MONITORING YEAR 1 ANNUAL REPORT
Final

HOLMAN MILL MITIGATION SITE
Alamance County, NC
NCDEQ Contract 005795
DMS ID No. 96316

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EXECUTIVE SUMMARY

Wildlands Engineering, Inc. (Wildlands) completed a full delivery project at the Holman Mill Mitigation Site (Site) for the North Carolina Department of Environmental Quality Division of Mitigation Services (DMS) to restore and enhance a total of 8,717 linear feet (LF) of perennial and intermittent stream in Alamance County, NC. It is anticipated that the Site will generate 3,884 Stream Mitigation Units (SMUs) through the restoration and enhancement of six unnamed tributaries (UT to Pine Hill Branch, UT1, UT1A, UT2, UT2A, and UT2B). The project is located in the Cape Fear River Basin Hydrologic Unit Code (HUC) 03030002 (Cape Fear 02) near Snow Camp, NC (Figure 1) and is within the Cane Creek Targeted Local Watershed (TLW) (HUC 03030002050050). On-site streams flow into Cane Creek and eventually into the Haw River.

The Site is located within the Jordan Lake Water Supply Watershed, which has been designated as a Nutrient Sensitive Water. The TLW was identified in DMS's Cape Fear River Basin Restoration Priorities 2009 (RBRP) report. This RBRP plan identifies agricultural operations and degraded water quality based on "fair" and "good-fair" benthic ratings as the impairments in the Cane Creek watershed. The RBRP report also identifies the successful completion of a number of stream and wetland projects within the Cane Creek watershed. The Site fully supports the Cataloging Unit (CU)-wide functional objectives stated in the 2011 Request for Proposals (RFP) to reduce and control nutrient inputs, reduce and control sediment inputs, and protect and augment Significant Natural Heritage Areas in the Cape Fear 02 River Basin.

The mitigation project is intended to provide numerous ecological benefits within the Cape Fear River Basin. While many of these benefits are limited to the Holman Mill Mitigation Site project area, others, such as pollutant removal and improved aquatic and terrestrial habitat, have more far-reaching effects. Expected improvements to water quality and ecological processes are outlined below as project goals and objectives. These project goals were established and completed with careful consideration of the goals and objectives described in the RBRP and to meet the DMS's mitigation needs, while maximizing the ecological and water quality uplift within the watershed. The following project specific goals established in the mitigation plan (Wildlands, 2015) are to:

- Reduce fecal coliform, nitrogen, and phosphorous inputs by removing cattle from streams and establishing and augmenting a forested riparian corridor *to* intercept and process sediment and nutrients before they reach the channel during storm events;
- Reduce sediment loads by stabilizing eroding stream banks;
- Return a network of streams to a stable form that is capable of supporting biological functions;
- Install instream structures to improve bed and bank stability, create fish and macroinvertebrate habitat, and help oxygenate streamflows; and
- Protect existing high quality streams and forested buffers.

The project is helping meet the goals for the watershed and providing numerous ecological benefits within the Cape Fear River Basin. While many of these benefits are limited to the project area, others, such as pollutant removal and reduced sediment loading have farther-reaching effects. In addition, protected parcels downstream of this site promote cumulative project benefits within the watershed.

The Site construction and as-built surveys were completed between January 2016 and April 2016. A conservation easement is in place on 32.4 acres of the riparian corridors to protect them in perpetuity.

Monitoring Year 1 (MY1) assessments and site visits were completed between March and October, 2016 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 603 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. Hydrologic monitoring stations with crest gages and pressure transducers were installed on the Site to document bankfull events on the restoration reaches. Multiple bankfull events were recorded on each restoration reach during the 2016 annual monitoring period, therefor partially fulfilling the Monitoring Year 7 hydrology success criteria.

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APPENDICES

Section 1: PROJECT OVERVIEW

The Holman Mill Mitigation Site (Site) is located in the southern portion of Alamance County, southeast of Snow Camp off of Holman Mill Road (Figure 1). The Site is located within the Jordan Lake Water Supply Watershed (HUC 03030002050050), which has been designated as a Nutrient Sensitive Water. The Site is in in the Carolina Slate Belt of the Piedmont Physiographic Province (USGS, 1998). The project watershed consists primarily of agricultural and wooded land. The drainage area for project site is 1,077 acres (1.68 square miles).

The project streams consist of six unnamed tributaries to Pine Hill Branch. Stream restoration reaches included UT1 (Reach 1 and 3), UT2 (Reach 3 and 4) and UT2A. Stream enhancement I (EI) and enhancement II (EII) reaches included UT1 (Reach 2 and 4), EII; UT2 (Reach 1), EII; UT2 (Reach 2), EI; UT2B, EII; UT1A, EII; and UT to Pine Hill Branch, EII. Mitigation work within the Site included restoration and enhancement of 8,717 linear feet (LF) of perennial and intermittent stream channels. The riparian areas were planted with native vegetation to improve habitat and protect water quality. The final mitigation plan was submitted and accepted by the DMS in May 2015. Construction activities were completed by Land Mechanic Designs, Inc. in March 2016. Planting and seeding activities were completed by Bruton Natural Systems, Inc. in March 2016. Baseline monitoring (MY0) was conducted between January 2016 and April 2016. Annual monitoring will occur for seven years with the close-out anticipated to commence in 2023 given the success criteria are met. Appendix 1 provides more detailed project activity, history, contact information, and watershed/site background information for the Site.

A conservation easement (32.4 ac; Deed Book 3472, Page 968; Deed Book 3472, Page 951) has been recorded and is in place along the stream riparian corridors to protect them in perpetuity within two tracts; a tract owned by the Russell B. Hadley Revocable Trust and a tract owned by the M. Darryl Lindley Revocable Trust, respectively. The project is expected to provide 3,884 SMU's by closeout.

A project vicinity map and directions are provided in Figure 1 and project components are illustrated in Figure 2.

1.1 Project Goals and Objectives

Prior to construction activities, the streams and vegetative communities on the Site had been severely impacted due to direct livestock access to the streams and riparian zones. Table 4 in Appendix 1 and Tables 10a through 10c in Appendix 4 present the pre-restoration conditions in detail.

This Site is intended to provide numerous ecological benefits within the Cape Fear River Basin. While many of these benefits are limited to the Holman Mill Site area, others such as pollutant removal and reduced sediment loading have more far-reaching effects. Expected improvements to water quality and ecological processes are outlined below as project goals and objectives. These project goals were established and completed with careful consideration of goals and objectives that were described in the RBRP and to meet the DMS mitigation needs while maximizing the ecological and water quality uplift within the watershed.

The following project goals and related objectives established in the mitigation plan (Wildlands, 2015) included:

The primary project goals will be:

- Reduce fecal coliform, nitrogen, and phosphorous inputs by removing cattle from streams and establishing and augmenting a forested riparian corridor *to* intercept and process sediment and nutrients before they reach the channel during storm events;
- Reduce sediment loads by stabilizing eroding stream banks;

- Return a network of streams to a stable form that is capable of supporting biological functions;
- Install instream structures to improve bed and bank stability, create fish and macroinvertibrate habitat, and help oxygenate streamflows; and
- Protect existing high quality streams and forested buffers.

Secondary project objectives are expected to include:

- Improving instream nutrient cycling by incorporating woody debris into constructed riffles and bank stabilization measures;
- Reducing thermal loadings through establishment of riparian shading;
- Reconnecting channels with floodplains to raise the local water table; and
- Create and implement a stream and riparian area restoration design that is both natural and aesthetically pleasing.

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 vegetation and stream success criteria for the Site follows the approved success criteria presented in the Holman Mill Mitigation Project Mitigation Plan (Wildlands, 2015).

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 12 standard 10-meter by 10-meter vegetation plots were established during the baseline monitoring within the project easement area.

The final vegetative success criteria will be the survival of 210 planted stems per acre at the end of the seven-year monitoring period (MY7). The interim measure of vegetative success 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 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 2016. The 2016 vegetation monitoring resulted in an average stem density of 603 stems per acre within the standard planting zones, which is well above the interim requirement of 320 stems/acre required at MY3 and approximately 4% less than the baseline density recorded (634 stems/acre). There is an average of 14 stems per plot as compared to 15 stems per plot in MY0. All 12 of the plots are on track to meet the success criteria required for MY7 (Table 9, Appendix 3). 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

No vegetation areas of concern were identified during MY1.

1.2.3 Stream Assessment

Morphological surveys for MY1 were conducted in September 2016. All streams within the Site are stable. In general, cross sections at the Site show little to no change in the bankfull area, maximum depth ratio, or width-to-depth ratio. Bank height ratios fall within the appropriate Rosgen stream type parameters. Substrate materials in the restoration and enhancement reaches indicated maintenance of

coarser materials in the riffle reaches and finer particles in the pools. 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, Current Condition Plan View (CCPV) map, and stream photographs. Refer to Appendix 4 for the morphological data and plots.

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. Two 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.

1.2.6 Maintenance Plan

No maintenance plan is necessary at this time.

1.3 Monitoring Year 1 Summary

All vegetation plots are on track to meet the MY3 interim requirement of 320 planted stems per acre as noted in CCPV. All streams within the Site are stable and functioning as designed. Multiple bankfull events have been documented on all restored stream reaches at the Site, resulting in partial fulfillment of the hydrologic success criteria.

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

Section 2: METHODOLOGY

Geomorphic data were collected following the standards outlined in The Stream Channel Reference Site: An Illustrated Guide to Field Techniques (Harrelson et al., 1994) and in the Stream Restoration: A Natural Channel Design Handbook (Doll et al., 2003). All Integrated Current Condition Mapping was recorded using 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.

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

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

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

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

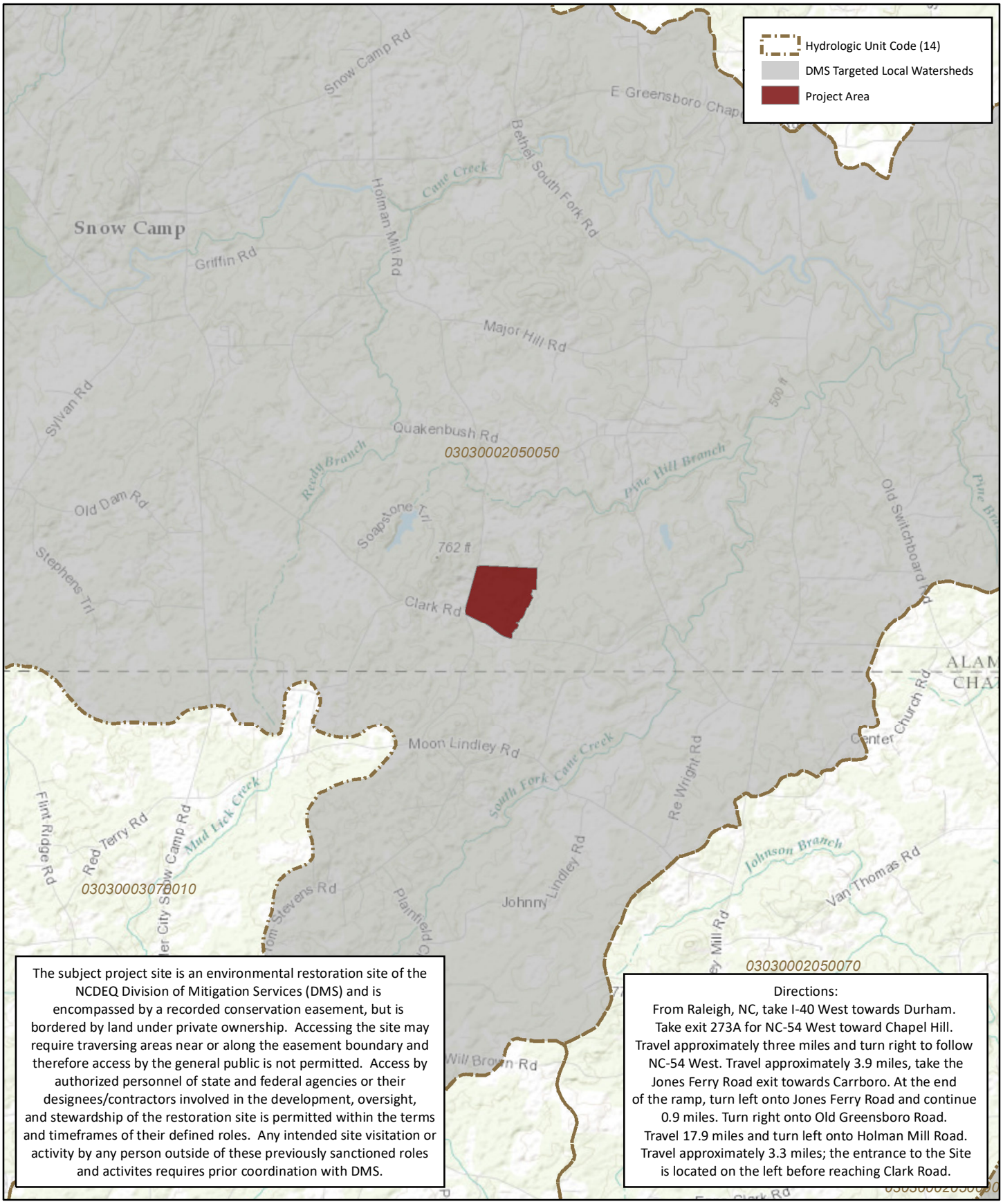
United States Army Corps of Engineers. 2003. Stream Mitigation Guidelines. USACE, NCDENR-DWQ, USEPA, NCWRC.

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

Wildlands Engineering, Inc. 2016. Holman Mill Mitigation Site Baseline Monitoring Document and As-Built Baseline Report. DMS, Raleigh, NC.

Wildlands Engineering, Inc. 2015. Holman Mill Mitigation Project Mitigation Plan. DMS, Raleigh, NC.

APPENDIX 1. General Figures and Tables



WILDLANDS ENGINEERING

0 0.5 1 Miles

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Figure 1 Project Vicinity Map
Holman Mill Mitigation Site
DMS Project No. 96316
Monitoring Year 1 - 2016
Alamance County, NC

WILDLANDS ENGINEERING

0 200 400 Feet

Figure 2 Project Component/ Asset Map
Holman Mill Mitigation Site
DMS Project No. 96316
Monitoring Year 1 - 2016
Alamance County, NC

Table 1. Project Components and Mitigation Credits
Holman Mill Mitigation Site
DMS Project No. 96316
Monitoring Year 1 - 2016

MITIGATION CREDITS									
	Stream		Riparian Wetland		Non-Riparian Wetland		Buffer	Nitrogen Nutrient Offset	Phosphorous Nutrient Offset
Type	R	RE	R	RE	R	RE			
Totals	3,884	N/A	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							
UT to Pine Hill Branch	600+00 - 635+26	3,526	EII	Restoration	3,526	5	705
UT1 Reach 1	100+00-102+08	215	P1	Restoration	208	1	208
UT1 Reach 2	102+08 - 106+31	433	EII	Restoration	423	2.5	169
UT1 Reach 3	106+31 - 109+40	331	P1	Restoration	309	1	309
UT1 Reach 4	109+40 - 125+98	1,687	EII	Restoration	1,658	2.5	663
UT1A	400+00 - 400+94	84	EII	Restoration	94	2.5	38
UT2A	300+00 - 305+40	468	P1	Restoration	540	1	540
UT2 Reach 1	200+00 - 205+88	588	EII	Restoration	588	2.5	235
UT2 Reach2	205+88 - 208+81	298	E1	Restoration	293	1.5	195
UT2 Reach 3	208+81 - 213+63	396	P1	Restoration	482	1	482
UT2 Reach 4	213+63 - 215+30	242	P1	Restoration	167	1	167
UT2B	500+00 - 504+29	429	EII	Restoration	429	2.5	172

COMPONENT SUMMATION						
Restoration Level	Stream (LF)	Riparian Wetland (acres)		Non-Riparian Wetland (acres)	Buffer (acres)	Upland (acres)
		Riverine	Non-Riverine			
Restoration	1,706	-	-	-	-	-
Enhancement		-	-	-	-	-
Enhancement I	293					
Enhancement II	6,718					
Creation		-	-	-		
Preservation	-	-	-	-		-
High Quality Preservation	-	-	-	-		-

N/A: not applicable

Table 2. Project Activity and Reporting History
Holman Mill Mitigation Site
DMS Project No. 96316
Monitoring Year 1 - 2016

Activity or Report	Date Collection Complete	Completion or Scheduled Delivery
Mitigation Plan	April 2014 - April 2015	May 2015
Final Design - Construction Plans	May 2015 - October 2015	October 2015
Construction	January 2016 - March 2016	March 2016
Temporary S&E mix applied to entire project area[1]	March 2016	March 2016
Permanent seed mix applied to reach/segments[1]	March 2016	March 2016
Bare root and live stake plantings for reach/segments	March 2016	March 2016
Baseline Monitoring Document (Year 0)	January 2016 - April 2016	May 2016
Year 1 Monitoring	March 2016 - October 2016	December 2016
Year 2 Monitoring	2017	December 2017
Year 3 Monitoring	2018	December 2018
Year 4 Monitoring	2019	December 2019
Year 5 Monitoring	2020	December 2020
Year 6 Monitoring	2021	December 2021
Year 7 Monitoring	2022	December 2022

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

Table 3. Project Contact Table
Holman Mill Mitigation Site
DMS Project No. 96316
Monitoring Year 1 - 2016

Designer Angela Allen, PE	**Wildlands Engineering, Inc.** 312 West Millbrook Road, Suite 225 Raleigh, NC 27609 919.851.9986, ext. 106
Construction Contractor	**Land Mechanic 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	**Land Mechanic Designs, Inc.** 126 Circle G Lane Willow Spring, NC 27592
Seed Mix Sources	**Green Resource, LLC**
Nursery Stock Suppliers	
Bare Roots	**Dykes and Son Nursery**
Live Stakes	**Bruton Natural Systems, Inc**
Monitoring Performers Monitoring, POC	**Wildlands Engineering, Inc.** Jason Lorch 919.851.9986, ext. 107

Table 4. Project Information and Attributes

Holman Mill Mitigation Site

DMS Project No.96316

Monitoring Year 1 - 2016

PROJECT INFORMATION	
Project Name	Holman Mill Mitigation Site
County	Alamance County
Project Area (acres)	32.4 Acres
Project Coordinates (latitude and longitude)	35°51'310.12"N, 79°23'16.00"W
PROJECT WATERSHED SUMMARY INFORMATION	
Physiographic Province	Carolina Slate Belt of the Piedmont Physiographic Province
River Basin	Cape Fear River
USGS Hydrologic Unit 8-digit	03030002
USGS Hydrologic Unit 14-digit	03030002050050
DWR Sub-basin	03-06-04
Project Drainage Area (acres)	1,077
Project Drainage Area Percentage of Impervious Area	3%
CGIA Land Use Classification	49% Forested/Scrubland, 42% Agriculture/Managed Herbaceous, 4% Pasture, 3% Watershed Impervious Cover, 2% Residential, <1% Open Water

REACH SUMMARY INFORMATION						
Parameters	**UT to Pine Hill Branch**	**UT1**	**UT1A**	**UT2**	**UT2A**	**UT2B**
Length of reach (linear feet) - Post-Restoration	3,526	2,598	94	1,530	540	429
Drainage area (acres)	1,077	102	20	130	47	18
NCDWR stream identification score	44.5	33.5/30.5	25.5	35	36.75	26.5
NCDWR Water Quality Classification	N/A					
Morphological Desription (stream type)	P	P	I	P	P	I
Evolutionary trend (Simon's Model) - Pre- Restoration	I	II	NA	III/IV	III/IV	NA
Underlying mapped soils	Georgeville silty clay loam, Local alluvial land, Herndon silt loam, Goldston Channery silt loam					
Drainage class	---	---	---	---	---	---
Soil Hydric status	---	---	---	---	---	---
Slope	---	---	---	---	---	---
FEMA classification	AE	AE	---	AE	AE	---
Native vegetation community	Piedmont bottomland forest, Bottomland hardwood forest					
Percent composition exotic invasive vegetation - Post-Restoration	0%					

REGULATORY CONSIDERATIONS			
Regulation	**Applicable?**	**Resolved?**	**Supporting Documentation**
Waters of the United States - Section 404	Yes	Yes	USACE Nationwide Permit No.27 and DWQ 401 Water Quality Certification No. 3885.
Waters of the United States - Section 401	Yes	Yes	
Division of Land Quality (Dam Safety)	No	N/A	N/A
Endangered Species Act	Yes	Yes	Holman Mill Mitigation Plan (2015); Wildlands determined "no effect" on Alamance County listed endangered species.
Historic Preservation Act	Yes	Yes	No historic resources were found to be impacted (letter from SHPO dated 3/24/14).
Coastal Zone Management Act (CZMA)/Coastal Area Management Act (CAMA)	No	N/A	N/A
FEMA Floodplain Compliance	Yes	Yes	UT to Pine Hill Branch and portions of UT2 and UT2A are located within the floodway and flood fringe (FEMA Zone AE, FIRM panel 8786).
Essential Fisheries Habitat	No	N/A	N/A

APPENDIX 2. Visual Assessment Data

WILDLANDS ENGINEERING

0 175 350 525 700 Feet

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Figure 3.0 Integrated Current Condition Plan View
(Key)
Holman Mill Mitigation Site
DMS Project No. 96316
Monitoring Year 1 - 2016

Alamance County, NC

WILDLANDS ENGINEERING

0 125 250 375 500 Feet

Figure 3.1 Integrated Current Condition Plan View
Holman Mill Mitigation Site
DMS Project No. 96316
Monitoring Year 1 - 2016

Alamance County, NC

Figure 3.2 Integrated Current Condition Plan View
Holman Mill Mitigation Site
DMS Project No. 96316
Monitoring Year 1 - 2016

Alamance County, NC

Table 5a. Visual Stream Morphology Stability Assessment Table
Holman Mill Mitigation Project
DMS Project No.96316
Monitoring Year 1 - 2016

UT1

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	14	14			100%			
	3. Meander Pool Condition	Depth Sufficient	13	13			100%			
		Length Appropriate	13	13			100%			
	4. Thalweg Position	Thalweg centering at upstream of meander bend (Run)	12	12			100%			
		Thalweg centering at downstream of meander bend (Glide)	13	13			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.	10	10			100%			
	2. Grade Control	Grade control structures exhibiting maintenance of grade across the sill.	10	10			100%			
	2a. Piping	Structures lacking any substantial flow underneath sills or arms.	10	10			100%			
	3. Bank Protection	Bank erosion within the structures extent of influence does not exceed 15%.	10	10			100%			
	4. Habitat	Pool forming structures maintaining ~Max Pool Depth : Bankfull Depth ≥ 1.6 Rootwads/logs providing some cover at baseflow.	10	10			100%			

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

Table 5b. Visual Stream Morphology Stability Assessment Table
Holman Mill Mitigation Project
DMS Project No.96316
Monitoring Year 1 - 2016

UT1A

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	n/a	n/a			n/a			
		Length Appropriate	n/a	n/a			n/a			
	4. Thalweg Position	Thalweg centering at upstream of meander bend (Run)	n/a	n/a			n/a			
		Thalweg centering at downstream of meander bend (Glide)	n/a	n/a			n/a			
2. Bank	**1. Scoured/Eroded**	Bank lacking vegetative cover resulting simply from poor growth and/or scour and erosion.			0	0	100%	n/a	n/a	n/a
	2. Undercut	Banks undercut/overhanging to the extent that mass wasting appears likely. Does NOT include undercuts that are modest, appear sustainable and are providing habitat.			0	0	100%	n/a	n/a	n/a
	3. Mass Wasting	Bank slumping, calving, or collapse			0	0	100%	n/a	n/a	n/a
				Totals	0	0	100%	n/a	n/a	n/a
3. Engineered Structures[1]	**1. Overall Integrity**	Structures physically intact with no dislodged boulders or logs.	n/a	n/a			n/a			
	2. Grade Control	Grade control structures exhibiting maintenance of grade across the sill.	n/a	n/a			n/a			
	2a. Piping	Structures lacking any substantial flow underneath sills or arms.	n/a	n/a			n/a			
	3. Bank Protection	Bank erosion within the structures extent of influence does not exceed 15%.	n/a	n/a			n/a			
	4. Habitat	Pool forming structures maintaining ~Max Pool Depth : Bankfull Depth ≥ 1.6 Rootwads/logs providing some cover at baseflow.	n/a	n/a			n/a			

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

Table 5c. Visual Stream Morphology Stability Assessment Table
Holman Mill Mitigation Project
DMS Project No.96316
Monitoring Year 1 - 2016

UT2

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	14	14			100%			
	3. Meander Pool Condition	Depth Sufficient	10	10			100%			
		Length Appropriate	10	10			100%			
	4. Thalweg Position	Thalweg centering at upstream of meander bend (Run)	13	13			100%			
		Thalweg centering at downstream of meander bend (Glide)	13	13			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.	3	3			100%			
	2. Grade Control	Grade control structures exhibiting maintenance of grade across the sill.	3	3			100%			
	2a. Piping	Structures lacking any substantial flow underneath sills or arms.	3	3			100%			
	3. Bank Protection	Bank erosion within the structures extent of influence does not exceed 15%.	3	3			100%			
	4. Habitat	Pool forming structures maintaining ~Max Pool Depth : Bankfull Depth ≥ 1.6 Rootwads/logs providing some cover at baseflow.	3	3			100%			

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

Table 5d. Visual Stream Morphology Stability Assessment Table
Holman Mill Mitigation Project
DMS Project No.96316
Monitoring Year 1 - 2016

UT2A

Major Channel Category	Channel Sub-Category	Metric	Number Stable, Performing as Intended	Total Number in As-Built	Number of Unstable Segments	Amount of Unstable Footage	% Stable, Performing as Intended	Number with Stabilizing Woody Vegetation	Footage with Stabilizing Woody Vegetation	Adjust % for Stabilizing Woody Vegetation
1. Bed	**1. Vertical Stability (Riffle and Run Units)**	Aggradation			0	0	100%			
		Degradation			0	0	100%			
	2. Riffle Condition	Texture/Substrate	11	11			100%			
	3. Meander Pool Condition	Depth Sufficient	10	10			100%			
		Length Appropriate	10	10			100%			
	4. Thalweg Position	Thalweg centering at upstream of meander bend (Run)	11	11			100%			
		Thalweg centering at downstream of meander bend (Glide)	10	10			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.	2	2			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%.	2	2			100%			
	4. Habitat	Pool forming structures maintaining ~Max Pool Depth : Bankfull Depth ≥ 1.6 Rootwads/logs providing some cover at baseflow.	2	2			100%			

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

Table 5e. Visual Stream Morphology Stability Assessment Table
Holman Mill Mitigation Project
DMS Project No.96316
Monitoring Year 1 - 2016

UT2B

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	n/a	n/a			n/a			
	3. Meander Pool Condition	Depth Sufficient	n/a	n/a			n/a			
		Length Appropriate	n/a	n/a			n/a			
	4. Thalweg Position	Thalweg centering at upstream of meander bend (Run)	n/a	n/a			n/a			
		Thalweg centering at downstream of meander bend (Glide)	n/a	n/a			n/a			
2. Bank	**1. Scoured/Eroded**	Bank lacking vegetative cover resulting simply from poor growth and/or scour and erosion.			0	0	100%	n/a	n/a	n/a
	2. Undercut	Banks undercut/overhanging to the extent that mass wasting appears likely. Does NOT include undercuts that are modest, appear sustainable and are providing habitat.			0	0	100%	n/a	n/a	n/a
	3. Mass Wasting	Bank slumping, calving, or collapse			0	0	100%	n/a	n/a	n/a
				Totals	0	0	100%	n/a	n/a	n/a
3. Engineered Structures[1]	**1. Overall Integrity**	Structures physically intact with no dislodged boulders or logs.	n/a	n/a			n/a			
	2. Grade Control	Grade control structures exhibiting maintenance of grade across the sill.	n/a	n/a			n/a			
	2a. Piping	Structures lacking any substantial flow underneath sills or arms.	n/a	n/a			n/a			
	3. Bank Protection	Bank erosion within the structures extent of influence does not exceed 15%.	n/a	n/a			n/a			
	4. Habitat	Pool forming structures maintaining ~Max Pool Depth : Bankfull Depth ≥ 1.6 Rootwads/logs providing some cover at baseflow.	n/a	n/a			n/a			

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

Table 5f. Visual Stream Morphology Stability Assessment Table
Holman Mill Mitigation Project
DMS Project No.96316
Monitoring Year 1 - 2016

UT to Pine Hill Branch

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	n/a	n/a			n/a			
	3. Meander Pool Condition	Depth Sufficient	n/a	n/a			n/a			
		Length Appropriate	n/a	n/a			n/a			
	4. Thalweg Position	Thalweg centering at upstream of meander bend (Run)	n/a	n/a			n/a			
		Thalweg centering at downstream of meander bend (Glide)	n/a	n/a			n/a			
2. Bank	**1. Scoured/Eroded**	Bank lacking vegetative cover resulting simply from poor growth and/or scour and erosion.			0	0	100%	n/a	n/a	n/a
	2. Undercut	Banks undercut/overhanging to the extent that mass wasting appears likely. Does NOT include undercuts that are modest, appear sustainable and are providing habitat.			0	0	100%	n/a	n/a	n/a
	3. Mass Wasting	Bank slumping, calving, or collapse			0	0	100%	n/a	n/a	n/a
				Totals	0	0	100%	n/a	n/a	n/a
3. Engineered Structures[1]	**1. Overall Integrity**	Structures physically intact with no dislodged boulders or logs.	n/a	n/a			n/a			
	2. Grade Control	Grade control structures exhibiting maintenance of grade across the sill.	n/a	n/a			n/a			
	2a. Piping	Structures lacking any substantial flow underneath sills or arms.	n/a	n/a			n/a			
	3. Bank Protection	Bank erosion within the structures extent of influence does not exceed 15%.	n/a	n/a			n/a			
	4. Habitat	Pool forming structures maintaining ~Max Pool Depth : Bankfull Depth ≥ 1.6 Rootwads/logs providing some cover at baseflow.	n/a	n/a			n/a			

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

Table 6. Vegetation Condition Assessment Table

Holman Mill Mitigation Project
DMS Project No.96316
Monitoring Year 1 - 2016

Planted Acreage **14**

Vegetation Category	Definitions	Mapping Threshold (Ac)	Number of Polygons	Combined Acreage	% of Planted Acreage
Bare Areas	Very limited cover of both woody and herbaceous material	0.1	0	0	0%
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%
		Total	**0**	**0**	**0%**
Areas of Poor Growth Rates or Vigor	Areas with woody stems of a size class that are obviously small given the monitoring year.	0.25 Ac	0	0	0%
		Cumulative Total	**0**	**0.0**	**0%**

Easement Acreage **32.4**

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	0	0	0%
Easement Encroachment Areas	Areas of points (if too small to render as polygons at map scale).	none	0	0	0%

Stream Photographs

PHOTO POINT 1 – looking upstream (09/06/2016)

PHOTO POINT 1 – looking downstream (09/06/2016)

PHOTO POINT 2 – looking upstream (09/06/2016)

PHOTO POINT 2 – looking downstream (09/06/2016)

PHOTO POINT 3 – looking upstream (09/06/2016)

PHOTO POINT 3 – looking downstream (09/06/2016)

	
PHOTO POINT 4 – looking upstream (09/06/2016)	**PHOTO POINT 4 – looking downstream (09/06/2016)**
	
PHOTO POINT 5 – looking upstream (09/06/2016)	**PHOTO POINT 5 – looking downstream (09/06/2016)**
	
PHOTO POINT 6 – looking upstream (09/06/2016)	**PHOTO POINT 6 – looking downstream (09/06/2016)**

	
PHOTO POINT 7 – looking upstream (09/06/2016)	**PHOTO POINT 7 – looking downstream (09/06/2016)**
	
PHOTO POINT 8 – looking upstream (09/06/2016)	**PHOTO POINT 8 – looking downstream (09/06/2016)**
	
PHOTO POINT 9 – looking upstream (09/06/2016)	**PHOTO POINT 9 – looking downstream (09/06/2016)**

	
PHOTO POINT 10 – looking upstream (09/06/2016)	**PHOTO POINT 10 – looking downstream (09/06/2016)**
	
PHOTO POINT 11 – looking upstream (09/06/2016)	**PHOTO POINT 11 – looking downstream (09/06/2016)**
	
PHOTO POINT 12 – looking upstream (09/06/2016)	**PHOTO POINT 12 – looking downstream (09/06/2016)**

	
PHOTO POINT 13 – looking upstream (09/06/2016)	**PHOTO POINT 13 – looking downstream (09/06/2016)**
	
PHOTO POINT 14 – looking upstream (09/06/2016)	**PHOTO POINT 14 – looking downstream (09/06/2016)**
	
PHOTO POINT 15 – looking upstream (09/06/2016)	**PHOTO POINT 15 – looking downstream (09/06/2016)**

	
PHOTO POINT 16 – looking upstream (09/06/2016)	**PHOTO POINT 16 – looking downstream (09/06/2016)**
	
PHOTO POINT17 – looking upstream (09/06/2016)	**PHOTO POINT 17 – looking downstream (09/06/2016)**
	
PHOTO POINT 18 – looking upstream (09/06/2016)	**PHOTO POINT 18 – looking downstream (09/06/2016)**

	
PHOTO POINT 19 – looking upstream (09/06/2016)	**PHOTO POINT 19 – looking downstream (09/06/2016)**

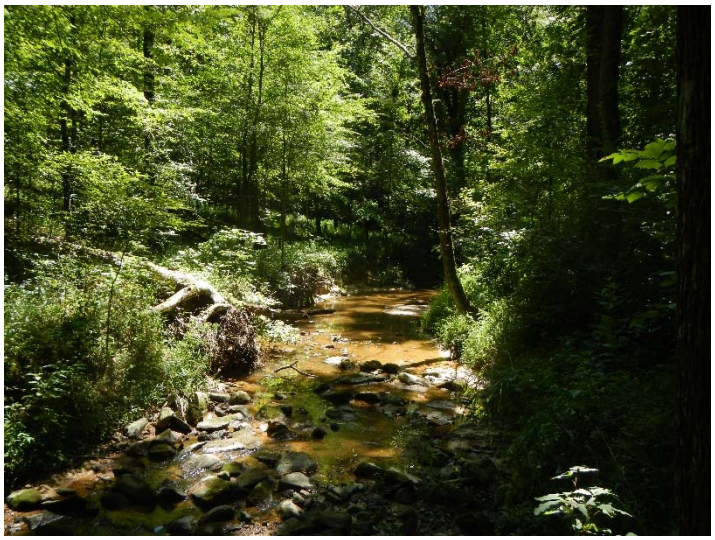



PHOTO POINT 20 – looking upstream (09/06/2016)	**PHOTO POINT 20 – looking downstream (09/06/2016)**
	
PHOTO POINT 21 – looking upstream (09/06/2016)	**PHOTO POINT 21 – looking downstream (09/06/2016)**

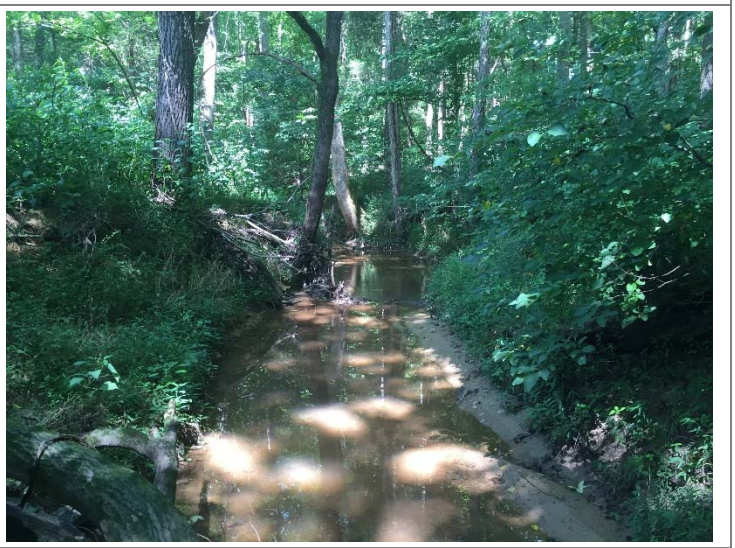
	
PHOTO POINT 22 – looking upstream (09/06/2016)	**PHOTO POINT 22 – looking downstream (09/06/2016)**
	
PHOTO POINT 23 – looking upstream (09/06/2016)	**PHOTO POINT 23 – looking downstream (09/06/2016)**
	
PHOTO POINT 24 – looking upstream (09/06/2016)	**PHOTO POINT 24 – looking downstream (09/06/2016)**

	
PHOTO POINT 25 – looking upstream (09/06/2016)	**PHOTO POINT 25 – looking downstream (09/06/2016)**
	
PHOTO POINT 26 – looking upstream (09/06/2016)	**PHOTO POINT 26 – looking downstream (09/06/2016)**
	
PHOTO POINT 27 – looking upstream (09/06/2016)	**PHOTO POINT 27 – looking downstream (09/06/2016)**

	
PHOTO POINT 28 – looking upstream (09/06/2016)	**PHOTO POINT 28 – looking downstream (09/06/2016)**
	
PHOTO POINT 29 – looking upstream (09/06/2016)	**PHOTO POINT 29 – looking downstream (09/06/2016)**
	
PHOTO POINT 30 – looking upstream (09/06/2016)	**PHOTO POINT 30 – looking downstream (09/06/2016)**

	
PHOTO POINT 31 – looking upstream (09/06/2016)	**PHOTO POINT 31 – looking downstream (09/06/2016)**
	
PHOTO POINT 32 – looking upstream (09/06/2016)	**PHOTO POINT 32 – looking downstream (09/06/2016)**
	
PHOTO POINT 33 – looking upstream (09/06/2016)	**PHOTO POINT 33 – looking downstream (09/06/2016)**

	
PHOTO POINT 34 – looking upstream (09/06/2016)	**PHOTO POINT 34 – looking downstream (09/06/2016)**
	
PHOTO POINT 35 – looking upstream (09/06/2016)	**PHOTO POINT 35 – looking downstream (09/06/2016)**
	
PHOTO POINT 36 – looking upstream (09/06/2016)	**PHOTO POINT 36 – looking downstream (09/06/2016)**

	
PHOTO POINT 37 – looking upstream (09/06/2016)	**PHOTO POINT 37 – looking downstream (09/06/2016)**
	
PHOTO POINT 38 – looking upstream (09/06/2016)	**PHOTO POINT 38 – looking downstream (09/06/2016)**
	
PHOTO POINT 39 – looking upstream (09/06/2016)	**PHOTO POINT 39 – looking downstream (09/06/2016)**

	
PHOTO POINT 40 – looking upstream (09/06/2016)	**PHOTO POINT 40 – looking downstream (09/06/2016)**
	
PHOTO POINT 41 – looking upstream (09/06/2016)	**PHOTO POINT 41 – looking downstream (09/06/2016)**
	
PHOTO POINT 42 – looking upstream (09/06/2016)	**PHOTO POINT 42 – looking downstream (09/06/2016)**

	
PHOTO POINT 43 – looking upstream (09/06/2016)	**PHOTO POINT 43 – looking downstream (09/06/2016)**
	
PHOTO POINT 44 – looking upstream (09/06/2016)	**PHOTO POINT 44 – looking downstream (09/06/2016)**
	
PHOTO POINT 45 – looking upstream (09/06/2016)	**PHOTO POINT 45– looking downstream (09/06/2016)**

Vegetation Photographs

Vegetation Plot 1 *(09/06/2016)*

Vegetation Plot 2 *(09/06/2016)*

Vegetation Plot 3 *(09/06/2016)*

Vegetation Plot 4 *(09/06/2016)*

Vegetation Plot 5 *(09/06/2016)*

Vegetation Plot 6 *(09/06/2016)*

Vegetation Plot 7 *(09/06/2016)*

Vegetation Plot 8 *(09/06/2016)*

Vegetation Plot 9 *(09/06/2016)*

Vegetation Plot 10 *(09/06/2016)*

Vegetation Plot 11 *(09/06/2016)*

Vegetation Plot 12 *(09/06/2016)*

APPENDIX 3. Vegetation Plot Data

Table 7. Vegetation Plot Criteria Attainment Table

Holman Mill Mitigation Project
DMS Project No.96316
Monitoring Year 1 - 2016

Plot	MY1 Success Criteria	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	

Table 8. CVS Vegetation Tables - Metadata
Holman Mill Mitigation Project
DMS Project No.96316
Monitoring Year 1 - 2016

Report Prepared By	Kenton Beal
Date Prepared	12/5/2016 10:10
Database Name	Holman Mill MY1- cvs-eep-entrytool-v2.5.0.mdb
Database Location	F:\Projects\005-02146 Holman Mill\Monitoring\Monitoring Year 1\Vegetation Assessment
Computer Name	KENTON
File Size	82616320
DESCRIPTION OF WORKSHEETS IN THIS DOCUMENT----------	
Metadata	Description of database file, the report worksheets, and a summary of project(s) and project data.
Project Planted	Each project is listed with its PLANTED stems per acre, for each year. This excludes live stakes.
Project Total Stems	Each project is listed with its TOTAL stems per acre, for each year. This includes live stakes, all planted stems, and all natural/volunteer stems.
Plots	List of plots surveyed with location and summary data (live stems, dead stems, missing, etc.).
Vigor	Frequency distribution of vigor classes for stems for all plots.
Vigor by Spp	Frequency distribution of vigor classes listed by species.
Damage	List of most frequent damage classes with number of occurrences and percent of total stems impacted by each.
Damage by Spp	Damage values tallied by type for each species.
Damage by Plot	Damage values tallied by type for each plot.
Planted Stems by Plot and Spp	A matrix of the count of PLANTED living stems of each species for each plot; dead and missing stems are excluded.
ALL Stems by Plot and Spp	A matrix of the count of total living stems of each species (planted and natural volunteers combined) for each plot; dead and missing stems are excluded.
PROJECT SUMMARY----------	
Project Code	96316
Project Name	Holman Mill
Description	Stream Restoration Project
Sampled Plots	12

Table 9. Planted and Total Stem Counts

Holman Mill Mitigation Project

DMS Project No.96316

Monitoring Year 1 - 2016

			Current Plot Data (MY1 2016)														
			96316-WEI-0001			96316-WEI-0002			96316-WEI-0003			96316-WEI-0004			96316-WEI-0005		
Scientific Name	**Common Name**	**Species Type**	**PnoLS**	**P-all**	**T**	**PnoLS**	**P-all**	**T**	**PnoLS**	**P-all**	**T**	**PnoLS**	**P-all**	**T**	**PnoLS**	**P-all**	**T**
Betula nigra	River Birch	Tree	5	5	5	6	6	6	3	3	3				3	3	3
Fraxinus pennsylvanica	Green Ash	Tree	6	6	6	4	4	4	4	4	4	6	6	6	4	4	4
Liriodendron tulipifera	Tulip Poplar	Tree	3	3	3	3	3	3	5	5	5	5	5	5	4	4	4
Platanus occidentalis	Sycamore, American	Tree										2	2	2	2	2	2
Quercus palustris	Pin Oak	Tree				2	2	2	2	2	2	2	2	2	2	2	2
Quercus phellos	Willow Oak	Tree	1	1	1	1	1	1	1	1	1						
		Stem count	15	15	15	16	16	16	15	15	15	15	15	15	15	15	15
		size (ares)	1			1			1			1			1		
		size (ACRES)	0.02			0.02			0.02			0.02			0.02		
		Species count	4	4	4	5	5	5	5	5	5	4	4	4	5	5	5
		Stems per ACRE	607	607	607	647.5	647.5	647.5	607	607	607	607	607	607	607	607	607

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 Stem Counts

Holman Mill Mitigation Project

DMS Project No.96316

Monitoring Year 1 - 2016

			Current Plot Data (MY1 2016)														
			96316-WEI-0006			96316-WEI-0007			96316-WEI-0008			96316-WEI-0009			96316-WEI-0010		
Scientific Name	**Common Name**	**Species Type**	**PnoLS**	**P-all**	**T**	**PnoLS**	**P-all**	**T**	**PnoLS**	**P-all**	**T**	**PnoLS**	**P-all**	**T**	**PnoLS**	**P-all**	**T**
Betula nigra	River Birch	Tree										1	1	1	5	5	5
Fraxinus pennsylvanica	Green Ash	Tree	7	7	7	3	3	3	5	5	5						
Liriodendron tulipifera	Tulip Poplar	Tree	1	1	1	1	1	1				1	1	1	2	2	2
Platanus occidentalis	Sycamore, American	Tree				5	5	5	6	6	6	9	9	9	5	5	5
Quercus palustris	Pin Oak	Tree	3	3	3	2	2	2	1	1	1	1	1	1	1	1	1
Quercus phellos	Willow Oak	Tree				5	5	5	4	4	4	2	2	2	2	2	2
		Stem count	11	11	11	16	16	16	16	16	16	14	14	14	15	15	15
		size (ares)	1			1			1			1			1		
		size (ACRES)	0.02			0.02			0.02			0.02			0.02		
		Species count	3	3	3	5	5	5	4	4	4	5	5	5	5	5	5
		Stems per ACRE	445.2	445.2	445.2	647.5	647.5	647.5	647.5	647.5	647.5	566.6	566.6	566.6	607	607	607

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 Stem Counts

Holman Mill Mitigation Project

DMS Project No.96316

Monitoring Year 1 - 2016

			Current Plot Data (MY1 2016)						Annual Means					
			96316-WEI-0011			96316-WEI-0012			MY1 (2016)			MY0 (2016)		
Scientific Name	**Common Name**	**Species Type**	**PnoLS**	**P-all**	**T**	**PnoLS**	**P-all**	**T**	**PnoLS**	**P-all**	**T**	**PnoLS**	**P-all**	**T**
Betula nigra	River Birch	Tree	4	4	4	1	1	1	28	28	28	31	31	31
Fraxinus pennsylvanica	Green Ash	Tree							39	39	39	39	39	39
Liriodendron tulipifera	Tulip Poplar	Tree	3	3	3	5	5	5	33	33	33	35	35	35
Platanus occidentalis	Sycamore, American	Tree	5	5	5	7	7	7	41	41	41	45	45	45
Quercus palustris	Pin Oak	Tree	1	1	1	1	1	1	18	18	18	18	18	18
Quercus phellos	Willow Oak	Tree	3	3	3	1	1	1	20	20	20	20	20	20
		Stem count	16	16	16	15	15	15	179	179	179	188	188	188
		size (ares)		1			1			12			12	
		size (ACRES)		0.02			0.02			0.30			0.30	
		Species count	5	5	5	5	5	5	6	6	6	6	6	6
		Stems per ACRE	647.5	647.5	647.5	607	607	607	603.7	603.7	603.7	634	634	634

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
Holman Mill Mitigation Site
DMS Project No. 96316
Monitoring Year 1 - 2016

UT1

		PRE-RESTORATION		REFERENCE REACH DATA						DESIGN		AS-BUILT/BASELINE	
Parameter	**Gage**	**UT1 - Reach 1/3**		**Agony Acres UT1A-Reach 1**		**UT to Polecat Creek**		**UT to Varnals Creek**		**UT1 - Reach 1/3**		**UT1 - Reach 1/3**	
				Min	**Max**	**Min**	**Max**	**Min**	**Max**	**Min**	**Max**	**Min**	**Max**
Dimension and Substrate - Riffle													
Bankfull Width (ft)		5.7		9.1	10.4	5.3	10.9	9.3	10.5	7.8		7.5	7.9
Floodprone Width (ft)		12		>36		25	65	20	64	15	65	23	24
Bankfull Mean Depth		0.7		1.0	1.2	1.0	1.1	1.1	1.2	0.6		0.6	
Bankfull Max Depth		1.0		1.8		1.4	1.7	1.5	1.7	0.8	1.0	0.9	
Bankfull Cross Sectional Area (ft^2)	N/A	4.3		10.7	11.3	5.4	12.4	10.3	12.3	4.3		4.3	4.6
Width/Depth Ratio		8.1		7.3	10.1	5.2	9.6	8.1	9.3	14.1		13.1	13.6
Entrenchment Ratio		2.0		>3.9		3.2	8.3	1.9	6.1	1.9	8.3	3.0	3.1
Bank Height Ratio		2.2		1.0		1.0	1.1	0.9	1.0	0.9	1.1	1.0	
D50 (mm)		33.1										28.8	32.0
Profile													
Riffle Length (ft)				---		---		---		---		12.5	31.4
Riffle Slope (ft/ft)		---		N/A		0.0040	0.0470	0.0240	0.0570	0.0158	0.0661	0.0200	0.0690
Pool Length (ft)	N/A			---		---		---		---		6.0	23.6
Pool Max Depth (ft)		---		2.5		1.8		2.5	2.6	0.9	1.7	1.5	3.4
Pool Spacing (ft)		---		N/A		34	52	8	82	2	44	20	53
Pool Volume (ft^3)													
Pattern													
Channel Beltwidth (ft)		62	82	21	93	28	50	15	45	12	69	11	45
Radius of Curvature (ft)		56	90	14	60	19	50	8	47	10	45	9	37
Rc:Bankfull Width (ft/ft)	N/A	6.2	9.9	1.5	5.8	2.0	5.3	0.6	3.2	1.3	5.8	1.2	4.7
Meander Length (ft)		209	300	N/A		--	--	--	--	25	128	31	75
Meander Width Ratio		6.8	9.0	2.3	8.9	3.0	5.3	1.0	3.0	1.6	8.9	1.5	5.7
Substrate, Bed and Transport Parameters													
Ri%/Ru%/P%/G%/S%													
SC%/Sa%/G%/C%/B%/Be%													
d16/d35/d50/d84/d95/d100	N/A	0.18/8.66/33.11/ 128/2655/>2048		---		---		---				.22/2.97/6.6/38.7/ 69.7/128	
Reach Shear Stress (Competency) lb/ft^2		1.6								0.9		0.7	
Max part size (mm) mobilized at bankfull													
Stream Power (Capacity) W/m^2													
Additional Reach Parameters													
Drainage Area (SM)		0.16		0.30		0.41		0.41		0.16		0.16	
Watershed Impervious Cover Estimate (%)		2%		---		---		---		2%		2%	
Rosgen Classification		B4		E4		E4		E4		C4		C4	
Bankfull Velocity (fps)		3.0		2.2	2.4	2.2	3.5	4.4	5.2	3.2		3.5	3.6
Bankfull Discharge (cfs)		14.0		25.3		20.3		54.0		14.0		15.0	16.7
Q-NFF regression		---											
Q-USGS extrapolation	N/A	---											
Q-Mannings		---											
Valley Length (ft)		---		---		---		---		468		468	
Channel Thalweg Length (ft)		2,648								519		517	
Sinuosity		1.12		1.35		1.40		1.20		1.15	1.20	1.10	
Water Surface Slope ($ft/ft)^2$		---		---		---		---		---		0.0246	
Bankfull Slope (ft/ft)		0.025		0.004	0.028	0.012		0.017		0.015	0.03	0.0203	

(---): Data was not provided
N/A: Not Applicable

Table 10b. Baseline Stream Data Summary
Holman Mill Mitigation Site
DMS Project No. 96316
Monitoring Year 1 - 2016

UT2

		PRE-RESTORATION CONDITION		REFERENCE REACH DATA						DESIGN				AS-BUILT/BASELINE			
Parameter	**Gage**	**UT2 - Reach 3**	**UT2 - Reach 4**	**Agony Acres UT1A-Reach 1**		**UT to Polecat Creek**		**UT to Varnals Creek**		**UT2 - Reach 3**		**UT2 - Reach 4**		**UT2 - Reach 3**		**UT2 - Reach 4**	
				Min	**Max**	**Min**	**Max**	**Min**	**Max**	**Min**	**Max**	**Min**	**Max**	**Min**	**Max**	**Min**	**Max**
Dimension and Substrate - Riffle																	
Bankfull Width (ft)		5.7	5.4	9.1	10.4	5.3	10.9	9.3	10.5	7.9		11.2		9.7		9.7	
Floodprone Width (ft)		12	26	>36		25	65	20	64	17	79	25	90	100		100	
Bankfull Mean Depth		0.7	0.8	1.0	1.2	1.0	1.1	1.1	1.2	0.6		0.8		0.5		0.5	
Bankfull Max Depth		1.0	1.5	1.8		1.4	1.7	1.5	1.7	0.8	1.0	1.1	1.5	0.8		0.8	
Bankfull Cross Sectional Area (ft^2)	N/A	4.3	4.1	10.7	11.3	5.4	12.4	10.3	12.3	4.4		9.1		4.5		4.5	
Width/Depth Ratio		8.1	6.8	7.3	10.1	5.2	9.6	8.1	9.3	14.0		14.0		20.5		20.5	
Entrenchment Ratio		2.0	4.7	>3.9		3.2	8.3	1.9	6.1	2.2	10.0	2.2	8.0	10.4		10.4	
Bank Height Ratio		2.2	2.1	1.0		1.0	1.1	0.9	1.0	1.0	1.1	1.0	1.1	1.0		1.0	
D50 (mm)		33.1	0.7											11.4		11.4	
Profile																	
Riffle Length (ft)				---		---		---		---		---		14.7	45.8	23.7	31.4
Riffle Slope (ft/ft)		---	---	N/A		0.0040	0.0470	0.024	0.057	0.0138	0.0598	0.0062	0.0264	0.0135	0.0288	0.0395*	0.0592*
Pool Length (ft)				---		---		---		---		---		20.4	59.8	10.5	12.1
Pool Max Depth (ft)	N/A	---	2.3	2.5		1.8		2.5	2.6	0.9	1.7	1.3	2.5	1.5	2.7	1.9	3.1
Pool Spacing (ft)		---	---	N/A		34	52	8	82	4	44	3	63	56	87	33	61
Pool Volume (ft^3)																	
Pattern																	
Channel Beltwidth (ft)		62	82	16	50	21	93	28	50	15	45	13	70	18	100	31	52	20	
Radius of Curvature (ft)		56	90	10	47	14	60	19	50	8	47	10	46	15	65	18	42	45	
Rc:Bankfull Width (ft/ft)	N/A	6.2	9.9	1.2	5.6	1.5	5.8	2.0	5.3	0.6	3.2	1.3	5.8	1.3	5.8	1.9	4.3	4.6	
Meander Length (ft)		209	300	42	192	N/A		--	--	--	--	25	130	36	184	56	92	130	
Meander Width Ratio		6.8	9.0	1.9	6.0	2.3	8.9	3.0	5.3	1.0	3.0	1.6	8.9	1.6	8.9	3.2	5.4	2.1	
Substrate, Bed and Transport Parameters																	
Ri%/Ru%/P%/G%/S%																	
SC%/Sa%/G%/C%/B%/Be%																	
d16/d35/d50/d84/d95/d100	N/A	0.18/8.66/33.11/ 128/2655/>2048	SC/0.43/0.69/ 17.84/32.14/64	---		---		---						SC/2.18/5.6/ 34.0/56.9/362.0		SC/2.18/5.6/ 34.0/56.9/362.0	
Reach Shear Stress (Competency) lb/ft^2		1.77	1.10							0.38		0.59		0.38		0.44	
Max part size (mm) mobilized at bankfull																	
Stream Power (Capacity) W/m^2																	
Additional Reach Parameters																	
Drainage Area (SM)		0.13	0.21	0.30		0.41		0.41		0.13		0.21		0.13		0.21	
Watershed Impervious Cover Estimate (%)		2%	2%	---		---		---		2%		2%		2%		2%	
Rosgen Classification		B4	E5	E4		E4		E4		C4		C4		C4		C4	
Bankfull Velocity (fps)		3.0	2.9	2.2	2.4	2.2	3.5	4.4	5.2	2.9		2.5		2.6		N/A	
Bankfull Discharge (cfs)		13.0	22.0	25.3		20.3		54.0		13.0		22.0		11.7		N/A	
Q-NFF regression		---	---														
Q-USGS extrapolation	N/A	---	---														
Q-Mannings		---	---														
Valley Length (ft)		---	---	---		---		---		386		152					
Channel Thalweg Length (ft)		396	242							479		210		482		167	
Sinuosity		1.12	1.17	1.35		1.40		1.20		1.15	1.25	1.13	1.20			1.05	
Water Surface Slope ($ft/ft)^2$		---	---	---		---		---		---		---		0.0119		0.0237	
Bankfull Slope (ft/ft)		0.0300	0.013	0.0040	0.028	0.012		0.0170		0.014		0.02		0.0120		0.0176	

*: Alignment change during consturction created steeper riffles
(---): Data was not provided
N/A: Not Applicable

Table 10c. Baseline Stream Data Summary
Holman Mill Mitigation Site
DMS Project No. 96316
Monitoring Year 1 - 2016

UT2A

		PRE-RESTORATION		REFERENCE REACH DATA						DESIGN		AS-BUILT/ BASELINE	
Parameter	**Gage**	**UT2A**		**Agony Acres UT1A-Reach 1**		**UT to Polecat Creek**		**UT to Varnals Creek**		**UT2A**		**UT2A**	
				Min	**Max**	**Min**	**Max**	**Min**	**Max**	**Min**	**Max**	**Min**	**Max**
Dimension and Substrate - Riffle													
Bankfull Width (ft)	N/A	5.1		9.1	10.4	5.3	10.9	9.3	10.5	6.4		6.6	
Floodprone Width (ft)		11.5		>36		25	65	20	64	14	80	100	
Bankfull Mean Depth		0.4		1.0	1.2	1.0	1.1	1.1	1.2	0.5		0.5	
Bankfull Max Depth		0.9		1.8		1.4	1.7	1.5	1.7	0.7	0.9	0.7	
Bankfull Cross Sectional Area (ft^2)		2.1		10.7	11.3	5.4	12.4	10.3	12.3	3.3		3.2	
Width/Depth Ratio		12		7.3	10.1	5.2	9.6	8.1	9.3	13.0		13.5	
Entrenchment Ratio		2.3		>3.9		3.2	8.3	1.9	6.1	2.2	12.5	15.1	
Bank Height Ratio		3.4		1.0		1.0	1.1	0.9	1.0	0.9	1.1	1.0	
D50 (mm)		3.2										18.3	
Profile													
Riffle Length (ft)	N/A			---		---		---		---		17.9	38.2
Riffle Slope (ft/ft)		---		N/A		0.0040	0.0470	0.0240	0.0570	0.018	0.08	0.0007	0.0520
Pool Length (ft)				---		---		---		---		16.3	33.0
Pool Max Depth (ft)		2.4		2.5		1.8		2.5	2.6	0.8	1.6	1.5	3.3
Pool Spacing (ft)		---		N/A		34	52	8	82	2	36	29	62
Pool Volume (ft^3)													
Pattern													
Channel Beltwidth (ft)	N/A	15	30	21	93	28	50	15	45	10	57	25	40
Radius of Curvature (ft)		5.8	33	14	60	19	50	8	47	8	37	11	31
Rc:Bankfull Width (ft/ft)		1.1	6.5	1.5	5.8	2.0	5.3	0.6	3.2	1.3	5.8	1.7	4.7
Meander Length (ft)		27	69	N/A		--	--	--	--	20	105	41	61
Meander Width Ratio		2.9	9.0	2.3	8.9	3.0	5.3	1.0	3.0	1.6	8.6	3.8	6.1
Substrate, Bed and Transport Parameters													
Ri%/Ru%/P%/G%/S%	N/A												
SC%/Sa%/G%/C%/B%/Be%													
d16/d35/d50/d84/d95/d100		0.18/8.66/33.11/ 128/2655/>2048		---		---		---				5.13/ 11.80/ 18.3/45 .5/ 101.2/362	
Reach Shear Stress (Competency) lb/ft^2		1.85								0.52		0.45	
Max part size (mm) mobilized at bankfull													
Stream Power (Capacity) W/m^2													
Additional Reach Parameters													
Drainage Area (SM)	N/A	0.08		0.30		0.41		0.41		0.08		0.08	
Watershed Impervious Cover Estimate (%)		2%		---		---		---		2%		2%	
Rosgen Classification		C4b		E4		E4		E4		C4		C4	
Bankfull Velocity (fps)		2.5		2.2	2.4	2.2	3.5	4.4	5.2	3.1		2.9	
Bankfull Discharge (cfs)		9.0		25.3		20.3		54.0		9.0		8.6	
Q-NFF regression		---											
Q-USGS extrapolation		---											
Q-Mannings		---											
Valley Length (ft)		---		---		---		---		480		480	
Channel Thalweg Length (ft)		468								540		540	
Sinuosity		1.15		1.35		1.40		1.20		1.15	1.25	1.13	
Water Surface Slope ($ft/ft)^2$		---		---		---		---		---		0.0129	
Bankfull Slope (ft/ft)		0.023		0.0040	0.028	0.012		0.0170		0.007	0.018	0.0143	

(---): Data was not provided
N/A: Not Applicable

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

Holman Mill Mitigation Site

DMS Project No. 96316

Monitoring Year 1 - 2016

	UT1 Reach 1																UT1 Reach 3													
	Cross Section 1 (Riffle)								Cross Section 2 (Pool)								Cross Section 3 (Pool)								Cross Section 4 (Riffle)							
Dimension and Substrate	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**MY6**	**MY7**	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**MY6**	**MY7**	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**MY6**	**MY7**	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**MY6**	**MY7**
based on fixed bankfull elevation	570.5	570.5							569.8	569.8							554.1	554.1							553.9	553.9						
Bankfull Width (ft)	7.9	7.7							8.4	7.3							9.6	8.9							7.5	6.8						
Floodprone Width (ft)	23.6	21.6							N/A	N/A							N/A	N/A							23.4	17.0						
Bankfull Mean Depth (ft)	0.6	0.5							0.9	0.9							0.9	0.9							0.6	0.4						
Bankfull Max Depth (ft)	0.9	0.8							1.6	1.5							1.8	1.9							0.9	0.8						
Bankfull Cross Sectional Area (ft^2)	4.6	3.8							7.4	6.5							8.2	8.1							4.3	3.0						
Bankfull Width/Depth Ratio	13.6	15.8							9.5	8.3							11.3	9.8							13.1	15.4						
Bankfull Entrenchment Ratio	3.0	2.8							N/A	N/A							N/A	N/A							3.1	2.5						
Bankfull Bank Height Ratio	1.0	1.0							1.0	1.0							1.0	1.0							1.0	1.0						
	UT2 Reach 3																UT2A													
	Cross Section 5 (Riffle)								Cross Section 6 (Pool)								Cross Section 7 (Riffle)								Cross Section 8 (Pool)							
Dimension and Substrate	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**MY6**	**MY7**	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**MY6**	**MY7**	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**MY6**	**MY7**	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**MY6**	**MY7**
based on fixed bankfull elevation	520.1	520.1							519.5	519.5							520.5	520.5							520.2	520.2						
Bankfull Width (ft)	9.7	9.8							9.9	10.7							6.6	7.5							9.7	8.6						
Floodprone Width (ft)	100.0	100.0							N/A	N/A							100.0	100.0							N/A	N/A						
Bankfull Mean Depth (ft)	0.5	0.4							0.9	0.8							0.5	0.4							0.9	0.8						
Bankfull Max Depth (ft)	0.8	0.9							1.6	1.7							0.7	0.7							1.5	1.6						
Bankfull Cross Sectional Area (ft^2)	4.5	4.4							8.9	9.0							3.2	2.7							9.1	8.6						
Bankfull Width/Depth Ratio	20.5	21.9							11.0	12.7							13.5	20.7							10.4	12.3						
Bankfull Entrenchment Ratio	10.4	10.2							N/A	N/A							15.1	13.3							N/A	N/A						
Bankfull Bank Height Ratio	1.0	1.0							1.0	1.0							1.0	1.0							1.0	1.0						

N/A: Not Applicable

Table 12a. Monitoring Data - Stream Reach Data Summary
Holman Mill Mitigation Project
DMS Project No.96316
Monitoring Year 1 - 2016

UT1 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 - Shallow																
Bankfull Width (ft)	7.9		7.7													
Floodprone Width (ft)	24		22													
Bankfull Mean Depth	0.6		0.5													
Bankfull Max Depth	0.9		0.8													
Bankfull Cross Sectional Area (ft^2)	4.6		3.8													
Width/Depth Ratio	13.6		15.8													
Entrenchment Ratio	3.0		2.8													
Bank Height Ratio	1.0		1.0													
D50 (mm)	32.0		43.7													
Profile																
Riffle Length (ft)	12.5	31.4														
Riffle Slope (ft/ft)	0.0200	0.0690														
Pool Length (ft)	6.0	23.6														
Pool Max Depth (ft)	1.5	3.4														
Pool Spacing (ft)	20	53														
Pool Volume (ft^3)																
Pattern																
Channel Beltwidth (ft)	11	45														
Radius of Curvature (ft)	9	37														
Rc:Bankfull Width (ft/ft)	1.1	4.7														
Meander Wave Length (ft)	31	75														
Meander Width Ratio	1.4	5.7														
Additional Reach Parameters																
Rosgen Classification	C4															
Channel Thalweg Length (ft)	208															
Sinuosity (ft)	1.1															
Water Surface Slope (ft/ft)	0.0246															
Bankfull Slope (ft/ft)	0.0203															
Ri%/Ru%/P%/G%/S%																
SC%/Sa%/G%/C%/B%/Be%																
d16/d35/d50/d84/d95/d100	0.22/2.97/6.6/38.7/ 69.7/128		SC/1.19/9.1/57.4/ 107.3/256													
% of Reach with Eroding Banks	0%		0%													

(---): Data was not provided

Table 12b. Monitoring Data - Stream Reach Data Summary
Holman Mill Mitigation Project
DMS Project No.96316
Monitoring Year 1 - 2016

UT1 Reach 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 - Shallow																
Bankfull Width (ft)	7.5		6.8													
Floodprone Width (ft)	23		17													
Bankfull Mean Depth	0.6		0.4													
Bankfull Max Depth	0.9		0.8													
Bankfull Cross Sectional Area (ft^2)	4.3		3.0													
Width/Depth Ratio	13.1		15.4													
Entrenchment Ratio	3.1		2.5													
Bank Height Ratio	1.0		1.0													
D50 (mm)	28.8		22.6													
Profile																
Riffle Length (ft)	12.5	31.4														
Riffle Slope (ft/ft)	0.0200	0.0690														
Pool Length (ft)	6.0	23.6														
Pool Max Depth (ft)	1.5	3.4														
Pool Spacing (ft)	20	53														
Pool Volume (ft^3)																
Pattern																
Channel Beltwidth (ft)	11	45														
Radius of Curvature (ft)	9	37														
Rc:Bankfull Width (ft/ft)	1.2	4.9														
Meander Wave Length (ft)	31	75														
Meander Width Ratio	1.5	6.0														
Additional Reach Parameters																
Rosgen Classification	C4															
Channel Thalweg Length (ft)	309															
Sinuosity (ft)	1.1															
Water Surface Slope (ft/ft)	0.0246															
Bankfull Slope (ft/ft)	0.0203															
Ri%/Ru%/P%/G%/S%																
SC%/Sa%/G%/C%/B%/Be%																
d16/d35/d50/d84/d95/d100	0.22/2.97/6.6/38.7/ 69.7/128		SC/1.19/9.1/57.4/ 107.3/256													
% of Reach with Eroding Banks	0%		0%													

(---): Data was not provided

Table 12c. Monitoring Data - Stream Reach Data Summary
Holman Mill Mitigation Project
DMS Project No.96316
Monitoring Year 1 - 2016

UT2 Reaches 3, 4

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 - Shallow																
Bankfull Width (ft)	9.7		9.8													
Floodprone Width (ft)	100		100													
Bankfull Mean Depth	0.5		0.4													
Bankfull Max Depth	0.8		0.9													
Bankfull Cross Sectional Area (ft^2)	4.5		4.4													
Width/Depth Ratio	20.5		21.9													
Entrenchment Ratio	10.4		10.2													
Bank Height Ratio	1.0		1.0													
D50 (mm)	11.4		35.0													
Profile																
Riffle Length (ft)	15	46														
Riffle Slope (ft/ft)	0.0135	0.0592														
Pool Length (ft)	11	60														
Pool Max Depth (ft)	1.5	3.1														
Pool Spacing (ft)	33	61														
Pool Volume (ft^3)																
Pattern																
Channel Beltwidth (ft)	20	52														
Radius of Curvature (ft)	18	45														
Rc:Bankfull Width (ft/ft)	1.9	4.6														
Meander Wave Length (ft)	56	130														
Meander Width Ratio	2.1	3.2														
Additional Reach Parameters																
Rosgen Classification	C4															
Channel Thalweg Length (ft)	649															
Sinuosity (ft)	1.15															
Water Surface Slope (ft/ft)	0.0119	0.0237														
Bankfull Slope (ft/ft)	0.0120	0.0176														
Ri%/Ru%/P%/G%/S%																
SC%/Sa%/G%/C%/B%/Be%																
d16/d35/d50/d84/d95/d100	SC/2.18/5.6/ 34.0/56.9/362.0		1.0/9.17/24.5/53.7/ 77.8/128													
% of Reach with Eroding Banks	0%		0%													

(---): Data was not provided

Table 12d. Monitoring Data - Stream Reach Data Summary
Holman Mill Mitigation Project
DMS Project No.96316
Monitoring Year 1 - 2016

UT2A

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 - Shallow																
Bankfull Width (ft)	6.6		7.5													
Floodprone Width (ft)	100		100													
Bankfull Mean Depth	0.5		0.4													
Bankfull Max Depth	0.7		0.7													
Bankfull Cross Sectional Area (ft^2)	3.2		2.7													
Width/Depth Ratio	13.5		20.7													
Entrenchment Ratio	15.1		13.3													
Bank Height Ratio	1.0		1.0													
D50 (mm)	18.3		29.7													
Profile																
Riffle Length (ft)	17.9	38.2														
Riffle Slope (ft/ft)	0.0007	0.0520														
Pool Length (ft)	16.3	33.0														
Pool Max Depth (ft)	1.5	3.3														
Pool Spacing (ft)	29	62														
Pool Volume (ft^3)																
Pattern																
Channel Beltwidth (ft)	25	40														
Radius of Curvature (ft)	11	31														
Rc:Bankfull Width (ft/ft)	1.7	4.7														
Meander Wave Length (ft)	41	61														
Meander Width Ratio	3.8	6.1														
Additional Reach Parameters																
Rosgen Classification	C4															
Channel Thalweg Length (ft)	540															
Sinuosity (ft)	1.10															
Water Surface Slope (ft/ft)	0.0129															
Bankfull Slope (ft/ft)	0.0143															
Ri%/Ru%/P%/G%/S%																
SC%/Sa%/G%/C%/B%/Be%																
d16/d35/d50/d84/d95/d100	3.15/11.86/18.3/43.5/ 101.2/362		.21/6.69/20.1/53.1/ 75.9/128													
% of Reach with Eroding Banks	0%		0%													

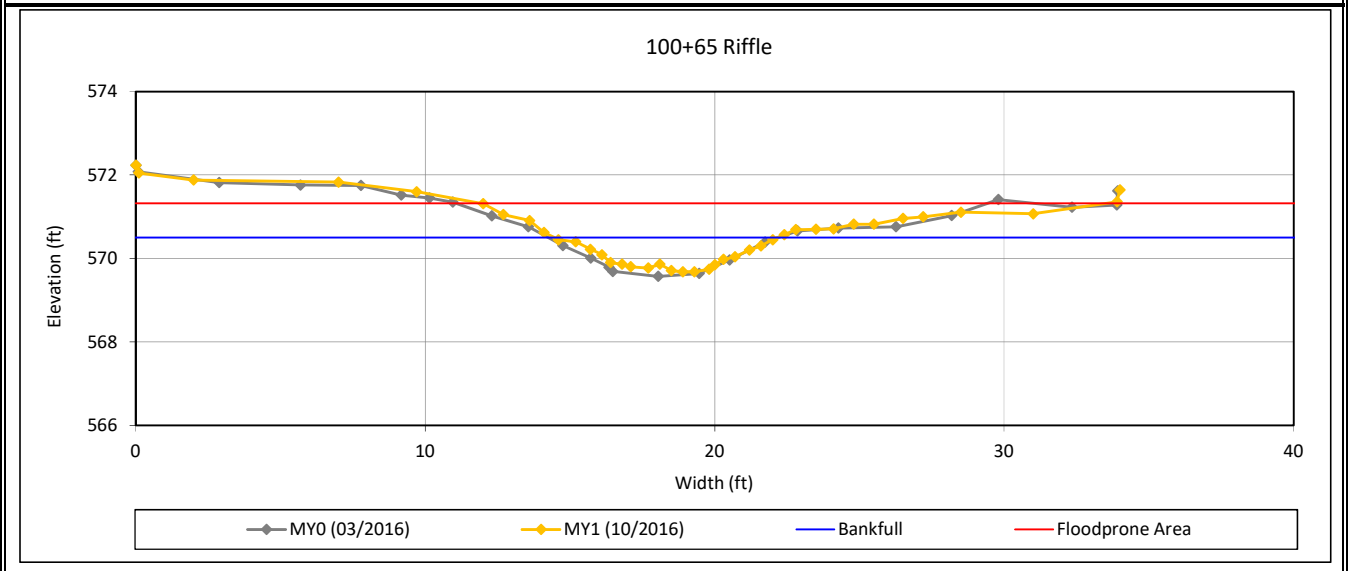
(---): Data was not provided

Cross Section Plots

Holman Mill Mitigation Site (DMS Project No. 93616)

Monitoring Year 1 - 2016

Cross Section 1 - UT1



Bankfull Dimensions	
3.8	x-section area (ft.sq.)
7.7	width (ft)
0.5	mean depth (ft)
0.8	max depth (ft)
8.0	wetted parimeter (ft)
0.5	hyd radi (ft)
15.8	width-depth ratio
21.6	W flood prone area (ft)
2.8	entrenchment ratio
1.0	low bank height ratio

Survey Date: 10/2016

Field Crew: Wildlands Engineering

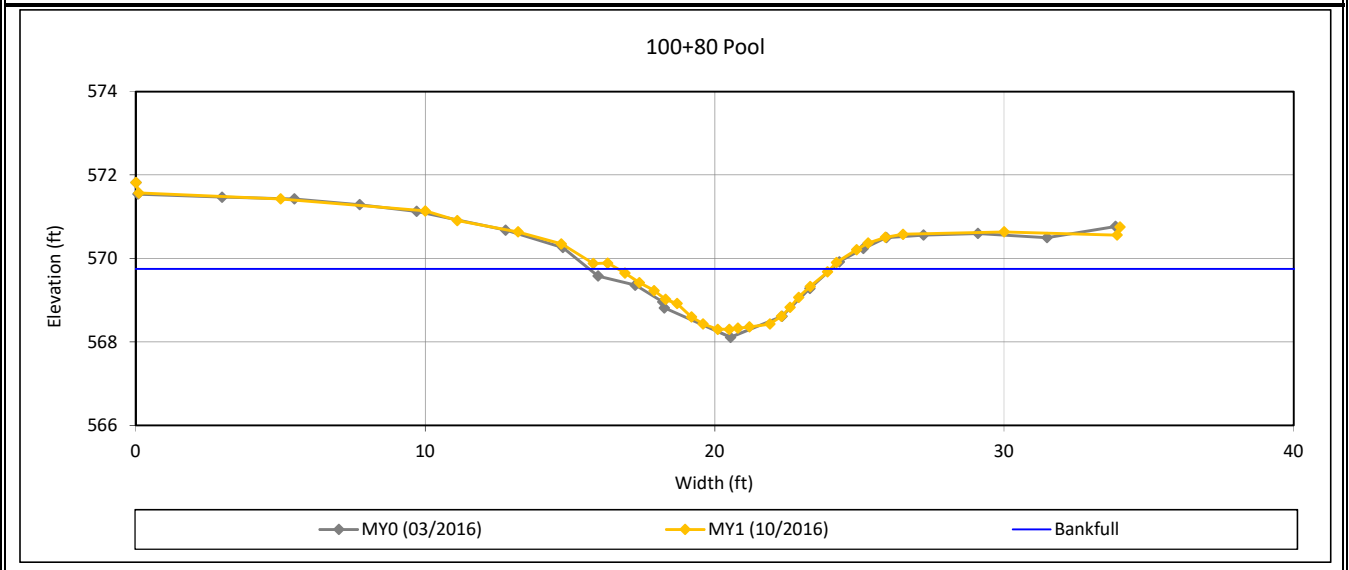
View Downstream

Cross Section Plots

Holman Mill Mitigation Site (DMS Project No. 93616)

Monitoring Year 1 - 2016

Cross Section 2 - UT1



Bankfull Dimensions

6.5	x-section area (ft.sq.)
7.3	width (ft)
0.9	mean depth (ft)
1.5	max depth (ft)
8.1	wetted parimeter (ft)
0.8	hyd radi (ft)
8.3	width-depth ratio

Survey Date: 10/2016

Field Crew: Wildlands Engineering

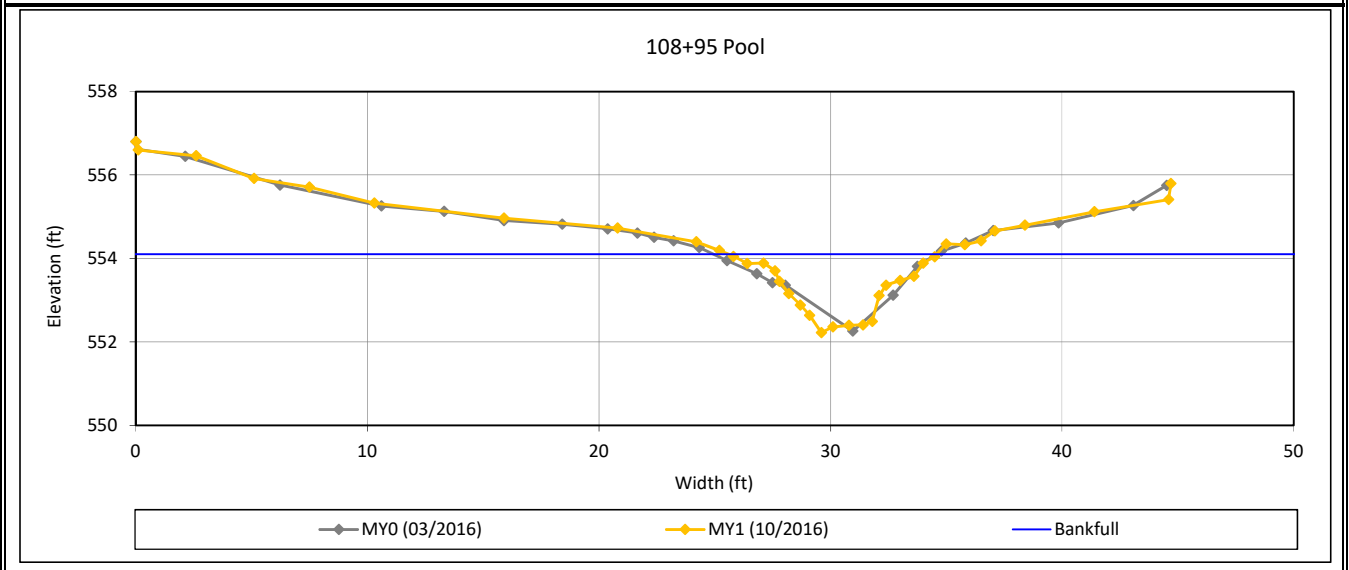
View Downstream

Cross Section Plots

Holman Mill Mitigation Site (DMS Project No. 93616)

Monitoring Year 1 - 2016

Cross Section 3 - UT1



Bankfull Dimensions	
8.1	x-section area (ft.sq.)
8.9	width (ft)
0.9	mean depth (ft)
1.9	max depth (ft)
10.1	wetted parimeter (ft)
0.8	hyd radi (ft)
9.8	width-depth ratio

Survey Date: 10/2016

Field Crew: Wildlands Engineering

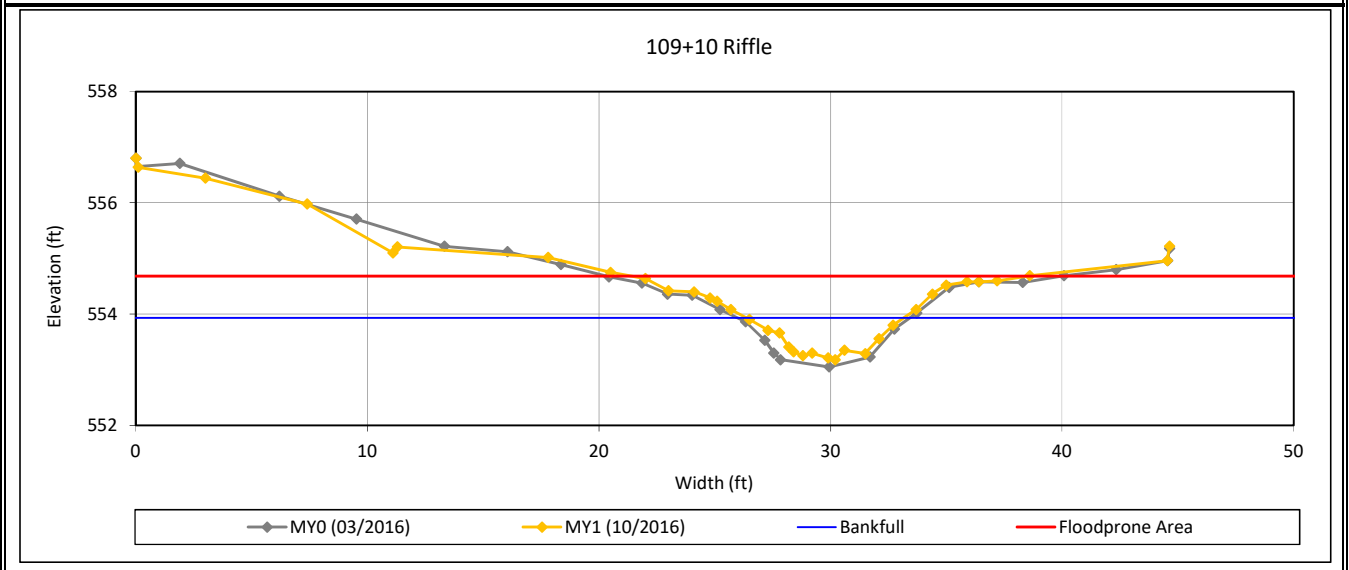
View Downstream

Cross Section Plots

Holman Mill Mitigation Site (DMS Project No. 93616)

Monitoring Year 1 - 2016

Cross Section 4 - UT1



Bankfull Dimensions	
3.0	x-section area (ft.sq.)
6.8	width (ft)
0.4	mean depth (ft)
0.8	max depth (ft)
7.1	wetted parimeter (ft)
0.4	hyd radi (ft)
15.4	width-depth ratio
17.0	W flood prone area (ft)
2.5	entrenchment ratio
1.0	low bank height ratio

Survey Date: 10/2016

Field Crew: Wildlands Engineering

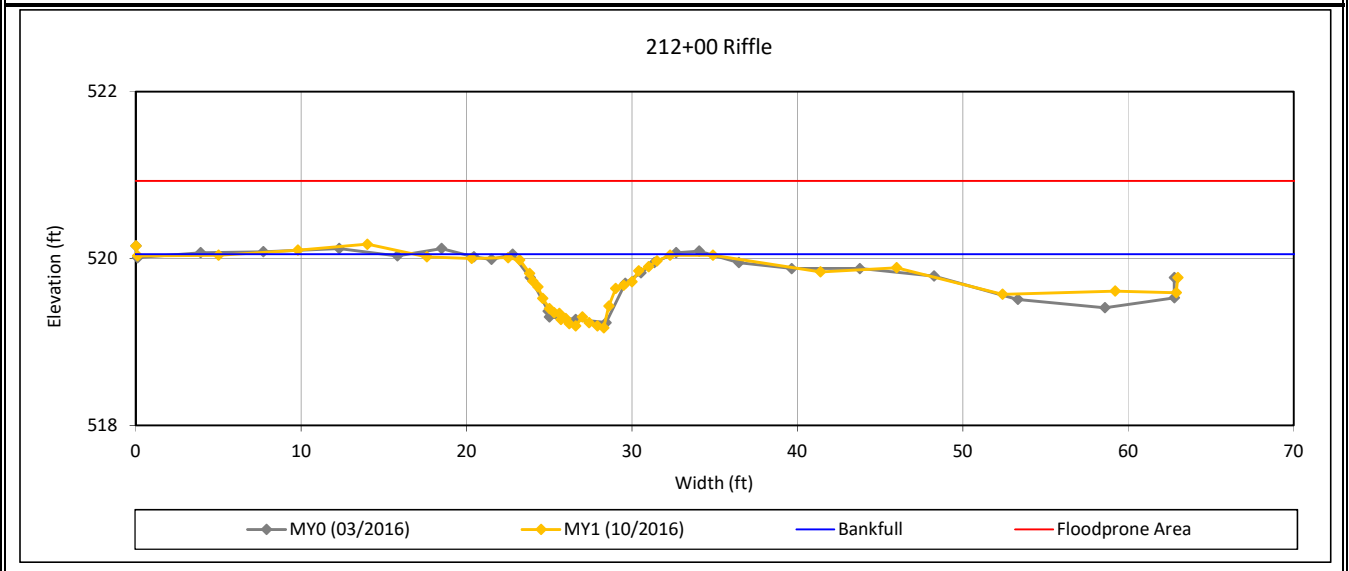
View Downstream

Cross Section Plots

Holman Mill Mitigation Site (DMS Project No. 93616)

Monitoring Year 1 - 2016

Cross Section 5 - UT2



Bankfull Dimensions	
4.4	x-section area (ft.sq.)
9.8	width (ft)
0.4	mean depth (ft)
0.9	max depth (ft)
10.1	wetted parimeter (ft)
0.4	hyd radi (ft)
21.9	width-depth ratio
100.0	W flood prone area (ft)
10.2	entrenchment ratio
1.0	low bank height ratio

Survey Date: 10/2016

Field Crew: Wildlands Engineering

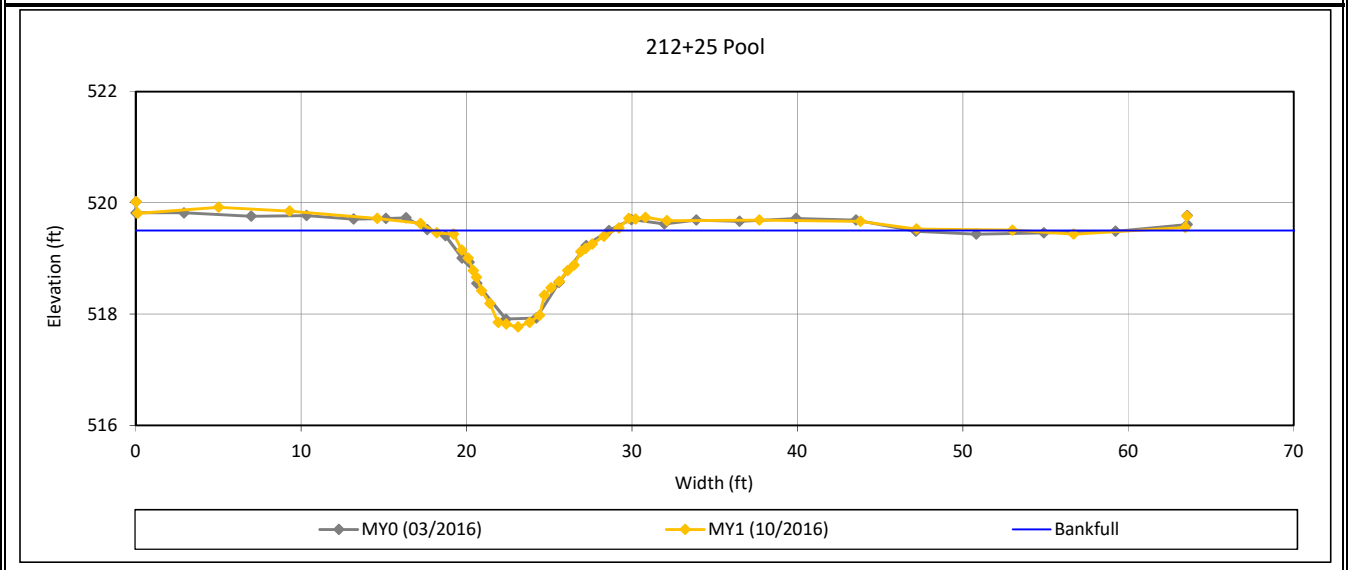
View Downstream

Cross Section Plots

Holman Mill Mitigation Site (DMS Project No. 93616)

Monitoring Year 1 - 2016

Cross Section 6 - UT2



Bankfull Dimensions	
9.0	x-section area (ft.sq.)
10.7	width (ft)
0.8	mean depth (ft)
1.7	max depth (ft)
11.5	wetted parimeter (ft)
0.8	hyd radi (ft)
12.7	width-depth ratio

Survey Date: 10/2016

Field Crew: Wildlands Engineering

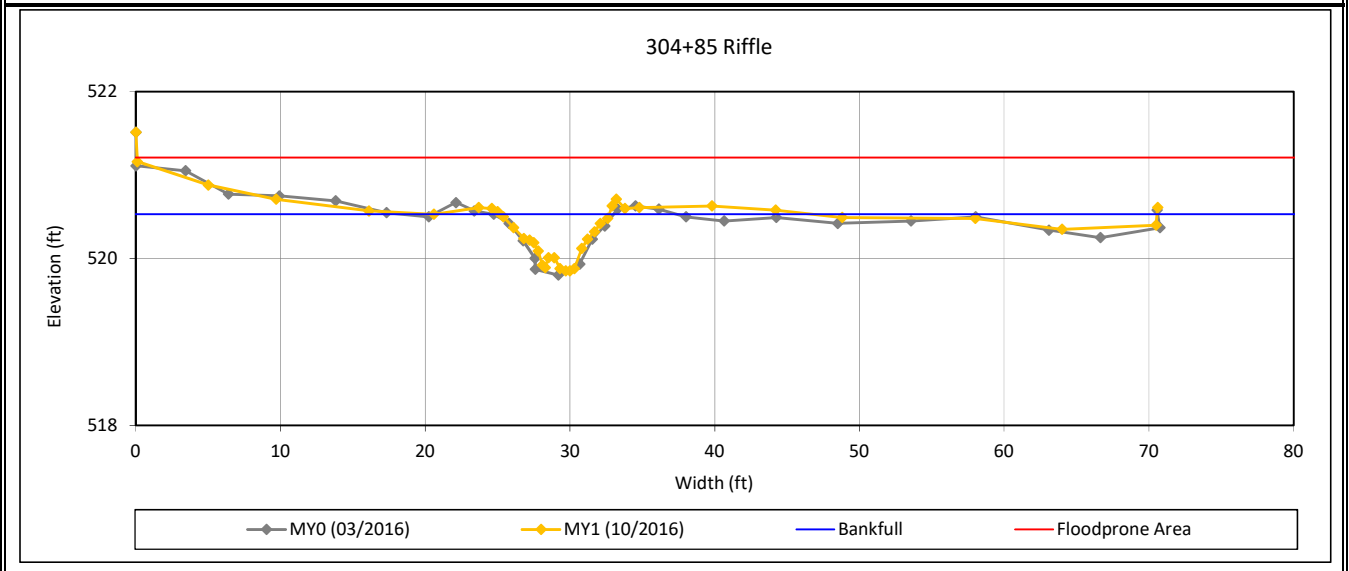
View Downstream

Cross Section Plots

Holman Mill Mitigation Site (DMS Project No. 93616)

Monitoring Year 1 - 2016

Cross Section 7 - UT2A



Bankfull Dimensions	
2.7	x-section area (ft.sq.)
7.5	width (ft)
0.4	mean depth (ft)
0.7	max depth (ft)
7.8	wetted parimeter (ft)
0.3	hyd radi (ft)
20.7	width-depth ratio
100.0	W flood prone area (ft)
13.3	entrenchment ratio
1.0	low bank height ratio

Survey Date: 10/2016

Field Crew: Wildlands Engineering

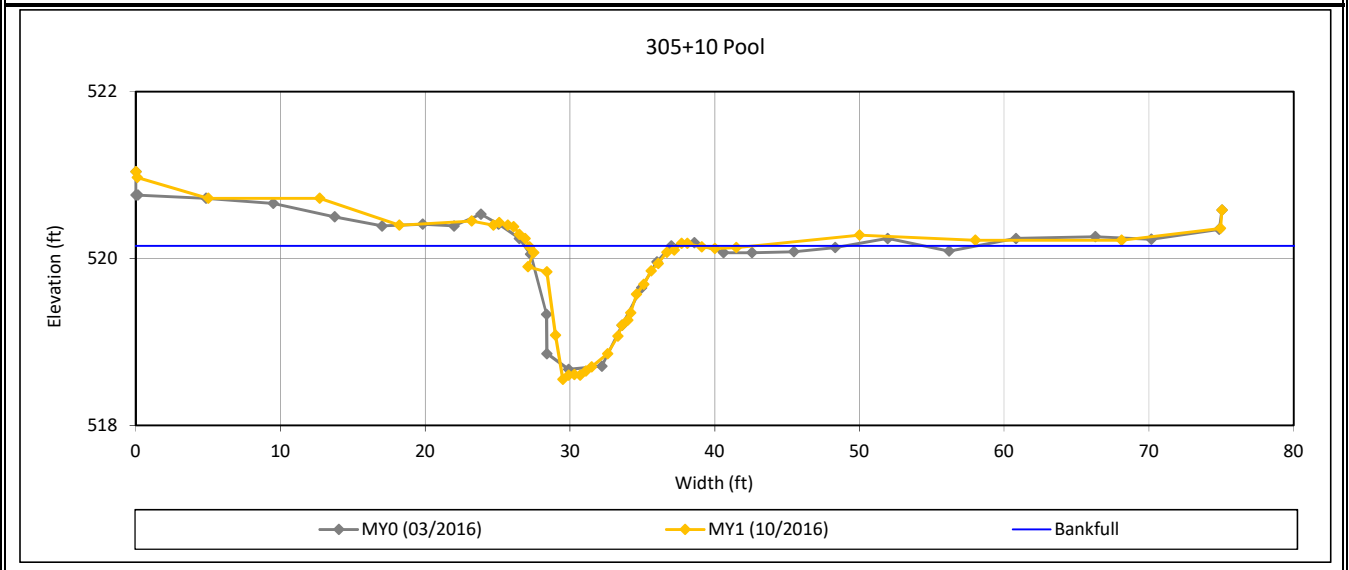
View Downstream

Cross Section Plots

Holman Mill Mitigation Site (DMS Project No. 93616)

Monitoring Year 1 - 2016

Cross Section 8 - UT2A



Bankfull Dimensions	
8.6	x-section area (ft.sq.)
10.3	width (ft)
0.8	mean depth (ft)
1.6	max depth (ft)
12.0	wetted parimeter (ft)
0.7	hyd radi (ft)
12.3	width-depth ratio

Survey Date: 10/2016

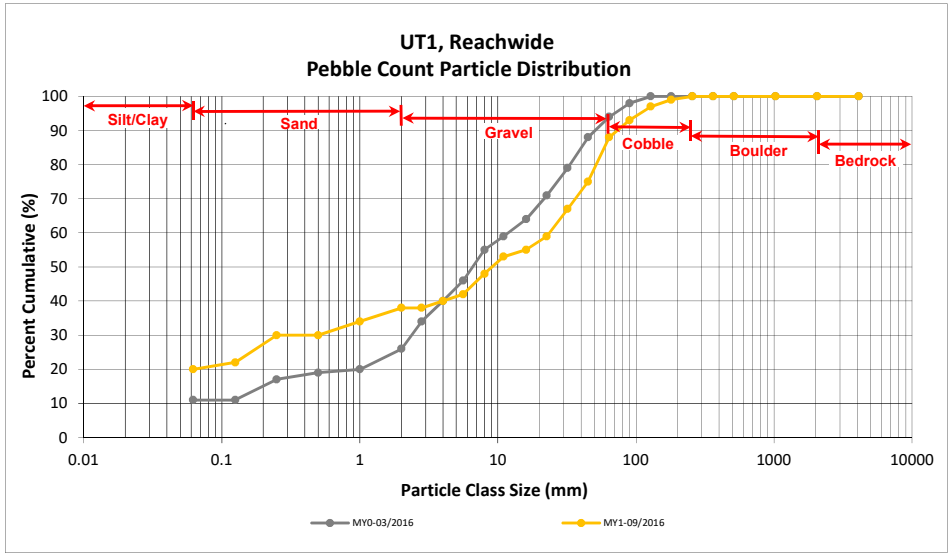
Field Crew: Wildlands Engineering

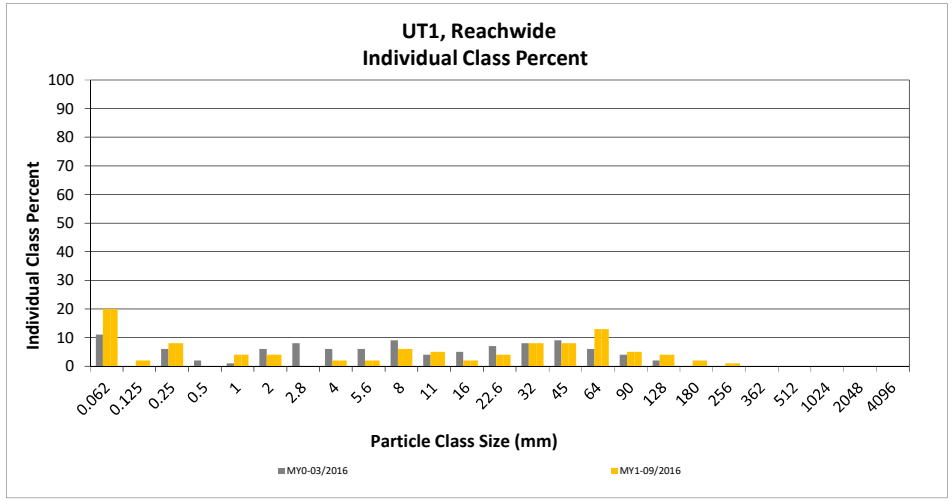
View Downstream

Reachwide and Cross Section Pebble Count Plots
Holman Mill Mitigation Site (DMS Project No. 93616)
Monitoring Year 1 - 2016
UT1, Reachwide

Particle Class		Diameter (mm)		Particle Count			Reach Summary	
		min	max	Riffle	Pool	Total	Class Percentage	Percent Cumulative
SILT/CLAY	Silt/Clay	0.000	0.062	2	9	11	11	11
SAND	Very fine	0.062	0.125					11
	Fine	0.125	0.250		6	6	6	17
	Medium	0.25	0.50		2	2	2	19
	Coarse	0.5	1.0		1	1	1	20
	Very Coarse	1.0	2.0	1	5	6	6	26
GRAVEL	Very Fine	2.0	2.8	2	6	8	8	34
	Very Fine	2.8	4.0	2	4	6	6	40
	Fine	4.0	5.6	2	4	6	6	46
	Fine	5.6	8.0	4	5	9	9	55
	Medium	8.0	11.0	3	1	4	4	59
	Medium	11.0	16.0	3	2	5	5	64
	Coarse	16.0	22.6	6	1	7	7	71
	Coarse	22.6	32	5	3	8	8	79
	Very Coarse	32	45	9		9	9	88
	Very Coarse	45	64	5	1	6	6	94
COBBLE	Small	64	90	4		4	4	98
	Small	90	128	2		2	2	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	**50**	**50**	**100**	**100**	**100**

Reachwide	
Channel materials (mm)	
D_{16} =	0.22
D_{35} =	2.97
D_{50} =	6.6
D_{84} =	38.7
D_{95} =	69.7
D_{100} =	128.0

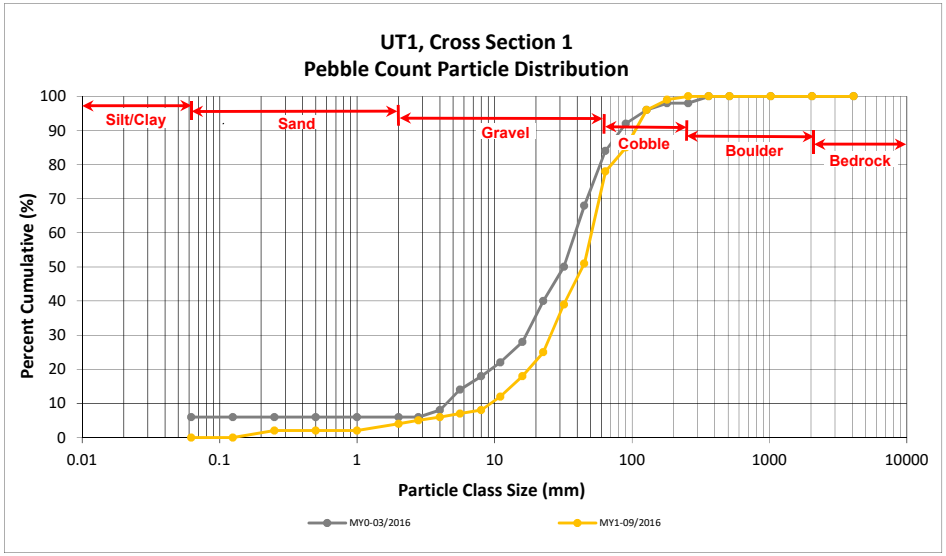


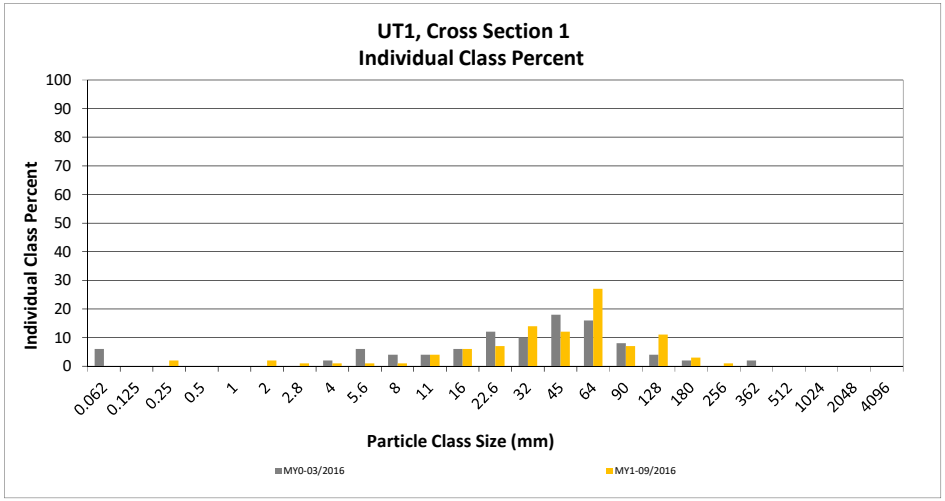


Reachwide and Cross Section Pebble Count Plots
Holman Mill Mitigation Site (DMS Project No. 93616)
Monitoring Year 1 - 2016
UT1, Cross Section 1

Particle Class		Diameter (mm) min	Diameter (mm) max	Riffle 100-Count	Summary: Class Percentage	Summary: Percent Cumulative
SILT/CLAY	Silt/Clay	0.000	0.062	6	6	6
SAND	Very fine	0.062	0.125			6
	Fine	0.125	0.250			6
	Medium	0.25	0.50			6
	Coarse	0.5	1.0			6
	Very Coarse	1.0	2.0			6
GRAVEL	Very Fine	2.0	2.8			6
	Very Fine	2.8	4.0	2	2	8
	Fine	4.0	5.6	6	6	14
	Fine	5.6	8.0	4	4	18
	Medium	8.0	11.0	4	4	22
	Medium	11.0	16.0	6	6	28
	Coarse	16.0	22.6	12	12	40
	Coarse	22.6	32	10	10	50
	Very Coarse	32	45	18	18	68
	Very Coarse	45	64	16	16	84
COBBLE	Small	64	90	8	8	92
	Small	90	128	4	4	96
	Large	128	180	2	2	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 1	
Channel materials (mm)	
D_{16} =	6.69
D_{35} =	19.57
D_{50} =	32.0
D_{84} =	64.0
D_{95} =	117.2
D_{100} =	362.0

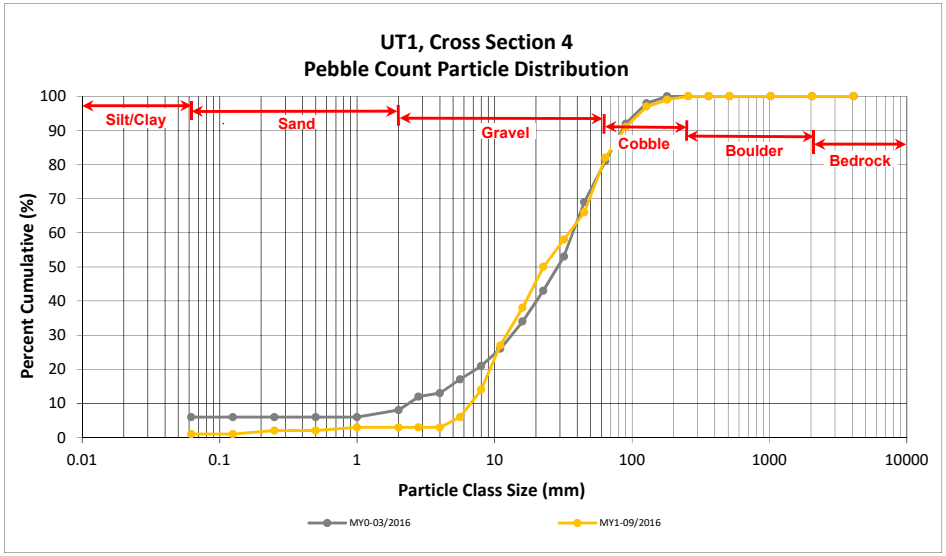


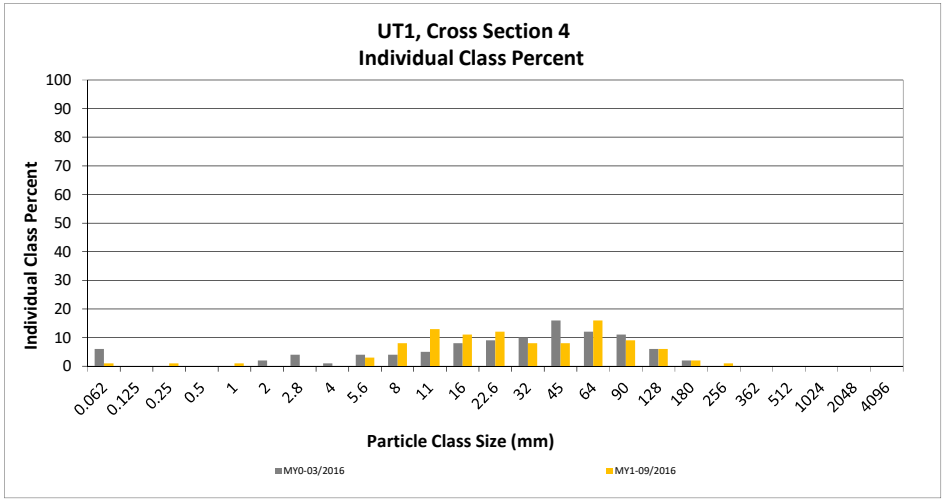


Reachwide and Cross Section Pebble Count Plots
Holman Mill Mitigation Site (DMS Project No. 93616)
Monitoring Year 1 - 2016
UT1, Cross Section 4

Particle Class		Diameter (mm) min	Diameter (mm) max	Riffle 100-Count	Summary Class Percentage	Summary Percent Cumulative
SILT/CLAY	Silt/Clay	0.000	0.062	6	6	6
SAND	Very fine	0.062	0.125			6
	Fine	0.125	0.250			6
	Medium	0.25	0.50			6
	Coarse	0.5	1.0			6
	Very Coarse	1.0	2.0	2	2	8
GRAVEL	Very Fine	2.0	2.8	4	4	12
	Very Fine	2.8	4.0	1	1	13
	Fine	4.0	5.6	4	4	17
	Fine	5.6	8.0	4	4	21
	Medium	8.0	11.0	5	5	26
	Medium	11.0	16.0	8	8	34
	Coarse	16.0	22.6	9	9	43
	Coarse	22.6	32	10	10	53
	Very Coarse	32	45	16	16	69
	Very Coarse	45	64	12	12	81
COBBLE	Small	64	90	11	11	92
	Small	90	128	6	6	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	**100**	**100**	**100**

Cross Section 4	
Channel materials (mm)	
D_{16} =	5.15
D_{35} =	16.63
D_{50} =	28.8
D_{84} =	70.2
D_{95} =	107.3
D_{100} =	180.0

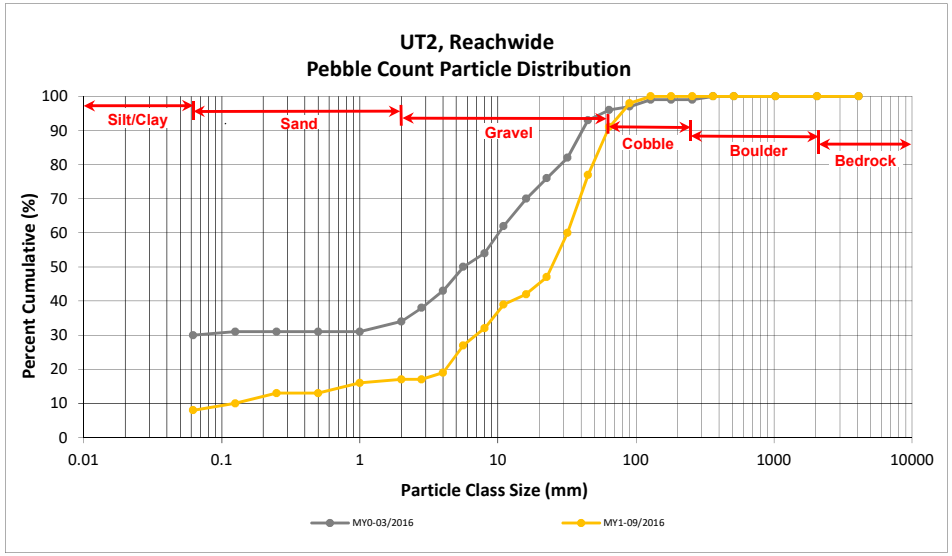


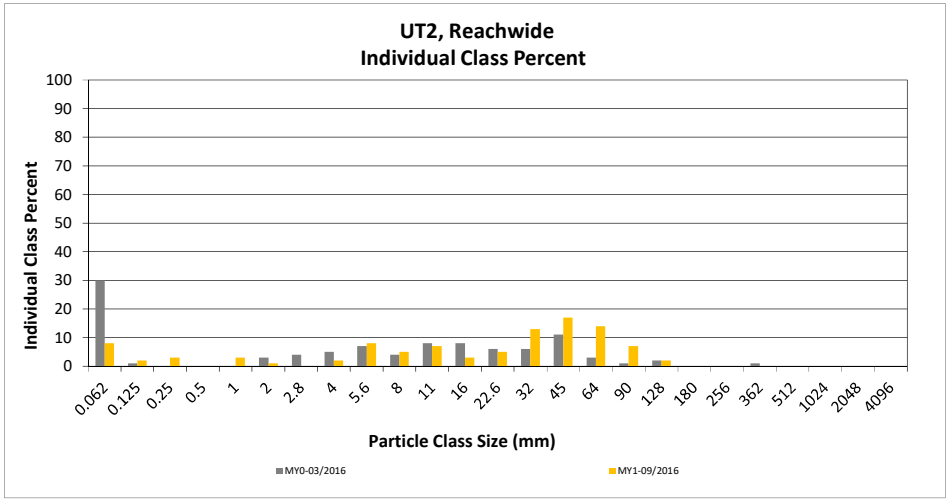


Reachwide and Cross Section Pebble Count Plots
Holman Mill Mitigation Site (DMS Project No. 93616)
Monitoring Year 1 - 2016
UT2, Reachwide

Particle Class		Diameter (mm)		Particle Count			Reach Summary	
		min	max	Riffle	Pool	Total	Class Percentage	Percent Cumulative
SILT/CLAY	Silt/Clay	0.000	0.062	1	29	30	30	30
SAND	Very fine	0.062	0.125		1	1	1	31
	Fine	0.125	0.250					31
	Medium	0.25	0.50					31
	Coarse	0.5	1.0					31
	Very Coarse	1.0	2.0		3	3	3	34
GRAVEL	Very Fine	2.0	2.8	2	2	4	4	38
	Very Fine	2.8	4.0	4	1	5	5	43
	Fine	4.0	5.6	5	2	7	7	50
	Fine	5.6	8.0	2	2	4	4	54
	Medium	8.0	11.0	6	2	8	8	62
	Medium	11.0	16.0	6	2	8	8	70
	Coarse	16.0	22.6	5	1	6	6	76
	Coarse	22.6	32	4	2	6	6	82
	Very Coarse	32	45	9	2	11	11	93
	Very Coarse	45	64	3		3	3	96
COBBLE	Small	64	90	1		1	1	97
	Small	90	128	1	1	2	2	99
	Large	128	180					99
	Large	180	256					99
BOULDER	Small	256	362	1		1	1	100
	Small	362	512					100
	Medium	512	1024					100
	Large/Very Large	1024	2048					100
BEDROCK	Bedrock	2048	>2048					100
			Total	**50**	**50**	**100**	**100**	**100**

Reachwide	
Channel materials (mm)	
D_{16} =	Silt/Clay
D_{35} =	2.18
D_{50} =	5.6
D_{84} =	34.0
D_{95} =	56.9
D_{100} =	362.0

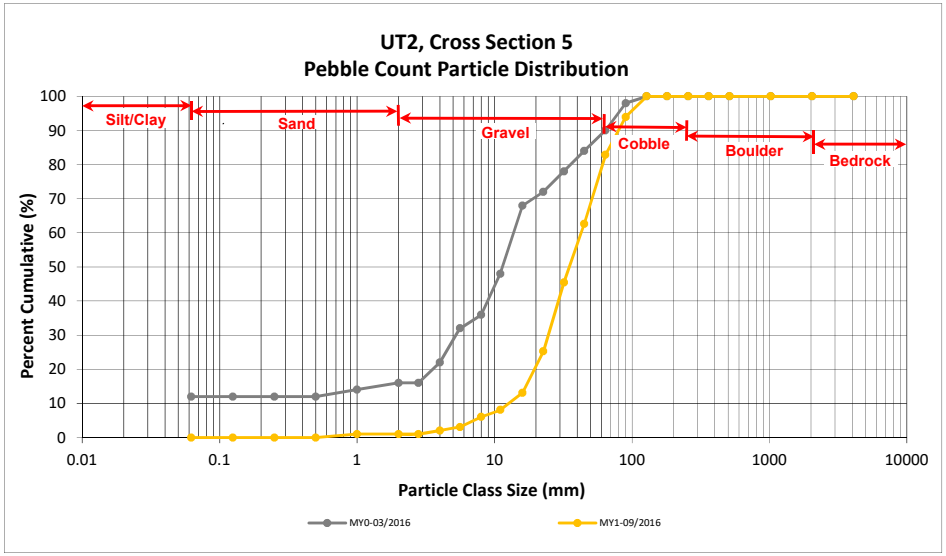


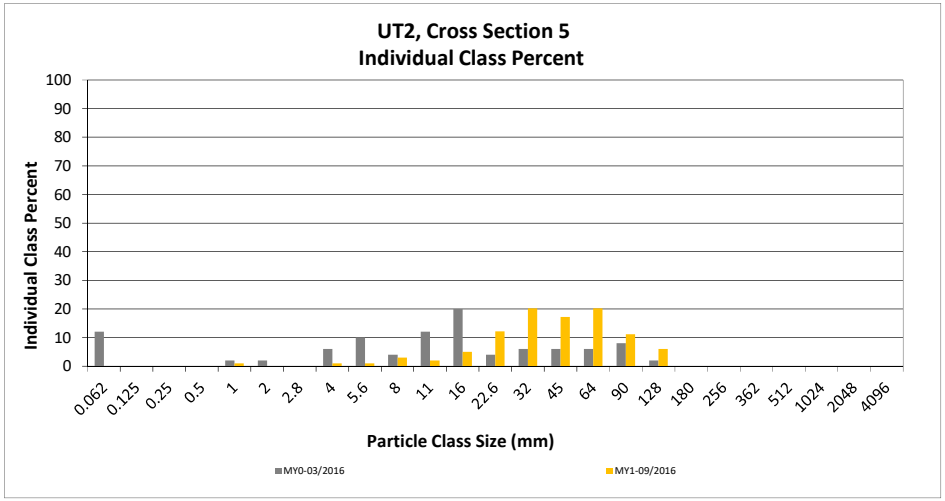


Reachwide and Cross Section Pebble Count Plots
Holman Mill Mitigation Site (DMS Project No. 93616)
Monitoring Year 1 - 2016
UT2, Cross Section 5

Particle Class		Diameter (mm)		Riffle 100-Count	Summary	
		min	max		Class Percentage	Percent Cumulative
SILT/CLAY	Silt/Clay	0.000	0.062	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	2	2	16
GRAVEL	Very Fine	2.0	2.8			16
	Very Fine	2.8	4.0	6	6	22
	Fine	4.0	5.6	10	10	32
	Fine	5.6	8.0	4	4	36
	Medium	8.0	11.0	12	12	48
	Medium	11.0	16.0	20	20	68
	Coarse	16.0	22.6	4	4	72
	Coarse	22.6	32	6	6	78
	Very Coarse	32	45	6	6	84
	Very Coarse	45	64	6	6	90
COBBLE	Small	64	90	8	8	98
	Small	90	128	2	2	100
	Large	128	180			100
	Large	180	256			100
BOULDER	Small	256	362			100
	Small	362	512			100
	Medium	512	1024			100
	Large/Very Large	1024	2048			100
BEDROCK	Bedrock	2048	>2048			100
			Total	**100**	**100**	**100**

Cross Section 5	
Channel materials (mm)	
D_{16} =	2.00
D_{35} =	7.32
D_{50} =	11.4
D_{84} =	45.0
D_{95} =	79.2
D_{100} =	128.0

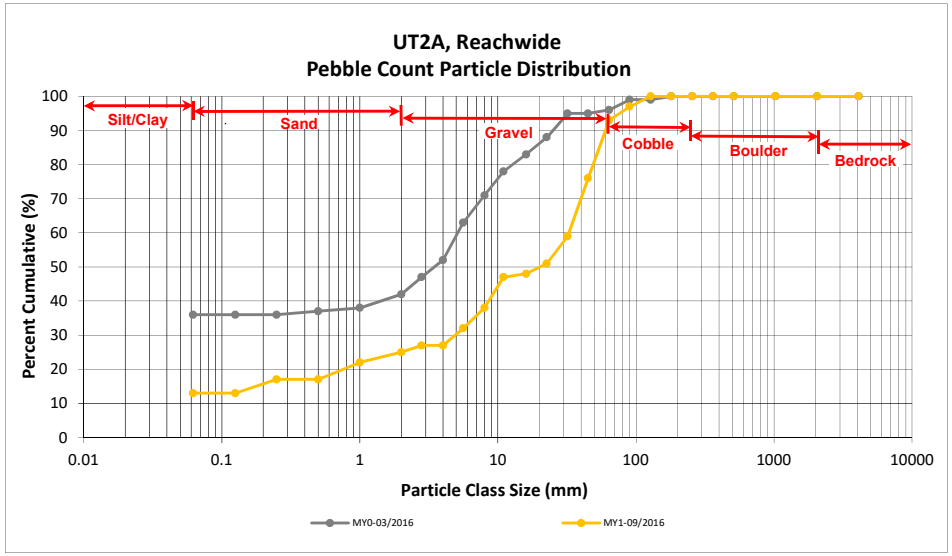


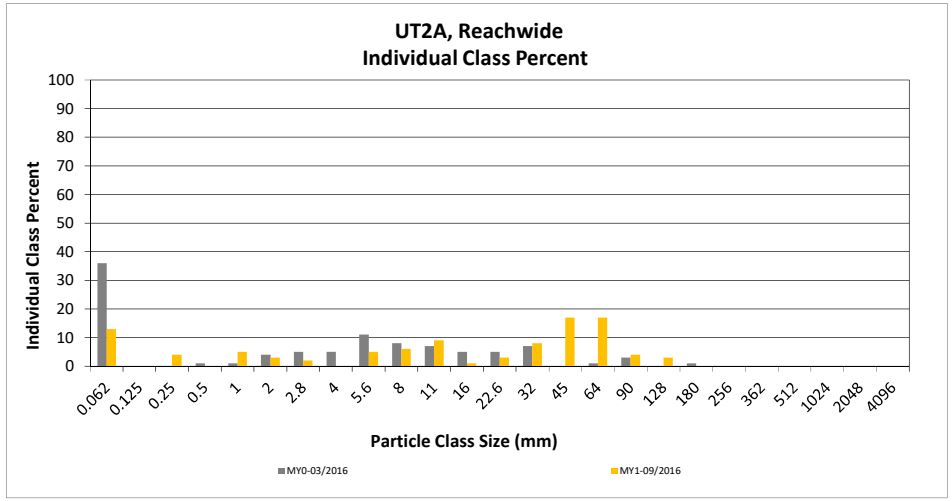


Reachwide and Cross Section Pebble Count Plots
Holman Mill Mitigation Site (DMS Project No. 93616)
Monitoring Year 1 - 2016
UT2A, Reachwide

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		36	36	36	36
SAND	Very fine	0.062	0.125					36
	Fine	0.125	0.250					36
	Medium	0.25	0.50		1	1	1	37
	Coarse	0.5	1.0		1	1	1	38
	Very Coarse	1.0	2.0	1	3	4	4	42
GRAVEL	Very Fine	2.0	2.8	2	3	5	5	47
	Very Fine	2.8	4.0	2	3	5	5	52
	Fine	4.0	5.6	8	3	11	11	63
	Fine	5.6	8.0	8		8	8	71
	Medium	8.0	11.0	7		7	7	78
	Medium	11.0	16.0	5		5	5	83
	Coarse	16.0	22.6	5		5	5	88
	Coarse	22.6	32	7		7	7	95
	Very Coarse	32	45					95
	Very Coarse	45	64	1		1	1	96
COBBLE	Small	64	90	3		3	3	99
	Small	90	128					99
	Large	128	180	1		1	1	100
	Large	180	256					100
BOULDER	Small	256	362					100
	Small	362	512					100
	Medium	512	1024					100
	Large/Very Large	1024	2048					100
BEDROCK	Bedrock	2048	>2048					100
			Total	**50**	**50**	**100**	**100**	**100**

Reachwide	
Channel materials (mm)	
D_{16} =	Silt/Clay
D_{35} =	Silt/Clay
D_{50} =	3.5
D_{84} =	17.1
D_{95} =	32.0
D_{100} =	180.0

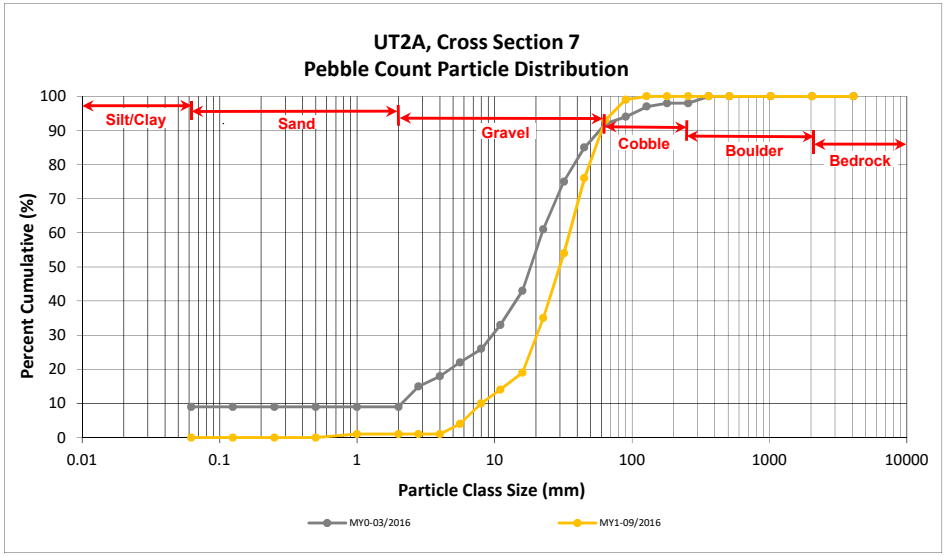


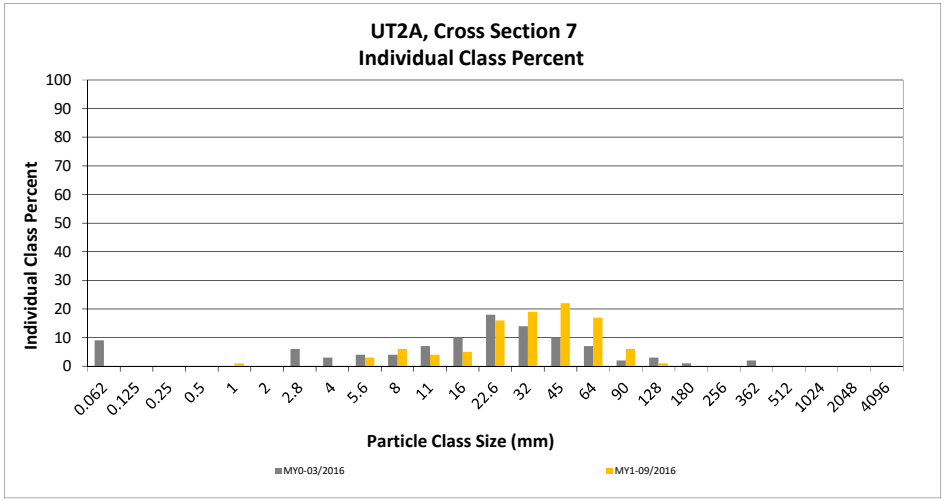


Reachwide and Cross Section Pebble Count Plots
Holman Mill Mitigation Site (DMS Project No. 93616)
Monitoring Year 1 - 2016
UT2A, Cross Section 7

Particle Class		Diameter (mm) min	Diameter (mm) max	Riffle 100-Count	Summary: Class Percentage	Summary: Percent Cumulative
SILT/CLAY	Silt/Clay	0.000	0.062	9	9	9
SAND	Very fine	0.062	0.125			9
	Fine	0.125	0.250			9
	Medium	0.25	0.50			9
	Coarse	0.5	1.0			9
	Very Coarse	1.0	2.0			9
GRAVEL	Very Fine	2.0	2.8	6	6	15
	Very Fine	2.8	4.0	3	3	18
	Fine	4.0	5.6	4	4	22
	Fine	5.6	8.0	4	4	26
	Medium	8.0	11.0	7	7	33
	Medium	11.0	16.0	10	10	43
	Coarse	16.0	22.6	18	18	61
	Coarse	22.6	32	14	14	75
	Very Coarse	32	45	10	10	85
	Very Coarse	45	64	7	7	92
COBBLE	Small	64	90	2	2	94
	Small	90	128	3	3	97
	Large	128	180	1	1	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 7	
Channel materials (mm)	
D_{16} =	3.15
D_{35} =	11.86
D_{50} =	18.3
D_{84} =	43.5
D_{95} =	101.2
D_{100} =	362.0





APPENDIX 5. Hydrology Summary Data

Table 13. Verification of Bankfull Events

Holman Mill Mitigation Site (DMS Project No.96316)

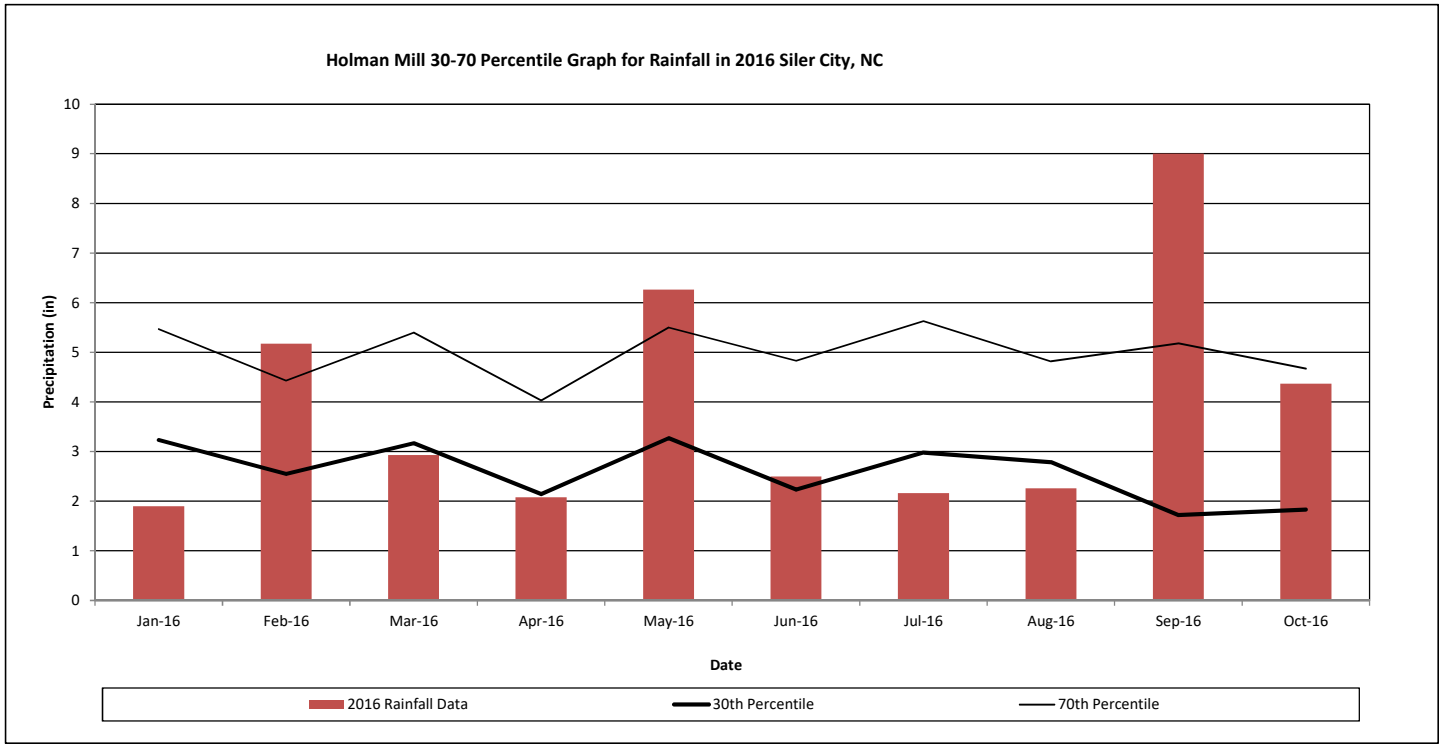
Monitoring Year 1 - 2016

Reach	Date of Data Collection	Date of Occurrence	Method
UT1	9/6/2016	7/31/2016	Crest Gage/ Pressure Transducer
	10/11/2016	10/8/2016	
UT2	9/6/2016	7/31/2016	
	10/11/2016	10/8/2016	
UT2A	9/6/2016	7/31/2016	
	10/11/2016	10/8/2016	

Monthly Rainfall Data

Holman Mill Mitigation Site (DMS Project No.96316)

Monitoring Year 1 - 2016



[1] 2016 monthly rainfall from USDA Station SILER CITY (317924)

[2] 30th and 70th percentile rainfall data collected from weather station Siler City 2 S, NC7924 (USDA, 2002).