



MONITORING YEAR 6 ANNUAL REPORT

Final

HOGAN CREEK STREAM MITIGATION PROJECT

Surry County, NC

DEQ Contract 6496

DMS Project Number 94708

DWR # 20120182

USACE Action ID SAW-2011-02268

Data Collection Period: February - September 2020

Draft Submission Date: October 19, 2020

Final Submission Date: November 13, 2020

PREPARED FOR:



NC Department of Environmental Quality

Division of Mitigation Services

1652 Mail Service Center

Raleigh, NC 27699-1652

Mitigation Project Name Hogan Creek
DMS ID 94708
River Basin Yadkin
Cataloging Unit 03040101
County Surry

USACE Action ID 2011-02268
DWR Permit 2012-0182
Date Project Instituted 10/18/2020
Date Prepared 4/20/2020
Stream/Wet. Service Area Yadkin 03040101



Signature & Date of Official Approving Credit Release

- 1 - For NCDMS, no credits are released during the first milestone
2 - For NCDMS projects, the initial credit release milestone occurs automatically when the as-built report (baseline monitoring report) has been made available to the IRT by posting it to the DMS portal, provided the following have been met:
1) Approved of Final Mitigation Plan
2) Recordation of the preservation mechanism, as well as a title opinion acceptable to the USACE covering the property.
3) Completion of all physical and biological improvements to the mitigation site pursuant to the mitigation plan.
4) Receipt of necessary DA permit authorization or written DA approval for projects where DA permit issuance is not required.
3 - A 10% reserve of credits is to be held back until the bankfull event performance standard has been met.

Credit Release Milestone	Cool Stream Credits						
	Scheduled Releases %	Proposed Releases %	Proposed Released #	Not Approved # Releases	Approved Credits	Anticipated Release Year	Actual Release Date
1 - Site Establishment	N/A	N/A	N/A	N/A	N/A	N/A	N/A
2 - Year 0 / As-Built	30.00%	30.00%	1,526.700	0.000	1,526.700	2015	9/29/2015
3 - Year 1 Monitoring	10.00%	10.00%	508.900	0.000	508.900	2016	4/25/2016
4 - Year 2 Monitoring	10.00%	10.00%	499.371	38.113	461.258	2017	10/20/2017
5 - Year 3 Monitoring	10.00%	10.00%	499.371	0.000	499.371	2018	4/26/2019
6 - Year 4 Monitoring	10.00%	10.00%	499.371	0.000	499.371	2019	4/26/2019
7 - Year 5 Monitoring	15.00%	5.00%	749.057	499.372	249.686	2020	4/20/2020
8 - Year 6 Monitoring		10.00%	499.372			2021	
Stream Bankfull Standard	15.00%	15.00%	749.058	0.000	749.058	2017	10/20/2017
			Totals	38.113	4,494.344		

Total Gross Credits	4,993.716
Total Unrealized Credits to Date	0.000
Total Released Credits to Date	4,494.344
Total Percentage Released	90.00%
Remaining Unrealized Credits	499.372

Notes

- 10/20/2017: Adjustment required due to IRT concerns on how the as-built credits were calculated.
8/15/2018: Due to repairs required on this project, stream credits scheduled for release in 2018 were withheld and additional monitoring years required.
4/20/2020: IRT wants an additional year of monitoring and continue treating evasives prior to considering close out. Agreed to release 5% of the credits this year.

Contingencies (if any)

Project Quantities

Mitigation Type	Restoration Type	Physical Quantity
Cool Stream	Restoration	2,493.000
Cool Stream	Enhancement I	1,200.000
Cool Stream	Enhancement II	416.000
Cool Stream	Preservation	5,673.000

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Debits

							Stream Restoration Credits	Stream Restoration Equivalent Credits
Beginning Balance (mitigation credits)							3,859.324	1,134.392
Released Credits							3,473.392	1,020.953
Unrealized Credits							0.000	0.000
Owning Program	Req. Id	TIP #	Project Name	USACE Permit #	DWR Permit #	DCM Permit #		
NCDOT Stream & Wetland ILF Program	REQ-005879		SR 1740 Improvements - Division 11	2013-01145			35.000	
NCDOT Stream & Wetland ILF Program	REQ-006913		SR 1302 - Bridges 403 & 700 - Division 11	2017-01457			191.000	
NCDOT Stream & Wetland ILF Program	REQ-006916		SR 1728 - Bridges 150 & 151 - Division 11	2017-01747			100.000	
NCDOT Stream & Wetland ILF Program	REQ-008412	B-4977	B-4977 - Bridge on SR 1313 over a UT to Fish Dam Creek	2019-02450			77.000	
NCDOT Stream & Wetland ILF Program	REQ-008476	BR-0125	BR-0125 - Bridge 662 on SR 1002	2020-00329			225.000	
NCDOT Stream & Wetland ILF Program	REQ-006913		SR 1302 - Bridges 403 & 700 - Division 11	2017-01457				153.000
NCDOT Stream & Wetland ILF Program	REQ-006916		SR 1728 - Bridges 150 & 151 - Division 11	2017-01747				100.000
NCDOT Stream & Wetland ILF Program	REQ-008412	B-4977	B-4977 - Bridge on SR 1313 over a UT to Fish Dam Creek	2019-02450				77.000
NCDOT Stream & Wetland ILF Program	REQ-008476	BR-0125	BR-0125 - Bridge 662 on SR 1002	2020-00329				225.000
Total Credits Debited							628.000	555.000
Remaining Available balance (Released credits)							2,845.392	465.953
Remaining balance (Unreleased credits)							385.932	113.439

PREPARED BY:



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Charlotte, NC 28203

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November 13, 2020

Mr. Matthew Reid
Western Project Manager
Division of Mitigation Services
5 Ravenscroft Dr., Suite 102
Asheville, NC 28801

RE: Hogan Creek Stream Mitigation Project
Yadkin River Basin – CU# 03040101
Surry County, North Carolina
NCEEP Project # 94708
Contract No. 6496

Dear Mr. Reid:

Wildlands Engineering, Inc. (Wildlands) has reviewed the Division of Mitigation Services (DMS) comments from the Draft Monitoring Year 6 report for the Hogan Creek Stream Mitigation Project. The following Wildlands responses to DMS's report comments are noted in italics lettering.

DMS comment; MY6 is the final year of monitoring activities for the Hogan Creek Stream Mitigation Project. The site will be presented to the IRT for regulatory closeout in 2021. Please update the Executive Summary and Project Overview to acknowledge that MY6 is the final year of monitoring, success criteria have been met and the site will be presented for closeout in 2021.

Wildlands response; Text in the Executive Summary and Project Overview has been updated to acknowledge that MY6 is the final year of monitoring, success criteria have been met and the Site will be presented for closeout in 2021.

DMS comment; Section 1: Project Overview: Third paragraph discusses final design, asbuilt information and the stream maintenance completed in 2015. Since this information is found in Table 2 and has previously been mentioned in past monitoring reports, please revise this paragraph to focus on MY6 monitoring and upcoming closeout.

Wildlands response; Text in the third paragraph of the Project Overview has been revised to focus on MY6 monitoring and upcoming closeout.

DMS comment; 1.2.2 Vegetation Areas of concern and Management Activities: Please add a sentence stating that additional invasive treatment occurred in May, August and September of 2020.

Wildlands response; Text in Section 1.2.2 has been updated to indicate that invasive treatments occurred in May, August, and September 2020.

DMS comment; Table 2: Please add Invasive Species Treatment dates: May/Aug/Sep – 2020



Wildlands response; The invasive species treatment dates have been added to Table 2.

DMS comment; Thank you for updating the CCPV to reflect the invasive treatment that has occurred on the site. DMS will continue to have the invasives treated through December 2021.

Wildlands response; Text in Section 1.2.2 has been updated to specify that invasive treatments will continue through December 2021.

DMS comment; Table 6b and 6c: There are two structures marked as unstable under the “Overall Integrity” category, but they are not shown on the CCPV or discussed in the stream problem area of the report. Can you please verify if these are still problems or if they have healed over time? Please add a call out or mark the location of the structures on the CCPV if they are a problem or remove from the table.

Wildlands response; Two rootwad structures, one along Hogan Creek Reach 2 near station 37+30 and the other along UT2 near station 9+50, were noted to have some bank scour at these locations which is shown on the CCPV. However, upon additional consideration, the overall integrity of these structures has not been compromised since the bank scour is minor with woody vegetation still established along the bank. Tables 6b and 6c have been updated to account for this just in the Bank Protection channel sub-category.

DMS comment; Please include the attached invasive species treatment log in the appendix.

Wildlands response; The invasive species treatment log has been included in the appendix.

DMS comment; As Wildlands has done in the past, please include a response to the comment letter and how/where the comments were addressed. Please insert this letter directly behind the cover page in the final deliverables. The IRT has requested that we include this letter with the final deliverables. The response letter will need to be included with all future monitoring deliverables.

Wildlands response; The comment response letter has been inserted behind the cover page in the final deliverables.

Enclosed please find one (1) hard copy and one (1) electronic copy on CD of the Final Monitoring Report. Please contact me at 704-941-9093 if you have any questions.

Sincerely,

Kirsten Y. Gimbert
Project Manager
kgimbert@wildlandseng.com

EXECUTIVE SUMMARY

The North Carolina Department of Environmental Quality (NCDEQ) Division of Mitigation Services (DMS) restored, enhanced, and preserved approximately 9,782 linear feet (LF) of stream channel at the Hogan Creek Stream Mitigation Site (Site) in Surry County, North Carolina. The restoration project was developed to fulfill stream mitigation requirements accepted by the DMS for the Upper Yadkin River Basin 8-digit Hydrologic Unit Code (HUC) 03040101. The Hogan Creek Stream Mitigation Project will net 4,994 stream mitigation credits through a combination of restoration, enhancement I and II, and preservation.

The Site is within a Targeted Local Watershed (TLW) identified in the Upper Yadkin River Basin Restoration Priority (RBRP) plan (NCDENR, 2009). The RBRP identified the Candiff Creek/Hogan Creek 14-digit HUC as a TLW due to water quality and habitat impacts from past and present agricultural practices. Agriculture is the primary land use in the watershed (41% agriculture land cover) and the RBRP identified non-forested buffers and livestock operations as major stressors to water quality. There are twenty-six permitted animal operations, and twenty-five (25%) of the watershed has non-forested riparian buffers. The site assessment phase of the project identified other stressors as well, including bank erosion, sediment deposition, disconnection of the streams and floodplains, and exotic plant species. The project was identified as an opportunity to improve water quality and aquatic and terrestrial habitats within the TLW. In addition to being within an TLW, the upper Hogan Creek subwatershed has been identified as a priority area for stream restoration and agricultural best management practices (BMPs) as part of DMS's initial Ararat River Local Watershed Planning (LWP) effort (EcoEngineering, 2008).

The final design was completed in November of 2012. Construction activities and as-built surveys were completed in December of 2014. Planting of the Site took place in March of 2015. Baseline monitoring efforts began in May of 2015, and Monitoring Year (MY) 1 efforts began in October of 2015. The region experienced an unusually high amount of precipitation during fall/winter 2015. The storm events damaged several areas on Hogan Creek Reach 1 and Reach 2 that were subsequently repaired in December of 2015. Beginning in 2016, monitoring has been conducted annually with MY6 activities completed in September of 2020.

To address previously noted areas of bank erosion, a repair along Hogan Creek was completed in March 2019. Approximately 980 feet of live lifts were installed and a constructed riffle was repaired on Hogan Reach 2. Transplants were used where possible, and disturbed areas were replanted with bare roots, live stakes and permanent/temporary seeding. Construction began in February 2019 and finished up March 2019. Following the Interagency Review Team (IRT) credit release site walk in MY4, an additional year of monitoring was requested to further assess the repairs.

The Hogan Creek Stream Mitigation Project has met monitoring success criteria for vegetation, geomorphology, and hydrology performance standards. The MY6 vegetation survey resulted in an average stem density of 425 planted stems per acre and is meeting the final success criterion of 260 stems per acre with all six plots (100%) individually meeting this requirement. The MY6 vegetation monitoring and visual assessment revealed that the invasive treatments are working to significantly reduce the areas of invasive plant populations. Geomorphic surveys and visual assessments indicate that project streams, including recently stabilized areas along Hogan Creek Reach 1 and Reach 2, appear stable and functioning as intended. The hydrology performance standard of two recorded bankfull events in separate monitoring years was met in MY2 for Hogan Creek and UT2. MY6 is the final year of monitoring and since project success criteria has been met, the Site will be presented for closeout in 2021.



HOGAN CREEK STREAM MITIGATION PROJECT
Year 6 Monitoring Report

TABLE OF CONTENTS

Section 1: PROJECT OVERVIEW1-1

 1.1 Project Goals and Objectives 1-1

 1.2 Monitoring Year 6 Data Assessment..... 1-2

 1.2.1 Vegetation Assessment..... 1-2

 1.2.2 Vegetation Areas of Concern and Management Activity 1-2

 1.2.3 Stream Assessment..... 1-3

 1.2.4 Stream Areas of Concern and Management Activity..... 1-3

 1.2.5 Hydrology Assessment..... 1-3

 1.3 Monitoring Year 6 Summary 1-4

Section 2: METHODOLOGY.....2-1

Section 3: REFERENCES3-1

APPENDICES

Appendix A General Tables and Figures

Figure 1 Project Vicinity Map

Figure 2 Project Component/Asset Map

Table 1 Project Components and Mitigation Credits

Table 2 Project Activity and Reporting History

Table 3 Project Contacts Table

Table 4 Project Baseline Information and Attributes

Table 5 Monitoring Component Summary

Appendix B Visual Assessment Data

Figures 3.0-3.3 Current Condition Plan View Maps

Table 6a-d Visual Stream Morphology Stability Assessment Table

Table 7 Vegetation Condition Assessment Table

Stream Photographs

Vegetation Photographs

Appendix C Vegetation Plot Data

Table 8 Vegetation Plot Criteria Attainment

Table 9 CVS Vegetation Plot Metadata

Table 10 Planted and Total Stem Counts

Appendix D Morphological Summary Data and Plots

Table 11a-c Baseline Stream Data Summary

Table 12 Morphology and Hydraulic Summary (Dimensional Parameters – Cross-Section)

Table 13a-c Monitoring Data - Stream Reach Data Summary

Cross-Section Plots with Annual Overlays

Longitudinal Profiles with Annual Overlays

Pebble Count Plots with Annual Overlays

Appendix E Hydrology Summary Data and Plots

Table 14 Verification of Bankfull Events

Monthly Rainfall Data

Appendix F Invasive Species Treatment Logs



Section 1: PROJECT OVERVIEW

The Site was implemented under a design-bid-build contract in Surry County, NC. The Site is located in the Yadkin River Basin; eight-digit Hydrologic Unit Code (HUC) 03040101 and the 14-digit HUC 03040101110060 (Figure 1). Located in the Piedmont physiographic province (NCGS 2004), the project watershed primarily includes agricultural land cover. The drainage area for the lower end of Hogan Creek is 1,514 acres. Hogan Creek is a main tributary to the Yadkin River in the Upper Yadkin River Basin. The Site is located approximately 2 miles south of NC 268 on Miller Gap Road, which bisects the project at the triple box culvert over Hogan Creek. A vicinity map is included in Appendix A as Figure 1.

The NCDEQ DMS restored, enhanced, and preserved approximately 9,782 LF of Hogan Creek and three unnamed tributaries (UTs), provided livestock fencing and alternative water sources to keep livestock out of the streams, removed invasive plant species across the project, established native riparian buffer, and preserved relatively un-impacted forested streams. The restoration project was developed to fulfill stream mitigation requirements accepted by the DMS for the Upper Yadkin River Basin.

Mitigation work within the Site included restoring and enhancing 4,109 LF and preserving 5,673 LF of stream. The Hogan Creek Mitigation Project will net 4,994 stream mitigation credits through a combination of restoration, enhancement I and II, and preservation. To further assess the repairs along Hogan Creek that were completed in March 2019, an additional year of monitoring (MY6) was requested by the IRT. MY6 is the final year of monitoring and activities were completed in September of 2020. All success criteria have been met in MY6 and the Site will be presented for closeout in 2021.

More detailed information related to the project activity, history, and contacts can be found in Appendix A, Tables 1 and 2. Directions and a map of the Site are provided in Figure 1. Project components are illustrated in the Project Component Map (Figure 2) while Table 1 outlines the project component and mitigation credit information for the Site. This report documents the results of the MY6 efforts.

1.1 Project Goals and Objectives

Prior to construction activities, non-forested buffers and livestock operations were identified as major stressors to water quality within the watershed. The site assessment phase of the project identified other stressors as well, including bank erosion, sediment deposition, disconnection of the streams and floodplains, and exotic plant species. The majority of the project area was utilized as a cattle operation for over fifty years. Cattle accessed Hogan Creek and the downstream reach of UT2 exacerbating bank erosion and allowing direct nutrient and fecal inputs to the streams. Deforested riparian buffers and levee construction along Hogan Creek and UTs also contributed to channel degradation. Table 11 in Appendix D present the pre-restoration conditions in detail.

This mitigation site is providing numerous ecological benefits within the Yadkin River Basin. The project goals identified in the Mitigation Plan (Confluence, 2012) include:

- Improve water quality in Hogan Creek and the UTs through reductions in sediment and nutrient inputs from local sources;
- Create conditions for dynamic equilibrium of water and sediment movement between the supply reaches and project reaches;
- Promote floodwater attenuation and secondary functions associated with more frequent and extensive floodwater contact times;
- Improve in-stream habitat by increasing the diversity of bedform features;
- Enhance and protect native riparian vegetation communities; and

- Reduce fecal, nutrient, and sediment loads to project streams by promoting and implementing livestock best management practices.

The project objectives have been defined as follows:

- Restoration of the dimension, pattern, profile of 684 LF of Hogan Creek Reach 1, 962 LF of Hogan Creek Reach 2, 555 LF of UT2, and 292 LF of UT3;
- Restoration of the dimension and profile (Enhancement I) of 1,200 LF of Hogan Creek Reach 1;
- Limited channel work coupled with livestock exclusion and/or invasive species control (Enhancement II) on 66 LF of UT1 and 350 LF of UT2;
- Livestock exclusion fencing and alternative water source installations;
- Invasive plant species control measures across the entire project wherever necessary; and
- Preservation of approximately 5,673 LF relatively un-impacted forested streams in a permanent conservation easement.

1.2 Monitoring Year 6 Data Assessment

Annual monitoring was conducted between February and September 2020 to assess the condition of the project. The stream restoration success criteria for the Site follows the approved performance standards presented in the Hogan Creek Stream Mitigation Plan (Confluence, 2012).

1.2.1 Vegetation Assessment

A total of 6 vegetation monitoring plots were established during the baseline monitoring within the project easement using standard 10 by 10 meter or 5 by 20 meter plots. Please refer to Figures 3.0-3.3 in Appendix B for the vegetation monitoring locations. The final vegetation success criterion is the survival of 260 planted stems per acre in the riparian corridor along restored and enhanced reaches at the end of year five of the monitoring period.

The MY6 vegetation survey was completed in August 2020. The data indicate an average stem density of 425 planted stems per acre for the Site. The Site is meeting the final requirement of 260 stems per acre, with all plots (100%) individually meeting this requirement. Vegetation Plot 2 has an increased density compared to last year and has met the density success criterion due to supplemental planting that occurred in 2019 associated with the stream repair areas along Hogan Creek. In other plots, stems that were previously missing in MY5 were found this year. Therefore, the site has an overall increased stem density of about 8%.

A majority of the living planted stems (94%) scored a vigor of 3 or 4, indicating that they are likely to survive. Approximately 4% of the planted stems scored a vigor of 2, indicating fair plant health with some damage present. Observed damage was from vine strangulation, suffocation from dense herbaceous cover, or other unknown factors. The Site is developing a healthy tree canopy, with an overall average stem height of approximately 16.5 feet. Of the planted species, sycamore and river birch trees have the highest average stem height by far but even the slower growing species such as persimmon, black gum, and willow oak are averaging heights of over 7.5 feet. Desirable volunteer species such as tulip poplar, spice bush, and black cherry are filling in the understory of these planted areas. Please refer to Appendix B for vegetation plot photographs and Appendix C for vegetation data tables.

1.2.2 Vegetation Areas of Concern and Management Activity

MY6 visual assessments indicate that invasive plant populations have been reduced by ongoing invasive treatments. Small areas of invasive plant populations are still present within the conservation easement. These species include: kudzu (*Pueraria montana*), Chinese privet (*Ligustrum sinense*), Japanese

honeysuckle (*Lonicera japonica*), multiflora rose (*Rosa multiflora*), mimosa tree (*Albizia julibrissin*), and tree of heaven (*Ailanthus altissima*). DMS contracted with a provider for ongoing invasive species treatments which will continue through December 2021. In 2020, additional invasive treatment occurred in May, August, and September. There was about a 50% reduction in invasive areas of concern compared to last year with less than 1% of the easement acreage currently affected by invasive species. Current vegetation areas of concern are shown in Figure 3.0-3.3 of Appendix B.

1.2.3 Stream Assessment

Morphological surveys for MY6 were conducted in April and June 2020. The surveyed longitudinal profile data illustrates that bedform features are maintaining lateral and vertical stability for the majority of the surveyed reaches. Profile dimensions for Hogan Creek and UT2 show little change between MY5 and MY6. Along Hogan Creek Reach 2 (around station 37+25), the previously observed bed scour downstream of a log vane has maintained stability and created desirable pool habitat within the meander bend. Please refer to Appendix D for longitudinal profiles with annual overlays and Table 13a-c for stream reach summaries.

Overall, cross-section data throughout the Site is demonstrating stable bankfull dimensions. When occurring, adjustments are minor in comparison to baseline conditions and seem to be trending towards increased stability. Cross-sections 3, 5, and 6 are located where recent bank repair work was completed in early 2019 along Hogan Creek and are continuing to maintain stable conditions. Minor changes occurring within some cross-sections include deposition in the floodplain, the formation of point bars, the deepening of pools, and narrowing of riffles. Cross-section 9 along UT2 is representative of the deposition occurring downstream of the bridge as the valley flattens near the confluence with Hogan Creek. However, as demonstrated in cross-section 9, alluvial deposits have caused the bed and bank elevations to rise but the bankfull dimensions remain consistent as compared to MY0. Please refer to Appendix D for cross-section plots with annual overlays and Table 12 for morphology and hydraulic summary.

The MY6 riffle pebble counts conducted for riffle cross-sections indicate similar or coarser sediment size distribution as compared to MY0. Refer to Appendix D for pebble count plots with annual overlays.

1.2.4 Stream Areas of Concern and Management Activity

The stream repairs that were completed in March 2019 along Hogan Creek are continuing to maintain stability. Live stake woody stems have become well established and banks have remained stable, even after several large storm events in 2020. A few segments of scoured banks are present along Hogan Creek and UT2. However, most of these segments have stabilizing woody vegetation along the top of banks, thus minimizing the percentage of unstable banks. The downstream portions of UT2 and UT3 have some aggradation present, but willows and other woody stems along the banks have maintained these channels' bankfull form and function. Stream areas of concern are depicted on the current condition plan view Figures 3.0-3.3 and Table 6 in Appendix B.

1.2.5 Hydrology Assessment

Site walks conducted on February 26 and September 8, 2020 along with visual observations, indicate that bankfull events occurred in MY6. At least two bankfull events occurred on Hogan Creek and UT2 and were documented with the observation of wrack lines, recent alluvial deposits, and crest gage measurements. Monthly rainfall data indicate higher than the normal rainfall amounts occurred during the months of February, April, May, and August 2020. Project performance standards state that two bankfull flow events must be documented on restoration reaches within the monitoring period and must occur in separate. Therefore, the performance standard has been met and in MY6, at least 6

bankfull events in separate years has been documented for each reach. Please refer to Appendix E for hydrologic data and graphs.

1.3 Monitoring Year 6 Summary

The Hogan Creek Stream Mitigation Project has met monitoring success criteria for vegetation, geomorphology, and hydrology performance standards. The MY6 vegetation survey resulted in an average stem density of 425 planted stems per acre and is meeting the final success criterion of 260 stems per acre with all six plots (100%) individually meeting this requirement. The MY6 vegetation monitoring and visual assessment revealed that the treatments are working to significantly reduce the areas of invasive plant populations. Geomorphic surveys and visual assessments indicate that project streams, including recently stabilized areas along Hogan Creek Reach 1 and Reach 2, appear stable and functioning as intended. The hydrology performance standard of two recorded bankfull events in separate monitoring years was met in MY2 for Hogan Creek and UT2.

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 annual monitoring 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

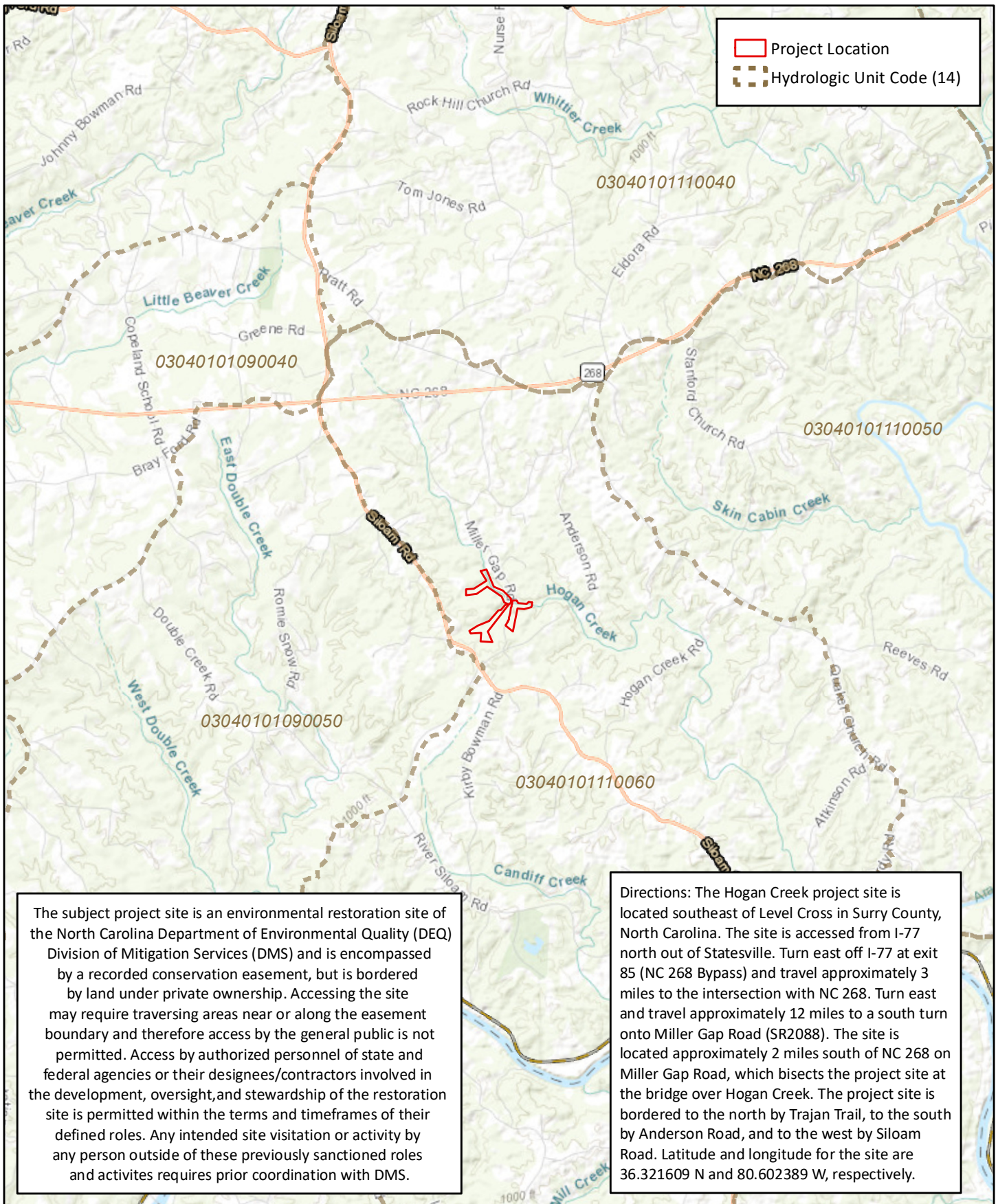
The stream monitoring methodologies utilized in 2020 are based on standard guidance and procedures documents (Rosgen 1996 and USACE 2003). Geomorphic data were collected following the standards outlined in *The Stream Channel Reference Site: An Illustrated Guide to Field Techniques* (Harrelson et al., 1994) and in *Stream Restoration: A Natural Channel Design Handbook* (Doll et al., 2003). All Integrated Current Condition Mapping was recorded using a Trimble handheld GPS with sub-meter accuracy and processed using Pathfinder and ArcGIS. 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., 2008). Crest gages were installed near surveyed riffle cross-sections and monitored semi-annually.



Section 3: REFERENCES

- Confluence Engineering, PC. 2012. Hogan Creek Stream Mitigation Plan. NCEEP, Raleigh, NC.
- Doll, B.A., Grabow, G.L., Hall, K.A., Halley, J., Harman, W.A., Jennings, G.D., and Wise, D.E. 2003. Stream Restoration A Natural Channel Design Handbook.
- EcoEngineering. 2008. Technical Memorandum Task 2, Upper Yadkin Basin Local Watershed Plan.
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- North Carolina Climate Retrieval and Observations Network of the Southeast Database (NCCRONOS). 2020. State Climate Office of North Carolina. Version 2.7.2. NC-SR-2-Dobson 2.3 SE. Station ID Dobson 2.3 SE. Accessed September 2020.
- NCDENR. 2009. Upper Yadkin River Basin Restoration Priorities. Retrieved from <https://deq.nc.gov/about/divisions/mitigation-services/dms-planning/watershed-planning-documents/yadkin-river-basin>
- North Carolina Geological Survey (NCGS). 2004. Physiography of North Carolina. Map compiled by the Division of Land Resources. Raleigh.
- Rosgen, D.L. 1996. Applied River Morphology. Pagosa Springs, CO: Wildland Hydrology Books.
- United States Army Corps of Engineers (USACE), 2003. Stream Mitigation Guidelines. USACE, NCDENR-DWQ, USEPA, NCWRC.

APPENDIX A. General Tables and Figures



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

Directions: The Hogan Creek project site is located southeast of Level Cross in Surry County, North Carolina. The site is accessed from I-77 north out of Statesville. Turn east off I-77 at exit 85 (NC 268 Bypass) and travel approximately 3 miles to the intersection with NC 268. Turn east and travel approximately 12 miles to a south turn onto Miller Gap Road (SR2088). The site is located approximately 2 miles south of NC 268 on Miller Gap Road, which bisects the project site at the bridge over Hogan Creek. The project site is bordered to the north by Trajan Trail, to the south by Anderson Road, and to the west by Siloam Road. Latitude and longitude for the site are 36.321609 N and 80.602389 W, respectively.

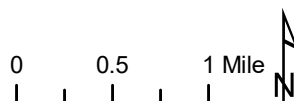


Figure 1 Project Vicinity Map
 Hogan Creek Stream Mitigation Project
 DMS Project No. 94708
 Monitoring Year 6 - 2020

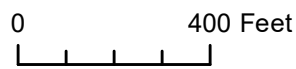
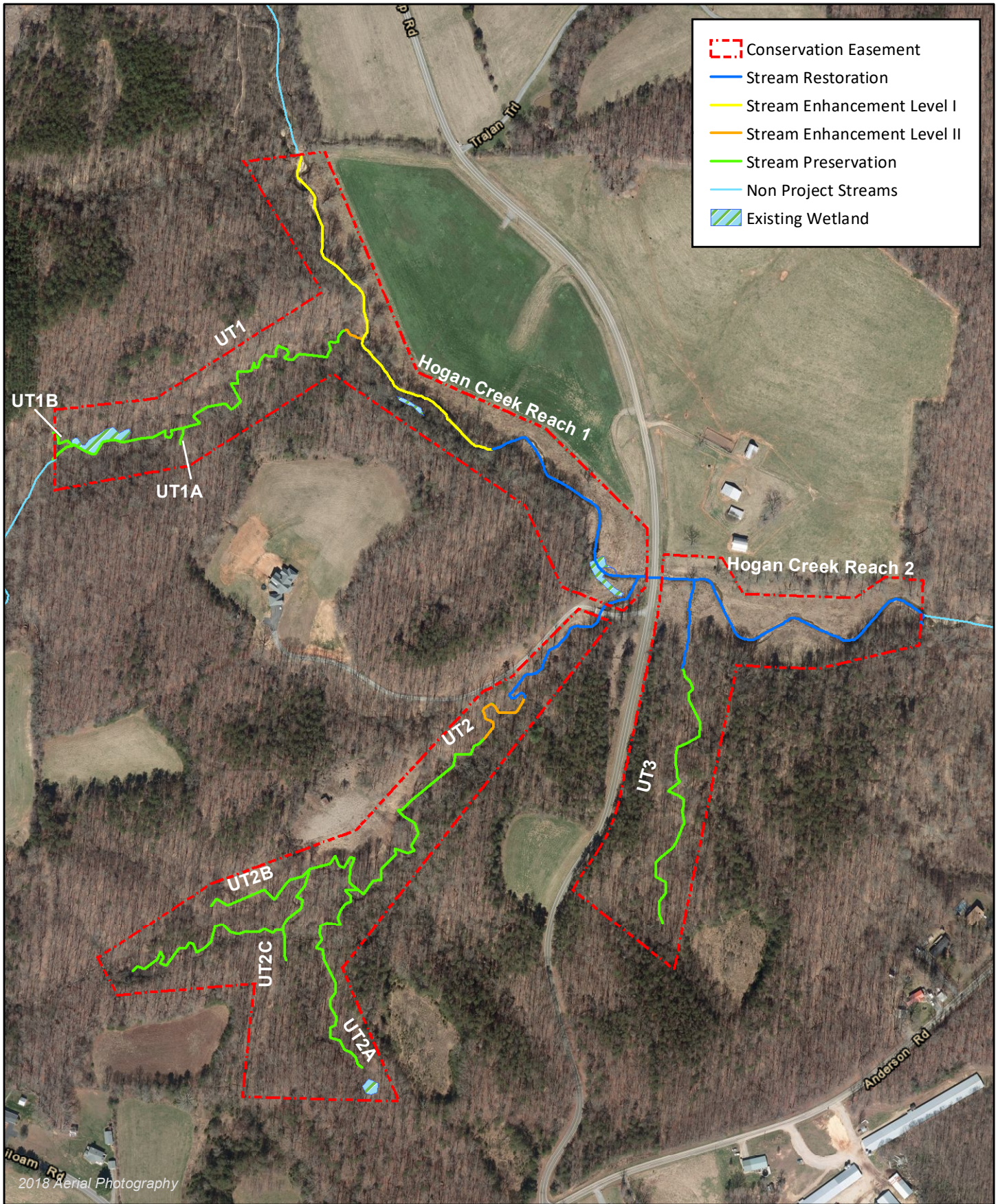


Figure 2 Project Component/Asset Map
 Hogan Creek Stream Mitigation Project
 DMS Project No. 94708
 Monitoring Year 6 - 2020

Table 1. Project Components and Mitigation Credits

Hogan Creek Stream Mitigation Project
 DMS Project No. 94708
 Monitoring Year 6 - 2020

Mitigation Credit Summaries ¹								
	Stream	Riparian Wetland	Non-Riparian Wetland	Buffer	Nitrogen Nutrient Offset	Phosphorous Nutrient Offset		
Overall Credit	4,994.000	N/A	N/A	N/A	N/A	N/A		
Project Components ¹								
Project Component or Reach ID	Stationing	Pre-project Footage or Acreage	Restoration Footage or Acreage	Restoration Level	Restoration or Rest Equiv.	Mitigation Ratio	Mitigation Credits	Notes
Hogan Reach 1	10+00 - 22+00	1,331	1,200	P2	EI	1:1	1,200.000	-
Hogan Reach 1	22+00 - 28+84	797	684	P2	R	1:1	684.000	Crossing was removed from total
Hogan Reach 2	29+35 - 38+97	876	962	P2	R	1:1	962.000	-
UT1,1A, 1B	Upstream of 10+00	1,485	1,485	Preservation	P	5:1	297.000	-
UT1	10+00 - 10+66	66	66	P3	EII	2.5:1	26.400	-
UT2, 2A, 2B,2C	Upstream of 6+50	3,225	3,225	Preservation	P	5:1	645.000	-
UT2	6+50 - 10+00	370	350	P3	EII	2.5:1	140.000	-
UT2	10+00 - 15+55	633	555	P2	R	1:1	555.000	Crossing was removed from total
UT3	Upstream of 9+40	963	963	Preservation	P	5:1	192.600	-
UT3	9+40 - 12+32	260	292	P2	R	1:1	292.000	-
Length and Area Summations ¹								
Restoration Level	Stream (Linear Feet)	Riparian Wetland (acres)		Non-riparian Wetland (acres)	Buffer (Square feet)		Upland (acres)	
		Riverine	Non-Riverine					
		-	-					
Restoration	2,493	-	-	-	-	-	-	-
Enhancement		-	-	-	-	-	-	-
Enhancement I	1,200							
Enhancement II	416							
Creation		-	-	-			-	-
Preservation	5,673	-	-	-			-	-
High Quality		-	-	-			-	-
Preservation		-	-	-			-	-

N/A - Not Applicable

¹ Project components and mitigation credits reverted back to Mitigation Plan asset totals as requested by IRT.

Table 2. Project Activity and Reporting History

Hogan Creek Stream Mitigation Project

DMS Project No. 94708

Monitoring Year 6 - 2020

Activity or Deliverable		Data Collection Complete	Completion or Delivery
Mitigation Plan		October-2011	February-2012
Final Design – Construction Plans		October-2011	November-2012
Construction		N/A	December-2014
Temporary S&E Mix Applied		N/A	December-2014
Permanent Seed Mix Applied		N/A	December-2014
Containerized, bare root and B&B plantings for reach/segments		N/A	March-2015
Baseline Monitoring Document (Year 0)	Vegetation Survey	May-2015	August-2015
	Stream Survey	June-2015	
Stream Repair/Maintenance		N/A	December-2015
Year 1 Monitoring	Vegetation Survey	October-2015	January-2016
	Stream Survey	December-2015	
Invasive Species Treatment		May-2016	May-2016
Supplemental Planting		N/A	January-2016
Invasive Species Treatment		September-2016	September-2016
Year 2 Monitoring	Vegetation Survey	October-2016	November-2016
	Stream Survey	June-2016	
Year 3 Monitoring	Vegetation Survey	August-2017	December-2017
	Stream Survey	July-2017	
Invasive Species Treatment		N/A	June/August -2018
Year 4 Monitoring	Vegetation Survey	August-2018	November-2018
	Stream Survey	June-2018	
Stream Repair/Maintenance		N/A	March-2019
Invasive Species Treatment		N/A	June/August -2019
Year 5 Monitoring	Vegetation Survey	August-2019	November-2019
	Stream Survey	July-2019	
Invasive Species Treatment		N/A	May/Aug/Sept - 2020
Year 6 Monitoring	Vegetation Survey	August-2020	November-2020
	Stream Survey	June-2020	

N/A - Not Applicable

Table 3. Project Contacts Table

Hogan Creek Stream Mitigation Project

DMS Project No. 94708

Monitoring Year 6 - 2020

Designer	Confluence Engineering, PC 16 Broad Street Asheville, NC 28801
Primary Project Design POC	Andrew Bick 828-606-0306
Construction Contractor	Carolina Environmental Contracting, Inc. 150 Pine Ridge Road Mount Airy, NC 27030
Construction Contractor POC	Wayne Taylor 336-341-6489
Survey Contractor	Turner Land Surveying, PLLC PO Box 41023 Raleigh, NC 27629
Survey Contractor POC	David Turner 919-623-5095
Planting Contractor	Keller Environmental, LLC 7921 Haymarket Lane Raleigh, NC 27615
Planting Contractor POC	Jay Keller 919-749-8259
Seeding Contractor	Carolina Environmental Contracting, Inc. 150 Pine Ridge Road Mount Airy, NC 27030
Seeding Contractor POC	Wayne Taylor 336-341-6489
Seed Mix Sources	Green Resources 336-855-6363
Nursery Stock Suppliers	Foggy Mountain Nursery 336-384-5323
Monitoring Performers	Wildlands Engineering, Inc. 1430 South Mint Street, Ste 104 Charlotte, NC 28205 704.332.7754
Monitoring POC	Kirsten Gimbert 704-332-7754

Table 4. Project Baseline Information and Attributes

Hogan Creek Stream Mitigation Project
 DMS Project No. 94708
 Monitoring Year 6 - 2020

Project Information					
Project Name	Hogan Creek Stream Mitigation Project				
County	Surry				
Project Area (acres)	36				
Project Coordinates (latitude and longitude)	36.321609 N, 80.602389 W				
Project Watershed Summary Information					
Physiographic Province	Piedmont				
River Basin	Yadkin				
USGS Hydrologic Unit 8-digit	03040101				
USGS Hydrologic Unit 14-digit	03040101110060				
DWR Sub-basin	Pee Dee River Subbasin 03-07-02				
Project Drainage Area (acres)	1,514 ac (2.37 mi ²)				
Project Drainage Area Percentage of Impervious Area	0.40%				
CGIA Land Use Classification	Managed Herbaceous Cover, Broadleaf Deciduous Forest Land				
Reach Summary Information					
Parameters	Hogan Creek Reach 1	Hogan Creek Reach 2	Main Stem UT1	Main Stem UT2	UT3
Length of Reach Post Construction (LF)	1,961	992	1,442	2,869	1,227
Valley classification (Rosgen)	VIII	VIII	VI	VI	VI
Drainage area (acres)	1,479	1,514	60	81	18
NCDWQ stream identification score	40	37	31	31.5	32.5
NCDWQ Water Quality Classification	C	C	C	C	C
Morphological Description (Rosgen stream type)	C4	C4	E4b	E4b	G4
Evolutionary trend	C-F	C-F	Eb-G	Eb-G	Eb-G
Underlying mapped soils	CsA	CsA	CsA, FsE	FsE	FsE
Drainage class	well drained	well drained	well drained	well drained	well drained
Soil Hydric status	not hydric	not hydric	not hydric	not hydric	not hydric
Slope	0.007	0.005	0.031	0.021	0.030
FEMA classification	AE	AE	Not in SFHA	Not in SFHA	Not in SFHA
Native vegetation community	Felsic Mesic Forest	Felsic Mesic Forest	Felsic Mesic Forest	Felsic Mesic Forest	Felsic Mesic Forest
Percent composition of exotic invasive vegetation	0	0	0	0	0
Wetland Summary Information					
Parameters	Wetland 1	Wetland 2	Wetland 3	Wetland 4	
Size of Wetland (acres)	0.09	0.02	0.13	0.10	
Wetland Type	riparian non-riverine	riparian non-riverine	riparian non-riverine	riparian non-riverine	
Mapped Soil Series	CsA	CsA and FsE	CsA and FsE	CsA and FsE	
Drainage class	well drained	well drained	well drained	well drained	
Soil Hydric Status	not hydric	not hydric	not hydric	not hydric	
Source of Hydrology	Creek (oxbow)	Toe seep	Toe seep	Impoundment	
Hydrologic Impairment	none	none	none	none	
Native vegetation community	Dist. Small Stream/ Narrow FP Forest	Dist. Small Stream/ Narrow FP Forest	Dist. Small Stream/ Narrow FP Forest	Herbaceous	
Percent composition of exotic invasive vegetation	0	0	0	0	
Regulatory Considerations					
Regulation	Applicable?	Resolved?	Supporting Documentation		
Waters of the United States – Section 404	Y	Y	USACE Action ID # SAW-2011-02268		
Waters of the United States – Section 401	Y	Y	NCDWR # 20120182		
Endangered Species Act	Y	Y	CE Approved 9/30/11		
Historic Preservation Act	N	N/A	-		
Coastal Zone Management Act (CZMA)/ Coastal Area Management Act (CAMA)	N	N/A	-		
FEMA Floodplain Compliance	Y	Y	LOMR Submitted 5/2015		
Essential Fisheries Habitat	N	N/A	-		

N/A Not-applicable

Table 5. Monitoring Component Summary

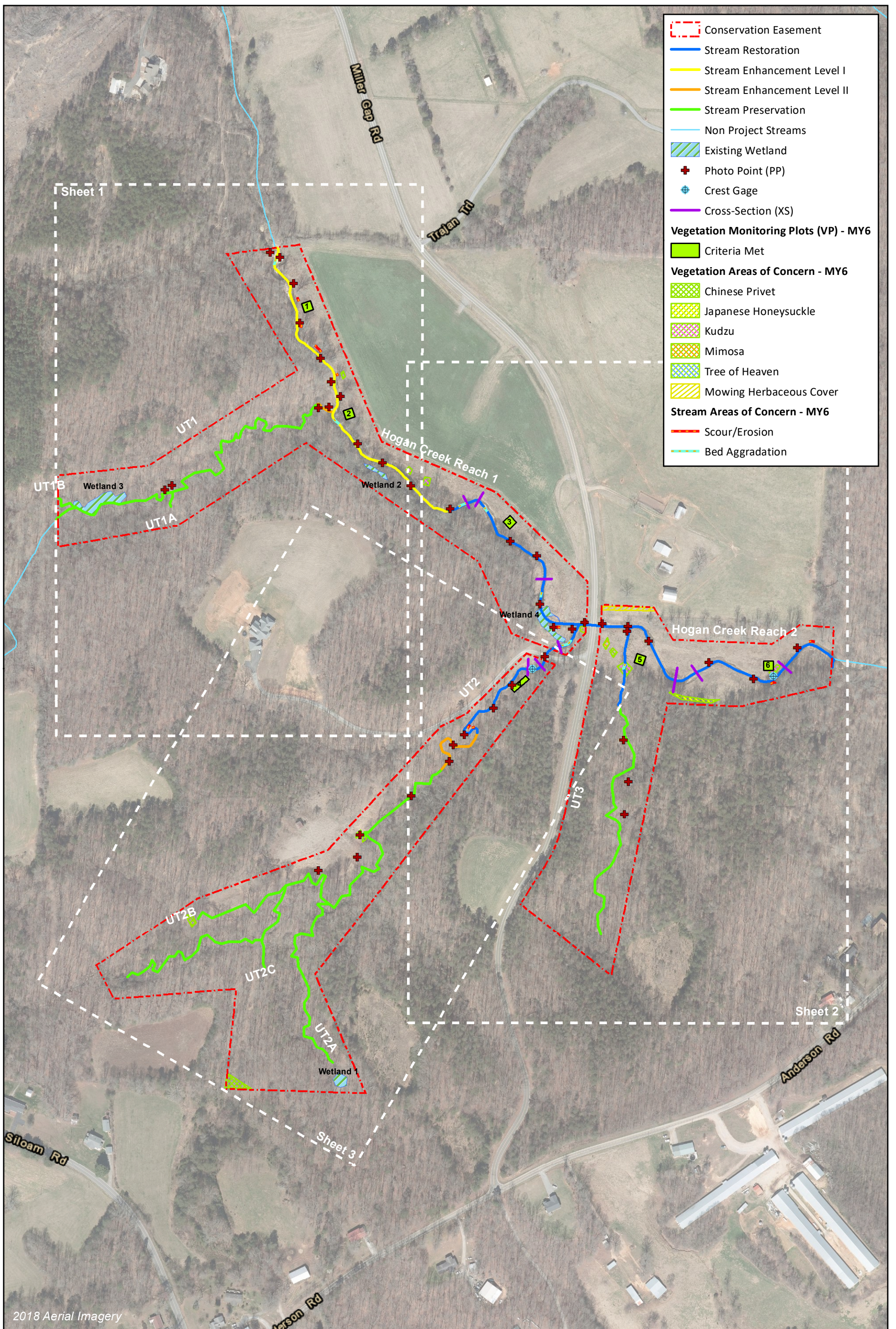
Hogan Creek Stream Mitigation Project

DMS Project No. 94708

Monitoring Year 6 - 2020

Parameter	Monitoring Feature	Quantity Length By Reach (ft)					Frequency
		Hogan Creek Reach 1	Hogan Creek Reach 2	UT1	UT2	UT3	
Dimension	Riffle XS	2	2		2		Annual
	Pool XS	1	1		1		Annual
Pattern/Profile	Longitudinal Profile	1500	1000		675		Annual
Substrate	100 Pebble Count	2	2				Annual
Hydrology	Crest Gage		1		1		Semi-Annual
Vegetation	Vegetation Plots	3	2		1		Annual
Visual Assessment	Project Site	Y	Y	Y	Y	Y	Semi-Annual
Reference Photos	Permanent Photo Points	18	6	3	10	4	Annual

APPENDIX B. Visual Assessment Data



Conservation Easement
 [Red dashed line]

Stream Restoration
 [Blue line]

Stream Enhancement Level I
 [Yellow line]

Stream Enhancement Level II
 [Orange line]

Stream Preservation
 [Green line]

Non Project Streams
 [Light blue line]

Existing Wetland
 [Blue hatched area]

Photo Point (PP)
 [Red cross symbol]

Crest Gage
 [Blue cross symbol]

Cross-Section (XS)
 [Purple line]

Vegetation Monitoring Plots (VP) - MY6
 [Green square]

Criteria Met
 [Yellow square]

Vegetation Areas of Concern - MY6

- [Green hatched] Chinese Privet
- [Yellow hatched] Japanese Honeysuckle
- [Red hatched] Kudzu
- [Orange hatched] Mimosa
- [Blue hatched] Tree of Heaven
- [Yellow hatched] Mowing Herbaceous Cover

Stream Areas of Concern - MY6

- [Red dashed line] Scour/Erosion
- [Green dashed line] Bed Aggradation

2018 Aerial Imagery

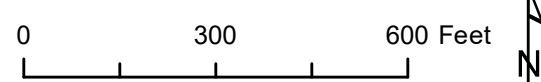


Figure 3.0 Current Condition Plan View Map (Key)
 Hogan Creek Stream Mitigation Project
 DMS Project No. 94708
 Monitoring Year 6 - 2020

Surry County, NC

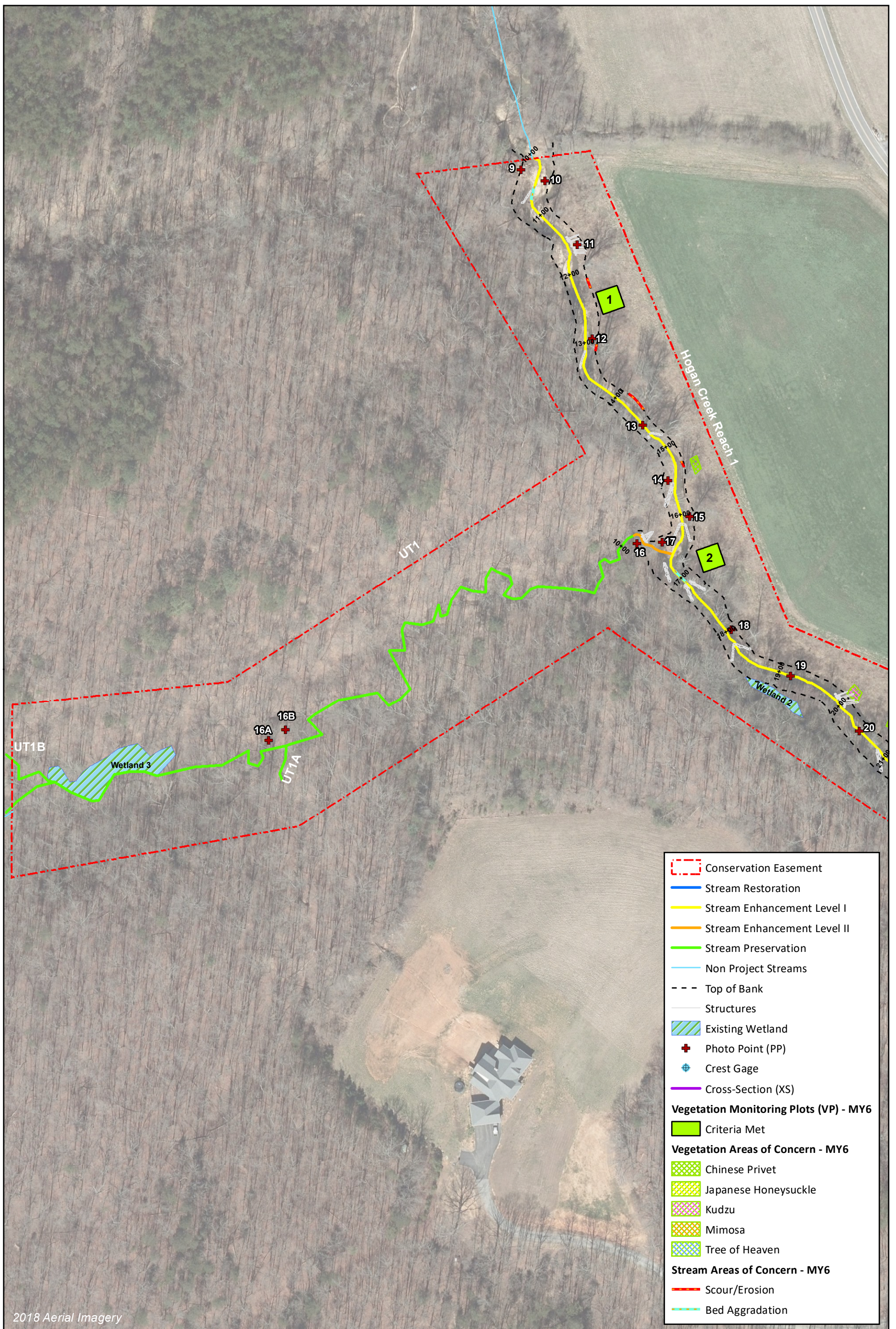
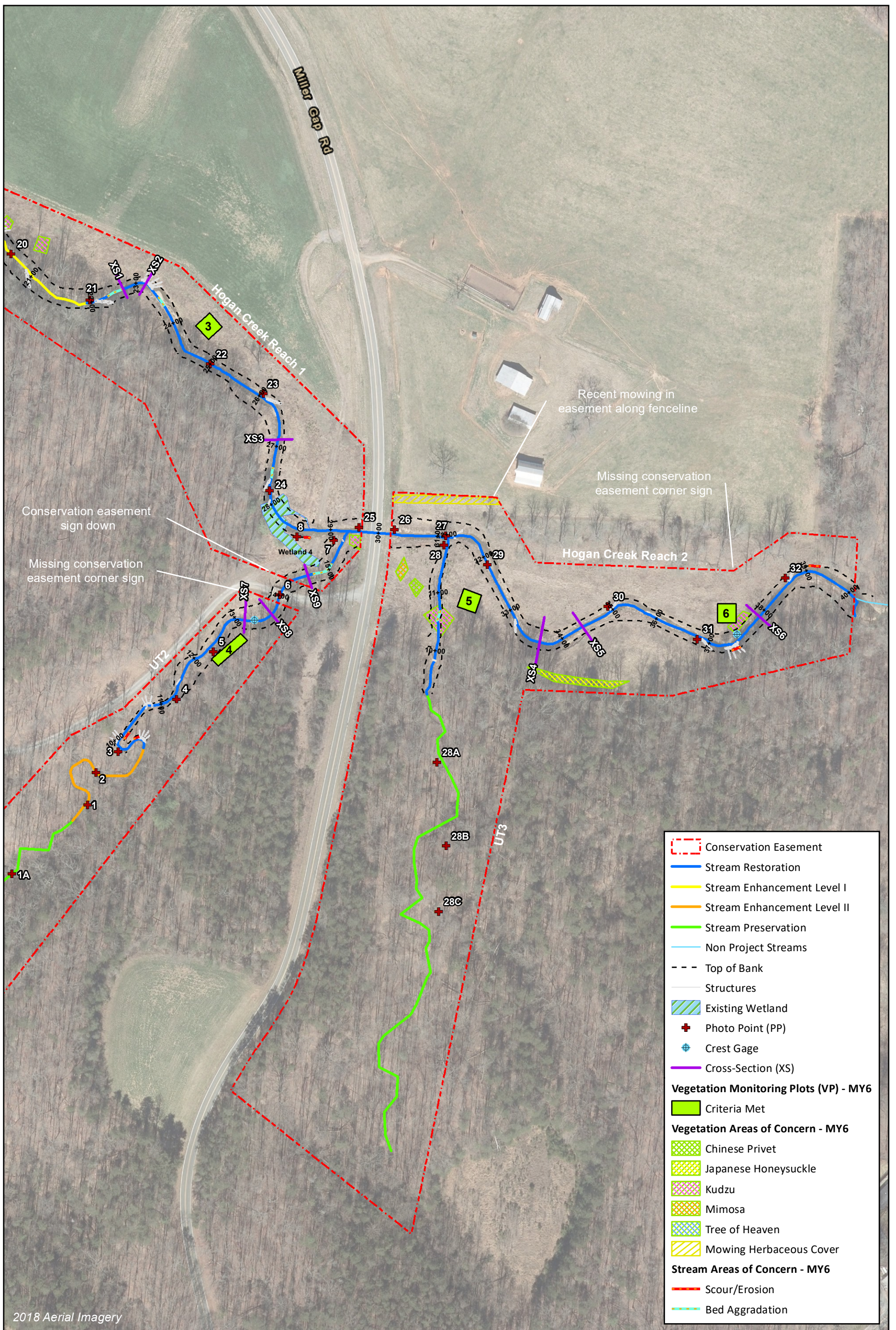
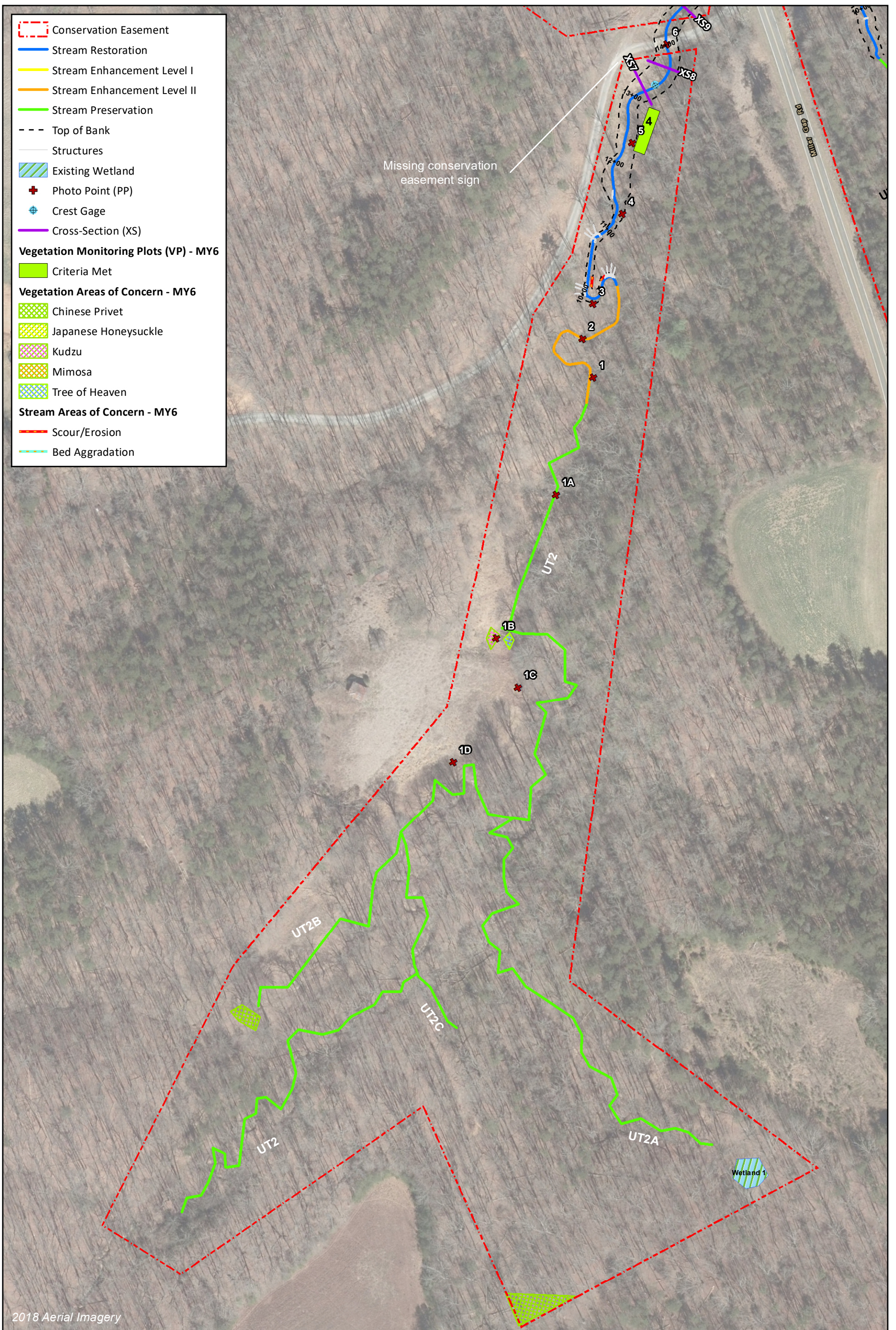


Figure 3.1 Current Condition Plan View Map (Sheet 1 of 3)
 Hogan Creek Stream Mitigation Project
 DMS Project No. 94708
 Monitoring Year 6 - 2020





2018 Aerial Imagery



0 125 250 Feet



Figure 3.3 Current Condition Plan View Map (Sheet 3 of 3)
 Hogan Creek Stream Mitigation Project
 DMS Project No. 94708
 Monitoring Year 6 - 2020

Surry County, NC

Table 6a. Visual Stream Morphology Stability Assessment Table

Hogan Creek Stream Mitigation Project

DMS Project No. 94708

Monitoring Year 6 - 2020

Hogan Creek Reach 1 (Assessed Length : 1,961 feet)

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	Adjusted % for Stabilizing Woody Vegetation
1. Bed	1. Vertical Stability (Riffle and Run units)	1. <u>Aggradation</u> - Bar formation/growth sufficient to significantly deflect flow laterally (not to include point bars)			5	110	94%			
		2. <u>Degradation</u> - Evidence of downcutting			0	0	100%			
	2. Riffle Condition	1. <u>Texture/Substrate</u> - Riffle maintains coarser substrate	14	14		100%				
	3. Meander Pool Condition	1. <u>Depth</u> Sufficient (Max Pool Depth : Mean Bankfull Depth \geq 1.6)	13	13		100%				
		2. <u>Length</u> appropriate (>30% of centerline distance between tail of upstream riffle and head of downstream riffle)	13	13		100%				
	4. Thalweg Position	1. Thalweg centering at upstream of meander bend (Run)	13	13		100%				
2. Thalweg centering at downstream of meander (Glide)		13	13	100%						
2. Bank	1. Scoured/Eroding	Bank lacking vegetative cover resulting simply from poor growth and/or scour and erosion			5	78	98%	4	65	99.7%
	2. Undercut	Banks undercut/overhanging to the extent that mass wasting appears likely. Does <u>NOT</u> include undercuts that are modest, appear sustainable and are providing habitat.			0	0	100%	0	0	N/A
	3. Mass Wasting	Bank slumping, calving, or collapse			0	0	100%	0	0	N/A
Totals					5	78	98%	4	65	99.7%
3. Engineered Structures	1. Overall Integrity	Structures physically intact with no dislodged boulders or logs.	15	15			100%			
	2. Grade Control	Grade control structures exhibiting maintenance of grade across the sill.	5	5			100%			
	2a. Piping	Structures lacking any substantial flow underneath sills or arms.	12	12			100%			
	3. Bank Protection	Bank erosion within the structures extent of influence does <u>not</u> exceed 15%. (See guidance for this table in EEP monitoring guidance document)	15	15			100%			
	4. Habitat	Pool forming structures maintaining ~ Max Pool Depth : Mean Bankfull Depth ratio \geq 1.6 Rootwads/logs providing some cover at base-flow.	15	15			100%			

Table 6b. Visual Stream Morphology Stability Assessment Table

Hogan Creek Stream Mitigation Project

DMS Project No. 94708

Monitoring Year 6 - 2020

Hogan Creek Reach 2 (Assessed Length : 992 feet)

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	Adjusted % for Stabilizing Woody Vegetation	
1. Bed	1. Vertical Stability (Riffle and Run units)	1. <u>Aggradation</u> - Bar formation/growth sufficient to significantly deflect flow laterally (not to include point bars)			0	0	100%				
		2. <u>Degradation</u> - Evidence of downcutting			0	0	100%				
	2. Riffle Condition	1. <u>Texture/Substrate</u> - Riffle maintains coarser substrate	6	6		100%					
	3. Meander Pool Condition	1. <u>Depth</u> Sufficient (Max Pool Depth : Mean Bankfull Depth \geq 1.6)	5	5		100%					
		2. <u>Length</u> appropriate (>30% of centerline distance between tail of upstream riffle and head of downstream riffle)	5	5		100%					
	4. Thalweg Position	1. Thalweg centering at upstream of meander bend (Run)	5	5		100%					
		2. Thalweg centering at downstream of meander (Glide)	5	5		100%					
					Totals	2	36	98%	0	0	N/A
2. Bank	1. <u>Scoured/Eroding</u>	Bank lacking vegetative cover resulting simply from poor growth and/or scour and erosion			2	36	98%	0	0	N/A	
	2. <u>Undercut</u>	Banks undercut/overhanging to the extent that mass wasting appears likely. Does <u>NOT</u> include undercuts that are modest, appear sustainable and are providing habitat.			0	0	100%	0	0	N/A	
	3. <u>Mass Wasting</u>	Bank slumping, calving, or collapse			0	0	100%	0	0	N/A	
					Totals	2	36	98%	0	0	N/A
3. Engineered Structures	1. <u>Overall Integrity</u>	Structures physically intact with no dislodged boulders or logs.	6	6			100%				
	2. <u>Grade Control</u>	Grade control structures exhibiting maintenance of grade across the sill.	1	1			100%				
	2a. <u>Piping</u>	Structures lacking any substantial flow underneath sills or arms.	5	5			100%				
	3. <u>Bank Protection</u>	Bank erosion within the structures extent of influence does <u>not</u> exceed 15%. (See guidance for this table in EEP monitoring guidance document)	5	6			83%				
	4. <u>Habitat</u>	Pool forming structures maintaining ~ Max Pool Depth : Mean Bankfull Depth ratio \geq 1.6 Rootwads/logs providing some cover at base-flow.	6	6			100%				

Table 6c. Visual Stream Morphology Stability Assessment Table

Hogan Creek Stream Mitigation Project

DMS Project No. 94708

Monitoring Year 6 - 2020

UT2 (Assessed Length : 930 feet)

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	Adjusted % for Stabilizing Woody Vegetation
1. Bed	1. Vertical Stability (Riffle and Run units)	1. <u>Aggradation</u> - Bar formation/growth sufficient to significantly deflect flow laterally (not to include point bars)			1	40	96%			
		2. <u>Degradation</u> - Evidence of downcutting			0	0	100%			
	2. Riffle Condition	1. <u>Texture/Substrate</u> - Riffle maintains coarser substrate	12	14			86%			
	3. Meander Pool Condition	1. <u>Depth</u> Sufficient (Max Pool Depth : Mean Bankfull Depth \geq 1.6)	13	13			100%			
		2. <u>Length</u> appropriate (>30% of centerline distance between tail of upstream riffle and head of downstream riffle)	13	13			100%			
	4. Thalweg Position	1. Thalweg centering at upstream of meander bend (Run)	13	13			100%			
2. Thalweg centering at downstream of meander (Glide)		13	13	100%						
Totals										
2. Bank	1. <u>Scoured/Eroding</u>	Bank lacking vegetative cover resulting simply from poor growth and/or scour and erosion			2	25	99%	2	25	100%
	2. <u>Undercut</u>	Banks undercut/overhanging to the extent that mass wasting appears likely. Does <u>NOT</u> include undercuts that are modest, appear sustainable and are providing habitat.			0	0	100%	0	0	100%
	3. <u>Mass Wasting</u>	Bank slumping, calving, or collapse			0	0	100%	0	0	100%
Totals										
3. Engineered Structures	1. <u>Overall Integrity</u>	Structures physically intact with no dislodged boulders or logs.	6	6			100%			
	2. <u>Grade Control</u>	Grade control structures exhibiting maintenance of grade across the sill.	2	2			100%			
	2a. <u>Piping</u>	Structures lacking any substantial flow underneath sills or arms.	4	4			100%			
	3. <u>Bank Protection</u>	Bank erosion within the structures extent of influence does <u>not</u> exceed 15%. (See guidance for this table in EEP monitoring guidance document)	5	6			83%			
	4. <u>Habitat</u>	Pool forming structures maintaining ~ Max Pool Depth : Mean Bankfull Depth ratio \geq 1.6 Rootwads/logs providing some cover at base-flow.	6	6			100%			

Table 6d. Visual Stream Morphology Stability Assessment Table

Hogan Creek Stream Mitigation Project

DMS Project No. 94708

Monitoring Year 6 - 2020

UT3 (Assessed Length : 275 feet)

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	Adjusted % for Stabilizing Woody Vegetation	
1. Bed	1. Vertical Stability (Riffle and Run units)	1. <u>Aggradation</u> - Bar formation/growth sufficient to significantly deflect flow laterally (not to include point bars)			1	20	93%				
		2. <u>Degradation</u> - Evidence of downcutting			0	0	100%				
	2. Riffle Condition	1. <u>Texture/Substrate</u> - Riffle maintains coarser substrate	4	4		100%					
	3. Meander Pool Condition	1. <u>Depth</u> Sufficient (Max Pool Depth : Mean Bankfull Depth \geq 1.6)	4	4		100%					
		2. <u>Length</u> appropriate (>30% of centerline distance between tail of upstream riffle and head of downstream riffle)	4	4		100%					
	4. Thalweg Position	1. Thalweg centering at upstream of meander bend (Run)	4	4		100%					
		2. Thalweg centering at downstream of meander (Glide)	4	4		100%					
					Totals	0	0	100%	0	0	100%
2. Bank	1. Scoured/Eroding	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 <u>NOT</u> 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. Overall Integrity	Structures physically intact with no dislodged boulders or logs.	1	1			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 <u>not</u> exceed 15%. (See guidance for this table in EEP monitoring guidance document)	1	1			100%				
	4. Habitat	Pool forming structures maintaining ~ Max Pool Depth : Mean Bankfull Depth ratio \geq 1.6 Rootwads/logs providing some cover at base-flow.	1	1			100%				

Table 7. Vegetation Condition Assessment Table

Hogan Creek Stream Mitigation Project

DMS Project No. 94708

Monitoring Year 6 - 2020

Planted Acreage 6.7

Vegetation Category	Definitions	Mapping Threshold	CCPV Depiction	Number of Polygons	Combined Acreage	% of Planted Acreage
1. Bare Areas	Very limited cover of both woody and herbaceous material.	0.1 acres	Cross Hatch Yellow	0	0.00	0.0%
2. Low Stem Density Areas	Woody stem densities clearly below target levels based on MY3, 4, or 5 stem count criteria.	0.1 acres	N/A	0	0.00	0.0%
Total				0	0.00	0.0%
3. 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 acres	N/A	0	0.00	0.0%
Cumulative Total				0	0.00	0.0%

Easement Acreage 36

Vegetation Category	Definitions	Mapping Threshold	CCPV Depiction	Number of Polygons	Combined Acreage	% of Easement Acreage
4. Invasive Areas of Concern	Areas or points (if too small to render as polygons at map scale).	100 SF	Cross Hatch (Color varies by Species)	13	0.21	0.6%
5. Easement Encroachment Areas	Areas or points (if too small to render as polygons at map scale).	none	Cross Hatch Yellow	1	0.05	0.1%

Stream Photographs



PP1 – Main Stem UT2, looking downstream (9/8/2020)



PP1A – Main Stem UT2, looking upstream (9/8/2020)



PP1B – Main Stem UT2, looking downstream (9/8/2020)



PP1C – Main Stem UT2, looking upstream (9/8/2020)



PP1D – Main Stem UT2, looking upstream (9/8/2020)



PP2 – Main Stem UT2, looking downstream (9/8/2020)



PP3 – Main Stem UT2, looking upstream (9/8/2020)



PP4 – Main Stem UT2, looking upstream (9/8/2020)



PP5 – Main Stem UT2, looking downstream (9/8/2020)



PP6 – Main Stem UT2, looking downstream (9/8/2020)



PP7 – Main Stem UT2, looking downstream (9/8/2020)



PP8 – Reach 1 Hogan Creek, looking upstream (9/8/2020)



PP9 – Reach 1 Hogan Creek, looking downstream (8/13/2020)



PP10 – Reach 1 Hogan Creek, looking downstream (8/13/2020)



PP11 – Reach 1 Hogan Creek, looking downstream (8/13/2020)



PP12 – Reach 1 Hogan Creek, looking downstream (8/13/2020)



PP13 – Reach 1 Hogan Creek, looking downstream (8/13/2020)



PP14 – Reach 1 Hogan Creek, looking downstream (8/13/2020)



PP15 – Reach 1 Hogan Creek, looking downstream (8/13/2020)



PP16 – Main Stem UT1, looking downstream (8/13/2020)



PP16A – Main Stem UT1, looking upstream (8/13/2020)



PP16B – Main Stem UT1, looking downstream (8/13/2020)



PP17 – Reach 1 Hogan Creek, looking downstream (9/8/2020)



PP18 – Reach 1 Hogan Creek, looking downstream (9/8/2020)



PP19 – Reach 1 Hogan Creek, looking downstream (9/8/2020)



PP20 – Reach 1 Hogan Creek, looking downstream (9/8/2020)



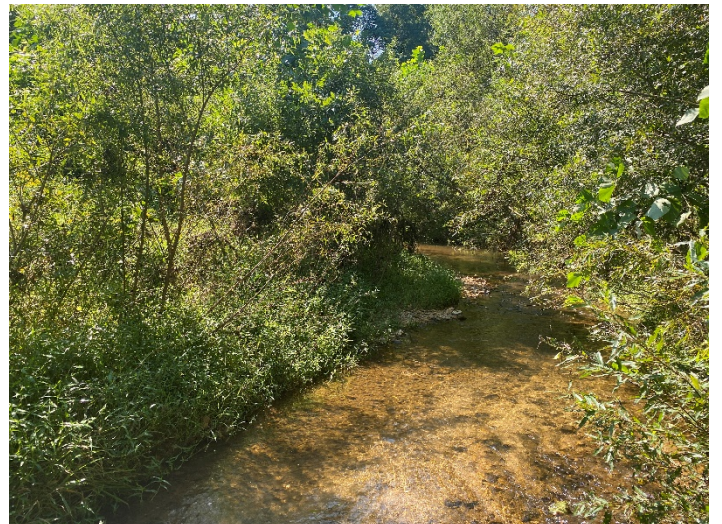
PP21 – Reach 1 Hogan Creek, looking downstream (9/8/2020)



PP22 – Reach 1 Hogan Creek, looking downstream (9/8/2020)



PP23 – Reach 1 Hogan Creek, looking downstream (9/8/2020)



PP24 – Reach 1 Hogan Creek, looking downstream (9/8/2020)



PP25 – Reach 1 Hogan Creek, looking upstream (9/8/2020)



PP26 – Reach 2 Hogan Creek, looking downstream (9/8/2020)



PP27 – Reach 2 Hogan Creek, looking downstream (9/8/2020)



PP28 – UT3, looking upstream (9/8/2020)



PP28A – UT3, looking upstream (9/8/2020)



PP28B – UT3, looking downstream (9/8/2020)



PP28C – UT3, looking upstream (9/8/2020)



PP29 – Reach 2 Hogan Creek, looking downstream (9/8/2020)



PP30 – Reach 2 Hogan Creek, looking downstream (9/8/2020)



PP31 – Reach 2 Hogan Creek, looking downstream (9/8/2020)



PP32 – Reach 2 Hogan Creek, looking downstream (9/8/2020)

Vegetation Photographs



Vegetation Plot 1 – (8/13/2020)



Vegetation Plot 2 – (8/13/2020)



Vegetation Plot 3 – (8/13/2020)



Vegetation Plot 4 – (8/13/2020)



Vegetation Plot 5 – (8/13/2020)



Vegetation Plot 6 – (8/13/2020)

APPENDIX C. Vegetation Plot Data

Table 8. Vegetation Plot Criteria Attainment

Hogan Creek Stream Mitigation Project
 DMS Project No. 94708
 Monitoring Year 6 - 2020

Plot	MYS Success Criteria Met (Y/N)	Tract Mean
1	Y	100%
2	Y	
3	Y	
4	Y	
5	Y	
6	Y	

Table 9. CVS Vegetation Plot Metadata

Hogan Creek Stream Mitigation Project
 DMS Project No. 94708
 Monitoring Year 6 - 2020

Database Name	cvs-eep-entrytool-v2.3.1 Hogan MY6.mdb
Database Location	L:\Active Projects\005-02152 Hogan Monitoring\Monitoring\MY6 (2020)\Vegetation Assessment
Computer Name	MIMI-PC
File Size	61771776
DESCRIPTION OF WORKSHEETS IN THIS DOCUMENT-----	
Metadata	Description of database file, the report worksheets, and a summary of project(s) and project data.
Proj, planted	Each project is listed with its PLANTED stems per acre, for each year. This excludes live stakes.
Proj, 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	94708
Project Name	Hogan Creek
Description	
River Basin	
Length(ft)	
Stream-to-edge Width (ft)	
Area (sq m)	
Required Plots (calculated)	
Sampled Plots	6
Required Plots (calculated)	6
Sampled Plots	6

Table 10. Planted and Total Stem Counts

Hogan Creek Stream Mitigation Project

DMS Project No. 94708

Monitoring Year 6 - 2020

Scientific Name	Common Name	Species Type	Current Plot Data (MY6 2020)																	
			94708-01-0001			94708-01-0002			94708-01-0003			94708-01-0004			94708-01-0005			94708-01-0006		
			PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T
<i>Acer rubrum</i>	red maple	Tree																		
<i>Betula nigra</i>	river birch	Tree	3	3	78	2	2	12	2	2	4	4	4	4	1	1	3			
<i>Diospyros virginiana</i>	common persimmon	Tree												3	3	3	5	5	5	
<i>Fraxinus pennsylvanica</i>	green ash	Tree	3	3	3	2	2	2	2	2	2	3	3	3	1	1	1			
<i>Juglans nigra</i>	black walnut	Tree															1			
<i>Lindera benzoin</i>	northern spicebush	Shrub			5															
<i>Liriodendron tulipifera</i>	tuliptree	Tree			8			1						25					1	
<i>Nyssa sylvatica</i>	blackgum	Tree															2	2	2	
<i>Pinus taeda</i>	loblolly pine	Tree			1															
<i>Platanus occidentalis</i>	American sycamore	Tree	2	2	2	3	3	3	1	1	1	8	8	8				1	1	1
<i>Prunus serotina</i>	black cherry	Tree			5			3			3									
<i>Quercus alba</i>	white oak	Tree																		
<i>Quercus lyrata</i>	overcup oak	Tree	1	1	1				4	4	4	1	1	1	2	2	2	5	5	5
<i>Quercus phellos</i>	willow oak	Tree													2	2	2			
Stem count			9	9	103	7	7	21	9	9	14	16	16	41	9	9	12	13	13	14
size (ares)			1			1			1			1			1			1		
size (ACRES)			0.0247			0.0247			0.0247			0.0247			0.0247			0.0247		
Species count			4	4	8	3	3	5	4	4	5	4	4	5	5	5	6	4	4	5
Stems per ACRE			364	364	4168	283	283	850	364	364	567	647	647	1659	364	364	486	526	526	567

Scientific Name	Common Name	Species Type	Annual Stem Counts & Means																				
			MY0 (2015)			MY1 (2015)			MY2 (2016)			MY3 (2017)			MY4 (2018)			MY5 (2019)			MY6 (2020)		
			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
<i>Acer rubrum</i>	red maple	Tree			1			7			1			5									
<i>Betula nigra</i>	river birch	Tree	10	10	10	10	10	149	10	10	169	10	10	165	10	10	193	8	8	162	12	12	101
<i>Diospyros virginiana</i>	common persimmon	Tree							11	11	11	9	9	9	10	10	10	8	8	8	8	8	8
<i>Fraxinus pennsylvanica</i>	green ash	Tree	17	17	17	14	14	14	15	15	15	13	13	13	13	13	13	10	10	10	11	11	11
<i>Juglans nigra</i>	black walnut	Tree			1									2			3			2			1
<i>Lindera benzoin</i>	northern spicebush	Shrub																		10			5
<i>Liriodendron tulipifera</i>	tuliptree	Tree						70			62			64			19			15			35
<i>Nyssa sylvatica</i>	blackgum	Tree	12	12	12	12	12	12	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
<i>Pinus taeda</i>	loblolly pine	Tree									3			2			15						1
<i>Platanus occidentalis</i>	American sycamore	Tree	13	13	13	14	14	17	14	14	20	14	14	15	14	14	31	14	14	15	15	15	15
<i>Prunus serotina</i>	black cherry	Tree			27			41			33												11
<i>Quercus alba</i>	white oak	Tree			2			1			1												
<i>Quercus lyrata</i>	overcup oak	Tree	13	13	13	15	15	15	17	17	17	16	16	16	16	16	16	14	14	14	13	13	13
<i>Quercus phellos</i>	willow oak	Tree	6	6	6	4	4	4	1	1	1	1	1	1	2	2	2	2	2	2	2	2	2
Stem count			71	71	102	69	69	330	70	70	335	65	65	294	67	67	304	58	58	240	63	63	205
size (ares)			6			6			6			6			6			6			6		
size (ACRES)			0.148			0.148			0.148			0.148			0.148			0.148			0.148		
Species count			6	6	10	6	6	10	7	7	12	7	7	11	7	7	10	7	7	10	7	7	12
Stems per ACRE			479	479	688	465	465	2226	472	472	2259	438	438	1983	452	452	2050	391	391	1619	425	425	1383

Color for Density

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

PnoLS: Number of planted stems excluding live stakes

P-all: Number of planted stems including live stakes

T: Total stems

APPENDIX D. Morphological Summary Data and Plots

Table 11a. Baseline Stream Data Summary

Hogan Creek Stream Mitigation Project
 DMS Project No.94708
 Monitoring Year 6 - 2020

Hogan Creek - Reach 1 (1,532 feet)

Parameter	Gage	Regional Curve			Pre-Existing Condition						Reference Reach Data						Design			Monitoring Baseline					
		LL	UL	Eq.	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n	Min	Med	Max	Min	Mean	Med	Max	SD	n
Dimension and Substrate - Riffle Only																									
Bankfull Width (ft)		-	-	-	21.5	-	25.7	29.7	-	-	27.2	-	30.4	33.6	-	-	22.5	23.3	24.0	22.8	24.2	24.2	25.6	-	2
Floodprone Width (ft)					178.0	-	220.0	246.0	-	-	72.1	-	72.3	72.5	-	-	100.0	150.0	200.0	>100	>100	>100	>100	-	2
Bankfull Mean Depth (ft)		-	-	-	2.0	-	1.9	2.1	-	-	1.9	-	2.0	2.2	-	-	1.8	1.9	2.2	1.7	1.8	1.8	1.8	-	2
Bankfull Max Depth (ft)	N/A	-	-	-	2.5	-	2.7	3.2	-	-	2.4	-	2.5	2.7	-	-	2.5	2.6	2.8	2.7	2.8	2.8	2.9	-	2
Bankfull Cross Sectional Area (ft ²)		-	-	-	45.1	-	48.6	59.3	-	-	50.8	-	61.6	72.4	-	-	40.6	44.1	47.6	41.4	42.7	42.7	43.9	-	2
Width/Depth Ratio					10.3	-	13.6	14.9	-	-	14.5	-	15.0	15.6	-	-	12.1	12.3	12.5	12.6	13.8	13.8	14.9	-	2
Entrenchment Ratio					8.3	-	8.6	8.3	-	-	2.7	-	2.7	2.7	-	-	4.4	6.5	8.3	>3.9	>4.2	>4.2	>4.4	-	2
Bank Height Ratio					1.3	-	1.3	1.4	-	-	1.0	-	1.0	1.1	-	-	1.0	1.0	1.0	1.0	1.0	1.0	1.0	-	2
Profile																									
Riffle Length (ft)					-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	37.17	58.9	-	98.4	-	8
Riffle Slope (ft/ft)					0.010	-	0.024	0.055	-	-	0.019	-	0.020	0.021	-	-	0.007	0.010	0.013	0.002	0.010	-	0.018	-	8
Pool Length (ft)	N/A				-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	25.0	62.6	-	88.0	-	13
Pool Max depth (ft)					4.0	-	4.3	4.7	-	-	3.4	-	3.5	3.5	-	-	4.0	4.0	4.0	2.5	3.2	-	4.1	-	13
Pool Spacing (ft)					-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	73.3	120.9	-	200.08	-	12
Pattern																									
Channel Beltwidth (ft)					44.0	-	65.0	117.0	-	-	86.0	-	86.0	86.0	-	-	48.0	88.0	126.0	63.0	96.5	101.0	121.0	24.9	4
Radius of Curvature (ft)					20.0	-	29.0	52.0	-	-	19.6	-	22.7	25.8	-	-	67.0	73.0	101.0	70.0	76.5	75.0	86.0	6.8	4
Rc:Bankfull width (ft/ft)	N/A				0.9	-	1.1	1.8	-	-	0.7	-	0.8	0.9	-	-	3.0	3.1	4.2	2.9	3.2	3.1	3.6	N/A	N/A
Meander Wavelength (ft)					133.0	-	297.0	479.0	-	-	81.0	-	81.0	81.0	-	-	133.0	311.0	325.0	165.0	263.7	306.0	320.0	85.7	3
Meander Width Ratio					2.0	-	2.5	3.9	-	-	3.2	-	3.2	3.2	-	-	2.1	3.8	5.3	2.6	4.0	4.2	5.0	N/A	N/A
Substrate, Bed, and Transport parameters																									
Ri% / Ru% / P% / G% / S%																									
SC% / Sa% / G% / C% / B% / Be%																									
d16 / d35 / d50 / d84 / d95 (mm)																									
Reach Shear Stress (competency) lb/ft ²	N/A																								
Max part size (mm) mobilized at bankfull																									
Stream Power (transport capacity) W/m ²																									
Additional Reach Parameters																									
Rosgen Classification																									
Bankfull Velocity (fps)		-	-	-																					
Bankfull Discharge (cfs)		-	-	-																					
Valley length (ft)																									
Channel Thalweg length (ft)																									
Sinuosity (ft)																									
Water Surface Slope (Channel) (ft/ft)	N/A																								
BF slope (ft/ft)																									
Bankfull Floodplain Area (acres)																									
% of Reach with Eroding Banks																									
Channel Stability or Habitat Metric																									
Biological or Other																									

N/A - Not Applicable
 - Information Unavailable

Table 11b. Baseline Stream Data Summary

Hogan Creek Stream Mitigation Project

DMS Project No.94708

Monitoring Year 6 - 2020

Hogan Creek - Reach 2 (1,085 feet)

Parameter	Gage	Regional Curve			Pre-Existing Condition						Reference Reach Data						Design			Monitoring Baseline					
		LL	UL	Eq.	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n	Min	Med	Max	Min	Mean	Med	Max	SD	n
Dimension and Substrate - Riffle Only																									
Bankfull Width (ft)		-	-	-	21.5	-	25.7	29.7	-	-	27.2	-	30.4	33.6	-	-	22.5	23.3	24.0	24.2	24.5	24.5	24.7	-	2
Floodprone Width (ft)					178.0	-	220.0	246.0	-	-	72.1	-	72.3	72.5	-	-	100.0	150.0	200.0	>100	>100	>100	>100	-	2
Bankfull Mean Depth (ft)		-	-	-	2.0	-	1.9	2.1	-	-	1.9	-	2.0	2.2	-	-	1.8	1.9	2.2	1.9	2.1	2.1	2.3	-	2
Bankfull Max Depth (ft)		-	-	-	2.5	-	2.7	3.2	-	-	2.4	-	2.5	2.7	-	-	2.5	2.6	2.8	3.2	3.4	3.4	3.6	-	2
Bankfull Cross Sectional Area (ft ²)	N/A	-	-	-	45.1	-	48.6	59.3	-	-	50.8	-	61.6	72.4	-	-	40.6	44.1	47.6	45.2	50.9	50.9	56.6	-	2
Width/Depth Ratio					10.3	-	13.6	14.9	-	-	14.5	-	15.0	15.6	-	-	12.1	12.3	12.5	10.8	11.9	11.9	13.0	-	2
Entrenchment Ratio					8.3	-	8.6	8.3	-	-	2.7	-	2.7	2.7	-	-	4.4	6.5	8.3	>4.0	>4.1	>4.1	>4.1	-	2
Bank Height Ratio					1.3	-	1.3	1.4	-	-	1.0	-	1.0	1.1	-	-	1.0	1.0	1.0	1.0	1.0	1.0	1.0	-	2
Profile																									
Riffle Length (ft)					-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	95.63	111.62	-	130.25	-	5
Riffle Slope (ft/ft)					0.010	-	0.024	0.055	-	-	0.019	-	0.020	0.021	-	-	0.007	0.010	0.013	0.004	0.005	-	0.007	-	5
Pool Length (ft)	N/A				-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	43.7	68.8	-	117.1	-	5
Pool Max depth (ft)					4.0	-	4.3	4.7	-	-	3.4	-	3.5	3.5	-	-	4.0	4.0	4.0	3.80	4.73	-	5.8	-	5
Pool Spacing (ft)					-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	164.1	208.4	-	253.1	-	4
Pattern																									
Channel Beltwidth (ft)					44.0	-	65.0	117.0	-	-	86.0	-	86.0	86.0	-	-	48.0	88.0	126.0	84.0	114.0	117.0	141.0	28.6	3
Radius of Curvature (ft)					20.0	-	29.0	52.0	-	-	19.6	-	22.7	25.8	-	-	67.0	73.0	101.0	69.0	73.3	74.0	75.0	2.8	5
Rc:Bankfull width (ft/ft)	N/A				0.9	-	1.1	1.8	-	-	0.7	-	0.8	0.9	-	-	3.0	3.1	4.2	2.8	3.0	3.0	3.1	N/A	N/A
Meander Wavelength (ft)					133.0	-	297.0	479.0	-	-	81.0	-	81.0	81.0	-	-	133.0	311.0	325.0	292.0	307.0	301.0	328.0	18.7	3
Meander Width Ratio					2.0	-	2.5	3.9	-	-	3.2	-	3.2	3.2	-	-	2.1	3.8	5.3	3.4	4.7	4.8	5.8	N/A	N/A
Substrate, Bed, and Transport parameters																									
Ri% / Ru% / P% / G% / S%																									
SC% / Sa% / G% / C% / B% / Be%																									
d16 / d35 / d50 / d84 / d95 (mm)	N/A																								
Reach Shear Stress (competency) lb/ft ²																									
Max part size (mm) mobilized at bankfull																									
Stream Power (transport capacity) W/m ²																									
Additional Reach Parameters																									
Rosgen Classification																									
Bankfull Velocity (fps)		-	-	-																					
Bankfull Discharge (cfs)		-	-	-																					
Valley length (ft)																									
Channel Thalweg length (ft)																									
Sinuosity (ft)																									
Water Surface Slope (Channel) (ft/ft)	N/A																								
BF slope (ft/ft)																									
Bankfull Floodplain Area (acres)																									
% of Reach with Eroding Banks																									
Channel Stability or Habitat Metric																									
Biological or Other																									

N/A - Not Applicable

- Information Unavailable

Table 11c. Baseline Stream Data Summary

Hogan Creek Stream Mitigation Project

DMS Project No.94708

Monitoring Year 6 - 2020

UT2 (675 feet)

Parameter	Gage	Regional Curve			Pre-Existing Condition						Reference Reach Data						Design			Monitoring Baseline					
		LL	UL	Eq.	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n	Min	Med	Max	Min	Mean	Med	Max	SD	n
Dimension and Substrate - Riffle Only																									
Bankfull Width (ft)	N/A	-	-	-	-	-	8.2	-	-	-	-	-	7.1	-	-	-	-	9.0	-	6.5	7.1	7.1	7.6	-	2
Floodprone Width (ft)		-	-	-	-	-	66.0	-	-	-	-	-	15.0	-	-	-	-	30.0	-	21	24.9	24.9	28.8	-	2
Bankfull Mean Depth (ft)		-	-	-	-	-	1.5	-	-	-	-	-	0.9	-	-	-	-	0.7	-	0.5	0.6	0.6	0.7	-	2
Bankfull Max Depth (ft)		-	-	-	-	-	2.1	-	-	-	-	-	1.2	-	-	-	-	1.0	-	0.9	1.1	1.1	1.2	-	2
Bankfull Cross Sectional Area (ft ²)		-	-	-	-	-	12.1	-	-	-	-	-	6.6	-	-	-	-	6.5	-	4.0	4.4	4.4	4.7	-	2
Width/Depth Ratio		-	-	-	-	-	5.6	-	-	-	-	-	7.6	-	-	-	-	12.5	-	8.9	11.6	11.6	14.2	-	2
Entrenchment Ratio		-	-	-	-	-	8.0	-	-	-	-	-	2.1	-	-	-	-	3.3	-	3.2	3.5	3.5	3.8	-	2
Bank Height Ratio		-	-	-	-	-	1.6	-	-	-	-	-	1.0	-	-	-	-	1.0	-	1.0	1.0	1.0	1.0	-	2
Profile																									
Riffle Length (ft)	N/A	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	14.3	34.4	-	67.3	-	11
Riffle Slope (ft/ft)		0.030	-	0.033	0.056	-	-	-	0.023	-	0.033	0.036	-	-	-	0.027	0.032	0.038	0.014	0.028	-	0.052	-	11	
Pool Length (ft)		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4.2	11.0	-	27.1	-	12
Pool Max depth (ft)		-	-	-	-	-	2.7	-	-	-	-	-	1.5	-	-	-	-	1.6	-	1.2	2.0	-	3.2	-	12
Pool Spacing (ft)		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	13.1	54.8	-	151.0	-	11
Pattern																									
Channel Beltwidth (ft)	N/A	-	-	-	28.0	-	42.0	56.0	-	-	62.0	-	67.5	73.0	-	-	17.0	26.0	49.0	26.0	38.0	39.0	54.0	2.7	5
Radius of Curvature (ft)		16.0	-	18.5	21.0	-	-	7.0	-	16.0	25.0	-	-	22.0	27.0	30.0	19.0	21.6	22.0	26.0	2.4	6			
Rc:Bankfull width (ft/ft)		2.0	-	2.3	2.6	-	-	1.0	-	2.3	3.5	-	-	2.4	3.0	3.3	2.7	3.0	3.1	3.7	N/A	N/A			
Meander Wavelength (ft)		128.0	-	159.0	190.0	-	-	53.0	-	58.5	64.0	-	-	73.0	103.0	130.0	101.0	112.3	109.5	132.0	2.7	6			
Meander Width Ratio		3.4	-	5.1	6.8	-	-	8.7	-	9.5	10.3	-	-	1.9	2.9	5.5	3.7	5.4	5.5	7.6	N/A	N/A			
Substrate, Bed, and Transport parameters																									
Ri% / Ru% / P% / G% / S%	N/A	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SC% / Sa% / G% / C% / B% / Be%		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
d16 / d35 / d50 / d84 / d95 (mm)		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Reach Shear Stress (competency) lb/ft ²		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Max part size (mm) mobilized at bankfull		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Stream Power (transport capacity) W/m ²	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Additional Reach Parameters																									
Rosgen Classification	N/A	-	-	-	E4b						E4b						B4			B4					
Bankfull Velocity (fps)		-	-	-	-						-						-			-					
Bankfull Discharge (cfs)		-	-	-	-						-						-			-					
Valley length (ft)		641						1,350						544											
Channel Thalweg length (ft)		568						1,980						675											
Sinuosity (ft)		1.33						1.47						1.24											
Water Surface Slope (Channel) (ft/ft)		0.0235						0.0263						0.0223						0.0218					
BF slope (ft/ft)		0.0312						0.0356						0.0312						0.0229					
Bankfull Floodplain Area (acres)		-						-						-											
% of Reach with Eroding Banks		-						-						-											
Channel Stability or Habitat Metric		-						-						-											
Biological or Other		-						-						-											

N/A - Not Applicable

- Information Unavailable

Table 12. Morphology and Hydraulic Summary (Dimensional Parameters - Cross-Section)

Hogan Creek Stream Mitigation Project

DMS Project No. 94708

Monitoring Year 6 - 2020

Hogan Reach 1 (1,532 feet)

Dimension and Substrate ^{2,3}	Cross-Section 1 (Riffle)							Cross-Section 2 (Pool)							Cross-Section 3 (Riffle)						
	Base	MY1	MY2	MY3	MY4	MY5	MY6	Base	MY1	MY2	MY3	MY4	MY5	MY6	Base	MY1	MY2	MY3	MY4	MY5	MY6
bankfull elevation (ft)	990.8	990.8	990.8	990.8	991.0	990.9	991.0	990.7	990.7	990.7	990.7	990.6	990.7	990.9	987.6	987.6	987.6	987.6	987.4	987.3	987.3
low bank elevation (ft)	990.8	990.8	990.9	990.9	990.8	990.8	990.7	990.7	990.7	990.7	990.6	990.6	990.7	990.9	987.6	987.6	987.7	987.9	987.9	987.4	987.6
Bankfull Width (ft)	25.6	25.4	25.6	22.7	24.0	23.5	20.0	29.1	30.6	26.2	25.8	23.7	25.1	28.1	22.8	22.9	22.9	22.4	23.5	22.9	23.5
Floodprone Width (ft)	>100	>100	>100	>100	>100	>100	>100	N/A	N/A	N/A	N/A	N/A	N/A	N/A	>100	>100	>100	>100	>100	>100	>100
Bankfull Mean Depth (ft)	1.7	1.6	1.7	1.8	1.6	1.7	1.9	2.0	2.2	2.0	2.1	2.2	2.4	2.2	1.8	2.0	2.4	2.5	2.2	1.9	2.0
Bankfull Max Depth (ft)	2.9	2.9	3.2	3.3	3.2	3.4	3.0	4.5	4.9	4.9	4.4	4.6	4.2	4.2	2.7	3.6	4.0	4.0	3.9	3.5	3.8
Bankfull Cross Sectional Area (ft ²)	43.9	41.8	44.2	39.9	37.6	41.0	37.1	57.6	66.7	64.2	54.9	51.1	59.8	62.5	41.4	45.9	54.6	55.3	52.0	43.9	47.3
Bankfull Width/Depth Ratio	14.9	15.4	14.8	12.9	15.3	13.4	10.7	14.7	14.1	10.7	12.1	11.0	10.6	12.7	12.6	11.4	9.6	9.1	10.6	11.9	11.7
Bankfull Entrenchment Ratio	>3.9	>3.9	>3.8	>4.4	>4.2	>4.3	>5.0	N/A	N/A	N/A	N/A	N/A	N/A	N/A	>4.4	>4.4	>4.4	>4.5	>4.3	>4.4	>4.3
Bankfull Bank Height Ratio	1.0	1.0	1.0	1.0	<1.0	<1.0	<1.0	N/A	N/A	N/A	N/A	N/A	N/A	N/A	1.0	1.0	1.0	1.1	1.1	1.0	1.1
d50 (mm)	19	23	17	41	42	52	26	N/A	N/A	N/A	N/A	N/A	N/A	N/A	26	29	6.9	1.0	7.1	32	25

Hogan Reach 2 (1,085 feet)

Dimension and Substrate ^{2,3}	Cross-Section 4 (Pool)							Cross-Section 5 (Riffle)							Cross-Section 6 (Riffle)						
	Base	MY1	MY2	MY3	MY4	MY5	MY6	Base	MY1	MY2 ¹	MY3	MY4	MY5	MY6	Base	MY1	MY2	MY3	MY4	MY5	MY6
bankfull elevation (ft)	984.0	984.0	984.0	984.0	984.0	983.5	984.1	983.6	983.6	983.6	983.3	983.7	983.7	982.1	982.1	982.1	982.1	981.9	981.9	981.6	981.6
low bank elevation (ft)	984.0	984.0	984.0	984.0	984.0	983.5	984.1	983.6	983.6	983.7	983.8	983.8	983.6	983.6	982.1	982.1	982.0	981.9	981.9	981.7	981.5
Bankfull Width (ft)	44.6	45.5	44	43.2	32.1	25.5	22.5	24.2	24.8	23.6	24.7	26.1	26.2	25.5	24.7	28.1	28.2	28.7	26.1	29.0	26.9
Floodprone Width (ft)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	>100	>100	>100	>100	>100	>100	>100	>100	>100	>100	>100	>100	>100	>100
Bankfull Mean Depth (ft)	2.2	2.1	1.6	1.7	1.8	1.9	2.1	1.9	2.0	2.4	2.5	2.2	1.6	1.6	2.3	2.0	2.2	2.1	2.2	2.1	2.0
Bankfull Max Depth (ft)	4.2	4.3	4.2	4.6	4.0	3.3	3.4	3.2	3.6	3.9	3.6	3.4	2.7	2.7	3.6	3.8	3.9	3.8	4.1	3.2	3.2
Bankfull Cross Sectional Area (ft ²)	98.9	95.4	69.1	72.5	58.6	48.5	47.8	45.2	49.2	56.6	61	58.2	42.7	40.6	56.6	56.5	61.1	61.4	56.5	60.1	54.8
Bankfull Width/Depth Ratio	20.1	21.7	28.1	25.7	17.5	13.4	10.6	13.0	12.5	9.8	10	11.7	16	16	10.8	14.0	13	13.4	12.0	14.0	13.2
Bankfull Entrenchment Ratio	N/A	N/A	N/A	N/A	N/A	N/A	N/A	>4.1	>4.0	>4.2	>4.0	>3.8	>3.8	>3.9	>4.0	>3.6	>3.5	>3.5	>3.8	>3.4	>3.7
Bankfull Bank Height Ratio	N/A	N/A	N/A	N/A	N/A	N/A	N/A	1.0	1.0	1.0	1.0	1.2	<1.0	<1.0	1.0	1.0	1.0	<1.0	1.0	1.0	1.0
d50 (mm)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	27	32	6.4	41	29	47	34	31	30	0.18	64	56	63	51

UT2 (675 feet)

Dimension and Substrate ^{2,3}	Cross-Section 7 (Riffle)							Cross-Section 8 (Pool)							Cross-Section 9 (Riffle)						
	Base	MY1	MY2 ¹	MY3	MY4	MY5	MY6	Base	MY1	MY2	MY3	MY4	MY5	MY6	Base	MY1	MY2	MY3	MY4	MY5	MY6
bankfull elevation (ft)	989.4	989.4	989.4	989.4	989.7	989.5	989.5	988.2	988.2	988.2	988.2	988.4	988.3	988.3	986.4	986.4	986.4	986.4	986.9	987.0	987.0
low bank elevation (ft)	989.4	989.4	989.3	989.4	989.7	989.8	989.7	988.2	988.3	988.3	988.3	988.4	988.3	988.3	986.4	986.5	986.4	986.5	986.8	986.9	987.0
Bankfull Width (ft)	7.6	6.9	7.9	6.2	8.6	7.4	8.0	6.9	7.1	7.1	5.7	6.6	5.8	5.7	6.5	6.8	6.8	5.5	7.9	5.9	6.5
Floodprone Width (ft)	29	29	30	29	26	35	32	N/A	N/A	N/A	N/A	N/A	N/A	N/A	21	21	19	19	18	28	26
Bankfull Mean Depth (ft)	0.5	0.5	0.6	0.6	0.5	0.8	0.7	0.6	0.7	0.7	0.7	0.6	0.7	0.7	0.7	0.7	0.6	0.5	0.5	0.7	0.7
Bankfull Max Depth (ft)	0.9	1.0	1.1	1.0	1.0	1.4	1.2	1.0	1.3	1.0	1.3	1.2	1.2	1.0	1.2	1.1	0.9	0.8	1.0	1.1	1.0
Bankfull Cross Sectional Area (ft ²)	4.0	3.5	4.9	3.5	4.3	5.8	5.5	4.4	5.1	4.7	4.3	4.0	4.2	4.0	4.7	4.6	4.1	2.7	4.2	4.0	4.6
Bankfull Width/Depth Ratio	14.2	13.6	12.8	10.8	17.2	9.5	11.8	10.7	9.8	10.8	7.7	10.7	8.0	8.2	8.9	10.3	11.3	11.2	15.0	8.6	9.2
Bankfull Entrenchment Ratio	3.8	4.2	3.8	4.7	3.0	4.7	4.0	N/A	N/A	N/A	N/A	N/A	N/A	N/A	3.2	3.0	2.8	3.4	2.2	4.8	4.0
Bankfull Bank Height Ratio	1.0	1.0	1.0	1.0	1.0	1.3	1.2	N/A	N/A	N/A	N/A	N/A	N/A	N/A	1.0	1.0	1.0	1.1	<1.0	<1.0	1.0
d50 (mm)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

N/A - Not Applicable

¹Adjustment in survey points included in bankfull calculations resulting in change to previous monitoring year bankfull dimensions.

²Prior to MY4, bankfull dimensions were calculated using a fixed bankfull elevation.

³MY4-MY6 Bank Height Ratio is calculated based on the As-built (MY0) cross-sectional area as described in the Standard Measurement of the BHR Monitoring Parameter document provided by NCIRT and NCDMS (9/2018). The remainder of the bankfull dimensions are calculated based on the current year's low bank height. MY4 dimensions were updated in MY5.

Table 13a. Monitoring Data - Stream Reach Data Summary

Hogan Creek Stream Mitigation Project

DMS Project No. 94708

Monitoring Year 6 - 2020

Hogan Creek-Reach 1 (1,532 feet)

Parameter	Baseline						MY1						MY2						MY3						MY4						MY5						MY6					
	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n
Dimension and Substrate - Riffle only ^{1,2}																																										
Bankfull Width (ft)	22.8	24.2	24.2	25.6	N/A	2	22.9	24.2	24.2	25.4	N/A	2	22.9	24.25	24.25	25.6	N/A	2	22.4	22.6	22.6	22.7	N/A	2	23.5	23.8	23.8	24.0	N/A	2	22.9	23.2	23.2	23.5	N/A	2	20.0	21.8	21.8	23.5	N/A	2
Floodprone Width (ft)	>100	>100	>100	>100	N/A	2	>100	>100	>100	>100	N/A	2	>100	>100	>100	>100	N/A	2	>100	>100	>100	>100	N/A	2	>100	>100	>100	>100	N/A	2	>100	>100	>100	>100	N/A	2	>100	>100	>100	>100	N/A	2
Bankfull Mean Depth (ft)	1.7	1.8	1.8	1.8	N/A	2	1.6	1.8	1.8	2.0	N/A	2	1.7	2.1	2.1	2.4	N/A	2	1.8	2.2	2.2	2.5	N/A	2	1.6	1.9	1.9	2.2	N/A	2	1.7	1.8	1.8	1.9	N/A	2	1.9	1.95	1.95	2.0	N/A	2
Bankfull Max Depth (ft)	2.7	2.8	2.8	2.9	N/A	2	2.9	3.3	3.3	3.6	N/A	2	3.2	3.6	3.6	4	N/A	2	3.3	3.7	3.7	4.0	N/A	2	3.2	3.6	3.6	3.9	N/A	2	3.4	3.5	3.5	3.5	N/A	2	3.0	3.4	3.4	3.8	N/A	2
Bankfull Cross Sectional Area (ft ²)	41.4	42.7	42.7	43.9	N/A	2	41.8	43.9	43.9	45.9	N/A	2	44.2	49.4	49.4	54.6	N/A	2	39.9	47.6	47.6	55.3	N/A	2	37.6	44.8	44.8	52.0	N/A	2	41.0	42.5	42.5	43.9	N/A	2	37.1	42.2	42.2	47.3	N/A	2
Width/Depth Ratio	12.6	13.8	13.8	14.9	N/A	2	11.4	13.4	13.4	15.4	N/A	2	9.6	12.2	12.2	14.8	N/A	2	9.1	11.0	11.0	12.9	N/A	2	10.6	13.0	13.0	15.3	N/A	2	11.9	12.7	12.7	13.4	N/A	2	10.7	11.2	11.2	11.7	N/A	2
Entrenchment Ratio	>3.9	>4.2	>4.2	>4.4	N/A	2	>3.9	>4.2	>4.2	>4.4	N/A	2	>3.8	>4.1	>4.1	>4.4	N/A	2	>4.4	>4.45	>4.45	>4.5	N/A	2	>4.2	>4.25	>4.25	>4.3	N/A	2	>4.3	>4.35	>4.35	>4.4	N/A	2	>4.3	>4.65	>4.65	>5.0	N/A	2
Bank Height Ratio	1.0	1.0	1.0	1.0	N/A	2	1.0	1.0	1.0	1.0	N/A	2	1.0	1.0	1.0	1.0	N/A	2	1.0	1.1	1.1	1.1	N/A	2	<1.0	1.0	1.0	1.1	N/A	2	<1.0	1.0	1.0	1.0	N/A	2	<1.0	1.0	1.0	1.1	N/A	2
Profile																																										
Riffle Length (ft)	37.17	58.9	N/A	98.4	N/A	8	15.0	62.1	73.5	98.0	N/A	8	11.7	23.2	23.6	38	N/A	10	10.1	29.0	26.1	53.3	N/A	10	16.6	43.0	37.4	97.6	N/A	11	11.0	71.0	64.0	193.0	N/A	9	7.0	69.0	56.0	180.0	N/A	9
Riffle Slope (ft/ft)	0.002	0.010	N/A	0.018	N/A	8	0.006	0.013	0.011	0.020	N/A	8	0.011	0.05	0.022	0.057	N/A	10	0.011	0.029	0.022	0.072	N/A	10	0.007	0.023	0.021	0.051	N/A	11	0.006	0.022	0.013	0.080	N/A	9	0.005	0.015	0.012	0.035	N/A	9
Pool Length (ft)	25.0	62.6	N/A	88.0	N/A	13	20.0	67.1	76.0	105.0	N/A	13	30.87	85.3	89.5	140.8	N/A	13	32.4	100.7	115.4	170.7	N/A	12	13.8	98.1	99.7	172.0	N/A	11	67.0	170.0	103.0	170.0	N/A	9	69.0	155.0	95.0	155.0	N/A	9
Pool Max depth (ft)	2.5	3.2	N/A	4.1	N/A	13	2.8	3.7	3.4	4.8	N/A	13	2.3	3.7	3.6	5.1	N/A	13	2.4	3.8	3.8	5.8	N/A	12	3.2	4.0	3.9	5.6	N/A	11	3.0	4.2	4.0	6.3	N/A	9	2.9	4.2	4.3	6.0	N/A	9
Pool Spacing (ft)	73.3	120.9	N/A	200.1	N/A	12	52.0	112.8	111.0	148.0	N/A	12	57	110.1	103	204.0	N/A	12	46.9	122.5	120.9	180.5	N/A	11	61.5	132.0	129.1	230.6	N/A	10	104.0	162.0	134.0	372.0	N/A	8	103.0	165.0	135.0	388.0	N/A	8
Pattern																																										
Channel Beltwidth (ft)	63.0	96.5	101.0	121.0	24.9	4																																				
Radius of Curvature (ft)	70.0	76.5	75.0	86.0	6.8	4																																				
Rc:Bankfull width (ft/ft)	2.9	3.2	3.1	3.6	N/A	N/A																																				
Meander Wavelength (ft)	165.0	263.7	306.0	320.0	85.7	3																																				
Meander Width Ratio	2.6	4.0	4.2	5.0	N/A	N/A																																				
Additional Reach Parameters																																										
Rosgen Classification	C4						C4						C4						C4						C4						C4											
Channel Thalweg length (ft)	1,532						1,530						1,532						1,532						1,532						1,532											
Sinuosity (ft)	1.18						1.18						1.18						1.18						1.18						1.18											
Water Surface Slope (Channel) (ft/ft)	0.0063						0.0064						0.0070						0.0064						0.0060						0.0062											
BF slope (ft/ft)	0.0067						0.0069						0.0069						0.0068						0.0067						0.0066											
Ri% / Ru% / P% / G% / S%	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SC% / Sa% / G% / C% / B% / Be%	0%	3.5%	96%	0.5%	0%	0%	0%	0.5%	98%	1.5%	0%	0%	13%	21.0%	64%	3.0%	0%	0%	12%	20%	53%	14.5%	0.5%	0%	5%	23%	58%	14.0%	0%	0%	0%	2%	72%	26%	0%	0%	0%	5%	86%	9%	0%	0%
d16 / d35 / d50 / d84 / d95 /	14	19	23	41	56		13	21	27	44	62		0.19	6.1	10	33	50		0.20	5.6	21	63	139		0.40	7.5	17	61	105		19	31	42	75	90		10	19	25	54	84	
% of Reach with Eroding Banks	0%						7%						9%						9%						9%						1%											
Channel Stability or Habitat Metric																																										
Biological or Other																																										

N/A - Not Applicable

- Information Unavailable

¹Prior to MY4, bankfull dimensions were calculated using a fixed bankfull elevation.

²MY4-MY6 Bank Height Ratio is calculated based on the As-built (MY0) cross-sectional area as described in the Standard Measurement of the BHR Monitoring Parameter document provided by NCIRT and NCDMS (9/2018). The remainder of the bankfull dimensions are calculated based on the current year's low bank height. MY4 dimensions were updated in MY5.

Table 13b. Monitoring Data - Stream Reach Data Summary

Hogan Creek Stream Mitigation Project

DMS Project No. 94708

Monitoring Year 6 - 2020

Hogan Creek-Reach 2 (1,085 feet)

Parameter	Baseline						MY1						MY2						MY3						MY4						MY5						MY6					
	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n
Dimension and Substrate - Riffle only ^{1,2}																																										
Bankfull Width (ft)	24.2	24.5	24.5	24.7	N/A	2	24.8	26.5	26.5	28.1	N/A	2	23.6	25.9	25.9	28.2	N/A	2	24.7	26.7	26.7	28.7	N/A	2	26.1	26.1	26.1	26.1	N/A	2	26.2	27.6	27.6	29.0	N/A	2	25.5	26.2	26.2	26.9	N/A	2
Floodprone Width (ft)	>100	>100	>100	>100	N/A	2	>100	>100	>100	>100	N/A	2	>100	>100	>100	>100	N/A	2	>100	>100	>100	>100	N/A	2	>100	>100	>100	>100	N/A	2	>100	>100	>100	>100	N/A	2	>100	>100	>100	>100	N/A	2
Bankfull Mean Depth (ft)	1.9	2.1	2.1	2.3	N/A	2	2.0	2.0	2.0	2.0	N/A	2	2.2	2.3	2.3	2.4	N/A	2	2.1	2.3	2.3	2.5	N/A	2	2.2	2.2	2.2	2.2	N/A	2	1.6	1.9	1.9	2.1	N/A	2	1.6	1.8	1.8	2.0	N/A	2
Bankfull Max Depth (ft)	3.2	3.4	3.4	3.6	N/A	2	3.6	3.7	3.7	3.8	N/A	2	3.9	3.9	3.9	3.9	N/A	2	3.6	3.7	3.7	3.8	N/A	2	3.4	3.8	3.8	4.1	N/A	2	2.7	3.0	3.0	3.2	N/A	2	2.7	2.95	2.95	3.2	N/A	2
Bankfull Cross Sectional Area (ft ²)	45.2	50.9	50.9	56.6	N/A	2	49.2	52.9	52.9	56.5	N/A	2	56.6	58.9	58.9	61.1	N/A	2	61.0	61.2	61.2	61.4	N/A	2	56.5	57.4	57.4	58.2	N/A	2	42.7	51.4	51.4	60.1	N/A	2	40.6	47.7	47.7	54.8	N/A	2
Width/Depth Ratio	10.8	11.9	11.9	13.0	N/A	2	12.5	13.3	13.3	14.0	N/A	2	9.8	11.4	11.4	13.0	N/A	2	10.0	11.7	11.7	13.4	N/A	2	11.7	11.9	11.9	12.0	N/A	2	14.0	15.0	15.0	16.0	N/A	2	13.2	14.6	14.6	16.0	N/A	2
Entrenchment Ratio	>4.0	>4.1	>4.1	>4.1	N/A	2	>3.6	>3.8	>3.8	>4.0	N/A	2	>3.5	>3.75	>3.75	>4.0	N/A	2	>3.5	>3.75	>3.75	>4.0	N/A	2	>3.8	>3.8	>3.8	>3.8	N/A	2	>3.4	>3.6	>3.6	>3.8	N/A	2	3.7	3.8	3.8	3.9	N/A	2
Bank Height Ratio	1.0	1.0	1.0	1.0	N/A	2	1.0	1.0	1.0	1.0	N/A	2	1.0	1.0	1.0	1.0	N/A	2	0.9	1.0	1.0	1.0	N/A	2	1.0	1.1	1.1	1.2	N/A	2	<1.0	1.0	1.0	1.0	N/A	2	<1.0	1.0	1.0	1.0	N/A	2
Profile																																										
Riffle Length (ft)	95.6	111.6	N/A	130.3	N/A	5	56.0	91.0	101.0	125.0	N/A	5	24.7	51.8	46.9	97.6	N/A	5	19.6	46.3	43.2	68.2	N/A	5	51.5	94.0	69.9	151.2	N/A	5	69.0	110.0	107.0	157.0	N/A	5	41.9	63.5	56.1	99.8	N/A	5
Riffle Slope (ft/ft)	0.004	0.005	N/A	0.007	N/A	5	0.004	0.009	0.007	0.018	N/A	5	0.008	0.012	0.01	0.017	N/A	5	0.006	0.009	0.007	0.014	N/A	5	0.004	0.0089	0.009	0.012	N/A	5	0.007	0.0077	0.007	0.010	N/A	5	0.010	0.013	0.012	0.019	N/A	5
Pool Length (ft)	43.7	68.8	N/A	117.1	N/A	5	60.0	87.3	64.0	135.0	N/A	5	29.91	74.4	75.4	107.0	N/A	5	54.0	71.1	58.1	117.1	N/A	5	42.3	98.1	87.5	184.1	N/A	5	45.0	118.0	86.0	118.0	N/A	5	50.2	171.2	99.9	171.2	N/A	5
Pool Max depth (ft)	3.8	4.7	N/A	5.8	N/A	5	4.0	4.8	4.6	5.7	N/A	5	3.77	4.4	4.4	5.4	N/A	5	3.5	4.5	4.4	6.0	N/A	5	4.2	4.9	4.5	6.0	N/A	5	4.1	4.8	5.0	5.7	N/A	5	3.0	4.5	4.3	6.0	N/A	5
Pool Spacing (ft)	164.1	208.4	N/A	253.1	N/A	4	169.0	196.5	189.5	238.0	N/A	4	93.7	134.2	129.4	201.0	N/A	4	76.8	140.8	142.6	201.3	N/A	4	188.1	202.1	203.0	214.4	N/A	4	162.0	198.0	203.0	222.0	N/A	4	41.0	140.1	158.5	202.3	N/A	4
Pattern																																										
Channel Beltwidth (ft)	84.0	114.0	117.0	141.0	28.6	3																																				
Radius of Curvature (ft)	69.0	73.3	74.0	75.0	2.8	5																																				
Rc:Bankfull width (ft/ft)	2.8	3.0	3.0	3.1	N/A	N/A																																				
Meander Wavelength (ft)	292.0	307.0	301.0	328.0	18.7	3																																				
Meander Width Ratio	3.4	4.7	4.8	5.8	N/A	N/A																																				
Additional Reach Parameters																																										
Rosgen Classification	C4						C4						C4						C4						C4						C4											
Channel Thalweg length (ft)	1,085						1,085						1,085						1,085						1,085						1,085											
Sinuosity (ft)	1.37						1.37						1.37						1.37						1.37						1.37											
Water Surface Slope (Channel) (ft/ft)	0.0050						0.0045						0.005						0.0054						0.0053						0.0052											
BF slope (ft/ft)	0.0053						0.0053						0.0053						0.0057						0.0062						0.0067											
Ri% / Ru% / P% / G% / S%	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SC% / Sa% / G% / C% / B% / Be%	0%	3%	9%	89%	0%	0%	0%	0%	99%	1%	0%	0%	17%	50.0%	31%	2.0%	0%	0%	0%	13.0%	51%	32%	4%	0%	0%	5.0%	69%	23%	3%	0%	0%	4%	53%	39%	2%	2%	0%	4%	63%	32%	2%	0%
d16 / d35 / d50 / d84 / d95 /	13	24	22	35	49		18	25	31	52	70		0.062	0.16	0.3	17	40		7.1	31	46	138	243		13	24	37	95	224		23	47	58	110	180		15	29	43	111	214	
% of Reach with Eroding Banks	0%						2%						13%						6%						10%						2%											
Channel Stability or Habitat Metric																																										
Biological or Other																																										

N/A - Not Applicable

- Information Unavailable

¹Prior to MY4, bankfull dimensions were calculated using a fixed bankfull elevation.

²MY4-MY6 Bank Height Ratio is calculated based on the As-built (MY0) cross-sectional area as described in the Standard Measurement of the BHR Monitoring Parameter document provided by NCIRT and NCDMS (9/2018). The remainder of the bankfull dimensions are calculated based on the current year's low bank height. MY4 dimensions were updated in MY5.

Table 13c. Monitoring Data - Stream Reach Data Summary

Hogan Creek Stream Mitigation Project

DMS Project No. 94708

Monitoring Year 6 - 2020

UT2 (675 feet)

Parameter	Baseline						MY1						MY2						MY3						MY4						MY5						MY6					
	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n
Dimension and Substrate - Riffle only ^{1,2}																																										
Bankfull Width (ft)	6.5	7.1	7.1	7.6	N/A	2	6.8	6.9	6.9	6.9	N/A	2	6.8	7.4	7.4	7.9	N/A	2	5.5	5.85	5.85	6.2	N/A	2	7.9	8.3	8.3	8.6	N/A	2	5.9	6.7	6.7	7.4	N/A	2	6.5	7.25	7.25	8.0	N/A	2
Floodprone Width (ft)	21	24.9	24.9	28.8	N/A	2	20.6	24.8	24.8	29.0	N/A	2	19.2	24.6	24.6	30	N/A	2	18.8	24.05	24.05	29.3	N/A	2	17.8	21.9	21.9	25.9	N/A	2	27.9	31.3	31.3	34.6	N/A	2	>100	>100	>100	>100	N/A	2
Bankfull Mean Depth (ft)	0.5	0.6	0.6	0.7	N/A	2	0.5	0.6	0.6	0.7	N/A	2	0.6	0.6	0.6	0.6	N/A	2	0.5	0.55	0.55	0.6	N/A	2	0.5	0.5	0.5	0.5	N/A	2	0.7	0.8	0.8	0.8	N/A	2	0.7	0.7	0.7	0.7	N/A	2
Bankfull Max Depth (ft)	0.9	1.1	1.1	1.2	N/A	2	1.0	1.1	1.1	1.1	N/A	2	0.9	1.0	1.0	1.1	N/A	2	0.8	0.9	0.9	1	N/A	2	1.0	1.0	1.0	1.0	N/A	2	1.1	1.3	1.3	1.4	N/A	2	1	1.1	1.1	1.2	N/A	2
Bankfull Cross Sectional Area (ft ²)	4.0	4.4	4.4	4.7	N/A	2	3.5	4.1	4.1	4.6	N/A	2	4.1	4.5	4.5	4.9	N/A	2	2.7	3.1	3.1	3.5	N/A	2	4.2	4.3	4.3	4.3	N/A	2	4.0	4.9	4.9	5.8	N/A	2	4.6	5.05	5.05	5.5	N/A	2
Width/Depth Ratio	8.9	11.6	11.6	14.2	N/A	2	10.3	12.0	12.0	13.6	N/A	2	11.3	12.1	12.1	12.8	N/A	2	10.8	11	11	11.2	N/A	2	15.0	16.1	16.1	17.2	N/A	2	8.6	9.1	9.1	9.5	N/A	2	9.2	10.5	10.5	11.8	N/A	2
Entrenchment Ratio	3.2	3.5	3.5	3.8	N/A	2	3.0	3.6	3.6	4.2	N/A	2	2.8	3.3	3.3	3.8	N/A	2	3.4	4.05	4.05	4.7	N/A	2	2.2	2.6	2.6	3.0	N/A	2	4.7	4.8	4.8	4.8	N/A	2	4.0	4.0	4.0	4.0	N/A	2
Bank Height Ratio	1.0	1.0	1.0	1.0	N/A	2	1.0	1.0	1.0	1.0	N/A	2	1.0	1.0	1.0	1.0	N/A	2	1	1.05	1.05	1.1	N/A	2	<1.0	<1.0	<1.0	1.0	N/A	2	<1.0	1.1	1.1	1.3	N/A	2	1.0	1.2	1.2	1.3	N/A	2
Profile																																										
Riffle Length (ft)	14.3	34.4	N/A	67.3	N/A	11	12.0	28.9	29.0	62.0	N/A	11	7.88	29.3	25.6	69.8	N/A	11	12.4	26.8	24.4	45.9	N/A	11	5.2	19.7	16.6	55.4	N/A	16	6.0	34.0	21.0	178.0	N/A	11	3.7	24.7	15.7	132.0	N/A	15
Riffle Slope (ft/ft)	0.014	0.028	N/A	0.052	N/A	11	0.014	0.026	0.024	0.050	N/A	11	0.012	0.041	0.030	0.099	N/A	11	0.011	0.036	0.032	0.071	N/A	11	0.023	0.050	0.044	0.130	N/A	16	0.008	0.049	0.047	0.135	N/A	11	0.009	0.043	0.039	0.116	N/A	15
Pool Length (ft)	4.2	11.0	N/A	27.1	N/A	12	7.0	13.3	12.0	28.0	N/A	13	7.07	17.2	13.7	50.4	N/A	13	7.9	19.5	19.4	35.6	N/A	10	10.0	18.8	18.0	39.8	N/A	16	14.0	37.0	22.0	37.0	N/A	9	13.2	38.8	18.3	38.8	N/A	14
Pool Max depth (ft)	1.2	2.0	N/A	3.2	N/A	12	1.1	1.7	1.7	2.4	N/A	13	1.14	1.7	1.7	2.3	N/A	13	1.0	1.8	1.9	2.8	N/A	10	0.8	1.6	1.6	2.6	N/A	15	1.1	1.8	1.8	2.7	N/A	9	0.9	1.7	1.8	2.5	N/A	14
Pool Spacing (ft)	13.1	54.8	N/A	151.0	N/A	11	8.0	50.4	43.5	145.0	N/A	12	11.9	47.8	35.9	137.8	N/A	12	22.1	57.6	48.6	134.3	N/A	9	14.6	42.0	36.8	142.0	N/A	14	19.0	73.0	47.0	241.0	N/A	8	12.0	46.9	44.3	154.3	N/A	13
Pattern																																										
Channel Beltwidth (ft)	26.0	38.0	39.0	54.0	2.7	5																																				
Radius of Curvature (ft)	19.0	21.6	22.0	26.0	2.4	6																																				
Rc:Bankfull width (ft/ft)	2.7	3.0	3.1	3.7	N/A	N/A																																				
Meander Wavelength (ft)	101.0	112.3	109.5	132.0	2.7	6																																				
Meander Width Ratio	3.7	5.4	5.5	7.6	N/A	N/A																																				
Additional Reach Parameters																																										
Rosgen Classification	B4						B4						B4						B4						B4						B4											
Channel Thalweg length (ft)	675						670						675						675						675						675											
Sinuosity (ft)	1.24						1.24						1.24						1.24						1.24						1.24											
Water Surface Slope (Channel) (ft/ft)	0.0218						0.0208						0.0215						0.0205						0.0199						0.0201											
BF slope (ft/ft)	0.0229						0.0226						0.0224						0.0222						0.0224						0.0216											
Ri% / Ru% / P% / G% / S%	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SC% / Sa% / G% / C% / B% / Be%	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
d16 / d35 / d50 / d84 / d95 /	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
% of Reach with Eroding Banks	0%						0%						0%						0%						0%																	
Channel Stability or Habitat Metric																																										
Biological or Other																																										

N/A - Not Applicable

- Information Unavailable

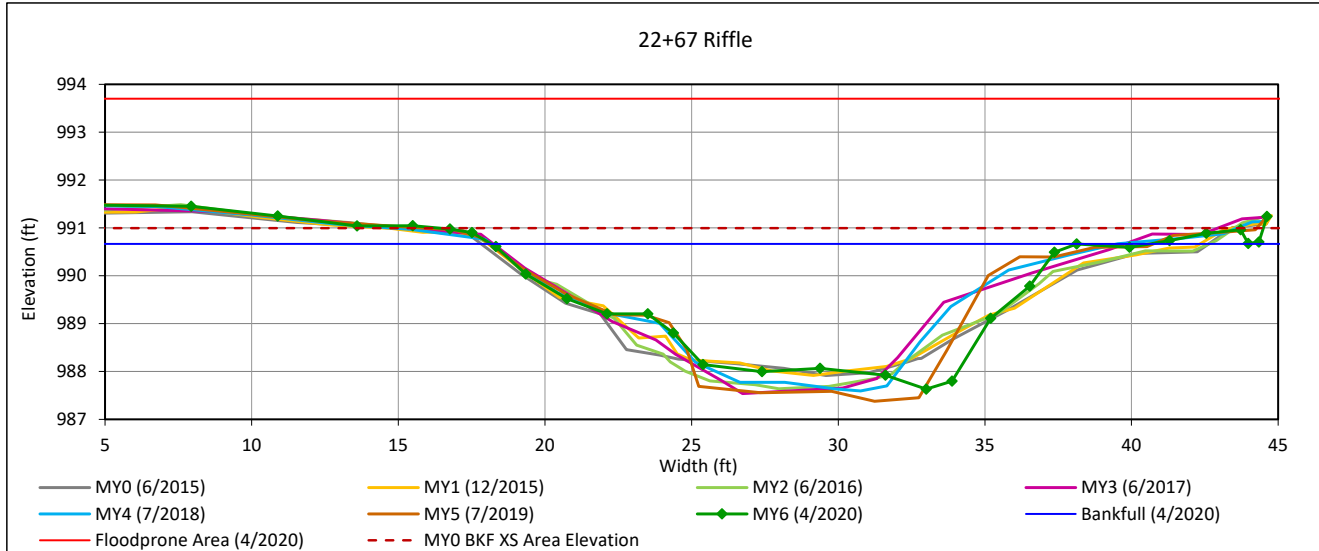
¹Prior to MY4, bankfull dimensions were calculated using a fixed bankfull elevation.

²MY4-MY6 Bank Height Ratio is calculated based on the As-built (MY0) cross-sectional area as described in the Standard Measurement of the BHR Monitoring Parameter document provided by NCIRT and NCDMS (9/2018). The remainder of the bankfull dimensions are calculated based on the current year's low bank height. MY4 dimensions were updated in MY5.

Cross-Section Plots

Hogan Creek Stream Mitigation Project
 NCDMS Project No. 94708
 Monitoring Year 6 - 2020

Cross-Section 1-Hogan Creek Reach 1



Bankfull Dimensions

37.1	x-section area (ft.sq.)
20.0	width (ft)
1.9	mean depth (ft)
3.0	max depth (ft)
21.6	wetted perimeter (ft)
1.7	hydraulic radius (ft)
10.7	width-depth ratio
100.0	W flood prone area (ft)
5.0	entrenchment ratio
0.9	low bank height ratio

Survey Date: 4/2020

Field Crew: Kee Mapping & Surveying

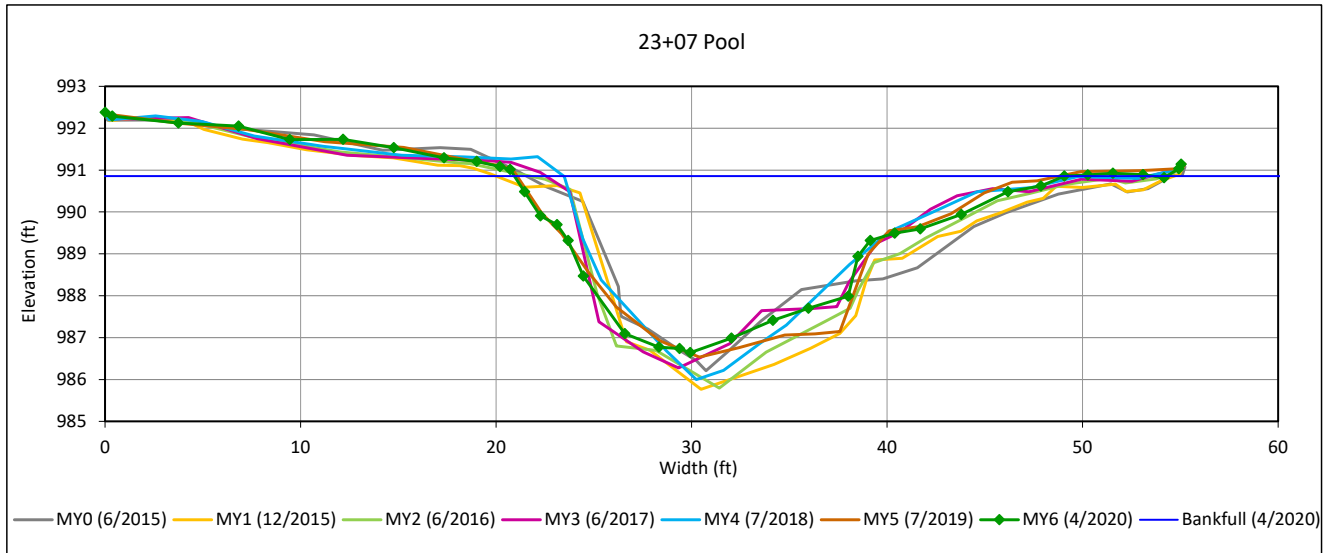


View Downstream

Cross-Section Plots

Hogan Creek Stream Mitigation Project
 NCDMS Project No. 94708
Monitoring Year 6 - 2020

Cross-Section 2-Hogan Creek Reach 1



Bankfull Dimensions

62.5	x-section area (ft.sq.)
28.1	width (ft)
2.2	mean depth (ft)
4.2	max depth (ft)
30.3	wetted perimeter (ft)
2.1	hydraulic radius (ft)
12.7	width-depth ratio

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

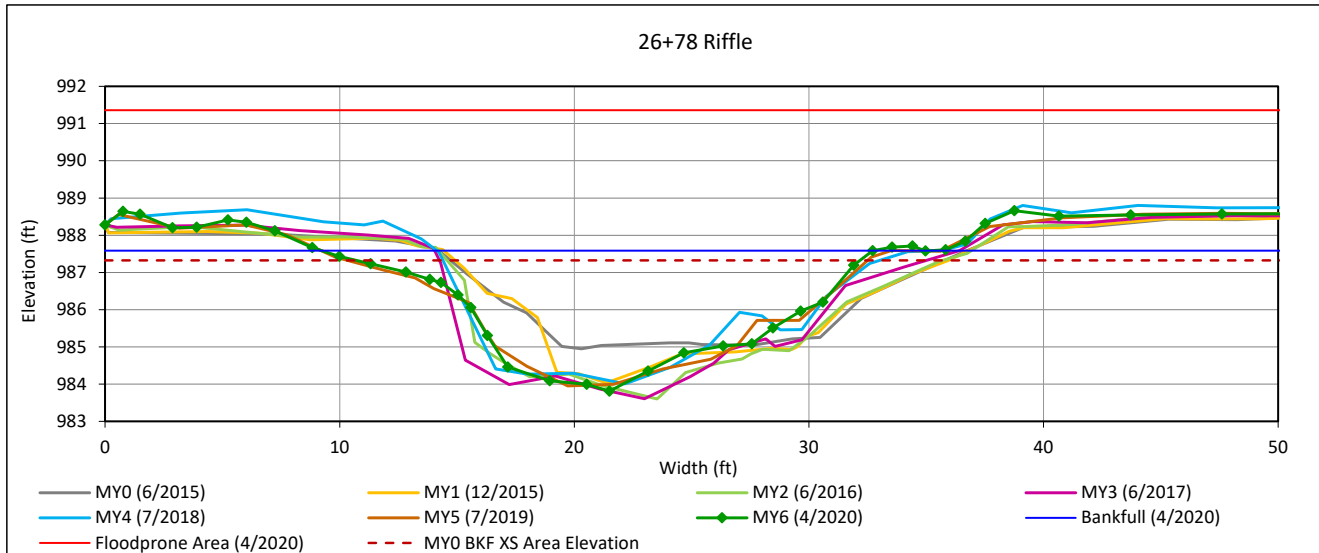


View Downstream

Cross-Section Plots

Hogan Creek Stream Mitigation Project
 NCDMS Project No. 94708
 Monitoring Year 6 - 2020

Cross-Section 3-Hogan Creek Reach 1



Bankfull Dimensions

47.3	x-section area (ft.sq.)
23.5	width (ft)
2.0	mean depth (ft)
3.8	max depth (ft)
25.3	wetted perimeter (ft)
1.9	hydraulic radius (ft)
11.7	width-depth ratio
100.0	W flood prone area (ft)
4.3	entrenchment ratio
1.1	low bank height ratio

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

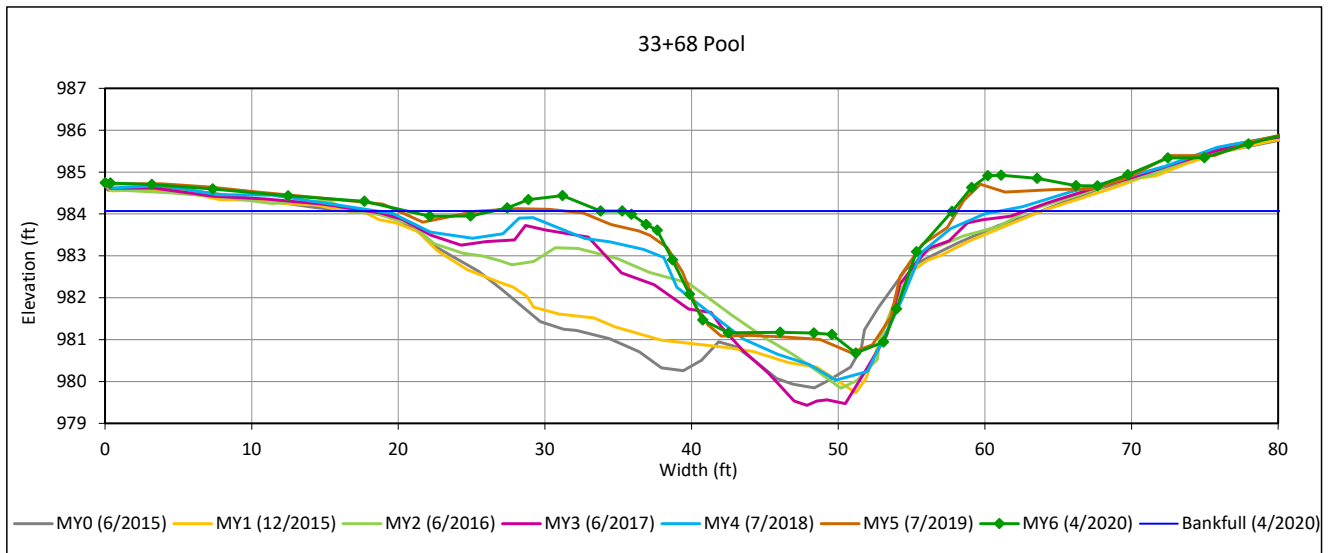


View Downstream

Cross-Section Plots

Hogan Creek Stream Mitigation Project
 NCDMS Project No. 94708
Monitoring Year 6 - 2020

Cross-Section 4-Hogan Creek Reach 2



Bankfull Dimensions

47.8	x-section area (ft.sq.)
22.5	width (ft)
2.1	mean depth (ft)
3.4	max depth (ft)
24.4	wetted perimeter (ft)
2.0	hydraulic radius (ft)
10.6	width-depth ratio

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

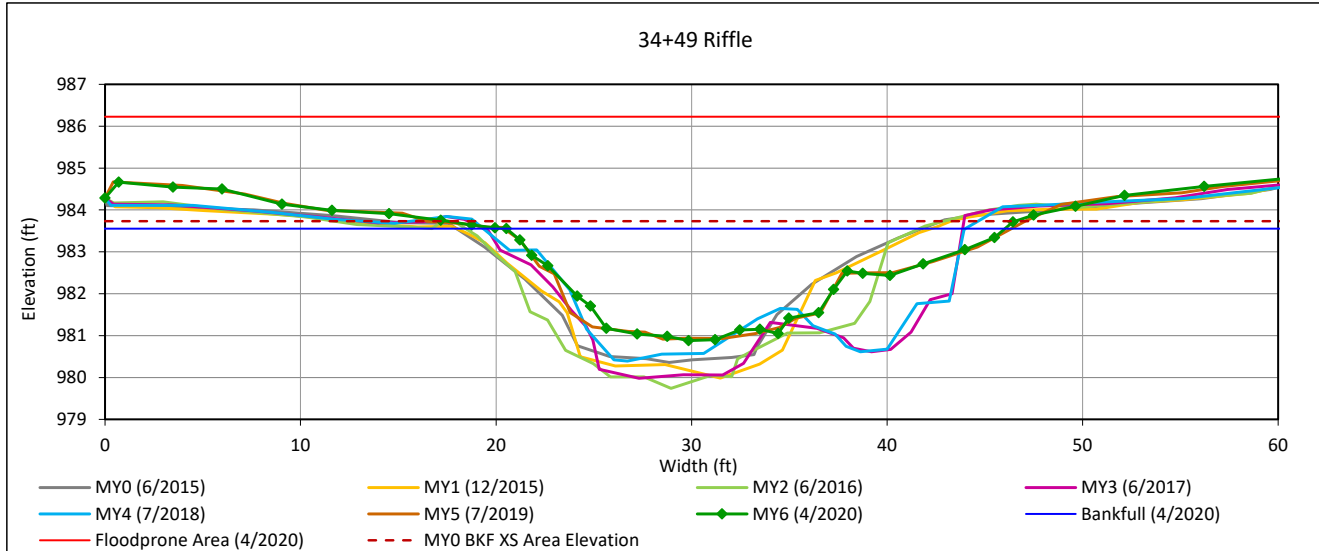


View Downstream

Cross-Section Plots

Hogan Creek Stream Mitigation Project
 NCDMS Project No. 94708
 Monitoring Year 6 - 2020

Cross-Section 5-Hogan Creek Reach 2



Bankfull Dimensions

40.6	x-section area (ft.sq.)
25.5	width (ft)
1.6	mean depth (ft)
2.7	max depth (ft)
26.6	wetted perimeter (ft)
1.5	hydraulic radius (ft)
16.0	width-depth ratio
100.0	W flood prone area (ft)
3.9	entrenchment ratio
0.9	low bank height ratio

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

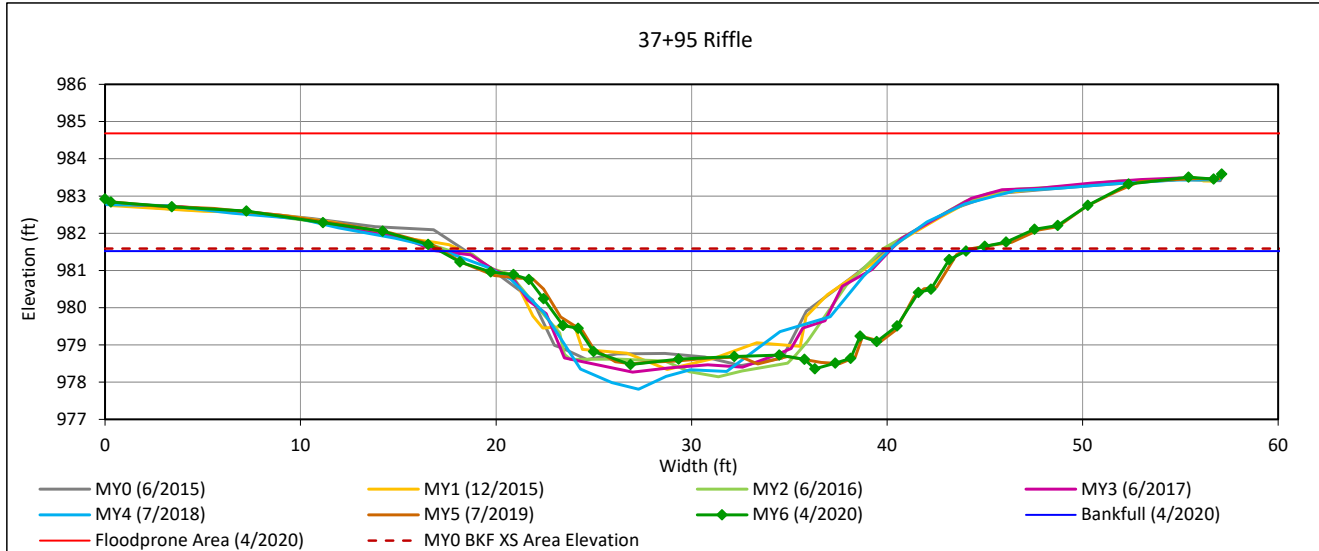


View Downstream

Cross-Section Plots

Hogan Creek Stream Mitigation Project
 NCDMS Project No. 94708
 Monitoring Year 6 - 2020

Cross-Section 6-Hogan Creek Reach 2



Bankfull Dimensions

54.8	x-section area (ft.sq.)
26.9	width (ft)
2.0	mean depth (ft)
3.2	max depth (ft)
28.7	wetted perimeter (ft)
1.9	hydraulic radius (ft)
13.2	width-depth ratio
100.0	W flood prone area (ft)
3.7	entrenchment ratio
1.0	low bank height ratio

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

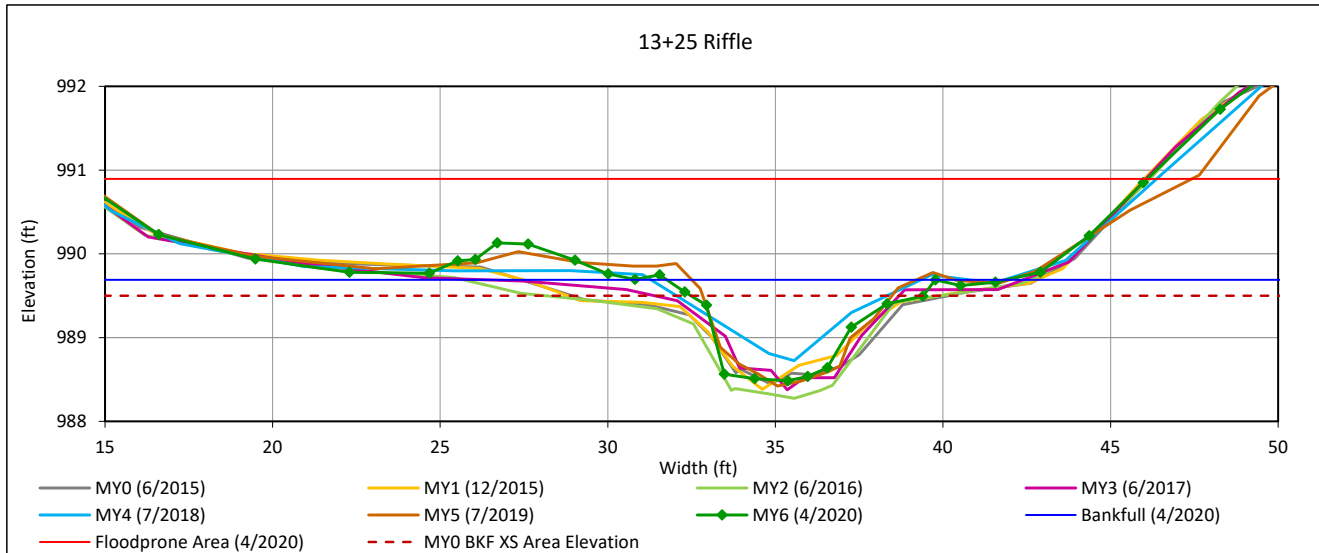


View Downstream

Cross-Section Plots

Hogan Creek Stream Mitigation Project
 NCDMS Project No. 94708
 Monitoring Year 6 - 2020

Cross-Section 7-UT2



Bankfull Dimensions

5.5	x-section area (ft.sq.)
8.0	width (ft)
0.7	mean depth (ft)
1.2	max depth (ft)
8.8	wetted perimeter (ft)
0.6	hydraulic radius (ft)
11.8	width-depth ratio
31.9	W flood prone area (ft)
4.0	entrenchment ratio
1.2	low bank height ratio

Survey Date: 4/2020

Field Crew: Kee Mapping & Surveying

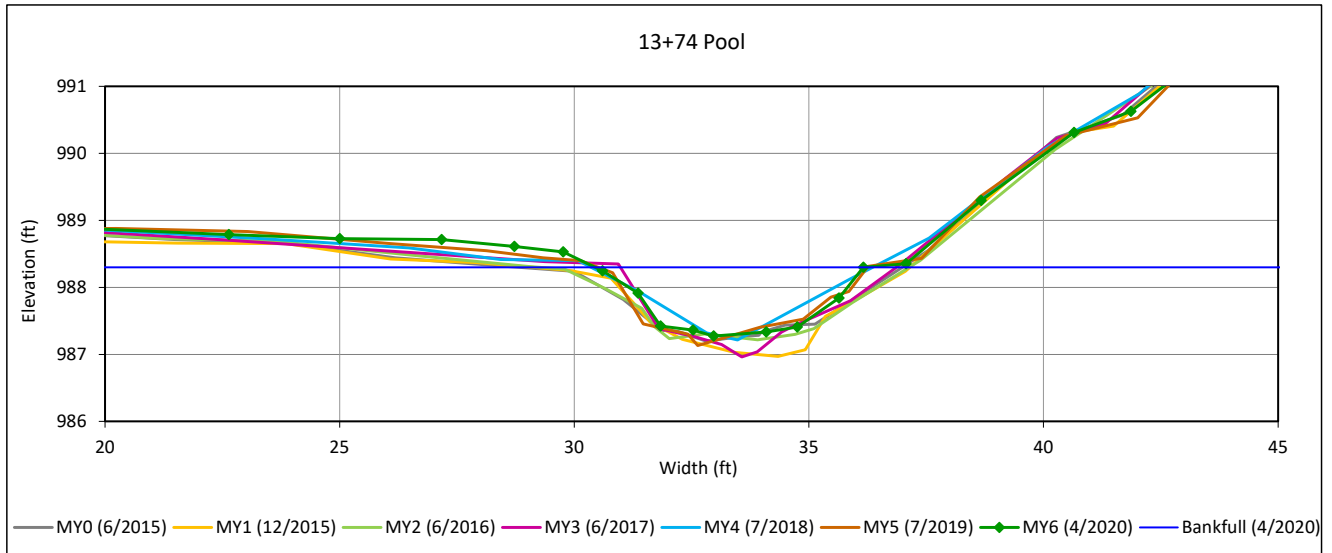


View Downstream

Cross-Section Plots

Hogan Creek Stream Mitigation Project
NCDMS Project No. 94708
Monitoring Year 6 - 2020

Cross-Section 8-UT2



Bankfull Dimensions

4.0	x-section area (ft.sq.)
5.7	width (ft)
0.7	mean depth (ft)
1.0	max depth (ft)
6.3	wetted perimeter (ft)
0.6	hydraulic radius (ft)
8.2	width-depth ratio

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

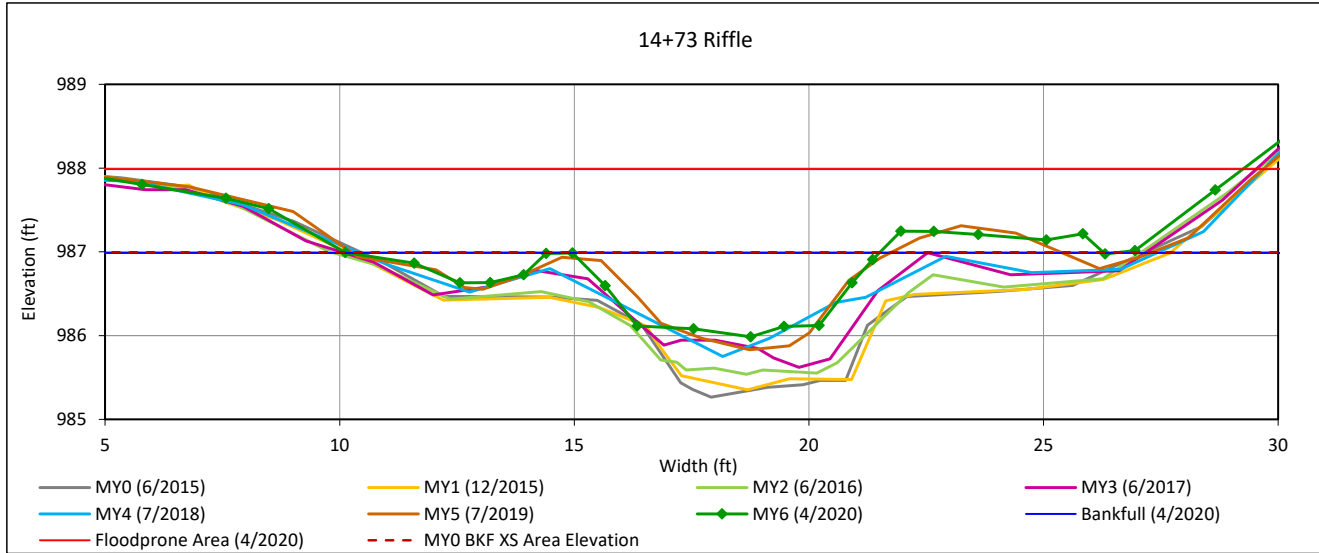


View Downstream

Cross-Section Plots

Hogan Creek Stream Mitigation Project
 NCDMS Project No. 94708
 Monitoring Year 6 - 2020

Cross-Section 9-UT2



Bankfull Dimensions

4.6	x-section area (ft.sq.)
6.5	width (ft)
0.7	mean depth (ft)
1.0	max depth (ft)
7.1	wetted perimeter (ft)
0.7	hydraulic radius (ft)
9.2	width-depth ratio
26.0	W flood prone area (ft)
4.0	entrenchment ratio
1.0	low bank height ratio

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



View Downstream

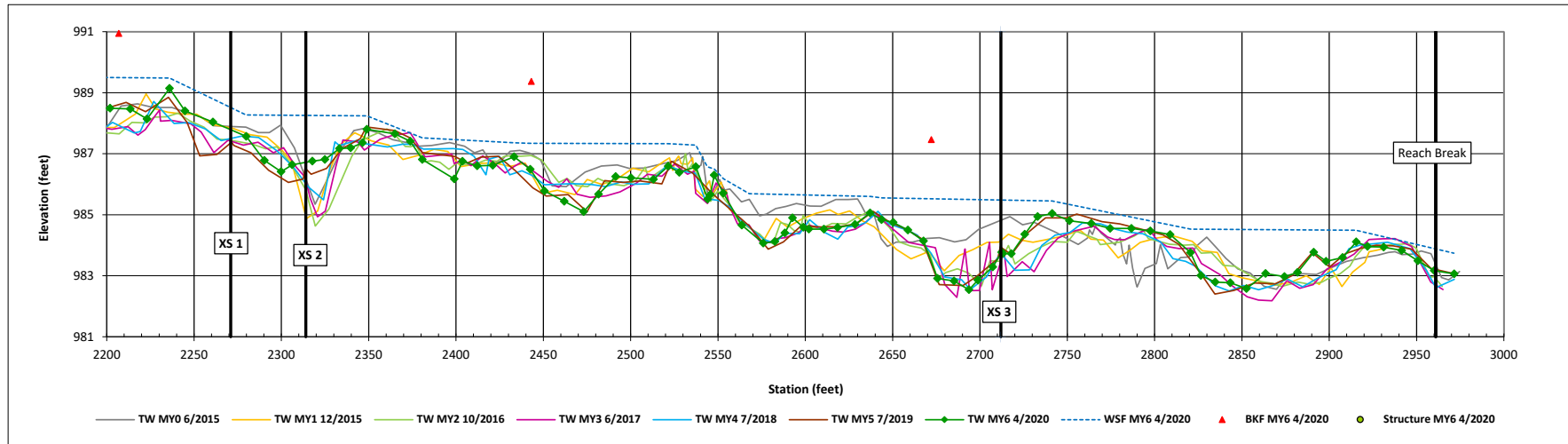
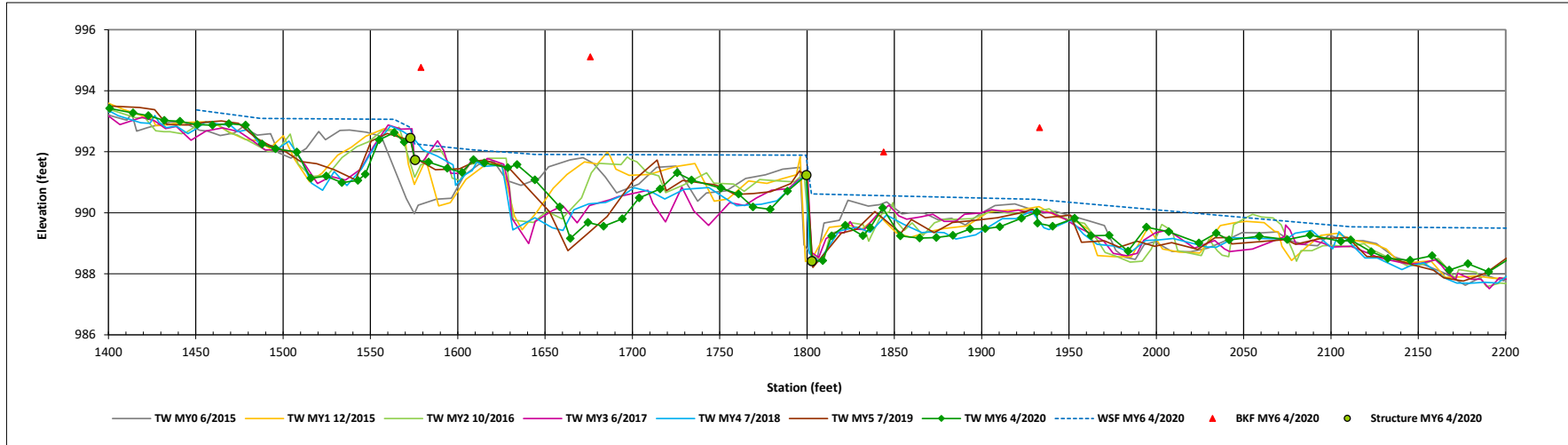
Longitudinal Profile Plots

Hogan Creek Stream Mitigation Project

DMS Project No. 92343

Monitoring Year 6 - 2020

Hogan Creek Reach 1 (STA 14+29 - STA 29+61)



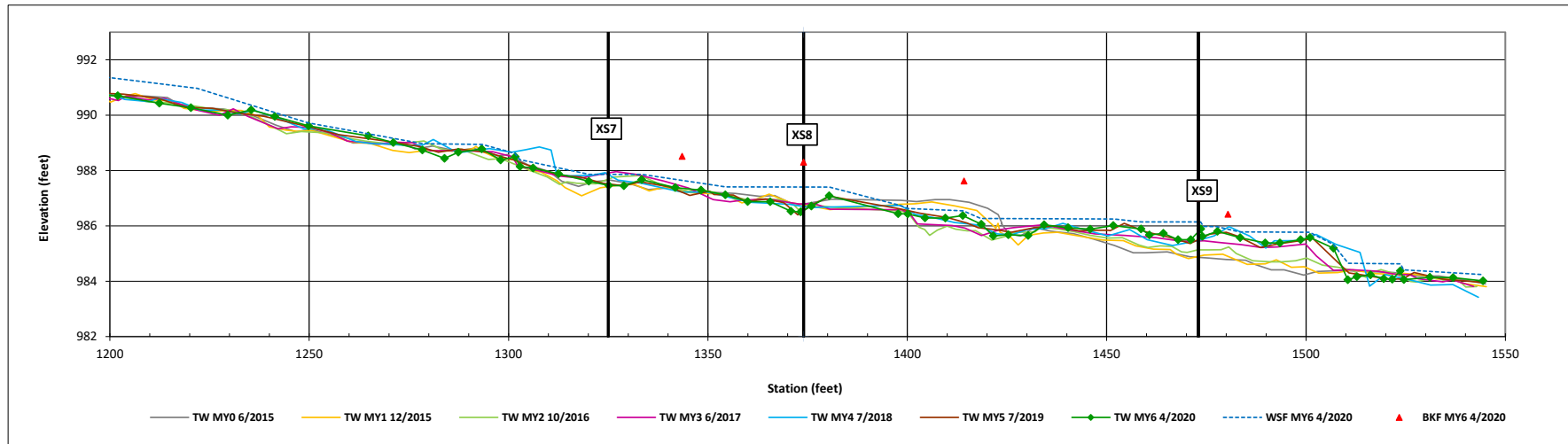
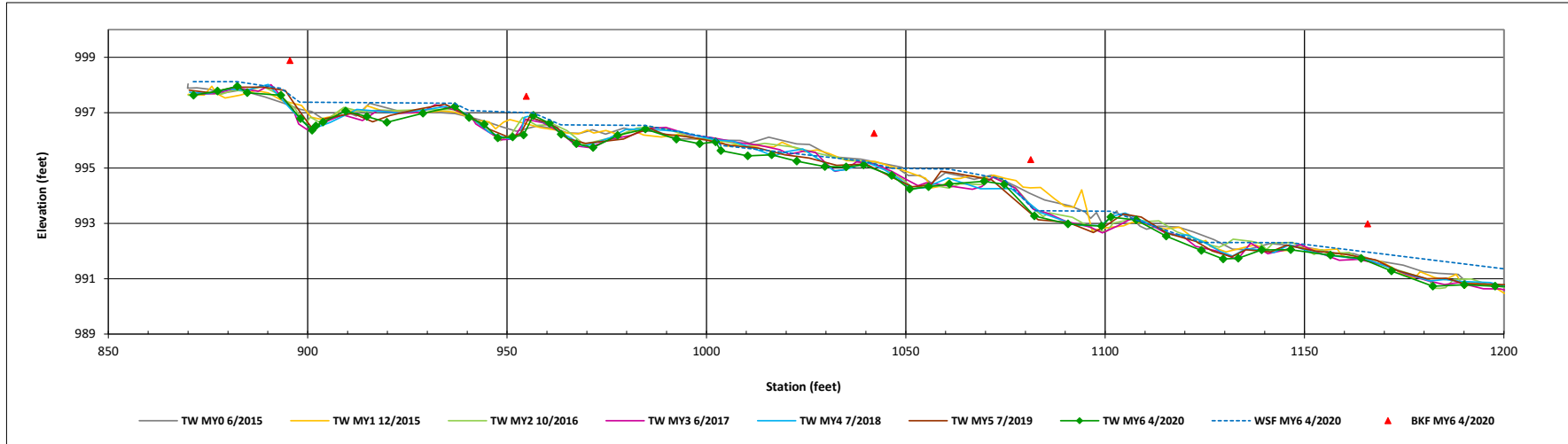
Longitudinal Profile Plots

Hogan Creek Stream Mitigation Project

DMS Project No. 92343

Monitoring Year 6 - 2020

UT2 (STA 8+70 - STA 15+45)



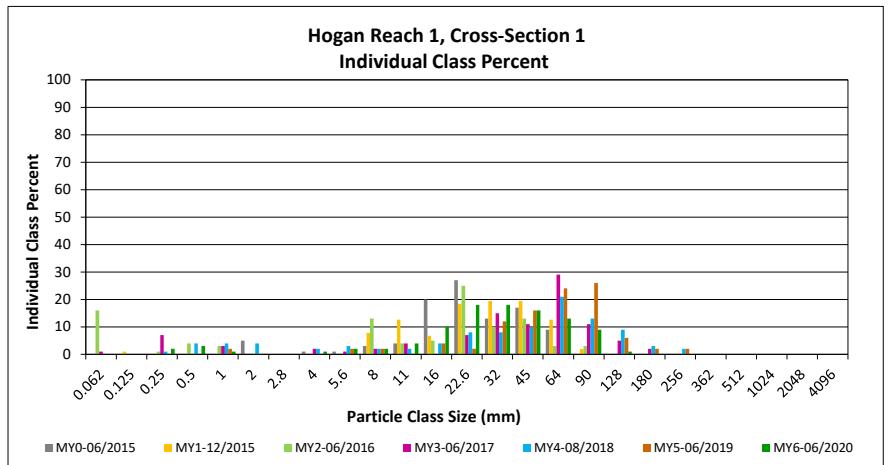
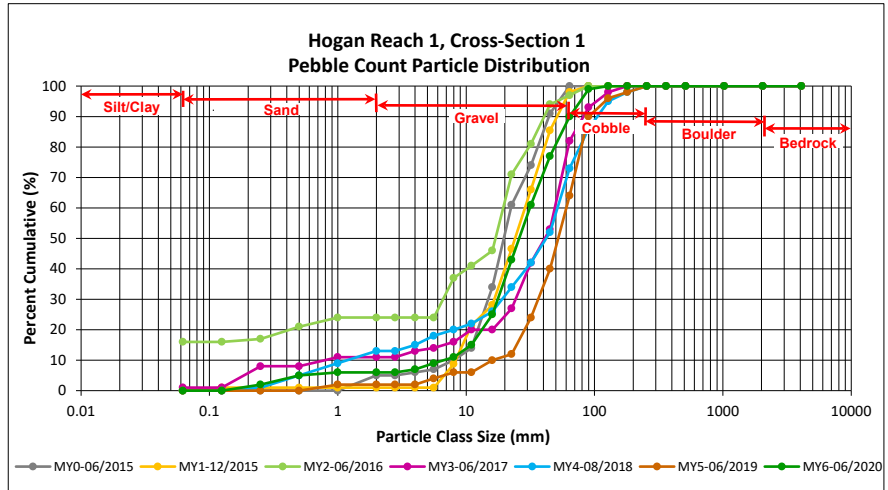
Cross-Section Pebble Count Plots

Hogan Creek Stream Mitigation Project
 DMS Project No. 94708
 Monitoring Year 6 - 2020

Hogan Reach 1, Cross-Section 1

Particle Class		Diameter (mm)		Riffle 100-Count	Summary	
		min	max		Class Percentage	Percent Cumulative
SILT/CLAY		Silt/Clay	0.000	0.062		0
SAND	Very fine	0.062	0.125			0
	Fine	0.125	0.250	2	2	2
	Medium	0.25	0.50	3	3	5
	Coarse	0.5	1.0	1	1	6
	Very Coarse	1.0	2.0			6
GRAVEL	Very Fine	2.0	2.8			6
	Very Fine	2.8	4.0	1	1	7
	Fine	4.0	5.6	2	2	9
	Fine	5.6	8.0	2	2	11
	Medium	8.0	11.0	4	4	15
	Medium	11.0	16.0	10	10	25
	Coarse	16.0	22.6	18	18	43
	Coarse	22.6	32	18	18	61
	Very Coarse	32	45	16	16	77
	Very Coarse	45	64	13	13	90
COBBLE	Small	64	90	9	9	99
	Small	90	128	1	1	100
	Large	128	180			100
	Large	180	256			100
BOULDER	Small	256	362			100
	Small	362	512			100
	Medium	512	1024			100
BEDROCK	Large/Very Large	1024	2048			100
	Bedrock	2048	>2048			100
		Total			100	100

Cross-Section 1	
Channel materials (mm)	
D ₁₆ =	11.4
D ₃₅ =	19.4
D ₅₀ =	25.9
D ₈₄ =	54.4
D ₉₅ =	77.3
D ₁₀₀ =	128.0



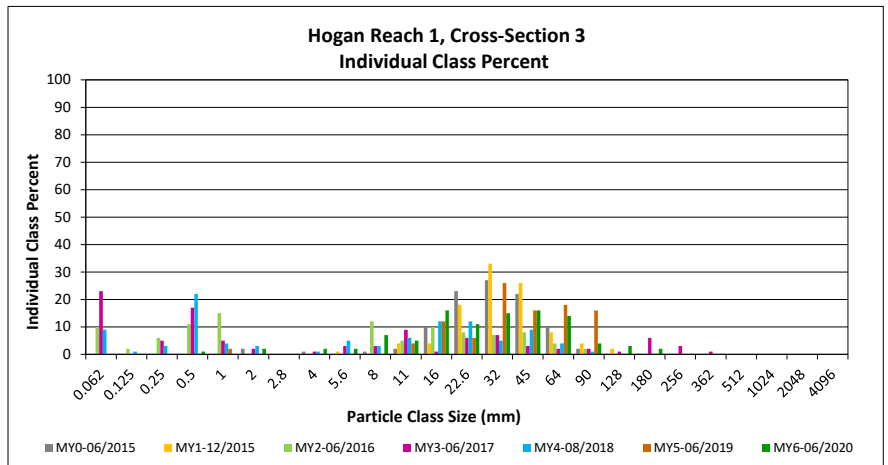
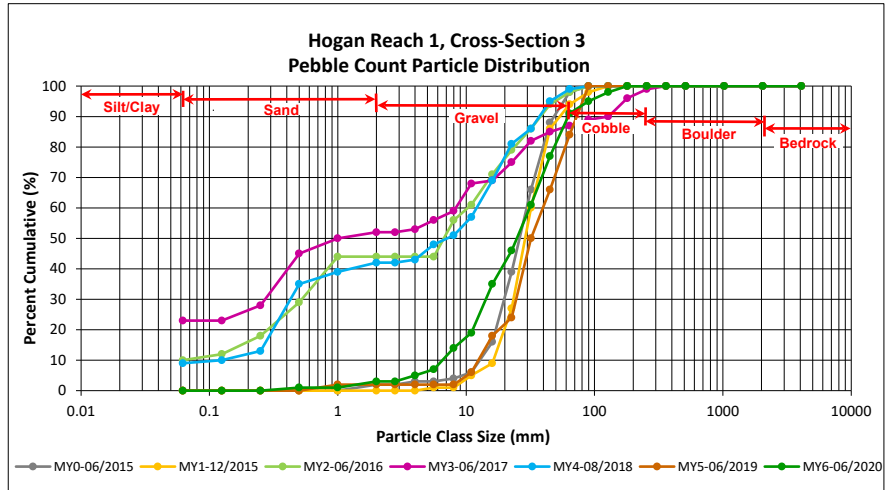
Cross-Section Pebble Count Plots

Hogan Creek Stream Mitigation Project
 DMS Project No. 94708
 Monitoring Year 6 - 2020

Hogan Reach 1, Cross-Section 3

Particle Class		Diameter (mm)		Riffle 100-Count	Summary	
		min	max		Class Percentage	Percent Cumulative
SILT/CLAY	Silt/Clay	0.000	0.062			0
SAND	Very fine	0.062	0.125			0
	Fine	0.125	0.250			0
	Medium	0.25	0.50	1	1	1
	Coarse	0.5	1.0			1
	Very Coarse	1.0	2.0	2	2	3
GRAVEL	Very Fine	2.0	2.8			3
	Very Fine	2.8	4.0	2	2	5
	Fine	4.0	5.6	2	2	7
	Fine	5.6	8.0	7	7	14
	Medium	8.0	11.0	5	5	19
	Medium	11.0	16.0	16	16	35
	Coarse	16.0	22.6	11	11	46
	Coarse	22.6	32	15	15	61
	Very Coarse	32	45	16	16	77
	Very Coarse	45	64	14	14	91
COBBLE	Small	64	90	4	4	95
	Small	90	128	3	3	98
	Large	128	180	2	2	100
	Large	180	256			100
BOULDER	Small	256	362			100
	Small	362	512			100
	Medium	512	1024			100
BEDROCK	Large/Very Large	1024	2048			100
	Bedrock	2048	>2048			100
Total				100	100	100

Cross-Section 3	
Channel materials (mm)	
D ₁₆ =	9.1
D ₃₅ =	16.0
D ₅₀ =	24.8
D ₈₄ =	53.7
D ₉₅ =	90.0
D ₁₀₀ =	180.0



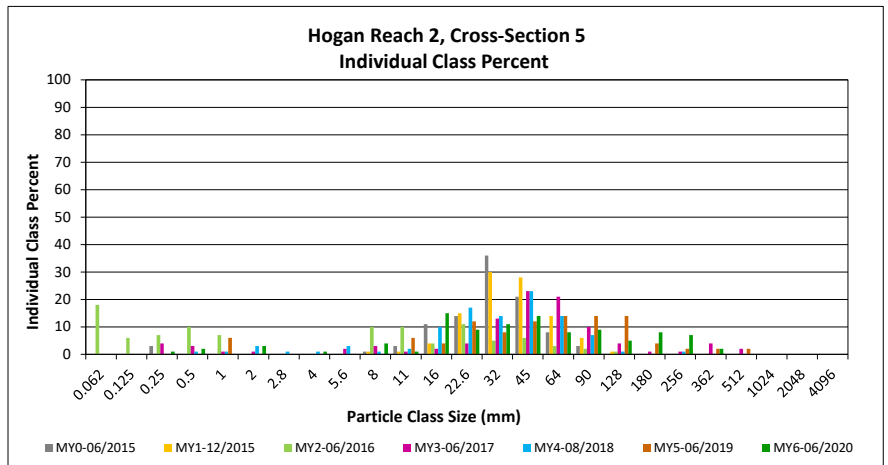
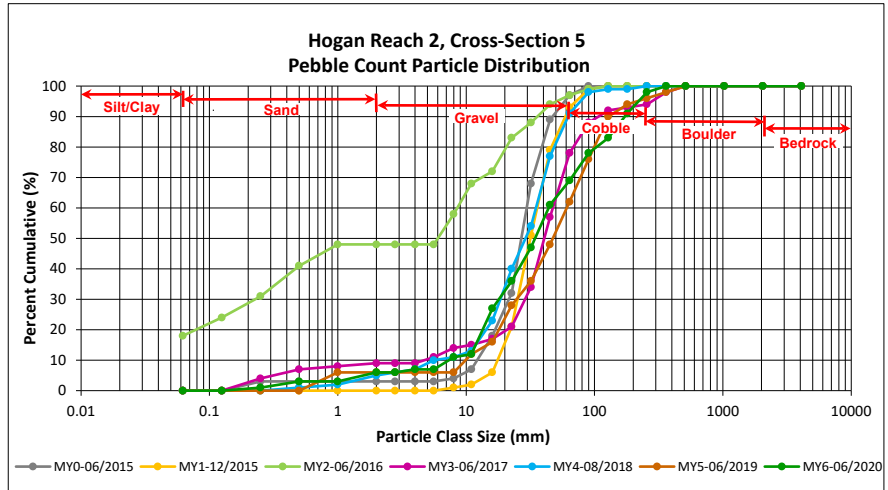
Cross-Section Pebble Count Plots

Hogan Creek Stream Mitigation Project
 DMS Project No. 94708
 Monitoring Year 6 - 2020

Hogan Reach 2, Cross-Section 5

Particle Class		Diameter (mm)		Riffle 100-Count	Summary	
		min	max		Class Percentage	Percent Cumulative
SILT/CLAY	Silt/Clay	0.000	0.062			0
SAND	Very fine	0.062	0.125			0
	Fine	0.125	0.250	1	1	1
	Medium	0.25	0.50	2	2	3
	Coarse	0.5	1.0	3	3	6
	Very Coarse	1.0	2.0	3	3	6
GRAVEL	Very Fine	2.0	2.8			6
	Very Fine	2.8	4.0	1	1	7
	Fine	4.0	5.6			7
	Fine	5.6	8.0	4	4	11
	Medium	8.0	11.0	1	1	12
	Medium	11.0	16.0	15	15	27
	Coarse	16.0	22.6	9	9	36
	Coarse	22.6	32	11	11	47
	Very Coarse	32	45	14	14	61
	Very Coarse	45	64	8	8	69
COBBLE	Small	64	90	9	9	78
	Small	90	128	5	5	83
	Large	128	180	8	8	91
	Large	180	256	7	7	98
BOULDER	Small	256	362	2	2	100
	Small	362	512			100
	Medium	512	1024			100
BEDROCK	Large/Very Large	1024	2048			100
	Bedrock	2048	>2048			100
Total				100	100	100

Cross-Section 5 Channel materials (mm)	
D ₁₆ =	12.2
D ₃₅ =	21.7
D ₅₀ =	34.4
D ₈₄ =	133.6
D ₉₅ =	220.1
D ₁₀₀ =	362.0



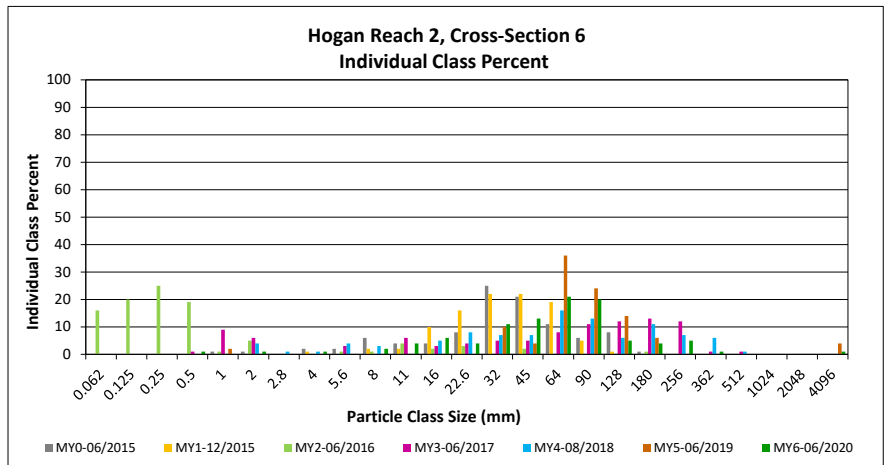
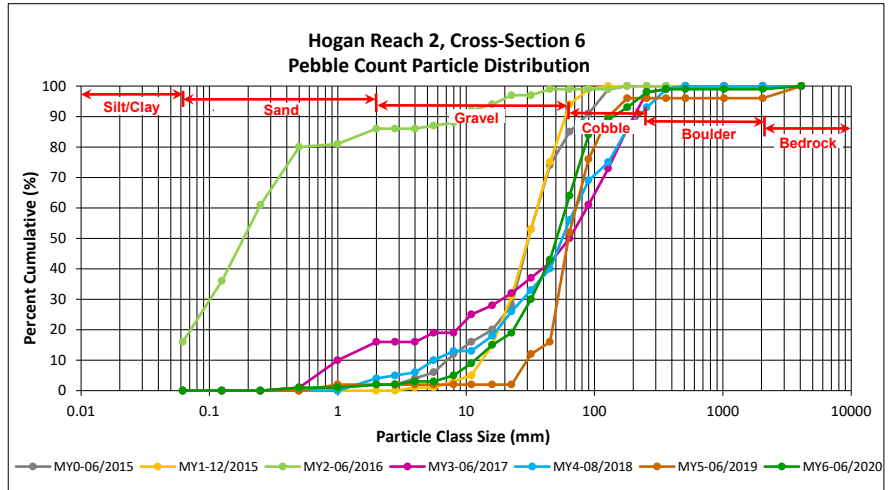
Cross-Section Pebble Count Plots

Hogan Creek Stream Mitigation Project
 DMS Project No. 94708
 Monitoring Year 6 - 2020

Hogan Reach 2, Cross-Section 6

Particle Class		Diameter (mm)		Riffle 100-Count	Summary	
		min	max		Class Percentage	Percent Cumulative
SILT/CLAY	Silt/Clay	0.000	0.062			0
SAND	Very fine	0.062	0.125			0
	Fine	0.125	0.250			0
	Medium	0.25	0.50	1	1	1
	Coarse	0.5	1.0			1
	Very Coarse	1.0	2.0	1	1	2
GRAVEL	Very Fine	2.0	2.8			2
	Very Fine	2.8	4.0	1	1	3
	Fine	4.0	5.6			3
	Fine	5.6	8.0	2	2	5
	Medium	8.0	11.0	4	4	9
	Medium	11.0	16.0	6	6	15
	Coarse	16.0	22.6	4	4	19
	Coarse	22.6	32	11	11	30
	Very Coarse	32	45	13	13	43
	Very Coarse	45	64	21	21	64
COBBLE	Small	64	90	20	20	84
	Small	90	128	5	5	89
	Large	128	180	4	4	93
	Large	180	256	5	5	98
BOULDER	Small	256	362	1	1	99
	Small	362	512			99
	Medium	512	1024			99
	Large/Very Large	1024	2048			99
BEDROCK	Bedrock	2048	>2048	1	1	100
Total				100	100	100

Cross-Section 6 Channel materials (mm)	
D ₁₆ =	17.4
D ₃₅ =	36.5
D ₅₀ =	50.6
D ₈₄ =	90.0
D ₉₅ =	207.2
D ₁₀₀ =	>2048



APPENDIX E. Hydrology Summary Data and Plots

Table 14. Verification of Bankfull Events

Hogan Creek Stream Mitigation Project

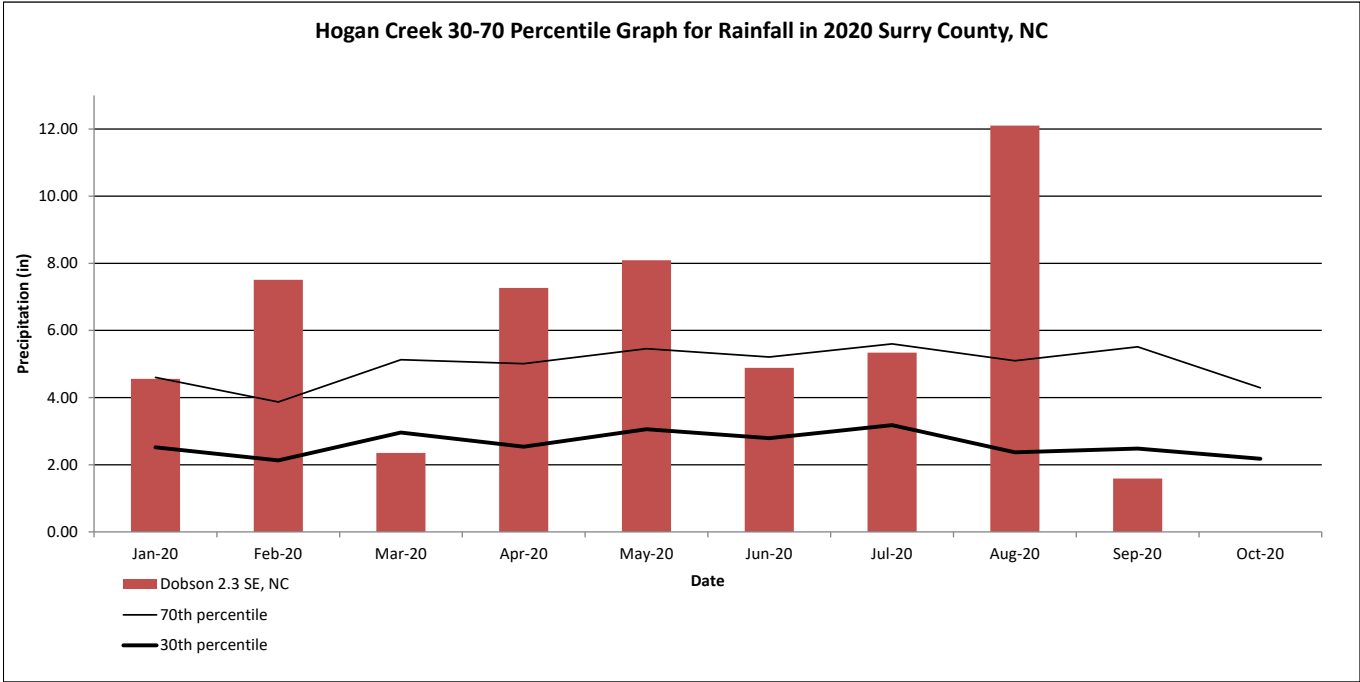
DMS Project No. 94708

Monitoring Year 6 - 2020

Reach	Monitoring Year	Date of Data Collection	Date of Occurrence	Method
Hogan Creek Reach 2	MY1*	10/26/2015	10/2/2015-10/3/2015	Crest Gage
	MY2	4/12/2016	4/1/2016-4/12/2016	Wrack Lines/Sediment Deposition
	MY3	7/5/2017	~5/22/2017-5/23/2017	Wrack Lines
	MY4	4/19/2018	~4/16/2018	Crest Gage/Wrack Lines
	MY5	3/14/2019	~2/23/2019-2/24/2019	Wrack Lines
	MY6	2/26/2020 9/8/2020	~2/6/2020 - 2/7/2020 ~8/21/2020	Wrack Lines Wrack Lines
UT2	MY1	10/26/2015	10/2/2015-10/3/2015	Crest Gage
	MY2	8/2/2016	~ 6/16/2016	Crest Gage
		4/12/2016	4/1/2016-4/12/2016	Wrack Lines/Sediment Deposition
	MY3	7/5/2017	~5/22/2017-5/23/2017	Crest Gage/Wrack Lines
	MY4	4/19/2018	~4/16/2018	Crest Gage/Wrack Lines
	MY6	3/14/2019 2/26/2020 9/8/2020	~2/23/2019-2/24/2019 ~2/6/2020 - 2/7/2020 ~8/21/2020	Crest Gage/Wrack Lines Crest Gage/Wrack Lines Wrack Lines

*Crest Gage was damaged from bankfull event

Monthly Rainfall Data
 Hogan Creek Stream Mitigation Project
 DMS Project No. 94708
 Monitoring Year 6 - 2020



¹ 2020 rainfall collected from NC CRONOS Station Name: Dobson 2.3 SE, NC (NCSU, 2020)

² 30th and 70th percentile rainfall data collected from weather station ELKIN, NC (USDA, 2020)

APPENDIX F. Invasive Species Treatment Logs

MEMO

To: Matthew Reid and Kelly Phillips, NCDEQ
From: Ben Balke and Joe Secoges
Date: June 2020
Subject: Hogan Creek Mitigation Site Maintenance Report

Tasks Performed:

- On May 26, 2020 Eastern Forest Consultants spent the day spraying invasive species along Hogan Creek Reaches 1 and 2 as well as two tributaries. We did not treat along the tributary that flows along the landowner's driveway. Invasive species found in the management area include Japanese honeysuckle, kudzu, Chinese privet, and multi-flora rose. Japanese Honeysuckle was the most prolific invasive species on the property and was found to have the highest densities along the main branches of Hogan Creek. Japanese Honeysuckle was also found in lighter quantities along the tributaries to Hogan's Creek. Large multi-flora rose bushes were found in expected locations as noted in the recent site assessment report, and smaller plants were found in patches mainly along Hogan Creek Reach 1. The herbicides used to treat the invasive on this site was a mix of 4 oz Rodeo and 2 oz Vastlan per gallon of water plus surfactant.

Additional Comments:

- 5/26/2020- Our estimation is that approximately 90 percent of the invasive species component on this site consists of Japanese Honeysuckle. Therefore, in order to reduce collateral damage to desirable species intermixed with the honeysuckle, we plan to adjust our strategy and dedicate more time to spraying when the desirable species are dormant. However, we do plan to treat kudzu and monitor/treat rose later in the summer.