

# **Russell Gap Stream Mitigation Project Year 1 (2020) Monitoring Report FINAL**

DMS Project ID No. 100003, DEQ Contract No. 6980

USACE Action ID No. SAW-2017-00826, DWR# 20150416

Alexander County, North Carolina, Catawba River Basin: 03050101-120010

MY1 Data Collection Period: September – November 2020



Submitted to/Prepared for:

NC Department of Environmental Quality  
Division of Mitigation Services (DMS)  
1652 Mail Service Center  
Raleigh, North Carolina 27699-1652

**Michael Baker**

**INTERNATIONAL**

Submission Date: December 2020

 *This document was printed using 30% recycled paper.*

Mitigation Project Name Russell Gap  
 DMS ID 100003  
 River Basin Catawba  
 Cataloging Unit 03050101  
 County Alexander

USACE Action ID 2015-00826  
 DWR Permit 2015-0416  
 Date Project Instituted 9/15/2016  
 Stream/Wet. Service Area Catawba 03050101  
 Date Printed 9/14/2020

BROWNING.KIMBERLY.DANIELLE.1527683510 Digitally signed by BROWNING.KIMBERLY.DANIELLE.1527683510  
 Date: 2020.10.06 08:35:35 -04'00'

Signature of Official Approving Credit Release

Credit Release Milestone	Warm Stream Credits						
Project Credits	Scheduled Releases %	Estimated Scheduled Release #	Proposed Released #	Not Approved # Releases	Approved Credits	Anticipated Release Year	Actual Release Date
1 - Site Establishment	N/A	N/A	N/A	N/A	N/A	N/A	N/A
2 - Year 0 / As-Built	30.00%	2,750.085	2,750.085	0.000	2,750.085	2020	9/14/2020
3 - Year 1 Monitoring	10.00%	916.695				2021	
4 - Year 2 Monitoring	10.00%	916.695				2022	
5 - Year 3 Monitoring	10.00%	916.695				2023	
6 - Year 4 Monitoring	5.00%	458.347				2024	
7 - Year 5 Monitoring	10.00%	916.695				2025	
8 - Year 6 Monitoring	5.00%	458.347				2026	
9 - Year 7 Monitoring	10.00%	916.695				2027	
Stream Bankfull Standard	10.00%	916.695				2022	
				<b>Totals</b>	2,750.085		

Total Gross Credits	9,166.949
Total Unrealized Credits to Date	0.000
Total Released Credits to Date	2,750.085
Total Percentage Released	30.00%
Remaining Unreleased Credits	6,416.864

Credit Release Milestone	Riparian Credits						
Project Credits	Scheduled Releases %	Estimated Scheduled Release #	Proposed Released #	Not Approved # Releases	Approved Credits	Anticipated Release Year	Actual Release Date
1 - Site Establishment	N/A	N/A	N/A	N/A	N/A	N/A	N/A
2 - Year 0 / As-Built	30.00%	2.116	2.116	0.000	2.116	2020	9/14/2020
3 - Year 1 Monitoring	10.00%	0.705				2021	
4 - Year 2 Monitoring	10.00%	0.705				2022	
5 - Year 3 Monitoring	15.00%	1.058				2023	
6 - Year 4 Monitoring	5.00%	0.353				2024	
7 - Year 5 Monitoring	15.00%	1.058				2025	
8 - Year 6 Monitoring	5.00%	0.353				2026	
9 - Year 7 Monitoring	10.00%	0.705				2027	
Stream Bankfull Standard	N/A	N/A	N/A	N/A	N/A	N/A	N/A
				<b>Totals</b>	2.116		

Total Gross Credits	7.053
Total Unrealized Credits to Date	0.000
Total Released Credits to Date	2.116
Total Percentage Released	30.00%
Remaining Unreleased Credits	4.937

January 7, 2021

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

**Subject:** Response to DMS Comments for DRAFT MY1 Report  
Russell Gap Mitigation Project, Alexander County  
DMS Project # 100003, DEQ Contract #6980, Catawba River Basin

Mr. Reid:

Please find enclosed our responses to the NC Division of Mitigation Services (DMS) review comments dated December 11, 2020 in reference to the Russell Gap Mitigation Project - DRAFT MY1 Report. We have revised the draft document in response to the review comments as outlined below.

**Report Comments/Questions:**

- Please include discussion regarding wetland performance and flow gauge performance in Section 1.4 Monitoring Results and Project Performance.  
**Response: Revision made as requested.**
- While no vegetation problem areas were identified, please acknowledge this and include short discussion of VPA including invasive species, bare areas, areas of poor growth, etc. in section 1.4.  
**Response: Revision made as requested.**
- A total of 81.4 inches of rainfall was observed for the project. Please include what station was used for this measurement and also add in Section 1.5 Technical and Methodological Descriptions.  
**Response: Revision made as requested.**
- CCPV: Previous Random Veg Plots are shown on the CCPV. Please turn off and only show the Random Plots from MY1.  
**Response: Revision made as requested.**
- Table 5: All streams are functioning at 100% based on the metrics measured by Table 5. This is impressive for a site of this size and considering the numerous storm events the region experienced this year. This will likely raise questions during the 2021 Credit Release Meeting. Please be prepared to discuss this at the meeting.  
**Response: At the time of monitoring no Stream Problem Areas were documented. We will be prepared to discuss this at the 2021 Credit Release Meeting.**
- Table 6: Please fill out the top of the table. It is currently blank and appears that it may have been neglected. NA, 0 and 0.0% is adequate if there is nothing to note.  
**Response: Revision made as requested.**

- Cross-section plots: Please turn off markers for Asbuilt data and only show markers for current monitoring year data.  
**Response: Revision made as requested.**
- Table 8: Please add grid lines to aid in reviewing report.  
**Response: Revision made as requested.**
- Wetland Monitoring Well Graphs: Consider adding a note indicating the hydroperiod performance criteria that was approved in the Mitigation plan of “12% of 234 is 28 days” or something similar.  
**Response: Revision made as requested.**
- Flow Gauge Graphs: The note for the Daily Rain portion indicates data is from onsite gauge from the Browns Summit site. Please revise.  
**Response: Revision made as requested.**
- Figure 7: Please use bars for the “Observed Project Rainfall”.  
**Response: Revision made as requested.**
- Figure 7: Please specify what weather station(s) was used to compile data.  
**Response: Revision made as requested.**

**Electronic Deliverables:**

- Please submit random veg plots as polygons.  
**Response: Random veg plots have been included as polygons.**
- Please include photos as jpegs in the final submittal.  
**Response: Microsoft Word versions of photo logs containing jpeg files have been included.**
- Please submit the data that supports the groundwater gauge and surface water gauge figures, including the precipitation data.  
**Response: Raw data from groundwater, flow gauges, and rain data have been included.**
- If available, please submit features that characterize the mitigation plan design lengths.  
**Response: Mitigation plan design lengths were derived from AUTO CADD provided when the mitigation plan was submitted.**

As requested, Michael Baker has provided one (1) hardcopy of the FINAL report, and the updated e-submission digital files will be sent via secure ftp link. A full final electronic copy with electronic support files have been included on a USB drive. Please do not hesitate to contact me (Jason.york@mbakerintl.com 828-412-6101) should you have any questions regarding our response submittal.

Sincerely,

Jason York  
Environmental Scientist



Enclosure: Final MY1 Report Russell Gap Mitigation Project

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## 1.0 PROJECT SUMMARY

### 1.1 Project Description

Michael Baker Engineering, Inc. (Michael Baker) restored approximately 4,209 linear feet of existing stream, enhanced 8,857 linear feet of stream along Unnamed Tributaries (UTs) to Davis Creek, the East Prong Lower Little River, and UTs to the East Prong Lower Little River. Michael Baker also restored and/or enhance approximately 7.3 acres of riparian wetland in the Catawba River Watershed. The project is located in the Catawba River Basin, within the Hydrologic Unit Code (HUC) 03050101-120010, which is identified as a Targeted Local Watershed (TLW) in the NC Division of Mitigation Services' (DMS) 2009 *Upper Catawba River Basin Restoration Priorities* (RBRP) report.

The Russell Gap Stream Mitigation project is located on an active cattle farm in Alexander County, North Carolina, 10 miles northwest of the Town of Taylorsville as shown on the Project Vicinity Map (Figure 1). Historic agriculture uses on the project site include cattle production, row crops, and apple orchards. These activities had negatively impacted both water quality and streambank stability along the project streams and their tributaries (Table 4). The project is being conducted as part of the NCDMS Full Delivery In-Lieu Fee Program and is anticipated to generate at close-out a total of 9,166.949 stream mitigation credits (contracted for 9,400) and up to 7.053 riparian wetland mitigation units (contracted for 4.0) (Table 1) and is protected by a 35.97-acre permanent conservation easement.

### 1.2 Goals and Objectives

The goals of this project are identified below:

- Establishment of geomorphically stable conditions along all project reaches,
- Improvement of water quality by reducing nutrient and sediment inputs,
- Restoration of natural stream and floodplain interactions,
- Restoration and enhancement of riparian wetland functions,
- Restoration and protection of riparian buffer functions and corridor habitat,
- Improvement of in-stream aquatic habitat, and
- Establishment of a permanent conservation easement on the entire project.

To accomplish these goals, the following objectives were identified:

- To restore appropriate bankfull dimensions, remove spoil berms, and/or raise channel beds, by utilizing either a Priority I Restoration approach or an Enhancement Level I approach.
- To construct streams of appropriate dimensions, pattern, and profile in restored reaches, slope stream banks and provide bankfull benches on enhanced streams and utilize bioengineering to provide long-term stability.
- Construct a correct channel morphology to all streams increasing the number and depths of pools, with structures including geo-lifts with brush toe, log vanes/weirs, root wads, and/or J-hooks.
- Raise ground water levels in delineated hydric soils areas through the implementation of Priority I restoration and the filling of ditches. Wetland vegetation will also be planted.
- Establish riparian buffers at a 50-foot minimum width along all stream reaches, planted with native tree and shrub species.
- Establish a permanent conservation easement restricting land use in perpetuity. This will prevent site disturbance and allow the project to mature and stabilize.

### 1.3 Project Success Criteria

The success criteria and performance standards for the project will follow the North Carolina Interagency Review Team (NCIRT) guidance document *Wilmington District Stream and Wetland Compensatory Mitigation Update* dated October 24, 2016 and as described in Section 7 of the approved Mitigation Plan. All specific monitoring activities will follow those outlined in detail in Section 8 of the approved Mitigation Plan and will be conducted for a period of seven years unless otherwise noted. Annual monitoring reports will follow the DMS document *Annual Monitoring Report Format, Data Requirements, and Content Guidance* from April 2015. The performance standards for the riparian buffer assets will be held in accordance with 15A NCAC 02B.0295(n)(2)(B) and 15A NCAC 02B.0295(n)(4), and annual monitoring reports will be submitted at the end of each of the seven monitoring years.

### 1.4 Monitoring Results and Project Performance

The Year 1 monitoring survey data of the twenty-six permanent cross-sections indicates that these stream sections are geomorphically stable and are within the lateral/vertical stability and in-stream structure performance categories. All reaches are stable and performing as designed and are rated at 100 percent for all the parameters evaluated (Table 5 in Appendix B). There were no Stream Problem Areas (SPAs) identified.

During Year 1 monitoring, the planted acreage performance categories were functioning well overall. The planted stems endured longer than usual saturated growing conditions in their first year, with multiple heavy rain events throughout the spring, summer, and fall. However, the average density of total planted stems, based on data collected from the 20 permanent and 9 random monitoring plots for the Year 1 monitoring conducted in October and November 2020 was 621 stems per acre (Table 7 in Appendix C). Thus, the Year 1 vegetation data demonstrate that the Site is on track to meet the minimum success interim criteria of 320 trees per acre by the end of Year 3. No vegetation problem areas (VPAs) were identified as exceeding the reportable mapping threshold of 0.1 acres. Minor areas of poor growth will be supplemental planted and seeded where needed during MY2 at a rate of 200 stems per acre. Scattered stems of privet (*Ligustrum spp.*) and multiflora rose (*Rosa multiflora*) are located throughout the site and will be mechanically removed and/or treated with herbicide during MY2 and future monitoring years.

During Year 1 monitoring, two separate post-construction bankfull events were observed (see Table 10 in Appendix E and the Overbank Photographs in Appendix B). The first occurred on 5/28/20 as documented through photographs of the manual cork crest gauge located on Reach 4 along with post-flood visual evidence such as debris jams, flow scour, and wrack lines in the floodplain. The second event, Hurricane Zeta, occurred on 10/29/20 and 10/30/20 as documented through photographs of the manual cork crest gauges located on Reach 1 and Reach 4, and from visual evidence in the floodplain. Crest gauges located on R6 and R9 did not record an overbank event during MY1.

As the observed monthly rainfall data for the project presented in Figure 6 in Appendix E demonstrates, the past 12 months have varied dramatically as compared to historic average precipitation. A total of 81.4 inches of rainfall was observed for the project, while Alexander County averages 47.2 inches of annual rainfall, an excess of 34.2 inches. All observed project rainfall was collected from the North Carolina Climate Office Weather Climate Database CRONOS station TAYL, located in Taylorsville, NC.

During Year 1 monitoring, the twelve automated groundwater monitoring wells met or exceeded the minimum hydroperiod performance criteria approved in the Mitigation Plan of 12% of the 234-day growing season (28 or more consecutive days). The five automated flow gauges met or exceeded the minimum 30-day performance criteria during MY1.

Summary information/data related to the Site and statistics related to performance of various project and monitoring elements can be found in the tables and figures in the report Appendices. Narrative background and supporting information formerly found in these reports can be found in the Baseline Monitoring Report

and in the Mitigation Plan available on the DMS website. Any raw data supporting the tables and figures in the Appendices is available from DMS upon request.

This report documents the successful completion of the Year 1 monitoring activities for the post-construction monitoring period.

## 1.5 Technical and Methodological Descriptions

Stream survey data was collected to a minimum of Class C Vertical and Class A Horizontal Accuracy using a Leica TS06 Total Station and was georeferenced to the NAD83 State Plane Coordinate System, FIPS3200 in US Survey Feet, which was derived from the MY-1 Survey. The survey data from the permanent project cross-sections were collected and classified using the Rosgen Stream Classification System to confirm design stream type (Rosgen 1994 and 1996).

The twenty permanent and nine annual random vegetation-monitoring quadrants (plots) were installed across the site in accordance with the CVS-DMS Protocol for Recording Vegetation, Version 4.1 (Lee 2007) and the data collected from each was input into the CVS-DMS Data Entry Tool v. 2.3.1 (CVS 2012).

Nine automated groundwater monitoring wells were installed in the floodplain along Reach R1 following USACE protocols (USACE 2005). Three additional groundwater monitoring wells were installed in the floodplain along R9. Flow gauges were installed on R11, R13, R14, R19 and R20. Collective data will document that these intermittent streams continue to exhibit base flow for at least thirty consecutive day throughout each monitoring year. The gauges themselves are all Van Essen DI800 BARO Diver data loggers. Four manual cork crest gauges were installed on R1, R4, R6, and R9.

All observed project rainfall was collected from the North Carolina Climate Office Weather Climate Database CRONOS station TAYL, located in Taylorsville, NC approximately nine miles south of the project at 35.9139, -81.19087.

The specific locations of monitoring features, such as vegetation plots, permanent cross-sections, reference photograph stations, and crest gauges, are shown on the CCPV map found in Appendix B.

## 1.6 References

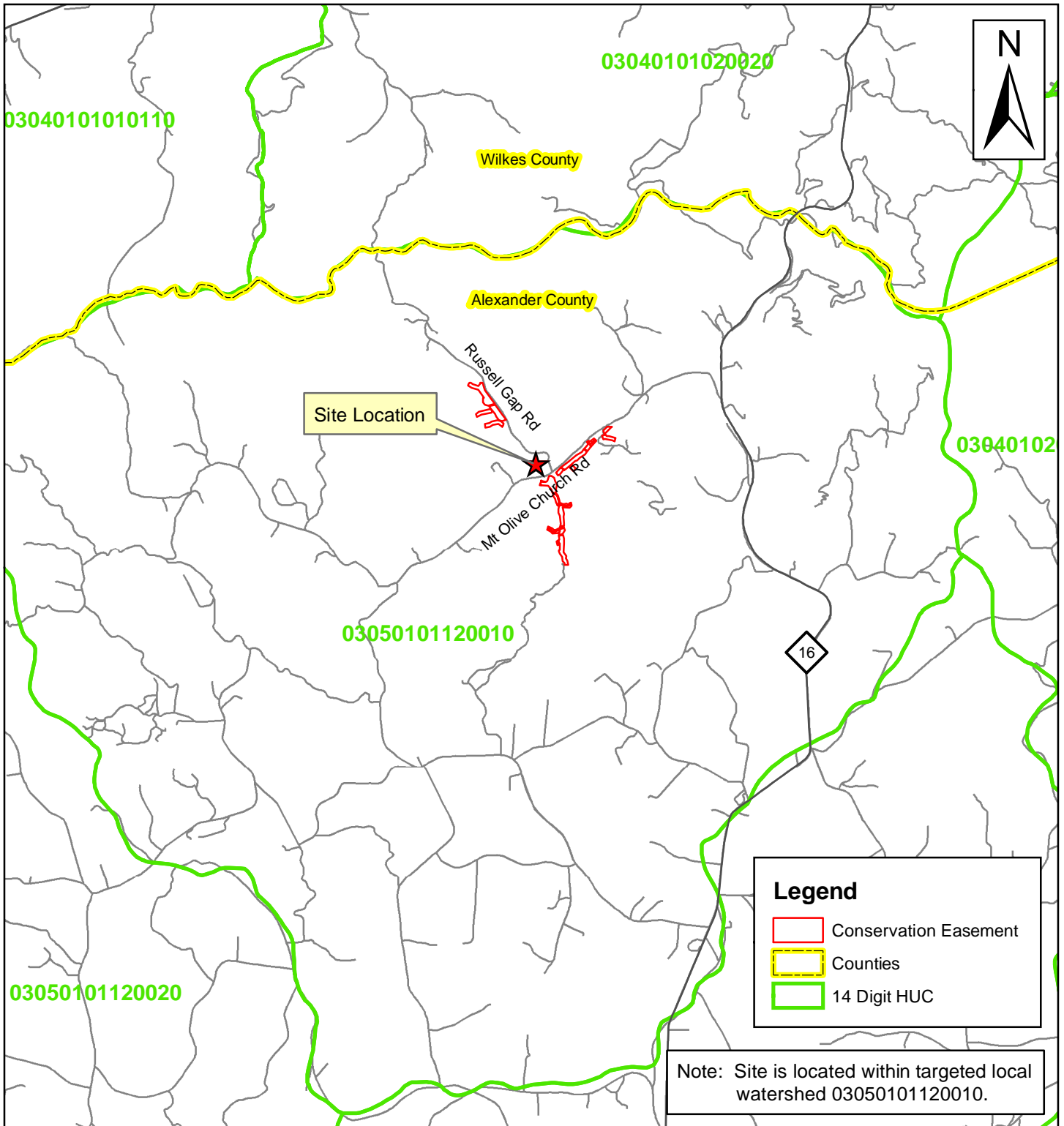
- Carolina Vegetation Survey (CVS) and NC Division of Mitigation Services (DMS). CVS-DMS Data Entry Tool v. 2.3.1. University of North Carolina, Raleigh, NC. 2012.
- Lee, M., Peet R., Roberts, S., Wentworth, T. 2007. CVS-DMS Protocol for Recording Vegetation, Version 4.1.
- North Carolina Division of Mitigation Services. 2010. Neuse River Basin Restoration Priorities. NC Department of Environmental Quality. Raleigh, NC.
- North Carolina Division of Mitigation Services. 2016. Neuse River Basin Restoration Priorities: Neuse-01 Catalog Unit *Update*. NC Department of Environmental Quality. Raleigh, NC.
- North Carolina Division of Mitigation Services. 2017. *Annual Monitoring Report Format, Data Requirements, and Content Guidance June 2017*. NC Department of Environmental Quality. Raleigh, NC.
- North Carolina Interagency Review Team (NCIRT). 2016. Guidance document “*Wilmington District Stream and Wetland Compensatory Mitigation Update*”. October 24, 2016
- Rosgen, D.L. 1994. A Classification of Natural Rivers. *Catena* 22:169-199.
- Rosgen, D.L. 1996. *Applied River Morphology*. Wildlands Hydrology. Pagosa Springs, CO.



United States Army Corps of Engineers (USACE). 2005. "Technical Standard for Water-Table Monitoring of Potential Wetland Sites," WRAP Technical Notes Collection (ERDC TN-WRAP-05-2), U.S. Army Engineer Research and Development Center. Vicksburg, MS.

# **APPENDIX A**

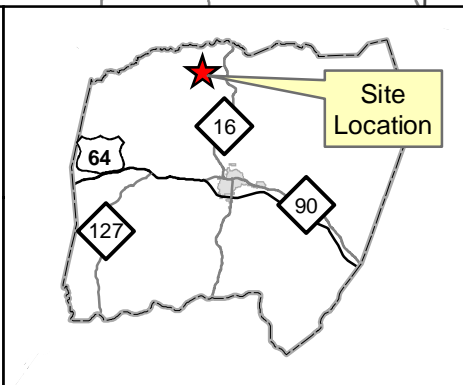
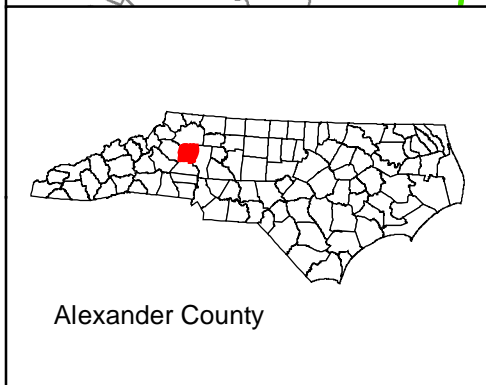
## Background Tables and Figures



**Legend**

- Conservation Easement
- Counties
- 14 Digit HUC

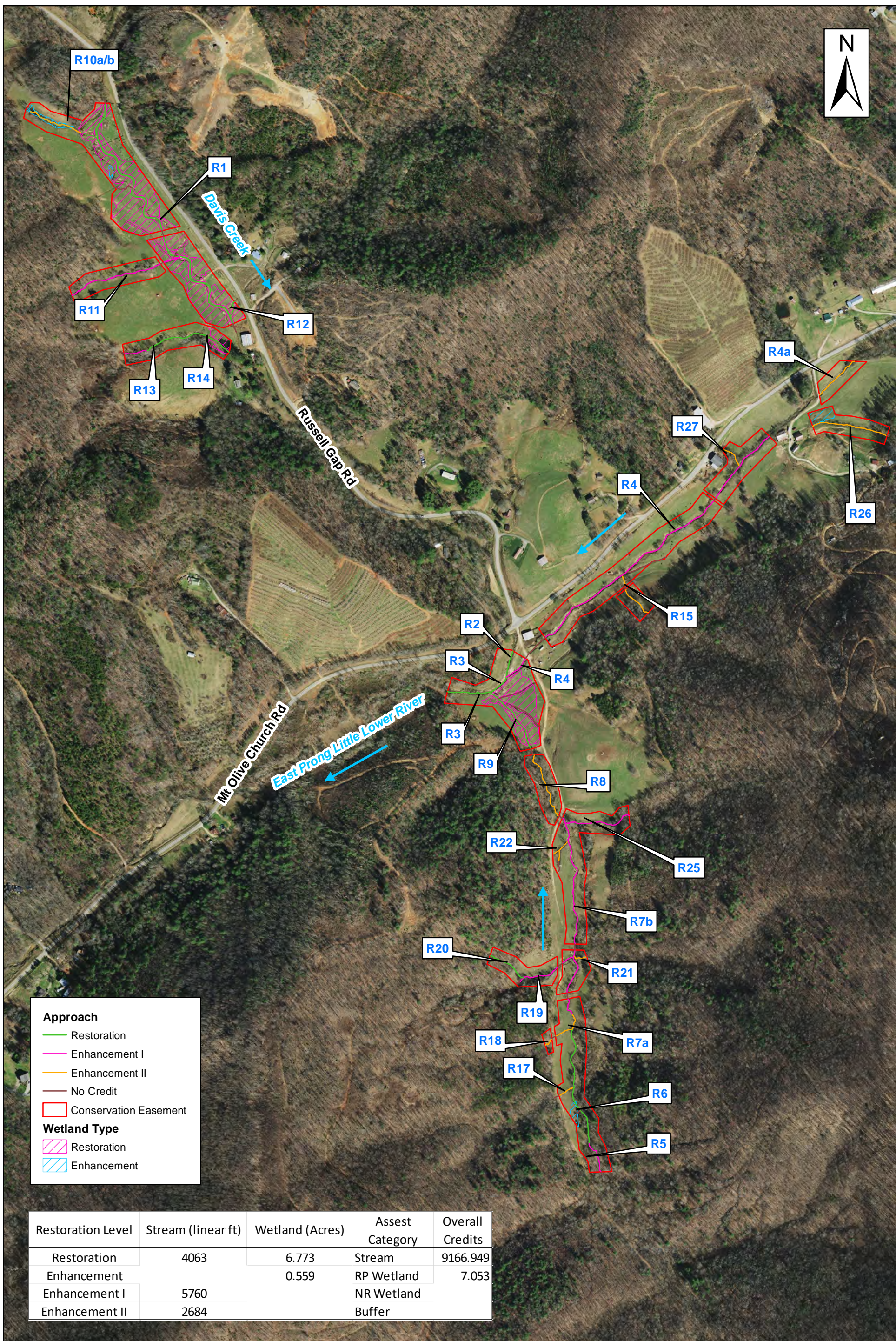
Note: Site is located within targeted local watershed 03050101120010.



**Figure 1**  
**Project Vicinity Map**  
**Russell Gap Project**

**Michael Baker**  
**INTERNATIONAL**

0      0.5      1      2  
Miles



**Table 1. Project Components and Mitigation Credits**  
**Russell Gap Stream Mitigation Project - NCDMS Project No. 100003**

Project Component (reach ID, etc.)	Wetland Position and HydroType	Existing Footage or Acreage	Stationing	As-Built CL Restored Footage, or SF <sup>1</sup>	As-Built CL w/o Xing Footage, or SF <sup>2</sup>	Mitigation Plan Designed Footage	Restoration Level	Approach Priority Level	Mitigation Ratio (X:1)	Mitigation Plan Credits <sup>3</sup>
Reach R1		2,142	10+00 - 29+45.90	1,946	1,910.90	1,841.60	R	PI	1.0	1,841.60
Reach R2		288	10+00 - 11+65.62	166	165.62	174.21	R	P2	1.0	174.21
Reach R3		388	32+28.36 - 36+34.66	406	406.30	388.74	R	P2	1.0	388.74
Reach R4a		299	10+00 - 13+00.00	300	300.00	300.00	EII	-	2.5	120.00
Reach R4		2,245	10+00 - 32+28.36	2,228	2,038.36	2,063.32	EI	-	1.5	1,375.55
Reach R5		256	10+00 - 12+10.00 w/o pipe	193	193.00	193.00	EII	-	2.5	77.20
Reach R5 Pipe Removal		17	10+32 - 10+49 pipe	17	17.00	17.00	R	PI	1.0	17.00
Reach R6		631	12+10.00 - 19+57.36	747	747.36	741.05	R	P1	1.0	741.05
Reach R7a		155	19+57.36- 20+61.17	104	103.81	110.12	EII	-	2.5	44.05
Reach R7b		1,170	20+61.17 - 33+51.48	1,290	1,216.31	1,202.37	EI	-	1.5	801.58
Reach R8		463	33+75.40 - 38+28.55	453	453.15	455.79	EII	-	2.5	182.32
Reach R9		439	38+65.34 - 43+10.91	446	445.57	445.52	R	PI	1.0	445.52
Reach R10a		371	10+08.40 - 13+74.94	367	366.54	376.11	EII	-	2.0	188.06
Reach R10b		0	13+74.94 - 14+79.77	105	104.83	112.65	R	P1	1.0	112.65
Reach R11		481	10+00 - 17+31.85	732	711.85	725.83	EI	-	1.5	483.89
Reach R12		86	10+00 - 11+01.78	102	101.78	120.02	R	PI	1.0	120.02
Reach R13		124	10+00 - 11+45.00	145	145.00	145.00	EI	-	1.5	96.67
Reach R14		528	11+45.00 - 17+14.80	570	569.80	572.27	R	P1/2	1.0	572.27
Reach R15		226	10+00 - 13+02.77	303	283.77	281.80	EII	-	2.5	112.72
Reach R17		130	10+00 - 11+06.64	107	106.64	104.44	EII	-	2.5	41.78
Reach R18		185	10+00 - 12+03.31	203	176.31	179.01	EII	-	2.5	71.60
Reach R19		481	9+86.00 - 13+75.96	390	352.96	359.49	EI	-	1.5	239.66
Reach R20		206	10+00 - 12+52.61	253	252.61	252.68	R	P1	1.0	252.68
Reach R21		67	10+00 - 10+91.76	92	91.76	89.11	EII	-	2.5	35.64
Reach R22		161	10+00 - 11+19.46	119	119.46	136.87	EII	-	2.5	54.75
Reach R22a		68	10+60 - 11+28.42	68	68.42	68.42	EII	-	2.5	27.37
Reach R25		422	10+00 - 14+30.52 (w/o pipe)	403	402.52	399.05	EI	-	1.5	266.03
Reach R25 Pipe Removal		28	12+62 - 12+90 pipe	28	28.00	28.00	R	PI	1.0	28.00
Reach R26		548	10+00 - 14+72.96	473	472.96	472.13	EII	-	2.5	188.85
Reach R27		165	10+00 - 11+63.76	164	163.76	163.76	EII	-	2.5	65.50
Wetland Group 1	RR	0		5,285		5,285	Restoration		1.0	5,285
Wetland Group 2	RR	0		1,488		1,488	Restoration		1.0	1,488
Wetland Group 3	RR	0.261		0.261		0.261	Enhancement		2.0	0.131
Wetland Group 4	RR	0.156		0.156		0.156	Enhancement		2.0	0.078
Wetland Group 5	RR	0.034		0.034		0.034	Enhancement		2.0	0.017
Wetland Group 6	RR	0.108		0.108		0.108	Enhancement		2.0	0.054

1 All stream stationing and restored footage numbers reported here, discussed in the report text, and shown in the as-built plan sheets use survey values.

2 The stream footage reported here uses the as-built stream centerline survey values and have all easement breaks removed from their totals. Buffer group values reported here are the creditable areas as allowed for each group as described in detail in the mitigation plan.

3 Credits reported here are taken directly from the approved mitigation plan Table 11.1

**Table 1.1**  
**As-Built Centerline Length and Area Summations by Mitigation Category**

Restoration Level	Stream (linear feet)	Riparian Wetland (acres)		Non-riparian Wetland (acres)	Credited Buffer (square feet)
		Riverine	Non-Riverine		
Restoration	4,063	6.773			
Enhancement		0.559			
Enhancement I	5,760				
Enhancement II	2,684				
Creation					
Preservation					
High Quality Press					

**Table 1.2**  
**Overall Assets Summary**

Asset Category	Overall Credits
Stream	9,166.949
RP Wetland	7.053
NR Wetland	
Buffer	

**Table 2. Project Activity and Reporting History**  
**Russell Gap Stream Mitigation Project - NCDMS Project No. 100003**

**Elapsed Time Since grading complete:** 10 months  
**Elapsed Time Since planting complete:** 9 months  
**Number of Reporting Years<sup>1</sup>:** 1

<b>Activity or Deliverable</b>	<b>Data Collection Complete</b>	<b>Completion or Delivery</b>
404 permit date	N/A	Dec-18
Mitigation Plan	N/A	Sep-18
Final Design – Construction Plans	N/A	Sep-18
Construction Grading Completed	N/A	Feb-20
As-Built Survey	May-20	May-20
Livestake and Bareroot Planting Completed	N/A	Mar-20
As-Built Baseline Monitoring Report (MY0)	Mar-20	Sep-20
Year 1 Monitoring	Nov-20	Dec-20
Year 2 Monitoring		
Year 3 Monitoring		
Year 4 Monitoring		
Year 5 Monitoring		
Year 6 Monitoring		
Year 7 Monitoring		

<sup>1</sup> = The number of monitoring reports excluding the as-built/baseline report

**Table 3. Project Contacts**

**Russell Gap Stream Mitigation Project - NCDMS Project No. 100003**

<b>Designer</b>	8000 Regency Parkway, Suite 600 Cary, NC 27518
<b>Michael Baker Engineering, Inc.</b>	Contact: Katie McKeithan, Tel. 919-481-5703
<b>Construction Contractor</b>	5616 Coble Church Rd Julian, NC 27283
<b>KBS Earthworks, Inc.</b>	Contact: Kory Strader, Tel. 336-362-0289
<b>Survey Contractor</b>	P.O. Box 148 Swannanoa, NC 28778
<b>Turner Land Surveying (As-Built Only)</b>	Contact: David Turner, Tel. 919-827-0745
<b>Kee Mapping and Surveying (MY1 Survey)</b>	88 Central Avenue Asheville, NC 28801 Contact: Brad Kee, Tel. 828-575-9021
<b>Planting Contractor</b>	5616 Coble Church Rd Julian, NC 27283
<b>KBS Earthworks, Inc.</b>	Contact: Kory Strader, Tel. 336-362-0289
<b>Seeding Contractor</b>	5616 Coble Church Rd Julian, NC 27283
<b>KBS Earthworks, Inc.</b>	Contact: Kory Strader, Tel. 336-362-0289
<b>Seed Mix Sources</b>	
<b>Green Resources</b>	Telephone: 336-855-6363
<b>Nursery Stock Suppliers</b>	
<b>Mellow Marsh Farm ArborGen</b>	Telephone: 919-742-1200 Telephone: 843-528-3204
<b>Monitoring Performers</b>	
<b>Michael Baker Engineering, Inc.</b>	8000 Regency Parkway, Suite 600 Cary, NC 27518
Stream Monitoring POC Vegetation Monitoring POC	Katie McKeithan, Tel. 919-481-5703 Katie McKeithan, Tel. 919-481-5703

**Table 4. Project Attributes**

**Russell Gap Stream Mitigation Project - NCDMS Project No. 100003**

Project Name		Russell Gap Stream Mitigation Project			
County		Alexander County			
Project Area (acres)		35.97			
Project Coordinates (latitude and longitude)		36.0091 N, -81.2139 W			
Planted Acreage (Acres of Woody Stems Planted)		29.67			
<b>Project Watershed Summary Information</b>					
Physiographic Province		Peidmont			
River Basin		Catawba			
USGS Hydrologic Unit 8-digit	3050101	USGS Hydrologic Unit 14-digit	03050101-120010		
DWR Sub-basin		03-08-32			
Project Drainage Area (Acres and Square Miles)		2.227 acres / 3.48 square miles (at downstream end of R3)			
Project Drainage Area Percentage of Impervious Area		0.13% impervious area			
CGIA Land Use Classification		82.6% forested, 14.5% agriculture, 1.5% rural residential, 1.4% roadway			
<b>Existing Reach Summary Information</b>					
<b>Parameters</b>		<b>Reach R1</b>	<b>Reach R2</b>	<b>Reach R3</b>	<b>Reach R4</b>
Length of reach (linear feet)		2,142	288	388	2,245
Valley confinement (Confined, moderately confined, unconfined)		Unconfined	Unconfined	Unconfined	Unconfined
Drainage area (Acres)		960	1,056	2227	806
Perennial, Intermittent, Ephemeral		Perennial	Perennial	Perennial	Perennial
NCDWR Water Quality Classification		C	C	C	C
Stream Classification (existing)		E4 (incised)	E4 (incised)	E4	E4
Stream Classification (proposed)		C4	C4	C4	B4c
Evolutionary trend (Simon)		IV - Degradation and Widening	III - Degradation	III - Degradation	IV - Degradation and Widening
FEMA classification		Zone X	Zone X	Zone X	Zone X
<b>Existing Reach Summary Information</b>					
<b>Parameters</b>		<b>Reach R4a</b>	<b>Reach R5</b>	<b>Reach R6</b>	<b>Reach R7a</b>
Length of reach (linear feet)		299	256	631	155
Valley confinement (Confined, moderately confined, unconfined)		Unconfined	Unconfined	Unconfined	Unconfined
Drainage area (Acres)		716	150	154	210
Perennial, Intermittent, Ephemeral		Perennial	Perennial	Perennial	Perennial
NCDWR Water Quality Classification		C	C	C	C
Stream Classification (existing)		E4	C4b	G4	E4b
Stream Classification (proposed)		B4c	C4b	B4	E4b
Evolutionary trend (Simon)		I - Stable System	I - Stable System	IV - Degradation and Widening	I - Stable System
FEMA classification		Zone X	Zone X	Zone X	Zone X
<b>Existing Reach Summary Information</b>					
<b>Parameters</b>		<b>Reach R7b</b>	<b>Reach R8</b>	<b>Reach R9</b>	<b>Reach R10(A/B)</b>
Length of reach (linear feet)		1,170	463	439	371
Valley confinement (Confined, moderately confined, unconfined)		Unconfined	Unconfined	Unconfined	Unconfined
Drainage area (Acres)		288	333	358	17
Perennial, Intermittent, Ephemeral		Perennial	Perennial	Perennial	Perennial
NCDWR Water Quality Classification		C	C	C	C
Stream Classification (existing)		E4b	C4	E4b	E4b
Stream Classification (proposed)		E4b	C4	B4	E4b-C4
Evolutionary trend (Simon)		III - Degradation	I - Stable System	IV - Degradation and Widening	II - Disturbance
FEMA classification		Zone X	Zone X	Zone X	Zone X

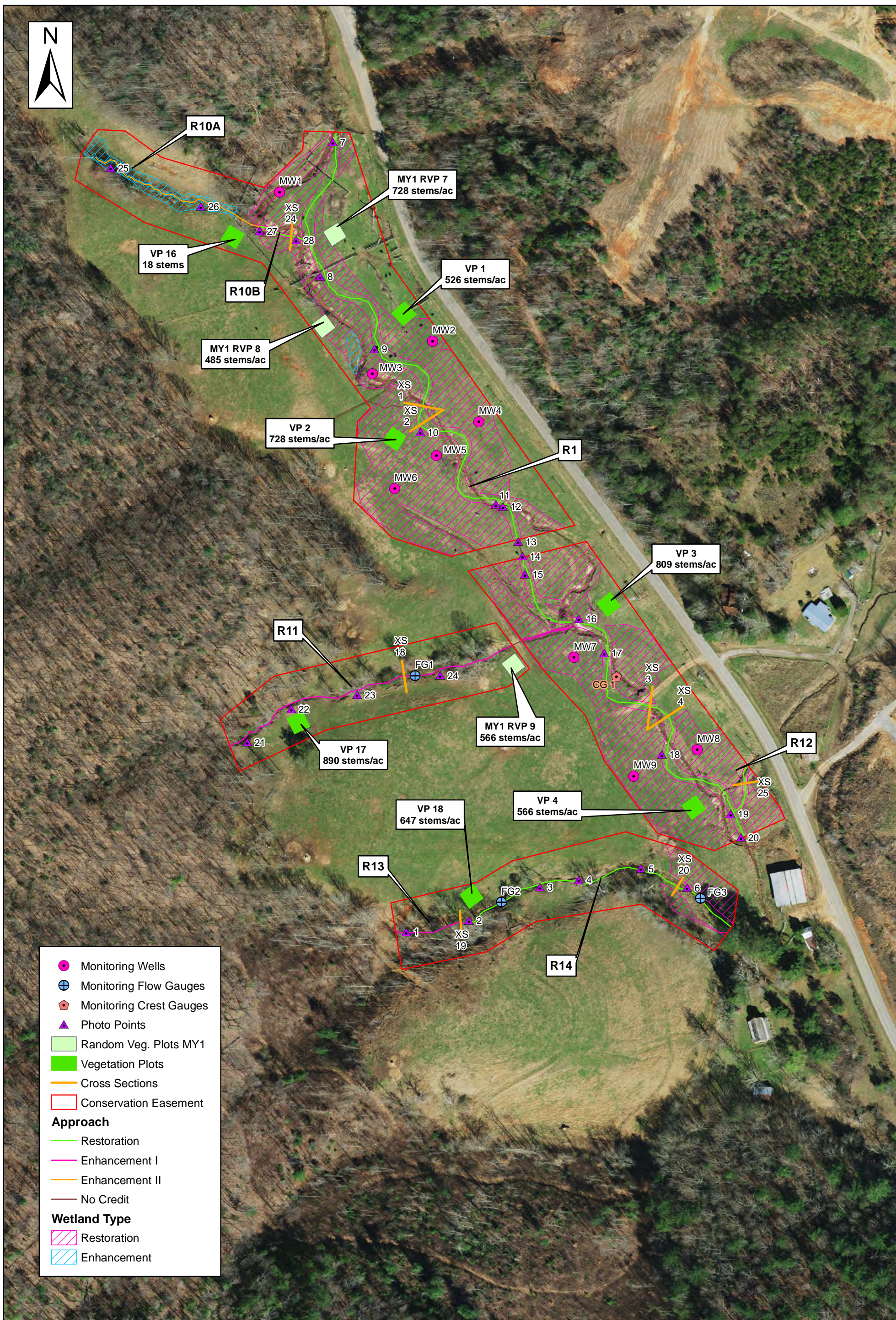


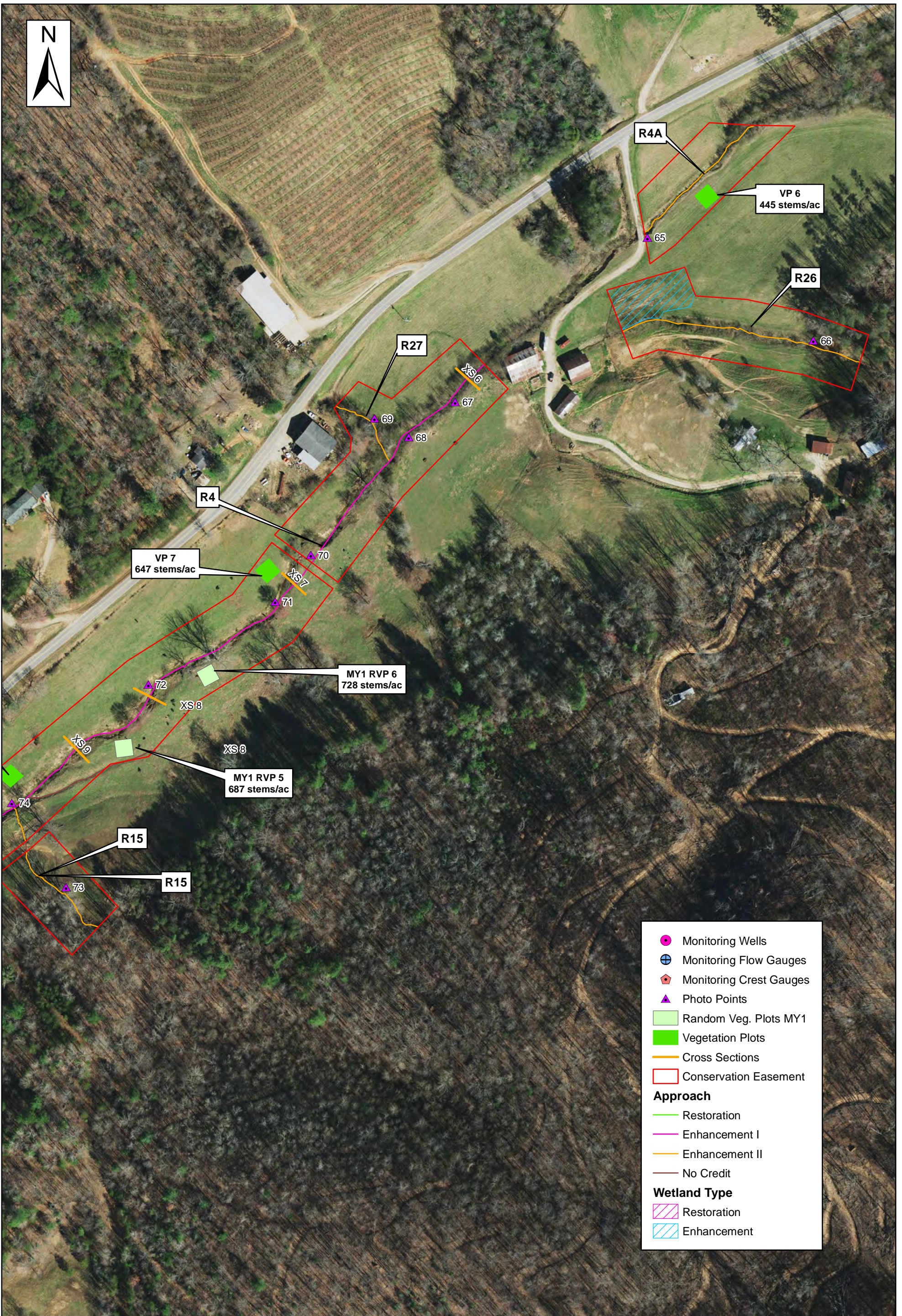
Existing Reach Summary Information				
Parameters	Reach R11	Reach R12	Reach R13	Reach R14
Length of reach (linear feet)	481	86	124	528
Valley confinement (Confined, moderately confined, unconfined)	Confined	Unconfined	Moderately Confined	Confined (Upper) Unconfined (Lower)
Drainage area (Acres)	17	115	21	22
Perennial, Intermittent, Ephemeral	Intermittent	Perennial	Intermittent	Perennial
NCDWR Water Quality Classification	C	C	C	C
Stream Classification (existing)	B4a	Eb	C4	A4
Stream Classification (proposed)	B4a	C4b	C4	E4
Evolutionary trend (Simon)	III - Degradation	IV - Degradation and Widening	II - Disurbance	IV - Degradation and Widening
FEMA classification	Zone X	Zone X	Zone X	Zone X
Existing Reach Summary Information				
Parameters	Reach R15	Reach R17	Reach R18	Reach R19
Length of reach (linear feet)	226	130	185	481
Valley confinement (Confined, moderately confined, unconfined)	Unconfined	Unconfined	Unconfined	Moderately Confined
Drainage area (Acres)	19	26	24	22
Perennial, Intermittent, Ephemeral	Intermittent	Intermittent	Intermittent	Perennial
NCDWR Water Quality Classification	C	C	C	C
Stream Classification (existing)	E4b	E4b	E4b	B4a
Stream Classification (proposed)	E4b	E4b	E4b	B4a
Evolutionary trend (Simon)	I - Stable System	I - Stable System	I - Stable System	IV - Degradation and Widening
FEMA classification	Zone X	Zone X	Zone X	Zone X
Existing Reach Summary Information				
Parameters	Reach R20	Reach R21	Reach R22	Reach R22a
Length of reach (linear feet)	206	67	161	68
Valley confinement (Confined, moderately confined, unconfined)	Confined	Unconfined	Moderately Confined	Moderately Confined
Drainage area (Acres and Square Miles)	9	33	3	3
Perennial, Intermittent, Ephemeral	Perennial	Perennial	Perennial	Perennial
NCDWR Water Quality Classification	C	C	C	C
Stream Classification (existing)	A4a+	B4	B4	B4
Stream Classification (proposed)	A4a+	B4	B4	B4
Evolutionary trend (Simon)	III - Degrading	I - Stable System	II - Channelized	II - Channelized
FEMA classification	Zone X	Zone X	Zone X	Zone X
Existing Reach Summary Information				
Parameters	Reach R25	Reach R26	Reach R27	
Length of reach (linear feet)	422	548	165	
Valley confinement (Confined, moderately confined, unconfined)	Moderately Confined	Unconfined	Moderately Confined	
Drainage area (Acres and Square Miles)	33	32	19	
Perennial, Intermittent, Ephemeral	Perennial	Perennial	Perennial	
NCDWR Water Quality Classification	C	C	C	
Stream Classification (existing)	B4a	E4b	E4b	
Stream Classification (proposed)	B4a	E4b	E4b	
Evolutionary trend (Simon)	III - Degrading	I - Stable System	I - Stable System	
FEMA classification	Zone X	Zone X	Zone X	
Regulatory Considerations				
Parameters	Applicable?	Resolved?	Supporting Docs?	
Water of the United States - Section 404	Yes	Yes	PCN	
Water of the United States - Section 401	Yes	Yes	PCN	
Endangered Species Act	Yes	Yes	Categorical Exclusion	
Historic Preservation Act	Yes	Yes	Categorical Exclusion	
Coastal Zone Management Act (CZMA or CAMA)	No	N/A	N/A	
FEMA Floodplain Compliance	No	N/A	N/A	
Essential Fisheries Habitat	No	N/A	N/A	

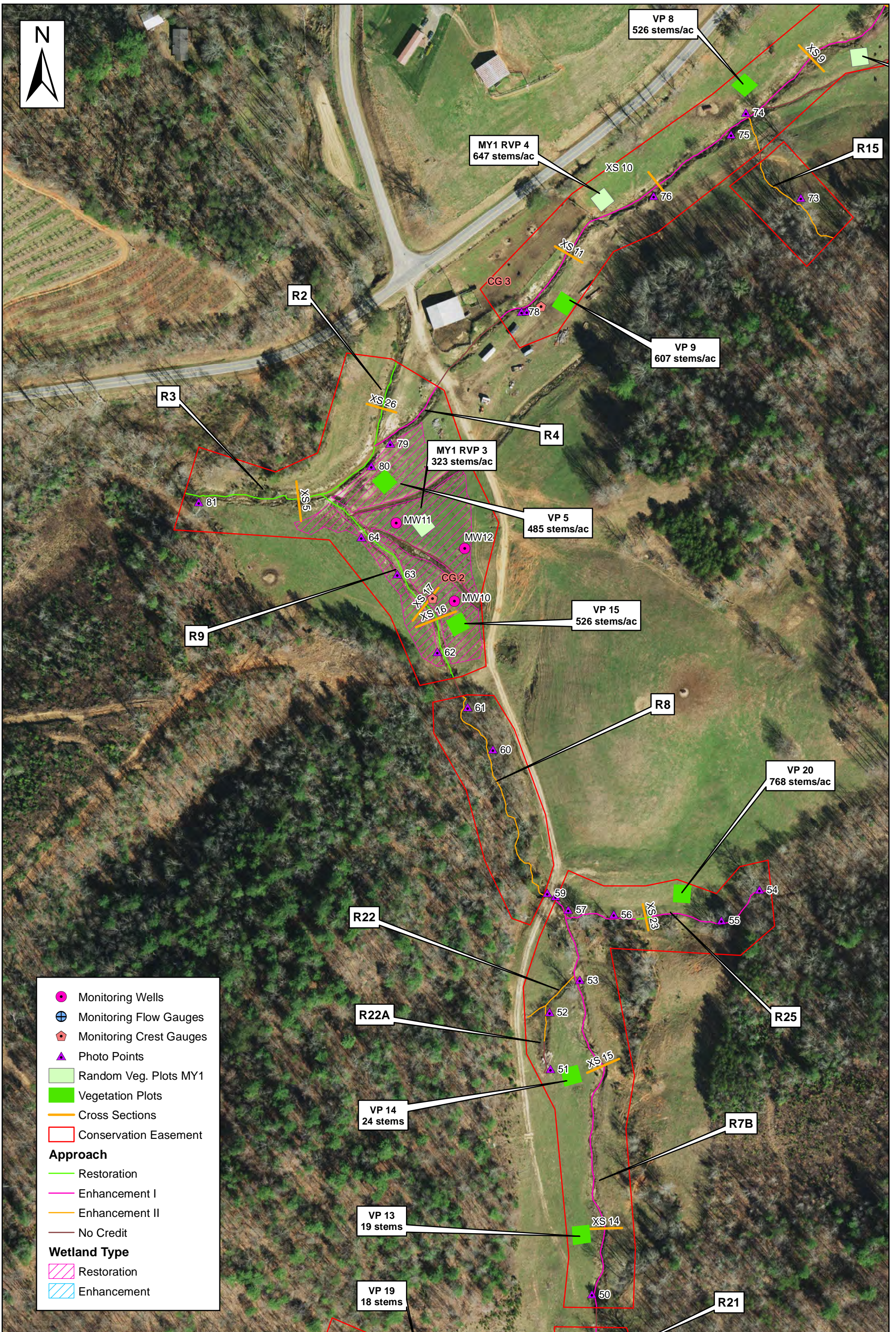
# **APPENDIX B**

## Visual Assessment Data









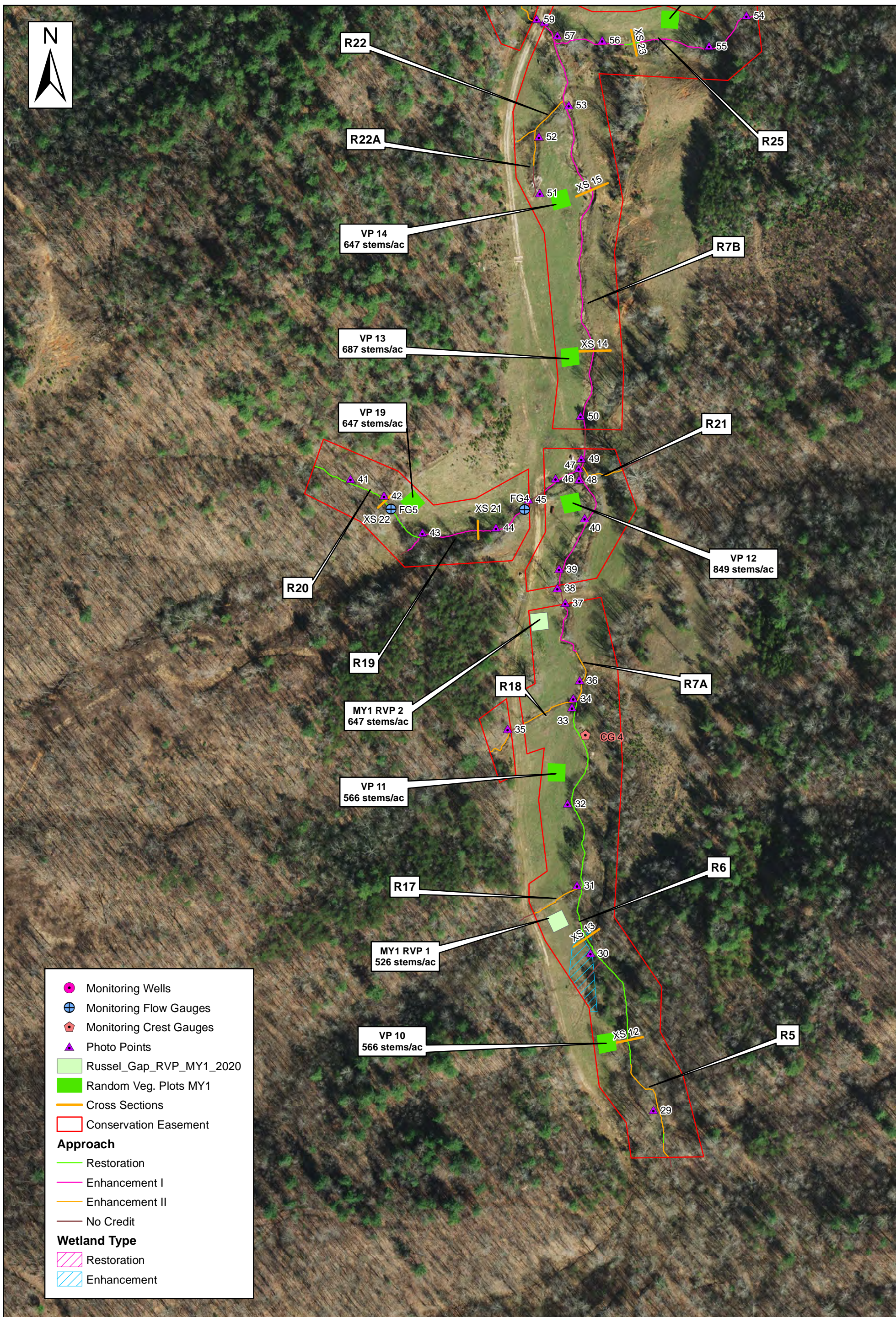


Table 5. Visual Stream Morphology Stability Assessment  
 Russell Gap Stream Mitigation Project - NCDMS Project No. 100003

Reach ID: Reach R1								
Assessed Length (LF): 1,911								
Major Channel Category	Channel Sub-Category	Metric	Number Stable, Performing as Intended	Total Number per As-built	Number of Unstable Segments	Amount of Unstable Footage	% Stable, Performing as Intended	
1. Bed	1. Vertical Stability	1. Aggradation - Bar formation/growth sufficient to significantly deflect flow laterally (not to include point bars)			0	0	100%	
		2. Degradation - Evidence of downcutting			0	0	100%	
	2. Riffle Condition	1. Texture Substrate - Riffle maintains coarser substrate	21	21	0.00	0.00	100%	
		1. Depth - Sufficient (Max Pool Depth/Mean Bkf Depth $\geq$ 1.5)	19	19			100%	
	3. Meander Pool Condition	2. Length - Sufficient (>30% of centerline distance between tail of upstream riffle and head of downstream riffle)	19	19			100%	
		4. Thalweg Position	1. Thalweg centering at upstream of meander bend (Run)	21	21			100%
2. Thalweg centering at downstream of meander bend (Glide)	19		19			100%		
2. Bank	1. Scoured/Eroding	Bank lacking vegetative cover due to active scour and erosion			0	0	100%	
		2. Undercut	Banks undercut/overhanging to the extent that mass wasting is expected			0	0	100%
			3. Mass Wasting	Banks slumping, caving or collapse			0	0
	<b>Totals</b>					0	0	100%
3. Engineering Structures	1. Overall Integrity	Structures physically intact with no dislodged boulders or logs	27	27			100%	
		2. Grade Control	Grade control structures exhibiting maintenance of grade across the sill	27	27			100%
	2a. Piping	Structures lacking any substantial flow underneath or around sills or arms	27	27			100%	
	3. Bank Position	Bank erosion within the structures extent of influence <b>does not</b> exceed 15%	27	27			100%	
	4. Habitat	Pool forming structures maintaining - Max Pool Depth/Mean Bankfull Depth ratio $\geq$ 1.5. Rootwads/logs providing some cover at low flow	24	24			100%	
Reach ID: Reach R2								
Assessed Length (LF): 166								
Major Channel Category	Channel Sub-Category	Metric	Number Stable, Performing as Intended	Total Number per As-built	Number of Unstable Segments	Amount of Unstable Footage	% Stable, Performing as Intended	
1. Bed	1. Vertical Stability	1. Aggradation - Bar formation/growth sufficient to significantly deflect flow laterally (not to include point bars)			0	0	100%	
		2. Degradation - Evidence of downcutting			0	0	100%	
	2. Riffle Condition	1. Texture Substrate - Riffle maintains coarser substrate	1	1	0.00	0.00	100%	
		1. Depth - Sufficient (Max Pool Depth/Mean Bkf Depth $\geq$ 1.5)	1	1			100%	
	3. Meander Pool Condition	2. Length - Sufficient (>30% of centerline distance between tail of upstream riffle and head of downstream riffle)	1	1			100%	
		4. Thalweg Position	1. Thalweg centering at upstream of meander bend (Run)	1	1			100%
2. Thalweg centering at downstream of meander bend (Glide)	1		1			100%		
2. Bank	1. Scoured/Eroding	Bank lacking vegetative cover due to active scour and erosion			0	0	100%	
		2. Undercut	Banks undercut/overhanging to the extent that mass wasting is expected			0	0	100%
			3. Mass Wasting	Banks slumping, caving or collapse			0	0
	<b>Totals</b>					0	0	100%
3. Engineering Structures	1. Overall Integrity	Structures physically intact with no dislodged boulders or logs	1	1	0	0	100%	
		2. Grade Control	Grade control structures exhibiting maintenance of grade across the sill	1	1	0	0	100%
	2a. Piping	Structures lacking any substantial flow underneath or around sills or arms	1	1	0	0	100%	
	3. Bank Position	Bank erosion within the structures extent of influence <b>does not</b> exceed 15%	1	1			100%	
	4. Habitat	Pool forming structures maintaining - Max Pool Depth/Mean Bankfull Depth ratio $\geq$ 1.5. Rootwads/logs providing some cover at low flow	1	1			100%	



Table 5. Visual Stream Morphology Stability Assessment

Russell Gap Stream Mitigation Project - NCDMS Project No. 100003

Reach ID: Reach R3							
Assessed Length (LF): 406							
Major Channel Category	Channel Sub-Category	Metric	Number Stable, Performing as Intended	Total Number per As-built	Number of Unstable Segments	Amount of Unstable Footage	% Stable, Performing as Intended
1. Bed	1. Vertical Stability	1. Aggradation - Bar formation/growth sufficient to significantly deflect flow laterally (not to include point bars)			0	0	100%
		2. Degradation - Evidence of downcutting			0	0	100%
	2. Riffle Condition	1. Texture Substrate - Riffle maintains coarser substrate	0	0			100%
		1. Depth - Sufficient (Max Pool Depth/Mean Bkf Depth $\geq$ 1.5)	0	0			100%
	3. Meander Pool Condition	2. Length - Sufficient (>30% of centerline distance between tail of upstream riffle and head of downstream riffle)	0	0			100%
		1. Thalweg centering at upstream of meander bend (Run)	0	0			100%
	4. Thalweg Position	2. Thalweg centering at downstream of meander bend (Glide)	0	0			100%
2. Bank	1. Scoured/Eroding	Bank lacking vegetative cover due to active scour and erosion			0	0	100%
	2. Undercut	Banks undercut/overhanging to the extent that mass wasting is expected			0	0	100%
	3. Mass Wasting	Banks slumping, caving or collapse			0	0	100%
<b>Totals</b>					0	0	100%
<b>3. Engineering Structures</b>							
	1. Overall Integrity	Structures physically intact with no dislodged boulders or logs	1	1			100%
	2. Grade Control	Grade control structures exhibiting maintenance of grade across the sill	1	1			100%
	2a. Piping	Structures lacking any substantial flow underneath or around sills or arms	1	1			100%
	3. Bank Position	Bank erosion within the structures extent of influence <b>does not</b> exceed 15%	1	1			100%
	4. Habitat	Pool forming structures maintaining - Max Pool Depth/Mean Bankfull Depth ratio $\geq$ 1.5. Rootwads/logs providing some cover at low flow	0	0			100%
Reach ID: Reach R4a							
Assessed Length (LF): 300							
Major Channel Category	Channel Sub-Category	Metric	Number Stable, Performing as Intended	Total Number per As-built	Number of Unstable Segments	Amount of Unstable Footage	% Stable, Performing as Intended
1. Bed	1. Vertical Stability	1. Aggradation - Bar formation/growth sufficient to significantly deflect flow laterally (not to include point bars)			0	0	100%
		2. Degradation - Evidence of downcutting			0	0	100%
	2. Riffle Condition	1. Texture Substrate - Riffle maintains coarser substrate			0		100%
		1. Depth - Sufficient (Max Pool Depth/Mean Bkf Depth $\geq$ 1.5)			0		100%
	3. Meander Pool Condition	2. Length - Sufficient (>30% of centerline distance between tail of upstream riffle and head of downstream riffle)			0		100%
		1. Thalweg centering at upstream of meander bend (Run)			0		100%
	4. Thalweg Position	2. Thalweg centering at downstream of meander bend (Glide)			0		100%
2. Bank	1. Scoured/Eroding	Bank lacking vegetative cover due to active scour and erosion			0	0	100%
	2. Undercut	Banks undercut/overhanging to the extent that mass wasting is expected			0	0	100%
	3. Mass Wasting	Banks slumping, caving or collapse			0	0	100%
<b>Totals</b>					0	0	100%
<b>3. Engineering Structures</b>							
	1. Overall Integrity	Structures physically intact with no dislodged boulders or logs		0			100%
	2. Grade Control	Grade control structures exhibiting maintenance of grade across the sill		0			100%
	2a. Piping	Structures lacking any substantial flow underneath or around sills or arms		0			100%
	3. Bank Position	Bank erosion within the structures extent of influence <b>does not</b> exceed 15%		0			100%
	4. Habitat	Pool forming structures maintaining - Max Pool Depth/Mean Bankfull Depth ratio $\geq$ 1.5. Rootwads/logs providing some cover at low flow		0			100%

Table 5. Visual Stream Morphology Stability Assessment  
 Russell Gap Stream Mitigation Project - NCDMS Project No. 100003

Reach ID: Reach R4								
Assessed Length (LF): 2,063								
Major Channel Category	Channel Sub-Category	Metric	Number Stable, Performing as Intended	Total Number per As-built	Number of Unstable Segments	Amount of Unstable Footage	% Stable, Performing as Intended	
1. Bed	1. Vertical Stability	1. Aggradation - Bar formation/growth sufficient to significantly deflect flow laterally (not to include point bars)			0	0	100%	
		2. Degradation - Evidence of downcutting			0	0	100%	
	2. Riffle Condition	1. Texture Substrate - Riffle maintains coarser substrate	17	17			100%	
		1. Depth - Sufficient (Max Pool Depth/Mean Bkf Depth $\geq 1.5$ )	15	15			100%	
	3. Meander Pool Condition	2. Length - Sufficient (>30% of centerline distance between tail of upstream riffle and head of downstream riffle)	15	15			100%	
4. Thalweg Position		1. Thalweg centering at upstream of meander bend (Run)	17	17			100%	
		2. Thalweg centering at downstream of meander bend (Glide)	15	15			100%	
2. Bank	1. Scoured/Eroding	Bank lacking vegetative cover due to active scour and erosion			0	0	100%	
		2. Undercut	Banks undercut/overhanging to the extent that mass wasting is expected			0	0	100%
			3. Mass Wasting	Banks slumping, caving or collapse			0	0
<b>Totals</b>					0	0	100%	
3. Engineering Structures	1. Overall Integrity	Structures physically intact with no dislodged boulders or logs	20	20			100%	
		2. Grade Control	Grade control structures exhibiting maintenance of grade across the sill	20	20			100%
	2a. Piping	Structures lacking any substantial flow underneath or around sills or arms	20	20			100%	
		3. Bank Position	Bank erosion within the structures extent of influence <b>does not</b> exceed 15%	20	20			100%
	4. Habitat	Pool forming structures maintaining - Max Pool Depth/Mean Bankfull Depth ratio $\geq 1.5$ . Rootwads/logs providing some cover at low flow	15	15			100%	
Reach ID: Reach R5								
Assessed Length (LF): 193								
Major Channel Category	Channel Sub-Category	Metric	Number Stable, Performing as Intended	Total Number per As-built	Number of Unstable Segments	Amount of Unstable Footage	% Stable, Performing as Intended	
1. Bed	1. Vertical Stability	1. Aggradation - Bar formation/growth sufficient to significantly deflect flow laterally (not to include point bars)			0	0	100%	
		2. Degradation - Evidence of downcutting			0	0	100%	
	2. Riffle Condition	1. Texture Substrate - Riffle maintains coarser substrate	1	1			100%	
		1. Depth - Sufficient (Max Pool Depth/Mean Bkf Depth $\geq 1.5$ )	8	8			100%	
	3. Meander Pool Condition	2. Length - Sufficient (>30% of centerline distance between tail of upstream riffle and head of downstream riffle)	1	1			100%	
4. Thalweg Position		1. Thalweg centering at upstream of meander bend (Run)	1	1			100%	
		2. Thalweg centering at downstream of meander bend (Glide)	1	1			100%	
2. Bank	1. Scoured/Eroding	Bank lacking vegetative cover due to active scour and erosion			0	0	100%	
		2. Undercut	Banks undercut/overhanging to the extent that mass wasting is expected			0	0	100%
			3. Mass Wasting	Banks slumping, caving or collapse			0	0
<b>Totals</b>					0	0	100%	
3. Engineering Structures	1. Overall Integrity	Structures physically intact with no dislodged boulders or logs	1	1			100%	
		2. Grade Control	Grade control structures exhibiting maintenance of grade across the sill	1	1			100%
	2a. Piping	Structures lacking any substantial flow underneath or around sills or arms	1	1			100%	
		3. Bank Position	Bank erosion within the structures extent of influence <b>does not</b> exceed 15%	1	1			100%
	4. Habitat	Pool forming structures maintaining - Max Pool Depth/Mean Bankfull Depth ratio $\geq 1.5$ . Rootwads/logs providing some cover at low flow	8	8			100%	

Table 5. Visual Stream Morphology Stability Assessment  
 Russell Gap Stream Mitigation Project - NCDMS Project No. 100003

Reach ID: Reach R6							
Assessed Length (LF): 747							
Major Channel Category	Channel Sub-Category	Metric	Number Stable, Performing as Intended	Total Number per As-built	Number of Unstable Segments	Amount of Unstable Footage	% Stable, Performing as Intended
1. Bed	1. Vertical Stability	1. Aggradation - Bar formation/growth sufficient to significantly deflect flow laterally (not to include point bars)			0	0	100%
		2. Degradation - Evidence of downcutting			0	0	100%
	2. Riffle Condition	1. Texture Substrate - Riffle maintains coarser substrate	9	9			100%
		1. Depth - Sufficient (Max Pool Depth/Mean Bkf Depth $\geq$ 1.5)	8	8			100%
	3. Meander Pool Condition	2. Length - Sufficient (>30% of centerline distance between tail of upstream riffle and head of downstream riffle)	8	8			100%
		1. Thalweg centering at upstream of meander bend (Run)	9	9			100%
4. Thalweg Position	2. Thalweg centering at downstream of meander bend (Glide)	8	8			100%	
2. Bank	1. Scoured/Eroding	Bank lacking vegetative cover due to active scour and erosion			0	0	100%
	2. Undercut	Banks undercut/overhanging to the extent that mass wasting is expected			0	0	100%
	3. Mass Wasting	Banks slumping, caving or collapse			0	0	100%
<b>Totals</b>					0	0	100%
3. Engineering Structures	1. Overall Integrity	Structures physically intact with no dislodged boulders or logs	8	8			100%
		Grade control structures exhibiting maintenance of grade across the sill	8	8			100%
	2a. Piping	Structures lacking any substantial flow underneath or around sills or arms	8	8			100%
		Bank erosion within the structures extent of influence <b>does not</b> exceed 15%	8	8			100%
	3. Bank Position	Pool forming structures maintaining - Max Pool Depth/Mean Bankfull Depth ratio $\geq$ 1.5. Rootwads/logs providing some cover at low flow	8	8			100%
Reach ID: Reach R7a							
Assessed Length (LF): 104							
Major Channel Category	Channel Sub-Category	Metric	Number Stable, Performing as Intended	Total Number per As-built	Number of Unstable Segments	Amount of Unstable Footage	% Stable, Performing as Intended
1. Bed	1. Vertical Stability	1. Aggradation - Bar formation/growth sufficient to significantly deflect flow laterally (not to include point bars)			0	0	100%
		2. Degradation - Evidence of downcutting			0	0	100%
	2. Riffle Condition	1. Texture Substrate - Riffle maintains coarser substrate			0		100%
		1. Depth - Sufficient (Max Pool Depth/Mean Bkf Depth $\geq$ 1.5)			0		100%
	3. Meander Pool Condition	2. Length - Sufficient (>30% of centerline distance between tail of upstream riffle and head of downstream riffle)			0		100%
		1. Thalweg centering at upstream of meander bend (Run)			0		100%
4. Thalweg Position	2. Thalweg centering at downstream of meander bend (Glide)			0		100%	
2. Bank	1. Scoured/Eroding	Bank lacking vegetative cover due to active scour and erosion			0	0	100%
	2. Undercut	Banks undercut/overhanging to the extent that mass wasting is expected			0	0	100%
	3. Mass Wasting	Banks slumping, caving or collapse			0	0	100%
<b>Totals</b>					0	0	100%
3. Engineering Structures	1. Overall Integrity	Structures physically intact with no dislodged boulders or logs		0			100%
		Grade control structures exhibiting maintenance of grade across the sill		0			100%
	2a. Piping	Structures lacking any substantial flow underneath or around sills or arms		0			100%
		Bank erosion within the structures extent of influence <b>does not</b> exceed 15%		0			100%
	3. Bank Position	Pool forming structures maintaining - Max Pool Depth/Mean Bankfull Depth ratio $\geq$ 1.5. Rootwads/logs providing some cover at low flow		0			100%

Table 5. Visual Stream Morphology Stability Assessment  
 Russell Gap Stream Mitigation Project - NCDMS Project No. 100003

Reach ID: Reach R7b								
Assessed Length (LF): 1,216								
Major Channel Category	Channel Sub-Category	Metric	Number Stable, Performing as Intended	Total Number per As-built	Number of Unstable Segments	Amount of Unstable Footage	% Stable, Performing as Intended	
1. Bed	1. Vertical Stability	1. Aggradation - Bar formation/growth sufficient to significantly deflect flow laterally (not to include point bars)			0	0	100%	
		2. Degradation - Evidence of downcutting			0	0	100%	
	2. Riffle Condition	1. Texture Substrate - Riffle maintains coarser substrate	9	9			100%	
		1. Depth - Sufficient (Max Pool Depth/Mean Bkf Depth $\geq$ 1.5)	7	7			100%	
	3. Meander Pool Condition	2. Length - Sufficient (>30% of centerline distance between tail of upstream riffle and head of downstream riffle)	7	7			100%	
4. Thalweg Position		1. Thalweg centering at upstream of meander bend (Run)	9	9			100%	
		2. Thalweg centering at downstream of meander bend (Glide)	7	7			100%	
2. Bank	1. Scoured/Eroding	Bank lacking vegetative cover due to active scour and erosion			0	0	100%	
		2. Undercut	Banks undercut/overhanging to the extent that mass wasting is expected			0	0	100%
			3. Mass Wasting	Banks slumping, caving or collapse			0	0
<b>Totals</b>					0	0	100%	
3. Engineering Structures	1. Overall Integrity	Structures physically intact with no dislodged boulders or logs					100%	
		2. Grade Control	Grade control structures exhibiting maintenance of grade across the sill				100%	
	2a. Piping	Structures lacking any substantial flow underneath or around sills or arms					100%	
		3. Bank Position	Bank erosion within the structures extent of influence <b>does not</b> exceed 15%				100%	
	4. Habitat	Pool forming structures maintaining - Max Pool Depth/Mean Bankfull Depth ratio $\geq$ 1.5. Rootwads/logs providing some cover at low flow					100%	
Reach ID: Reach R8								
Assessed Length (LF): 453								
Major Channel Category	Channel Sub-Category	Metric	Number Stable, Performing as Intended	Total Number per As-built	Number of Unstable Segments	Amount of Unstable Footage	% Stable, Performing as Intended	
1. Bed	1. Vertical Stability	1. Aggradation - Bar formation/growth sufficient to significantly deflect flow laterally (not to include point bars)			0	0	100%	
		2. Degradation - Evidence of downcutting			0	0	100%	
	2. Riffle Condition	1. Texture Substrate - Riffle maintains coarser substrate			0		100%	
		1. Depth - Sufficient (Max Pool Depth/Mean Bkf Depth $\geq$ 1.5)			0		100%	
	3. Meander Pool Condition	2. Length - Sufficient (>30% of centerline distance between tail of upstream riffle and head of downstream riffle)			0		100%	
4. Thalweg Position		1. Thalweg centering at upstream of meander bend (Run)			0		100%	
		2. Thalweg centering at downstream of meander bend (Glide)			0		100%	
2. Bank	1. Scoured/Eroding	Bank lacking vegetative cover due to active scour and erosion			0	0	100%	
		2. Undercut	Banks undercut/overhanging to the extent that mass wasting is expected			0	0	100%
			3. Mass Wasting	Banks slumping, caving or collapse			0	0
<b>Totals</b>					0	0	100%	
3. Engineering Structures	1. Overall Integrity	Structures physically intact with no dislodged boulders or logs		0			100%	
		2. Grade Control	Grade control structures exhibiting maintenance of grade across the sill		0		100%	
	2a. Piping	Structures lacking any substantial flow underneath or around sills or arms		0			100%	
		3. Bank Position	Bank erosion within the structures extent of influence <b>does not</b> exceed 15%		0		100%	
	4. Habitat	Pool forming structures maintaining - Max Pool Depth/Mean Bankfull Depth ratio $\geq$ 1.5. Rootwads/logs providing some cover at low flow		0			100%	

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Reach ID: Reach R9								
Assessed Length (LF): 446								
Major Channel Category	Channel Sub-Category	Metric	Number Stable, Performing as Intended	Total Number per As-built	Number of Unstable Segments	Amount of Unstable Footage	% Stable, Performing as Intended	
1. Bed	1. Vertical Stability	1. Aggradation - Bar formation/growth sufficient to significantly deflect flow laterally (not to include point bars)			0	0	100%	
		2. Degradation - Evidence of downcutting			0	0	100%	
	2. Riffle Condition	1. Texture Substrate - Riffle maintains coarser substrate	7	7			100%	
		1. Depth - Sufficient (Max Pool Depth/Mean Bkf Depth $\geq 1.5$ )	6	6			100%	
	3. Meander Pool Condition	2. Length - Sufficient (>30% of centerline distance between tail of upstream riffle and head of downstream riffle)	6	6			100%	
4. Thalweg Position		1. Thalweg centering at upstream of meander bend (Run)	7	7			100%	
		2. Thalweg centering at downstream of meander bend (Glide)	6	6			100%	
2. Bank	1. Scoured/Eroding	Bank lacking vegetative cover due to active scour and erosion			0	0	100%	
		2. Undercut	Banks undercut/overhanging to the extent that mass wasting is expected			0	0	100%
			3. Mass Wasting	Banks slumping, caving or collapse			0	0
<b>Totals</b>					0	0	100%	
3. Engineering Structures	1. Overall Integrity	Structures physically intact with no dislodged boulders or logs	6	6			100%	
		2. Grade Control	Grade control structures exhibiting maintenance of grade across the sill	6	6		100%	
	2a. Piping	Structures lacking any substantial flow underneath or around sills or arms	6	6			100%	
		3. Bank Position	Bank erosion within the structures extent of influence <b>does not</b> exceed 15%	6	6		100%	
	4. Habitat	Pool forming structures maintaining - Max Pool Depth/Mean Bankfull Depth ratio $\geq 1.5$ . Rootwads/logs providing some cover at low flow	6	6			100%	
Reach ID: Reach R10a								
Assessed Length (LF): 367								
Major Channel Category	Channel Sub-Category	Metric	Number Stable, Performing as Intended	Total Number per As-built	Number of Unstable Segments	Amount of Unstable Footage	% Stable, Performing as Intended	
1. Bed	1. Vertical Stability	1. Aggradation - Bar formation/growth sufficient to significantly deflect flow laterally (not to include point bars)			0	0	100%	
		2. Degradation - Evidence of downcutting			0	0	100%	
	2. Riffle Condition	1. Texture Substrate - Riffle maintains coarser substrate	0	0			100%	
		1. Depth - Sufficient (Max Pool Depth/Mean Bkf Depth $\geq 1.5$ )	0	0			100%	
	3. Meander Pool Condition	2. Length - Sufficient (>30% of centerline distance between tail of upstream riffle and head of downstream riffle)	0	0			100%	
4. Thalweg Position		1. Thalweg centering at upstream of meander bend (Run)	0	0			100%	
		2. Thalweg centering at downstream of meander bend (Glide)	0	0			100%	
2. Bank	1. Scoured/Eroding	Bank lacking vegetative cover due to active scour and erosion			0	0	100%	
		2. Undercut	Banks undercut/overhanging to the extent that mass wasting is expected			0	0	100%
			3. Mass Wasting	Banks slumping, caving or collapse			0	0
<b>Totals</b>					0	0	100%	
3. Engineering Structures	1. Overall Integrity	Structures physically intact with no dislodged boulders or logs	7	7			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 or around sills or arms	1	1			100%	
		3. Bank Position	Bank erosion within the structures extent of influence <b>does not</b> exceed 15%	1	1		100%	
	4. Habitat	Pool forming structures maintaining - Max Pool Depth/Mean Bankfull Depth ratio $\geq 1.5$ . Rootwads/logs providing some cover at low flow	0	0			100%	

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Reach ID: Reach R10b								
Assessed Length (LF):								
Major Channel Category	Channel Sub-Category	Metric	Number Stable, Performing as Intended	Total Number per As-built	Number of Unstable Segments	Amount of Unstable Footage	% Stable, Performing as Intended	
1. Bed	1. Vertical Stability	1. Aggradation - Bar formation/growth sufficient to significantly deflect flow laterally (not to include point bars)			0	0	100%	
		2. Degradation - Evidence of downcutting			0	0	100%	
	2. Riffle Condition	1. Texture Substrate - Riffle maintains coarser substrate	1	1			100%	
		1. Depth - Sufficient (Max Pool Depth/Mean Bkf Depth $\geq 1.5$ )	0	0			100%	
	3. Meander Pool Condition	2. Length - Sufficient (>30% of centerline distance between tail of upstream riffle and head of downstream riffle)	0	0			100%	
4. Thalweg Position		1. Thalweg centering at upstream of meander bend (Run)	1	1			100%	
		2. Thalweg centering at downstream of meander bend (Glide)	0	0			100%	
2. Bank	1. Scoured/Eroding	Bank lacking vegetative cover due to active scour and erosion			0	0	100%	
		2. Undercut	Banks undercut/overhanging to the extent that mass wasting is expected			0	0	100%
			3. Mass Wasting	Banks slumping, caving or collapse			0	0
<b>Totals</b>					0	0	100%	
3. Engineering 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	2	2		100%	
	2a. Piping	Structures lacking any substantial flow underneath or around sills or arms	2	2			100%	
		3. Bank Position	Bank erosion within the structures extent of influence <b>does not</b> exceed 15%	2	2		100%	
	4. Habitat	Pool forming structures maintaining - Max Pool Depth/Mean Bankfull Depth ratio $\geq 1.5$ . Rootwads/logs providing some cover at low flow	0	0			100%	
Reach ID: Reach R11								
Assessed Length (LF): 712								
Major Channel Category	Channel Sub-Category	Metric	Number Stable, Performing as Intended	Total Number per As-built	Number of Unstable Segments	Amount of Unstable Footage	% Stable, Performing as Intended	
1. Bed	1. Vertical Stability	1. Aggradation - Bar formation/growth sufficient to significantly deflect flow laterally (not to include point bars)			0	0	100%	
		2. Degradation - Evidence of downcutting			0	0	100%	
	2. Riffle Condition	1. Texture Substrate - Riffle maintains coarser substrate	2	2			100%	
		1. Depth - Sufficient (Max Pool Depth/Mean Bkf Depth $\geq 1.5$ )	0	0			100%	
	3. Meander Pool Condition	2. Length - Sufficient (>30% of centerline distance between tail of upstream riffle and head of downstream riffle)	0	0			100%	
4. Thalweg Position		1. Thalweg centering at upstream of meander bend (Run)	2	2			100%	
		2. Thalweg centering at downstream of meander bend (Glide)	0	0			100%	
2. Bank	1. Scoured/Eroding	Bank lacking vegetative cover due to active scour and erosion			0	0	100%	
		2. Undercut	Banks undercut/overhanging to the extent that mass wasting is expected			0	0	100%
			3. Mass Wasting	Banks slumping, caving or collapse			0	0
<b>Totals</b>					0	0	100%	
3. Engineering Structures	1. Overall Integrity	Structures physically intact with no dislodged boulders or logs	38	38			100%	
		2. Grade Control	Grade control structures exhibiting maintenance of grade across the sill	38	38		100%	
	2a. Piping	Structures lacking any substantial flow underneath or around sills or arms	38	38			100%	
		3. Bank Position	Bank erosion within the structures extent of influence <b>does not</b> exceed 15%	38	38		100%	
	4. Habitat	Pool forming structures maintaining - Max Pool Depth/Mean Bankfull Depth ratio $\geq 1.5$ . Rootwads/logs providing some cover at low flow	0	0			100%	

Table 5. Visual Stream Morphology Stability Assessment  
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Reach ID: Reach R12							
Assessed Length (LF): 120							
Major Channel Category	Channel Sub-Category	Metric	Number Stable, Performing as Intended	Total Number per As-built	Number of Unstable Segments	Amount of Unstable Footage	% Stable, Performing as Intended
1. Bed	1. Vertical Stability	1. Aggradation - Bar formation/growth sufficient to significantly deflect flow laterally (not to include point bars)			0	0	100%
		2. Degradation - Evidence of downcutting			0	0	100%
	2. Riffle Condition	1. Texture Substrate - Riffle maintains coarser substrate	2	2			100%
		1. Depth - Sufficient (Max Pool Depth/Mean Bkf Depth $\geq 1.5$ )	1	1			100%
	3. Meander Pool Condition	2. Length - Sufficient (>30% of centerline distance between tail of upstream riffle and head of downstream riffle)	1	1			100%
4. Thalweg Position		1. Thalweg centering at upstream of meander bend (Run)	2	2			100%
		2. Thalweg centering at downstream of meander bend (Glide)	1	1			100%
2. Bank	1. Scoured/Eroding	Bank lacking vegetative cover due to active scour and erosion			0	0	100%
		2. Undercut	Banks undercut/overhanging to the extent that mass wasting is expected		0	0	100%
			3. Mass Wasting	Banks slumping, caving or collapse		0	0
<b>Totals</b>					0	0	100%
3. Engineering 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 or around sills or arms	3	3			100%
		3. Bank Position	Bank erosion within the structures extent of influence <b>does not</b> exceed 15%	3	3		100%
	4. Habitat	Pool forming structures maintaining - Max Pool Depth/Mean Bankfull Depth ratio $\geq 1.5$ . Rootwads/logs providing some cover at low flow	1	1			100%
Reach ID: Reach R13							
Assessed Length (LF): 145							
Major Channel Category	Channel Sub-Category	Metric	Number Stable, Performing as Intended	Total Number per As-built	Number of Unstable Segments	Amount of Unstable Footage	% Stable, Performing as Intended
1. Bed	1. Vertical Stability	1. Aggradation - Bar formation/growth sufficient to significantly deflect flow laterally (not to include point bars)			0	0	100%
		2. Degradation - Evidence of downcutting			0	0	100%
	2. Riffle Condition	1. Texture Substrate - Riffle maintains coarser substrate	0	0			100%
		1. Depth - Sufficient (Max Pool Depth/Mean Bkf Depth $\geq 1.5$ )	0	0			100%
	3. Meander Pool Condition	2. Length - Sufficient (>30% of centerline distance between tail of upstream riffle and head of downstream riffle)	0	0			100%
4. Thalweg Position		1. Thalweg centering at upstream of meander bend (Run)	1	1			100%
		2. Thalweg centering at downstream of meander bend (Glide)	0	0			100%
2. Bank	1. Scoured/Eroding	Bank lacking vegetative cover due to active scour and erosion			0	0	100%
		2. Undercut	Banks undercut/overhanging to the extent that mass wasting is expected		0	0	100%
			3. Mass Wasting	Banks slumping, caving or collapse		0	0
<b>Totals</b>					0	0	100%
3. Engineering 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	9	9		100%
	2a. Piping	Structures lacking any substantial flow underneath or around sills or arms	9	9			100%
		3. Bank Position	Bank erosion within the structures extent of influence <b>does not</b> exceed 15%	9	9		100%
	4. Habitat	Pool forming structures maintaining - Max Pool Depth/Mean Bankfull Depth ratio $\geq 1.5$ . Rootwads/logs providing some cover at low flow	0	0			100%

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Reach ID: Reach R14								
Assessed Length (LF): 570								
Major Channel Category	Channel Sub-Category	Metric	Number Stable, Performing as Intended	Total Number per As-built	Number of Unstable Segments	Amount of Unstable Footage	% Stable, Performing as Intended	
1. Bed	1. Vertical Stability	1. Aggradation - Bar formation/growth sufficient to significantly deflect flow laterally (not to include point bars)			0	0	100%	
		2. Degradation - Evidence of downcutting			0	0	100%	
	2. Riffle Condition	1. Texture Substrate - Riffle maintains coarser substrate	2	2			100%	
		1. Depth - Sufficient (Max Pool Depth/Mean Bkf Depth $\geq 1.5$ )	0	0			100%	
	3. Meander Pool Condition	2. Length - Sufficient (>30% of centerline distance between tail of upstream riffle and head of downstream riffle)	0	0			100%	
4. Thalweg Position		1. Thalweg centering at upstream of meander bend (Run)	1	1			100%	
		2. Thalweg centering at downstream of meander bend (Glide)	0	0			100%	
2. Bank	1. Scoured/Eroding	Bank lacking vegetative cover due to active scour and erosion			0	0	100%	
		2. Undercut	Banks undercut/overhanging to the extent that mass wasting is expected			0	0	100%
			3. Mass Wasting	Banks slumping, caving or collapse			0	0
<b>Totals</b>					0	0	100%	
3. Engineering Structures	1. Overall Integrity	Structures physically intact with no dislodged boulders or logs	26	26			100%	
		2. Grade Control	Grade control structures exhibiting maintenance of grade across the sill	26	26			100%
	2a. Piping	Structures lacking any substantial flow underneath or around sills or arms	26	26			100%	
		3. Bank Position	Bank erosion within the structures extent of influence <b>does not</b> exceed 15%	26	26			100%
	4. Habitat	Pool forming structures maintaining - Max Pool Depth/Mean Bankfull Depth ratio $\geq 1.5$ . Rootwads/logs providing some cover at low flow	0	0			100%	
Reach ID: Reach R15								
Assessed Length (LF): 284								
Major Channel Category	Channel Sub-Category	Metric	Number Stable, Performing as Intended	Total Number per As-built	Number of Unstable Segments	Amount of Unstable Footage	% Stable, Performing as Intended	
1. Bed	1. Vertical Stability	1. Aggradation - Bar formation/growth sufficient to significantly deflect flow laterally (not to include point bars)			0	0	100%	
		2. Degradation - Evidence of downcutting			0	0	100%	
	2. Riffle Condition	1. Texture Substrate - Riffle maintains coarser substrate	0	0			100%	
		1. Depth - Sufficient (Max Pool Depth/Mean Bkf Depth $\geq 1.5$ )	0	0			100%	
	3. Meander Pool Condition	2. Length - Sufficient (>30% of centerline distance between tail of upstream riffle and head of downstream riffle)	0	0			100%	
4. Thalweg Position		1. Thalweg centering at upstream of meander bend (Run)	0	0			100%	
		2. Thalweg centering at downstream of meander bend (Glide)	0	0			100%	
2. Bank	1. Scoured/Eroding	Bank lacking vegetative cover due to active scour and erosion			0	0	100%	
		2. Undercut	Banks undercut/overhanging to the extent that mass wasting is expected			0	0	100%
			3. Mass Wasting	Banks slumping, caving or collapse			0	0
<b>Totals</b>					0	0	100%	
3. Engineering Structures	1. Overall Integrity	Structures physically intact with no dislodged boulders or logs	8	8			100%	
		2. Grade Control	Grade control structures exhibiting maintenance of grade across the sill	8	8			100%
	2a. Piping	Structures lacking any substantial flow underneath or around sills or arms	8	8			100%	
		3. Bank Position	Bank erosion within the structures extent of influence <b>does not</b> exceed 15%	0	0			100%
	4. Habitat	Pool forming structures maintaining - Max Pool Depth/Mean Bankfull Depth ratio $\geq 1.5$ . Rootwads/logs providing some cover at low flow	0	0			100%	



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Reach ID: Reach R17							
Assessed Length (LF): 107							
Major Channel Category	Channel Sub-Category	Metric	Number Stable, Performing as Intended	Total Number per As-built	Number of Unstable Segments	Amount of Unstable Footage	% Stable, Performing as Intended
1. Bed	1. Vertical Stability	1. Aggradation - Bar formation/growth sufficient to significantly deflect flow laterally (not to include point bars)			0	0	100%
		2. Degradation - Evidence of downcutting			0	0	100%
	2. Riffle Condition	1. Texture Substrate - Riffle maintains coarser substrate	0	0			100%
		1. Depth - Sufficient (Max Pool Depth/Mean Bkf Depth $\geq 1.5$ )	0	0			100%
	3. Meander Pool Condition	2. Length - Sufficient (>30% of centerline distance between tail of upstream riffle and head of downstream riffle)	0	0			100%
4. Thalweg Position		1. Thalweg centering at upstream of meander bend (Run)	0	0			100%
		2. Thalweg centering at downstream of meander bend (Glide)	0	0			100%
2. Bank	1. Scoured/Eroding	Bank lacking vegetative cover due to active scour and erosion			0	0	100%
		2. Undercut	Banks undercut/overhanging to the extent that mass wasting is expected		0	0	100%
			Banks slumping, caving or collapse		0	0	100%
<b>Totals</b>					0	0	100%
3. Engineering Structures	1. Overall Integrity	Structures physically intact with no dislodged boulders or logs		0			100%
		Grade control structures exhibiting maintenance of grade across the sill		0			100%
	2a. Piping	Structures lacking any substantial flow underneath or around sills or arms		0			100%
		Bank erosion within the structures extent of influence <b>does not</b> exceed 15%		0			100%
	4. Habitat	Pool forming structures maintaining - Max Pool Depth/Mean Bankfull Depth ratio $\geq 1.5$ . Rootwads/logs providing some cover at low flow		0			100%
Reach ID: Reach R18							
Assessed Length (LF): 176							
Major Channel Category	Channel Sub-Category	Metric	Number Stable, Performing as Intended	Total Number per As-built	Number of Unstable Segments	Amount of Unstable Footage	% Stable, Performing as Intended
1. Bed	1. Vertical Stability	1. Aggradation - Bar formation/growth sufficient to significantly deflect flow laterally (not to include point bars)			0	0	100%
		2. Degradation - Evidence of downcutting			0	0	100%
	2. Riffle Condition	1. Texture Substrate - Riffle maintains coarser substrate	0	0			100%
		1. Depth - Sufficient (Max Pool Depth/Mean Bkf Depth $\geq 1.5$ )	0	0			100%
	3. Meander Pool Condition	2. Length - Sufficient (>30% of centerline distance between tail of upstream riffle and head of downstream riffle)	0	0			100%
4. Thalweg Position		1. Thalweg centering at upstream of meander bend (Run)	0	0			100%
		2. Thalweg centering at downstream of meander bend (Glide)	0	0			100%
2. Bank	1. Scoured/Eroding	Bank lacking vegetative cover due to active scour and erosion			0	0	100%
		2. Undercut	Banks undercut/overhanging to the extent that mass wasting is expected		0	0	100%
			Banks slumping, caving or collapse		0	0	100%
<b>Totals</b>					0	0	100%
3. Engineering Structures	1. Overall Integrity	Structures physically intact with no dislodged boulders or logs	2	2			100%
		Grade control structures exhibiting maintenance of grade across the sill	2	2			100%
	2a. Piping	Structures lacking any substantial flow underneath or around sills or arms	2	2			100%
		Bank erosion within the structures extent of influence <b>does not</b> exceed 15%	2	2			100%
	4. Habitat	Pool forming structures maintaining - Max Pool Depth/Mean Bankfull Depth ratio $\geq 1.5$ . Rootwads/logs providing some cover at low flow	0	0			100%

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Reach ID: Reach R19								
Assessed Length (LF): 353								
Major Channel Category	Channel Sub-Category	Metric	Number Stable, Performing as Intended	Total Number per As-built	Number of Unstable Segments	Amount of Unstable Footage	% Stable, Performing as Intended	
1. Bed	1. Vertical Stability	1. Aggradation - Bar formation/growth sufficient to significantly deflect flow laterally (not to include point bars)			0	0	100%	
		2. Degradation - Evidence of downcutting			0	0	100%	
	2. Riffle Condition	1. Texture Substrate - Riffle maintains coarser substrate	1	1			100%	
		1. Depth - Sufficient (Max Pool Depth/Mean Bkf Depth $\geq 1.5$ )	0	0			100%	
	3. Meander Pool Condition	2. Length - Sufficient (>30% of centerline distance between tail of upstream riffle and head of downstream riffle)	0	0			100%	
4. Thalweg Position		1. Thalweg centering at upstream of meander bend (Run)	1	1			100%	
		2. Thalweg centering at downstream of meander bend (Glide)	0	0			100%	
2. Bank	1. Scoured/Eroding	Bank lacking vegetative cover due to active scour and erosion			0	0	100%	
		2. Undercut	Banks undercut/overhanging to the extent that mass wasting is expected			0	0	100%
			3. Mass Wasting	Banks slumping, caving or collapse			0	0
<b>Totals</b>					0	0	100%	
3. Engineering Structures	1. Overall Integrity	Structures physically intact with no dislodged boulders or logs	26	26			100%	
		2. Grade Control	Grade control structures exhibiting maintenance of grade across the sill	26	26			100%
	2a. Piping	Structures lacking any substantial flow underneath or around sills or arms	26	26			100%	
		3. Bank Position	Bank erosion within the structures extent of influence <b>does not</b> exceed 15%	26	26			100%
	4. Habitat	Pool forming structures maintaining - Max Pool Depth/Mean Bankfull Depth ratio $\geq 1.5$ . Rootwads/logs providing some cover at low flow	0	0			100%	
Reach ID: Reach R20								
Assessed Length (LF): 253								
Major Channel Category	Channel Sub-Category	Metric	Number Stable, Performing as Intended	Total Number per As-built	Number of Unstable Segments	Amount of Unstable Footage	% Stable, Performing as Intended	
1. Bed	1. Vertical Stability	1. Aggradation - Bar formation/growth sufficient to significantly deflect flow laterally (not to include point bars)			0	0	100%	
		2. Degradation - Evidence of downcutting			0	0	100%	
	2. Riffle Condition	1. Texture Substrate - Riffle maintains coarser substrate	0	0			100%	
		1. Depth - Sufficient (Max Pool Depth/Mean Bkf Depth $\geq 1.5$ )	0	0			100%	
	3. Meander Pool Condition	2. Length - Sufficient (>30% of centerline distance between tail of upstream riffle and head of downstream riffle)	0	0			100%	
4. Thalweg Position		1. Thalweg centering at upstream of meander bend (Run)	0	0			100%	
		2. Thalweg centering at downstream of meander bend (Glide)	0	0			100%	
2. Bank	1. Scoured/Eroding	Bank lacking vegetative cover due to active scour and erosion			0	0	100%	
		2. Undercut	Banks undercut/overhanging to the extent that mass wasting is expected			0	0	100%
			3. Mass Wasting	Banks slumping, caving or collapse			0	0
<b>Totals</b>					0	0	100%	
3. Engineering Structures	1. Overall Integrity	Structures physically intact with no dislodged boulders or logs	36	36			100%	
		2. Grade Control	Grade control structures exhibiting maintenance of grade across the sill	36	36			100%
	2a. Piping	Structures lacking any substantial flow underneath or around sills or arms	36	36			100%	
		3. Bank Position	Bank erosion within the structures extent of influence <b>does not</b> exceed 15%	36	36			100%
	4. Habitat	Pool forming structures maintaining - Max Pool Depth/Mean Bankfull Depth ratio $\geq 1.5$ . Rootwads/logs providing some cover at low flow	0	0			100%	

Table 5. Visual Stream Morphology Stability Assessment  
 Russell Gap Stream Mitigation Project - NCDMS Project No. 100003

Reach ID: Reach R21							
Assessed Length (LF): 92							
Major Channel Category	Channel Sub-Category	Metric	Number Stable, Performing as Intended	Total Number per As-built	Number of Unstable Segments	Amount of Unstable Footage	% Stable, Performing as Intended
1. Bed	1. Vertical Stability	1. Aggradation - Bar formation/growth sufficient to significantly deflect flow laterally (not to include point bars)			0	0	100%
		2. Degradation - Evidence of downcutting			0	0	100%
	2. Riffle Condition	1. Texture Substrate - Riffle maintains coarser substrate		0			100%
		1. Depth - Sufficient (Max Pool Depth/Mean Bkf Depth $\geq 1.5$ )		0			100%
	3. Meander Pool Condition	2. Length - Sufficient (>30% of centerline distance between tail of upstream riffle and head of downstream riffle)		0			100%
4. Thalweg Position		1. Thalweg centering at upstream of meander bend (Run)		0			100%
		2. Thalweg centering at downstream of meander bend (Glide)		0			100%
2. Bank	1. Scoured/Eroding	Bank lacking vegetative cover due to active scour and erosion			0	0	100%
		2. Undercut	Banks undercut/overhanging to the extent that mass wasting is expected		0	0	100%
			3. Mass Wasting	Banks slumping, caving or collapse		0	0
<b>Totals</b>					0	0	100%
3. Engineering Structures	1. Overall Integrity	Structures physically intact with no dislodged boulders or logs		0			100%
		2. Grade Control	Grade control structures exhibiting maintenance of grade across the sill		0		100%
	2a. Piping	Structures lacking any substantial flow underneath or around sills or arms		0			100%
		3. Bank Position	Bank erosion within the structures extent of influence <b>does not</b> exceed 15%		0		100%
	4. Habitat	Pool forming structures maintaining - Max Pool Depth/Mean Bankfull Depth ratio $\geq 1.5$ . Rootwads/logs providing some cover at low flow		0			100%
Reach ID: Reach R22, R22a							
Assessed Length (LF): 187							
Major Channel Category	Channel Sub-Category	Metric	Number Stable, Performing as Intended	Total Number per As-built	Number of Unstable Segments	Amount of Unstable Footage	% Stable, Performing as Intended
1. Bed	1. Vertical Stability	1. Aggradation - Bar formation/growth sufficient to significantly deflect flow laterally (not to include point bars)			0	0	100%
		2. Degradation - Evidence of downcutting			0	0	100%
	2. Riffle Condition	1. Texture Substrate - Riffle maintains coarser substrate		0			100%
		1. Depth - Sufficient (Max Pool Depth/Mean Bkf Depth $\geq 1.5$ )		0			100%
	3. Meander Pool Condition	2. Length - Sufficient (>30% of centerline distance between tail of upstream riffle and head of downstream riffle)		0			100%
4. Thalweg Position		1. Thalweg centering at upstream of meander bend (Run)		0			100%
		2. Thalweg centering at downstream of meander bend (Glide)		0			100%
2. Bank	1. Scoured/Eroding	Bank lacking vegetative cover due to active scour and erosion			0	0	100%
		2. Undercut	Banks undercut/overhanging to the extent that mass wasting is expected		0	0	100%
			3. Mass Wasting	Banks slumping, caving or collapse		0	0
<b>Totals</b>					0	0	100%
3. Engineering Structures	1. Overall Integrity	Structures physically intact with no dislodged boulders or logs		0			100%
		2. Grade Control	Grade control structures exhibiting maintenance of grade across the sill		0		100%
	2a. Piping	Structures lacking any substantial flow underneath or around sills or arms		0			100%
		3. Bank Position	Bank erosion within the structures extent of influence <b>does not</b> exceed 15%		0		100%
	4. Habitat	Pool forming structures maintaining - Max Pool Depth/Mean Bankfull Depth ratio $\geq 1.5$ . Rootwads/logs providing some cover at low flow		0			100%

Table 5. Visual Stream Morphology Stability Assessment  
 Russell Gap Stream Mitigation Project - NCDMS Project No. 100003

Reach ID: Reach R25								
Assessed Length (LF): 402								
Major Channel Category	Channel Sub-Category	Metric	Number Stable, Performing as Intended	Total Number per As-built	Number of Unstable Segments	Amount of Unstable Footage	% Stable, Performing as Intended	
1. Bed	1. Vertical Stability	1. Aggradation - Bar formation/growth sufficient to significantly deflect flow laterally (not to include point bars)			0	0	100%	
		2. Degradation - Evidence of downcutting			0	0	100%	
	2. Riffle Condition	1. Texture Substrate - Riffle maintains coarser substrate	6	6			100%	
		1. Depth - Sufficient (Max Pool Depth/Mean Bkf Depth $\geq 1.5$ )	0	0			100%	
	3. Meander Pool Condition	2. Length - Sufficient (>30% of centerline distance between tail of upstream riffle and head of downstream riffle)	0	0			100%	
4. Thalweg Position		1. Thalweg centering at upstream of meander bend (Run)	6	6			100%	
		2. Thalweg centering at downstream of meander bend (Glide)	0	0			100%	
2. Bank	1. Scoured/Eroding	Bank lacking vegetative cover due to active scour and erosion			0	0	100%	
		2. Undercut	Banks undercut/overhanging to the extent that mass wasting is expected			0	0	100%
			3. Mass Wasting	Banks slumping, caving or collapse			0	0
<b>Totals</b>					0	0	100%	
3. Engineering Structures	1. Overall Integrity	Structures physically intact with no dislodged boulders or logs	13	13			100%	
		2. Grade Control	Grade control structures exhibiting maintenance of grade across the sill	13	13			100%
	2a. Piping	Structures lacking any substantial flow underneath or around sills or arms	13	13			100%	
		3. Bank Position	Bank erosion within the structures extent of influence <b>does not</b> exceed 15%	13	13			100%
	4. Habitat	Pool forming structures maintaining - Max Pool Depth/Mean Bankfull Depth ratio $\geq 1.5$ . Rootwads/logs providing some cover at low flow	0	0			100%	
Reach ID: Reach R26								
Assessed Length (LF): 473								
Major Channel Category	Channel Sub-Category	Metric	Number Stable, Performing as Intended	Total Number per As-built	Number of Unstable Segments	Amount of Unstable Footage	% Stable, Performing as Intended	
1. Bed	1. Vertical Stability	1. Aggradation - Bar formation/growth sufficient to significantly deflect flow laterally (not to include point bars)			0	0	100%	
		2. Degradation - Evidence of downcutting			0	0	100%	
	2. Riffle Condition	1. Texture Substrate - Riffle maintains coarser substrate	0	0			100%	
		1. Depth - Sufficient (Max Pool Depth/Mean Bkf Depth $\geq 1.5$ )	0	0			100%	
	3. Meander Pool Condition	2. Length - Sufficient (>30% of centerline distance between tail of upstream riffle and head of downstream riffle)	0	0			100%	
4. Thalweg Position		1. Thalweg centering at upstream of meander bend (Run)	0	0			100%	
		2. Thalweg centering at downstream of meander bend (Glide)	0	0			100%	
2. Bank	1. Scoured/Eroding	Bank lacking vegetative cover due to active scour and erosion			0	0	100%	
		2. Undercut	Banks undercut/overhanging to the extent that mass wasting is expected			0	0	100%
			3. Mass Wasting	Banks slumping, caving or collapse			0	0
<b>Totals</b>					0	0	100%	
3. Engineering Structures	1. Overall Integrity	Structures physically intact with no dislodged boulders or logs	4	4			100%	
		2. Grade Control	Grade control structures exhibiting maintenance of grade across the sill	4	4			100%
	2a. Piping	Structures lacking any substantial flow underneath or around sills or arms	4	4			100%	
		3. Bank Position	Bank erosion within the structures extent of influence <b>does not</b> exceed 15%	4	4			100%
	4. Habitat	Pool forming structures maintaining - Max Pool Depth/Mean Bankfull Depth ratio $\geq 1.5$ . Rootwads/logs providing some cover at low flow	0	0			100%	

Table 5. Visual Stream Morphology Stability Assessment  
 Russell Gap Stream Mitigation Project - NCDMS Project No. 100003

Reach ID: Reach R27 Assessed Length (LF):							
Major Channel Category	Channel Sub-Category	Metric	Number Stable, Performing as Intended	Total Number per As-built	Number of Unstable Segments	Amount of Unstable Footage	% Stable, Performing as Intended
1. Bed	1. Vertical Stability	1. Aggradation - Bar formation/growth sufficient to significantly deflect flow laterally (not to include point bars)			0	0	100%
		2. Degradation - Evidence of downcutting			0	0	100%
	2. Riffle Condition	1. Texture Substrate - Riffle maintains coarser substrate	0	0			100%
		2. Depth - Sufficient (Max Pool Depth/Mean Bkf Depth $\geq$ 1.5)	0	0			100%
	3. Meander Pool Condition	1. Length - Sufficient (>30% of centerline distance between tail of upstream riffle and head of downstream riffle)	0	0			100%
		2. Thalweg centering at upstream of meander bend (Run)	0	0			100%
	4. Thalweg Position	1. Thalweg centering at upstream of meander bend (Run)	0	0			100%
		2. Thalweg centering at downstream of meander bend (Glide)	0	0			100%
2. Bank	1. Scoured/Eroding	Bank lacking vegetative cover due to active scour and erosion			0	0	100%
	2. Undercut	Banks undercut/overhanging to the extent that mass wasting is expected			0	0	100%
	3. Mass Wasting	Banks slumping, caving or collapse			0	0	100%
	<b>Totals</b>					<b>0</b>	<b>0</b>
3. Engineering Structures	1. Overall Integrity	Structures physically intact with no dislodged boulders or logs	7	7			100%
	2. Grade Control	Grade control structures exhibiting maintenance of grade across the sill	7	7			100%
	2a. Piping	Structures lacking any substantial flow underneath or around sills or arms	7	7			100%
	3. Bank Position	Bank erosion within the structures extent of influence <b>does not</b> exceed 15%	7	7			100%
	4. Habitat	Pool forming structures maintaining - Max Pool Depth/Mean Bankfull Depth ratio $\geq$ 1.5. Rootwads/logs providing some cover at low flow	0	0			100%

Table 6. Vegetation Conditions Assessment

Russell Gap Stream Mitigation Project - NCDMS Project No. 100003

<b>Planted Acreage: 9.8</b>						
<b>Vegetation Category</b>	<b>Defintions</b>	<b>Mapping Threshold (acres)</b>	<b>CCPV Depiction</b>	<b>Number of Polygons</b>	<b>Combined Acreage</b>	<b>% of Planted Acreage</b>
1. Bare Areas *	Very limited cover both woody and herbaceous material.	0.1 acres	N/A	0	0.00	0.0%
2. Low Stem Density Areas	Woody stem densities clearly below target levels based on MY3, 4, or 5 stem count criteria.	0.1 acres	N/A	0	0.00	0.0%
<b>Total</b>						
3. Areas of Poor Growth Rates or Vigor	Areas with woody stems or a size class that are obviously small given the monitoring year.	0.25 acres	N/A	0	0.00	0.0%
<b>Cumulative Total</b>						
<b>Easement Acreage: 15.8</b>						
<b>Vegetation Category</b>	<b>Defintions</b>	<b>Mapping Threshold</b>	<b>CCPV Depiction</b>	<b>Number of Points</b>	<b>Combined Acreage</b>	<b>% of Planted Acreage</b>
4. Invasive Areas of Concern	Areas or points (if too small to render as polygons at map scale)	1000 ft <sup>2</sup>	N/A	0	0.00	0.0%
5. Easement Encroachment Areas	Areas or points (if too small to render as polygons at map scale)	none	N/A	0	0.00	0.0%

\* The bare areas reported here for MY1 do have woody stems growing in them but have sparse/scattered herbaceous cover only.

**Russell Gap: MY1 Stream Station Photo-Points**



PP-1: Reach 13, view upstream Station 10+20.  
(November 5, 2020)



PP-2: Reach 14, view upstream toward Reach 13 at Station 11+45. (November 5, 2020)



PP-3: Reach 14, view upstream Station 13+00.  
(November 5, 2020)



PP-4: Reach 14, view upstream Station 13+75.  
(November 5, 2020)



PP-5: Reach 14, view upstream Station 15+00.  
(November 5, 2020)



PP-6: Reach 14, end of reach Station 16+00.  
(November 5, 2020)

# Russell Gap: MY1 Stream Station Photo-Points



PP-7: Reach 1, view upstream, at Station 10+20.  
(November 5, 2020)



PP-8: Reach 1, view upstream Reach 1 at Station 13+00.  
(November 5, 2020)



PP-9: Reach 1, view upstream at Station 15+00.  
(November 5, 2020)



PP-10: Reach 1, view upstream at Station 17+25.  
(November 5, 2020)



PP-11: Reach 1, view upstream at Station 20+00.  
(November 5, 2020)



PP-12: Reach 1, view downstream at Station 20+00.  
(November 5, 2020)



# Russell Gap: MY1 Stream Station Photo-Points



PP-13: Reach 1, view upstream at Station 20+75.  
(November 5, 2020)



PP-14: Reach 1, view downstream at Station 20+75.  
(November 5, 2020)



PP-15: Reach 1, view upstream at Station 21+50.  
(November 5, 2020)



PP-16: Reach 1, confluence of Reach 1 and Reach 11 at  
Station 22+75. (November 5, 2020)



PP-17: Reach 1, view upstream at Station 24+20.  
(November 5, 2020)



PP-18: Reach 1, view of upstream at Station 27+00.  
(November 5, 2020)

# Russell Gap: MY1 Stream Station Photo-Points



PP-19: Reach 1, view upstream Reach 12 at Station 29+10.  
(November 5, 2020)



PP-20: Reach 1, view upstream at Station 29+20.  
(November 5, 2020)



PP-21: Reach 11, view upstream at Station 10+20.  
(November 5, 2020)



PP-22: Reach 11, view upstream at Station 11+50.  
(November 5, 2020)



PP-23: Reach 11, view upstream at Station 12+75.  
(November 5, 2020)



PP-24: Reach 11, view upstream at Station 14+50.  
(November 5, 2020)

# Russell Gap: MY1 Stream Station Photo-Points



PP-25: Reach 10A, view upstream at Station 10+50.  
(November 5, 2020)



PP-26: Reach 10A, view upstream at Station 12+50.  
(November 5, 2020)



PP-27: Reach 10A, view upstream at Station 13+75.  
(November 5, 2020)



PP-28: Reach 10B, view upstream at Station 14+50.  
(November 5, 2020)



PP-29: Reach 5, view upstream at Station 11+00.  
(October 21, 2020)



PP-30: Reach 6, view upstream at Station 14+50.  
(October 21, 2020)

# Russell Gap: MY1 Stream Station Photo-Points



PP-31: Reach 17, view upstream at Station 11+00.  
(October 21, 2020)



PP-32: Reach 6, view upstream at Station 17+50.  
(October 21, 2020)



PP-33: Reach 6, view upstream at Station 19+50.  
(November 10, 2020)



PP-34: Reach 18, view upstream at Station 12+00.  
(November 10, 2020)



PP-35: Reach 18, view upstream at Station 10+60.  
(October 21, 2020)



PP-36: Reach 7A, view upstream at Station 20+00.  
(November 10, 2020)

# Russell Gap: MY1 Stream Station Photo-Points



PP-37: Reach 7B, view upstream at Station 21+75.  
(November 10, 2020)



PP-38: Reach7B, view downstream at Station 22+00.  
(October 21, 2020)



PP-39: Reach 7B, view upstream at Station 22+25.  
(October 21, 2020)



PP-40: Reach 7B, view upstream at Station 23+50.  
(October 21, 2020)



PP-41: Reach 20, view upstream at Station 10+80.  
(November 5, 2020)



PP-42: Reach 20, view upstream at Station 11+50.  
(October 21, 2020)

# Russell Gap: MY1 Stream Station Photo-Points



PP-43: Reach 19, view upstream at Station 10+15.  
(November 5, 2020)



PP-44: Reach 19, view upstream at Station 11+85.  
(November 5, 2020)



PP-45: Reach 19, view upstream at Station 12+80.  
(October 21, 2020)



PP-46: Reach 19, view upstream at Station 13+20.  
(November 10, 2020)



PP-47: Reach 19, view upstream at Station 013+80.  
(November 10, 2020)



PP-48: Reach 7B, view upstream at Station 24+10.  
(November 10, 2020)

# Russell Gap: MY1 Stream Station Photo-Points



PP-49: Reach 7B, view downstream at Station 24+60.  
(November 10, 2020)



PP-50: Reach 7B, view upstream at Station 25+25.  
(November 10, 2020)



PP-51: Reach 22A, view upstream at Station 10+00.  
(November 10, 2020)



PP-52: Reach 22A, view of upstream at Station 11+15.  
(October 21, 2020)



PP-53: Reach 7B, view upstream at Station 32+00.  
(October 21, 2020)



PP-54: Reach 25, view upstream at Station 10+10.  
(October 21, 2020)

# Russell Gap: MY1 Stream Station Photo-Points



PP-55: Reach 25, view upstream at Station 11+20.  
(October 21, 2020)



PP-56: Reach 25, view upstream at Station 13+40.  
(October 21, 2020)



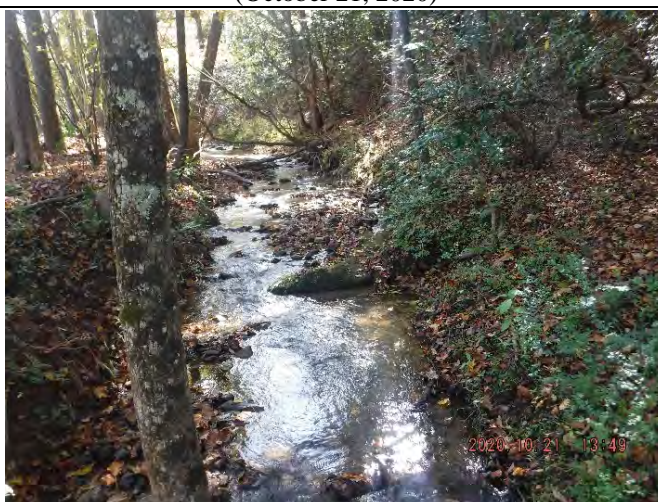
PP-57: Reach 7B, view downstream at Station 33+00.  
(October 21, 2020)



PP-58: Reach 7B, view upstream at Station 33+20.  
(October 21, 2020)



PP-59: Reach 8, view downstream at Station 34+00.  
(October 21, 2020)



PP-60: Reach 8, view upstream at Station 37+00.  
(October 21, 2020)



# Russell Gap: MY1 Stream Station Photo-Points



PP-61: Reach 8, view upstream at Station 38+00.  
(October 21, 2020)



PP-62: Reach 9, view upstream at Station 39+20.  
(October 21, 2020)



PP-63: Reach 9, view upstream at Station 41+00.  
(October 21, 2020)



PP-64: Reach 9, view upstream at Station 42+00.  
(October 21, 2020)



PP-65: Reach 4A, view upstream at Station 13+00.  
(November 10, 2020)



PP-66: Reach 26, view upstream at Station 11+00.  
(October 21, 2020)

**Russell Gap: MY1 Stream Station Photo-Points**



PP-67: Reach 4, view upstream at Station 11+10.  
(November 10, 2020)



PP-68: Reach 4, view upstream at Station 12+00.  
(November 10, 2020)



PP-69: Reach 27, view upstream at Station 11+60.  
(November 10, 2020)



PP-70: Reach 4, view upstream at Station 15+00.  
(November 10, 2020)



PP-71: Reach 4, view upstream at Station 16+10.  
(November 10, 2020)



PP-72: Reach 4, view upstream at Station 19+00.  
(November 10, 2020)

**Russell Gap: MY1 Stream Station Photo-Points**



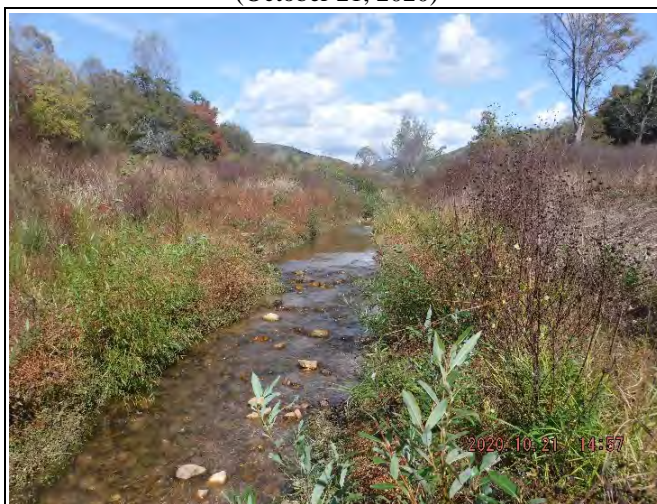
**PP-73: Reach 15, view upstream at Station 11+00.  
(October 21, 2020)**



**PP-74: Reach 15, view upstream at Station 13+00.  
(October 21, 2020)**



**PP-75: Reach 4, view upstream at Station 23+20.  
(October 21, 2020)**



**PP-76: Reach 4, view upstream at Station 25+00.  
(October 21, 2020)**



**PP-77: Reach 4, view upstream at Station 28+30.  
(October 21, 2020)**



**PP-78: Reach 4, view upstream at Station 28+00.  
(November 10, 2020)**

## Russell Gap: MY1 Stream Station Photo-Points



PP-79: Reach 4, view upstream at Station 32+00.  
(October 21, 2020)



PP-80: Reach 3, view upstream at Station 33+00.  
(October 21, 2020)



PP-81: Reach 3, view upstream at Station 36+40.  
(October 21, 2020)

**MY1 Vegetation Monitoring Plot Photos  
Russell Gap - DMS Project #100003**



Photo 1. Vegetation Plot 1 – (October 7, 2020).



Photo 2. Vegetation Plot 2 – (October 7, 2020).



Photo 3. Vegetation Plot 3 – (October 7, 2020).



Photo 4. Vegetation Plot 4 – (October 8, 2020).



Photo 5. Vegetation Plot 5- (October 21, 2020).



Photo 6. Vegetation Plot 6- (October 8, 2020).



Photo 7. Vegetation Plot 7 – (October 8, 2020).



Photo 8. Vegetation Plot 8 – (October 8, 2020).



Photo 9. Vegetation Plot 9 – (September 2, 2020).



Photo 10. Vegetation Plot 10 – (October 8, 2020).



Photo 11. Vegetation Plot 11 – (October 8, 2020).



Photo 12. Vegetation Plot 12 – (October 21, 2020).



Photo 13. Vegetation Plot 13 – (October 21, 2020).



Photo 14. Vegetation Plot 14 – (October 21, 2020).



Photo 15. Vegetation Plot 15 – (October 21, 2020).



Photo 16. Vegetation Plot 16 – (October 7, 2020).



Photo 17. Vegetation Plot 17 – (October 7, 2020).



Photo 18. Vegetation Plot 18 – (October 8, 2020).



Photo 19. Vegetation Plot 19 – (October 21, 2020).



Photo 20. Vegetation Plot 20 – (October 21, 2020).



Photo 21. Random Vegetation Plot 1- (November 10, 2020).



Photo 22. Random Vegetation Plot 2 – (November 10, 2020).



Photo 23. Random Vegetation Plot 3 – (November 10, 2020).



Photo 24. Random Vegetation Plot 4 – (November 10, 2020).





Photo 25. Random Vegetation Plot 5 – (November 10, 2020). Photo 26. Random Vegetation Plot 6 – (November 10, 2020).



Photo 27. Random Vegetation Plot 7 – (November 10, 2020). Photo 28. Random Vegetation Plot 8 – (November 10, 2020).



Photo 29. Random Vegetation Plot 9 – (November 10, 2020).

Russell Gap MY1 Monitoring Gauges and Overbank Photographs



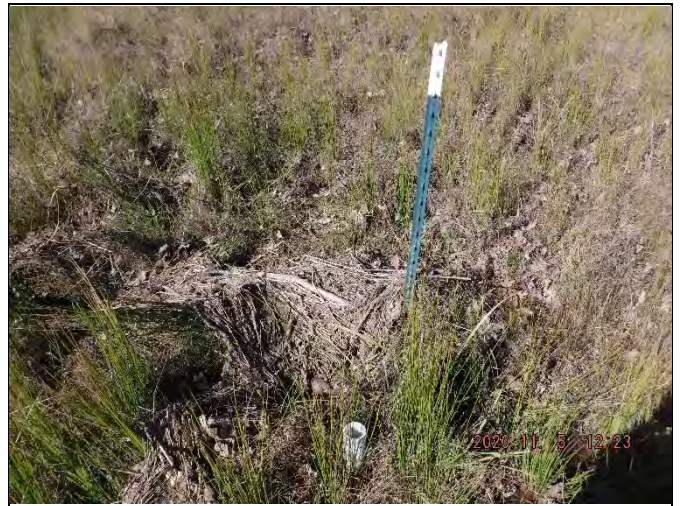
Monitoring Well 1. (November 5, 2020)



Monitoring Well 2. (November 5, 2020)



Monitoring Well 3. (November 5, 2020)



Monitoring Well 4. (November 5, 2020)



Monitoring Well 5. (November 5, 2020)



Monitoring Well 6. (November 5, 2020)

Russell Gap MY1 Monitoring Gauges and Overbank Photographs



Monitoring Well 7. (November 5, 2020)



Monitoring Well 8. (November 5, 2020)



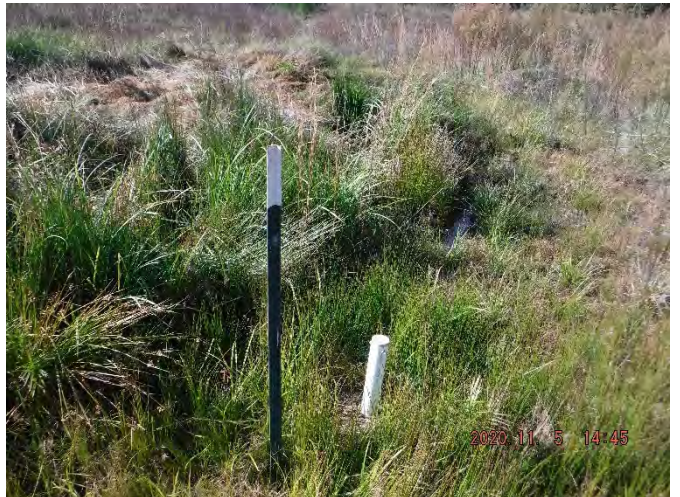
Monitoring Well 9. (November 5, 2020)



Monitoring Well 10. (November 5, 2020)



Monitoring Well 5. (November 5, 2020)



Monitoring Well 12. (November 5, 2020)

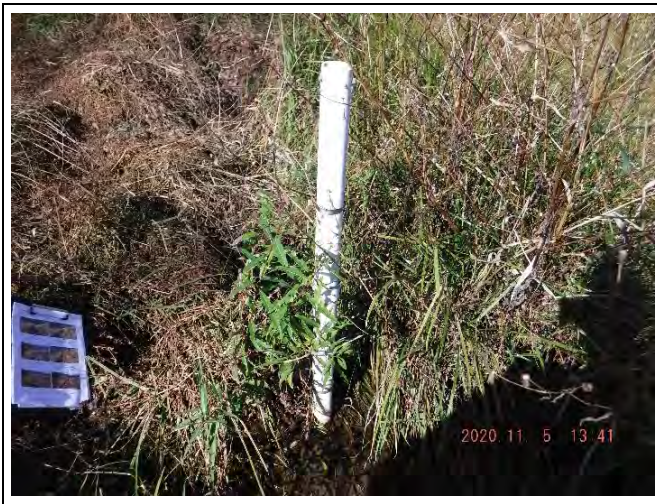
Russell Gap MY1 Monitoring Gauges and Overbank Photographs



Flow Gauge 1. Reach 11. (November 5, 2020)



Flow Gauge 2. Reach 14. (November 5, 2020)



Flow Gauge 3. Reach 13. (November 5, 2020)



Flow Gauge 4. Reach 19. (November 5, 2020)



Flow Gauge 5. Reach 20. (November 5, 2020)



Crest Gauge 1 Reach 1. Flood debris. (November 5, 2020)

Russell Gap MY1 Monitoring Gauges and Overbank Photographs



Crest Gauge 1 R1.

BKF reading 18". (November 5, 2020)



Crest Gauge 2 R9. (November 5, 2020)



Crest Gauge 3 R4. Wrack lines. (November 5, 2020)



Crest Gauge 3 R4. BKF reading at 26" and 30." (November 5, 2020)



Crest Gauge 4 R6. (November 5, 2020)

# **APPENDIX C**

## Vegetation Plot Data







# **APPENDIX D**

## Stream Geomorphology Data

Figure 4. Cross Sections with Annual Overlay

**Permanent Cross-Section 1**

Year 1 Survey Collected: October 2020

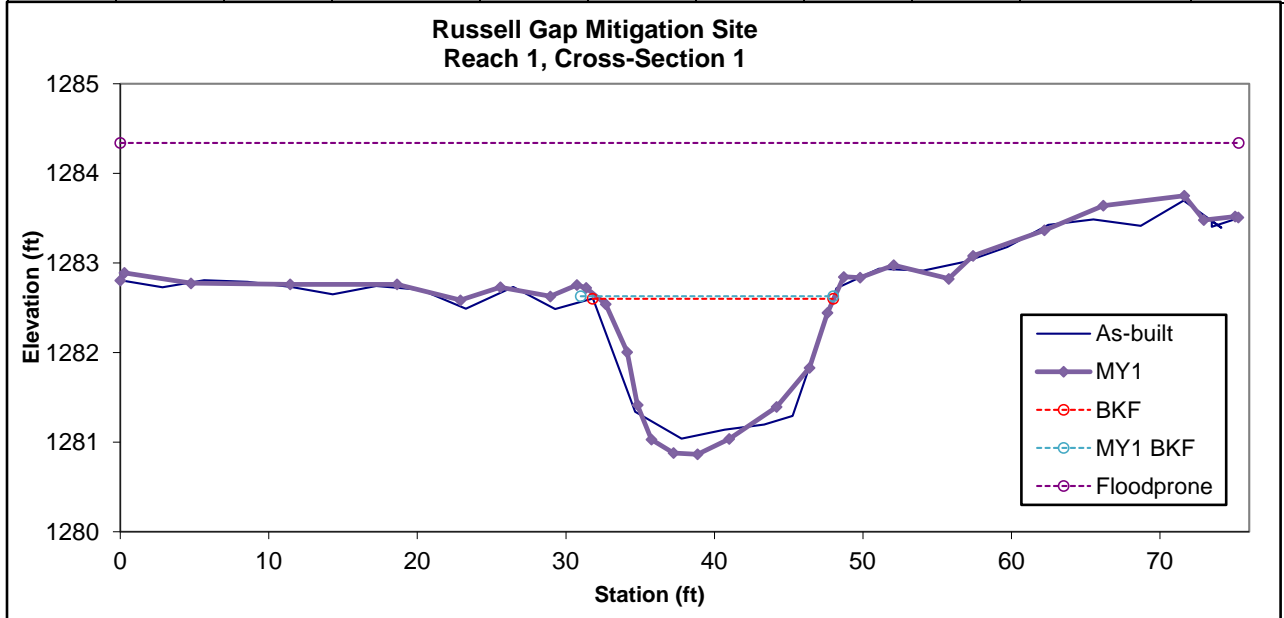


Looking at the Left Bank



Looking at the Right Bank

Feature	Stream Type	BKF Area	BKF Width	BKF Depth	Max BKF Depth	W/D	BH Ratio	ER	BKF Elev	LTOB Elev
Riffle	C	18.4	15.8	1.2	1.7	13.6	1.1	4.8	1282.60	1282.72



Note: Per DMS/IRT request, bank height ratio for MY1 has been calculated using the bankfull elevation as determined from the as-built bankfull area. All other values were calculated using the as-built bankfull elevation.

Figure 4. Cross Sections with Annual Overlay

**Permanent Cross-Section 2**

Year 1 Survey Collected: October 2020



Looking at the Left Bank



Looking at the Right Bank

Feature	Stream Type	BKF Area	BKF Width	BKF Depth	Max BKF Depth	W/D	BH Ratio	ER	BKF Elev	LTOB Elev
Pool	--	23.6	18.6	1.3	2.3	14.7	--	--	1282.20	1282.26

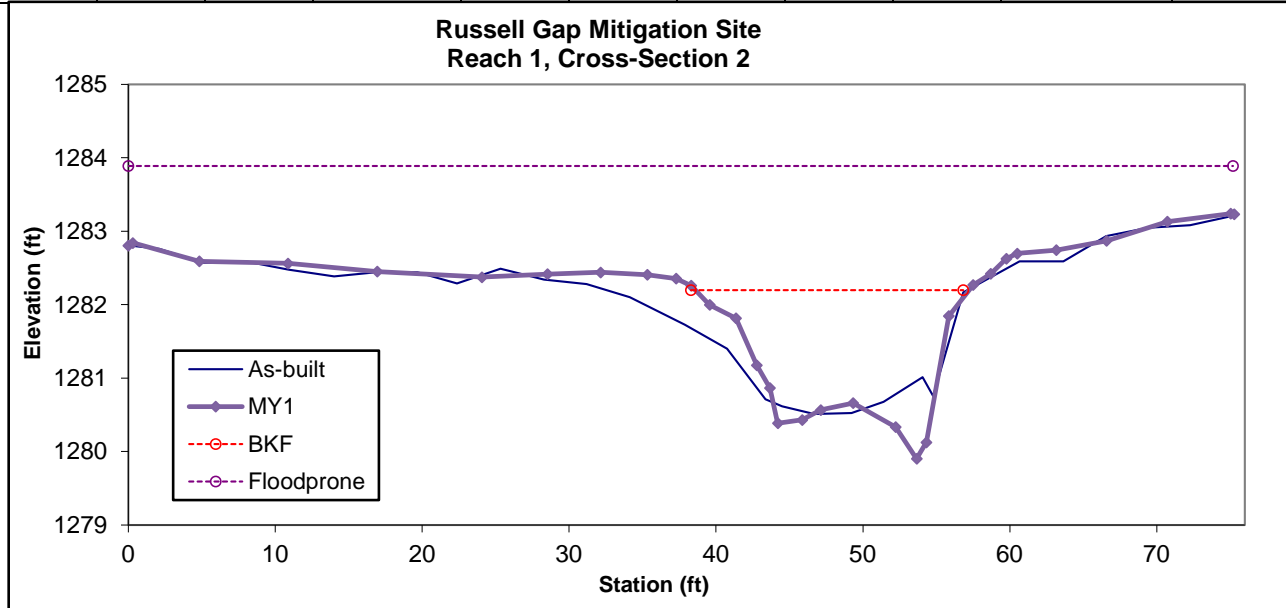


Figure 4. Cross Sections with Annual Overlay

**Permanent Cross-Section 3**  
 Year 1 Survey Collected: October 2020

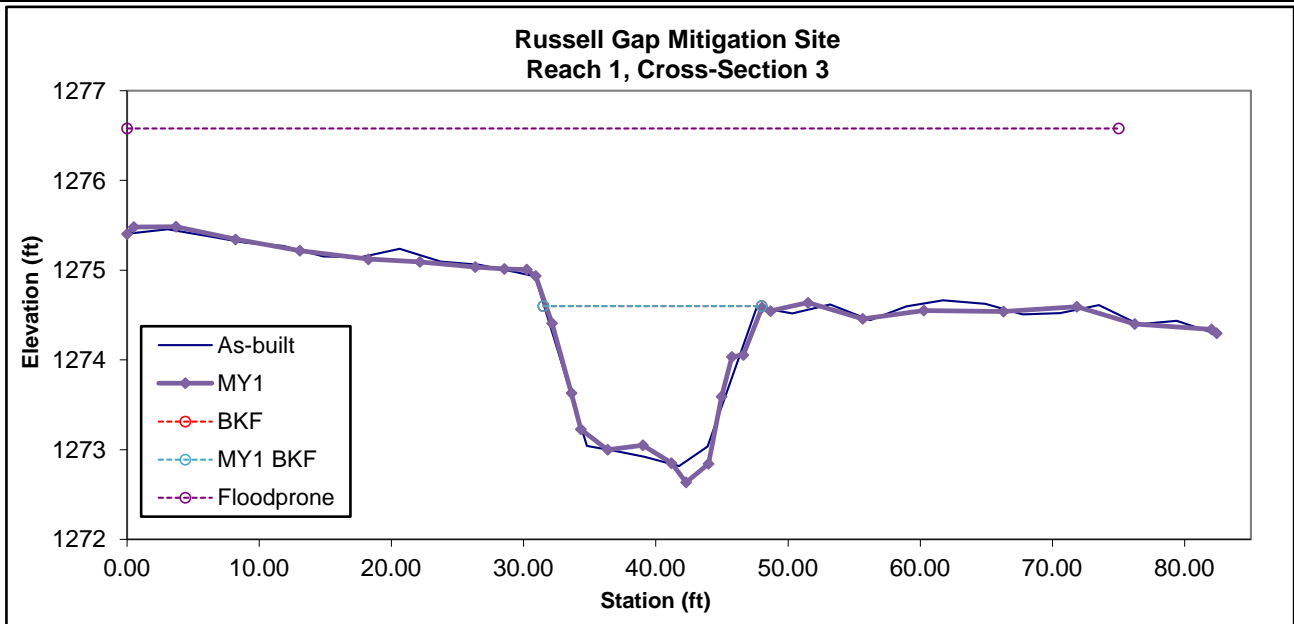


Looking at the Left Bank



Looking at the Right Bank

Feature	Stream Type	BKF Area	BKF Width	BKF Depth	Max BKF Depth	W/D	BH Ratio	ER	BKF Elev	LTOB Elev
Riffle	C	20.6	16.3	1.3	2.0	12.9	1.0	5.0	1274.60	1274.58



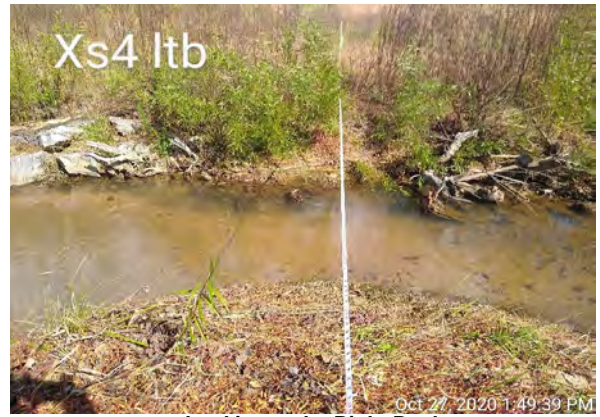
Note: Per DMS/IRT request, bank height ratio for MY1 has been calculated using the bankfull elevation as determined from the as-built bankfull area. All other values were calculated using the as-built bankfull elevation.

Figure 4. Cross Sections with Annual Overlay

**Permanent Cross-Section 4**  
 Year 1 Survey Collected: October 2020



Looking at the Left Bank



Looking at the Right Bank

Feature	Stream Type	BKF Area	BKF Width	BKF Depth	Max BKF Depth	W/D	BH Ratio	ER	BKF Elev	LTOB Elev
Pool		24.4	16.6	1.5	2.7	11.3			1274.00	1274.20

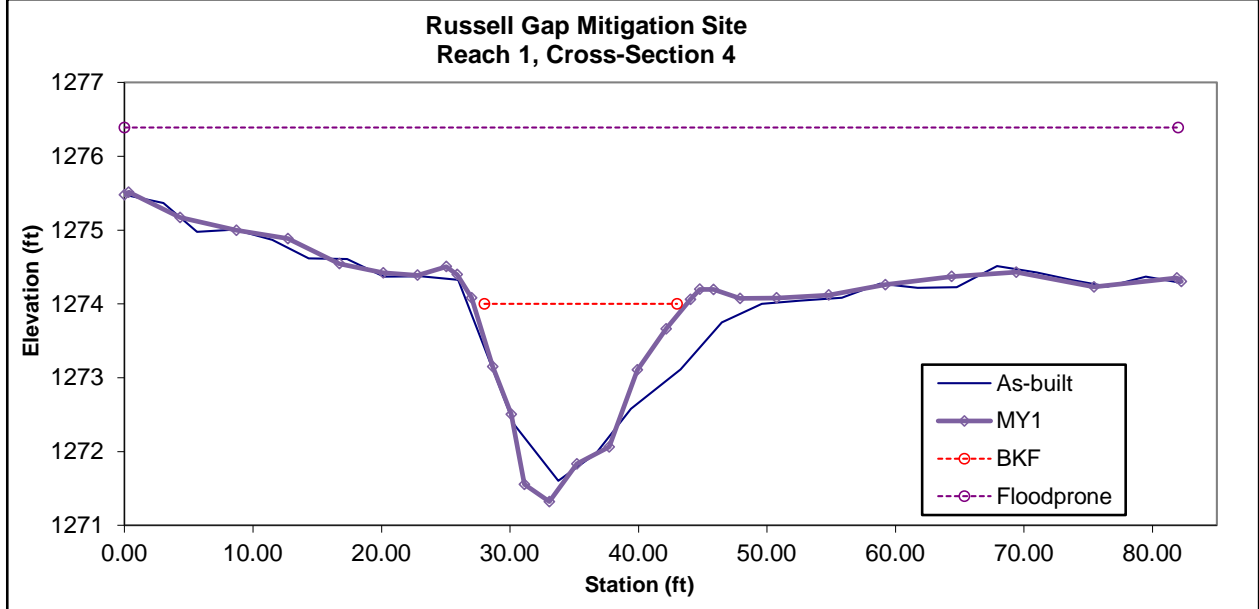


Figure 4. Cross Sections with Annual Overlay

**Permanent Cross-Section 5**

Year 1 Survey Collected: October 2020

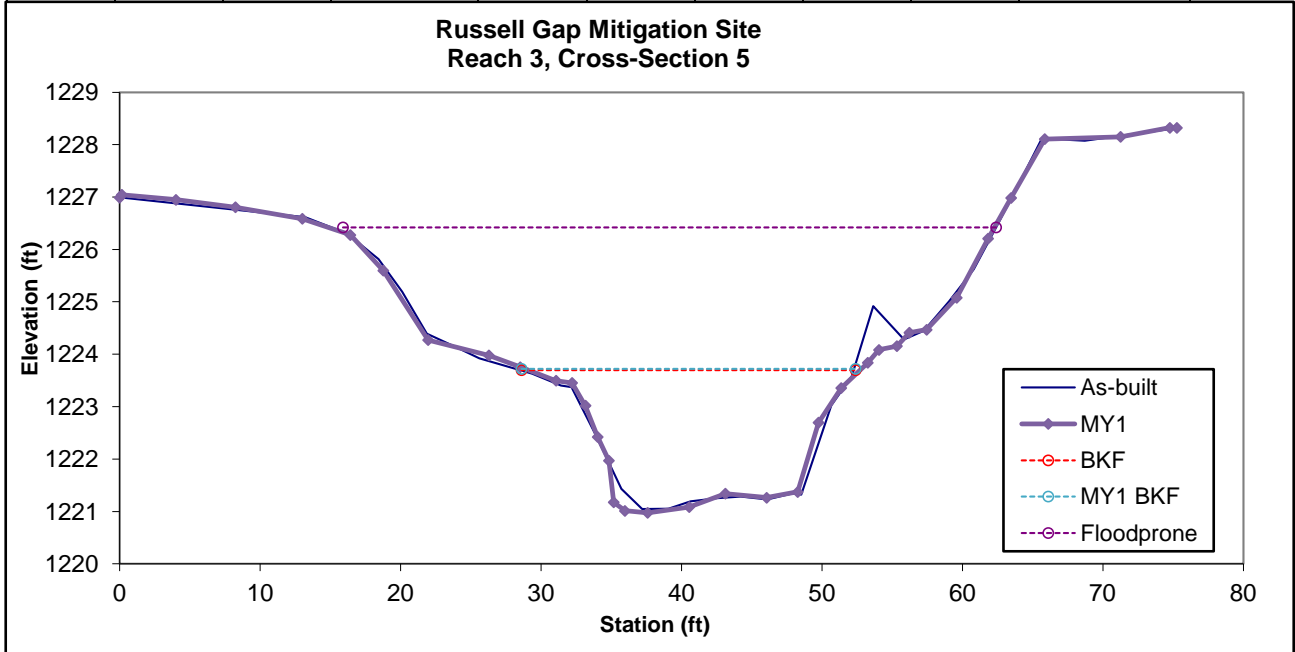


Looking at the Left Bank



Looking at the Right Bank

Feature	Stream Type	BKF Area	BKF Width	BKF Depth	Max BKF Depth	W/D	BH Ratio	ER	BKF Elev	LTOB Elev
Riffle	C	40.6	23.7	1.7	2.7	13.8	0.9	2.5	1223.70	1223.45



Note: Per DMS/IRT request, bank height ratio for MY1 has been calculated using the bankfull elevation as determined from the as-built bankfull area. All other values were calculated using the as-built bankfull elevation.

Figure 4. Cross Sections with Annual Overlay

**Permanent Cross-Section 6**

Year 1 Survey Collected: October 2020

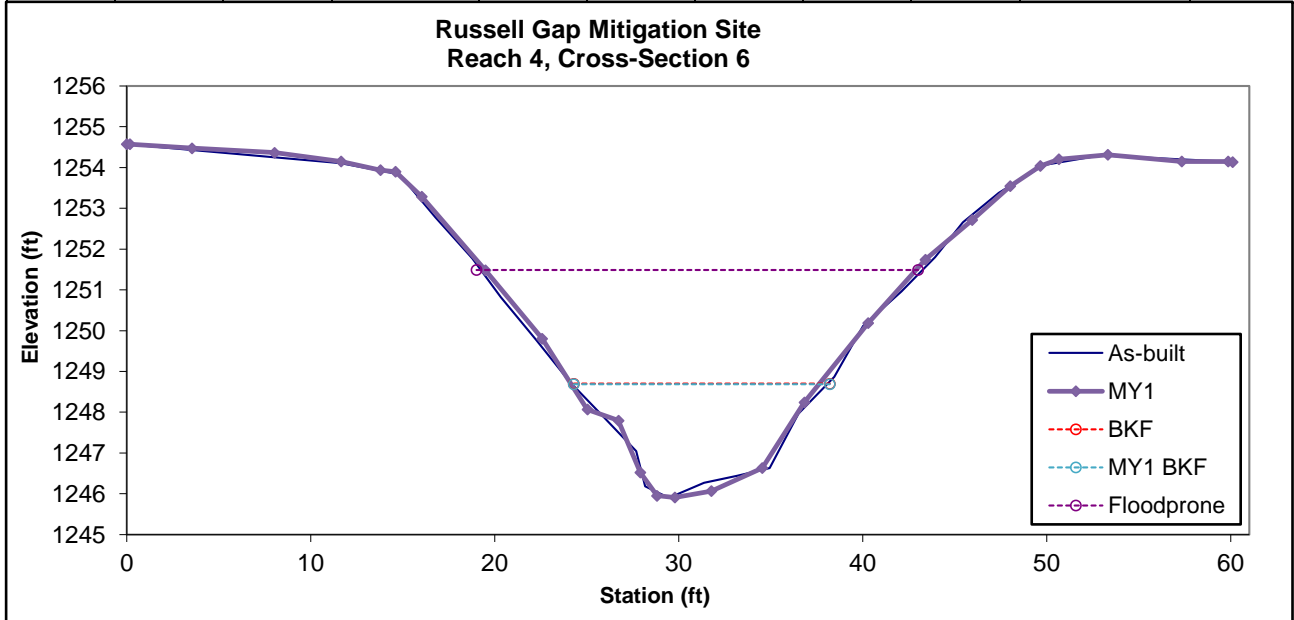


Looking at the Left Bank



Looking at the Right Bank

Feature	Stream Type	BKF Area	BKF Width	BKF Depth	Max BKF Depth	W/D	BH Ratio	ER	BKF Elev	LTOB Elev
Riffle	B	23.3	13.5	1.7	2.8	7.8	0.8	1.6	1248.70	1248.10



Note: Per DMS/IRT request, bank height ratio for MY1 has been calculated using the bankfull elevation as determined from the as-built bankfull area. All other values were calculated using the as-built bankfull elevation.

Figure 4. Cross Sections with Annual Overlay

**Permanent Cross-Section 7**

Year 1 Survey Collected: October 2020

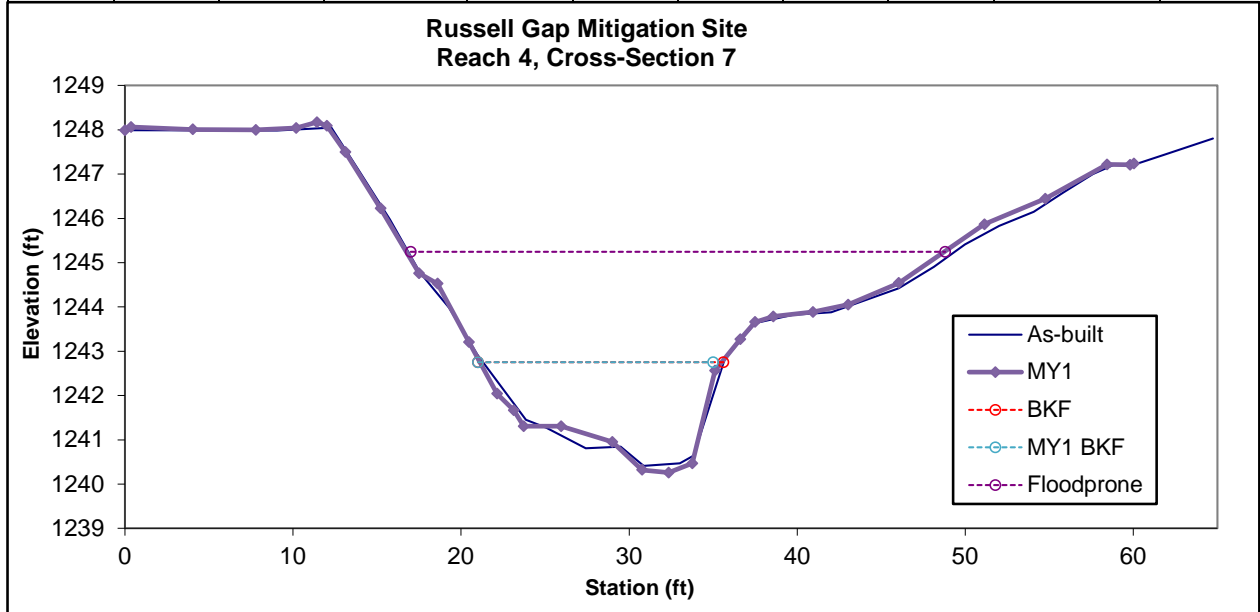


Looking at the Left Bank



Looking at the Right Bank

Feature	Stream Type	BKF Area	BKF Width	BKF Depth	Max BKF Depth	W/D	BH Ratio	ER	BKF Elev	LTOB Elev
Riffle	B	22.8	14.4	1.6	2.5	9.1	1.3	2.1	1242.75	1243.60



Note: Per DMS/IRT request, bank height ratio for MY1 has been calculated using the bankfull elevation as determined from the as-built bankfull area. All other values were calculated using the as-built bankfull elevation.



Figure 4. Cross Sections with Annual Overlay

**Permanent Cross-Section 8**

Year 1 Survey Collected: October 2020

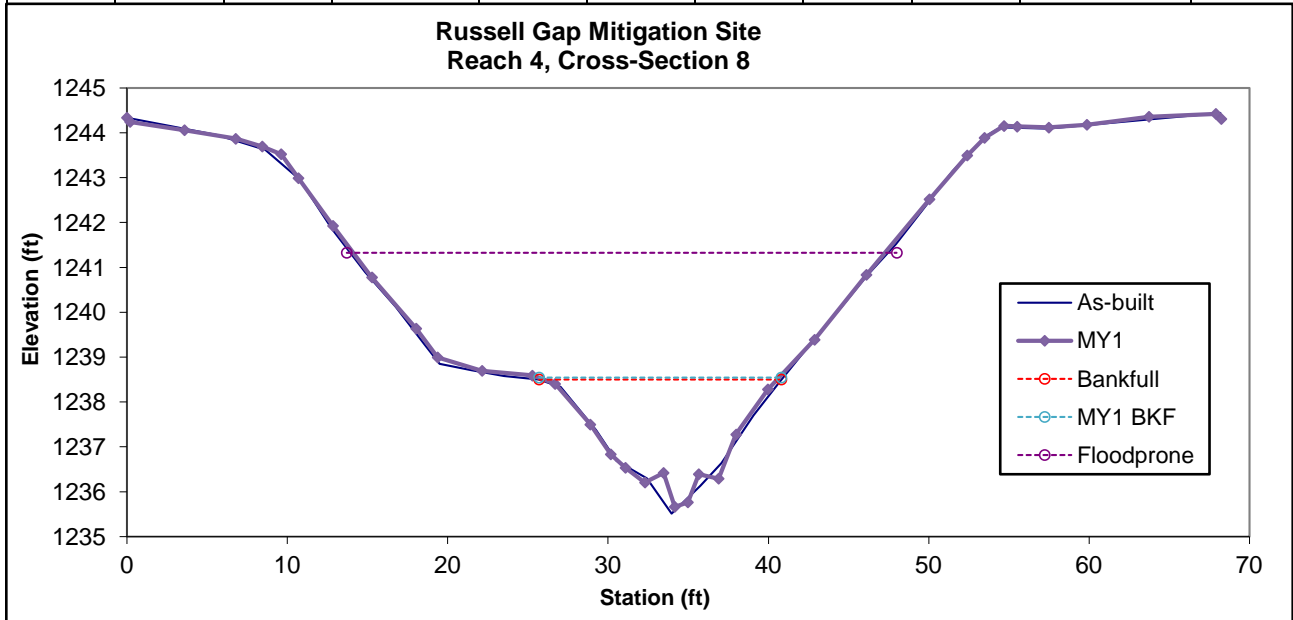


Looking at the Left Bank



Looking at the Right Bank

Feature	Stream Type	BKF Area	BKF Width	BKF Depth	Max BKF Depth	W/D	BH Ratio	ER	BKF Elev	LTOB Elev
Riffle	B	21.4	14.6	1.5	2.8	9.9	1.0	2.2	1238.50	1238.50



Note: Per DMS/IRT request, bank height ratio for MY1 has been calculated using the bankfull elevation as determined from the as-built bankfull area. All other values were calculated using the as-built bankfull elevation.

Figure 4. Cross Sections with Annual Overlay

**Permanent Cross-Section 9**

Year 1 Survey Collected: October 2020

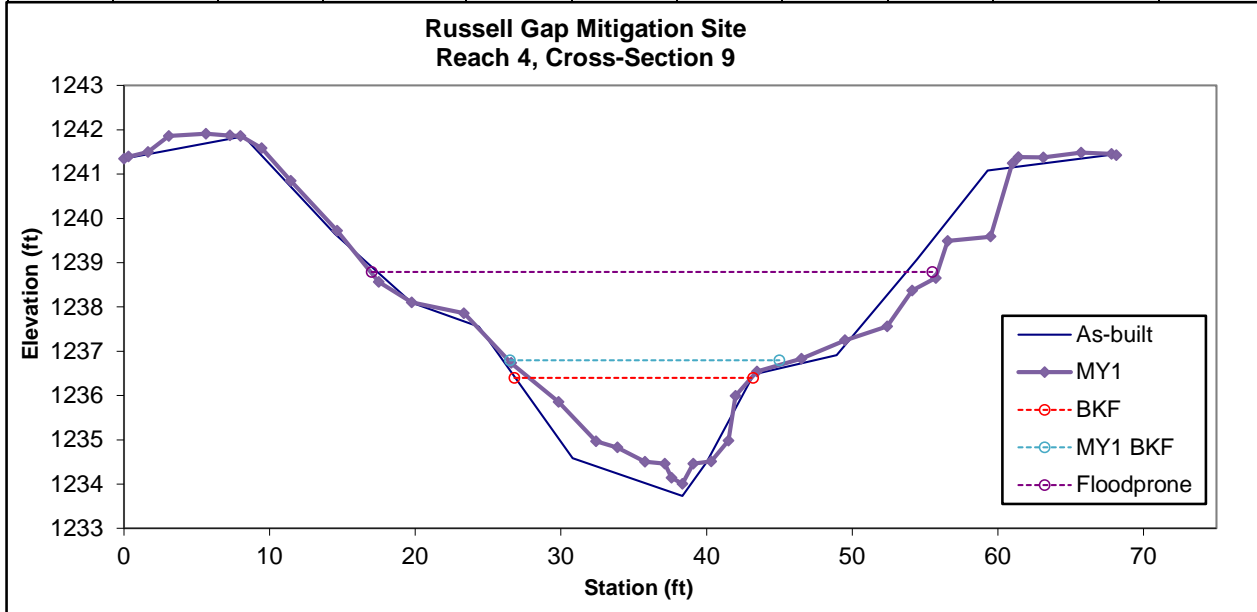


Looking at the Left Bank



Looking at the Right Bank

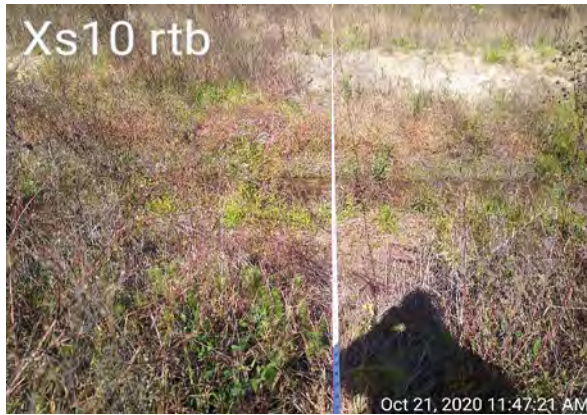
Feature	Stream Type	BKF Area	BKF Width	BKF Depth	Max BKF Depth	W/D	BH Ratio	ER	BKF Elev	LTOB Elev
Riffle	B	20.5	15.2	1.3	2.4	11.4	0.9	2.5	1236.40	1236.50



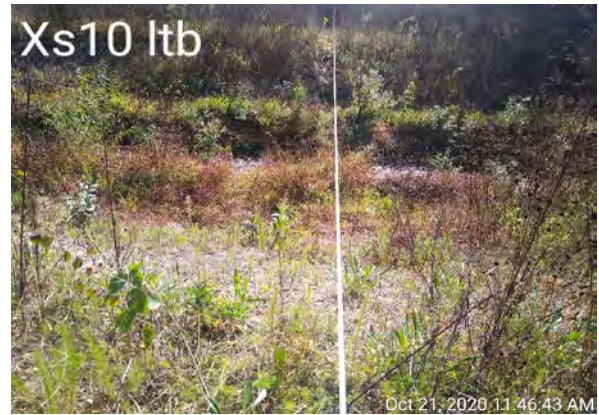
Note: Per DMS/IRT request, bank height ratio for MY1 has been calculated using the bankfull elevation as determined from the as-built bankfull area. All other values were calculated using the as-built bankfull elevation.

Figure 4. Cross Sections with Annual Overlay

**Permanent Cross-Section 10**  
 Year 1 Survey Collected: October 2020

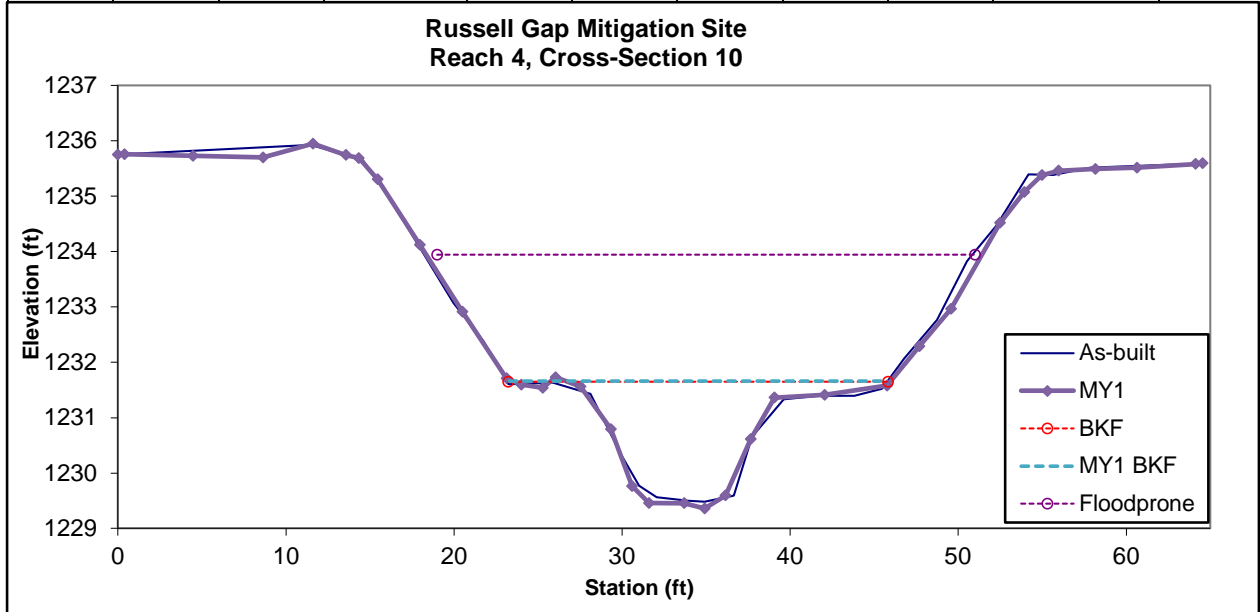


Looking at the Left Bank



Looking at the Right Bank

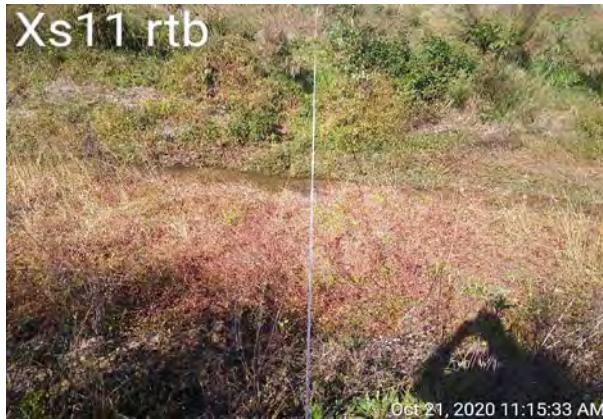
Feature	Stream Type	BKF Area	BKF Width	BKF Depth	Max BKF Depth	W/D	BH Ratio	ER	BKF Elev	LTOB Elev
Riffle	B	19.4	21.3	0.9	2.3	23.4	1.0	1.5	1231.65	1231.70



Note: Per DMS/IRT request, bank height ratio for MY1 has been calculated using the bankfull elevation as determined from the as-built bankfull area. All other values were calculated using the as-built bankfull elevation.

Figure 4. Cross Sections with Annual Overlay

**Permanent Cross-Section 11**  
 Year 1 Survey Collected: October 2020

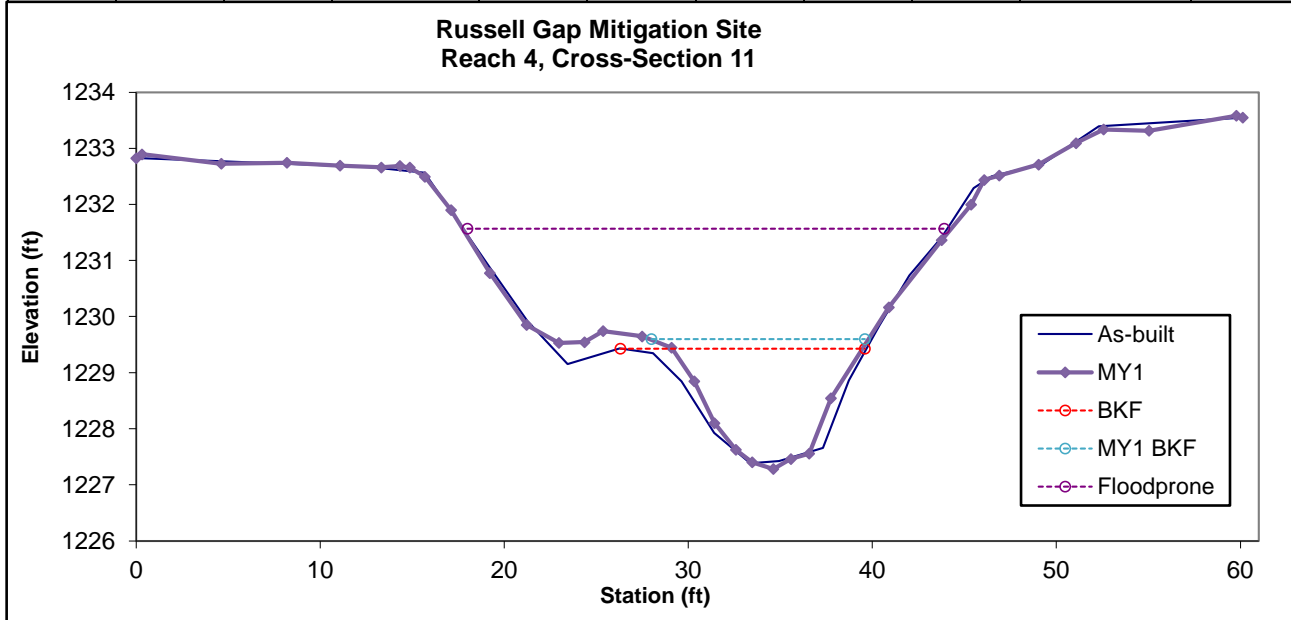


Looking at the Left Bank



Looking at the Right Bank

Feature	Stream Type	BKF Area	BKF Width	BKF Depth	Max BKF Depth	W/D	BH Ratio	ER	BKF Elev	LTOB Elev
Riffle	B	13.6	10.3	1.3	2.1	7.9	1.1	2.3	1229.43	1229.70



Note: Per DMS/IRT request, bank height ratio for MY1 has been calculated using the bankfull elevation as determined from the as-built bankfull area. All other values were calculated using the as-built bankfull elevation.

Figure 4. Cross Sections with Annual Overlay

**Permanent Cross-Section 12**  
 Year 1 Survey Collected: October 2020



Looking at the Left Bank



Looking at the Right Bank

Feature	Stream Type	BKF Area	BKF Width	BKF Depth	Max BKF Depth	W/D	BH Ratio	ER	BKF Elev	LTOB Elev
Pool	--	7.9	9.2	0.9	1.9	10.8	--	--	1300.30	1300.30

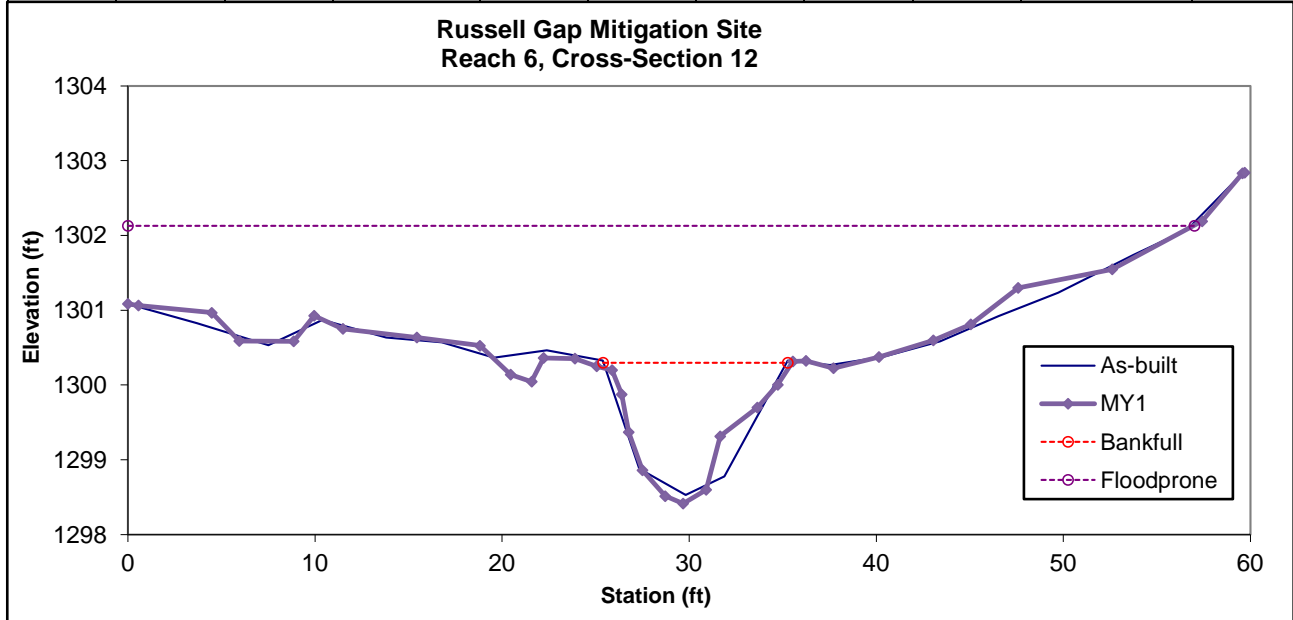
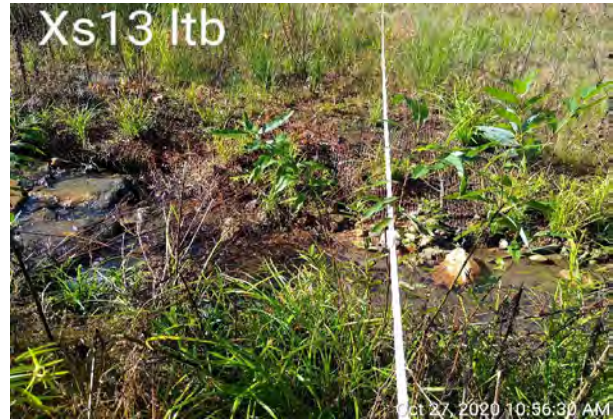


Figure 4. Cross Sections with Annual Overlay

**Permanent Cross-Section 13**  
 Year 1 Survey Collected: October 2020

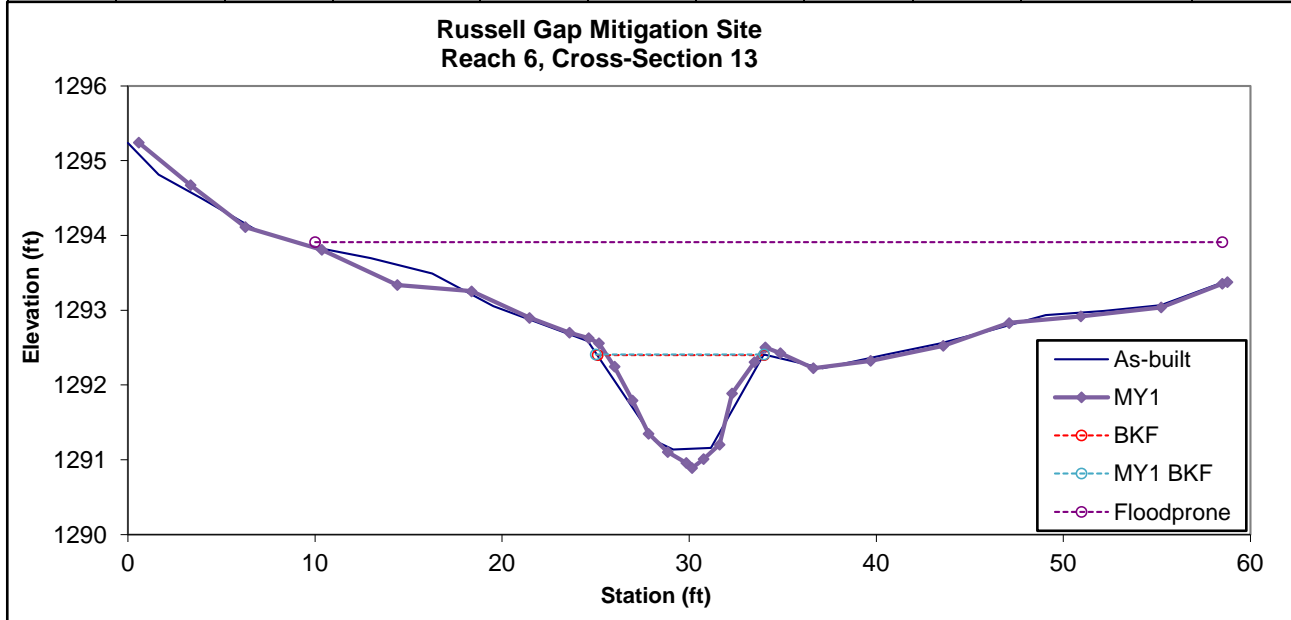


Looking at the Left Bank



Looking at the Right Bank

Feature	Stream Type	BKF Area	BKF Width	BKF Depth	Max BKF Depth	W/D	BH Ratio	ER	BKF Elev	LTOB Elev
Riffle	B	7.1	8.2	0.9	1.5	9.4	1.0	5.5	1292.40	1292.40



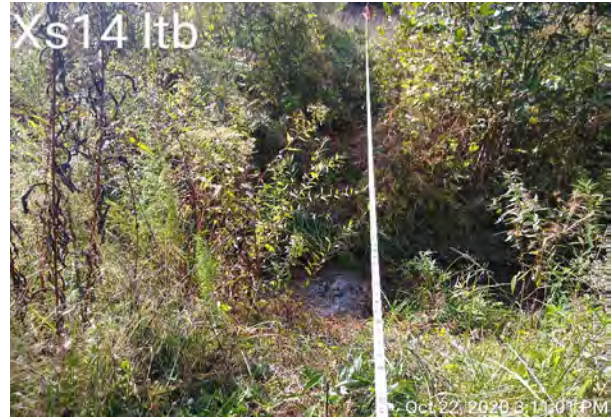
Note: Per DMS/IRT request, bank height ratio for MY1 has been calculated using the bankfull elevation as determined from the as-built bankfull area. All other values were calculated using the as-built bankfull elevation.

Figure 4. Cross Sections with Annual Overlay

**Permanent Cross-Section 14**  
 Year 1 Survey Collected: October 2020

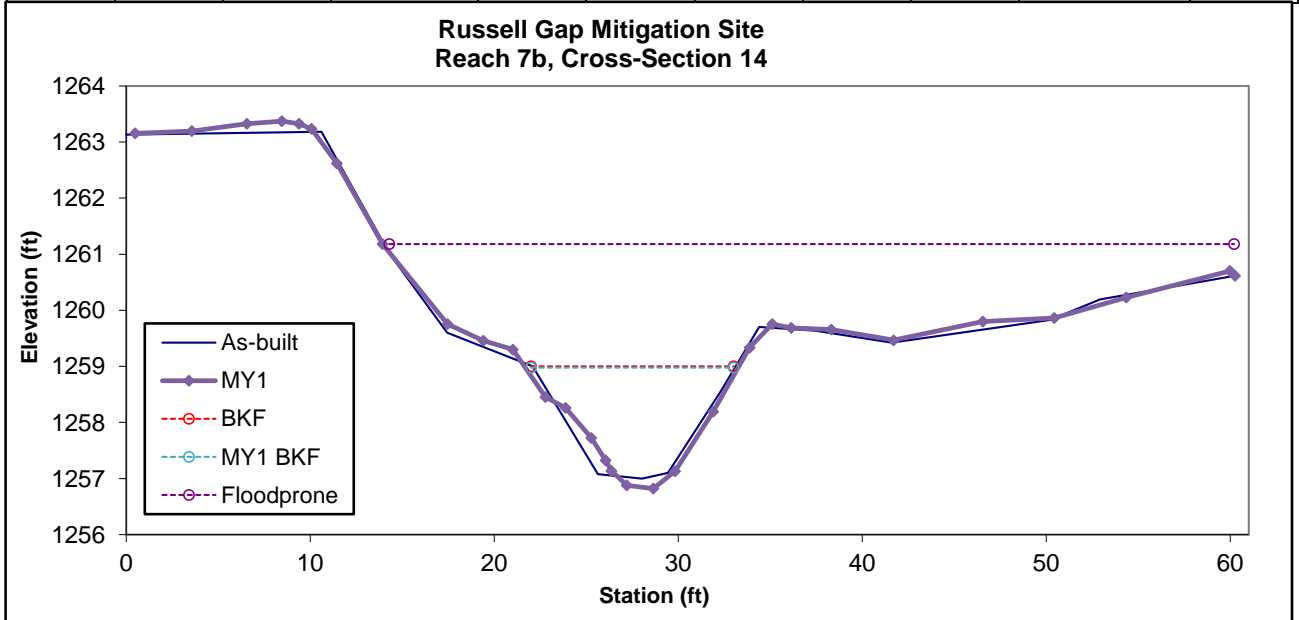


Looking at the Left Bank



Looking at the Right Bank

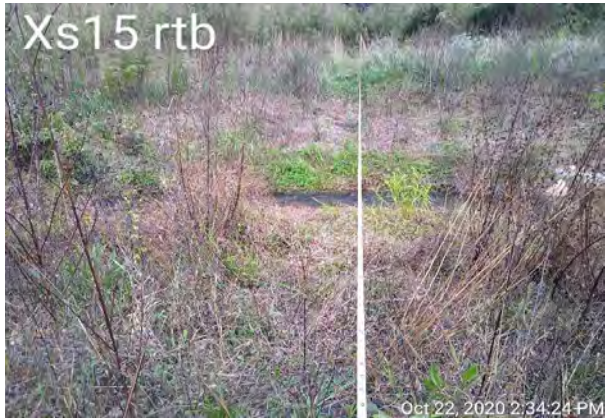
Feature	Stream Type	BKF Area	BKF Width	BKF Depth	Max BKF Depth	W/D	BH Ratio	ER	BKF Elev	LTOB Elev
Riffle	B	14.6	11.7	1.3	2.2	9.3	1.1	3.9	1259.00	1259.30



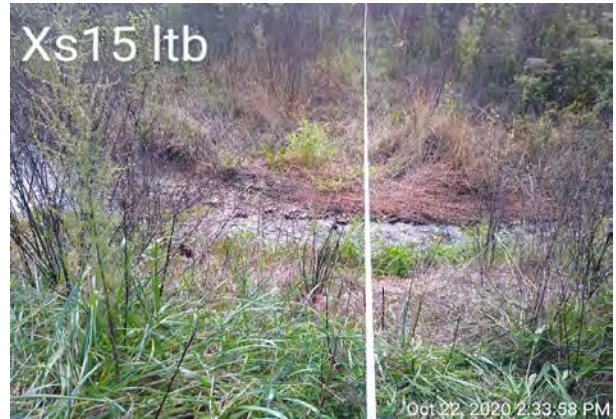
Note: Per DMS/IRT request, bank height ratio for MY1 has been calculated using the bankfull elevation as determined from the as-built bankfull area. All other values were calculated using the as-built bankfull elevation.

Figure 4. Cross Sections with Annual Overlay

**Permanent Cross-Section 15**  
 Year 1 Survey Collected: October 2020



Looking at the Left Bank



Looking at the Right Bank

Feature	Stream Type	BKF Area	BKF Width	BKF Depth	Max BKF Depth	W/D	BH Ratio	ER	BKF Elev	LTOB Elev
Pool	--	13.2	14.3	0.9	1.7	15.5	--	--	1252.08	1254.40

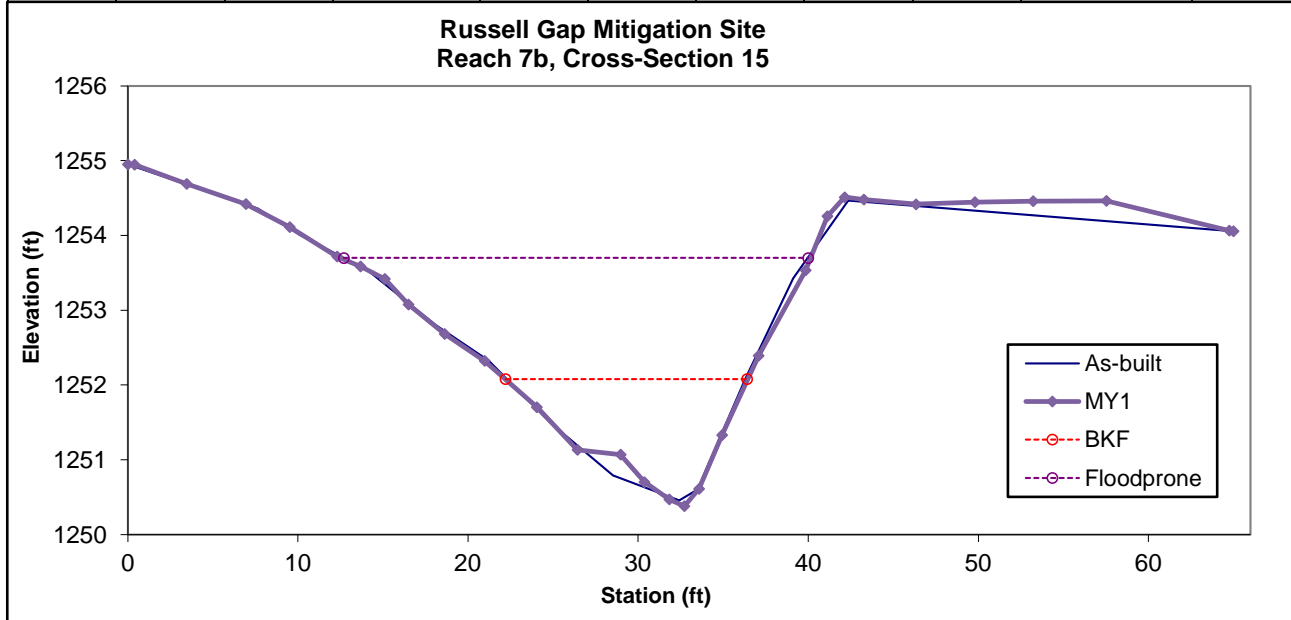




Figure 4. Cross Sections with Annual Overlay

**Permanent Cross-Section 16**  
 Year 1 Survey Collected: October 2020



Looking at the Left Bank



Looking at the Right Bank

Feature	Stream Type	BKF Area	BKF Width	BKF Depth	Max BKF Depth	W/D	BH Ratio	ER	BKF Elev	LTOB Elev
Pool	--	7.1	9.0	0.8	1.8	11.4	--	--	1231.10	1231.10

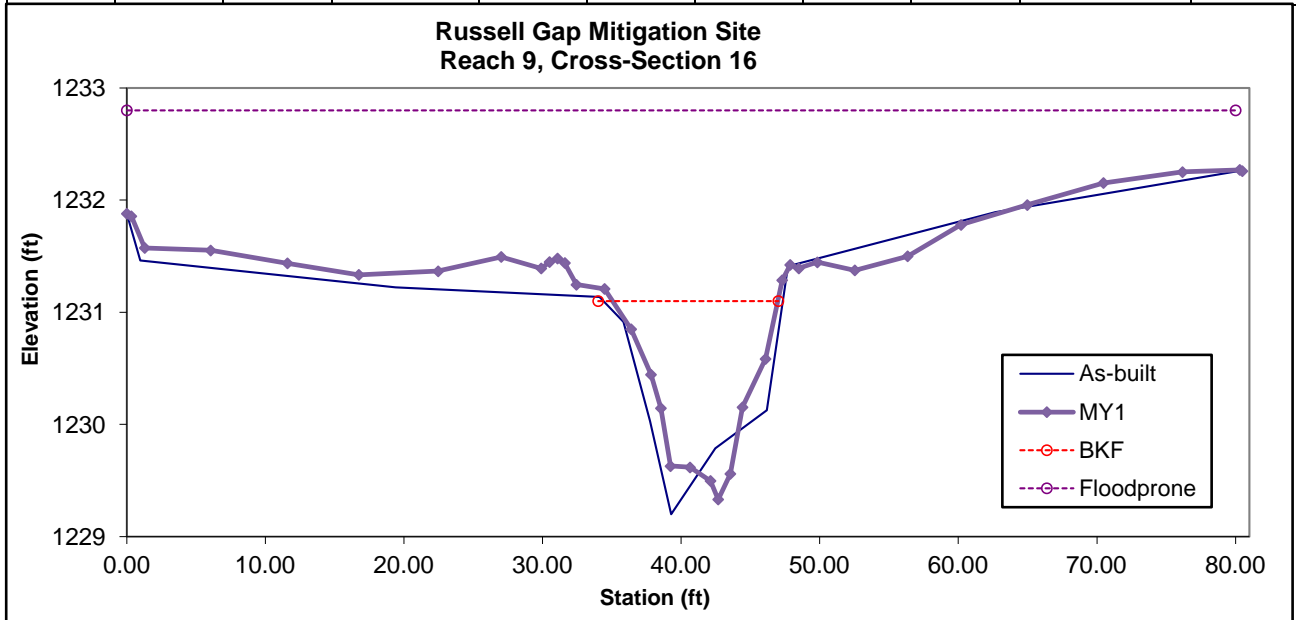


Figure 4. Cross Sections with Annual Overlay

**Permanent Cross-Section 17**  
 Year 1 Survey Collected: October 2020

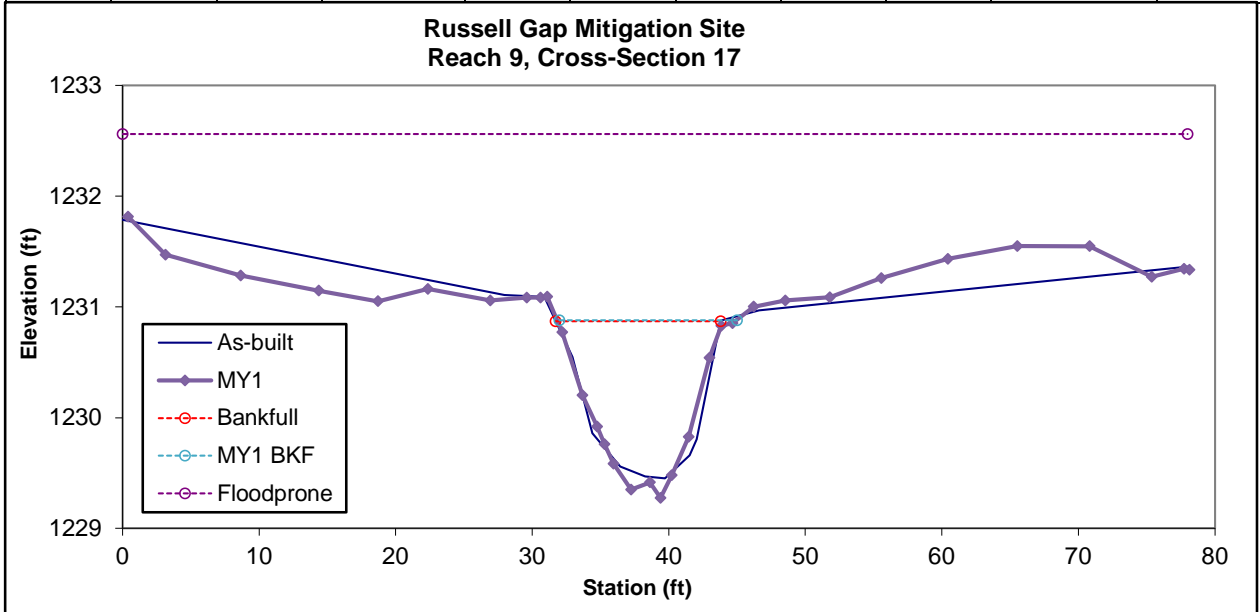


Looking at the Left Bank



Looking at the Right Bank

Feature	Stream Type	BKF Area	BKF Width	BKF Depth	Max BKF Depth	W/D	BH Ratio	ER	BKF Elev	LTOB Elev
Riffle	C	12.4	12.2	1.0	1.6	11.9	1.0	6.4	1230.87	1230.87

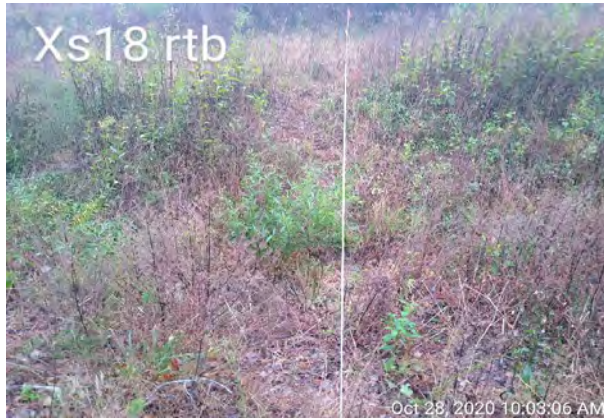


Note: Per DMS/IRT request, bank height ratio for MY1 has been calculated using the bankfull elevation as determined from the as-built bankfull area. All other values were calculated using the as-built bankfull elevation.

Figure 4. Cross Sections with Annual Overlay

**Permanent Cross-Section 18**

Year 1 Survey Collected: October 2020

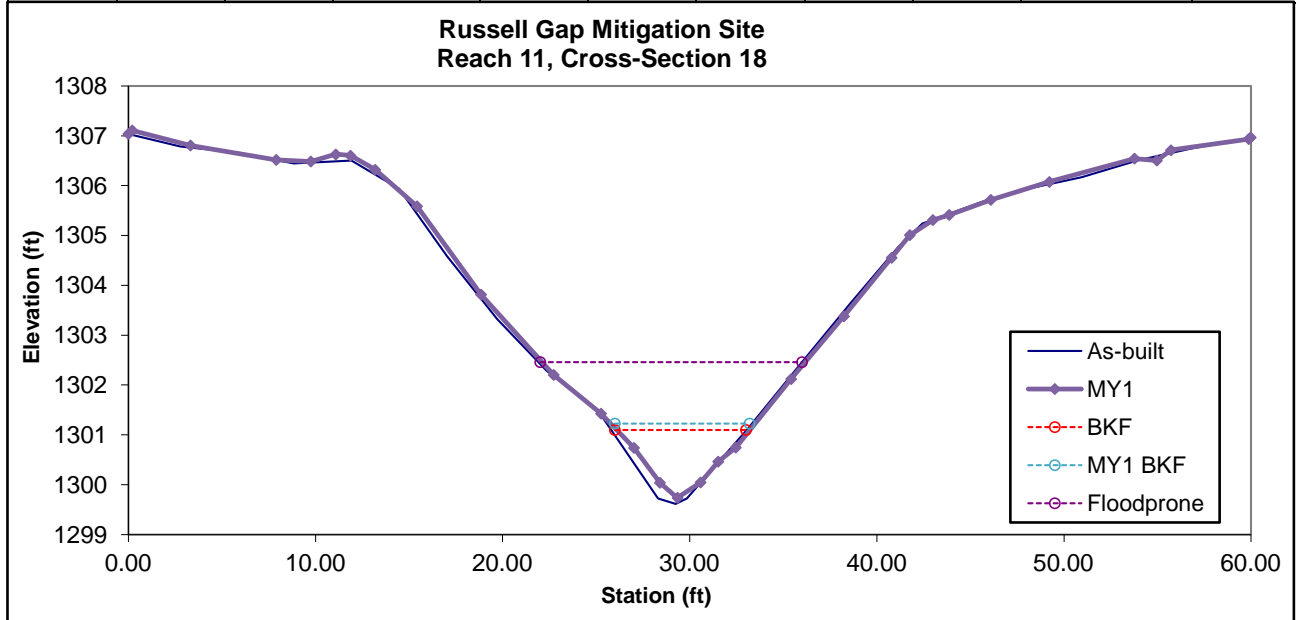


Looking at the Left Bank



Looking at the Right Bank

Feature	Stream Type	BKF Area	BKF Width	BKF Depth	Max BKF Depth	W/D	BH Ratio	ER	BKF Elev	LTOb Elev
Riffle	E	5.2	7.1	0.7	1.4	9.8	1.2	2.1	1301.10	1301.50



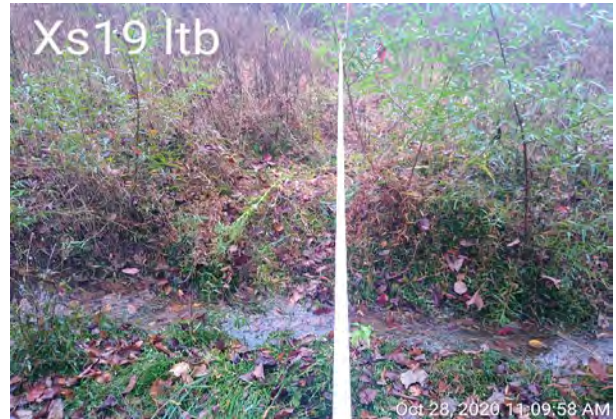
Note: Per DMS/IRT request, bank height ratio for MY1 has been calculated using the bankfull elevation as determined from the as-built bankfull area. All other values were calculated using the as-built bankfull elevation.

Figure 4. Cross Sections with Annual Overlay

**Permanent Cross-Section 19**  
 Year 1 Survey Collected: October 2020

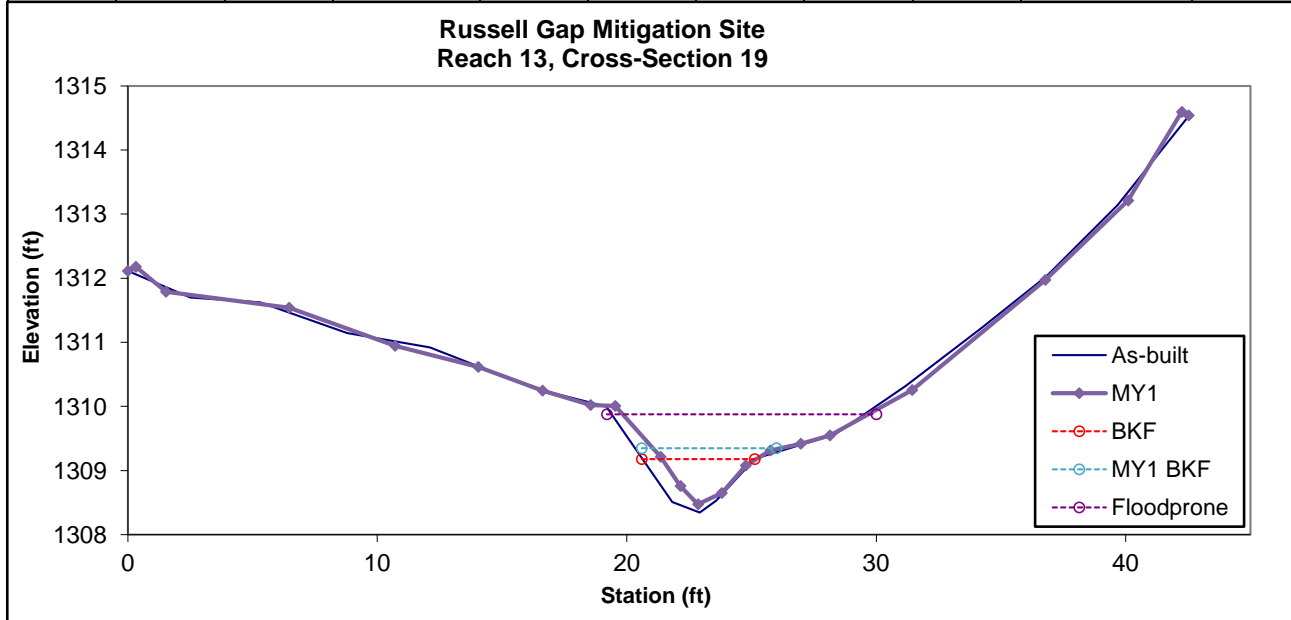


Looking at the Left Bank



Looking at the Right Bank

Feature	Stream Type	BKF Area	BKF Width	BKF Depth	Max BKF Depth	W/D	BH Ratio	ER	BKF Elev	LTOB Elev
Riffle	B	1.5	3.8	0.4	0.7	9.7	1.1	2.9	1309.18	1309.40



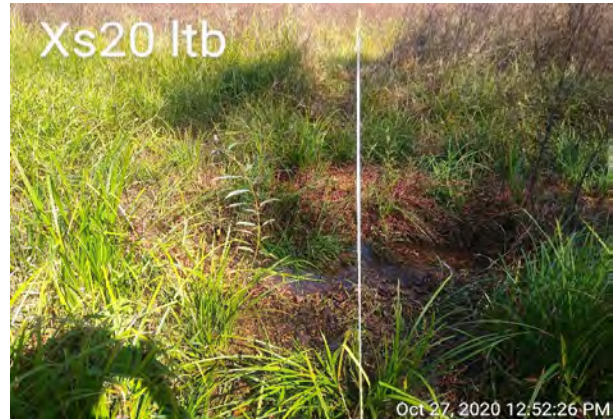
Note: Per DMS/IRT request, bank height ratio for MY1 has been calculated using the bankfull elevation as determined from the as-built bankfull area. All other values were calculated using the as-built bankfull elevation.

Figure 4. Cross Sections with Annual Overlay

**Permanent Cross-Section 20**  
 Year 1 Survey Collected: October 2020

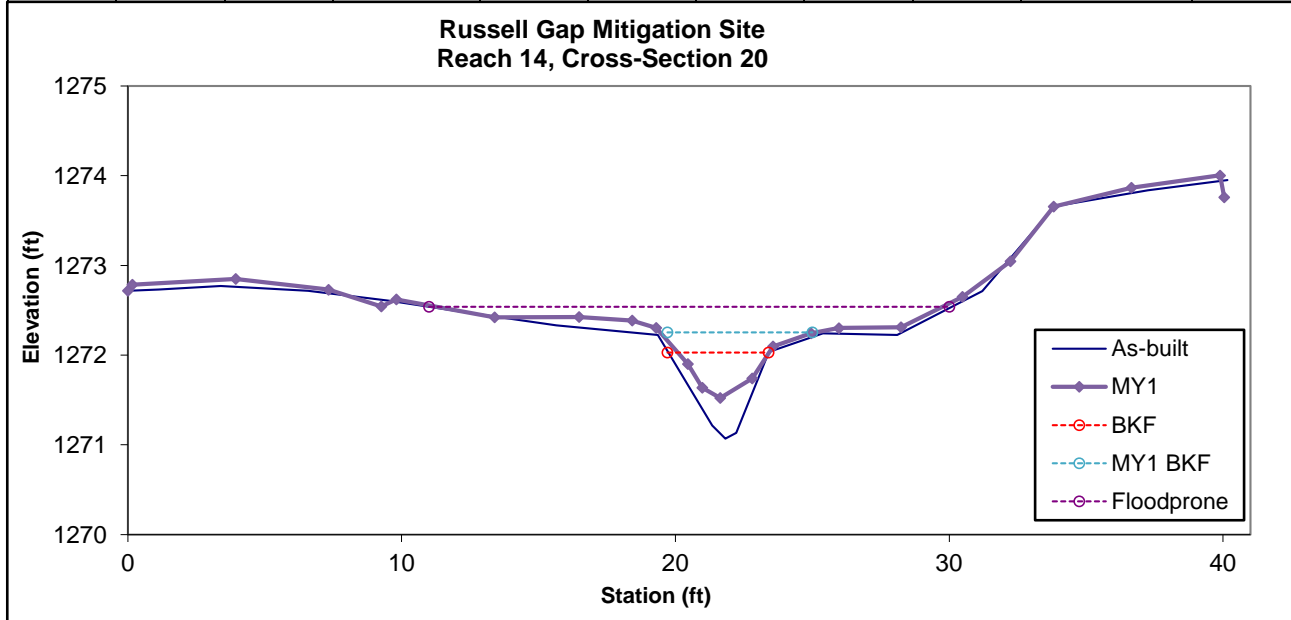


Looking at the Left Bank



Looking at the Right Bank

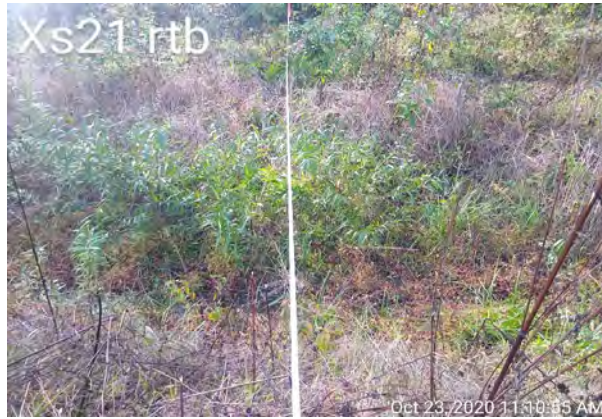
Feature	Stream Type	BKF Area	BKF Width	BKF Depth	Max BKF Depth	W/D	BH Ratio	ER	BKF Elev	LTOB Elev
Riffle	B	1.0	3.3	0.3	0.5	11.0	1.0	9.6	1272.03	1272.20



Note: Per DMS/IRT request, bank height ratio for MY1 has been calculated using the bankfull elevation as determined from the as-built bankfull area. All other values were calculated using the as-built bankfull elevation.

Figure 4. Cross Sections with Annual Overlay

**Permanent Cross-Section 21**  
 Year 1 Survey Collected: October 2020

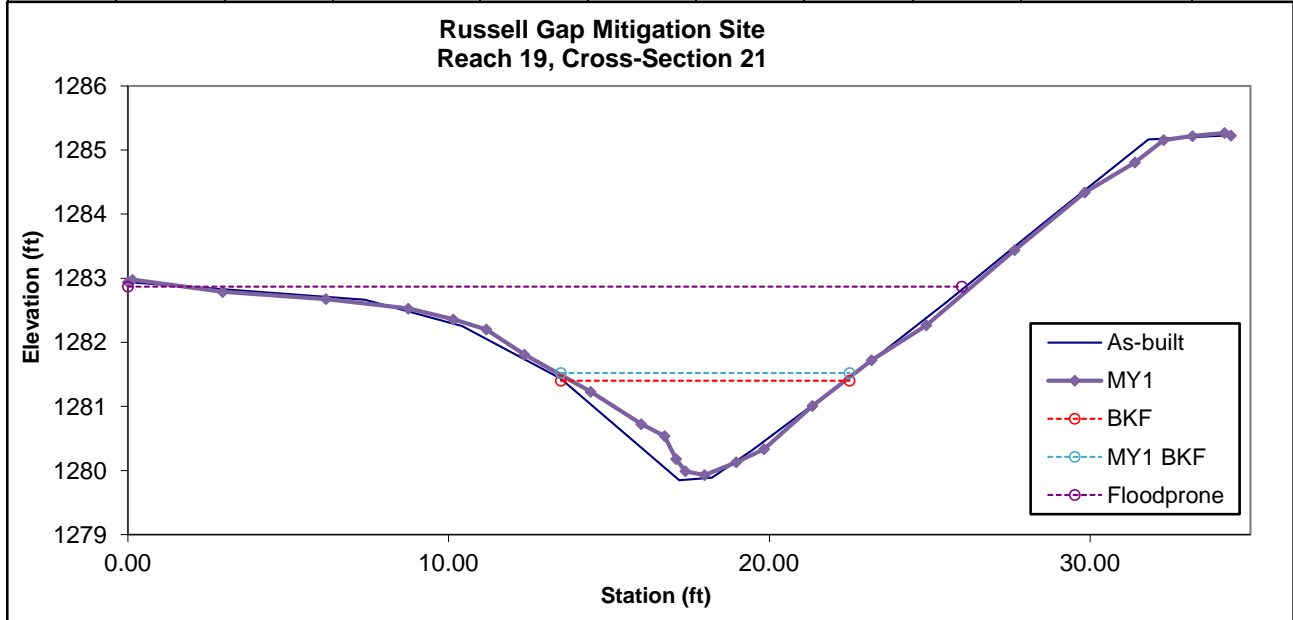


Looking at the Left Bank



Looking at the Right Bank

Feature	Stream Type	BKF Area	BKF Width	BKF Depth	Max BKF Depth	W/D	BH Ratio	ER	BKF Elev	LTOB Elev
Riffle	E	6.6	8.5	0.8	1.5	11.1	1.1	3.1	1281.40	1281.60



Note: Per DMS/IRT request, bank height ratio for MY1 has been calculated using the bankfull elevation as determined from the as-built bankfull area. All other values were calculated using the as-built bankfull elevation.

Figure 4. Cross Sections with Annual Overlay

**Permanent Cross-Section 22**  
 Year 1 Survey Collected: October 2020

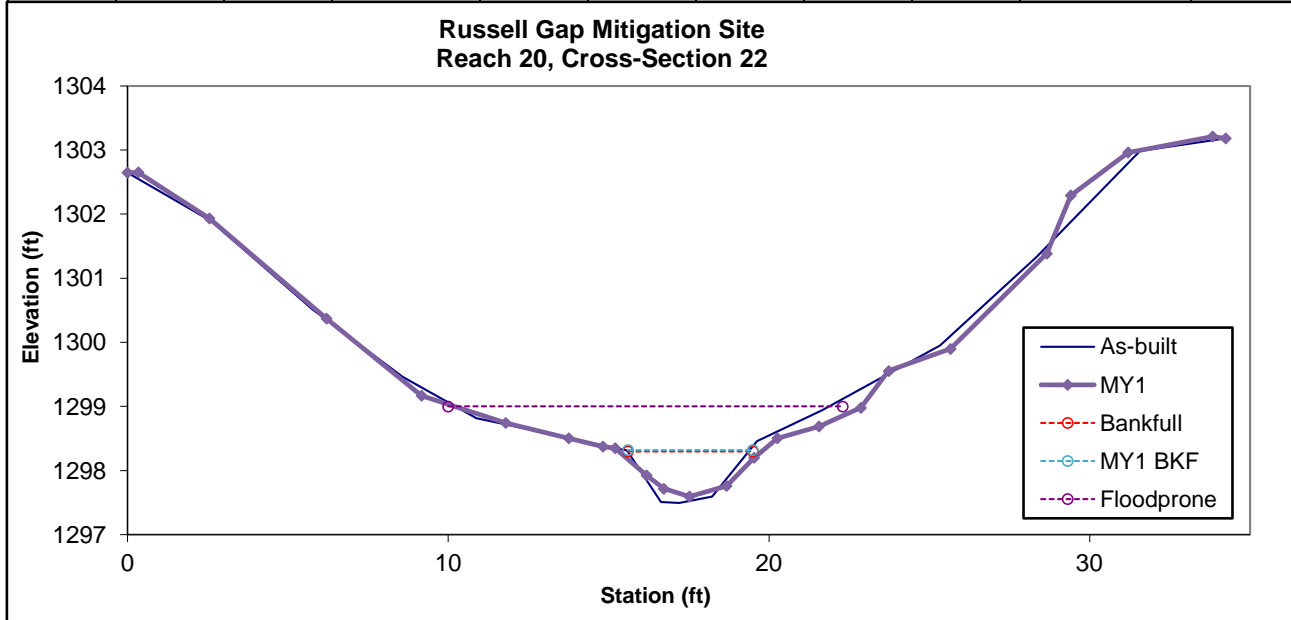


Looking at the Left Bank



Looking at the Right Bank

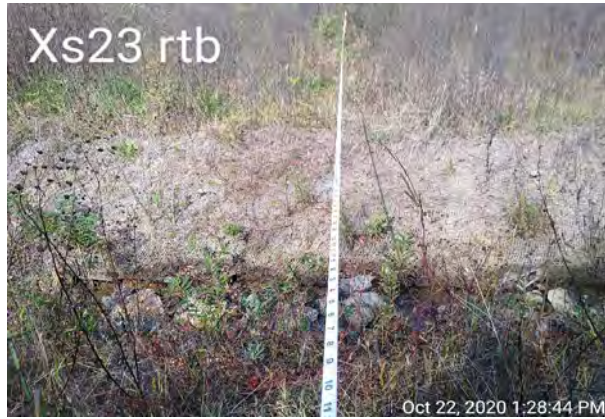
Feature	Stream Type	BKF Area	BKF Width	BKF Depth	Max BKF Depth	W/D	BH Ratio	ER	BKF Elev	LTOB Elev
Riffle	E	1.9	4.5	0.4	0.7	10.2	1.0	2.8	1298.30	1298.30



Note: Per DMS/IRT request, bank height ratio for MY1 has been calculated using the bankfull elevation as determined from the as-built bankfull area. All other values were calculated using the as-built bankfull elevation.

Figure 4. Cross Sections with Annual Overlay

**Permanent Cross-Section 23**  
 Year 1 Survey Collected: October 2020

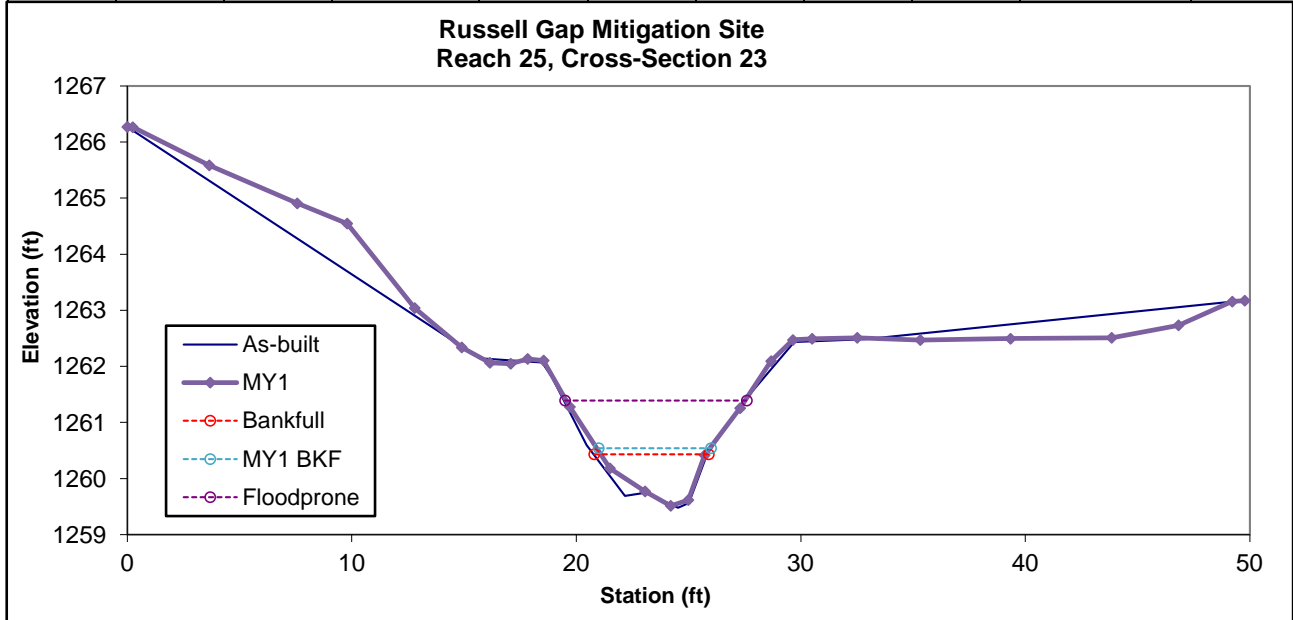


Looking at the Left Bank



Looking at the Right Bank

Feature	Stream Type	BKF Area	BKF Width	BKF Depth	Max BKF Depth	W/D	BH Ratio	ER	BKF Elev	LTOB Elev
Riffle	B	2.7	4.7	0.6	0.9	8.2	0.9	1.7	1260.44	1260.44

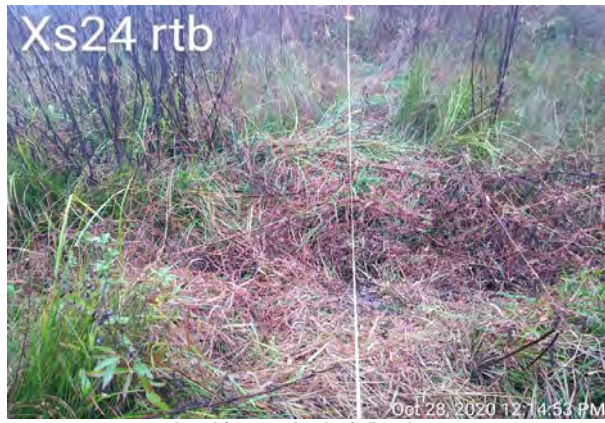


Note: Per DMS/IRT request, bank height ratio for MY1 has been calculated using the bankfull elevation as determined from the as-built bankfull area. All other values were calculated using the as-built bankfull elevation.



Figure 4. Cross Sections with Annual Overlay

**Permanent Cross-Section 24**  
 Year 1 Survey Collected: October 2020

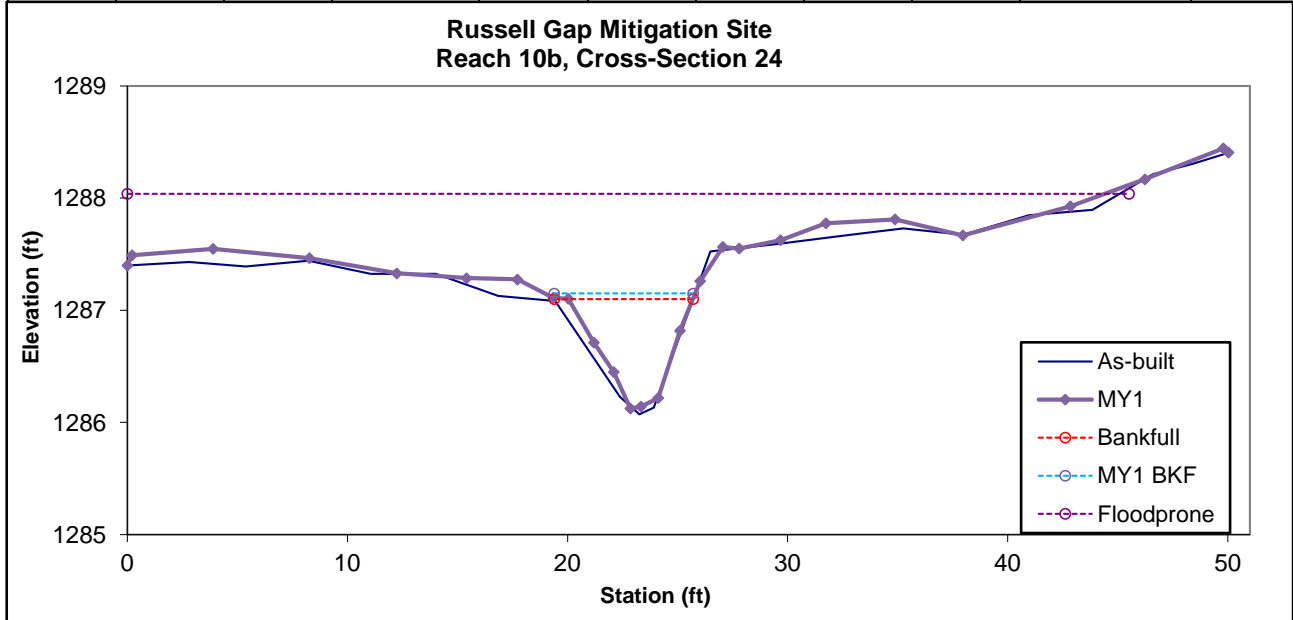


Looking at the Left Bank



Looking at the Right Bank

Feature	Stream Type	BKF Area	BKF Width	BKF Depth	Max BKF Depth	W/D	BH Ratio	ER	BKF Elev	LTOB Elev
Riffle	C	3.0	5.5	0.5	1.0	10.1	1.0	8.2	1287.10	1287.10



Note: Per DMS/IRT request, bank height ratio for MY1 has been calculated using the bankfull elevation as determined from the as-built bankfull area. All other values were calculated using the as-built bankfull elevation.

Figure 4. Cross Sections with Annual Overlay

**Permanent Cross-Section 25**

Year 1 Survey Collected: October 2020

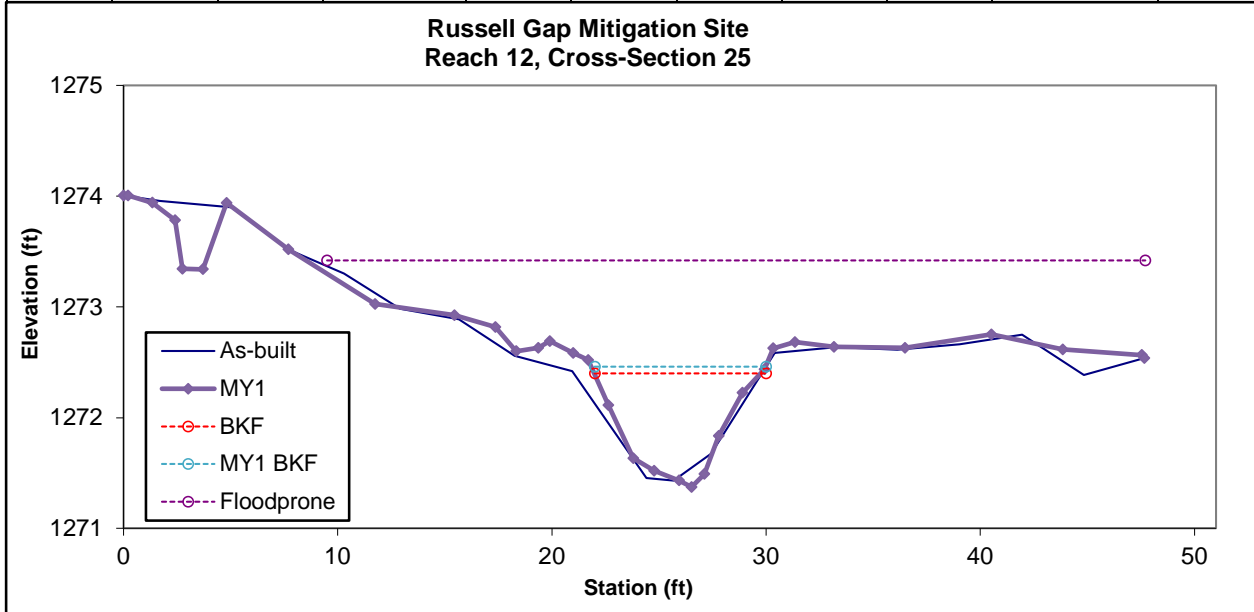


Looking at the Left Bank



Looking at the Right Bank

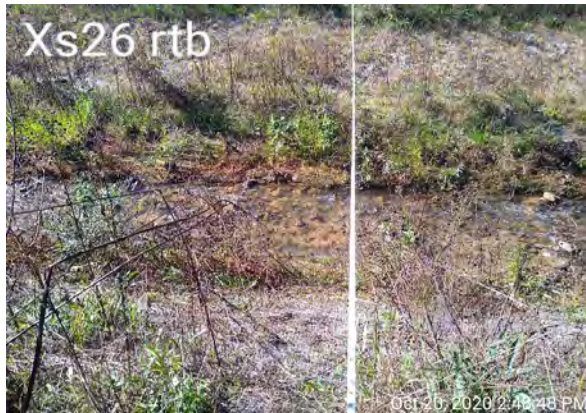
Feature	Stream Type	BKF Area	BKF Width	BKF Depth	Max BKF Depth	W/D	BH Ratio	ER	BKF Elev	LTOB Elev
Riffle	C	4.7	7.8	0.6	1.0	12.8	0.9	4.9	1272.40	1272.40



Note: Per DMS/IRT request, bank height ratio for MY1 has been calculated using the bankfull elevation as determined from the as-built bankfull area. All other values were calculated using the as-built bankfull elevation.

Figure 4. Cross Sections with Annual Overlay

**Permanent Cross-Section 26**  
 Year 1 Survey Collected: October 2020

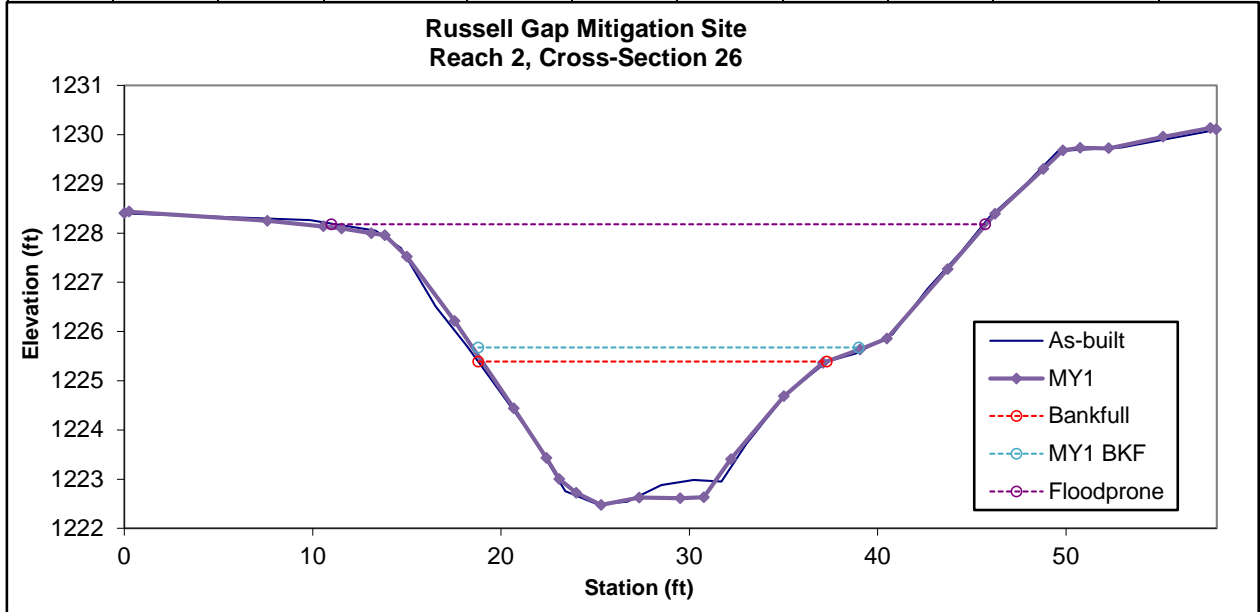


Looking at the Left Bank



Looking at the Right Bank

Feature	Stream Type	BKF Area	BKF Width	BKF Depth	Max BKF Depth	W/D	BH Ratio	ER	BKF Elev	LTOB Elev
Riffle	C	29.4	13.4	2.2	2.9	6.1	0.9	2.8	1225.39	1225.39



Note: Per DMS/IRT request, bank height ratio for MY1 has been calculated using the bankfull elevation as determined from the as-built bankfull area. All other values were calculated using the as-built bankfull elevation.

Table 8. Baseline Stream Data Summary

Russell Gap Stream Mitigation Project: DMS Project No ID. 100003

Reach R1 - (Restoration XS 1-4)																
Parameter	Pre-Existing Condition				Reference Reach(es) Data				Design				As-built			
					Composite											
Dimension and Substrate - Riffle	Min	Mean	Med	Max	Min	Mean	Med	Max	Min	Mean	Med	Max	Min	Mean	Med	Max
BF Width (ft)	15.52	16.59	-----	17.65	-----	-----	-----	-----	-----	16.90	-----	-----	16.10	16.15	16.15	16.20
Floodprone Width (ft)	71.92	74.43	-----	76.94	-----	-----	-----	-----	75.00	137.50	-----	200.00	75.30	78.85	78.85	82.40
BF Mean Depth (ft)	1.05	1.25	-----	1.44	-----	-----	-----	-----	-----	1.3	-----	-----	1.20	1.25	1.25	1.30
BF Max Depth (ft)	2.64	2.97	-----	3.30	-----	-----	-----	-----	-----	1.60	-----	-----	1.60	1.70	1.70	1.80
BF Cross-sectional Area (ft²)	22.35	23.43	-----	24.5	-----	-----	-----	-----	-----	22.0	-----	-----	18.80	19.70	19.70	20.60
Width/Depth Ratio	10.78	13.80	-----	16.81	-----	-----	-----	-----	-----	-----	-----	-----	12.50	13.20	13.20	13.90
Entrenchment Ratio	4.36	4.50	-----	4.64	-----	-----	-----	-----	4.40	8.10	-----	11.80	4.70	4.90	4.90	5.10
Bank Height Ratio	1.20	1.33	-----	1.46	1.00	1.05	-----	1.10	-----	1.00	-----	-----	1.00	1.00	1.00	1.00
d50 (mm)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
<b>Pattern</b>																
Channel Beltwidth (ft)	33.00	73.50	-----	114.00	-----	-----	-----	-----	60.00	97.50	-----	135.00	53.11	73.15	72.84	89.22
Radius of Curvature (ft)	21.00	39.50	-----	58.00	-----	-----	-----	-----	34.00	41.50	-----	49.00	19.00	41.88	39.50	78.00
Rc/Bankfull width (ft/ft)	17.65	10.70	-----	3.74	2.00	2.50	-----	3.00	2.00	2.45	-----	2.90	1.18	2.59	2.45	4.81
Meander Wavelength (ft)	-----		-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	142.35	192.15	163.81	303.38
Meander Width Ratio	1.87	4.61	-----	7.35	3.50	5.75	-----	8.00	3.60	5.80	-----	8.00	3.30	4.53	4.51	5.51
<b>Profile</b>																
Riffle Length (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	33.61	50.90	49.22	64.82
Riffle Slope (ft/ft)	0.0120	0.04	-----	0.0600	-----	-----	-----	-----	0.0110	0.0118	-----	0.0125	0.0029	0.0111	0.0098	0.0168
Pool Length (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	16.67	26.35	29.91	43.15
Pool to Pool Spacing (ft)	23.00	123.50	-----	224.00	60.00	89.50	-----	119.00	-----	-----	-----	-----	84.80	101.00	98.09	111.38
Pool Max Depth (ft)	1.60	2.30	-----	3.00	-----	-----	-----	-----	-----	3.50	-----	-----	1.16	1.77	1.85	2.54
<b>Substrate and Transport Parameters</b>																
SC% / Sa% / G% / C% / Bo%	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
d16 / d35 / d50 / d84 / d95	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
<b>Additional Reach Parameters</b>																
Drainage Area (SM)	-----	1.50	-----	-----	-----	-----	-----	-----	-----	1.50	-----	-----	-----	1.50	-----	-----
Impervious cover estimate (%)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Rosgen Classification	-----	C4/E4	-----	-----	-----	C4	-----	-----	-----	C4	-----	-----	-----	C4	-----	-----
BF Velocity (fps)	3.67	3.85	-----	4.03	3.50	4.25	-----	5.00	-----	4.10	-----	-----	-----	-----	-----	-----
BF Discharge (cfs)	-----	90.0	-----	-----	-----	-----	-----	-----	-----	90.00	-----	-----	-----	-----	-----	-----
Valley Length	-----	1,756	-----	-----	-----	-----	-----	-----	-----	1,535	-----	-----	-----	1,593	-----	-----
Channel Length (ft)	-----	2,142	-----	-----	-----	-----	-----	-----	-----	1,842	-----	-----	-----	1,911	-----	-----
Sinuosity	-----	1.22	-----	-----	1.20	1.30	-----	1.40	-----	1.20	-----	-----	-----	1.20	-----	-----

Table 8. Baseline Stream Data Summary																
Russell Gap Stream Mitigation Project: DMS Project No ID. 100003																
Reach R2 - (Restoration XS-26)																
Parameter	Pre-Existing Condition				Reference Reach(es) Data				Design				As-built			
	Min	Mean	Med	Max	Min	Mean	Med	Max	Min	Mean	Med	Max	Min	Mean	Med	Max
<b>Dimension and Substrate - Riffle</b>																
BF Width (ft)	-----	15.00	-----	-----	-----	-----	-----	-----	-----	18.00	-----	-----	----	18.50	----	----
Floodprone Width (ft)	22.00	26.00	-----	30.00	-----	-----	-----	-----	-----	42.00	-----	-----	----	38.00	----	----
BF Mean Depth (ft)	-----	1.60	-----	-----	-----	-----	-----	-----	-----	1.4	-----	-----	----	1.80	----	----
BF Max Depth (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	2.90	----	----
BF Cross-sectional Area (ft²)	-----	25.00	-----	-----	-----	-----	-----	-----	-----	25.0	-----	-----	----	33.60	----	----
Width/Depth Ratio	-----	9.40	-----	-----	10.00	12.50	-----	15.00	-----	13.00	-----	-----	----	10.20	----	----
Entrenchment Ratio	1.50	1.75	-----	2.00	-----	-----	-----	-----	-----	2.30	-----	-----	----	2.10	----	----
Bank Height Ratio	-----	2.30	-----	-----	1.00	1.05	-----	1.10	-----	1.00	-----	-----	----	1.00	----	----
d50 (mm)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	-----	----	----
<b>Pattern</b>																
Channel Beltwidth (ft)	-----	N/A	-----	-----	-----	-----	-----	-----	-----	N/A	-----	-----	----	24.78	----	----
Radius of Curvature (ft)	-----	N/A	-----	-----	-----	-----	-----	-----	-----	N/A	-----	-----	----	N/A	----	----
Rc/Bankfull width (ft/ft)	-----	N/A	-----	-----	2.00	2.50	-----	3.00	-----	N/A	-----	-----	----	N/A	----	----
Meander Wavelength (ft)	-----	N/A	-----	-----	-----	-----	-----	-----	-----	N/A	-----	-----	----	N/A	----	----
Meander Width Ratio	-----	N/A	-----	-----	3.50	5.75	-----	8.00	-----	N/A	-----	-----	----	N/A	----	----
<b>Profile</b>																
Riffle Length (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	32.58	48.51	48.51	64.43
Riffle Slope (ft/ft)	-----	0.0179	-----	-----	-----	-----	-----	-----	-----	0.0179	-----	-----	0.0058	0.0113	0.0113	0.0167
Pool Length (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	13.55	18.57	20.90	28.24
Pool to Pool Spacing (ft)	20.00	47.50	-----	75.00	-----	-----	-----	-----	65.00	95.00	-----	125.00	32.00	53.25	53.26	74.51
Pool Max Depth (ft)	-----	2.50	-----	-----	-----	-----	-----	-----	-----	3.50	-----	-----	0.43	0.95	1.05	1.66
<b>Substrate and Transport Parameters</b>																
SC% / Sa% / G% / C% / Bo%	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	-----	----	----
d16 / d35 / d50 / d84 / d95	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	-----	----	----
<b>Additional Reach Parameters</b>																
Drainage Area (SM)	-----	1.65	-----	-----	-----	-----	-----	-----	-----	1.65	-----	-----	----	1.65	----	----
Impervious cover estimate (%)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	-----	----	----
Rosgen Classification	-----	E4	-----	-----	-----	C4	-----	-----	-----	C4	-----	-----	----	C4	----	----
BF Velocity (fps)	-----	4.00	-----	-----	3.50	-----	-----	5.00	-----	4.00	-----	-----	----	-----	----	----
BF Discharge (cfs)	-----	100.0	-----	-----	-----	-----	-----	-----	-----	100.00	-----	-----	----	-----	----	----
Valley Length	-----	288	-----	-----	-----	-----	-----	-----	-----	174	-----	-----	----	166	----	----
Channel Length (ft)	-----	288	-----	-----	-----	-----	-----	-----	-----	174	-----	-----	----	166	----	----
Sinuosity	-----	1.00	-----	-----	1.20	1.30	-----	1.40	-----	1.00	-----	-----	----	1.00	----	----

Table 8. Baseline Stream Data Summary																
Russell Gap Stream Mitigation Project: DMS Project No ID. 100003																
Reach R3 - (Restoration XS-5)																
Parameter	Pre-Existing Condition				Reference Reach(es) Data				Design				As-built			
					Composite											
Dimension and Substrate - Riffle	Min	Mean	Med	Max	Min	Mean	Med	Max	Min	Mean	Med	Max	Min	Mean	Med	Max
BF Width (ft)	-----	21.00	-----	-----	-----	-----	-----	-----	-----	23.70	-----	-----	----	23.80	----	----
Floodprone Width (ft)	-----	71.00	-----	-----	-----	-----	-----	-----	-----	71.00	-----	-----	----	46.50	----	----
BF Mean Depth (ft)	-----	2.23	-----	-----	-----	-----	-----	-----	-----	2.0	-----	-----	----	1.70	----	----
BF Max Depth (ft)	-----	3.40	-----	-----	-----	-----	-----	-----	-----	2.50	-----	-----	----	2.70	----	----
BF Cross-sectional Area (ft²)	-----	46.87	-----	-----	-----	-----	-----	-----	-----	47.0	-----	-----	----	40.90	----	----
Width/Depth Ratio	-----	9.42	-----	-----	10.00	12.50	-----	15.00	-----	11.90	-----	-----	----	13.80	----	----
Entrenchment Ratio	-----	3.38	-----	-----	-----	-----	-----	-----	-----	3.00	-----	-----	----	2.00	----	----
Bank Height Ratio	-----	1.20	-----	-----	1.00	1.05	-----	1.10	-----	1.00	-----	-----	----	1.00	----	----
d50 (mm)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	-----	----	----
<b>Pattern</b>																
Channel Beltwidth (ft)	-----	N/A	-----	-----	-----	-----	-----	-----	-----	N/A	-----	-----	----	22.67	----	----
Radius of Curvature (ft)	-----	N/A	-----	-----	-----	-----	-----	-----	-----	N/A	-----	-----	----	N/A	----	----
Rc/Bankfull width (ft/ft)	-----	N/A	-----	-----	2.00	2.50	-----	3.00	-----	N/A	-----	-----	----	N/A	----	----
Meander Wavelength (ft)	-----	N/A	-----	-----	-----	-----	-----	-----	-----	N/A	-----	-----	----	N/A	----	----
Meander Width Ratio	-----	N/A	-----	-----	3.50	5.75	-----	8.00	-----	N/A	-----	-----	----	N/A	----	----
<b>Profile</b>																
Riffle Length (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	29.93	47.57	51.32	72.70
Riffle Slope (ft/ft)	-----	0.0075	-----	-----	-----	-----	-----	-----	-----	0.0075	-----	-----	0.0044	0.0158	0.0138	0.0233
Pool Length (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	4.28	26.01	29.94	55.59
Pool to Pool Spacing (ft)	18.00	26.00	-----	34.00	-----	-----	-----	-----	85.00	100.00	-----	115.00	47.04	86.95	85.53	124.01
Pool Max Depth (ft)	3.60	3.70	-----	3.80	-----	-----	-----	-----	-----	4.00	-----	-----	0.57	1.27	1.24	1.90
<b>Substrate and Transport Parameters</b>	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	-----	----	----
SC% / Sa% / G% / C% / Bo%	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	-----	----	----
d16 / d35 / d50 / d84 / d95	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	-----	----	----
<b>Additional Reach Parameters</b>																
Drainage Area (SM)	-----	3.48	-----	-----	-----	-----	-----	-----	-----	3.48	-----	-----	----	3.48	----	----
Impervious cover estimate (%)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	-----	----	----
Rosgen Classification	-----	E4 (Incised)	-----	-----	-----	-----	-----	-----	-----	C4	-----	-----	----	C4	----	----
BF Velocity (fps)	-----	5.00	-----	-----	3.50	4.25	-----	5.00	-----	5.00	-----	-----	----	-----	----	----
BF Discharge (cfs)	-----	235.0	-----	-----	-----	-----	-----	-----	-----	235.00	-----	-----	----	-----	----	----
Valley Length	-----	350	-----	-----	-----	-----	-----	-----	-----	350	-----	-----	----	366	----	----
Channel Length (ft)	-----	388	-----	-----	-----	-----	-----	-----	-----	389	-----	-----	----	406	----	----
Sinuosity	-----	1.11	-----	-----	1.20	1.30	-----	1.40	-----	1.11	-----	-----	----	1.11	----	----

Table 8. Baseline Stream Data Summary																
Russell Gap Stream Mitigation Project: DMS Project No ID. 100003																
Reach R4 - (Enhancement I XS 6-11)																
Parameter	Pre-Existing Condition				Reference Reach(es) Data				Design				As-built			
					Composite											
Dimension and Substrate - Riffle	Min	Mean	Med	Max	Min	Mean	Med	Max	Min	Mean	Med	Max	Min	Mean	Med	Max
BF Width (ft)	-----	16.00	-----	-----	-----	-----	-----	-----	-----	16.90	-----	-----	13.30	15.84	14.30	22.60
Floodprone Width (ft)	-----	22.82	-----	-----	-----	-----	-----	-----	-----	37.00	-----	-----	24.00	29.58	31.70	34.30
BF Mean Depth (ft)	-----	1.54	-----	-----	-----	-----	-----	-----	-----	1.3	-----	-----	0.90	1.38	1.50	1.70
BF Max Depth (ft)	-----	2.72	-----	-----	-----	-----	-----	-----	-----	1.60	-----	-----	2.00	2.46	2.30	3.00
BF Cross-sectional Area (ft²)	-----	24.5	-----	-----	-----	-----	-----	-----	-----	22.0	-----	-----	15.50	20.64	22.10	23.10
Width/Depth Ratio	-----	10.36	-----	-----	12.00	15.00	-----	18.00	-----	13.00	-----	-----	8.40	13.04	10.30	26.10
Entrenchment Ratio	-----	1.62	-----	-----	-----	-----	-----	-----	-----	2.20	-----	-----	1.40	1.90	1.90	2.30
Bank Height Ratio	-----	2.32	-----	-----	1.00	1.05	-----	1.10	-----	1.00	-----	-----	1.00	1.00	1.00	1.00
d50 (mm)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
<b>Pattern</b>	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Channel Beltwidth (ft)	-----	N/A	-----	-----	-----	-----	-----	-----	-----	N/A	-----	-----	-----	-----	-----	-----
Radius of Curvature (ft)	-----	N/A	-----	-----	-----	-----	-----	-----	-----	N/A	-----	-----	-----	-----	-----	-----
Rc/Bankfull width (ft/ft)	-----	N/A	-----	-----	-----	-----	-----	-----	-----	N/A	-----	-----	-----	-----	-----	-----
Meander Wavelength (ft)	-----	N/A	-----	-----	-----	-----	-----	-----	-----	N/A	-----	-----	-----	-----	-----	-----
Meander Width Ratio	-----	N/A	-----	-----	-----	-----	-----	-----	-----	N/A	-----	-----	-----	-----	-----	-----
<b>Profile</b>	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Riffle Length (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	33.46	58.40	68.03	102.60
Riffle Slope (ft/ft)	0.0150	0.0250	-----	0.0350	-----	-----	-----	-----	0.0110	0.0140	-----	0.0170	0.0102	0.0178	0.0195	0.0289
Pool Length (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	2.23	14.40	20.08	37.92
Pool to Pool Spacing (ft)	55.00	167.50	-----	280.00	-----	-----	-----	-----	85.00	100.00	-----	115.00	33.46	103.56	113.76	194.05
Pool Max Depth (ft)	1.10	-----	-----	2.40	-----	-----	-----	-----	-----	3.00	-----	-----	1.09	1.66	1.71	2.32
<b>Substrate and Transport Parameters</b>	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
SC% / Sa% / G% / C% / Bo%	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
d16 / d35 / d50 / d84 / d95	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
<b>Additional Reach Parameters</b>	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Drainage Area (SM)	-----	1.26	-----	-----	-----	-----	-----	-----	-----	1.26	-----	-----	-----	-----	1.26	-----
Impervious cover estimate (%)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Rosgen Classification	-----	E4 (Incised)	-----	-----	-----	B4c	-----	-----	-----	B4c	-----	-----	-----	-----	B4c	-----
BF Velocity (fps)	-----	4.01	-----	-----	4.00	5.00	-----	6.00	-----	4.00	-----	-----	-----	-----	-----	-----
BF Discharge (cfs)	-----	87.0	-----	-----	-----	-----	-----	-----	-----	87.00	-----	-----	-----	-----	-----	-----
Valley Length	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Channel Length (ft)	-----	2,245	-----	-----	-----	-----	-----	-----	-----	2,063	-----	-----	-----	2,038	-----	-----
Sinuosity	-----	1.06	-----	-----	1.10	1.20	-----	1.30	-----	1.06	-----	-----	-----	1.06	-----	-----

Table 8. Baseline Stream Data Summary																
Russell Gap Stream Mitigation Project: DMS Project No ID. 100003																
Reach R6,R7b - (Restoration, Enhancement I XS 12-15)																
Parameter	Pre-Existing Condition				Reference Reach(es) Data				Design				As-built			
					Composite											
Dimension and Substrate - Riffle	Min	Mean	Med	Max	Min	Mean	Med	Max	Min	Mean	Med	Max	Min	Mean	Med	Max
BF Width (ft)	-----	8.44	-----	-----	-----	-----	-----	-----	-----	10.20	-----	-----	11.00	12.40	12.40	13.80
Floodprone Width (ft)	-----	17.64	-----	-----	-----	-----	-----	-----	-----	22.00	-----	-----	45.00	45.45	45.00	45.90
BF Mean Depth (ft)	-----	0.94	-----	-----	-----	-----	-----	-----	-----	0.8	-----	-----	0.80	1.05	1.05	1.30
BF Max Depth (ft)	-----	1.27	-----	-----	-----	-----	-----	-----	-----	1.10	-----	-----	1.30	1.65	1.65	2.00
BF Cross-sectional Area (ft²)	-----	7.9	-----	-----	-----	-----	-----	-----	-----	8.0	-----	-----	7.20	10.80	10.80	14.40
Width/Depth Ratio	-----	8.98	-----	-----	12.00	15.00	-----	18.00	-----	12.80	-----	-----	8.40	9.65	9.65	10.90
Entrenchment Ratio	-----	2.09	-----	-----	-----	-----	-----	-----	-----	2.20	-----	-----	4.20	4.65	4.65	5.10
Bank Height Ratio	-----	3.10	-----	-----	1.00	1.05	-----	1.10	-----	1.00	-----	-----	1.00	1.00	1.00	1.00
d50 (mm)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
<b>Pattern</b>																
Channel Beltwidth (ft)	-----	N/A	-----	-----	-----	-----	-----	-----	-----	N/A	-----	-----	13.95	40.15	33.06	58.59
Radius of Curvature (ft)	-----	N/A	-----	-----	-----	-----	-----	-----	-----	N/A	-----	-----	20.00	46.82	43.00	86.00
Rc/Bankfull width (ft/ft)	-----	N/A	-----	-----	-----	-----	-----	-----	-----	N/A	-----	-----	1.82	3.78	3.47	6.23
Meander Wavelength (ft)	-----	N/A	-----	-----	-----	-----	-----	-----	-----	N/A	-----	-----	58.19	108.11	113.28	170.29
Meander Width Ratio	-----	N/A	-----	-----	-----	-----	-----	-----	-----	N/A	-----	-----	1.27	3.24	2.67	4.25
<b>Profile</b>																
Riffle Length (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	34.21	91.23	89.80	145.39
Riffle Slope (ft/ft)	0.0260	0.0430	-----	0.0600	-----	-----	-----	-----	0.0310	0.0375	-----	0.0440	0.0202	0.0384	0.0435	0.0667
Pool Length (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	17.11	20.53	21.39	25.66
Pool to Pool Spacing (ft)	53.00	159.00	-----	265.00	-----	-----	-----	-----	25.00	37.50	-----	50.00	31.36	90.16	138.27	245.18
Pool Max Depth (ft)	1.50	2.05	-----	2.60	-----	-----	-----	-----	-----	1.80	-----	-----	2.28	2.58	2.66	3.04
<b>Substrate and Transport Parameters</b>																
SC% / Sa% / G% / C% / Bo%	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
d16 / d35 / d50 / d84 / d95	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
<b>Additional Reach Parameters</b>																
Drainage Area (SM)	-----	0.29	-----	-----	-----	-----	-----	-----	-----	0.29	-----	-----	-----	0.2900	-----	-----
Impervious cover estimate (%)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Rosgen Classification	-----	E4	-----	-----	-----	B4	-----	-----	-----	B4	-----	-----	-----	B4	-----	-----
BF Velocity (fps)	-----	4.41	-----	-----	4.00	-----	-----	6.00	-----	4.40	-----	-----	-----	-----	-----	-----
BF Discharge (cfs)	-----	35.0	-----	-----	-----	-----	-----	-----	-----	35.00	-----	-----	-----	-----	-----	-----
Valley Length	-----	1,783	-----	-----	-----	-----	-----	-----	-----	1,816	-----	-----	-----	1,793	-----	-----
Channel Length (ft)	-----	1,801	-----	-----	-----	-----	-----	-----	-----	1,943	-----	-----	-----	1,919	-----	-----
Sinuosity	-----	1.01	-----	-----	1.10	1.15	-----	1.20	-----	1.07	-----	-----	-----	1.07	-----	-----



Table 8. Baseline Stream Data Summary																
Russell Gap Stream Mitigation Project: DMS Project No ID. 100003																
Reach 9 - (Restoration XS 16-17)																
Parameter	Pre-Existing Condition				Reference Reach(es) Data				Design				As-built			
					Composite											
Dimension and Substrate - Riffle	Min	Mean	Med	Max	Min	Mean	Med	Max	Min	Mean	Med	Max	Min	Mean	Med	Max
BF Width (ft)	-----	10.40	-----	-----	-----	-----	-----	-----	-----	12.70	-----	-----	-----	12.10	-----	-----
Floodprone Width (ft)	-----	45.00	-----	-----	-----	-----	-----	-----	-----	60.00	-----	-----	-----	18.70	-----	-----
BF Mean Depth (ft)	-----	1.15	-----	-----	-----	-----	-----	-----	-----	0.9	-----	-----	-----	1.00	-----	-----
BF Max Depth (ft)	-----	2.25	-----	-----	-----	-----	-----	-----	-----	1.20	-----	-----	-----	1.40	-----	-----
BF Cross-sectional Area (ft <sup>2</sup> )	-----	12.0	-----	-----	-----	-----	-----	-----	-----	12.0	-----	-----	-----	11.90	-----	-----
Width/Depth Ratio	-----	9.04	-----	-----	12.00	15.00	-----	18.00	-----	13.50	-----	-----	-----	12.20	-----	-----
Entrenchment Ratio	-----	4.33	-----	-----	-----	-----	-----	-----	-----	4.70	-----	-----	-----	1.60	-----	-----
Bank Height Ratio	-----	1.19	-----	-----	1.00	1.05	-----	1.10	-----	1.00	-----	-----	-----	1.00	-----	-----
d50 (mm)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
<b>Pattern</b>																
Channel Beltwidth (ft)	-----	N/A	-----	-----	-----	-----	-----	-----	-----	N/A	-----	-----	20.86	24.81	22.89	30.60
Radius of Curvature (ft)	-----	N/A	-----	-----	-----	-----	-----	-----	-----	N/A	-----	-----	41.00	73.83	56.00	176.00
Rc/Bankfull width (ft/ft)	-----	N/A	-----	-----	-----	-----	-----	-----	-----	N/A	-----	-----	3.39	6.10	4.63	2.53
Meander Wavelength (ft)	-----	N/A	-----	-----	-----	-----	-----	-----	-----	N/A	-----	-----	105.77	121.47	117.31	146.34
Meander Width Ratio	-----	N/A	-----	-----	-----	-----	-----	-----	-----	N/A	-----	-----	1.72	2.05	1.89	2.53
<b>Profile</b>																
Riffle Length (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	31.00	41.69	42.23	53.45
Riffle Slope (ft/ft)	0.0410	0.0480	-----	0.0550	-----	-----	-----	-----	0.2600	0.1505	-----	0.0410	0.0065	0.0218	0.0199	0.0332
Pool Length (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	10.49	19.56	20.03	29.57
Pool to Pool Spacing (ft)	29.00	47.50	-----	66.00	-----	-----	-----	-----	15.00	38.50	-----	62.00	45.71	62.03	62.51	79.31
Pool Max Depth (ft)	2.30	2.70	-----	3.10	-----	-----	-----	-----	-----	2.50	-----	-----	0.52	1.62	1.55	2.58
<b>Substrate and Transport Parameters</b>																
SC% / Sa% / G% / C% / Bo%	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
d16 / d35 / d50 / d84 / d95	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
<b>Additional Reach Parameters</b>																
Drainage Area (SM)	-----	0.56	-----	-----	-----	-----	-----	-----	-----	0.56	-----	-----	-----	0.5600	-----	-----
Impervious cover estimate (%)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Rosgen Classification	-----	E4b	-----	-----	-----	-----	-----	-----	-----	B4	-----	-----	-----	B4	-----	-----
BF Velocity (fps)	-----	4.00	-----	-----	4.00	5.00	-----	6.00	-----	4.00	-----	-----	-----	-----	-----	-----
BF Discharge (cfs)	-----	48.0	-----	-----	-----	B4	-----	-----	-----	48.00	-----	-----	-----	-----	-----	-----
Valley Length	-----	422	-----	-----	-----	-----	-----	-----	-----	429	-----	-----	-----	429	-----	-----
Channel Length (ft)	-----	439	-----	-----	-----	-----	-----	-----	-----	446	-----	-----	-----	446	-----	-----
Sinuosity	-----	1.04	-----	-----	1.10	1.15	-----	1.20	-----	1.04	-----	-----	-----	1.04	-----	-----

Table 8. Baseline Stream Data Summary																
Russell Gap Stream Mitigation Project: DMS Project No ID. 100003																
Reach 10b - (Restoration XS-24)																
Parameter	Pre-Existing Condition				Reference Reach(es) Data				Design				As-built			
					Composite											
Dimension and Substrate - Riffle	Min	Mean	Med	Max	Min	Mean	Med	Max	Min	Mean	Med	Max	Min	Mean	Med	Max
BF Width (ft)	-----	N/A	-----	-----	-----	-----	-----	-----	-----	4.90	-----	-----	----	6.20	----	----
Floodprone Width (ft)	-----	N/A	-----	-----	-----	-----	-----	-----	-----	115.00	-----	-----	----	32.00	----	----
BF Mean Depth (ft)	-----	N/A	-----	-----	-----	-----	-----	-----	-----	0.4	-----	-----	----	0.50	----	----
BF Max Depth (ft)	-----	N/A	-----	-----	-----	-----	-----	-----	-----	0.50	-----	-----	----	1.00	----	----
BF Cross-sectional Area (ft <sup>2</sup> )	-----	N/A	-----	-----	-----	-----	-----	-----	-----	2.0	-----	-----	----	3.50	----	----
Width/Depth Ratio	-----	N/A	-----	-----	10.00	12.50	-----	15.00	-----	12.30	-----	-----	----	11.00	----	----
Entrenchment Ratio	-----	N/A	-----	-----	-----	-----	-----	-----	-----	23.50	-----	-----	----	8.70	----	----
Bank Height Ratio	-----	N/A	-----	-----	1.00	1.05	-----	1.10	-----	1.00	-----	-----	----	1.00	----	----
d50 (mm)	-----	N/A	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	-----	----	----
<b>Pattern</b>																
Channel Beltwidth (ft)	-----	N/A	-----	-----	-----	-----	-----	-----	-----	N/A	-----	-----	10.37	13.70	11.86	18.87
Radius of Curvature (ft)	-----	N/A	-----	-----	-----	-----	-----	-----	-----	N/A	-----	-----	34.00	66.67	82.00	84.00
Rc/Bankfull width (ft/ft)	-----	N/A	-----	-----	2.00	2.50	-----	3.00	-----	N/A	-----	-----	5.48	10.75	1.91	13.55
Meander Wavelength (ft)	-----	N/A	-----	-----	-----	-----	-----	-----	-----	N/A	-----	-----	29.79	49.56	59.44	59.44
Meander Width Ratio	-----	N/A	-----	-----	3.50	5.75	-----	8.00	-----	N/A	-----	-----	1.67	2.21	1.91	3.04
<b>Profile</b>																
Riffle Length (ft)	-----	N/A	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	107.07	----	----
Riffle Slope (ft/ft)	-----	N/A	-----	-----	-----	-----	-----	-----	-----	0.0142	-----	-----	----	0.0196	----	----
Pool Length (ft)	-----	N/A	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	-----	----	----
Pool to Pool Spacing (ft)	-----	N/A	-----	-----	-----	-----	-----	-----	-----	38.00	-----	-----	----	-----	----	----
Pool Max Depth (ft)	-----	N/A	-----	-----	-----	-----	-----	-----	-----	1.00	-----	-----	----	-----	----	----
<b>Substrate and Transport Parameters</b>																
SC% / Sa% / G% / C% / Bo%	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	-----	----	----
d16 / d35 / d50 / d84 / d95	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	-----	----	----
<b>Additional Reach Parameters</b>																
Drainage Area (SM)	-----	0.26	-----	-----	-----	-----	-----	-----	-----	0.26	-----	-----	----	0.2600	----	----
Impervious cover estimate (%)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	-----	----	----
Rosgen Classification	-----	-----	-----	-----	-----	-----	-----	-----	-----	C4	-----	-----	----	C4	----	----
BF Velocity (fps)	-----	-----	-----	-----	3.50	4.25	-----	5.00	-----	3.50	-----	-----	----	-----	----	----
BF Discharge (cfs)	-----	-----	-----	-----	-----	-----	-----	-----	-----	7.00	-----	-----	----	-----	----	----
Valley Length	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	-----	----	----
Channel Length (ft)	-----	0	-----	-----	-----	-----	-----	-----	-----	113	-----	-----	----	105	----	----
Sinuosity	-----	-----	-----	-----	1.20	1.30	-----	1.40	-----	-----	-----	-----	----	-----	----	----

Table 8. Baseline Stream Data Summary																	
Russell Gap Stream Mitigation Project: DMS Project No ID. 100003																	
Reach 12 - (Restoration XS-25)																	
Parameter	Pre-Existing Condition				Reference Reach(es) Data				Design				As-built				
					Composite												
Dimension and Substrate - Riffle	Min	Mean	Med	Max	Min	Mean	Med	Max	Min	Mean	Med	Max	Min	Mean	Med	Max	
BF Width (ft)	-----	7.97	-----	-----	-----	-----	-----	-----	-----	8.80	-----	-----	-----	9.10	-----	-----	
Floodprone Width (ft)	-----	41.00	-----	-----	-----	-----	-----	-----	-----	20.00	-----	-----	-----	38.20	-----	-----	
BF Mean Depth (ft)	-----	0.91	-----	-----	-----	-----	-----	-----	-----	0.7	-----	-----	-----	0.60	-----	-----	
BF Max Depth (ft)	-----	1.84	-----	-----	-----	-----	-----	-----	-----	0.80	-----	-----	-----	1.00	-----	-----	
BF Cross-sectional Area (ft <sup>2</sup> )	-----	7.3	-----	-----	-----	-----	-----	-----	-----	6.0	-----	-----	-----	5.20	-----	-----	
Width/Depth Ratio	-----	8.75	-----	-----	12.00	13.50	-----	15.00	-----	12.60	-----	-----	-----	16.20	-----	-----	
Entrenchment Ratio	-----	5.14	-----	-----	-----	-----	-----	-----	-----	2.30	-----	-----	-----	4.20	-----	-----	
Bank Height Ratio	-----	1.63	-----	-----	1.00	1.05	-----	1.10	-----	1.00	-----	-----	-----	1.00	-----	-----	
d50 (mm)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	
<b>Pattern</b>																	
*Channel Beltwidth (ft)	-----	N/A	-----	-----	-----	-----	-----	-----	-----	N/A	-----	-----	-----	14.22	18.28	18.28	22.33
*Radius of Curvature (ft)	-----	N/A	-----	-----	-----	-----	-----	-----	-----	N/A	-----	-----	-----	40.00	40.00	40.00	40.00
*Rc/Bankfull width (ft/ft)	-----	N/A	-----	-----	-----	-----	-----	-----	-----	N/A	-----	-----	-----	4.40	4.40	4.40	4.40
*Meander Wavelength (ft)	-----	N/A	-----	-----	-----	-----	-----	-----	-----	N/A	-----	-----	-----	61.50	68.17	68.17	74.84
*Meander Width Ratio	-----	N/A	-----	-----	-----	-----	-----	-----	-----	N/A	-----	-----	-----	1.56	2.01	2.01	2.45
<b>Profile</b>																	
Riffle Length (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	16.04	25.93	25.93	35.81	
Riffle Slope (ft/ft)	0.0350	0.0365	-----	0.0380	-----	-----	-----	-----	0.0150	0.0160	-----	0.0170	0.0123	0.1365	0.1123	0.2123	
Pool Length (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	5.88	7.24	7.24	8.59	
Pool to Pool Spacing (ft)	24.00	32.00	-----	40.00	-----	-----	-----	-----	35.00	40.00	-----	45.00	10.16	49.98	49.98	89.80	
Pool Max Depth (ft)	1.80	2.00	-----	2.20	-----	-----	-----	-----	-----	1.50	-----	-----	0.61	0.78	0.82	1.03	
<b>Substrate and Transport Parameters</b>																	
SC% / Sa% / G% / C% / B%	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	
d16 / d35 / d50 / d84 / d95	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	
<b>Additional Reach Parameters</b>																	
Drainage Area (SM)	-----	0.18	-----	-----	-----	-----	-----	-----	-----	0.18	-----	-----	-----	0.1800	-----	-----	
Impervious cover estimate (%)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	
*Rosgen Classification	-----	E4	-----	-----	-----	C4	-----	-----	-----	C4	-----	-----	-----	C4	-----	-----	
BF Velocity (fps)	-----	4.13	-----	-----	3.50	-----	-----	5.00	-----	5.00	-----	-----	-----	-----	-----	-----	
BF Discharge (cfs)	-----	30.0	-----	-----	-----	-----	-----	-----	-----	30.00	-----	-----	-----	-----	-----	-----	
Valley Length	-----	83	-----	-----	-----	-----	-----	-----	-----	115	-----	-----	-----	98	-----	-----	
Channel Length (ft)	-----	86	-----	-----	-----	-----	-----	-----	-----	120	-----	-----	-----	102	-----	-----	
Sinuosity	-----	1.03	-----	-----	-----	-----	-----	-----	-----	1.04	-----	-----	-----	1.04	-----	-----	

Table 8. Baseline Stream Data Summary																
Russell Gap Stream Mitigation Project: DMS Project No ID. 100003																
Reach 14 - (Restoration XS 19-20)																
Parameter	Pre-Existing Condition				Reference Reach(es) Data				Design Values Upper				As-built			
					Composite											
Dimension and Substrate - Riffle	Min	Mean	Med	Max	Min	Mean	Med	Max	Min	Mean	Med	Max	Min	Mean	Med	Max
BF Width (ft)	-----	3.85	-----	-----	-----	-----	-----	-----	-----	5.10	-----	-----	3.70	4.10	4.10	4.50
Floodprone Width (ft)	-----	5.82	-----	-----	-----	-----	-----	-----	-----	10.00	-----	-----	11.10	21.55	21.55	32.00
BF Mean Depth (ft)	-----	0.51	-----	-----	-----	-----	-----	-----	-----	0.4	-----	-----	0.50	0.50	0.50	0.50
BF Max Depth (ft)	-----	0.70	-----	-----	-----	-----	-----	-----	-----	0.50	-----	-----	0.80	0.90	0.90	1.00
BF Cross-sectional Area (ft²)	-----	2.0	-----	-----	-----	-----	-----	-----	-----	2.0	-----	-----	2.00	2.10	2.10	2.20
Width/Depth Ratio	-----	7.55	-----	-----	12.00	15.00	-----	18.00	-----	12.80	-----	-----	6.80	7.95	7.95	9.10
Entrenchment Ratio	-----	1.51	-----	-----	-----	-----	-----	-----	-----	2.00	-----	-----	2.50	5.60	5.60	8.70
Bank Height Ratio	-----	9.60	-----	-----	1.00	1.05	-----	1.10	-----	1.00	-----	-----	1.00	1.00	1.00	1.00
d50 (mm)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
<b>Pattern</b>																
*Channel Beltwidth (ft)	-----	N/A	-----	-----	-----	-----	-----	-----	-----	N/A	-----	-----	24.51	40.15	33.06	58.59
*Radius of Curvature (ft)	-----	N/A	-----	-----	-----	-----	-----	-----	-----	N/A	-----	-----	21.00	72.88	56.00	178.00
*Rc/Bankfull width (ft/ft)	-----	N/A	-----	-----	-----	-----	-----	-----	-----	N/A	-----	-----	5.68	17.78	13.66	39.56
*Meander Wavelength (ft)	-----	N/A	-----	-----	-----	-----	-----	-----	-----	N/A	-----	-----	62.14	95.04	83.77	56.00
*Meander Width Ratio	-----	N/A	-----	-----	-----	-----	-----	-----	-----	N/A	-----	-----	6.62	9.79	8.06	13.02
<b>Profile</b>																
Riffle Length (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	4.19	15.81	25.68	47.17
Riffle Slope (ft/ft)	0.1000	0.1400	-----	0.1800	-----	-----	-----	-----	0.0850	0.1075	-----	0.1300	0.0108	0.0398	0.0518	0.0928
Pool Length (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	1.17	2.00	1.87	2.57
Pool to Pool Spacing (ft)	24.00	37.00	-----	50.00	-----	-----	-----	-----	5.00	12.50	-----	20.00	5.84	14.71	14.13	22.41
Pool Max Depth (ft)	0.50	0.65	-----	0.80	-----	-----	-----	-----	-----	0.70	-----	-----	0.69	1.10	1.15	1.60
<b>Substrate and Transport Parameters</b>																
SC% / Sa% / G% / C% / B%	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
d16 / d35 / d50 / d84 / d95	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
<b>Additional Reach Parameters</b>																
Drainage Area (SM)	-----	0.02	-----	-----	-----	-----	-----	-----	-----	0.02	-----	-----	-----	0.0180	-----	-----
Impervious cover estimate (%)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
*Rosgen Classification	-----	A4	-----	-----	-----	B4a	-----	-----	-----	B4a	-----	-----	-----	B4a	-----	-----
BF Velocity (fps)	-----	4.10	-----	-----	4.00	-----	-----	6.00	-----	4.00	-----	-----	-----	-----	-----	-----
BF Discharge (cfs)	-----	8.0	-----	-----	-----	-----	-----	-----	-----	8.00	-----	-----	-----	-----	-----	-----
Valley Length	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Channel Length (ft)	-----	528	-----	-----	-----	-----	-----	-----	-----	572	-----	-----	-----	570	-----	-----
Sinuosity	-----	N/A	-----	-----	1.10	-----	-----	1.20	-----	N/A	-----	-----	-----	N/A	-----	-----

Table 8. Baseline Stream Data Summary																
Russell Gap Stream Mitigation Project: DMS Project No ID. 100003																
Reach 19 - (Enhancement I XS-21)																
Parameter	Pre-Existing Condition				Reference Reach(es) Data				Design				As-built			
					Composite											
Dimension and Substrate - Riffle	Min	Mean	Med	Max	Min	Mean	Med	Max	Min	Mean	Med	Max	Min	Mean	Med	Max
BF Width (ft)	-----	4.31	-----	-----	-----	-----	-----	-----	-----	5.40	-----	-----	-----	8.80	-----	-----
Floodprone Width (ft)	-----	8.84	-----	-----	-----	-----	-----	-----	-----	10.00	-----	-----	-----	26.30	-----	-----
BF Mean Depth (ft)	-----	0.45	-----	-----	-----	-----	-----	-----	-----	0.4	-----	-----	-----	0.90	-----	-----
BF Max Depth (ft)	-----	0.91	-----	-----	-----	-----	-----	-----	-----	0.50	-----	-----	-----	1.50	-----	-----
BF Cross-sectional Area (ft²)	-----	1.9	-----	-----	-----	-----	-----	-----	-----	2.0	-----	-----	-----	7.60	-----	-----
Width/Depth Ratio	-----	9.58	-----	-----	12.00	15.00	-----	18.00	-----	13.50	-----	-----	-----	10.20	-----	-----
Entrenchment Ratio	-----	2.05	-----	-----	-----	-----	-----	-----	-----	1.90	-----	-----	-----	3.00	-----	-----
Bank Height Ratio	-----	1.10	-----	-----	1.00	1.05	-----	1.10	-----	1.00	-----	-----	-----	1.00	-----	-----
d50 (mm)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
<b>Pattern</b>																
*Channel Beltwidth (ft)	-----	N/A	-----	-----	-----	-----	-----	-----	-----	N/A	-----	-----	-----	-----	-----	-----
*Radius of Curvature (ft)	-----	N/A	-----	-----	-----	-----	-----	-----	-----	N/A	-----	-----	-----	-----	-----	-----
*Rc/Bankfull width (ft/ft)	-----	N/A	-----	-----	-----	-----	-----	-----	-----	N/A	-----	-----	-----	-----	-----	-----
*Meander Wavelength (ft)	-----	N/A	-----	-----	-----	-----	-----	-----	-----	N/A	-----	-----	-----	-----	-----	-----
*Meander Width Ratio	-----	N/A	-----	-----	-----	-----	-----	-----	-----	N/A	-----	-----	-----	-----	-----	-----
<b>Profile</b>																
Riffle Length (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	2.14	19.69	40.27	78.40
Riffle Slope (ft/ft)	0.0800	0.0950	-----	0.1100	-----	-----	-----	-----	0.0800	0.0950	-----	0.1100	0.0260	0.0561	0.0515	0.0771
Pool Length (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	1.27	2.01	2.06	2.85
Pool to Pool Spacing (ft)	7.00	31.50	-----	56.00	-----	-----	-----	-----	4.00	12.00	-----	20.00	6.35	9.34	9.34	12.33
Pool Max Depth (ft)	-----	0.95	-----	-----	-----	-----	-----	-----	-----	1.00	-----	-----	0.89	1.24	1.28	1.66
<b>Substrate and Transport Parameters</b>																
SC% / Sa% / G% / C% / B%	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
d16 / d35 / d50 / d84 / d95	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
<b>Additional Reach Parameters</b>																
Drainage Area (SM)	-----	0.03	-----	-----	-----	-----	-----	-----	-----	0.03	-----	-----	-----	0.0300	-----	-----
Impervious cover estimate (%)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
*Rosgen Classification	-----	B4a	-----	-----	-----	B4	-----	-----	-----	B4a	-----	-----	-----	B4a	-----	-----
BF Velocity (fps)	-----	4.12	-----	-----	4.00	-----	-----	6.00	-----	4.00	-----	-----	-----	-----	-----	-----
BF Discharge (cfs)	-----	8.0	-----	-----	-----	-----	-----	-----	-----	8.00	-----	-----	-----	-----	-----	-----
Valley Length	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Channel Length (ft)	-----	481	-----	-----	-----	-----	-----	-----	-----	359	-----	-----	-----	352	-----	-----
Sinuosity	-----	1.08	-----	-----	1.10	-----	-----	1.20	-----	1.08	-----	-----	-----	1.08	-----	-----

Table 8. Baseline Stream Data Summary																
Russell Gap Stream Mitigation Project: DMS Project No ID. 100003																
Reach 25 - (Enhancement I XS-23)																
Parameter	Pre-Existing Condition				Reference Reach(es) Data				Design				As-built			
					Composite											
Dimension and Substrate - Riffle	Min	Mean	Med	Max	Min	Mean	Med	Max	Min	Mean	Med	Max	Min	Mean	Med	Max
BF Width (ft)	-----	5.00	-----	-----	-----	-----	-----	-----	-----	5.40	-----	-----	-----	5.10	-----	-----
Floodprone Width (ft)	-----	12.00	-----	-----	-----	-----	-----	-----	-----	12.00	-----	-----	-----	11.10	-----	-----
BF Mean Depth (ft)	-----	0.40	-----	-----	-----	-----	-----	-----	-----	0.4	-----	-----	-----	0.50	-----	-----
BF Max Depth (ft)	-----	0.50	-----	-----	-----	-----	-----	-----	-----	0.50	-----	-----	-----	0.80	-----	-----
BF Cross-sectional Area (ft <sup>2</sup> )	-----	1.9	-----	-----	-----	-----	-----	-----	-----	2.0	-----	-----	-----	2.20	-----	-----
Width/Depth Ratio	-----	12.50	-----	-----	12.00	15.00	-----	18.00	-----	13.50	-----	-----	-----	9.10	-----	-----
Entrenchment Ratio	-----	2.40	-----	-----	-----	-----	-----	-----	-----	2.20	-----	-----	-----	2.50	-----	-----
Bank Height Ratio	-----	2.00	-----	-----	1.00	1.05	-----	1.10	-----	1.00	-----	-----	-----	1.00	-----	-----
d50 (mm)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
<b>Pattern</b>																
*Channel Beltwidth (ft)	-----	N/A	-----	-----	-----	-----	-----	-----	-----	N/A	-----	-----	-----	-----	-----	-----
*Radius of Curvature (ft)	-----	N/A	-----	-----	-----	-----	-----	-----	-----	N/A	-----	-----	-----	-----	-----	-----
*Rc/Bankfull width (ft/ft)	-----	N/A	-----	-----	-----	-----	-----	-----	-----	N/A	-----	-----	-----	-----	-----	-----
*Meander Wavelength (ft)	-----	N/A	-----	-----	-----	-----	-----	-----	-----	N/A	-----	-----	-----	-----	-----	-----
*Meander Width Ratio	-----	N/A	-----	-----	-----	-----	-----	-----	-----	N/A	-----	-----	-----	-----	-----	-----
<b>Profile</b>																
Riffle Length (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	6.68	17.65	18.60	30.52
Riffle Slope (ft/ft)	0.0800	0.0950	-----	0.1100	1.1000	1.4500	-----	1.8000	0.0950	0.1025	-----	0.1100	0.0165	0.0591	0.0564	0.0962
Pool Length (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	2.23	5.21	5.41	8.59
Pool to Pool Spacing (ft)	7.00	31.50	-----	56.00	-----	-----	-----	-----	7.00	13.50	-----	20.00	7.63	16.24	23.05	38.47
Pool Max Depth (ft)	-----	1.20	-----	-----	-----	-----	-----	-----	-----	1.20	-----	-----	1.16	1.75	1.68	2.19
<b>Substrate and Transport Parameters</b>	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
SC% / Sa% / G% / C% / B%	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
d16 / d35 / d50 / d84 / d95	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
<b>Additional Reach Parameters</b>																
Drainage Area (SM)	-----	0.30	-----	-----	-----	-----	-----	-----	-----	0.30	-----	-----	-----	0.3000	-----	-----
Impervious cover estimate (%)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
*Rosgen Classification	-----	B4a	-----	-----	-----	B4	-----	-----	-----	B4a	-----	-----	-----	B4a	-----	-----
BF Velocity (fps)	-----	4.64	-----	-----	4.00	-----	-----	6.00	-----	4.50	-----	-----	-----	-----	-----	-----
BF Discharge (cfs)	-----	9.0	-----	-----	-----	-----	-----	-----	-----	9.00	-----	-----	-----	-----	-----	-----
Valley Length	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Channel Length (ft)	-----	422	-----	-----	-----	-----	-----	-----	-----	427	-----	-----	-----	431	-----	-----
Sinuosity	-----	1.09	-----	-----	1.10	-----	-----	1.20	-----	1.08	-----	-----	-----	1.08	-----	-----

**Table 9. Cross-Section Morphology Data Summary**  
 Russell Gap Restoration Project: DMS Project No ID. 100003

Stream Reach	Reach 1																											
Dimension and substrate	Cross-section X-1 (Rifle)							Cross-section X-2 (Pool)							Cross-section X-3 (Rifle)							Cross-section X-4 (Pool)						
	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+
<b>Based on fixed baseline bankfull elevation</b>																												
BF Width (ft)	16.2	15.8						24.6	18.6						16.1	16.3						22.9	16.6					
BF Mean Depth (ft)	1.2	1.2						1.0	1.3						1.3	1.3						1.2	1.5					
Width/Depth Ratio	13.9	13.6						24.1	14.7						12.5	12.9						18.9	11.3					
BF Cross-sectional Area (ft²)	18.8	18.4						25.1	23.6						20.6	20.6						27.7	24.4					
BF Max Depth (ft)	1.6	1.7						1.7	2.3						1.8	2.0						2.4	2.7					
Width of Floodprone Area (ft)	75.3	75.3						75.3	75.3						82.4	82.4						82.2	82.2					
Entrenchment Ratio	4.7	4.8						3.1	4.0						5.1	5.0						3.6	5.0					
Bank Height Ratio	1.0	1.1						0.9	1.0						1.0	1.0						1.1	1.1					
Wetted Perimeter (ft)	16.7	16.4						25.3	20.0						16.8	17.2						23.5	17.7					
Hydraulic Radius (ft)	1.1	1.1						1.0	1.2						1.2	1.2						1.2	1.4					
d50 (mm)																												
<b>Stream Reach</b>	<b>Reach 3</b>							<b>Reach 4</b>							<b>Reach 4</b>							<b>Reach 6</b>						
Dimension and substrate	Cross-section X-5 (Rifle)							Cross-section X-6 (Rifle)							Cross-section X-7 (Rifle)							Cross-section X-8 (Rifle)						
	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+
<b>Based on fixed baseline bankfull elevation</b>																												
BF Width (ft)	23.8	23.7						13.9	13.5						14.3	14.4						15.1	14.6					
BF Mean Depth (ft)	1.7	2.7						1.7	1.7						1.6	1.6						1.5	1.5					
Width/Depth Ratio	13.8	13.8						8.4	7.8						9.0	9.1						10.3	9.9					
BF Cross-sectional Area (ft²)	40.9	40.6						23.1	23.3						22.9	22.8						22.1	21.4					
BF Max Depth (ft)	2.7	2.7						2.8	2.8						2.3	2.5						3.0	2.8					
Width of Floodprone Area (ft)	46.5	47.5						24.0	23.4						31.7	30.3						34.3	33.2					
Entrenchment Ratio	2.0	2.5						1.7	1.6						2.2	2.1						2.3	2.2					
Bank Height Ratio	1.0	0.9						1.0	0.8						1.0	1.3						1.0	1.0					
Wetted Perimeter (ft)	25.1	25.3						15.5	15.1						15.7	16.1						16.4	16.3					
Hydraulic Radius (ft)	1.6	1.6						1.5	1.5						1.5	1.4						1.4	1.3					
d50 (mm)																												
<b>Stream Reach</b>	<b>Reach 4</b>							<b>Reach 4</b>							<b>Reach 6</b>													
Dimension and substrate	Cross-section X-9 (Pool)							Cross-section X-10 (Rifle)							Cross-section X-11 (Rifle)							Cross-section X-12 (Pool)						
	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+
<b>Based on fixed baseline bankfull elevation</b>																												
BF Width (ft)	16.2	15.2						22.6	21.3						13.3	10.3						13.8	9.2					
BF Mean Depth (ft)	1.7	1.3						0.9	0.9						1.2	1.3						0.8	0.9					
Width/Depth Ratio	9.7	11.4						26.1	23.4						11.4	7.9						16.3	10.8					
BF Cross-sectional Area (ft²)	27.2	20.5						19.6	19.4						15.5	13.6						11.6	7.9					
BF Max Depth (ft)	2.7	2.4						2.2	2.3						2.0	2.1						1.8	1.9					
Width of Floodprone Area (ft)	38.0	38.0						32.0	31.5						25.9	23.3						56.8	56.8					
Entrenchment Ratio	2.3	2.5						1.4	1.5						1.9	2.3						5.7	6.1					
Bank Height Ratio	1.0	0.9						1.0	1.0						1.0	1.1						1.0	1.0					
Wetted Perimeter (ft)	17.4	16.6						23.7	22.5						14.3	11.4						10.8	9.9					
Hydraulic Radius (ft)	1.6	1.2						0.8	0.9						1.1	1.2						1.1	0.8					
d50 (mm)																												

Table 9. Cross-Section Morphology Data Summary  
Russell Gap Restoration Project: DMS Project No ID. 100003

Table 9. Cross-Section Morphology Data Summary  
Russell Gap Restoration Project: DMS Project No ID. 100003

Stream Reach	Reach 6							Reach 7b							Reach 9													
Dimension and substrate	Cross-section X-13 (Riffle)							Cross-section X-14 (Riffle)							Cross-section X-15 (Pool)							Cross-section X-16 (Pool)						
	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+
Based on fixed baseline bankfull elevation																												
BF Width (ft)	13.8	8.2						11.0	11.7						14.0	14.3						12.9	9.0					
BF Mean Depth (ft)	0.8	0.9						1.3	1.3						1.0	0.9						1.0	0.8					
Width/Depth Ratio	10.9	9.4						8.4	9.3						14.4	15.5						12.4	11.4					
BF Cross-sectional Area (ft²)	7.2	7.1						14.4	14.6						13.6	13.2						13.5	7.1					
BF Max Depth (ft)	1.3	1.5						2.0	2.2						1.6	1.7						1.9	1.8					
Width of Floodprone Area (ft)	45.0	45.0						45.9	45.9						27.3	27.3						80.4	80.4					
Entrenchment Ratio	5.1	5.5						4.2	3.9						1.9	1.9						6.2	8.9					
Bank Height Ratio	1.0	1.0						1.0	1.1						2.4	2.4						1.0	1.0					
Wetted Perimeter (ft)	9.4	8.9						12.0	12.6						14.5	14.8						13.8	9.8					
Hydraulic Radius (ft)	0.8	0.8						1.2	1.2						0.9	0.9						1.0	0.7					
d50 (mm)																												
Stream Reach	Reach 9							Reach 11							R14													
Dimension and substrate	Cross-section X-17 (Riffle)							Cross-section X-18 (Riffle)							Cross-section X-19 (Riffle)							Cross-section X-20 (Riffle)						
	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+
Based on fixed baseline bankfull elevation																												
BF Width (ft)	12.1	12.2						8.9	7.1						4.5	3.8						3.7	3.3					
BF Mean Depth (ft)	1.0	1.0						1.1	0.7						0.5	0.4						0.5	0.3					
Width/Depth Ratio	12.2	11.9						8.4	9.8						9.1	9.7						6.8	11.0					
BF Cross-sectional Area (ft²)	11.9	12.4						9.5	5.2						2.2	1.5						2.0	1.0					
BF Max Depth (ft)	1.4	1.6						1.9	1.4						0.8	0.7						1.0	0.5					
Width of Floodprone Area (ft)	18.7	78.1						18.6	14.7						11.1	11.1						32.0	32.0					
Entrenchment Ratio	1.6	6.4						2.1	2.1						2.5	2.9						8.7	9.6					
Bank Height Ratio	1.0	1.0						2.9	1.2						1.0	1.1						1.0	1.0					
Wetted Perimeter (ft)	12.6	12.7						9.8	7.7						4.8	4.1						4.2	3.5					
Hydraulic Radius (ft)	0.9	1.0						1.0	0.7						0.5	0.4						0.5	0.3					
d50 (mm)																												
Stream Reach	Reach 19							Reach 20							Reach 25							Reach 10b						
Dimension and substrate	Cross-section X-21 (Riffle)							Cross-section X-22 (Riffle)							Cross-section X-23 (Riffle)							Cross-section X-24 (Riffle)						
	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+
Based on fixed baseline bankfull elevation																												
BF Width (ft)	8.8	8.5						3.8	4.5						5.1	4.7						6.2	5.5					
BF Mean Depth (ft)	0.9	0.8						0.5	0.4						0.6	0.6						0.6	0.5					
Width/Depth Ratio	10.2	11.1						7.0	10.2						8.1	8.2						11.0	10.1					
BF Cross-sectional Area (ft²)	7.6	6.6						2.0	1.9						3.2	2.7						3.5	3.0					
BF Max Depth (ft)	1.5	1.5						0.8	0.7						1.0	0.9						1.0	1.0					
Width of Floodprone Area (ft)	26.3	26.3						12.4	12.4						8.1	8.1						45.5	45.5					
Entrenchment Ratio	3.0	3.1						3.3	2.8						1.6	1.7						7.3	8.2					
Bank Height Ratio	1.0	1.1						1.0	1.0						1.0	0.9						1.0	1.0					
Wetted Perimeter (ft)	9.4	9.1						4.3	4.7						5.7	5.2						6.6	5.9					
Hydraulic Radius (ft)	0.8	0.7						0.5	0.4						0.6	0.5						0.5	0.5					
d50 (mm)																												
Stream Reach	Reach 12							Reach 2																				
Dimension and substrate	Cross-section X-25 (Riffle)							Cross-section X-26 (Riffle)																				
	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+														
Based on fixed baseline bankfull elevation																												
BF Width (ft)	9.1	7.8						18.5	13.4																			
BF Mean Depth (ft)	0.6	0.6						1.8	2.2																			
Width/Depth Ratio	16.2	12.8						10.2	6.1																			
BF Cross-sectional Area (ft²)	5.2	4.7						33.6	29.4																			
BF Max Depth (ft)	1.0	1.0						2.9	2.9																			
Width of Floodprone Area (ft)	38.2	38.2						38.0	38.1																			
Entrenchment Ratio	4.2	4.9						2.1	2.8																			
Bank Height Ratio	1.0	0.9						1.0	0.9																			
Wetted Perimeter (ft)	9.4	8.1						19.4	14.3																			
Hydraulic Radius (ft)	0.5	0.6						1.7	2.1																			
d50 (mm)																												



# **APPENDIX E**

## Hydrologic Data

**Table 10. Verification of Bankfull Events**  
**Russell Gap Stream Mitigation Project - NCDMS Project No. 100003**

Date of Data Collection	R1 Manual Cork Crest Gauge #1	R9 Manual Cork Crest Gauge #2	R4 Manual Cork Crest Gauge #3	R6 Manual Cork Crest Gauge #4	Date of Bankfull Event Occurrence	Method of Data Collection
<b>Year 1 Monitoring (2020)</b>						
6/1/2020	NA	NA	1.25 ft.	NA	5/28/2020	Manual cork measurement
11/5/2020	1.5 ft.	NA	2.5 ft	NA	10/30/2020	Manual cork measurement

Note: Manual cork crest gauge readings were corroborated with associated spikes in the automated Continuous Stage Recorder (see graph in Appendix E) and/or with photographs (Appendix B).

Figure 5. Wetland Monitoring Well Graphs

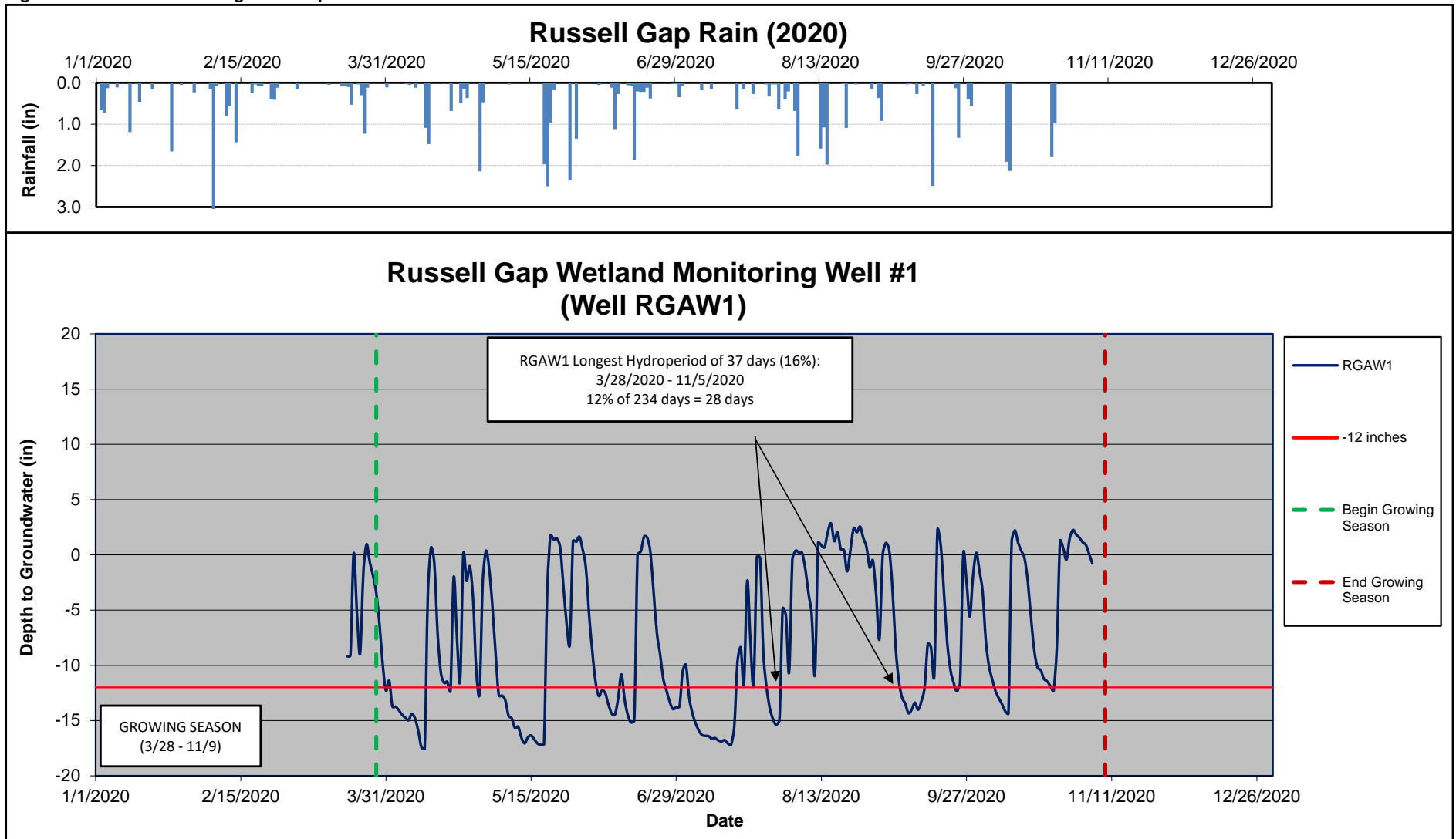


Figure 5. Wetland Monitoring Well Graphs

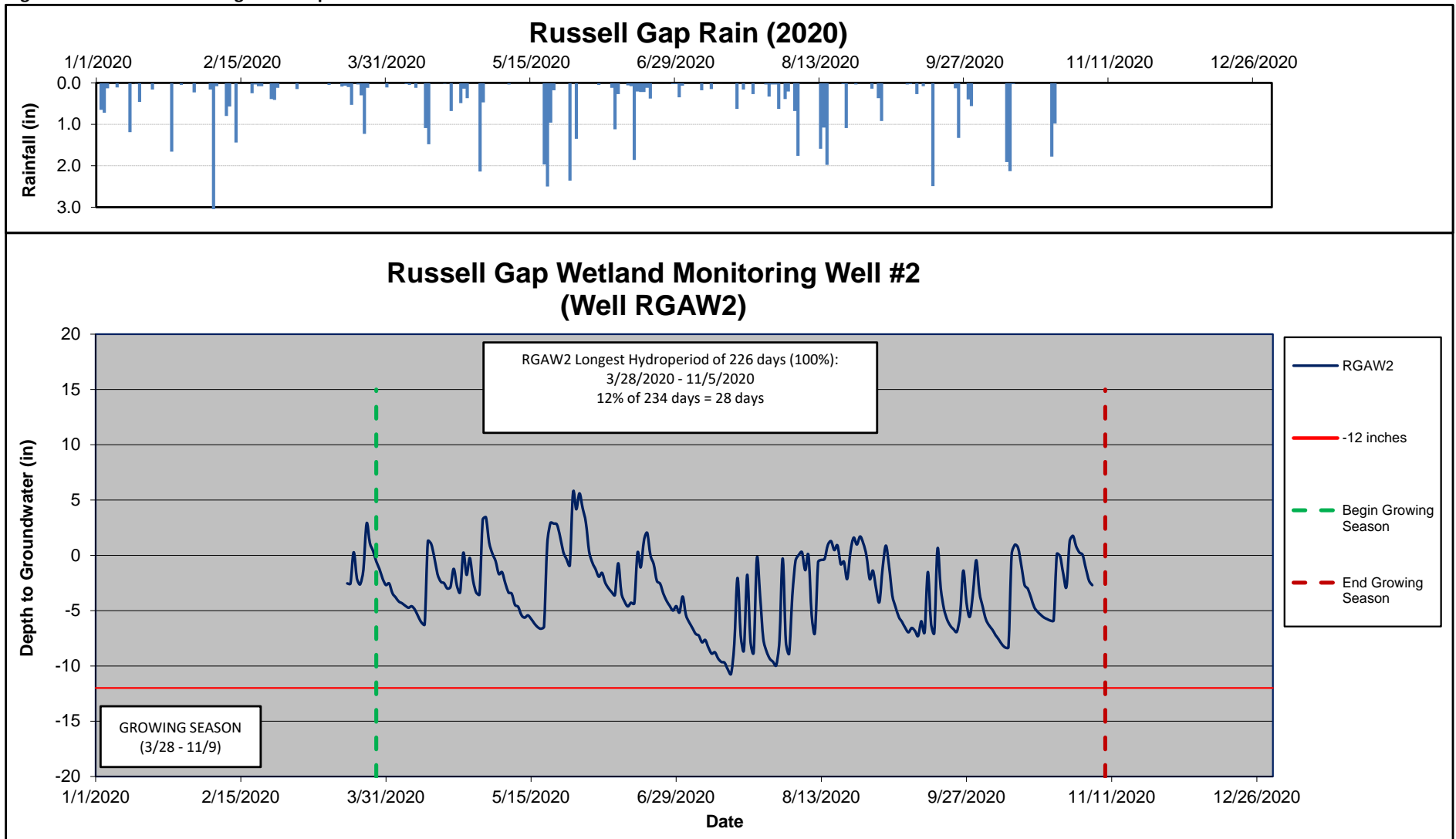


Figure 5. Wetland Monitoring Well Graphs

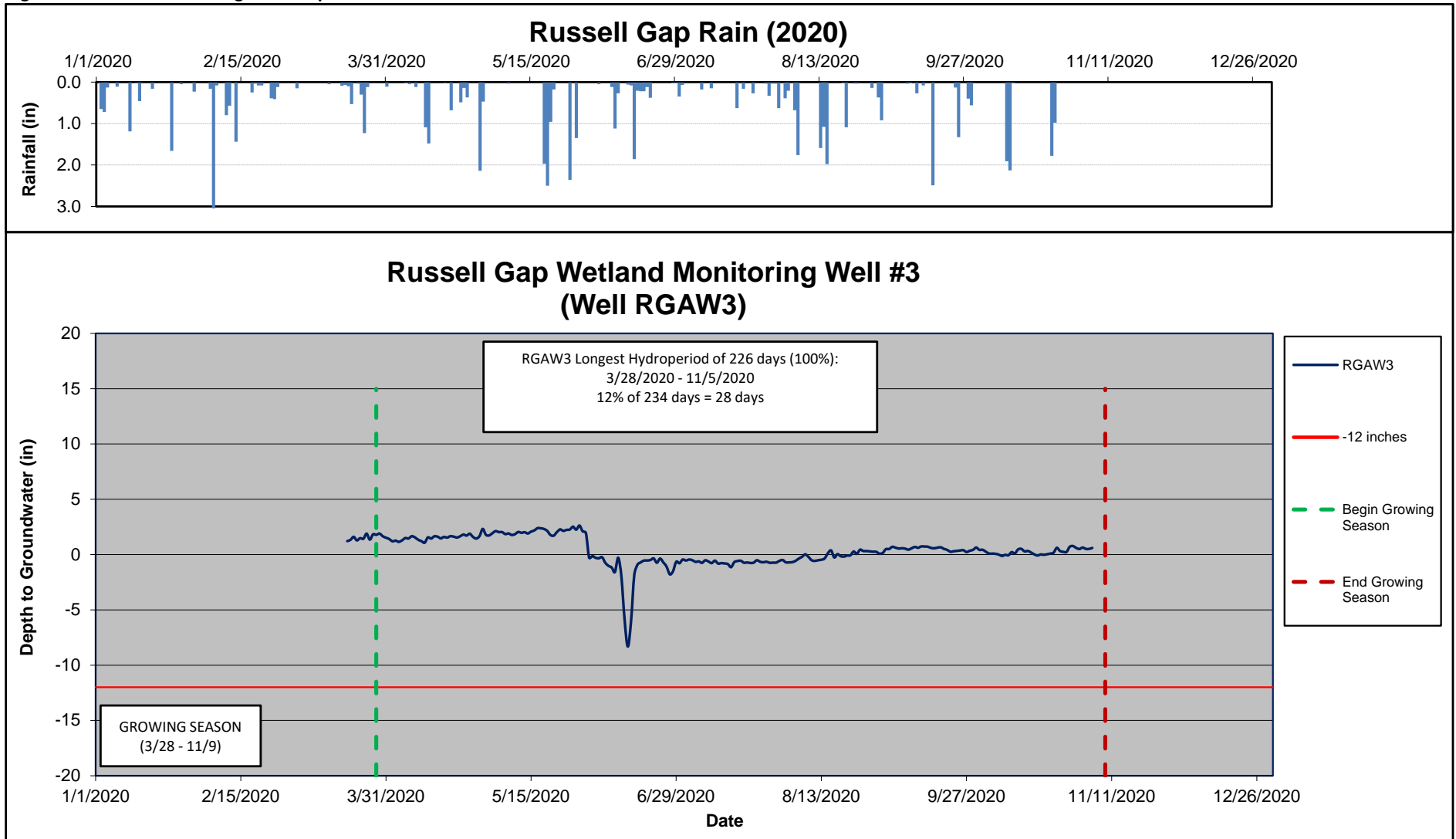


Figure 5. Wetland Monitoring Well Graphs

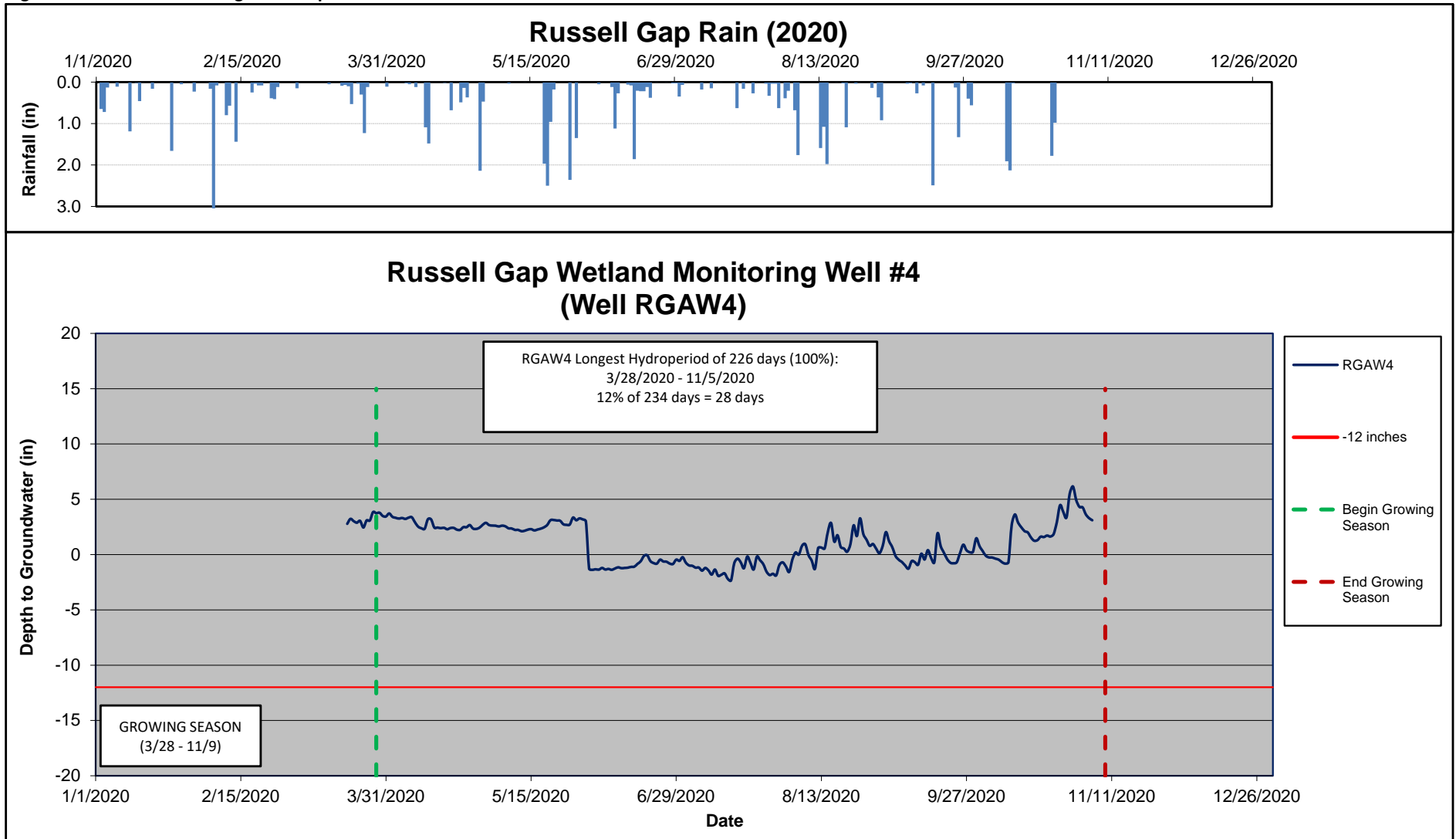


Figure 5. Wetland Monitoring Well Graphs

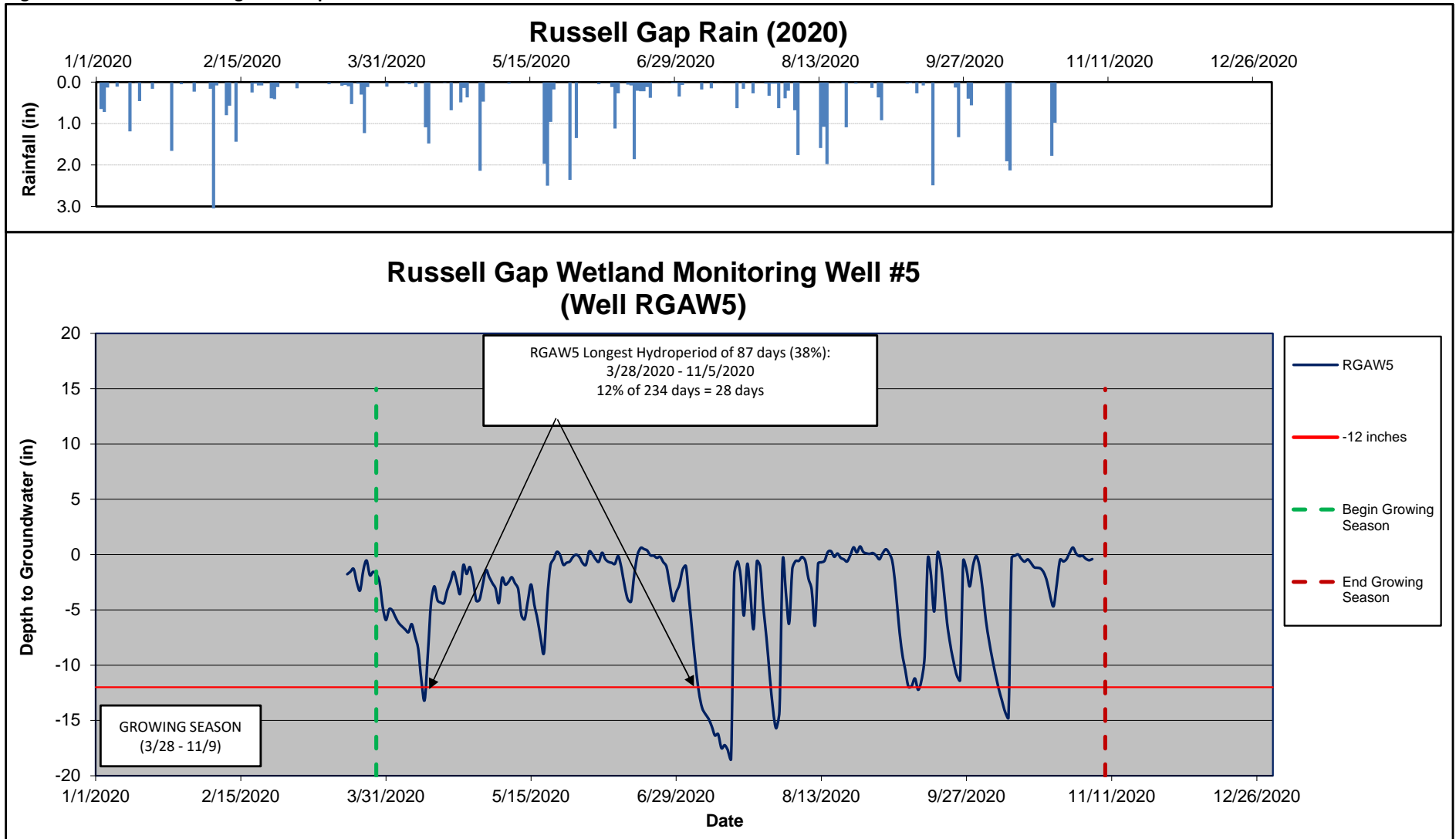


Figure 5. Wetland Monitoring Well Graphs

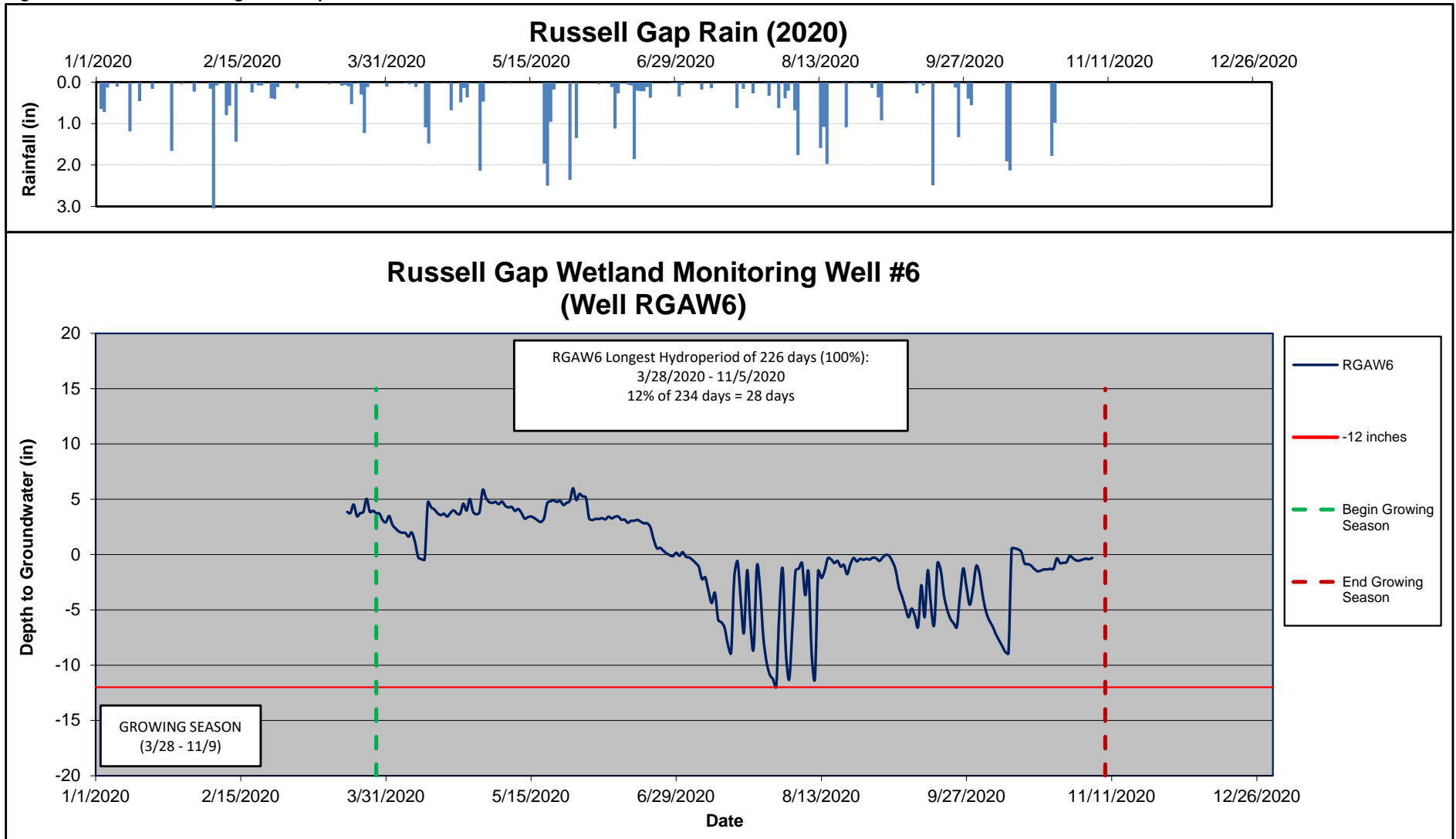




Figure 5. Wetland Monitoring Well Graphs

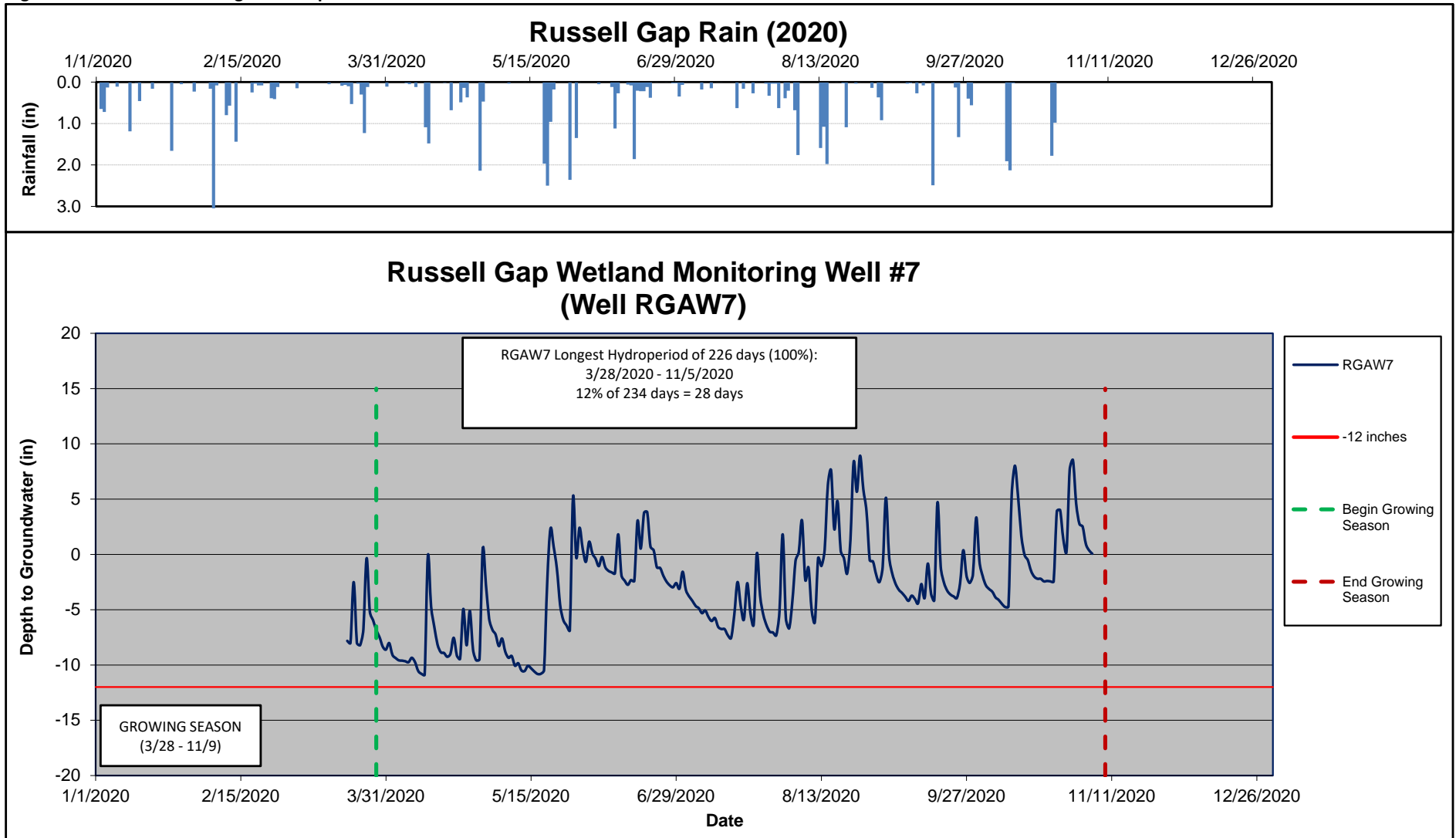


Figure 5. Wetland Monitoring Well Graphs

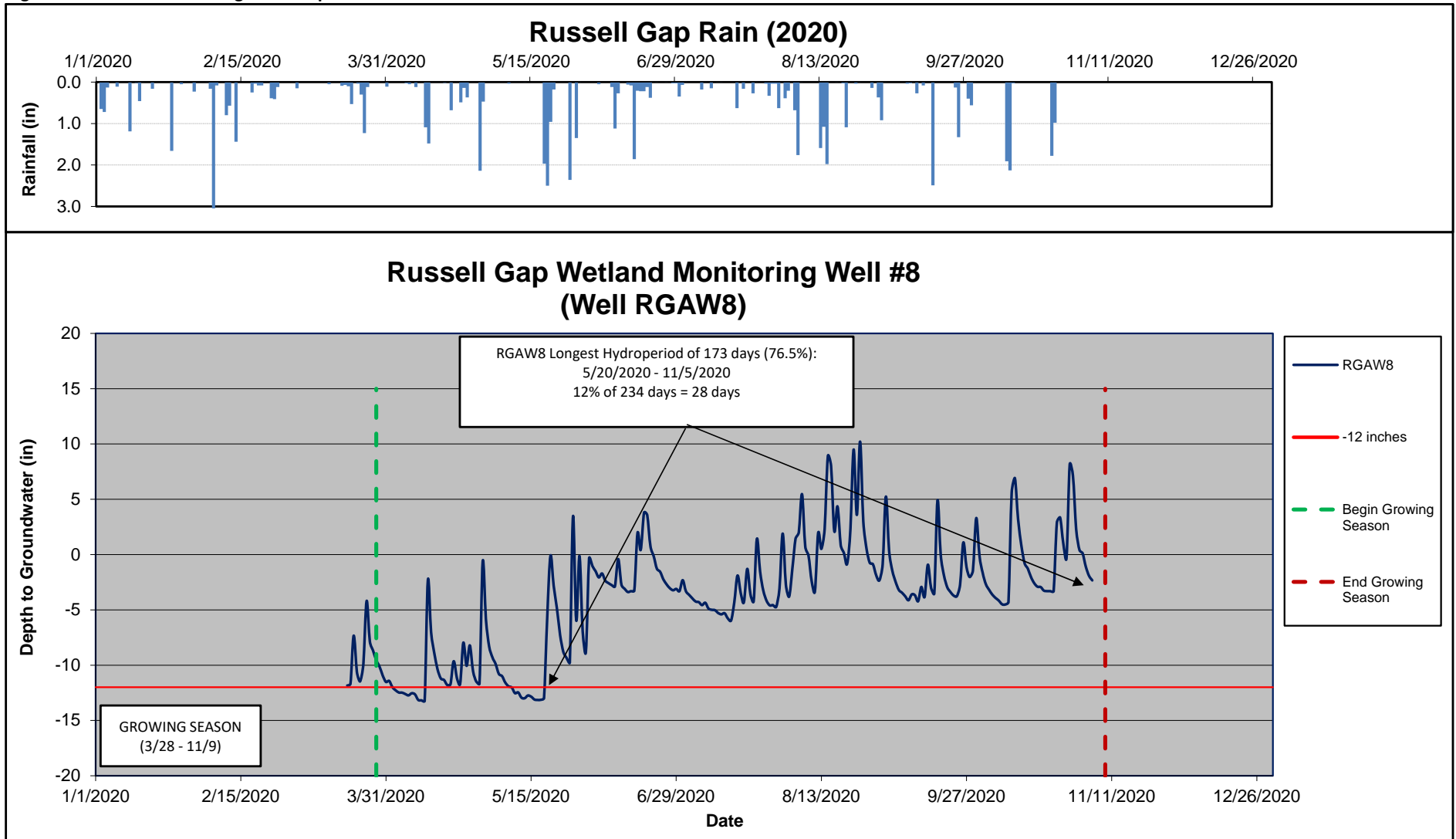


Figure 5. Wetland Monitoring Well Graphs

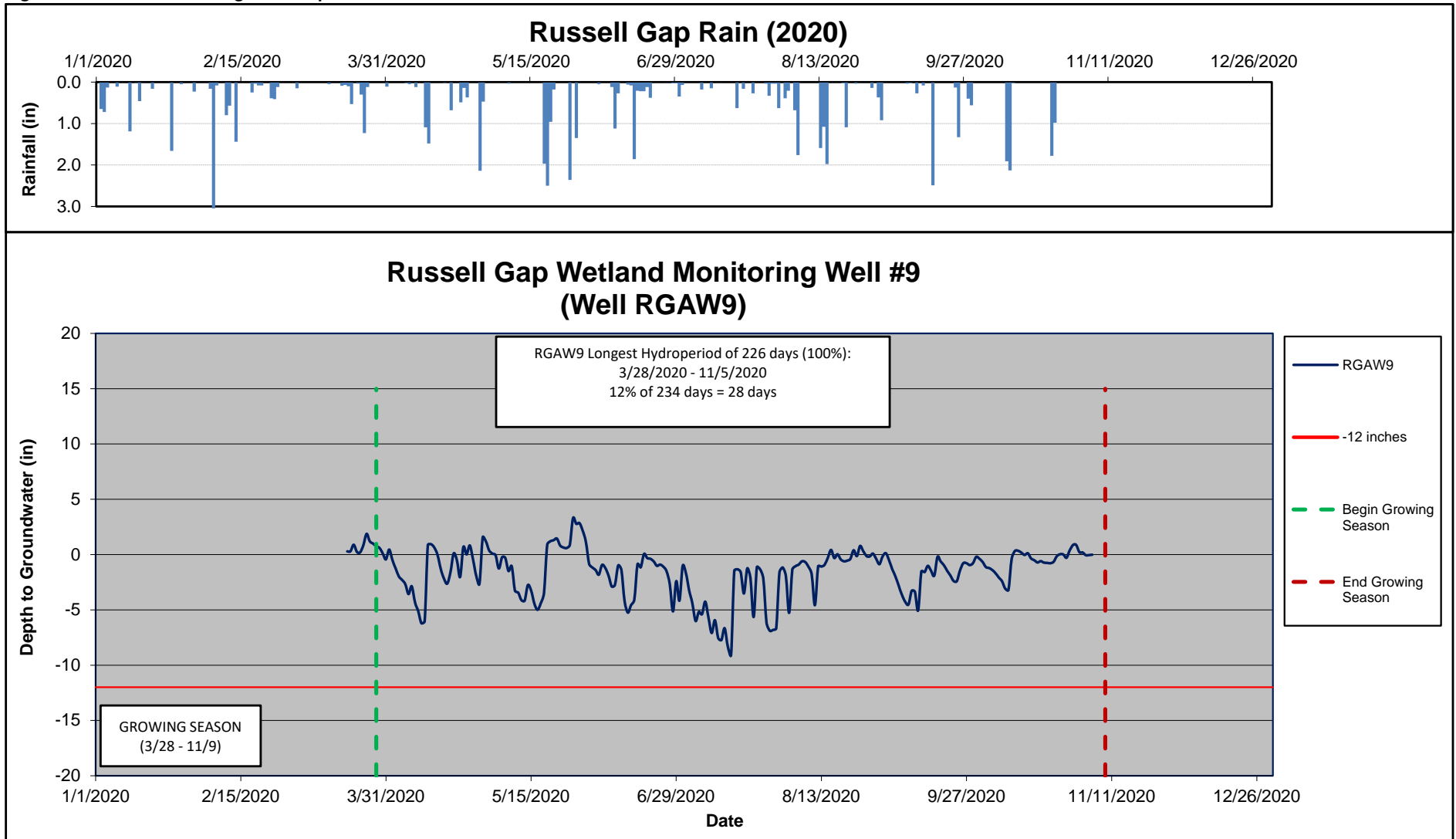


Figure 5. Wetland Monitoring Well Graphs

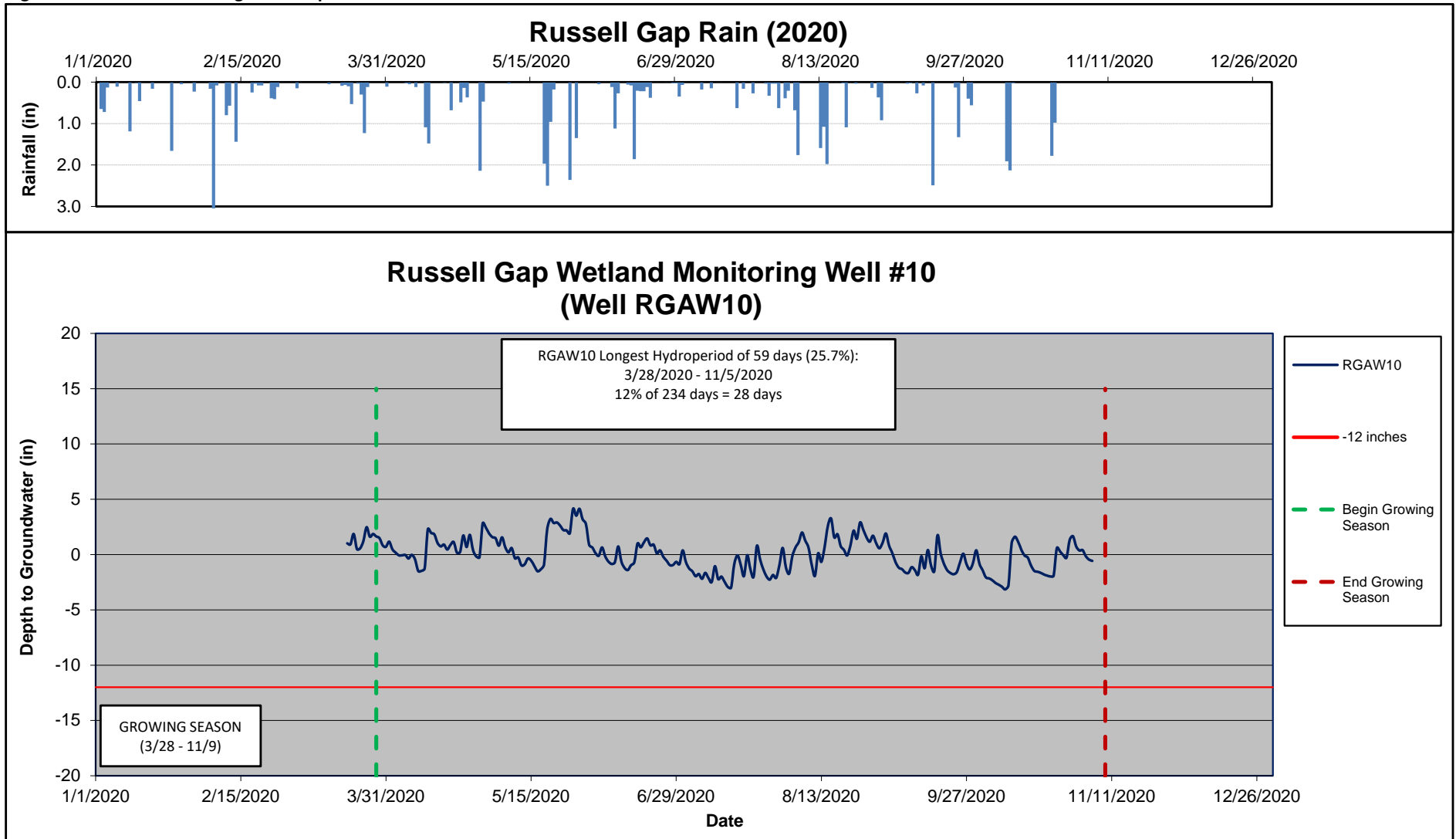


Figure 5. Wetland Monitoring Well Graphs

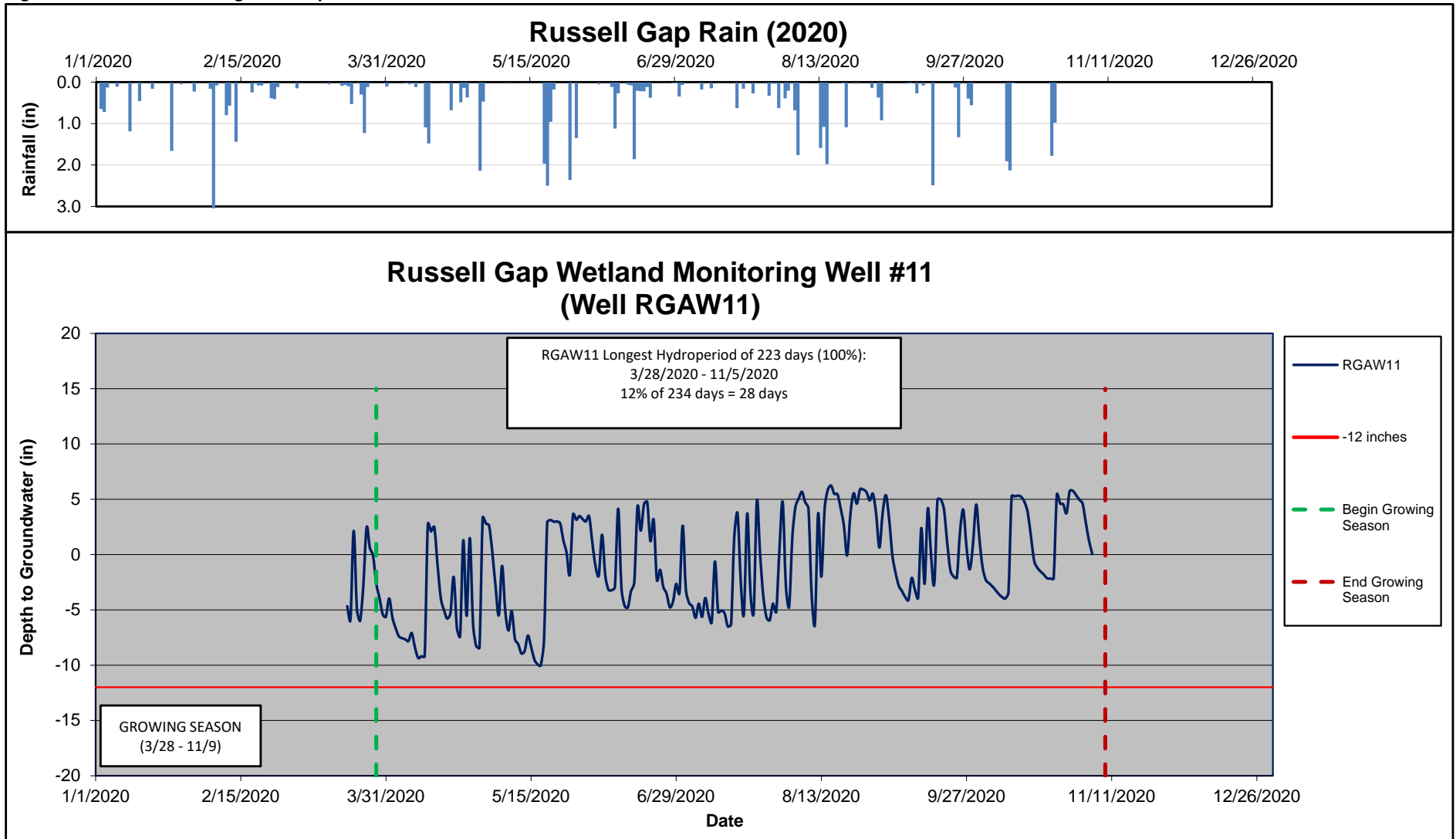


Figure 5. Wetland Monitoring Well Graphs

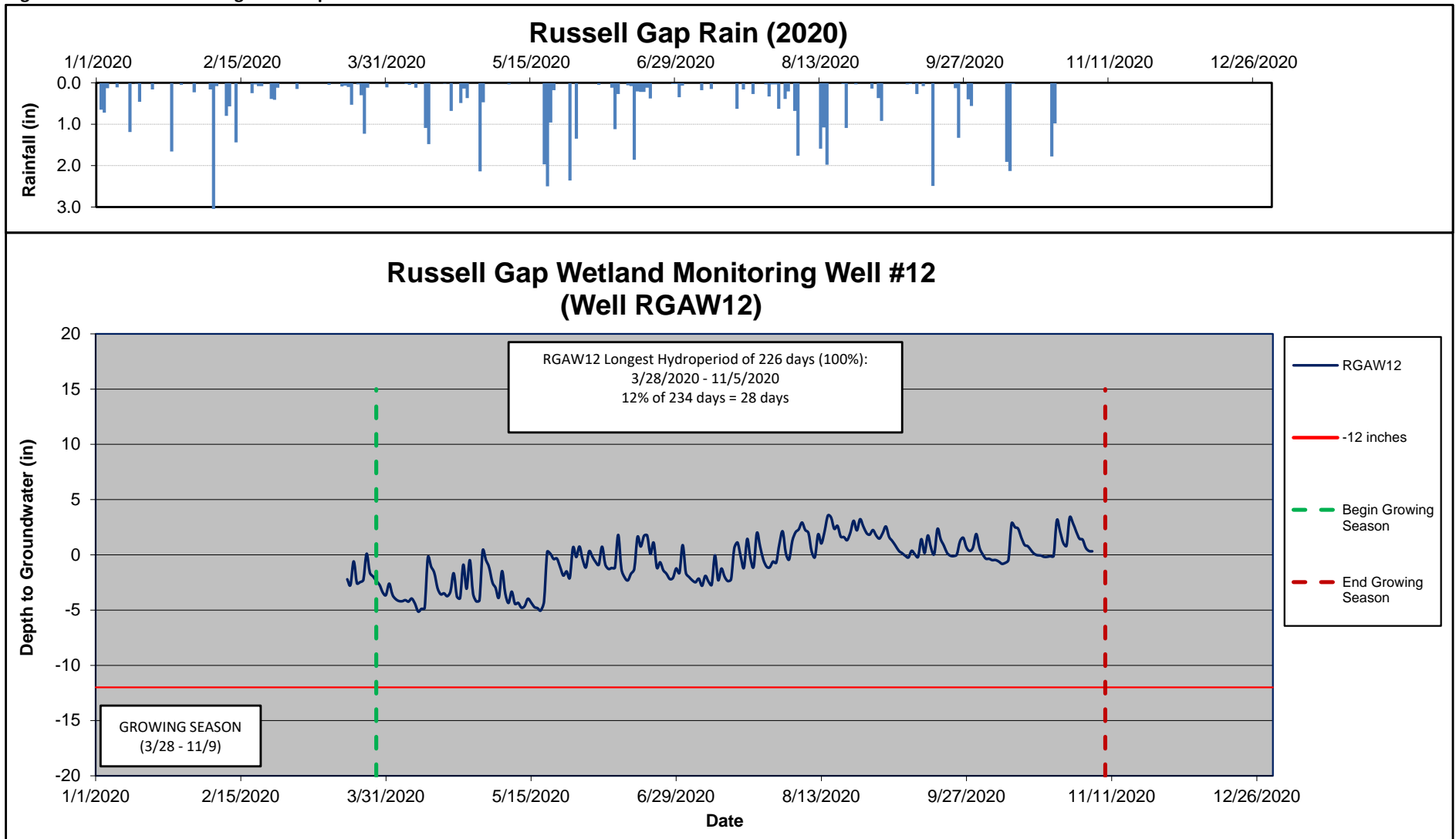
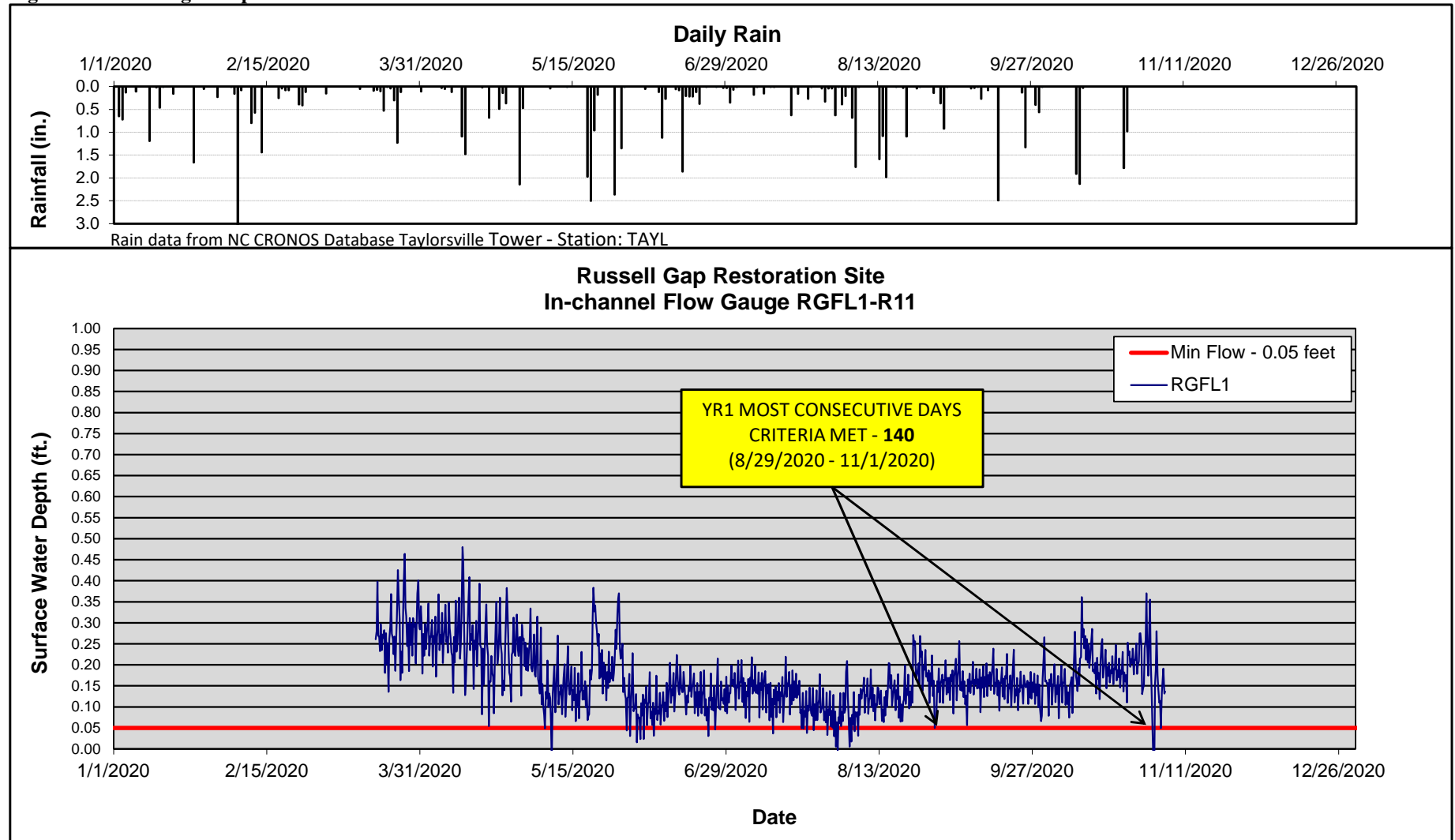


Table 11. Wetland Hydrology Summary Data																														
Russell Gap Stream Mitigation Project - NCDMS Project No. 100003																														
Well ID	Percentage of Consecutive Days <12 inches from Ground Surface <sup>1</sup>							Most Consecutive Days Meeting Criteria <sup>2</sup>							Percentage of Cumulative Days <12 inches from Ground Surface							Cumulative Days Meeting Criteria <sup>3</sup>								
	Year 1 (2020)	Year 2 (2021)	Year 3 (2022)	Year 4 (2023)	Year 5 (2024)	Year 6 (2025)	Year 7 (2026)	Year 1 (2020)	Year 2 (2021)	Year 3 (2022)	Year 4 (2023)	Year 5 (2024)	Year 6 (2025)	Year 7 (2026)	Year 1 (2020)	Year 2 (2021)	Year 3 (2022)	Year 4 (2023)	Year 5 (2024)	Year 6 (2025)	Year 7 (2026)	Year 1 (2020)	Year 2 (2021)	Year 3 (2022)	Year 4 (2023)	Year 5 (2024)	Year 6 (2025)	Year 7 (2026)		
<b>Wetland Monitoring Wells (Installed March 2020)</b>																														
RGAW1	16.0							59							66.4															
RGAW2	100.0							226							100.0															
RGAW3	100.0							226							100.0															
RGAW4	100.0							226							100.0															
RGAW5	38.0							87							92.0															
RGAW6	54.8							124							100.0															
RGAW7	100.0							226							100.0															
RGAW8	76.5							173							91.6															
RGAW9	100.0							226							100.0															
RGAW10	100.0							226							100.0															
RGAW11	100.0							226							100.0															
RGAW12	100.0							226							100.0															

<sup>1</sup>Indicates the percentage of the single greatest consecutive number of days within the monitored growing season with a water table 12 inches or less from the soil surface.  
<sup>2</sup>Indicates the single greatest consecutive number of days within the monitored growing season with a water table 12 inches or less from the soil surface.  
<sup>3</sup>Indicates the total number of days within the monitored growing season with a water table 12 inches or less from the soil surface.  
Growing season for Alexander County is from March 28 to November 8 and is **226** days long. 12% of the growing season is **27** days.

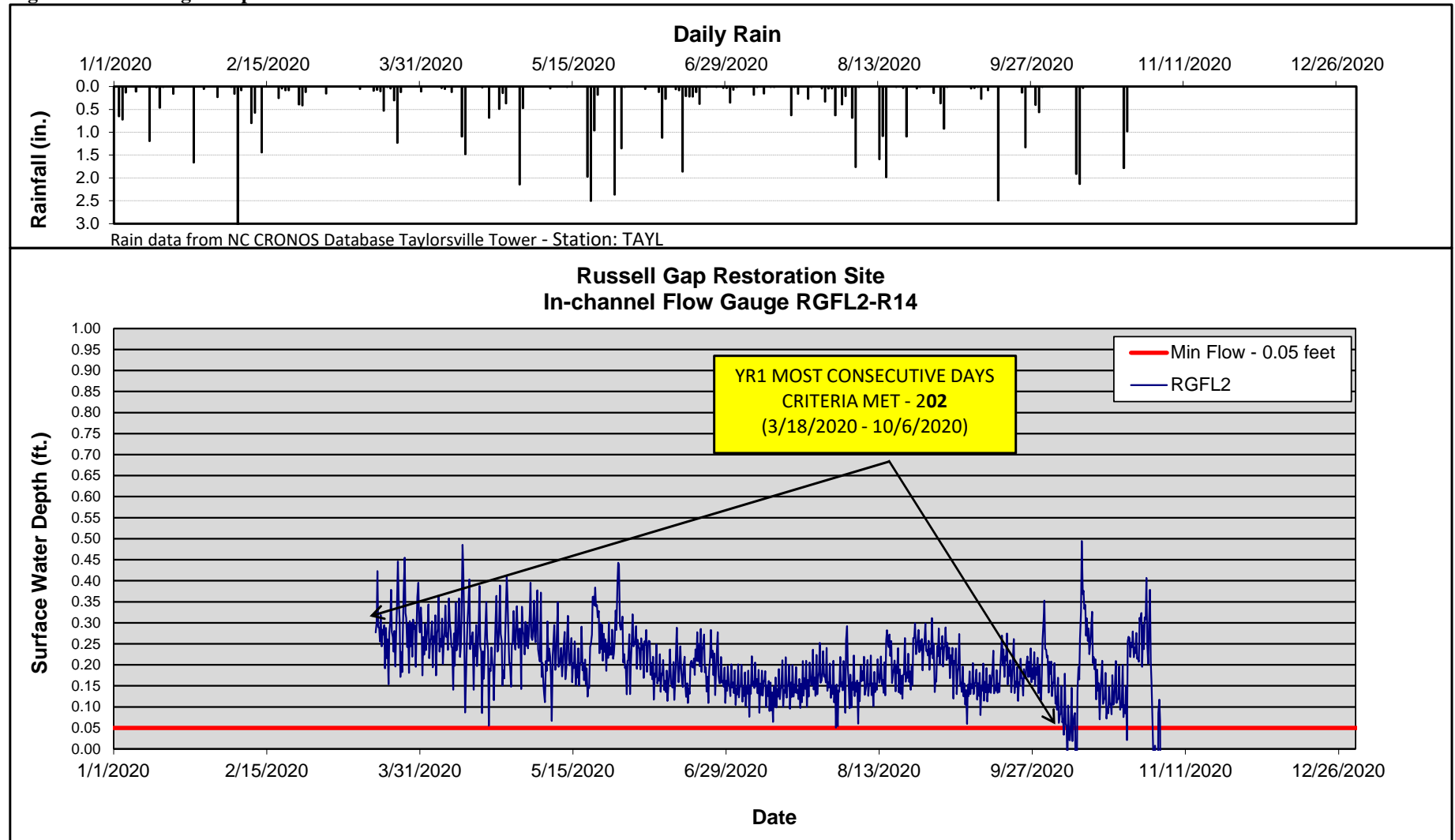
Figure 6. Flow Gauge Graphs



\* Surface water flow is estimated to have occurred when the pressure transducer reading is equal to or above 0.05 feet in depth.

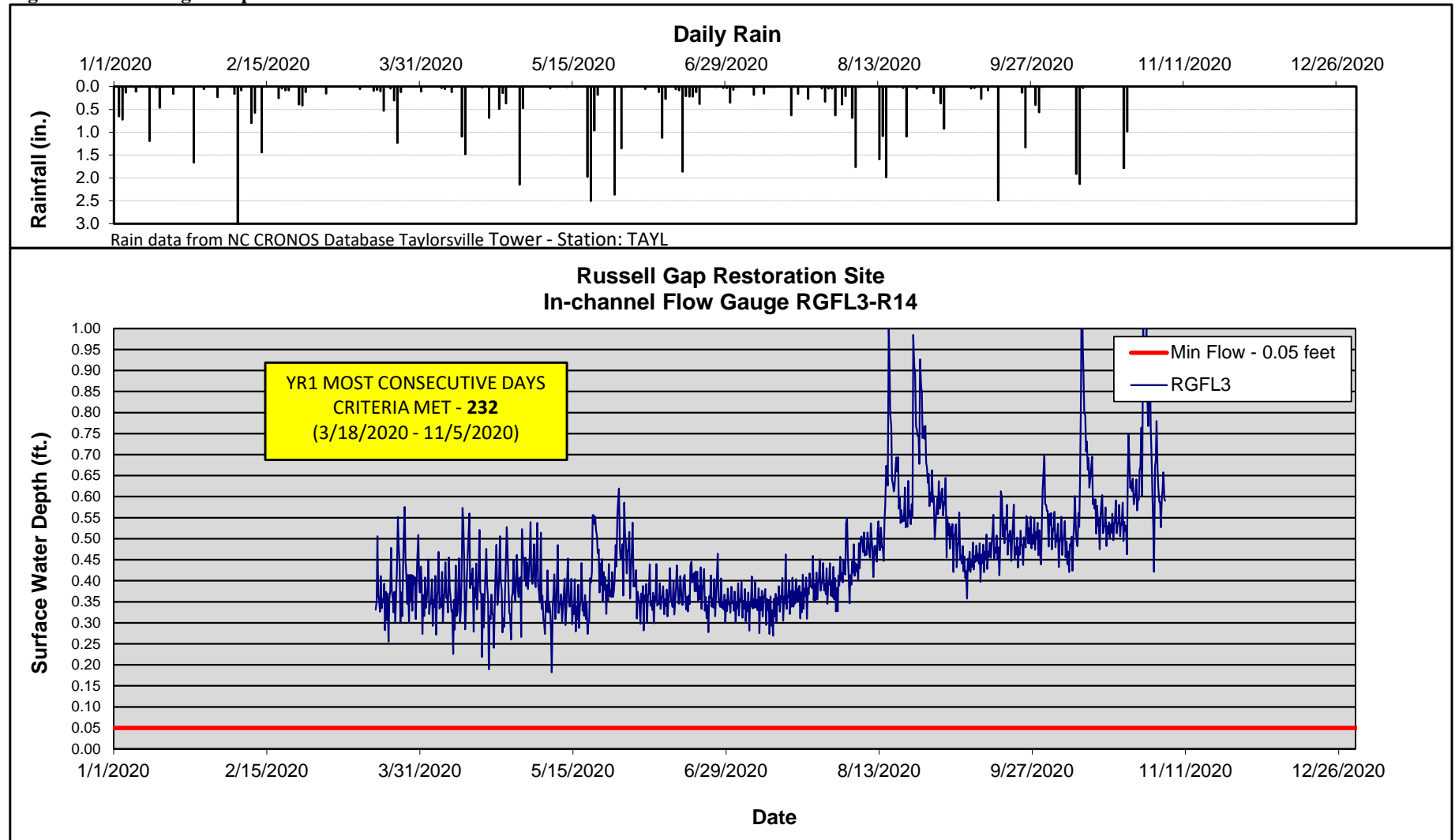


Figure 6. Flow Gauge Graphs



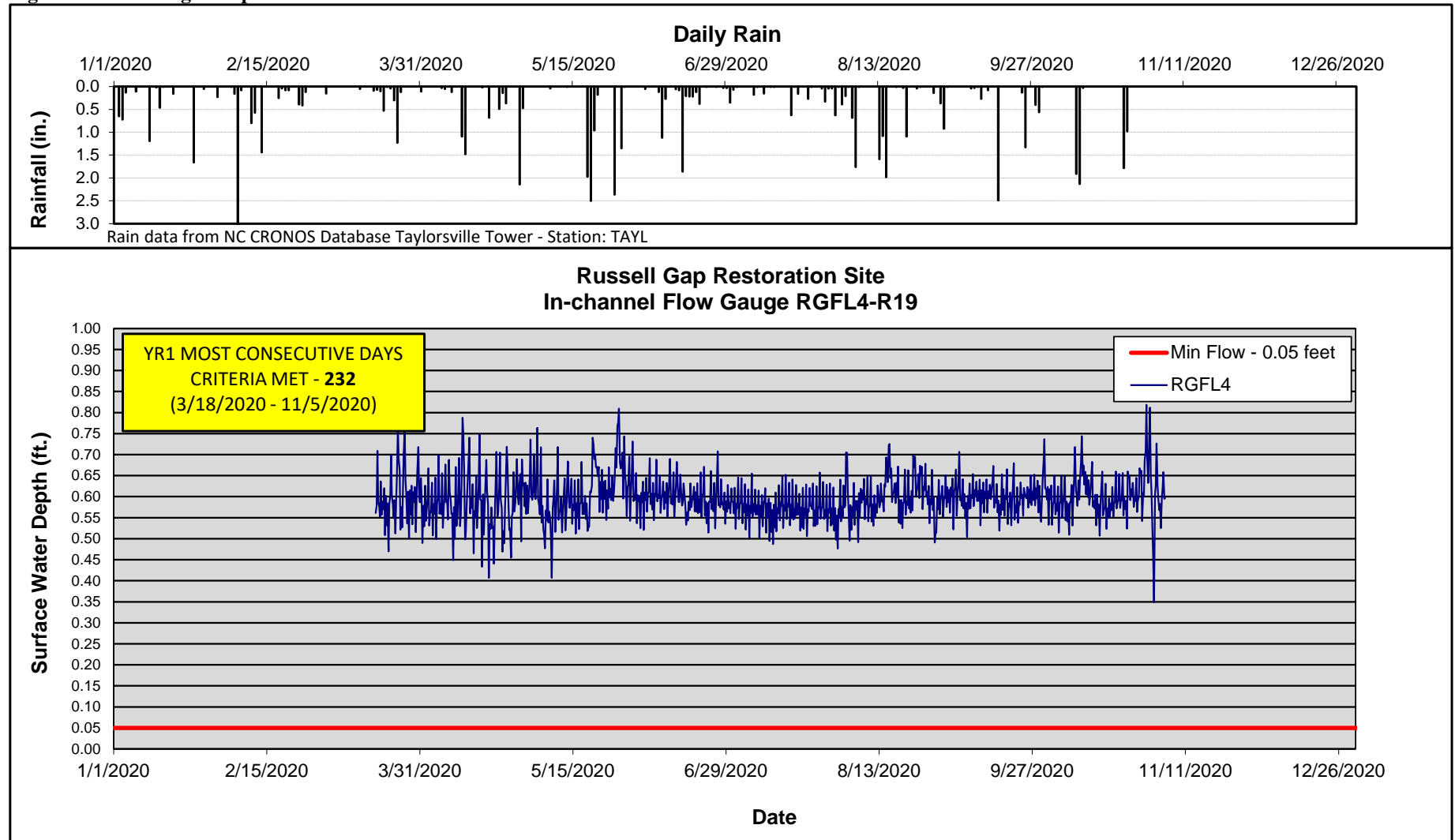
\* Surface water flow is estimated to have occurred when the pressure transducer reading is equal to or above 0.05 feet in depth.

Figure 6. Flow Gauge Graphs



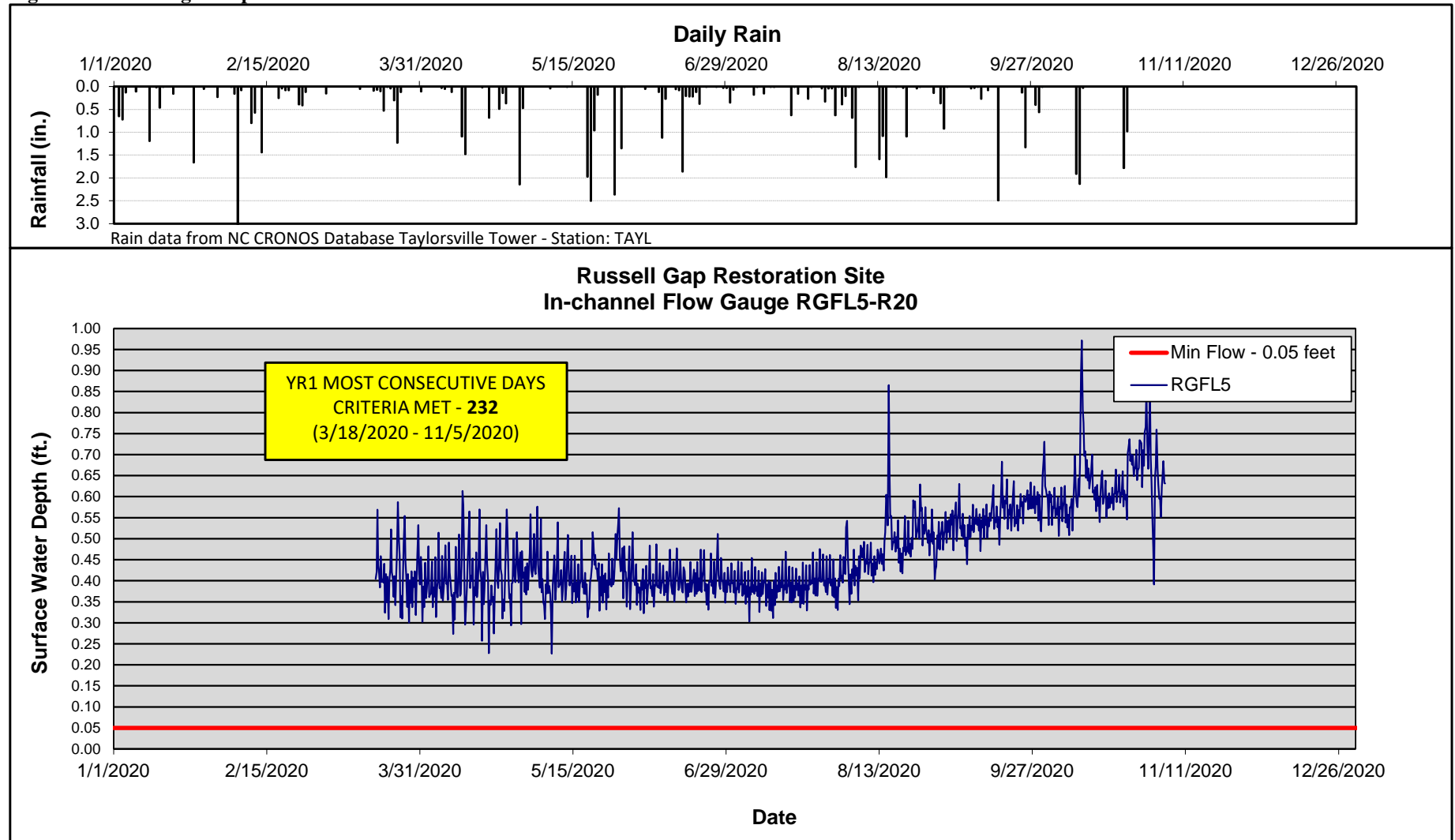
\* Surface water flow is estimated to have occurred when the pressure transducer reading is equal to or above 0.05 feet in depth.

Figure 6. Flow Gauge Graphs



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Figure 6. Flow Gauge Graphs



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**Table 12. All Years Flow Gauge Success**  
**Russell Gap Stream Restoration Project: DMS Project ID No. 100003**

Flow Gauge ID	Most Consecutive Days Meeting Criteria <sup>1</sup>							Cumulative Days Meeting Criteria <sup>2</sup>						
	Year 1 (2020)	Year 2 (2021)	Year 3 (2022)	Year 4 (2023)	Year 5 (2024)	Year 6 (2025)	Year 7 (2026)	Year 1 (2020)	Year 2 (2021)	Year 3 (2022)	Year 4 (2023)	Year 5 (2024)	Year 6 (2025)	Year 7 (2026)
<b>Flow Gauges (Installed March, 2020)</b>														
RGFL1	64.0							209.0						
RGFL2	202.0							222.0						
RGFL3	232.0							232.0						
RGFL4	232.0							232.0						
RGFL5	232.0							232.0						

Notes:

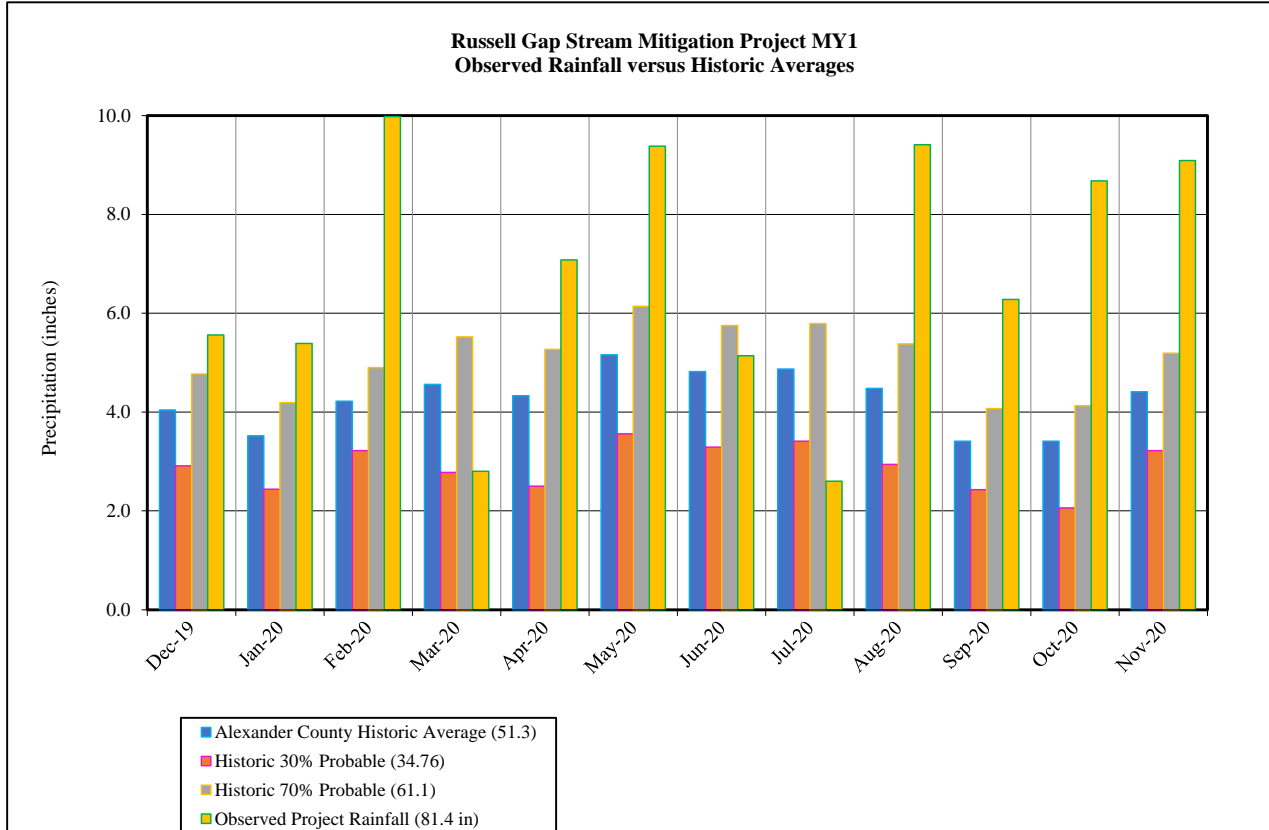
<sup>1</sup>Indicates the number of consecutive days within the monitoring year where flow was measured.

<sup>2</sup>Indicates the number of cumulative days within the monitoring year where flow was measured.

Success criteria will include 30 days of consecutive baseflow for monitoring gauges during a normal rainfall year.

Surface water flow is estimated to have occurred when the pressure transducer reading is equal to or above 0.05 feet in depth.

**Figure 7. Observed Rainfall Versus Historic Averages**



Note: Historic average annual rainfall for Alexander County, NC is 51.3 inches, while the observed project rainfall recorded a total of 81.4 inches over the previous 12 months (Dec. 2019 - Nov. 2020). Project rainfall data was collected from the NC-CRONOS station TAYL.