MY1 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: 2021

Prepared for:
North Carolina Department of Environmental Quality
Division of Mitigation Services
1652 Mail Service Center
Raleigh, NC 27699-1652

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December 23, 2021

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 7 Submittal, Draft Monitoring Year 1 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 1 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 1 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:

- **Hydroperiod table shows growing season dates 3/21-11/3 while gage graphs indicate 3/5-11/9. Mitigation Plan indicates the 3/21-11/3 dates will be used in the absence of soil temp/bud burst data. Please revise report and graphs to use Mitigation Plan dates.** Response: Gauge graphs were revised to reflect correct growing season dates 3/21-11/3.

- **Provide a picture of the encroachment area showing additional marking added to address area of concern (for buffer and IRT report).** Response: Photos have been added to Appendix A showing the encroachment area and additional marking to address the area.

Riparian Buffer MY0:

- **Page 3, section 2.1 please remove last sentence. DMS manages their own project ledgers.** Response: The last sentence was removed from section 2.1 on page 3.

- **Replace MY1 credit table #1 with the one from the As-built report. Total credit should be 291,419.839.** Response: The credit table was edited to have the correct total credits.

- **Table 2 contains the IRT performance criteria. Revise to update for riparian buffer performance.** Response: Table 2 was revised to only include riparian buffer criteria.

- **Provide headwater stream performance tables as part of this report as those are also performance requirements for credit on R1 and R5 sections.** Response: Headwater channel formation tables are included in Appendix E.

- **You may omit the vegetative monitoring data sheets and IRT comment letters in this report.** Response: Vegetation data sheets and IRT comments were removed from the appendices.

Electronic Comments

- **Please include the encroachment date in the project timeline table.** Response: The encroachment date has been added to the project timeline table.

- **The submitted veg input file produces a table with 1 stem in plot 10 R, but there are no stems for plot 10R in the table included in the report. Please edit the input template and re-run the tool rather than editing the output table. Editing the output table will mean there is a mismatch between the submitted raw veg data (see Input_Data sheet) and the table in the report.** Response: The input template was edited to the correct number of stems for plot 10 R (zero stems).

- **Please ensure that only days within the growing season are being included in the groundwater hydrologic criteria calculations. GW-4 shows 57 days but based on the provided data this gauge met criteria for 39 days continuously during the growing season. Please also adjust the line indicating the duration that gauge data met criteria so that the beginning of the line coincides with the beginning of the growing season.** Response: Data for GW-4 was corrected to include only days within the growing season. The graph for GW-4 was updated accordingly. Gauge graphs were revised to correctly reflect the duration that gauges met criteria.

Please contact me if you have any questions or comments.

Sincerely,

Water & Land Solutions, LLC

Emily Dunnigan
Water & Land Solutions, LLC

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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 1 (MY1) activities occurred during the second week of November 2021. This report presents the data for MY1. The Project meets the MY1 success criteria for stream hydrology, stream horizontal and vertical stability, streambed condition and stability, and wetland hydrology. Nine of the twelve vegetation plots met interim success criteria. 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

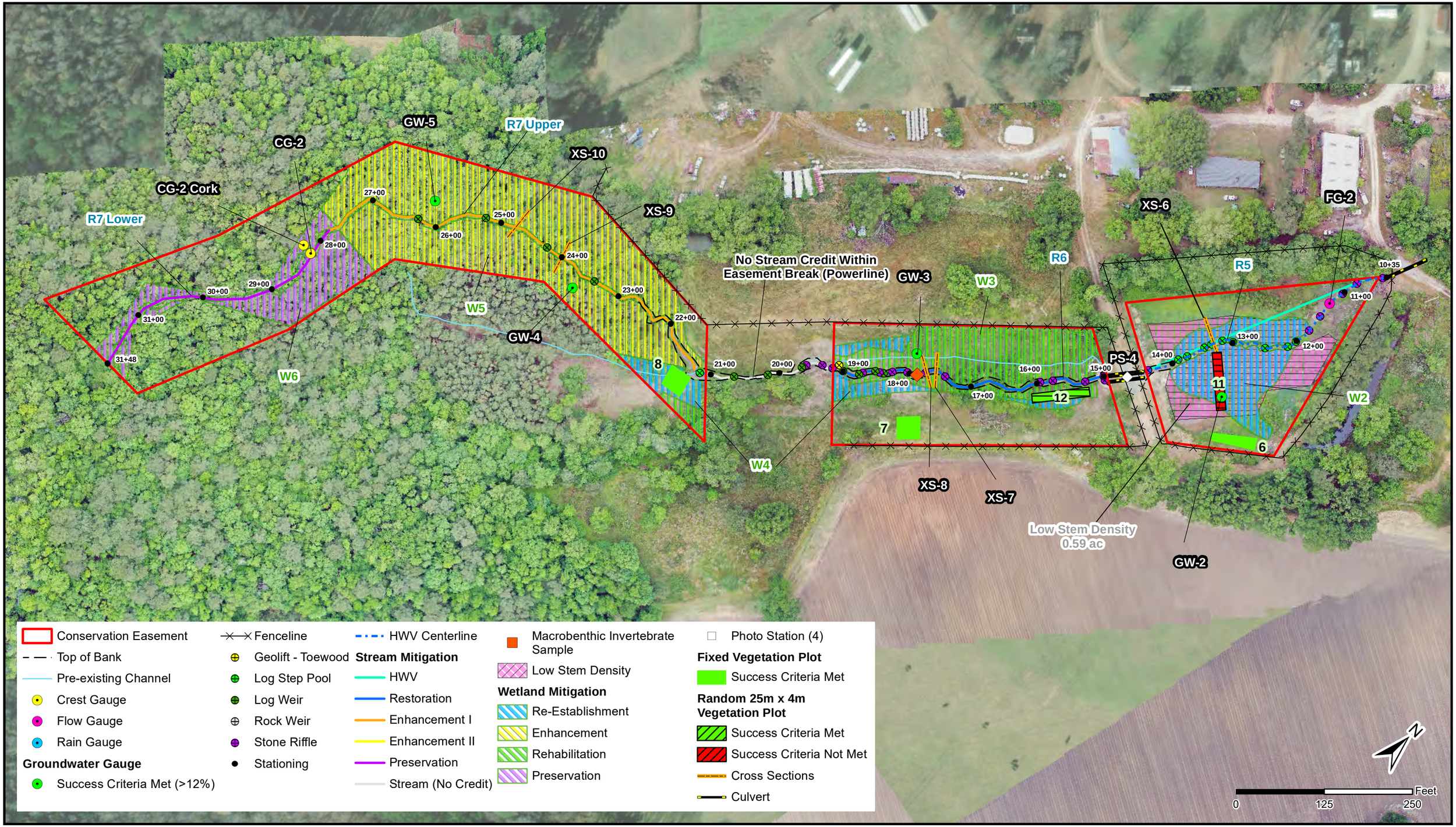
	Stream			Riparian	Non-Rip	Coastal
Restoration Level	Warm	Cool	Cold	Wetland	Wetland	Marsh
Restoration	2,300.000					
Re-establishment				1.126		
Rehabilitation				0.444		
Enhancement				0.662		
Enhancement I	416.667					
Enhancement II	273.733					
Creation						
Preservation	41.200			0.044		
Totals	**3,031.600**			**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 December 2021 MY1	USACE Current Conditions Plan View Monitoring Year 1 NAD 1983 2011 State Plane North Carolina FIPS 3200 FT US	FIGURE 1a



WATER & LAND™ SOLUTIONS

NC Mitigation Services ENVIRONMENTAL QUALITY

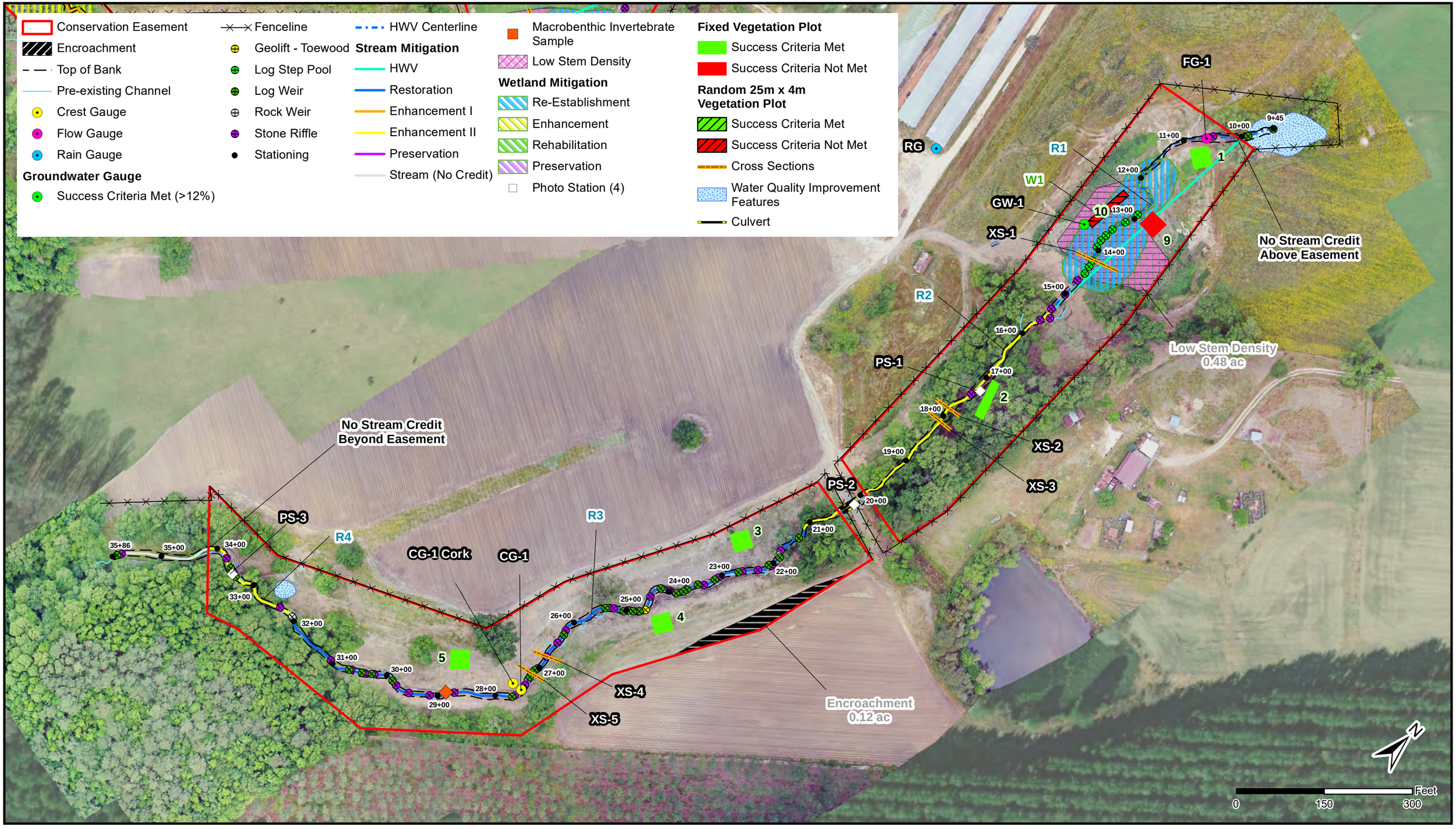
Odells House Mitigation Project
Johnston County, North Carolina

USACE Action ID Number:
SAW-2018-00431
December 2021
MY1

USACE
Current Conditions Plan View
Monitoring Year 1

NAD 1983 2011 State Plane
North Carolina FIPS 3200 FT US

FIGURE
1b



WATER & LAND™ SOLUTIONS	NC Mitigation Services ENVIRONMENTAL QUALITY	**Odells House Mitigation Project** **Johnston County, North Carolina**	USACE Action ID Number: SAW-2018-00431 December 2021 MY1	USACE Current Conditions Plan View Monitoring Year 1 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	2 Flow gauges (R1 & R5)	2/2 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 8% 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 5/5 wetland groundwater gauges met 8% 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	9/12 veg plots met - 2021

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 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 1 Assessment and Results

4.1 Morphological Assessment

Morphological data for the as-built profile was collected in November 2021. Refer to Appendices A and C for summary data tables, morphological plots, and stream photographs.

4.1.1 Stream Horizontal Pattern & Longitudinal Profile

The MY1 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 MY1 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). FG-1 on R1 had a maximum consecutive flow of 75 days from 3/5/2021 – 5/19/2021 with 123 days of cumulative flow and 126 days of no flow. FG-2 on R5 had a maximum consecutive flow of 143 days from 6/20/2021 – 11/9/2021 with 241 days of cumulative flow and 8 days of no flow. FG-1 experienced a download error on July 13th due to a malfunctioning Onset Shuttle and was relaunched during MY1 data collection on November 9th. A new flow gauge (FG-3) will be installed during MY2 on R1, near the center of the former pond bed, to better capture data within the old pond bottom. Additionally, to determine if rainfall amounts are normal for the given year, precipitation data was obtained from an onsite rain gauge.

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 MY1, bankfull events were recorded on both pressure transducer crest gauges. CG-1 recorded three events with a maximum of 0.437’ above bankfull on 6/10/2021. CG-2 recorded 11 events with a maximum of 0.455’ above bankfull on 6/10/2021. CG-1 experienced a download error on July 13th due to a malfunctioning Onset Shuttle and was relaunched during MY1 data collection on November 9th. Associated data are in Appendix E.

4.2.2 Headwater Stream Channel Formation

During MY1, streams R1 and R5 exhibited evidence indicative of channel formation within the topographic low-point of the valley (see table 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. All five wetland groundwater wells met the twelve percent hydrology criteria for MY1. Associated data is in Appendix E. GW-1 experienced a download error on July 14th due to a malfunctioning Onset Shuttle and was relaunched during MY1 data collection on November 9th.

4.4 Vegetation

Monitoring of the nine permanent vegetation plots and three random plots/transects was completed during the second week of November 2021. Vegetation data and photos can be found in Appendix B. The MY1 average planted density is 499 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. Eight of nine fixed vegetation plots met the interim measure requirement with 486 – 1,174 stems per acre. Fixed vegetation Plot 9 (W1) did not meet density criteria with 243 stems per acre. Random vegetation transects 10 (W1) and 11 (W2) did not meet density criteria with zero stems per acre, and 162 stems per acre, respectively. Low stem densities in these areas (~1.07 acres) are due to low planting densities at as-built, mortality due to high hydrology, and difficult to locate trees in dense herbaceous vegetation. Extremely soft and saturated soil conditions during construction and planting made areas of W1 and W2 unsafe for the contractor to plant bare roots. During MY2, both wetlands will be re-planted with wet tolerant species approved by the IRT prior to planting if species deviate from the approved mitigation plan plant list. Volunteer species were not noted at baseline monitoring but are expected to establish in upcoming years.

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 right bank slope (~0.12 acres). An active farm field along the easement has led to farm equipment encroachment. No trees have been damaged, and the area will be marked with additional easement signs in MY2 to discourage further encroachment.

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 for cut/stump and three percent for foliar spray. During MY1, foliar spray treatments of bamboo continued, see table below. 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%)

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

Table 4: Visual Stream Stability Assessment						
Reach		R1, R2, R3, R4, R5, R6, R7 (upper and lower)				
Assessed Stream Length		4,302				
Assessed Bank Length		5,384				
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.	116	116		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)	34	34		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	1.07	9.6%
		Total	1.07	9.6%
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	1.07	9.6%
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-01)

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

R1, XS-1, Downstream (MY-01)

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

R1, XS-1, Left Bank (MY-01)

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

R1, XS-1, Right Bank (MY-01)

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

R2, XS-2, Upstream (MY-01)

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

R2, XS-2, Downstream (MY-01)

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

R2, XS-2, Left Bank (MY-01)

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

R2, XS-2, Right Bank (MY-01)

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

R2, XS-3, Upstream (MY-01)

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

R2, XS-3, Downstream (MY-01)

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

R2, XS-3, Left Bank (MY-01)

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

R2, XS-3, Right Bank (MY-01)

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

R3, XS-4, Upstream (MY-01)

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

R3, XS-4, Downstream (MY-01)

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

R3, XS-4, Left Bank (MY-01)

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

R3, XS-4, Right Bank (MY-01)

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

R3, XS-5, Upstream (MY-01)

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

R3, XS-5, Downstream (MY-01)

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

R3, XS-5, Left Bank (MY-01)

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

R3, XS-5, Right Bank (MY-01)

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

R5, XS-6, Upstream (MY-01)

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

R5, XS-6, Downstream (MY-01)

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

R5, XS-6, Left Bank (MY-01)

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

R5, XS-6, Right Bank (MY-01)

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

R6, XS-7, Upstream (MY-01)

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

R6, XS-7, Downstream (MY-01)

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

R6, XS-7, Left Bank (MY-01)

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

R6, XS-7, Right Bank (MY-01)

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

R6, XS-8, Upstream (MY-01)

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

R6, XS-8, Downstream (MY-01)

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

R6, XS-8, Left Bank (MY-01)

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

R6, XS-8, Right Bank (MY-01)

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

R7 (upper), XS-9, Upstream (MY-01)

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

R7 (upper), XS-9, Downstream (MY-01)

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

R7 (upper), XS-9, Left Bank (MY-01)

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

R7 (upper), XS-9, Right Bank (MY-01)

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

R7 (upper), XS-10, Upstream (MY-01)

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

R7 (upper), XS-10, Downstream (MY-01)

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

R7 (upper), XS-10, Left Bank (MY-01)

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

R7 (upper), XS-10, Right Bank (MY-01)

PS-1 – R2, EII, Upstream (MY-00)

PS-1 – R2, EII, Upstream (MY-01)

PS-1 – R2, EII, Downstream (MY-00)

PS-1 – R2, EII, Downstream (MY-01)

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

PS-2 – R2 Culvert Crossing, Upstream (MY-01)

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

PS-2 – R2 Culvert Crossing, Downstream (MY-01)

PS-3 – R4, EII, Upstream (MY-00)

PS-3 – R4, EII, Upstream (MY-01)

PS-3 – R4, EII, Downstream (MY-00)

PS-3 – R4, EII, Downstream (MY-01)

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

PS-4 – R5 Culvert Crossing, Upstream (MY-01)

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

PS-4 – R5 Culvert Crossing, Downstream (MY-01)

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

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

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												
Monitoring Year 1	567	2	11	0	607	2	9	0	567	2	7	0
Monitoring Year 0	688	2	12	0	648	2	9	0	607	2	7	0
	Veg Plot 4 F				Veg Plot 5 F				Veg Plot 6 F			
	Stems/Ac.	Av. Ht. (ft)	# Species	% Invasives	Stems/Ac.	Av. Ht. (ft)	# Species	% Invasives	Stems/Ac.	Av. Ht. (ft)	# Species	% Invasives
Monitoring Year 7												
Monitoring Year 5												
Monitoring Year 3												
Monitoring Year 2												
Monitoring Year 1	607	2	7	0	486	2	7	0	1174	2	7	0
Monitoring Year 0	769	2	8	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												
Monitoring Year 1	526	2	8	0	729	2	6	0	243	2	4	0
Monitoring Year 0	850	2	10	0	769	2	6	0	688	2	8	0
	Veg Plot Group 10 R				Veg Plot Group 11 R				Veg Plot Goup 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												
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.

** Plot 10 R was surveyed in MY1 and zero stems were found.

Planted Acreage	11.17
Date of Initial Plant	2021-03-03
Date(s) of Supplemental Plant(s)	#N/A
Date(s) Mowing	#N/A
Date of Current Survey	2021-11-10
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 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
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	2	2	1	1					8	8	1	1	1	1				
	Carpinus caroliniana	American hornbeam	Tree	FAC	1	1					2	2							2	2				
	Corylus americana	American hazelnut	Shrub	FACU			1	1							1	1	1	1						
	Diospyros virginiana	common persimmon	Tree	FAC	2	2											1	1						
	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							1	1				
	Lindera benzoin	northern spicebush	Tree	FAC	1	1	1	1					1	1										
	Liriodendron tulipifera	tuliptree	Tree	FACU	1	1	2	2	4	4	3	3	5	5			2	2						
	Platanus occidentalis	American sycamore	Tree	FACW	3	3	2	2	4	4	1	1	2	2	5	5	3	3	7	7	1	1	2	4
	Quercus michauxii	swamp chestnut oak	Tree	FACW	1	1	2	2							4	4	1	1						1
	Quercus nigra	water oak	Tree	FAC	1	1			1	1			1	1	3	3					2	2		1
	Quercus pagoda	cherrybark oak	Tree	FACW	1	1	2	2	1	1	3	3	1	1			2	2			1	1		1
	Quercus phellos	willow oak	Tree	FAC					2	2	3	3	1	1	4	4	2	2	1	1	2	2		1
Sum	Performance Standard				14	14	15	15	14	14	15	15	12	12	29	29	13	13	18	18	6	6	4	8
Post Mitigation Plan Species	Alnus serrulata	hazel alder	Tree	OBL																				1
Sum	Proposed Standard				14	14	15	15	14	14	15	15	12	12	29	29	13	13	18	18	6	6	4	9
Mitigation Plan Performance Standard	Current Year Stem Count					14		15		14		15		12		29		13		18		6	4	8
	Stems/Acre					567		607		567		607		486		1174		526		729		243	162	324
	Species Count					11		9		7		7		7		7		8		6		4	2	5
	Dominant Species Composition (%)					21		13		29		20		42		28		23		39		33	50	44
	Average Plot Height					2		2		2		2		2		2		2		2		2	4	3
	% Invasives					0		0		0		0		0		0		0		0		0	0	0
Post Mitigation Plan Performance Standard	Current Year Stem Count					14		15		14		15		12		29		13		18		6	4	9
	Stems/Acre					567		607		567		607		486		1174		526		729		243	162	364
	Species Count					11		9		7		7		7		7		8		6		4	2	6
	Dominant Species Composition (%)					21		13		29		20		42		28		23		39		33	50	44
	Average Plot Height					2		2		2		2		2		2		2		2		2	4	3
	% Invasives					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.

* Plot 10 R was surveyed in MY1, zero stems were found.

Fixed Veg Plot 1 (MY-00)

Fixed Veg Plot 1 (MY-01)

Fixed Veg Plot 2 (MY-00)

Fixed Veg Plot 2 (MY-01)

Fixed Veg Plot 3 (MY-00)

Fixed Veg Plot 3 (MY-01)

Fixed Veg Plot 4 (MY-00)

Fixed Veg Plot 4 (MY-01)

Fixed Veg Plot 5 (MY-00)

Fixed Veg Plot 5 (MY-01)

Fixed Veg Plot 6 (MY-00)

Fixed Veg Plot 6 (MY-01)

Fixed Veg Plot 7 (MY-00)

Fixed Veg Plot 7 (MY-01)

Fixed Veg Plot 8 (MY-00)

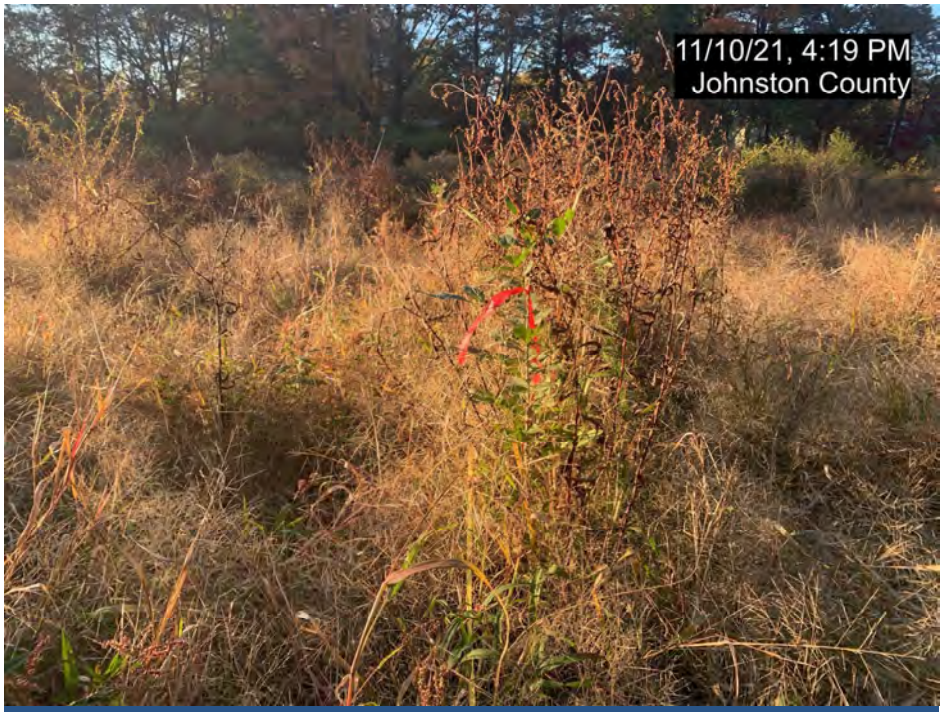
Fixed Veg Plot 8 (MY-01)

Fixed Veg Plot 9 (MY-00)

Fixed Veg Plot 9 (MY-01)

Random Veg Plot 10 (View Northwest) (MY-01)

Random Veg Plot 10 (View Southeast) (MY-01)



Random Veg Plot 11 (View East) (MY-01)

Random Veg Plot 11 (View West) (MY-01)

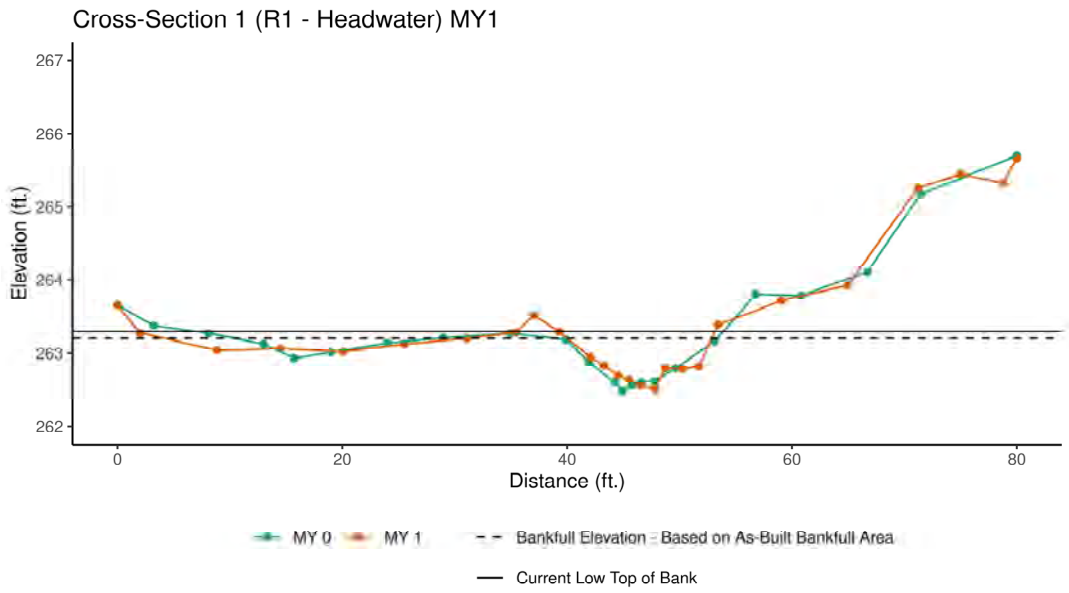
Random Veg Plot 12 (View Northeast) (MY-01)

Random Veg Plot 12 (View South west) (MY-01)

Appendix C:

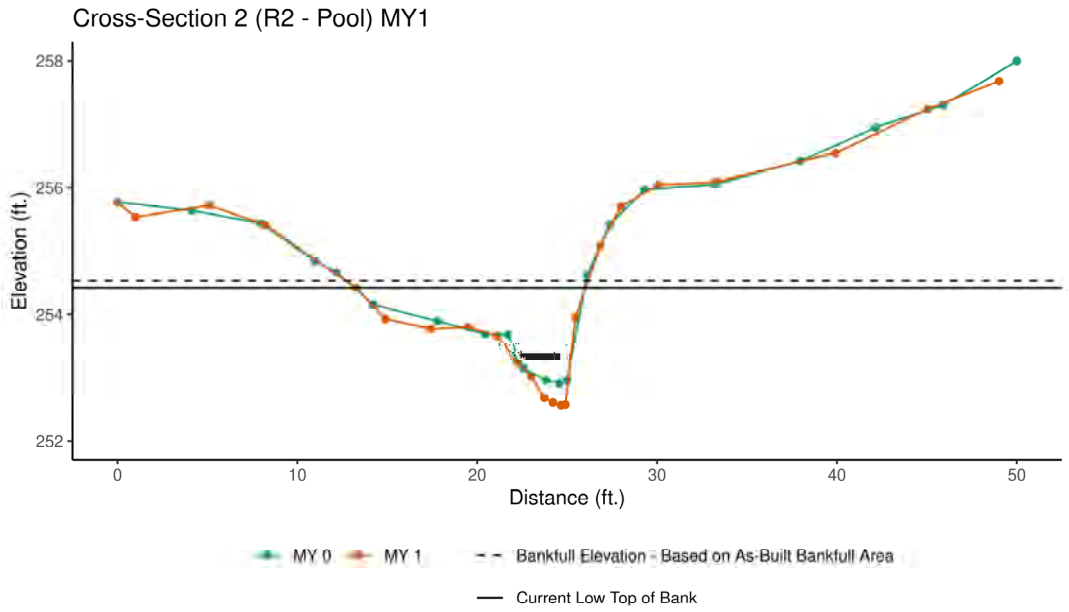
Stream Geomorphology Data

Cross-Sections with Annual Overlays
Baseline Stream Data Summary Tables
Cross-Section Morphology Data
Headwater Channel Formation Table



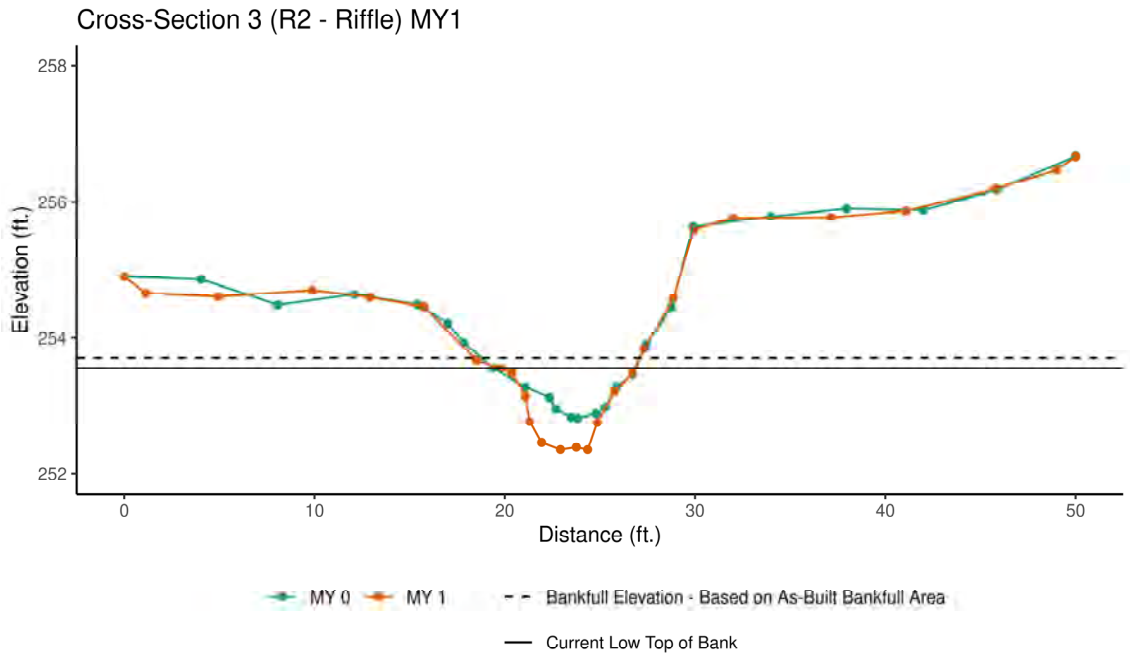
Distance	Elevation	Features
0	263.656	TLP
2.01633529	263.272	
8.86904149	263.04	
14.4899856	263.064	
20.0730009	263.022	
25.5320903	263.121	
31.0782878	263.199	
35.4356101	263.277	
37.0460969	263.522	
39.2979203	263.289	TLB, BKF
42.0826582	262.945	
43.291114	262.833	
44.5425021	262.695	
45.5136449	262.641	
46.5395386	262.555	
47.830548	262.511	THW
48.7300714	262.799	
50.2750959	262.789	
51.7297151	262.822	
53.4203907	263.39	TRB
59.038733	263.716	
64.952336	263.922	
71.2169236	265.259	
75.0001938	265.452	
78.7887552	265.33	
80	265.662	TRP

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



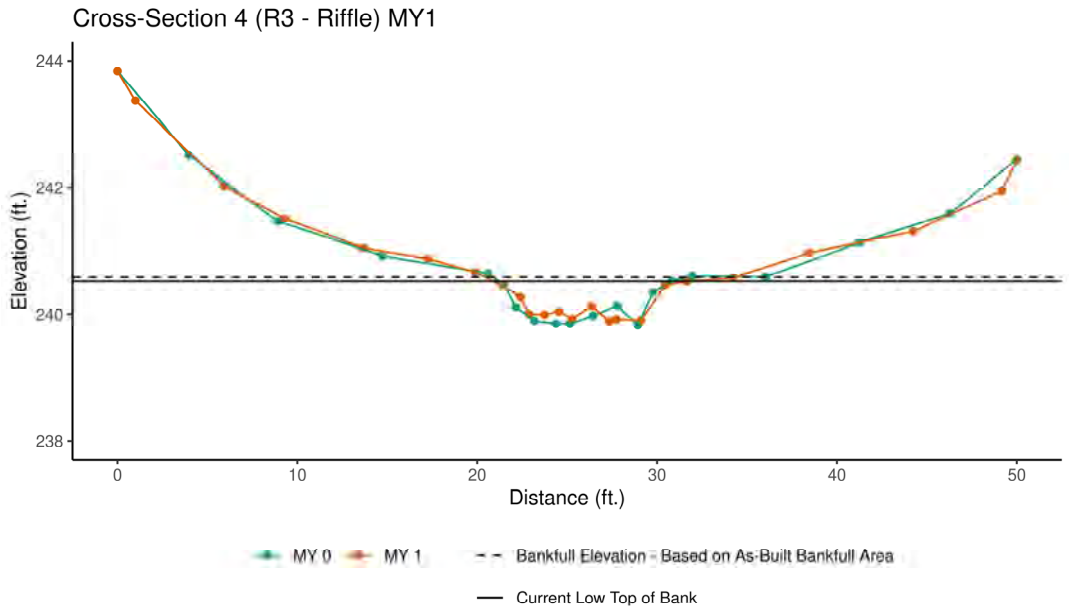
Distance	Elevation	Features
0	255.769	TLP
1.00702532	255.529	
5.10150292	255.72	
8.22288715	255.4	
13.2818058	254.41	TLB, BKF
14.9068073	253.926	
17.4078421	253.767	
19.5127823	253.795	
21.081682	253.658	
22.2343002	253.239	
22.9877571	253.021	
23.7341244	252.675	LEW
24.2076538	252.602	
24.6584205	252.558	THW
24.9015489	252.568	REW
25.4646562	253.951	
26.8345002	255.07	
27.9871696	255.705	TRB
30.0497514	256.04	
33.2811457	256.086	
39.9074141	256.543	
45.0428395	257.234	
49.0139772	257.683	
50	258.002	TRP

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



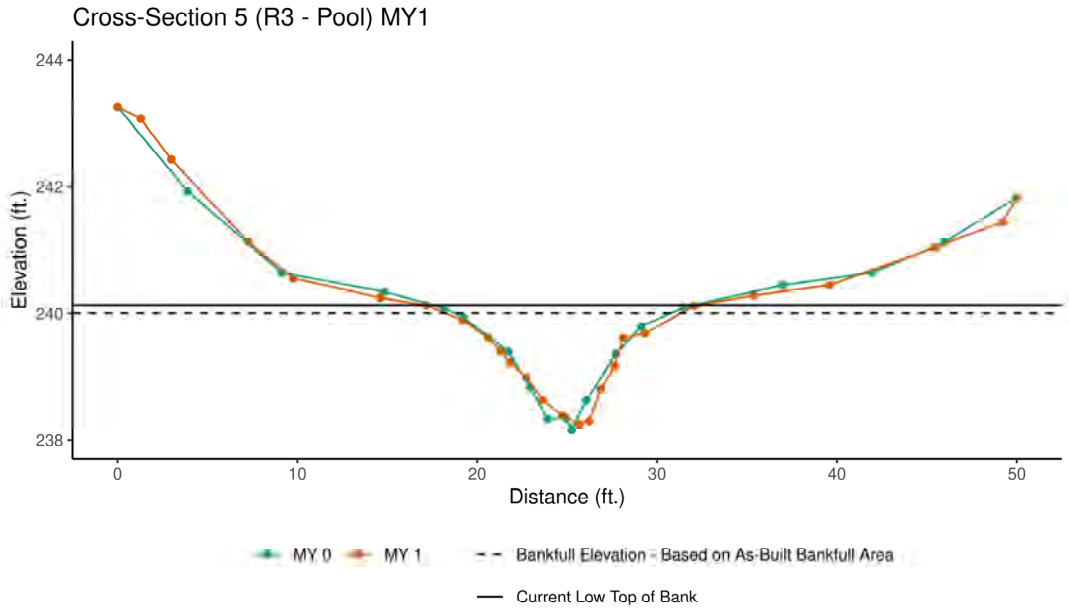
Distance	Elevation	Features
0	254.901	TLP
1.1347991	254.65	
4.96612142	254.599	
9.89360814	254.693	
12.9077472	254.59	
15.7475892	254.455	
18.5070676	253.673	
19.7919305	253.554	TLB, BKF
20.3875784	253.48	
21.0772705	253.14	
21.3012335	252.762	
21.9365772	252.455	
22.9250921	252.35	
23.7587855	252.385	
24.3538229	252.349	THW
24.8627872	252.748	
25.7645153	253.207	
26.708345	253.473	
27.3087107	253.838	TRB
28.8565668	254.569	
29.9355731	255.59	
32.0065402	255.759	
37.14815	255.768	
41.0946894	255.867	
45.778889	256.189	
48.9883092	256.468	
50	256.667	TRP

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



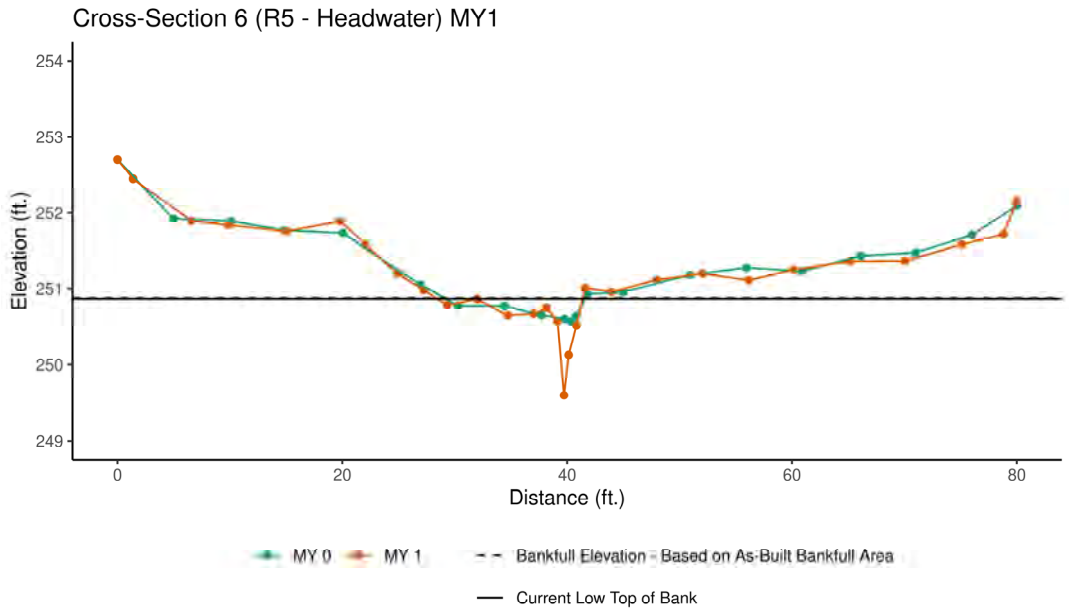
Distance	Elevation	Features
0	243.839	TLP
0.99381286	243.369	
5.90609888	242.028	
9.31465351	241.506	
13.6461085	241.044	
17.2619994	240.873	
19.8898237	240.663	TLB
21.4185526	240.445	
22.3966178	240.271	
22.876453	240.002	LEW
23.7425013	239.992	
24.5349607	240.042	
25.2764824	239.926	
26.3631855	240.128	
27.3509996	239.887	THW
27.7410639	239.921	REW
29.1017011	239.902	
30.4459623	240.451	
31.6417963	240.516	TRB, BKF
34.2352275	240.572	
38.4188854	240.963	
44.246983	241.302	
49.1633891	241.953	
50	242.426	TRP

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



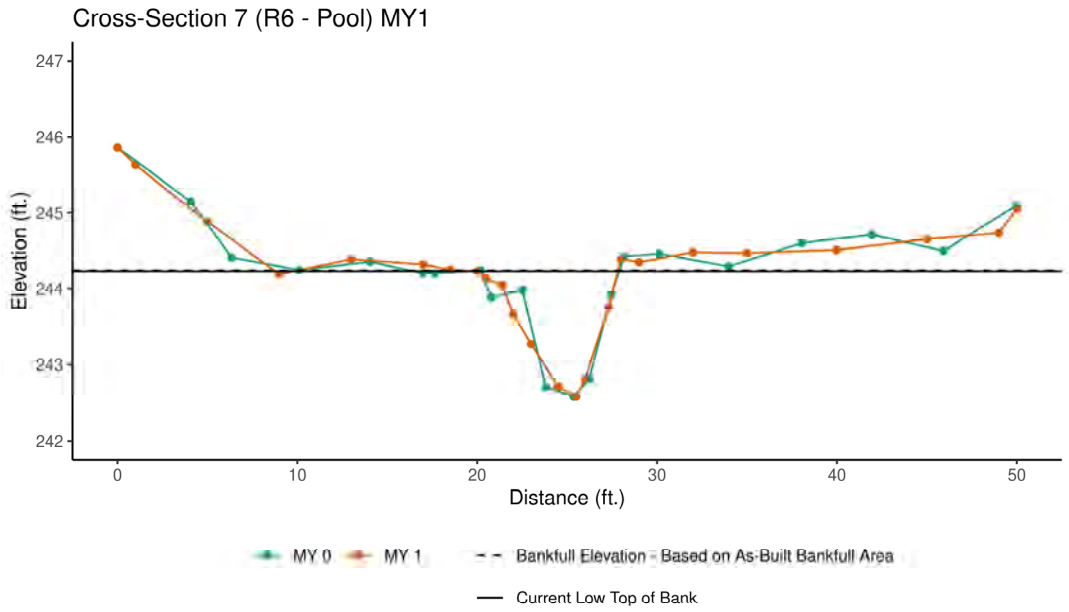
Distance	Elevation	Features
0	243.251	TLP
1.28983914	243.066	
2.99358531	242.427	
7.27924502	241.12	
9.774971	240.549	
14.6003077	240.241	
17.1517134	240.129	TLB, BKF
19.19661	239.888	
20.6223231	239.611	
21.295022	239.394	
21.82642	239.213	LEW
22.7265649	238.987	
23.6447727	238.625	
24.7457234	238.371	
25.6834348	238.237	THW
26.2177047	238.284	
26.8790244	238.8	
27.6285221	239.157	REW
28.1083093	239.608	
29.3310123	239.682	
32.0733849	240.119	TRb, BKF
35.3531239	240.276	
39.5748547	240.439	
45.4630706	241.036	
49.2068679	241.434	
50	241.818	TRP

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



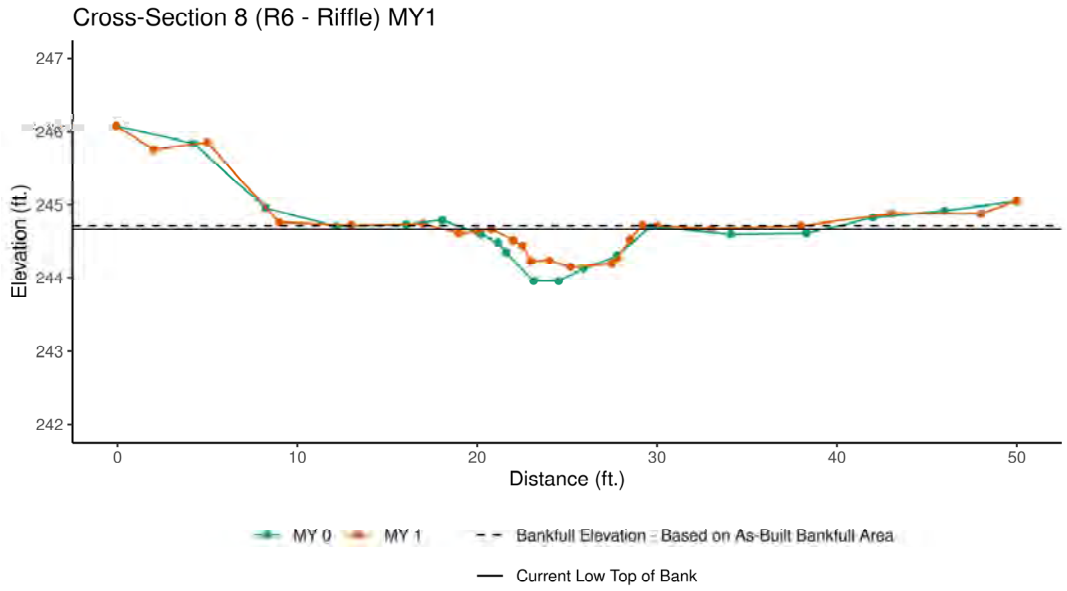
	MY0	MY1	MY2	MY3	MY4	MY5	MY6	MY7
Bankfull Elevation - Based on As-Built Bankfull Area	250.93	250.88						
Bank Height Ratio - Based on As-Built Bankfull Area	1.00	0.99						
Thalweg Elevation	250.57	249.60						
LTOB Elevation	250.93	250.87						
LTOB Max Depth	0.359	1.267						
LTOB Cross Sectional Area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

Distance	Elevation	Features
0	252.697	TLP
1.38729809	252.448	
6.61341402	251.892	
9.90164012	251.837	
14.9963729	251.753	
19.8294549	251.889	
22.0692758	251.58	
24.8970992	251.202	
27.2264419	250.981	
29.3234345	250.786	
31.9958663	250.865	TLB, BKF
34.7032357	250.654	
37.0369023	250.674	
38.179922	250.753	
39.1436109	250.575	
39.7213248	249.598	THW
40.135157	250.125	
40.8283046	250.516	
41.5920577	251.008	TRB
43.9867741	250.954	
47.9426363	251.114	
52.0365845	251.201	
56.143668	251.11	
60.1420364	251.25	
65.169399	251.362	
70.0559695	251.365	
75.1149029	251.581	
78.8049266	251.711	
80	252.154	TRP



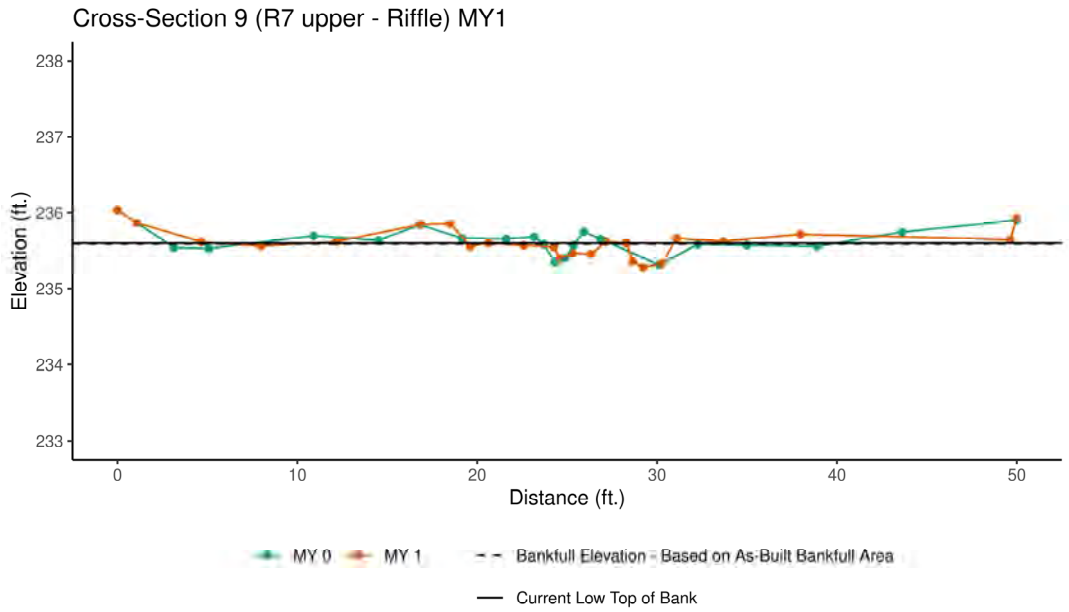
Distance	Elevation	Features
0	245.86	TLP
1	245.63	
5	244.88	
9	244.19	
13	244.39	
17	244.32	
18.5	244.25	
20	244.23	TLB, BKF
20.5	244.13	
21.4	244.04	LEW
22	243.67	
23	243.27	
24.5	242.71	
25.5	242.58	THW
26	242.81	
27.3	243.76	REW
28	244.39	TRB
29	244.35	
32	244.48	
35	244.47	
40	244.51	
45	244.65	
49	244.73	
50	245.05	TRP

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



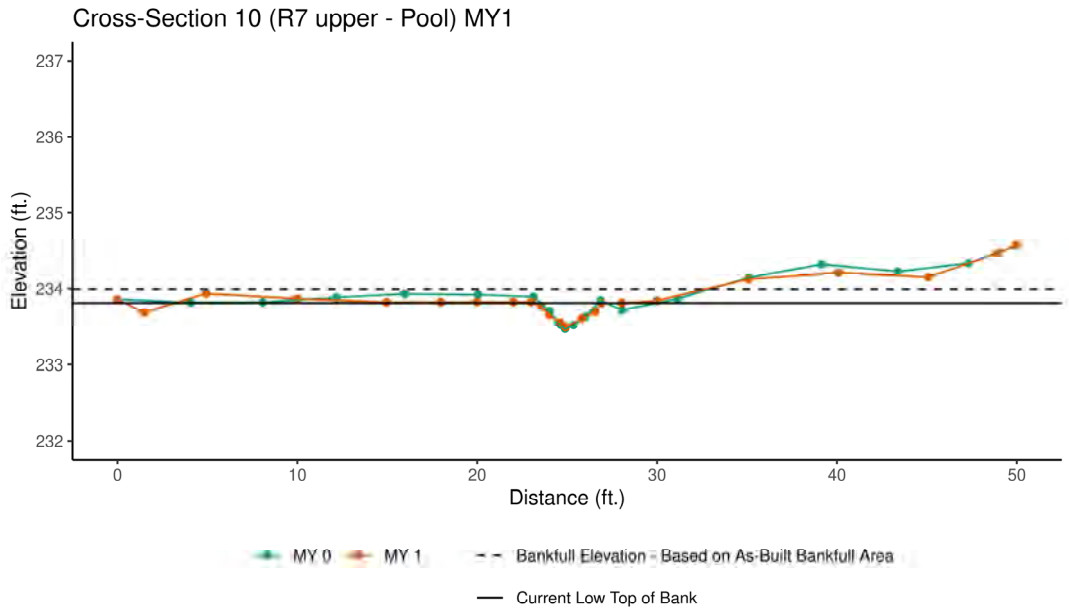
Distance	Elevation	Features
0	246.08	TLP
2	245.75	
5	245.85	
9	244.76	
13	244.72	
17	244.74	
19	244.6	
20	244.63	
20.8	244.66	TLB, BKF
22	244.51	
22.5	244.44	LEW
23	244.23	
24	244.24	
25.2	244.15	THW
27.5	244.2	
27.8	244.27	REW
28.5	244.52	
29.2	244.72	TRB
30	244.71	
33	244.67	
38	244.71	
43	244.88	
48	244.88	
50	245.05	TRP

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



Distance	Elevation	Features
0	236.034	TLP
1.07584618	235.866	
4.65200785	235.612	
7.98281485	235.561	
12.1919847	235.617	
16.8426602	235.843	
18.4949083	235.855	
19.6071155	235.556	
20.6482233	235.598	TLB, BKF
22.5906193	235.569	
24.2484974	235.548	
24.6001525	235.401	THW
25.2994416	235.467	
26.3353822	235.455	
27.1624523	235.616	TRB
28.2997113	235.599	
28.6445702	235.359	
29.2255287	235.282	
30.2882577	235.336	
31.0725213	235.658	
33.6620646	235.619	
37.9810545	235.711	
49.635578	235.641	
50	235.928	TRP

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



Distance	Elevation	Features
0	233.858	TLP
1.47365702	233.69	
4.93190278	233.934	
9.98312356	233.867	
14.9768418	233.823	
17.9603618	233.824	
19.9685397	233.825	
22.006762	233.826	
23.0012961	233.826	TLB
23.5479307	233.778	
23.9901815	233.657	LEW
24.6149606	233.558	
24.9127689	233.496	THW
25.8087063	233.61	REW
26.5548229	233.699	
26.9227745	233.812	TRB
28.0490163	233.813	
29.985679	233.841	
35.0541376	234.125	
40.0829068	234.211	
45.0887839	234.153	
48.9431345	234.469	
50	234.577	TRP

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

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 11/10/2021)

	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						254.61	254.52						253.90	253.70					
Bank Height Ratio_Based on AB Bankfull[1] Area	0.96	1.13						1.00	0.94						1.00	0.89					
Thalweg Elevation	262.48	262.51						252.91	252.56						252.81	252.35					
LTOB[2] Elevation	263.16	263.29						254.61	254.41						253.90	253.55					
LTOB[2] Max Depth (ft)	0.67	0.78						1.70	1.85						1.10	1.21					
LTOB[2] Cross Sectional Area (ft^2)	4.77	6.27						11.76	10.33						6.03	5.00					
Entrenchment Ratio	4.70	5.30						1.70	1.60						3.10	3.40					

	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						240.09	240.00						250.93	250.88					
Bank Height Ratio_Based on AB Bankfull[1] Area	1.00	0.90						1.00	1.07						1.00	0.99					
Thalweg Elevation	239.85	239.89						238.34	238.24						250.57	249.60					
LTOB[2] Elevation	240.60	240.52						240.09	240.13						250.93	250.87					
LTOB[2] Max Depth (ft)	0.75	0.63						1.75	1.89						0.36	1.27					
LTOB[2] Cross Sectional Area (ft^2)	4.90	4.18						10.02	11.78						2.55	2.46					
Entrenchment Ratio	3.10	2.90						3.50	2.80						2.80	8.10					

	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						244.59	244.71						235.65	235.59					
Bank Height Ratio_Based on AB Bankfull[1] Area	1.00	0.99						1.00	0.90						0.97	1.05					
Thalweg Elevation	242.58	242.58						243.96	244.15						235.35	235.40					
LTOB[2] Elevation	244.24	244.23						244.59	244.66						235.65	235.60					
LTOB[2] Max Depth (ft)	1.66	1.65						0.63	0.51						0.30	0.20					
LTOB[2] Cross Sectional Area (ft^2)	6.78	6.70						3.23	2.79						0.39	0.45					
Entrenchment Ratio	6.00	6.30						4.90	2.50						22.20	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					
Bank Height Ratio_Based on AB Bankfull[1] Area	0.68	0.64					
Thalweg Elevation	233.47	233.50					
LTOB[2] Elevation	233.85	233.81					
LTOB[2] Max Depth (ft)	0.37	0.32					
LTOB[2] Cross Sectional Area (ft^2)	0.70	0.63					
Entrenchment Ratio	13.40	9.90					

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.

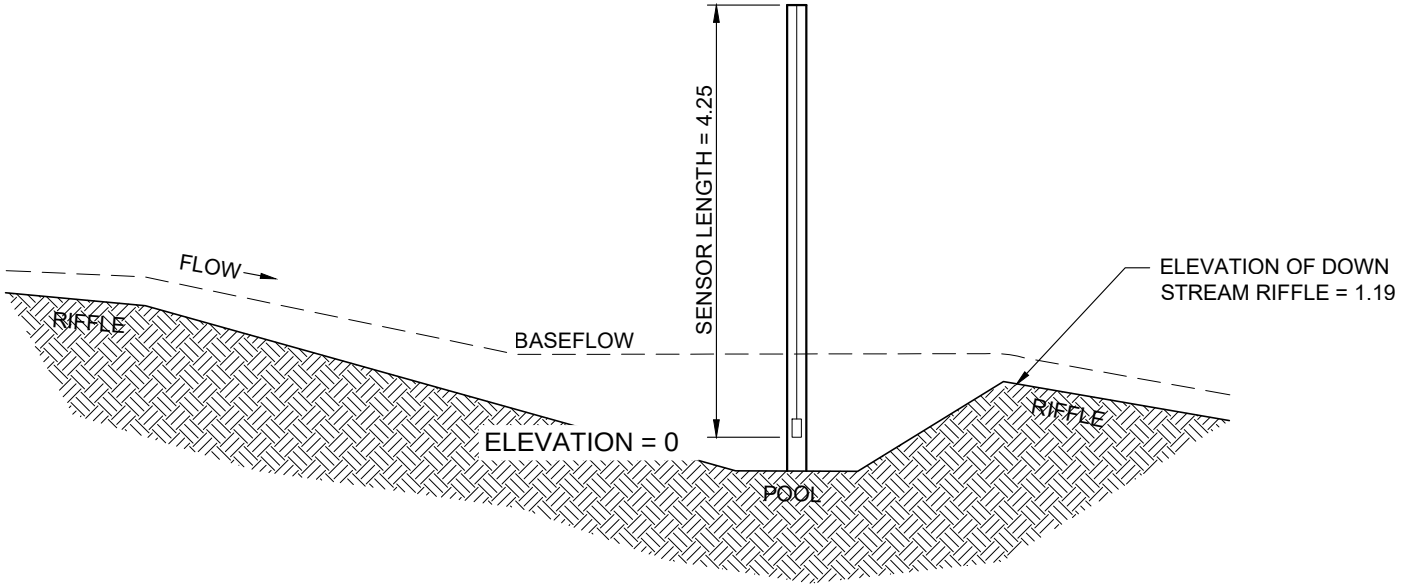
Headwater Stream Channel Formation Table Odells House Mitigaiton Project				
Channel Forming Indicators - R1	**MY1**	**MY2**	**MY3**	**MY4**
Scour (indicating sediment transport by flowing water)	No			
Sediment deposition (accumulations of sediment and/or formation of ripples)	No			
Sediment sorting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

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
Wetland Gauge Soil Notes MY0

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

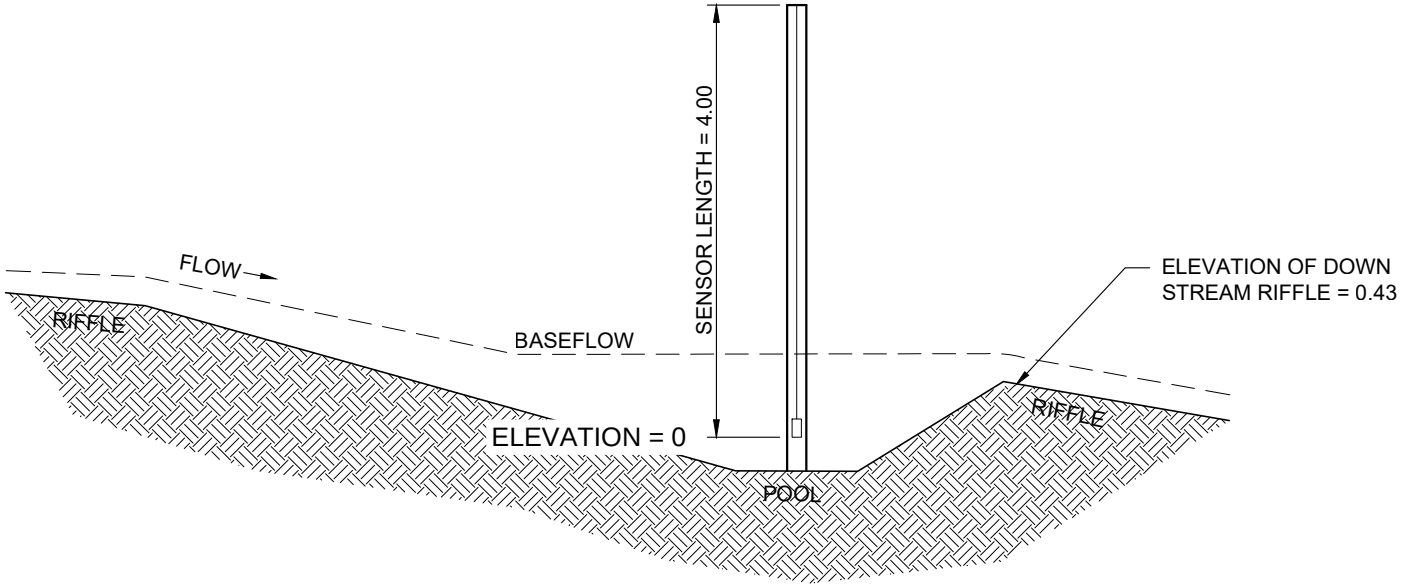
Verification of Bankfull Events: CG-2 (R7-lower) Odells House Mitigation Project					
Monitoring Year	Date of Collection	Date of Occurrence	Method	Photos	Measurement above bankfull (feet)
MY1	7/13/2021	3/16/2021	Pressure Transducer	No	0.108
	7/13/2021	3/19/2021	Pressure Transducer	No	0.101
	7/13/2021	3/28/2021	Pressure Transducer	No	0.329
	7/13/2021	3/31/2021	Pressure Transducer	No	0.141
	7/13/2021	4/11/2021	Pressure Transducer	No	0.329
	7/13/2021	6/10/2021	Pressure Transducer	No	0.455
	7/13/2021	7/8/2021	Pressure Transducer	No	0.281
	7/13/2021	7/11/2021	Pressure Transducer	No	0.167
	11/9/2021	7/27/2021	Pressure Transducer	No	0.432
	11/9/2021	10/26/2021	Pressure Transducer	No	0.241
	11/9/2021	10/29/2021	Pressure Transducer	No	0.195



FLOW GAUGE #1 - R1

Flow Depth = 1.19 feet

*All elevations relative to sensor depth

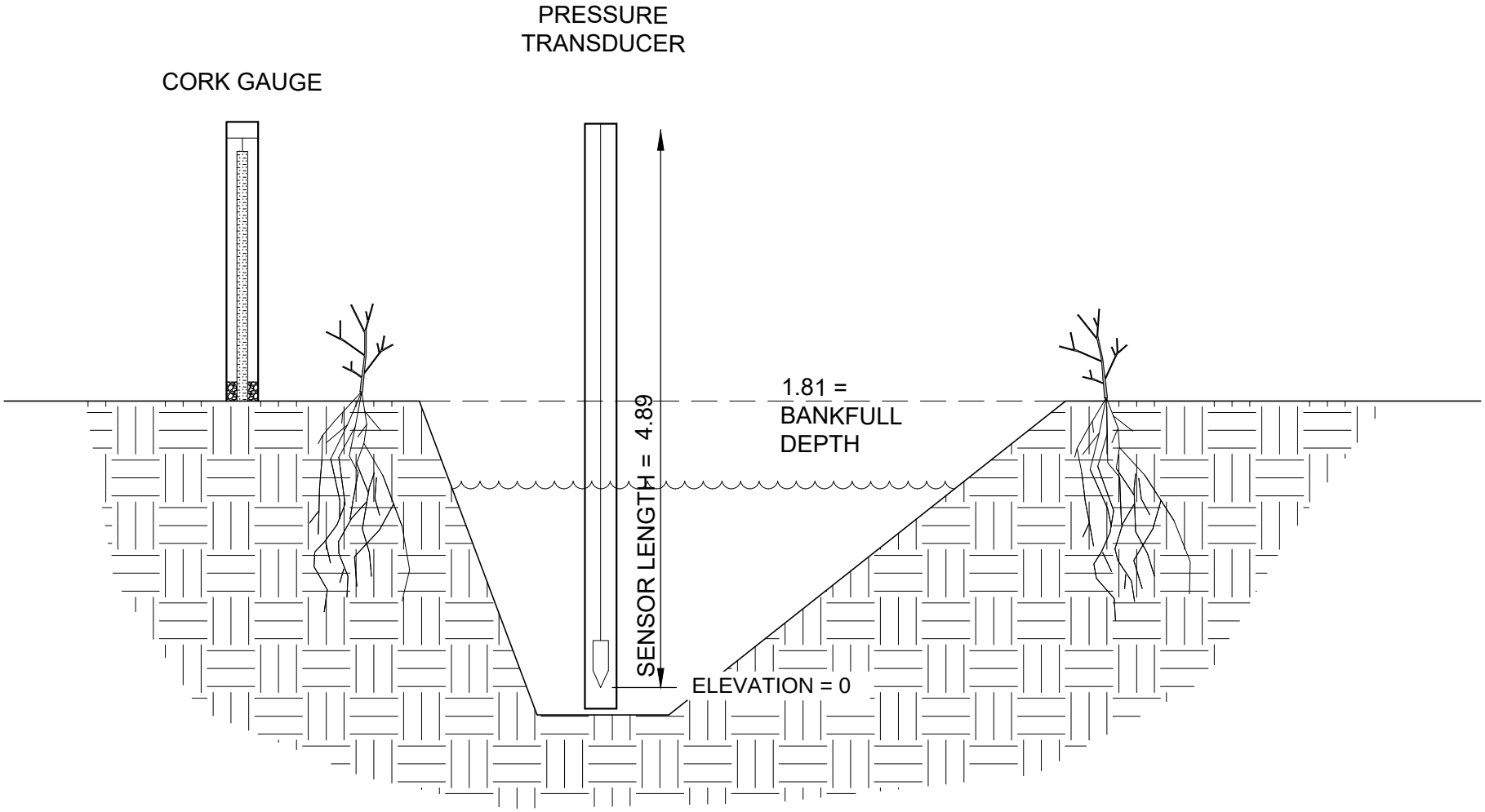


FLOW GAUGE #2 - R5

Flow Depth = 0.43 feet

*All elevations relative to sensor depth

CROSS SECTIONAL VIEW OF STREAM

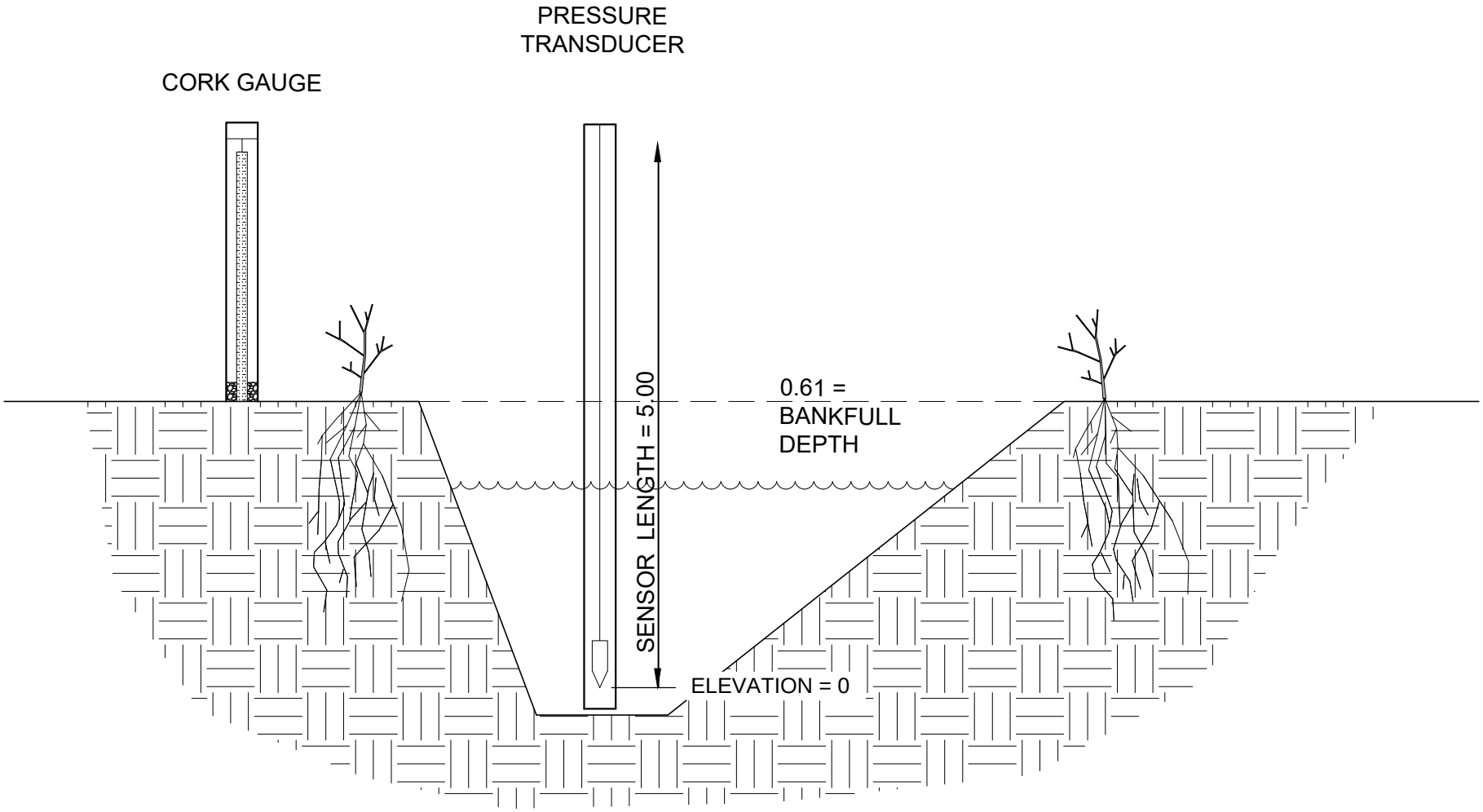


Crest Gauge CG-1 (R3)

Bankfull Event Depth = 1.81 feet

*All elevations relative to sensor depth

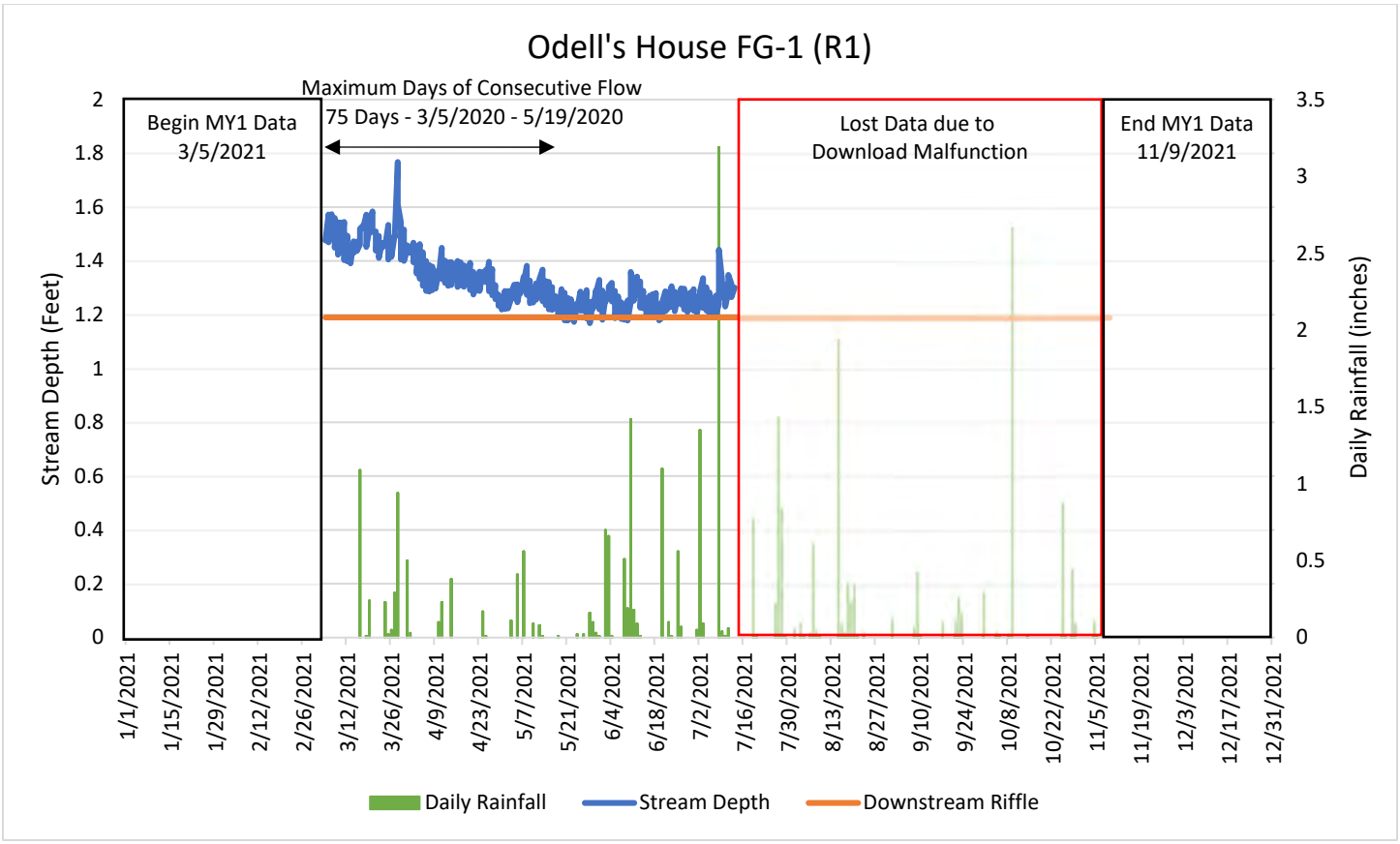
CROSS SECTIONAL VIEW OF STREAM



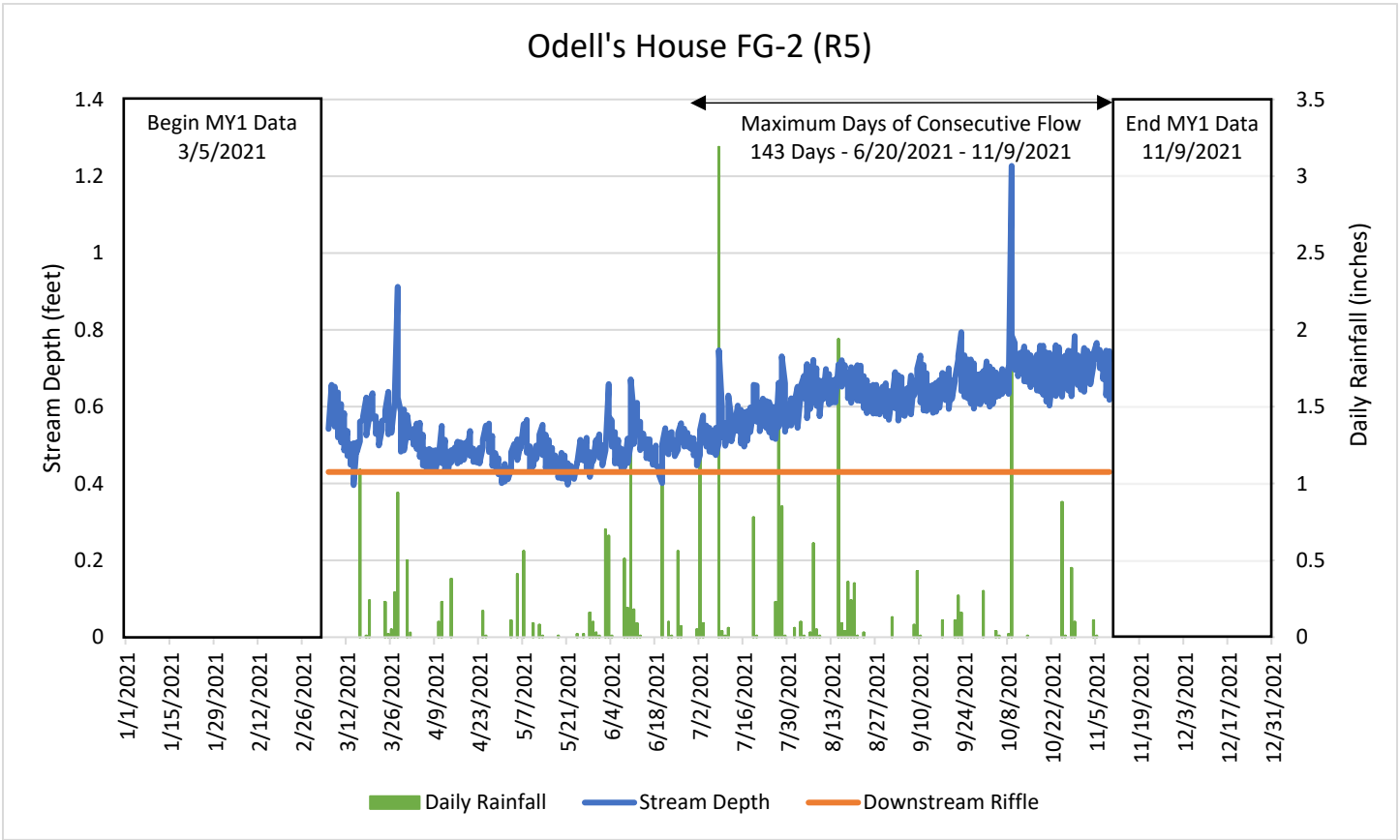
Crest Gauge CG-2 (R7 lower)

Bankfull Event Depth = 0.61 feet

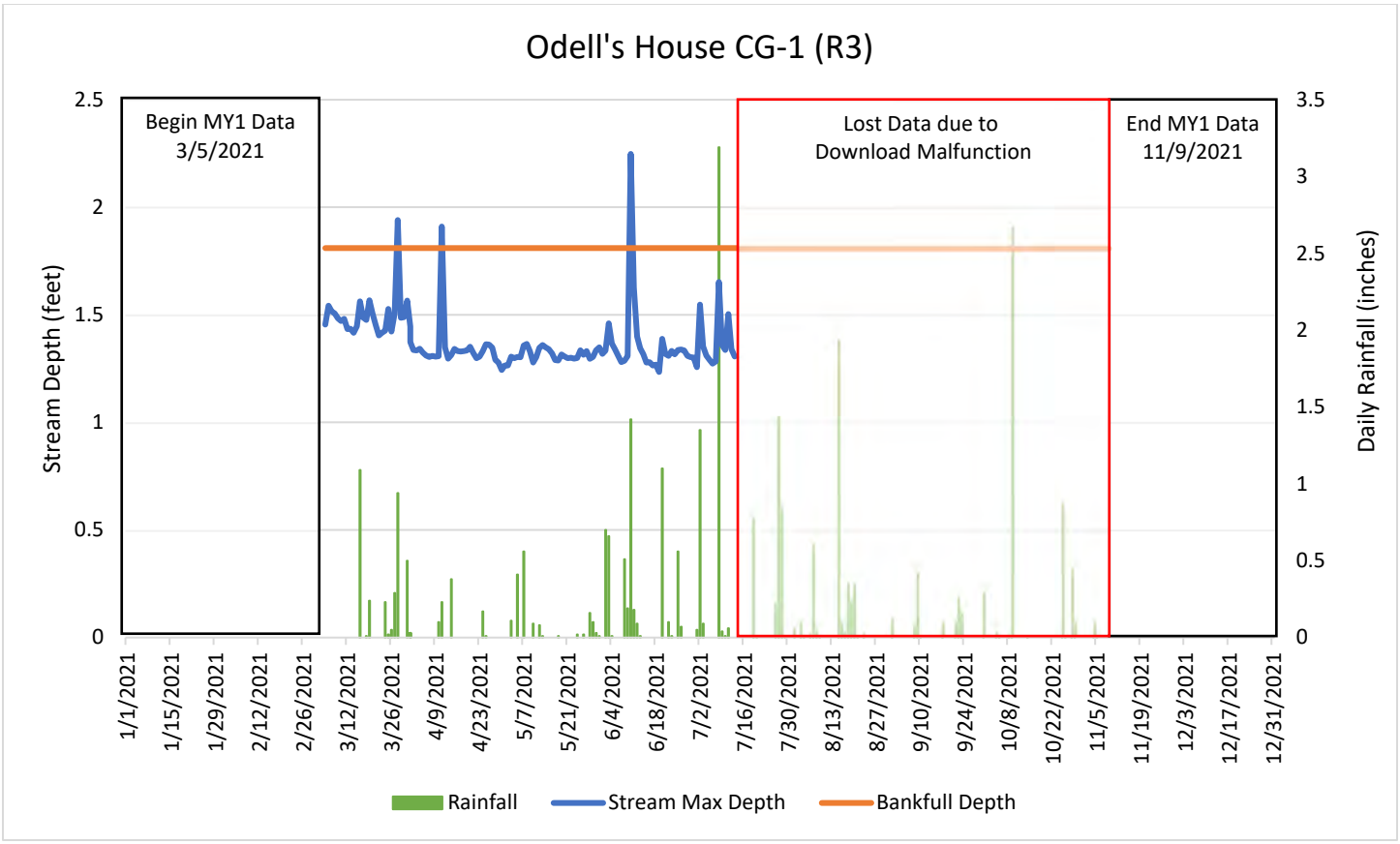
*All elevations relative to sensor depth

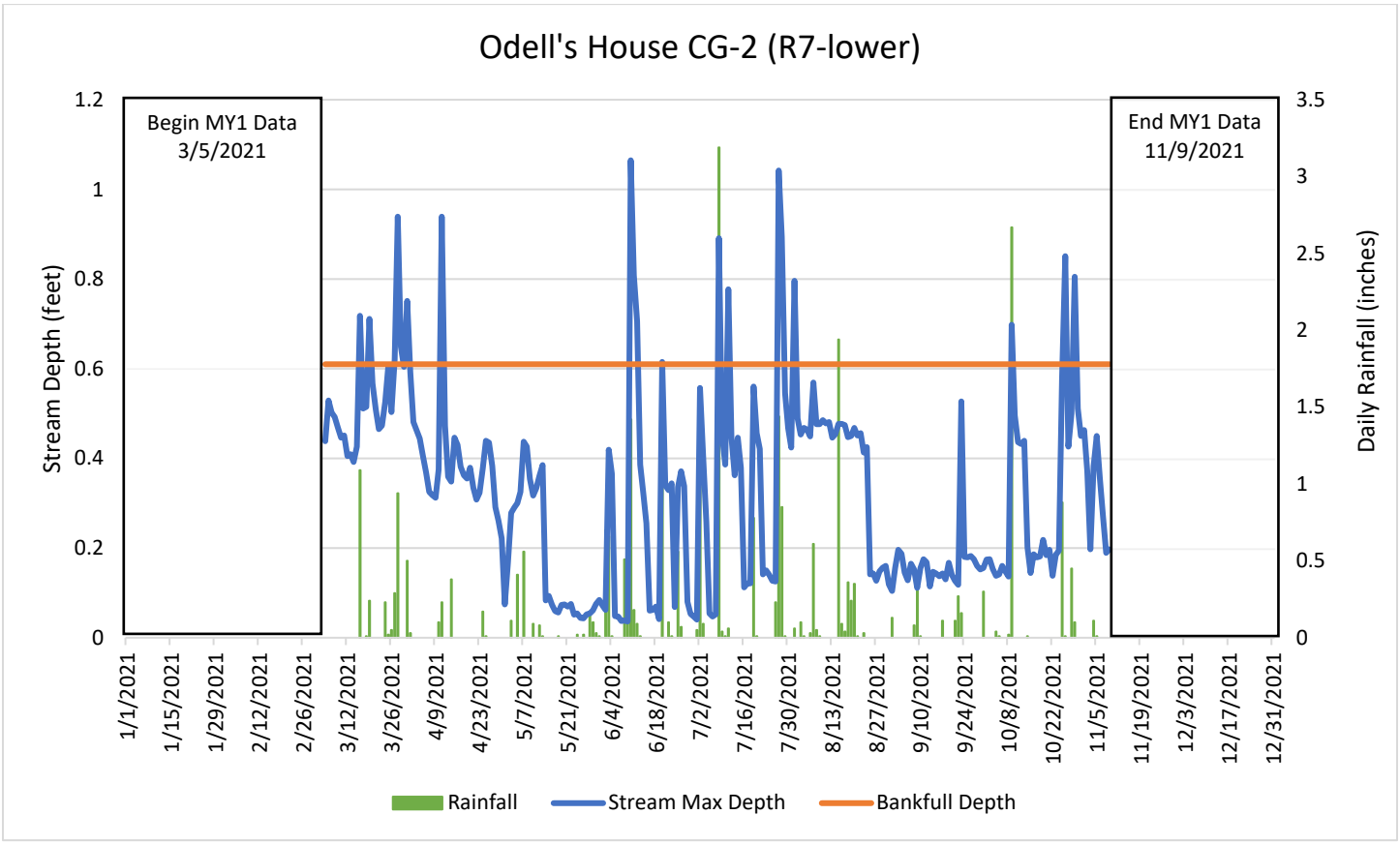


FG-1: 123 days total of Cumulative Flow, 126 days of no flow.

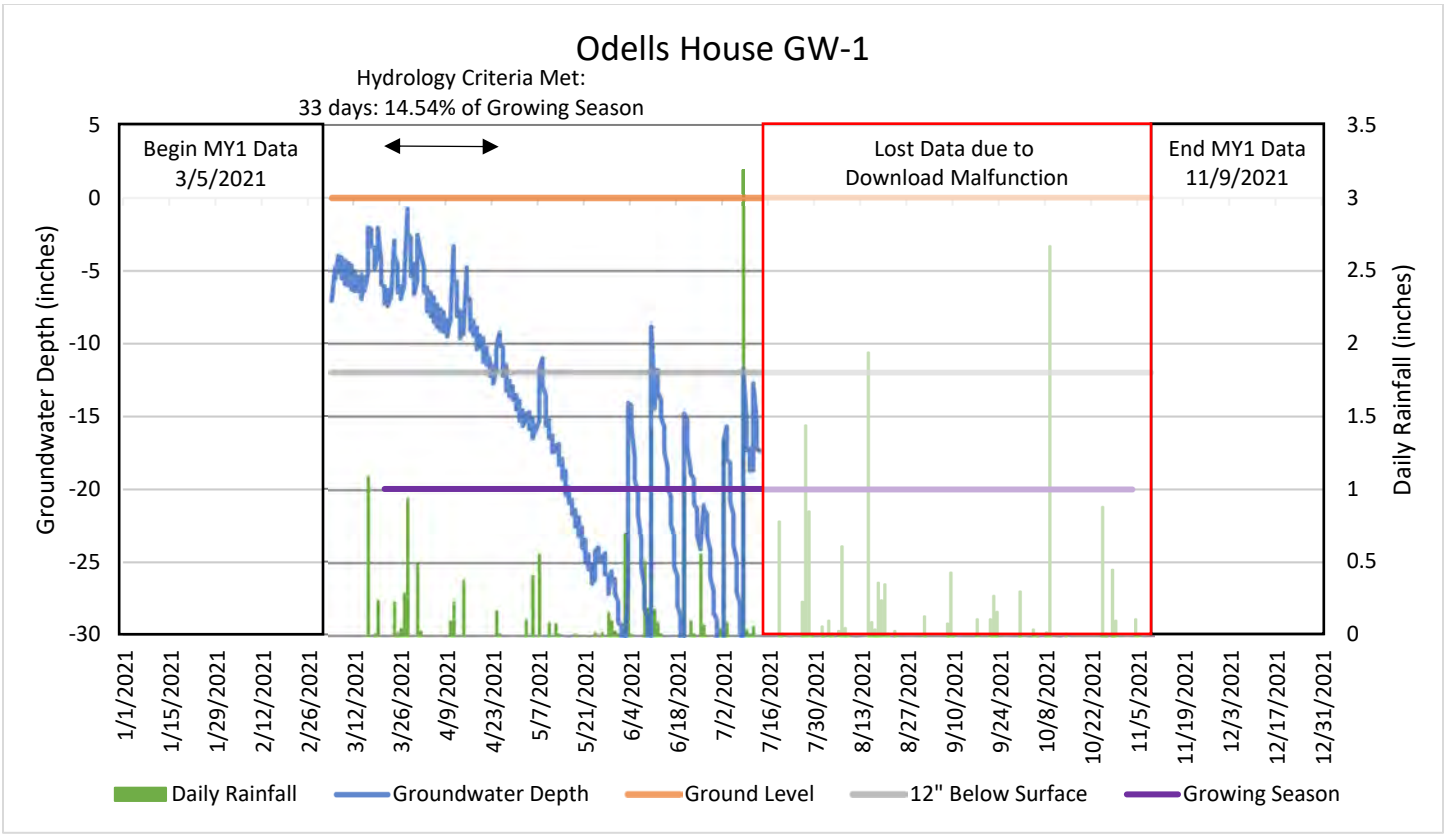


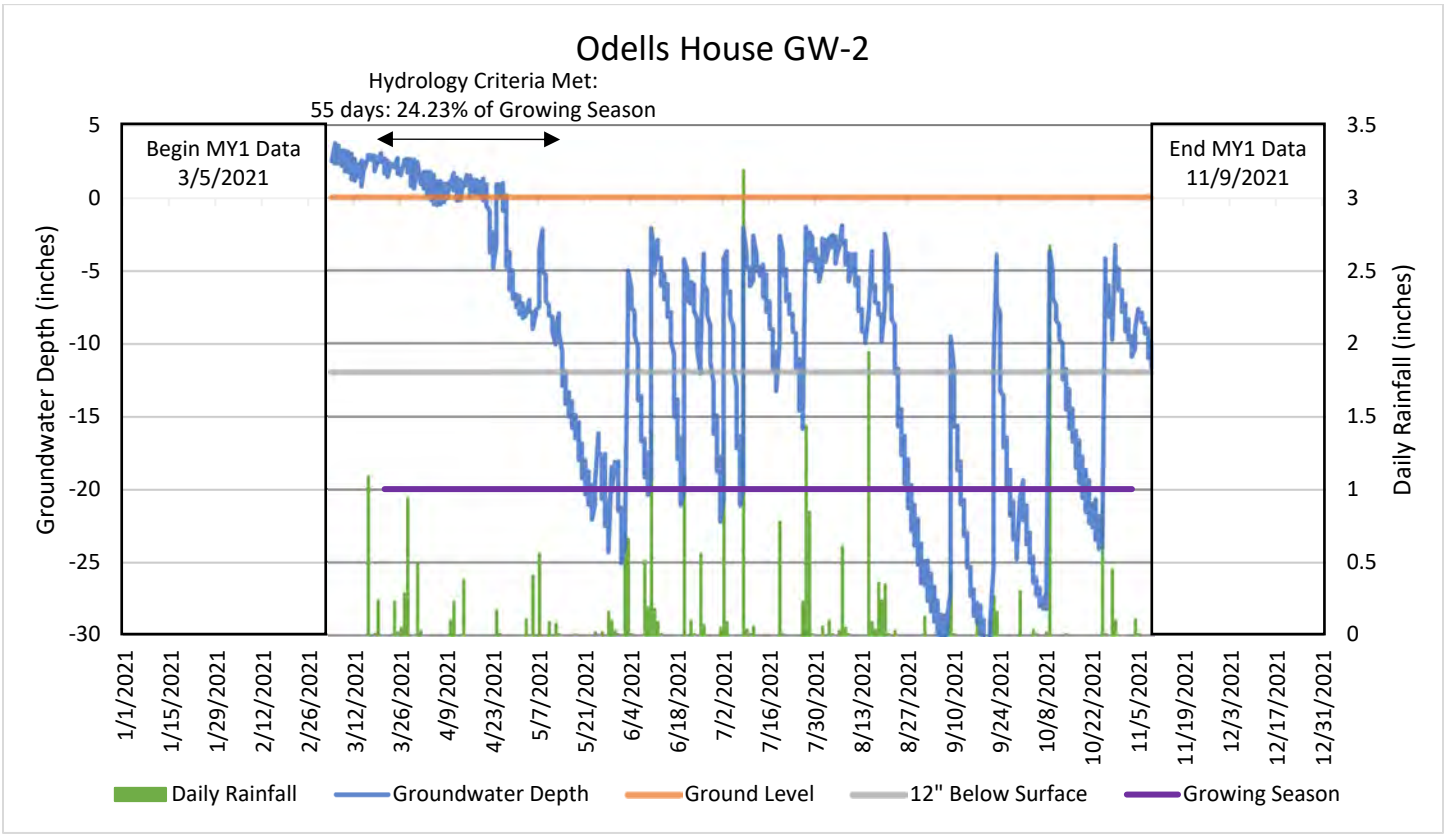
FG-2: 241 days of Cumulative Flow, 8 days of no flow.

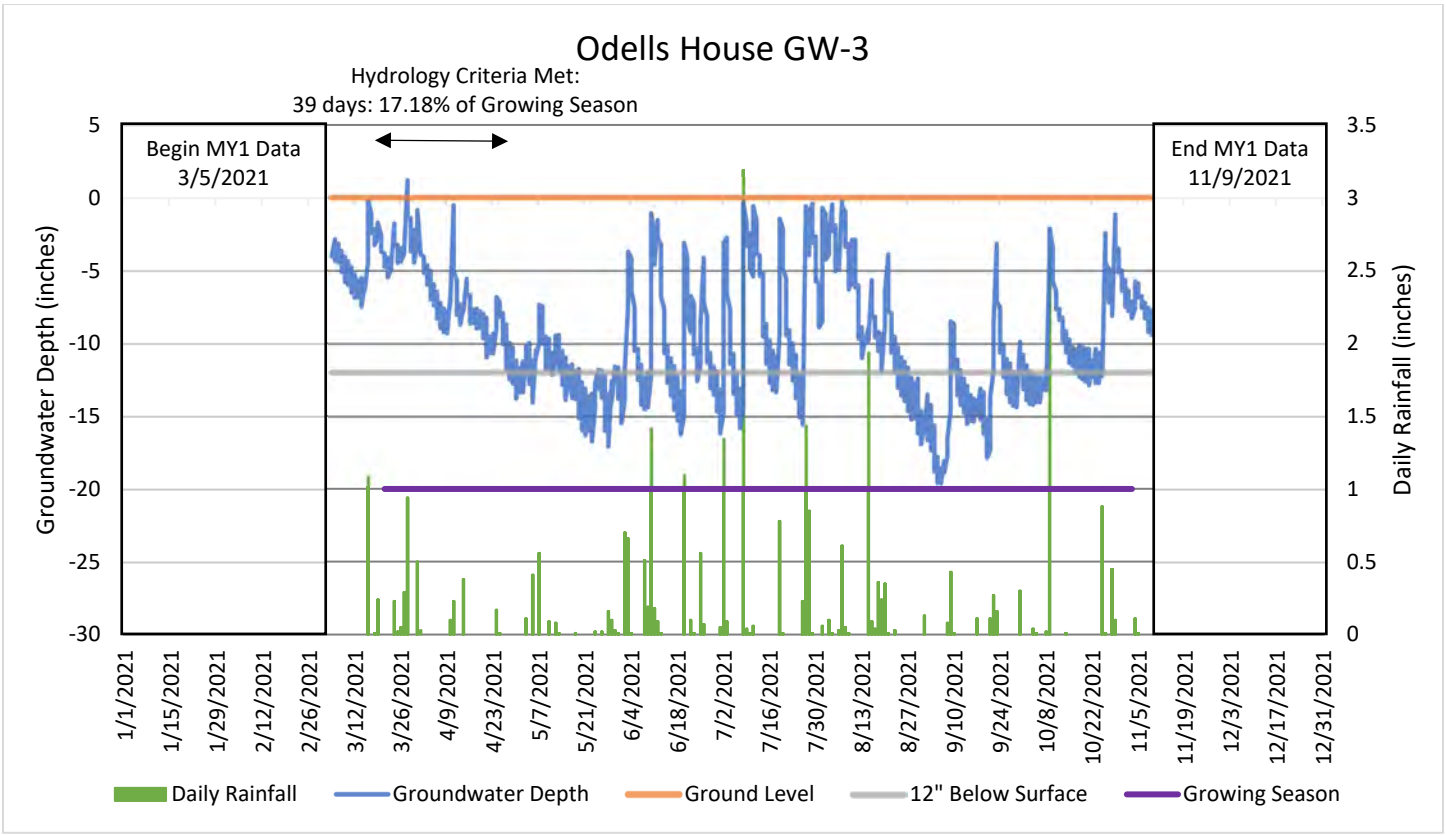

Odell's House CG-1 (R3)
Begin MY1 Data
3/5/2021
Lost Data due to
Download Malfunction
End MY1 Data
11/9/2021
Stream Depth (feet)
Daily Rainfall (inches)
0
0.5
1
1.5
2
2.5
3
3.5
1/1/2021
1/15/2021
1/29/2021
2/12/2021
2/26/2021
3/12/2021
3/26/2021
4/9/2021
4/23/2021
5/7/2021
5/21/2021
6/4/2021
6/18/2021
7/2/2021
7/16/2021
7/30/2021
8/13/2021
8/27/2021
9/10/2021
9/24/2021
10/8/2021
10/22/2021
11/5/2021
11/19/2021
12/3/2021
12/17/2021
12/31/2021
Rainfall
Stream Max Depth
Bankfull Depth

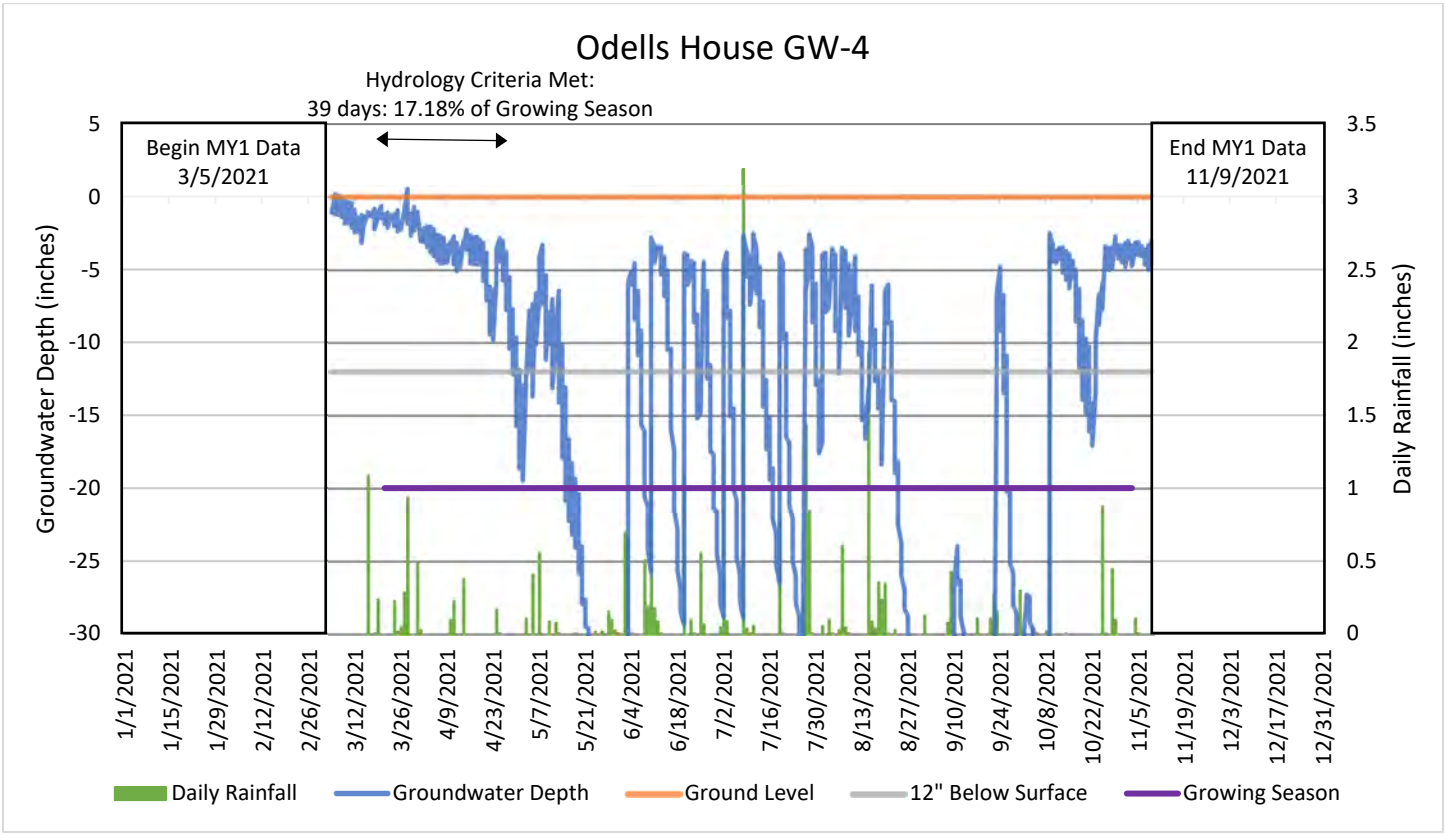

Odell's House CG-2 (R7-lower)
Begin MY1 Data
3/5/2021
End MY1 Data
11/9/2021
Stream Depth (feet)
Daily Rainfall (inches)
0
0.2
0.4
0.6
0.8
1
1.2
0
0.5
1
1.5
2
2.5
3
3.5
1/1/2021
1/15/2021
1/29/2021
2/12/2021
2/26/2021
3/12/2021
3/26/2021
4/9/2021
4/23/2021
5/7/2021
5/21/2021
6/4/2021
6/18/2021
7/2/2021
7/16/2021
7/30/2021
8/13/2021
8/27/2021
9/10/2021
9/24/2021
10/8/2021
10/22/2021
11/5/2021
11/19/2021
12/3/2021
12/17/2021
12/31/2021
Rainfall
Stream Max Depth
Bankfull Depth

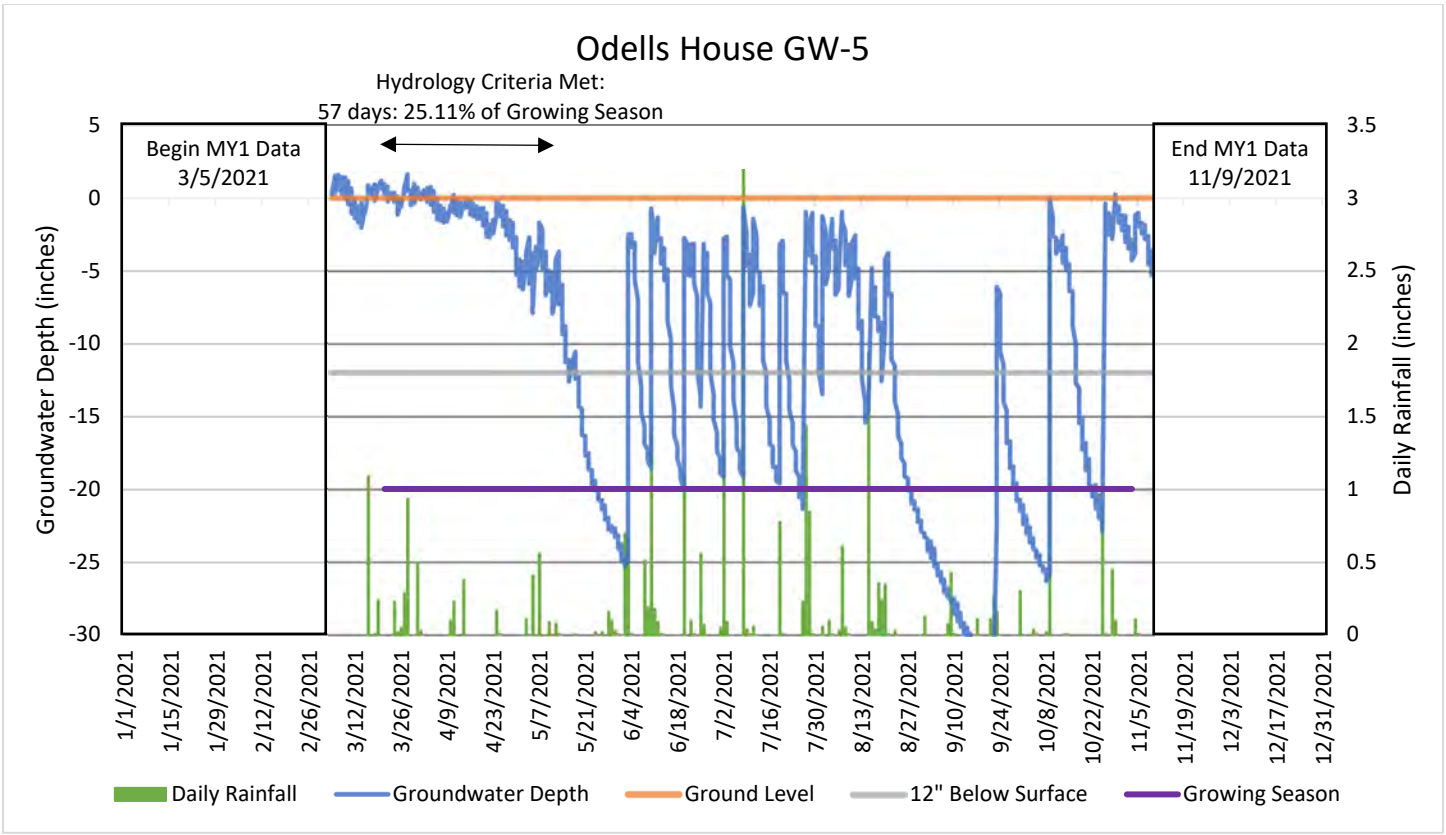
Max Consecutive Hydroperiod Saturation within 12 Inches of Soil Surface (Percent of Growing Season 3/21-11/3) CRONOS Station:Clayton (CLAY)								
Monitoring Gauge Name	**2021**	**2022**	**2023**	**2024**	**2025**	**2026**	**2027**	**Mean**
Groundwater Gauge 1 (W1)	14.54%							**14.54%**
Groundwater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


Odells House GW-1
Hydrology Criteria Met:
33 days: 14.54% of Growing Season
Begin MY1 Data
3/5/2021
Lost Data due to
Download Malfunction
End MY1 Data
11/9/2021
Groundwater Depth (inches)
Daily Rainfall (inches)
5
0
-5
-10
-15
-20
-25
-30
3.5
3
2.5
2
1.5
1
0.5
0
1/1/2021
1/15/2021
1/29/2021
2/12/2021
2/26/2021
3/12/2021
3/26/2021
4/9/2021
4/23/2021
5/7/2021
5/21/2021
6/4/2021
6/18/2021
7/2/2021
7/16/2021
7/30/2021
8/13/2021
8/27/2021
9/10/2021
9/24/2021
10/8/2021
10/22/2021
11/5/2021
11/19/2021
12/3/2021
12/17/2021
12/31/2021
Daily Rainfall
Groundwater Depth
Ground Level
12" Below Surface
Growing Season

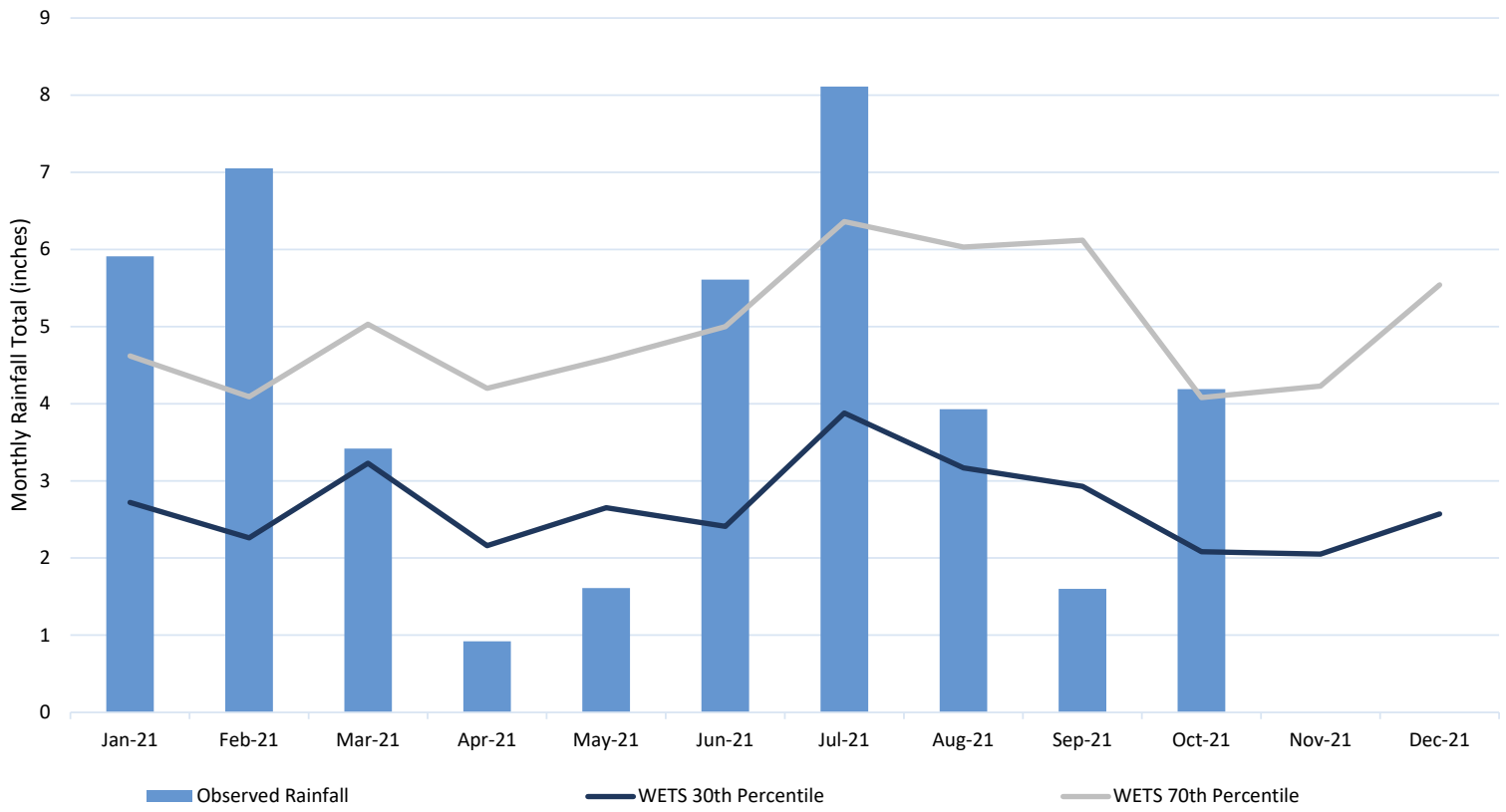

Odells House GW-2
Hydrology Criteria Met:
55 days: 24.23% of Growing Season
Begin MY1 Data
3/5/2021
End MY1 Data
11/9/2021
Groundwater Depth (inches)
Daily Rainfall (inches)
5
0
-5
-10
-15
-20
-25
-30
3.5
3
2.5
2
1.5
1
0.5
0
1/1/2021
1/15/2021
1/29/2021
2/12/2021
2/26/2021
3/12/2021
3/26/2021
4/9/2021
4/23/2021
5/7/2021
5/21/2021
6/4/2021
6/18/2021
7/2/2021
7/16/2021
7/30/2021
8/13/2021
8/27/2021
9/10/2021
9/24/2021
10/8/2021
10/22/2021
11/5/2021
11/19/2021
12/3/2021
12/17/2021
12/31/2021
Daily Rainfall
Groundwater Depth
Ground Level
12" Below Surface
Growing Season


Odells House GW-3
Hydrology Criteria Met:
39 days: 17.18% of Growing Season
Begin MY1 Data
3/5/2021
End MY1 Data
11/9/2021
Groundwater Depth (inches)
Daily Rainfall (inches)
5
0
-5
-10
-15
-20
-25
-30
3.5
3
2.5
2
1.5
1
0.5
0
1/1/2021
1/15/2021
1/29/2021
2/12/2021
2/26/2021
3/12/2021
3/26/2021
4/9/2021
4/23/2021
5/7/2021
5/21/2021
6/4/2021
6/18/2021
7/2/2021
7/16/2021
7/30/2021
8/13/2021
8/27/2021
9/10/2021
9/24/2021
10/8/2021
10/22/2021
11/5/2021
11/19/2021
12/3/2021
12/17/2021
12/31/2021
Daily Rainfall
Groundwater Depth
Ground Level
12" Below Surface
Growing Season


Odells House GW-4
Hydrology Criteria Met:
39 days: 17.18% of Growing Season
Begin MY1 Data
3/5/2021
End MY1 Data
11/9/2021
Groundwater Depth (inches)
Daily Rainfall (inches)
5
0
-5
-10
-15
-20
-25
-30
3.5
3
2.5
2
1.5
1
0.5
0
1/1/2021
1/15/2021
1/29/2021
2/12/2021
2/26/2021
3/12/2021
3/26/2021
4/9/2021
4/23/2021
5/7/2021
5/21/2021
6/4/2021
6/18/2021
7/2/2021
7/16/2021
7/30/2021
8/13/2021
8/27/2021
9/10/2021
9/24/2021
10/8/2021
10/22/2021
11/5/2021
11/19/2021
12/3/2021
12/17/2021
12/31/2021
Daily Rainfall
Groundwater Depth
Ground Level
12" Below Surface
Growing Season


Odells House GW-5
Hydrology Criteria Met:
57 days: 25.11% of Growing Season
Begin MY1 Data
3/5/2021
End MY1 Data
11/9/2021
Groundwater Depth (inches)
Daily Rainfall (inches)
5
0
-5
-10
-15
-20
-25
-30
3.5
3
2.5
2
1.5
1
0.5
0
1/1/2021
1/15/2021
1/29/2021
2/12/2021
2/26/2021
3/12/2021
3/26/2021
4/9/2021
4/23/2021
5/7/2021
5/21/2021
6/4/2021
6/18/2021
7/2/2021
7/16/2021
7/30/2021
8/13/2021
8/27/2021
9/10/2021
9/24/2021
10/8/2021
10/22/2021
11/5/2021
11/19/2021
12/3/2021
12/17/2021
12/31/2021
Daily Rainfall
Groundwater Depth
Ground Level
12" Below Surface
Growing Season

Odells House Mitigation Site
Rainfall Data



Rainfall Summary Table

	Jan-2021	Feb-2021	Mar-2021	Apr-2021	May-2021	Jun-2021	Jul-2021	Aug-2021	Sep-2021	Oct-2021	Nov-2021	Dec-2021
Observed Rainfall	5.91	7.05	3.42	0.92	1.61	5.61	8.11	3.93	1.6	4.19	**	**
WETS 30th Percentile	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	4.62	4.09	5.03	4.2	4.58	5	6.36	6.03	6.12	4.08	4.23	5.54
Normal	H	H	N	L	L	H	H	N	L	H	**	**

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

Wetland Gauge Installation Soil Notes MY0						
	Depth (inches)	Matrix Color	%	Redox Color	%	Texture
GW-1	0-2	10 YR 2/1	100			Muck
	2-10	10 YR 2/1	80	10 YR 5/1	20	Silty Loam
	10-36	10 YR 5/1	90	10 YR 7/1	10	Loam
GW-2	0-8	10 YR 2/1	95	10 YR 3/3	5	Silty Loam
	8-36	10 YR 5/1	90	10 YR 7/1	10	Sand
GW-3	0-3	10 YR 2/1	100			Muck
	3-30	10 YR 4/1	100			Clay
	30-36	10 YR 3/1	100			Sand
GW-4	0-6	10 YR 6/1	90	10 YR 6/8	10	Loam
	6-36	10 YR 6/1	85	10 YR 5/8	15	Clay
GW-5	0-4	10 YR 4/1	100			Loam
	4-10	10 YR 5/1	100			Sand
	10-36	10 YR 6/1	90	10 YR 5/8	10	Sandy Clay

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

Project Name/Number	
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

Appendix F: Correspondence

MY0 IRT Comments Memo
As-Built Site Visit Meeting Minutes

WLS Memo

Odell's House Mitigation Site, DMS Project #100041

USACE Action ID#: SAW-2018-00431

DWR Project #2018-0200

Subject: Odell's House As-Built Baseline IRT Comments

Date Prepared: November 29th, 2021

This memo addresses the North Carolina Interagency Review Team (NCIRT) comments on the Odell's House As-Built/MY0 report. These comments were provided via email by Kimberly Browning on September 24th, 2021. DMS directed WLS to address these comments in the MY1 report. WLS is providing our written responses to the NCIRT's review comments below. Each of the NCIRT review comments is copied below in bold text, followed by the appropriate response from WLS in regular text:

USACE Comments (Kim Browning)

1. **XS Morphology table: Please include the Entrenchment Ratio (ER) measurements of all channel cross-sections within riffles in future reports per the 2016 Guidance.** Response: The entrenchment ratio is no longer included in DMS templates they provide for sites per October 2020 guidance. WLS will add Entrenchment ratio to the Cross-section Morphology Table.

2. **Upstream of Flow Gauge FG-1 photo- What is the drop depth from this structure? Is there any concern with how it was installed?** Response: The drop depth over the log structure is 1.6'. The invert elevation was set to match the upstream bed elevation, provide grade control, and prevent future bed scour in the water quality treatment feature. As discussed on the IRT site visit, this headwater area is not classified as jurisdictional stream and the drop structure is not intended to facilitate aquatic passage.

3. **The upstream and downstream photos of the PS1 and PS2 culverts on R2 appear to have significant amounts of sediment accumulation. Does WLS have any concerns in this area or is the sediment being flushed out?** Response: Sediment deposits along R2 are being flushed out and this area will be monitored closely. WLS will identify any concerns in future reports.

4. **Please confirm the credible stream length for R1 & R5 were calculated using valley length.** Response: the creditable stream lengths for R1 and R5 were calculated using valley length.

5. **Concur with DWR comments below.**

DWR Comments (Erin Davis)

1. **In the future, please note any monitoring station location changes more than just a minor field shift. DWR understands that minor field shifts are expected, but we review and comment on the number and location of wetland gauges, flow gauges and veg plots based on what's presented on the mitigation plan monitoring figure. In this case, DWR requests that fixed veg plots be added or relocated fully within W1, W2 and W3 to demonstrate vegetative functional uplift associated with wetland restoration credit. Also, please explain why both flow gauges FG-1 & FG-2 have been moved from where they were proposed within the old pond bottoms on Figure 10 in the Final Mitigation Plan.** Response: WLS understands and will note any major monitoring station location changes in future MY0 reports. WLS did install monitoring equipment based on the approved mitigation plan (general locations, number of devices, etc.). FG-1 and FG-2 were moved from their proposed locations to deeper pools with adequate water depth for proper gauge function. Random transects 10, 11, and 12 will be randomly moved exclusively within W1, W2, and W3 respectively.

2. **The redline drawing sheet 7 shows the wetland gauge WG-2 within a floodplain depression. DWR believes that this location is not representative of the wetland system and we are not as concerned with the created depressions meeting the minimum hydroperiod. We request the gauge be relocated outside of the floodplain depression area.** Response: WG-2 moved from its original mapped location specifically to avoid a wetland depression. It was installed on the fringe of a depressional area but will be relocated outside of the floodplain depression and the new location and data will be included in the Year 2 report.

3. **Were soil borings collected near the installed wetland gauges (as per the 2016 IRT Guidance)? Please submit this data with the MY1 report.** Response: Soil borings were collected during installation and are provided in Appendix D.

4. **DWR agrees with DMS' comment that R1 and R5 may be at-risk as stream credit. DWR requests a site visit to observe the current conditions of these reaches.**

Meeting Minutes

Odell's House Mitigation Site

Subject: NCIRT As-Built Site Meeting
Date Prepared: November 24, 2021
Meeting Date and Time: November 10, 2021 @ 9:30 am
Meeting Location: On Site (Johnston County, NC)
Attendees: USACE: Kim Browning, Casey Haywood (NCIRT)
NCDEQ DWR: Erin Davis (NCIRT)
NCDMS: Lindsay Crocker, Periann Russell, Melonie Allen
WLS: Daniel Ingram, Catherine Manner, Emily Dunnigan, Kayne VanStell

These meeting minutes document notes and discussion points from the North Carolina Interagency Review Team (NCIRT) As-Built Site Meeting for the Odell's House Mitigation Project (Neuse River Basin, CU 03020202). The site is located in Johnston County, near Wendell, North Carolina. The meeting began at 9:30 am. Attendees toured the project site to review existing conditions. The project site review notes are presented below in the order they were discussed/visited.

R5

- Group started by walking down R5.
- Erin asked why WLS moved the location of the flow gauges on R5 and R1. She also asked that in future reports if monitoring devices are moved to new locations to include a sentence explain why they were moved. Emily responded that the gauges were moved to be placed in pools with adequate water depth for proper gauge function. WLS will add language for changes to gauge locations in future as-built reports.
- Kim asked for cumulative and consecutive flow data to be included in monitoring reports.
- Erin asked if we installed livestake and bare root plants in the wetland and areas surrounding R5. Emily responded that WLS did both.
- Casey asked that WLS provide photo/video evidence of flow in headwater systems during the winter months. Daniel responded that drone photos and video will be provided in future years.

R6

- Erin asked if we had random plots in the wetlands and would rather WLS used fixed plots in the areas of uplift. WLS will place one random plot in each of the 3 wetlands (W1, W2, W3) and those plots will move within those wetlands exclusively.

R7

- Kayne spoke about construction/enhancement activities on R7 (upper).

R3 and R4

- Erin asked who the powerline ROW belonged to. Daniel responded Duke Energy.
- Kim asked if we had any problems with vegetation on PII cuts along R3 and asked that WLS provide random transect data at least twice within the seven-year monitoring period for these areas. Emily responded that WLS has not had issues with vegetation and will provide those transects in future reports.
- Casey asked if there were any encroachment issues along the field of the left side of R3. Emily responded that we have had a few issues with farm equipment hitting signage and WLS intends on marking the easement more clearly to prevent future encroachment.
- Erin asked WLS to continue to monitor the culvert at the top of R3 for channel over widening. She noted that the as-built photos showed a large amount of sediment and a secondary channel forming from the floodplain culvert. Emily responded that photographs and monitoring will continue at the culvert and any issues will be noted in reports.

R2

- Erin asked if we needed to supplementally plant in bamboo areas. Emily responded that any supplemental planting will be done based on veg plot data WLS collects.

R1

- Kim asked if pond sediment was removed during construction. Kayne responded that some was removed, but construction crews had difficulty reaching the pond due to poor soil conditions.
- Kim noted that veg plot 9 should be shifted to be more in the wetland. Emily responded that at the time of installation WLS was unable to walk further into the wetland due to mucky conditions. In response Kim asked if the wetland was planted. Emily responded that it was planted as well as it could be under wet conditions.
- Erin asked if WLS could provide documentation on flow and veg conditions of the ponds/R1/R5. Emily responded that veg data will be noted, and the headwater preponderance of evidence checklist will be documented in monitoring reports.
- Casey had concerns about the drop of the log installed just above the FG-1. Kayne responded that WLS is not concerned with the installation and the logs were keyed in well into the banks and root wads were added along both banks to keep them stable.

General Comments/Summary

- Daniel noted that an additional flow gauge will be installed this winter on R1, in the middle of the reach, to better capture documentation of flow.
- Meeting minutes will be provided to the IRT in the appendices of the MY1 report.

The above minutes represents Water & Land Solutions' interpretation and understanding of the meeting discussion and actions. If recipients of these minutes should find any information contained in these minutes to be in error, incomplete, please notify the author with appropriate corrections and/or additions within five business days to allow adequate time for correction and redistribution.

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