MY2 FINAL MONITORING REPORT

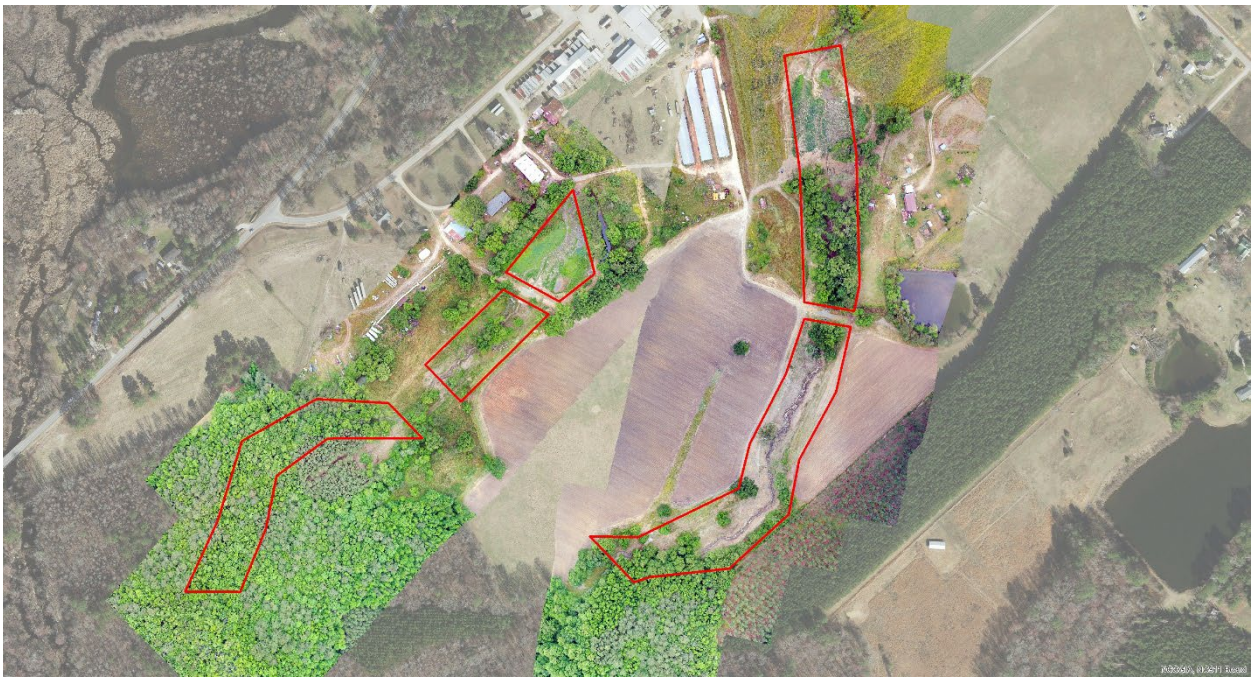
Odell's House Mitigation Project

Johnston County

Neuse River Basin

CU 03020201

DMS Project # 100041
DMS Contract # 7420
Contracted RFP # 16-007279
USACE Action ID Number: SAW-2018-00431
DWR Project # 2018-0200
Calendar Year of Data Collection: 2022



Prepared for:
North Carolina Department of Environmental Quality
Division of Mitigation Services
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Mitigation Services
ENVIRONMENTAL QUALITY

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November 30, 2022

NC Department of Environmental Quality
Division of Mitigation Services
Attn: Lindsay Crocker, Project Manager
217 W. Jones Street, Suite 3000
Raleigh, NC 27609

RE: WLS Responses to NCDEQ DMS Review Comments for Task 8 Submittal, Draft Monitoring Year 2 Report for the Odell's House Mitigation Project, DMS Full-Delivery Project ID #100041, Contract #7420, Neuse River Basin, Cataloging Unit 03020201, Johnston County, NC

Dear Ms. Crocker:

Water & Land Solutions, LLC (WLS) is pleased to present the Final Monitoring Year 2 Report for the Odell's House Mitigation Project to the North Carolina Department of Environmental Quality (NCDEQ) Division of Mitigation Services (DMS). Per the DMS review comments, WLS has updated the Final Monitoring Year 2 Report and associated deliverables accordingly. We are providing the electronic deliverables via cloud link. The electronic deliverables are organized under the following folder structure as required under the digital submission requirements:

1. Report PDF
2. Support Files
    1_ Tables
    2_CCPV
    3_Veg
    4_Geomorph
    5_Hydro
    6_Photos

We are providing our written responses to DMS' review comments on the Draft As-Built Baseline Report below. Each of the DMS review comments is copied below in **bold** text, followed by the appropriate response from WLS in regular text:

General:

- **DMS Comment: Table 2. Shows 8% in performance criteria for success. Update typo to 12%.** WLS Response: Table 2 has been updated to show 12% in performance criteria for success.

- **DMS Comment: Cross-sections: The 2016 guidance establishes that BHR should not exceed 1.2 or 10% change per year at any measured riffles, but this does not apply to pool cross-sections. Suggest revising narrative to describe that riffles have not changed.** WLS Response: The narrative has been revised to reflect the 2016 guidance for riffles.

- **DMS Comment: Confirm that the 'low stem density MY2' polygon shown on the CCPV is the 1.07-acre area of replant or show replant area on CCPV.** WLS Response: The area of low stem density that was replanted was added to the CCPV. A smaller polygon (0.19 acres) within that original planted area still has a low stem density based on vegetation plot data for MY2.

- **DMS Comment: Cross section graphs (starting at page 58 in PDF) are unclear. Confirm if this is from use of DMS tool or update with clearer visual if possible.** WLS Response: Graphics were generated using the DMS tool, but visuals became unclear when condensing into PDF. Appendices are updated with clearer visuals.

- **DMS Comment: Growing season for groundwater gages is through 11/3. Provide hydro data through that date if possible or explain if the entire length of growing season was used for calculations (i.e. did WLS assume worse case/no saturation from 9/14 on and use the total number of days for the denominator?).** WLS Response: The entire length of the growing season was used for the calculations. WLS assumed no saturation from 9/14 through 11/3 to calculate the hydroperiod. The total number of days was used as the denominator to calculate percent of growing season.

- **DMS Comment: Update rain data (monthly totals) to include Oct/Nov/Dec 2021 to show antecedent moisture conditions if possible.** WLS Response: Rain data was updated to show monthly rainfall totals for Oct/Nov/Dec 2021.

Riparian Buffer:

- **DMS Comment: Reminder to WLS that if IRT does not award headwater stream credit, then the buffer credit in those areas will no longer be eligible.** WLS Response: WLS appreciates this reminder.

Electronic Comments:

- **DMS Comment: Please clarify the need or verify redundancy for two unnamed crest gauges in the file 'crest gauge surveyed updated' file. It appears these should have been deleted.** WLS Response: The two unnamed crest gauges in the shapefile are the cork crest gauges. Each crest gauge on site has a pressure transducer crest gauge installed in the channel and a traditional cork crest gauge installed at bankfull in the floodplain. The attribute table was updated.

- **DMS Comment: Please add photo points to the CCPV.** WLS Response: Photo stations are on the CCPV as small white squares.

- **DMS Comment: Surface Water and Ground Water graphs are missing from the submission.** WLS Response: Hydrology graphs are provided in the Hydro folder.

Please contact me if you have any questions or comments.

Sincerely,

Water & Land Solutions, LLC

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Table of Contents

LIST OF APPENDICES

1 Project Summary

1.1 Project Location and Description

The Odell's House Mitigation Project ("Project") is a North Carolina Department of Environmental Quality (NCDEQ), Division of Mitigation Services (DMS) full-delivery stream and wetland mitigation project contracted with Water & Land Solutions, LLC (WLS) in response to RFP 16-007279. The Project provides stream and wetland mitigation credits in the Neuse River Basin (Cataloging Unit 03020201). The project site is in Johnston County, North Carolina, between the Town of Wendell and the Community of Archer Lodge. The Project is in the Lower Buffalo Creek Priority Sub-watershed 030202011504, study area for the Neuse 01 Regional Watershed Plan Phase II, Final Report (RWP), and in the Targeted Local Watershed 03020201180050, of the Neuse River Basin.

The Project involved the restoration, enhancement, preservation and permanent protection of eight stream reaches (R1, R2, R3, R4, R5, R6, R7 upper, and R7 lower), 6 wetland areas (W1, W2, W3, W4, W5, and W6), and their riparian buffers, totaling approximately 4,313 linear feet of designed streams, and 453,057.200 square feet of riparian buffers. Stream restoration is within the conservation easement and the existing powerline right-of-way. The Project also includes riparian wetland restoration (re-establishment and rehabilitation), enhancement and the preservation of 3.890 acres (based on design). The Project will provide significant ecological improvements and functional uplift through stream and wetland restoration and will decrease nutrient and sediment loads within the watershed. The mitigation plan provides a detailed project summary and Table 1 provides a summary of project assets. Figure 1a-c illustrates the project mitigation components.

Prior to construction, landowners historically manipulated streams and ditched riparian wetland systems to provide areas for crop production and cattle grazing. Cattle had complete access to streams and wetlands except for R7 and W5/W6, resulting in eroded banks, habitat destruction, and poor water quality. Two man-made ponds existed where reaches R1 and R5 are now located.

Monitoring Year 2 (MY2) activities occurred during August and September 2022. This report presents the data for MY2. The Project meets the MY2 success criteria for stream horizontal and vertical stability and streambed condition and stability. Stream hydrology is meeting success criteria for flow on R5, but not meeting flow requirements on R1. Eleven of the twelve vegetation plots met interim success criteria. The site is meeting wetland hydrology requirements at all locations except GW-1. Based on these results, the Project is on trajectory to meet interim and final success criteria. For more information on the chronology of the project history and activity, refer to Appendix E. Relevant project contact information is presented in Appendix E and project background information is presented in Table 3.

1.2 Project Quantities and Credits

The Project mitigation components include a combination of Stream Restoration, Enhancement, and Preservation activities, as well as Riparian Wetland Restoration (Re-establishment & Rehabilitation) Enhancement, and Preservation, as summarized in the Table 1 below.

Table 1. Odell's House (ID-100041) 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							
R1	437	533	Warm	R (PI/HW)	1.00000	437.000	Full Channel Restoration, Planted Buffer, Exclusion of Livestock, Permanent Conservation Easement
R2	526	518	Warm	EII	2.50000	210.400	Livestock Exclusion, Invasive Control, Supplemental Planting, Habitat Structures, Permanent Conservation Easement
R3	1,091	1,103	Warm	R (PI)	1.00000	1,091.000	Full Channel Restoration, Planted Buffer, Exclusion of Livestock, Permanent Conservation Easement
R4	190	199	Warm	EII	3.00000	63.333	Livestock Exclusion, Invasive Control, Supplemental Planting, Habitat Structures, Permanent Conservation Easement
R5	340	392	Warm	R (PI/HW)	1.00000	340.000	Full Channel Restoration, Planted Buffer, Exclusion of Livestock, Permanent Conservation Easement
R6	432	422	Warm	R (PI)	1.00000	432.000	Full Channel Restoration, Planted Buffer, Exclusion of Livestock, Permanent Conservation Easement
R7 (upper)	625	674	Warm	EI	1.50000	416.667	Dimension, Pattern and Profile modified, Livestock Exclusion, Supplemental Planting, Permanent Conservation Easement
R7 (lower)	412	461	Warm	P	10.00000	41.200	Permanent Conservation Easement
					Total:	**3,031.600**	
Wetland							
W1	0.476	0.477	R	REE	1.00000	0.476	Livestock Exclusion, Pond drainage, Limited soil manipulation, and Planting
W2	0.416	0.413	R	REE	1.00000	0.416	Livestock Exclusion, Pond drainage, Limited soil manipulation, and Planting
W3	0.666	0.645	R	RH	1.50000	0.444	Limited soil manipulation and Planting
W4	0.234	0.227	R	REE	1.00000	0.234	Limited soil manipulation, Restored groundwater hydrology and Planting
W5	1.654	1.636	R	E	2.50000	0.662	Restored hydrology and Planting
W6	0.444	0.440	R	P	10.00000	0.044	Permanent Conservation Easement
					Total:	**2.276**	

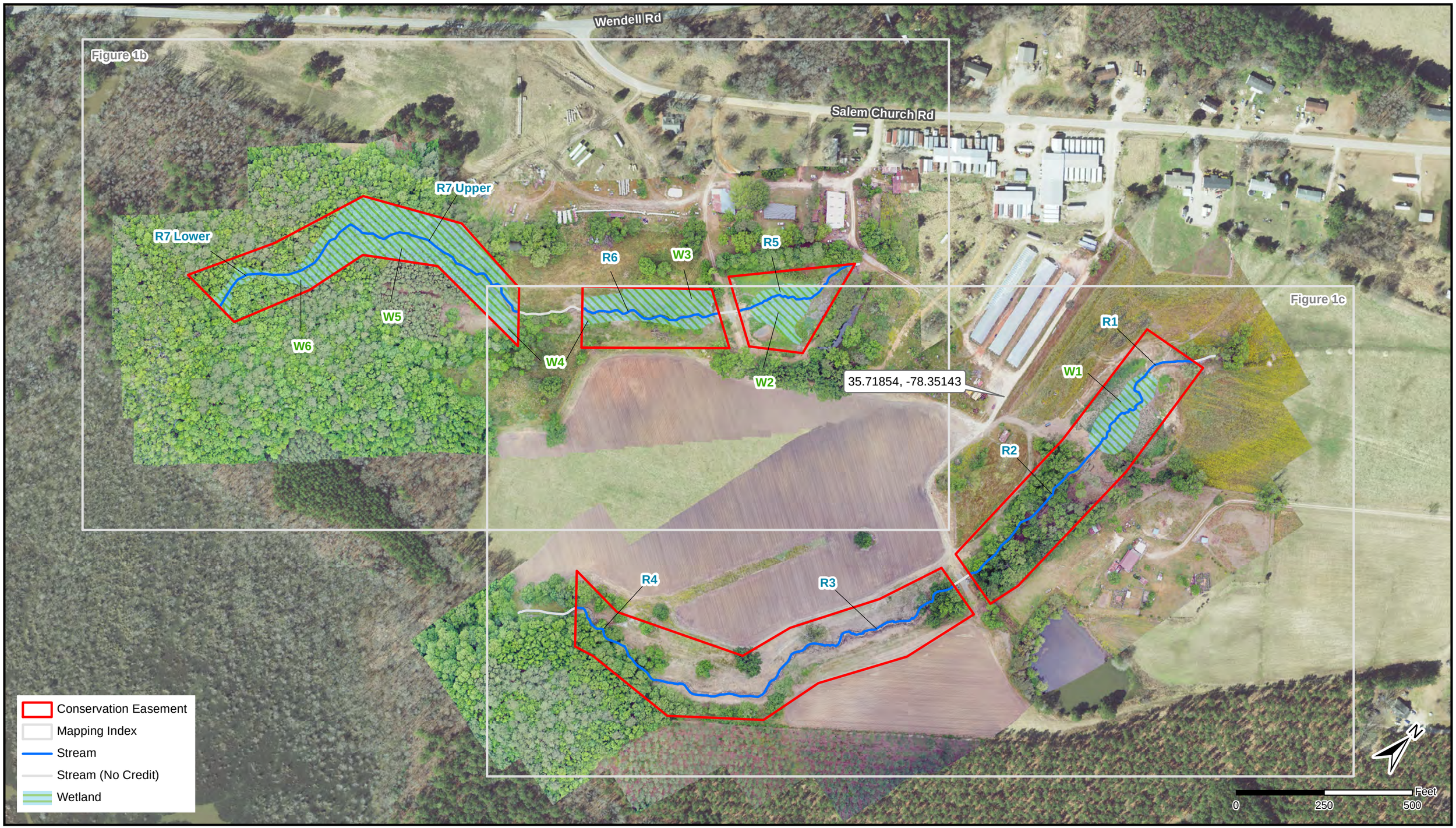
Project Credits

	Stream			Riparian	Non-Rip	Coastal
Restoration Level	Warm	Cool	Cold	Wetland	Wetland	Marsh
Restoration	2,300.000					
Re-establishment				1.126		
Rehabilitation				0.444		
Enhancement				0.662		
Enhancement I	416.667					
Enhancement II	273.733					
Creation						
Preservation	41.200			0.044		
Totals	**3,031.600**			**2.276**		

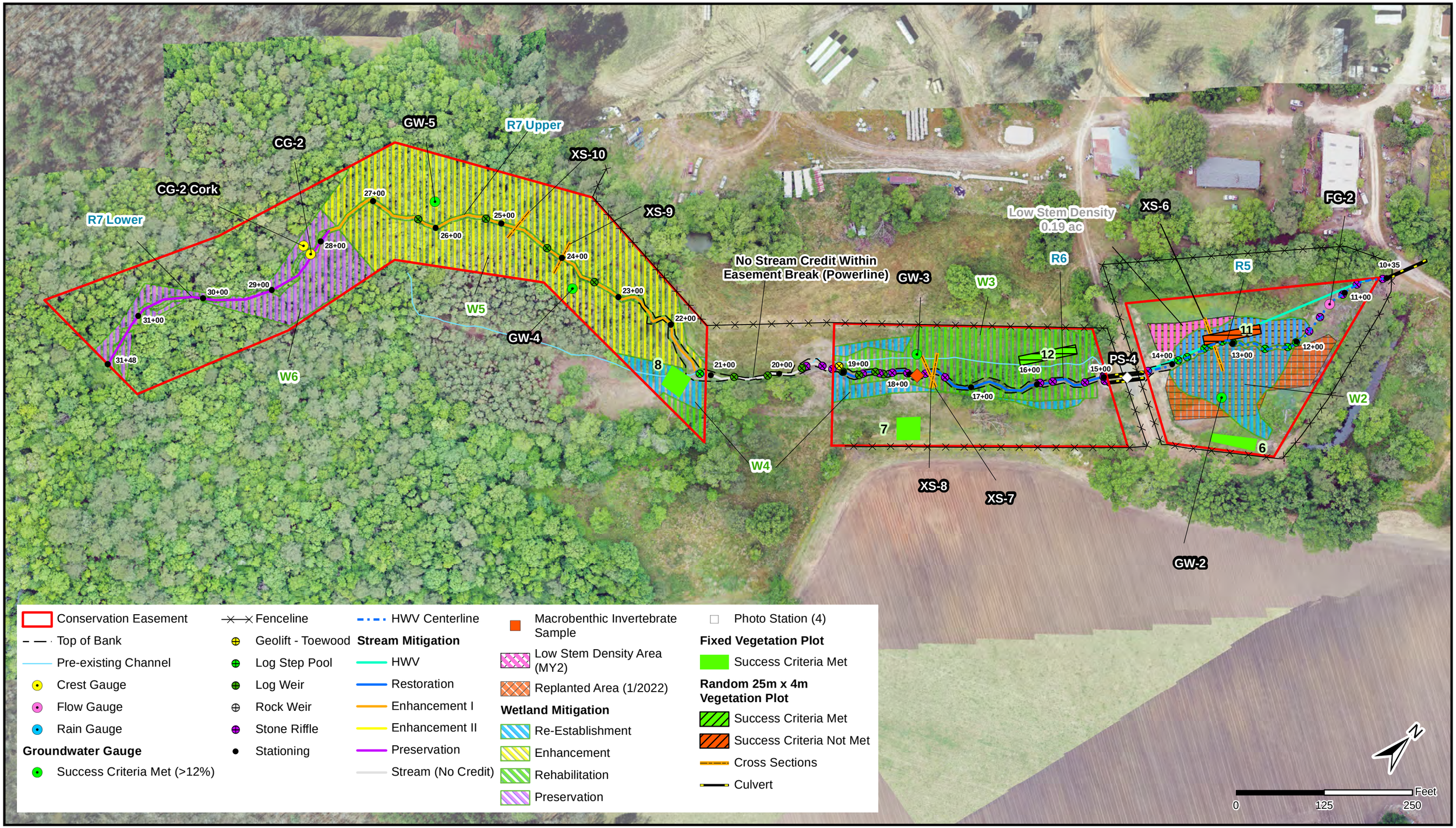
Total Stream Credit	**3,031.600**
Total Wetland Credit	**2.276**

1.3 Current Condition Plan View

The following pages present the Current Condition Plan View (CCPV).



WATER & LAND™ SOLUTIONS	NC Mitigation Services ENVIRONMENTAL QUALITY	**Odells House Mitigation Project** **Johnston County, North Carolina**	USACE Action ID Number: SAW-2018-00431 November 2022 MY2	USACE Current Conditions Plan View Monitoring Year 2 NAD 1983 2011 State Plane North Carolina FIPS 3200 FT US	FIGURE 1a



WATER & LAND™ SOLUTIONS

NC Mitigation Services ENVIRONMENTAL QUALITY

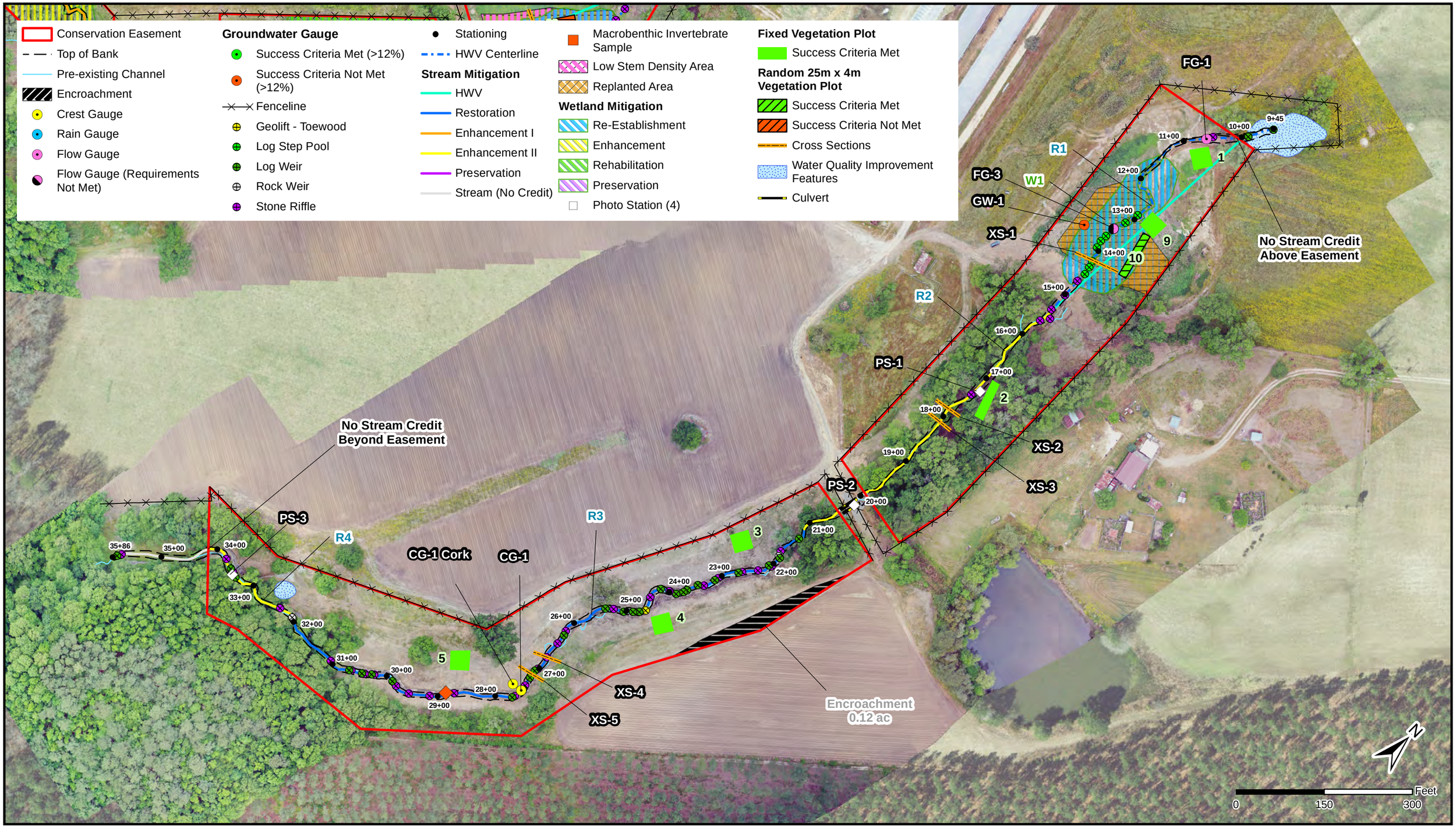
Odells House Mitigation Project
Johnston County, North Carolina

USACE Action ID Number:
SAW-2018-00431
November 2022
MY2

USACE
Current Conditions Plan View
Monitoring Year 2

NAD 1983 2011 State Plane
North Carolina FIPS 3200 FT US

FIGURE
1b



WATER & LAND™ SOLUTIONS	Mitigation Services ENVIRONMENTAL QUALITY	**Odells House Mitigation Project** **Johnston County, North Carolina**	USACE Action ID Number: SAW-2018-00431 November 2022 MY2	USACE Current Conditions Plan View Monitoring Year 2 NAD 1983 2011 State Plane North Carolina FIPS 3200 FT US	FIGURE 1 c

2 Goals, Performance Criteria, and Functional Improvements

2.1 Project Goals and Objectives

The Project will meet the goals and objectives described in the Odell's House Final Approved Mitigation Plan and address the general restoration goals and opportunities outlined in the DMS Neuse River Basin Watershed Restoration Priorities (RBRP). More specifically, three out of the four functional goals and objectives outlined in the Wake-Johnston Collaborative Local Watershed Plan (LWP) as well as the Neuse 01 RWP will be met by:

- Reducing sediment and nutrient inputs to the Buffalo Creek Watershed.
- Restoring, preserving, and protecting wetlands, streams, riparian buffers and aquatic habitat.
- Implementing agricultural BMPs and stream restoration in rural catchments together as "project clusters".

To accomplish these project-specific goals, the following objectives will be measured to document overall project success:

- Restore stream and floodplain interaction and geomorphically stable conditions by reconnecting historic flow paths and promoting more natural flood processes;
- Improve and protect water quality by reducing streambank erosion, nutrient and sediment inputs;
- Restore and protect riparian buffer functions and habitat connectivity in perpetuity by recording a permanent conservation easement;
- Incorporate water quality improvement features to reduce nonpoint source inputs to receiving waters

Table 2: Summary: Goals, Performance and Results					
Goal	**Objective/Treatment**	**Likely Functional Uplift**	**Performance Criteria**	**Measurement**	**Cumulative Monitoring Results**
Improve Stream Base Flow Duration	Improve and/or remove existing stream crossings and restore a more natural flow regime and aquatic passage.	Create a more natural and higher functioning headwater flow regime and provide aquatic passage; re-establish appropriate wetland hydroperiods and provide hydrologic storage	Maintain seasonal flow on intermittent stream for a minimum of 30 consecutive days during normal annual rainfall	3 Flow gauges (R1 & R5)	2/3 flow gauges met critiera
Reconnect channels with floodplains and riparian wetlands to allow a natural flooding regime.	Design BHRs to not exceed 1.2 and increase ERs no less than 2.2 for Rosgen 'C' and 'E' stream types and 1.4 for 'B' stream types.	Provide temporary water storage and reduce erosive forces (shear stress) in channel during larger flow events.	Minimum of four bankfull events in separate years. Wetland hydrology for 12% of growing season.	2 Crest Gauges/pressure transducers (R3 & R7 Lower) and 5 wetland groundwater gauges (W1, W2, W3, & W5)	2/2 crest gauges met critiera and 4/5 wetland groundwater gauges met 12% criteria.
Improve stabilty of stream channels	Construct stream channels that will maintain stable cross-sections, patterns, and profiles over time.	Reduction in sediment inputs from bank erosion, reduction of shear stress, and improved overall hydraulic function.	Bank height ratios remain below 1.2 over the monitoring period. Visual assessments showing progression towards stability.	10 Cross section surveys	10/10 cross sections BHR<1.2
Establish Riparian Buffer Vegetation	Plant native species vegetation a minimum 50' wide from the top of the streambanks with a composition/density comparable to downstream reference condition.	Increase woody and herbaceous vegetation will provide channel stability and reduce streambank erosion, runoff rates and exotic species vegetation.	Within planted portions of the site, a minimum of 320 stems per acre must be present at year three; a minimum of 260 stems per acre must be present at year five and average height of seven feet; and a minimum of 210 stems per acre and average ten foot tree heights must be present at year seven.	Tree data for 12 Veg Plots (species & height), visual assessment	11/12 veg plots met - 2022

2.2 Project Success Criteria

The success criteria for the Project will follow the approved performance standards and monitoring protocols from the final approved mitigation plan; which was developed in compliance with the USACE October 2016 Guidance, USACE Stream Mitigation Guidelines (April 2003 and October 2005), and 2008 Compensatory Mitigation Final Rule. Cross-section and vegetation plot data will be collected in Years 0, 1, 2, 3, 5, and 7. Stream hydrology data and visual monitoring will be reported annually. Specific success criteria components and evaluation methods are described below.

2.2.1 Streams

***Stream Hydrology*:** Four separate bankfull or over bank events must be documented within the seven-year monitoring period and the stream hydrology monitoring will continue until four bankfull events have been documented in separate years. Stream hydrology monitoring will be accomplished with pressure transducers installed in pools and correlating sensor depth to top of bank elevation (see appendix D for installation diagrams). Recorded water depth above the top of bank elevation will document a bankfull event. The devices will record water depth hourly and will be inspected quarterly. In addition to the pressure transducers, traditional cork gauges will be installed at bankfull elevation and will be used to document bankfull events with photographs.

Stream Profiles, Vertical Stability, and Floodplain Access: Stream profiles, as a measure of vertical stability and floodplain access will be evaluated by looking at Bank Height Ratios (BHR). In addition, observed bedforms should be consistent with those observed for channels of the design stream type(s). The BHR shall not exceed 1.2 along riffles within the restored Project stream reaches. This standard only applies to restored reaches of the channel where BHRs were corrected through design and construction. Vertical stability will be evaluated with visual assessment, cross-sections and, if directed by the IRT, longitudinal profile.

Stream Horizontal Stability: Cross-sections will be used to evaluate horizontal stream stability on restored streams. There should be little change expected in as-built restoration cross-sections. If measurable changes do occur, they should be evaluated to determine if the changes represent a movement toward a more unstable condition (e.g., downcutting, erosion) or a movement towards increased stability (e.g., settling, vegetation establishment, deposition along the streambanks, 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.

Stream cross-section monitoring will be conducted using a Topcon Total Station. Three-dimensional coordinates associated with cross-section data will be collected in the field (NAD83 State Plane feet FIPS 3200). Morphological data will be collected at ten cross-sections. Survey data will be imported into Microsoft Excel® and the DMS Shiny App for data processing and analysis.

Reference photo transects will be taken at each permanent cross-section. Lateral photos should not indicate excessive erosion or continuing degradation of the streambanks. Photographs will be taken of both streambanks at each cross-section. A survey tape stretched between the permanent cross-section monuments/pins will be centered in each of the streambank photographs. The water elevation will be shown in the lower edge of the frame, and as much of the streambank as possible will be included in each photo. Photographers will attempt to consistently maintain the same area in each photo over time.

Jurisdictional Stream Flow: Monitoring of stream flow will be conducted to demonstrate that the restored stream systems classified as intermittent exhibit surface flow for a minimum of 30 consecutive days throughout some portion of the year during a year with normal rainfall conditions. Stream flow monitoring will be accomplished with pressure transducers installed in pools and correlating sensor depth to the downstream top of riffle elevation (see appendix D for installation diagrams). If the pool water depth is at or above the top of riffle elevation, then the channel will be assumed to have surface flow. The devices will record water elevation twice per day and will be inspected quarterly to document surface hydrology and provide a basis for evaluating flow response to rainfall events.

The stage recorders include an automatic pressure transducer (HOBO Water Level (13 ft) Logger) set in PVC piping in the channel. The elevation of the bed and top of bank at each stage recorder location will be recorded to be able to document presence of water in the channel and out of bank events. Visual observations (i.e. wrack or debris lines) and traditional cork crest gauges will also be used to document out of bank events.

Channel Formation: During monitoring years 1 through 4, the preponderance of evidence must demonstrate a concentration of flow indicative of headwater stream channel formation within the topographic low-point of the valley or crenulation as documented by the following indicators for reaches R1 and R5:

- Scour (indicating sediment transport by flowing water)
- Sediment deposition (accumulations of sediment and/or formation of ripples)
- Sediment sorting (sediment sorting indicated by grain-size distribution with the primary path of flow)
- Multiple observed flow events (must be documented by gauge data and/or photographs)
- Destruction of terrestrial vegetation
- Presence of litter and debris
- Wracking (deposits of drift material indicating surface water flow)
- Vegetation matted down, bent, or absent (herbaceous or otherwise)
- Leaf litter disturbed or washed away

During monitoring years 5 through 7, the stream must successfully meet the requirements above and the preponderance of evidence must demonstrate the development of stream bed and banks as documented by the following indicators:

- Bed and banks (may include the formation of stream bed and banks, development of channel pattern such as meander bends and/or braiding at natural topographic breaks, woody debris, or plant root systems)
- Natural line impressed on the bank (visible high-water mark)
- Shelving (shelving of sediment depositions indicating transport)
- Water staining (staining of rooted vegetation)
- Change in plant community (transition to species adapted for flow or inundation for a long duration, including hydrophytes)
- Changes in character of soil (texture and/or chroma changes when compared to the soils abutting the primary path of flow)

2.2.2 Wetlands

Wetland Hydrology: The performance standard for wetland hydrology will be 12 percent based on the suggested wetland saturation thresholds for soils taxonomic subgroups. The proposed success criteria for wetland hydrology will be when the soils are saturated within 12 inches of the soil surface for 12 percent (27 days) of the 227-day growing season (March 21st through November 3rd) based on WETS data table for Johnston County, NC. The saturated conditions should occur during a period when antecedent precipitation has been normal or drier than normal for a minimum frequency of 5 years in 10 (USACE, 2005 and 2010b). Precipitation data will be obtained from an on-site rain gauge and the Clayton (CLAY) Research Weather Station, approximately nine miles southeast of the Project site. If a normal year of precipitation does not occur during the first seven years of monitoring, WLS will continue to monitor the Project hydrology until the Project site has been saturated for the appropriate hydroperiod. If rainfall

amounts for any given year during the monitoring period are abnormally low, reference wetland hydrology data will be compared to determine if there is a correlation with the weather conditions and site variability.

2.2.3 Vegetation

Vegetation monitoring will occur in the fall each required monitoring year, prior to leaf drop. Plots will be monitored in years 1, 2, 3, 5, and 7. Vegetative success for the Project during the intermediate monitoring years will be based the survival of at least 320, three-year-old trees per acre at the end of Year 3 of the monitoring period; and at least 260, five-year-old, trees per acre that must average seven feet in height at the end of Year 5 of the monitoring period. The final vegetative restoration success criteria will be achieving a density of no less than 210, seven-year-old stems per acre that must average ten feet in height in Year 7 of monitoring. Volunteer species on the approved planting list that meet success criteria standards will be counted towards success criteria.

Vegetation success will be monitored at a total of nine permanent vegetation plots (10m x 10m) and 3 random vegetation transects (25m x 4m). 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 will be processed using the DMS Shiny App. In the field, the four corners of each plot will be permanently marked with PVC at the origin and rebar at the other corners. Tree species and height will be recorded for each planted stem and photos of each plot are to be taken from the origin each monitoring year.

2.2.4 Visual Assessment

WLS will conduct visual assessments in support of mitigation performance monitoring. Visual assessments of all stream reaches will be conducted twice per monitoring year with at least five months in between each site visit for each of the seven years of monitoring. Photographs will be used to visually document system performance and any areas of concern related to streambank and bed stability, condition of in-stream structures, channel migration, active headcuts, live stake mortality, invasive plant species or animal browsing, easement boundary encroachments, cattle exclusion fence damage, and general streambed conditions.

3 Project Attributes

3.1 Design Approach

The Project stream design approach included a combination of Stream Restoration, Enhancement, and Preservation activities (see Table 1). Priority Level I restoration approaches were incorporated with the design of both single-thread meandering channels and headwater stream valleys. All non-vegetated areas within the conservation easement were planted with native species vegetation and any areas of invasive species were removed and/or treated.

3.2 Project Attributes

See Table 3 below for Project Attributes.

Table 3. Project Attribute Table								
Project Name	Odell's House Mitigation Project							
County	Johnston							
Project Area (acres)	15.092							
Project Coordinates (latitude and longitude decimal degrees)	35.71589, -78.35345							
Project Watershed Summary Information								
Physiographic Province	Piedmont							
River Basin	Neuse							
USGS Hydrologic Unit 8-digit	3020201							
DWR Sub-basin	03-04-06							
Project Drainage Area (acres)	41.8 (R7 lower) and 95.4 (R4)							
Project Drainage Area Percentage of Impervious Area	<1%							
Land Use Classification	2.01.03, 2.01.01, 3.02 (69% cultivated crops/hay, 2% grass/herbaceous, 25% mixed forest, 4% pond)							
Reach Summary Information								
Parameters	**R1**	**R2**	**R3**	**R4**	**R5**	**R6**	**R7 (upper)**	**R7 (lower)**
Pre-project length (feet)	N/A (pond)	632	1169	392	N/A (pond)	610	468	412
Post-project (feet)	533	518	1103	199	392	422	674	461
Valley confinement (Confined, moderately confined, unconfined)	N/A	moderately confined	moderately confined	unconfined	N/A	unconfined	unconfined	unconfined
Drainage area (acres)	42.9	64	83.2	95.4	19.4	30.7	39.7	41.8
Perennial, Intermittent, Ephemeral	N/A	Perennial	Intermittent	Intermittent	N/A	Intermittent	Intermittent	Intermittent
NCDWR Water Quality Classification	C, NSW	C, NSW	C, NSW	C, NSW	C, NSW	C, NSW	C, NSW	C, NSW
Dominant Stream Classification (existing)	N/A (pond)	C5	G5	E5	N/A (pond)	E5	G5	E5/DA
Dominant Stream Classification (proposed)	DA/E5	C5	B5	E5	DA/E5	B5c	B5c	E5
Dominant Evolutionary class (Simon) if applicable	N/A	IV/V	III	IV/V	N/A	III	I	I
Wetland Summary Information								
Parameters	**W1**	**W2**	**W3**	**W4**	**W5**	**W6**		
Pre-project (acres)	0.476	0.416	0.666	0.234	1.654	0.444		
Post-project (acres)	0.477	0.413	0.645	0.227	1.636	0.44		
Wetland Type (non-riparian, riparian)	Riparian Riverine	Riparian Riverine	Riparian Riverine	Riparian Riverine	Riparian Riverine	Riparian Riverine		
Mapped Soil Series	Water, Cowarts loamy sand	Water	Leaf silt loam, Cowarts loamy sand	Leaf silt loam, Cowarts loamy sand	Leaf silt loam, Bonneau sand, Wedowee sandy loam	Bonneau sand, Leaf silt loam		
Soil Hydric Status	N/A, non hydric	N/A	Hydric, non hydric	Hydric, non hydric	Hydric, non hydric	non-hydric, Hydric		
Regulatory Considerations								
Parameters	**Applicable?**			**Resolved?**		**Supporting Docs?**		
Water of the United States - Section 404	Yes			Yes		PCN/404 permit		
Water of the United States - Section 401	Yes			Yes		PCN/401 permit		
Endangered Species Act	Yes			Yes		Categorical Exclusion		
Historic Preservation Act	Yes			Yes		Categorical Exclusion		
Coastal Zone Management Act (CZMA or CAMA)	No			N/A		N/A		
Essential Fisheries Habitat	No			N/A		N/A		

4 Monitoring Year 2 Assessment and Results

4.1 Morphological Assessment

Morphological data for MY2 was collected in August 2022. Refer to Appendices A and C for summary data tables, morphological plots, and stream photographs.

4.1.1 Stream Horizontal Pattern & Longitudinal Profile

The MY2 visual observations of stream channel pattern and longitudinal profiles closely match the as-built parameters and did not show any significant deviation from as-built conditions. The minor channel adjustments in riffle slopes, pool depths and pattern do not present a stability concern or indicate a need for remedial action and will be assessed visually during the annual assessments.

4.1.2 Stream Horizontal Dimension

The MY2 channel dimensions generally match the design parameters and are within acceptable and stable ranges of tolerance. Ten cross-sections are located on restoration and enhancement I and II reaches on the project. Two cross-sections are in headwater reaches, four are in riffles and four are in pools. All ten cross-sections show little change in bankfull area, and all bank-height ratios are below 1.2. It is expected that over time that some pools may accumulate fine sediment and organic matter, however, this is not an indicator of channel instability. Maximum riffle depths are also expected to fluctuate slightly throughout the monitoring period as the channels adjust to the new flow regime.

4.2 Stream Hydrology

4.2.1 Stream Flow

Two pressure transducers (flow gauges), installed in March 2021 on reaches R1 and R5, documented that the stream exhibited surface flow for a minimum of 30 consecutive days throughout the monitoring year (Appendix E). An additional flow gauge (FG-3) was installed on December 16th, 2021, on R1 near the center of the old pond bed. FG-3 exhibit flow for a maximum of 18 consecutive days and failed to meet the 30-day criterium. WLS will continue to monitor FG-3 in Year 3 to determine if R1 is trending toward success. If needed, remedial actions will be planned following Year 3 data analysis. Additionally, to determine if rainfall amounts are normal for the given year, precipitation data was obtained from an onsite rain gauge and data is presented in Appendix D.

Flow Gauge Data

Flow Gauge Name	Flow Gauge Location	Longest Period of Consecutive Flow	Total Days of Cumulative Flow	Total Days of Cumulative No Flow	Longest Period of Consecutive No Flow
FG-1	R1	160 days 1/1/2022 – 6/9/2022	198 days	60 days	20 days
FG-2	R5	183 days 1/1/2022 – 7/2/2022	236 days	22 days	8 days
FG-3	R1	18 days 1/15/2022 – 2/2/2022	101 days	156 days	107 days

4.2.1.1 *Bankfull Events*

Two crest gauges were installed in March 2021 to document bankfull events. WLS installed a conventional cork crest gauge, along with a pressure transducer to validate flood status on R3 and R7 lower. During MY2, bankfull events were recorded on both pressure transducer crest gauges. CG-1 recorded six events with a maximum of 0.715' above bankfull on 8/18/2022. CG-2 recorded 10 events with a maximum of 0.54' above bankfull on 1/2/2022-1/10/2022. Associated data are in Appendix E.

4.2.2 Headwater Stream Channel Formation

During MY2, streams R1 and R5 exhibited evidence indicative of channel formation within the topographic low-point of the valley (see table and photos in Appendix C).

4.3 Wetlands

Five groundwater wells were installed in March 2021 to monitor wetland hydrology within wetland re-establishment and enhancement areas. Groundwater well locations are shown on the CCPV. Of the five wetland groundwater wells four met the twelve percent hydrology criteria for MY1. GW-1 did not meet hydrology criteria with only 5 days of consecutive hydrology or 2.2 percent of the growing season. Due to the surface cracking of old pond sediment, GW-1 is no longer sealed below the surface and will be reinstalled prior to MY3. WLS will add an additional gauge in W1 on the left floodplain of R1 to monitor groundwater more closely within the wetland. Associated data is in Appendix E.

4.4 Vegetation

Monitoring of the nine permanent vegetation plots and three random plots/transects was completed during September 2022. Vegetation data and photos can be found in Appendix B. The MY2 average planted density is 493 stems per acre, which exceeds the interim measure of vegetative success of at least 320 planted stems per acre at the end of the third monitoring year. All nine fixed vegetation plots and two of the random transects met the interim measure requirement with 324 - 769 stems per acre. Random vegetation transect 11 (W2) did not meet density criteria with 202 stems per acre. Low stem densities in this area are due to difficult to locate trees in dense herbaceous vegetation. WLS will continue to monitor random transects in W2 in Year 3. Volunteer species that can be counted toward success criteria were not noted during MY2 but are expected to meet criteria in Year 3.

Two areas located in W1 and W2, totaling approximately 1.07 acres, were identified in MY1 as having low stem density. Both areas were replanted on January 5th, 2022, with wet-tolerant species from the approved mitigation plan (see planting list below). Based on this year's data, the low stem density area has been reduced to the right floodplain of R5 (0.19 acres).

Supplemental Planting List

Species	Common Name	Total Number Planted	Total Percentage Planted
Platanus occidentalis	Sycamore	300	33.3%
Betula nigra	River Birch	300	33.3%
Quercus michauxii	Swamp Chestnut Oak	150	16.7%
Quercus phellos	Willow Oak	150	16.7%
	Total	900	100.0%

Visual assessment of vegetation outside of the monitoring plots indicates that the herbaceous vegetation is becoming well established throughout the project. One area of encroachment was noted in MY1 along R3 left bank slope (~0.12 acres). An active farm field along the easement has led to farm equipment encroachment. Prior to MY2, additional t-posts, string, and flagging was added to the easement (see photos in Appendix A). No trees were damaged from the encroachment, only herbaceous vegetation. No further encroachment in this area was found during MY2, but this area will continue to be monitored closely in MY3.

A large population of golden bamboo (*Phyllostachys aurea*) existed along the left floodplain of R2 prior to construction. Construction activities included bamboo removal in this area by ripping the roots/rhizomes, cut stump herbicide treatments, and foliar spray of small shoots. Herbicide treatments used 50 percent glyphosate (Rodeo) for cut/stump and 20 percent for foliar spray. During MY2, foliar spray treatments of bamboo continued, see table below. Current percent cover is less than five percent. This area will continue to be monitored closely and any treatments will be documented in future monitoring reports.

Herbicide Treatment Table

Monitoring Year	Invasive Targeted	Invasive Treatment	Date Treatment Conducted	Herbicide Used
1	Golden Bamboo	Foliar	7/1/2021	Rodeo (5%)
	Golden Bamboo	Foliar	8/17/2021	Rodeo (20%)
2	Golden Bamboo & Cattail	Foliar	4/20/2022	Rodeo (5% and 20%)

Appendix A:
Visual Assessment Data

Visual Stream Morphology Stability Assessment Table
Vegetation Condition Assessment Table
Photos: Cross-Section Photos
Photos: Stream Photo Points (Culvert Crossings and EII Reaches)
Photos: Encroachment Area Photos

Table 4: Visual Stream Stability Assessment						
Reach		R1				
Assessed Stream Length		533				
Assessed Bank Length		1,066				
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)	9	9		100%

Table 4: Visual Stream Stability Assessment						
Reach		R2				
Assessed Stream Length		518				
Assessed Bank Length		1,036				
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.	2	2		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)	0	0		#DIV/0!

Table 4: Visual Stream Stability Assessment						
Reach		R3				
Assessed Stream Length		1,103				
Assessed Bank Length		2,206				
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.	44	44		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)	23	23		100%

Table 4: Visual Stream Stability Assessment						
Reach		R4				
Assessed Stream Length		199				
Assessed Bank Length		398				
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.	5	5		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)	2	2		100%

Table 4: Visual Stream Stability Assessment						
Reach		R5				
Assessed Stream Length		392				
Assessed Bank Length		784				
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)	9	9		100%

Table 4: Visual Stream Stability Assessment						
Reach		R6				
Assessed Stream Length		422				
Assessed Bank Length		844				
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)	5	5		100%

Table 4: Visual Stream Stability Assessment						
Reach		R7				
Assessed Stream Length		1,135				
Assessed Bank Length		2,270				
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.	5	5		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)	5	5		100%

Visual Vegetation Assessment

Planted acreage	**11.17**

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	0.19	1.7%
	Total		0.19	1.7%
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		0.19	1.7%

Easement Acreage	**15.1**

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.	Black and White stripes	0.12	

R1, XS-1, Upstream (MY-00)

R1, XS-1, Upstream (MY-02)

R1, XS-1, Downstream (MY-00)

R1, XS-1, Downstream (MY-02)

R1, XS-1, Left Bank (MY-00)

R1, XS-1, Left Bank (MY-02)

R1, XS-1, Right Bank (MY-00)

R1, XS-1, Right Bank (MY-02)

R2, XS-2, Upstream (MY-00)

R2, XS-2, Upstream (MY-02)

R2, XS-2, Downstream (MY-00)

R2, XS-2, Downstream (MY-02)

R2, XS-2, Left Bank (MY-00)

R2, XS-2, Left Bank (MY-02)

R2, XS-2, Right Bank (MY-00)

R2, XS-2, Right Bank (MY-02)

R2, XS-3, Upstream (MY-00)

R2, XS-3, Upstream (MY-02)

R2, XS-3, Downstream (MY-00)

R2, XS-3, Downstream (MY-02)

R2, XS-3, Left Bank (MY-00)

R2, XS-3, Left Bank (MY-02)

R2, XS-3, Right Bank (MY-00)

R2, XS-3, Right Bank (MY-02)

R3, XS-4, Upstream (MY-00)

R3, XS-4, Upstream (MY-02)

R3, XS-4, Downstream (MY-00)

R3, XS-4, Downstream (MY-02)

R3, XS-4, Left Bank (MY-00)

R3, XS-4, Left Bank (MY-02)

R3, XS-4, Right Bank (MY-00)

R3, XS-4, Right Bank (MY-02)

R3, XS-5, Upstream (MY-00)

R3, XS-5, Upstream (MY-02)

R3, XS-5, Downstream (MY-00)

R3, XS-5, Downstream (MY-02)

R3, XS-5, Left Bank (MY-00)

R3, XS-5, Left Bank (MY-02)

R3, XS-5, Right Bank (MY-00)

R3, XS-5, Right Bank (MY-02)

R5, XS-6, Upstream (MY-00)

R5, XS-6, Upstream (MY-02)

R5, XS-6, Downstream (MY-00)

R5, XS-6, Downstream (MY-02)

R5, XS-6, Left Bank (MY-00)

R5, XS-6, Left Bank (MY-02)

R5, XS-6, Right Bank (MY-00)

R5, XS-6, Right Bank (MY-02)

R6, XS-7, Upstream (MY-00)

R6, XS-7, Upstream (MY-02)

R6, XS-7, Downstream (MY-00)

R6, XS-7, Downstream (MY-02)

R6, XS-7, Left Bank (MY-00)

R6, XS-7, Left Bank (MY-02)

R6, XS-7, Right Bank (MY-00)

R6, XS-7, Right Bank (MY-02)

R6, XS-8, Upstream (MY-00)

R6, XS-8, Upstream (MY-02)

R6, XS-8, Downstream (MY-00)

R6, XS-8, Downstream (MY-02)

R6, XS-8, Left Bank (MY-00)

R6, XS-8, Left Bank (MY-02)

R6, XS-8, Right Bank (MY-00)

R6, XS-8, Right Bank (MY-02)

R7 (upper), XS-9, Upstream (MY-00)

R7 (upper), XS-9, Upstream (MY-02)

R7 (upper), XS-9, Downstream (MY-00)

R7 (upper), XS-9, Downstream (MY-02)

R7 (upper), XS-9, Left Bank (MY-00)

R7 (upper), XS-9, Left Bank (MY-02)

R7 (upper), XS-9, Right Bank (MY-00)

R7 (upper), XS-9, Right Bank (MY-02)

R7 (upper), XS-10, Upstream (MY-00)

R7 (upper), XS-10, Upstream (MY-02)

R7 (upper), XS-10, Downstream (MY-00)

R7 (upper), XS-10, Downstream (MY-02)

R7 (upper), XS-10, Left Bank (MY-00)

R7 (upper), XS-10, Left Bank (MY-02)

R7 (upper), XS-10, Right Bank (MY-00)

R7 (upper), XS-10, Right Bank (MY-02)

PS-1 – R2, EII, Upstream (MY-00)

PS-1 – R2, EII, Upstream (MY-02)

PS-1 – R2, EII, Downstream (MY-00)

PS-1 – R2, EII, Downstream (MY-02)

PS-2 – R2 Culvert Crossing, Upstream (MY-00)

PS-2 – R2 Culvert Crossing, Upstream (MY-02)

PS-2 – R2 Culvert Crossing, Downstream (MY-00)

PS-2 – R2 Culvert Crossing, Downstream (MY-02)

PS-3 – R4, EII, Upstream (MY-00)

PS-3 – R4, EII, Upstream (MY-02)

PS-3 – R4, EII, Downstream (MY-00)

PS-3 – R4, EII, Downstream (MY-02)

PS-4 – R5 Culvert Crossing, Upstream (MY-00)

PS-4 – R5 Culvert Crossing, Upstream (MY-02)

PS-4 – R5 Culvert Crossing, Downstream (MY-00)

PS-4 – R5 Culvert Crossing, Downstream (MY-02)

Encroachment Area, R3, Facing South (MY-01)

Encroachment Area, R3, Facing South (MY-02)

Encroachment Area, R3, Facing North (MY-01)

Encroachment Area, R3, Facing North (MY-02)

Appendix B:
Vegetation Plot Data

Red-line Plant List
Vegetation Performance Standards Summary Table
Vegetation Plot Counts and Densities Table
Photos: Vegetation Plot Photos

Odell's House Mitigation Project Red-line Planting List				
Species	**Common Name**	**Stems**	**% Planted**	**Mitigation Plan %**
Fraxinus pennsylvanica	Green Ash	228	3.00%	3%
Betula nigra	River birch	608	8.00%	12%
Quercus michauxii	Swamp chestnut oak	608	8.00%	10%
Quercus pagoda	Cherrybark oak	532	7.00%	10%
Platanus occidentalis	American sycamore	684	9.00%	12%
Quercus nigra	Water Oak	532	7.00%	10%
Liriodendron tulipifera	Tulip Poplar	684	9.00%	12%
Quercus phellos	Willow Oak	532	7.00%	10%
Diospyros virginiana	Persimmon	456	6.00%	4%
Carpinus caroliniana	Ironwood	456	6.00%	3%
Hamamelis virginiana	Witch Hazel	456	6.00%	3%
Asimina triloba	Pawpaw	456	6.00%	4%
Lindera benzoin	Spicebush	456	6.00%	4%
Alnus serulatta	Tag Alder	456	6.00%	0%
Corylus americana	Hazelnut	456	6.00%	3%
Total		**7,600**	**100%**	

* changes from mitigation plan in red

*Tag Alder was not planted within potential Nutrient Buffer Areas

Riparian Buffer Live Stake Plantings – Streambanks			
(Proposed 2' to 3' Spacing @ Meander Bends and 6' to 8' Spacing @ Riffle Sections)			
Sambucus canadensis	Elderberry	20%	FACW
Salix sericea	Silky Willow	30%	OBL
Salix nigra	Black Willow	10%	OBL
Cornus amomum	Silky Dogwood	40%	FACW

Note: *Final species selection may change due to refinement or availability at the time of planting. Species substitutions will be coordinated between WLS and planting contractor prior to the procurement of plant stock and documented in the as-built report.*

Vegetation Performance Standards Summary Table												
	Veg Plot 1 F				Veg Plot 2 F				Veg Plot 3 F			
	Stems/Ac.	Av. Ht. (ft)	# Species	% Invasives	Stems/Ac.	Av. Ht. (ft)	# Species	% Invasives	Stems/Ac.	Av. Ht. (ft)	# Species	% Invasives
Monitoring Year 7												
Monitoring Year 5												
Monitoring Year 3												
Monitoring Year 2	445	3	8	0	526	3	8	0	486	2	8	0
Monitoring Year 1	567	2	11	0	607	2	9	0	567	2	8	0
Monitoring Year 0	688	2	12	0	648	2	9	0	607	2	8	0
	Veg Plot 4 F				Veg Plot 5 F				Veg Plot 6 F			
	Stems/Ac.	Av. Ht. (ft)	# Species	% Invasives	Stems/Ac.	Av. Ht. (ft)	# Species	% Invasives	Stems/Ac.	Av. Ht. (ft)	# Species	% Invasives
Monitoring Year 7												
Monitoring Year 5												
Monitoring Year 3												
Monitoring Year 2	445	2	6	0	405	2	6	0	769	3	6	0
Monitoring Year 1	607	2	8	0	486	2	7	0	1174	2	7	0
Monitoring Year 0	769	2	9	0	607	2	8	0	1214	2	8	0
	Veg Plot 7 F				Veg Plot 8 F				Veg Plot 9 F			
	Stems/Ac.	Av. Ht. (ft)	# Species	% Invasives	Stems/Ac.	Av. Ht. (ft)	# Species	% Invasives	Stems/Ac.	Av. Ht. (ft)	# Species	% Invasives
Monitoring Year 7												
Monitoring Year 5												
Monitoring Year 3												
Monitoring Year 2	486	3	7	0	729	3	6	0	324	2	4	0
Monitoring Year 1	526	2	7	0	729	2	6	0	243	2	4	0
Monitoring Year 0	850	2	10	0	769	2	6	0	688	2	9	0
	Veg Plot Group 10 R				Veg Plot Group 11 R				Veg Plot Group 12 R			
	Stems/Ac.	Av. Ht. (ft)	# Species	% Invasives	Stems/Ac.	Av. Ht. (ft)	# Species	% Invasives	Stems/Ac.	Av. Ht. (ft)	# Species	% Invasives
Monitoring Year 7												
Monitoring Year 5												
Monitoring Year 3												
Monitoring Year 2	648	1	4	0	202	3	3	0	445	4	7	0
Monitoring Year 1					162	4	2	0	324	3	5	0
Monitoring Year 0	648	2	7	0	688	2	10	0	810	2	10	0

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

Vegetation Plot Counts and Densities Table

Planted Acreage	11.17
Date of Initial Plant	2021-03-03
Date(s) of Supplemental Plant(s)	2022-01-05
Date(s) Mowing	N/A
Date of Current Survey	2022-09-16
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		Veg Plot 10 R	Veg Plot 11 R	Veg Plot 12 R
					Planted	Total	Planted	Total	Planted	Total	Planted	Total	Planted	Total	Planted	Total	Planted	Total	Planted	Total	Planted	Total	Total	Total	Total
Species Included in Approved Mitigation Plan	Asimina triloba	pawpaw	Tree	FAC			1	1			2	2	1	1											
	Betula nigra	river birch	Tree	FACW	1	1	1	1	1	1					4	4	1	1	1	1	2	2	8		1
	Carpinus caroliniana	American hornbeam	Tree	FAC							1	1							1	1					
	Corylus americana	American hazelnut	Shrub	FACU			1	1									1	1							
	Diospyros virginiana	common persimmon	Tree	FAC	2	2			2	2	2	2					3	3							
	Fraxinus pennsylvanica	green ash	Tree	FACW	1	1									4	4			6	6					2
	Hamamelis virginiana	American witchhazel	Tree	FACU	1	1	2	2	1	1									1	1					2
	Lindera benzoin	northern spicebush	Tree	FACW	1	1	2	2																	
	Liriodendron tulipifera	tuliptree	Tree	FACU					2	2	1	1	4	4											1
	Platanus occidentalis	American sycamore	Tree	FACW	3	3	2	2	2	2			2	2	4	4	3	3	7	7	1	1	1	5	3
	Quercus michauxii	swamp chestnut oak	Tree	FACW			2	2							4	4	1	1			4	4	5	1	1
	Quercus nigra	water oak	Tree	FAC	1	1			1	1			1	1	1	1									1
	Quercus pagoda	cherrybark oak	Tree	FACW	1	1	2	2	1	1	2	2	1	1			2	2							
	Quercus phellos	willow oak	Tree	FACW					2	2	3	3	1	1	2	2	1	1	2	2	1	1	2	1	
Sum	Performance Standard				11	11	13	13	12	12	11	11	10	10	19	19	12	12	18	18	8	8	16	7	11
Post Mitigation Plan Species	*Liquidambar styraciflua*	*sweetgum*	*Tree*	*FAC*		*1*						*2*						*4*							
	Prunus serotina	*black cherry*	*Tree*	*FACU*		*1*																			
	Rhus copallinum	*winged sumac*	*Tree*	*UPL*														*10*							
	Salix nigra	*black willow*	*Tree*	*OBL*												*10*									
Sum	Proposed Standard				11	11	13	13	12	12	11	11	10	10	19	19	12	12	18	18	8	8	16	7	11
Mitigation Plan Performance Standard	Current Year Stem Count				11		13		12		11		10		19		12		18		8	16	7	11	
	Stems/Acre				445		526		486		445		405		769		486		729		324	648	202	445	
	Species Count				8		8		8		6		6		6		7		6		4	4	3	7	
	Dominant Species Composition (%)				23		15		17		23		40		34		38		39		50	50	71	27	
	Average Plot Height (ft.)				3		3		2		2		2		3		3		3		2	1	3	4	
	% Invasives				0		0		0		0		0		0		0		0		0	0	0	0	
Post Mitigation Plan Performance Standard	Current Year Stem Count				11		13		12		11		10		19		12		18		8	16	7	11	
	Stems/Acre				445		526		486		445		405		769		486		729		324	648	202	445	
	Species Count				8		8		8		6		6		6		7		6		4	4	3	7	
	Dominant Species Composition (%)				23		15		17		23		40		34		38		39		50	50	71	27	
	Average Plot Height (ft.)				3		3		2		2		2		3		3		3		2	1	3	4	
	% Invasives				0		0		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.

Fixed Veg Plot 1 (MY-00)

Fixed Veg Plot 1 (MY-02)

Fixed Veg Plot 2 (MY-00)

Fixed Veg Plot 2 (MY-02)

Fixed Veg Plot 3 (MY-00)

Fixed Veg Plot 3 (MY-02)

Fixed Veg Plot 4 (MY-00)

Fixed Veg Plot 4 (MY-02)

Fixed Veg Plot 5 (MY-00)

Fixed Veg Plot 5 (MY-02)

Fixed Veg Plot 6 (MY-00)

Fixed Veg Plot 6 (MY-02)

Fixed Veg Plot 7 (MY-00)

Fixed Veg Plot 7 (MY-02)

Fixed Veg Plot 8 (MY-00)

Fixed Veg Plot 8 (MY-02)

Fixed Veg Plot 9 (MY-00)

Fixed Veg Plot 9 (MY-02)

Random Veg Plot 10 (View Northwest) (MY-02)

Random Veg Plot 10 (View Southeast) (MY-02)

Random Veg Plot 11 (View East) (MY-02)

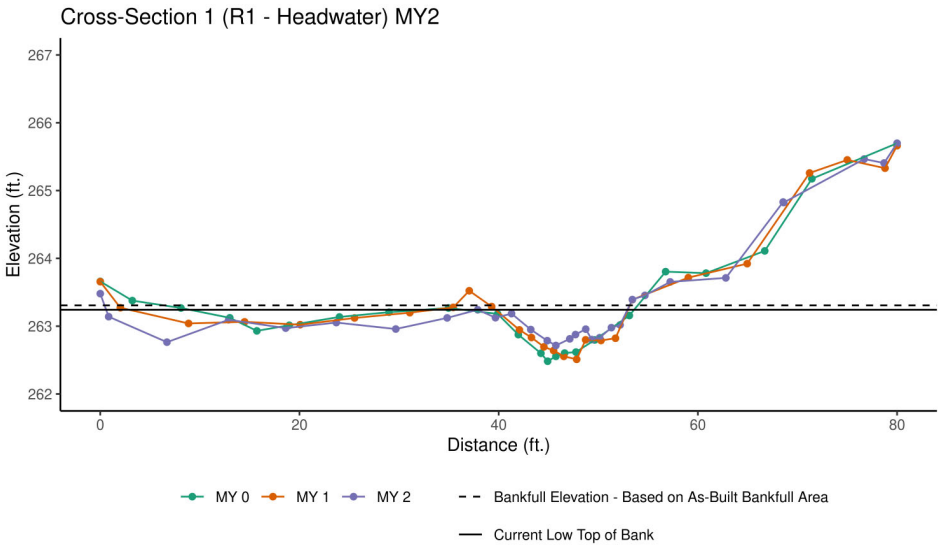
Random Veg Plot 11 (View West) (MY-02)

Random Veg Plot 12 (View Northeast) (MY-02)

Random Veg Plot 12 (View South west) (MY-02)

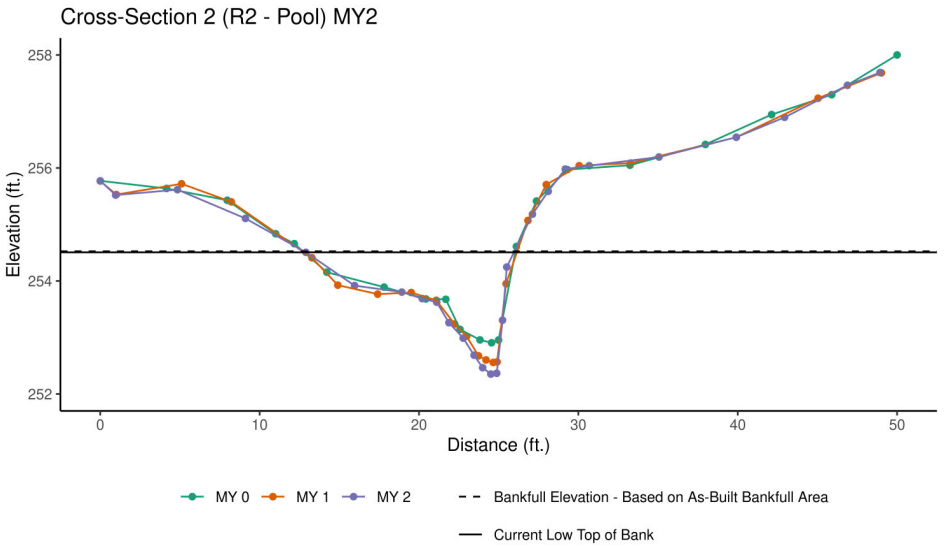
Appendix C:
Stream Geomorphology Data

MY2 Cross-Sections with Annual Overlays
Baseline Stream Data Summary Tables
Cross-Section Morphology Data
Headwater Channel Formation Table
Photos: Evidence of Headwater Channel Formation



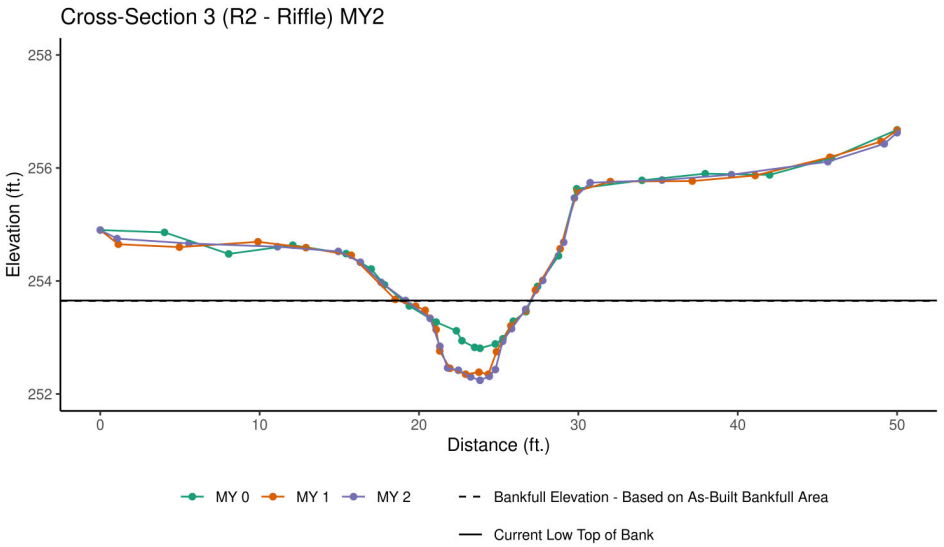
	MY0	MY1	MY2	MY3	MY4	MY5	MY6	MY7
Bankfull Elevation - Based on As-Built Bankfull Area	263.18	263.20	263.31					
Bank Height Ratio - Based on As-Built Bankfull Area	0.96	1.13	0.89					
Thalweg Elevation	262.48	262.51	262.72					
LTOB Elevation	263.16	263.29	263.24					
LTOB Max Depth	0.674	0.778	0.527					
LTOB Cross Sectional Area	4.77	6.27	4.11					

Distance	Elevation	Features
0	263.48	TLP
0.845	263.14	
6.6952342	262.764	
12.8911009	263.095	
18.6183932	262.971	
23.6981251	263.053	
29.6688576	262.958	
34.8297041	263.122	
37.8964471	263.242	TLB, BKF
39.6769239	263.125	
41.2925193	263.185	
43.2234544	262.95	
44.8784624	262.786	
45.74268	262.715	THW
47.1373274	262.813	
47.7135896	262.876	
48.7405696	262.956	
49.3510315	262.802	
50.1391338	262.83	
51.3168425	262.978	
52.1908061	263.018	
53.4226661	263.392	TRB
54.6824399	263.454	
57.2200784	263.653	
62.8077387	263.712	
68.5609301	264.831	
68.6154992	264.823	
76.6959772	265.465	
78.6942138	265.406	
80	265.698	TRP



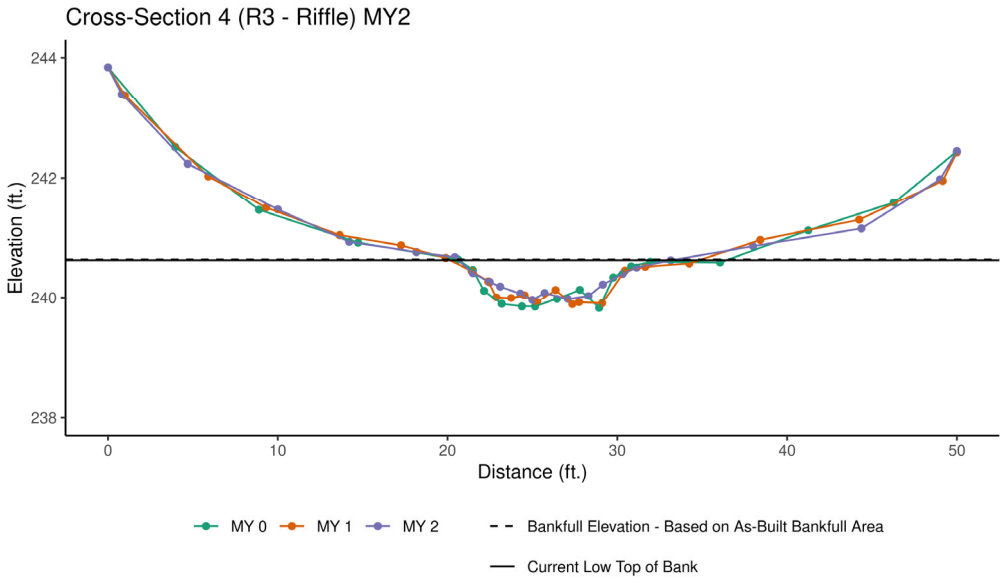
	MY0	MY1	MY2	MY3	MY4	MY5	MY6	MY7
Bankfull Elevation - Based on As-Built Bankfull Area	254.61	254.52	254.53					
Bank Height Ratio - Based on As-Built Bankfull Area	1.00	0.94	0.99					
Thalweg Elevation	252.91	252.56	252.35					
LTOB Elevation	254.61	254.41	254.51					
LTOB Max Depth	1.704	1.852	2.155					
LTOB Cross Sectional Area	11.76	10.33	11.53					

Distance	Elevation	Features
0	255.772	TLP
0.96688417	255.52	
4.84118012	255.616	
9.10851322	255.107	
12.9028935	254.507	TLB, BKF
15.9589469	253.918	
18.9211601	253.803	
20.2026522	253.688	
21.1118721	253.624	
21.8796808	253.261	
22.773209	252.989	
23.455809	252.686	
23.9947357	252.465	
24.509534	252.352	THW
24.876717	252.366	
25.2430269	253.305	
25.5078125	254.246	
27.120747	255.182	
28.1076045	255.586	
29.1770324	255.98	TRB
30.6778007	256.04	
35.0608736	256.194	
39.9150752	256.545	
42.9414357	256.896	
46.8862328	257.463	
48.9290937	257.689	
50	258.003	TRP



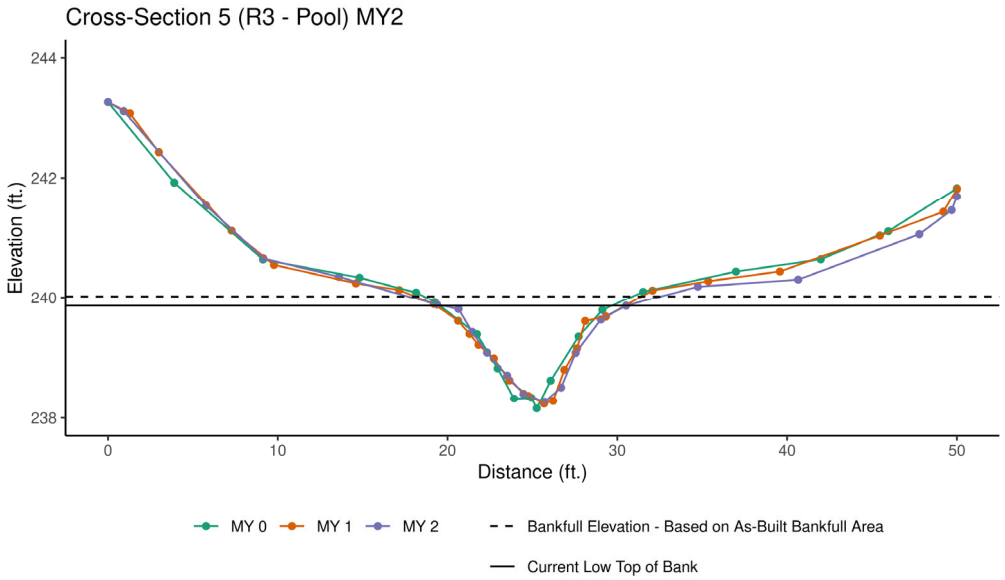
Distance	Elevation	Features
0	254.901	TLP
1.05694891	254.749	
5.5708283	254.664	
11.1229659	254.606	
14.9397515	254.523	
16.3199893	254.331	
17.6213575	253.976	
19.1559921	253.654	TLB, BKF
20.6979106	253.339	
21.308545	252.843	
21.7945683	252.462	
22.470698	252.42	
23.2419156	252.302	
23.8294578	252.242	THW
24.4111131	252.313	
24.7953519	252.432	
25.2523274	252.932	
25.8079103	253.155	
26.6963249	253.498	
27.7653781	254.009	TRB
29.0788788	254.685	
29.7501891	255.468	
30.7383831	255.739	
35.250762	255.786	
39.6076684	255.881	
45.6556198	256.111	
49.1948618	256.427	
50	256.624	TRP

	MY0	MY1	MY2	MY3	MY4	MY5	MY6	MY7
Bankfull Elevation - Based on As-Built Bankfull Area	253.90	253.70	253.65					
Bank Height Ratio - Based on As-Built Bankfull Area	1.00	0.89	1.01					
Thalweg Elevation	252.81	252.35	252.24					
LTOB Elevation	253.90	253.55	253.65					
LTOB Max Depth	1.095	1.205	1.412					
LTOB Cross Sectional Area	6.03	5.00	6.10					



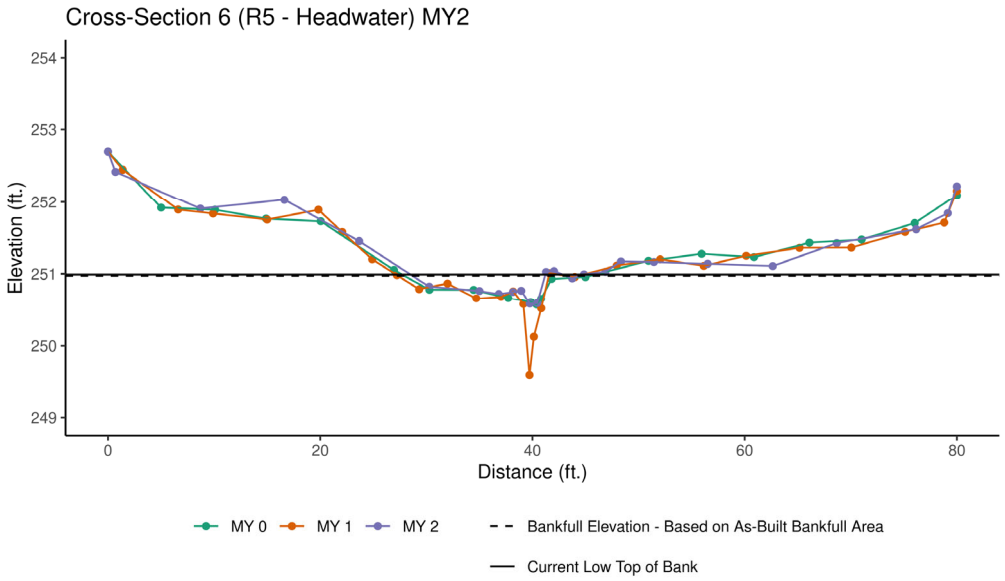
Distance	Elevation	Features
0	243.839	TLP
0.81339351	243.393	
4.69621177	242.235	
10.0039677	241.473	
14.2072631	240.933	
18.1610274	240.761	
20.4281872	240.677	TLB
21.4984534	240.409	
22.4883375	240.261	
23.0998084	240.184	
24.2850008	240.068	
24.9909801	239.96	THW
25.7155967	240.076	
27.0757396	239.977	
28.2961781	240.027	
29.144905	240.219	
30.3059499	240.395	
31.1353244	240.503	
33.1463823	240.625	TRB, BKF
37.9958088	240.859	
44.3755332	241.155	
49.0068928	241.978	
50	242.444	TRP

	MY0	MY1	MY2	MY3	MY4	MY5	MY6	MY7
Bankfull Elevation - Based on As-Built Bankfull Area	240.60	240.58	240.64					
Bank Height Ratio - Based on As-Built Bankfull Area	1.00	0.90	0.98					
Thalweg Elevation	239.85	239.89	239.96					
LTOB Elevation	240.60	240.52	240.63					
LTOB Max Depth	0.752	0.629	0.665					
LTOB Cross Sectional Area	4.90	4.18	4.73					



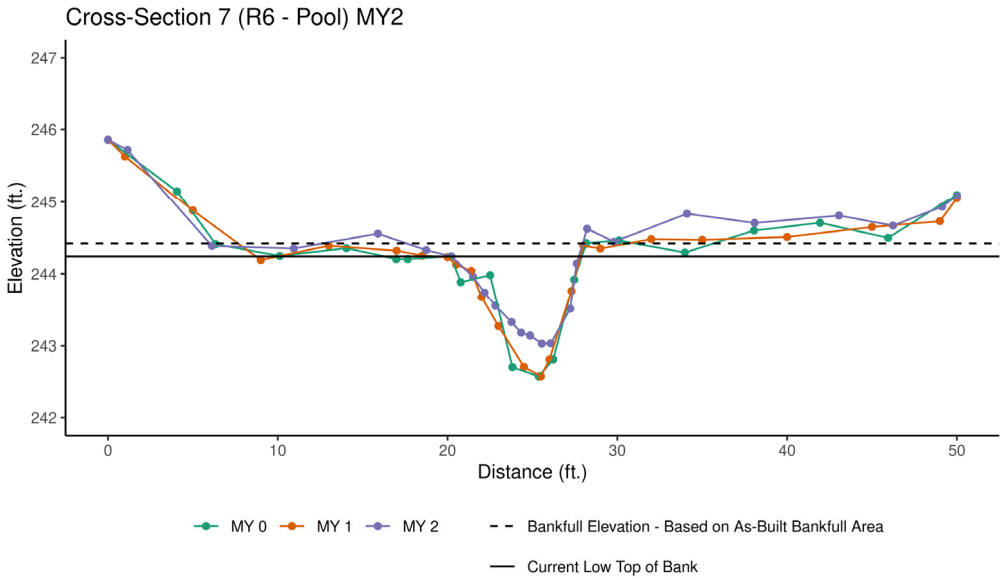
Distance	Elevation	Features
0	243.251	TLP
0.92527726	243.103	
5.7754263	241.537	
9.14782843	240.657	
13.6056872	240.349	
19.379747	239.88	TLB, BKF
20.6456632	239.807	
21.445276	239.428	
22.323339	239.087	
23.5080886	238.704	
24.4700327	238.404	
25.7207013	238.271	THW
26.6865766	238.508	
27.5457231	239.082	
29.0360878	239.633	
30.5142743	239.862	TRB
34.7413088	240.184	
40.6544355	240.302	
47.7857084	241.059	
49.6904463	241.461	
50	241.692	TRP

	MY0	MY1	MY2	MY3	MY4	MY5	MY6	MY7
Bankfull Elevation - Based on As-Built Bankfull Area	240.09	240.00	240.02					
Bank Height Ratio - Based on As-Built Bankfull Area	1.00	1.07	0.91					
Thalweg Elevation	238.34	238.24	238.27					
LTOB Elevation	240.09	240.13	239.86					
LTOB Max Depth	1.749	1.892	1.591					
LTOB Cross Sectional Area	10.02	11.78	8.32					



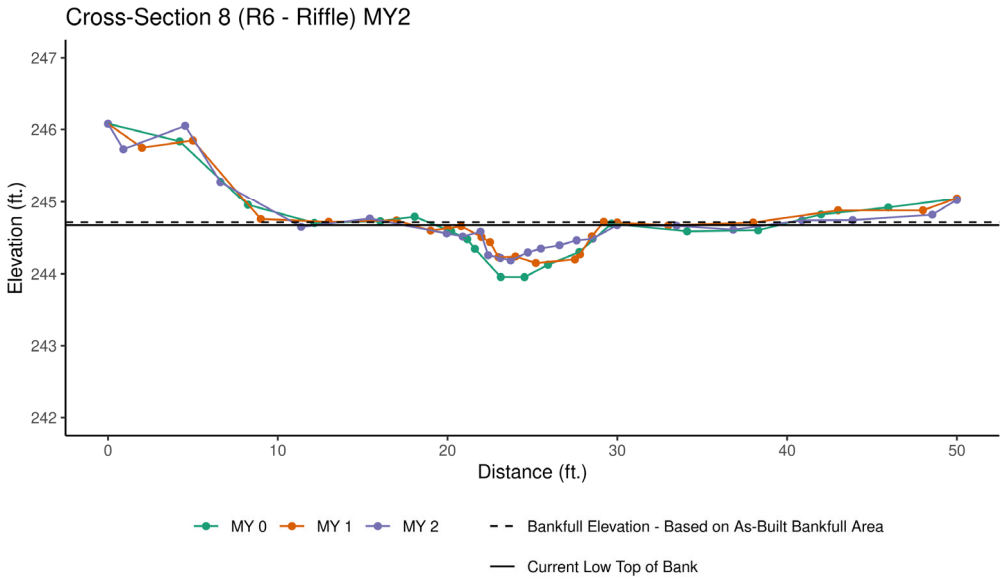
Distance	Elevation	Features
0	252.697	TLP
0.70265923	252.418	
8.70176649	251.906	
16.6200019	252.03	
23.6686253	251.454	TLB
30.2751049	250.82	
35.0024439	250.76	
36.824187	250.717	
38.1603815	250.745	
38.9410124	250.763	
39.7477272	250.581	THW
40.4498344	250.587	
41.2836361	251.025	
42.0290704	251.037	
43.7501405	250.936	
44.8584154	250.99	TRB, BKF
46.8754949	251.028	
48.3415507	251.171	
51.4454204	251.163	
56.5129813	251.138	
62.6469081	251.107	
68.6775266	251.427	
76.1635173	251.618	
79.1453118	251.842	
80	252.216	TRP

	MY0	MY1	MY2	MY3	MY4	MY5	MY6	MY7
Bankfull Elevation - Based on As-Built Bankfull Area	250.93	250.88	250.97					
Bank Height Ratio - Based on As-Built Bankfull Area	1.00	0.99	1.05					
Thalweg Elevation	250.57	249.60	250.58					
LTOB Elevation	250.93	250.87	250.99					
LTOB Max Depth	0.359	1.267	0.409					
LTOB Cross Sectional Area	2.55	2.46	2.78					



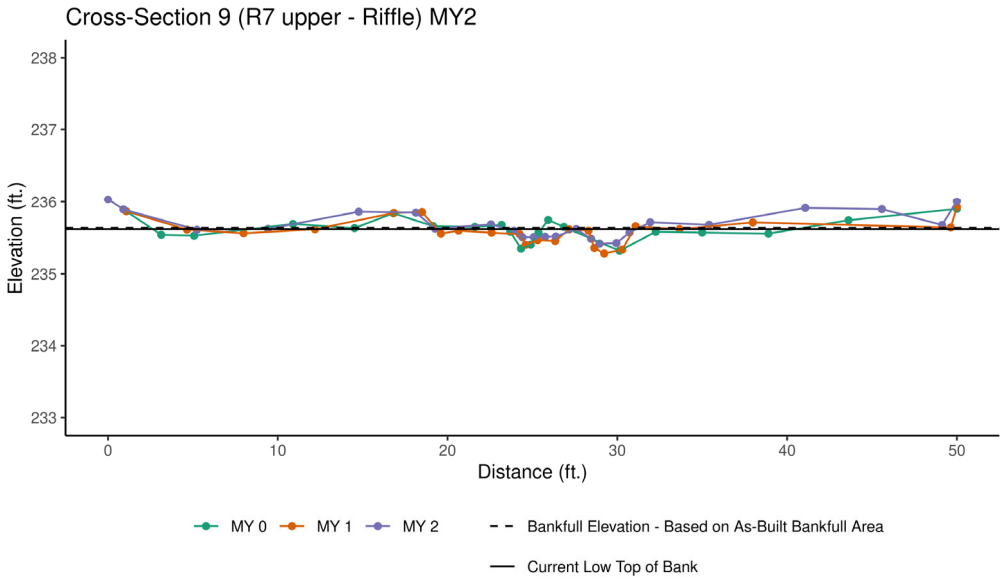
Distance	Elevation	Features
0	245.859	TLP
1.14604363	245.719	
6.11564952	244.387	
10.9441548	244.351	
15.8969781	244.556	
18.7439937	244.328	
20.2306478	244.241	TLB, BKF
21.5045006	243.959	
22.175622	243.737	
22.8173675	243.55	
23.7704717	243.324	
24.3322552	243.179	
24.8604975	243.14	
25.5529171	243.029	THW
26.0799756	243.033	
27.2236423	243.509	
27.6065803	244.142	
28.2184423	244.624	TRB
29.8093724	244.444	
34.0992076	244.834	
38.0862053	244.706	
43.0552625	244.808	
46.2385761	244.67	
49.1263607	244.932	
50	245.082	TRP

	MY0	MY1	MY2	MY3	MY4	MY5	MY6	MY7
Bankfull Elevation - Based on As-Built Bankfull Area	244.24	244.24	244.42					
Bank Height Ratio - Based on As-Built Bankfull Area	1.00	0.99	0.87					
Thalweg Elevation	242.58	242.58	243.03					
LTOB Elevation	244.24	244.23	244.24					
LTOB Max Depth	1.663	1.65	1.212					
LTOB Cross Sectional Area	6.78	6.70	5.43					



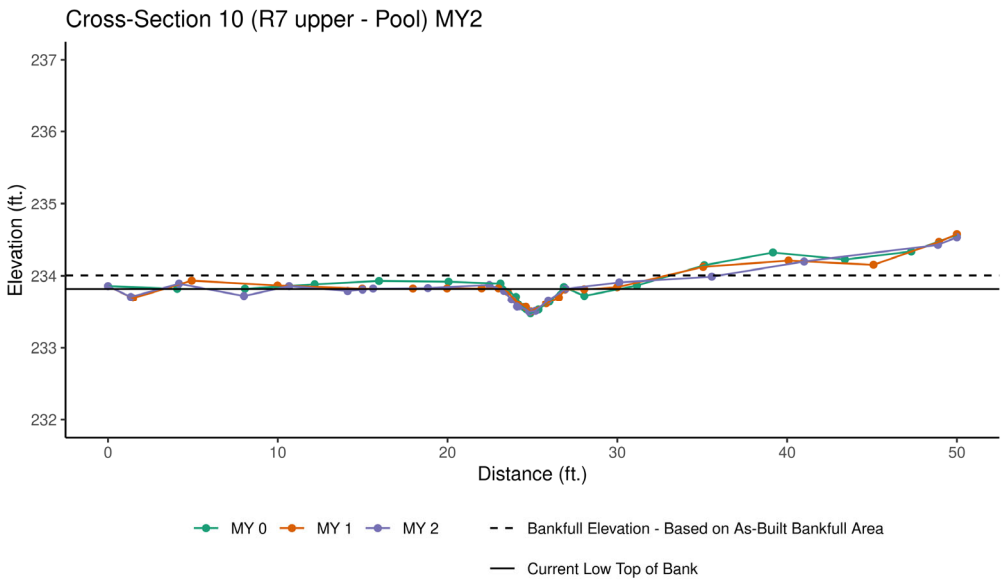
Distance	Elevation	Features
0	246.08	TLP
0.90589293	245.729	
4.54284426	246.05	
6.6186417	245.281	
11.3753188	244.65	
15.4189536	244.766	TLB
19.9479088	244.559	
20.8925239	244.517	
21.9394924	244.583	
22.3911147	244.258	
23.1150357	244.22	
23.7176331	244.187	THW
24.7280405	244.296	
25.4971944	244.35	
26.5906859	244.395	
27.6018387	244.464	
28.5427316	244.485	
29.9815678	244.674	TRB, BKF
33.489572	244.666	
36.8252394	244.612	
40.8793034	244.74	
43.8627214	244.744	
48.5539686	244.82	
50	245.027	TRP

	MY0	MY1	MY2	MY3	MY4	MY5	MY6	MY7
Bankfull Elevation - Based on As-Built Bankfull Area	244.59	244.71	244.72					
Bank Height Ratio - Based on As-Built Bankfull Area	1.00	0.90	0.92					
Thalweg Elevation	243.96	244.15	244.19					
LTOB Elevation	244.59	244.66	244.67					
LTOB Max Depth	0.632	0.51	0.487					
LTOB Cross Sectional Area	3.23	2.79	2.72					



Distance	Elevation	Features
0	236.034	TLP
0.90489557	235.892	
5.23873887	235.61	
9.4250183	235.622	
14.766208	235.86	
18.1324325	235.847	
19.2628729	235.626	TLB
22.5588816	235.684	
23.9086356	235.598	
24.4151802	235.506	THW
25.0837023	235.509	
25.7409661	235.514	
26.377687	235.517	
27.5782233	235.619	TRB, BKF
28.4518549	235.486	
28.9531063	235.418	
29.9469918	235.426	
30.7181645	235.572	
31.9381263	235.713	
35.4054541	235.678	
41.0703304	235.913	
45.5821155	235.896	
49.1249387	235.676	
50	236.008	TRP

	MY0	MY1	MY2	MY3	MY4	MY5	MY6	MY7
Bankfull Elevation - Based on As-Built Bankfull Area	235.65	235.59	235.64					
Bank Height Ratio - Based on As-Built Bankfull Area	0.97	1.05	0.86					
Thalweg Elevation	235.35	235.40	235.51					
LTOB Elevation	235.65	235.60	235.62					
LTOB Max Depth	0.299	0.197	0.113					
LTOB Cross Sectional Area	0.39	0.45	0.31					



Distance	Elevation	Features
0	233.858	TLP
1.34336071	233.708	
4.18106888	233.891	
8.0075003	233.721	
10.6666569	233.859	
14.1135412	233.791	
14.9944435	233.81	
15.6142793	233.824	
18.8416541	233.83	
22.4604204	233.873	TLB, BKF
23.3240149	233.793	
23.7707795	233.663	
24.0933168	233.565	
24.2358242	233.569	THW
24.8176187	233.492	
25.1727926	233.504	
25.9345298	233.655	
26.9515124	233.819	TRB
30.1148147	233.909	
35.5641095	233.988	
41.0031559	234.199	
48.8827604	234.429	
50	234.534	TRP

	MY0	MY1	MY2	MY3	MY4	MY5	MY6	MY7
Bankfull Elevation - Based on As-Built Bankfull Area	233.89	233.99	234.01					
Bank Height Ratio - Based on As-Built Bankfull Area	0.68	0.64	0.57					
Thalweg Elevation	233.47	233.50	233.57					
LTOB Elevation	233.85	233.81	233.82					
LTOB Max Depth	0.371	0.316	0.25					
LTOB Cross Sectional Area	0.70	0.63	0.57					

Baseline Stream Data Summary Odell's House, R1											Odell's House, R2										Odell's House, R3									
Parameter	Pre-Existing Condition (applicable)					Design		Monitoring Baseline (MY0)			Pre-Existing Condition (applicable)					Design		Monitoring Baseline (MY0)			Pre-Existing Condition (applicable)					Design		Monitoring Baseline (MY0)		
Riffle Only	Min	Mean	Med	Max	n	Min	Max	Min	Max	n	Min	Mean	Med	Max	n	Min	Max	Min	Max	n	Min	Mean	Med	Max	n	Min	Max	Min	Max	n
Bankfull Width (ft)		N/A			0		6.0		13.2	1.0		11.0			1.0		8.0		9.5	1.0		5.7			1.0		8.0		11.1	1.0
Floodprone Width (ft)		N/A			0	31.3	115.0		62.6	1.0		27.0			1.0	25.0	50.0		29.3	1.0		11.5			1.0	25.0	30.0		34.3	1.0
Bankfull Mean Depth (ft)		N/A			0		0.5		0.4	1.0		0.3			1.0		0.5		0.6	1.0		1.0			1.0		0.6		0.5	1.0
Bankfull Max Depth (ft)		N/A			0		0.7		0.7	1.0		0.7			1.0		0.7		1.1	1.0		1.4			1.0		0.8		0.8	1.0
Bankfull Cross Sectional Area (ft^2)		N/A			0		3.2		5.1	1.0		3.7			1.0		4.2		6.0	1.0		5.6			1.0		4.8		5.4	1.0
Width/Depth Ratio		N/A			0		11.4		34.3	1.0		33.0			1.0		15.2		15.0	1.0		5.8			1.0		13.3		23.2	1.0
Entrenchment Ratio		N/A			0	5.2	19.2		4.7	1.0		2.5			1.0	3.1	6.3		3.1	1.0		2.0			1.0	3.1	3.8		3.1	1.0
Bank Height Ratio		N/A			0		1.0		1.0	1.0		1.0			1.0		1.0		1.0	1.0		1.4			1.0		1.0		1.0	1.0
Max part size (mm) mobilized at bankfull	N/A					19.0		17.0			25.0					37.0		42.0			46.0					35.0		32.0		
Rosgen Classification	Pond					DA/E5		DA			C5					C5		C5			G5					B5		B5c		
Bankfull Discharge (cfs)	11.0					11.0		11.0			14.5					14.5		14.5			20.0					20.0		20.0		
Sinuosity (ft)	N/A					1.08		1.16			1.07					1.07		1.04			1.20					1.12		1.10		
Water Surface Slope (Channel) (ft/ft)	N/A					0.0089		0.0107			0.0168					0.0168		0.0195			0.0133					0.0142		0.0152		
Other																														

Baseline Stream Data Summary Odell's House, R5											Odell's House, R6										Odell's House, R7 upper									
Parameter	Pre-Existing Condition (applicable)					Design		Monitoring Baseline (MY0)			Pre-Existing Condition (applicable)					Design		Monitoring Baseline (MY0)			Pre-Existing Condition (applicable)					Design		Monitoring Baseline (MY0)		
Riffle Only	Min	Mean	Med	Max	n	Min	Max	Min	Max	n	Min	Mean	Med	Max	n	Min	Max	Min	Max	n	Min	Mean	Med	Max	n	Min	Max	Min	Max	n
Bankfull Width (ft)		N/A			0		5.5		13.4	1.0		4.1			1.0		6.0		8.9	1.0					1.0		6.0		2.2	1.0
Floodprone Width (ft)		N/A			0	49.0	103.0		38.1	1.0		53.3			1.0	22.0	40.0		44.0	1.0					1.0	126.0	145.0		49.6	1.0
Bankfull Mean Depth (ft)		N/A			0		0.3		0.2	1.0		0.6			1.0		0.4		0.4	1.0					1.0		0.4		0.2	1.0
Bankfull Max Depth (ft)		N/A			0		0.4		0.4	1.0		1.1			1.0		0.5		0.6	1.0					1.0		0.5		0.3	1.0
Bankfull Cross Sectional Area (ft^2)		N/A			0		1.8		2.6	1.0		2.5			1.0		2.4		3.3	1.0					1.0		2.4		0.4	1.0
Width/Depth Ratio		N/A			0		16.8		68.9	1.0		6.8			1.0		15.2		24.0	1.0		4.2			1.0		15.2		14.0	1.0
Entrenchment Ratio		N/A			0	8.9	18.7		2.8	1.0		12.9			1.0	3.7	6.7		4.9	1.0		1.5			1.0	21.0	24.2		22.2	1.0
Bank Height Ratio		N/A			0		1.0		1.0	1.0		2.3			1.0		1.0		1.0	1.0		1.3			1.0		1.0		1.0	1.0
Max part size (mm) mobilized at bankfull	N/A					10.0		7.0			32.0					22.0		20.0								20.0		11.0		
Rosgen Classification	Pond					DA/E5		DA			E5					B5c		B5c			G5 / Channelized					B5c		B5c		
Bankfull Discharge (cfs)	10.0					10.0		10.0			10.0					10.0		10.0			10.0					10.0		10.0		
Sinuosity (ft)	N/A					1.08		1.09			1.05					1.12		1.09			1.03					1.07		1.09		
Water Surface Slope (Channel) (ft/ft)	N/A					0.0077		0.0083			0.0145					0.0135		0.0129			0.0153					0.0123		0.0131		
Other																														

Cross-Section Morphology Data

Odell's House Mitigation Project: DMS #100041 (Data Collected 8/4/2022)

	Cross-Section 1 (Headwater - R1)							Cross-Section 2 (Pool - R2)							Cross-Section 3 (Riffle - R2)						
	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	263.18	263.20	263.31					254.61	254.52	254.53					253.90	253.70	253.65				
Bank Height Ratio_Based on AB Bankfull[1] Area	0.96	1.13	0.89					N/A	N/A	N/A					1.00	0.89	1.01				
Thalweg Elevation	262.48	262.51	262.72					252.91	252.56	252.35					252.81	252.35	252.24				
LTOB[2] Elevation	263.16	263.29	263.24					254.61	254.41	254.51					253.90	253.55	253.65				
LTOB[2] Max Depth (ft)	0.67	0.78	0.53					1.70	1.85	2.16					1.10	1.21	1.41				
LTOB[2] Cross Sectional Area (ft^2)	4.77	6.27	4.11					11.76	10.33	11.53					6.03	5.00	6.10				
Entrenchment Ratio	4.70	5.30	4.40					1.70	1.60	1.60					3.10	3.40	3.80				

	Cross Section-4 (Riffle - R3)							Cross-Section 5 (Pool - R3)							Cross-Section 6 (Headwater - R5)						
	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	240.60	240.58	240.64					240.09	240.00	240.02					250.93	250.88	250.97				
Bank Height Ratio_Based on AB Bankfull[1] Area	1.00	0.90	0.98					N/A	N/A	N/A					1.00	0.99	1.05				
Thalweg Elevation	239.85	239.89	239.96					238.34	238.24	238.27					250.57	249.60	250.58				
LTOB[2] Elevation	240.60	240.52	240.63					240.09	240.13	239.86					250.93	250.87	250.99				
LTOB[2] Max Depth (ft)	0.75	0.63	0.67					1.75	1.89	1.59					0.36	1.27	0.41				
LTOB[2] Cross Sectional Area (ft^2)	4.90	4.18	4.73					10.02	11.78	8.32					2.55	2.46	2.78				
Entrenchment Ratio	3.10	2.90	2.60					3.50	2.80	3.30					2.80	8.10	8.00				

	Cross-Section 7 (Pool - R6)							Cross-Section 8 (Riffle - R6)							Cross-Section 9 (Riffle - R7 upper)						
	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	244.24	244.24	244.42					244.59	244.71	244.72					235.65	235.59	235.64				
Bank Height Ratio_Based on AB Bankfull[1] Area	N/A	N/A	N/A					1.00	0.90	0.92					0.97	1.05	0.86				
Thalweg Elevation	242.58	242.58	243.03					243.96	244.15	244.19					235.35	235.40	235.51				
LTOB[2] Elevation	244.24	244.23	244.24					244.59	244.66	244.67					235.65	235.60	235.62				
LTOB[2] Max Depth (ft)	1.66	1.65	1.21					0.63	0.51	0.49					0.30	0.20	0.11				
LTOB[2] Cross Sectional Area (ft^2)	6.78	6.70	5.43					3.23	2.79	2.72					0.39	0.45	0.31				
Entrenchment Ratio	6.00	6.30	6.40					4.90	2.50	2.40					22.20	7.70	7.70				

	Cross-Section 10 (Pool - R7 upper)						
	MY0	MY1	MY2	MY3	MY5	MY7	MY+
Bankfull Elevation (ft) - Based on AB-Bankfull[1] Area	233.89	233.99	234.01				
Bank Height Ratio_Based on AB Bankfull[1] Area	N/A	N/A	N/A				
Thalweg Elevation	233.47	233.50	233.57				
LTOB[2] Elevation	233.85	233.81	233.82				
LTOB[2] Max Depth (ft)	0.37	0.32	0.25				
LTOB[2] Cross Sectional Area (ft^2)	0.70	0.63	0.57				
Entrenchment Ratio	13.40	9.90	11.10				

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 bankful 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.

Headwater Stream Channel Formation Table Odells House Mitigaiton Project				
Channel Forming Indicators - R1	**MY1**	**MY2**	**MY3**	**MY4**
Scour (indicating sediment transport by flowing water)	No	No		
Sediment deposition (accumulations of sediment and/or formation of ripples)	No	No		
Sediment sorting (sediment sorting indicated by grain-size distribution within primary flow path)	No	No		
Multiple observed flow events (must be documented by gauge data and/or photographs)	Yes	Yes		
Destruction of terrestrial vegetation	No	No		
Presence of litter and debris	No	No		
Wracking (deposits of drift material indicating surface water flow)	No	No		
Vegetation matted down, bent, or absent (herbaceous or otherwise)	No	Yes		
Leaf litter disturbed or washed away	No	No		
Channel Forming Indicators - R5	**MY1**	**MY2**	**MY3**	**MY4**
Scour (indicating sediment transport by flowing water)	Yes	No		
Sediment deposition (accumulations of sediment and/or formation of ripples)	No	No		
Sediment sorting (sediment sorting indicated by grain-size distribution within primary flow path)	No	No		
Multiple observed flow events (must be documented by gauge data and/or photographs)	Yes	Yes		
Destruction of terrestrial vegetation	Yes	Yes		
Presence of litter and debris	No	No		
Wracking (deposits of drift material indicating surface water flow)	No	No		
Vegetation matted down, bent, or absent (herbaceous or otherwise)	Yes	Yes		
Leaf litter disturbed or washed away	No	No		

R1 Flow Documentation (MY-02)

R1 Flow Documentation (MY-02)

R5 Flow Documentation (MY-02)

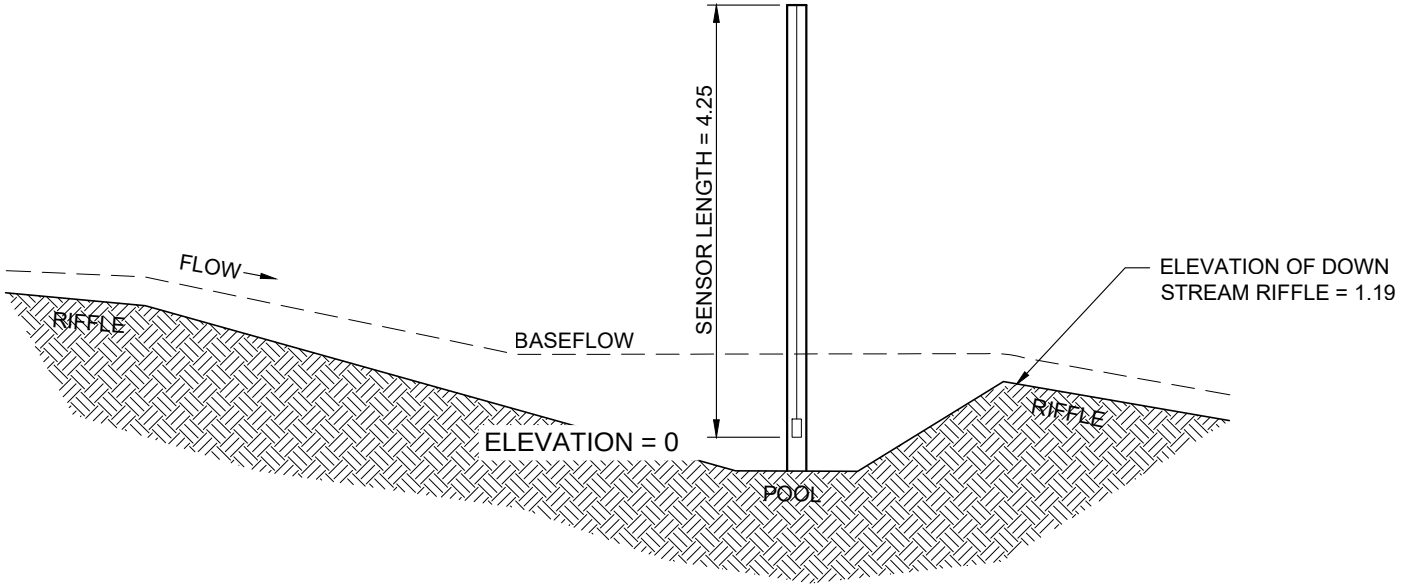
R5 Flow Documentation (MY-02)

Appendix D:
Hydrologic Data

Verification of Bankfull Events
Flow Gauge and Crest Gauge Installation Diagrams
Flow Gauge and Crest Gauge Graphs
Wetland Hydrology Criteria and Hydrographs
Rainfall Data Table

Verification of Bankfull Events: CG-1 (R3) Odells House Mitigation Project					
Monitoring Year	Date of Collection	Date of Occurrence	Method	Photos	Measurement above bankfull (feet)
MY1	7/13/2021	3/28/2021	Pressure Transducer	No	0.130
	7/13/2021	4/11/2021	Pressure Transducer	No	0.100
	7/13/2021	6/10/2021	Pressure Transducer	No	0.437
MY2	4/8/2022	1/3/2022	Pressure Transducer	No	0.316
	4/8/2022	1/16/2022	Pressure Transducer	No	0.137
	4/8/2022	3/24/2022	Pressure Transducer	No	0.203
	8/4/2022	7/9/2022	Pressure Transducer	No	0.157
	8/18/2022	8/12/2022	Pressure Transducer	No	0.715
	9/14/2022	Unknown	Cork	Yes	0.575
	9/14/2022	8/30/2022	Pressure Transducer	No	0.448

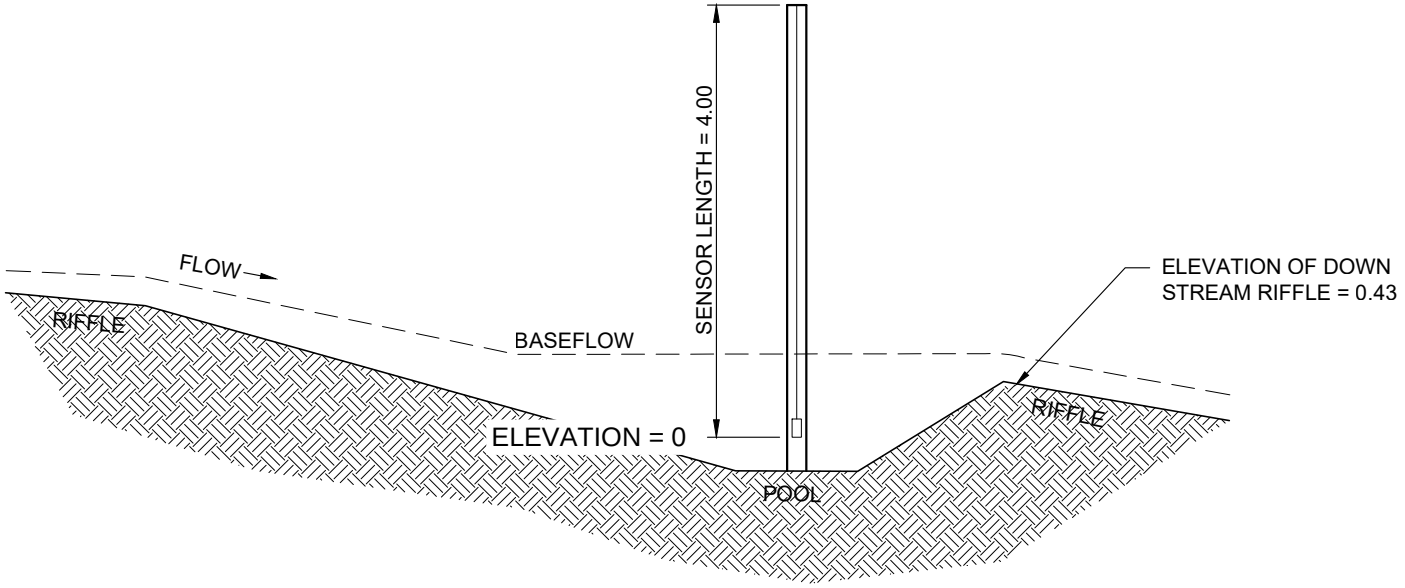
Verification of Bankfull Events: CG-2 (R7-lower) Odells House Mitigation Project					
Monitoring Year	Date of Collection	Date of Occurrence	Method	Photos	Measurement above bankfull (feet)
MY1	7/13/2021	3/16/2021	Pressure Transducer	No	0.11
	7/13/2021	3/19/2021	Pressure Transducer	No	0.10
	7/13/2021	3/28/2021	Pressure Transducer	No	0.33
	7/13/2021	3/31/2021	Pressure Transducer	No	0.14
	7/13/2021	4/11/2021	Pressure Transducer	No	0.33
	7/13/2021	6/10/2021	Pressure Transducer	No	0.46
	7/13/2021	7/8/2021	Pressure Transducer	No	0.28
	7/13/2021	7/11/2021	Pressure Transducer	No	0.17
	11/9/2021	7/27/2021	Pressure Transducer	No	0.43
	11/9/2021	10/26/2021	Pressure Transducer	No	0.24
	11/9/2021	10/29/2021	Pressure Transducer	No	0.20
MY2	4/8/2022	1/2/2022 - 1/10/2022	Pressure Transducer	No	0.54
	4/8/2022	1/16/2022 - 1/18/2022	Pressure Transducer	No	0.42
	4/8/2022	1/20/2022 - 1/23/2022	Pressure Transducer	No	0.13
	4/8/2022	2/7/2022 - 2/9/2022	Pressure Transducer	No	0.17
	4/8/2022	3/12/2022	Pressure Transducer	No	0.31
	4/8/2022	3/24/2022	Pressure Transducer	No	0.44
	4/8/2022	4/7/2022	Pressure Transducer	No	0.22
	4/8/2022	Unknown	Wrack lines	Yes	N/A
	6/9/2022	4/18/2022	Pressure Transducer	No	0.16
	6/9/2022	5/24/2022	Pressure Transducer	No	0.07
	8/18/2022	8/12/2022	Pressure Transducer	No	0.28



FLOW GAUGE #1 - R1

Flow Depth = 1.19 feet

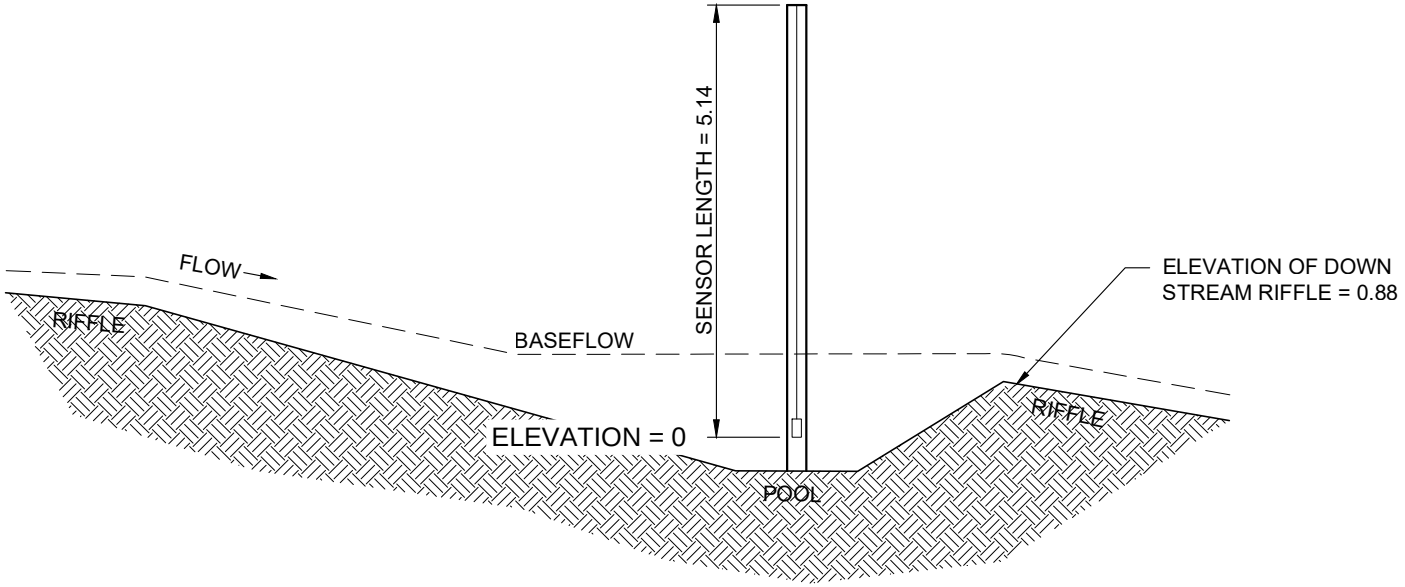
*All elevations relative to sensor depth



FLOW GAUGE #2 - R5

Flow Depth = 0.43 feet

*All elevations relative to sensor depth

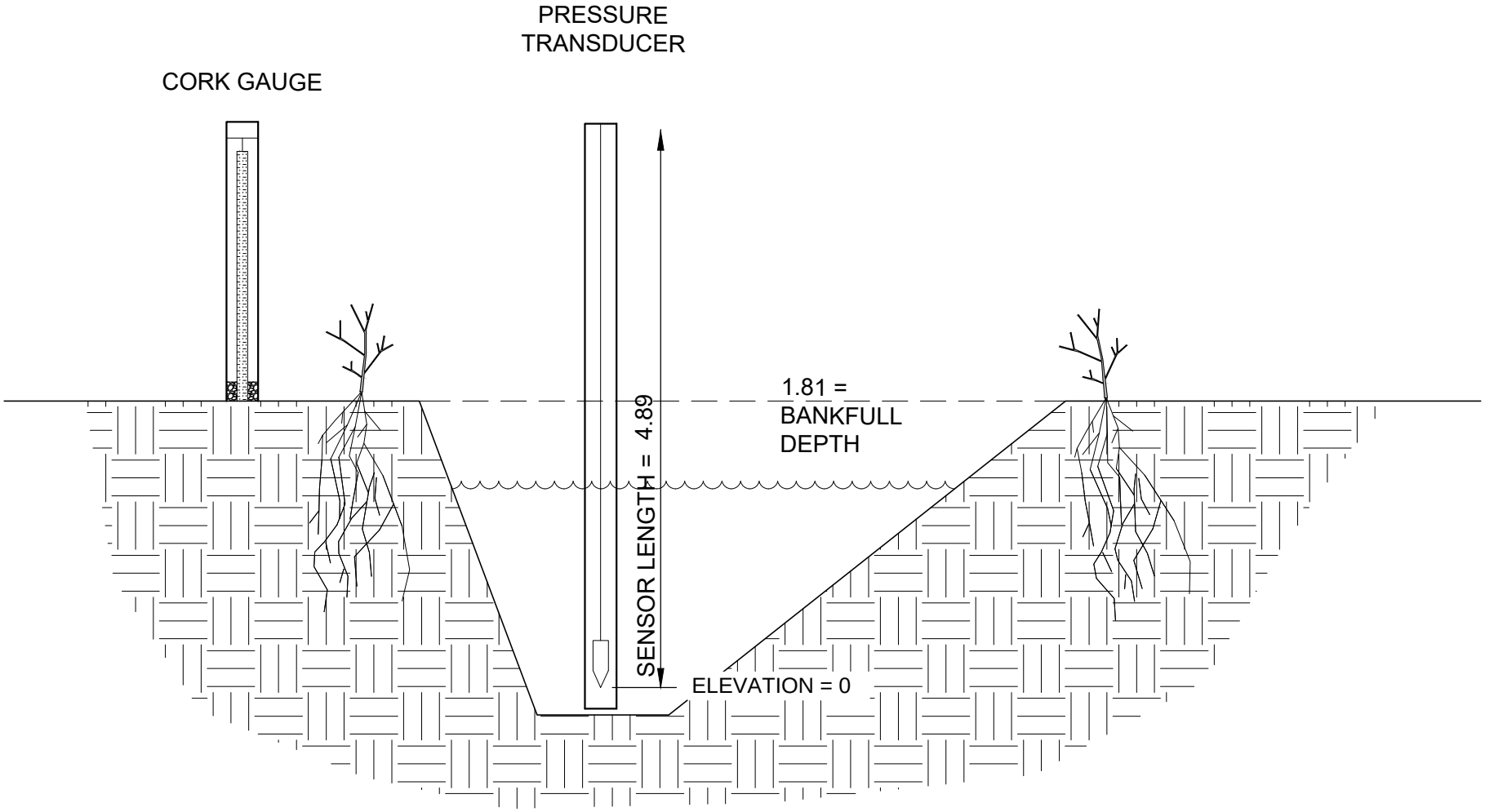


FLOW GAUGE #3 - R1

Flow Depth = 0.88 feet

*All elevations relative to sensor depth

CROSS SECTIONAL VIEW OF STREAM

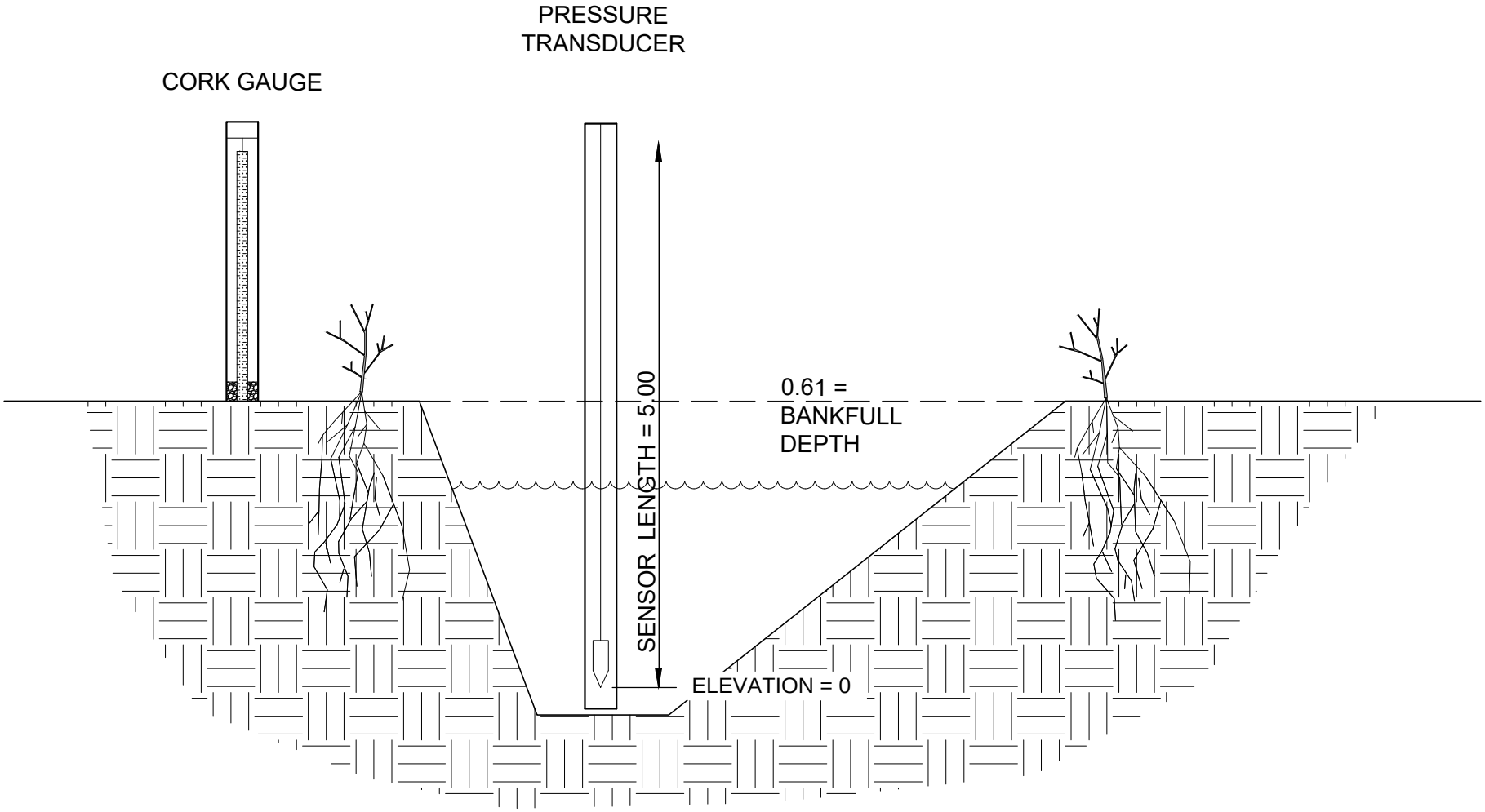


Crest Gauge CG-1 (R3)

Bankfull Event Depth = 1.81 feet

*All elevations relative to sensor depth

CROSS SECTIONAL VIEW OF STREAM

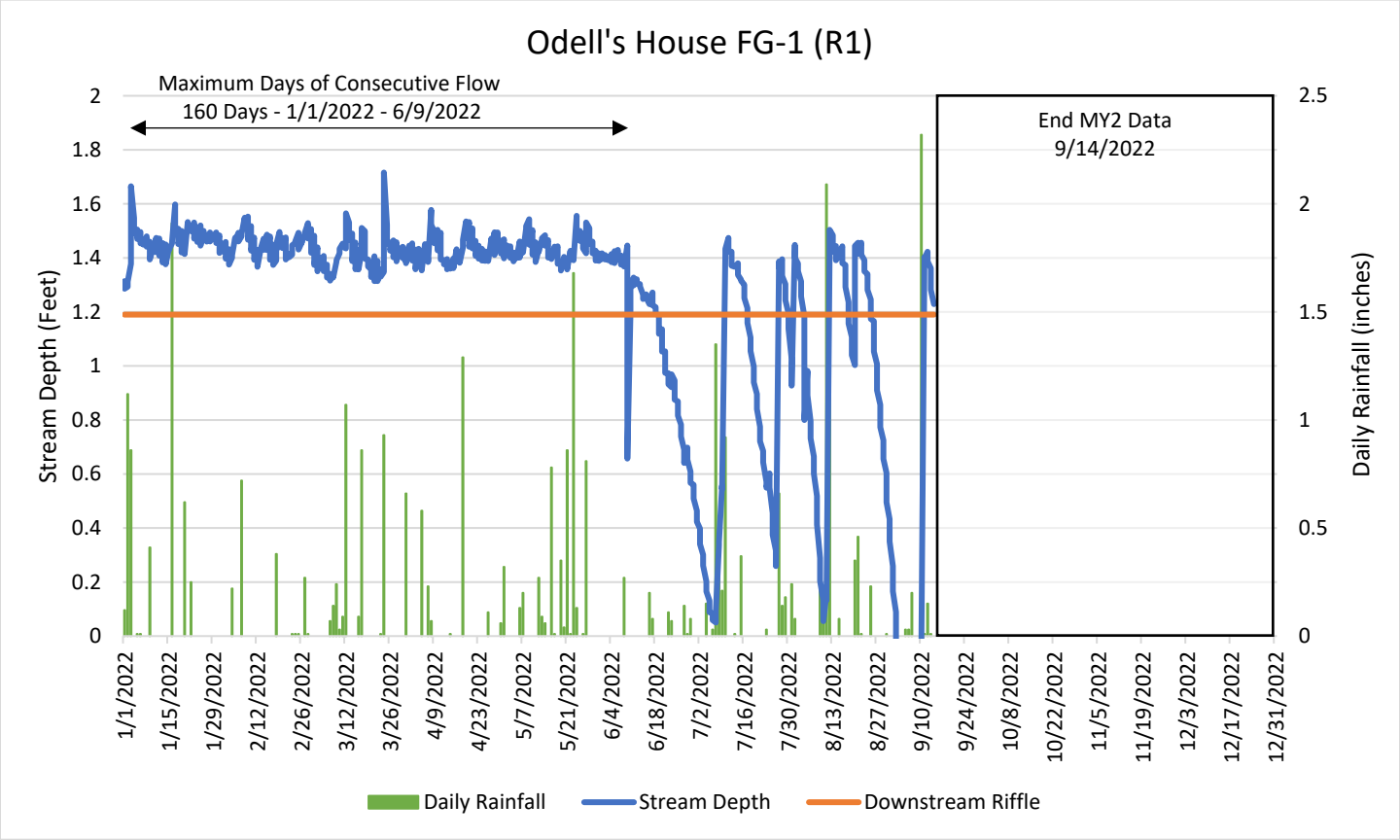


Crest Gauge CG-2 (R7 lower)

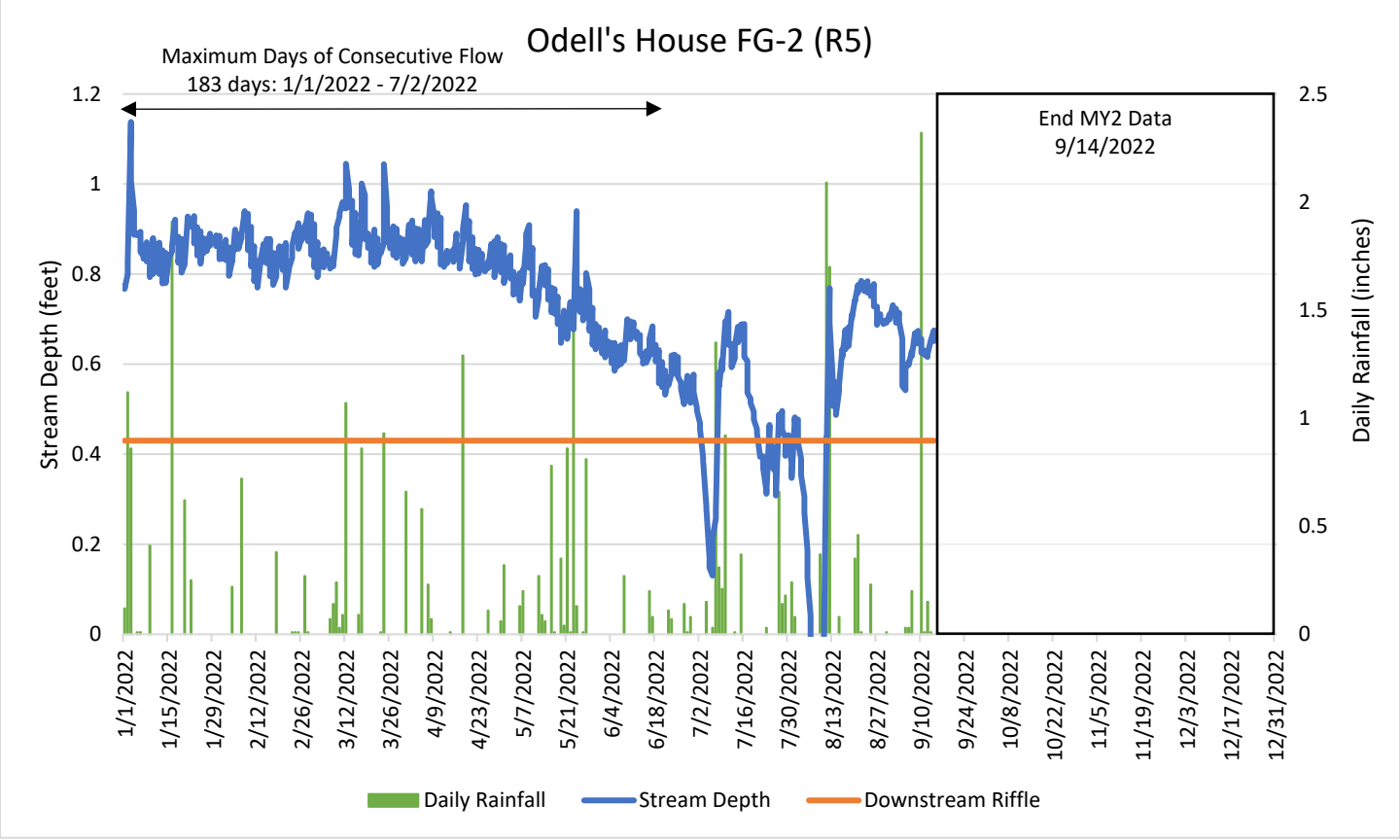
Bankfull Event Depth = 0.61 feet

*All elevations relative to sensor depth

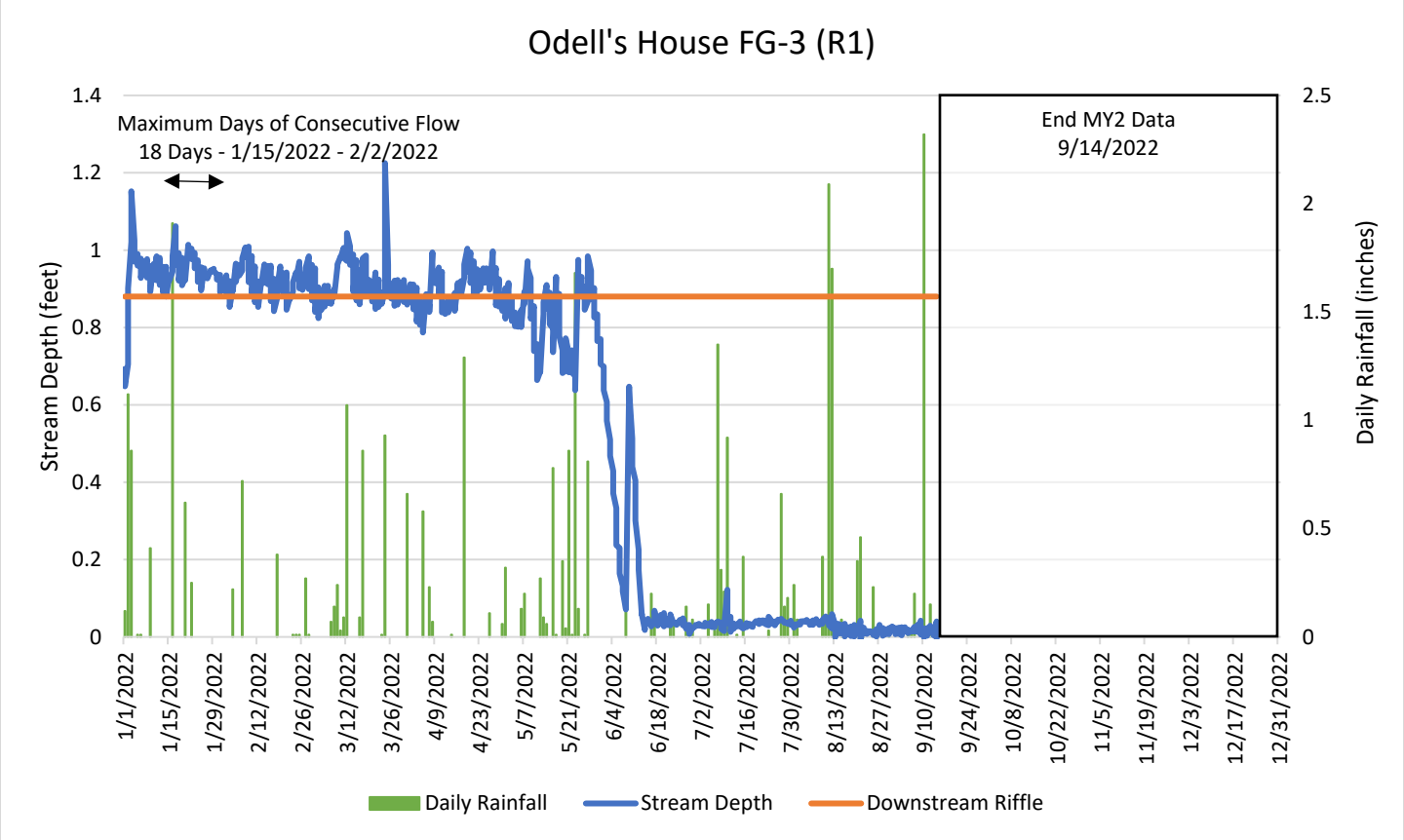
Flow Gauge Graphs



***FG-1:** 198 days total of Cumulative Flow, 60 days of no flow.

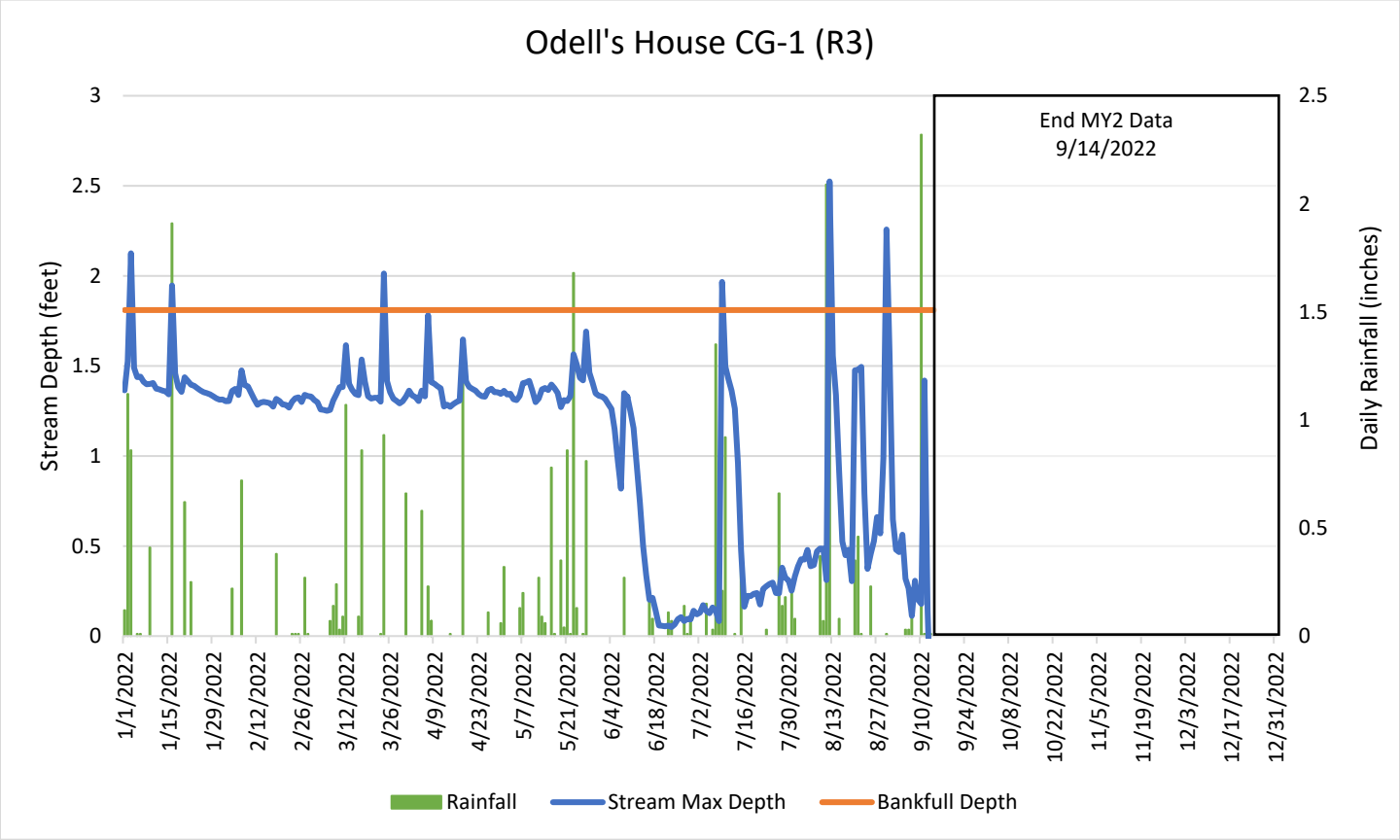


***FG-2:** 236 days of Cumulative Flow, 22 days of no flow.

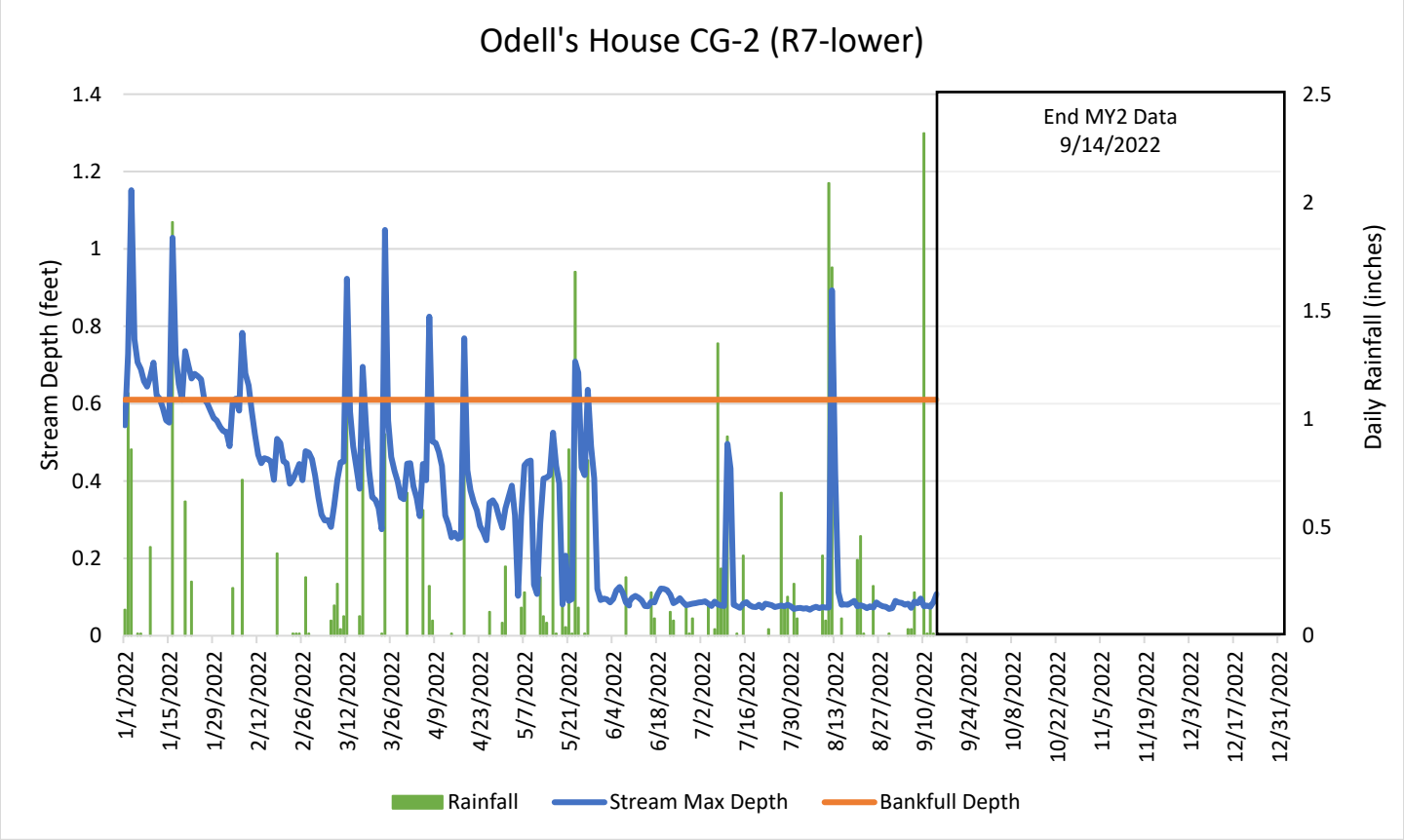


***FG-3:** 101 days of Cumulative Flow, 156 days of no flow.

Crest Gauge Graphs



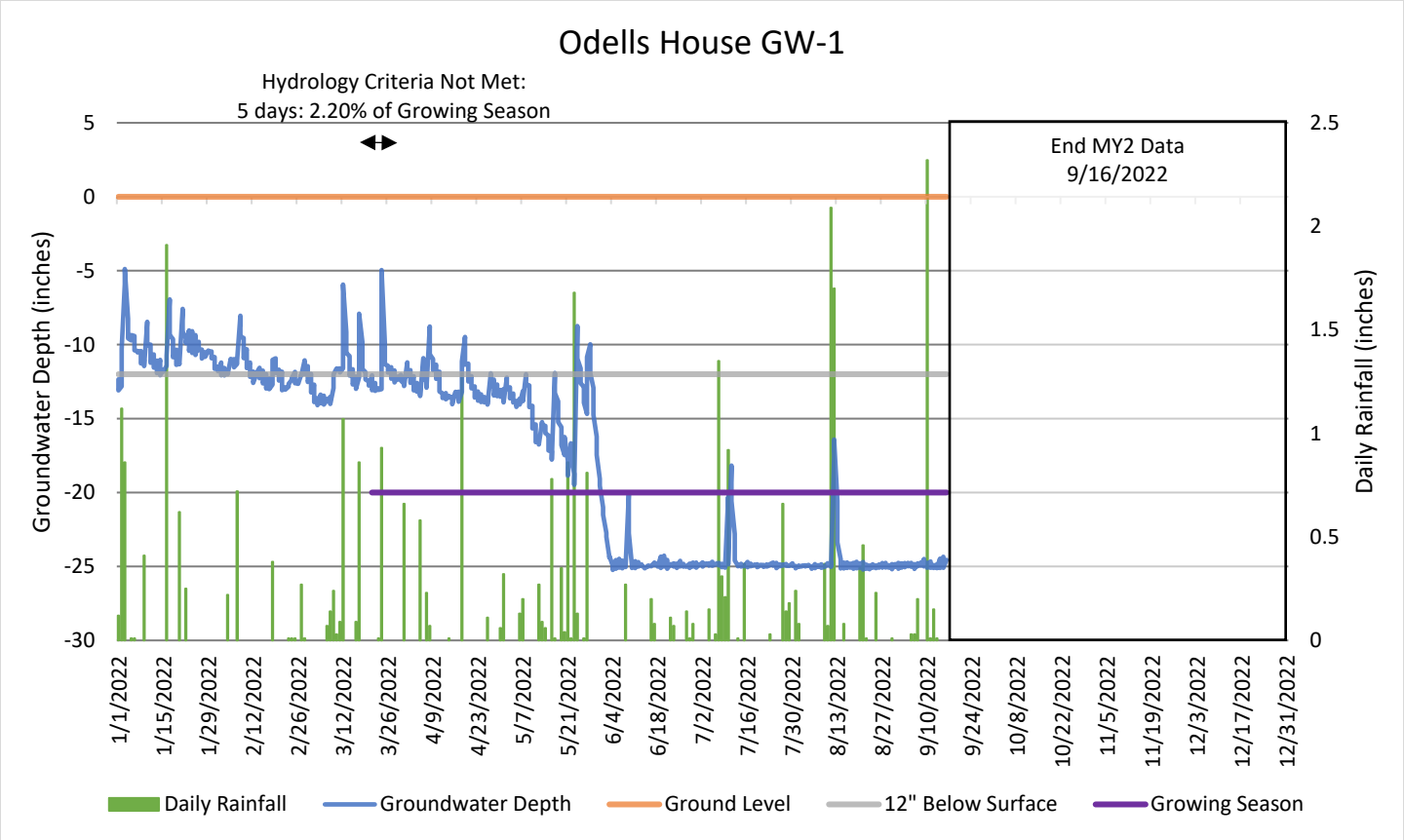
***CG-1:** 6 bankfull events with a maximum 0.72' above bankfull

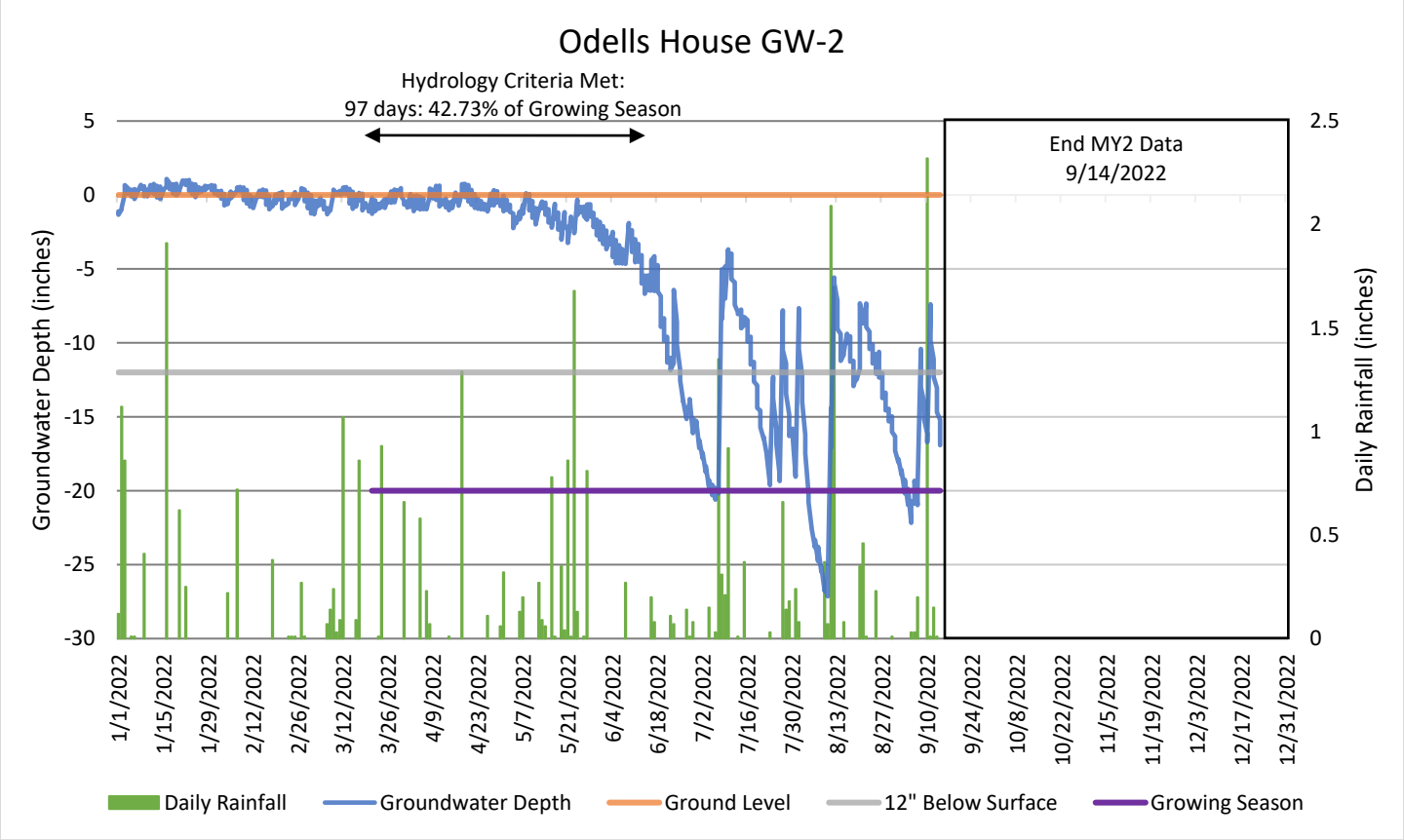


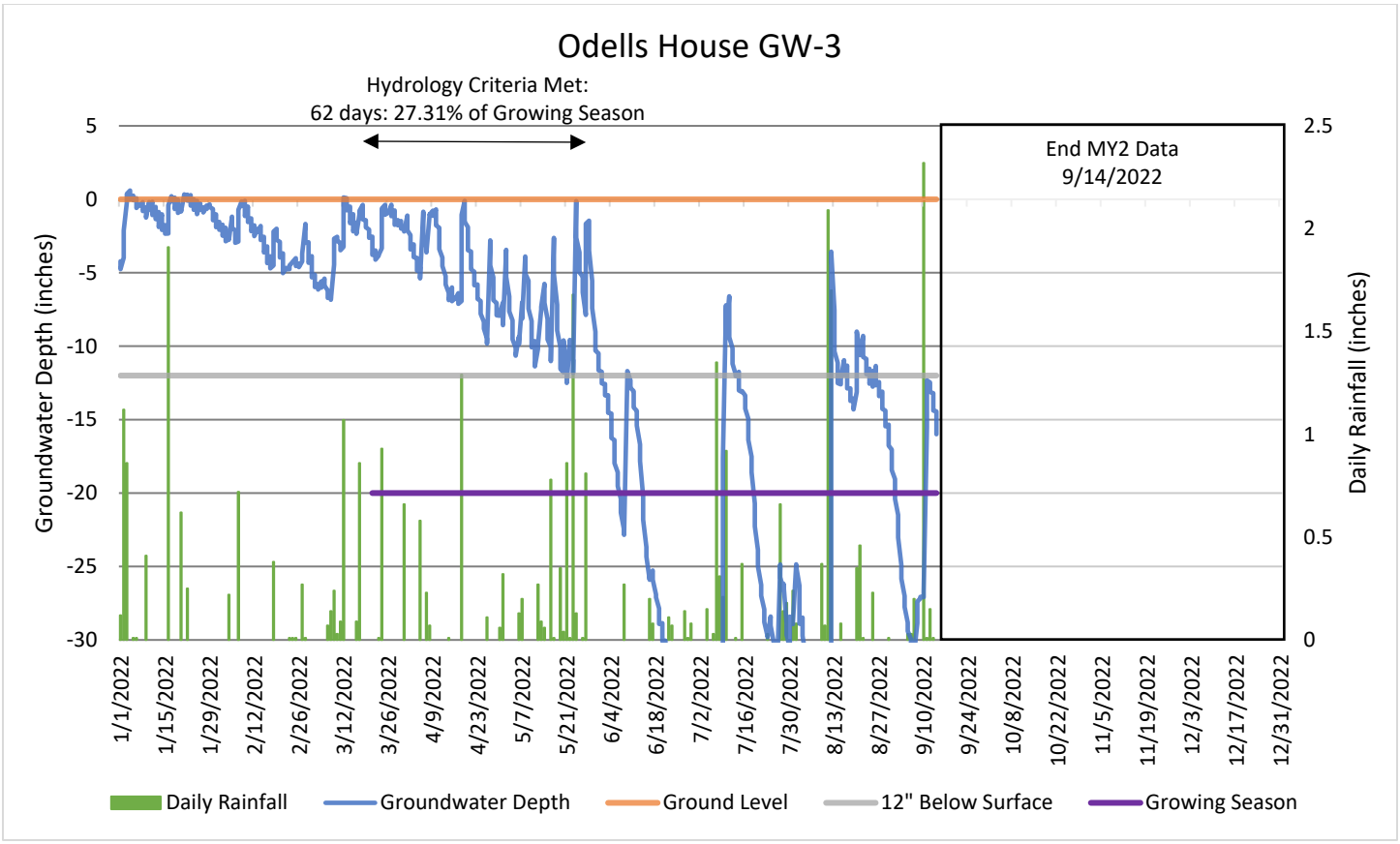
***CG-2:** 10 bankfull events with a maximum 0.54' above bankfull

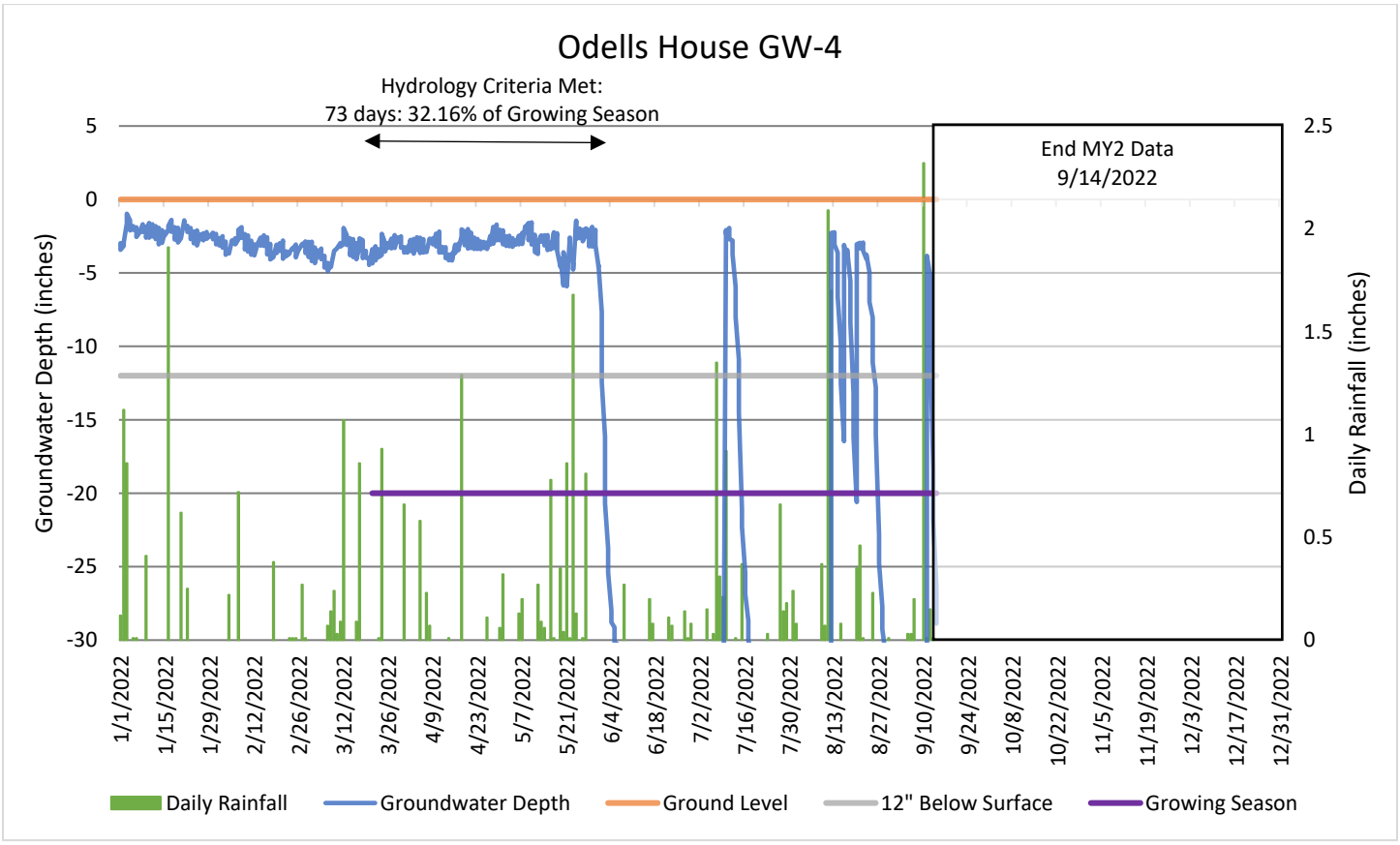
Max Consecutive Hydroperiod Saturation within 12 Inches of Soil Surface (Percent of Growing Season 3/21-11/3) CRONOS Station:Clayton (CLAY)								
Monitoring Gauge Name	**2021**	**2022**	**2023**	**2024**	**2025**	**2026**	**2027**	**Mean**
Groundwater Gauge 1 (W1)	**14.54%**	**2.20%**						**8.37%**
Groundwater Gauge 2 (W2)	**24.23%**	**42.73%**						**33.48%**
Groundwater Gauge 3 (W3)	**17.18%**	**27.31%**						**22.25%**
Groundwater Gauge 4 (W5)	**17.18%**	**32.16%**						**24.67%**
Groundwater Gauge 5 (W5)	**25.11%**	**22.47%**						**23.79%**

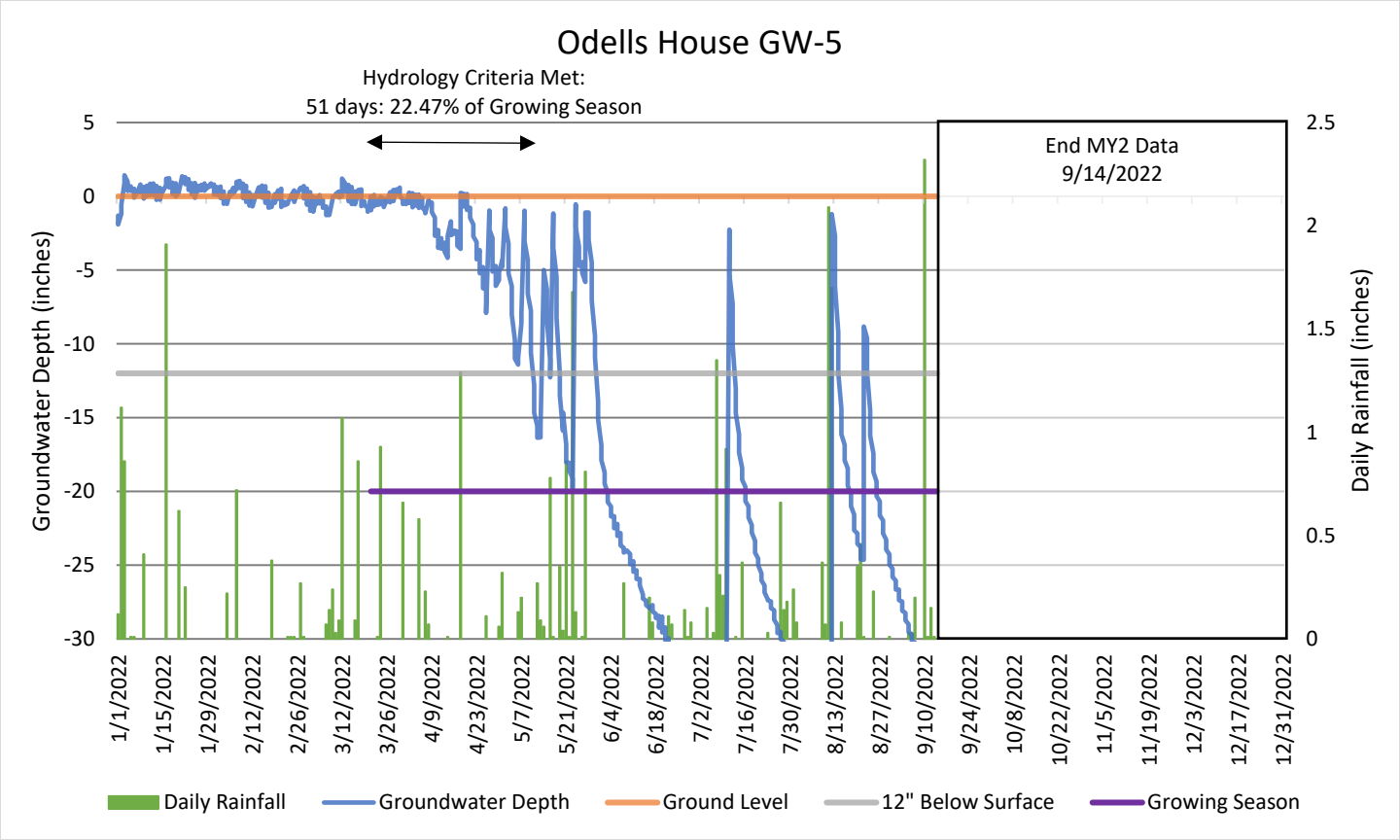
Groundwater Gauge Graphs

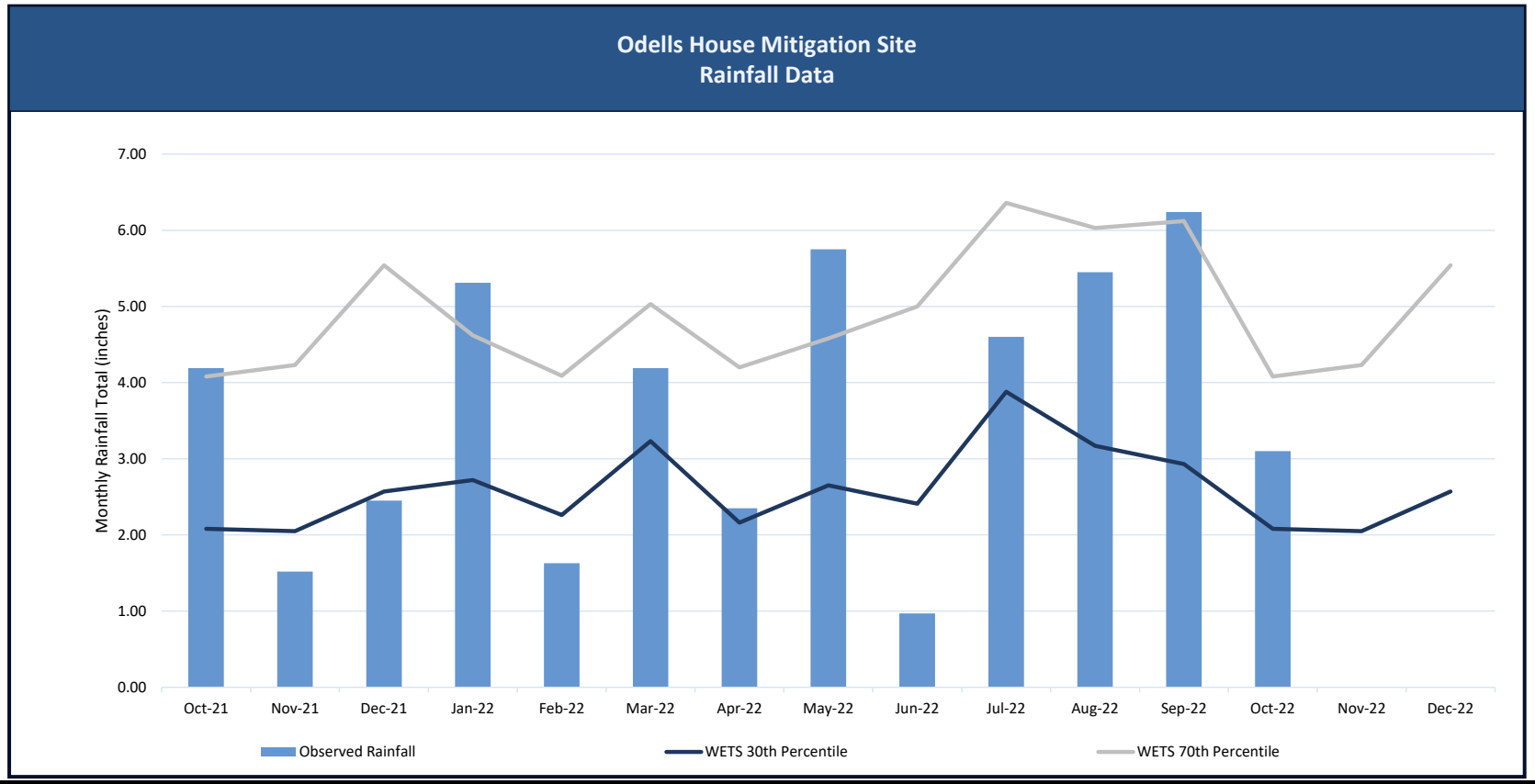





Odells House GW-3
Hydrology Criteria Met:
62 days: 27.31% of Growing Season
End MY2 Data
9/14/2022
Groundwater Depth (inches)
Daily Rainfall (inches)
5
0
-5
-10
-15
-20
-25
-30
2.5
2
1.5
1
0.5
0
1/1/2022
1/15/2022
1/29/2022
2/12/2022
2/26/2022
3/12/2022
3/26/2022
4/9/2022
4/23/2022
5/7/2022
5/21/2022
6/4/2022
6/18/2022
7/2/2022
7/16/2022
7/30/2022
8/13/2022
8/27/2022
9/10/2022
9/24/2022
10/8/2022
10/22/2022
11/5/2022
11/19/2022
12/3/2022
12/17/2022
12/31/2022
Daily Rainfall
Groundwater Depth
Ground Level
12" Below Surface
Growing Season


Odells House GW-4
Hydrology Criteria Met:
73 days: 32.16% of Growing Season
End MY2 Data
9/14/2022
Groundwater Depth (inches)
Daily Rainfall (inches)
5
0
-5
-10
-15
-20
-25
-30
2.5
2
1.5
1
0.5
0
1/1/2022
1/15/2022
1/29/2022
2/12/2022
2/26/2022
3/12/2022
3/26/2022
4/9/2022
4/23/2022
5/7/2022
5/21/2022
6/4/2022
6/18/2022
7/2/2022
7/16/2022
7/30/2022
8/13/2022
8/27/2022
9/10/2022
9/24/2022
10/8/2022
10/22/2022
11/5/2022
11/19/2022
12/3/2022
12/17/2022
12/31/2022
Daily Rainfall
Groundwater Depth
Ground Level
12" Below Surface
Growing Season


Odells House GW-5
Hydrology Criteria Met:
51 days: 22.47% of Growing Season
End MY2 Data
9/14/2022
Groundwater Depth (inches)
Daily Rainfall (inches)
5
0
-5
-10
-15
-20
-25
-30
2.5
2
1.5
1
0.5
0
1/1/2022
1/15/2022
1/29/2022
2/12/2022
2/26/2022
3/12/2022
3/26/2022
4/9/2022
4/23/2022
5/7/2022
5/21/2022
6/4/2022
6/18/2022
7/2/2022
7/16/2022
7/30/2022
8/13/2022
8/27/2022
9/10/2022
9/24/2022
10/8/2022
10/22/2022
11/5/2022
11/19/2022
12/3/2022
12/17/2022
12/31/2022
Daily Rainfall
Groundwater Depth
Ground Level
12" Below Surface
Growing Season



Rainfall Summary Table															
	Oct-2021	Nov-2021	Dec-2021	Jan-2022	Feb-2022	Mar-2022	Apr-2022	May-2022	Jun-2022	Jul-2022	Aug-2022	Sep-2022	Oct-2022	Nov-2022	Dec-2022
Observed Rainfall	4.19	1.52	2.45	5.31	1.63	4.19	2.35	5.75	0.97	4.60	5.45	6.24	3.10	**	**
WETS 30th Percentile	2.08	2.05	2.57	2.72	2.26	3.23	2.16	2.65	2.41	3.88	3.17	2.93	2.08	2.05	2.57
WETS 70th Percentile	4.08	4.23	5.54	4.62	4.09	5.03	4.2	4.58	5	6.36	6.03	6.12	4.08	4.23	5.54
Normal	H	L	L	H	L	N	N	H	L	N	N	H	N	**	**

*30th and 70th Percentile data collected from WETS Station : Johnston County

**Outside of MY Data

Appendix E:

Project Timeline and Contact Info

Project Timeline and Contacts Table		
Activity or Deliverable	**Data Collection Complete**	**Task Completion or Deliverable Submission**
Project Instituted	N/A	1/2/2018
Mitigation Plan Approved	N/A	8/26/2020
Construction (Grading) Completed	N/A	3/25/2021
Planting Completed	N/A	4/1/2021
As-built Survey Completed	N/A	6/11/2021
MY-0 Baseline Report	5/6/2021	6/15/2021
MY1 Monitoring Reports	11/23/2021	12/23/2021
Encroachment	N/A	5/26/2021
Wetland Planting	N/A	1/6/2022
MY2 Monitoring Reports	9/14/2022	11/30/2022

Odell's House DMS Project # 100041	
Provider	7721 Six Forks Road Suite 130
Water & Land Solutions, LLC	Raleigh, NC 27615
Mitigation Provider POC: Emily Dunnigan	(269) 908-6306
Designer	7721 Six Forks Road Suite 130
Water & Land Solutions, LLC	Raleigh, NC 27615
Primary project design POC: Chris Tomsic, WLS	(828) 492-3287
Construction Contractor	2889 Lowery Street
North State Environmental, Inc.	Winston-Salem, NC 27101
Primary contractor POC: Andrew Roten	(336) 406-9078