FINAL
MY1 (2022) MONITORING REPORT

LAUREL SPRINGS STREAM AND WETLAND MITIGATION SITE

Avery County, North Carolina
French Broad River Basin
Cataloging Unit 06010108

DMS Project No. 100122
Full Delivery Contract No. 7890
DMS RFP No. 16-007725 (issued 11/13/18)
USACE Action ID No. SAW-2019-00835
DWR Project No. 2019-0865

Data Collection: October 2021-November 2022
Submission: February 2023

Prepared for:

NORTH CAROLINA DEPARTMENT OF ENVIRONMENTAL QUALITY
DIVISION OF MITIGATION SERVICES
1652 MAIL SERVICE CENTER
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Response to DMS Comments – Monitoring Year 1 (2022)
Laurel Springs Stream and Wetland Mitigation Site
Avery County, North Carolina, French Broad River Basin: Cataloging Unit 06010108
DMS Project No. 100122, Full Delivery Contract No. 7890
USACE Action ID No. SAW-2019-00835, DWR Project No. 2019-0865

Comments Received (Black Text) & Responses (Blue Text)

General:

1. DMS plans to conduct a property boundary assessment on the site in 2023. The property boundary assessment will be conducted prior to the 2023 credit release meeting.
   Response: Understood.

Report

2. Table C. Monitoring Summary: Please include the three (3) temporary vegetation plots in the monitoring summary.
   Response: The three temporary plots were added to Table C.

3. Appendix A: Visual Assessment Data: Please provide an additional single page georeferenced "Asset Map" in the appendix that clearly identifies the project reaches, approaches and creditable wetland areas as specified in Table 1. Please only include the creditable reaches and wetlands in the project asset map.
   Response: Figure 2 "Asset Map" was added to Appendix A. This map depicts only creditable stream reaches and wetland areas.

4. Table 4 & Table 5 – Visual Assessment Tables: Please include the dates assessed at the top of the tables. This has been a recent IRT request.
   Response: The survey date (November 8, 2022) was added to Tables 4 and 5.

5. Table 5 - Visual Vegetation Assessment: Please confirm that the invasives reported in the project monitoring summary are minimal and below the 0.10-acre mapping threshold. If above the mapping threshold, they should be reported in the table and CCPV sheets.
   Response: Invasive treatments were limited to small populations below the 0.10-acre mapping threshold and do not pose a risk to planted vegetation or existing forests.

6. Laurel Springs MY-01 (2022) Photo Log: In the photo captions, please provide dates that the photos were taken. DMS recommends including the photo locations on the CCPV map or a separate map in Appendix G.
   Response: Dates were added to all photos in the photo log. Only 5 of the 20 photos are permanent photo points. These photos have been moved to the front of the photo log and are depicted on the CCPV. The additional photos in the photo log were meant to provide a general overview of site stream, vegetation, and easement boundary conditions. The quantity and location of additional photos will likely change from year to year, and therefore, their locations were not added to the CCPV.

7. Table 8 – Vegetation Plot Data: Vegetation Plots 1, 6, 9, 10, 13, 14, 15, 16, T1, and T3 did not meet the interim success criteria of 320 stems per acre. Stems/ acre cells should also be color coded to note vegetation plots that met the interim success criteria (green) and did not meet the interim success criteria (orange).
   Response: The rows in Table 8 indicating stems per acre have been color coded based on the MY3 success criteria.

8. Appendix D - Hydrologic Data: Are the stream crest gauges manual or automated? If automated, please provide the graph for the three bankfull events reported. Please report the bankfull events for each gauge separately in Table 11-Verification of Bankfull Events and include a column that indicates the applicable monitoring year.
   Response: Fork Creek has an automated crest gauge installed. A graph with this crest gauge data has been included in Appendix D. The gauge on UT-2 is being used to monitor continuous stream flow, and no bankfull events were captured with it during MY1. Table 11 has been revised to clarify.

9. Appendix D - Hydrologic Data: Please discuss the UT2 stream flow results in the report summary and report text.
   Response: A brief discussion of UT 2 stream flow results was added to the report summary and Section 3.1 Stream Assessment.

10. Table 11. Project Timeline: Please include all maintenance activities (invasive treatment, beaver removal, etc.) in the table.
    Response: Invasives treatment and encroachment maintenance work was added to the project timeline table.

Digital Support File Comments:

11. Please submit the missing low stem density spatial data file in the revised digital support files; the visual vegetation table indicates 2.67 aces of low stem density.
    Response: The low stem density shapefile was added to digital submittal.

12. The spatial data is consistent with the groundwater well locations depicted in the MY1 map. Once gauges 6, 9, 11, and 12 are moved into creditable wetland reestablishment areas, and gauge 1 is moved into the nearby wetland enhancement area, please revise the file in the MY2 (2023) digital submittal.
    Response: This shapefile will be updated and resubmitted with the MY2 (2023) digital submittal.

Laurel Springs -- Year 1 (2022) Monitoring Summary

General Notes

- Two areas of encroachment were documented and addressed during Year 1. Along UT3, RS worked with the adjacent landowner to remove the shed from the easement, clear the area of debris, and mark the easement boundary with 6-inch treated wood fence posts. The areas will be replanted in early 2023, per the IRT review adaptive management plan, Appendix F.
- No evidence of nuisance animal activity (i.e., heavy deer browsing, beaver, etc.) was observed.

Streams

- All stream restoration reaches were stable and exhibited no signs of erosion, and all structures were stable (Appendix C).
- Three bankfull events were documented during the year 1 (2022) monitoring period (Table 11, Appendix D).
- UT 2 showed evidence of channel formation during the year 1 (2022) monitoring period, with the stream flow gauge capturing 166 consecutive days of flow (Table 13, Appendix D).

Vegetation

- Measurements of all 16 permanent plots and three (3) temporary plots resulted in an average of 300 planted stems/acre. Additionally, 9 of the 19 individual plots met success criteria during year 1 (Appendix B).
- Several areas of low stem density were observed during year 1 (2022), predominantly along the upland slope (Acidic Cove Forest) areas. RS plans to supplementally plant 2.67 acres of the Site with 1800 bare-root stems during the dormant season 2022/2023. The area includes the 0.107-acre area of encroachment. Species and quantities of stems to be planted are summarized in the table below. The complete plan is provided in Appendix F, along with IRT correspondence.

2023 Remedial Planting – Species and Quantities

Species	Indicator Status	Number of Stems
American elm (*Ulmus americana*)	FACW	600
White oak (*Quercus alba*)	FACU	600
Persimmon (*Diospyros virginiana*)	FAC	600
Total		**1,800**

- Additional planted stem mortality will be monitored during year 2 (2022), and if needed, additional planting will be proposed. Per communications with the IRT in 2022, additional diversity planting maybe required – RS will coordinate with WRC and DWR on this effort if needed.

Wetlands

- Eleven of the thirteen groundwater gauges met success criteria for the year 1 (2022) monitoring period (Table 12, Appendix D). Rainfall data from an on-site gauge shows below average rainfall for the entire year until November when compared with the 30-year 30-70th percentile data at a nearby WETS station (Figure D1, Appendix D).

- Based on communications with the IRT in 2022, RS plans to move gauges 6, 9, 11, and 12 into creditable wetland reestablishment areas during the 2022/2023 dormant season. Also, gauge 1 will be moved into the wetland enhancement area, as depicted in Figure 9 of the approved Mitigation Plan.

Summary of Monitoring Period/Hydrology Success Criteria by Year

Gauge	12% Hydroperiod Success Criteria Achieved - Max Consecutive Days During Growing Season (Percentage)						
	Year 1 (2022)	Year 2 (2023)	Year 3 (2024)	Year 4 (2025)	Year 5 (2026)	Year 6 (2027)	Year 7 (2028)
1*	Yes - 45 days (19.1%)						
2	No - 2 days (0.9%)						
3	No - 17 days (7.2%)						
4	Yes - 167 days (71.1%)						
5	Yes - 46 days (19.6%)						
6*	Yes - 236 days (100%)						
7	Yes - 236 days (100%)						
8	Yes - 119 days (50.6)						
9*	Yes – 236 days (100%)						
10	Yes – 65 days (27.7%)						
11*	Yes – 45 days (19.1%)						
12*	Yes – 236 days (100%)						
13	Yes – 236 days (100%)						

*During the MY0 review, the IRT requested that gauges be moved into creditable wetland areas to more accurately represent what was presented in the detailed mitigation plan (Appendix F). During the 2022/2023 dormant season, gauges 6, 9, 11, ad 12 will be moved into creditable wetland reestablishment areas, and gauge 1 will be moved into the nearby wetland enhancement area.

Site Maintenance Report (2022)

Invasive Species Work	Maintenance work
09/14/2022: Japanese Knotweed, Chinese Bittersweet, Multiflora rose, Autumn Olive, Callery Pear, Japanese barberry, Cattail - Treatments were made to small patches of invasive species, and there are no areas of significant concern regarding planted vegetation and competition from invasive species. - Multiple treatments (spring, summer, and fall) are planned for 2023	10/19 – 10/21/2022: - Removal of a small shed and associated debris near the utility easement break of UT3. - A new shed was constructed 15 feet from the easement. - Additional easement boundary monuments (6-inch treated posts) were installed with additional signage throughout the project.

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APPENDICES

1 PROJECT SUMMARY

Restoration Systems, LLC (RS) has established the North Carolina Division of Mitigation Services (NCDMS) Laurel Springs Stream and Wetland Mitigation Site (Site). The Site is on one contiguous parcel along the cold-water Fork Creek and unnamed tributaries to Fork Creek in the Southern Crystalline Ridge and Mountains Ecoregion of North Carolina. Located in the French Broad River Basin, cataloging unit 06010108, the Site is in the Targeted Local Watershed (TLW) 06010108010020 and North Carolina Division of Water Resources (NCDWR) subbasin number 04-03-06. The Site is not located in a Local Watershed Plan (LWP), Regional Watershed Plan (RWP), or Targeted Resource Area (TRA). Site watersheds range from approximately 0.02 of a square mile (12 acres) on UT2 to 1.32 square miles (847 acres) at the Site's outfall.

1.1 Project Background, Components, and Structure

Located approximately 8 miles southwest of Linville and 7 miles northeast of Spruce Pine in southern Avery County, the Site encompasses 29.19 acres. Mitigation work within the Site included 1) stream restoration, 2) stream enhancement (Level I), 3) stream enhancement (Level II), 4) stream preservation, 5) wetland reestablishment, 6) wetland rehabilitation, 7) wetland enhancement, 8) wetland preservation, and 9) vegetation planting. The Site is expected to provide 4231.827 cold water stream credits and 3.688 riparian wetland credits by closeout (Table 1, Page 2). A conservation easement was granted to the State of North Carolina and recorded at the Avery County Register of Deeds on October 19, 2020.

Before construction, land use at the Site was characterized by disturbed forest, cow pasture, and hay fields. Site design was completed in February 2021. Construction started July 12, 2021, and ended with a final walkthrough on October 15, 2021. The Site was planted on January 12-13, 2022. Completed project activities, reporting history, completion dates, and project contacts are summarized in Tables 14-15 (Appendix E).

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Table 1. Laurel Springs Stream and Wetland Mitigation Site (ID-100122) Project Mitigation Quantities and Credits

Project Segment	Original Mitigation Plan Ft/Ac	As-Built Ft/Ac	Original Mitigation Category	Original Restoration Level	Original Mitigation Ratio (X:1)	Credits		Comments
Stream								
Fork Cr - A	91	92	Cold	EI	1.50000	60.667		
Fork Cr - B	2250	2242	Cold	R	1.00000	2,250.000		
UT 1	234	233	Cold	R	1.00000	234.000		
UT 2A	25	25	Cold	P	10.00000	2.500		
UT 2 - A	184	184	Cold	P	10.00000	18.400		
UT 2 - B	198	199	Cold	EII	2.50000	79.200		
UT 2 - C	467	463	Cold	R	1.00000	467.000		
UT 3A	103	103	Cold	P	10.00000	10.300		
UT 3 - A	265	265	Cold	P	10.00000	26.500		
UT 3 - B	248	250	Cold	EII	5.00000	49.600		
UT 3 – C	183	183	Cold	EI	1.50000	122.000		
UT 3 - D	233	223	Cold	R	1.00000	233.000		
UT 4 - A	541	541	Cold	P	10.00000	54.100		
UT 4 - B	112	110	Cold	R	1.00000	112.000		
UT 5 - A	60	60	Cold	P	10.00000	6.000		
UT 5 - B	67	67	Cold	P	10.00000	6.700		
					Total:	**3,731.967**		
Wetland								
Wetland Reestablish	7.656	7.656	R	REE	1.00000	7.656		
Wetland Rehabilitation	1.845	1.845	R	RH	NA*	0.000		
Wetland Enhancement	0.148	0.148	R	E	NA*	0.000		
Wetland Preservation	0.198	0.198	R	P	NA*	0.000		
					Total:	**7.656**		

*Wetland Rehabilitation, Enhancement, and Preservation acreage are not being included in credit calculations. These areas are being utilized by the wider buffer tool to generate additional stream credit

Project Credits

	Stream			Riparian	Non-Rip	Coastal
Restoration Level	Warm	Cool	Cold	Wetland	Wetland	Marsh
Restoration			3,296.000			
Re-establishment				3.688**		
Rehabilitation						
Enhancement						
Enhancement I			182.667			
Enhancement II			128.800			
Creation						
Preservation			124.500			
Wider Buffer Tool			499.860			
Totals	**0.000**	**0.000**	**4,231.827**	**3.688**	**0.000**	**0.000**

**** DMS contract is for 3.688 WMUs; therefore, excess wetland credit has been used for wider buffer tool calculations.**

Total Stream Credit **4,231.827**
Total Wetland Credit **3.688**

Table 2. Summary: Goals, Performance, and Results

Goals	Objectives	Success Criteria
(1) HYDROLOGY		
Minimize downstream flooding to the maximum extent possible.	Construct a new channel at historic floodplain elevation to restore overbank flows Remove drain tiles and agriculture ditches Plant woody riparian buffer Deep rip floodplain soils to reduce compaction and increase soil surface roughness Protect riparian buffers with a perpetual conservation easement	BHR not to exceed 1.2 Document four overbank events in separate monitoring years Livestock excluded from the easement Attain Wetland Hydrology Success Criteria Attain Vegetation Success Criteria Conservation Easement recorded
Increase stream stability within the Site so that channels are neither aggrading nor degrading.	Construct channels with the proper pattern, dimension, and longitudinal profile Remove livestock from the property Construct stable channels with the appropriate substrate Upgrade piped channel crossings Plant woody riparian buffer Stabilize stream banks	Cross-section measurements indicate a stable channel with the appropriate substrate Visual documentation of stable channels and structures BHR not to exceed 1.2 < 10% change in BHR in any given year Livestock excluded from the easement Attain Vegetation Success Criteria
(1) WATER QUALITY		
Remove direct nutrient and pollutant inputs from the Site and reduce contributions to downstream waters.	Remove agricultural livestock and reduce agricultural land/inputs Install marsh treatment areas Plant woody riparian buffer Restore/enhance jurisdictional wetlands adjacent to Site streams Provide surface roughness and reduce compaction through deep ripping/plowing. Restore overbank flooding by constructing channels at historic floodplain elevation.	Livestock excluded from the easement Attain Wetland Hydrology Success Criteria Attain Vegetation Success Criteria
(1) HABITAT		
Improve instream and streamside habitat.	Construct stable channels with the appropriate substrate Plant woody riparian buffer to provide organic matter and shade Construct a new channel at historic floodplain elevation to restore overbank flows Protect riparian buffers with a perpetual conservation easement Restore/enhance jurisdictional wetlands adjacent to Site streams Stabilize stream banks Install in-stream structures	Cross-section measurements indicate a stable channel with the appropriate substrate Visual documentation of stable channels and in-stream structures Attain Wetland Hydrology Success Criteria Attain Vegetation Success Criteria Conservation Easement recorded

Table 3. Project Attributes

Project Information					
Project Name	Laurel Springs Site				
Project County	Avery County, North Carolina				
Project Area (acres)	29.19				
Project Coordinates (latitude & latitude)	35.9913, -81.9837				
Planted Area (acres)	16.2				
Project Watershed Summary Information					
Physiographic Province	Blue Ridge				
Project River Basin	French Broad				
USGS HUC for Project (14-digit)	6010108010020				
NCDWR Sub-basin for Project	04-03-06				
Project Drainage Area (acres)	846.7				
Percentage of Project Drainage Area that is Impervious	<2%				
CGIA Land Use Classification	Managed Herbaceous Cover & Hardwood Swamps				
Reach Summary Information					
Parameters	**Fork Cr**	**UT 1**	**UT 2**	**UT3**	**UT 4**
Pre-Project Length (linear feet)	2401	234	926	1002	685
Post-Project Length (linear feet)	2334	233	870	1024	650
Valley Classification & Confinement	Alluvial, moderately confined	Alluvial, moderately confined	Alluvial, confined	Alluvial, confined	Alluvial, confined
Drainage Area (acres)	847	193	12	23	13
NCDWR Stream ID Score	--	--	25.5	22.5	33.5
Perennial, Intermittent, Ephemeral	Perennial	Perennial	Perennial/ Intermittent	Perennial/ Intermittent	Perennial
Thermal Regime	Cold	Cold	Cold	Cold	Cold
NCDWR Water Quality Classification	WS-IV, Tr				
Existing Morphological Description (Rosgen 1996)	Cg 4	Eg 4	Bg 5/6	Bg 5	B 4
Proposed Stream Classification (Rosgen 1996)	Ce 3/4	Ce 3/4	B 3/4	B 3/4	B 4
Existing Evolutionary Stage (Simon and Hupp 1986)	II/III	II/III	IV	II	I/II
Underlying Mapped Soils	Nikwasi loam, Reddies fine sandy loam,	Nikwasi loam	Chandler-Micaville complex	Chandler-Micaville complex	Chandler-Micaville complex
Drainage Class	poorly, moderately well	poorly	somewhat excessively	somewhat excessively	somewhat excessively
Hydric Soil Status	hydric, nonhydric (may contain hydric inclusions)	hydric	nonhydric	nonhydric	nonhydric
Parameters	**Fork Cr**	**UT 1**	**UT 2**	**UT3**	**UT 4**
Valley Slope	0.0271	0.0291	0.1047	0.0992	0.0992
FEMA Classification	NA	NA	NA	NA	NA
Native Vegetation Community	Montane Alluvial Forest and Swamp Forest-Bog Complex				
Watershed Land Use/Land Cover (Site)	87% forest, 11% agricultural land, <2% low density residential/impervious surface				
Watershed Land Use/Land Cover (Reference Channel)	95% forest, 3% agricultural land, <2% low density residential/impervious surface				
Percent Composition of Exotic Invasive Vegetation	<5%				

Wetland Summary Information	
Parameters	**Wetlands**
Wetland acreage	8.3 acre drained & 2.61 acres degraded
Wetland Type	Riparian riverine
Mapped Soil Series	Nikwasi
Drainage Class	Poorly drained
Hydric Soil Status	Hydric
Source of Hydrology	Groundwater, stream overbank
Hydrologic Impairment	Incised streams, compacted soils, livestock, ditches, drain tile
Native Vegetation Community	Montane Alluvial Forest and Swamp Forest-Bog Complex
% Composition of Exotic Invasive Vegetation	<5%
Restoration Method	Hydrologic, vegetative, livestock
Enhancement Method	Vegetative, livestock

Regulatory Considerations			
Regulation	**Applicable?**	**Resolved?**	**Supporting Documentation**
Waters of the United States-Section 401	Yes	Yes	JD Package (Mitigation Plan, App D)
Waters of the United States-Section 404	Yes	Yes	JD Package (Mitigation Plan, App D)
Endangered Species Act	Yes	Yes	CE Document (Mitigation Plan, App E)
Historic Preservation Act	Yes	Yes	CE Document (Mitigation Plan, App E)
Coastal Zone Management Act	No	--	NA
FEMA Floodplain Compliance	Yes	Yes	CE Document (Mitigation Plan, App E)
Essential Fisheries Habitat	No	--	CE Document (Mitigation Plan, App E)

1.2 Success Criteria

Monitoring and success criteria for stream restoration should relate to project goals and objectives identified from on-site NC SAM and NC WAM data collection. From a mitigation perspective, several of the goals and objectives are assumed to be functionally elevated by restoration activities without direct measurement. Other goals and objectives will be considered successful upon achieving success criteria. The following summarizes Site success criteria.

Table A. Success Criteria

Streams
• All streams must maintain an Ordinary High-Water Mark (OHWM), per RGL 05-05. • Continuous surface flow must be documented in intermittent reaches each year for at least 30 consecutive days. • Bank height ratio (BHR) cannot exceed 1.2 at any measured cross-section. • BHR at any measure riffle cross-section should not change by more than 10% from baseline condition during any given monitoring period. • The stream shall remain stable, and all other performance standards shall be met through four separate bankfull events, occurring in separate years, during the monitoring years 1-7. • Intermittent streams will demonstrate at least 30-days consecutive flow.
Wetland Hydrology
• Annual saturation or inundation within the upper 12 inches of the soil surface for, at a minimum, 12 percent of the growing season during average climatic conditions.
Vegetation
• Within planted portions of the Site, a minimum of 320 stems per acre must be present at year 3; a minimum of 260 stems per acre must be present at year 5; and a minimum of 210 stems per acre must be present at year 7. • Trees must average 6 feet in height at year 5 and 8 feet in height at year 7 in each plot. • Planted and volunteer stems are counted, provided they are included in the approved planting list for the Site; natural recruits not on the planting list may be considered by the IRT on a case-by-case basis. • Areas of herbaceous vegetation establishment will have a minimum of four species present.

2 METHODS

Monitoring will be conducted by Axiom Environmental, Inc. Annual monitoring reports of the data collected will be submitted to the NCDMS by Restoration Systems no later than December 31 of each monitoring year data is collected. The monitoring schedule is summarized in the following table.

Table B. Monitoring Schedule

Resource	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7
Streams	X	X	X		X		X
Wetlands	X	X	X	X	X	X	X
Vegetation	X	X	X		X		X
Visual Assessment	X	X	X	X	X	X	X
Report Submittal	X	X	X	X	X	X	X

2.1 Monitoring

The monitoring parameters are summarized in the following table.

Table C. Monitoring Summary

Stream Parameters				
Parameter	**Method**	**Schedule/Frequency**	**Number/Extent**	**Data Collected/Reported**
Stream Profile	Full longitudinal survey	As-built (unless otherwise required)	All restored stream channels	Graphic and tabular data.
Stream Dimension	Cross-sections	Years 1, 2, 3, 5, and 7	Total of 16 cross-sections on restored channels	Graphic and tabular data.
Channel Stability	Visual Assessments	Yearly	All restored stream channels	Areas of concern will be depicted on a plan view figure with a written assessment and photograph of the area included in the report.
	Additional Cross-sections	Yearly	Only if instability is documented during monitoring	Graphic and tabular data.
Bankfull Events	Continuous monitoring of surface water gauges and/or trail camera	Continuous recording through the monitoring period	One surface water gauge on UT2	Surface water data for each monitoring period
	Visual/Physical Evidence	Continuous through the monitoring period	One crest gauge on Fork Creek	Visual evidence, photo documentation, and/or rain data.
Wetland Parameters				
Parameter	**Method**	**Schedule/Frequency**	**Number/Extent**	**Data Collected/Reported**
Wetland Re-establishment	Groundwater gauges	Yearly with the growing season defined as March 1-October 22	13 gauges spread throughout restored wetlands	Soil temperature at the beginning of each monitoring period to verify the start of the growing season, groundwater and rain data for each monitoring period
Vegetation Parameters				
Parameter	**Method**	**Schedule/Frequency**	**Number/Extent**	**Data Collected/Reported**
Vegetation establishment and vigor	Permanent vegetation plots 0.0247 acres (100 square meters) in size; *CVS-EEP Protocol for Recording Vegetation*, *Version 4.2* (Lee et al. 2008)	As-built, Years 1, 2, 3, 5, and 7	16 permanent plots and 3 temporary plots spread across the Site	Species, height, planted vs. volunteer, stems/acre

Note: Volunteer species on the approved planting list must be established for 2 years to count towards success and will be subject to height standards.

3 MONITORING YEAR 1 – DATA ASSESSMENT

Annual monitoring and site visits were conducted between February 2022 and November 2022 to assess the condition of the project. Stream, wetland, and vegetation criteria for the Site follow the approved success criteria presented in the Mitigation Plan and summarized in Section 1.2; monitoring methods are detailed in Section 2.0.

3.1 Stream Assessment

Morphological surveys for MY1 were conducted on September 14, 2022, and no stream areas of concern were identified. All streams within the Site are stable and functioning as designed, with minimal changes from MY0 measurements. Refer to Appendix A for the Visual Stream Morphology Stability Assessment Table and Stream Photographs. Refer to Appendix C for Stream Geomorphology Data. Additionally, the UT2 stream gauge captured 166 consecutive days of stream flow (Table 13, Appendix D).

3.2 Wetland Assessment

Summary of Monitoring Period/Hydrology Success Criteria by Year

Year	Soil Temperatures/Date Bud Burst Documented	Monitoring Period Used for Determining Success	12 % of the Monitoring Period
2022 (Year 1)	March 1, 2022*	March 1-October 22 (236 days)	28 days

*Based on observed/documented bud burst on the Site on March 1, 2022, and soil temperature of 44.20° F documented March 1, 2022, and not dropping below 43.19° F thereafter.

Eleven of the thirteen groundwater gauges met success criteria for the year 1 (2022) monitoring period (Table 12, Appendix D). Rainfall data from an on-site gauge shows below-average rainfall for the entire year until November compared with the 30-year 30-70th percentile data at a nearby WETS station (Figure D1, Appendix D).

During the MY0 review, the IRT expressed concern that several groundwater gauges were installed in different credit areas than originally proposed and approved in the Site's Mitigation Plan. Gauges 6, 9, 11, ad 12 will be moved into creditable wetland reestablishment areas, and gauge 1 will be moved into the nearby wetland enhancement area. MY0 IRT comments and responses are in Appendix F.

3.3 Vegetative Assessment

The MY1 vegetative survey was completed between September 14 and November 8, 2022. Measurements of all 16 permanent plots and three (3) temporary plots resulted in an average of 300 planted stems/acre. Additionally, 9 of the 19 individual plots met success criteria during MY1 (Appendix B). Several areas of low stem density were observed during MY1, predominantly along upland slope (Acidic Cove Forest) areas. RS plans to supplementally plant 2.67 acres of the site with 1800 bare-root stems during the dormant season 2022/2023. The area includes the 0.107-acre area of encroachment. Species and quantities of stems to be planted are summarized in the table below. The complete plan is provided in Appendix F, along with IRT correspondence.

2023 Remedial Planting – Species and Quantities

Species	Indicator Status	Number of Stems
American elm (*Ulmus americana*)	FACW	600
White oak (*Quercus alba*)	FACU	600
Persimmon (*Diospyros virginiana*)	FAC	600
Total		**1,800**

Additional planted stem mortality will be assessed during MY2, and additional planting will be proposed if needed.

During the MY0 review, RS requested a modification of the Site's Mitigation Plan to include planted tree/shrub species that were not included in the Site's approved Mitigation Plan. The IRT agreed to approve all planted species to count toward Site vegetation success. Documentation is provided in Appendix F.

2022 IRT Approved – Non-Mitigation Plan Planted Stems for Success Criteria

Species	Indicator Status
Arrowwood viburnum (Viburnum dentatum)	FAC
Bitternut hickory (Carya cordiformis)	FACU
American hazelnut (Corylus americana)	FACU
Red spruce (Picea rubens)	FACU

3.4 Monitoring Year 1 Summary

With the exception of planted bare-root vegetation, the Site is performing well. All stream reaches are functioning as designed, and Site wetlands are trending toward success. The Site is meeting project goals.

The small encroachment area has been addressed, the easement remarked, and the adaptive management planting is scheduled for Q1-2023. RS will provide a summary upon completing the remedial planting to the IRT.

4 REFERENCES

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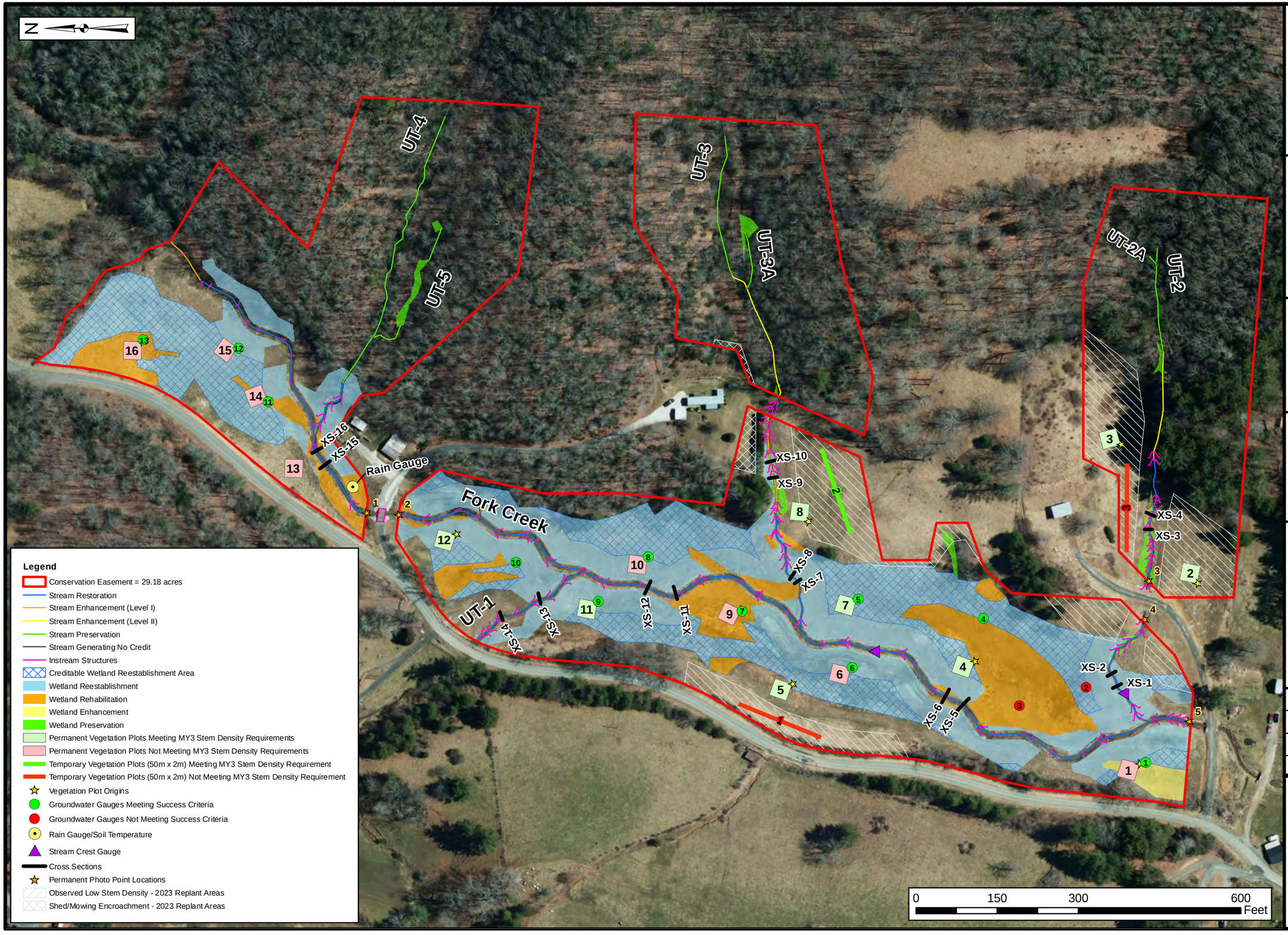
Appendix A: Visual Assessment Data

Figure 1. Current Conditions Plan View
Figure 2. Asset Map
Table 4A-E. Visual Stream Morphology Stability Assessment Table
Table 5. Vegetation Condition Assessment Table
Vegetation Plot Photographs
Site Photo Log



Axiom Environmental, Inc.

Prepared for:

RESTORATION SYSTEMS | LLC

Project:

LAUREL SPRINGS MITIGATION SITE

Avery County, NC

Title:

CURRENT CONDITIONS PLAN VIEW

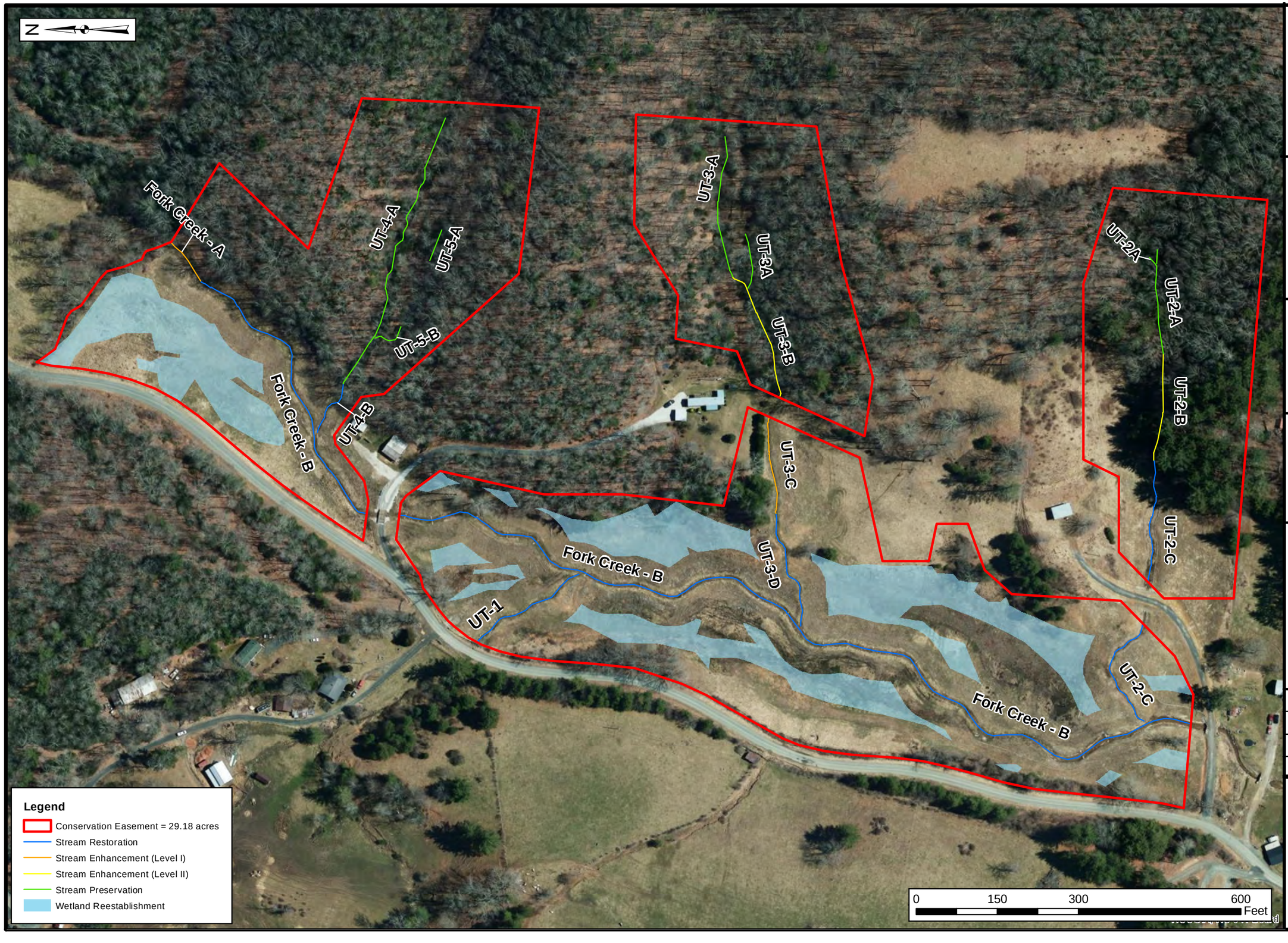
Notes:

1. Background Imagery Source: 2022 aerial photography provided by the NC OneMap program (online, provided by the NC Geographic Information Coordination Council)

Drawn by:	PHP
Date:	FEB 2023
Scale:	1:2000
Project No.:	19-006

FIGURE

1



Axiom Environmental, Inc.

Prepared for:

RESTORATION SYSTEMS | LLC

Project:

LAUREL SPRINGS MITIGATION SITE

Avery County, NC

Title:

ASSET MAP

Notes:

1. Background Imagery Source: 2022 aerial photography provided by the NC OneMap program (online, provided by the NC Geographic Information Coordination Council)

Drawn by:	KRJ
Date:	FEB 2023
Scale:	1:2000
Project No.:	19-006

FIGURE

1

Table 4A. Visual Stream Stability Assessment

Reach: Fork Creek

Assessed Stream Length: 2334

Assessed Bank Length: 4668

Survey Date: November 8, 2022

Major Channel Category		Metric	Number Stable, Performing as Intended	Total Number in As-built	Amount of Unstable Footage	% Stable, Performing as Intended
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.	45	45		100%
	Bank Protection	Bank erosion within the structures extent of influence does not exceed 15%. (See guidance for this table in DMS monitoring guidance document)	45	45		100%

Table 4B. Visual Stream Stability Assessment

Reach UT 1

Assessed Stream Length 233

Assessed Bank Length 466 Survey Date: November 8, 2022

Major Channel Category		Metric	Number Stable, Performing as Intended	Total Number in As-built	Amount of Unstable Footage	% Stable, Performing as Intended
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.	8	8		100%
	Bank Protection	Bank erosion within the structures extent of influence does not exceed 15%. (See guidance for this table in DMS monitoring guidance document)	8	8		100%

Table 4C. Visual Stream Stability Assessment

Reach UT 2

Assessed Stream Length 662

Assessed Bank Length 1324 Survey Date: November 8, 2022

Major Channel Category		Metric	Number Stable, Performing as Intended	Total Number in As-built	Amount of Unstable Footage	% Stable, Performing as Intended
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.	18	18		100%
	Bank Protection	Bank erosion within the structures extent of influence does not exceed 15%. (See guidance for this table in DMS monitoring guidance document)	18	18		100%

Table 4D. Visual Stream Stability Assessment

Reach UT 3

Assessed Stream Length 656

Assessed Bank Length 1312 Survey Date: November 8, 2022

Major Channel Category		Metric	Number Stable, Performing as Intended	Total Number in As-built	Amount of Unstable Footage	% Stable, Performing as Intended
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.	16	16		100%
	Bank Protection	Bank erosion within the structures extent of influence does not exceed 15%. (See guidance for this table in DMS monitoring guidance document)	16	16		100%

Table 4E. Visual Stream Stability Assessment

Reach UT 4

Assessed Stream Length 110

Assessed Bank Length 220 Survey Date: November 8, 2022

Major Channel Category		Metric	Number Stable, Performing as Intended	Total Number in As-built	Amount of Unstable Footage	% Stable, Performing as Intended
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.	3	3		100%
	Bank Protection	Bank erosion within the structures extent of influence does not exceed 15%. (See guidance for this table in DMS monitoring guidance document)	3	3		100%

Table 5. Visual Vegetation Assessment

Planted acreage **16.2** Survey Date: November 8, 2022

Vegetation Category	Definitions	Mapping Threshold	Combined Acreage	% of Planted Acreage
Bare Areas	Very limited cover of both woody and herbaceous material.	0.10 acres	0.00	0.0%
Low Stem Density Areas	Woody stem densities clearly below target levels based on current MY stem count criteria.	0.10acres	2.67	16.5%
	Total		2.67	16.5%
Areas of Poor Growth Rates	Planted areas where average height is not meeting current MY Performance Standard.	0.10 acres	0.00	0.0%
	Cumulative Total		2.67	16.5%

Easement Acreage **29.19**

Vegetation Category	Definitions	Mapping Threshold	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. Species included in summation above should be identified in report summary.	0.10 acres	0.00	0.0%
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	0 Encroachments noted	

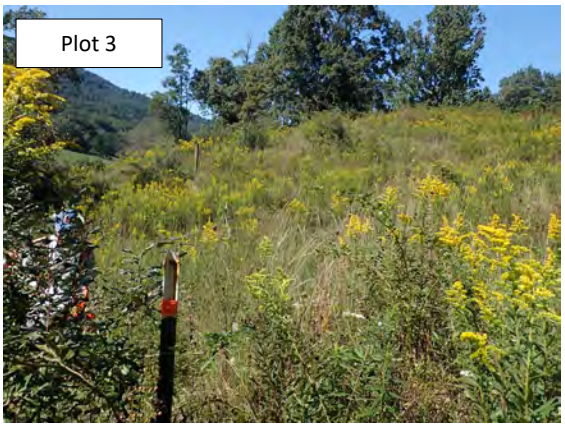
Laurel Springs Site

MY1 (2022) Vegetation Monitoring Photographs (taken September 14 and October 9, 2022)

Plot 1

Plot 2

Plot 3



Plot 4

Plot 5

Plot 6

Plot 7

Plot 8

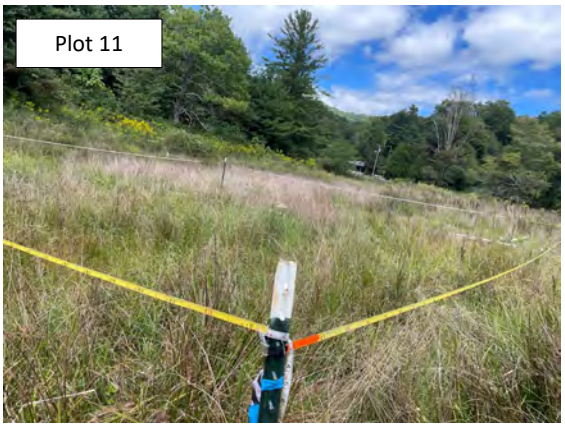
Laurel Springs Site

MY1 (2022) Vegetation Monitoring Photographs (taken September 14 and October 9, 2022)

Plot 9

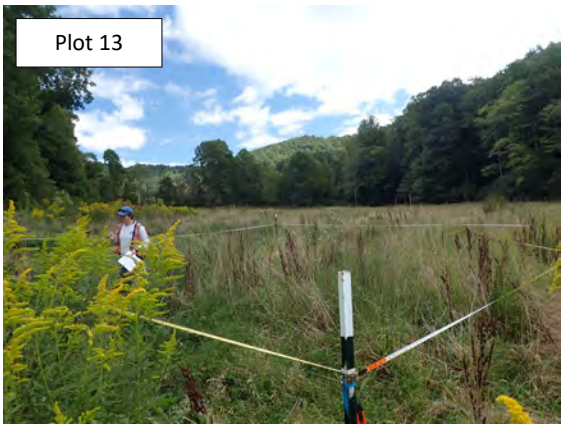
Plot 10

Plot 11



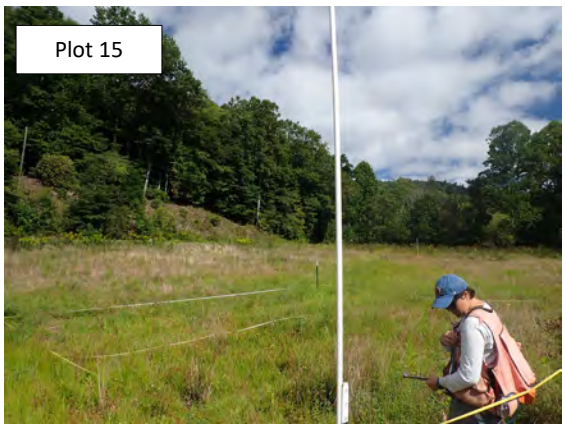
Plot 12

Plot 13

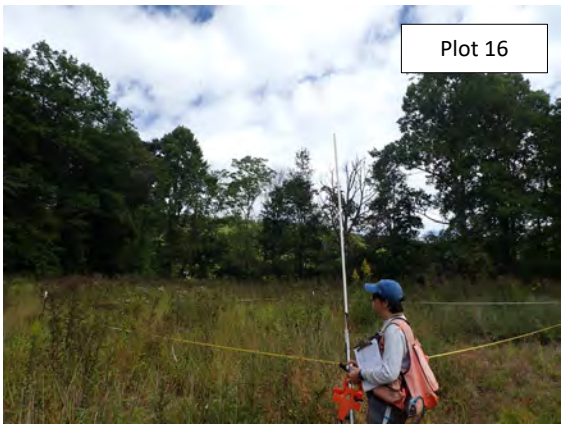


Plot 14

Plot 15



Plot 16



Laurel Springs
MY-01 (2022) Photo Log

Permanent Photo Point 1: Fork Creek Bridge Crossing
Upstream End, Facing Downstream (Taken 11/8/22)

Permanent Photo Point 2: Fork Creek Bridge Crossing
Downstream End, Facing Upstream (Taken 11/8/22)

Laurel Springs
MY-01 (2022) Photo Log

Permanent Photo Point 3: UT-2 Piped Crossing
Upstream End, Facing Downstream (Taken 6/24/22)

Permanent Photo Point 4: UT-2 Piped Crossing
Downstream End, Facing Upstream (Taken 6/24/22)

Laurel Springs
MY-01 (2022) Photo Log

Permanent Photo Point 5: Fork Creek Downstream Piped Crossing (Taken 9/14/22)

Photo 6: Easement Boundary Signage (Taken 11/8/22)

Laurel Springs
MY-01 (2022) Photo Log

Photo 7: Fork Creek Upper Reach Overview
(Taken 11/8/22)

Photo 8: Fork Creek Lower Reach Overview
(Taken 11/8/22)

Laurel Springs
MY-01 (2022) Photo Log

Photo 9: Fork Creek Lower Reach
(Taken 6/24/22)

Photo 10: Fork Creek Upper Reach
(Taken 6/24/22)

Laurel Springs
MY-01 (2022) Photo Log

Photo 11: UT-1
(Taken 6/24/22)

Photo 12: UT-1 Upper Pipe Outlet
(Taken 6/24/22)

Laurel Springs
MY-01 (2022) Photo Log

Photo 13: UT-2 Upper Reach
(Taken 6/24/22)

Photo 14: UT-2 Lower Reach
(Taken 6/24/22)

Laurel Springs
MY-01 (2022) Photo Log

Photo 15: UT-3
(Taken 6/24/22)

Photo 16: Wetland Area Adjacent to UT-3
(Taken 6/24/22)

Laurel Springs
MY-01 (2022) Photo Log

Photo 17: Confluence of Fork Creek and UT-4
(Taken 6/24/22)

Photo 18: UT-4
(Taken 6/24/22)

Laurel Springs
MY-01 (2022) Photo Log

Photo 19: Bud Burst of Carya sp.
Photo Taken 3/1/22

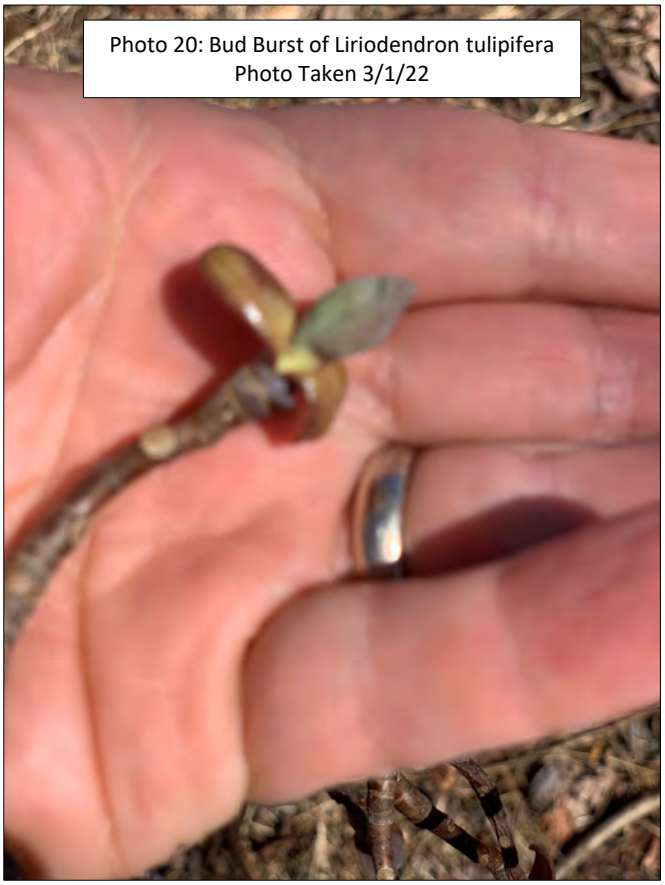


Photo 20: Bud Burst of Liriodendron tulipifera
Photo Taken 3/1/22

Appendix B: Vegetation Data

Table 6A. Planted Bare-Root Woody Vegetation
Table 6B. Permanent Seed Mix
Table 7. Vegetation Plot Counts and Densities
Table 8. Vegetation Plot Data Table from Vegetation Data Entry Tool

Table 6A. Planted Bare Root Woody Vegetation
Laurel Springs Mitigation Site

Vegetation Association		Montane Alluvial Forest*		Acidic Cove Forest*		Stream-side Assemblage**		TOTAL
Area (acres)		9.0		4.7		2.5		16.2
Species	Indicator Status	# planted*	% of total	# planted*	% of total	# planted**	% of total	# planted
Cherry birch *(Betula lenta*)	FACU	500	8%	600	18.75%	1500	15.96%	2600
Eastern hemlock (*Tsuga canadensis*)	FACU	400	6.4%	600	18.75%	--	--	1000
Red oak (*Quercus rubra*)	FACU	650	10.4%	650	20.31%	--	--	1300
White oak (*Quercus alba*)	FACU	550	8.8%			550	5.85%	1100
White pine (*Pinus strobus*)	FACU	600	9.6%			--	--	600
Yellow birch *(Betula alleghaniensis*)	FACU	200	3.2%			300	3.19%	500
Scarlet oak (*Quercus coccinea*)	FAC	600	9.6%	500	15.63%	--	--	1100
Tulip poplar (*Liriodendron tulipifera*)	FAC	450	7.2%	600	18.75%	1100	11.70%	2150
River birch (*Betula nigra*)	FACW	500	8%	--	--	950	10.10%	1450
Sycamore (*Platanus occidentalis*)	FACW	600	9.6%	--	--	1500	15.96%	2100
Silky dogwood (*Cornus amomum*)	FACW			--	--	600***	6.38%	600
Black willow (*Salix nigra*)	OBL			--	--	800***	8.51%	800
Elderberry (*Sambucus nigra*)	OBL	--	--	--	--	400***	4.26%	400
Buttonbush (*Cephalanthus occidentalis*)	OBL	--	--	--	--	400***	4.26%	400
^Common ninebark (*Physocarpus opulifolius*)	FACW	--	--	--	--	300***	3.19%	300
^Arrowwood viburnum (*Viburnum dentatum*)	FAC	400	6.4%			400	4.26%	800
^Bitternut hickory (*Carya cordiformis*)	FACU	800	12.8%					800
^American hazelnut (*Corylus americana*)	FACU					600	6.38%	600
^Red spruce (*Picea rubens*)	FACU			250	7.81%			250
TOTAL		**6250**	**100%**	**3200**	**100%**	**9400**	**100%**	**18850**

^Species added post-mitigation plan approval

* Planted at a density of 680 stems/acre.

** Planted at a density of 2720 stems/acre.

*** These species were live staked and planted along the stream channels – A total of 2500 live stakes were planted in addition to the 6900 bare-root Stream-Side Assemblage planting.

Table 6B. Permanent Seed Mix
Laurel Springs Stream and Wetland Mitigation Site

Scientific Name	Common Name	%	Scientific Name	Common Name	%
Asclepias incarnata	Swamp milkweed	0.3	*Helianthus angustifolius*	Narrowleaf sunflower	0.8
Agrostis gigantea	Redtop	16	*Heliopsis helianthoides*	False sunflower	1.2
Agrostis hyemalis	Winter bentgrass	4	*Hibiscus moscheutos*	Swamp rose mallow	0.8
Agrostis stolonifera	Creeping bentgrass	4	*Juncus effusus*	Soft rush	0.6
Carex lurida	Shallow sedge	3.22	*Lespedeza capitata*	Round-headed bush clover	0.8
Carex vulpinoidea	Fox sedge	10	*Lespedeza virginica*	Slender lespedeza	0.8
Chamaecrista fasciculata	Partridge pea	1.6	*Liatris spicata*	Dense blazing star	0.8
Chamaecrista nictitans	Sensitive partridge pea	0.8	*Mimulus ringens*	Allegheny monkeyflower	0.06
Chrysanthemum leucanthemum	Oxeye daisy	4	*Monarda fistulosa*	Wild bergamot	0.2
Coreopsis lanceolata	Lance-leaved coreopsis	4	*Panicum virgatum*	Switchgrass	4
Coreopsis tinctoria	Plains coreopsis	4	*Pycnanthemum tenuifolium*	Slender mountain mint	0.2
Cosmos bipinnatus	Garden cosmos	0.8	*Rhexia virginica*	Handsome-Harry	0.06
Desmodium canadense	Showy tick-trefoil	0.8	*Rudbeckia hirta*	Black-eyed Susan	4
Echinacea purpurea	Purple coneflower	2.4	*Scirpus cyperinus*	Woolgrass	0.06
Elymus virginicus	Virginia wildrye	8.6	*Silphium perfoliatum*	Cup plant	0.8
Eupatorium coelestinum	Blue mistflower	0.4	*Symphyotrichum puniceum*	Purplestem aster	0.1
Eupatorium perfoliatum	Common boneset	2.5	*Tridens flavus*	Purpletop tridens	16
Glyceria striata	Fowl manna grass	0.1	*Vernonia noveboracensis*	New York ironweed	0.2
Helenium autumnale	Common sneezeweed	0.2	*Verbena hastata*	Blue vervain	0.8
			Total		100

Table 7. Planted Vegetation Totals
Laurel Springs Stream and Wetland Mitigation Site

Plot #	Planted Stems/Acre	Success Criteria Met?
1	81	No
2	526	Yes
3	364	Yes
4	891	Yes
5	364	Yes
6	0	No
7	445	Yes
8	648	Yes
9	40	No
10	283	No
11	405	Yes
12	324	Yes
13	202	No
14	202	No
15	243	No
16	162	No
T1	81	No
T2	324	Yes
T3	121	No
Average Planted Stems/Acre	**300**	**No**

Table 8. Vegetation Plot Data Table from Vegetation Data Entry Tool

Planted Acreage	16.2
Date of Initial Plant	2022-01-13
Date(s) of Supplemental Plant(s)	NA
Date(s) Mowing	NA
Date of Current Survey	2022-11-08
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		Veg Plot 6 F		Veg Plot 7 F		Veg Plot 8 F		Veg Plot 9 F	
					Planted	Total	Planted	Total	Planted	Total	Planted	Total	Planted	Total	Planted	Total	Planted	Total	Planted	Total	Planted	Total
Species Included in Approved Mitigation Plan	Betula alleghaniensis	yellow birch	Tree	FAC							2	2					2	2	1	1		
	Betula nigra	river birch	Tree	FACW							2	2										
	Betula sp.										1	1							2	2		
	liriodendron tulipifera																					
	Liriodendron tulipifera	tuliptree	Tree	FACU	1	1	5	5	4	4	1	1	2	2					1	1		
	Pinus strobus	eastern white pine	Tree	FACU					4	4	3	3							1	1		
	Platanus occidentalis	American sycamore	Tree	FACW							4	4	1	1			1	1	4	4		
	Quercus alba	white oak	Tree	FACU									1	1								
	Quercus coccinea	scarlet oak	Tree								1	1					1	1				
	Quercus nigra	water oak	Tree	FAC															1	1		
	Quercus rubra	northern red oak	Tree	FACU			1	1									2	2	2	2		
	Quercus sp.						8	8			3	3					3	3	2	2	3	3
	Tsuga canadensis	eastern hemlock	Tree	FACU					1	1			1	1					2	2		
Sum	Performance Standard				1	1	14	14	9	9	17	17	5	5	0	0	9	9	16	16	3	3
Post Mitigation Plan Species	Carya cordiformis	bitternut hickory	Tree	FACU							4	4	3	3								
	Corylus americana	American hazelnut	Shrub	FACU													2	2				
	Viburnum dentatum	southern arrowwood	Tree	FAC	2	2					1	1	1	1								
Sum	Proposed Standard				3	3	14	14	9	9	22	22	9	9	0	0	11	11	16	16	3	3
Mitigation Plan Performance Standard	Current Year Stem Count					1		14		9		17		5		0		9		16		3
	Stems/Acre					40		526		364		688		202		0		364		648		40
	Species Count					1		3		3		8		4		0		5		9		1
	Dominant Species Composition (%)					100		57		44		18		33		0		27		25		100
	Average Plot Height (ft.)					1		1		1		1		1				1		1		1
	% Invasives					0		0		0		0		0				0		0		0
Post Mitigation Plan Performance Standard	Current Year Stem Count					3		14		9		22		9		0		11		16		3
	Stems/Acre					81		526		364		891		364		0		445		648		40
	Species Count					2		3		3		10		6		0		6		9		1
	Dominant Species Composition (%)					67		57		44		18		33		0		27		25		100
	Average Plot Height (ft.)					2		1		1		1		1				1		1		1
	% Invasives					0		0		0		0		0				0		0		0

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 8. Vegetation Plot Data Table from Vegetation Data Entry Tool (continued)

Planted Acreage	16.2
Date of Initial Plant	2022-01-13
Date(s) of Supplemental Plant(s)	NA
Date(s) Mowing	NA
Date of Current Survey	2022-11-08
Plot size (ACRES)	0.0247

	Scientific Name	Common Name	Tree/Shrub	Indicator Status	Veg Plot 10 F		Veg Plot 11 F		Veg Plot 12 F		Veg Plot 13 F		Veg Plot 14 F		Veg Plot 15 F		Veg Plot 16 F		Veg Plot 1 R	Veg Plot 2 R	Veg Plot 3 R
					Planted	Total	Planted	Total	Planted	Total	Planted	Total	Planted	Total	Planted	Total	Planted	Total	Total	Total	Total
Species Included in Approved Mitigation Plan	Betula alleghaniensis	yellow birch	Tree	FAC			2	2			2	2									
	Betula nigra	river birch	Tree	FACW											1	1	1	1			
	Betula sp.								2	2										1	
	liriodendron tulipifera																			1	
	Liriodendron tulipifera	tuliptree	Tree	FACU	1	1			3	3			2	2	2	2	1	1		2	1
	Pinus strobus	eastern white pine	Tree	FACU																	4
	Platanus occidentalis	American sycamore	Tree	FACW	1	1					5	5			1	1	3	3			
	Quercus alba	white oak	Tree	FACU															2		
	Quercus coccinea	scarlet oak	Tree																		
	Quercus nigra	water oak	Tree	FAC																	
	Quercus rubra	northern red oak	Tree	FACU																3	
	Quercus sp.				1	1	1	1	2	2					1	1			1	1	
	Tsuga canadensis	eastern hemlock	Tree	FACU																	
Sum	Performance Standard				3	3	3	3	7	7	7	7	2	2	5	5	5	5	3	8	5
Post Mitigation Plan Species	Carya cordiformis	bitternut hickory	Tree	FACU	1	1			1	1											
	Corylus americana	American hazelnut	Shrub	FACU									1	1							
	Viburnum dentatum	southern arrowwood	Tree	FAC	3	3	11	11					2	2	1	1					
Sum	Proposed Standard				7	7	14	14	8	8	7	7	5	5	6	6	5	5	3	8	5
Mitigation Plan Performance Standard	Current Year Stem Count					3		3		7		7		2		5		5	3	8	5
	Stems/Acre					121		121		283		202		81		202		162	81	324	121
	Species Count					3		2		3		2		1		4		3	2	5	2
	Dominant Species Composition (%)					43		79		38		71		40		33		60	67	38	80
	Average Plot Height (ft.)					2		1		2		2		1		2		1	1	1	1
	% Invasives					0		0		0		0		0		0		0	0	0	0
Post Mitigation Plan Performance Standard	Current Year Stem Count					7		14		8		7		5		6		5	3	8	5
	Stems/Acre					283		405		324		202		202		243		162	81	324	121
	Species Count					5		3		4		2		3		5		3	2	5	2
	Dominant Species Composition (%)					43		79		38		71		40		33		60	67	38	80
	Average Plot Height (ft.)					2		2		1		2		2		2		1	1	1	1
	% Invasives					0		0		0		0		0		0		0	0	0	0

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.

Appendix C: Stream Geomorphology Data

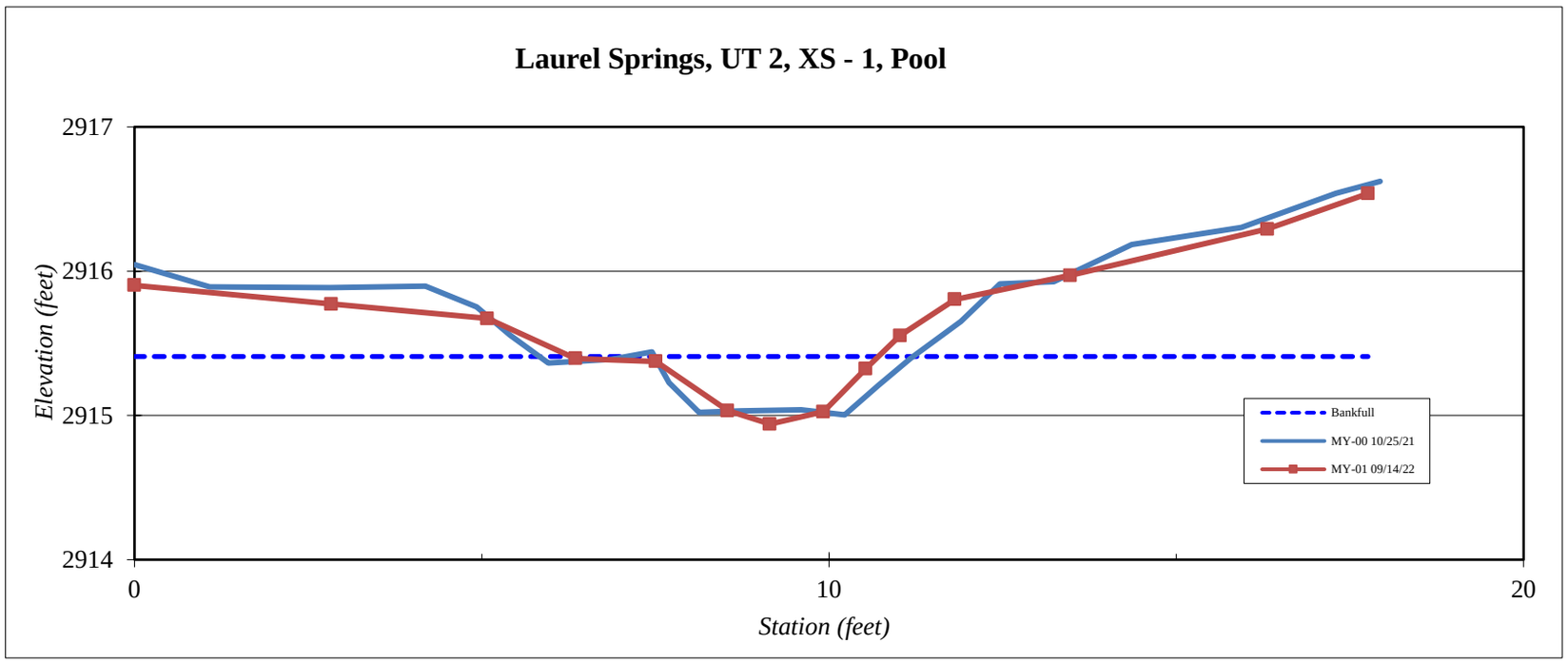
Cross-Sections with Annual Overlays
Table 9A-D. Baseline Stream Data Summary Tables
Table 10A-B. Cross-Section Morphology Monitoring Summary

Site	Laurel Springs
Watershed:	French Broad River Basin, 06010108
XS ID	UT2, XS -1, Pool
Feature	Pool
Date:	9/14/2022
Field Crew:	Perkinson, Adams

Station	Elevation
0.0	2915.7
2.8	2915.6
5.1	2915.4
6.3	2915.1
7.5	2915.1
8.5	2914.7
9.1	2914.6
9.9	2914.7
10.5	2915.0
11.0	2915.3
11.8	2915.6
13.5	2915.8
16.3	2916.1
17.8	2916.4

SUMMARY DATA	
Bankfull Elevation:	2915.1
Bank Hieght Ratio:	0.97
Thalweg Elevation:	2914.6
LTOB Elevation:	2915.1
LTOB Max Depth:	0.5
LTOB Cross Sectional Area:	1.0

Stream Type	E/C 5

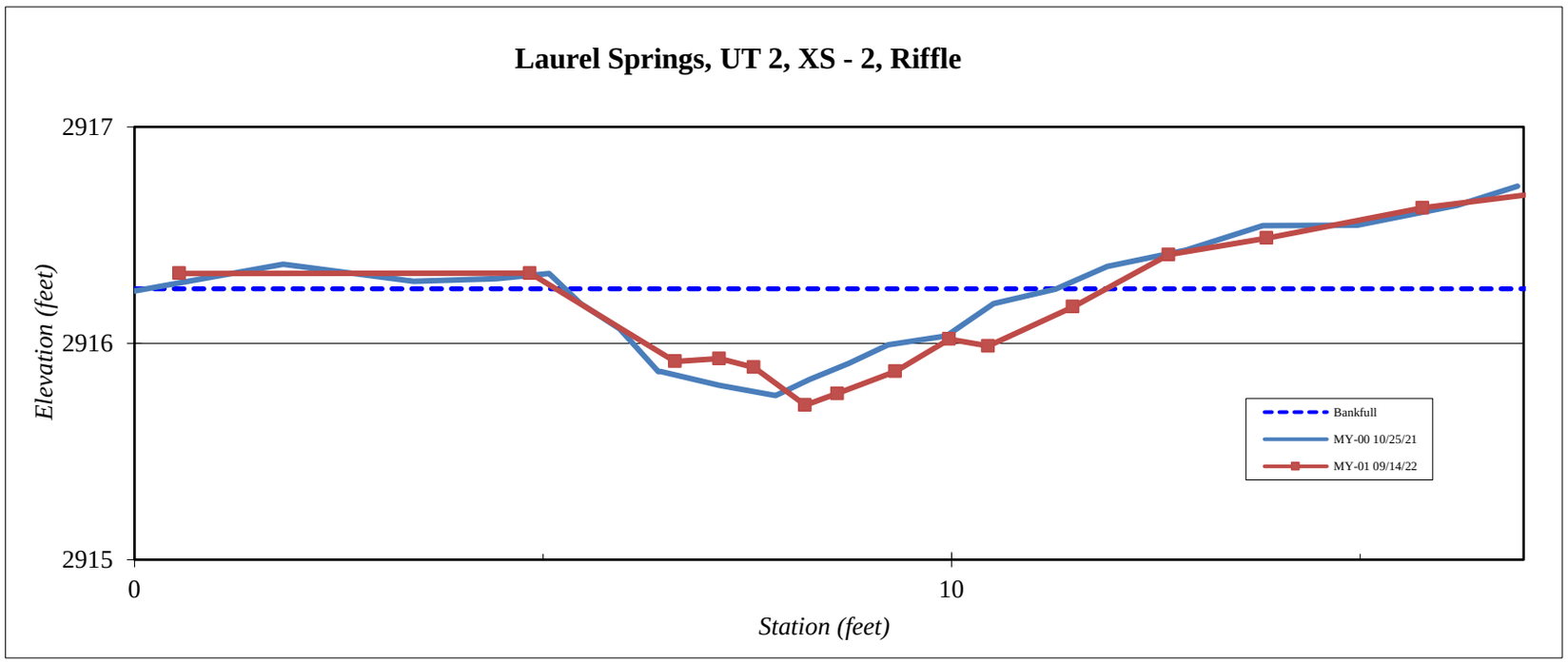


Site	Laurel Springs
Watershed:	French Broad River Basin, 06010108
XS ID	UT2, XS -2, Riffle
Feature	Riffle
Date:	9/14/2022
Field Crew:	Perkinson, Adams

Station	Elevation
0.6	2916.2
4.8	2916.2
6.6	2915.7
7.2	2915.7
7.6	2915.7
8.2	2915.5
8.6	2915.6
9.3	2915.7
10.0	2915.8
10.4	2915.8
11.5	2916.0
12.7	2916.3
13.9	2916.4
15.8	2916.5
17.2	2916.6

SUMMARY DATA	
Bankfull Elevation:	2916.1
Bank Hieght Ratio:	0.85
Thalweg Elevation:	2915.5
LTOB Elevation:	2916.0
LTOB Max Depth:	0.5
LTOB Cross Sectional Area:	1.5

Stream Type	E/C 5

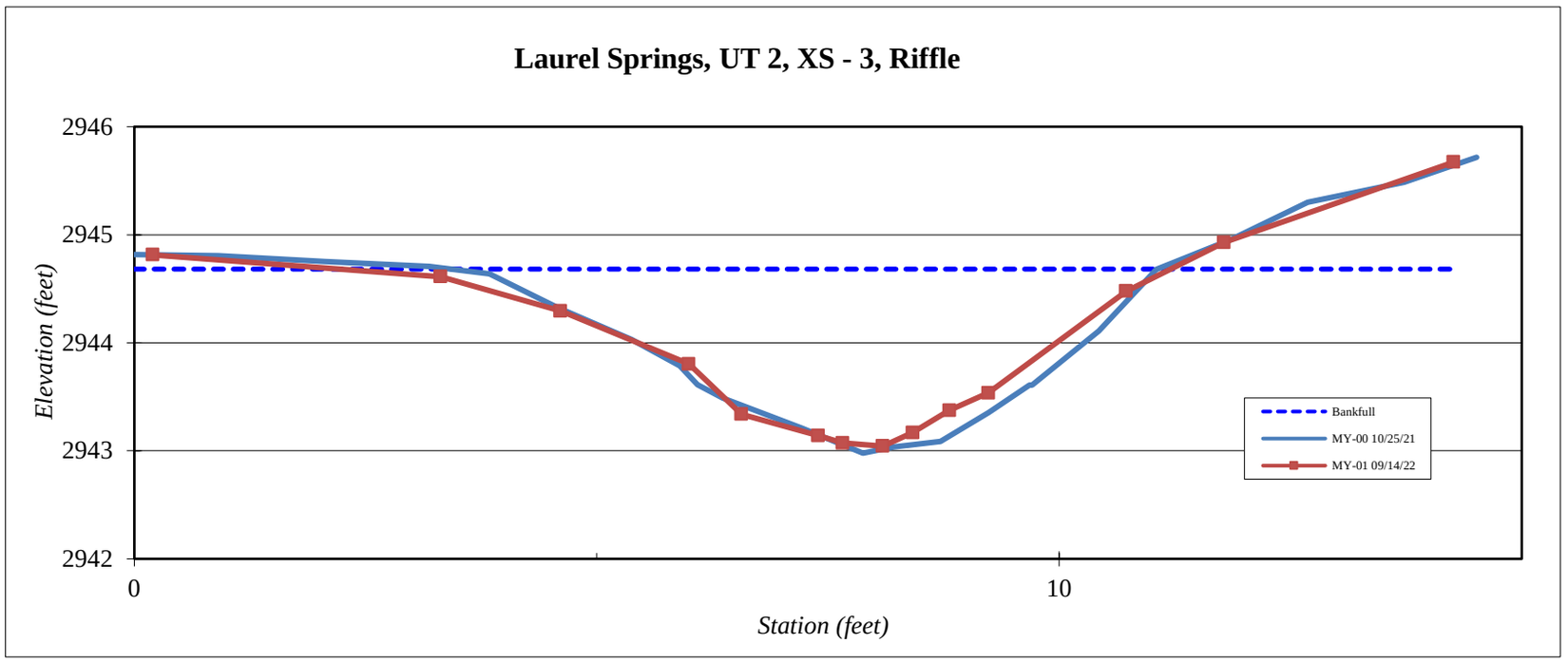


Site	Laurel Springs
Watershed:	French Broad River Basin, 06010108
XS ID	UT2, XS -3, Riffle
Feature	Riffle
Date:	9/14/2022
Field Crew:	Perkinson, Adams

Station	Elevation
0.2	2945.0
3.3	2944.8
4.6	2944.4
6.0	2943.9
6.6	2943.3
7.4	2943.1
7.7	2943.0
8.1	2943.0
8.4	2943.1
8.8	2943.4
9.2	2943.6
10.7	2944.6
11.8	2945.1
14.3	2946.0

SUMMARY DATA	
Bankfull Elevation:	2944.8
Bank Hieght Ratio:	1.08
Thalweg Elevation:	2943.0
LTOB Elevation:	2945.0
LTOB Max Depth:	2.0
LTOB Cross Sectional Area:	9.2

Stream Type	E/C 5

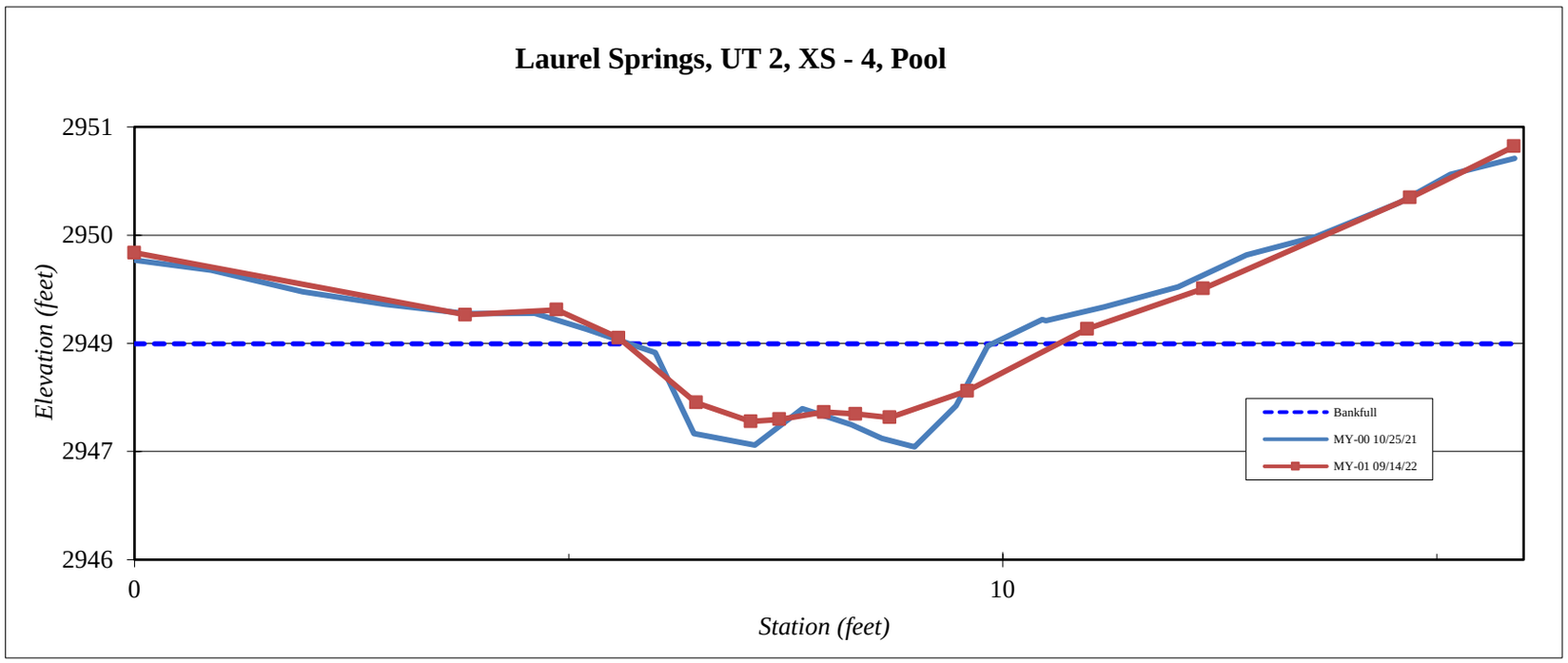


Site	Laurel Springs
Watershed:	French Broad River Basin, 06010108
XS ID	UT2, XS -4, Pool
Feature	Pool
Date:	9/14/2022
Field Crew:	Perkinson, Adams

Station	Elevation
0.0	2949.5
3.8	2948.9
4.9	2949.0
5.6	2948.7
6.5	2948.0
7.1	2947.8
7.4	2947.8
7.9	2947.9
8.3	2947.9
8.7	2947.8
9.6	2948.1
11.0	2948.8
12.3	2949.2
14.7	2950.1
15.9	2950.7

SUMMARY DATA	
Bankfull Elevation:	2948.6
Bank Hieght Ratio:	1.08
Thalweg Elevation:	2947.8
LTOB Elevation:	2948.7
LTOB Max Depth:	0.9
LTOB Cross Sectional Area:	3.0

Stream Type	E/C 5

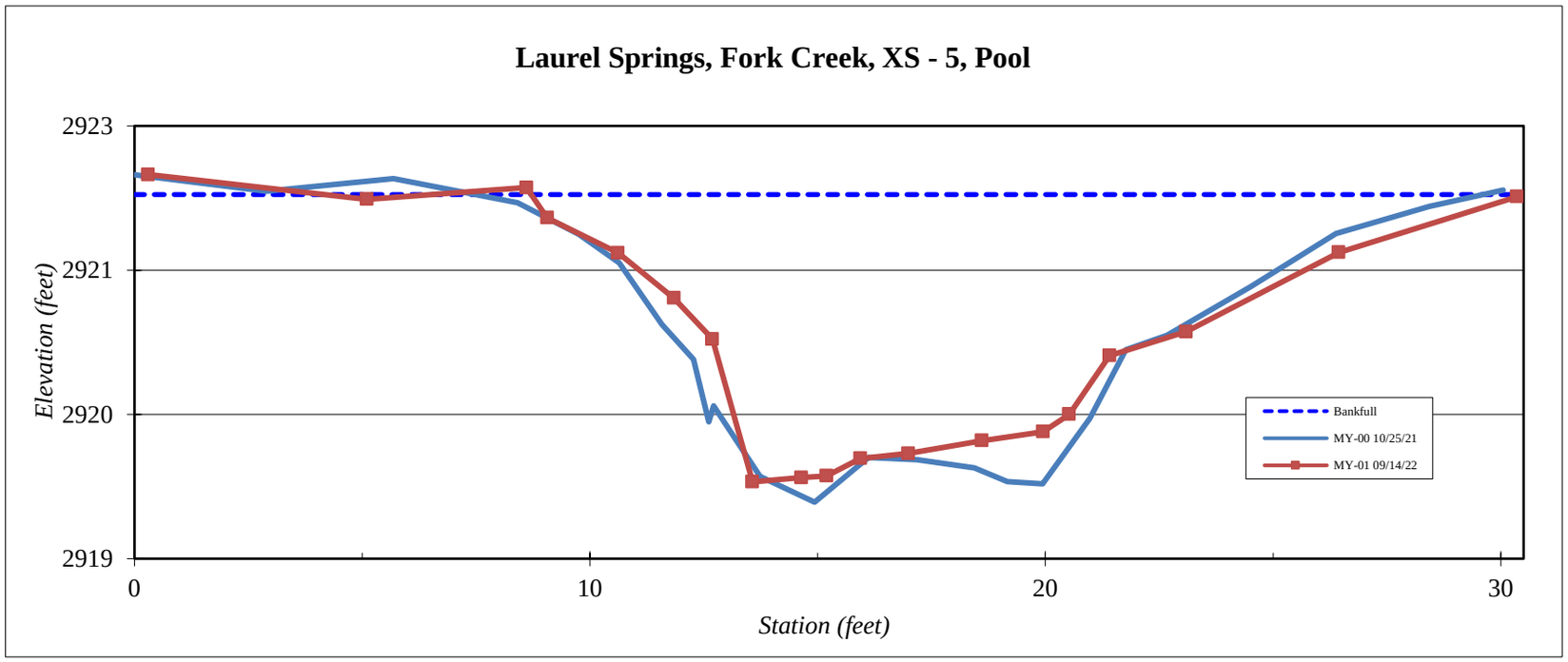


Site	Laurel Springs
Watershed:	French Broad River Basin, 06010108
XS ID	Fork Creek, XS -5, Pool
Feature	Pool
Date:	9/14/2022
Field Crew:	Perkinson, Adams

Station	Elevation
0.3	2922.2
5.1	2922.0
8.6	2922.1
9.1	2921.9
10.6	2921.6
11.8	2921.2
12.7	2920.9
13.6	2919.8
14.6	2919.8
15.2	2919.9
15.9	2920.0
17.0	2920.0
18.6	2920.1
19.9	2920.2
20.5	2920.3
21.4	2920.8
23.1	2921.0
26.4	2921.6
30.4	2922.0

SUMMARY DATA	
Bankfull Elevation:	2922.1
Bank Hieght Ratio:	0.99
Thalweg Elevation:	2919.8
LTOB Elevation:	2922.0
LTOB Max Depth:	2.2
LTOB Cross Sectional Area:	24.2

Stream Type	E/C 5

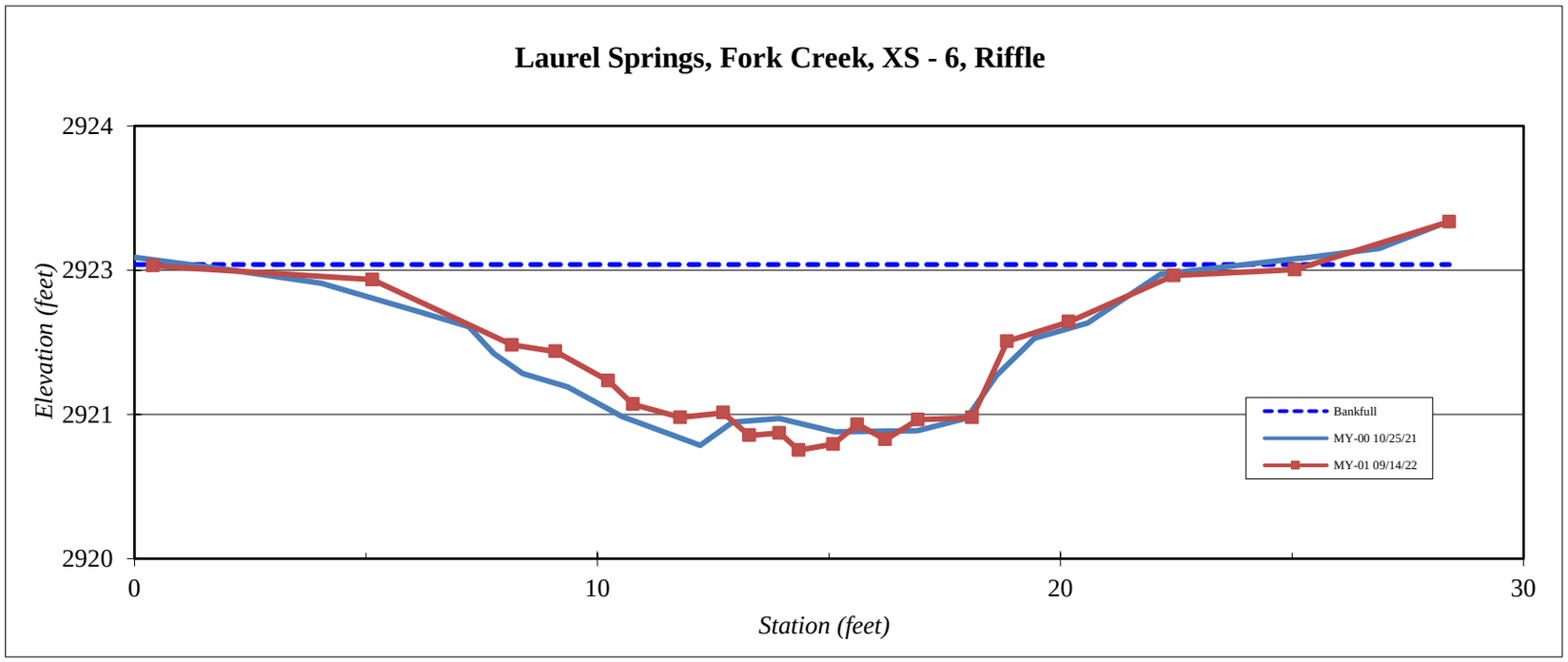


Site	Laurel Springs
Watershed:	French Broad River Basin, 06010108
XS ID	Fork Creek, XS -6, Riffle
Feature	Riffle
Date:	9/14/2022
Field Crew:	Perkinson, Adams

Station	Elevation
0.4	2922.6
5.1	2922.5
8.2	2922.0
9.1	2922.0
10.2	2921.7
10.8	2921.5
11.8	2921.4
12.7	2921.5
13.3	2921.3
13.9	2921.3
14.3	2921.2
15.1	2921.2
15.6	2921.4
16.2	2921.3
16.9	2921.4
18.1	2921.4
18.8	2922.0
20.2	2922.2
22.4	2922.6
25.1	2922.6
28.4	2922.98

SUMMARY DATA	
Bankfull Elevation:	2922.6
Bank Hieght Ratio:	0.92
Thalweg Elevation:	2921.2
LTOB Elevation:	2922.5
LTOB Max Depth:	1.3
LTOB Cross Sectional Area:	12.4

Stream Type	E/C 5

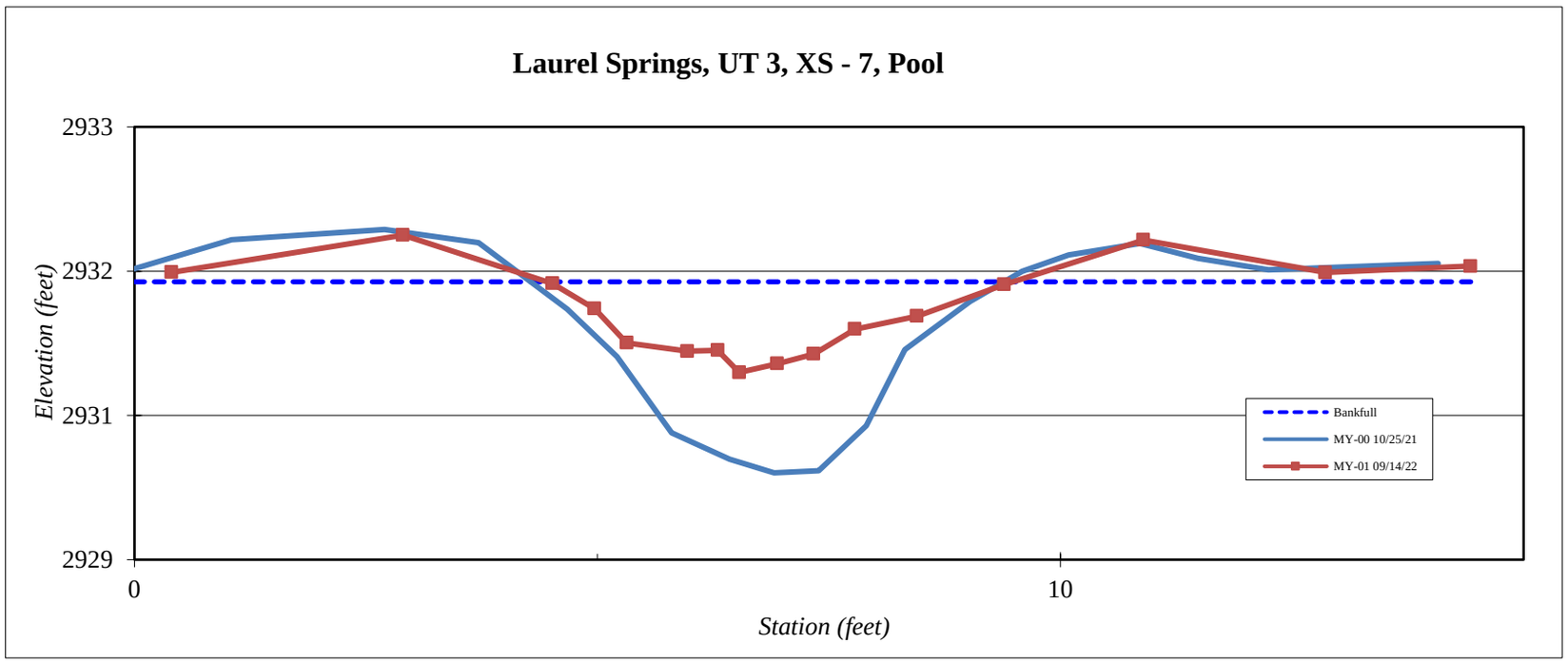


Site	Laurel Springs
Watershed:	French Broad River Basin, 06010108
XS ID	UT3, XS -7, Pool
Feature	Pool
Date:	9/14/2022
Field Crew:	Perkinson, Adams

Station	Elevation
0.4	2931.6
2.9	2931.9
4.5	2931.5
5.0	2931.3
5.3	2931.1
6.0	2931.0
6.3	2931.0
6.5	2930.8
6.9	2930.9
7.3	2931.0
7.8	2931.2
8.5	2931.3
9.4	2931.5
10.9	2931.9
12.9	2931.6
14.4	2931.7

SUMMARY DATA	
Bankfull Elevation:	2931.6
Bank Hieght Ratio:	0.97
Thalweg Elevation:	2930.8
LTOB Elevation:	2931.5
LTOB Max Depth:	0.7
LTOB Cross Sectional Area:	1.8

Stream Type	E/C 5

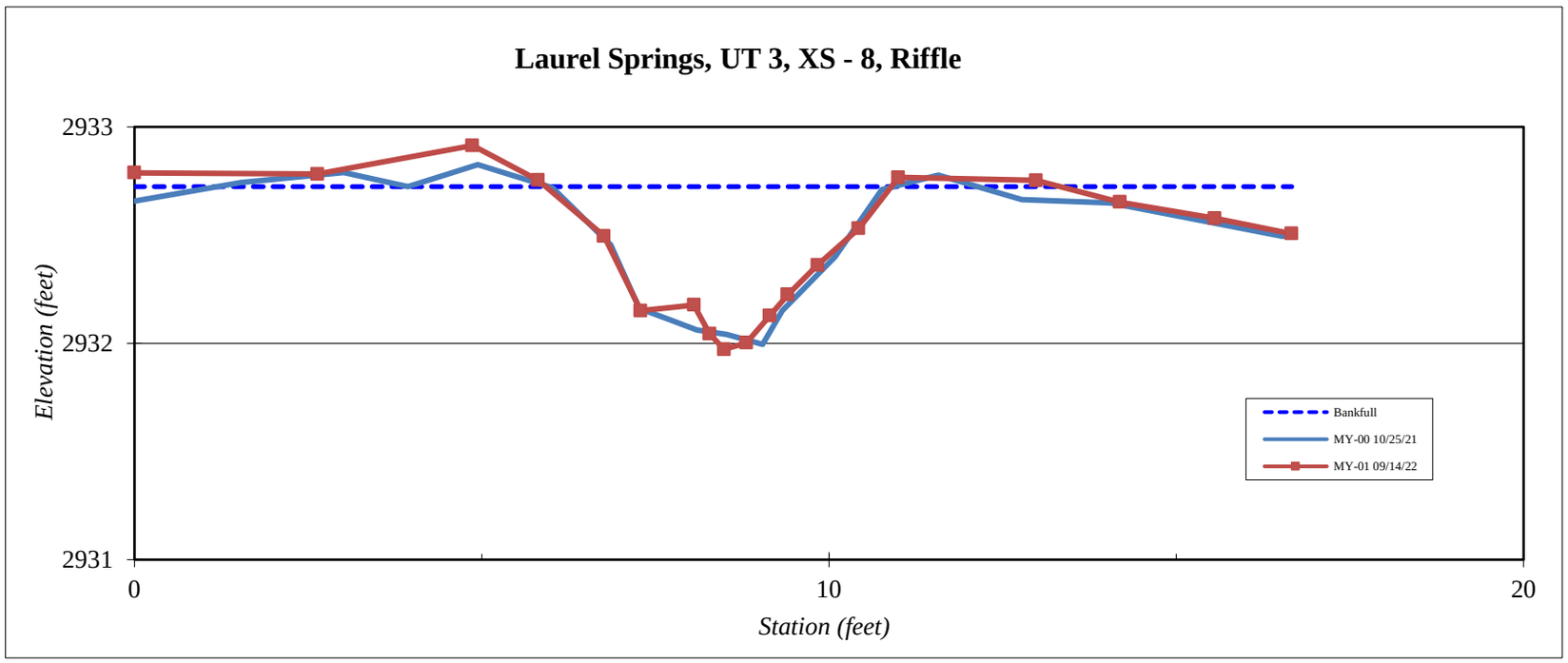


Site	Laurel Springs
Watershed:	French Broad River Basin, 06010108
XS ID	UT3, XS -8, Riffle
Feature	Riffle
Date:	9/14/2022
Field Crew:	Perkinson, Adams

Station	Elevation
0.0	2932.5
2.6	2932.5
4.9	2932.7
5.8	2932.5
6.8	2932.2
7.3	2931.8
8.1	2931.8
8.3	2931.7
8.5	2931.6
8.8	2931.6
9.1	2931.8
9.4	2931.9
9.8	2932.0
10.4	2932.2
11.0	2932.5
13.0	2932.5
14.2	2932.4
15.6	2932.3
16.7	2932.2

SUMMARY DATA	
Bankfull Elevation:	2932.5
Bank Hieght Ratio:	1.04
Thalweg Elevation:	2931.6
LTOB Elevation:	2932.5
LTOB Max Depth:	0.9
LTOB Cross Sectional Area:	2.5

Stream Type	E/C 5

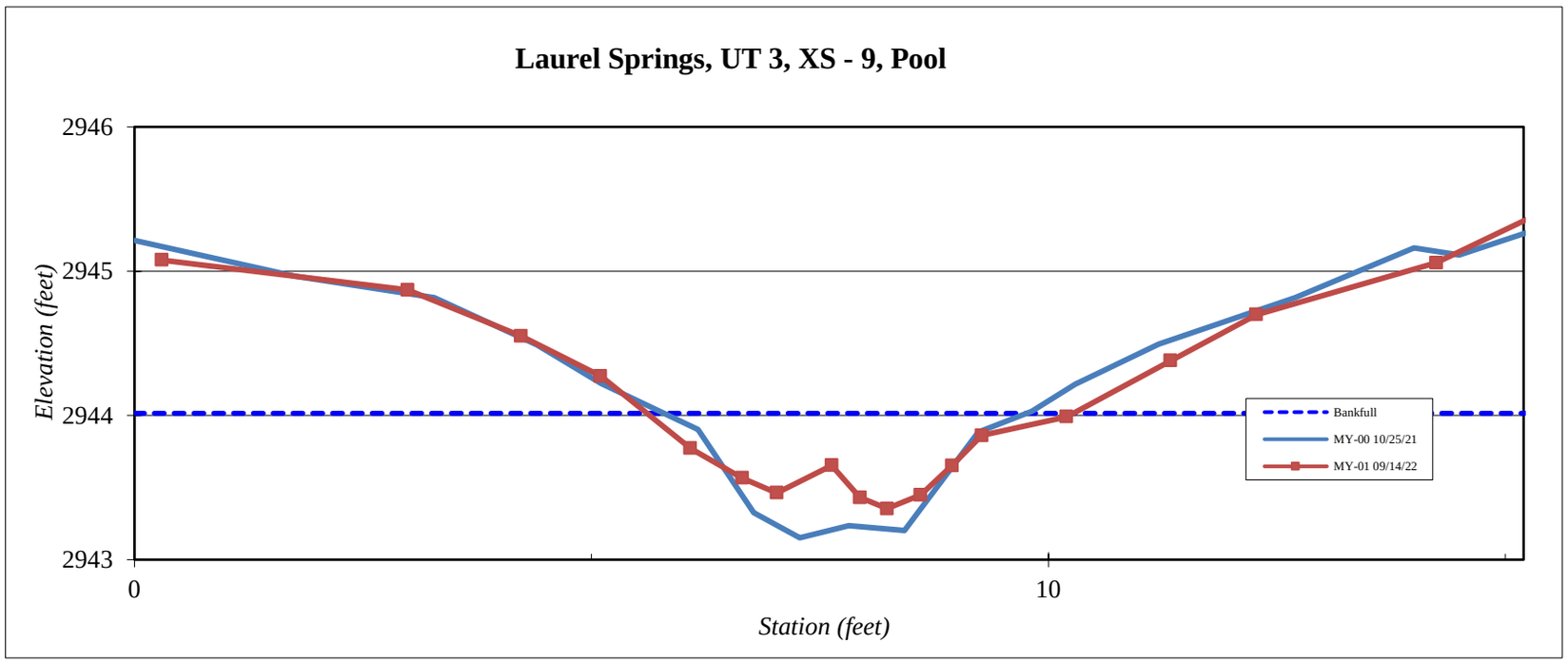


Site	Laurel Springs
Watershed:	French Broad River Basin, 06010108
XS ID	UT3, XS -9, Pool
Feature	Pool
Date:	9/14/2022
Field Crew:	Perkinson, Adams

Station	Elevation
0.3	2945.3
3.0	2945.1
4.2	2944.7
5.1	2944.4
6.1	2943.8
6.7	2943.6
7.0	2943.5
7.6	2943.7
7.9	2943.4
8.2	2943.3
8.6	2943.5
8.9	2943.7
9.3	2943.9
10.2	2944.1
11.3	2944.5
12.3	2944.9
14.2	2945.3
15.4	2945.7

SUMMARY DATA	
Bankfull Elevation:	2944.1
Bank Hieght Ratio:	0.96
Thalweg Elevation:	2943.3
LTOB Elevation:	2944.1
LTOB Max Depth:	0.7
LTOB Cross Sectional Area:	1.7

Stream Type	E/C 5

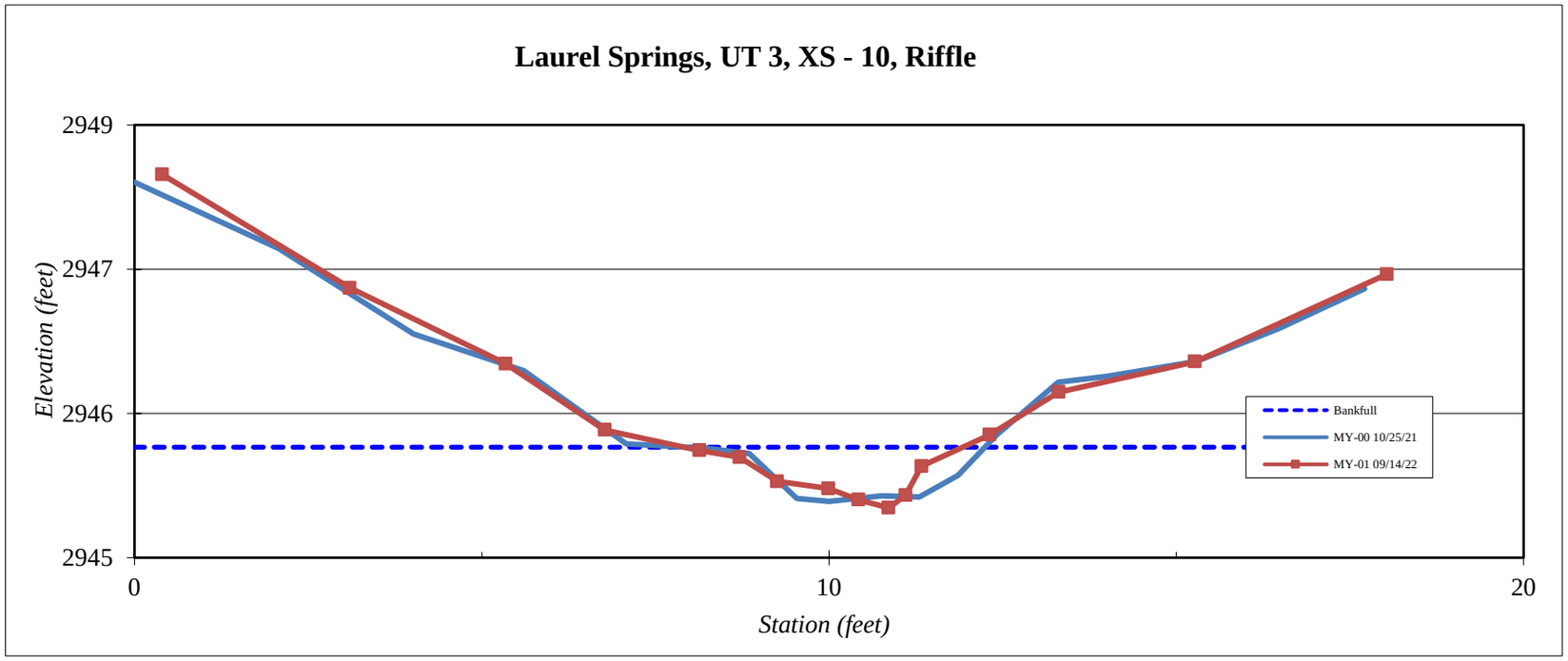


Site	Laurel Springs
Watershed:	French Broad River Basin, 06010108
XS ID	UT3, XS -10, Riffle
Feature	Riffle
Date:	9/14/2022
Field Crew:	Perkinson, Adams

Station	Elevation
0.4	2948.2
3.1	2947.3
5.3	2946.7
6.8	2946.2
8.1	2946.0
8.7	2946.0
9.3	2945.8
10.0	2945.8
10.4	2945.7
10.9	2945.6
11.1	2945.7
11.3	2945.9
12.3	2946.2
13.3	2946.5
15.3	2946.7
18.0	2947.4

SUMMARY DATA	
Bankfull Elevation:	2946.1
Bank Hieght Ratio:	0.95
Thalweg Elevation:	2945.6
LTOB Elevation:	2946.0
LTOB Max Depth:	0.5
LTOB Cross Sectional Area:	0.8

Stream Type	E/C 5

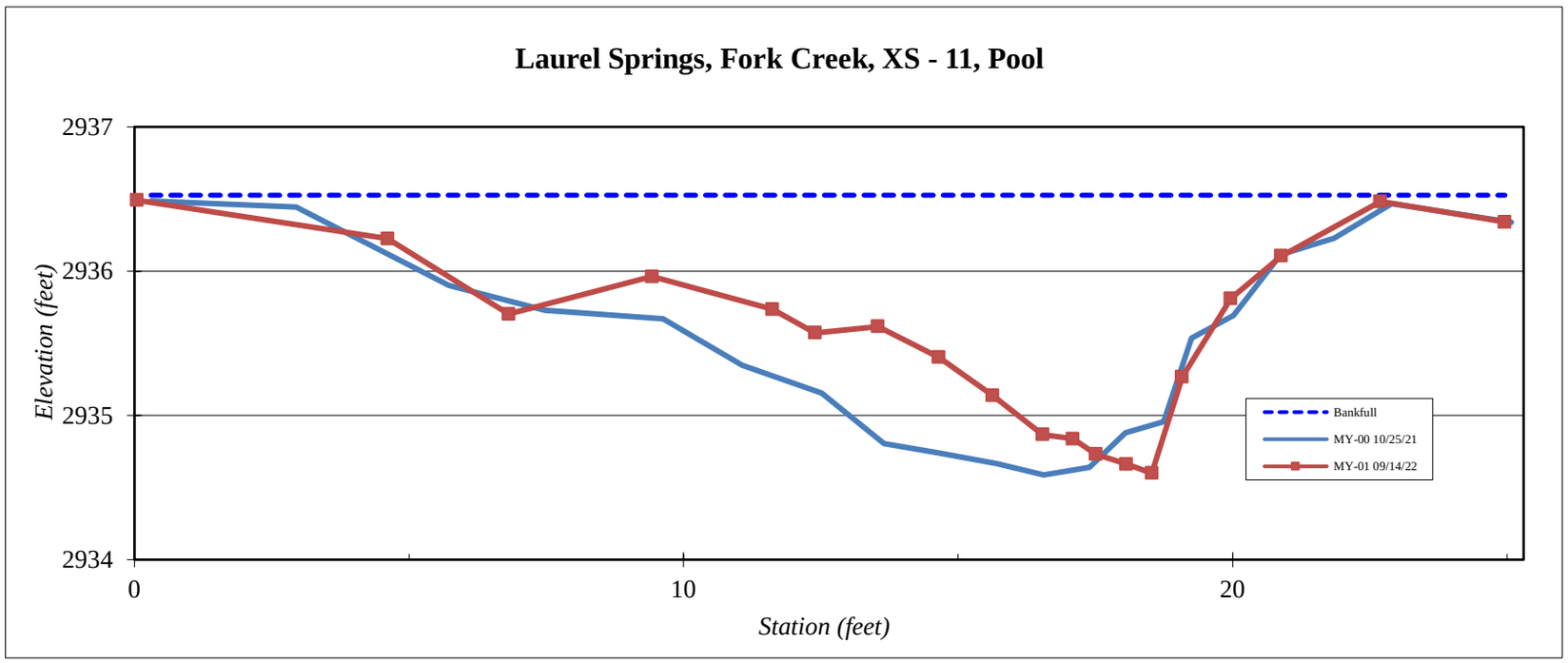


Site	Laurel Springs
Watershed:	French Broad River Basin, 06010108
XS ID	Fork Creek, XS -11, Pool
Feature	Pool
Date:	9/14/2022
Field Crew:	Perkinson, Adams

Station	Elevation
-0.3	2936.7
4.3	2936.4
6.5	2935.8
9.1	2936.1
11.3	2935.9
12.1	2935.7
13.2	2935.7
14.3	2935.5
15.3	2935.2
16.2	2934.9
16.8	2934.8
17.2	2934.7
17.8	2934.7
18.2	2934.6
18.8	2935.3
19.7	2935.9
20.6	2936.3
22.4	2936.7
24.7	2936.5

SUMMARY DATA	
Bankfull Elevation:	2936.8
Bank Hieght Ratio:	0.98
Thalweg Elevation:	2934.6
LTOB Elevation:	2936.7
LTOB Max Depth:	2.1
LTOB Cross Sectional Area:	18.2

Stream Type	E/C 5

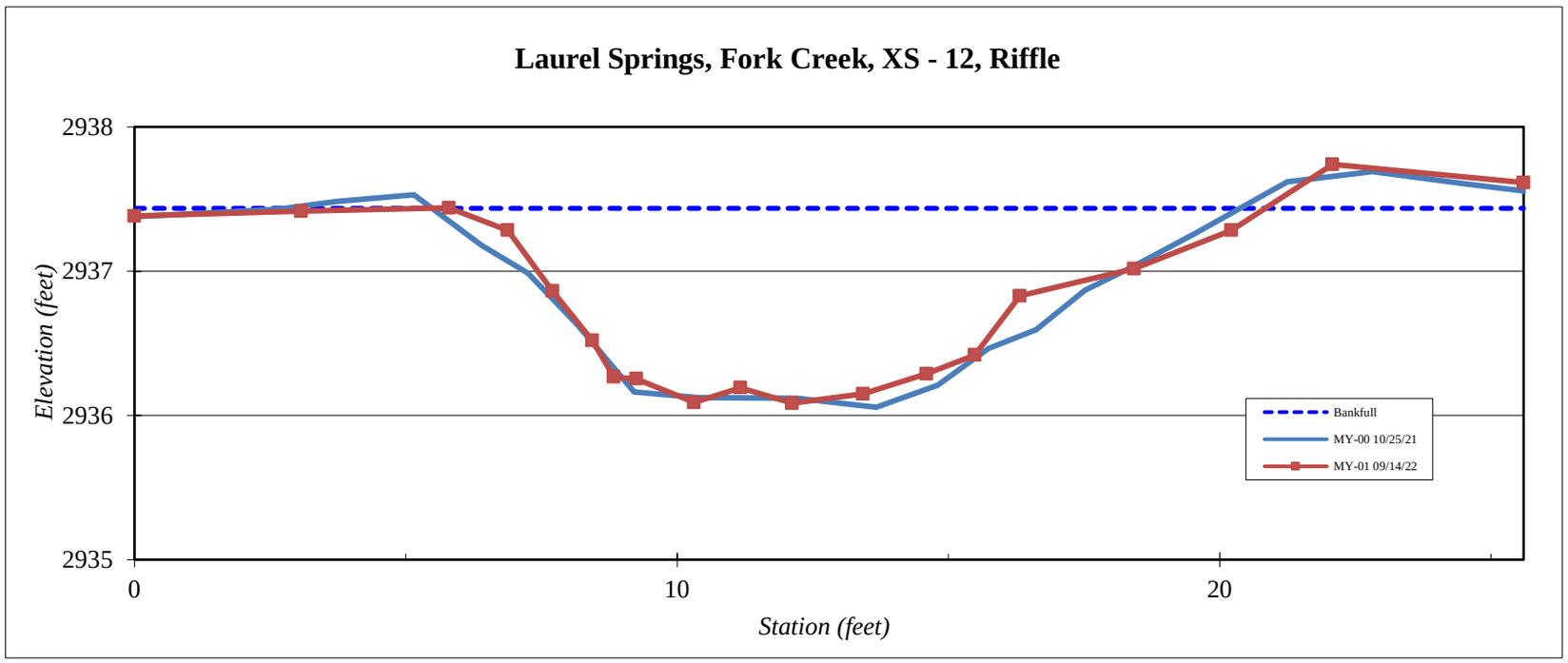


Site	Laurel Springs
Watershed:	French Broad River Basin, 06010108
XS ID	Fork Creek, XS -12, Riffle
Feature	Riffle
Date:	9/14/2022
Field Crew:	Perkinson, Adams

Station	Elevation
0.0	2937.7
3.1	2937.8
5.8	2937.8
6.9	2937.6
7.7	2937.1
8.4	2936.8
8.8	2936.5
9.2	2936.4
10.3	2936.3
11.2	2936.4
12.1	2936.3
13.4	2936.3
14.6	2936.5
15.5	2936.6
16.3	2937.1
18.4	2937.3
20.2	2937.6
22.1	2938.1
25.6	2938.0

SUMMARY DATA	
Bankfull Elevation:	2937.8
Bank Hieght Ratio:	1.00
Thalweg Elevation:	2936.3
LTOB Elevation:	2937.8
LTOB Max Depth:	1.5
LTOB Cross Sectional Area:	13.5

Stream Type	E/C 5

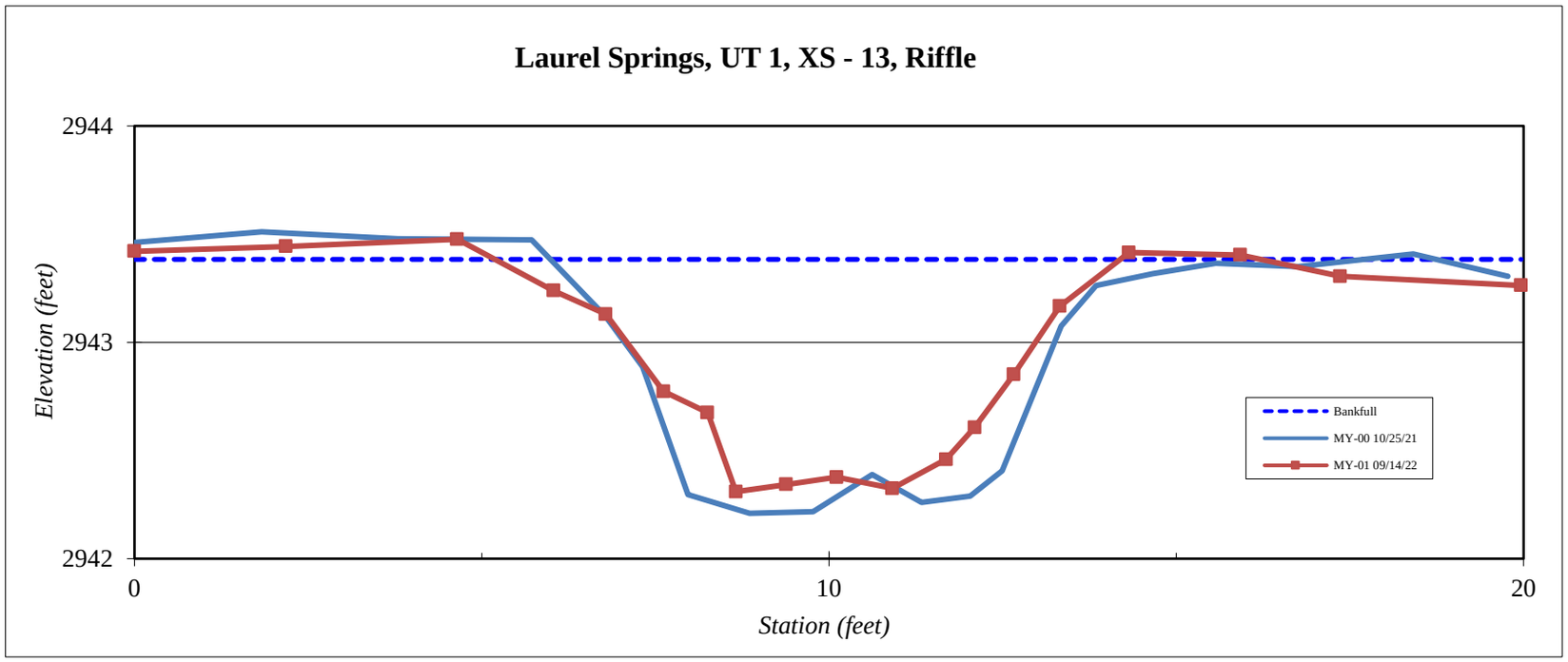


Site	Laurel Springs
Watershed:	French Broad River Basin, 06010108
XS ID	UT1, XS -13, Riffle
Feature	Riffle
Date:	9/14/2022
Field Crew:	Perkinson, Adams

Station	Elevation
0.0	2943.4
2.2	2943.4
4.6	2943.5
6.0	2943.2
6.8	2943.1
7.6	2942.7
8.3	2942.6
8.7	2942.2
9.4	2942.2
10.1	2942.2
10.9	2942.2
11.7	2942.3
12.1	2942.5
12.7	2942.8
13.3	2943.1
14.3	2943.4
15.9	2943.4
17.4	2943.3
20.0	2943.2

SUMMARY DATA	
Bankfull Elevation:	2943.4
Bank Hieght Ratio:	1.03
Thalweg Elevation:	2942.2
LTOB Elevation:	2943.4
LTOB Max Depth:	1.2
LTOB Cross Sectional Area:	6.6

Stream Type	E/C 5

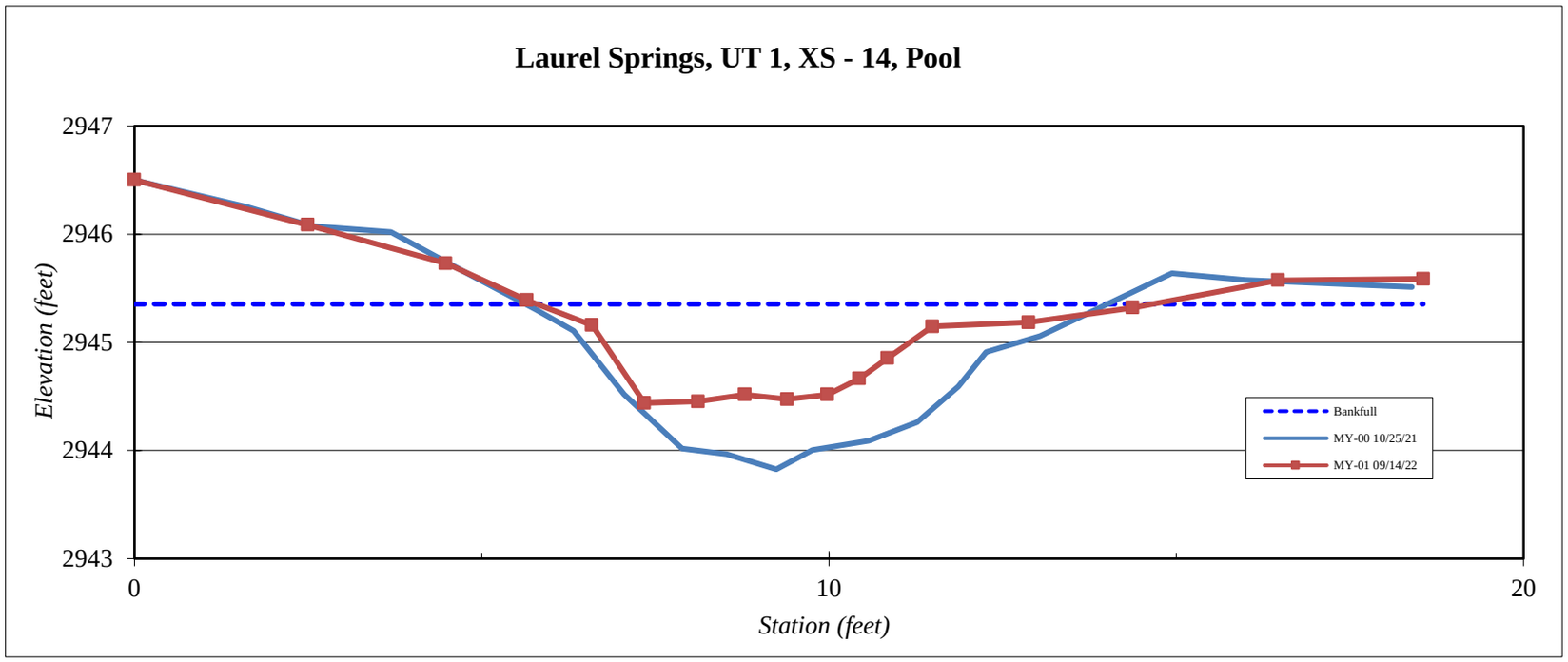


Site	Laurel Springs
Watershed:	French Broad River Basin, 06010108
XS ID	UT1, XS -14, Pool
Feature	Pool
Date:	9/14/2022
Field Crew:	Perkinson, Adams

Station	Elevation
0.0	2946.9
2.5	2946.4
4.5	2946.0
5.7	2945.6
6.6	2945.4
7.3	2944.6
8.1	2944.6
8.8	2944.7
9.4	2944.6
10.0	2944.7
10.4	2944.8
10.8	2945.0
11.5	2945.4
12.9	2945.4
14.4	2945.6
16.5	2945.9
18.6	2945.9

SUMMARY DATA	
Bankfull Elevation:	2945.6
Bank Hieght Ratio:	1.04
Thalweg Elevation:	2944.6
LTOB Elevation:	2945.6
LTOB Max Depth:	1.1
LTOB Cross Sectional Area:	4.9

Stream Type	E/C 5

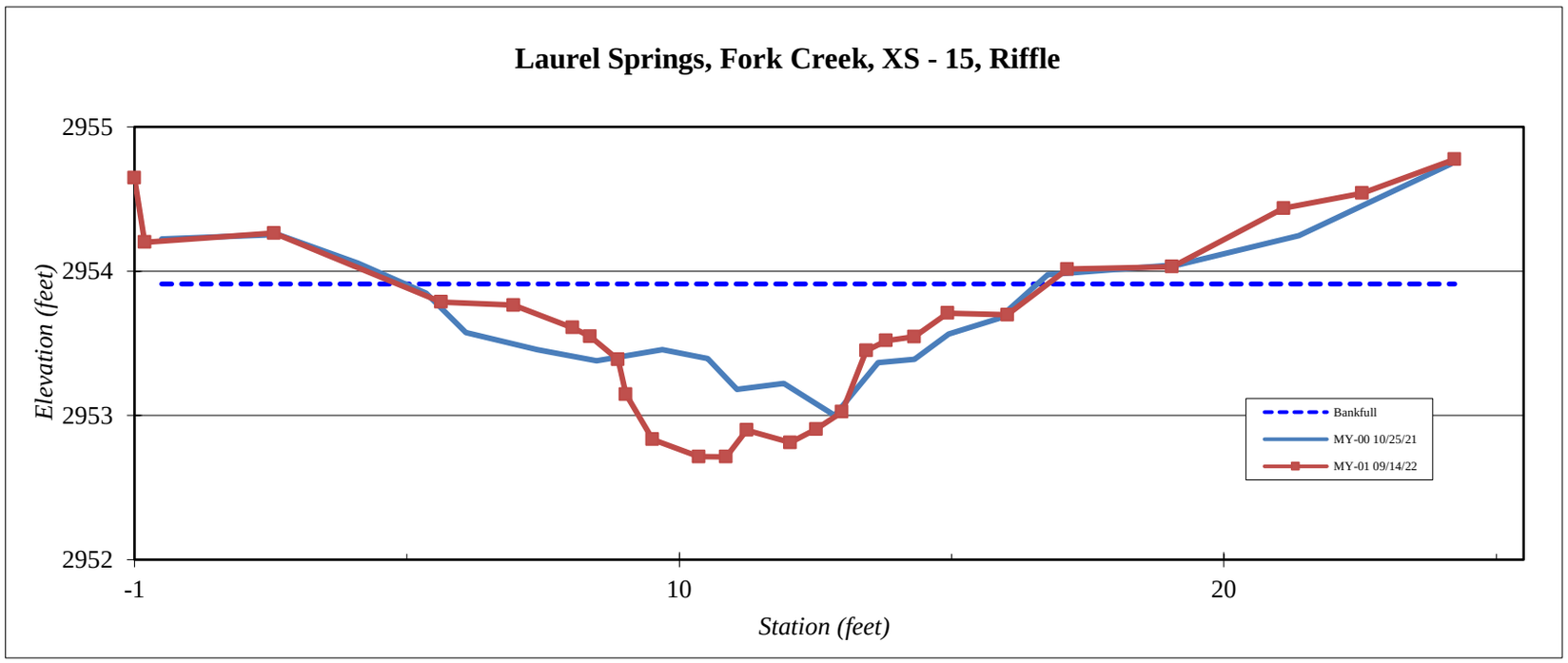


Site	Laurel Springs
Watershed:	French Broad River Basin, 06010108
XS ID	Fork Creek, XS -15, Riffle
Feature	Riffle
Date:	9/14/2022
Field Crew:	Perkinson, Adams

Station	Elevation
-0.5	2955.0
-0.3	2954.5
2.1	2954.6
5.1	2954.0
6.5	2954.0
7.5	2953.8
7.9	2953.7
8.4	2953.6
8.5	2953.3
9.0	2952.9
9.9	2952.8
10.4	2952.8
10.7	2953.0
11.5	2952.9
12.0	2953.0
12.5	2953.1
12.9	2953.6
13.3	2953.7
13.8	2953.7
14.4	2953.9
15.5	2953.91
16.6	2954.3
18.5	2954.3
20.6	2954.7
22.0	2954.9
23.7	2955.1

SUMMARY DATA	
Bankfull Elevation:	2954.2
Bank Hieght Ratio:	1.09
Thalweg Elevation:	2952.8
LTOB Elevation:	2954.3
LTOB Max Depth:	1.5
LTOB Cross Sectional Area:	8.5

Stream Type	E/C 5



Site	Laurel Springs
Watershed:	French Broad River Basin, 06010108
XS ID	Fork Creek, XS -16, Pool
Feature	Pool
Date:	9/14/2022
Field Crew:	Perkinson, Adams

Station	Elevation
-0.3	2954.7
2.1	2954.6
4.5	2954.7
6.1	2954.9
7.4	2954.9
8.0	2955.0
8.7	2954.9
9.0	2954.4
9.5	2954.0
10.3	2953.8
10.7	2953.9
11.6	2954.0
12.2	2953.7
12.7	2953.6
13.2	2953.6
13.7	2953.3
14.0	2953.3
14.4	2954.2
14.6	2954.5
15.1	2954.8
16.3	2954.70
17.3	2955.1
18.0	2955.3
19.1	2955.4
20.6	2955.4

SUMMARY DATA	
Bankfull Elevation:	2955.0
Bank Hieght Ratio:	0.92
Thalweg Elevation:	2953.3
LTOB Elevation:	2954.9
LTOB Max Depth:	1.6
LTOB Cross Sectional Area:	6.3

Stream Type	E/C 5

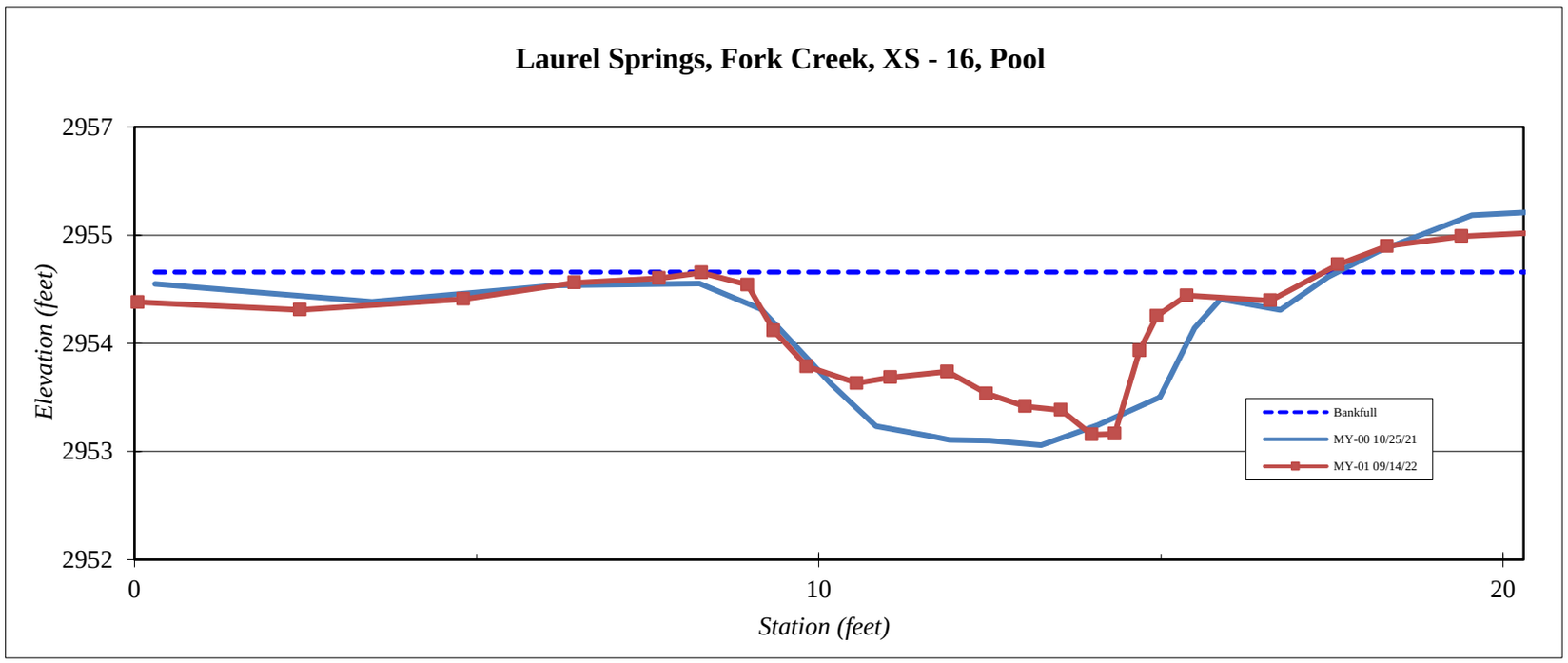


Table 9A. Baseline Stream Data Summary Laurel Springs - Fork Creek										
Parameter	**Pre-Existing Condition (applicaple)**					**Design**		**Monitoring Baseline (MY0)**		
Riffle Only	Min	Mean	Med	Max	n	Min	Max	Min	Max	n
Bankfull Width (ft)	11.7	17.2		25.1		15.1	17.4	12.3	19.7	3
Floodprone Width (ft)	18	100		100		50	150	200	200	3
Bankfull Mean Depth (ft)	0.8	1.1		1.6		1.1	1.3	0.6	0.9	3
Bankfull Max Depth (ft)	1.2	2.1		2.5		1.4	1.9	1.1	1.5	3
Bankfull Cross Sectional Area (ft^2)	18.9	18.9		18.9		7.3	18.9	7.1	14.6	3
Width/Depth Ratio	7.3	15.9		31.4		12	16	15.5	26.6	3
Entrenchment Ratio	0.9	5.1		8.5		3.3	8.6	10.2	16.2	3
Bank Height Ratio	**1**	**1.3**		**2.8**		**1**	**1.2**	**1.0**	**1.0**	3
Max part size (mm) mobilized at bankfull										
Rosgen Classification	Cg					Ce		Ce		
Bankfull Discharge (cfs)	99					99		99		
Sinuosity (ft)	1.05					1.15		1.15		
Water Surface Slope (Channel) (ft/ft)	0.0258					0.0236		0.0236		
Other										

Table 9B. Baseline Stream Data Summary Laurel Springs - UT 1										
Parameter	**Pre-Existing Condition (applicaple)**					**Design**		**Monitoring Baseline (MY0)**		
Riffle Only	Min	Mean	Med	Max	n	Min	Max	Min	Max	n
Bankfull Width (ft)	6.4	8.1		15.36		9.9	11.4	7.5	7.5	1
Floodprone Width (ft)	16	100		100		50	150	100.0	100.0	1
Bankfull Mean Depth (ft)	0.5	1		1.3		0.7	0.8	0.8	0.8	1
Bankfull Max Depth (ft)	1.4	2		2.4		0.9	1.2	1.2	1.2	1
Bankfull Cross Sectional Area (ft^2)	8.1	8.1		8.1		8.1	8.1	6.2	6.2	1
Width/Depth Ratio	4.9	8.2		30.6		12	16	8.9	8.9	1
Entrenchment Ratio	2	8.8		15.6		5.1	13.2	13.4	13.4	1
Bank Height Ratio	**1**	**1.5**		**2.1**		**1**	**1.2**	**1.0**	**1.0**	1
Max part size (mm) mobilized at bankfull										
Rosgen Classification	Eg					Ce		Ce		
Bankfull Discharge (cfs)	39.5					39.5		39.5		
Sinuosity (ft)	1.01					1.15		1.15		
Water Surface Slope (Channel) (ft/ft)	0.0288					0.0253		0.0253		
Other										

Table 9C. Baseline Stream Data Summary Laurel Springs - UT 2										
Parameter	**Pre-Existing Condition (applicaple)**					**Design**		**Monitoring Baseline (MY0)**		
Riffle Only	Min	Mean	Med	Max	n	Min	Max	Min	Max	n
Bankfull Width (ft)	4.4	5.8		9.8		4.6	5.4	6.7	7.2	2
Floodprone Width (ft)	11	17		22		20	30	75.0	75.0	2
Bankfull Mean Depth (ft)	0.2	0.4		0.4		0.3	0.4	0.3	1.1	2
Bankfull Max Depth (ft)	0.5	0.8		0.8		0.4	0.6	0.6	1.9	2
Bankfull Cross Sectional Area (ft^2)	1.8	1..8		1.8		1.8	1.8	2.1	7.7	2
Width/Depth Ratio	11	17.4		49		12	16	7.7	21.3	2
Entrenchment Ratio	2	2.3		4.5		4.3	5.6	10.5	11.2	2
Bank Height Ratio	**1**	**1.5**		**2**		**1**	**1.2**	**1.0**	**1.0**	2
Max part size (mm) mobilized at bankfull										
Rosgen Classification	Bg					B		Bc		
Bankfull Discharge (cfs)	7.7					7.7		7.7		
Sinuosity (ft)	1.02					1.05		1.05		
Water Surface Slope (Channel) (ft/ft)	0.1026					0.0997		0.0997		
Other										

Table 9D. Baseline Stream Data Summary Laurel Springs - UT 3										
Parameter	**Pre-Existing Condition (applicaple)**					**Design**		**Monitoring Baseline (MY0)**		
Riffle Only	Min	Mean	Med	Max	n	Min	Max	Min	Max	n
Bankfull Width (ft)	3	3.7		4.2		4.9	5.7	3.3	4.7	2
Floodprone Width (ft)	5.5	6		50		20	30	7.0	75.0	2
Bankfull Mean Depth (ft)	0.5	0.6		0.7		0.4	0.4	0.3	0.5	2
Bankfull Max Depth (ft)	0.7	0.8		1.4		0.5	0.6	0.4	0.8	2
Bankfull Cross Sectional Area (ft^2)	2	2		2		2	2	0.9	2.3	2
Width/Depth Ratio	4.3	6.2		8.4		12	16	9.7	12.1	2
Entrenchment Ratio	1.5	2		11.9		4.1	5.3	2.1	16.0	2
Bank Height Ratio	**1.4**	**1.7**		**2.6**		**1**	**1.2**	**1.0**	**1.0**	2
Max part size (mm) mobilized at bankfull										
Rosgen Classification	Bg					B		Bc		
Bankfull Discharge (cfs)	8.7					8.7		8.7		
Sinuosity (ft)	1.04					1.05		1.05		
Water Surface Slope (Channel) (ft/ft)	0.0954					0.0945		0.0945		
Other										

Table 10A. Monitoring Data - Cross Section Morphology Monitoring Summary
(Laurel Springs/ DMS:100122)

	UT 2 - Cross Section 1 (Pool)							UT 2 - Cross Section 2 (Riffle)							UT 2 - Cross Section 3 (Riffle)							UT 2 - Cross Section 4 (Pool)							Fork Cr - Cross Section 5 (Pool)						
	MY0	MY1	MY2	MY3	MY5	MY7	MY+	MY0	MY1	MY2	MY3	MY5	MY7	MY+	MY0	MY1	MY2	MY3	MY5	MY7	MY+	MY0	MY1	MY2	MY3	MY5	MY7	MY+	MY0	MY1	MY2	MY3	MY5	MY7	MY+
Bankfull Elevation (ft) - Based on AB-Bankfull[1] Area	2915.09	2915.14						2916.14	2916.10						2944.80	2944.85						2948.50	2948.59						2921.99	2922.06					
Bank Height Ratio_Based on AB Bankfull[1] Area	1.00	0.97						1.00	0.85						1.00	1.08						1.00	1.08						1.00	0.99					
Thalweg Elevation	2914.69	2914.61						2915.539	2915.49						2942.922	2943.00						2947.52	2947.78						2919.647	2919.81					
LTOB[2] Elevation	2915.09	2915.13						2916.136	2916.00			`			2944.80	2945.00						2948.50	2948.66						2921.994	2922.04					
LTOB[2] Max Depth (ft)	0.40	0.51						0.60	0.51						1.88	2.00						0.99	0.87						2.35	2.24					
LTOB[2] Cross Sectional Area (ft^2)	1.1	1.03						2.1	1.53						7.7	9.20						2.7	3.05						24.5	24.16					
	Fork Cr - Cross Section 6 (Pool)							**UT 3 - Cross Section 7 (Pool)**							**UT 3 - Cross Section 8 (Riffle)**							**UT 3 - Cross Section 9 (Pool)**							**UT 3 - Cross Section 10 (Riffle)**						
	MY0	MY1	MY2	MY3	MY5	MY7	MY+	MY0	MY1	MY2	MY3	MY5	MY7	MY+	MY0	MY1	MY2	MY3	MY5	MY7	MY+	MY0	MY1	MY2	MY3	MY5	MY7	MY+	MY0	MY1	MY2	MY3	MY5	MY7	MY+
Bankfull Elevation (ft) - Based on AB-Bankfull[1] Area	2922.56	2922.64						2930.97	2931.56						2932.44	2932.46						2943.97	2944.09						2946.02	2946.07					
Bank Height Ratio_Based on AB Bankfull[1] Area	1.00	0.92						1.00	0.97						1.00	1.04						1.00	0.96						1.00	0.95					
Thalweg Elevation	2921.22	2921.19						2930.078	2930.85						2931.64	2931.61						2943.12	2943.35						2945.65	2945.60					
LTOB[2] Elevation	2922.56	2922.52						2930.97	2931.54						2932.44	2932.49						2943.97	2944.07						2946.02	2946.05					
LTOB[2] Max Depth (ft)	1.34	1.34						0.89	0.69						0.81	0.88						0.85	0.72						0.37	0.45					
LTOB[2] Cross Sectional Area (ft^2)	14.4	12.43						1.9	1.80						2.3	2.46						1.8	1.68						0.9	0.81					

	Fork Cr - Cross Section 11 (Pool)						
	MY0	MY1	MY2	MY3	MY5	MY7	MY+
Bankfull Elevation (ft) - Based on AB-Bankfull[1] Area	2936.55	2936.76					
Bank Height Ratio_Based on AB Bankfull[1] Area	1.00	0.98					
Thalweg Elevation	2934.57	2934.58					
LTOB[2] Elevation	2936.55	2936.71					
LTOB[2] Max Depth (ft)	1.98	2.13					
LTOB[2] Cross Sectional Area (ft^2)	19.2	18.16					

The above morphology parameters reflect the 2018 guidance that arose from the mitigation technical workgroup consisting of DMS, the IRT and industry mitigation providers/practitioners. The outcome resulted in the focus on three primary morphological parameters of interest for the purposes of tracking channel change moving forward. They are the bank height ratio using a constant As-built bankfull area and the cross sectional area and max depth based on each years low top of bank. These are calculated as follows:

1 - **Bank Height Ratio (BHR)** takes the As-built bankfol area as the basis for adjusting each subsequent years bankfull elevation. For example if the As-built bankfull area was 10 ft2, then the MY1 bankfull elevation would be adjusted until the calculated bankfull area within the MY1 cross section survey = 10 ft2. The BHR would then be calculated with the difference between the low top of bank (LTOB) elevation for MY1 and the thalweg elevation for MY1 in the numerator with the difference between the MY1 bankfull elevation and the MY1 thalweg elevation in the denominator. This same process is then carried out in each successive year.
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.

Note: The smaller the channel the closer the survey measurements are to their limit of reliable detection, therefore inter-annual variation in morphological measurement (as a percentage) is by default magnified as channel size decereases. Some of the variability above is the result of this factor and some is due to the large amount of depositional sediments observed.

Table 10B. Monitoring Data - Cross Section Morphology Monitoring Summary
(Laurel Springs/ DMS:100122)

	Fork Cr - Cross Section 12 (Riffle)							UT 1 - Cross Section 13 (Riffle)							UT 1 - Cross Section 14 (Pool)							Fork Cr - Cross Section 15 (Riffle)							Fork Cr - Cross Section 16 (Pool)						
	MY0	MY1	MY2	MY3	MY5	MY7	MY+	MY0	MY1	MY2	MY3	MY5	MY7	MY+	MY0	MY1	MY2	MY3	MY5	MY7	MY+	MY0	MY1	MY2	MY3	MY5	MY7	MY+	MY0	MY1	MY2	MY3	MY5	MY7	MY+
Bankfull Elevation (ft) - Based on AB-Bankfull[1] Area	2937.72	2937.79						2943.24	2943.38						2945.11	2945.61						2954.23	2954.15						2954.72	2955.00					
Bank Height Ratio_Based on AB Bankfull[1] Area	1.00	1.00						1.00	1.03						1.00	1.04						1.00	1.09						1.00	0.92					
Thalweg Elevation	2936.23	2936.26						2942.061	2942.17						2943.881	2944.57						2953.12	2952.80						2953.19	2953.30					
LTOB[2] Elevation	2937.72	2937.79						2943.244	2943.42			`			2945.11	2945.65						2954.23	2954.27						2954.72	2954.87					
LTOB[2] Max Depth (ft)	1.49	1.53						1.18	1.25						1.23	1.07						1.10	1.47						1.53	1.57					
LTOB[2] Cross Sectional Area (ft^2)	13.5	13.54						6.2	6.56						4.6	4.93						7.1	8.54						7.4	6.33					
Bankfull Elevation (ft) - Based on AB-Bankfull[1] Area																																			
Bank Height Ratio_Based on AB Bankfull[1] Area																																			
Thalweg Elevation																																			
LTOB[2] Elevation																																			
LTOB[2] Max Depth (ft)																																			
LTOB[2] Cross Sectional Area (ft^2)																																			

Bankfull Elevation (ft) - Based on AB-Bankfull[1] Area	
Bank Height Ratio_Based on AB Bankfull[1] Area	
Thalweg Elevation	
LTOB[2] Elevation	
LTOB[2] Max Depth (ft)	
LTOB[2] Cross Sectional Area (ft^2)	

The above morphology parameters reflect the 2018 guidance that arose from the mitigation technical workgroup consisting of DMS, the IRT and industry mitigation providers/practitioners. The outcome resulted in the focus on three primary morphological parameters of interest for the purposes of tracking channel change moving forward. They are the bank height ratio using a constant As-built bankfull area and the cross sectional area and max depth based on each years low top of bank. These are calculated as follows:

1 - **Bank Height Ratio (BHR)** takes the As-built bankfol area as the basis for adjusting each subsequent years bankfull elevation. For example if the As-built bankfull area was 10 ft2, then the MY1 bankfull elevation would be adjusted until the calculated bankfull area within the MY1 cross section survey = 10 ft2. The BHR would then be calculated with the difference between the low top of bank (LTOB) elevation for MY1 and the thalweg elevation for MY1 in the numerator with the difference between the MY1 bankfull elevation and the MY1 thalweg elevation in the denominator. This same process is then carried out in each successive year.
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.

Note: The smaller the channel the closer the survey measurements are to their limit of reliable detection, therefore inter-annual variation in morphological measurement (as a percentage) is by default magnified as channel size decereases. Some of the variability above is the result of this factor and some is due to the large amount of depositional sediments observed.

Appendix D: Hydrologic Data

Table 11. Verification of Bankfull Events

Date of Data Collection	Date of Occurrence	Method	Photo (if available)	Monitoring Year
May 23, 2022	May 23, 2022	A bankfull event was documented on the Fork Creek trail camera and stream gauge after 1.13 inches of rain fell per the on-site rain gauge.	1	MY1
August 6, 2022	August 6, 2022	A bankfull event was documented on the Fork Creek trail camera and stream gauge after 0.98 inches of rain fell per the on-site rain gauge.	2	MY1
September 5, 2022	September 5, 2022	A bankfull event was documented on the Fork Creek trail camera and stream gauge after 1.45 inches of rain fell per the on-site rain gauge.	3	MY1

Photo 1: Fork Creek Swelling to Bankfull

Photo 2: Bankfull Event Documented on Fork Creek

Photo 3: Bankfull Event Documented on Fork Creek

Laurel Springs Fork Creek Grest Gauge (2022 Data)

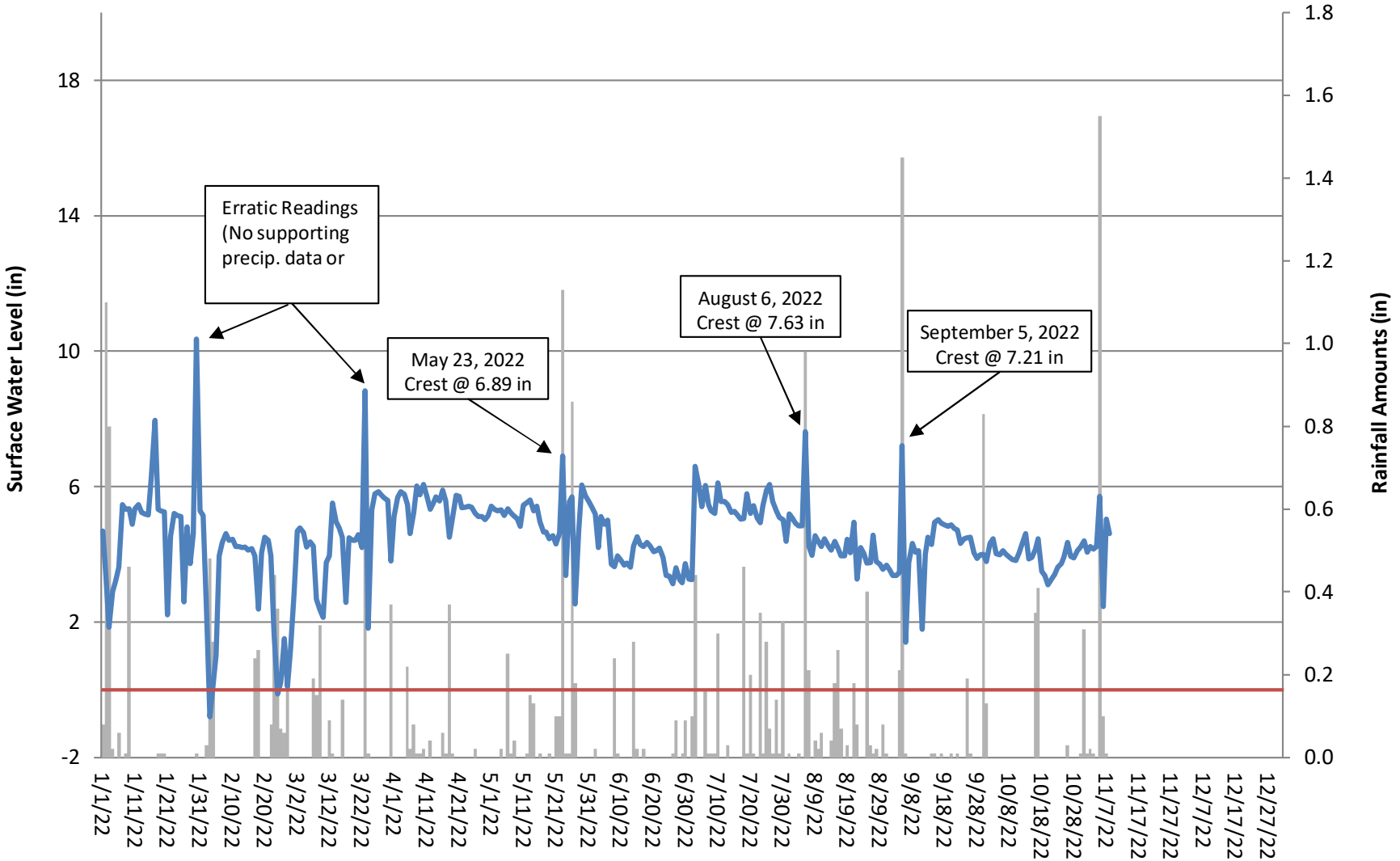
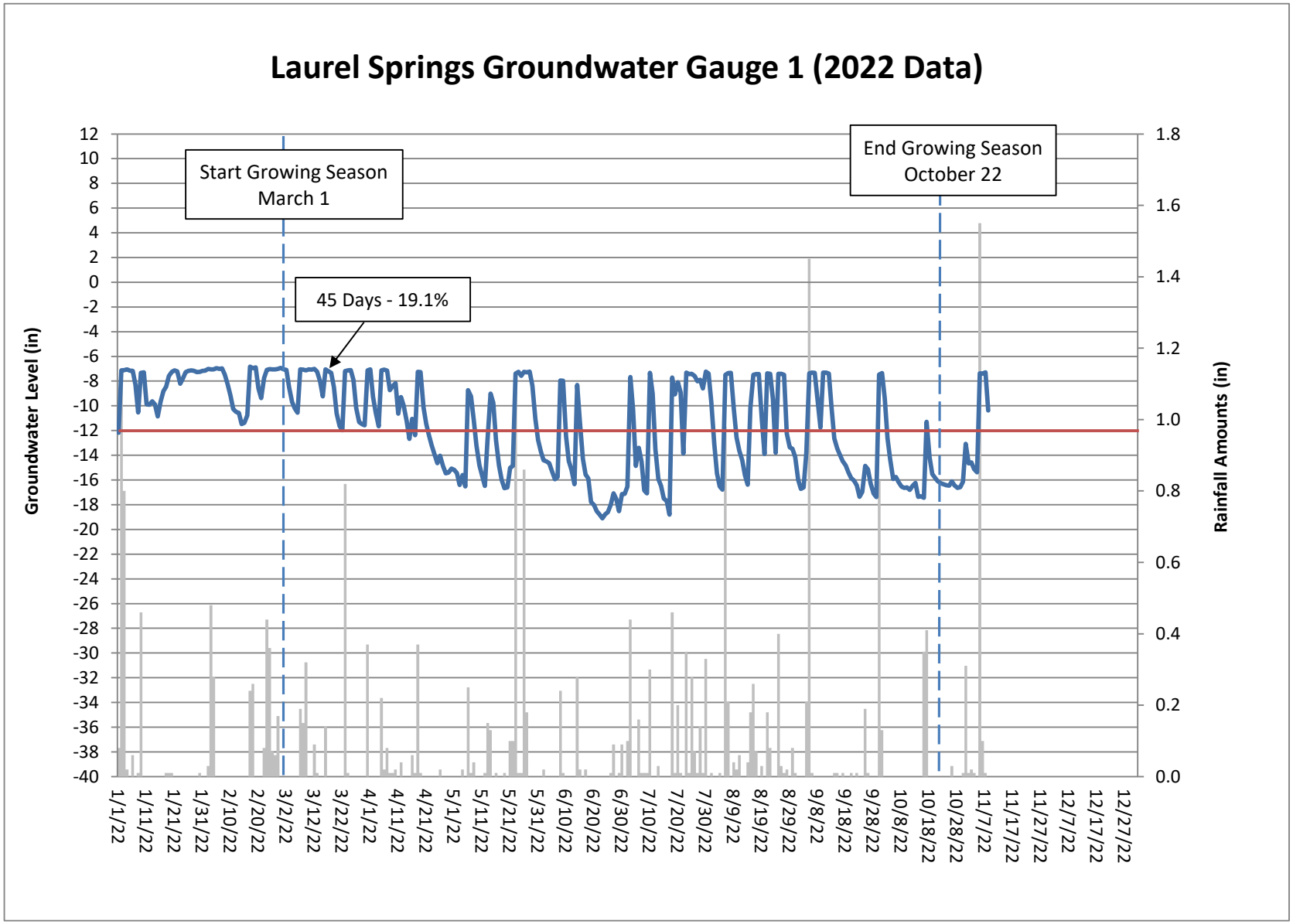


Table 12. Groundwater Hydrology Data
Summary of Monitoring Period/Hydrology Success Criteria by Year

Gauge	12% Hydroperiod Success Criteria Achieved - Max Consecutive Days During Growing Season (Percentage)						
	Year 1 (2022)	Year 2 (2023)	Year 3 (2024)	Year 4 (2025)	Year 5 (2026)	Year 6 (2027)	Year 7 (2028)
1*	Yes - 45 days (19.1%)						
2	No - 2 days (0.9%)						
3	No - 17 days (7.2%)						
4	Yes - 167 days (71.1%)						
5	Yes - 46 days (19.6%)						
6*	Yes - 235 days (100%)						
7	Yes - 235 days (100%)						
8	Yes - 119 days (50.6)						
9*	Yes – 236 days (100%)						
10	Yes – 65 days (27.7%)						
11*	Yes – 45 days (19.1%)						
12*	Yes – 236 days (100%)						
13	Yes – 236 days (100%)						

*During the MY0 review, the IRT requested that gauges be moved into creditable wetland areas to more accurately represent what was presented in the detailed mitigation plan (Appendix F). During the 2022/2023 dormant season, gauges 6, 9, 11, ad 12 will be moved into creditable wetland reestablishment areas, and gauge 1 will be moved into the nearby wetland enhancement area.


Laurel Springs Groundwater Gauge 1 (2022 Data)
Start Growing Season
March 1
End Growing Season
October 22
45 Days - 19.1%
Groundwater Level (in)
Rainfall Amounts (in)
12
10
8
6
4
2
0
-2
-4
-6
-8
-10
-12
-14
-16
-18
-20
-22
-24
-26
-28
-30
-32
-34
-36
-38
-40
1.8
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
1/1/22
1/11/22
1/21/22
1/31/22
2/10/22
2/20/22
3/2/22
3/12/22
3/22/22
4/1/22
4/11/22
4/21/22
5/1/22
5/11/22
5/21/22
5/31/22
6/10/22
6/20/22
6/30/22
7/10/22
7/20/22
7/30/22
8/9/22
8/19/22
8/29/22
9/8/22
9/18/22
9/28/22
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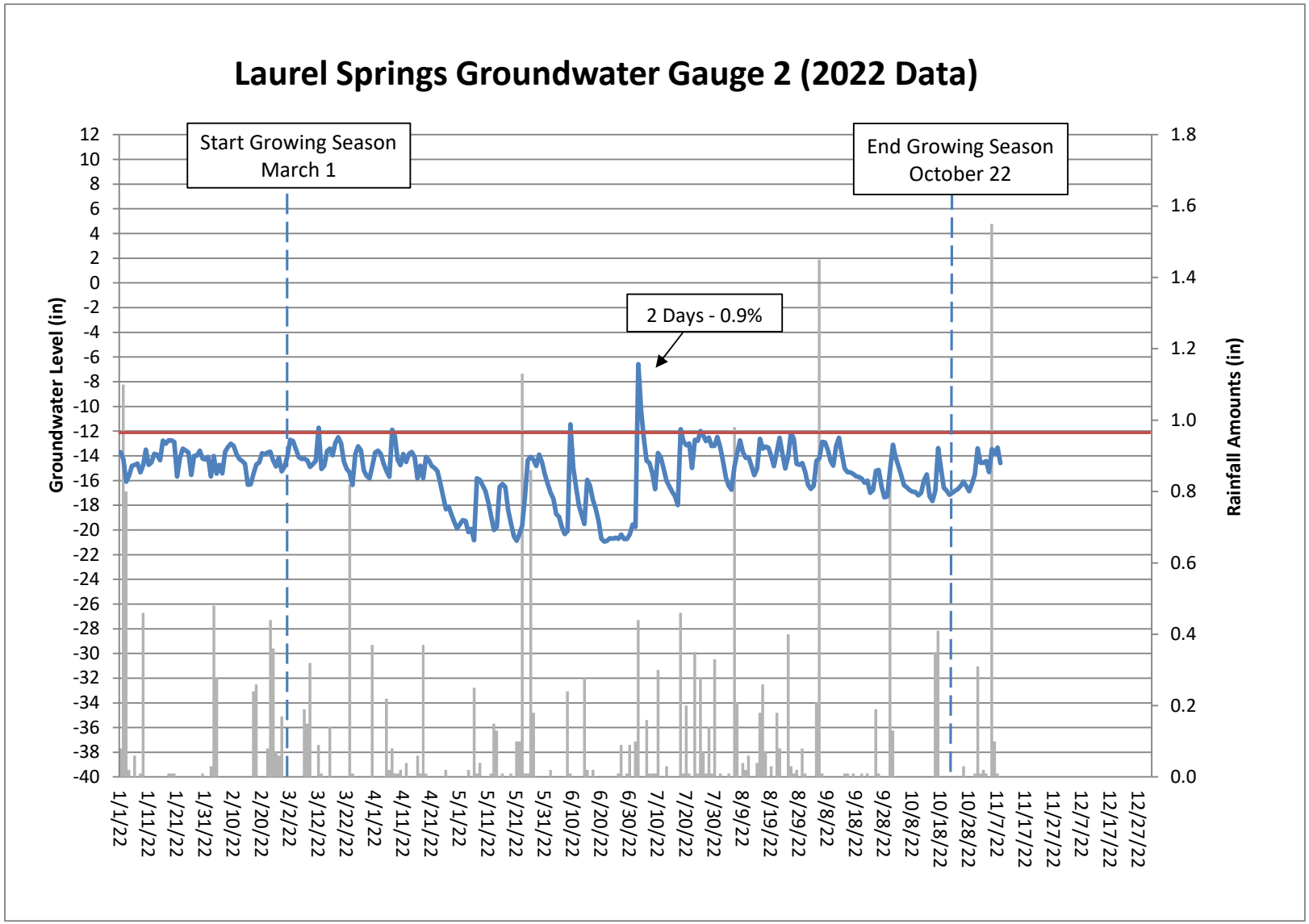
12/17/22
12/27/22


Laurel Springs Groundwater Gauge 2 (2022 Data)
Start Growing Season
March 1
End Growing Season
October 22
2 Days - 0.9%
Groundwater Level (in)
Rainfall Amounts (in)
12
10
8
6
4
2
0
-2
-4
-6
-8
-10
-12
-14
-16
-18
-20
-22
-24
-26
-28
-30
-32
-34
-36
-38
-40
1.8
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
1/1/22
1/11/22
1/21/22
1/31/22
2/10/22
2/20/22
3/2/22
3/12/22
3/22/22
4/1/22
4/11/22
4/21/22
5/1/22
5/11/22
5/21/22
5/31/22
6/10/22
6/20/22
6/30/22
7/10/22
7/20/22
7/30/22
8/9/22
8/19/22
8/29/22
9/8/22
9/18/22
9/28/22
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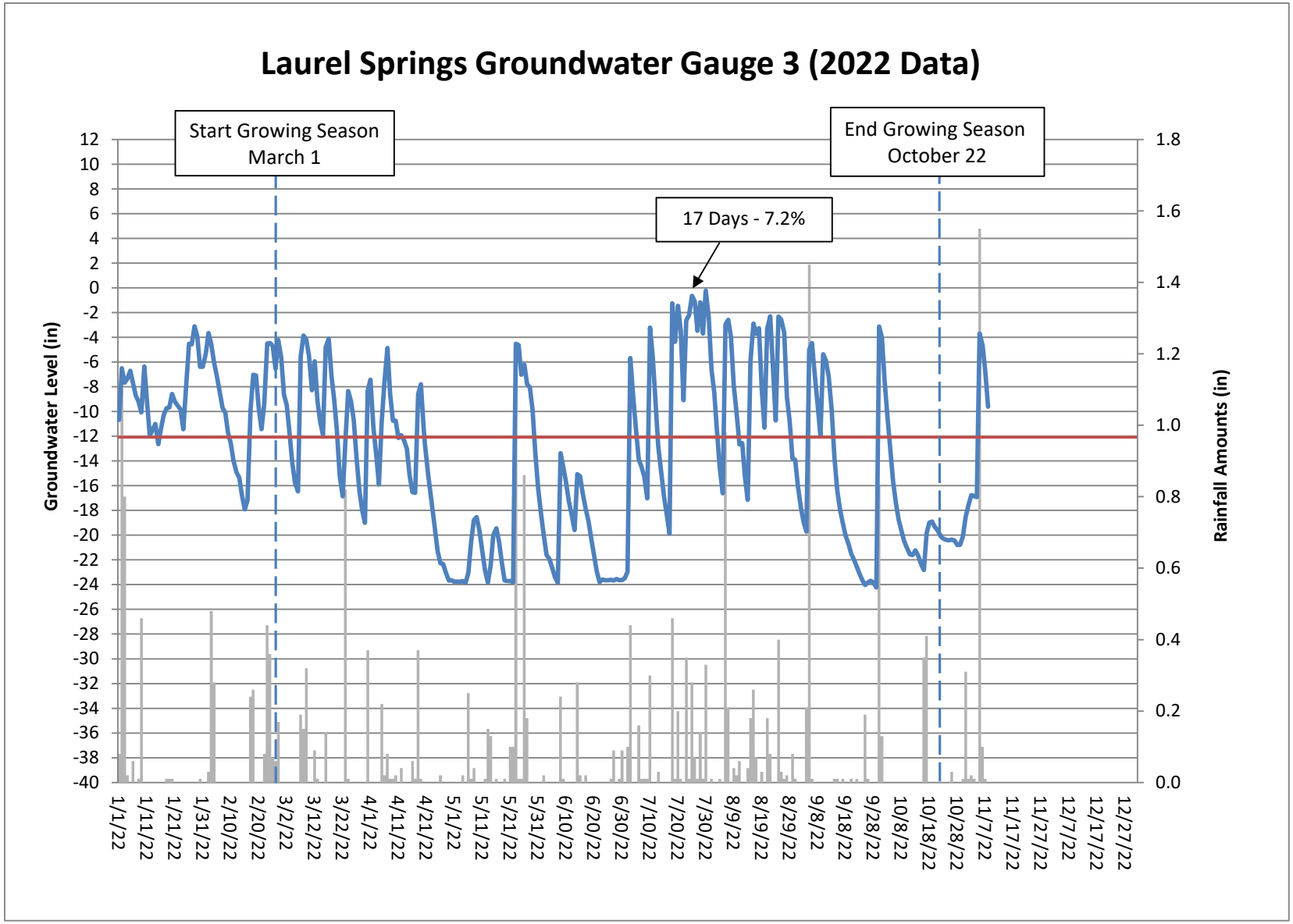
12/17/22
12/27/22


Laurel Springs Groundwater Gauge 3 (2022 Data)
Start Growing Season
March 1
End Growing Season
October 22
17 Days - 7.2%
Groundwater Level (in)
Rainfall Amounts (in)
12
10
8
6
4
2
0
-2
-4
-6
-8
-10
-12
-14
-16
-18
-20
-22
-24
-26
-28
-30
-32
-34
-36
-38
-40
1.8
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
1/1/22
1/11/22
1/21/22
1/31/22
2/10/22
2/20/22
3/2/22
3/12/22
3/22/22
4/1/22
4/11/22
4/21/22
5/1/22
5/11/22
5/21/22
5/31/22
6/10/22
6/20/22
6/30/22
7/10/22
7/20/22
7/30/22
8/9/22
8/19/22
8/29/22
9/8/22
9/18/22
9/28/22
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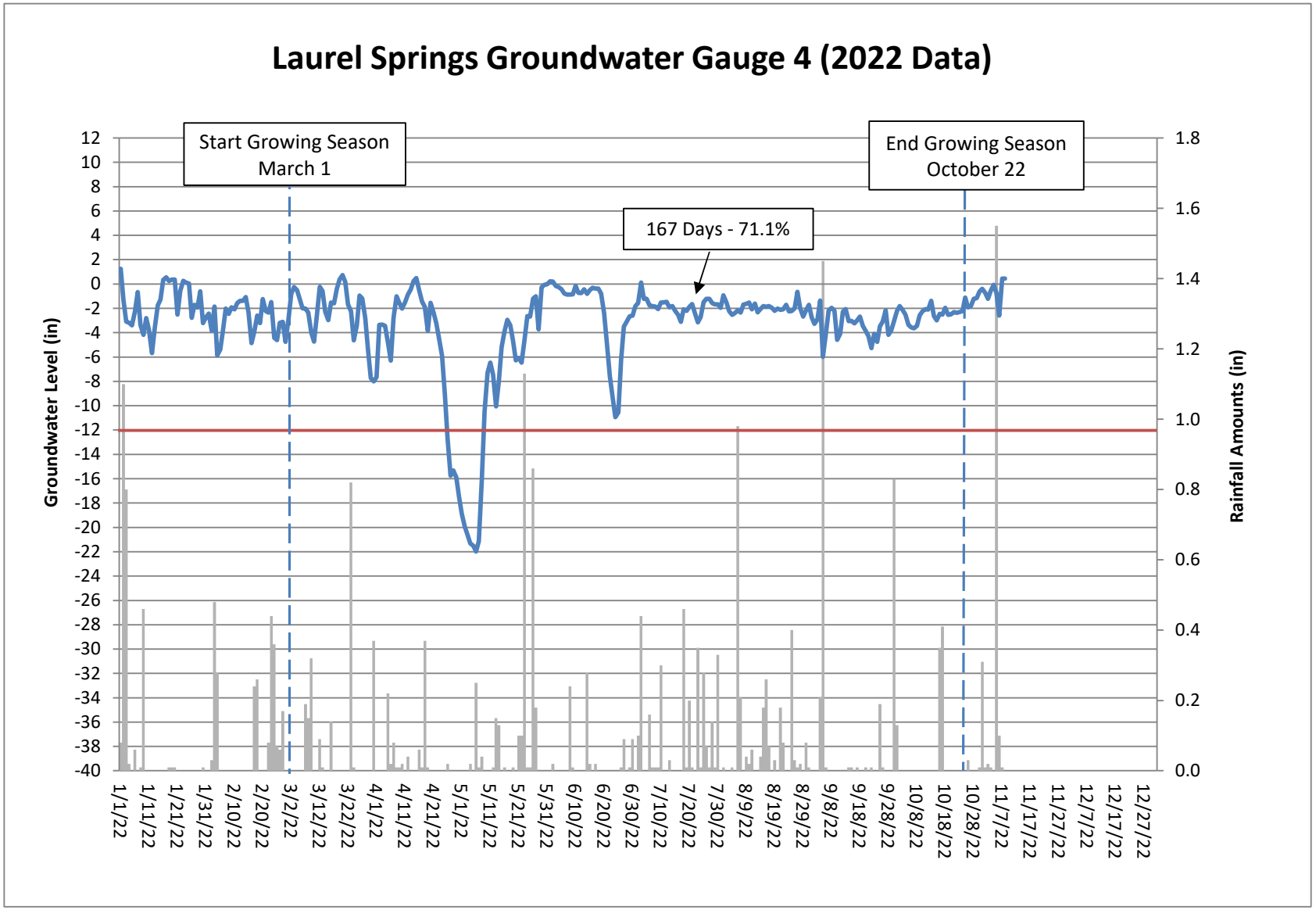
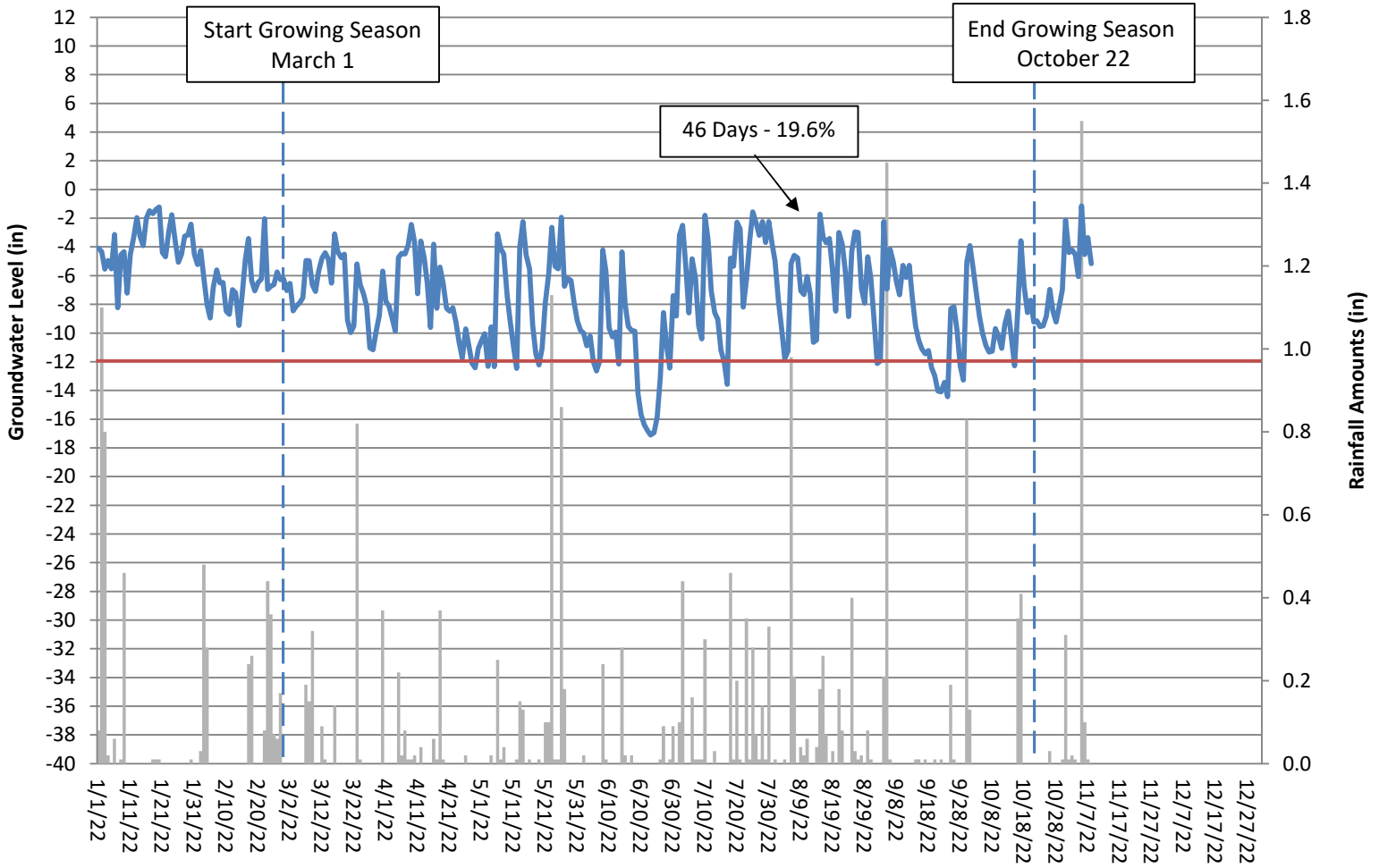
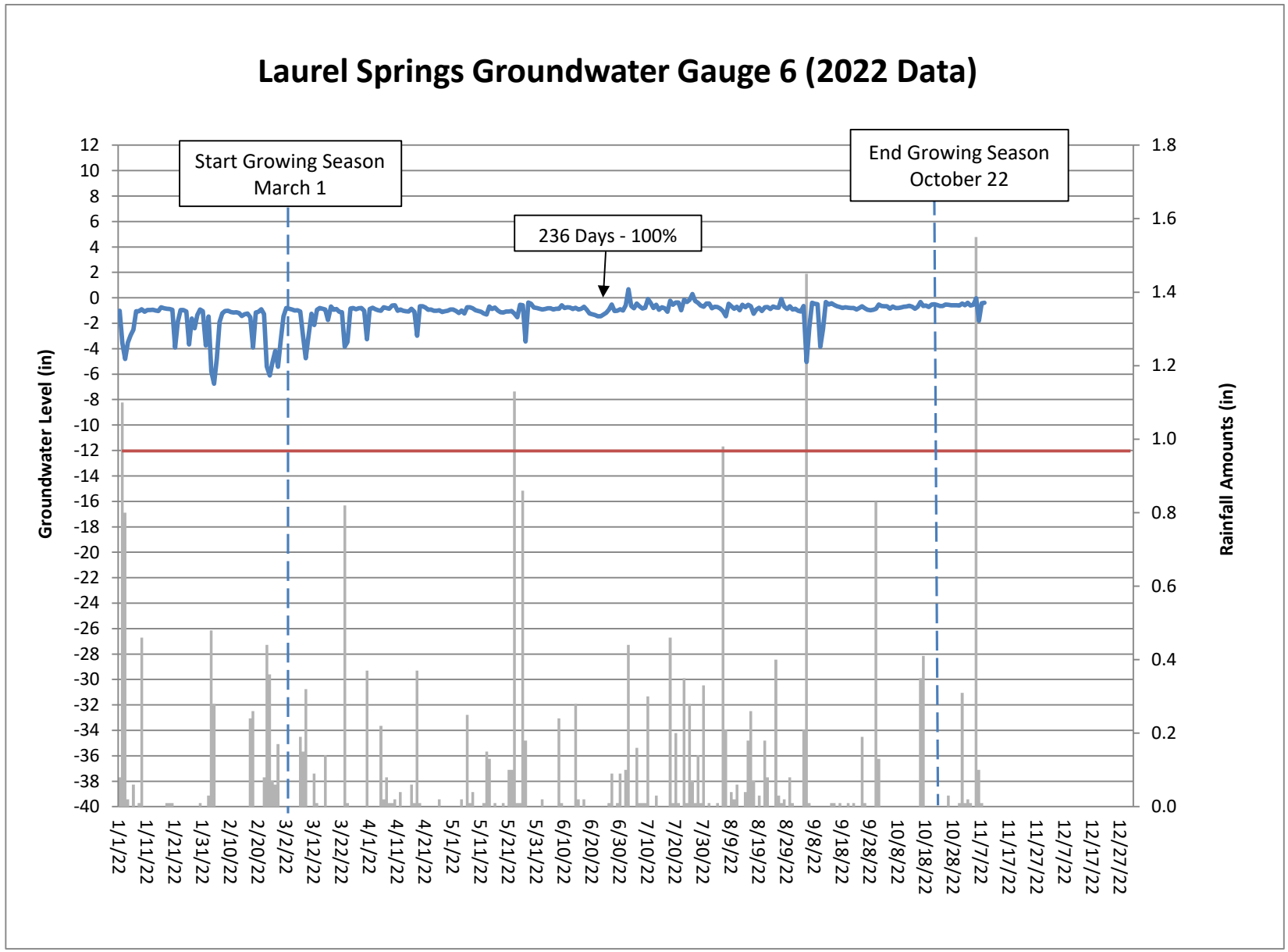
12/17/22
12/27/22


Laurel Springs Groundwater Gauge 4 (2022 Data)
Start Growing Season
March 1
End Growing Season
October 22
167 Days - 71.1%
Groundwater Level (in)
Rainfall Amounts (in)
12
10
8
6
4
2
0
-2
-4
-6
-8
-10
-12
-14
-16
-18
-20
-22
-24
-26
-28
-30
-32
-34
-36
-38
-40
1.8
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
1/1/22
1/11/22
1/21/22
1/31/22
2/10/22
2/20/22
3/2/22
3/12/22
3/22/22
4/1/22
4/11/22
4/21/22
5/1/22
5/11/22
5/21/22
5/31/22
6/10/22
6/20/22
6/30/22
7/10/22
7/20/22
7/30/22
8/9/22
8/19/22
8/29/22
9/8/22
9/18/22
9/28/22
10/8/22
10/18/22
10/28/22
11/7/22
11/17/22
11/27/22
12/7/22
12/17/22
12/27/22

Laurel Springs Groundwater Gauge 5 (2022 Data)




Laurel Springs Groundwater Gauge 6 (2022 Data)
Start Growing Season
March 1
End Growing Season
October 22
236 Days - 100%
Groundwater Level (in)
Rainfall Amounts (in)
12
10
8
6
4
2
0
-2
-4
-6
-8
-10
-12
-14
-16
-18
-20
-22
-24
-26
-28
-30
-32
-34
-36
-38
-40
1.8
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
1/1/22
1/11/22
1/21/22
1/31/22
2/10/22
2/20/22
3/2/22
3/12/22
3/22/22
4/1/22
4/11/22
4/21/22
5/1/22
5/11/22
5/21/22
5/31/22
6/10/22
6/20/22
6/30/22
7/10/22
7/20/22
7/30/22
8/9/22
8/19/22
8/29/22
9/8/22
9/18/22
9/28/22
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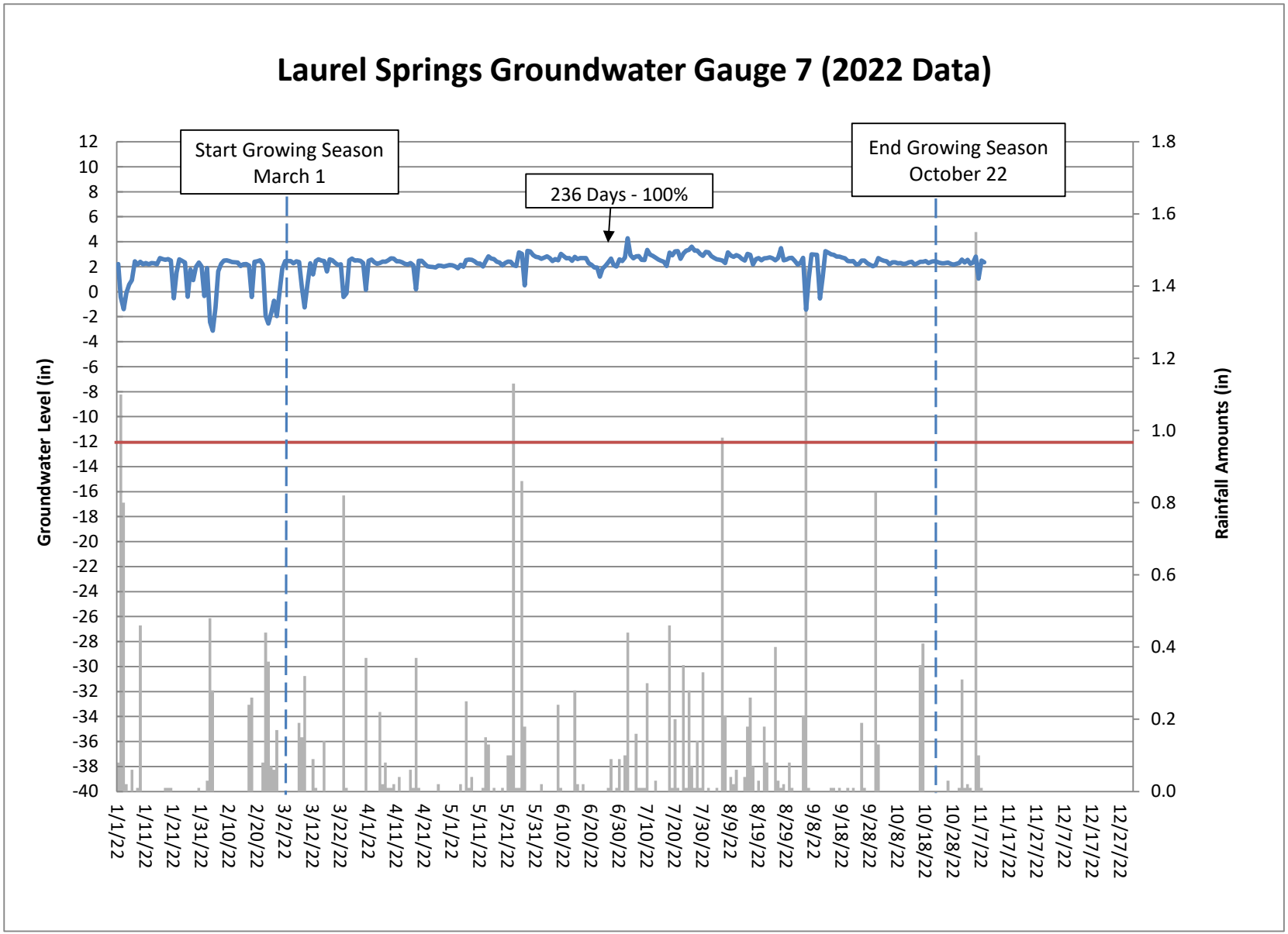
12/17/22
12/27/22


Laurel Springs Groundwater Gauge 7 (2022 Data)
Start Growing Season
March 1
236 Days - 100%
End Growing Season
October 22
Groundwater Level (in)
Rainfall Amounts (in)
12
10
8
6
4
2
0
-2
-4
-6
-8
-10
-12
-14
-16
-18
-20
-22
-24
-26
-28
-30
-32
-34
-36
-38
-40
1.8
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
1/1/22
1/11/22
1/21/22
1/31/22
2/10/22
2/20/22
3/2/22
3/12/22
3/22/22
4/1/22
4/11/22
4/21/22
5/1/22
5/11/22
5/21/22
5/31/22
6/10/22
6/20/22
6/30/22
7/10/22
7/20/22
7/30/22
8/9/22
8/19/22
8/29/22
9/8/22
9/18/22
9/28/22
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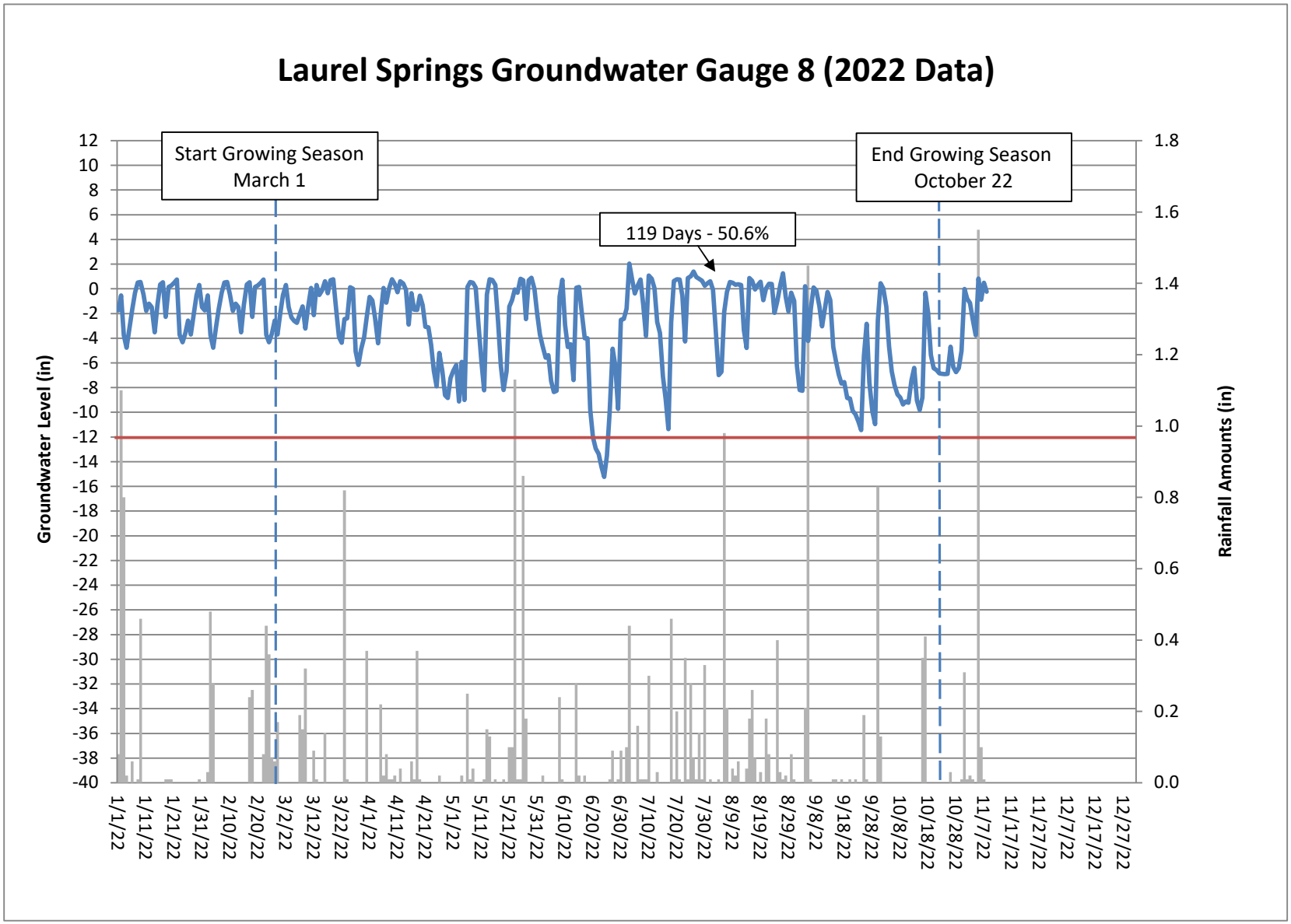
12/17/22
12/27/22


Laurel Springs Groundwater Gauge 8 (2022 Data)
Start Growing Season
March 1
End Growing Season
October 22
119 Days - 50.6%
Groundwater Level (in)
Rainfall Amounts (in)
12
10
8
6
4
2
0
-2
-4
-6
-8
-10
-12
-14
-16
-18
-20
-22
-24
-26
-28
-30
-32
-34
-36
-38
-40
1.8
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
1/1/22
1/11/22
1/21/22
1/31/22
2/10/22
2/20/22
3/2/22
3/12/22
3/22/22
4/1/22
4/11/22
4/21/22
5/1/22
5/11/22
5/21/22
5/31/22
6/10/22
6/20/22
6/30/22
7/10/22
7/20/22
7/30/22
8/9/22
8/19/22
8/29/22
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9/18/22
9/28/22
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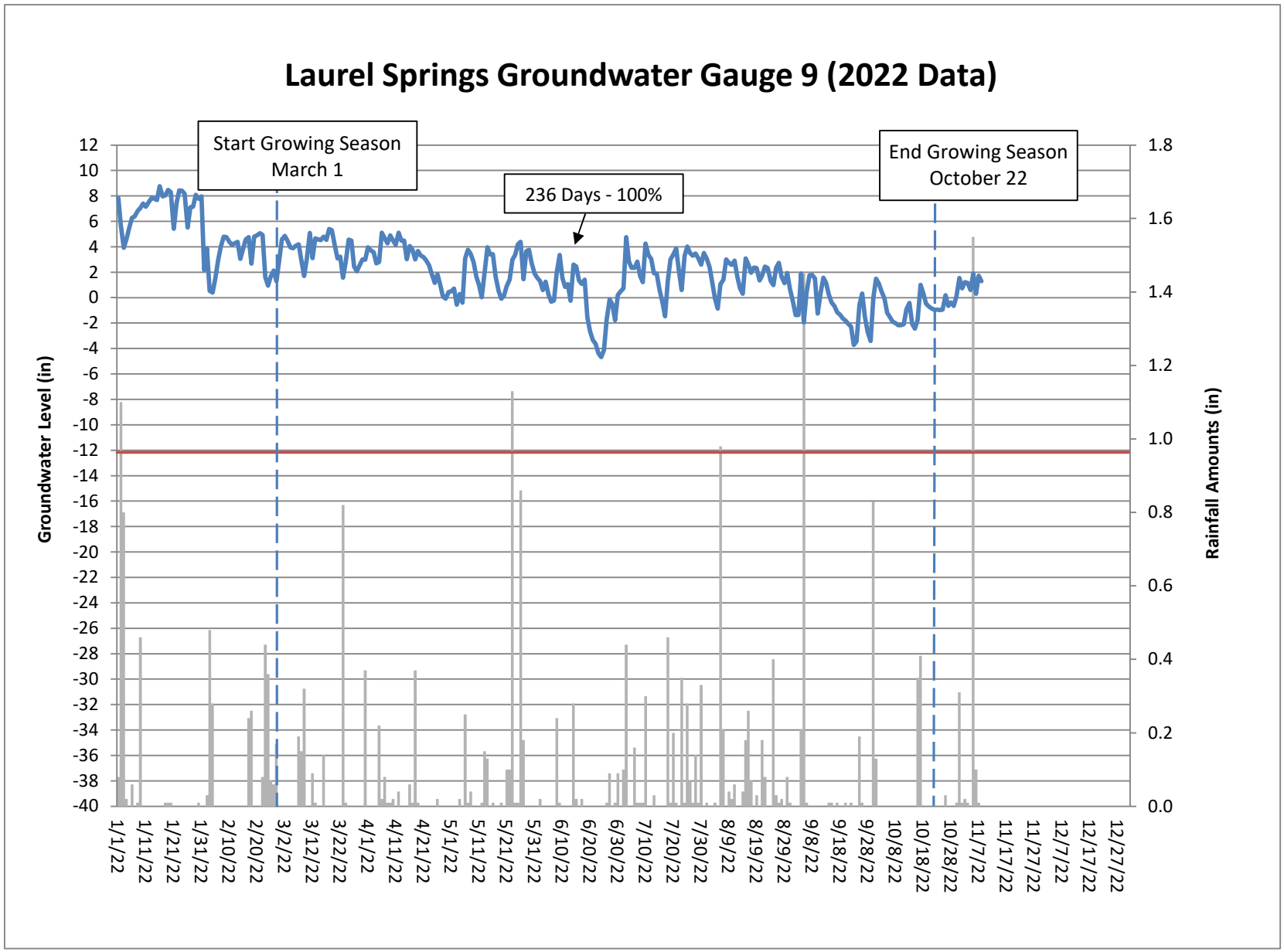
12/17/22
12/27/22


Laurel Springs Groundwater Gauge 9 (2022 Data)
Start Growing Season
March 1
236 Days - 100%
End Growing Season
October 22
Groundwater Level (in)
Rainfall Amounts (in)
12
10
8
6
4
2
0
-2
-4
-6
-8
-10
-12
-14
-16
-18
-20
-22
-24
-26
-28
-30
-32
-34
-36
-38
-40
1.8
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
1/1/22
1/11/22
1/21/22
1/31/22
2/10/22
2/20/22
3/2/22
3/12/22
3/22/22
4/1/22
4/11/22
4/21/22
5/1/22
5/11/22
5/21/22
5/31/22
6/10/22
6/20/22
6/30/22
7/10/22
7/20/22
7/30/22
8/9/22
8/19/22
8/29/22
9/8/22
9/18/22
9/28/22
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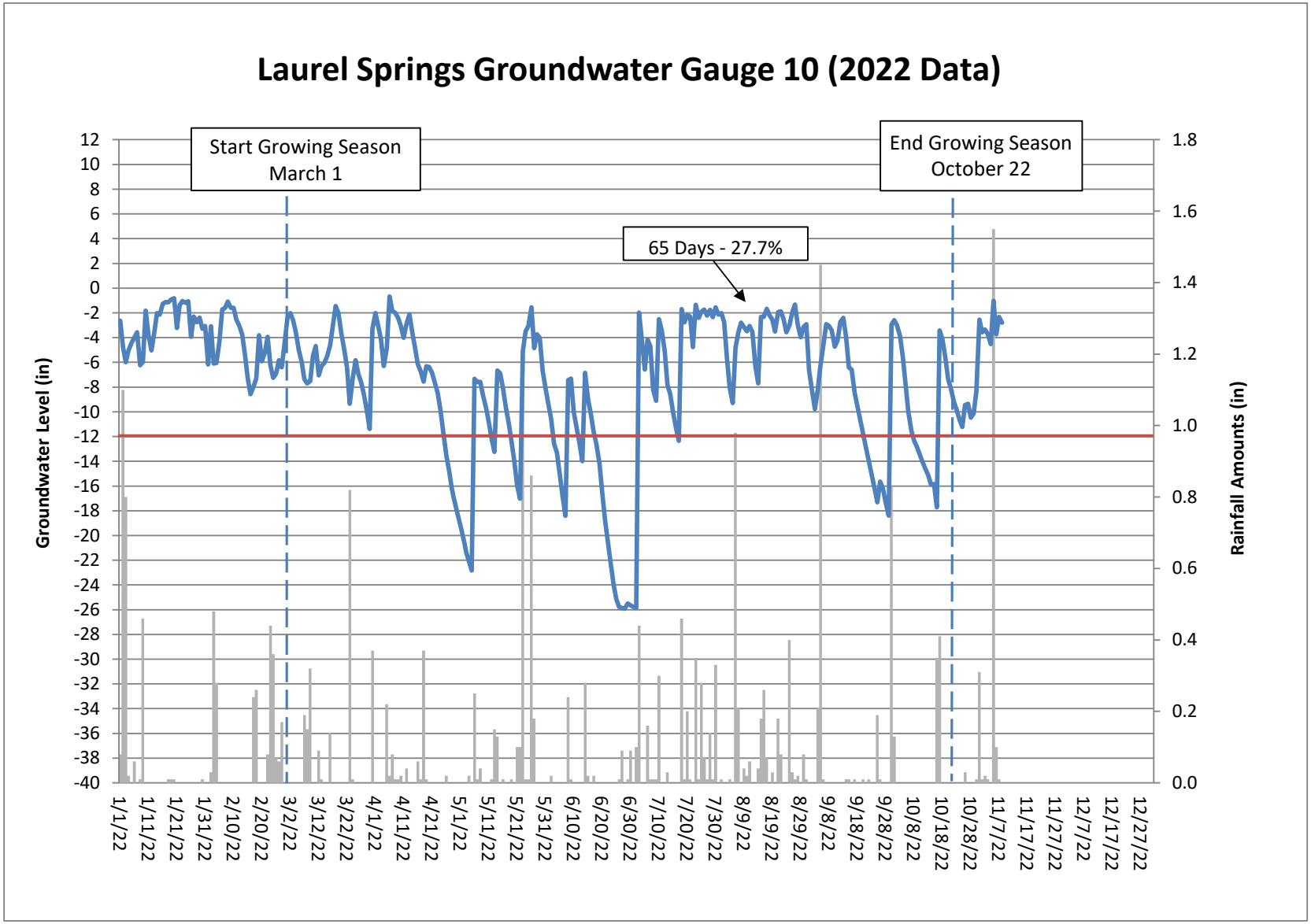
12/17/22
12/27/22


Laurel Springs Groundwater Gauge 10 (2022 Data)
Start Growing Season
March 1
End Growing Season
October 22
65 Days - 27.7%
Groundwater Level (in)
Rainfall Amounts (in)
12
10
8
6
4
2
0
-2
-4
-6
-8
-10
-12
-14
-16
-18
-20
-22
-24
-26
-28
-30
-32
-34
-36
-38
-40
1.8
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
1/1/22
1/11/22
1/21/22
1/31/22
2/10/22
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3/2/22
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3/22/22
4/1/22
4/11/22
4/21/22
5/1/22
5/11/22
5/21/22
5/31/22
6/10/22
6/20/22
6/30/22
7/10/22
7/20/22
7/30/22
8/9/22
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9/8/22
9/18/22
9/28/22
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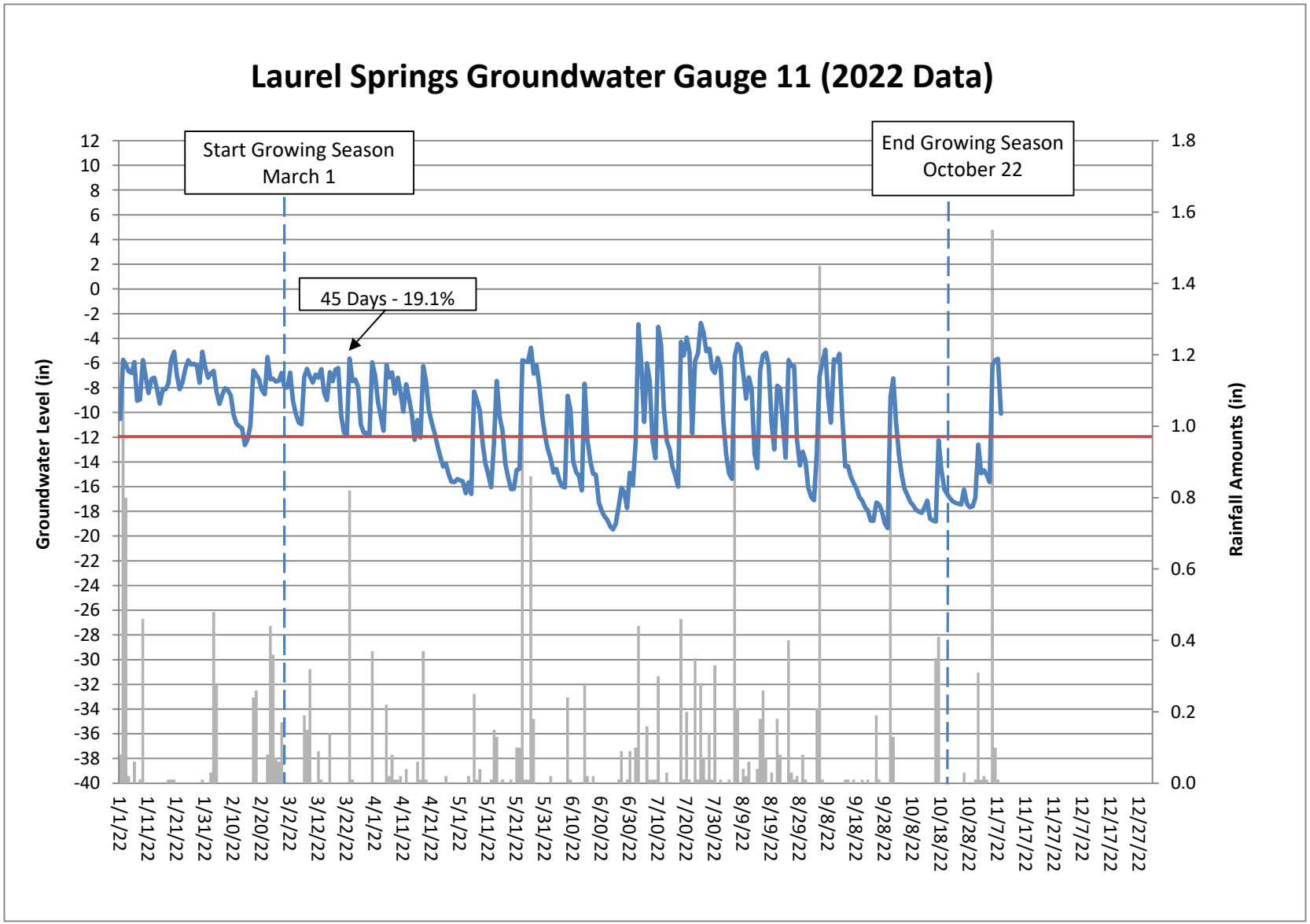
12/17/22
12/27/22


Laurel Springs Groundwater Gauge 11 (2022 Data)
Start Growing Season
March 1
End Growing Season
October 22
45 Days - 19.1%
Groundwater Level (in)
Rainfall Amounts (in)
12
10
8
6
4
2
0
-2
-4
-6
-8
-10
-12
-14
-16
-18
-20
-22
-24
-26
-28
-30
-32
-34
-36
-38
-40
1.8
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
1/1/22
1/11/22
1/21/22
1/31/22
2/10/22
2/20/22
3/2/22
3/12/22
3/22/22
4/1/22
4/11/22
4/21/22
5/1/22
5/11/22
5/21/22
5/31/22
6/10/22
6/20/22
6/30/22
7/10/22
7/20/22
7/30/22
8/9/22
8/19/22
8/29/22
9/8/22
9/18/22
9/28/22
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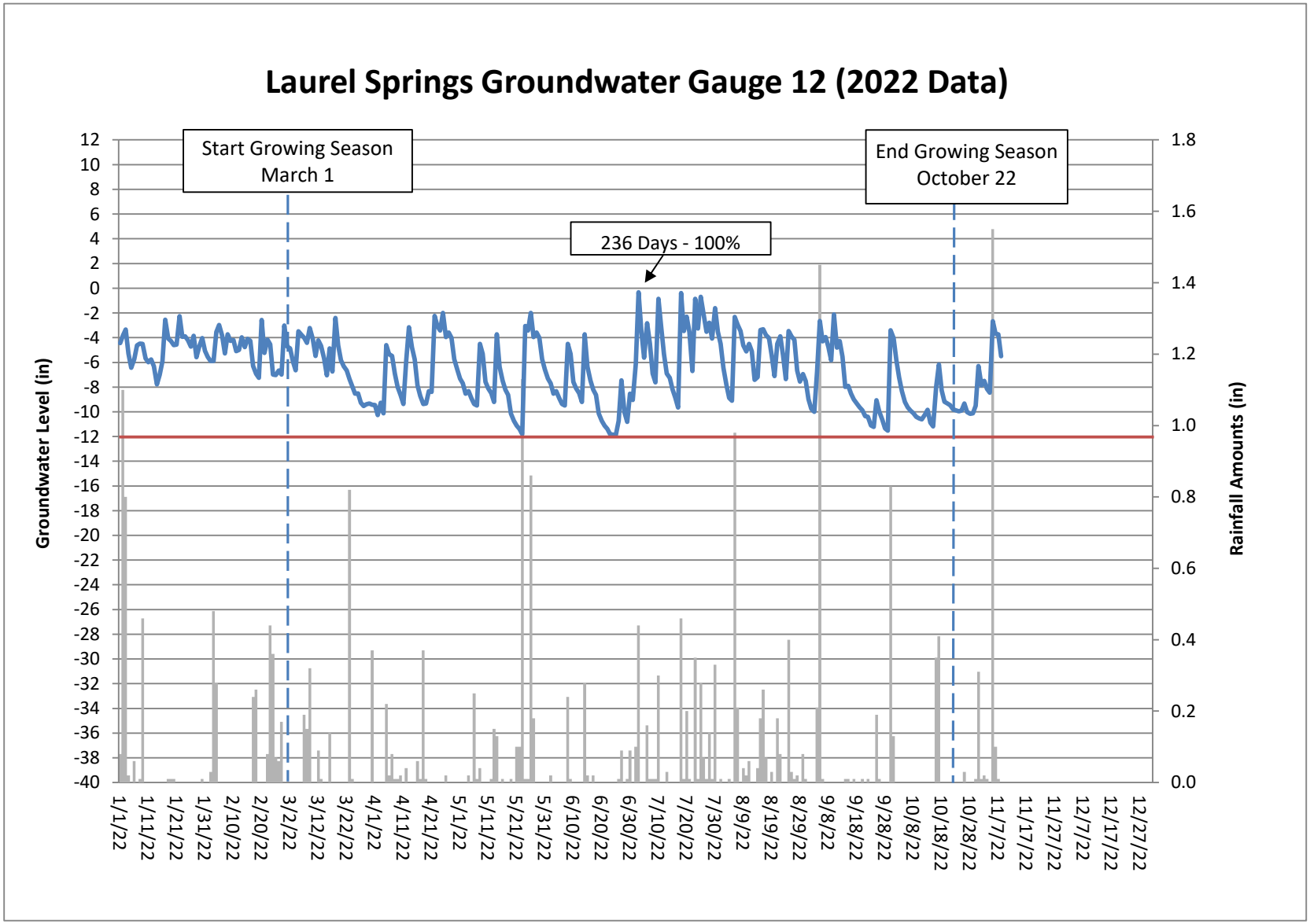
12/17/22
12/27/22


Laurel Springs Groundwater Gauge 12 (2022 Data)
Start Growing Season
March 1
End Growing Season
October 22
236 Days - 100%
Groundwater Level (in)
Rainfall Amounts (in)
12
10
8
6
4
2
0
-2
-4
-6
-8
-10
-12
-14
-16
-18
-20
-22
-24
-26
-28
-30
-32
-34
-36
-38
-40
1.8
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
1/1/22
1/11/22
1/21/22
1/31/22
2/10/22
2/20/22
3/2/22
3/12/22
3/22/22
4/1/22
4/11/22
4/21/22
5/1/22
5/11/22
5/21/22
5/31/22
6/10/22
6/20/22
6/30/22
7/10/22
7/20/22
7/30/22
8/9/22
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8/29/22
9/8/22
9/18/22
9/28/22
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12/17/22
12/27/22

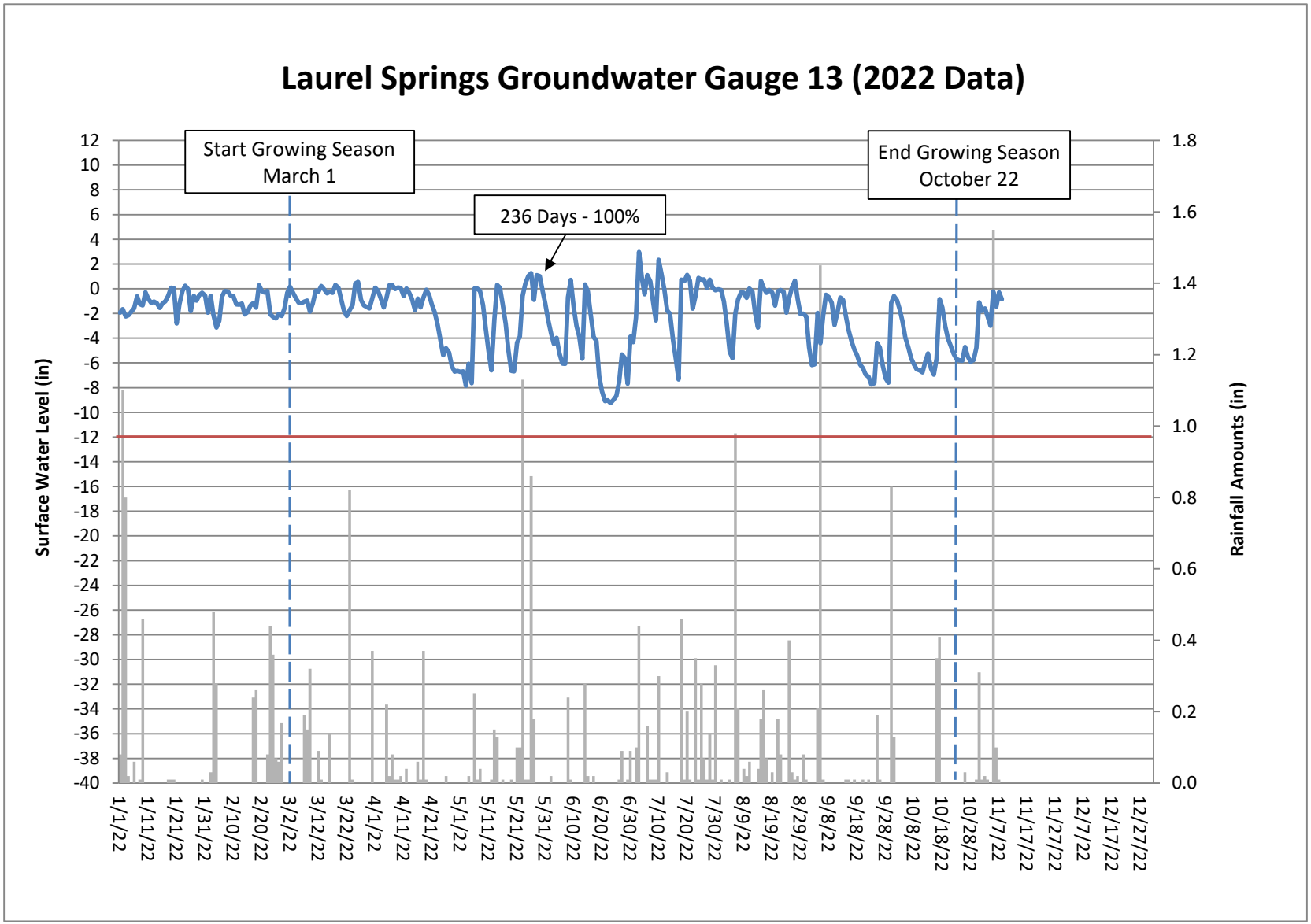

Laurel Springs Groundwater Gauge 13 (2022 Data)
Start Growing Season
March 1
End Growing Season
October 22
236 Days - 100%
Surface Water Level (in)
Rainfall Amounts (in)
12
10
8
6
4
2
0
-2
-4
-6
-8
-10
-12
-14
-16
-18
-20
-22
-24
-26
-28
-30
-32
-34
-36
-38
-40
1.8
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
1/1/22
1/11/22
1/21/22
1/31/22
2/10/22
2/20/22
3/2/22
3/12/22
3/22/22
4/1/22
4/11/22
4/21/22
5/1/22
5/11/22
5/21/22
5/31/22
6/10/22
6/20/22
6/30/22
7/10/22
7/20/22
7/30/22
8/9/22
8/19/22
8/29/22
9/8/22
9/18/22
9/28/22
10/8/22
10/18/22
10/28/22
11/7/22
11/17/22
11/27/22
12/7/22
12/17/22
12/27/22

Table 13. UT-2 Channel Evidence

UT-1 Upstream Channel Evidence	Year 1 (2022)
Max consecutive days channel flow	166
Presence of litter and debris (wracking)	Yes
Leaf litter disturbed or washed away	Yes
Matted, bent, or absence of vegetation (herbaceous or otherwise)	Yes
Sediment deposition and/or scour indicating sediment transport	Yes
Water staining due to continual presence of water	Yes
Formation of channel bed and banks	Yes
Sediment sorting within the primary path of flow	Yes
Sediment shelving or a natural line impressed on the banks	Yes
Change in plant community (absence or destruction of terrestrial vegetation and/or transition to species adapted for flow or inundation for a long duration, including hydrophytes)	Yes
Development of channel pattern (meander bends and/or channel braiding) at natural topographic breaks, woody debris piles, or plant root systems	Yes
Exposure of woody plant roots within the primary path of flow	No
Other:	

Laurel Springs UT2 Stream Flow (2022 Data)

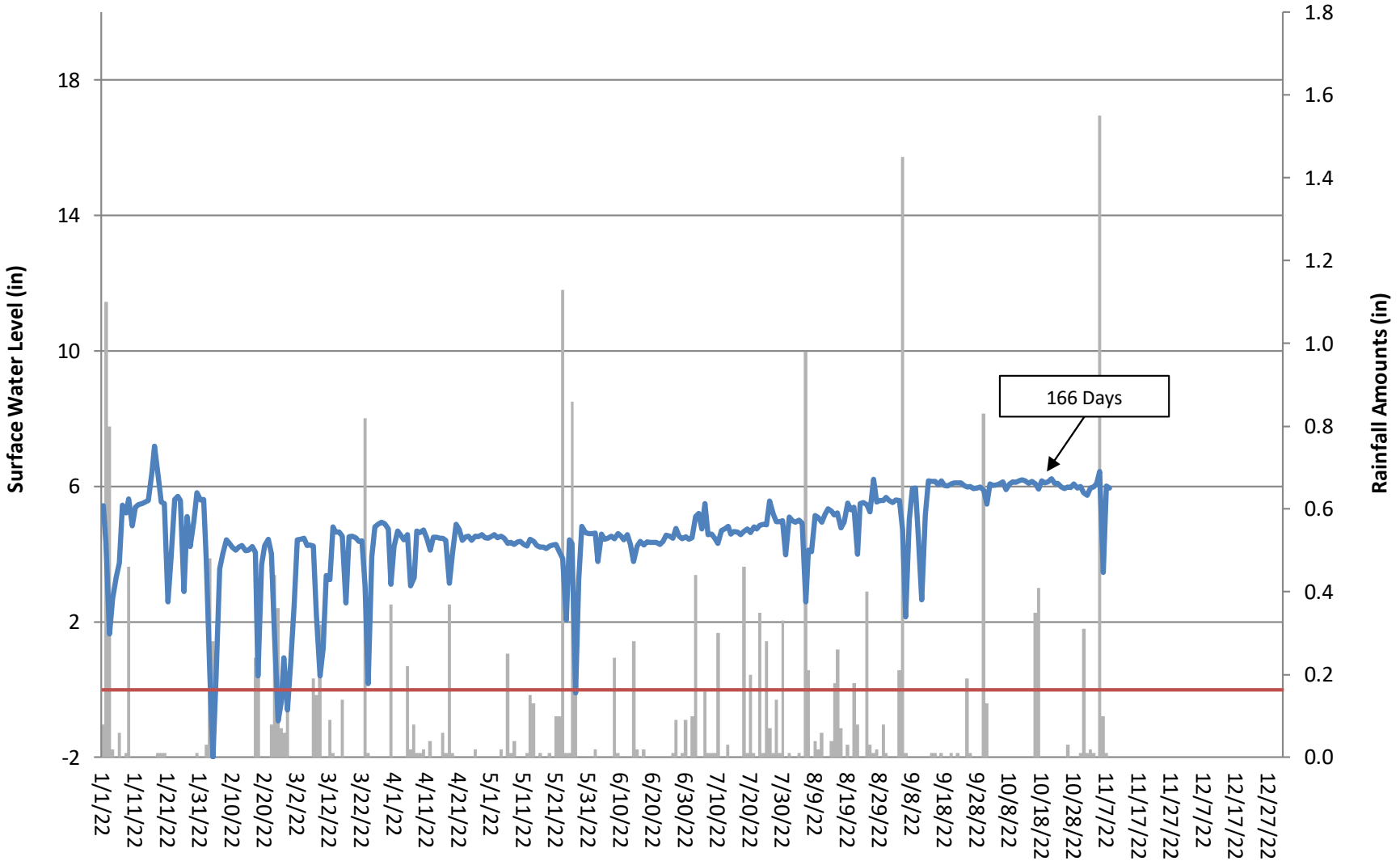
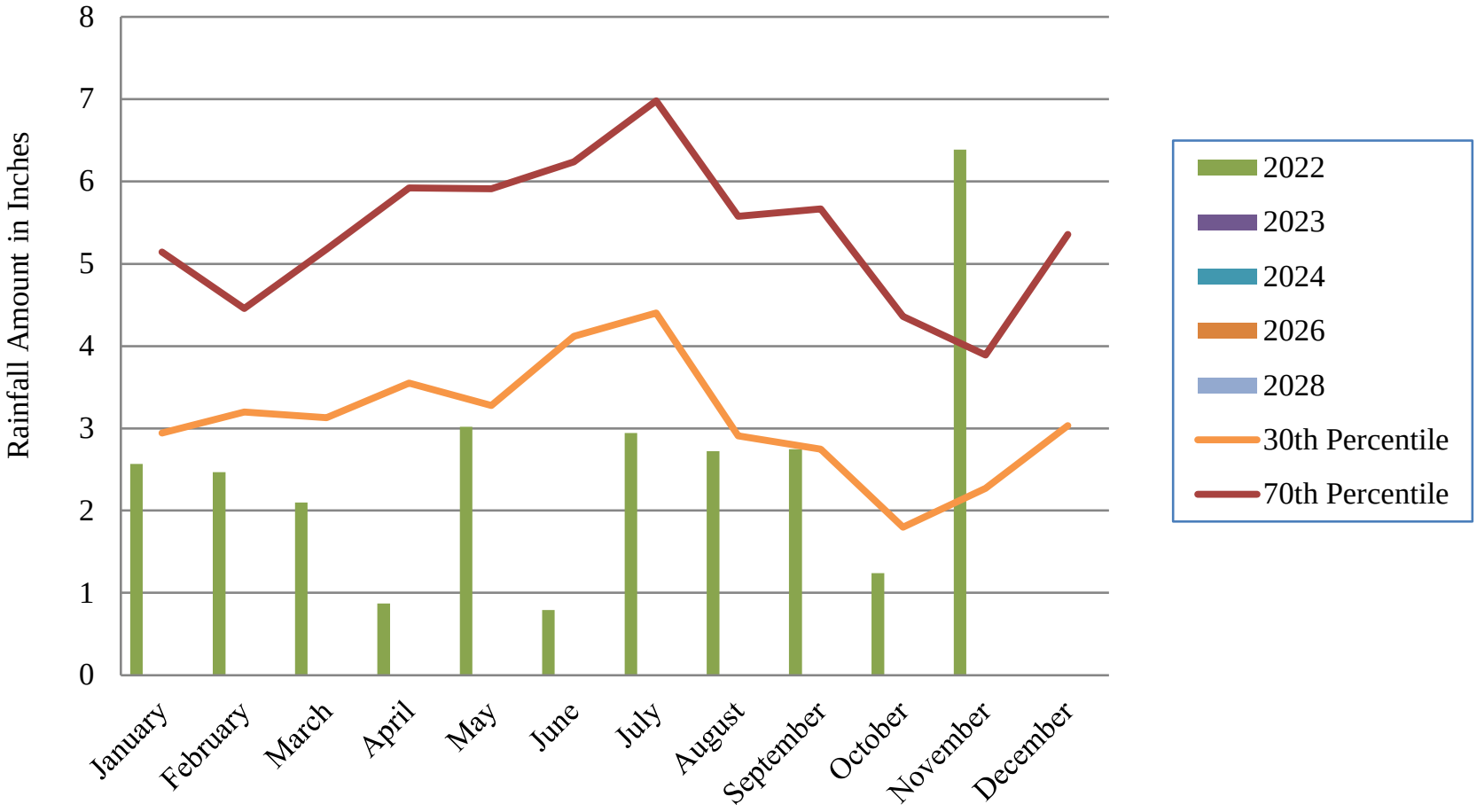
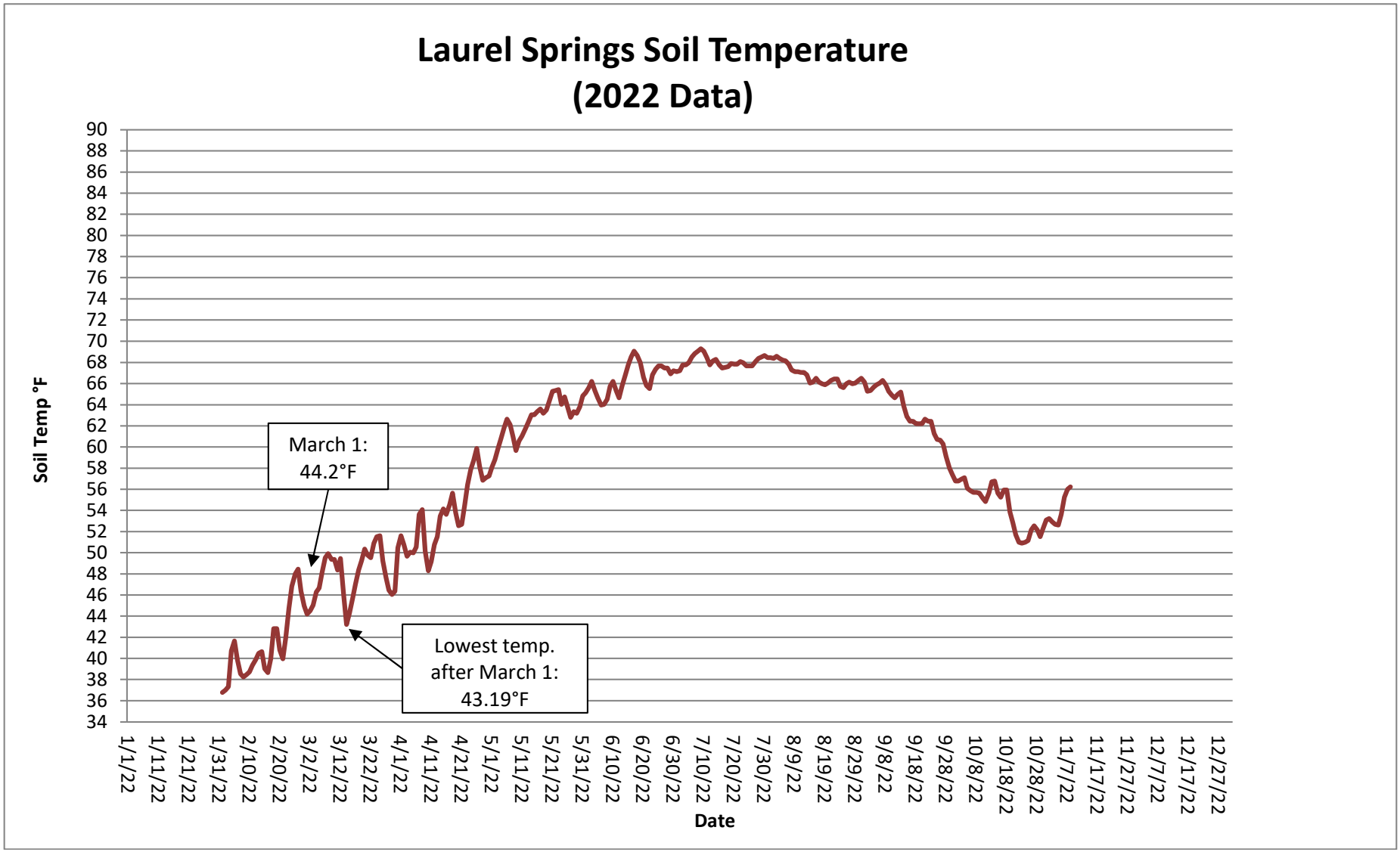


Figure D1: Laurel Springs
30-70 Percentile Graph for Rainfall
30-70th percentile data from WETS Station: Banner Elk, NC




Laurel Springs Soil Temperature
(2022 Data)
Soil Temp °F
90
88
86
84
82
80
78
76
74
72
70
68
66
64
62
60
58
56
54
52
50
48
46
44
42
40
38
36
34
March 1:
44.2°F
Lowest temp.
after March 1:
43.19°F
1/1/22
1/11/22
1/21/22
1/31/22
2/10/22
2/20/22
3/2/22
3/12/22
3/22/22
4/1/22
4/11/22
4/21/22
5/1/22
5/11/22
5/21/22
5/31/22
6/10/22
6/20/22
6/30/22
7/10/22
7/20/22
7/30/22
8/9/22
8/19/22
8/29/22
9/8/22
9/18/22
9/28/22
10/8/22
10/18/22
10/28/22
11/7/22
11/17/22
11/27/22
12/7/22
12/17/22
12/27/22
Date

Appendix E: Project Timeline and Contact Info

Table 14. Project Timeline
Table 15. Project Contacts

Table 14. Project Timeline

Activity or Deliverable	Data Collection Complete	Task Completion or Deliverable Submission
Technical Proposal (RFP No. 16-007725)	Mar-19	Mar-19
Institution Date (NCDMS Contract No. 100122)	NA	17-May-19
Mitigation Plan	Jul-20	11-Feb-21
Construction Plan (Grading) Completed	NA	18-Feb-21
Planting Completed	NA	13-Jan-22
As-built Survey Completed	25-Oct-20	Jun-22
MY-0 Baseline Report	Feb-22	Nov-22
Invasive Species Treatment - Japanese Knotweed, Chinese Bittersweet, Multiflora rose, Autumn Olive, Callery Pear, Japanese barberry, Cattail	NA	14-Sep-22
Encroachment (addressed during MY1)	NA	Oct-22
MY1 Monitoring Report	Nov-22	Feb-23

Table 15. Project Contacts

Laurel Springs/100122	
Provider	Restoration Systems, LLC 1101 Haynes Street, Suite 211 Raleigh, NC 27604
Mitigation Provider POC	Worth Creech 919-755-9490
Designer	Axiom Environmental, Inc. 218 Snow Ave Raleigh, NC 27603
Primary project design POC	Grant Lewis 919-215-1693
Construction Contractor	Land Mechanics Designs, Inc. 126 Circle G Lane Willow Spring, NC 27592 Charles Hill 919-639-6132

Appendix F: IRT Correspondence

Responses to IRT MY0 Comments
Mitigation Plan Modification Request
Remedial Planting Plan (Q1-2023)
12/9/22 IRT Concurrence Email from Kim Isenhour

Restoration Systems, LLC
1101 Haynes St. Suite 211
Raleigh, North Carolina
Ph: (919) 755-9490
Fx: (919) 755-9492

Response to IRT Comments – MY 0, Baseline Report
Laurel Springs Mitigation Site – Avery County
DMS Project ID No. 100122
Full Delivery Contract No. 7890
RFP No. 16-007725 (Issuance Date 11/13/2018)
USACE Action ID No. SAW-2019-00835
DWR Project No. 2019-0865

Comments Received (Black Text) & Responses (Blue Text)

Casey Haywood, USACE:

1. QAQC of the Vegetation tables need to be addressed in the report. Looking back at the Mitigation Plan, Table 18 Planting Plan does not match the listed species on the L5 Plan Sheet. It appears that some of the discrepancies listed below are likely a result of this. Please ensure these tables reflect the same information in future submittals.
   You are correct. The final Mitigation Plan, submitted with the permit application(s), was updated based on IRT comments, including updates to Table 18 – Planting Plan. However, the Planting Plan table within the construction drawings (Sheet L5) was not updated. Steps were taken to ensure this oversight does not occur in the future. Our sincere apologies for this lack of quality control.

   a. Table A lists yellow birch (Betula alleghaniensis) as a species that was not planted; however, Table B shows it was planted but had it listed as swamp birch (Betula alleghaniensis). Plan Sheet L5 also indicates it was planted. Please clarify.
      Response: *Betula alleghaniensis* was planted. The use of two different common names for *Betula alleghaniensis* (yellow birch and swamp birch) resulted in it being listed in Table A as a non-planted species. The row containing this species was deleted from Table A, and the common name listed in Table B was updated to *yellow birch*.

   b. Table A should reflect all species that were not planted to include elderberry and buttonbush as shown on Table 18 of the Final Mitigation Plan.
      Response: Elderberry and buttonbush were live-staked in the stream-side assemblage area. They have been included in Table B as such.

   c. Sheet L5 lists Scarlet Oak as an added species, however this is shown in Table B (and Table 18 in the Mitigation Plan) as an approved species. Table B lists Red Spruce as an added species, whereas Sheet L5 has it listed as an approved species. Please update.
      Response: Scarlett oak was planted and was included in the original mitigation plan planting plan; however, the species was incorrectly listed in the mitigation plan as Quercus imbricaria. This has been corrected in the redline Recording Drawings planting plan (Sheet L5) and is not considered a species substitution. Red spruce was not included in the mitigation plan. The redline Recording Drawings planting plan (Sheet L5) and Table F (As-Built Planted Species and Stems) of the Baseline Report were updated accordingly.

   d. Based on the information provided, it appears the modification request includes the addition of three species: arrowwood viburnum (Viburnum dentatum), bitternut hickory (Carya cordiformis) and American hazelnut (Corylus americana). Is this accurate? If so, I am okay with the inclusion of the replacement species, however, please provide an updated redline planting table to reflect Plan Sheet L5 and Table 18 of the Final Mitigation Plan to include consistency between common species names and planting numbers. Updating this table will be beneficial to use as a reference for potential replanting efforts in the future.
      Response: The modification request includes the addition of four species: arrowwood viburnum (*Viburnum dentatum*), bitternut hickory (*Carya cordiformis*), American hazelnut (*Corylus americana*), and Red Spruce (*Picea rubens*). Although no red spruce was counted during MY0 permanent vegetation plot monitoring, the species was planted, and RS requests its consideration for inclusion in the event it is

counted in temporary vegetation plots during the monitoring period. Additionally, common ninebark was included in the stream-side assemblage but was planted via live stake. This species is not being proposed for IRT consideration since live-stakes do not count toward planted stem success criteria. The redline Recording Drawings planting plan (Sheet L5) and Table F (As-Built Planted Species and Stems) of the Baseline Report were updated accordingly.

2. With the possibility of a replant in 2023, I concur with EPA's comment to include random vegetation plots and would support the replacement of 3 permeant plots to random plots (recommend plots 3, 5, and 13).
   Response: RS will continue monitoring all permanent vegetation plots and will add three additional plots within the 2023 proposed replant areas. Three random temporary vegetation plots will be monitored for the remainder of the monitoring period or until otherwise requested by the IRT.

3. When comparing the MY0 CCPV (Figure 1) to the updated Monitoring Map (Figure 9) provided on August 26, 2021, some of the veg plots and groundwater gauge locations appear to be flipped and are no longer located in creditable wetland reestablishment areas (GWG 1, 6, & 9). While it's beneficial to have some groundwater gauges located in non-credited wetlands, please ensure creditable wetland reestablishment areas have adequate monitoring wells to document hydrologic uplift.
   Response: During the 2022/2023 dormant season, RS plans to move gauges 6, 9, 11, and 12 into creditable wetland reestablishment areas. Also, gauge 1 will be moved into the wetland enhancement area, as depicted in Figure 9 of the approved Mitigation Plan. Please advise if the IRT would like additional changes to the locations of monitoring features.

4. Appreciate the efforts made to work with the landowner to remove the shed located in the easement near UT3. To help prevent future encroachments (such as mowing), were additional boundary markers or horse tape added to this area when the surveyor visited the site on 9/2022? When the new shed is constructed, please be sure to have the structure located far enough off the easement boundary to prevent any future encroachments.
   Response: Yes, 6-inch treated fence posts were used to delineate the easement boundary in this area. The new shed was erected approximately 15 feet from the easement.

Andrea Leslie, WRC:

1. The as-built and final mitigation plan do not match when it comes to planting. The numbers/percentages of what was planned (in black) to plant are not what is in the final plan. The planned percentages are also different from the as-built (e.g., hemlock at 2-3% in final plan, but in the as-built as planned at 8% and actually planted at 6%). The MY0 report does note that a number of species were not planted (but it is inaccurate, as it fails to include a number of those that were in the final plan and includes Betula alleganiensis, which was planted). Please include me in a discussion with RS; I'd like to have input on the supplemental planting.
   Response: Based on species availability and surrounding natural communities, several substitutions were made between the mitigation plan and the as-built planting. The addendum to the mitigation plan has been updated to indicate that *Betula alleghaniensis* was planted.

   RS has ordered trees to replant 2.67 acres at a density of 670 stems per acre within observed low stem density areas, which includes the 0.107-acre area of encroachment. These areas are within the Acidic Cove Forest Association. The following species and quantities were secured for Q1-2023 planting.

   Targeted Vegetation Associations: Acidic Cove Forest
   Area of Replant: 2.67 Acres

Species	Indicator Status	Number of Stems
American elm (*Ulmus americana*)	FACW	600
White Oak (*Quercus alba*)	FACU	600
Persimmon (*Diospyros virginiana*)	FAC	600
Total		**1,800**

These species were listed within the approved Mitigation Plan but were not planted within the Acidic Cove vegetation association during initial planting. These three species will add to the six species planted during initial planting for a total of nine species within the Acidic Cove vegetation association. A formal Remedial Planting Plan letter is provided after RS's Mitigation Plan Modification Request (request to count replacement tree species towards site success criteria) – immediately following these comment responses.

RS recognizes that additional "diversity plantings" may be desired by the IRT, and we welcome the opportunity to discuss a diversity planting effort with the IRT. RS will plan to reach out to Andrea Leslie and Erin Davis in Q1-2023 to discuss this effort.

Todd Bowers, EPA:

1. Table 8: Post Mitigation Plan dominant species composition needs to be recalculated for all plots.
   Response: Post Mitigation Plan dominant species composition was recalculated.

2. Were there no random vegetation plots installed? If not, I recommend adding 3 random plots in place of fixed plots for future vegetation monitoring.
   Response: 3 random vegetation plots will be measured annually in addition to the 16 permanent plots.

3. Modifications and red line changes in As-Built plans such as floodplain culvert features, added rock sills and log vanes, j-hooks, replacement of a box culvert with a bridge span, and the modified planting plan are all noted with no comment.
   Response: Noted.

4. Sheet L5.00: Recommend breaking down each species component (stem counts) into each vegetation community.
   Response: The revised redline planting table has broken down species stem counts by vegetation community.

5. I think the Corps (and IRT) should have been notified much earlier than concurrently with the MY0 Report of a modification request with changes or modifications to the planting plan.
   Response: Noted. Apologies for the lack of notice – RS has implemented new QA/QC procedures regarding ordering bare-root species from nurseries to prevent this situation from occurring on future sites.

6. Table 5: 16.5% of the site's planted acreage has low stem density based on visual assessment. Recommend placing some of the recommended random plots in areas of concern. If an adaptive management plan for supplemental planted is anticipated, please submit to the IRT as soon as possible so that the site can be replanted no later than March 2023.
   Response: Temporary plots will be measured in this area during MY1 monitoring, although RS plans to replant these areas in Q1-2023 – see WRC comment 1 response.

7. Overall, I am very satisfied with the report and the work that RS has completed at the site. Having not been able to visit this location, I really appreciated the detailed ground-level and drone level wetland, vegetation and stream feature photos to illustrate the grading, planting and features implemented.
   Response: Noted.

Erin Davis, DWR:

1. DWR appreciated DMS' report review and site visit comments.
   Response: Noted.

2. The inclusion of additional photos, particularly the drone images, were very helpful for this review. Thank you.
   Response: Noted.

3. I was confused about the addition of 29 rock sills that weren't engineered and installed to act as grade control. In hindsight, is there a better term to depict adding cobble to support a constructed riffle as described in Section 2.1?
   Response: RS agrees that the label "Rock Sills" is not appropriate for what occurred. "Rock Sills" was used by the surveyor and, in turn, by the Engineer of Record on the Recording Drawing Plan Set. We feel the description provided in Section 2.1 of "large cobble" is more appropriate. In hindsight, within the Recorded Drawing Plan Set, "Large Cobble Added" would have been more appropriate than "Rock Sill Added."

4. Once all straw wattles with plastic netting have been removed from the site, please add a note in the corresponding monitoring report narrative.
   Response: Will do. We expect all straw wattles to be removed during the spring/summer of 2023 and will report their removal in the MY2 (2023) monitoring report.

5. The mowing and shed encroachment should be identified in Table 5.
   Response: The two areas of encroachment have been depicted on the CCPV and are quantified in Table 5.

6. An additional five stormwater culverts were installed within project easement breaks. Throughout the monitoring period, please pay particular attention to associated easement areas that receive discharge from these structures for any evidence of wetland/floodplain instability or erosion.
   Response: All easement areas receiving discharge from stormwater culverts will be monitored throughout the monitoring period for erosion/instability.

7. DWR is very disappointed with the planted species list. First, looking back at the final mitigation plan, DWR reviewed and supported the Table 18 and Figure 8 plant list, which took into account the several IRT draft mitigation plan comments. It appears that Table 18/Figure 8 was not correctly updated in the associated construction plan sheets and that the draft mitigation plan plant list was used for construction planting. Additionally, it does not appear that the IRT comments were reviewed when making plant quantity adjustments as both WRC and DWR requested a cap for Eastern hemlock at 5 percent.
   Response: RS sincerely apologizes for the planted species issue – it was not intentional. RS has implemented new QA/QC procedures regarding the ordering of bare-root species from nurseries to prevent this situation from occurring again. Please see WRC comment response 1 and the Remedial Planting Plan included with this submittal. RS recognizes that additional "diversity plantings" may be desired by the IRT, and we welcome the opportunity to discuss a diversity planting effort with the IRT. RS will contact Andrea Leslie and Erin Davis in Q1-2023 to discuss this effort.

8. DWR understands that species availability is a common constraint during the construction phase. However, had DWR been notified and engaged on this issue we could have discussed and agreed upon an adaptive planning approach such as phased planting to ultimately ensure that appropriate species and appropriate species quantities were planted across the project.
   Response: Understood. We hope our new QA/QC procedures around bare-root species ordering will ensure appropriate species are ordered. If species are unavailable, we will know early enough to allow for collaboration with the DWR and other IRT members ahead of finalizing bare-root orders.

9. Please provide a supplemental list of species and quantities for the proposed supplemental planting effort. In addition to the proposed 18 percent supplemental planting area (total 16.2 acres), DWR recommends sitewide supplemental planting of understory/shrub species as specified in the approved Final Mitigation Plan Figure 8.
   Response: Please see the response to WRC comment 1 regarding the Q1-2023 replanting effort. Regarding the sitewide understory/shrub species planting, RS will reach out to DWR and WRC early in 2023 to discuss this planting and additional "diversity" planting efforts.

10. DWR recommends conducting random plots/transects in proposed supplemental planting areas, with at least one survey area within the UT3 decommissioned farm road footprint.
    Response: 3 temporary vegetation plots were measured within the supplemental planting areas as part of our response to these comments. Data is included in Table 8 of this submittal. RS plans to monitor 3 random

temporary vegetation plots for the remainder of the monitoring period or until otherwise requested by the IRT. Josh Merritt of RS walked the former soil path along UT3 and observed living planted stems. No mowing or vehicular access occurred along the decommissioned soil path in 2022, and planted stems are establishing. Josh oversaw the planting of two rows along the soil path during site planting. RS will continue to visually monitor this area. If planted stems do not survive into year two (2023) monitoring, RS will propose replanting the decommissioned road with potted trees/shrubs during the 2023/2024 dormant season.

11. Please provide wetland indicator status for proposed species additions to the approved plant list.
    Response: Wetland indicator status has been provided in Tables A and B in the Mitigation Plan Addendum and in the redline Recording Drawing planting plan on Sheet L5.

12. DWR respectfully disagrees with RS' response to DMS that there were no significant changes in monitoring device locations from the approved mitigation plan. As noted in the August 2021 correspondence, DWR was ok with relocating one groundwater gauge (#4) to a non-crediting area. However, the MY0 monitoring figure shows several gauges have been shifted outside of wetland credit generating areas. In order to demonstrate performance standard success there needs to be sufficient number and representative cover of monitoring devices across proposed credit areas. If gauge locations remain as-is, DWR may request additional gauge installation during the monitoring period.
    Response: Understood. During the 2022/2023 dormant season, RS plans to move gauges 6, 9, 11, and 12 into creditable wetland reestablishment areas. Also, gauge 1 will be moved into the wetland enhancement area, as depicted in Figure 9 of the approved mitigation plan. Please advise if the IRT would like additional changes to the locations of monitoring features.

Table F. As-Built Planted Species and Stems

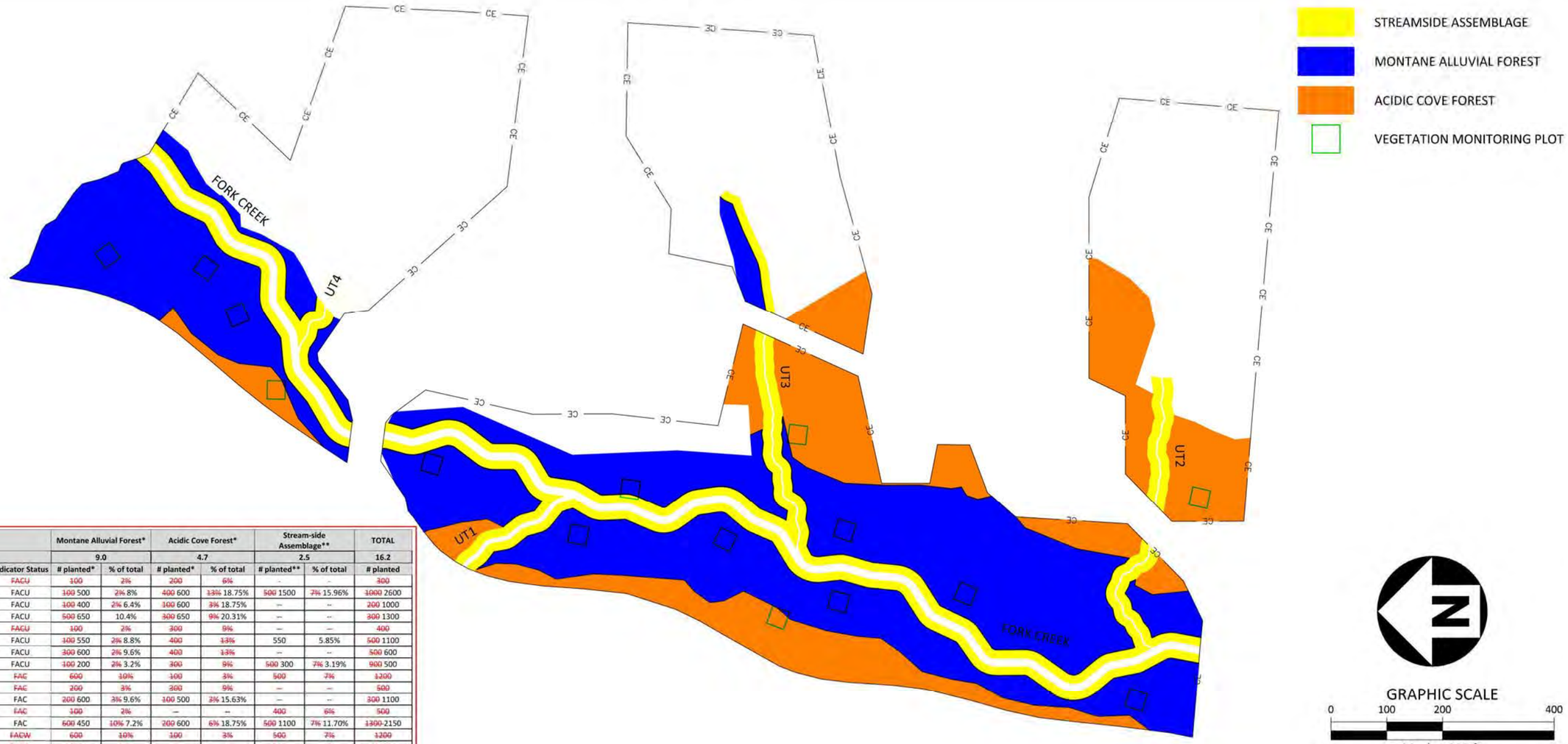
Vegetation Association		Montane Alluvial Forest*		Acidic Cove Forest*		Stream-side Assemblage**		TOTAL
Area (acres)		9.0		4.7		2.5		16.2
Species	Indicator Status	# planted*	% of total	# planted*	% of total	# planted**	% of total	# planted
~~Basswood (*Tilia americana*)~~	~~FACU~~	~~100~~	~~2%~~	~~200~~	~~6%~~	~~-~~	~~-~~	~~300~~
Cherry birch *(Betula lenta*)	FACU	~~100~~ 500	~~2%~~ 8%	~~400~~ 600	~~13%~~ 18.75%	~~500~~ 1500	~~7%~~ 15.96%	~~1000~~ 2600
Eastern hemlock (*Tsuga canadensis*)	FACU	~~100~~ 400	~~2%~~ 6.4%	~~100~~ 600	~~3%~~ 18.75%	--	--	~~200~~ 1000
Red oak (*Quercus rubra*)	FACU	~~500~~ 650	10.4%	~~300~~ 650	~~9%~~ 20.31%	--	--	~~300~~ 1300
~~White ash (Fraxinus americana)~~	~~FACU~~	~~100~~	~~2%~~	~~300~~	~~9%~~	~~--~~	~~--~~	~~400~~
White oak (*Quercus alba*)	FACU	~~100~~ 550	~~2%~~ 8.8%	~~400~~	~~13%~~	550	5.85%	~~500~~ 1100
White pine (*Pinus strobus*)	FACU	~~300~~ 600	~~2%~~ 9.6%	~~400~~	~~13%~~	--	--	~~500~~ 600
Yellow birch *(Betula alleghaniensis*)	FACU	~~100~~ 200	~~2%~~ 3.2%	~~300~~	~~9%~~	~~500~~ 300	~~7%~~ 3.19%	~~900~~ 500
~~Black gum (Nyssa sylvatica)~~	~~FAC~~	~~600~~	~~10%~~	~~100~~	~~3%~~	~~500~~	~~7%~~	~~1200~~
~~Persimmon (Diospyros virginiana)~~	~~FAC~~	~~200~~	~~3%~~	~~300~~	~~9%~~	~~--~~	~~--~~	~~500~~
Scarlet oak (*Quercus coccinea*)	FAC	~~200~~ 600	~~3%~~ 9.6%	~~100~~ 500	~~3%~~ 15.63%	--	--	~~300~~ 1100
~~Shadbush (Amelanchier arborea)~~	~~FAC~~	~~100~~	~~2%~~	~~--~~	~~--~~	~~400~~	~~6%~~	~~500~~
Tulip poplar (*Liriodendron tulipifera*)	FAC	~~600~~ 450	~~10%~~ 7.2%	~~200~~ 600	~~6%~~ 18.75%	~~500~~ 1100	~~7%~~ 11.70%	~~1300~~ 2150
~~American elm (Ulmus americana)~~	~~FACW~~	~~600~~	~~10%~~	~~100~~	~~3%~~	~~500~~	~~7%~~	~~1200~~
~~Hackberry (Celtis laevigata)~~	~~FACW~~	~~600~~	~~10%~~	~~--~~	~~--~~	~~500~~	~~7%~~	~~1100~~
River birch (*Betula nigra*)	FACW	~~600~~ 500	~~10%~~ 8%	--	--	~~500~~ 950	~~7%~~ 10.10%	~~1100~~ 1450
~~Swamp chestnut oak (Quercus michauxii)~~	~~FACW~~	~~600~~	~~10%~~	~~--~~	~~--~~	~~400~~	~~6%~~	~~1000~~
Sycamore (*Platanus occidentalis*)	FACW	600	~~10%~~ 9.6%	--	--	~~500~~ 1500	~~7%~~ 15.96%	~~1100~~ 2100
~~Tag alder (Alnus serrulata)~~	~~FACW~~	~~300~~	~~5%~~	~~--~~	~~--~~	~~400~~	~~6%~~	~~700~~
Silky dogwood (*Cornus amomum*)	FACW	~~200~~	~~3%~~	--	--	~~400~~ 600***	~~6%~~ 6.38%	600
Black willow (*Salix nigra*)	OBL	~~300~~	~~5%~~	--	--	~~400~~ 800***	~~6%~~ 8.51%	800
Elderberry (*Sambucus nigra*)	OBL	--	--	--	--	400***	~~6%~~ 4.26%	400
Buttonbush (*Cephalanthus occidentalis*)	OBL	--	--	--	--	400***	~~6%~~ 4.26%	400
^Common ninebark (*Physocarpus opulifolius*)	FACW	--	--	--	--	300***	3.19%	300
^Arrowwood viburnum (*Viburnum dentatum*)	FAC	400	6.4%			400	4.26%	800
^Bitternut hickory (*Carya cordiformis*)	FACU	800	12.8%					800
^American hazelnut (*Corylus americana*)	FACU					600	6.38%	600
^Red spruce (*Picea rubens*)	FACU			250	7.81%			250
TOTAL		~~6200~~ **6250**	**100%**	**3200**	**100%**	~~6800~~ **9400**	**100%**	~~**16200**~~ **18850**

^Species Added

* Planted at a density of 680 stems/acre.

** Planted at a density of 2720 stems/acre.

*** These species were live staked and planted along the stream channels – Total of 2500 live stakes were planted in addition to the 6900 bare-root Stream-Side Assemblage planting.



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^Species Added
* Planted at a density of 680 stems/acre.
** Planted at a density of 2720 stems/acre.
*** These species were live staked and planted along the stream channels – Total of 2500 live stakes were planted in addition to the 6900 bare-root Stream-Side Assemblage planting.

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LAUREL SPRINGS MITIGATION PLAN

AS-BUILT DRAWINGS
AVERY COUNTY, NORTH CAROLINA

RESTORATION SYSTEMS, LLC

Axiom Environmental, Inc.

PLAN INFORMATION

PROJECT NO.	AXI-19000
FILENAME	AXI19000-LS
CHECKED BY	RAS
DRAWN BY	CHJ
SCALE	1"=200'
DATE	11.15.2022

PLANTING PLAN

L5.00

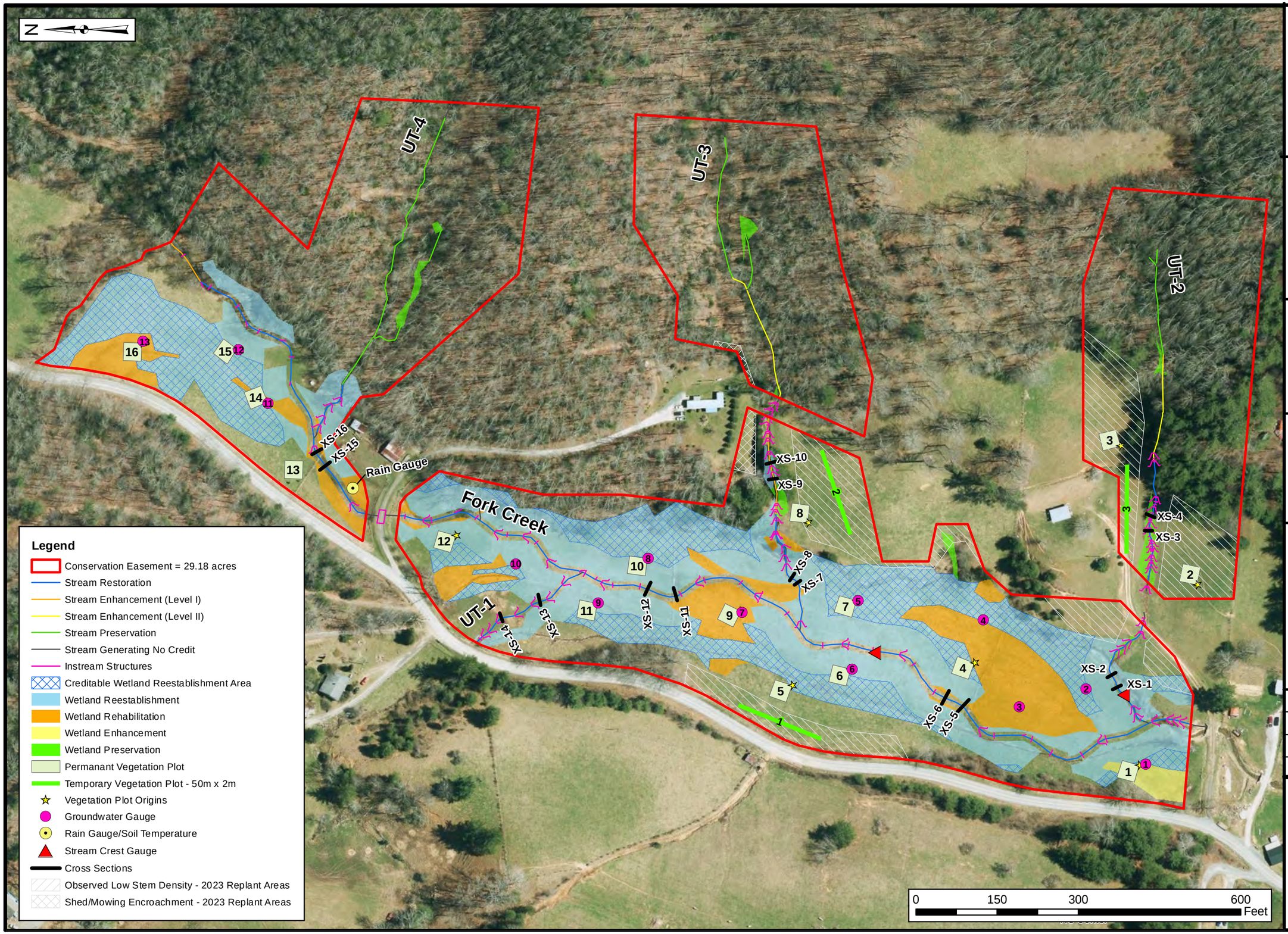
Table 5. Visual Vegetation Assessment

Planted acreage **16.2** Survey Date: February 1, 2022

Vegetation Category	Definitions	Mapping Threshold	Combined Acreage	% of Planted Acreage
Bare Areas	Very limited cover of both woody and herbaceous material.	0.10 acres	0.00	0.0%
Low Stem Density Areas	Woody stem densities clearly below target levels based on current MY stem count criteria.	0.10acres	2.67	16.5%
	Total		2.67	16.5%
Areas of Poor Growth Rates	Planted areas where average height is not meeting current MY Performance Standard.	0.10 acres	0.00	0.0%
	Cumulative Total		2.67	16.5%

Easement Acreage **29.19**

Vegetation Category	Definitions	Mapping Threshold	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. Species included in summation above should be identified in report summary.	0.10 acres	0.00	0.0%
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	2 Encroachments noted (0.107 acre)	



Legend

- Conservation Easement = 29.18 acres
- Stream Restoration
- Stream Enhancement (Level I)
- Stream Enhancement (Level II)
- Stream Preservation
- Stream Generating No Credit
- Instream Structures
- Creditable Wetland Reestablishment Area
- Wetland Reestablishment
- Wetland Rehabilitation
- Wetland Enhancement
- Wetland Preservation
- Permanant Vegetation Plot
- Temporary Vegetation Plot - 50m x 2m
- Vegetation Plot Origins
- Groundwater Gauge
- Rain Gauge/Soil Temperature
- Stream Crest Gauge
- Cross Sections
- Observed Low Stem Density - 2023 Replant Areas
- Shed/Mowing Encroachment - 2023 Replant Areas

Axiom Environmental, Inc.

Prepared for:

RESTORATION SYSTEMS | LLC

Project:

LAUREL SPRINGS MITIGATION SITE

Avery County, NC

Title:

CURRENT CONDITIONS PLAN VIEW

Notes:

1. Background Imagery Source: 2018 aerial photography provided by the NC OneMap program (online, provided by the NC Geographic Information Coordination Council)

Drawn by:	PHP
Date:	NOV 2022
Scale:	1:2000
Project No.:	19-006

FIGURE

1

Table 8. Vegetation Plot Data Table from Vegetation Data Entry Tool

Planted Acreage	16.2
Date of Initial Plant	2022-01-12
Date(s) of Supplemental Plant(s)	
Date(s) Mowing	
Date of Current Survey	2022-02-01
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		Veg Plot 6 F		Veg Plot 7 F		Veg Plot 8 F		Veg Plot 9 F	
					Planted	Total	Planted	Total	Planted	Total	Planted	Total	Planted	Total	Planted	Total	Planted	Total	Planted	Total	Planted	Total
Species Included in Approved Mitigation Plan	Betula alleghaniensis	yellow birch	Tree	FAC													1	1				
	Betula lenta	sweet birch	Tree	FACU	1	1					2	2							1	1		
	Betula nigra	river birch	Tree	FACW	10	10					3	3										
	Betula sp.						1	1			2	2	2	2	5	5	7	7	4	4	4	4
	Liriodendron tulipifera	tuliptree	Tree	FACU	2	2	4	4	3	3	2	2	2	2							8	8
	Other												1	1							1	1
	Pinus strobus	eastern white pine	Tree	FACU			1	1	4	4	4	4							1	1		
	Platanus occidentalis	American sycamore	Tree	FACW							6	6	1	1			1	1	5	5	2	2
	Quercus alba	white oak	Tree	FACU																		
	Quercus coccinea	scarlet oak	Tree								1	1					2	2				
	Quercus nigra	water oak	Tree	FAC															3	3		
	Quercus rubra	northern red oak	Tree	FACU																		
	Quercus sp.						12	12			2	2	3	3	2	2	1	1	4	4	3	3
	Tsuga canadensis	eastern hemlock	Tree	FACU			1	1	2	2			4	4					2	2		
Sum	Performance Standard				13	13	19	19	9	9	22	22	13	13	7	7	12	12	20	20	18	18
Post Mitigation Plan Species	**Carya cordiformis**	**bitternut hickory**	**Tree**	**FACU**			**1**	**1**			**4**	**4**	**5**	**5**	**1**	**1**						
	Corylus americana	**American hazelnut**	**Shrub**	**FACU**													**7**	**7**			**1**	**1**
	Viburnum dentatum	**southern arrowwood**	**Tree**	**FAC**	**3**	**3**					**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**			**1**	**1**
Sum	Proposed Standard				16	16	20	20	9	9	27	27	19	19	9	9	20	20	20	20	20	20
Mitigation Plan Performance Standard	Current Year Stem Count					13		19		9		22		13		7		12		20		18
	Stems/Acre					364		648		364		891		526		202		445		810		729
	Species Count					3		5		3		8		6		2		5		7		5
	Dominant Species Composition (%)					77		63		44		27		31		71		58		25		44
	Average Plot Height (ft.)					2		1		1		1		1		2		2		1		1
	% Invasives					0		0		0		0		0		0		0		0		0
Post Mitigation Plan Performance Standard	Current Year Stem Count					16		20		9		27		19		9		20		20		20
	Stems/Acre					486		688		364		1093		769		283		769		810		810
	Species Count					4		6		3		10		8		4		7		7		7
	Dominant Species Composition (%)					63		60		44		22		26		56		35		25		40
	Average Plot Height (ft.)					2		1		1		1		1		1		1		1		1
	% Invasives					0		0		0		0		0		0		0		0		0

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 8. Vegetation Plot Data Table from Vegetation Data Entry Tool (continued)

Acreage	16.2
Plant	2022-01-12
Supplemental	
Date(s) Mowing	
Survey	2022-02-01
(ACRES)	0.0247

	Scientific Name	Common Name	Tree/Shrub	Indicator Status	Veg Plot 10 F		Veg Plot 11 F		Veg Plot 12 F		Veg Plot 13 F		Veg Plot 14 F		Veg Plot 15 F		Veg Plot 16 F		Veg Plot 1 R	Veg Plot 2 R	Veg Plot 3 R
					Planted	Total	Planted	Total	Planted	Total	Planted	Total	Planted	Total	Planted	Total	Planted	Total	Total	Total	Total
Species Included in Approved Mitigation Plan	Betula alleghaniensis	yellow birch	Tree	FAC																	
	Betula lenta	sweet birch	Tree	FACU																	
	Betula nigra	river birch	Tree	FACW									1	1	3	3	7	7			
	Betula sp.				4	4			3	3	4	4	3	3			3	3		1	
	Liriodendron tulipifera	tuliptree	Tree	FACU	1	1			5	5	1	1	2	2	4	4	3	3		1	
	Other																				
	Pinus strobus	eastern white pine	Tree	FACU																	1
	Platanus occidentalis	American sycamore	Tree	FACW	2	2					6	6	2	2	1	1	2	2			
	Quercus alba	white oak	Tree	FACU															2		
	Quercus coccinea	scarlet oak	Tree																		
	Quercus nigra	water oak	Tree	FAC																	
	Quercus rubra	northern red oak	Tree	FACU																2	
	Quercus sp.				3	3	2	2	2	2	2	2	1	1	3	3			1	1	
	Tsuga canadensis	eastern hemlock	Tree	FACU									1	1	2	2					
Sum	Performance Standard				10	10	2	2	10	10	13	13	10	10	13	13	15	15	3	5	1
Post Mitigation Plan Species	**Carya cordiformis**	**bitternut hickory**	**Tree**	**FACU**	**1**	**1**			**4**	**4**											
	Corylus americana	**American hazelnut**	**Shrub**	**FACU**	**2**	**2**	**3**	**3**			**2**	**2**	**2**	**2**	**2**	**2**					
	Viburnum dentatum	**southern arrowwood**	**Tree**	**FAC**	**4**	**4**	**13**	**13**					**5**	**5**	**1**	**1**					
Sum	Proposed Standard				17	17	18	18	14	14	15	15	17	17	16	16	15	15	3	5	1
Mitigation Plan Performance Standard	Current Year Stem Count					10		2		10		13		10		13		15	3	5	1
	Stems/Acre					405		40		405		526		405		526		607	81	202	40
	Species Count					4		1		3		4		6		5		4	2	4	1
	Dominant Species Composition (%)					40		100		50		46		30		31		47	67	40	100
	Average Plot Height (ft.)					1		1		1		1		2		1		2	1	1	3
	% Invasives					0		0		0		0		0		0		0	0	0	0
Post Mitigation Plan Performance Standard	Current Year Stem Count					17		18		14		15		17		16		15	3	5	1
	Stems/Acre					688		688		567		607		688		648		607	81	202	40
	Species Count					7		3		4		5		8		7		4	2	4	1
	Dominant Species Composition (%)					12		72		36		40		29		25		47	67	40	100
	Average Plot Height (ft.)					2		2		1		1		2		1		2	1	1	3
	% Invasives					0		0		0		0		0		0		0	0	0	0

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.

November 30, 2022

Restoration Systems, LLC
1101 Haynes St. Suite 211
Raleigh, North Carolina
Ph: (919) 755-9490
Fx: (919) 755-9492

Kimberly Isenhour
Mitigation Project Manager, Regulatory Division
U.S. Army Corps of Engineers

Subject: Laurel Springs Mitigation Site - request to count replacement tree species towards site success criteria
DMS Project ID No. 100122
Full Delivery Contract No. 7890
RFP No. 16-007725 (Issuance Date 11/13/2018)
USACE Action ID No. SAW-2019-00835
DWR Project No. 2019-0865

Mrs. Isenhour,

Restoration Systems, LLC (RS), Sponsor of the Laurel Springs Mitigation Site (Site), is requesting a modification of the Site's Mitigation Plan to include planted tree/shrub species that were not included in the Site's approved Mitigation Plan. A lack of availability from nurseries of approved Mitigation Plan tree/shrub species required RS to adjust the number of stems planted for some approved species and include five additional species not included in the approved Mitigation Plan – four bare-root and one live-stake species. Table A below is a list of tree/shrub species detailed in the approved Mitigation Plan that were not planted at the Site due to lack of availability.

Table A. Non-planted Species Specified in the Mitigation Plan

Species (Mitigation Plan)	Wetland Indicator	Mit. Plan Stems
Basswood (*Tilia americana*)	FACU	300
White Ash (*Fraxinus americana*)	FACU	400
Black Gum (*Nyssa sylvatica*)	FAC	1,200
Persimmon (*Diospyros virginiana*)	FAC	500
Shadbush (*Amelanchier arborea*)	FAC	500
American elm (*Ulmus americana*)	FACW	1,200
Hackberry (*Celtis laevigata*)	FACW	1,100
Swamp Chestnut Oak (*Quercus michauxii*)	FACW	1,000
Tag alder (*Alnus serrulata*)	FACW	700
	Total =	6,900

Species summarized in Table A, as with others in the approved Mitigation Plan, were selected based on Reference Forest Ecosystem (RFE) data, on-site observations, and community descriptions from Classification of the Natural Communities of North Carolina (Schafale and Weakley 1990) – Montane Alluvial and Acidic Cove Forests.

Of the 6,900 bare-root stems detailed in Table A, 2,450 were supplemented by four species not included in the approved Mitigation Plan: Arrowwood viburnum, Bitternut hickory, American hazelnut, and Red spruce. RS selected these species based on their availability and that they were observed in nearby forest communities. The additional 4,450 stems needed to complete the targeted planting density were comprised of Mitigation Plan approved species. An extra 2,500 stems were live-staked in the stream-side assemblage area, including 300 stems of common ninebark, a species not included in the approved Mitigation Plan. Since live-staked species primarily provide stream-bank stability and do not count toward the stem density performance standard, RS is not proposing common ninebark to be considered for IRT approval. Table B summarizes planted species and their individual quantities within each planting zone and in total.

Table B. As-Built Planted Species and Stems

Vegetation Association		Montane Alluvial Forest*		Acidic Cove Forest*		Stream-side Assemblage**		TOTAL
Area (acres)		9.0		4.7		2.5		16.2
Species	Indicator Status	# planted*	% of total	# planted*	% of total	# planted**	% of total	# planted
~~Basswood (*Tilia americana*)~~	~~FACU~~	~~100~~	~~2%~~	~~200~~	~~6%~~	~~-~~	~~-~~	~~300~~
Cherry birch *(Betula lenta*)	FACU	~~100~~ 500	~~2%~~ 8%	~~400~~ 600	~~13%~~ 18.75%	~~500~~ 1500	~~7%~~ 15.96%	~~1000~~ 2600
Eastern hemlock (*Tsuga canadensis*)	FACU	~~100~~ 400	~~2%~~ 6.4%	~~100~~ 600	~~3%~~ 18.75%	--	--	~~200~~ 1000
Red oak (*Quercus rubra*)	FACU	~~500~~ 650	10.4%	~~300~~ 650	~~9%~~ 20.31%	--	--	~~300~~ 1300
~~White ash (Fraxinus americana)~~	~~FACU~~	~~100~~	~~2%~~	~~300~~	~~9%~~	~~--~~	~~--~~	~~400~~
White oak (*Quercus alba*)	FACU	~~100~~ 550	~~2%~~ 8.8%	~~400~~	~~13%~~	550	5.85%	~~500~~ 1100
White pine (*Pinus strobus*)	FACU	~~300~~ 600	~~2%~~ 9.6%	~~400~~	~~13%~~	--	--	~~500~~ 600
Yellow birch *(Betula alleghaniensis*)	FACU	~~100~~ 200	~~2%~~ 3.2%	~~300~~	~~9%~~	~~500~~ 300	~~7%~~ 3.19%	~~900~~ 500
~~Black gum (Nyssa sylvatica)~~	~~FAC~~	~~600~~	~~10%~~	~~100~~	~~3%~~	~~500~~	~~7%~~	~~1200~~
~~Persimmon (Diospyros virginiana)~~	~~FAC~~	~~200~~	~~3%~~	~~300~~	~~9%~~	~~--~~	~~--~~	~~500~~
Scarlet oak (*Quercus coccinea*)	FAC	~~200~~ 600	~~3%~~ 9.6%	~~100~~ 500	~~3%~~ 15.63%	--	--	~~300~~ 1100
~~Shadbush (Amelanchier arborea)~~	~~FAC~~	~~100~~	~~2%~~	~~--~~	~~--~~	~~400~~	~~6%~~	~~500~~
Tulip poplar (*Liriodendron tulipifera*)	FAC	~~600~~ 450	~~10%~~ 7.2%	~~200~~ 600	~~6%~~ 18.75%	~~500~~ 1100	~~7%~~ 11.70%	~~1300~~ 2150
~~American elm (Ulmus americana)~~	~~FACW~~	~~600~~	~~10%~~	~~100~~	~~3%~~	~~500~~	~~7%~~	~~1200~~
~~Hackberry (Celtis laevigata)~~	~~FACW~~	~~600~~	~~10%~~	~~--~~	~~--~~	~~500~~	~~7%~~	~~1100~~
River birch (*Betula nigra*)	FACW	~~600~~ 500	~~10%~~ 8%	--	--	~~500~~ 950	~~7%~~ 10.10%	~~1100~~ 1450
~~Swamp chestnut oak (Quercus michauxii)~~	~~FACW~~	~~600~~	~~10%~~	~~--~~	~~--~~	~~400~~	~~6%~~	~~1000~~
Sycamore (*Platanus occidentalis*)	FACW	600	~~10%~~ 9.6%	--	--	~~500~~ 1500	~~7%~~ 15.96%	~~1100~~ 2100
~~Tag alder (Alnus serrulata)~~	~~FACW~~	~~300~~	~~5%~~	~~--~~	~~--~~	~~400~~	~~6%~~	~~700~~
Silky dogwood (*Cornus amomum*)	FACW	~~200~~	~~3%~~	--	--	~~400~~ 600***	~~6%~~ 6.38%	600
Black willow (*Salix nigra*)	OBL	~~300~~	~~5%~~	--	--	~~400~~ 800***	~~6%~~ 8.51%	800
Elderberry (*Sambucus nigra*)	OBL	--	--	--	--	400***	~~6%~~ 4.26%	400
Buttonbush (*Cephalanthus occidentalis*)	OBL	--	--	--	--	400***	~~6%~~ 4.26%	400
^Common ninebark (*Physocarpus opulifolius*)	FACW	--	--	--	--	300***	3.19%	300
^Arrowwood viburnum (*Viburnum dentatum*)	FAC	400	6.4%			400	4.26%	800
^Bitternut hickory (*Carya cordiformis*)	FACU	800	12.8%					800
^American hazelnut (*Corylus americana*)	FACU					600	6.38%	600
^Red spruce (*Picea rubens*)	FACU			250	7.81%			250
TOTAL		~~6200~~ **6250**	**100%**	**3200**	**100%**	~~6800~~ **9400**	**100%**	~~**16200**~~ **18850**

^Species Added

* Planted at a density of 680 stems/acre.

** Planted at a density of 2720 stems/acre.

*** These species were live-staked and planted along the stream channels – A total of 2500 live stakes were planted in addition to the 6900 bare-root Stream-Side Assemblage planting.

November 30, 2022

Restoration Systems, LLC
1101 Haynes St. Suite 211
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RS included all planted species in the data collection for the MY0 Monitoring Report. Table 8 within the MY0 Monitoring Report, the DMS vegetation tool, requires providers to select from five options regarding the species status for inclusion in meeting performance standards, "Performance Standard Approval" column:

1. Approved Mit Plan
2. Approved Post Mit Plan
3. Proposed
4. Not Approved – Not Invasive or Exotic
5. Not Approved – Invasive or Exotic

The four additional bare-root species detailed in Table B (Arrowwood viburnum, Bitternut hickory, American hazelnut, and Red spruce) were included in the MY 0 Report as "Proposed" species for inclusion in meeting performance standards – Vegetation Plot Data Table from Vegetation Data Entry Tool, MY 0 Report Table 8, Appendix B.

RS requests the IRT allows these four species to be counted toward the Site's success criteria.

If the IRT concurs that these species may be included to count toward the Site's performance standards, RS will update the four species as "Approved Post Mit Plan" in the MY1 (2022) report.

Please let me know if you have any questions or if I can provide any additional information.

Sincerely,

Raymond Holz
Operations Manager
Restoration Systems, LLC

November 30, 2022

Restoration Systems, LLC
1101 Haynes St. Suite 211
Raleigh, North Carolina
Ph: (919) 755-9490
Fx: (919) 755-9492

Kimberly Isenhour
Mitigation Project Manager, Regulatory Division
U.S. Army Corps of Engineers

Subject: Laurel Springs Mitigation Site – Remedial Planting Plan (Q1-2023)
DMS Project ID No. 100122; Full Delivery Contract No. 7890; RFP No. 16-007725 (Issuance Date 11/13/2018)
USACE Action ID No. SAW-2019-00835; DWR Project No. 2019-0865

Mrs. Isenhour,

During the 2022 growing season, Restoration Systems (RS) has observed areas of low stem densities at the Laurel Springs Mitigation Site (Site). Observed areas total 2.67 acres, which includes a 0.107-acre area of encroachment – see attached remedial planting figure. The encroachment area was partially due to a storage shed left within the easement used by the adjacent landowner. RS worked with the neighbor to remove the shed and cleared the area of all debris. Additionally, 6-inch treated fence posts were used to delineate the easement boundary in this area. A new shed was erected approximately 15 feet from the easement.

RS has ordered trees to replant the 2.67 acres at a density of 670 stems per acre. The replant areas are within the Acidic Cove Forest Association. The following species and quantities were secured for Q1-2023 planting.

Targeted Vegetation Associations: Acidic Cove Forest
Area of Replant: 2.67 Acres

Species	Indicator Status	Number of Stems
American elm (*Ulmus americana*)	FACW	600
White Oak (*Quercus alba*)	FACU	600
Persimmon (*Diospyros virginiana*)	FAC	600
Total		**1,800**

These species were listed within the approved mitigation plan but not planted within the Acidic Cove vegetation association during initial planting. These three species will add to the six species planted during initial planting for nine total species within the Acidic Cove vegetation association.

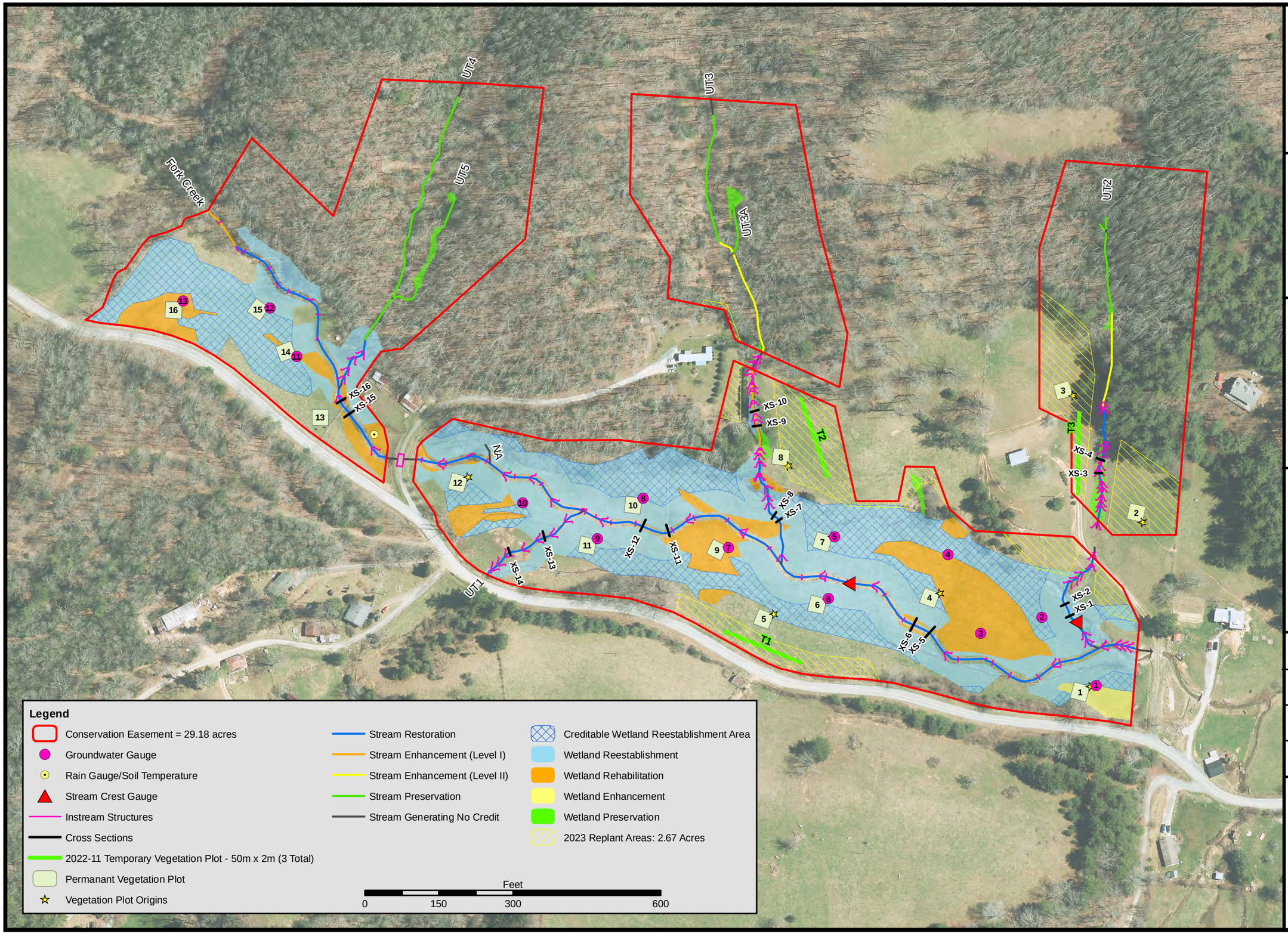
RS recognizes that additional "diversity plantings" may be desired by the IRT, and we welcome the opportunity to discuss a diversity planting effort with the IRT. RS will contact Andrea Leslie and Erin Davis in Q1-2023 to discuss this effort.

Please let me know if you have any questions or if I can provide any additional information.

Sincerely,

Raymond Holz
Operations Manager
Restoration Systems, LLC

Attachment – Remedial Planting Plan Figure



RESTORATION SYSTEMS | LLC

Prepared for:

NC DEQ
Division of Enviromental Quality

Division of Mitigation Services

Project:

LAUREL SPRINGS MITIGATION SITE

Avery County, NC

Title:

2022/2023 REMEDIAL PLANTING PLAN

2018 NC One Map Imagery

Drawn by: RJH

Date: NOV. 2022

Scale: 1:2,200

Project No.: DMS ID: 100122

FIGURE

A

N

Ray Holz

From: Isenhour, Kimberly T CIV USARMY CESAW (USA) <Kimberly.D.Browning@usace.army.mil>
Sent: Friday, December 09, 2022 10:08 AM
To: Ray Holz
Cc: Wiesner, Paul; Haywood, Casey M CIV USARMY CESAW (USA)
Subject: RE: Request for Additional Information/ NCDMS Laurel Springs Mitigation Site As-Built/ SAW-2019-00835/ Avery County

Follow Up Flag: Follow up
Flag Status: Completed

Hi Ray,
Thanks for the follow-up. In general, the IRT does not have any concerns with the Remedial Planting Plan or counting the bare root species towards success. WRC and DWR request that you contact them if you plan to supplement understory/shrub species next year. They would like to encourage diversity out there. Andrea Leslie did mention that American Hazelnut is not a typical riparian species and is often found on hillslopes. This species may not do well in the riparian zone. She would recommend Witch Hazel as an alternative. She also noted that Red Spruce is very elevation specific and survives in elevations in excess of 4,000 feet.
Thanks,
Kim

Kim Isenhour
Mitigation Project Manager, Regulatory Division I U.S. Army Corps of Engineers l 919.946.5107

-----Original Message-----
From: Ray Holz <rholz@restorationsystems.com>
Sent: Wednesday, November 30, 2022 4:26 PM
To: Isenhour, Kimberly T CIV USARMY CESAW (USA) <Kimberly.D.Browning@usace.army.mil>; Wiesner, Paul <paul.wiesner@ncdenr.gov>
Cc: Tugwell, Todd J CIV USARMY CESAW (USA) <Todd.J.Tugwell@usace.army.mil>; Haywood, Casey M CIV USARMY CESAW (USA) <Casey.M.Haywood@usace.army.mil>; 'erin.davis@ncdenr.gov' <erin.davis@ncdenr.gov>; bowers.todd@epa.gov; Youngman, Holland J <holland_youngman@fws.gov>; 'travis.wilson@ncwildlife.org' <travis.wilson@ncwildlife.org>; andrea.leslie@ncwildlife.org; Melonie Allen <melonie.allen@ncdenr.gov>; Crumbley, Tyler A CIV USARMY CESAW (USA) <Tyler.A.Crumbley2@usace.army.mil>; John Hamby <jhamby@restorationsystems.com>
Subject: [URL Verdict: Neutral][Non-DoD Source] RE: Request for Additional Information/ NCDMS Laurel Springs Mitigation Site As-Built/ SAW-2019-00835/ Avery County

To Kim and IRT Members -

Firstly, my personal and sincere apologies for the lack of QA/QC on not only the Laurel Springs As-Built/MY0 Baseline Report but also for the failure to appropriately updated all portions of the Mitigation Plan and with our ordering of non-approved bare-root species and quantities. I wholeheartedly believe the IRT's mitigation plan review and comment process results in a superior product, and it is never our intent to dismiss or disregard IRT's comments.

In this case, within the final/approved Mitigation Plan, RS failed to update the planting plan on Sheet L5.00 of the Construction Drawings; however, RS did apply the IRT's comments regarding the planting plan to Table 18 of the Mitigation Plan, which led to the discrepancy between the two.

During the bare-root tree ordering process, when species availability became an issue, RS staff charged with ordering trees did not notice or review the IRT's draft Mitigation Plan comments concerning the planting plan. Specifically, the IRT's request to cap the amount of Eastern hemlock planted. This mistake and the ordering of non-approved species caused us to review our bare-root tree ordering process in detail. We have established additional QA/QC measures as a result, which include:

1.) a full review of the IRT's mitigation plan comments while ordering trees by both personnel charged with ordering trees and the project manager, and

2.) if non-approved substitution species are required, or quantities of species change drastically due to a lack of availability, coordination with the IRT will occur immediately.

With that said, I have attached, as a single .pdf, the following items:

1. Response to IRT comments which includes revised MY0 Report and Recorded Drawing pages
2. A revised Mitigation Plan Amendment Request to count bare-root substitution species towards success criteria, and
3. A Remedial planting plan for areas of observed low-stem density within the Site's Acidic Cove Forest vegetation community

After discussing with Paul Wisner at DMS, we believe it would be best to allow the IRT to review the attached information and provide comments before updating the MY0 Report and re-posting the document.

If there are any items you wish to discuss with me directly, please feel free to email or call me at 919-604-9314.

Thank you for your time and patience.

Sincerely,

Raymond H.

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Raymond J. Holz | Restoration Systems, LLC

1101 Haynes St. Suite 211 | Raleigh, NC 27604