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Monitoring Report – Year 4  
FINAL VERSION  
Edwards-Johnson Mitigation Project  
Calendar Year of Data Collection: 2021

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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  
Data Collection Period: September 2021  
Submission Date: October 20<sup>th</sup>, 2021



Prepared for:



**North Carolina Department of Environmental Quality**  
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October 20<sup>th</sup>, 2021

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 10 Draft Monitoring Report Year 4 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 4 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 4 were developed by addressing NCDEQ DMS's review comments.

Under this cover, we are providing the Final Monitoring Report Year 4, 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 4 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: Add 'V2' to the DWR project number on the title page (2016-0404 V2).** WLS Response: V2 was added to the DWR project number on the title page.
- 2. DMS Comment: Clarify on the Legend for the Encroachment area (0.04 acres) to show planting year or remove shapefile because there were also replanted areas in previous monitoring years that are not shown (because this is considered no longer an encroachment).** WLS Response: The encroachment area was replanted in 2019 and is no longer an encroachment. The encroachment was removed from the CCPV.
- 3. DMS Comment: Please add the replanting to Table 2 and include the dates of any previous replants for clarity. It may also be useful to show the size of the areas replanted since they are minimal in that table.** WLS Response: All the replants and acreage of areas replanted was added to Table 2.
- 4. DMS Comment: Clarify in the text where the substrate samples were taken (which reach).** WLS Response: Language was added to clarify that samples were taken on R2 near station 26+00.
- 5. DMS Comment: Update rain report for additional months if possible.** WLS Response: September rain data has been added to Figure 5.

**Digital Deliverables:**

- 1. DMS Comment: Please submit the features for the stream problem, encroachment, and low stem density areas that are displayed in the CCPV. Please also ensure that these areas are reflected in Table 5 & 5a. If the encroachment area is removed then this feature does not need to be included.** WLS Response: Features for the stream problem area and low stem density area are included in the CCPV folder of the E-Data. Both areas are reflected in Table 5 and 5a.

Please contact me if you have any questions or comments.

Sincerely,

**Water & Land Solutions, LLC**

A handwritten signature in black ink that reads "Emily Dunnigan". The signature is written in a cursive style.

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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 4 (MY4) for monitoring activities. Data collection occurred in September 2021. This report presents the data for MY4. The Project meets the MY4 success criteria for stream hydrology, stream horizontal and vertical stability, and vegetation. Based on these results, the Project is meeting MY4 success criteria and is expected to meet the Monitoring Year 5 (MY5) success criteria in 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. |
| Geomorphology (Level 3)     | 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.                      |
|                             | 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.          |



| Functional Category (Level) | Project Goal / Parameter   | Measurement Method   | Performance Standard   | Potential Functional Uplift  |
|-----------------------------|--|--|--|--|
| 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 (MY3, MY5, 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 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

After construction, there should be minimal change in the particle size distribution of the streambed materials, over time, given the current watershed conditions and future sediment supply regime. Since the streams are predominantly sand-bed systems with minimal fine/coarse gravel, some coarsening is anticipated after restoration activities, however significant changes in particle size distribution are not expected. Streambed material condition is supplementary and is not part of success criteria.

#### 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 4 Assessment and Results

Annual monitoring was conducted during MY4 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). MY4 results are provided in the appendices. The Project meets the MY4 success criteria for stream hydrology, stream horizontal and vertical stability, and vegetation.

### 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 ( $Q_{gs}=0.66Q_2$ ) within the monitoring period, along with floodplain access by flood flows, is being conducted using a crest gauge, installed on December 12, 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. Two bankfull events occurred during MY4 (see table below). These events were documented using the described photography (Table 8). The documented occurrence of two flow events in MY3 and the three events during MY2 satisfies the requirement of the occurrence of four bankfull events (overbank flows) in at least two separate years



| Monitoring Year | Documented Bankfull Events | Requirement Met |
|-----------------|----------------------------|-----------------|
| 2               | 3                          | No              |
| 3               | 2                          | Yes             |
| 4               | 2                          | Yes             |

## 5.2 Stream Horizontal & Vertical Stability

Visual assessment and monitoring of 8 permanent cross sections were utilized for assessment of MY4 horizontal and vertical stream stability. The visual assessments for each stream reach concluded that the MY4 stream channel pattern and longitudinal profiles, instream structure locations, still closely match the profile design parameters and MY0/baseline conditions. Cross-section surveys were not required for MY4 per the mitigation plan, they will be completed in MY5.

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 occurred. This area was planted with livestakes and has stabilized throughout MY4 and will continue to be monitored in MY5. Photographs of the area can be found in Appendix B. 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.

## 5.3 Streambed Material Condition and Stability

A representative sediment samples were collected on R2, near station 26+00, to assess streambed material condition and stability. The dominant substrate for the project was verified as very coarse sand. The post-construction riffle substrate sampling indicated no significant change in streambed material condition or stability during MY4.

## 5.4 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 196 consecutive days from January 1<sup>st</sup> through July 15<sup>th</sup>, 2021, during a year with normal rainfall conditions (Figure 4).

## 5.5 Vegetation

Vegetation plot surveys were not required during MY4 per the mitigation plan, surveys will continue in MY5. The MY4 vegetation monitoring was conducted utilizing visual assessment throughout the easement. One area of concern located on the left bank of R2 totaling approximately 0.35 acres was noted in MY3. Replanting of the area using containerized trees to increase survivability occurred on February 1<sup>st</sup>, 2021, to meet success criteria for MY5 with species from the approved planting list from the mitigation



plan (see table below for species planted). The results of the visual assessment did not indicate any additional significant negative changes to the existing vegetation community.

#### Planted Species Table

| Common Name  | Scientific Name                | # Planted |
|--------------|--------------------------------|-----------|
| Tulip Poplar | <i>Liriodendron tulipifera</i> | 25        |
| Sycamore     | <i>Platanus occidentalis</i>   | 50        |
| River Birch  | <i>Betula nigra</i>            | 25        |
| <b>TOTAL</b> |                                | 100       |

## 5.6 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 4). 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. A gauge malfunction resulted in the loss of data from July 14th, 2021, to September 14th, 2021, for groundwater gauges 2 and 3. A malfunction with groundwater gauge 3 also resulted in lost data from January 29<sup>th</sup> to March 17<sup>th</sup>. The malfunctioning gauges were repaired on September 14th, 2021.



## 6 References

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## Appendices

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## Appendix A – Background Tables and Figures

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

| Project Component (reach ID, etc.) <sup>1</sup> | Wetland Position and HydroType <sup>2</sup> | 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            |
| 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: 3 yrs 5 months  
 Elapsed Time Since planting complete: 3 yrs 5 months  
 Number of reporting Years<sup>0</sup>: 4

| 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 Verification | 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              |
| Year 2 Monitoring Report Submittal                                | 10/18/2019               | 12/31/2019             |
| Year 3 Monitoring Report Submittal                                | 10/14/2019               | 11/3/2020              |
| Year 4 Monitoring Report Submittal                                | 9/15/2021                | 10/20/2021             |
| Year 5 Monitoring Report Submittal                                | N/A                      | N/A                    |
| Year 6 Monitoring Report Submittal                                | N/A                      | N/A                    |
| Year 7 Monitoring Report Submittal                                | N/A                      | N/A                    |
| Replant Encroachment (~0.04 acres)                                |                          | 3/2019                 |
| Replant Low Stem Density Areas (~0.43 acres)                      |                          | 2/2020                 |
| Replant Low Stem Density Area (~0.35 acres)                       |                          | 2/2021                 |

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

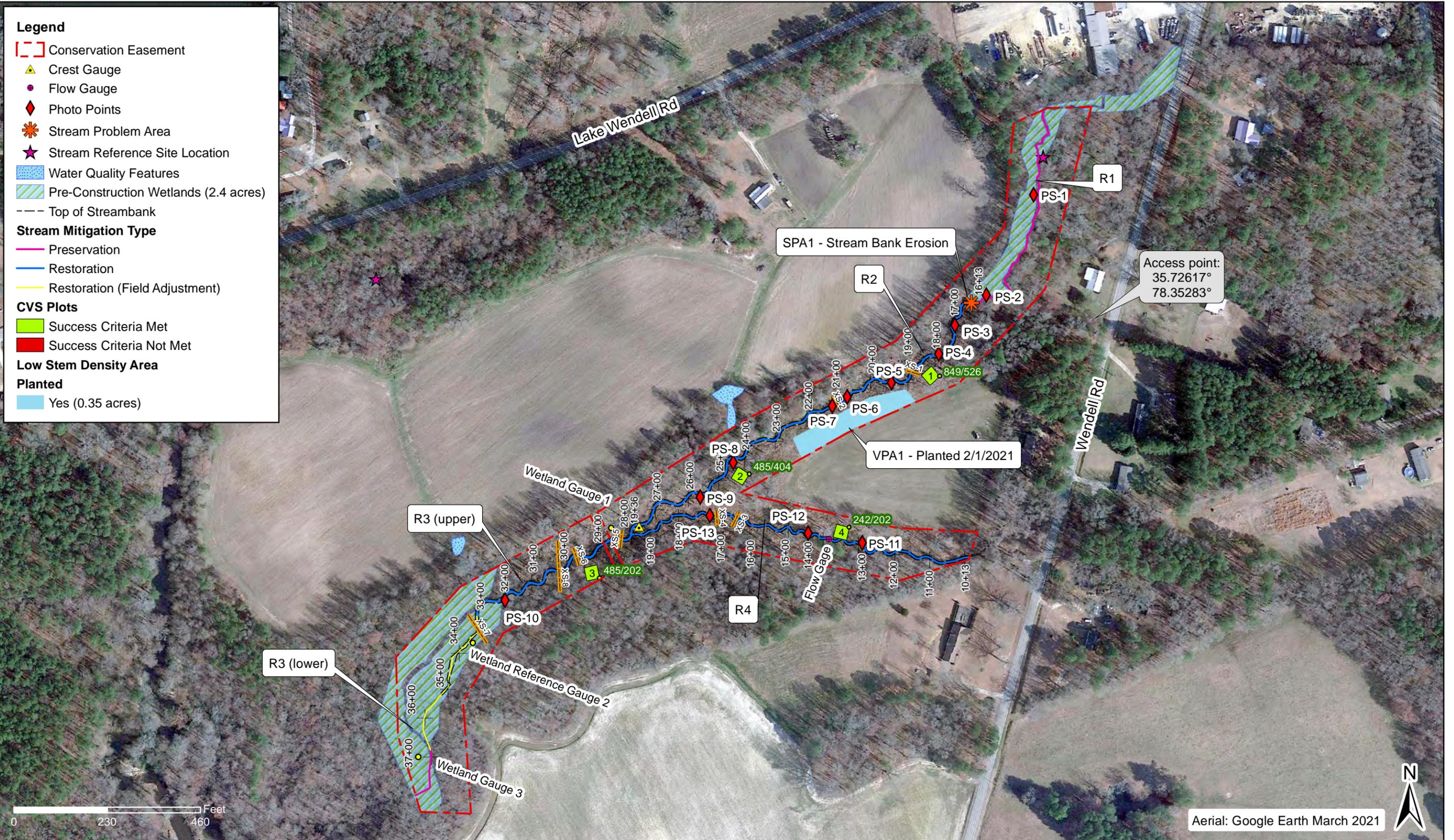
**Table 4. Project Information and Attributes**

|   |  |                       |                         |                        |                      |
|---|--|-----------------------|-------------------------|------------------------|----------------------|
| 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   |                       |                         |                        |                      |
| <b>Project Watershed Summary Information</b>                            |  |                       |                         |                        |                      |
| 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) |                       |                         |                        |                      |
| <b>Reach Summary Information</b>  |  |                       |                         |                        |                      |
| <b>Parameters</b>   | <b>Reach 1</b>   | <b>Reach 2</b>        | <b>Reach 3 (upper)</b>  | <b>Reach 3 (lower)</b> | <b>Reach 4</b>       |
| 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                  |
| <b>Wetland Summary Information</b>                                      |  |                       |                         |                        |                      |
| <b>Parameters</b>   | <b>Wetland 1</b>   | <b>Wetland 2</b>      | <b>Wetland 3</b>        |                        |                      |
| 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.)         |  |                       |                         |                        |                      |
| <b>Regulatory Considerations</b>  |  |                       |                         |                        |                      |
| <b>Parameters</b>   | <b>Applicable?</b>   | <b>Resolved?</b>      | <b>Supporting Docs?</b> |                        |                      |
| 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

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**Table 5. Visual Stream Morphology Stability Assessment**  
**Project Edwards-Johnson Mitigation Project (NCDEQ DMS Project ID# 97080)**  
**Reach ID R1, R2, R3 (upper) and R3 (lower)**  
**Assessed Length 3609**

| 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%  |
| <b>Totals</b>            |                      |  |                                       |                          | 1                           | 10                         | 100%                             | 0  | 0   | 100%  |
| 2. Engineered Structures | 1. Overall Integrity | Structures physically intact with no dislodged boulders or logs.   | 47                                    | 47                       |                             |                            | 100%                             |  |   |   |
|                          | 2. Grade Control     | Grade control structures exhibiting maintenance of grade across the sill.  | 24                                    | 24                       |                             |                            | 100%                             |  |   |   |
|                          | 2a. Piping           | Structures lacking any substantial flow underneath sills or arms.  | 11                                    | 11                       |                             |                            | 100%                             |  |   |   |
|                          | 3. Bank Protection   | Bank erosion within the structures extent of influence does <u>not</u> exceed 15%. (See guidance for this table in EEP monitoring guidance document)                 | 14                                    | 14                       |                             |                            | 100%                             |  |   |   |
|                          | 4. Habitat           | Pool forming structures maintaining ~ Max Pool Depth : Mean Bankfull Depth ratio $\geq$ 1.6 Rootwads/logs providing some cover at base-flow.                         | 12                                    | 12                       |                             |                            | 100%                             |  |   |   |

| Table 5a. Vegetation Condition Assessment                                |   |                   |                   |                    |                  |                       |
|--|---|-------------------|-------------------|--------------------|------------------|-----------------------|
| Project Edwards-Johnson Mitigation Project (NCDEQ DMS Project ID# 97080) |   |                   |                   |                    |                  |                       |
| Planted Acreage <sup>1</sup> 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.                                   | 1 acre            | 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  | 1                  | 0.35             | 9.7%                  |
| <b>Total</b>   |   |                   |                   | 1                  | 0.35             | 9.7%                  |
| 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%                  |
| <b>Cumulative Total</b>  |   |                   |                   | 1                  | 0.35             | 9.7%                  |
| Easement Acreage <sup>2</sup> 10.97                                      |   |                   |                   |                    |                  |                       |
| Vegetation Category  | Definitions   | Mapping Threshold | CCPV Depiction    | Number of Polygons | Combined Acreage | % of Easement Acreage |
| 4. Invasive Areas of Concern <sup>4</sup>                                | 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 <sup>3</sup>                              | 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, March 17, 2021 (MY-04)



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



PS-2, Reach R1, facing downstream, March 17, 2021 (MY-04)



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



PS-3, Reach R2, facing upstream, Sta 17+00, March 17, 2021 (MY-04)



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



PS-4, Reach R2, facing downstream, Sta 18+00, March 17, 2021 (MY-04)



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



PS-5, Reach R2, facing downstream, Sta 19+50, March 17, 2021 (MY-04)



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



PS-6, Reach R2, facing upstream, Sta 20+75, March 17, 2021 (MY-04)



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-04)



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



PS-8, Reach R2, facing downstream, Sta 24+50, March 17, 2021 (MY-04)



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



PS-9, Reach R2, facing upstream, Sta 25+75, March 17, 2021 (MY-04)



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



PS-10, Reach R3, facing downstream, Sta 32+00, March 17, 2021 (MY-04)



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



PS-11, Reach R4, facing upstream, Sta 13+00, March 17, 2021 (MY-04)



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



PS-11, Reach R4, facing downstream, Sta 13+00, March 17, 2021 (MY-04)



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



PS-12, Reach R4, facing upstream, Sta 14+00, March 17, 2021 (MY-04)



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



PS-13, Reach R4, facing upstream, Sta 17+00, March 17, 2021 (MY-04)



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



Veg Plot 1, September 15, 2021 (MY-04)



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



Veg Plot 2, September 15, 2021 (MY-04)



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



Veg Plot 3, September 15, 2021 (MY-04)



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



Veg Plot 4, September 15, 2021 (MY-04)



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)



VPA1, Low Stem Density Area, October 22, 2020 (MY-03)



VPA1, Low Stem Density Area, September 15, 2021 (MY-04)



VPA1, Low Stem Density Area, October 22, 2020 (MY-03)



VPA1, Low Stem Density Area, September 15, 2021 (MY-04)



## Appendix D – Stream Measurement and Geomorphology Data

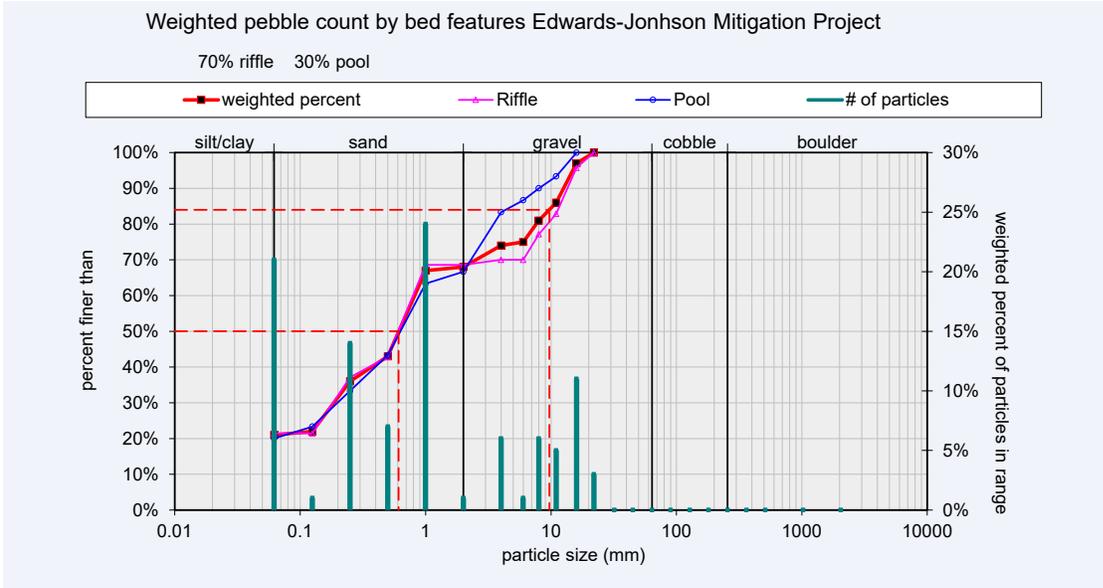
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Edwards-Johnson  
Figure 3: Pebble Count

|           |                  | Date Collected | 9/21/2018 | 10/18/2019 | 9/30/2020 | 9/15/2021 |         |         |         |
|-----------|------------------|----------------|-----------|------------|-----------|-----------|---------|---------|---------|
|           |                  |                | MY 1      | MY2        | MY3       | MY4       | MY5     | MY6     | MY7     |
| MATERIAL  | PARTICLE         | SIZE (mm)      | Total #   | Total #    | Total #   | Total #   | Total # | Total # | Total # |
| SILT/CLAY | Silt / Clay      | < .063         | 7         | 5          | 4         | 21        |         |         |         |
|           | Very Fine        | .063 - .125    | 4         | 6          | 2         | 1         |         |         |         |
|           | Fine             | .125 - .25     | 14        | 7          | 20        | 14        |         |         |         |
| SAND      | Medium           | .25 - .50      | 19        | 8          |           | 7         |         |         |         |
|           | Coarse           | .50 - 1.0      | 19        | 20         | 19        | 24        |         |         |         |
|           | Very Coarse      | 1.0 - 2.0      | 19        | 13         | 17        | 1         |         |         |         |
|           | Very Fine        | 2.0 - 2.8      | 7         | 7          | 1         | 4         |         |         |         |
|           | Very Fine        | 2.8 - 4.0      | 4         | 7          | 2         | 2         |         |         |         |
| GRAVEL    | Fine             | 4.0 - 5.6      | 2         | 7          | 2         | 1         |         |         |         |
|           | Fine             | 5.6 - 8.0      |           | 4          | 11        | 6         |         |         |         |
|           | Medium           | 8.0 - 11.0     | 1         | 3          | 7         | 5         |         |         |         |
|           | Medium           | 11.0 - 16.0    | 1         | 6          | 9         | 11        |         |         |         |
|           | Coarse           | 16 - 22.6      | 1         | 4          | 2         | 3         |         |         |         |
|           | Coarse           | 22.6 - 32      | 2         | 3          | 1         |           |         |         |         |
|           | Very Coarse      | 32 - 45        |           |            | 1         |           |         |         |         |
|           | Very Coarse      | 45 - 64        |           |            | 2         |           |         |         |         |
|           | Small            | 64 - 90        |           |            |           |           |         |         |         |
|           | Small            | 90 - 128       |           |            |           |           |         |         |         |
| COBBLE    | Large            | 128 - 180      |           |            |           |           |         |         |         |
|           | Large            | 180 - 256      |           |            |           |           |         |         |         |
| BOULDER   | Small            | 256 - 362      |           |            |           |           |         |         |         |
|           | Small            | 362 - 512      |           |            |           |           |         |         |         |
|           | Medium           | 512 - 1024     |           |            |           |           |         |         |         |
| BEDROCK   | Large-Very Large | 1024 - 2048    |           |            |           |           |         |         |         |
|           | Bedrock          | > 2048         |           |            |           |           |         |         |         |
| Total     |                  |                | 100       | 100        | 100       | 100       | 0       | 0       | 0       |

| Cumulative | D16 | 0.16 | 0.2  | 0.18 | 0.062 |  |  |  |
|------------|-----|------|------|------|-------|--|--|--|
|            | D35 | 0.36 | 0.66 | 0.69 | 0.24  |  |  |  |
|            | D50 | 0.62 | 1.1  | 1.2  | 0.61  |  |  |  |
|            | D65 | 1.1  | 2.5  | 4    | 0.94  |  |  |  |
|            | D84 | 2.4  | 7.8  | 11   | 9.7   |  |  |  |
|            | D95 | N/A  | 19   | 19   | 15    |  |  |  |

| MY4 | Riffle            |       | Pool              |       |
|-----|-------------------|-------|-------------------|-------|
|     | Channel materials |       | Channel materials |       |
|     | D16 =             | 0.062 | D16 =             | 0.062 |
|     | D35 =             | 0.23  | D35 =             | 0.28  |
|     | D50 =             | 0.61  | D50 =             | 0.63  |
|     | D65 =             | 0.91  | D65 =             | 1.4   |
|     | D84 =             | 11    | D84 =             | 4.3   |
|     | D95 =             | 16    | D95 =             | 12    |



**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 |     |
|--|---------------------------|-----------|----------------------|-------|--------|-----|--------------------|-----|
|  | Min                       | Max       | Min                  | Max   | Min    | Max | Min                | Max |
| <b>Reach ID: R1 (Preservation)</b>               |                           |           |                      |       |        |     |                    |     |
| <b>Dimension (Riffle)</b>                        | 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 <sup>2</sup> ) | 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   | -      | -   | -                  | -   |
| <b>Profile</b>                                   |                           |           |                      |       |        |     |                    |     |
| 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  | -      | -   | -                  | -   |
| <b>Pattern</b>                                   |                           |           |                      |       |        |     |                    |     |
| 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   | -      | -   | -                  | -   |
| <b>Transport Parameters</b>                      |                           |           |                      |       |        |     |                    |     |
| Boundary Shear Stress (lb/ft <sup>2</sup> )      | -                         | -         | -                    | -     | -      | -   | -                  | -   |
| Max part size (mm) mobilized at bankfull         | -                         | -         | -                    | -     | -      | -   | -                  | -   |
| Stream Power (W/m <sup>2</sup> )                 | -                         | -         | -                    | -     | -      | -   | -                  | -   |
| <b>Additional Reach Parameters</b>               |                           |           |                      |       |        |     |                    |     |
| 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 |      |
|--|---------------------------|-----------|----------------------|-------|--------|-------|--------------------|------|
|  | Min                       | Max       | Min                  | Max   | Min    | Max   | Min                | Max  |
| <b>Reach ID: R2</b>                              |                           |           |                      |       |        |       |                    |      |
| <b>Dimension (Riffle)</b>                        | 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 <sup>2</sup> ) | 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                | -    |
| <b>Profile</b>                                   |                           |           |                      |       |        |       |                    |      |
| 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 |
| <b>Pattern</b>                                   |                           |           |                      |       |        |       |                    |      |
| 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  |
| <b>Transport Parameters</b>                      |                           |           |                      |       |        |       |                    |      |
| Boundary Shear Stress (lb/ft <sup>2</sup> )      | -                         | -         | -                    | -     | 0.49   | -     | -                  | -    |
| Max part size (mm) mobilized at bankfull         | -                         | -         | -                    | -     | 2.00   | -     | -                  | -    |
| Stream Power (W/m <sup>2</sup> )                 | -                         | -         | -                    | -     | 31.00  | -     | -                  | -    |
| <b>Additional Reach Parameters</b>               |                           |           |                      |       |        |       |                    |      |
| 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/<br>Baseline |      |
|--|---------------------------|-------|----------------------|-------|--------|------|-----------------------|------|
| <b>Reach ID: R3 (upper)</b>                      |                           |       |                      |       |        |      |                       |      |
| <b>Dimension (Riffle)</b>                        | 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 <sup>2</sup> ) | 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  |
| <b>Profile</b>                                   |                           |       |                      |       |        |      |                       |      |
| 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 |
| <b>Pattern</b>                                   |                           |       |                      |       |        |      |                       |      |
| 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  |
| <b>Transport Parameters</b>                      |                           |       |                      |       |        |      |                       |      |
| Boundary Shear Stress (lb/ft <sup>2</sup> )      | -                         |       | -                    |       | 0.51   |      | -                     |      |
| Max part size (mm) mobilized at bankfull         | -                         |       | -                    |       | 2.00   |      | -                     |      |
| Stream Power (W/m <sup>2</sup> )                 | -                         |       | -                    |       | 28.90  |      | -                     |      |
| <b>Additional Reach Parameters</b>               |                           |       |                      |       |        |      |                       |      |
| 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/<br>Baseline |     |
|--|---------------------------|-------|----------------------|-------|--------|-----|-----------------------|-----|
| <b>Reach ID: R3 (lower) Preservation</b>         |                           |       |                      |       |        |     |                       |     |
| <b>Dimension (Riffle)</b>                        | 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 <sup>2</sup> ) | 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   | -      | -   | -                     | -   |
| <b>Profile</b>                                   |                           |       |                      |       |        |     |                       |     |
| 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  | -      | -   | -                     | -   |
| <b>Pattern</b>                                   |                           |       |                      |       |        |     |                       |     |
| 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   | -      | -   | -                     | -   |
| <b>Transport Parameters</b>                      |                           |       |                      |       |        |     |                       |     |
| Boundary Shear Stress (lb/ft <sup>2</sup> )      | -                         |       | -                    |       | 0.49   |     | -                     |     |
| Max part size (mm) mobilized at bankfull         | -                         |       | -                    |       | 2.00   |     | -                     |     |
| Stream Power (W/m <sup>2</sup> )                 | -                         |       | -                    |       | 29.00  |     | -                     |     |
| <b>Additional Reach Parameters</b>               |                           |       |                      |       |        |     |                       |     |
| 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/<br>Baseline |      |
|--|---------------------------|-------|----------------------|-------|--------|------|-----------------------|------|
| <b>Reach ID: R4</b>                              |                           |       |                      |       |        |      |                       |      |
| <b>Dimension (Riffle)</b>                        | 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 <sup>2</sup> ) | 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                   | -    |
| <b>Profile</b>                                   |                           |       |                      |       |        |      |                       |      |
| 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 |
| <b>Pattern</b>                                   |                           |       |                      |       |        |      |                       |      |
| 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  |
| <b>Transport Parameters</b>                      |                           |       |                      |       |        |      |                       |      |
| Boundary Shear Stress (lb/ft <sup>2</sup> )      | -                         |       | -                    |       | 0.48   |      | -                     |      |
| Max part size (mm) mobilized at bankfull         | -                         |       | -                    |       | 2.00   |      | -                     |      |
| Stream Power (W/m <sup>2</sup> )                 | -                         |       | -                    |       | 24.50  |      | -                     |      |
| <b>Additional Reach Parameters</b>               |                           |       |                      |       |        |      |                       |      |
| 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 |     |     | 8.4                      | 13.3 | 5.8   | 6.1   | N/A |     |     | 9.2                    | 9.3  | 8.7   | 7.8  | N/A |     |     |
| Floodprone Width (ft)                            | 32.0                     | 32.0 | 34.0  | 34.0  | N/A |     |     | 31.0                     | 30.7 | 31.0  | 31.0  | N/A |     |     | 40.0                   | 40.4 | 40.0  | 40.0 | N/A |     |     |
| Bankfull Mean Depth (ft)                         | 0.6                      | 0.7  | 0.6   | 0.6   | N/A |     |     | 0.8                      | 0.5  | 1.1   | 1.1   | N/A |     |     | 1.1                    | 1.2  | 1.3   | 1.4  | N/A |     |     |
| Bankfull Max Depth (ft)                          | 1.2                      | 1.3  | 1.2   | 1.3   | N/A |     |     | 1.7                      | 1.6  | 1.8   | 1.9   | N/A |     |     | 2.0                    | 2.1  | 2.3   | 2.3  | N/A |     |     |
| Bankfull Cross Sectional Area (ft <sup>2</sup> ) | 5.2                      | 4.9  | 4.9   | 4.9   | N/A |     |     | 6.7                      | 6.5  | 6.5   | 6.5   | N/A |     |     | 10.4                   | 11.0 | 11.0  | 11.0 | N/A |     |     |
| Bankfull Width/Depth Ratio                       | 15.9                     | 11.4 | 15.0  | 12.4  | N/A |     |     | 10.6                     | 27.8 | 5.1   | 5.8   | N/A |     |     | 8.2                    | 7.9  | 6.8   | 5.5  | N/A |     |     |
| Bankfull Entrenchment Ratio                      | 3.6                      | 4.2  | 4.0   | 4.4   | N/A |     |     | 3.7                      | 2.3  | 5.4   | 5.1   | N/A |     |     | 4.3                    | 4.3  | 4.6   | 5.1  | N/A |     |     |
| Bankfull Bank Height Ratio                       | 1.0                      | 1.0  | 0.9   | 0.9   | N/A |     |     | <1.0                     | 1.0  | 1.0   | 1.0   | N/A |     |     | 1.0                    | 1.0  | 1.0   | 1.0  | N/A |     |     |
| d50 (mm)   | N/a                      | 0.8  | 1.8   | 1.7   | 0.6 |     |     | N/a                      | 0.4  | 0.3   | 0.3   | 0.6 |     |     | N/a                    | 0.4  | 0.3   | 0.3  | 0.6 |     |     |
|  | 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 |     |     | 8.8                      | 8.0  | 6.8   | 6.8   | N/A |     |     | 10.4                   | 14.3 | 25.7  | 5.8  | N/A |     |     |
| Floodprone Width (ft)                            | 38.0                     | 38.2 | 38.0  | 38.0  | N/A |     |     | 38.0                     | 44.8 | 44.0  | 44.0  | N/A |     |     | 44.0                   | 44.5 | 44.0  | 44.0 | N/A |     |     |
| Bankfull Mean Depth (ft)                         | 0.6                      | 0.6  | 0.6   | 0.5   | N/A |     |     | 0.6                      | 0.7  | 0.7   | 0.7   | N/A |     |     | 0.7                    | 0.4  | 0.2   | 1.0  | N/A |     |     |
| Bankfull Max Depth (ft)                          | 1.0                      | 1.0  | 1.0   | 0.9   | N/A |     |     | 1.0                      | 1.3  | 1.4   | 1.4   | N/A |     |     | 1.4                    | 1.1  | 1.0   | 1.4  | N/A |     |     |
| Bankfull Cross Sectional Area (ft <sup>2</sup> ) | 5.4                      | 5.2  | 5.2   | 5.2   | N/A |     |     | 5.5                      | 4.7  | 4.7   | 4.7   | N/A |     |     | 7.7                    | 5.6  | 5.6   | 5.6  | N/A |     |     |
| Bankfull Width/Depth Ratio                       | 14.3                     | 13.0 | 13.0  | 17.8  | N/A |     |     | 14.3                     | 12.1 | 9.9   | 9.9   | N/A |     |     | 14.1                   | 37.1 | 117.0 | 6.0  | N/A |     |     |
| Bankfull Entrenchment Ratio                      | 4.3                      | 4.7  | 4.6   | 4.0   | N/A |     |     | 4.3                      | 5.6  | 6.4   | 6.5   | N/A |     |     | 4.2                    | 3.1  | 1.7   | 7.6  | N/A |     |     |
| Bankfull Bank Height Ratio                       | 1.0                      | 1.0  | 0.9   | 1.0   | N/A |     |     | 1.0                      | 1.0  | 1.1   | 1.0   | N/A |     |     | 1.0                    | 1.0  | 0.9   | 1.2  | N/A |     |     |
| d50 (mm)   | N/a                      | 0.8  | 1.8   | 1.7   | 0.6 |     |     | N/a                      | 0.8  | 1.8   | 1.7   | 0.6 |     |     | N/a                    | 0.4  | 0.3   | 0.3  | 0.6 |     |     |
|  | 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 |     |     | N/A                      | N/A  | 24.8  | 24.7  | N/A |     |     |                        |      |       |      |     |     |     |
| Floodprone Width (ft)                            | 27.0                     | 31.7 | 64.0  | 59.1  | N/A |     |     | N/A                      | N/A  | 135.8 | 131.0 | N/A |     |     |                        |      |       |      |     |     |     |
| Bankfull Mean Depth (ft)                         | 0.3                      | 0.3  | 0.4   | 0.2   | N/A |     |     | N/A                      | N/A  | 0.2   | 0.2   | N/A |     |     |                        |      |       |      |     |     |     |
| Bankfull Max Depth (ft)                          | 0.4                      | 0.3  | 0.2   | 0.4   | N/A |     |     | N/A                      | N/A  | 0.8   | 0.7   | N/A |     |     |                        |      |       |      |     |     |     |
| Bankfull Cross Sectional Area (ft <sup>2</sup> ) | 4.7                      | 4.7  | 4.7   | 4.7   | N/A |     |     | N/A                      | N/A  | 4.7   | 4.7   | N/A |     |     |                        |      |       |      |     |     |     |
| Bankfull Width/Depth Ratio                       | 71.8                     | 69.7 | 158.9 | 174.2 | N/A |     |     | N/A                      | N/A  | 130.6 | 131.4 | N/A |     |     |                        |      |       |      |     |     |     |
| Bankfull Entrenchment Ratio                      | 1.5                      | 1.7  | 2.4   | 2.1   | N/A |     |     | N/A                      | N/A  | 5.5   | 5.3   | N/A |     |     |                        |      |       |      |     |     |     |
| Bankfull Bank Height Ratio                       | 1.0                      | 1.0  | 1.1   | 0.9   | N/A |     |     | N/A                      | N/A  | 1.0   | 1.0   | N/A |     |     |                        |      |       |      |     |     |     |
| d50 (mm)   | N/a                      | 0.8  | 1.8   | 1.7   | 0.6 |     |     | N/a                      | 0.8  | 1.8   | 1.7   | 0.6 |     |     |                        |      |       |      |     |     |     |



| Parameter                                   | Baseline |       | MY1 |     | MY2 |     | MY3 |     | MY4 |     | MY5 |     |
|---|----------|-------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Reach ID: R3 (upper)                        |          |       |     |     |     |     |     |     |     |     |     |     |
|   | Min      | Max   | Min | Max | Min | Max | Min | Max | Min | Max | Min | Max |
| <b>Profile</b>                              |          |       |     |     |     |     |     |     |     |     |     |     |
| 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  |     |     |     |     |     |     |     |     |     |     |
| <b>Pattern</b>                              |          |       |     |     |     |     |     |     |     |     |     |     |
| 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   |     |     |     |     |     |     |     |     |     |     |
| <b>Additional Reach Parameters</b>          |          |       |     |     |     |     |     |     |     |     |     |     |
| Rosgen Classification                       | C5       |       |     |     |     |     |     |     |     |     |     |     |
| Sinuosity (ft)                              | 1.16     |       |     |     |     |     |     |     |     |     |     |     |
| Water Surface Slope (Channel) (ft/ft)       | 0.009    |       |     |     |     |     |     |     |     |     |     |     |
| BF slope (ft/ft)                            | 0.011    |       |     |     |     |     |     |     |     |     |     |     |
| <sup>3</sup> Ri% / Ru% / P% / G% / S%       |          |       |     |     |     |     |     |     |     |     |     |     |
| <sup>3</sup> SC% / Sa% / G% / C% / B% / Be% |          |       |     |     |     |     |     |     |     |     |     |     |
| <sup>3</sup> d16 / d35 / d50 / d84 / d95 /  |          |       |     |     |     |     |     |     |     |     |     |     |
| <sup>2</sup> % 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 |
| <b>Profile</b>                              |          |       |     |     |     |     |     |     |     |     |     |     |
| 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    |     |     |     |     |     |     |     |     |     |     |
| <b>Pattern</b>                              |          |       |     |     |     |     |     |     |     |     |     |     |
| 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     |     |     |     |     |     |     |     |     |     |     |
| <b>Additional Reach Parameters</b>          |          |       |     |     |     |     |     |     |     |     |     |     |
| Rosgen Classification                       | C5       |       |     |     |     |     |     |     |     |     |     |     |
| Sinuosity (ft)                              | 1.14     |       |     |     |     |     |     |     |     |     |     |     |
| Water Surface Slope (Channel) (ft/ft)       | 0.017    |       |     |     |     |     |     |     |     |     |     |     |
| BF slope (ft/ft)                            | 0.017    |       |     |     |     |     |     |     |     |     |     |     |
| <sup>3</sup> Ri% / Ru% / P% / G% / S%       |          |       |     |     |     |     |     |     |     |     |     |     |
| <sup>3</sup> SC% / Sa% / G% / C% / B% / Be% |          |       |     |     |     |     |     |     |     |     |     |     |
| <sup>3</sup> d16 / d35 / d50 / d84 / d95 /  |          |       |     |     |     |     |     |     |     |     |     |     |
| <sup>2</sup> % 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

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**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      |

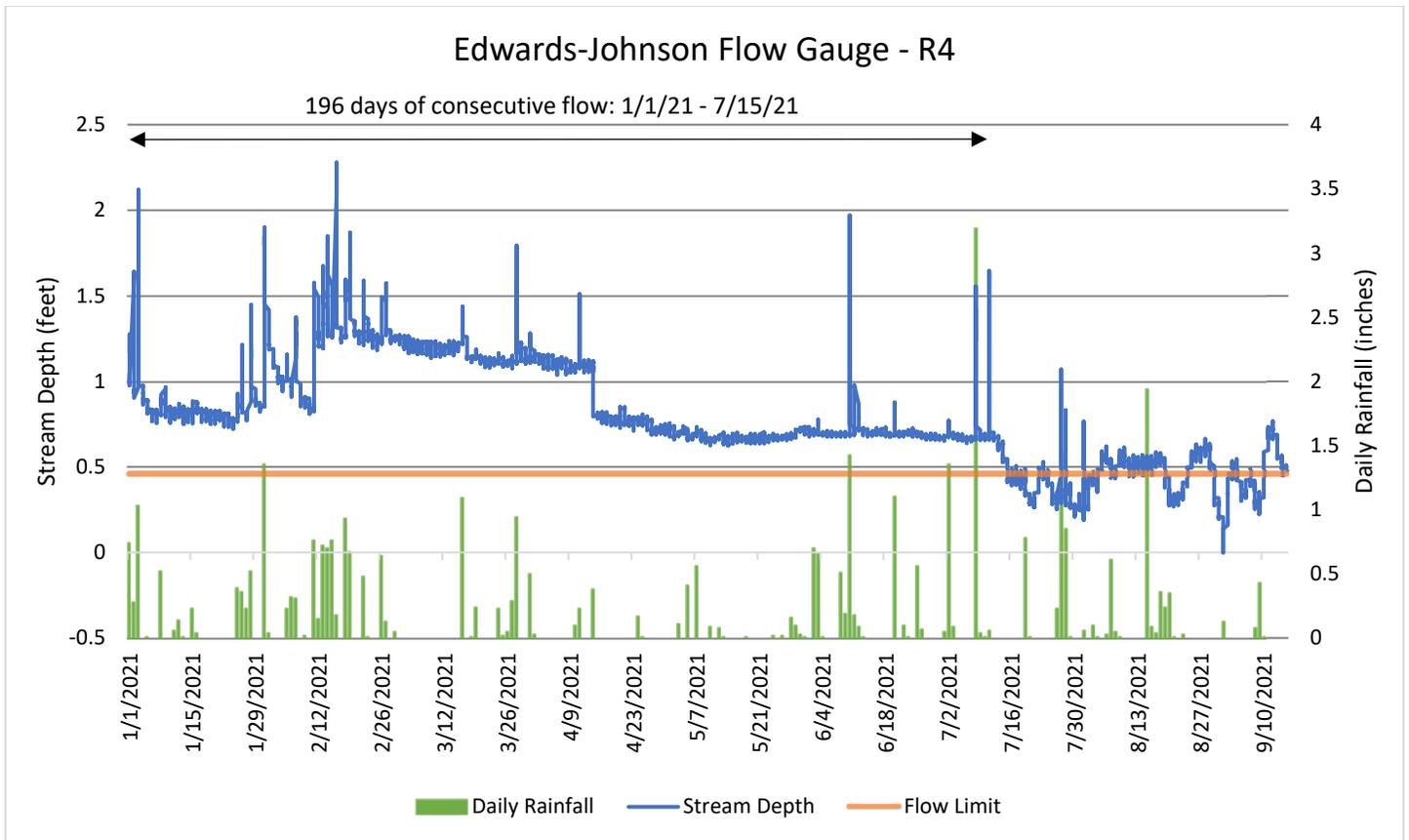


1/13/2021

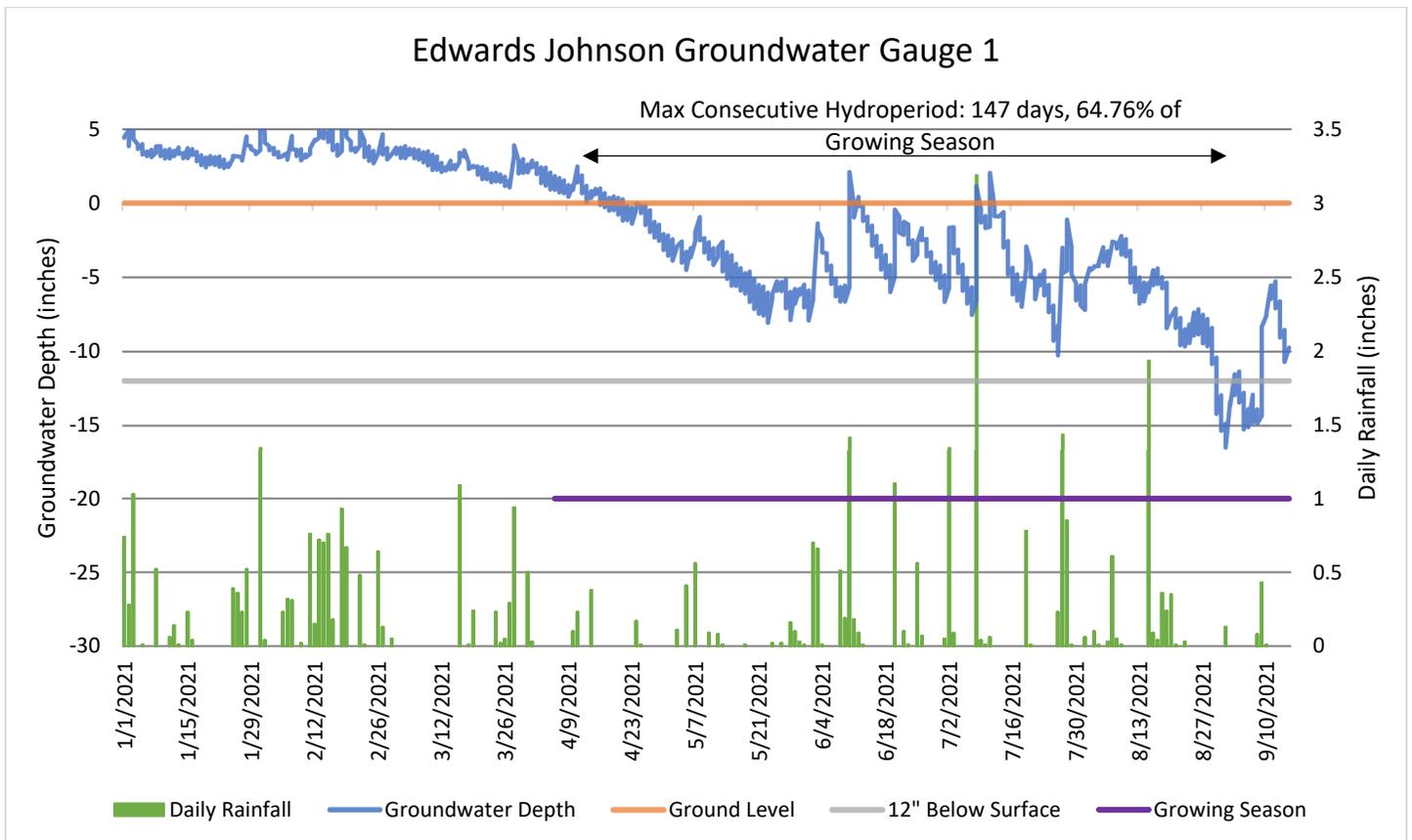


7/13/2021

Figure 4a:

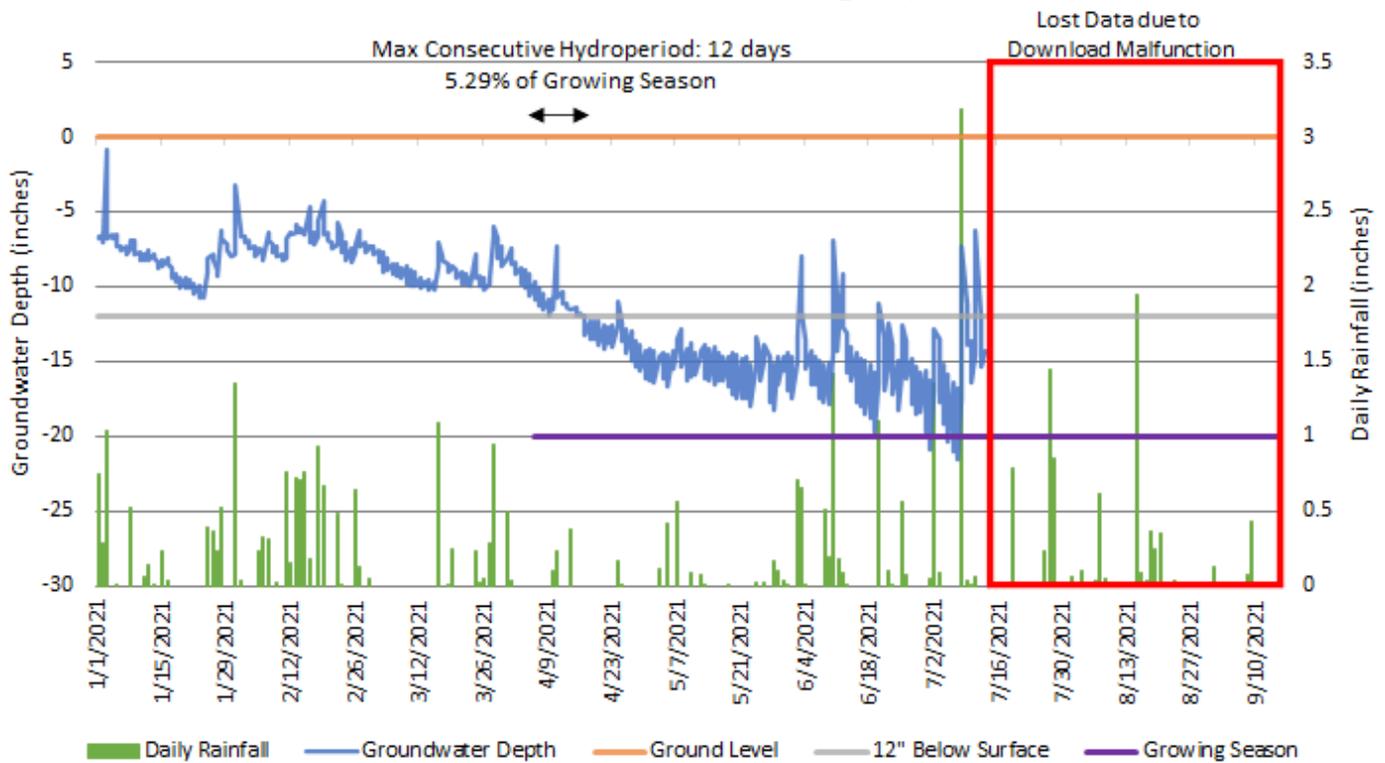


Longest consecutive days of flow: 196 days, January 1, 2021 - July 15, 2021.



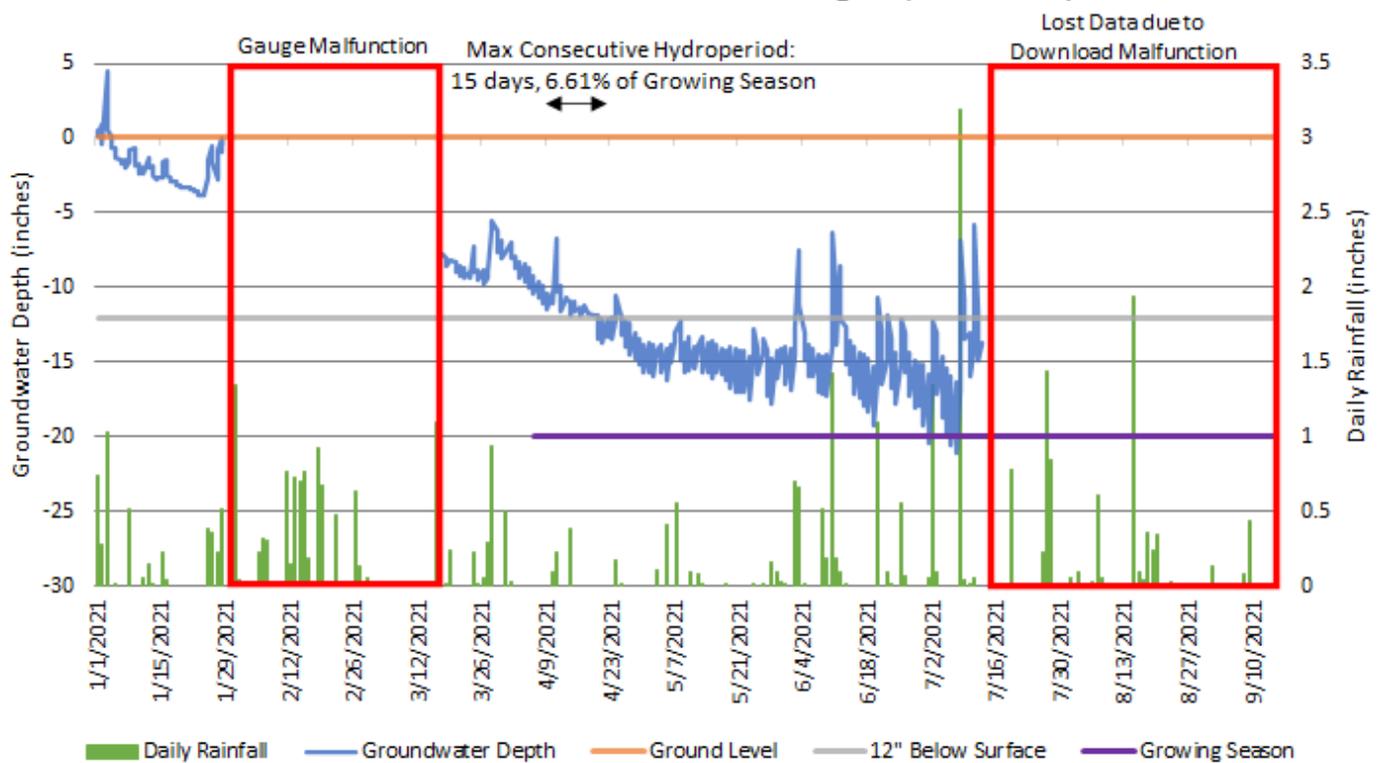
Max Consecutive Hydroperiod: 147 days, April 6, 2021 - August 30, 2021, 64.76 % of Growing Season

### Edwards Johnson Groundwater Gauge 2 (Reference)



Max Consecutive Hydroperiod: 12 days, April 6, 2021 - April 17, 2021, 5.29 % of Growing Season

### Edwards Johnson Groundwater Gauge 3 (Reference)



Max Consecutive Hydroperiod: 15 days, April 6, 2021 - April 20, 2021, 6.61 % of Growing Season

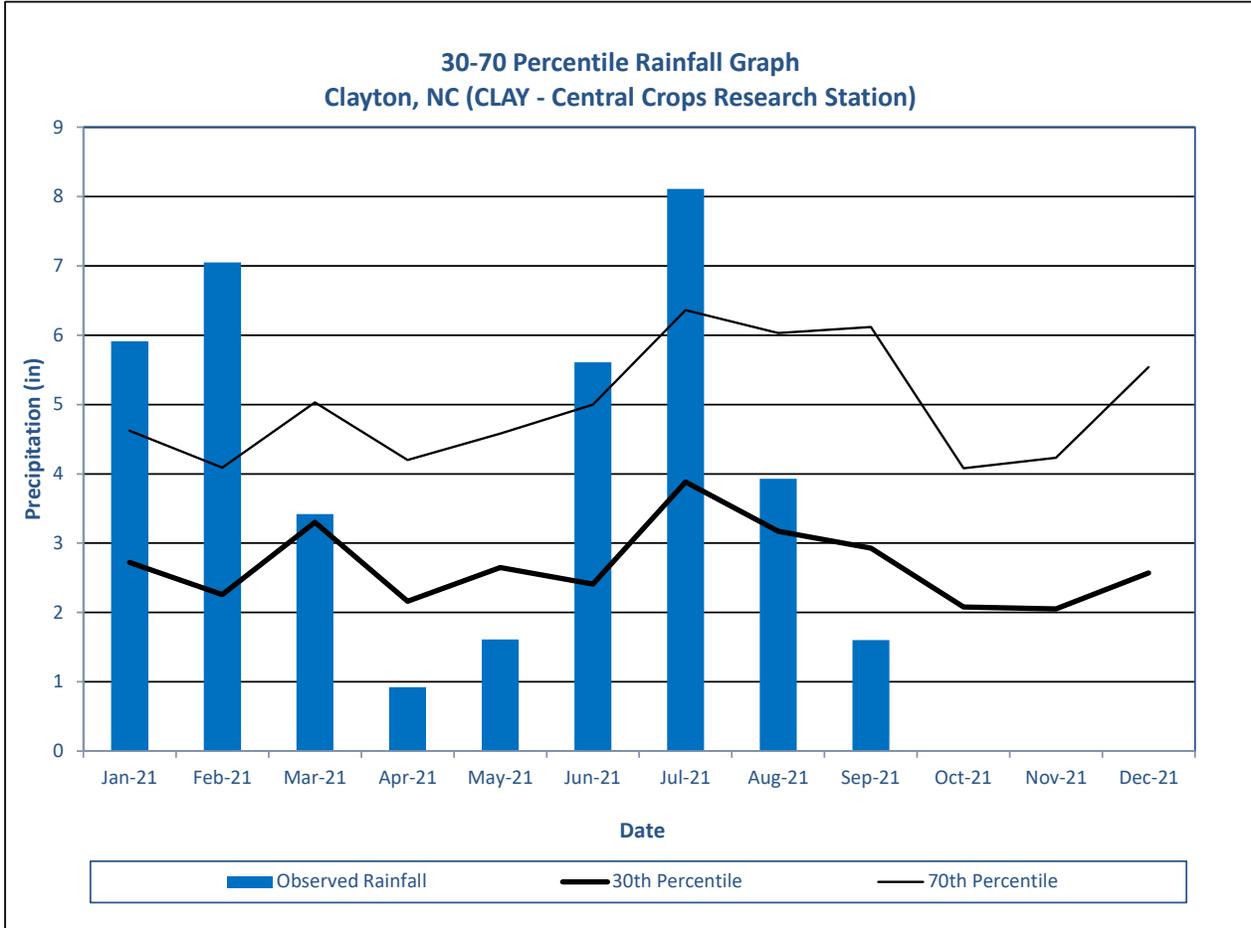
All Gauges are Pressure Transducers

Figure 4b - Groundwater Gauge Data  
 Edwards-Johnson Mitigation Project (NCDEQ DMS Project ID# 97080)  
 MY4 2021

| Monitoring Gauge Name                     | Max Consecutive Hydroperiod: Saturation within 12 Inches of Soil Surface<br>(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% |      |      |      |      |
| Edwards-Johnson Reference Wetland Gauge 2 | M   | 39.21% | 84.14% | 5.29%  |      |      |      |      |
| Edwards-Johnson Reference Wetland Gauge 3 | N/A   | N/A    | 37.00% | 6.61%  |      |      |      |      |

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

**Figure 5: Monthly Rainfall Data**  
**Edwards-Johnson Mitigation Project (NCDEQ DMS Project ID# 97080)**  
**MY4 2021**



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

\*\*Incomplete Month

| Month  | 30%  | 70%  | Observed |
|--------|------|------|----------|
| Jan-21 | 2.72 | 4.62 | 5.91     |
| Feb-21 | 2.26 | 4.09 | 7.05     |
| Mar-21 | 3.30 | 5.03 | 3.42     |
| Apr-21 | 2.16 | 4.20 | 0.92     |
| May-21 | 2.65 | 4.58 | 1.61     |
| Jun-21 | 2.41 | 5.00 | 5.61     |
| Jul-21 | 3.88 | 6.36 | 8.11     |
| Aug-21 | 3.17 | 6.03 | 3.93     |
| Sep-21 | 2.93 | 6.12 | 1.60     |
| Oct-21 | 2.08 | 4.08 | **       |
| Nov-21 | 2.05 | 4.23 | **       |
| Dec-21 | 2.57 | 5.54 | **       |