MONITORING YEAR 1 ANNUAL REPORT
FINAL

February 2024

Liberty Rock Mitigation Site
Randolph County, NC
Cape Fear River Basin
HUC 03030003
DMS Project No. 100135
NCDEQ Contract No. 7877-01
DMS RFP No. 16-007877
NCDWR Project No. 2020-0035 v1
USACE Action ID Number 2020-00047

Data Collection Period: January 2023 - November 2023

PREPARED FOR:

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

February 9, 2024

Jeremiah Dow
Eastern Regional Supervisor
North Carolina DEQ Division of Mitigation Services
217 West Jones Street, Raleigh, NC 27601

RE: DMS Comments on the MY1 Report
Liberty Rock, Project ID #100135, DMS Contract 7877-01

Dear Mr. Dow:

We have reviewed the comments on the MY1 Report for the above referenced project dated January 29, 2024 and have revised the report based on these comments. The revised documents are submitted with this letter. Below are responses to each of the comments. For your convenience, the comments are reprinted with responses in italics.

1. Table 2
    a. First row states that there are no performance criteria for stream stability. The criteria are BHR below 1.2, ER over 2.2, etc.
        Response: Stream stability performance criteria in Table 2 has been updated.
    b. Second row regarding exclusion of livestock. There should be functional uplift associated with removal of livestock.
        Response: Functional uplift associated with livestock removal has been updated and is included in Table 2.
    c. Last row indicates that there was no encroachment in MY1 which conflicts with Section 2.2 and the discussion there of the Greensboro Science Center encroachment.
        Response: The last row of Table 2 has been updated to include the Greensboro Science Center vehicle encroachment.
2. Section 2.6 – States that the growing season for this project was approved at the April 2023 credit release meeting, but this site was not on the April 2023 credit release meeting agenda and the IRT as-built site visit was in May. Was this site discussed at credit release? Please clarify.
    Response: The growing season was approved in the Mitigation Plan and is March 1st – November 21th each year. Section 2.6 has been updated.
3. Figure 1 & 1b – Please show your best estimation of the vehicle encroachment location.
    Response: Figure 1b has been updated to include approximate location of the vehicle encroachment extent.
4. Can the multiflora rose and privet treatment indicated in Section 2.2 be shown on the CCPV, or were these scattered occurrences?
    Response: These were small, sporadic occurrences all below the mapping threshold. This has been clarified in the report text.

5. Table 5 – It seems that the parrot feather treatment should be included here, or was it below the 0.1 acre threshold?

   Response: *Parrot feather treatment extended over 0.13 acres; Table 5 has been updated to include this.*

6. Mussel survey indicates that downstream reaches (A & B) and an upstream reach were surveyed. There are only results for 2 reaches. Were the downstream reaches combined? Was this intended? The mitigation plan (Figure 11) shows 3 distinct mussel monitoring locations (upstream of the site, Reach 1, and Reach 2). We suggested requesting a map from the subconsultant that performed the mussel survey showing survey locations.

   Response: *Per the Technical Memorandum sent to the IRT (12/15/2020) in the Liberty Rock Mitigation Plan, only the upstream off-site reach along with a second off-site reach downstream of restoration activities are surveyed in Monitoring Year 1. The 3 sampling points included in the Mitigation Plan (Figure 11), depict which reaches sampling will take place in. Transects within the reach of those points are sampled, as opposed to returning to a specific riffle. The off-site reach downstream of restoration activities sampled for MY1 is not called out in the Mitigation Plan (Figure 11). Reaches A and B mentioned in the Mussel Survey Report represent the two stream transects that were surveyed within the off-site reach downstream of restoration activities during MY1. This has been confirmed with the consultant, TranSystems. A map of MY1 mussel survey locations has been added to this report and will be included with future monitoring reports as well.*

If you have any questions, please contact me by phone (919) 851-9986, or by email (jlorch@wildlandseng.com).

Sincerely,

Jason Lorch, *Monitoring Coordinator*

PREPARED BY:

WILDLANDS
ENGINEERING

312 West Millbrook Road, Suite 225
Raleigh, NC 27609

Jason Lorch
jlorch@wildlandseng.com
Phone: 919.851.9986

LIBERTY ROCK MITIGATION SITE
Monitoring Year 1 Annual Report

TABLE OF CONTENTS

Section 1: PROJECT OVERVIEW 1-1
1.1 Project Quantities and Credits 1-1
1.2 Project Goals and Objectives 1-2
1.3 Project Attributes 1-4
Section 2: MONITORING YEAR 1 DATA ASSESSMENT 2-1
2.1 Vegetative Assessment 2-1
2.2 Vegetation Areas of Concern 2-1
2.3 Stream Assessment 2-2
2.4 Stream Areas of Concern 2-2
2.5 Hydrology Assessment 2-2
2.6 Wetland Assessment 2-2
2.7 Monitoring Year 1 Summary 2-2
Section 3: REFERENCES 3-1

TABLES

Table 1: Project Quantities and Credits 1-1
Table 2: Goals, Performance Criteria, and Functional Improvements 1-2
Table 3: Project Attributes 1-5

FIGURES

Figure 1 Current Condition Plan View Key
Figure 1a-b Current Condition Plan View

APPENDICES

Appendix A **Visual Assessment Data**
Table 4 Visual Stream Morphology Stability Assessment Table
Table 5 Vegetation Condition Assessment Table
Stream Photographs
Vegetation Plot Photographs
Groundwater Gauge Photographs

Appendix B **Vegetation Plot Data**
Table 6 Vegetation Plot Data
Table 7 Vegetation Performance Standards Summary Table

Appendix C **Stream Geomorphology Data**
Cross-Section Plots
Table 8 Baseline Stream Data Summary
Table 9 Cross-Section Morphology Monitoring Summary

Appendix D **Hydrology Data**
Table 10 Bankfull Events
Table 11 Rainfall Summary
Recorded Bankfull Events Plots

Table 12 Recorded In-Stream Flow Events Summary
Recorded In-Stream Flot Events Plot
Table 13 Groundwater Gauge Summary
Groundwater Gauge Plots

Appendix E **Project Timeline and Contact Info**
Table 14 Project Activity and Reporting History
Table 15 Project Contact Table

Appendix F **Additional Documentation**
IRT Site Walk Notes
Freshwater Mussel Monitoring Survey Report

Section 1: PROJECT OVERVIEW

The Liberty Rock Mitigation Site (Site) is located in Randolph County two miles south of the Town of Liberty and nine miles northwest of Siler City. The Site is located within the Rocky River Headwaters targeted local watershed (TLW) Hydrologic Unit Code (HUC) 03030003070010 and the NC Division of Water Resources (DWR) Subbasin 03-06-12. The Site will provide stream and wetland credits to the Cape Fear River Basin Cataloging Unit (CU) 03030003 through restoration, enhancement, and preservation of the Rocky River and four unnamed tributaries to the Rocky River (referred to as Schist Creek, Gypsum Creek, Dolomite Creek, and Mica Creek for the project) and riparian wetland re-establishment, rehabilitation, and enhancement. The Site is located on 2 parcels owned by one landowner and a conservation easement was recorded on 41.12 acres.

1.1 Project Quantities and Credits

The Wilmington District Stream Buffer Credit Calculator (updated (1/19/2018) was used to determine final crediting for the "Additional Credit from Extended Buffers" shown in Table 1 below.

Table 1: Project Quantities and Credits

PROJECT MITIGATION QUANTITIES							
Project Segment	**Mitigation Plan Footage**	**As-Built Footage**	**Mitigation Category**	**Restoration Level**	**Mitigation Ratio (X:1)**	**Credits**	**Comments**
Stream							
Rocky River Reach 1	1,989	2,023	Warm	R	1.0	1,989.000	Full Channel Restoration, Planted Buffer, Extended Buffers
Rocky River Reach 2	580	585	Warm	EI	1.0	580.000	Bank Stabilization, Extended Buffers
Rocky River Reach 3	479	482	Warm	R	1.0	479.000	Full Channel Restoration, Planted Buffer, Extended Buffers
Schist Creek	420	476	Warm	R	1.0	420.000	
Gypsum Creek Reach 1	152	152	Warm	P	10.0	15.200	Conservation Easement
Gypsum Creek Reach 2	208	218	Warm	R	1.0	208.000	Full Channel Restoration, Planted Buffer, Extended Buffers
Dolomite Creek Reach 1	188	188	Warm	P	10.0	18.800	Conservation Easement
Dolomite Creek Reach 2	36	31	Warm	EII	5.0	7.200	Minor Bank Grading, Planted Buffer
Mica Creek	1,151	1,182	Warm	R	1.0	1,151.000	Full Channel Restoration, Planted Buffer, Extended Buffers
					Total:	**4,868.200**	

Blue = **Restoration**	Yellow = **Enhancement I**	Orange = **Enhancement II**	Green = **Preservation**

Wetland							
Re-establishment	N/A	12.868	Riverine	R	1	12.868	Restored Hydrology, Planted
Rehabilitation	3.308	3.308	Riverine	RE	1.5	2.205	Enhanced Hydrology, Planted
Enhancement	0.893	0.893	Riverine	RE	5	0.179	Conservation Easement
					Total:	**15.252**	

Restoration Level	Stream			Riparian Wetland	
	Warm	Cool	Cold	Riverine	Non-Riverine
Restoration	4,247.000				
Enhancement I	580.000				
Enhancement II	7.200				
Preservation	34.000				
Additional Credits from Extended Buffers	274.150				
Re-establishment				12.868	
Rehabilitation				2.205	
Enhancement				0.179	
TOTALS	**5,142.350**			**15.252**	

1.2 Project Goals and Objectives

The project is intended to provide numerous ecological benefits. Table 2 below describes expected outcomes to water quality and ecological processes and provides project goals and objectives.

Table 2: Goals, Performance Criteria, and Functional Improvements

Goal	Objective/ Treatment	Likely Functional Uplift	Performance Criteria	Measurement	Cumulative Monitoring Results
Improve the stability of stream channels.	Construct stream channels that will maintain stable cross-sections, patterns, and profiles over time.	Reduce sediment inputs from bank erosion. Reduce shear stress on channel boundary.	Entrenchment ratios over 2.2 and bank height ratios remaining below 1.2 with visual assessments showing progression towards stability.	Cross-section monitoring will be assessed during MY1, MY2, MY3, MY5, and MY7 and visual inspections will be performed annually.	Cross-section data meets performance criteria; all bank height ratios are below 1.2 and entrenchment ratios over 2.2.
Exclude livestock from streams.	Exclude livestock through removal of livestock from the project parcel.	Reduction in sediment, nutrient, and fecal coliform bacteria inputs through livestock exclusion.	Livestock have been removed from project parcel.	Livestock have been removed from project parcel.	Livestock have been removed from project parcel.

Goal	Objective/ Treatment	Likely Functional Uplift	Performance Criteria	Measurement	Cumulative Monitoring Results
Improve in-stream habitat.	Install habitat features such as constructed riffles, lunker logs, and brush toes into restored/enhanced streams. Add woody materials to channel beds. Construct pools of varying depth.	Increase and diversify available habitats for macroinvertebrates, fish, mussels, and amphibians leading to colonization and increase in biodiversity over time. Add complexity including LWD to the streams.	There is no performance criteria for this metric. However, mussel survey reports are required deliverables to the IRT.	Mussel surveys will take place in restoration and/or relocation reaches in MY1, MY2, MY3, MY5, and MY7.	MY1 mussel survey completed.
Improve wetland hydrology.	Remove livestock to allow soil profiles to stabilize. Remove drain effect of channelized stream and floodplain swales.	Increased surface water residence time will provide contact treatment and groundwater recharge potential.	Free groundwater surface within 12 inches of the ground surface for 12% of the growing season under normal precipitation conditions.	11 groundwater gauges equipped with pressure transducers are located in representative wetland areas and monitored annually.	7 out of 11 groundwater gauges met success criteria during MY1.
Reconnect channels with floodplains.	Reconstruct stream channels with designed bankfull dimensions and depth relative to the existing floodplain.	Allow more frequent flood flows to disperse on the floodplain. Support geomorphology and higher-level functions. Improve wetland hydrology in the Rocky River floodplain.	Four bankfull events in separate years within the monitoring period. Thirty days of continuous flow each year on intermittent streams during years of normal precipitation.	Crest and flow gauges (pressure transducers) recording flow elevations.	Multiple bankfull events were recorded on all reaches, and 199 days of consecutive flow were recorded on Gypsum Creek during MY1.
Restore and enhance native floodplain and streambank vegetation.	Plant native tree and understory species in riparian zones and plant native shrub and herbaceous species on streambanks. Treat invasive species within project area.	Reduce sediment inputs from bank erosion and runoff. Increase nutrient cycling and storage in floodplain. Provide riparian habitat. Add a source of LWD and organic material to stream. Support all stream functions.	Survival rate of 210 planted stems per acre at MY7. Interim survival rate of 320 planted stems per acre at MY3 and 260 at MY5. Trees in each plot must average 7 ft at MY5 and 10 ft at MY7 (excluding shrub and sub-canopy species).	One hundred square meter vegetation plots are placed on 2% of the planted area of the Site and monitored during MY1, MY2, MY3, MY5, and MY7 and assessed visually in MY4 and MY6.	All 19 vegetation plots have a planted stem density greater than 320 stems per acre.

Goal	Objective/ Treatment	Likely Functional Uplift	Performance Criteria	Measurement	Cumulative Monitoring Results
Permanently protect the Site from harmful uses.	Establish a conservation easement on the Site. Preserve high quality stream reaches through the placement of a conservation easement on site.	Protect Site from encroachment on the riparian corridor and direct impact to streams and wetlands. Support all stream functions.	Prevent easement encroachment.	Visually inspect the perimeter of the Site to ensure no easement encroachment is occurring.	Vehicle access occurred near the confluence of Mica Creek and Rocky River. This was an error made by the Greensboro Science Center while relocating mussels and should not be a continued concern.

1.3 Project Attributes

Five jurisdictional stream channels are located on Site: Rocky River, Schist Creek, Gypsum Creek, Dolomite Creek, and Mica Creek. As referenced in the Liberty Rock Mitigation Site Final Mitigation Plan, historic aerials indicate that on-site streams have existed in their same approximate location for over 75 years, with some changes to the agricultural management of the land. Aerials show that the riparian buffers for Dolomite, Gypsum, and Schist Creeks have remained undisturbed since prior to 1943. The riparian buffer of Mica Creek was timbered and converted to agricultural use in the 1960's and the riparian buffer and floodplain of Rocky River was timbered and converted to agricultural use in the 1980's. The Rocky River was straightened and moved to the south valley edge during that time. Land use and buffer extents have remained consistent since then. A review of historic imagery for the greater Rocky River Watershed draining to the Site shows little land use change since 1993 as well. Nearly 4% of the watershed area is planted pine trees for future harvesting. According to aerial photography, the most recent logging event occurred between 2006 and 2008 when approximately 75 acres of pines in the upper watershed were timbered.

Table 3: Project Attributes

PROJECT INFORMATION			
Project Name	Liberty Rock Mitigation Site	County	Randolph County
Project Area (acres)	41.12	Project Coordinates	35°49'12.34" N 79°33'43.89" W
PROJECT WATERSHED SUMMARY INFORMATION			
Physiographic Province	Piedmont	River Basin	Cape Fear River
USGS HUC 8-digit	03030003	USGS HUC 14-digit	03030003070010
DWR Sub-basin	03-06-12	Land Use Classification	42% Cultivated Crops, 24% Developed, 24% Forest, 5% Shrubland, 3% Grassland/Herbaceous, 1% Open Water, 1% Wetlands
Project Drainage Area (acres)	2,600	Percentage of Impervious Area	6.70%

RESTORATION TRIBUTARY SUMMARY INFORMATION					
Parameters	**Rocky River**	**Schist Creek**	**Gypsum Creek**	**Dolomite Creek**	**Mica Creek**
Pre-project length (feet)	2,652	211	113	44	952
Post-project (feet)	3,090	476	218	31	1,182
Valley confinement	Unconfined				Moderately confined
Drainage area (acres)	2,600	219	2	7	92
Perennial, Intermittent, Ephemeral	P	P	I	I	P
DWR Water Quality Classification	Water Supply III				
Dominant Stream Classification (existing)	C4	C4/E4	N/A[1]	N/A[1]	C4/E4
Dominant Stream Classification (proposed)	C4	C4	C4	N/A[2]	C4
Dominant Evolutionary class (Simon) if applicable	N/A	N/A	N/A	N/A	N/A

REGULATORY CONSIDERATIONS			
Parameters	**Applicable?**	**Resolved?**	**Supporting Documentation**
Water of the United States - Section 404	Yes	Yes	USACE Nationwide Permit No. 27 and DWQ 401 Water Quality Certification No. 4134.
Water of the United States - Section 401	Yes	Yes	
Endangered Species Act	Yes	Yes	Categorical Exclusion in Mitigation Plan (Wildlands, 2020)
Historic Preservation Act	Yes	Yes	
Coastal Zone Management Act	N/A	N/A	N/A
Essential Fisheries Habitat	N/A	N/A	N/A

1. Gypsum Creek Reach 2 and Dolomite Creek Reach 2 were severely degraded and eroded due to cattle trampling. Cross-section surveys could not be performed.

2. Source: Rosgen, D. L. 1994. A classification of natural rivers. Catena 22:169-199. Reaches not slated for restoration or enhancement I were not classified (NC).

Section 2: MONITORING YEAR 1 DATA ASSESSMENT

Annual monitoring and site visits were conducted during MY1 to assess the condition of the project. The vegetation and stream success criteria for the Site follow the approved success criteria presented in the Mitigation Plan (Wildlands, 2021). Performance criteria for vegetation, stream, and hydrologic assessment are located in Section 1.2 Table 2: Goals, Performance Criteria, and Functional Improvements. Methodology for annual monitoring is described in the Monitoring Year 0 Annual Report (Wildlands, 2022).

2.1 Vegetative Assessment

The MY1 vegetative survey was completed in August 2023. Vegetation monitoring resulted in a stem density range of 364 to 688 planted stems per acre which is well above the interim requirement of 320 stems per acre required at MY3. Average stem density across all vegetation plots was 560 planted stems per acre. All 19 vegetation plots met the interim success criteria and are on track to meet the final success criteria required for MY7. Additionally, herbaceous groundcover has become well established across the site. Refer to Appendix A for Vegetation Plot Photographs and the Vegetation Condition Assessment Table and Appendix B for Vegetation Plot Data.

2.2 Vegetation Areas of Concern

Vegetation management and herbicide treatments were applied prior to construction in sporadic areas across the site to prevent the spread of invasive species that could potentially compete with planted native species. To further establish invasive treatment effectiveness, small, scattered occurrences of multiflora rose (*Rosa multiflora*) and Chinese privet (*Ligustrum sinense*) received follow-up chemical and physical supplemental treatments throughout March-May 2023. Secondly, a vigorous approach has been taken to eradicate Parrot feather (*Myriophyllum aquaticum*) from the Site and a huge reduction has been observed along Rocky River, with only a 0.13 acre area requiring treatment. Parrot feather treatment included alternating between physical and chemical removal, utilizing glyphosate and triclopyr several times although imazapyr was ultimately most effective for sporadic populations within isolated wetlands. Treated sporadic wetland areas have been reseeded with a wetland winter cover crop mix that has already germinated and begun to grow. Additional physical and chemical removal is planned for these areas throughout 2024. Invasive populations will continue to be monitored and retreated as necessary.

Prior to construction, the floodplain along Mica Creek was dominated by pasture grasses. Wildlands proactively treated these areas by chemically burning pasture grasses with 2% glyphosate before seeding in Fall 2022. To further ensure trees outcompete dense herbaceous vegetation, Wildlands has continued to treat these areas with herbicide ring sprays and tree boosters at the drip line around planted trees. This was completed in April 2023 and will continue in this area in early Spring to reduce vegetative competition and promote tree growth.

During a Site visit on April 12, 2023, an easement encroachment created by tire tracks was observed along the eastern side of Mica Creek leading toward the confluence of Mica Creek and Rocky River. It has been determined that this was an error made by the Greensboro Science Center, during a NCWRC approved mussel relocation effort. A vehicle was driven inside the conservation easement to the Rocky River stream bank to relocate mussels. Wildlands has contacted the Greensboro Science Center, and this should not be a continued concern.

2.3 Stream Assessment

Morphological surveys for MY1 were conducted in April 2023. Visual assessment shows all streams on Site are stable and functioning as designed. Cross-sections show minimal change in max depth and bankfull cross-sectional area. Cross-sections only show slight deviations from as-built due to sediment deposition and establishment of vegetation post-construction. Cross-section 9 shows slight deviation in bank shape from as-built due to natural settling of the underlying sod mats and sediment. Cross-sections show entrenchment ratios within an acceptable range of the design parameters and bank height ratios are less than 1.2. Specific entrenchment ratio numbers are not included in this report template but are available upon request. Refer to Appendix A for the Visual Stream Morphology Stability Assessment Table and Stream Photographs. Refer to Appendix C for Stream Geomorphology Data.

Post-construction mussel surveys for MY1 were conducted by TranSystems on June 9, 2023. Visual and tactile surveying located six different freshwater mussel species. Refer to Appendix F for Additional Documentation and Mussel Survey Report.

2.4 Stream Areas of Concern

No stream areas of concern were identified, all streams are stable and functioning as intended.

2.5 Hydrology Assessment

By the end of MY7, four bankfull events must have occurred in separate years on Rocky River and Mica Creek. Two crest gauges were installed initially, one on Rocky River Reach 2 (Enhancement I) and another on Mica Creek. An additional crest gauge was installed on Rocky River Reach 1 on February 21, 2023 during MY1 to better reflect the interaction of flow conditions within the restored portion of the site. A bankfull event was recorded on all three crest gauges in April 2023 and additional events were captured on both Rocky River Reach 2 and Mica Creek during MY1. Additionally, the presence of baseflow must be documented annually on intermittent reaches (Gypsum Creek) for a minimum of 30 consecutive days during a normal precipitation year. Gypsum Creek exceeded this criterion, maintaining baseflow for 199 consecutive days during MY1. Refer to Appendix D for hydrology summary data and the Recorded Bankfull Events Plot.

2.6 Wetland Assessment

Eleven groundwater gauges were installed in wetlands across the Site. The performance criterion for wetland hydrology is groundwater within 12 inches of the ground surface for 12.0% (31 days) of the growing season consecutively. The growing season for this project has been set as March 1 through November 21 (265 days) and was approved by the IRT in the Mitigation Plan (Wildlands 2021). Per IRT request, groundwater gauge 6 will be relocated to higher ground during winter 2023-2024; the updated location and data will be reported in MY2.

Of the eleven groundwater gauges, seven exceeded the success criteria during MY1 with hydroperiods ranging from 12.8% (34 consecutive days) to 55.8% (148 consecutive days). Groundwater gauges 2, 7, 9, and 11 missed the performance criteria with hydroperiods ranging from 1.1% (3 consecutive days) to 5.7% (15 consecutive days). After construction of the stream channel, it is anticipated that the groundwater table will take some time to recharge. Although continued hydrology observation throughout upcoming monitoring years is needed to evaluate success, it is expected that groundwater gauges 2, 7, 9, and 11 will show a positive trend in future monitoring years.

2.7 Monitoring Year 1 Summary

Overall, the Site looks great, is performing as intended, and is on course to meet success criteria. All vegetation plots are individually on track to exceed the MY3 interim requirement of 320 planted stems

per acre. MY1 vegetation plot data shows an average density of 560 planted stems per acre across the Site. Dense herbaceous vegetation has filled in across the floodplain. Ring sprays will be applied around the base of trees in early spring 2024 to continue to help planted trees compete with herbaceous vegetation. Invasive species will continue to be assessed and treated as necessary in future monitoring years. All project streams are stable, functioning as intended, and meeting project goals. Several bankfull events were documented on both Rocky River Reach 2 and Mica Creek and one bankfull event was captured on Rocky River Reach 1. Gypsum Creek had 199 consecutive days of flow, far exceeding success criterion. Seven of the eleven groundwater well gauges surpassed the success criterion, although the remaining four have yet to recharge post-construction and meet criteria. After construction of the stream channel, it is anticipated that the groundwater table will take some time to recharge. They are expected to show a positive trend in subsequent monitoring years. The easement boundary has been walked and no signage issues were observed. One vehicular access easement encroachment from a NCWRC approved mussel relocation effort was observed in April, has been resolved, and is no longer a concern.

Summary information and data related to the performance of various project and monitoring elements can be found in the tables and figures in the report appendices. All raw data supporting the tables and figures in the appendices are available from DMS upon request.

Section 3: REFERENCES

Doll, B.A., Grabow, G.L., Hall, K.A., Halley, J., Harman, W.A., Jennings, G.D., and Wise, D.E. 2003. Stream Restoration, A Natural Channel Design Handbook.

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

Lee, M.T., Peet, R.K., Roberts, S.D., & Wentworth, T.R. 2008. CVS-EEP Protocol for Recording Vegetation Version 4.2.

North Carolina Interagency Review Team (NCIRT). 2016. Wilmington District Stream and Wetland Compensatory Mitigation Update.

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

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

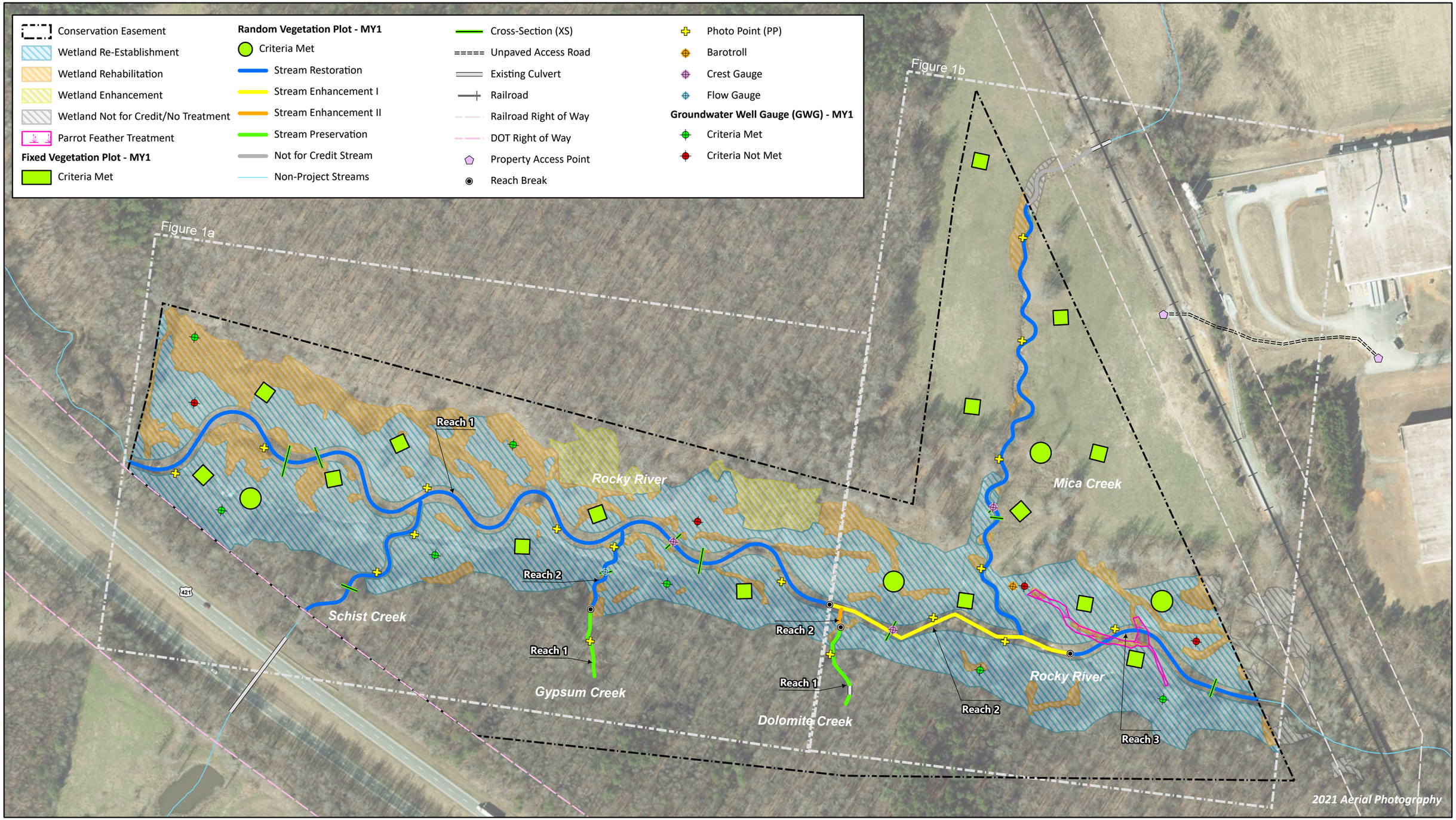
Rosgen, D.L. 1997. A Geomorphological Approach to Restoration of Incised Rivers. Proceedings of the Conference on Management of Landscapes Disturbed by Channel Incision. Center For Computational Hydroscience and Bioengineering, Oxford Campus, University of Mississippi, Pages 12-22.

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

United States Geological Survey. 1998. North Carolina Geology.

Wildlands Engineering, Inc. 2021. Liberty Rock Mitigation Site - Final Mitigation Plan. DMS, Raleigh, NC.

Wildlands Engineering, Inc. (2023). Liberty Rock Monitoring Year 0 Annual Report. DMS, Raleigh, NC.



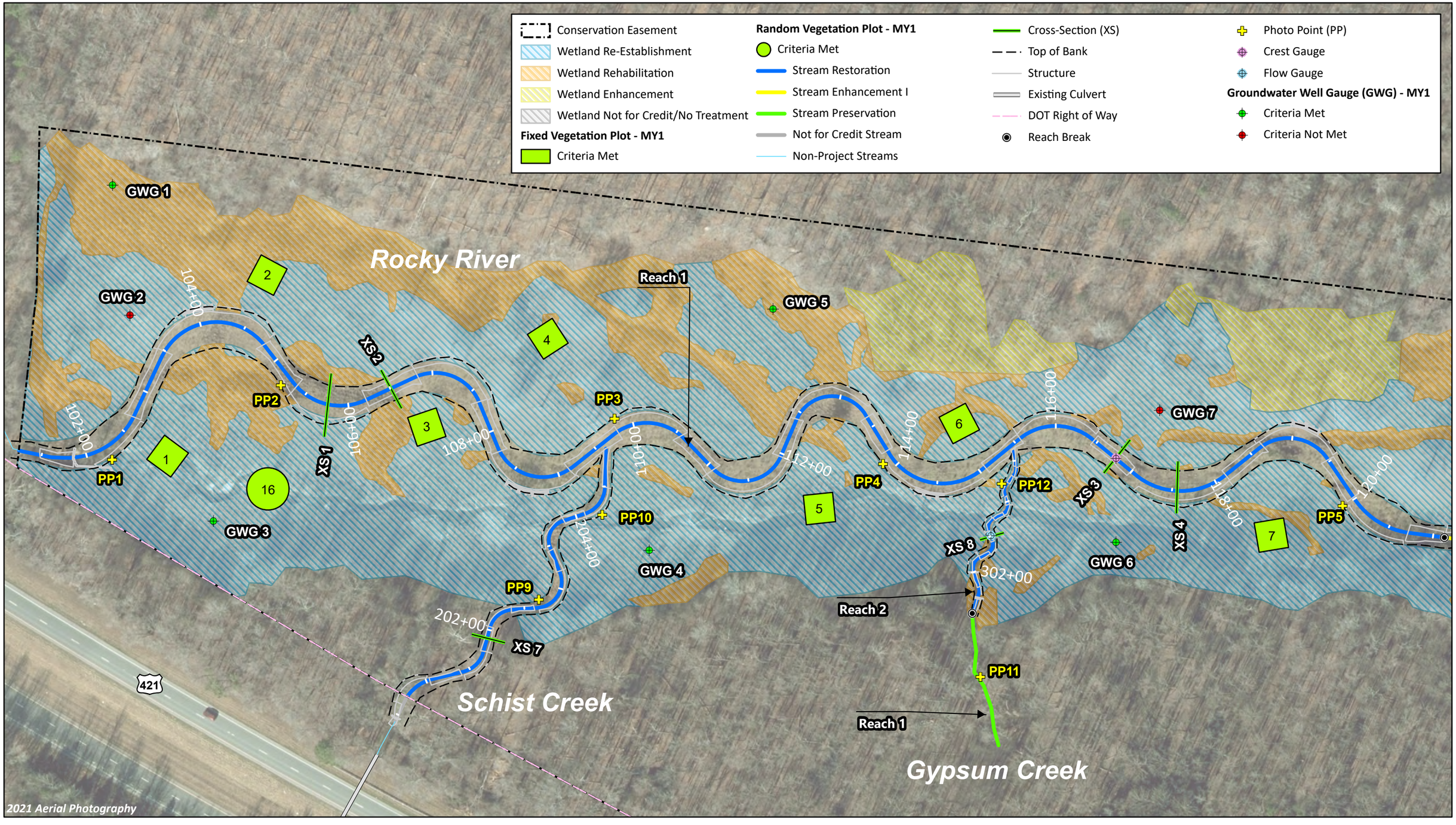
WILDLANDS ENGINEERING

0 100 200 Feet

N

Figure 1. Current Condition Plan View Key
Liberty Rock Mitigation Site
DMS Project No. 100135
Monitoring Year 1 - 2023

Randolph County, NC



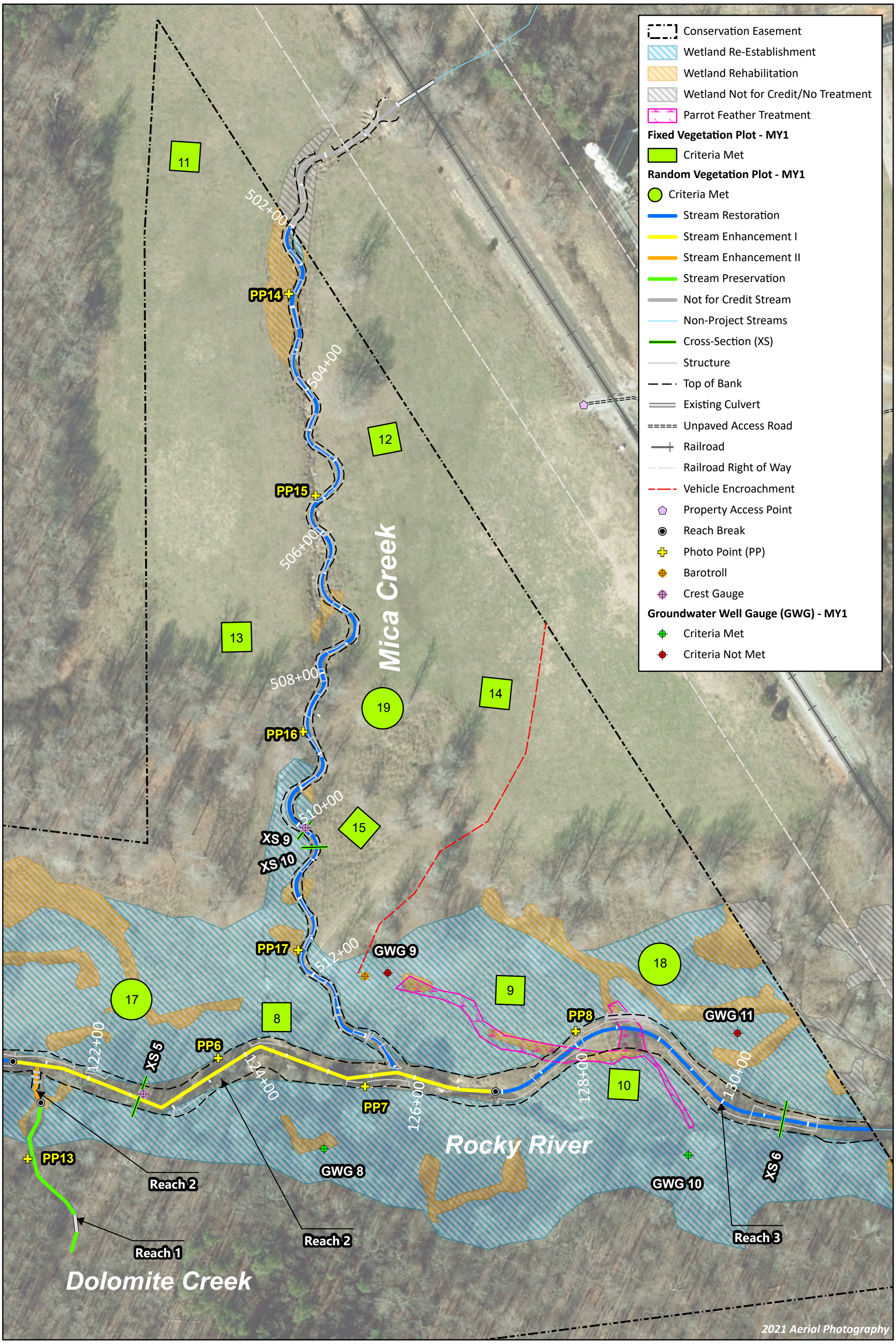
WILDLANDS ENGINEERING

0 50 100 Feet

N

Figure 1a. Current Condition Plan View
Liberty Rock Mitigation Site
DMS Project No. 100135
Monitoring Year 1 - 2023

Randolph County, NC



WILDLANDS ENGINEERING

0 50 100 Feet

N

Figure 1b. Current Condition Plan View
Liberty Rock Mitigation Site
DMS Project No. 100135
Monitoring Year 1 - 2023

Randolph County, NC

APPENDIX A. Visual Assessment Data

Table 4. Visual Stream Morphology Stability Assessment Table

Liberty Rock Mitigation Site
DMS Project No. 100135
Monitoring Year 1 - 2023

Rocky River Reaches 1-3

Major Channel Category		Metric	Number Stable, Performing as Intended	Total Number in As-Built	Amount of Unstable Footage	% Stable, Performing as Intended
					Assessed Stream Length	3,090
					Assessed Bank Length	6,180
Bank	**Surface Scour/ Bare Bank**	Bank lacking vegetative cover resulting simply from poor growth and/or surface scour.			0	100%
	Toe Erosion	Bank toe eroding to the extent that bank failure appears likely. Does NOT include undercuts that are modest, appear sustainable and are providing habitat.			0	100%
	Bank Failure	Fluvial and geotechnical - rotational, slumping, calving, or collapse.			0	100%
				Totals:	**0**	**100%**
Structure	**Grade Control**	Grade control structures exhibiting maintenance of grade across the sill.	1	1		100%
	Bank Protection	Bank erosion within the structures extent of influence does not exceed 15%.	21	21		100%

Visual Assessment was completed November 21, 2023

Schist Creek

Major Channel Category		Metric	Number Stable, Performing as Intended	Total Number in As-Built	Amount of Unstable Footage	% Stable, Performing as Intended
					Assessed Stream Length	476
					Assessed Bank Length	952
Bank	**Surface Scour/ Bare Bank**	Bank lacking vegetative cover resulting simply from poor growth and/or surface scour.			0	100%
	Toe Erosion	Bank toe eroding to the extent that bank failure appears likely. Does NOT include undercuts that are modest, appear sustainable and are providing habitat.			0	100%
	Bank Failure	Fluvial and geotechnical - rotational, slumping, calving, or collapse.			0	100%
				Totals:	**0**	**100%**
Structure	**Grade Control**	Grade control structures exhibiting maintenance of grade across the sill.	N/A	N/A		N/A
	Bank Protection	Bank erosion within the structures extent of influence does not exceed 15%.	6	6		100%

Visual Assessment was completed November 21, 2023

Table 4. Visual Stream Morphology Stability Assessment Table

Liberty Rock Mitigation Site
DMS Project No. 100135
Monitoring Year 1 - 2023

Gypsum Creek Reach 2

Major Channel Category		Metric	Number Stable, Performing as Intended	Total Number in As-Built	Amount of Unstable Footage	% Stable, Performing as Intended
					Assessed Stream Length	218
					Assessed Bank Length	436
Bank	**Surface Scour/ Bare Bank**	Bank lacking vegetative cover resulting simply from poor growth and/or surface scour.			0	100%
	Toe Erosion	Bank toe eroding to the extent that bank failure appears likely. Does NOT include undercuts that are modest, appear sustainable and are providing habitat.			0	100%
	Bank Failure	Fluvial and geotechnical - rotational, slumping, calving, or collapse.			0	100%
				Totals:	**0**	**100%**
Structure	**Grade Control**	Grade control structures exhibiting maintenance of grade across the sill.	2	2		100%
	Bank Protection	Bank erosion within the structures extent of influence does not exceed 15%.	7	7		100%

Visual Assessment was completed November 21, 2023

Mica Creek

Major Channel Category		Metric	Number Stable, Performing as Intended	Total Number in As-Built	Amount of Unstable Footage	% Stable, Performing as Intended
					Assessed Stream Length	1,182
					Assessed Bank Length	2,364
Bank	**Surface Scour/ Bare Bank**	Bank lacking vegetative cover resulting simply from poor growth and/or surface scour.			0	100%
	Toe Erosion	Bank toe eroding to the extent that bank failure appears likely. Does NOT include undercuts that are modest, appear sustainable and are providing habitat.			0	100%
	Bank Failure	Fluvial and geotechnical - rotational, slumping, calving, or collapse.			0	100%
				Totals:	**0**	**100%**
Structure	**Grade Control**	Grade control structures exhibiting maintenance of grade across the sill.	6	6		100%
	Bank Protection	Bank erosion within the structures extent of influence does not exceed 15%.	19	19		100%

Visual Assessment was completed November 21, 2023

Table 5. Vegetation Condition Assessment Table

Liberty Rock Mitigation Site
DMS Project No. 100135
Monitoring Year 1 - 2023

Planted Acreage **23.70**

Vegetation Category	Definitions	Mapping Threshold (ac)	Combined Acreage	% of Planted Acreage
Bare Areas	Very limited cover of both woody and herbaceous material.	0.10	0.00	0.00
Low Stem Density Areas	Woody stem densities clearly below target levels based on current MY stem count criteria.	0.10	0.00	0.00
		Total	**0.0**	**0%**
Areas of Poor Growth Rates	Planted areas where average height is not meeting current MY Performance Standard.	0.10	0.00	0.00
		Cumulative Total	**0.0**	**0%**

Visual Assessment was completed November 21, 2023

Easement Acreage **41.12**

Vegetation Category	Definitions	Mapping Threshold (ac)	Combined Acreage	% of Easement Acreage
Invasive Areas of Concern	Invasives may occur outside of planted areas and within the easement and will therefore be calculated against the total easement acreage. Include species with the potential to directly outcompete native, young, woody stems in the short-term or community structure for existing communities. Invasive species included in summation above should be identified in report summary.	0.10	0.13	0.32%*
Easement Encroachment Areas	Encroachment may be point, line, or polygon. Encroachment to be mapped consists of any violation of restrictions specified in the conservation easement. Common encroachments are mowing, cattle access, vehicular access. Encroachment has no threshold value as will need to be addressed regardless of impact area.	none	1 Encroachment Noted** / 0 ac	

Visual Assessment was completed November 21, 2023

*Parrot feather (*Myriophyllum aquaticum*) treated in MY1.

**Tire tracks from a NCWRC approved mussel relocation effort were discovered inside the easement. The vehicular access encroachment has been resolved.

STREAM PHOTOGRAPHS

PHOTO POINT 1 Rocky River R1 – upstream *(2/21/2023)*

PHOTO POINT 1 Rocky River R1 – downstream *(2/21/2023)*

PHOTO POINT 2 Rocky River R1 – upstream *(2/21/2023)*

PHOTO POINT 2 Rocky River R1 – downstream *(2/21/2023)*

PHOTO POINT 3 Rocky River R1 – upstream *(2/21/2023)*

PHOTO POINT 3 Rocky River R1 – downstream *(2/21/2023)*

PHOTO POINT 4 Rocky River R1 – upstream *(2/21/2023)*

PHOTO POINT 4 Rocky River R1 – downstream *(2/21/2023)*

PHOTO POINT 5 Rocky River R1 – upstream *(2/21/2023)*

PHOTO POINT 5 Rocky River R1 – downstream *(2/21/2023)*

PHOTO POINT 6 Rocky River R2 – upstream *(2/21/2023)*

PHOTO POINT 6 Rocky River R2 – downstream *(2/21/2023)*

PHOTO POINT 7 Rocky River R2 – upstream *(2/21/2023)*

PHOTO POINT 7 Rocky River R2 – downstream *(2/21/2023)*

PHOTO POINT 8 Rocky River R3 – upstream *(2/21/2023)*

PHOTO POINT 8 Rocky River R3 – downstream *(2/21/2023)*

PHOTO POINT 9 Schist Creek – upstream *(2/21/2023)*

PHOTO POINT 9 Schist Creek – downstream *(2/21/2023)*

PHOTO POINT 10 Schist Creek – upstream *(2/21/2023)*

PHOTO POINT 10 Schist Creek – downstream *(2/21/2023)*

PHOTO POINT 11 Gypsum Creek R1 – upstream *(2/21/2023)*

PHOTO POINT 11 Gypsum Creek R1 – downstream *(2/21/2023)*

PHOTO POINT 12 Gypsum Creek R2 – upstream *(2/21/2023)*

PHOTO POINT 12 Gypsum Creek R2 – downstream *(2/21/2023)*

PHOTO POINT 13 Dolomite Creek R1 – upstream *(2/21/2023)*

PHOTO POINT 13 Dolomite Creek R1 – downstream *(2/21/2023)*

PHOTO POINT 14 Mica Creek – upstream *(2/21/2023)*

PHOTO POINT 14 Mica Creek – downstream *(2/21/2023)*

PHOTO POINT 15 Mica Creek – upstream *(2/21/2023)*

PHOTO POINT 15 Mica Creek – downstream *(2/21/2023)*

	
PHOTO POINT 16 Mica Creek – upstream *(2/21/2023)*	**PHOTO POINT 16 Mica Creek – downstream *(2/21/2023)***
	
PHOTO POINT 17 Mica Creek – upstream *(2/21/2023)*	**PHOTO POINT 17 Mica Creek – downstream *(2/21/2023)***

VEGETATION PLOT PHOTOGRAPHS

FIXED VEG PLOT 1 *(08/09/2023)*

FIXED VEG PLOT 2 *(08/09/2023)*

FIXED VEG PLOT 3 *(08/09/2023)*

FIXED VEG PLOT 4 *(08/09/2023)*

FIXED VEG PLOT 5 *(08/09/2023)*

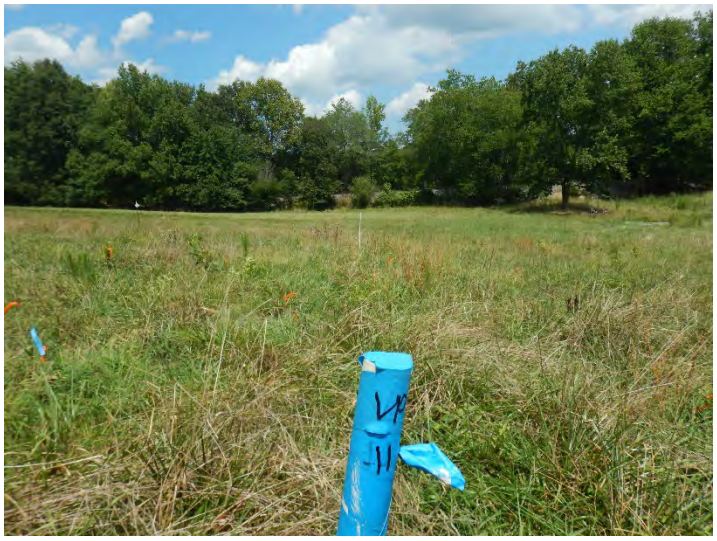
FIXED VEG PLOT 6 *(08/09/2023)*

FIXED VEG PLOT 7 *(08/09/2023)*

FIXED VEG PLOT 8 *(08/09/2023)*

FIXED VEG PLOT 9 *(08/09/2023)*

FIXED VEG PLOT 10 *(08/09/2023)*



FIXED VEG PLOT 11 *(08/09/2023)*

FIXED VEG PLOT 12 *(08/09/2023)*

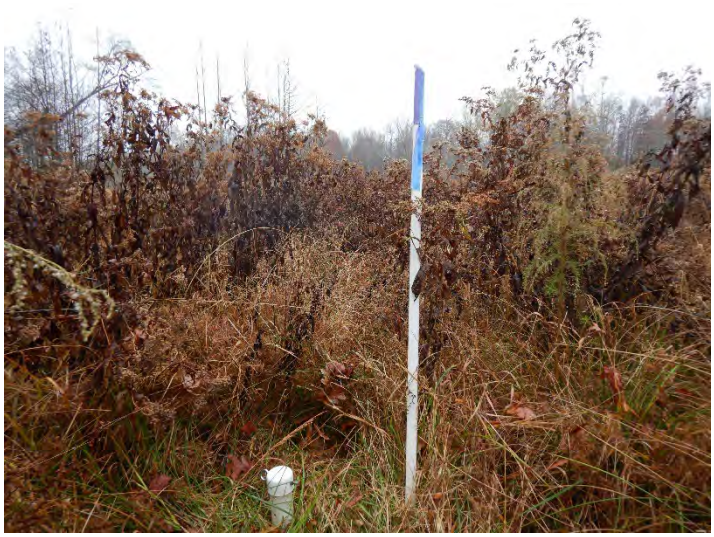
FIXED VEG PLOT 13 *(08/09/2023)*

FIXED VEG PLOT 14 *(08/09/2023)*

FIXED VEG PLOT 15 *(08/09/2023)*

	
RANDOM VEG PLOT 16 *(08/09/2023)*	**RANDOM VEG PLOT 17** *(08/09/2023)*
	
RANDOM VEG PLOT 18 (*08/09/2023*)	**RANDOM VEG PLOT 19** (*08/09/2023*)

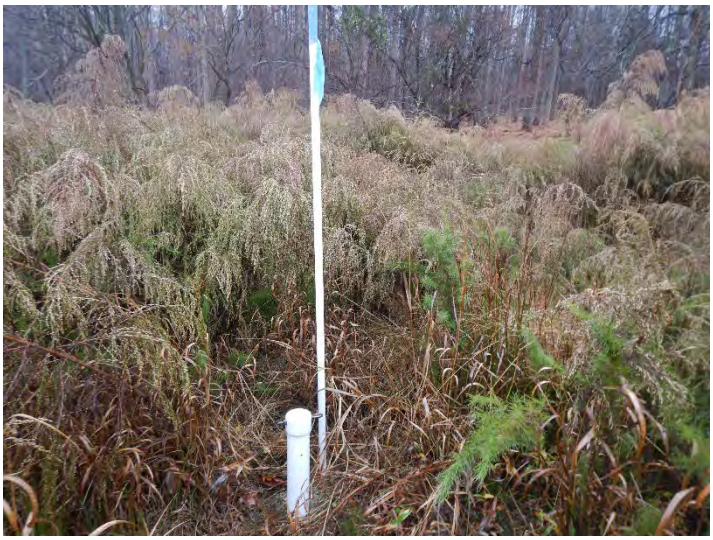
GROUNDWATER GAUGE PHOTOGRAPHS



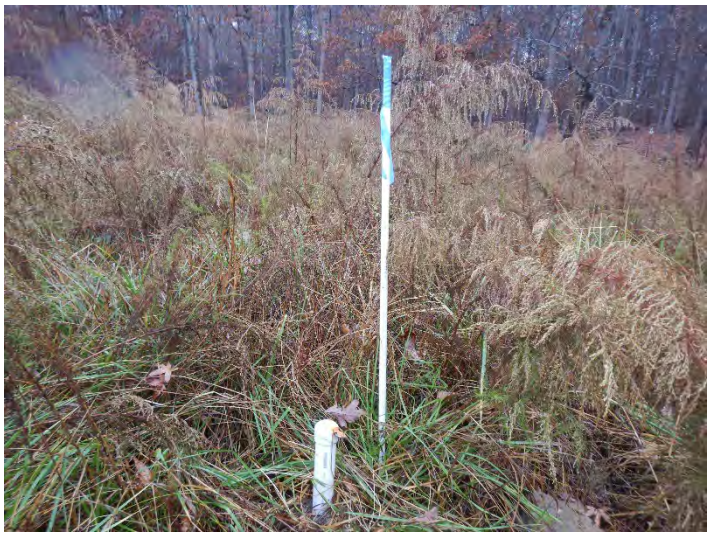
GROUNDWATER GAUGE 1 - *(11/21/2023)*

GROUNDWATER GAUGE 2 - *(11/21/2023)*

GROUNDWATER GAUGE 3 – *(11/21/2023)*

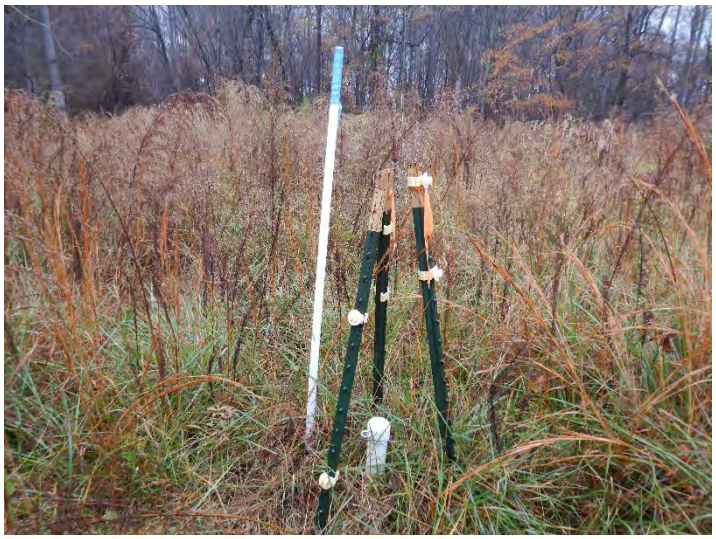


GROUNDWATER GAUGE 4 – *(11/21/2023)*



GROUNDWATER GAUGE 5 – *(11/21/2023)*

GROUNDWATER GAUGE 6 – *(11/21/2023)*



GROUNDWATER GAUGE 7 – *(11/21/2023)*

GROUNDWATER GAUGE 8 – *(11/21/2023)*

GROUNDWATER GAUGE 9 – *(11/21/2023)*

GROUNDWATER GAUGE 10 – *(11/21/2023)*

GROUNDWATER GAUGE 11 – *(11/21/2023)*

APPENDIX B. Vegetation Plot Data

Table 6. Vegetation Plot Data
Liberty Rock Mitigation Site
DMS Project No. 100135
Monitoring Year 1 - 2023

Planted Acreage	23.7
Date of Initial Plant	2023-01-06
Date of Current Survey	2023-08-09
Plot size (ACRES)	0.0247

	Scientific Name	Common Name	Tree/ Shrub	Indicator Status	Veg Plot 1 F		Veg Plot 2 F		Veg Plot 3 F		Veg Plot 4 F		Veg Plot 5 F	
					Planted	Total	Planted	Total	Planted	Total	Planted	Total	Planted	Total
Species Included in Approved Mitigation Plan	Acer negundo	boxelder	Tree	FAC	1	1	1	1	1	1				
	Alnus serrulata	hazel alder	Tree	FACW					1	1	1	1		
	Asimina triloba*	pawpaw	Tree	FAC										
	Betula nigra	river birch	Tree	FACW	1	1	2	2			3	3	4	4
	Celtis laevigata	sugarberry	Tree	FACW										
	Cephalanthus occidentalis*	common buttonbush	Shrub	OBL	2	2	2	2					1	1
	Cornus amomum*	silky dogwood	Shrub	FACW	1	1	1	1	1	1	1	1		
	Diospyros virginiana	common persimmon	Tree	FAC										
	Euonymus americanus*	strawberry bush	Shrub	FAC										
	Platanus occidentalis	American sycamore	Tree	FACW	3	3	2	2	2	2	2	2	2	2
	Quercus lyrata	overcup oak	Tree	OBL	2	2	1	1	2	2	3	3		
	Quercus michauxii	swamp chestnut oak	Tree	FACW			1	1	2	2	1	1	1	1
	Quercus phellos	willow oak	Tree	FACW	1	1	1	1	1	1	3	3	1	1
	Quercus rubra	northern red oak	Tree	FACU										
	Salix nigra*	black willow	Tree	OBL	2	2	2	2	2	2	1	1	2	2
	Sambucus canadensis*	American black elderberry	Tree	FACW			1	1						
	Ulmus alata	winged elm	Tree	FACU										
	Ulmus americana	American elm	Tree	FAC	1	1	3	3	3	3			1	1
Sum				Performance Standard	14	14	17	17	15	15	15	15	12	12
Mitigation Plan Performance Standard				Current Year Stem Count		14		17		15		15		12
				Stems/Acre		567		688		607		607		486
				Species Count		9		11		9		8		7
				Dominant Species Composition (%)		21		18		20		20		33
				Average Plot Height (ft.)		2		2		2		2		2
				% Invasives		0		0		0		0		0
Post Mitigation Plan Performance Standard				Current Year Stem Count		14		17		15		15		12
				Stems/Acre		567		688		607		607		486
				Species Count		9		11		9		8		7
				Dominant Species Composition (%)		21		18		20		20		33
				Average Plot Height (ft.)		2		2		2		2		2
				% Invasives		0		0		0		0		0

*Species not subject to monitoring height requirement due to species growth habit.
1). Bolded species are proposed for the current monitoring year, italicized species are not approved, and a regular font indicates that the species has been approved.
2). The "Species Included in Approved Mitigation Plan" section contains only those species that were included in the original approved mitigation plan. The "Post Mitigation Plan Species" section includes species that are being proposed through a mitigation plan addendum for the current monitoring year (bolded) , species that have been approved in prior monitoring years through a mitigation plan addendum (regular font), and species that are not approved (italicized).
3). The "Mitigation Plan Performance Standard" section is derived only from stems included in the original mitigation plan, whereas the "Post Mitigation Plan Performance Standard" includes data from mitigation plan approved, post mitigation plan approved, and proposed stems.

Table 6. Vegetation Plot Data
Liberty Rock Mitigation Site
DMS Project No. 100135
Monitoring Year 1 - 2023

Planted Acreage	23.7
Date of Initial Plant	2023-01-06
Date of Current Survey	2023-08-09
Plot size (ACRES)	0.0247

	Scientific Name	Common Name	Tree/ Shrub	Indicator Status	Veg Plot 6 F		Veg Plot 7 F		Veg Plot 8 F		Veg Plot 9 F		Veg Plot 10 F	
					Planted	Total	Planted	Total	Planted	Total	Planted	Total	Planted	Total
Species Included in Approved Mitigation Plan	Acer negundo	boxelder	Tree	FAC	1	1	1	1	1	1	2	2	1	1
	Alnus serrulata	hazel alder	Tree	FACW	2	2					1	1	1	1
	Asimina triloba*	pawpaw	Tree	FAC										
	Betula nigra	river birch	Tree	FACW			3	3	3	3	2	2	1	1
	Celtis laevigata	sugarberry	Tree	FACW										
	Cephalanthus occidentalis*	common buttonbush	Shrub	OBL	1	1	1	1					2	2
	Cornus amomum*	silky dogwood	Shrub	FACW			1	1	1	1	1	1		
	Diospyros virginiana	common persimmon	Tree	FAC										
	Euonymus americanus*	strawberry bush	Shrub	FAC										
	Platanus occidentalis	American sycamore	Tree	FACW	3	3	3	3	2	2	2	2	1	1
	Quercus lyrata	overcup oak	Tree	OBL			1	1	3	3			2	2
	Quercus michauxii	swamp chestnut oak	Tree	FACW	3	3	1	1	2	2				
	Quercus phellos	willow oak	Tree	FACW			1	1	1	1	2	2	1	1
	Quercus rubra	northern red oak	Tree	FACU										
	Salix nigra*	black willow	Tree	OBL	2	2	1	1	2	2	2	2	2	2
	Sambucus canadensis*	American black elderberry	Tree	FACW			1	1	1	1	1	1	1	1
	Ulmus alata	winged elm	Tree	FACU										
	Ulmus americana	American elm	Tree	FAC	2	2	1	1	1	1	2	2	2	2
Sum	Performance Standard				14	14	15	15	17	17	15	15	14	14
Mitigation Plan Performance Standard	Current Year Stem Count					14		15		17		15		14
	Stems/Acre					567		607		688		607		567
	Species Count					7		11		10		9		10
	Dominant Species Composition (%)					21		20		18		13		14
	Average Plot Height (ft.)					3		2		2		3		2
	% Invasives					0		0		0		0		0
Post Mitigation Plan Performance Standard	Current Year Stem Count					14		15		17		15		14
	Stems/Acre					567		607		688		607		567
	Species Count					7		11		10		9		10
	Dominant Species Composition (%)					21		20		18		13		14
	Average Plot Height (ft.)					3		2		2		3		2
	% Invasives					0		0		0		0		0

*Species not subject to monitoring height requirement due to species growth habit.
1). Bolded species are proposed for the current monitoring year, italicized species are not approved, and a regular font indicates that the species has been approved.
2). The "Species Included in Approved Mitigation Plan" section contains only those species that were included in the original approved mitigation plan. The "Post Mitigation Plan Species" section includes species that are being proposed through a mitigation plan addendum for the current monitoring year (bolded) , species that have been approved in prior monitoring years through a mitigation plan addendum (regular font), and species that are not approved (italicized).
3). The "Mitigation Plan Performance Standard" section is derived only from stems included in the original mitigation plan, whereas the "Post Mitigation Plan Performance Standard" includes data from mitigation plan approved, post mitigation plan approved, and proposed stems.

Table 6. Vegetation Plot Data

Liberty Rock Mitigation Site

DMS Project No. 100135

Monitoring Year 1 - 2023

Planted Acreage	23.7
Date of Initial Plant	2023-01-06
Date of Current Survey	2023-08-09
Plot size (ACRES)	0.0247

	Scientific Name	Common Name	Tree/ Shrub	Indicator Status	Veg Plot 11 F		Veg Plot 12 F		Veg Plot 13 F		Veg Plot 14 F		Veg Plot 15 F	
					Planted	Total	Planted	Total	Planted	Total	Planted	Total	Planted	Total
Species Included in Approved Mitigation Plan	Acer negundo	boxelder	Tree	FAC	1	1	2	2	3	3	2	2	1	1
	Alnus serrulata	hazel alder	Tree	FACW										
	Asimina triloba*	pawpaw	Tree	FAC									1	1
	Betula nigra	river birch	Tree	FACW	2	2	3	3	1	1	2	2	3	3
	Celtis laevigata	sugarberry	Tree	FACW	1	1	1	1			1	1	1	1
	Cephalanthus occidentalis*	common buttonbush	Shrub	OBL										
	Cornus amomum*	silky dogwood	Shrub	FACW										
	Diospyros virginiana	common persimmon	Tree	FAC	2	2	1	1	3	3	2	2	2	2
	Euonymus americanus*	strawberry bush	Shrub	FAC	1	1	1	1	1	1	1	1	1	1
	Platanus occidentalis	American sycamore	Tree	FACW	2	2	3	3	2	2	3	3	2	2
	Quercus lyrata	overcup oak	Tree	OBL										
	Quercus michauxii	swamp chestnut oak	Tree	FACW	2	2	2	2	2	2	1	1	2	2
	Quercus phellos	willow oak	Tree	FACW	2	2			1	1	1	1		
	Quercus rubra	northern red oak	Tree	FACU							1	1		
	Salix nigra*	black willow	Tree	OBL										
	Sambucus canadensis*	American black elderberry	Tree	FACW										
	Ulmus alata	winged elm	Tree	FACU										
	Ulmus americana	American elm	Tree	FAC	1	1	1	1	2	2	1	1	1	1
Sum	Performance Standard				14	14	14	14	15	15	15	15	14	14
Mitigation Plan Performance Standard	Current Year Stem Count					14		14		15		15		14
	Stems/Acre					567		567		607		607		567
	Species Count					9		8		8		10		9
	Dominant Species Composition (%)					14		21		20		20		21
	Average Plot Height (ft.)					2		2		2		2		2
	% Invasives					0		0		0		0		0
Post Mitigation Plan Performance Standard	Current Year Stem Count					14		14		15		15		14
	Stems/Acre					567		567		607		607		567
	Species Count					9		8		8		10		9
	Dominant Species Composition (%)					14		21		20		20		21
	Average Plot Height (ft.)					2		2		2		2		2
	% Invasives					0		0		0		0		0

*Species not subject to monitoring height requirement due to species growth habit.

1). Bolded species are proposed for the current monitoring year, italicized species are not approved, and a regular font indicates that the species has been approved.

2). The "Species Included in Approved Mitigation Plan" section contains only those species that were included in the original approved mitigation plan. The "Post Mitigation Plan Species" section includes species that are being proposed through a mitigation plan addendum for the current monitoring year (bolded) , species that have been approved in prior monitoring years through a mitigation plan addendum (regular font), and species that are not approved (italicized).

3). The "Mitigation Plan Performance Standard" section is derived only from stems included in the original mitigation plan, whereas the "Post Mitigation Plan Performance Standard" includes data from mitigation plan approved, post mitigation plan approved, and proposed stems.

Table 6. Vegetation Plot Data
Liberty Rock Mitigation Site
DMS Project No. 100135
Monitoring Year 1 - 2023

Planted Acreage	23.7
Date of Initial Plant	2023-01-06
Date of Current Survey	2023-08-09
Plot size (ACRES)	0.0247

	Scientific Name	Common Name	Tree/ Shrub	Indicator Status	Veg Plot 16 R Total	Veg Plot 17 R Total	Veg Plot 18 R Total	Veg Plot 19 R Total
Species Included in Approved Mitigation Plan	Acer negundo	boxelder	Tree	FAC		2	1	1
	Alnus serrulata	hazel alder	Tree	FACW				
	Asimina triloba*	pawpaw	Tree	FAC				
	Betula nigra	river birch	Tree	FACW	3	1		
	Celtis laevigata	sugarberry	Tree	FACW				
	Cephalanthus occidentalis*	common buttonbush	Shrub	OBL		1	1	
	Cornus amomum*	silky dogwood	Shrub	FACW				
	Diospyros virginiana	common persimmon	Tree	FAC				
	Euonymus americanus*	strawberry bush	Shrub	FAC				
	Platanus occidentalis	American sycamore	Tree	FACW	3	2		
	Quercus lyrata	overcup oak	Tree	OBL	2	2	2	
	Quercus michauxii	swamp chestnut oak	Tree	FACW			1	2
	Quercus phellos	willow oak	Tree	FACW		1	1	
	Quercus rubra	northern red oak	Tree	FACU				
	Salix nigra*	black willow	Tree	OBL	2	3	2	
	Sambucus canadensis*	American black elderberry	Tree	FACW				1
	Ulmus alata	winged elm	Tree	FACU				1
	Ulmus americana	American elm	Tree	FAC	1	1	2	4
Sum				Performance Standard	11	13	10	9
Mitigation Plan Performance Standard				Current Year Stem Count	11	13	10	9
				Stems/Acre	445	526	405	364
				Species Count	5	8	7	5
				Dominant Species Composition (%)	27	23	20	44
				Average Plot Height (ft.)	3	2	3	2
				% Invasives	0	0	0	0
Post Mitigation Plan Performance Standard				Current Year Stem Count	11	13	10	9
				Stems/Acre	445	526	405	364
				Species Count	5	8	7	5
				Dominant Species Composition (%)	27	23	20	44
				Average Plot Height (ft.)	3	2	3	2
				% Invasives	0	0	0	0

*Species not subject to monitoring height requirement due to species growth habit.
1). Bolded species are proposed for the current monitoring year, italicized species are not approved, and a regular font indicates that the species has been approved.
2). The "Species Included in Approved Mitigation Plan" section contains only those species that were included in the original approved mitigation plan. The "Post Mitigation Plan Species" section includes species that are being proposed through a mitigation plan addendum for the current monitoring year (bolded) , species that have been approved in prior monitoring years through a mitigation plan addendum (regular font), and species that are not approved (italicized).
3). The "Mitigation Plan Performance Standard" section is derived only from stems included in the original mitigation plan, whereas the "Post Mitigation Plan Performance Standard" includes data from mitigation plan approved, post mitigation plan approved, and proposed stems.

Table 7. Vegetation Performance Standards Summary Table
Liberty Rock Mitigation Site
DMS Project No. 100135
Monitoring Year 1 - 2023

	Veg Plot 1 F				Veg Plot 2 F				Veg Plot 3 F			
	Stems/Ac.	Av. Ht. (ft)**	# Species	% Invasives	Stems/Ac.	Av. Ht. (ft)**	# Species	% Invasives	Stems/Ac.	Av. Ht. (ft)**	# Species	% Invasives
Monitoring Year 7												
Monitoring Year 5												
Monitoring Year 3												
Monitoring Year 2												
Monitoring Year 1	567	2	9	0	688	2	11	0	607	2	9	0
Monitoring Year 0	607	2	10	0	688	2	10	0	607	2	8	0
	Veg Plot 4 F				Veg Plot 5 F				Veg Plot 6 F			
	Stems/Ac.	Av. Ht. (ft)**	# Species	% Invasives	Stems/Ac.	Av. Ht. (ft)**	# Species	% Invasives	Stems/Ac.	Av. Ht. (ft)**	# Species	% Invasives
Monitoring Year 7												
Monitoring Year 5												
Monitoring Year 3												
Monitoring Year 2												
Monitoring Year 1	607	2	8	0	486	2	7	0	567	3	7	0
Monitoring Year 0	607	3	8	0	567	2	8	0	607	2	7	0
	Veg Plot 7 F				Veg Plot 8 F				Veg Plot 9 F			
	Stems/Ac.	Av. Ht. (ft)**	# Species	% Invasives	Stems/Ac.	Av. Ht. (ft)**	# Species	% Invasives	Stems/Ac.	Av. Ht. (ft)**	# Species	% Invasives
Monitoring Year 7												
Monitoring Year 5												
Monitoring Year 3												
Monitoring Year 2												
Monitoring Year 1	607	2	11	0	688	2	10	0	607	3	9	0
Monitoring Year 0	607	2	10	0	688	3	9	0	607	3	9	0
	Veg Plot 10 F				Veg Plot 11 F				Veg Plot 12 F			
	Stems/Ac.	Av. Ht. (ft)**	# Species	% Invasives	Stems/Ac.	Av. Ht. (ft)**	# Species	% Invasives	Stems/Ac.	Av. Ht. (ft)**	# Species	% Invasives
Monitoring Year 7												
Monitoring Year 5												
Monitoring Year 3												
Monitoring Year 2												
Monitoring Year 1	567	2	10	0	567	2	9	0	567	2	8	0
Monitoring Year 0	648	3	10	0	607	2	10	0	607	2	8	0
	Veg Plot 13 F				Veg Plot 14 F				Veg Plot 15 F			
	Stems/Ac.	Av. Ht. (ft)**	# Species	% Invasives	Stems/Ac.	Av. Ht. (ft)**	# Species	% Invasives	Stems/Ac.	Av. Ht. (ft)**	# Species	% Invasives
Monitoring Year 7												
Monitoring Year 5												
Monitoring Year 3												
Monitoring Year 2												
Monitoring Year 1	607	2	8	0	607	2	10	0	567	2	9	0
Monitoring Year 0	688	2	8	0	607	2	9	0	567	2	8	0

*Each monitoring year represents a different plot for the random vegetation plot "groups". Random plots are denoted with an R, and fixed plots with an F.

**Species not subject to monitoring height requirement due to species growth habit are not included in height calculations.

Table 7. Vegetation Performance Standards Summary Table
Liberty Rock Mitigation Site
DMS Project No. 100135
Monitoring Year 1 - 2023

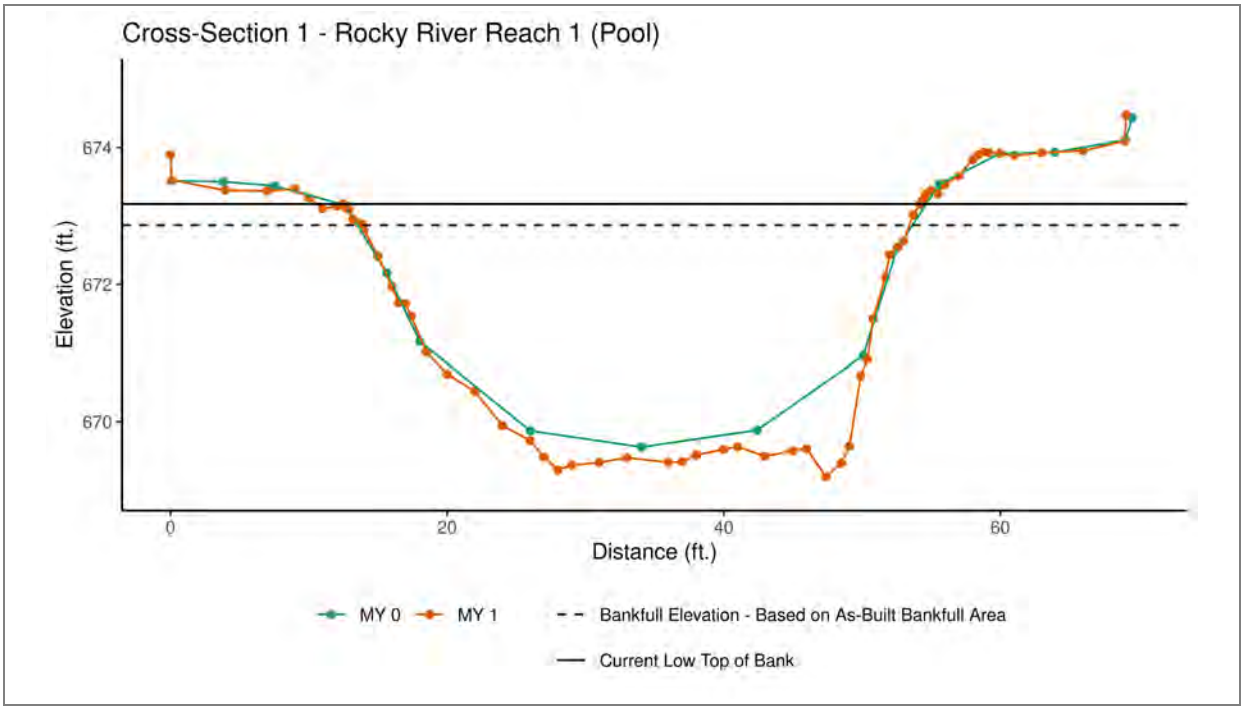
	Veg Plot Group 16 R				Veg Plot Group 17 R				Veg Plot Group 18 R			
	Stems/Ac.	Av. Ht. (ft)**	# Species	% Invasives	Stems/Ac.	Av. Ht. (ft)**	# Species	% Invasives	Stems/Ac.	Av. Ht. (ft)**	# Species	% Invasives
Monitoring Year 7												
Monitoring Year 5												
Monitoring Year 3												
Monitoring Year 2												
Monitoring Year 1	526	3	6	0	526	2	8	0	405	3	7	0
Monitoring Year 0	607	2	9	0	607	3	8	0	526	2	8	0

	Veg Plot Group 19 R			
	Stems/Ac.	Av. Ht. (ft)**	# Species	% Invasives
Monitoring Year 7				
Monitoring Year 5				
Monitoring Year 3				
Monitoring Year 2				
Monitoring Year 1	364	2	5	0
Monitoring Year 0	526	2	10	0

*Each monitoring year represents a different plot for the random vegetation plot "groups". Random plots are denoted with an R, and fixed plots with an F.
**Species not subject to monitoring height requirement due to species growth habit are not included in height calculations.

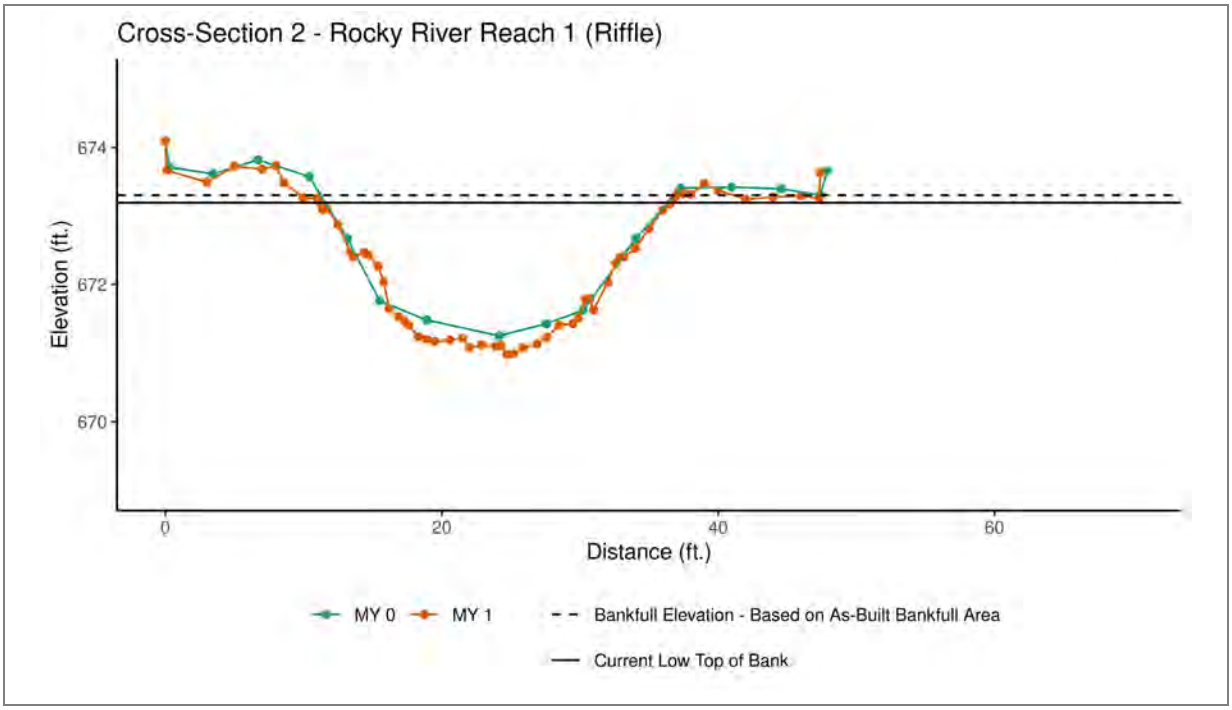
APPENDIX C. Stream Geomorphology Data

Cross-Section Plots



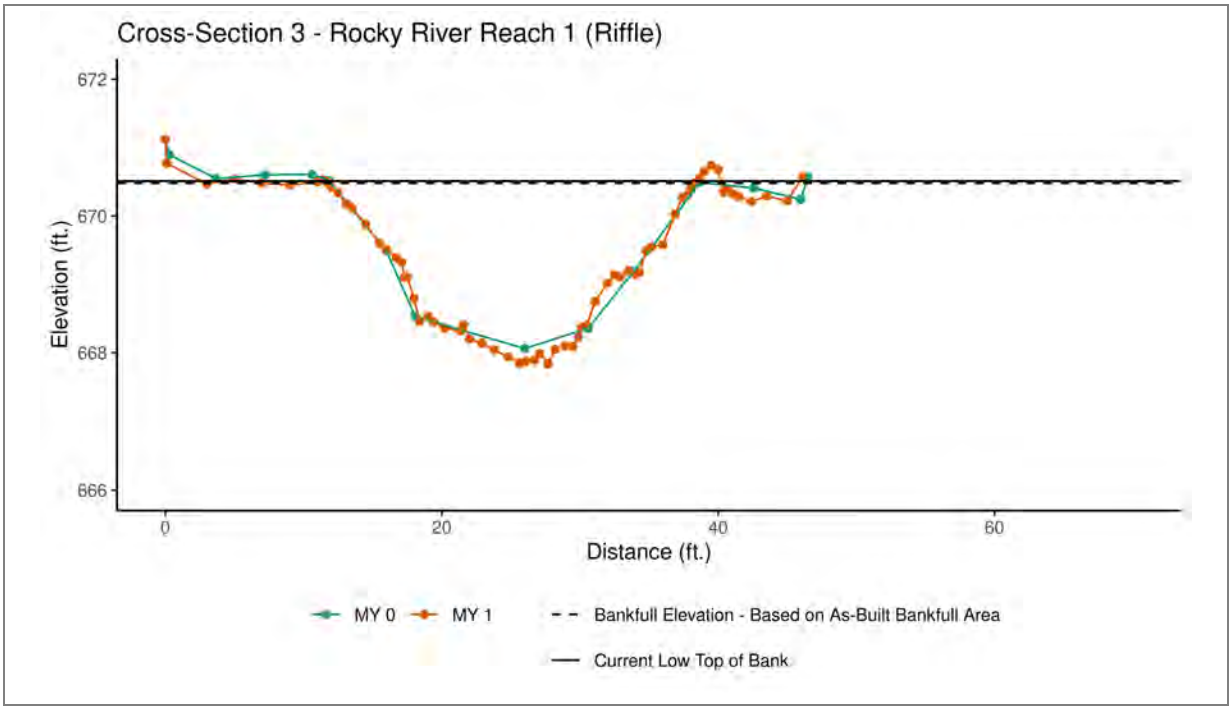
	MY0	MY1	MY2	MY3	MY5	MY7
Bankfull Elevation - Based on AB-Bankfull Area	N/A	N/A				
Bank Height Ratio - Based on AB-Bankfull Area	N/A	N/A				
Thalweg Elevation	669.63	669.20				
LTOB Elevation	673.16	673.18				
LTOB Max Depth	3.53	3.98				
LTOB Cross Sectional Area	107.09	119.65				

Downstream *(04/12/2023)*



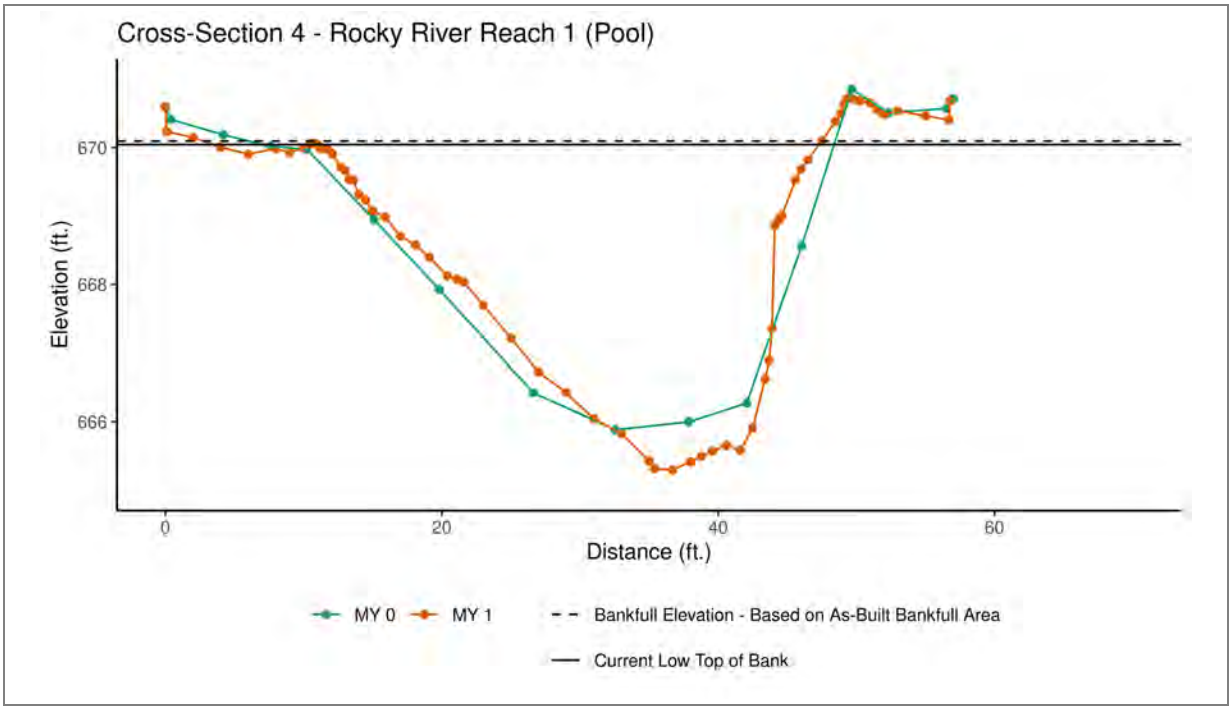
	MY0	MY1	MY2	MY3	MY5	MY7
Bankfull Elevation - Based on AB-Bankfull Area	673.41	673.30				
Bank Height Ratio - Based on AB-Bankfull Area	1.00	0.95				
Thalweg Elevation	671.25	670.98				
LTOB Elevation	673.41	673.20				
LTOB Max Depth	2.16	2.22				
LTOB Cross Sectional Area	38.51	35.78				

Downstream *(04/12/2023)*



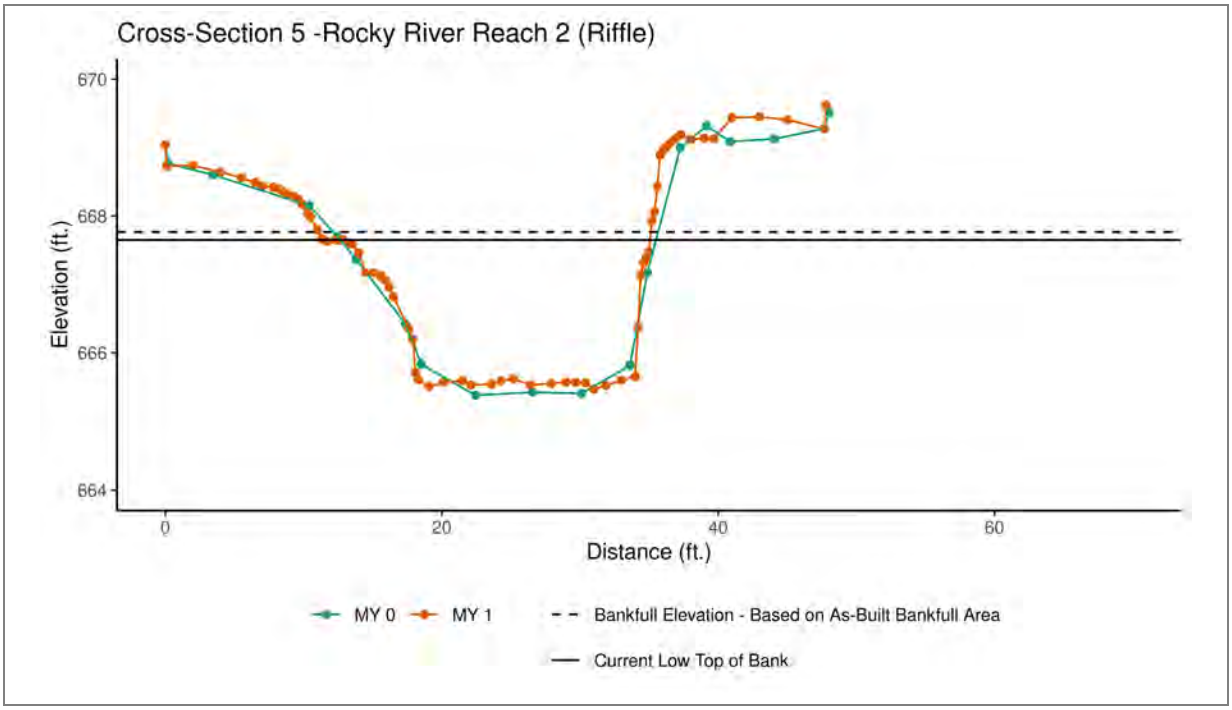
	MY0	MY1	MY2	MY3	MY5	MY7
Bankfull Elevation - Based on AB-Bankfull Area	670.49	670.48				
Bank Height Ratio - Based on AB-Bankfull Area	1.00	1.01				
Thalweg Elevation	668.06	667.84				
LTOB Elevation	670.49	670.51				
LTOB Max Depth	2.43	2.67				
LTOB Cross Sectional Area	41.72	42.54				

Downstream *(04/12/2023)*



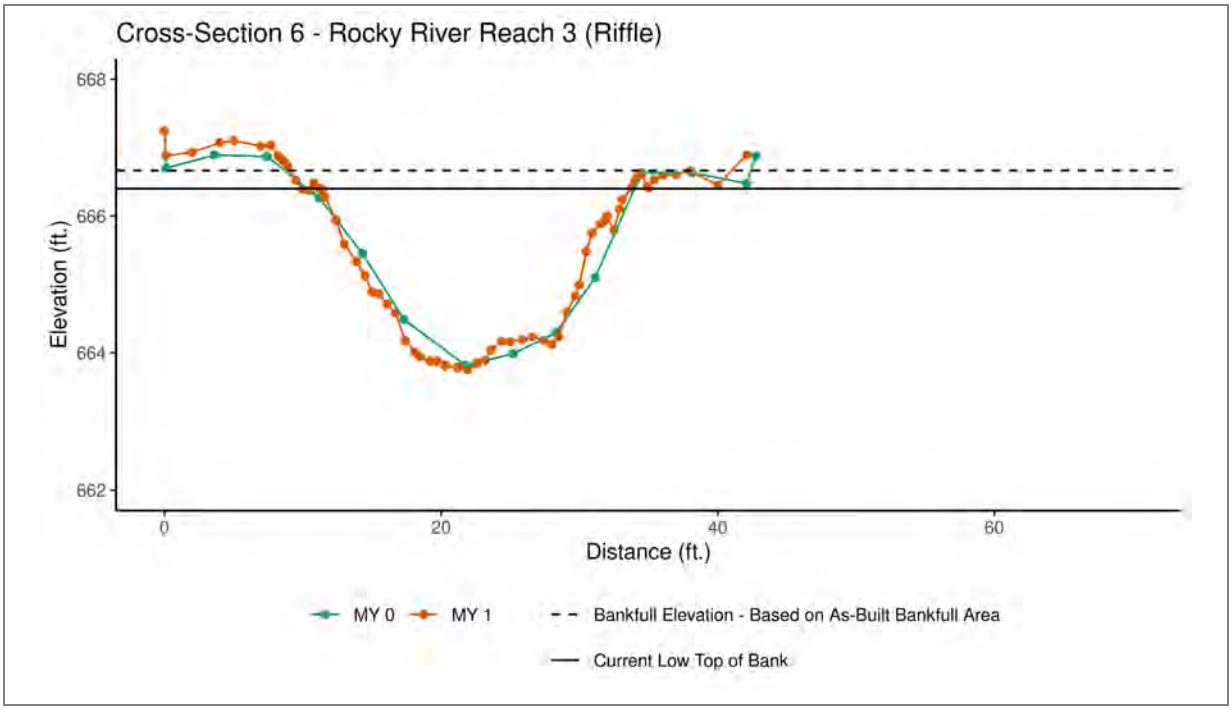
	MY0	MY1	MY2	MY3	MY5	MY7
Bankfull Elevation - Based on AB-Bankfull Area	N/A	N/A				
Bank Height Ratio - Based on AB-Bankfull Area	N/A	N/A				
Thalweg Elevation	665.88	665.30				
LTOB Elevation	669.97	670.05				
LTOB Max Depth	4.09	4.75				
LTOB Cross Sectional Area	100.78	98.93				

Downstream *(04/12/2023)*



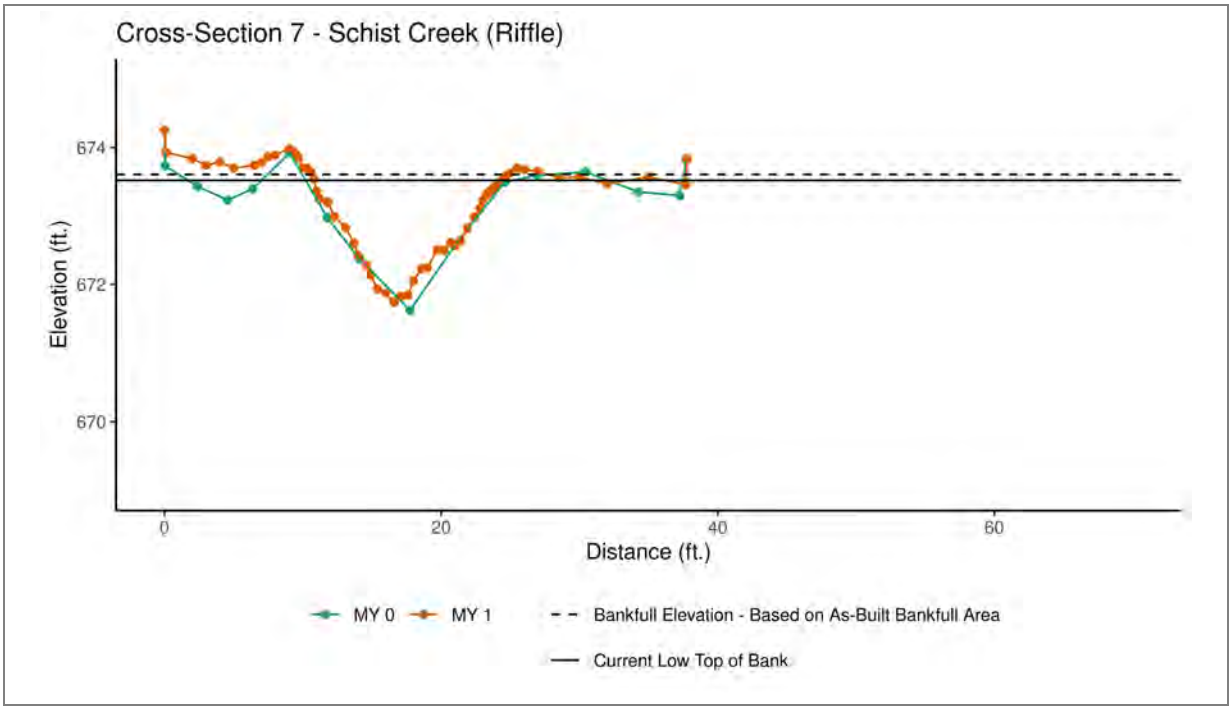
	MY0	MY1	MY2	MY3	MY5	MY7
Bankfull Elevation - Based on AB-Bankfull Area	667.70	667.77				
Bank Height Ratio - Based on AB-Bankfull Area	1.19	0.95				
Thalweg Elevation	665.39	665.48				
LTOB Elevation	668.15	667.65				
LTOB Max Depth	2.76	2.17				
LTOB Cross Sectional Area	50.63	37.04				

Downstream *(04/12/2023)*



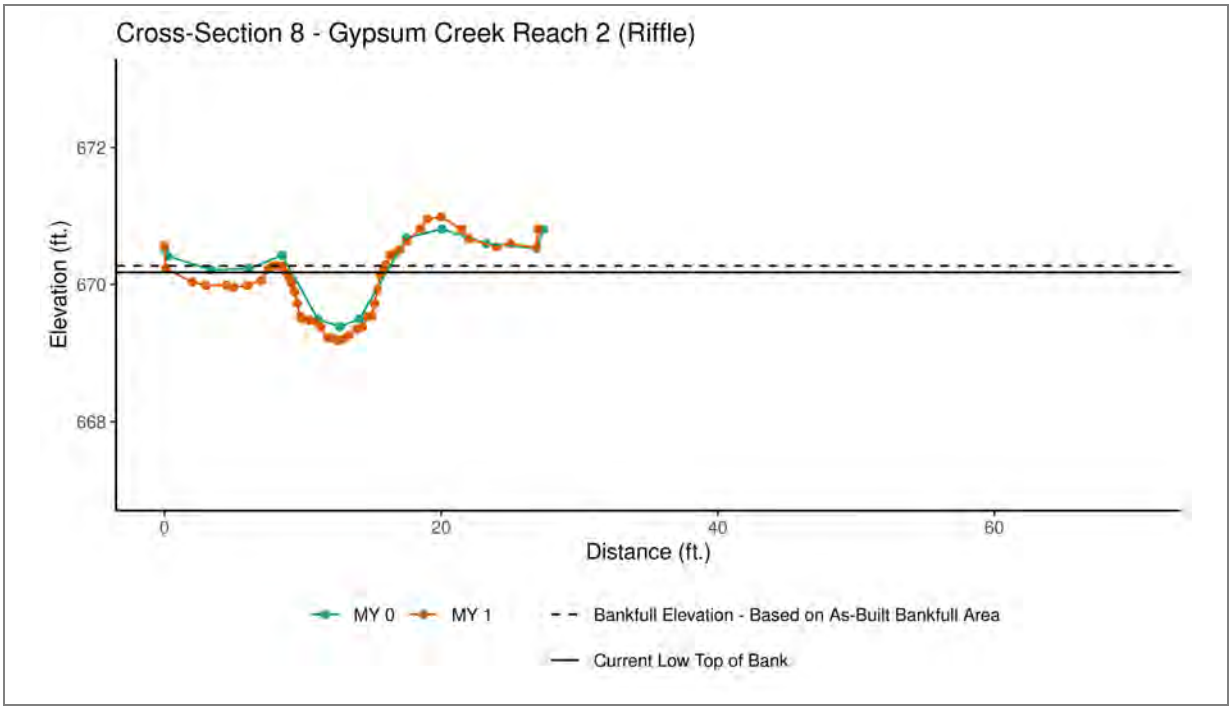
	MY0	MY1	MY2	MY3	MY5	MY7
Bankfull Elevation - Based on AB-Bankfull Area	666.63	666.66				
Bank Height Ratio - Based on AB-Bankfull Area	1.00	0.91				
Thalweg Elevation	663.81	663.85				
LTOB Elevation	666.63	666.40				
LTOB Max Depth	2.82	2.55				
LTOB Cross Sectional Area	44.03	38.10				

Downstream *(04/12/2023)*



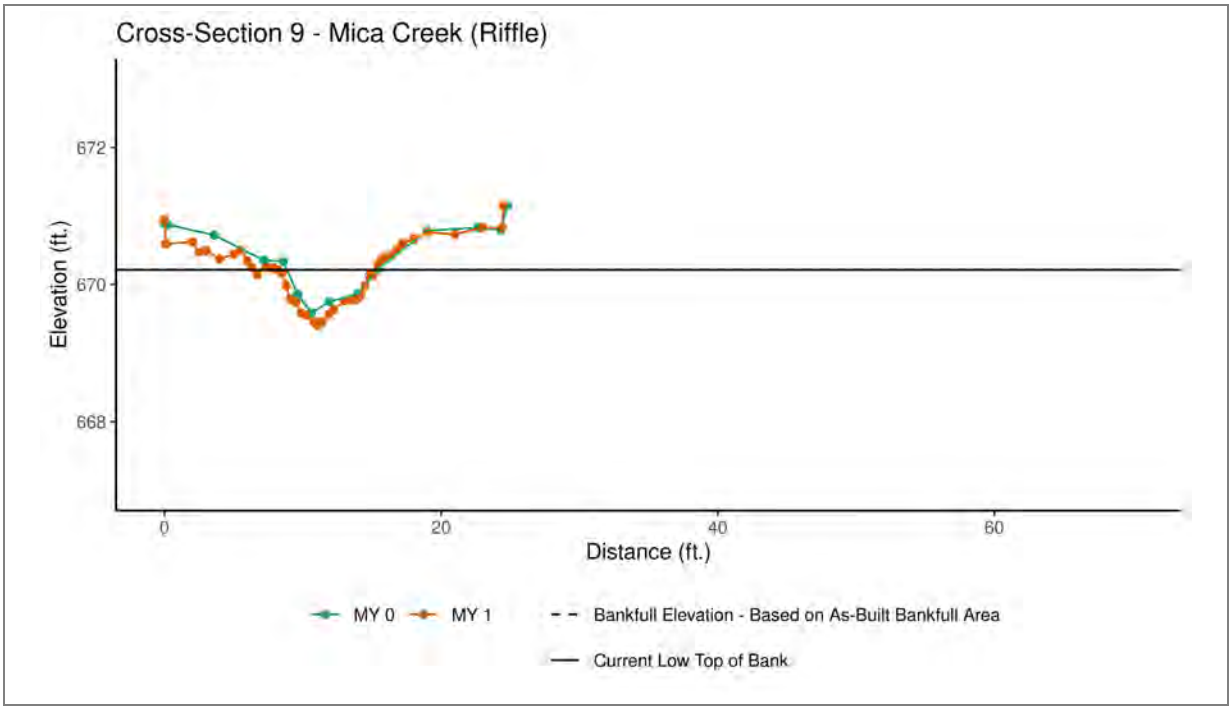
	MY0	MY1	MY2	MY3	MY5	MY7
Bankfull Elevation - Based on AB-Bankfull Area	673.50	673.61				
Bank Height Ratio - Based on AB-Bankfull Area	1.00	0.95				
Thalweg Elevation	671.62	671.74				
LTOB Elevation	673.50	673.52				
LTOB Max Depth	1.88	1.78				
LTOB Cross Sectional Area	14.01	12.84				

Downstream *(04/12/2023)*



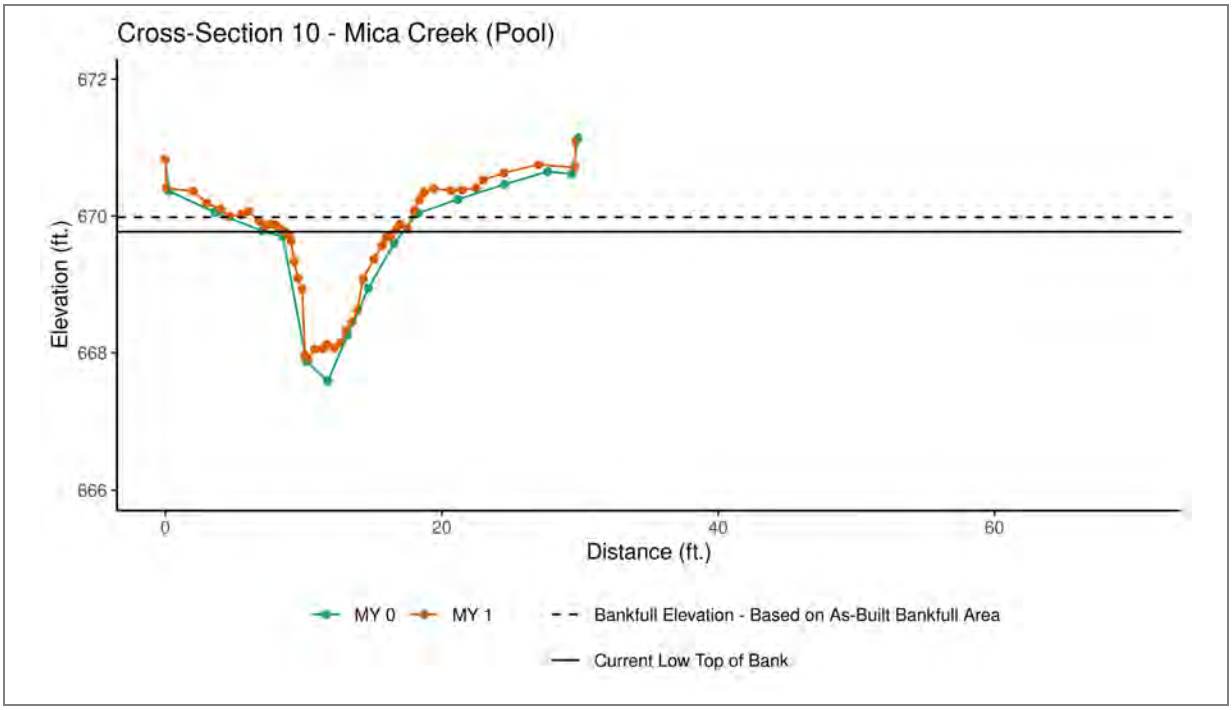
	MY0	MY1	MY2	MY3	MY5	MY7
Bankfull Elevation - Based on AB-Bankfull Area	670.42	670.27				
Bank Height Ratio - Based on AB-Bankfull Area	1.00	0.91				
Thalweg Elevation	669.38	669.18				
LTOB Elevation	670.42	670.18				
LTOB Max Depth	1.04	1.00				
LTOB Cross Sectional Area	5.42	4.76				

Downstream *(04/12/2023)*



	MY0	MY1	MY2	MY3	MY5	MY7
Bankfull Elevation - Based on AB-Bankfull Area	670.34	670.21				
Bank Height Ratio - Based on AB-Bankfull Area	1.00	1.00				
Thalweg Elevation	669.58	669.49				
LTOB Elevation	670.34	670.21				
LTOB Max Depth	0.75	0.81				
LTOB Cross Sectional Area	3.29	3.27				

Downstream *(04/12/2023)*



	MY0	MY1	MY2	MY3	MY5	MY7
Bankfull Elevation - Based on AB-Bankfull Area	N/A	N/A				
Bank Height Ratio - Based on AB-Bankfull Area	N/A	N/A				
Thalweg Elevation	667.60	667.90				
LTOB Elevation	669.70	669.77				
LTOB Max Depth	2.11	1.87				
LTOB Cross Sectional Area	9.62	7.93				

Downstream *(04/12/2023)*

Table 8. Baseline Stream Data Summary

Liberty Rock Mitigation Site

DMS Project No. 100135

Monitoring Year 1 - 2023

	PRE-EXISTING CONDITIONS			DESIGN		MONITORING BASELINE (MY0)		
Parameter	**Rocky River Reach 1**							
Riffle Only	**Min**	**Max**	**n**	**Min**	**Max**	**Min**	**Max**	**n**
Bankfull Width (ft)	21.6		2	28.0		30.6	30.7	2
Floodprone Width (ft)	200.0		2	>100.0		200.0		2
Bankfull Mean Depth (ft)	1.7		2	1.6		1.3	1.4	2
Bankfull Max Depth (ft)	2.8		2	2.5		2.2	2.4	2
Bankfull Cross Sectional Area (ft^2)	35.7		2	45.5		38.5	41.7	2
Width/Depth Ratio	12.7		2	17.2		22.4	24.2	2
Entrenchment Ratio	>2.2		2	>2.2		6.5		2
Bank Height Ratio	1.0		2	1.0		1.0		2
Max particle size (mm) mobilized at bankfull	19.0			60.0		12.0	13.0	2
Rosgen Classification	C4			C4		C4		
Bankfull Discharge (cfs)	110.0	121.0	2	110.0		94.1	107.2	2
Sinuosity	1.10		2	1.26		1.26		
Water Surface Slope (ft/ft)	0.0010	0.0090	2	0.0010	0.0050	---[2]		
Other	---			---		---		
Parameter	**Rocky River Reach 2[1]**							
Riffle Only	**Min**	**Max**	**n**	**Min**	**Max**	**Min**	**Max**	**n**
Bankfull Width (ft)	22.8		1	N/A		22.4		1
Floodprone Width (ft)	200.0		1	>20.0		200.0		1
Bankfull Mean Depth (ft)	2.1		1	N/A		1.8		1
Bankfull Max Depth (ft)	3.0		1	N/A		2.3		1
Bankfull Cross Sectional Area (ft^2)	48.1		1	N/A		39.4		1
Width/Depth Ratio	12.6		1	N/A		12.8		1
Entrenchment Ratio	>2.2		1	N/A		8.9		1
Bank Height Ratio	1.0		1	N/A		1.2		1
Max particle size (mm) mobilized at bankfull	11.0			N/A		8.0		
Rosgen Classification	C4			N/A		C4		
Bankfull Discharge (cfs)	110.0	121.0	1	N/A		83.3		
Sinuosity	1.00		1	N/A		1.09		
Water Surface Slope (ft/ft)	0.0010	0.0090	1	N/A		0.0027		
Other	---			---		---		

[1]Restoration activities along Rocky River Reach 2 were limited to bank grading and stabilization. No work was done on the channel bed per agreement with USFWS and WRC on potential impact to on-site mussels. Design parameters were not used on this reach.

[2]Water Surface not recorded, no water present in channel at time of as-built survey.

Table 8. Baseline Stream Data Summary

Liberty Rock Mitigation Site

DMS Project No. 100135

Monitoring Year 1 - 2023

	PRE-EXISTING CONDITIONS			DESIGN		MONITORING BASELINE (MY0)		
Parameter	**Rocky River Reach 3**							
Riffle Only	**Min**	**Max**	**n**	**Min**	**Max**	**Min**	**Max**	**n**
Bankfull Width (ft)	18.1		1	26.0		22.5		1
Floodprone Width (ft)	200.0		1	>100.0		200.0		1
Bankfull Mean Depth (ft)	2.3		1	1.9		1.6		1
Bankfull Max Depth (ft)	2.9		1	3.0		2.5		1
Bankfull Cross Sectional Area (ft^2)	41.4		1	49.0		44.0		1
Width/Depth Ratio	7.9		1	13.8		14.4		1
Entrenchment Ratio	>2.2		1	>2.2		8.9		1
Bank Height Ratio	1.0		1	1.0		1.0		1
Max particle size (mm) mobilized at bankfull	12.0			55.0		17.0		
Rosgen Classification	C4			C4		C4		
Bankfull Discharge (cfs)	110.0	121.0	1	128.0		105.7		
Sinuosity	1.00	1.10	1	1.10		1.10		
Water Surface Slope (ft/ft)	0.0010	0.0090	1	0.0020		0.0002		
Other	---			---		---		
Parameter	**Schist Creek**							
Riffle Only	**Min**	**Max**	**n**	**Min**	**Max**	**Min**	**Max**	**n**
Bankfull Width (ft)	11.2		1	12.8		24.4		1
Floodprone Width (ft)	75.0		1	>75.0		75.0		1
Bankfull Mean Depth (ft)	0.9		1	1.0		0.6		1
Bankfull Max Depth (ft)	1.8		1	1.5		1.9		1
Bankfull Cross Sectional Area (ft^2)	10.4		1	12.5		14.0		1
Width/Depth Ratio	12.4		1	13.0		38.7		1
Entrenchment Ratio	>2.2		1	>2.2		3.1		1
Bank Height Ratio	1.2		1	1.0		1.0		1
Max particle size (mm) mobilized at bankfull	7.0			62.0		3.0		
Rosgen Classification	C4/E4			C4		C4		
Bankfull Discharge (cfs)	20.9		1	31.0		17.2		
Sinuosity	1.00		1	1.17		1.17		
Water Surface Slope (ft/ft)	0.0000	0.0010	1	0.0060	0.0170	0.0038		
Other	---			---		---		

Table 8. Baseline Stream Data Summary

Liberty Rock Mitigation Site

DMS Project No. 100135

Monitoring Year 1 - 2023

	PRE-EXISTING CONDITIONS			DESIGN		MONITORING BASELINE (MY0)		
Parameter	**Gypsum Creek Reach 2[3]**							
Riffle Only	**Min**	**Max**	**n**	**Min**	**Max**	**Min**	**Max**	**n**
Bankfull Width (ft)	---		---	8.7		8.3		1
Floodprone Width (ft)	---		---	>100.0		100.0		1
Bankfull Mean Depth (ft)	---		---	0.5		0.7		1
Bankfull Max Depth (ft)	---		---	0.8		1.0		1
Bankfull Cross Sectional Area (ft^2)	---		---	2.9		5.4		1
Width/Depth Ratio	---		---	13.0		12.7		1
Entrenchment Ratio	---		---	>2.2		12.1		1
Bank Height Ratio	---		---	1.0		1.0		1
Max particle size (mm) mobilized at bankfull	---			31.0		12.0		
Rosgen Classification	---			C4		C4		
Bankfull Discharge (cfs)	---			4.0		11.7		
Sinuosity	1.00			1.15		1.15		
Water Surface Slope (ft/ft)	0.0001	0.0100	1	0.0096		0.0057		
Other	---			---		---		
Parameter	**Mica Creek**							
Riffle Only	**Min**	**Max**	**n**	**Min**	**Max**	**Min**	**Max**	**n**
Bankfull Width (ft)	6.6		1	8.7		7.5		1
Floodprone Width (ft)	50.0		1	>50.0		50.0		1
Bankfull Mean Depth (ft)	0.7		1	0.7		0.4		1
Bankfull Max Depth (ft)	1.5		1	1.0		0.8		1
Bankfull Cross Sectional Area (ft^2)	4.9		1	5.7		3.3		1
Width/Depth Ratio	9.4		1	13.0		17.3		1
Entrenchment Ratio	>2.2		1	>2.2		6.6		1
Bank Height Ratio	1.7		1	1.0		1.0		1
Max particle size (mm) mobilized at bankfull	25.0			79.0		24.0		
Rosgen Classification	C4/E4			C4		C4		
Bankfull Discharge (cfs)	20.1			16.0		9.5		
Sinuosity	1.00			1.12		1.18		
Water Surface Slope (ft/ft)	0.0090	0.0150	1	0.0140		0.0138		
Other	---			---		---		

[3]Gypsum Creek Pre-Exisiting Conditions data not recorded.

Table 9. Cross-Section Morphology Monitoring Summary

Liberty Rock Mitigation Site

DMS Project No. 100135

Monitoring Year 1 - 2023

	Rocky River Reach 1																					
	Cross-Section 1 (Pool)						Cross-Section 2 (Riffle)						Cross-Section 3 (Riffle)						Cross-Section 4 (Pool)					
	MY0	MY1	MY2	MY3	MY5	MY7	MY0	MY1	MY2	MY3	MY5	MY7	MY0	MY1	MY2	MY3	MY5	MY7	MY0	MY1	MY2	MY3	MY5	MY7
Bankfull Elevation (ft) - Based on AB-Bankfull[1] Area	N/A	N/A					673.41	673.30					670.49	670.48					N/A	N/A				
Bank Height Ratio - Based on AB Bankfull[1] Area	N/A	N/A					1.00	0.95					1.00	1.01					N/A	N/A				
Thalweg Elevation	669.63	669.20					671.25	670.98					668.06	667.84					665.88	665.30				
LTOB[2] Elevation	673.16	673.18					673.41	673.20					670.49	670.51					669.97	670.05				
LTOB[2] Max Depth (ft)	3.53	3.98					2.16	2.22					2.43	2.67					4.09	4.75				
LTOB[2] Cross Sectional Area (ft^2)	107.09	119.65					38.51	35.78					41.72	42.54					100.78	98.93				
	Rocky River Reach 2						Rocky River Reach 3						Schist Creek						Gypsum Creek					
	Cross-Section 5 (Riffle)						Cross-Section 6 (Riffle)						Cross-Section 7 (Riffle)						Cross-Section 8 (Riffle)					
	MY0	MY1	MY2	MY3	MY5	MY7	MY0	MY1	MY2	MY3	MY5	MY7	MY0	MY1	MY2	MY3	MY5	MY7	MY0	MY1	MY2	MY3	MY5	MY7
Bankfull Elevation (ft) - Based on AB-Bankfull[1] Area	667.70	667.77					666.63	666.66					673.50	673.61					670.42	670.27				
Bank Height Ratio - Based on AB Bankfull[1] Area	1.19	0.95					1.00	0.91					1.00	0.95					1.00	0.91				
Thalweg Elevation	665.39	665.48					663.81	663.85					671.62	671.74					669.38	669.18				
LTOB[2] Elevation	668.15	667.65					666.63	666.40					673.50	673.52					670.42	670.18				
LTOB[2] Max Depth (ft)	2.76	2.17					2.82	2.55					1.88	1.78					1.04	1.00				
LTOB[2] Cross Sectional Area (ft^2)	50.63	37.04					44.03	38.10					14.01	12.84					5.42	4.76				
	Mica Creek																							
	Cross-Section 9 (Riffle)						Cross-Section 10 (Pool)																	
	MY0	MY1	MY2	MY3	MY5	MY7	MY0	MY1	MY2	MY3	MY5	MY7												
Bankfull Elevation (ft) - Based on AB-Bankfull[1] Area	670.34	670.21					N/A	N/A																
Bank Height Ratio - Based on AB Bankfull[1] Area	1.00	1.00					N/A	N/A																
Thalweg Elevation	669.58	669.49					667.60	667.90																
LTOB[2] Elevation	670.34	670.21					669.70	669.77																
LTOB[2] Max Depth (ft)	0.75	0.81					2.11	1.87																
LTOB[2] Cross Sectional Area (ft^2)	3.29	3.27					9.62	7.93																

[1]Bank Height Ratio (BHR) takes the As-built bankful area as the basis for adjusting each subsequent years bankfull elevation.

[2]LTOB Area and Max depth - These are based on the LTOB elevation for each years survey (The same elevation used for the LTOB in the BHR calculation). Area below the LTOB elevation will be used and tracked for each year as above. The difference between the LTOB elevation and the thalweg elevation (same as in the BHR calculation) will be recroded and tracked above as LTOB max depth.

APPENDIX D. Hydrology Data

Table 10. Bankfull Events

Liberty Rock Mitigation Site
DMS Project No. 100135
Monitoring Year 1 - 2023

Reach	MY1 (2023)*	MY2 (2024)	MY3 (2025)	MY4 (2026)	MY5 (2027)	MY6 (2028)	MY7 (2029)
Rocky River Reach 1**	4/7/2023						
Rocky River Reach 2	1/25/2023						
	2/12/2023						
	3/2/2023						
	4/7/2023						
	4/9/2023						
	6/23/2023						
Mica Creek	1/25/2023						
	2/12/2023						
	3/2/2023						
	4/7/2023						
	6/23/2023						

*Data was collected 1/1/2023 to 11/21/2023. Data from the remainder of MY1 will be updated in MY2.

**Installed on February 21, 2023.

Table 11. Rainfall Summary

Liberty Rock Mitigation Site
DMS Project No. 100135
Monitoring Year 1 - 2023

	MY1 (2023)	MY2 (2024)	MY3 (2025)	MY4 (2026)	MY5 (2027)	MY6 (2028)	MY7 (2029)
Annual Precipitation Total	32.74*						
30 Year Average Precip. WETS 30th Percentile	40.90 in.						
30 Year Average Precip. WETS 70th Percentile	48.62 in.						
Annual Precipitation Compared to Normal	--*						

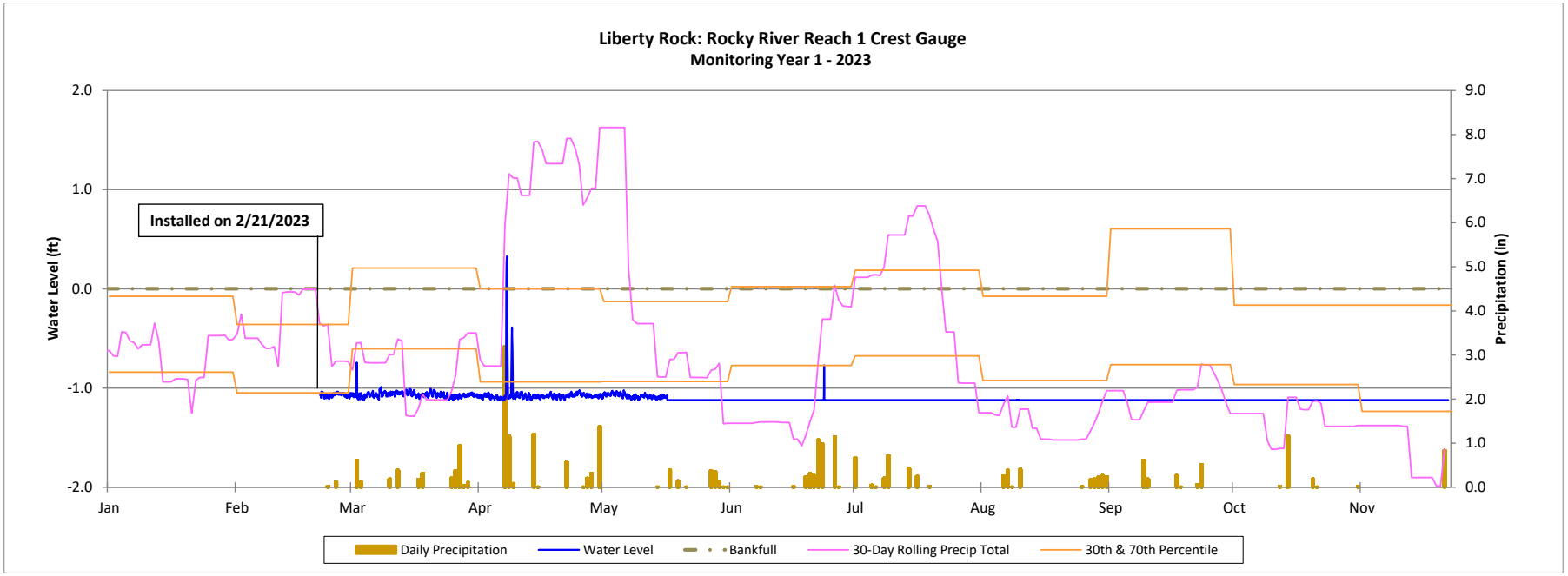
Annual Precipitation Source: **Siler City Airport (SILR)** Station, Chatham County, NC, State Climate Office, approximately 8.7-mi. southeast.

30 Year Average Precipitation Source: **Randleman** Station, Randolph County, NC, AgACIS, approximately 17-mi. west.

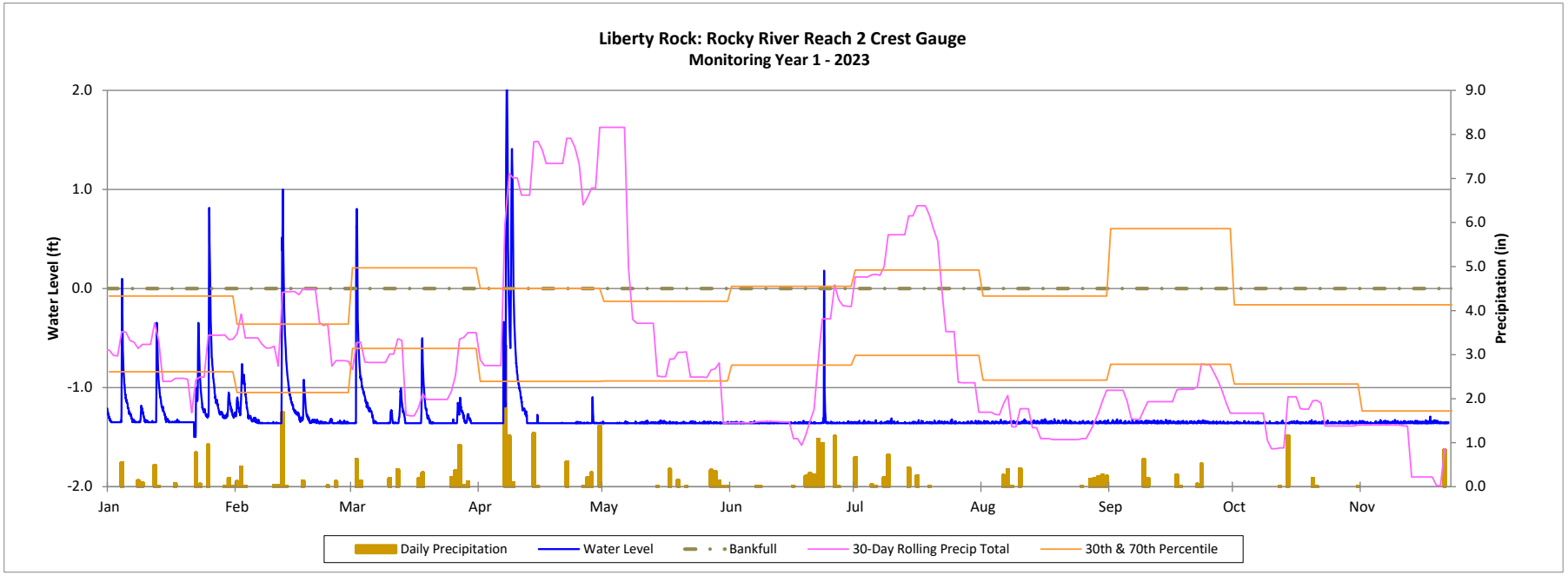
*Annual precipitation was collected 1/1/2023 to 11/21/2023. Data from the remainder of MY1 will be updated in MY2.

Recorded Bankfull Events Plot

Liberty Rock Mitigation Site
DMS Project No. 100135
Monitoring Year 1 - 2023



Recorded Bankfull Events Plot
Liberty Rock Mitigation Site
DMS Project No. 100135
Monitoring Year 1 - 2023



Recorded Bankfull Events Plot
Liberty Rock Mitigation Site
DMS Project No. 100135
Monitoring Year 1 - 2023

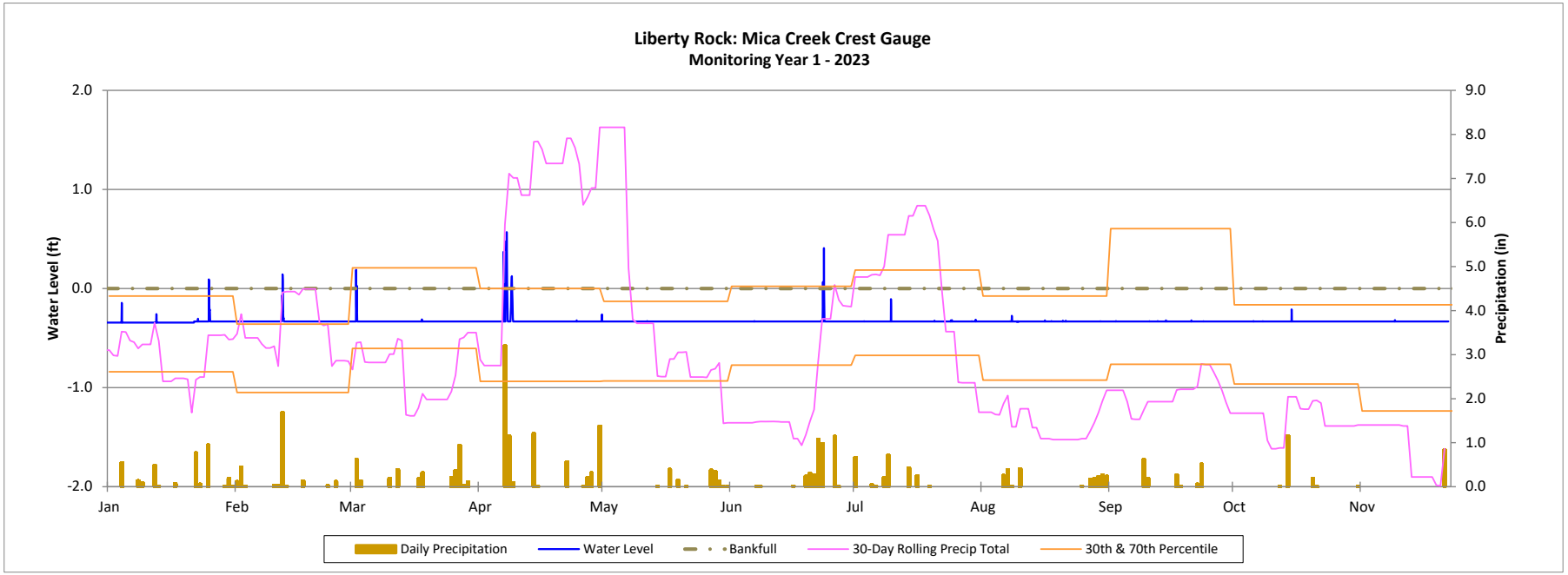


Table 12. Recorded In-Stream Flow Events Summary

Liberty Rock Mitigation Site
DMS Project No. 100135
Monitoring Year 1 - 2023

Reach	Max Consecutive Days/Total Days Meeting Success Criteria*						
	MY1 (2023)**	MY2 (2024)	MY3 (2025)	MY4 (2026)	MY5 (2027)	MY6 (2028)	MY7 (2029)
Gypsum Creek	199 Days/ 203 Days						

*Success criteria is 30 consecutive days of flow.

**Data was colleted through 11/21/2023. Data will be updated in MY2.

Recorded In-Stream Flow Events Plot
Liberty Rock Mitigation Site
DMS Project No. 100135
Monitoring Year 1 - 2023

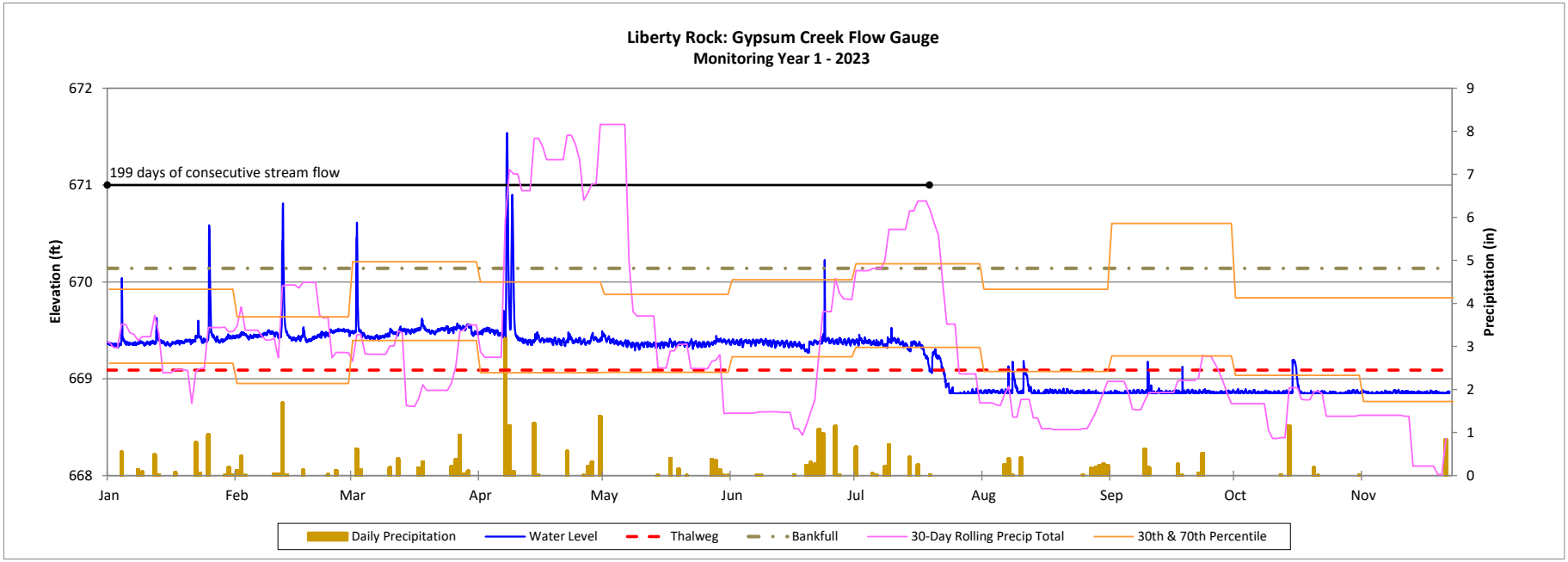


Table 13. Groundwater Gauge Summary

Liberty Rock Mitigation Site

DMS Project No. 100135

Monitoring Year 1 - 2023

Gauge	Max. Consecutive Hydroperiod (Percentage)						
	MY1 (2023)	MY2 (2024)	MY3 (2025)	MY4 (2026)	MY5 (2027)	MY6 (2028)	MY7 (2029)
1	148 Days (55.8%)						
2	3 Days (1.1%)						
3	107 Days (40.4%)						
4	34 Days (12.8%)						
5	71 Days (26.8%)						
6	109 Days (41.1%)						
7	15 Days (5.7%)						
8	75 Days (28.3%)						
9	13 Days (4.9%)						
10	75 Days (28.3%)						
11	6 Days (2.3%)						

Performance Standard: Free groundwater table within 12 inches of the ground surface for 12% (31 days) of the growing season.

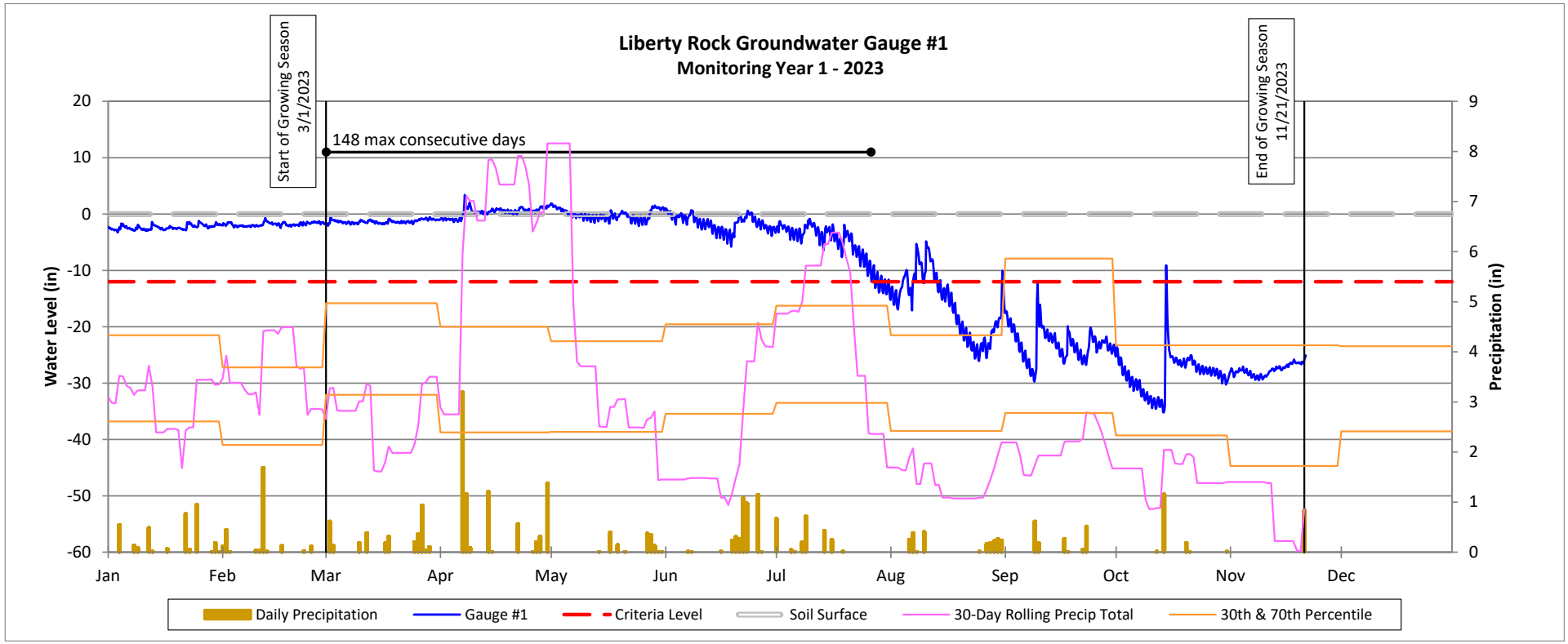
Growing Season: **3/1 to 11/21 (265 Days)**

Groundwater Gauge Plot

Liberty Rock Mitigation Site

DMS Project No. 100135

Monitoring Year 1 - 2023

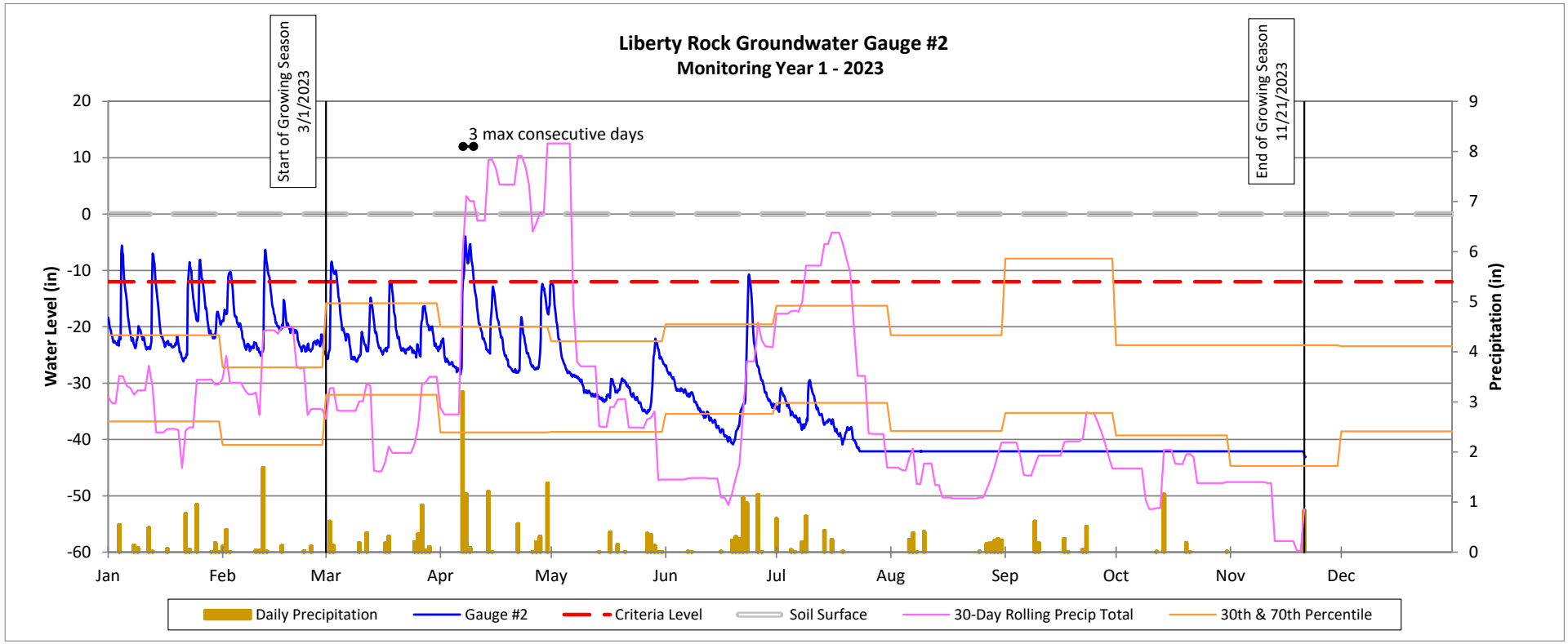


Groundwater Gauge Plot

Liberty Rock Mitigation Site

DMS Project No. 100135

Monitoring Year 1 - 2023

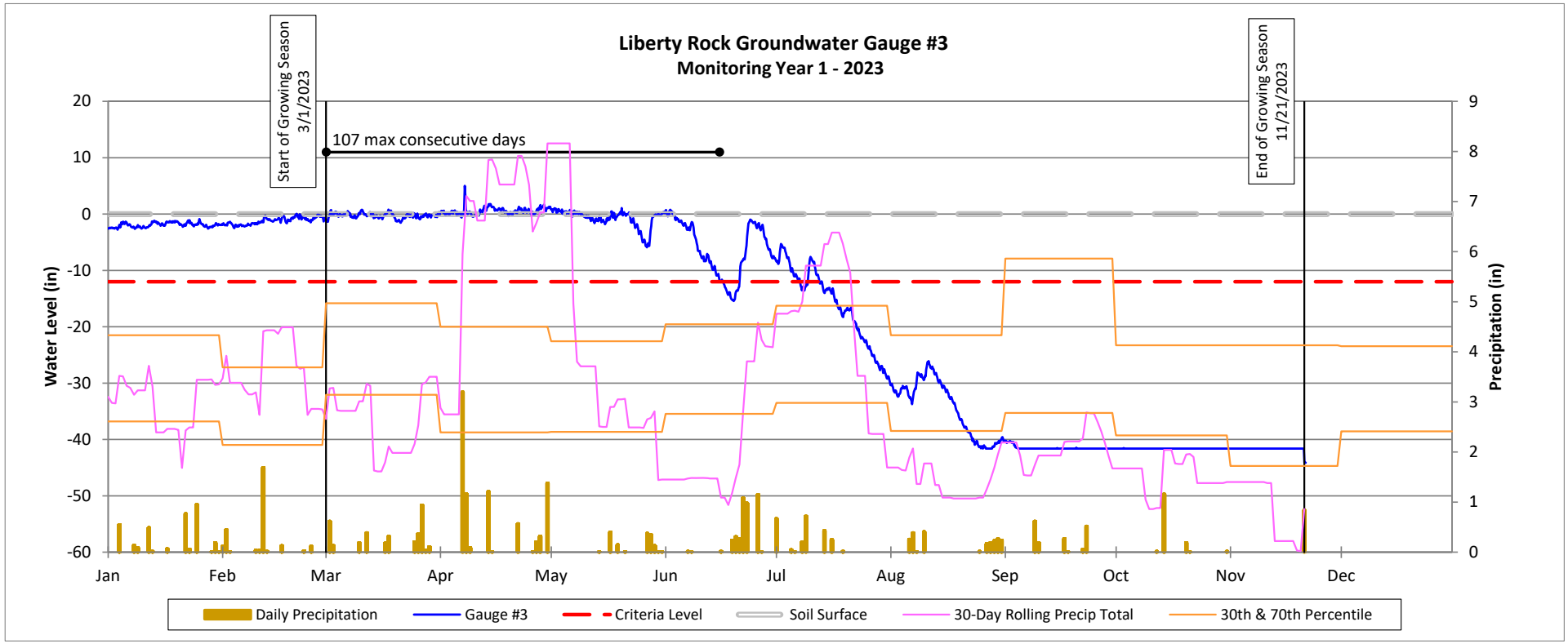


Groundwater Gauge Plot

Liberty Rock Mitigation Site

DMS Project No. 100135

Monitoring Year 1 - 2023

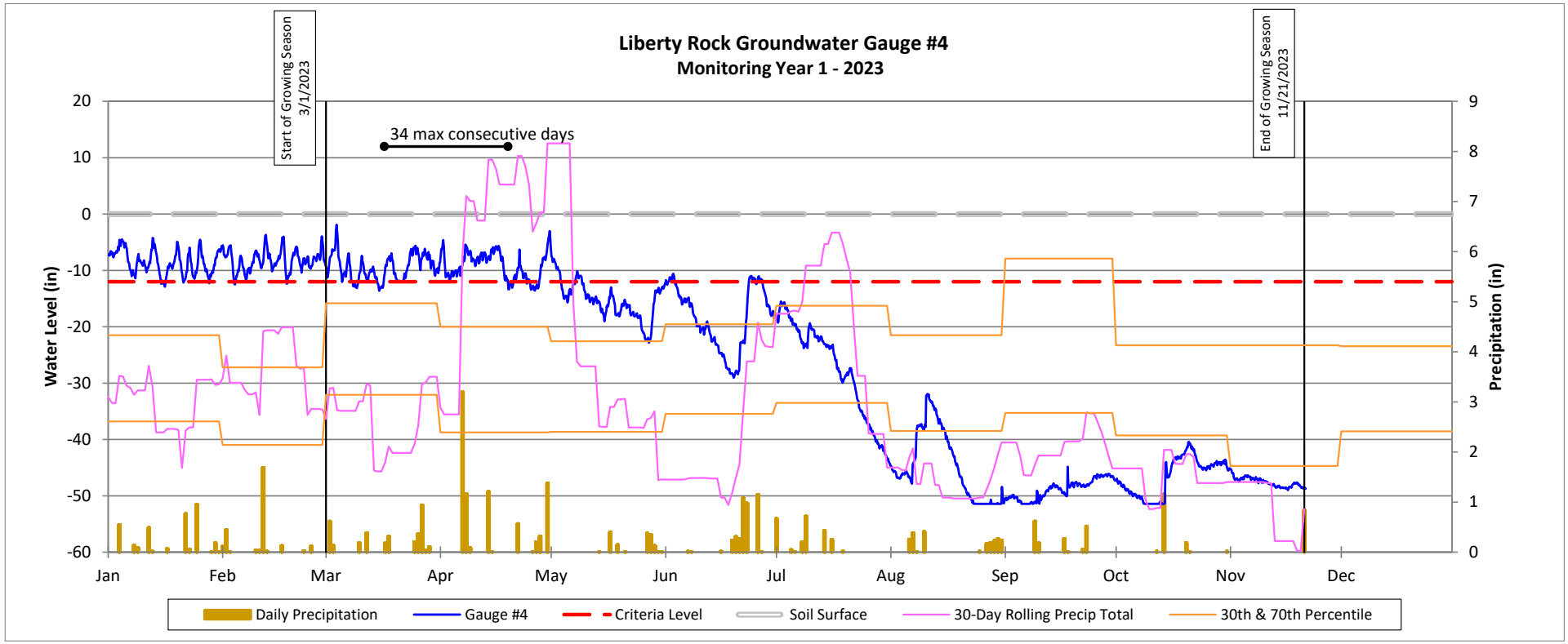


Groundwater Gauge Plot

Liberty Rock Mitigation Site

DMS Project No. 100135

Monitoring Year 1 - 2023

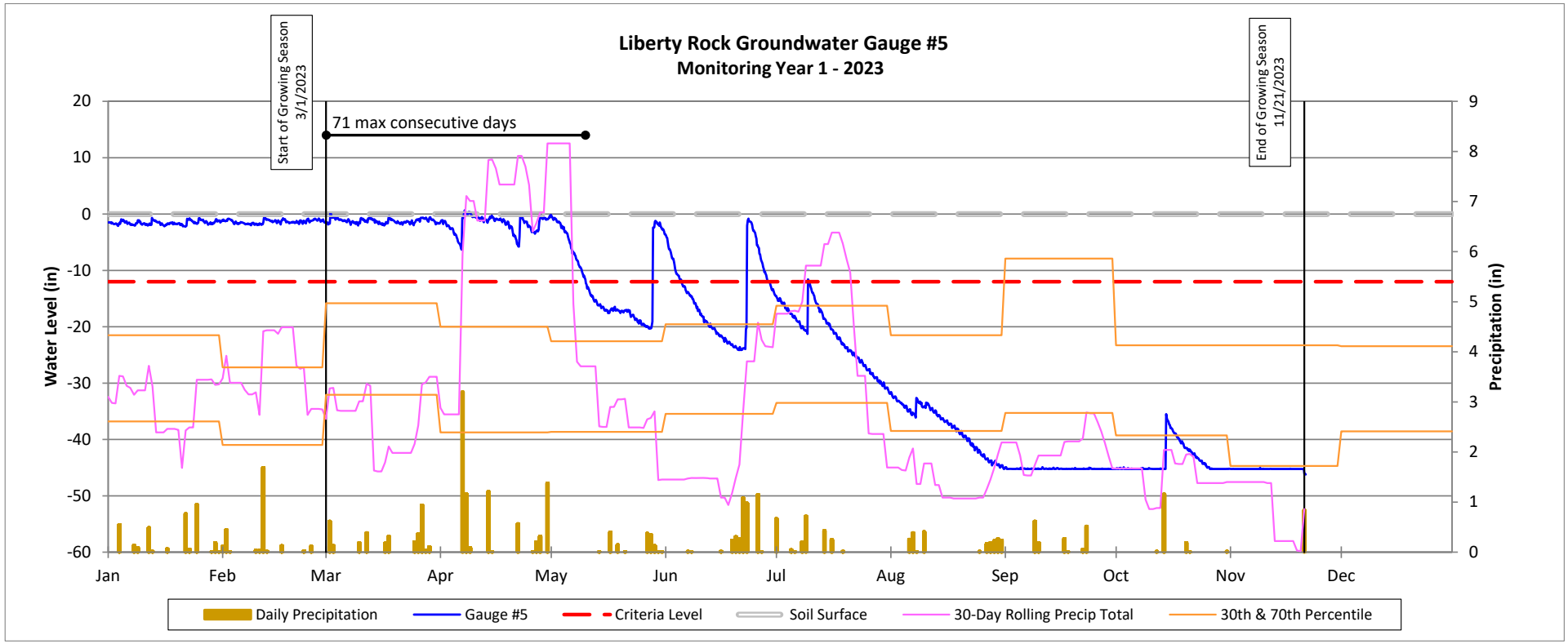


Groundwater Gauge Plot

Liberty Rock Mitigation Site

DMS Project No. 100135

Monitoring Year 1 - 2023

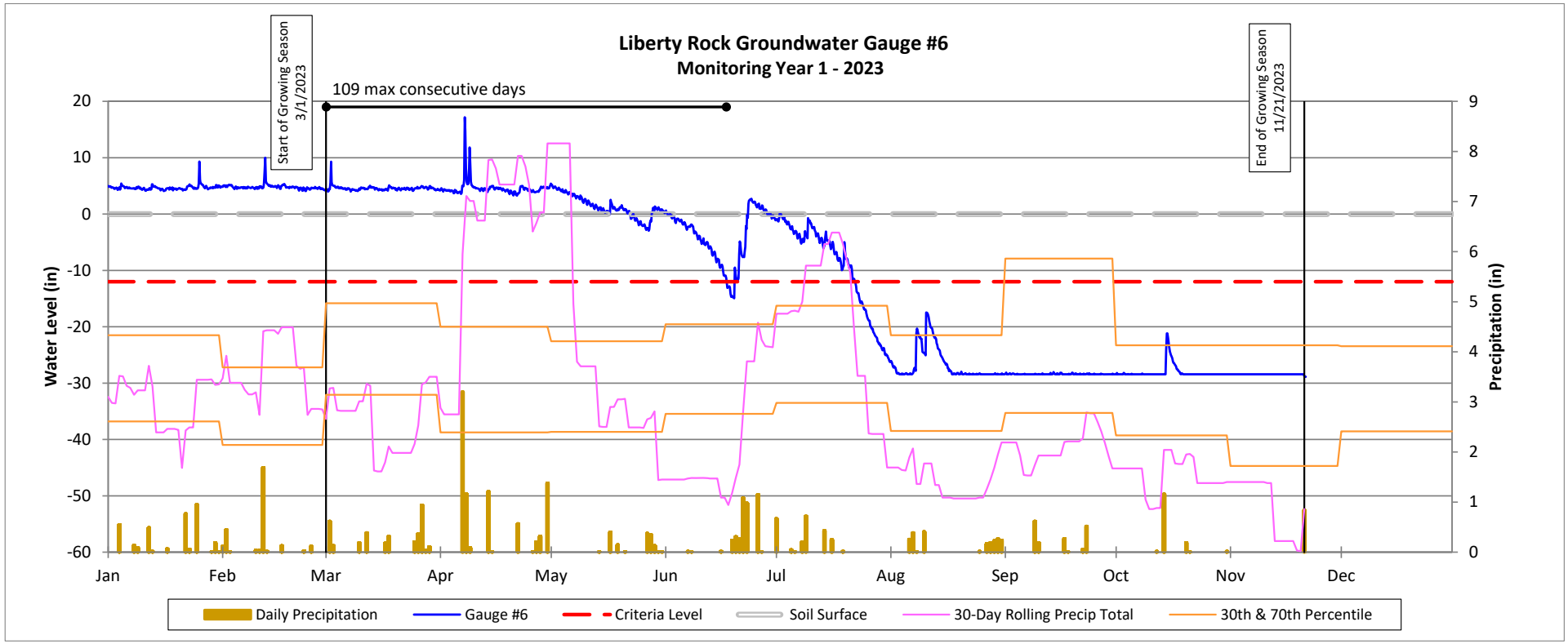


Groundwater Gauge Plot

Liberty Rock Mitigation Site

DMS Project No. 100135

Monitoring Year 1 - 2023

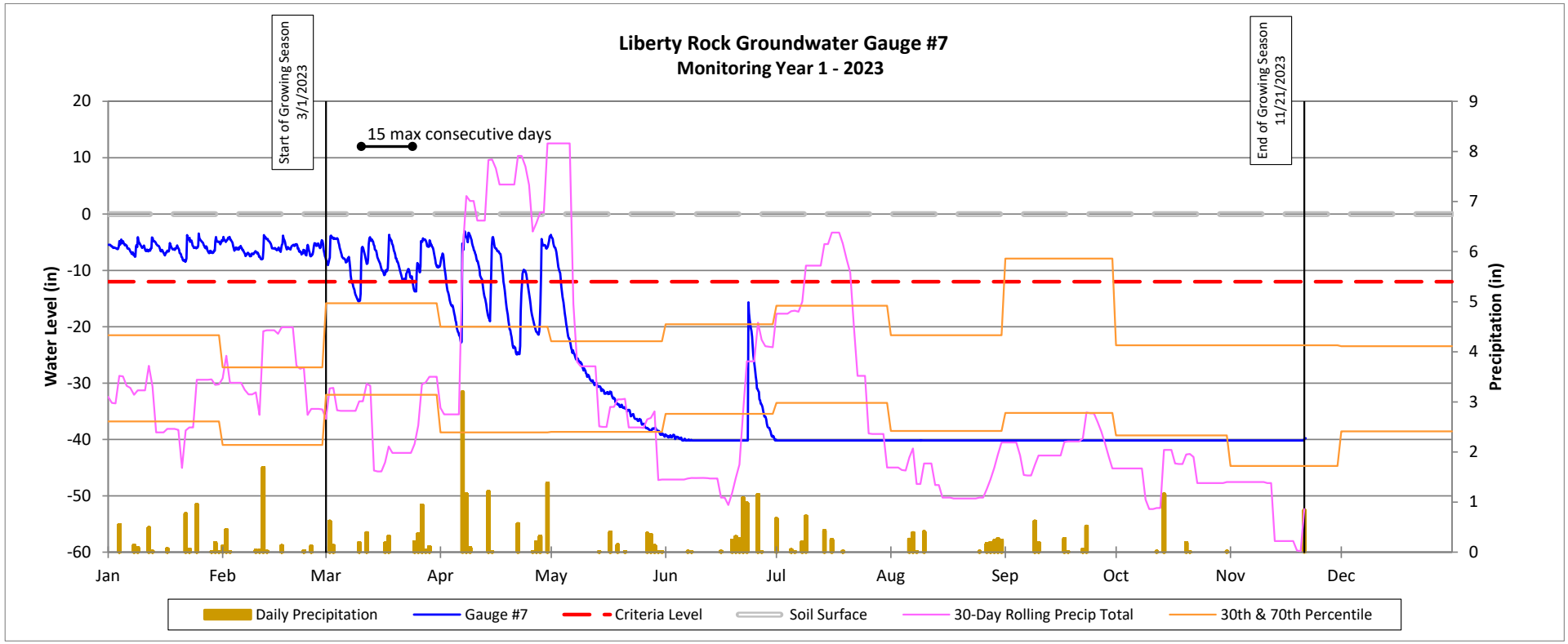


Groundwater Gauge Plot

Liberty Rock Mitigation Site

DMS Project No. 100135

Monitoring Year 1 - 2023

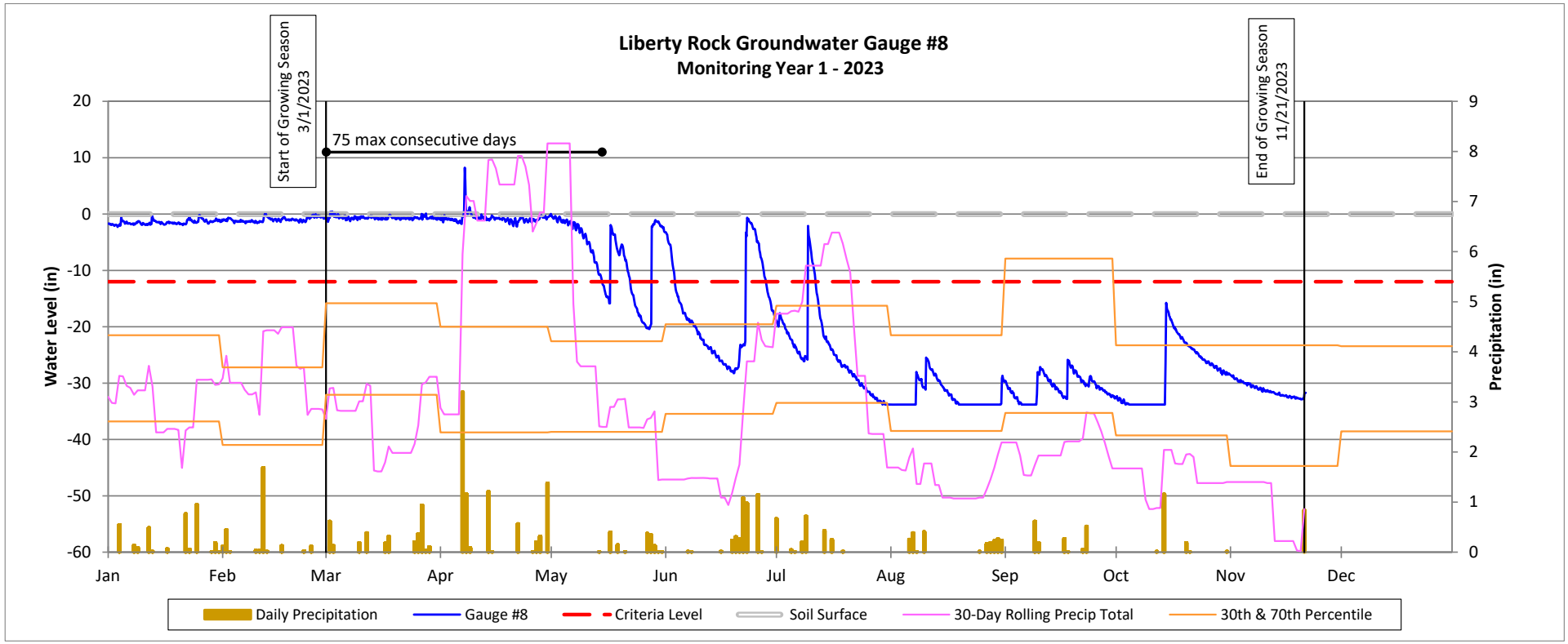


Groundwater Gauge Plot

Liberty Rock Mitigation Site

DMS Project No. 100135

Monitoring Year 1 - 2023

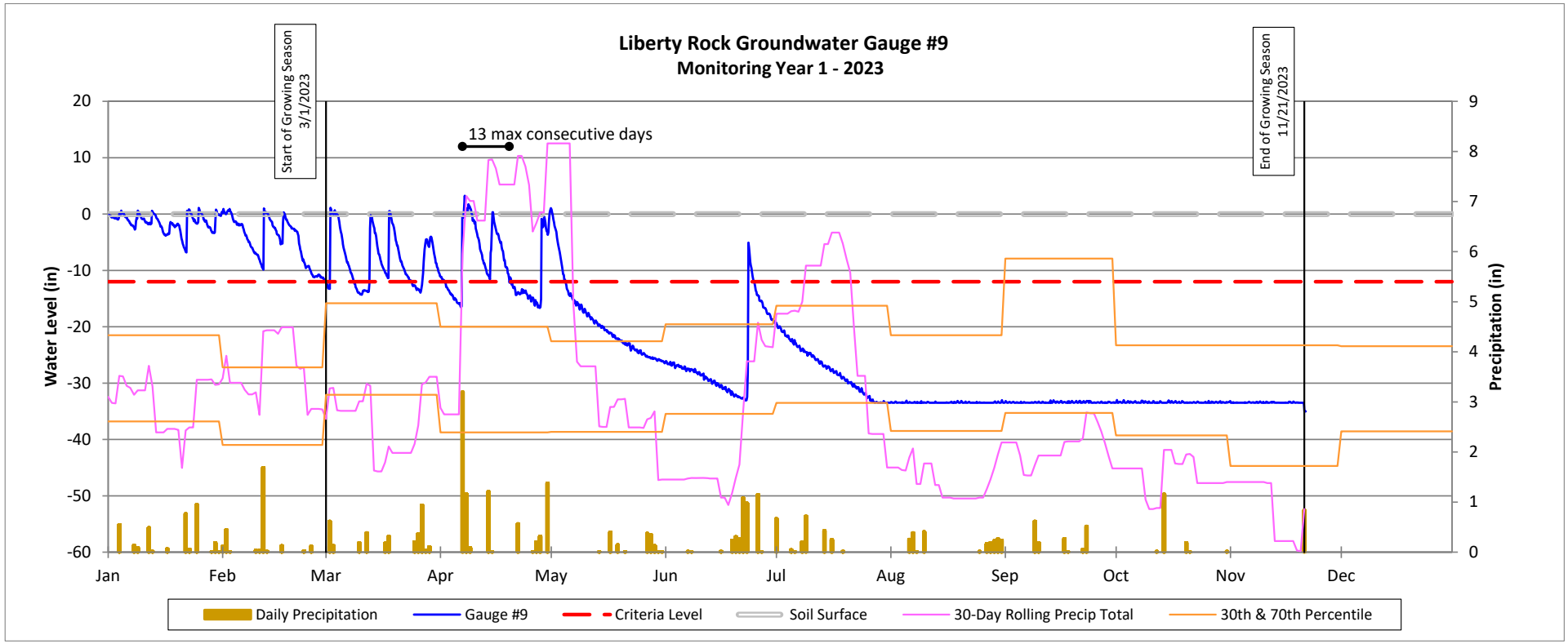


Groundwater Gauge Plot

Liberty Rock Mitigation Site

DMS Project No. 100135

Monitoring Year 1 - 2023

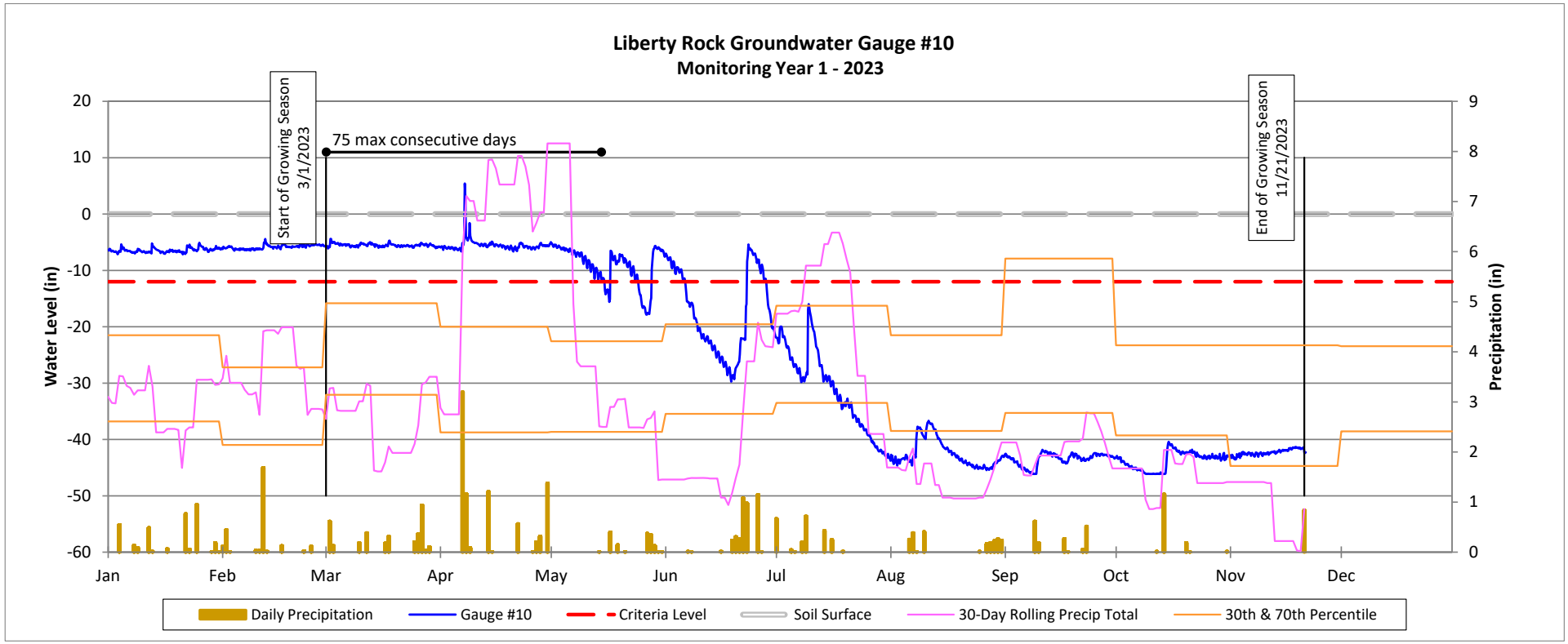


Groundwater Gauge Plot

Liberty Rock Mitigation Site

DMS Project No. 100135

Monitoring Year 1 - 2023

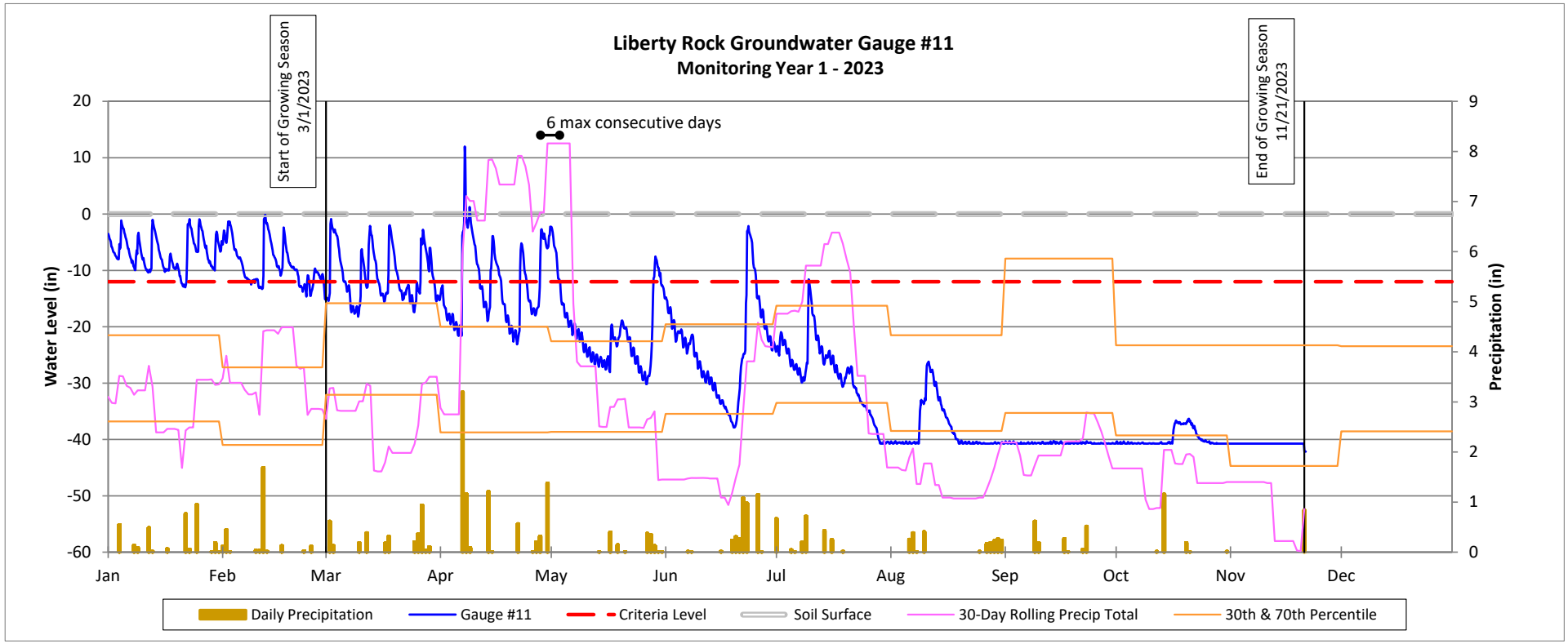


Groundwater Gauge Plot

Liberty Rock Mitigation Site

DMS Project No. 100135

Monitoring Year 1 - 2023



APPENDIX E. Project Timeline and Contact Info

Table 14. Project Activity and Reporting History
Liberty Rock Mitigation Site
DMS ID No. 100135
Monitoring Year 1 - 2023

Activity or Report		Data Collection Complete	Completion or Scheduled Delivery
Project Instituted		N/A	November 2019
Mitigation Plan Approved		N/A	October 2021
Invasive Vegetation Treatment			March-June 2021
Construction (Grading) Completed		N/A	August 2022
Invasive Vegetation Treatment			August-December 2022
As-Built Survey Completed		October 2022	October 2022
Planting Completed		N/A	January 2023
Baseline Monitoring Document (Year 0)	Stream Survey	October 2022	January 2023
	Vegetation Survey	January 2023	
Year 1 Monitoring	Invasive Treatment		May 2023
	Ring Sprays + Tree Boosters		April 2023
	Stream Survey	April 2023	December 2023
	Vegetation Survey	August 2023	
Year 2 Monitoring	Stream Survey	2024	December 2024
	Vegetation Survey	2024	
Year 3 Monitoring	Stream Survey	2025	December 2025
	Vegetation Survey	2025	
Year 4 Monitoring		2026	December 2026
Year 5 Monitoring	Stream Survey	2027	December 2027
	Vegetation Survey	2027	
Year 6 Monitoring		2028	December 2028
Year 7 Monitoring	Stream Survey	2029	December 2029
	Vegetation Survey	2029	

Table 15. Project Contact Table
Liberty Rock Mitigation Site
DMS ID No. 100135
Monitoring Year 1 - 2023

Designer **Abigail Vieira, PE**	**Wildlands Engineering, Inc.** 312 West Millbrook Road, Suite 225 Raleigh, NC 27609 919.851.9986
Construction Contractor	**Wildlands Construction** 312 West Millbrook Road, Suite 225 Raleigh, NC 27609
Monitoring Performers Monitoring, POC	**Wildlands Engineering, Inc.** Jason Lorch 919.851.9986

APPENDIX F. Additional Documentation

MEETING SUMMARY

MEETING: As-Built IRT Site Walk
Liberty Rock Mitigation Site
Cape Fear 03030003; Randolph County, NC
DEQ Contract No. 7877-01
DMS Project No. 100135
USACE ID: 2020-00047

DATE: *On-Site Meeting*: Wednesday, May 10, 2023
Meeting Notes Distributed: Wednesday, May 24, 2023

Attendees

Kim Browning, USACE	Travis Wilson, WRC	Tasha King, Wildlands
Casey Haywood, USACE	Daniel Taylor, Wildlands	
Jeremiah Dow, DMS	Jason Lorch, Wildlands	

Meeting Notes

- **Mica Creek**
    - The site walk began approximately midway down Mica Creek and continued downstream to the confluence of Rocky River. The IRT had some concerns about the flatness of Mica Creek and asked that Wildlands keep an eye on it. Along the Mica Creek floodplain herbaceous vegetation was tall and dense, but there was evidence of recent ring sprays along most of the floodplain. The IRT would like to see Wildlands continue with ring sprays or mow in between the rows of trees to assist with tree survival. Wildlands will keep up with ring sprays as long as pasture grass is competing with trees. Overall Mica Creek looked good and everyone seemed happy with it.
- **Rocky River Enhancement I Section**
    - The group continued up the Rocky River Enhancement I section. Kim had concerns about this section of stream being able to access the floodplain and how it may affect wetland hydrology. She asked that Wildlands keep an eye on the groundwater well data in this area. If the data is not favorable, she mentioned that Wildlands should look at other areas within the easement that are not delineated for potential wetlands that may generate credit to replace what could be lost around EI section. This would need to be done early in the monitoring period and groundwater wells and vegetation plots would need to be installed. Wildlands will watch this area and decide if this is necessary based on groundwater well data. Travis said this reach of Rocky River looked good and found several mussels. Overall the IRT seemed pleased with this section of stream, other than potential floodplain access concerns.

- **Rocky River Restoration Reach**
    - The group continued walking upstream along Rocky River Reach 1. The IRT asked why the pools were so wide compared to the riffles. Daniel explained that they are designed this way to allow for a natural point bar to form over time. Travis mentioned that if pools are too wide, it is possible that mid-channel bars can form instead of point bars. He asked that Wildlands keep an eye on this. Travis did not find mussels in this reach of Rocky River, which led to a discussion on bed material. The riffle material in the restoration section of Rocky River is different from the bed material in the Enhancement section of Rocky River. The substrate on the restoration section is a dense clay, but mussels prefer sand or rocks with gaps in between them so they can burrow in the stream bed. Travis acknowledged that the stream needs to hold grade and be stable, but also doesn't believe it provides suitable habitat for mussels since they don't live in the clay. This is a discussion to be had on future projects of this type, especially since there may not be a simple solution. The IRT looked at the vernal pools on site and agreed that they were a good depth and should provide good habitat. Kim would like to see groundwater gauge 6 moved to higher ground, closer to vegetation plot 7. The well was at the edge of a vernal pool, and not representative of the surrounding wetland area. Casey clarified that a vegetation plot was no longer needed near groundwater well 7. She had requested this in the mitigation plan and the vegetation plot was installed near existing conditions groundwater well 7, which is no longer present. She would like to have random vegetation plots along the old haul road, the old channel, and Mica Creek where herbaceous vegetation was thick. This doesn't need to be done during monitoring year 1, but throughout the monitoring period. Overall the stream looked good and the IRT was pleased.
- **Gypsum & Dolomite Creeks**
    - On the way back to the vehicles the group walked along Gypsum and Dolomite Creeks. The IRT mentioned that a defined channel must be maintained on both streams and recommended monitoring live stake survival so they can assist in shading out any instream vegetation, especially in the flatter sections of channel.

Liberty Rock Post-Construction Year 1
Freshwater Mussel Monitoring Survey Report

Upper Rocky River

Randolph County, North Carolina

Prepared For:

WILDLANDS
ENGINEERING

Wildlands Engineering, Inc.
Raleigh, North Carolina

Contact Person:

Angela Allen
312 West Millbrook Road, Suite 325
Raleigh, NC 27609

December 2023

Prepared by:

1 Glenwood Avenue, Suite 600
Raleigh, NC 27603

Contact Person:

Chris Sheats
csheats@transystems.com
919-417-2732

Table of Contents

1.0 Introduction 1
2.0 Survey Efforts 1
3.0 Results.....1
4.0 Discussion.....2

Appendix A.
Tagged Freshwater Mussels

1.0 INTRODUCTION

TranSystems conducted Monitoring Year 1 Post-Construction surveys to evaluate the freshwater mussel communities downstream and upstream of the Liberty Rock stream restoration reach.

2.0 SURVEY EFFORTS

Survey Efforts

Freshwater mussel surveys were completed on June 9, July 5, 6, and 18, 2023 in the downstream reaches (Reaches A & B), and in the upstream relocation reach to locate and identify resident and relocated freshwater mussels. Surveys were completed using visual and tactile methods. All individuals found were identified and placed back in the stream. Tagged species that were re-captured from pre-construction relocation efforts were recorded, measured and noted as a recaptured individuals. Common species marked during pre-construction relocation efforts that were re-captured were identified and recorded. A catch per unit effort (CPUE) for each species was estimated for each reach.

3.0 RESULTS

Rocky River-Downstream Reach

A total of 1871 freshwater mussels including five species were observed including Eastern Elliptio (*Elliptio complanata*), Carolina Slabshell (*Elliptio congaraea*), Florida Pondhorn (*Uniomerous carolinianus*), Eastern Creekshell (*Villosa delumbis*), and the Notched Rainbow (*Venusticoncha constricta*) (Table 1).

Table 1. Rocky River-Downstream Reach (15.33 hours total survey time).

Common Name	Scientific Name	NC Status*	Species Total	CPUE*
Eastern Creekshell	*Villosa delumbis*	SR	32	2.09
Notched Rainbow	*Venusticoncha constricta*	T	12	0.78
Eastern Elliptio	*Elliptio complanata*	-	1696	110.63
Carolina Slabshell	*Elliptio congaraea*	-	87	5.68
Florida Pondhorn	*Uniomerous carolinianus*	-	44	2.87
Total			**1871**	**122.05**

*NC Status (SR- State Rare; T- Threatened); CPUE- Catch Per Unit Effort

The stream was 2 – 4 meters wide with majority of the reach having depths less than 0.5 meter. Riffle, run, and pool habitats were present throughout the reach. Substrate was dominated by sand, cobble, gravel, and bedrock. No tagged individuals were observed. Three Eastern Creekshell shells and one Notched Rainbow shell were found. Freshwater mussels were observed throughout the stream channel in stable gravel substrate and silty banks.

Rocky River-Upstream Relocation Reach

A total of 829 freshwater mussels composed of five species were observed including Eastern Elliptio (*Elliptio complanata*), Eastern Floater (*Pyganodon cataracta*), Florida Pondhorn (*Uniomerous carolinianus*), Eastern Creekshell (*Villosa delumbis*), and the Notched Rainbow (*Venusticoncha constricta*) (Table 2).

Table 2. Rocky River-Upstream Relocation Reach (13.5 hours total survey time).

Common Name	Scientific Name	# Tagged	% Observed with Tags	# Untagged	% Observed without Tags	Species Total	*CPUE
Eastern Creekshell	*Villosa delumbis*	95	53	85	48	180	13.33
Notched Rainbow	*Venusticoncha constricta*	4	75	1	25	4	0.30
Eastern Elliptio	*Elliptio complanata*	277	45	345	55	622	46.07
Florida Pondhorn	*Uniomerous carolinianus*	4	18	18	82	22	1.63
Eastern Floater	*Pyganodon cataracta*	-	0	1	100	1	0.07
Total		**379**	**46**	**450**	**54**	**829**	**61.41**

*CPUE- Catch Per Unit Effort

The stream was 2 – 4 meters wide with majority of the reach having depths less than 0.75 meter. Riffle, run, and pool habitats were present throughout the surveyed area. Substrate was dominated by sand, silt, cobble, gravel, boulder, and bedrock. A total of 379 marked individuals were recaptured in the relocation reach.

4.0 DISCUSSION

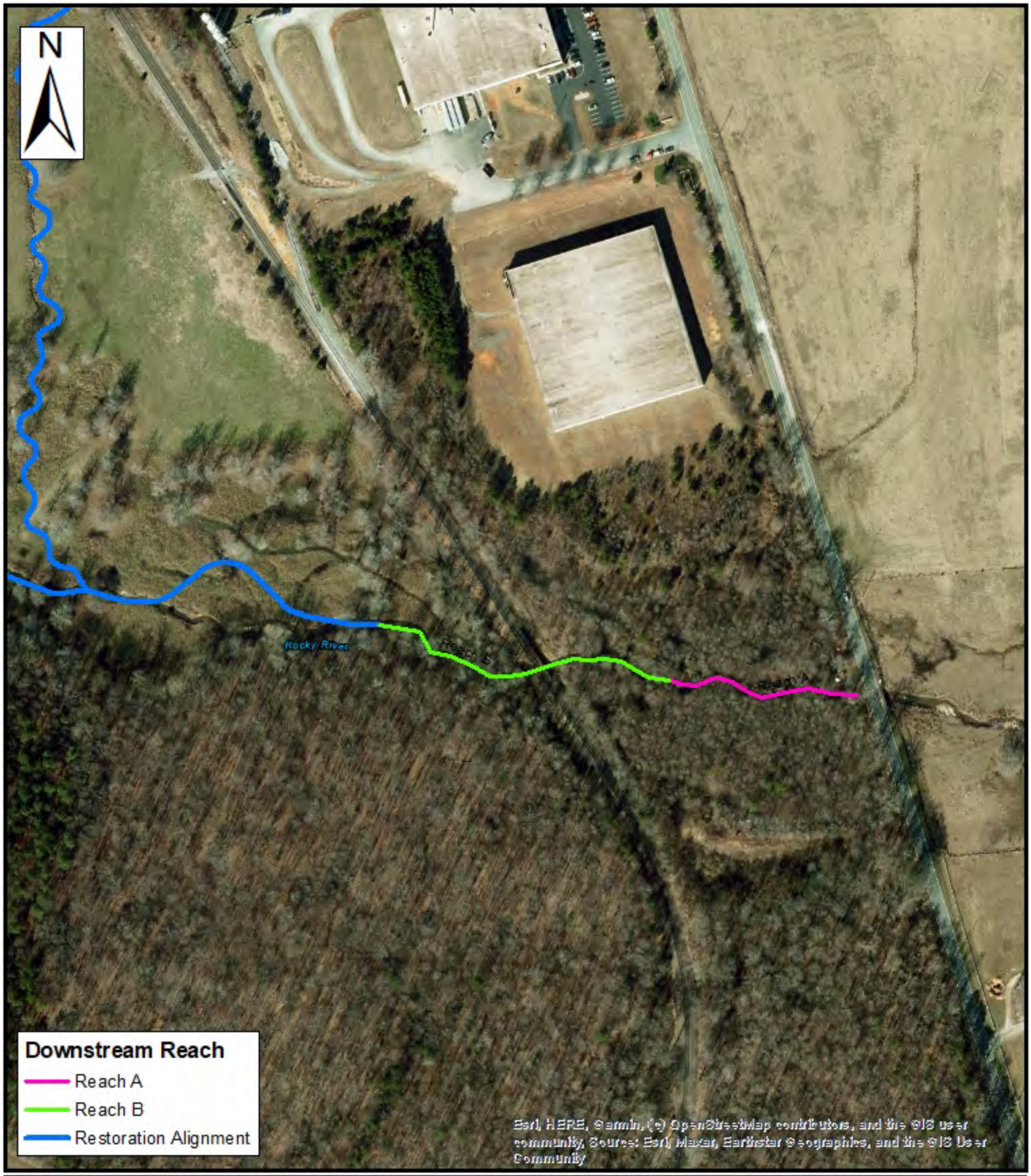
Six freshwater mussel species were observed during the survey efforts including Eastern Elliptio, Notched Rainbow, Eastern Creekshell, Florida Pondhorn, Carolina Slabshell, and Eastern Floater. The Downstream Reach appeared to be stable with condition similar to the pre-construction period species diversity and abundance. The Upstream Relocation Reach appeared stable with conditions similar to the pre-construction period. 53% of the Eastern Creekshell individuals detected in the relocation reach were recaptures from pre-construction relocation efforts. 75% of Notched Rainbow individuals detected in the relocation reach were recaptures from pre-construction relocation efforts (Appendix A). 45% of the Eastern Elliptio individuals detected were recaptures from pre-construction relocation efforts. 18% of the Florida Pondhorn individuals detected were recaptures, and one untagged Eastern Floater was observed.

APPENDIX A

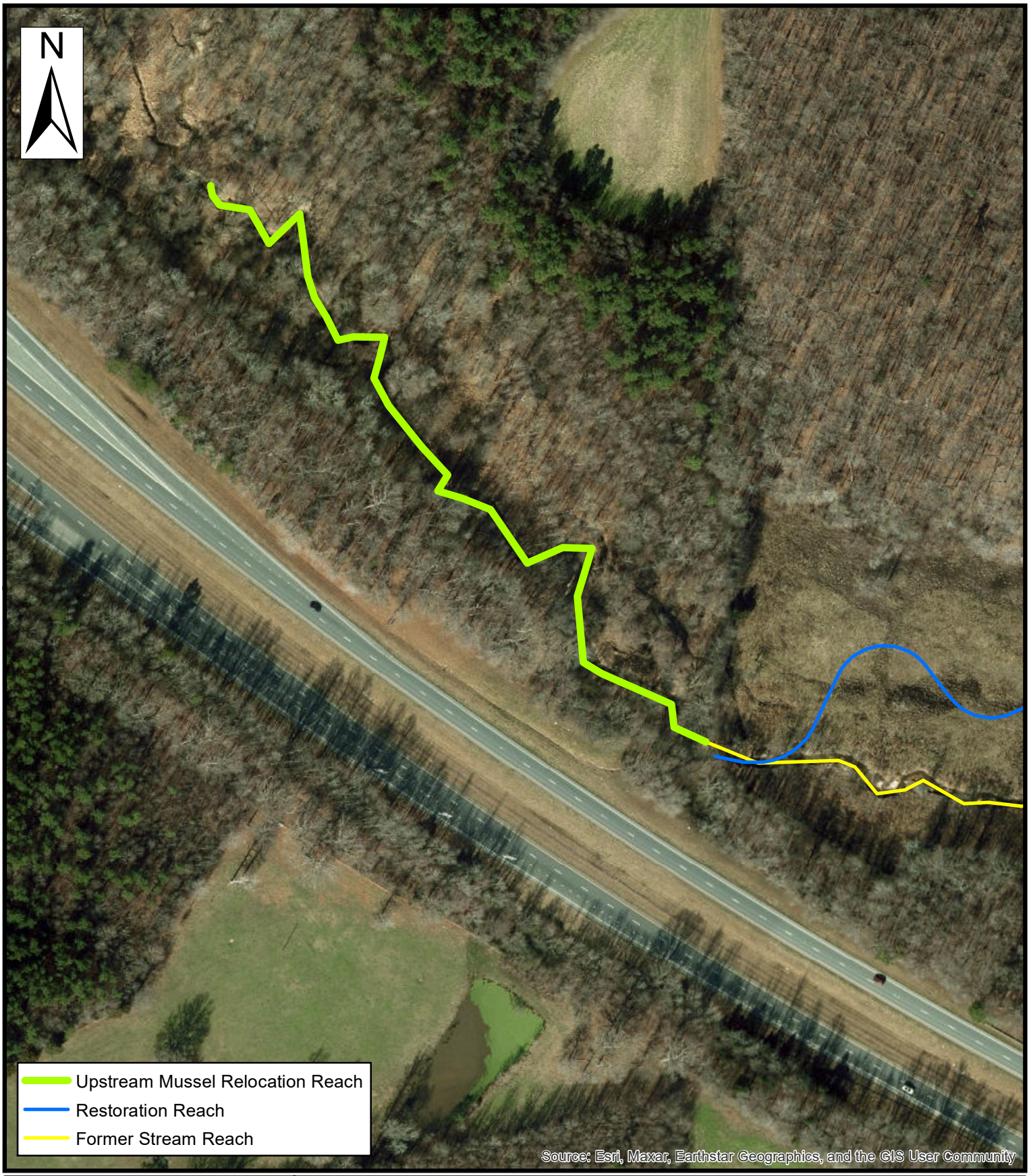
Tagged Freshwater Mussels

Eastern Creekshell (*Villosa delumbis*)
A010- A018
A020- A034
A036- A047
A049
A056- A060
A062- A067
A069- A082
A083- A098
A107
A109- A110
A112- A131
A135- A162
A163- A180
A182 - A190
A199- A242
A249- A310
A311- A334
A336 - A357
A358 - A374
A384 - A394
A395- A414
A416- A442
A444
A445- A460
A461- A472
A473- A485
A492- A497
A501- A532
A534- A547
A498- A500
A548- A557
A561- A574
A575- A618
A623- A626
A629- A679
A688- A708

Notched Rainbow (*Venusticoncha constricta*)
A019
A035
A050- A055
A099- A106
A132- A133
A181
A192- A198
A245- A248
A308
A335
A375- A383
A443
A486- A491
A533
A558- A560
A619- A622
A627- A628
A680- A684



Prepared By:	Prepared For:			
TRANSYSTEMS formerly SEPI	WILDLANDS ENGINEERING	**Liberty Rock Stream Restoration Project** Post-Construction Monitoring Year 1 **Randolph County, North Carolina**	Created By: CMS Scale: 0 75 150 Feet Date: January 2024	**Figure 1**



Prepared By:

TRANSYSTEMS formerly SEPI

Prepared For:

WILDLANDS ENGINEERING

Liberty Rock Stream Restoration Project

Post-Construction Monitoring Year 1

Randolph County, North Carolina

Created By: CMS

Scale: 0 50 100 Feet

Date: January 2024

Figure 2