MONITORING YEAR 3 ANNUAL REPORT

Final

BYRDS CREEK MITIGATION SITE
Person County, NC
NCDEQ Contract 003987
DMS Project Number 95020

Data Collection Period: March 2016-August 2016
Draft Submission Date: September 26, 2016
Final Submission Date: October 19, 2016

PREPARED FOR:

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

PREPARED BY:

Wildlands Engineering, Inc.
312 West Millbrook Road, Suite 225
Raleigh, NC 27609

Jason Lorch
jlorch@wildlandseng.com
Phone: 919.851.9986

EXECUTIVE SUMMARY

Wildlands Engineering (Wildlands) completed a full delivery project for the North Carolina Division of Mitigation Services (DMS) to restore and enhance a total of 7,328 linear feet (LF) of stream in Person County, North Carolina. The project streams consist of Byrds Creek, a third order stream, as well as three unnamed first and second order tributaries to Byrds Creek (South Branch, Southeast Branch, and West Branch). The project provides 5,371 stream mitigation units (SMU's). At the downstream limits of the project, the drainage area is 2,957 acres (4.62 square miles).

The Byrds Creek Mitigation Site, hereafter referred to as the Site, is approximately 1.8 miles south of Hurdle Mills, NC off of Wolfe Road in southwestern Person County (Figure 1). The Site is located in the Carolina Slate Belt of the Piedmont Physiographic Province (USGS, 1998). The Site is within the South Flat River watershed, North Carolina Division of Water Resources (NCDWR) Subbasin 03-04-01 of the Neuse River Basin and United States Geological Survey (USGS) Hydrologic Unit Code (HUC) 03020201010020. Land use within the watershed is rural and is dominated by forestry, agriculture, and livestock operations; with approximately 60% of the watershed used for agriculture and 40% forested. The Site is located in an active cattle pasture surrounded by wooded lots, small agricultural operations, and rural residential areas. Prior to construction activities, the streams on the Site were heavily impacted by cattle, which led to stream bank erosion and instability.

The following project goals were established to address the effects from watershed and project site stressors:

- Reduce nutrient loads within the watershed and to downstream waters;
- Stabilize eroding stream banks greatly reducing, if not eliminating, sediment loads;
- Restore riffle/pool sequencing resulting in decreased water temperatures and increased dissolved oxygen concentrations;
- Establish in-stream structures to improve habitat diversity and trap detritus;
- Restore native vegetation and riparian buffers; and
- Protect the restored land in perpetuity through a conservation easement.

These goals were achieved by restoring 3,096 LF of perennial and intermittent stream channel and enhancing 4,232 LF of perennial stream channel. Restoration and enhancement construction and planting efforts were completed in December 2013. A conservation easement is in place on 24.4 acres of riparian corridor and stream resources to protect them in perpetuity.

Monitoring Year 3 (MY-3) monitoring and site visits were completed between the months of March and August 2016 to assess the conditions of the Site. All streams within the Site are stable and functioning as designed. Repair work was performed on sections of Byrds Creek Reach 3 during the spring of 2016. The Site's overall average planted stem density of 520 stems per acre is greater than the interim success criteria of 320 stems per acre density required for MY-3. Hydrologic monitoring gages documented bankfull events for all streams on the Site. All streams have met the Monitoring Year 5 (MY-5) hydrology success criteria.

BYRDS CREEK MITIGATION SITE
Monitoring Year 3 Annual Report

TABLE OF CONTENTS

APPENDICES

Section 1: PROJECT OVERVIEW

The Byrds Creek Mitigation Site, hereafter referred to as the Site, is located in southwestern Person County within the Neuse River Basin (USGS Hydrologic Unit 03020201). The project site is located south of Hurdle Mills off of Wolfe Road. The Site is located in the Carolina Slate Belt of the Piedmont Physiographic Province (USGS, 1998). The Multi-Resolution Land Characteristics Consortium (MRLC, 2001) classified approximately 57% of the land in the project watershed as managed herbaceous cover or agricultural, 42% is classified as forested/scrubland, and the remaining 1% is open water. The drainage area for the Byrds Creek Site is 2,957 acres (4.62 square miles).

The project stream reaches consist of Byrds Creek reach 2 (BC2), Byrds Creek reach 3 (BC3), South branch (SB1), Southeast branch reach 1 (SE1), and Southeast branch reach 2 (SE2) which are stream restoration and/or enhancement level I approach and Byrds Creek reach 1 (BC1), Byrds Creek reach 4 (BC4), and West branch (WB1) which are enhancement level II approach. Mitigation work within the Site included restoring and enhancing 7,328 linear feet of perennial and intermittent stream channel. The stream areas were also planted with native vegetation to improve habitat and protect water quality. The project provides 5,371 stream mitigation units (SMU's). The final mitigation plan was submitted and accepted by DMS in January of 2013. Construction activities were completed by North State Environmental in September 2013. Planting and seeding activities were completed by Bruton Natural Systems, Inc. in December 2013. Baseline monitoring (MY-0) was conducted between October 2013 and January of 2014. Annual monitoring will be conducted for five years with the close-out anticipated to commence in 2019 given the success criteria are met. Appendix 1 provides more detailed project activity, history, contact information, and watershed/site background information for this project. Three separate conservation easements have been recorded and are in place along the riparian corridors and stream resources to protect them in perpetuity. 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, the streams on the Byrds Creek Site were heavily impacted by cattle, which led to stream bank erosion and instability. Related degradation included declining aquatic habitat, loss of forest, degraded riparian buffers, and water quality problems related to increased sediment and nutrient loadings. Tables 10a, 10b, and 10c in Appendix 4 present the pre-restoration conditions in detail.

The Site was designed to meet the over-arching goals as described in the mitigation plan (Wildlands, 2013). The project is intended to provide numerous ecological benefits within the Neuse River Basin. While many of these benefits are limited to the Site, others, such as pollutant removal and improved aquatic and terrestrial habitat, have more far-reaching effects. The following project specific goals established in the mitigation plan include:

- Reduce nutrient loads within the watershed and to downstream waters;
- Stabilize eroding stream banks greatly reducing sediment loads;
- Restore riffle/pool sequencing resulting in decreased water temperatures and increased dissolved oxygen concentrations;
- Establish in-stream structures to improve habitat diversity and trap detritus;
- Restore native vegetation and riparian buffers; and
- Protect the restored land in perpetuity through a conservation easement.

The design features of this project were developed to achieve multiple project objectives. The stream restoration elements were designed to frequently flood the reconnected floodplain. This design

approach provides more frequent dissipation of energy from higher flows (bankfull and above) to improve channel stability; provide water quality treatment through detention, settling, and biological removal of pollutants; and restore a more natural hydrologic regime. The project objectives defined in the mitigation plan (Wildlands, 2013) are as follows:

- On-site nutrient inputs will be decreased by removing cattle from streams and filtering on-site runoff through buffer zones. Off-site nutrient input will be absorbed on-site by filtering flood flows through restored floodplain areas, where flood flow will spread through native vegetation. Vegetation is expected to uptake excess nutrients.
- Stream bank erosion which contributes sediment load to the creek will be greatly reduced 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 grit and 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. Sediment load reduction will be monitored through assessing bank stability with cross section and profile surveys and visual assessment through photo documentation which serves as an accepted surrogate for direct turbidity measurements.
- 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 rock 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 creatures. 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.
- 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 designs were developed to correct incision and lack of pattern caused by channelization, bank instability caused by erosion and livestock access, lack of vegetation in riparian zones, and lack of riparian and aquatic habitat.

1.2 Monitoring Year 3 Data Assessment

Annual monitoring and quarterly site visits were conducted during MY-3 to assess the condition of the project. The stream success criteria for the Site follows the approved success criteria presented in the Byrds Creek Mitigation Plan (Wildlands, 2013).

1.2.1 Vegetative Assessment

A total of 14 vegetation plots were established within the project easement area during the baseline monitoring. The majority of the plots were established as standard 10 meter by 10 meter plot with one plot established as a 5 meter by 20 meter plot. The final vegetative success criteria will be the survival of 260 planted stems per acre in the riparian corridor along restored and enhanced reaches at the end of year five of the monitoring period. The interim measure of vegetative success for the Site will be the survival of at least 320 planted stems per acre at the end of MY-3.

The MY-3 vegetative survey was completed in June 2016. The 2016 annual vegetation monitoring resulted in an average planted stem density of 520 stems per acre, which is greater than the interim requirement of 320 stems per acre. Twelve of 14 vegetation plots met success criteria during MY-3. However, when volunteers are included in the total stem count, all 14 plots met interim success criteria. The MY-3 planted stem density is approximately 30% less than the baseline density recorded (734 stems per acre) in January 2014. There is an average of 12 stems per plot and all plots are on track to meet the success criteria required for MY-5 (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

Vegetation plots 3 and 7 did not meet the interim success criteria in MY-3 for planted stems but did meet when volunteer stems were included. Plot 3 had a planted stem density of 283 stems per acre, however when counting volunteers, it increases to 405 stems per acre. Plot 7 had a planted stem density of 283 stems per acre, when counting volunteers, it increases to 364 stems per acre. Both plots met the MY-3 interim success criteria when counting volunteers. No corrective action is needed at this time, but these areas will continue to be monitored.

1.2.3 Stream Assessment

Morphological surveys for MY-3 were conducted in March 2016. All streams within the Site are stable with little to no erosion and have met the success criteria for MY-3. Refer to Appendix 2 for the visual assessment table, integrated current condition plan view (CCPV) map (Figure 3), and reference photographs. Refer to Appendix 4 for the morphological data and plots.

While there have been some minor post-construction adjustments within the restored channels; the cross sections 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. The surveyed longitudinal profile data for BC2, BC3, SB1, SE1, SE2a and SE2b illustrates that the bedform features are maintaining lateral and vertical stability. The riffles are remaining steeper and shallower than the pools, while the pools are remaining deeper than the riffles and maintaining flat water surface slopes. The longitudinal profiles show that the bank height ratios remain very near to 1.0 for the restoration reaches.

Bank scour was observed along portions of Byrds Creek Reach 3 below the culvert crossing at the end of MY-1 and MY-2. These areas were repaired at the beginning of MY-3 following the cross-sectional survey. Cross sections seven and eight show some minor bank scour that has occurred on Byrds Creek Reach 3. Scour in the cross sections has stabilized between MY-2 and MY-3. The cross-sectional areas and bankfull widths on cross sections seven and eight still fall within the appropriate Rosgen stream type parameters. These areas will be monitored for any active scour during subsequent monitoring years.

Pattern data will be collected in MY-5 only if there are indicators from the profile or dimensions that significant geomorphic adjustments have occurred. No changes were observed during MY-3 that indicate a change in the radius of curvature or channel belt width.

1.2.4 Stream Areas of Concern

During March of MY-3, existing areas of localized instability were repaired along Byrds Creek between stations 35+00 and 48+00. Banks were reconstructed with geolifts and live whips to minimize the effects of bank stress during high flow events. Additionally, permanent seed, live stakes and herbaceous plugs

were installed following the repair activities. These areas appear to be stable with strong support from vegetation. Wildlands will continue to monitor these areas and take corrective action as needed.

Beaver activity was observed in June of MY-3 on Reach 3 of Byrds Creek and Reach 2b of Southeast Branch. Following dam observation, five small dams were removed in June. The dams caused hydrologic change but did not cause any structural, bed, or bank problems on the Site. An USDA wildlife management specialist was hired to trap beavers and remove dams as they are rebuilt. Beaver presence will continue to be monitored in subsequent years.

1.2.5 Hydrology Assessment

At the end of the five year monitoring period, two or more bankfull events must have occurred in separate years within the restoration reaches. Bankfull events were recorded on all three gaged streams during the MY-3 data collection. Byrds Creek and South Branch have each had bankfull events during MY-1, MY-2, and MY-3. Therefore, they have met the hydrology success criteria for the Site. Southeast Branch recorded bankfull events during MY-2 and MY-3, also meeting hydrology success criteria. Refer to Appendix 5 for hydrologic data.

1.2.6 Maintenance Plan

No maintenance is required at this time.

1.3 Monitoring Year 3 Summary

All streams within the Site are stable and functioning as designed. The average planted stem density for the Site is 520 stems per acre and is on track to meeting the MY-5 success criteria. Bankfull events were documented with the gages located on all three streams during MY-3. The MY-5 stream hydrology success criteria has been met on Byrds Creek, South Branch, and Southeast Branch. Beaver activity has been observed but no issues were documented as a result during MY-3.

Summary information and data related to the performance of the 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 was 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). Longitudinal and cross sectional data were collected using a total station and were georeferenced. All CCPV mapping was recorded using a Trimble handheld GPS with sub-meter accuracy and processed using Pathfinder and ArcView. Crest gages were installed in surveyed riffle cross sections and monitored quarterly. Hydrology attainment installation and monitoring methods are in accordance with the USACE (2003) standards. Vegetation monitoring protocols followed the Carolina Vegetation Survey-DMS Level 2 Protocol (Lee et al., 2008). Reporting follows the DMS Monitoring Report Template and Guidance Version 1.3 (DMS, 2010).

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-DMS Protocol for Recording Vegetation Version 4.2. Retrieved from http://cvs.bio.unc.edu/protocol/cvs-eep-protocol-v4.2-lev1-5.pdf.

North Carolina Division of Mitigation Services (DMS). 2010. Monitoring Report Template and Guidance. Version 1.3. Raleigh, NC.

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

Rosgen, D.L. 1996. Applied River Morphology. Pagosa Springs, CO: Wildland Hydrology Books.

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 (USACE). 2003. Stream Mitigation Guidelines. USACE, NCDEQ-

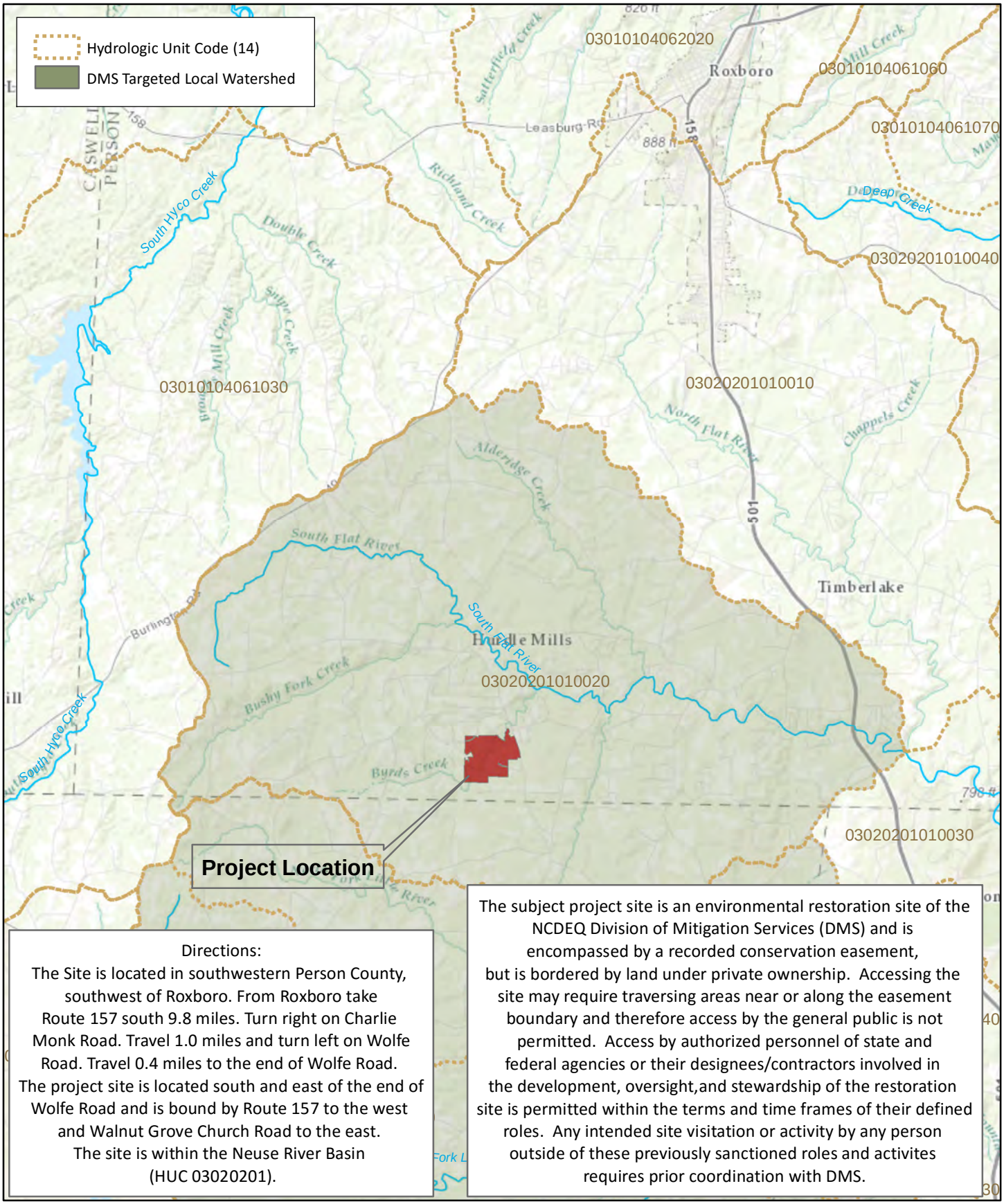
DWR, USEPA, NCWRC.

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

Wildlands Engineering, Inc. 2013. Byrds Creek Mitigation Site Mitigation Plan. DMS, Raleigh, NC.

Wildlands Engineering, Inc. 2014. Byrds Creek Mitigation Site Baseline Monitoring Document and As-Built Baseline Report. DMS, Raleigh, NC.

APPENDIX 1. General Tables and Figures



Directions:
The Site is located in southwestern Person County, southwest of Roxboro. From Roxboro take Route 157 south 9.8 miles. Turn right on Charlie Monk Road. Travel 1.0 miles and turn left on Wolfe Road. Travel 0.4 miles to the end of Wolfe Road. The project site is located south and east of the end of Wolfe Road and is bound by Route 157 to the west and Walnut Grove Church Road to the east. The site is within the Neuse River Basin (HUC 03020201).

The subject project site is an environmental restoration site of the NCDEQ 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 time frames of their defined roles. Any intended site visitation or activity by any person outside of these previously sanctioned roles and activites requires prior coordination with DMS.

WILDLANDS ENGINEERING

0 1 2 Miles

Figure 1 Project Vicinity Map
Byrds Creek Mitigation Site
DMS Project No. 95020
Monitoring Year 3 - 2016

Person County, NC

WILDLANDS ENGINEERING

0 250 500 Feet

N

Figure 2 Project Component/ Asset Map
Byrds Creek Mitigation Site
DMS Project No. 95020
Monitoring Year 3 - 2016

Person County, NC

Table 1. Project Components and Mitigation Credits
Byrds Creek Mitigation Site
DMS Project No.95020
Monitoring Year 3 - 2016

Mitigation Credits									
	Stream		Riparian Wetland		Non-Riparian Wetland		Buffer	Nitrogen Nutrient Offset	Phosphorous Nutrient Offset
Type	R	RE	R	RE	R	RE			
Totals	5,371	0	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Project Components							
Reach ID	As-Built Stationing / Location (LF)	Existing Footage (LF) / Acreage (Ac)	Approach	Restoration or Restoration Equivalent	Restoration Footage (LF) / Acreage (Ac)	Mitigation Ratio	Credits (SMU/ WMU)
Streams							
BC1	10+00-16+43	643	N/A	Enhancement Level II	643	2.5:1	257
BC2	16+43-32+89	1,630	N/A	Enhancement Level I	1,646	1.5:1	1,097
BC3	32+89-34+05 34+64-47+55	1,368	Priority 1	Restoration	1,407	1:1	1,407
BC4	47+55-55+51	796	N/A	Enhancement Level II	796	2.5:1	318
SB1	60+00-66+48 67+08-70+69	976	Priority 1	Restoration	1,009	1:1	1,009
SE1	80+00-84+85	916	Priority 1	Restoration	485	1:1	485
SE2a	85+88-91+24	524	N/A	Enhancement Level I	536	1.5:1	357
SE2b	91+24-93+19	50	Priority 1	Restoration	195	1:1	195
WB1	100+00-106+11	611	N/A	Enhancement Level II	611	2.5:1	244

Component Summation						
Restoration Level	Stream (linear feet)	Riparian Wetland (acres)		Non-Riparian Wetland (acres)	Buffer (square feet)	Upland (acres)
		Riverine	Non-Riverine			
Restoration	3,096	-	-	-	-	-
Enhancement		-	-	-	-	-
Enhancement I	2,182					
Enhancement II	2,050					
Creation		-	-	-		
Preservation	-	-	-	-		-
High Quality Preservation	-	-	-	-		-

Table 2. Project Activity and Reporting History

Byrds Creek Mitigation Site
DMS Project No.95020
Monitoring Year 3- 2016

Activity or Report	Date Collection Complete	Completion or Scheduled Delivery
Mitigation Plan	January 2013	January 2013
Final Design - Construction Plans	June 2013	June 2013
Construction	September 2013	September 2013
Temporary S&E mix applied to entire project area[1]	September 2013	September 2013
Permanent seed mix applied to reach/segments	September 2013	September 2013
Bare root and live stake plantings for reach/segments	December 2013	December 2013
Baseline Monitoring Document (Year 0)	October 2013	January 2014
Year 1 Monitoring	September 2014	December 2014
Year 2 Monitoring	October 2015	December 2015
Year 3 Monitoring	August 2016	December 2016
Year 4 Monitoring	2017	December 2017
Year 5 Monitoring	2018	December 2018

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

Table 3. Project Contact Table

Byrds Creek Mitigation Site
DMS Project No.95020
Monitoring Year 3 - 2016

Designer Jeff Keaton, PE	**Wildlands Engineering, Inc.** 312 West Millbrook Road, Suite 225 Raleigh, NC 27609 919.851.9986
Construction Contractor	**North State Environmental** 2889 Lowery Street Winston Salem, NC 27101
Planting Contractor	**Bruton Natural Systems, Inc** P.O. Box 1197 Fremont, NC 27830
Seeding Contractor	**North State Environmental** 2889 Lowery Street Winston Salem, NC 27101
Seed Mix Sources	**Green Resource, LLC**
Nursery Stock Suppliers **Bare Roots** **Live Stakes**	 **ArborGlen, Inc** **Foggy Mountain Nursery**
Monitoring Performers Stream and Vegetation Monitoring, POC	**Wildlands Engineering, Inc.** Jason Lorch 919.851.9986, ext. 107

Table 4. Project Information and Attributes

Byrds Creek Mitigation Site

DMS Project No.95020

Monitoring Year 3 - 2016

Project Information	
Project Name	Byrds Creek Mitigation Site
County	Person County
Project Area (acres)	24.4
Project Coordinates (latitude and longitude)	36° 14.744' N, 79° 79° 2.636' W
Project Watershed Summary Information	
Physiographic Province	Carolina Slate Belt of the Piedmont Physiographic Province
River Basin	Neuse
USGS Hydrologic Unit 8-digit	03020201
USGS Hydrologic Unit 14-digit	03020201010020
DWQ Sub-basin	03-04-01
Project Drainiage Area (acres)	2,957 ac
Project Drainage Area Percentage of Impervious Area	<1%
CGIA Land Use Classification	57% managed herbaceous cover/agricultural, 42% forested/scrubland, 1% open water

Reach Summary Information									
Parameters	**BC1**	**BC2**	**BC3**	**BC4**	**SB1**	**SE1**	**SE2a**	**SE2b**	**WB1**
Length of reach (linear feet) - Post-Restoration	643	1,646	1,407	796	1,009	485	536	195	611
Drainage area (acres)	2,635	2,637	2,703	2,957	164	56	62	62	255
NCDWQ stream identification score	51.75				25.75	46.25			46.75
NCDWQ Water Quality Classification	WS-III, NSW								
Morphological Desription (stream type)	P	P	P	P	I	P	P	P	P
Evolutionary trend (Simon's Model) - Pre- Restoration	IV/V	IV	IV/V	IV	III	IV/V	III/IV	III/IV	IV/V
Underlying mapped soils	Chewacla / Georgeville Loam								
Drainage class	---	---	---	---	---	---	---	---	---
Soil Hydric status	---	---	---	---	---	---	---	---	---
Slope	---	---	---	---	---	---	---	---	---
FEMA classification	---	---	---	---	---	---	---	---	---
Native vegetation community	Piedmont bottomland forest								
Percent composition exotic invasive vegetation -Post-Restoration	0.8%								

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	Byrds Creek Mitigation Plan; no critical habitat for listed species exists within the project area (Pedestrian Survey)
Historic Preservation Act	X	X	No historic resources were found to be impacted (letter from SHPO)
Coastal Zone Management Act (CZMA)/Coastal Area Management Act (CAMA)	N/A	N/A	N/A
FEMA Floodplain Compliance	N/A	N/A	N/A
Essential Fisheries Habitat	N/A	N/A	N/A

APPENDIX 2. Visual Assessment Data

WILDLANDS ENGINEERING

0 125 250 375 500 Feet

Figure 3 Integrated Current Condition Plan View
Byrds Creek Stream Restoration Site
DMS Project No. 95020
Monitoring Year 3 - 2016
Person County, NC

Table 5a. Visual Stream Morphology Stability Assessment Table

Byrds Creek Mitigation Site

DMS Project No. 95020

Monitoring Year 3 - 2016

Byrds Creek Reach 1 (643 LF)

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

Table 5b. Visual Stream Morphology Stability Assessment Table

Byrds Creek Mitigation Site

DMS Project No. 95020

Monitoring Year 3 - 2016

Byrds Creek Reach 2 (1,646 LF)

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

Table 5c. Visual Stream Morphology Stability Assessment Table

Byrds Creek Mitigation Site

DMS Project No. 95020

Monitoring Year 3 - 2016

Byrds Creek Reach 3 (1,407 LF)

Major Channel Category	Channel Sub-Category	Metric	Number Stable, Performing as Intended	Total Number in As-Built	Number of Unstable Segments	Amount of Unstable Footage	% Stable, Performing as Intended	Number with Stabilizing Woody Vegetation	Footage with Stabilizing Woody Vegetation	Adjust % for Stabilizing Woody Vegetation
1. Bed	1. Vertical Stability (Riffle and Run units)	Aggradation			0	0	100%			
		Degradation			0	0	100%			
	2. Riffle Condition	Texture/Substrate	11	11			100%			
	3. Meander Pool Condition	Depth Sufficient	11	11			100%			
		Length Appropriate	11	11			100%			
	4. Thalweg Position	Thalweg centering at upstream of meander bend (Run)	11	11			100%			
		Thalweg centering at downstream of meander bend (Glide)	11	11			100%			
2. Bank	1. Scoured/Eroded	Bank lacking vegetative cover resulting simply from poor growth and/or scour and erosion			0	0	100%	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, caving, 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. Overall Integrity	Structures physically intact with no dislodged boulders or logs	5	5			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	1	1			100%			

Table 5d. Visual Stream Morphology Stability Assessment Table

Byrds Creek Mitigation Site

DMS Project No. 95020

Monitoring Year 3 - 2016

Byrds Creek Reach 4 (796 LF)

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

Table 5e. Visual Stream Morphology Stability Assessment Table

Byrds Creek Mitigation Site

DMS Project No. 95020

Monitoring Year 3 - 2016

South Branch Reach 1 (1,009 LF)

Major Channel Category	Channel Sub-Category	Metric	Number Stable, Performing as Intended	Total Number in As-Built	Number of Unstable Segments	Amount of Unstable Footage	% Stable, Performing as Intended	Number with Stabilizing Woody Vegetation	Footage with Stabilizing Woody Vegetation	Adjust % for Stabilizing Woody Vegetation
1. Bed	1. Vertical Stability (Riffle and Run units)	Aggradation			0	0	100%			
		Degradation			0	0	100%			
	2. Riffle Condition	Texture/Substrate	17	17			100%			
	3. Meander Pool Condition	Depth Sufficient	14	14			100%			
		Length Appropriate	14	14			100%			
	4. Thalweg Position	Thalweg centering at upstream of meander bend (Run)	14	14			100%			
		Thalweg centering at downstream of meander bend (Glide)	14	14			100%			
2. Bank	1. Scoured/Eroded	Bank lacking vegetative cover resulting simply from poor growth and/or scour and erosion			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, caving, 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. 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			

Table 5f. Visual Stream Morphology Stability Assessment Table

Byrds Creek Mitigation Site

DMS Project No. 95020

Monitoring Year 3 - 2016

Southeast Reach 1 (485 LF)

Major Channel Category	Channel Sub-Category	Metric	Number Stable, Performing as Intended	Total Number in As-Built	Number of Unstable Segments	Amount of Unstable Footage	% Stable, Performing as Intended	Number with Stabilizing Woody Vegetation	Footage with Stabilizing Woody Vegetation	Adjust % for Stabilizing Woody Vegetation
1. Bed	1. Vertical Stability (Riffle and Run units)	Aggradation			0	0	100%			
		Degradation			0	0	100%			
	2. Riffle Condition	Texture/Substrate	12	12			n/a			
	3. Meander Pool Condition	Depth Sufficient	7	7			n/a			
		Length Appropriate	7	7			n/a			
	4. Thalweg Position	Thalweg centering at upstream of meander bend (Run)	7	7			n/a			
		Thalweg centering at downstream of meander bend (Glide)	7	7			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, caving, 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. Overall Integrity	Structures physically intact with no dislodged boulders or logs	11	11			100%			
	2. Grade Control	Grade control structures exhibiting maintenance of grade across the sill	11	11			100%			
	2a. Piping	Structures lacking any substantial flow underneath sills or arms	11	11			100%			
	3. Bank Protection	Bank erosion within the structures extent of influence does not exceed 15%	11	11			100%			
	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			

Table 5g. Visual Stream Morphology Stability Assessment Table

Byrds Creek Mitigation Site

DMS Project No. 95020

Monitoring Year 3 - 2016

Southeast Reach 2a (536 LF)

Major Channel Category	Channel Sub-Category	Metric	Number Stable, Performing as Intended	Total Number in As-Built	Number of Unstable Segments	Amount of Unstable Footage	% Stable, Performing as Intended	Number with Stabilizing Woody Vegetation	Footage with Stabilizing Woody Vegetation	Adjust % for Stabilizing Woody Vegetation
1. Bed	1. Vertical Stability (Riffle and Run units)	Aggradation			0	0	100%			
		Degradation			0	0	100%			
	2. Riffle Condition	Texture/Substrate	12	12			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, caving, 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. Overall Integrity	Structures physically intact with no dislodged boulders or logs	9	9			100%			
	2. Grade Control	Grade control structures exhibiting maintenance of grade across the sill	6	6			100%			
	2a. Piping	Structures lacking any substantial flow underneath sills or arms	6	6			100%			
	3. Bank Protection	Bank erosion within the structures extent of influence does not exceed 15%	9	9			100%			
	4. Habitat	Pool forming structures maintaining ~Max Pool Depth : Bankfull Depth ≥ 1.6 Rootwads/logs providing some cover at baseflow	3	3			100%			

Table 5h. Visual Stream Morphology Stability Assessment Table

Byrds Creek Mitigation Site

DMS Project No. 95020

Monitoring Year 3 - 2016

Southeast Reach 2b (195 LF)

Major Channel Category	Channel Sub-Category	Metric	Number Stable, Performing as Intended	Total Number in As-Built	Number of Unstable Segments	Amount of Unstable Footage	% Stable, Performing as Intended	Number with Stabilizing Woody Vegetation	Footage with Stabilizing Woody Vegetation	Adjust % for Stabilizing Woody Vegetation
1. Bed	1. Vertical Stability (Riffle and Run units)	Aggradation			0	0	100%			
		Degradation			0	0	100%			
	2. Riffle Condition	Texture/Substrate	4	4			100%			
	3. Meander Pool Condition	Depth Sufficient	3	3			100%			
		Length Appropriate	3	3			100%			
	4. Thalweg Position	Thalweg centering at upstream of meander bend (Run)	3	3			100%			
		Thalweg centering at downstream of meander bend (Glide)	3	3			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, caving, 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. 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	n/a	n/a			n/a			

Table 5i. Visual Stream Morphology Stability Assessment Table

Byrds Creek Mitigation Site

DMS Project No. 95020

Monitoring Year 3 - 2016

West Branch Reach 1 (611 LF)

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

Table 6. Vegetation Condition Assessment Table
Byrds Creek Mitigation Site
DMS Project No. 95020
Monitoring Year 3 - 2016

Planted Acreage **38**

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

Easement Acreage **38**

Vegetation Category	Definitions	Mapping Threshold (SF)	Number of Polygons	Combined Acreage	% of Planted Acreage
Invasive Areas of Concern	Areas of points (if too small to render as polygons at map scale).	1,000	0	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 *(03/03/2016)*	**PHOTO POINT 1 –** looking downstream *(03/03/2016)*
	
PHOTO POINT 2 – looking upstream *(03/03/2016)*	**PHOTO POINT 2 –** looking downstream *(03/03/2016)*
	
PHOTO POINT 3 – looking upstream *(03/03/2016)*	**PHOTO POINT 3 –** looking downstream *(03/03/2016)*

	
PHOTO POINT 4 – looking upstream *(03/03/2016)*	**PHOTO POINT 4 –** looking downstream *(03/03/2016)*
	
PHOTO POINT 5 – looking upstream *(03/03/2016)*	**PHOTO POINT 5 –** looking downstream *(03/03/2016)*
	
PHOTO POINT 6 – looking upstream *(03/03/2016)*	**PHOTO POINT 6 –** looking downstream *(03/03/2016)*

	
PHOTO POINT 7 – looking upstream *(03/03/2016)*	**PHOTO POINT 7 –** looking downstream *(03/03/2016)*
	
PHOTO POINT 8 – looking upstream *(03/03/2016)*	**PHOTO POINT 8 –** looking downstream *(03/03/2016)*
	
PHOTO POINT 9 – looking upstream *(03/03/2016)*	**PHOTO POINT 9 –** looking downstream *(03/03/2016)*

PHOTO POINT 10 – looking upstream *(03/03/2016)*

PHOTO POINT 10 – looking downstream *(03/03/2016)*

PHOTO POINT 11 – looking upstream *(03/03/2016)*

PHOTO POINT 11 – looking downstream *(03/03/2016)*

PHOTO POINT 12 – looking upstream *(03/03/2016)*

PHOTO POINT 12 – looking downstream *(03/03/2016)*

	
PHOTO POINT 13 – looking upstream *(03/03/2016)*	**PHOTO POINT 13 –** looking downstream *(03/03/2016)*
	
PHOTO POINT 14 – looking upstream *(03/03/2016)*	**PHOTO POINT 14 –** looking downstream *(03/03/2016)*
	
PHOTO POINT 15 – looking upstream *(03/03/2016)*	**PHOTO POINT 15 –** looking downstream *(03/03/2016)*

	
PHOTO POINT 16 – looking upstream *(03/03/2016)*	**PHOTO POINT 16 –** looking downstream *(03/03/2016)*
	
PHOTO POINT 19 – looking upstream *(03/03/2016)*	**PHOTO POINT 19 –** looking downstream *(03/03/2016)*
	
PHOTO POINT 20 – looking upstream *(03/03/2016)*	**PHOTO POINT 20 –** looking downstream *(03/03/2016)*

PHOTO POINT 21 – looking upstream *(03/03/2016)*

PHOTO POINT 21 – looking downstream *(03/03/2016)*

PHOTO POINT 22 – looking upstream *(03/03/2016)*

PHOTO POINT 22 – looking downstream *(03/03/2016)*

PHOTO POINT 23 – looking upstream *(03/03/2016)*

PHOTO POINT 23 – looking downstream *(03/03/2016)*

	
PHOTO POINT 24 – looking upstream *(03/03/2016)*	**PHOTO POINT 24 –** looking downstream *(03/03/2016)*
	
PHOTO POINT 25 – looking upstream *(03/03/2016)*	**PHOTO POINT 25 –** looking downstream *(03/03/2016)*
	
PHOTO POINT 26 – looking upstream *(03/03/2016)*	**PHOTO POINT 26 –** looking downstream *(03/03/2016)*

PHOTO POINT 27 – looking upstream *(03/03/2016)*

PHOTO POINT 27 – looking downstream *(03/03/2016)*

PHOTO POINT 28 – looking upstream *(03/03/2016)*

PHOTO POINT 28 – looking downstream *(03/03/2016)*

PHOTO POINT 29 – looking upstream *(03/03/2016)*

PHOTO POINT 29 – looking downstream *(03/03/2016)*

PHOTO POINT 30 – looking upstream *(03/03/2016)*

PHOTO POINT 30 – looking downstream *(03/03/2016)*

PHOTO POINT 31 – looking upstream *(03/03/2016)*

PHOTO POINT 31 – looking downstream *(03/03/2016)*

PHOTO POINT 32 – looking upstream *(03/03/2016)*

PHOTO POINT 32 – looking downstream *(03/03/2016)*

	
PHOTO POINT 33 – looking upstream *(03/03/2016)*	**PHOTO POINT 33 –** looking downstream *(03/03/2016)*
	
PHOTO POINT 34 – looking upstream *(03/03/2016)*	**PHOTO POINT 34 –** looking downstream *(03/03/2016)*
	
PHOTO POINT 35 – looking upstream *(03/03/2016)*	**PHOTO POINT 35 –** looking downstream *(03/03/2016)*

	
PHOTO POINT 36 – looking upstream *(03/03/2016)*	**PHOTO POINT 36 –** looking downstream *(03/03/2016)*

Vegetation Photographs

VEG PLOT 1 *(06/13/2016)*

VEG PLOT 2 *(06/13/2016)*

VEG PLOT 3 *(06/13/2016)*

VEG PLOT 4 *(06/13/2016)*

VEG PLOT 5 *(06/13/2016)*

VEG PLOT 6 *(06/13/2016)*

VEG PLOT 7 *(06/13/2016)*

VEG PLOT 8 *(06/13/2016)*

VEG PLOT 9 *(06/13/2016)*

VEG PLOT 10 *(06/13/2016)*

VEG PLOT 11 *(06/13/2016)*

VEG PLOT 12 *(06/13/2016)*

	
VEG PLOT 13 *(06/13/2016)*	**VEG PLOT 14** *(06/13/2016)*

APPENDIX 3. Vegetation Plot Data

Table 7. Vegetation Plot Criteria Attainment

Byrds Creek Mitigation Site
DMS Project No. 95020
Monitoring Year 3 - 2016

Plot	MY3 Success Criteria Met (Y/N)	Tract Mean
1	Y	86%
2	Y	
3	N	
4	Y	
5	Y	
6	Y	
7	N	
8	Y	
9	Y	
10	Y	
11	Y	
12	Y	
13	Y	
14	Y	

* When counting volunteers all vegetation plots met MY3 criteria.

Table 8. CVS Vegetation Table - Metadata

Byrds Creek Mitigation Site
DMS Project No. 95020
Monitoring Year 3 - 2016

Database name	Byrds Creek MY3 cvs-eep-entrytool-v2.3.1.mdb
Database location	F:\Projects\005-02128 Byrds Creek\Monitoring\Year 3\Vegetation Assessment
Computer name	KENTON
File size	55648256
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	95020
project Name	Byrds Creek Mitigation Site
Description	Stream Mitigation Site
River Basin	Neuse
Sampled Plots	14

Table 9. Planted and Total Stem Counts

Byrds Creek Mitigation Site
DMS Project No. 95020
Monitoring Year 3 - 2016

			Current Plot Data (MY3 2016)																	
			95020-01-0001			95020-01-0002			95020-01-0003			95020-01-0004			95020-01-0005			95020-01-0006		
Scientific Name	**Common Name**	**Species Type**	**PnoLS**	**P-all**	**T**	**PnoLS**	**P-all**	**T**	**PnoLS**	**P-all**	**T**	**PnoLS**	**P-all**	**T**	**PnoLS**	**P-all**	**T**	**PnoLS**	**P-all**	**T**
Acer rubrum	red maple	Tree									1									
Betula nigra	river birch	Tree				1	1	1							1	1	1	2	2	2
Carpinus caroliniana	American hornbeam	Tree																1	1	1
Cephalanthus occidentalis	common buttonbush	Shrub																		
Cercis canadensis	eastern redbud	Tree	1	1	1													1	1	1
Fraxinus pennsylvanica	green ash	Tree	3	3	3	7	7	10	5	5	5	13	13	13	1	1	1	4	4	4
Liquidambar styraciflua	sweetgum	Tree									2			20						
Liriodendron tulipifera	tuliptree	Tree	2	2	2	4	4	19							3	3	3	1	1	1
Platanus occidentalis	American sycamore	Tree	2	2	2	1	1	1	1	1	1				6	6	6	4	4	4
Quercus michauxii	swamp chestnut oak	Tree	1	1	1										1	1	1	1	1	1
Quercus phellos	willow oak	Tree	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1			
Quercus rubra	northern red oak	Tree	1	1	1	1	1	1										1	1	1
		Stem count	11	11	11	15	15	33	7	7	10	14	14	34	13	13	13	15	15	15
		size (ares)		1			1			1			1			1			1	
		size (ACRES)		0.02			0.02			0.02			0.02			0.02			0.02	
		Species count	7	7	7	6	6	6	3	3	5	2	2	3	6	6	6	8	8	8
		Stems per ACRE	445.2	445.2	445.2	607	607	1335	283.3	283.3	404.7	566.6	566.6	1376	526.1	526.1	526.1	607	607	607

Color Coding for Table

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

PnoLS: Number of Planted stems excluding live stakes

P-all: Number of planted stems including live stakes,

T: Total Stems

Table 9. Planted and Total Stem Counts

Byrds Creek Mitigation Site
DMS Project No. 95020
Monitoring Year 3 - 2016

			Current Plot Data (MY3 2016)																	
			95020-01-0007			95020-01-0008			95020-01-0009			95020-01-0010			95020-01-0011			95020-01-0012		
Scientific Name	**Common Name**	**Species Type**	**PnoLS**	**P-all**	**T**	**PnoLS**	**P-all**	**T**	**PnoLS**	**P-all**	**T**	**PnoLS**	**P-all**	**T**	**PnoLS**	**P-all**	**T**	**PnoLS**	**P-all**	**T**
Acer rubrum	red maple	Tree																		
Betula nigra	river birch	Tree	1	1	1	1	1	1	1	1	1	2	2	2	2	2	2	1	1	1
Carpinus caroliniana	American hornbeam	Tree																		
Cephalanthus occidentalis	common buttonbush	Shrub																		
Cercis canadensis	eastern redbud	Tree	1	1	1	1	1	1	2	2	2							1	1	1
Fraxinus pennsylvanica	green ash	Tree	1	1	2	1	1	1	5	5	5	12	12	12	5	5	5	2	2	2
Liquidambar styraciflua	sweetgum	Tree																		
Liriodendron tulipifera	tuliptree	Tree	2	2	3	1	1	1	4	4	4	2	2	2	1	1	5			
Platanus occidentalis	American sycamore	Tree	1	1	1	3	3	3				1	1	1				4	4	4
Quercus michauxii	swamp chestnut oak	Tree	1	1	1	1	1	1							3	3	3	1	1	1
Quercus phellos	willow oak	Tree				2	2	2	2	2	2				2	2	2	2	2	2
Quercus rubra	northern red oak	Tree				2	2	2				1	1	1				1	1	1
		Stem count	7	7	9	12	12	12	14	14	14	18	18	18	13	13	17	12	12	12
		size (ares)		1			1			1			1			1			1	
		size (ACRES)		0.02			0.02			0.02			0.02			0.02			0.02	
		Species count	6	6	6	8	8	8	5	5	5	5	5	5	5	5	5	7	7	7
		Stems per ACRE	283.3	283.3	364.2	485.6	485.6	485.6	566.6	566.6	566.6	728.4	728.4	728.4	526.1	526.1	688	485.6	485.6	485.6

Color Coding for Table

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

PnoLS: Number of Planted stems excluding live stakes

P-all: Number of planted stems including live stakes,

T: Total Stems

Table 9. Planted and Total Stem Counts
Byrds Creek Mitigation Site
DMS Project No. 95020
Monitoring Year 3 - 2016

			Current Plot Data (MY3 2016)						Annual Means											
			95020-01-0013			95020-01-0014			MY3 (2016)			MY2 (2015)			MY1 (2014)			MY0 (2014)		
Scientific Name	**Common Name**	**Species Type**	**PnoLS**	**P-all**	**T**	**PnoLS**	**P-all**	**T**	**PnoLS**	**P-all**	**T**	**PnoLS**	**P-all**	**T**	**PnoLS**	**P-all**	**T**	**PnoLS**	**P-all**	**T**
Acer rubrum	red maple	Tree						3			4									
Betula nigra	river birch	Tree	4	4	4	2	2	2	18	18	18	24	24	24	29	29	29	41	41	41
Carpinus caroliniana	American hornbeam	Tree							1	1	1	1	1	1	3	3	3	12	12	12
Cephalanthus occidentalis	common buttonbush	Shrub												11						
Cercis canadensis	eastern redbud	Tree							7	7	7	8	8	8	8	8	8			
Fraxinus pennsylvanica	green ash	Tree	4	4	4	6	6	6	69	69	73	75	75	83	73	73	73	72	72	72
Liquidambar styraciflua	sweetgum	Tree									22			102						
Liriodendron tulipifera	tuliptree	Tree	1	1	1	2	2	20	23	23	63	25	25	81	40	40	40	49	49	49
Platanus occidentalis	American sycamore	Tree	4	4	4				27	27	27	30	30	70	31	31	31	32	32	32
Quercus michauxii	swamp chestnut oak	Tree	1	1	1	1	1	1	11	11	11	11	11	11	13	13	13	19	19	19
Quercus phellos	willow oak	Tree	3	3	3	1	1	1	17	17	17	22	22	26	20	20	20	13	13	13
Quercus rubra	northern red oak	Tree							7	7	7	8	8	14	9	9	9	16	16	16
		Stem count	17	17	17	12	12	33	180	180	250	204	204	431	226	226	226	254	254	254
		size (ares)		1			1			14			14			14			14	
		size (ACRES)		0.02			0.02			0.35			0.35			0.35			0.35	
		Species count	6	6	6	5	5	6	9	9	11	9	9	11	9	9	9	8	8	8
		Stems per ACRE	688	688	688	485.6	485.6	1335	520.3	520.3	722.7	589.7	589.7	1246	653.3	653.3	653.3	734.2	734.2	734.2

Color Coding for Table

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

PnoLS: Number of Planted stems excluding live stakes
P-all: Number of planted stems including live stakes,
T: Total Stems

APPENDIX 4. Morphological Summary Data and Plots

Table 10a. Baseline Stream Data Summary
Byrds Creek Mitigation Site
DMS Project No. 95020
Monitoring Year 3 - 2016

Byrds Creek

		Pre-Restoration Condition				Reference Reach Data								Design				As-Built/Baseline			
Parameter	**Gage**	**Byrds Creek Reach 2**		**Byrds Creek Reach 3**		**Spencer Creek Downstream**		**UT Cane Creek[1]**		**UT Richland Creek Upstream[2]**		**UT Rocky Branch[2]**		**Byrds Creek Reach 2**		**Byrds Creek Reach 3**		**Byrds Creek Reach 2**		**Byrds Creek Reach 3**	
		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	19.0	26.1	27.4	35.9	10.7	11.2	11.5	12.3	8.8	10.4	12.2		33.2	38.3	25.0		28.9	42.7	20.4	36.9
Floodprone Width (ft)		145	231	116	124	60.0	114+	31.0		27.6	31.4	72.0		156	160	95	350	150+	150+	150+	150+
Bankfull Mean Depth		2.2	3.4	1.9	2.3	1.6	1.8	0.8	1.0	0.8	0.9	1.3		1.6	1.9	1.8		1.6	2.1	1.0	1.4
Bankfull Max Depth		3.8	4.4	2.6	3.4	2.1	2.6	1.2	1.6	1.1	1.3	1.8		2.8	3.2	2.8		2.9	3.4	2.1	3.0
Bankfull Cross Sectional Area (ft^2)		58.4	64.5	62.5	66.7	17.8	19.7	8.9	12.2	7.8	8.5	16.3		59.8	61.5	45.3		56.2	88.7	28.8	37.4
Width/Depth Ratio		5.6	11.7	9.3	19.3	5.8	7.1	12.3	14.4	10.0	12.8	9.1		18.0	24.5	13.8		14.8	22.2	14.5	36.5
Entrenchment Ratio		5.5	12.1	3.2	5.5	5.5	10.2	>2.5		2.5	4.0	6.0		4.1	4.8	3.8	14.0	3.5+	5.2+	4.7+	7.4+
Bank Height Ratio		1.0	1.0	1.0	1.3	1.0		---		1.4	2.1	1.0		1.0		1.0		1.0	1.0	1.0	1.0
D50 (mm)		0.41		22.6														12.5	26.4	29.3	45.0
Profile																					
Riffle Length (ft)	N/A					---		---		---		---		---		---		13	59	12	57
Riffle Slope (ft/ft)		0.0074	0.0075	0.0043	0.0133	0.0130		0.0188	0.0704	0.0210	0.0450	0.0606	0.0892	0.0029	0.0052	0.0076	0.0134	0.0036	0.0097	0.0022	0.0190
Pool Length (ft)						---		---		---		---		---		---		34	179	46	129
Pool Max Depth (ft)		---	---	---	---	---		---		---		---		---		---		1.21	2.58	0.97	2.43
Pool Spacing (ft)		54	103	70	124	71		27	73	N/A		26	81	102	211	60	141	84	278	73	129
Pool Volume (ft^3)																					
Pattern																					
Channel Beltwidth (ft)	N/A	N/A		N/A		38	41	102		N/A		N/A		---		52	116	26	57	31	62
Radius of Curvature (ft)		N/A		N/A		11	15	23	38	N/A		N/A		---		50	80	19	79	44	84
Rc:Bankfull Width (ft/ft)		---		---		1.0	1.3	2.0	3.1	N/A		N/A		---		2.0	3.2	0.7	1.9	2.2	2.3
Meander Length (ft)		N/A		N/A		46	48	45	81	N/A		N/A		---		177	263	279	603	190	255
Meander Width Ratio		---		---		3.6	3.7	3.9	6.6	N/A		N/A		---		2.1	4.6	0.9	1.3	1.5	1.7
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/0.19/0.41/116/ 232/>2048		SC/0.41/22.6/ 143.4/2048/>2048		---		---		---		---						SC/SC/SC/55/ 128/362		SC/SC/SC/107.3/ 362/>2048	
Reach Shear Stress (Competency) lb/ft^2		---		---										---		0.69	1.71	N/A		0.23	0.31
Max part size (mm) mobilized at bankfull																					
Stream Power (Capacity) W/m^2																					
Additional Reach Parameters																					
Drainage Area (SM)	N/A	4.12		4.22		0.96		0.29		0.28		1.10		4.12		4.22		4.12		4.22	
Watershed Impervious Cover Estimate (%)		1%		<1%		---		---		---		---		1%		<1%		1%		<1%	
Rosgen Classification		C5/E5		C4/E4		E4		C4/E4		C4/E4		E4b		C4		C4		C4		C4	
Bankfull Velocity (fps)		2.7	3.0	2.5	2.5	4.9	5.4	3.8		3.5	4.1	5.5		3.0	3.3	4.6		3.6		7.3	
Bankfull Discharge (cfs)		---		---		97		40		29.1	32.0	85.0		200		210		200		210	
Q-NFF regression		---		---																	
Q-USGS extrapolation		---		---																	
Q-Mannings		---		---																	
Valley Length (ft)		---		---		---		---		---		---		---		---					
Channel Thalweg Length (ft)		1,630		1,368		---		---		---		---		1,630		1,402		1,646		1,407	
Sinuosity		1.18		1.01		1.30		1.40		1.00		1.10		---		1.11		1.18		1.06	
Water Surface Slope $(ft/ft)^2$		---		---		---		---		---		---		---		0.0039		0.0016		0.0043	
Bankfull Slope (ft/ft)		---		---		---		---		---		---		---		0.0046		0.0013		0.0042	

(---): Data was not provided
N/A: Not Applicable
[1]UT Cane Creek reference reach data only utilized for pattern and a reference point in the project specific regional curve.
[2]Data only utilized as a reference point on the the project-specific drainage area-discharge curve.
[3]Existing condition sinuosity based on valley length/channel length given no flow and therefore no water sureface shots at time of survey.

Table 10b. Baseline Stream Data Summary
Byrds Creek Mitigation Site
DMS Project No. 95020
Monitoring Year 3 - 2016

South Branch and Southeast Branch

		Pre-Restoration Condition				Reference Reach Data										Design				As-Built/Baseline			
Parameter	**Gage**	**South Branch Reach 1**		**Southeast Branch Reach 1**		**Spencer Creek Upstream**		**UT Richland Creek Downstream**		**UT Cane Creek[1]**		**UT Richland Creek Upstream[2]**		**UT Rocky Branch[2]**		**South Branch Reach 1**		**Southeast Branch Reach 1**		**South Branch Reach 1**		**Southeast Branch Reach 1**	
		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	7.4	7.9	7.7		8.7		13.3	15.2	11.5	12.3	8.8	10.4	12.2		10.0		8.0		9.3		19.0	
Floodprone Width (ft)		96.0	98.0	9.5		229.0		>50		31.0		27.6	31.4	72.0		70.0	375.0	30	100	>100		>75	
Bankfull Mean Depth		1.0	1.2	0.8		1.2		1.1	1.3	0.8	1.0	0.8	0.9	1.3		1.0		0.7		0.7		0.5	
Bankfull Max Depth		2.3	2.4	1.0		1.9		1.8	2.1	1.2	1.6	1.1	1.3	1.8		1.3		1.0		1.4		1.5	
Bankfull Cross Sectional Area (ft^2)		8.0	8.7	6.2		10.6		16.5	17.5	8.9	12.2	7.8	8.5	16.3		9.6		5.7		6.5		9.6	
Width/Depth Ratio		6.2	7.8	9.6		7.3		10.1	13.9	12.3	14.4	10.0	12.8	9.1		10.4		11.2		13.4		37.7	
Entrenchment Ratio		12.4	13.1	1.2		26.3		>2.5		>2.5		2.5	4.0	6.0		7.0	37.5	3.8	12.5	>2.2		>2.2	
Bank Height Ratio		1.0		3.7		1.0		1.4	2.1	---		1.4	2.1	1.0		1.0		1.0		1.0		1.0	
D50 (mm)		1.0		0.09																56.1		28.5	
Profile																							
Riffle Length (ft)	N/A					---		---		---		---		---		---		---		8	46	10	28
Riffle Slope (ft/ft)		0.0176	0.0349	0.0247	0.049	0.0188	0.0704	0.0183	0.0355	0.0188	0.0704	0.0210	0.0450	0.0606	0.0892	0.0052	0.0199	0.0220	0.0410	0.0021	0.0178	0.0023	0.0527
Pool Length (ft)						---		---		---		---		---		---		---		20	64	7	45
Pool Max Depth (ft)		---	---	---	---	---		---		---		---		---		---		---		0.4	2.2	0.9	2.3
Pool Spacing (ft)		30	62	35	90	13	47	33	93	27	73	N/A		26	81	34	85	21	53	36	116	26	58
Pool Volume (ft^3)																							
Pattern																							
Channel Beltwidth (ft)	N/A	N/A		N/A		24	52	NA		102		N/A		N/A		25	48	16	39	14	35	10	27
Radius of Curvature (ft)		N/A		N/A		5.4	22.1	NA		23	38	N/A		N/A		20	35	18	26	17	32	14	30
Rc:Bankfull Width (ft/ft)		---		---		0.6	2.5	NA		2.0	3.1	N/A		N/A		2.0	3.5	2.3	3.3	1.8	3.4	1.3	2.9
Meander Length (ft)		N/A		N/A		54	196	NA		45	81	N/A		N/A		76	120	47	93	78	127	65	74
Meander Width Ratio		---		---		2.8	6	NA		3.9	6.6	N/A		N/A		7.6	12.0	5.9	11.6	8.4	13.6	6.3	7.1
Substrate, Bed and Transport Parameters																							
Ri%/Ru%/P%/G%/S%	N/A																						
SC%/Sa%/G%/C%/B%/Be%																							
d16/d35/d50/d84/d95/d100		SC/SC/1.0/45/ 107.33/180		SC/SC/0.09/26.23 /50.61/180		---		---		---		---		---						SC/SC/SC/103.6/ 256/362		SC/SC/SC/68.1/ 180/362	
Reach Shear Stress (Competency) lb/ft^2		---		---												0.28	0.98	0.94	1.34	0.23		0.43	
Max part size (mm) mobilized at bankfull																							
Stream Power (Capacity) W/m^2																							
Additional Reach Parameters																							
Drainage Area (SM)	N/A	0.25		0.09		0.50		0.97		0.29		0.28		1.10		0.25		0.09		0.25		0.09	
Watershed Impervious Cover Estimate (%)		<1%		1%		---		---		---		---		---		<1%		1%		<1%		1%	
Rosgen Classification		E5		E6/G6		E4		C4/E4		C4/E4		C4/E4		E4b		E4		E4		C3		C4	
Bankfull Velocity (fps)		3.7		2.8		---		4.2	4.5	3.8		3.5	4.1	5.5		3.1		3.5		4.6		2.1	
Bankfull Discharge (cfs)		---		---		---		68.9	78.6	40		29.1	32.0	85.0		30		20		30		20	
Q-NFF regression		---		---																			
Q-USGS extrapolation		---		---																			
Q-Mannings		---		---																			
Valley Length (ft)		---		---		---		---		---		---		---		---		---					
Channel Thalweg Length (ft)		976		916		---		---		---		---		---		971		792		1,009		485	
Sinuosity		1.03		1.31		1.40		1.10		1.40		1.00		1.10		---		1.13		1.06		1.18	
Water Surface Slope ($ft/ft)^2$		---		---		---		---		---		---		---		0.0068		0.0161		0.0070		0.0138	
Bankfull Slope (ft/ft)		---		---		---		---		---		---		---		0.0075		0.0182		0.0068		0.0136	

(---): Data was not provided
N/A: Not Applicable
[1]UT Cane Creek reference reach data only utilized for pattern and a reference point in the project specific regional curve.
[2]Data only utilized as a reference point on the the project-specific drainage area-discharge curve.
[3]Existing condition sinuosity based on valley length/channel length given no flow and therefore no water sureface shots at time of survey.

Table 10c. Baseline Stream Data Summary
Byrds Creek Mitigation Site
DMS Project No. 95020
Monitoring Year 3 - 2016

Southeast Branch

Parameter	Gage	Pre-Restoration Condition		Reference Reach Data										Design				As-Built/Baseline			
		Southeast Branch Reach 2		Spencer Creek Upstream		UT Richland Creek Downstream		UT Cane Creek[1]		UT Richland Creek Upstream[2]		UT Rocky Branch[2]		Southeast Branch Reach 2a		Southeast Branch Reach 2b		Southeast Branch Reach 2a		Southeast Branch Reach 2b	
		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	7.2	7.4	8.7		13.3	15.2	11.5	12.3	8.8	10.4	12.2		11.7	15.0	9.0		10.6			
Floodprone Width (ft)		8.0	9.8	229.0		>50		31.0		27.6	31.4	72.0		114.7	120.1	140.0	310.0	>100			
Bankfull Mean Depth		1.3	1.4	1.2		1.1	1.3	0.8	1.0	0.8	0.9	1.3		0.7	0.9	0.7		0.6			
Bankfull Max Depth		1.6	1.9	1.9		1.8	2.1	1.2	1.6	1.1	1.3	1.8		0.9	1.0	1.0		1.2			
Bankfull Cross Sectional Area (ft^2)		8.9	9.4	10.6		16.5	17.5	8.9	12.2	7.8	8.5	16.3		10.2	10.5	6.5		6.8			
Width/Depth Ratio		5.8	7.3	7.3		10.1	13.9	12.3	14.4	10.0	12.8	9.1		13.5	21.3	12.5		16.5			
Entrenchment Ratio		1.6	6.2	26.3		>2.5		>2.5		2.5	4.0	6.0		7.7	10.3	15.6	34.4	>2.2			
Bank Height Ratio		1.5	2.1	1.0		1.4	2.1	---		1.4	2.1	1.0		1.0		1.0		1.0			
D50 (mm)		0.04																37.2			
Profile																					
Riffle Length (ft)	N/A			---		---		---		---		---		---		---		4	20	11	36
Riffle Slope (ft/ft)		0.0047	0.0147	0.0188	0.0704	0.0183	0.0355	0.0188	0.0704	0.0210	0.0450	0.0606	0.0892	0.0122	0.0367	0.0202		0.0145	0.0454	0.0119	0.0606
Pool Length (ft)				---		---		---		---		---		---		---		21	53	27	45
Pool Max Depth (ft)		---	---	---		---		---		---		---		---		---		1.3	2.6	0.89	2.23
Pool Spacing (ft)		17	122	13	47	33	93	27	73	N/A		26	81	27	55	43	49	25	54	34	73
Pool Volume (ft^3)																					
Pattern																					
Channel Beltwidth (ft)	N/A	N/A		24	52	NA		102		N/A		N/A		N/A		27		3	22	12	22
Radius of Curvature (ft)		N/A		5.4	22.1	NA		23	38	N/A		N/A		N/A		22	30	7	58	21	25
Rc:Bankfull Width (ft/ft)		---		0.6	2.5	NA		2.0	3.1	N/A		N/A		N/A		2.4	3.3	0.7	5.5	N/A	
Meander Length (ft)		N/A		54	196	NA		45	81	N/A		N/A		N/A		82.0		43	80	88	88
Meander Width Ratio		---		2.8	6	NA		3.9	6.6	N/A		N/A		N/A		3.0		4.1	7.5	N/A	
Substrate, Bed and Transport Parameters																					
Ri%/Ru%/P%/G%/S%	N/A																				
SC%/Sa%/G%/C%/B%/Be%																					
d16/d35/d50/d84/d95/d100		SC/0.02/0.04/0.05/33.2/79.6		---		---		---		---		---						SC/SC/SC/70.9/256/362		SC/SC/SC/70.9/256/362	
Reach Shear Stress (Competency) lb/ft^2		---												0.93	1.14	0.93	1.14	0.47		N/A	
Max part size (mm) mobilized at bankfull																					
Stream Power (Capacity) W/m^2																					
Additional Reach Parameters																					
Drainage Area (SM)	N/A	0.09		0.50		0.97		0.29		0.28		1.10		0.09		0.10		0.09		0.10	
Watershed Impervious Cover Estimate (%)		1%		---		---		---		---		---		1%		1%		1%		1%	
Rosgen Classification		E6/G6		E4		C4/E4		C4/E4		C4/E4		E4b		C4		C4		C4		C4	
Bankfull Velocity (fps)		2.9	3.4	---		4.2	4.5	3.8		3.5	4.1	5.5		3.0	3.3	3.1		4.4		N/A	
Bankfull Discharge (cfs)		---		---		68.9	78.6	40		29.1	32.0	85.0		30		20		30		N/A	
Q-NFF regression		---																			
Q-USGS extrapolation		---																			
Q-Mannings		---																			
Valley Length (ft)		---		---		---		---		---		---		---		---					
Channel Thalweg Length (ft)		524		---		---		---		---		---		533		180		536		195	
Sinuosity		1.17		1.40		1.10		1.40		1.00		1.10		---		1.21		1.11		1.23	
Water Surface Slope $(ft/ft)^2$		---		---		---		---		---		---		---		0.0101		0.0144		0.0160	
Bankfull Slope (ft/ft)		---		---		---		---		---		---		---		0.0122		0.0146		0.0168	

(---): Data was not provided
N/A: Not Applicable
[1]UT Cane Creek reference reach data only utilized for pattern and a reference point in the project specific regional curve.
[2]Data only utilized as a reference point on the the project-specific drainage area-discharge curve.
[3]Existing condition sinuosity based on valley length/channel length given no flow and therefore no water sureface shots at time of survey.

Table 11. Morphology and Hydraulic Summary (Dimensional Parameters - Cross Section)
Byrds Creek Mitigation Site
DMS Project No. 95020
Monitoring Year 3 - 2016

	Byrds Creek- Reach 2																							
	Cross Section 1 (Riffle)						Cross Section 2 (Pool)						Cross Section 3 (Riffle)						Cross Section 4 (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**
based on fixed bankfull elevation	574.4						574.6						574.2						572.6					
Bankfull Width (ft)	36.4	36.6	35.3	35.6			42.2	42.1	42.6	40.3			28.9	24.7	22.9	22.1			42.7	36.0	36.9	32.8		
Floodprone Width (ft)	>150	>150	>150	>150			N/A	N/A	N/A	N/A			>150	>150	>150	>150			>150	>150	>150	>150		
Bankfull Mean Depth (ft)	1.6	1.4	1.4	1.4			1.9	1.9	1.9	2.0			1.9	2.1	2.0	2.1			2.1	2.2	2.3	2.2		
Bankfull Max Depth (ft)	2.9	2.7	2.7	2.7			4.6	4.5	4.3	4.3			3.4	3.2	3.2	3.1			3.2	3.2	3.3	3.1		
Bankfull Cross Sectional Area (ft^2)	59.8	51.1	50.6	50.6			80.3	79.9	79.6	79.3			56.2	51.6	46.5	45.9			88.7	78.3	83.9	73.4		
Bankfull Width/Depth Ratio	22.2	26.2	24.6	25.0			22.1	22.2	22.8	20.5			14.8	11.8	11.3	10.6			20.6	16.6	16.2	14.6		
Bankfull Entrenchment Ratio	4.5+	4.1+	4.2+	4.2+			N/A	N/A	N/A	N/A			5.2+	6.1+	6.6+	6.8+			3.4+	4.2+	4.1+	4.6+		
Bankfull Bank Height Ratio	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	1.0	1.0	1.0		
d50 (mm)	12.5	28.7	18.0	19.0			N/A	N/A	N/A	N/A			26.4	42.9	28.1	37.9			22.6	32.0	36.4	29.8		
	Byrds Creek- Reach 2						Byrds Creek- Reach 3																	
	Cross Section 5 (Pool)						Cross Section 6 (Pool)						Cross Section 7 (Riffle)						Cross Section 8 (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**
based on fixed bankfull elevation	572.0						569.0						568.7						565.0					
Bankfull Width (ft)	34.8	34.3	35.3	32.2			26.2	25.4	25.9	29.6			20.4	22.6	23.4	21.2			17.6	17.6	18.3	19.5		
Floodprone Width (ft)	N/A	N/A	N/A	N/A			N/A	N/A	N/A	N/A			>150	>150	>150	>150			>150	>150	>150	>150		
Bankfull Mean Depth (ft)	2.4	2.3	2.5	2.2			1.8	1.8	1.8	1.4			1.4	1.4	1.3	1.3			1.2	1.3	1.4	1.2		
Bankfull Max Depth (ft)	3.7	4.3	4.5	4.1			3.2	3.0	3.1	2.9			2.1	2.2	2.4	2.1			2.3	2.1	2.2	2.1		
Bankfull Cross Sectional Area (ft^2)	84.3	80.2	86.7	71.4			47.5	45.8	47.8	40.3			28.8	31.0	31.0	26.6			20.5	23.4	24.9	23.2		
Bankfull Width/Depth Ratio	14.3	14.7	14.4	14.5			14.4	14.1	14.1	21.7			14.4	16.5	17.7	16.8			15.1	13.3	13.4	16.3		
Bankfull Entrenchment Ratio	N/A	N/A	N/A	N/A			N/A	N/A	N/A	N/A			7.4+	6.6+	6.4+	7.1+			8.5+	8.5+	8.2+	7.7		
Bankfull Bank Height Ratio	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	1.0	1.0	1.0		
d50 (mm)	N/A	N/A	N/A	N/A			N/A	N/A	N/A	N/A			29.3	41.3	37.2	52.1			45.0	49.1	66.2	70.2		
	Byrds Creek- Reach 3						South Branch- Reach 1												Southeast Branch- Reach 1					
	Cross Section 9 (Pool)						Cross Section 10 (Riffle)						Cross Section 11 (Pool)						Cross Section 12 (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**
based on fixed bankfull elevation	565.5						571.4						571.3						580.3					
Bankfull Width (ft)	34.2	33.6	33.7	32.6			9.3	8.8	9.0	9.0			10.2	9.7	9.2	8.8			10.4	9.1	8.2	8.5		
Floodprone Width (ft)	N/A	N/A	N/A	N/A			>100	>100	>100	>100			N/A	N/A	N/A	N/A			>75	>75	>75	>75		
Bankfull Mean Depth (ft)	2.0	2.0	2.1	2.0			0.7	0.7	0.6	0.6			1.1	1.0	1.0	1.1			0.6	0.5	0.7	0.7		
Bankfull Max Depth (ft)	3.9	3.8	3.7	3.7			1.4	1.3	1.3	1.3			2.0	1.9	1.8	1.9			1.5	0.9	1.3	1.3		
Bankfull Cross Sectional Area (ft^2)	69.6	66.5	69.3	66.5			6.5	6.4	5.5	5.5			11.6	10.1	9.1	9.3			6.7	4.7	5.6	6.0		
Bankfull Width/Depth Ratio	16.8	17.0	16.3	16.0			13.4	12.2	14.8	14.8			8.9	9.2	9.4	8.3			16.3	17.6	12.0	12.0		
Bankfull Entrenchment Ratio	N/A	N/A	N/A	N/A			10.7+	11.4+	11.1+	11.1+			N/A	N/A	N/A	N/A			7.2+	8.3+	9.1+	8.8+		
Bankfull Bank Height Ratio	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	1.0	1.0	1.0		
d50 (mm)	N/A	N/A	N/A	N/A			56.1	9.4	30.9	29.3			N/A	N/A	N/A	N/A			28.5	37.0	68.0	52.3		
	Southeast Branch- Reach 1						Southeast Branch- Reach 2																	
	Cross Section 13 (Pool)						Cross Section 14 (Pool)						Cross Section 15 (Riffle)											
Dimension and Substrate	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**						
based on fixed bankfull elevation	579.5						572.7						572.6											
Bankfull Width (ft)	12.5	8.6	8.7	9.5			16.7	14.8	13.0	12.2			10.6	9.7	9.3	9.0								
Floodprone Width (ft)	N/A	N/A	N/A	N/A			N/A	N/A	N/A	N/A			>100	>100	>100	>100								
Bankfull Mean Depth (ft)	1.2	1.1	1.1	1.1			1.7	1.5	1.8	1.7			0.6	0.6	0.5	0.7								
Bankfull Max Depth (ft)	2.5	2.3	2.0	2.0			3.5	3.2	3.1	3.0			1.2	1.0	1.0	1.3								
Bankfull Cross Sectional Area (ft^2)	15.3	9.4	9.5	10.3			28.0	22.0	23.1	20.5			6.8	5.8	4.9	5.9								
Bankfull Width/Depth Ratio	10.1	7.9	8.0	8.8			10.0	10.0	7.3	7.2			16.5	16.4	17.6	13.8								
Bankfull Entrenchment Ratio	N/A	N/A	N/A	N/A			N/A	N/A	N/A	N/A			9.4+	10.3+	10.8+	11.1+								
Bankfull Bank Height Ratio	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)	N/A	N/A	N/A	N/A			N/A	N/A	N/A	N/A			37.2	13.5	45.0	43.8								

* Data for cross sections 6, 8, & 12 were updated during MY2 for previous monitoring years. Cross sections 6 and 12 had an error in the spreadsheet that was corrected. The spreadsheet was not calculating bankfull width correctly which affected cross-sectional area, and width to depth ratio. Bankfull eclevation was corrected on cross section 8 after careful evaluation. It was determined that during the baseline survey, bankfull was called at a higher elevation than it should have been.

Table 12a. Monitoring Data - Stream Reach Data Summary
Byrds Creek Mitigation Site
DMS Project No. 95020
Monitoring Year 3 - 2016

Byrds Creek- Reach 2

Parameter	As-Built/Baseline		MY-1		MY-2		MY-3		MY-4		MY-5	
	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
Dimension and Substrate - Riffle												
Bankfull Width (ft)	28.9	42.7	24.7	36.6	22.9	36.9	22.1	35.6				
Floodprone Width (ft)	>150	>150	>150	>150	>150	>150	>150	>150				
Bankfull Mean Depth	1.6	2.1	1.4	2.2	1.4	2.3	1.4	2.2				
Bankfull Max Depth	2.9	3.4	2.7	3.2	2.7	3.3	2.7	3.1				
Bankfull Cross-sectional Area (ft^2)	56.2	88.7	51.1	78.3	46.5	83.9	45.9	73.4				
Width/Depth Ratio	14.8	22.2	11.8	26.2	11.3	24.6	10.6	25.0				
Entrenchment Ratio	3.4+	5.2+	4.1+	6.1+	4.1+	6.6+	4.2+	6.8+				
Bank Height Ratio	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0				
D50 (mm)	12.5	26.4	28.7	42.9	18.0	36.4	19.0	37.9				
Profile												
Riffle Length (ft)	13	59	12	59	18	59	12	59				
Riffle Slope (ft/ft)	0.0036	0.0097	0.0019	0.0147	0.0003	0.0110	0.0009	0.0138				
Pool Length (ft)	34	179	34	182	59	183	70	185				
Pool Max Depth (ft)	3.7	4.6	4.3	4.5	4.2	5.8	3.6	4.8				
Pool Spacing (ft)	84	278	80	214	81	225	85	211				
Pool Volume (ft^3)												
Pattern												
Channel Beltwidth (ft)	26	57										
Radius of Curvature (ft)	19	79										
Rc:Bankfull Width (ft/ft)	0.7	1.9										
Meander Wave Length (ft)	279	603										
Meander Width Ratio	0.9	1.3										
Additional Reach Parameters												
Rosgen Classification	C4		C4		C4		C4					
Channel Thalweg Length (ft)	1,646		1,646		1,646		1,646					
Sinuosity (ft)	1.2		1.2		1.2		1.2					
Water Surface Slope (ft/ft)	0.0016		0.0018		0.0019		0.0017					
Bankfull Slope (ft/ft)	0.0013		0.0018		0.0020		0.0016					
Ri%/Ru%/P%/G%/S%												
SC%/Sa%/G%/C%/B%/Be%												
d16/d35/d50/d84/d95/d100	0.2/0.6/5.6/55/128/362		0.3/1.2/2.9/75.9/122.5/256		0.21/1.0/3.7/80.3/168.1/362		0.34/1.24/2.4/85.0/163.3/362.0					
% of Reach with Eroding Banks			0%		0%		0%					

Table 12b. Monitoring Data - Stream Reach Data Summary
Byrds Creek Mitigation Site
DMS Project No. 95020
Monitoring Year 3 - 2016

Byrds Creek- Reach 3

Parameter	As-Built/Baseline		MY-1		MY-2		MY-3		MY-4		MY-5	
	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
Dimension and Substrate - Riffle												
Bankfull Width (ft)	17.6	20.4	17.6	22.6	18.3	23.4	19.5	21.2				
Floodprone Width (ft)	>150	>150	>150	>150	>150	>150	>150	>150				
Bankfull Mean Depth	1.2	1.4	1.3	1.4	1.3	1.4	1.2	1.3				
Bankfull Max Depth	2.1	2.3	2.1	2.2	2.2	2.4	2.1	2.1				
Bankfull Cross-sectional Area (ft^2)	20.5	28.8	23.4	31.0	24.9	31.0	23.2	26.6				
Width/Depth Ratio	14.4	15.1	13.3	16.5	13.4	17.7	16.3	16.8				
Entrenchment Ratio	7.4+	8.5+	6.6+	8.5+	6.4+	8.2+	7.1+	7.7+				
Bank Height Ratio	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0				
D50 (mm)	29.3	45.0	41.3	49.1	37.2	66.2	52.1	70.2				
Profile												
Riffle Length (ft)	12	57	26	43	18	44	28	44				
Riffle Slope (ft/ft)	0.0022	0.0190	0.0065	0.0311	0.0018	0.0304	0.0054	0.0304				
Pool Length (ft)	46	129	33	134	32	132	31	134				
Pool Max Depth (ft)	3.2	3.9	3.0	3.8	2.9	4.3	3.4	4.6				
Pool Spacing (ft)	73	129	82	190	92	199	60	180				
Pool Volume (ft^3)												
Pattern												
Channel Beltwidth (ft)	31	62										
Radius of Curvature (ft)	44	84										
Rc:Bankfull Width (ft/ft)	2.2	2.3										
Meander Wave Length (ft)	190	255										
Meander Width Ratio	1.5	1.7										
Additional Reach Parameters												
Rosgen Classification	C4		C4		C4		C4					
Channel Thalweg Length (ft)	1,407		1,407		1,407		1,407					
Sinuosity (ft)	1.1		1.1		1.1		1.1					
Water Surface Slope (ft/ft)	0.0043		0.0045		0.0052		0.0047					
Bankfull Slope (ft/ft)	0.0042		0.0047		0.0047		0.0044					
Ri%/Ru%/P%/G%/S%												
SC%/Sa%/G%/C%/B%/Be%												
d16/d35/d50/d84/d95/d100	0.1/0.6/16/107.3/362/>2048		0.2/9.1/29/82.6/180/362		0.2/1.68/32.0/112.6/430.5/2048		0.5/4.73/23.4/105.6/256.0/2048					
% of Reach with Eroding Banks			0%		20%		4%					

Table 12c. Monitoring Data - Stream Reach Data Summary
Byrds Creek Mitigation Site
DMS Project No. 95020
Monitoring Year 3 - 2016

South Branch- Reach 1

Parameter	As-Built/Baseline		MY-1		MY-2		MY-3		MY-4		MY-5	
	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
Dimension and Substrate - Riffle												
Bankfull Width (ft)	9.3		8.8		9.0		9.0					
Floodprone Width (ft)	>100		>100		>100		>100					
Bankfull Mean Depth	0.7		0.7		0.6		0.6					
Bankfull Max Depth	1.4		1.3		1.3		1.3					
Bankfull Cross-sectional Area (ft^2)	6.5		6.4		5.5		5.5					
Width/Depth Ratio	13.4		12.2		14.8		14.8					
Entrenchment Ratio	10.7+		11.4+		11.1+		11.1+					
Bank Height Ratio	1.0		1.0		1.0		1.0					
D50 (mm)	56.1		9.4		30.9		29.3					
Profile												
Riffle Length (ft)	8	46	10	39	13	37	10	38				
Riffle Slope (ft/ft)	0.0021	0.0178	0.0022	0.0431	0.0029	0.0298	0.0023	0.0409				
Pool Length (ft)	20	64	22	65	21	67	21	69				
Pool Max Depth (ft)	2.0		1.9		2.8		2.5					
Pool Spacing (ft)	36	116	22	87	32	117	35	133				
Pool Volume (ft^3)												
Pattern												
Channel Beltwidth (ft)	14	35										
Radius of Curvature (ft)	17	32										
Rc:Bankfull Width (ft/ft)	1.8	3.4										
Meander Wave Length (ft)	78	127										
Meander Width Ratio	8.4	13.6										
Additional Reach Parameters												
Rosgen Classification	C3		C3		C3		C3					
Channel Thalweg Length (ft)	1,009		1,009		1,009		1,009					
Sinuosity (ft)	1.1		1.1		1.1		1.1					
Water Surface Slope (ft/ft)	0.0070		0.0065		0.0078		0.0092					
Bankfull Slope (ft/ft)	0.0068		0.0062		0.0070		0.0072					
Ri%/Ru%/P%/G%/S%												
SC%/Sa%/G%/C%/B%/Be%												
d16/d35/d50/d84/d95/d100	SC/SC/SC/103.6/256/362		SC/0.2/5.3/71.7/141.1/180		SC/0.09/0.3/75.9/143.4/256		SC/SC/0.6/99.5/180/512					
% of Reach with Eroding Banks			0%		0%		0%					

Table 12d. Monitoring Data - Stream Reach Data Summary
Byrds Creek Mitigation Site
DMS Project No. 95020
Monitoring Year 3 - 2016

Southeast Branch- Reach 1

Parameter	As-Built/Baseline		MY-1		MY-2		MY-3		MY-4		MY-5	
	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
Dimension and Substrate - Riffle												
Bankfull Width (ft)	10.4		9.1		8.2		8.5					
Floodprone Width (ft)	>75		>75		>75		>75					
Bankfull Mean Depth	0.6		0.5		0.7		0.7					
Bankfull Max Depth	1.5		0.9		1.3		1.3					
Bankfull Cross-sectional Area (ft^2)	6.7		4.7		5.6		6.0					
Width/Depth Ratio	16.3		17.6		12.0		12.0					
Entrenchment Ratio	7.2+		8.3+		9.1+		8.8+					
Bank Height Ratio	1.0		1.0		1.0		1.0					
D50 (mm)	28.5		37.0		68.0		52.3					
Profile												
Riffle Length (ft)	10	28	10	28	11	29	12	32				
Riffle Slope (ft/ft)	0.0023	0.0527	0.0100	0.0390	0.0039	0.0630	0.0035	0.0612				
Pool Length (ft)	7	45	10	54	19	48	19	47				
Pool Max Depth (ft)	2.5		2.3		2.6		2.8					
Pool Spacing (ft)	26	58	18	78	22	56	21	72				
Pool Volume (ft^3)												
Pattern												
Channel Beltwidth (ft)	10	27										
Radius of Curvature (ft)	14	30										
Rc:Bankfull Width (ft/ft)	1.3	2.9										
Meander Wave Length (ft)	65	74										
Meander Width Ratio	6.3	7.1										
Additional Reach Parameters												
Rosgen Classification	C4		C4		C4		C4					
Channel Thalweg Length (ft)	485		485		485		485					
Sinuosity (ft)	1.2		1.2		1.2		1.2					
Water Surface Slope (ft/ft)	0.0138		0.0140		0.0133		0.0143					
Bankfull Slope (ft/ft)	0.0136		0.0141		0.0126		0.0161					
Ri%/Ru%/P%/G%/S%												
SC%/Sa%/G%/C%/B%/Be%												
d16/d35/d50/d84/d95/d100	SC/0.2/8/68.1/180/362		SC/0.1/4/67.2/151.8/362		SC/SC/0.3/86.7/180.0/512.0		SC/SC/4/101.2/170.1/256					
% of Reach with Eroding Banks			0%		0%		0%					

Table 12e. Monitoring Data - Stream Reach Data Summary
Byrds Creek Mitigation Site
DMS Project No. 95020
Monitoring Year 3 - 2016

Southeast Branch- Reach 2a

Parameter	As-Built/Baseline		MY-1		MY-2		MY-3		MY-4		MY-5	
	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
Dimension and Substrate - Riffle												
Bankfull Width (ft)	10.6		9.7		9.3		9.0					
Floodprone Width (ft)	>100		>100		>100		>100					
Bankfull Mean Depth	0.6		0.6		0.5		0.7					
Bankfull Max Depth	1.2		1.0		1.0		1.3					
Bankfull Cross-sectional Area (ft^2)	6.8		5.8		4.9		5.9					
Width/Depth Ratio	16.5		16.4		17.6		13.8					
Entrenchment Ratio	9.4+		10.3+		10.8+		11.1+					
Bank Height Ratio	1.0		1.0		1.0		1.0					
D50 (mm)	37.2		13.5		45.0		43.8					
Profile												
Riffle Length (ft)	4	20	4	26	3	28	4	27				
Riffle Slope (ft/ft)	0.0145	0.0454	0.0017	0.0845	0.0026	0.0750	0.0010	0.0834				
Pool Length (ft)	21	53	9	44	16	49	10	48				
Pool Max Depth (ft)	3.5		3.2		3.4		2.9					
Pool Spacing (ft)	25	54	16	88	21	66	17	55				
Pool Volume (ft^3)												
Pattern												
Channel Beltwidth (ft)	3	22										
Radius of Curvature (ft)	7	58										
Rc:Bankfull Width (ft/ft)	0.7	5.5										
Meander Wave Length (ft)	43	80										
Meander Width Ratio	4.1	7.5										
Additional Reach Parameters												
Rosgen Classification	C4		C4		C4		C4					
Channel Thalweg Length (ft)	536		536		536		536					
Sinuosity (ft)	1.1		1.1		1.1		1.1					
Water Surface Slope (ft/ft)	0.0144		0.0134		0.0137		0.0137					
Bankfull Slope (ft/ft)	0.0146		0.0135		0.0148		0.0122					
Ri%/Ru%/P%/G%/S%												
SC%/Sa%/G%/C%/B%/Be%												
d16/d35/d50/d84/d95/d100	SC/0.1/17.1/70.9/256/362		SC/0.1/18/78.1/143.4/362		SC/0.13/24.7/128.0/214.7/256		SC/0.16/6.3/82.6/180/512					
% of Reach with Eroding Banks			0%		0%		0%					

Table 12f. Monitoring Data - Stream Reach Data Summary
Byrds Creek Mitigation Site
DMS Project No. 95020
Monitoring Year 3 - 2016

Southeast Branch- Reach 2b

Parameter	As-Built/Baseline		MY-1		MY-2		MY-3		MY-4		MY-5	
	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
Dimension and Substrate - Riffle												
Bankfull Width (ft)	10.6		9.7		9.3		9.0					
Floodprone Width (ft)	>100		>100		>100		>100					
Bankfull Mean Depth	0.6		0.6		0.5		0.7					
Bankfull Max Depth	1.2		1.0		1.0		1.3					
Bankfull Cross-sectional Area (ft^2)	6.8		5.8		4.9		5.9					
Width/Depth Ratio	16.5		16.4		17.6		13.8					
Entrenchment Ratio	9.4+		10.3+		10.8+		11.1+					
Bank Height Ratio	1.0		1.0		1.0		1.0					
D50 (mm)	37.2		13.5		45.0		43.8					
Profile												
Riffle Length (ft)	11	36	14	36	12	31	12	41				
Riffle Slope (ft/ft)	0.0119	0.0606	0.0017	0.0520	0.0073	0.0580	0.0021	0.0494				
Pool Length (ft)	27	45	27	44	28	45	28	46				
Pool Max Depth (ft)	3.5		3.2		2.7		2.7					
Pool Spacing (ft)	34	73	33	60	29	55	43	58				
Pool Volume (ft^3)												
Pattern												
Channel Beltwidth (ft)	12	22										
Radius of Curvature (ft)	21	25										
Rc:Bankfull Width (ft/ft)	N/A											
Meander Wave Length (ft)	88	88										
Meander Width Ratio	N/A											
Additional Reach Parameters												
Rosgen Classification	C4		C4		C4		C4					
Channel Thalweg Length (ft)	195		195		195		195					
Sinuosity (ft)	1.2		1.2		1.2		1.2					
Water Surface Slope (ft/ft)	0.0160		0.0085		0.0092		0.0124					
Bankfull Slope (ft/ft)	0.0168		0.0092		0.0081		0.0122					
Ri%/Ru%/P%/G%/S%												
SC%/Sa%/G%/C%/B%/Be%												
d16/d35/d50/d84/d95/d100	SC/0.1/17.1/70.9/256/362		SC/0.1/18/78.1/143.4/362		SC/0.13/24.7/128.0/214.7/256		SC/0.16/6.3/82.6/180/512					
% of Reach with Eroding Banks			0%		0%		0%					

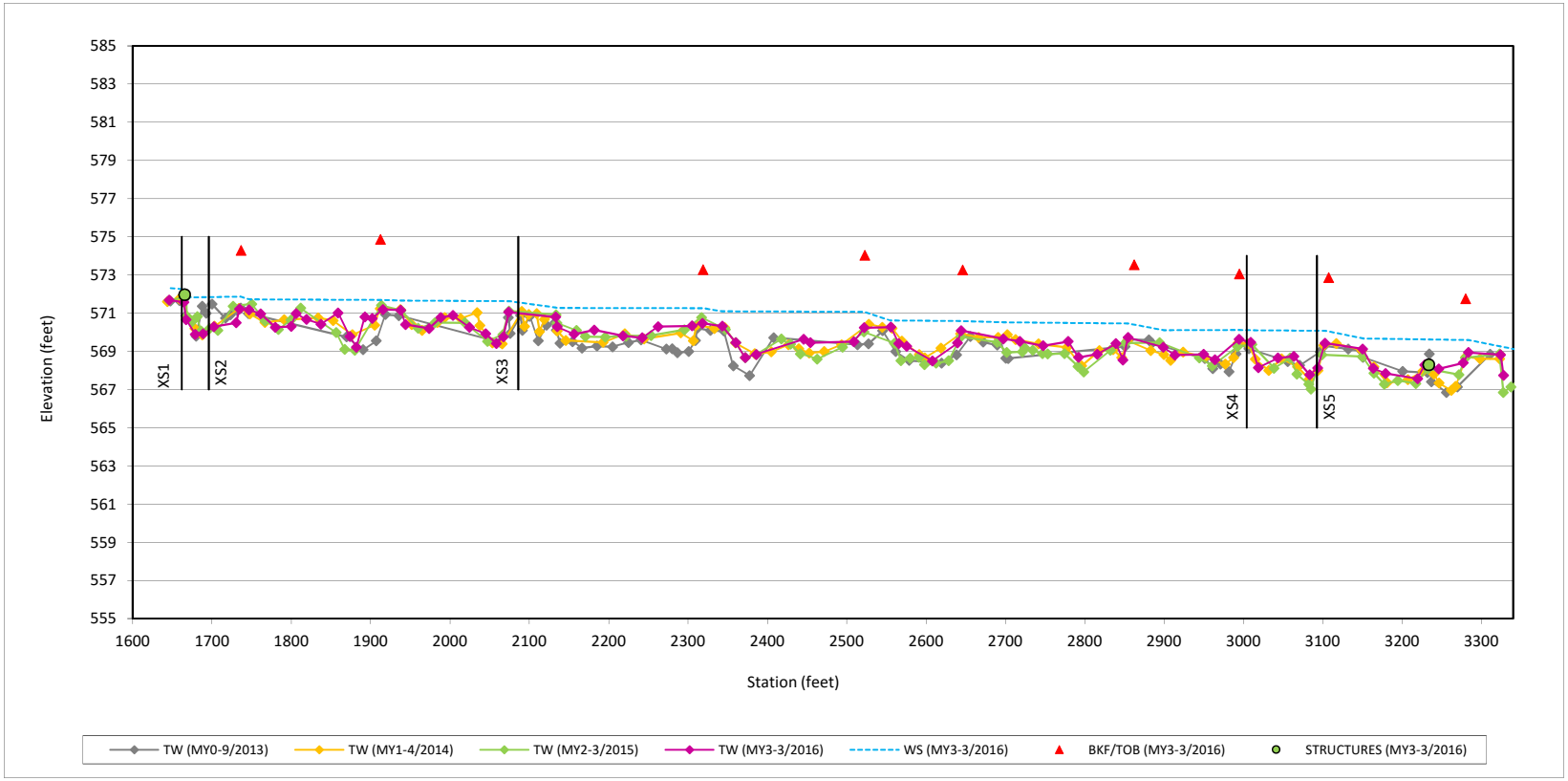
Longitudinal Profile Plots

Byrds Creek Mitigation Site

DMS Project No. 95020

Monitoring Year 3- 2016

Byrds Creek Reach 2



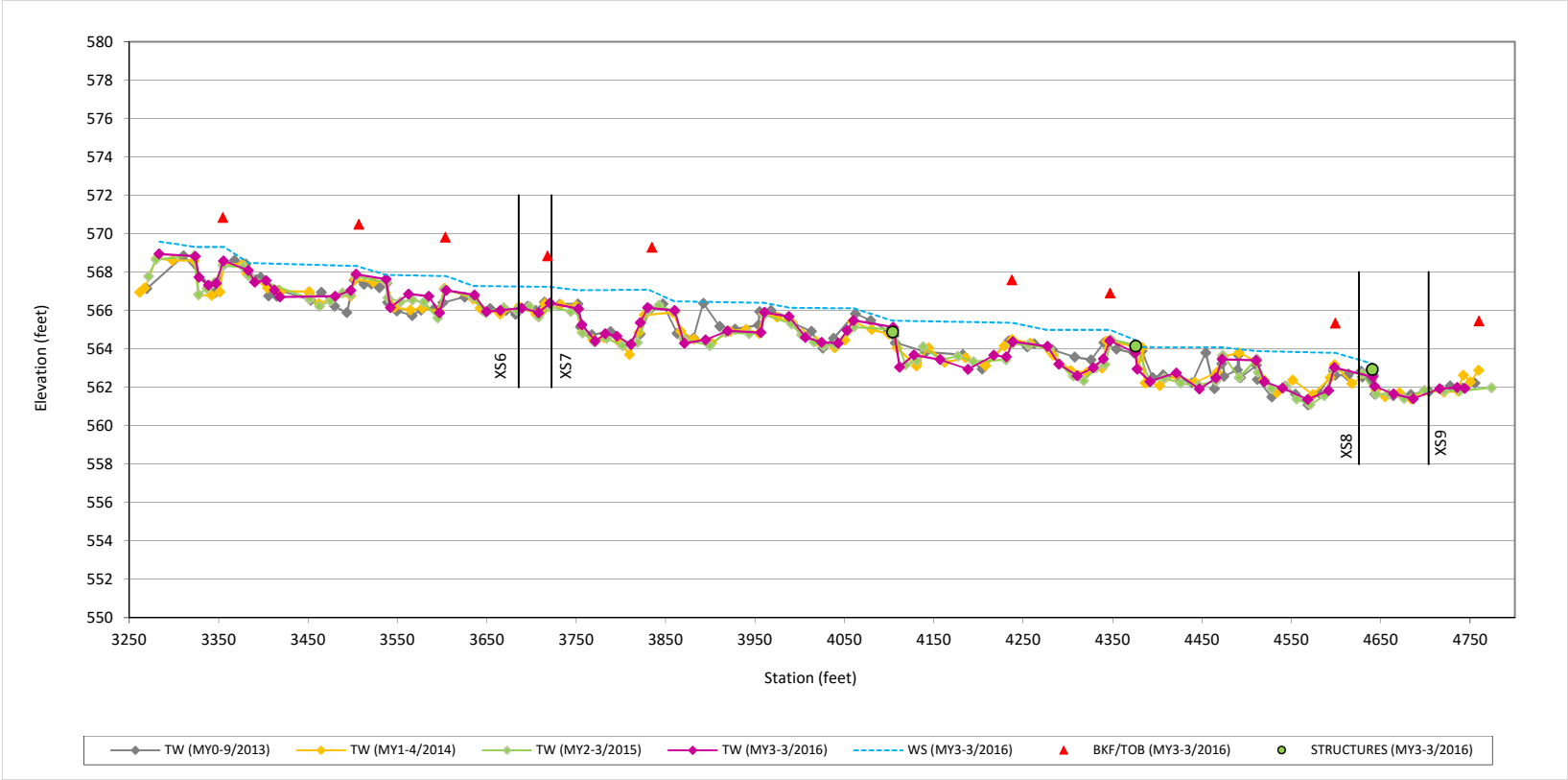
Longitudinal Profile Plots

Byrds Creek Mitigation Site

DMS Project No. 95020

Monitoring Year 3- 2016

Byrds Creek Reach 3



Longitudinal Profile Plots

Byrds Creek Mitigation Site

DMS Project No. 95020

Monitoring Year 3- 2016

South Branch Reach 1

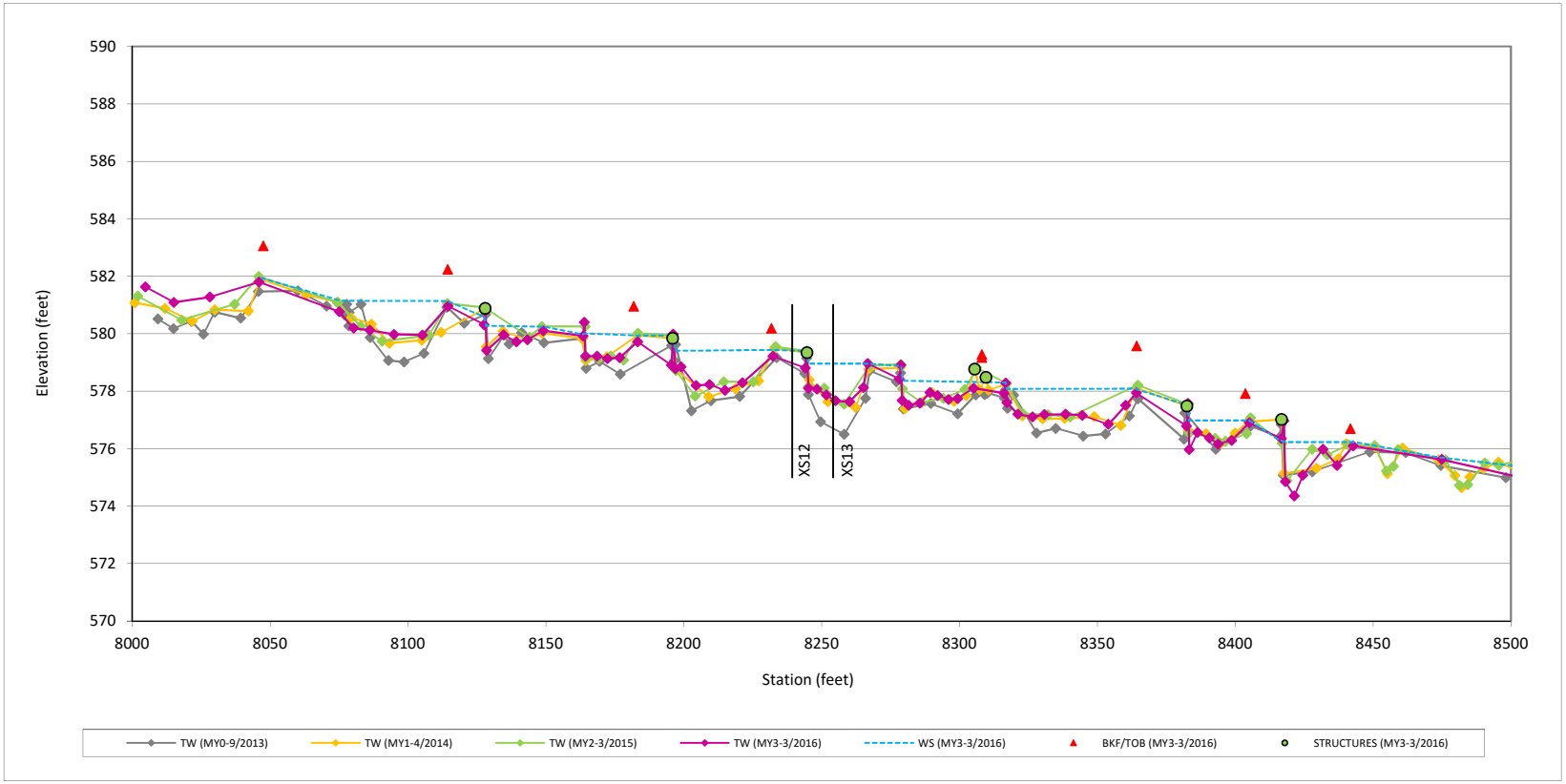
Longitudinal Profile Plots

Byrds Creek Mitigation Site

DMS Project No. 95020

Monitoring Year 3- 2016

Southeast Reach 1



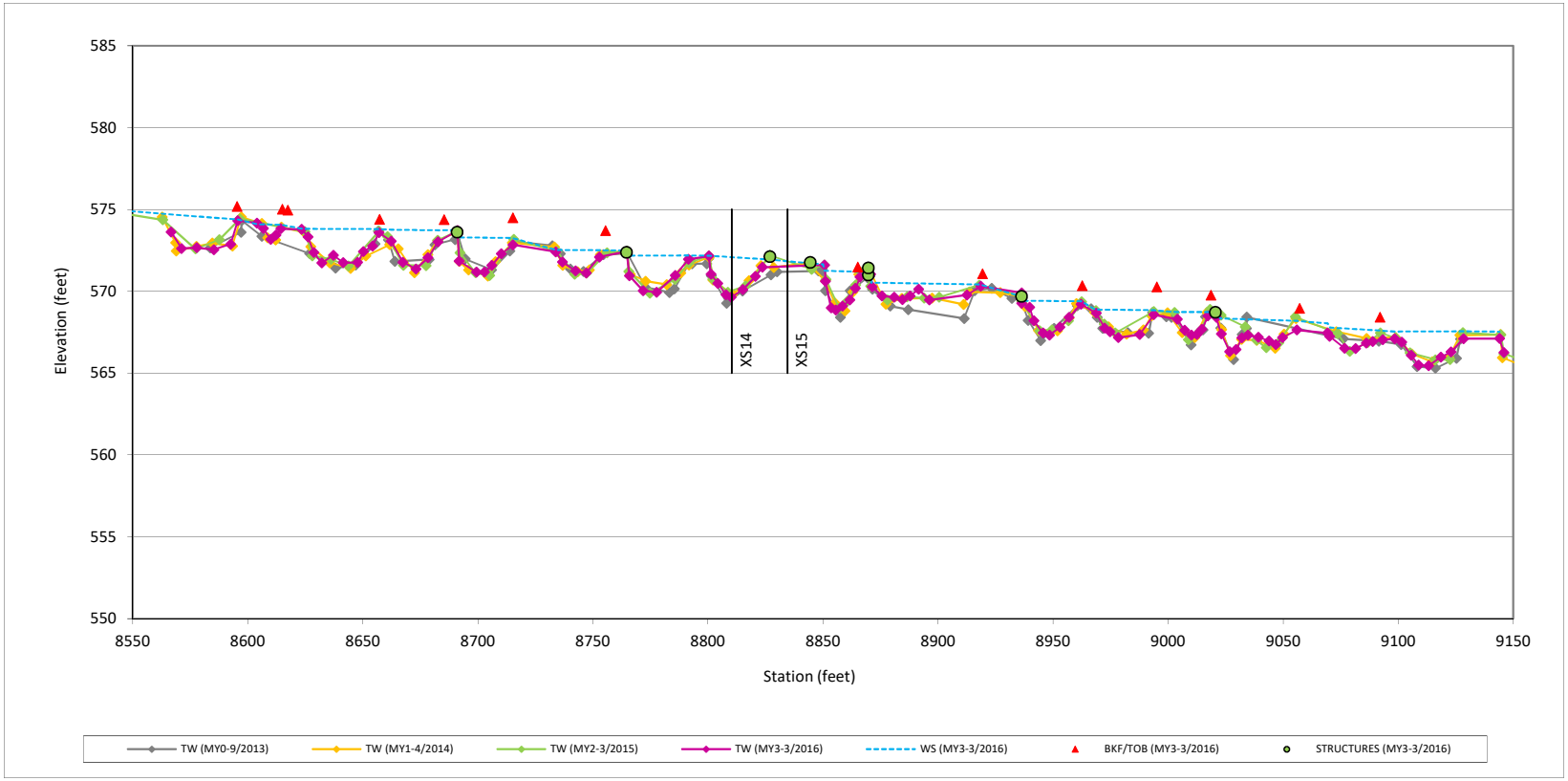
Longitudinal Profile Plots

Byrds Creek Mitigation Site

DMS Project No. 95020

Monitoring Year 3- 2016

Southeast Reach 2a



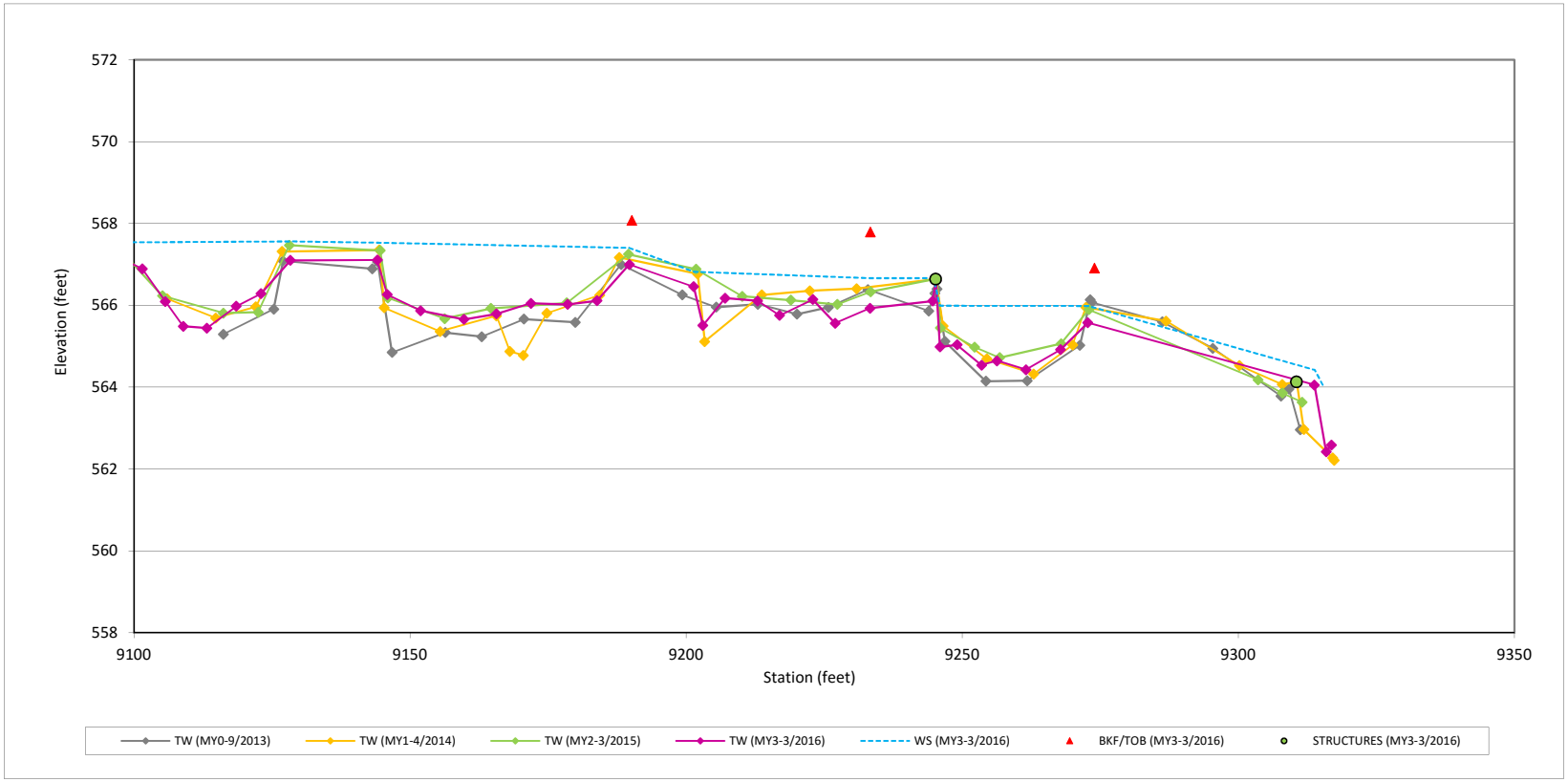
Longitudinal Profile Plots

Byrds Creek Mitigation Site

DMS Project No. 95020

Monitoring Year 3- 2016

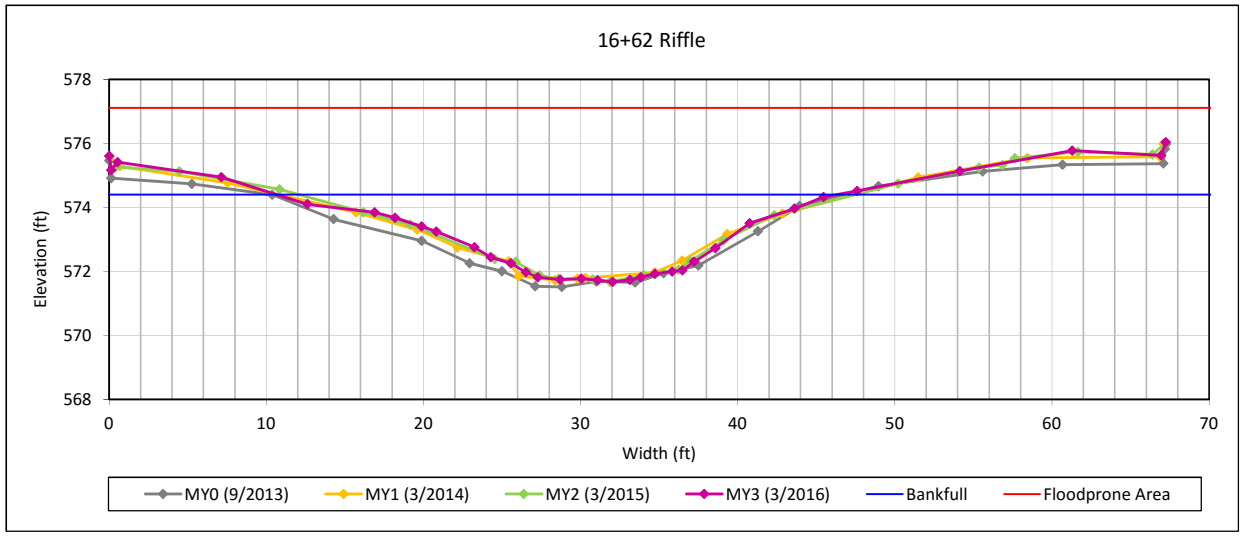
Southeast Reach 2b



Cross Section Plots

Byrds Creek Mitigation Site
DMS Project No. 95020
Monitoring Year 3 - 2016

Cross Section 1-Byrds Creek Reach 2



Bankfull Dimensions	
50.6	x-section area (ft.sq.)
35.6	width (ft)
1.4	mean depth (ft)
2.7	max depth (ft)
36.2	wetted parimeter (ft)
1.4	hyd radi (ft)
25.0	width-depth ratio
150.0	W flood prone area (ft)
4.2	entrenchment ratio
1.0	low bank height ratio

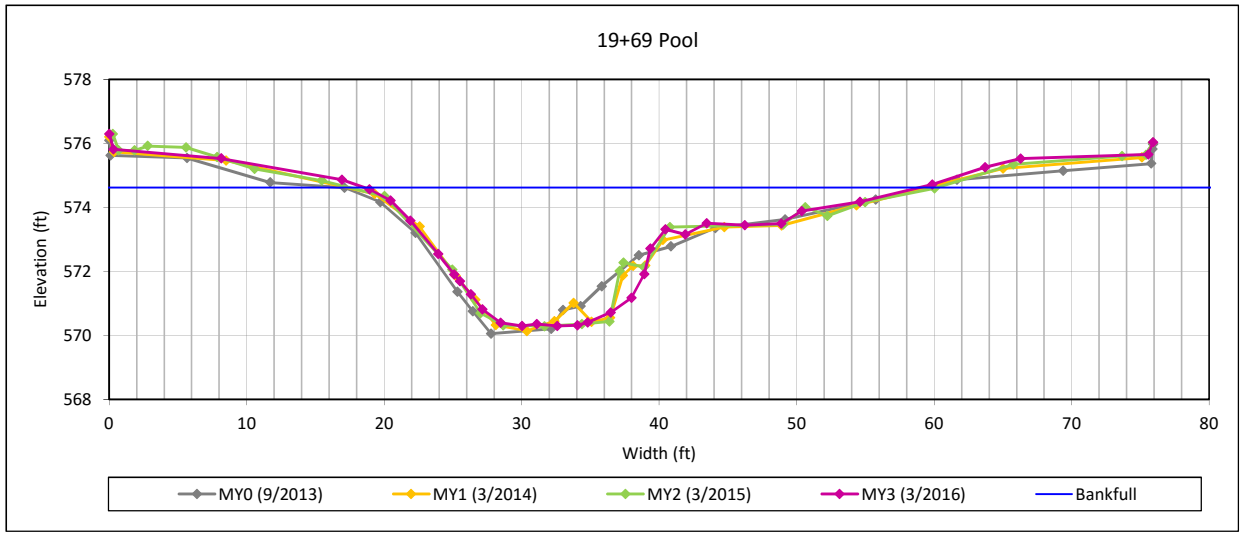
Survey Date: 3/2016
Field Crew: Wildlands Engineering

View Downstream

Cross Section Plots

Byrds Creek Mitigation Site
DMS Project No. 95020
Monitoring Year 3 - 2016

Cross Section 2-Byrds Creek Reach 2



Bankfull Dimensions	
79.3	x-section area (ft.sq.)
40.3	width (ft)
2.0	mean depth (ft)
4.3	max depth (ft)
42.3	wetted parimeter (ft)
1.9	hyd radi (ft)
20.5	width-depth ratio

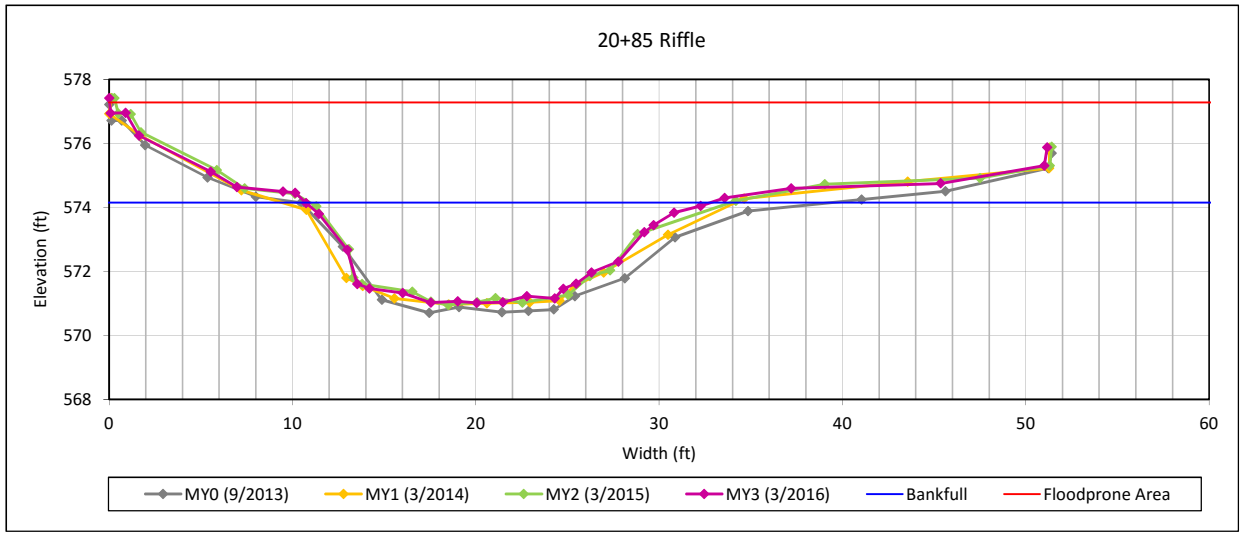
Survey Date: 3/2016
Field Crew: Wildlands Engineering

View Downstream

Cross Section Plots

Byrds Creek Mitigation Site
DMS Project No. 95020
Monitoring Year 3 - 2016

Cross Section 3-Byrds Creek Reach 2



Bankfull Dimensions	
45.9	x-section area (ft.sq.)
22.1	width (ft)
2.1	mean depth (ft)
3.1	max depth (ft)
23.9	wetted parimeter (ft)
1.9	hyd radi (ft)
10.6	width-depth ratio
150.0	W flood prone area (ft)
6.8	entrenchment ratio
1.0	low bank height ratio

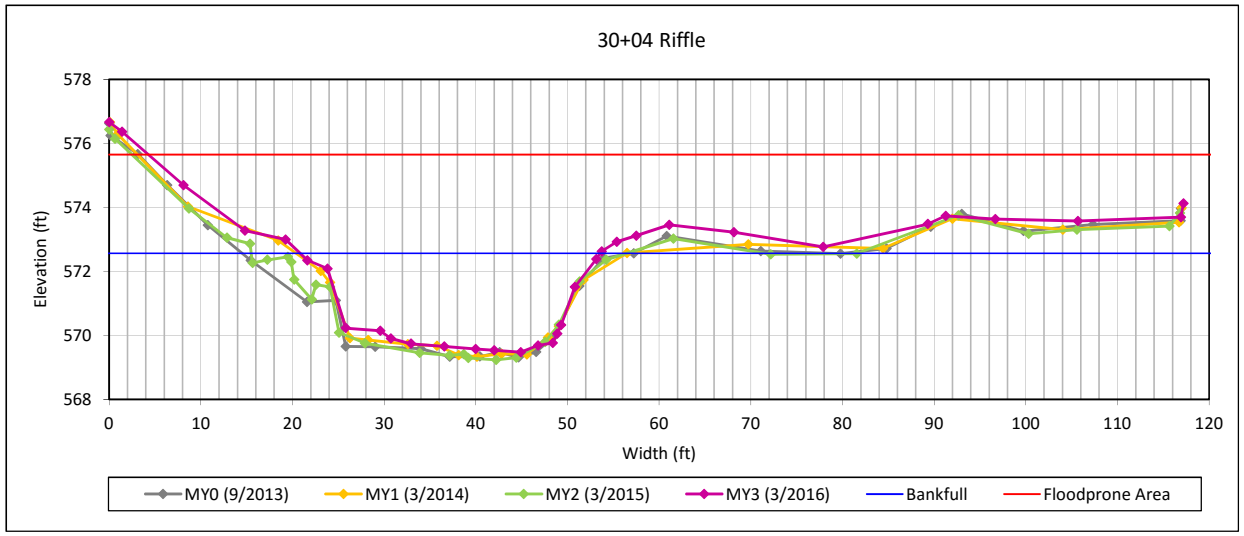
Survey Date: 3/2016
Field Crew: Wildlands Engineering

View Downstream

Cross Section Plots

Byrds Creek Mitigation Site
DMS Project No. 95020
Monitoring Year 3 - 2016

Cross Section 4-Byrds Creek Reach 2



Bankfull Dimensions	
73.4	x-section area (ft.sq.)
32.8	width (ft)
2.2	mean depth (ft)
3.1	max depth (ft)
34.3	wetted parimeter (ft)
2.1	hyd radi (ft)
14.6	width-depth ratio
150.0	W flood prone area (ft)
4.6	entrenchment ratio
1.0	low bank height ratio

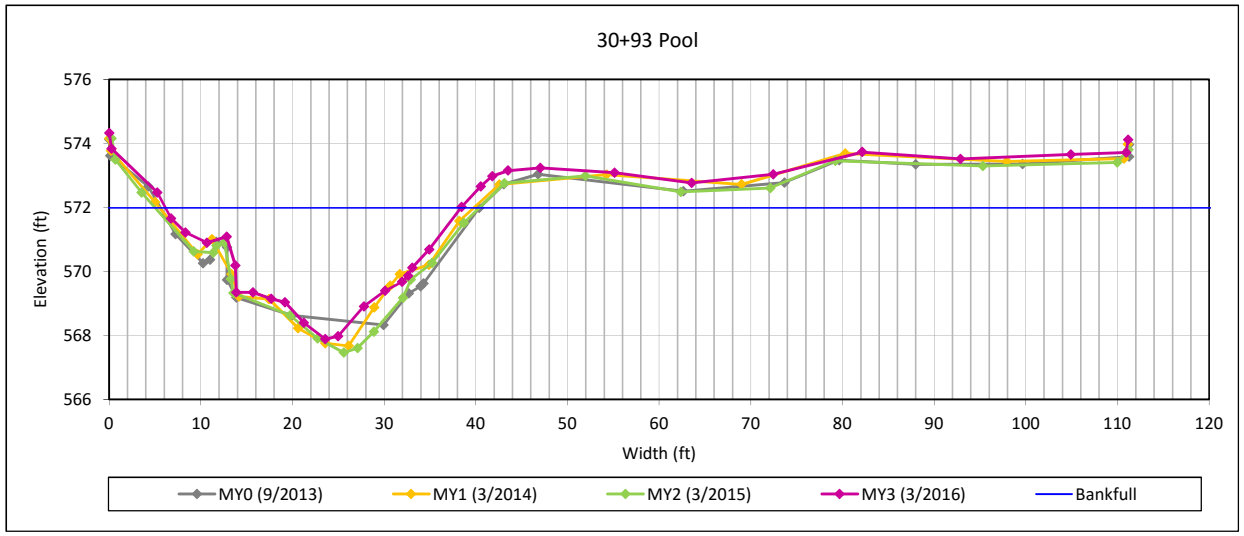
Survey Date: 3/2016
Field Crew: Wildlands Engineering

View Downstream

Cross Section Plots

Byrds Creek Mitigation Site
DMS Project No. 95020
Monitoring Year 3 - 2016

Cross Section 5-Byrds Creek Reach 2



Bankfull Dimensions	
71.4	x-section area (ft.sq.)
32.2	width (ft)
2.2	mean depth (ft)
4.1	max depth (ft)
34.3	wetted parimeter (ft)
2.1	hyd radi (ft)
14.5	width-depth ratio

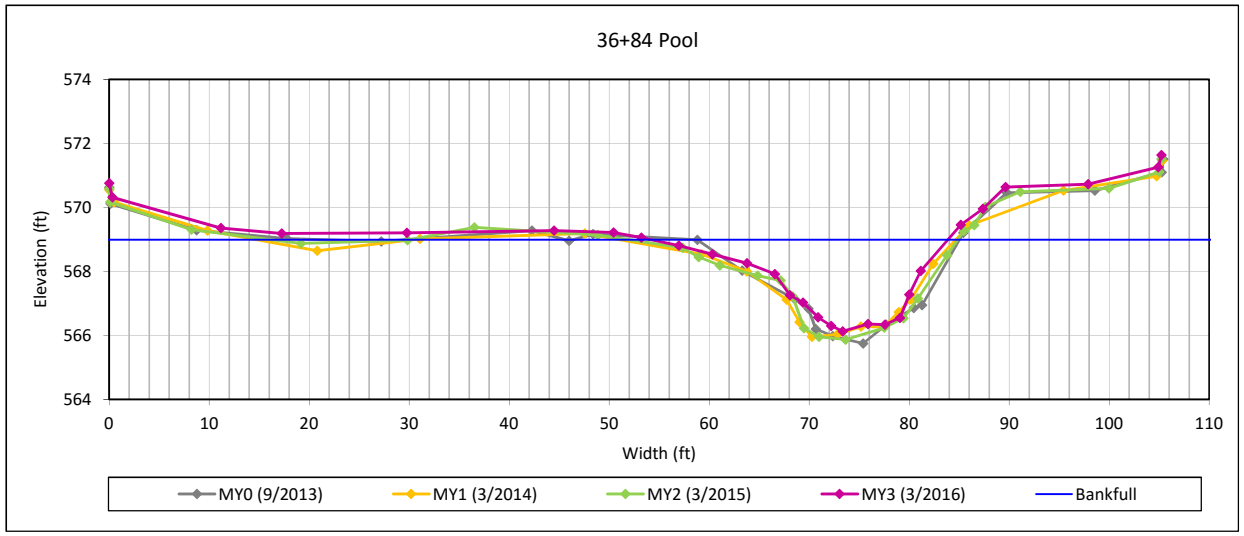
Survey Date: 3/2016
Field Crew: Wildlands Engineering

View Downstream

Cross Section Plots

Byrds Creek Mitigation Site
DMS Project No. 95020
Monitoring Year 3 - 2016

Cross Section 6-Byrds Creek Reach 3



Bankfull Dimensions	
40.3	x-section area (ft.sq.)
29.6	width (ft)
1.4	mean depth (ft)
2.9	max depth (ft)
30.6	wetted parimeter (ft)
1.3	hyd radi (ft)
21.7	width-depth ratio

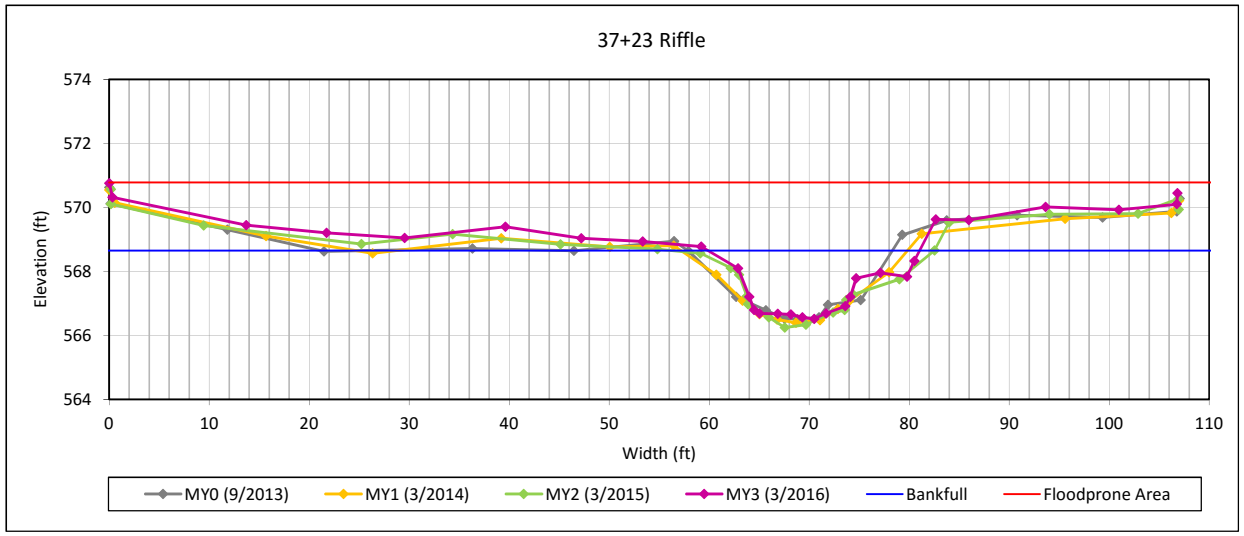
Survey Date: 3/2016
Field Crew: Wildlands Engineering

View Downstream

Cross Section Plots

Byrds Creek Mitigation Site
DMS Project No. 95020
Monitoring Year 3 - 2016

Cross Section 7- Byrds Creek Reach 3



Bankfull Dimensions	
26.6	x-section area (ft.sq.)
21.2	width (ft)
1.3	mean depth (ft)
2.1	max depth (ft)
22.3	wetted parimeter (ft)
1.2	hyd radi (ft)
16.8	width-depth ratio
150.0	W flood prone area (ft)
7.1	entrenchment ratio
1.0	low bank height ratio

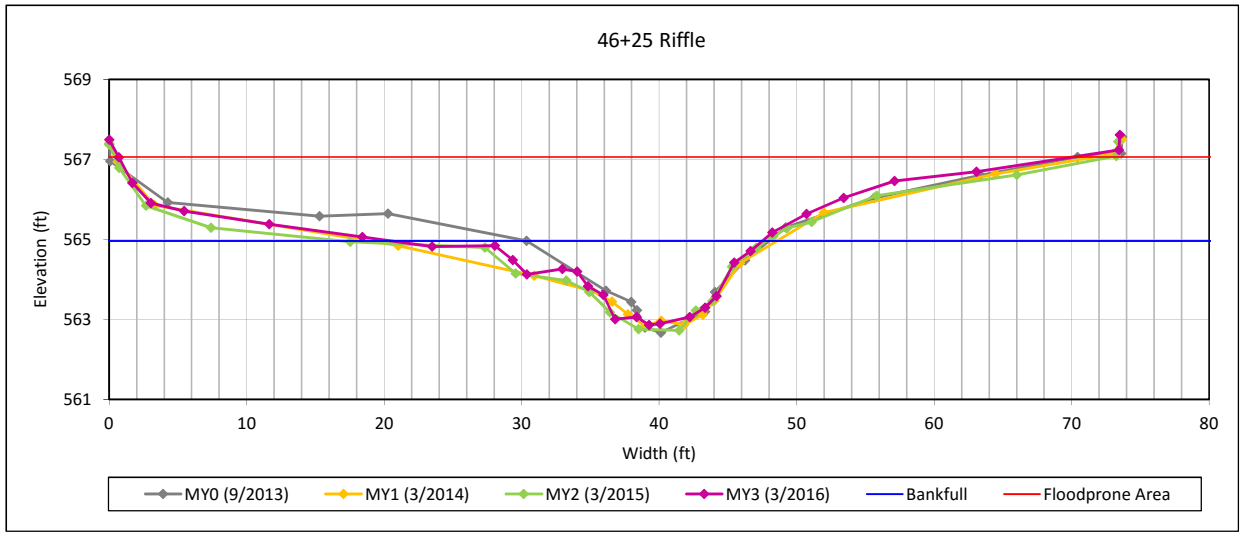
Survey Date: 3/2016
Field Crew: Wildlands Engineering

View Downstream

Cross Section Plots

Byrds Creek Mitigation Site
DMS Project No. 95020
Monitoring Year 3 - 2016

Cross Section 8- Byrds Creek Reach 3



Bankfull Dimensions	
23.2	x-section area (ft.sq.)
19.5	width (ft)
1.2	mean depth (ft)
2.1	max depth (ft)
20.3	wetted parimeter (ft)
1.1	hyd radi (ft)
16.3	width-depth ratio
150.0	W flood prone area (ft)
7.7	entrenchment ratio
1.3	low bank height ratio

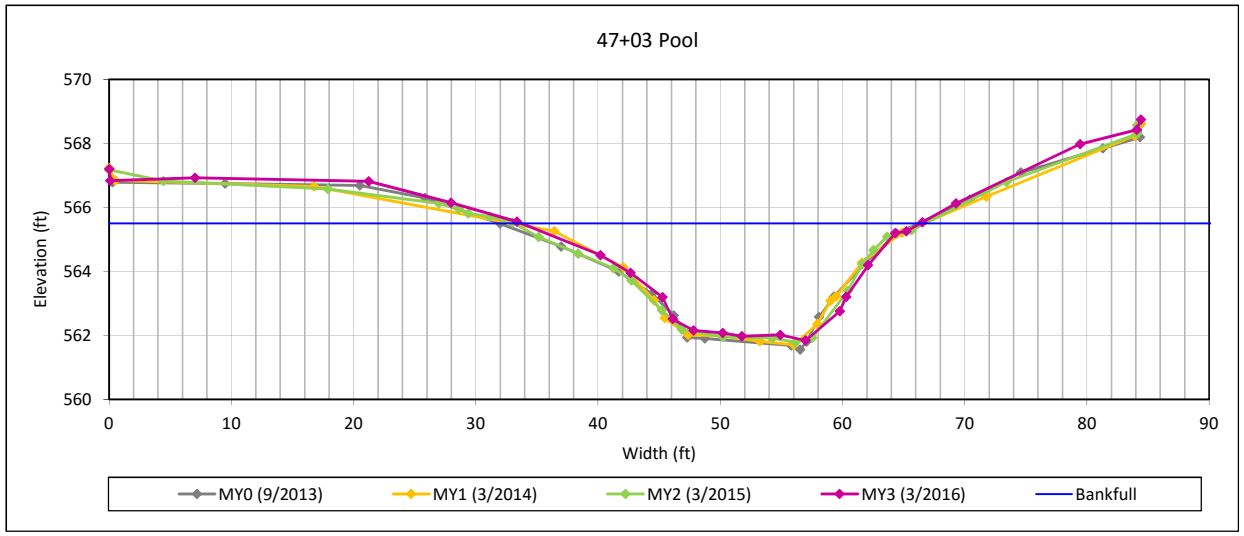
Survey Date: 3/2016
Field Crew: Wildlands Engineering

View Downstream

Cross Section Plots

Byrds Creek Mitigation Site
DMS Project No. 95020
Monitoring Year 3 - 2016

Cross Section 9- Byrds Creek Reach 3



Bankfull Dimensions	
66.5	x-section area (ft.sq.)
32.6	width (ft)
2.0	mean depth (ft)
3.7	max depth (ft)
34.0	wetted parimeter (ft)
2.0	hyd radi (ft)
16.0	width-depth ratio

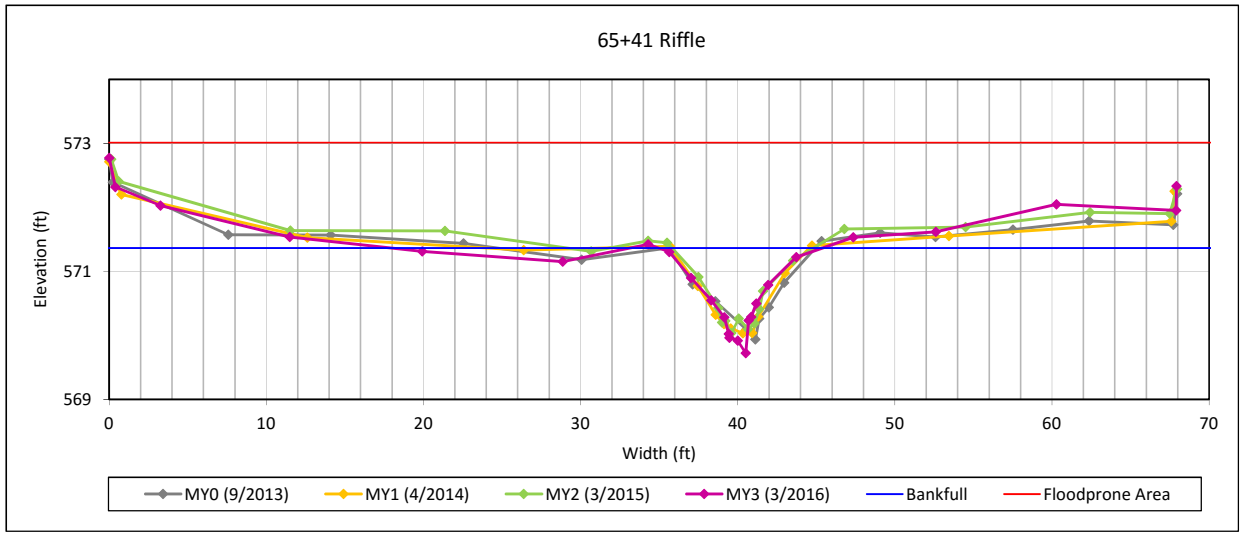
Survey Date: 3/2016
Field Crew: Wildlands Engineering

View Downstream

Cross Section Plots

Byrds Creek Mitigation Site
DMS Project No. 95020
Monitoring Year 3 - 2016

Cross Section 10-South Branch Reach 1



Bankfull Dimensions	
6.0	x-section area (ft.sq.)
9.8	width (ft)
0.6	mean depth (ft)
1.6	max depth (ft)
10.6	wetted parimeter (ft)
0.6	hyd radi (ft)
15.9	width-depth ratio
100.0	W flood prone area (ft)
10.2	entrenchment ratio
1.0	low bank height ratio

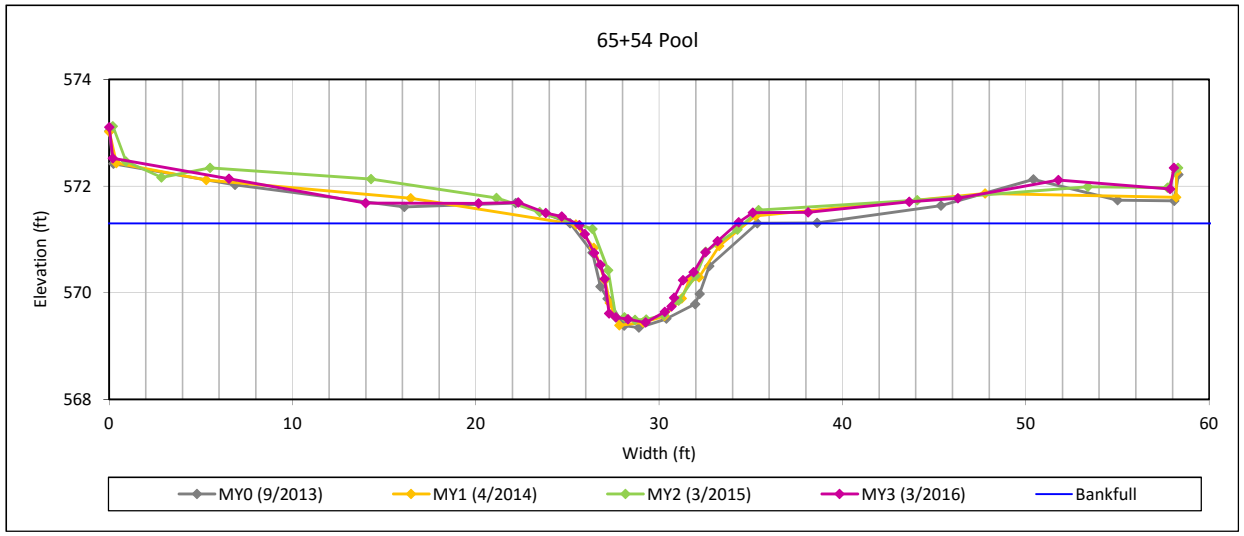
Survey Date: 3/2016
Field Crew: Wildlands Engineering

View Downstream

Cross Section Plots

Byrds Creek Mitigation Site
DMS Project No. 95020
Monitoring Year 3 - 2016

Cross Section 11- South Branch Reach 1



Bankfull Dimensions	
9.3	x-section area (ft.sq.)
8.8	width (ft)
1.1	mean depth (ft)
1.9	max depth (ft)
10.0	wetted parimeter (ft)
0.9	hyd radi (ft)
8.3	width-depth ratio

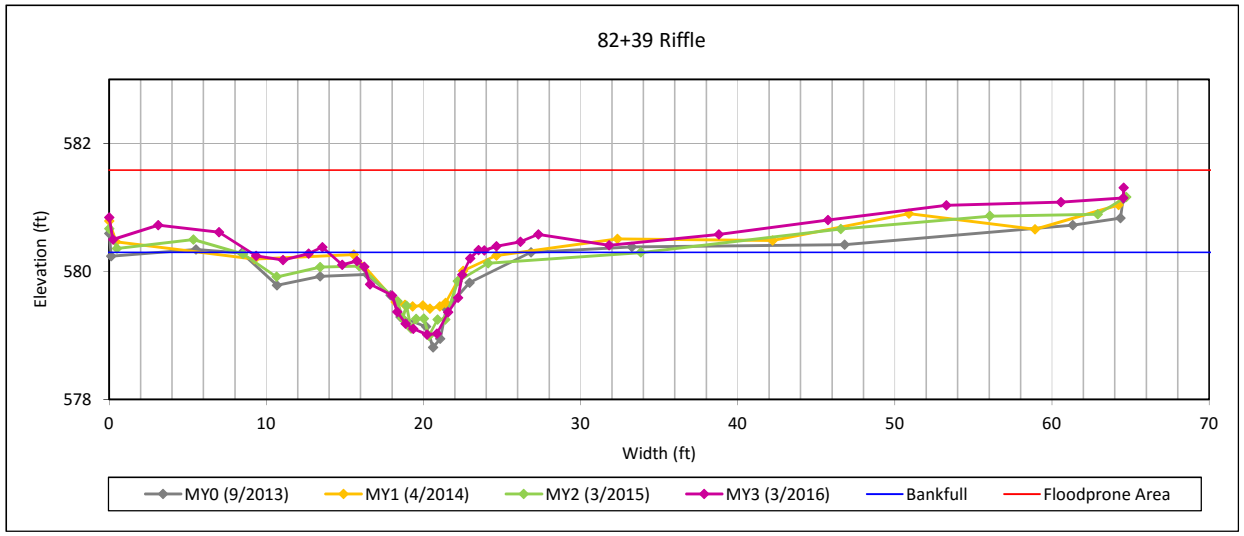
Survey Date: 3/2016
Field Crew: Wildlands Engineering

View Downstream

Cross Section Plots

Byrds Creek Mitigation Site
DMS Project No. 95020
Monitoring Year 3 - 2016

Cross Section 12 - Southeast Reach 1



Bankfull Dimensions	
6.0	x-section area (ft.sq.)
8.5	width (ft)
0.7	mean depth (ft)
1.3	max depth (ft)
9.1	wetted parimeter (ft)
0.7	hyd radi (ft)
12.0	width-depth ratio
75.0	W flood prone area (ft)
8.8	entrenchment ratio
1.0	low bank height ratio

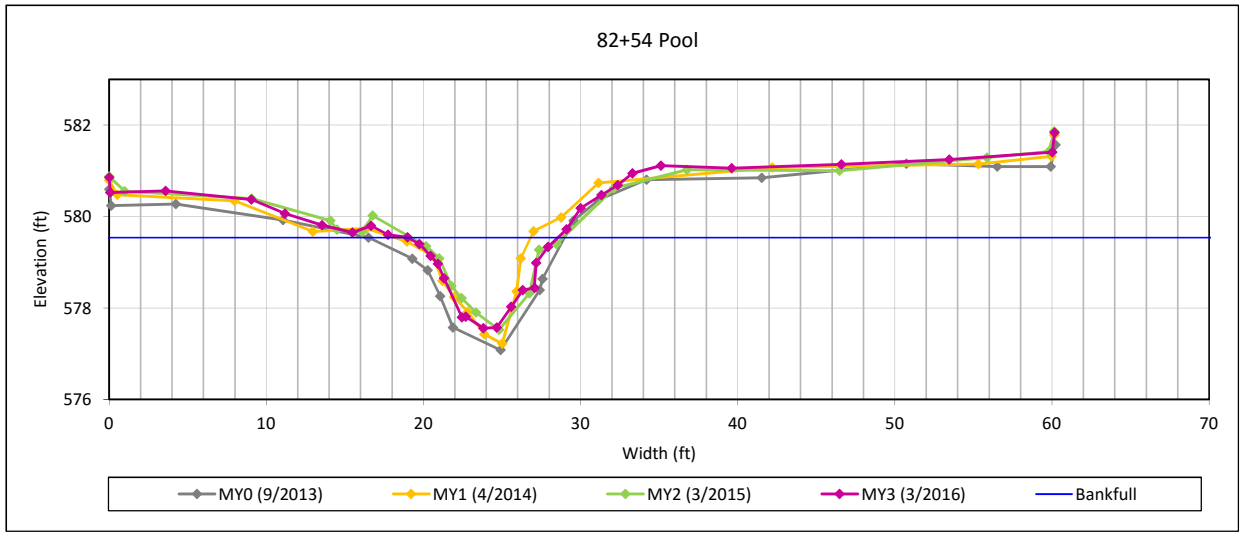
Survey Date: 3/2016
Field Crew: Wildlands Engineering

View Downstream

Cross Section Plots

Byrds Creek Mitigation Site
DMS Project No. 95020
Monitoring Year 3 - 2016

Cross Section 13 - Southeast Reach 1



Bankfull Dimensions	
10.3	x-section area (ft.sq.)
9.5	width (ft)
1.1	mean depth (ft)
2.0	max depth (ft)
10.8	wetted parimeter (ft)
1.0	hyd radi (ft)
8.8	width-depth ratio

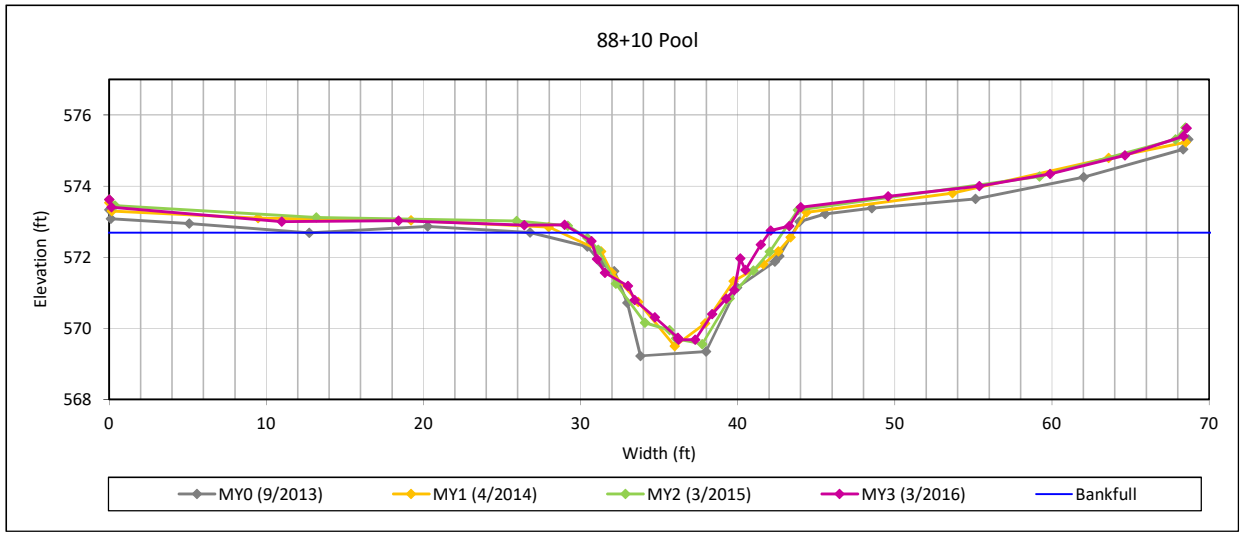
Survey Date: 3/2016
Field Crew: Wildlands Engineering

View Downstream

Cross Section Plots

Byrds Creek Mitigation Site
DMS Project No. 95020
Monitoring Year 3 - 2016

Cross Section 14 - Southeast Reach 2



Bankfull Dimensions	
20.5	x-section area (ft.sq.)
12.2	width (ft)
1.7	mean depth (ft)
3.0	max depth (ft)
14.5	wetted parimeter (ft)
1.4	hyd radi (ft)
7.2	width-depth ratio

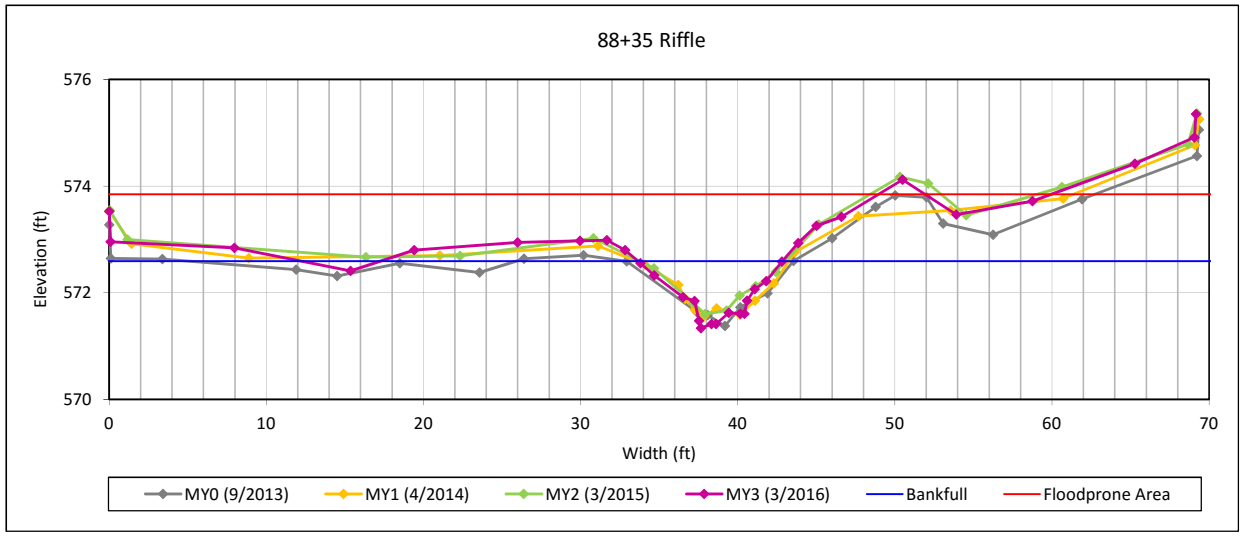
Survey Date: 3/2016
Field Crew: Wildlands Engineering

View Downstream

Cross Section Plots

Byrds Creek Mitigation Site
DMS Project No. 95020
Monitoring Year 3 - 2016

Cross Section 15 - Southeast Reach 2



Bankfull Dimensions	
5.9	x-section area (ft.sq.)
9.0	width (ft)
0.7	mean depth (ft)
1.3	max depth (ft)
9.6	wetted parimeter (ft)
0.6	hyd radi (ft)
13.8	width-depth ratio
100.0	W flood prone area (ft)
11.1	entrenchment ratio
1.0	low bank height ratio

Survey Date: 3/2016
Field Crew: Wildlands Engineering

View Downstream

Reachwide and Cross Section Pebble Count Plots

Byrds Creek Mitigation Project

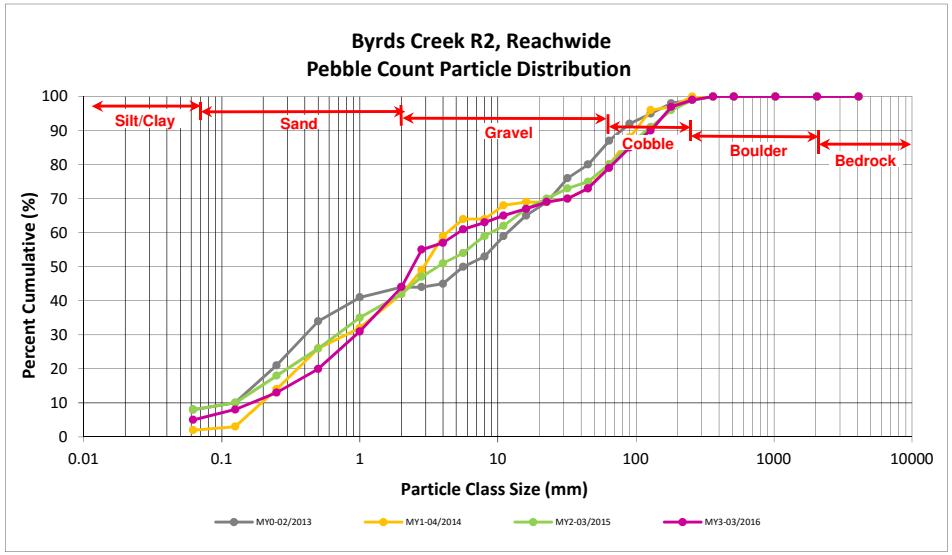
DMS Project No. 95020

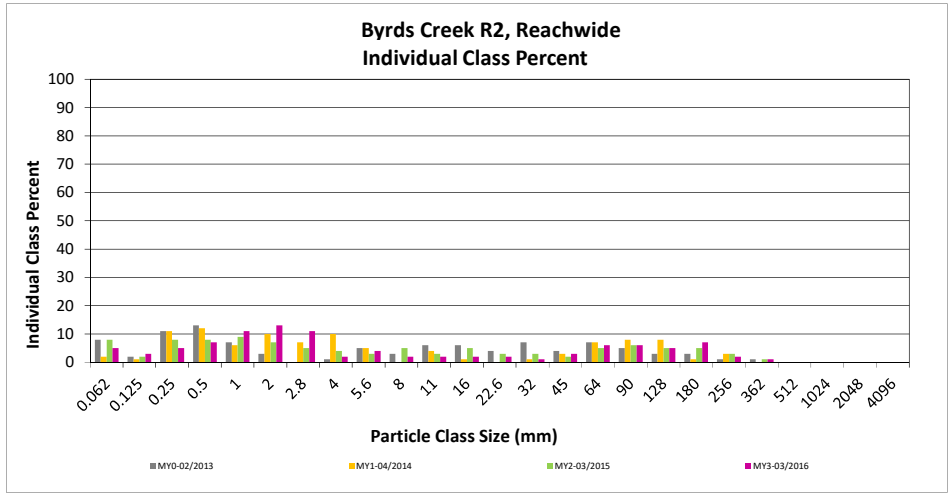
Monitoring Year 3 - 2016

Byrds Creek 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	4	5	5	5
SAND	Very fine	0.062	0.125	1	2	3	3	8
	Fine	0.125	0.250	1	4	5	5	13
	Medium	0.25	0.50	1	6	7	7	20
	Coarse	0.5	1.0	3	8	11	11	31
	Very Coarse	1.0	2.0	6	7	13	13	44
GRAVEL	Very Fine	2.0	2.8	3	8	11	11	55
	Very Fine	2.8	4.0		2	2	2	57
	Fine	4.0	5.6		4	4	4	61
	Fine	5.6	8.0		2	2	2	63
	Medium	8.0	11.0		2	2	2	65
	Medium	11.0	16.0	1	1	2	2	67
	Coarse	16.0	22.6	2		2	2	69
	Coarse	22.6	32	1		1	1	70
	Very Coarse	32	45	3		3	3	73
	Very Coarse	45	64	6		6	6	79
COBBLE	Small	64	90	6		6	6	85
	Small	90	128	5		5	5	90
	Large	128	180	7		7	7	97
	Large	180	256	2		2	2	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} =	0.34
D_{35} =	1.24
D_{50} =	2.4
D_{84} =	85.0
D_{95} =	163.3
D_{100} =	362.0





Reachwide and Cross Section Pebble Count Plots

Byrds Creek Mitigation Project

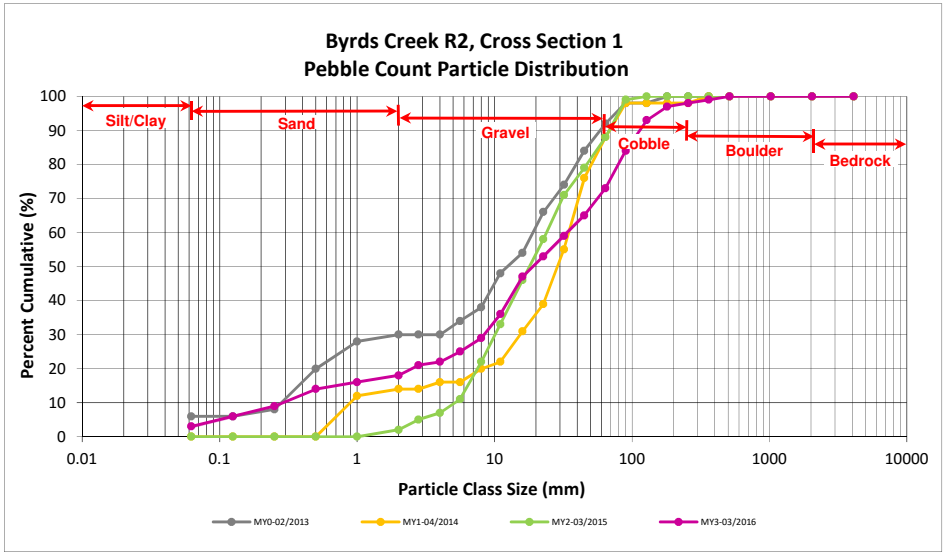
DMS Project No. 95020

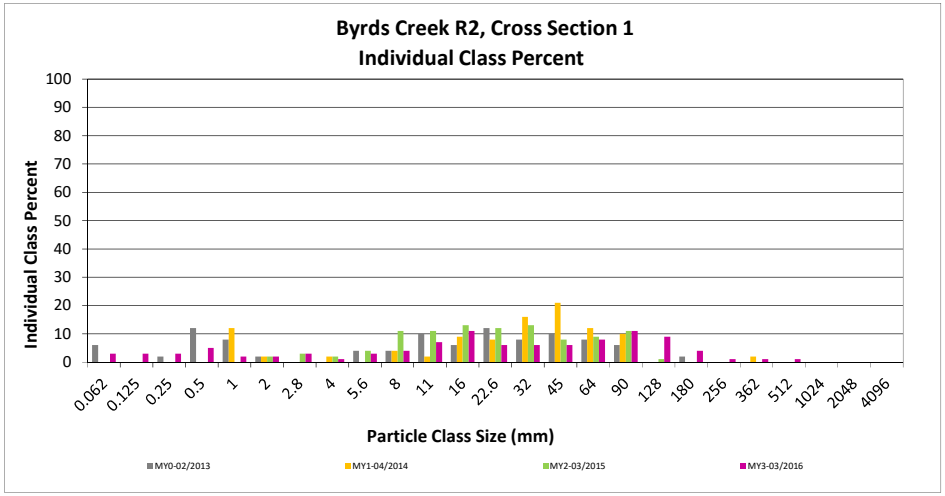
Monitoring Year 3 - 2016

Byrds Creek R2, 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	3	3	3
SAND	Very fine	0.062	0.125	3	3	6
	Fine	0.125	0.250	3	3	9
	Medium	0.25	0.50	5	5	14
	Coarse	0.5	1.0	2	2	16
	Very Coarse	1.0	2.0	2	2	18
GRAVEL	Very Fine	2.0	2.8	3	3	21
	Very Fine	2.8	4.0	1	1	22
	Fine	4.0	5.6	3	3	25
	Fine	5.6	8.0	4	4	29
	Medium	8.0	11.0	7	7	36
	Medium	11.0	16.0	11	11	47
	Coarse	16.0	22.6	6	6	53
	Coarse	22.6	32	6	6	59
	Very Coarse	32	45	6	6	65
	Very Coarse	45	64	8	8	73
COBBLE	Small	64	90	11	11	84
	Small	90	128	9	9	93
	Large	128	180	4	4	97
	Large	180	256	1	1	98
BOULDER	Small	256	362	1	1	99
	Small	362	512	1	1	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} =	1.00
D_{35} =	10.51
D_{50} =	19.0
D_{84} =	90.0
D_{95} =	151.8
D_{100} =	512.0





Reachwide and Cross Section Pebble Count Plots

Byrds Creek Mitigation Project

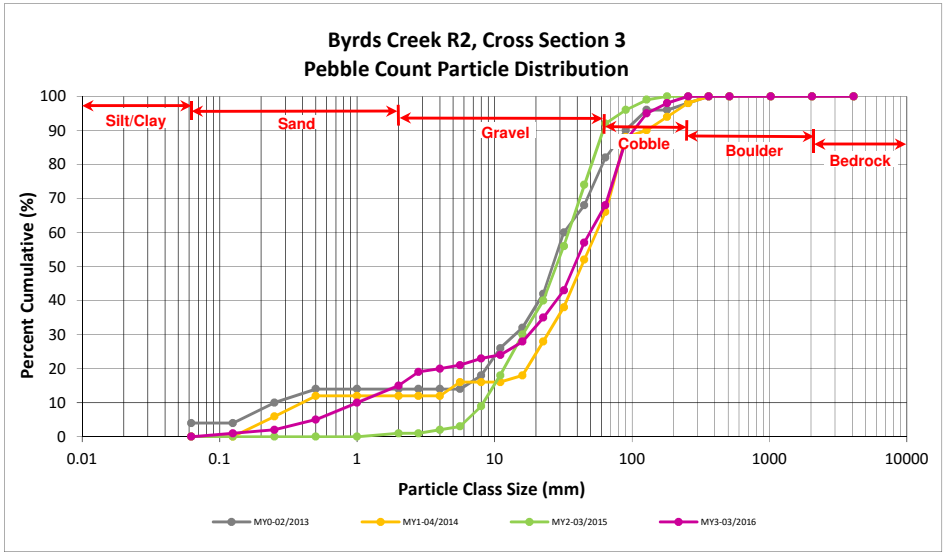
DMS Project No. 95020

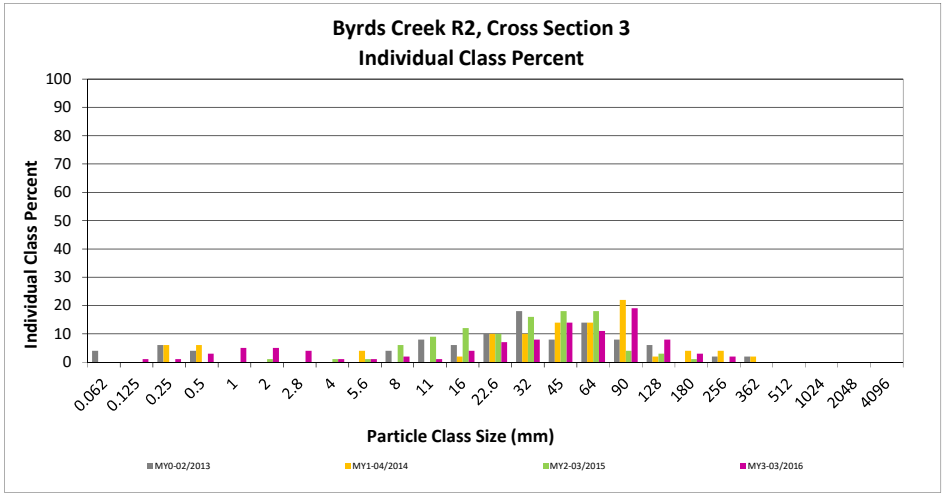
Monitoring Year 3 - 2016

Byrds Creek R2, Cross Section 3

Particle Class		Diameter (mm) min	Diameter (mm) max	Riffle 100-Count	Summary: Class Percentage	Summary: Percent Cumulative
SILT/CLAY	Silt/Clay	0.000	0.062			0
SAND	Very fine	0.062	0.125	1	1	1
	Fine	0.125	0.250	1	1	2
	Medium	0.25	0.50	3	3	5
	Coarse	0.5	1.0	5	5	10
	Very Coarse	1.0	2.0	5	5	15
GRAVEL	Very Fine	2.0	2.8	4	4	19
	Very Fine	2.8	4.0	1	1	20
	Fine	4.0	5.6	1	1	21
	Fine	5.6	8.0	2	2	23
	Medium	8.0	11.0	1	1	24
	Medium	11.0	16.0	4	4	28
	Coarse	16.0	22.6	7	7	35
	Coarse	22.6	32	8	8	43
	Very Coarse	32	45	14	14	57
	Very Coarse	45	64	11	11	68
COBBLE	Small	64	90	19	19	87
	Small	90	128	8	8	95
	Large	128	180	3	3	98
	Large	180	256	2	2	100
BOULDER	Small	256	362			100
	Small	362	512			100
	Medium	512	1024			100
	Large/Very Large	1024	2048			100
BEDROCK	Bedrock	2048	>2048			100
			Total	**100**	**100**	**100**

Cross Section 3	
Channel materials (mm)	
D_{16} =	2.18
D_{35} =	22.60
D_{50} =	37.9
D_{84} =	85.3
D_{95} =	128.0
D_{100} =	256.0





Reachwide and Cross Section Pebble Count Plots

Byrds Creek Mitigation Project

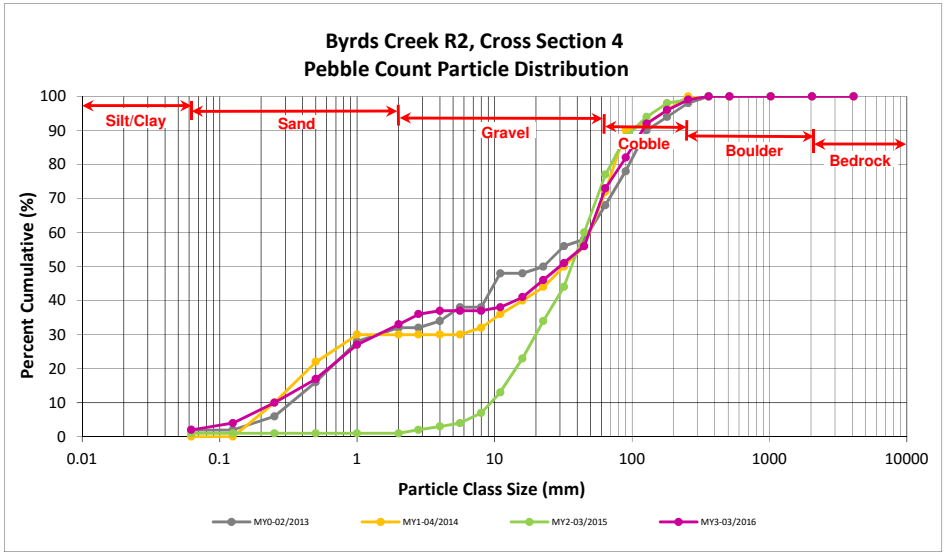
DMS Project No. 95020

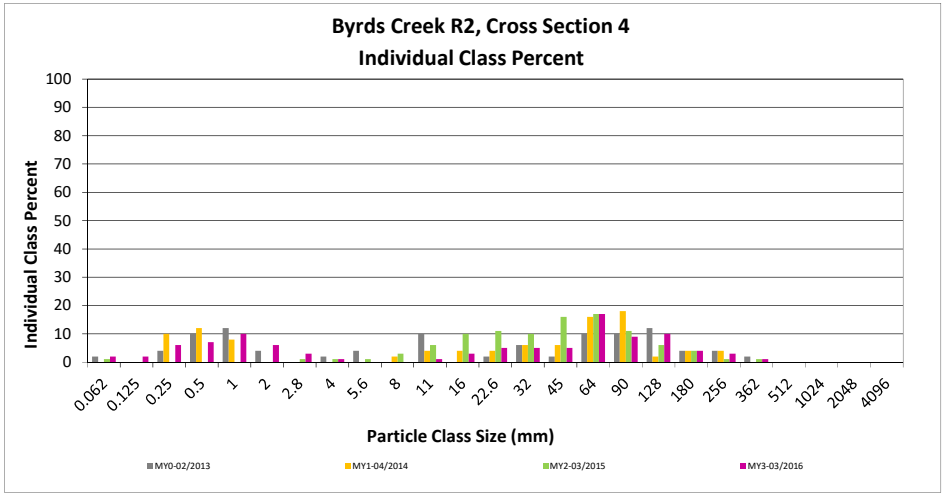
Monitoring Year 3 - 2016

Byrds Creek R2, 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	2	2	2
SAND	Very fine	0.062	0.125	2	2	4
	Fine	0.125	0.250	6	6	10
	Medium	0.25	0.50	7	7	17
	Coarse	0.5	1.0	10	10	27
	Very Coarse	1.0	2.0	6	6	33
GRAVEL	Very Fine	2.0	2.8	3	3	36
	Very Fine	2.8	4.0	1	1	37
	Fine	4.0	5.6			37
	Fine	5.6	8.0			37
	Medium	8.0	11.0	1	1	38
	Medium	11.0	16.0	3	3	41
	Coarse	16.0	22.6	5	5	46
	Coarse	22.6	32	5	5	51
	Very Coarse	32	45	5	5	56
	Very Coarse	45	64	17	17	73
COBBLE	Small	64	90	9	9	82
	Small	90	128	10	10	92
	Large	128	180	4	4	96
	Large	180	256	3	3	99
BOULDER	Small	256	362	1	1	100
	Small	362	512			100
	Medium	512	1024			100
	Large/Very Large	1024	2048			100
BEDROCK	Bedrock	2048	>2048			100
			Total	**100**	**100**	**100**

Cross Section 4	
Channel materials (mm)	
D_{16} =	0.45
D_{35} =	2.50
D_{50} =	29.8
D_{84} =	96.6
D_{95} =	165.3
D_{100} =	362.0





Reachwide and Cross Section Pebble Count Plots

Byrds Creek Mitigation Project

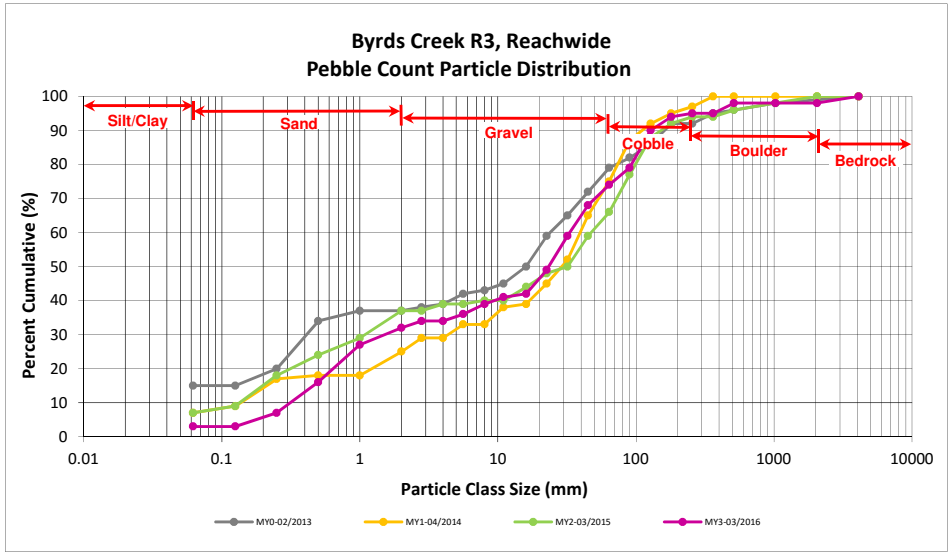
DMS Project No. 95020

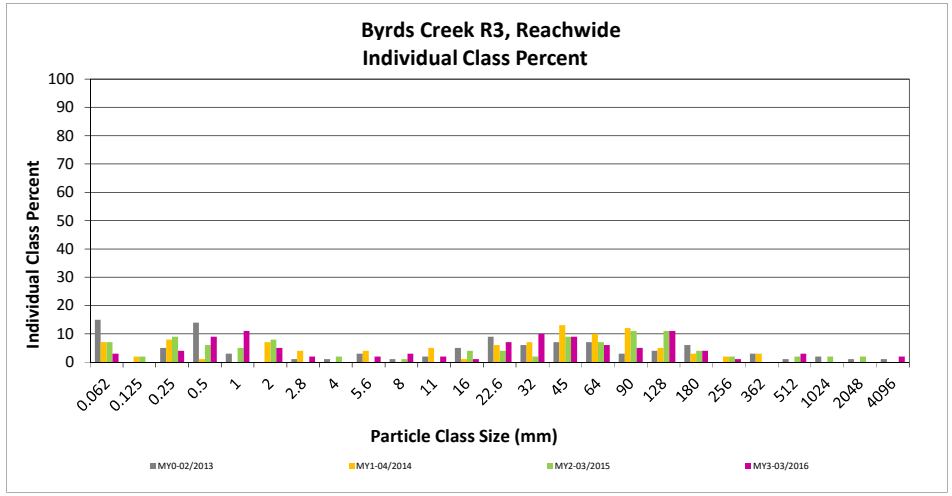
Monitoring Year 3 - 2016

Byrds Creek 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	2	1	3	3	3
SAND	Very fine	0.062	0.125					3
	Fine	0.125	0.250	2	2	4	4	7
	Medium	0.25	0.50	3	6	9	9	16
	Coarse	0.5	1.0	1	10	11	11	27
	Very Coarse	1.0	2.0	1	4	5	5	32
GRAVEL	Very Fine	2.0	2.8		2	2	2	34
	Very Fine	2.8	4.0					34
	Fine	4.0	5.6	1	1	2	2	36
	Fine	5.6	8.0	2	1	3	3	39
	Medium	8.0	11.0		2	2	2	41
	Medium	11.0	16.0	1		1	1	42
	Coarse	16.0	22.6	2	5	7	7	49
	Coarse	22.6	32	6	4	10	10	59
	Very Coarse	32	45	3	6	9	9	68
	Very Coarse	45	64	2	4	6	6	74
COBBLE	Small	64	90	5		5	5	79
	Small	90	128	9	2	11	11	90
	Large	128	180	4		4	4	94
	Large	180	256	1		1	1	95
BOULDER	Small	256	362					95
	Small	362	512	3		3	3	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} =	0.50
D_{35} =	4.73
D_{50} =	23.4
D_{84} =	105.6
D_{95} =	256.0
D_{100} =	>2048





Reachwide and Cross Section Pebble Count Plots

Byrds Creek Mitigation Project

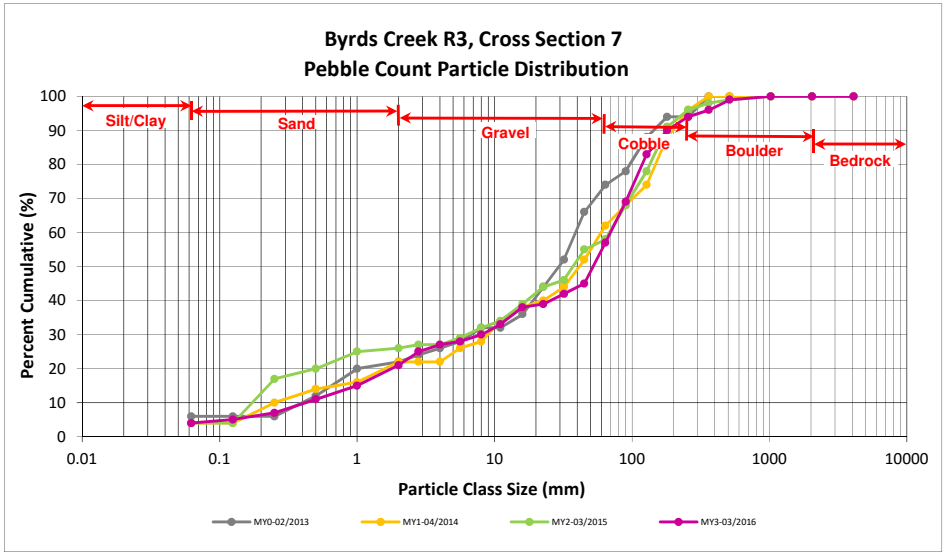
DMS Project No. 95020

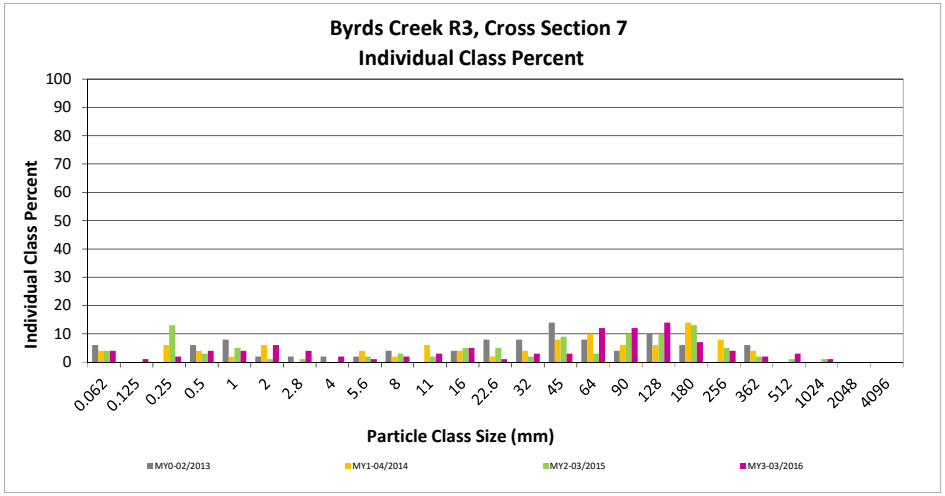
Monitoring Year 3 - 2016

Byrds Creek R3, Cross Section 7

Particle Class		Diameter (mm)		Riffle 100-Count	Summary	
		min	max		Class Percentage	Percent Cumulative
SILT/CLAY	Silt/Clay	0.000	0.062	4	4	4
SAND	Very fine	0.062	0.125	1	1	5
	Fine	0.125	0.250	2	2	7
	Medium	0.25	0.50	4	4	11
	Coarse	0.5	1.0	4	4	15
	Very Coarse	1.0	2.0	6	6	21
GRAVEL	Very Fine	2.0	2.8	4	4	25
	Very Fine	2.8	4.0	2	2	27
	Fine	4.0	5.6	1	1	28
	Fine	5.6	8.0	2	2	30
	Medium	8.0	11.0	3	3	33
	Medium	11.0	16.0	5	5	38
	Coarse	16.0	22.6	1	1	39
	Coarse	22.6	32	3	3	42
	Very Coarse	32	45	3	3	45
	Very Coarse	45	64	12	12	57
COBBLE	Small	64	90	12	12	69
	Small	90	128	14	14	83
	Large	128	180	7	7	90
	Large	180	256	4	4	94
BOULDER	Small	256	362	2	2	96
	Small	362	512	3	3	99
	Medium	512	1024	1	1	100
	Large/Very Large	1024	2048			100
BEDROCK	Bedrock	2048	>2048			100
			Total	**100**	**100**	**100**

Cross Section 7	
Channel materials (mm)	
D_{16} =	1.12
D_{35} =	12.78
D_{50} =	52.1
D_{84} =	134.4
D_{95} =	304.4
D_{100} =	1024.0





Reachwide and Cross Section Pebble Count Plots

Byrds Creek Mitigation Project

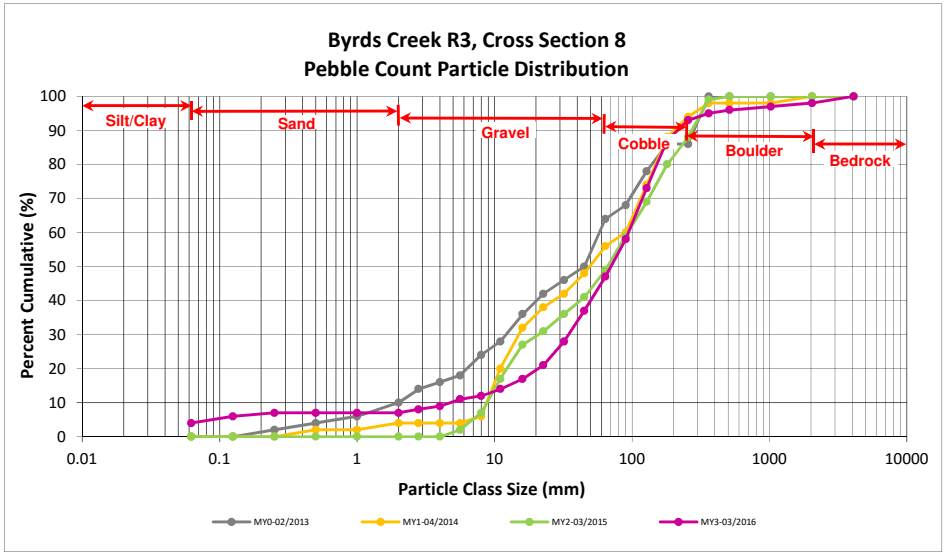
DMS Project No. 95020

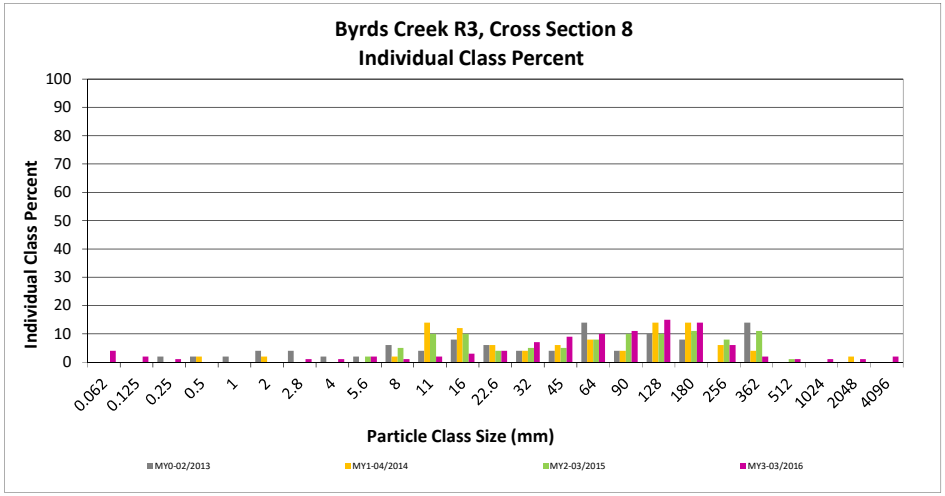
Monitoring Year 3 - 2016

Byrds Creek R3, Cross Section 8

Particle Class		Diameter (mm)		Riffle 100-Count	Summary	
		min	max		Class Percentage	Percent Cumulative
SILT/CLAY	Silt/Clay	0.000	0.062	4	4	4
SAND	Very fine	0.062	0.125	2	2	6
	Fine	0.125	0.250	1	1	7
	Medium	0.25	0.50			7
	Coarse	0.5	1.0			7
	Very Coarse	1.0	2.0			7
GRAVEL	Very Fine	2.0	2.8	1	1	8
	Very Fine	2.8	4.0	1	1	9
	Fine	4.0	5.6	2	2	11
	Fine	5.6	8.0	1	1	12
	Medium	8.0	11.0	2	2	14
	Medium	11.0	16.0	3	3	17
	Coarse	16.0	22.6	4	4	21
	Coarse	22.6	32	7	7	28
	Very Coarse	32	45	9	9	37
	Very Coarse	45	64	10	10	47
COBBLE	Small	64	90	11	11	58
	Small	90	128	15	15	73
	Large	128	180	14	14	87
	Large	180	256	6	6	93
BOULDER	Small	256	362	2	2	95
	Small	362	512	1	1	96
	Medium	512	1024	1	1	97
	Large/Very Large	1024	2048	1	1	98
BEDROCK	Bedrock	2048	>2048	2	2	100
			Total	**100**	**100**	**100**

Cross Section 8	
Channel materials (mm)	
D_{16} =	14.12
D_{35} =	41.72
D_{50} =	70.2
D_{84} =	167.3
D_{95} =	362.0
D_{100} =	>2048





Reachwide and Cross Section Pebble Count Plots

Byrds Creek Mitigation Project

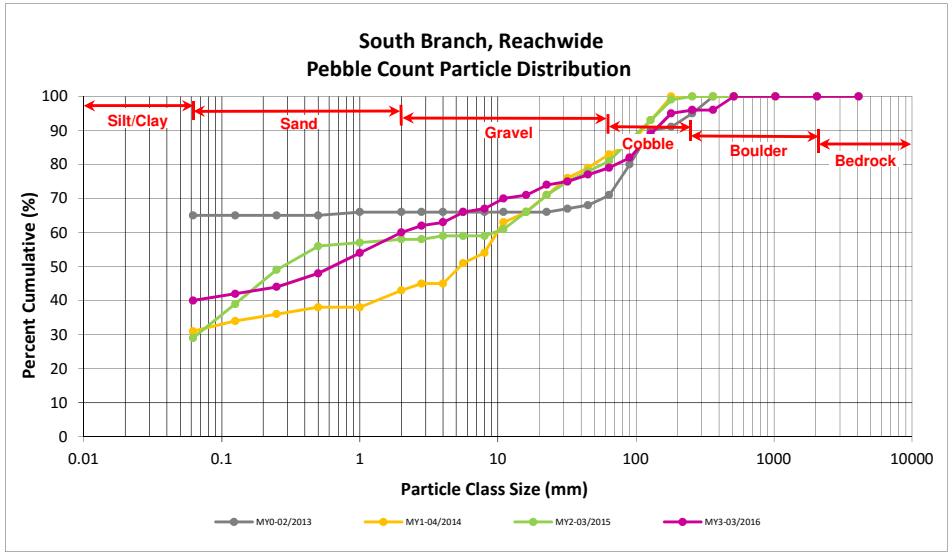
DMS Project No. 95020

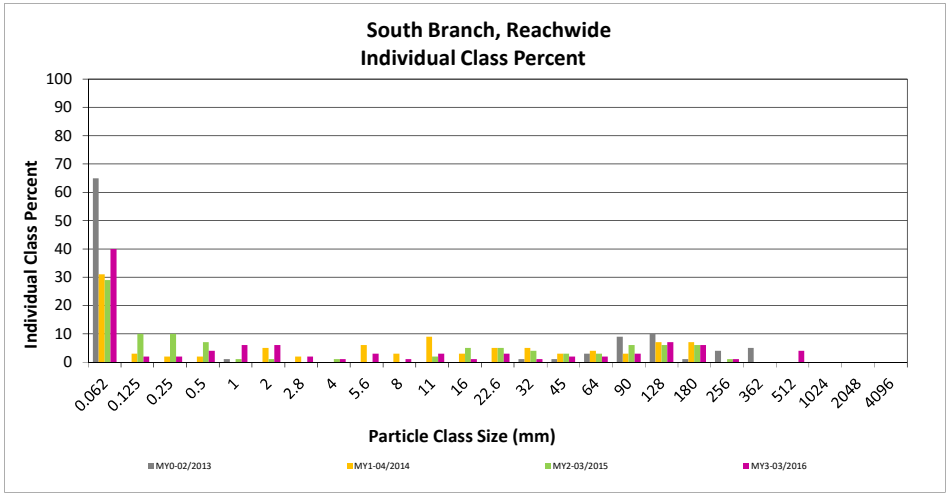
Monitoring Year 3 - 2016

South Branch, Reachwide

Particle Class		Diameter (mm)		Particle Count			Reach Summary	
		min	max	Riffle	Pool	Total	Class Percentage	Percent Cumulative
SILT/CLAY	Silt/Clay	0.000	0.062	10	30	40	40	40
SAND	Very fine	0.062	0.125		2	2	2	42
	Fine	0.125	0.250	1	1	2	2	44
	Medium	0.25	0.50	1	3	4	4	48
	Coarse	0.5	1.0	2	4	6	6	54
	Very Coarse	1.0	2.0	2	4	6	6	60
GRAVEL	Very Fine	2.0	2.8		2	2	2	62
	Very Fine	2.8	4.0	1		1	1	63
	Fine	4.0	5.6	1	2	3	3	66
	Fine	5.6	8.0		1	1	1	67
	Medium	8.0	11.0	2	1	3	3	70
	Medium	11.0	16.0	1		1	1	71
	Coarse	16.0	22.6	3		3	3	74
	Coarse	22.6	32	1		1	1	75
	Very Coarse	32	45	2		2	2	77
	Very Coarse	45	64	2		2	2	79
COBBLE	Small	64	90	3		3	3	82
	Small	90	128	7		7	7	89
	Large	128	180	6		6	6	95
	Large	180	256	1		1	1	96
BOULDER	Small	256	362					96
	Small	362	512	4		4	4	100
	Medium	512	1024					100
	Large/Very Large	1024	2048					100
BEDROCK	Bedrock	2048	>2048					100
			Total	**50**	**50**	**100**	**100**	**100**

Reachwide	
Channel materials (mm)	
D_{16} =	Silt/Clay
D_{35} =	Silt/Clay
D_{50} =	0.6
D_{84} =	99.5
D_{95} =	180.0
D_{100} =	512.0





Reachwide and Cross Section Pebble Count Plots

Byrds Creek Mitigation Project

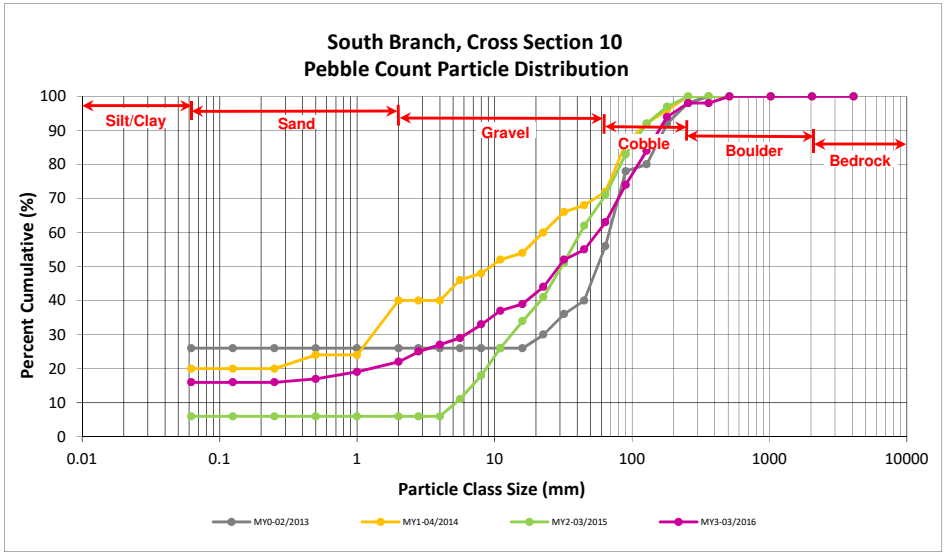
DMS Project No. 95020

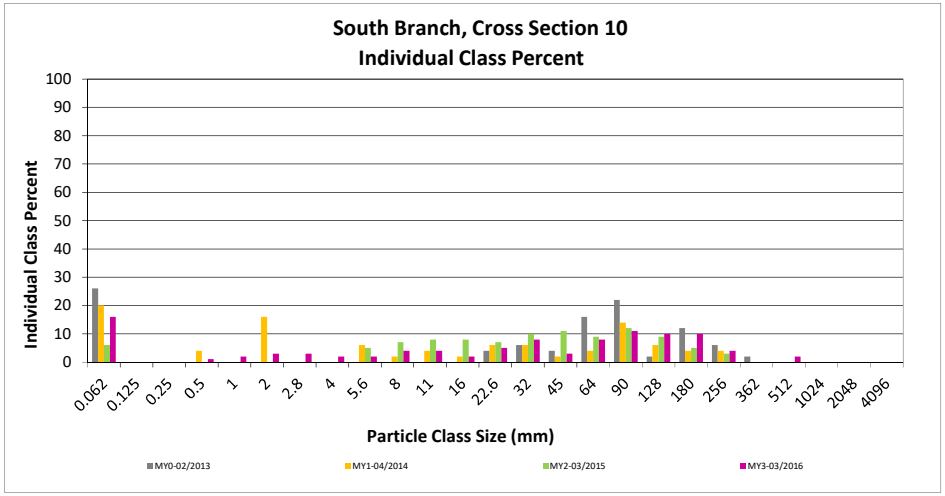
Monitoring Year 3 - 2016

South Branch, Cross Section 10

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	16	16	16
SAND	Very fine	0.062	0.125			16
	Fine	0.125	0.250			16
	Medium	0.25	0.50	1	1	17
	Coarse	0.5	1.0	2	2	19
	Very Coarse	1.0	2.0	3	3	22
GRAVEL	Very Fine	2.0	2.8	3	3	25
	Very Fine	2.8	4.0	2	2	27
	Fine	4.0	5.6	2	2	29
	Fine	5.6	8.0	4	4	33
	Medium	8.0	11.0	4	4	37
	Medium	11.0	16.0	2	2	39
	Coarse	16.0	22.6	5	5	44
	Coarse	22.6	32	8	8	52
	Very Coarse	32	45	3	3	55
	Very Coarse	45	64	8	8	63
COBBLE	Small	64	90	11	11	74
	Small	90	128	10	10	84
	Large	128	180	10	10	94
	Large	180	256	4	4	98
BOULDER	Small	256	362			98
	Small	362	512	2	2	100
	Medium	512	1024			100
	Large/Very Large	1024	2048			100
BEDROCK	Bedrock	2048	>2048			100
			Total	**100**	**100**	**100**

Cross Section 10	
Channel materials (mm)	
D_{16} =	Silt/Clay
D_{35} =	9.38
D_{50} =	29.3
D_{84} =	128.0
D_{95} =	196.6
D_{100} =	512.0





Reachwide and Cross Section Pebble Count Plots

Byrds Creek Mitigation Project

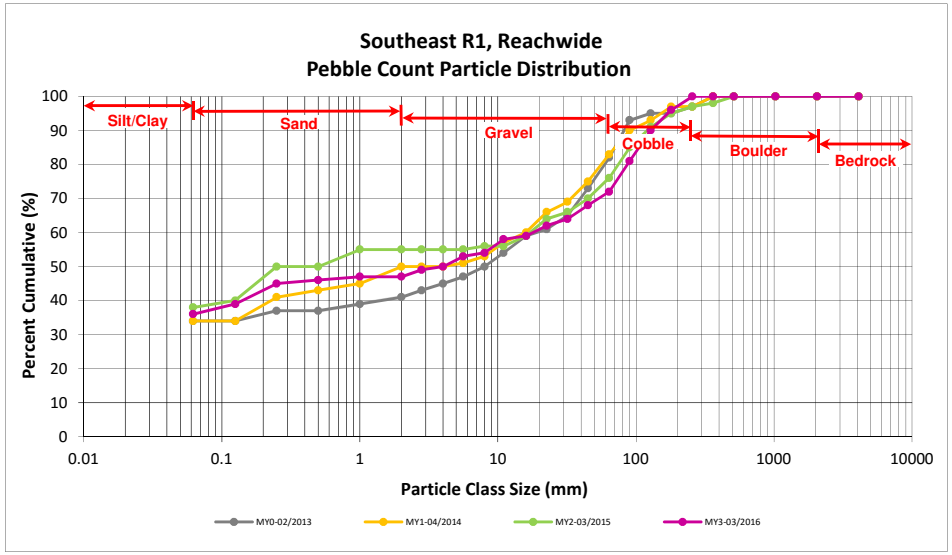
DMS Project No. 95020

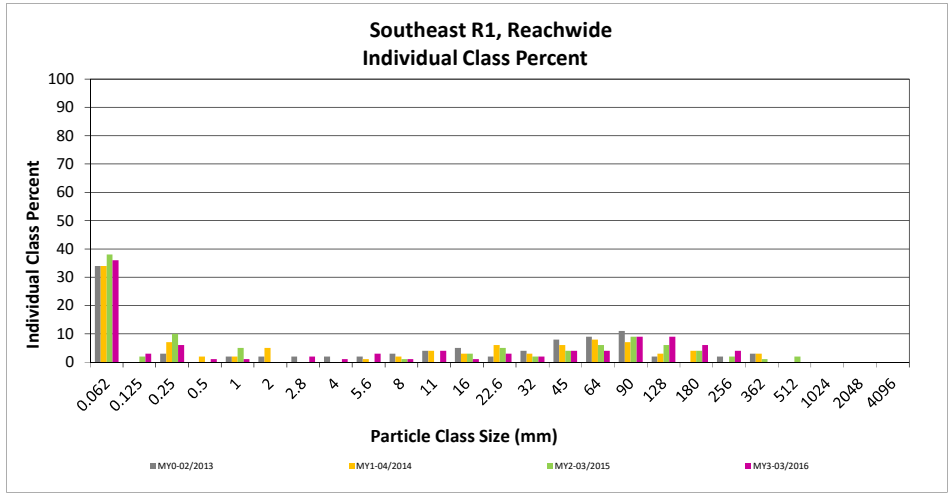
Monitoring Year 3 - 2016

Southeast 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	9	27	36	36	36
SAND	Very fine	0.062	0.125		3	3	3	39
	Fine	0.125	0.250	2	4	6	6	45
	Medium	0.25	0.50		1	1	1	46
	Coarse	0.5	1.0		1	1	1	47
	Very Coarse	1.0	2.0					47
GRAVEL	Very Fine	2.0	2.8		2	2	2	49
	Very Fine	2.8	4.0		1	1	1	50
	Fine	4.0	5.6	1	2	3	3	53
	Fine	5.6	8.0		1	1	1	54
	Medium	8.0	11.0	1	3	4	4	58
	Medium	11.0	16.0		1	1	1	59
	Coarse	16.0	22.6	1	2	3	3	62
	Coarse	22.6	32	1	1	2	2	64
	Very Coarse	32	45	4		4	4	68
	Very Coarse	45	64	4		4	4	72
COBBLE	Small	64	90	8	1	9	9	81
	Small	90	128	9		9	9	90
	Large	128	180	6		6	6	96
	Large	180	256	4		4	4	100
BOULDER	Small	256	362					100
	Small	362	512					100
	Medium	512	1024					100
	Large/Very Large	1024	2048					100
BEDROCK	Bedrock	2048	>2048					100
			Total	**50**	**50**	**100**	**100**	**100**

Reachwide	
Channel materials (mm)	
D_{16} =	Silt/Clay
D_{35} =	Silt/Clay
D_{50} =	4.0
D_{84} =	101.2
D_{95} =	170.1
D_{100} =	256.0





Reachwide and Cross Section Pebble Count Plots

Byrds Creek Mitigation Project

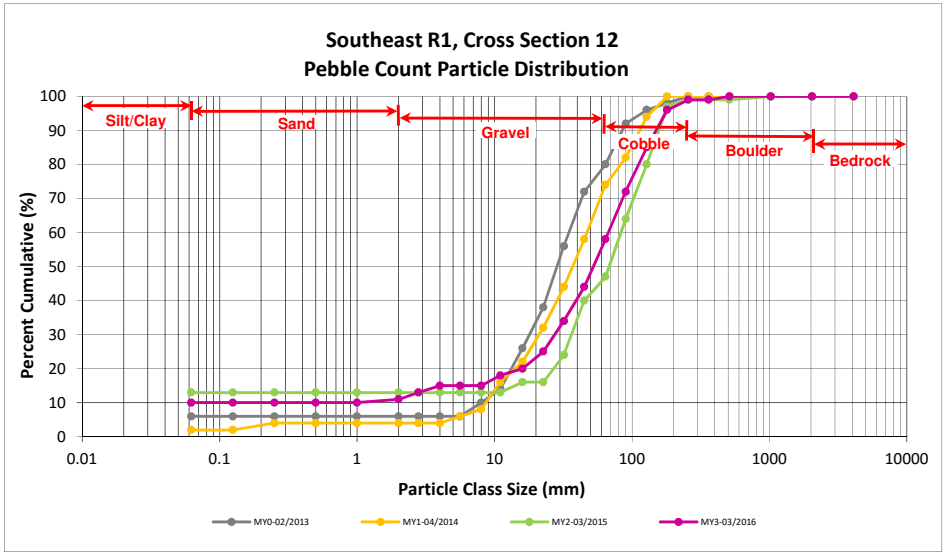
DMS Project No. 95020

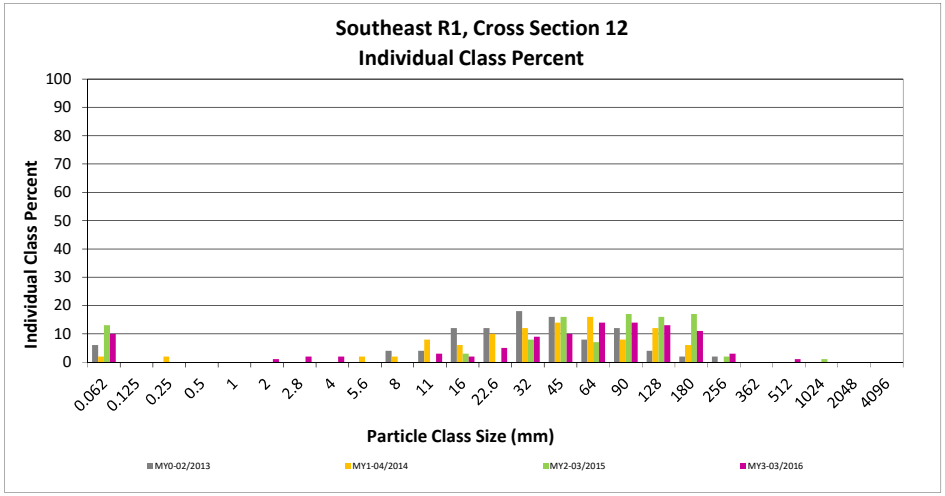
Monitoring Year 3 - 2016

Southeast R1, Cross Section 12

Particle Class		Diameter (mm)		Riffle 100-Count	Summary	
		min	max		Class Percentage	Percent Cumulative
SILT/CLAY	Silt/Clay	0.000	0.062	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	1	1	11
GRAVEL	Very Fine	2.0	2.8	2	2	13
	Very Fine	2.8	4.0	2	2	15
	Fine	4.0	5.6			15
	Fine	5.6	8.0			15
	Medium	8.0	11.0	3	3	18
	Medium	11.0	16.0	2	2	20
	Coarse	16.0	22.6	5	5	25
	Coarse	22.6	32	9	9	34
	Very Coarse	32	45	10	10	44
	Very Coarse	45	64	14	14	58
COBBLE	Small	64	90	14	14	72
	Small	90	128	13	13	85
	Large	128	180	11	11	96
	Large	180	256	3	3	99
BOULDER	Small	256	362			99
	Small	362	512	1	1	100
	Medium	512	1024			100
	Large/Very Large	1024	2048			100
BEDROCK	Bedrock	2048	>2048			100
			Total	**100**	**100**	**100**

Cross Section 12	
Channel materials (mm)	
D_{16} =	8.90
D_{35} =	33.11
D_{50} =	52.3
D_{84} =	124.6
D_{95} =	174.5
D_{100} =	512.0





Reachwide and Cross Section Pebble Count Plots

Byrds Creek Mitigation Project

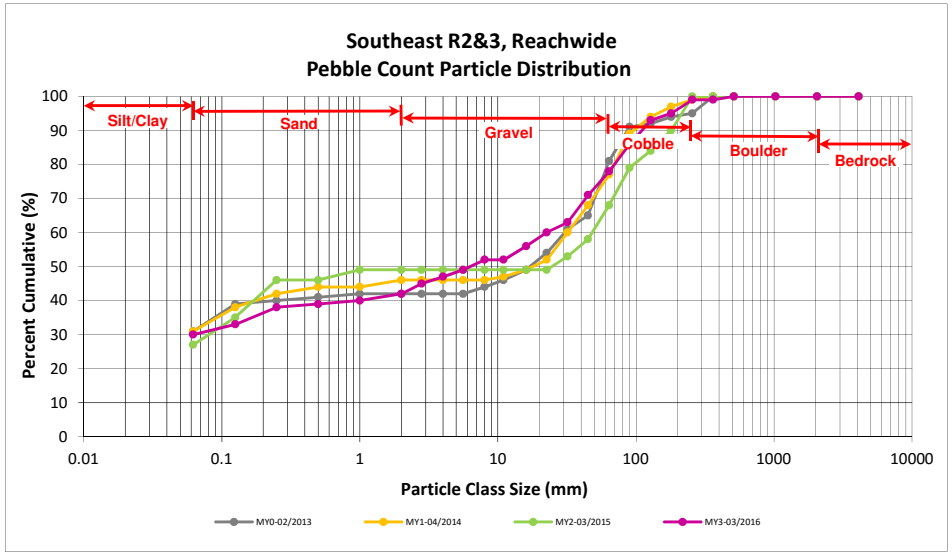
DMS Project No. 95020

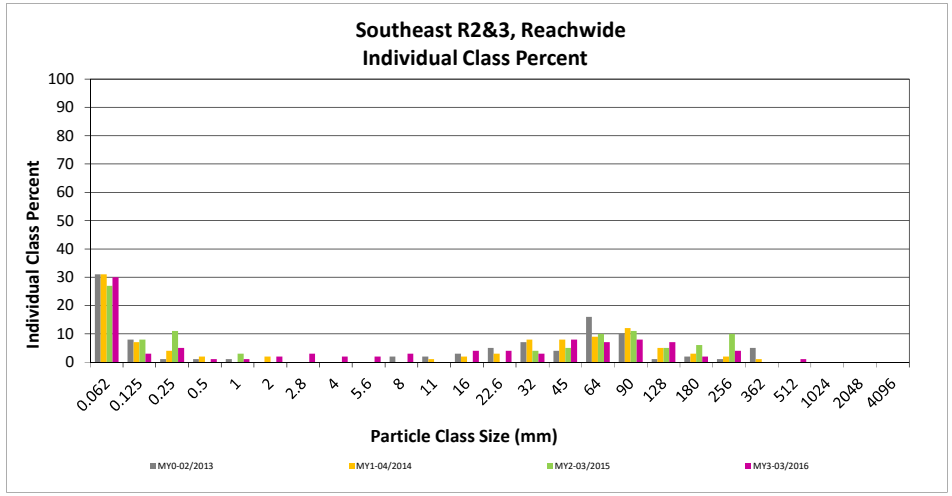
Monitoring Year 3 - 2016

Southeast R2&3, 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	6	24	30	30	30
SAND	Very fine	0.062	0.125		3	3	3	33
	Fine	0.125	0.250	1	4	5	5	38
	Medium	0.25	0.50		1	1	1	39
	Coarse	0.5	1.0		1	1	1	40
	Very Coarse	1.0	2.0	1	1	2	2	42
GRAVEL	Very Fine	2.0	2.8	1	2	3	3	45
	Very Fine	2.8	4.0		2	2	2	47
	Fine	4.0	5.6	1	1	2	2	49
	Fine	5.6	8.0	1	2	3	3	52
	Medium	8.0	11.0					52
	Medium	11.0	16.0	4		4	4	56
	Coarse	16.0	22.6	2	2	4	4	60
	Coarse	22.6	32	2	1	3	3	63
	Very Coarse	32	45	7	1	8	8	71
	Very Coarse	45	64	5	2	7	7	78
COBBLE	Small	64	90	6	2	8	8	86
	Small	90	128	7		7	7	93
	Large	128	180	2		2	2	95
	Large	180	256	4		4	4	99
BOULDER	Small	256	362					99
	Small	362	512		1	1	1	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} =	0.16
D_{50} =	6.3
D_{84} =	82.6
D_{95} =	180.0
D_{100} =	512.0





Reachwide and Cross Section Pebble Count Plots

Byrds Creek Mitigation Project

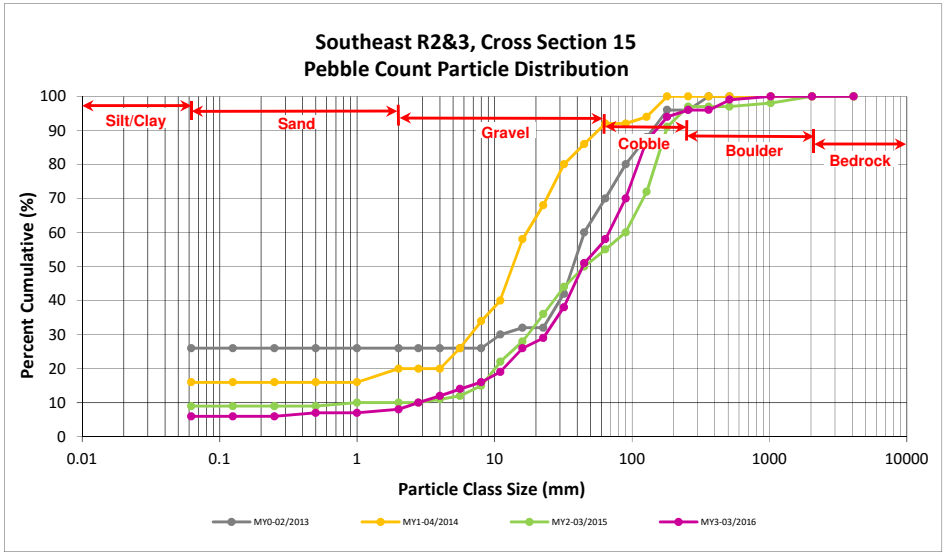
DMS Project No. 95020

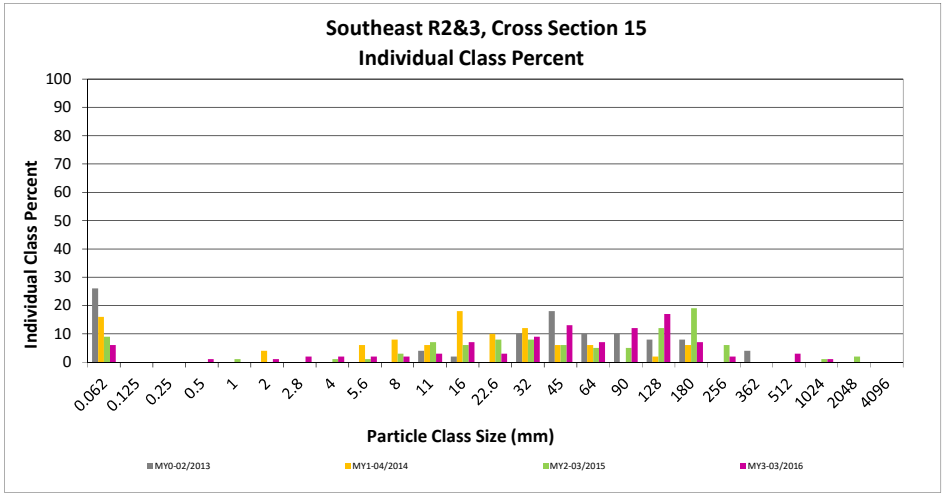
Monitoring Year 3 - 2016

Southeast R2&3, Cross Section 15

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	1	1	7
	Coarse	0.5	1.0			7
	Very Coarse	1.0	2.0	1	1	8
GRAVEL	Very Fine	2.0	2.8	2	2	10
	Very Fine	2.8	4.0	2	2	12
	Fine	4.0	5.6	2	2	14
	Fine	5.6	8.0	2	2	16
	Medium	8.0	11.0	3	3	19
	Medium	11.0	16.0	7	7	26
	Coarse	16.0	22.6	3	3	29
	Coarse	22.6	32	9	9	38
	Very Coarse	32	45	13	13	51
	Very Coarse	45	64	7	7	58
COBBLE	Small	64	90	12	12	70
	Small	90	128	17	17	87
	Large	128	180	7	7	94
	Large	180	256	2	2	96
BOULDER	Small	256	362			96
	Small	362	512	3	3	99
	Medium	512	1024	1	1	100
	Large/Very Large	1024	2048			100
BEDROCK	Bedrock	2048	>2048			100
			Total	**100**	**100**	**100**

Cross Section 15	
Channel materials (mm)	
D_{16} =	8.00
D_{35} =	28.50
D_{50} =	43.8
D_{84} =	120.3
D_{95} =	214.7
D_{100} =	1024.0





APPENDIX 5. Hydrology Summary Data and Plots

Table 13. Verification of Bankfull Events
Byrds Creek Mitigation Site (DMS Project No. 95020)
Monitoring Year 3 - 2016

Reach	Date of Data Collection	Approximate Date of Occurrence	Method
Byrds Creek	3/1/2016	2/16/2016	Crest Gage / Pressure Transducer
	8/15/2016	8/5/2016	
South Branch	3/1/2016	2/16/2016	
	8/15/2016	8/5/2016	
Southeast Branch	3/1/2016	2/16/2016	
	8/15/2016	8/5/2016	