MONITORING YEAR 5 ANNUAL REPORT

FINAL

VILE CREEK MITIGATION SITE
Alleghany County, NC
DEQ Contract No. 5999
DMS Project No. 96582

DWR No. 14-0869
USACE Action ID 2014-01585

Data Collection Period: April – October 2021
Submission Date: January 19, 2022

PREPARED FOR:

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

January 19, 2022

Mr. Harry Tsomides
NC Department of Environmental Quality
Division of Mitigation Services
5 Ravenscroft Dr., Suite 102
Asheville, NC 28801

RE: **Response to MY5 Draft Report Comments**
Vile Creek Mitigation Project
DMS Project # 96582
Contract Number 5999
New River Basin - HUC# 05050001 - Alleghany County, North Carolina

Dear Mr. Tsomides:

Wildlands Engineering, Inc. (Wildlands) has reviewed the Division of Mitigation Services, (DMS) comments from the Draft Monitoring Year 5 report for the Vile Creek Mitigation Project. DMS comments are noted below in bold, Wildland's responses to DMS report comments are noted in *italics*.

DMS' Comment: The Adaptive Management Plan was noted in the write up however it is not indicated whether or not the repairs were built according to the plan (i.e., "as built") or if planting itself met the plan specifics (quantities, species, locations, etc). Please indicate accordingly and detail/explain any deviations if they occurred.

Wildlands Response: Section 1.2.5 Areas of Concern/Adaptive Management Plan was updated to document that the repairs were built per the AMP and that when supplemental planting will be completed in the dormant season 2022. Any deviations from the AMP's supplemental planting plan will be described in the MY6 report.

DMS' Comment: Thank you for summarizing the UT1 easement encroachment and making additional marking efforts to rectify the scalloping/mowing; if this continues to be an issue with the landowner DMS is happy to discuss and offer further advice, however please continue to work with the landowner to eliminate this issue.

Wildlands' Response: Wildlands will continue to work with the landowner to resolve the encroachment issue. We appreciate the offer of advice and will reach out if needed.

DMS' Comment: In the Notes column of the project components (Table 1), please note the LF aggraded channel on UT1b (62') and UT1c (115').

Wildlands' Response: The LF of aggraded channel on UT1b and UT1c is now indicated on Table 1.

Digital Support File Comments

DMS' Comment: Please submit mobile plots/transect features as polygons (the polygon feature class is empty) and include a feature representing the supplemental planting area.

Wildlands' Response: The mobile plots/transect feature class was changed to a polygon. A feature class representing the supplemental planting areas is now included in the GDB.

DMS' Comment: Note that there appears to be only 9 invasive areas of concern polygons compared to the 13 reported in Table 6. Please update the table or submit missing features.

Wildlands' Response: The table was mislabeled with 13 polygon features. The correct number 9 is now recorded in Table 6.

DMS' Comment: Please double check the stream areas of concern features and ensure that feature lengths match reported lengths. For example, there is one feature labeled as Scour/Erosion UT1 R2, but there is no scour/erosion reported in Table 5b. Similarly, there is 1 feature for UT2 with a length of 45 ft, but Table 5f suggests there are 2 segments with a total length of 77 ft.

Wildlands' Response: Wildlands updated the attribute table for the Stream Areas of Concern – MY5 feature class. One of the scour/erosion areas was mislabel as UT1 R2 and is now properly labeled as UT2. Table 5f is now updated with the correct total length of 89 ft for the scour/erosion.

DMS' Comment: The Table 7 export and the simple export from the CVS mdb do not match the table included in the report. Please make sure that the data in the mdb support the table included in the report.

Wildlands' Response: The table 7 export from the CVS.mdb now matches Table 9a and 9b in the Vile MY5 report. The variation was because one newly found volunteers in VP 1 and VP 5 were included in the Table 9a and 9b. The additional stem was removed from these tables.

DMS' Comment: Please submit the data used to create the 30-70 figure.

Wildlands' Response: The data used to create the 30-70 figure is included in the Rainfall-Sparta 3.5 SSW folder. The CSV file was renamed to 30-70 figure.

Enclosed please find two (2) hard copies and one (1) electronic copy on USB of the Final Monitoring Report. Please contact me at 704-332-7754 x101 if you have any questions.

Sincerely,

Kristi Suggs,
Senior Environmental Scientist
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PREPARED BY:

WILDLANDS
ENGINEERING

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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 5,053.000 stream mitigation units (SMUs) and 5.703 riparian wetland mitigation units (WMUs) for the New River Basin (Table 1). The Site is located approximately one mile east of the Town of Sparta, NC in the New River Basin eight-digit Hydrologic Unit Code (HUC) 05050001 and the 14-digit 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 Little River (Figure 2). Vile Creek flows into Little River near the downstream project 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 planning area for the Little River & Brush Creek Local Watershed Plan (LWP). The LWP identified the following stressors to watershed function: Heavily grazed deforested buffer, livestock access to the streams, heavily eroded stream banks, land-disturbing activities on steep slopes, 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 goals and objectives that were described in the RBRP and to meet DMS mitigation needs while maximizing the ecological and water quality uplift with the watershed. The project goals established in the Mitigation Plan focused on permanent protection for the Site, re-establishing natural hydrology and vegetation, reducing water quality stressors, and enhancing terrestrial and aquatic habitat.

The Site construction and as-built survey were completed in February 2017. Monitoring Year (MY) 5 assessments and Site visits were completed between April and November 2021 to assess the conditions of the project.

Overall, the Site has partially met the required stream, vegetation, and hydrology success criteria for MY5 and is on track to meet MY7 performance standards/success criteria. All restored and enhancement I streams are geomorphically stable and functioning as designed. During MY5, 1 bankfull event was recorded on Vile Creek Reach 2 and 2 bankfull events were recorded on UT1 Reach 2. However, bankfull event criteria was already met in MY2. Multiple geomorphically significant events were recorded on Vile Creek Reach 2 and UT1 Reach 2. Pebble counts reflect no significant change in restoration and enhancement I stream substrate material. All ten gages in the wetland re-establishment and wetland rehabilitation, and bog areas are either meeting or exceeding hydrology success criteria.

Supplemental plantings were completed in March of MY5. In addition, an Adaptive Management Plan (AMP) was approved by the IRT prior to conducting stream repairs in September of MY5. The approved AMP can be found in appendix 6

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APPENDICES

Section 1: PROJECT OVERVIEW

The Site is located approximately one mile east of the Town Sparta in eastern Alleghany County, NC. The project is within the New River Basin eight-digit HUC 05050001 and the 14-digit HUC 05050001030020 (Figure 1). Located in the Blue Ridge Belt of the Blue Ridge Province (USGS, 1998), the project watershed primarily includes 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 project streams consist of Vile Creek and five unnamed tributaries (UT) to Vile Creek including UT1, UT1b, UT1c, UT2, UT3, and a portion of Little River. Stream restoration reaches include Vile Creek (Reaches 1 and 2) and UT1 Reach 2, which together comprise 3,047 linear feet (LF) of perennial stream channel. Stream enhancements reaches include UT1 Reach 1, UT1b, UT1c, UT2, UT3, and a portion of Little River, totaling 5,009 LF. Wetland components include 3.02 acres of wetland rehabilitation and 3.38 acres of wetland re-establishment.

Construction activities were completed by Land Mechanic Designs, Inc. in February 2017. Planting and seeding activities were completed by Bruton Natural Systems, Inc. in February 2017. The land required for construction, management, and stewardship of the mitigation project included portions of five parcels resulting in 25.04 acres of the conservation easement. The project is expected to generate 5,053.000 stream mitigation units (SMUs) and 5.703 riparian wetland mitigation units (WMUs). Annual monitoring will be conducted for seven years with close-out anticipated to commence in 2024 given the success criteria are met.

1.1 Project Goals and Objectives

The 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 and objectives were established with careful consideration of goals and objectives that were described in the RBRP and to address stressors identified in the LWP.

The following project specific goals established in the Mitigation Plan (Wildlands, 2016) include:

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.
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.

Goals	Objectives
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.

1.2 Monitoring Year 5 Data Assessment

Annual monitoring and quarterly Site visits were conducted during MY4 to assess the condition of the project. The stream, vegetation, and hydrologic success criteria for the Site follows the approved success criteria presented in the Vile Creek Mitigation Plan (Wildlands, 2016).

1.2.1 Stream Assessment

Riffle cross-sections on the restoration and enhancement I reaches should be stable and show little change in bankfull area, maximum depth ratio, and width-to-depth ratio. Per NCDMS guidance, bank height ratios (BHR) shall not exceed 1.2 and entrenchment ratios (ER) 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. Indicators most often include trends in vertical incision or bank erosion. Changes in the channel that indicate a movement toward stability or enhanced habitat include a decrease in the width-to-depth ratio in meandering channels or an increase in pool depth. Remedial action would not be taken if channel changes indicate a movement toward stability.

Morphological surveys for the MY5 were conducted in June and October 2021. In general, the cross-sections show little change in the bankfull area, maximum depth ratio, and width-to-depth ratio with minimal adjustment, indicating that channel dimensions are stable and project streams are function as

designed. All cross-sections fell within the parameters defined for channels of the appropriate stream type (Rosgen, 1994 & 1996). In MY5, left bank scour is present at cross-section 7, thus increasing bankfull area and resulting in a bank height ratio greater than 1.2. However, this is an isolated area of bank scour and does not appear to be widespread along UT1 Reach 1. See Section 1.2.5 for further discussion about stream areas of concern. The remaining cross-sections show little change in bankfull dimensions in comparison to the MY0 survey.

Reachwide pebble counts along all restoration and enhancement I reaches indicate of maintenance of coarser materials in riffle features and finer particles in the pool features. Riffle cross-section pebble counts indicate similar D50 particle sizes in comparison to MY0. Please refer to Appendix 4 for morphological tables and plots.

1.2.2 Stream Hydrology Assessment

At the end of the seven-year monitoring period, two or more bankfull events and geomorphically significant (60% of bankfull flow) events must have occurred in separate years within the restoration and enhancement reaches.

During MY5, two bankfull events and two geomorphically significant events were documented on UT1 Reach 2, while one bankfull event and one geomorphically significant event was documented on Vile Creek Reach 2. With at least three bankfull events occurring in separate years documented on UT1 Reach 2 and at least two bankfull events occurring in separate years documented on Vile Creek, the success criteria for bankfull and geomorphically significant events has been met on all monitored reaches.

Refer to Appendix 5 for hydrology summary data and plots.

1.2.3 Vegetative Assessment

A total of 25 vegetation monitoring plots were installed during baseline monitoring throughout the project easement to measure the survival of the planted trees, shrubs, and herbaceous vegetation. Seventeen of the plots were established to evaluate woody species composition, density, and survival rates, while 8 of the plots were established to evaluate percent coverage of herbaceous species of bog areas. The size of individual quadrants is 100 square meters (10m x 10m or 5m x 20m) for woody tree and shrub species and 20 square meters (5m x 4m) for herbaceous vegetation bog plots. In MY5 two transect vegetation plots were added to evaluate a supplemental planting area. Transect vegetation monitoring plot assessments will document number of planted stems and species using a circular or 100 square meters/rectangular plot.

Tree and shrub assessments are conducted following the 2006 Carolina Vegetation Survey (CVS) Level 2 Protocol for Recording Vegetation. The final planted stem vegetative success criteria for the Site is the survival of 210 planted stems per acre in the planted riparian and wetland corridor at the end of the required monitoring period (MY7). The interim measure of vegetative success for the Site is the survival of at least 320 planted stems per acre at the end of the third monitoring year (MY3) and at least 260 stems per acre at the end of the fifth monitoring year (MY5). In addition, planted trees must average 10 feet in height in each plot at the end of the seventh year of monitoring. Vegetation plots one and two contain only shrub species; therefore, shrub stem density success criteria of 160 surviving plants per acre at the end of year 3, 130 at the end of year 5, and 105 at the end of year 7 is used for these plots. There are no height criteria for shrubs. The bog plots are assessed by visually estimating the percent herbaceous coverage within each plot and must have at least 80% coverage success criteria.

The MY5 vegetative survey was completed in September 2021. The MY5 vegetation monitoring resulted in an average planted stem density of 386 stems per acre for woody tree species and 283 stems per acre

for shrubs species, both of which exceed the interim requirement of 320 stems per acre for tree species and 160 required for shrub species at MY5 and are on target to meet the requirements for MY7. In addition, 14 of the 17 plots individually met the success criteria with a stem density ranging from 364 to 607 stems per acre for tree species and 202 to 364 for shrub species. Vegetation plots 5 (202), 9 (162), and 14 (121) did not meet stem density requirements. The bog cells have become well established since project construction. Each with approximately 99% herbaceous coverage, the MY5 monitoring shows all herbaceous bog plots are exceeding success criteria. Both transect vegetation plots added to the supplemental planting area exceed the interim requirement of 320 stems per acre for tree species and are on target to meet the requirements for MY7.

The Gray's Lily (*Lilium grayi*) GPS locations are included in the CCPV. A picture from the last known occurrence of it on site is included in Appendix 2. The two known locations will be surveyed in during peak blooming season in June and July of MY6.

Refer to Appendix 2 for vegetation plot photographs and Appendix 3 for vegetation data tables

1.2.4 Wetland Assessment

A total of ten groundwater hydrology gages (GWG) and two soil temperature gages were established during baseline monitoring within the wetland rehabilitation, wetland re-establishment, and bog areas. A barotroll logger, used to measure barometric pressure and aid in the calculation of groundwater levels, was also installed on-site. The Barotroll quit working on 9/22/2021 but a new barotroll will be installed by the beginning of MY6 (2022). Groundwater monitoring gages are downloaded on a quarterly basis and maintained as needed. Calibration is completed by manually measuring water levels on all gages to confirm the downloaded data. Under typical precipitation conditions, the final performance success criteria for groundwater hydrology is the documentation of free groundwater within 12 inches of the ground surface for 14 consecutive days (8.5%) of the defined 169-day growing season (April 26 – October 11) for wetlands re-establishment and wetland rehabilitation areas and 20 consecutive days (12%) of the defined 169-day growing season (April 26 – October 11) for bog areas.

All the Site's GWGs met the success criteria for MY5, with the measured hydroperiod ranging from 16% to 88% of the growing season. The Barotroll malfunctioned starting on 9/22/21 therefore, the data collected after 9/22/21 was omitted from the reported data. Two manual measurements of each GWG water levels were recorded during MY5.

Rainfall data collected from the NC-AG-1-Sparta 3.5 SSW(NCCRONOS) rain gage, rainfall amounts for most months during the growing season fell between the 30th and 70th percentile rainfall for Alleghany County. While higher than normal rainfall occurred in August and October 2021. Refer to the CCPV Maps in Appendix 2 for the groundwater gage locations and Appendix 5 for groundwater hydrology and average rainfall summary data and plots.

1.2.5 Areas of Concern/Adaptive Management Plan

Overall, the streams are geomorphically stable and riparian and wetland vegetation is performing well. However, isolated stream and vegetation problem areas do exist on-site. A few stream areas of concern outside of the repair areas are noted on the CCPV. These areas are not negatively impacting stream function or stability currently, but they will be monitored in future years for signs of instability. The UT1 Reach 1 (Station 205+10-205+60) natural stream realignment in MY4 (approximately 21-feet) newly created channel appears to be stable and will be closely monitored for instability.

An Adaptive Management Plan (AMP) was prepared and approved by the IRT (Appendix 6). The AMP was developed to describe the extend of stream repairs and supplemental plantings to be completed by Wildlands. The stream repairs were conducted from September 8-10th, 2021 and constructed per the

details provided in the AMP. This work conducted on Vile Creek Reach 2 at Stations 118+50-118+80, 119+50-119+70, 120+70-121+00, and 122+20-123+00 included repairs to a j-hook, boulder sill, and an angled log riffle, and multiple bank stabilizations. There was only one area on Vile Creek Reach 2 that was not repaired as described in the AMP. It was at Station 121+00 to 121+25. The repair area was mislabeled and should have been Station 119+50-119+70. Here, the left and right banks were stabilized by grading them back and adding sod mats. Additional measures that were outlined in the AMP and implemented as proposed were the stabilization of bank erosion along a secondary channel of Vile Creek Reach 3 at Station 125+00- 125+60 and the addition of rock to stabilize a headcut at the intake of the BMP, which is located at the top of UT2. Supplemental plantings will occur during the 2022 dormant season and vegetation species, planting details, and quantities will be documented in the MY6 report. Completed stream repairs were observed in October, and they appear to be stable and functioning.

Aggradation on UT1b (Station 251+02 – 251+64 (62')) and UT1c (Station 271+66 – 272+81 (115')), have resulted in sheet flow onto the floodplain rather than maintaining flow within a single thread channel. A question about the wetland performance standards for hydrology and vegetation was raised concerning the change from stream to wetland credit for UT1B and UT1C. Wildlands installed a stream gage at baseline for internal data collection that can be used to verify the hydrology performance from previous monitoring years. Wildlands will install a GWG to monitor wetland hydrology for MY6 and MY7. Vegetation can be visually monitored for success using the existing photo points. AT MY7 Wildlands will verify the jurisdictional limits of UT1C and UT1B and include it in the monitoring report. Wildlands will coordinate with IRT and DMS prior to closeout to determine the mitigation approach, credit ratios, and acreage of these features so the appropriate amount of wetland credit can be added to the site and the necessary amount of stream credit can be removed.

Though invasive species, including Japanese barberry (*Berberis thunbergii*), Oriental bittersweet (*Celastrus orbiculatus*), and multiflora rose (*Rosa multiflora*) continue to be present within and around the Site, previous invasive species treatments of cutting the plants and applying glyphosate to the stumps or stems have reduced their populations from 11.6% in MY4 to 1.7 % in MY5. Invasive treatments were also conducted in August of MY5 and included spraying all fence lines. Although the presence of invasive species is not impacting survival rates of planted stems at this time, these areas will likely warrant additional treatment to prevent any advancement within the conservation easement and future impacts to the Site. Additional treatments will continue as needed to help manage and eliminate remaining invasive species populations.

Overall, the herbaceous cover has become well established throughout the Site. Small infrequent areas of poor herbaceous cover (less than 1% of the easement) are noted near GWGs 8-9 and along the right valley of UT2 near Station 305+00. In MY3, these areas were reseeded, and herbaceous cover is starting to become established but is not as well established as compared to the rest of the Site.

During MY5 areas of low stem density and height were documented on site and amount to 8.9% of the planted conservation easement. These areas include: a portion of the left floodplain on UT1 Reach 1, ten feet from top of bank along Vile Creek Reach 1, and along the left floodplain of UT2 just below the BMP. Supplemental planting of 854 1-gallon and 3-gallon trees were completed in the March of 2021 on the right bank of UT1 Reach 2 starting at UT1C and continuing down to Vile Creek Reach 2 and stopping at cross-section nine. In addition to the plantings, tree tubes were installed on the newly planted stems to protect them from deer grazing. Additional supplemental planting is planned for Winter 2022 on Vile Creek Reach 1 ten feet from top of bank and the left bank of Vile Creek Reach 3.

Minor easement encroachment from mowing on the left floodplain of UT1 Reach 1 was noted. In MY6, Wildlands further delineated the easement boundary in this area with additional signs. The additional

signs installed along the boundary helped reduce the mowing encroachment but did not eliminate it. Wildlands plans to add additional markings along the easement line to eliminate the encroachment.

Refer to Appendix 2 for the vegetation condition assessment table, the CCPV maps, stream repair photos, and area of concern photos.

1.3 Monitoring Year 5 Summary

Overall, the Site has partially met the required stream, vegetation, and hydrology success criteria for MY5 and is on track to meet MY7 performance standards/success criteria. All restored and enhancement I streams are geomorphically stable and functioning as designed. During MY5, 1 bankfull event was recorded on Vile Creek Reach 2 and 2 bankfull events were recorded on UT1 Reach 2. However, bankfull event criteria was already met in MY2. Multiple geomorphically significant events were recorded on Vile Creek Reach 2 and UT1 Reach 2. Pebble counts reflect no significant change in restoration and enhancement I stream substrate material. All ten gages in the wetland re-establishment and wetland rehabilitation, and bog areas are either meeting or exceeding hydrology success criteria.

Summary information and data related to the performance of various project and monitoring elements can be found in the tables and figures in the report appendices. Narrative background and supporting information formerly found in these reports can be found in the Mitigation Plan documents available on DMS's website. All raw data supporting the tables and figures in the appendices are available from DMS upon request.

Section 2: METHODOLOGY

Geomorphic data were collected following the standards outlined in The Stream Channel Reference Site: An Illustrated Guide to Field Techniques (Harrelson et al., 1994) and in the Stream Restoration: A Natural Channel Design Handbook (Doll et al., 2003). All Integrated Current Condition Mapping was recorded using either a Trimble or Topcon handheld GPS with sub-meter accuracy and processed using Pathfinder and ArcGIS. Crest gages were installed in surveyed riffle cross sections and monitored quarterly. Hydrologic monitoring instrument installation and monitoring methods are in accordance with the United States Army Corps of Engineers (USACE, 2016) standards. Planted woody vegetation is being monitored in accordance with the guidelines and procedures developed by the Carolina Vegetation Survey-EEP Level 2 Protocol (Lee et al., 2006).

Section 3: REFERENCES

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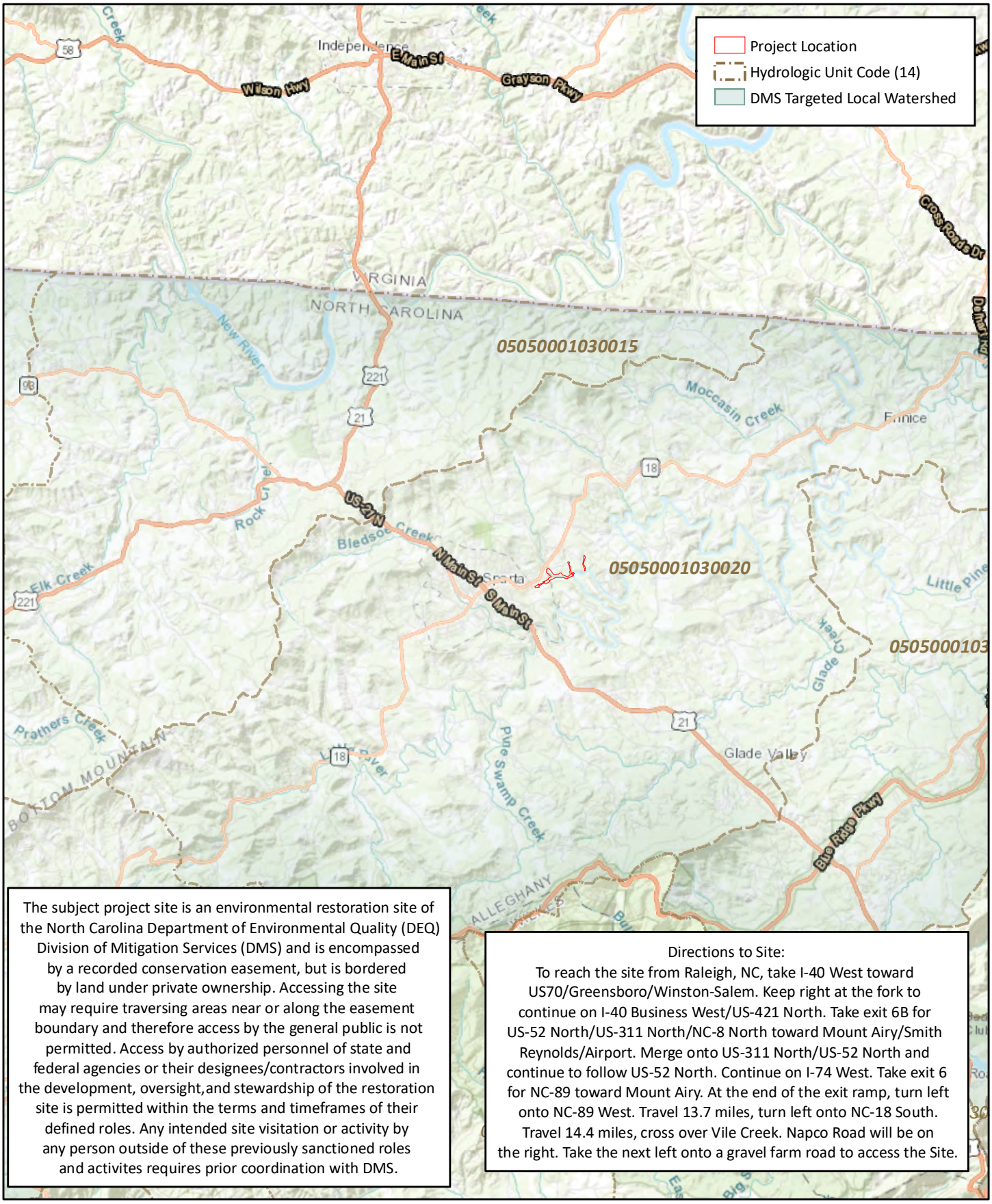
Wildlands Engineering, Inc. 2017. Vile Creek Stream Mitigation Site Baseline Monitoring Document and As-Built Baseline Report. DMS, Raleigh, NC.

APPENDIX 1. General Figures and Tables



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

Directions to Site:
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 1 2 Mile

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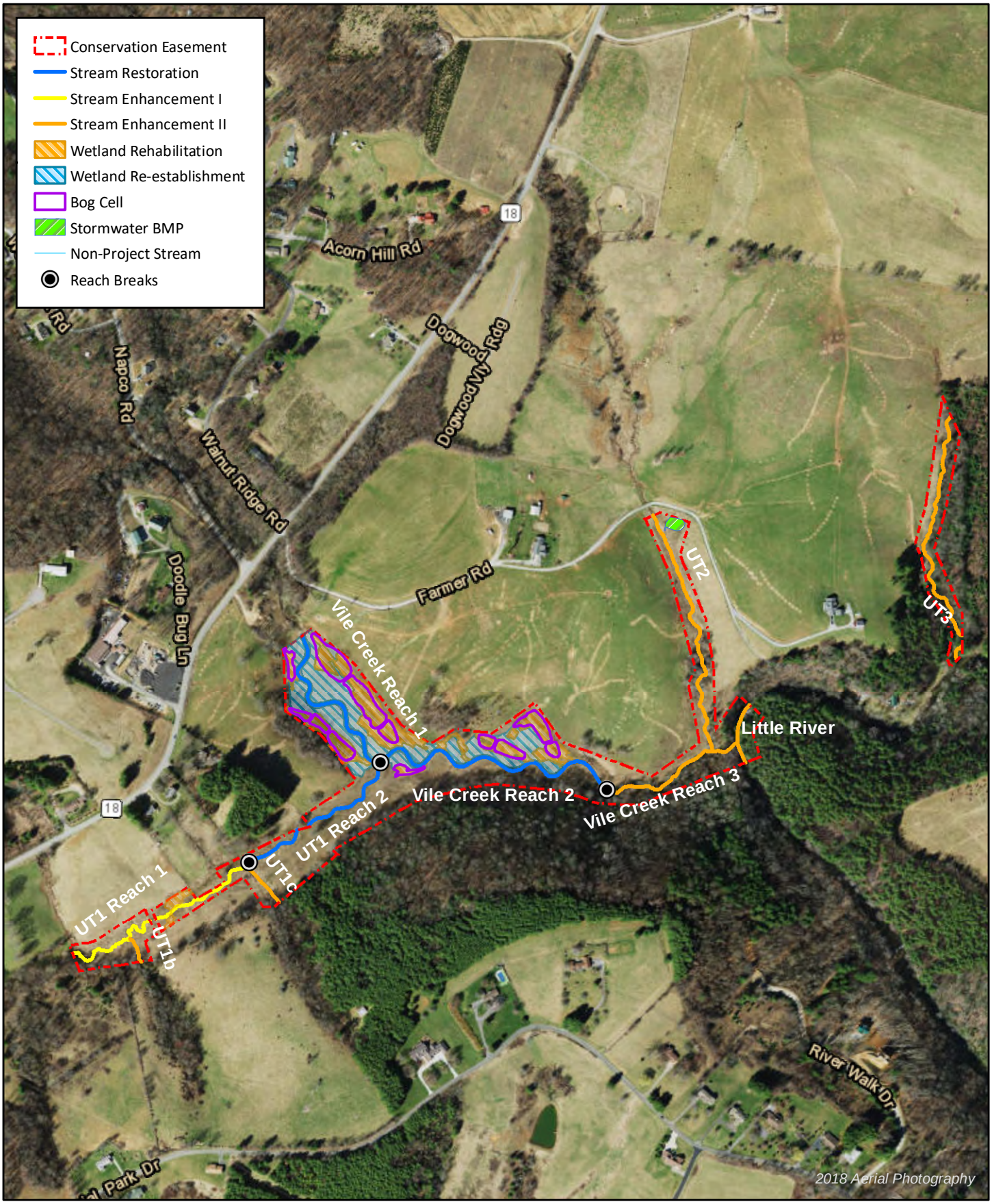
Figure 1 Project Vicinity Map
Vile Creek Mitigation Site
DMS Project No. 96582
Monitoring Year 5 - 2021

Alleghany County, NC



WILDLANDS ENGINEERING

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Figure 2 Project Component Map
Vile Creek Mitigation Site
DMS Project No. 96582
Monitoring Year 5 - 2021

Alleghany County, NC

Table 1. Project Components and Mitigation Credits
Vile Creek Mitigation Site
DMS Project No. 96582
Monitoring Year 5 - 2021

PROJECT COMPONENTS									
Project Area/Reach	**Existing Footage (LF) or Acreage**	**Mitigation Plan Footage (LF)/Acreage**	**Mitigation Category**	**Restoration Level**	**Priority Level**	**Mitigation Ratio (X:1)**	**As Built Footage/ Acreage[2]**	**Project Credit (SMU/WMU)[1,2]**	**Notes**
Vile Creek Reach 1	962	920	Warm	Restoration	P1	1:1	882	882.000	Alignment changed from mitigation plan/final design due to bedrock obstruction.
Vile Creek Reach 2	1,247	1,260	Warm	Restoration	P1	1:1	1,311	1,311.000	Alignment changed from mitigation plan/final design due to bedrock obstruction.
Vile Creek Reach 3	714	714	Warm	Enhancement II	N/A	2.5:1	713	279.000	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	Warm	Enhancement I	N/A	1.5:1	1,114	630.000	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	Warm	Restoration	P1	1:1	777	750.000	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	Warm	Enhancement II	N/A	2.5:1	128	48.000	As-Built credits were reduced for areas where easement is restricted and the full buffer width is not possible. 62 LF aggraded channel on UT1b.
UT1C	234	228	Warm	Enhancement II	N/A	2.5:1	228	89.000	As-Built credits were reduced for areas where easement is restricted and the full buffer width is not possible. 115 LF of aggraded channel on UT1c
UT2	1,226	1,226	Warm	Enhancement II	N/A	2.5:1	1,226	490.000	
UT3	1,316	1,236	Warm	Enhancement II	N/A	2.5:1	1,236	461.000	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	Warm	Enhancement II	N/A	2.5:1	284	114.000	
Wetland Rehabilitation	3.02	3.02	Warm	Rehabilitation		1.3:1	3.02	2.323	
Wetland Re-establishment	0	3.50	Warm	Re-establishment		1:1	3.38	3.380	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] 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.

[2] Stream mitigation credits and stationg noted above are based on the as-built stream centerline.

Project Credits							
Restoration Level	**Stream**			**Riparian Wetland**		**Non-Riparian Wetland**	**Coastal Marsh**
	Warm	**Cool**	**Cold**	**Riverine**	**Non-Riv**		
Restoration	2,943.000	N/A	N/A	N/A	N/A	N/A	N/A
Re-establishment				3.380	N/A	N/A	N/A
Rehabilitation				2.323	N/A	N/A	N/A
Enhancement							
Enhancement I	630.000	N/A	N/A				
Enhancement II	1,481.000	N/A	N/A				
Creation							
Preservation							
Total	5,053.000	N/A	N/A	5.703	N/A	N/A	N/A

Table 2. Project Activity and Reporting History
Vile Creek Mitigation Site
DMS Project No. 96582
Monitoring Year 5- 2021

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	
Year 1 Monitoring	Stream Survey	September 2017	December 2017
	Vegetation Survey	September 2017	
Year 2 Monitoring	Stream Survey	April 2018	November 2018
	Vegetation Survey	September 2018	
Year 3 Monitoring	Stream Survey	April 2019	December 2019
	Shrub Planting	June 2019	
	Invasive Treatment	June 2019	
	Vegetation Survey	September 2019	
Year 4 Monitoring	Supplimental Planting	March 2020	November 2020
	Stream Repairs	March 2020	
	Invasive Treatment	September 2020	
Year 5 Monitoring	Supplimental Planting	March 2021	November 2021
	Stream Survey	June 2021	
	Invasive Treatment	August 2021	
	Stream Repairs	September 2021	
	Vegetation Survey	September 2021	
Year 6 Monitoring	Stream Survey	N/A	November 2022
	Vegetation Survey	N/A	November 2022
Year 7 Monitoring	Stream Survey	N/A	November 2023
	Vegetation Survey	N/A	November 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 5 - 2020

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	Kristi Suggs 704.332.7754, ext. 110

Table 4. Project Information and Attributes
Vile Creek Mitigation Site
DMS Project No. 96582
Monitoring Year 5 - 2021

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%)

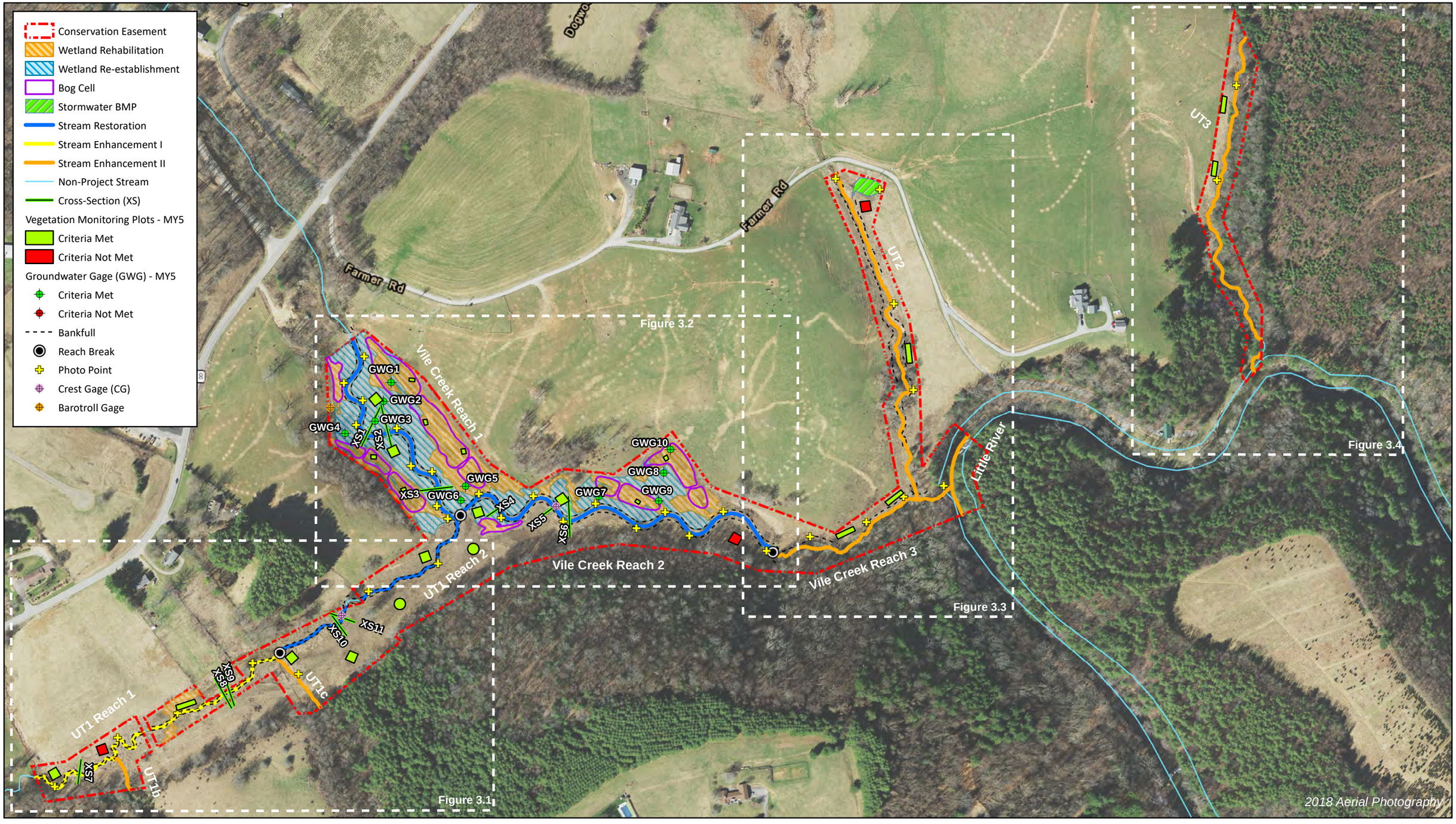
REACH SUMMARY INFORMATION

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-Restoration	<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.
Waters of the United States - Section 401	Yes	Yes	Action ID# SAW-2014-01585
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.	Vile Creek Final Mitigation Plan (June 2016) and Vile Creek Categorical Exclusion (CE) Approved 9/15/2014
Essential Fisheries Habitat	No	No	Vile Creek Final Mitigation Plan (June 2016) and Vile Creek Categorical Exclusion (CE) Approved 9/15/2014

APPENDIX 2. Visual Assessment Data



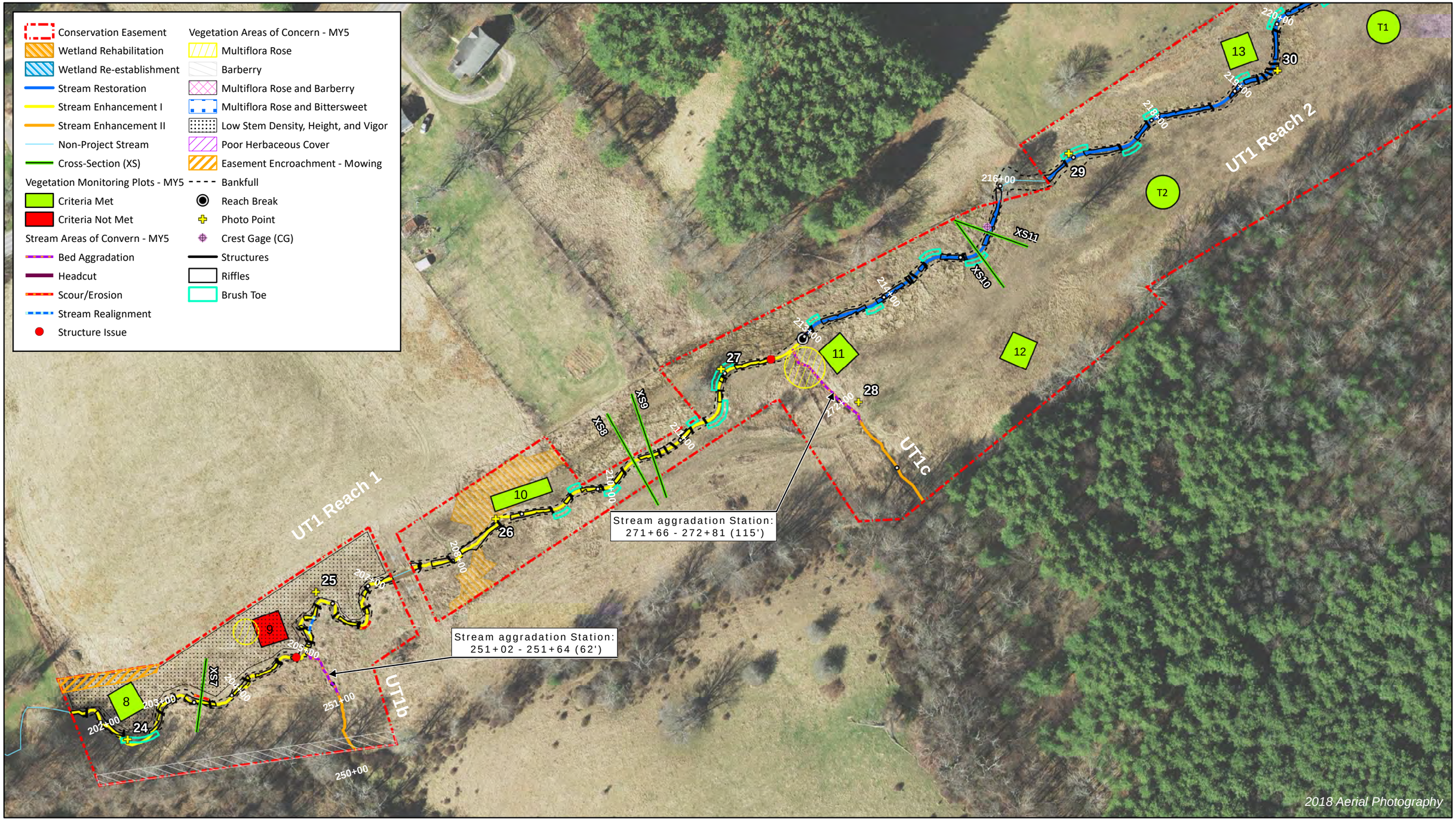
WILDLANDS ENGINEERING

0 300 600 Feet

N

Figure 3.0 Integrated Current Condition Plan View
Vile Creek Mitigation Site
DMS Project No. 96582
Monitoring Year 5 - 2021

Alleghany County, NC



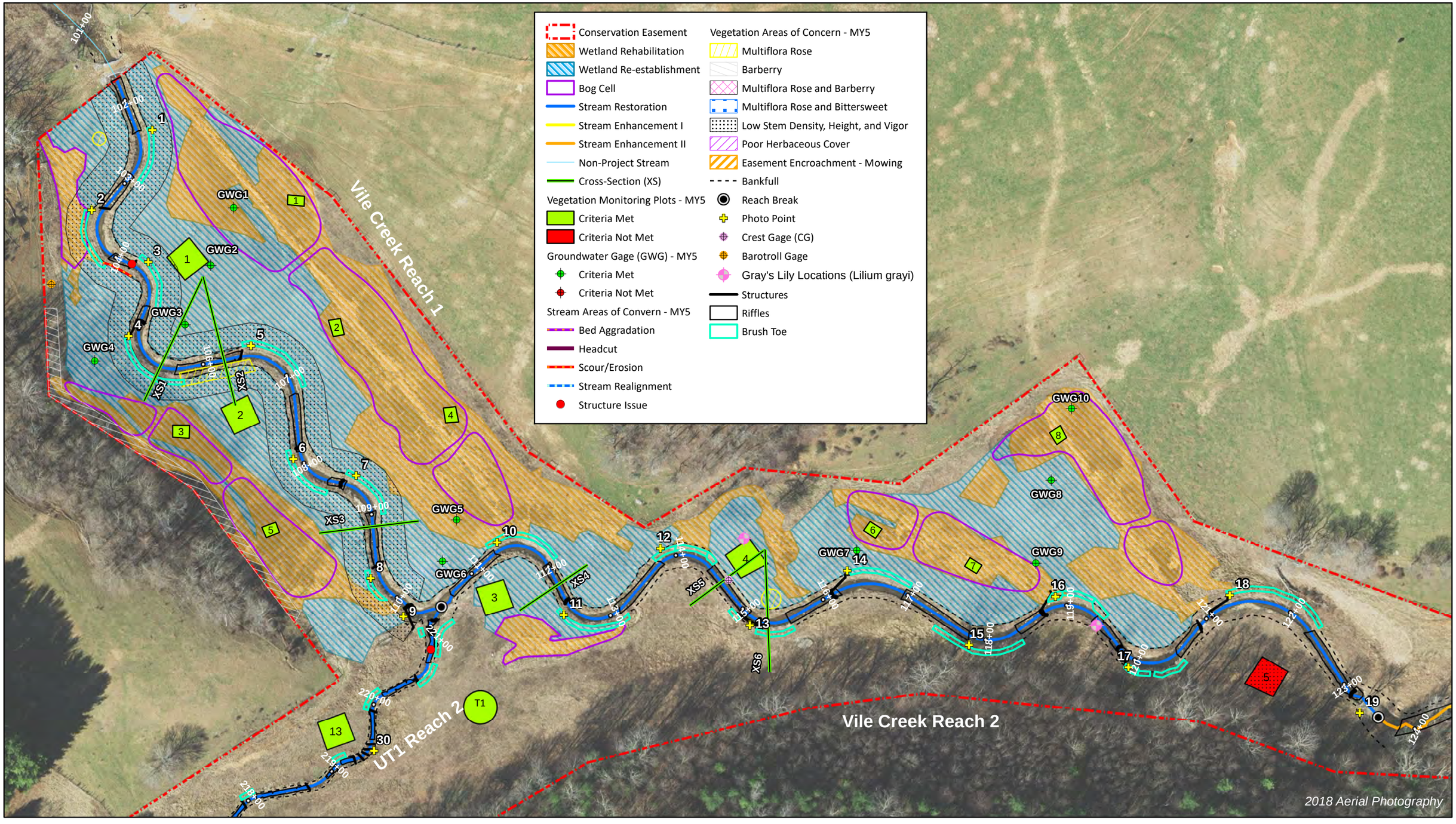
WILDLANDS ENGINEERING

0 100 200 Feet

N

Figure 3.1 Integrated Current Condition Plan View
Vile Creek Mitigation Site
DMS Project No. 96582
Monitoring Year 5 - 2021

Alleghany County, NC

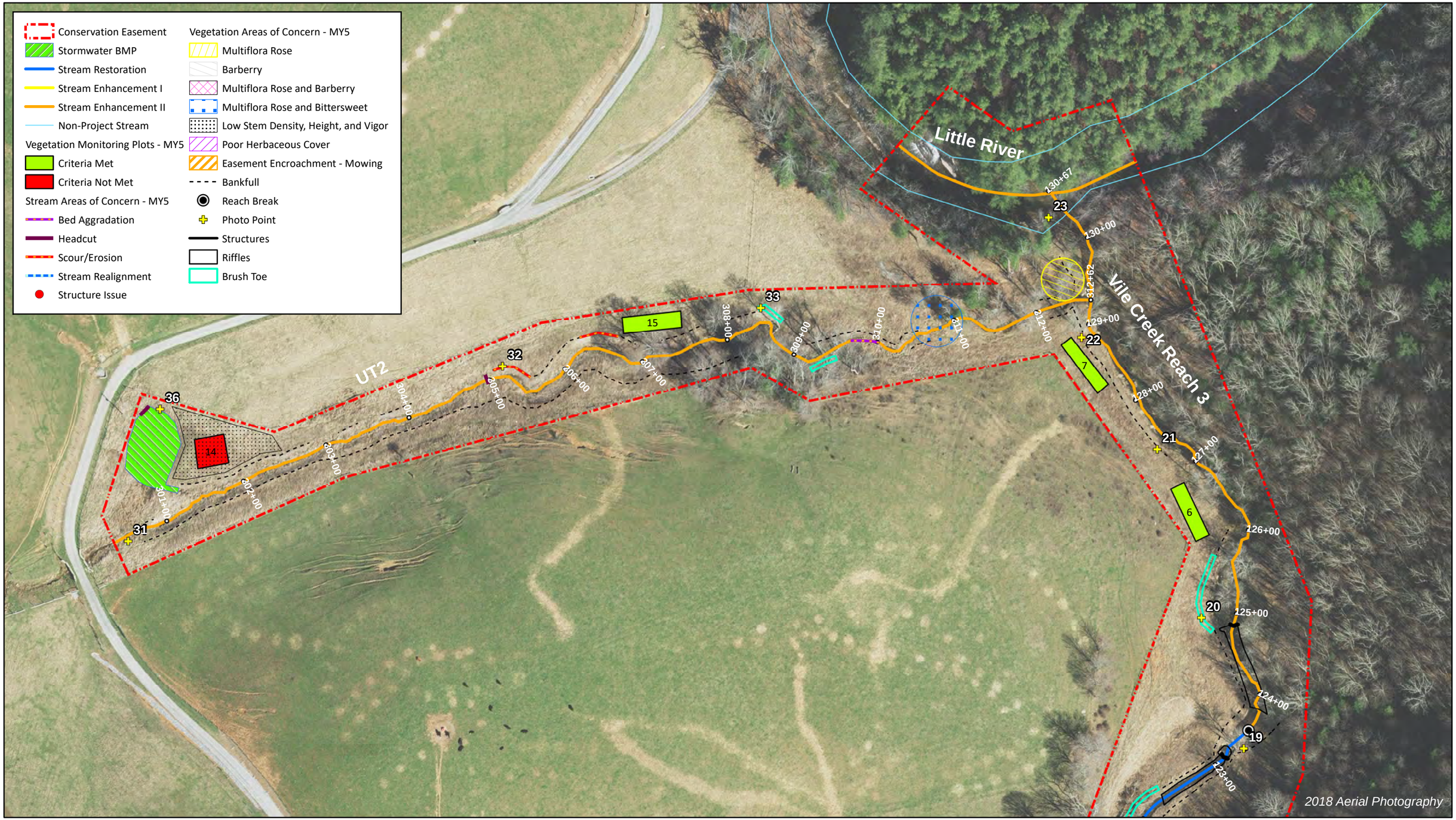


WILDLANDS ENGINEERING

0 100 200 Feet

Figure 3.2 Integrated Current Condition Plan View
Vile Creek Mitigation Site
DMS Project No. 96582
Monitoring Year 5 - 2021

Alleghany County, NC



WILDLANDS ENGINEERING

0 100 200 Feet

Figure 3.3 Integrated Current Condition Plan View
Vile Creek Mitigation Site
DMS Project No. 96582
Monitoring Year 5 - 2021

Alleghany County, NC

WILDLANDS ENGINEERING

0 100 200 Feet

Figure 3.4 Integrated Current Condition Plan View
Vile Creek Mitigation Site
DMS Project No. 96582
Monitoring Year 5 - 2021

Alleghany County, NC

Table 5a. Visual Stream Morphology Stability Assessment Table
Vile Creek Mitigation Site
DMS Project No. 96582
Monitoring Year 5 - 2021

Date of visual assessments: March 2021, October 2021
UT1 Reach 1 (1,114 LF)

Major Channel Category	Channel Sub-Category	Metric	Number Stable, Performing as Intended	Total Number in As-Built	Number of Unstable Segments	Amount of Unstable Footage	% Stable, Performing as Intended	Number with Stabilizing Woody Vegetation	Footage with Stabilizing Woody Vegetation	Adjust % for Stabilizing Woody Vegetation
1. Bed	1. Vertical Stability (Riffle and Run units)	Aggradation			0	0	100%			
		Degradation			0	0	100%			
	2. Riffle Condition	Texture/Substrate	22	22			100%			
	3. Meander Pool Condition	Depth Sufficient	14	14			100%			
		Length Appropriate	14	14			100%			
	4. Thalweg Position	Thalweg centering at upstream of meander bend (Run)	14	14			100%			
		Thalweg centering at downstream of meander bend (Glide)	14	14			100%			
2. Bank	1. Scoured/Eroded	Bank lacking vegetative cover resulting simply from poor growth and/or scour and erosion.			2	33	99%	0	0	99%
	2. Undercut	Banks undercut/overhanging to the extent that mass wasting appears likely. Does NOT include undercuts that are modest, appear sustainable and are providing habitat.			0	0	100%	0	0	100%
	3. Mass Wasting	Bank slumping, calving, or collapse			0	0	100%	0	0	100%
				Totals	2	33	99%	0	0	99%
3. Engineered Structures[1]	1. Overall Integrity	Structures physically intact with no dislodged boulders or logs.	35	37			95%			
	2. Grade Control	Grade control structures exhibiting maintenance of grade across the sill.	28	30			94%			
	2a. Piping	Structures lacking any substantial flow underneath sills or arms.	28	30			94%			
	3. Bank Protection	Bank erosion within the structures extent of influence does not exceed 15%.	36	37			97%			
	4. Habitat	Pool forming structures maintaining ~Max Pool Depth : Bankfull Depth ≥ 1.6 Rootwads/logs providing some cover at baseflow.	35	37			95%			

[1]Excludes constructed riffles since they are evaluated in section 1.

Table 5b. Visual Stream Morphology Stability Assessment Table

Vile Creek Mitigation Site

DMS Project No. 96582

Monitoring Year 5 - 2021

Date of visual assessments: March 2021, October 2021

UT1 Reach 2 (854 LF)

Major Channel Category	Channel Sub-Category	Metric	Number Stable, Performing as Intended	Total Number in As-Built	Number of Unstable Segments	Amount of Unstable Footage	% Stable, Performing as Intended	Number with Stabilizing Woody Vegetation	Footage with Stabilizing Woody Vegetation	Adjust % for Stabilizing Woody Vegetation
1. Bed	1. Vertical Stability (Riffle and Run units)	Aggradation			0	0	100%			
		Degradation			0	0	100%			
	2. Riffle Condition	Texture/Substrate	11	11			100%			
	3. Meander Pool Condition	Depth Sufficient	11	11			100%			
		Length Appropriate	11	11			100%			
	4. Thalweg Position	Thalweg centering at upstream of meander bend (Run)	11	11			100%			
		Thalweg centering at downstream of meander bend (Glide)	11	11			100%			
2. Bank	1. Scoured/Eroded	Bank lacking vegetative cover resulting simply from poor growth and/or scour and erosion.			0	0	100%	0	0	100%
	2. Undercut	Banks undercut/overhanging to the extent that mass wasting appears likely. Does NOT include undercuts that are modest, appear sustainable and are providing habitat.			0	0	100%	0	0	100%
	3. Mass Wasting	Bank slumping, calving, or collapse			0	0	100%	0	0	100%
				Totals	0	0	100%	0	0	100%
3. Engineered Structures[1]	1. Overall Integrity	Structures physically intact with no dislodged boulders or logs.	32	33			97%			
	2. Grade Control	Grade control structures exhibiting maintenance of grade across the sill.	21	22			95%			
	2a. Piping	Structures lacking any substantial flow underneath sills or arms.	21	22			95%			
	3. Bank Protection	Bank erosion within the structures extent of influence does not exceed 15%.	32	33			97%			
	4. Habitat	Pool forming structures maintaining ~Max Pool Depth : Bankfull Depth ≥ 1.6 Rootwads/logs providing some cover at baseflow.	32	33			97%			

[1]Excludes constructed riffles since they are evaluated in section 1.

Table 5c. Visual Stream Morphology Stability Assessment Table

Vile Creek Mitigation Site

DMS Project No. 96582

Monitoring Year 5 - 2021

Date of visual assessments: March 2021, October 2021

Vile Creek Reach 1 (882 LF)

Major Channel Category	Channel Sub-Category	Metric	Number Stable, Performing as Intended	Total Number in As-Built	Number of Unstable Segments	Amount of Unstable Footage	% Stable, Performing as Intended	Number with Stabilizing Woody Vegetation	Footage with Stabilizing Woody Vegetation	Adjust % for Stabilizing Woody Vegetation
1. Bed	1. Vertical Stability (Riffle and Run units)	Aggradation			0	0	100%			
		Degradation			0	0	100%			
	2. Riffle Condition	Texture/Substrate	8	8			100%			
	3. Meander Pool Condition	Depth Sufficient	8	8			100%			
		Length Appropriate	8	8			100%			
	4. Thalweg Position	Thalweg centering at upstream of meander bend (Run)	8	8			100%			
		Thalweg centering at downstream of meander bend (Glide)	8	8			100%			
2. Bank	1. Scoured/Eroded	Bank lacking vegetative cover resulting simply from poor growth and/or scour and erosion.			1	35	99%	0	0	99%
	2. Undercut	Banks undercut/overhanging to the extent that mass wasting appears likely. Does NOT include undercuts that are modest, appear sustainable and are providing habitat.			0	0	100%	0	0	100%
	3. Mass Wasting	Bank slumping, calving, or collapse			0	0	100%	0	0	100%
				Totals	1	35	99%	0	0	99%
3. Engineered Structures[1]	1. Overall Integrity	Structures physically intact with no dislodged boulders or logs.	15	16			94%			
	2. Grade Control	Grade control structures exhibiting maintenance of grade across the sill.	7	8			88%			
	2a. Piping	Structures lacking any substantial flow underneath sills or arms.	7	8			88%			
	3. Bank Protection	Bank erosion within the structures extent of influence does not exceed 15%.	15	16			94%			
	4. Habitat	Pool forming structures maintaining ~Max Pool Depth : Bankfull Depth ≥ 1.6 Rootwads/logs providing some cover at baseflow.	15	16			94%			

[1]Excludes constructed riffles since they are evaluated in section 1.

Table 5d. Visual Stream Morphology Stability Assessment Table

Vile Creek Mitigation Site

DMS Project No. 96582

Monitoring Year 5 - 2021

Date of visual assessments: March 2021, October 2021

Vile Creek Reach 2 (1,311 LF)

Major Channel Category	Channel Sub-Category	Metric	Number Stable, Performing as Intended	Total Number in As-Built	Number of Unstable Segments	Amount of Unstable Footage	% Stable, Performing as Intended	Number with Stabilizing Woody Vegetation	Footage with Stabilizing Woody Vegetation	Adjust % for Stabilizing Woody Vegetation
1. Bed	1. Vertical Stability (Riffle and Run units)	Aggradation			0	0	100%			
		Degradation			0	0	100%			
	2. Riffle Condition	Texture/Substrate	10	10			100%			
	3. Meander Pool Condition	Depth Sufficient	9	9			100%			
		Length Appropriate	9	9			100%			
	4. Thalweg Position	Thalweg centering at upstream of meander bend (Run)	9	9			100%			
		Thalweg centering at downstream of meander bend (Glide)	9	9			100%			
2. Bank	1. Scoured/Eroded	Bank lacking vegetative cover resulting simply from poor growth and/or scour and erosion.			0	0	100%	0	0	100%
	2. Undercut	Banks undercut/overhanging to the extent that mass wasting appears likely. Does NOT include undercuts that are modest, appear sustainable and are providing habitat.			0	0	100%	0	0	100%
	3. Mass Wasting	Bank slumping, calving, or collapse			0	0	100%	0	0	100%
				Totals	0	0	100%	0	0	100%
3. Engineered Structures[1]	1. Overall Integrity	Structures physically intact with no dislodged boulders or logs.	16	16			100%			
	2. Grade Control	Grade control structures exhibiting maintenance of grade across the sill.	7	7			100%			
	2a. Piping	Structures lacking any substantial flow underneath sills or arms.	7	7			100%			
	3. Bank Protection	Bank erosion within the structures extent of influence does not exceed 15%.	16	16			100%			
	4. Habitat	Pool forming structures maintaining ~Max Pool Depth : Bankfull Depth ≥ 1.6 Rootwads/logs providing some cover at baseflow.	16	16			100%			

[1]Excludes constructed riffles since they are evaluated in section 1.

Table 5e. Visual Stream Morphology Stability Assessment Table
Vile Creek Mitigation Site
DMS Project No. 96582
Monitoring Year 5 - 2021

Date of visual assessments: March 2021, October 2021
Vile Creek Reach 3 (713 LF)

Major Channel Category	Channel Sub-Category	Metric	Number Stable, Performing as Intended	Total Number in As-Built	Number of Unstable Segments	Amount of Unstable Footage	% Stable, Performing as Intended	Number with Stabilizing Woody Vegetation	Footage with Stabilizing Woody Vegetation	Adjust % for Stabilizing Woody Vegetation
1. Bed	1. Vertical Stability (Riffle and Run units)	Aggradation			0	0	100%			
		Degradation			0	0	100%			
	2. Riffle Condition	Texture/Substrate	1	1			100%			
	3. Meander Pool Condition	Depth Sufficient	1	1			100%			
		Length Appropriate	1	1			100%			
	4. Thalweg Position	Thalweg centering at upstream of meander bend (Run)	1	1			100%			
		Thalweg centering at downstream of meander bend (Glide)	1	1			100%			
2. Bank	1. Scoured/Eroded	Bank lacking vegetative cover resulting simply from poor growth and/or scour and erosion.			0	0	100%	0	0	100%
	2. Undercut	Banks undercut/overhanging to the extent that mass wasting appears likely. Does NOT include undercuts that are modest, appear sustainable and are providing habitat.			0	0	100%	0	0	100%
	3. Mass Wasting	Bank slumping, calving, or collapse			0	0	100%	0	0	100%
				Totals	0	0	100%	0	0	100%
3. Engineered Structures[1]	1. Overall Integrity	Structures physically intact with no dislodged boulders or logs.	2	2			100%			
	2. Grade Control	Grade control structures exhibiting maintenance of grade across the sill.	1	1			100%			
	2a. Piping	Structures lacking any substantial flow underneath sills or arms.	1	1			100%			
	3. Bank Protection	Bank erosion within the structures extent of influence does not exceed 15%.	2	2			100%			
	4. Habitat	Pool forming structures maintaining ~Max Pool Depth : Bankfull Depth ≥ 1.6 Rootwads/logs providing some cover at baseflow.	2	2			100%			

[1]Excludes constructed riffles since they are evaluated in section 1.

Table 5f. Visual Stream Morphology Stability Assessment Table

Vile Creek Mitigation Site

DMS Project No. 96582

Monitoring Year 5 - 2021

Date of visual assessments: March 2021, October 2021

UT2: (763 LF)

Major Channel Category	Channel Sub-Category	Metric	Number Stable, Performing as Intended	Total Number in As-Built	Number of Unstable Segments	Amount of Unstable Footage	% Stable, Performing as Intended	Number with Stabilizing Woody Vegetation	Footage with Stabilizing Woody Vegetation	Adjust % for Stabilizing Woody Vegetation
1. Bed	1. Vertical Stability (Riffle and Run units)	Aggradation			1	32	96%			
		Degradation			0	0	100%			
	2. Riffle Condition	Texture/Substrate	N/A	N/A			n/a			
	3. Meander Pool Condition	Depth Sufficient	N/A	N/A			n/a			
		Length Appropriate	N/A	N/A			n/a			
	4. Thalweg Position	Thalweg centering at upstream of meander bend (Run)	N/A	N/A			n/a			
		Thalweg centering at downstream of meander bend (Glide)	N/A	N/A			n/a			
2. Bank	1. Scoured/Eroded	Bank lacking vegetative cover resulting simply from poor growth and/or scour and erosion.			2	89	94%	0	0	95%
	2. Undercut	Banks undercut/overhanging to the extent that mass wasting appears likely. Does NOT include undercuts that are modest, appear sustainable and are providing habitat.			0	0	100%	0	0	100%
	3. Mass Wasting	Bank slumping, calving, or collapse			0	0	100%	0	0	100%
				Totals	2	77	95%	0	0	95%
3. Engineered Structures[1]	1. Overall Integrity	Structures physically intact with no dislodged boulders or logs.	2	2			N/A			
	2. Grade Control	Grade control structures exhibiting maintenance of grade across the sill.	N/A	N/A			N/A			
	2a. Piping	Structures lacking any substantial flow underneath sills or arms.	N/A	N/A			N/A			
	3. Bank Protection	Bank erosion within the structures extent of influence does not exceed 15%.	2	2			N/A			
	4. Habitat	Pool forming structures maintaining ~Max Pool Depth : Bankfull Depth ≥ 1.6 Rootwads/logs providing some cover at baseflow.	2	2			N/A			

[1]Excludes constructed riffles since they are evaluated in section 1.

N/A - Not applicable: No Engineered Structures applies to UT2

Table 6. Vegetation Condition Assessment Table
Vile Creek Mitigation Site
DMS Project No. 96582
Monitoring Year 5- 2021

Date of visual assessments: March 2021, October 2021
Planted Acreage **17**

Vegetation Category	Definitions	Mapping Threshold (Ac)	Number of Polygons	Combined Acreage	% of Planted Acreage
Bare Areas	Very limited cover of both woody and herbaceous material	0.1	0	0.0	0.0%
Low Stem Density Areas*	Woody stem densities clearly below target levels based on MY3, 4, or 5 stem count criteria.	0.1	5	1.5	8.6%
		Total	**5**	**1.5**	**8.6%**
Areas of Poor Growth Rates or Vigor*	Areas with woody stems of a size class that are obviously small given the monitoring year.	0.25	5	1.5	8.6%
		Cumulative Total	**5**	**1.5**	**8.6%**

*Low stem density areas and poor growth areas are the same areas on-site.

Easement Acreage **25**

Vegetation Category	Definitions	Mapping Threshold (SF)	Number of Polygons	Combined Acreage	% of Easement Acreage
Invasive Areas of Concern	Areas of points (if too small to render as polygons at map scale).	1,000	9	0.4	1.7%
Easement Encroachment Areas	Areas of points (if too small to render as polygons at map scale).	none	1	0.03	0.1%

Stream Photographs

Monitoring Year 5

	
Photo Point 1 – view upstream Vile Creek R1 *(6/8/2021)*	**Photo Point 1** – view downstream Vile Creek R1 *(6/8/2021)*
	
Photo Point 2 – view upstream Vile Creek R1 *(6/8/2021)*	**Photo Point 2** – view downstream Vile Creek R1 *(6/8/2021)*
	
Photo Point 3 – view upstream Vile Creek R1 *(6/8/2021)*	**Photo Point 3** – view downstream Vile Creek R1 *(6/8/2021)*

	
Photo Point 4 – view upstream Vile Creek R1 *(6/8/2021)*	**Photo Point 4** – view downstream Vile Creek R1 *(6/8/2021)*
	
Photo Point 5 – view upstream Vile Creek R1 *(6/8/2021)*	**Photo Point 5** – view downstream Vile Creek R1 *(6/8/2021)*
	
Photo Point 6 – view upstream Vile Creek R1 *(6/8/2021)*	**Photo Point 6** – view downstream Vile Creek R1 *(6/8/2021)*

	
Photo Point 7 – view upstream Vile Creek R1 *(6/8/2021)*	**Photo Point 7** – view downstream Vile Creek R1 *(6/8/2021)*
	
Photo Point 8 – view upstream Vile Creek R1 *(6/8/2021)*	**Photo Point 8** – view downstream Vile Creek R1 *(6/8/2021)*
	
Photo Point 9 – view upstream Vile Creek R1 *(6/8/2021)*	**Photo Point 9** – view downstream Vile Creek R1 *(6/8/2021)*

	
Photo Point 10 – view upstream Vile Creek R2 *(6/8/2021)*	**Photo Point 10** – view downstream Vile Creek R2 *(6/8/2021)*
	
Photo Point 11 – view upstream Vile Creek R2 *(6/8/2021)*	**Photo Point 11** – view downstream Vile Creek R2 *(6/8/2021)*
	
Photo Point 12 – view upstream Vile Creek R2 *(6/8/2021)*	**Photo Point 12** – view downstream Vile Creek R2 *(6/8/2021)*

	
Photo Point 13 – view upstream Vile Creek R2 *(6/8/2021)*	**Photo Point 13** – view downstream Vile Creek R2 *(6/8/2021)*
	
Photo Point 14 – view upstream Vile Creek R2 *(6/8/2021)*	**Photo Point 14** – view downstream Vile Creek R2 *(6/8/2021)*
	
Photo Point 15 – view upstream Vile Creek R2 *(6/8/2021)*	**Photo Point 15** – view downstream Vile Creek R2 *(6/8/2021)*

	
Photo Point 16 – view upstream Vile Creek R2 *(6/8/2021)*	**Photo Point 16** – view downstream Vile Creek R2 *(6/8/2021)*
	
Photo Point 17 – view upstream Vile Creek R2 *(6/8/2021)*	**Photo Point 17** – view downstream Vile Creek R2 *(6/8/2021)*
	
Photo Point 18 – view upstream Vile Creek R2 *(6/8/2021)*	**Photo Point 18** – view downstream Vile Creek R2 *(6/8/2021)*

	
Photo Point 19 – view upstream Vile Creek R3 *(6/8/2021)*	**Photo Point 19** – view downstream Vile Creek R3 *(6/8/2021)*
	
Photo Point 20 – view upstream Vile Creek R3 *(6/8/2021)*	**Photo Point 20** – view downstream Vile Creek R3 *(6/8/2021)*
	
Photo Point 21 – view upstream Vile Creek R3 *(6/8/2021)*	**Photo Point 21** – view downstream Vile Creek R3 *(6/8/2021)*

	
Photo Point 22 – view upstream Vile Creek R3 *(6/8/2021)*	**Photo Point 22** – view downstream Vile Creek R3 *(6/8/2021)*
	
Photo Point 23 – view upstream Little River *(6/8/2021)*	**Photo Point 23** – view downstream Little River *(6/8/2021)*
	
Photo Point 24 – view upstream UT1 R1 *(6/8/2021)*	**Photo Point 24** – view downstream UT1 R1 *(6/8/2021)*

	
Photo Point 25 – view upstream UT1 R1 (6*/8/2021*)	**Photo Point 25** – view downstream UT1 R1 (6*/8/2021*)
	
Photo Point 26 – view upstream UT1 R1 (6/8/2021)	**Photo Point 26** – view downstream UT1 R1 (6/8/2021)
	
Photo Point 27 – view upstream UT1 R1 (6/8/2021)	**Photo Point 27** – view downstream UT1 R1 (6/8/2021)

	
Photo Point 28 – view upstream UT1C *(6/8/2021)*	**Photo Point 28** – view downstream UT1C *(6/8/2021)*
	
Photo Point 29 – view upstream UT1 R2 *(6/8/2021)*	**Photo Point 29** – view downstream UT1 R2 *(6/8/2021)*
	
Photo Point 30 – view upstream UT1 R2 *(6/8/2021)*	**Photo Point 30** – view downstream UT1 R2 *(6/8/2021)*

Photo Point 31 – view upstream UT2 *(6/8/2021)*

Photo Point 31 – view downstream UT2 *(6/8/2021)*

Photo Point 31 – view of UT2 BMP *(6/8/2021)*

Photo Point 32 – view upstream UT2 *(6/8/2021)*

Photo Point 32 – view downstream UT2 *(6/8/2021)*

	
Photo Point 33 – view upstream UT2 *(6/8/2021)*	**Photo Point 33** – view downstream UT2 *(6/8/2021)*
	
Photo Point 34 – view upstream UT3 *(6/8/2021)*	**Photo Point 34** – view downstream UT3 *(6/8/2021)*
	
Photo Point 35 – view upstream UT3 *(6/8/2021)*	**Photo Point 35** – view downstream UT3 *(6/8/2021)*

Photo Point 36 –stormwater wetland *(6/8/2021)*

Vegetation Photographs

Monitoring Year 5

Vegetation Plot 1 - *(9/27/2021)*

Vegetation Plot 2 - *(9/27/2021)*

Vegetation Plot 3 - *(9/27/2021)*

Vegetation Plot 4 - *(9/27/2021)*

Vegetation Plot 5 - *(9/27/2021)*

Vegetation Plot 6 - *(9/27/2021)*

Vegetation Plot 7 - *(9/27/2021)*

Vegetation Plot 8 - *(9/28/2021)*

Vegetation Plot 9 - *(9/28/2021)*

Vegetation Plot 10 - *(9/28/2021)*

Vegetation Plot 11 - *(9/28/2021)*

Vegetation Plot 12 - *(9/27/2021)*

Vegetation Plot 13 - *(9/27/2021)*

Vegetation Plot 14 - *(9/28/2021)*

Vegetation Plot 15 - *(9/28/2021)*

Vegetation Plot 16 – (*9/28/2021*)

Vegetation Plot 17 - *(9/28/2021)*

Transect Vegetation Plot 1 - *(9/28/2021)*

Transect Vegetation Plot 2 - *(9/28/2021)*

Bog Vegetation Photographs

Monitoring Year 5

Bog Vegetation Plot 1 - *(9/27/2021)*

Bog Vegetation Plot 2 - *(9/27/2021)*

Bog Vegetation Plot 3 - *(9/27/2021)*

Bog Vegetation Plot 4 - *(9/27/2021)*

Bog Vegetation Plot 5 - *(9/27/2021)*

Bog Vegetation Plot 6 - *(9/27/2021)*

	
Bog Vegetation Plot 7 - *(9/27/2021)*	**Bog Vegetation Plot 8** - *(9/27/2021)*

Gray's Lily Photographs

Monitoring Year 5

	
Gray's Lily location 1 - *(6/04/2019)*	**Gray's Lily location 2** - *(6/04/2019)*

Photos – Stream Areas of Concern

Monitoring Year 5

Photo 1 – Vile Creek R1: Station 103+90 – Right bank piping and scour around log sill. 10-26-2021

Photo 2 – Vile Creek R1: Station 103+90-104+20 – Right bank scour. 10-26-2021

Photo 3 – UT1 R1: Station 202+90-203+15 – Left Bank Scour. 10-26-2021

Photo 4 – UT1 R1: Station 204+90 – Structure missing. 10-26-2021

Photo 5 – UT1 R1: Station 205+10-205+50- Stream realignment. 3-2021

Photo 6 – UT1 R1: Station 206+40 – 206+60 – Bank Scour 10-26-2021

Photo 7 – UT1 R1: Station 212+50 – Structure piping. 10-26-2021

Photo 8– UT1 R2: Station 220+98 – Piping around structure 3-17-2021

Photo 9 – UT2: Station 304+90– Headcut 3-17-2021

Photo 10 – UT2: Station 305+00 – 305+50 – Bank scour. 10-26-2021

Photo 11 – UT2: Station 306+30 – 306+70 – Bank scour. 10-26-2021

Photo 12 – UT2 Station 309+70: Stream aggradation. 10-26-2021

Photo 13 – UT1B: Stream aggradation. 3-17-2021

Photo 14– UT1C: Stream aggradation. 3-17-2021

Photo 15 - UT1 R1: Easement encroachment. 10-27-2021

Vile Creek
Repairs Photo Log

Vile Creek R2: STA 118+50 - 118+80 - Right Bank Repair 9-28-2021

Vile Creek R2: STA 118+80 – J-Hook Repair 9-28-2021

Vile Creek R2: STA 119+50 - 119+70 - Bank Repair 9-28-2021

Vile Creek R2: STA 121+00 - 121+25 - Right Bank Repair 9-28-2021

Vile Creek R2: STA 122+20 - 123+00 – Stream Repair 9-28-2021

Vile Creek R2: STA 123+00 – Rock Sill Repair 9-28-2021

	
Vile Creek R3: STA 125+00 - 125+60 - Secondary Channel Repair 9-28-2021	UT2 BMP – Headcut Repair 9-28-2021

APPENDIX 3. Vegetation Plot Data

Table 7. Vegetation Plot Criteria Attainment

Vile Creek Mitigation Site

DMS Project No. 96582

Monitoring Year 5 - 2021

Plot	MY5 Success Criteria Met (Y/N)	Tract Mean
1	Y	
2	Y	
3	Y	
4	Y	
5	N	
6	Y	
7	Y	
8	Y	
9	N	82%
10	Y	
11	Y	
12	Y	
13	Y	
14	N	
15	Y	
16	Y	
17	Y	

Table 8. CVS Vegetation Plot Metadata
Vile Creek Mitigation Site
DMS Project No. 96582
Monitoring Year 5 - 2021

Report Prepared By	Jordan Hessler
Date Prepared	10/13/2021 21:50
Database Name	cvs-eep-entrytool-v2.5.0 Vile MY5.mdb
Database Location	L:\ActiveProjects\005-02147 Vile Creek\Monitoring\Monitoring Year 5 (2021)\Vegetation Assessment
DESCRIPTION OF WORKSHEETS IN THIS DOCUMENT----------	
Metadata	Description of database file, the report worksheets, and a summary of project(s) and project data.
Project Planted	Each project is listed with its PLANTED stems per acre, for each year. This excludes live stakes.
Project Total Stems	Each project is listed with its TOTAL stems per acre, for each year. This includes live stakes, all planted stems, and all natural/volunteer stems.
Plots	List of plots surveyed with location and summary data (live stems, dead stems, missing, etc.).
Vigor	Frequency distribution of vigor classes for stems for all plots.
Vigor by Spp	Frequency distribution of vigor classes listed by species.
Damage	List of most frequent damage classes with number of occurrences and percent of total stems impacted by each.
Damage by Spp	Damage values tallied by type for each species.
Damage by Plot	Damage values tallied by type for each plot.
Planted Stems by Plot and Spp	A matrix of the count of PLANTED living stems of each species for each plot; dead and missing stems are excluded.
ALL Stems by Plot and spp	A matrix of the count of total living stems of each species (planted and natural volunteers combined) for each plot; dead and missing stems are excluded.
PROJECT SUMMARY----------	
Project Code	96582
project Name	Vile Creek Restoration Project
Description	Stream and Wetland Mitigation
Required Plots (calculated)	17
Sampled Plots	17

Table 9a. Planted and Total Stem Counts

Vile Creek Mitigation Site
DMS Project No. 96582
Monitoring Year 5 - 2021

			Current Plot Data (MY5 2021)																		
			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**
Acer rubrum	Red Maple	Tree			3			45	1	1	1									20			
Alnus serrulata	Tag Alder	Shrub Tree			2			1															
Aronia arbutifolia	Red Chokeberry	Shrub																					
Betula nigra	River Birch, Red Birch	Tree										3	3	3	1	1	1	3	3	3			
Carpinus caroliniana	Ironwood	Shrub Tree										1	1	1				2	2	2	1	1	1
Cephalanthus occidentalis	Buttonbush	Shrub Tree	4	4	4	6	6	**6**															
Cornus amomum	Silky Dogwood	Shrub Tree	1	1	1	3	3	**3**	13	13	13												
Diospyros virginiana	American Persimmon	Tree																			1	1	1
Fraxinus pennsylvanica	Green Ash	Tree										3	3	3	3	3	3	2	2	2	7	7	7
Lindera benzoin	Northern Spicebush	Shrub Tree																					
Liriodendron tulipifera	Tulip Poplar	Tree												1				1	1	1			
Platanus occidentalis	Sycamore	Tree						1				4	4	4	1	1	1	3	3	3	2	2	2
Quercus pagoda	Cherrybark Oak	Tree										2	2	2				2	2	2	2	2	2
		Stem count	5	5	10	9	9	**56**	14	14	14	13	13	14	5	5	5	13	13	33	13	13	13
		size (ares)		1			1			1			1			1			1		1	
		size (ACRES)		0.0247			0.0247			0.0247			0.0247			0.0247			0.0247		0.0247	
		Species count	2	2	4	2	2	**5**	2	2	2	4	4	5	3	3	3	5	5	6	4	4	4
		Stems per ACRE	202	202	405	364	364	**2266.2396**	567	567	567	526	526	567	202	202	202	526	526	1335	526	526	526

			Current Plot Data (MY5 2021)																		
			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**
Acer rubrum	Red Maple	Tree																					
Alnus serrulata	Tag Alder	Shrub Tree																		3			
Aronia arbutifolia	Red Chokeberry	Shrub																					
Betula nigra	River Birch, Red Birch	Tree							2	2	2	3	3	3	1	1	1						
Carpinus caroliniana	Ironwood	Shrub Tree										3	3	3	1	1	1						
Cephalanthus occidentalis	Buttonbush	Shrub Tree																					
Cornus amomum	Silky Dogwood	Shrub Tree									1												
Diospyros virginiana	American Persimmon	Tree	1	1	1													2	2	2			
Fraxinus pennsylvanica	Green Ash	Tree	6	6	6	1	1	1	5	5	5	1	1	1	3	3	3	1	1	1			
Lindera benzoin	Northern Spicebush	Shrub Tree																					
Liriodendron tulipifera	Tulip Poplar	Tree	1	1	1							1	1	1									
Platanus occidentalis	Sycamore	Tree	2	2	2	3	3	3	5	5	5	2	2	2	1	1	1	4	4	4	1	1	1
Quercus pagoda	Cherrybark Oak	Tree	1	1	1				3	3	3	1	1	1	3	3	3	3	3	3	2	2	2
		Stem count	11	11	11	4	4	4	15	15	16	11	11	11	9	9	9	10	10	13	3	3	3
		size (ares)		1			1		1				1		1				1		1		
		size (ACRES)		0.0247			0.0247			0.0247			0.0247			0.0247			0.0247		0.0247	
		Species count	5	5	5	2	2	2	4	4	5	6	6	6	5	5	5	4	4	5	2	2	2
		Stems per ACRE	445	445	445	162	162	162	607	607	647	445	445	445	364	364	364	405	405	526	121	121	121

			Current Plot Data (MY5 2021)								
			Vegetation Plot 15			Vegetation Plot 16			Vegetation Plot 17		
Scientific Name	**Common Name**	**Species Type**	**PnoLS**	**P-all**	**T**	**PnoLS**	**P-all**	**T**	**PnoLS**	**P-all**	**T**
Acer rubrum	Red Maple	Tree									
Aronia arbutifolia	Red Chokeberry	Shrub									
Alnus serrulata	Tag Alder	Shrub Tree									
Betula nigra	River Birch	Tree	1	1	1	6	6	6			
Carpinus caroliniana	Ironwood	Shrub Tree	3	3	3	1	1	1			
Cephalanthus occidentalis	Buttonbush	Shrub Tree									
Cornus amomum	Silky Dogwood	Shrub Tree									
Diospyros virginiana	American Persimmon	Tree							1	1	1
Fraxinus pennsylvanica	Green Ash	Tree							1	1	1
Lindera benzoin	Northern Spicebush	Shrub Tree									
Liriodendron tulipifera	Tulip Poplar	Tree							3	3	3
Platanus occidentalis	Sycamore	Tree	5	5	5				3	3	3
Quercus pagoda	Cherrybark Oak	Tree	1	1	1	1	1	1	1	1	1
		Stem count	10	10	10	8	8	8	9	9	9
		size (ares)		1			1			1	
		size (ACRES)		0.0247			0.0247			0.0247	
		Species count	4	4	4	3	3	3	5	5	5
		Stems per ACRE	405	405	405	324	324	324	364	364	364

* MY3 - MY7 vegetation plots one and two will use shrub density requirements to determine if success critera is met.

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 9b. Planted Stem Annual Means

Vile Creek Mitigation Site
DMS Project No. 96582
Monitoring Year 5 - 2021

Current Permanent Vegetation Plot Data (MY5 2021) Total Stem Counts and Annual Means																	
			MY5 (9/2021)			MY3 (9/2019)			MY2 (9/2018)			MY1 (9/2017)			MY0 (3/2017)		
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**
Acer rubrum	Red Maple	Tree	1	1	69	1	1	1	1	1	2	1	1	1			
Aronia arbutifolia	Red Chokeberry	Shrub									3						
Alnus serrulata	Tag Alder	Shrub Tree			6										1	1	1
Betula nigra	River Birch	Tree	20	20	20	27	27	27	29	29	29	43	43	43	55	55	55
Carpinus caroliniana	Ironwood	Shrub Tree	12	12	12	13	13	13	16	16	16	21	21	21	21	21	21
Cephalanthus occidentalis	Buttonbush	Shrub Tree	10	10	10	8	8	8	12	12	12	12	12	12	14	14	14
Cornus amomum	Silky Dogwood	Shrub Tree	17	17	18	17	17	17	17	17	19	16	16	16	19	19	19
Diospyros virginiana	American Persimmon	Tree	5	5	5	7	7	7	9	9	9	11	11	11	12	12	12
Fraxinus pennsylvanica	Green Ash	Tree	33	33	33	34	34	34	35	35	35	36	36	36	35	35	35
Lindera benzoin	Northern Spicebush	Shrub Tree				2	2	2	7	7	7	11	11	11	14	14	14
Liriodendron tulipifera	Tulip Poplar	Tree	6	6	7	15	15	16	18	18	18	24	24	24	38	38	38
Platanus occidentalis	Sycamore	Tree	36	36	37	37	37	37	38	38	39	40	40	40	40	40	40
Quercus pagoda	Cherrybark Oak	Tree	22	22	22	26	26	26	29	29	29	35	35	35	39	39	39
		Stem count	162	162	239	187	187	188	211	211	218	250	250	250	288	288	288
		size (ares)		17			17			17			17			17	
		size (ACRES)		0.420			0.420			0.420			0.420			0.420	
		Species count	10	10	11	11	11	11	11	11	12	11	11	11	11	11	11
		Stems per ACRE	386	386	569	445	445	448	502	502	519	595	595	595	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 9c. Transect Plots and Planted Stem Annual Means

Vile Creek Mitigation Site
DMS Project No. 96582
Monitoring Year 5 - 2021

Supplimental Planting Transect Vegetation Plot (MP) Data (MY5 2021) and Total Stem Counts and Annual Means					
			MP 1	MP2	MY5 (9/2021)
Scientific Name	**Common Name**	**Species Type**	**Pnols**	**Pnols**	**PnoLS**
Acer rubrum	Red Maple	Tree			
Aronia arbutifolia	Red Chokeberry	Shrub			
Alnus serrulata	Tag Alder	Shrub Tree			
Betula nigra	River Birch	Tree	3	4	7
Carpinus caroliniana	Ironwood	Shrub Tree	2		2
Cephalanthus occidentalis	Buttonbush	Shrub Tree			
Cornus amomum	Silky Dogwood	Shrub Tree			
Diospyros virginiana	American Persimmon	Tree			
Fraxinus pennsylvanica	Green Ash	Tree			
Lindera benzoin	Northern Spicebush	Shrub Tree			
Liriodendron tulipifera	Tulip Poplar	Tree	1		1
Platanus occidentalis	Sycamore	Tree	5	3	8
Quercus pagoda	Cherrybark Oak	Tree	1		1
Nyssa sylvatica**	Blackgum	Tree	1	1	2
		Stem count	13	8	21
		size (ares)	1	1	2
		size (ACRES)	0.0247	0.0247	0.049
		Species count	6	3	6
		Stems per ACRE	526	324	425

** Blackgum included in the approved supplimental planting list.

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 9d. Planted Herbaceous Cover (Bog Cells)
Vile Creek Mitigation Site
DMS Project No. 96582
Monitoring Year 5 - 2021

Percent Cover %								
Plot ID	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**MY6**	**MY7**
1	<5	30	65	100	N/A	100		
2	10	75	100	100	N/A	95		
3	<5	75	95	95	N/A	100		
4	<5	90	100	100	N/A	100		
5	<5	80	90	100	N/A	95		
6	<5	85	95	100	N/A	98		
7	<5	100	100	100	N/A	98		
8	50	95	100	100	N/A	100		

APPENDIX 4. Morphological Summary Data and Plots

Table 10a. Baseline Stream Data Summary

Vile Creek Mitigation Site
DMS Project No. 96582
Monitoring Year 5 - 2021

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	0.014		0.012	
Bankfull Slope (ft/ft)	0.017		0.016		---		---		---		---		0.016		0.017		0.015		0.012	

(---): Data was not provided

Table 10b. Baseline Stream Data Summary
Vile Creek Mitigation Site
DMS Project No. 96582
Monitoring Year 5 - 2021

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	

(---): Data was not provided

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

Table 11. Morphology and Hydraulic Summary (Dimensional Parameters - Cross-Section)

Vile Creek Mitigation Site

DMS Project No. 96582

Monitoring Year 5 - 2021

	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[1]	**Base**	**MY1**	**MY2**	**MY3**	**MY5**	**MY7**	**Base**	**MY1**	**MY2**	**MY3**	**MY5**	**MY7**	**Base**	**MY1**	**MY2**	**MY3**	**MY5**	**MY7**
Bankfull Elevation (ft)	2700.8	2700.7	2700.8	2700.8	2701.3		2700.0	2700.0	2700.2	2700.2	2699.83		2695.7	2695.7	2695.8	2695.6	2695.85	
Low Bank Elevation (ft)	2700.8	2700.7	2700.8	2700.8	2701.3		2700.0	2700.0	2700.2	2700.2	2700.21		2695.7	2695.7	2695.8	2695.6	2695.89	
Bankfull Width (ft)	25.1	24.6	25.6	15.8	25.3		17.1	17.6	20.4	18.9	17.7		18.8	17.9	19.4	19.9	14.2	
Floodprone Width (ft)	---	---	---	---	---		>200	>200	143.9	145.9	144.8		>200	>200	108.6	110.9	110.7	
Bankfull Mean Depth (ft)	1.2	1.1	1.0	1.5	1.6		1.2	1.3	1.6	1.7	1.5		1.1	1.2	1.2	1.1	1.4	
Bankfull Max Depth (ft)	3.0	2.8	2.5	2.6	2.8		2.1	2.3	3.1	3.3	2.8		1.9	2.2	2.6	2.5	2.3	
Bankfull Cross-Sectional Area (ft^2)	29.2	25.8	25.6	23.9	25.3		21.2	22.7	32.8	32.5	27.3		19.8	20.9	23.9	22.2	20.5	
Bankfull Width/Depth Ratio	---	---	---	---	---		13.7	13.7	12.8	10.9	11.5		17.8	15.3	15.8	17.9	9.9	
Bankfull Entrenchment Ratio[2]	---	---	---	---	---		>10.6	11.4	7.0	7.7	8.2		>10.7	>11.2	5.6	5.6	7.8	
Bankfull Bank Height Ratio	---	---	---	---	---		1.1	1.1	1.3	1.3	1.2		1.0	1.0	1.1	1.1	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[1]	**Base**	**MY1**	**MY2**	**MY3**	**MY5**	**MY7**	**Base**	**MY1**	**MY2**	**MY3**	**MY5**	**MY7**	**Base**	**MY1**	**MY2**	**MY3**	**MY5**	**MY7**
Bankfull Elevation (ft)	2691.7	2691.7	2691.7	2691.5	2691.79		2688.9	2688.9	2689.0	2689.0	2689.27		2687.9	2687.9	2688.1	2687.9	2687.95	
Low Bank Elevation (ft)	2691.7	2691.7	2691.7	2691.5	2691.68		2688.9	2688.9	2689.0	2689.0	2688.87		2687.9	2687.9	2688.1	2687.9	2687.95	
Bankfull Width (ft)	18.7	19.4	19.5	17.6	15.0		19.2	19.8	19.9	19.5	22.6		24.1	24.0	26.1	18.2	18.2	
Floodprone Width (ft)	188.0	188.0	88.6	89.2	89.0		156.0	156.0	96.9	101.0	100.1		---	---	---	---	---	
Bankfull Mean Depth (ft)	1.2	1.2	1.1	1.3	1.4		1.5	1.5	1.6	1.6	1.5		1.8	1.6	1.6	2.0	2.0	
Bankfull Max Depth (ft)	2.0	2.3	2.2	2.5	2.4		2.3	2.5	2.7	2.7	2.4		3.6	4.0	3.8	4.0	4.0	
Bankfull Cross-Sectional Area (ft^2)	22.5	23.1	21.7	22.0	20.8		28.6	29.7	31.3	31.0	22.6		44.3	39.6	41.9	36.3	37.0	
Bankfull Width/Depth Ratio	15.5	16.3	17.5	14.0	10.8		12.9	13.2	12.7	12.2	9.8		---	---	---	---	---	
Bankfull Entrenchment Ratio[2]	10.1	9.7	4.6	5.1	5.9		8.1	7.9	4.9	5.2	6.7		---	---	---	---	---	
Bankfull Bank Height Ratio	1.0	1.0	1.0	1.0	1.0		1.0	1.0	1.1	1.1	0.9		---	---	---	---	---	
	Cross-Section 7, UT1 Reach 1 (Riffle)						**Cross-Section 8, UT1 Reach 1 (Pool)**						**Cross-Section 9, UT1 Reach 1 (Riffle)**					
Dimension and Substrate[1]	**Base**	**MY1**	**MY2**	**MY3**	**MY5**	**MY7**	**Base**	**MY1**	**MY2**	**MY3**	**MY5**	**MY7**	**Base**	**MY1**	**MY2**	**MY3**	**MY5**	**MY7**
Bankfull Elevation (ft)	2743.9	2743.9	2744.1	2744.0	2743.52		2725.7	2725.7	2726.0	2726.1	2726.61		2725.3	2725.3	2725.4	2725.3	2725.33	
Low Bank Elevation (ft)	2743.9	2743.9	2744.1	2744.0	2744.36		2725.7	2725.7	2726.0	2726.1	2726.61		2725.3	2725.3	2725.4	2725.3	2725.33	
Bankfull Width (ft)	8.6	8.1	8.9	8.5	9.5		11.3	8.2	6.8	8.2	8.2		7.7	6.5	7.2	5.3	5.2	
Floodprone Width (ft)	63.0	63.0	83.7	85.5	83.9		---	---	---	---	---		97.0	97.0	81.8	83.2	85.7	
Bankfull Mean Depth (ft)	0.7	1.2	1.2	1.1	1.3		0.6	0.5	0.7	0.8	0.9		0.5	0.7	0.6	0.7	0.8	
Bankfull Max Depth (ft)	1.1	2.2	2.3	2.0	2.2		1.4	0.8	0.9	1.4	1.9		1.1	1.1	1.1	1.0	1.0	
Bankfull Cross-Sectional Area (ft^2)	5.9	9.4	10.3	9.3	12.5		7.1	4.4	4.5	6.6	7.6		4.1	4.2	4.2	3.6	4.1	
Bankfull Width/Depth Ratio	12.4	7.0	7.6	7.8	7.2		---	---	---	---	---		14.7	9.9	12.5	7.9	6.6	
Bankfull Entrenchment Ratio[2]	7.3	7.8	9.5	10.1	8.9		---	---	---	---	---		12.5	15.0	11.3	15.6	16.5	
Bankfull Bank Height Ratio	1.0	1.0	1.4	1.3	1.6		---	---	---	---	---		1.0	1.0	1.0	0.9	1.0	
	Cross-Section 10, UT1 Reach 2 (Pool)						**Cross-Section 11, UT1 Reach 2 (Riffle)**											
Dimension and Substrate[1]	**Base**	**MY1**	**MY2**	**MY3**	**MY5**	**MY7**	**Base**	**MY1**	**MY2**	**MY3**	**MY5**	**MY7**						
Bankfull Elevation (ft)	2713.5	2713.5	2713.3	2713.3	2713.88		2712.9	2712.9	2712.9	2712.9	2712.97							
Low Bank Elevation (ft)	2713.5	2713.5	2713.3	2713.3	2713.88		2712.9	2712.9	2712.9	2712.9	2713.03							
Bankfull Width (ft)	13.3	12.6	11.8	5.6	7.2		9.0	12.6	8.4	8.2	8.6							
Floodprone Width (ft)	---	---	---	---	---		96.0	96.0	85.3	86.8	86.9							
Bankfull Mean Depth (ft)	0.9	0.7	0.5	0.9	1.1		0.8	0.5	0.8	0.9	0.9							
Bankfull Max Depth (ft)	1.9	1.8	1.7	1.8	2.2		1.3	1.4	1.5	1.4	1.6							
Bankfull Cross-Sectional Area (ft^2)	12.6	9.0	6.3	4.8	7.6		7.8	6.5	7.0	7.4	7.6							
Bankfull Width/Depth Ratio	---	---	---	---	---		11.4	24.5	10.2	9.0	9.7							
Bankfull Entrenchment Ratio[2]	---	---	---	---	---		10.7	7.6	10.1	10.6	10.1							
Bankfull Bank Height Ratio	---	---	---	---	---		1.0	1.0	0.9	1.0	1.0							

[1] MY2 – MY7 Bank Height Ratio was calculated based on the As-built (MY0) cross-sectional area as described in the Standard Measurement of the BHR Monitoring Parameter document provided by the NCIRT and NCDMS (9/2018). The remainder of the cross-section dimension parameters were calculated based on the current year's low bank height.

[2] ER in MY3 is based on the width of the cross-section, in lieu of assuming the width across the floodplain as was done in previous monitoring years.

Prior to MY2, bankfull dimensions were calculated using a fixed bankfull elevation.

Table 12a. Monitoring - Stream Reach Data Summary
Vile Creek Mitigation Site
DMS Project No. 96582
Monitoring Year 5 - 2021

Vile Creek, Reach 1 and Reach 2

Parameter	As-Built/Baseline				MY1				MY2				MY3				MY5			
	Vile Reach 1		Vile Reach 2		Vile Reach 1		Vile Reach 2		Vile Reach 1		Vile Reach 2		Vile Reach 1		Vile Reach 2		Vile Reach 1		Vile 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)	17.1	18.8	18.7	19.2	17.6	17.9	19.4	19.8	19.4	20.4	19.5	19.9	18.9	19.9	17.6	19.5	14.2	17.7	15.0	22.6
Floodprone Width (ft)	>200		156	188	>200		156.0	188.0	108.6	143.9	88.6	96.9	110.9	145.9	89.2	101.0	110.7	144.8	89.0	100.1
Bankfull Mean Depth	1.1	1.2	1.2	1.5	1.2	1.3	1.2	1.5	1.2	1.6	1.1	1.6	1.1	1.7	1.3	1.6	1.4	1.5	1.4	1.5
Bankfull Max Depth	1.9	2.1	2.0	2.3	2.2	2.3	2.3	2.5	2.6	3.1	2.2	2.7	2.5	3.3	2.5	2.7	2.3	2.8	2.4	
Bankfull Cross Sectional Area (ft^2)	19.8	21.2	22.5	28.6	20.9	22.7	23.1	29.7	23.9	32.8	21.7	31.3	22.2	32.5	22.0	31.0	20.5	27.3	20.8	22.6
Width/Depth Ratio	13.7	17.8	12.9	15.5	13.7	15.3	13.2	16.3	12.8	15.8	12.7	17.5	10.9	17.9	12.2	14.0	9.9	11.5	9.8	10.8
Entrenchment Ratio	>2.2		>2.2		>2.2		>2.2		7.0	5.6	4.6	4.9	5.6	7.7	5.1	5.2	7.8	8.2	5.9	6.7
Bank Height Ratio	1.0	1.1	1.0		1.0		1.0		1.1	1.3	1.0	1.1	1.0	1.3	1.0	1.1	1.0	1.2	0.9	1.0
D50 (mm)	60.4	69.3	58.6	61.5	82.0	101.2	70.9	78.5	77.8	92.3	78.1	93.6	49.5	53.2	52.7	71.5	55.9	59.2	64.0	79.5
Profile																				
Riffle Length (ft)	19.7	74.1	18.3	94.1																
Riffle Slope (ft/ft)	0.0164	0.0420	0.0187	0.0385																
Pool Length (ft)	38.8	149.3	47.1	123.7																
Pool Max Depth (ft)	3.1	4.4	3.4	5.5																
Pool Spacing (ft)	55	161	87	172																
Pool Volume (ft^3)	---		---																	
Pattern																				
Channel Beltwidth (ft)	34	127	48	88																
Radius of Curvature (ft)	34	50	38	76																
Rc:Bankfull Width (ft/ft)	1.8	2.9	2.0	4.1																
Meander Wave Length (ft)	125	214	177	235																
Meander Width Ratio	2	7	3	5																
Additional Reach Parameters																				
Rosgen Classification	C		C																	
Channel Thalweg Length (ft)	882		1,311																	
Sinuosity (ft)	1.21		1.26																	
Water Surface Slope (ft/ft)	0.0135		0.0122																	
Bankfull Slope (ft/ft)	0.0145		0.0122																	
Ri%/Ru%/P%/G%/S%																				
SC%/Sa%/G%/C%/B%/Be%																				
d16/d35/d50/d84/d95/d100																				
% of Reach with Eroding Banks					0%		0%		<1%		<1%		<1%		<1%		<1%		<1%	

[1] MY2 – MY7 Bank Height Ratio was calculated based on the As-built (MY0) cross-sectional area as described in the Standard Measurement of the BHR Monitoring Parameter document provided by the NCIRT and NCDMS (9/2018). The remainder of the cross-section dimension parameters were calculated based on the current year's low bank height.

[2] ER in MY3 is based on the width of the cross-section, in lieu of assuming the width across the floodplain as was done in previous monitoring years.
Prior to MY2, bankfull dimensions were calculated using a fixed bankfull elevation.

Table 12b. Monitoring - Stream Reach Data Summary
Vile Creek Mitigation Site
DMS Project No. 96582
Monitoring Year 5 - 2021

UT1 Reach 1 and Reach 2

Parameter	As-Built/Baseline				MY1				MY2				MY3				MY5			
	UT1 Reach 1		UT1 Reach 2		UT1 Reach 1		UT1 Reach 2		UT1 Reach 1		UT1 Reach 2		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)	7.7	8.6	9.0		6.5	8.1	12.6		7.2	8.9	8.4		5.3	8.5	8.2		5.2	9.5	8.6	
Floodprone Width (ft)	63	91	96		63.0	82.4	96.0		81.8	83.7	85.3		83.2	85.5	86.8		83.9	85.7	86.9	
Bankfull Mean Depth	0.5	0.7	0.8		0.7	1.2	0.5		0.6	1.2	0.8		0.7	1.1	0.9		0.8	1.3	0.9	
Bankfull Max Depth	1.1	1.1	1.3		1.1	2.2	1.4		1.1	2.3	1.5		1.0	2.0	1.4		1	2.2	1.6	
Bankfull Cross Sectional Area (ft^2)	4.1	5.9	7.8		4.2	9.4	6.5		4.2	10.3	7.0		3.6	9.3	7.4		4.1	12.5	7.6	
Width/Depth Ratio	12.4	14.7	11.4		7.0	9.9	24.5		7.6	12.5	10.2		7.8	7.9	9.0		6.6	9.9	9.7	
Entrenchment Ratio	>2.2		>2.2		>2.2		>2.2		9.5	11.3	10.1		10.1	15.6	10.6		11.5	16.5	10.1	
Bank Height Ratio	1.0	1.0	1.0		1.0		1.0		1.0	1.4	0.9		0.9	1.3	1.0		1.0	1.6	1.0	
D50 (mm)	22.6	34.3	28.1		29.8	48.3	58.6		45	78.1	72.7		25.9	30.2	54.7		35.7	47.0	52.3	
Profile																				
Shallow Length (ft)	11.0	53.1	13.5	60.7																
Shallow Slope (ft/ft)	0.0149	0.0410	0.0176	0.0897																
Pool Length (ft)	13.0	36.9	8.6	42.5																
Pool Max Depth (ft)	0.8	2.6	1.1	2.5																
Pool Spacing (ft)	7	59	38	88																
Pool Volume (ft^3)	---		---																	
Pattern																				
Channel Beltwidth (ft)	N/A[1]		6	66																
Radius of Curvature (ft)	N/A[1]		18	59																
Rc:Bankfull Width (ft/ft)	N/A[1]		2.0	6.5																
Meander Wave Length (ft)	N/A[1]		56	152																
Meander Width Ratio	N/A[1]		1	7																
Additional Reach Parameters																				
Rosgen Classification	B		B																	
Channel Thalweg Length (ft)	1,114		854																	
Sinuosity (ft)	1.2		1.1																	
Water Surface Slope (ft/ft)	0.0264		0.0288																	
Bankfull Slope (ft/ft)	0.0261		0.0284																	
Ri%/Ru%/P%/G%/S%																				
SC%/Sa%/G%/C%/B%/Be%																				
d16/d35/d50/d84/d95/d100																				
% of Reach with Eroding Banks					0%		0%		<1%		<1%		<1%		0%		<1%		0%	

N/A: Not Applicable

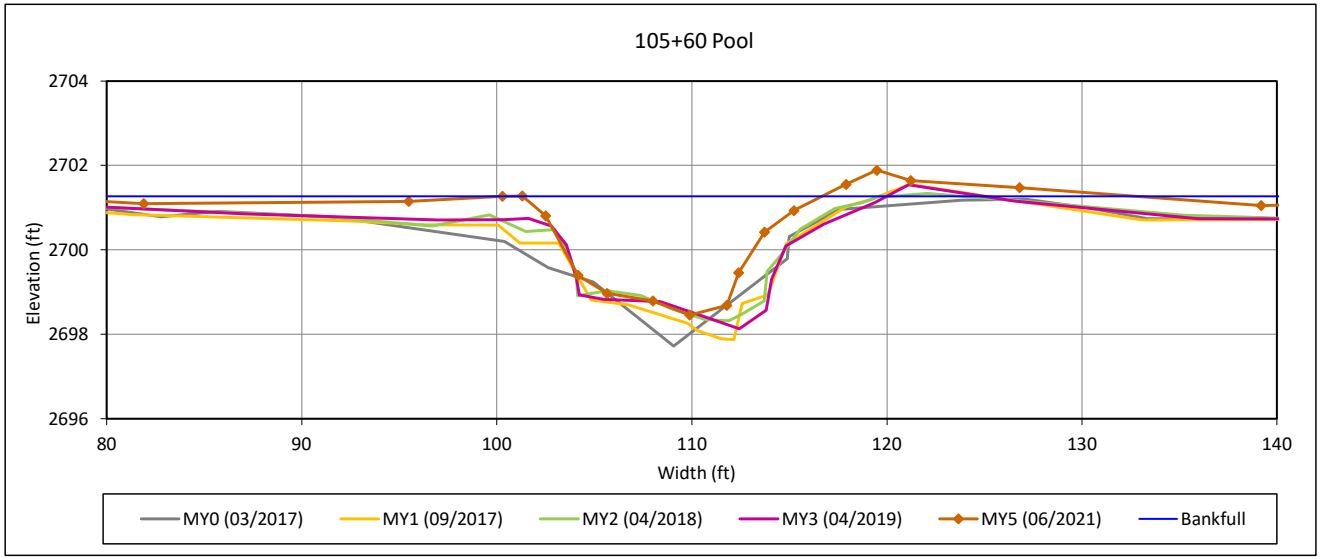
[1] MY2 – MY7 Bank Height Ratio was calculated based on the As-built (MY0) cross-sectional area as described in the Standard Measurement of the BHR Monitoring Parameter document provided by the NCIRT and NCDMS (9/2018). The remainder of the cross-section dimension parameters were calculated based on the current year's low bank height.

[2] ER in MY3 is based on the width of the cross-section, in lieu of assuming the width across the floodplain as was done in previous monitoring years.
Prior to MY2, bankfull dimensions were calculated using a fixed bankfull elevation.

Cross-section Plots

Vile Creek Mitigation Site
DMS Project No. 96582
Monitoring Year 5 - 2021

Cross-section 1 - Vile Creek Reach 1



Bankfull Dimensions	
25.3	x-section area (ft.sq.)
15.4	width (ft)
1.6	mean depth (ft)
2.8	max depth (ft)
16.9	wetted perimeter (ft)
1.5	hydraulic radius (ft)
9.3	width-depth ratio

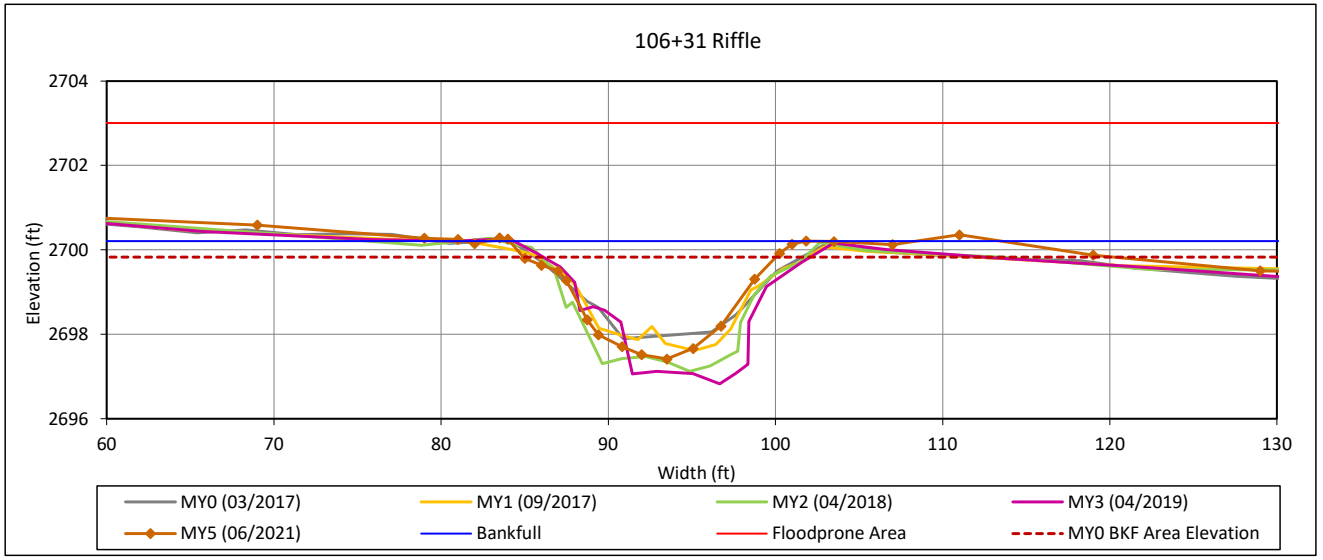
Survey Date: 06/2021
Field Crew: Wildlands Engineering

View Downstream

Cross-section Plots

Vile Creek Mitigation Site
DMS Project No. 96582
Monitoring Year 5 - 2021

Cross-section 2 - Vile Creek Reach 1



Bankfull Dimensions	
27.3	x-section area (ft.sq.)
17.7	width (ft)
1.5	mean depth (ft)
2.8	max depth (ft)
18.9	wetted perimeter (ft)
1.4	hydraulic radius (ft)
11.5	width-depth ratio
144.8	W flood prone area (ft)
8.2	entrenchment ratio
1.2	low bank height ratio

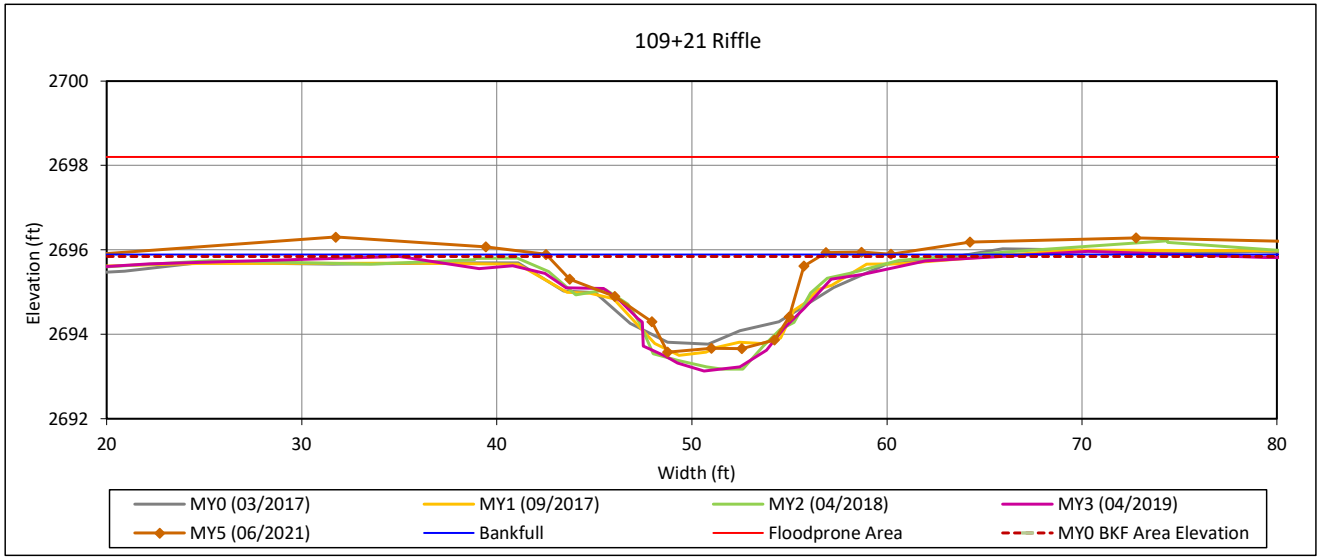
Survey Date: 08/2021
Field Crew: Wildlands Engineering

View Downstream

Cross-section Plots

Vile Creek Mitigation Site
DMS Project No. 96582
Monitoring Year 5 - 2021

Cross-section 3 - Vile Creek Reach 1



Bankfull Dimensions	
20.5	x-section area (ft.sq.)
14.2	width (ft)
1.4	mean depth (ft)
2.3	max depth (ft)
15.6	wetted perimeter (ft)
1.3	hydraulic radius (ft)
9.9	width-depth ratio
110.7	W flood prone area (ft)
7.8	entrenchment ratio
1.0	low bank height ratio

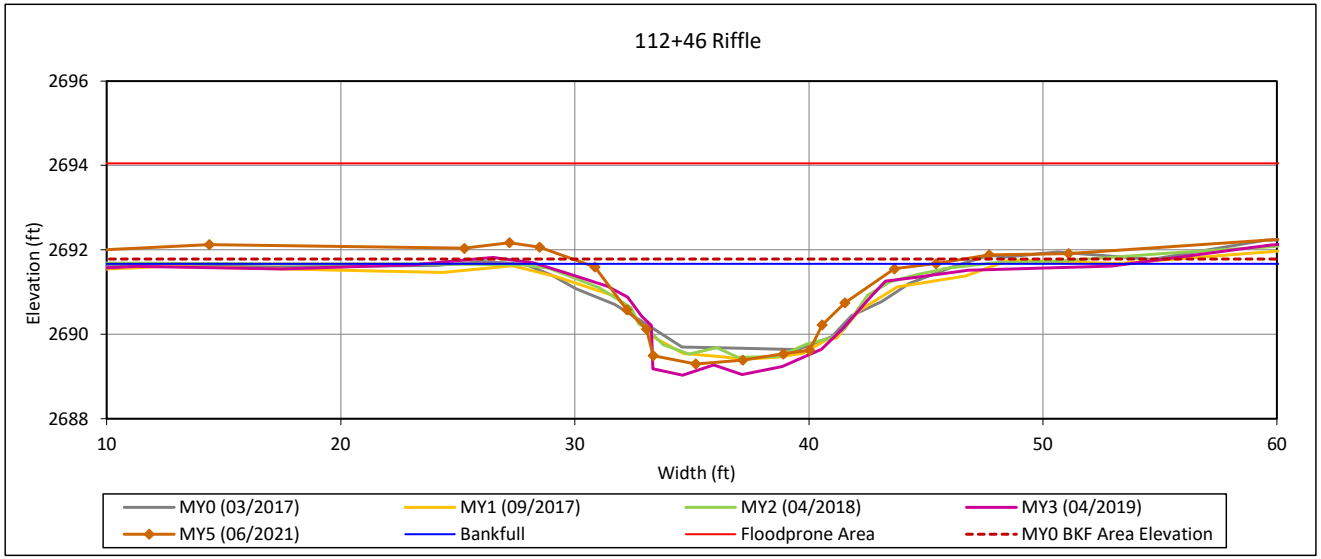
Survey Date: 06/2021
Field Crew: Wildlands Engineering

View Downstream

Cross-section Plots

Vile Creek Mitigation Site
DMS Project No. 96582
Monitoring Year 5 - 2021

Cross-section 4 - Vile Creek Reach 2



Bankfull Dimensions	
20.8	x-section area (ft.sq.)
15.0	width (ft)
1.4	mean depth (ft)
2.4	max depth (ft)
16.4	wetted perimeter (ft)
1.3	hydraulic radius (ft)
10.8	width-depth ratio
89.0	W flood prone area (ft)
5.9	entrenchment ratio
1.0	low bank height ratio

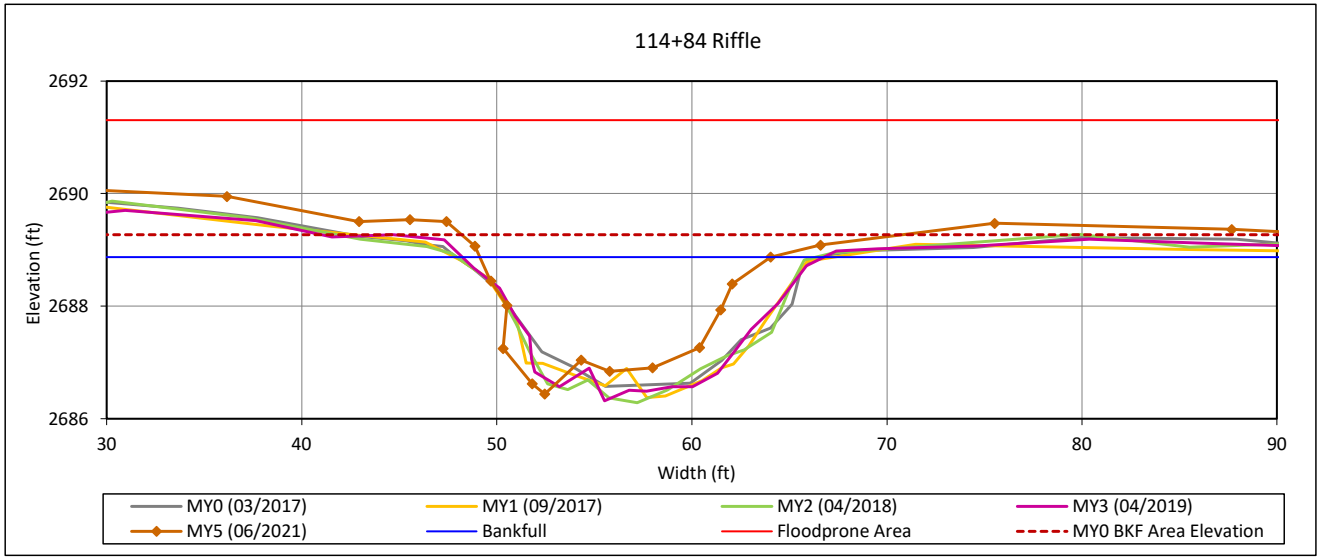
Survey Date: 06/2021
Field Crew: Wildlands Engineering

View Downstream

Cross-section Plots

Vile Creek Mitigation Site
DMS Project No. 96582
Monitoring Year 5 - 2021

Cross-section 5 - Vile Creek Reach 2



Bankfull Dimensions	
22.6	x-section area (ft.sq.)
14.9	width (ft)
1.5	mean depth (ft)
2.4	max depth (ft)
16.8	wetted perimeter (ft)
1.3	hydraulic radius (ft)
9.8	width-depth ratio
100.1	W flood prone area (ft)
6.7	entrenchment ratio
0.9	low bank height ratio

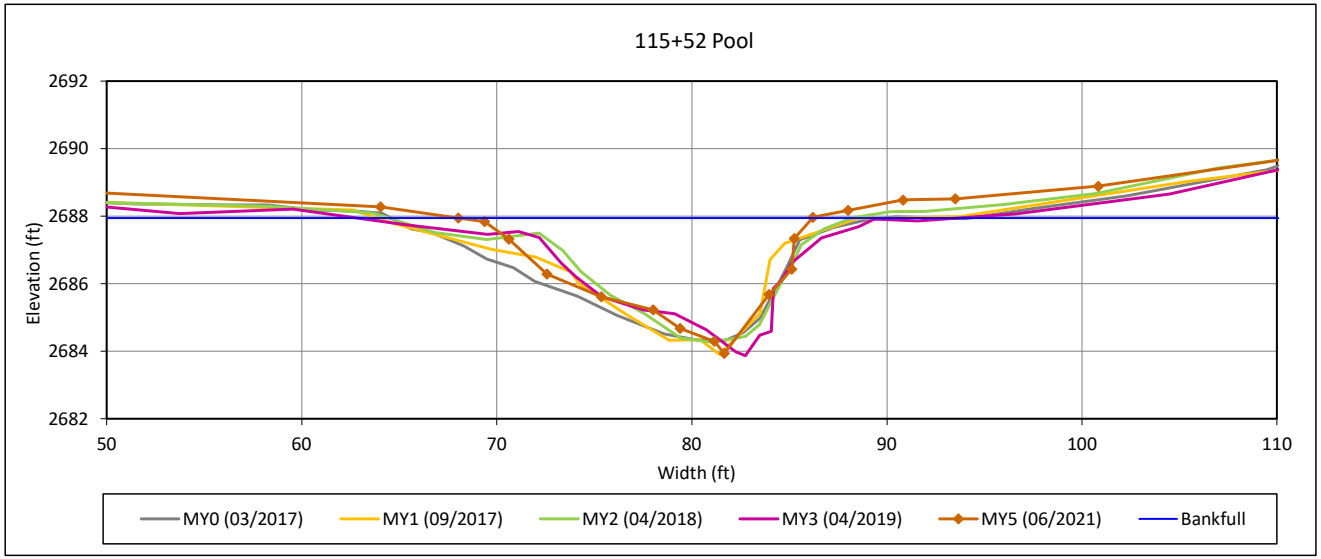
Survey Date: 06/2021
Field Crew: Wildlands Engineering

View Downstream

Cross-section Plots

Vile Creek Mitigation Site
DMS Project No. 96582
Monitoring Year 5 - 2021

Cross-section 6 - Vile Creek Reach 2



Bankfull Dimensions	
37.0	x-section area (ft.sq.)
18.2	width (ft)
2.0	mean depth (ft)
4.0	max depth (ft)
20.7	wetted perimeter (ft)
1.8	hydraulic radius (ft)
8.9	width-depth ratio

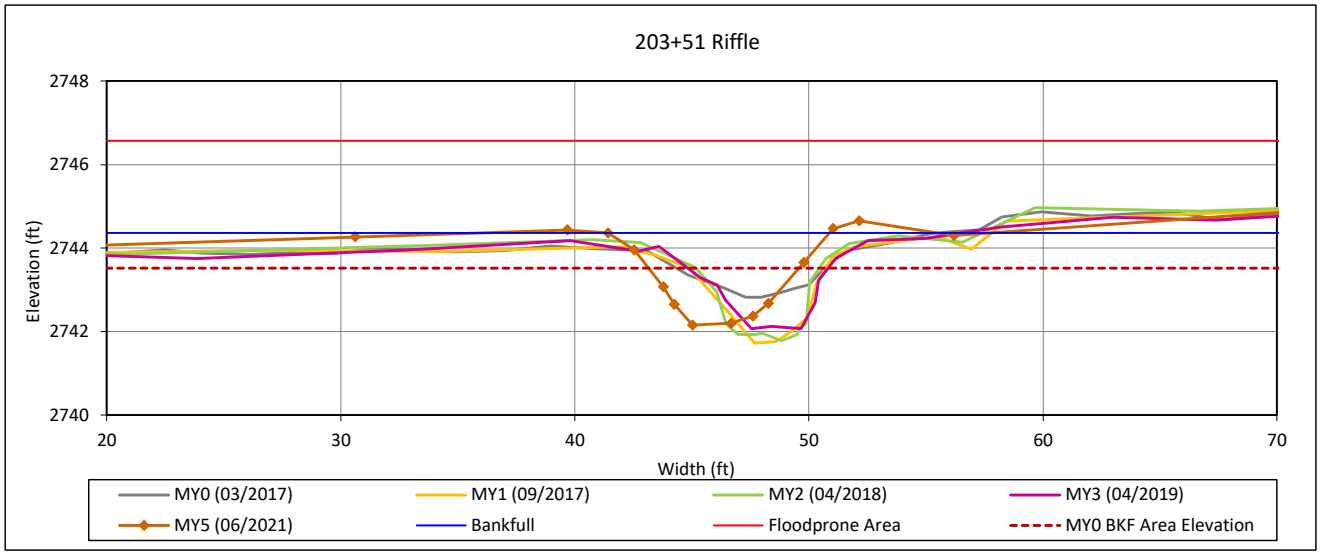
Survey Date: 06/2021
Field Crew: Wildlands Engineering

View Downstream

Cross-section Plots

Vile Creek Mitigation Site
DMS Project No. 96582
Monitoring Year 5 - 2021

Cross-section 7 - UT1 Reach 1



Bankfull Dimensions	
12.5	x-section area (ft.sq.)
9.5	width (ft)
1.3	mean depth (ft)
2.2	max depth (ft)
10.7	wetted perimeter (ft)
1.2	hydraulic radius (ft)
7.2	width-depth ratio
83.9	W flood prone area (ft)
8.9	entrenchment ratio
1.6	low bank height ratio

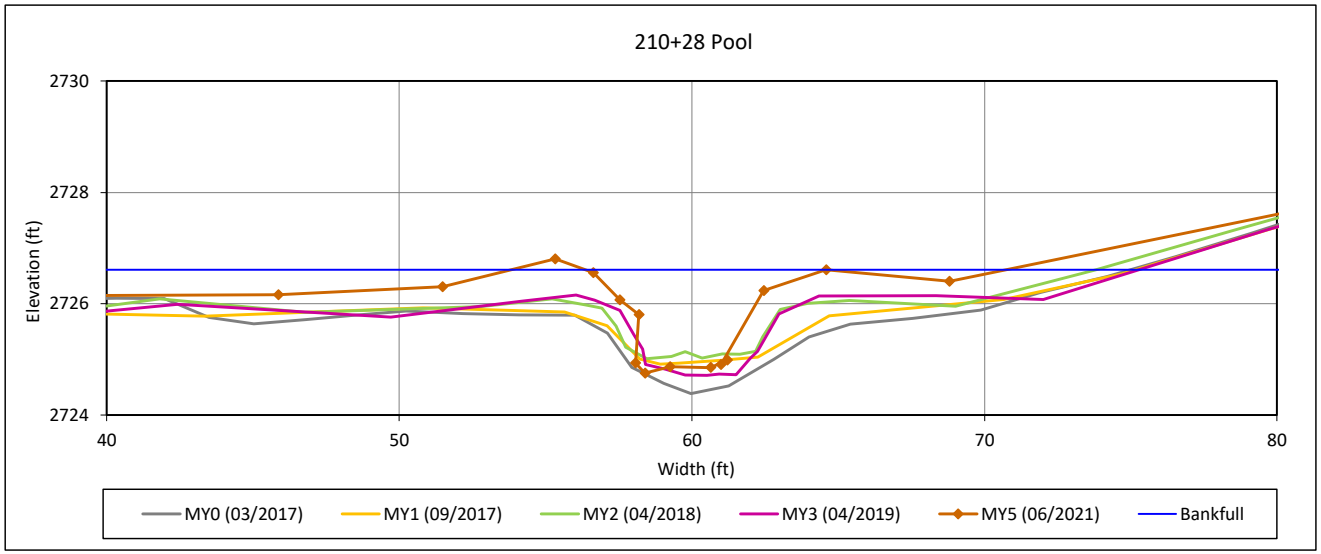
Survey Date: 06/2021
Field Crew: Wildlands Engineering

View Downstream

Cross-section Plots

Vile Creek Mitigation Site
DMS Project No. 96582
Monitoring Year 5 - 2021

Cross-section 8 - UT1 Reach 1



Bankfull Dimensions	
7.6	x-section area (ft.sq.)
8.2	width (ft)
0.9	mean depth (ft)
1.9	max depth (ft)
10.5	wetted perimeter (ft)
0.7	hydraulic radius (ft)
8.9	width-depth ratio

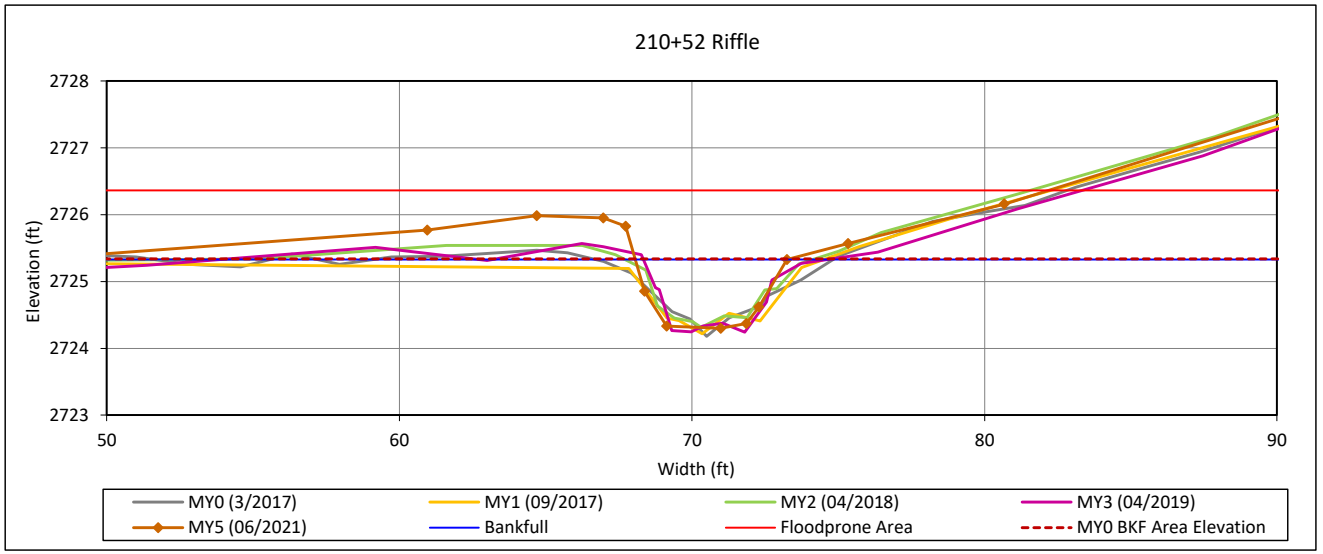
Survey Date: 06/2021
Field Crew: Wildlands Engineering

View Downstream

Cross-section Plots

Vile Creek Mitigation Site
DMS Project No. 96582
Monitoring Year 5 - 2021

Cross-section 9 - UT1 Reach 1



Bankfull Dimensions	
4.1	x-section area (ft.sq.)
5.2	width (ft)
0.8	mean depth (ft)
1.0	max depth (ft)
5.9	wetted perimeter (ft)
0.7	hydraulic radius (ft)
6.6	width-depth ratio
85.7	W flood prone area (ft)
16.5	entrenchment ratio
1.0	low bank height ratio

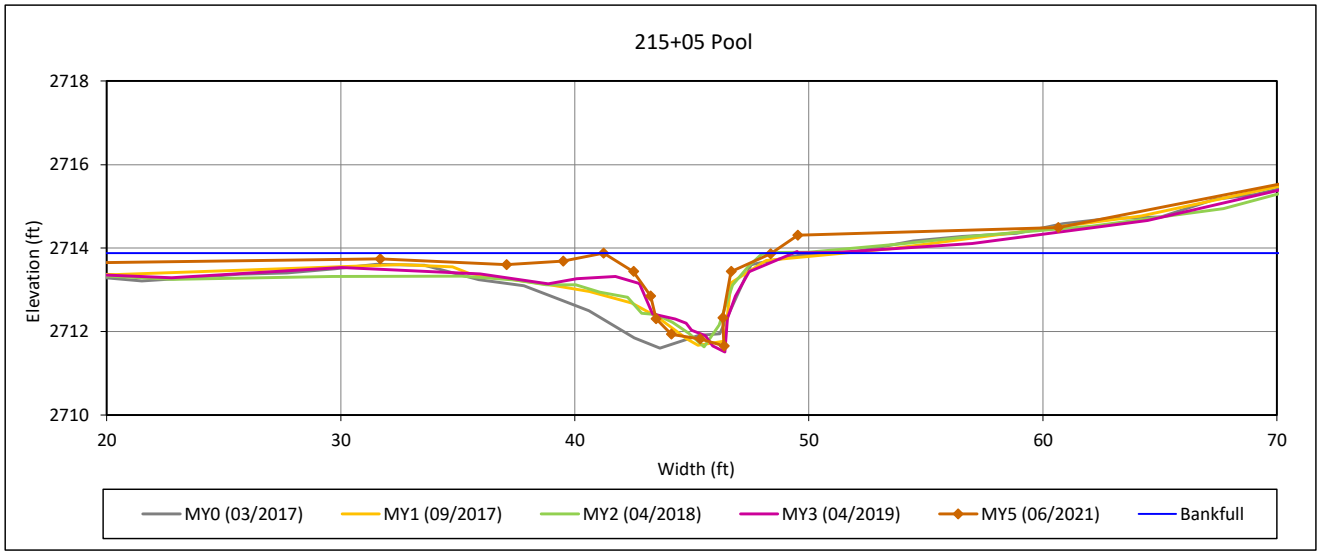
Survey Date: 06/2021
Field Crew: Wildlands Engineering

View Downstream

Cross-section Plots

Vile Creek Mitigation Site
DMS Project No. 96582
Monitoring Year 5 - 2021

Cross-section 10 - UT1 Reach 2



Bankfull Dimensions	
7.6	x-section area (ft.sq.)
7.2	width (ft)
1.1	mean depth (ft)
2.2	max depth (ft)
9.5	wetted perimeter (ft)
0.8	hydraulic radius (ft)
6.8	width-depth ratio

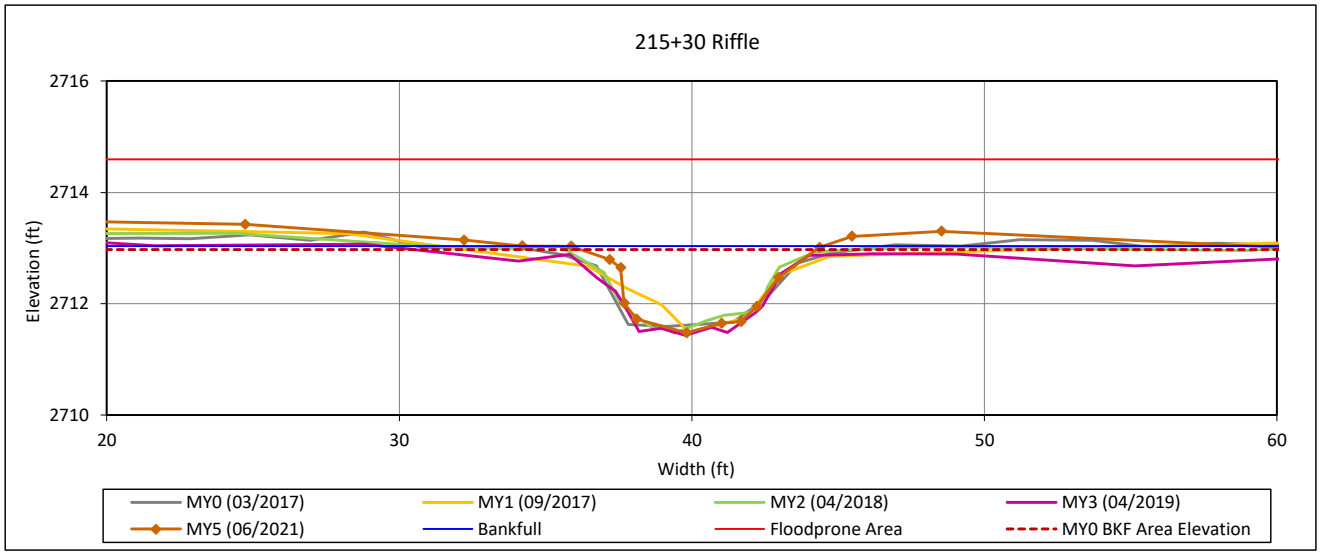
Survey Date: 06/2021
Field Crew: Wildlands Engineering

View Downstream

Cross-section Plots

Vile Creek Mitigation Site
DMS Project No. 96582
Monitoring Year 5 - 2021

Cross-section 11 - UT1 Reach 2



Bankfull Dimensions	
7.6	x-section area (ft.sq.)
8.6	width (ft)
0.9	mean depth (ft)
1.6	max depth (ft)
9.6	wetted perimeter (ft)
0.8	hydraulic radius (ft)
9.7	width-depth ratio
86.9	W flood prone area (ft)
10.1	entrenchment ratio
1.0	low bank height ratio

Survey Date: 06/2021
Field Crew: Wildlands Engineering

View Downstream

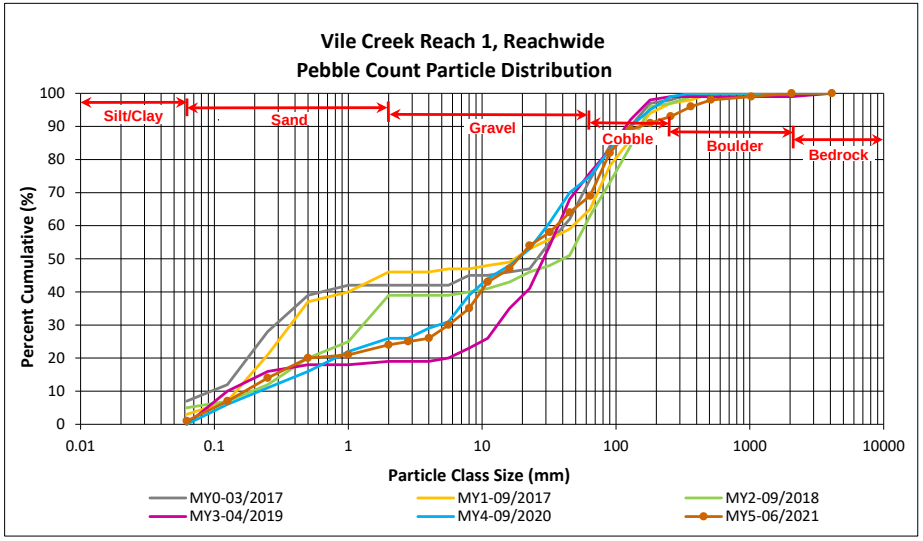
Reachwide and Cross-section Pebble Count Plots

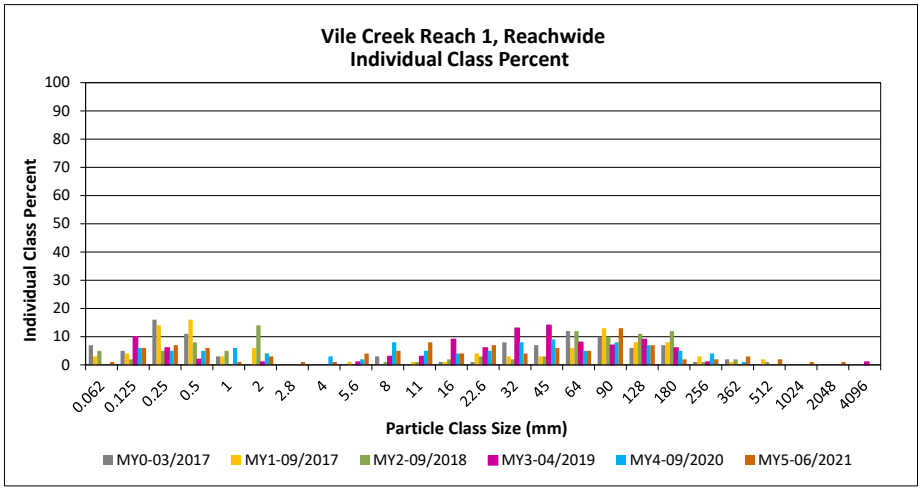
Vile Creek Restoration Site
DMS Project No. 96582
Monitoring Year 5 - 2021

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		1	1	1	1
SAND	Very fine	0.062	0.125		6	6	6	7
	Fine	0.125	0.250		7	7	7	14
	Medium	0.25	0.50		6	6	6	20
	Coarse	0.5	1.0		1	1	1	21
	Very Coarse	1.0	2.0		3	3	3	24
GRAVEL	Very Fine	2.0	2.8		1	1	1	25
	Very Fine	2.8	4.0		1	1	1	26
	Fine	4.0	5.6		4	4	4	30
	Fine	5.6	8.0	1	4	5	5	35
	Medium	8.0	11.0	2	6	8	8	43
	Medium	11.0	16.0	1	3	4	4	47
	Coarse	16.0	22.6	4	3	7	7	54
	Coarse	22.6	32	3	1	4	4	58
	Very Coarse	32	45	4	2	6	6	64
	Very Coarse	45	64	5		5	5	69
COBBLE	Small	64	90	13		13	13	82
	Small	90	128	6	1	7	7	89
	Large	128	180	2		2	2	91
	Large	180	256	2		2	2	93
BOULDER	Small	256	362	3		3	3	96
	Small	362	512	2		2	2	98
	Medium	512	1024	1		1	1	99
	Large/Very Large	1024	2048	1		1	1	100
BEDROCK	Bedrock	2048	>2048					100
			Total	**50**	**50**	**100**	**100**	**100**

Reachwide	
Channel materials (mm)	
D_{16} =	0.3
D_{35} =	8.0
D_{50} =	18.6
D_{84} =	99.5
D_{95} =	322.5
D_{100} =	2048.0





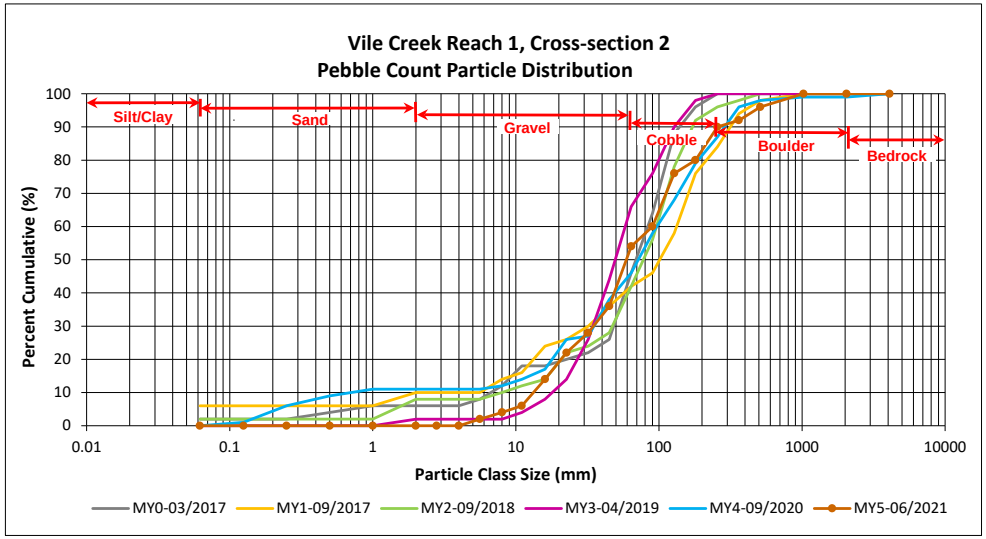
Reachwide and Cross-section Pebble Count Plots

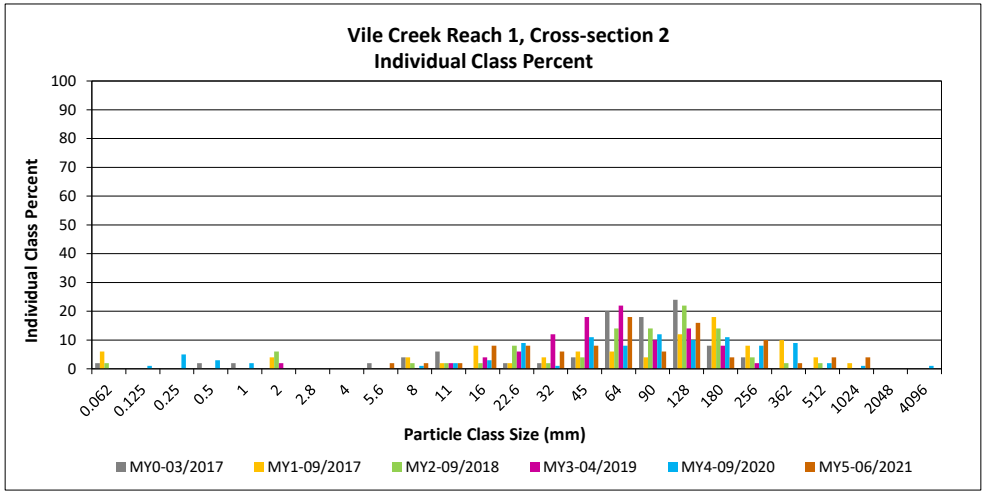
Vile Creek Restoration Site
DMS Project No. 96582
Monitoring Year 5 - 2021

Vile Creek Reach 1, Cross-section 2

Particle Class		Diameter (mm) min	Diameter (mm) max	Riffle 100-Count	Summary: Class Percentage	Summary: Percent Cumulative
SILT/CLAY	Silt/Clay	0.000	0.062			0
SAND	Very fine	0.062	0.125			0
	Fine	0.125	0.250			0
	Medium	0.25	0.50			0
	Coarse	0.5	1.0			0
	Very Coarse	1.0	2.0			0
GRAVEL	Very Fine	2.0	2.8			0
	Very Fine	2.8	4.0			0
	Fine	4.0	5.6	2	2	2
	Fine	5.6	8.0	2	2	4
	Medium	8.0	11.0	2	2	6
	Medium	11.0	16.0	8	8	14
	Coarse	16.0	22.6	8	8	22
	Coarse	22.6	32	6	6	28
	Very Coarse	32	45	8	8	36
	Very Coarse	45	64	18	18	54
COBBLE	Small	64	90	6	6	60
	Small	90	128	16	16	76
	Large	128	180	4	4	80
	Large	180	256	10	10	90
BOULDER	Small	256	362	2	2	92
	Small	362	512	4	4	96
	Medium	512	1024	4	4	100
	Large/Very Large	1024	2048			100
BEDROCK	Bedrock	2048	>2048			100
			Total	**100**	**100**	**100**

Cross-section 2	
Channel materials (mm)	
D_{16} =	17.4
D_{35} =	43.1
D_{50} =	59.2
D_{84} =	207.2
D_{95} =	469.5
D_{100} =	1024.0





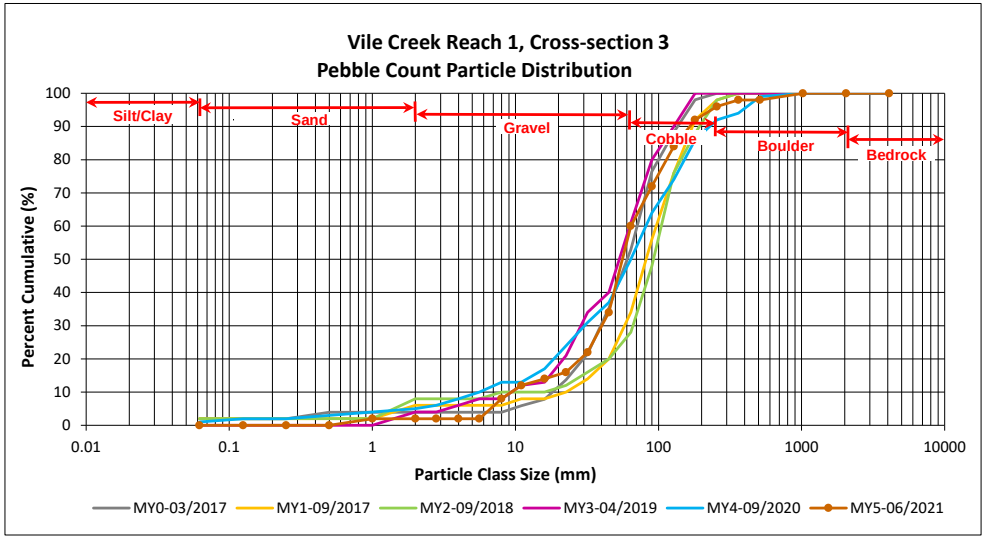
Reachwide and Cross-section Pebble Count Plots

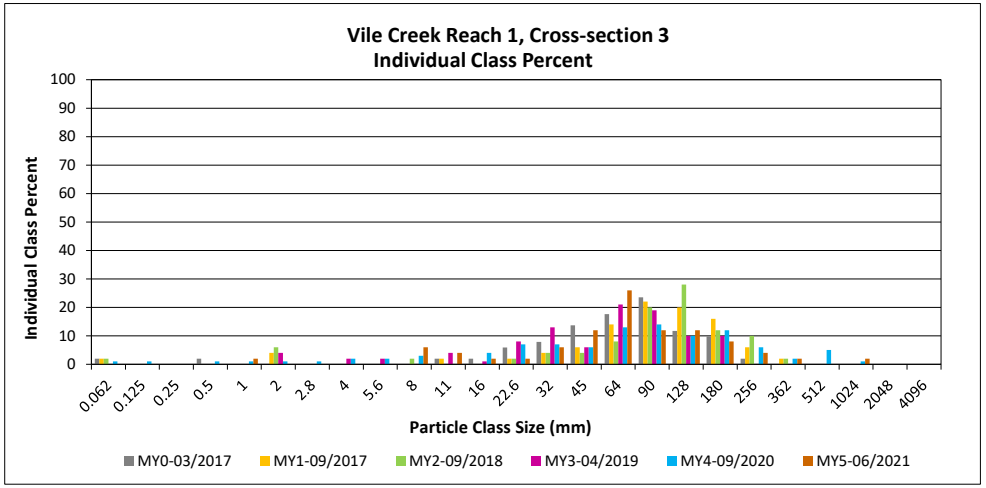
Vile Creek Restoration Site
DMS Project No. 96582
Monitoring Year 5 - 2021

Vile Creek Reach 1, Cross-section 3

Particle Class		Diameter (mm) min	Diameter (mm) max	Riffle 100-Count	Summary: Class Percentage	Summary: Percent Cumulative
SILT/CLAY	Silt/Clay	0.000	0.062			0
SAND	Very fine	0.062	0.125			0
	Fine	0.125	0.250			0
	Medium	0.25	0.50			0
	Coarse	0.5	1.0	2	2	2
	Very Coarse	1.0	2.0			2
GRAVEL	Very Fine	2.0	2.8			2
	Very Fine	2.8	4.0			2
	Fine	4.0	5.6			2
	Fine	5.6	8.0	6	6	8
	Medium	8.0	11.0	4	4	12
	Medium	11.0	16.0	2	2	14
	Coarse	16.0	22.6	2	2	16
	Coarse	22.6	32	6	6	22
	Very Coarse	32	45	12	12	34
	Very Coarse	45	64	26	26	60
COBBLE	Small	64	90	12	12	72
	Small	90	128	12	12	84
	Large	128	180	8	8	92
	Large	180	256	4	4	96
BOULDER	Small	256	362	2	2	98
	Small	362	512			98
	Medium	512	1024	2	2	100
	Large/Very Large	1024	2048			100
BEDROCK	Bedrock	2048	>2048			100
			Total	**100**	**100**	**100**

Cross-section 3	
Channel materials (mm)	
D_{16} =	22.6
D_{35} =	45.6
D_{50} =	55.9
D_{84} =	128.0
D_{95} =	234.4
D_{100} =	1024.0





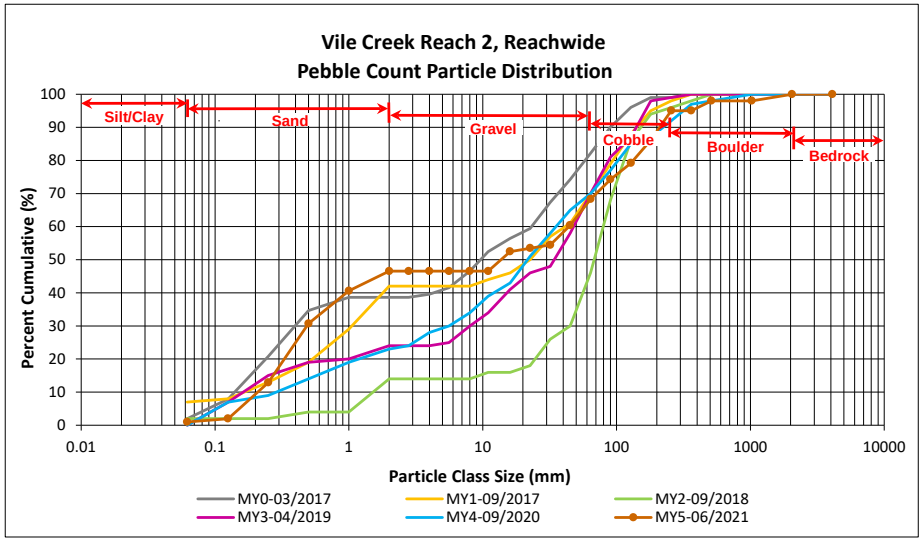
Reachwide and Cross-section Pebble Count Plots

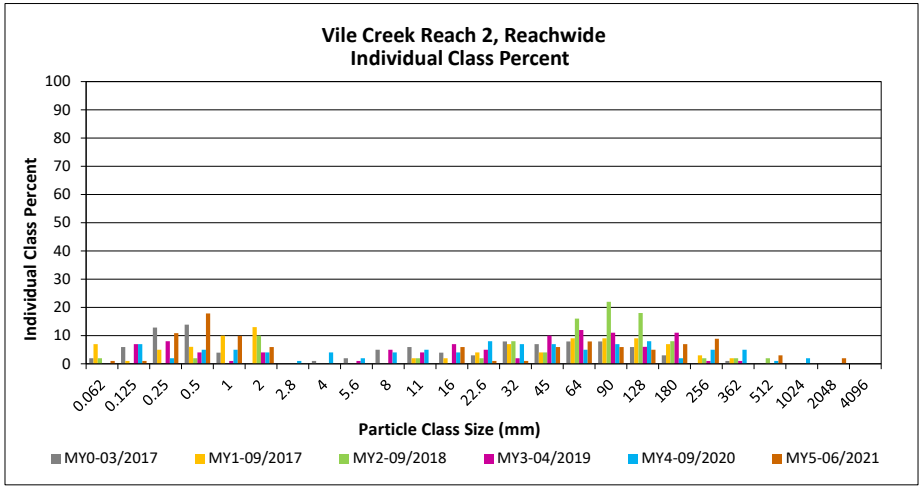
Vile Creek Restoration Site
DMS Project No. 96582
Monitoring Year 5 - 2021

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		1	1	1	1
SAND	Very fine	0.062	0.125		1	1	1	2
	Fine	0.125	0.250	1	10	11	11	13
	Medium	0.25	0.50		18	18	18	31
	Coarse	0.5	1.0		10	10	10	41
	Very Coarse	1.0	2.0	2	4	6	6	47
GRAVEL	Very Fine	2.0	2.8					47
	Very Fine	2.8	4.0					47
	Fine	4.0	5.6					47
	Fine	5.6	8.0					47
	Medium	8.0	11.0					47
	Medium	11.0	16.0	2	4	6	6	52
	Coarse	16.0	22.6		1	1	1	53
	Coarse	22.6	32		1	1	1	54
	Very Coarse	32	45	6		6	6	60
	Very Coarse	45	64	8		8	8	68
COBBLE	Small	64	90	6		6	6	74
	Small	90	128	5		5	5	79
	Large	128	180	6	1	7	7	86
	Large	180	256	9		9	9	95
BOULDER	Small	256	362					95
	Small	362	512	3		3	3	98
	Medium	512	1024					98
	Large/Very Large	1024	2048	2		2	2	100
BEDROCK	Bedrock	2048	>2048					100
			Total	**50**	**51**	**101**	**100**	**100**

Reachwide	
Channel materials (mm)	
D_{16} =	0.3
D_{35} =	0.7
D_{50} =	13.7
D_{84} =	162.0
D_{95} =	255.5
D_{100} =	2048.0





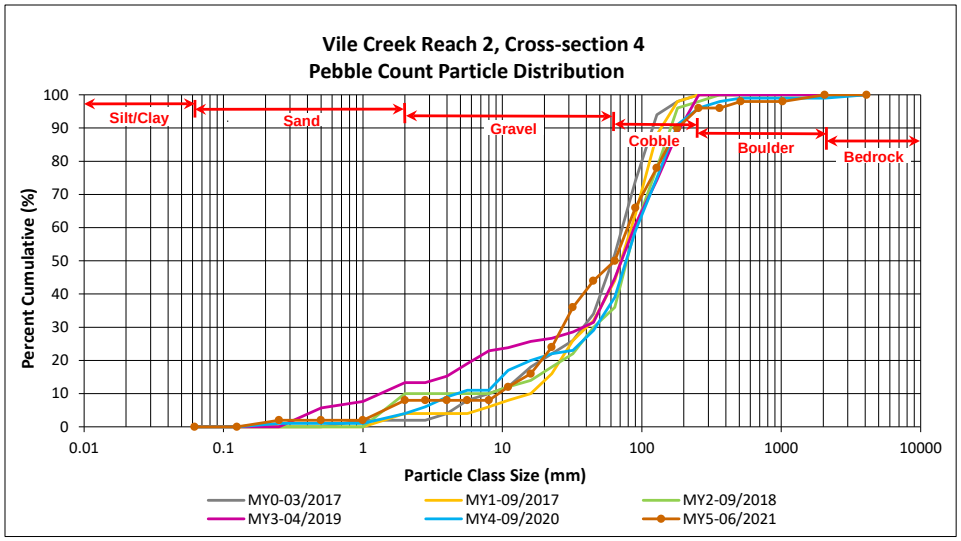
Reachwide and Cross-section Pebble Count Plots

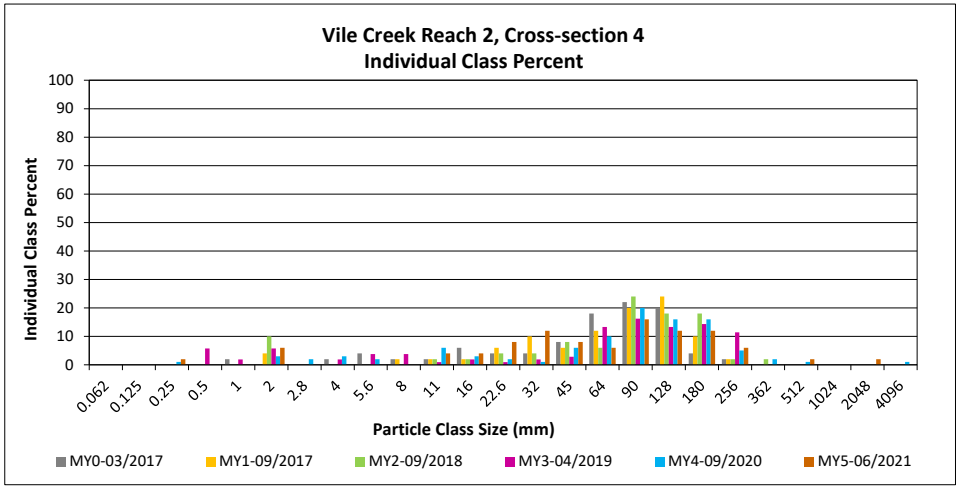
Vile Creek Restoration Site
DMS Project No. 96582
Monitoring Year 5 - 2021

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	2	2	2
	Medium	0.25	0.50			2
	Coarse	0.5	1.0			2
	Very Coarse	1.0	2.0	6	6	8
GRAVEL	Very Fine	2.0	2.8			8
	Very Fine	2.8	4.0			8
	Fine	4.0	5.6			8
	Fine	5.6	8.0			8
	Medium	8.0	11.0	4	4	12
	Medium	11.0	16.0	4	4	16
	Coarse	16.0	22.6	8	8	24
	Coarse	22.6	32	12	12	36
	Very Coarse	32	45	8	8	44
	Very Coarse	45	64	6	6	50
COBBLE	Small	64	90	16	16	66
	Small	90	128	12	12	78
	Large	128	180	12	12	90
	Large	180	256	6	6	96
BOULDER	Small	256	362			96
	Small	362	512	2	2	98
	Medium	512	1024			98
	Large/Very Large	1024	2048	2	2	100
BEDROCK	Bedrock	2048	>2048			100
			Total	100	100	100

Cross-section 4	
Channel materials (mm)	
D_{16} =	16.0
D_{35} =	31.1
D_{50} =	64.0
D_{84} =	151.8
D_{95} =	241.4
D_{100} =	2048.0





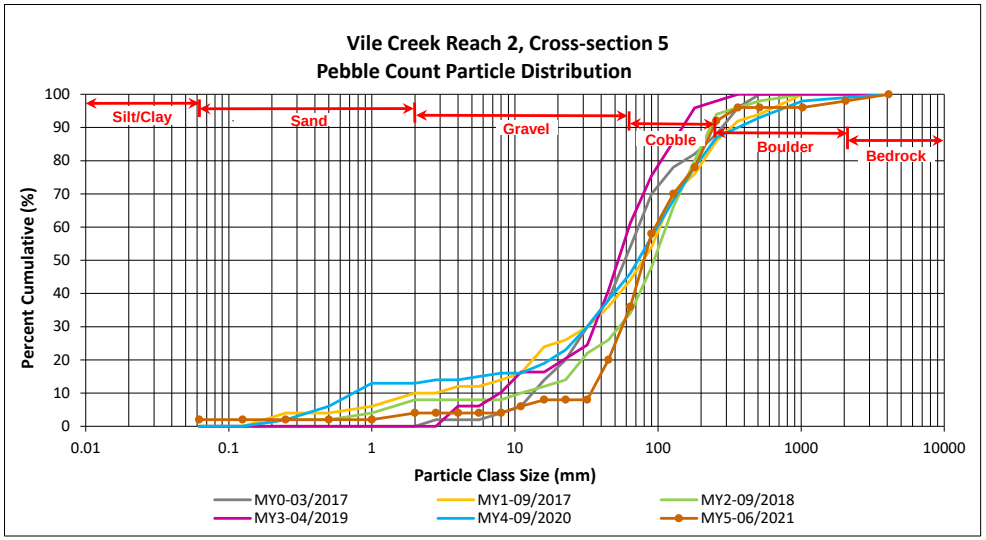
Reachwide and Cross-section Pebble Count Plots

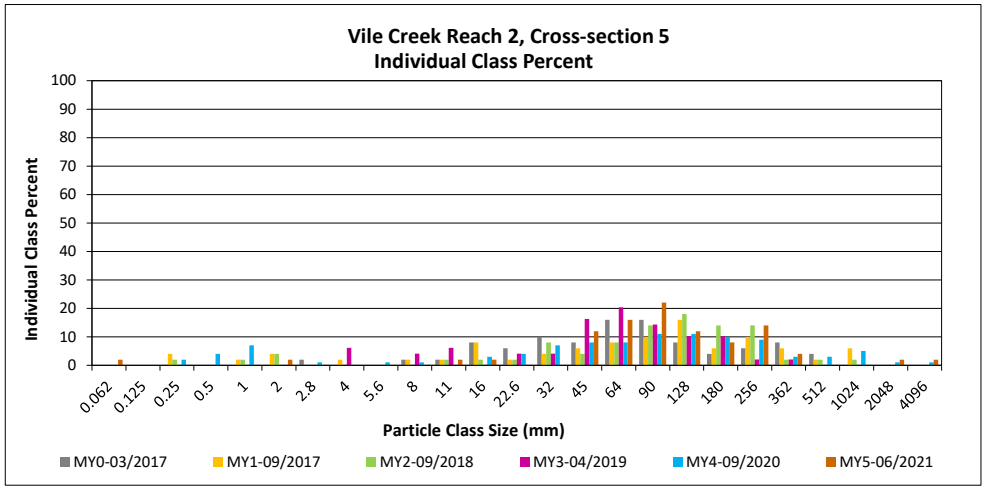
Vile Creek Restoration Site
DMS Project No. 96582
Monitoring Year 5 - 2021

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	2	2	2
SAND	Very fine	0.062	0.125			2
	Fine	0.125	0.250			2
	Medium	0.25	0.50			2
	Coarse	0.5	1.0			2
	Very Coarse	1.0	2.0	2	2	4
GRAVEL	Very Fine	2.0	2.8			4
	Very Fine	2.8	4.0			4
	Fine	4.0	5.6			4
	Fine	5.6	8.0			4
	Medium	8.0	11.0	2	2	6
	Medium	11.0	16.0	2	2	8
	Coarse	16.0	22.6			8
	Coarse	22.6	32			8
	Very Coarse	32	45	12	12	20
	Very Coarse	45	64	16	16	36
COBBLE	Small	64	90	22	22	58
	Small	90	128	12	12	70
	Large	128	180	8	8	78
	Large	180	256	14	14	92
BOULDER	Small	256	362	4	4	96
	Small	362	512			96
	Medium	512	1024			96
	Large/Very Large	1024	2048	2	2	98
BEDROCK	Bedrock	2048	>2048	2	2	100
			Total	**100**	**100**	**100**

Cross-section 5	
Channel materials (mm)	
D_{16} =	40.2
D_{35} =	62.6
D_{50} =	79.5
D_{84} =	209.3
D_{95} =	332.0
D_{100} =	>2048





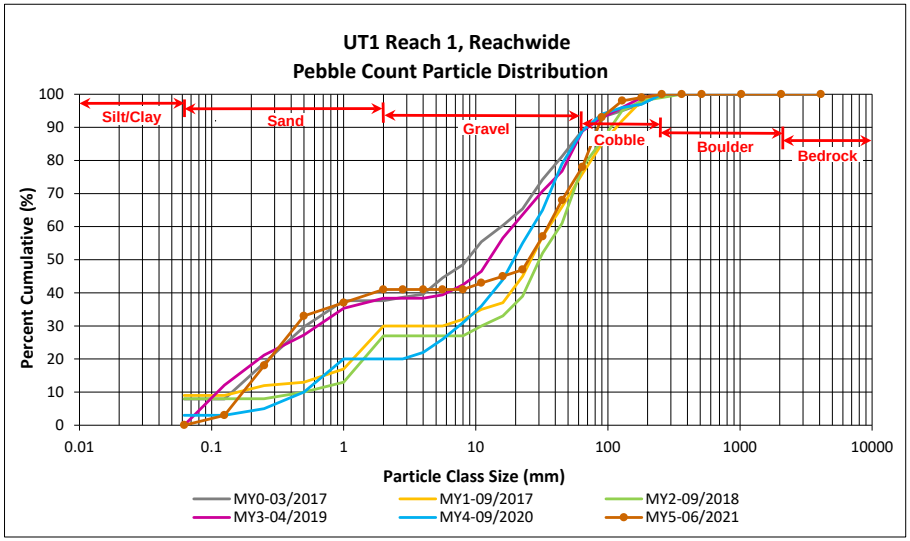
Reachwide and Cross-section Pebble Count Plots

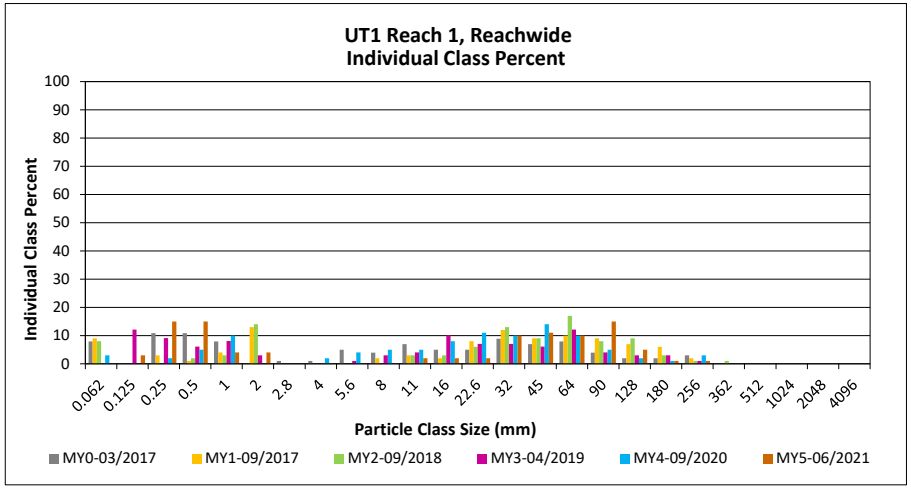
Vile Creek Restoration Site
DMS Project No. 96582
Monitoring Year 5 - 2021

UT1 Reach 1, Reachwide

Particle Class		Diameter (mm) min	Diameter (mm) max	Particle Count Riffle	Particle Count Pool	Particle Count Total	Reach Summary Class Percentage	Reach Summary Percent Cumulative
SILT/CLAY	Silt/Clay	0.000	0.062					0
SAND	Very fine	0.062	0.125		3	3	3	3
	Fine	0.125	0.250	1	14	15	15	18
	Medium	0.25	0.50	1	14	15	15	33
	Coarse	0.5	1.0		4	4	4	37
	Very Coarse	1.0	2.0		4	4	4	41
GRAVEL	Very Fine	2.0	2.8					41
	Very Fine	2.8	4.0					41
	Fine	4.0	5.6					41
	Fine	5.6	8.0					41
	Medium	8.0	11.0		2	2	2	43
	Medium	11.0	16.0		2	2	2	45
	Coarse	16.0	22.6		2	2	2	47
	Coarse	22.6	32	8	2	10	10	57
	Very Coarse	32	45	10	1	11	11	68
	Very Coarse	45	64	10		10	10	78
COBBLE	Small	64	90	15		15	15	93
	Small	90	128	4	1	5	5	98
	Large	128	180	1		1	1	99
	Large	180	256		1	1	1	100
BOULDER	Small	256	362					100
	Small	362	512					100
	Medium	512	1024					100
	Large/Very Large	1024	2048					100
BEDROCK	Bedrock	2048	>2048					100
			Total	**50**	**50**	**100**	**100**	**100**

Reachwide	
Channel materials (mm)	
D_{16} =	0.2
D_{35} =	0.7
D_{50} =	25.1
D_{84} =	73.4
D_{95} =	103.6
D_{100} =	256.0





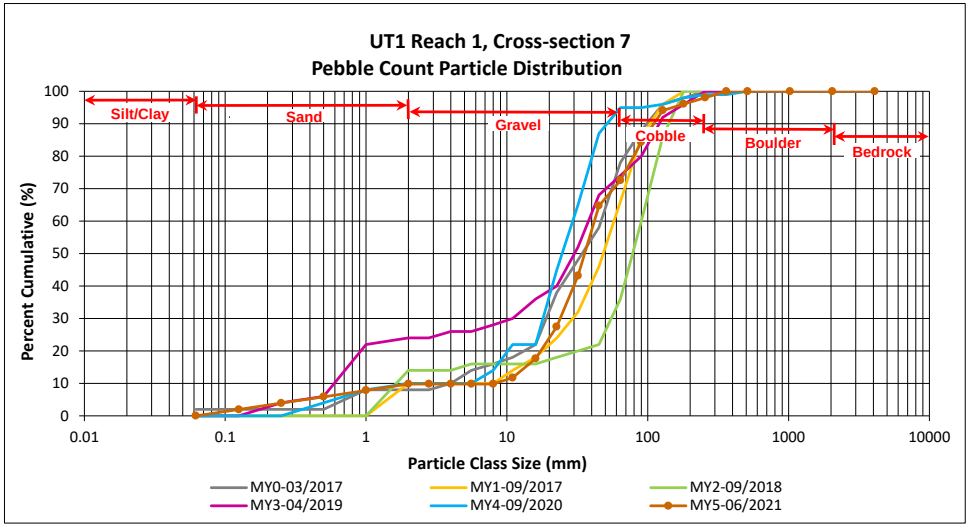
Reachwide and Cross-section Pebble Count Plots

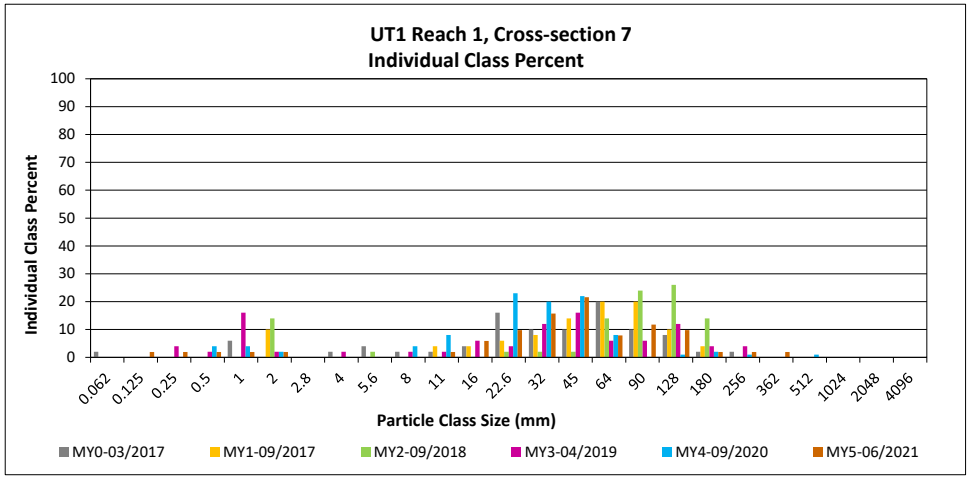
Vile Creek Restoration Site
DMS Project No. 96582
Monitoring Year 5 - 2021

UT1 Reach 1, Cross-section 7

Particle Class		Diameter (mm) min	Diameter (mm) max	Riffle 100-Count	Summary: Class Percentage	Summary: Percent Cumulative
SILT/CLAY	Silt/Clay	0.000	0.062			0
SAND	Very fine	0.062	0.125	2	2	2
	Fine	0.125	0.250	2	2	4
	Medium	0.25	0.50	2	2	6
	Coarse	0.5	1.0	2	2	8
	Very Coarse	1.0	2.0	2	2	10
GRAVEL	Very Fine	2.0	2.8			10
	Very Fine	2.8	4.0			10
	Fine	4.0	5.6			10
	Fine	5.6	8.0			10
	Medium	8.0	11.0	2	2	12
	Medium	11.0	16.0	6	6	18
	Coarse	16.0	22.6	10	10	27
	Coarse	22.6	32	16	16	43
	Very Coarse	32	45	22	22	65
	Very Coarse	45	64	8	8	73
COBBLE	Small	64	90	12	12	84
	Small	90	128	10	10	94
	Large	128	180	2	2	96
	Large	180	256	2	2	98
BOULDER	Small	256	362	2	2	100
	Small	362	512			100
	Medium	512	1024			100
	Large/Very Large	1024	2048			100
BEDROCK	Bedrock	2048	>2048			100
			Total	**102**	**100**	**100**

Cross-section 7	
Channel materials (mm)	
D_{16} =	14.4
D_{35} =	26.7
D_{50} =	35.7
D_{84} =	89.2
D_{95} =	149.2
D_{100} =	362.0





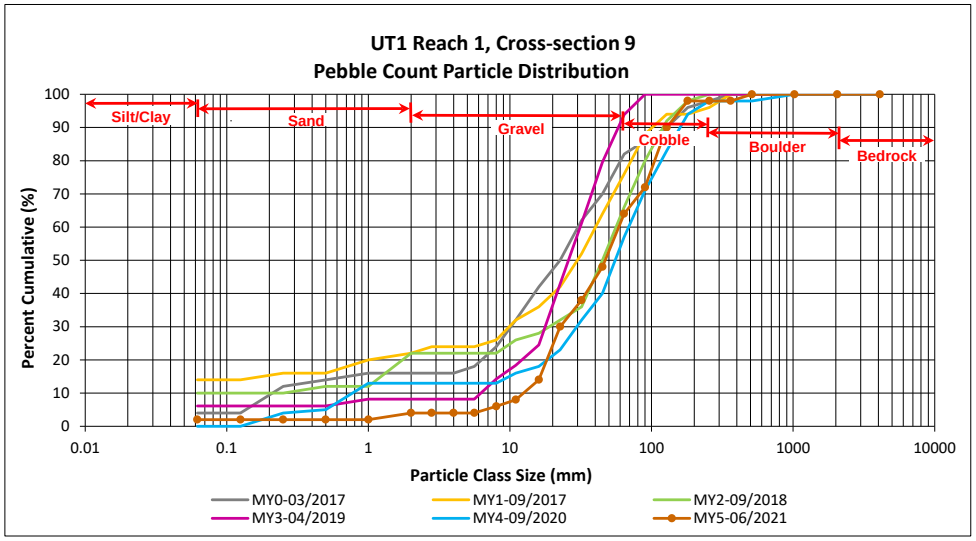
Reachwide and Cross-section Pebble Count Plots

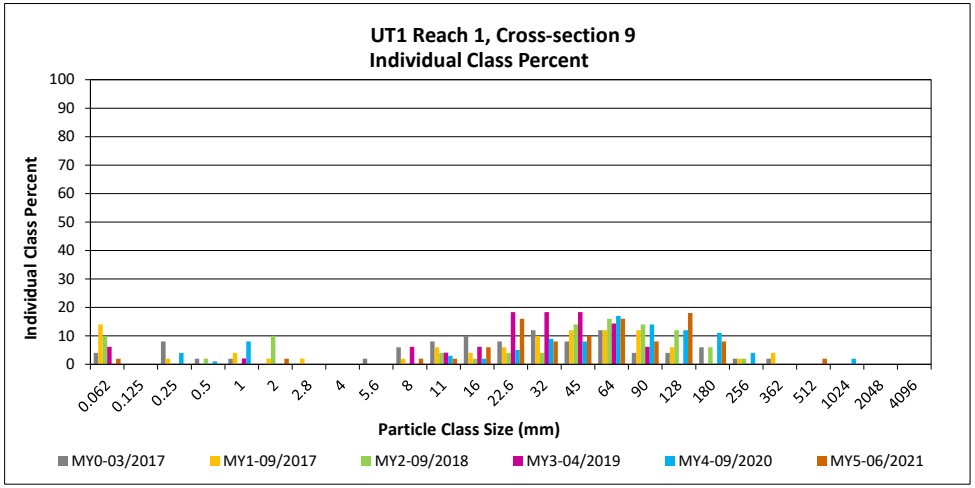
Vile Creek Restoration Site
DMS Project No. 96582
Monitoring Year 5 - 2021

UT1 Reach 1, Cross-section 9

Particle Class		Diameter (mm) min	Diameter (mm) max	Riffle 100-Count	Summary: Class Percentage	Summary: Percent Cumulative
SILT/CLAY	Silt/Clay	0.000	0.062	2	2	2
SAND	Very fine	0.062	0.125			2
	Fine	0.125	0.250			2
	Medium	0.25	0.50			2
	Coarse	0.5	1.0			2
	Very Coarse	1.0	2.0	2	2	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	2	2	6
	Medium	8.0	11.0	2	2	8
	Medium	11.0	16.0	6	6	14
	Coarse	16.0	22.6	16	16	30
	Coarse	22.6	32	8	8	38
	Very Coarse	32	45	10	10	48
	Very Coarse	45	64	16	16	64
COBBLE	Small	64	90	8	8	72
	Small	90	128	18	18	90
	Large	128	180	8	8	98
	Large	180	256			98
BOULDER	Small	256	362			98
	Small	362	512	2	2	100
	Medium	512	1024			100
	Large/Very Large	1024	2048			100
BEDROCK	Bedrock	2048	>2048			100
			Total	**100**	**100**	**100**

Cross-section 9	
Channel materials (mm)	
D_{16} =	16.7
D_{35} =	28.1
D_{50} =	47.0
D_{84} =	113.8
D_{95} =	158.4
D_{100} =	512.0





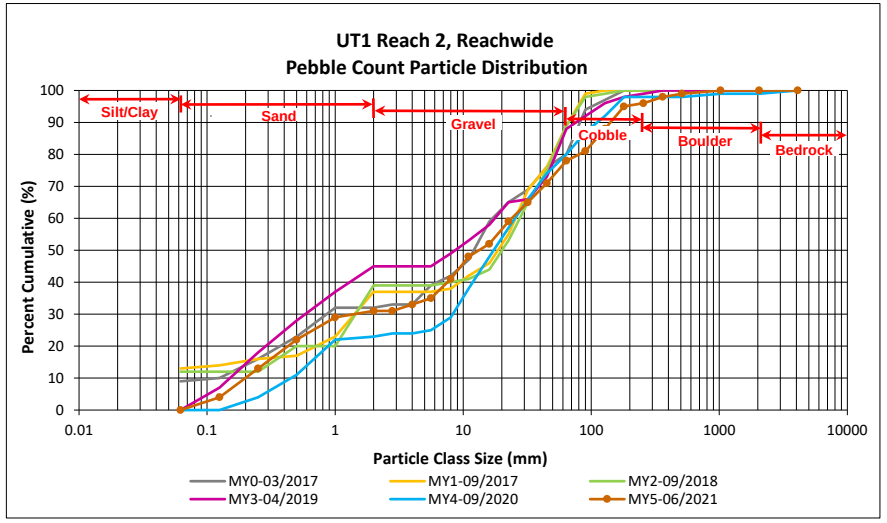
Reachwide and Cross-section Pebble Count Plots

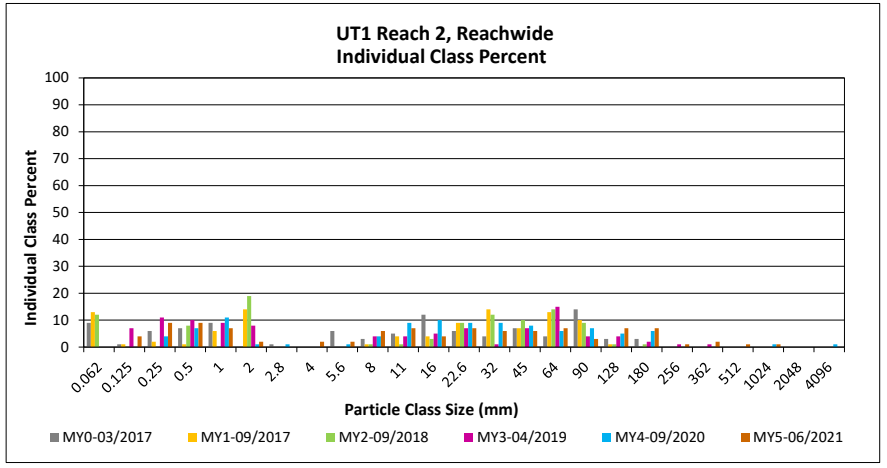
Vile Creek Restoration Site
DMS Project No. 96582
Monitoring Year 5 - 2021

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					0
SAND	Very fine	0.062	0.125		4	4	4	4
	Fine	0.125	0.250		9	9	9	13
	Medium	0.25	0.50	1	8	9	9	22
	Coarse	0.5	1.0		7	7	7	29
	Very Coarse	1.0	2.0	1	1	2	2	31
GRAVEL	Very Fine	2.0	2.8					31
	Very Fine	2.8	4.0		2	2	2	33
	Fine	4.0	5.6		2	2	2	35
	Fine	5.6	8.0		6	6	6	41
	Medium	8.0	11.0	2	5	7	7	48
	Medium	11.0	16.0	2	2	4	4	52
	Coarse	16.0	22.6	5	2	7	7	59
	Coarse	22.6	32	5	1	6	6	65
	Very Coarse	32	45	6		6	6	71
	Very Coarse	45	64	7		7	7	78
COBBLE	Small	64	90	3		3	3	81
	Small	90	128	7		7	7	88
	Large	128	180	7		7	7	95
	Large	180	256	1		1	1	96
BOULDER	Small	256	362	1	1	2	2	98
	Small	362	512	1		1	1	99
	Medium	512	1024	1		1	1	100
	Large/Very Large	1024	2048					100
BEDROCK	Bedrock	2048	>2048					100
			Total	**50**	**50**	**100**	**100**	**100**

Reachwide	
Channel materials (mm)	
D_{16} =	0.3
D_{35} =	5.6
D_{50} =	13.3
D_{84} =	104.7
D_{95} =	180.0
D_{100} =	1024.0





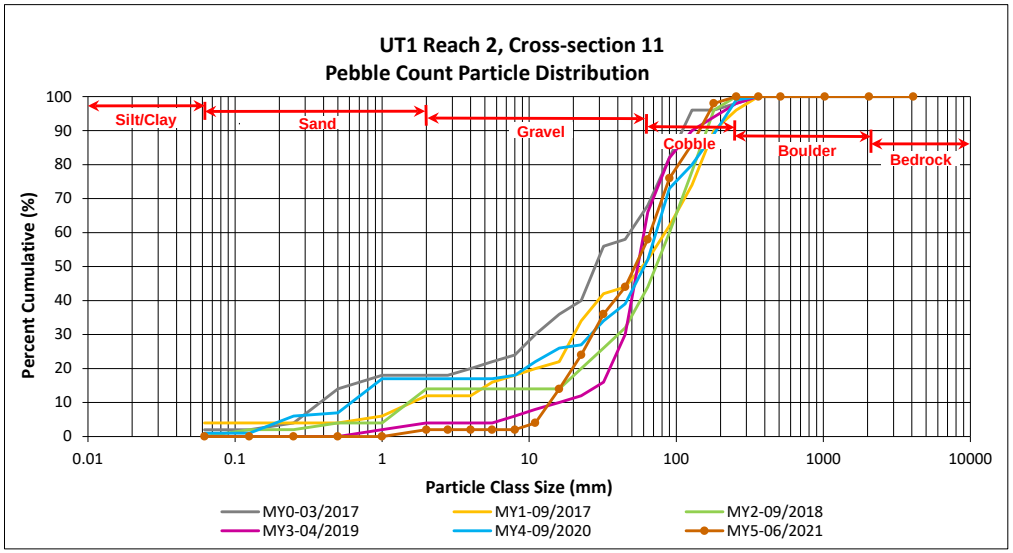
Reachwide and Cross-section Pebble Count Plots

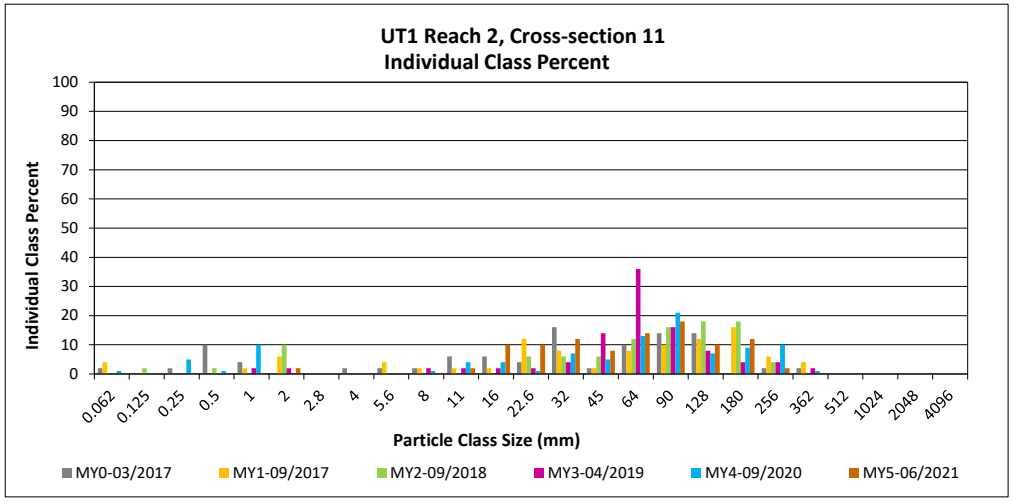
Vile Creek Restoration Site
DMS Project No. 96582
Monitoring Year 5 - 2021

UT1 Reach 2, Cross-section 11

Particle Class		Diameter (mm) min	Diameter (mm) max	Riffle 100-Count	Summary: Class Percentage	Summary: Percent Cumulative
SILT/CLAY	Silt/Clay	0.000	0.062			0
SAND	Very fine	0.062	0.125			0
	Fine	0.125	0.250			0
	Medium	0.25	0.50			0
	Coarse	0.5	1.0			0
	Very Coarse	1.0	2.0	2	2	2
GRAVEL	Very Fine	2.0	2.8			2
	Very Fine	2.8	4.0			2
	Fine	4.0	5.6			2
	Fine	5.6	8.0			2
	Medium	8.0	11.0	2	2	4
	Medium	11.0	16.0	10	10	14
	Coarse	16.0	22.6	10	10	24
	Coarse	22.6	32	12	12	36
	Very Coarse	32	45	8	8	44
	Very Coarse	45	64	14	14	58
COBBLE	Small	64	90	18	18	76
	Small	90	128	10	10	86
	Large	128	180	12	12	98
	Large	180	256	2	2	100
BOULDER	Small	256	362			100
	Small	362	512			100
	Medium	512	1024			100
	Large/Very Large	1024	2048			100
BEDROCK	Bedrock	2048	>2048			100
			Total	**100**	**100**	**100**

Cross-section 11	
Channel materials (mm)	
D_{16} =	17.1
D_{35} =	31.1
D_{50} =	52.3
D_{84} =	119.3
D_{95} =	165.3
D_{100} =	256.0





APPENDIX 5. Hydrology Summary Data and Plots

Table 13a. Verification of Bankfull Events
Vile Creek Mitigation Site
DMS Project No. 96582
Monitoring Year 5 - 2021

Reach	Monitoring Year	Date of Occurrence	Method
Vile Reach 2	MY1	3/31/2017	Crest Gage
		4/24/2017	
		10/8/2017	
	MY2	9/16/2018	
		10/11/2018	
	MY4	1/11/2020	
		1/22/2020	
		2/7/2020	
		4/13/2020	
		5/20/2020	
		5/27/2020	
		8/15/2020	
		9/29/2020	
		10/29/2020	
	MY5	4/10/2021	
UT1 Reach 2	MY1	5/5/2017	
		10/8/2017	
	MY2	10/11/2018	
	MY3	6/17/2019	
		8/1/2019	
		9/30/2019	
	MY4	1/11/2020	
		1/24/2020	
		2/6/2020	
		4/13/2020	
		4/29/2020	
		5/20/2020	
		5/27/2020	
		7/23/2020	
		8/15/2020	
		9/12/2020	
		9/29/2020	
		10/29/2020	
	MY5	2/3/2021	
		4/10/2021	

Table 13b. Verification of Geomorphically Significant Events
Vile Creek Mitigation Site
DMS Project No. 96582
Monitoring Year 5 - 2021

Reach	Monitoring Year	Date of Occurrence	Method
Vile Reach 2	MY3	2/23/2019	Crest Gage
		4/14/2019	
		4/19/2019	
		6/17/2019	
		7/5/2019	
		8/1/2019	
		9/30/2019	
	MY4	1/11/2020	
		1/21/2020	
		1/24/2020	
		2/6/2020	
		4/13/2020	
		4/29/2020	
		5/20/2020	
		5/27/2020	
		8/3/2020	
		8/15/2020	
		9/12/2020	
		9/29/2020	
		10/11/2020	
		10/29/2020	
	MY5	4/10/2021	
		8/17/2021	
UT1 Reach 2	MY3	2/23/2019	
		4/14/2019	
		4/19/2019	
		6/17/2019	
		7/30/2019	
		8/1/2019	
		9/30/2019	
	MY4	1/11/2020	
		1/21/2020	
		1/24/2020	
		2/6/2020	
		4/13/2020	
		4/29/2020	
		5/20/2020	
		5/27/2020	
		7/19/2020	
		7/23/2020	
		8/15/2020	
		8/20/2020	
		9/12/2020	
		9/29/2020	
		10/11/2020	
		10/29/2020	
	MY5	2/3/2021	
		4/10/2021	

Table 14. Wetland Gage Attainment Summary

Vile Creek Mitigation Site

DMS Project No. 96582

Monitoring Year 5 - 2021

Summary of Groundwater Gage Results for Monitoring Years 1 through 7							
Gage	Success Criteria Achieved/Max Consecutive Days During Growing Season (Percentage)						
	Year 1 (2017)	Year 2 (2018)	Year 3 (2019)	Year 4 (2020)	Year 5 (2021)**	Year 6 (2022)	Year 7 (2023)
1*	Yes/169 Days (100%)	Yes/169 Days (100%)	Yes/169 Days (100%)	Yes/169 Days (100%)	Yes/150 Days (89%)		
2	Yes/ 129 Days (77%)	Yes/33 Days (20%)	Yes/15 Days (9%)	Yes/70 Days (41%)	Yes/150 Days (89%)		
3	Yes/169 Days (100%)	Yes/73 Days (43%)	Yes/14 Days (8.5%)	Yes/85 Days (50%)	Yes/127 Days (75%)		
4	Yes/169 Days (100%)	Yes/169 Days (100%)	Yes/169 Days (100%)	Yes/169 Days (100%)	Yes/150 Days (89%)		
5	Yes/169 Days (100%)	Yes/169 Days (100%)	Yes/169 Days (100%)	Yes/169 Days (100%)	Yes/150 Days (89%)		
6	Yes/169 Days (100%)	Yes/169 Days (100%)	Yes/169 Days (100%)	Yes/169 Days (100%)	Yes/150 Days (89%)		
7	Yes/ 129 Days (77%)	Yes/33 Days (20%)	Yes/24 Days (14%)	Yes/85 Days (50%)	Yes/150 Days (89%)		
8	Yes/125 Days (74%)	Yes/14 Days (8%)	No/4 Days (2%)	Yes/44 Days (26%)	Yes/27 Days (16%)		
9	Yes/40 Days (24%)	Yes/33 Days (20%)	Yes/106 Days (63%)	Yes/169 Days (100%)	Yes/150 Days (89%)		
10*	Yes/169 Days (100%)	Yes/169 Days (100%)	Yes/169 Days (100%)	Yes/169 Days (100%)	Yes/150 Days (89%)		

*Gages are located in bog habitat.

**The barotroll at Vile Creek malfunctioned starting on 9/22/21: therefore, the data collected after 9/22/21 was omitted from the report data

Growing season is April 26th -October 11th.

Success criteria for wetlands is 14 consecutive days (8.5%) and 20 consecutive days (12%) for bogs.

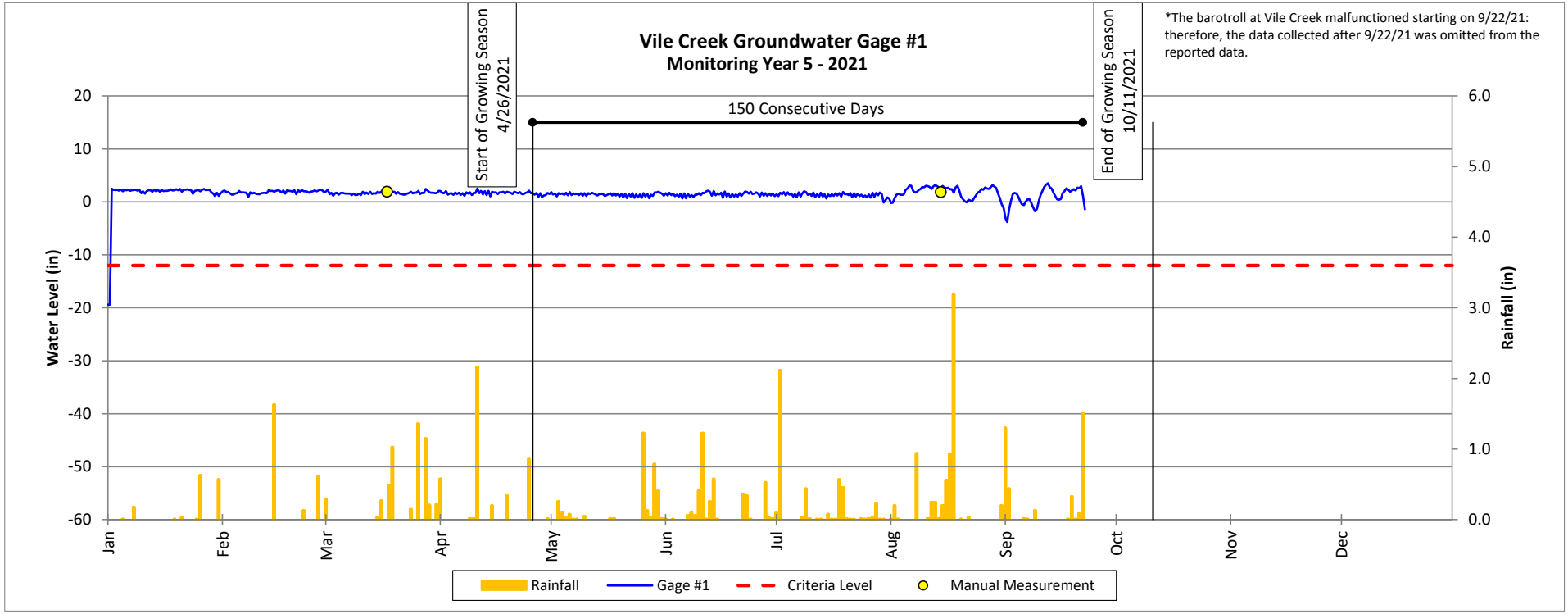
Groundwater Gage Plots

Vile Creek Mitigation Site

DMS Project No. 96582

Monitoring Year 5 - 2021

Wetland Bog Rehabilitation



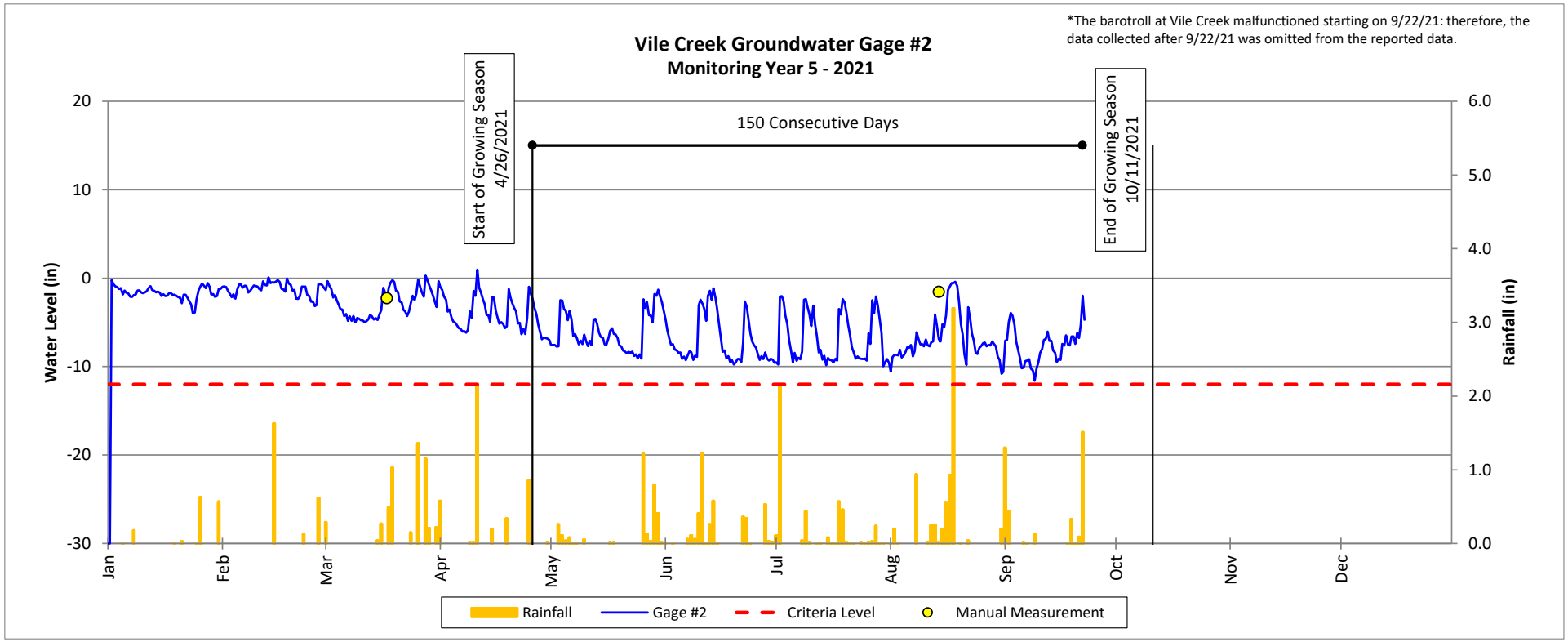
Groundwater Gage Plots

Vile Creek Mitigation Site

DMS Project No. 96582

Monitoring Year 5 - 2021

Wetland Re-establishment



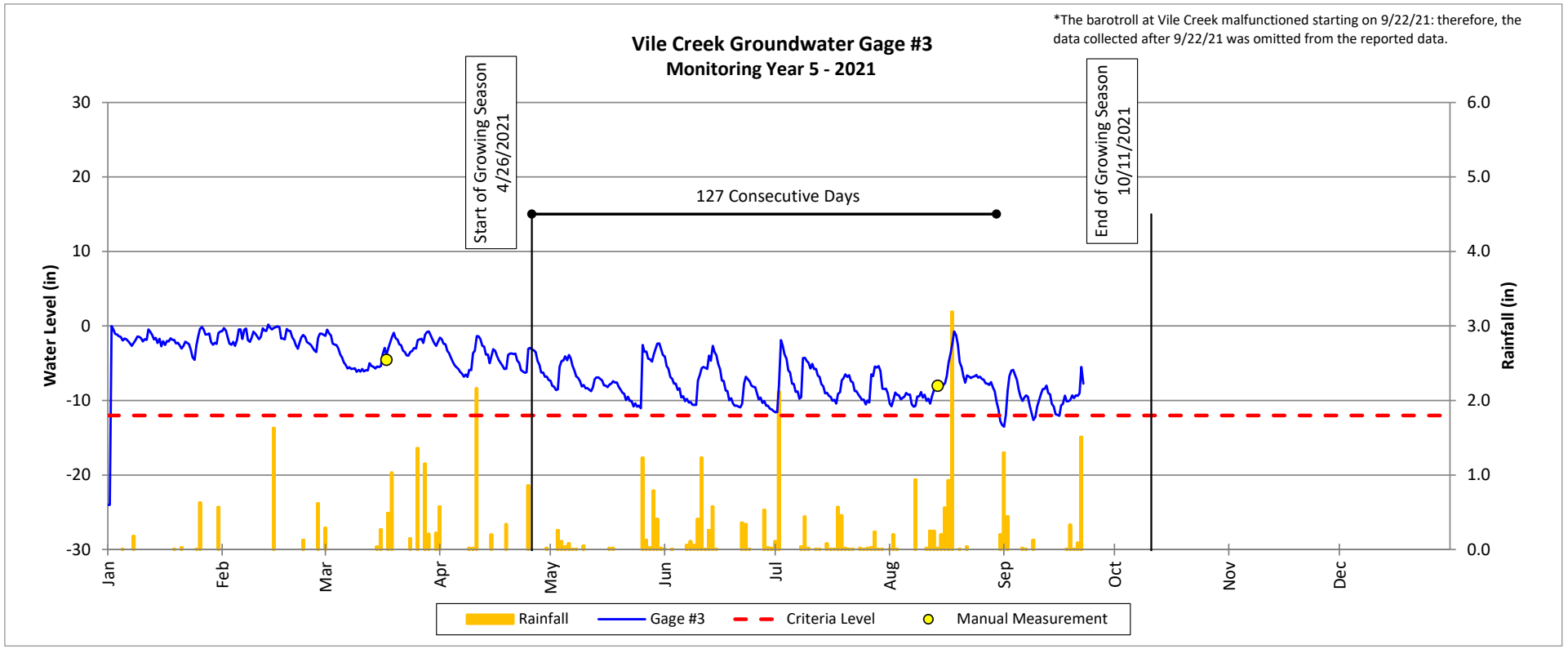
Groundwater Gage Plots

Vile Creek Mitigation Site

DMS Project No. 96582

Monitoring Year 5 - 2021

Wetland Re-establishment



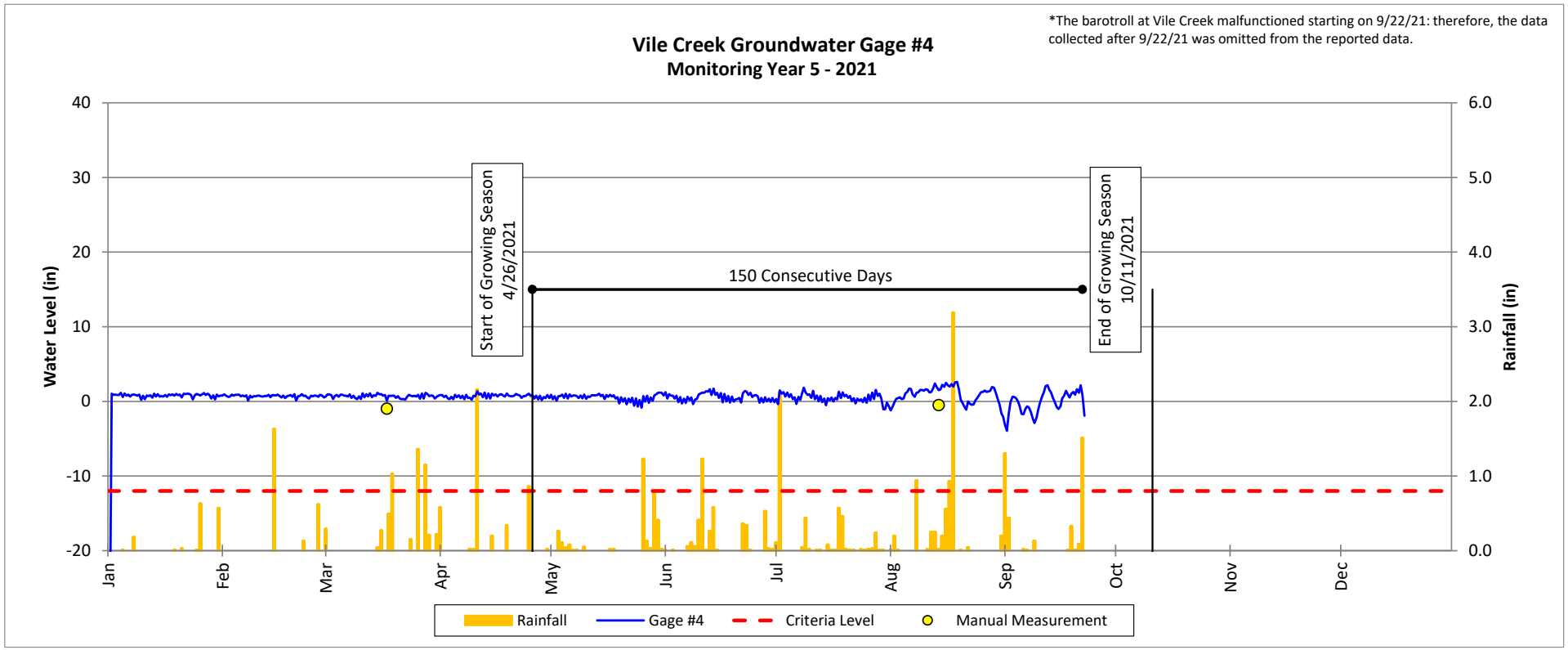
Groundwater Gage Plots

Vile Creek Mitigation Site

DMS Project No. 96582

Monitoring Year 5 - 2021

Wetland Re-establishment



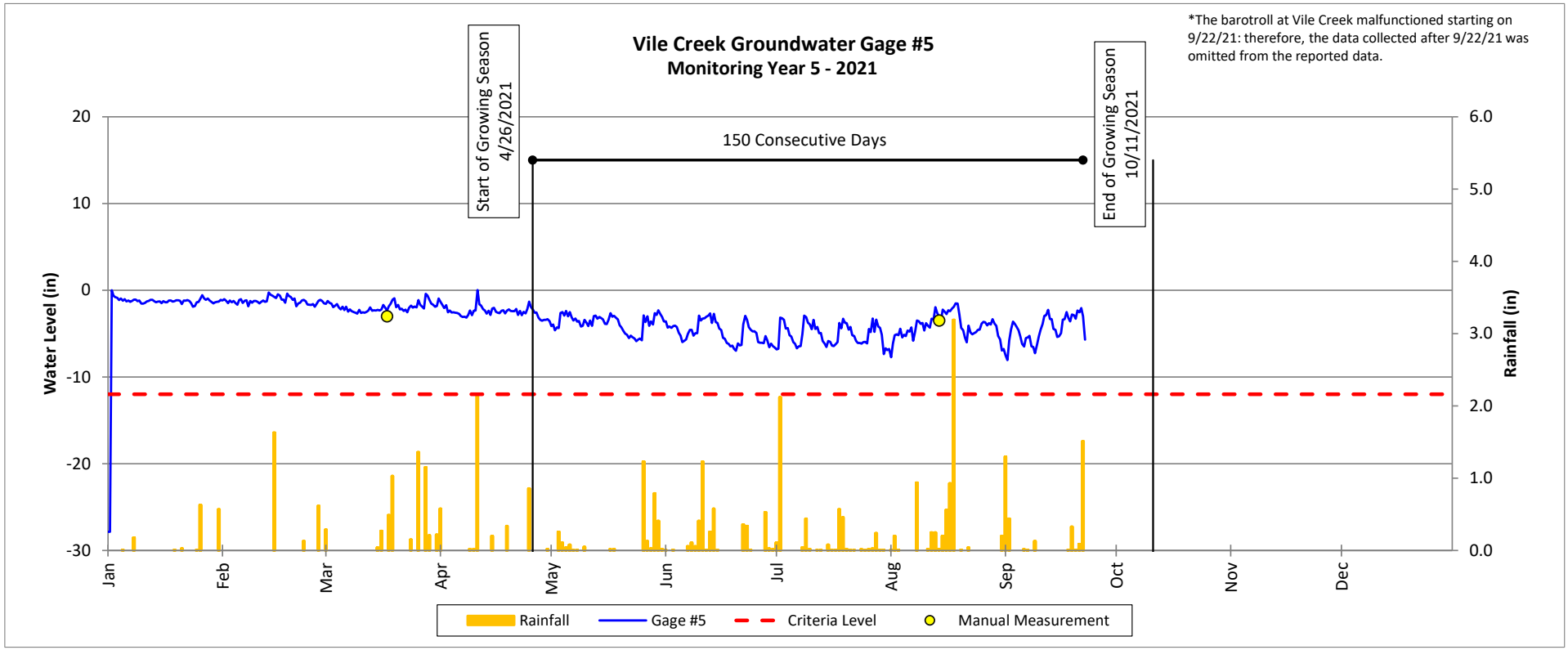
Groundwater Gage Plots

Vile Creek Mitigation Site

DMS Project No. 96582

Monitoring Year 5 - 2021

Wetland Rehabilitation



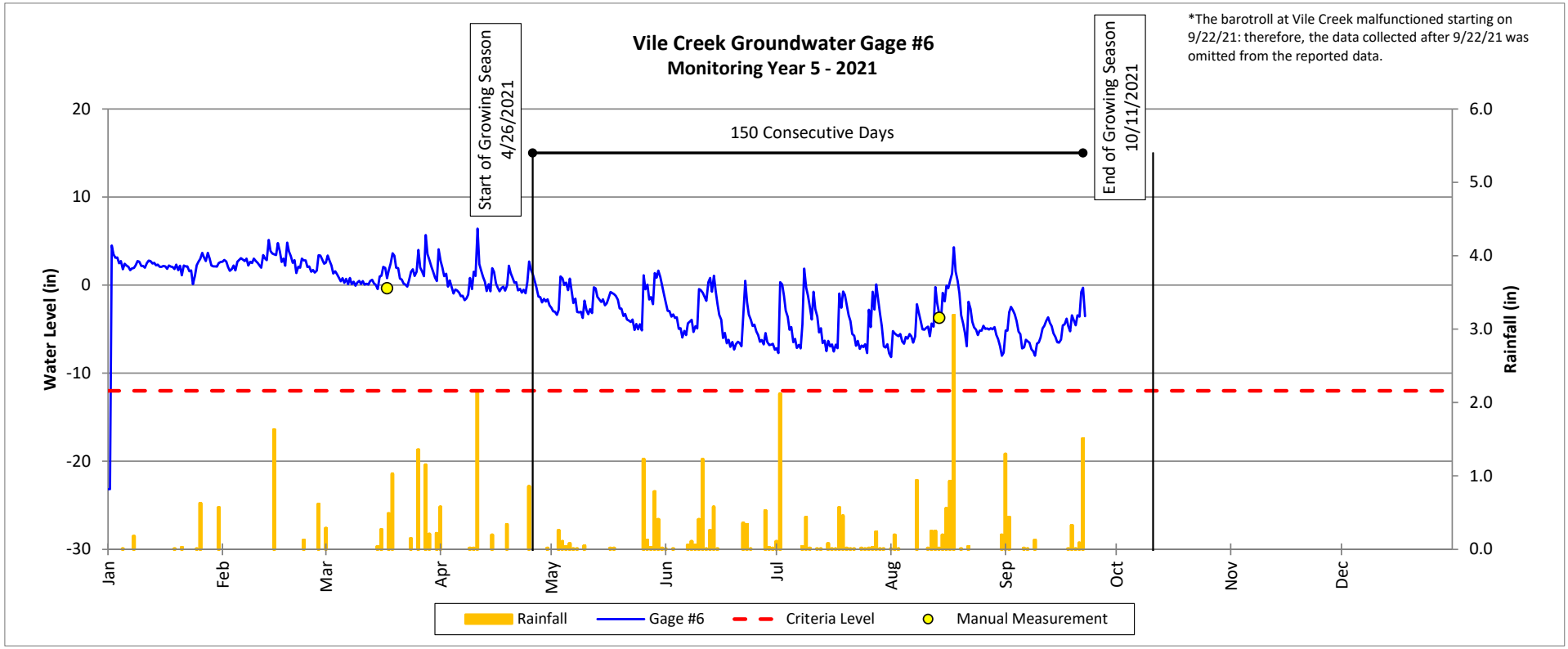
Groundwater Gage Plots

Vile Creek Mitigation Site

DMS Project No. 96582

Monitoring Year 5 - 2021

Wetland Re-establishment



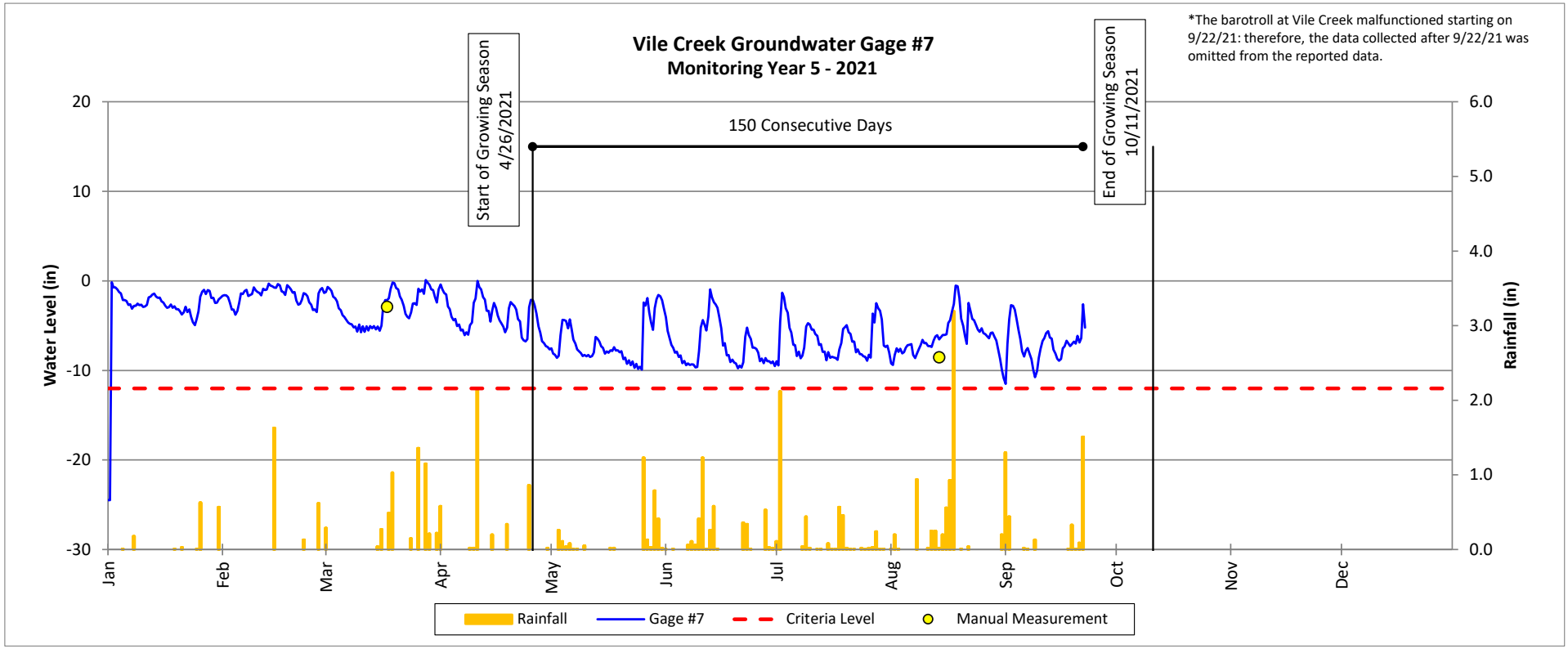
Groundwater Gage Plots

Vile Creek Mitigation Site

DMS Project No. 96582

Monitoring Year 5 - 2021

Wetland Re-establishment



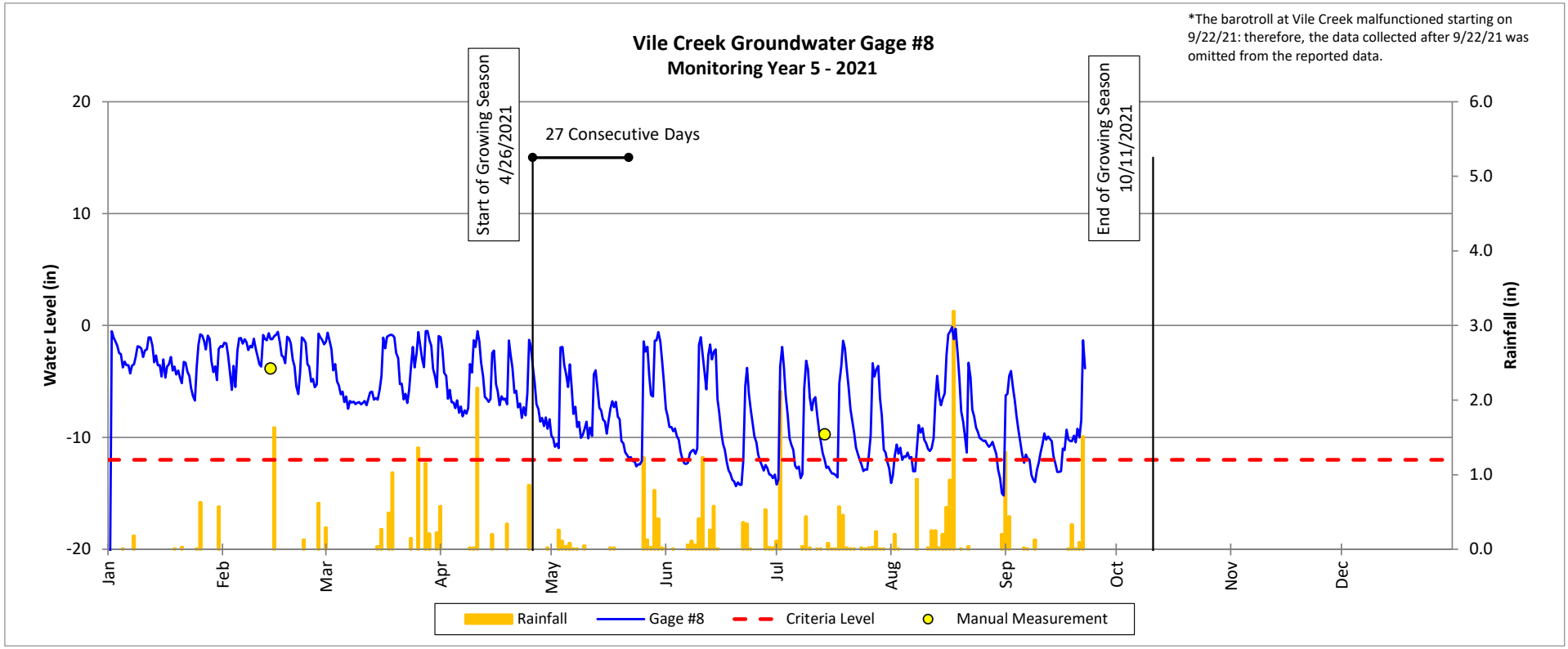
Groundwater Gage Plots

Vile Creek Mitigation Site

DMS Project No. 96582

Monitoring Year 5 - 2021

Wetland Re-establishment



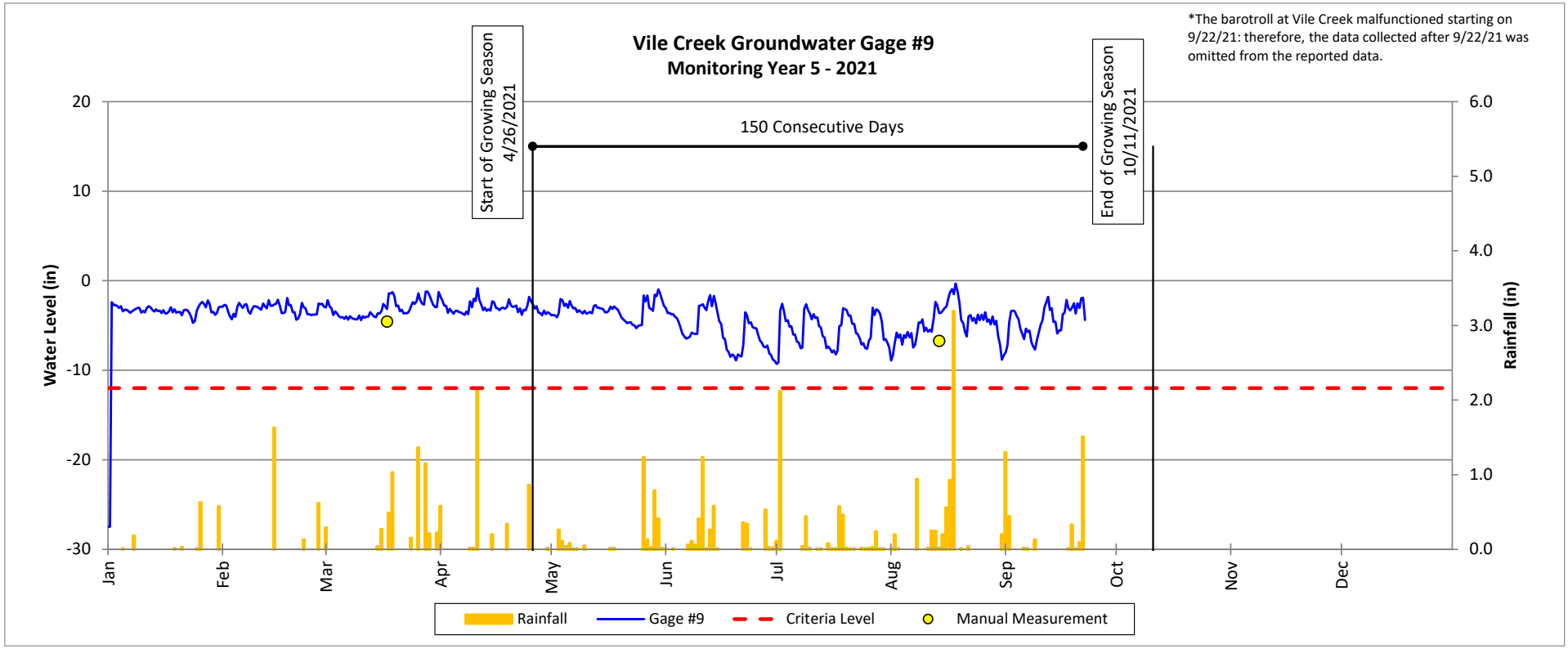
Groundwater Gage Plots

Vile Creek Mitigation Site

DMS Project No. 96582

Monitoring Year 5 - 2021

Wetland Re-establishment



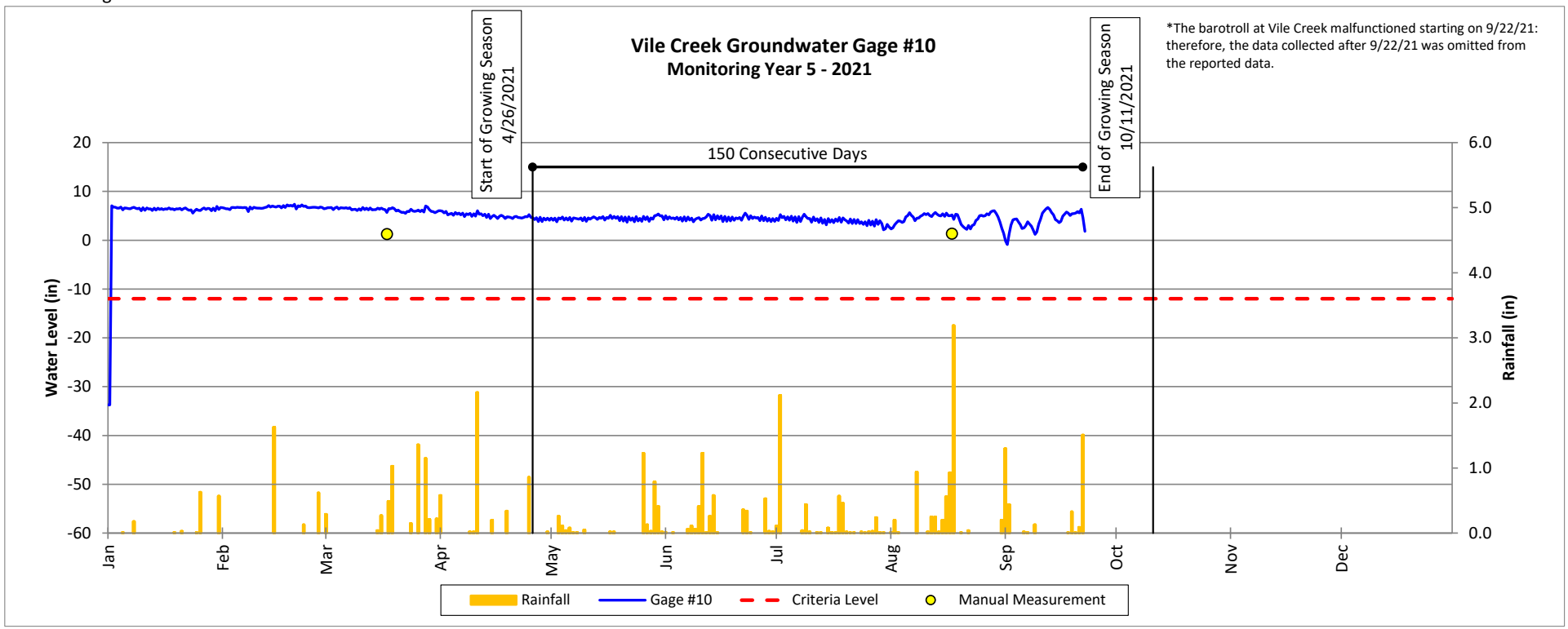
Groundwater Gage Plots

Vile Creek Mitigation Site

DMS Project No. 96582

Monitoring Year 5 - 2021

Wetland Bog Rehabilitation

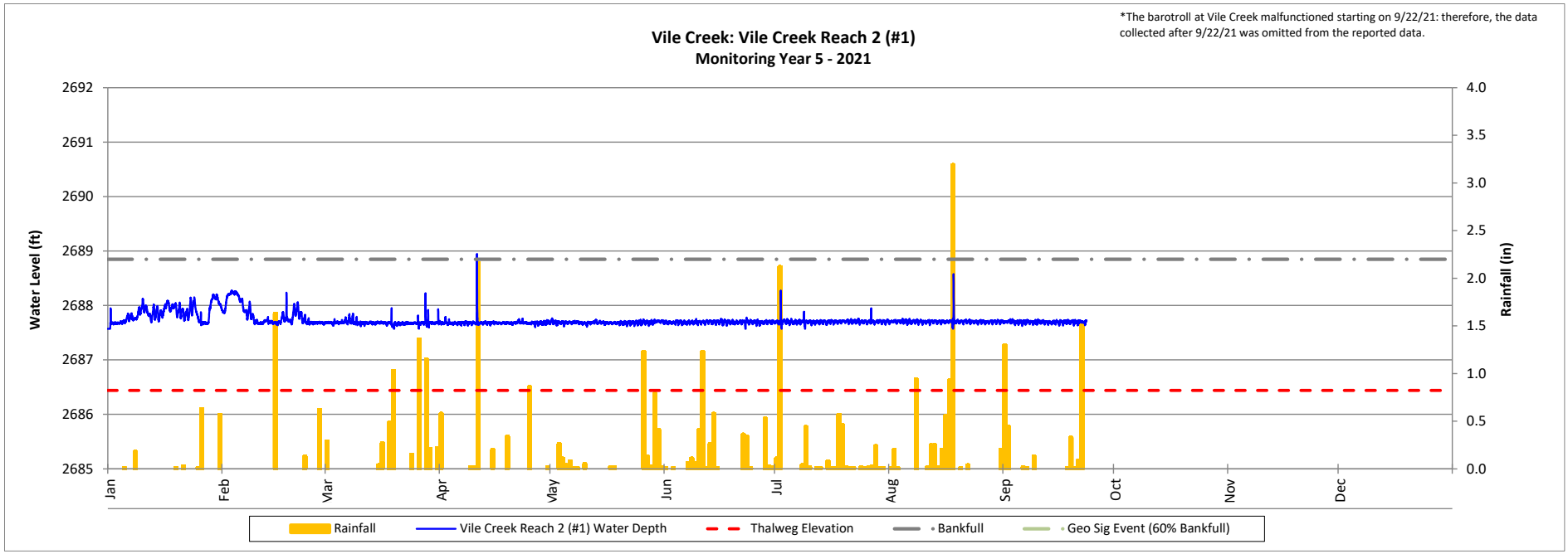


Recorded Geomorphic Significant Flow and Bankfull Events

Vile Creek Mitigation Site

DMS Project No. 96582

Monitoring Year 5 - 2021

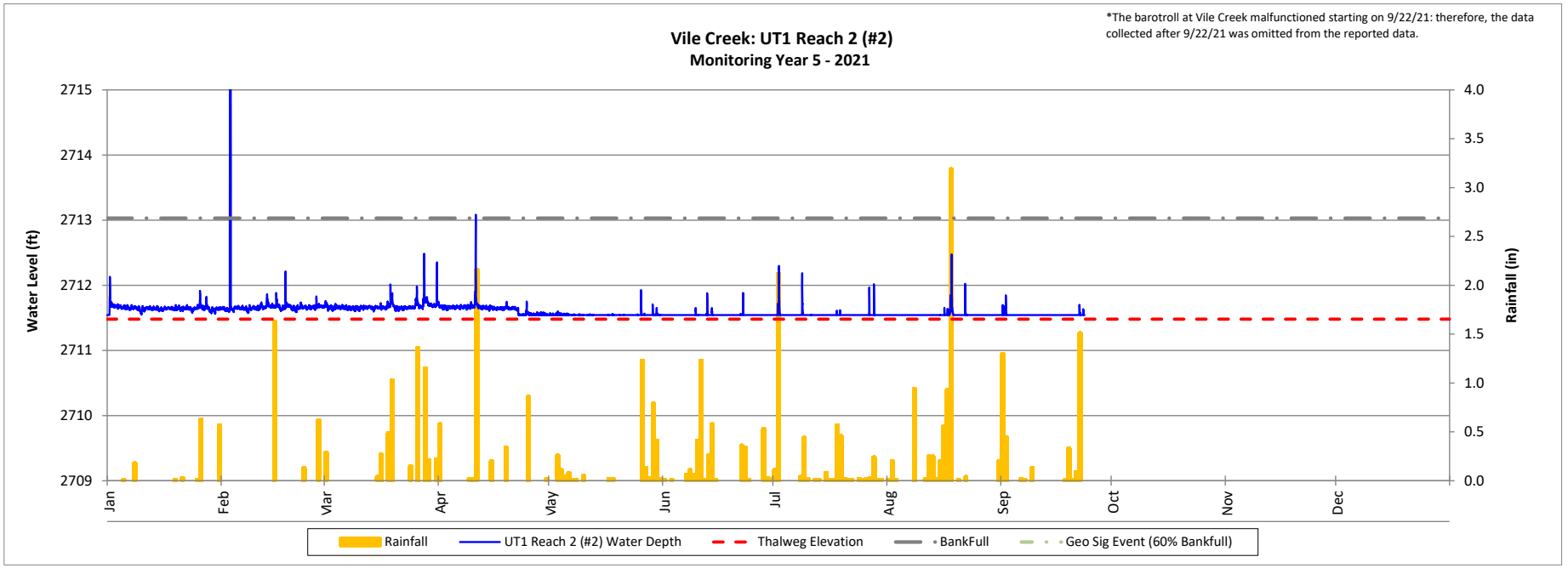


Recorded Geomorphic Significant Flow and Bankfull Events

Vile Creek Mitigation Site

DMS Project No. 96582

Monitoring Year 5 - 2021

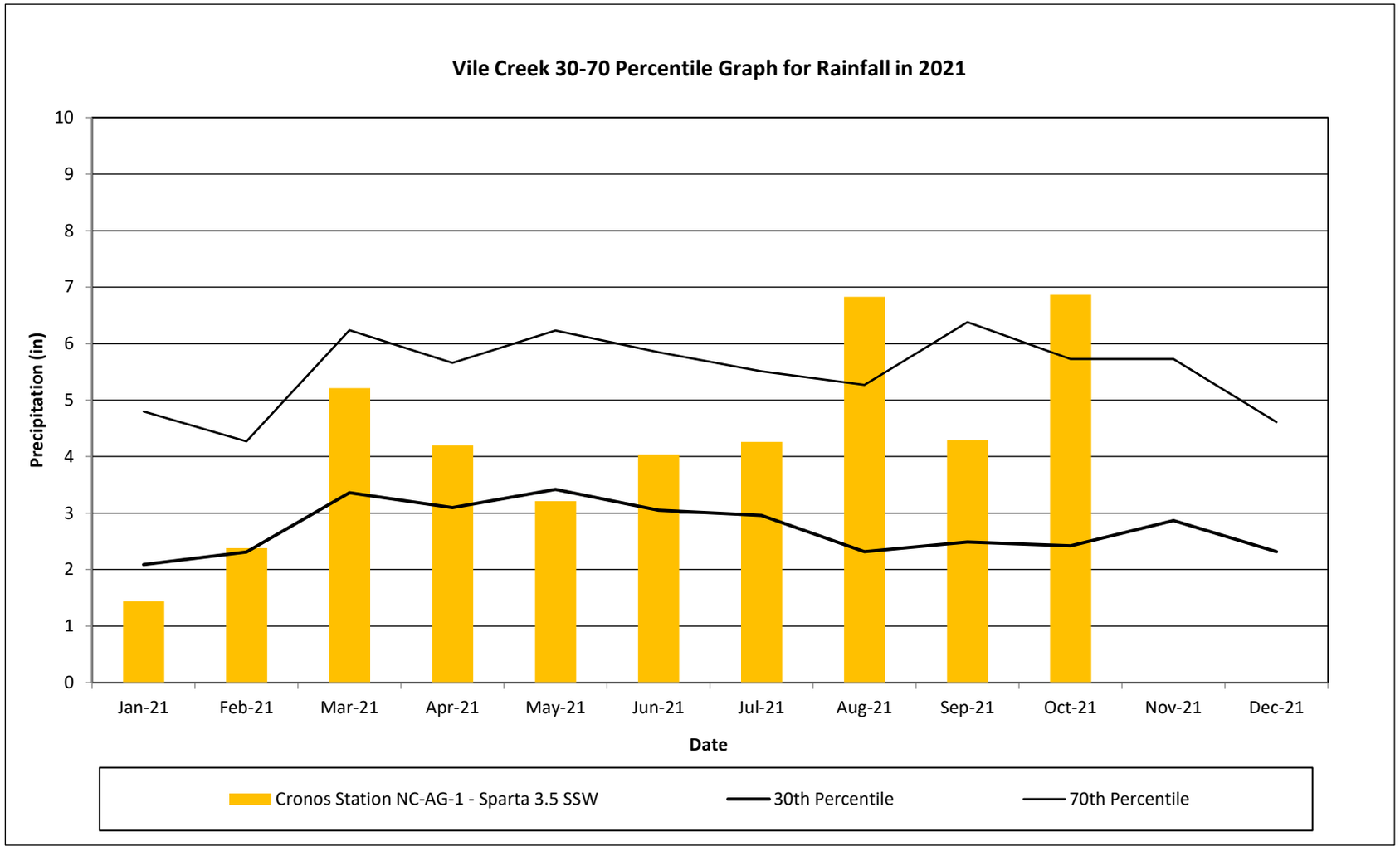


Monthly Rainfall Data

Vile Creek Mitigation Site

DMS Project No. 96582

Monitoring Year 5 - 2021



2021 rainfall collected by Cronos Station NC-AG-1 - Sparta 3.5 SSW

30th and 70th percentile rainfall data collected from Wets Station Sparta 3.5 SSW, NC (Years 1971 - 2021)

APPENDIX 6. Meeting Notes - IRT Site Walk - June 24, 2021

WILDLANDS
ENGINEERING

MEETING NOTES

MEETING:	IRT Site Walk **VILE CREEK Mitigation Site** New River Basin 05050001; Alleghany County, NC DEQ Contract No. 5999 DMS Project No. 96582 USACE ID No.: 2014-01585 DWR No.: 14-0869 Wildlands Project No. 005-02147
DATE:	Thursday, June 24, 2021, 8:30 am to 12 pm
LOCATION:	Sparta Alleghany County, NC

Attendees

Todd Tugwell, USACE
Kim Browning, USACE
Casey Haywood, USACE
Erin Davis, NC DWR
Andrea Leslie, NC WRC
Paul Wiesner, NC DMS
Melonie Allen, NC DMS
Jeff Keaton, Wildlands Engineering
Kristi Suggs, Wildlands Engineering
Jordan Hessler, Wildlands Engineering

Meeting Notes

1. Jeff Keaton began the meeting with an overview of the project.
2. The group decided to shuttle up to the top of Vile Creek Reach 1 to start the site walk. The group briefly stopped to examine and discuss the existing BMP. IRT members expressed a minor concern the BMP has an existing cattail population and wildlands should consider removing or reducing it. The headcut at the inlet to the BMP was discussed. Although it didn't seem to be a priority to the IRT, Jeff said Wildlands would add some rock to stabilize it.
3. The group continued the tour at the top of Vile Creek Reach 1.
4. IRT members asked about the Bog vegetation criteria. Wildlands explained it was a visual assessment based on percent coverage of herbaceous vegetation in bog vegetation plots.
5. Erin Davis and others discussed the tree density in the riparian tree zone on Vile Creek Reach 1. Due to Vile Creek being cold stream credits, denser woody vegetation is expected to shade the stream, especially along the top of bank. This area should be shown as a problem area in the MY5 monitoring

report. Supplemental planting of containerized trees should be completed during the next dormant season. Note: Vile Creek Reach 1 only has trees planted withing the first ten feet from the top of the streambanks. Beyond that zone, shrubs were planted except in the bog areas, which were planted with herbaceous vegetation. A description of the planting zones and a detailed map are included in the mitigation plan.

6. The group continued to walk down the right floodplain of Vile Creek Reach 1 and moved on to the right bank of Vile Creek Reach 2 and UT1 Reach 2.
7. The group reviewed the newly planted trees. Jeff explained that the tree cones were used to prevent deer browse. When these new trees were planted, a pepper pellet was also placed beneath the root ball which gives the leaves and branches a bad taste, also to discourages deer browse. It was determined the tree cones protecting the newly planted trees from deer browse were not readily biodegradable and should be removed by closeout.
8. Jordan and Kristi asked for input of method of monitoring newly planted trees. Erin discussed the possibility of running transects through the planted areas to determine planting success. Wildlands will consider if adding the transect is the best approach. Wildlands will continue to monitor the vegetation plots in MY5, MY6, and MY7. If the vegetation plots are not trending towards success Wildlands will add a year of vegetation monitoring.
9. The group walked up the left floodplain of UT1 Reach 2 and stopped to discuss the aggradation on UT1C. Todd Tugwell and others determined the lower section was functioning as a linear wetland feature rather than a stream. If this trend continues to close out this stream and UT1B (which is in a similar situation) will be credited as wetlands. The portions of UT1C and UT1B that are functioning as wetlands will be tracked in linear footage in the MY5, MY6, and MY7 monitoring reports to determine if the wetlands areas are increasing or decreasing. An additional photo point in each of these reaches will be added in the MY5-MY7 reports as well. Wildlands believes these areas will meet the wetland performance standards for hydrology and vegetation. Wildlands installed stream gages at the baseline for internal data collection that can be used to verify the hydrology performance standard. The vegetation will be visually monitored. At MY7 Wildlands will verify the jurisdictional limits of UT1C and UT1B and include it in the monitoring report. Wildlands will coordinate with the IRT and DMS prior to closeout to determine the mitigation approach, credit ratios, and acreage of these wetlands so that the appropriate amount of wetland credit can be added to the site and the necessary amount of stream credit can be removed.
10. The group decided not to continue up and see UT1 Reach 1. The section of channel that naturally realigned itself and left an oxbow on UT1 Reach 1 was discussed. IRT decided they did not need to see the stream realignment. However, they want Wildlands to add a photo point to the monitoring report to document its stability over time.
11. Next the group walked Vile Creek Reach 2 and discussed the stream banks that have eroded and sill structures that have failed. After a review of all three banks and the structures, the IRT determined Wildlands will need to repair these areas. The repairs will be completed in MY5 and documented in the MY5 monitoring report. A map showing the locations of the repairs is attached.
12. IRT members noted treatment is needed for many small patches of multiflora rose throughout the site.
13. The site review continued to Vile Creek reach 3. IRT members expressed concern about the bare bank along the overflow channel. Wildlands will stabilize the erosion on the bank and replant this area with bare roots to establish woody vegetation. The repairs will be completed in MY5 and documented in the MY5 monitoring report. A map showing the locations of the repair is attached.
14. Concern was expressed over the lack of woody vegetation on the left bank of Vile Creek Reach 3. IRT suggested Wildlands supplementally plant the area if additional planting is done on the project.

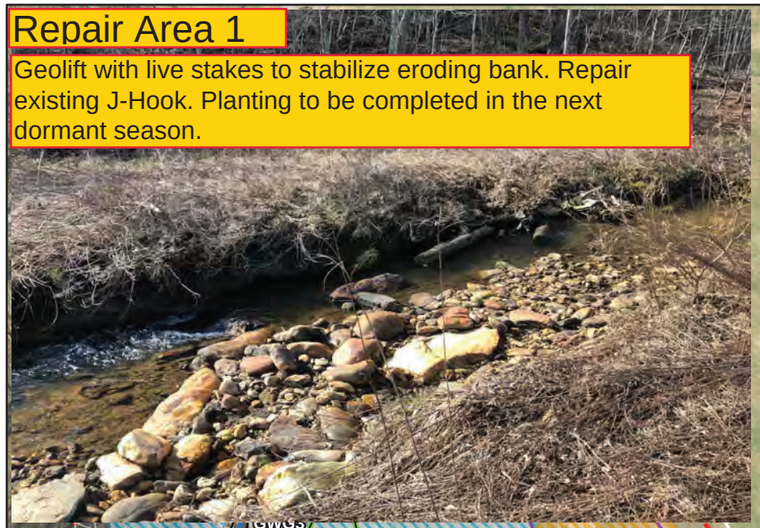
15. The final stream the group reviewed was UT3. There was discussion that understory planting was not done along this reach. However, understory planting was done along this reach and the right floodplain of Vile Creek Reaches 2 and 3. Species planted included spicebush, winter berry, red chokeberry, and American hornbeam.
16. Part of the group tried to find one of the known Gray's Lily locations but couldn't find it. Wildlands will go back and resurvey during peak blooming time in June and July of MY6 to try and find both instances of the Gray's Lily on site.
17. There was a summary discussion at the end of the site review. The key points included:
    - Wildlands will repair the lower end of Vile Creek Reach 2 including bank repairs and repair/replace log sills and a boulder sill (see attached map).
    - Wildlands will plant bare spots along Vile Creek Reach 1 to provide shade for cold water stream habitat. The planting density will be 200 trees per acre, the plants will be 1-gallon containerized plants, and the likely species to be planted include persimmon, sycamore, tag alder, American basswood, and black cherry. The last two are deviations from the planting plan in the approved mitigation plan and need approval of the IRT before planting begins. Live stakes may also be planted on the stream banks. These will be species from the approved mitigation plan planting list but may also include black willow, if approved.
    - Wildlands will not repair UT1b and UT1c where they have filled in. These areas will likely be converted to wetland credits at closeout. Additional monitoring to be performed for MY5-MY7 is discussed in item #9 above.
    - Wildlands will treat invasives on the project site including multiflora rose, Chinese privet, and Japanese barberry.
    - As a follow-up to the discussion of cattails in the BMP at the top of UT2, Wildlands' position on this issue is that the cattails are not negatively affecting the performance of the BMP. So, at this time, we are not planning to treat cattails on the site unless IRT members inform us of a strong preference to treat them.
    - Wildlands will perform supplemental planting along the left bank of Vile Creek Reach 3 during the next dormant season.
    - The IRT noted that if the repairs and supplemental planting were completed in in MY5 (2021), MY6 and MY7 should be sufficient to close the site and additional monitoring would not be required. This is contingent upon the repairs and supplemental planting showing success during the remaining 2-year monitoring term. The MY5-MY7 monitoring reports will discuss the success of the repairs and supplemental plantings.
    - The IRT members agreed to release the MY4 (2020) credits as proposed.

Attachments:

1. Repair Plan Map
2. MY4 Project Components Map

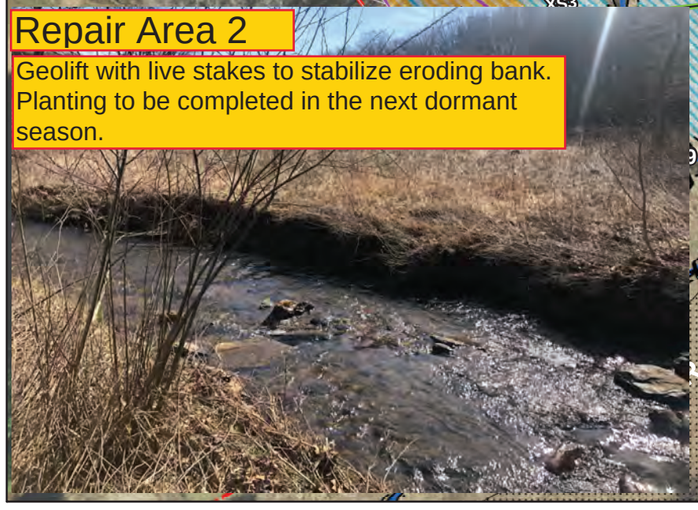
Repair Area 1

Geolift with live stakes to stabilize eroding bank. Repair existing J-Hook. Planting to be completed in the next dormant season.



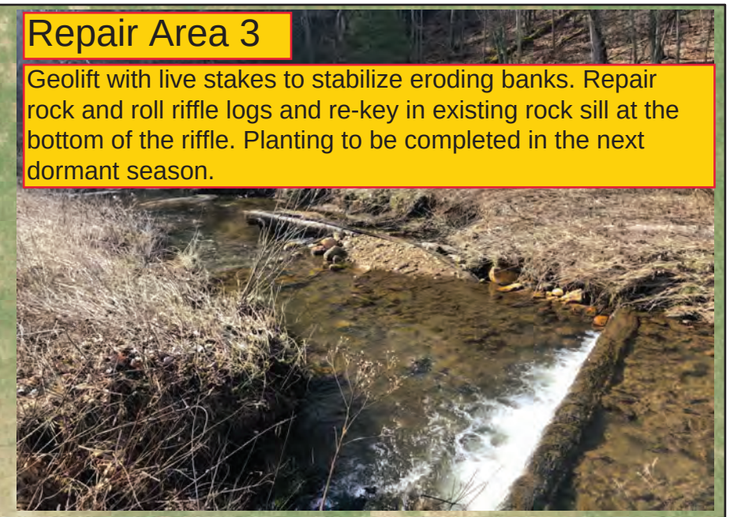
Repair Area 2

Geolift with live stakes to stabilize eroding bank. Planting to be completed in the next dormant season.



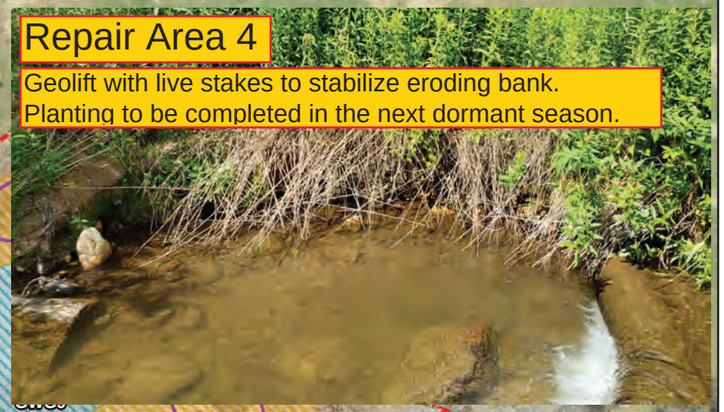
Repair Area 3

Geolift with live stakes to stabilize eroding banks. Repair rock and roll riffle logs and re-key in existing rock sill at the bottom of the riffle. Planting to be completed in the next dormant season.



Repair Area 4

Geolift with live stakes to stabilize eroding bank. Planting to be completed in the next dormant season.



- Conservation Easement
- Wetland Rehabilitation
- Wetland Re-establishment
- Bog Cell
- Stormwater BMP
- Stream Restoration
- Stream Enhancement I
- Stream Enhancement II
- Non-Project Stream
- Cross-Section (XS)

Vegetation Monitoring Plots - MY4

- Not Monitored
- Herbaceous Bog Plots

Groundwater Gage (GWG) - MY4

- Criteria Met
- Criteria Not Met

Stream Areas of Concern - MY4

- Bed Aggradation
- Headcut
- Scour/Erosion
- Stream Realignment
- Structure Issue

Vegetation Areas of Concern - MY4

- Multiflora Rose
- Barberry
- Multiflora Rose and Barberry
- Multiflora Rose and Bittersweet
- Low Stem Density, Height, and Vigor
- Poor Herbaceous Cover
- Easement Encroachment - Mowing
- Bankfull
- Reach Break
- Photo Point
- Crest Gage (CG)
- Barotroll Gage
- Structures
- Riffles
- Brush Toe

GWG3 GWG4 GWG5 GWG6 GWG7

XS1 XS2 XS3 XS4 XS5 XS6

Repair Area 1

Repair Area 2

Repair Area 3

Repair Area 4

Vile Creek Reach 2

2018 Aerial Photography

WILDLANDS ENGINEERING

0 100 200 Feet

N

Figure 3.2 Integrated Current Condition Plan View
Vile Creek Mitigation Site
DMS Project No. 96582
Monitoring Year 4 - 2020

Alleghany County, NC

Repair Area 5

Smooth out slope with excavator. Use Coir fiber matting and seed to stabilize slope. Planting will be completed in the next dormant season.

Little River

Vile Creek Reach 3

UT2

Repair Area 5

Conservation Easement	Vegetation Areas of Concern - MY4
Wetland Rehabilitation	Multiflora Rose
Wetland Re-establishment	Barberry
Bog Cell	Multiflora Rose and Barberry
Stormwater BMP	Multiflora Rose and Bittersweet
Stream Restoration	Low Stem Density, Height, and Vigor
Stream Enhancement I	Poor Herbaceous Cover
Stream Enhancement II	Easement Encroachment - Mowing
Non-Project Stream	Bankfull
Cross-Section (XS)	Reach Break
Vegetation Monitoring Plots - MY4	Photo Point
Not Monitored	Crest Gage (CG)
Stream Areas of Concern - MY4	Barotroll Gage
Bed Aggradation	Structures
Headcut	Riffles
Scour/Erosion	Brush Toe
Stream Realignment	
Structure Issue	

2018 Aerial Photography

WILDLANDS ENGINEERING

0 100 200 Feet

Figure 3.3 Integrated Current Condition Plan View
Vile Creek Mitigation Site
DMS Project No. 96582
Monitoring Year 4 - 2020

Alleghany County, NC

Jordan Hessler

From: Kristi Suggs
Sent: Friday, July 23, 2021 9:17 AM
To: Jordan Hessler
Cc: Jeff Keaton
Subject: RE: IRT/ DMS/ Wildlands - Vile Creek Mitigation Site Meeting Minutes (6-24-2021): Vile Creek (DMS# 96582) SAW-2014-01585; DWR#2014-0869

Follow Up Flag: Follow up
Flag Status: Flagged

Jordan,

Make sure to update the minutes from the IRT walk referencing the email from Andrea Leslie below and include them in the MY5 report. Also, let's include a map with the location/s shown and coordinates.

Thanks!

ks

From: Kristi Suggs
Sent: Friday, July 23, 2021 9:11 AM
To: Tsomides, Harry <harry.tsomides@ncdenr.gov>
Cc: Wiesner, Paul <paul.wiesner@ncdenr.gov>; Jeff Keaton <jkeaton@wildlandseng.com>; Jordan Hessler <jhessler@wildlandseng.com>
Subject: RE: IRT/ DMS/ Wildlands - Vile Creek Mitigation Site Meeting Minutes (6-24-2021): Vile Creek (DMS# 96582) SAW-2014-01585; DWR#2014-0869

Harry,

Yes, we can address this in the MY5 report.

Thanks!

Kristi

From: Tsomides, Harry <harry.tsomides@ncdenr.gov>
Sent: Thursday, July 22, 2021 7:16 PM
To: Kristi Suggs <ksuggs@wildlandseng.com>
Cc: Wiesner, Paul <paul.wiesner@ncdenr.gov>; Jeff Keaton <jkeaton@wildlandseng.com>
Subject: FW: IRT/ DMS/ Wildlands - Vile Creek Mitigation Site Meeting Minutes (6-24-2021): Vile Creek (DMS# 96582) SAW-2014-01585; DWR#2014-0869

Kristi,
Could you please address this Gray's Lily comment in the final memo that you will include in the MY5 report.
Thanks!

==========

Harry Tsomides
Project Manager
Division of Mitigation Services
NC Department of Environmental Quality

Tel. (828) 545-7057
Harry.Tsomides@ncdenr.gov

5 Ravenscroft Drive
Suite 102
Asheville, NC 28801

From: Leslie, Andrea J
Sent: Monday, July 19, 2021 10:57 AM
To: Wiesner, Paul <paul.wiesner@ncdenr.gov>; Haywood, Casey M CIV (USA) <Casey.M.Haywood@usace.army.mil>; Kim Browning <Kimberly.D.Browning@usace.army.mil>; Davis, Erin B <erin.davis@ncdenr.gov>; Tugwell, Todd J CIV USARMY CESAW (US) <Todd.J.Tugwell@usace.army.mil>
Cc: Tsomides, Harry <harry.tsomides@ncdenr.gov>; Kristi Suggs <ksuggs@wildlandseng.com>; Jordan Hessler <jhessler@wildlandseng.com>; Jeff Keaton <jkeaton@wildlandseng.com>; Allen, Melonie <melonie.allen@ncdenr.gov>
Subject: RE: IRT/ DMS/ Wildlands - Vile Creek Mitigation Site Meeting Minutes (6-24-2021): Vile Creek (DMS# 96582) SAW-2014-01585; DWR#2014-0869

Thanks for these, Paul. I'd add that in the notes that we tried to find the Gray's Lily but couldn't, and that I asked Wildlands to follow up to figure out it it's still present. My understanding is that there were 2 locations of Gray's Lily, but we only looked for one.

Andrea

Andrea Leslie
Mountain Habitat Conservation Coordinator
NC Wildlife Resources Commission
645 Fish Hatchery Rd., Building B
Marion, NC 28752
828-400-4223 (cell)
www.ncwildlife.org

From: Wiesner, Paul <paul.wiesner@ncdenr.gov>
Sent: Friday, July 16, 2021 2:29 PM

To: Haywood, Casey M CIV (USA) <Casey.M.Haywood@usace.army.mil>; Kim Browning <Kimberly.D.Browning@usace.army.mil>; Davis, Erin B <erin.davis@ncdenr.gov>; Tugwell, Todd J CIV USARMY CESAW (US) <Todd.J.Tugwell@usace.army.mil>; Leslie, Andrea J <andrea.leslie@ncwildlife.org>
Cc: Tsomides, Harry <harry.tsomides@ncdenr.gov>; Kristi Suggs <ksuggs@wildlandseng.com>; Jordan Hessler <jhessler@wildlandseng.com>; Jeff Keaton <jkeaton@wildlandseng.com>; Allen, Melonie <melonie.allen@ncdenr.gov>
Subject: IRT/ DMS/ Wildlands - Vile Creek Mitigation Site Meeting Minutes (6-24-2021): Vile Creek (DMS# 96582) SAW-2014-01585; DWR#2014-0869

Casey, Erin, Kim, Andrea, and Todd;

Please find Wildlands meeting minutes for the June 24, 2021 site visit attached.

Let us know if you have any additions, questions, comments or concerns.

Wildlands will put the final meeting minutes in the 2021 (MY5) report as an Appendix for documentation.

Thanks

Paul Wiesner
Western Regional Supervisor
North Carolina Department of Environmental Quality
Division of Mitigation Services

828-273-1673 Mobile
paul.wiesner@ncdenr.gov

Western DMS Field Office
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Suite 102
Asheville, N.C. 28801

Jordan Hessler

From: Wiesner, Paul <paul.wiesner@ncdenr.gov>
Sent: Tuesday, July 27, 2021 9:21 AM
To: Kristi Suggs; Jeff Keaton; Jordan Hessler
Cc: Tsomides, Harry
Subject: RE: [External] RE: Vile Creek Mitigation Site Meeting Minutes (6-24-2021): Vile Creek (DMS# 96582) SAW-2014-01585; DWR#2014-0869

Follow Up Flag: Follow up
Flag Status: Flagged

Jeff,

Can you all respond to Kim's questions (#1) below?

Please include the email chain (including the WEI response) along with the final meeting minutes as an appendix in the MY5 (2021) report.

Thanks

Paul Wiesner
Western Regional Supervisor
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-----Original Message-----
From: Browning, Kimberly D CIV USARMY CESAW (USA) <Kimberly.D.Browning@usace.army.mil>
Sent: Friday, July 23, 2021 2:27 PM
To: Wiesner, Paul <paul.wiesner@ncdenr.gov>; Haywood, Casey M CIV (USA) <Casey.M.Haywood@usace.army.mil>; Davis, Erin B <erin.davis@ncdenr.gov>; Tugwell, Todd J CIV USARMY CESAW (US) <Todd.J.Tugwell@usace.army.mil>; Leslie, Andrea J <andrea.leslie@ncwildlife.org>; Wilson, Travis W. <travis.wilson@ncwildlife.org>
Cc: Tsomides, Harry <harry.tsomides@ncdenr.gov>; Kristi Suggs <ksuggs@wildlandseng.com>; Jordan Hessler <jhessler@wildlandseng.com>; Jeff Keaton <jkeaton@wildlandseng.com>; Allen, Melonie <melonie.allen@ncdenr.gov>
Subject: [External] RE: Vile Creek Mitigation Site Meeting Minutes (6-24-2021): Vile Creek (DMS# 96582) SAW-2014-01585; DWR#2014-0869

Thanks Paul. I have a couple comments:
1. Comment #9-- Perhaps I missed part of the conversation, but for the portions of UT1C and UT1B that are functioning as wetlands and may potentially be added for additional wetland credit, are those areas being monitored (other than visually)? Do you anticipate that those areas will meet the wetland performance standards for hydrology and vegetation? At the very least we would require a verification of jurisdictional limits for these areas to be appropriate for wetland credit.

2. Comment #16-- USACE, WRC and DWR are OK with the proposed basswood and black cherry additions to the planting list. Both species are FACU, which may affect their success given the extent of wetlands on site. The black willow proposed is ok, but WRC noted that they're not preferred in shady areas.

3. I know that on-site we discussed that the repairs would be covered under the original permit, but I was not aware that the permit expired in 2017 (I thought it was the current NW27 that expires in 2022). After discussing this with Jeff Keaton and Erin, we determined that since the repairs are each less than 75 LF in length, the repairs can be done under a non-notifying NWP-3, which saves time and documentation from obtaining a new permit verification. The short adaptive management plan you provided with the meeting summary describing the repairs meets the conditions required to move forward. Please keep in mind that Alleghany County contains trout waters and so a trout moratorium may apply. I have copied Regional Condition 4.1 regarding notification in trout waters.

4.1 NWP #3 - Maintenance 4.1.1 In designated trout watersheds, a PCN is not required for impacts to a maximum of 75 linear feet (150 linear feet for temporary dewatering) of streams and waterbodies when conducting maintenance activities. Minor deviations in an existing structure's configuration, temporary structures and temporary fills are authorized as part of the maintenance activity. In designated trout watersheds, the permittee shall submit a PCN (see Regional Condition 2.7 and General Condition 32) to the District Engineer prior to commencing the activity if; 1) impacts (other than temporary dewatering to work in dry conditions) to streams or waterbodies exceed 75 linear feet; 2) temporary impacts to streams or waterbodies associated with dewatering to work in dry conditions exceeds 150 linear feet; 3) the project will involve impacts to wetlands; 4) the project involves the replacement of a bridge or spanning structure with a culvert or nonspanning structure in waters of the United States; or 5) the activity will be constructed during the trout waters moratorium (October 15 through April 15).

Please reach out if you have any questions.
Thanks
Kim

Kim Browning
Mitigation Project Manager, Regulatory Division I U.S. Army Corps of Engineers

-----Original Message-----
From: Wiesner, Paul <paul.wiesner@ncdenr.gov>
Sent: Friday, July 16, 2021 2:29 PM
To: Haywood, Casey M CIV (USA) <Casey.M.Haywood@usace.army.mil>; Browning, Kimberly D CIV USARMY CESAW (USA) <Kimberly.D.Browning@usace.army.mil>; Davis, Erin B <erin.davis@ncdenr.gov>; Tugwell, Todd J CIV USARMY CESAW (USA) <Todd.J.Tugwell@usace.army.mil>; Leslie, Andrea J <andrea.leslie@ncwildlife.org>
Cc: Tsomides, Harry <harry.tsomides@ncdenr.gov>; Kristi Suggs <ksuggs@wildlandseng.com>; Jordan Hessler <jhessler@wildlandseng.com>; Jeff Keaton <jkeaton@wildlandseng.com>; Allen, Melonie <melonie.allen@ncdenr.gov>
Subject: [Non-DoD Source] IRT/ DMS/ Wildlands - Vile Creek Mitigation Site Meeting Minutes (6-24-2021): Vile Creek (DMS# 96582) SAW-2014-01585; DWR#2014-0869

Casey, Erin, Kim, Andrea, and Todd;

Please find Wildlands meeting minutes for the June 24, 2021 site visit attached.

Let us know if you have any additions, questions, comments or concerns.

Wildlands will put the final meeting minutes in the 2021 (MY5) report as an Appendix for documentation.

Thanks

Paul Wiesner

Western Regional Supervisor

North Carolina Department of Environmental Quality

Division of Mitigation Services

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Asheville, N.C. 28801

APPENDIX 7: Adaptive Management Plan

ADAPTIVE MANAGEMENT PLAN

Vile Creek Mitigation Site

Alleghany County, NC
NCDEQ Contract No. 5999
DMS ID No. 96582

New River Basin
HUC 05050001

USACE Action ID No. SAW-2014-01585
DWR No. 14-0869

Submission Date: August 18, 2021

PREPARED FOR:

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

ADAPTIVE MANAGEMENT PLAN

Vile Creek Mitigation Site
Alleghany County, NC
NCDEQ Contract No. 5999
DMS ID No. 96582
New River Basin
HUC 05050001
USACE Action ID No. SAW-2014-01585
DWR No. 14-0869

PREPARED FOR:

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

PREPARED BY:

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

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APPENDICES

1.0 Introduction

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 5,053.000 stream mitigation units (SMUs) and 5.703 riparian wetland mitigation units (WMUs) for the New River Basin (Table 1). The Site is located approximately one mile east of the Town of Sparta, NC in the New River Basin eight-digit Hydrologic Unit Code (HUC) 05050001 and the 14-digit HUC 05050001030020. On-site streams consist of Vile Creek and five unnamed tributaries (UT) to Vile Creek including UT1, UT1b, UT1c, UT2, UT3, and a portion of Little River. Vile Creek flows into Little River near the downstream project boundary. The land adjacent to the project streams and wetlands is primarily maintained cattle pasture and forest. The land required for construction, management, and stewardship of the mitigation project included portions of five parcels resulting in 25.04 acres of the conservation easement.

Construction activities were completed by Land Mechanic Designs, Inc. in February 2017. Planting and seeding activities were completed by Bruton Natural Systems, Inc. in February 2017. The final Baseline Monitoring Document was completed in April 2017. The Site is currently in Monitoring Year 5 (MY5).

Overall, the Site is geomorphically stable, and riparian and wetland vegetation are performing well. Performance criteria for stream hydrology has been met, and all wetland groundwater gauges met their success criteria during MY4. However, isolated stream and vegetation problems areas do exist on-site. One of these areas consisting of erosion on the outside meander bend of Vile Creek Reach 2 was observed during MY1 and discussed during an IRT site walk conducted on July 18, 2017. The remainder of the stream problem areas have occurred and been documented in subsequent monitoring year reports (MY2 – MY4) including damage that occurred during a hurricane and a tropical storm in the fall of 2018 (MY2). In addition, areas of concern related to vegetation performance have been documented. Three supplemental plantings have already occurred. The first was completed to correct the planting of trees in shrub zones, which were intended to minimize shade on the bog areas. Trees were removed from the shrub zones and shrubs were planted to replace them during the winter of 2017. The second supplemental planting consisted of 300 1-gallon trees and was completed in the spring of 2020 on the right bank UT1 R2 starting at UT1C and continuing down to Vile Creek Reach 2. Elderberry live stakes were also planted along the top of bank of UT1 to further shade out the stream. All of the 1-gallon plantings were considered unsuccessful because the deer population located on-site grazed the newly planted stems causing a mortality rate of greater than 50% of the supplementally planted stems. A third supplemental planting was the performed to replace the grazed container plants during the winter of 2021. This planting consisted of 854 1-gallon and 3-gallon containerized plants in the same area along UT1 R2 and tree cones were used to prevent deer browse. When these new trees were planted, a pepper pellet was also placed beneath the root ball of many of the trees which gives the leaves and branches a bad taste, also to discourages deer browse.

An IRT site visit was conducted on June 24, 2021. During this site visit, potential repairs were discussed with the members of the IRT. A determination was made to move forward with on-site repairs including bank stabilization of four areas, repairs to certain failing structures, reconstruction of a failing angled-log riffle, and multiple small areas of replanting. These repairs are discussed in Section 3.0 of this document.

2.0 Monitoring Years 3 and 4 Assessments

Annual monitoring and quarterly Site visits have been conducted since project completion to assess the condition of the project. The stream, vegetation, and hydrologic success criteria for the Site follows the approved success criteria presented in the Vile Creek Mitigation Plan (Wildlands, 2016). Stream and vegetative monitoring features and locations are shown in Figures 1 to 3 in Appendix 1.

2.1 Performance Criteria

2.1.1 Vegetation

The vegetative success criteria for the Site consists of species survival in three designated zones (trees, shrubs, and bogs) along the open, planted riparian corridor. The vegetative success criteria for tree species will be the final survival of 210 planted stems per acre at the end of the required seventh monitoring period, as well as an interim criteria of the survival of at least 320 planted stems per acre at the end of MY3 and at least 260 stems per acre at the end of MY5. Planted tree height must average 6 feet in height by MY5 and 8 feet in height at the end of the MY7. The vegetative success criteria for shrub species will be the final survival of 105 planted stems per acre at the end of MY7, of at least 160 planted stems per acre at the end of MY3, and at least 130 stems per acre at the end of MY5. There is no height requirement for shrub species. The vegetative success criterium for bog areas is at least 80% herbaceous cover.

2.1.2 Stream

Stream channels should maintain a stable pattern and profile considering the hydrologic and sediment inputs to the system, the landscape setting, and the watershed conditions. Bank height ratios should stay below 1.2. Visual assessments should indicate a progression towards stability. Entrenchment ratios should be >1.4 for restored B channels and ≥2.2 for C/E channels. Cross-sections should show little change in bankfull area and width-to-depth ratio.

2.2 MY3 and MY4 Assessment Results

2.2.1 Vegetation

MY4 (2020) was a reduced monitoring year that does not require detailed vegetation inventory and analysis; therefore, no vegetation plot monitoring was performed in 2020. Visual assessments were conducted in MY4 and indicated isolated areas of low stem density and height. Detailed vegetative inventories were completed in MY3 (September 2019). This resulted in an average planted stem density of 445 stems per acre for woody tree species, 284 stems per acre for shrubs species, and approximately 99% herbaceous cover in bog areas, which exceed the interim requirement of 320 stems per acre for trees and the 160 required for shrub species at MY3, as well as the final 80 percent cover for bog areas. Of the 25 vegetative plots monitored, twelve of the fifteen plots designated for monitoring tree species, both of the plots designated for monitoring shrub species, and all eight plots designated for monitoring herbaceous cover in bog areas, individually met the success criteria with a stem density ranging from 364 to 728 stems per acre for trees and 162 to 405 stems per acre for shrubs and a vegetative cover of 95 – 100% for bog areas. Vegetation plots five, nine, and fourteen did not meet stem density requirements. See Appendix 2 (Tables 2 and 3a-b) for the MY3 vegetation plot monitoring results.

2.2.2 Stream

MY4 was a reduced monitoring year that does not require full morphological surveys; therefore, no cross-sectional surveys were performed in 2020; however, pebble counts were conducted and found no significant change in stream bed material throughout the site. Morphological cross-sectional surveys conducted in MY3 (April 2019) indicated, in general, that streams within the Site appeared stable with some areas exhibiting minor bank scour. In general, site streams showed little change in the bankfull

area, maximum depth ratio, and width-to-depth ratio, and fell within the parameters defined for channels of the appropriate stream type (Rosgen, 1994 & 1996).

During MY3, cross-sectional survey results showed a bank height ratio greater than 1.2 for cross-section (XS) 2 and XS7. XS7 had degraded during MY1, but remained stable in subsequent years. Cross section two began to degrade in MY1 and continued to degrade through MY3. However, this cross-section is located in between two logs in a log riffle and is expected to see some deepening of a scour pool in this location of the riffle.

2.3 Areas of Concern

2.3.1 Vegetation

Invasive species including Japanese barberry (*Berberis thunbergii*), Oriental bittersweet (*Celastrus orbiculatus*), and multiflora rose (*Rosa multiflora*) continue to be present within and around the Site. Although their presence is not impacting survival rates of planted stems at this time, these areas will likely continue to warrant additional treatment to prevent any advancement within the conservation easement and future impacts to the Site.

During MY4 areas of low stem density and height were documented on-site and amounted to 18.2% of the planted conservation easement. These areas included: A portion of the left floodplain on UT1 Reach 1, an area along the right floodplain of UT1C, which continues downstream to Vile Creek Reach 2 (this area was replanted a second time during the winter of 2021), and along the left floodplain of UT2 just below the BMP. During the 2021 IRT site visit, low tree density was also observed along both banks of Vile Creek Reach 1 and portions of the left bank of Vile Creek Reach 3. See figures in Appendix 1 for locations of low tree density discussed during the 2021 IRT site visit.

2.3.2 Stream

The site has been assessed quarterly since the completion of construction as discussed in Section 2 above. The following areas are experiencing localized bank instability to varying degrees: Vile Creek Reach 1 station 103+90-104+20 (30 LF), Vile Creek Reach 2 stations 118+50-118+80 (30 LF), 120+50-121+00 (50 LF), 121+00 to 121+25 (25 LF), and 122+20-123+00 (80 LF), UT1 Reach 1 station 206+40-206+60 (20 LF), UT2 stations 305+00-305+50 (50 LF), 306+30-306+70 (40 LF), and 310+00-310+15 (15 LF). Aggradation along enhancement II reaches UT1b and UT1c has resulted in the 51 LF and a 115 LF loss of the single-thread channels, respectively. The stormwater best management practice (BMP) at the top of UT2 has formed a headcut at the inlet flowing into the BMP. An area of instability along UT1 Reach 1 (Station 205+10-205+60) that was previously mentioned in the MY3 report, naturally realigned itself (21 LF) in MY4; thereby, abandoning an existing meander bend and creating an ox bow. The newly created channel appears to be stable but resulted in a loss of 14 LF of stream. Stream structures currently failing include: rock sill UT1 Reach 2 at station 220+98, log sill Vile Creek Reach 1 station 104+10, j-hook Vile Creek Reach 2 at station 118+80, rock sill Vile Creek Reach 2 at station 123+00. A constructed angled log riffle has down-cut and has failing log sills on Vile Creek Reach 2 at station 122+25.

3.0 Corrective Measures for Implementation

3.1 Site Assessment

As previously mentioned in Section 1.0, an IRT site visit was conducted on June 24, 2021. During this visit, areas within the project's conservation easement were discussed for stream repair and additional supplemental planting. Key points discussed during this visit are outlined below and resulted in the proposed corrective measures for implementation. Supplemental planting and stream repair measures are discussed in further detailed in Sections 3.2 and 3.3.

- Wildlands to repair the lower end of Vile Creek Reach 2 including bank repairs and repair/replace log sills and a boulder sill.
- Wildlands to install container sized plants and live stakes within the bare spots along Vile Creek Reach 1 to provide shade for cold water stream habitat.
- Wildlands will not remove and/or repair aggradation areas along UT1b and UT1c.
- Wildlands will continue to treat invasives on the project site including multiflora rose, Chinese privet, and Japanese barberry, as needed.
- Since cattails are not negatively affecting the performance of the stormwater BMP at the top of UT2, Wildlands is not planning to treat them at this time.
- Wildlands will add rock to stabilize the headcut at the inlet to the stormwater BMP.
- Wildlands to stabilize the erosion and replant the overflow channel on Vile Creek Reach 3.
- Wildlands will perform supplemental planting along the left bank of Vile Creek Reach 3 during the next dormant season.

3.2 Replanting

3.2.1 Areas to Be Replanted

A fourth replanting will be completed on a portion of the site during the upcoming dormant season (winter 2022). This planting will focus on the areas discussed at the recent IRT site visit and will include:

Vile Creek Reach 1

- Replant with containerized trees within the riparian planting zone (extending 15 feet from top of bank) along both banks of the stream along the entire reach.
- Install additional live stakes to streambanks to help with shading the stream.

Vile Creek Reach 3

- Replant with containerized trees along the left bank of the stream from approximately station 125+00 to 126+00 and 127+00 to 128+25.
- Install additional live stakes on left bank of the secondary high-flow channel on Vile Creek Reach 3 from approximately station 124+80 to 125+60.

See Section 3.2.2 and 3.2.3 below for the list of the proposed planted tree and live stake species.

3.2.2 Container Plantings

Approximately 200 containerized trees will be replanted during the next dormant season (winter 2022) along both banks of Vile Creek Reach 1 and a small area on the left bank of Vile Creek Reach 3 as shown on the figures in Appendix 1. The total area of the replanting will be approximately 1 acre. The trees will be a combination of one-gallon and three-gallon containers, depending on the availability of stock. The species for replanting were selected based on recent experience with planting similar sites and are listed below. Many of these species were not in the approved Final Mitigation Plan (Wildlands, 2016) and these species are noted below with an asterisk. The proposed trees to plant include:

- Box elder (*Acer negundo*)* - FAC – 10%
- American sycamore (*Platanus occidentalis*) – FACW – 15%
- River birch (*Betula nigra*) – FACW – 15%
- Persimmon (*Diospyros virginiana*) – FAC – 15%
- Red oak (*Quercus rubra*)* - FACU – 15%
- White oak (*Quercus alba*)* - FACU – 15%
- Black gum (*Nyssa sylvatica*)* - FAC – 15%

Potential alternate species will be used if any of the above are not available and include:

- Black cherry (*Prunus serotina*)* - FACU
- Tag alder (*Alnus serrulata*) - OBL
- Yellow buckeye (*Aesculus flava*)* - FACU

See Appendix 3 for the approved planting list from the Final Mitigation Plan (Wildlands, 2019).

3.2.3 Live Stakes

Live stake plantings will also be conducted during the winter of 2022. The additional live stakes will be placed primarily in areas where repairs are being done. Live stakes will consist of a mix of black willow (*Salix nigra*), silky willow (*Salix sericea*), and silky dogwood (*Cornus amomum*). Both silky willow and silky dogwood were included in the approved Final Mitigation Plan (Wildlands, 2019); however, black willow was not. Wildlands believes that adding black willow as an additional species to the live stake planting list will aid stream bank stabilization with their ability to become quickly established and will further increase species diversity.

See Appendix 3 for the approved planting list from the Final Mitigation Plan (Wildlands, 2019).

3.2.4 Soil Amendments

Soil amendments will also be applied to the newly planted areas at a rate of approximately 3 ounces to the base of each planted tree. Soil amendments will include humic acid, biochar, dried molasses, slow-release fertilizer (2-4-3), rock phosphate, and azomite (a trace mineral supplement). Beyond boosting macro- and micronutrients in the soil, the addition of these amendments will improve other soil properties including cation exchange capacity, pH, and microbial communities. Expected improvements include greater moisture-holding capacity, organic matter, and nutrient availability for plants.

3.3 Stream Repairs

3.3.1 Areas to be Repaired

The following areas will be repaired as described:

<u>Vile Creek Reach 2</u>

- Repair eroding right stream bank from station 118+50 to 118+80.
- Repair existing J-Hook at station 118+80.
- Repair eroding right stream bank from station 120+70 to 121+00.
- Repair eroding left stream bank from station 121+00 to 121+25.
- Repair eroding right stream banks from station 122+20-123+00.
- Rebuild log riffle from station 122+20 to 123+00.
- Repair rock sill at station 123+00.

<u>Vile Creek Reach 3</u>

- Repair eroding left bank of overflow channel from station 125+00 to 125+60 and replant with bare roots.

Pre-repair photos of the locations described above are included in Appendix 1. All completed repairs listed above will be documented in the MY5 report. Most other areas of concern listed in Sections 2.3.2 are minor and will continue to be monitored by Wildlands and discussed in upcoming monitoring reports for monitoring years 5 through 7. According to IRT members, the aggradation of UT1b and UT1c may result in the change of credit type from stream to linear wetland. Wildlands will coordinate with the IRT and DMS prior to closeout to determine the mitigation approach, credit ratios, and acreage of these wetlands so that the appropriate amount of wetland credit can be added to the site and the necessary amount of stream credit can be removed.

3.3.2 Description of Repairs

The repairs will be conducted with a small excavator during late summer or early fall of 2021. All of the areas to be repaired are located on the lower half of Vile Creek Reach 2 and access will be limited to one route in and out of that location. All of the bank repairs will consist of building geolifts to stabilize the eroding areas. Live stakes will be installed during the winter of 2022 to add stability to the geolifts. The log riffle to be repaired will be rebuilt to the original design elevation and all of the angled logs will be replaced and keyed into the bank sufficiently to remain stable. The rock sill and j-hook will be repaired by replacing the rocks that washed out and keying them into the bank sufficiently so that they remain stable.

3.3.3 Permitting

Wildlands discussed permitting requirements with the U.S. Army Corps of Engineers (USACE) and the NC Division of Water Resources (NCDWR). The project's 401 and 404 permits expired in 2017. However, the USACE indicated that the work would be covered under a non-reporting NW3 and GC4132 because these permits allow for maintenance work on previously authorized modifications, as outlined in paragraph (a) of the NW3. Because the repair work is located within the project's previously permitted stream restoration construction area and with proposed in-stream structures and bank stabilizations consistent with the original restoration design, DWR considers the proposed work to be temporary impacts not requiring written 401 approval. Therefore, for these repairs, no additional 401 or 404 notifications are required. The project repairs will comply with trout moratorium rules. Any other necessary permits will be obtained. A land disturbance permit should not be necessary because less than 1 acre will be disturbed.

4.0 Proposed Monitoring

4.1 Vegetative

Wildlands will continue to monitor Site vegetation as previously planned. If the monitoring requirements are not met during MY7 in any of the planted areas, including ones with supplemental planting, Wildlands proposes to add another year of vegetation monitoring for those areas. Vegetation monitoring will continue until success criteria are met. We will include two transects in the supplemental planting area that was recently planted in March of 2021 to monitor success for MY5, and MY6, and MY7. Full vegetation monitoring at the site will be conducted in MY6. MY6 is a reduced monitoring year and does not typically include vegetation monitoring.

4.2 Stream

Wildlands will continue to monitor the stream as previously planned. However, the portions of UT1C and UT1B that are functioning as wetlands will be tracked in linear footage to determine if the aggraded areas are increasing or decreasing in length. An additional photo point will be added on each of these two reaches and on UT1 Reach 1 at station 205+10-205+60 where the stream realigned itself and formed an oxbow where the channel used to be. In addition, a photo point will be added at each of the seven stream repair areas. This data will be added to the MY5, MY6, and MY7 reports. If other areas of concern begin to threaten the stability of the project, then remedial actions will be implemented and documented for all future reports.

5.0 Conclusion

In summary, Wildlands proposes to repair damage that has occurred since construction was completed in 2017 to the lower part of Vile Creek Reach 2 during the late summer of 2021. Additional replanting will be done during the following dormant season (Winter 2022). Soil amendments will be placed around each supplementally planted bare root to aid in growth and establishment. Stability of repair areas and growth and health of supplementally planted areas will be reevaluated in the Monitoring Year 5 to 7 reports along with pictures of the addressed areas.

6.0 References

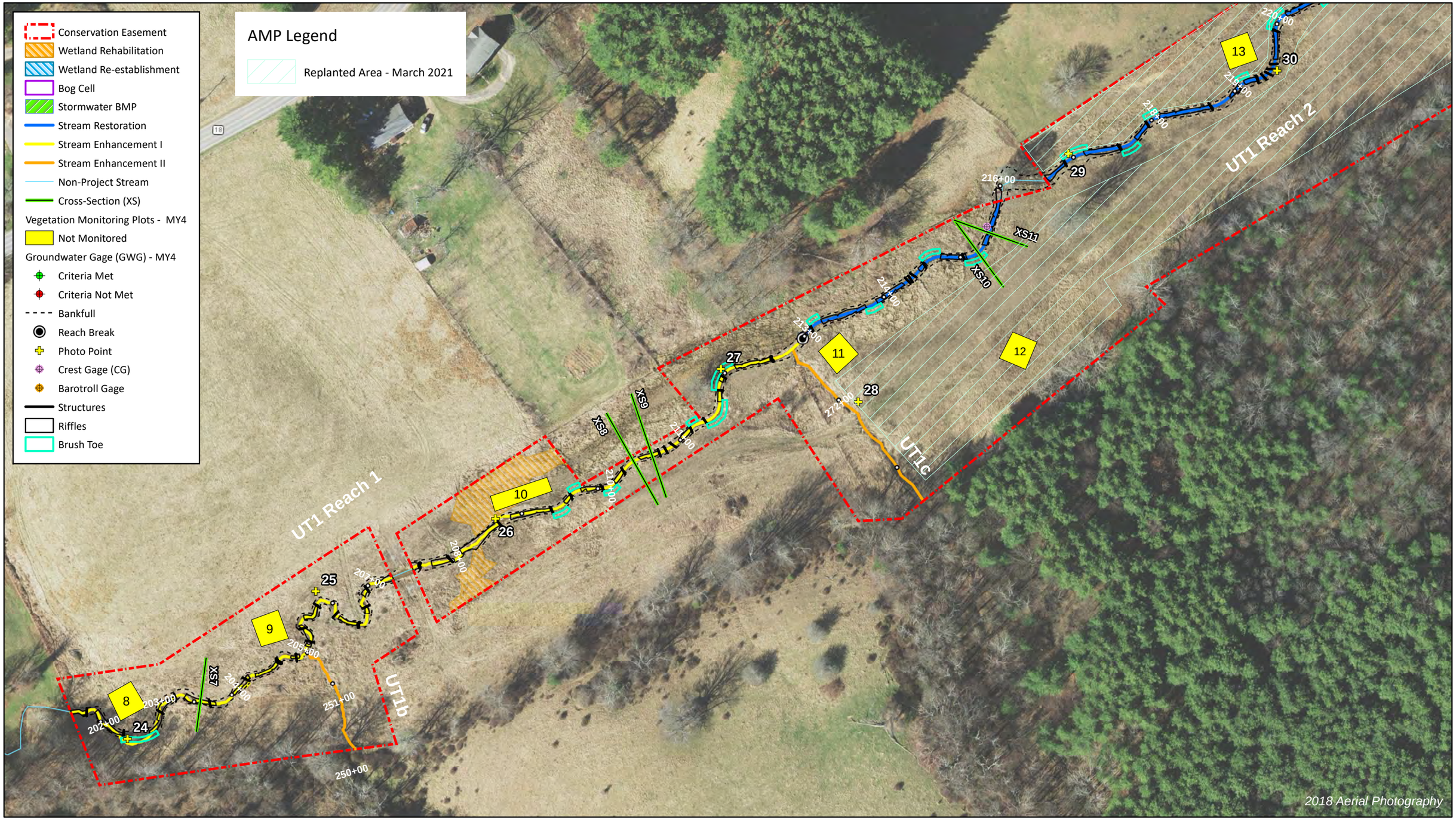
Wildlands Engineering, Inc. (Wildlands), 2021. Vile Creek Meeting Notes – IRT Site Walk on June 24th, 2021. Sparta, NC.

Wildlands, 2020. Vile Mitigation Site Monitoring Year 4 Annual Report. DMS, Raleigh, NC.

Wildlands, 2019. Vile Mitigation Site Monitoring Year 3 Annual Report. DMS, Raleigh, NC.

Wildlands, 2016. Vile Creek Mitigation Site Mitigation Plan. DMS, Raleigh, NC.

APPENDIX 1



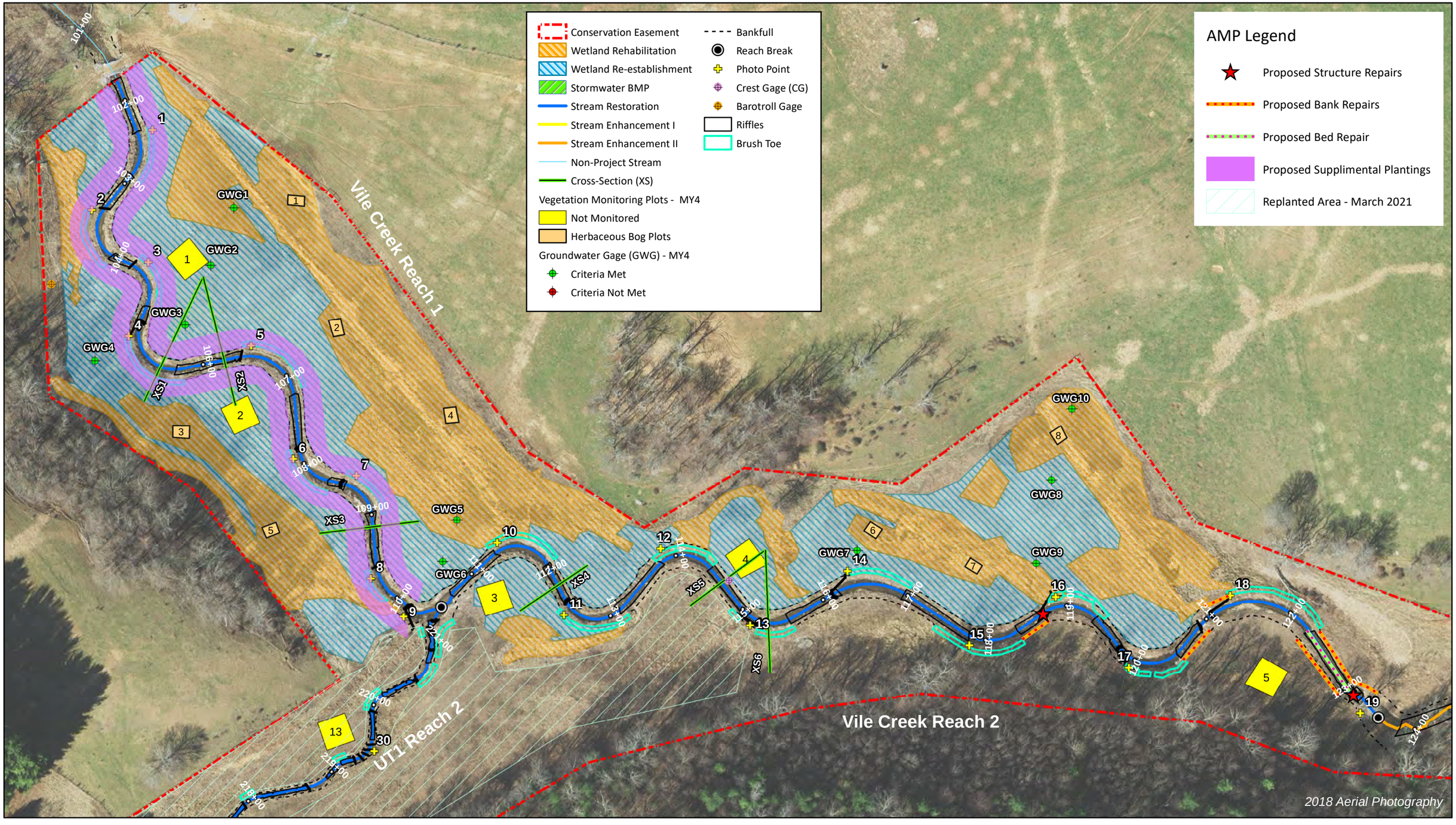
WILDLANDS ENGINEERING

0 100 200 Feet

N

Figure 1 Adaptive Management Plan
Vile Creek Mitigation Site
DMS Project No. 96582
Monitoring Year 5 - 2021

Alleghany County, NC

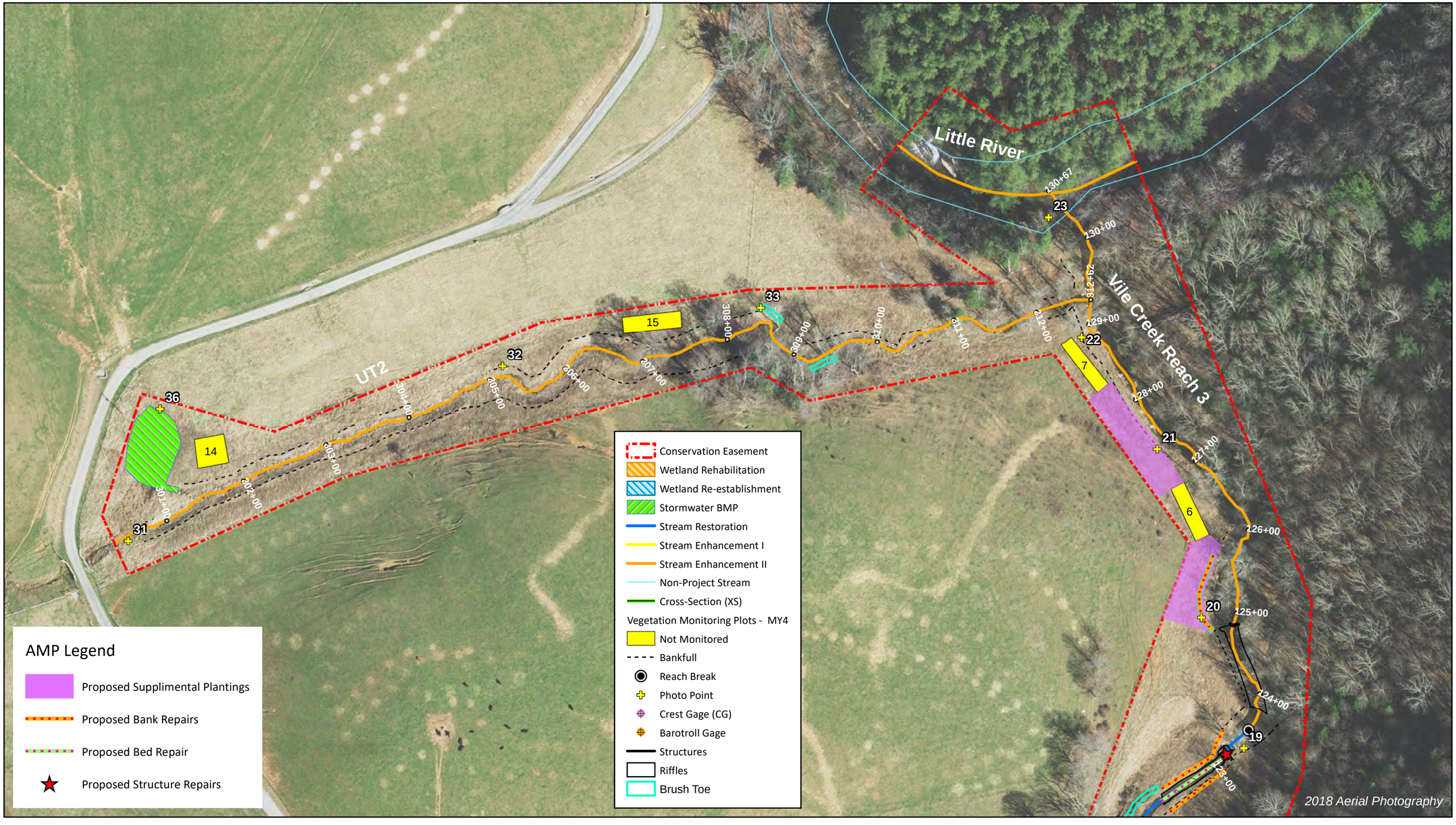


WILDLANDS ENGINEERING

0 100 200 Feet

Figure 2 Adaptive Management Plan
Vile Creek Mitigation Site
DMS Project No. 96582
Monitoring Year 5 - 2021

Alleghany County, NC



WILDLANDS ENGINEERING

0 100 200 Feet

N

Figure 3 Adaptive Management Plan
Vile Creek Mitigation Site
DMS Project No. 96582
Monitoring Year 5 - 2021

Alleghany County, NC

Vile Creek
Repairs Photo Log

Vile Creek R2: STA 118+50 - 118+80 - Right Bank Erosion 3-17-2021

Vile Creek R2: STA 118+80 – J-Hook structure failure 3-17-2021

Vile Creek R2: STA 120+70 - 121+00 – Right Bank Erosion. 3-17-2021

Vile Creek R2: STA 122+20 - 123+00 – Right Bank Erosion 3-17-2021

Vile Creek R2: STA 122+20 - 123+00 – Angled Log Riffle Failure. 7-01-2021

Vile Creek R2: STA 122+20-123+00 – Left Bank Erosion 3-17-2021

Vile Creek R2: STA 123+00 – Rock Sill Failure 3-17-2021

Vile Creek R2: STA 121+00 - 121+25 - Left Bank Erosion 5-23-2021

Vile Creek R3: STA 125+00 - 125+60 - Secondary Channel Erosion 3-17-2021

APPENDIX 2

Table 1. Project Components and Mitigation Credits
Vile Creek Mitigation Site
DMS Project No. 96582
Monitoring Year 3 - 2019

MITIGATION CREDITS									
	Stream		Riparian Wetland		Non-Riparian Wetland		Buffer	Nitrogen Nutrient Offset	Phosphorous Nutrient Offset
Type	R	RE	R	RE	R	RE			
Totals	5,053.000	N/A	5.703	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	882.000	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	1,311.000	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	279.000	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	630.000	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	750.000	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	48.000	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	89.000	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	490.000	
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	461.000	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	114.000	
WETLANDS											
Wetland Rehabilitation	3.02	3.02	Planting / Minor grading	Restoration (R)	N/A	3.02	3.02	1.3:1	N/A	2.323	
Wetland Re-establishment	0	3.50	Grading / Planting	Restoration (R)	N/A	3.38	3.38	1:1	N/A	3.380	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	3,047.000				
Enhancement I	1,114.000				
Enhancement II	3,895.000				
Wetland Rehabilitation		3.020			
Wetland Re-establishment		3.380			

Table 2. Vegetation Plot Criteria Attainment

Vile Creek Mitigation Site

DMS Project No. 96582

Monitoring Year 3 - 2019

Plot	MY3 Success Criteria Met (Y/N)	Tract Mean
1	Y	
2	Y	
3	Y	
4	Y	
5	N	
6	Y	
7	Y	
8	Y	
9	N	82%
10	Y	
11	Y	
12	Y	
13	Y	
14	N	
15	Y	
16	Y	
17	Y	

Table 3a. Planted and Total Stem Counts

Vile Creek Mitigation Site
DMS Project No. 96582
Monitoring Year 3 - 2019

			Current Plot Data (MY3 2019)																				
			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
Acer rubrum	Red Maple	Tree							1	1	1												
Alnus serrulata	Tag Alder	Shrub Tree																					
Aronia arbutifolia	Red Chokeberry	Shrub																					
Betula nigra	River Birch, Red Birch	Tree										3	3	3	1	1	1	4	4	4			
Carpinus caroliniana	Ironwood	Shrub Tree										1	1	1				2	2	2	1	1	1
Cephalanthus occidentalis	Buttonbush	Shrub Tree	2	2	2	6	6	6															
Cornus amomum	Silky Dogwood	Shrub Tree	1	1	1	3	3	3	13	13	13												
Diospyros virginiana	American Persimmon	Tree																					
Fraxinus pennsylvanica	Green Ash	Tree										3	3	3	3	3	3	2	2	2	7	7	7
Lindera benzoin	Northern Spicebush	Shrub Tree	1	1	1	1	1	1															
Liriodendron tulipifera	Tulip Poplar	Tree																3	3	3			
Platanus occidentalis	Sycamore	Tree										4	4	4	1	1	1	2	2	2	2	2	2
Quercus pagoda	Cherrybark Oak	Tree										2	2	2				3	3	3	2	2	2
		Stem count	4	4	4	10	10	10	14	14	14	13	13	13	5	5	5	16	16	16	12	12	12
		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	3	3	3	3	3	3	2	2	2	4	4	4	3	3	3	5	5	5	3	3	3
		Stems per ACRE	162	162	162	405	405	405	567	567	567	526	526	526	202	202	202	647	647	647	486	486	486

			Current Plot Data (MY3 2019)																				
			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
Acer rubrum	Red Maple	Tree																					
Alnus serrulata	Tag Alder	Shrub Tree																					
Aronia arbutifolia	Red Chokeberry	Shrub																					
Betula nigra	River Birch, Red Birch	Tree							2	2	2	3	3	3	2	2	2	2	2	2			
Carpinus caroliniana	Ironwood	Shrub Tree				1	1	1				3	3	3									
Cephalanthus occidentalis	Buttonbush	Shrub Tree																					
Cornus amomum	Silky Dogwood	Shrub Tree																					
Diospyros virginiana	American Persimmon	Tree	1	1	1										2	2	2	2	2	2			
Fraxinus pennsylvanica	Green Ash	Tree	6	6	6	1	1	1	6	6	6	1	1	1	3	3	3	1	1	1			
Lindera benzoin	Northern Spicebush	Shrub Tree																					
Liriodendron tulipifera	Tulip Poplar	Tree	2	2	2	1	1	1	2	2	2	3	3	3	1	1	2						
Platanus occidentalis	Sycamore	Tree	2	2	2	3	3	3	5	5	5	2	2	2	1	1	1	4	4	4	1	1	1
Quercus pagoda	Cherrybark Oak	Tree	2	2	2				3	3	3	1	1	1	4	4	4	3	3	3	2	2	2
		Stem count	13	13	13	6	6	6	18	18	18	13	13	13	13	13	14	12	12	12	3	3	3
		size (ares)		1			1		1				1			1			1			1	
		size (ACRES)		0.02			0.02		0.02				0.02			0.02			0.02			0.02	
		Species count	5	5	5	4	4	4	5	5	5	6	6	6	6	6	6	5	5	5	2	2	2
		Stems per ACRE	526	526	526	243	243	243	728	728	728	526	526	526	526	526	567	486	486	486	121	121	121

			Current Plot Data (MY3 2019)									Annual Means											
			Vegetation Plot 15			Vegetation Plot 16			Vegetation Plot 17			MY3 (9/2019)			MY2 (9/2018)			MY1 (9/2017)			MY0 (3/2017)		
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
Acer rubrum	Red Maple	Tree										1	1	1	1	1	2	1	1	1			
Aronia arbutifolia	Red Chokeberry	Shrub															3						
Alnus serrulata	Tag Alder	Shrub Tree																			1	1	1
Betula nigra	River Birch	Tree	2	2	2	8	8	8	1	1	1	27	27	27	29	29	29	43	43	43	55	55	55
Carpinus caroliniana	Ironwood	Shrub Tree	3	3	3				1	1	1	13	13	13	16	16	16	21	21	21	21	21	21
Cephalanthus occidentalis	Buttonbush	Shrub Tree										8	8	8	12	12	12	12	12	12	14	14	14
Cornus amomum	Silky Dogwood	Shrub Tree										17	17	17	17	17	19	16	16	16	19	19	19
Diospyros virginiana	American Persimmon	Tree	1	1	1				1	1	1	7	7	7	9	9	9	11	11	11	12	12	12
Fraxinus pennsylvanica	Green Ash	Tree							1	1	1	34	34	34	35	35	35	36	36	36	35	35	35
Lindera benzoin	Northern Spicebush	Shrub Tree										2	2	2	7	7	7	11	11	11	14	14	14
Liriodendron tulipifera	Tulip Poplar	Tree	1	1	1				3	3	3	15	15	16	18	18	18	24	24	24	38	38	38
Platanus occidentalis	Sycamore	Tree	6	6	6				3	3	3	37	37	37	38	38	39	40	40	40	40	40	40
Quercus pagoda	Cherrybark Oak	Tree	1	1	1	1	1	1	2	2	2	26	26	26	29	29	29	35	35	35	39	39	39
		Stem count	14	14	14	9	9	9	12	12	12	187	187	188	211	211	218	250	250	250	288	288	288
		size (ares)		1			1			1			1			1			1			1	
		size (ACRES)		0.02			0.02			0.02			0.42			0.42			0.42			0.42	
		Species count	6	6	6	2	2	2	7	7	7	11	11	11	11	11	12	11	11	11	11	11	11
		Stems per ACRE	567	567	567	364	364	364	486	486	486	445	445	448	502	502	519	595	595	595	686	686	686

* MY3 - MY7 vegetation plots one and two will use shrub density requirements to determine if success critera is met.

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 3b. Planted Herbaceous Cover (Bog Cells)
Vile Creek Mitigation Site
DMS Project No. 96582
Monitoring Year 3 - 2019

Percent Cover %								
Plot ID	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**MY6**	**MY7**
1	<5	30	65	100				
2	10	75	100	100				
3	<5	75	95	95				
4	<5	90	100	100				
5	<5	80	90	100				
6	<5	85	95	100				
7	<5	100	100	100				
8	50	95	100	100				

Table 4. Morphology and Hydraulic Summary (Dimensional Parameters - Cross-Section)

Vile Creek Mitigation Site

DMS Project No. 96582

Monitoring Year 3 - 2019

	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[1]	**Base**	**MY1**	**MY2**	**MY3**	**MY5**	**MY7**	**Base**	**MY1**	**MY2**	**MY3**	**MY5**	**MY7**	**Base**	**MY1**	**MY2**	**MY3**	**MY5**	**MY7**
Bankfull Elevation (ft)	2700.8	2700.7	2700.8	2700.8			2700.0	2700.0	2700.2	2700.2			2695.7	2695.7	2695.8	2695.6		
Low Bank Elevation (ft)	2700.8	2700.7	2700.8	2700.8			2700.0	2700.0	2700.2	2700.2			2695.7	2695.7	2695.8	2695.6		
Bankfull Width (ft)	25.1	24.6	25.6	15.8			17.1	17.6	20.4	18.9			18.8	17.9	19.4	19.9		
Floodprone Width (ft)	---	---	---	---			>200	>200	143.9	145.9			>200	>200	108.6	110.9		
Bankfull Mean Depth (ft)	1.2	1.1	1.0	1.5			1.2	1.3	1.6	1.7			1.1	1.2	1.2	1.1		
Bankfull Max Depth (ft)	3.0	2.8	2.5	2.6			2.1	2.3	3.1	3.3			1.9	2.2	2.6	2.5		
Bankfull Cross-Sectional Area (ft^2)	29.2	25.8	25.6	23.9			21.2	22.7	32.8	32.5			19.8	20.9	23.9	22.2		
Bankfull Width/Depth Ratio	---	---	---	---			13.7	13.7	12.8	10.9			17.8	15.3	15.8	17.9		
Bankfull Entrenchment Ratio[2]	---	---	---	---			>10.6	11.4	7.0	7.7			>10.7	>11.2	5.6	5.6		
Bankfull Bank Height Ratio	---	---	---	---			1.1	1.1	1.3	1.3			1.0	1.0	1.1	1.1		
	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[1]	**Base**	**MY1**	**MY2**	**MY3**	**MY5**	**MY7**	**Base**	**MY1**	**MY2**	**MY3**	**MY5**	**MY7**	**Base**	**MY1**	**MY2**	**MY3**	**MY5**	**MY7**
Bankfull Elevation (ft)	2691.7	2691.7	2691.7	2691.5			2688.9	2688.9	2689.0	2689.0			2687.9	2687.9	2688.1	2687.9		
Low Bank Elevation (ft)	2691.7	2691.7	2691.7	2691.5			2688.9	2688.9	2689.0	2689.0			2687.9	2687.9	2688.1	2687.9		
Bankfull Width (ft)	18.7	19.4	19.5	17.6			19.2	19.8	19.9	19.5			24.1	24.0	26.1	18.2		
Floodprone Width (ft)	188.0	188.0	88.6	89.2			156.0	156.0	96.9	101.0			---	---	---	---		
Bankfull Mean Depth (ft)	1.2	1.2	1.1	1.3			1.5	1.5	1.6	1.6			1.8	1.6	1.6	2.0		
Bankfull Max Depth (ft)	2.0	2.3	2.2	2.5			2.3	2.5	2.7	2.7			3.6	4.0	3.8	4.0		
Bankfull Cross-Sectional Area (ft^2)	22.5	23.1	21.7	22.0			28.6	29.7	31.3	31.0			44.3	39.6	41.9	36.3		
Bankfull Width/Depth Ratio	15.5	16.3	17.5	14.0			12.9	13.2	12.7	12.2			---	---	---	---		
Bankfull Entrenchment Ratio[2]	10.1	9.7	4.6	5.1			8.1	7.9	4.9	5.2			---	---	---	---		
Bankfull Bank Height Ratio	1.0	1.0	1.0	1.0			1.0	1.0	1.1	1.1			---	---	---	---		
	Cross-Section 7, UT1 Reach 1 (Riffle)						**Cross-Section 8, UT1 Reach 1 (Pool)**						**Cross-Section 9, UT1 Reach 1 (Riffle)**					
Dimension and Substrate[1]	**Base**	**MY1**	**MY2**	**MY3**	**MY5**	**MY7**	**Base**	**MY1**	**MY2**	**MY3**	**MY5**	**MY7**	**Base**	**MY1**	**MY2**	**MY3**	**MY5**	**MY7**
Bankfull Elevation (ft)	2743.9	2743.9	2744.1	2744.0			2725.7	2725.7	2726.0	2726.1			2725.3	2725.3	2725.4	2725.3		
Low Bank Elevation (ft)	2743.9	2743.9	2744.1	2744.0			2725.7	2725.7	2726.0	2726.1			2725.3	2725.3	2725.4	2725.3		
Bankfull Width (ft)	8.6	8.1	8.9	8.5			11.3	8.2	6.8	8.2			7.7	6.5	7.2	5.3		
Floodprone Width (ft)	63.0	63.0	83.7	85.5			---	---	---	---			97.0	97.0	81.8	83.2		
Bankfull Mean Depth (ft)	0.7	1.2	1.2	1.1			0.6	0.5	0.7	0.8			0.5	0.7	0.6	0.7		
Bankfull Max Depth (ft)	1.1	2.2	2.3	2.0			1.4	0.8	0.9	1.4			1.1	1.1	1.1	1.0		
Bankfull Cross-Sectional Area (ft^2)	5.9	9.4	10.3	9.3			7.1	4.4	4.5	6.6			4.1	4.2	4.2	3.6		
Bankfull Width/Depth Ratio	12.4	7.0	7.6	7.8			---	---	---	---			14.7	9.9	12.5	7.9		
Bankfull Entrenchment Ratio[2]	7.3	7.8	9.5	10.1			---	---	---	---			12.5	15.0	11.3	15.6		
Bankfull Bank Height Ratio	1.0	1.0	1.4	1.3			---	---	---	---			1.0	1.0	1.0	0.9		
	Cross-Section 10, UT1 Reach 2 (Pool)						**Cross-Section 11, UT1 Reach 2 (Riffle)**											
Dimension and Substrate[1]	**Base**	**MY1**	**MY2**	**MY3**	**MY5**	**MY7**	**Base**	**MY1**	**MY2**	**MY3**	**MY5**	**MY7**						
Bankfull Elevation (ft)	2713.5	2713.5	2713.3	2713.3			2712.9	2712.9	2712.9	2712.9								
Low Bank Elevation (ft)	2713.5	2713.5	2713.3	2713.3			2712.9	2712.9	2712.9	2712.9								
Bankfull Width (ft)	13.3	12.6	11.8	5.6			9.0	12.6	8.4	8.2								
Floodprone Width (ft)	---	---	---	---			96.0	96.0	85.3	86.8								
Bankfull Mean Depth (ft)	0.9	0.7	0.5	0.9			0.8	0.5	0.8	0.9								
Bankfull Max Depth (ft)	1.9	1.8	1.7	1.8			1.3	1.4	1.5	1.4								
Bankfull Cross-Sectional Area (ft^2)	12.6	9.0	6.3	4.8			7.8	6.5	7.0	7.4								
Bankfull Width/Depth Ratio	---	---	---	---			11.4	24.5	10.2	9.0								
Bankfull Entrenchment Ratio[2]	---	---	---	---			10.7	7.6	10.1	10.6								
Bankfull Bank Height Ratio	---	---	---	---			1.0	1.0	0.9	1.0								

[1] MY2 – MY7 Bank Height Ratio was calculated based on the As-built (MY0) cross-sectional area as described in the Standard Measurement of the BHR Monitoring Parameter document provided by the NCIRT and NCDMS (9/2018). The remainder of the cross-section dimension parameters were calculated based on the current year's low bank height.

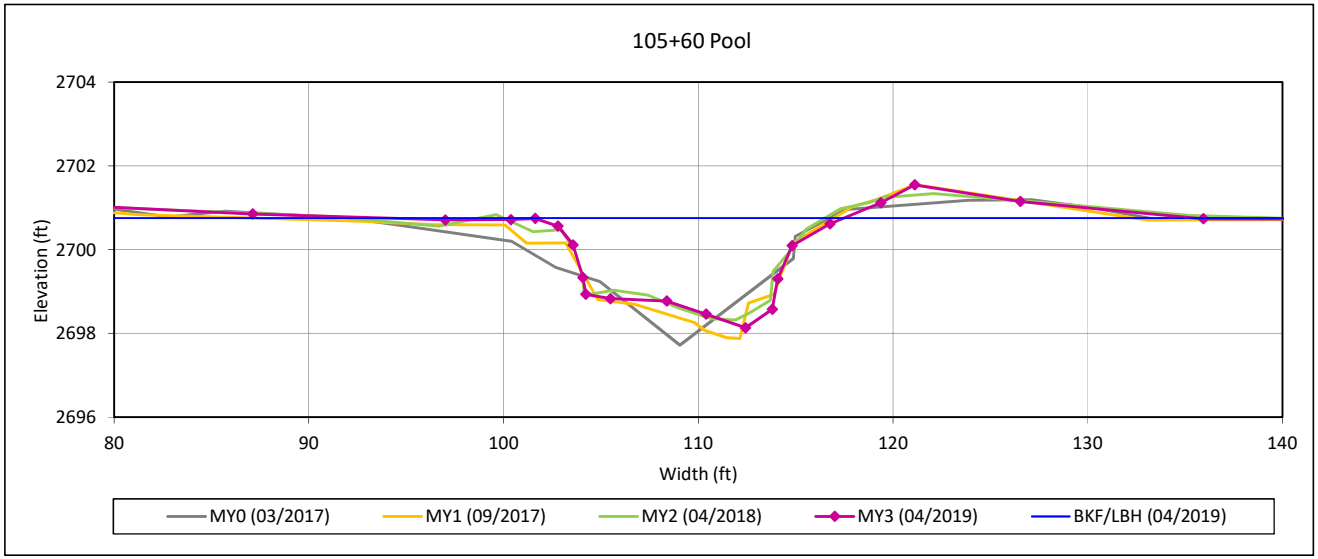
[2] ER in MY3 is based on the width of the cross-section, in lieu of assuming the width across the floodplain as was done in previous monitoring years.

Prior to MY2, bankfull dimensions were calculated using a fixed bankfull elevation.

Cross-section Plots

Vile Creek Mitigation Site
DMS Project No. 96582
Monitoring Year 3 - 2019

Cross-section 1 - Vile Creek Reach 1



Bankfull Dimensions	
23.9	x-section area (ft.sq.)
15.8	width (ft)
1.5	mean depth (ft)
2.6	max depth (ft)
17.7	wetted perimeter (ft)
1.3	hydraulic radius (ft)
10.5	width-depth ratio

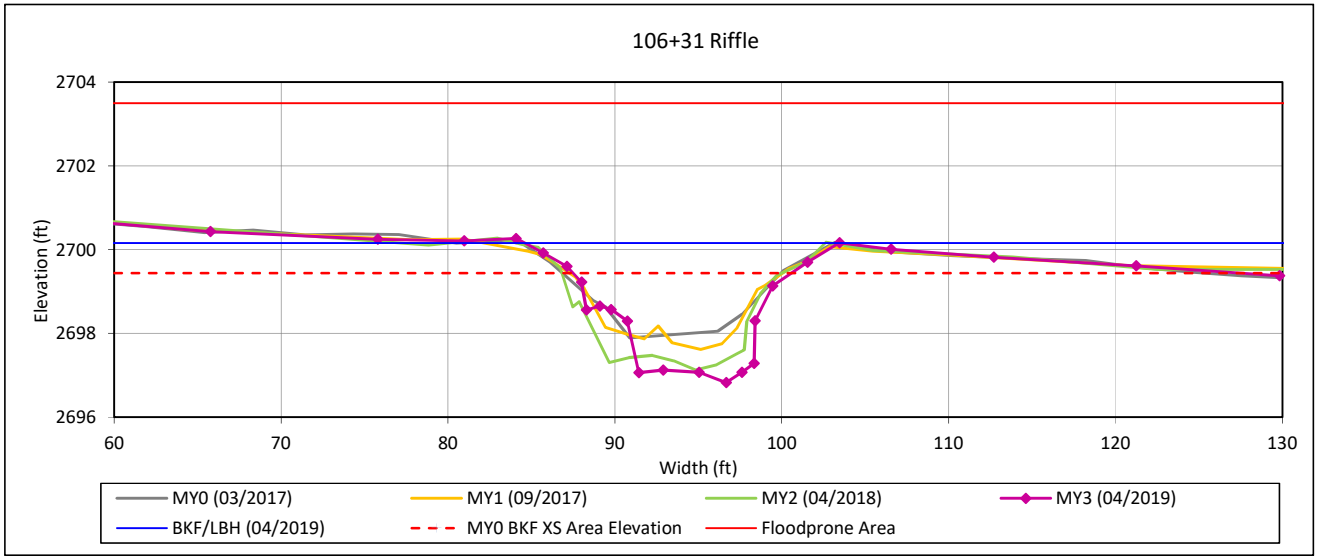
Survey Date: 04/2019
Field Crew: Wildlands Engineering

View Downstream

Cross-section Plots

Vile Creek Mitigation Site
DMS Project No. 96582
Monitoring Year 3 - 2019

Cross-section 2 - Vile Creek Reach 1



Bankfull Dimensions	
32.5	x-section area (ft.sq.)
18.9	width (ft)
1.7	mean depth (ft)
3.3	max depth (ft)
21.7	wetted perimeter (ft)
1.5	hydraulic radius (ft)
10.9	width-depth ratio
145.9	W flood prone area (ft)
7.7	entrenchment ratio
1.3	low bank height ratio

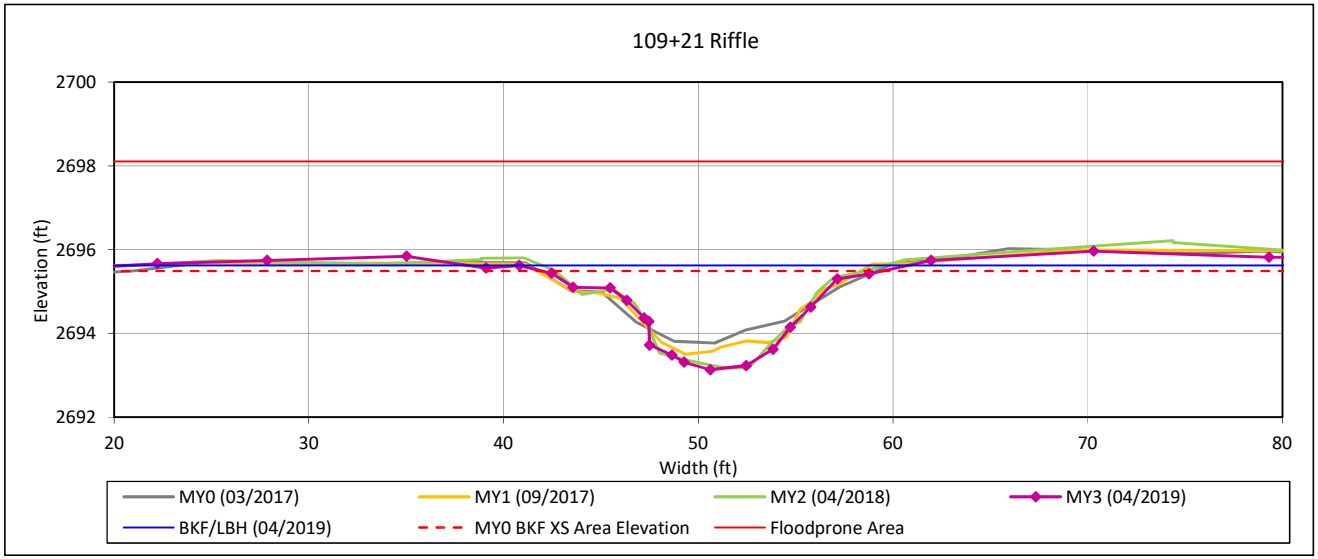
Survey Date: 04/2019
Field Crew: Wildlands Engineering

View Downstream

Cross-section Plots

Vile Creek Mitigation Site
DMS Project No. 96582
Monitoring Year 3 - 2019

Cross-section 3 - Vile Creek Reach 1



Bankfull Dimensions	
22.2	x-section area (ft.sq.)
19.9	width (ft)
1.1	mean depth (ft)
2.5	max depth (ft)
21.2	wetted perimeter (ft)
1.0	hydraulic radius (ft)
17.9	width-depth ratio
110.9	W flood prone area (ft)
5.6	entrenchment ratio
1.1	low bank height ratio

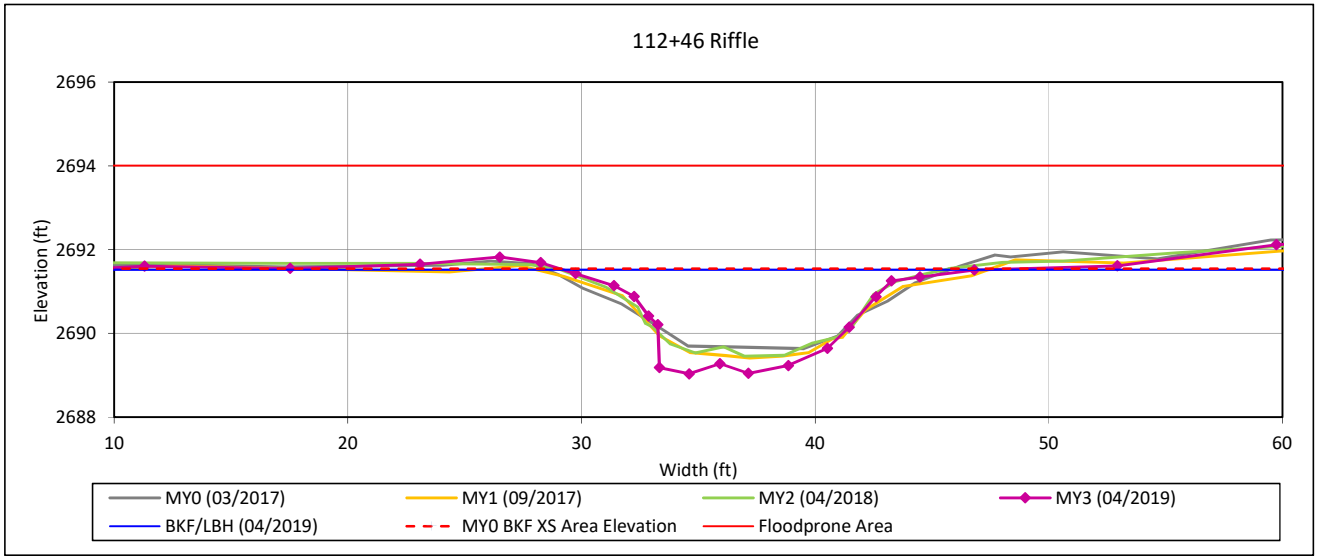
Survey Date: 04/2019
Field Crew: Wildlands Engineering

View Downstream

Cross-section Plots

Vile Creek Mitigation Site
DMS Project No. 96582
Monitoring Year 3 - 2019

Cross-section 4 - Vile Creek Reach 2



Bankfull Dimensions	
22.0	x-section area (ft.sq.)
17.6	width (ft)
1.3	mean depth (ft)
2.5	max depth (ft)
19.4	wetted perimeter (ft)
1.1	hydraulic radius (ft)
14.0	width-depth ratio
89.2	W flood prone area (ft)
5.1	entrenchment ratio
1.0	low bank height ratio

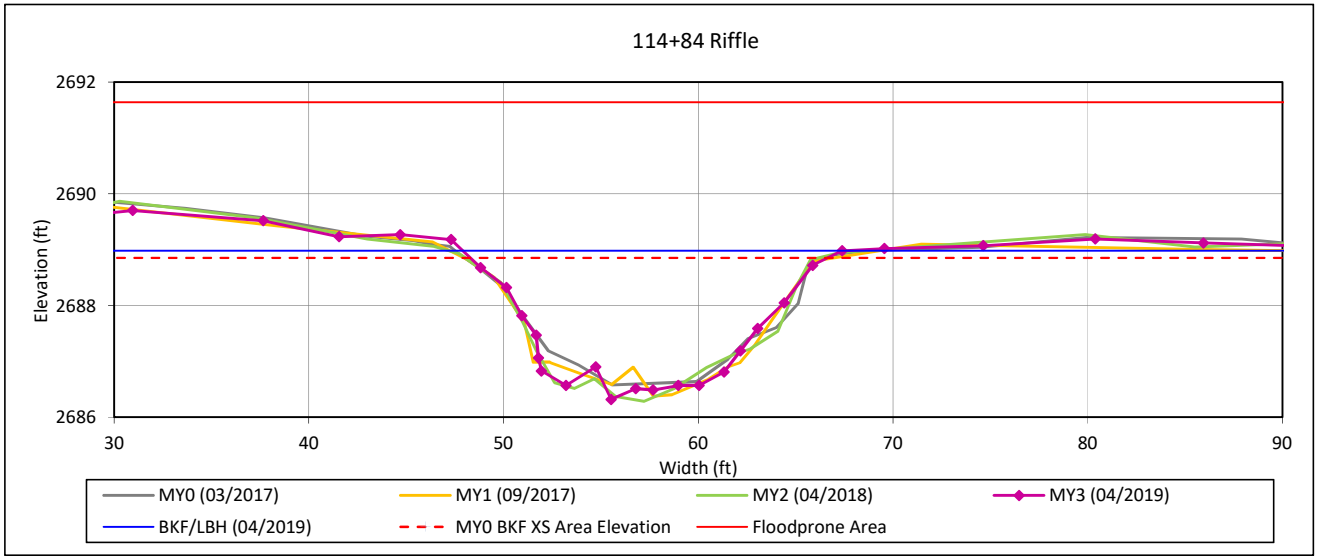
Survey Date: 04/2019
Field Crew: Wildlands Engineering

View Downstream

Cross-section Plots

Vile Creek Mitigation Site
DMS Project No. 96582
Monitoring Year 3 - 2019

Cross-section 5 - Vile Creek Reach 2



Bankfull Dimensions	
31.0	x-section area (ft.sq.)
19.5	width (ft)
1.6	mean depth (ft)
2.7	max depth (ft)
20.9	wetted perimeter (ft)
1.5	hydraulic radius (ft)
12.2	width-depth ratio
101.0	W flood prone area (ft)
5.2	entrenchment ratio
1.1	low bank height ratio

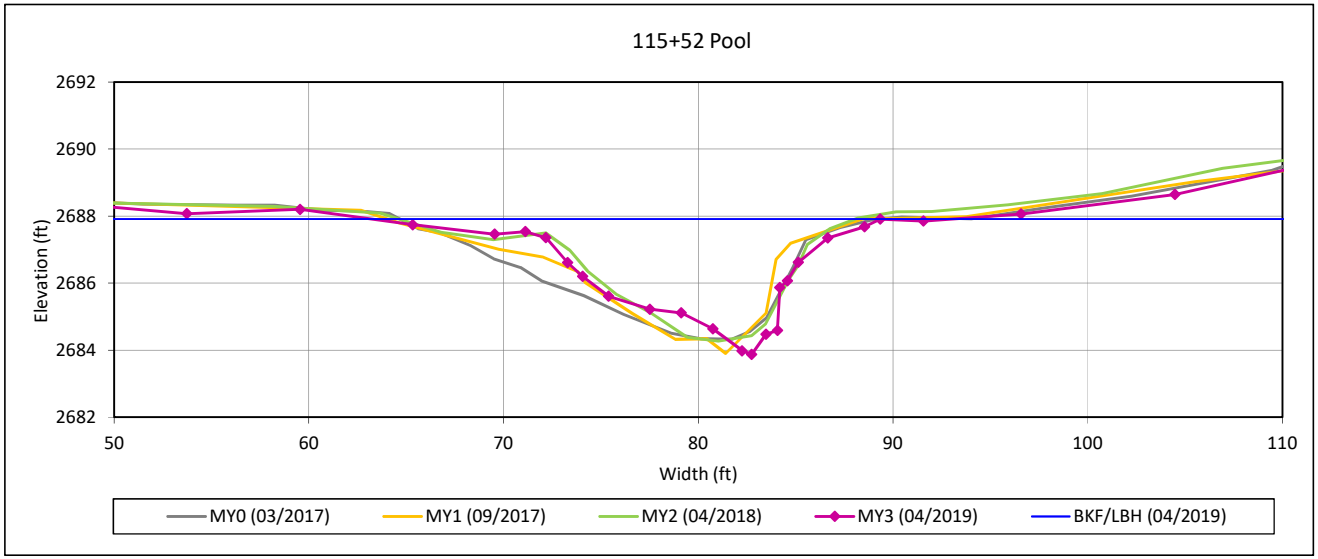
Survey Date: 04/2019
Field Crew: Wildlands Engineering

View Downstream

Cross-section Plots

Vile Creek Mitigation Site
DMS Project No. 96582
Monitoring Year 3 - 2019

Cross-section 6 - Vile Creek Reach 2



Bankfull Dimensions	
36.3	x-section area (ft.sq.)
18.2	width (ft)
2.0	mean depth (ft)
4.0	max depth (ft)
20.9	wetted perimeter (ft)
1.7	hydraulic radius (ft)
9.2	width-depth ratio

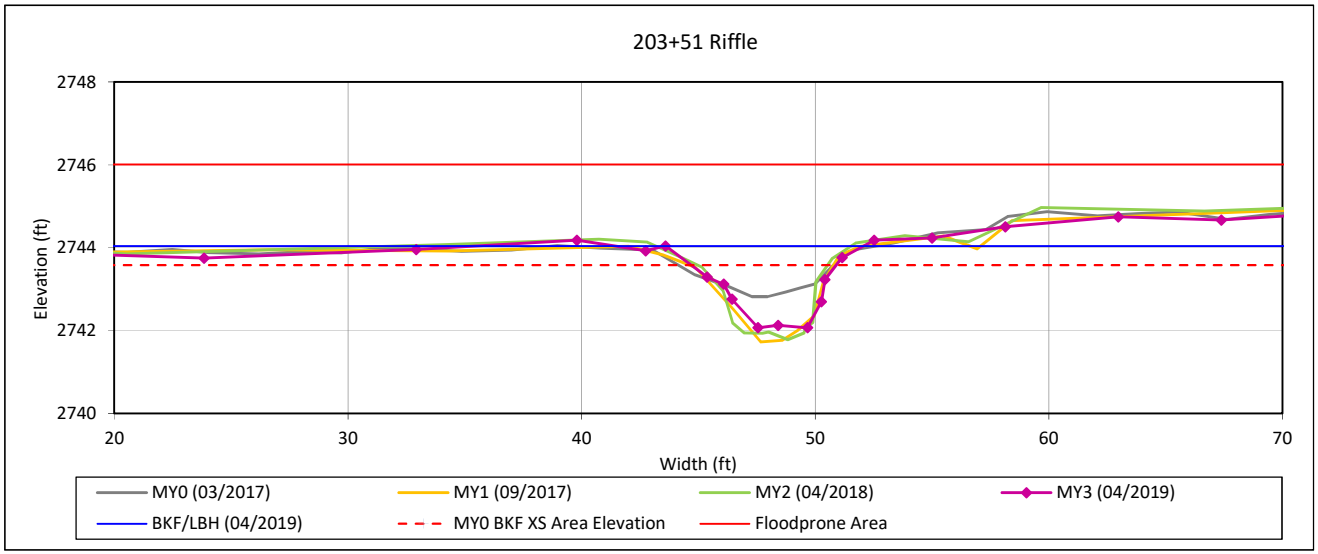
Survey Date: 04/2019
Field Crew: Wildlands Engineering

View Downstream

Cross-section Plots

Vile Creek Mitigation Site
DMS Project No. 96582
Monitoring Year 3 - 2019

Cross-section 7 - UT1 Reach 1



Bankfull Dimensions	
9.3	x-section area (ft.sq.)
8.5	width (ft)
1.1	mean depth (ft)
2.0	max depth (ft)
9.9	wetted perimeter (ft)
0.9	hydraulic radius (ft)
7.8	width-depth ratio
85.5	W flood prone area (ft)
10.1	entrenchment ratio
1.3	low bank height ratio

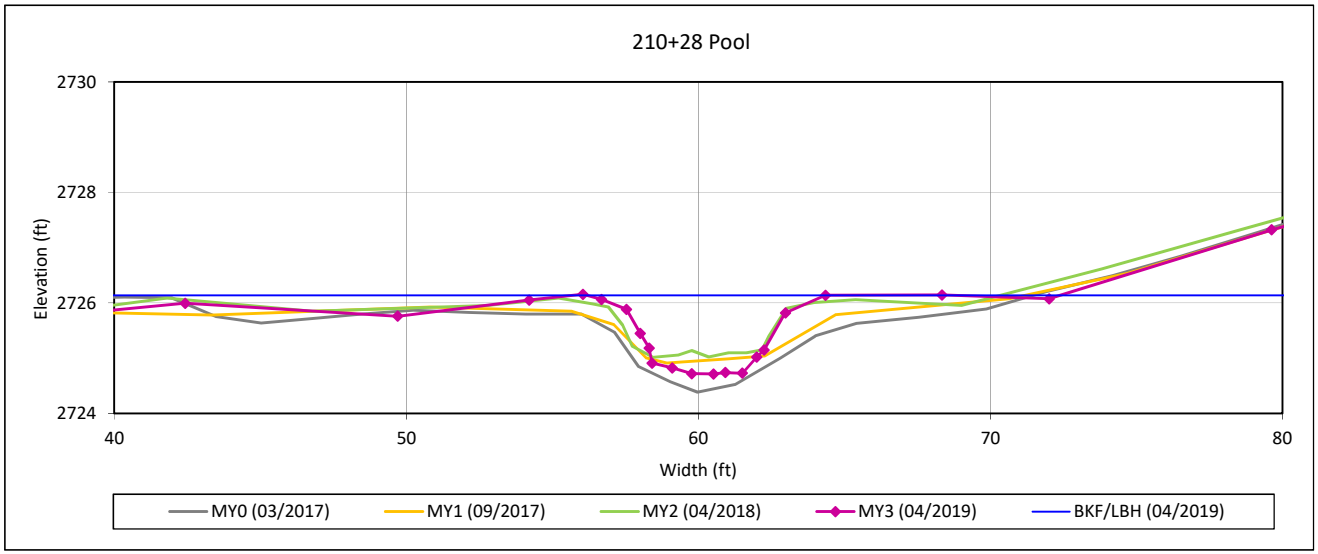
Survey Date: 04/2019
Field Crew: Wildlands Engineering

View Downstream

Cross-section Plots

Vile Creek Mitigation Site
DMS Project No. 96582
Monitoring Year 3 - 2019

Cross-section 8 - UT1 Reach 1



Bankfull Dimensions	
6.6	x-section area (ft.sq.)
8.2	width (ft)
0.8	mean depth (ft)
1.4	max depth (ft)
9.1	wetted perimeter (ft)
0.7	hydraulic radius (ft)
10.2	width-depth ratio

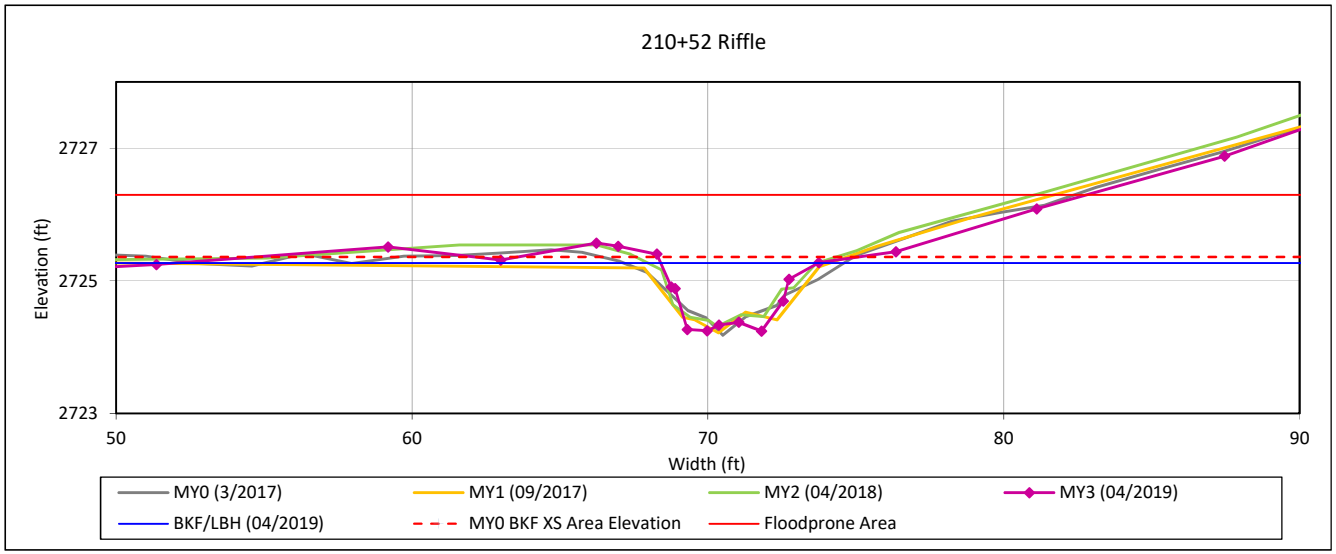
Survey Date: 04/2019
Field Crew: Wildlands Engineering

View Downstream

Cross-section Plots

Vile Creek Mitigation Site
DMS Project No. 96582
Monitoring Year 3 - 2019

Cross-section 9 - UT1 Reach 1



Bankfull Dimensions	
3.6	x-section area (ft.sq.)
5.3	width (ft)
0.7	mean depth (ft)
1.0	max depth (ft)
6.2	wetted perimeter (ft)
0.6	hydraulic radius (ft)
7.9	width-depth ratio
83.2	W flood prone area (ft)
15.6	entrenchment ratio
0.9	low bank height ratio

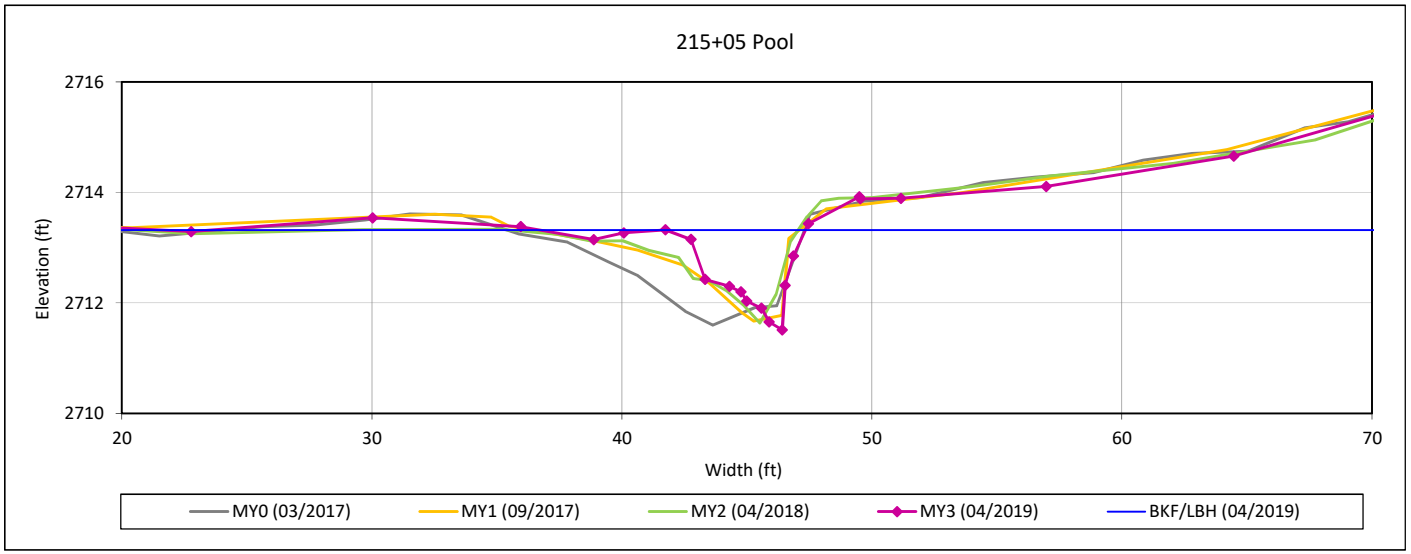
Survey Date: 04/2019
Field Crew: Wildlands Engineering

View Downstream

Cross-section Plots

Vile Creek Mitigation Site
DMS Project No. 96582
Monitoring Year 3 - 2019

Cross-section 10 - UT1 Reach 2



Bankfull Dimensions	
4.8	x-section area (ft.sq.)
5.6	width (ft)
0.9	mean depth (ft)
1.8	max depth (ft)
7.3	wetted perimeter (ft)
0.7	hydraulic radius (ft)
7.1	width-depth ratio

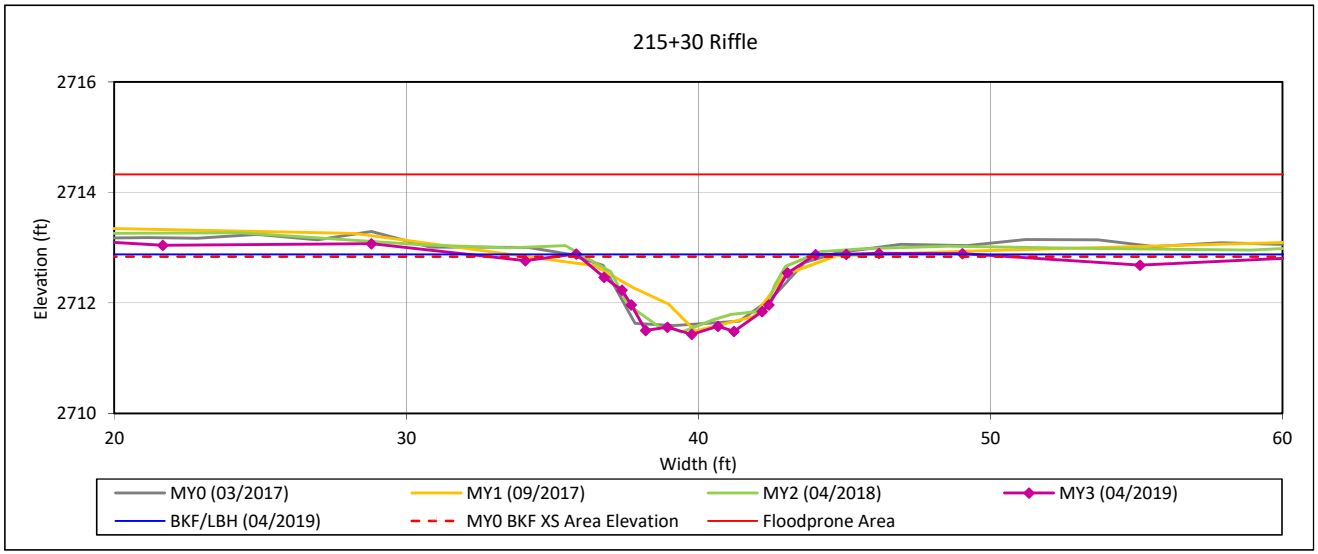
Survey Date: 04/2019
Field Crew: Wildlands Engineering

View Downstream

Cross-section Plots

Vile Creek Mitigation Site
DMS Project No. 96582
Monitoring Year 3 - 2019

Cross-section 11 - UT1 Reach 2



Bankfull Dimensions	
7.4	x-section area (ft.sq.)
8.2	width (ft)
0.9	mean depth (ft)
1.4	max depth (ft)
9.0	wetted perimeter (ft)
0.8	hydraulic radius (ft)
9.0	width-depth ratio
86.8	W flood prone area (ft)
10.6	entrenchment ratio
1.0	low bank height ratio

Survey Date: 04/2019
Field Crew: Wildlands Engineering

View Downstream

APPENDIX 3

Approved Planting Plan from Vile Creek Mitigation Plan

Riparian Planting Zone Plant List

Species	Common Name	Spacing	Min. Caliper	Percentage
Alnus serrulata	Tag Alder	12ft x 6ft	0.25"	10%
Carpinus caroliniana	American Hornbeam	12ft x 6ft	0.25"	10%
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%
Diospyros virginiana	Persimmon	12ft x 6ft	0.25"	10%

Understory Planting Zone Plant List

Species	Common Name	Spacing	Min. Caliper	Percentage
Carpinus caroliniana	American Hornbeam	12ft x 12ft	0.25"	25%
Aronia arbutifolia	Red Chokeberry	12ft x 12ft	0.25"	25%
Ilex verticillata	Winter Berry	12ft x 12ft	0.25"	25%
Lindera benzoin	Spicebush	12ft x 12ft	0.25"	25%

Wetland Shrub Planting Zone Plant List

Species	Common Name	Spacing	Min. Caliper	Percentage
Aronia arbutifolia	Red Chokeberry	12ft x 12ft	0.25"	15%
Cornus amomum	Silky Dogwood	12ft x 12ft	0.25"	15%
Ilex verticillata	Winter Berry	12ft x 12ft	0.25"	15%
Lindera benzoin	Spicebush	12ft x 12ft	0.25"	15%
Sambucus nigra	Elderberry	12ft x 12ft	0.25"	10%
Vaccinium corymbosum	Highbush Blueberry	12ft x 12ft	0.25"	15%
Cephalanthus occidentalis L.	Common Buttonbush	12ft x 12ft	0.25"	15%

Herbaceous Planting Zone Plant List

Species	Common Name	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%

Table 14e. Streambank Planting Zone Livestakes Plant List

Species	Common Name	Spacing	Min. Caliper	Percentage
Cornus amomum (livestake)	Silky Dogwood	3-5 ft	0.5"	20%
Cephalanthus occidentalis L.	Common Buttonbush	3-5 ft	0.5"	20%

Salix sericea (livestake)	Silky Willow	3-5 ft	0.5"	20%
Physocarpos opulifolius	Ninebark	3-5 ft	0.5"	20%
Alnus serrulata	Tag Alder	3-5 ft	0.5"	20%

Streambank Planting Zone Herbaceous Plugs Plant List

Species	Common Name	Spacing	Percentage
Juncus effusus	Common Rush	4 ft	40%
Carex alata	Broadwing Sedge	4 ft	40%
Panicum virgatum	Switchgrass	4 ft	20%

Permanent Seed Mix

Approved Date	Species Name	Common Name	Stratum	Density (lbs/acre)
All Year	*Schizachyrium scoparium*	Little Bluestem	Herb	3.0
All Year	*Panicum virgatum*	Swithgrass	Herb	3.0
All Year	*Rudbeckia hirta*	Blackeyed Susan	Herb	3.0
All Year	*Carex vulpinoidea*	Fox Sedge	Herb	3.0
All Year	*Panicum clandestinum*	Deertongue	Herb	3.0
All Year	*Elymus virginicus*	Virginia Wild Rye	Herb	3.0
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