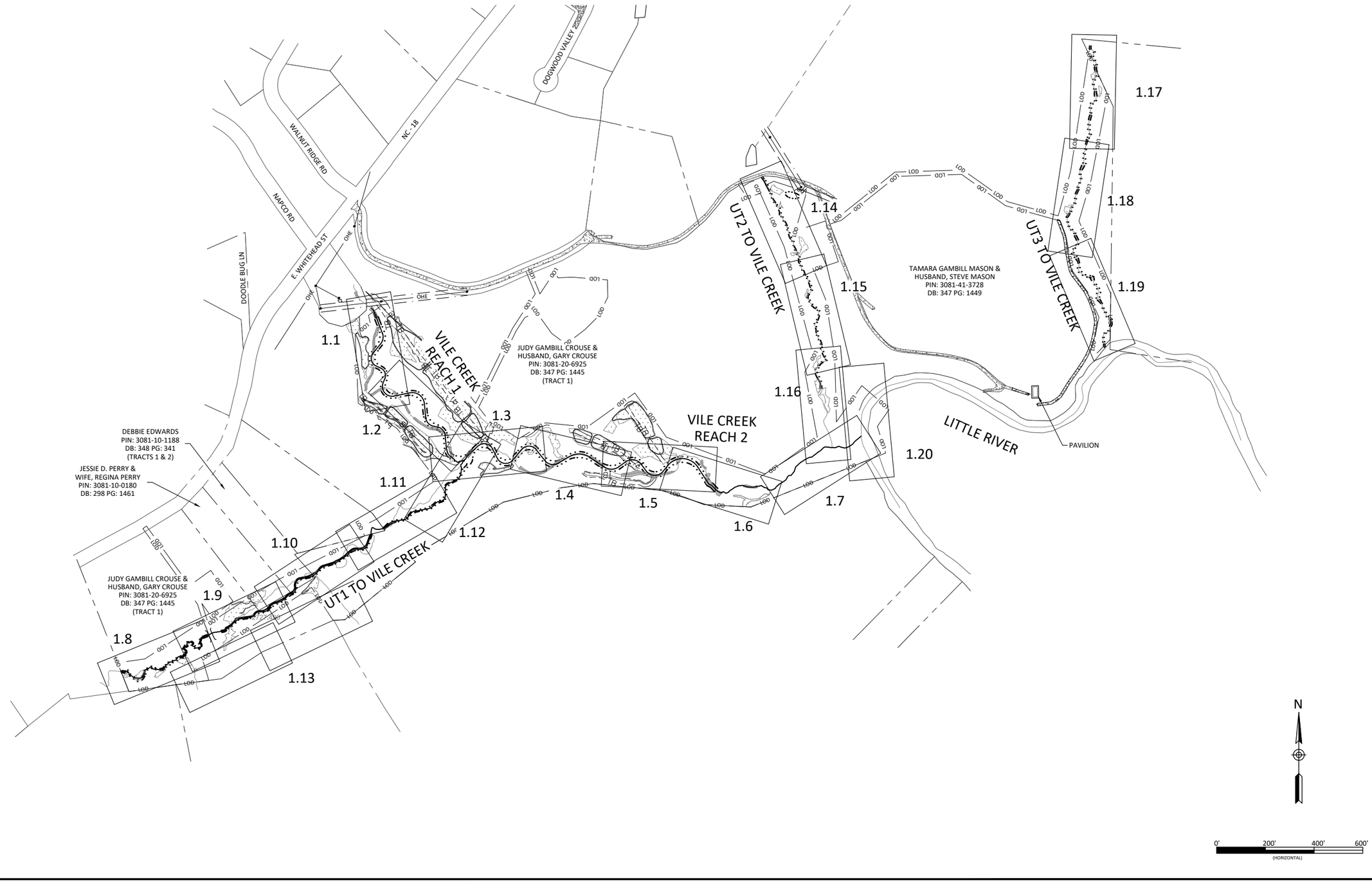

WILDLANDS
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Firm License No. F-0831

NORTH CAROLINA PROFESSIONAL SEAL 031027 ENGINEER JEFFERSON M. KANE

Date:

Vile Creek Mitigation Site Record Drawings
Alleghany County, North Carolina

Project Overview

Revisions:

Date:	June 13, 2017
Job Number:	005-02147
Project Engineer:	JNK
Drawn By:	JCK
Checked By:	KG

Sheet 0.2

As-Built Features

- Recorded Conservation Easement (CE)
- As-Built Centerline Alignment (10+00)
- As-Built Bankfull (TB)
- As-Built Major Contour (5' Interval) (100)
- As-Built Minor Contour (1' interval)

As-Built Structures

- As-Built Various Constructed Riffles
- As-Built Brush Toe
- Floodplain Outlet
- Berm Spillway

As-Built Structures

- As-Built Log Sill
- As-Built Lunker Log
- As-Built J-Hook
- As-Built Log Vane
- As-Built Boulder Sill
- As-Built Bog Area

RECORD DRAWINGS:
Deviations from the design will be shown in red.

Existing Features

- Existing Property Line
- Existing Alignment
- Existing Major Contour (5' Interval) (100)
- Existing Minor Contour (1' interval)
- Existing Overhead Electric (OHE)
- Existing Power Pole
- Existing Easement
- Existing Fence
- Existing Top of Bank (TB)
- Existing Treeline

Existing Features

- Existing Storm Pipe
- Existing Gravel Road
- Existing Wetland
- Existing Tree
- Existing Groundwater Gauge
- Existing Bedrock
- Existing Spring

Designed Features

- Recorded Conservation Easement
- Designed Centerline Alignment
- Designed Bankfull
- Designed Major Contour (5' Interval) (100)
- Designed Minor Contour (1' interval)
- Designed Limits of Disturbance (LOD)

Designed Structures

- Designed Channel Plug
- Designed Various Constructed Riffles
- Designed Brush Toe
- Floodplain Outlet
- Berm Spillway

Designed Structures

- Designed Log Sill See Detail 3, Sheet 5.2
- Designed Lunker Log See Detail 2, Sheet 5.2
- Designed Log J-Hook See Detail 1, Sheet 5.2
- Designed Log Vane See Detail 4, Sheet 5.6
- Designed Boulder Sill See Detail 2, Sheet 5.8
- Designed Stream Crossing
- Designed Bog Area

PROJECT NOTES:

Topographic survey completed by Kee Mapping and Surveying in January 2015. Parcel boundary survey completed by Kee Mapping and Surveying in January 2015. As-Built survey completed March 2017.

Types of Constructed Riffles used at certain locations may be modified at Engineer's discretion.

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NORTH CAROLINA PROFESSIONAL SEAL 031027 ENGINEER JEFFERSON M. KLEIN

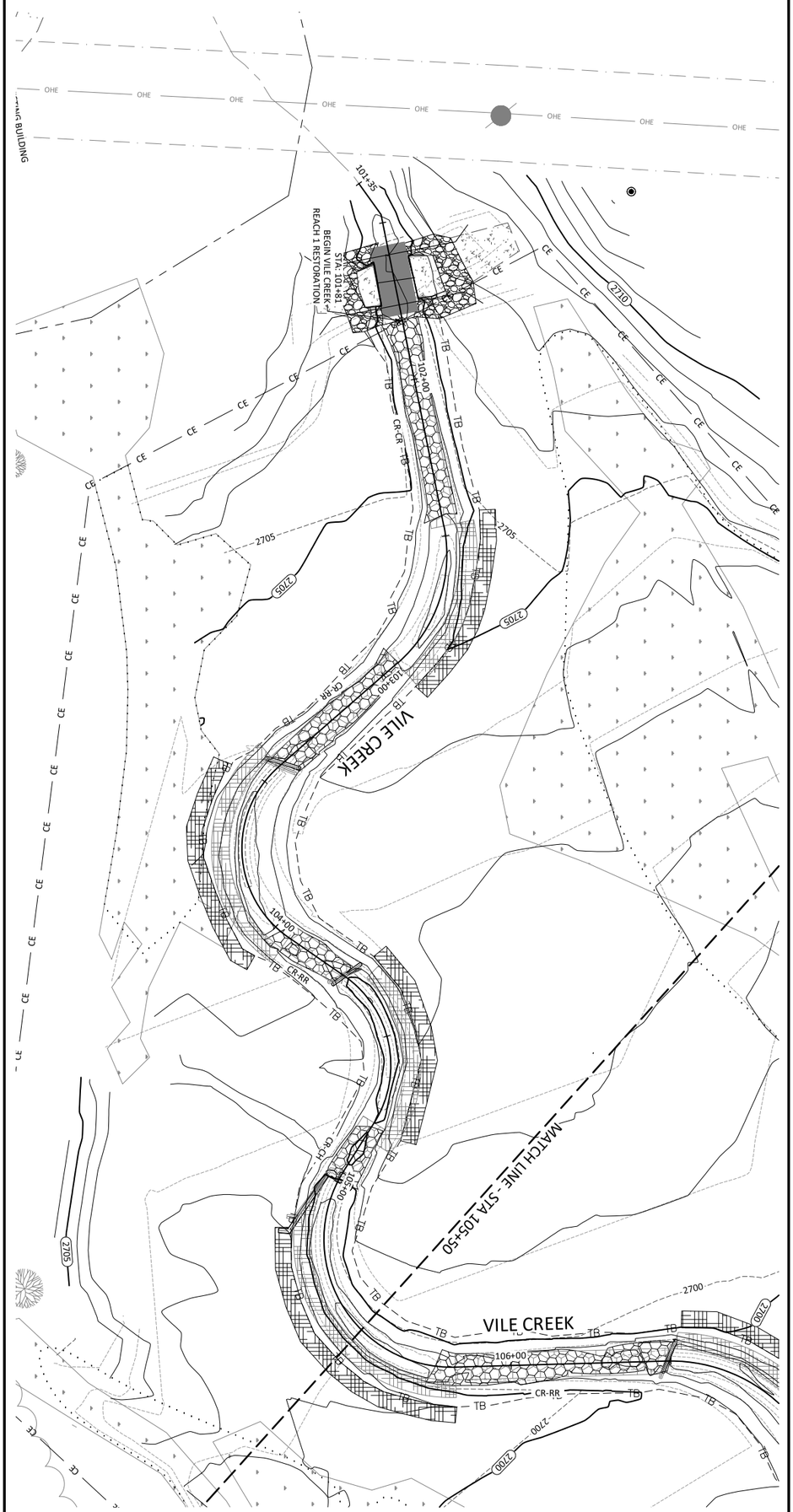
Date: 6/15/17

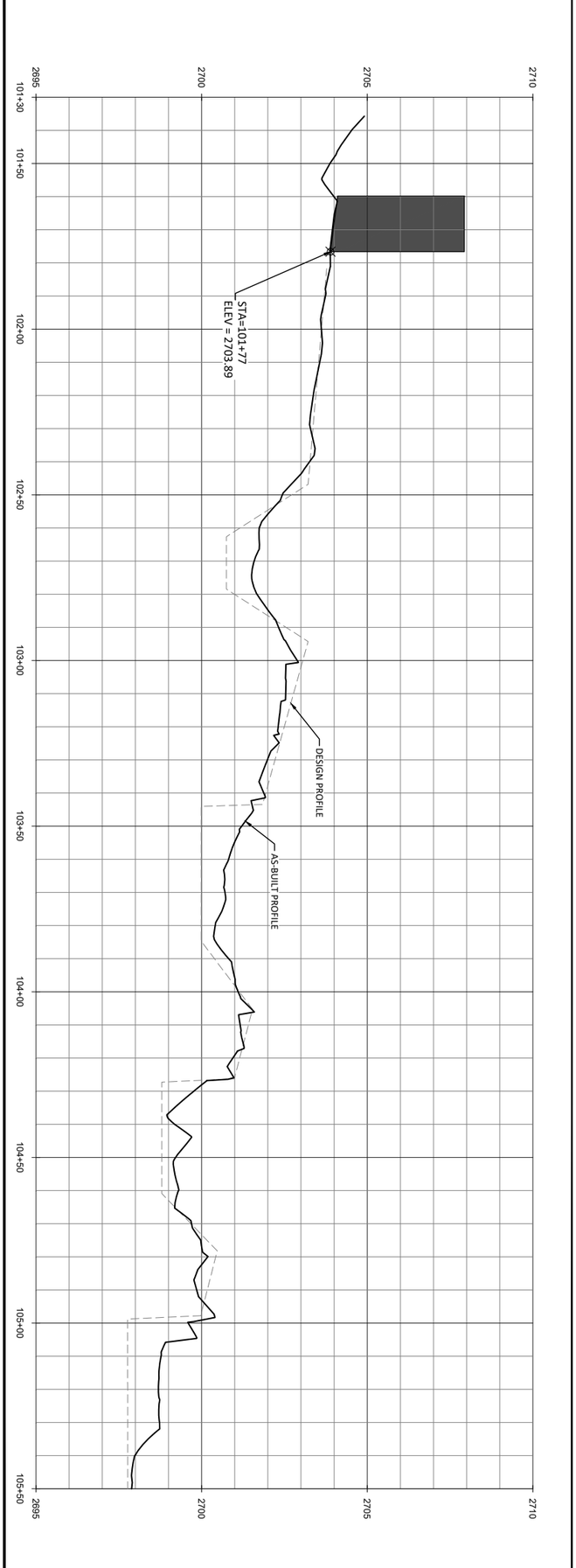
Vile Creek Mitigation Site Record Drawings
Alleghany County, North Carolina
General Notes and Symbols

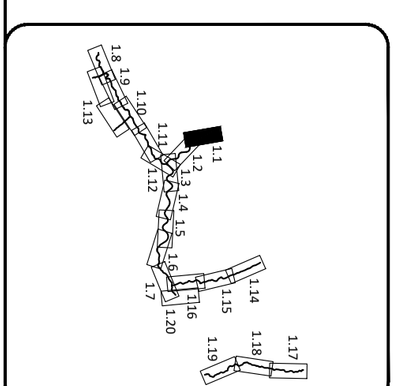
Revisions:

Date: June 13, 2017
Job Number: 085-02147
Project Engineer: JNK
Drawn By: JCK
Checked By: KG

Sheet 0.3







Sheet Index

NOTE:
SOD MATS ADDED ON MOST BANKS WHERE NO BANK REVETMENTS EXIST.

N

0' 20' 40' 60' (HORIZONTAL)

0' 2' 4' 6' (VERTICAL)

Date:	June 13, 2017
Job Number:	005-02147
Project Engineer:	JNK
Drawn By:	JCK
Checked By:	KG

Revisions:

1.1
Sheet

Vile Creek Mitigation Site Record Drawings
Alleghany County, North Carolina

Vile Creek
Record Drawings

NORTH CAROLINA PROFESSIONAL SEAL 031027 ENGINEER JEFFERSON N. KEATON

Date: xx/xx/xx

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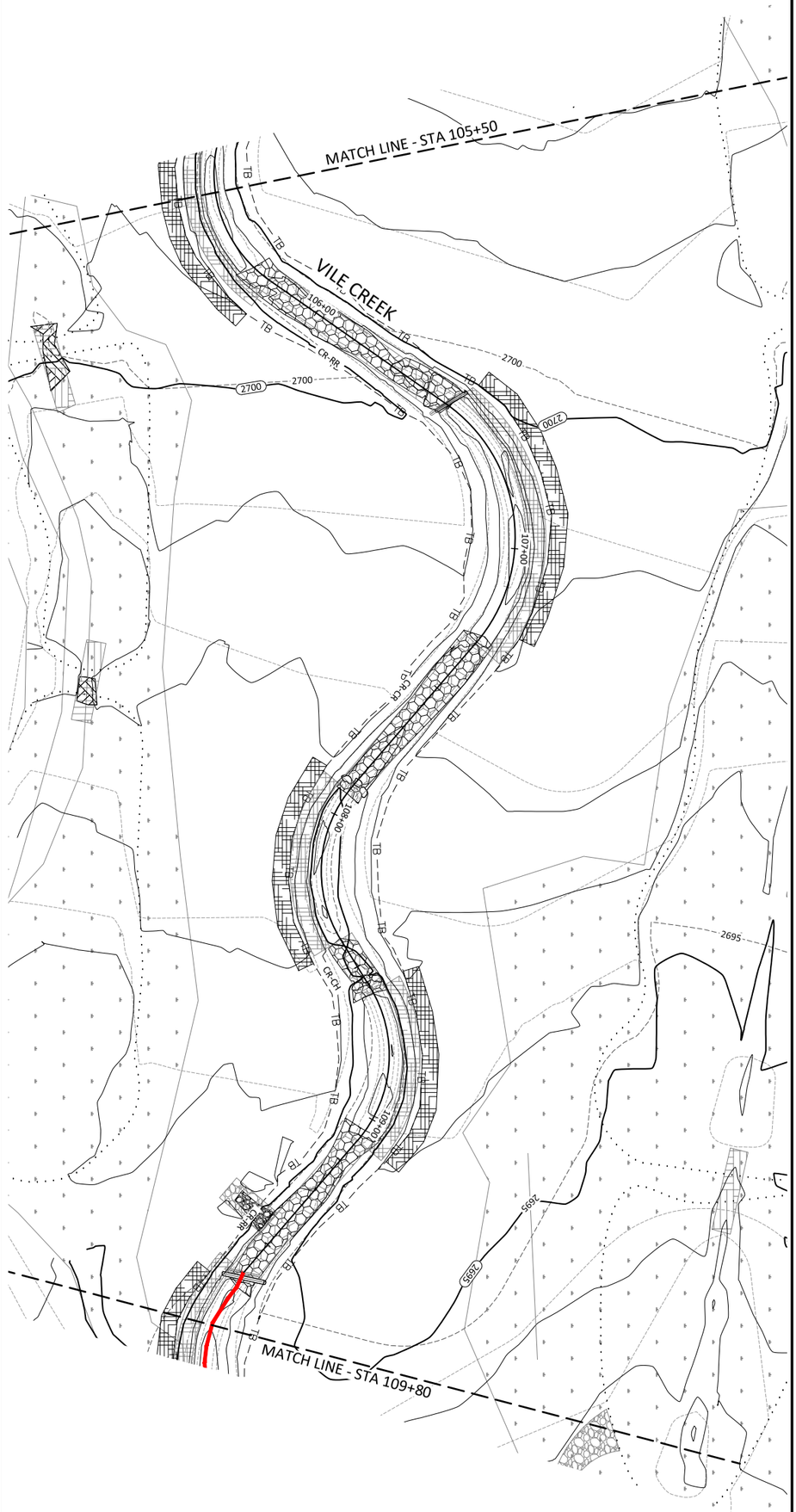

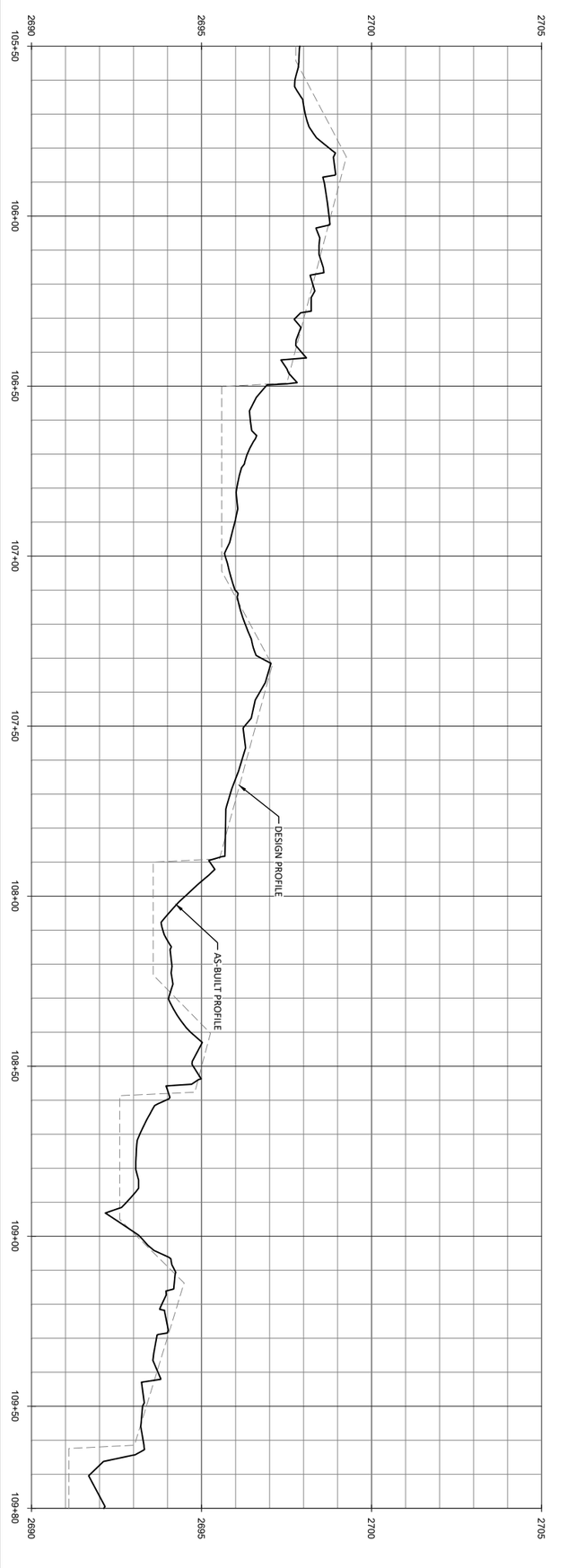

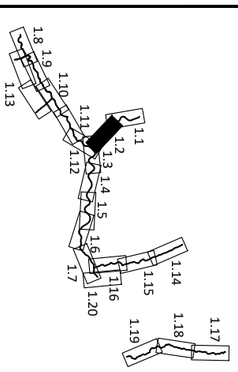

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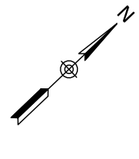

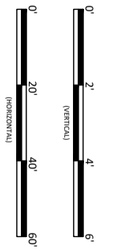

Date:	June 13, 2017
Job Number:	005-02147
Project Engineer:	JNK
Drawn By:	JCK
Checked By:	KG

Revisions:

1.2
Sheet

Vile Creek Mitigation Site Record Drawings
Alleghany County, North Carolina

Vile Creek
Record Drawings

NORTH CAROLINA PROFESSIONAL SEAL 031027 ENGINEER PETERSON N. KEATON

Date: xx/xx/xx

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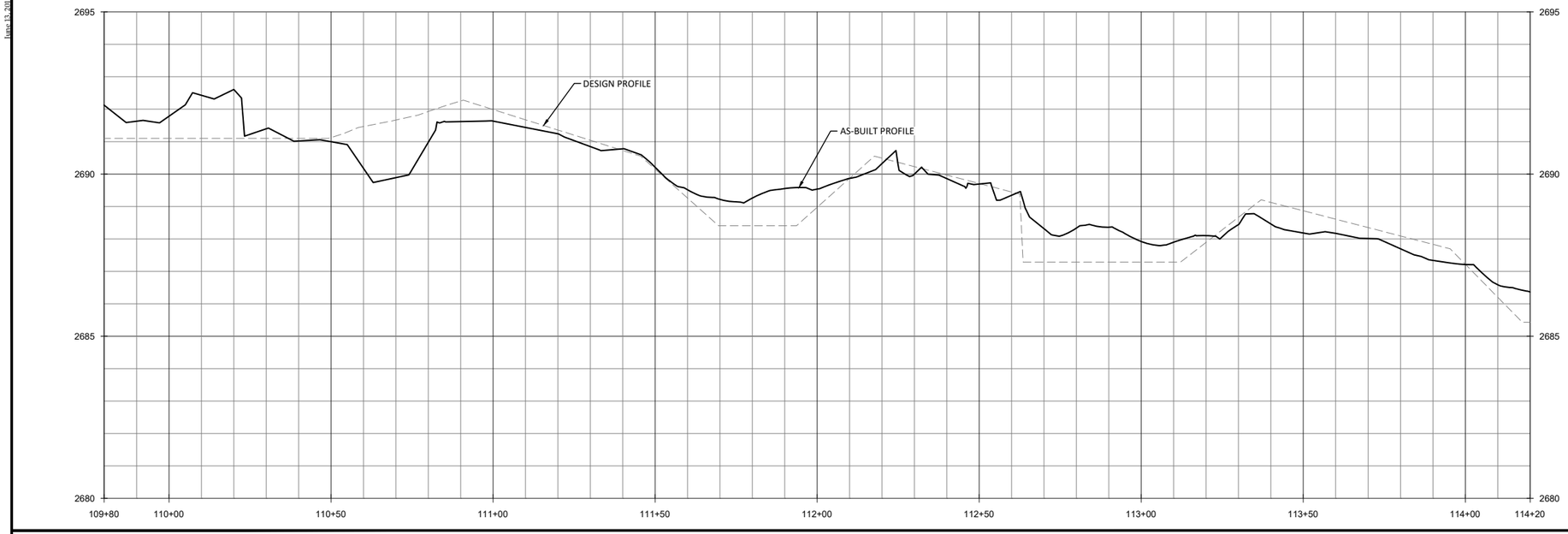

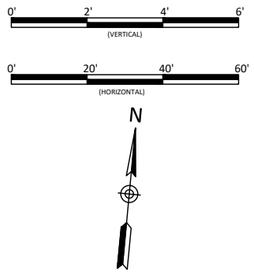

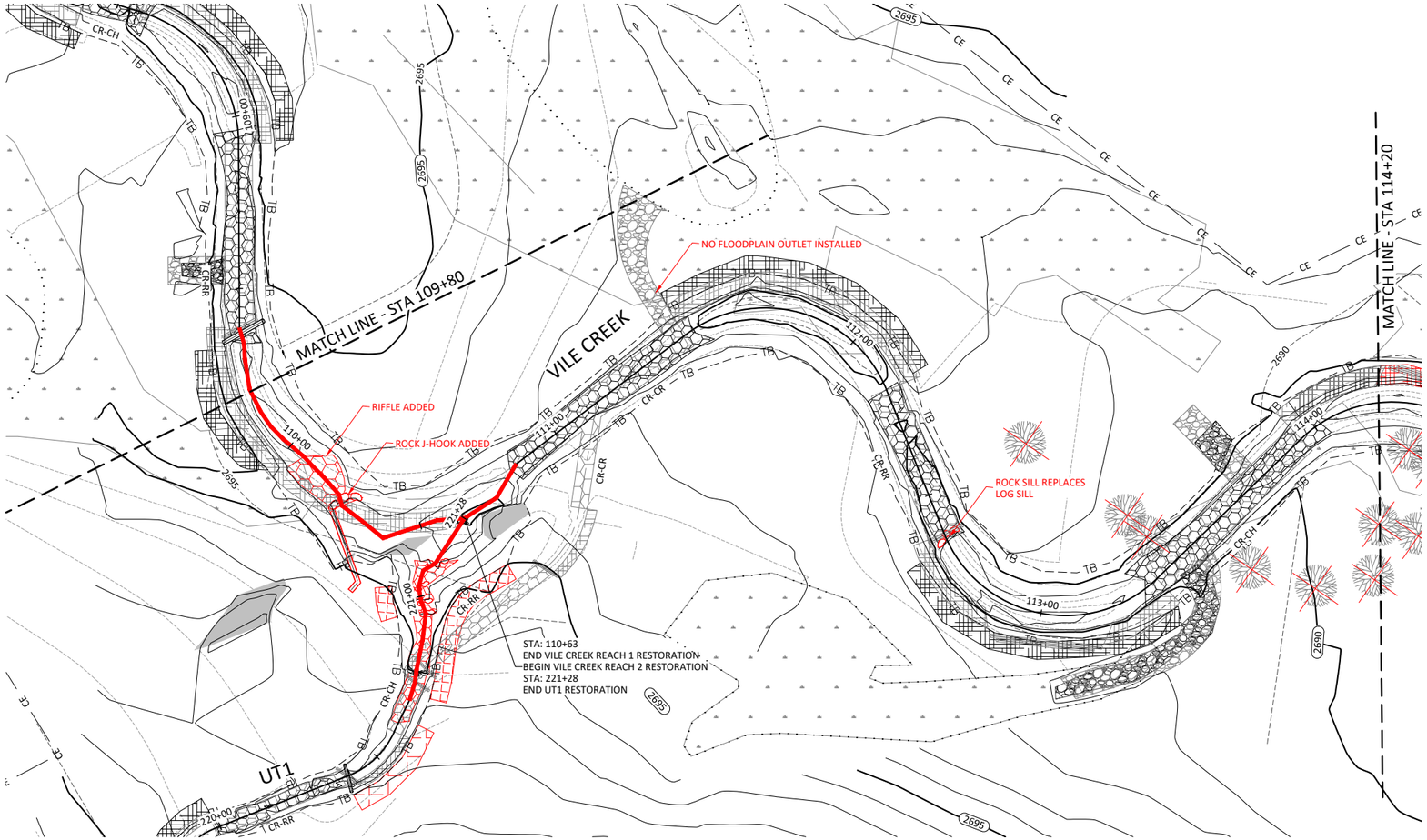

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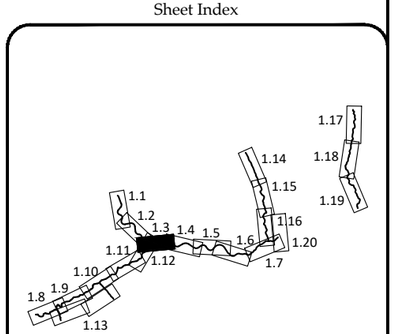
STA: 109+64 - 110+83

Sheet Index



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NORTH CAROLINA PROFESSIONAL SEAL 031027 ENGINEER JEFFERSON C. KING

Date: 6/13/17

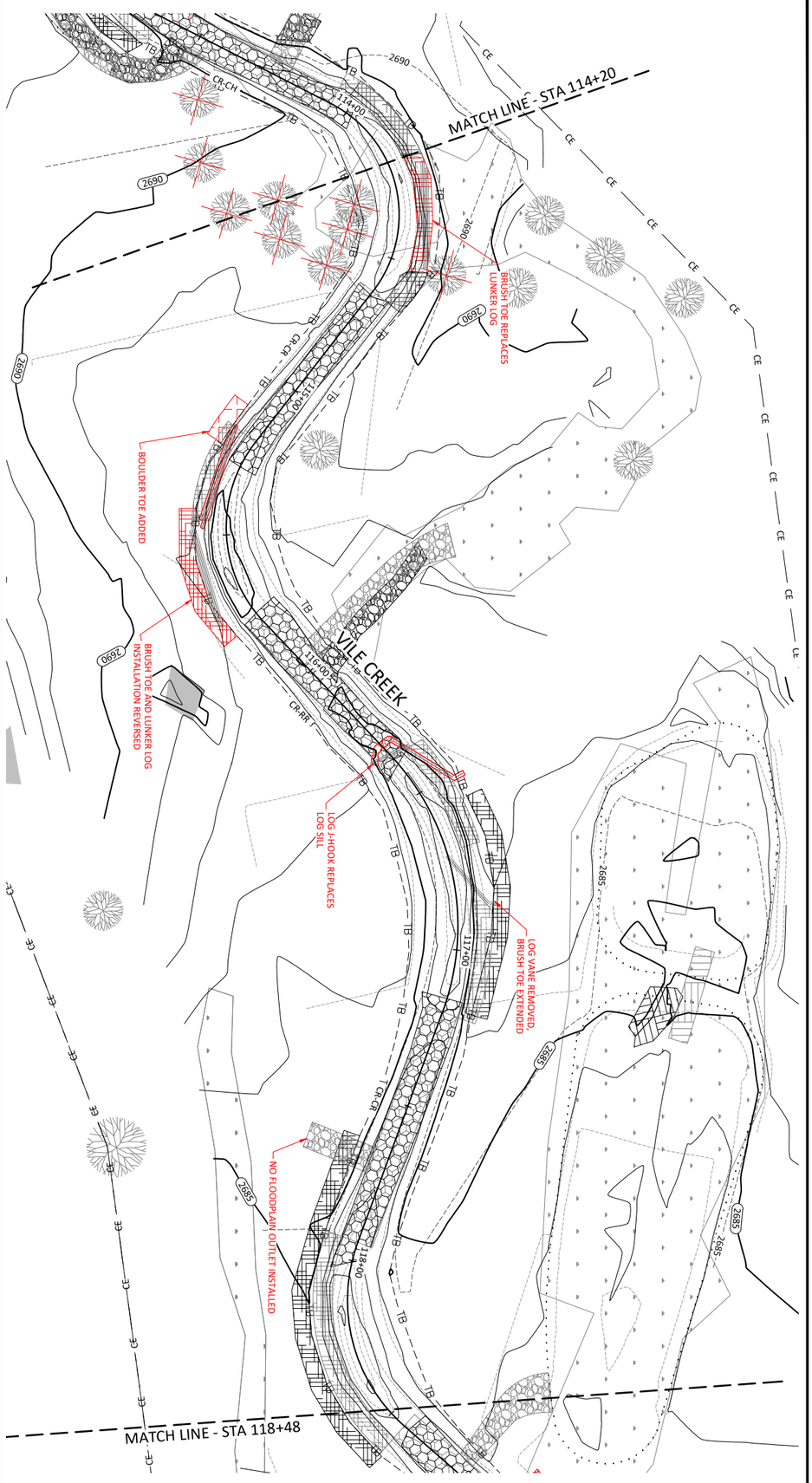
Vile Creek Mitigation Site Record Drawings
Alleghany County, North Carolina

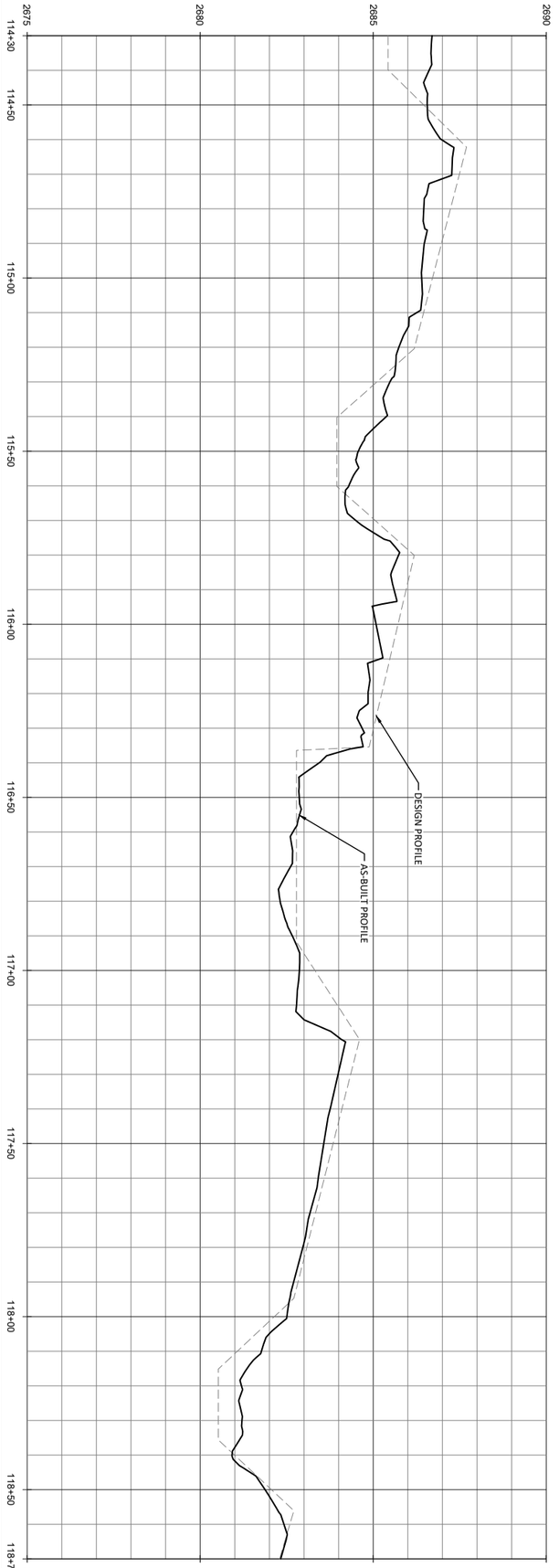
Vile Creek
Record Drawings

Revisions:

Date:	June 13, 2017
Job Number:	005-02147
Project Engineer:	JNK
Drawn By:	JCK
Checked By:	KG

Sheet 1.3





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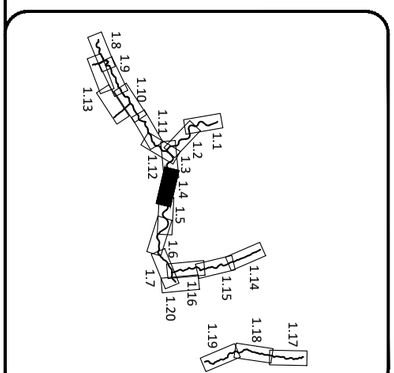

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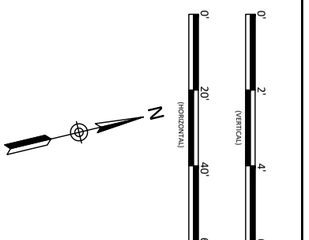


Date:	June 13, 2017
Job Number:	005-02147
Project Engineer:	JNK
Drawn By:	JCK
Checked By:	KG

Revisions:

1.4
Sheet

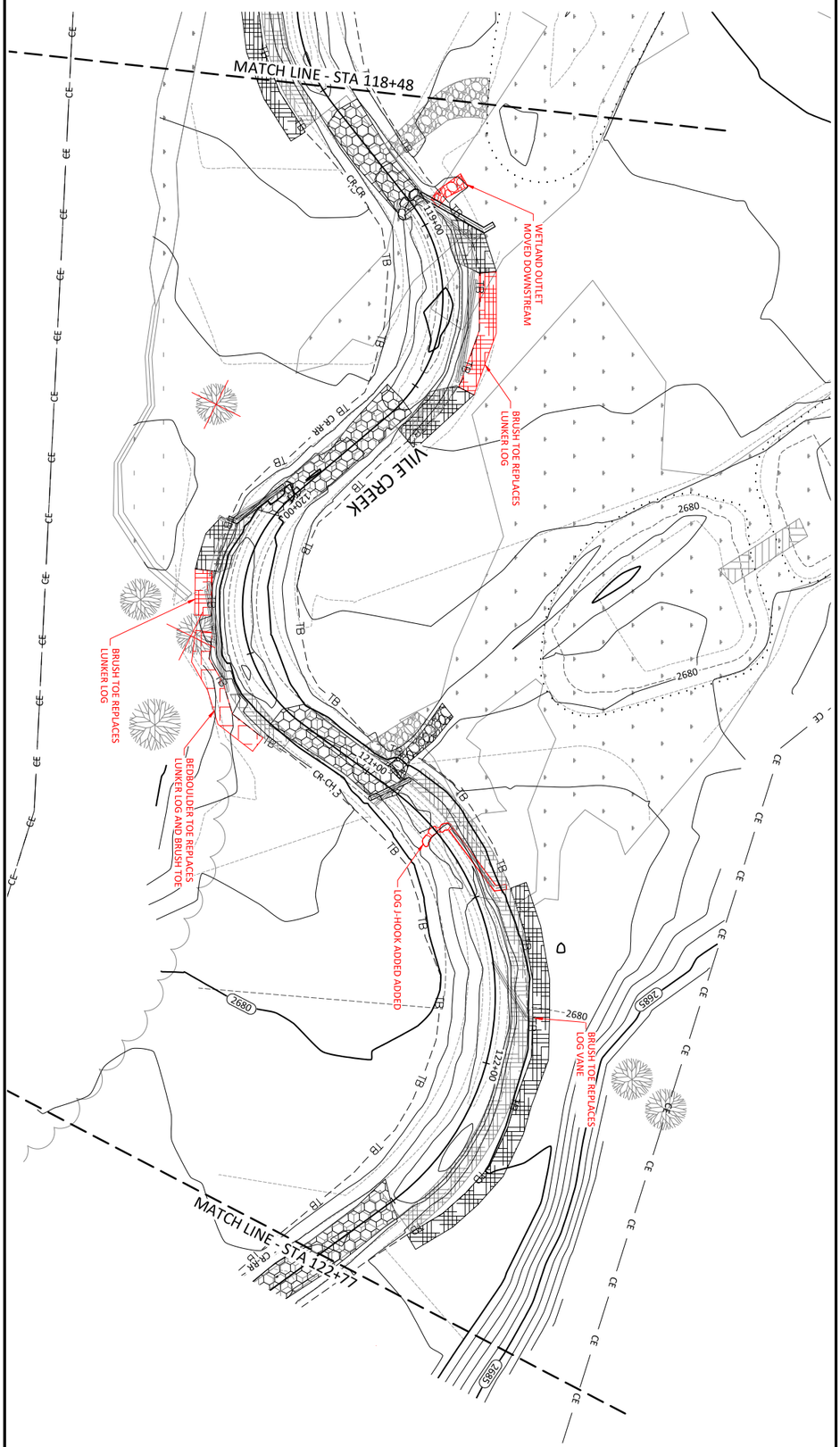
Vile Creek Mitigation Site Record Drawings
Alleghany County, North Carolina

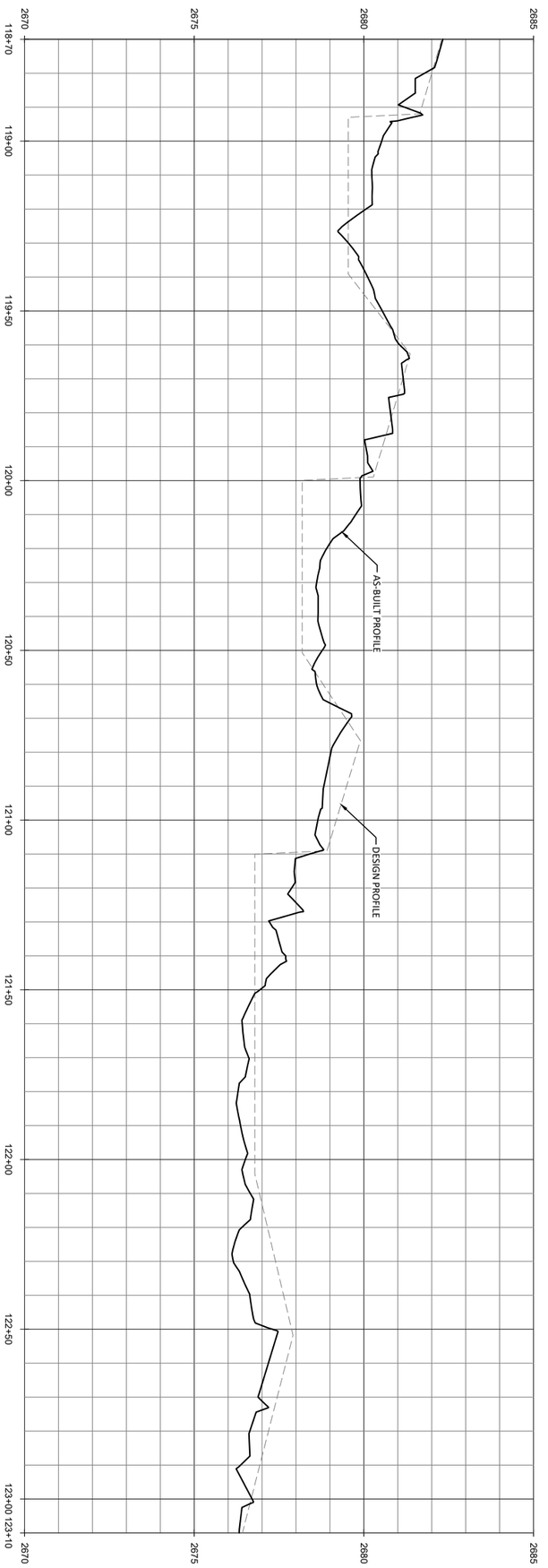
Vile Creek
Record Drawings

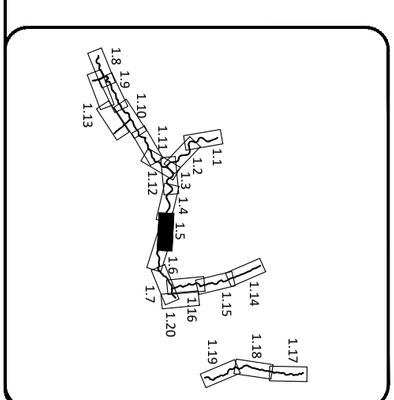
NORTH CAROLINA PROFESSIONAL SEAL 031027 ENGINEER JEFFERSON N. KEATON

Date: xx/xx/xx

WILDLANDS
ENGINEERING
312 West Millbrook Rd., Ste.225
Raleigh, NC 27609
Tel: 919.851.9986
Fax: 919.851.9986
Firm License No. F-0831







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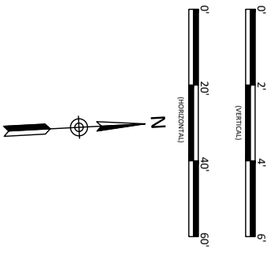

Date:	June 13, 2017
Job Number:	005-02147
Project Engineer:	JNK
Drawn By:	JCK
Checked By:	KG

Revisions:

1.5
Sheet

Vile Creek Mitigation Site Record Drawings
Alleghany County, North Carolina

Vile Creek
Record Drawings

NORTH CAROLINA PROFESSIONAL SEAL 031027 ENGINEER JEFFERSON N. KEATON

Date: xx/xx/xx

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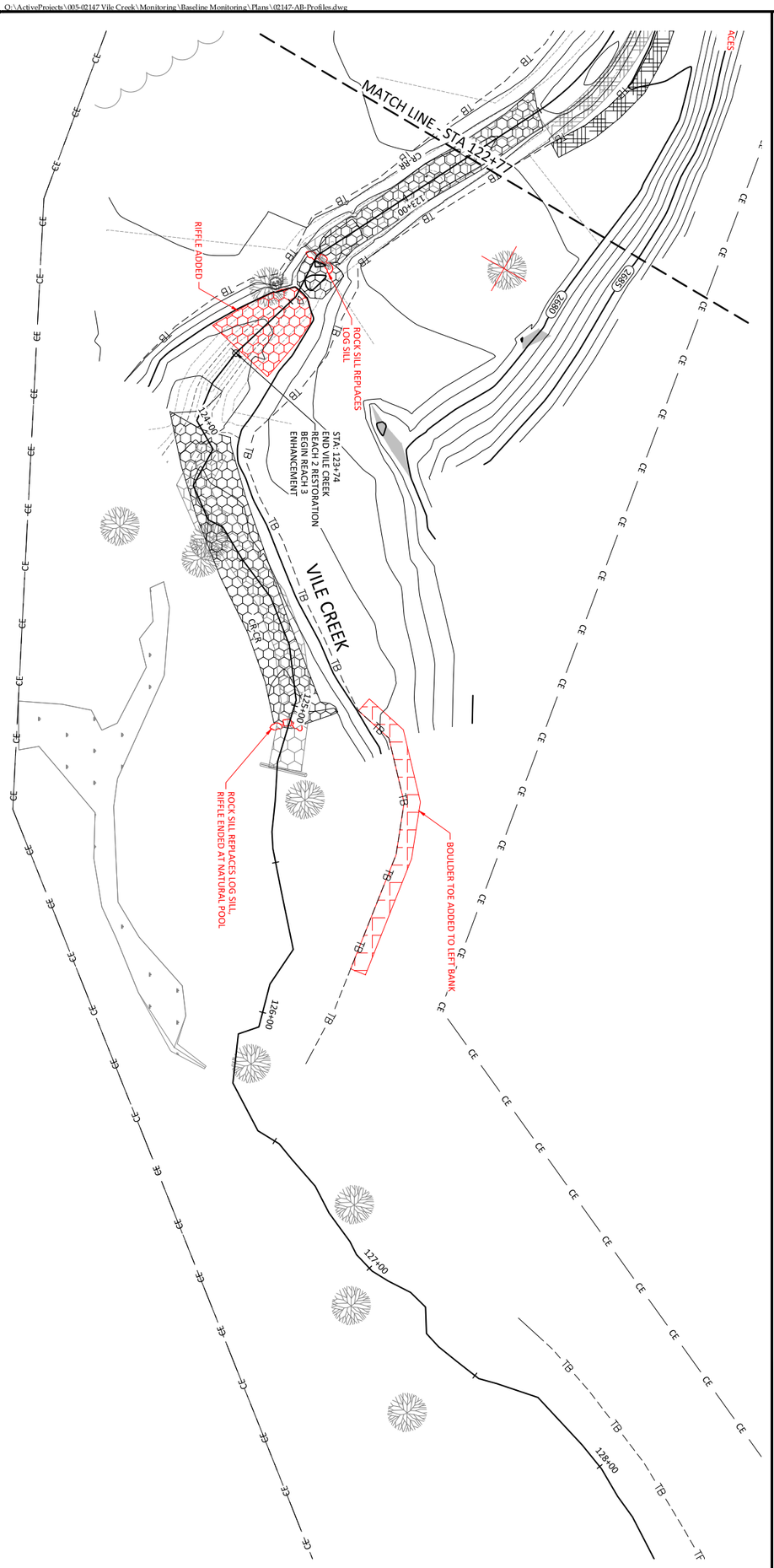
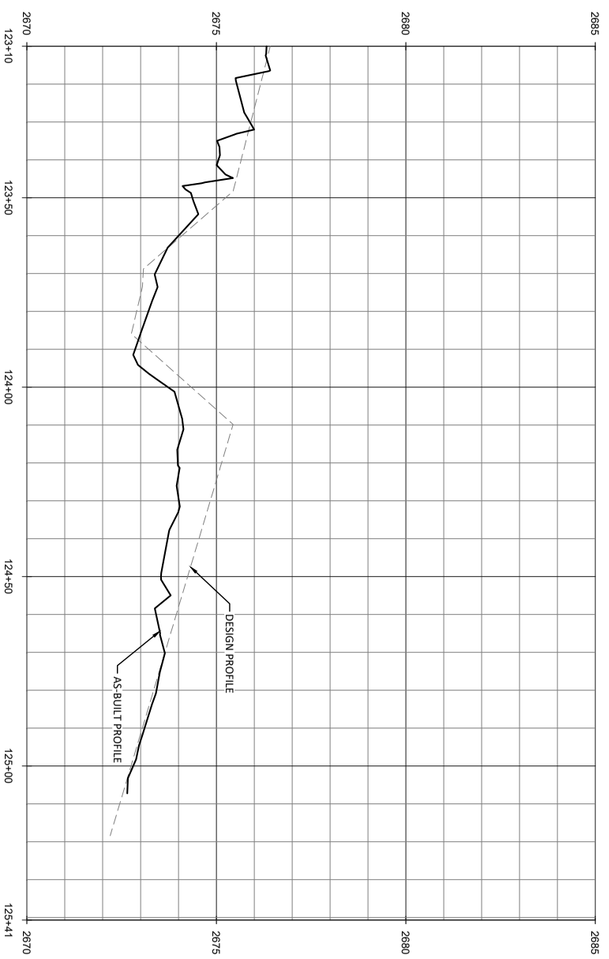
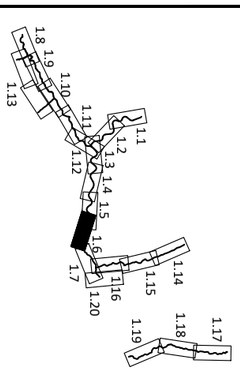
Firm License No. F-0831







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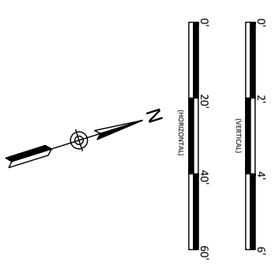
NOTE:
STA: 126+00 - 127+50 - ADDITIONAL BANK GRADING PERFORMED AND BOULDER TOE ADDED ON LEFT BANK



Date:	June 13, 2017
Job Number:	005-02147
Project Engineer:	JNK
Drawn By:	JCK
Checked By:	KG

Revisions:

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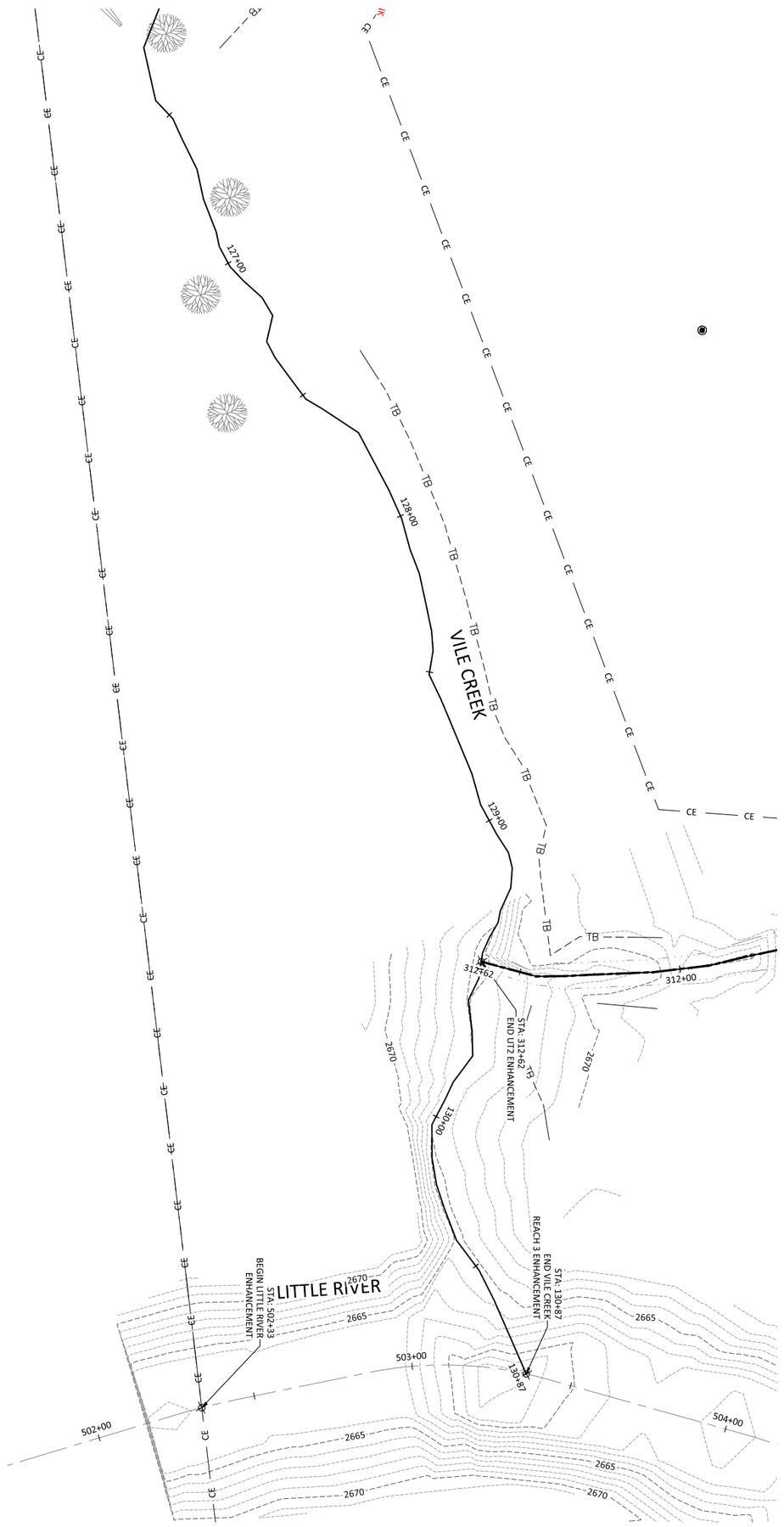
Vile Creek Mitigation Site Record Drawings
Alleghany County, North Carolina

Vile Creek
Record Drawings

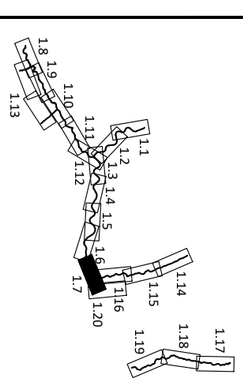
NORTH CAROLINA PROFESSIONAL SEAL 031027 ENGINEER JEFFERSON N. KEATON

Date: xx/xx/xx

WILDLANDS
ENGINEERING
312 West Millbrook Rd., Ste.225
Raleigh, NC 27609
Tel: 919.851.9986
Fax: 919.851.9986
Firm License No. F-0831



NOTE:
STA: 126+00 - 127+50 - BANK GRADING ON LEFT BANK



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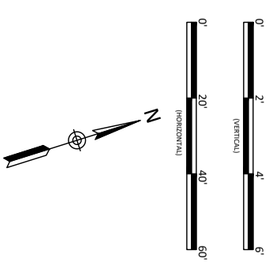

Date:	June 13, 2017
Job Number:	005-02147
Project Engineer:	JNK
Drawn By:	JCK
Checked By:	KG

Revisions:

1.7
Sheet

Vile Creek Mitigation Site Record Drawings
Alleghany County, North Carolina

Vile Creek
Record Drawings

NORTH CAROLINA PROFESSIONAL SEAL 031027 ENGINEER JEFFERSON N. KEATON

Date: xx/xx/xx

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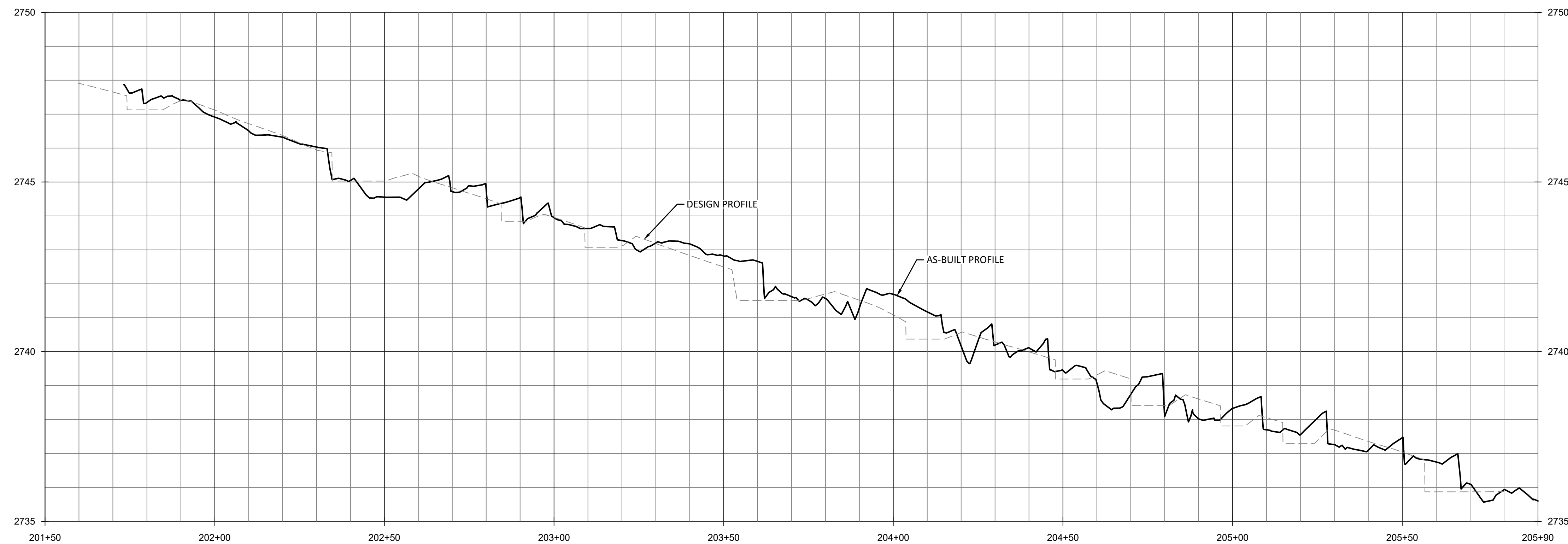

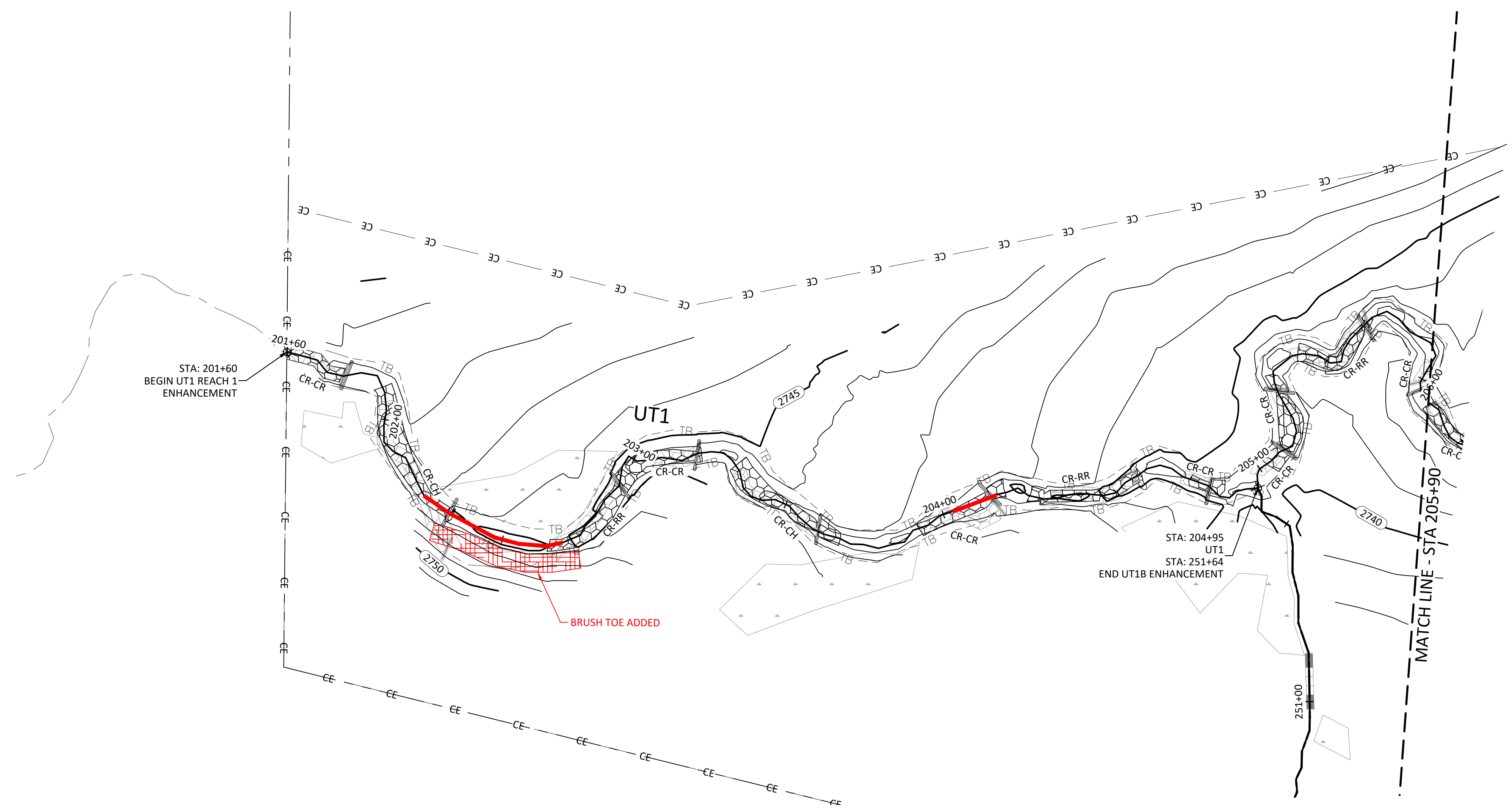

NOTE:
STA: 202+25 - 202+67 - ALIGNMENT REVISION IN FIELD
STA: 204+03 - 204+15 ALIGNMENT REVISION IN FIELD

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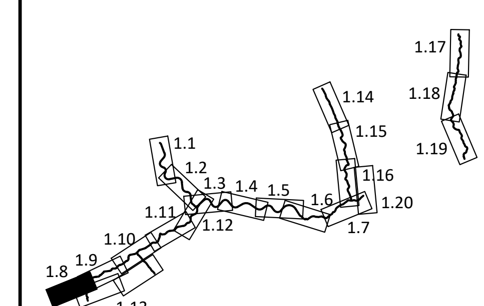

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NORTH CAROLINA PROFESSIONAL SEAL 031027 ENGINEER JEFFERSON N. KEATON

Date: xx/xx/xx

Vile Creek Mitigation Site Record Drawings
Alleghany County, North Carolina

UT1
Record Drawings

Revisions:

Date:	June 13, 2017
Job Number:	005-02147
Project Engineer:	JNK
Drawn By:	JCK
Checked By:	KG

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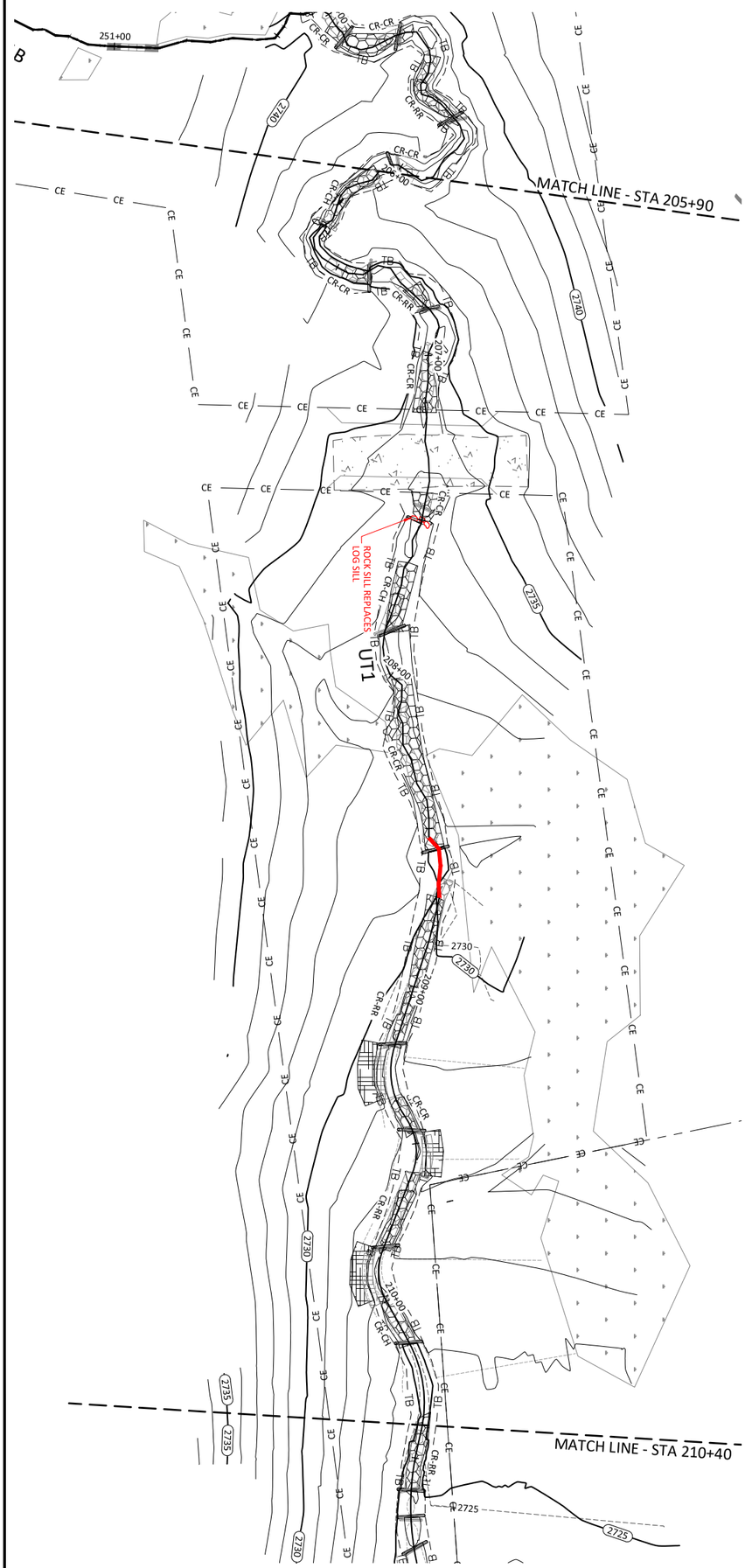
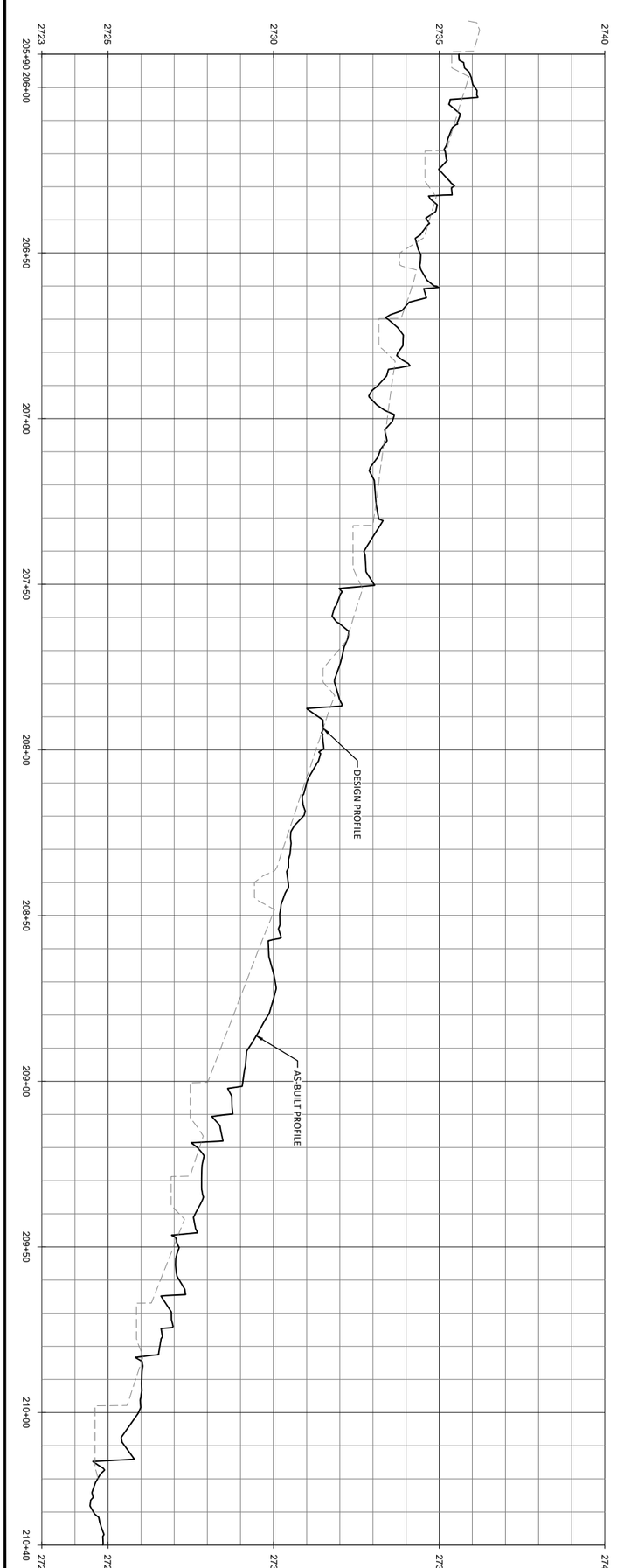
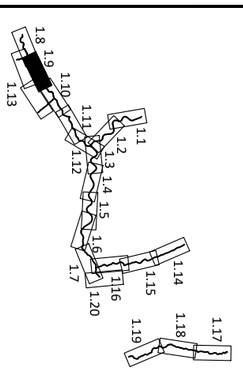




NOTE:
STA: 208+53 - 208+72 - ALIGNMENT REVISION IN FIELD



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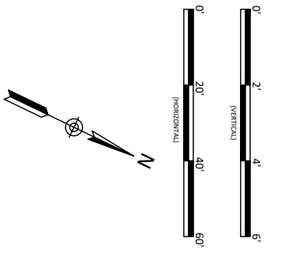

Date:	June 13, 2017
Job Number:	005-02147
Project Engineer:	JNK
Drawn By:	JCK
Checked By:	KG

Revisions:

1.9
Sheet

Vile Creek Mitigation Site Record Drawings
Alleghany County, North Carolina

UT1
Record Drawings

NORTH CAROLINA PROFESSIONAL SEAL 031027 ENGINEER JEFFERSON N. KEATON

Date: xx/xx/xx

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312 West Millbrook Rd., Ste.225
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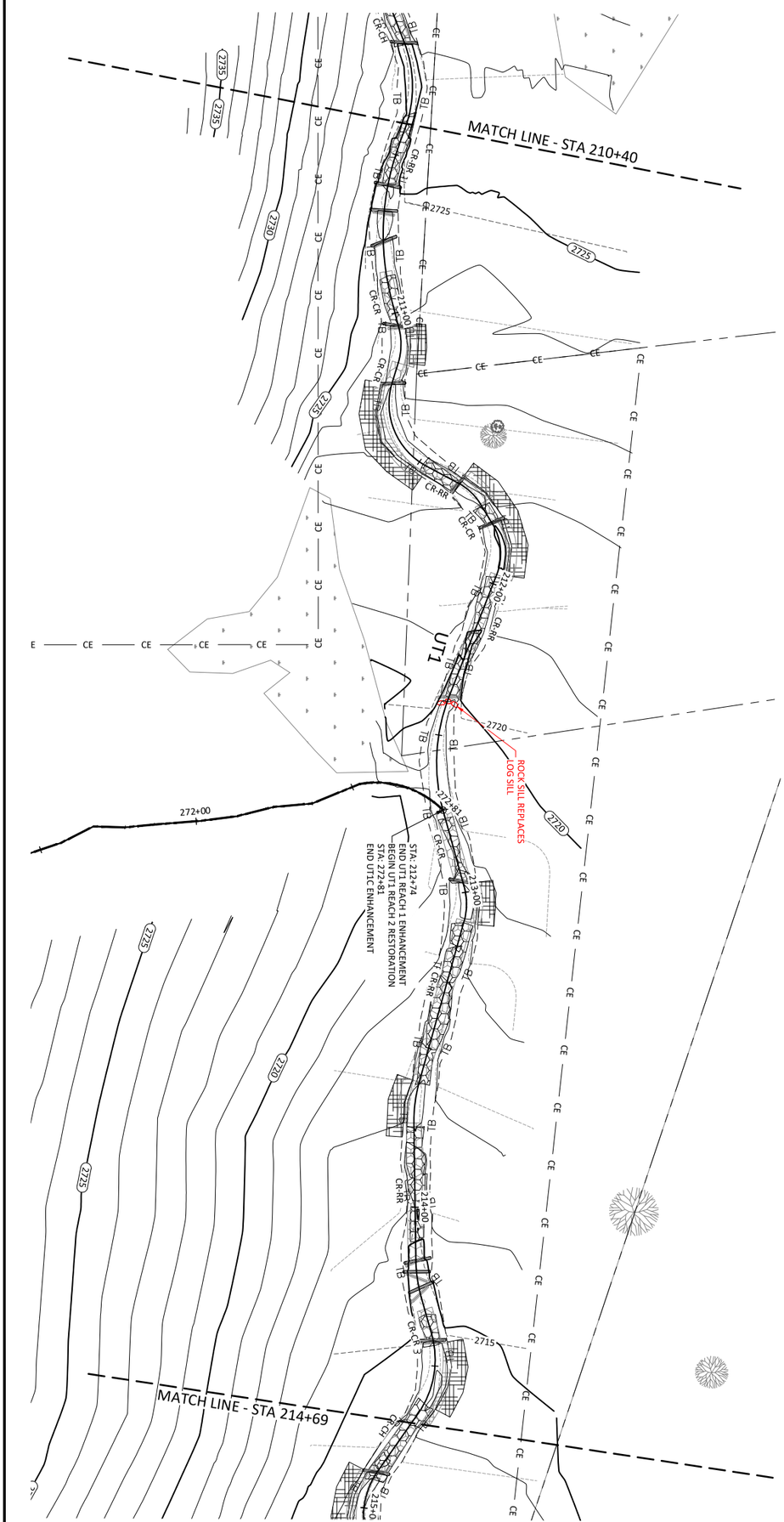
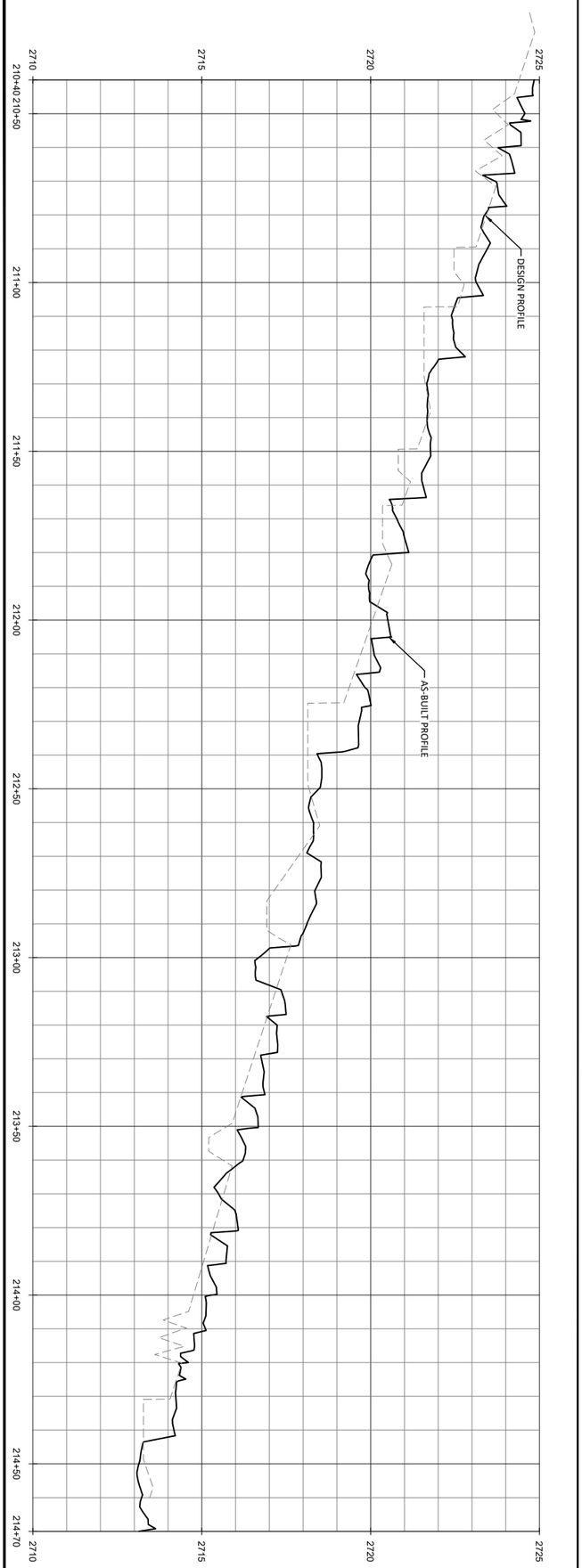
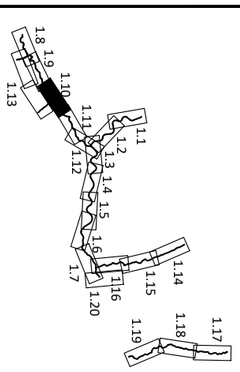
Fax: 919.851.9986
Firm License No. F-0831







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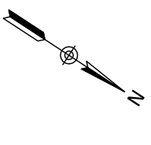

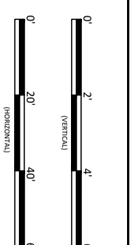

Date:	June 13, 2017
Job Number:	005-02147
Project Engineer:	JNK
Drawn By:	JCK
Checked By:	KG

Revisions:

1.10
Sheet

Vile Creek Mitigation Site Record Drawings
Alleghany County, North Carolina

UT1
Record Drawings

NORTH CAROLINA PROFESSIONAL SEAL 031027 ENGINEER JEFFERSON N. KEATON

Date: xx/xx/xx

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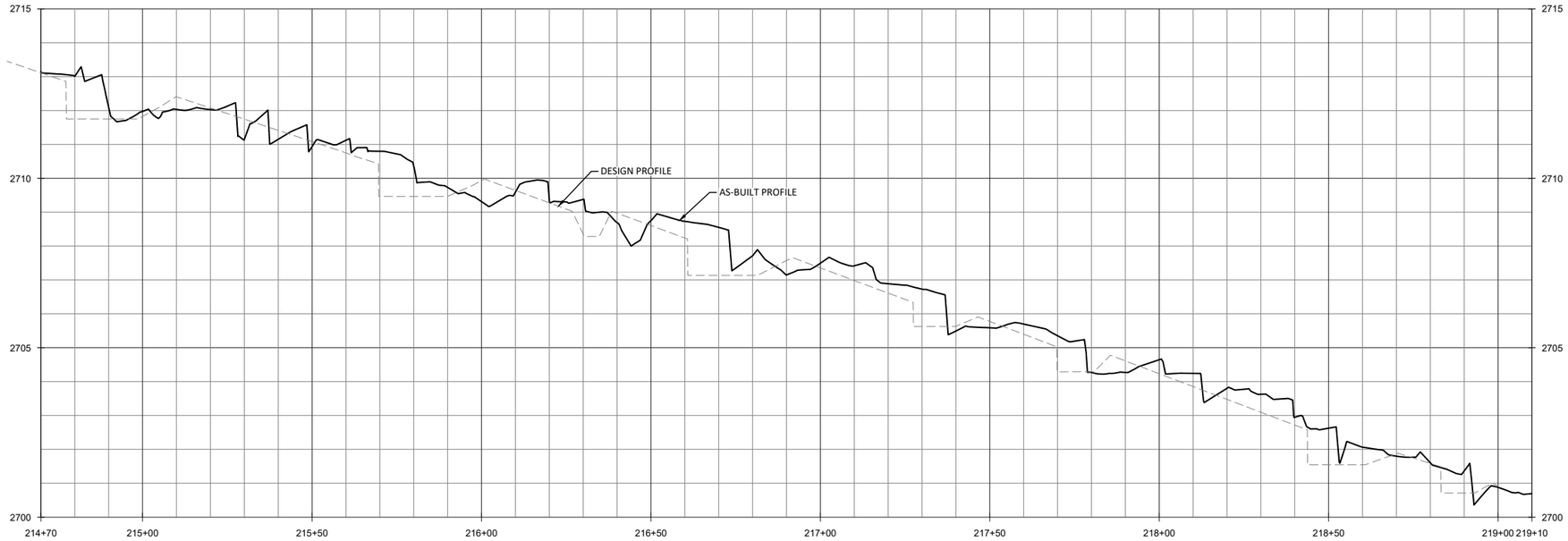
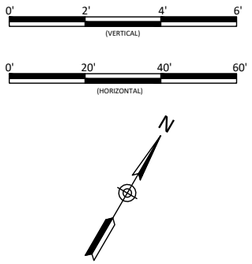
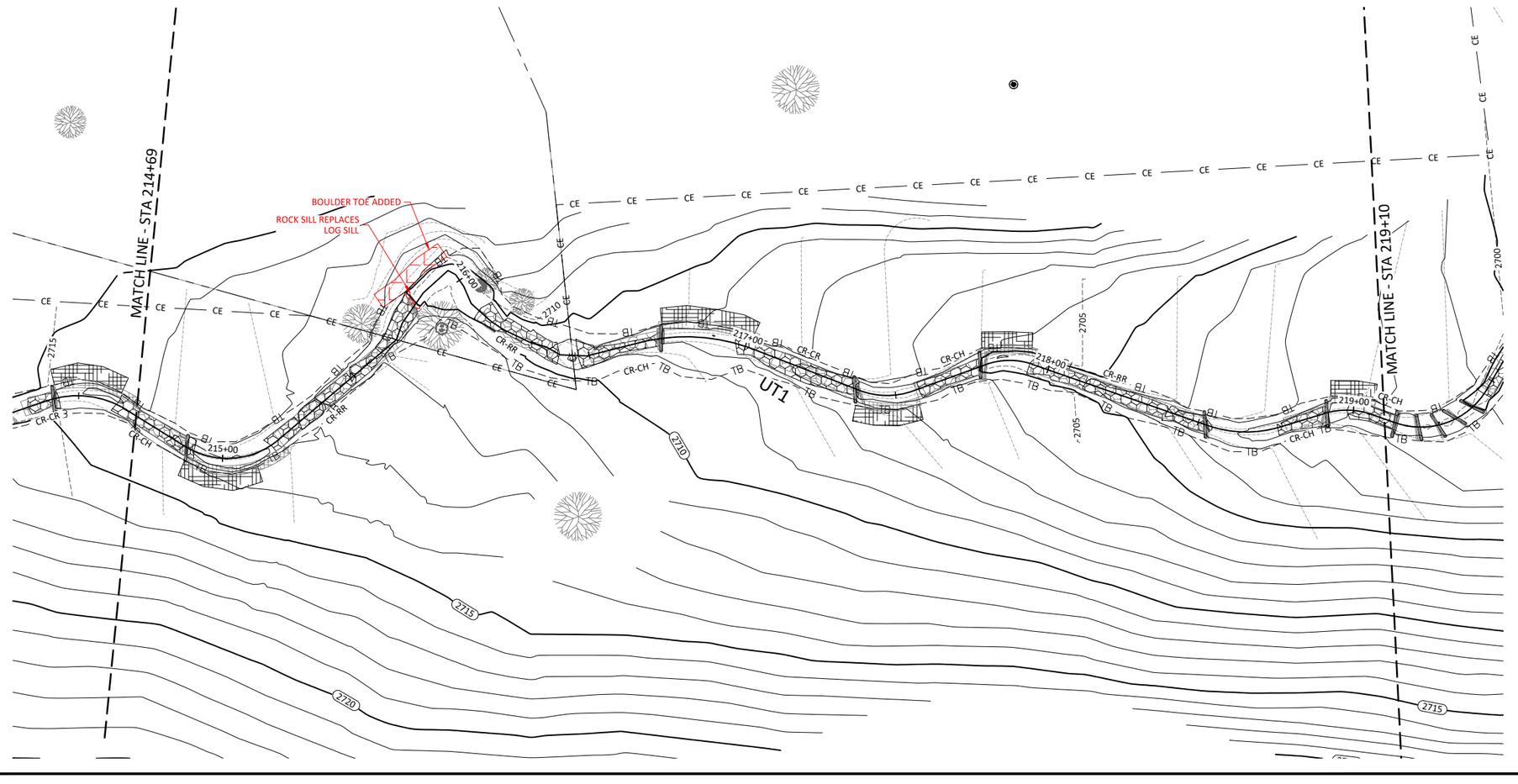
Firm License No. F-0831







NOTE:
STARTING AT STA: 217+15 DOWNSTREAM - SOD MATS ADDED ON MOST BANKS WHERE NO BANK REVETMENTS EXIST.

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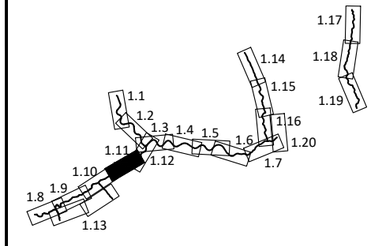

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NORTH CAROLINA PROFESSIONAL SEAL 031027 ENGINEER JEFFERSON M. FLEMING

Date: 10/25/17

Vile Creek Mitigation Site Record Drawings
Alleghany County, North Carolina

UT1
Record Drawings

Revisions:

Date: June 13, 2017
Job Number: 005-02147
Project Engineer: JNK
Drawn By: JCK
Checked By: KG

Sheet 1.11

June 13, 2017

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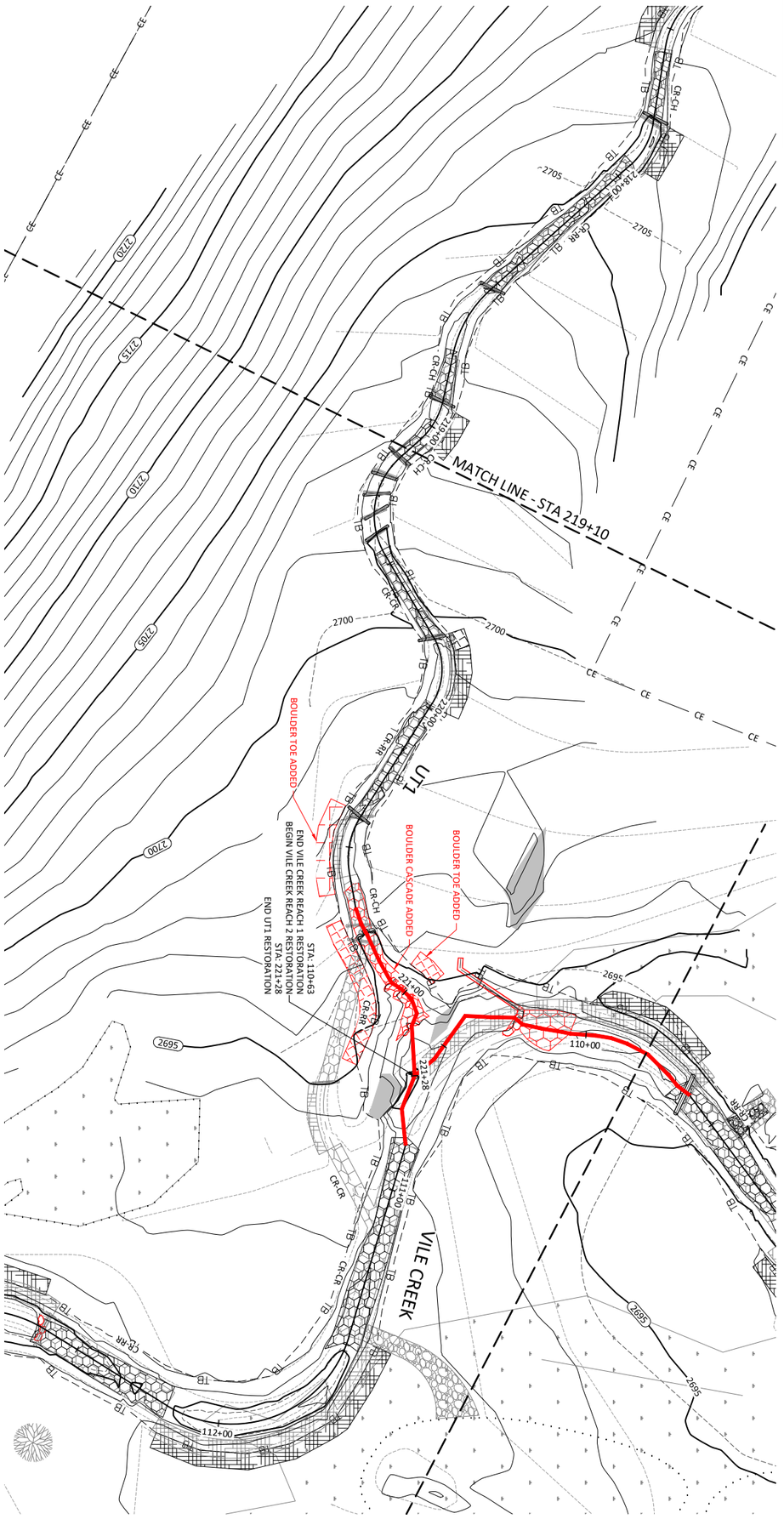

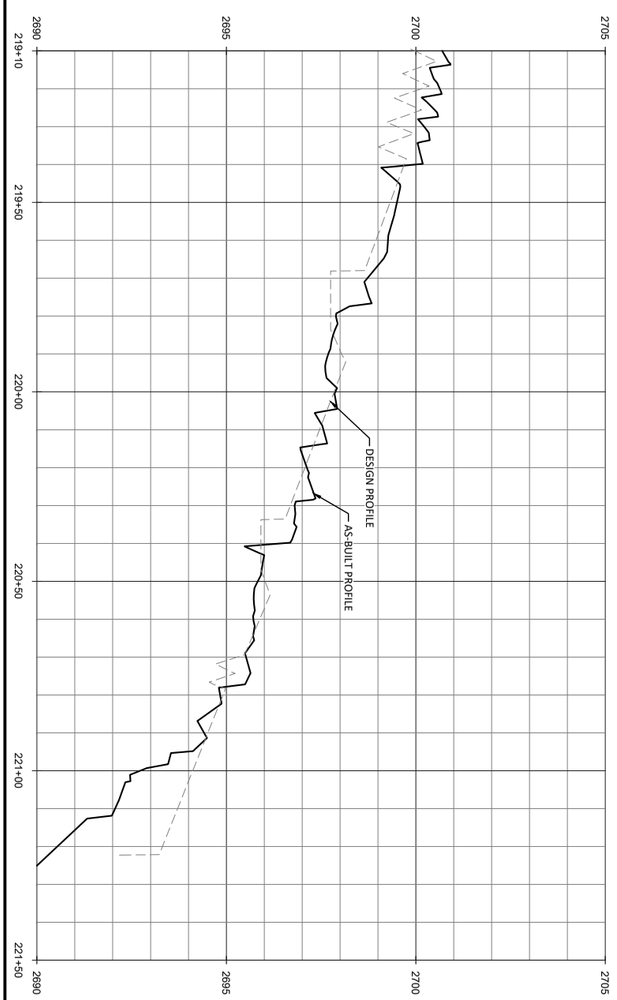

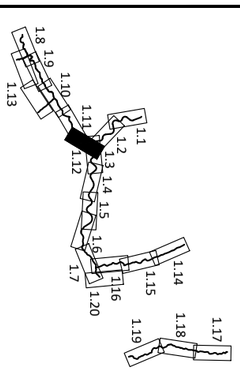

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NOTE:
SOD MATS ADDED ON MOST BANKS WHERE NO BANK REVETMENTS EXIST.
STA: 220+69 - 221+28 - ALIGNMENT REVISION IN FIELD IN ORDER TO UTILIZE AND MAINTAIN BEDROCK

N

0' 20' 40' 60' (HORIZONTAL)

0' 2' 4' 6' (VERTICAL)

Date:	June 13, 2017
Job Number:	005-02147
Project Engineer:	JNK
Drawn By:	JCK
Checked By:	KG

Revisions:

1.12
Sheet

Vile Creek Mitigation Site Record Drawings
Alleghany County, North Carolina

UT1
Record Drawings

NORTH CAROLINA PROFESSIONAL SEAL 031027 ENGINEER JEFFERSON N. KEATON

Date: xx/xx/xx

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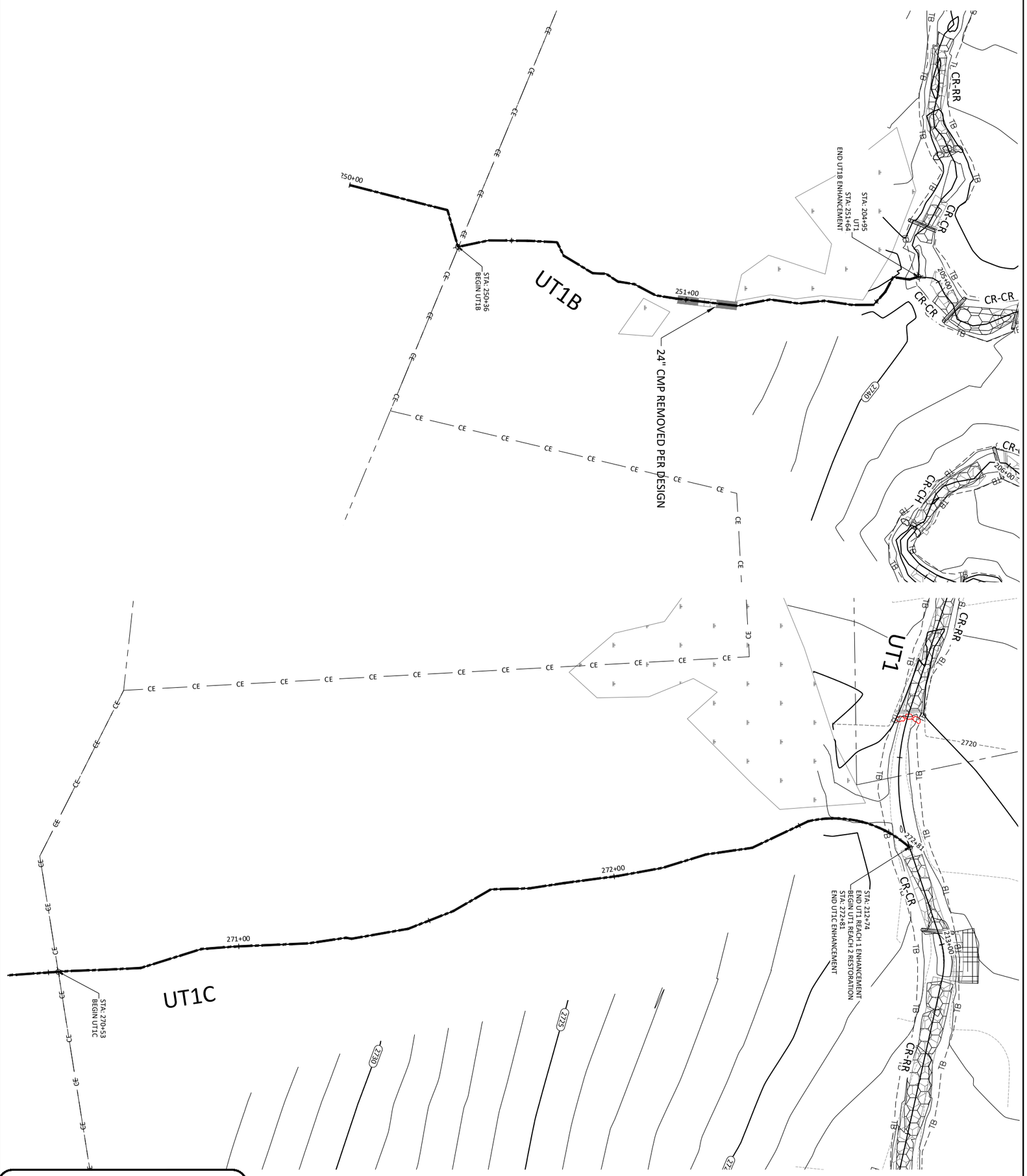
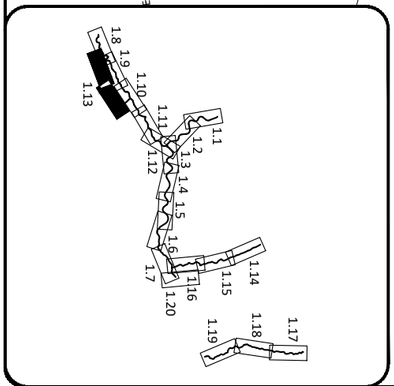
312 West Millbrook Rd., Ste.225
Raleigh, NC 27609
Tel: 919.851.9986
Fax: 919.851.9986
Firm License No. F-0831





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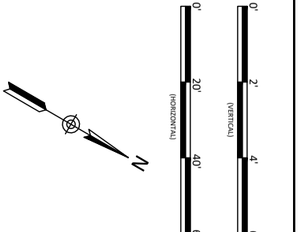

Date:	June 13, 2017
Job Number:	005-02147
Project Engineer:	JNK
Drawn By:	JCK
Checked By:	KG

Revisions:

1.13
Sheet

Vile Creek Mitigation Site Record Drawings
Alleghany County, North Carolina

UT1B & UT1C
Record Drawings

NORTH CAROLINA PROFESSIONAL SEAL 031027 ENGINEER JEFFERSON N. KEATON

Date: xx/xx/xx

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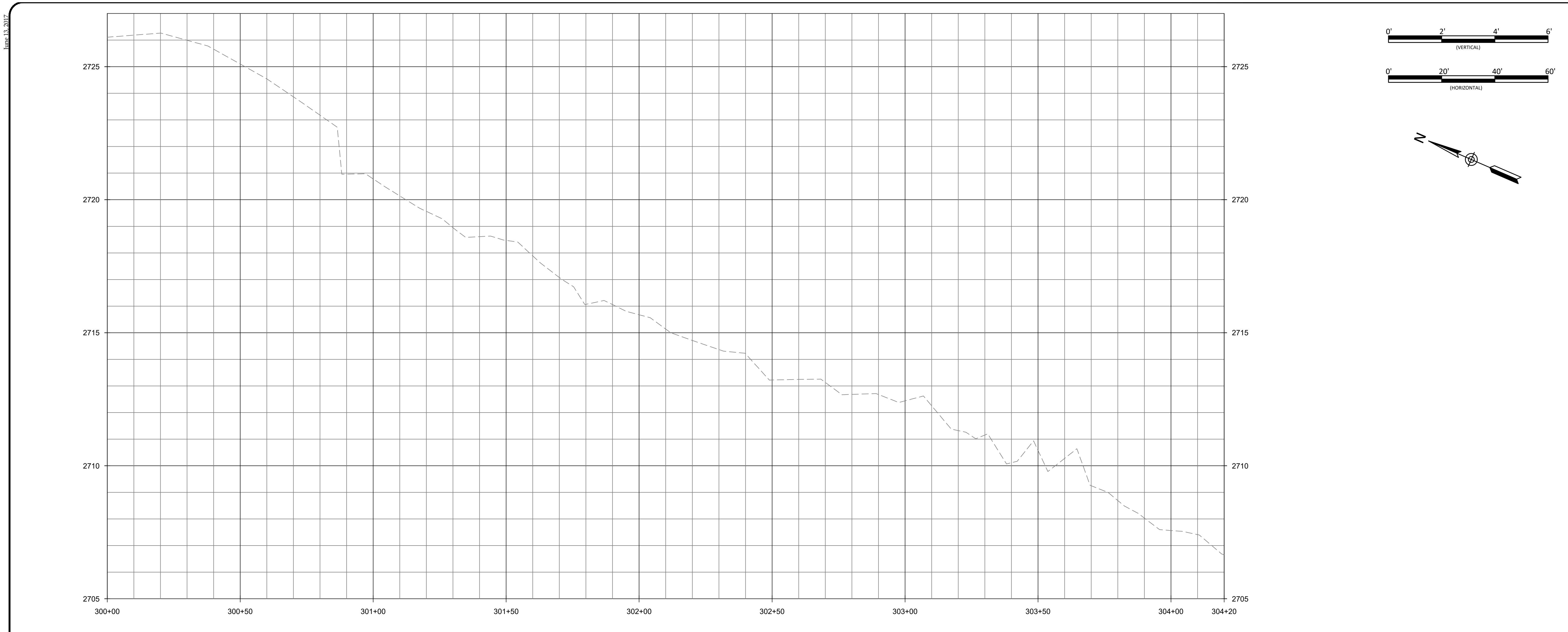
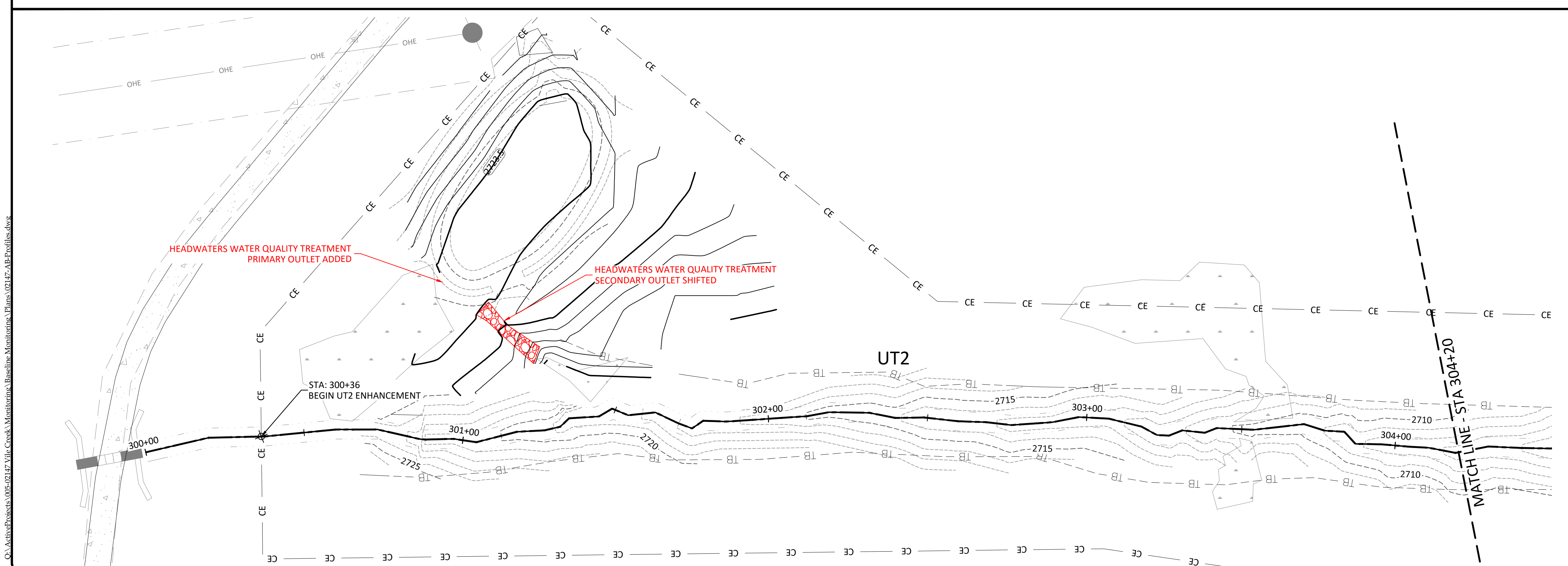
Firm License No. F-0831





NOTE:
STA: 303+00-303+50 - BANK GRADING AND LIGHT MATTING ON BOTH BANKS.
STA: 303+00 - 303+50 - BANK GRADING AND LIGHT MATTING ON LEFT BANK.

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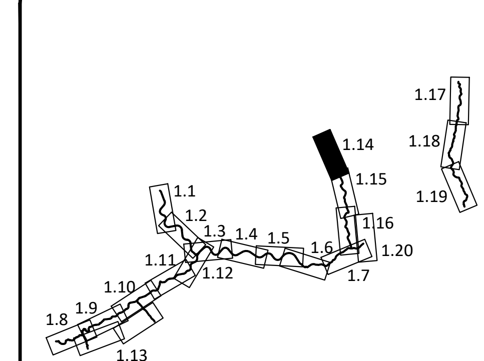

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NORTH CAROLINA PROFESSIONAL ENGINEER SEAL 031027

Date: xx/xx/xx

Vile Creek Mitigation Site Record Drawings
Alleghany County, North Carolina

UT2
Record Drawings

Revisions:

Date: June 13, 2017
Job Number: 005-02147
Project Engineer: JNK
Drawn By: JCK
Checked By: KG

Sheet 1.14

June 13, 2017

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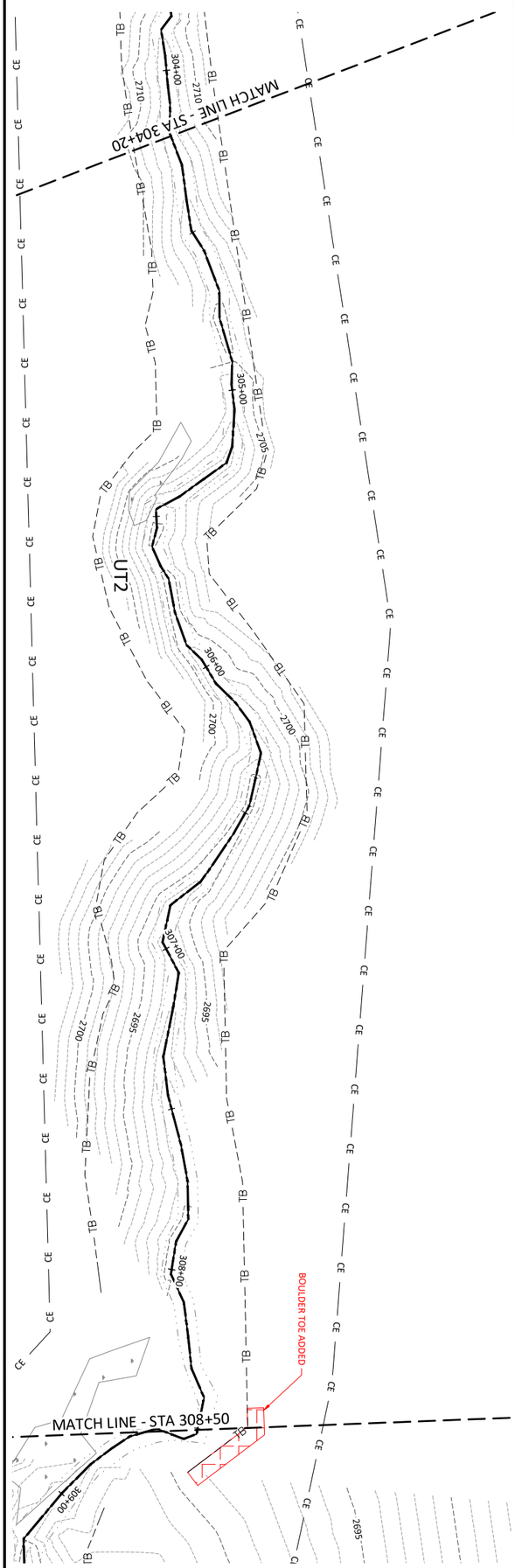
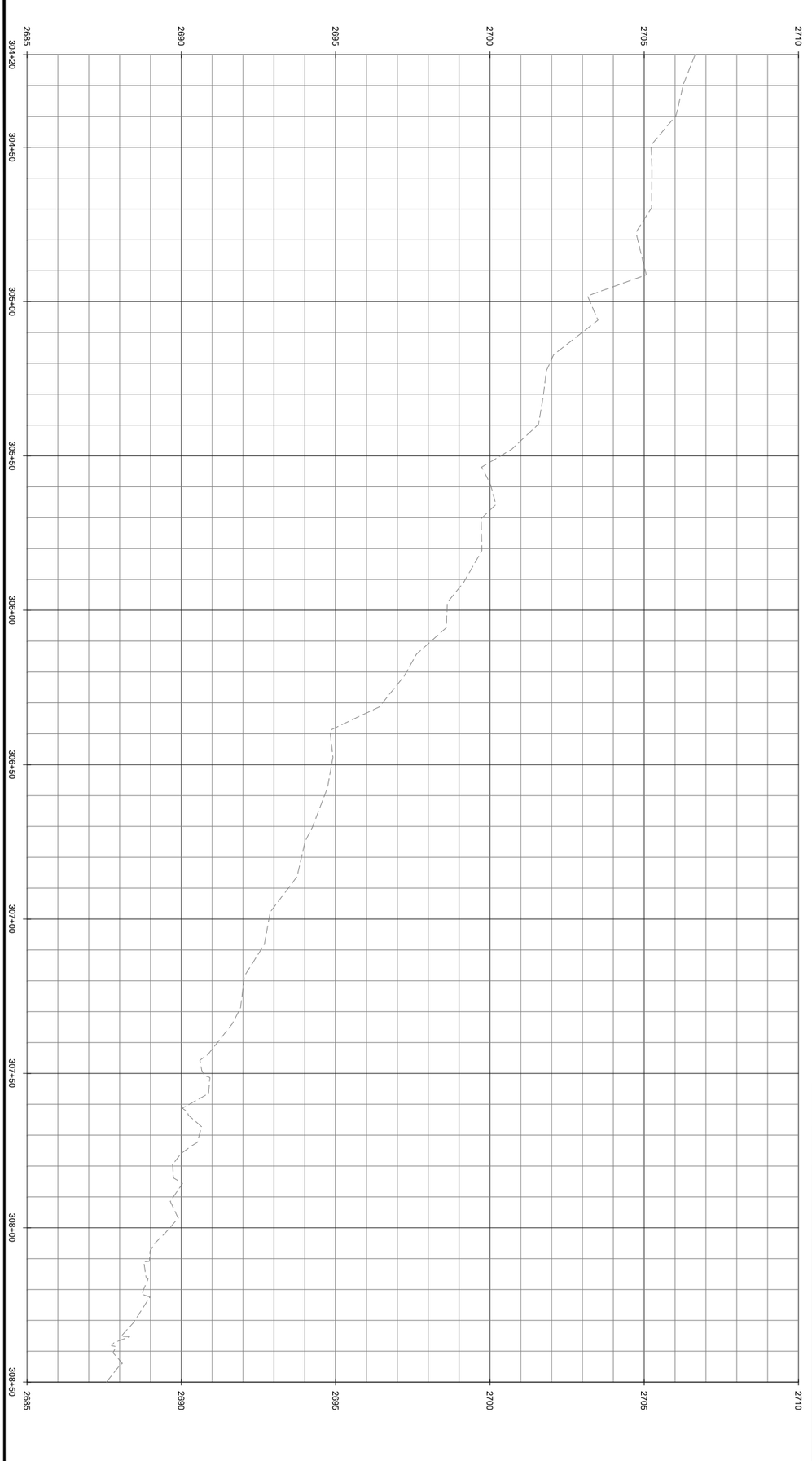
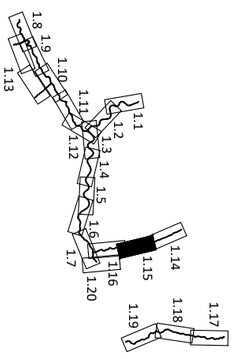
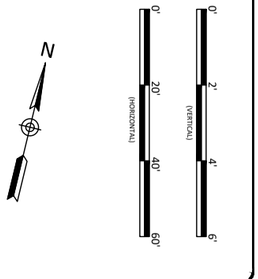






Sheet Index

NOTE:
STA. 305+25 - 306+75 - BANK GRADING AND LIGHT MATTING ON RIGHT BANK
STA. 306+50 - BOULDER TOE ADDED TO LEFT BANK
STA. 307+00 - 307+50 - BANK GRADING AND LIGHT MATTING ON BOTH BANKS



Date:	June 13, 2017
Job Number:	005-02147
Project Engineer:	JNK
Drawn By:	JCK
Checked By:	KG

1.15
Sheet

Revisions:

Vile Creek Mitigation Site Record Drawings
Alleghany County, North Carolina

UT2
Record Drawings

NORTH CAROLINA PROFESSIONAL SEAL 031027 ENGINEER PATTERSON N. KELTON

Date: xx/xx/xx

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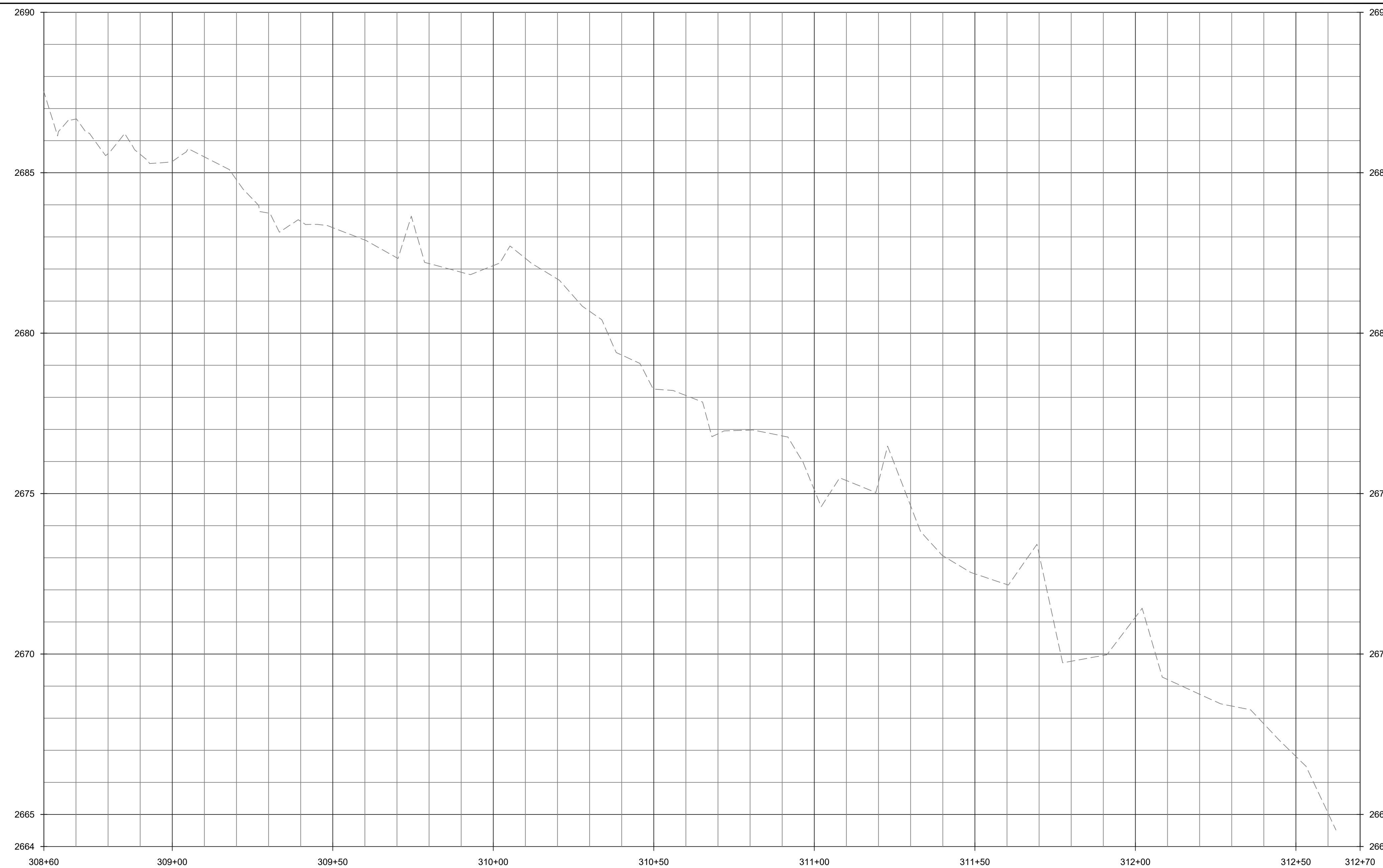
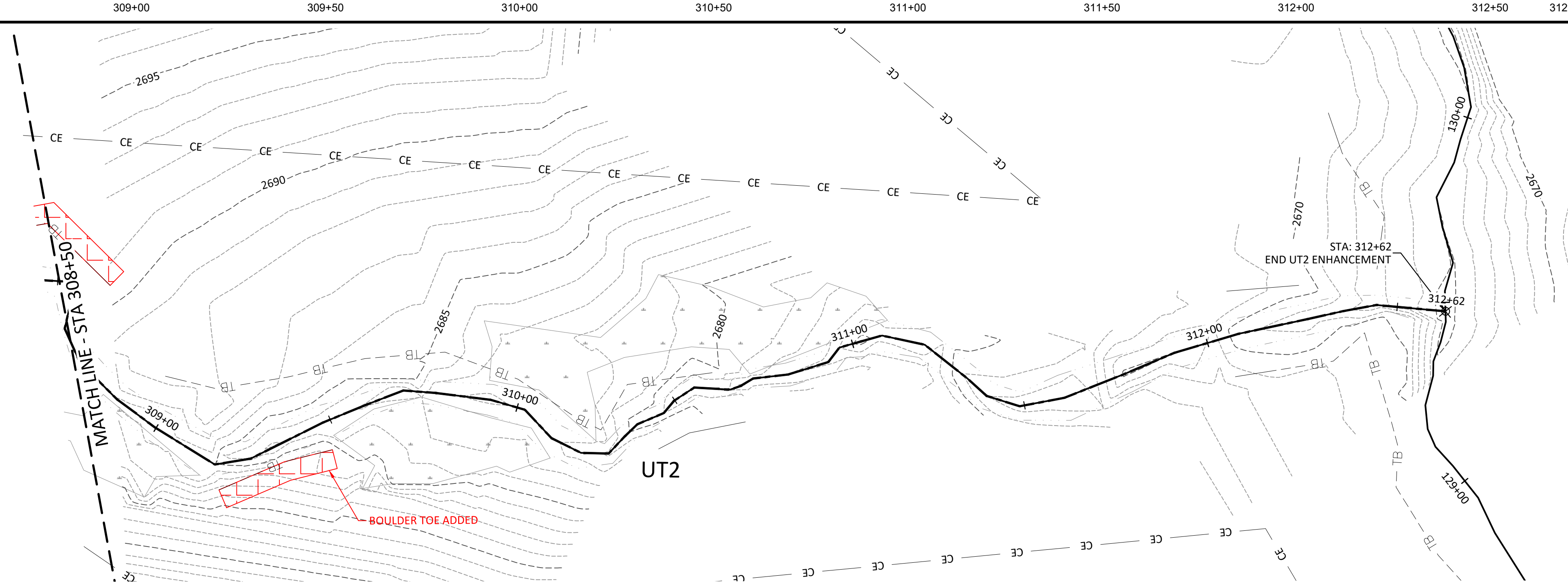
312 West Millbrook Rd., Ste.225
Raleigh, NC 27609
Tel: 919.851.9986
Fax: 919.851.9986
Firm License No. F-0831



0' 2' 4' 6'
(VERTICAL)
0' 20' 40' 60'
(HORIZONTAL)
N



NOTE:
STA: 308+50 - BOULDER TOE ADDED TO LEFT BANK
STA: 309+50 - BOULDER TOE ADDED TO RIGHT BANK
STA: 309+75 - 309+85 - BANK GRADING AND LIGHT MATTING ON LEFT BANK
STA: 310+50 - 311+00 - BANK GRADING AND LIGHT MATTING ON BOTH BANKS
STA: 312+25 - 312+62 - BANK GRADING AND LIGHT MATTING ON BOTH BANKS

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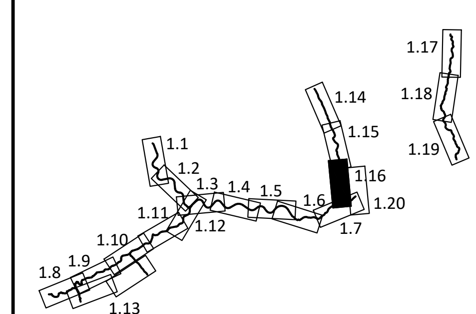

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Tel: 919.851.9986
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NORTH CAROLINA PROFESSIONAL SEAL 031027 ENGINEER

Date: xx/xx/xx

Vile Creek Mitigation Site Record Drawings
Alleghany County, North Carolina

UT2
Record Drawings

Revisions:

Date:	June 13, 2017
Job Number:	005-02147
Project Engineer:	JNK
Drawn By:	JCK
Checked By:	KG

Sheet 1.16

June 13, 2017

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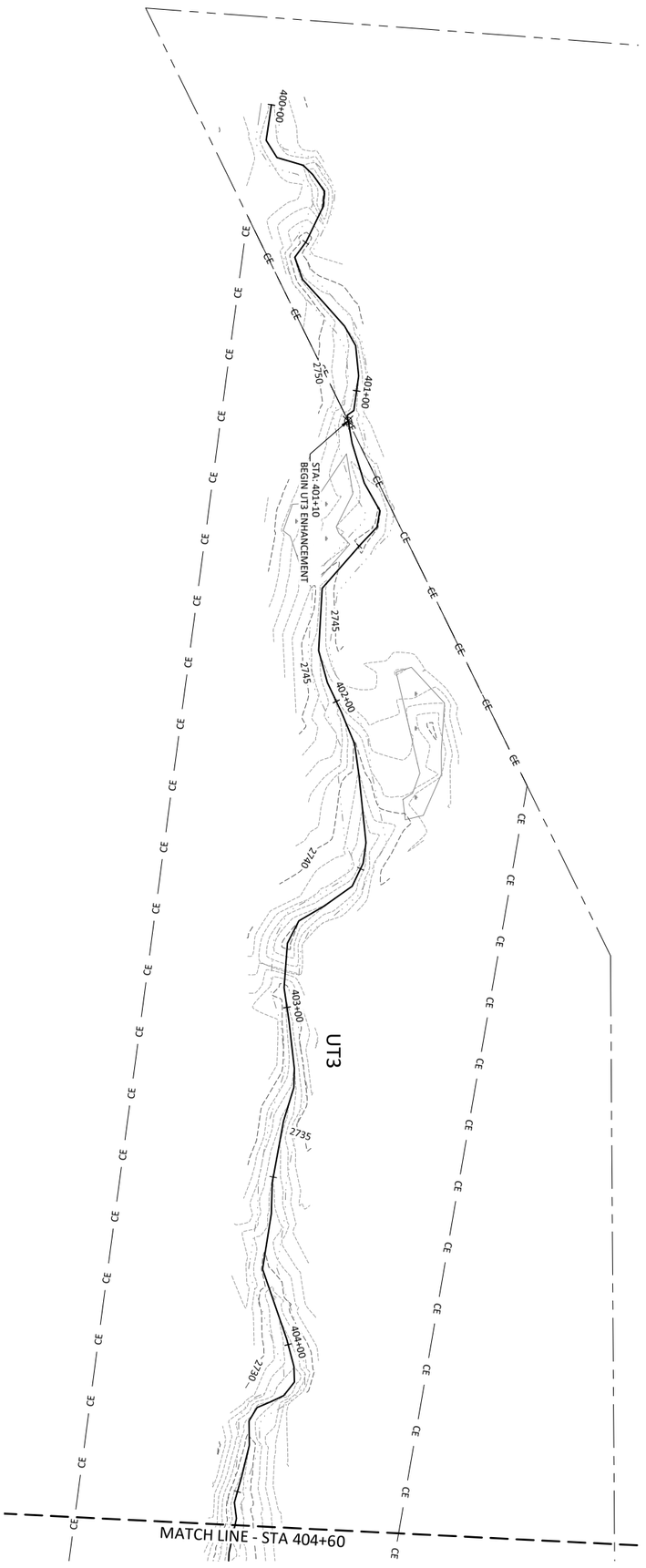

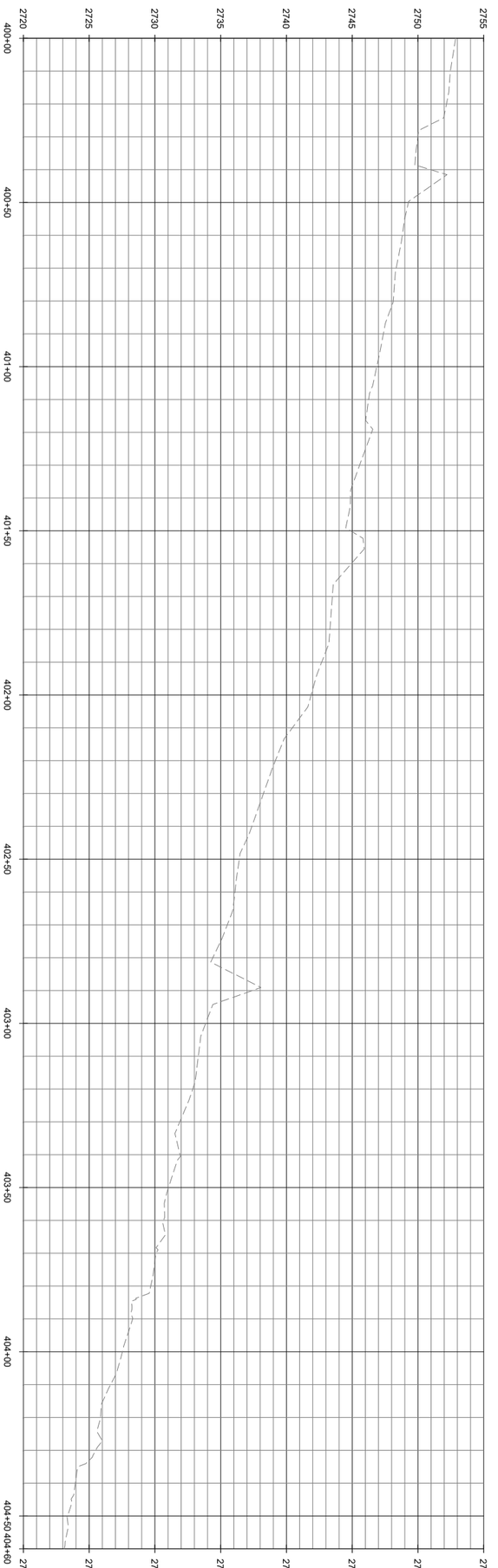

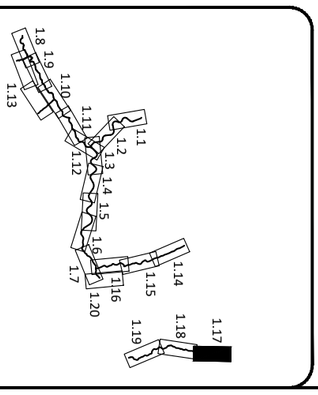

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N

0' 20' 40' 60' (HORIZONTAL)

0' 5' 10' 15' (VERTICAL)

Date:	June 13, 2017
Job Number:	005-02147
Project Engineer:	JNK
Drawn By:	JCK
Checked By:	KG

Revisions:

1.17
Sheet

Vile Creek Mitigation Site Record Drawings
Alleghany County, North Carolina

UT3
Record Drawings

NORTH CAROLINA PROFESSIONAL SEAL 031027 ENGINEER PATTERSON N. KELTON

Date: xx/xx/xx

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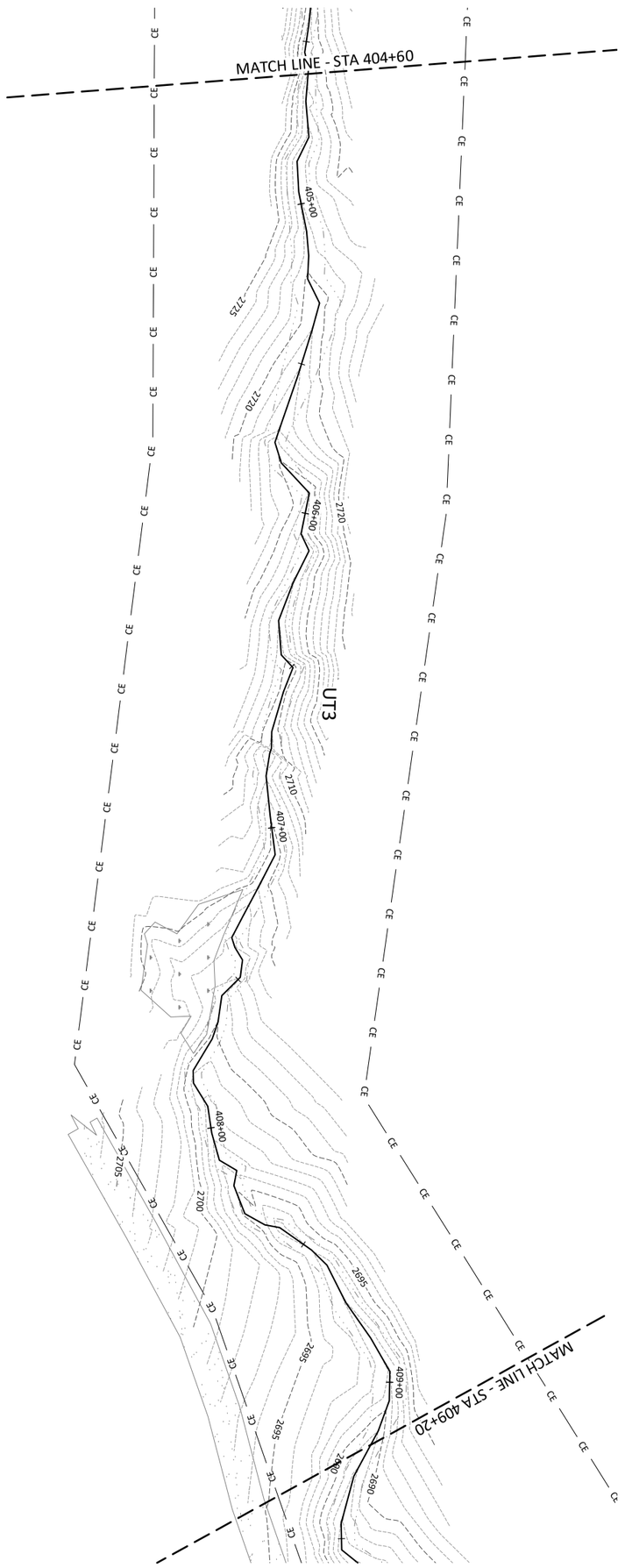

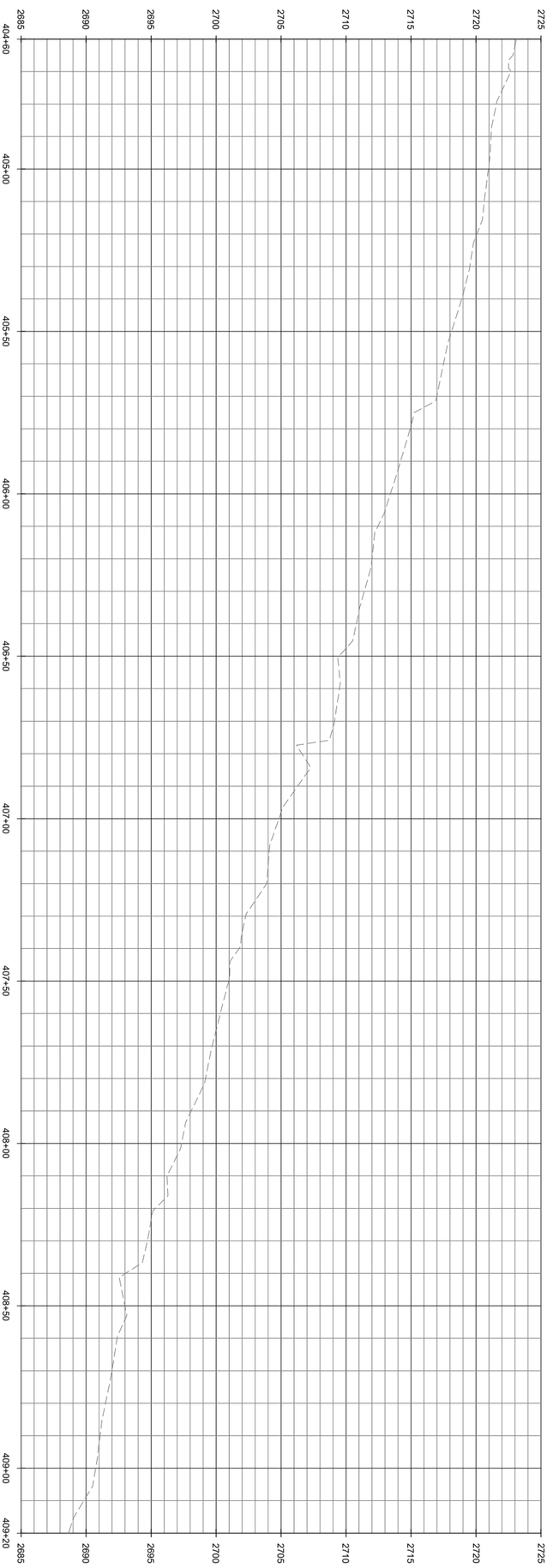

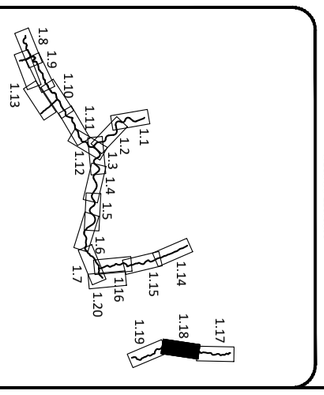

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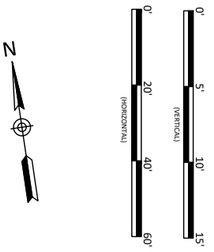

Date:	June 13, 2017
Job Number:	005-02147
Project Engineer:	JNK
Drawn By:	JCK
Checked By:	KG

Revisions:

Vile Creek Mitigation Site Record Drawings
Alleghany County, North Carolina

UT3
Record Drawings

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NORTH CAROLINA PROFESSIONAL SEAL 031027 ENGINEER JEFFERSON N. KEATON

Date: xx/xx/xx

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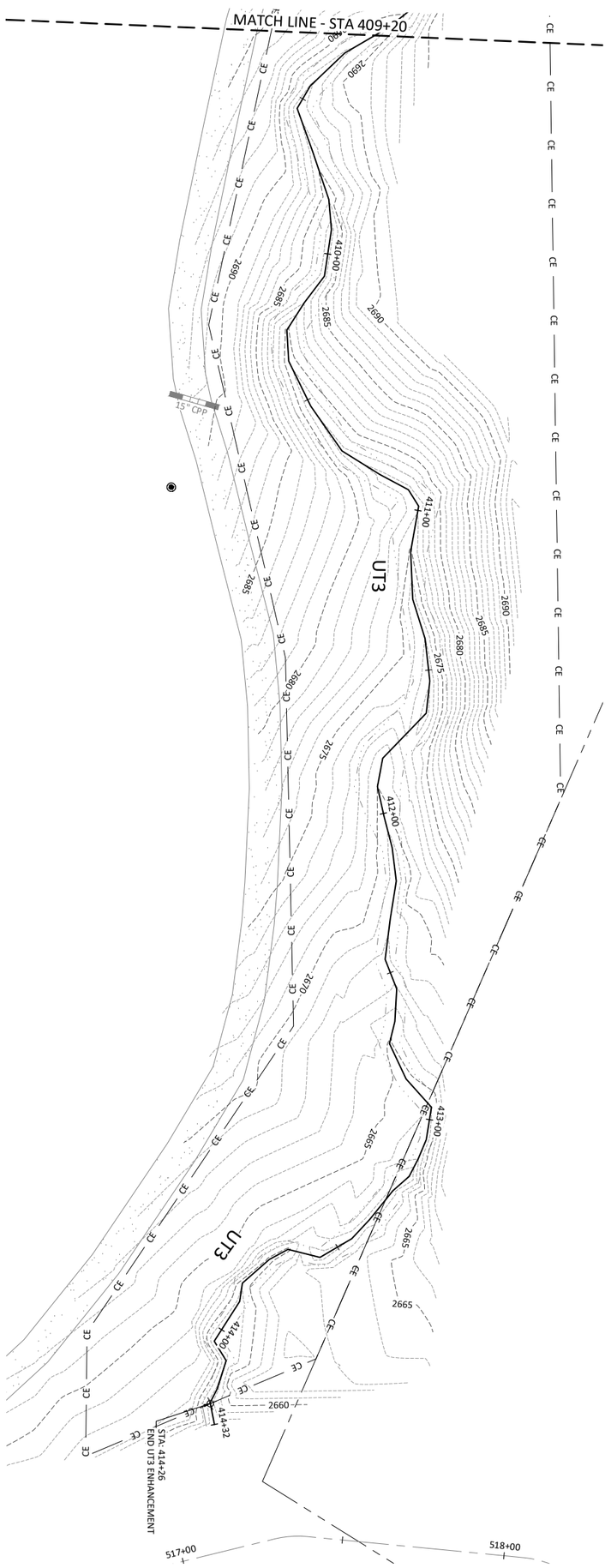

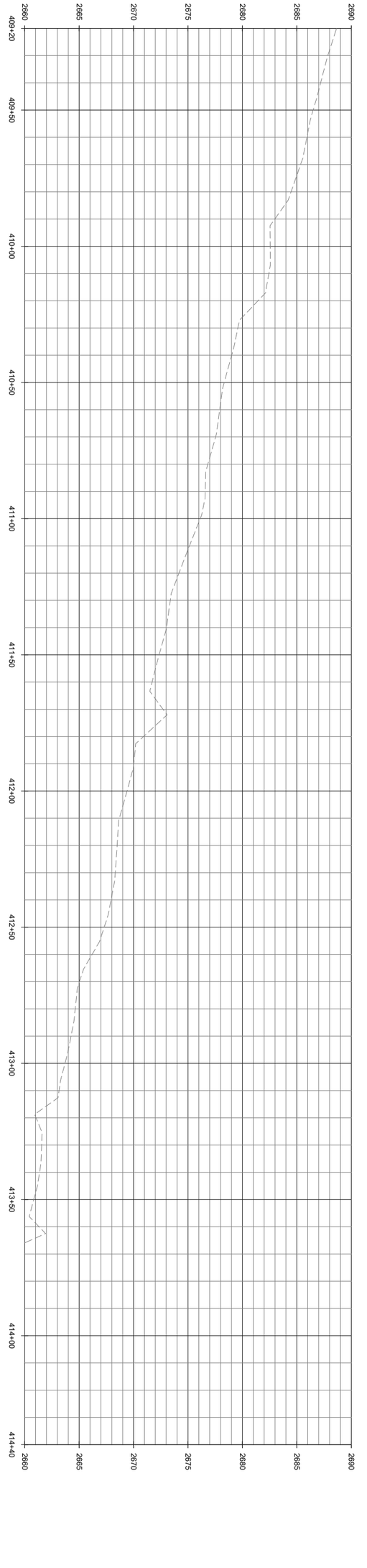

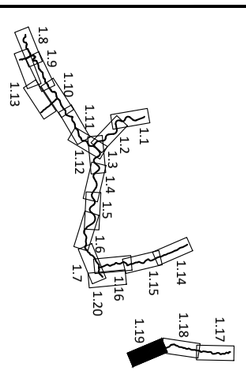

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Vile Creek Mitigation Site Record Drawings
Alleghany County, North Carolina

UT3
Record Drawings

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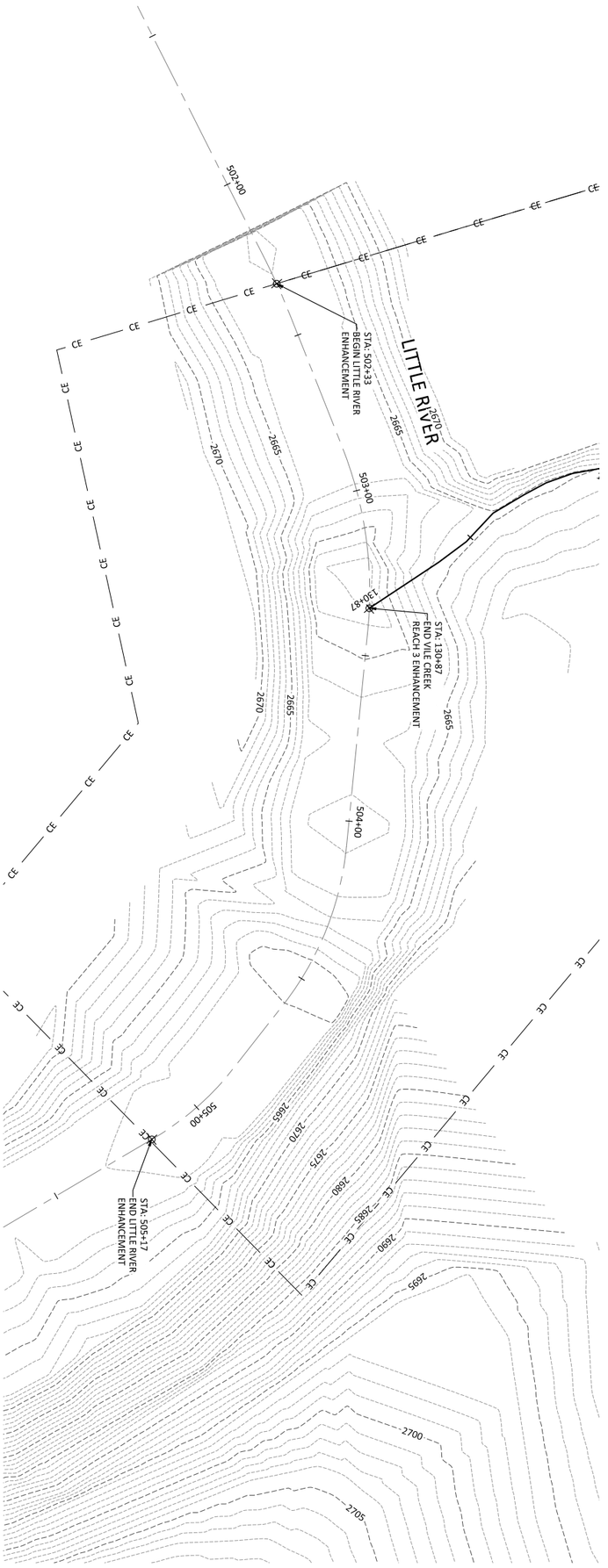

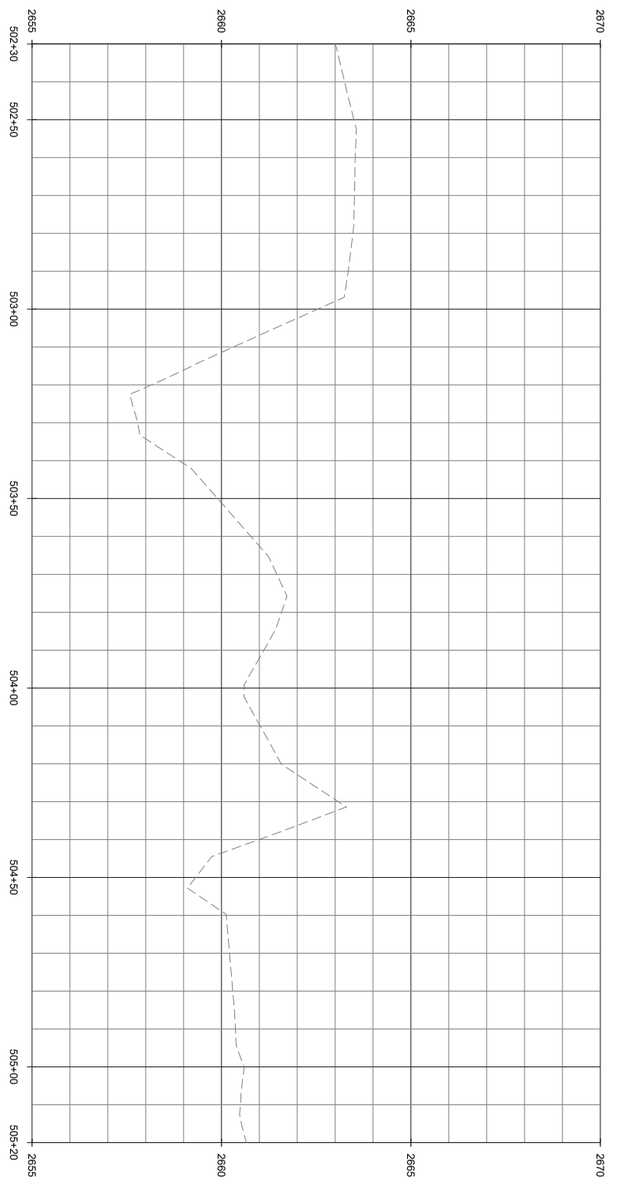

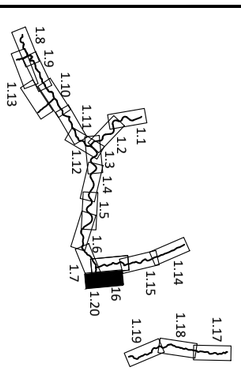

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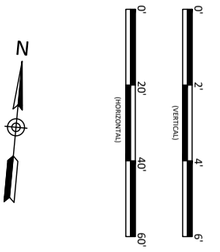

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Vile Creek Mitigation Site Record Drawings
Alleghany County, North Carolina

Little River
Record Drawings

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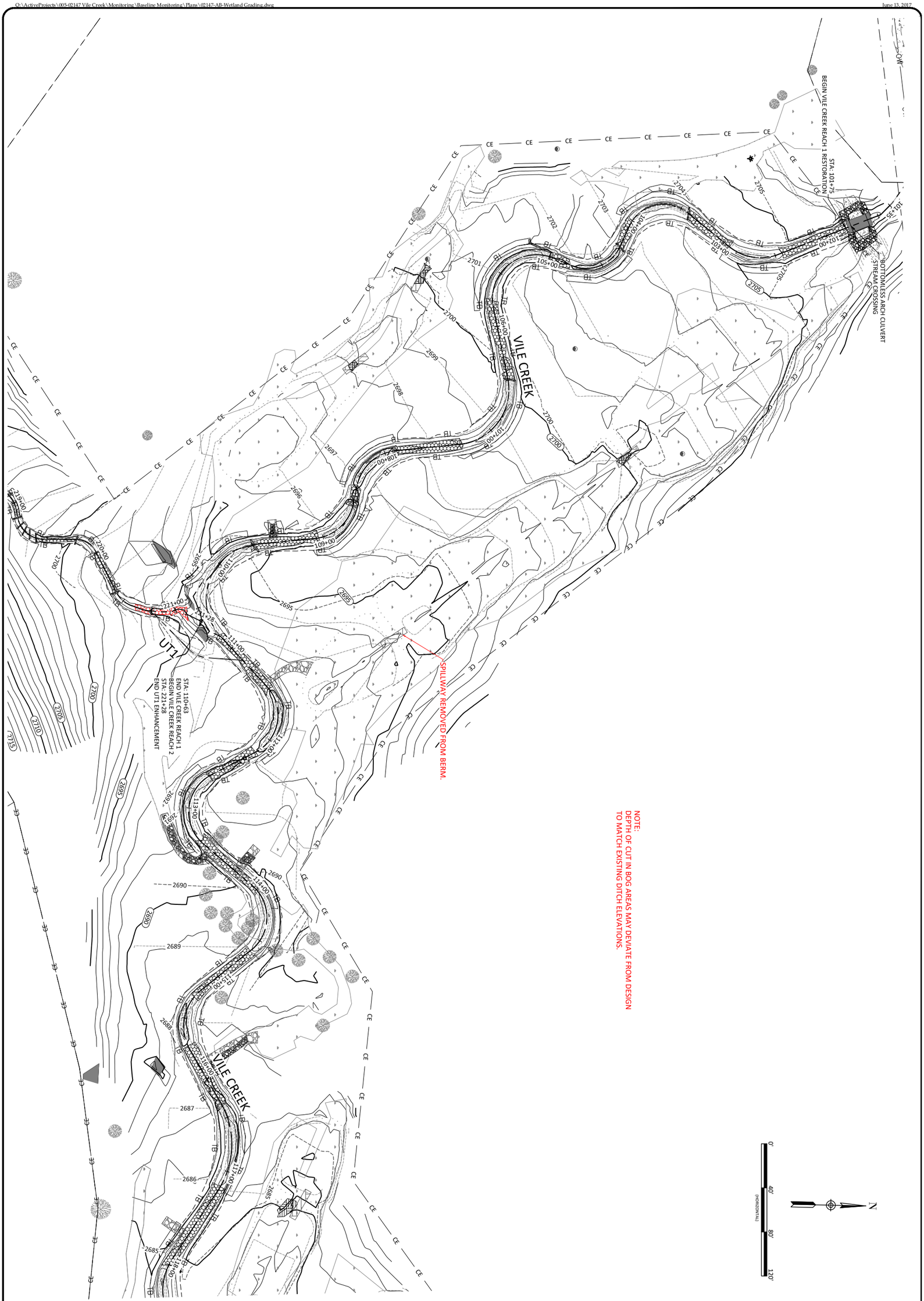

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Revisions:

Vile Creek Mitigation Site Record Drawings
Alleghany County, North Carolina

Wetland Grading

NORTH CAROLINA PROFESSIONAL SEAL 031027 ENGINEER JEFFERSON N. KEATON

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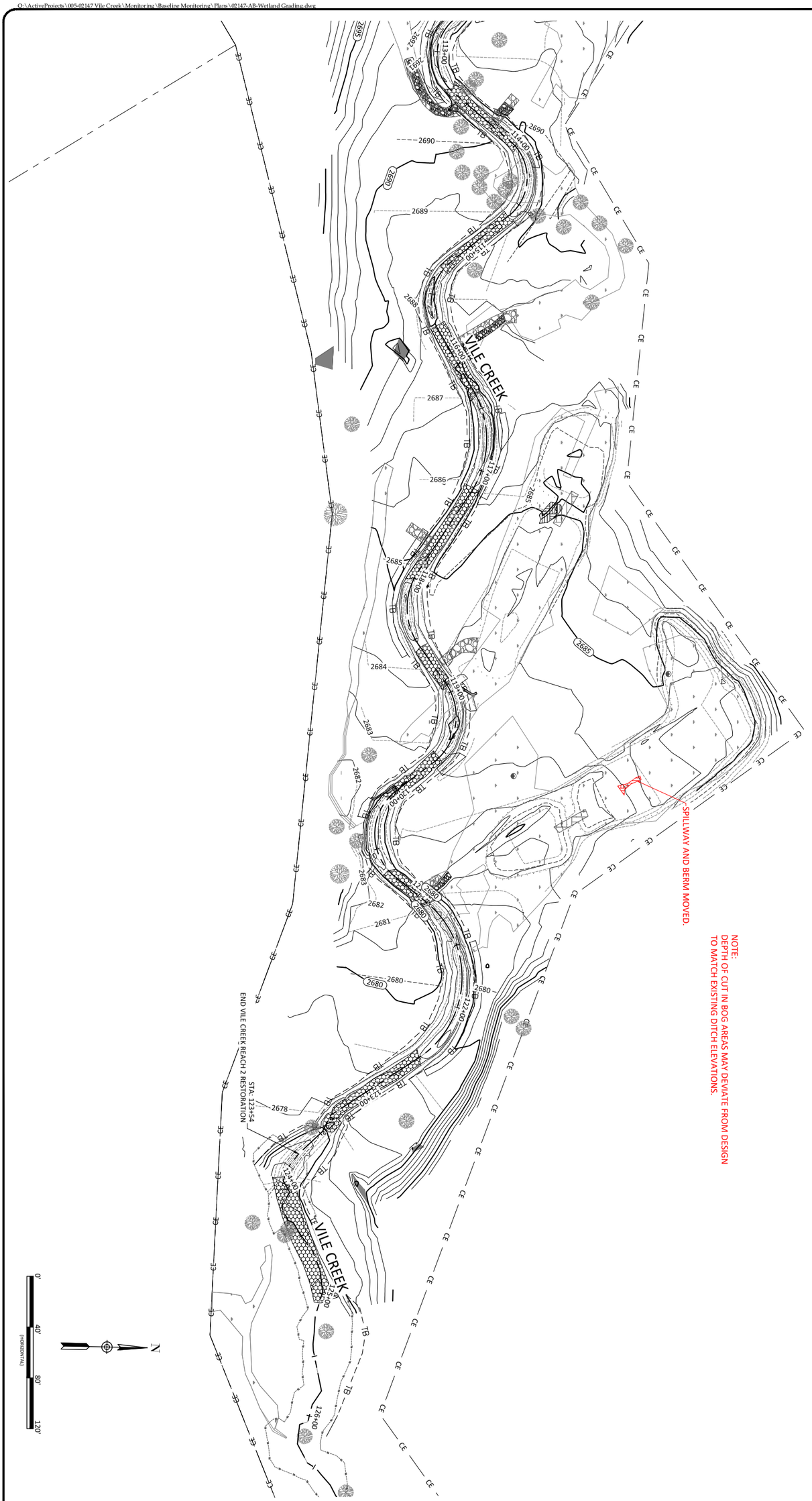

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Alleghany County, North Carolina

Wetland Grading

NORTH CAROLINA PROFESSIONAL SEAL 031027 ENGINEER JEFFERSON N. KEATON

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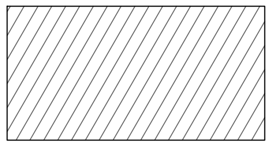
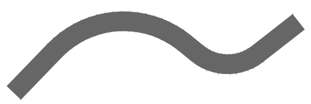


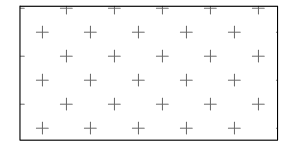
RIPARIAN ZONE					
Species	Common Name	Spacing	Min. Caliper	Percentage	Revision note
~~*Alnus serrulata*~~	~~Tag Alder~~	~~12ft x 6ft~~	~~0.25"~~	~~10%~~	UNABLE TO GET TAG ALDER.
Carpinus caroliniana	American Hornbeam	12ft x 6ft	0.25"	~~10%~~	12.5%
Liriodendron tulipifera	Tulip Poplar	12ft x 6ft	0.25"	15%	
Platanus occidentalis	Sycamore	12ft x 6ft	0.25"	15%	
Betula nigra	River Birch	12ft x 6ft	0.25"	15%	
Quercus pagoda	Cherrybark Oak	12ft x 6ft	0.25"	15%	
Fraxinus pennsylvanica	Green Ash	12ft x 6ft	0.25"	~~10%~~	15%
Diospyros virginiana	Persimmon	12ft x 6ft	0.25"	~~10%~~	12.5%



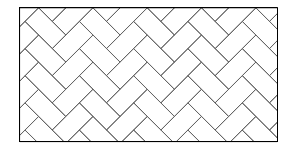
STREAM BANK ZONE - Livestakes				
Species	Common Name	Indiv. Spacing	Min. Caliper	Percentage
Cornus amomum	Silky Dogwood	3-5 ft	0.5"	20%
Cephalanthus occidentalis L.	Common Buttonbush	3-5 ft	0.5"	20%
Salix sericea	Silky Willow	3-5 ft	0.5"	20%
Physocarpus opulifolius	Ninebark	3-5 ft	0.5"	20%
Alnus serrulata	Tag Alder	3-5 ft	0.5"	20%

STREAM BANK ZONE - Herbaceous Plugs			
Species	Common Name	Indiv. Spacing	Percentage
Juncus effusus	Common Rush	4 ft	40%
Carex alata	Broadwing Sedge	4 ft	40%
Panicum virgatum	Switchgrass	4 ft	20%

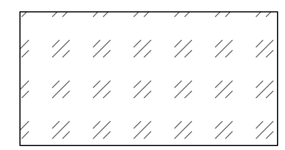
NOTE:
1. TOP SOIL TO BE STOCK PILED AND REAPPLIED TO ALL AREAS WHERE FLOODPLAIN AND WETLAND EXCAVATION IS GREATER THAN 6".
2. FERTILIZER AND LIME TO BE ADDED TO PLANTED AREAS BASED ON SOIL TEST RESULTS.
3. LIVESTAKES ARE TO BE INSTALLED IN A SINGLE ROW. SPACING SHALL BE 5 FEET IN TANGENT SECTIONS (BOTH BANKS) AND 3 FEET IN BENDS (OUTSIDE BANK ONLY).



WETLAND SHRUB ZONE					
Species	Common Name	Spacing	Min. Caliper	Percentage	Revision note
Aronia arbutifolia	Red Chokeberry	12ft x 12ft	0.25"	15%	20%
Cornus amomum	Silky Dogwood	12ft x 12ft	0.25"	15%	20%
~~*Ilex verticillata*~~	~~Winter Berry~~	~~12ft x 12ft~~	~~0.25"~~	~~15%~~	UNABLE TO GET WINTER BERRY.
Lindera benzoin	Spicebush	12ft x 12ft	0.25"	15%	20%
Sambucus nigra	Elderberry	12ft x 12ft	0.25"	10%	20%
~~*Vaccinium corymbosum*~~	~~Highbush Blueberry~~	~~12ft x 12ft~~	~~0.25"~~	~~15%~~	UNABLE TO GET HIGHBUSH BLUEBERRY.
Cephalanthus occidentalis L.	Common Buttonbush	12ft x 12ft	0.25"	15%	20%



HERBACEOUS ZONE			
Species	Common Name	Indiv. Spacing	Percentage
Juncus effusus	Common Rush	8 ft	15%
Carex alata	Broadwing Sedge	8 ft	15%
Carex lurida	Shallow Sedge	8 ft	15%
Carex crinita	Fringed Sedge	8 ft	15%
Scirpus cyperinus	Woolgrass	8 ft	20%
Sagittaria latifolia	Broadleaf Arrowhead	8 ft	20%



UNDERSTORY ZONE					
Species	Common Name	Spacing	Min. Caliper	Percentage	Revision note
Carpinus caroliniana	American Hornbeam	12ft x 12ft	0.25"	25%	30%
Aronia arbutifolia	Red Chokeberry	12ft x 12ft	0.25"	25%	35%
~~*Ilex verticillata*~~	~~Winter Berry~~	~~12ft x 12ft~~	~~0.25"~~	~~25%~~	UNABLE TO GET WINTER BERRY.
Lindera benzoin	Spicebush	12ft x 12ft	0.25"	25%	30%

Permanent Riparian Seeding				
Pure Live Seed				
Approved Date	Species Name	Common Name	Stratum	Density (lbs/acre)
All Year	*Schizachyrium scoparium*	Little Bluestem	Herb	5.0
All Year	*Panicum virgatum*	Swithgrass	Herb	2.5
All Year	*Rudbeckia hirta*	Blackeyed Susan	Herb	3.0
All Year	*Carex vulpinoidea*	Fox Sedge	Herb	1.5
All Year	*Panicum clandestinum*	Deertongue	Herb	4.0
All Year	*Elymus virginicus*	Virginia Wild Rye	Herb	4.0
All Year	*Asclepias syrica*	Common Milkweed	Herb	0.8
All Year	Lobelia cardinalis L.	Cardinal Flower	Herb	0.2
All Year	*Eupatorium perfoliatum*	Boneset	Herb	1.0
All Year	*Panicum rigidulum*	Redtop Panicgrass	Herb	2.5
All Year	*Agrostis hyemalis*	Winter Bentgrass	Herb	4.0

TEMPORARY SEEDING		
APPROVED DATE	TYPE	PLANTING RATE (lbs/acre)
Jan 1 – May 1	Rye Grain (Secale Cereale)	120
	Ground Agricultural Limestone	2,000
	10-10-10 Fertilizer	750
	Straw Mulch	4,000
May 1 – Aug 15	German Millet (Setaria italica)	40
	Ground Agricultural Limestone	2,000
	10-10-10 Fertilizer	750
	Straw Mulch	4,000
Aug 15 – Dec 30	Rye Grain (Secale Cereale)	120
	Ground Agricultural Limestone	2,000
	10-10-10 Fertilizer	1,000
	Straw Mulch	4,000

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Vile Creek Mitigation Site Record Drawings
Alleghany County, North Carolina

Plant Lists
Record Drawings

Revisions:

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Job Number: 005-02147
Project Engineer: JNK
Drawn By: JCK
Checked By: KG

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