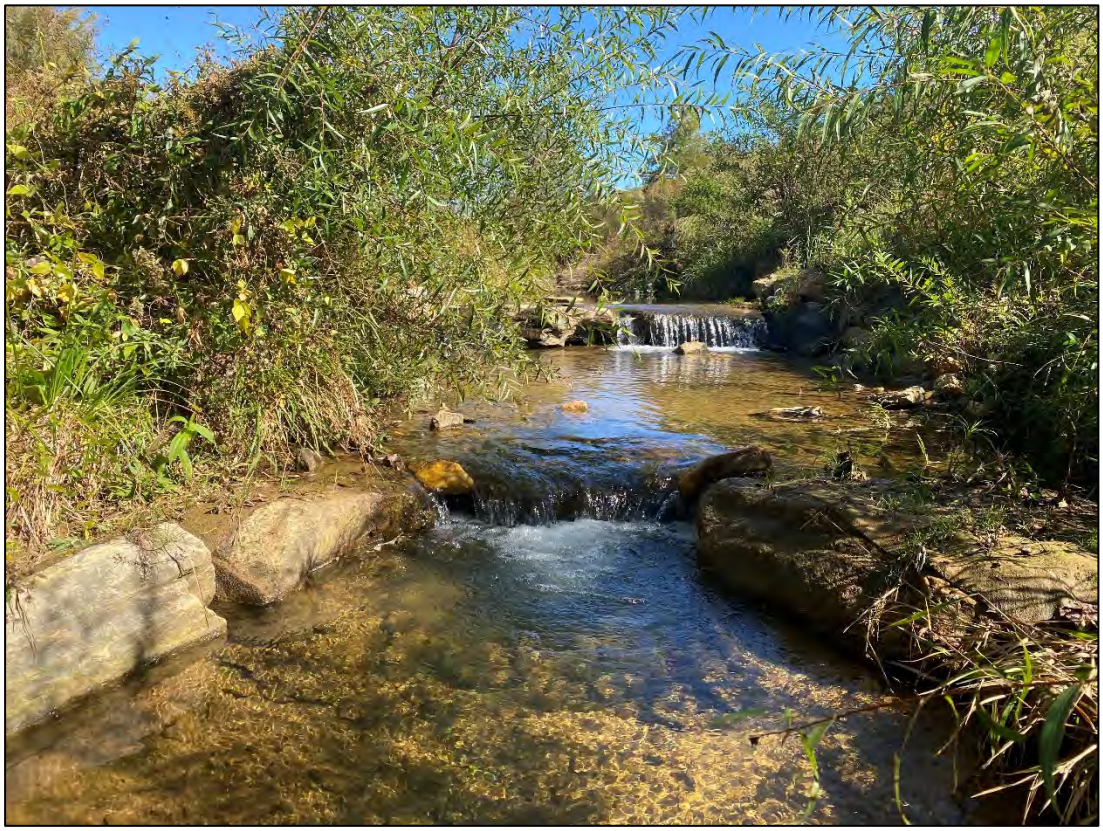
Russell Gap Stream Mitigation Project
Year 2 (2021) Monitoring Report FINAL

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

MY2 Data Collection Period: January – October 2021



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 2021

This document was printed using 30% recycled paper.

Michael Baker
INTERNATIONAL

Michael Baker Engineering, Inc.
797 Haywood Rd. Suite 201 | Asheville, North Carolina 28806
Office: 828.412.6101

January 7, 2022

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

Subject: Response to DMS Comments for DRAFT MY2 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 17, 2021 in reference to the Russell Gap Mitigation Project - DRAFT MY2 Report. We have revised the draft document in response to the review comments as outlined below.

Report Comments/Questions:

- Please include IRT meeting minutes from the June 23, 2021 site visit in the appendix.
  Response: IRT meeting minutes have been included in Appendix F.

- Please include encroachment discussed in section 1.4 Monitoring Results on CCPV.
  Response: The encroachment area has been added to the CCPV as a shapefile.

- Section 1.4 states 64.4 inches of rainfall was observed for the project and the annual historic average is 56.1 inches. Figure 7 note states historic average annual rainfall is 52.51 inches while the observed project rainfall was 55.76 inches. Please review and revise as necessary.
  Response: These data have been reviewed and corrections made to Figure 7.

- There is a discrepancy between growing season days listed in Section 1.4 and the note onTable 11 (227 vs 226). Please review and revise.
  Response: This discrepancy has been corrected on Table 11.

- Table 2: Add the following to the table:
  - "Maintenance – repairs, live staking, bridge replacement – Nov 2020"
  - "Invasive Treatment – Jun/Oct 2021"

  Response: These items have been added to Table 2.

- Table 2: Please add two lines directly under the Year 2 Monitoring line. The listed activity for one line should be Vegetation Monitoring, and the second line should be Stream Survey.Under the data collection column please include the date that each of these activities was completed. Please include this information in future monitoring reports.
  Response: Lines have been added as requested.

Michael Baker
INTERNATIONAL

Michael Baker Engineering, Inc.
797 Haywood Rd. Suite 201 | Asheville, North Carolina 28806
Office: 828.412.6101

- CCPV: Include all areas that were repaired and replanted on CCPV.
  Response: Repair areas have been added to the CCPV.

- Table 5 and 6: Please add dates to the tables to indicate when the field assessment was completed for the Stream Stability Assessment and Vegetation Assessment. The IRT has requested this information be included on these tables.
  Response: Dates have been added to Tables 5 and 6 as requested.

- Table 5: R10b section is missing the assessed LF length amount.
  Response: The assessed LF length amount has been added for R10b to Table 5.

- Table 6: Please include easement encroachment discussed on R26. Once this encroachment has been rectified for a monitoring year, it can be removed.
  Response: This easement encroachment is discussed in Section 1.4 Monitoring Results and Project Performance and is included on the CCPV.

- Table 10: Table currently shows the MY2 data under MY1 2020. Please update table to separate MY1 and MY2 data.
  Response: The table has been updated as requested.

- Please ensure the Monitoring Phase Performance Bond has been updated and approved by Kristie Corson before invoicing for Task 8.
  Response: The monitoring Phase Performance Bond has been updated and approved.

IRT Meeting Minute Action Items:

- The IRT recommended relocating the flow gauge on R11 to the upper 1/3 of the reach. According to the CCPV, this does not appear to have occurred. Does Baker intend to move the flow gauge?
  Response: The flow gauge on R11 was installed in its location due to steep topography at the top of the reach. The stream bed has a lesser grade where it is currently installed which was thought to be more effective in capturing flow. In addition to the flow gauge, a programmed camera was installed at the bottom of R11 at the end of MY2 to capture photographic evidence of flow in the channel during MY3.

- The outer bend upstream of the R11 and R1 confluence had erosion and there were concerns of future alignment problems. Baker indicated that live staking and manual repairs would occur and be discussed in the MY2 report. Please update report with discussion on this issue. If erosion is still present, please update CCPV and Table 5.
  Response: Live stakes were installed on the right bank of R1 at SPA-1 (shown on CCPV) at the end of the 2021 growing season. Matting that had been displaced during flooding was repaired and re-staked. Live vegetation that had fallen into R11 was cut back to allow for flow in the design channel as to not undermine the right bank of R1 at SPA-1.

Michael Baker
INTERNATIONAL

Michael Baker Engineering, Inc.
797 Haywood Rd. Suite 201 | Asheville, North Carolina 28806
Office: 828.412.6101

Table 5 shows SPA-1 on R1 as requested and the report has been updated.

- IRT expressed concern with potential livestock access to the tops of R17 and R18. Baker was going to discuss options with the landowner. Please provide an update to these two areas.
  Response: The landowner is not interested in pursuing any further action beyond the original scope of the project. The area in question is outside of the existing and agreed upon project Conservation Easement. All fencing surrounding the original CE line on R17 and R18 is fully intact and functioning as intended.

- Areas of bank erosion were noticed at the bottom of R4a. Manual repairs and live staking were to occur and updates included in MY2 report. Please update report with discussion on this section. If erosion is still present, please update CCPV and Table 5.
  Response: This area, SPA-2, was monitored for continuing erosion during MY2. Monitoring will continue during MY3. Maintenance and live staking will be implemented as needed. Table 5 shows SPA-2 on R4a as requested and the area is included on the CCPV and discussed in Section 1.4 Monitoring Results and Project Performance.

Electronic Deliverables:

- Please submit the features representing random veg plots as polygons rather than points.
  Response: Random veg plots for MY2 have been changed to polygons on the CCPV and shapefiles have been included with the electronic deliverables.

- Please include features representing the scoured eroding area along R1 and R4a and displaythese segments in the CCPV.
  Response: These areas are shown as "Stream Problem Areas" on the CCPV and the shapefile has been included with the electronic deliverables.

- The reported cross section data cannot consistently be used to replicate BHR calculations. For example, cross section 17 has a reported LTOB elevation that exceeds the maximum elevation for that plot. As another example, cross section 23 reports a bankfull elevation that achieves the as-built bankfull area (BKF-ab) and a LTOB elevation that would produce aBHR other than what is reported. Also, the BKF-ab for cross section 23 may have been calculated before excluding points outside of the main channel but below the Low Bank Height elevation. Failing to exclude those points would include those regions in the cross sectional area and influence BKF-ab. Please ensure that the cross section data are reported such that these calculations can be replicated and resubmit the excel workbook.
  Response: Data has been reviewed and corrected as necessary to ensure that BHR calculations can be consistently replicated and the excel workbook has be re-submitted as requested.

- Please include the data used to create the flow gauge and monitoring well figures. The raw data folder was empty.
  Response: The raw data has been included in the folder as requested.

Michael Baker
INTERNATIONAL

Michael Baker Engineering, Inc.
797 Haywood Rd. Suite 201 | Asheville, North Carolina 28806
Office: 828.412.6101

As requested, Michael Baker has provided a written response letter addressing the DMS comments and two (2) hardcopies 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 MY2 Report Russell Gap Mitigation Project

TABLE OF CONTENTS

APPENDICES

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 2 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. Stream Problem Area 1 (SPA1) was identified on R1 from approximately station 22+50 to 23+00 on the outer bend of the right bank where scour and erosion occurred in November 2020. This SPA makes up 1% of R1 and was planted with live stakes to stabilize the bank during MY2. SPA2 is located on the left bank at the bottom of R4a and is approximately 30 feet of scoured bank making up 5% of R4a. All other reaches were stable and performing as designed and are rated at 100 percent for all the parameters evaluated (Table 5 in Appendix B).

During Year 2 monitoring, the planted acreage performance categories were functioning well overall. The average density of total planted stems based on data collected from the 20 permanent and 9 random monitoring plots for the Year 2 monitoring conducted in October 2021 was 614 stems per acre (Table 7 in Appendix C). Thus, the Year 2 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. Scattered stems of privet (*Ligustrum spp.)* and multiflora rose *(Rosa multiflora)* located throughout the site were treated with herbicide in June and October 2021 and follow up treatment is anticipated to occur in future monitoring years.

A culverted crossing on Reach 1 was damaged during a high flow event in November 2020 following the completion of monitoring during MY1. The culvert was replaced with a railcar bridge in May 2021. During MY2 the bridge is stable. IRT and DMS staff agreed that the bridge repair was functioning as intended during the June 2021 site visit. Storms during November 2020 also caused boulders in a structure at the confluence of Reach 15 and Reach 4 to become dislodged which created a small area of bank erosion immediately downstream on the left bank. The structure and bank were repaired during MY2 and is stable and functioning. A sink hole that formed on the right floodplain of Reach 11 was also filled during MY2. A Stream Problem Area (SPA1) was identified on the right bank of R1, upstream of the confluence with R11. Approximately 50ft of the bank were scoured and eroding. Repairs to matting and live stake planting was completed in October 2021. Approximately 100ft of R11 upstream from the confluence of R1 was cleared of hanging bank vegetation to expose the intact stream bed to allow flow to follow the design channel. Vegetation on the right bank of R11 was then pinned back with landscape fabric to expose the streambed. An automated camera was installed near the confluence of R11 and R1 to capture photos of flow on the lower portion of R11. SPA2 on the left bank of R4a was identified as an area of bank scour and was monitored during MY2. Monitoring will continue during MY3 and maintenance and live staking will be implemented as necessary. During installation of easement boundary posts and signs an encroachment of approximately 577 square feet of mowing was noted on the right floodplain at the bottom of R26. This area is shown on CCPV Figure 3B. The boundary is now clearly marked and will be monitored for future encroachments. This area will be re-planted during MY3.

During Year 2 monitoring three separate post-construction bankfull events were observed (see Table 10 in Appendix E and the Overbank Photographs in Appendix B). They were documented using manual cork crest gauge readings and post-flood event site inspection photographs. Rain data and groundwater well inundation is also considered to determine the approximate date of bankfull events. Crest gauges located on R6 and R9 did not record an overbank event during MY2.

Figure 6 in Appendix E demonstrates that rainfall in the past 12 months has decreased since its peak in November 2020. Rainfall since April 2021 has been lower than the historic averages five of seven months during the growing season. A total of 64.4 inches of rainfall was observed for the project which is greater than the annual historic average of 56.1 inches; however, 19.9 inches of rainfall were recorded in October and November 2020. All observed project rainfall was collected from the North Carolina Climate Office Weather Climate Database CRONOS station TAYL, located in Taylorsville, NC.

During Year 2 monitoring, eleven of twelve automated groundwater monitoring wells met or exceeded the minimum hydroperiod performance criteria approved in the Mitigation Plan of 12% of the 227-day growing season (27 or more consecutive days). Four of five automated flow gauges met or exceeded the minimum 30-day performance criteria during MY2 (See Appendix E, Table 12). Flow gauge 2 on R14 was perched above the streambed during part of monitoring year due to minor localized scour. The gauge was adjusted to sit on the streambed in October 2021 and will be monitored for future scour in MY3.

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 2 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 and an additional camera was installed on R11 to capture pictures of flow. 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

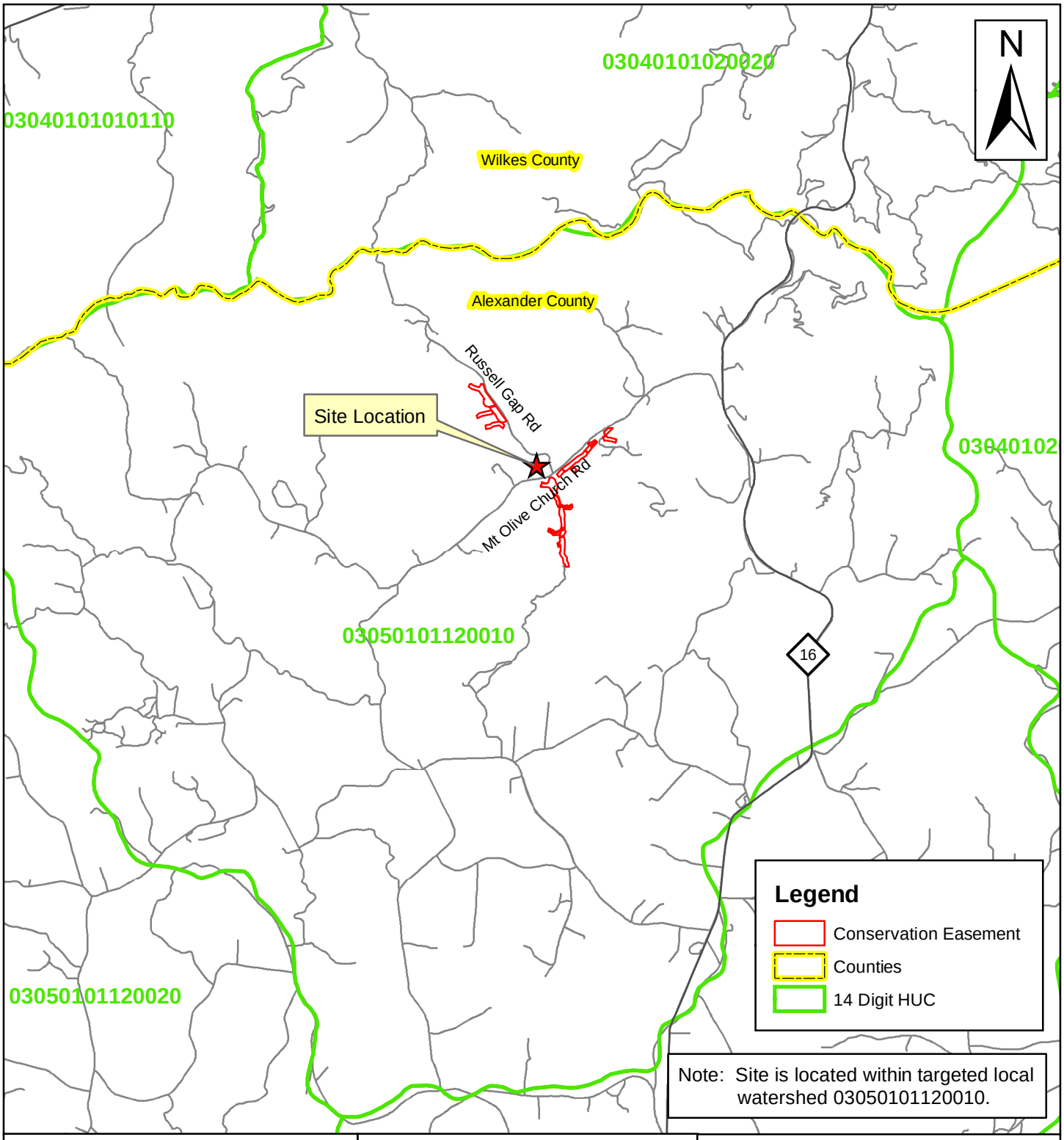
Rosgen, D.L. 1994. A Classification of Natural Rivers. Catena 22:169-199.

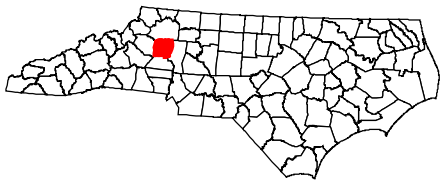
Rosgen, D.L. 1996. Applied River Morphology. Wildlands Hydrology. Pagosa Springs, CO.

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





Alexander County

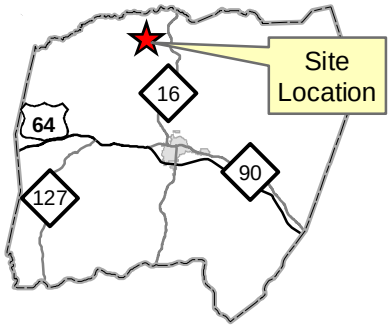


Figure 1
Project Vicinity Map
Russell Gap Project

Michael Baker INTERNATIONAL

0 0.5 1 2 Miles

Restoration Level	Stream (linear feet)	Riparian Wetland (acres)		Non-riparian Wetland (acres)	Credited Buffer (square feet)
		Riverine	Non-Riverine		
Restoration	4,058	6.773			
Enhancement		0.559			
Enhancement I	5,774				
Enhancement II	3,131				
Creation					
Preservation					
High Quality Pres					

Asset Category	Overall Credits
Stream	9,167
RP Wetland	7.053
NR Wetland	
Buffer	

N

R10a/b
R1
Davis Creek
R11
R12
R13
R14
R4a
Russell Gap Rd
R27
R26
R4
R15
R2
R3
R4
R3
R9
Mt Olive Church Rd
East Prong Little Lower River
R8
R22
R25
R7b
R20
R21
R19
R18
R7a
R17
R6
R5

Russell Gap Stream Centerline

Steam Approach

- Restoration
- Enhancement I
- Enhancement II
- No Credit
- Conservation Easement

RussellGap Wetland Boundaries

Wetland Type

- Restoration
- Enhancement

Michael Baker INTERNATIONAL

0 500 1,000 Feet

Figure 2
Project Asset Map
Russell Gap Project

rev: 5Dec2016

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 [1]	As-Built CL w/o Xing Footage, or SF [2]	Mitigation Plan Designed Footage	Restoration Level	Approach Priority Level	Mitigation Ratio (X:1)	Mitigation Plan Credits [3]
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	P1	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	P1	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	P1	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	P1	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 Pres					

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:	**22 months**
Elapsed Time Since planting complete:	**21 months**
Number of Reporting Years[1]:	**2**

Activity or Deliverable	Data Collection Complete	Completion or Delivery
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	Oct-21	Dec-21
Vegetation Monitoring	Oct-21	Dec-21
Stream Survey	Oct-21	Dec-21
Maintenance, Repairs, Live Staking	May and Oct-21	Dec-21
Invasive Treatment	June and Oct-21	Dec-21
Year 3 Monitoring		
Year 4 Monitoring		
Year 5 Monitoring		
Year 6 Monitoring		
Year 7 Monitoring		

[1] = The number of monitoring reports excluding the as-built/baseline report

Table 3. Project Contacts
Russell Gap Stream Mitigation Project - NCDMS Project No. 100003

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

Existing Reach Summary Information				
Parameters	**Reach R1**	**Reach R2**	**Reach R3**	**Reach R4**
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

Existing Reach Summary Information				
Parameters	**Reach R4a**	**Reach R5**	**Reach R6**	**Reach R7a**
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

Existing Reach Summary Information				
Parameters	**Reach R7b**	**Reach R8**	**Reach R9**	**Reach R10(A/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

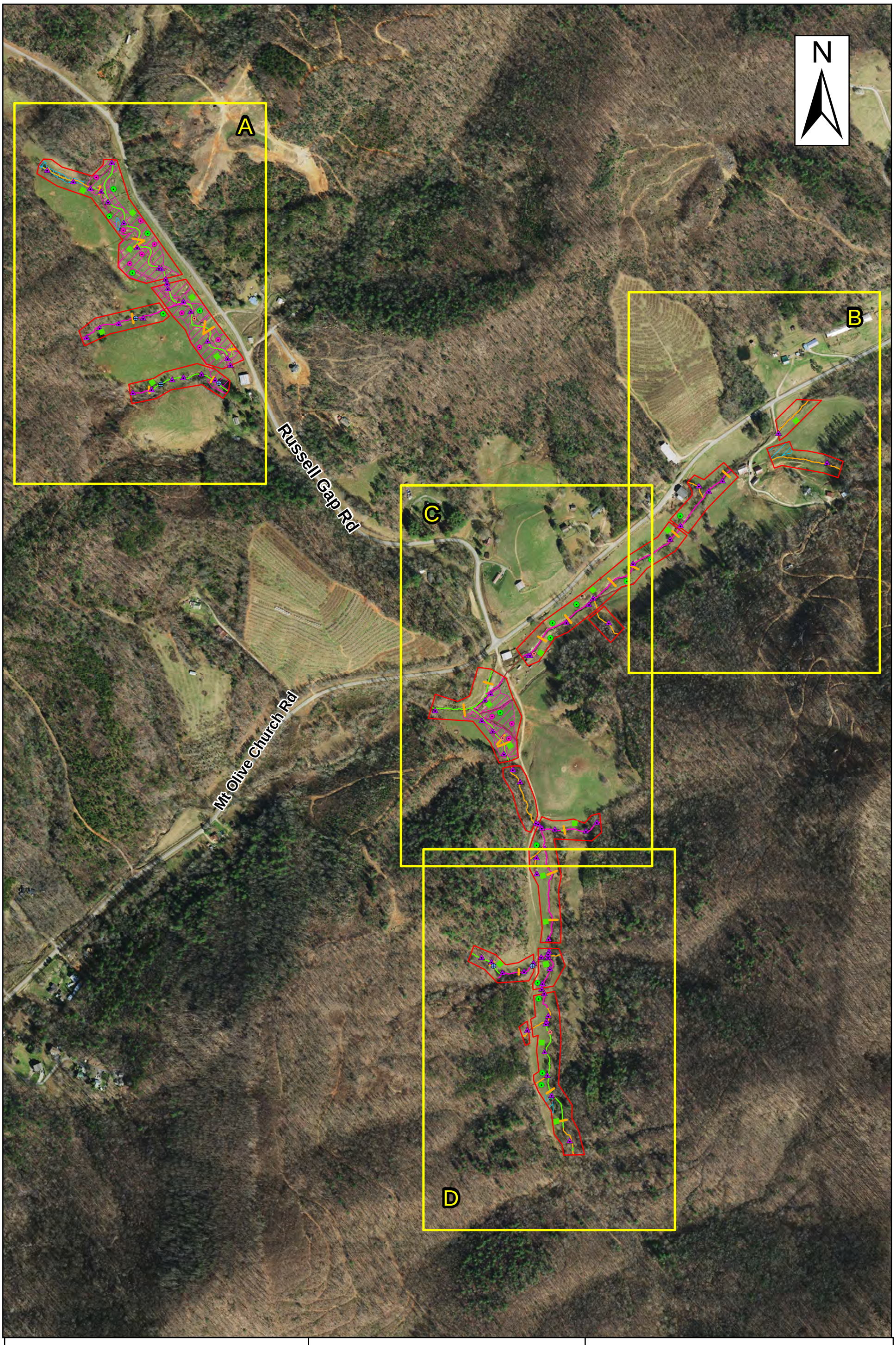
Existing Reach Summary Information				
Parameters	**Reach R20**	**Reach R21**	**Reach R22**	**Reach R22a**
Length of reach (linear feet)	206	67	161	68
Valley confinement (Confined, moderately confined, unconfined)	Confined	Unconfined	Moderately Confined	Moderately Confined
Drainage area (Acres and Square 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

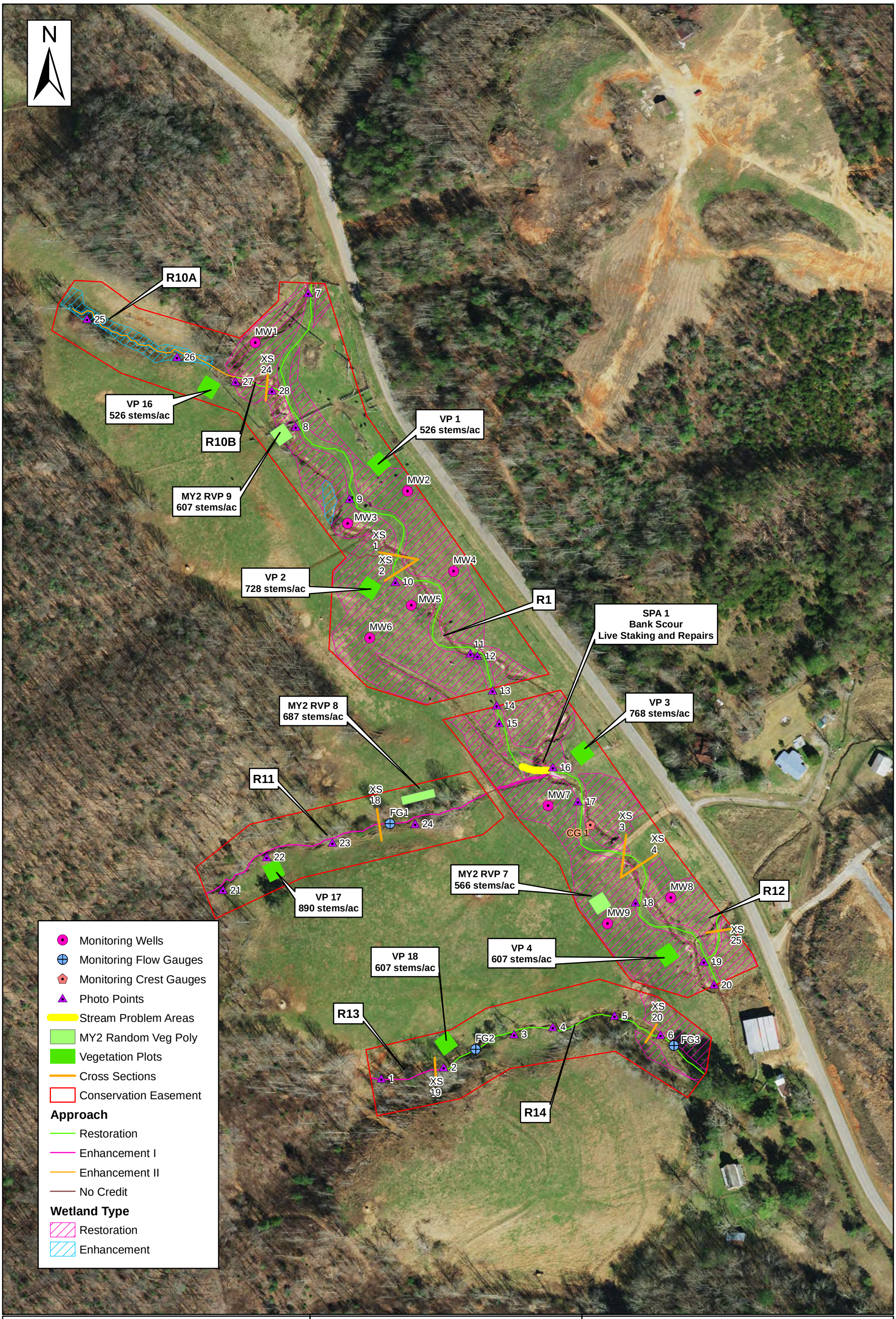
Visual Assessment Data



Michael Baker INTERNATIONAL

0 500 1,000 Feet

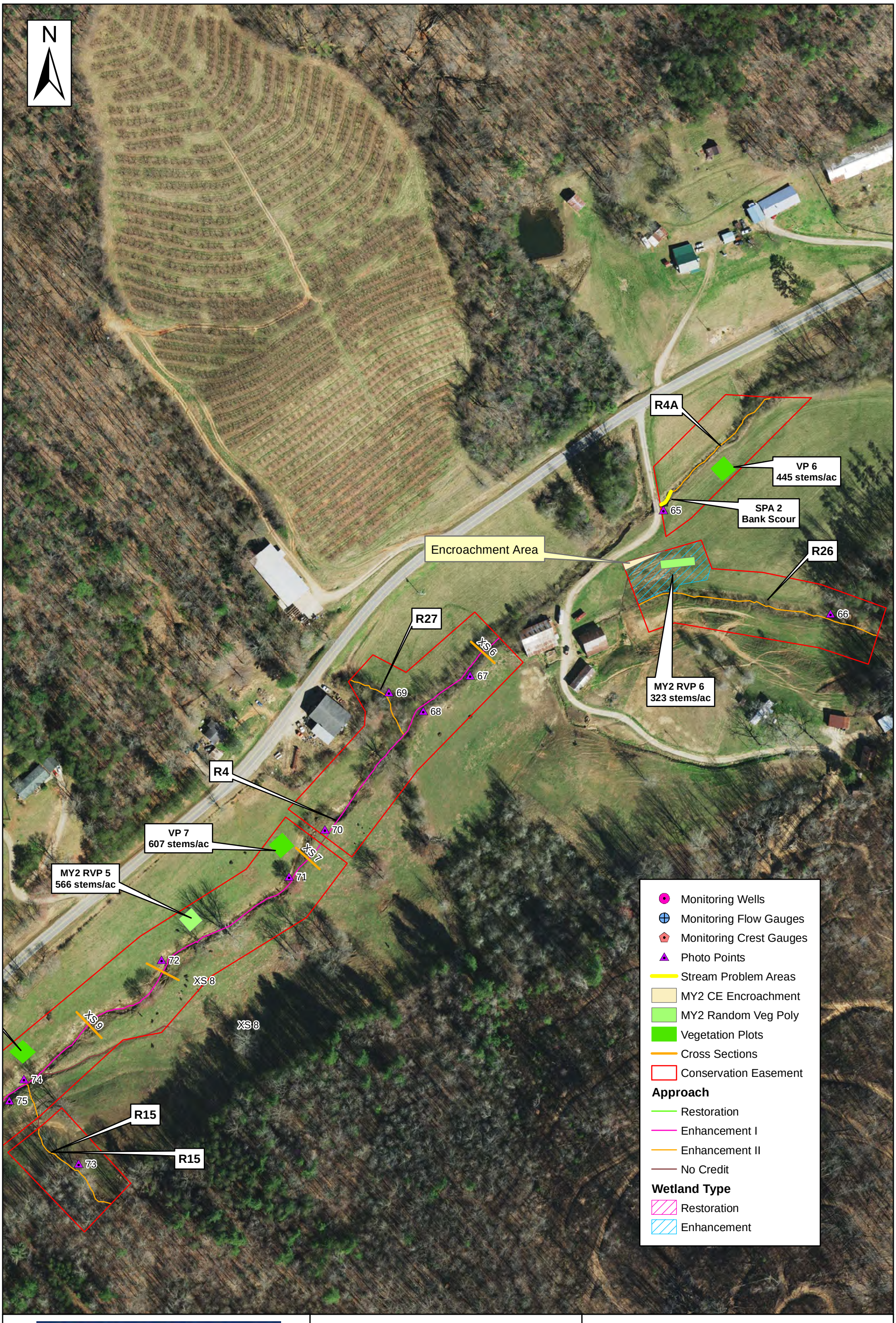
Figure 3 Overview
Current Conditions Plan View
Russell Gap Project



Michael Baker INTERNATIONAL

0 150 300 Feet

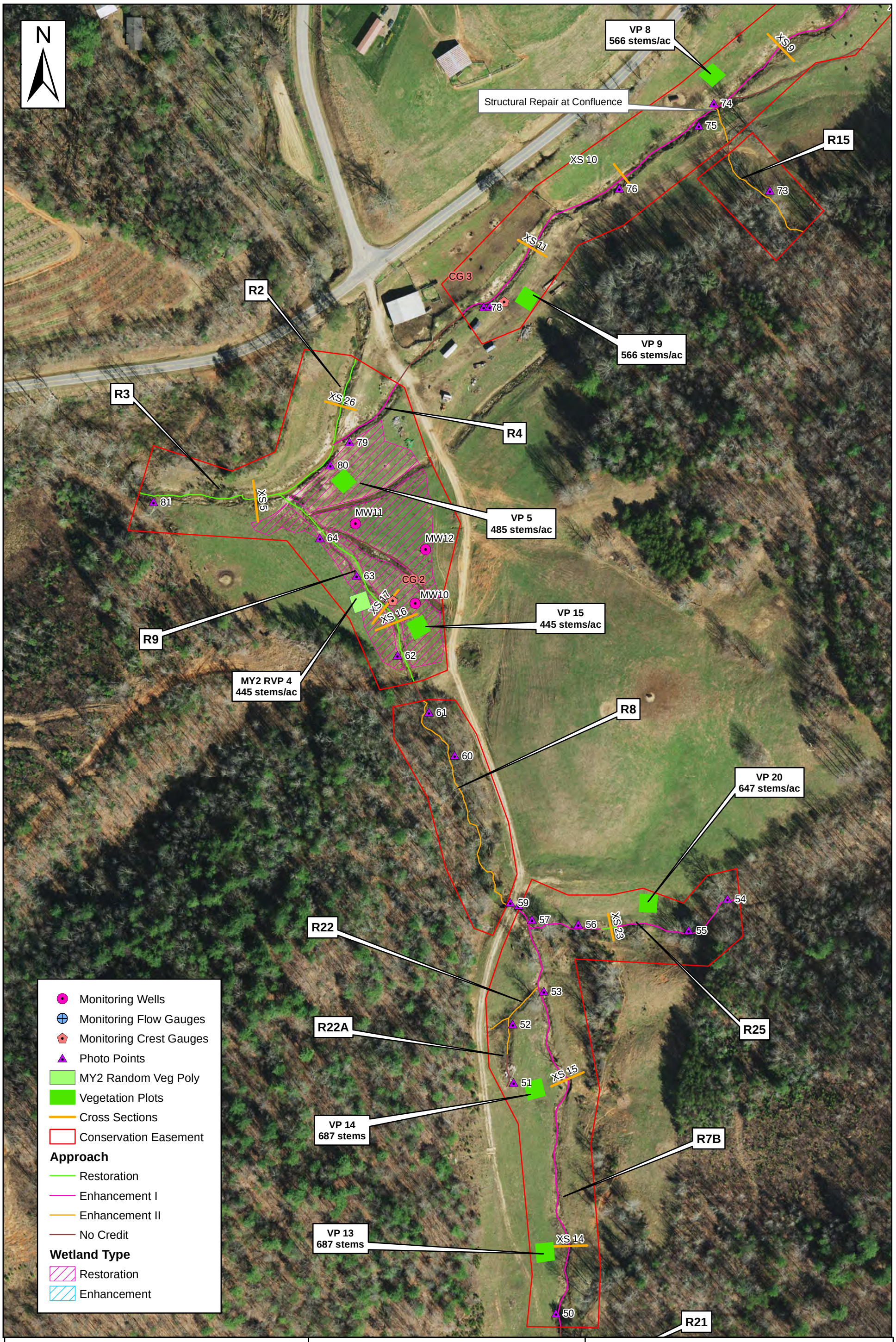
Figure 3A
Current Conditions Plan View
Russell Gap Project



Michael Baker INTERNATIONAL

0 150 300 Feet

Figure 3B
Current Conditions Plan View
Russell Gap Project



Michael Baker INTERNATIONAL

0 150 300 Feet

Figure 3C
Current Conditions Plan View
Russell Gap Project

N

R22

R22A

R25

VP 14
687 stems/ac

R7B

VP 13
687 stems/ac

MY2 RVP3
647 stems/ac

VP 19
647 stems/ac

R21

R20

VP 12
849 stems/ac

R19

R7A

R18

MY2 RVP2
809 stems/ac

VP 11
566 stems/ac

R17

R6

VP 10
566 stems/ac

R5

MY2 RVP1
728 stems/ac

59 57 56 XS 23 55 54 53 52 51 XS 15 50 49 47 46 48 41 42 FG5 XS 22 43 XS 21 44 FG4 45 40 39 38 37 36 34 33 35 CG 4 32 31 XS 13 30 XS 12 29

- Monitoring Wells
- Monitoring Flow Gauges
- Monitoring Crest Gauges
- Photo Points
- MY2 Random Veg Poly
- Vegetation Plots
- Cross Sections
- Conservation Easement

Approach

- Restoration
- Enhancement I
- Enhancement II
- No Credit

Wetland Type

- Restoration
- Enhancement

Michael Baker INTERNATIONAL

0 150 300 Feet

Figure 3D
Current Conditions Plan View
Russell Gap Project

Table 5. Visual Stream Morphology Stability Assessment - Assessed October 2021
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%
	3. Meander Pool Condition	1. Depth - Sufficent (Max Pool Depth/Mean Bkf Depth ≥ 1.5)	19	19			100%
		2. Length - Sufficent (>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	1	50	99%
	2. Undercut	Banks undercut/overhanging to the extent that mass wasting is expected		0	0	0	100%
	3. Mass Wasting	Banks slumping, caving or collapse		0	0	0	100%
				Totals	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 **does not** exceed 15%	27	27			100%
	4. Habitat	Pool forming structures maintaining - Max Pool Depth/Mean Bankfull Depth ratio ≥ 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%
	3. Meander Pool Condition	1. Depth - Sufficent (Max Pool Depth/Mean Bkf Depth ≥ 1.5)	1	1			100%
		2. Length - Sufficent (>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	100%
				Totals	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 **does not** exceed 15%	1	1			100%
	4. Habitat	Pool forming structures maintaining - Max Pool Depth/Mean Bankfull Depth ratio ≥ 1.5. Rootwads/logs providing some cover at low flow	1	1			100%

Table 5. Visual Stream Morphology Stability Assessment - Assessed October 2021
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%
	3. Meander Pool Condition	1. Depth - Sufficent (Max Pool Depth/Mean Bkf Depth ≥ 1.5)	0	0			100%
		2. Length - Sufficent (>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	100%
				Totals	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 **does not** exceed 15%	1	1			100%
	4. Habitat	Pool forming structures maintaining - Max Pool Depth/Mean Bankfull Depth ratio ≥ 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%
	3. Meander Pool Condition	1. Depth - Sufficent (Max Pool Depth/Mean Bkf Depth ≥ 1.5)		0			100%
		2. Length - Sufficent (>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			1	30	95%
	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%
				Totals	1	30	95%
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 **does not** exceed 15%		0			100%
	4. Habitat	Pool forming structures maintaining - Max Pool Depth/Mean Bankfull Depth ratio ≥ 1.5. Rootwads/logs providing some cover at low flow		0			100%

Table 5. Visual Stream Morphology Stability Assessment - Assessed October 2021
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%
	3. Meander Pool Condition	1. Depth - Sufficent (Max Pool Depth/Mean Bkf Depth ≥ 1.5)	15	15			100%
		2. Length - Sufficent (>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	100%
				Totals	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 **does not** exceed 15%	20	20			100%
	4. Habitat	Pool forming structures maintaining - Max Pool Depth/Mean Bankfull Depth ratio ≥ 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%
	3. Meander Pool Condition	1. Depth - Sufficent (Max Pool Depth/Mean Bkf Depth ≥ 1.5)	8	8			100%
		2. Length - Sufficent (>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	100%
				Totals	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 **does not** exceed 15%	1	1			100%
	4. Habitat	Pool forming structures maintaining - Max Pool Depth/Mean Bankfull Depth ratio ≥ 1.5. Rootwads/logs providing some cover at low flow	8	8			100%

Table 5. Visual Stream Morphology Stability Assessment - Assessed October 2021
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%
	3. Meander Pool Condition	1. Depth - Sufficent (Max Pool Depth/Mean Bkf Depth ≥ 1.5)	8	8			100%
		2. Length - Sufficent (>30% of centerline distance between tail of upstream riffle and head of downstream riffle)	8	8			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)	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%
				Totals	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 **does not** exceed 15%	8	8			100%
	4. Habitat	Pool forming structures maintaining - Max Pool Depth/Mean Bankfull Depth ratio ≥ 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%
	3. Meander Pool Condition	1. Depth - Sufficent (Max Pool Depth/Mean Bkf Depth ≥ 1.5)		0			100%
		2. Length - Sufficent (>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	100%
				Totals	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 **does not** exceed 15%		0			100%
	4. Habitat	Pool forming structures maintaining - Max Pool Depth/Mean Bankfull Depth ratio ≥ 1.5. Rootwads/logs providing some cover at low flow		0			100%

Table 5. Visual Stream Morphology Stability Assessment - Assessed October 2021
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%
	3. Meander Pool Condition	1. Depth - Sufficent (Max Pool Depth/Mean Bkf Depth ≥ 1.5)	7	7			100%
		2. Length - Sufficent (>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	100%
				Totals	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 **does not** exceed 15%					100%
	4. Habitat	Pool forming structures maintaining - Max Pool Depth/Mean Bankfull Depth ratio ≥ 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%
	3. Meander Pool Condition	1. Depth - Sufficent (Max Pool Depth/Mean Bkf Depth ≥ 1.5)		0			100%
		2. Length - Sufficent (>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	100%
				Totals	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 **does not** exceed 15%		0			100%
	4. Habitat	Pool forming structures maintaining - Max Pool Depth/Mean Bankfull Depth ratio ≥ 1.5. Rootwads/logs providing some cover at low flow		0			100%

Table 5. Visual Stream Morphology Stability Assessment - Assessed October 2021
Russell Gap Stream Mitigation Project - NCDMS Project No. 100003

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%
	3. Meander Pool Condition	1. Depth - Sufficent (Max Pool Depth/Mean Bkf Depth ≥ 1.5)	6	6			100%
		2. Length - Sufficent (>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	100%
				Totals	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 **does not** exceed 15%	6	6			100%
	4. Habitat	Pool forming structures maintaining - Max Pool Depth/Mean Bankfull Depth ratio ≥ 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%
	3. Meander Pool Condition	1. Depth - Sufficent (Max Pool Depth/Mean Bkf Depth ≥ 1.5)	0	0			100%
		2. Length - Sufficent (>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	100%
				Totals	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 **does not** exceed 15%	1	1			100%
	4. Habitat	Pool forming structures maintaining - Max Pool Depth/Mean Bankfull Depth ratio ≥ 1.5. Rootwads/logs providing some cover at low flow	0	0			100%

Table 5. Visual Stream Morphology Stability Assessment - Assessed October 2021
Russell Gap Stream Mitigation Project - NCDMS Project No. 100003

Reach ID: Reach R10b							
Assessed Length (LF):	**105**						
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%
	3. Meander Pool Condition	1. Depth - Sufficent (Max Pool Depth/Mean Bkf Depth ≥ 1.5)	0	0			100%
		2. Length - Sufficent (>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	100%
				Totals	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 **does not** exceed 15%	2	2			100%
	4. Habitat	Pool forming structures maintaining - Max Pool Depth/Mean Bankfull Depth ratio ≥ 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%
	3. Meander Pool Condition	1. Depth - Sufficent (Max Pool Depth/Mean Bkf Depth ≥ 1.5)	0	0			100%
		2. Length - Sufficent (>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	100%
				Totals	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 **does not** exceed 15%	38	38			100%
	4. Habitat	Pool forming structures maintaining - Max Pool Depth/Mean Bankfull Depth ratio ≥ 1.5. Rootwads/logs providing some cover at low flow	0	0			100%

Table 5. Visual Stream Morphology Stability Assessment - Assessed October 2021
Russell Gap Stream Mitigation Project - NCDMS Project No. 100003

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%
	3. Meander Pool Condition	1. Depth - Sufficent (Max Pool Depth/Mean Bkf Depth ≥ 1.5)	1	1			100%
		2. Length - Sufficent (>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	100%
				Totals	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 **does not** exceed 15%	3	3			100%
	4. Habitat	Pool forming structures maintaining - Max Pool Depth/Mean Bankfull Depth ratio ≥ 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%
	3. Meander Pool Condition	1. Depth - Sufficent (Max Pool Depth/Mean Bkf Depth ≥ 1.5)	0	0			100%
		2. Length - Sufficent (>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	100%
				Totals	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 **does not** exceed 15%	9	9			100%
	4. Habitat	Pool forming structures maintaining - Max Pool Depth/Mean Bankfull Depth ratio ≥ 1.5. Rootwads/logs providing some cover at low flow	0	0			100%

Table 5. Visual Stream Morphology Stability Assessment - Assessed October 2021
Russell Gap Stream Mitigation Project - NCDMS Project No. 100003

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%
	3. Meander Pool Condition	1. Depth - Sufficent (Max Pool Depth/Mean Bkf Depth ≥ 1.5)	0	0			100%
		2. Length - Sufficent (>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	100%
				Totals	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 **does not** exceed 15%	26	26			100%
	4. Habitat	Pool forming structures maintaining - Max Pool Depth/Mean Bankfull Depth ratio ≥ 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%
	3. Meander Pool Condition	1. Depth - Sufficent (Max Pool Depth/Mean Bkf Depth ≥ 1.5)	0	0			100%
		2. Length - Sufficent (>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	100%
				Totals	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 **does not** exceed 15%	0	0			100%
	4. Habitat	Pool forming structures maintaining - Max Pool Depth/Mean Bankfull Depth ratio ≥ 1.5. Rootwads/logs providing some cover at low flow	0	0			100%

Table 5. Visual Stream Morphology Stability Assessment - Assessed October 2021
Russell Gap Stream Mitigation Project - NCDMS Project No. 100003

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			100%
	3. Meander Pool Condition	1. Depth - Sufficent (Max Pool Depth/Mean Bkf Depth ≥ 1.5)		0			100%
		2. Length - Sufficent (>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	100%
				Totals	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 **does not** exceed 15%		0			100%
	4. Habitat	Pool forming structures maintaining - Max Pool Depth/Mean Bankfull Depth ratio ≥ 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%
	3. Meander Pool Condition	1. Depth - Sufficent (Max Pool Depth/Mean Bkf Depth ≥ 1.5)	0	0			100%
		2. Length - Sufficent (>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	100%
				Totals	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 **does not** exceed 15%	2	2			100%
	4. Habitat	Pool forming structures maintaining - Max Pool Depth/Mean Bankfull Depth ratio ≥ 1.5. Rootwads/logs providing some cover at low flow	0	0			100%

Table 5. Visual Stream Morphology Stability Assessment - Assessed October 2021
Russell Gap Stream Mitigation Project - NCDMS Project No. 100003

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%
	3. Meander Pool Condition	1. Depth - Sufficent (Max Pool Depth/Mean Bkf Depth ≥ 1.5)	0	0			100%
		2. Length - Sufficent (>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	100%
				Totals	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 **does not** exceed 15%	26	26			100%
	4. Habitat	Pool forming structures maintaining - Max Pool Depth/Mean Bankfull Depth ratio ≥ 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%
	3. Meander Pool Condition	1. Depth - Sufficent (Max Pool Depth/Mean Bkf Depth ≥ 1.5)	0	0			100%
		2. Length - Sufficent (>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	100%
				Totals	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 **does not** exceed 15%	36	36			100%
	4. Habitat	Pool forming structures maintaining - Max Pool Depth/Mean Bankfull Depth ratio ≥ 1.5. Rootwads/logs providing some cover at low flow	0	0			100%

Table 5. Visual Stream Morphology Stability Assessment - Assessed October 2021
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%
	3. Meander Pool Condition	1. Depth - Sufficent (Max Pool Depth/Mean Bkf Depth ≥ 1.5)		0			100%
		2. Length - Sufficent (>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	100%
				Totals	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 **does not** exceed 15%		0			100%
	4. Habitat	Pool forming structures maintaining - Max Pool Depth/Mean Bankfull Depth ratio ≥ 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%
	3. Meander Pool Condition	1. Depth - Sufficent (Max Pool Depth/Mean Bkf Depth ≥ 1.5)		0			100%
		2. Length - Sufficent (>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	100%
				Totals	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 **does not** exceed 15%		0			100%
	4. Habitat	Pool forming structures maintaining - Max Pool Depth/Mean Bankfull Depth ratio ≥ 1.5. Rootwads/logs providing some cover at low flow		0			100%

Table 5. Visual Stream Morphology Stability Assessment - Assessed October 2021
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%
	3. Meander Pool Condition	1. Depth - Sufficent (Max Pool Depth/Mean Bkf Depth ≥ 1.5)	0	0			100%
		2. Length - Sufficent (>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	100%
				Totals	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 **does not** exceed 15%	13	13			100%
	4. Habitat	Pool forming structures maintaining - Max Pool Depth/Mean Bankfull Depth ratio ≥ 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%
	3. Meander Pool Condition	1. Depth - Sufficent (Max Pool Depth/Mean Bkf Depth ≥ 1.5)	0	0			100%
		2. Length - Sufficent (>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	100%
				Totals	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 **does not** exceed 15%	4	4			100%
	4. Habitat	Pool forming structures maintaining - Max Pool Depth/Mean Bankfull Depth ratio ≥ 1.5. Rootwads/logs providing some cover at low flow	0	0			100%

Table 5. Visual Stream Morphology Stability Assessment - Assessed October 2021
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%
	3. Meander Pool Condition	1. Depth - Sufficent (Max Pool Depth/Mean Bkf Depth ≥ 1.5)	0	0			100%
		2. Length - Sufficent (>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	100%
				Totals	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	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 **does not** exceed 15%	7	7			100%
	4. Habitat	Pool forming structures maintaining - Max Pool Depth/Mean Bankfull Depth ratio ≥ 1.5. Rootwads/logs providing some cover at low flow	0	0			100%

Table 6. Vegetation Conditions Assessment - Assessed October 2021

Russell Gap Stream Mitigation Project - NCDMS Project No. 100003

Planted Acreage: 9.8						
Vegetation Category	**Defintions**	**Mapping Threshold (acres)**	**CCPV Depiction**	**Number of Polygons**	**Combined Acreage**	**% of Planted Acreage**
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%
			Total			
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%
			Cumulative Total			
Easement Acreage: 15.8						
Vegetation Category	**Defintions**	**Mapping Threshold**	**CCPV Depiction**	**Number of Points**	**Combined Acreage**	**% of Planted Acreage**
4. Invasive Areas of Concern	Areas or points (if too small to render as polygons at map scale)	1000 ft²	N/A	0	0.00	0.0%
5. Easement Encroachment Areas	Areas or points (if too small to render as polygons at map scale)	577 ft²	Polygon	0	0.01	0.1%

Russell Gap: MY2 Stream Station Photo-Points

PP-1: Reach 13, view upstream Station 10+20.
(April 15, 2021)

PP-2: Reach 14, view upstream toward Reach 13 at Station 11+45. (April 15, 2021)

PP-3: Reach 14, view upstream Station 13+00.
(April 15, 2021)

PP-4: Reach 14, view upstream Station 13+75.
(April 15, 2021)

PP-5: Reach 14, view upstream Station 15+00.
(April 15, 2021)

PP-6: Reach 14, end of reach Station 16+00.
(April 15, 2021)

Russell Gap: MY2 Stream Station Photo-Points

PP-7: Reach 1, view upstream, at Station 10+20.
(April 15, 2021)

PP-8: Reach 1, view upstream Reach 1 at Station 13+00.
(April 15, 2021)

PP-9: Reach 1, view upstream at Station 15+00.
(April 15, 2021)

PP-10: Reach 1, view upstream at Station 17+25.
(April 15, 2021)

PP-11: Reach 1, view upstream at Station 20+00.
(April 15, 2021)

PP-12: Reach 1, view downstream at Station 20+00.
(April 15, 2021)

Russell Gap: MY2 Stream Station Photo-Points

PP-13: Reach 1, view upstream at Station 20+75. (April 15, 2021)

PP-14: Reach 1, view downstream at Station 20+75. (April 15, 2021)

PP-15: Reach 1, view upstream at Station 21+50. (April 15, 2021)

PP-16: Reach 1, confluence of Reach 1 and Reach 11 at Station 22+75. (April 15, 2021)

PP-17: Reach 1, view upstream at Station 24+20. (April 15, 2021)

PP-18: Reach 1, view of upstream at Station 27+00. (April 15, 2021)

Russell Gap: MY2 Stream Station Photo-Points

PP-19: Reach 1, view upstream Reach 12 at Station 29+10.
(April 15, 2021)

PP-20: Reach 1, view upstream at Station 29+20.
(April 15, 2021)

PP-21: Reach 11, view upstream at Station 10+20.
(April 15, 2021)

PP-22: Reach 11, view upstream at Station 11+50.
(April 15, 2021)

PP-23: Reach 11, view upstream at Station 12+75.
(April 15, 2021)

PP-24: Reach 11, view upstream at Station 14+50.
(April 15, 2021)

Russell Gap: MY2 Stream Station Photo-Points

PP-25: Reach 10A, view upstream at Station 10+50.
(April 15, 2021)

PP-26: Reach 10A, view upstream at Station 12+50.
(April 15, 2021)

PP-27: Reach 10A, view upstream at Station 13+75.
(April 15, 2021)

PP-28: Reach 10B, view upstream at Station 14+50.
(April 15, 2021)

PP-29: Reach 5, view upstream at Station 11+00.
(April 15, 2021)

PP-30: Reach 6, view upstream at Station 14+50.
(April 15, 2021)

Russell Gap: MY2 Stream Station Photo-Points

PP-31: Reach 17, view upstream at Station 11+00.
(April 15, 2021)

PP-32: Reach 6, view upstream at Station 17+50.
(April 15, 2021)

PP-33: Reach 6, view upstream at Station 19+50.
(April 15, 2021)

PP-34: Reach 18, view upstream at Station 12+00.
(April 15, 2021)

PP-35: Reach 18, view upstream at Station 10+60.
(April 15, 2021)

PP-36: Reach 7A, view upstream at Station 20+00.
(April 15, 2021)

Russell Gap: MY2 Stream Station Photo-Points

PP-37: Reach 7B, view upstream at Station 21+75.
(April 15, 2021)

PP-38: Reach7B, view downstream at Station 22+00.
(April 15, 2021)

PP-39: Reach 7B, view upstream at Station 22+25.
(April 15, 2021)

PP-40: Reach 7B, view upstream at Station 23+50.
(April 15, 2021)

PP-41: Reach 20, view upstream at Station 10+80.
(April 15, 2021)

PP-42: Reach 20, view upstream at Station 11+50.
(April 15, 2021)

Russell Gap: MY2 Stream Station Photo-Points

PP-43: Reach 19, view upstream at Station 10+15.
(April 15, 2021)

PP-44: Reach 19, view upstream at Station 11+85.
(April 15, 2021)

PP-45: Reach 19, view upstream at Station 12+80.
(April 15, 2021)

PP-46: Reach 19, view upstream at Station 13+20.

PP-47: Reach 19, view upstream at Station013+80.
(April 15, 2021)

PP-48: Reach 7B, view upstream at Station 24+10.
(April 15, 2021)

Russell Gap: MY2 Stream Station Photo-Points

PP-49: Reach 7B, view downstream at Station 24+60.
(April 15, 2021)

PP-50: Reach 7B, view upstream at Station 25+25.
(April 15, 2021)

PP-51: Reach 22A, view upstream at Station 10+00.
(April 15, 2021)

PP-52: Reach 22A, view of upstream at Station 11+15.
(April 15, 2021)

PP-53: Reach 7B, view upstream at Station 32+00.
(April 15, 2021)

PP-54: Reach 25, view upstream at Station 10+10.
(April 15, 2021)

Russell Gap: MY2 Stream Station Photo-Points

PP-55: Reach 25, view upstream at Station 11+20.
(April 15, 2021)

PP-56: Reach 25, view upstream at Station 13+40.
(April 15, 2021)

PP-57: Reach 7B, view downstream at Station 33+00.
(April 15, 2021)

PP-58: Reach 7B, view upstream at Station 33+20.
(April 15, 2021)

PP-59: Reach 8, view downstream at Station 34+00.
(April 15, 2021)

PP-60: Reach 8, view upstream at Station 37+00.
(April 15, 2021)

Russell Gap: MY2 Stream Station Photo-Points

PP-61: Reach 8, view upstream at Station 38+00.
(April 15, 2021)

PP-62: Reach 9, view upstream at Station 39+20.
(April 15, 2021)

PP-63: Reach 9, view upstream at Station 41+00.
(April 15, 2021)

PP-64: Reach 9, view upstream at Station 42+00.
(April 15, 2021)

PP-65: Reach 4A, view upstream at Station 13+00.
(April 15, 2021)

PP-66: Reach 26, view upstream at Station 11+00.
(April 15, 2021)

Russell Gap: MY2 Stream Station Photo-Points

PP-67: Reach 4, view upstream at Station 11+10.
(April 15, 2021)

PP-68: Reach 4, view upstream at Station 12+00.
(April 15, 2021)

PP-69: Reach 27, view upstream at Station 11+60.
(April 15, 2021)

PP-70: Reach 4, view upstream at Station 15+00.
(April 15, 2021)

PP-71: Reach 4, view upstream at Station 16+10.
(April 15, 2021)

PP-72: Reach 4, view upstream at Station 19+00.
(April 15, 2021)

Russell Gap: MY2 Stream Station Photo-Points

PP-73: Reach 15, view upstream at Station 11+00.

PP-74: Reach 15, view upstream at Station 13+00.
(April 15, 2021)

PP-75: Reach 4, view upstream at Station 23+20.
(April 15, 2021)

PP-76: Reach 4, view upstream at Station 25+00.
(April 15, 2021)

PP-77: Reach 4, view upstream at Station 28+30.
(April 15, 2021)

PP-78: Reach 4, view upstream at Station 28+00.
(April 15, 2021)

Russell Gap: MY2 Stream Station Photo-Points

PP-79: Reach 4, view upstream at Station 32+00.
(April 15, 2021)

PP-80: Reach 3, view upstream at Station 33+00.
(April 15, 2021)

PP-81: Reach 3, view upstream at Station 36+40.

(April 15, 2021)

MY2 Vegetation Monitoring Plot Photos
Russell Gap – DMS Project #100003

Photo 1. Vegetation Plot 1 – (October 26, 2021).

Photo 2. Vegetation Plot 2 – (October 26, 2021).

Photo 3. Vegetation Plot 3 – (October 26, 2021).

Photo 4. Vegetation Plot 4 – (October 26, 2021).

Photo 5. Vegetation Plot 5- (October 26, 2021).

Photo 6. Vegetation Plot 6- (October 26, 2021).

MY2 Vegetation Monitoring Plot Photos
Russell Gap – DMS Project #100003

Photo 7. Vegetation Plot 7 – (October 26, 2021).

Photo 8. Vegetation Plot 8 – (October 26, 2021).

Photo 9. Vegetation Plot 9 – (October 26, 2021).

Photo 10. Vegetation Plot 10 – (October 26, 2021).

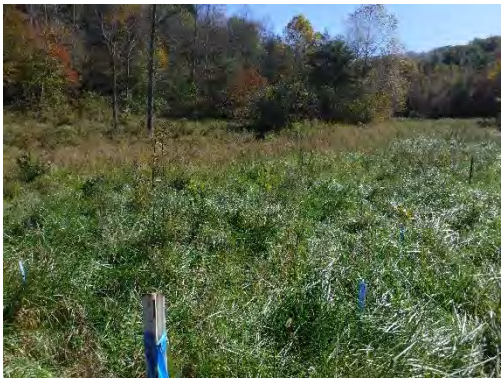


Photo 11. Vegetation Plot 11 – (October 26, 2021).

Photo 12. Vegetation Plot 12 – (October 26, 2021).

MY2 Vegetation Monitoring Plot Photos
Russell Gap – DMS Project #100003

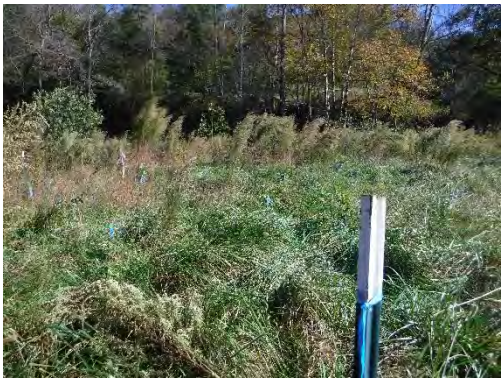


Photo 13. Vegetation Plot 13 – (October 26, 2021).

Photo 14. Vegetation Plot 14 – (October 26, 2021).

Photo 15. Vegetation Plot 15 – (October 26, 2021).

Photo 16. Vegetation Plot 16 – (October 26, 2021).

Photo 17. Vegetation Plot 17 – (October 19, 2021).

Photo 18. Vegetation Plot 18 – (October 19, 2021).

MY2 Vegetation Monitoring Plot Photos
Russell Gap – DMS Project #100003

Photo 19. Vegetation Plot 19 – (October 19, 2021).

Photo 20. Vegetation Plot 20 – (October 26, 2021).

Photo 21. Random Vegetation Plot 1- (July 30, 2021).

Photo 22. Random Vegetation Plot 2 – (July 30, 2021).

Photo 23. Random Vegetation Plot 3 – (July 30, 2021)

Photo 24. Random Vegetation Plot 4 – (October 26, 2021).

MY2 Vegetation Monitoring Plot Photos
Russell Gap – DMS Project #100003

Photo 25. Random Vegetation Plot 5 – (October 26, 2021).

Photo 26. Random Vegetation Plot 6 (Transect) – (October 26, 2021).

Photo 27. Random Vegetation Plot 7 – (October 19, 2021).

Photo 28. Random Vegetation Plot 8 – (October 19, 2021).

Photo 29. Random Vegetation Plot 9 – (October 26, 2021).

Russell Gap MY2 Monitoring Gauges and Overbank Photographs

Monitoring Well 1. (October 19, 2021)

Monitoring Well 2. (October 19, 2021)

Monitoring Well 3. (October 19, 2021)

Monitoring Well 4. (October 19, 2021)

Monitoring Well 5. (October 19, 2021)

Monitoring Well 6. (October 19, 2021)

Russell Gap MY2 Monitoring Gauges and Overbank Photographs

Monitoring Well 7. (October 19, 2021)

Monitoring Well 8. (October 19, 2021)

Monitoring Well 9. (October 19, 2021)

Monitoring Well 10. (October 19, 2021)

Monitoring Well 11. (October 19, 2021)

Monitoring Well 12. (October 19, 2021)

Russell Gap MY2 Monitoring Gauges and Overbank Photographs

Flow Gauge 1. Reach 11. (March 18, 2021)

Flow Gauge 2. Reach 14. (March 18, 2021)

Flow Gauge 3. Reach 13. (March 18, 2021)

Flow Gauge 4. Reach 19. (March 18, 2021)

Flow Gauge 5. Reach 20. (March 18, 2021)

Crest Gauge 1 Reach 1. (October 19, 2021)

Russell Gap MY2 Monitoring Gauges and Overbank Photographs

Crest Gauge 1 R1.

BKF reading 1.1 ft. (October 19, 2021)

Crest Gauge 2 R9. (October 19, 2021)

Crest Gauge 3 R4. BKF reading at 7.5 inches and 20.5 inches (June 14, 2021)

Crest Gauge 3 R4. (October 19, 2021)

Crest Gauge 4 R6. (October 19, 2021)

APPENDIX C

Vegetation Plot Data

Table 7: Planted Stem Counts by Plot and Species
DMS Project Code 100003. Project Name: Russell Gap Mitigation Project

			Current Plot Data (MY2 2021)																									
			157329-01-0001			157329-01-0002			157329-01-0003			157329-01-0004			157329-01-0005			157329-01-0006			157329-01-0007			157329-01-0008			157329-01-0009		
Scientific Name	Common Name	Species Type	P	V	T	P	V	T	P	V	T	P	V	T	P	V	T	P	V	T	P	V	T	P	V	T	P	V	T
Acer negundo		Tree						2												1			5						
Acer rubrum		Tree																					5						
Alnus serrulata	Tag Alder, Smooth Alder, Hazel Alder	Shrub Tree									2	1	1	1			1							4	4	14			1
Asimina triloba	Common Pawpaw, Indian-banana	Shrub Tree										1	1	1															
Betula lenta		Tree										1	1	1															
Betula nigra	River Birch, Red Birch	Tree	5	5	5	3	3	3	9	9	9	2	2	2	1	1	1	4	4	4	1	1	1	1	1	1			
Carpinus caroliniana		Shrub Tree																											
Cercis canadensis		Shrub Tree				1	1	1													2	2	2	5	5	5			
Cornus amomum	Silky Dogwood	Shrub Tree				1	1	1																			4	4	5
Cornus florida	Flowering Dogwood	Shrub Tree																											
Corylus americana	American Hazelnut, American Filbert	Shrub																											
Crataegus	Hawthorn, Haw, Thornapple	Shrub Tree																											
Diospyros virginiana	American Persimmon, Possumwood	Tree																			3	3	3				1	1	1
Fraxinus pennsylvanica	Green Ash, Red Ash	Tree			2				1	1	1																3	3	3
Hamamelis virginiana		Shrub Tree																											
Juglans nigra	Black Walnut	Tree				1	1	1							1	1	1										2	2	2
Liriodendron tulipifera		Tree				4	4	4	3	3	3	5	5	5	3	3	3				3	3	3				1	1	1
Nyssa sylvatica	Sour Gum, Black Gum, Pepperidge	Tree																											
Platanus occidentalis	Sycamore, Plane-tree	Tree	3	3	5	2	2	9				5	5	5	1	1	11	6	6	6	5	5	10						
Quercus alba	White Oak	Tree																											
Quercus falcata	Spanish Oak, Southern Red Oak	Tree							2	2	2																1	1	1
Quercus lyrata	Overcup Oak	Tree																											
Quercus michauxii	Basket Oak, Swamp Chestnut Oak	Tree																									2	2	2
Quercus phellos	Willow Oak	Tree	5	5	5	6	6	6	4	4	4				6	6	6	1	1	1	1	1	1	4	4	4			
Rhus copallinum		Shrub Tree																											
Salix nigra	Black Willow	Tree																											1
		Stem count	13	13	17	18	18	27	19	19	21	15	15	15	12	12	23	11	11	12	15	15	30	14	14	24	14	14	17
		size (ares)	1			1			1			1			1			1			1			1			1		
		size (ACRES)	0.02			0.02			0.02			0.02			0.02			0.02			0.02			0.02			0.02		
		Species count	3	3	4	7	7	8	5	5	6	6	6	6	5	5	6	3	3	4	6	6	8	4	4	4	7	7	9
		Stems per ACRE	526.0913	526.0913	687.9656	728.4342	728.4342	1092.651	768.9027	768.9027	849.8398	607.0285	607.0285	607.0285	485.6228	485.6228	930.777	445.1542	445.1542	485.6228	607.0285	607.0285	1214.057	566.5599	566.5599	971.2455	566.5599	566.5599	687.9656

			Current Plot Data (MY2 2021)																									
			157329-01-0010			157329-01-0011			157329-01-0012			157329-01-0013			157329-01-0014			157329-01-0015			157329-01-0016			157329-01-0017			157329-01-0018		
Scientific Name	Common Name	Species Type	P	V	T	P	V	T	P	V	T	P	V	T	P	V	T	P	V	T	P	V	T	P	V	T	P	V	T
Acer negundo		Tree																											
Acer rubrum		Tree							1	1	1																		
Alnus serrulata	Tag Alder, Smooth Alder, Hazel Alder	Shrub Tree			4	2	2	7			1						1	1	1	6									
Asimina triloba	Common Pawpaw, Indian-banana	Shrub Tree																											
Betula lenta		Tree				2	2	2																					
Betula nigra	River Birch, Red Birch	Tree	2	2	2				3	3	3				1	1	1	3	3	3	4	4	4						
Carpinus caroliniana		Shrub Tree							1	1	1	1	1	1				2	2	2									
Cercis canadensis		Shrub Tree				3	3	3	1	1	1	4	4	4															
Cornus amomum	Silky Dogwood	Shrub Tree	2	2	2																			5	5	5	8	8	8
Cornus florida	Flowering Dogwood	Shrub Tree																											
Corylus americana	American Hazelnut, American Filbert	Shrub																											
Crataegus	Hawthorn, Haw, Thornapple	Shrub Tree																											
Diospyros virginiana	American Persimmon, Possumwood	Tree				2	2	2							2	2	2	1	1	2									
Fraxinus pennsylvanica	Green Ash, Red Ash	Tree	2	2	2	1	1	1	5	5	5	1	1	1	6	6	6							7	7	7	5	5	5
Hamamelis virginiana		Shrub Tree										2	2	2															
Juglans nigra	Black Walnut	Tree										2	2	2	2	2	2				1	1	1				2	2	2
Liriodendron tulipifera		Tree	2	2	2	1	1	1	2	2	2	2	2	2	3	3	3	2	2	2	1	1	1						
Nyssa sylvatica	Sour Gum, Black Gum, Pepperidge	Tree																											
Platanus occidentalis	Sycamore, Plane-tree	Tree	4	4	6				3	3	4				1	1	2				3	3	3			1			
Quercus alba	White Oak	Tree	2	2	2							2	2	2										4	4	4			
Quercus falcata	Spanish Oak, Southern Red Oak	Tree				3	3	3	4	4	4	1	1	1	1	1	1							6	6	6			
Quercus lyrata	Overcup Oak	Tree																											
Quercus michauxii	Basket Oak, Swamp Chestnut Oak	Tree																											
Quercus phellos	Willow Oak	Tree							1	1	1	2	2	2	1	1	1	2	2	2	4	4	4						
Rhus copallinum		Shrub Tree																											
Salix nigra	Black Willow	Tree																											
		Stem count	14	14	20	14	14	19	21	21	23	17	17	17	17	17	19	11	11	17	13	13	13	22	22	23	15	15	15
		size (ares)	1			1			1			1			1			1			1			1			1		
		size (ACRES)	0.02			0.02			0.02			0.02			0.02			0.02			0.02			0.02			0.02		
		Species count	6	6	7	7	7	7	9	9	10	9	9	9	8	8	9	6	6	6	5	5	5	4	4	5	3	3	3
		Stems per ACRE	566.5599	566.5599	809.3713	566.5599	566.5599	768.9027	849.8398	849.8398	930.777	687.9656	687.9656	687.9656	687.9656	687.9656	768.9027	445.1542	445.1542	687.9656	526.0913	526.0913	526.0913	890.3084	890.3084	930.777	607.0285	607.0285	607.0285

Table 7: CVS Density Per Plot
DMS Project Code 100003. Project Name: Russell Gap Mitigation Project

			Current Plot Data (MY2 2021)																									
			157329-01-0019			157329-01-0020			157329-01-RV1_MY2			157329-01-RV2_MY2			157329-01-RV3_MY2			157329-01-RV4_MY2			157329-01-RV5_MY2			157329-01-RV6_MY2			157329-01-RV7_MY2		
Scientific Name	Common Name	Species Type	P	V	T	P	V	T	P	V	T	P	V	T	P	V	T	P	V	T	P	V	T	P	V	T	P	V	T
Acer negundo		Tree						2							1	1	1				3	3	3						
Acer rubrum		Tree	2	2	2						1			3				4	4	4	1	1	1						
Alnus serrulata	Tag Alder, Smooth Alder, Hazel Alder	Shrub Tree										3	3	8															
Asimina triloba	Common Pawpaw, Indian-banana	Shrub Tree																											
Betula lenta		Tree																											
Betula nigra	River Birch, Red Birch	Tree				1	1	1	4	4	4							1	1	1	1	1	1	2	2	2	4	4	4
Carpinus caroliniana		Shrub Tree																											
Cercis canadensis		Shrub Tree	3	3	3				2	2	2	3	3	3	3	3	3	2	2	2	3	3	3						
Cornus amomum	Silky Dogwood	Shrub Tree	1	1	1	1	1	1																					
Cornus florida	Flowering Dogwood	Shrub Tree							2	2	2																		
Corylus americana	American Hazelnut, American Filbert	Shrub				1	1	1																					
Crataegus	Hawthorn, Haw, Thornapple	Shrub Tree																											
Diospyros virginiana	American Persimmon, Possumwood	Tree							1	1	1	1	1	1				2	2	2	1	1	1	1	1	1			
Fraxinus pennsylvanica	Green Ash, Red Ash	Tree	2	2	2	4	4	4	2	2	2	2	2	2	1	1	1										2	2	2
Hamamelis virginiana		Shrub Tree																											
Juglans nigra	Black Walnut	Tree	2	2	2	4	4	4																					
Liriodendron tulipifera		Tree	3	3	3	2	2	2	2	2	7	4	4	4	1	1	1	1	1	1	3	3	3	1	1	1	2	2	2
Nyssa sylvatica	Sour Gum, Black Gum, Pepperidge	Tree				1	1	1																					
Platanus occidentalis	Sycamore, Plane-tree	Tree	3	3	3				3	3	18	2	2	7	3	3	13				2	2	2	3	3	3	3	3	3
Quercus alba	White Oak	Tree										1	1	1	5	5	5												
Quercus falcata	Spanish Oak, Southern Red Oak	Tree				1	1	1																					
Quercus lyrata	Overcup Oak	Tree										1	1	1															
Quercus michauxii	Basket Oak, Swamp Chestnut Oak	Tree				1	1	1																					
Quercus phellos	Willow Oak	Tree							1	1	1	2	2	2				1	1	1							3	3	3
Rhus copallinum		Shrub Tree							1	1	1	1	1	1	2	2	2												
Salix nigra	Black Willow	Tree																						1	1	1			
		Stem count	16	16	16	16	16	18	18	18	39	20	20	33	16	16	26	11	11	11	14	14	14	8	8	8	14	14	14
		size (ares)	1			1			1			1			1			1			1			1			1		
		size (ACRES)	0.02			0.02			0.02			0.02			0.02			0.02			0.02			0.02			0.02		
		Species count	7	7	7	9	9	10	9	9	10	10	10	11	7	7	7	6	6	6	7	7	7	5	5	5	5	5	5
		Stems per ACRE	647.497	647.497	647.497	647.497	647.497	728.4342	728.4342	728.4342	1578.274	809.3713	809.3713	1335.463	647.497	647.497	1052.183	445.1542	445.1542	445.1542	566.5599	566.5599	566.5599	323.7485	323.7485	323.7485	566.5599	566.5599	566.5599

			Current Plot Data (MY2 2021)						Annual Means								
			157329-01-RV8_MY2			157329-01-RV9_MY2			MY2 (2021)			MY1 (2020)			MY0 (2020)		
Scientific Name	Common Name	Species Type	P	V	T	P	V	T	P	V	T	P	V	T	P	V	T
Acer negundo		Tree							4	4	14	15	15	20			
Acer rubrum		Tree							8	8	17	6	6	6			
Alnus serrulata	Tag Alder, Smooth Alder, Hazel Alder	Shrub Tree							11	11	46	4	4	14			
Asimina triloba	Common Pawpaw, Indian-banana	Shrub Tree							1	1	1	1	1	1			
Betula lenta		Tree							3	3	3	4	4	4			
Betula nigra	River Birch, Red Birch	Tree				8	8	8	60	60	60	50	50	50			
Carpinus caroliniana		Shrub Tree							4	4	4	11	11	11			
Cercis canadensis		Shrub Tree							32	32	32	26	26	26			
Cornus amomum	Silky Dogwood	Shrub Tree	9	9	9				31	31	32	38	38	38			
Cornus florida	Flowering Dogwood	Shrub Tree							2	2	2	2	2	2			
Corylus americana	American Hazelnut, American Filbert	Shrub							1	1	1	1	1	1			
Crataegus	Hawthorn, Haw, Thornapple	Shrub Tree										1	1	1			
Diospyros virginiana	American Persimmon, Possumwood	Tree							15	15	16	12	12	12			
Fraxinus pennsylvanica	Green Ash, Red Ash	Tree	3	3	3				47	47	49	49	49	49			
Hamamelis virginiana		Shrub Tree							2	2	2						
Juglans nigra	Black Walnut	Tree	1	1	1				18	18	18	21	21	21			
Liriodendron tulipifera		Tree				3	3	3	54	54	59	62	62	62			
Nyssa sylvatica	Sour Gum, Black Gum, Pepperidge	Tree							1	1	1	7	7	7			
Platanus occidentalis	Sycamore, Plane-tree	Tree				3	3	3	55	55	114	44	44	54			
Quercus alba	White Oak	Tree							14	14	14	9	9	9			
Quercus falcata	Spanish Oak, Southern Red Oak	Tree	4	4	4				23	23	23	25	25	25			
Quercus lyrata	Overcup Oak	Tree							1	1	1						
Quercus michauxii	Basket Oak, Swamp Chestnut Oak	Tree							3	3	3	5	5	5			
Quercus phellos	Willow Oak	Tree				1	1	1	45	45	45	52	52	52			
Rhus copallinum		Shrub Tree							4	4	4						
Salix nigra	Black Willow	Tree							1	1	2						
		Stem count	17	17	17	15	15	15	440	440	563	445	445	470	388	388	388
		size (ares)	1			1			29			20			20		
		size (ACRES)	0.02			0.02			0.72			0.49			0.49		
		Species count	4	4	4	4	4	4	25	25	25	22	22	22	1	1	1
		Stems per ACRE	687.9656	687.9656	687.9656	607.0285	607.0285	607.0285	614.0058	614.0058	785.6483	900.4256	900.4256	951.0113	785.1	785.1	785.1

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

APPENDIX D

Stream Geomorphology Data

Figure 4. Cross-Sections with Annual Overlay

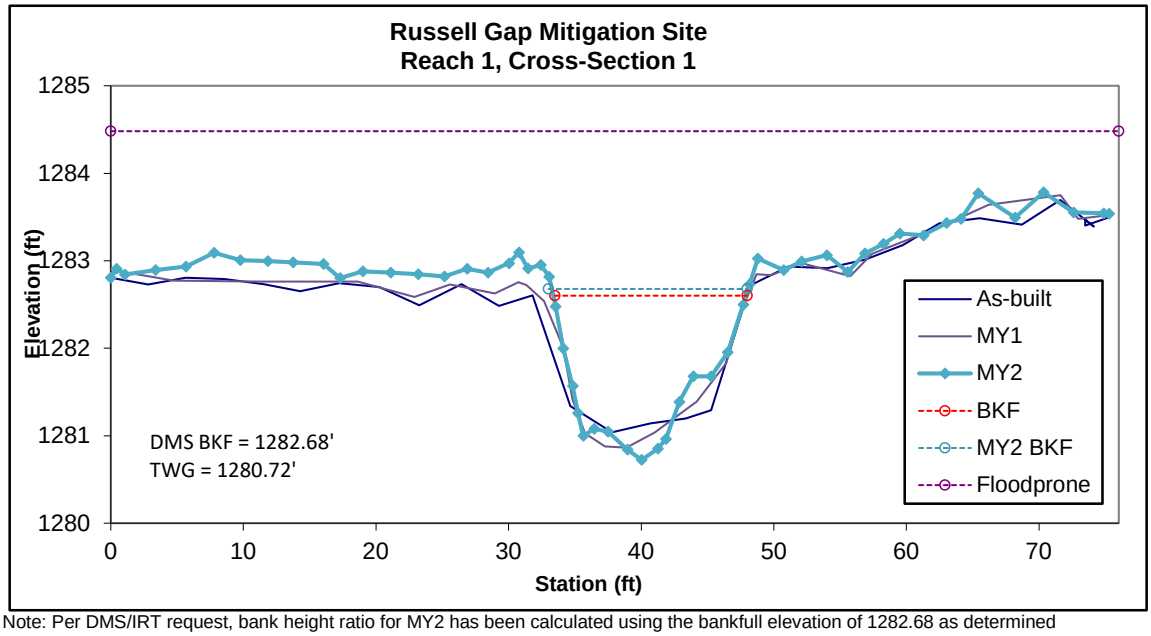
Permanent Cross-Section 1

Year 2 Survey Collected: September 2021

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	17.6	14.5	1.2	1.96	12.0	1.1	5.2	1282.60	1282.95



Note: Per DMS/IRT request, bank height ratio for MY2 has been calculated using the bankfull elevation of 1282.68 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 2 Survey Collected: September 2021

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	--	22.6	16.1	1.4	2.0	11.5	--	--	1282.20	1282.40

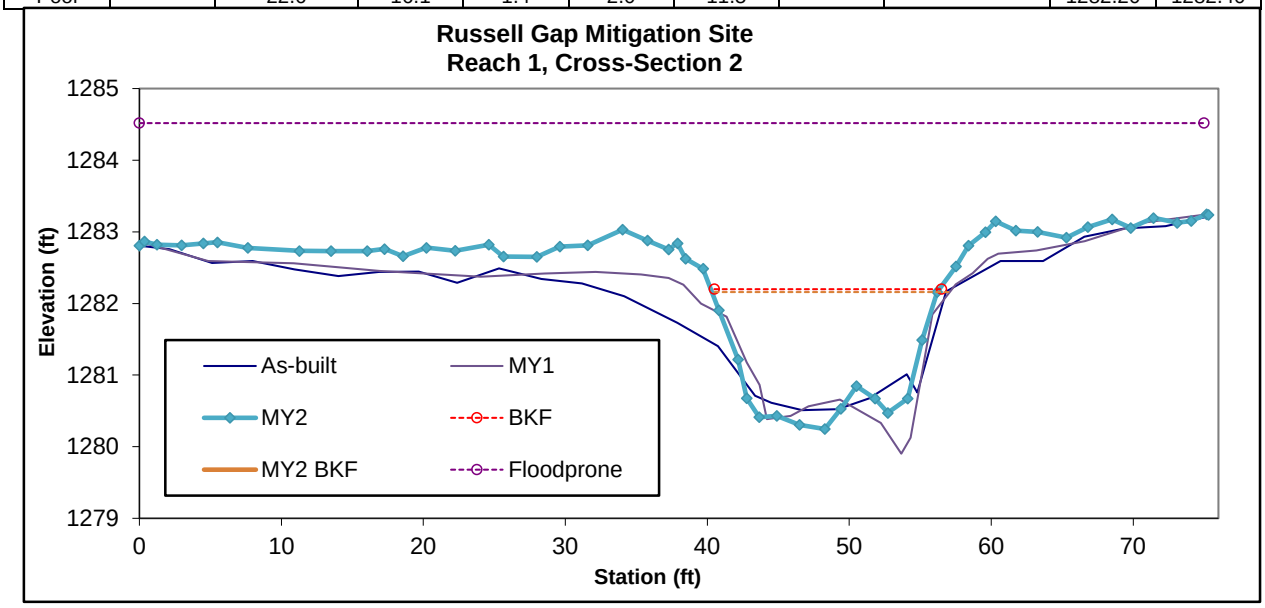


Figure 4. Cross-Sections with Annual Overlay

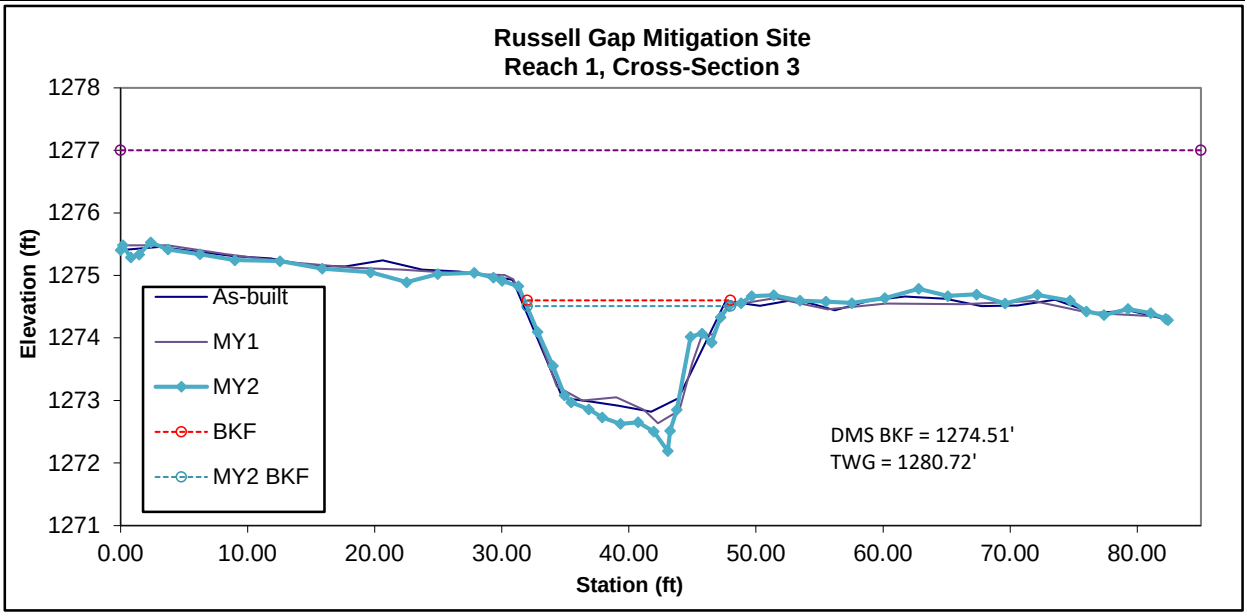
Permanent Cross-Section 3

Year Survey Collected: September 2021

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	22.2	17.4	1.3	2.4	13.7	1.0	4.7	1274.60	1274.60



Note: Per DMS/IRT request, bank height ratio for MY2 has been calculated using the bankfull elevation of 1274.51 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 2 Survey Collected: September 2021

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	---	34.1	14.1	2.4	3.9	5.8	---	---	1274.00	1273.01

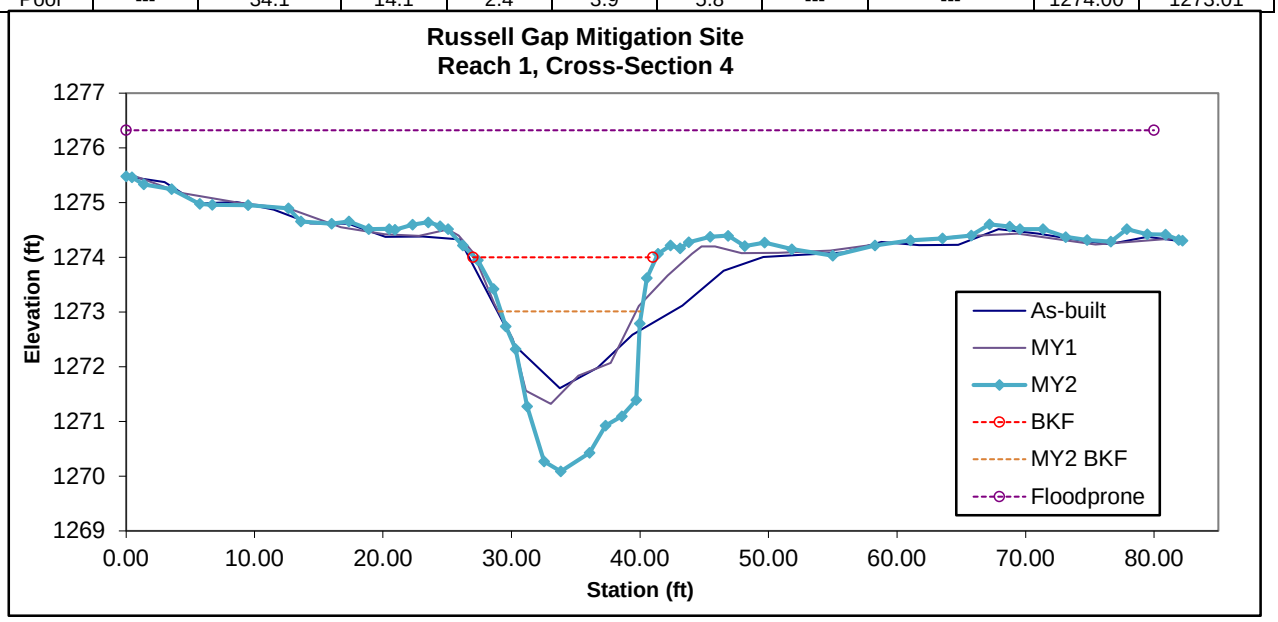


Figure 4. Cross-Sections with Annual Overlay

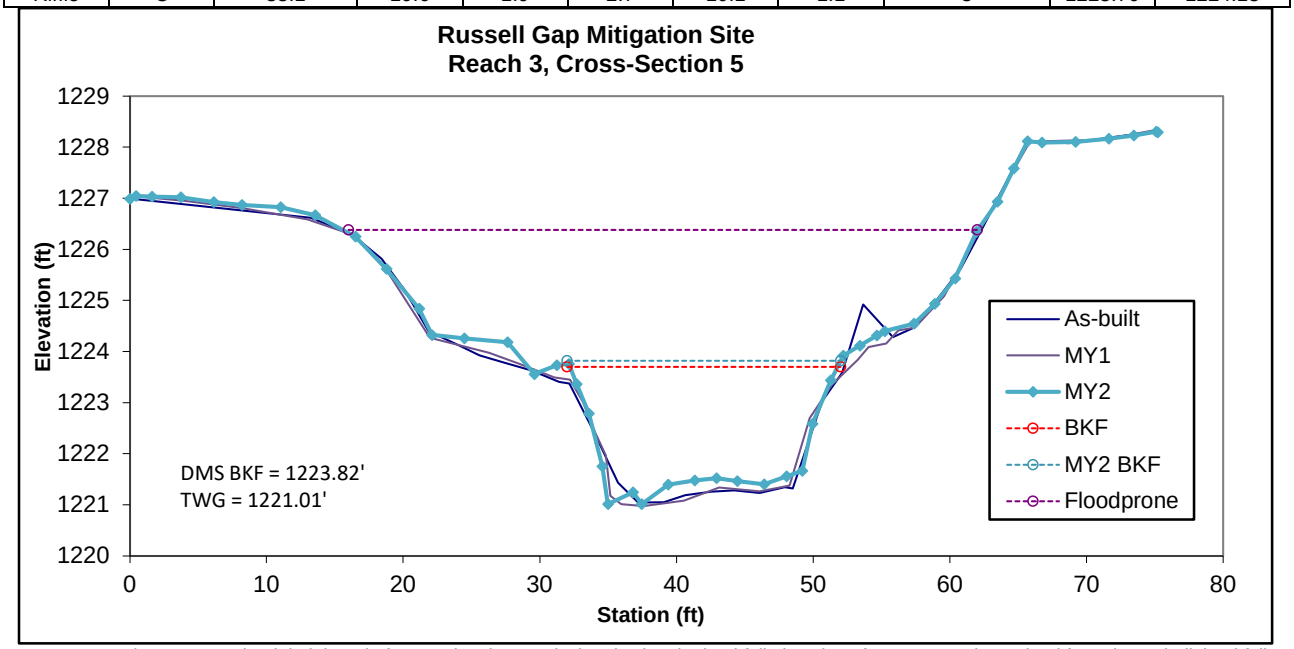
Permanent Cross-Section 5

Year 2 Survey Collected: October 2021

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	38.1	19.6	1.9	2.7	10.1	1.1	3	1223.70	1224.18



Note: Per DMS/IRT request, bank height ratio for MY2 has been calculated using the bankfull elevation of 1223.82 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

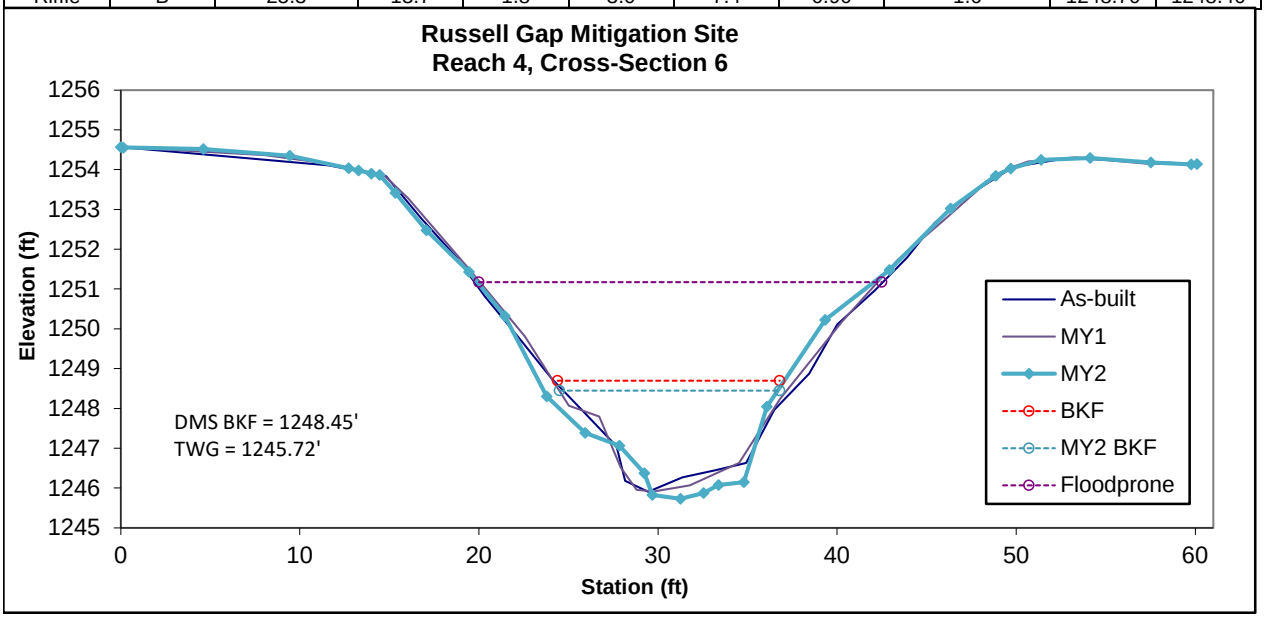
Permanent Cross-Section 6

Year 2 Survey Collected: October 2021

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	25.3	13.7	1.8	3.0	7.4	0.90	1.6	1248.70	1248.40



Note: Per DMS/IRT request, bank height ratio for MY2 has been calculated using the bankfull elevation of 1248.45 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

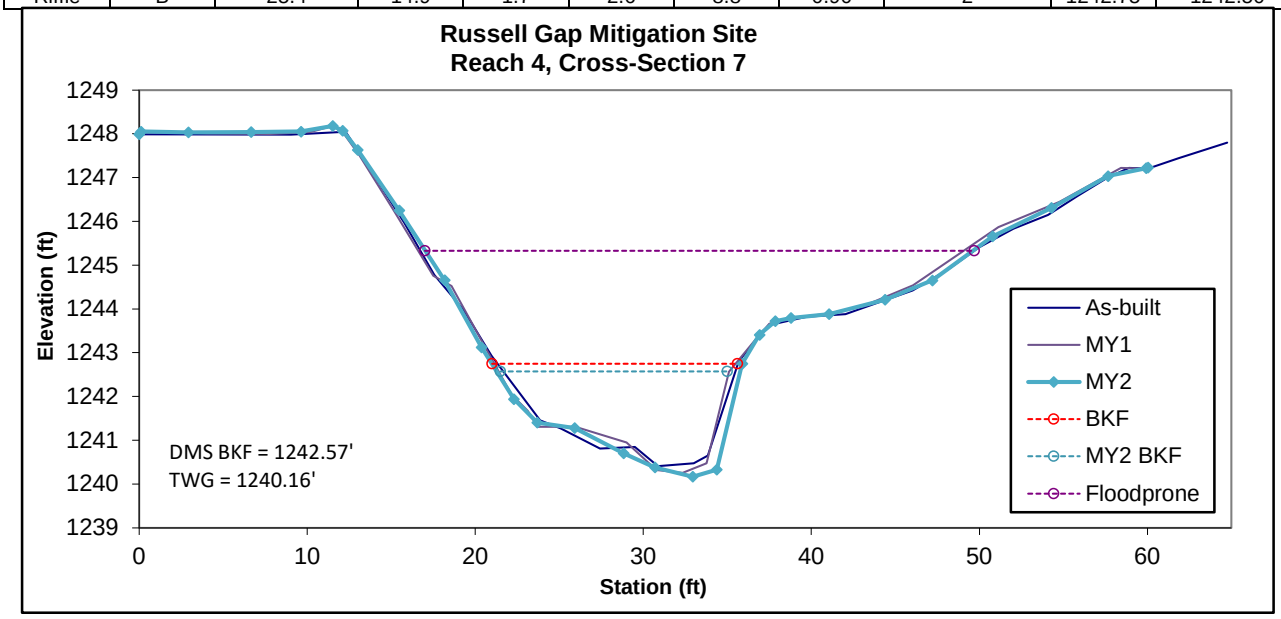
Permanent Cross-Section 7

Year 2 Survey Collected: October 2021

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	25.4	14.9	1.7	2.6	8.8	0.90	2	1242.75	1242.50



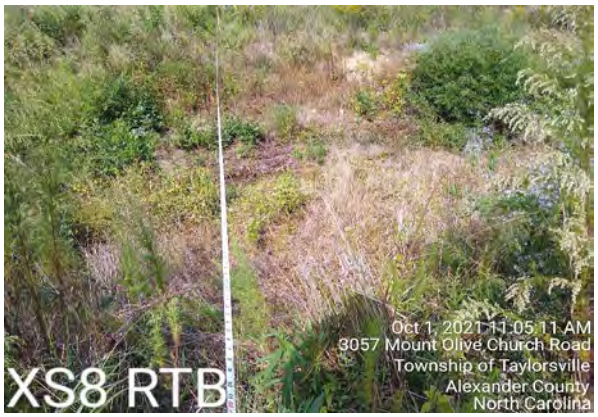
Note: Per DMS/IRT request, bank height ratio for MY2 has been calculated using the bankfull elevation of 1242.57 as determined from the as-built bankfull area. All other values were calculated using the as-built bankfull elevation.

Figure 4. Cross-Sections with Annual Overlay

Permanent Cross-Section 8

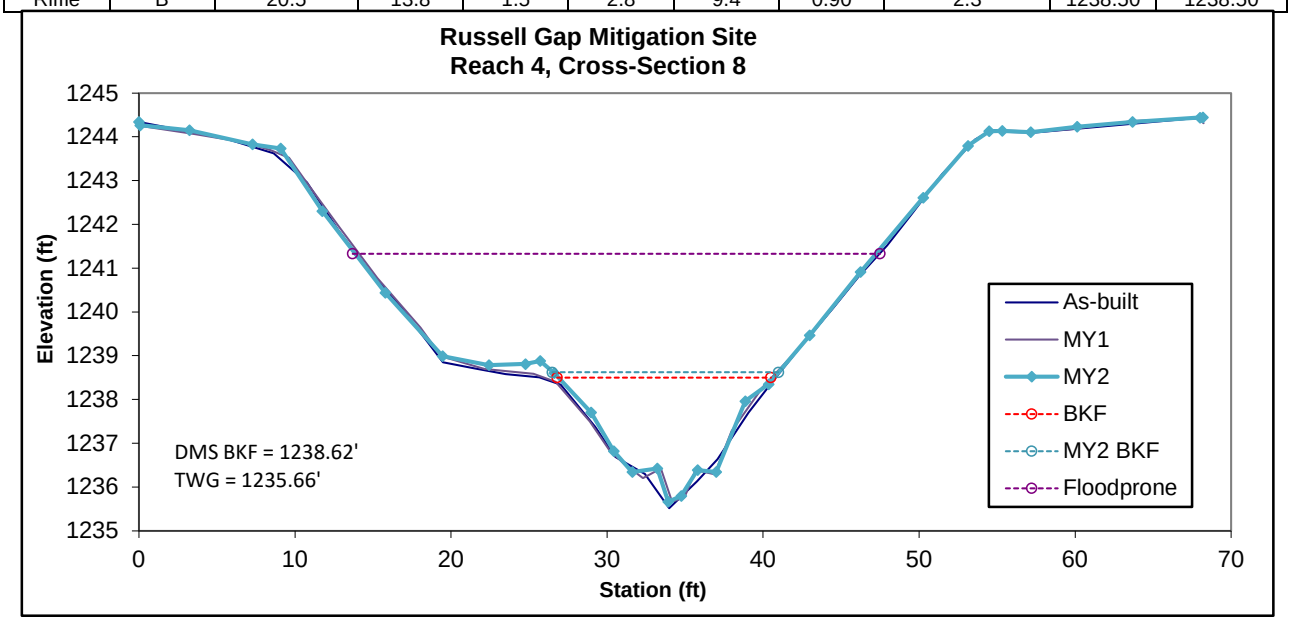
Year 2 Survey Collected: October 2021

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	13.8	1.5	2.8	9.4	0.90	2.3	1238.50	1238.50



Note: Per DMS/IRT request, bank height ratio for MY2 has been calculated using the bankfull elevation of 1238.62 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

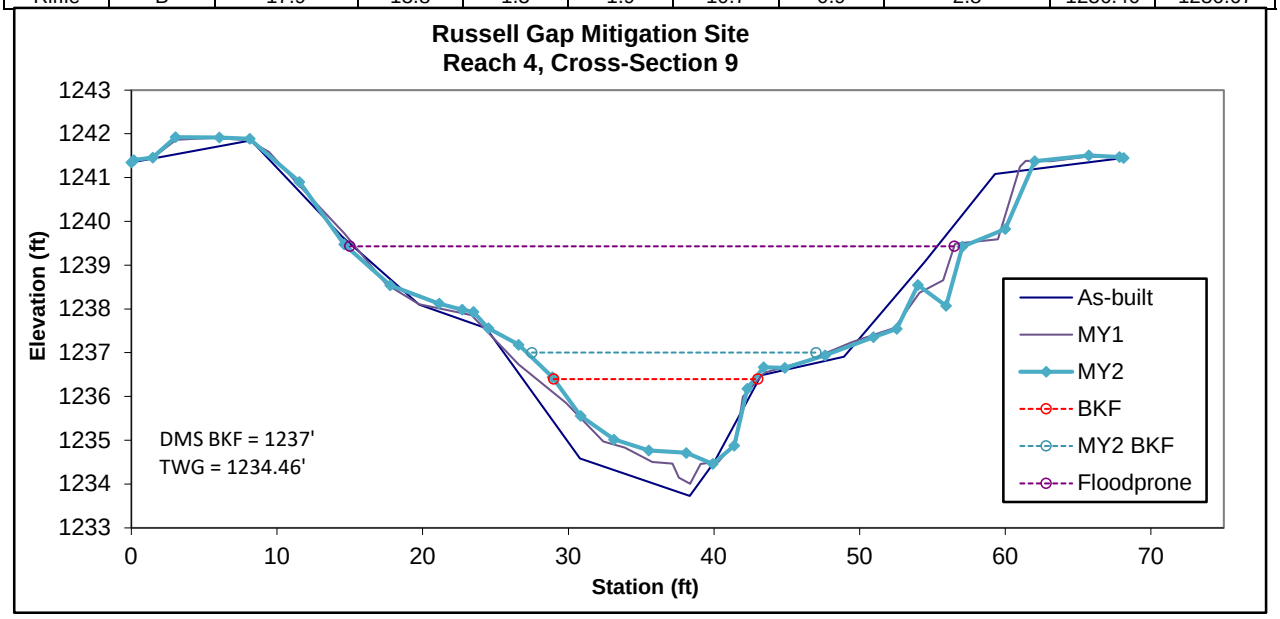
Permanent Cross-Section 9

Year 2 Survey Collected: October 2021

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	17.9	13.8	1.3	1.9	10.7	0.9	2.8	1236.40	1236.67



Note: Per DMS/IRT request, bank height ratio for MY2 has been calculated using the bankfull elevation of 1237 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

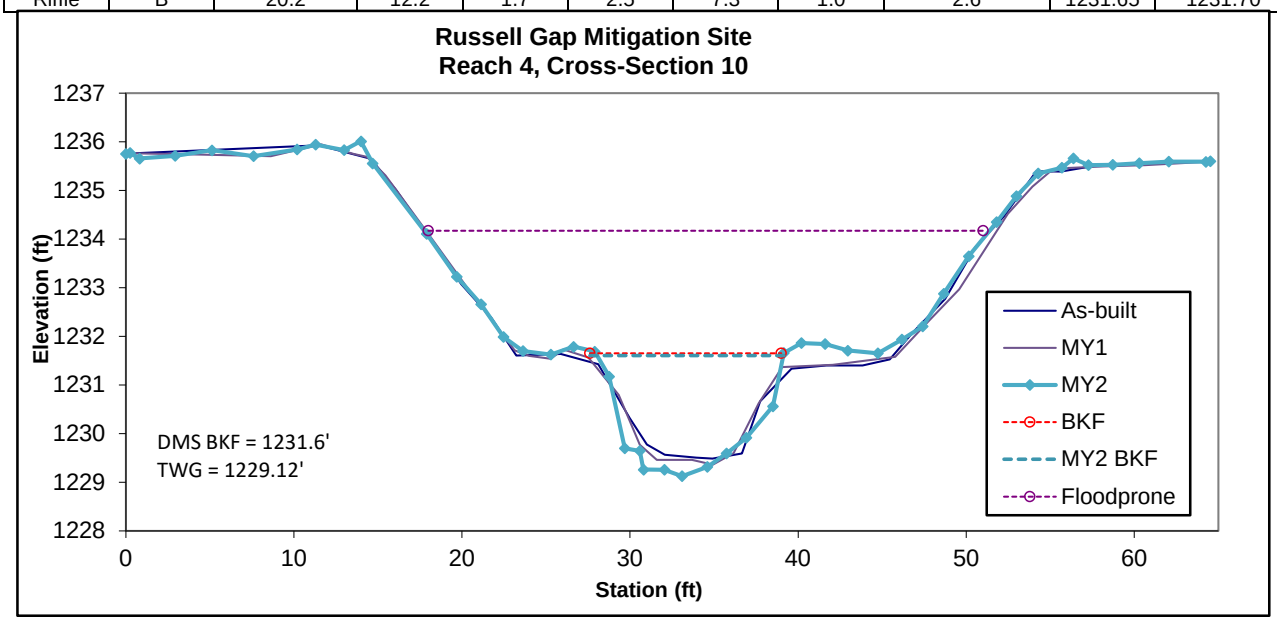
Permanent Cross-Section 10

Year 2 Survey Collected: October 2021

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	20.2	12.2	1.7	2.5	7.3	1.0	2.6	1231.65	1231.70



Note: Per DMS/IRT request, bank height ratio for MY2 has been calculated using the bankfull elevation of 1231.6 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

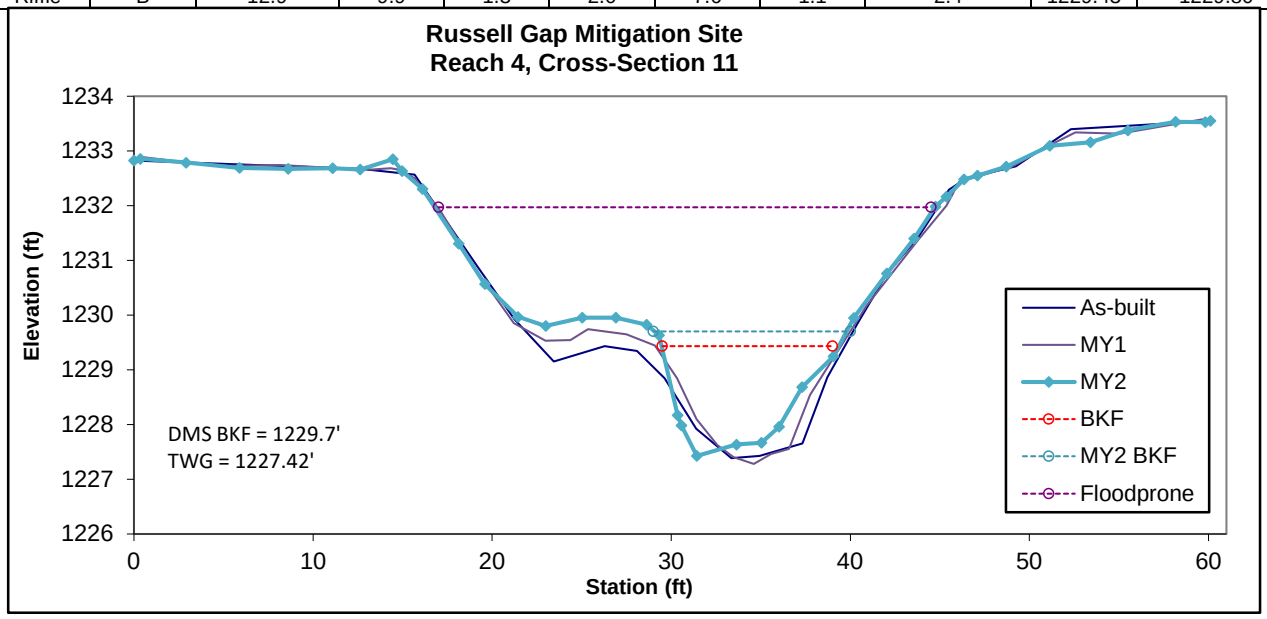
Permanent Cross-Section 11

Year 2 Survey Collected: October 2021

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	12.9	9.9	1.3	2.0	7.6	1.1	2.4	1229.43	1229.80



Note: Per DMS/IRT request, bank height ratio for MY2 has been calculated using the bankfull elevation of 1229.7 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 2 Survey Collected: September 2021

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	--	11.0	13.1	0.8	2.0	15.6	---	---	1300.30	1300.20

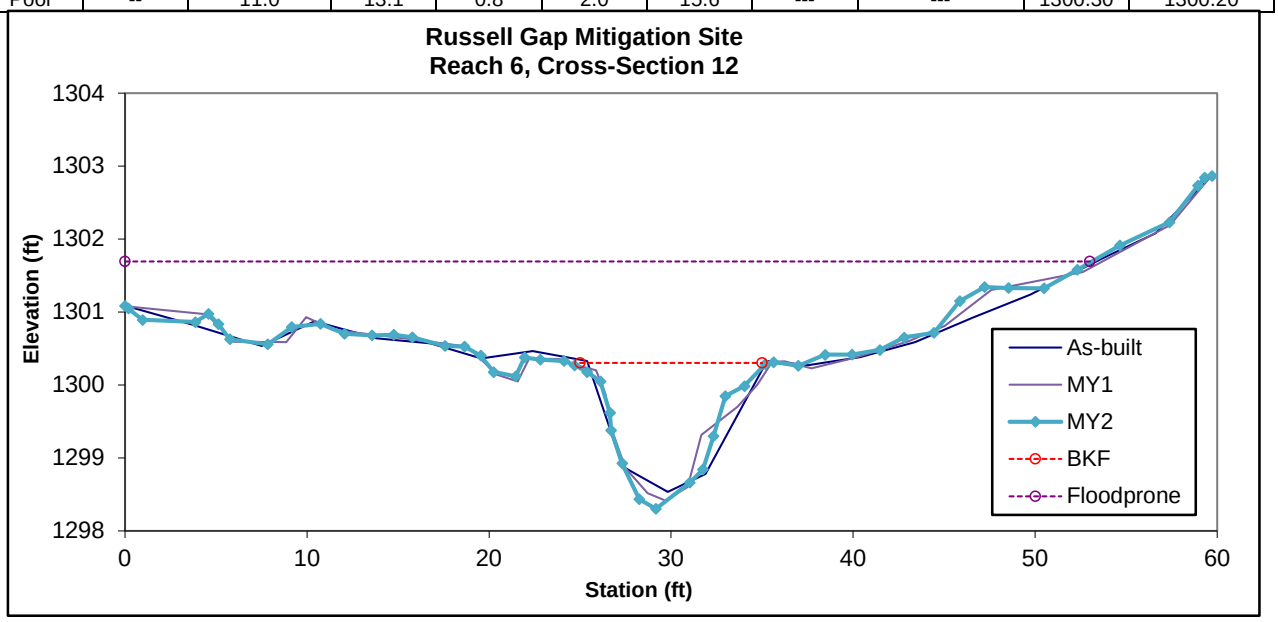


Figure 4. Cross-Sections with Annual Overlay

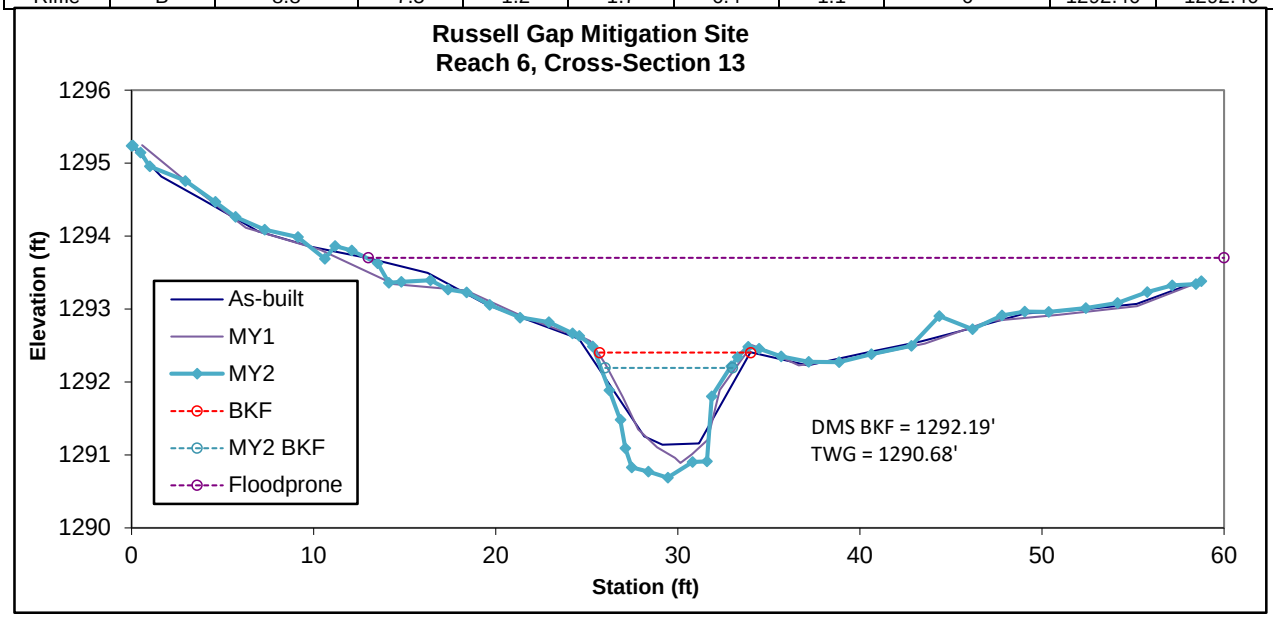
Permanent Cross-Section 13

Year 2 Survey Collected: September 2021

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	8.8	7.5	1.2	1.7	6.4	1.1	6	1292.40	1292.40



Note: Per DMS/IRT request, bank height ratio for MY2 has been calculated using the bankfull elevation of 1292.19 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

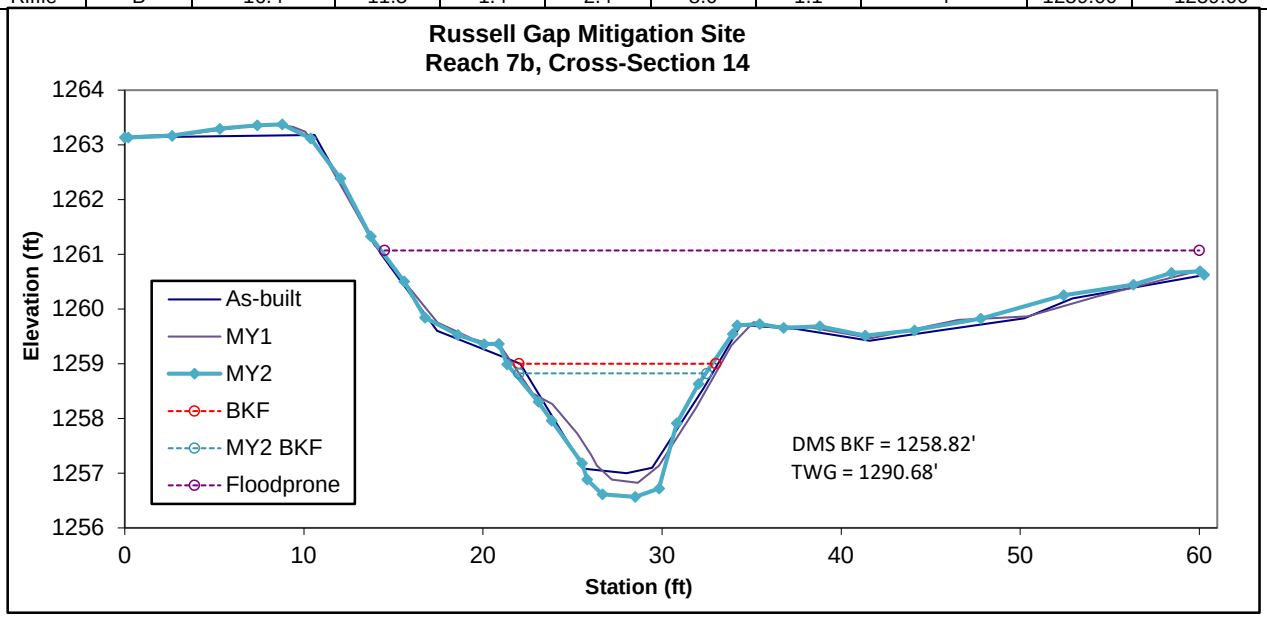
Permanent Cross-Section 14

Year 2 Survey Collected: September 2021

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	16.4	11.5	1.4	2.4	8.0	1.1	4	1259.00	1259.00



Note: Per DMS/IRT request, bank height ratio for MY2 has been calculated using the bankfull elevation of 1258.82 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 2 Survey Collected: October 2021

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	--	13.4	14.6	0.9	2.0	15.8	--	--	1252.08	1251.80

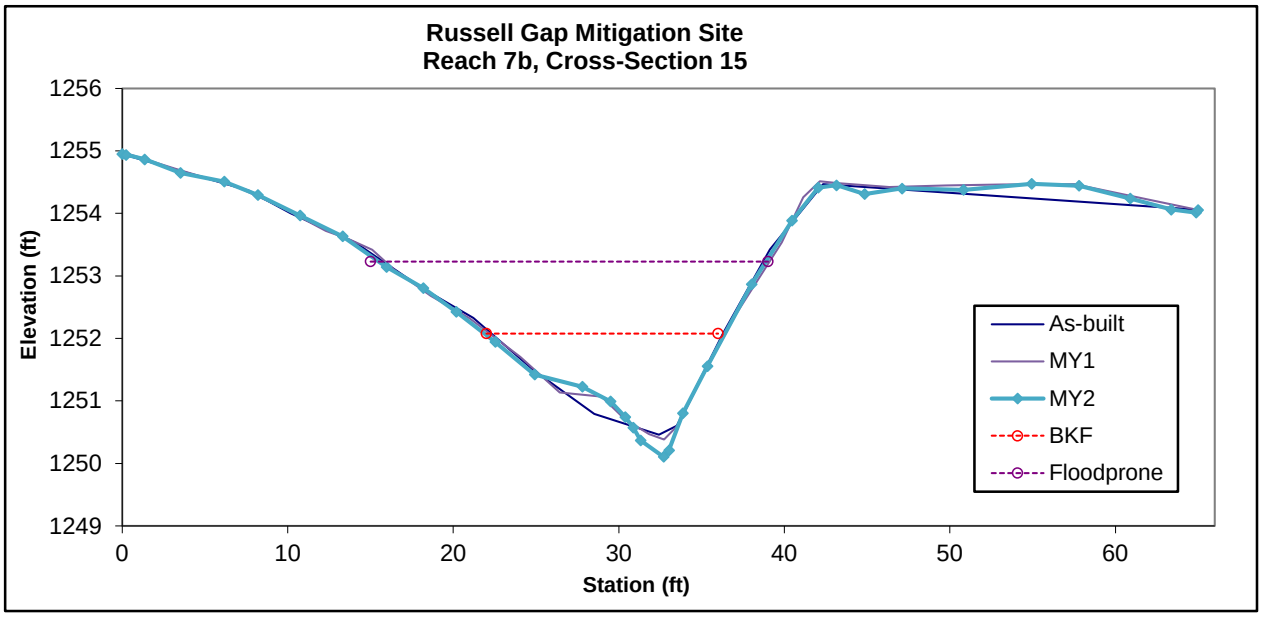


Figure 4. Cross-Sections with Annual Overlay

Permanent Cross-Section 16

Year 2 Survey Collected: September 2021

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	--	11.5	11.4	1.0	1.8	11.2	--	--	1231.10	1231.30

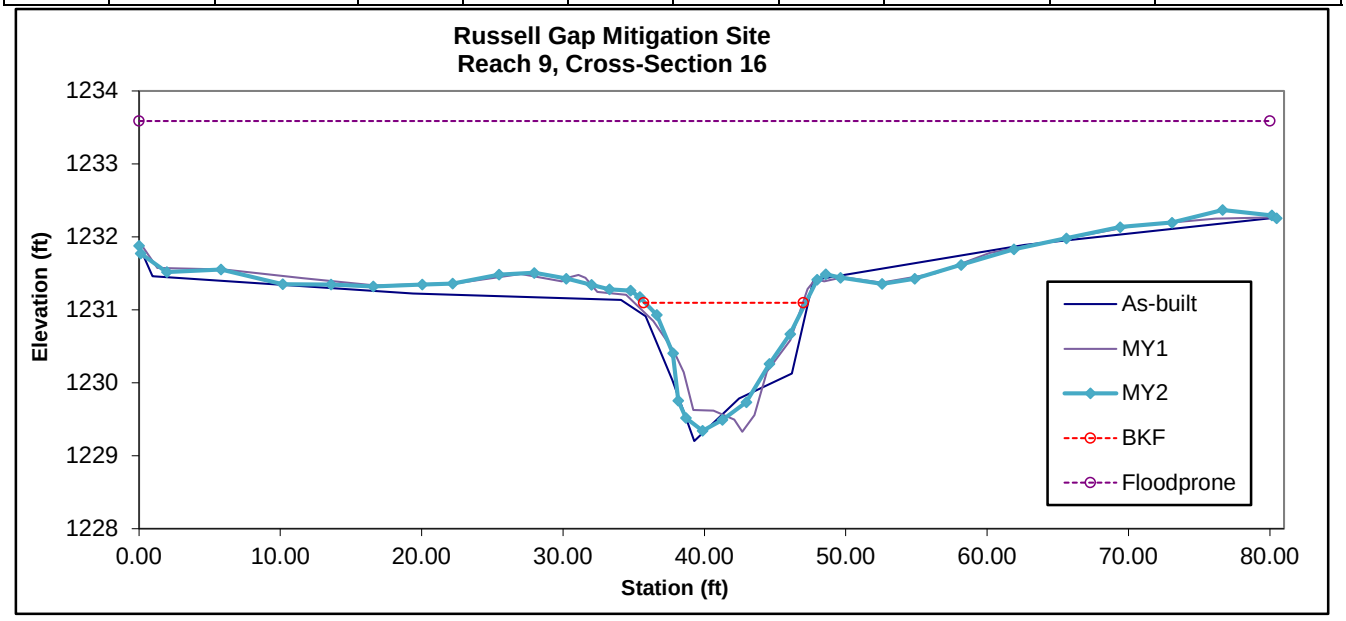


Figure 4. Cross-Sections with Annual Overlay

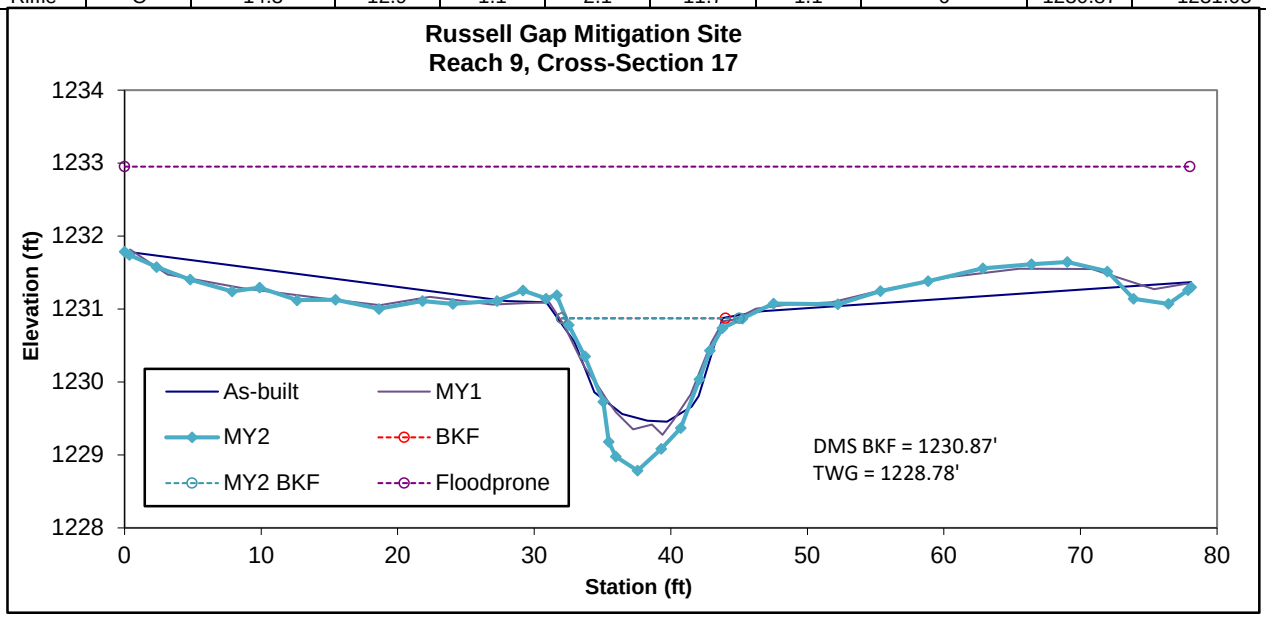
Permanent Cross-Section 17

Year 2 Survey Collected: September 2021

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	14.3	12.9	1.1	2.1	11.7	1.1	6	1230.87	1231.05



Note: Per DMS/IRT request, bank height ratio for MY2 has been calculated using the bankfull elevation of 1230.87 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

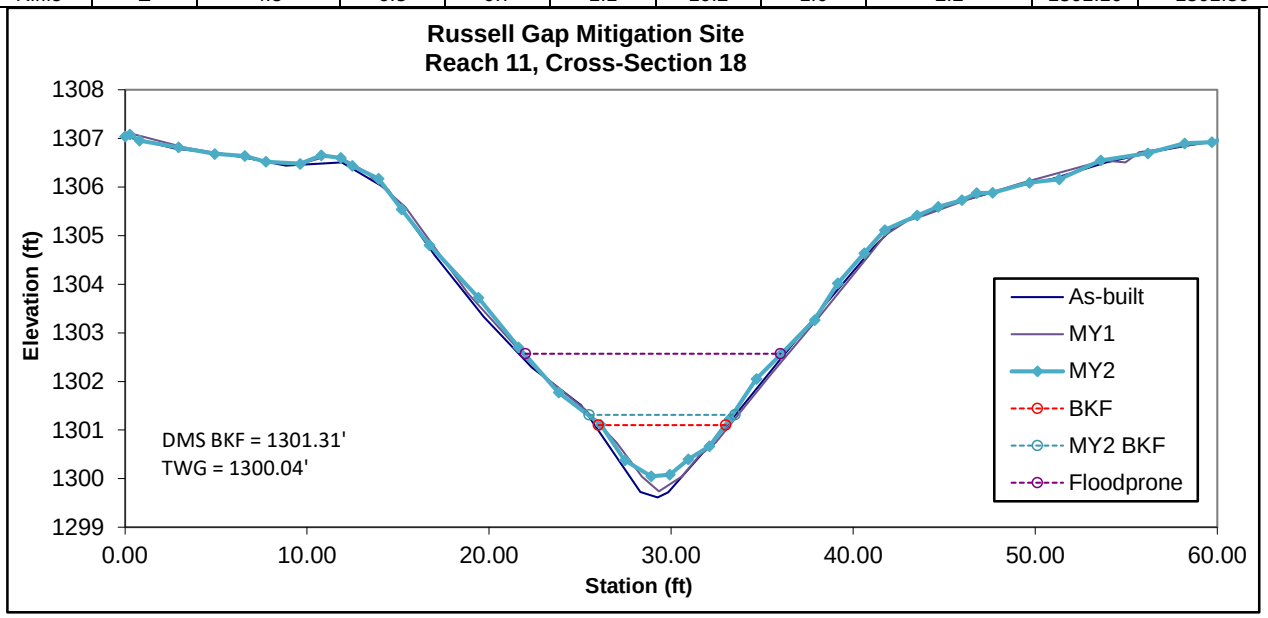
Permanent Cross-Section 18

Year 2 Survey Collected: September 2021

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	4.5	6.8	0.7	1.1	10.2	1.0	2.2	1301.10	1301.30



Note: Per DMS/IRT request, bank height ratio for MY2 has been calculated using the bankfull elevation of 1301.31 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

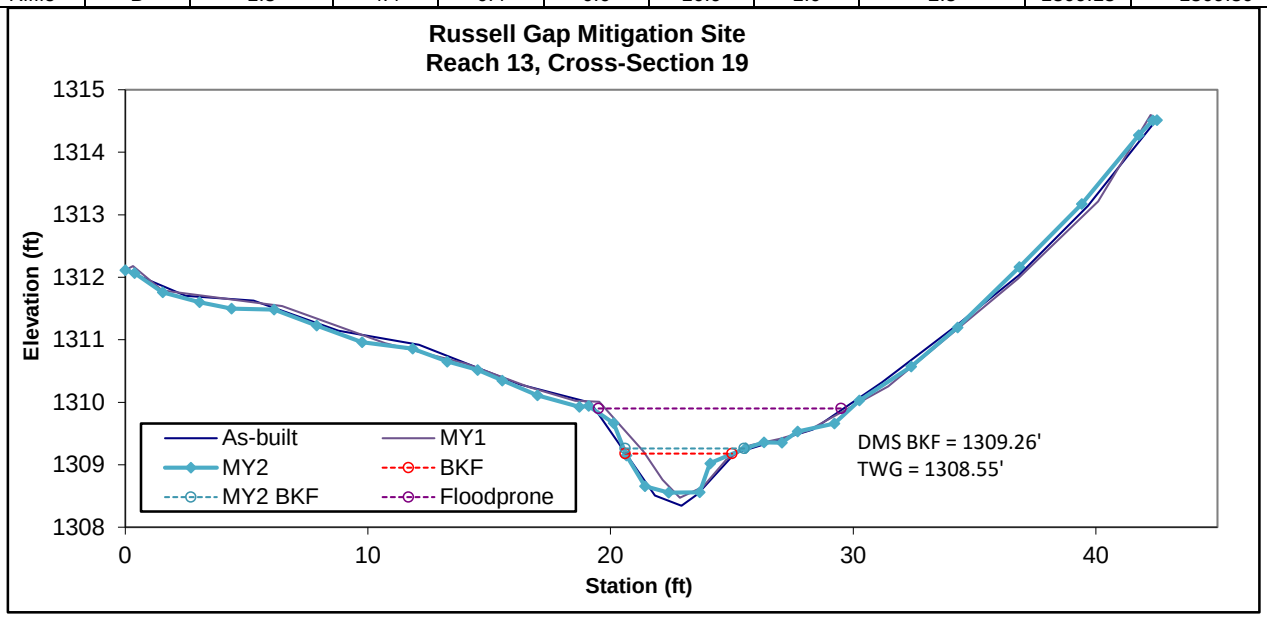
Permanent Cross-Section 19

Year 2 Survey Collected: September 2021

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	1.8	4.4	0.4	0.6	10.9	1.0	2.5	1309.18	1309.30



Note: Per DMS/IRT request, bank height ratio for MY2 has been calculated using the bankfull elevation of 1309.26 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

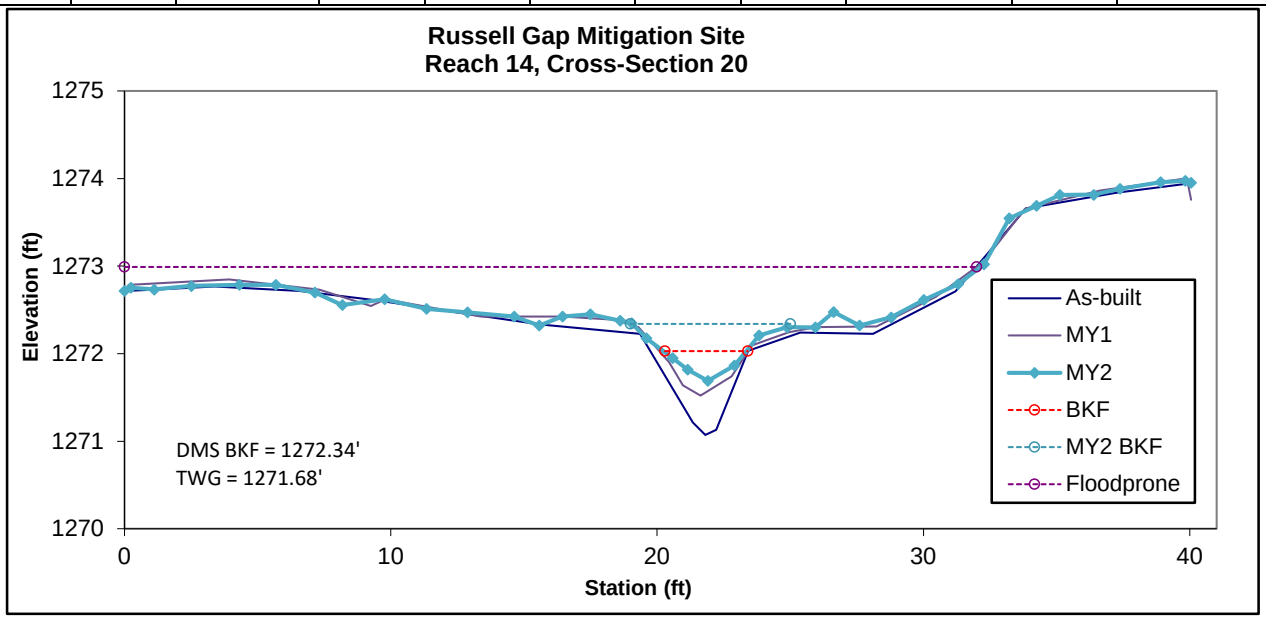
Permanent Cross-Section 20

Year 2 Survey Collected: September 2021

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	0.6	3.1	0.2	0.3	16.3	1.0	10.3	1272.03	1272.34

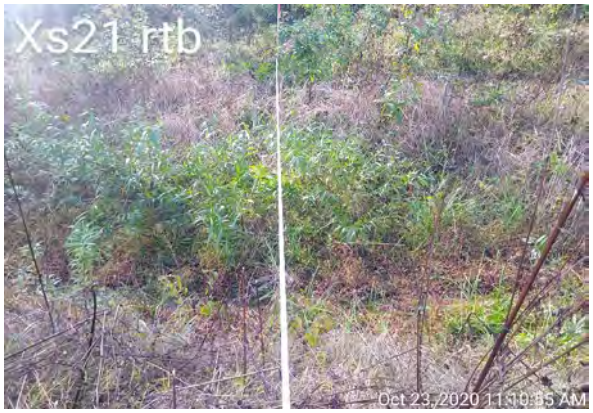


Note: Per DMS/IRT request, bank height ratio for MY2 has been calculated using the bankfull elevation of 1272.34 as determined from the as-built bankfull area. All other values were calculated using the as-built bankfull elevation.

Figure 4. Cross-Sections with Annual Overlay

Permanent Cross-Section 21

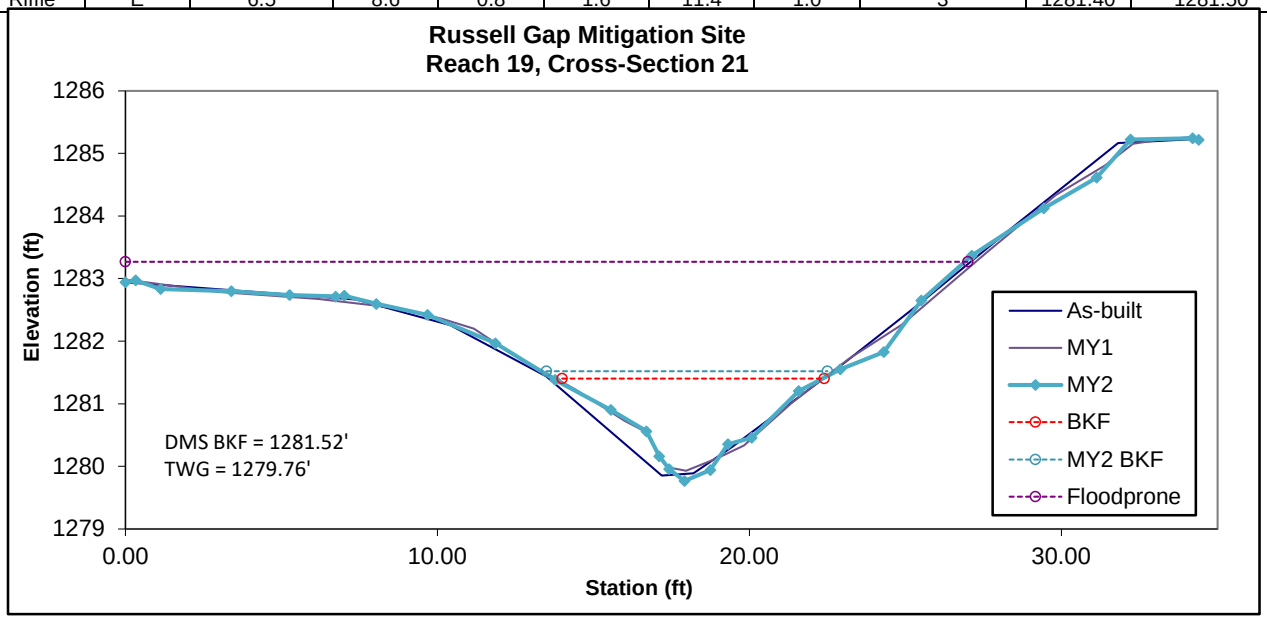
Year 2 Survey Collected: October 2021



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	6.5	8.6	0.8	1.6	11.4	1.0	3	1281.40	1281.50



Note: Per DMS/IRT request, bank height ratio for MY2 has been calculated using the bankfull elevation of 1281.52 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

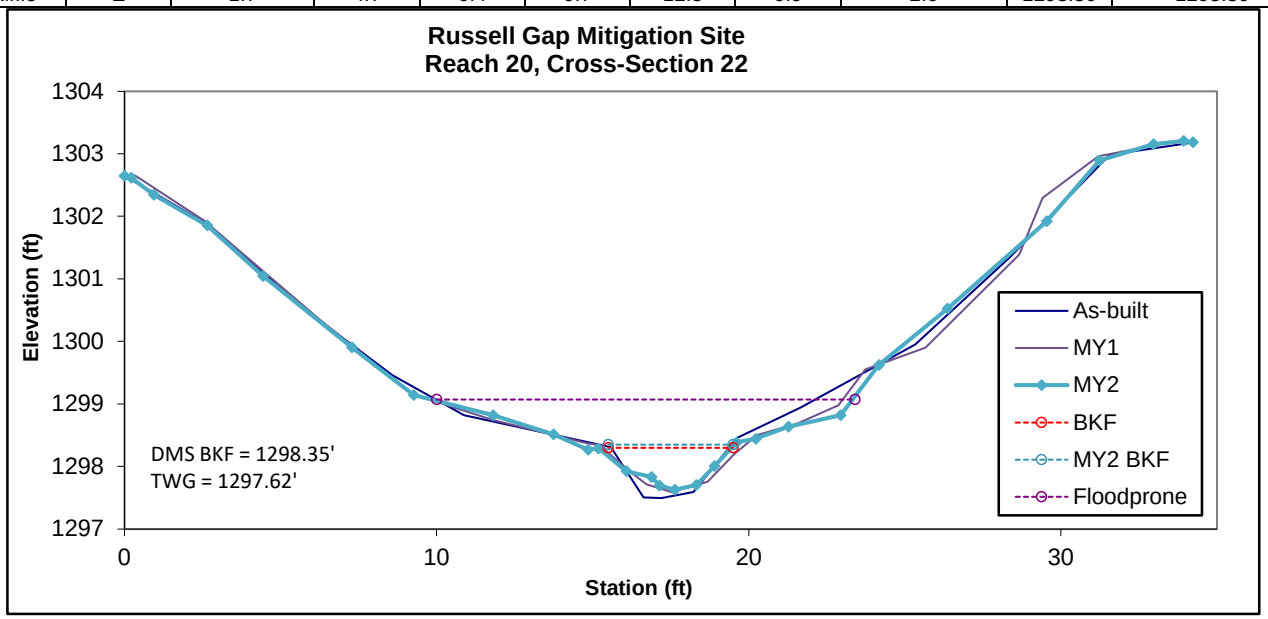
Permanent Cross-Section 22

Year 2 Survey Collected: September 2021

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	1.7	4.7	0.4	0.7	12.8	0.9	2.6	1298.30	1298.30



Note: Per DMS/IRT request, bank height ratio for MY2 has been calculated using the bankfull elevation 1298.35 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

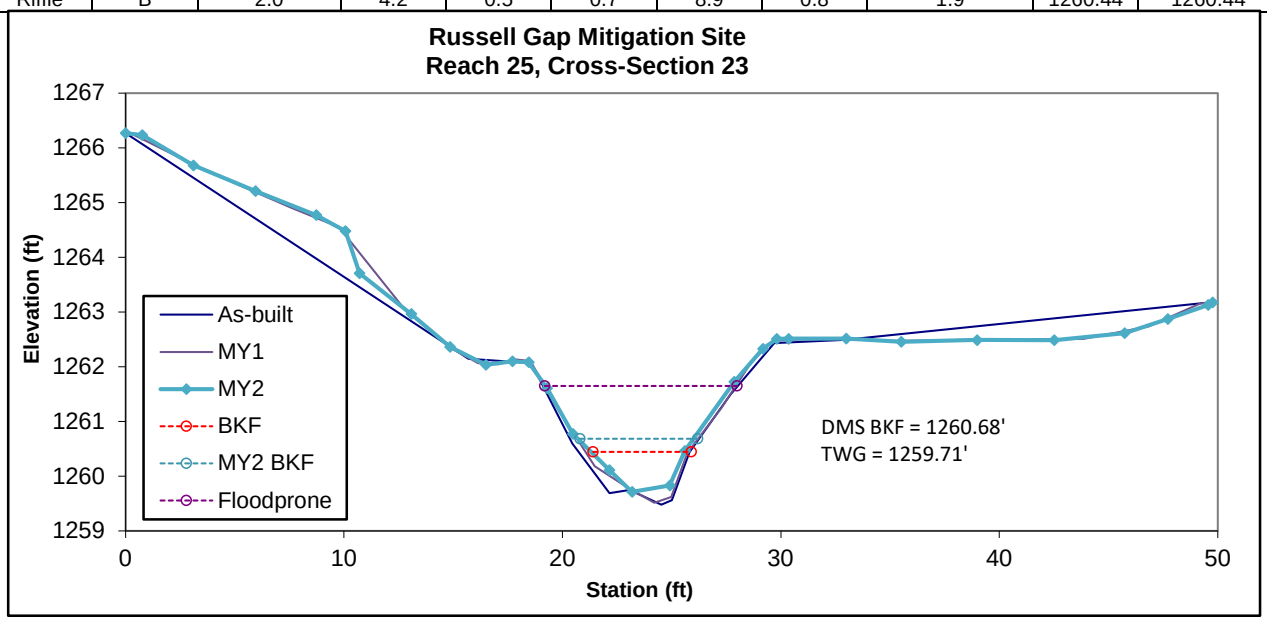
Permanent Cross-Section 23

Year 2 Survey Collected: September 2021

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	2.0	4.2	0.5	0.7	8.9	0.8	1.9	1260.44	1260.44



Note: Per DMS/IRT request, bank height ratio for MY2 has been calculated using the bankfull elevation of 1260.68 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

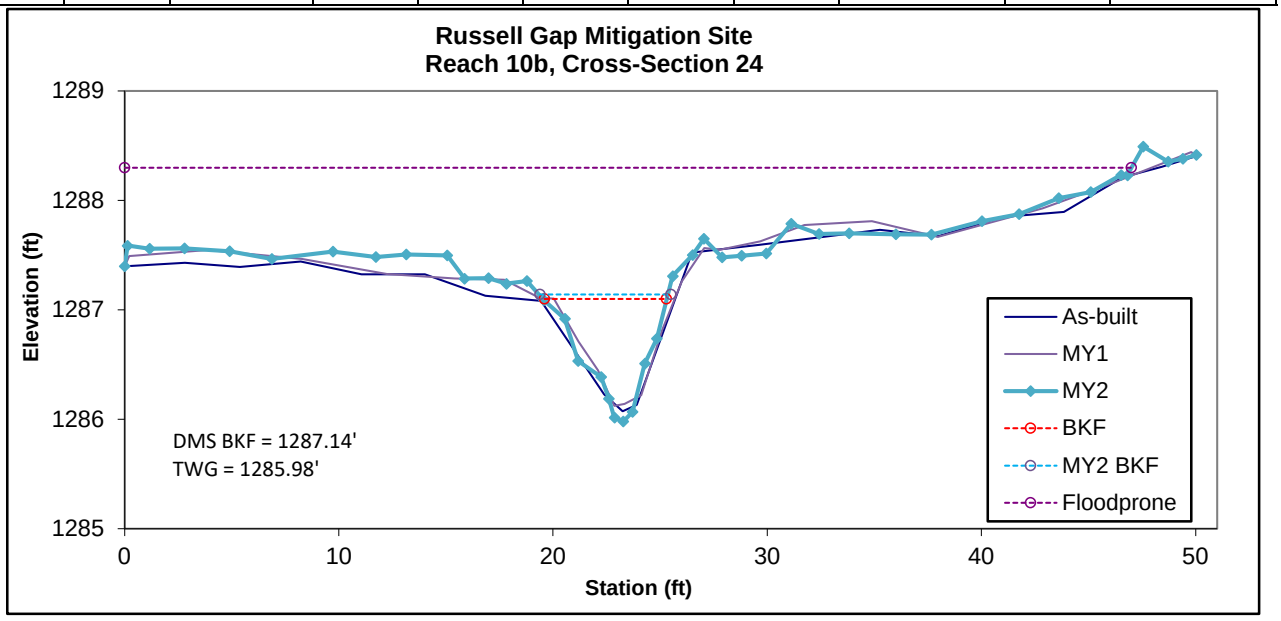
Permanent Cross-Section 24

Year 2 Survey Collected: September 2021

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	3.2	5.7	0.6	1.1	10.0	1.0	8	1287.10	1287.10



Note: Per DMS/IRT request, bank height ratio for MY2 has been calculated using the bankfull elevation of 1287.14 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

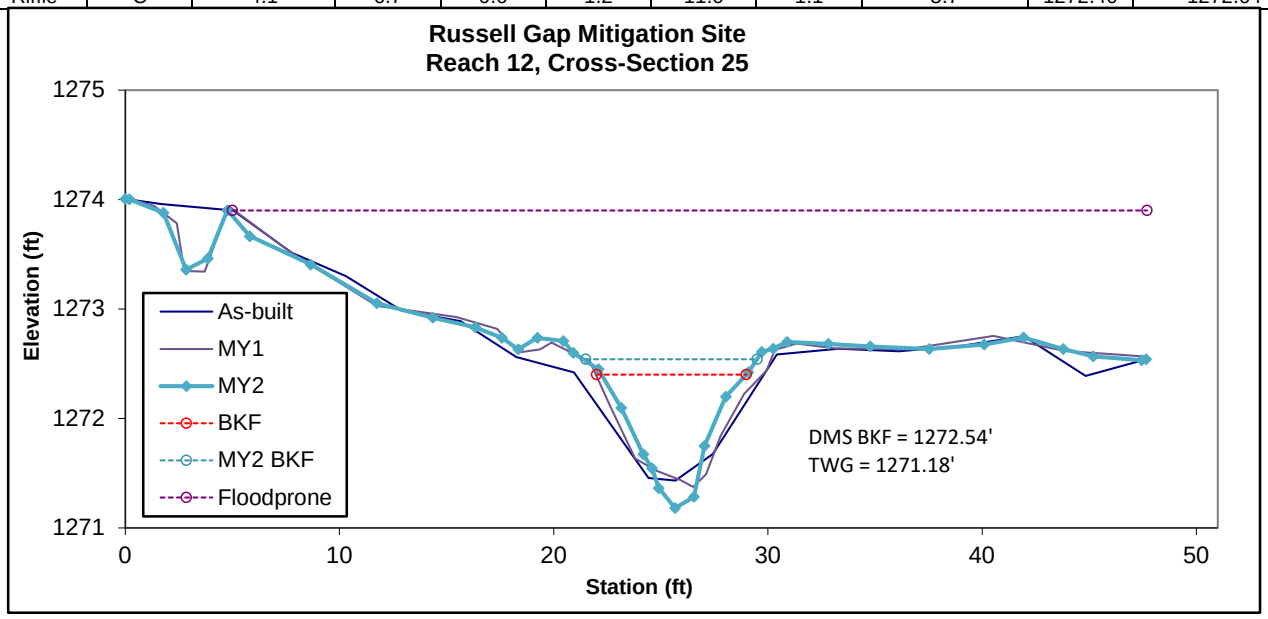
Permanent Cross-Section 25

Year 2 Survey Collected: September 2021

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	4.1	6.7	0.6	1.2	11.0	1.1	5.7	1272.40	1272.64



Note: Per DMS/IRT request, bank height ratio for MY2 has been calculated using the bankfull elevation of 1272.54 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

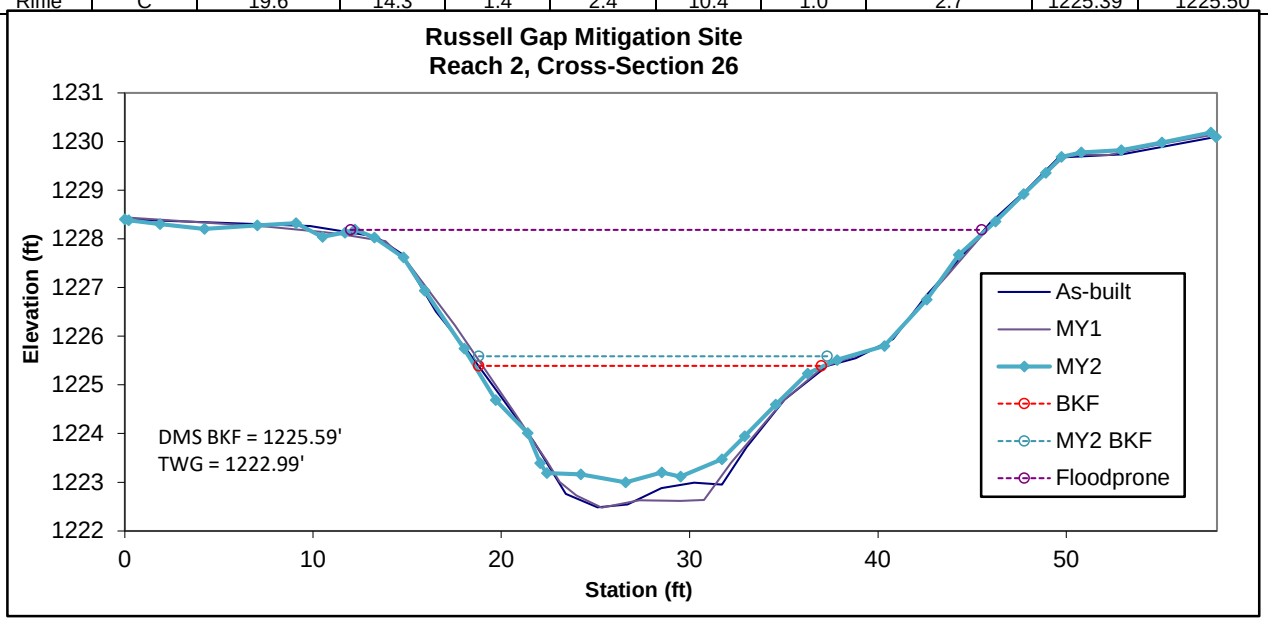
Permanent Cross-Section 26

Year 2 Survey Collected: October 2021

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	19.6	14.3	1.4	2.4	10.4	1.0	2.7	1225.39	1225.50



Note: Per DMS/IRT request, bank height ratio for MY2 has been calculated using the bankfull elevation of 1225.59 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)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	----	----	----
Pattern																
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
Profile																
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
Substrate and Transport Parameters	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	----	----	----
SC% / Sa% / G% / C% / Bo%	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	----	----	----
d16 / d35 / d50 / d84 / d95	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	----	----	----
Additional Reach Parameters																
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			
					Composite											
Dimension and Substrate - Riffle	Min	Mean	Med	Max	Min	Mean	Med	Max	Min	Mean	Med	Max	Min	Mean	Med	Max
BF Width (ft)	-----	15.00	-----	-----	-----	-----	-----	-----	-----	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)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	----	----	----
Pattern																
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	----	----
Profile																
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
Substrate and Transport Parameters	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	----	----	----
SC% / Sa% / G% / C% / Bo%	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	----	----	----
d16 / d35 / d50 / d84 / d95	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	----	----	----
Additional Reach Parameters																
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)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	----	----	----
Pattern																
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	----	----
Profile																
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
Substrate and Transport Parameters	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	----	----	----
SC% / Sa% / G% / C% / Bo%	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	----	----	----
d16 / d35 / d50 / d84 / d95	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	----	----	----
Additional Reach Parameters																
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)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	----	----	----
Pattern	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	----	----	----
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	-----	-----	----	----	----	----
Profile	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	----	----	----
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
Substrate and Transport Parameters	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	----	----	----
SC% / Sa% / G% / C% / Bo%	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	----	----	----
d16 / d35 / d50 / d84 / d95	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	----	----	----
Additional Reach Parameters																
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 Composite				Design				As-built			
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)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	----	----	----
Pattern																
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
Profile																
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
Substrate and Transport Parameters	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	----	----	----
SC% / Sa% / G% / C% / Bo%	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	----	----	----
d16 / d35 / d50 / d84 / d95	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	----	----	----
Additional Reach Parameters																
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 Composite				Design				As-built			
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 (ft²)	-----	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)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	----	----	----
Pattern																
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
Profile																
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
Substrate and Transport Parameters	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	----	----	----
SC% / Sa% / G% / C% / Bo%	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	----	----	----
d16 / d35 / d50 / d84 / d95	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	----	----	----
Additional Reach Parameters																
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 Composite				Design				As-built			
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 (ft²)	-----	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	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	----	----	----
Pattern																
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
Profile																
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	-----	-----	----	----	----	----
Substrate and Transport Parameters	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	----	----	----
SC% / Sa% / G% / C% / Bo%	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	----	----	----
d16 / d35 / d50 / d84 / d95	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	----	----	----
Additional Reach Parameters																
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 Composite				Design				As-built			
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 (ft²)	-----	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)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	----	----	----
Pattern																
*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
Profile																
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
Substrate and Transport Parameters	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	----	----	----
SC% / Sa% / G% / C% / B%	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	----	----	----
d16 / d35 / d50 / d84 / d95	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	----	----	----
Additional Reach Parameters																
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 Composite				Design Values Upper				As-built			
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)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	----	----	----
Pattern																
*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
Profile																
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
Substrate and Transport Parameters	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	----	----	----
SC% / Sa% / G% / C% / B%	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	----	----	----
d16 / d35 / d50 / d84 / d95	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	----	----	----
Additional Reach Parameters																
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)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	----	----	----
Pattern																
*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	-----	-----	----	----	----	----
Profile																
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
Substrate and Transport Parameters	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	----	----	----
SC% / Sa% / G% / C% / B%	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	----	----	----
d16 / d35 / d50 / d84 / d95	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	----	----	----
Additional Reach Parameters																
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 Composite				Design				As-built			
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 (ft²)	-----	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)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	----	----	----
Pattern																
*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	-----	-----	----	----	----	----
Profile																
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
Substrate and Transport Parameters	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	----	----	----
SC% / Sa% / G% / C% / B%	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	----	----	----
d16 / d35 / d50 / d84 / d95	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	----	----	----
Additional Reach Parameters																
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																												
	Cross-section X-1 (Riffle)							Cross-section X-2 (Pool)							Cross-section X-3 (Riffle)							Cross-section X-4 (Pool)						
Dimension and substrate	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)	16.2	15.8	14.5					24.6	18.6	16.1					16.1	16.3	17.4					22.9	16.6	14.1				
BF Mean Depth (ft)	1.2	1.2	1.9					1.0	1.3	1.4					1.3	1.3	1.3					1.2	1.5	2.4				
Width/Depth Ratio	13.9	13.6	12.0					24.1	14.7	11.5					12.5	12.9	13.7					18.9	11.3	5.8				
BF Cross-sectional Area (ft²)	18.8	18.4	17.6					25.1	23.6	22.6					20.6	20.6	22.2					27.7	24.4	34.1				
BF Max Depth (ft)	1.6	1.7	2.0					1.7	2.3	2.0					1.8	2.0	2.4					2.4	2.7	3.9				
Width of Floodprone Area (ft)	75.3	75.3	75.3					75.3	75.3	75.3					82.4	82.4	82.4					82.2	82.2	82.2				
Entrenchment Ratio	4.7	4.8	5.2					3.1	4.0	4.7					5.1	5.0	4.7					3.6	5.0	5.8				
Bank Height Ratio	1.0	1.1	1.1					0.9	1.0	1.1					1.0	1.0	1.0					1.1	1.1	0.7				
Wetted Perimeter (ft)	16.7	16.4	15.4					25.3	20.0	17.2					16.8	17.2	18.7					23.5	17.7	17.2				
Hydraulic Radius (ft)	1.1	1.1	1.1					1.0	1.2	1.3					1.2	1.2	1.2					1.2	1.4	2.0				
d50 (mm)																													

Stream Reach	Reach 3							Reach 4																					
	Cross-section X-5 (Riffle)							Cross-section X-6 (Riffle)							Cross-section X-7 (Riffle)							Cross-section X-8 (Riffle)						
Dimension and substrate	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)	23.8	23.7	19.6					13.9	13.5	13.7					14.3	14.4	14.9					15.1	14.6	13.8				
BF Mean Depth (ft)	1.7	2.7	1.9					1.7	1.7	1.8					1.6	1.6	1.7					1.5	1.5	1.5				
Width/Depth Ratio	13.8	13.8	10.1					8.4	7.8	7.4					9.0	9.1	8.8					10.3	9.9	9.4				
BF Cross-sectional Area (ft²)	40.9	40.6	38.1					23.1	23.3	25.3					22.9	22.8	25.4					22.1	21.4	20.5				
BF Max Depth (ft)	2.7	2.7	2.7					2.8	2.8	3.0					2.3	2.5	2.6					3.0	2.8	2.8				
Width of Floodprone Area (ft)	46.5	47.5	59.3					24.0	23.4	21.8					31.7	30.3	30.3					34.3	33.2	31.5				
Entrenchment Ratio	2.0	2.5	3.0					1.7	1.6	1.6					2.2	2.1	2.0					2.3	2.2	2.3				
Bank Height Ratio	1.0	0.9	1.1					1.0	0.8	1.0					1.0	1.3	1.0					1.0	1.0	1.0				
Wetted Perimeter (ft)	25.1	25.3	21.6					15.5	15.1	15.8					15.7	16.1	0.9					16.4	16.3	1.0				
Hydraulic Radius (ft)	1.6	1.6	1.8					1.5	1.5	1.6					1.5	1.4	1.5					1.4	1.3	1.3				
d50 (mm)																													

Stream Reach	Reach 4																					Reach 6							
	Cross-section X-9 (Riffle)							Cross-section X-10 (Riffle)							Cross-section X-11 (Riffle)							Cross-section X-12 (Pool)						
Dimension and substrate	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)	16.2	15.2	13.8					22.6	21.3	12.2					13.3	10.3	9.9					13.8	9.2	11.0				
BF Mean Depth (ft)	1.7	1.3	1.3					0.9	0.9	1.7					1.2	1.3	9.9					0.8	0.9	0.8				
Width/Depth Ratio	9.7	11.4	10.7					26.1	23.4	7.3					11.4	7.9	7.6					16.3	10.8	15.6				
BF Cross-sectional Area (ft²)	27.2	20.5	17.9					19.6	19.4	20.2					15.5	13.6	12.9					11.6	7.9	11.0				
BF Max Depth (ft)	2.7	2.4	1.9					2.2	2.3	2.5					2.0	2.1	2.0					1.8	1.9	2.0				
Width of Floodprone Area (ft)	38.0	38.0	38.0					32.0	31.5	31.5					25.9	23.3	23.3					56.8	56.8	56.8				
Entrenchment Ratio	2.3	2.5	2.8					1.4	1.5	2.6					1.9	2.3	2.4					5.7	6.1	4.3				
Bank Height Ratio	1.0	0.9	0.9					1.0	1.0	1.0					1.0	1.1	1.1					1.0	1.0	0.9				
Wetted Perimeter (ft)	17.4	16.6	14.9					23.7	22.5	14.2					14.3	11.4	11.2					10.8	9.9	14.2				
Hydraulic Radius (ft)	1.6	1.2	1.2					0.8	0.9	1.4					1.1	1.2	1.2					1.1	0.8	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						
	Cross-section X-13 (Riffle)							Cross-section X-14 (Riffle)							Cross-section X-15 (Pool)							Cross-section X-16 (Pool)						
Dimension and substrate	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	7.5					11.0	11.7	11.5					14.0	14.3	14.6					12.9	9.0	11.4				
BF Mean Depth (ft)	0.8	0.9	1.2					1.3	1.3	1.4					1.0	0.9	0.9					1.0	0.8	1.0				
Width/Depth Ratio	10.9	9.4	6.4					8.4	9.3	8.0					14.4	15.5	15.8					12.4	11.4	11.2				
BF Cross-sectional Area (ft²)	7.2	7.1	8.8					14.4	14.6	16.4					13.6	13.2	13.4					13.5	7.1	11.5				
BF Max Depth (ft)	1.3	1.5	1.7					2.0	2.2	2.4					1.6	1.7	2.0					1.9	1.8	1.8				
Width of Floodprone Area (ft)	45.0	45.0	45.0					45.9	45.9	45.9					27.3	27.3	27.3					80.4	80.4	80.4				
Entrenchment Ratio	5.1	5.5	6.0					4.2	3.9	4.0					1.9	1.9	1.9					6.2	8.9	7.1				
Bank Height Ratio	1.0	1.0	1.1					1.0	1.1	1.1					2.4	2.4	0.9					1.0	1.0	1.1				
Wetted Perimeter (ft)	9.4	8.9	8.8					12.0	12.6	12.9					14.5	14.8	15.3					13.8	9.8	12.2				
Hydraulic Radius (ft)	0.8	0.8	1.0					1.2	1.2	1.3					0.9	0.9	0.9					1.0	0.7	0.9				
d50 (mm)																												

Stream Reach	Reach 9							Reach 11																		
	Cross-section X-17 (Riffle)							Cross-section X-18 (Riffle)							Cross-section X-19 (Riffle)							Cross-section X-20 (Riffle)						
Dimension and substrate	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	12.9					8.9	7.1	6.8					4.5	3.8	4.4					3.7	3.3	3.1				
BF Mean Depth (ft)	1.0	1.0	1.1					1.1	0.7	0.7					0.5	0.4	0.4					0.5	0.3	0.2				
Width/Depth Ratio	12.2	11.9	11.7					8.4	9.8	10.2					9.1	9.7	10.9					6.8	11.0	16.3				
BF Cross-sectional Area (ft²)	11.9	12.4	14.3					9.5	5.2	4.5					2.2	1.5	1.8					2.0	1.0	0.6				
BF Max Depth (ft)	1.4	1.6	2.1					1.9	1.4	1.1					0.8	0.7	0.6					1.0	0.5	0.3				
Width of Floodprone Area (ft)	18.7	78.1	78.1					18.6	14.7	14.7					11.1	11.1	11.1					32.0	32.0	32.0				
Entrenchment Ratio	1.6	6.4	6.0					2.1	2.1	2.2					2.5	2.9	2.5					8.7	9.6	10.3				
Bank Height Ratio	1.0	1.0	1.1					2.9	1.2	1.0					1.0	1.1	1.0					1.0	1.0	1.0				
Wetted Perimeter (ft)	12.6	12.7	13.8					9.8	7.7	7.2					4.8	4.1	4.8					4.2	3.5	3.2				
Hydraulic Radius (ft)	0.9	1.0	1.0					1.0	0.7	0.6					0.5	0.4	0.4					0.5	0.3	0.2				
d50 (mm)																												

Stream Reach	Reach 19							Reach 20							Reach 25							Reach 10b						
	Cross-section X-21 (Riffle)							Cross-section X-22 (Riffle)							Cross-section X-23 (Riffle)							Cross-section X-24 (Riffle)						
Dimension and substrate	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	8.6					3.8	4.5	4.7					5.1	4.7	4.2					6.2	5.5	5.7				
BF Mean Depth (ft)	0.9	0.8	0.8					0.5	0.4	0.4					0.6	0.6	0.5					0.6	0.5	0.6				
Width/Depth Ratio	10.2	11.1	11.4					7.0	10.2	12.8					8.1	8.2	8.9					11.0	10.1	10.0				
BF Cross-sectional Area (ft²)	7.6	6.6	6.5					2.0	1.9	1.7					3.2	2.7	2.0					3.5	3.0	3.2				
BF Max Depth (ft)	1.5	1.5	1.6					0.8	0.7	0.7					1.0	0.9	0.7					1.0	1.0	1.1				
Width of Floodprone Area (ft)	26.3	26.3	26.3					12.4	12.4	12.4					8.1	8.1	8.1					45.5	45.5	45.5				
Entrenchment Ratio	3.0	3.1	3.0					3.3	2.8	2.9					1.6	1.7	1.9					7.3	8.2	8.0				
Bank Height Ratio	1.0	1.1	1.0					1.0	1.0	0.9					1.0	0.9	1.0					1.0	1.0	1.0				
Wetted Perimeter (ft)	9.4	9.1	9.4					4.3	4.7	5.0					5.7	5.2	4.6					6.6	5.9	6.2				
Hydraulic Radius (ft)	0.8	0.7	0.7					0.5	0.4	0.3					0.6	0.5	0.4					0.5	0.5	0.5				
d50 (mm)																												

Stream Reach	Reach 12							Reach 2						
	Cross-section X-25 (Riffle)							Cross-section X-26 (Riffle)						
Dimension and substrate	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	6.7					18.5	13.4	14.3				
BF Mean Depth (ft)	0.6	0.6	0.6					1.8	2.2	1.4				
Width/Depth Ratio	16.2	12.8	11.0					10.2	6.1	10.4				
BF Cross-sectional Area (ft²)	5.2	4.7	4.1					33.6	29.4	19.6				
BF Max Depth (ft)	1.0	1.0	1.2					2.9	2.9	2.4				
Width of Floodprone Area (ft)	38.2	38.2	38.2					38.0	38.1	38.1				
Entrenchment Ratio	4.2	4.9	5.7					2.1	2.8	2.7				
Bank Height Ratio	1.0	0.9	1.1					1.0	0.9	1.0				
Wetted Perimeter (ft)	9.4	8.1	7.3					19.4	14.3	15.3				
Hydraulic Radius (ft)	0.5	0.6	0.6					1.7	2.1	1.3				
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
Year 1 Monitoring (2020)						
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
Year 2 Monitoring (2021)						
6/14/2021			7.5 inches and 20.5 inches		3/25/2021 and 5/3/2021	Manual cork measurement
10/19/2021	1.1 ft.				10/7/2021	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

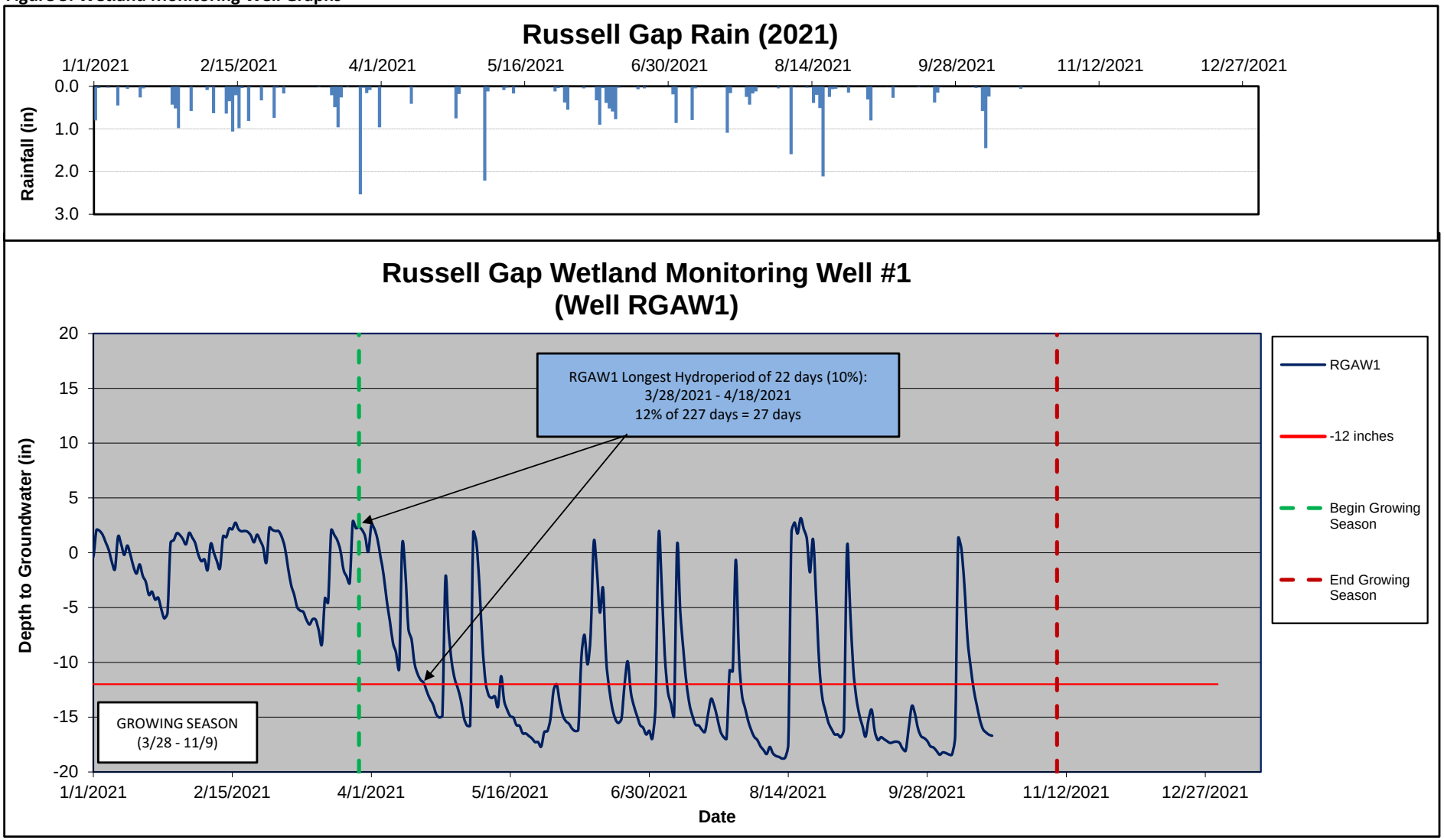


Figure 5. Wetland Monitoring Well Graphs

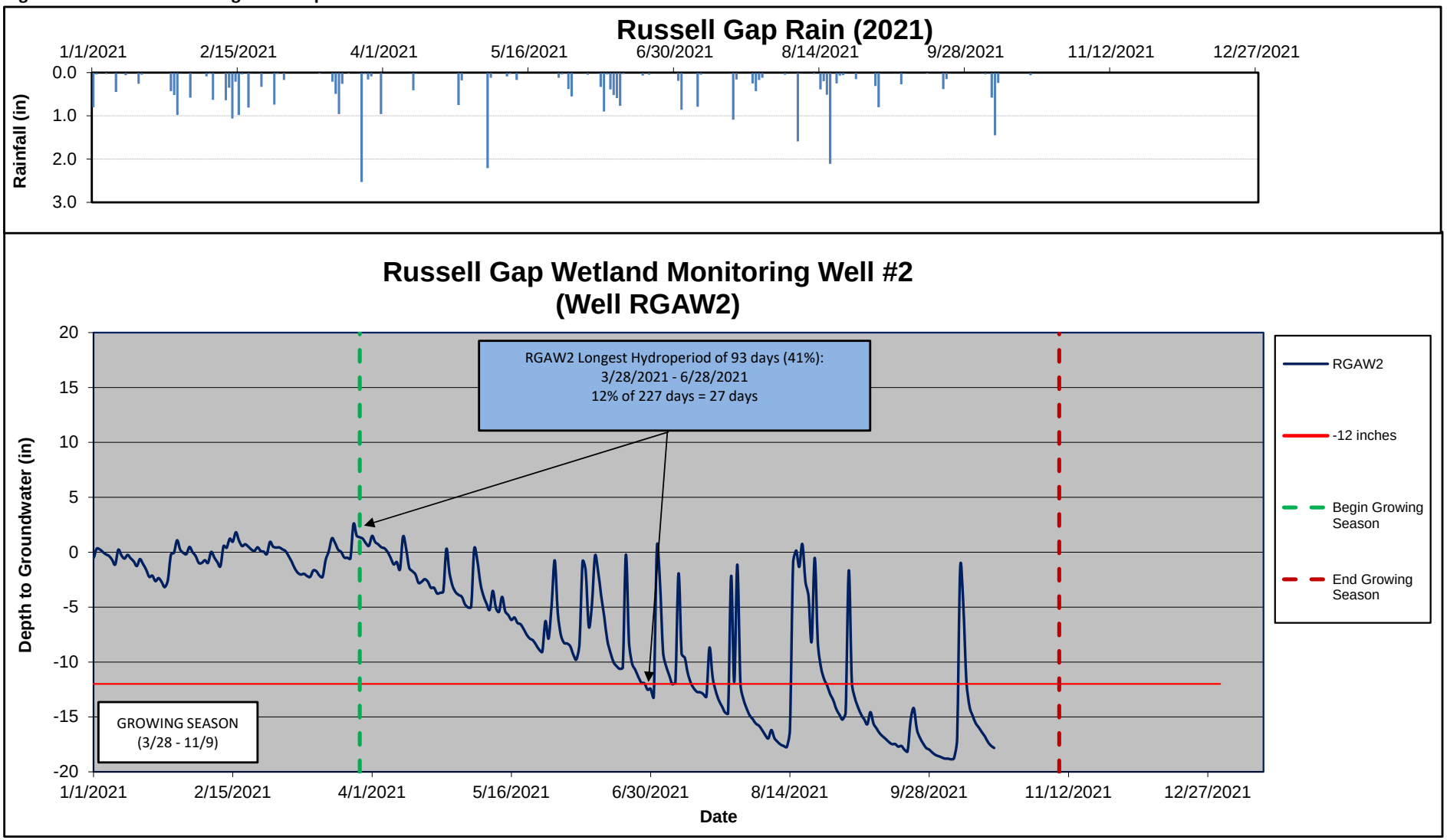


Figure 5. Wetland Monitoring Well Graphs

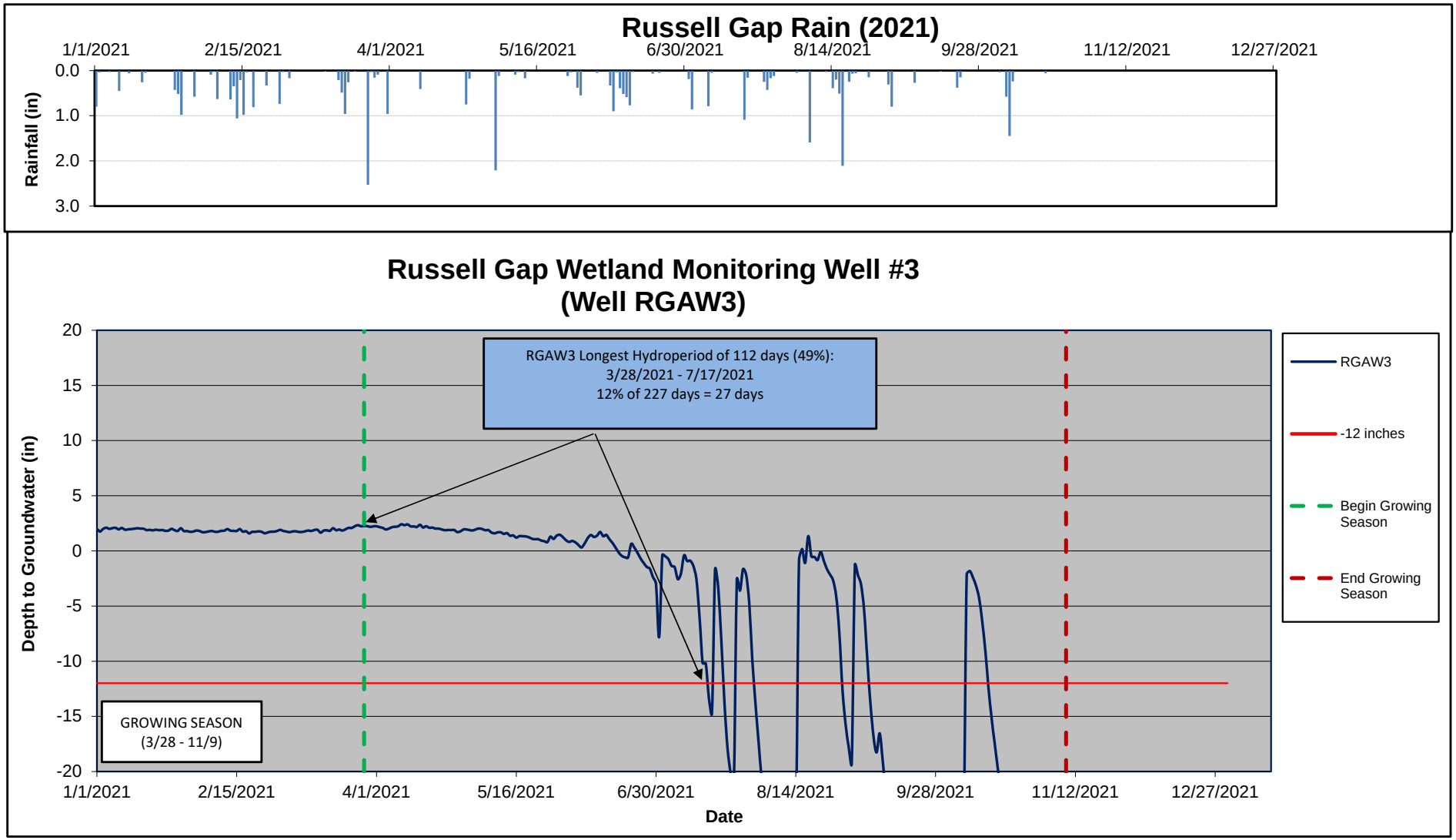


Figure 5. Wetland Monitoring Well Graphs

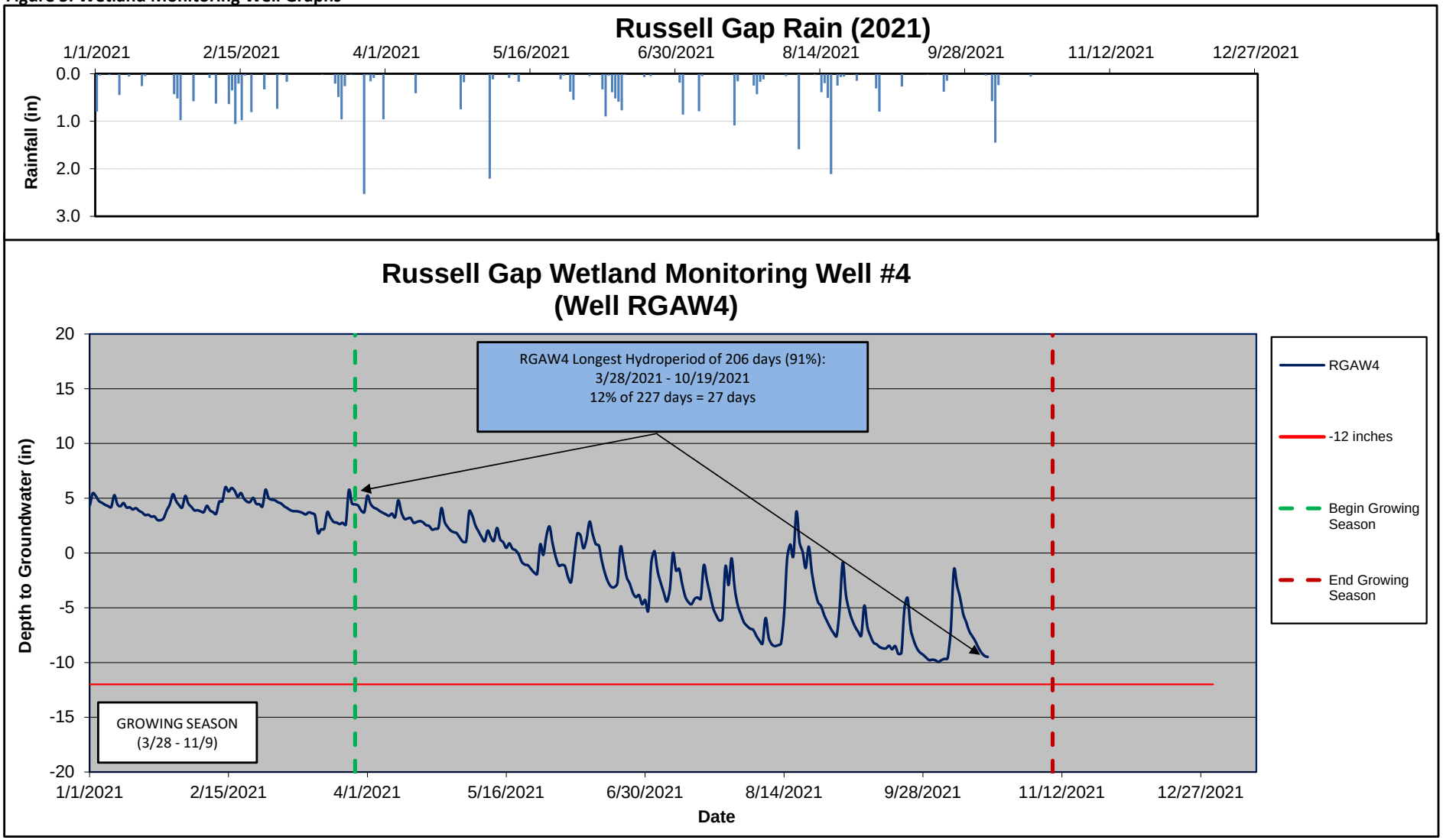


Figure 5. Wetland Monitoring Well Graphs

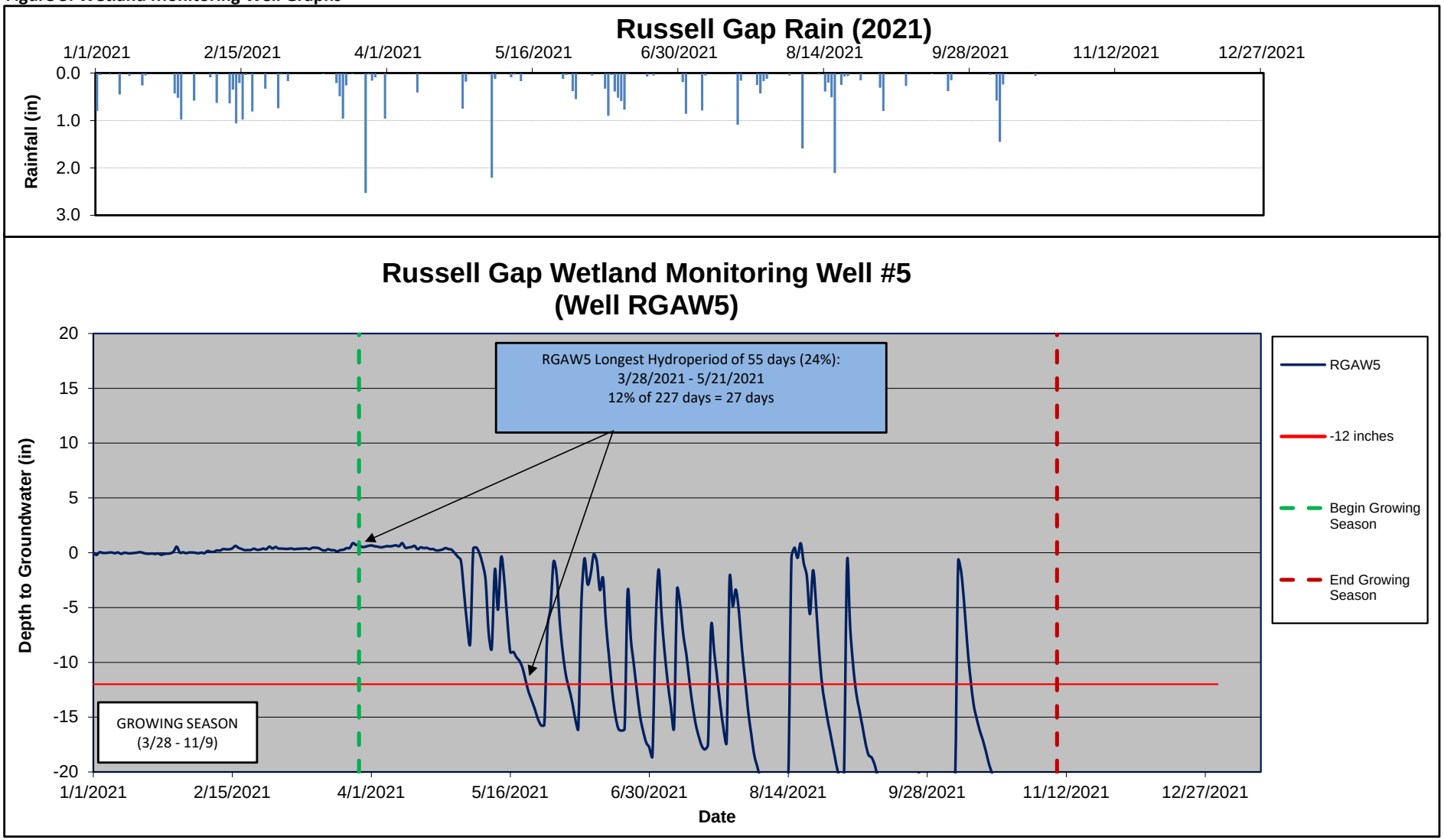


Figure 5. Wetland Monitoring Well Graphs

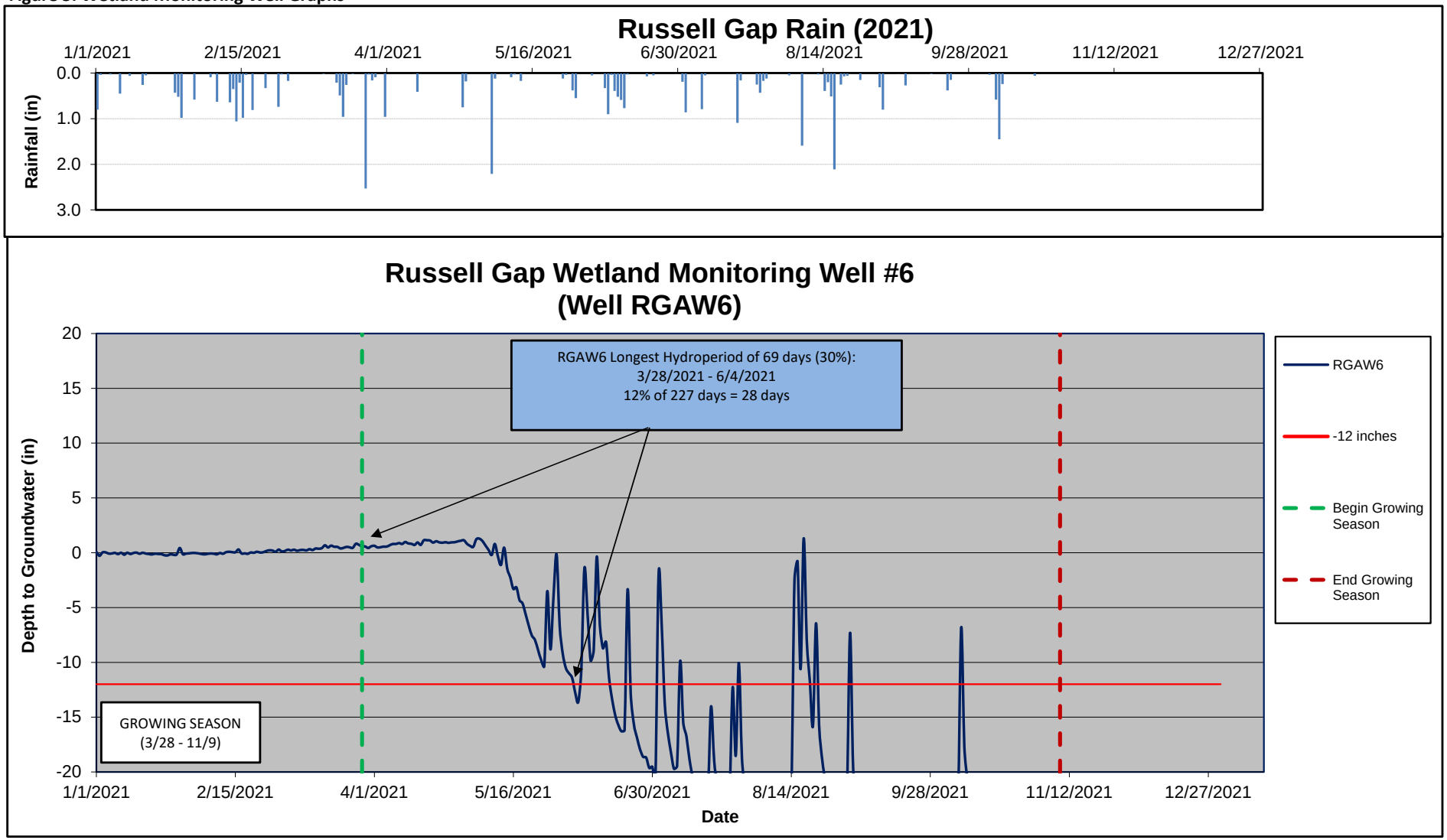


Figure 5. Wetland Monitoring Well Graphs

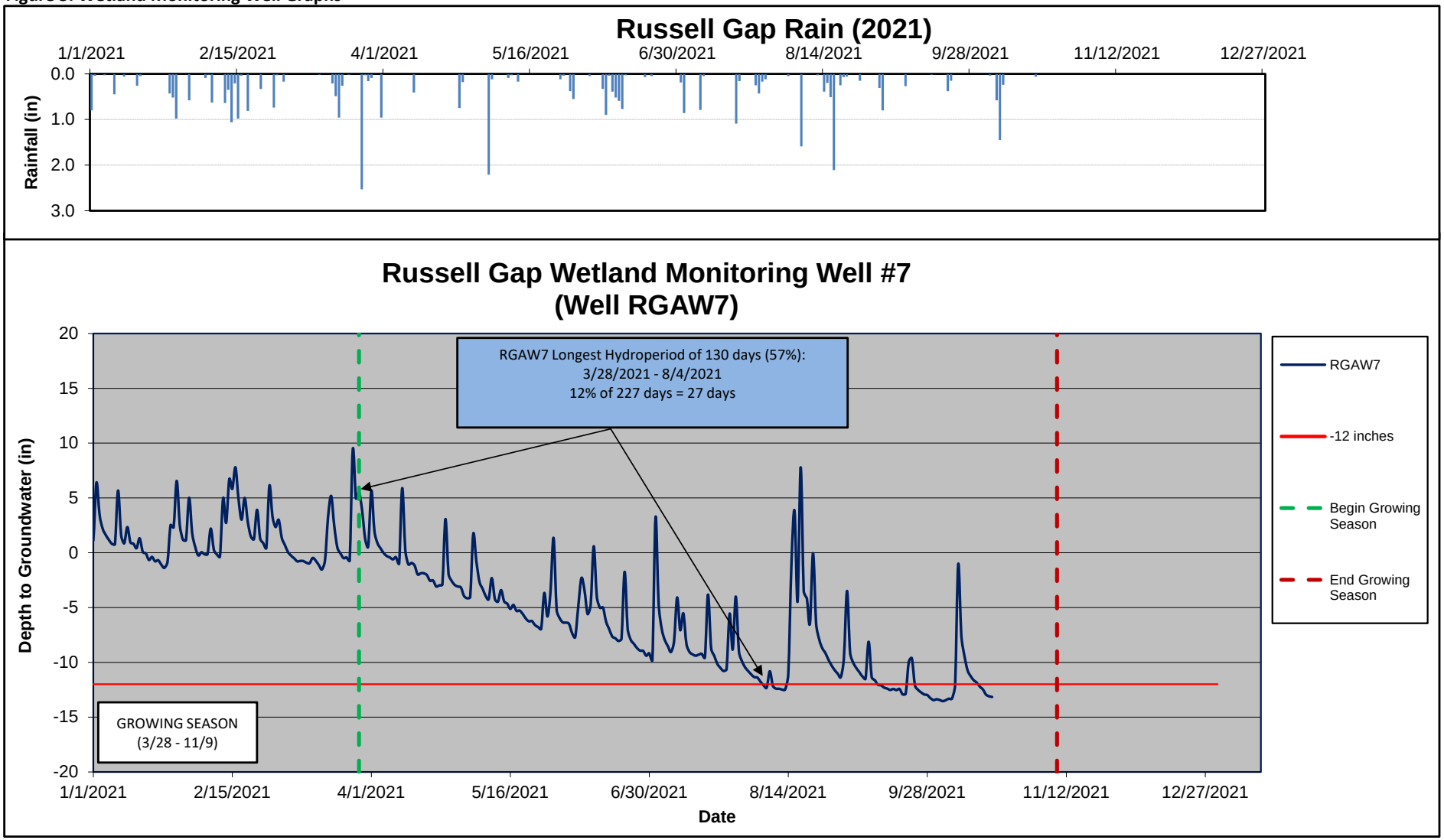


Figure 5. Wetland Monitoring Well Graphs

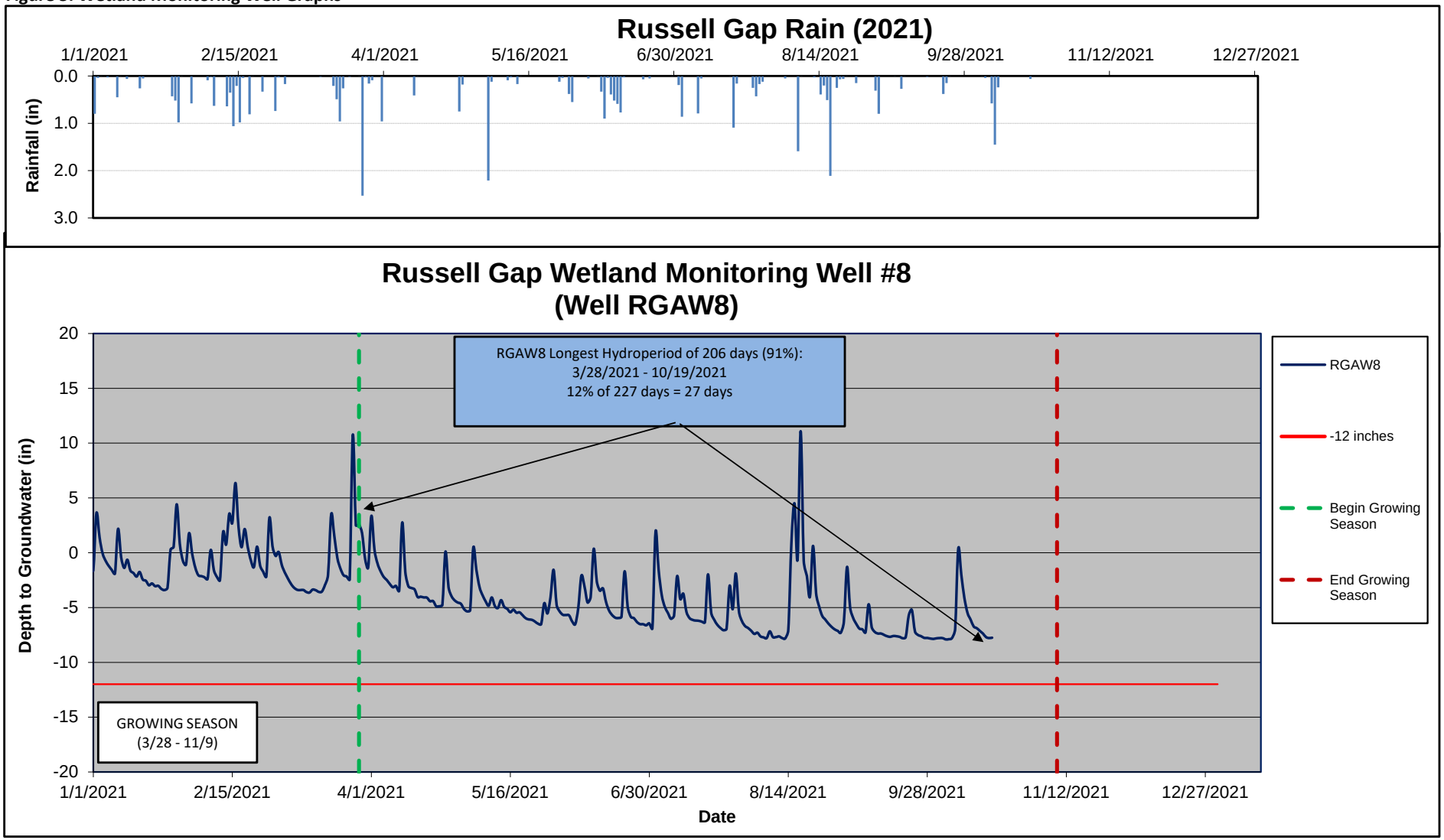


Figure 5. Wetland Monitoring Well Graphs

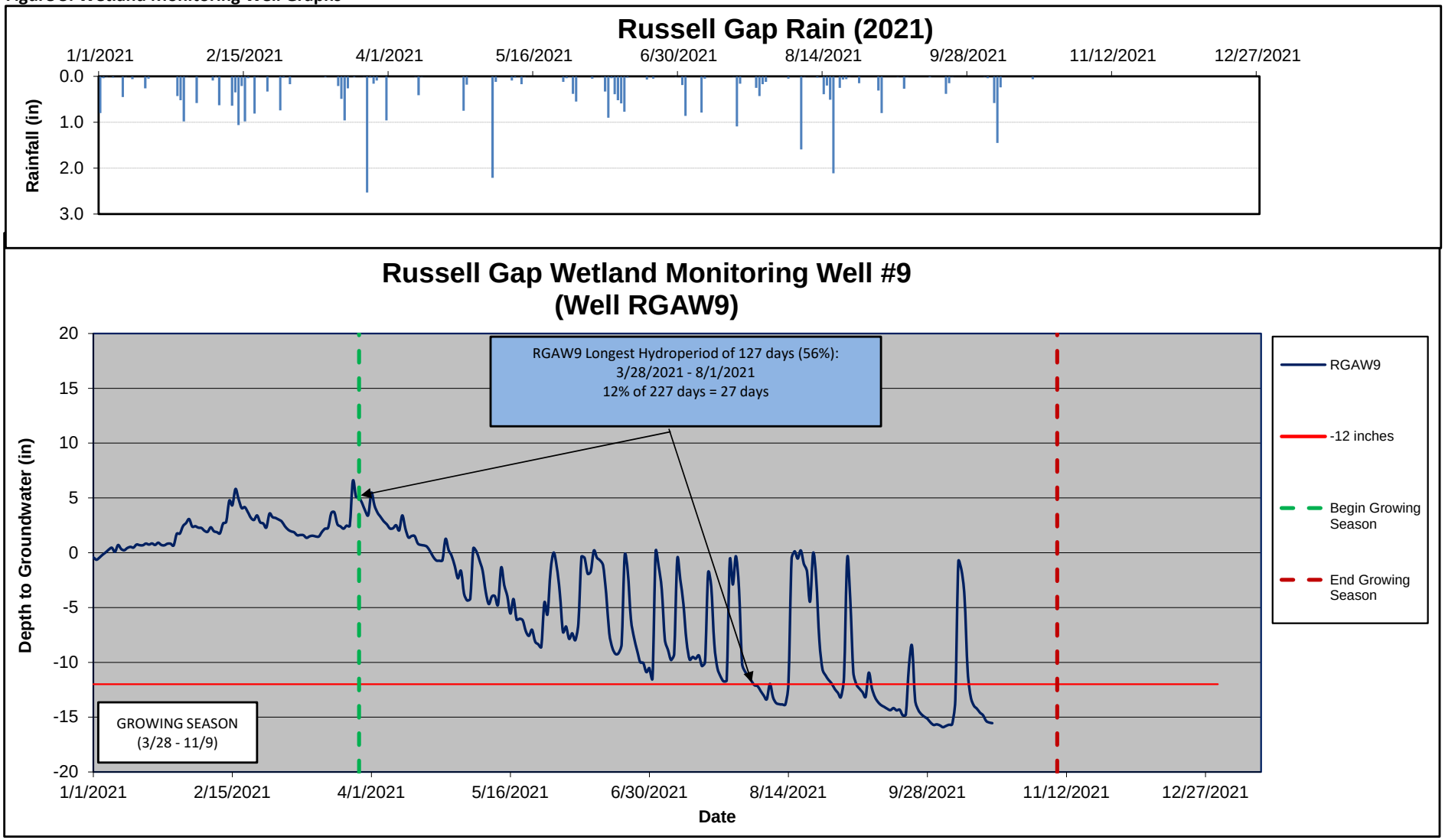


Figure 5. Wetland Monitoring Well Graphs

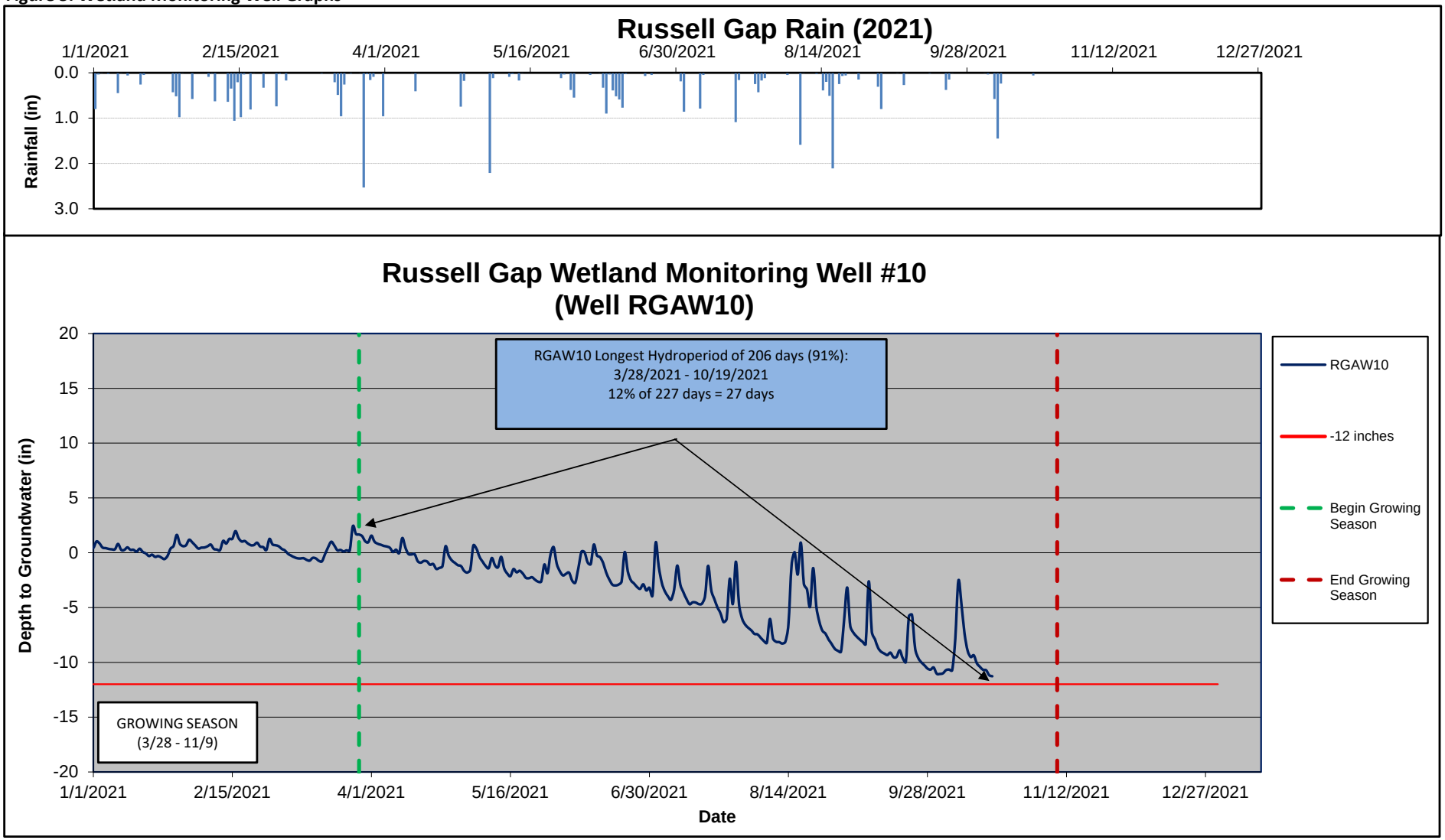


Figure 5. Wetland Monitoring Well Graphs

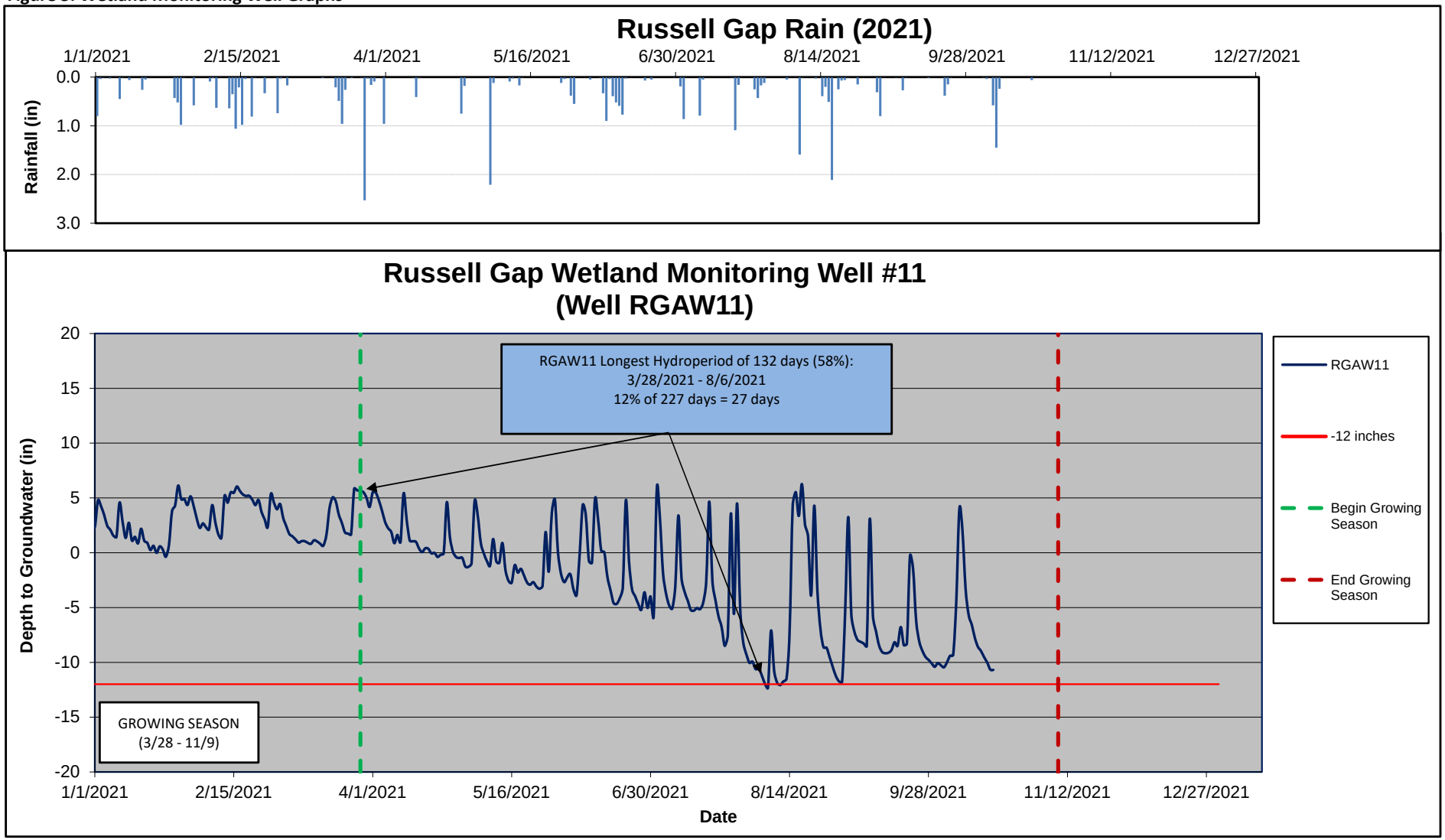


Figure 5. Wetland Monitoring Well Graphs

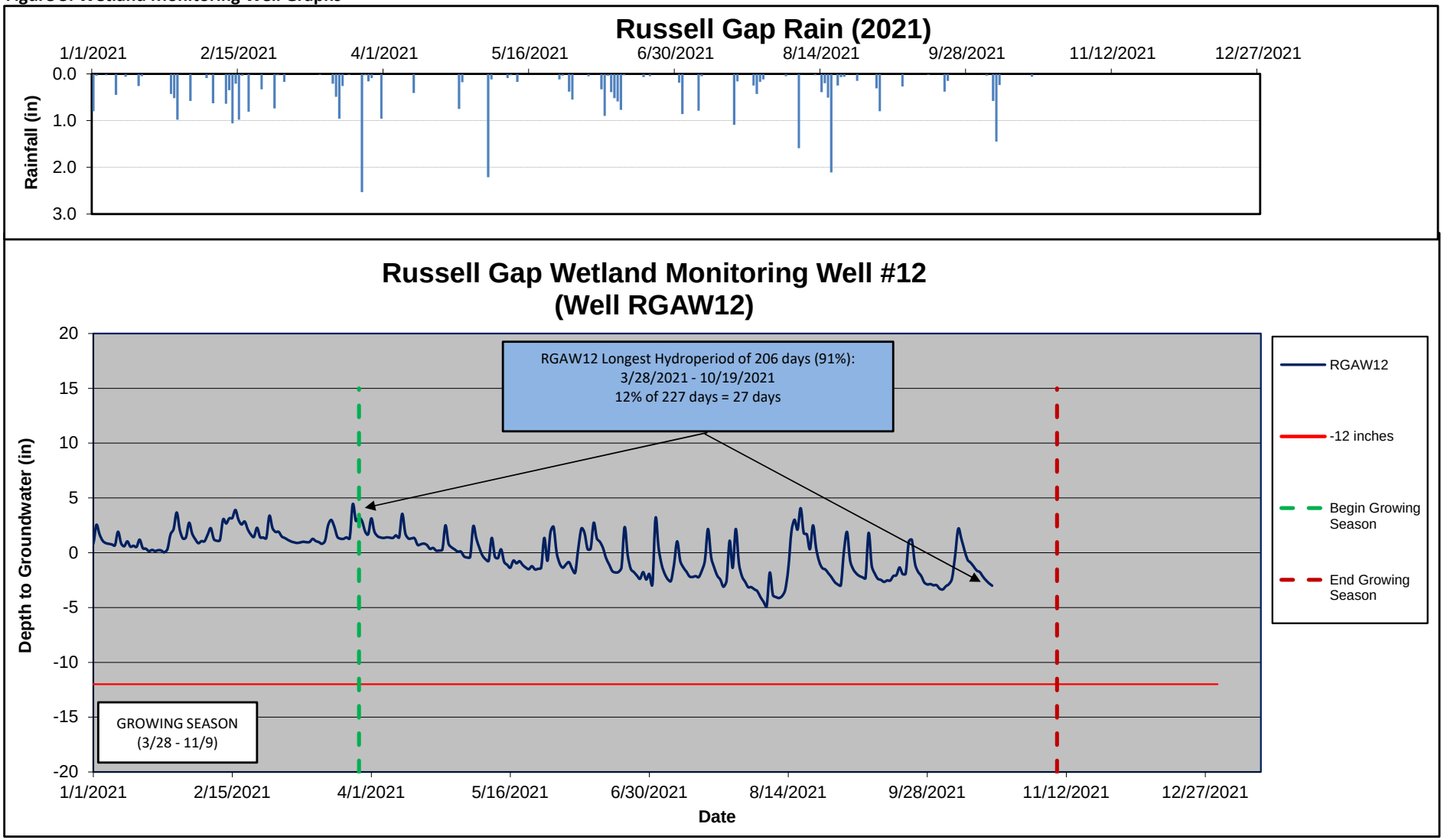
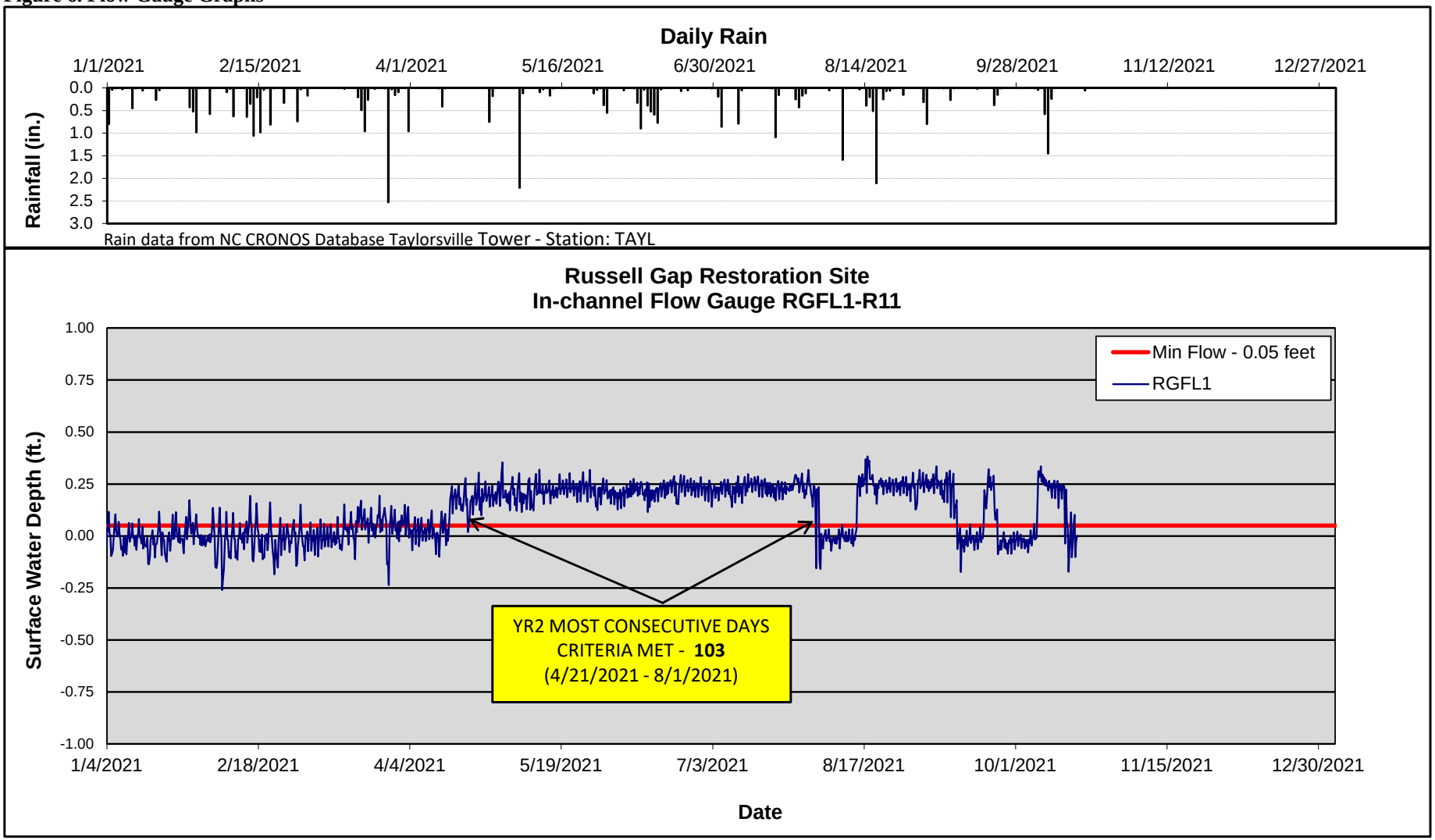


Table 11. Wetland Hydrology Summary Data
Russell Gap Stream Mitigation Project - NCDMS Project No. 100003

Well ID	Percentage of Consecutive Days <12 inches from Ground Surface[1]							Most Consecutive Days Meeting Criteria[2]							Percentage of Cumulative Days <12 inches from Ground Surface							Cumulative Days Meeting Criteria[3]						
	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)
Wetland Monitoring Wells (Installed March 2020)																												
RGAW1	16.0	10.0						59	22.0						66.4	31.0						150	71.0					
RGAW2	100.0	41.0						226	93.0						100.0	55.0						226	124.0					
RGAW3	100.0	49.0						226	112.0						100.0	64.0						226	145.0					
RGAW4	100.0	91.0						226	206.0						100.0	91.0						226	205.0					
RGAW5	38.0	24.0						87	55.0						92.0	49.0						208	111.0					
RGAW6	54.8	30.0						124	69.0						100.0	41.0						226	92.0					
RGAW7	100.0	57.0						226	130.0						100.0	75.0						226	169.0					
RGAW8	76.5	91.0						173	206.0						91.6	91.0						207	205.0					
RGAW9	100.0	56.0						226	127.0						100.0	68.0						226	154.0					
RGAW10	100.0	91.0						226	206.0						100.0	91.0						226	205.0					
RGAW11	100.0	58.0						226	132.0						100.0	90.0						226	203.0					
RGAW12	100.0	91.0						226	206.0						100.0	91.0						226	205.0					

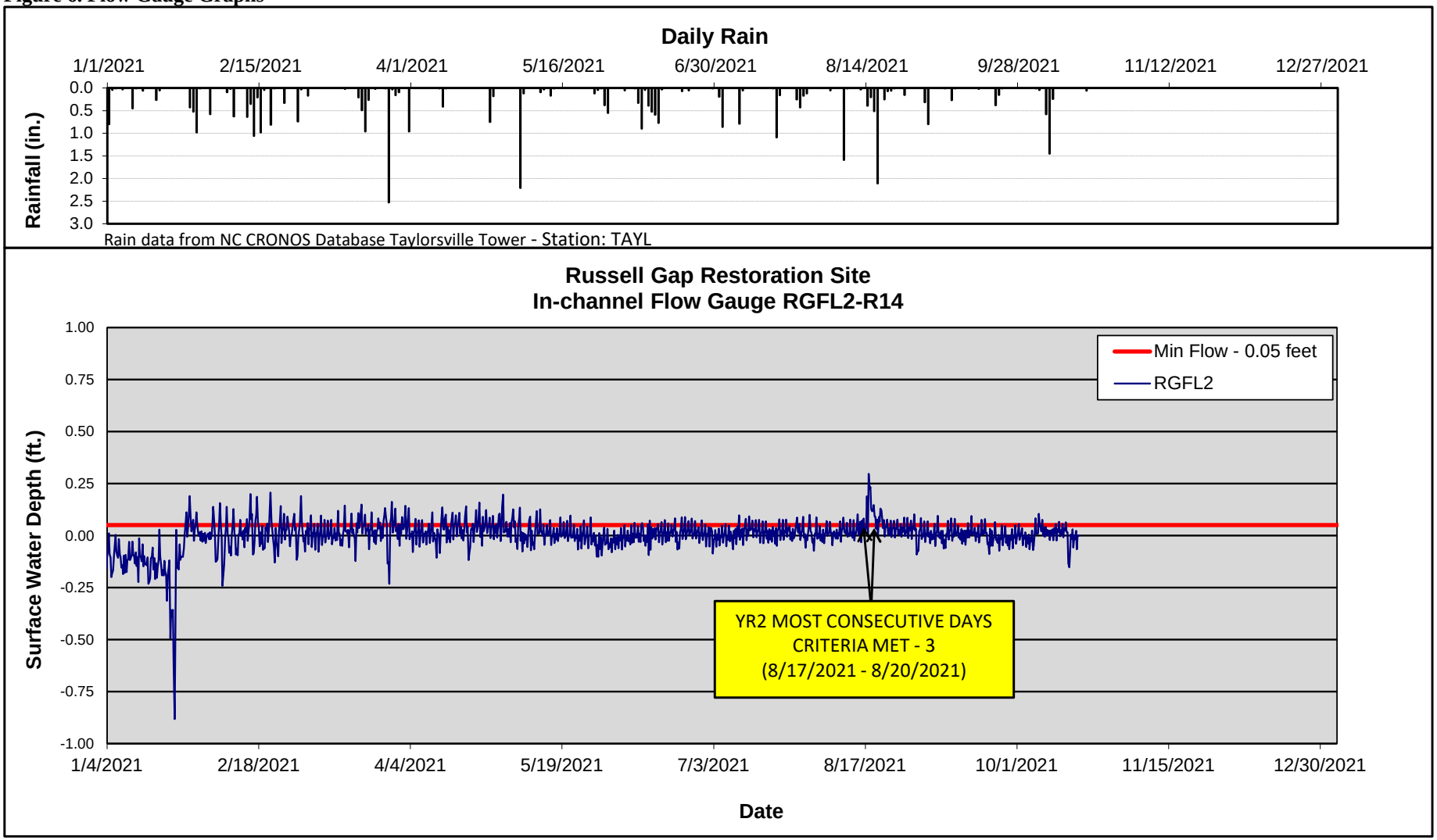
[1]Indicates the percentage of the single greatest consecutive number of days within the monitored growing season with a water table 12 inches or less from the soil surface.
[2]Indicates the single greatest consecutive number of days within the monitored growing season with a water table 12 inches or less from the soil surface.
[3]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 9 and is **227** days long. 12% of the growing season is **27** days.

Figure 6. Flow Gauge Graphs



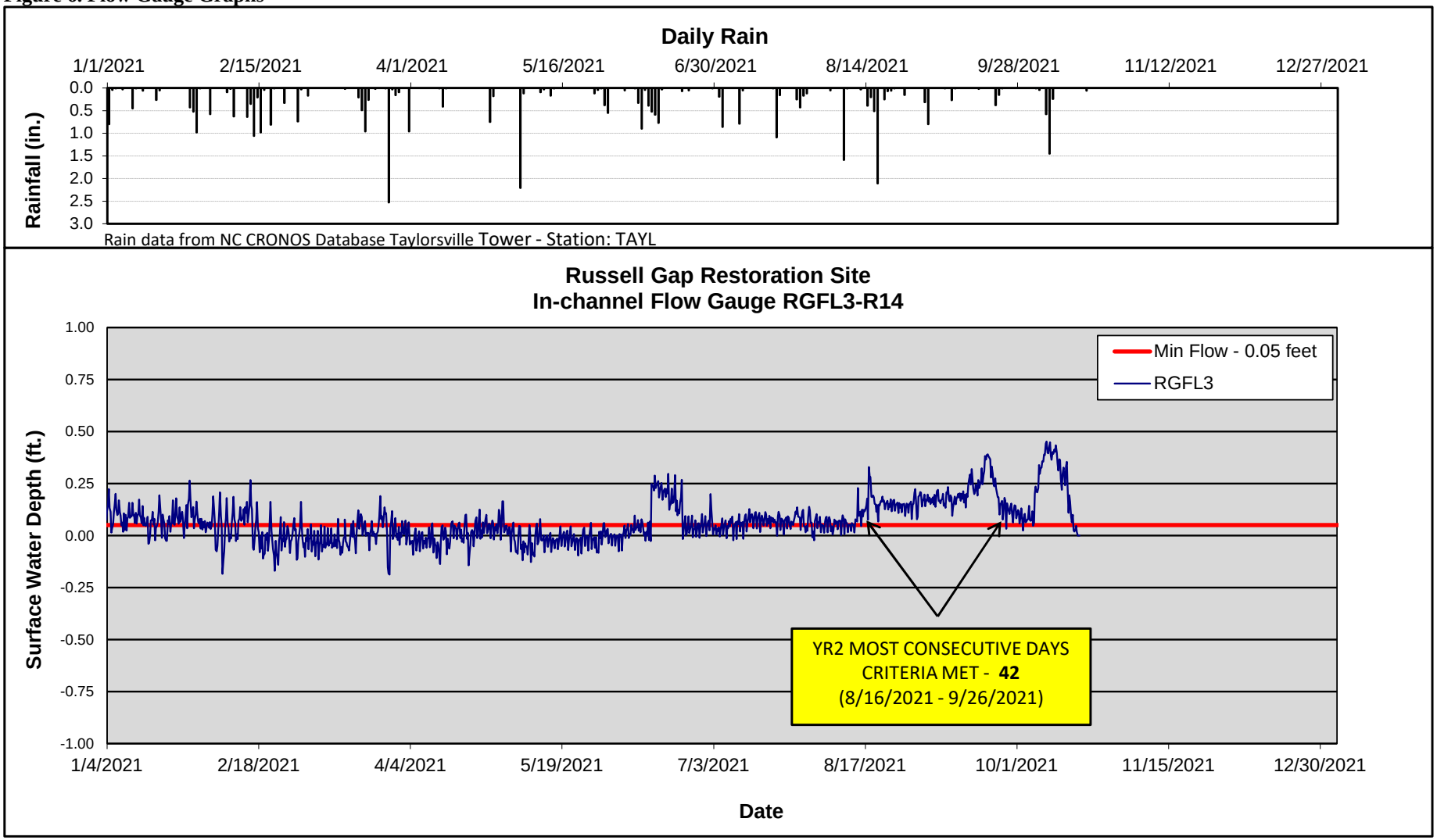
* Surface water flow is estimated to have occurred when the pressure transducer reading is equal to or above 0.05 feet in depth.

Figure 6. Flow Gauge Graphs



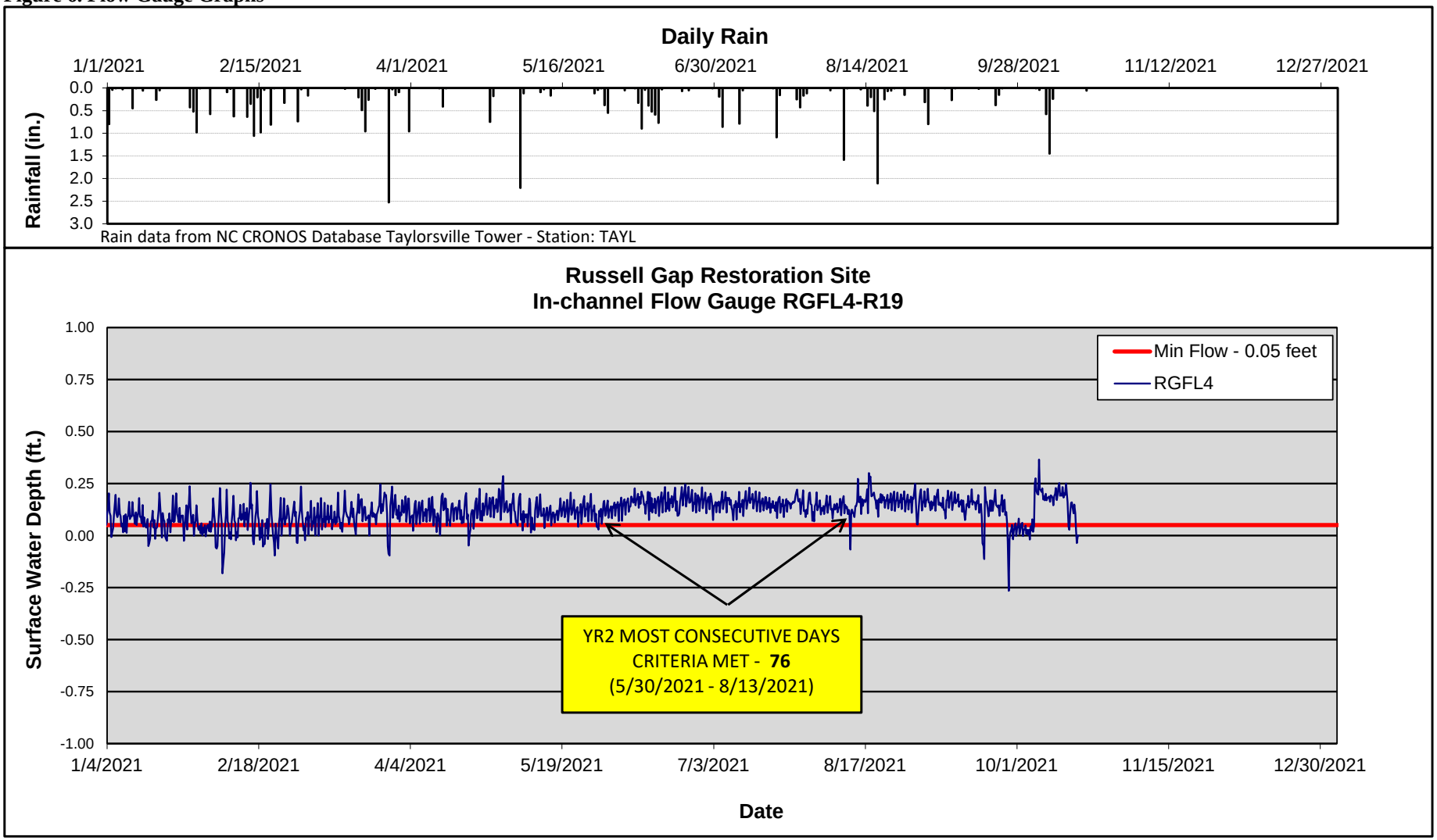
* Surface water flow is estimated to have occurred when the pressure transducer reading is equal to or above 0.05 feet in depth.

Figure 6. Flow Gauge Graphs



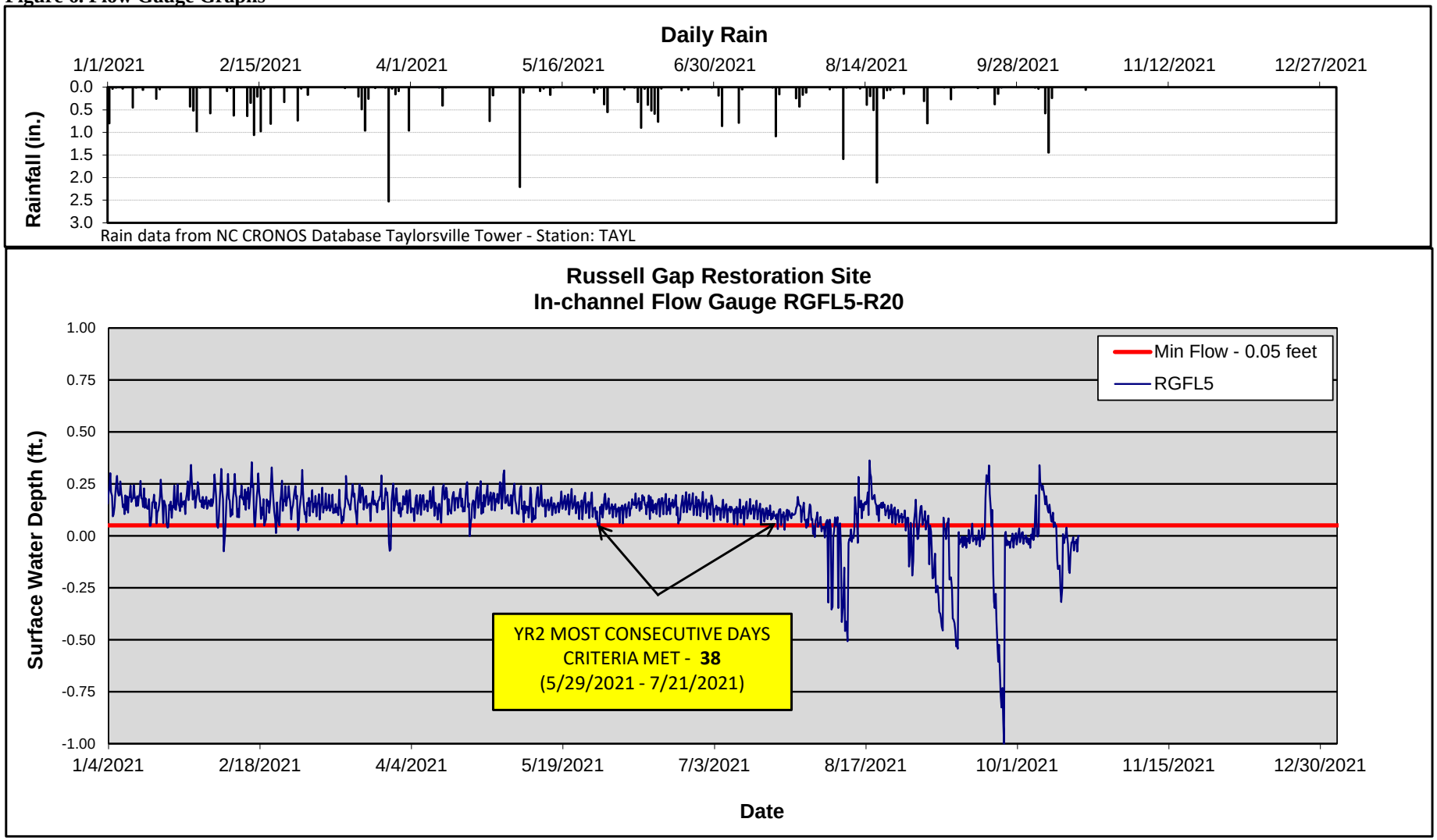
* Surface water flow is estimated to have occurred when the pressure transducer reading is equal to or above 0.05 feet in depth.

Figure 6. Flow Gauge Graphs



* 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.

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[1]							Cumulative Days Meeting Criteria[2]						
	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)
Flow Gauges (Installed March, 2020)														
RGFL1	64.0	103.0						209.0	146.0					
RGFL2	202.0	3.0						222.0	12.0					
RGFL3	232.0	42.0						232.0	93.0					
RGFL4	232.0	76.0						232.0	206.0					
RGFL5	232.0	38.0						232.0	214.0					

Notes:

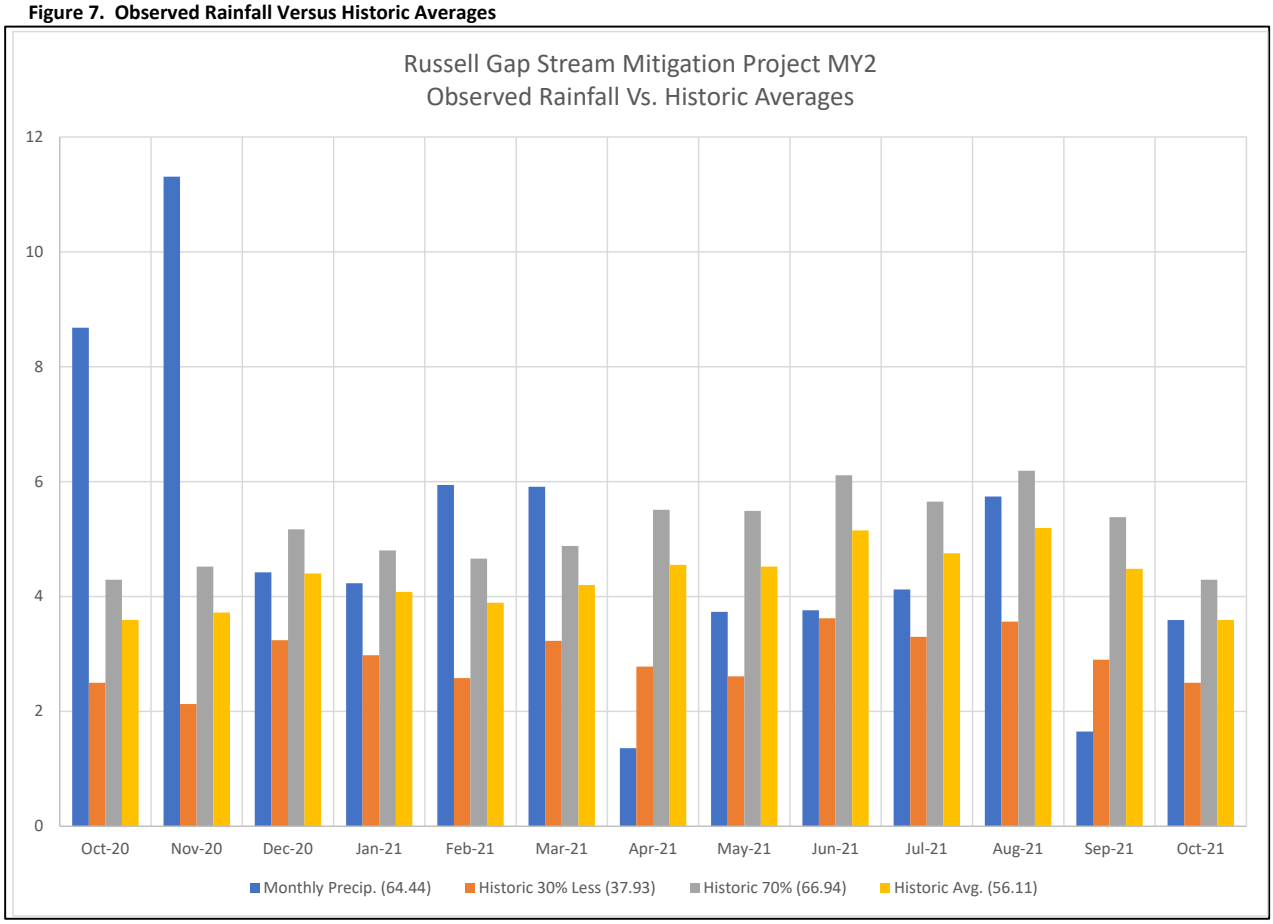
[1]Indicates the number of consecutive days within the monitoring year where flow was measured.

[2]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 56.11 inches, while the observed project rainfall recorded a total of 64.44 inches over the previous 12 months (Oct. 2020 - Oct. 2021). Project rainfall data was collected from the NC-CRONOS station TAYL.

APPENDIX F

IRT Meeting Minutes

Meeting Minutes

Russell Gap Stream Mitigation Project

DMS Project ID. 100003
DWR #20150416
NC DEQ Contract# 6980
USACE Action ID: SAW-2017-00826
Catawba River Basin: 03050101-120010

Date Prepared:	July 1, 2021
Meeting Date, Time, Location:	June 23, 2021, 12:30 PM On-site (Alexander County, NC)
Attendees:	USACE – Todd Tugwell, Kim Browning, Casey Haywood DEQ - Erin Davis DMS – Matthew Reid, Melonie Allen, Paul Wiesner NCWRC – Olivia Munzer Michael Baker International (MBI) – Scott King, Katie McKeithan, Jason York
Subject:	IRT Credit Release Site Visit
Recorded By:	Jason York

An on-site meeting was held on June 23rd, 2021 at 12:30 PM to review the as-built conditions for the Russell Gap stream mitigation project (Full Delivery) in Alexander County, NC. The purpose of the meeting was to inspect the as-built and MY1 (2020) conditions on the site as part of the IRT credit release process. Participants met at the railcar bridge crossing on Reach 1 and then inspected tributaries R11, R13, and R14 (see attached Project Asset Map for reference and reach labels). The channel and wetlands were then inspected on the lower half of R1. The group continued to the southern portion of the project and walked south along the farm road to R17 and walked back downstream in the easement along R6 and R7a. Participants then inspected the culvert at the head of R9 and the lower third of R4 paralleling Mt. Olive Church Rd and observed a structural repair at the confluence of R15 and R4. Next, the group drove up Mt. Olive Church road northeast to R4a and R26 where the lack of a marked easement boundary was discussed. Lastly, participants reviewed the concerns of the IRT and possible strategies to correct for existing and potential issues. Generally, the site is looking good for MY2 and much will be determined in future monitoring years depending on the success of vegetation and proper maintenance. Below is a list of notes and comments that were discussed at the walk-through:

Summary Notes and Comments:

- A culverted crossing on R1 was replaced with a railcar bridge after sustaining damage during heavy rains from tropical storms in late November 2020 (after MY1 reporting). This repair/installation was inspected and approved by all present.

- Low flow was noted in the lower half of R11. Flow was visible at the location of mid-reach flow gauge and at the top of the reach. USACE staff suggested re-locating the flow gauge to the upper third of the reach. A sink hole in the right floodplain was filled during maintenance and the repair looks good. Additionally, the outer bend upstream of the confluence of R11 and R1 has some bank erosion that threatens to impact the alignment and hydrology of R11. Strategies to prevent this from happening were discussed. This problem area was damaged when the culvert on R1 failed during flooding in November 2020. We do not anticipate future erosion on R1 that will impact or change the alignment of R11 following the installation of the railcar bridge where the failed culvert was previously located. Live staking and manual repairs will be done to stabilize the outer bend of R1 upstream of the R11 confluence. This area will be discussed in the MY2 monitoring report.

- Erin Davis from NCDWR observed a steep slope with little vegetation on the left bank of R14. This area will need to be re-seeded and stabilized.

- Kim Browning from the USACE and Erin Davis from NCDWR expressed concern about the impact dense populations of *Juncus spp*. may have on the density, diversity, and vigor of planted vegetation. These rushes are widespread in the R1 floodplain. MBI staff noted that the presence of *Juncus* likely minimized damage to the banks and floodplain and agreed to monitor the success of other vegetation in these locations. All wetlands on the R1 floodplain are functional. One auger test in a small area of low-growing vegetation revealed a small pocket of non-hydric soil near wetland well #7; however, it was determined in the field to be a minor spot of ditch filling (as clearly observable on old aerials) and additional pulls were hydric. All of the site's groundwater wells met the established hydrology success criteria in MY1 (2020).

- R17 should be monitored to make sure it does not become more like a wetland area. The head of the culvert should be protected to ensure the stream continues to flow through the pipe. Erin Davis suggested that the tops of R17 and R18 culverts be inspected and fenced out to eliminate livestock access and potential sediment and nutrient inputs into the project. It should be noted that this area is outside of the conservation easement; however, MBI will discuss with the landowner.

- CE signs were not hung on fence posts on site. This is a requirement and must be completed before credit will be released. MBI staff agreed that this was an oversight and plan to install all necessary signage as soon as possible. Photos of the installed conservation easement signage will be forwarded to DMS for review and approval. Upon receipt, DMS will request release of the MY1 (2020) project credits as proposed.

- The culvert between the bottom of R8 and the head of R9 should be monitored for piping.

- The structural repair at the confluence of R15 and R4 looked good.

- R26 was missing CE signs and posts along the right bank. This area is not active pasture therefore fencing is not required; however, the easement boundary must still be clearly marked. No encroachments on the easement were noted despite the lack of signage.

- The R26 portion of the easement should contain a “random” vegetation plot or transect during MY2. The invasive Princess tree, *Pawlonia tomentosa,* was observed along with other scattered invasive plants. This area should be treated in MY2.

- Areas of bank erosion were noticed at the bottom of R4a which is an Enhancement I reach. Manual repairs and live staking will be completed to stabilize the banks and this location will be monitored for further damage during MY2 and included in the monitoring report.

- Scattered populations of invasive vegetation were noted around the site. Multiflora rose, Privet, Honeysuckle, and Princess Tree were all observed and will be treated with herbicide in MY2.

- DMS staff requested that some survey pins be uncovered and photographed to confirm their installation in required locations. These photos will be sent to DMS along with photo documentation of the installation of easement markers and posts where needed.

Jason York, Environmental Scientist

Jason.york@mbakerintl.com
828-380-0118