



MONITORING YEAR 5 ANNUAL REPORT
Final

HOPEWELL STREAM MITIGATION SITE
Randolph County, NC
DEQ Contract No. 004642
DMS Project N 95352
USACE Action ID Number 2012-01111
NCDWR Project Number 13-0933

Data Collection Period: March – September 2019
Final Submission Date: January 27, 2020

PREPARED FOR:

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

Mitigation Project Name	**Hopewell Stream Mitigation Site**	**County**	**Randolph**	**USACE Action ID**	**2012-01111**
DMS ID	**95352**	**Date Project Instituted**	**6/12/2012**	**NCDWR Permit No**	**2013-0933**
River Basin	**Yadkin**	**Date Prepared**	**6/13/2019**		
Cataloging Unit	**03040104**				

Credit Release Milestone	Stream Credits						Wetland Credits							
	Scheduled Releases (Stream)	Warm	Cool	Cold	Anticipated Release Year (Stream)	Actual Release Date (Stream)	Scheduled Releases (Forested)	Riparian Riverine	Riparian Non-riverine	Non-riparian	Scheduled Releases (Coastal)	Coastal	Anticipated Release Year (Wetland)	Actual Release Date (Wetland)
Potential Credits (Mitigation Plan)		**7,463.400**												
Potential Credits (As-Built Survey)		**7,412.133**												
1 (Site Establishment)	**N/A**				N/A	N/A	**N/A**				**N/A**		N/A	N/A
2 (Year 0 / As-Built)	**30%**	2,223.640			2015	4/16/2015	**N/A**				**N/A**		N/A	N/A
3 (Year 1 Monitoring)	**10%**	741.213			2016	4/25/2016	**N/A**				**N/A**		N/A	N/A
4 (Year 2 Monitoring)	**10%**	741.213			2017	4/3/2017	**N/A**				**N/A**		N/A	N/A
5 (Year 3 Monitoring)	**10%**	741.213			2018	4/25/2018	**N/A**				**N/A**		N/A	N/A
6 (Year 4 Monitoring)	**5%**	370.607			2019	4/26/2019	**N/A**				**N/A**		N/A	N/A
7 (Year 5 Monitoring)	**10%**				2020		**N/A**				**N/A**		N/A	N/A
8 (Year 6 Monitoring)	**5%**				2021		**N/A**				**N/A**		N/A	N/A
9 (Year 7 Monitoring)	**10%**				2022		**N/A**				**N/A**		N/A	N/A
Stream Bankfull Standard	**10%**	741.213			2017	4/3/2017	**N/A**				**N/A**		N/A	N/A
Total Credits Released to Date		**5,559.100**												

NOTES:

CONTINGENCIES:

Signature of Wilmington District Official Approving Credit Release

27 Sept 2019

Date

1 - For DMS, no credits are released during the first milestone
2 - For DMS projects, the second credit release milestone occurs automatically when the as-built report (baseline monitoring report) has been made available to the NCIRT by posting it to the NCEEP Portal, provided the following criteria have been met:
1) Approval of the 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) Reciept of necessary DA permit authorization or written DA approval for porjects 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

Mitigation Project Name	**Hopewell Stream Mitigation Site**	**County**	**Randolph**	**USACE Action ID**	**2012-01111**
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River Basin	**Yadkin**	**Date Prepared**	**6/13/2019**		
Cataloging Unit	**03040104**				

DEBITS (released credits only)

			Ratios	1	1.5	2.5	5	1	3	2	5	1	3	2	5	1	3	2	5
				Stream Restoration	Stream Enhancment I	Stream Enhancement II	Stream Preservation	Riparian Restoration	Riparian Creation	Riparian Enhancement	Riparian Preservation	Nonriparian Restoration	Nonriparian Creation	Nonriparian Enhancement	Nonriparian Preservation	Coastal Marsh Restoration	Coastal Marsh Creation	Coastal Marsh Enhancement	Coastal Marsh Preservation
As-Built Amounts (feet and acres)				**4,037.000**	**866.000**	**6,584.000**	**821.000**												
As-Built Amounts (mitigation credits)				**4,037.000**	**577.333**	**2,633.600**	**164.200**												
Percentage Released				**75%**	**75%**	**75%**	**75%**												
Released Amounts (feet / acres)				**3,027.750**	**649.500**	**4,938.000**	**615.750**												
Released Amounts (credits)				**3,027.750**	**433.000**	**1,975.200**	**123.150**												
NCDWR Permit	USACE Action ID	Project Name																	
2016-0299	2002-01260	NCDOT TIP R-2536 - Asheboro Bypass, Randolph County		2,422.200	519.600	3,950.400	492.600												
2018-1416	2008-02315	NCDOT TIP R-2530B - NC 24 / 27 Widening		605.550		987.600	123.150												
Remaining Amounts (feet / acres)				**0.000**	**129.900**	**0.000**	**0.000**												
Remaining Amounts (credits)				**0.000**	**86.600**	**0.000**	**0.000**												

January 27, 2020

Mr. Harry Tsomides
Project Manager
Division of Mitigation Services
5 Ravenscroft Dr., Suite 102
Asheville, NC 28801

RE: Monitoring Year 5 Annual Report – Final Submittal
Hopewell Stream Mitigation Site
DMS Project No. 95352
DEQ Contract No. 004642

Dear Mr. Tsomides:

Wildlands Engineering, Inc. (Wildlands) has reviewed the Division of Mitigation Services (DMS) comments from the Draft Monitoring Year 5 report for the Hopewell Stream Mitigation Site. The following Wildlands responses to DMS's report comments are noted in italics lettering.

DMS comment; Please include Wildlands' meeting minutes from the May 29, 2019 IRT/DMS meeting, as an Appendix, and reference in the Executive Summary.

Wildlands response; The meeting minutes from the IRT/DMS meeting have been added as an appendix (Appendix 6) and are referenced in the Executive Summary.

DMS comment; Vegetative Assessment – It is indicated that areas of sweetgum monocultures will be treated between October and December 2019. Have treatments begun yet? Also, during the IRT visit, containerized planting was discussed, to follow the sweetgum removals. Is Wildlands planning to supplemental plant these thinned areas during the winter 2019-20? Please briefly discuss any planting plans for these areas.

Wildlands response; A majority of the sweetgum monoculture areas were treated between October and December. Remaining sweetgum treatment will be completed in early 2020. Supplemental planting of containerized trees will be performed in early 2020 within areas of sweetgum treatment on UT1B Reach 1 as discussed during the May 29, 2019 IRT/DMS site meeting. Report text in Section 1.2.1 (Vegetative Assessment) has been updated to reflect the completion of sweetgum treatment in early 2020 and includes a statement about the planned supplemental planting.

DMS comment; Stream Assessment - Vegetative 'mats' and growth are discussed as affecting the cross sections 14, 16, and 17 (trapping sediments). Please briefly describe the of vegetation (e.g., grasses, juncus, algae, willows, etc).

Wildlands response; Report text in Section 1.2.2 (Stream Assessment) has been updated to include specific vegetation species affecting cross-sections 14, 16, and 17.

DMS comment; Areas of Concern – Please give a brief update, pursuant to the May 2019 IRT memo, briefly discussing the status along UT1B reach 1 where the landowner was not allowing the fence to be moved outside the easement.

Wildlands response; Wildlands sent a letter requesting the landowner remove and re-install the fencing outside the easement on UT1B Reach 1 and has followed up via phone. The landowner hasn't been responsive, and Wildlands has turned the issue over to the State for further action.

DMS Digital File Comment; Geodatabase stream features do not match restoration footage reported in asset table. DMS needs features that are representative of current creditable assets.

Wildlands Response; Shapefiles for project stream features have been updated to match current creditable assets. Updated shapefiles are included with the final submittal.

DMS Digital Files Review Comment; Veg plots 5 and 8 are missing Y coordinates in CVS tool.

Wildlands Response; The Y coordinates for plots 5 and 8 have been added. The CVS database has been updated and included with the final report.

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

Sincerely,

Kristi Suggs
Senior Environmental Scientist
ksuggs@wildlandseng.com

PREPARED BY:

WILDLANDS
ENGINEERING

1430 South Mint Street, Suite 104
Charlotte, NC 28203

Phone: 704.332.7754
Fax: 704.332.3306

EXECUTIVE SUMMARY

Wildlands Engineering, Inc. (Wildlands) completed a full delivery project at the Hopewell Mitigation Site (Site) for the North Carolina Division of Mitigation Services (DMS) to restore, enhance, and preserve a total of 12,308 linear feet (LF) of perennial and intermittent streams in Randolph County, NC. The Site is expected to generate 7,412 stream mitigation units (SMUs) by closeout. The Site is located near the town of Asheboro in Randolph County, NC in the Yadkin-Pee Dee River Basin. The eight-digit Cataloging Unit (CU) is 03040104 and the 14-digit Hydrologic Unit Code (HUC) is 03040104030010 (Figure 1). The Little River eventually flows into the Pee Dee River near the town of Ingram in Richmond County. The other five streams are small headwater tributaries to the Little River. The project streams consist of the Little River, and five unnamed tributaries (UTs) to the Little River (Figure 2). The adjacent land to the streams and wetlands is primarily pasture land and forest.

The Site is located in the Little River watershed which was designated as a Targeted Local Watershed (TLW) in the 2009 Lower Yadkin Pee-Dee River Basin Restoration Priorities (RBRP) plan. The RBRP plan does not specifically identify stressors or project goals in this TLW, but states that continuing watershed improvements will increase ecological uplift. The intent of this project is to help meet the goals for the watershed outlined in the RBRP and provide numerous ecological benefits within the Yadkin-Pee Dee River Basin.

The project goals established in the mitigation plan (Wildlands, 2013) were completed with careful consideration of goals and objectives that were described in the RBRP and to meet DMS mitigation needs while maximizing the ecological and water quality uplift within the watershed. The following project goals established include:

- Restoring a degraded stream impacted by cattle to create and improve aquatic habitat, reduce sediment inputs from streambank erosion, and reduce agricultural runoff pollution; and
- Restoring a riparian buffer along stream corridors for additional terrestrial and aquatic habitat, nutrient input reduction, and water quality benefits.

The Site construction, planting, and as-built surveys were completed between July 2014 and January 2015. Annual monitoring activities have been conducted since 2015 with an anticipated closeout date in 2022. A conservation easement is in place on 35.4 acres of the riparian corridors to protect them in perpetuity.

Monitoring Year (MY) 5 assessments and site visits were completed between March and September 2019 to assess the conditions of the project. Overall, the Site has met the required stream and vegetation success criteria for MY5. The overall average stem density for the Site is 430 stems per acre and is therefore meeting the interim MY5 requirement of 260 stems per acre and on track to meeting MY7 success criteria of 210 stems per acre. Stem heights within the vegetation plots average 10.5 feet in MY5 with most plots exceeding the final stem height success criteria of 10 feet. All restored and enhanced streams are stable and functioning as designed. Multiple bankfull events have been recorded since project construction and the Site has met the MY7 hydrology success criteria in which two or more bankfull events must have occurred in separate years within the restoration reaches.

An Interagency Review Team (IRT) MY4 credit release site walk occurred on May 29th, 2019 (Refer to Appendix 6 for meeting minutes).

HOPEWELL STREAM MITIGATION SITE
Monitoring Year 5 Annual Report

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APPENDICES

Section 1: PROJECT OVERVIEW

The Site is located in central Randolph County within the Yadkin-Pee Dee River Basin (USGS Hydrologic Unit 03040104) near the town of Asheboro, North Carolina. The Site is located along Hopewell Friends Road, Mack Road, and Pisgah Covered Bridge Road, just west of Interstate 74/73. The Site is located in in the Carolina Slate Belt of the Piedmont Physiographic Province (USGS, 1998). The project watershed consists primarily of agricultural and wooded land. The only significant development in the watershed is within the northern extent which includes portions of the City of Asheboro. The drainage area for the western portion of the project site is 429 acres (0.67 square miles). The drainage area for the eastern portion of the project site; which includes a reach on the Little River, is 4,517 acres (7.06 square miles).

The project streams consist of the Little River and five UTs to the Little River. Mitigation work within the Site included restoration, enhancement, and preservation of 12,308 linear feet (LF) of perennial and intermittent stream channel. Stream restoration reaches included UT2 (Reach 1 and 2), UT2A (Reach 2), UT2B (Reach 2), and UT2C (Reach 2 and 3). Stream enhancement I (EI) included UT1B Reach 1 and UT2A Reach 1. Stream enhancement II (EII) reaches included Little River Reach 2, UT1A Reach 1, UT1B Reach 2 and 3, UT2B Reach 1, and UT2C Reach 1. Preservation reaches at the Site included Little River Reach 1 and UT1A Reach 2. The riparian areas were planted with native vegetation to improve habitat and protect water quality. Construction activities were completed by Terry's Plumbing and Land Mechanics Designs, Inc. in November 2014. Planting and seeding activities were completed by Bruton Natural Systems, Inc. and Terry's Plumbing in January 2015. A conservation easement has been recorded and is in place along the stream riparian corridors to protect them in perpetuity. The conservation easement includes 35.954 acres (Deed Book 2371, Page 108-122) within a tract owned by Double T Farms of Randolph, LLC. The project provides 7,412 stream mitigation units (SMU's).

Directions and a map of the Site are provided in Figure 1 and project components are illustrated for the Site in Figure 2.

1.1 Project Goals and Objectives

Prior to construction activities, many of the streams on the Site, especially those that were accessed less by cattle, exhibited relative stability. However, other project reaches appeared incised and had been severely trampled by cattle resulting in unstable banks and the bed morphologies were often destroyed. Table 4 in Appendix 1 and Tables 10a through 10d in Appendix 4 present the pre-restoration conditions in detail.

This Site is intended to provide numerous ecological benefits within the Yadkin-Pee Dee River Basin. The Site will help meet the goals for the watershed outlined in the RBRP and provide numerous ecological benefits within the Yadkin-Pee Dee River Basin. While many of these benefits are limited to the Hopewell project area, others, such as pollutant removal, reduced sediment loading, and improved aquatic and terrestrial habitat, have farther-reaching effects. Expected improvements to water quality and ecological processes are outlined below as project goals and objectives. These project goals were established with careful consideration of goals and objectives that were described in the RBRP and to meet DMS mitigation needs while maximizing the ecological and water quality uplift within the watershed.

The RBRP describes the goals for the 8-digit HUC as the following:

- Continuation of watershed improvement efforts already on-going;
- Protection of valuable natural resources; and

- Development of local partnerships that will work together to implement management strategies for stormwater impacts.

The following project specific goals were established in the mitigation plan (Wildlands, 2013) to contribute to meeting management goals as described above for the Yadkin-Pee Dee Catalog Unit 03040104 and the Little River TLW include:

- Restoring a degraded stream impacted by cattle to create and improve aquatic habitat, reduce sediment inputs from streambank erosion, and reduce agricultural runoff pollution; and
- Restoring a riparian buffer along stream corridors for additional terrestrial and aquatic habitat, nutrient input reduction, and water quality benefits.

The project goals were addressed through the following project objectives as stated in the mitigation plan:

- On-site nutrient inputs will be decreased by removing cattle from streams and filtering on-site runoff through buffer zones. Off-site nutrient inputs will be absorbed on-site by filtering flood flows through restored floodplain areas, where flood flow will spread through native vegetation;
- Restored buffers and exclusion of livestock to streams will significantly reduce inputs of livestock wastes to streams. This will eliminate a major source of fecal coliform pollution;
- Streambank erosion which contributes sediment load to the creek will be greatly reduced, if not eliminated, in the project area. Eroding stream banks will be stabilized using bioengineering, natural channel design techniques, and grading to reduce bank angles and bank height. Storm flow containing fine sediment will be filtered through restored floodplain areas, where flow will spread through native vegetation. Spreading flood flows will also reduce velocity and allow sediment to settle out. Sediment transport capacity of restored reaches will be improved so that capacity balances more closely to load;
- Restored riffle/pool sequences will promote aeration of water and create deep water zones, helping to lower water temperature. Establishment and maintenance of riparian buffers will create long-term shading of the channel flow to minimize thermal heating. Lower water temperatures will help maintain dissolved oxygen concentrations;
- In-stream structures will be constructed to improve habitat diversity and trap detritus. Wood habitat structures will be included in the stream as part of the restoration design. Such structures may include log drops and riffle structures that incorporate woody debris;
- Adjacent buffer and riparian habitats will be restored with native vegetation as part of the project. Native vegetation will provide cover and food for terrestrial wildlife. Native plant species will be planted and invasive species will be treated. Eroding and unstable areas will also be stabilized with vegetation as part of this project; and
- The restored land will be protected in perpetuity through a conservation easement.

The design streams were restored to the appropriate type based on the surrounding landscape, climate, and natural vegetation communities but also with strong consideration to existing watershed conditions and trajectory. The final mitigation plan was submitted and accepted by the DMS in October of 2013. Construction activities were completed by Terry's Plumbing and Land Mechanic Designs, Inc. in November 2014. Planting and seeding activities were completed by Bruton Natural Systems, Inc. in January 2015. Baseline monitoring (MY0) was conducted between December 2014 and January 2015. Annual monitoring will be conducted for seven years with the close-out anticipated to commence in 2021 given the success criteria are met. Appendix 1 provides more detailed project activity, history, contact information, and watershed/site background information for this project.

1.2 Monitoring Year 4 Data Assessment

Annual monitoring and quarterly site visits were conducted during MY5 to assess the condition of the project. The stream and vegetation success criteria for the Site follows the approved success criteria presented in the Hopewell Stream Mitigation Plan (Wildlands, 2013). The MY5 vegetation and stream surveys were completed in September 2019.

1.2.1 Vegetative Assessment

A total of 31 vegetation plots were established during the baseline monitoring within the project easement areas. All of the plots were installed using a standard 10 meter by 10 meter plot. The final vegetative success criteria will be the survival of 210 planted stems per acre in the riparian corridor along restored and enhanced reaches at the end of the MY7. The interim measure of vegetative success for the Site is the survival of at least 260 stems per acre at the end of the fifth year of monitoring (MY5). Planted vegetation must average 10 feet in height in each plot at the end of the seventh year of monitoring. If this performance standard is met by MY5 and stem density is trending towards success (i.e., no less than 260 five year old stems/acre), monitoring of vegetation on the Site may be terminated provided written approval by the United States Army Corps of Engineers in consultation with the NC Interagency Review Team.

The 2019 vegetation monitoring resulted in an average stem density of 430 stems per acre, which is well above the interim requirement of 260 stems per acre required at MY5 and approximately 34% less than the baseline density recorded (649 stems/acre). There is an average of 11 stems per plot as compared to 16 stems per plot in MY0. In MY5, stem heights averaged 10.5 feet which is a 43% increase in height compared to the MY4 stem height average of 7.4 feet. All plots have met the interim MY5 success criteria and are on track to meet the success criteria required for MY7. Refer to Appendix 2 for vegetation plot photographs and the vegetation condition assessment table and Appendix 3 for vegetation data tables. Significant efforts were implemented during construction to control the invasive species within the Site and additional follow up treatments have been and may continue to be necessary throughout the post-construction monitoring period. Invasive species treatments have been implemented annually with the primary focus on the non-native invasive shrub, Chinese privet (*Lingustrum sinese*). During late 2018, Chinese privet and tree of heaven (*Ailanthus altissima*) were treated including previously treated areas where re-sprouting was occurring. Additional treatment of invasive species will be performed in November/December 2019. Areas of Chinese privet and tree of heaven account for approximately 3% of the overall easement acreage. These areas will continue to be monitored and controlled on an annual basis during the fall/winter of subsequent years. One other non-native species of concern noted at the Site, multiflora rose (*Rosa multiflora*), was not negatively impacting planted stem densities.

Small bare areas (<1% of the planted acreage) noted during previous monitoring years along the upper section of UT1B Reach 1 have established herbaceous cover as a result of re-seeding, liming, and fertilizing during MY2. No bare areas are noted in MY5. A few pockets of dense sweetgum (*Liquidambar styraciflua*) volunteers are present in the upper section of UT1B Reach 1 and UT2 Reach 2 as a result of mature sweetgums along the reaches. The natural recruitment of this native, early successional species has resulted in small monocultures (~0.2 acres) in these areas. Areas of sweetgum monocultures will be treated by early 2020. A supplemental planting of containerized trees will be performed in early 2020 within areas of sweetgum treatment on UT1B Reach 1 as discussed during the IRT/DMS site meeting in May 2019. Refer to Appendix 6 for IRT/DMS meeting minutes.

Refer to Appendix 2 for the vegetation condition assessment table and the Integrated Current Condition Plan View (CCPV).

1.2.2 Stream Assessment

In general, cross-sections for UT2, UT2A, UT2B, UT2C, and UT1B show little to no change in the bankfull area, maximum depth ratio, or width-to-depth ratio. In MY5, the minor aggradation documented during MY4 at cross-sections 1 and 2 (UT2A – Reach 1) hasn't changed indicating that they are stable. During MY5, aggradation was recorded at cross-sections 16 and 17 (UT2C – Reach 2). The adjustments in channel dimension will be monitored in subsequent years and currently don't indicate instability. Changes observed at cross-section 7 (UT2 - Reach 2) between MY1 and MY2 were the result of pool scouring at this location. No additional scouring was observed in MY3, MY4, or MY5. Minor riffle scour observed in MY3 at cross-section 9 (UT2B – Reach 2) wasn't documented during the MY4 or MY5 survey suggesting the channel has adjusted back towards the design bed elevation. During MY4 the bankfull stage was adjusted at cross-section 9 because the bankfull elevation appeared to have been set slightly below top of bank during the baseline assessment.

Pool scouring during MY2 at cross-section 10 (UT2B – Reach 2) resulted in an increase in bankfull depth. Since then cross-section 10 has remained stable. Vegetation root mat growth of herbaceous species such as rice cutgrass (*Leersia oryzoides*) and sedges (*Carex* spp.) have continued in MY5 at cross-section 14 (UT1B – Reach 1) which has resulted in a decrease in the cross-sectional area. During MY5, the bankfull area and depth of cross-sections 16 and 17 (UT2C – Reach 2) decreased which appears to be a result of continued growth of silky willows (*Salix sericea*) and aggradation from large storm events (precipitation greater than two inches per event) during the fall of 2018 including remnants of Hurricane Florence and Michael.

Prior to MY4, bankfull dimensions were calculated using a fixed bankfull elevation. For MY4 through MY7, bankfull elevation is calculated using a fixed Abkf as described in the Standard Measurement of the BHR Monitoring Parameter document provided by DMS and the North Carolina Interagency Review Team technical work group (NCDMS, 2018). Using the fixed Abkf elevation in MY5 there have been documented changes in the Bank Height Ratios. Cross-section 3 increased from 1.0 to 1.1. Cross-sections 8 (UT2 – Reach 2), 11 (UT2 – Reach 1), and 16 (UT2C – Reach 2) have all decreased to 0.9 in MY5 from 1.0 in MY0. All other channel dimensions indicate stability.

In MY5, a greater number of finer particles were documented in cross-sections 11 and 15; however, they have stable cross-sectional areas compared to MY0. The increase in finer particles at cross-section 11 may be natural fluctuation in transported bed material. Increased fines at cross-section 15 may be due to in-stream vegetation accumulating fines. In general, substrate materials in the restoration and enhancement reaches indicated coarser materials in the riffle reaches and finer particles in the pools.

The changes in cross-sectional area and depth noted for cross-sections 14, 16, and 17 will continue to be monitored during subsequent years for signs of instability and a maintenance plan will be established if deemed necessary.

Refer to Appendix 2 for the visual stability assessment table, CCPV map, and reference photographs. Refer to Appendix 4 for the morphological data and plots.

1.2.3 Areas of Concern/Adaptive Management Plan

Wildlands will continue to monitor and implement invasive treatments to reduce and control the extent of invasive species at the Site. Follow up treatments will be conducted in December 2019 and annually as necessary.

Several sections of perimeter fence were repaired in late 2018/early 2019. Repairs addressed areas where fence was installed incorrectly and deviated inside the conservation easement boundaries including sections on the north side of UT1A, the northwest and south sides of UT1B, northeast side of UT2A, and the northeast side of UT2C. A small portion of fencing long UT1B Reach 1 still deviates from the conservation easement and the landowner is reluctant to address. Wildlands sent a letter requesting the landowner reinstall the fencing outside the easement and followed up via phone. The landowner hasn't been responsive, and Wildlands has turned the issue over to the State for further action.

1.2.4 Hydrology Assessment

At the end of the seven year monitoring period, two or more bankfull events must have occurred in separate years within the restoration reaches. The hydrology success criteria were met for the seven-year monitoring period after MY2. During MY5, at least one bankfull event was recorded on all restoration reaches during annual monitoring. Refer to Appendix 5 for hydrologic data.

1.3 Monitoring Year 5 Summary

All streams within the Site are stable and functioning as designed. The overall, average stem density for the Site meets the interim MY5 and it on track to meet the final MY7 success criteria. Multiple bankfull events have been documented within the restored stream reaches at the Site in separate monitoring years and has satisfied the MY7 hydrology success criteria. Minor areas of concern will to be monitored and addressed if necessary.

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

Section 2: METHODOLOGY

Geomorphic data were collected following the standards outlined in The Stream Channel Reference Site: An Illustrated Guide to Field Techniques (Harrelson et al., 1994) and in the Stream Restoration: A Natural Channel Design Handbook (Doll et al., 2003). All Integrated Current Condition Mapping was recorded using a Trimble handheld GPS with sub-meter accuracy and processed using Pathfinder and ArcGIS. Crest gages and pressure transducers were installed in surveyed riffle cross sections and monitored quarterly to document bankfull events and consecutive days of flow. Hydrologic monitoring instrument installation and monitoring methods are in accordance with the United States Army Corps of Engineers (USACE, 2003) standards. Vegetation monitoring protocols followed the Carolina Vegetation Survey-EEP Level 2 Protocol (Lee et al., 2008).

Section 3: REFERENCES

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

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

Lee, M.T., Peet, R.K., S.D., Wentworth, T.R. 2008. CVS-EEP Protocol for Recording Vegetation Version 4.2. Retrieved from http://cvs.bio.unc.edu/protocol/cvs-eep-protocol-v4.2-lev1-5.pdf.

North Carolina Division of Mitigation Services and Interagency Review Team Technical Workgroup. 2018. Standard Measurement of the BHR Monitoring Parameter. Raleigh, NC.

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

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Rosgen, D.L. 1997. A Geomorphological Approach to Restoration of Incised Rivers. Proceedings of the Conference on Management of Landscapes Disturbed by Channel Incision. Center For Computational Hydroscience and Bioengineering, Oxford Campus, University of Mississippi, Pages 12-22.

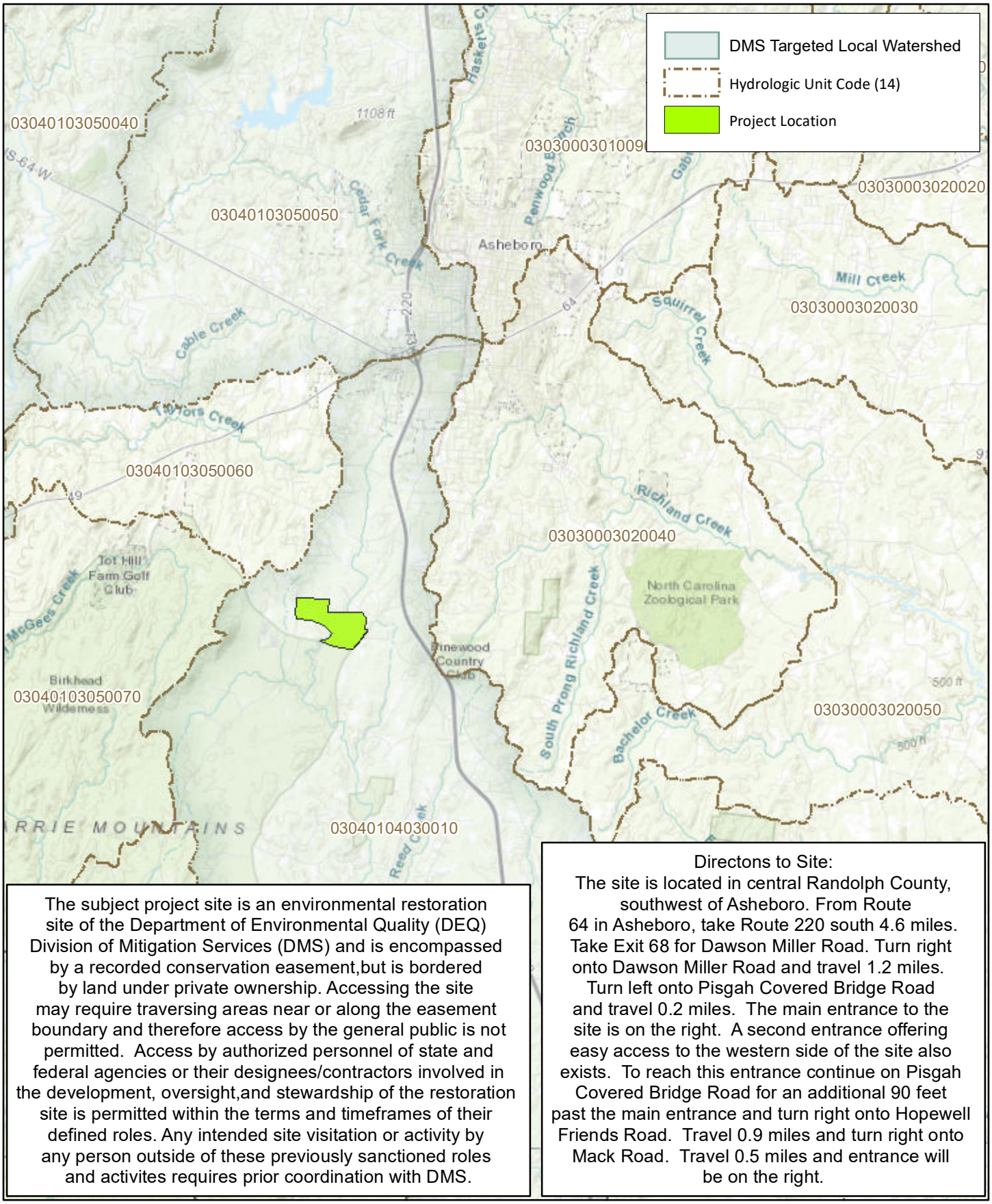
United States Army Corps of Engineers. 2003. Stream Mitigation Guidelines. USACE, NCDENR-DWQ, USEPA, NCWRC.

United States Geological Survey. 1998. North Carolina Geology. http://www.geology.enr.state.nc.us/usgs/carolina.htm

Wildlands Engineering, Inc. 2013. Hopewell Stream Mitigation Site Mitigation Plan. NCEEP, Raleigh, NC.

Wildlands Engineering, Inc. 2015. Hopewell Stream Mitigation Site Baseline Monitoring Document and As-Built Baseline Report. NCEEP, Raleigh, NC.

APPENDIX 1. General Figures and Tables



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

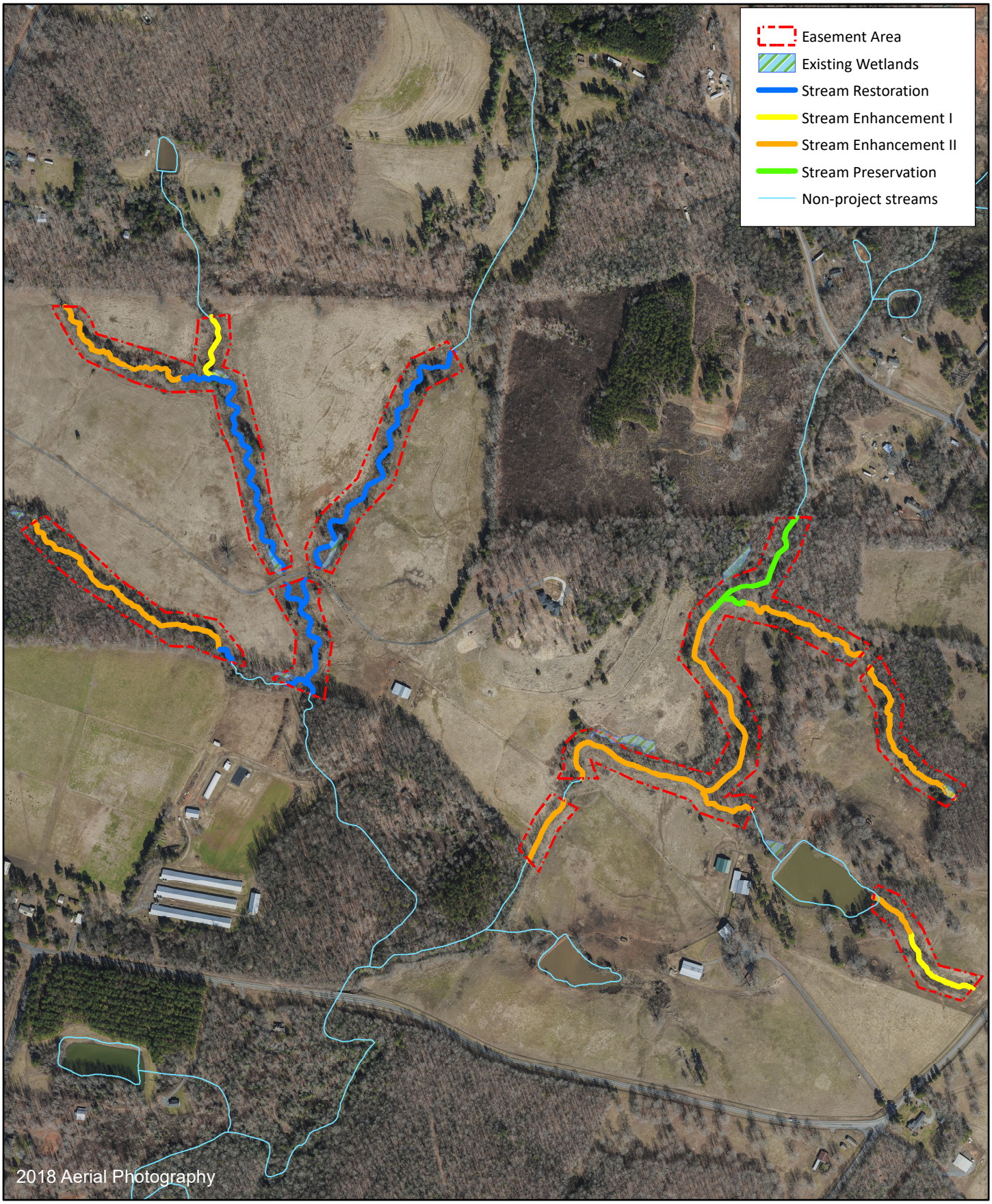
Directons to Site:
The site is located in central Randolph County, southwest of Asheboro. From Route 64 in Asheboro, take Route 220 south 4.6 miles. Take Exit 68 for Dawson Miller Road. Turn right onto Dawson Miller Road and travel 1.2 miles. Turn left onto Pisgah Covered Bridge Road and travel 0.2 miles. The main entrance to the site is on the right. A second entrance offering easy access to the western side of the site also exists. To reach this entrance continue on Pisgah Covered Bridge Road for an additional 90 feet past the main entrance and turn right onto Hopewell Friends Road. Travel 0.9 miles and turn right onto Mack Road. Travel 0.5 miles and entrance will be on the right.

WILDLANDS ENGINEERING

0 0.5 1 2 Miles

N

Figure 1 Vicinity Map
Hopewell Stream Mitigation Site
DMS Project No. 95352
Monitoring Year 5 - 2019
Randolph County, NC



WILDLANDS ENGINEERING

0 500 Feet

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Figure 2 Project Component Map
Hopewell Stream Mitigation Site
DMS Project No. 95352
Monitoring Year 5 - 2019
Randolph County, NC

Table 1. Project Components and Mitigation Credits
Hopewell Stream Mitigation Site
DMS Project No. 95352
Monitoring Year 5 - 2019

Mitigation Credits									
	Stream		Riparian Wetland		Non-Riparian Wetland		Buffer	Nitrogen Nutrient Offset	Phosphorous Nutrient Offset
Type	R	RE	R	RE	R	RE			
Totals	7,247.933	164.200	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Project Components							
Reach ID	As-Built Stationing / Location	Existing Footage / Acreage	Approach	Restoration or Restoration Equivalent	Restoration Footage / Acreage	Mitigation Ratio	Credits (SMU / WMU)
STREAMS							
Little River Reach 1	100+00 - 107+04	704	Preservation	P	704	5:1	140.800
Little River Reach 2	107+04 - 126+53 128+06 - 131+57	2,374	Fencing / Invasives Control	EII	2,300	2.5:1	920.000
UT1A Reach 1	200+00 - 208+95 209+84 - 217+00	1,611	Fencing / Invasives Control	EII	1,611	2.5:1	644.400
UT1A Reach 2	217+00 - 218+17	117	Preservation	P	117	5:1	23.400
UT1B Reach 1	300+87 - 305+67	475	Fencing / Invasives Control	EI	480	1.5:1	320.000
UT1B Reach 2 & 3	305+67 - 308+25 350+00 - 353+17	580	Fencing / Invasives Control	EII	575	2.5:1	230.000
UT2 Reach 1 & 2	400+00 - 415+47 416+35 - 423+16	2,419	Priority 1	Restoration	2,228	1:1	2,228.000
UT2A Reach 1	500+39 - 504+25	386	Fencing / Invasives Control	EI	386	1.5:1	257.333
UT2A Reach 2	504+25 - 516+21 517+00 - 518+68	1,368	Priority 1	Restoration	1,364	1:1	1,364.000
UT2B Reach 1	600+00 - 608+48	848	Fencing / Invasives Control	EII	848	2.5:1	339.200
UT2B Reach 2	608+48 - 610+46	114	Priority 1	Restoration	198	1:1	198.000
UT2C Reach 1	700+00 - 712+50	1,215	Fencing / Invasives Control	EII	1,250	2.5:1	500.000
UT2C Reach 2	712+50 - 713+60	326	Priority 1	Restoration	110	1:1	110.000
UT2C Reach 3	800+00 - 801+37		Priority 1	Restoration	137	1:1	137.000

Component Summation						
Restoration Level	Stream (LF)	Riparian Wetland (acres)		Non-Riparian (acres)	Buffer (square	Upland (acres)
		Riverine	on-Riverin			
Restoration	4,037	-	-	-	-	-
Enhancement		-	-	-	-	-
Enhancement I	866					
Enhancement II	6,584					
Preservation	821	-	-	-		
High Quality Preservation	-	-	-	-		-

Table 2. Project Activity and Reporting History
Hopewell Stream Mitigation Site
DMS Project No. 95352
Monitoring Year 5 - 2019

Activity or Report		Data Collection Complete	Completion or Scheduled Delivery
Mitigation Plan		January 2013	November 2013
Final Design - Construction Plans		January 2013	March 2014
Construction		July 2014-November 2014	November 2014
Temporary S&E mix applied to entire project area[1]		November 2014	November 2014
Permanent seed mix applied to reach/segments		November 2014	November 2014
Bare root and live stake plantings for reach/segments		January 2015	January 2015
Baseline Monitoring Document (Year 0)		December 2014-January 2015	February 2015
Year 1 Monitoring	Stream Survey	September 2015	December 2015
	Vegetation Survey	September 2015	
Invasive Plant Control		April 2016	
Bare Areas (UT2A) Limed/Fertilized/Seeded		April 2016	
Year 2 Monitoring	Stream Survey	August 2016	December 2016
	Vegetation Survey	August 2016	
Invasive Plant Control		February 2017	
Year 3 Monitoring	Stream Survey	July 2017	December 2017
	Vegetation Survey	July 2017	
Invasive Plant Control		October 2017	
Year 4 Monitoring	Stream Survey	July 2018	December 2018
	Vegetation Survey	July 2018	
Invasive Plant Control		October 2018	
Year 5 Monitoring	Stream Survey	September 2019	November 2019
	Vegetation Survey	September 2019	
Sweetgum Monoculture Treatment		October - December 2019	
Invasive Plant Control		November - December 2019	
Year 6 Monitoring		2020	December 2020
Year 7 Monitoring		2021	December 2021

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

Table 3. Project Contact Table
Hopewell Stream Mitigation Site
DMS Project No. 95352
Monitoring Year 5 - 2019

Designer Jeff Keaton, PE	**Wildlands Engineering, Inc.** 1430 South Mint Street, Suite 104 Charlotte, NC 28203 704.332.7754
Construction Contractor	**Terry's Plumbing** 465 Lewallen Road Asheboro, NC 27205
	Land Mechanics Designs, Inc. 126 Circle G Lane Willow Spring, NC 27592
Planting Contractor	**Bruton Natural Systems, Inc** P.O. Box 1197 Fremont, NC 27830
Seeding Contractor	**Terry's Plumbing** 465 Lewallen Road Asheboro, NC 27205
Seed Mix Sources	**Green Resource, LLC**
Nursery Stock Suppliers	
Bare Roots	**Dykes and Son Nursery**
Live Stakes	**Bruton Natural Systems, Inc**
Monitoring Performers	**Wildlands Engineering, Inc.**
Monitoring, POC	Kristi Suggs 704.332.7754, ext. 110

Table 4. Project Information and Attributes
Hopewell Stream Mitigation Site
DMS Project No. 95352
Monitoring Year 5 - 2019

Project Information	
Project Name	Hopewell Stream Mitigation Site
County	Randolph county
Project Area (acres)	35.4
Project Coordinates (latitude and longitude)	35°37'37.32" N, 79° 51'13.27" W

Project Watershed Summary Information	
Physiographic Province	Carolina Slate Belt of the Piedmont Physiographic Province
River Basin	Yadkin-Pee Dee
USGS Hydrologic Unit 8-digit	03040104
USGS Hydrologic Unit 14-digit	03040104030010
DWR Sub-basin	03-07-15
Project Drainiage Area (acres)	4,083
Project Drainage Area Percentage of Impervious Area	2%
CGIA Land Use Classification	2.01.03 – Hay and Pasture Land; 2.99.05 - Farm Ponds; 4 – Forest Land; 1 - Urban and Developed Land

Reach Summary Information

Parameters	Little River	UT1A	UT1B Reach 1	UT1B Reach 2 & 3	UT2 Reach 1	UT2 Reach 2	UT2A Reach 1	UT2A Reach 2	UT2B	UT2C
Length of reach (linear feet) - Post-Restoration	3,911	597	480	575	1,547	681	386	1,364	1,046	247
Drainage area (acres)	4,083	38	19	45	246	378	64	102	22	51
NCDWR stream identification score	43.5	22.5	24.5	30	35.5	35.5	27	35	23.7	31
NCDWR Water Quality Classification	C									
Morphological Desription (stream type)	P	I	I	P	P	P	I	P	I	P
Evolutionary trend (Simon's Model) - Pre- Restoration	I/II	I	III	I	III/IV	IV	III	III/IV	III	III
Underlying mapped soils	Badin-Tarrus Complex, Chewacla Loam, Georgeville silt loam, Georgeville silty clay loam, Mecklenburg clay loam, Riverview sandy loam									
Drainage class	---	---	---	---	---	---	---	---	---	---
Soil hydric status	---	---	---	---	---	---	---	---	---	---
Slope	0.0051	0.0389	0.03	0.0583	0.0093	0.0075	0.0102	0.011	0.0259	0.0154
FEMA classification	AE*									
Native vegetation community	Piedmont Bottomland Forest / Mixed Mesic Hardwood Forest									
Percent composition exotic invasive vegetation-Post-Restoration	0%									

Regulatory Considerations

Regulation	Applicable?	Resolved?	Supporting Documentation
Waters of the United States - Section 404	X	X	USACE Nationwide Permit No.27 and DWQ 401 Water Quality Certification No. 3885.
Waters of the United States - Section 401	X	X	
Division of Land Quality (Dam Safety)	N/A	N/A	N/A
Endangered Species Act	X	X	Hopewell Mitigation Plan; Wildlands determined "no effect" on Randolph County listed endangered species. (Letter from USFWS dated July 27, 2012)
Historic Preservation Act	X	X	No historic resources were found to be impacted (letter from SHPO dated 7/13/2012).
Coastal Zone Management Act (CZMA)/Coastal Area Management Act (CAMA)	N/A	N/A	N/A
FEMA Floodplain Compliance	X	X	Little River is a mapped Zone AE floodplain with defined base flood elevations. A floodway has not been delineated but non-encroachment widths have been defined; (FEMA Zone AE, FIRM panel 7648).
Essential Fisheries Habitat	N/A	N/A	N/A

APPENDIX 2. Visual Assessment Data

WILDLANDS ENGINEERING

0 200 400 800 Feet

N

Figure 3.0 Integrated Current Condition Plan View (Key)
Hopewell Stream Mitigation Site
DMS Project No. 95352
Monitoring Year 5 - 2019
Randolph County

WILDLANDS ENGINEERING

0 50 100 200 Feet

N

Figure 3.1 Integrated Current Condition Plan View (Sheet 1 of 7)
Hopewell Stream Mitigation Site
DMS Project No. 95352
Monitoring Year 5 - 2019
Randolph County

0 50 100 200 Feet

Figure 3.2 Integrated Current Condition Plan View (Sheet 2 of 7)
Hopewell Stream Mitigation Site
DMS Project No. 95352
Monitoring Year 5 - 2019
Randolph County

Easement Area
Existing Wetlands
Stream Restoration
Stream Enhancement I
Stream Enhancement II
Stream Preservation
Non-project streams
Cross-Section (XS)
Reach Break
Crest Gage (CG)
Rain Gage
Photo Point
Vegetation Plot Condition-MY5
Did Not Meet Criteria
Meets Criteria
Vegetation Problem Area- MY5
Chinese Privet
Sweetgum colony
Tree of Heaven

UT2B Reach 2
UT2A Reach 2
UT2 Reach 1
CG #4
CG #3
XS 1
XS 2
XS 3
XS 4
XS 5
XS 6
XS 9
XS 10
XS 11
XS 12
XS 13
608+00
609+00
610+00
610+46
503+00
504+00
505+00
506+00
507+00
508+00
509+00
510+00
511+00
512+00
513+00
401+00
402+00
403+00
404+00
405+00
406+00
407+00
408+00
409+00
410+00
411+00
412+00
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4
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9
10
11

2018 Aerial Photography

0 50 100 200 Feet

WILDLANDS ENGINEERING

Figure 3.3 Integrated Current Condition Plan View (Sheet 3 of 7)
Hopewell Stream Mitigation Site
DMS Project No. 95352
Monitoring Year 5 - 2019
Randolph County

Easement Area
Existing Wetlands
Stream Restoration
Stream Enhancement I
Stream Enhancement II
Stream Preservation
Non-project streams
Cross-Section (XS)
Reach Break
Crest Gage (CG)
Rain Gage
Photo Point

Vegetation Plot Condition-MY5
Did Not Meet Criteria
Meets Criteria

Vegetation Problem Area- MY5
Chinese Privet
Sweetgum colony
Tree of Heaven

41
112+00
113+00
24
42
114+00
115+00
46
125+00
124+00
27
123+00
45
122+00
126+00
121+00
26
120+00
44
119+00
25
116+00
117+00
43
118+00
127+00
128+00
28
129+00
47
130+00
131+00
131+57
353+00
354+00
64
352+00
63
351+00
350+00

Little River
Reach 2

UT1B
Reach 3

2018 Aerial Photography

WILDLANDS ENGINEERING

0 50 100 200 Feet

N

Figure 3.4 Integrated Current Condition Plan View (Sheet 4 of 7)
Hopewell Stream Mitigation Site
DMS Project No. 95352
Monitoring Year 5 - 2019
Randolph County

Easement Area
Existing Wetlands
Stream Restoration
Stream Enhancement I
Stream Enhancement II
Stream Preservation
Non-project streams
Cross-Section (XS)
Reach Break
Crest Gage (CG)
Rain Gage
Photo Point

Vegetation Plot Condition-MY5
Did Not Meet Criteria
Meets Criteria

Vegetation Problem Area- MY5
Chinese Privet
Sweetgum colony
Tree of Heaven

Little River Reach 1
Little River Reach 2
UT1A Reach 1
UT1A Reach 2

100+00
101+00
102+00
103+00
104+00
105+00
106+00
107+00
108+00
109+00
110+00
111+00
208+00
209+00
210+00
211+00
212+00
213+00
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218+00

36
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2018 Aerial Photography

WILDLANDS ENGINEERING

0 50 100 200 Feet

N

Figure 3.5 Integrated Current Condition Plan View (Sheet 5 of 7)
Hopewell Stream Mitigation Site
DMS Project No. 95352
Monitoring Year 5 - 2019
Randolph County

WILDLANDS ENGINEERING

0 50 100 200 Feet

N

Figure 3.6 Integrated Current Condition Plan View (Sheet 6 of 7)
Hopewell Stream Mitigation Site
DMS Project No. 95352
Monitoring Year 5 - 2019
Randolph County

WILDLANDS ENGINEERING

0 50 100 200 Feet

N

Figure 3.7 Integrated Current Condition Plan View (Sheet 7 of 7)
Hopewell Stream Mitigation Site
DMS Project No. 95352
Monitoring Year 5 - 2019
Randolph County

Table 5a. Visual Stream Morphology Stability Assessment Table
Hopewell Stream Mitigation Site
DMS Project No. 95352
Monitoring Year 5 - 2019

UT1B Reach 1 (480 LF)

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

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

Table 5b. Visual Stream Morphology Stability Assessment Table
Hopewell Stream Mitigation Site
DMS Project No. 95352
Monitoring Year 5 - 2019

UT2 Reach 1 & 2 (2,228 LF)

Major Channel Category	Channel Sub-Category	Metric	Number Stable, Performing as Intended	Total Number in As-Built	Number of Unstable Segments	Amount of Unstable Footage	% Stable, Performing as Intended	Number with Stabilizing Woody Vegetation	Footage with Stabilizing Woody Vegetation	Adjust % for Stabilizing Woody Vegetation
1. Bed	1. Vertical Stability (Shallow and Run units)	Aggradation			0	0	100%			
		Degradation			0	0	100%			
	2. Riffle Condition	Texture/Substrate	30	30			100%			
	3. Meander Pool Condition	Depth Sufficient	29	29			100%			
		Length Appropriate	29	29			100%			
	4. Thalweg Position	Thalweg centering at upstream of meander bend (Run)	29	29			100%			
		Thalweg centering at downstream of meander bend (Glide)	29	29			100%			
2. Bank	1. Scoured/Eroded	Bank lacking vegetative cover resulting simply from poor growth and/or scour and erosion.			0	0	100%	n/a	n/a	n/a
	2. Undercut	Banks undercut/overhanging to the extent that mass wasting appears likely. Does NOT include undercuts that are modest, appear sustainable and are providing habitat.			0	0	100%	n/a	n/a	n/a
	3. Mass Wasting	Bank slumping, calving, or collapse			0	0	100%	n/a	n/a	n/a
				Totals	0	0	100%	n/a	n/a	n/a
3. Engineered Structures[1]	1. Overall Integrity	Structures physically intact with no dislodged boulders or logs.	32	32			100%			
	2. Grade Control	Grade control structures exhibiting maintenance of grade across the sill.	13	13			100%			
	2a. Piping	Structures lacking any substantial flow underneath sills or arms.	13	13			100%			
	3. Bank Protection	Bank erosion within the structures extent of influence does not exceed 15%.	20	20			100%			
	4. Habitat	Pool forming structures maintaining ~Max Pool Depth : Bankfull Depth ≥ 1.6 Rootwads/logs providing some cover at baseflow.	20	20			100%			

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

Table 5c. Visual Stream Morphology Stability Assessment Table
Hopewell Stream Mitigation Site
DMS Project No. 95352
Monitoring Year 5 - 2019

UT2A Reach 1 & 2 (1,750 LF)

Major Channel Category	Channel Sub-Category	Metric	Number Stable, Performing as Intended	Total Number in As-Built	Number of Unstable Segments	Amount of Unstable Footage	% Stable, Performing as Intended	Number with Stabilizing Woody Vegetation	Footage with Stabilizing Woody Vegetation	Adjust % for Stabilizing Woody Vegetation
1. Bed	1. Vertical Stability (Shallow and Run units)	Aggradation			0	0	100%			
		Degradation			0	0	100%			
	2. Riffle Condition	Texture/Substrate	31	31			100%			
	3. Meander Pool Condition	Depth Sufficient	31	31			100%			
		Length Appropriate	31	31			100%			
	4. Thalweg Position	Thalweg centering at upstream of meander bend (Run)	31	31			100%			
		Thalweg centering at downstream of meander bend (Glide)	31	31			100%			
2. Bank	1. Scoured/Eroded	Bank lacking vegetative cover resulting simply from poor growth and/or scour and erosion.			0	0	100%	n/a	n/a	n/a
	2. Undercut	Banks undercut/overhanging to the extent that mass wasting appears likely. Does NOT include undercuts that are modest, appear sustainable and are providing habitat.			0	0	100%	n/a	n/a	n/a
	3. Mass Wasting	Bank slumping, calving, or collapse			0	0	100%	n/a	n/a	n/a
				Totals	0	0	100%	n/a	n/a	n/a
3. Engineered Structures[1]	1. Overall Integrity	Structures physically intact with no dislodged boulders or logs.	32	32			100%			
	2. Grade Control	Grade control structures exhibiting maintenance of grade across the sill.	2	2			100%			
	2a. Piping	Structures lacking any substantial flow underneath sills or arms.	2	2			100%			
	3. Bank Protection	Bank erosion within the structures extent of influence does not exceed 15%.	21	21			100%			
	4. Habitat	Pool forming structures maintaining ~Max Pool Depth : Bankfull Depth ≥ 1.6 Rootwads/logs providing some cover at baseflow.	20	20			100%			

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

Table 5d. Visual Stream Morphology Stability Assessment Table
Hopewell Stream Mitigation Site
DMS Project No. 95352
Monitoring Year 5 - 2019

UT2B Reach 2 (198 LF)

Major Channel Category	Channel Sub-Category	Metric	Number Stable, Performing as Intended	Total Number in As-Built	Number of Unstable Segments	Amount of Unstable Footage	% Stable, Performing as Intended	Number with Stabilizing Woody Vegetation	Footage with Stabilizing Woody Vegetation	Adjust % for Stabilizing Woody Vegetation
1. Bed	1. Vertical Stability (Shallow and Run units)	Aggradation			0	0	100%			
		Degradation			0	0	100%			
	2. Riffle Condition	Texture/Substrate	7	7			100%			
	3. Meander Pool Condition	Depth Sufficient	6	6			100%			
		Length Appropriate	6	6			100%			
	4. Thalweg Position	Thalweg centering at upstream of meander bend (Run)	6	6			100%			
		Thalweg centering at downstream of meander bend (Glide)	6	6			100%			
2. Bank	1. Scoured/Eroded	Bank lacking vegetative cover resulting simply from poor growth and/or scour and erosion.			0	0	100%	n/a	n/a	n/a
	2. Undercut	Banks undercut/overhanging to the extent that mass wasting appears likely. Does NOT include undercuts that are modest, appear sustainable and are providing habitat.			0	0	100%	n/a	n/a	n/a
	3. Mass Wasting	Bank slumping, calving, or collapse			0	0	100%	n/a	n/a	n/a
				Totals	0	0	100%	n/a	n/a	n/a
3. Engineered Structures[1]	1. Overall Integrity	Structures physically intact with no dislodged boulders or logs.	6	6			100%			
	2. Grade Control	Grade control structures exhibiting maintenance of grade across the sill.	n/a	n/a			n/a			
	2a. Piping	Structures lacking any substantial flow underneath sills or arms.	n/a	n/a			n/a			
	3. Bank Protection	Bank erosion within the structures extent of influence does not exceed 15%.	6	6			100%			
	4. Habitat	Pool forming structures maintaining ~Max Pool Depth : Bankfull Depth ≥ 1.6 Rootwads/logs providing some cover at baseflow.	6	6			100%			

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

Table 5e. Visual Stream Morphology Stability Assessment Table
Hopewell Stream Mitigation Site
DMS Project No. 95352
Monitoring Year 5 - 2019

UT2C Reach 2 (110 LF)

Major Channel Category	Channel Sub-Category	Metric	Number Stable, Performing as Intended	Total Number in As-Built	Number of Unstable Segments	Amount of Unstable Footage	% Stable, Performing as Intended	Number with Stabilizing Woody Vegetation	Footage with Stabilizing Woody Vegetation	Adjust % for Stabilizing Woody Vegetation
1. Bed	1. Vertical Stability (Shallow and Run units)	Aggradation			0	0	100%			
		Degradation			0	0	100%			
	2. Riffle Condition	Texture/Substrate	5	5			100%			
	3. Meander Pool Condition	Depth Sufficient	4	4			100%			
		Length Appropriate	4	4			100%			
	4. Thalweg Position	Thalweg centering at upstream of meander bend (Run)	4	4			100%			
		Thalweg centering at downstream of meander bend (Glide)	4	4			100%			
2. Bank	1. Scoured/Eroded	Bank lacking vegetative cover resulting simply from poor growth and/or scour and erosion.			0	0	100%	n/a	n/a	n/a
	2. Undercut	Banks undercut/overhanging to the extent that mass wasting appears likely. Does NOT include undercuts that are modest, appear sustainable and are providing habitat.			0	0	100%	n/a	n/a	n/a
	3. Mass Wasting	Bank slumping, calving, or collapse			0	0	100%	n/a	n/a	n/a
				Totals	0	0	100%	n/a	n/a	n/a
3. Engineered Structures[1]	1. Overall Integrity	Structures physically intact with no dislodged boulders or logs.	4	4			100%			
	2. Grade Control	Grade control structures exhibiting maintenance of grade across the sill.	n/a	n/a			n/a			
	2a. Piping	Structures lacking any substantial flow underneath sills or arms.	n/a	n/a			n/a			
	3. Bank Protection	Bank erosion within the structures extent of influence does not exceed 15%.	4	4			100%			
	4. Habitat	Pool forming structures maintaining ~Max Pool Depth : Bankfull Depth ≥ 1.6 Rootwads/logs providing some cover at baseflow.	4	4			100%			

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

Table 5f. Visual Stream Morphology Stability Assessment Table
Hopewell Stream Mitigation Site
DMS Project No. 95352
Monitoring Year 5 - 2019

UT2C Reach 3 (137 LF)

Major Channel Category	Channel Sub-Category	Metric	Number Stable, Performing as Intended	Total Number in As-Built	Number of Unstable Segments	Amount of Unstable Footage	% Stable, Performing as Intended	Number with Stabilizing Woody Vegetation	Footage with Stabilizing Woody Vegetation	Adjust % for Stabilizing Woody Vegetation
1. Bed	1. Vertical Stability (Shallow and Run units)	Aggradation			0	0	100%			
		Degradation			0	0	100%			
	2. Riffle Condition	Texture/Substrate	3	3			100%			
	3. Meander Pool Condition	Depth Sufficient	2	2			100%			
		Length Appropriate	2	2			100%			
	4. Thalweg Position	Thalweg centering at upstream of meander bend (Run)	2	2			100%			
		Thalweg centering at downstream of meander bend (Glide)	2	2			100%			
2. Bank	1. Scoured/Eroded	Bank lacking vegetative cover resulting simply from poor growth and/or scour and erosion.			0	0	100%	n/a	n/a	n/a
	2. Undercut	Banks undercut/overhanging to the extent that mass wasting appears likely. Does NOT include undercuts that are modest, appear sustainable and are providing habitat.			0	0	100%	n/a	n/a	n/a
	3. Mass Wasting	Bank slumping, calving, or collapse			0	0	100%	n/a	n/a	n/a
				Totals	0	0	100%	n/a	n/a	n/a
3. Engineered Structures[1]	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.	n/a	n/a			n/a			
	2a. Piping	Structures lacking any substantial flow underneath sills or arms.	n/a	n/a			n/a			
	3. Bank Protection	Bank erosion within the structures extent of influence does not exceed 15%.	1	1			100%			
	4. Habitat	Pool forming structures maintaining ~Max Pool Depth : Bankfull Depth ≥ 1.6 Rootwads/logs providing some cover at baseflow.	1	1			100%			

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

Table 6. Vegetation Condition Assessment Table
Hopewell Stream Mitigation Site
DMS Project No. 95352
Monitoring Year 5 - 2019

Planted Acreage **24**

Vegetation Category	Definitions	Mapping Threshold (Ac)	Number of Polygons	Combined Acreage	% of Planted Acreage
Bare Areas	Very limited cover of both woody and herbaceous material	0.1	0	0	0.0%
Low Stem Density Areas	Woody stem densities clearly below target levels based on MY3, 4, or 5 stem count criteria.	0.1	0	0.0	0.0%
		Total	**0**	**0.0**	**0.0%**
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 Ac	0	0	0%
		Cumulative Total	**0**	**0.0**	**0.0%**

Easement Acreage **35**

Vegetation Category	Definitions	Mapping Threshold (SF)	Number of Polygons	Combined Acreage	% of Easement Acreage
Invasive Areas of Concern	Areas of points (if too small to render as polygons at map scale).	1,000	19	1.2	3.4%
Easement Encroachment Areas	Areas of points (if too small to render as polygons at map scale).	none	0	0	0%

Stream Photographs
Monitoring Year 5

	
UT2B R1 – Photo Point 1 looking upstream *(09/12/2019)*	**UT2B R1** – Photo Point 1 looking downstream *(09/12/2019)*
	
UT2B R1 – Photo Point 2 looking upstream *(09/12/2019)*	**UT2B R1** – Photo Point 2 looking downstream *(09/12/2019)*
	
UT2B R1 – Photo Point 3 looking upstream *(09/12/2019)*	**UT2B R1** – Photo Point 3 looking downstream *(09/12/2019)*

	
UT2B R1 – Photo Point 4 looking upstream *(09/12/2019)*	**UT2B R1** – Photo Point 4 looking downstream *(09/12/2019)*
	
UT2B R1 – Photo Point 5 looking upstream *(09/12/2019)*	**UT2B R1** – Photo Point 5 looking downstream *(09/12/2019)*
	
UT2A R1 – Photo Point 6 looking upstream *(09/12/2019)*	**UT2A R1** – Photo Point 6 looking downstream *(09/12/2019)*

UT2A R1 – Photo Point 7 looking upstream *(09/12/2019)*

UT2A R1 – Photo Point 7 looking downstream *(09/12/2019)*

UT2A R2 – Photo Point 8 looking upstream *(09/12/2019)*

UT2A R2 – Photo Point 8 looking downstream *(09/12/2019)*

UT2A R2 – Photo Point 9 looking upstream *(09/12/2019)*

UT2A R2 – Photo Point 9 looking downstream *(09/12/2019)*

UT2A R2 – Photo Point 10 looking upstream *(09/12/2019)*

UT2A R2 – Photo Point 10 looking downstream (*09/12/2019)*

UT2A R2 – Photo Point 11 looking upstream *(09/12/2019)*

UT2A R2 – Photo Point 11 looking downstream *(09/12/2019)*

UT2A R2 – Photo Point 12 looking upstream *(09/12/2019)*

UT2A R2 – Photo Point 12 looking downstream *(09/12/2019)*

UT2A R2 – Photo Point 13 looking upstream *(09/12/2019)*

UT2A R2 – Photo Point 13 looking downstream *(09/12/2019)*

UT2A R2 – Photo Point 14 looking upstream *(09/12/2019)*

UT2A R2 – Photo Point 14 looking downstream *(09/12/2019)*

UT2A R2 – Photo Point 15 looking upstream *(09/12/2019)*

UT2A R2 – Photo Point 15 looking downstream *(09/12/2019)*

UT2C R1 – Photo Point 16 looking upstream *(09/12/2019)*

UT2C R1 – Photo Point 16 looking downstream *(09/12/2019)*

UT2C R1 – Photo Point 17 looking upstream *(09/12/2019)*

UT2C R1 – Photo Point 17 looking downstream *(09/12/2019)*

UT2C R1 – Photo Point 18 looking upstream *(09/12/2019)*

UT2C R1 – Photo Point 18 looking downstream *(09/12/2019)*

UT2C R1 – Photo Point 19 looking upstream *(09/12/2019)*

UT2C R1 – Photo Point 19 looking downstream *(09/12/2019)*

UT2C R1 – Photo Point 20 looking upstream *(09/12/2019)*

UT2C R1 – Photo Point 20 looking downstream *(09/12/2019)*

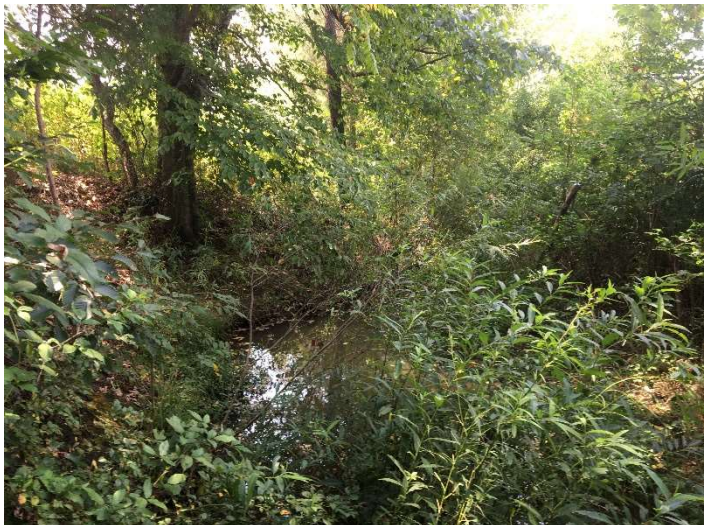
UT2C R1 – Photo Point 21 looking upstream *(09/12/2019)*

UT2C R1 – Photo Point 21 looking downstream *(09/12/2019)*

	
UT2C R2 – Photo Point 22 looking upstream *(09/12/2019)*	**UT2C R2** – Photo Point 22 looking downstream *(09/12/2019)*
	
UT2C R3 – Photo Point 23 looking upstream *(09/12/2019)*	**UT2C R3** – Photo Point 23 looking downstream *(09/12/2019)*
	
UT2 R1 – Photo Point 24 looking upstream *(09/11/2019)*	**UT2 R1** – Photo Point 24 looking downstream *(09/11/2019)*

	
UT2 R1 – Photo Point 25 looking upstream *(09/11/2019)*	**UT2 R1** – Photo Point 25 looking downstream *(09/11/2019)*
	
UT2 R1 – Photo Point 26 looking upstream *(09/11/2019)*	**UT2 R1** – Photo Point 26 looking downstream *(09/11/2019)*
	
UT2 R1 – Photo Point 27 looking upstream *(09/11/2019)*	**UT2 R1** – Photo Point 27 looking downstream *(09/11/2019)*

UT2 R1 – Photo Point 28 looking upstream *(09/11/2019)*



UT2 R1 – Photo Point 28 looking downstream *(09/11/2019)*

UT2 R1 – Photo Point 29 looking upstream *(09/11/2019)*

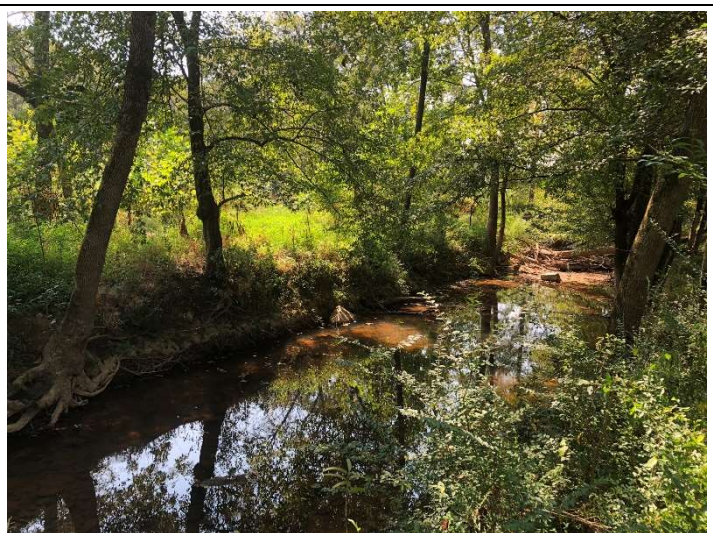
UT2 R1 – Photo Point 29 looking downstream *(09/11/2019)*

UT2 R1 – Photo Point 30 looking upstream *(09/11/2019)*

UT2 R1 – Photo Point 30 looking downstream *(09/11/2019)*

	
UT2 R1 – Photo Point 31 looking upstream *(09/11/2019)*	**UT2 R1** – Photo Point 31 looking downstream *(09/11/2019)*
	
UT2 R1 – Photo Point 32 looking upstream *(09/12/2019)*	**UT2 R1** – Photo Point 32 looking downstream *(09/12/2019)*
	
UT2 R2 – Photo Point 33 looking upstream *(09/12/2019)*	**UT2 R2** – Photo Point 33 looking downstream *(09/12/2019)*

	
UT2 R2 – Photo Point 34 looking upstream *(09/12/2019)*	**UT2 R2** – Photo Point 34 looking downstream *(09/12/2019)*
	
UT2 R2 – Photo Point 35 looking upstream *(09/12/2019)*	**UT2 R2** – Photo Point 35 looking downstream *(09/12/2019)*
	
Little River R1 – Photo Point 36 looking upstream *(09/12/2019)*	**Little River R1**–Photo Point 36 looking downstream *(09/12/2019)*

	
Little River R1 – Photo Point 37 looking upstream *(09/12/2019)*	**Little River R1**–Photo Point 37 looking downstream *(09/12/2019)*
	
Little River R1 – Photo Point 38 looking upstream *(09/12/2019)*	**Little River R1**–Photo Point 38 looking downstream *(09/12/2019)*
	
Little River R2 – Photo Point 39 looking upstream *(09/12/2019)*	**Little River R2**–Photo Point 39 looking downstream *(09/12/2019)*

	
Little River R2 – Photo Point 40 looking upstream *(09/12/2019)*	**Little River R2**–Photo Point 40 looking downstream *(09/12/2019)*
	
Little River R2 – Photo Point 41 looking upstream *(09/12/2019)*	**Little River R2**–Photo Point 41 looking downstream *(09/12/2019)*
	
Little River R2 – Photo Point 42 looking upstream *(09/12/2019)*	**Little River R2**–Photo Point 42 looking downstream *(09/12/2019)*

	
Little River R2 – Photo Point 43 looking upstream *(09/12/2019)*	**Little River R2**–Photo Point 43 looking downstream *(09/12/2019)*
	
Little River R2 – Photo Point 44 looking upstream *(09/12/2019)*	**Little River R2**–Photo Point 44 looking downstream *(09/12/2019)*
	
Little River R2 – Photo Point 45 looking upstream *(09/12/2019)*	**Little River R2**–Photo Point 45 looking downstream *(09/12/2019)*

	
Little River R2 – Photo Point 46 looking upstream *(09/12/2019)*	**Little River R2**–Photo Point 46 looking downstream *(09/12/2019)*
	
Little River R2 – Photo Point 47 looking upstream *(09/12/2019)*	**Little River R2**–Photo Point 47 looking downstream *(09/12/2019)*
	
UT1A R1 – Photo Point 48 looking upstream *(09/10/2019)*	**UT1A R1** – Photo Point 48 looking downstream *(09/10/2019)*

	
UT1A R1 – Photo Point 49 looking upstream *(09/10/2019)*	**UT1A R1** – Photo Point 49 looking downstream *(09/10/2019)*
	
UT1A R1 – Photo Point 50 looking upstream *(09/10/2019)*	**UT1A R1** – Photo Point 50 looking downstream *(09/10/2019)*
	
UT1A R1 – Photo Point 51 looking upstream *(09/10/2019)*	**UT1A R1** – Photo Point 51 looking downstream *(09/10/2019)*

	
UT1A R1 – Photo Point 52 looking upstream *(09/10/2019)*	**UT1A R1** – Photo Point 52 looking downstream *(09/10/2019)*
	
UT1A R1 – Photo Point 53 looking upstream *(09/12/2019)*	**UT1A R1** – Photo Point 53 looking downstream *(09/12/2019)*
	
UT1A R1 – Photo Point 54 looking upstream *(09/12/2019)*	**UT1A R1** – Photo Point 54 looking downstream *(09/12/2019)*

	
UT1A R1 – Photo Point 55 looking upstream *(09/12/2019)*	**UT1A R1** – Photo Point 55 looking downstream *(09/12/2019)*
	
UT1A R1 – Photo Point 56 looking upstream *(09/12/2019)*	**UT1A R1** – Photo Point 56 looking downstream *(09/12/2019)*
	
UT1B R1 – Photo Point 57 looking upstream *(09/10/2019)*	**UT1B R1** – Photo Point 57 looking downstream *(09/10/2019)*

	
UT1B R1 – Photo Point 58 looking upstream *(09/10/2019)*	**UT1B R1** – Photo Point 58 looking downstream *(09/10/2019)*
	
UT1B R1 – Photo Point 59 looking upstream *(09/10/2019)*	**UT1B R1** – Photo Point 59 looking downstream *(09/10/2019)*
	
UT1B R1 – Photo Point 60 looking upstream *(09/10/2019)*	**UT1B R1** – Photo Point 60 looking downstream *(09/10/2019)*

	
UT1B R2 – Photo Point 61 looking upstream *(09/10/2019)*	**UT1B R2** – Photo Point 61 looking downstream *(09/10/2019)*
	
UT1B R2 – Photo Point 62 looking upstream *(09/10/2019)*	**UT1B R2** – Photo Point 62 looking downstream *(09/10/2019)*
	
UT1B R3 – Photo Point 63 looking upstream *(09/12/2019)*	**UT1B R3** – Photo Point 63 looking downstream *(09/12/2019)*

	
UT1B R3 – Photo Point 64 looking upstream *(09/12/2019)*	**UT1B R3** – Photo Point 64 looking downstream *(09/12/2019)*

Vegetation Photographs
Monitoring Year 5

Vegetation Plot 1 – (09/09/2019)

Vegetation Plot 2 – (09/09/2019)

Vegetation Plot 3 – (09/09/2019)

Vegetation Plot 4 – (09/09/2019)

Vegetation Plot 5 – (09/10/2019)

Vegetation Plot 6 – (09/09/2019)

Vegetation Plot 7 – (09/09/2019)

Vegetation Plot 8 – (09/09/2019)

Vegetation Plot 9 – (09/09/2019)

Vegetation Plot 10 – (09/09/2019)

Vegetation Plot 11 – (09/09/2019)

Vegetation Plot 12 – (09/09/2019)

	
Vegetation Plot 13 – (09/09/2019)	Vegetation Plot 14 – (09/09/2019)
	
Vegetation Plot 15 – (09/09/2019)	Vegetation Plot 16 – (09/09/2019)
	
Vegetation Plot 17 – (09/09/2019)	Vegetation Plot 18 – (09/10/2019)

Vegetation Plot 19 – (09/10/2019)

Vegetation Plot 20 – (09/10/2019)

Vegetation Plot 21 – (09/10/2019)

Vegetation Plot 22 – (09/10/2019)

Vegetation Plot 23– (09/10/2019)

Vegetation Plot 24 – (09/10/2019)

Vegetation Plot 25 – (09/10/2019)

Vegetation Plot 26 – (09/10/2019)

Vegetation Plot 27 – (09/10/2019)

Vegetation Plot 28 – (09/10/2019)

Vegetation Plot 29 – (09/10/2019)

Vegetation Plot 30 – (09/10/2019)

Vegetation Plot 31 – (09/10/2019)

APPENDIX 3. Vegetation Plot Data

Table 7. Vegetation Plot Criteria Attainment Table

Hopewell Stream Mitigation Site

DMS Project No. 95352

Monitoring Year 5 - 2019

Plot	MY5 Success Criteria Met (Y/N)	Tract Mean
1	Y	
2	Y	
3	Y	
4	Y	
5	Y	
6	Y	
7	Y	
8	Y	
9	Y	
10	Y	
11	Y	
12	Y	
13	Y	
14	Y	
15	Y	
16	Y	100%
17	Y	
18	Y	
19	Y	
20	Y	
21	Y	
22	Y	
23	Y	
24	Y	
25	Y	
26	Y	
27	Y	
28	Y	
29	Y	
30	Y	
31	Y	

Table 8. CVS Vegetation Tables - Metadata
Hopewell Stream Mitigation Site
DMS Project No. 95352
Monitoring Year 5 - 2019

Report Prepared By	Henry Reed
Date Prepared	10/4/2019 9:50
Database Name	cvs-eep-entrytool-v2.5.0 Hopewell MY5.mdb
Database Location	Q:\ActiveProjects\005-02133 Hopewell Mitigation FDP\Monitoring\Monitoring Year 5 (2019)\Vegetation Assessment
Computer Name	HENRY
File Size	61997056
DESCRIPTION OF WORKSHEETS IN THIS DOCUMENT----------	
Metadata	Description of database file, the report worksheets, and a summary of project(s) and project data.
Project Planted	Each project is listed with its PLANTED stems per acre, for each year. This excludes live stakes.
Project Total Stems	Each project is listed with its TOTAL stems per acre, for each year. This includes live stakes, all planted stems, and all natural/volunteer stems.
Plots	List of plots surveyed with location and summary data (live stems, dead stems, missing, etc.).
Vigor	Frequency distribution of vigor classes for stems for all plots.
Vigor by Spp	Frequency distribution of vigor classes listed by species.
Damage	List of most frequent damage classes with number of occurrences and percent of total stems impacted by each.
Damage by Spp	Damage values tallied by type for each species.
Damage by Plot	Damage values tallied by type for each plot.
Planted Stems by Plot and Spp	A matrix of the count of PLANTED living stems of each species for each plot; dead and missing stems are excluded.
ALL Stems by Plot and Spp	A matrix of the count of total living stems of each species (planted and natural volunteers combined) for each plot; dead and missing stems are excluded.
PROJECT SUMMARY----------	
Project Code	95352
Project Name	Hopewell Stream Mitigation Site
Area (sq m)	128285.35
Required Plots (calculated)	22
Sampled Plots	31

Table 9a. Planted and Total Stems (Species by Plot with Annual Means)

Hopewell Stream Mitigation Site
DMS Project No. 95352
Monitoring Year 5 - 2019

			Current Plot Data (MY5 2019)														
			Vegetation Plot 1			Vegetation Plot 2			Vegetation Plot 3			Vegetation Plot 4			Vegetation Plot 5		
Scientific Name	**Common Name**	**Species Type**	**PnoLS**	**P-all**	**T**	**PnoLS**	**P-all**	**T**	**PnoLS**	**P-all**	**T**	**PnoLS**	**P-all**	**T**	**PnoLS**	**P-all**	**T**
Acer negundo	box elder	Tree															
Acer rubrum	Red maple	Tree						2			22						
Alnus serrulata	Hazel alder	Shrub															
Betula nigra	River birch	Tree				1	1	1				1	1	1			
Carya	Hickory	Tree															
Cedrus	Cedar	Tree															
Celtis laevigata	Sugarberry	Tree															
Chamaecyparis thyoides	Atlantic white cedar	Tree															
Crataegus	Hawthorn	Tree															
Diospyros virginiana	Common persimmon	Tree									2						
Fraxinus pennsylvanica	Green ash	Tree			1				6	6	6	5	5	7			
Juglans nigra	Black walnut	Tree			3			3									
Juniperus virginiana	Eastern redcedar	Tree															
Liquidambar styraciflua	Sweetgum	Tree			2			1			84			50			
Liriodendron tulipifera	Tuliptree	Tree									5			20	1	1	14
Nyssa sylvatica	Blackgum	Tree															
Pinus	Pine	Tree															
Pinus palustris	longleaf pine	Tree															
Pinus rigida	Pitch pine	Tree															
Pinus serotina	Pond pine	Tree															
Pinus taeda	loblolly pine	Tree									7			20			5
Pinus virginiana	Virginia Pine	Tree															
Platanus occidentalis	American sycamore	Tree	2	2	2	1	1	3				7	7	37	2	2	2
Prunus serotina	Black cherry	Tree															
Quercus	Oak	Tree															
Quercus accutissima	sawtooth oak	Tree															
Quercus alba	white oak	Tree															
Quercus michauxii	Swamp chestnut oak	Tree	4	4	4	3	3	3	2	2	2				3	3	3
Quercus phellos	Willow oak	Tree	2	2	2			1	4	4	4				3	3	3
Quercus rubra	Northern red oak	Tree	2	2	2	2	2	2							2	2	2
Rhus glabra	Smooth sumac	Shrub															
Rhus typhina	Staghorn sumas	shrub															
Robinia pseudoacacia	Black locust	Tree															
Salix nigra	Black willow	Tree															
Salix sericea	Silky willow	Shrub															
Sambucus canadensis	Common elderberry	Shrub			1			1									
Taxodium distichum	bald cypress	Tree															
Ulmus alata	Winged elm	Tree			2			1						10			
Ulmus americana	American elm	Tree															
		Stem count	10	10	19	7	7	18	12	12	132	13	13	145	11	11	29
		Size (ares)		1			1			1			1			1	
		Size (ACRES)		0.02			0.02			0.02			0.02			0.02	
		Species count	4	4	9	4	4	10	3	3	8	3	3	7	5	5	6
		Stems per ACRE	405	405	769	283	283	728	486	486	5,342	526	526	5,868	445	445	1,174

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%
Volunteers included

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

Table 9b. Planted and Total Stems (Species by Plot with Annual Means)
Hopewell Stream Mitigation Site
DMS Project No. 95352
Monitoring Year 5 - 2019

			Current Plot Data (MY5 2019)														
			Vegetation Plot 6			Vegetation Plot 7			Vegetation Plot 8			Vegetation Plot 9			Vegetation Plot 10		
Scientific Name	**Common Name**	**Species Type**	**PnoLS**	**P-all**	**T**	**PnoLS**	**P-all**	**T**	**PnoLS**	**P-all**	**T**	**PnoLS**	**P-all**	**T**	**PnoLS**	**P-all**	**T**
Acer negundo L.	Boxelder	Tree															
Acer rubrum	Red maple	Tree			3												
Alnus serrulata	Hazel alder	Shrub															
Betula nigra	River birch	Tree							3	3	3	2	2	2	1	1	1
Carya	Hickory	Tree															
Cedrus	Cedar	Tree															
Celtis laevigata	Sugarberry	Tree															
Chamaecyparis thyoides	Atlantic white cedar	Tree															
Crataegus	Hawthorn	Tree															
Diospyros virginiana	Common persimmon	Tree			30						1						
Fraxinus pennsylvanica	Green ash	Tree	3	3	3	1	1	1				1	1	15	2	2	10
Juglans nigra	Black walnut	Tree			1												
Juniperus virginiana	Eastern redcedar	Tree															
Liquidambar styraciflua	Sweetgum	Tree			1			1									
Liriodendron tulipifera	Tuliptree	Tree	1	1	4	1	1	1						7	4	4	9
Nyssa sylvatica	Blackgum	Tree															
Pinus	Pine	Tree															
Pinus palustris	Longleaf pine	Tree															
Pinus rigida	Pitch pine	Tree															
Pinus serotina	Pond pine	Tree															
Pinus taeda	Loblolly pine	Tree															
Pinus virginiana	Virginia pine	Tree															
Platanus occidentalis	American sycamore	Tree	1	1	1	8	8	8	5	5	5	7	7	7	2	2	2
Prunus serotina	Black cherry	Tree			1			5									
Quercus	Oak	Tree															
Quercus acutissima	Sawtooth oak	Tree															
Quercus alba	White Oak	Tree															
Quercus michauxii	Swamp chestnut oak	Tree	4	4	4	3	3	3	1	1	1	1	1	1			
Quercus phellos	Willow oak	Tree										1	1	1	1	1	1
Quercus rubra	Northern red oak	Tree							1	1	1	1	1	1	5	5	5
Rhus glabra	Smooth sumac	Shrub															
Rhus typhina	Staghorn sumac	Tree															
Robinia pseudoacacia	Black locust	Tree															
Salix nigra	Black willow	Tree															
Salix sericea	Silky willow	Shrub									1						
Sambucus canadensis	Common elderberry	Shrub															
Taxodium distichum	Bald cypress	Tree												17			
Ulmus alata	Winged elm	Tree															
Ulmus americana	American elm	Tree						1									
		Stem count	9	9	48	13	13	20	10	10	12	13	13	51	15	15	28
		Size (ares)		1			1			1			1			1	
		Size (ACRES)		0.02			0.02			0.02			0.02			0.02	
		Species count	4	4	9	4	4	7	4	4	6	6	6	8	6	6	6
		Stems per ACRE	364	447	1,942	526	526	809	405	405	486	526	526	2,064	607	607	1,133

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%
Volunteers included

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

Table 9c. Planted and Total Stems (Species by Plot with Annual Means)

Hopewell Stream Mitigation Site

DMS Project No. 95352

Monitoring Year 5 - 2019

			Current Plot Data (MY5 2019)														
			Vegetation Plot 11			Vegetation Plot 12			Vegetation Plot 13			Vegetation Plot 14			Vegetation Plot 15		
Scientific Name	**Common Name**	**Species Type**	**PnoLS**	**P-all**	**T**	**PnoLS**	**P-all**	**T**	**PnoLS**	**P-all**	**T**	**PnoLS**	**P-all**	**T**	**PnoLS**	**P-all**	**T**
Acer negundo L.	Boxelder	Tree															
Acer rubrum	Red maple	Tree															
Alnus serrulata	Hazel alder	Shrub															
Betula nigra	River birch	Tree	3	3	4	2	2	2				1	1	1	1	1	1
Carya	Hickory	Tree															
Cedrus	Cedar	Tree															
Celtis laevigata	Sugarberry	Tree															
Chamaecyparis thyoides	Atlantic white cedar	Tree															
Crataegus	Hawthorn	Tree															
Diospyros virginiana	Common persimmon	Tree									3			1			17
Fraxinus pennsylvanica	Green ash	Tree	3	3	3	3	3	3	2	2	2	1	1	1	2	2	2
Juglans nigra	Black walnut	Tree						1									
Juniperus virginiana	Eastern redcedar	Tree															
Liquidambar styraciflua	Sweetgum	Tree												5			12
Liriodendron tulipifera	Tuliptree	Tree				2	2	3			2	3	3	10			1
Nyssa sylvatica	Blackgum	Tree															
Pinus	Pine	Tree															
Pinus palustris	Longleaf pine	Tree															
Pinus rigida	Pitch pine	Tree															
Pinus serotina	Pond pine	Tree															
Pinus taeda	Loblolly pine	Tree												3			
Pinus virginiana	Virginia pine	Tree															
Platanus occidentalis	American sycamore	Tree	1	1	1	4	4	4	9	9	16			4	9	9	9
Prunus serotina	Black cherry	Tree						1									
Quercus	Oak	Tree															
Quercus acutissima	Sawtooth oak	Tree															
Quercus alba	White Oak	Tree															
Quercus michauxii	Swamp chestnut oak	Tree	2	2	2	1	1	1				5	5	5	1	1	1
Quercus phellos	Willow oak	Tree															
Quercus rubra	Northern red oak	Tree				1	1	1	1	1	1	1	1	1	2	2	2
Rhus glabra	Smooth sumac	Shrub															
Rhus typhina	Staghorn sumac	Tree															
Robinia pseudoacacia	Black locust	Tree															
Salix nigra	Black willow	Tree															
Salix sericea	Silky willow	Shrub															
Sambucus canadensis	Common elderberry	Shrub															
Taxodium distichum	Bald cypress	Tree															
Ulmus alata	Winged elm	Tree						5									
Ulmus americana	American elm	Tree															
		Stem count	9	9	10	13	13	21	12	12	24	11	11	31	15	15	45
		Size (ares)		1			1			1			1			1	
		Size (ACRES)		0.02			0.02			0.02			0.02			0.02	
		Species count	8	8	20	6	6	9	3	3	5	5	5	9	5	5	8
		Stems per ACRE	364	447	405	526	526	850	486	486	971	445	445	1,255	607	607	1,821

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%

Volunteers included

PnoLS: Number of planted stems excluding live stakes

P-All: Number of planted stems including live stakes

T: Total stems

Table 9d. Planted and Total Stems (Species by Plot with Annual Means)
Hopewell Stream Mitigation Site
DMS Project No. 95352
Monitoring Year 5 - 2019

			Current Plot Data (MY5 2019)														
			Vegetation Plot 16			Vegetation Plot 17			Vegetation Plot 18			Vegetation Plot 19			Vegetation Plot 20		
Scientific Name	**Common Name**	**Species Type**	**PnoLS**	**P-all**	**T**	**PnoLS**	**P-all**	**T**	**PnoLS**	**P-all**	**T**	**PnoLS**	**P-all**	**T**	**PnoLS**	**P-all**	**T**
Acer negundo L.	Boxelder	Tree															
Acer rubrum	Red maple	Tree															
Alnus serrulata	Hazel alder	Shrub															
Betula nigra	River birch	Tree	1	1	1	3	3	3	2	2	2	1	1	1	4	4	4
Carya	Hickory	Tree															
Cedrus	Cedar	Tree															
Celtis laevigata	Sugarberry	Tree															
Chamaecyparis thyoides	Atlantic white cedar	Tree															
Crataegus	Hawthorn	Tree															
Diospyros virginiana	Common persimmon	Tree									1						
Fraxinus pennsylvanica	Green ash	Tree	4	4	4	4	4	4	2	2	2	5	5	5	5	5	7
Juglans nigra	Black walnut	Tree			1						3						
Juniperus virginiana	Eastern redcedar	Tree															2
Liquidambar styraciflua	Sweetgum	Tree						105			25			10			11
Liriodendron tulipifera	Tuliptree	Tree				1	1	41									1
Nyssa sylvatica	Blackgum	Tree															
Pinus	Pine	Tree															
Pinus palustris	Longleaf pine	Tree															4
Pinus rigida	Pitch pine	Tree															
Pinus serotina	Pond pine	Tree															
Pinus taeda	Loblolly pine	Tree						15									
Pinus virginiana	Virginia pine	Tree															1
Platanus occidentalis	American sycamore	Tree	6	6	6	4	4	4	2	2	2	4	4	5	1	1	1
Prunus serotina	Black cherry	Tree															
Quercus	Oak	Tree															
Quercus acutissima	Sawtooth oak	Tree															4
Quercus alba	White Oak	Tree															
Quercus michauxii	Swamp chestnut oak	Tree	2	2	2	1	1	1									
Quercus phellos	Willow oak	Tree															
Quercus rubra	Northern red oak	Tree				1	1	1	1	1	1				4	4	4
Rhus glabra	Smooth sumac	Shrub															
Rhus typhina	Staghorn sumac	Tree															
Robinia pseudoacacia	Black locust	Tree									1						
Salix nigra	Black willow	Tree															
Salix sericea	Silky willow	Shrub															
Sambucus canadensis	Common elderberry	Shrub															
Taxodium distichum	Bald cypress	Tree															
Ulmus alata	Winged elm	Tree									1			2			10
Ulmus americana	American elm	Tree															
		Stem count	13	13	14	14	14	174	7	7	38	10	10	23	14	14	49
		Size (ares)		1			1			1			1			1	
		Size (ACRES)		0.02			0.02			0.02			0.02			0.02	
		Species count	8	8	20	6	6	8	4	4	9	3	3	5	4	4	11
		Stems per ACRE	526	447	567	567	567	7,042	283	283	1,538	405	405	931	567	567	1,983

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%
Volunteers included

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

Table 9e. Planted and Total Stems (Species by Plot with Annual Means)
Hopewell Stream Mitigation Site
DMS Project No. 95352
Monitoring Year 5 - 2019

			Current Plot Data (MY5 2019)														
			Vegetation Plot 21			Vegetation Plot 22			Vegetation Plot 23			Vegetation Plot 24			Vegetation Plot 25		
Scientific Name	**Common Name**	**Species Type**	**PnoLS**	**P-all**	**T**	**PnoLS**	**P-all**	**T**	**PnoLS**	**P-all**	**T**	**PnoLS**	**P-all**	**T**	**PnoLS**	**P-all**	**T**
Acer negundo L.	Boxelder	Tree															
Acer rubrum	Red maple	Tree															
Alnus serrulata	Hazel alder	Shrub															
Betula nigra	River birch	Tree	1	1	1	2	2	5	1	1	1				1	1	1
Carya	Hickory	Tree															
Cedrus	Cedar	Tree						1									
Celtis laevigata	Sugarberry	Tree															
Chamaecyparis thyoides	Atlantic white cedar	Tree															
Crataegus	Hawthorn	Tree															
Diospyros virginiana	Common persimmon	Tree						8						1			1
Fraxinus pennsylvanica	Green ash	Tree	1	1	1	3	3	3	2	2	22	1	1	1	1	1	1
Juglans nigra	Black walnut	Tree															
Juniperus virginiana	Eastern redcedar	Tree															
Liquidambar styraciflua	Sweetgum	Tree			17			2			6						1
Liriodendron tulipifera	Tuliptree	Tree	1	1	2												
Nyssa sylvatica	Blackgum	Tree															
Pinus	Pine	Tree															
Pinus palustris	Longleaf pine	Tree															
Pinus rigida	Pitch pine	Tree															
Pinus serotina	Pond pine	Tree															
Pinus taeda	Loblolly pine	Tree						1									
Pinus virginiana	Virginia pine	Tree															
Platanus occidentalis	American sycamore	Tree	2	2	2	1	1	1	6	6	6	4	4	8	4	4	7
Prunus serotina	Black cherry	Tree															
Quercus	Oak	Tree															
Quercus accutissima	Sawtooth oak	Tree			1												
Quercus alba	White Oak	Tree															
Quercus michauxii	Swamp chestnut oak	Tree				3	3	3									
Quercus phellos	Willow oak	Tree	2	2	2												
Quercus rubra	Northern red oak	Tree	4	4	4							2	2	2	2	2	2
Rhus glabra	Smooth sumac	Shrub															
Rhus typhina	Staghorn sumac	Tree															
Robinia pseudoacacia	Black locust	Tree															
Salix nigra	Black willow	Tree															
Salix sericea	Silky willow	Shrub															
Sambucus canadensis	Common elderberry	Shrub															
Taxodium distichum	Bald cypress	Tree															
Ulmus alata	Winged elm	Tree			12			2			1						
Ulmus americana	American elm	Tree															
		Stem count	11	11	42	9	9	26	9	9	36	7	7	12	8	8	13
		Size (ares)		1			1			1			1			1	
		Size (ACRES)		0.02			0.02			0.02			0.02			0.02	
		Species count	8	8	20	4	4	9	3	3	5	3	3	4	4	4	6
		Stems per ACRE	445	447	1,700	364	364	1,052	364	364	1,457	283	283	486	324	324	526

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%
Volunteers included

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

Table 9f. Planted and Total Stems (Species by Plot with Annual Means)
Hopewell Stream Mitigation Site
DMS Project No. 95352
Monitoring Year 5 - 2019

			Current Plot Data (MY5 2019)																	
			Vegetation Plot 26			Vegetation Plot 27			Vegetation Plot 28			Vegetation Plot 29			Vegetation Plot 30			Vegetation Plot 31		
Scientific Name	**Common Name**	**Species Type**	**PnoLS**	**P-all**	**T**	**PnoLS**	**P-all**	**T**	**PnoLS**	**P-all**	**T**	**PnoLS**	**P-all**	**T**	**PnoLS**	**P-all**	**T**	**PnoLS**	**P-all**	**T**
Acer negundo L.	Boxelder	Tree																		
Acer rubrum	Red maple	Tree																		
Alnus serrulata	Hazel alder	Shrub																		
Betula nigra	River birch	Tree	1	1	1							1	1	1	1	1	1			
Carya	Hickory	Tree																		
Cedrus	Cedar	Tree																		
Celtis laevigata	Sugarberry	Tree																1	1	1
Chamaecyparis thyoides	Atlantic white cedar	Tree																		
Crataegus	Hawthorn	Tree																		
Diospyros virginiana	Common persimmon	Tree																		
Fraxinus pennsylvanica	Green ash	Tree	2	2	2	4	4	16	5	5	6	2	2	2	4	4	4	5	5	5
Juglans nigra	Black walnut	Tree															2			4
Juniperus virginiana	Eastern redcedar	Tree															1			
Liquidambar styraciflua	Sweetgum	Tree			1			1						57			600			200
Liriodendron tulipifera	Tuliptree	Tree				1	1	1				1	1	1				1	1	2
Nyssa sylvatica	Blackgum	Tree																		
Pinus	Pine	Tree																		
Pinus palustris	Longleaf pine	Tree												6			2			
Pinus rigida	Pitch pine	Tree																		
Pinus serotina	Pond pine	Tree																		
Pinus taeda	Loblolly pine	Tree																		1
Pinus virginiana	Virginia pine	Tree												2						
Platanus occidentalis	American sycamore	Tree	1	1	1	4	4	4	4	4	4	1	1	20						2
Prunus serotina	Black cherry	Tree																		
Quercus	Oak	Tree																		
Quercus acutissima	Sawtooth oak	Tree																		
Quercus alba	White Oak	Tree																		
Quercus michauxii	Swamp chestnut oak	Tree				3	3	3												
Quercus phellos	Willow oak	Tree	1	1	1	1	1	1												
Quercus rubra	Northern red oak	Tree	3	3	3							2	2	2	4	4	4	3	3	3
Rhus glabra	Smooth sumac	Shrub																		
Rhus typhina	Staghorn sumac	Tree												4						
Robinia pseudoacacia	Black locust	Tree			1															
Salix nigra	Black willow	Tree																		
Salix sericea	Silky willow	Shrub																		
Sambucus canadensis	Common elderberry	Shrub																		
Taxodium distichum	Bald cypress	Tree																		
Ulmus alata	Winged elm	Tree						1												
Ulmus americana	American elm	Tree																		
		Stem count	8	8	10	13	13	27	9	9	10	7	7	95	9	9	614	10	10	218
		Size (ares)		1			1			1			1			1			1	
		Size (ACRES)		0.02			0.02			0.02			0.02			0.02			0.02	
		Species count	8	8	20	5	5	7	2	2	2	5	5	9	3	3	7	4	4	8
		Stems per ACRE	324	447	405	526	526	1,093	364	364	405	283	283	3,845	364	364	24,848	405	405	8,822

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%
Volunteers included

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

Table 9g. Planted and Total Stems (Species by Plot with Annual Means)
Hopewell Stream Mitigation Site
DMS Project No. 95352
Monitoring Year 5 - 2019

			Annual Means																	
			MY5 (2019)			MY4 (2018)			MY3 (2017)			MY2 (2016)			MY1 (2015)			MY0 (2015)		
Scientific Name	Common Name	Species Type	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T
Acer negundo	Boxelder	Tree						1												
Acer rubrum	Red maple	Tree			27			50			45						2			
Alnus serrulata	Hazel alder	Shrub									1			1						
Betula nigra	River birch	Tree	34	34	38	38	38	46	37	37	47	37	37	42	44	44	51	53	53	53
Carya	Hickory	Tree															1			
Cedrus	Cedar	Tree			1															
Celtis laevigata	Sugarberry	Tree	1	1	1	1	1	1	1	1	2	1	1	1						
Chamaecyparis thyoides	Atlantic white cedar	Tree															1			
Crataegus	Hawthorn	Tree												1						
Diospyros virginiana	Common persimmon	Tree			65			74			93			82			51			
Fraxinus pennsylvanica	Green ash	Tree	79	79	139	80	80	174	79	79	113	86	86	133	85	85	116	92	92	92
Juglans nigra	Black walnut	Tree			18			13			13			14						
Juniperus virginiana	Eastern redcedar	Tree			3						4						1			
Liquidambar styraciflua	Sweetgum	Tree			1192			500			565			261			102			
Liriodendron tulipifera	Tuliptree	Tree	17	17	124	17	17	78	17	17	98	24	24	64	24	24	28	52	52	52
Nyssa sylvatica	Blackgum	Tree						2			2			1						
Pinus	Pine	Tree						24			25									
Pinus palustris	Longleaf pine	Tree			12															
Pinus rigida	Pitch pine	Tree						22			25									
Pinus serotina	Pond pine	Tree												1						
Pinus taeda	Loblolly pine	Tree			52															
Pinus virginiana	Virginia pine	Tree			3			1												
Platanus occidentalis	American sycamore	Tree	102	102	174	103	103	186	105	105	133	110	110	146	108	108	115	114	114	114
Prunus serotina	Black cherry	Tree			7									4						
Quercus	Oak	Tree									5			2						
Quercus acutissima	Sawtooth oak	Tree			5															
Quercus alba	White Oak	Tree						2												
Quercus michauxii	Swamp chestnut oak	Tree	39	39	39	39	39	39	42	42	42	45	45	45	45	45	45	46	46	46
Quercus phellos	Willow oak	Tree	15	15	16	17	17	17	20	20	20	34	34	34	36	36	36	71	71	71
Quercus rubra	Northern red oak	Tree	44	44	44	48	48	49	52	52	55	58	58	61	60	60	62	69	69	69
Rhus glabra	Smooth sumac	Shrub									7									
Rhus typhina	Staghorn sumac	Tree			4															
Robinia pseudoacacia	Black locust	Tree			2			2			1									
Salix nigra	Black willow	Tree						1												
Salix sericea	Silky willow	Shrub			1						1									
Sambucus canadensis	Common Elderberry	Shrub			2			4						3						
Taxodium distichum	Bald cypress	Tree			17															
Ulmus alata	Winged elm	Tree			47			33			4						1			
Ulmus americana	American elm	Tree			1															
		Stem count	331	331	2,034	343	343	1,319	353	353	1301	395	395	896	402	402	612	497	497	497
		Size (ares)		31			31			31			31			31			31	
		Size (ACRES)		0.77			0.77			0.77			0.77			0.77			0.77	
		Species count	8	8	20	8	8	21	8	8	22	8	8	18	7	7	14	7	7	7
		Stems per ACRE	430	447	2,642	448	448	1,722	461	461	1,698	516	516	1,170	525	525	799	649	649	649

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%
Volunteers included

APPENDIX 4. Morphological Summary Data and Plots

Table 10a. Baseline Stream Data Summary
Hopewell Stream Mitigation Site
DMS Project No. 95352
Monitoring Year 5 - 2019

Hopewell-UT2 Reaches 1 and 2

		Pre-Restoration Condition				Reference Reach Data										Design				As-Built/Baseline			
Parameter	Gage	UT2 Reach 1		UT2 Reach 2		Dutchman's Creek		UT to Rocky Creek		Spencer Creek Reach 1		Spencer Creek Reach 2		Spencer Creek Reach 3		UT2 Reach 1		UT2 Reach 2		UT2 Reach 1		UT2 Reach 2	
		Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
Dimension and Substrate - Riffle																							
Bankfull Width (ft)		7.9	10.9	10.7		23.0	32.0	12.2		8.7		2.1	2.6	1.0	1.2	12.5		14.0		10.6	14.2	15.3	
Floodprone Width (ft)		12	18	14		61	69	72		229		60	>114	14	125	50	125	50	125	>68	101	>55	
Bankfull Mean Depth		1.0	1.4	1.4		1.1	1.4	1.3		1.2		1.6	1.8	0.8	1.0	1.0		1.0		0.8	0.9	1.0	
Bankfull Max Depth		1.4	1.8	2.0		1.9	2.1	1.8		1.9		2.1	2.6	1.0	1.2	1.5		1.5		1.3	1.7	1.5	
Bankfull Cross-sectional Area (ft^2)	N/A	11.1	11.4	14.9		32.9	36.1	16.3		10.6		17.8	19.7	6.6	8.7	12.0		14.3		8.4	12.7	14.8	
Width/Depth Ratio		5.7	10.4	7.7		16.4	28.9	9.1		7.3		5.8	7.1	7.9	9.3	13.0		14.0		13.2	15.8	15.8	
Entrenchment Ratio		1.5	1.7	1.3		2.2	2.6	6.0		26.3		5.5	10.2	1.7	4.3	4.0	10.0	3.6	8.9	>7	7.1	>4	
Bank Height Ratio		1.4	1.9	2.1		---		1.0		1.0		1.0		1.0		1.0		1.0		1.0		1.0	
D50 (mm)		0.100		12.5																24.2	28.0	45.8	
Riffle Length (ft)						---		---		---				---		---		---		11	120	24	36
Riffle Slope (ft/ft)		---		---		---		0.0606	0.0892	0.01	0.067	0.013		0.0184	0.0343	0.0105	0.0225	0.0154	0.033	0.0033	0.0227	0.0104	0.0386
Pool Length (ft)	N/A					---		---		---		---		---		---		---		17	66	41	105
Pool Max Depth (ft)		2.0	2.2	2.2		---		2.2	6.7	2.5		3.3		1.2	1.8	1.8	2.4	1.9	2.5	1.7	3.6	3.2	5.0
Pool Spacing (ft)		---		---		---		26	81	13	47	71		9	46	19	81	21	91	20	108	65	132
Pool Volume (ft^3)																							
Pattern																							
Channel Beltwidth (ft)		45	79	67	69	84		---		24	52	38	41	10	50	20	75	22	84	5	11	32	79
Radius of Curvature (ft)		12	28	22	25	---		---		5	22	11	15	12	85	23	38	25	42	13	35	21	24
Rc:Bankfull Width (ft/ft)	N/A	1.5	2.6	2.1	2.3	---		---		0.6	2.5	1.3	1.4	1.9	9.1	1.8	3.0	1.8	3	1.2	2.5	1.4	1.6
Meander Length (ft)		102	245	125	132	---		---		---		---		53	178	50	188	56	120	60	171	113	120
Meander Width Ratio		5.7	7.2	6.3	6.4	---		---		6.0	6.0	#DIV/0!	3.6	1.6	5.4	1.6	6.0	1.6	6.0	0.5	0.8	2.1	5.2
Substrate, Bed and Transport Parameters																							
Ri%/Ru%/P%/G%/S%																							
SC%/Sa%/G%/C%/B%/Be%																							
d16/d35/d50/d84/d95/d100	N/A	SC/SC/0.1/45/180		SC/4.6/12.5/70/128		---		SC/2.4/22.6/120/256		0.1/3/8.6/77/180		SC/3/8.8/42/90		1.9/8.85/11/64/128						15/31/46/97/228/>2048		15/31/46/97/228/>2048	
Reach Shear Stress (Competency) lb/ft^2		---		---												0.39		0.61		0.37	0.43	0.67	
Max part size (mm) mobilized at bankfull																							
Stream Power (Capacity) W/m^2																							
Additional Reach Parameters																							
Drainage Area (SM)		0.38		0.59		2.90		1.10		0.50		0.96		0.37		0.38		0.59		0.38		0.59	
Watershed Impervious Cover Estimate (%)		1%		1%		---		---		---		---		---		1%		1%		1%		1%	
Rosgen Classification		G5/4		G4		B/C		E4b		E4/C4		E4		E4		C4		C4		C4		C4	
Bankfull Velocity (fps)		3.7	4.0	3.9		---		5.5		---		4.9	5.4		5.6	3.1		3.9		2.7	3.0	3.8	
Bankfull Discharge (cfs)		45		58		203		85		---		97		35		40		54		23	38	56	
Q-NFF regression (2-yr)		85		112																			
Q-USGS extrapolation (1.2-yr)	N/A	46		62																			
Q-Mannings		---		---																			
Valley Length (ft)		1,465		428		---		---		---		---		---		1,465		428		1,465		428	
Channel Thalweg Length (ft)		1,527		704		---		---		---		---		---		1,715		732		1,787		529	
Sinuosity		1.3		1.1		---		1.1		1.1		1.3		1.0	1.3	1.0	1.2	1.0	1.2	1.2		1.2	
Water Surface Slope ($ft/ft)^2$		---		---		---		---		---		---		---		---		---		0.0087		0.0126	
Bankfull Slope (ft/ft)		0.0083		0.0082		0.019		0.0235		0.132		0.0047		0.019	0.022	0.0083		0.0108		0.0085	0.0086	0.0103	0.0107

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

Table 10b. Baseline Stream Data Summary
Hopewell Stream Mitigation Site
DMS Project No. 95352
Monitoring Year 5 - 2019

Hopewell-UT2A Reaches 1 and 2

		Pre-Restoration Condition				Reference Reach Da	Design				As-Built/Baseline			
Parameter	**Gage**	**UT2A Reach 1**		**UT2A Reach 2**		**See Table 10a.**	**UT2A Reach 1**		**UT2A Reach 2**		**UT2A Reach 1**		**UT2A Reach 2**	
		Min	**Max**	**Min**	**Max**		**Min**	**Max**	**Min**	**Max**	**Min**	**Max**	**Min**	**Max**
Dimension and Substrate - Riffle														
Bankfull Width (ft)		6.2		6.0	7.9		9.0		10.0		10.3		9.8	10.9
Floodprone Width (ft)		40		6	10		50	125	50	125	>87		63	>88
Bankfull Mean Depth		1.0		0.8	1.0		0.6		0.7		0.8		0.7	
Bankfull Max Depth		2.0		1.1	1.5		0.9		0.8	1.1	1.6		1.1	1.2
Bankfull Cross-sectional Area (ft^2)	N/A	6.2		6.1	6.2	See Table 10a.	5.7		7.0		8.0		6.8	8.0
Width/Depth Ratio		6.2		5.9	10.0		14.0		14.0		13.3		14.0	14.9
Entrenchment Ratio		6.5		0.8	1.7		5.6	13.9	5	12.5	>8		5.7	>9
Bank Height Ratio		1.4		2.3	2.9		1.0		1.0		1.0		1.0	
D50 (mm)		0.1		0.1							30.9		34.3	39.8
Profile														
Riffle Length (ft)							---		---		18	54	10	67
Riffle Slope (ft/ft)		---		---			0.119	0.0255	0.013	0.028	0.0032	0.0210	0.0034	0.0330
Pool Length (ft)	N/A					See Table 10a.	---		---		18	54	14	55
Pool Max Depth (ft)		2.3		1.9	2.7		1.2	1.5	1.4	1.7	1.4	2.9	1.5	4.1
Pool Spacing (ft)		---		---			14	59	15	65	40	67	27	88
Pool Volume (ft^3)														
Pattern														
Channel Beltwidth (ft)		18	22	26	72		14	54	16	60	20	38	15	42
Radius of Curvature (ft)		8	31	6	28		16	27	18	30	16	25	18	30
Rc:Bankfull Width (ft/ft)	N/A	1.3	5.0	1.0	3.5	See Table 10a.	1.8	3.0	1.8	3.0	0.5	2.4	1.8	2.8
Meander Length (ft)		54	61	102	173		36	135	40	150	76	116	64	147
Meander Width Ratio		2.9	3.6	4.3	9.1		1.6	6.0	1.6	6.0	1.9	3.7	1.5	3.9
Substrate, Bed and Transport Parameters														
Ri%/Ru%/P%/G%/S%														
SC%/Sa%/G%/C%/B%/Be%														
d16/d35/d50/d84/d95/d100	N/A	SC/SC/0.1/3/7		SC/SC/0.1/3/7		See Table 10a.					SC/2/18/57/87/180		SC/2/18/57/87/180	
Reach Shear Stress (Competency) lb/ft^2		---		---			0.3		0.36		0.25		0.44	0.45
Max part size (mm) mobilized at bankfull														
Stream Power (Capacity) W/m^2														
Additional Reach Parameters														
Drainage Area (SM)		0.10		0.16			0.10		0.16		0.10		0.16	
Watershed Impervious Cover Estimate (%)		<1%		<1%			<1%		<1%		<1%		<1%	
Rosgen Classification		E/G5/4		E/G5/4			C4		C4		C4		C4	
Bankfull Velocity (fps)		3.0		2.7	3.1		2.6		3.0		2.2		2.8	
Bankfull Discharge (cfs)		19		19			15		21		18		19	25
Q-NFF regression (2-yr)		35		48										
Q-USGS extrapolation (1.2-yr)	N/A	18		25		See Table 10a.								
Q-Mannings		---		---										
Valley Length (ft)		283		1,198			283		1,198		283		1,198	
Channel Thalweg Length (ft)		368		1,368			386		1,311		386		1,443	
Sinuosity		1.3		1.2			1.0	1.2	1.0	1.2	1.3		1.2	
Water Surface Slope ($ft/ft)^2$		---		---			---		---		0.006		0.0108	
Bankfull Slope (ft/ft)		0.0082		0.0086			0.0102		0.0110		0.0084	0.0092	0.0107	0.0109

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

Table 10c. Baseline Stream Data Summary
Hopewell Stream Mitigation Site
DMS Project No. 95352
Monitoring Year 5 - 2019

Hopewell-UT2B Reach 2 and UT2C Reaches 2 and 3

		Pre-Restoration Condition				Reference Reach Da	Design				As-Built/Baseline			
Parameter	**Gage**	**UT2B**		**UT2C**		**See Table 10a.**	**UT2B Reach 2**		**UT2C Reach 2 & 3**		**UT2B Reach 2**		**UT2C Reach 2 & 3**	
		Min	**Max**	**Min**	**Max**		**Min**	**Max**	**Min**	**Max**	**Min**	**Max**	**Min**	**Max**
Dimension and Substrate - Riffle														
Bankfull Width (ft)	N/A	3.4	5.1	4.2	6.4	See Table 10a.	5.0		7.8		5.2		9.9	
Floodprone Width (ft)		4	8	7	53		50	125	50	125	>41		>48	
Bankfull Mean Depth		0.4	0.6	0.6	0.9		0.4		0.6		0.4		0.5	
Bankfull Max Depth		0.7	1.0	0.9	1.4		0.5	0.6	0.7	0.8	0.6		1.1	
Bankfull Cross-sectional Area (ft^2)		2.2	2.3	3.8	4.2		2.1		4.3		2.1		5.3	
Width/Depth Ratio		5.5	11.3	4.6	9.6		12.0		14.0		13.0		18.4	
Entrenchment Ratio		1.2	1.6	1.2	2.6		10.0	25.0	6.4	16.0	>8		>5	
Bank Height Ratio		1.7	4.0	1.0	3.4		1.0		1.0		1.0		1.0	
D50 (mm)		2.1		6.0							25.4		18.4	
Profile														
Riffle Length (ft)	N/A					See Table 10a.	---		---		7	25	6	20
Riffle Slope (ft/ft)		---		---			0.03	0.065	0.0180	0.0380	0.0146	0.0441	0.0051	0.0584
Pool Length (ft)							---		---		10	21	3	25
Pool Max Depth (ft)		---		1.1	1.2		0.6	1.0	1.1	1.5	1.3	2.8	2.2	3.7
Pool Spacing (ft)		---		---			8	33	12	51	19	36	23	36
Pool Volume (ft^3)														
Pattern														
Channel Beltwidth (ft)	N/A	25	32	33	46	See Table 10a.	8	30	12	47	8	19	10	25
Radius of Curvature (ft)		20		6	20		9	15	14	23	9	15	14	15
Rc:Bankfull Width (ft/ft)		2.9	3.9	1.4	3.1		1.8	3.0	1.9	3.0	1.7	2.9	1.4	1.5
Meander Length (ft)		23	21	160	165		20	75	31	117	40	62	45	82
Meander Width Ratio		7.4	6.3	7.9	7.2		1.6	6.0	1.6	6.0	1.6	3.6	1.0	2.5
Substrate, Bed and Transport Parameters														
Ri%/Ru%/P%/G%/S%	N/A					See Table 10a.								
SC%/Sa%/G%/C%/B%/Be%														
d16/d35/d50/d84/d95/d100		SC/SC/2.1/18/107		SC/0.8/6/45/78							SC/6/21/55/128/256		SC/SC/9/45/78/128	
Reach Shear Stress (Competency) lb/ft^2		---		---			0.49		0.46	0.72	0.46		0.25	1.11
Max part size (mm) mobilized at bankfull														
Stream Power (Capacity) W/m^2														
Additional Reach Parameters														
Drainage Area (SM)	N/A	0.03		0.08		See Table 10a.	0.03		0.08		0.03		0.08	
Watershed Impervious Cover Estimate (%)		<1%		<1%			<1%		<1%		<1%		<1%	
Rosgen Classification		G4		E/G4			C4		C4		C4b		C4/C4b	
Bankfull Velocity (fps)		3.0	3.2	3.3	3.7		3		2.7		2.7		2.1	
Bankfull Discharge (cfs)		7		14			7		13		6		11	
Q-NFF regression (2-yr)		18		31										
Q-USGS extrapolation (1.2-yr)		9		15										
Q-Mannings		---		---										
Valley Length (ft)		183		296			183		229		183		229	
Channel Thalweg Length (ft)		114		326			198		247		198		247	
Sinuosity		1.2		1.1			1.0	1.2	1.0	1.2	1.1		1.1	
Water Surface Slope ($ft/ft)^2$		---		---			---		---		0.0211		0.0083	0.0365
Bankfull Slope (ft/ft)		0.0250		0.0120			0.0259		0.0154	0.024	0.0207	0.0215	0.0102	0.0459

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

Table 10d. Baseline Stream Data Summary

Hopewell Stream Mitigation Site
DMS Project No. 95352
Monitoring Year 5 - 2019

Hopewell-UT1B Reach 1

		Pre-Restoration		Reference Reach Data	Design		As-Built/Baseline	
Parameter	**Gage**	**UT1B**		**See Table 10a.**	**UT1B Reach 1**		**UT1B Reach 1**	
		Min	**Max**		**Min**	**Max**	**Min**	**Max**
Dimension and Substrate - Riffle								
Bankfull Width (ft)	N/A	7.1	13.2	See Table 10a.	5.0		4.8	
Floodprone Width (ft)		8	28		10	25	12.4	
Bankfull Mean Depth		0.7	1.1		0.4		0.4	
Bankfull Max Depth		1.2	1.9		0.5		0.6	
Bankfull Cross-sectional Area (ft^2)		8.0	12.0		1.9		1.8	
Width/Depth Ratio		10.1	12.0		13.0		13.3	
Entrenchment Ratio		2.2			10.0	25.0	2.6	
Bank Height Ratio		2.5			1.0		1.0	
D50 (mm)		52.3					56.3	
Profile								
Riffle Length (ft)	N/A			See Table 10a.	---		11	47
Riffle Slope (ft/ft)		---			0.0154	0.033	0.0185	0.0646
Pool Length (ft)					---		20	105
Pool Max Depth (ft)		1.4	2.6		1.9	2.5	1.1	1.6
Pool Spacing (ft)		---			21	91	56	103
Pool Volume (ft^3)								
Pattern								
Channel Beltwidth (ft)	N/A	20	47	See Table 10a.	22	84	---	
Radius of Curvature (ft)		10	84		25	42	---	
Rc:Bankfull Width (ft/ft)		0.9	7.5		1.8	3.0	---	
Meander Length (ft)		68	294		56	210	---	
Meander Width Ratio		1.8	4.2		1.6	6.0	---	
Substrate, Bed and Transport Parameters								
Ri%/Ru%/P%/G%/S%	N/A			See Table 10a.				
SC%/Sa%/G%/C%/B%/Be%								
d16/d35/d50/d84/d95/d100		SC/15.41/52.3/136/172					SC/1/6/128/256/512	
Reach Shear Stress (Competency) lb/ft^2		---			0.61		0.54	
Max part size (mm) mobilized at bankfull								
Stream Power (Capacity) W/m^2								
Additional Reach Parameters								
Drainage Area (SM)	N/A	0.03		See Table 10a.	0.03		0.03	
Watershed Impervious Cover Estimate (%)		<1%			<1%		<1%	
Rosgen Classification		Eb/B4			C4b		C4b	
Bankfull Velocity (fps)		1.7			3.3		2.8	
Bankfull Discharge (cfs)		12			6		5	
Q-NFF regression (2-yr)		15						
Q-USGS extrapolation (1.2-yr)		7						
Q-Mannings		---						
Valley Length (ft)		431			431		431	
Channel Thalweg Length (ft)		475			475		480	
Sinuosity		1.1			1.0	1.2	1.1	
Water Surface Slope $(ft/ft)^2$		---			---		0.0270	
Bankfull Slope (ft/ft)		0.0369			0.0360		0.0246	0.0260

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

Table 11a. Morphology and Hydraulic Summary (Dimensional Parameters - Cross Section)
Hopewell Stream Mitigation Site
DMS Project No. 95352
Monitoring Year 5 - 2019

	Cross-Section 1, UT2A Reach 1 (Pool)								Cross-Section 2, UT2A Reach 1 (Riffle)								Cross-Section 3, UT2A Reach 2 (Riffle)							
Dimension and Substrate	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**MY6**	**MY7**	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**MY6**	**MY7**	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**MY6**	**MY7**
Bankfull Elevation (ft)	722.6	722.6	722.6	722.6	722.8	722.8			722.4	722.4	722.4	722.4	722.6	722.7			719.7	719.7	719.7	719.7	719.7	720.0		
Low Bank Elevation (ft)	722.6	722.6	722.6	722.6	722.8	722.8			722.4	722.4	722.4	722.4	722.6	722.7			719.7	719.7	719.7	719.7	719.7	720.0		
Bankfull Width (ft)	12.1	12.7	12.7	13.1	15.9	14.0			10.3	9.7	10.1	10.7	11.9	11.8			9.8	10.3	10.2	10.2	10.2	10.4		
Floodprone Width (ft)	---	---	---	---	---	---			>87	>88	>88	>88	>87	>87			>88	>87	>92	>75	>89	>93		
Bankfull Mean Depth (ft)	1.4	1.3	1.3	1.2	1.0	1.1			0.8	0.8	0.8	0.7	0.7	0.7			0.7	0.7	0.8	0.5	0.7	0.8		
Bankfull Max Depth (ft)	2.7	2.5	2.5	2.7	2.4	2.2			1.6	1.3	1.4	1.3	1.5	1.6			1.1	1.1	1.3	1.0	1.2	1.4		
Bankfull Cross-Sectional Area (ft^2)	16.8	16.5	16.5	15.1	16.3	15.3			8.0	7.6	7.6	7.0	8.0	8.4			6.8	6.7	7.7	5.6	6.7	8.0		
Bankfull Width/Depth Ratio	8.7	9.8	9.8	11.4	15.5	12.8			13.3	12.4	13.3	16.3	17.7	16.7			14.0	15.8	13.6	18.6	15.4	13.6		
Bankfull Entrenchment Ratio	---	---	---	---	---	---			>8	>9	>9	>8	>7	>7			>9	>8	>9	>7	>9	>9		
Bankfull Bank Height Ratio[1,2]	---	---	---	---	---	---			1.0	1.0	1.0	1.0	1.0	1.0			1.0	1.0	1.0	1.0	1.0	1.1		
d50 (mm)	---	---	---	---	---	---			30.9	40.3	27.7	0.3	37.9	11.0			39.8	26.3	26.9	43.3	48.3	37.9		
	Cross-Section 4, UT2A Reach 2 (Pool)								**Cross-Section 5, UT2A Reach 2 (Pool)**								**Cross-Section 6, UT2A Reach 2 (Riffle)**							
Dimension and Substrate	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**MY6**	**MY7**	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**MY6**	**MY7**	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**MY6**	**MY7**
Bankfull Elevation (ft)	719.6	719.6	719.6	719.6	719.6	719.8			713.5	713.5	713.5	713.5	713.5	713.4			713.4	713.4	713.4	713.4	713.3	713.3		
Low Bank Elevation (ft)	719.6	719.6	719.6	719.6	719.6	719.8			713.5	713.5	713.5	713.5	713.5	713.4			713.4	713.4	713.4	713.4	713.3	713.3		
Bankfull Width (ft)	12.1	12.1	12.7	11.8	12.0	11.9			12.7	12.8	12.6	12.6	13.0	11.8			10.9	14.0	13.8	10.9	11.3	12.4		
Floodprone Width (ft)	---	---	---	---	---	---			---	---	---	---	---	---			63.0	66.0	69.0	67.0	65.4	66.2		
Bankfull Mean Depth (ft)	1.4	1.3	1.3	1.3	1.4	1.3			1.0	0.9	1.1	1.0	1.0	1.0			0.7	0.6	0.7	0.7	0.6	0.6		
Bankfull Max Depth (ft)	3.0	2.7	2.8	3.1	2.9	2.6			1.6	1.7	1.8	1.9	1.9	1.9			1.2	1.2	1.4	1.3	1.3	1.3		
Bankfull Cross-Sectional Area (ft^2)	16.7	15.6	16.7	16.0	16.8	15.6			12.3	12.1	11.1	13.0	13.3	11.8			8.0	9.0	9.2	8.0	6.9	7.6		
Bankfull Width/Depth Ratio	8.8	9.4	9.7	8.8	8.6	9.1			13.2	13.5	12.4	12.2	12.8	11.8			14.9	21.8	20.6	14.8	18.4	20.1		
Bankfull Entrenchment Ratio	---	---	---	---	---	---			---	---	---	---	---	---			5.7	4.7	5.0	6.1	5.8	5.3		
Bankfull Bank Height Ratio[1,2]	---	---	---	---	---	---			---	---	---	---	---	---			1.0	1.0	1.0	1.0	1.0	1.0		
d50 (mm)	---	---	---	---	---	---			---	---	---	---	---	---			34.3	41.6	29.1	18.6	62.8	27.5		
	Cross-Section 7, UT2 Reach 2 (Pool)[3]								**Cross-Section 8, UT2 Reach 2 (Riffle)**								**Cross-Section 9, UT2B Reach 2 (Riffle)[4]**							
Dimension and Substrate	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**MY6**	**MY7**	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**MY6**	**MY7**	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**MY6**	**MY7**
Bankfull Elevation (ft)	705.9	705.9	705.9	705.9	705.6	705.4			705.0	705.0	705.0	705.0	704.9	704.9			724.8	724.8	724.8	724.8	724.8	724.7		
Low Bank Elevation (ft)	705.9	705.9	705.9	705.9	705.6	705.4			705.0	705.0	705.0	705.0	704.9	704.9			724.8	724.8	724.8	724.8	724.8	724.7		
Bankfull Width (ft)	32.2	32.4	32.8	32.7	18.5	16.6			13.1	13.1	13.5	13.9	13.7	13.6			7.9	9.6	8.3	8.5	9.2	7.4		
Floodprone Width (ft)	---	---	---	---	---	---			>55	>60	>60	>59	>55	>56			>67	>62	>68	>68	>68	>68		
Bankfull Mean Depth (ft)	1.2	1.3	1.6	1.5	2.3	2.3			1.1	1.2	1.2	1.1	0.9	0.9			0.6	0.5	0.6	0.7	0.6	0.6		
Bankfull Max Depth (ft)	3.8	3.6	5.1	5.1	4.6	4.5			1.5	1.8	1.9	1.7	1.5	1.7			1.0	0.9	1.1	1.6	1.2	1.1		
Bankfull Cross-Sectional Area (ft^2)	38.6	41.8	52.1	50.1	41.8	38.1			14.6	16.2	16.5	14.4	12.6	12.6			4.9	5.0	5.2	6.1	5.5	4.6		
Bankfull Width/Depth Ratio	26.9	25.1	20.7	21.4	8.2	7.3			11.8	10.6	11.1	13.6	15.0	14.7			12.8	18.4	13.2	11.8	15.2	11.8		
Bankfull Entrenchment Ratio	---	---	---	---	---	---			>4	>5	>5	>4	>4	>4			>8	>7	>8	>8	>7	>9		
Bankfull Bank Height Ratio[1,2]	---	---	---	---	---	---			1.0	1.0	1.0	1.0	0.9	0.9			1.0	1.0	1.0	1.0	1.1	1.0		
d50 (mm)	---	---	---	---	---	---			45.8	25.7	23.4	38.7	23.3	49.1			25.4	33.7	11.0	22.6	22.6	17.1		

	Cross-Section 10, UT2B Reach 2 (Pool)							
Dimension and Substrate	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**MY6**	**MY7**
Bankfull Elevation (ft)	723.4	723.4	723.4	723.4	723.2	723.5		
Low Bank Elevation (ft)	723.4	723.4	723.4	723.4	723.2	723.5		
Bankfull Width (ft)	10.8	11.3	10.5	10.7	9.1	10.5		
Floodprone Width (ft)	---	---	---	---	---	---		
Bankfull Mean Depth (ft)	0.8	0.8	0.7	0.8	0.8	0.9		
Bankfull Max Depth (ft)	1.5	1.5	1.8	1.8	1.8	1.8		
Bankfull Cross-Sectional Area (ft^2)	8.3	8.6	7.8	9.0	6.9	9.0		
Bankfull Width/Depth Ratio	14.1	14.8	14.0	12.8	11.8	12.2		
Bankfull Entrenchment Ratio	---	---	---	---	---	---		
Bankfull Bank Height Ratio[1,2]	---	---	---	---	---	---		
d50 (mm)	---	---	---	---	---	---		

[1] Prior to MY4, bankfull dimensions were calculated using a fixed baseline bankfull elevation.
[2] MY4-MY5 Bank Height Ratio was calculated based on the As-built (MY0) cross-sectional area as described in the Standard Measurement of the BHR Monitoring Parameter document provided by the NCIRT (9/2018). The remainder of the cross-section dimension parameters were calculated based on the current year's low bank height.
[3] Bankfull elevation was set too high on Cross-Section 7 between MY0 and MY3 which resulted in a wider bankfull width in those years.
[4] Bankfull dimension calcuations were adjusted at Cross-Section 9 between MY0 and MY3 because the baseline bankfull elevation was set low and fell within the active channel.
(---): Data was not provided

Table 11b. Morphology and Hydraulic Summary (Dimensional Parameters - Cross Section)
Hopewell Stream Mitigation Site
DMS Project No. 95352
Monitoring Year 5 - 2019

	Cross-Section 11, UT2 Reach 1 (Riffle)								Cross-Section 12, UT2 Reach 1 (Riffle)								Cross-Section 13, UT2 Reach 1 (Pool)								Cross-Section 14, UT1B Reach 1 (Pool)							
Dimension and Substrate	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**MY6**	**MY7**	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**MY6**	**MY7**	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**MY6**	**MY7**	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**MY6**	**MY7**
Bankfull Elevation (ft)	719.3	719.3	719.3	719.3	719.1	719.0			717.3	717.3	717.3	717.3	717.5	717.5			717.4	717.4	717.4	717.4	717.5	717.4			764.2	764.2	764.2	764.2	764.7	764.5		
Low Bank Elevation (ft)	719.3	719.3	719.3	719.3	719.1	719.0			717.3	717.3	717.3	717.3	717.5	717.5			717.4	717.4	717.4	717.4	717.5	717.4			764.7	764.7	764.7	764.7	764.7	764.5		
Bankfull Width (ft)	14.2	13.7	13.9	13.8	11.4	12.1			10.6	10.6	11.2	10.9	12.7	12.4			19.6	17.4	17.1	18.2	18.2	16.0			5.2	4.9	5.3	5.0	5.1	8.1		
Floodprone Width (ft)	101	105	104	103	98	100			>68	>57	>68	>66	>69	>70			---	---	---	---	---	---			---	---	---	---	---	---		
Bankfull Mean Depth (ft)	0.9	1.0	1.0	0.8	0.9	0.9			0.8	0.7	0.7	0.6	0.7	0.7			1.2	1.1	1.3	1.1	1.1	1.1			0.5	0.2	0.2	0.1	0.4	0.2		
Bankfull Max Depth (ft)	1.7	1.8	1.9	1.8	1.7	1.7			1.3	1.1	1.3	1.2	1.3	1.4			2.4	2.0	2.3	2.3	2.4	2.4			0.7	0.3	0.4	0.3	0.8	0.3		
Bankfull Cross-Sectional Area (ft^2)	12.7	14.1	14.0	11.7	10.4	11.3			8.4	7.3	7.7	7.1	8.4	8.6			23.1	18.5	21.5	19.8	19.5	18.4			2.5	1.0	1.2	0.6	2.1	1.8		
Bankfull Width/Depth Ratio	15.8	13.3	13.8	16.4	12.4	13.0			13.2	15.6	16.2	16.9	19.1	17.8			16.7	16.4	13.6	16.7	16.9	13.9			10.4	23.3	22.5	40.5	12.8	36.6		
Bankfull Entrenchment Ratio	7.1	7.6	7.4	7.4	8.6	8.2			>7	>5	>6	>6	>5	>5			---	---	---	---	---	---			---	---	---	---	---	---		
Bankfull Bank Height Ratio[1,2]	1.0	1.0	1.0	1.0	0.9	0.9			1.0	1.0	1.0	1.0	1.0	1.0			---	---	---	---	---	---			---	---	---	---	---	---		
d50 (mm)	28.0	17.4	14.6	74.5	56.2	48.8			24.2	22.1	12.8	25.4	25.5	23.6			---	---	---	---	---	---			---	---	---	---	---	---		

	Cross-Section 15, UT1B Reach 1 (Riffle)								Cross-Section 16, UT2C Reach 2 (Riffle)								Cross-Section 17, UT2C Reach 2 (Pool)							
Dimension and Substrate	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**MY6**	**MY7**	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**MY6**	**MY7**	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**MY6**	**MY7**
Bankfull Elevation (ft)	761.9	761.9	761.9	761.9	762.0	762.1			709.2	709.2	709.2	709.2	709.5	709.5			708.3	708.3	708.3	708.3	708.1	708.2		
Low Bank Elevation (ft)	761.9	761.9	761.9	761.9	762.0	762.1			709.2	709.2	709.2	709.2	709.5	709.5			708.3	708.3	708.3	708.3	708.1	708.2		
Bankfull Width (ft)	4.8	4.6	5.2	3.6	5.2	6.9			9.9	9.0	9.3	8.9	9.3	10.0			13.0	12.8	11.8	10.8	4.3	5.4		
Floodprone Width (ft)	12	8	10	9	17	19			>48	>45	>47	>47	>49	>45			---	---	---	---	---	---		
Bankfull Mean Depth (ft)	0.4	0.2	0.3	0.2	0.3	0.3			0.5	0.5	0.5	0.4	0.5	0.5			0.9	0.8	0.5	0.5	0.9	0.7		
Bankfull Max Depth (ft)	0.6	0.3	0.5	0.4	0.6	0.7			1.1	1.0	1.1	1.1	1.3	1.0			2.0	2.0	1.2	1.3	1.5	1.1		
Bankfull Cross-Sectional Area (ft^2)	1.8	1.0	1.5	0.7	1.5	1.9			5.3	4.6	4.9	3.9	5.0	4.9			11.2	10.7	5.9	5.7	4.0	3.7		
Bankfull Width/Depth Ratio	13.3	22.1	18.8	19.0	18.4	24.4			18.4	17.5	17.6	20.3	17.2	20.2			15.1	15.3	23.8	20.4	4.7	7.9		
Bankfull Entrenchment Ratio	2.6	1.6	1.9	2.4	3.2	2.8			>5	>5	>5	>5	>5	>5			---	---	---	---	---	---		
Bankfull Bank Height Ratio[1,2]	1.0	1.0	1.0	1.3	0.8	1.0			1.0	1.0	1.0	1.1	1.0	0.9			---	---	---	---	---	---		
d50 (mm)	56.3	69.7	13.3	23.9	11.0	S/C			18.4	10.8	8.0	11.5	22.6	24.3			---	---	---	---	---	---		

[1] Prior to MY4, bankfull dimensions were calculated using a fixed baseline bankfull elevation.
[2] MY4-MY5 Bank Height Ratio was calculated based on the As-built (MY0) cross-sectional area as described in the Standard Measurement of the BHR Monitoring Parameter document provided by the NCIRT (9/2018). The remainder of the cross-section dimension parameters were calculated based on the current year's low bank height.
(---): Data was not provided

Table 12a. Monitoring Data - Stream Reach Data Summary

Hopewell Stream Mitigation Site

DMS Project No. 95352

Monitoring Year 5 - 2019

Hopewell-UT1B Reach 1

Parameter	As-Built/Baseline		MY1		MY2		MY3		MY4		MY5		MY6		MY7	
	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
Dimension and Substrate - Riffle																
Bankfull Width (ft)	4.8		4.6		5.2		3.6		5.2		6.9					
Floodprone Width (ft)	12.0		8.0		10.0		9.0		16.7		19.2					
Bankfull Mean Depth	0.4		0.2		0.3		0.2		0.3		0.3					
Bankfull Max Depth	0.6		0.3		0.5		0.4		0.6		0.7					
Bankfull Cross Sectional Area (ft^2)	1.8		1.0		1.5		0.7		1.5		1.9					
Width/Depth Ratio	13.3		22.1		18.8		19.0		18.4		24.4					
Entrenchment Ratio	2.6		1.6		1.9		2.4		3.2		2.8					
Bank Height Ratio[1,2]	1.0		1.0		1.0		1.3		0.8		1.0					
D50 (mm)	56.3		69.7		13.3		23.9		11.0		Silt/Clay					
Profile																
Riffle Length (ft)	11	47														
Riffle Slope (ft/ft)	0.0185	0.0646														
Pool Length (ft)	20	105														
Pool Max Depth (ft)	1.1	1.6														
Pool Spacing (ft)	56	103														
Pool Volume (ft^3)	---															
Pattern																
Channel Beltwidth (ft)	---															
Radius of Curvature (ft)	---															
Rc:Bankfull Width (ft/ft)	---															
Meander Wave Length (ft)	---															
Meander Width Ratio	---															
Additional Reach Parameters																
Rosgen Classification	C4b															
Channel Thalweg Length (ft)	480															
Sinuosity (ft)	1.1															
Water Surface Slope (ft/ft)	0.0270															
Bankfull Slope (ft/ft)	0.0246	0.0260														
Ri%/Ru%/P%/G%/S%	---															
SC%/Sa%/G%/C%/B%/Be%	---															
d16/d35/d50/d84/d95/d100	SC/1/6/128/256/512		SC/0.7/7/139/241/>2048		SC/6/9/23/57/180		SC/SC/1.1/128/1248/2048		SC/SC/3.6/23.9/50.6/90[3]		SC/SC/SC/77/143/>2048					
% of Reach with Eroding Banks	0%		0%		0%		0%		0%		0%					

(---): Data was not provided

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

[2] MY4-MY7 Bank Height Ratio was calculated based on the As-built (MY0) cross-sectional area as described in the Standard Measurement of the BHR Monitoring Parameter document provided by the NCIRT (9/2018). The remainder of the cross-section dimension parameters were calculated based on the current year's low bank height.

[3] Reachwide sediment results were incorrectly reported in MY4. This data has been updated to reflect the correct results.

Table 12b. Monitoring Data - Stream Reach Data Summary
Hopewell Stream Mitigation Site
DMS Project No. 95352
Monitoring Year 5 - 2019

Hopewell-UT2 Reach 1

Parameter	As-Built/Baseline		MY1		MY2		MY3		MY4		MY5		MY6		MY7	
	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
Dimension and Substrate - Riffle																
Bankfull Width (ft)	10.6	14.2	10.6	13.7	11.2	13.9	10.9	13.8	11.4	12.7	12.1	12.4				
Floodprone Width (ft)	>68	101	>57	105	>68	104	>66	103	>69	98.0	>70	100				
Bankfull Mean Depth	0.8	0.9	0.7	1.0	0.7	1.0	0.6	0.8	0.7	0.9	0.7	0.9				
Bankfull Max Depth	1.3	1.7	1.1	1.8	1.3	1.9	1.2	1.8	1.3	1.7	1.4	1.7				
Bankfull Cross Sectional Area (ft^2)	8.4	12.7	7.3	14.1	7.7	14.0	7.1	11.7	8.4	10.4	8.6	11.3				
Width/Depth Ratio	13.2	15.8	13.3	15.6	13.8	16.2	13.6	16.4	12.4	19.1	13.0	17.8				
Entrenchment Ratio	>7	7.1	>5	7.6	>6	7.4	>6	7.4	>5	8.6	>6	8.2				
Bank Height Ratio[1,2]	1.0		1.0		1.0		1.0		0.9	1.0	0.9	1.0				
D50 (mm)	24.2	28.0	17.4	22.1	12.8	14.6	25.4	74.5	25.5	56.2	23.6	48.8				
Profile																
Riffle Length (ft)	11	120														
Riffle Slope (ft/ft)	0.0033	0.0227														
Pool Length (ft)	17	66														
Pool Max Depth (ft)	1.7	3.6														
Pool Spacing (ft)	20	108														
Pool Volume (ft^3)	---															
Pattern																
Channel Beltwidth (ft)	5	11														
Radius of Curvature (ft)	13	36														
Rc:Bankfull Width (ft/ft)	1.2	2.5														
Meander Wave Length (ft)	60	171														
Meander Width Ratio	0.5	0.8														
Additional Reach Parameters																
Rosgen Classification	C4															
Channel Thalweg Length (ft)	1,787															
Sinuosity (ft)	1.20															
Water Surface Slope (ft/ft)	0.0087															
Bankfull Slope (ft/ft)	0.0085	0.0086														
Ri%/Ru%/P%/G%/S%	---															
SC%/Sa%/G%/C%/B%/Be%	---															
d16/d35/d50/d84/d95/d100	SC/1.4/24/73/128/180		SC/5.6/20/112/237/2048		SC/10/17/51/174/2048		SC/SC/25/70/116/180		SC/SC/3.6/23.9/50.6/90[3]		SC/SC/1.8/76/157/256					
% of Reach with Eroding Banks	0%		0%		0%		0%		0%		0%					

(---): Data was not provided

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

[2] MY4-MY7 Bank Height Ratio was calculated based on the As-built (MY0) cross-sectional area as described in the Standard Measurement of the BHR Monitoring Parameter document provided by the NCIRT (9/2018). The remainder of the cross-section dimension parameters were calculated based on the current year's low bank height.

[3] Reachwide sediment results were incorrectly reported in MY4. This data has been updated to reflect the correct results.

Table 12c. Monitoring Data - Stream Reach Data Summary

Hopewell Stream Mitigation Site

DMS Project No. 95352

Monitoring Year 5 - 2019

Hopewell-UT2 Reach 2

Parameter	As-Built/Baseline		MY1		MY2		MY3		MY4		MY5		MY6		MY7	
	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
Dimension and Substrate - Riffle																
Bankfull Width (ft)	15.3		13.1		13.5		13.9		13.7		13.6					
Floodprone Width (ft)	>55		>60		>60		>59		>55		>56					
Bankfull Mean Depth	1.0		1.2		1.2		1.0		0.9		0.9					
Bankfull Max Depth	1.5		1.8		1.9		1.7		1.5		1.7					
Bankfull Cross Sectional Area (ft^2)	14.8		16.2		16.5		14.4		12.6		12.6					
Width/Depth Ratio	15.8		10.6		11.1		13.6		15.0		14.7					
Entrenchment Ratio	>4		>5		>5		>4		>4		>4					
Bank Height Ratio[1,2]	1.0		1.0		1.0		1.0		0.9		0.9					
D50 (mm)	45.8		25.7		23.4		38.7		23.3		49.1					
Profile																
Riffle Length (ft)	24	36														
Riffle Slope (ft/ft)	0.01039	0.03859														
Pool Length (ft)	41	105														
Pool Max Depth (ft)	3.2	5.0														
Pool Spacing (ft)	65	132														
Pool Volume (ft^3)	---															
Pattern																
Channel Beltwidth (ft)	32	79														
Radius of Curvature (ft)	21	24														
Rc:Bankfull Width (ft/ft)	1.4	1.6														
Meander Wave Length (ft)	113	120														
Meander Width Ratio	2.1	5.2														
Additional Reach Parameters																
Rosgen Classification	C4															
Channel Thalweg Length (ft)	529															
Sinuosity (ft)	1.2															
Water Surface Slope (ft/ft)	0.0126															
Bankfull Slope (ft/ft)	0.0103	0.0107														
Ri%/Ru%/P%/G%/S%	---															
SC%/Sa%/G%/C%/B%/Be%	---															
d16/d35/d50/d84/d95/d100	SC/1.4/24/73/128/180[4]		SC/5.6/20/112/237/2048		SC/10/17/51/174/2048		SC/SC/25/70/116/180[4]		SC/SC/3.6/23.9/50.6/90[3]		SC/SC/1.8/76/157/256					
% of Reach with Eroding Banks	0%		0%		0%		0%		0%		0%					

(---): Data was not provided

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

[2] MY4-MY7 Bank Height Ratio was calculated based on the As-built (MY0) cross-sectional area as described in the Standard Measurement of the BHR Monitoring Parameter document provided by the NCIRT (9/2018). The remainder of the cross-section dimension parameters were calculated based on the current year's low bank height.

[3] Reachwide sediment results were incorrectly reported in MY4. This data has been updated to reflect the correct results.

Table 12d. Monitoring Data - Stream Reach Data Summary

Hopewell Stream Mitigation Site

DMS Project No. 95352

Monitoring Year 5 - 2019

Hopewell-UT2A Reach 1

Parameter	As-Built/Baseline		MY1		MY2		MY3		MY4		MY5		MY6		MY7	
	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
Dimension and Substrate - Riffle																
Bankfull Width (ft)	10.3		9.7		10.1		10.7		11.9		11.8					
Floodprone Width (ft)	>87		>88		>88		>87		>87		>87					
Bankfull Mean Depth	0.8		0.8		0.8		0.7		0.7		0.7					
Bankfull Max Depth	1.6		1.3		1.4		1.3		1.5		1.6					
Bankfull Cross Sectional Area (ft^2)	8.0		7.6		7.6		7.0		8.0		8.4					
Width/Depth Ratio	13.3		12.4		13.3		16.3		17.7		16.7					
Entrenchment Ratio	>8		>9		>9		>8		>7		>7					
Bank Height Ratio[1,2]	1.0		1.0		1.0		1.0		1.0		1.0					
D50 (mm)	30.9		40.3		27.7		0.3		37.9		11.0					
Profile																
Riffle Length (ft)	18	54														
Riffle Slope (ft/ft)	0.0032	0.0210														
Pool Length (ft)	18	54														
Pool Max Depth (ft)	1.4	2.9														
Pool Spacing (ft)	40	67														
Pool Volume (ft^3)	---															
Pattern																
Channel Beltwidth (ft)	20	38														
Radius of Curvature (ft)	16	25														
Rc:Bankfull Width (ft/ft)	0.5	2.4														
Meander Wave Length (ft)	76	116														
Meander Width Ratio	1.9	3.7														
Additional Reach Parameters																
Rosgen Classification	C4															
Channel Thalweg Length (ft)	1,443															
Sinuosity (ft)	1.2															
Water Surface Slope (ft/ft)	0.0108															
Bankfull Slope (ft/ft)	0.0107	0.0109														
Ri%/Ru%/P%/G%/S%	---															
SC%/Sa%/G%/C%/B%/Be%	---															
d16/d35/d50/d84/d95/d100	SC/2/18/57/87/180		SC/13/28/128/220/362[4]		SC/4/12/78/152/256[4]		SC/SC/12/61/110/180[4]		SC/SC/3.6/23.9/50.6/90[3]		SC/SC/5.6/58/90/180					
% of Reach with Eroding Banks	0%		0%		0%		0%		0%		0%					

(---): Data was not provided

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

[2] MY4-MY7 Bank Height Ratio was calculated based on the As-built (MY0) cross-sectional area as described in the Standard Measurement of the BHR Monitoring Parameter document provided by the NCIRT (9/2018). The remainder of the cross-section dimension parameters were calculated based on the current year's low bank height.

[3] Reachwide sediment results were incorrectly reported in MY4. This data has been updated to reflect the correct results.

Table 12e. Monitoring Data - Stream Reach Data Summary

Hopewell Stream Mitigation Site

DMS Project No. 95352

Monitoring Year 5 - 2019

Hopewell-UT2A Reach 2

Parameter	As-Built/Baseline		MY1		MY2		MY3		MY4		MY5		MY6		MY7	
	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
Dimension and Substrate - Riffle																
Bankfull Width (ft)	9.8	10.9	10.3	14.0	10.2	13.8	10.9	12.6	10.2	11.3	10.4	12.4				
Floodprone Width (ft)	63	>88	66	>87	69	>92	67	>75	65	>89	66	>93				
Bankfull Mean Depth	0.7		0.6	0.7	0.7	0.8	0.5	0.7	0.6	0.7	0.6	0.8				
Bankfull Max Depth	1.1	1.2	1.1	1.2	1.3	1.4	1.0	1.3	1.2	1.3	1.3	1.4				
Bankfull Cross Sectional Area (ft^2)	6.8	8.0	6.7	9.0	7.7	9.2	5.6	8.0	6.7	6.9	7.6	8.0				
Width/Depth Ratio	14.0	14.9	15.8	21.8	13.6	20.6	14.8	18.6	15.4	18.4	13.6	20.1				
Entrenchment Ratio	5.7	>9	4.7	>8	5.0	>9	6.1	>7	5.8	>9	5.3	>9				
Bank Height Ratio[1,2]	1.0		1.0		1.0		1.0		1.0	1.0	1.0	1.1				
D50 (mm)	34.3	39.8	26.3	41.6	26.9	29.1	18.6	43.3	48.3	62.8	27.5	37.9				
Profile																
Riffle Length (ft)	10	67														
Riffle Slope (ft/ft)	0.0034	0.0330														
Pool Length (ft)	14	55														
Pool Max Depth (ft)	1.5	4.1														
Pool Spacing (ft)	27	88														
Pool Volume (ft^3)	---															
Pattern																
Channel Beltwidth (ft)	15	42														
Radius of Curvature (ft)	18	30														
Rc:Bankfull Width (ft/ft)	1.8	2.8														
Meander Wave Length (ft)	64	147														
Meander Width Ratio	1.5	3.9														
Additional Reach Parameters																
Rosgen Classification	C4															
Channel Thalweg Length (ft)	1,443															
Sinuosity (ft)	1.2															
Water Surface Slope (ft/ft)	0.0108															
Bankfull Slope (ft/ft)	0.0107	0.0109														
Ri%/Ru%/P%/G%/S%	---															
SC%/Sa%/G%/C%/B%/Be%	---															
d16/d35/d50/d84/d95/d100	SC/2/18/57/87/180		SC/13/28/128/220/362		SC/4/12/78/152/256		SC/SC/12/61/110/180		SC/SC/3.6/23.9/50.6/90[3]		SC/SC/5.6/58/90/180					
% of Reach with Eroding Banks	0%		0%		0%		0%		0%		0%					

(---): Data was not provided

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

[2] MY4-MY7 Bank Height Ratio was calculated based on the As-built (MY0) cross-sectional area as described in the Standard Measurement of the BHR Monitoring Parameter document provided by the NCIRT (9/2018). The remainder of the cross-section dimension parameters were calculated based on the current year's low bank height.

[3] Reachwide sediment results were incorrectly reported in MY4. This data has been updated to reflect the correct results.

Table 12f. Monitoring Data - Stream Reach Data Summary

Hopewell Stream Mitigation Site

DMS Project No. 95352

Monitoring Year 5 - 2019

Hopewell-UT2B Reach 2

Parameter	As-Built/Baseline[4]		MY1		MY2		MY3		MY4		MY5		MY6		MY7	
	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
Dimension and Substrate - Riffle																
Bankfull Width (ft)	7.9		9.6		8.3		8.5		9.2		7.4					
Floodprone Width (ft)	>67		>62		>68		>68		>68		>68					
Bankfull Mean Depth	0.6		0.5		0.6		0.7		0.6		0.6					
Bankfull Max Depth	1.0		0.9		1.1		1.6		1.2		1.1					
Bankfull Cross Sectional Area (ft^2)	4.9		5.0		5.2		6.1		5.5		4.6					
Width/Depth Ratio	12.8		18.4		13.2		11.8		15.2		11.8					
Entrenchment Ratio	>8		>7		>8		>8		>7		>9					
Bank Height Ratio[1,2]	1.0		1.0		1.0		1.0		1.1		1.0					
D50 (mm)	25.4		33.7		11.0		22.6		22.6		17.1					
Profile																
Riffle Length (ft)	7	25														
Riffle Slope (ft/ft)	0.0146	0.0441														
Pool Length (ft)	10	21														
Pool Max Depth (ft)	1.3	2.8														
Pool Spacing (ft)	19	36														
Pool Volume (ft^3)	---															
Pattern																
Channel Beltwidth (ft)	8	19														
Radius of Curvature (ft)	9	15														
Rc:Bankfull Width (ft/ft)	1.1	1.9														
Meander Wave Length (ft)	40	62														
Meander Width Ratio	1.1	2.4														
Additional Reach Parameters																
Rosgen Classification	C4b															
Channel Thalweg Length (ft)	198															
Sinuosity (ft)	1.1															
Water Surface Slope (ft/ft)	0.0211															
Bankfull Slope (ft/ft)	0.0207	0.0215														
Ri%/Ru%/P%/G%/S%	---															
SC%/Sa%/G%/C%/B%/Be%	---															
d16/d35/d50/d84/d95/d100	SC/6/21/55/128/256		SC/4/9/38/83/180		2.2/7/19/54/82/180		SC/SC/1.7/41/76/180		SC/SC/3.6/23.9/50.6/90[3]		SC/SC/0.8/67/110/180					
% of Reach with Eroding Banks	0%		0%		0%		0%		0%		0%					

(---): Data was not provided

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

[2] MY4-MY7 Bank Height Ratio was calculated based on the As-built (MY0) cross-sectional area as described in the Standard Measurement of the BHR Monitoring Parameter document provided by the NCIRT (9/2018). The remainder of the cross-section dimension parameters were calculated based on the current year's low bank height.

[3] Reachwide sediment results were incorrectly reported in MY4. This data has been updated to reflect the correct results.

Table 12g. Monitoring Data - Stream Reach Data Summary

Hopewell Stream Mitigation Site

DMS Project No. 95352

Monitoring Year 5 - 2019

Hopewell-UT2C Reach 2 & 3

Parameter	As-Built/Baseline		MY1		MY2		MY3		MY4		MY5		MY6		MY7	
	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
Dimension and Substrate - Riffle																
Bankfull Width (ft)	9.9		9.0		9.3		8.9		9.3		10.0					
Floodprone Width (ft)	>48		>45		>47		>47		>49		>45					
Bankfull Mean Depth	0.5		0.5		0.5		0.4		0.5		0.5					
Bankfull Max Depth	1.1		1.0		1.1		1.1		1.3		1.0					
Bankfull Cross Sectional Area (ft^2)	5.3		4.6		4.9		3.9		5.0		4.9					
Width/Depth Ratio	18.4		17.5		17.6		20.3		17.2		20.2					
Entrenchment Ratio	>5		>5		>5		>5		>5		>5					
Bank Height Ratio[1,2]	1.0		1.0		1.0		1.0		1.0		0.9					
D50 (mm)	18.4		10.8		8.0		11.5		22.6		24.3					
Profile																
Riffle Length (ft)	6	20														
Riffle Slope (ft/ft)	0.0051	0.0584														
Pool Length (ft)	3	25														
Pool Max Depth (ft)	2.2	3.7														
Pool Spacing (ft)	23	36														
Pool Volume (ft^3)	---															
Pattern																
Channel Beltwidth (ft)	10	25														
Radius of Curvature (ft)	14	15														
Rc:Bankfull Width (ft/ft)	1.4	1.5														
Meander Wave Length (ft)	45	82														
Meander Width Ratio	1.0	2.6														
Additional Reach Parameters																
Rosgen Classification	C4/C4b															
Channel Thalweg Length (ft)	247															
Sinuosity (ft)	1.1															
Water Surface Slope (ft/ft)	0.0083	0.0365														
Bankfull Slope (ft/ft)	0.0102	0.0459														
Ri%/Ru%/P%/G%/S%	---															
SC%/Sa%/G%/C%/B%/Be%	---															
d16/d35/d50/d84/d95/d100	SC/SC/9/45/78/128		SC/0.2/6/73/124/256		0.2/0.5/1.3/9/45/128		0.28/1.3/3.5/17/30/90		SC/SC/3.6/23.9/50.6/90[3]		SC/SC/0.6/14/32/362					
% of Reach with Eroding Banks	0%		0%		0%		0%		0%		0%					

(---): Data was not provided

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

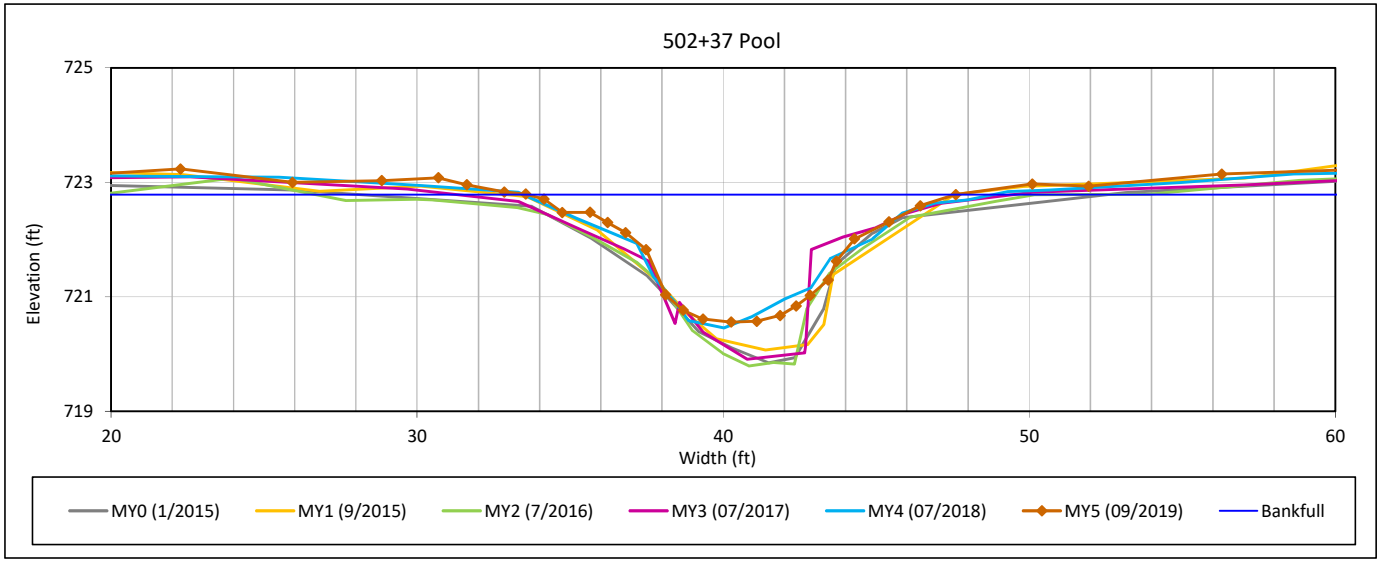
[2] MY4-MY7 Bank Height Ratio was calculated based on the As-built (MY0) cross-sectional area as described in the Standard Measurement of the BHR Monitoring Parameter document provided by the NCIRT (9/2018). The remainder of the cross-section dimension parameters were calculated based on the current year's low bank height.

[3] Reachwide sediment results were incorrectly reported in MY4. This data has been updated to reflect the correct results.

Cross-Section Plots

Hopewell Stream Mitigation Site
DMS Project No. 95352
Monitoring Year 5 - 2019

Cross Section 1, UT2A Reach 1



Bankfull Dimensions	
15.3	x-section area (ft.sq.)
14.0	width (ft)
1.1	mean depth (ft)
2.2	max depth (ft)
15.1	wetted parimeter (ft)
1.0	hyd radi (ft)
12.8	width-depth ratio

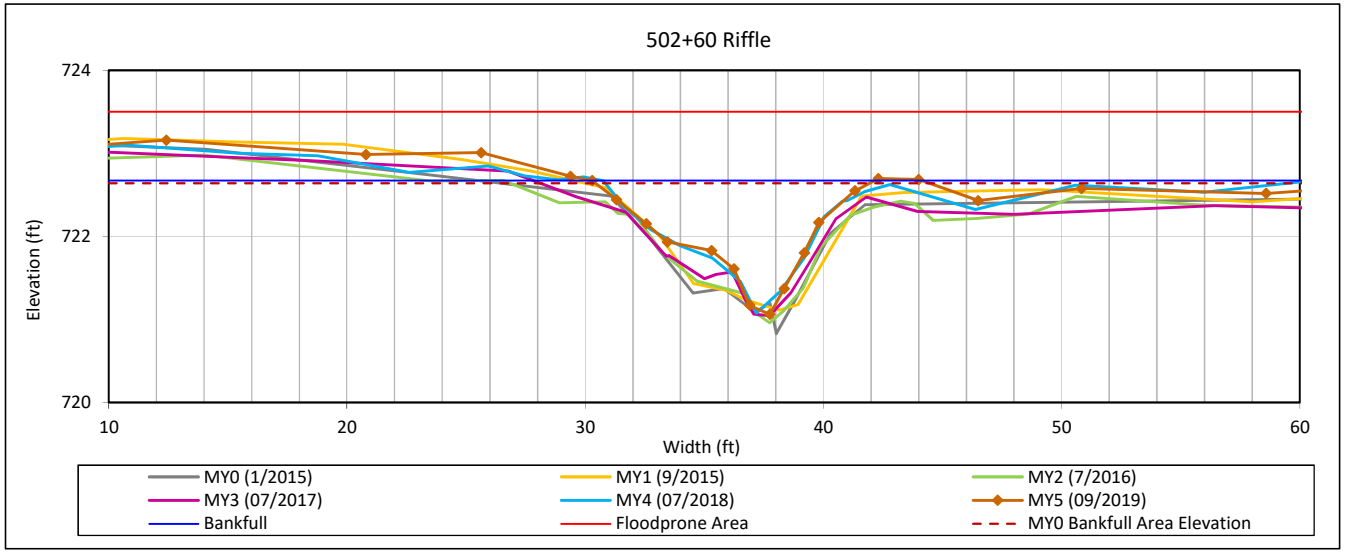
Survey Date: 09/2019
Field Crew: Wildlands Engineering

View Downstream

Cross-Section Plots

Hopewell Stream Mitigation Site
DMS Project No. 95352
Monitoring Year 5 - 2019

Cross-Section 2, UT2A Reach 1



Bankfull Dimensions	
8.4	x-section area (ft.sq.)
11.8	width (ft)
0.7	mean depth (ft)
1.6	max depth (ft)
12.4	wetted parimeter (ft)
0.7	hyd radi (ft)
16.7	width-depth ratio
87.4	W flood prone area (ft)
7.4	entrenchment ratio
1.0	low bank height ratio

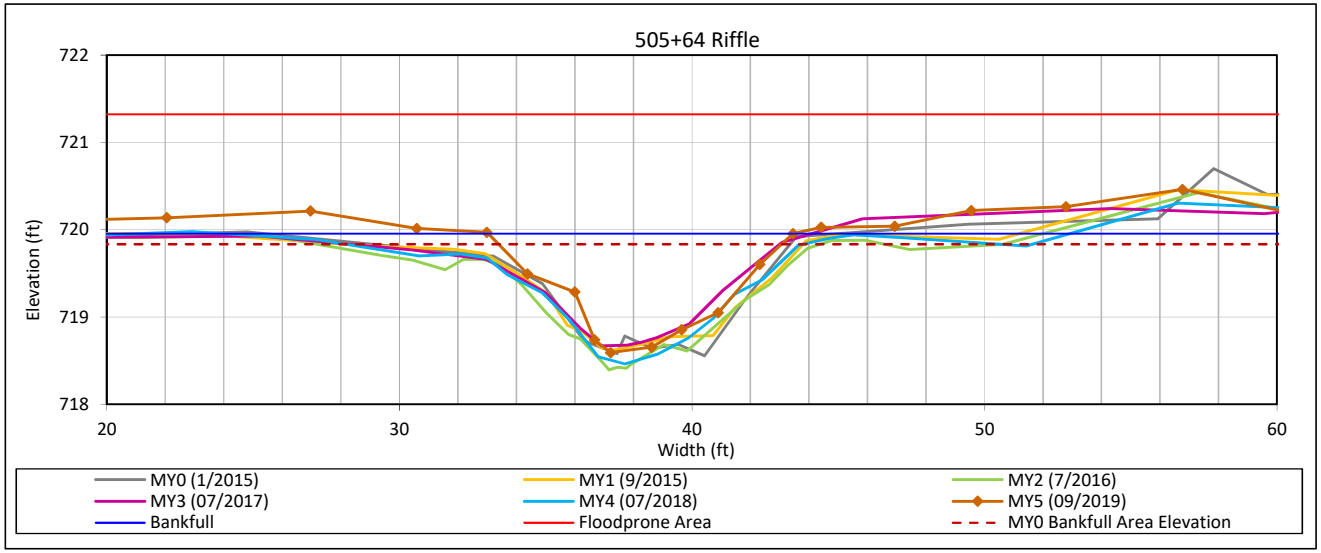
Survey Date: 09/2019
Field Crew: Wildlands Engineering

View Downstream

Cross-Section Plots

Hopewell Stream Mitigation Site
DMS Project No. 95352
Monitoring Year 5 - 2019

Cross-Section 3, UT2A Reach 2



Bankfull Dimensions	
8.0	x-section area (ft.sq.)
10.4	width (ft)
0.8	mean depth (ft)
1.4	max depth (ft)
10.9	wetted parimeter (ft)
0.7	hyd radi (ft)
13.6	width-depth ratio
93.2	W flood prone area (ft)
8.9	entrenchment ratio
1.1	low bank height ratio

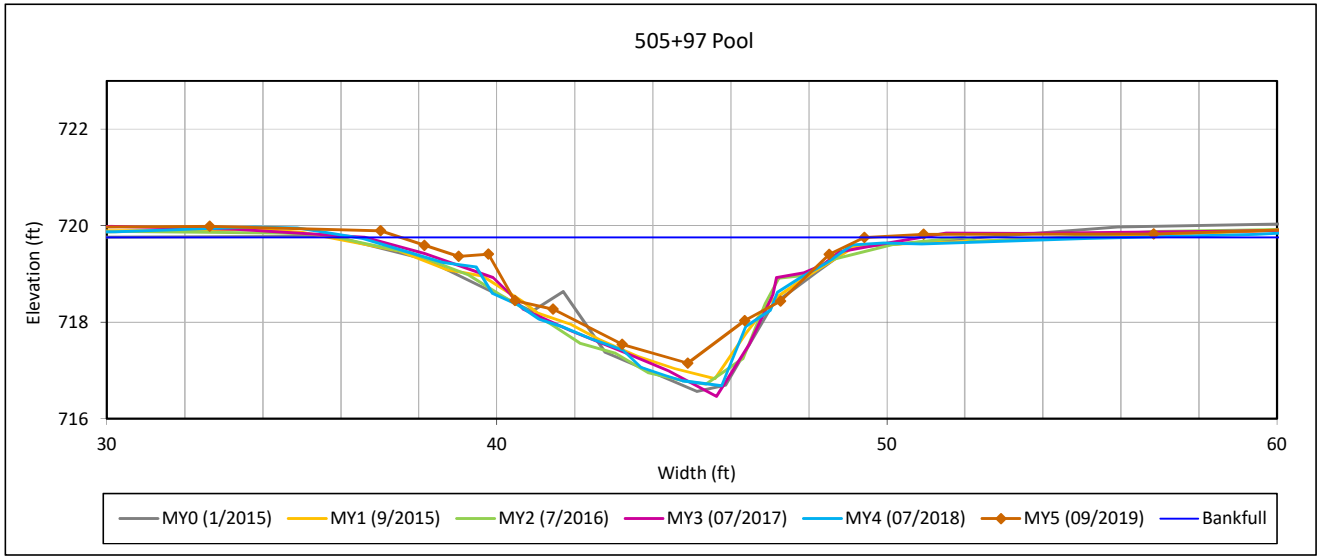
Survey Date: 09/2019
Field Crew: Wildlands Engineering

View Downstream

Cross-Section Plots

Hopewell Stream Mitigation Site
DMS Project No. 95352
Monitoring Year 5 - 2019

Cross-Section 4, UT2A Reach 2



Bankfull Dimensions	
15.6	x-section area (ft.sq.)
11.9	width (ft)
1.3	mean depth (ft)
2.6	max depth (ft)
13.4	wetted parimeter (ft)
1.2	hyd radi (ft)
9.1	width-depth ratio

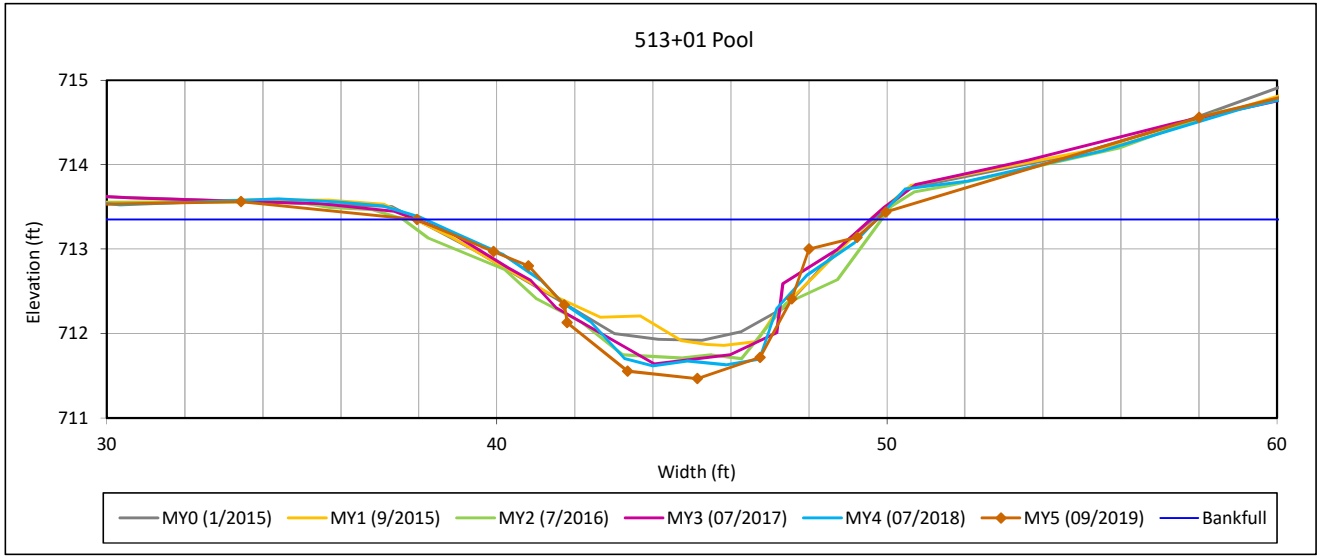
Survey Date: 09/2019
Field Crew: Wildlands Engineering

View Downstream

Cross-Section Plots

Hopewell Stream Mitigation Site
DMS Project No. 95352
Monitoring Year 5 - 2019

Cross-Section 5, UT2A Reach 2



Bankfull Dimensions	
11.8	x-section area (ft.sq.)
11.8	width (ft)
1.0	mean depth (ft)
1.9	max depth (ft)
12.8	wetted parimeter (ft)
0.9	hyd radi (ft)
11.8	width-depth ratio

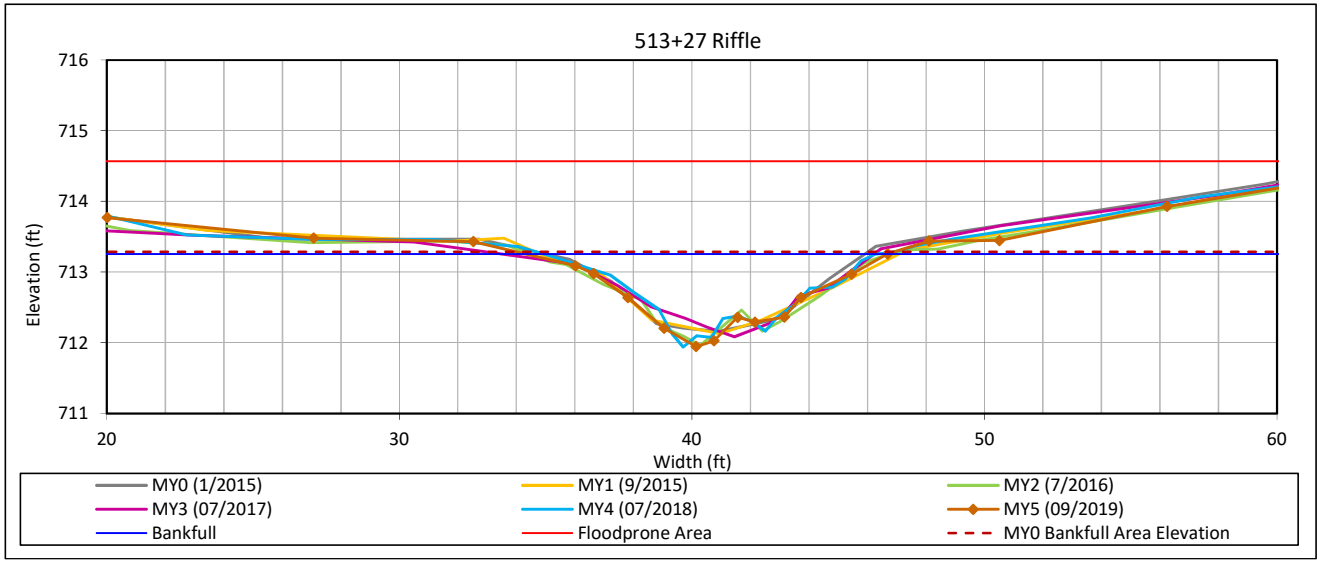
Survey Date: 09/2019
Field Crew: Wildlands Engineering

View Downstream

Cross-Section Plots

Hopewell Stream Mitigation Site
DMS Project No. 95352
Monitoring Year 5 - 2019

Cross-Section 6, UT2A R2



Bankfull Dimensions	
7.6	x-section area (ft.sq.)
12.4	width (ft)
0.6	mean depth (ft)
1.3	max depth (ft)
12.8	wetted parimeter (ft)
0.6	hyd radi (ft)
20.1	width-depth ratio
66.2	W flood prone area (ft)
5.3	entrenchment ratio
1.0	low bank height ratio

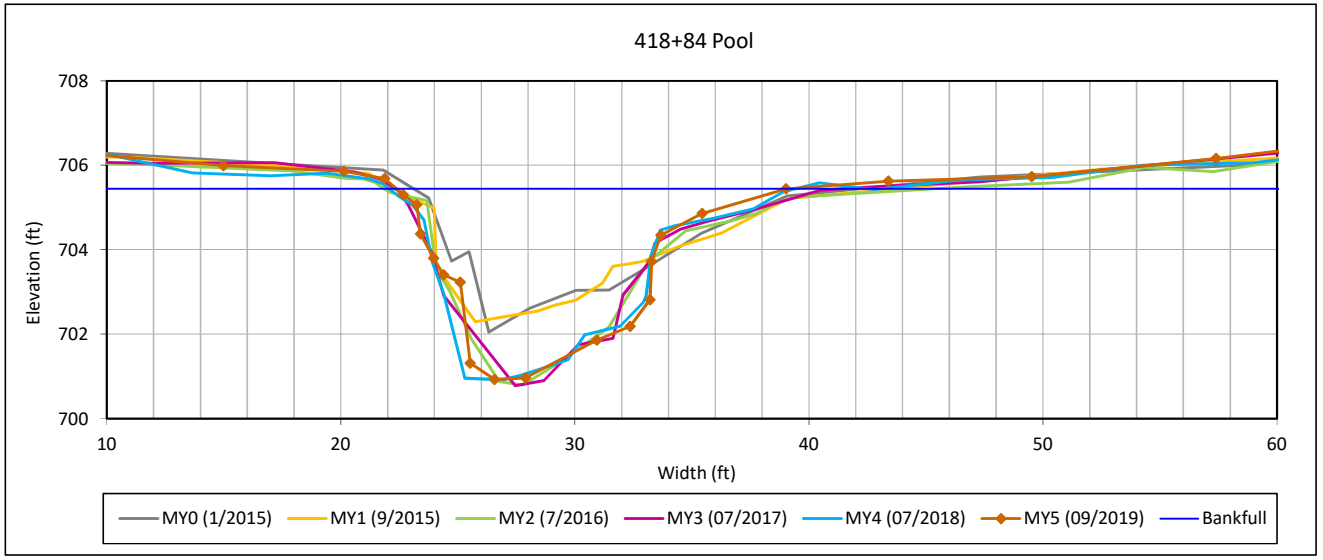
Survey Date: 09/2019
Field Crew: Wildlands Engineering

View Downstream

Cross-Section Plots

Hopewell Stream Mitigation Site
DMS Project No. 95352
Monitoring Year 5 - 2019

Cross-Section 7, UT2 R2



Bankfull Dimensions	
38.1	x-section area (ft.sq.)
16.6	width (ft)
2.3	mean depth (ft)
4.5	max depth (ft)
21.0	wetted parimeter (ft)
1.8	hyd radi (ft)
7.3	width-depth ratio

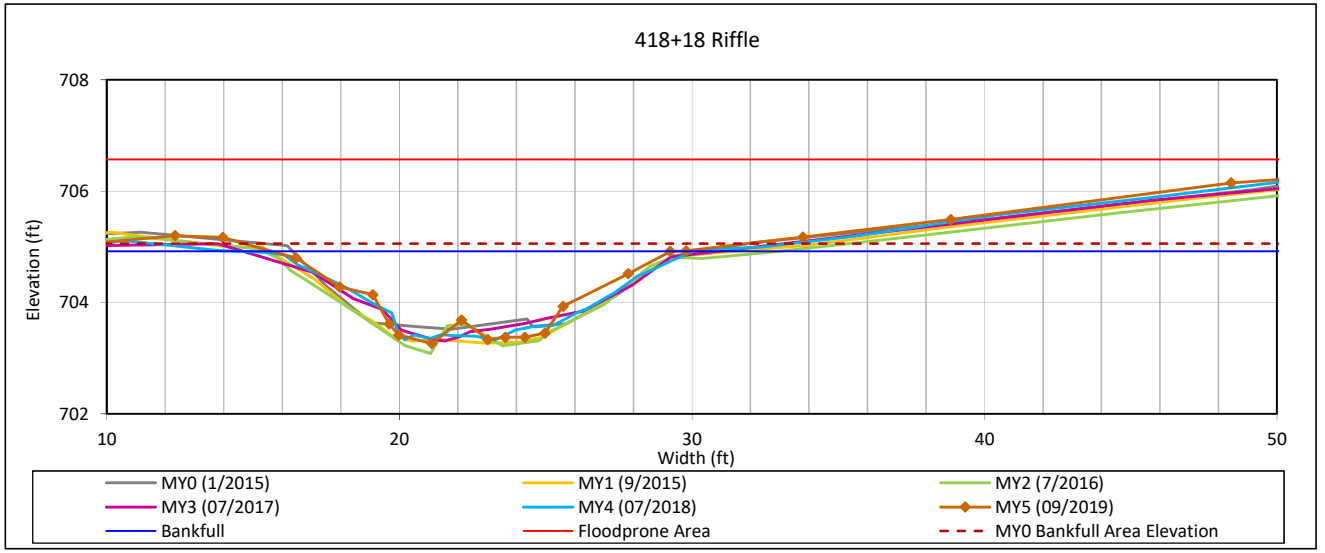
Survey Date: 09/2019
Field Crew: Wildlands Engineering

View Downstream

Cross-Section Plots

Hopewell Stream Mitigation Site
DMS Project No. 95352
Monitoring Year 5 - 2019

Cross-Section 8, UT2 R2



Bankfull Dimensions	
12.6	x-section area (ft.sq.)
13.6	width (ft)
0.9	mean depth (ft)
1.7	max depth (ft)
14.4	wetted parimeter (ft)
0.9	hyd radi (ft)
14.7	width-depth ratio
56.2	W flood prone area (ft)
4.1	entrenchment ratio
0.9	low bank height ratio

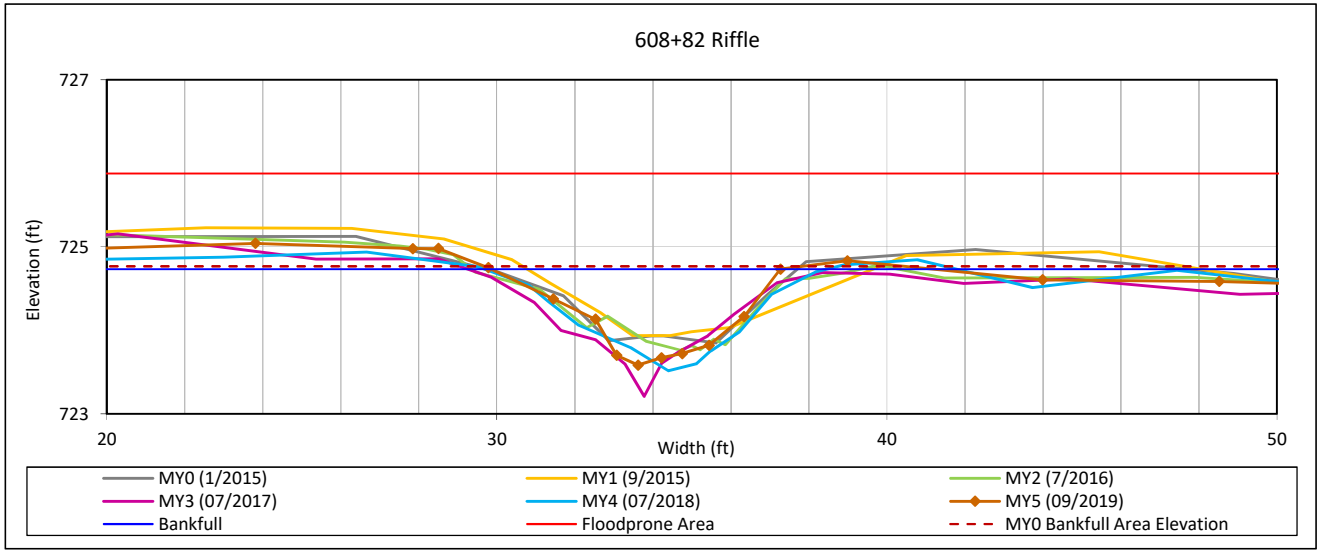
Survey Date: 09/2019
Field Crew: Wildlands Engineering

View Downstream

Cross-Section Plots

Hopewell Stream Mitigation Site
DMS Project No. 95352
Monitoring Year 5 - 2019

Cross-Section 9, UT2B R2



Bankfull Dimensions	
4.6	x-section area (ft.sq.)
7.4	width (ft)
0.6	mean depth (ft)
1.1	max depth (ft)
7.9	wetted parimeter (ft)
0.6	hyd radi (ft)
11.8	width-depth ratio
67.5	W flood prone area (ft)
9.1	entrenchment ratio
1.0	low bank height ratio

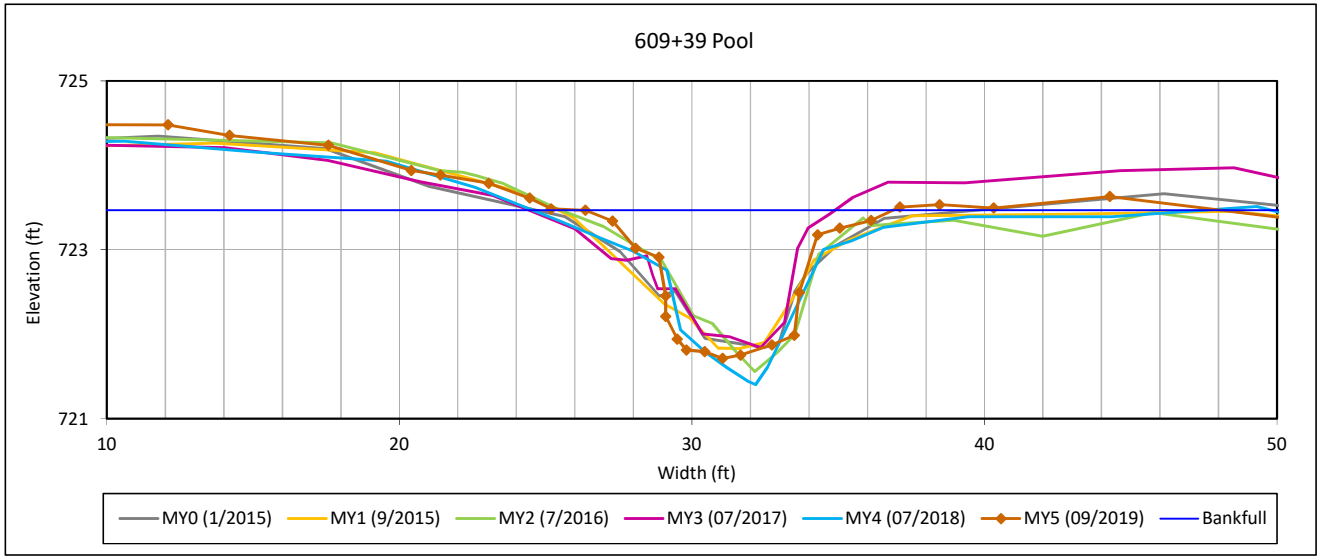
Survey Date: 09/2019
Field Crew: Wildlands Engineering

View Downstream

Cross-Section Plots

Hopewell Stream Mitigation Site
DMS Project No. 95352
Monitoring Year 5 - 2019

Cross-Section 10, UT2B R2



Bankfull Dimensions	
9.0	x-section area (ft.sq.)
10.5	width (ft)
0.9	mean depth (ft)
1.8	max depth (ft)
11.9	wetted parimeter (ft)
0.8	hyd radi (ft)
12.2	width-depth ratio

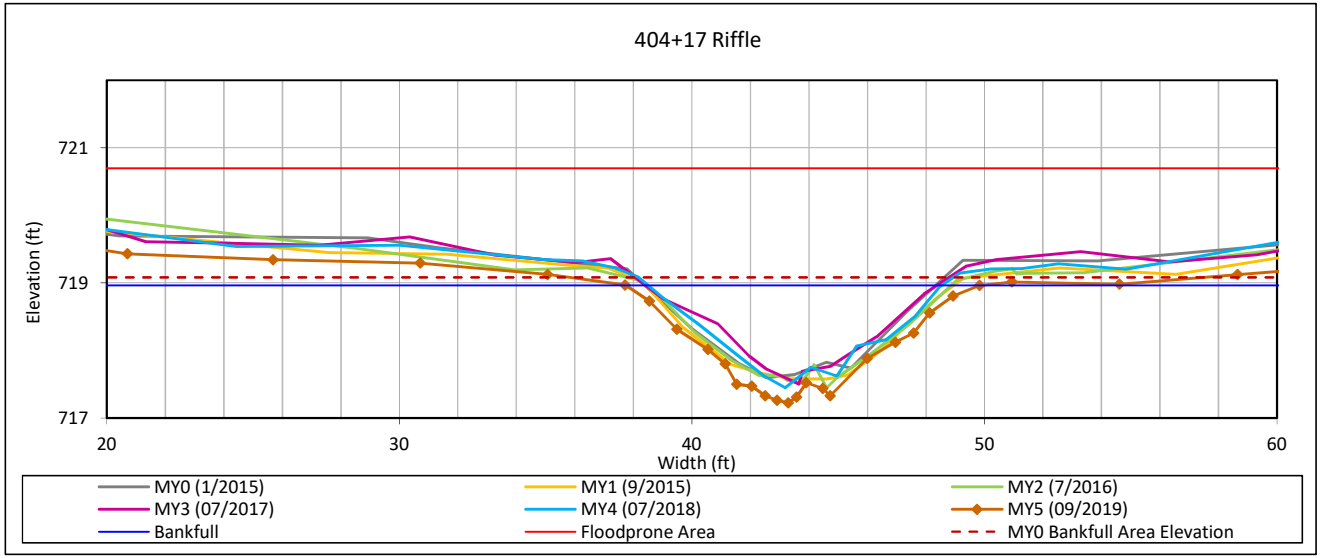
Survey Date: 09/2019
Field Crew: Wildlands Engineering

View Downstream

Cross-Section Plots

Hopewell Stream Mitigation Site
DMS Project No. 95352
Monitoring Year 5 - 2019

Cross-Section 11, UT2 R1



Bankfull Dimensions	
11.3	x-section area (ft.sq.)
12.1	width (ft)
0.9	mean depth (ft)
1.7	max depth (ft)
12.8	wetted parimeter (ft)
0.9	hyd radi (ft)
13.0	width-depth ratio
99.6	W flood prone area (ft)
8.2	entrenchment ratio
0.9	low bank height ratio

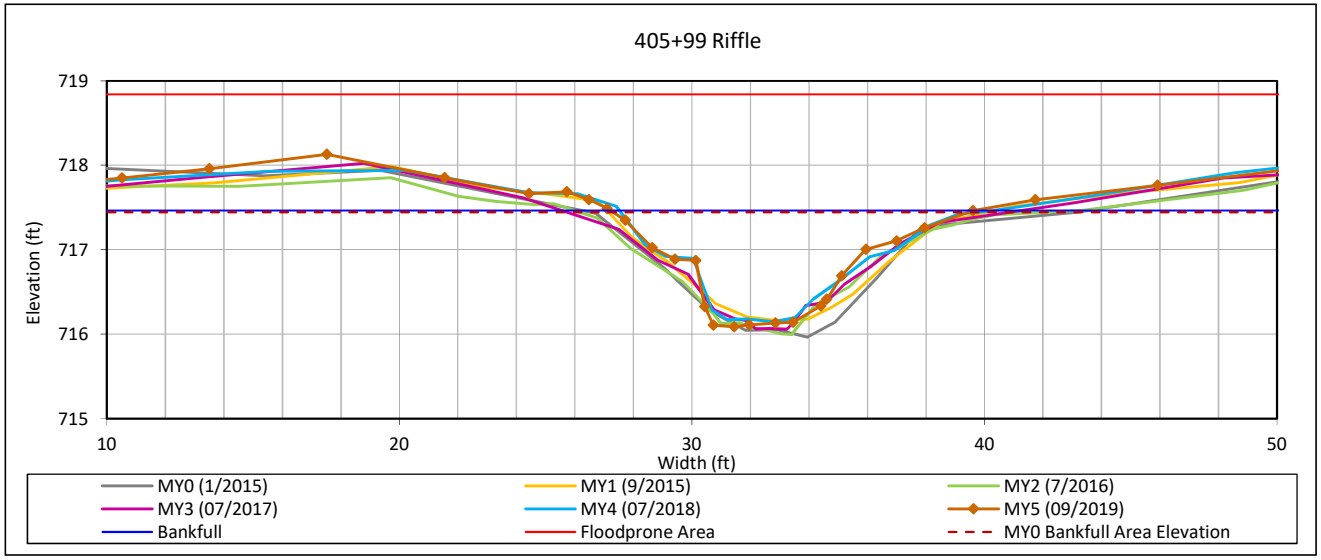
Survey Date: 09/2019
Field Crew: Wildlands Engineering

View Downstream

Cross-Section Plots

Hopewell Stream Mitigation Site
DMS Project No. 95352
Monitoring Year 5 - 2019

Cross-Section 12, UT2 R1



Bankfull Dimensions	
8.6	x-section area (ft.sq.)
12.4	width (ft)
0.7	mean depth (ft)
1.4	max depth (ft)
13.1	wetted parimeter (ft)
0.7	hyd radi (ft)
17.8	width-depth ratio
69.7	W flood prone area (ft)
5.6	entrenchment ratio
1.0	low bank height ratio

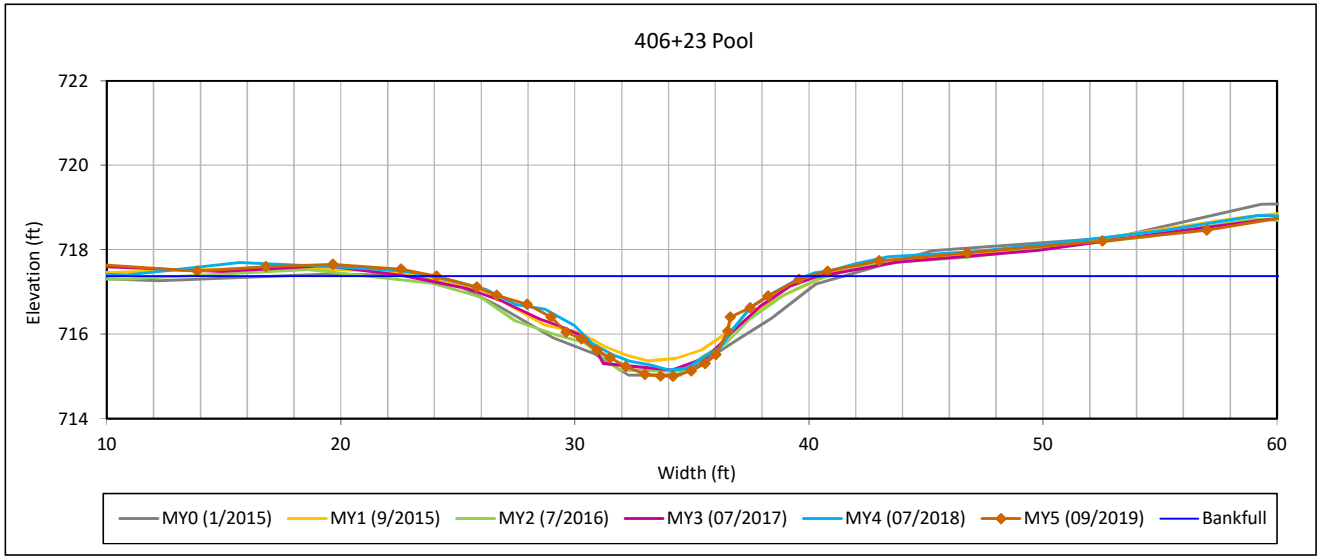
Survey Date: 09/2019
Field Crew: Wildlands Engineering

View Downstream

Cross-Section Plots

Hopewell Stream Mitigation Site
DMS Project No. 95352
Monitoring Year 5 - 2019

Cross-Section 13, UT2 R1



Bankfull Dimensions	
18.4	x-section area (ft.sq.)
16.0	width (ft)
1.1	mean depth (ft)
2.4	max depth (ft)
17.0	wetted parimeter (ft)
1.1	hyd radi (ft)
13.9	width-depth ratio

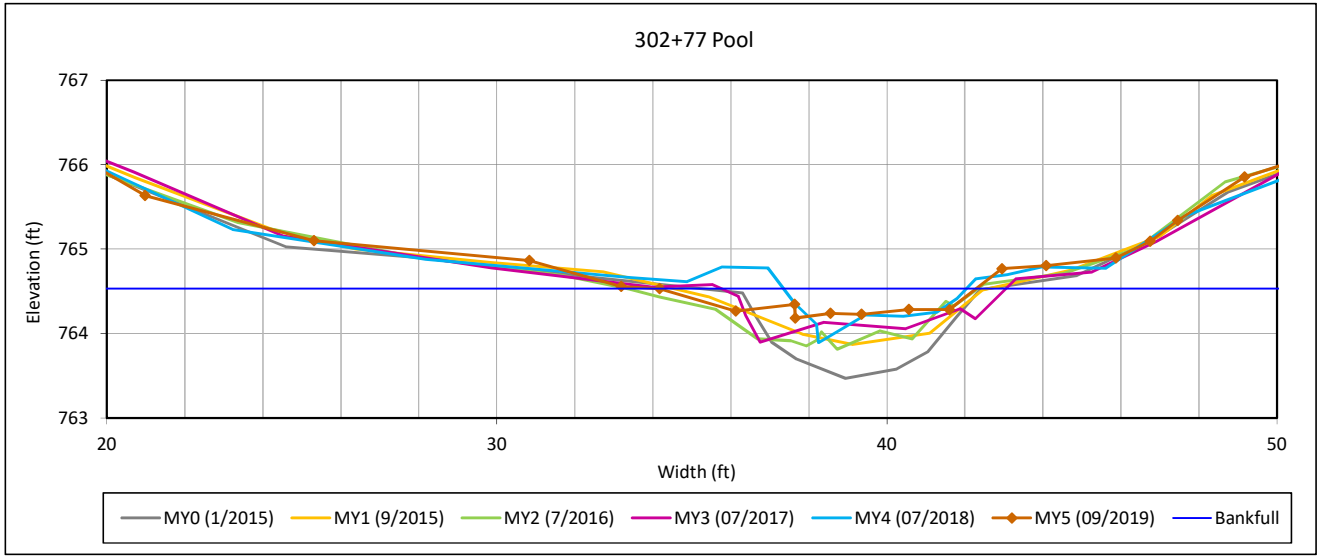
Survey Date: 09/2019
Field Crew: Wildlands Engineering

View Downstream

Cross-Section Plots

Hopewell Stream Mitigation Site
DMS Project No. 95352
Monitoring Year 5 - 2019

Cross-Section 14, UT1B R1



Bankfull Dimensions	
1.8	x-section area (ft.sq.)
8.1	width (ft)
0.2	mean depth (ft)
0.3	max depth (ft)
8.3	wetted parimeter (ft)
0.2	hyd radi (ft)
36.6	width-depth ratio

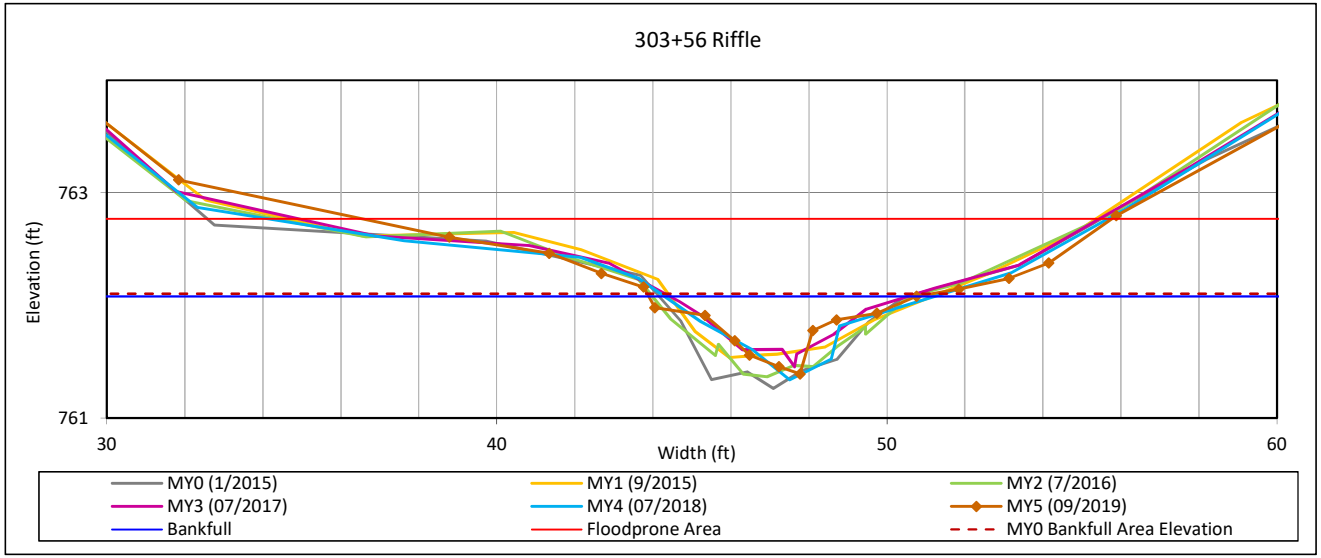
Survey Date: 09/2019
Field Crew: Wildlands Engineering

View Downstream

Cross-Section Plots

Hopewell Stream Mitigation Site
DMS Project No. 95352
Monitoring Year 5 - 2019

Cross-Section 15, UT1B R1



Bankfull Dimensions	
1.9	x-section area (ft.sq.)
6.9	width (ft)
0.3	mean depth (ft)
0.7	max depth (ft)
7.2	wetted parimeter (ft)
0.3	hyd radi (ft)
24.4	width-depth ratio
19.2	W flood prone area (ft)
2.8	entrenchment ratio
1.0	low bank height ratio

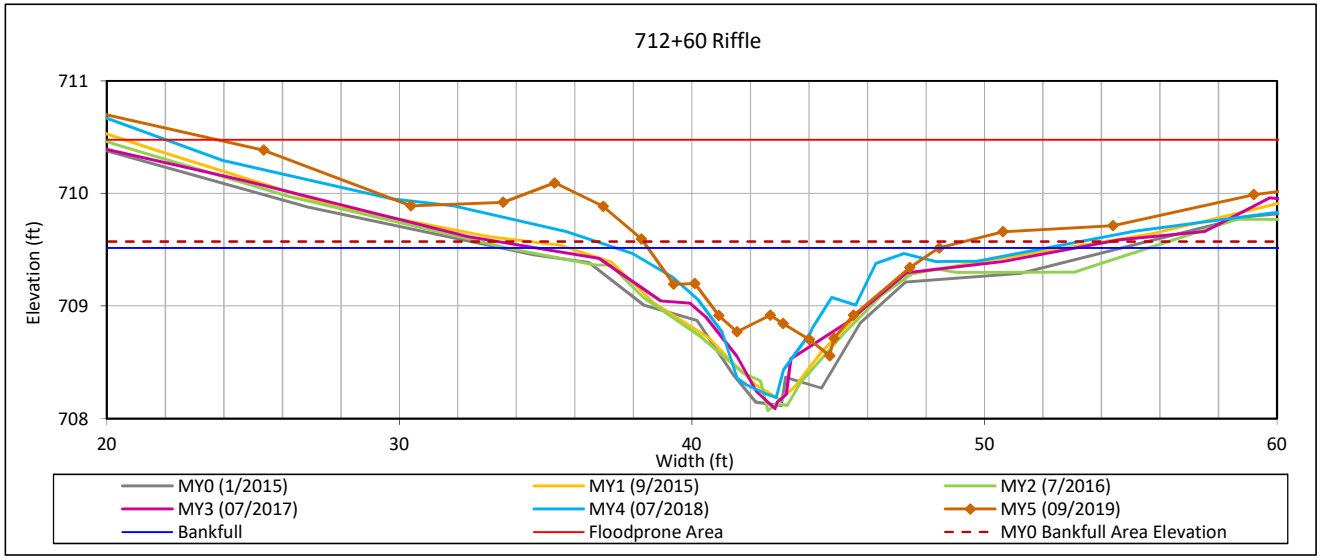
Survey Date: 09/2019
Field Crew: Wildlands Engineering

View Downstream

Cross-Section Plots

Hopewell Stream Mitigation Site
DMS Project No. 95352
Monitoring Year 5 - 2019

Cross-Section 16, UT2C R2



Bankfull Dimensions	
4.9	x-section area (ft.sq.)
10.0	width (ft)
0.5	mean depth (ft)
1.0	max depth (ft)
10.3	wetted parimeter (ft)
0.5	hyd radi (ft)
20.2	width-depth ratio
44.5	W flood prone area (ft)
4.5	entrenchment ratio
0.9	low bank height ratio

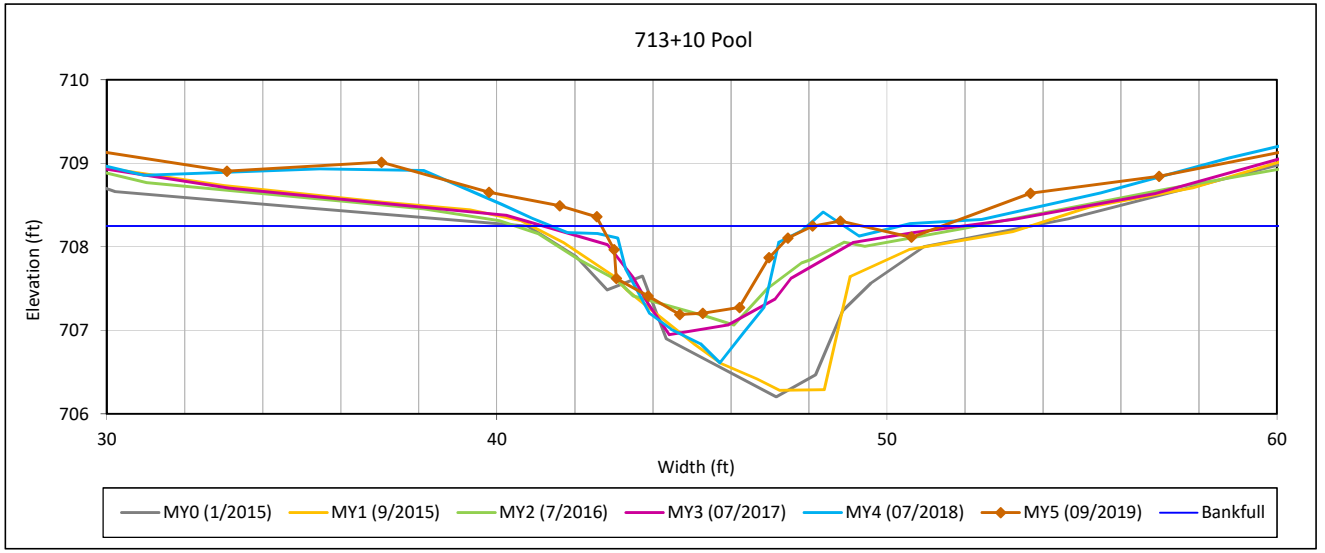
Survey Date: 09/2019
Field Crew: Wildlands Engineering

View Downstream

Cross-Section Plots

Hopewell Stream Mitigation Site
DMS Project No. 95352
Monitoring Year 5 - 2019

Cross-Section 17, UT2C R2



Bankfull Dimensions	
3.7	x-section area (ft.sq.)
5.4	width (ft)
0.7	mean depth (ft)
1.1	max depth (ft)
6.1	wetted parimeter (ft)
0.6	hyd radi (ft)
7.9	width-depth ratio

Survey Date: 09/2019
Field Crew: Wildlands Engineering

View Downstream

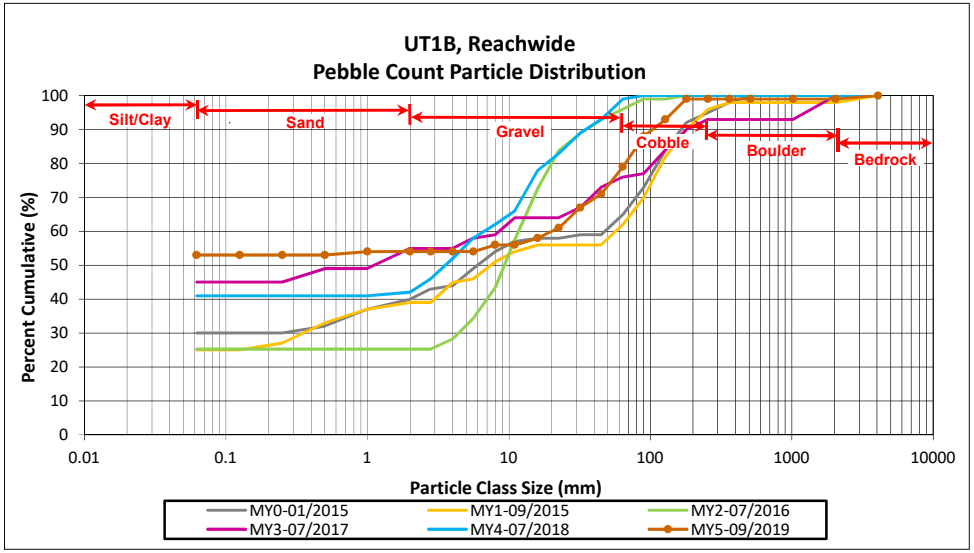
Reachwide and Cross-Section Pebble Count Plots

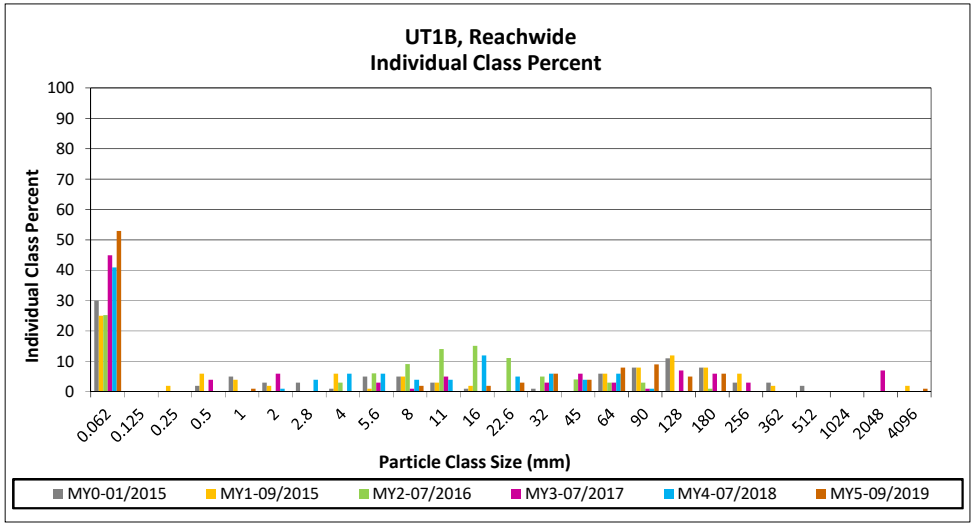
Hopewell Stream Mitigation Site
DMS Project No. 95352
Monitoring Year 5 - 2019

UT1B, Reachwide

Particle Class		Diameter (mm)		Particle Count			Reach Summary	
		min	max	Riffle	Pool	Total	Class Percentage	Percent Cumulative
SILT/CLAY	Silt/Clay	0.000	0.062	24	29	53	53	53
SAND	Very fine	0.062	0.125					53
	Fine	0.125	0.250					53
	Medium	0.25	0.50					53
	Coarse	0.5	1.0		1	1	1	54
	Very Coarse	1.0	2.0					54
GRAVEL	Very Fine	2.0	2.8					54
	Very Fine	2.8	4.0					54
	Fine	4.0	5.6					54
	Fine	5.6	8.0		2	2	2	56
	Medium	8.0	11.0					56
	Medium	11.0	16.0	2		2	2	58
	Coarse	16.0	22.6	1	2	3	3	61
	Coarse	22.6	32	4	2	6	6	67
	Very Coarse	32	45	3	1	4	4	71
	Very Coarse	45	64	3	5	8	8	79
COBBLE	Small	64	90	4	5	9	9	88
	Small	90	128	4	1	5	5	93
	Large	128	180	4	2	6	6	99
	Large	180	256					99
BOULDER	Small	256	362					99
	Small	362	512					99
	Medium	512	1024					99
	Large/Very Large	1024	2048					99
BEDROCK	Bedrock	2048	>2048	1		1	1	100
			Total	**50**	**50**	**100**	**100**	**100**

Reachwide	
Channel materials (mm)	
D_{16} =	Silt/Clay
D_{35} =	Silt/Clay
D_{50} =	Silt/Clay
D_{84} =	77.3
D_{95} =	143.4
D_{100} =	>2048





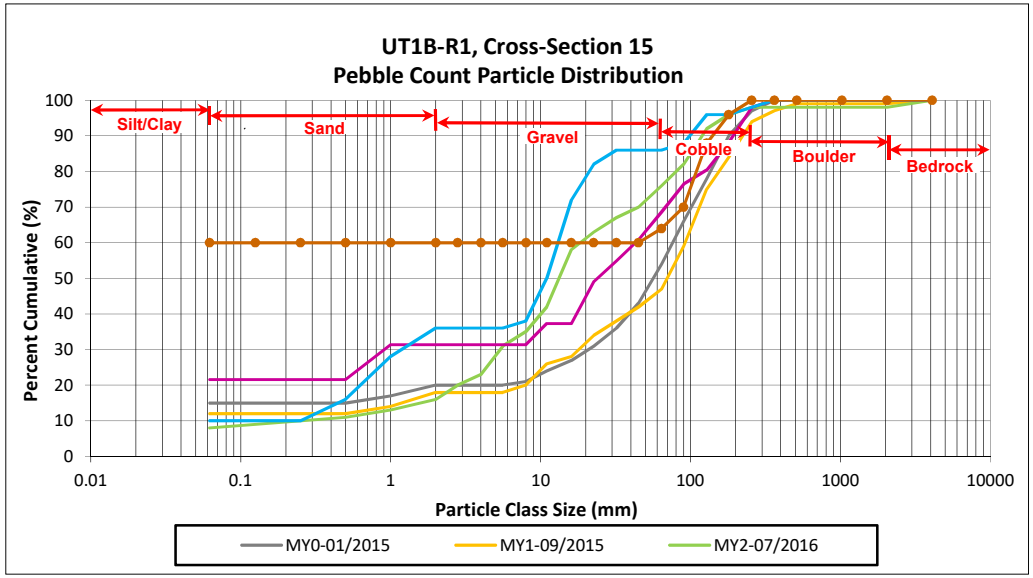
Reachwide and Cross-Section Pebble Count Plots

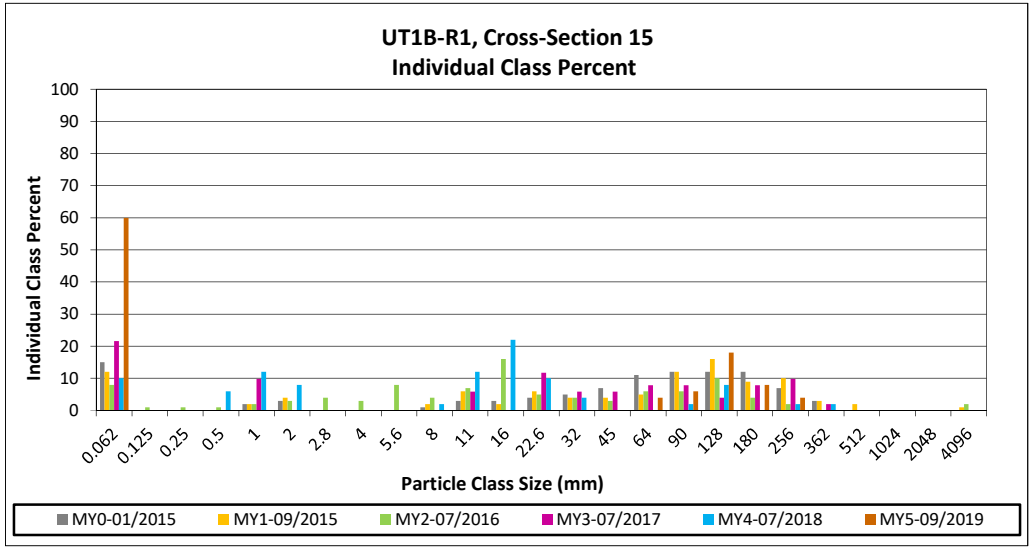
Hopewell Stream Mitigation Site
DMS Project No. 95352
Monitoring Year 5 - 2019

UT1B-R1, Cross-Section 15

Particle Class		Diameter (mm)		Riffle 100-Count	Summary	
		min	max		Class Percentage	Percent Cumulative
SILT/CLAY	Silt/Clay	0.000	0.062	60	60	60
SAND	Very fine	0.062	0.125			60
	Fine	0.125	0.250			60
	Medium	0.25	0.50			60
	Coarse	0.5	1.0			60
	Very Coarse	1.0	2.0			60
GRAVEL	Very Fine	2.0	2.8			60
	Very Fine	2.8	4.0			60
	Fine	4.0	5.6			60
	Fine	5.6	8.0			60
	Medium	8.0	11.0			60
	Medium	11.0	16.0			60
	Coarse	16.0	22.6			60
	Coarse	22.6	32			60
	Very Coarse	32	45			60
	Very Coarse	45	64	4	4	64
COBBLE	Small	64	90	6	6	70
	Small	90	128	18	18	88
	Large	128	180	8	8	96
	Large	180	256	4	4	100
BOULDER	Small	256	362			100
	Small	362	512			100
	Medium	512	1024			100
	Large/Very Large	1024	2048			100
BEDROCK	Bedrock	2048	>2048			100
			Total	**100**	**100**	**100**

Cross-Section 15	
Channel materials (mm)	
D_{16} =	Silt/Clay
D_{35} =	Silt/Clay
D_{50} =	Silt/Clay
D_{84} =	118.4
D_{95} =	172.5
D_{100} =	256.0





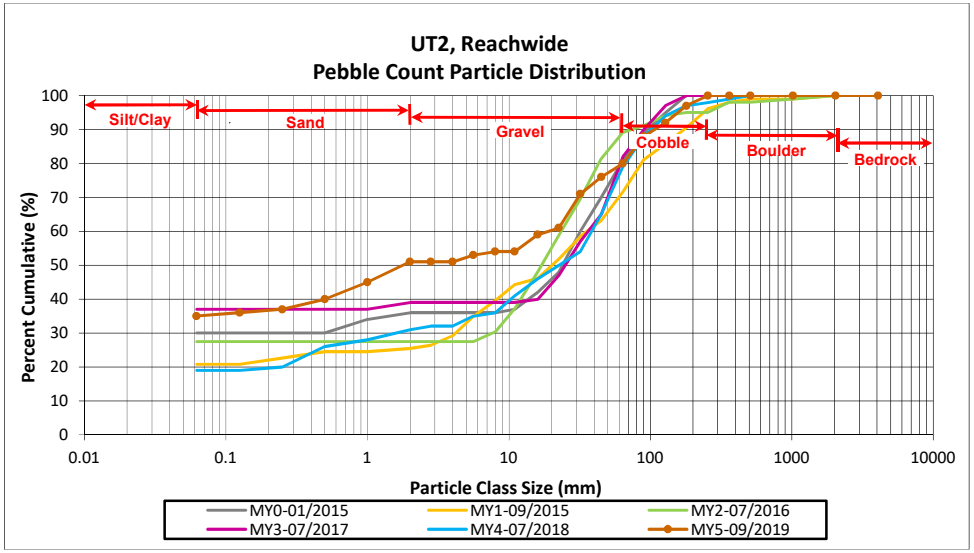
Reachwide and Cross-Section Pebble Count Plots

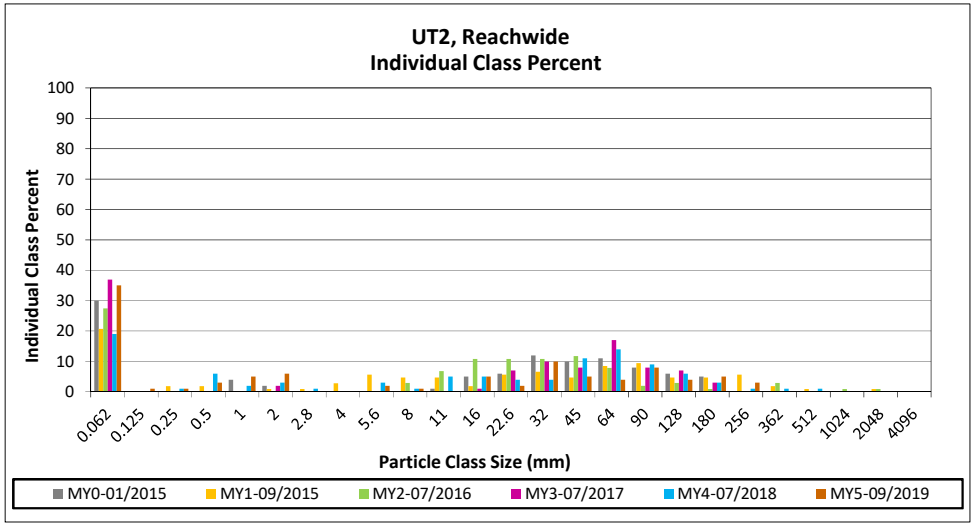
Hopewell Stream Mitigation Site
DMS Project No. 95352
Monitoring Year 5 - 2019

UT2, Reachwide

Particle Class		Diameter (mm)		Particle Count			Reach Summary	
		min	max	Riffle	Pool	Total	Class Percentage	Percent Cumulative
SILT/CLAY	Silt/Clay	0.000	0.062	10	25	35	35	35
SAND	Very fine	0.062	0.125		1	1	1	36
	Fine	0.125	0.250		1	1	1	37
	Medium	0.25	0.50		3	3	3	40
	Coarse	0.5	1.0	2	3	5	5	45
	Very Coarse	1.0	2.0	2	4	6	6	51
GRAVEL	Very Fine	2.0	2.8					51
	Very Fine	2.8	4.0					51
	Fine	4.0	5.6	1	1	2	2	53
	Fine	5.6	8.0	1		1	1	54
	Medium	8.0	11.0					54
	Medium	11.0	16.0	2	3	5	5	59
	Coarse	16.0	22.6	1	1	2	2	61
	Coarse	22.6	32	8	2	10	10	71
	Very Coarse	32	45	5		5	5	76
	Very Coarse	45	64	2	2	4	4	80
COBBLE	Small	64	90	6	2	8	8	88
	Small	90	128	2	2	4	4	92
	Large	128	180	5		5	5	97
	Large	180	256	3		3	3	100
BOULDER	Small	256	362					100
	Small	362	512					100
	Medium	512	1024					100
	Large/Very Large	1024	2048					100
BEDROCK	Bedrock	2048	>2048					100
			Total	**50**	**50**	**100**	**100**	**100**

Reachwide	
Channel materials (mm)	
D_{16} =	Silt/Clay
D_{35} =	Silt/Clay
D_{50} =	1.8
D_{84} =	75.9
D_{95} =	157.1
D_{100} =	256.0





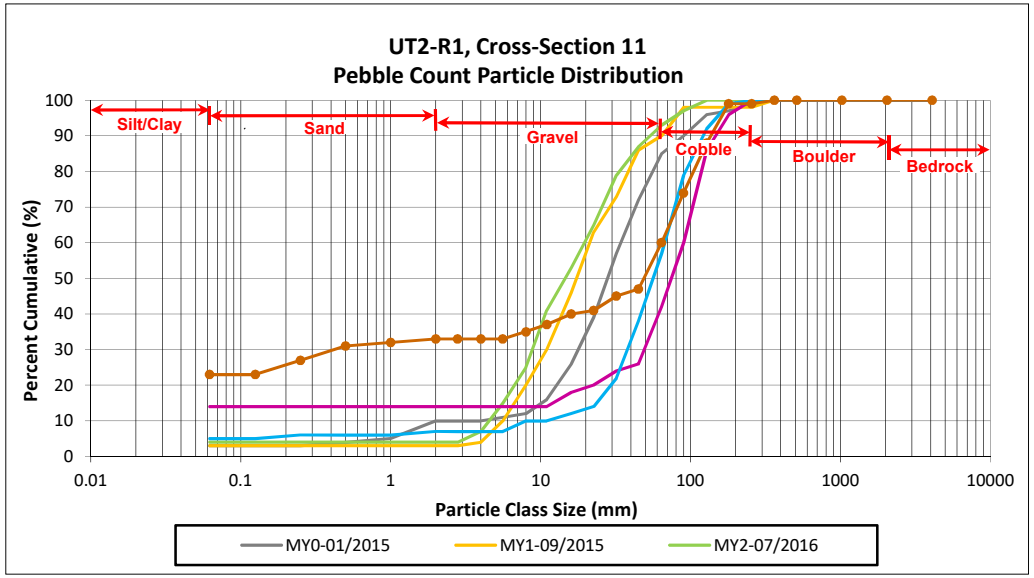
Reachwide and Cross-Section Pebble Count Plots

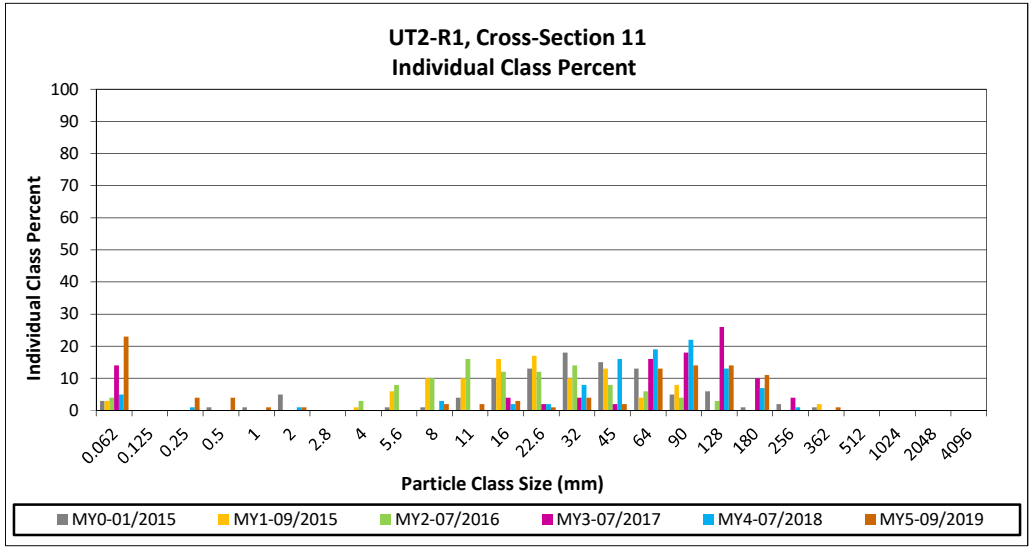
Hopewell Stream Mitigation Site
DMS Project No. 95352
Monitoring Year 5 - 2019

UT2-R1, Cross-Section 11

Particle Class		Diameter (mm)		Riffle 100-Count	Summary	
		min	max		Class Percentage	Percent Cumulative
SILT/CLAY	Silt/Clay	0.000	0.062	23	23	23
SAND	Very fine	0.062	0.125			23
	Fine	0.125	0.250	4	4	27
	Medium	0.25	0.50	4	4	31
	Coarse	0.5	1.0	1	1	32
	Very Coarse	1.0	2.0	1	1	33
GRAVEL	Very Fine	2.0	2.8			33
	Very Fine	2.8	4.0			33
	Fine	4.0	5.6			33
	Fine	5.6	8.0	2	2	35
	Medium	8.0	11.0	2	2	37
	Medium	11.0	16.0	3	3	40
	Coarse	16.0	22.6	1	1	41
	Coarse	22.6	32	4	4	45
	Very Coarse	32	45	2	2	47
	Very Coarse	45	64	13	13	60
COBBLE	Small	64	90	14	14	74
	Small	90	128	14	14	88
	Large	128	180	11	11	99
	Large	180	256			99
BOULDER	Small	256	362	1	1	100
	Small	362	512			100
	Medium	512	1024			100
	Large/Very Large	1024	2048			100
BEDROCK	Bedrock	2048	>2048			100
			Total	**100**	**100**	**100**

Cross-Section 11	
Channel materials (mm)	
D_{16} =	Silt/Clay
D_{35} =	8.0
D_{50} =	48.8
D_{84} =	115.7
D_{95} =	159.0
D_{100} =	362.0





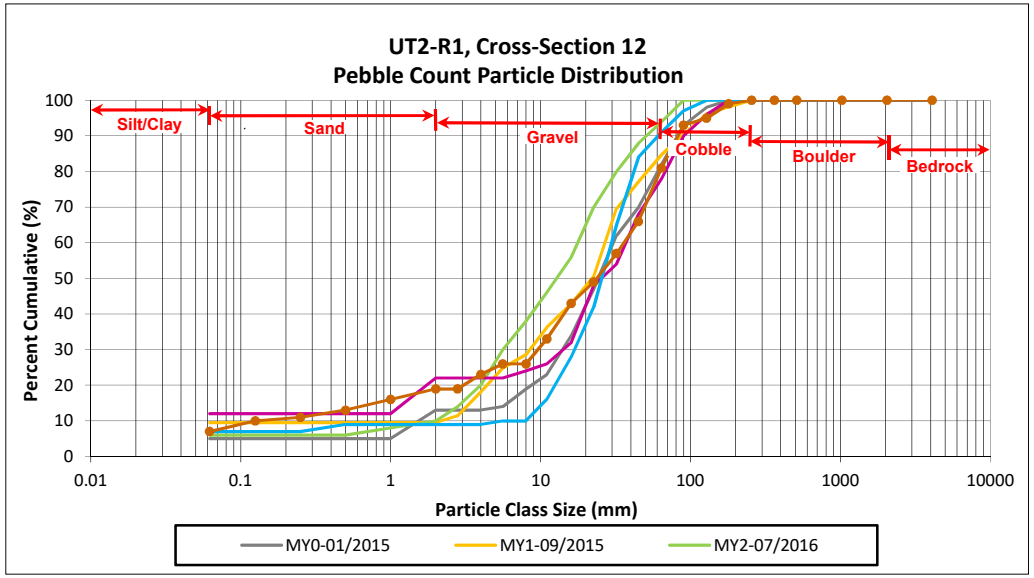
Reachwide and Cross-Section Pebble Count Plots

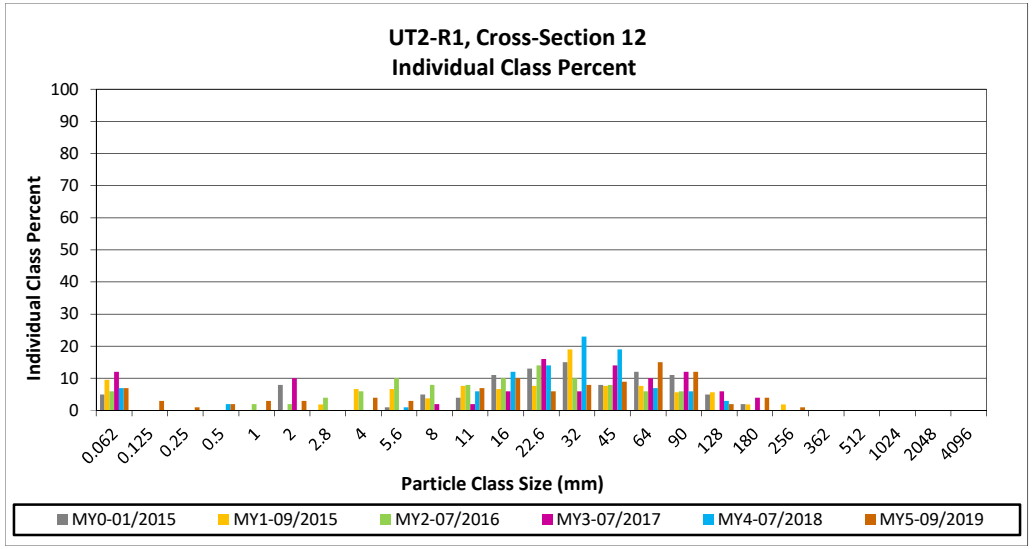
Hopewell Stream Mitigation Site
DMS Project No. 95352
Monitoring Year 5 - 2019

UT2-R1, Cross-Section 12

Particle Class		Diameter (mm)		Riffle 100-Count	Summary	
		min	max		Class Percentage	Percent Cumulative
SILT/CLAY	Silt/Clay	0.000	0.062	7	7	7
SAND	Very fine	0.062	0.125	3	3	10
	Fine	0.125	0.250	1	1	11
	Medium	0.25	0.50	2	2	13
	Coarse	0.5	1.0	3	3	16
	Very Coarse	1.0	2.0	3	3	19
GRAVEL	Very Fine	2.0	2.8			19
	Very Fine	2.8	4.0	4	4	23
	Fine	4.0	5.6	3	3	26
	Fine	5.6	8.0			26
	Medium	8.0	11.0	7	7	33
	Medium	11.0	16.0	10	10	43
	Coarse	16.0	22.6	6	6	49
	Coarse	22.6	32	8	8	57
	Very Coarse	32	45	9	9	66
	Very Coarse	45	64	15	15	81
COBBLE	Small	64	90	12	12	93
	Small	90	128	2	2	95
	Large	128	180	4	4	99
	Large	180	256	1	1	100
BOULDER	Small	256	362			100
	Small	362	512			100
	Medium	512	1024			100
	Large/Very Large	1024	2048			100
BEDROCK	Bedrock	2048	>2048			100
			Total	**100**	**100**	**100**

Cross-Section 12	
Channel materials (mm)	
D_{16} =	1.0
D_{35} =	11.9
D_{50} =	23.6
D_{84} =	69.7
D_{95} =	128.0
D_{100} =	256.0





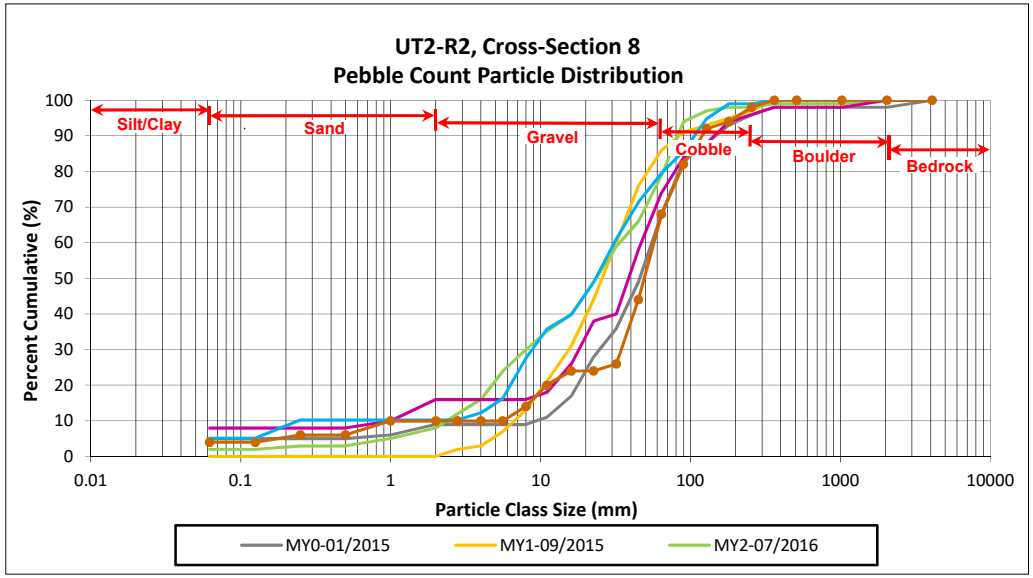
Reachwide and Cross-Section Pebble Count Plots

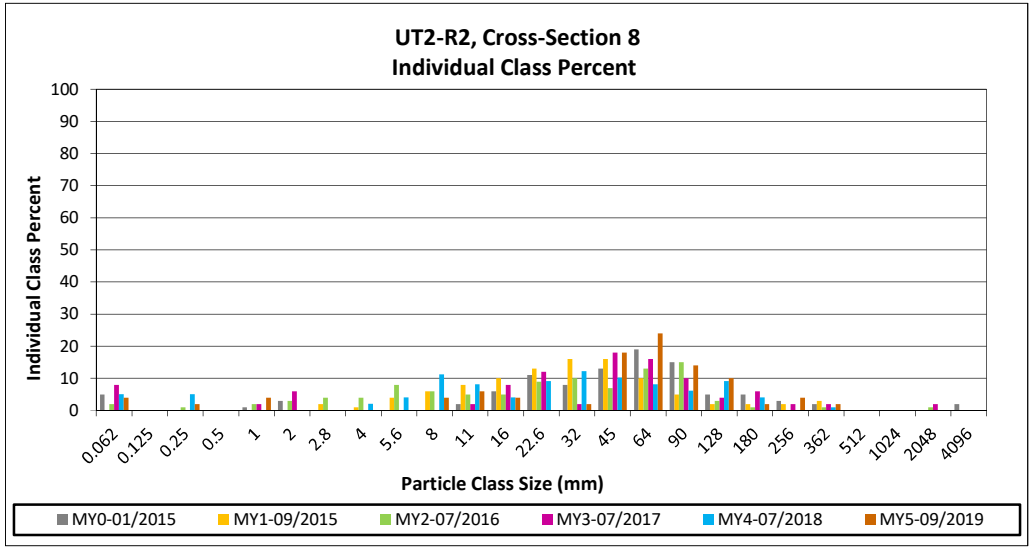
Hopewell Stream Mitigation Site
DMS Project No. 95352
Monitoring Year 5 - 2019

UT2-R2, Cross-Section 8

Particle Class		Diameter (mm) min	Diameter (mm) max	Riffle 100-Count	Summary: Class Percentage	Summary: Percent Cumulative
SILT/CLAY	Silt/Clay	0.000	0.062	4	4	4
SAND	Very fine	0.062	0.125			4
	Fine	0.125	0.250	2	2	6
	Medium	0.25	0.50			6
	Coarse	0.5	1.0	4	4	10
	Very Coarse	1.0	2.0			10
GRAVEL	Very Fine	2.0	2.8			10
	Very Fine	2.8	4.0			10
	Fine	4.0	5.6			10
	Fine	5.6	8.0	4	4	14
	Medium	8.0	11.0	6	6	20
	Medium	11.0	16.0	4	4	24
	Coarse	16.0	22.6			24
	Coarse	22.6	32	2	2	26
	Very Coarse	32	45	18	18	44
	Very Coarse	45	64	24	24	68
COBBLE	Small	64	90	14	14	82
	Small	90	128	10	10	92
	Large	128	180	2	2	94
	Large	180	256	4	4	98
BOULDER	Small	256	362	2	2	100
	Small	362	512			100
	Medium	512	1024			100
	Large/Very Large	1024	2048			100
BEDROCK	Bedrock	2048	>2048			100
			Total	**100**	**100**	**100**

Cross-Section 8	
Channel materials (mm)	
D_{16} =	8.9
D_{35} =	37.9
D_{50} =	49.1
D_{84} =	96.6
D_{95} =	196.6
D_{100} =	362.0





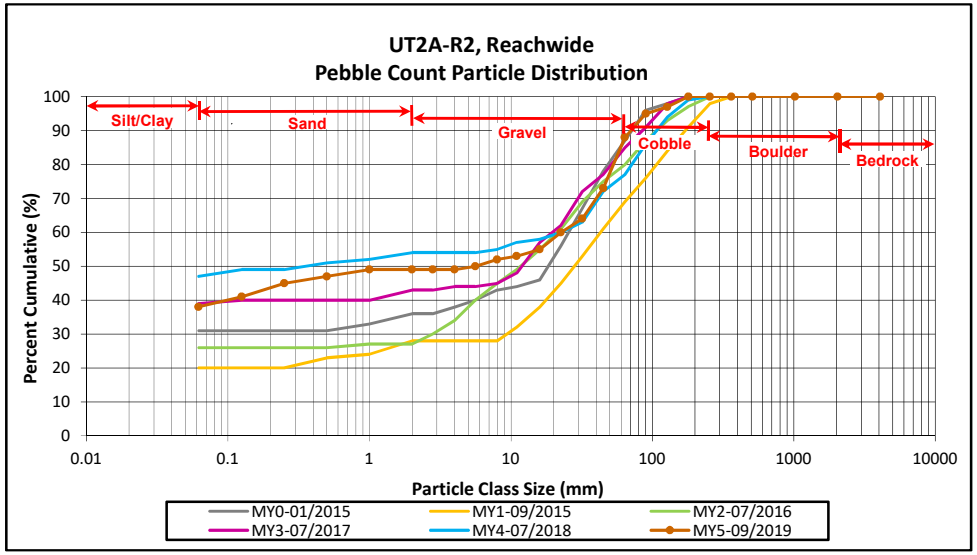
Reachwide and Cross-Section Pebble Count Plots

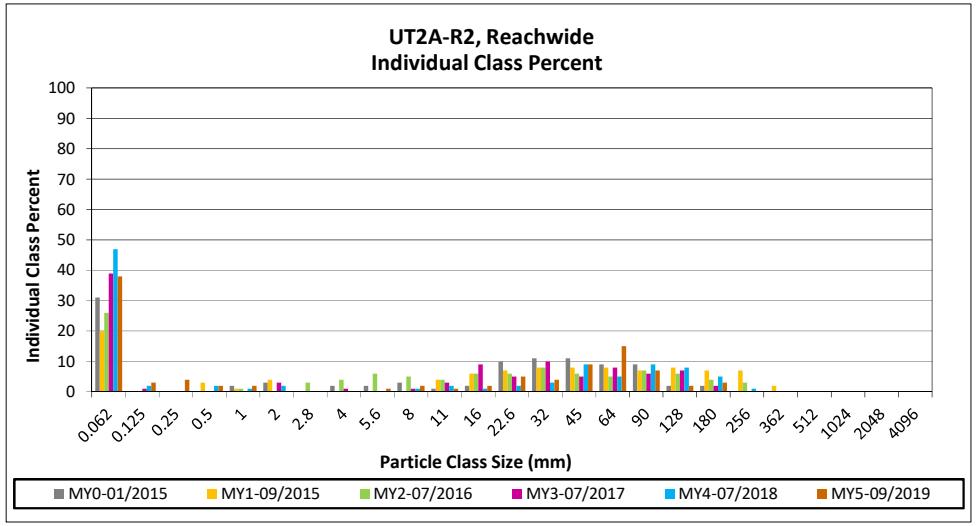
Hopewell Stream Mitigation Site
DMS Project No. 95352
Monitoring Year 5 - 2019

UT2A-R2, Reachwide

Particle Class		Diameter (mm)		Particle Count			Reach Summary	
		min	max	Riffle	Pool	Total	Class Percentage	Percent Cumulative
SILT/CLAY	Silt/Clay	0.000	0.062	7	31	38	38	38
SAND	Very fine	0.062	0.125		3	3	3	41
	Fine	0.125	0.250		4	4	4	45
	Medium	0.25	0.50	1	1	2	2	47
	Coarse	0.5	1.0	1	1	2	2	49
	Very Coarse	1.0	2.0					49
GRAVEL	Very Fine	2.0	2.8					49
	Very Fine	2.8	4.0					49
	Fine	4.0	5.6		1	1	1	50
	Fine	5.6	8.0	2		2	2	52
	Medium	8.0	11.0		1	1	1	53
	Medium	11.0	16.0	2		2	2	55
	Coarse	16.0	22.6	3	2	5	5	60
	Coarse	22.6	32	3	1	4	4	64
	Very Coarse	32	45	5	4	9	9	73
	Very Coarse	45	64	14	1	15	15	88
COBBLE	Small	64	90	7		7	7	95
	Small	90	128	2		2	2	97
	Large	128	180	3		3	3	100
	Large	180	256					100
BOULDER	Small	256	362					100
	Small	362	512					100
	Medium	512	1024					100
	Large/Very Large	1024	2048					100
BEDROCK	Bedrock	2048	>2048					100
			Total	**50**	**50**	**100**	**100**	**100**

Reachwide	
Channel materials (mm)	
D_{16} =	Silt/Clay
D_{35} =	Silt/Clay
D_{50} =	5.6
D_{84} =	58.3
D_{95} =	90.0
D_{100} =	180.0





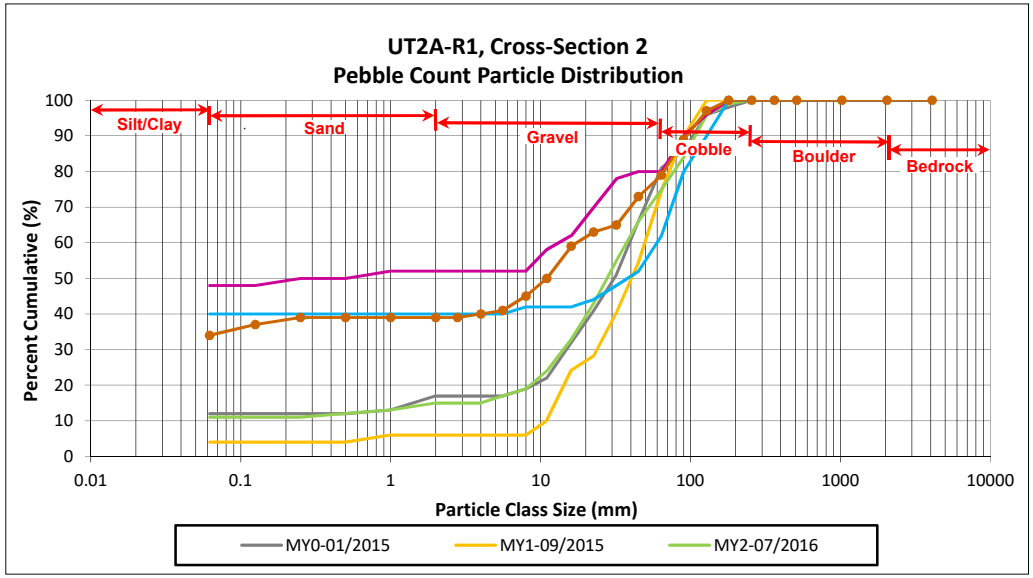
Reachwide and Cross-Section Pebble Count Plots

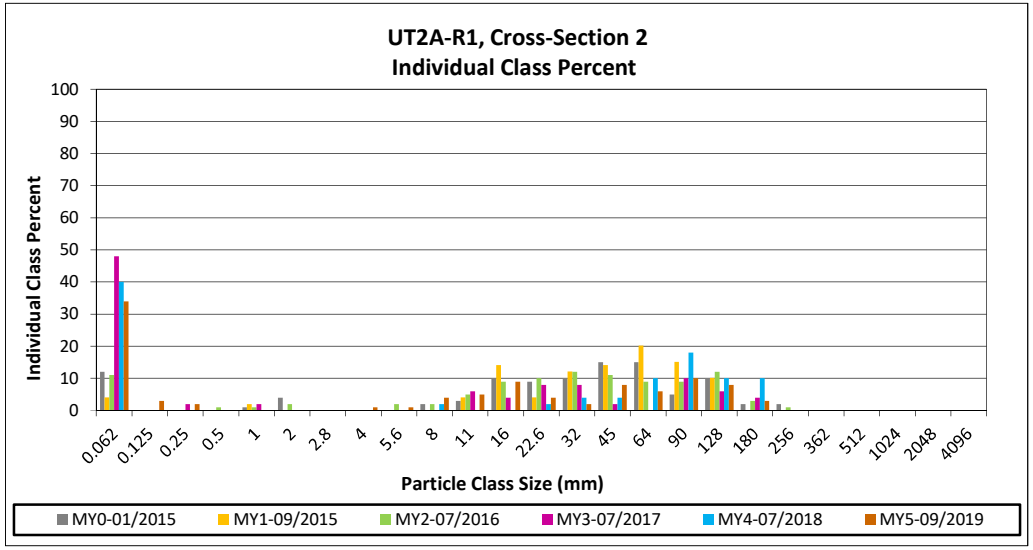
Hopewell Stream Mitigation Site
DMS Project No. 95352
Monitoring Year 5 - 2019

UT2A-R1, Cross-Section 2

Particle Class		Diameter (mm)		Riffle 100-Count	Summary	
		min	max		Class Percentage	Percent Cumulative
SILT/CLAY	Silt/Clay	0.000	0.062	34	34	34
SAND	Very fine	0.062	0.125	3	3	37
	Fine	0.125	0.250	2	2	39
	Medium	0.25	0.50			39
	Coarse	0.5	1.0			39
	Very Coarse	1.0	2.0			39
GRAVEL	Very Fine	2.0	2.8			39
	Very Fine	2.8	4.0	1	1	40
	Fine	4.0	5.6	1	1	41
	Fine	5.6	8.0	4	4	45
	Medium	8.0	11.0	5	5	50
	Medium	11.0	16.0	9	9	59
	Coarse	16.0	22.6	4	4	63
	Coarse	22.6	32	2	2	65
	Very Coarse	32	45	8	8	73
	Very Coarse	45	64	6	6	79
COBBLE	Small	64	90	10	10	89
	Small	90	128	8	8	97
	Large	128	180	3	3	100
	Large	180	256			100
BOULDER	Small	256	362			100
	Small	362	512			100
	Medium	512	1024			100
	Large/Very Large	1024	2048			100
BEDROCK	Bedrock	2048	>2048			100
			Total	**100**	**100**	**100**

Cross-Section 2	
Channel materials (mm)	
D_{16} =	Silt/Clay
D_{35} =	0.1
D_{50} =	11.0
D_{84} =	75.9
D_{95} =	117.2
D_{100} =	180.0





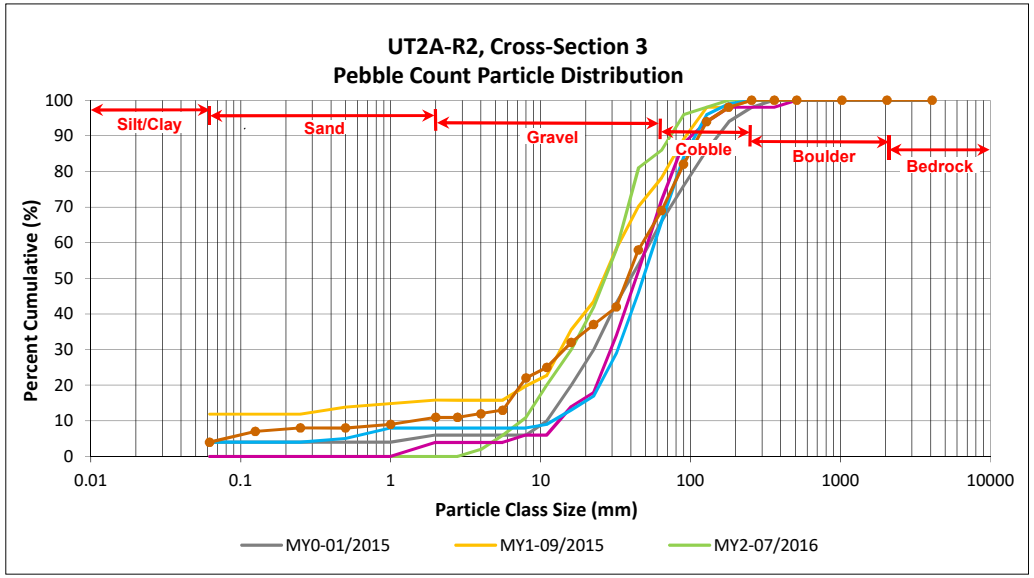
Reachwide and Cross-Section Pebble Count Plots

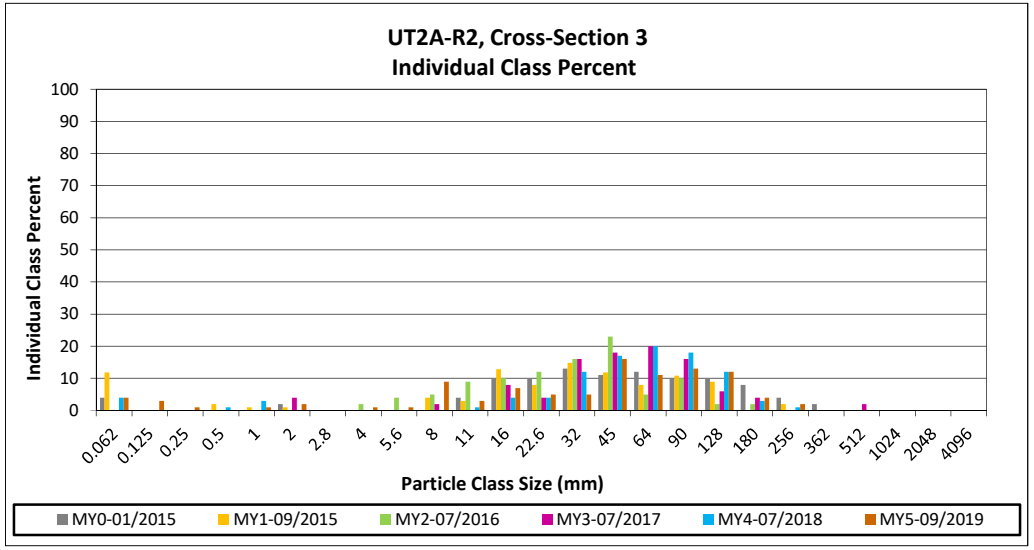
Hopewell Stream Mitigation Site
DMS Project No. 95352
Monitoring Year 5 - 2019

UT2A-R2, Cross-Section 3

Particle Class		Diameter (mm)		Riffle 100-Count	Summary	
		min	max		Class Percentage	Percent Cumulative
SILT/CLAY	Silt/Clay	0.000	0.062	4	4	4
SAND	Very fine	0.062	0.125	3	3	7
	Fine	0.125	0.250	1	1	8
	Medium	0.25	0.50			8
	Coarse	0.5	1.0	1	1	9
	Very Coarse	1.0	2.0	2	2	11
GRAVEL	Very Fine	2.0	2.8			11
	Very Fine	2.8	4.0	1	1	12
	Fine	4.0	5.6	1	1	13
	Fine	5.6	8.0	9	9	22
	Medium	8.0	11.0	3	3	25
	Medium	11.0	16.0	7	7	32
	Coarse	16.0	22.6	5	5	37
	Coarse	22.6	32	5	5	42
	Very Coarse	32	45	16	16	58
	Very Coarse	45	64	11	11	69
COBBLE	Small	64	90	13	13	82
	Small	90	128	12	12	94
	Large	128	180	4	4	98
	Large	180	256	2	2	100
BOULDER	Small	256	362			100
	Small	362	512			100
	Medium	512	1024			100
	Large/Very Large	1024	2048			100
BEDROCK	Bedrock	2048	>2048			100
			Total	**100**	**100**	**100**

Cross-Section 3	
Channel materials (mm)	
D_{16} =	6.3
D_{35} =	19.7
D_{50} =	37.9
D_{84} =	95.4
D_{95} =	139.4
D_{100} =	256.0





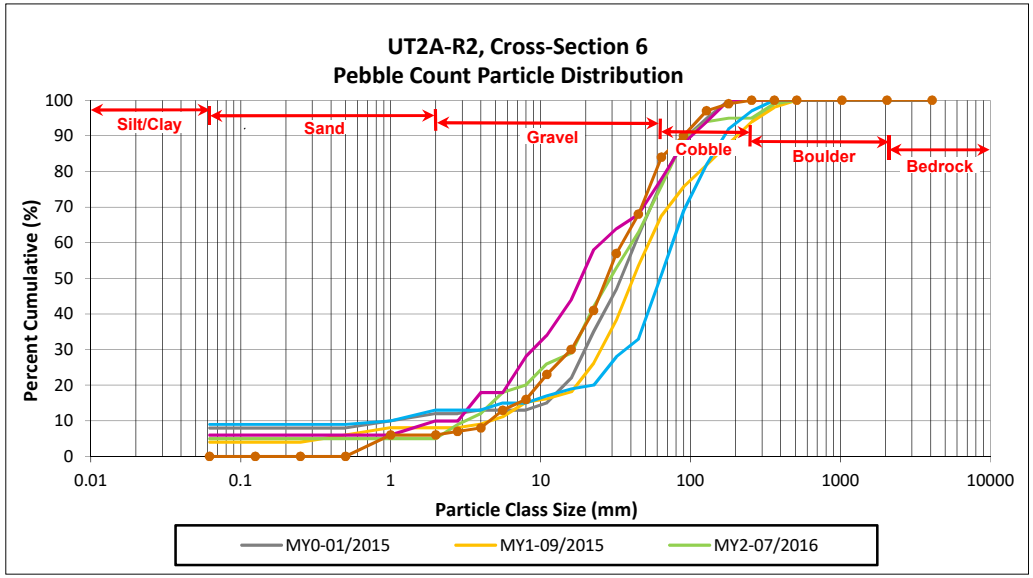
Reachwide and Cross-Section Pebble Count Plots

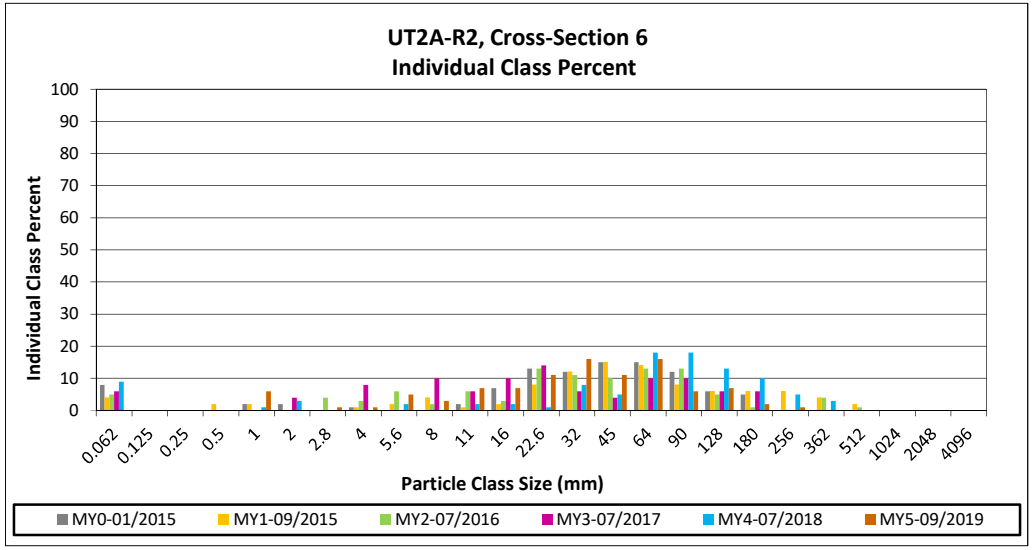
Hopewell Stream Mitigation Site
DMS Project No. 95352
Monitoring Year 5 - 2019

UT2A-R2, 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			0
	Coarse	0.5	1.0	6	6	6
	Very Coarse	1.0	2.0			6
GRAVEL	Very Fine	2.0	2.8	1	1	7
	Very Fine	2.8	4.0	1	1	8
	Fine	4.0	5.6	5	5	13
	Fine	5.6	8.0	3	3	16
	Medium	8.0	11.0	7	7	23
	Medium	11.0	16.0	7	7	30
	Coarse	16.0	22.6	11	11	41
	Coarse	22.6	32	16	16	57
	Very Coarse	32	45	11	11	68
	Very Coarse	45	64	16	16	84
COBBLE	Small	64	90	6	6	90
	Small	90	128	7	7	97
	Large	128	180	2	2	99
	Large	180	256	1	1	100
BOULDER	Small	256	362			100
	Small	362	512			100
	Medium	512	1024			100
	Large/Very Large	1024	2048			100
BEDROCK	Bedrock	2048	>2048			100
			Total	**100**	**100**	**100**

Cross-Section 6	
Channel materials (mm)	
D_{16} =	8.0
D_{35} =	18.7
D_{50} =	27.5
D_{84} =	64.0
D_{95} =	115.7
D_{100} =	256.0





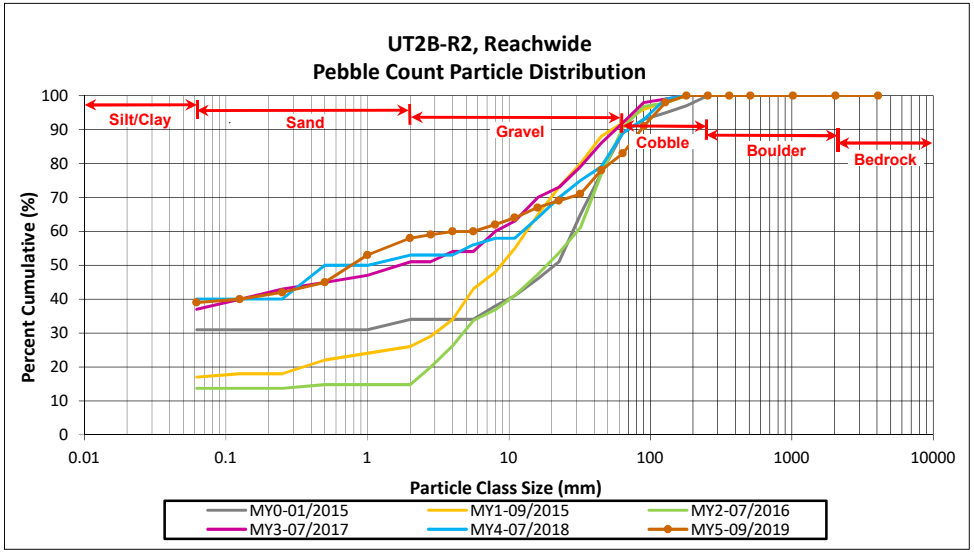
Reachwide and Cross-Section Pebble Count Plots

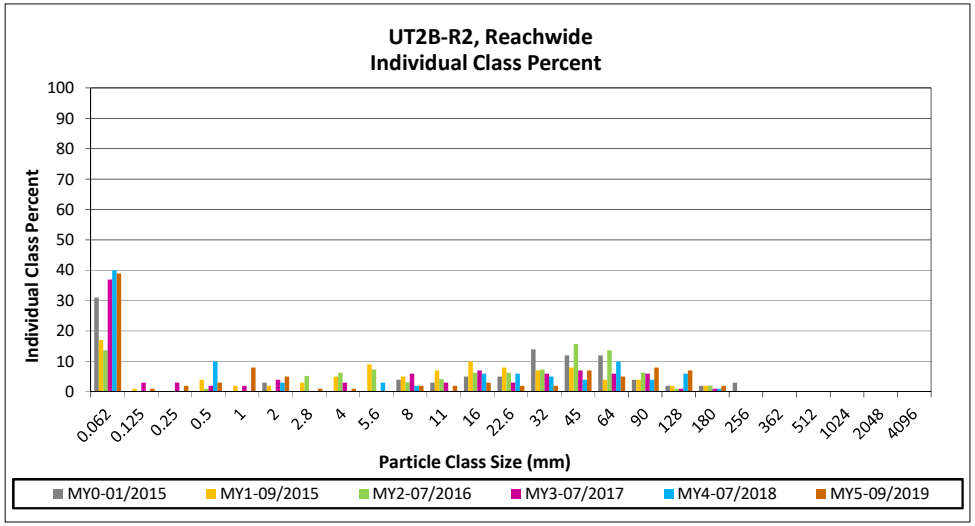
Hopewell Stream Mitigation Site
DMS Project No. 95352
Monitoring Year 5 - 2019

UT2B-R2, Reachwide

Particle Class		Diameter (mm)		Particle Count			Reach Summary	
		min	max	Riffle	Pool	Total	Class Percentage	Percent Cumulative
SILT/CLAY	Silt/Clay	0.000	0.062	11	28	39	39	39
SAND	Very fine	0.062	0.125		1	1	1	40
	Fine	0.125	0.250		2	2	2	42
	Medium	0.25	0.50	1	2	3	3	45
	Coarse	0.5	1.0	2	6	8	8	53
	Very Coarse	1.0	2.0	1	4	5	5	58
GRAVEL	Very Fine	2.0	2.8	1		1	1	59
	Very Fine	2.8	4.0		1	1	1	60
	Fine	4.0	5.6					60
	Fine	5.6	8.0	1	1	2	2	62
	Medium	8.0	11.0	2		2	2	64
	Medium	11.0	16.0	2	1	3	3	67
	Coarse	16.0	22.6	2		2	2	69
	Coarse	22.6	32	2		2	2	71
	Very Coarse	32	45	6	1	7	7	78
	Very Coarse	45	64	4	1	5	5	83
COBBLE	Small	64	90	6	2	8	8	91
	Small	90	128	7		7	7	98
	Large	128	180	2		2	2	100
	Large	180	256					100
BOULDER	Small	256	362					100
	Small	362	512					100
	Medium	512	1024					100
	Large/Very Large	1024	2048					100
BEDROCK	Bedrock	2048	>2048					100
			Total	**50**	**50**	**100**	**100**	**100**

Reachwide	
Channel materials (mm)	
D_{16} =	Silt/Clay
D_{35} =	Silt/Clay
D_{50} =	0.8
D_{84} =	66.8
D_{95} =	110.1
D_{100} =	180.0





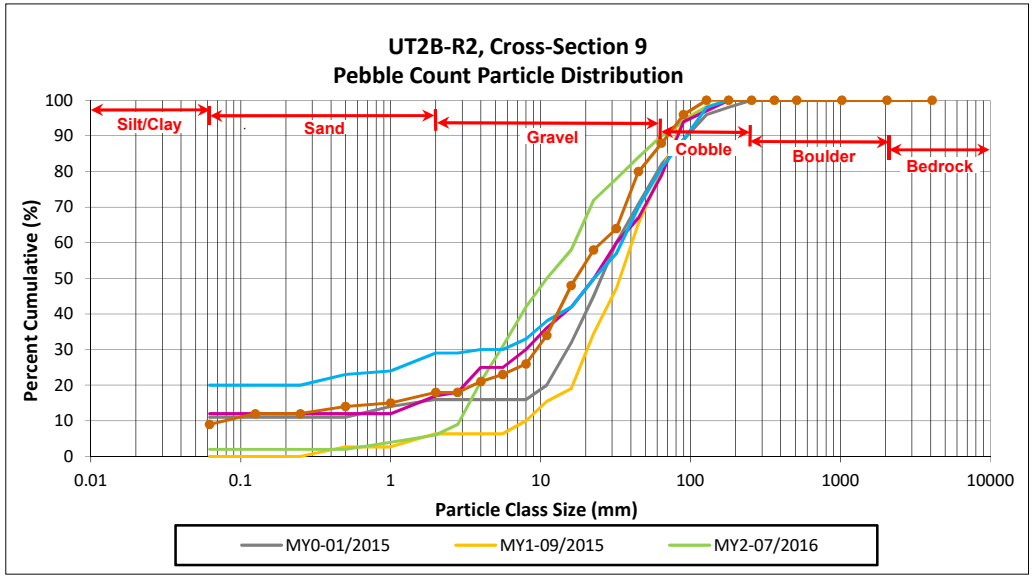
Reachwide and Cross-Section Pebble Count Plots

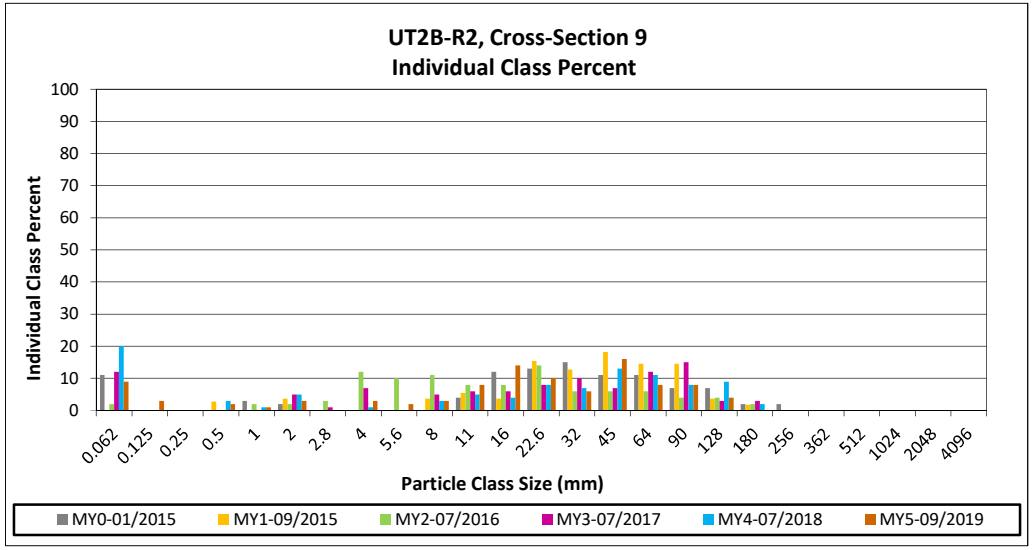
Hopewell Stream Mitigation Site
DMS Project No. 95352
Monitoring Year 5 - 2019

UT2B-R2, Cross-Section 9

Particle Class		Diameter (mm)		Riffle 100-Count	Summary	
		min	max		Class Percentage	Percent Cumulative
SILT/CLAY	Silt/Clay	0.000	0.062	9	9	9
SAND	Very fine	0.062	0.125	3	3	12
	Fine	0.125	0.250			12
	Medium	0.25	0.50	2	2	14
	Coarse	0.5	1.0	1	1	15
	Very Coarse	1.0	2.0	3	3	18
GRAVEL	Very Fine	2.0	2.8			18
	Very Fine	2.8	4.0	3	3	21
	Fine	4.0	5.6	2	2	23
	Fine	5.6	8.0	3	3	26
	Medium	8.0	11.0	8	8	34
	Medium	11.0	16.0	14	14	48
	Coarse	16.0	22.6	10	10	58
	Coarse	22.6	32	6	6	64
	Very Coarse	32	45	16	16	80
	Very Coarse	45	64	8	8	88
COBBLE	Small	64	90	8	8	96
	Small	90	128	4	4	100
	Large	128	180			100
	Large	180	256			100
BOULDER	Small	256	362			100
	Small	362	512			100
	Medium	512	1024			100
	Large/Very Large	1024	2048			100
BEDROCK	Bedrock	2048	>2048			100
			Total	**100**	**100**	**100**

Cross-Section 9	
Channel materials (mm)	
D_{16} =	1.3
D_{35} =	11.3
D_{50} =	17.1
D_{84} =	53.7
D_{95} =	86.2
D_{100} =	128.0





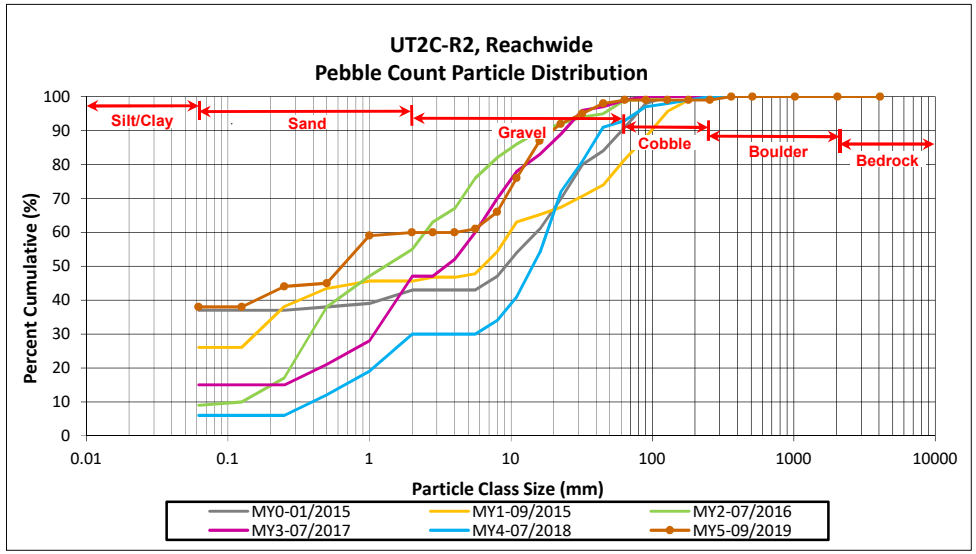
Reachwide and Cross-Section Pebble Count Plots

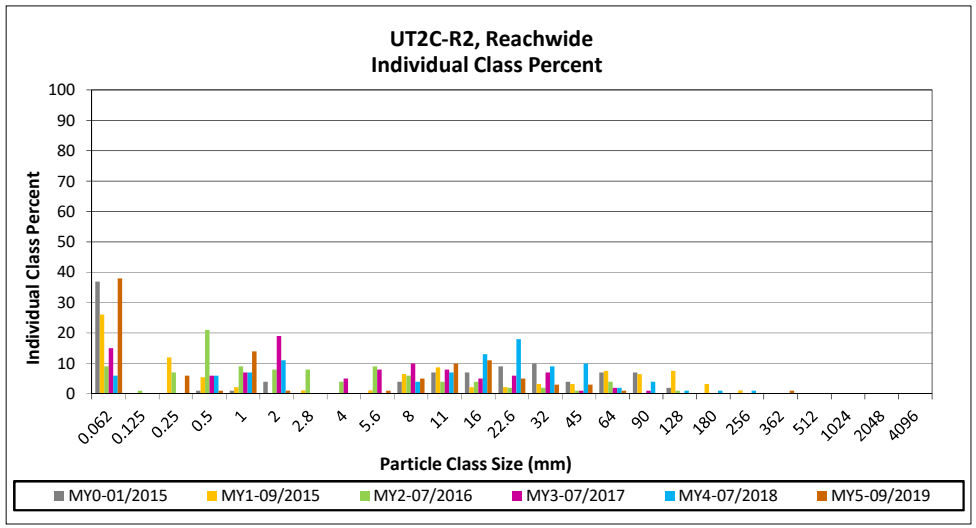
Hopewell Stream Mitigation Site
DMS Project No. 95352
Monitoring Year 5 - 2019

UT2C-R2, Reachwide

Particle Class		Diameter (mm)		Particle Count			Reach Summary	
		min	max	Riffle	Pool	Total	Class Percentage	Percent Cumulative
SILT/CLAY	Silt/Clay	0.000	0.062	7	31	38	38	38
SAND	Very fine	0.062	0.125					38
	Fine	0.125	0.250	1	5	6	6	44
	Medium	0.25	0.50		1	1	1	45
	Coarse	0.5	1.0	6	8	14	14	59
	Very Coarse	1.0	2.0	1		1	1	60
GRAVEL	Very Fine	2.0	2.8					60
	Very Fine	2.8	4.0					60
	Fine	4.0	5.6	1		1	1	61
	Fine	5.6	8.0	4	1	5	5	66
	Medium	8.0	11.0	7	3	10	10	76
	Medium	11.0	16.0	10	1	11	11	87
	Coarse	16.0	22.6	5		5	5	92
	Coarse	22.6	32	3		3	3	95
	Very Coarse	32	45	3		3	3	98
	Very Coarse	45	64	1		1	1	99
COBBLE	Small	64	90					99
	Small	90	128					99
	Large	128	180					99
	Large	180	256					99
BOULDER	Small	256	362	1		1	1	100
	Small	362	512					100
	Medium	512	1024					100
	Large/Very Large	1024	2048					100
BEDROCK	Bedrock	2048	>2048					100
			Total	**50**	**50**	**100**	**100**	**100**

Reachwide	
Channel materials (mm)	
D_{16} =	Silt/Clay
D_{35} =	Silt/Clay
D_{50} =	0.6
D_{84} =	14.4
D_{95} =	32.0
D_{100} =	362.0





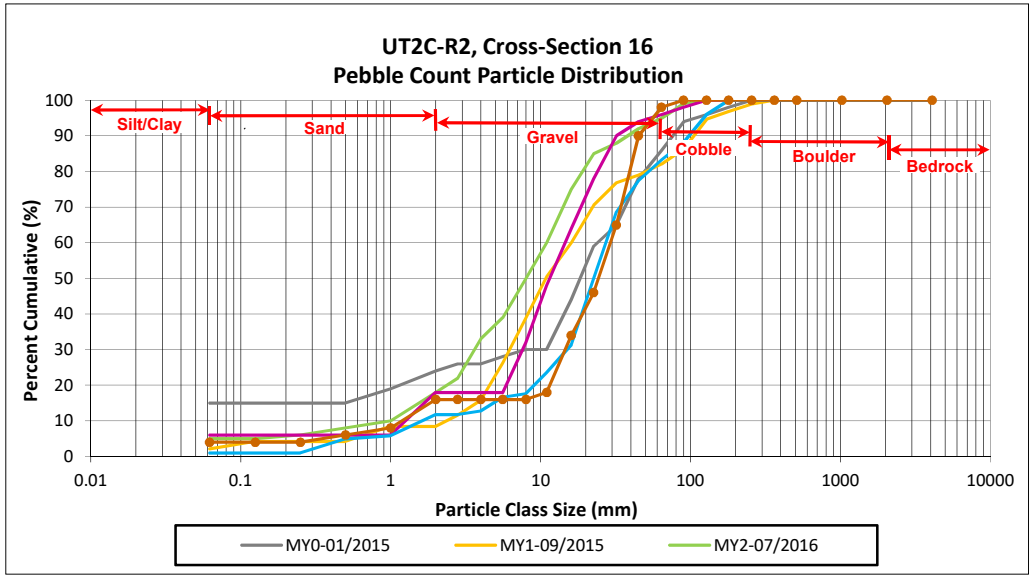
Reachwide and Cross-Section Pebble Count Plots

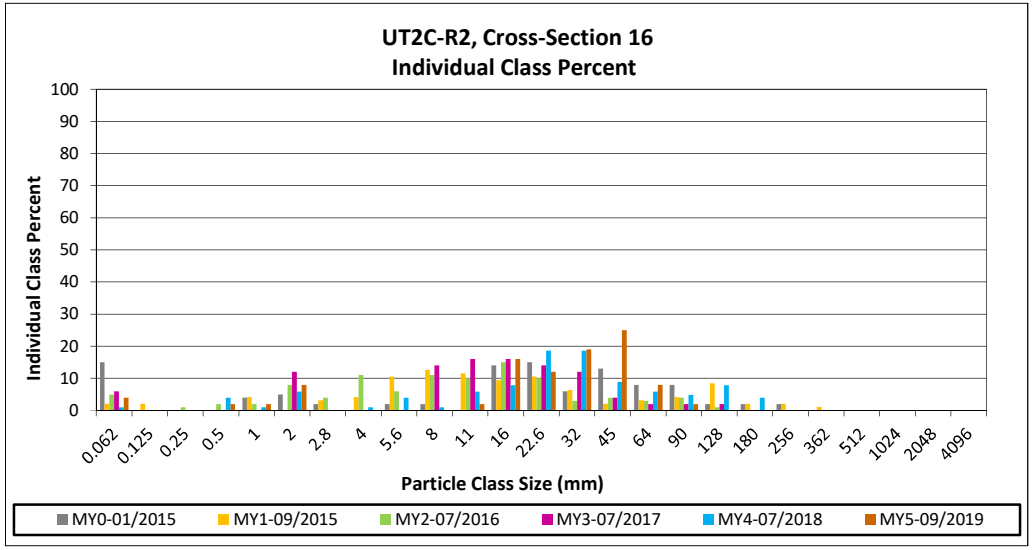
Hopewell Stream Mitigation Site
DMS Project No. 95352
Monitoring Year 5 - 2019

UT2C-R2, Cross-Section 16

Particle Class		Diameter (mm)		Riffle 100-Count	Summary	
		min	max		Class Percentage	Percent Cumulative
SILT/CLAY	Silt/Clay	0.000	0.062	4	4	4
SAND	Very fine	0.062	0.125			4
	Fine	0.125	0.250			4
	Medium	0.25	0.50	2	2	6
	Coarse	0.5	1.0	2	2	8
	Very Coarse	1.0	2.0	8	8	16
GRAVEL	Very Fine	2.0	2.8			16
	Very Fine	2.8	4.0			16
	Fine	4.0	5.6			16
	Fine	5.6	8.0			16
	Medium	8.0	11.0	2	2	18
	Medium	11.0	16.0	16	16	34
	Coarse	16.0	22.6	12	12	46
	Coarse	22.6	32	19	19	65
	Very Coarse	32	45	25	25	90
	Very Coarse	45	64	8	8	98
COBBLE	Small	64	90	2	2	100
	Small	90	128			100
	Large	128	180			100
	Large	180	256			100
BOULDER	Small	256	362			100
	Small	362	512			100
	Medium	512	1024			100
	Large/Very Large	1024	2048			100
BEDROCK	Bedrock	2048	>2048			100
			Total	**100**	**100**	**100**

Cross-Section 16	
Channel materials (mm)	
D_{16} =	2.0
D_{35} =	16.5
D_{50} =	24.3
D_{84} =	41.5
D_{95} =	56.1
D_{100} =	90.0





APPENDIX 5. Hydrology Summary Data

Table 13a. Verification of Bankfull Events
Hopewell Stream Mitigation Site
DMS Project No. 95352
Monitoring Year 5 - 2019

Reach	Monitoring Year	Date of Data Collection	Date of Occurrence	Method
UT1B Reach 1	MY1	3/25/2015	Unknown	Crest Gage
		7/9/2015	Unknown	Crest Gage
		8/6/2015	8/6/2015	Stream Gage
		10/3/2015	10/3/2015	Stream Gage
		11/5/2015	11/2/2015	Crest/Stream Gage
	MY2	2/16/2016	2/16/2016	Stream Gage
		4/19/2016	Unknown	Crest Gage
	MY3	1/2/2017	1/2/2017	Stream Gage
		4/6/2017	4/6/2017	Stream Gage
		4/24/2017	4/24/2017	Stream Gage
		5/5/2017	5/5/2017	Stream Gage
		5/24/2017	5/24/2017	Stream Gage
		6/21/2017	6/21/2017	Stream Gage
		7/8/2017	7/8/2017	Stream Gage
		9/1/2017	9/1/2017	Stream Gage
	MY4	7/23/2018	7/23/2018	Stream Gage
		8/3/2018	8/3/2018	Stream Gage
		8/20/2018	8/20/2018	Stream Gage
		8/31/2018	8/31/2018	Stream Gage
		9/15/2018	9/15/2018	Stream Gage
		9/16/2018[1]	9/16/2018	Stream Gage
		9/16/2018[1]	9/16/2018	Stream Gage
		9/27/2018	9/27/2018	Stream Gage
		10/11/2018	10/11/2018	Stream Gage
	MY5	1/11/2019	1/11/2019	Stream Gage
		1/19/2019	1/19/2019	Stream Gage
		1/21/2019	1/21/2019	Stream Gage
		2/16/2019	2/16/2019	Stream Gage
		2/21/2019	2/21/2019	Stream Gage
		2/22/2019	2/22/2019	Stream Gage
		3/3/2019	3/3/2019	Stream Gage
		4/5/2019	4/5/2019	Stream Gage
		4/8/2019	4/8/2019	Stream Gage
		4/13/2019	4/13/2019	Stream Gage
		6/9/2019	6/9/2019	Stream Gage
		9/9/2019	Unknown	Crest/Stream Gage

[1] Two bankfull events were documented on UT1B R1 during heavy rainfall related to the remnants of Hurricane Florence on 9/16/18.

Table 13b. Verification of Bankfull Events
Hopewell Stream Mitigation Site
DMS Project No. 95352
Monitoring Year 5 - 2019

Reach	Monitoring Year	Date of Data Collection	Date of Occurrence	Method
UT2 Reach 2	MY1	7/9/2015	Unknown	Crest Gage
		10/3/2015	10/3/2015	Stream Gage
		11/5/2015	11/2/2015	Crest/Stream Gage
	MY2	1/6/2016	1/6/2016	Stream Gage
		2/3/2016	2/3/2016	Stream Gage
		2/10/2016	2/10/2016	Stream Gage
		2/16/2016	2/16/2016	Stream Gage
		3/27/2016	3/27/2016	Stream Gage
		4/19/2016	Unknown	Crest Gage
		6/15/2016	6/15/2016	Stream Gage
	MY3	4/24/2017	4/24/2017	Stream Gage
		5/5/2017	5/5/2017	Stream Gage
		6/5/2017	6/5/2017	Stream Gage
		9/1/2017	9/1/2017	Stream Gage
	MY4	7/23/2018	7/23/2018	Stream Gage
		7/25/2018	7/25/2018	Stream Gage
		8/20/2018	8/20/2018	Stream Gage
		8/31/2018	8/31/2018	Stream Gage
		9/16/2018	9/16/2018	Stream Gage
		10/11/2018	10/11/2018	Stream Gage
	MY5	1/11/2019	1/11/2019	Stream Gage
		1/21/2019	1/21/2019	Stream Gage
		3/18/2019	Unknown	Crest Gage
		4/13/2019	4/13/2019	Stream Gage
		9/9/2019	Unknown	Crest Gage
UT2A Reach 2	MY1	3/25/2015	Unknown	Crest Gage
		10/3/2015	10/3/2015	Stream Gage
		11/5/2015	11/2/2015	Crest Gage
	MY2	1/20/2016	1/20/2016	Stream Gage
		6/15/2016	6/15/2016	Stream Gage
	MY3	1/9/2017	1/9/2017	Stream Gage
		5/5/2017	5/5/2017	Stream Gage
		6/21/2017	6/21/2017	Stream Gage
		7/8/2017	7/8/2017	Stream Gage
		9/1/2017	9/1/2017	Stream Gage
	MY4	7/23/2018	7/23/2018	Stream Gage
		8/20/2018	8/20/2018	Stream Gage
		8/31/2018	8/31/2018	Stream Gage
		9/16/2018	9/16/2018	Stream Gage
	MY5	1/11/2019	1/11/2019	Stream Gage
		1/21/2019	1/21/2019	Stream Gage
		3/18/2019	Unknown	Crest Gage
		4/13/2019	4/13/2019	Stream Gage

Table 13c. Verification of Bankfull Events
Hopewell Stream Mitigation Site
DMS Project No. 95352
Monitoring Year 5 - 2019

Reach	Monitoring Year	Date of Data Collection	Date of Occurrence	Method
UT2B Reach 2	MY1	3/25/2015	Unknown	Crest Gage
		7/9/2015	Unknown	Crest Gage
		10/3/2015	10/3/2015	Stream Gage
	MY2	1/25/2016	1/25/2016	Stream Gage
		2/16/2016	2/16/2016	Stream Gage
		4/19/2016	Unknown	Crest Gage
	MY3	4/6/2017	4/6/2017	Stream Gage
		4/24/2017	4/24/2017	Stream Gage
		5/5/2017	5/5/2017	Stream Gage
		5/24/2017	5/24/2017	Stream Gage
		6/21/2017	6/21/2017	Stream Gage
	MY4	9/16/2018	9/16/2018	Stream Gage
	MY5	1/11/2019	1/11/2019	Stream Gage
		1/21/2019	1/21/2019	Stream Gage
		3/18/2019	Unknown	Crest Gage
UT2C Reach 2	MY1	10/3/2015	10/3/2015	Stream Gage
		11/5/2015	11/2/2015	Crest Gage
	MY2	1/6/2016	1/7/2016	Stream Gage
		1/20/2016	1/20/2016	Stream Gage
		2/14/2016	2/15/2016	Stream Gage
		4/19/2016	Unknown	Crest Gage
	MY3	1/9/2017	1/9/2017	Stream Gage
	MY5	1/11/2019	1/11/2019	Stream Gage
		1/21/2019	1/21/2019	Stream Gage
		2/21/2019	2/21/2019	Stream Gage
		3/18/2019	Unknown	Crest Gage
		4/13/2019	4/14/2019	Stream Gage
		9/9/2019	Unknown	Crest Gage

APPENDIX 6. IRT MY4 Credit Release Site Walk Meeting Minutes

WILDLANDS
ENGINEERING

MEETING NOTES

MEETING: IRT MY4 Credit Release Site Walk
Hopewell Mitigation Site
Yadkin 03040104; Randolph County, NC
DEQ Contract No. 4642
DMS Project No. 95352
Wildlands Project No. 005-02133

DATE: Wednesday, May 29, 2019

LOCATION: Pisgah Covered Bridge Road
Asheboro, NC

Attendees

Todd Tugwell, USACE	Melonie Allen, DMS	Shawn Wilkerson, Wildlands
Kim Browning, USACE	Paul Wiesner, DMS	Jeff Keaton, Wildlands
Mac Haupt, DWR	Harry Tsomides, DMS	Kristi Suggs, Wildlands
Erin Davis, DWR	Joe Famularo, DMS	Ian Eckardt, Wildlands

Materials
Wildlands Engineering Hopewell Mitigation Site MY4 Monitoring Report dated December 13, 2018.

Meeting Notes

The purpose of the tour was to present the site to a group of IRT members and to get input into the condition of the site at this point in the monitoring period. Jeff Keaton of Wildlands Engineering, Inc. (Wildlands or WEI) began the meeting by giving the IRT members an overview of the project site. Then, portions of each of the project reaches were walked and discussed by the group.

1. UT2C

The tour began with Reaches 1 and 2 of UT2C. Jeff pointed out that the stream is spring fed and consistently has good flow. Reach 2 is a short reach where restoration was performed. The group only looked at a short section of this reach. Reach 1 is an enhancement reach. Todd Tugwell asked what work was done on the reach. Jeff and Shawn Wilkerson explained that the work consisted of fencing out cattle, planting trees in the left floodplain buffer zone, and treating privet. Todd noted several small privet trees, mostly in the right buffer area. Jeff explained that Wildlands has been treating privet every fall but not necessarily every location every year.

At this point, Erin Davis of DWR asked about the status of the issues with the fencing on the project. Jeff explained that there were a few spots where the fence was incorrectly installed inside the easement in short sections or a post was placed right on an easement corner. There was also an area on Little River where cows

were able to get into the easement and into the river. Jeff explained that the fencing issues have been corrected except for one small area on UT1 B where the landowner has refused to allow the fence to be moved.

Shawn explained that Wildlands has discussed this area with the landowner multiple times. Wildlands attempted to modify the easement, so that the existing fence would be outside of it, but DMS would not allow it. Shawn stated the next and last step would be for Wildlands to send a letter explaining that if the fence is not relocated outside of the easement, that State would further pursue the issue and legally require the fence to be moved. Shawn said that the letter would go out within a few of weeks after the completion of the site visit.

2. UT2A Reach 2

The tour continued with UT2A Reach 2. The stream was difficult to access due to vegetation growth within the easement. A short section was walked. The group seemed to agree that the stream looked stable and that the tree growth was good. Shawn mentioned that this small stream has always had flow.

3. UT2B

Next, the group walked the lower section of UT2B. Todd was interested to see how much privet remained along this reach. Many dead privet plants that had been treated the previous fall were observed but a few plants remained.

4. UT2A Reach 1

The group walked a portion of UT2A next. Jeff explained that this Enhancement I reach was constructed by adding a series of riffles to raise the bed of the stream. Portions of the reach were completely reconstructed. It was noted that there was previously a lot of privet in this area too, but that it has been successfully treated.

5. UT2 Reach 1

The group walked a short section of this reach. It was difficult to access due to dense vegetation growth within the easement. It was noted that the stream looked stable.

6. UT1B Reach 1

At this point, the group drove to the east side of the property. The first area visited on the east side of the site was UT1B Reach 1. There was discussion about this area because the planted vegetation is not performing as well as the rest of the site and sweetgums and pines have proliferated in the last couple of years. Jeff explained that, due to the cut in this area, the soils were not as good for growing the planted trees. Todd stated that this area is not meeting the intent of the mitigation plan or the success criteria for vegetation. It was also noted that the stream channel has a lot of herbaceous growth, probably due to the open canopy.

Todd and Mac suggested that Wildlands should remove the sweetgums and some of the pines and replant the trees specified in the planting plan, possibly as containerized plants rather than bare roots. Shawn indicated that he agreed, and Wildlands would conduct the activities during the next planting season. There was also an agreement that no work, such as removing in-stream vegetation or sediment by raking, hand digging, or other mechanical means, should be conducted in the channel. Instead, the planting of some of the proposed container plants, closer to the stream's top of bank, would be implemented in order to shade out the in-stream wetland vegetation.

The group also looked at the area where the landowner would not allow the fence to be moved (previously referenced in Section 1. UT2C). During this discussion, Kristi Suggs said she believed the corner fence post was about 32 feet inside the easement. Jeff stated that the buffer width in this area is still at least 50 feet. Shawn

reiterated his earlier statement from when the group was walking UT2C. The IRT also felt that the fence line should be moved out to the easement, reiterating Wildlands' and DMS' position.

Wildlands indicated that they will send the landowner a letter, within the next few weeks, asking the property owner once again to allow the fence line to be moved, in order to be easement-compliant, or the matter will be turned over to the State for possible legal action. Wildlands will let DMS look at the WEI letter before it is sent to the landowner. The letter will explain to the landowner that the fence needs to be moved into alignment with the easement and will give a timeline (60 days) for completion.

7. UT1A Reach 1

The group then walked to UT1A. There have been questions about the possibility that this stream is ephemeral. During the site visit the stream was flowing. Jeff and Ian Eckardt explained that Wildlands had installed a trail cam and had about 6 months of data indicating that the stream had flow continuously through that period. Todd asked what work had been done on this reach. Jeff stated that cows had been fenced out and supplemental planting had been done outside the woods line on the left floodplain.

8. Little River

The group walked a short portion of Little River. Shawn pointed out how successful the privet removal had been in this area. A large debris jam in the river was noted.

9. UT1B Reach 3

The last reach the group looked at was UT1B Reach 3. There have been some concerns that this reach, which is below the pond dam, would have issues with maintaining adequate flow frequencies. The stream was flowing on this day, and Wildlands indicated that flow frequencies have not been of issue on the reach.

10. Summary Discussion

Back at the vehicles, the group briefly discussed the overall site. Todd stated that the main issues are the vegetation problems on UT1B Reach 1, the remaining fencing issue on that reach, and on-going privet treatment throughout the site. The IRT agreed to release MY4 credits per the credit release schedule established in the approved Mitigation Plan.

These meeting minutes were prepared by Jeff Keaton and Kristi Suggs on June 6, 2019 and reviewed by Shawn Wilkerson on June 7, 2019 and represent the authors' interpretation of events. The minutes were subsequently revised on 6/14/2019 to incorporate comments received in an email from Harry Tsmoides with DMS on 6/12/2019.