



MONITORING YEAR 1 ANNUAL REPORT

Final

HOPEWELL STREAM MITIGATION SITE

Randolph County, NC
NCDEQ Contract 004642
NCDMS Project Number 95352

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EXECUTIVE SUMMARY

Wildlands Engineering (Wildlands) completed a full delivery project at the Hopewell Mitigation Site (Site) for the North Carolina Division of Mitigation Services (NCDMS) 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). The Site is located near the town of Asheboro in Randolph County, NC in the Yadkin-Pee Dee River Basin; eight digit Cataloging Unit (CU) 03040104 and the 14-digit Hydrologic Unit Code (HUC) 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 (Figures 2a and 2b). The adjacent land to the streams and wetlands is primarily pasture lands 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 NCDMS 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 and as-built surveys were completed between July 2014 and January 2015. A conservation easement is in place on 35.954 acres of the riparian corridors to protect them in perpetuity.

Monitoring Year 1 (MY1) assessments and site visits were completed during July and September, 2015 to assess the conditions of the project. Overall, the Site has met the required vegetation and stream success criteria for MY1. The overall average stem density for the Site is 526 stems per acre and is therefore on track to meet the MY3 requirement of 320 stems per acre. All restored and enhanced streams are stable and functioning as designed. Five hydrology monitoring stations with crest gages and pressure transducers were installed on the Site to document bankfull events. At least one bankfull event has been recorded since construction completion.



HOPEWELL STREAM MITIGATION SITE
Monitoring Year 1 Annual Report

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Section 1: PROJECT OVERVIEW

The Hopewell Stream Mitigation Site is located in central Randolph 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 east of Interstate 74/73. The Site is located 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. 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) and enhancement II (EII) reaches included UT1B, EI (Reach 1); UT2A, EI (Reach 1); Little River, EII (Reach 2); UT1A, EII (Reach 1); UT1B, EII (Reach 2 and 3); UT2B, EII (Reach 1); and UT2C, EII (Reach 1). Preservation reaches at the Site included Little River (Reach 1) and UT1A (Reach 2). Mitigation work within the Site included restoration, enhancement, and preservation of 12,308 linear feet (LF) of perennial and intermittent stream channel. The riparian areas were planted with native vegetation to improve habitat and protect water quality. Construction activities were completed by Terry's Plumbing 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; 35.954 ac (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 established were completed with careful consideration of goals and objectives that were described in the RBRP and to meet NCDMS 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:

- 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 NCDMS in October of 2013. Construction activities were completed by 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 2022 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 1 Data Assessment

Annual monitoring and quarterly site visits were conducted during MY1 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).

1.2.1 Vegetative Assessment

Planted woody vegetation is being monitored in accordance with the guidelines and procedures developed by the Carolina Vegetation Survey-EEP Level 2 Protocol (Lee et al., 2008). 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 seven year monitoring period (MY7). The interim measure of vegetative success for the Site will be the survival of at least 320 planted stems per acre at the end of year three of the monitoring period (MY3) and 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 is provided by the United States Army Corps of Engineers in consultation with the NC Interagency Review Team.

The MY1 vegetative survey was completed in September 2015. The 2015 vegetation monitoring resulted in an average stem density of 526 stems per acre, which is greater than the interim requirement of 320 stems/acre required at MY3, but approximately 19% less than the baseline density recorded at MY0, 649 stems/acre in January 2015. There is an average of 13 stems per plot as compared to 16 stems per plot in MY0. All 31 of the plots are on track to meet the success criteria required for MY7 (Table 9, Appendix 3). Please refer to Appendix 2 for vegetation plot photographs and the vegetation condition assessment table and Appendix 3 for vegetation data tables.

1.2.2 Vegetation Areas of Concern

While significant efforts were implemented during construction to control the invasive species within the Site, visual assessments in MY1 revealed areas in which follow up treatments will be necessary. Re-sprouts from the initial treatment of the non-native invasive shrub, Chinese privet (*Ligustrum sinense*), is present along the restoration and enhancement reaches. The non-native tree of heaven (*Ailanthus altissima*) was also noted in isolated areas along UT2 and UT2C. Other non-native species of concern include multiflora rose (*Rosa multiflora*) and Japanese honeysuckle (*Lonicera japonica*), which were identified within isolated areas along reaches of Little River, UT1A, UT1B, UT2, and UT2C. The native invasive cattail (*Typha latifolia*) is colonizing small sections of the channel within the restoration reaches of UT2C, UT2, and UT2A.

Along the upper section of UT1B Reach 1 there are several, small bare areas (<1% of the planted acreage). In these bare areas the planted trees appear healthy, but the herbaceous layer is not well established. Refer to Appendix 2 for the vegetation condition assessment table, Integrated Current Condition Plan View (CCPV), and reference photographs.

1.2.3 Stream Assessment

Morphological surveys for the MY1 were conducted in September 2015. All streams within the site are stable.

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. Surveyed riffle cross sections fell within the parameters defined for channels of the appropriate Rosgen stream type.

Longitudinal profile surveys are not required on the project unless visual inspection indicates reach wide vertical instability. 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.

In general, substrate materials in the restoration and enhancement reaches indicated maintenance of coarser materials in the riffle reaches and finer particles in the pools. In most riffle cross sections, the particle size distribution for MY1 is similar or slightly larger than the as-built conditions.

1.2.4 Stream Areas of Concern

No stream areas of concern were identified during MY1.

1.2.5 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. Bankfull events were recorded on the stream reaches during the MY1 data collection.

Bankfull events were recorded on all restoration reaches during MY1 resulting in partial attainment of the stream hydrology assessment criteria. Refer to Appendix 5 for hydrologic data and graphs.

1.2.6 Maintenance Plan

Wildlands plans to implement an invasive treatment plan to reduce and control the extent of invasive species at the Site. Herbicidal treatments are planned for the fall and winter of 2015/2016. Additional follow up treatments will be conducted annually as necessary.

Wildlands plans to incorporate lime into the soil at those areas along UT1B Reach 1 that were noted with poor herbaceous growth. Incorporation of lime in these areas is expected to result in a decrease in the soil pH therefor promoting improved herbaceous growing conditions. This area will be monitored, and any additional actions deemed necessary to promote herbaceous plant growth will be taken.

1.3 Monitoring Year 1 Summary

All streams within the Site are stable and functioning as designed. The average stem density for the Site is on track to meeting the MY7 success criteria; all individual vegetation plots meet the MY1 success criteria as noted in CCPV. At least one bankfull event has been documented within the restored stream reaches at the Site.

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 NCDMS's website. All raw data supporting the tables and figures in the appendices are available from NCDMS upon request.

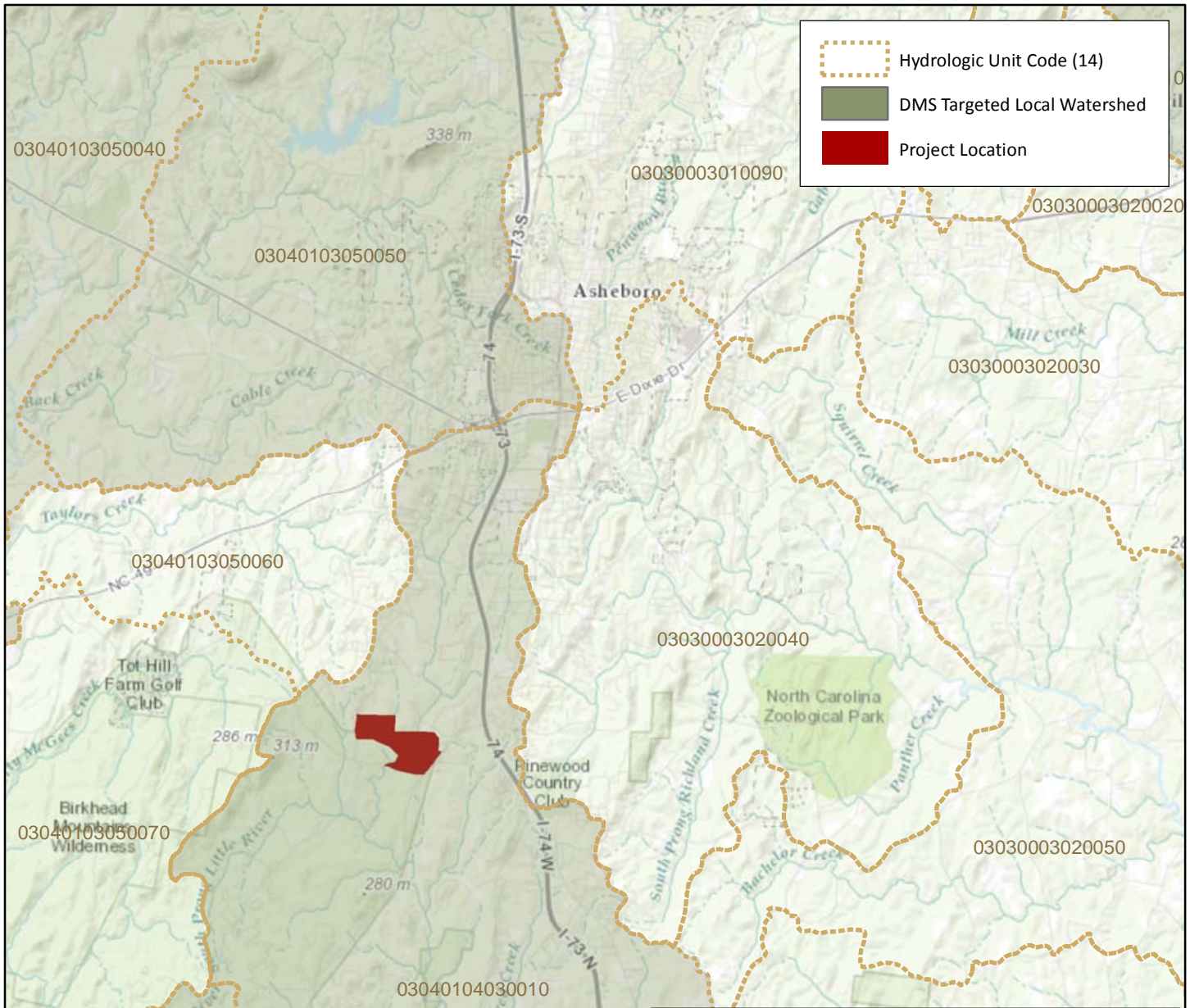
Section 2: METHODOLOGY

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. 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.
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- Wildlands Engineering, Inc. 2015. Hopewell Stream Mitigation Site Baseline Monitoring Document and As-Built Baseline Report. NCEEP, Raleigh, NC.
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APPENDIX 1. General Tables and Figures



	Hydrologic Unit Code (14)
	DMS Targeted Local Watershed
	Project Location

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 activities requires prior coordination with DMS.

Directions 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.



Figure 1 Vicinity Map
 Hopewell Stream Mitigation Site
 DMS Project Number 95352
 Monitoring Year 1 - 2015
 Randolph County, NC

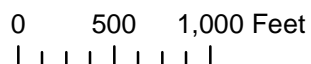
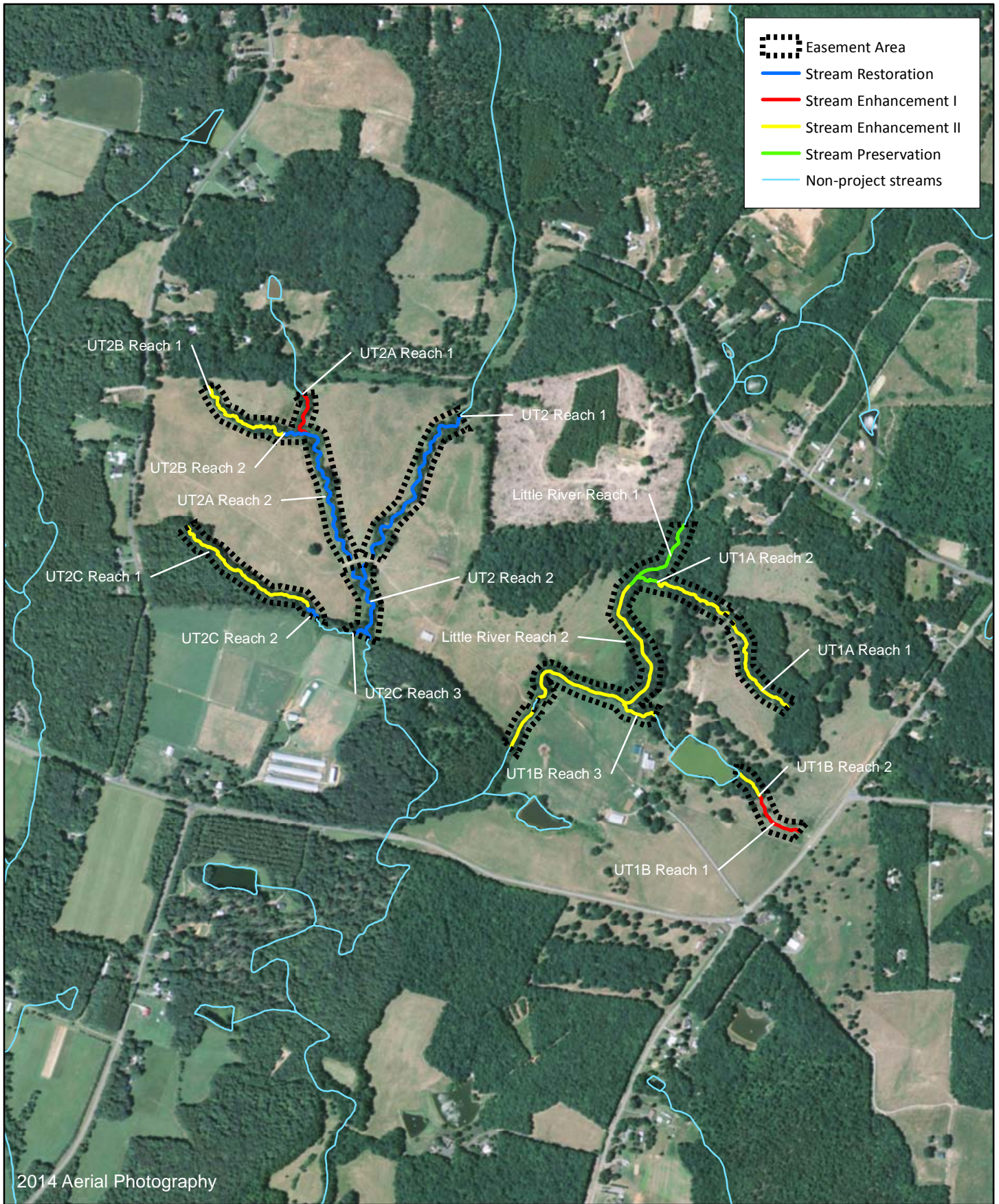


Figure 2 Project Component Map
 Hopewell Stream Mitigation Site
 DMS Project Number 95352
 Monitoring Year 1 - 2015
 Randolph County, NC

Table 1. Project Components and Mitigation Credits
 Hopewell Stream Mitigation Site (NCDMS Project No.95352)
 Monitoring Year 1 - 2015

MITIGATION CREDITS									
Type	Stream		Riparian Wetland		Non-Riparian Wetland		Buffer	Nitrogen Nutrient Offset	Phosphorous Nutrient Offset
	R	RE	R	RE	R	RE			
Totals	7,248	164	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	141	
Little River Reach 2	107+04 - 126+53 128+06 - 131+57	2,374	Fencing / Invasives Control	EII	2,300	2.5:1	920	
UT1A Reach 1	200+00 - 208+95 209+84 - 217+00	1,611	Fencing / Invasives Control	EII	1,611	2.5:1	644	
UT1A Reach 2	217+00 - 218+17	117	Preservation	P	117	5:1	23	
UT1B Reach 1	300+87 - 305+67	475	Fencing / Invasives Control	EI	480	1.5:1	320	
UT1B Reach 2 & 3	305+67 - 308+25 350+00 - 353+17	580	Fencing / Invasives Control	EII	575	2.5:1	230	
UT2 Reach 1 & 2	400+00 - 415+47 416+35 - 423+16	2,419	Priority 1	Restoration	2,228	1:1	2,228	
UT2A Reach 1	500+39 - 504+25	386	Fencing / Invasives Control	EI	386	1.5:1	257	
UT2A Reach 2	504+25 - 516+21 517+00 - 518+68	1,368	Priority 1	Restoration	1,364	1:1	1,364	
UT2B Reach 1	600+00 - 608+48	848	Fencing / Invasives Control	EII	848	2.5:1	339	
UT2B Reach 2	608+48 - 610+46	114	Priority 1	Restoration	198	1:1	198	
UT2C Reach 1	700+00 - 712+50	1,215	Fencing / Invasives Control	EII	1,250	2.5:1	500	
UT2C Reach 2	712+50 - 713+60	326	Priority 1	Restoration	110	1:1	110	
UT2C Reach 3	800+00 - 801+37		Priority 1	Restoration	137	1:1	137	

COMPONENT SUMMATION						
Restoration Level	Stream (LF)	Riparian Wetland (acres)		Non-Riparian Wetland (acres)	Buffer (square feet)	Upland (acres)
		Riverine	Non-Riverine			
Restoration	4,037	-	-	-	-	-
Enhancement		-	-	-	-	-
Enhancement I	866					
Enhancement II	6,584					
Creation		-	-	-		
Preservation	821	-	-	-		-
High Quality Preservation	-	-	-	-		-

Table 2. Project Activity and Reporting History

Hopewell Stream Mitigation Site (NCDMS Project No.95352)
Monitoring Year 1 - 2015

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	September 2015	December 2015
Year 2 Monitoring	2016	December 2016
Year 3 Monitoring	2017	December 2017
Year 4 Monitoring	2018	December 2018
Year 5 Monitoring	2019	December 2019
Year 6 Monitoring	2020	December 2020
Year 7 Monitoring	2021	December 2021

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

Table 3. Project Contact Table

Hopewell Stream Mitigation Site (NCDMS Project No.95352)
Monitoring Year 1 - 2015

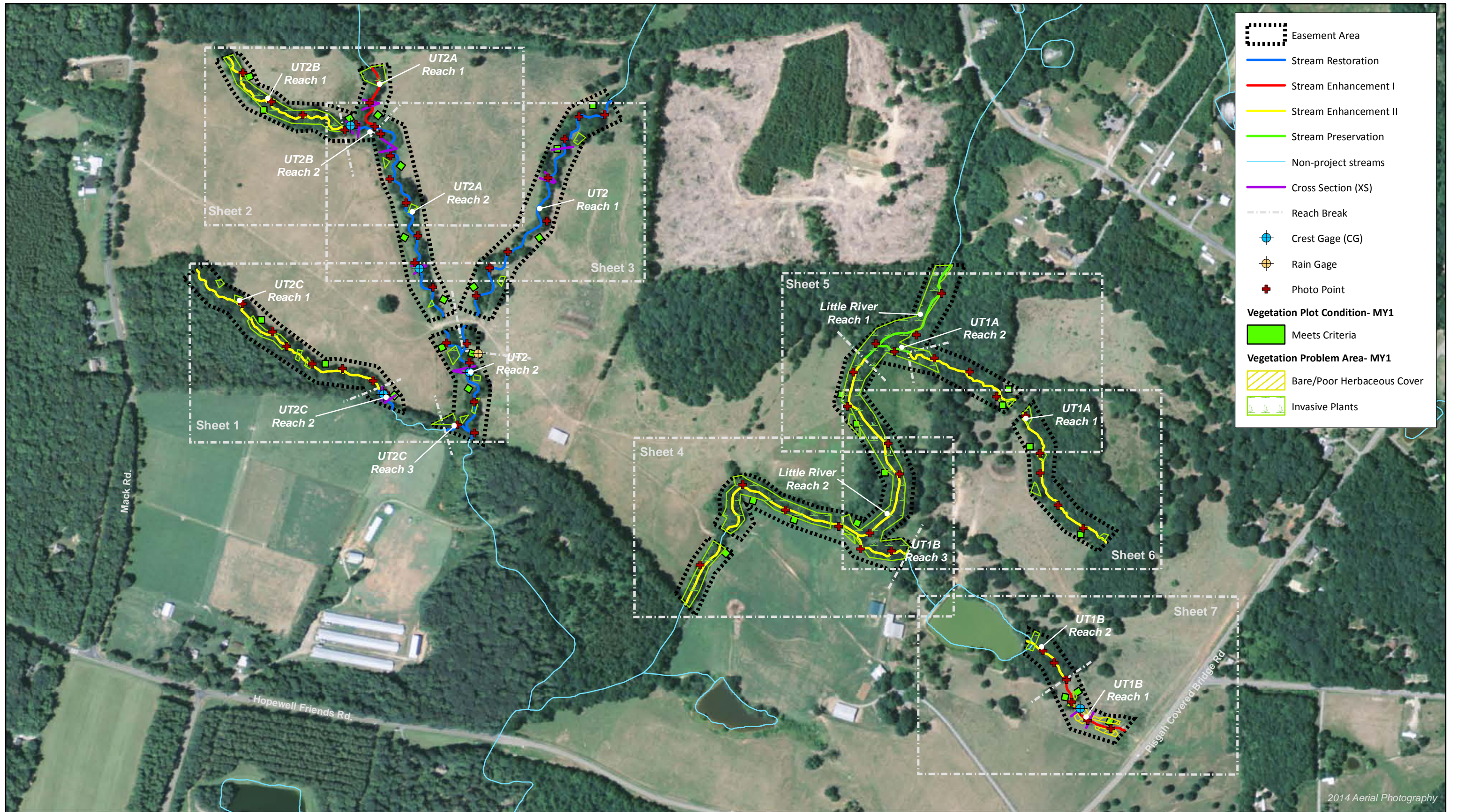
Designer Jeff Keaton, PE	Wildlands Engineering, Inc. 312 West Millbrook Road, Suite 225 Raleigh, NC 27609 919.851.9986
Construction Contractor	Terry's Plumbing 465 Lewallen Road Asheboro, NC 27205
	Land Mechanics Designs, Inc. 126 Circle G Lane Willow Spring, NC 27592
Planting Contractor	Bruton Natural 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 Live Stakes	Dykes and Son Nursery Bruton Natural Systems, Inc
Monitoring Performers	Wildlands Engineering, Inc.
Monitoring, POC	Kirsten Gimbert 704.332.7754, ext. 110

Table 4. Project Information and Attributes

Hopewell Stream Mitigation Site (NCDMS Project No.95352)
Monitoring Year 1 - 2015

PROJECT INFORMATION										
Project Name	Hopewell Stream Mitigation Site									
County	Randolph county									
Project Area (acres)	35									
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 Drainage Area (acres)	4,517									
Project Drainage Area Percentage of Impervious Area	<1%									
CGIA Land Use Classification	2.01.03 – Hay and Pasture Land; 2.99.05 - Farm Ponds; 4 – Forest 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	3,004	1,728	480	575	1,547	681	386	1,364	1,046	1,497
Drainage Area (acres)	4083	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 Description (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



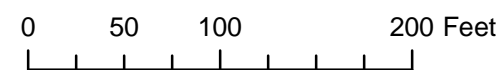
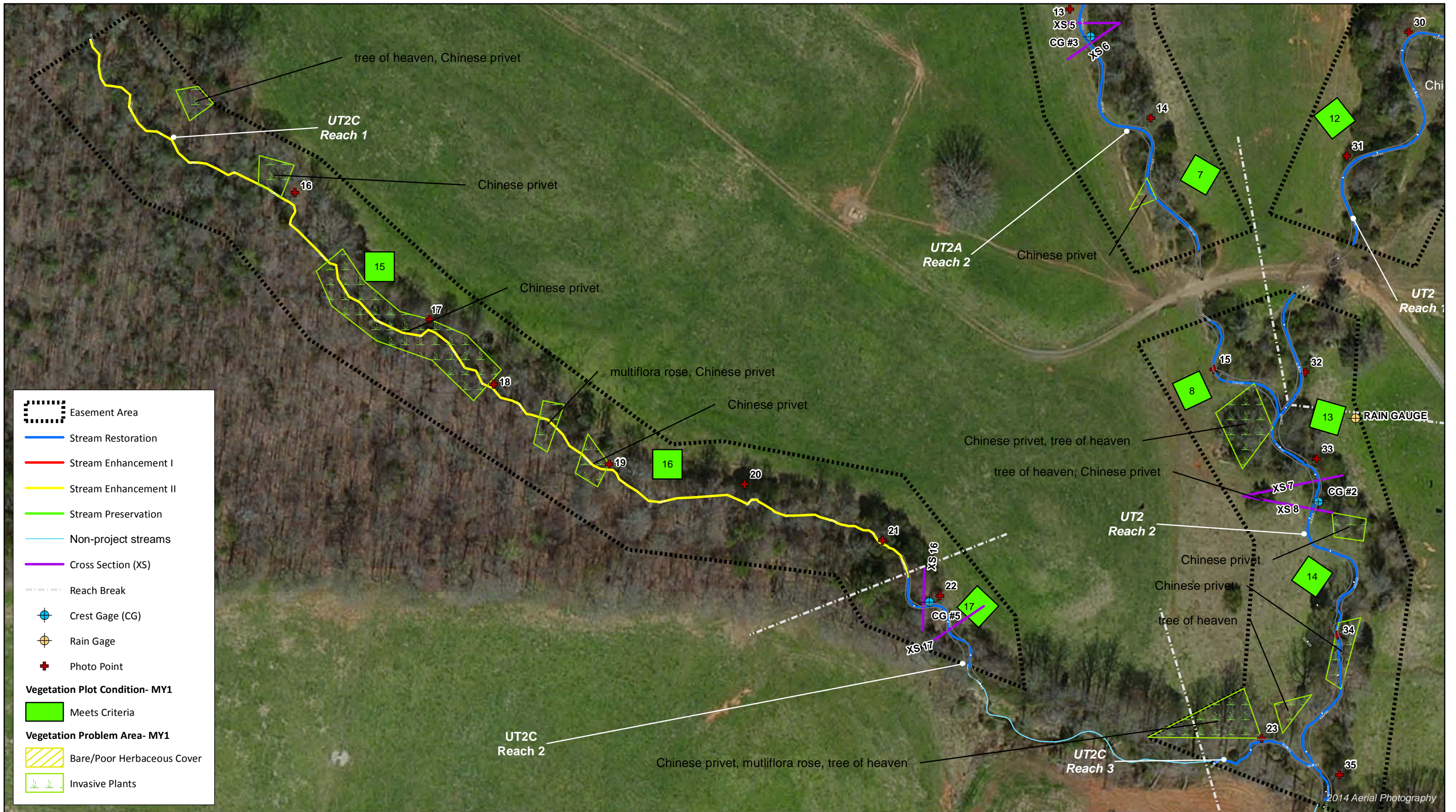


Figure 3.1 Integrated Current Condition Plan View (Sheet 1 of 7)
 Hopewell Stream Mitigation Site
 DMS Project Number 95352
 Monitoring Year 1 - 2015
 Randolph County



2014 Aerial Photography

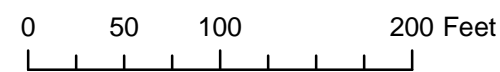
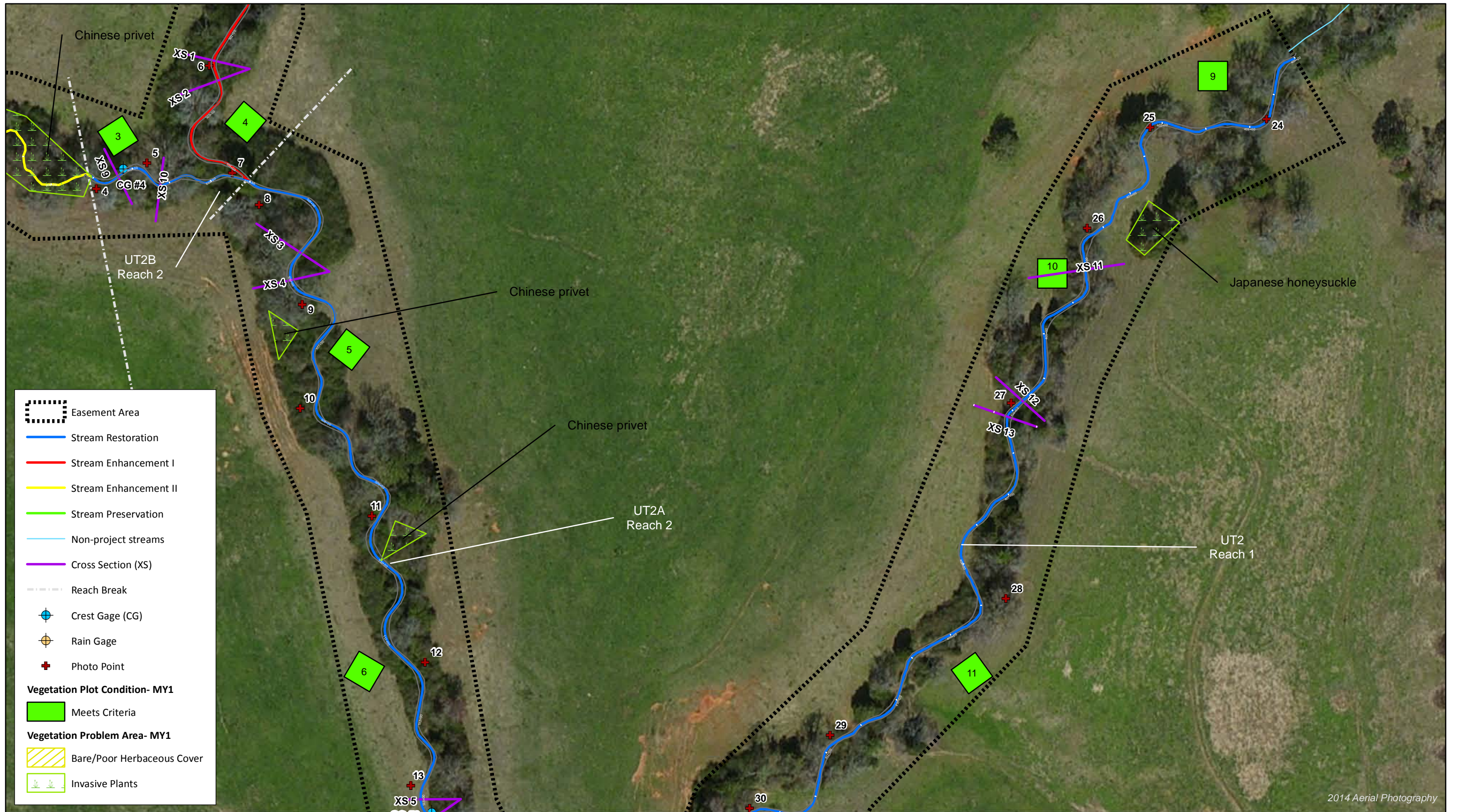


Figure 3.2 Integrated Current Condition Plan View (Sheet 2 of 7)
 Hopewell Stream Mitigation Site
 DMS Project Number 95352
 Monitoring Year 1 - 2015
 Randolph County



2014 Aerial Photography

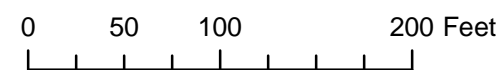


Figure 3.3 Integrated Current Condition Plan View (Sheet 3 of 7)
 Hopewell Stream Mitigation Site
 DMS Project Number 95352
 Monitoring Year 1 - 2015
 Randolph County





2014 Aerial Photography

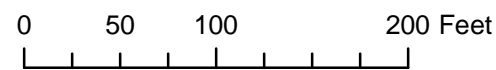
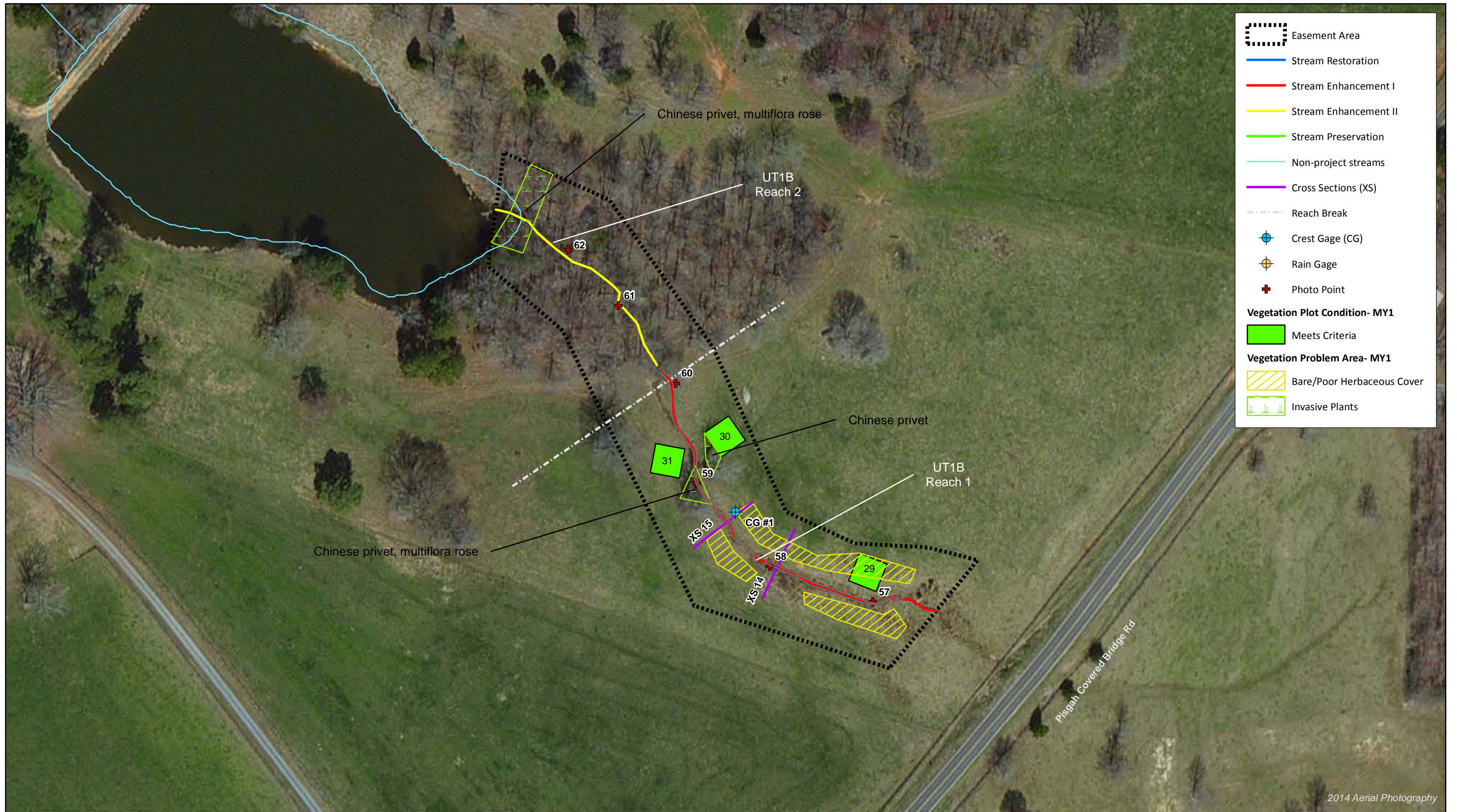


Figure 3.6 Integrated Current Condition Plan View (Sheet 6 of 7)
 Hopewell Stream Mitigation Site
 DMS Project Number 95352
 Monitoring Year 1 - 2015
 Randolph County



	Easement Area
	Stream Restoration
	Stream Enhancement I
	Stream Enhancement II
	Stream Preservation
	Non-project streams
	Cross Sections (XS)
	Reach Break
	Crest Gage (CG)
	Rain Gage
	Photo Point
Vegetation Plot Condition- MY1	
	Meets Criteria
Vegetation Problem Area- MY1	
	Bare/Poor Herbaceous Cover
	Invasive Plants

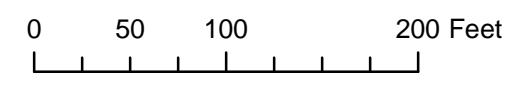


Figure 3.7 Integrated Current Condition Plan View (Sheet 7 of 7)
 Hopewell Stream Mitigation Site
 DMS Project Number 95352
 Monitoring Year 1 - 2015
 Randolph County

2014 Aerial Photography

Table 5a. Visual Stream Morphology Stability Assessment Table

Hopewell Stream Mitigation Site (NCDMS Project No. 95352)

UT1B Reach 1 (480 LF)

Monitoring Year 1 - 2015

Major Channel Category	Channel Sub-Category	Metric	Number Stable, Performing as Intended	Total Number in As-Built	Number of Unstable Segments	Amount of Unstable Footage	% Stable, Performing as Intended	Number with Stabilizing Woody Vegetation	Footage with Stabilizing Woody Vegetation	Adjust % for Stabilizing Woody Vegetation
1. Bed	1. Vertical Stability (Riffle and Run units)	Aggradation			0	0	100%			
		Degradation			0	0	100%			
	2. Riffle Condition	Texture/Substrate	8	8			100%			
	3. Meander Pool Condition	Depth Sufficient	8	8			100%			
		Length Appropriate	8	8			100%			
	4. Thalweg Position	Thalweg centering at upstream of meander bend (Run)	8	8			100%			
		Thalweg centering at downstream of meander bend (Glide)	8	8			100%			
2. Bank	1. Scoured/Eroded	Bank lacking vegetative cover resulting simply from poor growth and/or scour and erosion.			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			

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

Table 5b. Visual Stream Morphology Stability Assessment Table

Hopewell Stream Mitigation Site (NCDMS Project No. 95352)

UT2 Reach 1 & 2 (2,228 LF)

Monitoring Year 1 - 2015

Major Channel Category	Channel Sub-Category	Metric	Number Stable, Performing as Intended	Total Number in As-Built	Number of Unstable Segments	Amount of Unstable Footage	% Stable, Performing as Intended	Number with Stabilizing Woody Vegetation	Footage with Stabilizing Woody Vegetation	Adjust % for Stabilizing Woody Vegetation
1. Bed	1. Vertical Stability (Riffle and Run units)	Aggradation			0	0	100%			
		Degradation			0	0	100%			
	2. Riffle Condition	Texture/Substrate	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%			

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

Table 5c. Visual Stream Morphology Stability Assessment Table

Hopewell Stream Mitigation Site (NCDMS Project No. 95352)

UT2A Reach 1 & 2 (1,750 LF)

Monitoring Year 1 - 2015

Major Channel Category	Channel Sub-Category	Metric	Number Stable, Performing as Intended	Total Number in As-Built	Number of Unstable Segments	Amount of Unstable Footage	% Stable, Performing as Intended	Number with Stabilizing Woody Vegetation	Footage with Stabilizing Woody Vegetation	Adjust % for Stabilizing Woody Vegetation		
1. Bed	1. Vertical Stability (Riffle and Run units)	Aggradation			0	0	100%					
		Degradation			0	0	100%					
	2. Riffle Condition	Texture/Substrate	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%					

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

Table 5d. Visual Stream Morphology Stability Assessment Table

Hopewell Stream Mitigation Site (NCDMS Project No. 95352)

UT2B Reach 2 (198 LF)

Monitoring Year 1 - 2015

Major Channel Category	Channel Sub-Category	Metric	Number Stable, Performing as Intended	Total Number in As-Built	Number of Unstable Segments	Amount of Unstable Footage	% Stable, Performing as Intended	Number with Stabilizing Woody Vegetation	Footage with Stabilizing Woody Vegetation	Adjust % for Stabilizing Woody Vegetation
1. Bed	1. Vertical Stability (Riffle and Run units)	Aggradation			0	0	100%			
		Degradation			0	0	100%			
	2. Riffle Condition	Texture/Substrate	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%			

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

Table 5e. Visual Stream Morphology Stability Assessment Table

Hopewell Stream Mitigation Site (NCDMS Project No. 95352)

UT2C Reach 2 (110 LF)

Monitoring Year 1 - 2015

Major Channel Category	Channel Sub-Category	Metric	Number Stable, Performing as Intended	Total Number in As-Built	Number of Unstable Segments	Amount of Unstable Footage	% Stable, Performing as Intended	Number with Stabilizing Woody Vegetation	Footage with Stabilizing Woody Vegetation	Adjust % for Stabilizing Woody Vegetation
1. Bed	1. Vertical Stability (Riffle and Run units)	Aggradation			0	0	100%			
		Degradation			0	0	100%			
	2. Riffle Condition	Texture/Substrate	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%			
					0	0	100%	n/a	n/a	n/a
2. Bank	1. Scoured/Eroded	Bank lacking vegetative cover resulting simply from poor growth and/or scour and erosion.			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%			

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

Table 5f. Visual Stream Morphology Stability Assessment Table

Hopewell Stream Mitigation Site (NCDMS Project No. 95352)

UT2C Reach 3 (137 LF)

Monitoring Year 1 - 2015

Major Channel Category	Channel Sub-Category	Metric	Number Stable, Performing as Intended	Total Number in As-Built	Number of Unstable Segments	Amount of Unstable Footage	% Stable, Performing as Intended	Number with Stabilizing Woody Vegetation	Footage with Stabilizing Woody Vegetation	Adjust % for Stabilizing Woody Vegetation
1. Bed	1. Vertical Stability (Riffle and Run units)	Aggradation			0	0	100%			
		Degradation			0	0	100%			
	2. Riffle Condition	Texture/Substrate	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%			

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

Table 6. Visual Stream Morphology Stability Assessment Table
 Hopewell Stream Mitigation Site (NCDMS Project No. 95352)
 Monitoring Year 1 - 2015

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	3	0.2	0.8%
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	3	0.2
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	3	0.2

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	31	7.9	22.6%
<hr/>					
Easement Encroachment Areas	Areas of points (if too small to render as polygons at map scale).	none	0	0	0%

Stream Photographs



UT2B R1 – Photo Point 1 looking upstream (09/08/2015)



UT2B R1 – Photo Point 1 looking downstream (09/08/2015)



UT2B R1 – Photo Point 2 looking upstream (09/08/2015)



UT2B R1 – Photo Point 2 looking downstream (09/08/2015)



UT2B R1 – Photo Point 3 looking upstream (09/08/2015)



UT2B R1 – Photo Point 3 looking downstream (09/08/2015)





UT2B R1 – Photo Point 4 looking upstream (09/08/2015)



UT2B R1 – Photo Point 4 looking downstream (09/08/2015)



UT2B R1 – Photo Point 5 looking upstream (09/08/2015)



UT2B R1 – Photo Point 5 looking downstream (09/08/2015)



UT2A R1 – Photo Point 6 looking upstream (09/08/2015)



UT2A R1 – Photo Point 6 looking downstream (09/08/2015)





UT2A R1 – Photo Point 7 looking upstream (09/08/2015)



UT2A R1 – Photo Point 7 looking downstream (09/08/2015)



UT2A R2 – Photo Point 8 looking upstream (09/08/2015)



UT2A R2 – Photo Point 8 looking downstream (09/08/2015)



UT2A R2 – Photo Point 9 looking upstream (09/08/2015)



UT2A R2 – Photo Point 9 looking downstream (09/08/2015)





UT2A R2 – Photo Point 10 looking upstream (09/08/2015)



UT2A R2 – Photo Point 10 looking downstream (09/08/2015)



UT2A R2 – Photo Point 11 looking upstream (09/08/2015)



UT2A R2 – Photo Point 11 looking downstream (09/08/2015)



UT2A R2 – Photo Point 12 looking upstream (09/08/2015)



UT2A R2 – Photo Point 12 looking downstream (09/08/2015)





UT2A R2 – Photo Point 13 looking upstream (09/08/2015)



UT2A R2 – Photo Point 13 looking downstream (09/08/2015)



UT2A R2 – Photo Point 14 looking upstream (09/08/2015)



UT2A R2 – Photo Point 14 looking downstream (09/08/2015)



UT2A R2 – Photo Point 15 looking upstream (09/08/2015)



UT2A R2 – Photo Point 15 looking downstream (09/08/2015)





UT2C R1 – Photo Point 16 looking upstream (09/08/2015)



UT2C R1 – Photo Point 16 looking downstream (09/08/2015)



UT2C R1 – Photo Point 17 looking upstream (09/08/2015)



UT2C R1 – Photo Point 17 looking downstream (09/08/2015)



UT2C R1 – Photo Point 18 looking upstream (09/08/2015)



UT2C R1 – Photo Point 18 looking downstream (09/08/2015)





UT2C R1 – Photo Point 19 looking upstream (09/08/2015)



UT2C R1 – Photo Point 19 looking downstream (09/08/2015)



UT2C R1 – Photo Point 20 looking upstream (09/08/2015)



UT2C R1 – Photo Point 20 looking downstream (09/08/2015)



UT2C R1 – Photo Point 21 looking upstream (09/08/2015)



UT2C R1 – Photo Point 21 looking downstream (09/08/2015)





UT2C R2 – Photo Point 22 looking upstream (09/08/2015)



UT2C R2 – Photo Point 22 looking downstream (09/08/2015)



UT2C R3 – Photo Point 23 looking upstream (09/08/2015)



UT2C R3 – Photo Point 23 looking downstream (09/08/2015)



UT2 R1 – Photo Point 24 looking upstream (09/08/2015)



UT2 R1 – Photo Point 24 looking downstream (09/08/2015)





UT2 R1 – Photo Point 25 looking upstream (09/08/2015)



UT2 R1 – Photo Point 25 looking downstream (09/08/2015)



UT2 R1 – Photo Point 26 looking upstream (09/08/2015)



UT2 R1 – Photo Point 26 looking downstream (09/08/2015)



UT2 R1 – Photo Point 27 looking upstream (09/08/2015)



UT2 R1 – Photo Point 27 looking downstream (09/08/2015)





UT2 R1 – Photo Point 28 looking upstream (09/08/2015)



UT2 R1 – Photo Point 28 looking downstream (09/08/2015)



UT2 R1 – Photo Point 29 looking upstream (09/08/2015)



UT2 R1 – Photo Point 29 looking downstream (09/08/2015)



UT2 R1 – Photo Point 30 looking upstream (09/08/2015)



UT2 R1 – Photo Point 30 looking downstream (09/08/2015)





UT2 R1 – Photo Point 31 looking upstream (09/08/2015)



UT2 R1 – Photo Point 31 looking downstream (09/08/2015)



UT2 R1 – Photo Point 32 looking upstream (09/08/2015)



UT2 R1 – Photo Point 32 looking downstream (09/08/2015)



UT2 R2 – Photo Point 33 looking upstream (09/08/2015)



UT2 R2 – Photo Point 33 looking downstream (09/08/2015)





UT2 R2 – Photo Point 34 looking upstream (09/08/2015)



UT2 R2 – Photo Point 34 looking downstream (09/08/2015)



UT2 R2 – Photo Point 35 looking upstream (09/08/2015)



UT2 R2 – Photo Point 35 looking downstream (09/08/2015)



Little River R1 – Photo Point 36 looking upstream (09/09/2015)



Little River R1 – Photo Point 36 looking downstream (09/09/2015)





Little River R1 – Photo Point 37 looking upstream (09/09/2015)



Little River R1 – Photo Point 37 looking downstream (09/09/2015)



Little River R1 – Photo Point 38 looking upstream (09/09/2015)



Little River R1 – Photo Point 38 looking downstream (09/09/2015)



Little River R2 – Photo Point 39 looking upstream (09/09/2015)



Little River R2 – Photo Point 39 looking downstream (09/09/2015)





Little River R2 – Photo Point 40 looking upstream (09/09/2015)



Little River R2 – Photo Point 40 looking downstream (09/09/2015)



Little River R2 – Photo Point 41 looking upstream (09/09/2015)



Little River R2 – Photo Point 41 looking downstream (09/09/2015)



Little River R2 – Photo Point 42 looking upstream (09/09/2015)



Little River R2 – Photo Point 42 looking downstream (09/09/2015)





Little River R2 – Photo Point 43 looking upstream (09/09/2015)



Little River R2 – Photo Point 43 looking downstream (09/09/2015)



Little River R2 – Photo Point 44 looking upstream (09/09/2015)



Little River R2 – Photo Point 44 looking downstream (09/09/2015)



Little River R2 – Photo Point 45 looking upstream (09/09/2015)



Little River R2 – Photo Point 45 looking downstream (09/09/2015)





Little River R2 – Photo Point 46 looking upstream (09/09/2015)



Little River R2 – Photo Point 46 looking downstream (09/09/2015)



Little River R2 – Photo Point 47 looking upstream (09/09/2015)



Little River R2 – Photo Point 47 looking downstream (09/09/2015)



UT1A Reach 1 – Photo Point 48 looking upstream (09/09/2015)



UT1A Reach 1 – Photo Point 48 – looking downstream





UT1A R1 – Photo Point 49 looking upstream (09/09/2015)



UT1A R1 – Photo Point 49 looking downstream (09/09/2015)



UT1A R1 – Photo Point 50 looking upstream (09/09/2015)



UT1A R1 – Photo Point 50 looking downstream (09/09/2015)



UT1A R1 – Photo Point 51 looking upstream (09/09/2015)



UT1A R1 – Photo Point 51 looking downstream (09/09/2015)





UT1A R1 – Photo Point 52 looking upstream (09/09/2015)



UT1A R1 – Photo Point 52 looking downstream (09/09/2015)



UT1A R1 – Photo Point 53 looking upstream (09/09/2015)



UT1A R1 – Photo Point 53 looking downstream (09/09/2015)



UT1A R1 – Photo Point 54 looking upstream (09/09/2015)



UT1A R1 – Photo Point 54 looking downstream (09/09/2015)





UT1A R1 – Photo Point 55 looking upstream (09/09/2015)



UT1A R1 – Photo Point 55 looking downstream (09/09/2015)



UT1A R1 – Photo Point 56 looking upstream (09/09/2015)



UT1A R1 – Photo Point 56 looking downstream (09/09/2015)



UT1B R1 – Photo Point 57 looking upstream (09/09/2015)



UT1B R1 – Photo Point 57 looking downstream (09/09/2015)





UT1B R1 – Photo Point 58 looking upstream (09/09/2015)



UT1B R1 – Photo Point 58 looking downstream (09/09/2015)



UT1B R1 – Photo Point 59 looking upstream (09/09/2015)



UT1B R1 – Photo Point 59 looking downstream (09/09/2015)



UT1B R1 – Photo Point 60 looking upstream (09/09/2015)



UT1B R1 – Photo Point 60 looking downstream (09/09/2015)





UT1B R2 – Photo Point 61 looking upstream (09/09/2015)



UT1B R2 – Photo Point 61 looking downstream (09/09/2015)



UT1B R2 – Photo Point 62 looking upstream (09/09/2015)



UT1B R2 – Photo Point 62 looking downstream (09/09/2015)



UT1B R3 – Photo Point 63 looking upstream (09/09/2015)



UT1B R3 – Photo Point 63 looking downstream (09/09/2015)





UT1B R3 – Photo Point 64 looking upstream (09/09/2015)



UT1B R3 – Photo Point 64 looking downstream (09/09/2015)



Vegetation Photographs



Vegetation Plot 1 – (09/08/2015)



Vegetation Plot 2 – (09/08/2015)



Vegetation Plot 3 – (09/08/2015)



Vegetation Plot 4 – (09/08/2015)



Vegetation Plot 5 – (09/08/2015)



Vegetation Plot 6 – (09/08/2015)





Vegetation Plot 7 – (09/08/2015)



Vegetation Plot 8 – (09/08/2015)



Vegetation Plot 9 – (09/09/2015)



Vegetation Plot 10 – (09/09/2015)



Vegetation Plot 11 – (09/09/2015)



Vegetation Plot 12 – (09/09/2015)





Vegetation Plot 13 – (09/08/2015)



Vegetation Plot 14 – (09/08/2015)



Vegetation Plot 15 – (09/08/2015)



Vegetation Plot 16 – (09/08/2015)



Vegetation Plot 17 – (09/08/2015)



Vegetation Plot 18 – (09/09/2015)





Vegetation Plot 19 – (09/09/2015)



Vegetation Plot 20 – (09/09/2015)



Vegetation Plot 21 – (09/09/2015)



Vegetation Plot 22 – (09/09/2015)



Vegetation Plot 23 – (09/09/2015)



Vegetation Plot 24– (01/19/2015)





Vegetation Plot 25 – (09/09/2015)



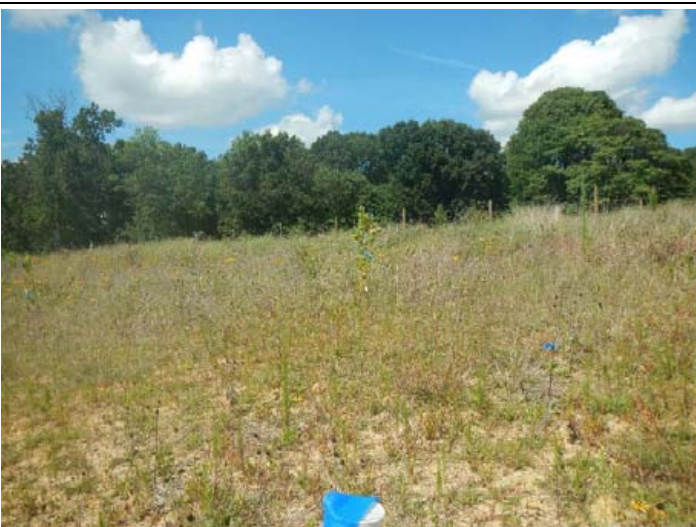
Vegetation Plot 26 – (09/09/2015)



Vegetation Plot 27 – (09/09/2015)



Vegetation Plot 28 – (09/09/2015)



Vegetation Plot 29 – (09/09/2015)



Vegetation Plot 30– (09/09/2015)





Vegetation Plot 31 – (09/09/2015)



APPENDIX 3. Vegetation Plot Data

Table 7. Vegetation Plot Criteria Attainment
Hopewell Stream Mitigation Site (NCDMS Project No. 95352)
Monitoring Year 1 - 2015

Plot	MY1 Success Criteria Met (Y/N)	Tract Mean
1	Y	100%
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	
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 (NCDMS Project No. 95352)

Monitoring Year 1 - 2015

Database name	Hopewell MY0 cvs-eep-entrytool-v2.3.1.mdb
Database location	Q:\ActiveProjects\005-02133 Hopewell Mitigation FDP\Monitoring\Monitoring Year 1\Vegetation Assessment\revised data base 9.18.15
Computer name	RUBY
File size	61239296
DESCRIPTION OF WORKSHEETS IN THIS DOCUMENT-----	
Metadata	Description of database file, the report worksheets, and a summary of project(s) and project data.
Proj, planted	Each project is listed with its PLANTED stems per acre, for each year. This excludes live stakes.
Proj, total stems	Each project is listed with its TOTAL stems per acre, for each year. This includes live stakes, all planted stems, and all natural/volunteer stems.
Plots	List of plots surveyed with location and summary data (live stems, dead stems, missing, etc.).
Vigor	Frequency distribution of vigor classes for stems for all plots.
Vigor by Spp	Frequency distribution of vigor classes listed by species.
Damage	List of most frequent damage classes with number of occurrences and percent of total stems impacted by each.
Damage by Spp	Damage values tallied by type for each species.
Damage by Plot	Damage values tallied by type for each plot.
Planted Stems by Plot and Spp	A matrix of the count of PLANTED living stems of each species for each plot; dead and missing stems are excluded.
ALL Stems by Plot and spp	A matrix of the count of total living stems of each species (planted and natural volunteers combined) for each plot; dead and missing stems are excluded.
PROJECT SUMMARY-----	
Project Code	95352
project Name	Hopewell Stream Mitigation Site
Description	Stream Mitigation
River Basin	Yadkin-Pee Dee
Sampled Plots	31

Table 9. Planted and Total Stems
Hopewell Stream Mitigation Site (NCDMS Project No.95352)
Monitoring Year 1 - 2015

			Current Plot Data (MY1 2015)																							
Scientific Name	Common Name	Species Type	Vegetation Plot 1			Vegetation Plot 2			Vegetation Plot 3			Vegetation Plot 4			Vegetation Plot 5			Vegetation Plot 6			Vegetation Plot 7					
			PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T			
Betula nigra	River birch	Tree				1	1	1				1	1	1							3	3	3	1	1	1
Fraxinus pennsylvanica	Green ash	Tree				1	1	1	6	6	6	5	5	5							3	3	3	1	1	1
Liriodendron tulipifera	Tuliptree	Tree													1	1	1	2	2	2	1	1	1	1	1	1
Platanus occidentalis	American sycamore	Tree	3	3	3	2	2	2	2	2	2	7	7	7	3	3	3	3	3	3	1	1	1	8	8	8
Quercus michauxii	Swamp chestnut oak	Tree	4	4	4	3	3	3	2	2	2				3	3	3	5	5	5	4	4	4	4	4	4
Quercus phellos	Willow oak	Tree	2	2	2	3	3	3	4	4	4	1	1	1	3	3	3	3	3	3	3	3	3			
Quercus rubra	Northern red oak	Tree	2	2	2	3	3	3							3	3	3	1	1	1						
Stem count			11	11	11	13	13	13	14	14	14	14	14	14	13	13	13	15	15	15	15	15	15	15	15	15
Size (ares)			1			1			1			1			1			1			1					
Size (ACRES)			0.02			0.02			0.02			0.02			0.02			0.02			0.02					
Species count			4	4	4	6	6	6	4	4	4	4	4	4	5	5	5	6	6	6	5	5	5	5	5	5
Stems per ACRE			445	445	445	526	526	526	567	567	567	567	567	567	526	526	526	607	607	607	607	607	607	607	607	607

			Current Plot Data (MY1 2015)																							
Scientific Name	Common Name	Species Type	Vegetation Plot 8			Vegetation Plot 9			Vegetation Plot 10			Vegetation Plot 11			Vegetation Plot 12			Vegetation Plot 13			Vegetation Plot 14					
			PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T			
Betula nigra	River birch	Tree	3	3	3	2	2	2	1	1	1	4	4	4	2	2	2				1	1	1	1	1	1
Fraxinus pennsylvanica	Green ash	Tree				1	1	1	2	2	2	4	4	4	3	3	3	2	2	2	1	1	1	1	1	1
Liriodendron tulipifera	Tuliptree	Tree							4	4	4	2	2	2	2	2	2				3	3	3			
Platanus occidentalis	American sycamore	Tree	5	5	5	6	6	6	2	2	2	1	1	1	4	4	4	9	9	9						
Quercus michauxii	Swamp chestnut oak	Tree	2	2	2	1	1	1				2	2	2	1	1	1				6	6	6			
Quercus phellos	Willow oak	Tree	2	2	2	1	1	1	1	1	1										2	2	2			
Quercus rubra	Northern red oak	Tree	1	1	1	2	2	2	5	5	5				2	2	2	1	1	1	1	1	1	1	1	1
Stem count			13	13	13	13	13	13	15	15	15	13	13	13	14	14	14	12	12	12	14	14	14	14	14	14
Size (ares)			1			1			1			1			1			1			1					
Size (ACRES)			0.02			0.02			0.02			0.02			0.02			0.02			0.02					
Species count			5	5	5	6	6	6	6	6	6	5	5	5	6	6	6	3	3	3	6	6	6	6	6	6
Stems per ACRE			526	526	526	526	526	526	607	607	607	526	526	526	567	567	567	486	486	486	567	567	567	567	567	567

Color for Density

- Exceeds requirements by 10%
- Exceeds requirements, but by less than 10%
- Fails to meet requirements, by less than 10%
- Fails to meet requirements by more than 10%

Table 9. Planted and Total Stems
Hopewell Stream Mitigation Site (NCDMS Project No.95352)
Monitoring Year 1 - 2015

			Current Plot Data (MY1 2015)																				
Scientific Name	Common Name	Species Type	Vegetation Plot 15			Vegetation Plot 16			Vegetation Plot 17			Vegetation Plot 18			Vegetation Plot 19			Vegetation Plot 20			Vegetation Plot 21		
			PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T
Betula nigra	River birch	Tree	1	1	1	1	1	1	3	3	3	3	3	3	1	1	1	4	4	4	2	2	2
Fraxinus pennsylvanica	Green ash	Tree	2	2	2	4	4	4	4	4	4	2	2	2	6	6	6	5	5	5	1	1	1
Liriodendron tulipifera	Tuliptree	Tree							1	1	1	2	2	2							1	1	1
Platanus occidentalis	American sycamore	Tree	9	9	9	5	5	5	4	4	4	2	2	2	4	4	4	1	1	1	2	2	2
Quercus michauxii	Swamp chestnut oak	Tree	1	1	1	2	2	2	1	1	1	1	1	1	1	1	1						
Quercus phellos	Willow oak	Tree							1	1	1	1	1	1							2	2	2
Quercus rubra	Northern red oak	Tree	2	2	2	1	1	1	1	1	1	2	2	2				5	5	5	4	4	4
Stem count			15	15	15	13	13	13	15	15	15	13	13	13	12	12	12	15	15	15	12	12	12
Size (ares)			1			1			1			1			1			1			1		
Size (ACRES)			0.02			0.02			0.02			0.02			0.02			0.02			0.02		
Species count			5	5	5	5	5	5	7	7	7	7	7	7	4	4	4	4	4	4	6	6	6
Stems per ACRE			607	607	607	526	526	526	607	607	607	526	526	526	486	486	486	607	607	607	486	486	486

			Current Plot Data (MY1 2015)																				
Scientific Name	Common Name	Species Type	Vegetation Plot 22			Vegetation Plot 23			Vegetation Plot 24			Vegetation Plot 25			Vegetation Plot 26			Vegetation Plot 27			Vegetation Plot 28		
			PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T
Betula nigra	River birch	Tree	2	2	2	2	2	2	2	2	2	2	2	2	1	1	1						
Fraxinus pennsylvanica	Green ash	Tree	4	4	4	1	1	1	1	1	1	2	2	2	3	3	3	4	4	4	6	6	6
Liriodendron tulipifera	Tuliptree	Tree				2	2	2	1	1	1							1	1	1			
Platanus occidentalis	American sycamore	Tree	1	1	1	9	9	9	4	4	4	4	4	4	2	2	2	4	4	4	4	4	4
Quercus michauxii	Swamp chestnut oak	Tree	3	3	3													3	3	3			
Quercus phellos	Willow oak	Tree							3	3	3	1	1	1	2	2	2	1	1	1	3	3	3
Quercus rubra	Northern red oak	Tree	1	1	1	1	1	1	2	2	2	3	3	3	3	3	3						
Stem count			11	11	11	15	15	15	13	13	13	12	12	12	11	11	11	13	13	13	13	13	13
Size (ares)			1			1			1			1			1			1			1		
Size (ACRES)			0.02			0.02			0.02			0.02			0.02			0.02			0.02		
Species count			5	5	5	5	5	5	6	6	6	5	5	5	5	5	5	5	5	5	3	3	3
Stems per ACRE			445	445	445	607	607	607	526	526	526	486	486	486	445	445	445	526	526	526	526	526	526

Color for Density

- Exceeds requirements by 10%
- Exceeds requirements, but by less than 10%
- Fails to meet requirements, by less than 10%
- Fails to meet requirements by more than 10%

Table 9. Planted and Total Stems
Hopewell Stream Mitigation Site (NCDMS Project No.95352)
Monitoring Year 1 - 2015

Scientific Name	Common Name	Species Type	Current Plot Data (MY1 2015)									Annual Summary					
			Vegetation Plot 29			Vegetation Plot 30			Vegetation Plot 31			MY1 (9/2015)			MY0 (1/2015)		
			PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T
Betula nigra	River birch	Tree	2	2	2	1	1	1	1	1	1	44	44	44	53	53	53
Fraxinus pennsylvanica	Green ash	Tree	3	3	3	4	4	4	4	4	4	85	85	85	92	92	92
Liriodendron tulipifera	Tuliptree	Tree							1	1	1	24	24	24	52	52	52
Platanus occidentalis	American sycamore	Tree	1	1	1							109	109	109	114	114	114
Quercus michauxii	Swamp chestnut oak	Tree										45	45	45	46	46	46
Quercus phellos	Willow oak	Tree										36	36	36	71	71	71
Quercus rubra	Northern red oak	Tree	5	5	5	4	4	4	5	5	5	60	60	60	69	69	69
	Stem count		11	11	11	9	9	9	11	11	11	403	403	403	497	497	497
	Size (ares)		1			1			1			31			31		
	Size (ACRES)		0.02			0.02			0.02			0.77			0.77		
	Species count		4	4	4	3	3	3	4	4	4	7	7	7	7	7	7
	Stems per ACRE		445	445	445	364	364	364	445	445	445	526	526	526	649	649	649

Color for Density

- Exceeds requirements by 10%
- Exceeds requirements, but by less than 10%
- Fails to meet requirements, by less than 10%
- Fails to meet requirements by more than 10%

APPENDIX 4. Morphological Summary Data and Plots

Table 10a. Baseline Stream Data Summary

Hopewell Stream Mitigation Site (NCDMS Project No. 95352)
Monitoring Year 1 - 2015

Hopewell-UT2 Reaches 1 and 2

Parameter	Gage	PRE-RESTORATION CONDITION				REFERENCE REACH DATA									DESIGN				AS-BUILT/BASELINE						
		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)	N/A	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	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	1.5	1.5	1.3	1.7	1.5						
Bankfull Cross-sectional Area (ft ²)		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	14.0	14.0	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	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	1.0	1.0	1.0	1.0	1.0						
D50 (mm)		0.1	---	12.5	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	24.2	28.0	45.8	---	---	
Profile																									
Riffle Length (ft)	N/A	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	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)		---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	17	66	41	105	---	---
Pool Max Depth (ft)		2	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)	N/A	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)		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%	N/A	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	
SC%/Sa%/G%/C%/B%/Be%		---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	
d16/d35/d50/d84/d95/d100		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)	N/A	0.38	0.59	2.90	1.10	0.50	0.96	0.37	0.38	0.59	0.38	0.59	0.38	0.59	0.38	0.59	0.38	0.59	0.38	0.59	0.38	0.59	0.38	0.59	
Watershed Impervious Cover Estimate (%)		1%	1%	---	---	---	---	---	---	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%
Rosgen Classification		G5/4	G4	B/C	E4b	E4/C4	E4	E4	E4	C4	C4	C4	C4	C4	C4	C4	C4	C4	C4	C4	C4	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)		46	62	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Q-Mannings		---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Valley Length (ft)		1,465	428	---	---	---	---	---	---	---	---	---	1,465	428	1,465	428	1,465	428	1,465	428	1,465	428	1,465	428	
Channel Thalweg Length (ft)		1,527	704	---	---	---	---	---	---	---	---	---	1,715	732	1,787	529	1,787	529	1,787	529	1,787	529	1,787	529	
Sinuosity		1.3	1.1	---	1.1	1.1	1.1	1.3	1.0	1.3	1.0	1.2	1.0	1.2	1.0	1.2	1.2	1.2	1.2	1.2	1.2	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 (NCDMS Project No. 95352)
Monitoring Year 1 - 2015

Hopewell-UT2A Reaches 1 and 2

Parameter	Gage	PRE-RESTORATION CONDITION				REFERENCE REACH DATA	DESIGN				AS-BUILT/BASELINE			
		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)	N/A	6.2		See Table 10a.		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)		6.2		6.1		6.2	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							34.3		37.4	
Profile														
Riffle Length (ft)	N/A			See Table 10a.			---		---		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)				---			---		---		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)	N/A	18	22	See Table 10a.		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)		1.3	5.0	1.0		3.5	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%	N/A			See Table 10a.										
SC%/Sa%/G%/C%/B%/Be%				---										
d16/d35/d50/d84/d95/d100		SC/SC/0.1/3/7		SC/SC/0.1/3/7							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)	N/A	0.10		See Table 10a.			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		35		48										
Q-USGS extrapolation		18		25										
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 (NCDMS Project No. 95352)
Monitoring Year 1 - 2015

Hopewell-UT2B Reach 2 and UT2C Reaches 2 and 3

Parameter	Gage	PRE-RESTORATION CONDITION				REFERENCE REACH DATA	DESIGN				AS-BUILT/BASELINE					
		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	See Table 10a.	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.				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	See Table 10a.	46	See Table 10a.	8	30	12	47	8	19	10	25		
Radius of Curvature (ft)		20	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.				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		See Table 10a.		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		18		31												
Q-USGS extrapolation		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 (NCDMS Project No. 95352)
Monitoring Year 1 - 2015

Hopewell-UT1B Reach 1

		PRE-RESTORATION CONDITION		REFERENCE REACH DATA	DESIGN		AS-BUILT/BASELINE		
Parameter	Gage	UT1B Reach 1		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		15							
Q-USGS extrapolation		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. Baseline Stream Data Summary
Hopewell Stream Mitigation Site (NCDMS Project No. 95352)
Monitoring Year 1 - 2015

	Cross-Section 1, UT2A R1 (Pool)						Cross-Section 2, UT2A R1 (Riffle)						Cross-Section 3, UT2A R2 (Riffle)						Cross-Section 4, UT2A R2 (Pool)						
Dimension and Substrate	Base	MY1	MY2	MY3	MY4	Table 1	Base	MY1	MY2	MY3	MY4	MY5	Base	MY1	MY2	MY3	MY4	MY5	Base	MY1	MY2	MY3	MY4	MY5	
<i>based on fixed bankfull elevation (ft)</i>	722.6	722.6					722.4	722.4					719.7	719.7					719.6	719.6					
Bankfull Width (ft)	12.1	12.7					10.3	9.7					9.8	10.3					12.1	12.1					
Floodprone Width (ft)	---	---					>87	>88					>88	>87					---	---					
Bankfull Mean Depth (ft)	1.4	1.3					0.8	0.8					0.7	0.7					1.4	1.3					
Bankfull Max Depth (ft)	2.7	2.5					1.6	1.3					1.1	1.1					3.0	2.7					
Bankfull Cross-Sectional Area (ft ²)	16.8	16.5					8.0	7.6					6.8	6.7					16.7	15.6					
Bankfull Width/Depth Ratio	8.7	9.8					13.3	12.4					14.0	15.8					8.8	9.4					
Bankfull Entrenchment Ratio	---	---					>8	>9					>9	>8					---	---					
Bankfull Bank Height Ratio	1.0	1.0					1.0	1.0					1.0	1.0					1.0	1.0					
d50 (mm)	---	---					34.3	40.3					39.8	26.3					---	---					
	Cross-Section 5, UT2A R2 (Pool)						Cross-Section 6, UT2A R2 (Riffle)						Cross-Section 7, UT2 R2 (Pool)						Cross-Section 8, UT2 R2 (Riffle)						
Dimension and Substrate	Base	MY1	MY2	MY3	MY4	MY5	Base	MY1	MY2	MY3	MY4	MY5	Base	MY1	MY2	MY3	MY4	MY5	Base	MY1	MY2	MY3	MY4	MY5	
<i>based on fixed bankfull elevation (ft)</i>	713.5	713.5					713.4	713.4					705.9	705.9					705.0	705.0					
Bankfull Width (ft)	12.7	12.8					10.9	14.0					32.2	32.4					13.1	12.4					
Floodprone Width (ft)	---	---					63	66					---	---					>55	>60					
Bankfull Mean Depth (ft)	1.0	0.9					0.7	0.6					1.2	1.3					1.1	1.3					
Bankfull Max Depth (ft)	1.6	1.7					1.2	1.2					3.8	3.6					1.5	1.8					
Bankfull Cross-Sectional Area (ft ²)	12.3	12.1					8.0	9.0					38.6	41.8					14.6	16.0					
Bankfull Width/Depth Ratio	13.2	13.5					14.9	21.8					26.9	25.1					11.8	9.6					
Bankfull Entrenchment Ratio	---	---					5.7	4.7					---	---					>4	>5					
Bankfull Bank Height Ratio	1.0	1.0					1.0	1.0					1.0	1.0					1.0	1.0					
d50 (mm)	---	---					37.4	41.6					---	---					45.8	25.7					
	Cross-Section 9, UT2B R2 (Riffle)						Cross-Section 10, UT2B R2 (Pool)																		
Dimension and Substrate	Base	MY1	MY2	MY3	MY4	MY5	Base	MY1	MY2	MY3	MY4	MY5													
<i>based on fixed bankfull elevation (ft)</i>	724.4	724					723.4	723.4																	
Bankfull Width (ft)	5.2	6.0					10.8	11.3																	
Floodprone Width (ft)	>41	>29					---	---																	
Bankfull Mean Depth (ft)	0.4	0.3					0.8	0.8																	
Bankfull Max Depth (ft)	0.6	0.5					1.5	1.5																	
Bankfull Cross-Sectional Area (ft ²)	2.1	1.8					8.3	8.6																	
Bankfull Width/Depth Ratio	13.0	19.9					14.1	14.8																	
Bankfull Entrenchment Ratio	>8	>5					---	---																	
Bankfull Bank Height Ratio	1.0	1.0					1.0	1.0																	
d50 (mm)	25.4	33.7					---	---																	

Table 12a. Monitoring Data - Stream Reach Data Summary
Hopewell Stream Mitigation Site (NCDMS Project No. 95352)
Monitoring Year 1 - 2015

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													
Floodprone Width (ft)	12.4		7.5													
Bankfull Mean Depth	0.4		0.2													
Bankfull Max Depth	0.6		0.3													
Bankfull Cross Sectional Area (ft ²)	1.8		1.0													
Width/Depth Ratio	13.3		22.1													
Entrenchment Ratio	2.6		1.6													
Bank Height Ratio	1.0		1.0													
D50 (mm)	56.3		69.7													
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													
% of Reach with Eroding Banks	0%		0%													

(---): Data was not provided

Table 12b. Monitoring Data - Stream Reach Data Summary
Hopewell Stream Mitigation Site (NCDMS Project No. 95352)
Monitoring Year 1 - 2015

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												
Floodprone Width (ft)	>68	101	>57	105												
Bankfull Mean Depth	0.8	0.9	0.7	1.0												
Bankfull Max Depth	1.3	1.7	1.1	1.8												
Bankfull Cross Sectional Area (ft ²)	8.4	12.7	7.3	14.1												
Width/Depth Ratio	13.2	15.8	13.3	15.6												
Entrenchment Ratio	>7	7.1	>5	7.6												
Bank Height Ratio	1.0		1.0													
D50 (mm)	24.2	28.0	17.4	22.1												
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	15/31/46/97/228/>2048		SC/5.6/20112/237/2048													
% of Reach with Eroding Banks	0%		0%													

(---): Data was not provided

Table 12c. Monitoring Data - Stream Reach Data Summary
Hopewell Stream Mitigation Site (NCDMS Project No. 95352)
Monitoring Year 1 - 2015

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		12.4													
Floodprone Width (ft)	>55		>60													
Bankfull Mean Depth	1.0		1.3													
Bankfull Max Depth	1.5		1.8													
Bankfull Cross Sectional Area (ft ²)	14.8		16.0													
Width/Depth Ratio	15.8		9.6													
Entrenchment Ratio	>4		>5													
Bank Height Ratio	1.0		1.0													
D50 (mm)	45.8		25.7													
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	15/31/46/97/228/>2048		SC/5.6/20112/237/2048													
% of Reach with Eroding Banks	0%		0%													

(---): Data was not provided

Table 12d. Monitoring Data - Stream Reach Data Summary
Hopewell Stream Mitigation Site (NCDMS Project No. 95352)
Monitoring Year 1 - 2015

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													
Floodprone Width (ft)	>87		>88													
Bankfull Mean Depth	0.8		0.8													
Bankfull Max Depth	1.6		1.3													
Bankfull Cross Sectional Area (ft ²)	8.0		7.6													
Width/Depth Ratio	13.3		12.4													
Entrenchment Ratio	>8		>9													
Bank Height Ratio	1.0		1.0													
D50 (mm)	34.3		40.3													
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															
% of Reach with Eroding Banks	0%		0%													

(---): Data was not provided

Table 12e. Monitoring Data - Stream Reach Data Summary
Hopewell Stream Mitigation Site (NCDMS Project No. 95352)
Monitoring Year 1 - 2015

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												
Floodprone Width (ft)	63	>88	66	>87												
Bankfull Mean Depth	0.7		0.6	0.7												
Bankfull Max Depth	1.1	1.2	1.1	1.2												
Bankfull Cross Sectional Area (ft ²)	6.8	8.0	6.7	9.0												
Width/Depth Ratio	14.0	14.9	15.8	21.8												
Entrenchment Ratio	5.7	>9	4.7	>8												
Bank Height Ratio	1.0		1.0													
D50 (mm)	34.3	37.4	26.3	41.6												
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													
% of Reach with Eroding Banks	0%		0%													

(---): Data was not provided

Table 12f. Monitoring Data - Stream Reach Data Summary
Hopewell Stream Mitigation Site (NCDMS Project No. 95352)
Monitoring Year 1 - 2015

Hopewell-UT2B 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)	5.2		6.0													
Floodprone Width (ft)	>41		>29													
Bankfull Mean Depth	0.4		0.3													
Bankfull Max Depth	0.6		0.5													
Bankfull Cross Sectional Area (ft ²)	2.1		1.8													
Width/Depth Ratio	13.0		19.9													
Entrenchment Ratio	>8		>5													
Bank Height Ratio	1.0		1.0													
D50 (mm)	25.4		33.7													
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)	1.7	2.9														
Meander Wave Length (ft)	40	62														
Meander Width Ratio	1.6	3.6														
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													
% of Reach with Eroding Banks	0%		0%													

(---): Data was not provided

Table 12g. Monitoring Data - Stream Reach Data Summary
Hopewell Stream Mitigation Site (NCDMS Project No. 95352)
Monitoring Year 1 - 2015

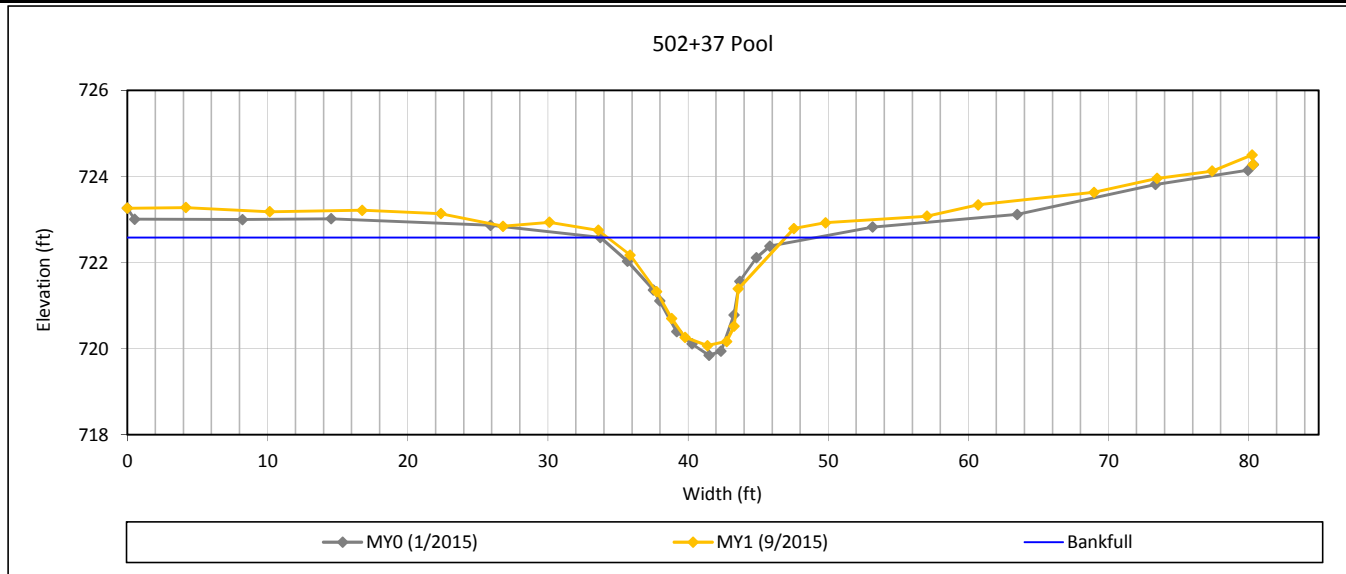
Hopewell-UT2C Reach 2 & 3

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													
Floodprone Width (ft)	>48		45													
Bankfull Mean Depth	0.5		0.5													
Bankfull Max Depth	1.1		1.0													
Bankfull Cross Sectional Area (ft ²)	5.3		4.6													
Width/Depth Ratio	18.4		17.5													
Entrenchment Ratio	>5		5.0													
Bank Height Ratio	1.0		1.0													
D50 (mm)	18.4		10.8													
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													
% of Reach with Eroding Banks	0%		0%													

(---): Data was not provided

Cross Section Plots
 Hopewell Stream Mitigation Site (NCDMS Project No. 95352)
 Monitoring Year 1

Cross Section 1, UT2A Reach 1



Bankfull Dimensions

16.5	x-section area (ft.sq.)
12.7	width (ft)
1.3	mean depth (ft)
2.5	max depth (ft)
14.1	wetted parimeter (ft)
1.2	hyd radi (ft)
9.8	width-depth ratio
---	W flood prone area (ft)
---	entrenchment ratio
1.0	low bank height ratio

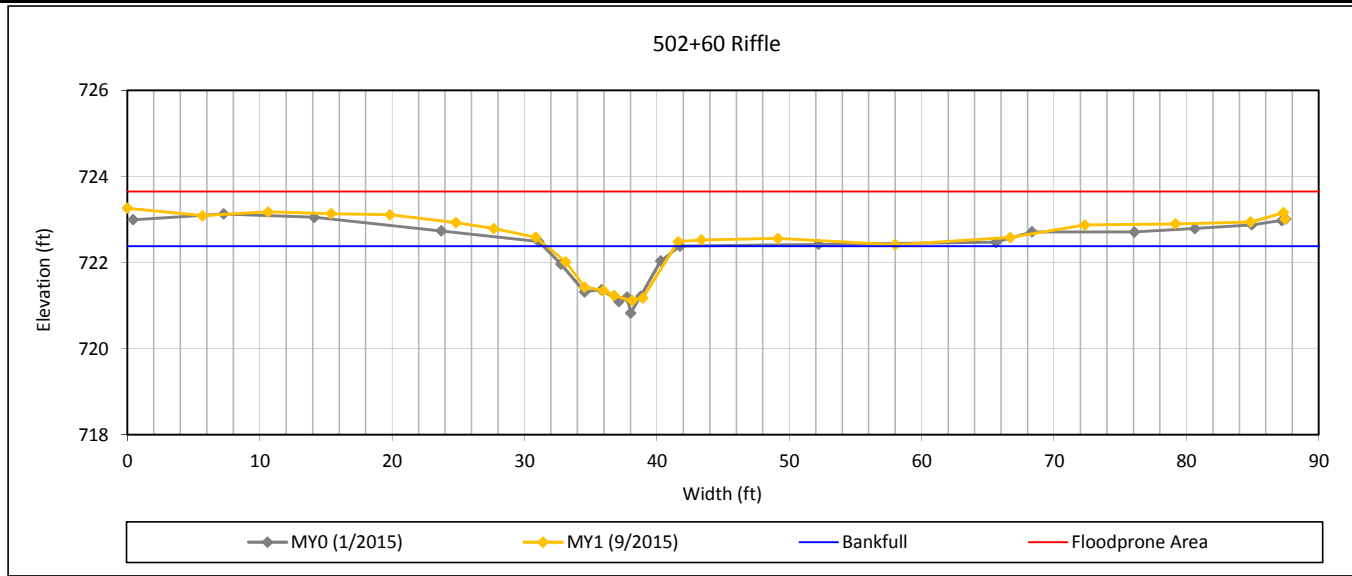
Survey Date: 7/2015
 Field Crew: Wildlands Engineering



View Downstream

Cross Section Plots
 Hopewell Stream Mitigation Site (NCDMS Project No. 95352)
 Monitoring Year 1

Cross Section 2, UT2A Reach 1



Bankfull Dimensions

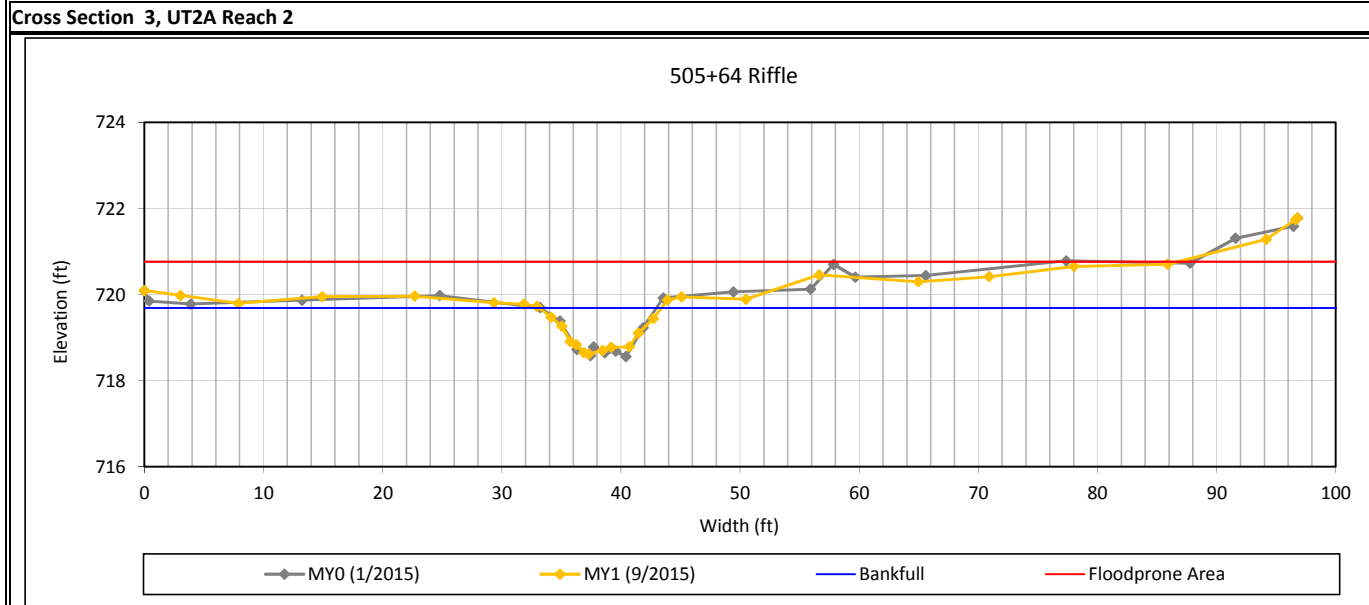
7.6	x-section area (ft.sq.)
9.7	width (ft)
0.8	mean depth (ft)
1.3	max depth (ft)
10.2	wetted parimeter (ft)
0.7	hyd radi (ft)
12.4	width-depth ratio
87.5	W flood prone area (ft)
9.0	entrenchment ratio
1.0	low bank height ratio

Survey Date: 7/2015
 Field Crew: Wildlands Engineering



View Downstream

Cross Section Plots
 Hopewell Stream Mitigation Site (NCDMS Project No. 95352)
 Monitoring Year 1



Bankfull Dimensions

6.7	x-section area (ft.sq.)
10.3	width (ft)
0.7	mean depth (ft)
1.1	max depth (ft)
10.6	wetted parimeter (ft)
0.6	hyd radi (ft)
15.8	width-depth ratio
86.7	W flood prone area (ft)
8.4	entrenchment ratio
1.0	low bank height ratio

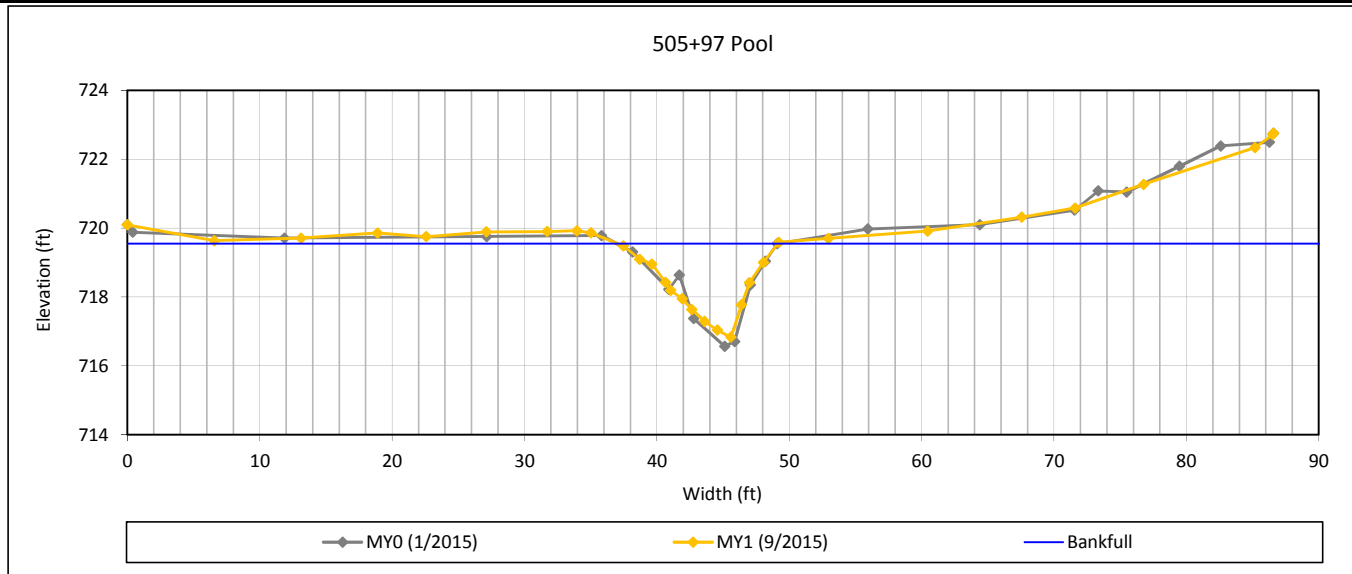
Survey Date: 9/2015
 Field Crew: Wildlands Engineering



View Downstream

Cross Section Plots
 Hopewell Stream Mitigation Site (NCDMS Project No. 95352)
 Monitoring Year 1

Cross Section 4, UT2A Reach 2



Bankfull Dimensions

15.6	x-section area (ft.sq.)
12.1	width (ft)
1.3	mean depth (ft)
2.7	max depth (ft)
13.6	wetted parimeter (ft)
1.1	hyd radi (ft)
9.4	width-depth ratio
---	W flood prone area (ft)
---	entrenchment ratio
1.0	low bank height ratio

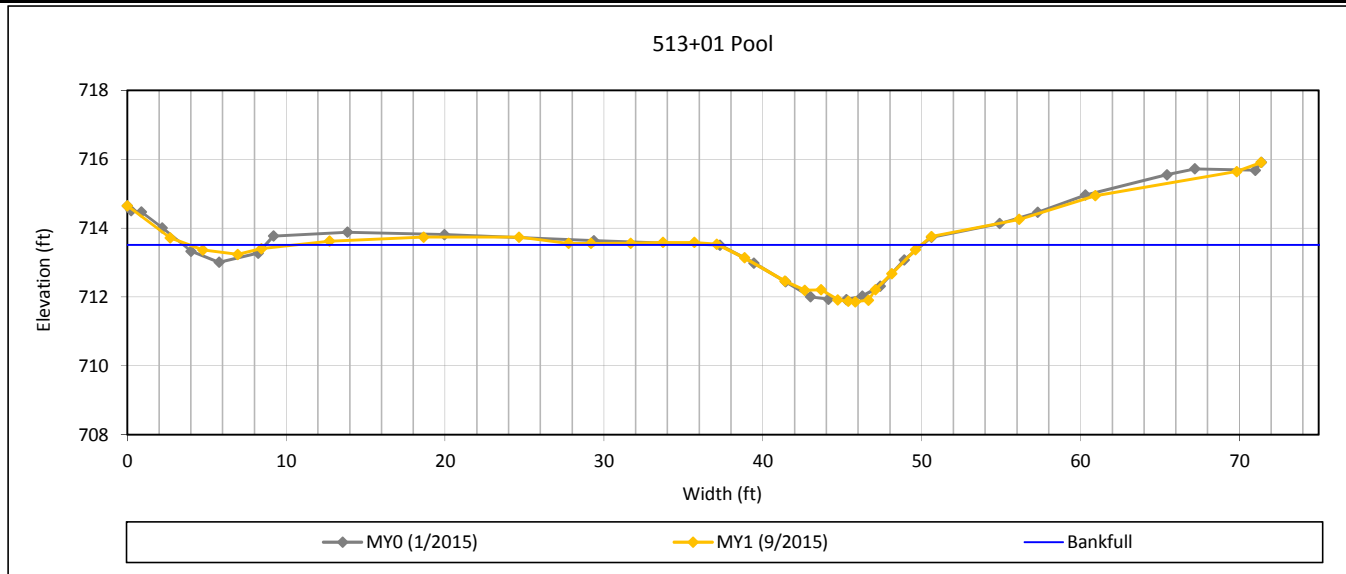
Survey Date: 9/2015
 Field Crew: Wildlands Engineering



View Downstream

Cross Section Plots
 Hopewell Stream Mitigation Site (NCDMS Project No. 95352)
 Monitoring Year 1

Cross Section 5, UT2A Reach 2



Bankfull Dimensions

- 12.1 x-section area (ft.sq.)
- 12.8 width (ft)
- 0.9 mean depth (ft)
- 1.7 max depth (ft)
- 13.4 wetted perimeter (ft)
- 0.9 hyd radi (ft)
- 13.5 width-depth ratio
- W flood prone area (ft)
- entrenchment ratio
- 1.0 low bank height ratio

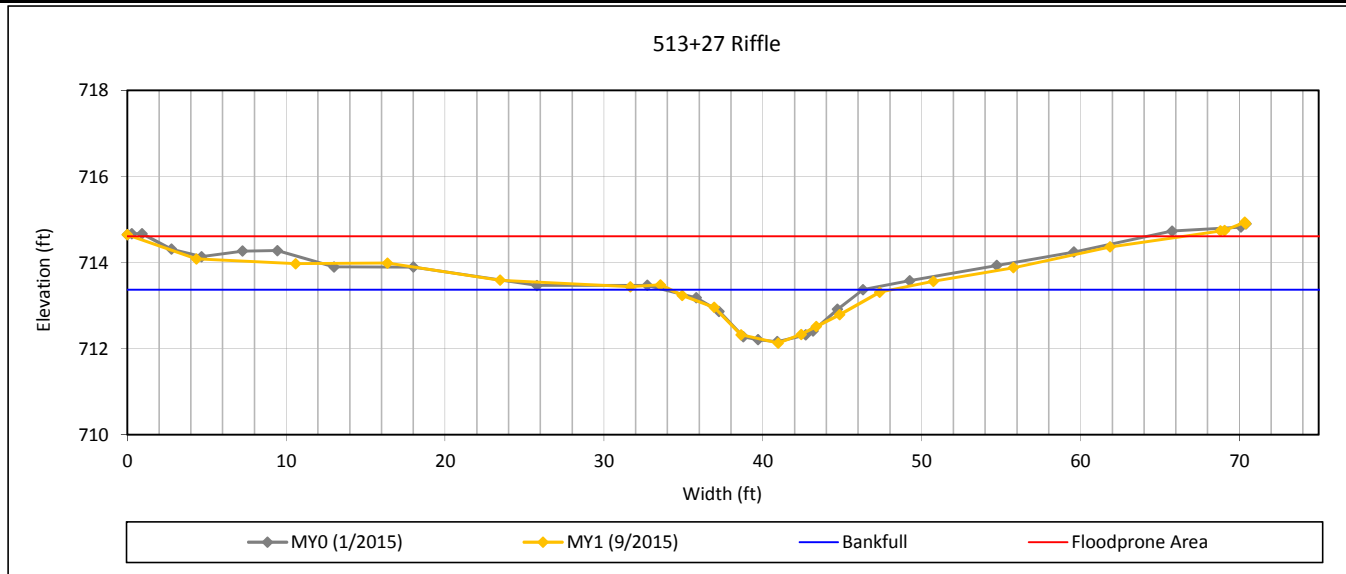
Survey Date: 9/2015
 Field Crew: Wildlands Engineering



View Downstream

Cross Section Plots
 Hopewell Stream Mitigation Site (NCDMS Project No. 95352)
 Monitoring Year 1

Cross Section 6, UT2A R2



Bankfull Dimensions

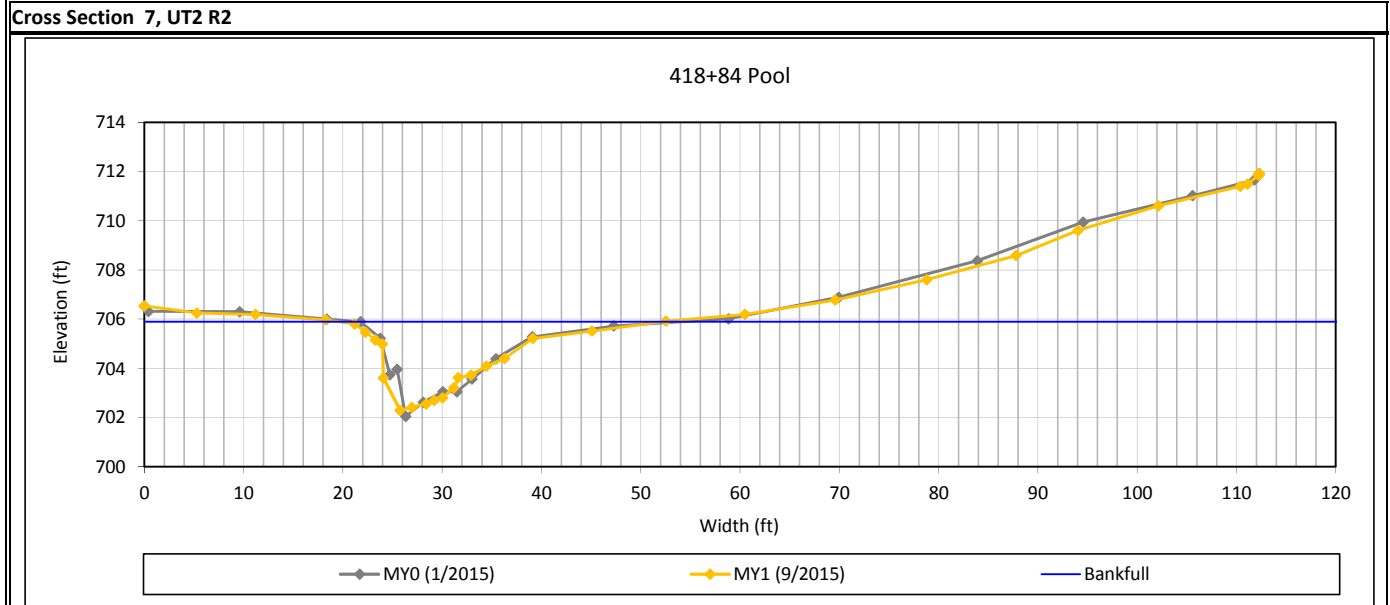
9.0	x-section area (ft.sq.)
14.0	width (ft)
0.6	mean depth (ft)
1.2	max depth (ft)
14.2	wetted parimeter (ft)
0.6	hyd radi (ft)
21.8	width-depth ratio
66.2	W flood prone area (ft)
4.7	entrenchment ratio
1.0	low bank height ratio

Survey Date: 9/2015
 Field Crew: Wildlands Engineering



View Downstream

Cross Section Plots
 Hopewell Stream Mitigation Site (NCDMS Project No. 95352)
 Monitoring Year 1



Bankfull Dimensions

41.8	x-section area (ft.sq.)
32.4	width (ft)
1.3	mean depth (ft)
3.6	max depth (ft)
34.7	wetted parimeter (ft)
1.2	hyd radi (ft)
25.1	width-depth ratio
---	W flood prone area (ft)
---	entrenchment ratio
1.0	low bank height ratio

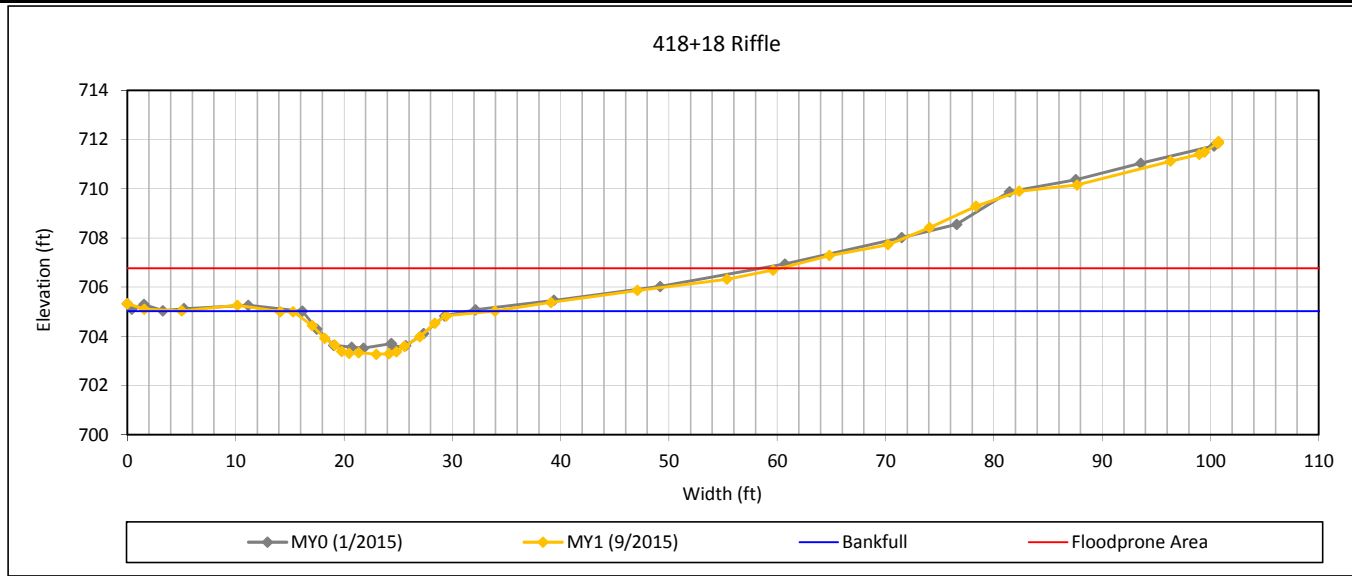
Survey Date: 9/2015
 Field Crew: Wildlands Engineering



View Downstream

Cross Section Plots
 Hopewell Stream Mitigation Site (NCDMS Project No. 95352)
 Monitoring Year 1

Cross Section 8, UT2 R2



Bankfull Dimensions

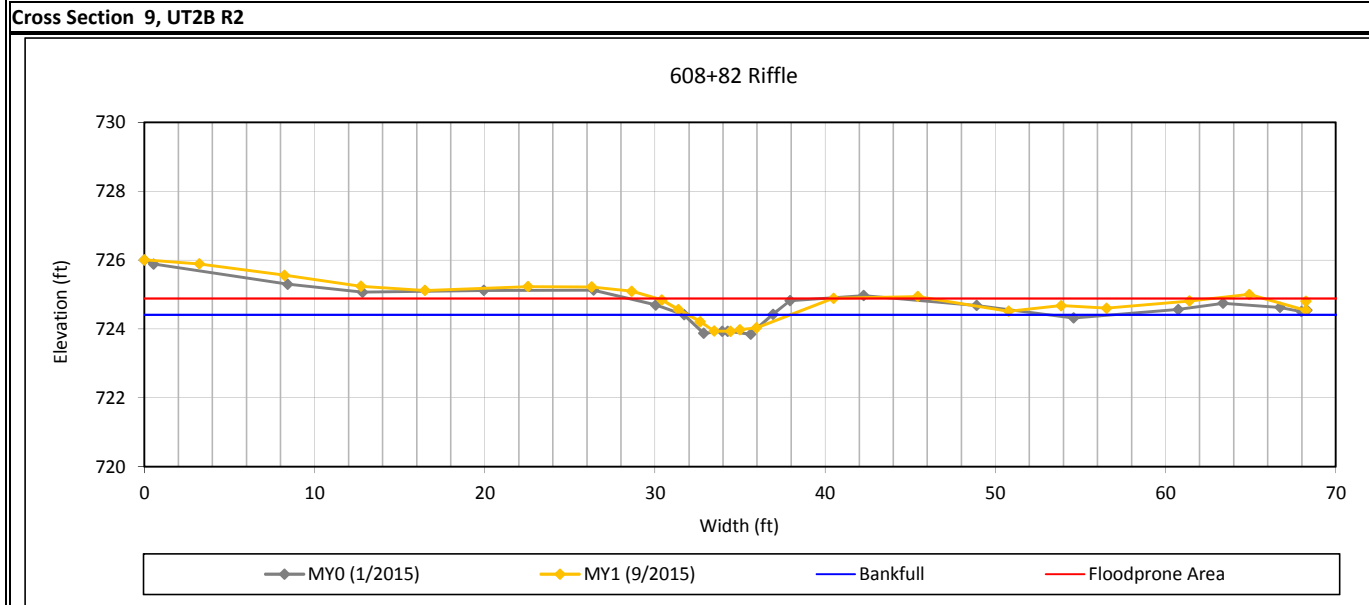
16.0	x-section area (ft.sq.)
12.4	width (ft)
1.3	mean depth (ft)
1.8	max depth (ft)
12.8	wetted perimeter (ft)
1.3	hyd radi (ft)
9.6	width-depth ratio
60.0	W flood prone area (ft)
4.8	entrenchment ratio
1.0	low bank height ratio

Survey Date: 9/2015
 Field Crew: Wildlands Engineering



View Downstream

Cross Section Plots
 Hopewell Stream Mitigation Site (NCDMS Project No. 95352)
 Monitoring Year 1



Bankfull Dimensions

1.8	x-section area (ft.sq.)
6.0	width (ft)
0.3	mean depth (ft)
0.5	max depth (ft)
6.1	wetted perimeter (ft)
0.3	hyd radi (ft)
19.9	width-depth ratio
29.4	W flood prone area (ft)
4.9	entrenchment ratio
1.0	low bank height ratio

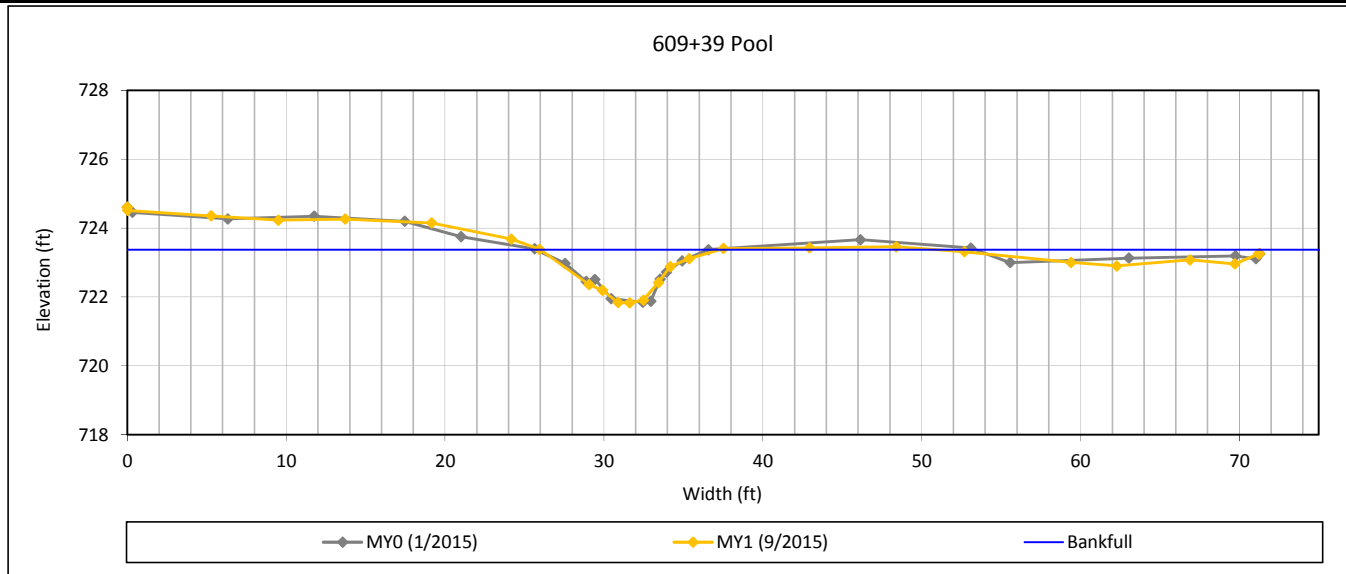
Survey Date: 7/2015
 Field Crew: Wildlands Engineering



View Downstream

Cross Section Plots
 Hopewell Stream Mitigation Site (NCDMS Project No. 95352)
 Monitoring Year 1

Cross Section 10, UT2B R2



Bankfull Dimensions

8.6	x-section area (ft.sq.)
11.3	width (ft)
0.8	mean depth (ft)
1.5	max depth (ft)
11.8	wetted parimeter (ft)
0.7	hyd radi (ft)
14.8	width-depth ratio
---	W flood prone area (ft)
---	entrenchment ratio
1.0	low bank height ratio

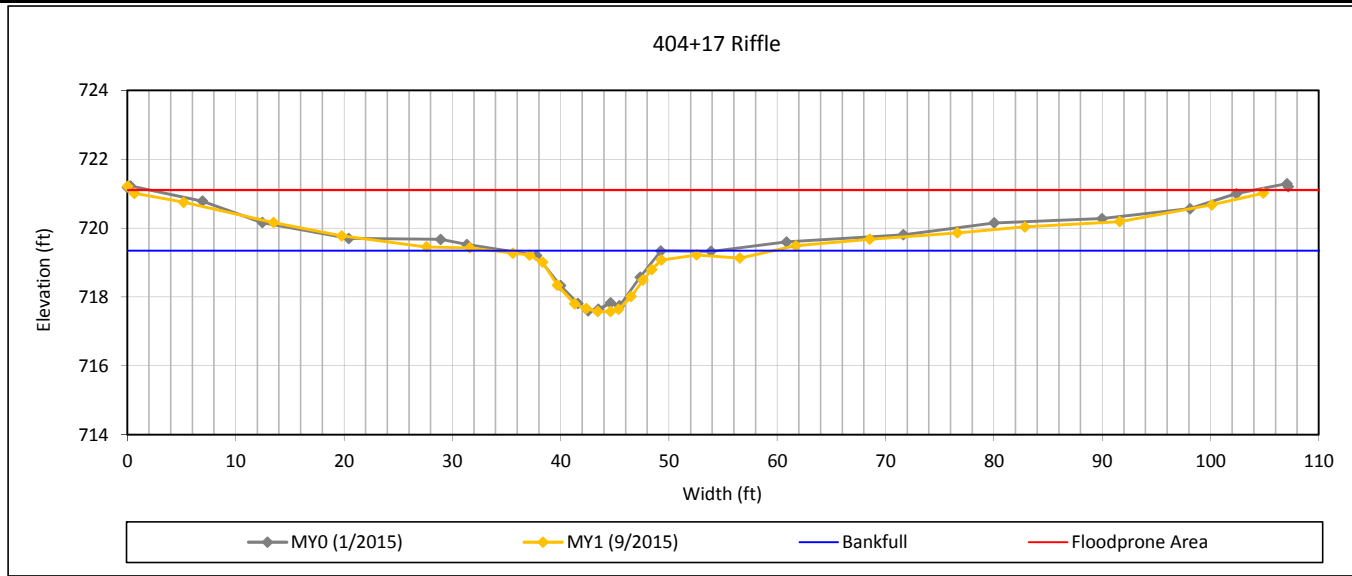
Survey Date: 7/2015
 Field Crew: Wildlands Engineering



View Downstream

Cross Section Plots
 Hopewell Stream Mitigation Site (NCDMS Project No. 95352)
 Monitoring Year 1

Cross Section 11, UT2 R1



Bankfull Dimensions

14.1	x-section area (ft.sq.)
13.7	width (ft)
1.0	mean depth (ft)
1.8	max depth (ft)
14.2	wetted parimeter (ft)
1.0	hyd radi (ft)
13.3	width-depth ratio
104.5	W flood prone area (ft)
7.6	entrenchment ratio
1.0	low bank height ratio

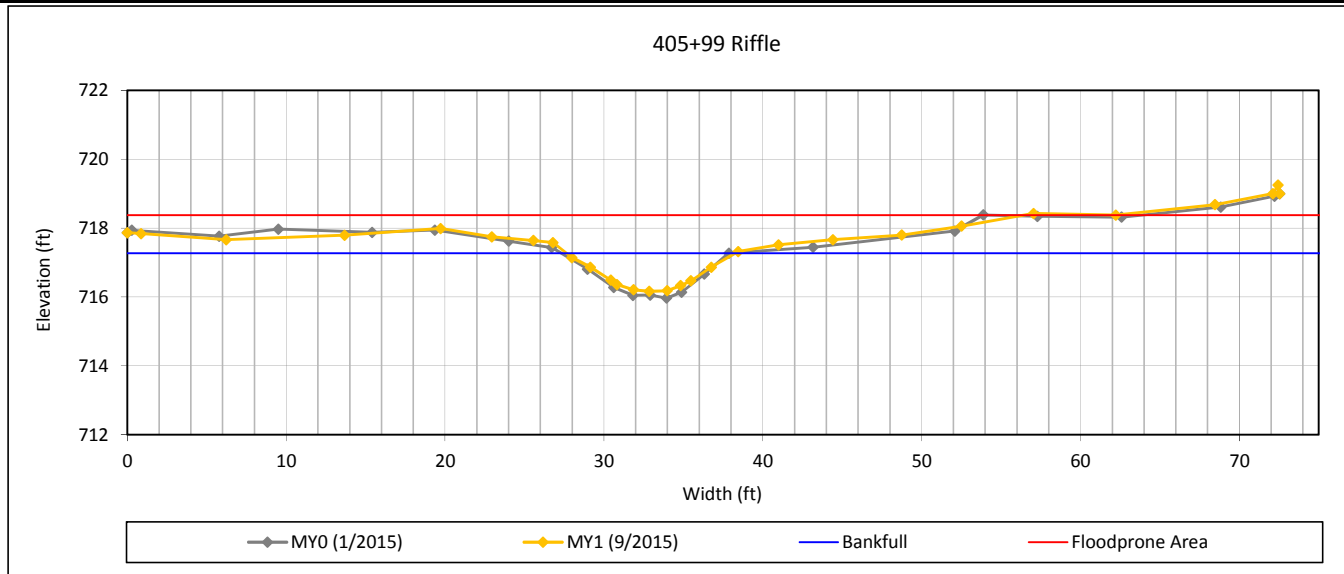
Survey Date: 9/2015
 Field Crew: Wildlands Engineering



View Downstream

Cross Section Plots
 Hopewell Stream Mitigation Site (NCDMS Project No. 95352)
 Monitoring Year 1

Cross Section 12, UT2 R1



Bankfull Dimensions

7.3	x-section area (ft.sq.)
10.6	width (ft)
0.7	mean depth (ft)
1.1	max depth (ft)
10.9	wetted parimeter (ft)
0.7	hyd radi (ft)
15.6	width-depth ratio
56.6	W flood prone area (ft)
5.3	entrenchment ratio
1.0	low bank height ratio

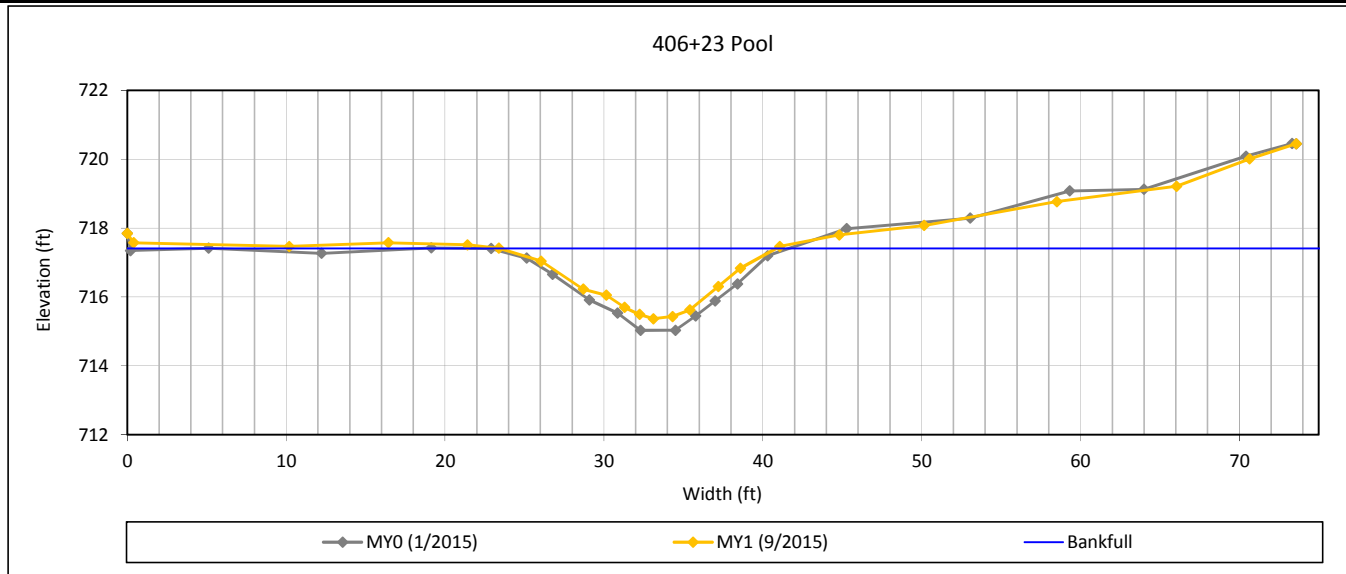
Survey Date: 9/2015
 Field Crew: Wildlands Engineering



View Downstream

Cross Section Plots
 Hopewell Stream Mitigation Site (NCDMS Project No. 95352)
 Monitoring Year 1

Cross Section 13, UT2 R1



Bankfull Dimensions

18.5	x-section area (ft.sq.)
17.4	width (ft)
1.1	mean depth (ft)
2.0	max depth (ft)
18.0	wetted parimeter (ft)
1.0	hyd radi (ft)
16.4	width-depth ratio
---	W flood prone area (ft)
---	entrenchment ratio
1.0	low bank height ratio

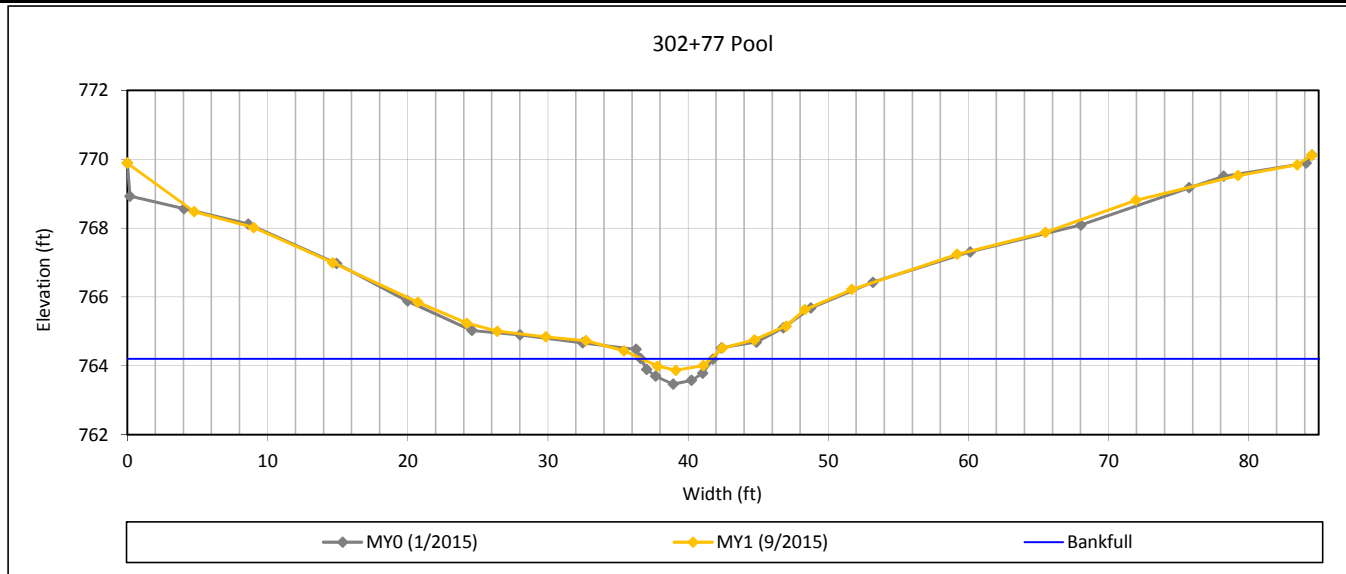
Survey Date: 9/2015
 Field Crew: Wildlands Engineering



View Downstream

Cross Section Plots
 Hopewell Stream Mitigation Site (NCDMS Project No. 95352)
 Monitoring Year 1

Cross Section 14, UT1B R1



Bankfull Dimensions

1.0	x-section area (ft.sq.)
4.9	width (ft)
0.2	mean depth (ft)
0.3	max depth (ft)
5.0	wetted parimeter (ft)
0.2	hyd radi (ft)
23.3	width-depth ratio
---	W flood prone area (ft)
---	entrenchment ratio
1.0	low bank height ratio

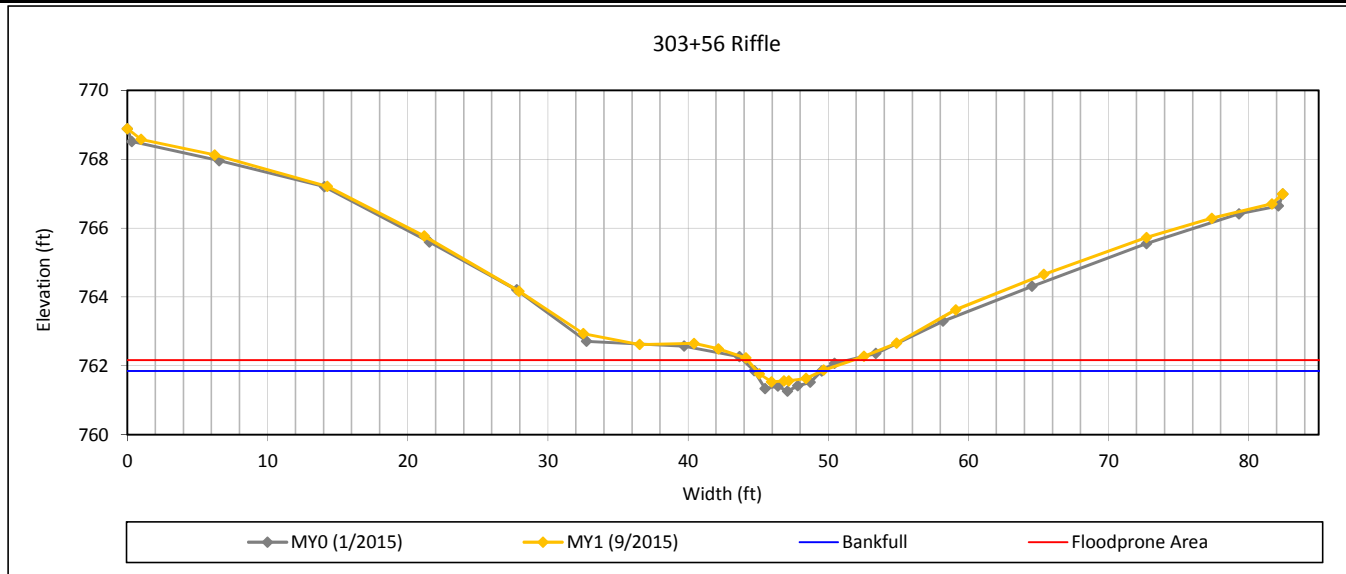
Survey Date: 9/2015
 Field Crew: Wildlands Engineering



View Downstream

Cross Section Plots
 Hopewell Stream Mitigation Site (NCDMS Project No. 95352)
 Monitoring Year 1

Cross Section 15, UT1B R1



Bankfull Dimensions

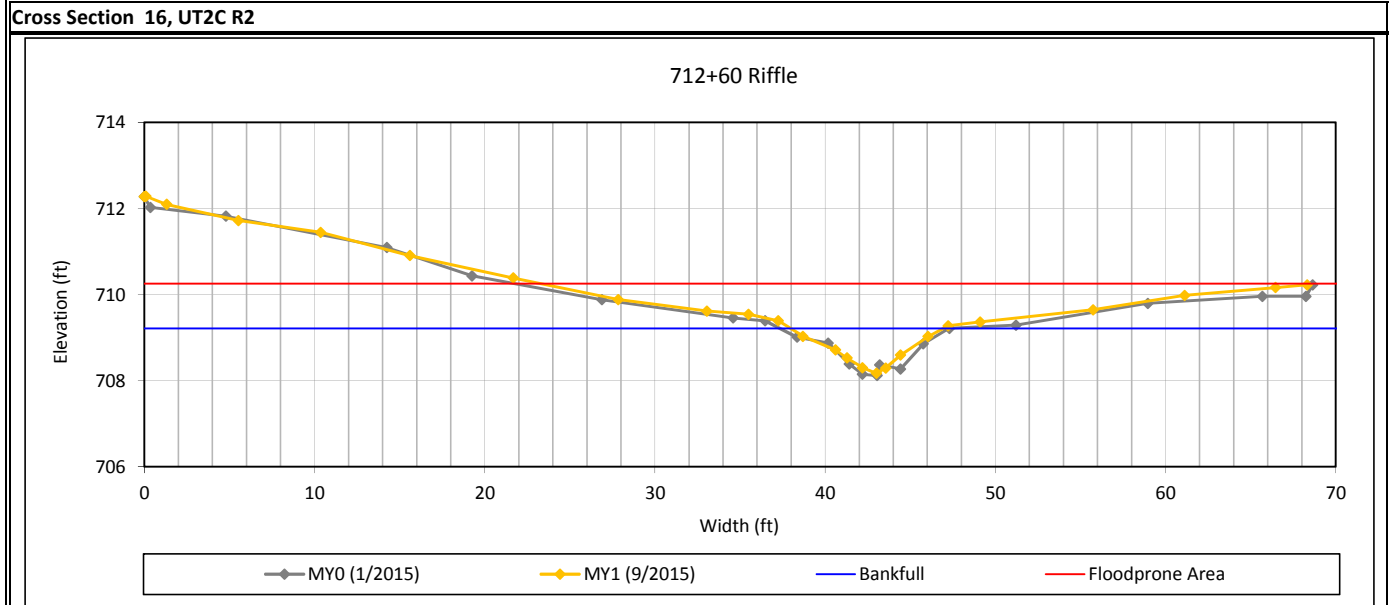
1.0	x-section area (ft.sq.)
4.6	width (ft)
0.2	mean depth (ft)
0.3	max depth (ft)
4.7	wetted parimeter (ft)
0.2	hyd radi (ft)
22.1	width-depth ratio
7.5	W flood prone area (ft)
1.6	entrenchment ratio
1.0	low bank height ratio

Survey Date: 9/2015
 Field Crew: Wildlands Engineering



View Downstream

Cross Section Plots
 Hopewell Stream Mitigation Site (NCDMS Project No. 95352)
 Monitoring Year 1



Bankfull Dimensions

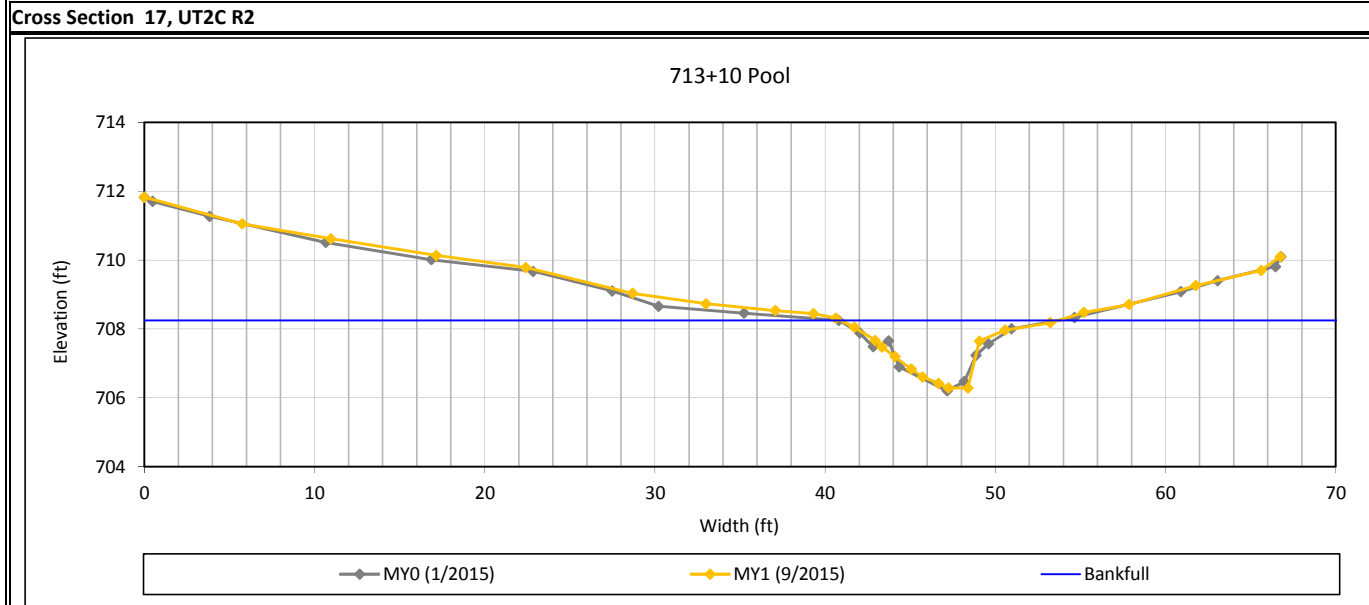
4.6	x-section area (ft.sq.)
9.0	width (ft)
0.5	mean depth (ft)
1.0	max depth (ft)
9.2	wetted parimeter (ft)
0.5	hyd radi (ft)
17.5	width-depth ratio
45.0	W flood prone area (ft)
5.0	entrenchment ratio
1.0	low bank height ratio

Survey Date: 9/2015
 Field Crew: Wildlands Engineering



View Downstream

Cross Section Plots
 Hopewell Stream Mitigation Site (NCDMS Project No. 95352)
 Monitoring Year 1



Bankfull Dimensions

10.7	x-section area (ft.sq.)
12.8	width (ft)
0.8	mean depth (ft)
2.0	max depth (ft)
14.0	wetted parimeter (ft)
0.8	hyd radi (ft)
15.3	width-depth ratio
---	W flood prone area (ft)
---	entrenchment ratio
1.0	low bank height ratio

Survey Date: 9/2015
 Field Crew: Wildlands Engineering

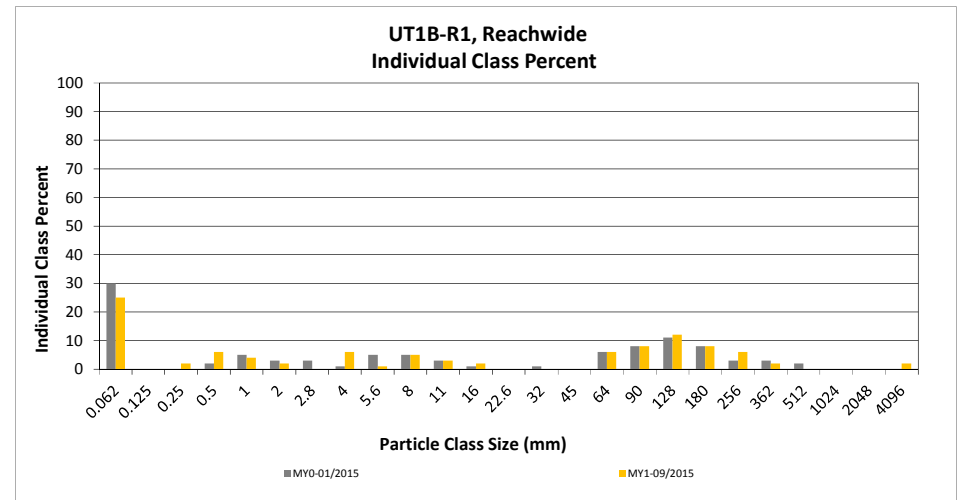
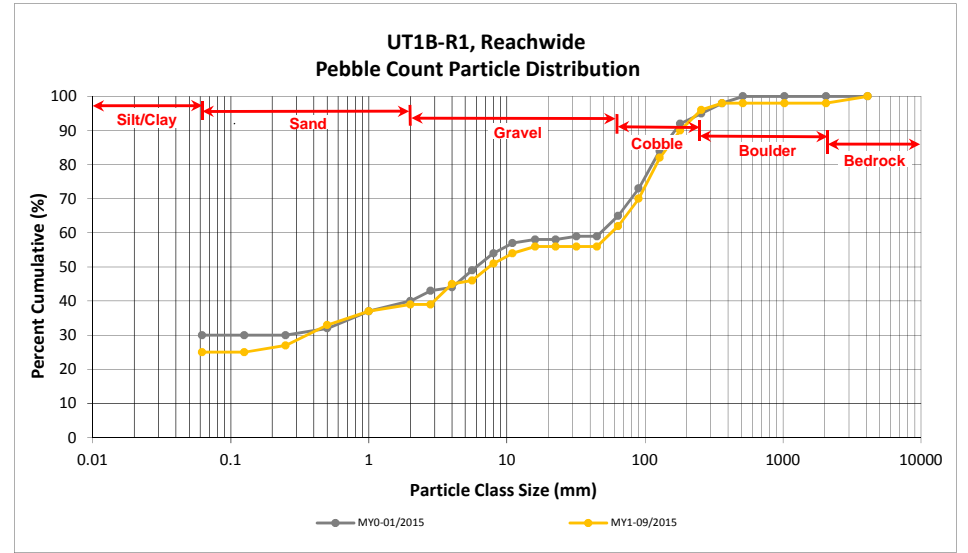


View Downstream

Reachwide and Cross Section Pebble Count Plots
 Hopewell Stream Mitigation Site (NCDMS Project No. 95352)
 Monitoring Year 1 - 2015
 UT1B-R1, Reachwide

Particle Class		Diameter (mm)		Particle Count			Reach Summary	
		min	max	Riffle	Pool	Total	Class Percentage	Percent Cumulative
SILT/CLAY	Silt/Clay	0.000	0.062	3	22	25	25	25
SAND	Very fine	0.062	0.125					25
	Fine	0.125	0.250		2	2	2	27
	Medium	0.25	0.50	2	4	6	6	33
	Coarse	0.5	1.0		4	4	4	37
	Very Coarse	1.0	2.0		2	2	2	39
GRAVEL	Very Fine	2.0	2.8					39
	Very Fine	2.8	4.0	3	3	6	6	45
	Fine	4.0	5.6		1	1	1	46
	Fine	5.6	8.0	1	4	5	5	51
	Medium	8.0	11.0		3	3	3	54
	Medium	11.0	16.0		2	2	2	56
	Coarse	16.0	22.6					56
	Coarse	22.6	32					56
	Very Coarse	32	45					56
	Very Coarse	45	64	6		6	6	62
COBBLE	Small	64	90	7	1	8	8	70
	Small	90	128	10	2	12	12	82
	Large	128	180	8		8	8	90
	Large	180	256	6		6	6	96
Boulder	Small	256	362	2		2	2	98
	Small	362	512					98
	Medium	512	1024					98
	Large/Very Large	1024	2048					98
BEDROCK	Bedrock	2048	>2048	2		2	2	100
Total				50	50	100	100	100

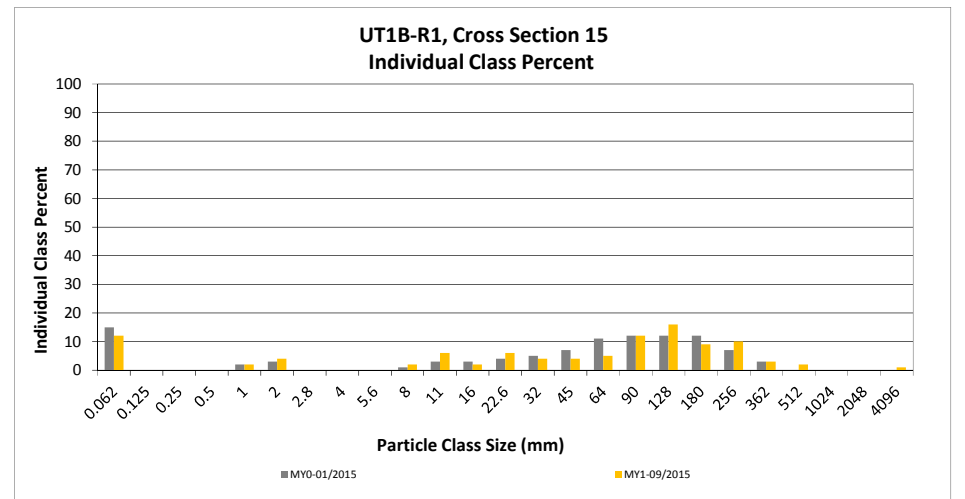
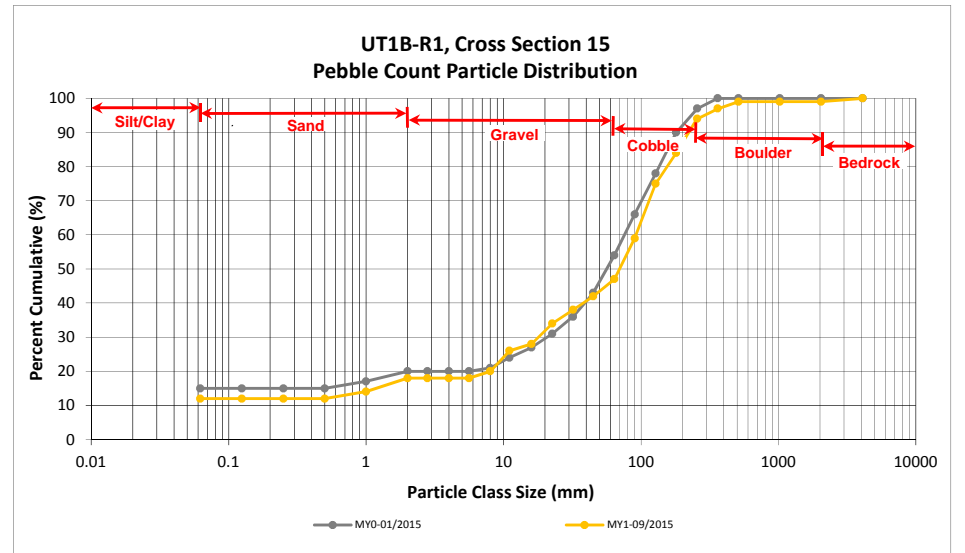
Reachwide	
Channel materials (mm)	
D ₁₆ =	Silt/Clay
D ₃₅ =	0.71
D ₅₀ =	7.4
D ₈₄ =	139.4
D ₉₅ =	241.4
D ₁₀₀ =	>2048



Reachwide and Cross Section Pebble Count Plots
Hopewell Stream Mitigation Site (NCDMS Project No. 95352)
Monitoring Year 1 - 2015
UT1B-R1, Cross Section 15

Particle Class		Diameter (mm)		Riffle 100-Count	Summary	
		min	max		Class Percentage	Percent Cumulative
<i>SILT/CLAY</i>	Silt/Clay	0.000	0.062	12	12	12
SAND	Very fine	0.062	0.125			12
	Fine	0.125	0.250			12
	Medium	0.25	0.50			12
	Coarse	0.5	1.0	2	2	14
	Very Coarse	1.0	2.0	4	4	18
GRAVEL	Very Fine	2.0	2.8			18
	Very Fine	2.8	4.0			18
	Fine	4.0	5.6			18
	Fine	5.6	8.0	2	2	20
	Medium	8.0	11.0	6	6	26
	Medium	11.0	16.0	2	2	28
	Coarse	16.0	22.6	6	6	34
	Coarse	22.6	32	4	4	38
	Very Coarse	32	45	4	4	42
	Very Coarse	45	64	5	5	47
COBBLE	Small	64	90	12	12	59
	Small	90	128	16	16	75
	Large	128	180	9	9	84
	Large	180	256	10	10	94
BOULDER	Small	256	362	3	3	97
	Small	362	512	2	2	99
	Medium	512	1024			99
	Large/Very Large	1024	2048			99
BEDROCK	Bedrock	2048	>2048	1	1	100
Total				100	100	100

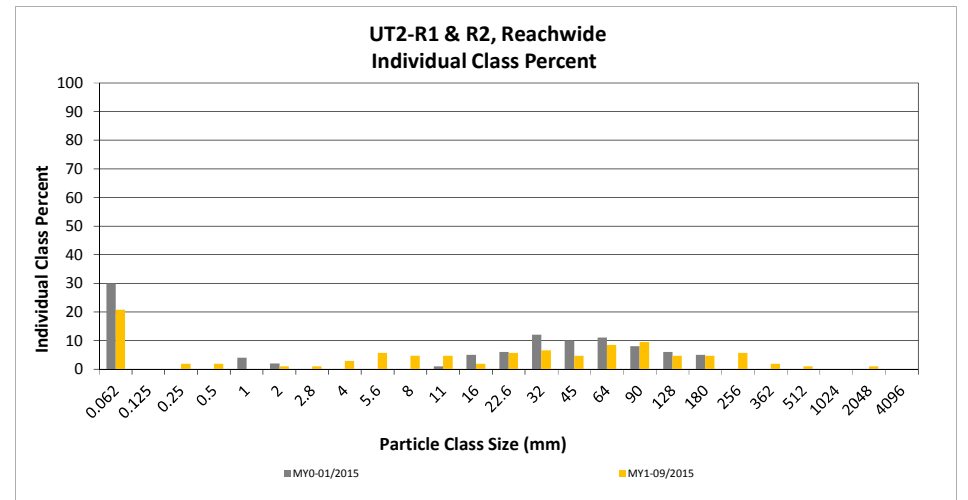
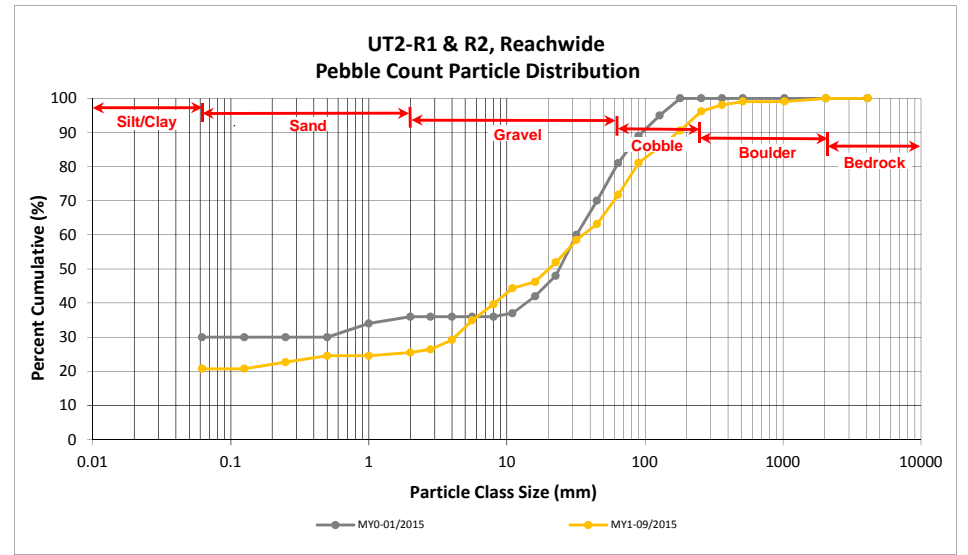
Cross Section 15	
Channel materials (mm)	
D ₁₆ =	1.41
D ₃₅ =	24.65
D ₅₀ =	69.7
D ₈₄ =	180.0
D ₉₅ =	287.3
D ₁₀₀ =	>2048



Reachwide and Cross Section Pebble Count Plots
 Hopewell Stream Mitigation Site (NCDMS Project No. 95352)
 Monitoring Year 1 - 2015
 UT2-R1 & 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	1	21	22	21	21
SAND	Very fine	0.062	0.125					21
	Fine	0.125	0.250		2	2	2	23
	Medium	0.25	0.50		2	2	2	25
	Coarse	0.5	1.0					25
	Very Coarse	1.0	2.0		1	1	1	25
GRAVEL	Very Fine	2.0	2.8		1	1	1	26
	Very Fine	2.8	4.0		3	3	3	29
	Fine	4.0	5.6		6	6	6	35
	Fine	5.6	8.0		5	5	5	40
	Medium	8.0	11.0	1	4	5	5	44
	Medium	11.0	16.0	1	1	2	2	46
	Coarse	16.0	22.6	3	3	6	6	52
	Coarse	22.6	32	5	2	7	7	58
	Very Coarse	32	45	5		5	5	63
	Very Coarse	45	64	9		9	8	72
COBBLE	Small	64	90	10		10	9	81
	Small	90	128	5		5	5	86
	Large	128	180	5		5	5	91
	Large	180	256	6		6	6	96
Boulder	Small	256	362	2		2	2	98
	Small	362	512	1		1	1	99
	Medium	512	1024					99
	Large/Very Large	1024	2048	1		1	1	100
BEDROCK	Bedrock	2048	>2048					100
Total				55	51	106	100	100

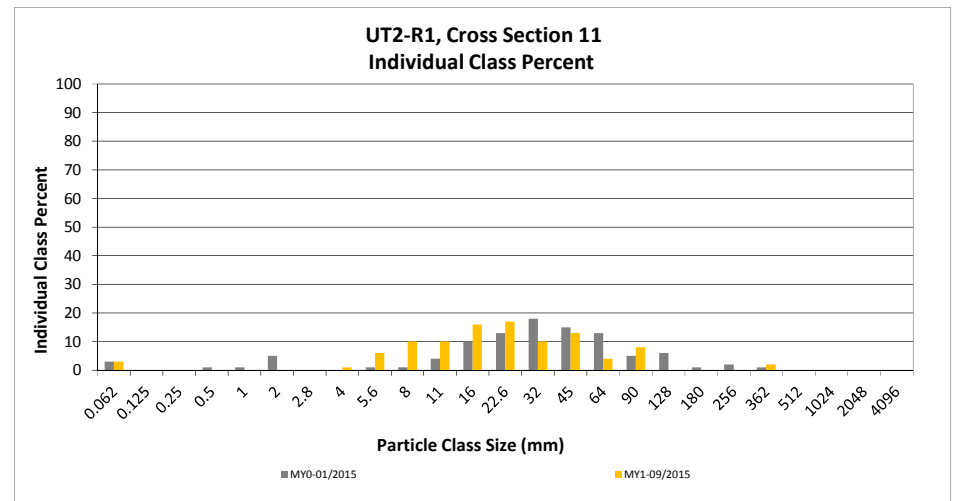
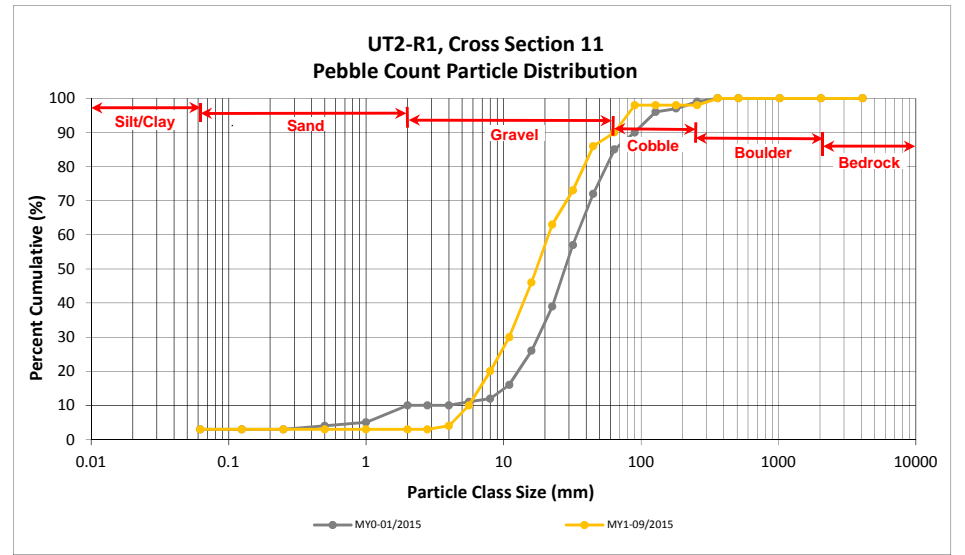
Reachwide Channel materials (mm)	
D ₁₆ =	Silt/Clay
D ₃₅ =	5.64
D ₅₀ =	20.1
D ₈₄ =	111.5
D ₉₅ =	237.2
D ₁₀₀ =	2048.0



Reachwide and Cross Section Pebble Count Plots
 Hopewell Stream Mitigation Site (NCDMS Project No. 95352)
 Monitoring Year 1 - 2015
 UT2-R1, Cross Section 11

Particle Class		Diameter (mm)		Riffle 100-Count	Summary	
		min	max		Class Percentage	Percent Cumulative
<i>SILT/CLAY</i>	Silt/Clay	0.000	0.062	3	3	3
SAND	Very fine	0.062	0.125			3
	Fine	0.125	0.250			3
	Medium	0.25	0.50			3
	Coarse	0.5	1.0			3
	Very Coarse	1.0	2.0			3
GRAVEL	Very Fine	2.0	2.8			3
	Very Fine	2.8	4.0	1	1	4
	Fine	4.0	5.6	6	6	10
	Fine	5.6	8.0	10	10	20
	Medium	8.0	11.0	10	10	30
	Medium	11.0	16.0	16	16	46
	Coarse	16.0	22.6	17	17	63
	Coarse	22.6	32	10	10	73
	Very Coarse	32	45	13	13	86
	Very Coarse	45	64	4	4	90
COBBLE	Small	64	90	8	8	98
	Small	90	128			98
	Large	128	180			98
	Large	180	256			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

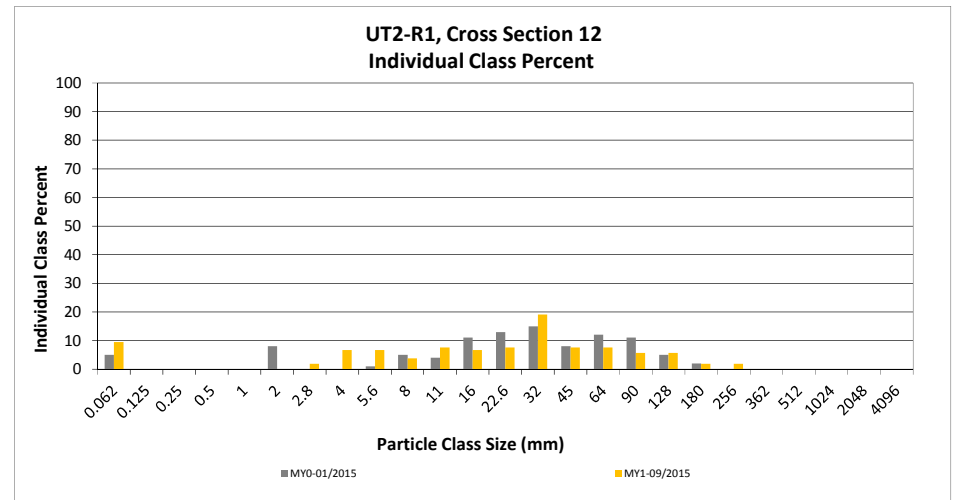
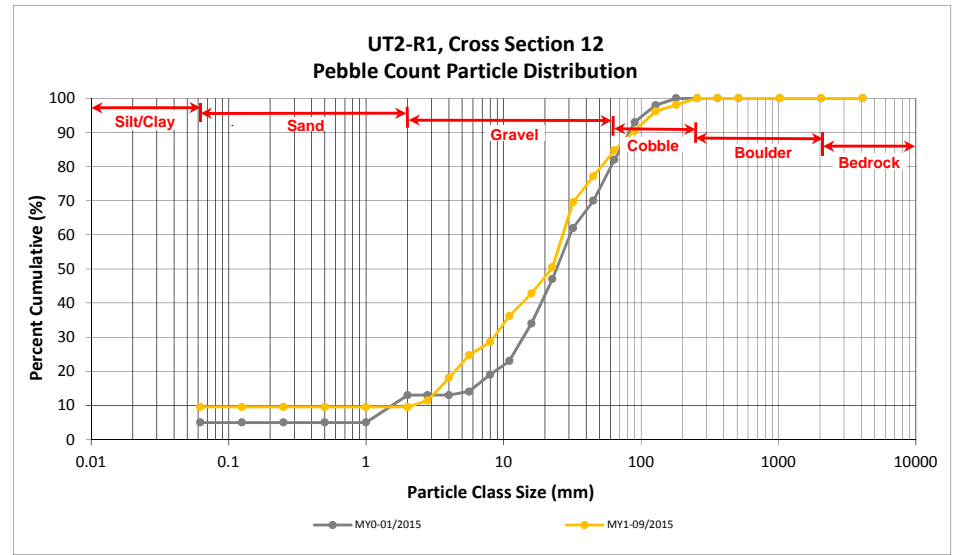
Cross Section 11	
Channel materials (mm)	
D ₁₆ =	6.94
D ₃₅ =	12.37
D ₅₀ =	17.4
D ₈₄ =	42.7
D ₉₅ =	79.2
D ₁₀₀ =	362.0



Reachwide and Cross Section Pebble Count Plots
 Hopewell Stream Mitigation Site (NCDMS Project No. 95352)
 Monitoring Year 1 - 2015
 UT2-R1, Cross Section 12

Particle Class		Diameter (mm)		Riffle 100-Count	Summary	
		min	max		Class Percentage	Percent Cumulative
<i>SILT/CLAY</i>	Silt/Clay	0.000	0.062	10	10	10
SAND	Very fine	0.062	0.125			10
	Fine	0.125	0.250			10
	Medium	0.25	0.50			10
	Coarse	0.5	1.0			10
	Very Coarse	1.0	2.0			10
GRAVEL	Very Fine	2.0	2.8	2	2	11
	Very Fine	2.8	4.0	7	7	18
	Fine	4.0	5.6	7	7	25
	Fine	5.6	8.0	4	4	29
	Medium	8.0	11.0	8	8	36
	Medium	11.0	16.0	7	7	43
	Coarse	16.0	22.6	8	8	50
	Coarse	22.6	32	20	19	70
	Very Coarse	32	45	8	8	77
	Very Coarse	45	64	8	8	85
COBBLE	Small	64	90	6	6	90
	Small	90	128	6	6	96
	Large	128	180	2	2	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				105	100	100

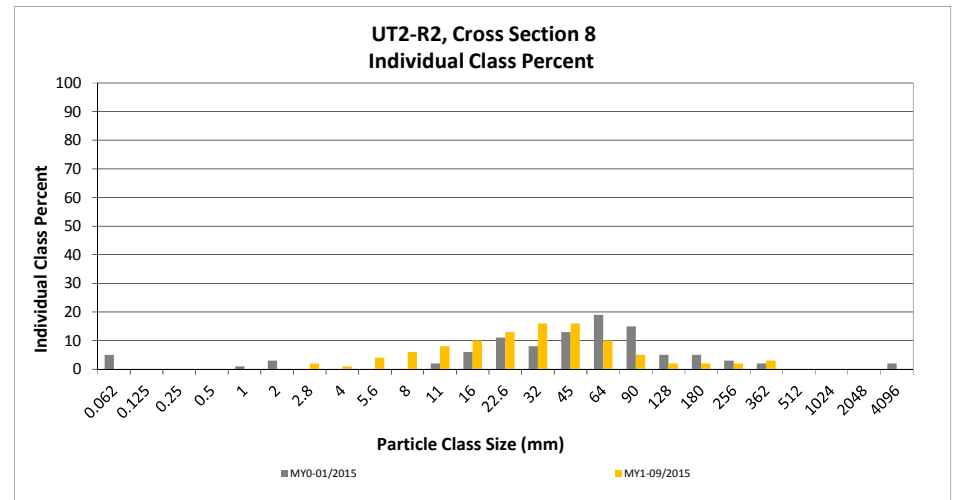
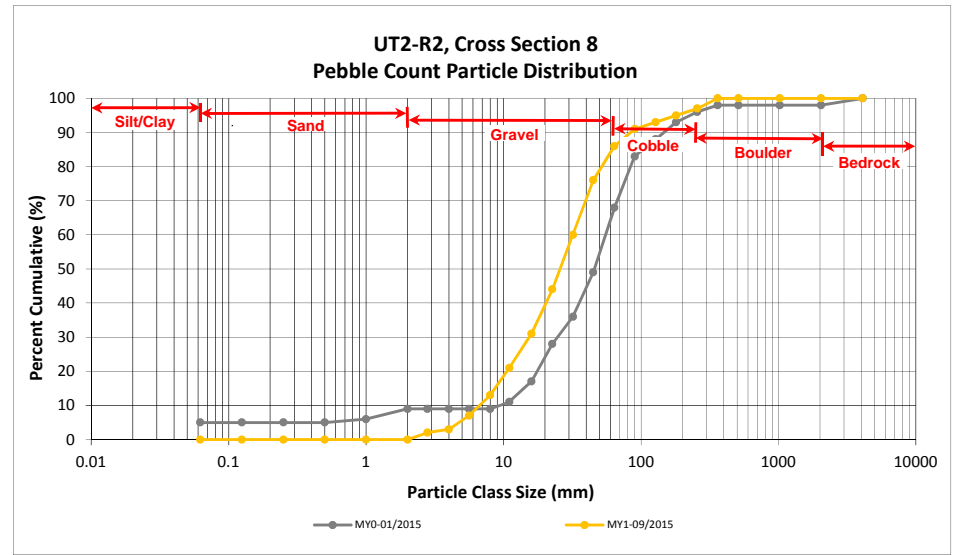
Cross Section 12	
Channel materials (mm)	
D ₁₆ =	3.58
D ₃₅ =	10.47
D ₅₀ =	22.1
D ₈₄ =	61.8
D ₉₅ =	118.9
D ₁₀₀ =	256.0



Reachwide and Cross Section Pebble Count Plots
 Hopewell Stream Mitigation Site (NCDMS Project No. 95352)
 Monitoring Year 1 - 2015
 UT2-R2, Cross Section 8

Particle Class		Diameter (mm)		Riffle 100-Count	Summary	
		min	max		Class Percentage	Percent Cumulative
<i>SILT/CLAY</i>	Silt/Clay	0.000	0.062			0
SAND	Very fine	0.062	0.125			0
	Fine	0.125	0.250			0
	Medium	0.25	0.50			0
	Coarse	0.5	1.0			0
	Very Coarse	1.0	2.0			0
GRAVEL	Very Fine	2.0	2.8	2	2	2
	Very Fine	2.8	4.0	1	1	3
	Fine	4.0	5.6	4	4	7
	Fine	5.6	8.0	6	6	13
	Medium	8.0	11.0	8	8	21
	Medium	11.0	16.0	10	10	31
	Coarse	16.0	22.6	13	13	44
	Coarse	22.6	32	16	16	60
	Very Coarse	32	45	16	16	76
	Very Coarse	45	64	10	10	86
COBBLE	Small	64	90	5	5	91
	Small	90	128	2	2	93
	Large	128	180	2	2	95
	Large	180	256	2	2	97
BOULDER	Small	256	362	3	3	100
	Small	362	512			100
	Medium	512	1024			100
	Large/Very Large	1024	2048			100
BEDROCK	Bedrock	2048	>2048			100
Total				100	100	100

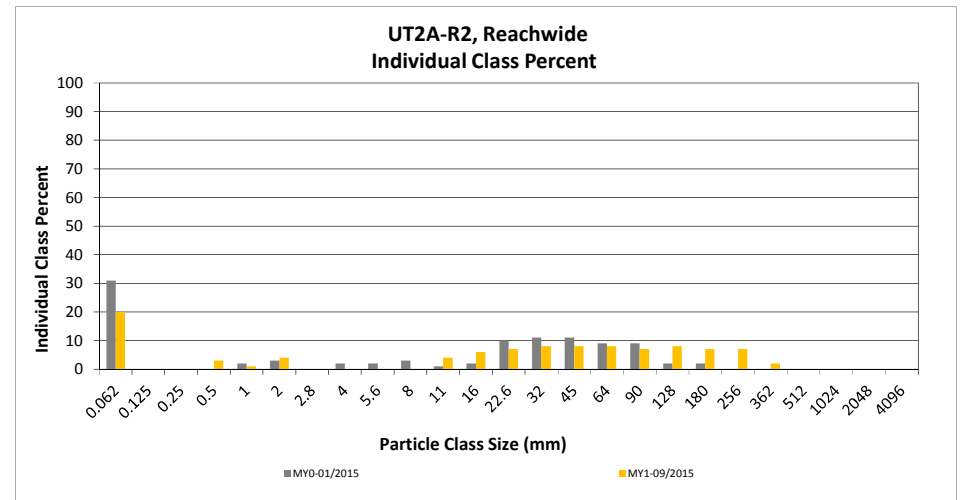
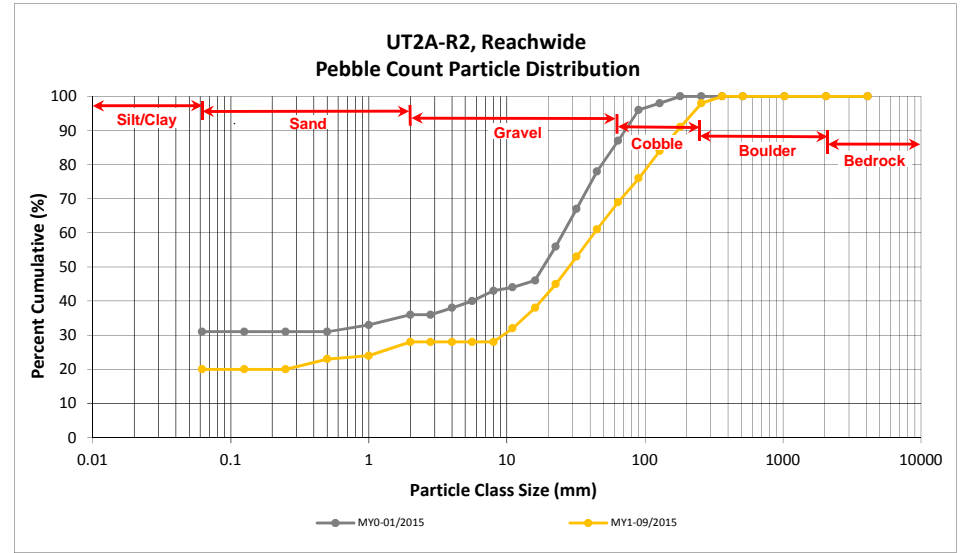
Cross Section 8	
Channel materials (mm)	
D ₁₆ =	9.01
D ₃₅ =	17.79
D ₅₀ =	25.7
D ₈₄ =	59.6
D ₉₅ =	180.0
D ₁₀₀ =	362.0



Reachwide and Cross Section Pebble Count Plots
 Hopewell Stream Mitigation Site (NCDMS Project No. 95352)
 Monitoring Year 1 - 2015
 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		20	20	20	20
SAND	Very fine	0.062	0.125					20
	Fine	0.125	0.250					20
	Medium	0.25	0.50		3	3	3	23
	Coarse	0.5	1.0		1	1	1	24
	Very Coarse	1.0	2.0		4	4	4	28
GRAVEL	Very Fine	2.0	2.8					28
	Very Fine	2.8	4.0					28
	Fine	4.0	5.6					28
	Fine	5.6	8.0					28
	Medium	8.0	11.0	2	2	4	4	32
	Medium	11.0	16.0	2	4	6	6	38
	Coarse	16.0	22.6	3	4	7	7	45
	Coarse	22.6	32	2	6	8	8	53
	Very Coarse	32	45	4	4	8	8	61
	Very Coarse	45	64	6	2	8	8	69
COBBLE	Small	64	90	7		7	7	76
	Small	90	128	8		8	8	84
	Large	128	180	7		7	7	91
	Large	180	256	7		7	7	98
Boulder	Small	256	362	2		2	2	100
	Small	362	512					100
	Medium	512	1024					100
	Large/Very Large	1024	2048					100
BEDROCK	Bedrock	2048	>2048					100
Total				50	50	100	100	100

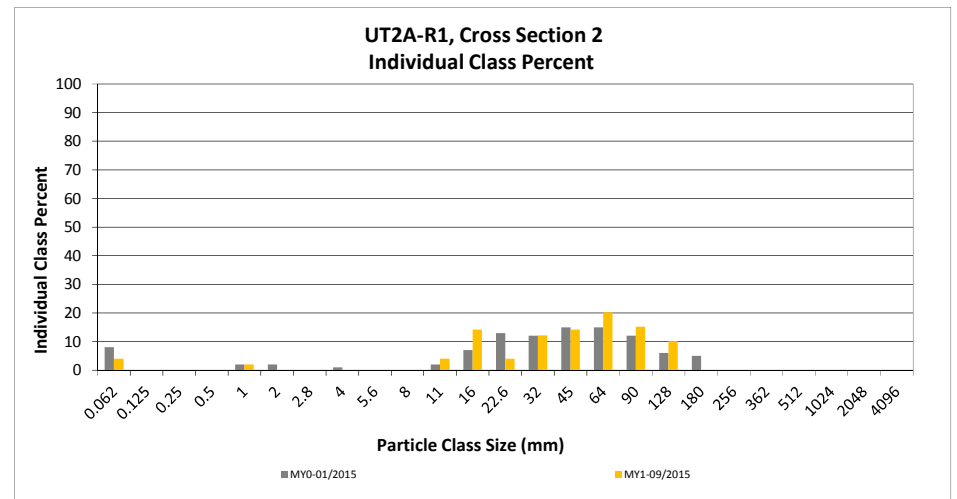
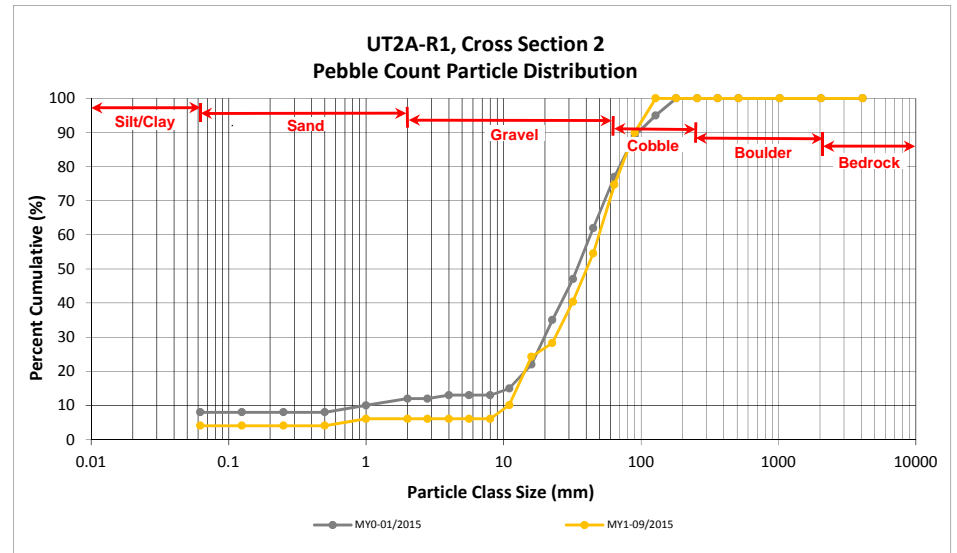
Reachwide	
Channel materials (mm)	
D ₁₆ =	Silt/Clay
D ₃₅ =	13.27
D ₅₀ =	28.1
D ₈₄ =	128.0
D ₉₅ =	220.1
D ₁₀₀ =	362.0



Reachwide and Cross Section Pebble Count Plots
 Hopewell Stream Mitigation Site (NCDMS Project No. 95352)
 Monitoring Year 1 - 2015
 UT2A-R1, Cross Section 2

Particle Class		Diameter (mm)		Riffle 100-Count	Summary	
		min	max		Class Percentage	Percent Cumulative
<i>SILT/CLAY</i>	Silt/Clay	0.000	0.062	4	4	4
SAND	Very fine	0.062	0.125			4
	Fine	0.125	0.250			4
	Medium	0.25	0.50			4
	Coarse	0.5	1.0	2	2	6
	Very Coarse	1.0	2.0			6
GRAVEL	Very Fine	2.0	2.8			6
	Very Fine	2.8	4.0			6
	Fine	4.0	5.6			6
	Fine	5.6	8.0			6
	Medium	8.0	11.0	4	4	10
	Medium	11.0	16.0	14	14	24
	Coarse	16.0	22.6	4	4	28
	Coarse	22.6	32	12	12	40
	Very Coarse	32	45	14	14	55
	Very Coarse	45	64	20	20	75
COBBLE	Small	64	90	15	15	90
	Small	90	128	10	10	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				99	100	100

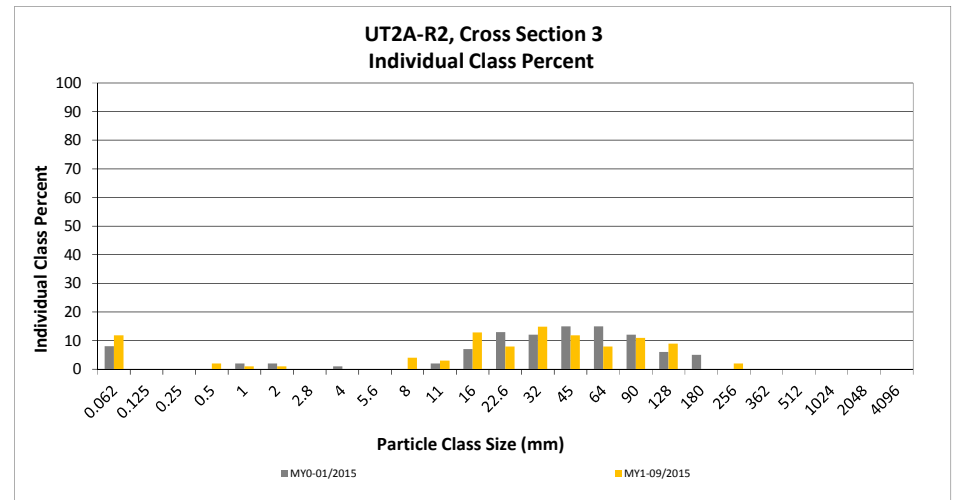
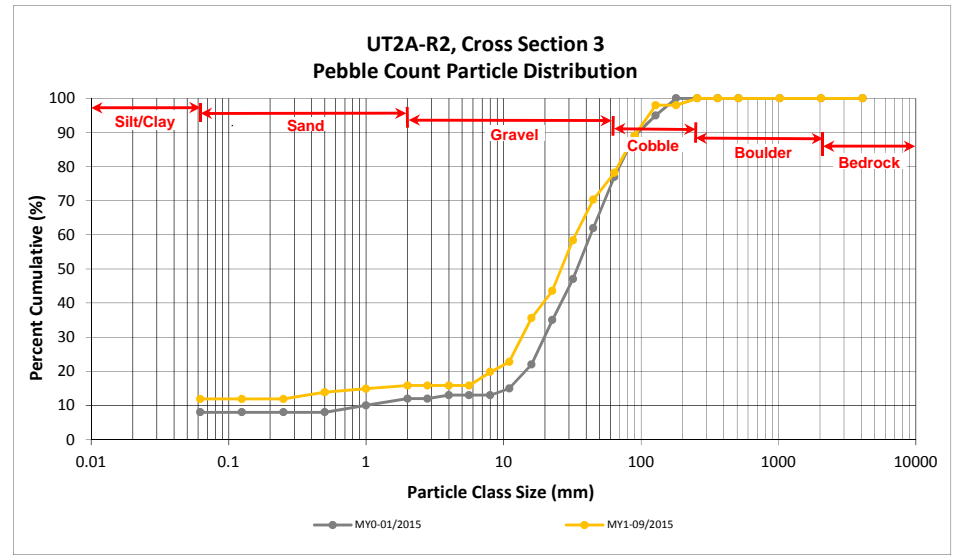
Cross Section 2	
Channel materials (mm)	
D ₁₆ =	12.86
D ₃₅ =	27.40
D ₅₀ =	40.3
D ₈₄ =	78.8
D ₉₅ =	107.5
D ₁₀₀ =	128.0



Reachwide and Cross Section Pebble Count Plots
 Hopewell Stream Mitigation Site (NCDMS Project No. 95352)
 Monitoring Year 1 - 2015
 UT2A-R2, Cross Section 3

Particle Class		Diameter (mm)		Riffle 100-Count	Summary	
		min	max		Class Percentage	Percent Cumulative
<i>SILT/CLAY</i>	Silt/Clay	0.000	0.062	12	12	12
SAND	Very fine	0.062	0.125			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	1	1	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	4	4	20
	Medium	8.0	11.0	3	3	23
	Medium	11.0	16.0	13	13	36
	Coarse	16.0	22.6	8	8	44
	Coarse	22.6	32	15	15	58
	Very Coarse	32	45	12	12	70
	Very Coarse	45	64	8	8	78
COBBLE	Small	64	90	11	11	89
	Small	90	128	9	9	98
	Large	128	180			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				101	100	100

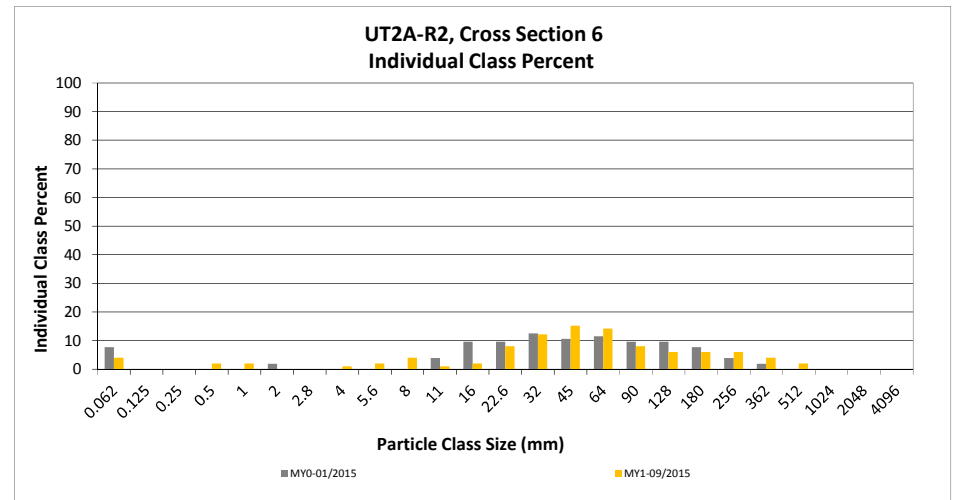
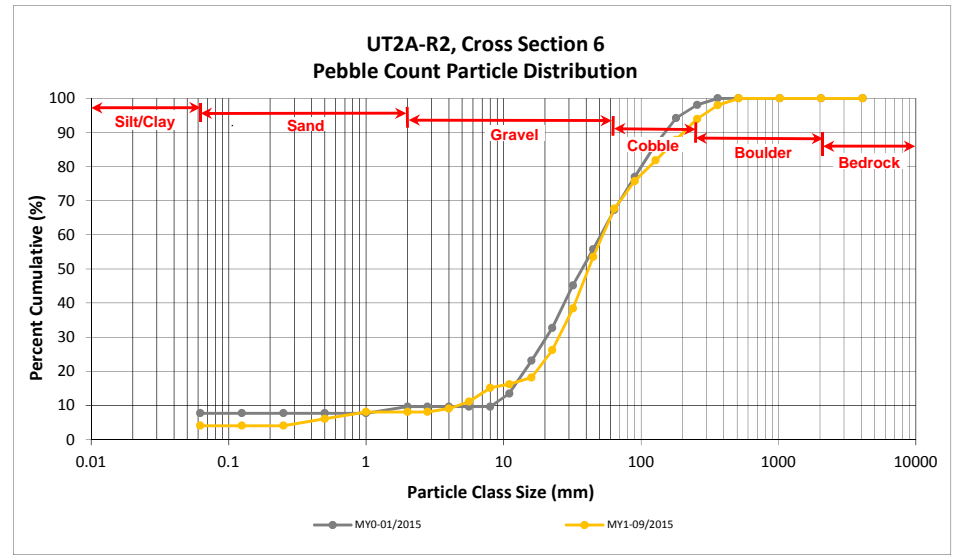
Cross Section 3	
Channel materials (mm)	
D ₁₆ =	5.68
D ₃₅ =	15.70
D ₅₀ =	26.3
D ₈₄ =	76.7
D ₉₅ =	113.6
D ₁₀₀ =	256.0



Reachwide and Cross Section Pebble Count Plots
 Hopewell Stream Mitigation Site (NCDMS Project No. 95352)
 Monitoring Year 1 - 2015
 UT2A-R2, Cross Section 6

Particle Class		Diameter (mm)		Riffle 100-Count	Summary	
		min	max		Class Percentage	Percent Cumulative
<i>SILT/CLAY</i>	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
GRAVEL	Very Fine	2.0	2.8			8
	Very Fine	2.8	4.0	1	1	9
	Fine	4.0	5.6	2	2	11
	Fine	5.6	8.0	4	4	15
	Medium	8.0	11.0	1	1	16
	Medium	11.0	16.0	2	2	18
	Coarse	16.0	22.6	8	8	26
	Coarse	22.6	32	12	12	38
	Very Coarse	32	45	15	15	54
	Very Coarse	45	64	14	14	68
COBBLE	Small	64	90	8	8	76
	Small	90	128	6	6	82
	Large	128	180	6	6	88
	Large	180	256	6	6	94
BOULDER	Small	256	362	4	4	98
	Small	362	512	2	2	100
	Medium	512	1024			100
	Large/Very Large	1024	2048			100
BEDROCK	Bedrock	2048	>2048			100
Total				99	100	100

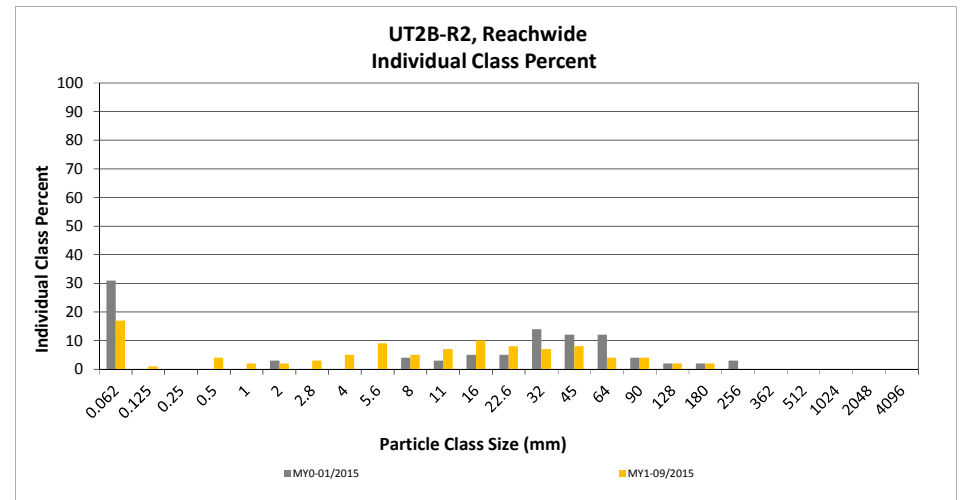
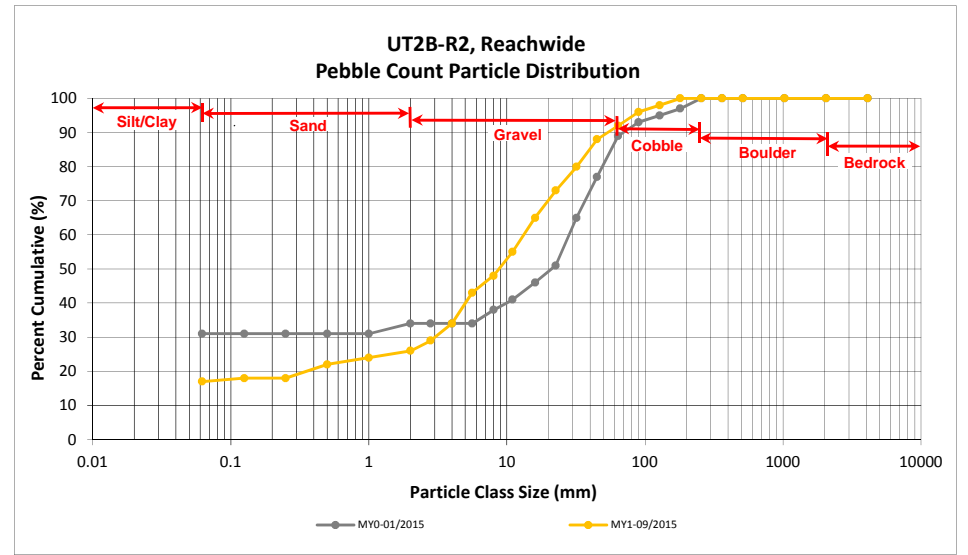
Cross Section 5	
Channel materials (mm)	
D ₁₆ =	10.45
D ₃₅ =	29.04
D ₅₀ =	41.6
D ₈₄ =	144.7
D ₉₅ =	280.4
D ₁₀₀ =	512.0



Reachwide and Cross Section Pebble Count Plots
 Hopewell Stream Mitigation Site (NCDMS Project No. 95352)
 Monitoring Year 1 - 2015
 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	1	16	17	17	17
SAND	Very fine	0.062	0.125		1	1	1	18
	Fine	0.125	0.250					18
	Medium	0.25	0.50	2	2	4	4	22
	Coarse	0.5	1.0	1	1	2	2	24
	Very Coarse	1.0	2.0		2	2	2	26
GRAVEL	Very Fine	2.0	2.8		3	3	3	29
	Very Fine	2.8	4.0	1	4	5	5	34
	Fine	4.0	5.6	3	6	9	9	43
	Fine	5.6	8.0	2	3	5	5	48
	Medium	8.0	11.0	5	2	7	7	55
	Medium	11.0	16.0	8	2	10	10	65
	Coarse	16.0	22.6	5	3	8	8	73
	Coarse	22.6	32	5	2	7	7	80
	Very Coarse	32	45	5	3	8	8	88
	Very Coarse	45	64	4	4	8	4	92
COBBLE	Small	64	90	4		4	4	96
	Small	90	128	2		2	2	98
	Large	128	180	2		2	2	100
	Large	180	256					100
BEDROCK	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

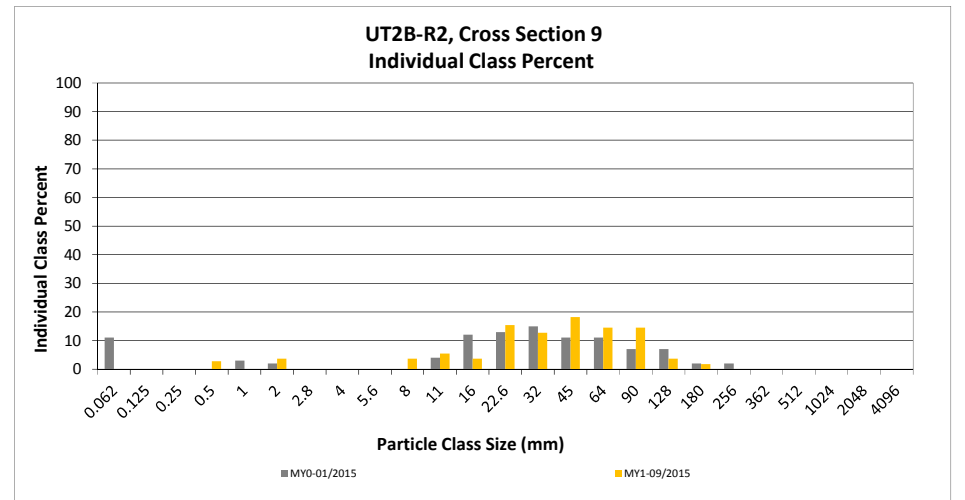
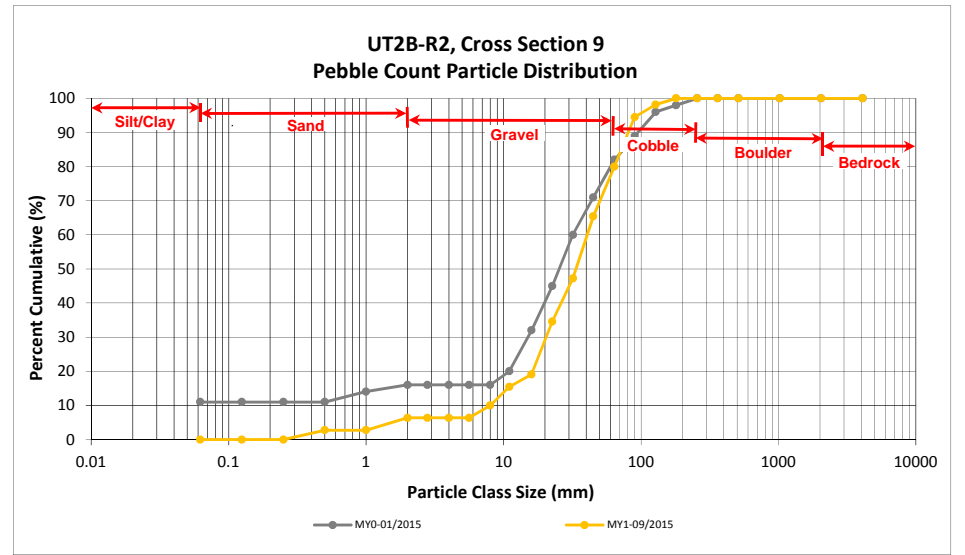
Reachwide	
Channel materials (mm)	
D ₁₆ =	Silt/Clay
D ₃₅ =	4.15
D ₅₀ =	8.8
D ₈₄ =	37.9
D ₉₅ =	82.6
D ₁₀₀ =	180.0



Reachwide and Cross Section Pebble Count Plots
 Hopewell Stream Mitigation Site (NCDMS Project No. 95352)
 Monitoring Year 1 - 2015
 UT2B-R2, Cross Section 9

Particle Class		Diameter (mm)		Riffle 100-Count	Summary	
		min	max		Class Percentage	Percent Cumulative
<i>SILT/CLAY</i>	Silt/Clay	0.000	0.062			0
SAND	Very fine	0.062	0.125			0
	Fine	0.125	0.250			0
	Medium	0.25	0.50	3	3	3
	Coarse	0.5	1.0			3
	Very Coarse	1.0	2.0	4	4	6
GRAVEL	Very Fine	2.0	2.8			6
	Very Fine	2.8	4.0			6
	Fine	4.0	5.6			6
	Fine	5.6	8.0	4	4	10
	Medium	8.0	11.0	6	5	15
	Medium	11.0	16.0	4	4	19
	Coarse	16.0	22.6	17	15	35
	Coarse	22.6	32	14	13	47
	Very Coarse	32	45	20	18	65
	Very Coarse	45	64	16	15	80
COBBLE	Small	64	90	16	15	95
	Small	90	128	4	4	98
	Large	128	180	2	2	100
	Large	180	256			100
BOULDER	Small	256	362			100
	Small	362	512			100
	Medium	512	1024			100
	Large/Very Large	1024	2048			100
BEDROCK	Bedrock	2048	>2048			100
Total				110	100	100

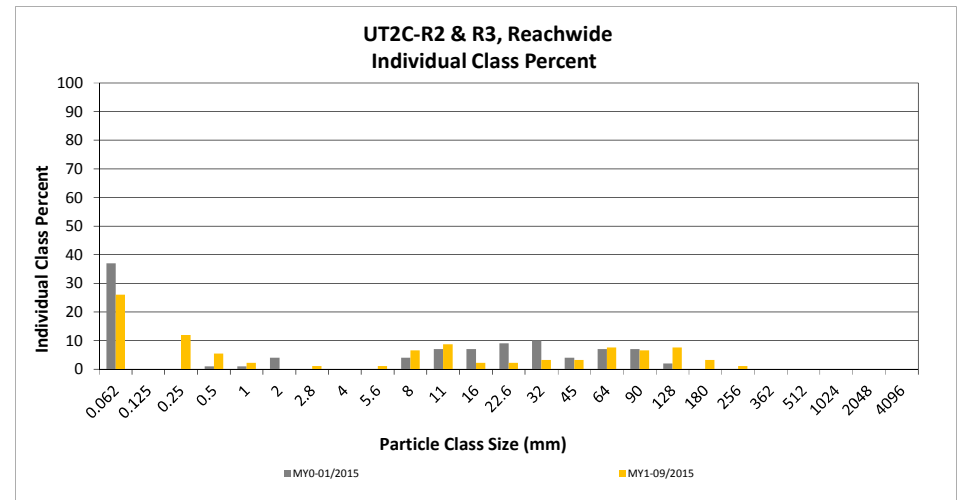
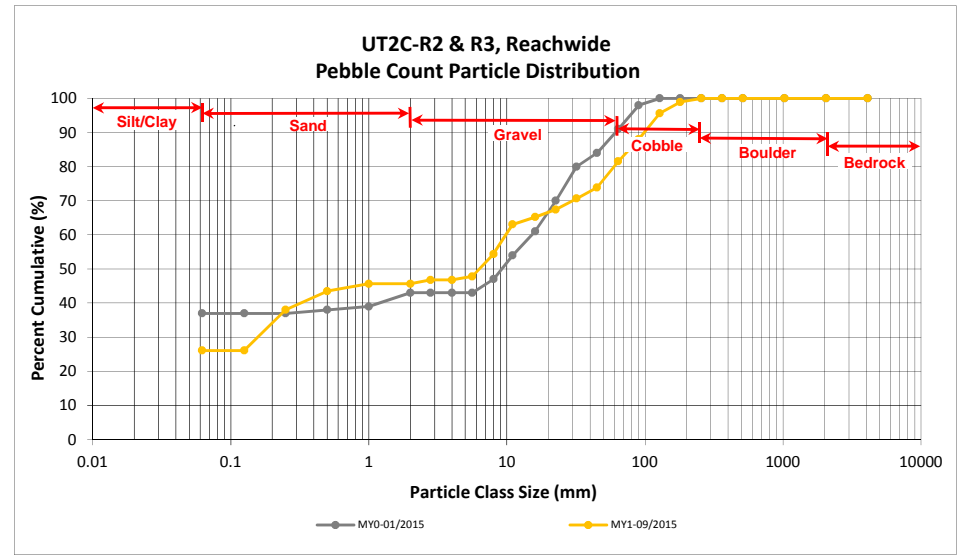
Cross Section 9	
Channel materials (mm)	
D ₁₆ =	11.64
D ₃₅ =	22.88
D ₅₀ =	33.7
D ₈₄ =	70.3
D ₉₅ =	94.1
D ₁₀₀ =	180.0



Reachwide and Cross Section Pebble Count Plots
 Hopewell Stream Mitigation Site (NCDMS Project No. 95352)
 Monitoring Year 1 - 2015
 UT2C-R2 & R3, Reachwide

Particle Class		Diameter (mm)		Particle Count			Reach Summary	
		min	max	Riffle	Pool	Total	Class Percentage	Percent Cumulative
SILT/CLAY	Silt/Clay	0.000	0.062	4	20	24	26	26
SAND	Very fine	0.062	0.125					26
	Fine	0.125	0.250	1	10	11	12	38
	Medium	0.25	0.50	1	4	5	5	43
	Coarse	0.5	1.0		2	2	2	46
	Very Coarse	1.0	2.0					46
GRAVEL	Very Fine	2.0	2.8	1		1	1	47
	Very Fine	2.8	4.0					47
	Fine	4.0	5.6	1		1	1	48
	Fine	5.6	8.0	4	2	6	7	54
	Medium	8.0	11.0	6	2	8	9	63
	Medium	11.0	16.0	2		2	2	65
	Coarse	16.0	22.6	2		2	2	67
	Coarse	22.6	32	3		3	3	71
	Very Coarse	32	45	3		3	3	74
	Very Coarse	45	64	7		7	8	82
COBBLE	Small	64	90	6		6	7	88
	Small	90	128	7		7	8	96
	Large	128	180	3		3	3	99
	Large	180	256	1		1	1	100
BEDROCK	Small	256	362					100
	Small	362	512					100
	Medium	512	1024					100
	Large/Very Large	1024	2048					100
BEDROCK	Bedrock	2048	>2048					100
Total				52	40	92	100	100

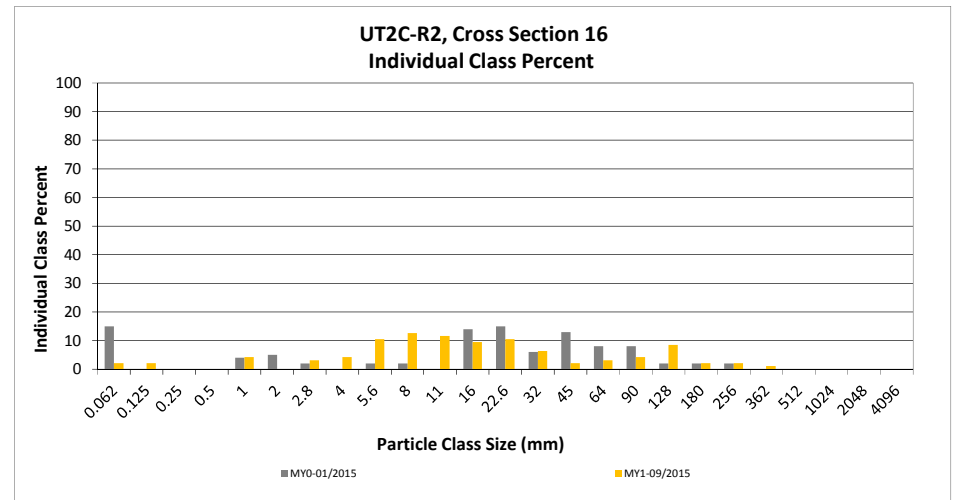
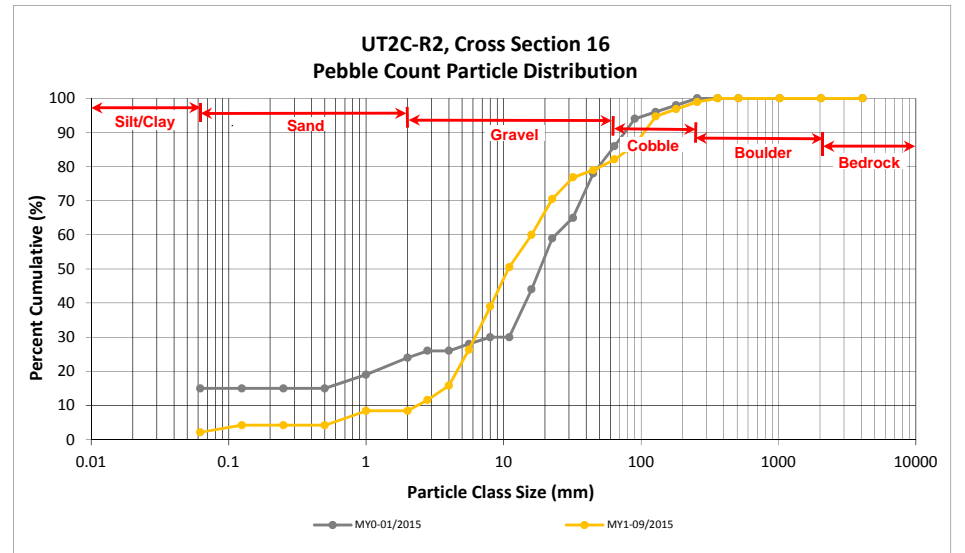
Reachwide	
Channel materials (mm)	
D ₁₆ =	Silt/Clay
D ₃₅ =	0.21
D ₅₀ =	6.3
D ₈₄ =	72.9
D ₉₅ =	124.2
D ₁₀₀ =	256.0



Reachwide and Cross Section Pebble Count Plots
 Hopewell Stream Mitigation Site (NCDMS Project No. 95352)
 Monitoring Year 1 - 2015
 UT2C-R2, Cross Section 16

Particle Class		Diameter (mm)		Riffle 100-Count	Summary	
		min	max		Class Percentage	Percent Cumulative
<i>SILT/CLAY</i>	Silt/Clay	0.000	0.062	2	2	2
SAND	Very fine	0.062	0.125	2	2	4
	Fine	0.125	0.250			4
	Medium	0.25	0.50			4
	Coarse	0.5	1.0	4	4	8
	Very Coarse	1.0	2.0			8
GRAVEL	Very Fine	2.0	2.8	3	3	12
	Very Fine	2.8	4.0	4	4	16
	Fine	4.0	5.6	10	11	26
	Fine	5.6	8.0	12	13	39
	Medium	8.0	11.0	11	12	51
	Medium	11.0	16.0	9	9	60
	Coarse	16.0	22.6	10	11	71
	Coarse	22.6	32	6	6	77
	Very Coarse	32	45	2	2	79
	Very Coarse	45	64	3	3	82
COBBLE	Small	64	90	4	4	86
	Small	90	128	8	8	95
	Large	128	180	2	2	97
	Large	180	256	2	2	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				95	100	100

Cross Section 16	
Channel materials (mm)	
D ₁₆ =	4.03
D ₃₅ =	7.16
D ₅₀ =	10.8
D ₈₄ =	74.6
D ₉₅ =	133.6
D ₁₀₀ =	362.0



APPENDIX 5. Hydrology Summary Data and Plots

Table 13. Verification of Bankfull Events

Hopewell Stream Mitigation Site (NCDMS Project No. 95352)

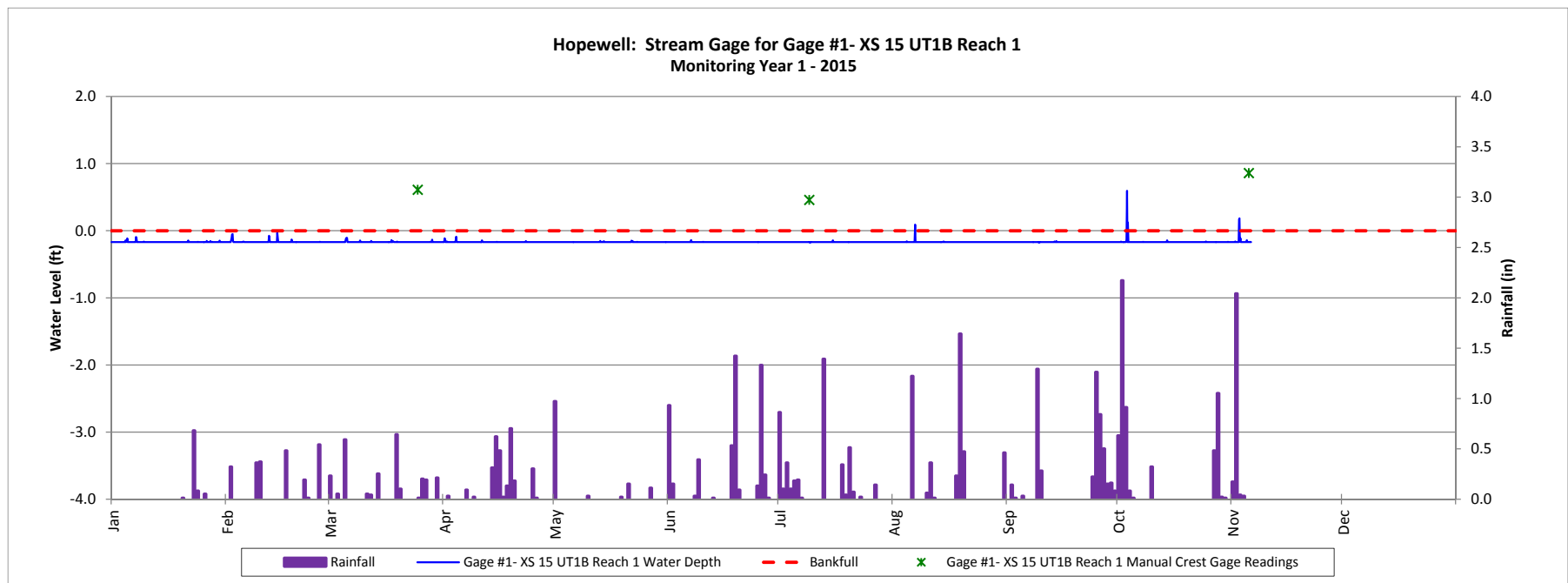
Monitoring Year 1 - 2015

Monitoring Year	Reach	Date of Data Collection	Date of Occurrence	Method
MY1	UT1B Reach 1 (Gage #1- XS 15)	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 Gage, Stream Gage
	UT2 Reach 2 (Gage #2- XS 8)	7/9/2015	Unknown	Crest Gage
		10/3/2015	10/3/2015	Stream Gage
		11/5/2015	11/2/2015	Crest Gage, Stream Gage
	UT2A Reach 2 (Gage #3- XS 6)	3/25/2015	Unknown	Crest Gage
		10/3/2015	10/3/2015	Stream Gage
		11/5/2015	11/2/2015	Crest Gage
	UT2B Reach 2 (Gage #4- XS 9)	3/25/2015	Unknown	Crest Gage
		7/9/2015	Unknown	Crest Gage
		10/3/2015	10/3/2015	Stream Gage
		11/5/2015	11/2/2015	Crest Gage
	UT2C Reach 2 (Gage #5- XS 16)	10/3/2015	10/3/2015	Stream Gage
11/5/2015		11/2/2015	Crest Gage	

Stream Flow Gage Plots

Hopewell Stream Mitigation Site (NCDMS Project No. 95352)

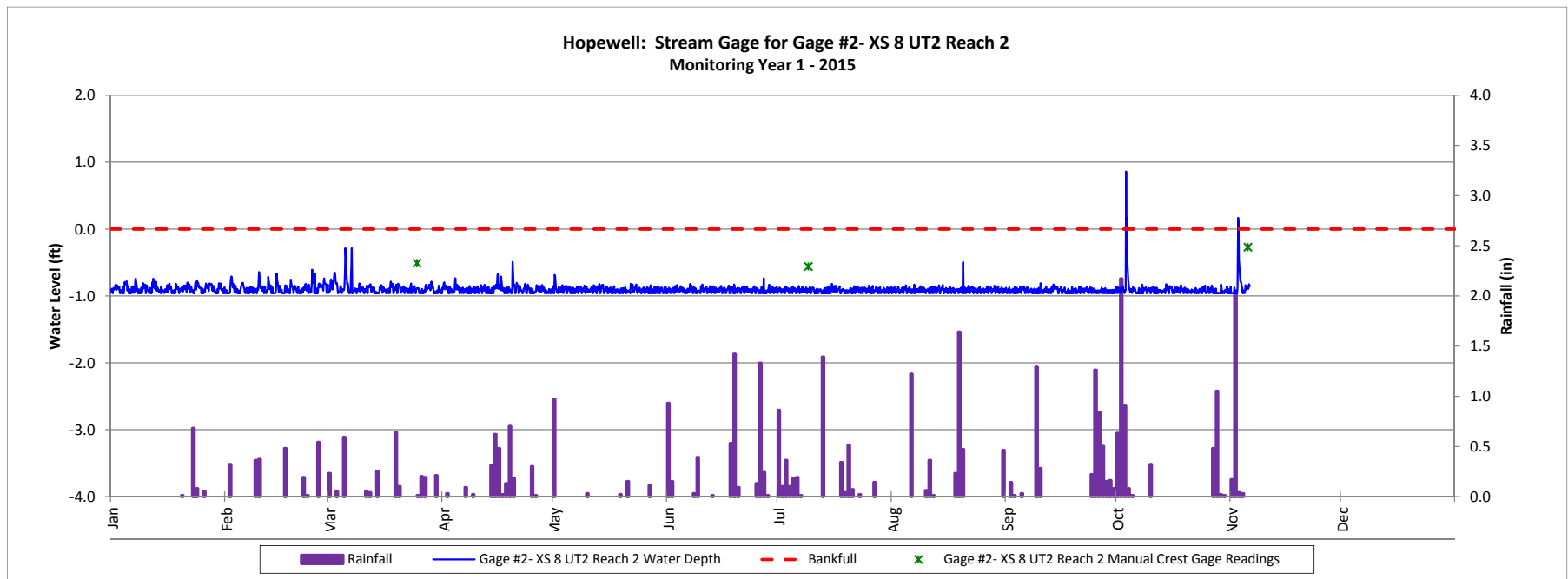
Monitoring Year 1 - 2015



Stream Flow Gage Plots

Hopewell Stream Mitigation Site (NCDMS Project No. 95352)

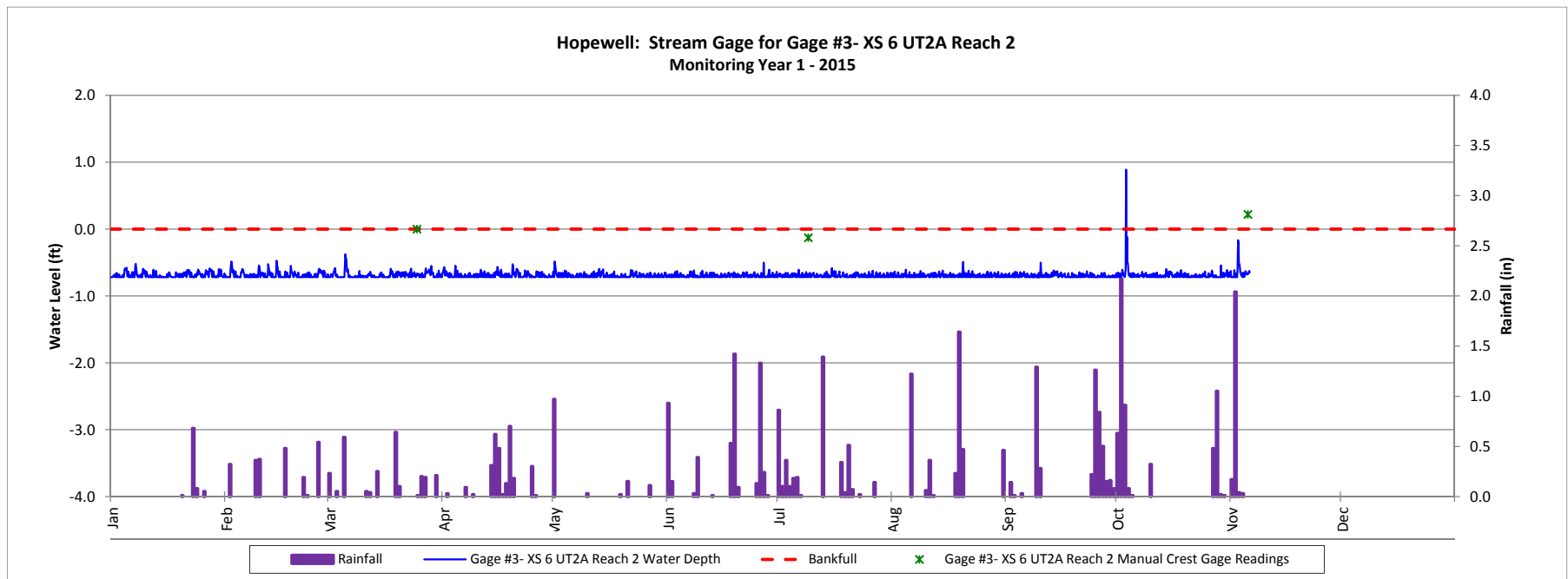
Monitoring Year 1 - 2015



Stream Flow Gage Plots

Hopewell Stream Mitigation Site (NCDMS Project No. 95352)

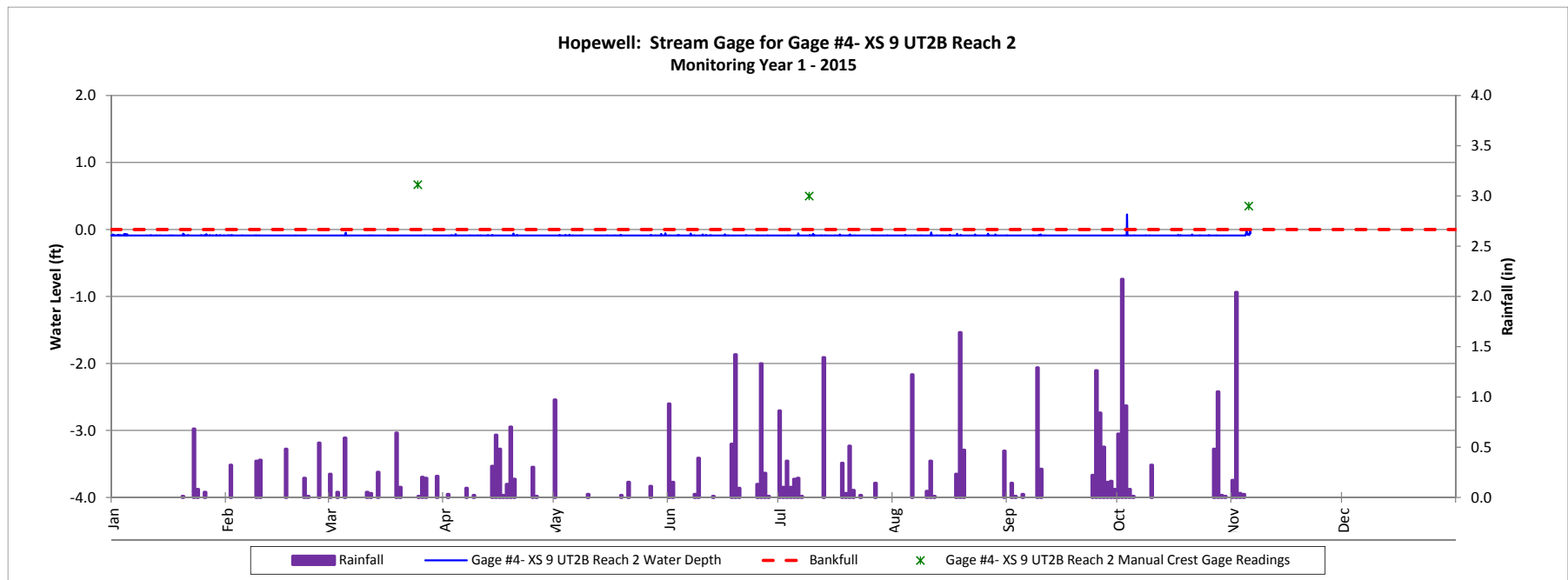
Monitoring Year 1 - 2015



Stream Flow Gage Plots

Hopewell Stream Mitigation Site (NCDMS Project No. 95352)

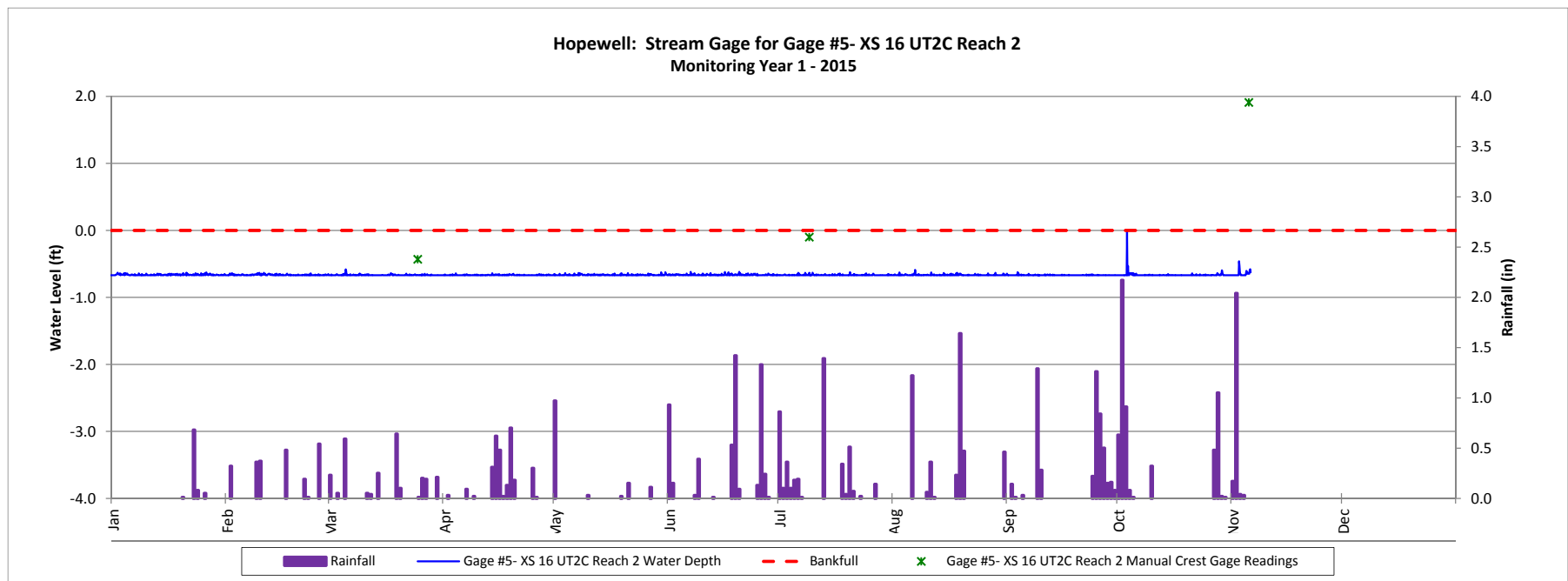
Monitoring Year 1 - 2015



Stream Flow Gage Plots

Hopewell Stream Mitigation Site (NCDMS Project No. 95352)

Monitoring Year 1 - 2015



BANKFULL VERIFICATION PHOTOGRAPHS



UT2 Reach 2 – (11/05/2015)



UT2 Reach 2 – (11/05/2015)



UT2C Reach 2 – (11/05/2015)



UT2A Reach 2 – (11/05/2015)



UT2 Reach 1 – (11/05/2015)



Little River Reach 2 – (11/05/2015)

