Monitoring Report – Year 5
FINAL VERSION
Edwards-Johnson Mitigation Project
Calendar Year of Data Collection: 2022

NCDEQ DMS Project Identification # 97080
NCDEQ DMS Contract # 6825
Neuse River Basin (Cataloging Unit 03020201)
USACE Action ID Number: SAW-2016-00883
NCDEQ DWR Project # 2016-0404 V2
Johnston County, NC
Contracted Under RFP # 16-006477
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Prepared for:

Environmental Quality

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November 30th, 2022

NC Department of Environmental Quality
Division of Mitigation Services
Attn: Lindsay Crocker
217 West Jones Street, Suite 3000-A
Raleigh, NC 27603

RE: WLS Responses to NCDEQ DMS Review Comments for Task 11 Draft Monitoring Report Year 5 for the Edwards-Johnson Mitigation Project, NCDEQ DMS Full-Delivery Project ID #97080, Contract #006825, Neuse River Basin, Cataloging Unit 03020201, Johnston County, NC

Dear Ms. Crocker:

Water & Land Solutions, LLC (WLS) is pleased to present the Final Monitoring Report Year 5 for the Edwards-Johnson Mitigation Project to the North Carolina Department of Environmental Quality (NCDEQ) Division of Mitigation Services (DMS). The Final Monitoring Report Year 5 were developed by addressing NCDEQ DMS's review comments.

Under this cover, we are providing the Final Monitoring Report Year 5, and the required digital data for each (the .pdf copies of the entire updated reports and the updated digital data) via electronic delivery. We are providing our written responses to NCDEQ DMS's review comments on the Draft Monitoring Report Year 5 below. Each of the DMS review comments is copied below in **bold** text, followed by the appropriate response from WLS in regular text:

Report:

1. **DMS Comment: Reminder to include any site visit notes from the 10/21/22 IRT site walk at the end of this report. These are typically approved via email from site attendees.** WLS Response: Erin Davis stated that site visit notes were not necessary for the site visit and to simply state that a site visit was conducted by the IRT somewhere in the report. Language was added to the project summary section stating there was an IRT and DMS site visit on October 21st, 2022.

2. **DMS Comment: Update credit table to show three significant digits (3,023.100 shown on the credit ledger). Stream footage is measured by the foot, but credit is shown to the thousandth.** WLS Response: The credit table was updated to show three significant digits for the total credits.

3. **DMS Comment: There is mention of a red maple threshold for performance criteria in this report and in the Mitigation Plan but is not a traditional performance requirement. There are also several plots that exceed that threshold. Please provide explanation of where that criterion was established and explanation for current condition in the narrative.** WLS Response: The red maple threshold states that no red maple in a vegetation plot will count for more than 20 percent of the total stems. This criterion was established in the mitigation plan when red maple were included as a planted species. No red maples were noted in any vegetation plots during MY5.

4. **DMS Comment: Section 5.2 (p.7) and Figure 2 geomorphic tables and MY5 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 removing BHR and % change BHR from riffle tables.**

Consider also revising narrative on p. 7 referring to these changes in pool xs-6, which appear to be natural geomorphologic processes for this site. It may also be relevant to explain that xs-7 is headwater, and therefore some of the standard geomorphology measurements may not be relevant. WLS Response: WLS agrees with the 2016 guidance that only riffle BHRs and associated changes above 10 percent are relevant. Language on page seven was updated to remove pool cross-sections and corresponding BHRs. BHR for pools was removed from riffle tables.

Electronic Deliverables:

1. **Please submit a stream problem area shapefile or database. Any problem area indicated on the CCPV should be submitted in digital format.** WLS Response: The stream problem area shapefile is included in the CCPV folder.

2. **Please add wetland gauge symbology to CCPV.** WLS Response: Wetland gauge symbology are on the CCPV as small yellow circles.

3. **Please submit cross section data. The morphology tables were submitted, cross section graphs and raw data were not found.** WLS Response: Raw cross-section data and graphs are included in the Geomorphology folder.

Please contact me if you have any questions or comments.

Sincerely,

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1 Project Summary

Water and Land Solutions, LLC (WLS) completed the construction and planting of the Edwards-Johnson Mitigation Project (Project) full-delivery project for the North Carolina Department of Environmental Quality (NCDEQ), Division of Mitigation Services (DMS) in March 2018. The Project is located in Johnston County, North Carolina between the Community of Archer Lodge and the Town of Wendell at 35.7251°, 78.35636°. The Project site is located in the NCDEQ Sub-basin 03-04-06, in the Lower Buffalo Creek Priority Sub-watershed 030202011504.

The Project involved the restoration, preservation, and permanent protection of four stream reaches (R1, R2, R3, and R4) totaling 3,729 linear feet of streams and their riparian buffers. WLS staff visited the site several times throughout Monitoring Year 5 (MY5) for monitoring activities. Data collection occurred in March and September 2022. This report presents the data for MY5. The Project meets the MY5 success criteria for stream hydrology, stream horizontal and vertical stability. The project meets the stems/acre vegetation requirements, but all plots fail to meet height requirements. Based on these results, the Project is expected to meet the Monitoring Year 6 (MY6) success criteria in 2023. An IRT and DMS site visit was conducted on October 21st, 2022.

2 Project Background

2.1 Project Location, Setting, and Existing Conditions

The Project site is located in the Lower Buffalo Creek Priority Sub-watershed 030202011504 study area of the Neuse 01 Regional Watershed Plan, in the Wake-Johnston Collaborative Local Watershed Plan, and in Targeted Local Watershed 03020201180050.

The catchment area is 223 acres and has an impervious cover less than one percent. The dominant surrounding land uses are agriculture and mixed forest. Prior to construction, some of the riparian buffers were less than 50 feet wide.

2.2 Mitigation Project Goals and Objectives

WLS established project mitigation goals and objectives based on the resource condition and functional capacity of the watershed to improve and protect diverse aquatic resources comparable to stable headwater stream systems within the Piedmont Physiographic Province. The proposed mitigation types and design approaches described in the final approved mitigation plan considered the general restoration and resource protection goals and strategies outlined in the 2010 Neuse River Basin Restoration Priority Plan (RBRP). The functional goals and objectives were further defined in the 2013 Wake-Johnston Collaborative Local Watershed Plan and 2015 Neuse 01 Regional Watershed Plan and include:

- Reducing sediment and nutrient inputs to the upper 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”.

The following site-specific goals were developed to address the primary concerns outlined in the LWP and RWP and include:

- 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,
- Implement agricultural BMPs to reduce nonpoint source inputs to receiving waters.

To accomplish these site-specific goals, the following function-based objectives will be measured and included with the performance standards to document overall project success as described in the table below:

Functional Category (Level)	Functional Goal / Parameter	Functional Design Objective
Hydrology (Level 1)	Improve Base Flow	Remove man-made pond dam and restore a more natural flow regime and aquatic passage.
Hydraulics (Level 2)	Reconnect Floodplain / Increase Floodprone Area Widths	Lower BHRs from >2.0 to 1.0-1.2 and maintain ERs at 2.2 or greater.
Geomorphology (Level 3)	Improve Bedform Diversity	Increase riffle/pool percentage to 70/30 and pool-to-pool spacing ratio 4-7X bankfull width.
	Increase Lateral Stability	Reduce BEHI/NBS streambank erosion rates comparable to downstream reference condition and stable cross-section values.
	Enhance Riparian Buffer Vegetation	Plant or protect native species vegetation a minimum 50' wide from the top of the streambanks with a composition/density comparable to reference condition.
Physicochemical (Level 4)	Improve Water Quality	Install water quality treatment basins along the riparian corridor and reduce sediment and nutrient levels.
Biology (Level 5)	Improve Macroinvertebrate Community and Aquatic Species Health	Incorporate native woody debris and bedform diversity into channel and change DWR bioclassification rating from 'Poor' to a minimum 'Fair' by Monitoring Year 7.

2.3 Project History, Contacts, and Timeframe

The chronology of the project history and activity is presented in Table 2. Relevant project contact information is presented in Table 3. Relevant project background information is presented in Table 4.

3 Project Mitigation Components

Refer to Figure 1 and Table 1 for the project components/asset information. A recorded conservation easement consisting of 10.96 acres protects and preserves all stream reaches, existing wetland areas, and riparian buffers in perpetuity.

3.1 Stream Mitigation Types and Approaches

Stream restoration practices involved raising the existing streambed and reconnecting the stream to the relic floodplain. Some portions of the existing degraded channels that were abandoned within the restoration areas were filled to decrease surface and subsurface drainage and raise the local water table.

The project also included restoring, enhancing, and protecting riparian buffers and riparian wetlands within the conservation easement. The vegetative components of this project included stream bank, floodplain, and transitional upland zones planting. The Site was planted with native species riparian buffer vegetation (Appendix C) and now protected through a permanent conservation easement. Table 1 (Appendix A) and Figure 1 (Appendix B) provide a summary of the project components.

3.1.1 R1 Preservation

Preservation was implemented along this reach since the existing stream and wetland system is mostly stable with a mature riparian buffer due to minimal historic impacts. The preservation area is being protected in perpetuity through a permanent conservation easement. This approach will extend the wildlife corridor from the Buffalo Creek floodplain boundary throughout a majority of the riparian valley, while providing a hydrologic connection and critical habitat linkage within the catchment area.

3.1.2 R2 Restoration

Work along R2 involved a Priority Level I Restoration approach by raising the bed elevation and reconnecting the stream with its abandoned floodplain. This approach will promote more frequent over bank flooding in areas with hydric soils, thereby creating favorable conditions for wetland re-establishment. The reach was restored using appropriate riffle-pool morphology with a conservative meander planform geometry that accommodates the valley slope and width. This approach allowed restoration of a stable channel form with appropriate bedform diversity, as well as, improved biological functions through increased aquatic and terrestrial habitats. Proposed in-stream structures included constructed wood riffles for grade control and habitat, log j-hook vanes, and log weirs/jams for encouraging step-pool formation energy dissipation, bank stability, and bedform diversity. Riparian buffers greater than 50 feet were enhanced and will be protected along the entire length of R2. Mature trees and significant native vegetation were protected and incorporated into the design.

Bioengineering techniques such as vegetated geolifts and live stakes were also used to protect streambanks and promote woody vegetation growth along the streambanks. The existing unstable channel was filled to an elevation sufficient to connect the new bankfull channel to its active floodplain using suitable fill material excavated from the newly restored channels and remnant spoil piles. Additionally, water quality treatment basins were installed to reduce direct sediment and nutrient inputs.

3.1.3 R3 (Upper Reach) Restoration

A Priority Level I Restoration approach was implemented for the upstream portion to improve stream functions and water quality. Prior to restoration activities, the reach exhibited both lateral and vertical instability, as shown by active headcuts and moderate bank erosion. A new single-thread meandering channel was constructed offline in this area before reconnecting with multiple relic channel features and the existing channel alignment farther downstream. In-stream structures, including log riffles, log weirs and log vanes were used to dissipate flow energy, protect streambanks, and eliminate potential for future incision. Shallow floodplain depressions and vernal pools were created or preserved in the floodplain to provide habitat diversity, nutrient cycling, and improved treatment of overland flows. Restored streambanks were graded to stable side slopes and the floodplain was reconnected to further promote stability and hydrological function.

3.1.4 R3 (Lower Reach) Preservation

Preservation was implemented along this reach since the existing stream and wetland system is mostly stable with a mature riparian buffer due to minimal historic impacts. The preservation is being protected in perpetuity through a permanent conservation easement. This approach will extend the wildlife corridor from the Buffalo Creek floodplain boundary throughout a majority of the riparian valley, while providing a hydrologic connection and critical habitat linkage within the catchment area.

3.1.5 R4 Restoration

The restoration of R4 involved raising the existing bed elevation gradually to reconnect the stream with its active floodplain. Prior to restoration activities, the existing channel began experiencing backwater conditions and sediment aggradation from a man-made pond. The failing dam and remnant spoil piles were removed, and the pond was drained to reconnect the new stream channel with its geomorphic floodplain. Channel and floodplain excavation in this reach segment included the removal of shallow legacy sediments (approx. 12" depth) to accommodate a new bankfull channel and in-stream structures, as well as a more natural step-pool morphology using grade control structures in the steeper transitional areas. Shallow floodplain depressions were created to provide habitat diversity, nutrient cycling, and improved treatment of overland flows. Riparian buffers greater than 50 feet were restored and protected along all R4.

4 Performance Standards

The applied success criteria for the Project will follow necessary performance standards and monitoring protocols presented in final approved mitigation plan. Annual monitoring and semi-annual site visits will be conducted to assess the condition of the project throughout the monitoring period. Monitoring activities will be conducted for a period of seven years with the final duration dependent upon performance trends toward achieving project goals and objectives.

The following Proposed Monitoring Plan Summary from the approved final mitigation plan summarizes the measurement methods and performance standards. Specific success criteria components and evaluation methods follow.

Functional Category (Level)	Project Goal / Parameter	Measurement Method	Performance Standard	Potential Functional Uplift
Hydrology (Level 1)	Improve Base Flow Duration and Overbank Flows (i.e. channel forming discharge)	Remove man-made pond, pressure transducer, regional curve, regression equations, catchment assessment	Maintain seasonal flow for a minimum of 30 consecutive days during normal annual rainfall.	Create a more natural and higher functioning headwater flow regime and provide aquatic passage.
Hydraulics (Level 2)	Reconnect Floodplain / Increase Floodprone Area Widths	Bank Height Ratio, Entrenchment Ratio, crest gauge	Maintain average BHRs at 1.2 and increase ERs at 2.2 or greater and document bankfull/geomorphically significant flow events.	Provide temporary water storage and reduce erosive forces (shear stress) in channel during larger flow events.
	Improve Bedform Diversity	Pool to Pool spacing, riffle-pool sequence, pool max depth ratio, Longitudinal Profile	Increase riffle/pool percentage and pool-to-pool spacing ratios compared to reference reach conditions.	Provide a more natural stream morphology, energy dissipation and aquatic habitat/refugia.

Functional Category (Level)	Project Goal / Parameter	Measurement Method	Performance Standard	Potential Functional Uplift
Geomorphology (Level 3)	Increase Vertical and Lateral Stability	BEHI / NBS, Cross-sections and Longitudinal Profile Surveys, visual assessment	Decrease streambank erosion rates comparable to reference condition cross-section, pattern and vertical profile values.	Reduce sedimentation, excessive aggradation, and embeddedness to allow for interstitial flow habitat.
Geomorphology (Level 3)	Establish Riparian Buffer Vegetation	CVS Level I & II Protocol Tree Veg Plots (Strata Composition and Density), visual assessment	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 a minimum of 210 stems per acre must be present at year seven.	Increase woody and herbaceous vegetation will provide channel stability and reduce streambank erosion, runoff rates and exotic species vegetation.
Physicochemical (Level 4)	Improve Water Quality	N/A	N/A	Reduction of excess nutrients and organic pollutants will increase the hyporheic exchange and dissolved oxygen (DO) levels.
Biology (Level 5)	Improve Benthic Macroinvertebrate Communities and Aquatic Health	DWR Small Stream/ Qual v4 sampling, IBI (MY7)	N/A	Increase leaf litter and organic matter critical to provide in-stream cover/shade, wood recruitment, and carbon sourcing.

Note: Level 4 and 5 project parameters and monitoring activities will not be tied to performance standards nor required to demonstrate success for credit release.

4.1 Streams

4.1.1 Stream Hydrology

Two separate bankfull events must be documented within the seven-year monitoring period. These two bankfull events must occur in separate years. Otherwise, the stream monitoring will continue until two bankfull events have been documented in separate years. In addition to the two bankfull flow events, two geomorphically significant flow events (Q_{gs}=0.66Q_2) must also be documented during the monitoring period. There are no temporal requirements regarding the distribution of the geomorphically significant flows.

4.1.2 Stream Profiles, Vertical Stability, and Floodplain Access

Stream profiles, as a measure of vertical stability will be evaluated by looking at Bank Height Ratios (BHR). The BHR shall not exceed 1.2 within riffles along the restored project reaches. This standard only applies to the restored project reaches where BHRs were corrected through design and construction. In addition, observed bedforms should be consistent with those observed for channels of the design stream type(s).

4.1.3 Stream Horizontal Stability

Cross-sections will be used to evaluate horizontal stream stability. 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.

4.1.4 Streambed Material Condition and Stability

Pebble counts or streambed material samples will not be collected per the DMS Pebble Count Data Requirements memo sent on October 19, 2021. The IRT reserves the right to request pebble count data/particle distributions if deemed necessary during the monitoring period.

4.1.5 Jurisdictional Stream Flow

The restored stream systems must be classified as at least intermittent, and therefore must exhibit base flow with at least 30 days of continuous flow during a year with normal rainfall conditions as described in the approved mitigation plan.

4.2 Vegetation

Vegetative restoration success for the project during the intermediate monitoring years will be based on the survival of at least 320, three-year-old planted trees per acre at the end of Year 3 of the monitoring period and at least 260, five-year-old, planted trees per acre at the end of Year 5 of the monitoring period. The final vegetative restoration success criteria will be achieving a density of not less than 210, seven-year-old planted stems per acre in Year 7 of monitoring. Planted vegetation (for projects in coastal plain and piedmont counties) must average seven feet in height at Year 5 of monitoring and 10 feet in height at Year 7 of monitoring. Volunteer stems will only be counted toward success if they are surviving for at least 2 years, are at least 12 inches tall, and are species from the approved planting list. For all of the monitoring years (Year 1 through Year 7), the number of Red maple (*Acer rubrum*) stems cannot exceed 20 percent of the total stems in any of the vegetation monitoring plots.

5 Monitoring Year 5 Assessment and Results

Annual monitoring was conducted during MY5 in accordance with the monitoring plan as described in the approved mitigation plan to document the site conditions. All monitoring device locations are depicted on the CCPV (Figure 1). MY5 results are provided in the appendices. The Project meets the MY5 success criteria for stream hydrology, stream horizontal and vertical stability. The project meets the stems/acre vegetation requirements, but all plots failed to meet height requirements.

5.1 Stream Hydrology

Monitoring to document the occurrence of the two required bankfull events (overbank flows) and the two required geomorphically significant flow events (Qgs=0.66Q2) within the monitoring period, along with floodplain access by flood flows, is being conducted using a crest gauge, installed on December 12th, 2018, on the floodplain of and across the dimension of the restored channel at the left top of bank of Reach R2, immediately upstream of the confluence of Reach R2 and R4 (Figure 1), to record the watermark associated with the highest flood stage between monitoring site visits. Photographs are also being used to document the occurrence of debris lines and sediment deposition on the floodplain during monitoring site visits. One bankfull event occurred during MY5 (see table below). This event was documented using the described photography (Table 8). The documented occurrence of two flow events in MY3 and the three flow events during MY2 satisfies the requirement of the occurrence of four bankfull events (overbank flows) in at least two separate years.

Bankfull Events Table

Monitoring Year	Documented Bankfull Events	Requirement Met
2	3	No
3	2	Yes
4	2	Yes
5	1	Yes

5.2 Stream Horizontal & Vertical Stability

Visual assessment and monitoring of eight permanent cross sections were utilized for assessment of MY5 horizontal and vertical stream stability. The visual assessments for each stream reach concluded that the MY5 stream channel pattern and longitudinal profiles, instream structure locations, still closely match the profile design parameters and MY0/baseline conditions. The MY5 plan form geometry or pattern still fall within acceptable ranges of the design parameters for all restored reaches.

An area on the right bank of R2 located at the transition of R1 to R2 at station 16+13 has approximately 10 linear feet of undercut bank and was noted during a MY3 visual assessment (SPA1). This area is where the transition from preservation to restoration occurs. This area was planted with livestakes in MY4 and has stabilized throughout MY4/MY5 and will continue to be monitored in MY6. Photographs of the area can be found in Appendix B. Cross-section 7 is in a headwater system and standard geomorphological measurements are not necessarily relevant for stability. Overall, only minor (non-systemic) channel adjustments in riffle slopes, pool depths and pattern were observed and therefore did not present a stability concern or indicate a need for immediate remedial action. Maximum riffle depths are expected to fluctuate slightly throughout the monitoring period as the channels adjust to the new flow regime. It is expected over time that some pools may accumulate fine sediment and organic matter, however, this may not be an indicator of channel instability.

5.3 Jurisdictional Stream Flow Documentation

Jurisdictional stream flow documentation and monitoring of restored intermittent reaches is achieved using a flow gauge (continuous-read pressure transducers) within the thalweg of the channel towards the middle portion of the Reach R4 (Figure 1). Additionally, to determine if rainfall amounts are normal for the given year, precipitation data was obtained from CLAY Central Crops Research Station in Johnston County, approximately nine miles southwest of the site. The flow gauge documented that the stream exhibited surface flow for 139 consecutive days from January 1st through May 19th, 2022, during a year with normal rainfall conditions (Figure 3).

5.4 Vegetation

Vegetation monitoring for MY5 was conducted utilizing the four vegetation monitoring plots, with monitoring conducted in accordance with the CVS-EEP Level I & II Monitoring Protocol (CVS, 2008) and DMS Stream and Wetland Monitoring Guidelines (DMS, 2017). See Figure 1 in Appendix B for the vegetation monitoring plot locations. Summary data and photographs of each plot can be found in Appendix B.

The four vegetation plots met the required success criteria at year 5 of 260 stems per acre. The vegetation plots had a range of 323 to 769 stems per acre (including appropriate volunteers). All four vegetation plots failed to meet the MY5 height requirement of seven feet. Height averages across plots ranged from 4.1 feet to 6.5 feet. Shading from existing mature canopy, wet soil conditions, and supplemental plantings during recent monitoring years have resulted in reduced height growth (see table below). All plots mostly consist of trees less than seven feet high, but each has a couple of trees greater than seven feet. During MY6 tree heights will continue to be recorded and no remedial action is being proposed at this time. Red maple did not account for more than 20 percent of stems in any vegetation plot.

Vegetation Plot Tree Height Summary Table

Plot	# Of Trees	Average Tree Height (ft)	# Of Trees at Or Above 7 (ft)	Max Tree Height (ft)
1	13	5.1	3	12.0
2	8	6.5	3	20.0
3	7	4.1	1	8.0
4	10	5.7	3	13.0

A random vegetation plot was surveyed on November 22nd, 2022, to document tree survival in the recently planted low stem density area (VPA-1). See table below for results.

Random Vegetation Plot Data Table

Species	Number of Stems	Height (ft)
Tulip Poplar	2	3.9, 1.9
River Birch	3	2.8, 4.9, 6.4
Silky Dogwood	1	2.3
Sycamore	1	4.9
Total	**7**	**Average Height: 3.9**

The MY5 vegetation monitoring was conducted utilizing visual assessment throughout the easement. An area of pine establishment (~0.82 acres) was noted during the IRT site visit in October 2022. Pine in this area were thinned on November 22nd, 2022, using hand tools to allow desirable planted and volunteer species to establish. Future management in this area will be documented in annual reports as needed. The results of the visual assessment did not indicate any additional significant negative changes to the existing vegetation community.

5.5 Wetlands

Wetland mitigation credits are not contracted or proposed for this project. One groundwater monitoring well was installed during the baseline monitoring along Reach R3. Two additional groundwater monitoring wells are installed along Reach R3 near station 33 + 75 and 37 + 00 (Figure 3). These wells were installed to document groundwater levels within the restoration area for reference and comparison to the preservation areas, at the request of the NCIRT (DWR). No performance standards for wetland hydrology success were proposed in the Mitigation Plan and therefore wetland mitigation monitoring is not included for this project. The well data are presented in the appendices. Groundwater gauge 1 exhibited a max consecutive hydroperiod of 71 days during the growing season or 31.28 percent. Groundwater gauge 2 exhibited a max consecutive hydroperiod of 9 days during the growing season or 3.96 percent.

Groundwater gauge 3 exhibited a max consecutive hydroperiod of 59 days during the growing season or 26.0 percent.

6 References

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Appendix A:
Background Tables and Figures

Table 1: Project Mitigation Components
Table 2: Project Activity and Reporting History
Table 3: Project Contacts
Table 4: Project Information and Attributes

Table 1. Mitigation Assets and Components
Edwards-Johnson Mitigation Project (NCDEQ DMS Project ID# 97080)

Project Component (reach ID, etc.)[1]	Wetland Position and HydroType[2]	Existing Footage or Acreage	Stationing	Mitigation Plan Footage or Acreage	As-Built Footage or Acreage	Restoration Level	Approach Priority Level	Mitigation Ratio (X:1)	Mitigation Credits*	Notes/Comments
R1		611	10+00 -16+11	611	611	P	-	10	61	Invasive Control, Permanent Conservation Easement.
R2		1007	16+11 - 27+94	1183	1180	R	PI	1	1183	Full Channel Restoration, Invasive Control, Permanent Conservation Easement.
R3 (upper		629	27+94 - 36+09	815	853	R	PI	1	815	Full Channel Restoration, Invasive Control, Permanent Conservation Easement.
R3 (lower)		240	36+09 - 37+39	130	149	P	-	10	13	Invasive Control, Permanent Conservation Easement.
R4		815	10+00 - 19+36	951	936	R	PI/PII	1	951	Full Channel Restoration, Pond Removal, Invasive Control, Permanent Conservation Easement.

Length and Area Summations by Mitigation Category

Restoration Level	Stream (linear feet)	Riparian Wetland (acres)		Non-riparian Wetland (acres)
		Riverine	Non-Riverine	
Restoration	2949			
Enhancement				
Enhancement I				
Enhancement II				
Creation				
Preservation	741			
High Quality Pres				

Overall Assets Summary

Asset Category	Overall Credits*
Stream	**3,023.100**
RP Wetland	
NR Wetland	

* Mitigation Credits are from the final approved mitigation plan, as verified by the as-built survey.

Table 2. Project Activity and Reporting History
Edwards-Johnson Mitigation Project (NCDEQ DMS Project ID# 97080)

Elapsed Time Since grading complete:	**4 yrs 5 months**
Elapsed Time Since planting complete:	**4 yrs 5 months**
Number of reporting Years[0]:	**5**

Activity or Deliverable	Data Collection Complete	Completion or Delivery
Project Contract Execution	N/A	3/18/2016
Final Mitigation Plan Submittal	N/A	9/29/2017
Section 404 General (Regional and Nationwide) Permit Verfication	N/A	1/12/2017
Begin Construction	N/A	3/23/2018
Mitigation Site Earthwork Completed	N/A	5/5/2018
Mitigation Site Planting Completed	N/A	5/5/2018
Installation of Monitoring Devices Completed	N/A	5/14/2018
Installation of Survey Monumentation and Boundary Marking	N/A	8/13/2018
As-built/Baseline (Year 0) Monitoring Report Submittal	6/23/2018	12/3/2018
Year 1 Monitoring Report Submittal	11/24/2018	12/4/2018
Replant Encroachment (~0.04 acres)	N/A	3/2019
Year 2 Monitoring Report Submittal	10/18/2019	12/31/2019
Replant Low Stem Density Areas (~0.43 acres)	N/A	2/2020
Year 3 Monitoring Report Submittal	10/14/2019	11/3/2020
Replant Low Stem Density Area (~0.35 acres)	N/A	2/2021
Year 4 Monitoring Report Submittal	9/15/2021	10/20/2021
Year 5 Monitoring Report Submittal	9/13/2022	11/30/2022
Year 6 Monitoring Report Submittal	N/A	N/A
Year 7 Monitoring Report Submittal	N/A	N/A

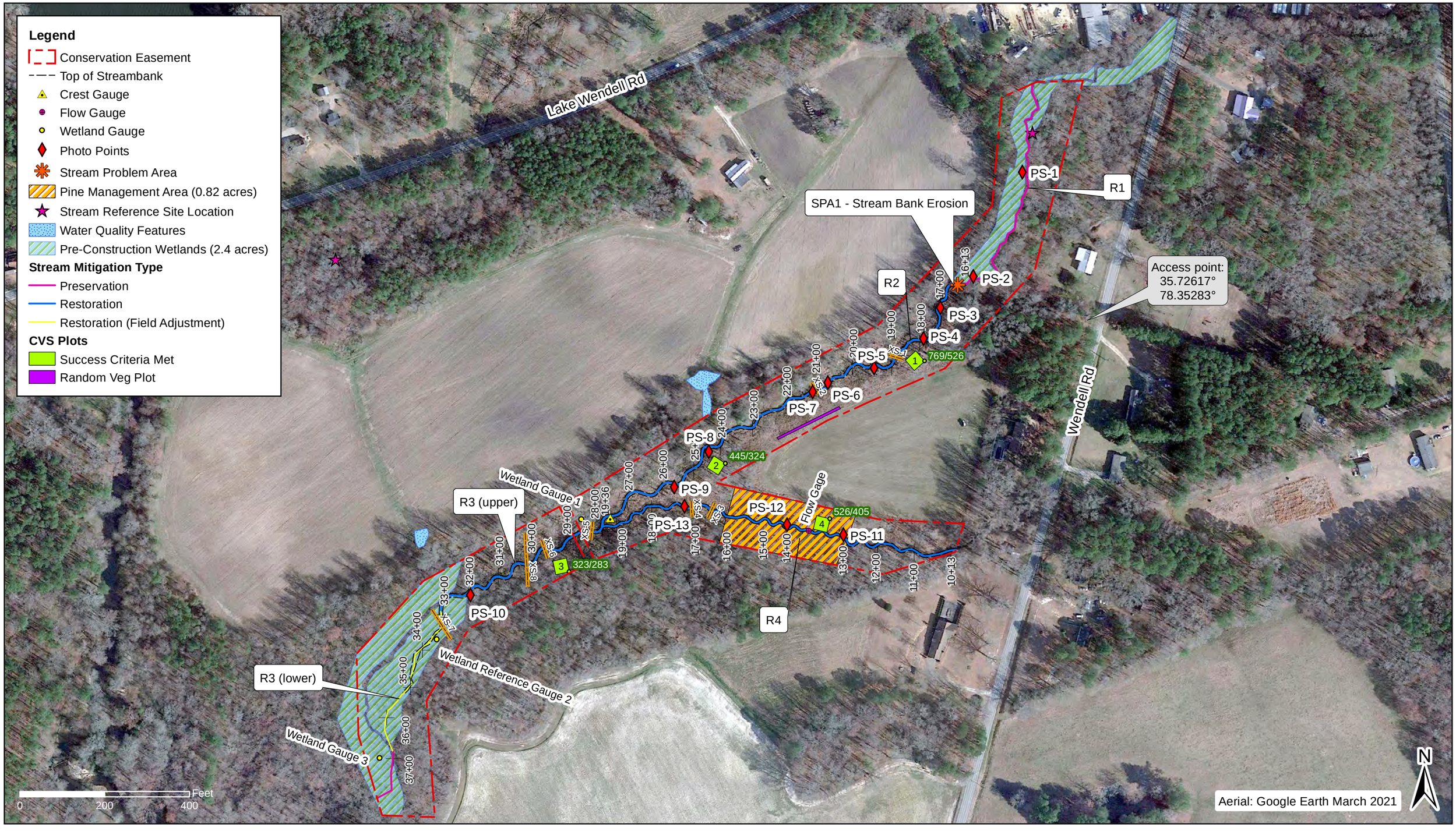
Table 3. Project Contacts Edwards-Johnson Mitigation Project (NCDEQ DMS Project ID# 97080)	
Mitigation Provider	Water & Land Solutions, LLC
	7721 Six Forks Road, Suite 130, Raleigh, NC 27615
Primary Project POC	Catherine Manner Phone: 571-643-3165
Construction Contractor	RiverWorks Construction
	114 W. Main Street, Suite 106, Clayton, NC 27520
Primary Project POC	Bill Wright Phone: 919-590-5193
Survey Contractor (Existing Condition Surveys)	WithersRavenel
	115 MacKenan Drive, Cary, NC 27511
Primary Project POC	Marshall Wight, PLS Phone: 919-469-3340
Survey Contractor (Conservation Easement, Construction and As-Builts Surveys)	True Line Surveying, PC
	205 West Main Street, Clayton, NC 27520
Primary Project POC	Curk T. Lane, PLS 919-359-0427
Planting Contractor	RiverWorks Construction
	114 W. Main Street, Suite 106, Clayton, NC 27520
Primary Project POC	Bill Wright Phone: 919-590-5193
Seeding Contractor	RiverWorks Construction
	114 W. Main Street, Suite 106, Clayton, NC 27520
Primary Project POC	Bill Wright Phone: 919-590-5193
Seed Mix Sources	Green Resource
	5204 Highgreen Ct., Colfax, NC 27235
	Rodney Montgomery Phone: 336-215-3458
Nursery Stock Suppliers	Foggy Mountain Nursery (Live Stakes) 797 Helton Creek Rd, Lansing, NC 28643 Glenn Sullivan Phone: 336-977-2958
	Dykes & Son Nursery (Bare Root Stock) 825 Maude Etter Rd, Mcminnville, Tn 37110 Jeff Dykes Phone: 931-668-8833
Monitoring Performers	Water & Land Solutions, LLC
	7721 Six Forks Road, Suite 130, Raleigh, NC 27615
Stream Monitoring POC	Emily Dunnigan Phone: 269-908-6306
Vegetation Monitoring POC	Emily Dunnigan Phone: 269-908-6306

Table 4. Project Information and Attributes					
Project Name	Edwards-Johnson Mitigation Project				
County	Johnston				
Project Area (acres)	11.0				
Project Coordinates (latitude and longitude)	35.7245361 N, -78.3570806 W				
Planted Acreage (Acres of Woody Stems Planted)	3.69				
Project Watershed Summary Information					
Physiographic Province	Piedmont				
River Basin	Neuse				
USGS Hydrologic Unit 8-digit	03020201				
DWR Sub-basin	30406				
Project Drainage Area (Acres and Square Miles)	223 acres, 0.35 sq mi				
Project Drainage Area Percentage of Impervious Area	2.30%				
CGIA Land Use Classification	2.01.03, 2.99.05, 413, 4.98 (33% crops/hay, 16% pasture, 51% mixed forest)				
Reach Summary Information					
Parameters	**Reach 1**	**Reach 2**	**Reach 3 (upper)**	**Reach 3 (lower)**	**Reach 4**
Length of reach (linear feet)	611	1173	770	130	1176
Valley confinement (Confined, moderately confined, unconfined)	unconfined	unconfined	unconfined	unconfined	unconfined
Drainage area (Acres and Square Miles)	96 acres, 0.15 sq mi	120 acres, 0.19 sq mi	211 acres, 0.33 sq mi	223 acres, 0.35 sq mi	55 acres, 0.09 sq mi
Perennial, Intermittent, Ephemeral	Intermittent	Perennial	Perennial	Perennial	Intermittent
NCDWR Water Quality Classification	C; NSW	C; NSW	C;NSW	C; NSW	C; NSW
Stream Classification (existing)	C5	G5c	E5(incised)	E5(incised)	G5c/Pond
Stream Classification (proposed)	C5	C5	C5	C5, D5	C5
Evolutionary trend (Simon)	I	III/IV	IV	V	III/IV
FEMA classification	N/A	N/A	N/A	Zone AE	N/A
Wetland Summary Information					
Parameters	**Wetland 1**	**Wetland 2**	**Wetland 3**		
Size of Wetland (acres)	N/A	N/A	N/A		
Wetland Type (non-riparian, riparian riverine or riparian non-riverine)					
Mapped Soil Series					
Drainage class					
Soil Hydric Status					
Source of Hydrology					
Restoration or enhancement method (hydrologic, vegetative etc.)					
Regulatory Considerations					
Parameters	**Applicable?**	**Resolved?**	**Supporting Docs?**		
Water of the United States - Section 404	Yes	Yes	Categorical Exclusion		
Water of the United States - Section 401	Yes	Yes	Categorical Exclusion		
Endangered Species Act	No	Yes	Categorical Exclusion		
Historic Preservation Act	No	N/A	Categorical Exclusion		
Coastal Zone Management Act (CZMA or CAMA)	No	N/A	N/A		
FEMA Floodplain Compliance	Yes	Yes	Categorical Exclusion		
Essential Fisheries Habitat	No	N/A	Categorical Exclusion		

Appendix B:

Visual Assessment Data

Figure 1: Current Condition Plan View (CCPV)
Table 5a-d: Visual Stream Morphology Stability Assessment
Table 5e: Vegetation Condition Assessment
Stream Station Photographs
Vegetation Plot Photographs
Stream Problem Area Photographs



WATER & LAND™ SOLUTIONS	Mitigation Services ENVIRONMENTAL QUALITY	**Edwards-Johnson Mitigation Project** **Johnston County, North Carolina**	NCDMS Contract No. 6825 NCDMS Project No. 97080 November 2022 MY5	Current Conditions Plan View Monitoring Year 5 NAD 1983 2011 State Plane North Carolina FIPS 3200 FT US	FIGURE 1

Table 5a	Visual Stream Morphology Stability Assessment
Project	Edwards-Johnson Mitigation Project (NCDEQ DMS Project ID# 97080)
Reach ID	R1
Assessed Length	611

Major Channel Category	Channel Sub-Category	Metric	Number Stable, Performing as Intended	Total Number in As-built	Number of Unstable Segments	Amount of Unstable Footage	% Stable, Performing as Intended	Number with Stabilizing Woody Vegetation	Footage with Stabilizing Woody Vegetation	Adjusted % for Stabilizing Woody Vegetation
1. Bank	1. Scoured/Eroding	Bank lacking vegetative cover resulting simply from poor growth and/or scour and erosion			0	0	100%	0	0	100%
	2. Undercut	Banks undercut/overhanging to the extent that mass wasting appears likely. Does NOT include undercuts that are modest, appear sustainable and are providing habitat.			0	0	100%	0	0	100%
	3. Mass Wasting	Bank slumping, calving, or collapse			0	0	100%	0	0	100%
				Totals	0	0	100%	0	0	100%
2. Engineered Structures	1. Overall Integrity	Structures physically intact with no dislodged boulders or logs.	0	0			#DIV/0!			
	2. Grade Control	Grade control structures exhibiting maintenance of grade across the sill.	0	0			#DIV/0!			
	2a. Piping	Structures lacking any substantial flow underneath sills or arms.	0	0			#DIV/0!			
	3. Bank Protection	Bank erosion within the structures extent of influence does not exceed 15%. (See guidance for this table in EEP monitoring guidance document)	0	0			#DIV/0!			
	4. Habitat	Pool forming structures maintaining ~ Max Pool Depth : Mean Bankfull Depth ratio ≥ 1.6 Rootwads/logs providing some cover at base-flow.	0	0			#DIV/0!			

Table 5b	Visual Stream Morphology Stability Assessment
Project	Edwards-Johnson Mitigation Project (NCDEQ DMS Project ID# 97080)
Reach ID	R2
Assessed Length	1,180

Major Channel Category	Channel Sub-Category	Metric	Number Stable, Performing as Intended	Total Number in As-built	Number of Unstable Segments	Amount of Unstable Footage	% Stable, Performing as Intended	Number with Stabilizing Woody Vegetation	Footage with Stabilizing Woody Vegetation	Adjusted % for Stabilizing Woody Vegetation
1. Bank	1. Scoured/Eroding	Bank lacking vegetative cover resulting simply from poor growth and/or scour and erosion			0	0	100%	0	0	100%
	2. Undercut	Banks undercut/overhanging to the extent that mass wasting appears likely. Does NOT include undercuts that are modest, appear sustainable and are providing habitat.			1	10	100%	0	0	100%
	3. Mass Wasting	Bank slumping, calving, or collapse			0	0	100%	0	0	100%
				Totals	1	10	100%	0	0	100%
2. Engineered Structures	1. Overall Integrity	Structures physically intact with no dislodged boulders or logs.	29	29			100%			
	2. Grade Control	Grade control structures exhibiting maintenance of grade across the sill.	5	5			100%			
	2a. Piping	Structures lacking any substantial flow underneath sills or arms.	8	8			100%			
	3. Bank Protection	Bank erosion within the structures extent of influence does not exceed 15%. (See guidance for this table in EEP monitoring guidance document)	8	8			100%			
	4. Habitat	Pool forming structures maintaining ~ Max Pool Depth : Mean Bankfull Depth ratio ≥ 1.6 Rootwads/logs providing some cover at base-flow.	8	8			100%			

Table 5c	Visual Stream Morphology Stability Assessment
Project	Edwards-Johnson Mitigation Project (NCDEQ DMS Project ID# 97080)
Reach ID	R3
Assessed Length	1,002

Major Channel Category	Channel Sub-Category	Metric	Number Stable, Performing as Intended	Total Number in As-built	Number of Unstable Segments	Amount of Unstable Footage	% Stable, Performing as Intended	Number with Stabilizing Woody Vegetation	Footage with Stabilizing Woody Vegetation	Adjusted % for Stabilizing Woody Vegetation
1. Bank	1. Scoured/Eroding	Bank lacking vegetative cover resulting simply from poor growth and/or scour and erosion			0	0	100%	0	0	100%
	2. Undercut	Banks undercut/overhanging to the extent that mass wasting appears likely. Does NOT include undercuts that are modest, appear sustainable and are providing habitat.			0	0	100%	0	0	100%
	3. Mass Wasting	Bank slumping, calving, or collapse			0	0	100%	0	0	100%
				Totals	0	0	100%	0	0	100%
2. Engineered Structures	1. Overall Integrity	Structures physically intact with no dislodged boulders or logs.	6	6			100%			
	2. Grade Control	Grade control structures exhibiting maintenance of grade across the sill.	0	0			#DIV/0!			
	2a. Piping	Structures lacking any substantial flow underneath sills or arms.	1	1			100%			
	3. Bank Protection	Bank erosion within the structures extent of influence does not exceed 15%. (See guidance for this table in EEP monitoring guidance document)	4	4			100%			
	4. Habitat	Pool forming structures maintaining ~ Max Pool Depth : Mean Bankfull Depth ratio ≥ 1.6 Rootwads/logs providing some cover at base-flow.	4	4			100%			

Table 5d	Visual Stream Morphology Stability Assessment
Project	Edwards-Johnson Mitigation Project (NCDEQ DMS Project ID# 97080)
Reach ID	R4
Assessed Length	936

Major Channel Category	Channel Sub-Category	Metric	Number Stable, Performing as Intended	Total Number in As-built	Number of Unstable Segments	Amount of Unstable Footage	% Stable, Performing as Intended	Number with Stabilizing Woody Vegetation	Footage with Stabilizing Woody Vegetation	Adjusted % for Stabilizing Woody Vegetation
1. Bank	1. Scoured/Eroding	Bank lacking vegetative cover resulting simply from poor growth and/or scour and erosion			0	0	100%	0	0	100%
	2. Undercut	Banks undercut/overhanging to the extent that mass wasting appears likely. Does NOT include undercuts that are modest, appear sustainable and are providing habitat.			1	10	99%	0	0	99%
	3. Mass Wasting	Bank slumping, calving, or collapse			0	0	100%	0	0	100%
				Totals	1	10	99%	0	0	99%
2. Engineered Structures	1. Overall Integrity	Structures physically intact with no dislodged boulders or logs.	22	22			100%			
	2. Grade Control	Grade control structures exhibiting maintenance of grade across the sill.	4	4			100%			
	2a. Piping	Structures lacking any substantial flow underneath sills or arms.	6	6			100%			
	3. Bank Protection	Bank erosion within the structures extent of influence does not exceed 15%. (See guidance for this table in EEP monitoring guidance document)	9	9			100%			
	4. Habitat	Pool forming structures maintaining ~ Max Pool Depth : Mean Bankfull Depth ratio ≥ 1.6 Rootwads/logs providing some cover at base-flow.	9	9			100%			

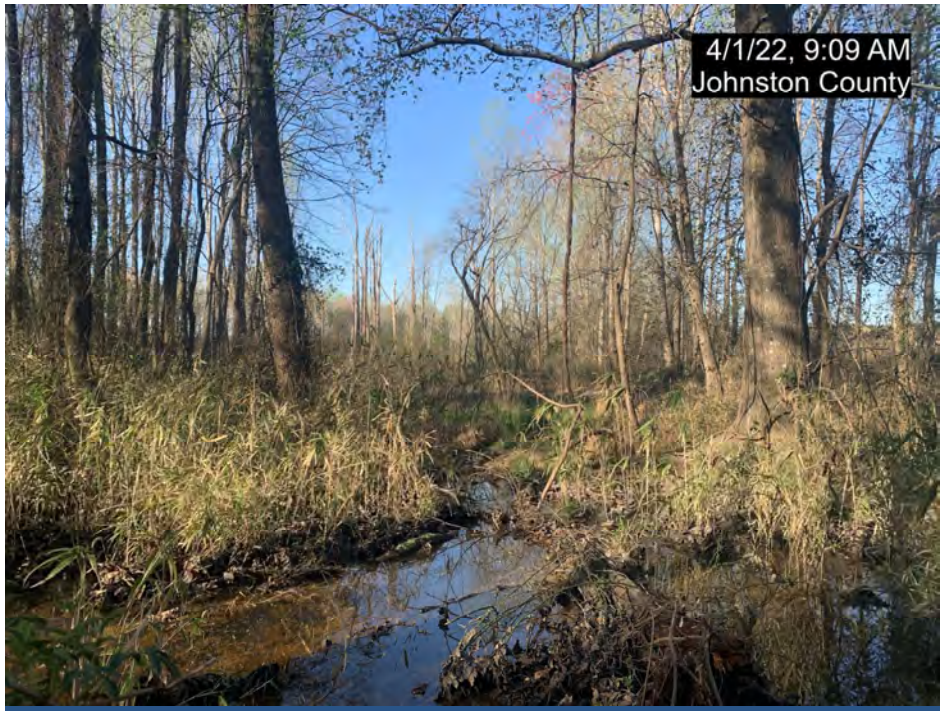
Table 5e Project Planted Acreage[1]	Vegetation Condition Assessment Edwards-Johnson Mitigation Project (NCDEQ DMS Project ID# 97080) 3.6					
Vegetation Category	**Definitions**	**Mapping Threshold**	**CCPV Depiction**	**Number of Polygons**	**Combined Acreage**	**% of Planted Acreage**
1. Bare Areas	Very limited cover of both woody and herbaceous material.	0.01 acres	Pattern and Color	0	0.00	0.0%
2. Low Stem Density Areas	Woody stem densities clearly below target levels based on MY3, 4, or 5 stem count criteria.	0.1 acres	solid light blue	0	0.00	0.0%
			Total	0	0.00	0.0%
3. Areas of Poor Growth Rates or Vigor	Areas with woody stems of a size class that are obviously small given the monitoring year.	0.25 acres	Pattern and Color	0	0.00	0.0%
			Cumulative Total	0	0.00	0.0%

Easement Acreage[2]	10.97					
Vegetation Category	**Definitions**	**Mapping Threshold**	**CCPV Depiction**	**Number of Polygons**	**Combined Acreage**	**% of Easement Acreage**
4. Invasive Areas of Concern[4]	Areas or points (if too small to render as polygons at map scale).	1000 SF	Pattern and Color	0	0.00	0.0%
5. Easement Encroachment Areas[3]	Areas or points (if too small to render as polygons at map scale).	none	Pattern and Color	0	0.00	0.0%

PS-1, Reach R1, facing upstream, April 12, 2018 (MY-00)

PS-1, Reach R1, facing upstream, April 1, 2022 (MY-05)

PS-2, Reach R1, facing downstream, Dec 6, 2018 (MY-01)



PS-2, Reach R1, facing downstream, April 1, 2022 (MY-05)

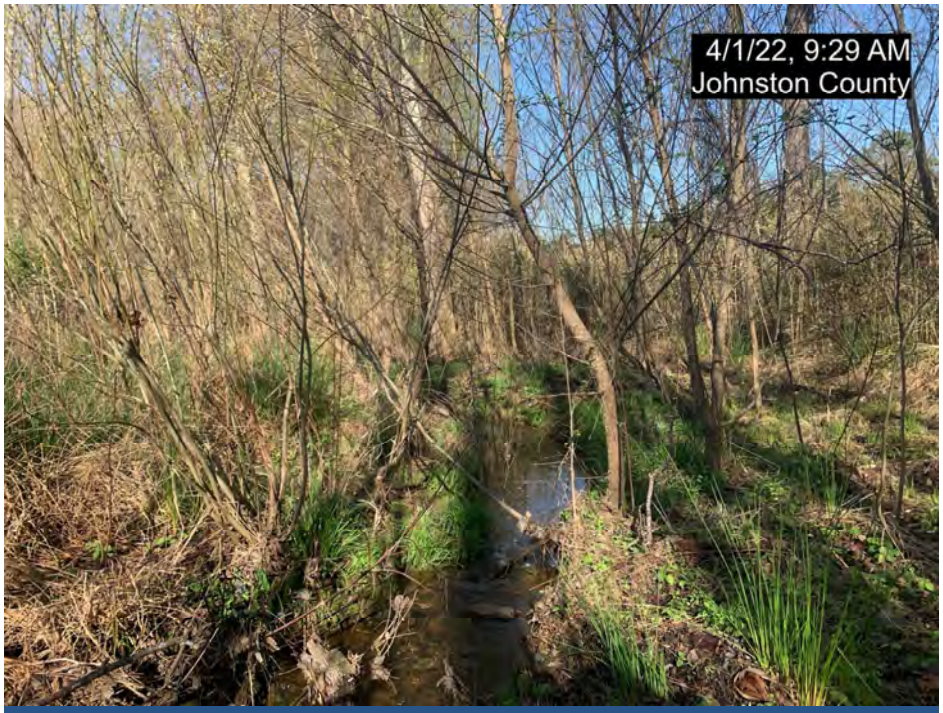
PS-3, Reach R2, facing upstream, Sta 17+00, April 23, 2018 (MY-00)

PS-3, Reach R2, facing upstream, Sta 17+00, April 1, 2022 (MY-05)

PS-4, Reach R2, facing downstream, Sta 18+00, April 23, 2018 (MY-00)

PS-4, Reach R2, facing downstream, Sta 18+00, April 1, 2022 (MY-05)

PS-5, Reach R2, facing downstream, Sta 19+50, Sept 17, 2018 (MY-00)

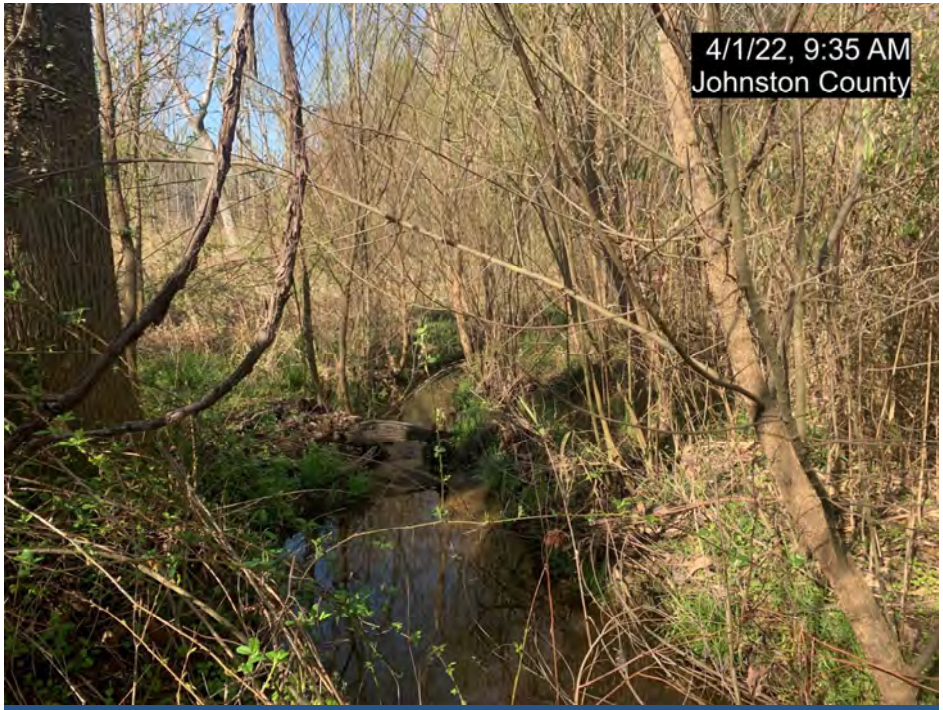


PS-5, Reach R2, facing downstream, Sta 19+50 , April 1, 2022 (MY-05)

PS-6, Reach R2, facing upstream, Sta 20+75, April 23, 2018 (MY-00)

PS-6, Reach R2, facing upstream, Sta 20+75, April 1, 2022 (MY-05)

PS-7, Reach R2, facing downstream, Sta 21+00, April 23, 2018 (MY-00)

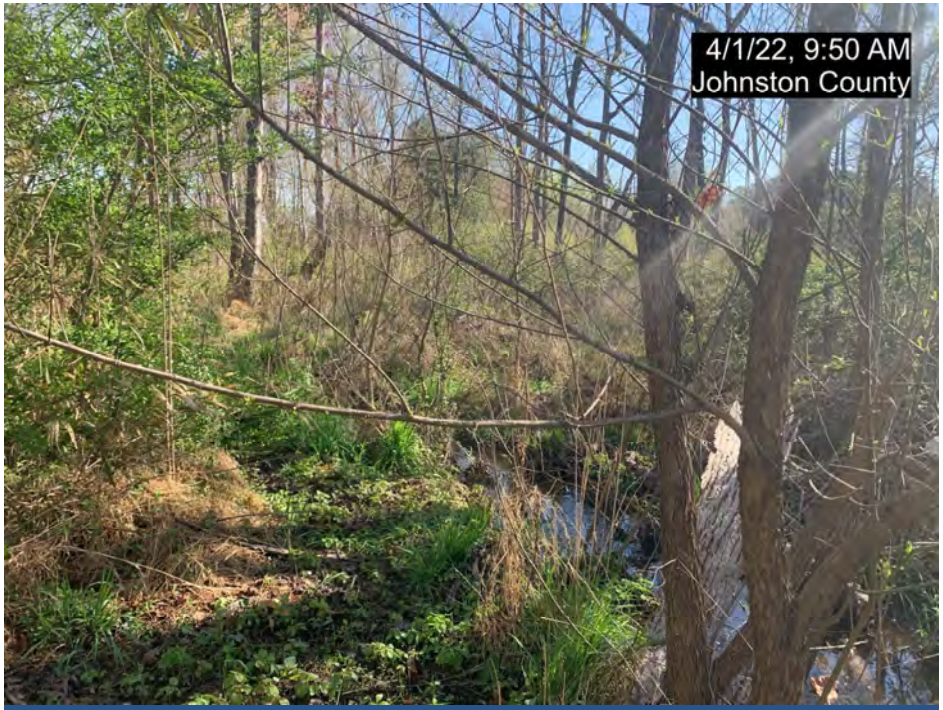


PS-7, Reach R2, facing downstream, Sta 21+00, March 10, 2021 (MY-05)

PS-8, Reach R2, facing downstream, Sta 24+50, April 23, 2018 (MY-00)

PS-8, Reach R2, facing downstream, Sta 24+50, April 1, 2022 (MY-05)

PS-9, Reach R2, facing upstream, Sta 25+75, April 23, 2018 (MY-00)



PS-9, Reach R2, facing upstream, Sta 25+75, April 1, 2022 (MY-05)

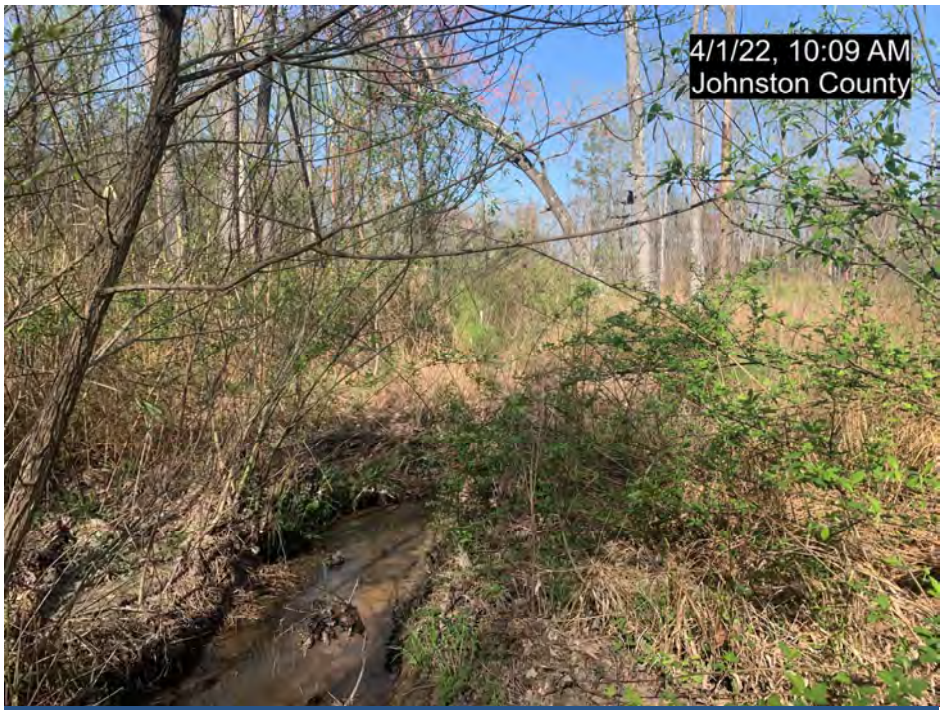
PS-10, Reach R3, facing downstream, Sta 32+00, October 14, 2019 (MY-02)

PS-10, Reach R3, facing downstream, Sta 32+00, April 1, 2022 (MY-05)

PS-11, Reach R4, facing upstream, Sta 13+00, June 11, 2018 (MY-00)

PS-11, Reach R4, facing upstream, Sta 13+00, April 1, 2022 (MY-05)

PS-11, Reach R4, facing downstream, Sta 13+00, June 11, 2018 (MY-00)



PS-11, Reach R4, facing downstream, Sta 13+00, April 1, 2022 (MY-05)

PS-12, Reach R4, facing upstream, Sta 14+00, June 11, 2018 (MY-00)

PS-12, Reach R4, facing upstream, Sta 14+00, April 1, 2022 (MY-05)

PS-13, Reach R4, facing upstream, Sta 17+00, June 11, 2018 (MY-00)

PS-13, Reach R4, facing upstream, Sta 17+00, April 1, 2022 (MY-05)

Veg Plot 1, May 14, 2018 (MY-00)

Veg Plot 1, September 13, 2022 (MY-05)

Veg Plot 2, May 14, 2018 (MY-00)

Veg Plot 2, September 13, 2022 (MY-05)

Veg Plot 3, May 14, 2018 (MY-00)

Veg Plot 3, September 13, 2022 (MY-05)

Veg Plot 4, May 14, 2018 (MY-00)
*plot origin at corner to the right

Veg Plot 4, September 13, 2022 (MY-05)

Random Veg Plot, November 22, 2022 (MY-05)

Random Veg Plot, November 22, 2022 (MY-05)

SPA1, Erosion on R2, March 17, 2020 (MY-03)

SPA1, Erosion on R2, September 15, 2021 (MY-04)

SPA1, Erosion on R2, September 15, 2021 (MY-04)

SPA1, Erosion on R2, September 13, 2022 (MY-05)

Appendix C:
Vegetation Plot Data

Table 6: Planted and Total Stem Counts
Table 6a: Vegetation Plot Mitigation Success Summary

Table 6: Planted and Total Stem Counts

Edwards-Johnson

			Current Plot Data (MY5 2022)												Annual Means													
			003-01-0001			003-01-0002			003-01-0003			003-01-0004			MY5 (2022)			MY3 (2020)			MY2 (2019)			MY1 (2018)			MY0 (2018)		
Scientific Name	Common Name	Species Type	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T
Acer rubrum		Tree																		4	1	1	5	2	2	17	1	1	1
Alnus serrulata	Tag Alder, Smooth Ald	Shrub Tree																									3	3	3
Baccharis halimifolia	Silverling, High-tide Bu	Shrub Tree			1												1												
Betula nigra	River Birch, Red Birch	Tree	4	4	4				2	2	2	2	2	2	8	8	8	6	6	6	6	6	6	7	7	7	8	8	8
Carpinus caroliniana		Shrub Tree																						2	2	2			
Cornus amomum	Silky Dogwood	Shrub Tree	1	1	1				1	1	1	1	1	1	3	3	3	4	4	4	4	4	4	5	5	5	8	8	8
Cornus florida	Flowering Dogwood	Shrub Tree																					2						
Diospyros virginiana	American Persimmon,	Tree	1	1	1										1	1	1							1	1	1			
Fraxinus pennsylvanica	Green Ash, Red Ash	Tree	2	2	4	1	1	1				1	1	1	4	4	6	4	4	4	4	4	4	4	4	5	4	4	4
Ilex verticillata	Winterberry	Shrub Tree										1	1	1	1	1	1										1	1	1
Lindera benzoin	Northern Spicebush	Shrub Tree				1	1	1				1	1	1	2	2	2	4	4	4	4	4	4	8	8	8	11	11	11
Liquidambar styraciflua	Sweet Gum, Red Gum	Tree			2						1						3			4			7			4			
Liriodendron tulipifera		Tree	1	1	5			2				2	2	5	3	3	12			3			2			11	7	7	7
Platanus occidentalis	Sycamore, Plane-tree	Tree	4	4	4	1	1	2	2	2	3	2	2	2	9	9	11	9	9	9	8	8	9	7	7	8	10	10	10
Quercus michauxii	Basket Oak, Swamp Ch	Tree				2	2	2							2	2	2	2	2	2	2	2	2	3	3	3	4	4	4
Quercus nigra	Water Oak, Paddle Oal	Tree																1	1	1	1	1	1	2	2	2	6	6	6
Quercus phellos	Willow Oak	Tree				3	3	3	2	2	2				5	5	5	3	3	3	3	3	3	8	8	10	7	7	7
Rhus copallinum		Shrub Tree												2			2												
Rhus typhina	Staghorn Sumac	Shrub																								1			
Salix nigra	Black Willow	Tree			2			2									4						2			6			
Sambucus canadensis	Common Elderberry	Shrub Tree									1						1			1						5			
Ulmus rubra	Slippery Elm, Red Elm	Tree																								2			
		Stem count	13	13	24	8	8	13	7	7	10	10	10	15	38	38	62	33	33	45	33	33	51	49	49	97	70	70	70
		size (ares)	1			1			1			1			4			4			4			4			4		
		size (ACRES)	0.02			0.02			0.02			0.02			0.10			0.10			0.10			0.10			0.10		
		Species count	6	6	9	5	5	7	4	4	6	7	7	8	10	10	15	8	8	12	9	9	13	11	11	17	12	12	12
		Stems per ACRE	526.1	526.1	971.2	323.7	323.7	526.1	283.3	283.3	404.7	404.7	404.7	607	384.5	384.5	627.3	333.9	333.9	455.3	333.9	333.9	516	495.7	495.7	981.4	708.2	708.2	708.2

Color for Density

Exceeds requirements by 10%

Exceeds requirements, but by less than 10%

Fails to meet requirements, by less than 10%

Fails to meet requirements by more than 10%

Table 6a: Vegetation Plot Mitigation Success Summary Table							
Plot #	Planted Stems/Acre	Volunteers/ Acre	Total Stems/Acre	Success Criteria Met	Average Stem Height (ft)	Height Success Criteria Met	Percent Red Maple
1	526	243	769	Yes	5.1	No	0%
2	324	121	445	Yes	6.5	No	0%
3	283	40	323	Yes	4.1	No	0%
4	405	121	526	Yes	5.7	No	0%
Project Average	385	132	516	Yes	5.3	No	0%

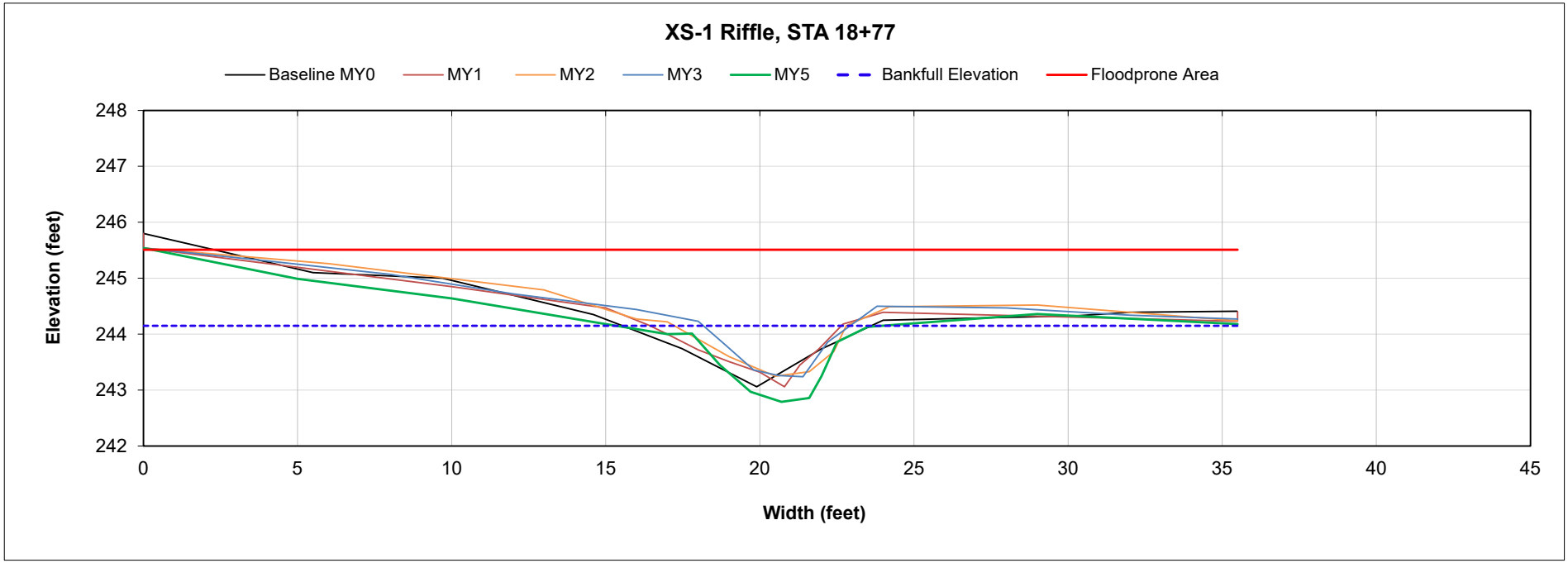
Appendix D:
Stream Measurement and Geomorphology Data

Figure 2: MY5 Cross-Sections
Table 7a: Baseline Stream Data Summary
Table 7b: Cross-section Morphology Data
Table 7c: Stream Reach Morphology Data

Project Name	Edwards-Johnson Mitigation Project
Project ID	97080
Reach ID	R2
Cross Section ID	XS-1
Field Crew	K. Obermiller, C. Durham

Dimension Data Summary: MY5 2022	
Bankfull Elevation (ft)	244.2
Low Bank Height Elevation (ft)	244.0
Bankfull Max Depth (ft)	1.4
Low Bank Height (ft)	1.2
Bank Height Ratio	0.90
Bankfull X-section Area (ft²)	4.9
% Change Bank Height Ratio	10.0%

Looking Downstream



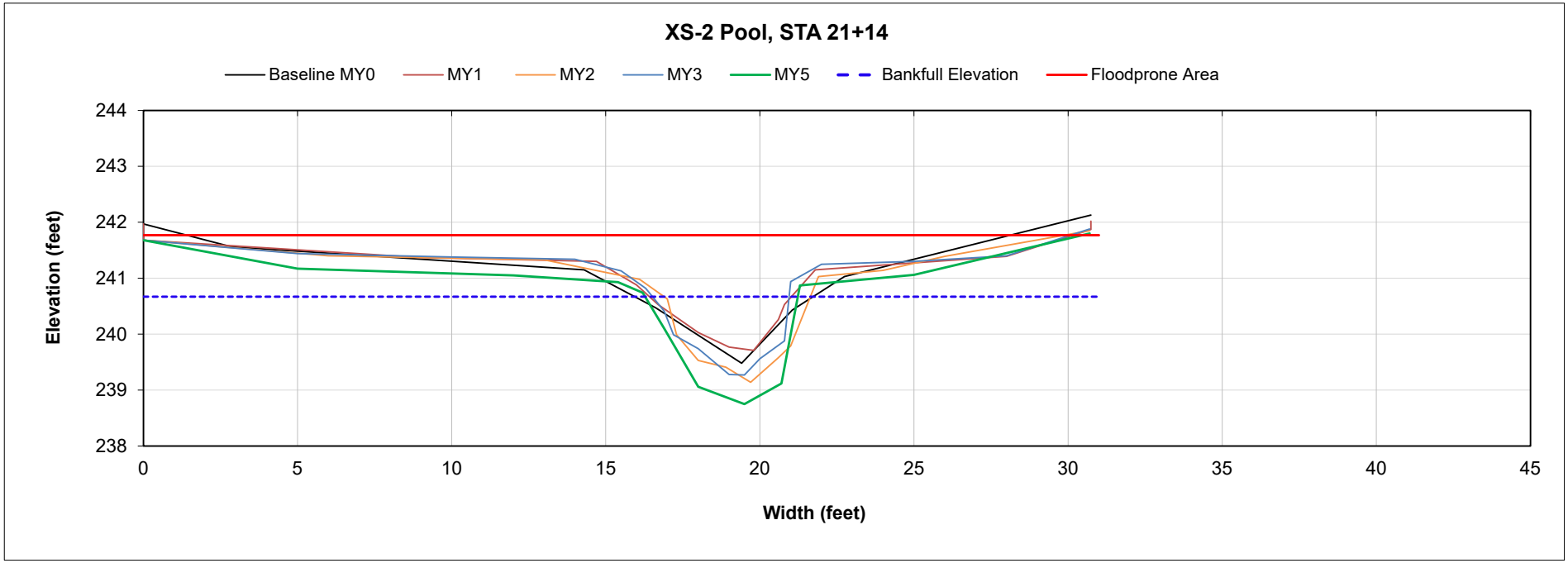
** Bank Height Ratio is calculated based on MY1 cross-sectional area as described in the Standard Measurement of the BHR Monitoring Parameter document produced by the technical industry work group consisting of the NCIRT, NCDMS, and Industry Practitioner sin NC (9/2018). The remainder of the bankfull dimensions are calculated based on the current year's low bank height.*

*** MY1 used in place of as-built (MY0) due to issues with the as-built survey standards identified during MY1.*

Project Name	Edwards-Johnson Mitigation Project
Project ID	97080
Reach ID	R2
Cross Section ID	XS-2
Field Crew	K. Obermiller, C. Durham

Dimension Data Summary: MY5 2022	
Bankfull Elevation (ft)	240.7
Low Bank Height Elevation (ft)	240.7
Bankfull Max Depth (ft)	1.9
Low Bank Height (ft)	2.0
Bank Height Ratio	N/A
Bankfull X-section Area (ft²)	6.5
% Change Bank Height Ratio	N/A

Looking Downstream



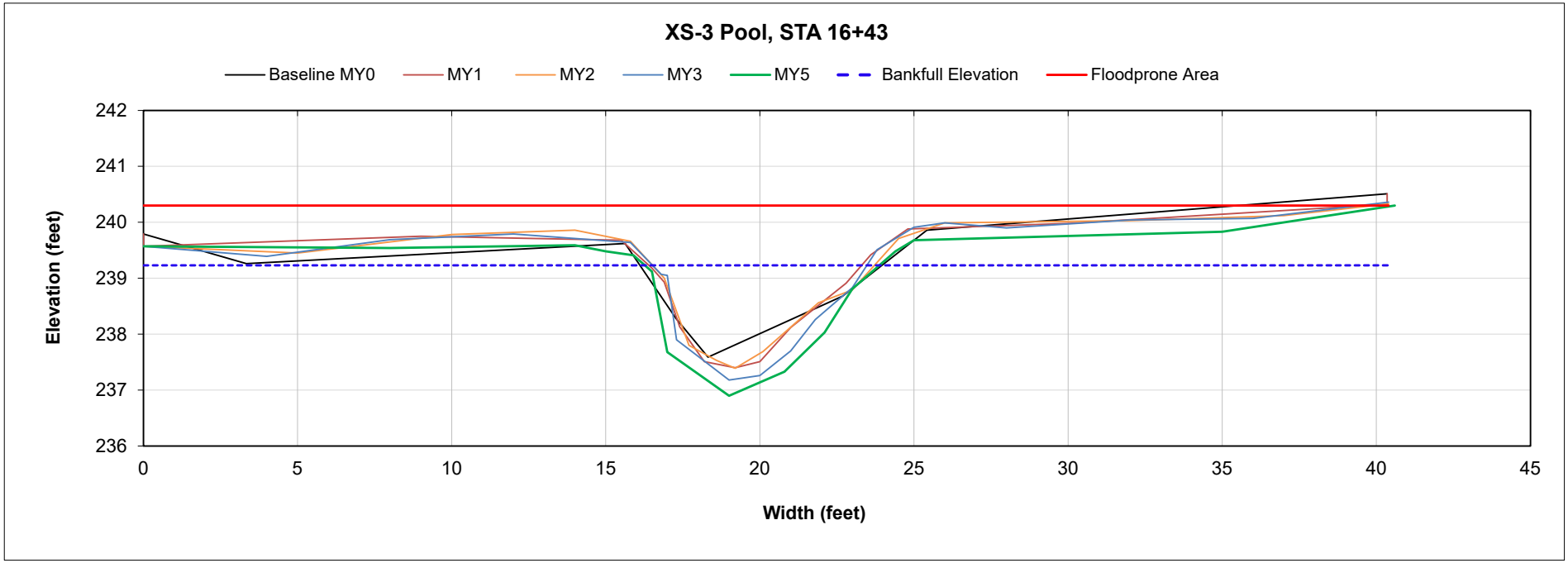
** Bank Height Ratio is calculated based on MY1 cross-sectional area as described in the Standard Measurement of the BHR Monitoring Parameter document produced by the technical industry work group consisting of the NCIRT, NCDMS, and Industry Practitioner sin NC (9/2018). The remainder of the bankfull dimensions are calculated based on the current year's low bank height.*

*** MY1 used in place of as-built (MY0) due to issues with the as-built survey standards identified during MY1.*

Project Name	Edwards-Johnson Mitigation Project
Project ID	97080
Reach ID	R4
Cross Section ID	XS-3
Field Crew	K. Obermiller, C. Durham

Dimension Data Summary: MY5 2022	
Bankfull Elevation (ft)	239.2
Low Bank Height Elevation (ft)	239.4
Bankfull Max Depth (ft)	2.3
Low Bank Height (ft)	2.5
Bank Height Ratio	N/A
Bankfull X-section Area (ft²)	11.0
% Change Bank Height Ratio	N/A

Looking Downstream



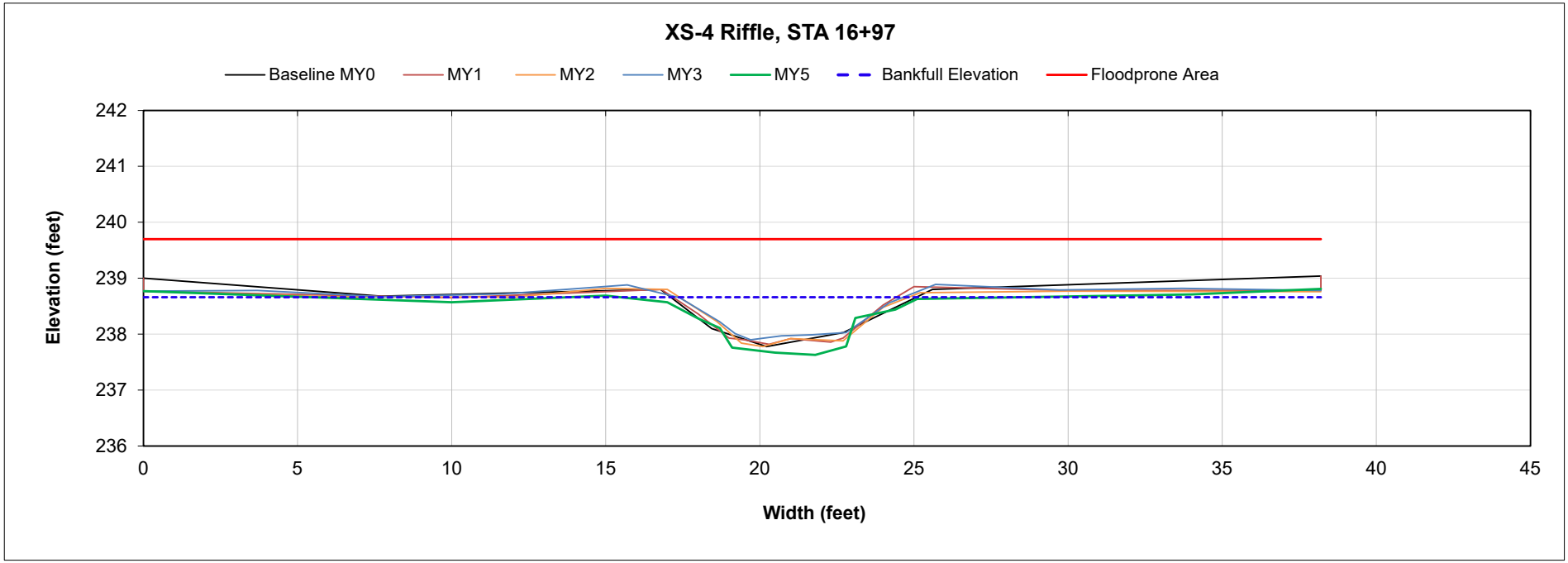
** Bank Height Ratio is calculated based on MY1 cross-sectional area as described in the Standard Measurement of the BHR Monitoring Parameter document produced by the technical industry work group consisting of the NCIRT, NCDMS, and Industry Practitioner sin NC (9/2018). The remainder of the bankfull dimensions are calculated based on the current year's low bank height.*

*** MY1 used in place of as-built (MY0) due to issues with the as-built survey standards identified during MY1.*

Project Name	Edwards-Johnson Mitigation Project
Project ID	97080
Reach ID	R4
Cross Section ID	XS-4
Field Crew	K. Obermiller, C. Durham

Dimension Data Summary: MY5 2022	
Bankfull Elevation (ft)	238.6
Low Bank Height Elevation (ft)	238.6
Bankfull Max Depth (ft)	1.0
Low Bank Height (ft)	1.0
Bank Height Ratio	0.97
Bankfull X-section Area (ft²)	5.2
% Change Bank Height Ratio	3.0%

Looking Downstream



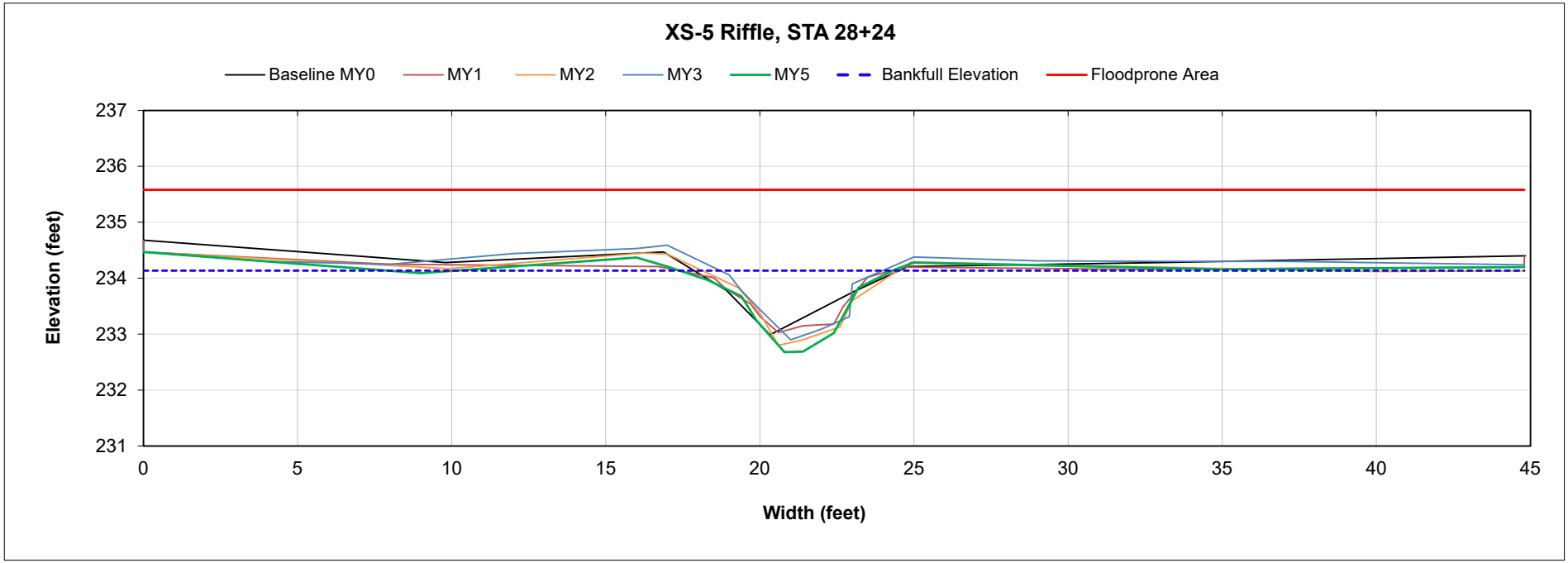
** Bank Height Ratio is calculated based on MY1 cross-sectional area as described in the Standard Measurement of the BHR Monitoring Parameter document produced by the technical industry work group consisting of the NCIRT, NCDMS, and Industry Practitioner sin NC (9/2018). The remainder of the bankfull dimensions are calculated based on the current year's low bank height.*

*** MY1 used in place of as-built (MY0) due to issues with the as-built survey standards identified during MY1.*

Project Name	Edwards-Johnson Mitigation Project
Project ID	97080
Reach ID	R3
Cross Section ID	XS-5
Field Crew	K. Obermiller, C. Durham

Dimension Data Summary: MY5 2022	
Bankfull Elevation (ft)	234.1
Low Bank Height Elevation (ft)	234.2
Bankfull Max Depth (ft)	1.5
Low Bank Height (ft)	1.5
Bank Height Ratio	1.02
Bankfull X-section Area (ft²)	4.7
% Change Bank Height Ratio	2.0%

Looking Downstream



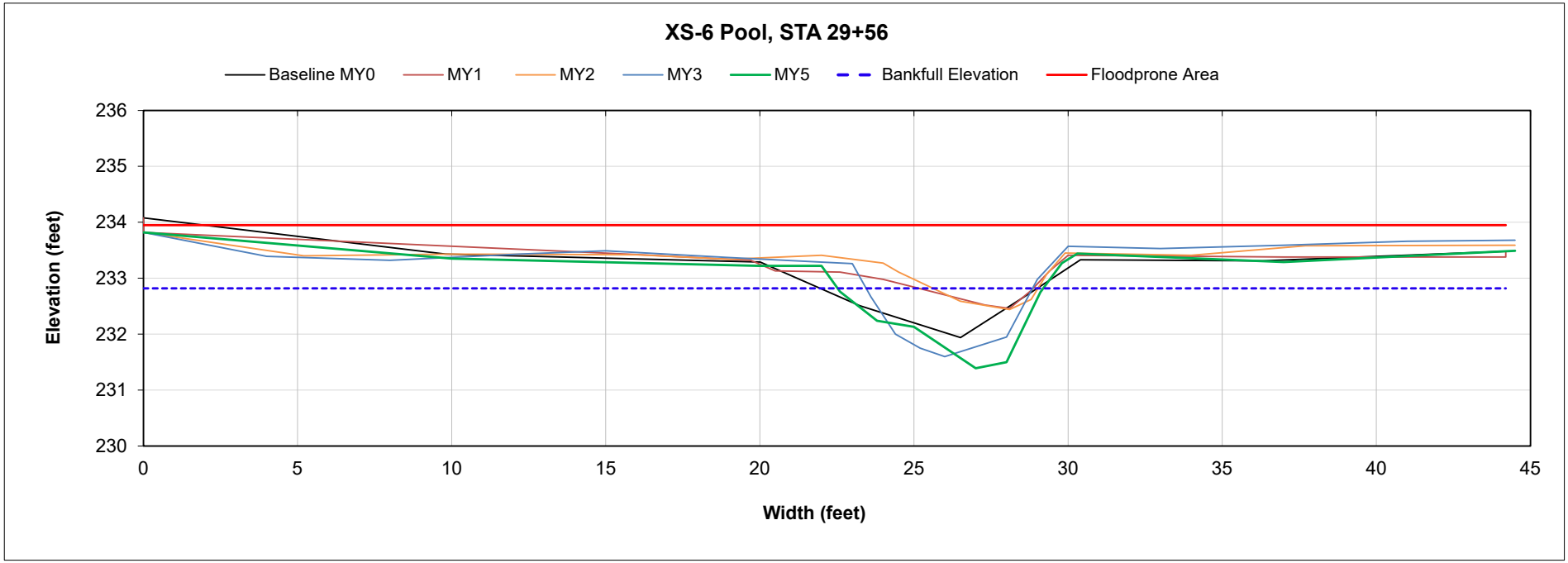
** Bank Height Ratio is calculated based on MY1 cross-sectional area as described in the Standard Measurement of the BHR Monitoring Parameter document produced by the technical industry work group consisting of the NCIRT, NCDMS, and Industry Practitioner sin NC (9/2018). The remainder of the bankfull dimensions are calculated based on the current year's low bank height.*

*** MY1 used in place of as-built (MY0) due to issues with the as-built survey standards identified during MY1.*

Project Name	Edwards-Johnson Mitigation Project
Project ID	97080
Reach ID	R3
Cross Section ID	XS-6
Field Crew	K. Obermiller, C. Durham

Dimension Data Summary: MY5 2022	
Bankfull Elevation (ft)	232.9
Low Bank Height Elevation (ft)	233.2
Bankfull Max Depth (ft)	1.5
Low Bank Height (ft)	1.8
Bank Height Ratio	N/A
Bankfull X-section Area (ft²)	5.6
% Change Bank Height Ratio	N/A

Looking Downstream



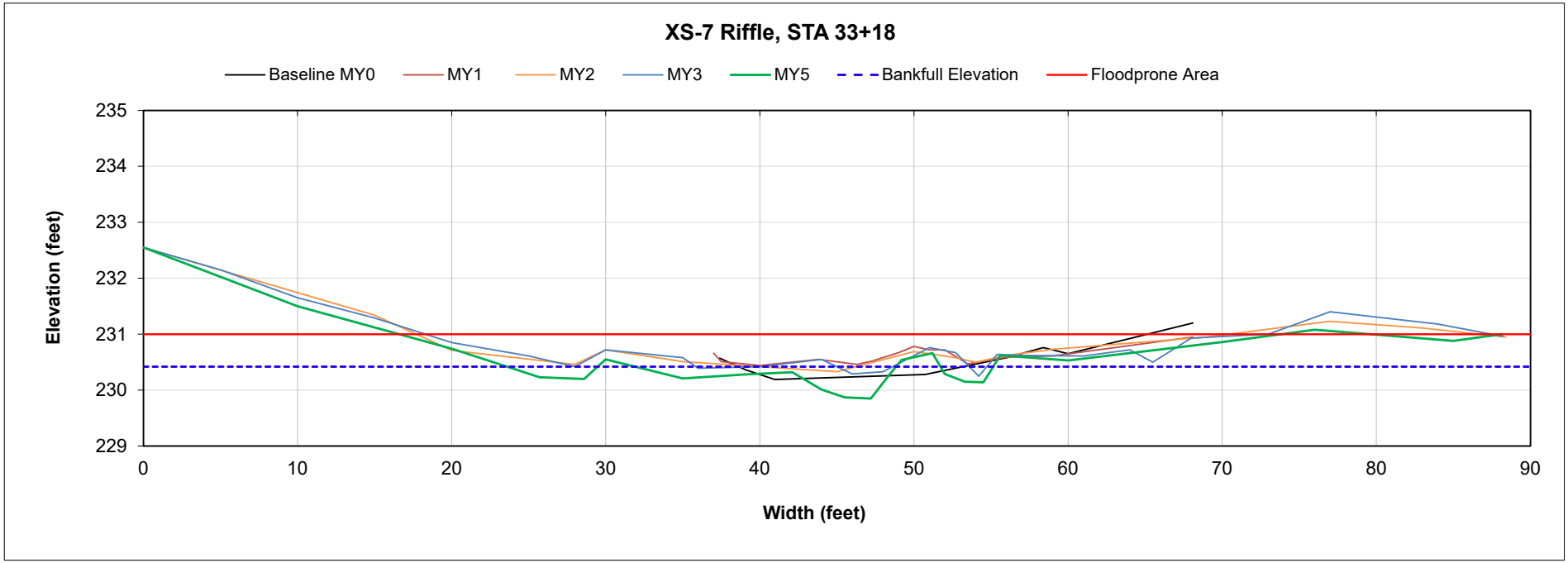
** Bank Height Ratio is calculated based on MY1 cross-sectional area as described in the Standard Measurement of the BHR Monitoring Parameter document produced by the technical industry work group consisting of the NCIRT, NCDMS, and Industry Practitioner sin NC (9/2018). The remainder of the bankfull dimensions are calculated based on the current year's low bank height.*

*** MY1 used in place of as-built (MY0) due to issues with the as-built survey standards identified during MY1.*

Project Name	Edwards-Johnson Mitigation Project
Project ID	97080
Reach ID	R3 (Multi-Thread Channel)
Cross Section ID	XS-7
Field Crew	K. Obermiller, C. Durham

Dimension Data Summary: MY5 2022	
Bankfull Elevation (ft)	230.4
Low Bank Height Elevation (ft)	230.3
Bankfull Max Depth (ft)	0.6
Low Bank Height (ft)	0.5
Bank Height Ratio	0.82
Bankfull X-section Area (ft²)	4.7
% Change Bank Height Ratio	18.0%

Looking Downstream



** Bank Height Ratio is calculated based on MY1 cross-sectional area as described in the Standard Measurement of the BHR Monitoring Parameter document produced by the technical industry work group consisting of the NCIRT, NCDMS, and Industry Practitioner sin NC (9/2018). The remainder of the bankfull dimensions are calculated based on the current year's low bank height.*

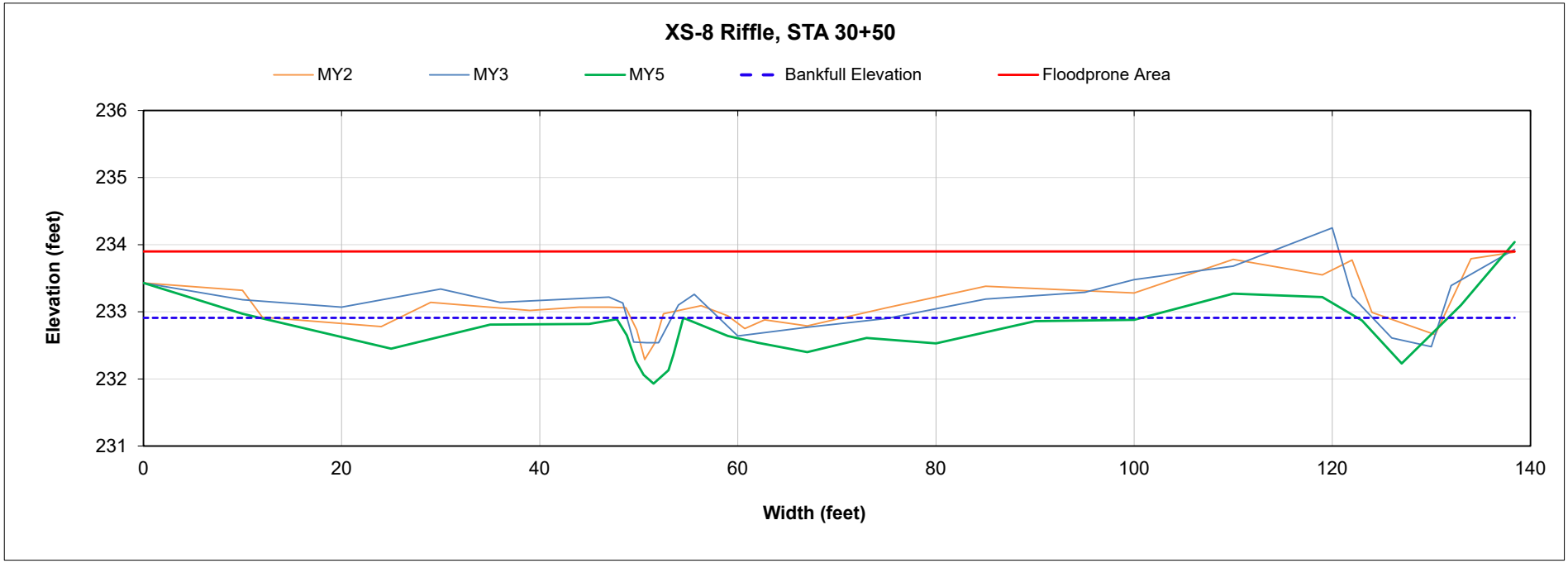
*** MY1 used in place of as-built (MY0) due to issues with the as-built survey standards identified during MY1.*

****X7 right and left pins extended per request after MY1*

Project Name	Edwards-Johnson Mitigation Project
Project ID	97080
Reach ID	R3 (Multi-Thread Channel)
Cross Section ID	XS-8
Field Crew	K. Obermiller, C. Durham

Dimension Data Summary: MY5 2022	
Bankfull Elevation (ft)	233.2
Low Bank Height Elevation (ft)	233.2
Bankfull Max Depth (ft)	0.7
Low Bank Height (ft)	0.7
Bank Height Ratio	1.0
Bankfull X-section Area (ft²)	4.7
% Change Bank Height Ratio	0.0%

Looking Downstream



** Bank Height Ratio is calculated based on MY1 cross-sectional area as described in the Standard Measurement of the BHR Monitoring Parameter document produced by the technical industry work group consisting of the NCIRT, NCDMS, and Industry Practitioner sin NC (9/2018). The remainder of the bankfull dimensions are calculated based on the current year's low bank height.*

*** MY2 used in place of as-built (MY0) for BHR calculations.*

***XS-8 was added during MY1 post-monitoring site visit

Table 7a. Baseline Stream Data Summary
Edwards-Johnson Mitigation Project (NCDEQ DMS Project ID# 97080)

Parameter	Pre-Restoration Condition		Reference Reach Data		Design		As-Built/ Baseline	
Reach ID: R1 (Preservation)								
Dimension (Riffle)	Min	Max	Min	Max	Min	Max	Min	Max
Bankfull Width (ft)	5.5	7.2	4.5	8.3	-	-	-	-
Floodprone Width (ft)	30.0	80.0	10.0	20.0	-	-	-	-
Bankfull Mean Depth (ft)	0.4	0.8	0.8	1.6	-	-	-	-
Bankfull Max Depth (ft)	0.5	0.9	0.9	1.3	-	-	-	-
Bankfull Cross Sectional Area (ft^2)	4.1	5.0	3.0	5.0	-	-	-	-
Width/Depth Ratio	8.2	15.2	6.2	14.2	-	-	-	-
Entrenchment Ratio	4.2	12.0	7.1	8.4	-	-	-	-
Bank Height Ratio	1.1	1.1	0.9	1.1	-	-	-	-
Profile								
Riffle Length (ft)	7.5	38.2	9.5	22.7	-	-	-	-
Riffle Slope (ft/ft)	0.011	0.014	0.009	0.015	-	-	-	-
Pool Length (ft)	4.1	7.9	6.1	8.7	-	-	-	-
Pool Max Depth (ft)	1.2	1.4	1.8	2.4	-	-	-	-
Pool Spacing (ft)	22.0	50.0	14.4	22.3	-	-	-	-
Pattern								
Channel Beltwidth (ft)	22.0	28.0	23.4	29.0	-	-	-	-
Radius of Curvature (ft)	11.3	19.1	11.2	17.5	-	-	-	-
Rc:Bankfull Width (ft/ft)	1.6	2.9	1.6	2.5	-	-	-	-
Meander Wavelength (ft)	27.0	60.0	43.4	65.1	-	-	-	-
Meander Width Ratio	2.2	6.4	3.9	4.5	-	-	-	-
Transport Parameters								
Boundary Shear Stress (lb/ft^2)	-		-		-		-	
Max part size (mm) mobilized at bankfull	-		-		-		-	
Stream Power (W/m^2)	-		-		-		-	
Additional Reach Parameters								
Rosgen Classification	C5		E5/C5		E5/C5		E5/C5	
Bankfull Velocity (fps)	4.1		4.5		-		-	
Bankfull Discharge (cfs)	20.0		---		-		-	
Sinuosity	1.21		1.1 - 1.3		-		-	
Water Surface Slope (Channel) (ft/ft)	0.010		0.015		-		-	
Bankfull Slope (ft/ft)	0.012		0.015		-		-	

Parameter	Pre-Restoration Condition		Reference Reach Data		Design		As-Built/ Baseline	
Reach ID: R2								
Dimension (Riffle)	Min	Max	Min	Max	Min	Max	Min	Max
Bankfull Width (ft)	4.4	7.2	4.5	8.3	7.7	-	8.9	-
Floodprone Width (ft)	30.0	70.0	10.0	20.0	20.0	50.0	32.0	-
Bankfull Mean Depth (ft)	0.4	0.8	0.8	1.6	0.6	-	0.6	-
Bankfull Max Depth (ft)	1.3	1.5	0.9	1.3	0.9	-	1.2	-
Bankfull Cross Sectional Area (ft^2)	3.3	5.1	3.0	5.0	5.0	-	5.0	-
Width/Depth Ratio	8.2	15.2	6.2	14.2	12.0	-	16.0	-
Entrenchment Ratio	4.3	10.0	7.1	8.4	2.2	-	3.6	-
Bank Height Ratio	1.1	1.6	0.9	1.1	1.0	-	1.0	-
Profile								
Riffle Length (ft)	17.0	44.0	9.5	22.7	10.0	30.0	12.0	34.0
Riffle Slope (ft/ft)	0.011	0.013	0.009	0.015	0.0	0.0	0.0	0.0
Pool Length (ft)	3.9	6.0	6.1	8.7	6.0	9.0	6.2	9.9
Pool Max Depth (ft)	1.2	1.3	1.8	2.4	1.1	1.5	1.1	1.6
Pool Spacing (ft)	22.0	39.0	14.4	22.3	30.0	55.0	11.8	36.1
Pattern								
Channel Beltwidth (ft)	28.0		23.4	29.0	28.0	51.0	27.0	46.0
Radius of Curvature (ft)	11.3	19.1	11.2	17.5	15.0	25.0	13.0	29.0
Rc:Bankfull Width (ft/ft)	1.6	2.9	1.6	2.5	2.0	3.0	2.1	3.5
Meander Wavelength (ft)	31.0	45.0	43.4	65.1	55.0	100.0	35.0	88.0
Meander Width Ratio	2.3	6.4	3.9	4.5	3.0	8.0	4.4	7.6
Transport Parameters								
Boundary Shear Stress (lb/ft^2)	-		-		0.49		-	
Max part size (mm) mobilized at bankfull	-		-		2.00		-	
Stream Power (W/m^2)	-		-		31.00		-	
Additional Reach Parameters								
Rosgen Classification	G5		E5/C5		C5		C5	
Bankfull Velocity (fps)	4.1		4.5		4.7		4.7	
Bankfull Discharge (cfs)	26.0		-		26.0		26.0	
Sinuosity	1.16		1.1 - 1.3		1.17		1.17	
Water Surface Slope (Channel) (ft/ft)	0.011		0.015		0.011		0.012	
Bankfull Slope (ft/ft)	0.012		0.015		0.012		0.013	

Parameter	Pre-Restoration Condition		Reference Reach Data		Design		As-Built/ Baseline	
Reach ID: R3 (upper)								
Dimension (Riffle)	Min	Max	Min	Max	Min	Max	Min	Max
Bankfull Width (ft)	4.4	7.2	4.5	8.3	8.2	-	8.8	18.4
Floodprone Width (ft)	30.0	70.0	10.0	35.0	30.0	80.0	27.0	38.0
Bankfull Mean Depth (ft)	1.0	1.8	0.8	1.6	0.7	-	0.3	0.6
Bankfull Max Depth (ft)	1.5	2.3	0.9	1.3	1.0	-	0.4	1.0
Bankfull Cross Sectional Area (ft^2)	3.3		3.0	5.0	5.6	-	4.7	5.5
Width/Depth Ratio	8.2	15.2	6.2	14.2	12.0	-	14.3	71.8
Entrenchment Ratio	4.3	10.0	7.1	8.4	3.7	8.0	1.5	4.3
Bank Height Ratio	1.1	1.7	0.9	1.1	1.0	-	1.0	1.1
Profile								
Riffle Length (ft)	33.0	55.0	9.5	22.7	12.0	33.0	10.0	30.0
Riffle Slope (ft/ft)	0.007	0.009	0.009	0.015	0.0	0.0	0.0	0.0
Pool Length (ft)	8.0	13.0	6.1	8.7	8.0	11.0	7.0	10.0
Pool Max Depth (ft)	1.4	2.0	1.8	2.4	1.4	2.0	1.1	1.6
Pool Spacing (ft)	22.0	39.0	14.4	22.3	25.0	51.0	11.8	35.5
Pattern								
Channel Beltwidth (ft)	28.0		23.4	29.0	25.0	45.0	30.0	45.0
Radius of Curvature (ft)	10.0		11.2	17.5	12.0	22.0	15.0	25.0
Rc:Bankfull Width (ft/ft)	1.6		1.6	2.5	2.0	3.0	2.5	4.2
Meander Wavelength (ft)	27.0		43.4	65.1	30.0	42.0	30.0	44.8
Meander Width Ratio	6.4		3.9	4.5	3.3	5.1	5.1	7.6
Transport Parameters								
Boundary Shear Stress (lb/ft^2)	-		-		0.51		-	
Max part size (mm) mobilized at bankfull	-		-		2.00		-	
Stream Power (W/m^2)	-		-		28.90		-	
Additional Reach Parameters								
Rosgen Classification	E5 incised		E5/C5		C5		C5	
Bankfull Velocity (fps)	4.1		4.5		5.7		4.5	
Bankfull Discharge (cfs)	34.0		-		34.0		34.0	
Sinuosity	1.20		1.1 - 1.3		1.20		1.16	
Water Surface Slope (Channel) (ft/ft)	0.007		0.015		0.009		0.009	
Bankfull Slope (ft/ft)	0.009		0.015		0.011		0.011	

Parameter	Pre-Restoration Condition		Reference Reach Data		Design		As-Built/ Baseline	
Reach ID: R3 (lower) Preservation								
Dimension (Riffle)	Min	Max	Min	Max	Min	Max	Min	Max
Bankfull Width (ft)	4.4	7.2	4.5	8.3	-	-	-	-
Floodprone Width (ft)	30.0	70.0	10.0	35.0	-	-	-	-
Bankfull Mean Depth (ft)	0.4	0.8	0.8	1.6	-	-	-	-
Bankfull Max Depth (ft)	0.5	0.9	0.9	1.3	-	-	-	-
Bankfull Cross Sectional Area (ft^2)	3.3	5.3	3.0	5.0	-	-	-	-
Width/Depth Ratio	8.0	20.0	6.2	14.2	-	-	-	-
Entrenchment Ratio	3.0	8.0	7.1	8.4	-	-	-	-
Bank Height Ratio	1.0	-	0.9	1.1	-	-	-	-
Profile								
Riffle Length (ft)	11.0	22.0	9.5	22.7	-	-	-	-
Riffle Slope (ft/ft)	0.008	0.009	0.009	0.015	-	-	-	-
Pool Length (ft)	5.0	8.0	6.1	8.7	-	-	-	-
Pool Max Depth (ft)	1.3	1.7	1.8	2.4	-	-	-	-
Pool Spacing (ft)	22.0	39.0	14.4	22.3	-	-	-	-
Pattern								
Channel Beltwidth (ft)	28.0	40.0	23.4	29.0	-	-	-	-
Radius of Curvature (ft)	11.0	19.0	11.2	17.5	-	-	-	-
Rc:Bankfull Width (ft/ft)	1.6	2.9	1.6	2.5	-	-	-	-
Meander Wavelength (ft)	27.0	50.0	43.4	65.1	-	-	-	-
Meander Width Ratio	6.4	8.5	3.9	4.5	-	-	-	-
Transport Parameters								
Boundary Shear Stress (lb/ft^2)	-		-		0.49		-	
Max part size (mm) mobilized at bankfull	-		-		2.00		-	
Stream Power (W/m^2)	-		-		29.00		-	
Additional Reach Parameters								
Rosgen Classification	E5		E5/C5		-		-	
Bankfull Velocity (fps)	4.1		4.0		-		-	
Bankfull Discharge (cfs)	37.0		-		-		-	
Sinuosity	1.21		1.1 - 1.3		-		-	
Water Surface Slope (Channel) (ft/ft)	0.008		0.015		-		-	
Bankfull Slope (ft/ft)	0.009		0.015		-		-	

Parameter	Pre-Restoration Condition		Reference Reach Data		Design		As-Built/ Baseline	
Reach ID: R4								
Dimension (Riffle)	Min	Max	Min	Max	Min	Max	Min	Max
Bankfull Width (ft)	6.9	-	4.5	8.3	6.6	-	8.8	-
Floodprone Width (ft)	6.1	-	10.0	35.0	25.0	70.0	38.0	-
Bankfull Mean Depth (ft)	2.4	-	0.8	1.6	0.5	-	0.6	-
Bankfull Max Depth (ft)	3.1	-	0.9	1.3	0.7	-	1.0	-
Bankfull Cross Sectional Area (ft^2)	15.8	-	3.0	5.0	3.6	-	5.5	-
Width/Depth Ratio	5.6	-	10.3	14.2	12.0	-	14.3	-
Entrenchment Ratio	1.0	-	2.0	5.0	3.8	10.0	4.3	-
Bank Height Ratio	1.7	-	0.9	1.1	1.0	-	1.0	-
Profile								
Riffle Length (ft)	17.0	44.0	5.1	13.9	13.0	31.0	12.0	27.0
Riffle Slope (ft/ft)	0.019	0.027	0.017	0.026	0.0	0.0	0.0	0.0
Pool Length (ft)	4.0	6.6	4.5	7.0	6.8	9.4	6.0	8.7
Pool Max Depth (ft)	1.9	2.2	1.1	1.7	1.1	1.6	1.1	1.6
Pool Spacing (ft)	38.0	87.0	10.0	30.0	22.0	50.0	19.0	41.0
Pattern								
Channel Beltwidth (ft)	-	-	23.4	29.0	22.0	35.0	19.0	31.0
Radius of Curvature (ft)	-	-	11.2	17.5	12.0	20.0	10.0	19.0
Rc:Bankfull Width (ft/ft)	-	-	1.6	2.5	1.8	3.0	2.1	3.4
Meander Wavelength (ft)	-	-	43.4	65.1	40.0	60.0	34.0	77.0
Meander Width Ratio	-	-	3.9	4.5	3.3	5.3	3.0	6.0
Transport Parameters								
Boundary Shear Stress ($lb/ft^{2)}$	-		-		0.48		-	
Max part size (mm) mobilized at bankfull	-		-		2.00		-	
Stream Power ($W/m^{2)}$	-		-		24.50		-	
Additional Reach Parameters								
Rosgen Classification	G5c		C5		C5		C5	
Bankfull Velocity (fps)	7.0		4.0		4.5		4.5	
Bankfull Discharge (cfs)	16.0		-		16.0		16.0	
Sinuosity	1.06		1.1 - 1.2		1.15		1.14	
Water Surface Slope (Channel) (ft/ft)	0.019		0.015		0.017		0.017	
Bankfull Slope (ft/ft)	0.018		0.015		0.017		0.017	

Table 7b. Monitoring Data - Dimensional Morphology Summary (Dimensional Parameters – Cross Sections)

Edwards-Johnson Mitigation Project (NCDEQ DMS Project ID# 97080)

	Cross Section 1 (Riffle)							Cross Section 2 (Pool)							Cross Section 3 (Pool)						
Parameters	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+
Bankfull Width (ft)	8.9	7.7	8.6	7.8	N/A	8.2		8.4	13.3	5.8	6.1	N/A	5.0		9.2	9.3	8.7	7.8	N/A	7.6	
Floodprone Width (ft)	32.0	32.0	34.0	34.0	N/A	35.5		31.0	30.7	31.0	31.0	N/A	30.6		40.0	40.4	40.0	40.0	N/A	38.1	
Bankfull Mean Depth (ft)	0.6	0.7	0.6	0.6	N/A	0.6		0.8	0.5	1.1	1.1	N/A	1.3		1.1	1.2	1.3	1.4	N/A	1.5	
Bankfull Max Depth (ft)	1.2	1.3	1.2	1.3	N/A	1.4		1.7	1.6	1.8	1.9	N/A	1.9		2.0	2.1	2.3	2.3	N/A	2.3	
Bankfull Cross Sectional Area (ft^2)	5.2	4.9	4.9	4.9	N/A	4.9		6.7	6.5	6.5	6.5	N/A	6.5		10.4	11.0	11.0	11.0	N/A	11.0	
Bankfull Width/Depth Ratio	15.9	11.4	15.0	12.4	N/A	13.6		10.6	27.8	5.1	5.8	N/A	3.8		8.2	7.9	6.8	5.5	N/A	5.2	
Bankfull Entrenchment Ratio	3.6	4.2	4.0	4.4	N/A	4.3		3.7	2.3	5.4	5.1	N/A	6.2		4.3	4.3	4.6	5.1	N/A	5.0	
Bankfull Bank Height Ratio	1.0	1.0	0.9	0.9	N/A	0.90		N/A	N/A	N/A	N/A	N/A	N/A		N/A	N/A	N/A	N/A	N/A	N/A	
d50 (mm)	N/A	0.8	1.8	1.7	0.6	N/A		N/A	0.4	0.3	0.3	0.6	N/A		N/A	0.4	0.3	0.3	0.6	N/A	

	Cross Section 4 (Riffle)							Cross Section 5 (Riffle)							Cross Section 6 (Pool)						
Parameters	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+
Bankfull Width (ft)	8.8	8.2	8.2	9.6	N/A	9.6		8.8	8.0	6.8	6.8	N/A	6.9		10.4	14.3	25.7	5.8	N/A	6.8	
Floodprone Width (ft)	38.0	38.2	38.0	38.0	N/A	38.7		38.0	44.8	44.0	44.0	N/A	44.8		44.0	44.5	44.0	44.0	N/A	44.7	
Bankfull Mean Depth (ft)	0.6	0.6	0.6	0.5	N/A	0.5		0.6	0.7	0.7	0.7	N/A	0.7		0.7	0.4	0.2	1.0	N/A	0.8	
Bankfull Max Depth (ft)	1.0	1.0	1.0	0.9	N/A	1.0		1.0	1.3	1.4	1.4	N/A	1.5		1.4	1.1	1.0	1.4	N/A	1.5	
Bankfull Cross Sectional Area (ft^2)	5.4	5.2	5.2	5.2	N/A	5.2		5.5	4.7	4.7	4.7	N/A	4.7		7.7	5.6	5.6	5.6	N/A	5.6	
Bankfull Width/Depth Ratio	14.3	13.0	13.0	17.8	N/A	17.8		14.3	12.1	9.9	9.9	N/A	10.1		14.1	37.1	117.0	6.0	N/A	8.1	
Bankfull Entrenchment Ratio	4.3	4.7	4.6	4.0	N/A	4.0		4.3	5.6	6.4	6.5	N/A	6.5		4.2	3.1	1.7	7.6	N/A	6.6	
Bankfull Bank Height Ratio	1.0	1.0	0.9	1.0	N/A	0.97		1.0	1.0	1.1	1.0	N/A	1.02		N/A	N/A	N/A	N/A	N/A	N/A	
d50 (mm)	N/A	0.8	1.8	1.7	0.6	N/A		N/A	0.8	1.8	1.7	0.6	N/A		N/A	0.4	0.3	0.3	0.6	N/A	

	Cross Section 7 (Riffle)							Cross Section 8 (Riffle)						
Parameters	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+
Bankfull Width (ft)	18.4	18.1	27.2	28.5	N/A	20.3		N/A	N/A	24.8	24.7	N/A	14.0	
Floodprone Width (ft)	27.0	31.7	64.0	59.1	N/A	64.7		N/A	N/A	135.8	131.0	N/A	136.5	
Bankfull Mean Depth (ft)	0.3	0.3	0.4	0.2	N/A	0.2		N/A	N/A	0.2	0.2	N/A	0.3	
Bankfull Max Depth (ft)	0.4	0.3	0.2	0.4	N/A	0.6		N/A	N/A	0.8	0.7	N/A	1.0	
Bankfull Cross Sectional Area (ft^2)	4.7	4.7	4.7	4.7	N/A	4.7		N/A	N/A	4.7	4.7	N/A	4.7	
Bankfull Width/Depth Ratio	71.8	69.7	158.9	174.2	N/A	87.9		N/A	N/A	130.6	131.4	N/A	41.3	
Bankfull Entrenchment Ratio	1.5	1.7	2.4	2.1	N/A	3.2		N/A	N/A	5.5	5.3	N/A	9.8	
Bankfull Bank Height Ratio	1.0	1.0	1.1	0.9	N/A	0.82		N/A	N/A	1.0	1.0	N/A	1.00	
d50 (mm)	N/A	0.8	1.8	1.7	0.6	N/A		N/A	0.8	1.8	1.7	0.6	N/A	

Table 7c. Monitoring Data - Stream Reach Summary

Edwards-Johnson Mitigation Project (NCDEQ DMS Project ID# 97080)

Parameter	Baseline		MY1		MY2		MY3		MY4		MY5	
Reach ID: R1 (Preservation)												
	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
Profile												
Riffle Length (ft)	-	-										
Riffle Slope (ft/ft)	-	-										
Pool Length (ft)	-	-										
Pool Max depth (ft)	-	-										
Pool Spacing (ft)	-	-										
Pattern												
Channel Beltwidth (ft)	-	-										
Radius of Curvature (ft)	-	-										
Rc:Bankfull width (ft/ft)	-	-										
Meander Wavelength (ft)	-	-										
Meander Width Ratio	-	-										
Additional Reach Parameters												
Rosgen Classification	C5											
Sinuosity (ft)	1.21											
Water Surface Slope (Channel) (ft/ft)	0.01											
BF slope (ft/ft)	0.012											
[3]Ri% / Ru% / P% / G% / S%												
[3]SC% / Sa% / G% / C% / B% / Be%												
[3]d16 / d35 / d50 / d84 / d95 /												
[2]% of Reach with Eroding Banks												
Channel Stability or Habitat Metric												
Biological or Other												

Pattern and Profile data will not typically be collected unless visual data, dimensional data or profile data indicate significant deviations from baseline conditions

Pattern data will not typically be collected unless visual data, dimensional data or profile data

Parameter	Baseline		MY1		MY2		MY3		MY4		MY5	
Reach ID: R2												
	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
Profile												
Riffle Length (ft)	12	34										
Riffle Slope (ft/ft)	0.017	0.029										
Pool Length (ft)	6.2	9.9										
Pool Max depth (ft)	1.1	1.6										
Pool Spacing (ft)	11.8	36.1										
Pattern												
Channel Beltwidth (ft)	27	46										
Radius of Curvature (ft)	13	29										
Rc:Bankfull width (ft/ft)	2.1	3.5										
Meander Wavelength (ft)	35	88										
Meander Width Ratio	4.4	7.6										
Additional Reach Parameters												
Rosgen Classification	C5											
Sinuosity (ft)	1.17											
Water Surface Slope (Channel) (ft/ft)	0.012											
BF slope (ft/ft)	0.013											
[3]Ri% / Ru% / P% / G% / S%												
[3]SC% / Sa% / G% / C% / B% / Be%												
[3]d16 / d35 / d50 / d84 / d95 /												
[2]% of Reach with Eroding Banks												
Channel Stability or Habitat Metric												
Biological or Other												

Pattern and Profile data will not typically be collected unless visual data, dimensional data or profile data indicate significant deviations from baseline conditions

Pattern data will not typically be collected unless visual data, dimensional data or profile data indicate significant shifts from baseline

Parameter	Baseline		MY1		MY2		MY3		MY4		MY5	
Reach ID: R3 (upper)												
	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
Profile												
Riffle Length (ft)	10	30										
Riffle Slope (ft/ft)	0.02	0.035										
Pool Length (ft)	7	10										
Pool Max depth (ft)	1.1	1.6										
Pool Spacing (ft)	11.8	35.5										
Pattern												
Channel Beltwidth (ft)	30	45										
Radius of Curvature (ft)	15	25										
Rc:Bankfull width (ft/ft)	2.5	4.2										
Meander Wavelength (ft)	30	44.8										
Meander Width Ratio	5.1	7.6										
Additional Reach Parameters												
Rosgen Classification	C5											
Sinuosity (ft)	1.16											
Water Surface Slope (Channel) (ft/ft)	0.009											
BF slope (ft/ft)	0.011											
[3]Ri% / Ru% / P% / G% / S%												
[3]SC% / Sa% / G% / C% / B% / Be%												
[3]d16 / d35 / d50 / d84 / d95 /												
[2]% of Reach with Eroding Banks												
Channel Stability or Habitat Metric												
Biological or Other												

Pattern and Profile data will not typically be collected unless visual data, dimensional data or profile data indicate significant deviations from baseline conditions

Pattern data will not typically be collected unless visual data, dimensional data or profile data indicate significant shifts from baseline

Parameter	Baseline		MY1		MY2		MY3		MY4		MY5	
Reach ID: R4												
	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
Profile												
Riffle Length (ft)	12	27										
Riffle Slope (ft/ft)	0.015	0.027										
Pool Length (ft)	6	8.7										
Pool Max depth (ft)	1.1	1.6										
Pool Spacing (ft)	19	41										
Pattern												
Channel Beltwidth (ft)	19	31										
Radius of Curvature (ft)	10	19										
Rc:Bankfull width (ft/ft)	2.1	3.4										
Meander Wavelength (ft)	34	77										
Meander Width Ratio	3	6										
Additional Reach Parameters												
Rosgen Classification	C5											
Sinuosity (ft)	1.14											
Water Surface Slope (Channel) (ft/ft)	0.017											
BF slope (ft/ft)	0.017											
[3]Ri% / Ru% / P% / G% / S%												
[3]SC% / Sa% / G% / C% / B% / Be%												
[3]d16 / d35 / d50 / d84 / d95 /												
[2]% of Reach with Eroding Banks												
Channel Stability or Habitat Metric												
Biological or Other												

Pattern and Profile data will not typically be collected unless visual data, dimensional data or profile data indicate significant deviations from baseline conditions

Pattern data will not typically be collected unless visual data, dimensional data or profile data indicate significant shifts from baseline

Appendix E: Hydrologic Data

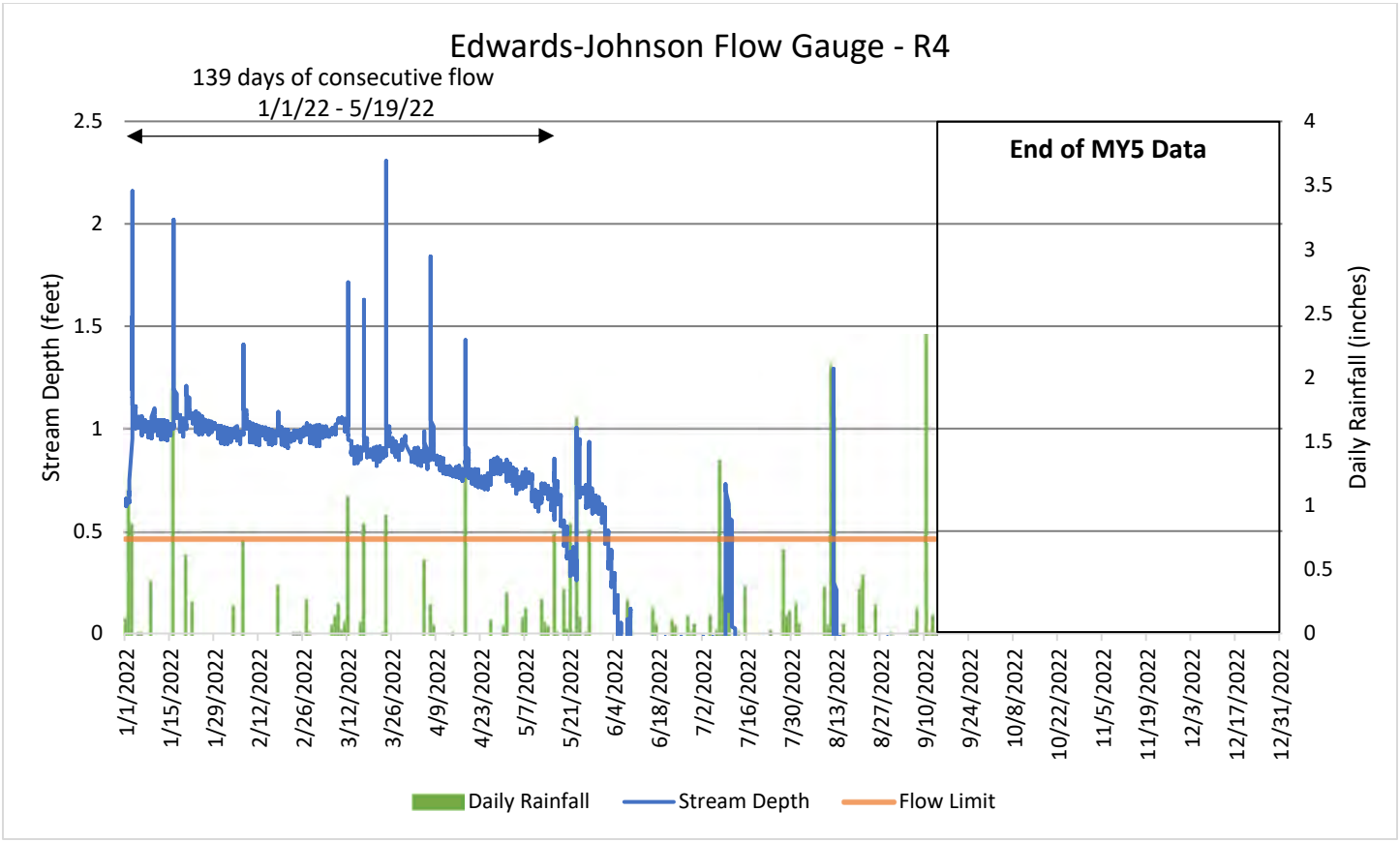
Table 8: Verification of Flow Events
Figure 3a: Hydrograph Data
Figure 3b: Groundwater Gauge Data
Figure 4: Monthly Rainfall Data

Table 8 Edwards-Johnson Mitigation Project (NCDEQ DMS Project ID# 97080)						
Monitoring Year	**Date of Data Collection**	**Date of Occurrence**	**Method**	**Greater than Bankfull (Bkf) or Qgs (Q2*0.66 = 50.66 CFS) Stage?**	**Photo/ Notes**	**Measurement**
MY1	9/17/2018	9/16-9/17/2018	Observed indicators of bankfull stage (wrack lines) after storm event	Bkf	Photo	
MY2	7/26/2019	7/24/2019	Crest Gauge	Bkf	Photo	.25 ft
	8/20/2019	unknown	Crest Gauge	Bkf	Photo	.28 ft
	9/6/2019	9/5/2019	Crest Gauge	Bkf	Photo	.25 ft
	9/6/2019	9/5/2019	Observed indicators of bankfull stage (wrack lines) after storm event	Bkf	Photo	NA
MY3	2/7/2020	2/6/2020	Crest Gauge	Bkf & Qgs	Photo	.85 ft
	8/4/2020	8/4/2020	Crest Gauge	Bkf & Qgs	Photo	0.5 ft
MY4	1/13/2021	unknown	Crest Gauge	Bkf	Photo	0.95 ft
	7/13/2021	unknown	Crest Gauge	Bkf	Photo	0.7 ft
MY5	4/1/2022	unknown	Observed indicators of bankfull stage (wrack lines) after storm event	Bkf	Photo	N/A

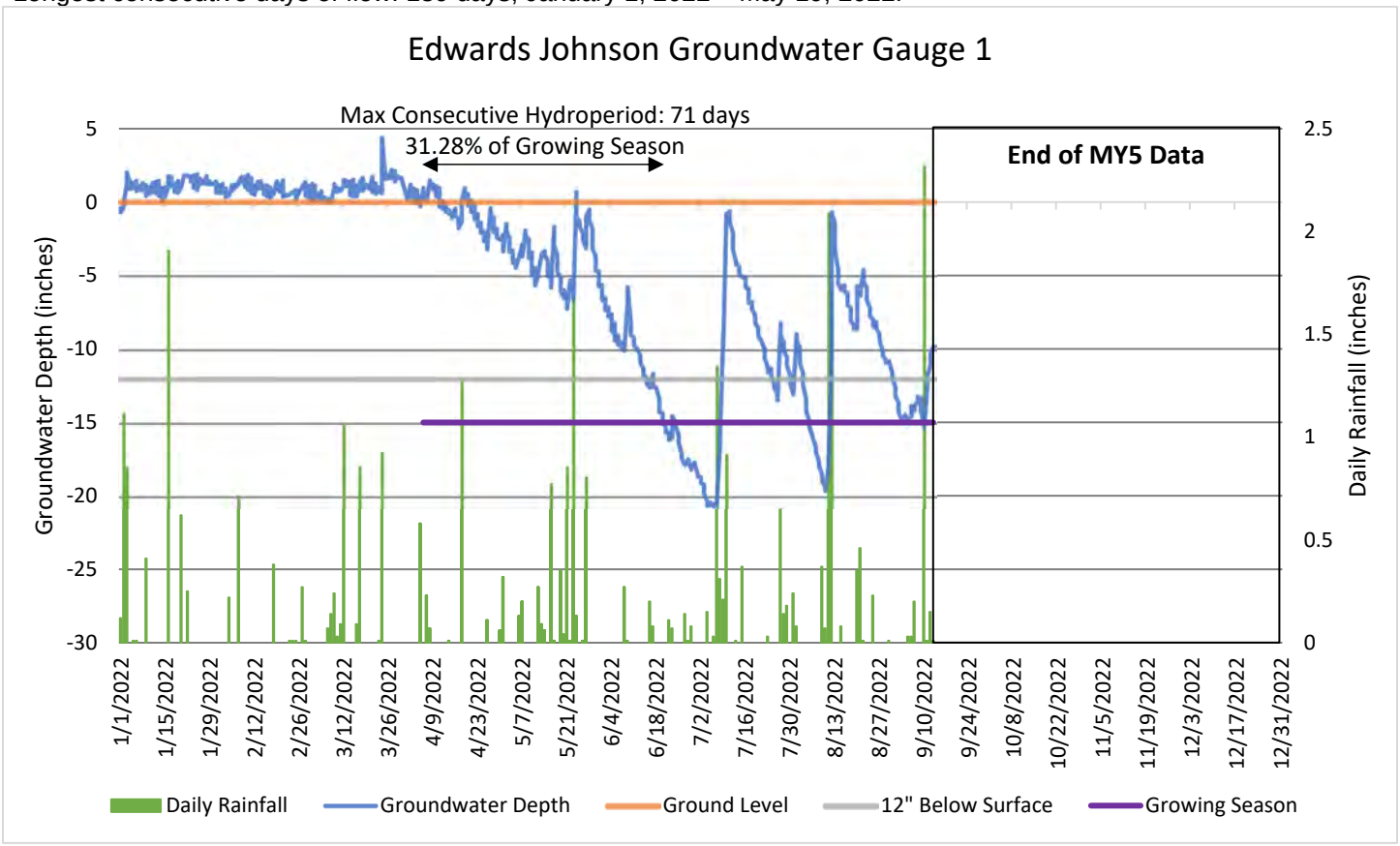
4/1/2022

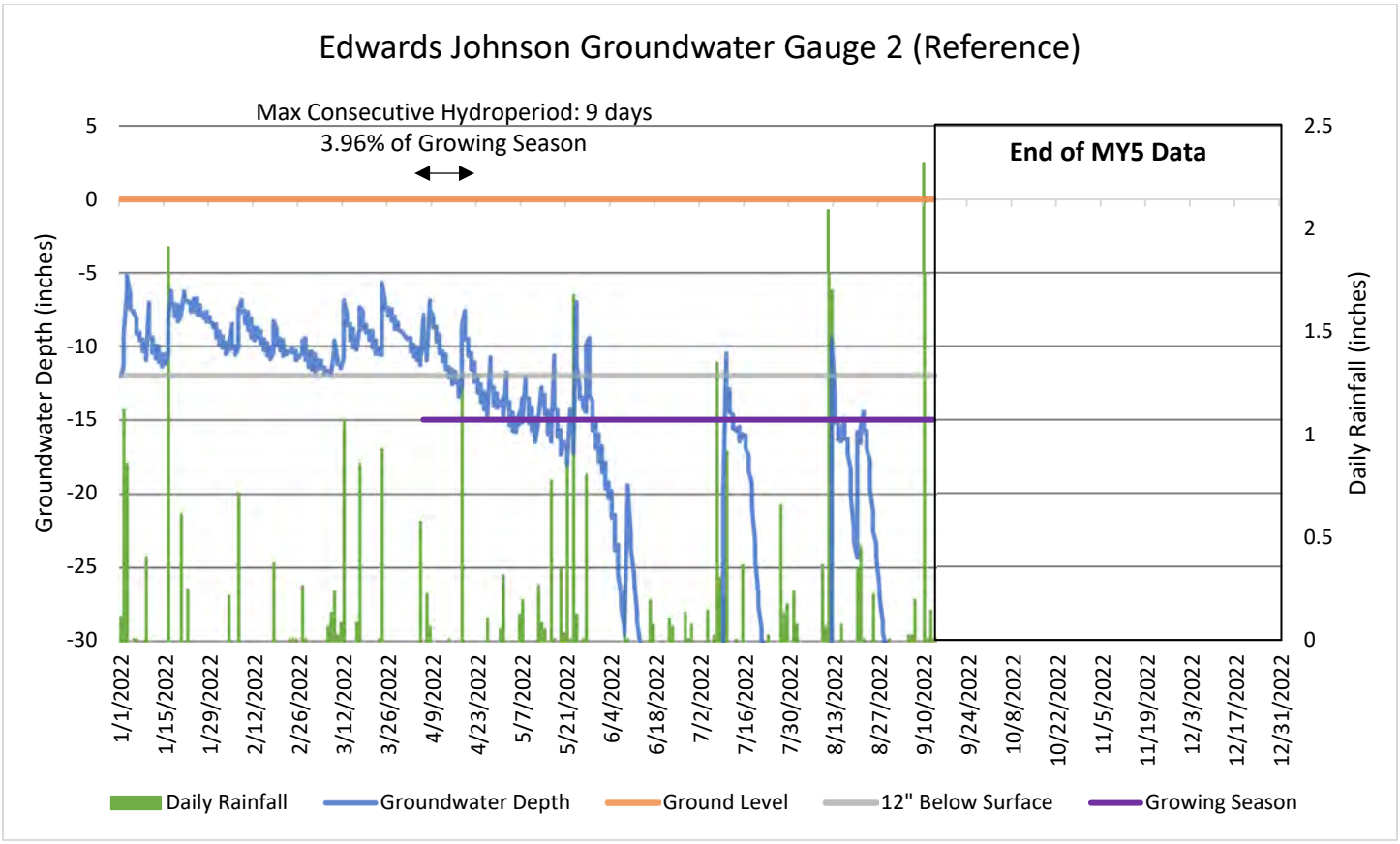
4/1/2022

Figure 3a:



*Longest consecutive days of flow: 139 days, January 1, 2022 – May 19, 2022.




Edwards Johnson Groundwater Gauge 2 (Reference)
Max Consecutive Hydroperiod: 9 days
3.96% of Growing Season
End of MY5 Data
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

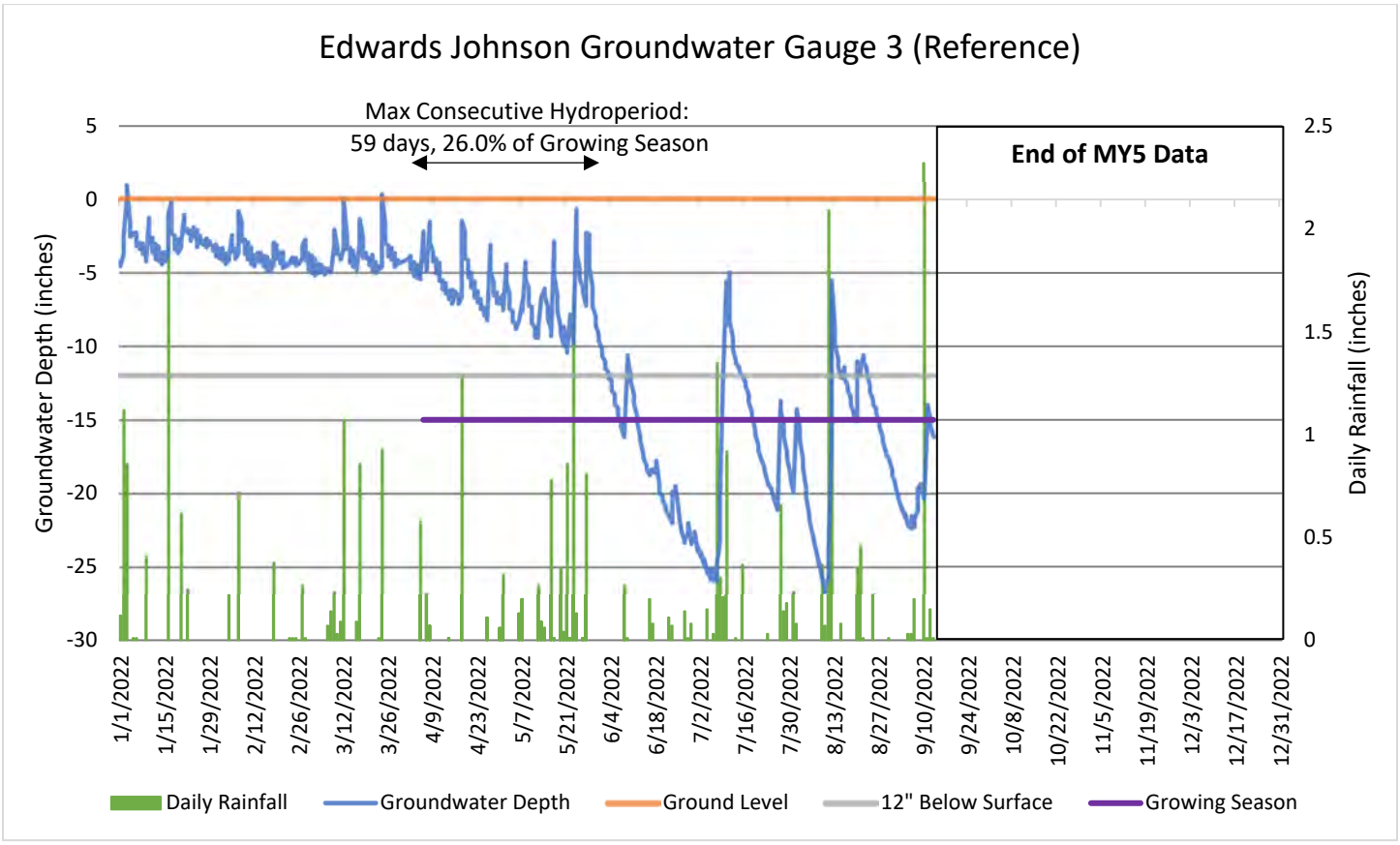
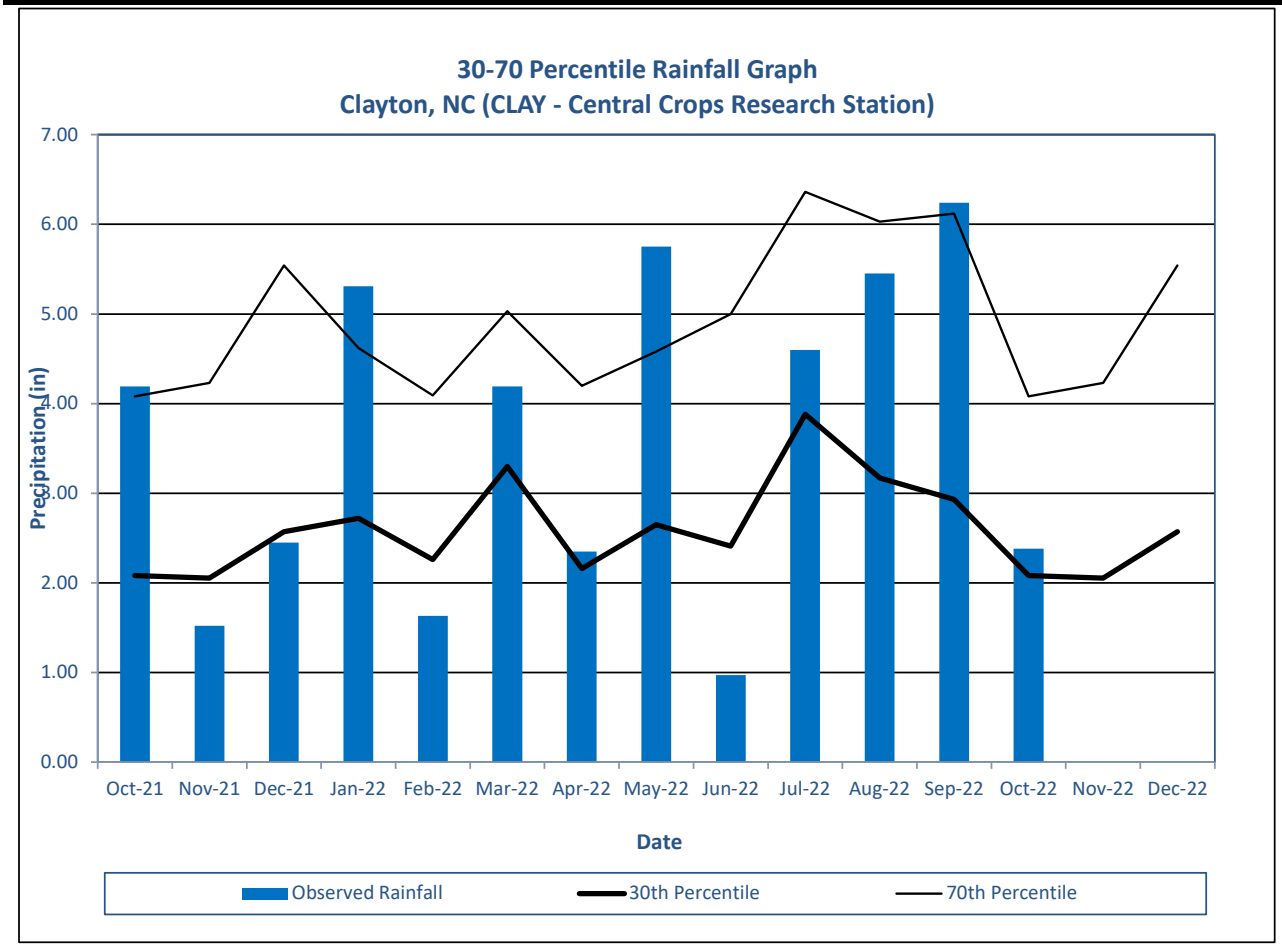

Edwards Johnson Groundwater Gauge 3 (Reference)
Max Consecutive Hydroperiod:
59 days, 26.0% of Growing Season
End of MY5 Data
Groundwater Depth (inches)
Daily Rainfall (inches)
5
0
-5
-10
-15
-20
-25
-30
2.5
2
1.5
1
0.5
0
1/1/2022
1/15/2022
1/29/2022
2/12/2022
2/26/2022
3/12/2022
3/26/2022
4/9/2022
4/23/2022
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

Figure 3b - Groundwater Gauge Data
Edwards-Johnson Mitigation Project (NCDEQ DMS Project ID# 97080)
MY5 2022

Monitoring Gauge Name	Max Consecutive Hydroperiod: Saturation within 12 Inches of Soil Surface (Percent of Growing Season) WETS Station: 317994 - Smithfield Growing Season: 4/6-11/4 (227 days)							
	2018	2019	2020	2021	2022	2023	2024	Mean
Edwards-Johnson Wetland Gauge 1	M	6.17%	6.61%	64.76%	31.28%			
Edwards-Johnson Reference Wetland Gauge 2	M	39.21%	84.14%	5.29%	3.96%			
Edwards-Johnson Reference Wetland Gauge 3	N/A	N/A	37.00%	6.61%	26.00%			

Annual Precip Total	NA
WETS 30th Percentile	42.7
WETS 70th Percentile	51.8
Normal	Y

Figure 4: Monthly Rainfall Data
Edwards-Johnson Mitigation Project (NCDEQ DMS Project ID# 97080)
MY5 2022



*30th and 70th percentile rainfall data collected from weather station CLAY - Central Crops Research Station in Clayton, NC.
**Incomplete Month

Month	30%	70%	Observed
Oct-21	2.08	4.08	4.19
Nov-21	2.05	4.23	1.52
Dec-21	2.57	5.54	2.45
Jan-22	2.72	4.62	5.31
Feb-22	2.26	4.09	1.63
Mar-22	3.30	5.03	4.19
Apr-22	2.16	4.20	2.35
May-22	2.65	4.58	5.75
Jun-22	2.41	5.00	0.97
Jul-22	3.88	6.36	4.6
Aug-22	3.17	6.03	5.45
Sep-22	2.93	6.12	6.24
Oct-22	2.08	4.08	2.38
Nov-22	2.05	4.23	**
Dec-22	2.57	5.54	**