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January 10, 2024

Danielle Mir
NC DEQ Division of Mitigation Services
217 West Jones Street
Raleigh, NC 27604

RE: Cowford, Project ID #100095, DMS Contract #0007746

Listed below are comments provided by DMS on January 10, 2024 regarding the Cowford Site: Year 2 Monitoring Report and RES' responses.

Comments:

Report & Field Visit

1. Table 1 - Please correct the Project Credits under Re-establishment should be listed as "riparian wetland" not as "non-riparian".
Table 1 has been updated.

Digital Comments

2. Please correct the wetland data adjacent to the stream reach, listed as non-riparian instead of riparian.
Table 1 has been updated.

Year 2 Monitoring Report

FINAL

COWFORD PROJECT

NCDMS Project #100095 (Contract #0007746)
USACE Action ID: SAW-2019-00487
DWR Project #2019-0495

Onslow County, North Carolina
White Oak River Basin
HUC 03030001

Provided by:

Resource Environmental Solutions, LLC
for Environmental Banc & Exchange, LLC

Provided for:
NC Department of Environmental Quality
Division of Mitigation Services

January 2024

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1.0 Project Summary

1.1 Project Location and Description

The Cowford Project (Project) is located within a rural watershed in Onslow County, North Carolina approximately three and half miles northwest of Richlands, North Carolina. The Project lies within the White Oak River Basin, North Carolina United States Geological Survey (USGS) 8-digit Cataloguing Unit 03030001 and 14-digit hydrologic unit code (HUC) 03030001010010, a Targeted Local Watershed (TLW) and the Division of Water Resources (NCDWR) sub-basin 03-05-02 (**Figure 1**). The Project provides 3,337 linear feet (LF) of stream as well as re-establish 2.991 acres of wetland that will provide water quality benefit for 238 acres of drainage area.

The Project area is comprised of a 17.20-acre easement involving one unnamed tributary within an entrenched channel between agricultural fields, totaling 2,988 existing LF, that drains into Cowford Branch, which eventually drains to the New River. The Project is accessible from U.S. route NC-258. Coordinates for the Project areas are approximately 34.9233, -77.5917, at the crossing in the middle of the project.

1.2 Project Goals and Objectives

Through the comprehensive analysis of the Project's maximum functional uplift using the Stream Functions Pyramid Framework and conclusions based on a Site Hydric Soils Detailed Study, the Project will realize specific, attainable goals and objectives. These goals clearly address the degraded water quality and nutrient input from agricultural practices that were identified as major watershed stressors in the 2010 White Oak RBRP. The Project will address outlined RBRP Goal one and two of the TLW specific goals (listed in **Section 2**).

The Project goals are:

- Re-establish hydrology to a historical stream/wetland complex that has been impacted by historic channel realignment, channel entrenchment, field ditching, and field drain tiling;
- To transport water in a stable, non-erosive manner and maintain a stable water table in riparian floodplain wetlands that will also contribute to stream baseflow;
- Improve flood flow attenuation on site and downstream by allowing for overbank flows and connection to the floodplain;
- Create diverse bedforms and stable channels that achieve healthy dynamic equilibrium and provide suitable in-stream habitat for aquatic organisms;
- Limit sediment and nutrient inputs into stream system;
- Re-establish wetland;
- Restore native wetland and riparian vegetation;
- Indirectly support the goals of the 2010 White Oak RBRP to improve water quality and to reduce sediment and nutrient loads; and
- To support the life histories of aquatic and riparian plants and animals through stream restoration activities.

Functional uplift, benefits, and improvements within the Project area, as based on the Function Based Framework are outlined in the table below.

Functional Benefits and Improvements Table.

Level	Function	Goal	Objective	Measurement Method
1	***Hydrology°*** *Transport of water from the watershed to the channel*	to transport water from the watershed to the channel in a non-erosive manner and maintain a stable water table in the riparian wetland	Convert the land-use of streams and their watersheds from cropland into riparian forest Maintain appropriate hydroperiod for Muckalee soil series	Percent Project drainage area converted to riparian forest (indirect measurement) Groundwater wells
2	***Hydraulic*** *Transport of water in the channel, on the floodplain, and through the sediments*	to transport water in a stable non-erosive manner	Improve flood bank connectivity by reducing bank height ratios and increasing entrenchment ratios Maintain regular, seasonal flow in restored, intermittent streams	Cross sections Stage Recorders Bank Height Ratio Entrenchment Ratio Flow gauge
3	**Geomorphology** *Transport of wood and sediment to create diverse bedforms and dynamic equilibrium*	to create a diverse bedform and a stable channel that achieves healthy dynamic equilibrium and provides suitable habitat for life	Limit erosion rates and increase channel stability to reference reach conditions Improve bedform diversity (pool spacing, percent riffles, etc.) Increase buffer width to at least 50 feet	As-built stream profile Cross sections Visual monitoring Vegetation plots
4	**Physicochemical °** *Temperature and oxygen regulation; processing of organic matter and nutrients*	Indirectly support the goals of the 2010 White Oak RBRP to achieve appropriate levels for water temperature, dissolved oxygen concentration, and other important nutrients including but not limited to Nitrogen and Phosphorus through buffer/wetland planting and wetland hydrologic restoration	Establish native hardwood riparian buffer to provide canopy shade and absorb nutrients Install in-stream structures to created aeration zones Promote sediment filtration, nutrient cycling, and organic accumulation through natural wetland biogeochemical processes	

5	**<u>Biology</u> °** *Biodiversity and life histories of aquatic life histories and riparian life*	to achieve functionality in levels 1-4 to support the life histories of aquatic and riparian plants and animals through instream	Improve aquatic habitat by installing habitat features, constructing pools of varying depths, and planting the riparian buffer and wetlands

° These are benefits that are presumed and will not be measured by the monitoring

1.3 Project Success Criteria

The success criteria for the Project will follow the 2016 USACE Wilmington District Stream and Wetland Compensatory Mitigation Update, the Cowford Site Final Mitigation Plan, and subsequent agency guidance. Specific success criteria components are presented below. Cross section and vegetation plot monitoring takes place in Years 0, 1, 2, 3, 5, and 7. Hydrology and visual monitoring takes place annually. Specific success criteria components are presented below.

<u>Stream Restoration Success Criteria</u>

Four bankfull flow events must be documented within the seven-year monitoring period. The bankfull events must occur in separate years. Otherwise, the stream monitoring will continue until four bankfull events have been documented in separate years.

There should be minor change in as-built cross sections. If changes do take place, they should be evaluated to determine if they represent a movement toward a less stable condition (for example downcutting or erosion) or are minor changes that represent an increase in stability (for example settling, vegetative changes, deposition along the banks, or decrease in width/depth ratio). Cross sections shall be classified using the Rosgen stream classification method, and all monitored cross sections should fall within the quantitative parameters defined for channels of the design stream type. Bank height ratio shall not exceed 1.2, and the entrenchment ratio shall be above 2.2 within restored riffle cross sections (for C and E streams).

Digital images are used to subjectively evaluate channel aggradation or degradation, bank erosion, success of riparian vegetation, and effectiveness of erosion control measures. Longitudinal images should not indicate the absence of developing bars within the channel or an excessive increase in channel depth. Lateral images should not indicate excessive erosion or continuing degradation of the banks over time. A series of images over time should indicate successional maturation of riparian vegetation.

Stream restoration reaches will be monitored to document intermittent or seasonal surface flow. This will be accomplished through direct observation and the use of hydraulic pressure transducers with data loggers. Reaches must demonstrate a minimum of 30 consecutive days of flow. One flow gauge was installed on KJ1-A and one stage recorder was installed on KJ1-C.

Headwater Stream Restoration Success Criteria

Continuous surface water flow must be documented every year for at least 30 days. Channel formation must be documented through consistent indicators. Monitoring years 1-4 require evidence of scour, sediment deposition, sediment sorting, multiple observed flow events, destruction of terrestrial vegetation, presence of litter and debris, wracking, vegetation matted down or bet, and leaf litter disturbed. Monitoring years 5-7, the headwater valley reach must meet the previous requirements as well as demonstrate bed and banks, natural line impressed on the bank, shelving, water staining, change in plant community and changes in character of soil.

Wetland Hydrology Success Criteria

The Natural Resources Conservation Service (NRCS) has a current WETs table (1990-2019) for Onslow County upon which to base a normal rainfall amount and average growing season. The closest comparable data station was determined to be the WETS station for New River MCAF, NC. The growing season for Onslow County is 269 days long, extending from March 10 to December 4, and is based on a daily minimum temperature greater than 28 degrees Fahrenheit occurring in five of ten years.

Based upon field observation across the site the NRCS mapping units show a good correlation to actual site conditions in areas of the site. Mitigation guidance for soils in the Coastal Plain suggests a hydroperiod for the Muckalee soil of 12-16 percent of the growing season. The hydrology success criterion for the Site is to restore the water table so that it will remain continuously within 12 inches of the soil surface for 12-16 percent of the growing season (approximately 33 days) at each groundwater gauge location. Due to the extensive drainage efforts, it may take at least a year for the site to become completely saturated and reach the target hydroperiods.

Vegetation Success Criteria

Specific and measurable success criteria for plant density within the riparian buffers on the Project will follow IRT Guidance. The interim measures of vegetative success for the Project will be the survival of at least 320 planted three-year old trees per acre at the end of Year 3, 260 five-year old trees at seven feet in height at the end of Year 5, and the final vegetative success criteria will be 210 trees per acre with an average height of ten feet at the end of Year 7. Volunteer trees that are listed on the approved planting list will be counted, identified to species, and included in the yearly monitoring reports, and if established for two or more years, may be counted towards the success criteria of total planted stems. Moreover, any single species can only account for up to 50 percent of the required number of stems within any vegetation plot. Any stems more than 50 percent will be shown in the monitoring table but will not be used to demonstrate success.

1.4 Project Components

The streams and wetlands provided for restoration have been significantly impacted by ditching, drain tiling, and other agricultural practices for over 50 years. Provided improvements to the Project will help address impacts specifically discussed as priorities in in the 2010 White Oak River Basin Restoration Priorities (RBRP).

Through stream restoration, headwater valley (HWV) restoration, and wetland restoration, the Project presents 3,347 LF of provided stream, generating 3,538.67 Warm Stream Mitigation Units (SMU) and 2.991 acres of provided wetland, generating 2.991 Wetland Mitigation Units (WMU).

Cowford Project Components Summary (Mitigation Plan)

Stream Mitigation			
Mitigation Approach	**Linear Feet**	**Ratio**	**Warm SMU**
Restoration (HWV)	923	1:1	913.000*
Restoration	2,424	1:1	2,424.000
Total	**3,347**		**3,337**
Non-standard Buffer Width Adjustment			**201.670**
Total Adjusted SMU's			**3,538.67**
Wetland Mitigation			
Mitigation Approach	**Area (acres)**	**Ratio**	**WMU**
Re-establishment	2.991	1:1	2.991
Total	**2.991**		**2.991**

**Headwater valley credits are calculated from valley length, not included in NSBW calculations.*

*** Credit adjustment for Non-standard Buffer Width calculation using the Wilmington District Stream Buffer Credit Calculator issued by the USACE in January 2021. See Section 6.6 for further information*

1.5 Stream and Wetland Design/Approach

Streams

The Project includes stream and headwater valley restoration. Stream restoration will incorporate the design of a single-thread, meandering channel, with parameters based on data taken from reference site, published empirical relationships, regional curves developed from existing project streams, and NC Regional Curves. Analytical design techniques will also be a crucial element of the project and will be used to determine the design discharge and to verify the design. Based on soil type, valley slope, and drainage area headwater valley restoration was incorporated in the design. Headwater valley restoration includes the design of a vegetated diffuse flow system that will allow for the passive development of a headwater stream.

The Project has been broken into the following design reaches:

Reach KJ1-A (HWV)

A headwater valley restoration approach is provided for this reach to address historic ditching and buffer impacts. Restoration activities includes:

- Grading a headwater valley,
- Installing wood structures to provide grade control and habitat,
- Installing live stakes to stabilize the bed and banks,
- Riparian planting.

Reach KJ1-B

An offline restoration approach is provided for this reach to address historic ditching and buffer impacts. Restoration activities includes:

- Grading a new, single-thread channel in the existing floodplain (Priority I Restoration),
- Installing log structures to provide grade control and habitat,
- Establishing a riffle-pool sequence throughout the new channel,
- Installing toe protection on meander bends,
- Installing live stakes to stabilize the banks and provide channel shading,
- Filling and grading the existing channel to create wetland habitat,
- Riparian planting.

Reach KJ1-C

An inline, P2 restoration approach is provided for this reach to address historic ditching, channelization, and buffer impacts. Restoration activities includes:

- Grading a new, single-thread channel in an excavated floodplain,
- Installing rock and log structures to provide grade control and habitat,
- Establishing a riffle-pool sequence throughout the new channel,
- Installing toe protection on meander bends,
- Installing live stakes to stabilize the banks and provide channel shading,
- Filling the existing channel,
- Riparian planting, and
- Invasive vegetation treatment.

Wetlands

The Cowford Project offers a total ecosystem restoration opportunity. As such, the wetland restoration is closely tied to the stream restoration and drain tile interruption. The Project provides 2.991 WMUs through wetland re-establishment. Wetland re-establishment is only provided in areas that have been determined appropriate for wetland restoration by a licensed soil scientist due to the presence of hydric soils and potential hydrology. Re-establishment activities includes a successful restoration that raises the local groundwater elevation, allows frequent flooding, the plugging of ditches, removing all drain tiles within the easement, and creating shallow depression features in the wetland.

A 2D model of the provided stream restoration was run in HEC-RAS to evaluate the effectiveness of the design at increasing wetland flooding. Inundation maps from this model of the 1- and 10-year design storms demonstrate that the provided design will function in this capacity. These activities help to raise the local groundwater and have a more natural hydrologic cycle in the riparian zone. Surface roughening through shallow soil ripping improves infiltration and slow

runoff through the floodplain. Surface roughening also creates microtopography and shallow depressional areas, re-establishing more natural conditions and establishing habitat diversity. Historic land-use impacts will be addressed through the planting of a native hardwood wetland community.

1.6 Construction and As-Built Conditions

Site construction was completed on July 30th, 2021, and planting was completed on March 8th, 2022. The Cowford Site was built to design plans and guidelines, as-built stream and wetland areas were only slightly different than proposed. Wetland Depressions were designed to be 0.3-0.5 feet deep but As-Built Wetland Depressions were found to be slightly deeper than proposed ranging from 0.5-1.0 feet deep. During construction additional drain tiles were found, which were then interrupted at the easement boundary. Additionally, extra t-posts were installed around the boundary of the easement in 100-foot intervals to reduce concerns of encroachment by farming practices. Minor monitoring device location changes were made during as-built installation, however, the quantities remained as proposed in the Mitigation Plan.

1.7 Year 2 Monitoring Performance (MY2)

The Cowford Year 2 monitoring activities were performed in June and November 2023. All Year 2 Monitoring data is present below and in the appendices. The Site is on track to meeting vegetation and stream interim success criteria. The wetland hydroperiods are below success criteria but are improving.

Vegetation

Monitoring of the nine permanent vegetation plots and five random vegetation plots were completed on November 2nd, 2023. Vegetation data are in **Appendix C**, associated photos are in **Appendix B,** and plot locations are in **Appendix B**. MY2 monitoring data indicates that all plots are exceeding the interim success criteria of 320 planted stems per acre. Planted stem densities ranged from 405 to 931 planted stems per acre with a mean of 636 planted stems per acre across all plots. A total of 13 species were documented within the plots. Volunteer species were noted in four out of nine plots during Year 2 monitoring and are expected to increase in upcoming years. The average stem height in the vegetation plots was 3.4 feet. Visual assessment of vegetation outside of the monitoring plots indicates that the herbaceous vegetation is becoming well established throughout the project. No invasives were present during MY2 site visits.

Stream Geomorphology

Cross section geomorphology data collection for MY2 was collected on June 7th, 2023. Summary tables and cross section plots are in **Appendix D**. Overall the baseline cross sections and profile relatively match the proposed design. The MY2 conditions show that shear stress and velocities have been reduced for all restoration/enhancement reaches.

Visual assessment of the stream channel was performed to document signs of instability, such as eroding banks, structural instability, or excessive sedimentation. The channel is transporting sediment as designed and will continue to be monitored for aggradation and degradation.

Stream Hydrology

One stage recorder on KJ1-C, was installed on January 19th, 2022. One flow gauge, on KJ1-A, was installed on January 19th, 2022. The stage recorder is in place to document bankfull events, while the flow gauge is in place to track frequency and duration of stream flow events. The stage recorder on KJ1-C measured 10 bankfull events with the highest being 1.74 feet above the top of bank. The flow gauge on KJ1-A (HWV reach) measured 8 flow events with the longest flow event lasting 129 days. Gauge locations can be found on **Figure 2** and photos are in **Appendix B**.

Wetland Hydrology

A total of five groundwater wells with automatic recording pressure transducers were installed throughout the wetland areas on November 2nd, 2021, and April 28th, 2022. All five groundwater wells failed to meet success of 12-16 percent of the growing season (GW1 2%, GW2 2%, GW3 6%, GW4 5%, and GW5 5%) **Appendix E**. It is important to note that GW5 is located outside of the wetland crediting area. Although all five groundwater wells did not meet success again in MY2, it was noted that due to historic draining efforts it may take more than a year for the site to become completely saturated and reach the target hydroperiods. Onslow county has experienced abnormally dry and moderate drought conditions in 2022 and 2023 (**Appendix E**). Rainfall amounts in December (2022), March, April, and October were below normal limits which could have attributed to lower hydroperiods. RES expects the hydroperiods to increase in subsequent years as the wetlands continue to establish. In addition, RES plans to install supplemental groundwater wells throughout the wetland crediting area to capture a more accurate representation of the wetland hydroperiod. These wells will be installed in the upcoming dormant season. RES has provided additional full calendar year hydroperiod data in **Appendix E**. Full calendar year hydroperiods are as follows: GW1 2%, GW2 2%, GW3 12%, GW4 9%, GW5 9%.

Headwater Valley

Setup of cross sections 1, 2, and 3 in the headwater valley took place on January 19th, 2022. Overall, the baseline cross sections and profile relatively match the proposed design. The flow gauge located in the headwater valley measured 160 consecutive flow days. The live stakes are becoming established within the channel and will provide opportunities for flow paths to develop in subsequent years. Additional headwater valley channel performance criteria are listed in **Appendix D**. Digital images can be found in **Appendix B**. Visual assessments and updated images will be documented in years to follow as indicators are established.

Visual Assessment

Digital images will be used to subjectively evaluate channel aggradation or degradation, bank erosion, success of riparian vegetation, and effectiveness of erosion control measures. All easement boundaries were inspected, and no major signs of encroachment were noted in MY2. Digital images will also capture the headwater valley and culverts of the site, located in **Appendix B**.

2.0 Methods

Stream monitoring was conducted using a Topcon GTS-312 Total Station. Three-dimensional coordinates associated with cross-section data were collected in the field (NAD83 State Plane feet FIPS 3200). Morphological data were collected at 15 cross-sections. Survey data were imported into CAD, ArcGIS®, and Microsoft Excel® for data processing and analysis. The stage recorders include an automatic pressure transducer placed in PVC casing in a pool. The elevation of the bed and top of bank at each stage recorder are used to detect bankfull events.

Vegetation success is being monitored at nine permanent vegetation plots and five random vegetation plots. Vegetation plot monitoring follows the CVS-EEP Level 2 Protocol for Recording Vegetation, version 4.2 (Lee et al. 2008) and includes analysis of species composition and density of planted species. Data are processed using the CVS data entry tool. In the field, the four corners of each plot were permanently marked with PVC at the origin and metal conduit at the other corners. Photos of each plot are to be taken from the origin each monitoring year. The random plots are to be collected in locations where there are no permanent vegetation plots. Random plots are collected in the form of 100 square meter belt transects with variable dimensions. Tree species and height will be recorded for each planted stem and the transects will be mapped and new locations will be monitored in subsequent years.

Wetland hydrology is monitored to document success in wetland restoration areas where hydrology was affected. This is accomplished with three automatic pressure transducer gauges (located in groundwater wells) that record daily groundwater levels. Three have been installed within the wetland restoration crediting area and one within the adjacent upland area to document the wetland boundary. One automatic pressure transducer is installed above ground for use as a barometric reference. Gauges are downloaded quarterly and wetland hydroperiods are calculated during the growing season. Gauge installation followed current regulatory guidance. Visual observations of primary and secondary wetland hydrology indicators are also recorded during quarterly site visits.

3.0 References

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for Recording Vegetation Level. Version 4.2

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Schafale, M.P. 2012. Classification of the Natural Communities of North Carolina, Third Approximation. North Carolina Natural Heritage Program, Division of Parks, and Recreation, NCDENR, Raleigh, NC.

USACE. (2016). Wilmington District Stream and Wetland Compensatory Mitigation Update. NC: Interagency Review Team (IRT).

Appendix A

Background Tables

Table 1. Cowford (100095) - Mitigation Assets and Components

Project Segment	Existing Footage or Acreage	Mitigation Plan Footage or Acreage	Mitigation Category	Restoration Level	Priority Level	Mitigation Ratio (X:1)	Mitigation Plan Credits		As-Built Footage or Acreage	Comments
KJ1-A*	923	913	Warm	Restoration	HWV	1.00000	913.000		935	Headwater valley restoration, riparian planting
KJ1-B	647	852	Warm	Restoration	P1	1.00000	852.000		852	Channel restoration, riparian planting
KJ1-C	1,428	1,572	Warm	Restoration	P2	1.00000	1572.000		1,574	Channel restoration, riparian planting
WA	0	2.991	RR	Re-establishment		1.00000	2.991		2.969	Stream restoration, drain tile interruption, native planting

*Headwater valley credits are calculated from valley length, not included in NSBW calculations.

Project Credits

Restoration Level	Stream			Riparian Wetland	Non-Rip Wetland	Coastal Marsh
	Warm	Cool	Cold			
Restoration	**3337.000**					
Re-establishment				**2.991**		
Rehabilitation						
Enhancement						
Enhancement I						
Enhancement II						
Creation						
Preservation						
NSBW Adjustment	**201.670**					
Total	**3538.670**			**2.991**		

Table 2. Project Activity and Reporting History
Cowford Mitigation Site

Elapsed Time Since grading complete: 2 years 4 months
Elapsed Time Since planting complete: 1 year 8 months
Number of reporting Years[1]: 2

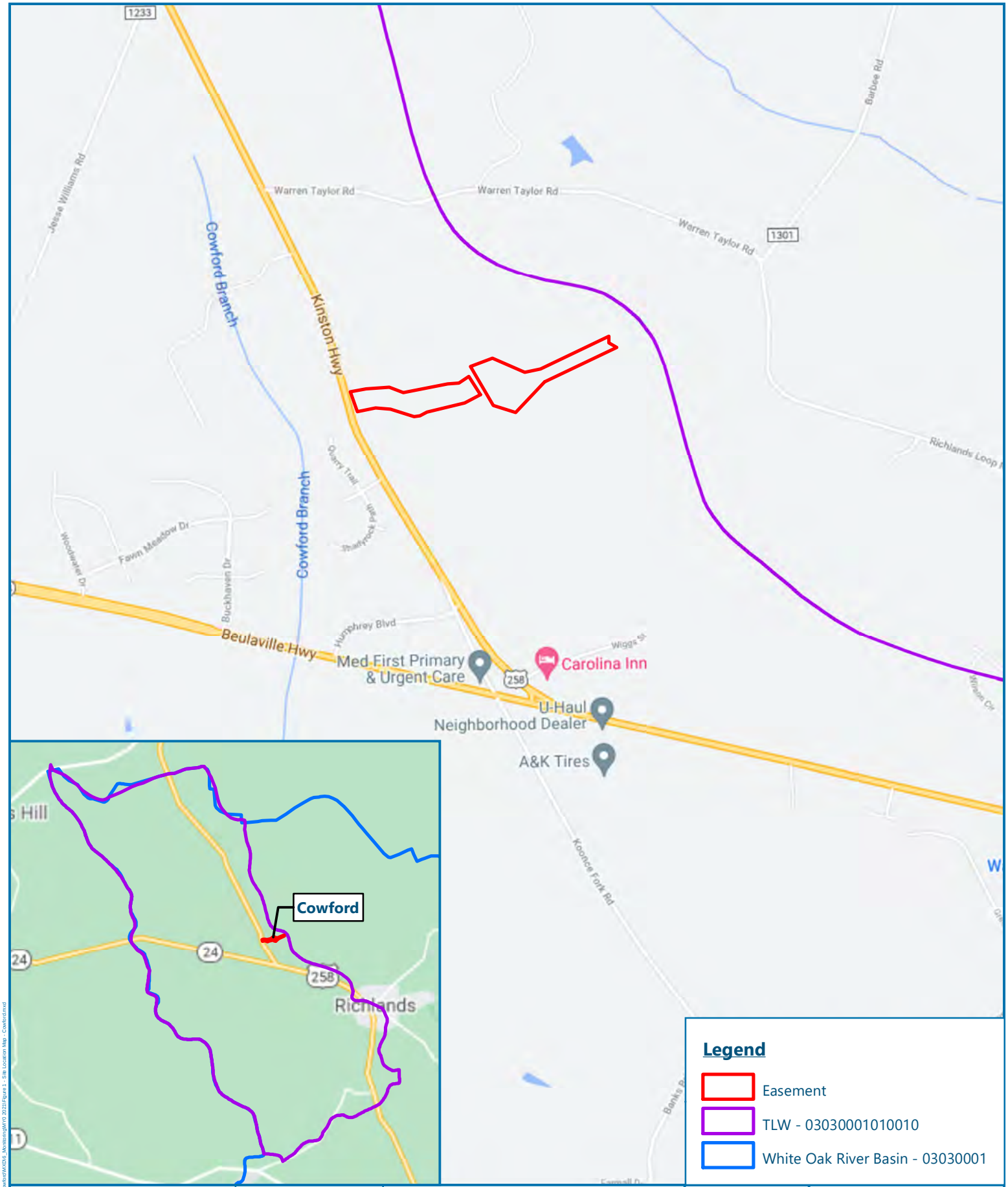
Activity or Deliverable	Data Collection Complete	Completion or Delivery
Restoration Plan	NA	26-Mar-21
Final Design – Construction Plans	NA	03-May-21
Stream Construction	NA	30-Jul-21
Site Planting	NA	08-Mar-22
Invasive Treatment	NA	21-Nov-22
As-built (Year 0 Monitoring – baseline)	Jan/March 2022	Apr-22
Supplemental Planting	NA	Apr-22
Year 1 Monitoring	Nov-22	Dec-22
Year 2 Monitoring	XS:Jun-23 VP:Nov-23	Nov-23
Year 3 Monitoring		
Year 4 Monitoring		
Year 5 Monitoring		
Year 6 Monitoring		
Year 7 Monitoring		

1 = The number of reports or data points produced excluding the baseline

Table 3. Project Contacts Table Cowford Mitigation Site	
Designer	RES / 3600 Glenwood Ave., Suite 100, Raleigh, NC 27612
Primary project design POC	Benton Carroll, PE
Construction Contractor	RES / 3600 Glenwood Ave., Suite 100, Raleigh, NC 27612
Construction POC	Andrew Dimmette
Survey Contractor	RES / 3600 Glenwood Ave., Suite 100, Raleigh, NC 27612
Survey POC	Brian Hockett
Planting Contractor	Shenandoah Habitats
Planting contractor POC	David Coleman
Monitoring Performers	RES / 3600 Glenwood Ave, Suite 100, Raleigh, NC 27612
Monitoring POC	Heath Hidlay (717& 543-7711)

Table 4. Project Background Information				
Project Name		Cowford Project		
County		Onslow		
Project Area (acres)		17.20		
Project Coordinates (latitude and longitude)		34.92293, -77.5917		
Planted Acreage (Acres of Woody Stems Planted)		16.35		
Project Watershed Summary Information				
Level IV Ecoregion		63h - Carolina Flatwoods		
River Basin		White Oak		
USGS Hydrologic Unit 8-digit	3020302	USGS Hydrologic Unit 14-digit	30203020102	
DWR Sub-basin		03-05-02		
Project Drainage Area (Acres and Square Miles)		238 ac (.37 sqmi)		
Project Drainage Area Percentage of Impervious Area		<1%		
Reach Summary Information				
Parameters		**Reach KJ1-A**	**Reach KJ1-B**	**Reach KJ1-C**
Length of reach (linear feet)		935	852	1574
Valley confinement (Confined, moderately confined, unconfined)		Unconfined	Unconfined	Moderately confined
Drainage area (Acres and Square Miles)		115	181	238
Perennial, Intermittent, Ephemeral		Intermittent	Intermittent	Intermittent
NCDWR Water Quality Classification		None	None	None
Stream Classification (existing)		G5	G5	G5 to E5
Stream Classification (proposed)		N/A	E5 / C5	E4 / C4
Evolutionary trend (Simon)		III	III	III-IV
FEMA classification		Zone X (Minimal Risk)	Zone X (Minimal Risk)	Zone X (Minimal Risk)

Wetland Summary Information	
Parameters	**WA**
Size of Wetland (acres)	2.969
Wetland Type	RR
Mapped Soil Series	Muckalee loam
Drainage Class	Poorly
Soil Hydric Status	Yes (LESS)
Source of Hydrology	GW, OL, SF
Restoration or enhancement method	H, V



Document Path: R:\Respiclerigis\Projects\100900_Cowford\MXD\6_Monitoring\MY0 2021\Figure 1 - Site Location Map - Cowford.mxd

Appendix B

Visual Assessment Data

res

N
W E
S

0 125 250
Feet

Figure 2

Current Conditions
Plan View

MY2 2023

Cowford
Mitigation Project

Onslow County, NC

Date: 11/21/2023	Drawn by: HKH
Lat: 35.671107	Long: -82.669235

LEGEND

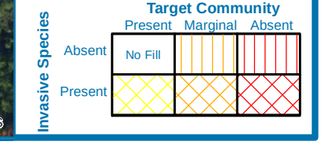
- Easement - 17.20 Acres
- Wetland Re-establishment
- Existing Ag Ditch
- Engineered Sediment Pack
- Drain Tile Outlet
- Flow Gauge
- Stage Recorder

MY2 Well Success

- <5%
- 5-12%

- Fixed Plot
- Random Vegetation Plots MY2
- Random Veg Plots MY1
- Cross Sections
- MY0 Random Veg Plot
- Wetland Depressions
- Photo Point
- Stream Restoration
- HWV Restoration
- Structures
- Top of Bank

Vegetation Condition Assessment



Visual Stream Stability Assessment

Reach JK1-A

Assessed Stream Length 925

Assessed Bank Length 1850

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)	3	3		100%

Visual Stream Stability Assessment

Reach JK1-B

Assessed Stream Length 850

Assessed Bank Length 1700

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.	7	7		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%

Visual Stream Stability Assessment

Reach JK1-C

Assessed Stream Length 1572

Assessed Bank Length 3144

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.	17	17		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)	28	28		100%

Table 6 Vegetation Condition Assessment

Planted Acreage[1] **16.4**

Vegetation Category	Definitions	Mapping Threshold	CCPV Depiction	Number of Polygons	Combined Acreage	% of Planted Acreage
1. Bare Areas	Very limited cover of both woody and herbaceous material.	0.1 acres	Red Simple Hatch	0	0.00	0.0%
2. Low Stem Density Areas	Woody stem densities clearly below target levels based on MY3, 4, or 5 stem count criteria.	0.1 acres	Orange Simple Hatch	0	0.00	0.0%
			Total			0.0%
3. Areas of Poor Growth Rates or Vigor	Areas with woody stems of a size class that are obviously small given the monitoring year.	0.25 acres	Orange Simple Hatch	0	0.00	0.0%
			Cumulative Total			0.0%

Easement Acreage[2] **17.2**

Vegetation Category	Definitions	Mapping Threshold	CCPV Depiction	Number of Polygons	Combined Acreage	% of Easement Acreage
4. Invasive Areas of Concern[4]	Areas or points (if too small to render as polygons at map scale).	1000 SF	Yellow Crosshatch	0	0.00	0.0%
5. Easement Encroachment Areas[3]	Areas or points (if too small to render as polygons at map scale).	none	Red Simple Hatch	0	0.00	0.0%

1 = Enter the planted acreage within the easement. This number is calculated as the easement acreage minus any existing mature tree stands that were not subject to supplemental planting of the understory, the channel acreage, crossings or any other elements not directly planted as part of the project effort.

2 = The acreage within the easement boundaries.

3 = Encroachment may occur within or outside of planted areas and will therefore be calculated against the overall easement acreage. In the event a polygon is cataloged into items 1, 2 or 3 in the table and is the result of encroachment, the associated acreage should be tallied in the relevant item (i.e., item 1,2 or 3) as well as a parallel tally in item 5.

4 = Invasives may occur in or out of planted areas, but still within the easement and will therefore be calculated against the overall easement acreage. Invasives of concern/interest are listed below. The list of high concern spcies are those with the potential to directly outcompete native, young, woody stems in the short-term (e.g. monitoring period or shortly thereafter) or affect the community structure for existing, more established tree/shrub stands over timeframes that are slightly longer (e.g. 1-2 decades). The low/moderate concern group are those species that generally do not have this capacity over the timeframes discussed and therefore are not expected to be mapped with regularity, but can be mapped, if in the judgement of the observer their coverage, density or distribution is suppressing the viability, density, or growth of planted woody stems. Decisions as to whether remediation will be needed are based on the integration of risk factors by EEP such as species present, their coverage, distribution relative to native biomass, and the practicality of treatment. For example, even modest amounts of Kudzu or Japanese Knotweed early in the projects history will warrant control, but potentially large coverages of Microstegium in the herb layer will not likley trigger control because of the limited capacities to impact tree/shrub layers within the timeframes discussed and the potential impacts of treating extensive amounts of ground cover. Those species with the "watch list" designator in gray shade are of interest as well, but have yet to be observed across the state with any frequency. Those in *red italics* are of particular interest given their extreme risk/threat level for mapping as points where isolated specimens are found, particularly ealry in a projects monitoring history. However, areas of discreet, dense patches will of course be mapped as polygons. The symbology scheme below was one that was found to be helpful for symbolzing invasives polygons, particulalry for situations where the conditon for an area is somewhere between isolated specimens and dense, discreet patches. In any case, the point or polygon/area feature can be symbolized to describe things like high or low concern and species can be listed as a map inset, in legend items if the number of species are limited or in the narrative section of the executive summary.

Cowford MY2 Vegetation Monitoring Plot Photos

Vegetation Plot 1 (11/2/2023)

Vegetation Plot 2 (11/2/2023)

Vegetation Plot 3 (11/2/2023)

Vegetation Plot 4 (11/3/2022)

Vegetation Plot 5 (11/2/2023)

Vegetation Plot 6 (11/2/2023)

Vegetation Plot 7 (11/2/2023)

Vegetation Plot 8 (11/2/2023)

Vegetation Plot 9 (11/2/2023)

Cowford MY2 Random Vegetation Monitoring Plot Photo

Random Vegetation Plot 1 (11/2/2023)

Random Vegetation Plot 2 (11/2/2023)

Random Vegetation Plot 3 (11/2/2023)

Random Vegetation Plot 4 (11/2/2023)

Random Vegetation Plot 5 (11/2/2023)

Cowford Monitoring Device Photos MY2 2023

Stage Recorder KJ1-C (6/7/2023)

Flow Gauge KJ1-A (6/7/2023)

Wetland Gauge 1 (11/2/2023)

Wetland Gauge 2 (11/2/2023)

Wetland Gauge 3 (11/2/2023)

Wetland Gauge 4 (11/2/2023)

Wetland Gauge 5 (11/2/2023)

Cowford General Site Photos MY2 2023

Photo Point 1: Culvert at the bottom of KJ1-B (11/2/2023)

Photo Point 2: Culvert at the top of KJ1-C (11/2/2023)

Photo Point 3: Treatment pool at edge of Wetland (6/7/2023)

Photo Point 4: Culvert at Kinston Highway (11/3/2022)

ESP & Treatment Pool (6/7/2023)

Crossing (11/2/2023)

Headwater Valley (6/7/2023)

Appendix C

Vegetation Plot Data

Table 7. Planted Species Summary

Bare Root Planting Tree Species				
Common Name	**Scientific Name**	**Mit Plan %**	**As-Built %**	**Total Stems Planted**
River Birch	*Betula nigra*	15	15	2,000
Buttonbush	*Cephalanthus occidentalis*	15	15	2,000
Bald Cypress	*Taxodium distichum*	10	10	1,300
Water Oak	*Quercus nigra*	10	10	1,300
Willow Oak	*Quercus phellos*	10	10	1,300
Overcup Oak	*Quercus lyrata*	10	10	1,300
Swamp Tupelo	*Nyssa biflora*	10	10	1,300
American sycamore	*Platanus occidentalis*	10	10	1,300
Southern red oak	*Quercus falcata*	5	5	700
Green ash	*Fraxinus pennsylvanica*	5	5	700
			Total	13,200
			Planted Area	16.35
			As-built Planted Stems/Acre	807

Table 8. Vegetation Plot Mitigation Success Summary

Plot #	Planted Stems/Acre	Volunteer Stems/Acre	Total Stems/Acre	Success Criteria Met?	Average Planted Stem Height (ft)
1	931	0	931	Yes	3.0
2	931	81	1012	Yes	4.3
3	688	0	688	Yes	5.3
4	567	0	567	Yes	3.7
5	850	81	931	Yes	2.7
6	607	162	769	Yes	2.2
7	486	0	486	Yes	3.2
8	769	0	769	Yes	2.7
9	607	81	688	Yes	3.2
R1	647	0	647	Yes	2.4
R2	445	0	445	Yes	4.0
R3	405	0	405	Yes	2.8
R4	526	0	526	Yes	3.2
R5	445	0	445	Yes	4.3
Project Avg	**636**	**29**	**665**	**Yes**	**3.4**

Table 9. Stem Count Total and Planted by Plot Species

Cowford			Current Plot Data (MY2 2023)																										
			100043-01-0001			100043-01-0002			100043-01-0003			100043-01-0004			100043-01-0005			100043-01-0006			100043-01-0007			100043-01-0008			100043-01-0009		
Scientific Name	Common Name	Species Type	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T
Betula nigra	river birch	Tree	10	10	10	3	3	3	6	6	6	3	3	3										5	5	5	1	1	1
Cephalanthus occidentali	common buttonbush	Shrub				5	5	5				2	2	2				1	1	1				2	2	2	1	1	1
Fraxinus pennsylvanica	green ash	Tree	2	2	2							2	2	2				1	1	1	1	1	1	4	4	4	1	1	1
Liquidambar styraciflua	sweetgum	Tree						1																					2
Nyssa biflora	swamp tupelo	Tree	5	5	5	1	1	1	1	1	1				3	3	3	2	2	2	4	4	4	1	1	1	4	4	4
Pinus	pine	Tree						1																					
Platanus occidentalis	American sycamore	Tree				2	2	2	2	2	2				5	5	5	2	2	2	4	4	4						
Quercus falcata	southern red oak	Tree	2	2	2	3	3	3	1	1	1				2	2	2	1	1	1				1	1	1			
Quercus lyrata	overcup oak	Tree				1	1	1				6	6	6	7	7	7	3	3	3	1	1	1	2	2	2			
Quercus nigra	water oak	Tree	1	1	1																2	2	2	1	1	1	1	1	1
Quercus phellos	willow oak	Tree	3	3	3	3	3	3	6	6	6				4	4	4	2	2	2				3	3	3	2	2	2
Rhus copallinum	flameleaf sumac	shrub															2			4									
Taxodium distichum	bald cypress	Tree				5	5	5	1	1	1	1	1	1				3	3	3							5	5	5
	Stem count		23	23	23	23	23	25	17	17	17	14	14	14	21	21	23	15	15	19	12	12	12	19	19	19	15	15	17
	size (ares)		1			1			1			1			1			1			1			1			1		
	size (ACRES)		0.02			0.02			0.02			0.02			0.02			0.02			0.02			0.02			0.02		
	Species count		6	6	6	8	8	10	6	6	6	5	5	5	5	5	6	8	8	9	5	5	5	8	8	8	7	7	8
	Stems per ACRE		931	931	931	931	931	1012	688	688	688	567	567	567	850	850	931	607	607	769	486	486	486	769	769	769	607	607	688

Cowford			Current Plot Data (MY2 2023)															Annual Means								
			R1			R2			R3			R4			R5			MY2 (2023)			MY1 (2022)			MY0 (2021)		
Scientific Name	Common Name	Species Type	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T
Betula nigra	river birch	Tree	4	4	4				2	2	2	2	2	2	2	2	2	38	38	38	49	49	49	47	47	47
Cephalanthus occidentali	common buttonbush	Shrub	2	2	2				1	1	1	1	1	1				15	15	15	20	20	20	19	19	19
Fraxinus pennsylvanica	green ash	Tree										1	1	1				12	12	12	16	16	17	13	13	13
Liquidambar styraciflua	sweetgum	Tree																0	0	3						
Nyssa biflora	swamp tupelo	Tree										2	2	2				23	23	23	31	31	31	41	41	41
Pinus	pine	Tree																0	0	1						
Platanus occidentalis	American sycamore	Tree	2	2	2	3	3	3	2	2	2	2	2	2	2	2	2	26	26	26	19	19	19	32	32	32
Quercus falcata	southern red oak	Tree	1	1	1	1	1	1										12	12	12	13	13	13	19	19	19
Quercus lyrata	overcup oak	Tree				6	6	6	1	1	1	3	3	3				30	30	30	22	22	22	14	14	14
Quercus nigra	water oak	Tree																5	5	5	6	6	6	13	13	13
Quercus phellos	willow oak	Tree	4	4	4	1	1	1	3	3	3				1	1	1	32	32	32	33	33	33	33	33	33
Rhus copallinum	flameleaf sumac	shrub																0	0	6						
Taxodium distichum	bald cypress	Tree	3	3	3				1	1	1	2	2	2	6	6	6	27	27	27	19	19	19	28	28	28
	Stem count		16	16	16	11	11	11	10	10	10	13	13	13	11	11	11	220	220	230	228	228	229	259	259	259
	size (ares)		1			1			1			1			1			14			14			14		
	size (ACRES)		0.02			0.02			0.02			0.02			0.02			0.35			0.35			0.35		
	Species count		6	6	6	4	4	4	6	6	6	7	7	7	4	4	4	13	13	13	10	10	10	10	10	10
	Stems per ACRE		648	648	648	445	445	445	405	405	405	526	526	526	445	445	445	636	636	665	659	659	662	749	749	749

Appendix D

Stream Measurement and Geomorphology Data

Table 8. Baseline Stream Data Summary
Cowford Mitigation Site - Reach KJ1-B

Parameter	Gauge[2]	Regional Curve			Pre-Existing Condition						Reference Reach(es) Data						Design			Monitoring Baseline					
Dimension and Substrate - Riffle Only		LL	UL	Eq.	Min	Mean	Med	Max	SD[5]	n	Min	Mean	Med	Max	SD[5]	n	Min	Med	Max	Min	Mean	Med	Max	SD[5]	n
Bankfull Width (ft)		---	---	---	---	---	4.9	---	---	1	---	---	---	---	---	---	---	8.0	---	9.5	10.4	10.4	11.3	1.3	2
Floodprone Width (ft)					---	---	7.3	---	---	1	---	---	---	---	---	---	---	>50	---	48.7	49.0	49.0	49.3	0.4	2
Bankfull Mean Depth (ft)		---	---	---	---	---	0.9	---	---	1	---	---	---	---	---	---	---	0.6	---	0.6	0.7	0.7	0.8	0.1	2
[1]Bankfull Max Depth (ft)					---	---	1.3	---	---	1	---	---	---	---	---	---	---	1.0	---	1.0	1.1	1.1	1.2	0.1	2
Bankfull Cross Sectional Area (ft^2)		---	---	---	---	---	4.5	---	---	1	---	---	---	---	---	---	---	5.0	---	6.4	6.9	6.9	7.3	0.6	2
Width/Depth Ratio					---	---	5.3	---	---	1	---	---	---	---	---	---	---	12.8	---	17.2	17.3	17.3	17.4	0.1	2
Entrenchment Ratio					---	---	1.5	---	---	1	---	---	---	---	---	---	---	>2.2	---	4.3	4.8	4.8	5.2	0.6	2
[1]Bank Height Ratio					---	---	3.9	---	---	1	---	---	---	---	---	---	---	1.0	---	1.0	1.0	1.0	1.0	0.0	2
Profile																									
Riffle Length (ft)					---	---	---	---	---	---	---	---	---	---	---	---	5	---	27	---	---	---	---	---	---
Riffle Slope (ft/ft)					---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Pool Length (ft)					---	---	---	---	---	---	---	---	---	---	---	---	9	---	30	---	---	---	---	---	---
Pool Max depth (ft)					---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Pool Spacing (ft)					---	---	---	---	---	---	---	---	---	---	---	---	20	---	53	---	---	---	---	---	---
Pattern																									
Channel Beltwidth (ft)					---	---	---	---	---	---	---	---	---	---	---	---	4	---	27	4	---	---	27	---	---
Radius of Curvature (ft)					---	---	---	---	---	---	---	---	---	---	---	---	10	---	14	10	---	---	14	---	---
Rc:Bankfull width (ft/ft)					---	---	---	---	---	---	---	---	---	---	---	---	1.3	---	1.8	1.3	---	---	1.8	---	---
Meander Wavelength (ft)					---	---	---	---	---	---	---	---	---	---	---	---	33	---	61	33	---	---	61	---	---
Meander Width Ratio					---	---	---	---	---	---	---	---	---	---	---	---	4.1	---	7.6	4.1	---	---	7.6	---	---
Transport parameters																									
Reach Shear Stress (competency) lb/f^2					---						---						---			---					
Max part size (mm) mobilized at bankfull					---						---						---			---					
Stream Power (transport capacity) W/m^2					---						---						---			---					
Additional Reach Parameters																									
Rosgen Classification					G5						---						E5/C5			E4					
Bankfull Velocity (fps)		---	---	---	---						---						---			---					
Bankfull Discharge (cfs)		---	---	---	---						---						---			---					
Valley length (ft)					680						---						602			601					
Channel Thalweg length (ft)					688						---						852			850					
Sinuosity (ft)					1.01						---						1.42			1.41					
Water Surface Slope (Channel) (ft/ft)					---						---						---			---					
Channel slope (ft/ft)					0.007						---						0.002			0.002					
[3]Bankfull Floodplain Area (acres)					---						---						---			---					
[4]% of Reach with Eroding Banks					---						---														
Channel Stability or Habitat Metric					---						---														
Biological or Other					---						---														

Shaded cells indicate that these will typically not be filled in.

1 = The distributions for these parameters can include information from both the cross-section measurements and the longitudinal profile. 2 = For projects with a proximal USGS gauge in-line with the project reach (added bankfull verification - rare).

3. Utilizing XS measurement data produce an estimate of the bankfull floodplain area in acres, which should be the area from the top of bank to the toe of the terrace riser/slope.

4 = Proportion of reach exhibiting banks that are eroding based on the visual survey for comparison to monitoring data; 5. Of value/needed only if the n exceeds 3

Table 8. Baseline Stream Data Summary
Cowford Mitigation Site - Reach KJ1-C

Parameter	Gauge[2]	Regional Curve			Pre-Existing Condition						Reference Reach(es) Data						Design			Monitoring Baseline					
Dimension and Substrate - Riffle Only		LL	UL	Eq.	Min	Mean	Med	Max	SD[5]	n	Min	Mean	Med	Max	SD[5]	n	Min	Med	Max	Min	Mean	Med	Max	SD[5]	n
Bankfull Width (ft)		---	---	---	6.6	6.7	6.7	6.7	---	2	---	---	---	---	---	---	---	8.0	---	8.6	11.0	9.7	16.1	3.4	4
Floodprone Width (ft)					12.5	13.4	13.4	14.3	---	2	---	---	---	---	---	---	---	>50	---	46.00	47.8	47.9	49.4	1.4	4
Bankfull Mean Depth (ft)		---	---	---	1.0	1.1	1.1	1.2	---	2	---	---	---	---	---	---	---	0.6	---	0.5	0.5	0.5	0.5	0.0	4
[1]Bankfull Max Depth (ft)					1.5	1.6	1.6	1.7	---	2	---	---	---	---	---	---	---	1.0	---	0.8	1	1.1	1.1	0.1	4
Bankfull Cross Sectional Area (ft^2)		---	---	---	6.5	7.4	7.4	8.2	---	2	---	---	---	---	---	---	---	5.0	---	4.5	5.6	5.1	7.8	1.5	4
Width/Depth Ratio					5.4	6.1	6.1	6.8	---	2	---	---	---	---	---	---	---	12.8	---	16.4	21.7	18.7	33.1	7.7	4
Entrenchment Ratio					1.9	2.0	2.0	2.1	---	2	---	---	---	---	---	---	---	>2.2	---	3.1	4.6	4.9	5.3	1.0	4
[1]Bank Height Ratio					1.8	3.0	3.0	4.2	---	2	---	---	---	---	---	---	---	1.0	---	1.00	1.0	1.0	1.0	0.0	4
Profile																									
Riffle Length (ft)					---	---	---	---	---	---	---	---	---	---	---	---	8	---	32	---	---	---	---	---	---
Riffle Slope (ft/ft)					---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Pool Length (ft)					---	---	---	---	---	---	---	---	---	---	---	---	9	---	30	---	---	---	---	---	---
Pool Max depth (ft)					---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Pool Spacing (ft)					---	---	---	---	---	---	---	---	---	---	---	---	20	---	49	---	---	---	---	---	---
Pattern																									
Channel Beltwidth (ft)					---	---	---	---	---	---	---	---	---	---	---	---	7	---	23	7	---	---	23	---	---
Radius of Curvature (ft)					---	---	---	---	---	---	---	---	---	---	---	---	11	---	24	11	---	---	24	---	---
Rc:Bankfull width (ft/ft)					---	---	---	---	---	---	---	---	---	---	---	---	1.4	---	3	1.4	---	---	3	---	---
Meander Wavelength (ft)					---	---	---	---	---	---	---	---	---	---	---	---	38	---	77	38	---	---	77	---	---
Meander Width Ratio					---	---	---	---	---	---	---	---	---	---	---	---	4.8	---	9.6	4.8	---	---	9.6	---	---
Transport parameters																									
Reach Shear Stress (competency) lb/f^2					---						---						---			---					
Max part size (mm) mobilized at bankfull					---						---						---			---					
Stream Power (transport capacity) W/m^2					---						---						---			---					
Additional Reach Parameters																									
Rosgen Classification					G5 to E5						---						E4/C4			E4/C4					
Bankfull Velocity (fps)		---	---	---	---						---						---			---					
Bankfull Discharge (cfs)		---	---	---	---						---						---			---					
Valley length (ft)					1395						---						1392			1392					
Channel Thalweg length (ft)					1429						---						1572			1572					
Sinuosity (ft)					1.02						---						1.13			1.13					
Water Surface Slope (Channel) (ft/ft)					---						---						---			---					
Channel slope (ft/ft)					0.007						---						0.003			0.003					
[3]Bankfull Floodplain Area (acres)					---						---						---			---					
[4]% of Reach with Eroding Banks					---						---														
Channel Stability or Habitat Metric					---						---														
Biological or Other					---						---														

Shaded cells indicate that these will typically not be filled in.

1 = The distributions for these parameters can include information from both the cross-section measurements and the longitudinal profile. 2 = For projects with a proximal USGS gauge in-line with the project reach (added bankfull verification - rare).

3. Utilizing XS measurement data produce an estimate of the bankfull floodplain area in acres, which should be the area from the top of bank to the toe of the terrace riser/slope.

4 = Proportion of reach exhibiting banks that are eroding based on the visual survey for comparison to monitoring data; 5. Of value/needed only if the n exceeds 3

Appendix D. Table 11 - Monitoring Data - Dimensional Morphology Summary (Dimensional Parameters – Cross Sections)

Cowford

	Cross Section 1 (Pool)							Cross Section 2 (Riffle)							Cross Section 3 (Riffle)							Cross Section 4 (Pool)							Cross Section 5 (Riffle)						
	Base	MY1	MY2	MY3	MY5	MY7	MY+	Base	MY1	MY2	MY3	MY5	MY7	MY+	Base	MY1	MY2	MY3	MY5	MY7	MY+	Base	MY1	MY2	MY3	MY5	MY7	MY+	Base	MY1	MY2	MY3	MY5	MY7	MY+
Bankfull Elevation (ft) - Based on AB-XSA[1]	(Headwater Valley Restoration) No Morpohological Parameters were determined for HWV Reach A							(Headwater Valley Restoration) No Morpohological Parameters were determined for HWV Reach A							(Headwater Valley Restoration) No Morpohological Parameters were determined for HWV Reach A							65.6	65.6	65.7					65.8	65.7	65.8				
Bankfull Width (ft)[1]																						11.0	11.9	10.0					11.3	12.1	11.9				
Floodprone Width (ft)[1]																						-	-	-					49	48.7	>48.8				
Bankfull Max Depth (ft)[2]																						1.5	1.4	1.5					1.2	1.1	1.3				
Low Bank Elevation (ft)																						65.6	65.5	65.7					65.8	65.6	65.8				
Bankfull Cross Sectional Area (ft^2)[2]																						8.6	8.0	8.4					7.3	6.3	7.9				
Bankfull Entrenchment Ratio[1]																						-	-	-					4.3	4.0	>4.1				
Bankfull Bank Height Ratio[1]																						-	-	-					1.0	0.9	1.0				

	Cross Section 6 (Riffle)							Cross Section 7 (Pool)							Cross Section 8 (Pool)							Cross Section 9 (Riffle)							Cross Section 10 (Riffle)						
	Base	MY1	MY2	MY3	MY5	MY7	MY+	Base	MY1	MY2	MY3	MY5	MY7	MY+	Base	MY1	MY2	MY3	MY5	MY7	MY+	Base	MY1	MY2	MY3	MY5	MY7	MY+	Base	MY1	MY2	MY3	MY5	MY7	MY+
Bankfull Elevation (ft) - Based on AB-XSA[1]	65.1	65.0	65.1					65.0	64.9	64.9					61.0	60.9	60.9					60.8	60.8	60.8					57.9	57.9	57.9				
Bankfull Width (ft)[1]	9.5	9.6	9.0					8.2	9.9	9.2					11.1	8.4	9.4					9.5	8.8	8.9					9.9	9.4	8.5				
Floodprone Width (ft)[1]	49.3	49.2	>49.2					-	-	-					-	-	-					48.1	46.9	>47.3					48	46.6	>49.2				
Bankfull Max Depth (ft)[2]	1.0	1.0	0.9					1.5	1.5	1.3					1.6	1.4	1.5					1.1	0.8	0.9					1.0	1.0	1.1				
Low Bank Elevation (ft)	65.1	64.9	65.0					65.0	65.0	64.8					61.0	60.8	60.9					60.8	60.7	60.8					57.9	57.8	58.0				
Bankfull Cross Sectional Area (ft^2)[2]	5.3	4.6	4.2					6.4	7.6	5.5					6.6	5.6	6.6					4.8	3.8	4.3					5.3	5.0	5.6				
Bankfull Entrenchment Ratio[1]	5.2	5.1	>5.5					-	-	-					-	-	-					5.0	5.3	>5.3					4.8	5.0	>5.8				
Bankfull Bank Height Ratio[1]	1.0	0.9	0.9					-	-	-					-	-	-					1.0	0.9	0.9					1.0	1.0	1.0				

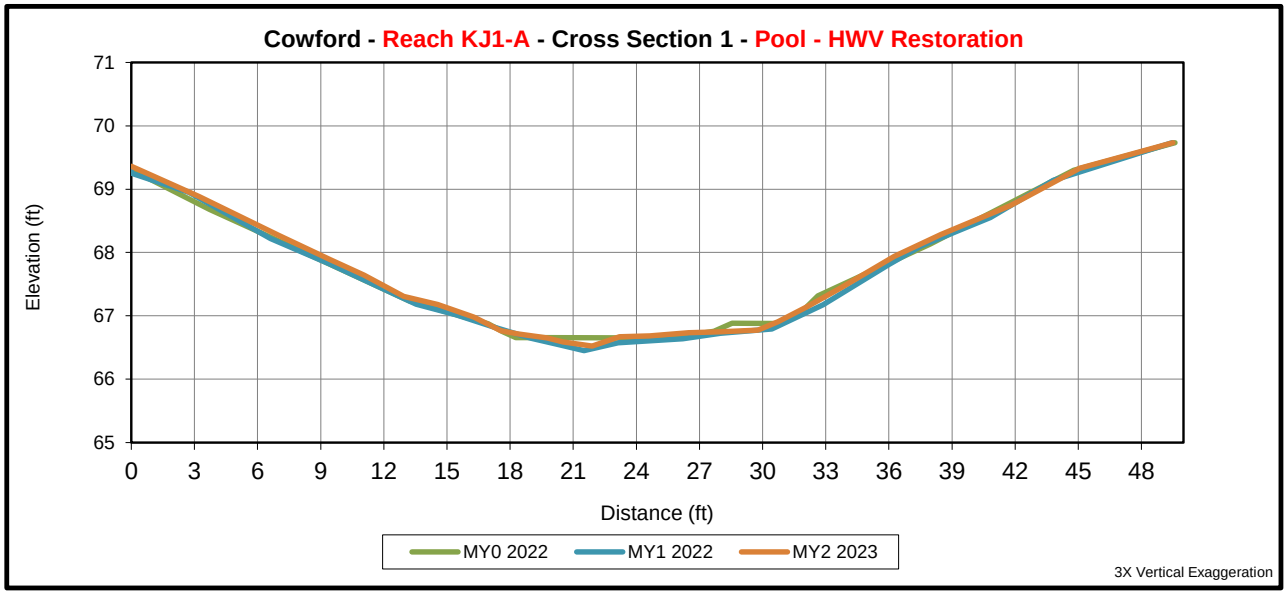
	Cross Section 11 (Pool)							Cross Section 12 (Riffle)							Cross Section 13 (Pool)							Cross Section 14 (Riffle)							Cross Section 15 (Pool)						
	Base	MY1	MY2	MY3	MY5	MY7	MY+	Base	MY1	MY2	MY3	MY5	MY7	MY+	Base	MY1	MY2	MY3	MY5	MY7	MY+	Base	MY1	MY2	MY3	MY5	MY7	MY+	Base	MY1	MY2	MY3	MY5	MY7	MY+
Bankfull Elevation (ft) - Based on AB-XSA[1]	57.9	57.9	58.0					54.6	54.5	54.6					54.7	54.6	54.6					48.0	47.9	48.0					47.6	47.4	47.5				
Bankfull Width (ft)[1]	11.8	10.7	11.5					8.6	9.2	9.1					10.3	10.0	9.6					16.1	14.9	14.8					9.1	8.9	9.3				
Floodprone Width (ft)[1]	-	-	-					46.0	45.5	>48					-	-	-					49.4	49.3	>49.7					-	-	-				
Bankfull Max Depth (ft)[2]	1.6	1.6	1.7					0.8	0.8	0.9					1.9	1.7	1.8					1.1	1.2	1.1					3.4	3.4	3.2				
Low Bank Elevation (ft)	57.9	57.9	58.0					54.6	54.5	54.6					54.7	54.5	54.6					48.0	48.0	48.0					47.6	47.5	47.6				
Bankfull Cross Sectional Area (ft^2)[2]	8.4	7.9	8.6					4.5	4.2	5.0					9.3	8.7	9.3					7.8	9.1	7.4					12.3	13.7	12.7				
Bankfull Entrenchment Ratio[1]	-	-	-					5.3	4.9	>5.3					-	-	-					3.1	3.3	>3.3					-	-	-				
Bankfull Bank Height Ratio[1]	-	-	-					1.0	1.0	1.0					-	-	-					1.0	1.0	1.0					-	-	-				

1 - Uses the as-built cross sectional area as the basis for adjusting each subsequent years bankfull elevation

2 - Uses the current years low top of bank as the basis for adjusting each subsequent years bankfull elevation

Upstream

Downstream

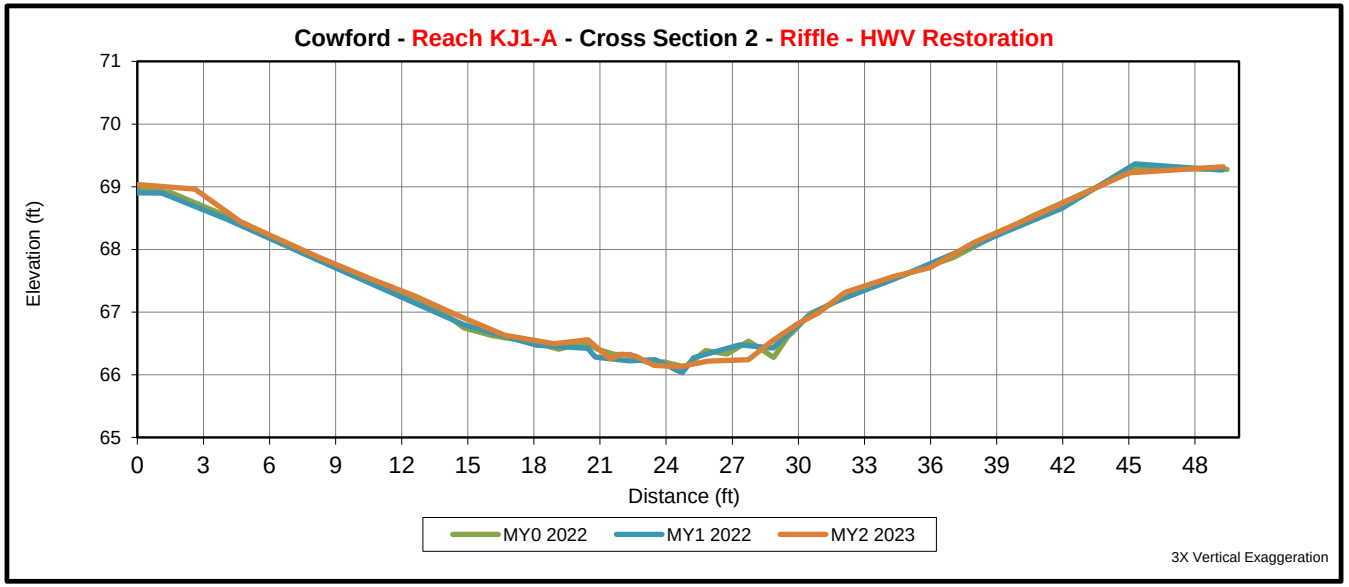


	Cross Section 1 (Pool)						
	MY0	MY1	MY2	MY3	MY5	MY7	MY+
Bankfull Elevation (ft) - Based on AB-XSA[1]	(Headwater Valley Restoration) No Morpohological Parameters were determined for HWV Reach A						
Bankfull Width (ft)[1]							
Floodprone Width (ft)[1]							
Bankfull Max Depth (ft)[2]							
Low Bank Elevation (ft)							
Bankfull Cross Sectional Area (ft^2)[2]							
Bankfull Entrenchment Ratio[1]							
Bankfull Bank Height Ratio[1]							

1 - Uses the as-built cross sectional area as the basis for adjusting each subsequent years bankfull elevation
2 - Uses the current years low top of bank as the basis for adjusting each subsequent years bankfull elevation

Upstream

Downstream

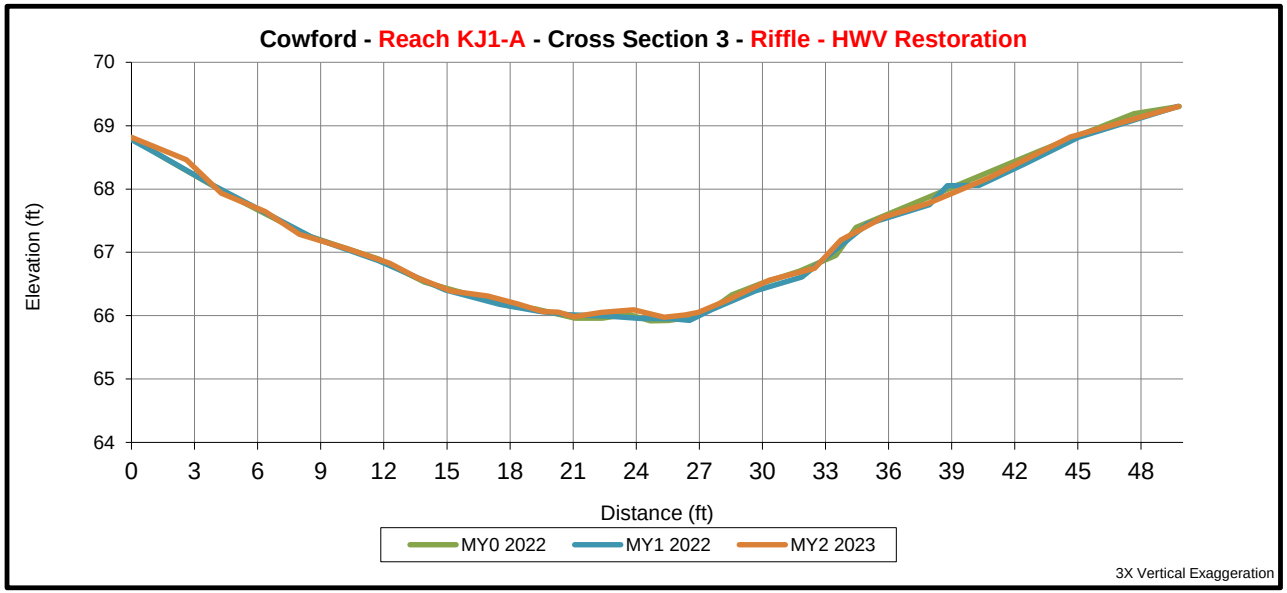


	Cross Section 2 (Riffle)						
	MY0	MY1	MY2	MY3	MY5	MY7	MY+
Bankfull Elevation (ft) - Based on AB-XSA[1]	(Headwater Valley Restoration) No Morpohological Parameters were determined for HWV Reach A						
Bankfull Width (ft)[1]							
Floodprone Width (ft)[1]							
Bankfull Max Depth (ft)[2]							
Low Bank Elevation (ft)							
Bankfull Cross Sectional Area (ft^2)[2]							
Bankfull Entrenchment Ratio[1]							
Bankfull Bank Height Ratio[1]							

1 - Uses the as-built cross sectional area as the basis for adjusting each subsequent years bankfull elevation
2 - Uses the current years low top of bank as the basis for adjusting each subsequent years bankfull elevation

Upstream

Downstream



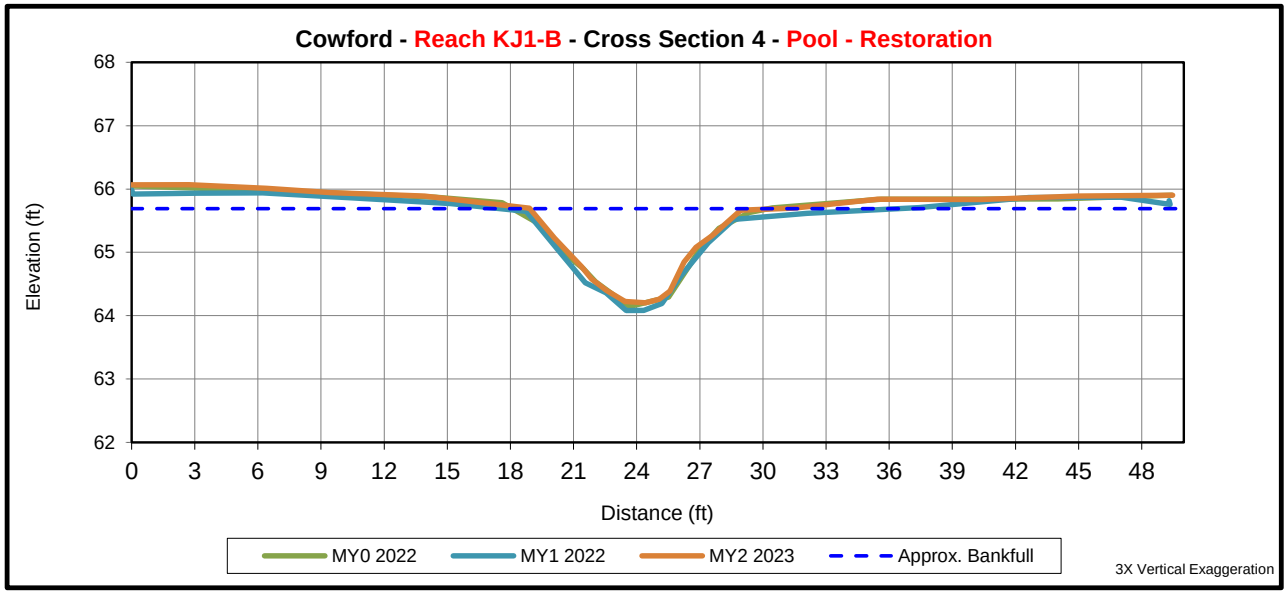
	Cross Section 3 (Riffle)						
	MY0	MY1	MY2	MY3	MY5	MY7	MY+
Bankfull Elevation (ft) - Based on AB-XSA[1]	(Headwater Valley Restoration) No Morpohological Parameters were determined for HWV Reach A						
Bankfull Width (ft)[1]							
Floodprone Width (ft)[1]							
Bankfull Max Depth (ft)[2]							
Low Bank Elevation (ft)							
Bankfull Cross Sectional Area (ft^2)[2]							
Bankfull Entrenchment Ratio[1]							
Bankfull Bank Height Ratio[1]							

1 - Uses the as-built cross sectional area as the basis for adjusting each subsequent years bankfull elevation

2 - Uses the current years low top of bank as the basis for adjusting each subsequent years bankfull elevation

Upstream

Downstream

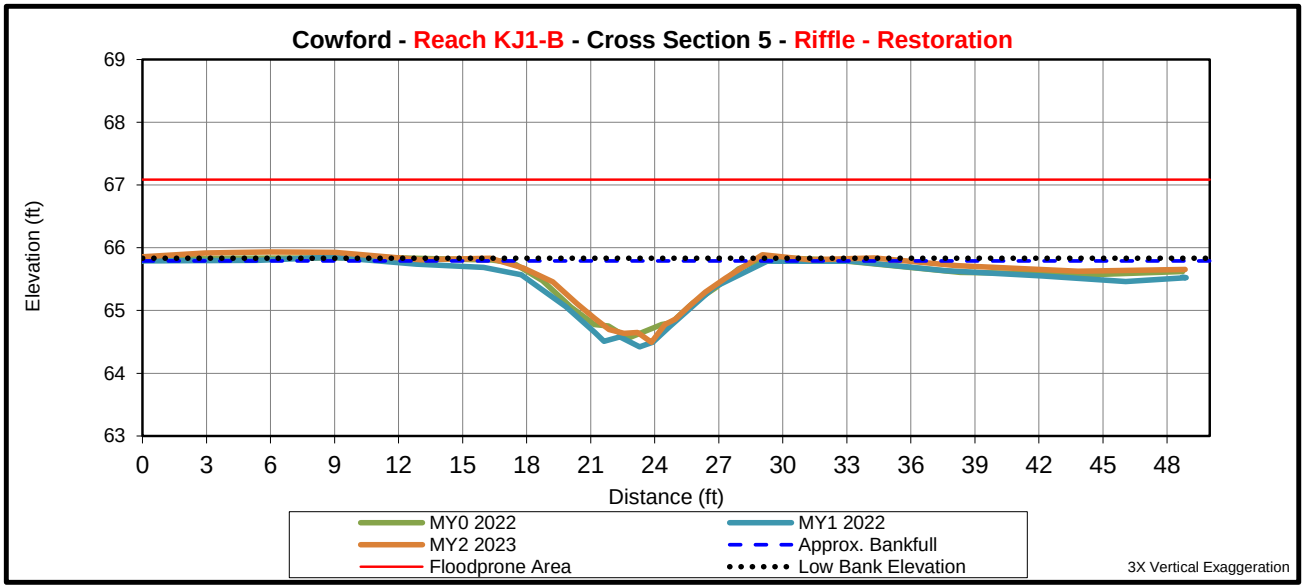


	Cross Section 4 (Pool)						
	MY0	MY1	MY2	MY3	MY5	MY7	MY+
Bankfull Elevation (ft) - Based on AB-XSA[1]	65.63	65.6	65.7				
Bankfull Width (ft)[1]	11.0	11.9	10.0				
Floodprone Width (ft)[1]	-	-	-				
Bankfull Max Depth (ft)[2]	1.5	1.4	1.5				
Low Bank Elevation (ft)	65.63	65.5	65.7				
Bankfull Cross Sectional Area (ft^2)[2]	8.6	8.0	8.4				
Bankfull Entrenchment Ratio[1]	-	-	-				
Bankfull Bank Height Ratio[1]	-	-	-				

1 - Uses the as-built cross sectional area as the basis for adjusting each subsequent years bankfull elevation
2 - Uses the current years low top of bank as the basis for adjusting each subsequent years bankfull elevation

Upstream

Downstream

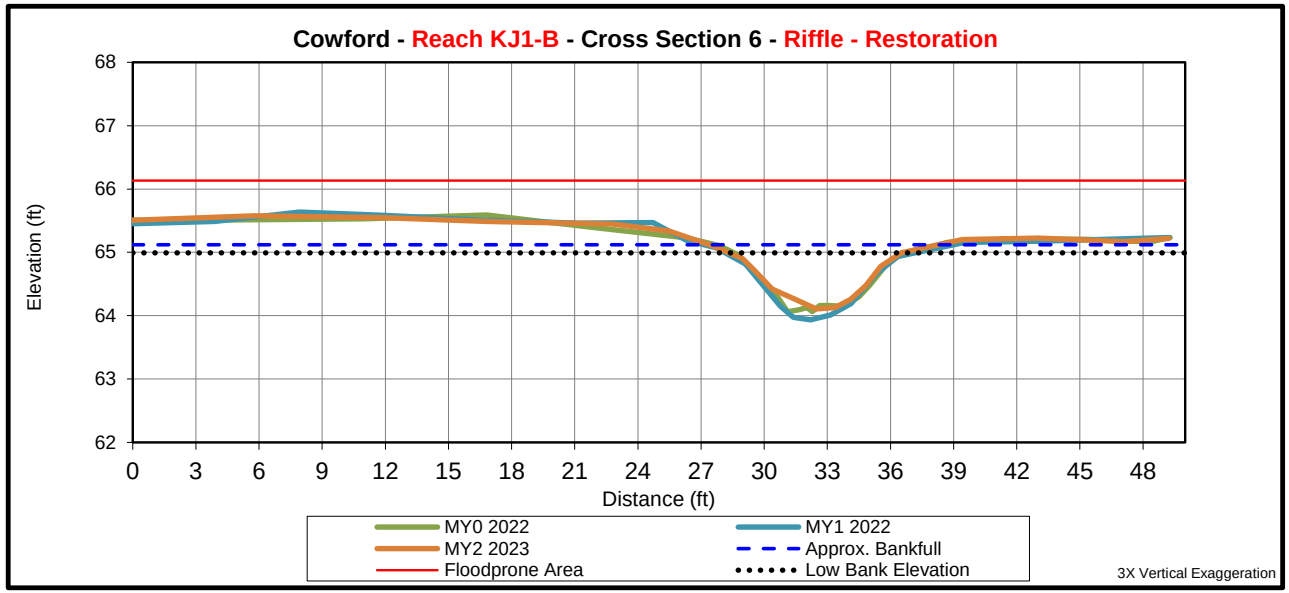


	Cross Section 5 (Riffle)						
	MY0	MY1	MY2	MY3	MY5	MY7	MY+
Bankfull Elevation (ft) - Based on AB-XSA[1]	65.76	65.7	65.8				
Bankfull Width (ft)[1]	11.3	12.1	11.9				
Floodprone Width (ft)[1]	49	48.7	>48.8				
Bankfull Max Depth (ft)[2]	1.2	1.1	1.3				
Low Bank Elevation (ft)	65.76	65.6	65.8				
Bankfull Cross Sectional Area (ft^2)[2]	7.3	6.3	7.9				
Bankfull Entrenchment Ratio[1]	4.3	4.0	>4.1				
Bankfull Bank Height Ratio[1]	1.0	0.9	1.0				

1 - Uses the as-built cross sectional area as the basis for adjusting each subsequent years bankfull elevation
2 - Uses the current years low top of bank as the basis for adjusting each subsequent years bankfull elevation

Upstream

Downstream

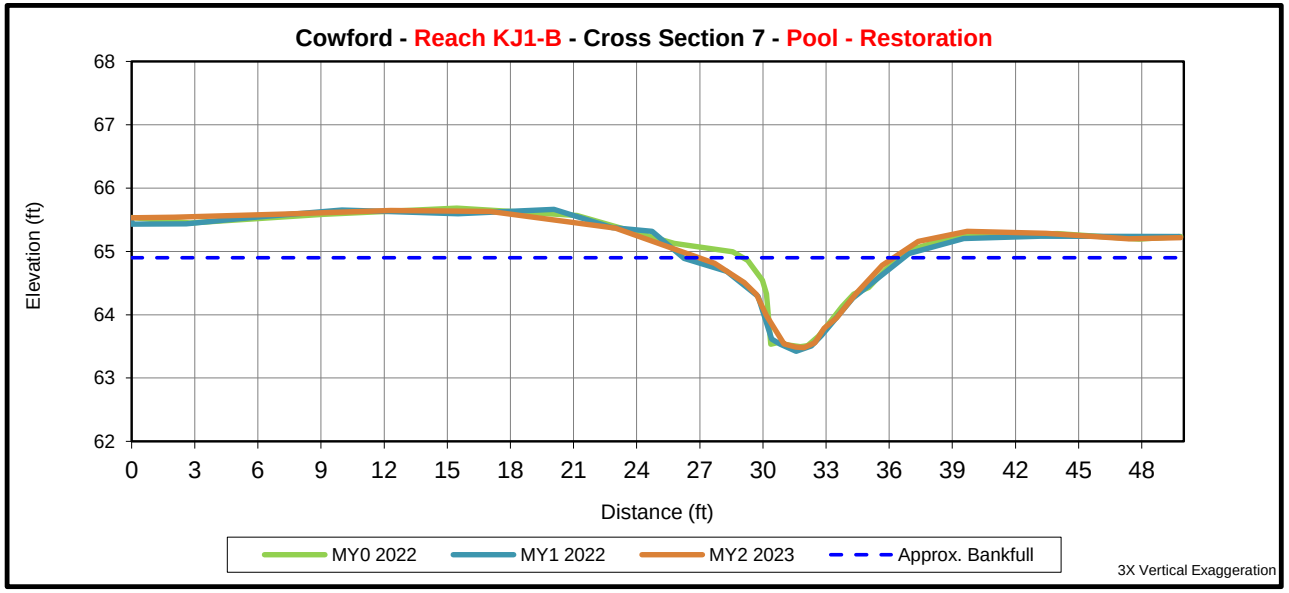


	Cross Section 6 (Riffle)						
	MY0	MY1	MY2	MY3	MY5	MY7	MY+
Bankfull Elevation (ft) - Based on AB-XSA[1]	65.06	65.0	65.1				
Bankfull Width (ft)[1]	9.5	9.6	9.0				
Floodprone Width (ft)[1]	49.3	49.2	>49.2				
Bankfull Max Depth (ft)[2]	1.0	1.0	0.9				
Low Bank Elevation (ft)	65.06	64.9	65.0				
Bankfull Cross Sectional Area (ft^2)[2]	5.3	4.6	4.2				
Bankfull Entrenchment Ratio[1]	5.2	5.1	>5.5				
Bankfull Bank Height Ratio[1]	1.0	0.9	0.9				

1 - Uses the as-built cross sectional area as the basis for adjusting each subsequent years bankfull elevation
2 - Uses the current years low top of bank as the basis for adjusting each subsequent years bankfull elevation

Upstream

Downstream

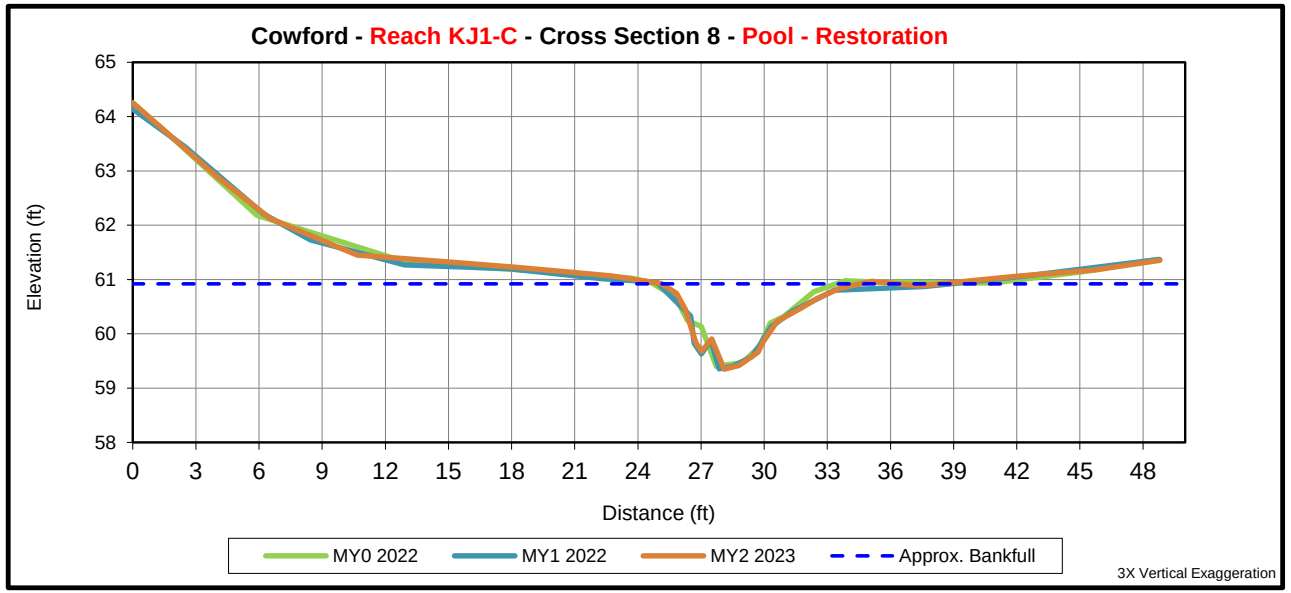


	Cross Section 7 (Pool)						
	MY0	MY1	MY2	MY3	MY5	MY7	MY+
Bankfull Elevation (ft) - Based on AB-XSA[1]	64.99	64.9	64.9				
Bankfull Width (ft)[1]	8.2	9.9	9.2				
Floodprone Width (ft)[1]	-	-	-				
Bankfull Max Depth (ft)[2]	1.5	1.5	1.3				
Low Bank Elevation (ft)	64.99	65.0	64.8				
Bankfull Cross Sectional Area (ft^2)[2]	6.4	7.6	5.5				
Bankfull Entrenchment Ratio[1]	-	-	-				
Bankfull Bank Height Ratio[1]	-	-	-				

1 - Uses the as-built cross sectional area as the basis for adjusting each subsequent years bankfull elevation
2 - Uses the current years low top of bank as the basis for adjusting each subsequent years bankfull elevation

Upstream

Downstream

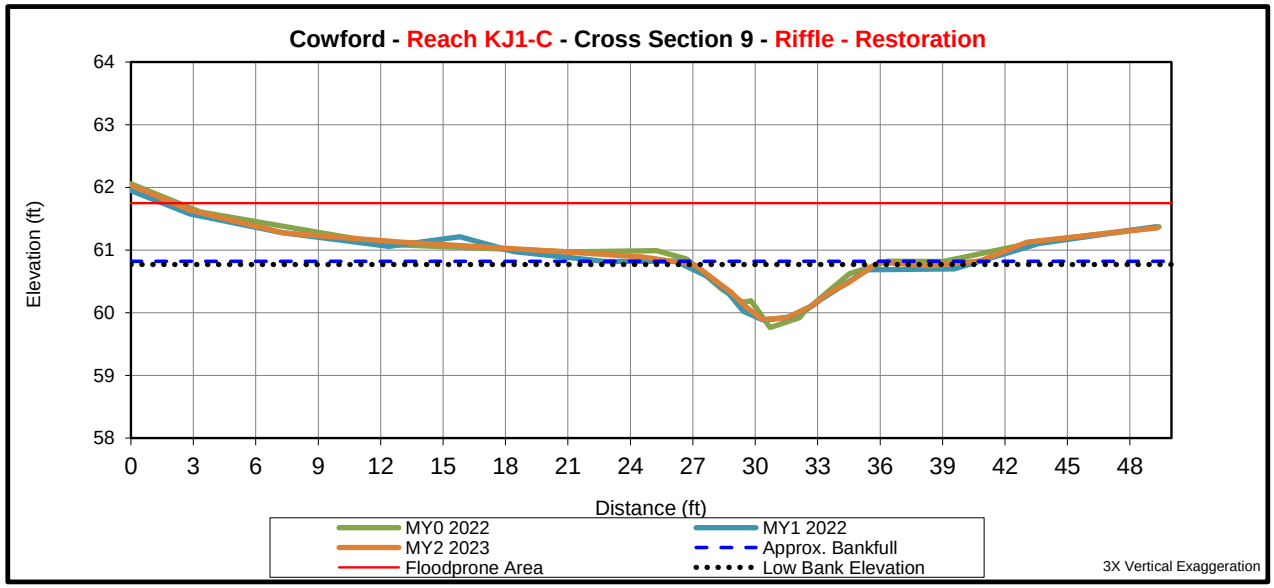


	Cross Section 8 (Pool)						
	MY0	MY1	MY2	MY3	MY5	MY7	MY+
Bankfull Elevation (ft) - Based on AB-XSA[1]	60.97	60.9	60.9				
Bankfull Width (ft)[1]	11.1	8.4	9.4				
Floodprone Width (ft)[1]	-	-	-				
Bankfull Max Depth (ft)[2]	1.6	1.4	1.5				
Low Bank Elevation (ft)	60.97	60.8	60.9				
Bankfull Cross Sectional Area (ft^2)[2]	6.6	5.6	6.6				
Bankfull Entrenchment Ratio[1]	-	-	-				
Bankfull Bank Height Ratio[1]	-	-	-				

1 - Uses the as-built cross sectional area as the basis for adjusting each subsequent years bankfull elevation
2 - Uses the current years low top of bank as the basis for adjusting each subsequent years bankfull elevation

Upstream

Downstream

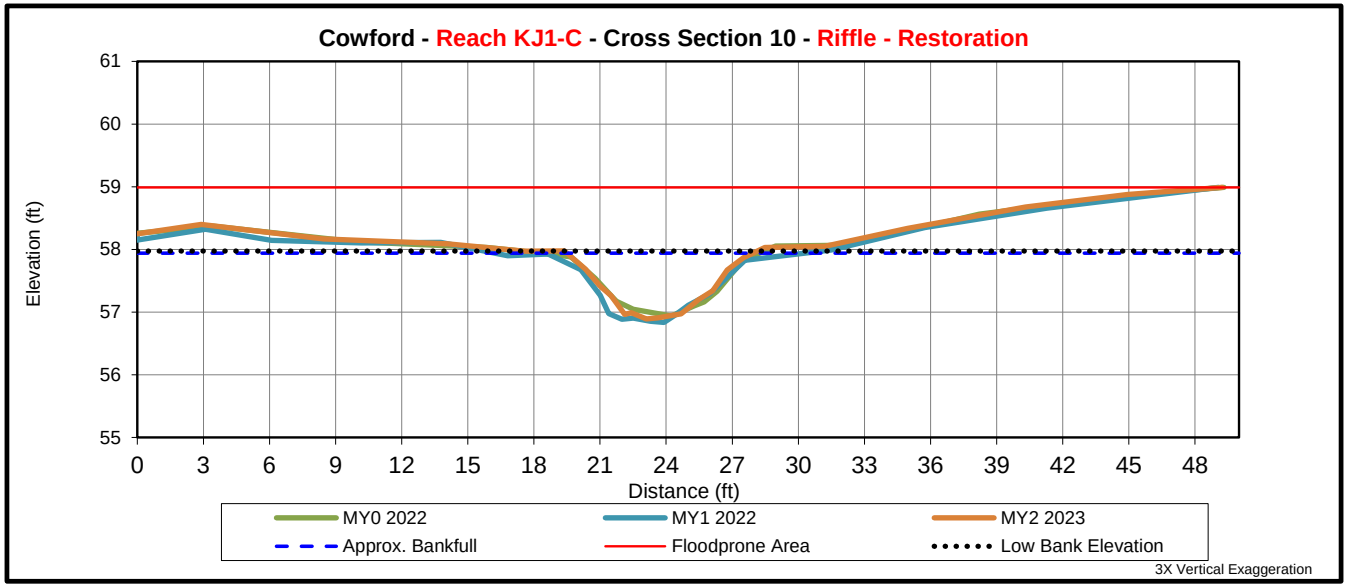


	Cross Section 9 (Riffle)						
	MY0	MY1	MY2	MY3	MY5	MY7	MY+
Bankfull Elevation (ft) - Based on AB-XSA[1]	60.82	60.8	60.8				
Bankfull Width (ft)[1]	9.5	8.8	8.9				
Floodprone Width (ft)[1]	48.1	46.9	>47.3				
Bankfull Max Depth (ft)[2]	1.1	0.8	0.9				
Low Bank Elevation (ft)	60.82	60.7	60.8				
Bankfull Cross Sectional Area (ft^2)[2]	4.8	3.8	4.3				
Bankfull Entrenchment Ratio[1]	5.0	5.3	>5.3				
Bankfull Bank Height Ratio[1]	1.0	0.9	0.9				

1 - Uses the as-built cross sectional area as the basis for adjusting each subsequent years bankfull elevation
2 - Uses the current years low top of bank as the basis for adjusting each subsequent years bankfull elevation

Upstream

Downstream

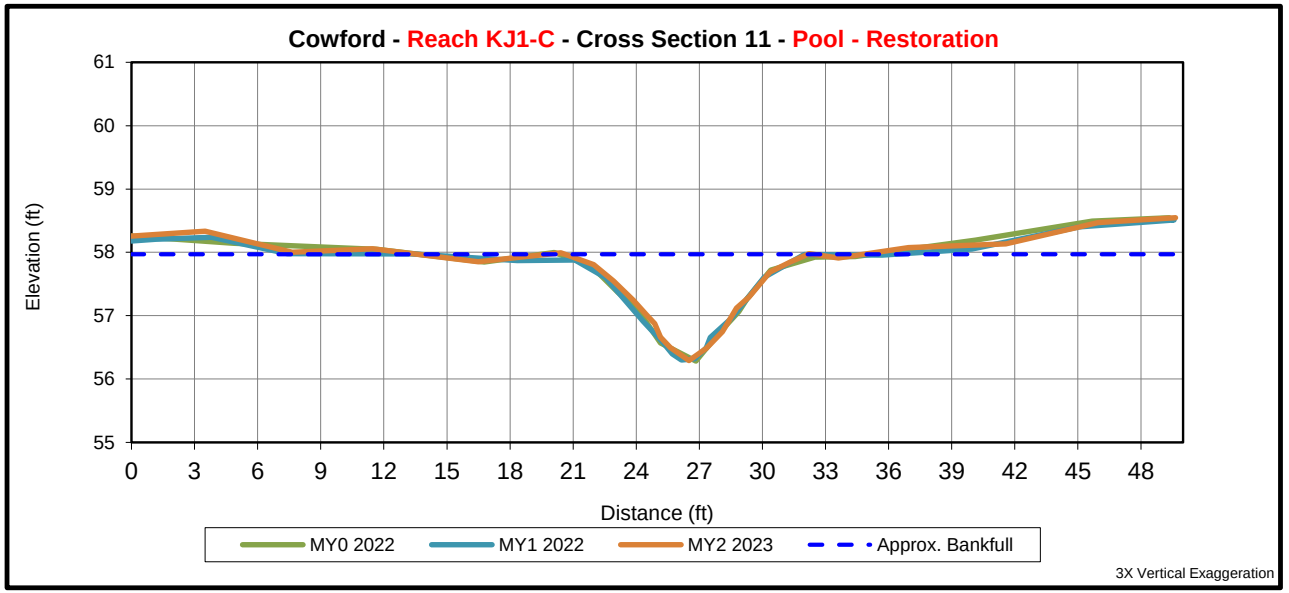


	Cross Section 10 (Riffle)						
	MY0	MY1	MY2	MY3	MY5	MY7	MY+
Bankfull Elevation (ft) - Based on AB-XSA[1]	57.93	57.9	57.9				
Bankfull Width (ft)[1]	9.9	9.4	8.5				
Floodprone Width (ft)[1]	48	46.6	>49.2				
Bankfull Max Depth (ft)[2]	1.0	1.0	1.1				
Low Bank Elevation (ft)	57.93	57.8	58.0				
Bankfull Cross Sectional Area (ft^2)[2]	5.3	5.0	5.6				
Bankfull Entrenchment Ratio[1]	4.8	5.0	>5.8				
Bankfull Bank Height Ratio[1]	1.0	1.0	1.0				

1 - Uses the as-built cross sectional area as the basis for adjusting each subsequent years bankfull elevation
2 - Uses the current years low top of bank as the basis for adjusting each subsequent years bankfull elevation

Upstream

Downstream

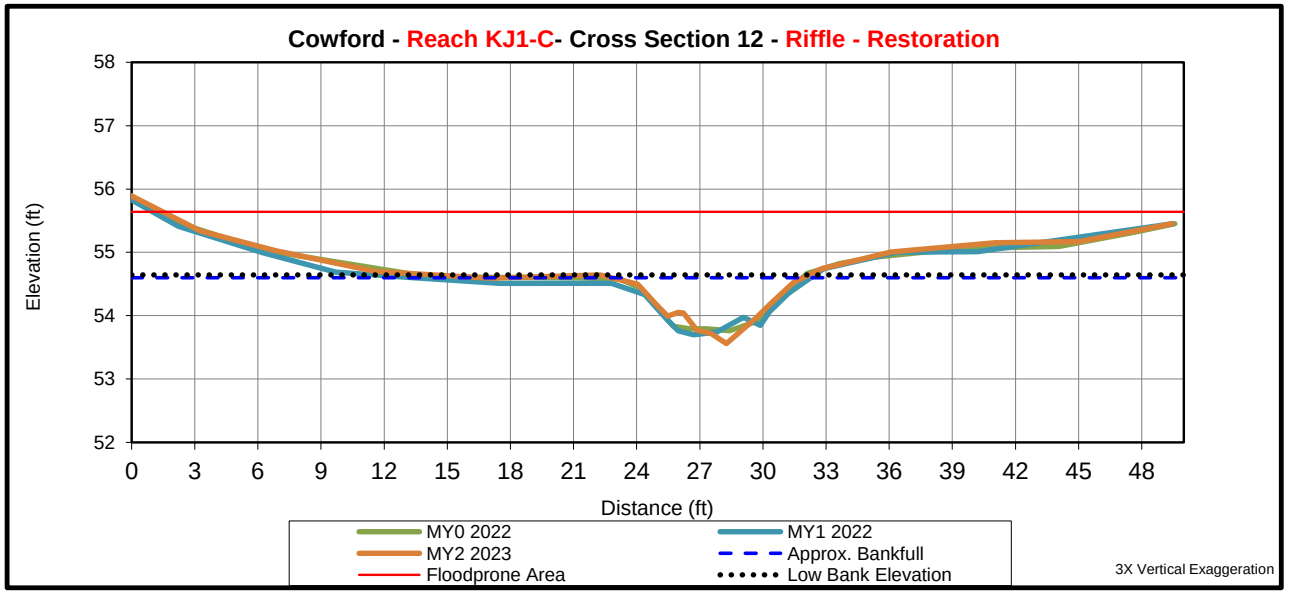


	Cross Section 11 (Pool)						
	MY0	MY1	MY2	MY3	MY5	MY7	MY+
Bankfull Elevation (ft) - Based on AB-XSA[1]	57.92	57.9	58.0				
Bankfull Width (ft)[1]	11.8	10.7	11.5				
Floodprone Width (ft)[1]	-	-	-				
Bankfull Max Depth (ft)[2]	1.6	1.6	1.7				
Low Bank Elevation (ft)	57.92	57.9	58.0				
Bankfull Cross Sectional Area (ft^2)[2]	8.4	7.9	8.6				
Bankfull Entrenchment Ratio[1]	-	-	-				
Bankfull Bank Height Ratio[1]	-	-	-				

1 - Uses the as-built cross sectional area as the basis for adjusting each subsequent years bankfull elevation
2 - Uses the current years low top of bank as the basis for adjusting each subsequent years bankfull elevation

Upstream

Downstream

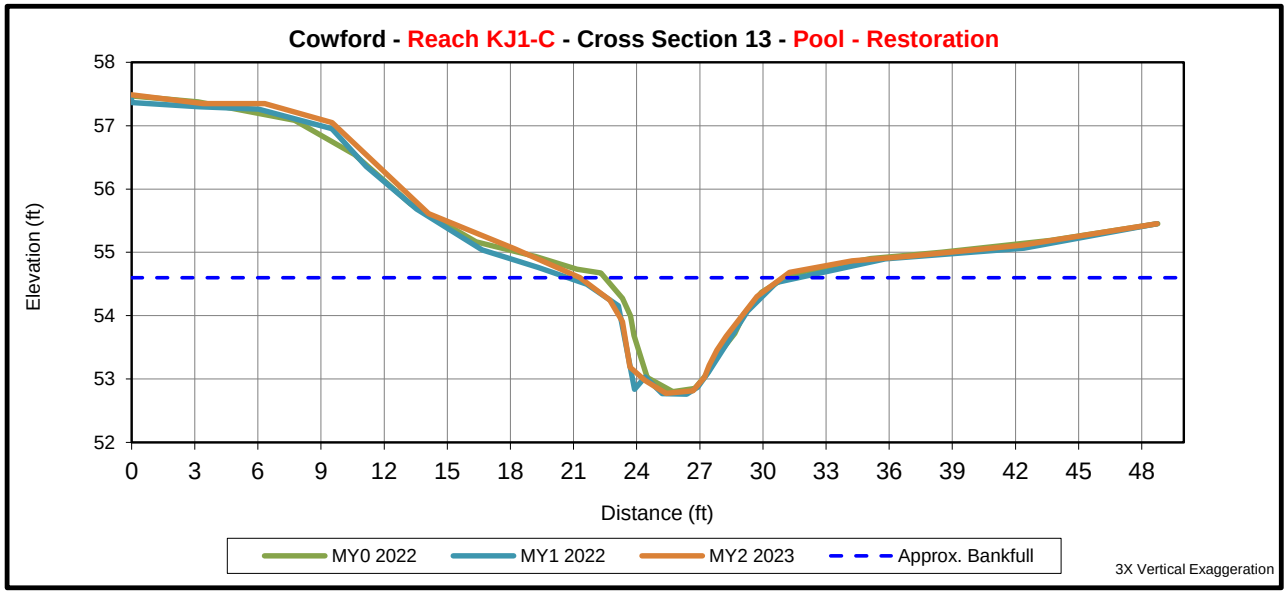


	Cross Section 12 (Riffle)						
	MY0	MY1	MY2	MY3	MY5	MY7	MY+
Bankfull Elevation (ft) - Based on AB-XSA[1]	54.58	54.5	54.6				
Bankfull Width (ft)[1]	8.6	9.2	9.1				
Floodprone Width (ft)[1]	46.0	45.5	>48				
Bankfull Max Depth (ft)[2]	0.8	0.8	0.9				
Low Bank Elevation (ft)	54.58	54.5	54.6				
Bankfull Cross Sectional Area (ft^2)[2]	4.5	4.2	5.0				
Bankfull Entrenchment Ratio[1]	5.3	4.9	>5.3				
Bankfull Bank Height Ratio[1]	1.0	1.0	1.0				

1 - Uses the as-built cross sectional area as the basis for adjusting each subsequent years bankfull elevation
2 - Uses the current years low top of bank as the basis for adjusting each subsequent years bankfull elevation

Upstream

Downstream



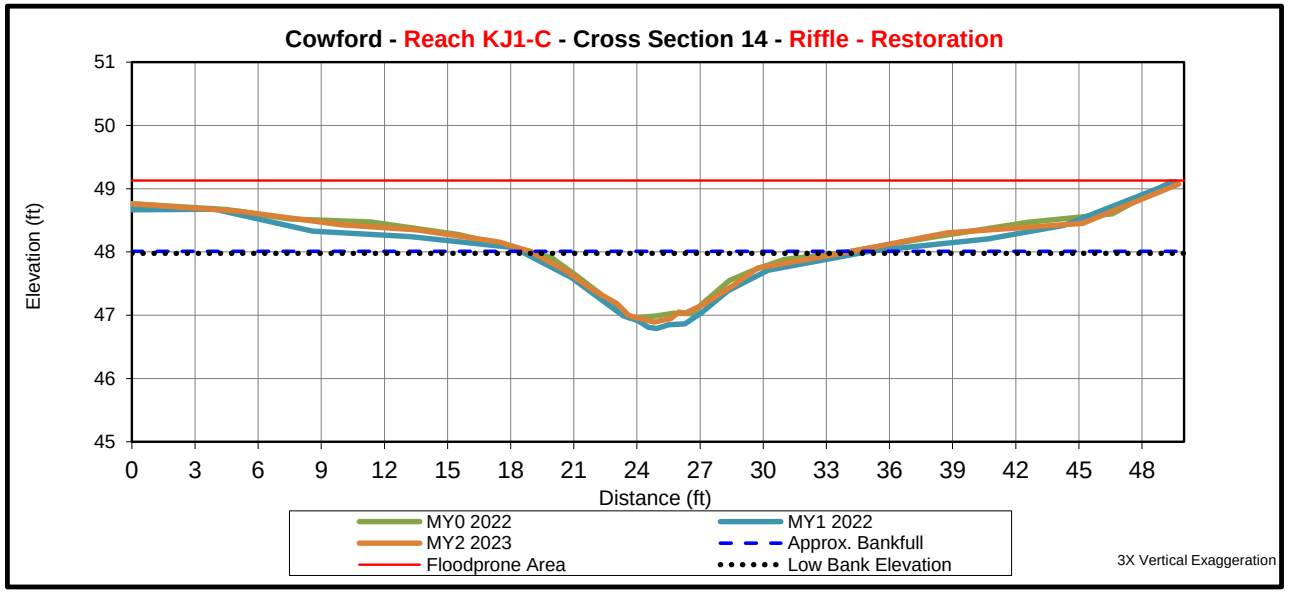
	Cross Section 13 (Pool)						
	MY0	MY1	MY2	MY3	MY5	MY7	MY+
Bankfull Elevation (ft) - Based on AB-XSA[1]	54.70	54.6	54.6				
Bankfull Width (ft)[1]	10.3	10.0	9.6				
Floodprone Width (ft)[1]	-	-	-				
Bankfull Max Depth (ft)[2]	1.9	1.7	1.8				
Low Bank Elevation (ft)	54.70	54.5	54.6				
Bankfull Cross Sectional Area (ft^2)[2]	9.3	8.7	9.3				
Bankfull Entrenchment Ratio[1]	-	-	-				
Bankfull Bank Height Ratio[1]	-	-	-				

1 - Uses the as-built cross sectional area as the basis for adjusting each subsequent years bankfull elevation

2 - Uses the current years low top of bank as the basis for adjusting each subsequent years bankfull elevation

Upstream

Downstream

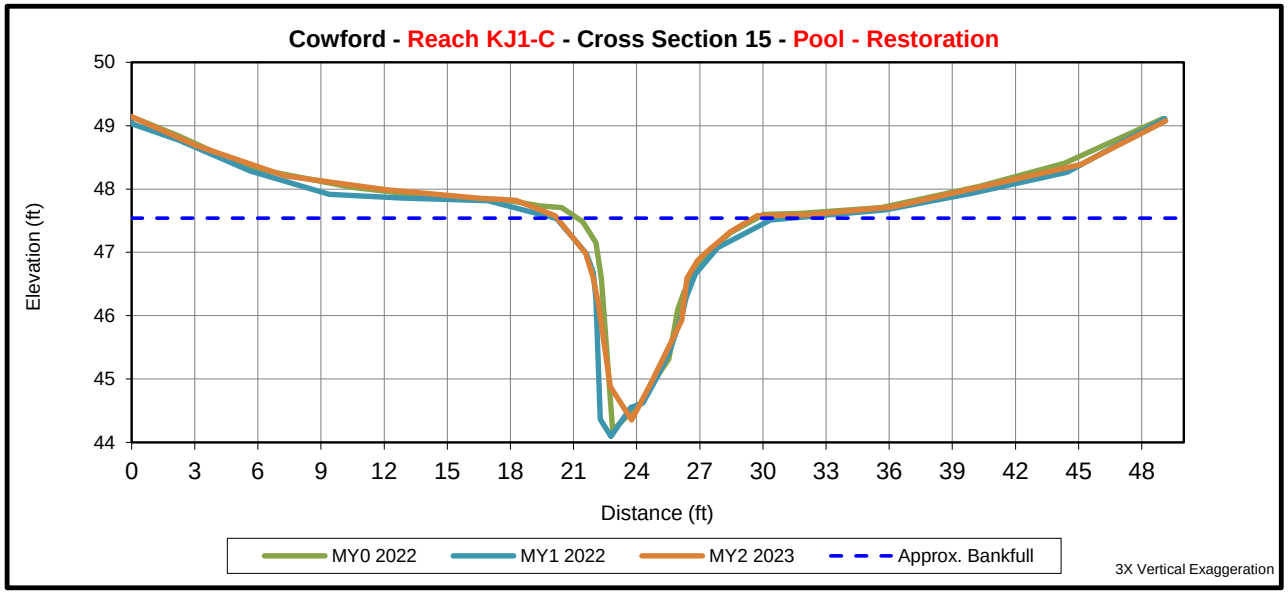


	Cross Section 14 (Riffle)						
	MY0	MY1	MY2	MY3	MY5	MY7	MY+
Bankfull Elevation (ft) - Based on AB-XSA[1]	48.03	47.9	48.0				
Bankfull Width (ft)[1]	16.1	14.9	14.8				
Floodprone Width (ft)[1]	49.4	49.3	>49.7				
Bankfull Max Depth (ft)[2]	1.1	1.2	1.1				
Low Bank Elevation (ft)	48.03	48.0	48.0				
Bankfull Cross Sectional Area (ft^2)[2]	7.8	9.1	7.4				
Bankfull Entrenchment Ratio[1]	3.1	3.3	>3.3				
Bankfull Bank Height Ratio[1]	1.0	1.0	1.0				

1 - Uses the as-built cross sectional area as the basis for adjusting each subsequent years bankfull elevation
2 - Uses the current years low top of bank as the basis for adjusting each subsequent years bankfull elevation

Upstream

Downstream



	Cross Section 15 (Pool)						
	MY0	MY1	MY2	MY3	MY5	MY7	MY+
Bankfull Elevation (ft) - Based on AB-XSA[1]	47.59	47.4	47.5				
Bankfull Width (ft)[1]	9.1	8.9	9.3				
Floodprone Width (ft)[1]	-	-	-				
Bankfull Max Depth (ft)[2]	3.4	3.4	3.2				
Low Bank Elevation (ft)	47.59	47.5	47.6				
Bankfull Cross Sectional Area (ft^2)[2]	12.3	13.7	12.7				
Bankfull Entrenchment Ratio[1]	-	-	-				
Bankfull Bank Height Ratio[1]	-	-	-				

1 - Uses the as-built cross sectional area as the basis for adjusting each subsequent years bankfull elevation
2 - Uses the current years low top of bank as the basis for adjusting each subsequent years bankfull elevation

Headwater Valley Performance Table							
KJ1-A Channel Evidence	**Year 1**	**Year 2**	**Year 3**	**Year 4**	**Year 5**	**Year 6**	**Year 7**
Max consecutive days of channel flow	55	160					
Presence of litter and debris (wracking)	No	Yes					
Leaf litter disturbed or washed away	No	Yes					
Matted, bent, or absence of vegetation (herbaceous or otherwise)	No	No					
Sediment depostion and/or scour indicating sediment transport	No	Yes					
Water staining due to continual presence of water*	No	Yes					
Formation of channel bed and banks*	No	No					
Sediment sorting within the primary path of flow	No	No					
Sediment shelving or a natural line impressed on the banks*	No	No					
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)*	No	No					
Development of channel pattern (meander bends and/or channel braiding) at natural topographic breaks, woody debris piles, or plant root systems*	No	No					
Exposure of woody plant roots within the primary path of flow*	No	No					
Other:	NA	NA					
**represents indicators that are required in monitoring years 5-7*							

Appendix E

Hydrology

Data

Table 12. Rainfall Summary MY2 2023

Month	Average	Normal Limits		Richland Station Precipitation*
		30 Percent	70 Percent	
November	3.68	1.96	4.41	1.96
December	3.66	2.63	4.27	1.62
January	3.70	2.78	4.57	3.49
February	3.50	2.32	4.20	2.37
March	3.76	2.68	4.43	1.77
April	3.00	1.69	3.77	1.68
May	4.11	2.51	4.85	3.05
June	5.31	3.51	6.38	5.17
July	6.05	4.40	7.46	5.86
August	7.23	3.66	8.95	5.36
September	7.02	3.91	8.39	4.44
October	4.11	2.24	4.97	0.14
November	3.68	1.96	4.41	-
December	3.66	2.63	4.27	-
Total Annual **		34.29	66.65	36.91
Above Normal Limits	Below Normal Limits			

*Rainfall data was acquired from Richland Station which is approximately 4 miles from the Site.

**Normal Limits were determined from WETS Station New River MCAF, NC. Approximately 20 miles from the Site Total Rainfall is from November 1, 2022 - October 31,2023

Table 13. Documentation of Geomorphically Significant Flow Events

Table 13. Documentation of Significant Flow Events				
Year	**Bankfull Events**	**Height Over Bankfull (ft)**	**Estimated Date of Highest Event**	
Stage Recorder KJ1-C				
MY1 2022	2	0.38	4/5/2022	
MY2 2023	10	1.74	7/7/2023	
MY3 2024				
MY4 2025				
MY5 2026				
MY6 2027				
MY7 2028				
Year	**Flow Events**	**Maximum Consecutive Flow Days**	**Cummlative Flow Days**	**Maximum Consecutive Date Range**
Flow Gauge KJ1-A				
MY1 2022	11	55	160	3/9/2022 - 5/3/2023
MY2 2023	8	129	226	1/1/2023 - 5/9/2023
MY3 2024				
MY4 2025				
MY5 2026				
MY6 2027				
MY7 2028				

Table 14. 2023 Max Hydroperiod

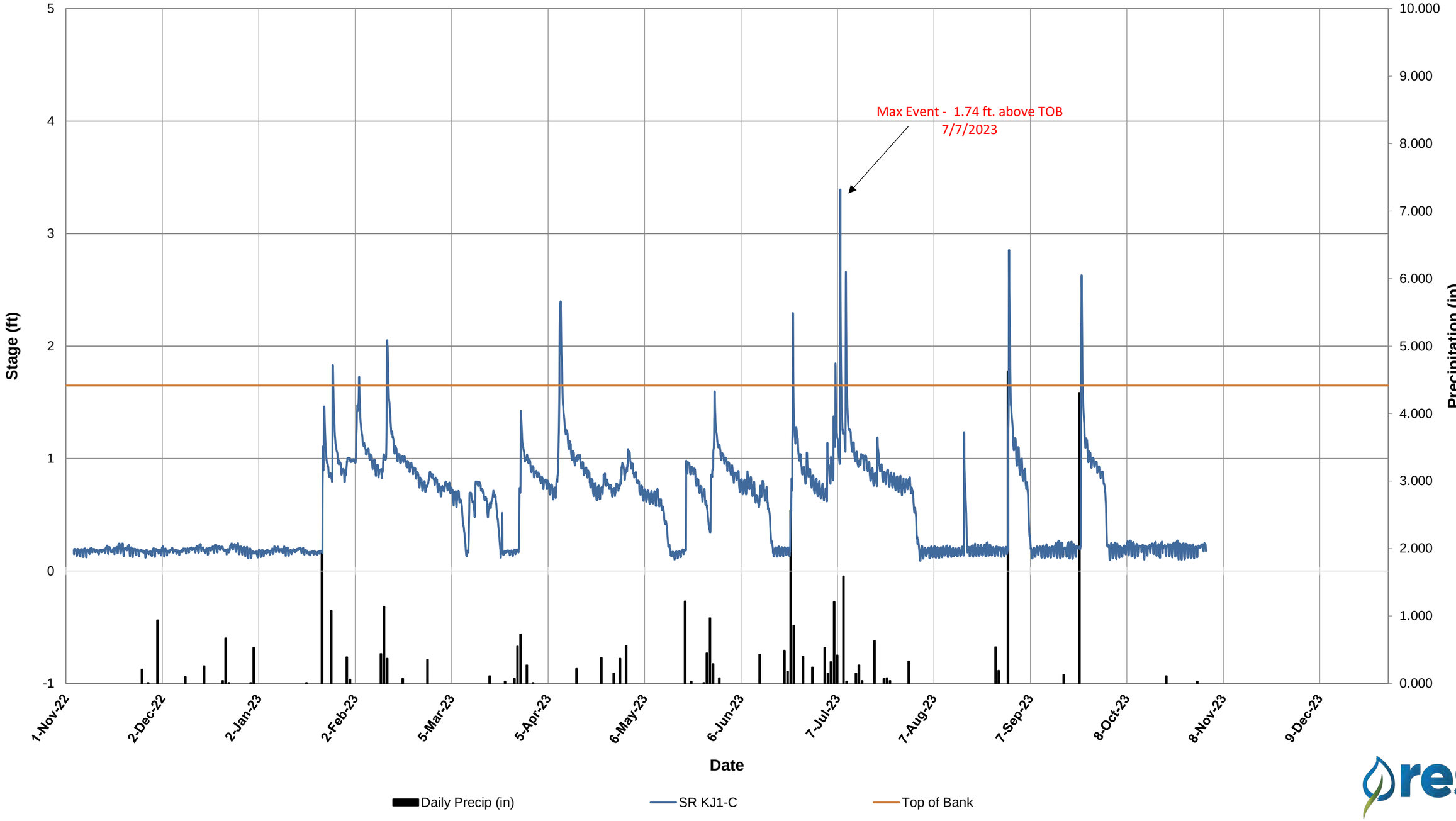
2023 Max Hydroperiod (Growing Season 10-Mar through 2-Dec, 267 days)				
Well ID	**Consecutive (Growing Season)**		**Consectuive (Jan 1 - Nov 2, 2023)**	
	Days	**Hydroperiod (%)**	**Days**	**Hydroperiod (%)**
GW1	6	2	6	2
GW2	6	2	6	2
GW3	15	6	41	12
GW4	14	5	30	9
GW5	14	5	31	9

<5%	5-12%	>12%

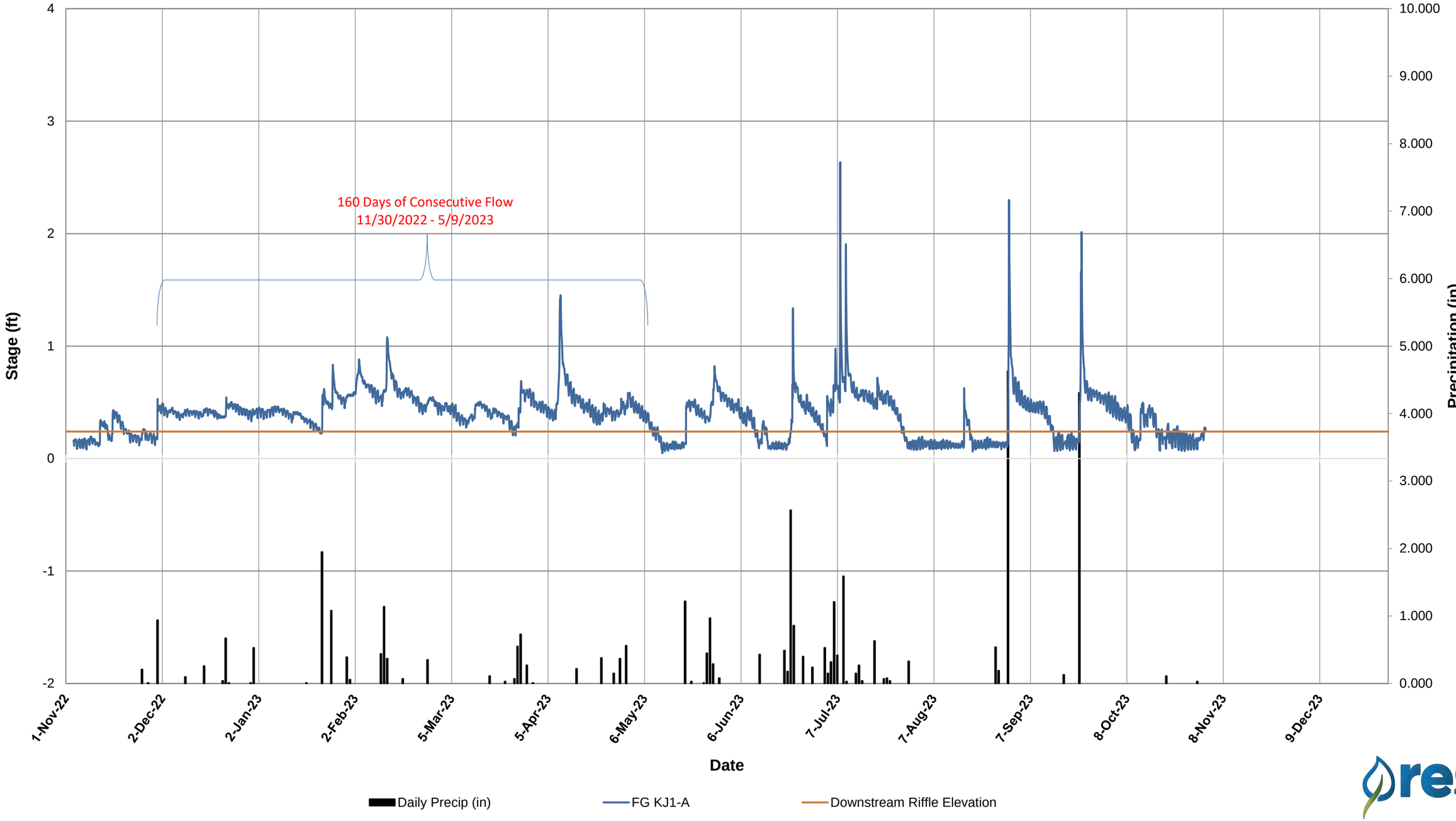
Table 15. Summary of Groundwater Monitoring Results

Summary of Groundwater Monitoring Results (Growing Season) Cowford										
Well ID	Wetland ID	Hydroperiod (%)								
		Pre Con (2020)	Pre Con (2021)	Year 1 (2022)	Year 2 (2023)	Year 3 (2024)	Year 4 (2025)	Year 5 (2026)	Year 6 (2027)	Year 7 (2028)
GW1	WA	1	0	0	2					
GW2	WA			1	2					
GW3	WA			7	6					
GW4	WA			4	5					
GW5	UPL			5	5					

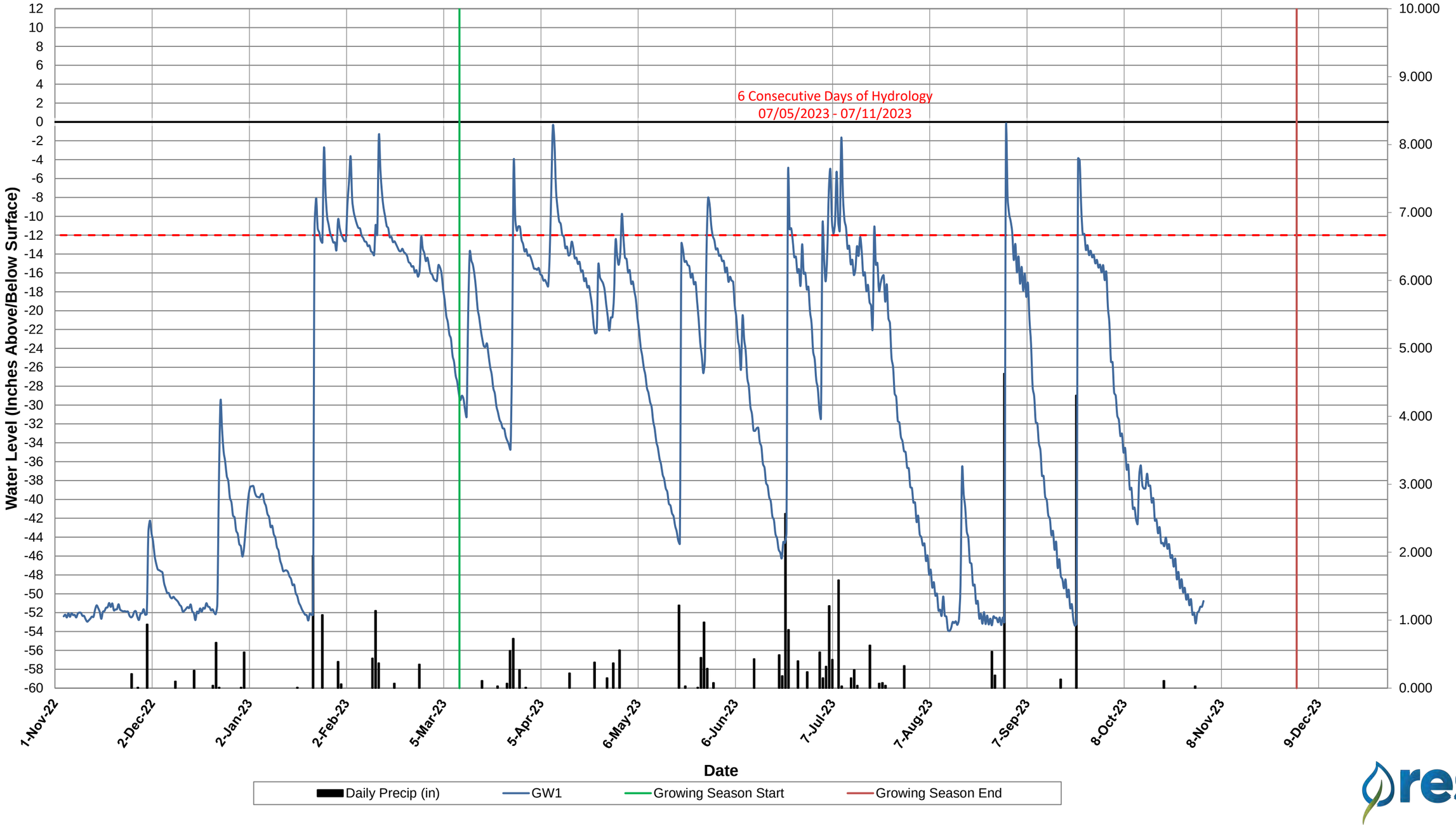
Cowford MY2 2023 KJ1-C Stage Recorder Graph



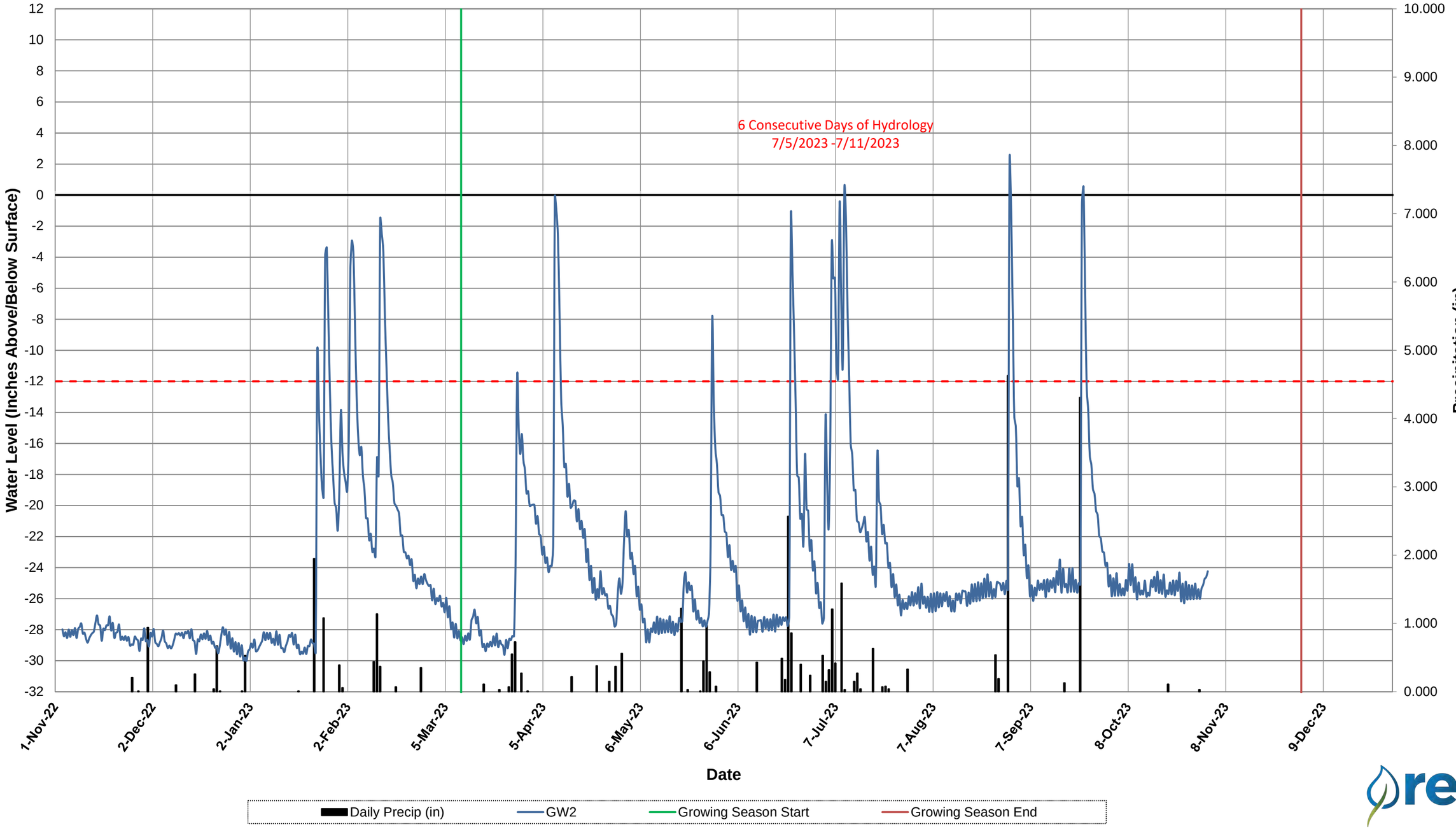
Cowford MY2 2023 KJ1-A Flow Gauge Graph



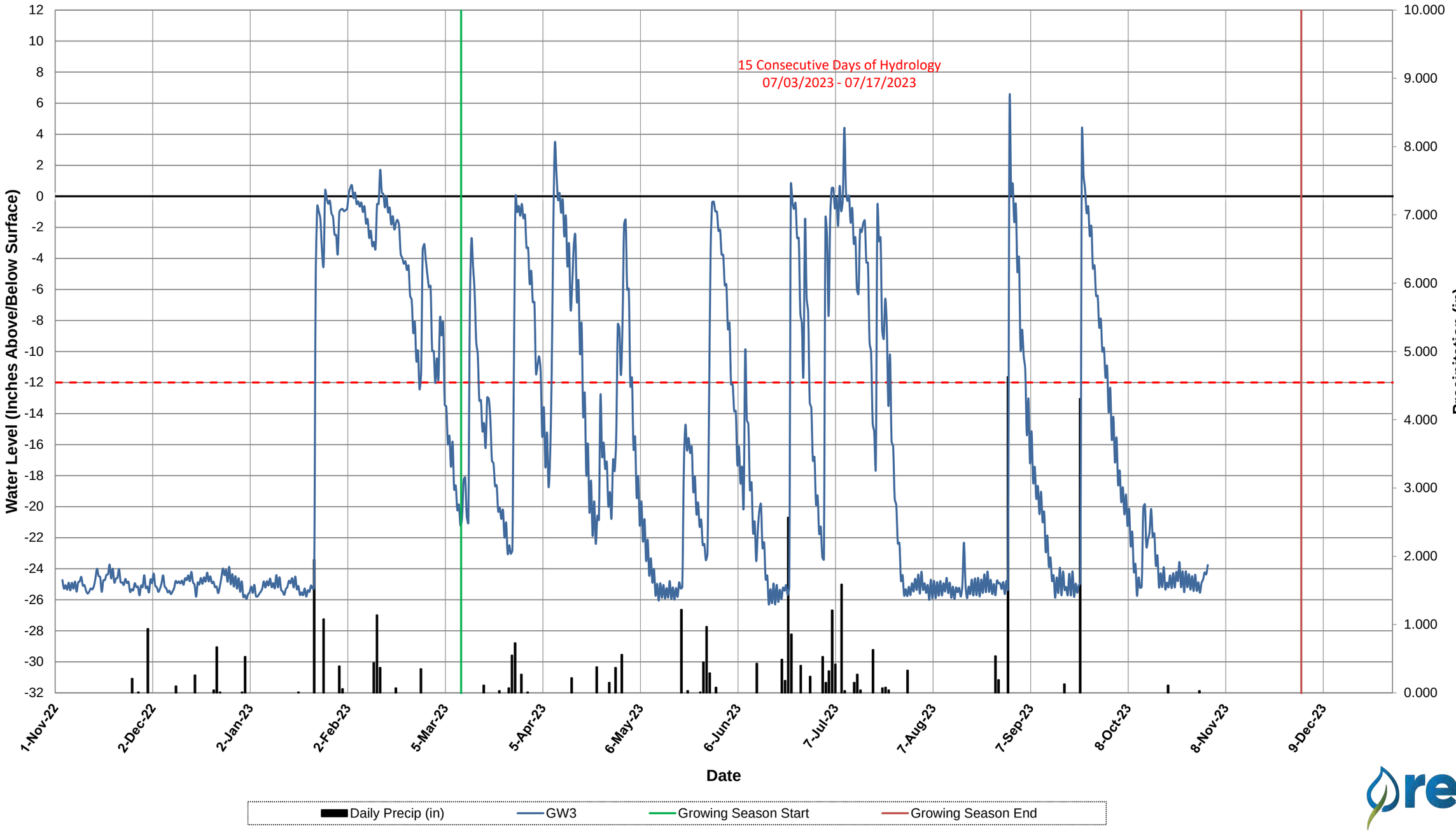
Cowford MY2 2023 GW1



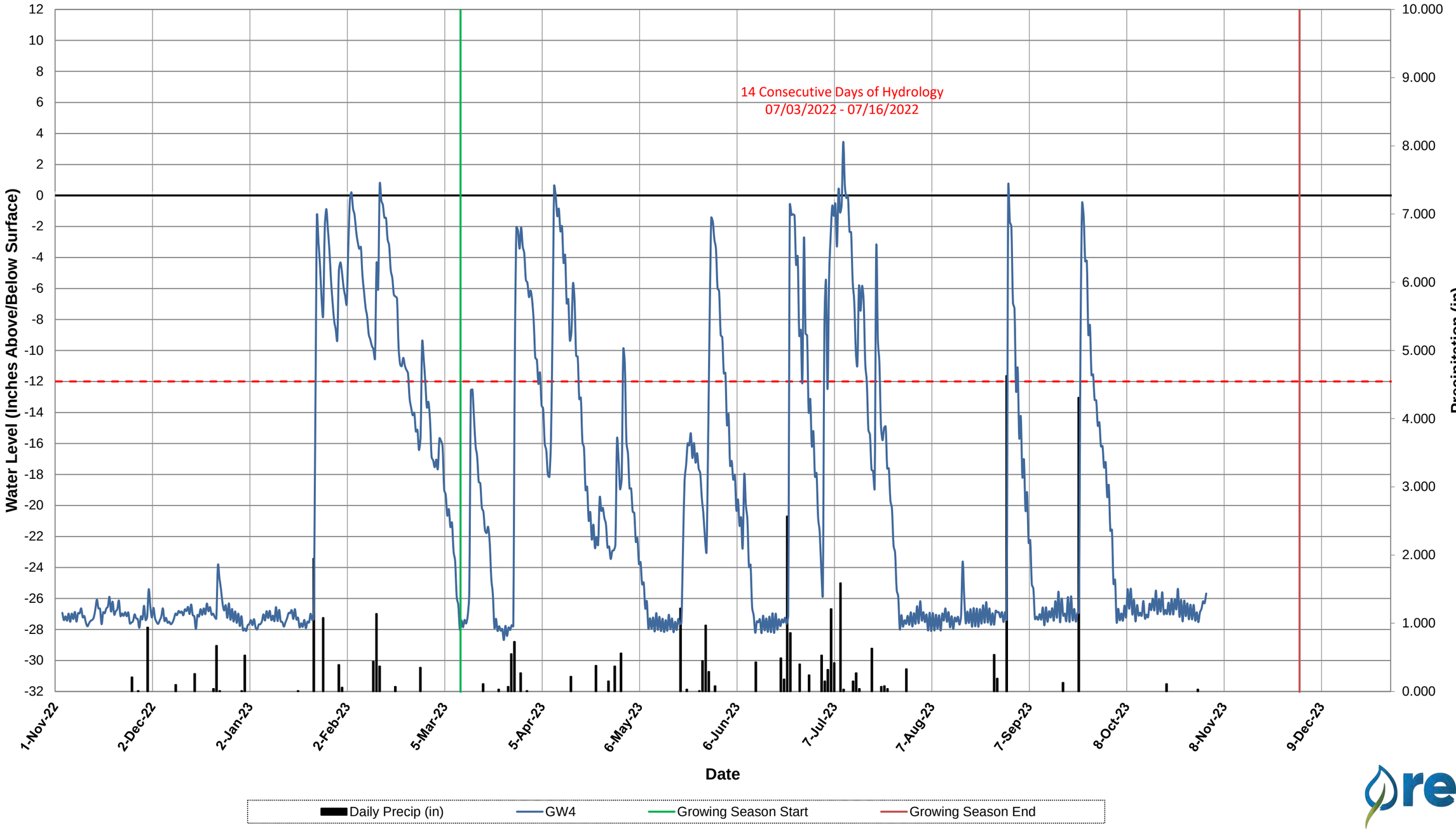
Cowford MY2 2023 GW2



Cowford MY2 2023 GW3



Cowford MY2 2023 GW4



Cowford MY2 2023 GW5