AS-BUILT BASELINE MONITORING REPORT

FINAL

DEEP MEADOW MITIGATION SITE

Union County, NC
DEQ Contract No. 6887
DMS Project No. 97131
USACE Action ID No. SAW-2012-01107
NCDEQ DWR Certification No. 18-0264
Yadkin River Basin
HUC 03040105

Data Collection Period: October 2019 – January 2020
Submission Date: April 6, 2020

PREPARED FOR:

NC Department of Environmental Quality
Division of Mitigation Services
217 West Jones Street; 3rd Floor
Raleigh, NC 27603

April 6, 2020

Mr. Harry Tsomides
Project Manager
NCDEQ – Division of Mitigation Services
5 Ravenscroft Dr., Suite 102
Asheville, NC 28801

RE: Final Milestone 6 - As-built Baseline Monitoring Report for the Deep Meadow Mitigation Site;
Yadkin River Basin – CU# 03040105 – Yadkin County
DMS Project ID No. 97131
Contract # 006887

Dear Mr. Tsomides:

Wildlands Engineering, Inc. (Wildlands) has reviewed the Division of Mitigation Services (DMS) comments from the Draft As-built Baseline Monitoring report for the Deep Meadow Mitigation Site. The report has been updated to reflect those comments. The Final As-built Baseline Monitoring Document and Record Drawings are included. Wildlands' responses to DMS' report comments are noted below in *italics*.

DMS comment: Please include the Post-Contract IRT Site Walk Meeting Minutes (July 20, 2016) as a project appendix. There were discussions relevant to performance criteria and monitoring. This need not be carried over to the annual monitoring reports moving forward.

Wildlands response: The Post-Contract IRT Site Walk Meeting Minutes (July 20, 2016) are included in Appendix 1.

DMS comment: Please include the credit release schedule from the approved Mitigation Plan. This need not be carried over to the annual monitoring reports moving forward.

Wildlands response: The Credit Release Schedule from the approved Mitigation Plan has been added and is located in the document as Sections 6.0, 6.1, and 6.2. The References have been moved to Section 7.0.

DMS comment; The report looks complete and accurate. However, there are a few minor instances where the as-built report does not reflect the approved Mitigation Plan; these need to be rectified or explained more fully. These are as follows:

a) **Table 1 (Project Assets): Stream as-built lengths and assets match the approved Mitigation Plan. However, there are minor variances in wetland acreages, and the resulting credits (8.647) exceed the credits approved in the Mitigation Plan (8.59). Any changes in crediting from the approved Mitigation Plan moving forward would require submittal to the IRT and approval of a Mitigation Plan Addendum. Please adjust the listed wetland credits to match the approved Mitigation Plan, and add a footnote to the Table explaining that, while as-built wetland acreage/potential crediting exceeds that of the Mitigation Plan, the project assets listed reflect the approved Mitigation Plan.**

b) **Section 2.3 (Wetland Performance Standards): It is stated "If a gage does not meet the performance standard for a given monitoring year, rainfall patterns will be analyzed, and the hydrograph will be compared to that of the reference wetlands analyzed in the Deep Meadow**

Mitigation Plan (2018) to assess whether atypical weather conditions occurred during the monitoring period. In addition, on-site soil temperatures corroborated with vegetative indicators, including bud burst and leaf drop, may be used as documentation to extend the growing season."

Growing season adjustments were not discussed in the Mitigation Plan. Please note that any growing season adjustments would require prior approval before being used to evaluate project success.

c) Section 3.2 (Vegetation Monitoring): It is indicated here (as well as Table 5, Monitoring Components) that 4 mobile plots will replace 4 of the permanent plots. Please clarify and justify why WEI is proposing to install and monitor 4 random circular plots and 12 permanent plots, versus the 16 permanent plots approved in the Mitigation Plan.

d) Section 4.1 (Adaptive Management Plan): Narrative has been added to explain the conditions under which WEI would take adaptive management actions, if deemed necessary. Please add to the section that if, during annual monitoring it is determined the Site's ability to achieve Site performance standards are jeopardized, Wildlands will notify the members of the IRT and work with the IRT to develop contingency plans and remedial actions.

Wildlands response:

a). In Table 1 Project Assets: Because minor variances in the as-built wetland acreages would have resulted in a credit discrepancy from what was approved in the Mitigation Plan, the listed wetland credits were adjusted to match the approved Mitigation Plan. A footnote has been added to the Table explaining that, while the "Actual as-built wetland acreage/potential crediting slightly differs (excess or loss) from the Mitigation Plan, the project credit assets listed have been adjusted to reflect those of the approved Mitigation Plan".

b). Section 2.3 (Wetland Performance Standards): The discussion text for growing season adjustments has been removed from this section.

c.) Section 3.2 (Vegetation Monitoring): The vegetation monitoring protocol outlined in the Deep Meadow Mitigation Site As-built Baseline Monitoring Report follows the requirements presented in Section V, Planted Vegetation Monitoring, of the 2016 Stream Mitigation Guidelines development by the US Army Corp of Engineers. Whereas it states that "A combination of permanent fixed plots and random plots should be used to demonstrate vegetation coverage. Random plots should not make up more than 50% of the total required plots. Random plots may be a different plot type (e.g., circular, transect, etc.), but should be the same size as the fixed plots. The monitoring plots must make up a minimum of 2% of the planted portion of the site with a minimum of 4 plots." Therefore, based on these guidelines with respect to this site, since the required number of vegetation monitoring plots is 16, the number of random plots should not make up more than 50% of the required plots. Our number of random plots equals 4, which is only 25% of the required plots.

d.) Section 4.1 (Adaptive Management Plan): The requested text has been added to this section.

DMS comment; Table 2 (Project Activity and Reporting): Cells should be blank where no data has been collected or reported (MY1 through MY7).

Wildlands response: As directed, text has been removed from the cells where no data has been collected or reported (MY1 through MY7).

DMS comment; As stipulated in Section 6.2 (Financial Assurance) of RFP #16-006785, you will need to retire the performance bond for this project and substitute it for a monitoring phase performance bond for 25% of the value of the Deep Meadow contract #006887.

Wildlands response: The performance bond has been retired and a monitoring phase performance bond has been secured and reviewed by Jeff Jurek with DMS.

DMS comment; Digital Submittal

a) **Please provide the as-built survey .pdf and .dwg files with the final electronic submittal. This as-built survey should bear a Professional Land Surveyor (PLS) seal.**

b) **Please provide the final record drawings .dwg files with the final electronic submittal.**

c) **Please include all required project permits and the FEMA Floodplain Compliance permit (if applicable) and any supporting documentation in the final electronic submittal. This should be included in a separate "Project Permits" folder.**

d) **DMS have approved the draft GIS digitals submittal. All GIS features match with the as-built condition.**

e) **Please resubmit the complete set of digital support files previously submitted, so that any changes as the result of these edits are captured.**

Wildlands response: As directed, the following has been included as part of the digital submittal.

a) A pdf of the sealed as-built survey and the associated .dwg files have been included the As-Built Plans\PDFs and \DWGs folders, respectively, of the electronic submittal.
b) The final record drawings .dwg files have been included in As-Built Plans\DWGs folder of the electronic submittal.
c) A copy of all required project permits and any supporting documentation in the "Project Permits" folder of the electronic submittal.
d) As requested, a complete set of the revised digital support files have included.

As requested, Wildlands has included two hard copies of the Final Deep Meadow Mitigation Site As-built Baseline Monitoring Report, as well as a CD with a PDF of the report and all digital support files in the correct file structure. Additionally, a copy of our response letter has been included inside the front cover of each hard copy report and included in the final PDF of the report.

Sincerely,

Kristi Suggs
Senior Environmental Scientist
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PREPARED BY:

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EXECUTIVE SUMMARY

Wildlands Engineering, Inc. (Wildlands) implemented a full-delivery stream and wetland mitigation project at the Deep Meadow Mitigation Site (Site) for the North Carolina Department of Environmental Quality (DEQ) Division of Mitigation Services (DMS). The project restored, enhanced and preserved a total of 4,365 linear feet (LF) of perennial stream in Union County, NC. In addition, the project rehabilitated 0.58 acres and re-established 8.26 acres of riparian wetlands. The Site is located within the DMS targeted watershed for the Yadkin River Basin HUC 03040105070060 and the NC Division of Water Resources (DWR) Subbasin 03-07-14. The project is providing 2,838.933 stream mitigation units (SMUs) and 8.590 wetland mitigation units (WMUs) for the Yadkin River Basin Hydrologic Unit Code (HUC) 03040105 (Yadkin 05).

The Site's immediate drainage area as well as the surrounding watershed has a long history of agricultural activity. Stream and wetland functional stressors for the Site were related to both historic and current land use practices. Major stream stressors for the Site included channel incision and widening, a lack of stabilizing riparian vegetation, a lack of bedform diversity and aquatic habitat, and agricultural related impacts such as channel manipulation or straightening and concentrated run-off inputs from agricultural fields. The primary stressors to the wetlands on the Site were the lack of wetland vegetation, agricultural impact including ditching to drawdown the water table, and the lack of hydrologic connection to the floodplain tributaries and hillside seeps. The effects of these stressors resulted in channel instability, loss of floodplain connection, degraded water quality, and the loss of both aquatic and riparian habitat throughout the Site's watershed when compared to reference conditions. The project approach for the Site focused on evaluating the Site's existing functional condition and evaluating its potential for recovery and need for intervention.

The project goals defined in the mitigation plan (Wildlands, 2018) were established with careful consideration of 2009 Lower Yadkin Pee Dee River Basin Restoration Priorities (RBRP) goals and objectives to address stressors identified in the watershed through the implementation of stream restoration and enhancement activities and wetland re-establishment and rehabilitation activities, as well as riparian buffer re-vegetation. The established project goals include:

- Improve stream channel stability,
- Reconnect channels with historic floodplains and re-establish wetland hydrology and function in relic wetland areas,
- Improve in-stream habitat,
- Reduce sediment and nutrient inputs from adjacent agricultural fields,
- Restore and enhance native floodplain and wetland vegetation, and
- Permanently protect the project site from harmful uses.

The Site construction and as-built surveys were completed between September and November 2019. Planting and baseline vegetation data collection occurred between November 2019 and January 2020. Minimal adjustments were made during construction and specific changes are detailed in Section 5.1. Baseline (MY0) profiles and cross-section dimensions closely match the design parameters with little variation. The Site has been built as designed and is expected to meet the upcoming monitoring year's success criteria.

TABLE OF CONTENTS

Section 1: PROJECT GOALS, BACKGROUND, AND ATTRIBUTES 1-1

1.1 **Project Location and Setting 1-1**

1.2 **Project Goals and Objectives 1-1**

1.3 **Project Structure, Restoration Type and Approach 1-2**

1.3.1 Project Structure 1-2

1.3.2 Restoration Type and Approach 1-3

1.4 **Project History, Contacts and Attribute Data 1-3**

Section 2: PERFORMANCE STANDARDS 2-1

2.1 **Streams 2-1**

2.1.1 Dimension 2-1

2.1.2 Pattern and Profile 2-1

2.1.3 Substrate 2-1

2.1.4 Photo Documentation 2-2

2.1.5 Hydrology Documentation 2-2

2.2 **Vegetation 2-2**

2.3 **Wetlands 2-2**

2.4 **Visual Assessments 2-2**

2.5 **Schedule and Reporting 2-2**

Section 3: MONITORING PLAN & METHODOLOGY 3-1

3.1 **Streams 3-1**

3.1.1 Dimension 3-1

3.1.2 Pattern and Profile 3-1

3.1.3 Substrate 3-1

3.1.4 Photo Reference Points 3-2

3.1.5 Hydrology Documentation 3-2

3.1.6 Visual Assessment 3-2

3.2 **Vegetation 3-2**

3.3 **Wetlands 3-3**

Section 4: ADAPTIVE MANAGEMENT AND CONTINGENCY PLAN 4-1

4.1 **Adaptive Management Plan 4-1**

Section 5: AS-BUILT CONDITION (BASELINE) 5-1

5.1 Record Drawings 5-1
5.1.1 Stream Plan and Profile 5-1
5.1.2 Vegetation Planting Plan 5-1
5.2 **Baseline Data Assessment 5-1**
5.2.1 Morphological State of the Channel 5-2
5.2.2 Vegetation 5-2
5.2.3 Wetlands 5-2
Section 6: CREDIT RELEASE SCHEDULE 6-1
6.1 **Initial Allocation of Released Credits 6-1**
6.2 **Record Drawings 6-2**
Section 7: REFERENCES 7-1

APPENDICES

Appendix 1 General Figures, Tables, and Documentation

Figure 1 Project Vicinity Map
Figure 2 Project Component/Asset Map
Figure 3.0 – 3.2 As-Built Monitoring Plan View
Table 1 Mitigation Assets and Components
Table 2 Project Activity and Reporting History
Table 3 Project Contact Table
Table 4 Project Information and Attributes
Table 5 Monitoring Component Summary
Post Contract IRT Site Walk Meeting Minutes (July 20, 2016)

Appendix 2 Morphological Summary Data and Plots

Table 6 Baseline Stream Data Summary
Table 7 Reference Reach Data Summary
Table 8 Morphology and Hydraulic Summary (Dimensional Parameters-Cross-Section)
Longitudinal Profile Plots
Cross-Section Plots
Reachwide and Cross-Section Pebble Count Plots
Stream Photographs

Appendix 3 Vegetation Plot Data

Table 9 Vegetation Plot Criteria Attainment
Table 10 CVS Permanent Vegetation Plot Metadata
Table 11 Planted and Total Stem Counts
Vegetation Photographs

Appendix 4 Record Drawings

LIST OF ACRONYMS

Current Condition Plan View (CCPV)
Department of Environmental Quality (DEQ)
Division of Mitigation Services (DMS)
Hydrologic Unit Code (HUC)
Interagency Review Team (IRT)
Monitoring Year (MY)
Division of Water Resources (DWR)
Stream Mitigation Unit (SMU)
Targeted Local Watershed (TLW)
United States Army Corps of Engineers (USACE)
Unnamed Tributary (UT)
Wetland Mitigation Unit (WMU)
Yadkin Pee Dee River Basin Priorities (RBRP)

Section 1: PROJECT GOALS, BACKGROUND, AND ATTRIBUTES

1.1 Project Location and Setting

The Deep Meadow Mitigation Site (Site) is located in Union County approximately two miles north of Wingate, NC and approximately six miles northeast of Monroe, NC (Figure 1). The project is located within the NC Division of Mitigation Services (DMS) targeted watershed for the Yadkin River Basin Hydrologic Unit (HU) 03040105070060 and NC Division of Water Resources (DWR) Subbasin 03-07-14. Located in the Slate Belt within the Piedmont physiographic province (NCGS, 1985), the project watershed is dominated by agricultural and forested land.

The site contains Meadow Branch, three unnamed tributaries of Meadow Branch, two existing riparian wetlands and ten proposed riparian wetlands. The unnamed tributaries are referred to by Wildlands as West Fork 1 (WF1), West Fork 2 (WF2), and East Fork 1 (EF1). The existing wetlands are referred to as W-H1 and W-H2, while the proposed wetlands are named W-E1 through W-E10.

Meadow branch has a gentle (0.22%) unconfined alluvial valley. EF1 transitions from a gentle (1.00%) moderately confined valley at the upstream project limits to an unconfined valley as it approaches Meadow Branch. WF1 and WF2 are also located in unconfined valleys within the project. The two existing riparian wetlands are located in the floodplain of Meadow Branch at the toe of slope. The Site drains approximately 6.99 square miles of rural land.

Prior to construction activities, the Site had a history of use for crop production resulting in degraded in-stream habitat and sediment erosion. On-site streams have had their adjacent floodplains altered for agricultural uses. EF1 was re-routed to the edge of the valley and shortened to join Meadow Branch at the perpendicular angle. Existing wetlands were ditched to improve field drainage and cleared for row crops. Riparian buffers also exhibited a lack of stabilizing streamside vegetation due to agricultural practices.

Pre-construction conditions are outlined in Table 4 of Appendix 1 and Table 6 of Appendix 2.

1.2 Project Goals and Objectives

The Site is providing numerous ecological benefits within the Yadkin Valley Basin. The project goals were established with careful consideration to address stressors that were identified in the DWR 2008 Yadkin River Basinwide Plan (NCDWR, 2008). Improvements to water quality and ecological processes are outlined below as project goals and objectives.

Goals	Objectives
Improve stream channel stability.	Restore stream channels that will maintain a stable pattern and profile considering the hydrologic and sediment inputs to the system, the landscape setting, and the watershed conditions. Create stable tie-ins for tributaries joining restored channels. Add bank revetments and in-stream structures to protect restored streams.
Reconnect channels with historic floodplains and re-establish wetland hydrology and function in relic wetland areas.	Remove man-made impoundments, remove culvert crossings, and restore historic valley profile. Remove historic overburden from farm fields. Reconstruct stream channels with bankfull dimensions relative to the floodplain. Restore stream plan form to promote development of mutually beneficial stream/wetland complex.
Improve instream habitat.	Remove man-made impoundments and culvert crossings within easement. Install habitat features such as constructed riffles, cover logs, and brush toes into restored/enhanced streams. Add woody materials to channel beds. Construct pools of varying depth.
Reduce sediment and nutrient input from adjacent farm fields.	Construct two step pool stormwater conveyance and three dry detention BMPs to slow and treat runoff from farm fields before entering Site streams.
Restore and enhance native floodplain and wetland vegetation.	Plant native tree and understory species in riparian zone where currently insufficient.
Permanently protect the project site from harmful uses.	Establish a conservation easement on the Site.

1.3 Project Structure, Restoration Type and Approach

The final mitigation plan was submitted and accepted by DMS in January of 2018 and the IRT in May of 2018. Construction activities were completed in September 2019 by Land Mechanic Designs, Inc. Kee Mapping and Surveying completed the as-built survey in December 2019. Planting was completed following construction in January 2020 by Bruton Natural Systems, Inc. Field adjustments made during construction are described in further detail in section 5.1 and depicted in the Record Drawings in Appendix 4. Please refer to Appendix 1 for detailed project activity, history, contact information, and watershed/site background information.

1.3.1 Project Structure

Project mitigation components are outlined in the Mitigation Assets and Components Table (Table 1) and depicted in the As-built Monitoring Plan View Maps (Figures 3.0 - 3.2) that are located in Appendix 1.

1.3.2 Restoration Type and Approach

The design approach for this Site was chosen based on the surrounding landscape, climate, natural vegetation communities but also with thorough consideration of existing watershed conditions. The project includes stream restoration, enhancement, and preservation as well as wetland re-habilitation and re-establishment. The specific proposed stream and wetland mitigation types are illustrated in Figure 2 and detailed below. The Site vegetative planting plan is depicted on sheets 3.0 through 3.4 of the record drawings located in Appendix 4.

Meadow Branch is a Rosgen C4/5 stream that was enhanced using an EII approach. Bank erosion was addressed through bank grading and bank stabilization structures. Riffles and pools were added to the channel to enhance habitat. Concentrated run-off ditches were plugged or stabilized to reduce sedimentation inputs to the stream. A 70-ft easement break was implemented to allow for landowner access to the western agricultural fields.

EF1 begins at station 200+38 and flows west to enter Meadow Branch at station 214+01. EF1 was raised through priority 1 restoration and relocated away from the hillside slope to the center of the valley. A short downstream section of EF1 underwent priority 2 restoration to tie into the bed elevation of Meadow Branch. Riffle-pool sequences and woody cover structures were added to increase habitat diversity. Landowner access was provided by a 41-ft easement break near the downstream end of the reach.

The preservation portion of WF1 begins at station 400+57 and flows east for 20-feet. At station 400+77, WF1 continues east to enter Meadow Branch at station 401+93. This portion of the reach was designed as a Rosgen C4b and was improved through a E1 approach. Bed and bank stability were achieved by installing in-stream grade control structures and grading the banks. Invasive plants were removed from the stream banks as part of the grading process. Adjustments to the bed elevation were made to tie into an existing bedrock knickpoint at the upstream end of WF1 and to achieve a more uniform profile.

WF2 begins at station 301+29 and flows northeast to connect with Meadow Branch at station 305+87. Most of the channel was restored as a Rosgen E-type stream using priority 1 restoration; however, a short section the downstream extent was designed to be incised as it drops to meet the invert elevation of Meadow Branch. Riffle-pool sequences were installed along with woody cover structures to provide bedform diversity and habitat.

The Site includes the re-establishment of a stream wetland complex and the rehabilitation of existing jurisdictional wetlands through the floodplain bottom to Meadow Branch. To improve wetland hydrology and restore the natural topography of the floodplain, grading was performed to eliminate drainage swales and to remove overburden within wetland areas; thereby, bringing buried hydric soils within the 12 inches of the soil surface. Additionally, the wetland areas were disked and planted with native wetland plants.

Native vegetation was planted within the non-forested riparian and wetland planting zones of the conservation easement along Meadow Branch and its tributaries. Disturbed areas outside of the easement were re-established with permanent grass.

1.4 Project History, Contacts and Attribute Data

The Site was restored by Wildlands through a Full Delivery contract with DMS. Tables 2, 3, and 4 in Appendix 1 provide detailed information regarding the project activity and reporting history, project contacts, and project baseline information and attributes.

Section 2: PERFORMANCE STANDARDS

The stream and wetland performance criteria for the Site follow approved performance criteria presented in the Deep Meadow Mitigation Site Mitigation Plan (2018) and is based on performance criteria presented in the DMS Mitigation Plan Template (October 2015), the Annual Monitoring and Closeout Reporting Template (April 2015), and the Stream and Wetland Mitigation Guidance issued in October 2016 by the USACE. Annual monitoring and semi-annual site visits will be conducted to assess the condition of the finished project. Specific performance standard components are proposed for stream morphology, hydrology, vegetation, and wetland hydrology. Performance criteria will be evaluated throughout the seven-year post-construction monitoring period. The monitoring program designed to verify that performance standards are met is described in Section 3.

2.1 Streams

2.1.1 Dimension

Riffle cross-sections on the restoration reaches should be stable and should show little change in bankfull area, bank height ratio, and width-to-depth ratio. All riffle cross-sections should fall within the parameters defined for the designated stream type. Bank height ratios shall not exceed 1.2 and entrenchment ratios shall be at least 1.4 for B-type channels and 2.2 for restored E and C-type channels. If any changes do occur, these changes will be evaluated to assess whether the stream channel is showing signs of instability. Indicators of instability include a vertically incising thalweg or eroding channel banks. Remedial action will not be taken if channel changes indicate a movement toward stability.

2.1.2 Pattern and Profile

A longitudinal profile was conducted as part of the as-built survey to provide a baseline for comparison should it become necessary to perform longitudinal profile surveys later during monitoring and to insure accordance with design plans. Annual longitudinal profile surveys are not required during the seven-year monitoring period unless other indicators during the annual monitoring indicate a trend toward vertical and lateral instability. If a longitudinal profile is deemed necessary, monitoring will follow standards as described in the 2016 USACE Stream and Wetland Mitigation Guidance for the necessary reaches.

Restoration reaches must remain vertically stable throughout the monitoring period with little indication of downcutting or significant aggradation. Deposition of sediments at certain locations (such as the inside of meander bends) is expected and acceptable. Changes in pool depth are not an indication of vertical instability. Restoration reaches must remain laterally stable and major changes planform pattern dimensions and sinuosity should not occur. However, migration of meanders on alluvial channels is not an indication of instability if cross sectional dimensions continue to meet the requirements.

2.1.3 Substrate

A pebble count was conducted at each surveyed riffle to characterize the pavement during the baseline monitoring only. A reach-wide pebble count will be performed in each restoration reach for monitoring years 1, 2, 3, 5 and 7. Reach-wide counts will be conducted for classification purposes. Restoration reaches should show maintenance of coarser materials in the riffle features and finer particles in the pool features. Riffles may fine over the course of monitoring due to the stabilization of contributing watershed sediment sources. Successful substrate measurements show that the restored stream meet the objective of maintaining stable banks through reduced shear stress.

2.1.4 Photo Documentation

Photographs should illustrate the Site's vegetation and morphological stability on an annual basis. Cross-section photos should demonstrate no excessive erosion or degradation of the banks. Longitudinal photos should indicate the absence of persistent of mid-channel bars or vertical incision. Grade control structures should remain stable. Deposition of sediment on the bank side of vane arms is preferable. Maintenance of scour pools on the channel side of vane arms is expected.

2.1.5 Hydrology Documentation

The occurrence of bankfull events will be documented throughout the monitoring period. Four bankfull flow events must be documented within the seven-year monitoring period. The four bankfull events must occur in separate years.

2.2 Vegetation

The final vegetative performance standard will be the survival of 210 planted stems per acre in the planted riparian areas at the end of the required seven-year monitoring period. The interim measure of vegetative success for the Site will be the survival of at least 320 planted stems per acre at the end of MY3 and at least 260 stems per acre at the end of MY5. The extent of invasive species coverage will also be monitored and controlled as necessary throughout the required monitoring period.

2.3 Wetlands

The final performance standard for wetland hydrology will be a free groundwater surface within 12 inches of the ground surface for 23 consecutive days (10% percent) of the defined growing season for Union County (March 23 through November 6) under typical precipitation conditions.

2.4 Visual Assessments

Visual assessments should support the specific performance standards for each metric as described above.

2.5 Schedule and Reporting

Monitoring reports will be prepared in the fall of each year of monitoring and submitted to DMS. Based on the DMS Annual Monitoring Template (April 2015), the monitoring reports will include the following:

- Project background which includes project objectives, project structure, restoration type and approach, location and setting, history and background,
- Project Asset Map of major project elements,
- Photographs showing views of the restored Site taken from fixed point stations,
- CCPV Map with monitoring features and current problem areas noted such as stability and easement encroachment based on the cross-section surveys and annual visual assessments,
- Assessment of the stability of the stream based on the cross-sections,
- Vegetative data as described above including the identification of any invasion by undesirable plant species,
- Groundwater gage plots,
- A description of damage by animals or vandalism,

- Maintenance issues and recommended remediation measures will be detailed and documented, and
- Wildlife observations.

Section 3: MONITORING PLAN & METHODOLOGY

Annual monitoring will consist of collecting morphologic, vegetative, and hydrologic data to assess the project success based on the restoration goals, as outlined in the Deep Meadow Site Mitigation Plan (2018). Monitoring requirements will follow guidelines outlined in the DMS Annual Monitoring and Closeout Reporting Template (April 2015) and the USACE Stream and Wetland Mitigation Guidance (October 2016). Installed monitoring device and plot locations closely mimic the locations of those proposed in the Site's Mitigation Plan. Deviations from these locations were made when professional judgement deemed them necessary to better represent as-built field conditions or when installation of the device in the proposed location was not physically feasible. Project success will be assessed by measuring channel dimension, substrate composition, vegetation, surface water hydrology, groundwater hydrology and by analyzing photographs and performing visual assessments. Any high priority problem areas identified, such as unstable stream banks, bed instability, aggradation/degradation, and/or poor vegetation establishment will be evaluated on a case-by-case basis. The problem areas will be visually noted and reported to DMS staff in the annual report. Refer to Table 5 in Appendix 1 for the monitoring component summary.

3.1 Streams

Geomorphic assessments follow guidelines outlined in the Stream Channel Reference Sites: An Illustrated Guide to Field Techniques (Harrelson et al., 1994), methodologies utilized in the Rosgen stream assessment and classification documents (Rosgen, 1994 and 1996), and in the Stream Restoration: A Natural Channel Design Handbook (Doll et al., 2003). Please refer to Figures 3.0 through 3.2 in Appendix 1 for monitoring locations discussed below.

3.1.1 Dimension

To assess channel dimension performance, 6 permanent cross-sections were installed along stream restoration and enhancement I reaches to represent approximately 50% riffles and 50% pools as defined in Table 16 of the Mitigation Plan. Cross-section locations were chosen in the field to be representative of the typical dimensions for each project reach. Each cross-section is permanently marked with rebar installed in concrete and ½ inch PVC pipes. Cross-section surveys will include points measured at all breaks in slope, including top of bank, bankfull, edge of water, and thalweg. Cross-section surveys will be conducted in monitoring years one, two, three, five, and seven. Photographs will be taken of the cross-sections looking upstream and downstream during the survey assessment.

3.1.2 Pattern and Profile

Longitudinal profile surveys will not be conducted during the seven-year post-construction monitoring period unless other indicators during the annual monitoring indicate a trend toward vertical and lateral instability. If a longitudinal profile is deemed necessary, monitoring will follow standards as described in the DMS Annual Monitoring and Closeout Reporting Template (April 2015) and the Stream Mitigation Guidelines issued in October 2016 by the USACE for the necessary reaches. Stream pattern and profile will be assessed visually as described below in Section 3.1.6.

3.1.3 Substrate

Reach-wide pebble counts will be performed on each restoration and enhancement I reach for classification purposes only and will be conducted in monitoring years one, two, three, five, and seven. Riffle 100-count substrate sampling will be collected during the baseline monitoring only to characterize pavement at as-built.

3.1.4 Photo Reference Points

A total of 18 permanent photograph reference points were established along the stream reaches and the floodplain area after construction. Photographs will be taken once a year to visually document stability for the seven-year monitoring period. Permanent markers were established and located with GPS equipment so that the same locations and view directions on the site are photographed each year. Photos will be used to monitor all restoration and preservation stream reaches.

Longitudinal reference photos were established approximately every 300-500 LF along the channel by taking a photo looking upstream and downstream. Cross-sectional photos will be taken of each permanent cross-section looking upstream and downstream.

3.1.5 Hydrology Documentation

The occurrence of bankfull events will be documented throughout the seven-year monitoring period using pressure transducers, photographs, and visual assessments such as debris lines. Streamflow stage will be monitored using a continuous stage recorder (pressure transducer) and recorded every three hours. A total of 3 gages were installed along restoration and enhancement I reaches. The gages will be downloaded semi-annually to determine if a bankfull event has occurred. Photographs will be used to document the occurrence of debris lines and sediment deposition observed during field visits. The transducer data will be plotted and included in the annual monitoring reports.

3.1.6 Visual Assessment

Visual assessments will be performed along stream reaches on a semi-annual basis during the seven-year monitoring period. Areas of concern, such as channel instability (i.e. lateral and/or vertical instability and in-stream structure failure, instability, and/or piping), poor vegetation health and/or establishment (i.e. low stem density, bare areas, high mortality rates, and/or invasive species), easement encroachment, beaver activity, and/or livestock trespass will be mapped, photographed, and described in the annual monitoring reports. Problem areas will be re-evaluated during each subsequent visual assessment. Should remedial actions be required, recommendations will be provided in the annual monitoring report.

3.2 Vegetation

Vegetative plot monitoring will be conducted in post-construction monitoring years 1, 2, 3, 5, and 7. Permanent plots will be monitored in accordance with the guidelines and procedures developed by the Carolina Vegetation Survey-EEP Level 2 Protocol (Lee et al., 2006) and the 2016 USACE Stream and Wetland Mitigation Guidance to assess the vegetation success. For both permanent and random plots, all woody stems, including exotic and invasive species, should be counted. Supplemental plantings and volunteer plants must be present for at least two growing seasons before counting toward performance standards for monitoring years five and seven. Exotic/invasive species will not count toward success of performance standards.

A total of 12 permanent vegetation plots were established within the project easement area. Permanent vegetation plots were randomly established within the planted stream riparian buffer areas to capture the heterogeneity of the designed vegetative communities. The locations of permanent vegetation plots were chosen in the field using the same distribution throughout the planting areas, as shown in the Site's Mitigation Plan, and to best represent the planted areas within the easement.

All of the permanent vegetative plots were established as a standard 10-meter by 10-meter square plot. The vegetation plot corners have been marked and are recoverable either through field identification or with the use of a GPS unit. Reference photographs at the origin looking diagonally across the plot to the opposite corner were taken during the MY0 in January 2020. Subsequent assessments in monitoring

years one, two, three, five, and seven following baseline survey will capture the same reference photograph locations.

Individual permanent plot data will include diameter, height, density, vigor, damage (if any), and percent survival. Planted woody stems were marked in MY0 and will be re-marked, if needed, during subsequent monitoring year assessments using a known origin so they can be found. Mortality will be determined from the difference between the baseline year's living planted stems and the current year's living planted stems.

To evaluate random vegetation performance for the Site, 4 mobile vegetation plots were established in MY0, for use in MY1, using a circular or 100 m^2 square/rectangular plot. Mobile plots will be re-established in different and random locations throughout the planted conservation easement in monitoring years 2, 3, 5, and 7. These locations will be geographically recorded and depicted in the CCPV maps for the corresponding monitoring assessment year. Mobile vegetation plot assessments will document the number of stems, species type, and stem height within the plot.

Please refer to Figures 3.0 through 3.2 in Appendix 1 for the permanent and mobile MY0/1 vegetation monitoring plot locations.

3.3 Wetlands

To monitor the wetland re-establishment area, eleven groundwater monitoring gages were installed in October and November of 2019 per USACE recommended procedures within the wetland areas using In-situ Level TROLL® 100 pressure transducers. The locations of the installed gages closely mimic those of the Site's Mitigation Plan. Minor adjustments in these locations were made to best represent wetland topography or when installation of a gage met ground refusal. An additional gage was established in a nearby reference wetland and will be utilized to compare the hydrologic response within the restored wetland areas at the Site. The groundwater gages are set to record the groundwater level four times per day and will be downloaded quarterly during site visits. The locations of the groundwater gages are denoted in Figures 3.0 through 3.2.

Section 4: ADAPTIVE MANAGEMENT AND CONTINGENCY PLAN

4.1 Adaptive Management Plan

Wildlands will perform maintenance as needed on the mitigation project. A physical inspection of the Site shall be conducted a minimum of once per year throughout the post-construction monitoring period or until performance standards are met. These site inspections may identify site components and features that require routine maintenance. Routine maintenance for stream features should be most often expected in the first two years following site construction. The need for maintenance will be evaluated annually during monitoring activities. Maintenance may include the following activities.

Component/ Feature	Maintenance through project close-out
Stream	Routine channel maintenance and repair activities may include chinking of in-stream structures to prevent piping, securing of loose coir matting, and supplemental installations of live stakes and other target vegetation along the channel – these shall be conducted where success criteria are threatened or at the discretion of the Designer. Areas where storm water and floodplain flows intercept the channel may also require maintenance to prevent bank failures and head-cutting. Beaver activity will be monitored and beaver dams on project streams will typically be removed, at the discretion of the Designer, during the monitoring period to allow for bank stabilization and stream development outside of this type of influence.
Wetlands	Routine wetland maintenance and repair activities may include supplemental installations of target vegetation within the wetland. Areas where storm water and floodplain flows intercept the wetland may also require maintenance to prevent scour that adversely and persistently threatens wetland habitat or function.
Vegetation	Vegetation shall be maintained to ensure the health and vigor of the targeted community. Routine vegetation maintenance and repair activities may include supplemental planting, pruning, mulching, and fertilizing. Exotic invasive plant species treatment will be conducted per the Invasive Species Treatment Plan, outlined in Appendix 8 of the Deep Meadow Mitigation Plan (2018), and in accordance with NC Department of Agriculture (NCDA) rules and regulations.
Site Boundary	Site boundaries shall be identified in the field to ensure clear distinction between the mitigation site and adjacent properties. Boundaries may be identified by fence, marker, bollard, post, tree-blazing, or other means as allowed by site conditions and/or conservation easement. Boundary markers disturbed, damaged, or destroyed will be repaired and/or replaced on an as-needed basis.

The Wildlands Team will develop necessary adaptive measures or implement appropriate remedial actions in the event that the Site or a specific component of the Site fails to achieve the success criteria outlined above. The project-specific monitoring plan developed during the design phase identifies an appropriate threshold for maintenance intervention based on the monitored items. Any actions implemented will be designed to achieve the success criteria specified previously and will include a work schedule and updated monitoring criteria. If, during annual monitoring it is determined the Site's ability to achieve Site performance standards are jeopardized, Wildlands will notify the members of the IRT and work with the IRT to develop contingency plans and remedial actions.

Section 5: AS-BUILT CONDITION (BASELINE)

The Site construction and as-built surveys were completed between September and November 2019. The survey included developing an as-built topographic surface and locating the channel boundaries, structures, and cross-sections. Planting and baseline vegetation data collection occurred between November 2019 and January 2020.

5.1 Record Drawings

A sealed half-size record drawing is located in Appendix 4 and includes redlines for any significant field adjustments made during construction that were different from the design plans. Specific changes by each project area are detailed below:

5.1.1 Stream Plan and Profile

- Sheet 1.1: Station 102+98 – Log vane replaced rock vane at Engineer's discretion,
- Sheet 1.2: Station 104+32 – Rock J-hook replaced rock vane at Engineer's discretion,
- Sheet 1.3: Station 213+35 – 213+65 – Rock toe replaced brush toe,
- Sheet 1.5: Station 117+85 – 118+08 – Riffle added on Meadow Branch at its confluence with WF2,
- Sheet 1.6: Station 125+25 – 125+75 – Riffle added on Meadow Branch with available on-site native material,
- Sheet 1.7: Station 201+98 – 202+30 – Rock toe replaced vegetated soil lift due to surrounding bedrock and available on-site native material,
- Sheet 1.8: Station 205+05 – 205+49 – Rock toe replaced brush toe due to surrounding bedrock that limited excavation for brush toe anchor and available on-site native material,
- Sheet 1.8: Station 206+51 – 206+93 – Rock toe replaced brush toe due to surrounding bedrock that limited excavation for brush toe anchor and available on-site native material,
- Sheet 1.9: Station 209+87 – 209+97 – Rock toe added along left bank tie-in with culvert outfall,
- Sheet 1.9: Station 209+97 – 210+30 – Brush toe replaced vegetated soil lift,
- Sheet 1.9: Station 213+33 – Log vane removed due to bedrock in the field,
- Sheet 1.9: Station 213+35 – 213+65 – Rock Toe replaced brush toe due to surrounding bedrock and available on-site native material,

5.1.2 Vegetation Planting Plan

No changes were made to planting plan.

5.2 Baseline Data Assessment

MY0 was conducted between October and November 2019 with the vegetation data collection occurring between December 2019 and January 2020, immediately following planting. The first annual monitoring assessment (MY1) will be completed in the fall of 2020. The streams will be monitored for a total of seven years, with the final monitoring activities scheduled for 2026.

5.2.1 Morphological State of the Channel

As-built morphological data was collected between October and November 2019. Please refer to Appendix 2 for summary data tables, morphological plots, and stream photographs.

Profile

The MY0 profiles generally match the profile design parameters. As-built riffle slopes calculated for both WF2 and EF1 resulted in a greater variation in range than those of design; however, overall channel slopes were similar to design parameters, and on-site as-built reviews showed no visual indicators of vertically instability. Variations from the design profile often reflect field changes during construction as a result of field conditions and do not constitute a problem or indicate a need for remedial actions. Channels profiles will continue to be assessed visually during the CCPV Site walks.

Dimension

The MY0 dimension numbers closely match the design parameters with minor variations. Bankfull widths for as-built channels slight exceed design parameters; however, channels are likely to narrow over time as vegetation is established. This narrowing over time would not be an indicator of instability in and of itself. On-site as-built reviews showed no visual indicators of lateral instability.

Pattern

The MY0 pattern metrics fell within acceptable ranges of the design parameters.

Bankfull Events

Bankfull events recorded following completion of construction will be reported in the Year 1 monitoring report.

5.2.2 Vegetation

The overall MY0 planted density is 607 stems/acre for permanent vegetation plots and 647 stems/acre for mobile vegetation plots. The total overall planted Site mean density is 612 stems/acre, which exceeds the interim measure of vegetative success of at least 320 planted stems per acre required atthe end of the third monitoring year. Summary data and photographs of each plot can be found in Appendix 3.

5.2.3 Wetlands

Groundwater gage data will be reported in the annual MY1 report.

Section 6: CREDIT RELEASE SCHEDULE

All credit releases will be based on the total credit generated as reported by the as-built survey of the mitigation site. Under no circumstances shall any mitigation project be debited until the necessary Department of the Army (DA) authorization has been received for its construction or the District Engineer (DE) has otherwise provided written approval for the project in the case where no DA authorization is required for construction of the mitigation project. The DE, in consultation with the Interagency Review Team (IRT), will determine if performance standards have been satisfied sufficiently to meet the requirements of the release schedules below. In cases where some performance standards have not been met, credits may still be released depending on the specifics of the case. Monitoring may be required to restart or be extended, depending on the extent to which the site fails to meet the specified performance standard. The release of project credits will be subject to the criteria described as follows:

Table A: Credit Release Schedule – Stream Credits – *Deep Meadow Mitigation Site*

Monitoring Year	Credit Release Activity	Interim Release	Total Released
0	Initial Allocation – see requirements below	30%	30%
1	First year monitoring report demonstrates performance standards are being met	10%	40%
2	Second year monitoring report demonstrates performance standards are being met (additional 10% released at second bankfull event in a separate year)	10%	50% (60%)
3	Third year monitoring report demonstrates performance standards are being met	10%	60% (70%)
4	Fourth year monitoring report demonstrates performance standards are being met	5%	65% (75%)
5	Fifth year monitoring report demonstrates performance standards are being met	10%	75% (85%)
6	Sixth year monitoring report demonstrates performance standards are being met	5%	80% (90%)
7	Seventh year monitoring report demonstrates performance standards are being met and project has received closeout approval	10%	90% (100%)

Table B: Credit Release Schedule – Forested Wetland Credits – *Deep Meadow Mitigation Site*

Monitoring Year	Credit Release Activity	Interim Release	Total Released
0	Initial Allocation – see requirements below	30%	30%
1	First year monitoring report demonstrates performance standards are being met	10%	40%
2	Second year monitoring report demonstrates performance standards are being met	10%	50%
3	Third year monitoring report demonstrates performance standards are being met	10%	60%
4	Fourth year monitoring report demonstrates performance standards are being met	10%	70%

Monitoring Year	Credit Release Activity	Interim Release	Total Released
5	Fifth year monitoring report demonstrates performance standards are being met; Provided that all performance standards are met, the IRT may allow the DMS to discontinue hydrologic monitoring after the fifth year, but vegetation monitoring must continue for an additional two years after the fifth year for a total of seven years.	10%	80%
6	Sixth year monitoring report demonstrates performance standards are being met	10%	90%
7	Seventh year monitoring report demonstrates performance standards are being met, and project has received close-out approval	10%	100%

6.1 Initial Allocation of Released Credits

The initial allocation of released credits, as specified in the mitigation plan can be released by DMS without prior written approval of the DE upon satisfactory completion of the following activities:

a. Approval of the final Mitigation Plan.
b. Recordation of the preservation mechanism, as well as a title opinion acceptable to the USACE covering the property.
c. Completion of project construction (the initial physical and biological improvements to the mitigation site) pursuant to the mitigation plan; per the DMS Instrument, construction means that a mitigation site has been constructed in its entirety, to include planting, and an as-built report has been produced. As-built reports must be sealed by an engineer prior to project closeout, if appropriate but not prior to the initial allocation of released credits.
d. Receipt of necessary DA permit authorization or written DA approval for projects where DA permit issuance is not required.

6.2 Subsequent Credit Releases

All subsequent credit releases must be approved by the DE, in consultation with the IRT, based on a determination that required performance standards have been achieved. For stream projects a reserve of 10% of a site's total stream credits shall be released after two bankfull events have occurred, in separate years, provided the channel is stable and all other performance standards are met. In the event that less than two bankfull events occur during the monitoring period, release of these reserve credits shall be at the discretion of the IRT. As projects approach milestones associated with credit release, the DMS will submit a request for credit release to the DE along with documentation substantiating achievement of criteria required for release to occur.

Section 7: REFERENCES

Doll, B.A., Grabow, G.L., Hall, K.A., Halley, J., Harman, W.A., Jennings, G.D., and Wise, D.E. 2003. Stream Restoration A Natural Channel Design Handbook.

Harrelson, Cheryl C; Rawlins, C.L.; Potyondy, John P. 1994. *Stream Channel Reference Sites: An Illustrated Guide to Field Technique.* Gen. Tech. Rep. RM-245. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Forest and Range Experiment Station. 61 p.

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United States Army Corps of Engineers (USACE), October 2016. Stream Mitigation Guidelines. USACE, NCDENR-DWQ, USEPA, NCWRC.

Wildlands Engineering, Inc (Wildlands), 2018. Deep Meadow Mitigation Site Mitigation Plan. DMS, Raleigh, NC.

APPENDIX 1. General Figures, Tables, and Documentation

Table 1. Mitigation Assets and Components
Deep Meadow Mitigation Site
DMS Project No. 97131
Monitoring Year 0 - 2020

Project Components									
Project Area/Reach	**Existing Footage (LF) or Acreage**	**Mitigation Plan Footage/ Acreage**	**Mitigation Category**	**Restoration Level**	**Priority Level**	**Mitigation Ratio (X:1)**	**As-Built Footage/ Acreage**	**Project Credit**	**Notes/Comments**
Medow Branch	2,507	2,449	Warm	Enhancement II	N/A	2.500	2,449	979.600	Bank stabilization and in-stream structures with planted buffer. Creditable length accounts for 96 LF of stream within an easement break.
EF1	1,201	1,322	Warm	Restoration	P1, P2	1.000	1,322	1,322.000	Full channel restoration and planted buffer. Creditable length accounts for 41 LF of stream within an easement break
WF1	116	116	Warm	Enhancement I	N/A	1.500	116	77.333	Dimension and profile modified to provide stability.
WF1	20	20	Warm	Preservation	N/A	10.000	20	2.000	
WF2	391	458	Warm	Restoration	P1, P2	1.000	458	458.000	Full channel restoration and planted buffer.
WH-1	0.28	0.28	Warm	Rehabilitation		1.500	0.28	0.190*	Rehabilitation. Planted, removed agricultural activities, increased hydrology by reducing drainage to Meadow Branch.
WH-2	0.30	0.30	Warm	Rehabilitation		1.500	0.30	0.200	Rehabilitation. Planted, removed agricultural activities, increased hydrology by reducing drainage to Meadow Branch.
WE-1	0.40	0.40	Warm	Re-establishment		1.000	0.37	0.400*	Re-establishment. Planted, removed agricultural activities, increased hydrology by eliminating adjacent drainage swales.
WE-2	1.70	1.70	Warm	Re-establishment		1.000	1.72	1.700*	Re-establishment. Planted, removed agricultural activities, increased hydrology by eliminating adjacent drainage swales.
WE-3	0.40	0.40	Warm	Re-establishment		1.000	0.41	0.400*	Re-establishment. Planted, removed agricultural activities, increased hydrology by eliminating adjacent drainage swales.
WE-4	0.40	0.40	Warm	Re-establishment		1.000	0.36	0.400*	Re-establishment. Planted, removed agricultural activities, increased hydrology by eliminating adjacent drainage swales.
WE-5	0.40	0.40	Warm	Re-establishment		1.000	0.37	0.400*	Re-establishment. Planted, removed agricultural activities, increased hydrology by eliminating adjacent drainage swales.
WE-6	0.20	0.20	Warm	Re-establishment		1.000	0.20	0.200	Re-establishment. Planted, removed agricultural activities, increased hydrology by eliminating adjacent drainage swales.
WE-7	1.50	1.50	Warm	Re-establishment		1.000	1.53	1.500*	Re-establishment. Planted, removed agricultural activities, increased hydrology by eliminating adjacent drainage swales.
WE-8	1.00	1.00	Warm	Re-establishment		1.000	1.04	1.000*	Re-establishment. Planted, removed agricultural activities, increased hydrology by eliminating adjacent drainage swales.
WE-9	0.50	0.50	Warm	Re-establishment		1.000	0.53	0.500*	Re-establishment. Planted, removed agricultural activities, increased hydrology by eliminating adjacent drainage swales.
WE-10	1.70	1.70	Warm	Re-establishment		1.000	1.73	1.700*	Re-establishment. Planted, removed agricultural activities, increased hydrology by eliminating adjacent drainage swales.

Project Credits							
Restoration Level	**Stream**			**Riparian Wetland**		**Non-Riparian Wetland**	**Coastal Marsh**
	Warm	**Cool**	**Cold**	**Riverine**	**Non-Riv**		
Restoration	1,780.000	N/A	N/A	N/A	N/A	N/A	N/A
Re-establishment				0.390*	N/A	N/A	N/A
Rehabilitation				8.200*	N/A	N/A	N/A
Enhancement				N/A	N/A	N/A	N/A
Enhancement I	77.333	N/A	N/A				
Enhancement II	979.600	N/A	N/A				
Creation				N/A	N/A	N/A	N/A
Preservation	2.000	N/A	N/A	N/A	N/A	N/A	
Totals	**2,838.933**	**N/A**	**N/A**	**8.590***	**N/A**	**N/A**	**N/A**

* Actual as-built wetland acreage/potential crediting slightly differs (excess or loss) that of the Mitigation Plan, the project credit assets listed reflect those of the approved Mitigation Plan.

Table 2. Project Activity and Reporting History

Deep Meadow Mitigation Site
DMS Project No. 97131
Monitoring Year 0 - 2020

Activity or Report		Data Collection Complete	Completion or Delivery
404 Permit		July 2018	July 2018
Mitigation Plan		June 2016 - October 2017	May/June 2018
Final Design - Construction Plans		January 2019	January 2019
Construction		July - September 2019	September 2019
Temporary S&E mix applied to entire project area[1]		July - September 2019	September 2019
Permanent seed mix applied to reach/segments[1]		July - September 2019	September 2019
Bare root and live stake plantings for reach/segments		December 2019 - January 2020	January 2020
Baseline Monitoring Document (Year 0)		October 2019 - January 2020	March 2020
Year 1 Monitoring	Stream Survey		
	Vegetation Survey		
Year 2 Monitoring	Stream Survey		
	Vegetation Survey		
Year 3 Monitoring	Stream Survey		
	Vegetation Survey		
Year 4 Monitoring	Stream Survey		
	Vegetation Survey		
Year 5 Monitoring	Stream Survey		
	Vegetation Survey		
Year 6 Monitoring	Stream Survey		
	Vegetation Survey		
Year 7 Monitoring	Stream Survey		
	Vegetation Survey		

[1]Seed and mulch is added as each section of construction is completed.

Table 3. Project Contact Table

Deep Meadow Mitigation Site
DMS Project No. 97131
Monitoring Year 0 - 2020

Designers Aaron Earley, PE, CFM	**Wildlands Engineering, Inc.** 1430 South Mint Street, Suite 104 Charlotte, NC 28203 704.332.7754
Construction Contractors	**Land Mechanic Designs, Inc.** 126 Circle G Lane Willow Spring, NC 27592
Planting Contractor	**Bruton Natural Systems, Inc.** PO Box 1197 Freymont, NC 27830
Seeding Contractor	**Land Mechanic Designs, Inc.** 126 Circle G Lane Willow Spring, NC 27592
Seed Mix Sources	**Land Mechanic Designs, Inc.**
Nursery Stock Suppliers Bare Roots Live Stakes Herbaceous Plugs	**Bruton Natural Systems, Inc.**
Monitoring Performers	**Wildlands Engineering, Inc.**
Monitoring, POC	Kristi Suggs (704) 332.7754 x.110

Table 4. Project Information and Attributes
Deep Meadow Mitigation Site
DMS Project No. 97131
Monitoring Year 0 - 2020

Project Information	
Project Name	Deep Meadow Mitigation Site
	Union County
Project Area (acres)	23.800
Project Coordinates (latitude and longitude)	35° 1' 24.44"N 80° 27' 4.33"W
Planted Acreage (Acre of Woody Stems Planted)	21.480

Project Watershed Summary Information	
Physiographic Province	Piedmont Physiographic Province
River Basin	Yadkin River
USGS Hydrologic Unit 8-digit	3040105
USGS Hydrologic Unit 14-digit	3040105070060
DWR Sub-basin	03-07-14
Project Drainage Area (acres)	EF1 226, WF1 58, WF2 131, Meadow Branch 4,472
Project Drainage Area Percentage of Impervious Area	4%
2011 NLCD Land Use Classification	Meadow Branch- Forest (25%), Cultivated (50%), Grassland (3%), Shrubland (< 1%), Urban (21%), Open Water (< 1%) EF1 - Forest (27%), Cultivated (65%), Grassland (4%), Shrubland (2%), Urban (2%), Open Water (0%) WF1 - Forest (28%), Cultivated (70%), Grassland (0%), Shrubland (0%), Urban (2%), Open Water (0%) WF2 - Forest (16%), Cultivated (57%), Grassland (20%), Shrubland (4%), Urban (3%), Open Water (0%)

Reach Summary Information				
Parameters	**Meadow Branch**	**EF1**	**WF1**	**WF2**
Length of reach (linear feet) - Post-Restoration	2,449	1,322	136	458
Valley confinement (Confined, moderately confined, unconfined)	Unconfined	Moderatley Confined	Unconfined	Unconfined
Drainage area (acres)	4,472	226	58	131
Perennial, Intermittent, Ephemeral	P	P	P	P
NCDWR Water Quality Classification	C			
Morphological Description (stream type) - Pre-Restoration	C4/5	Incised and Straightened E4	G4	Incised and straighteded E4
Morphological Description (stream type) - Post-Restoration	C4/5	C4	C4	C4
Evolutionary trend (Simon's Model) - Pre- Restoration	VI	III	III	IV
FEMA classification	Zone AE			

Wetland Summary Information		
Parameters	**Wetlands**	
	W-H1	W-H2
Size of Wetland (acres)	0.28	0.30
Wetland Type	Riparian Riverine	
Mapped Soil Series	Tatum/ Chewacla	Chewacla
Drainage class	Well Drained/ Poorly Drained	Poorly Drained
Soil Hydric Status	No / Yes	Yes
Source of Hydrology	Groundwater and over bank events	
Restoration or enhancement method (hydrologic, vegetative etc.)	Re-habilitation (hydrologic, vegetative)	

Regulatory Considerations			
Regulation	**Applicable?**	**Resolved?**	**Supporting Documentation**
Waters of the United States - Section 404	Yes	Yes	USACE Action ID #SAW-2012-01107
Waters of the United States - Section 401	Yes	Yes	DWR# 18-0264
Division of Land Quality (Erosion and Sediment Control)	Yes	Yes	NPDES Construction Stormwater General Permit NCG010000
Endangered Species Act	Yes	Yes	Categorical Exclusion Document in Mitigation Plan
Historic Preservation Act	Yes	Yes	Categorical Exclusion Document in Mitigation Plan
Coastal Zone Management Act (CZMA)/Coastal Area Management Act (CAMA)	No	N/A	N/A
FEMA Floodplain Compliance	Yes	Yes	Union County Floodplain Development Permit #20180991
Essential Fisheries Habitat	No	N/A	N/A

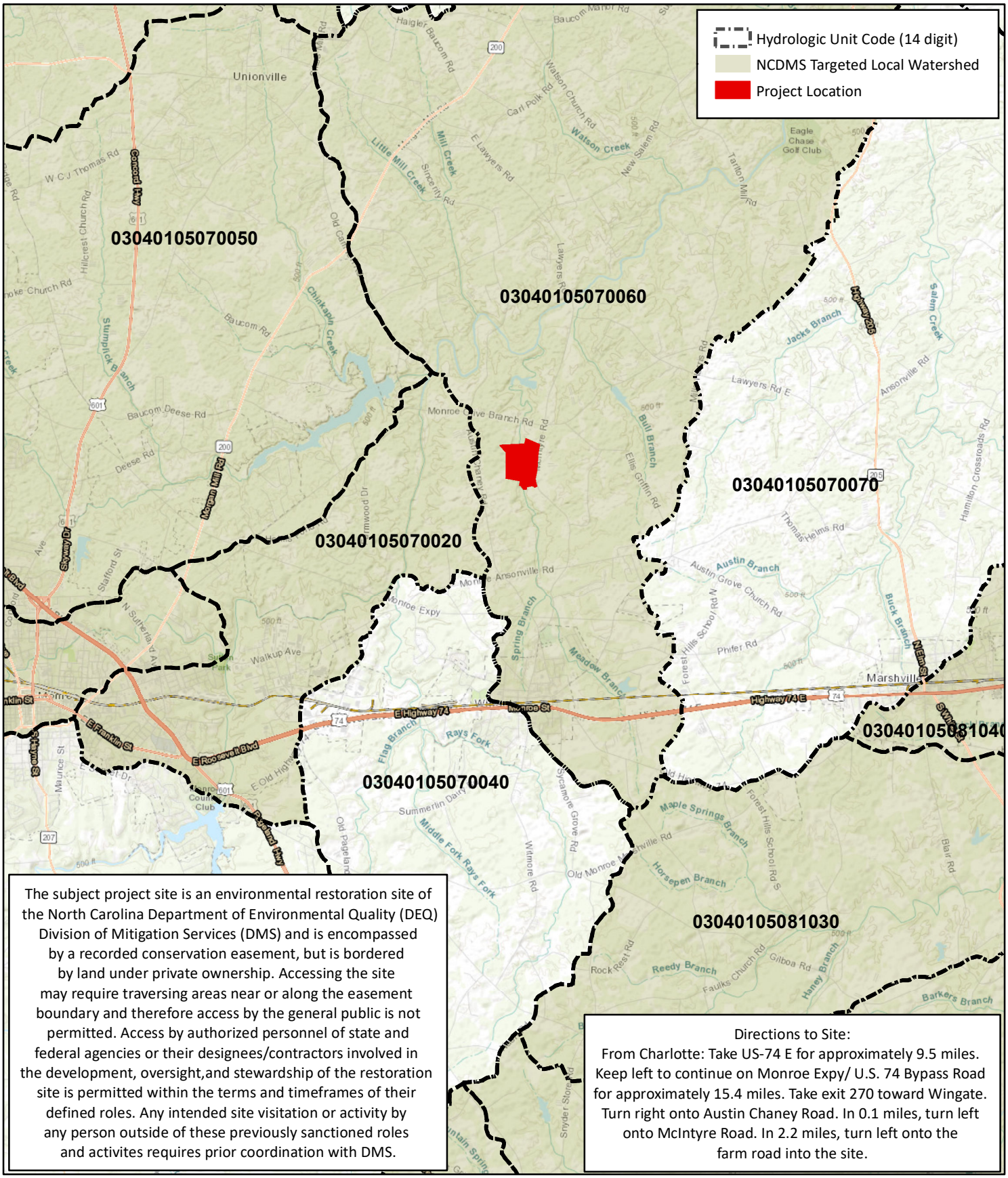
Table 5. Monitoring Component Summary

Deep Meadow Mitigation Site
DMS Project No. 97131
Monitoring Year 0 - 2020

Parameter	Monitoring Feature	Quantity / Length by Reach				Wetlands	Frequency	Notes
		Meadow Branch	EF1	WF1	WF2			
Dimension	Riffle Cross-Section	N/A	2	1	1	N/A	Year 1, 2, 3, 5, and 7	1
	Pool Cross-Section	N/A	1	N/A	1	N/A		
Pattern	Pattern	N/A	N/A	N/A	N/A	N/A	Year 0	2
Profile	Longitudinal Profile	N/A	N/A	N/A	N/A	N/A	Year 0	
Substrate	Reach Wide (RW) Pebble Count	N/A	1 RW	1 RW	1 RW	N/A	Year 1, 2, 3, 5, and 7	3
Hydrology	Crest Gage (CG) and or/Transducer (SG)	N/A	1 CG	1 CG	1 CG	N/A	Quarterly	4
Wetland Hydrology	Groundwater Gages	N/A	N/A	N/A	N/A	11	Quarterly	
Vegetation	CVS Level 2/Mobile plots	16 (12 permanent, 4 mobile)					Year 1, 2, 3, 5, and 7	5
Visual Assessment		Yes					Semi-Annual	
Exotic and Nuisance Vegetation							Semi-Annual	6
Project Boundary							Semi-Annual	7
Reference Photos	Photographs	18					Annual	

Notes:

1. Cross-sections were permanently marked with rebar to establish location. Surveys include points measured at all breaks in slope, including top of bank, bankfull, edge of water, and thalweg.
2. Pattern and profile will be assessed visually during semi-annual site visits. Longitudinal profile was collected during the as-built baseline monitoring survey only, unless observations indicate widespread lack of vertical stability (greater than 10% of reach is affected) and profile survey is warranted in additional years to monitor adjustments or survey repair work.
3. Riffle 100-count substrate sampling were collected during the baseline monitoring only. A reach-wide pebble count will be performed on each restoration or enhancement I reach each year for classification purposes.
4. Crest gages and/or transducers will be inspected and downloaded quarterly or semi-annually. Evidence of bankfull events such as rack lines or floodplain deposition will be documented with a photo when possible. Transducers, if used, will be set to record stage once every three hours.
5. Permanent vegetation monitoring plot assessments will follow CVS Level 2 protocols. Mobile vegetation monitoring plot assessments will document number of planted stems, height, and species using a circular or 100 m2 square/rectangular plot.
6. Locations of exotic and nuisance vegetation will be mapped.
7. Locations of vegetation damage, boundary encroachments, etc. will be mapped.



The subject project site is an environmental restoration site of the North Carolina Department of Environmental Quality (DEQ) Division of Mitigation Services (DMS) and is encompassed by a recorded conservation easement, but is bordered by land under private ownership. Accessing the site may require traversing areas near or along the easement boundary and therefore access by the general public is not permitted. Access by authorized personnel of state and federal agencies or their designees/contractors involved in the development, oversight,and stewardship of the restoration site is permitted within the terms and timeframes of their defined roles. Any intended site visitation or activity by any person outside of these previously sanctioned roles and activites requires prior coordination with DMS.

Directions to Site:
From Charlotte: Take US-74 E for approximately 9.5 miles. Keep left to continue on Monroe Expy/ U.S. 74 Bypass Road for approximately 15.4 miles. Take exit 270 toward Wingate. Turn right onto Austin Chaney Road. In 0.1 miles, turn left onto McIntyre Road. In 2.2 miles, turn left onto the farm road into the site.

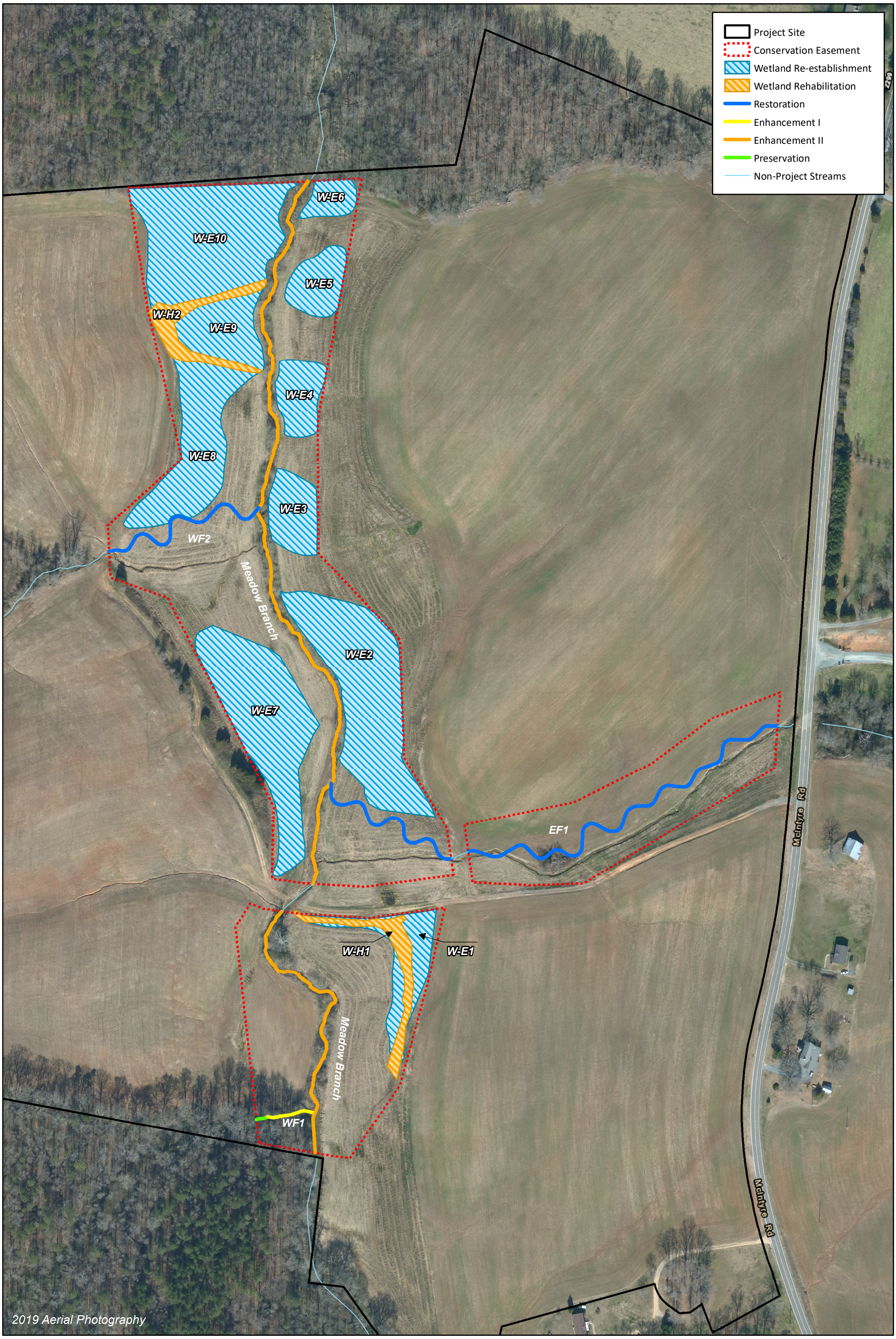
WILDLANDS ENGINEERING

0 1.5 3 Miles

N

Figure 1 Project Vicinity Map
Deep Meadow Mitigation Site
DMS Project No. 97131
Monitoring Year 0 - 2020

Union County, NC



WILDLANDS ENGINEERING

0 200 400 Feet

N

Figure 2 Project Component/ Asset Map
Deep Meadow Mitigation Site
DMS Project No. 97131
Monitoring Year 0 - 2020

Union County, NC

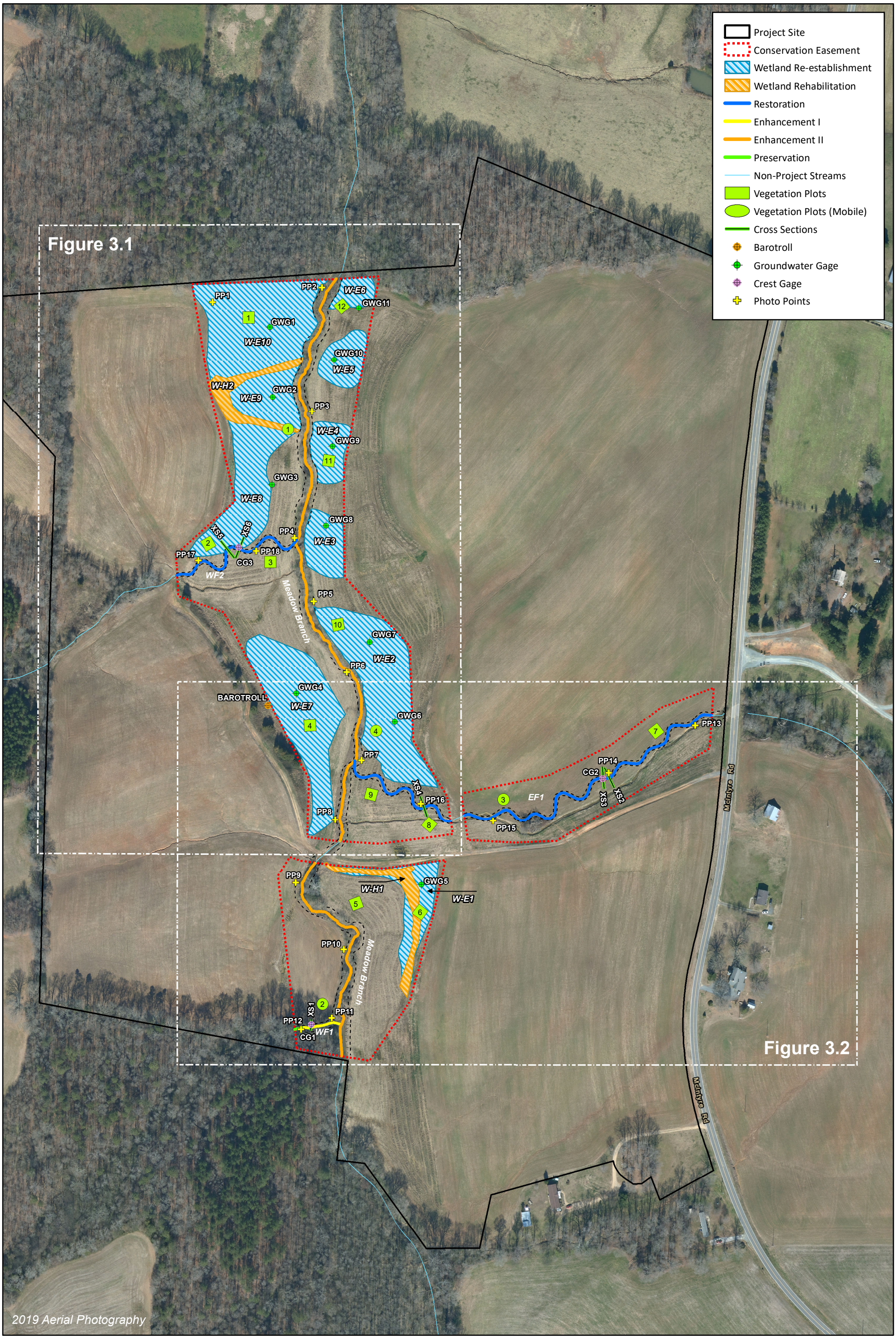
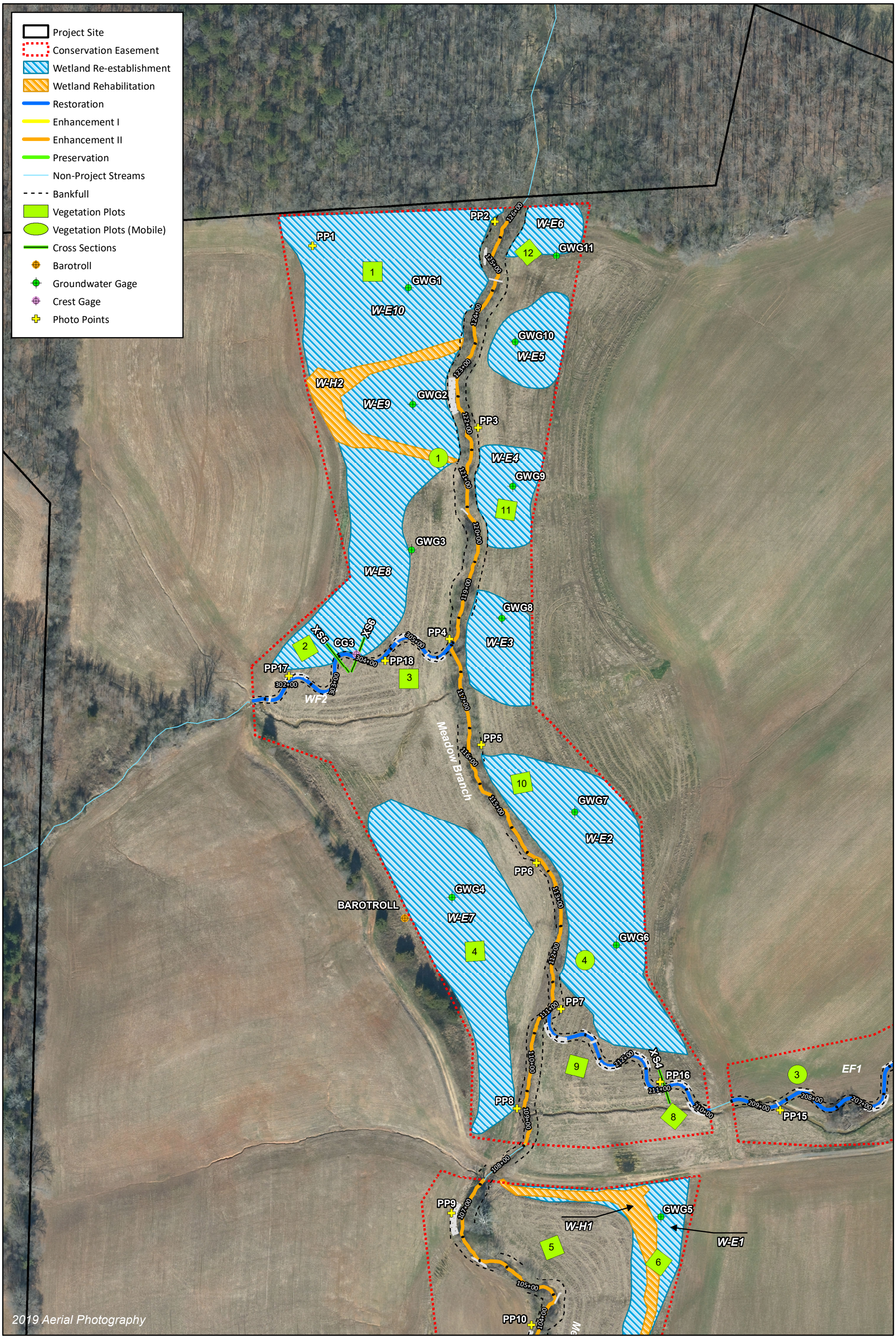


Figure 3.0 As-Built Monitoring Plan View (Key)
Deep Meadow Mitigation Site
DMS Project No. 97131
Monitoring Year 0 - 2020

Union County, NC



WILDLANDS ENGINEERING

0 150 300 Feet

N

Figure 3.1 As-Built Monitoring Plan View
Deep Meadow Mitigation Site
DMS Project No. 97131
Monitoring Year 0 - 2020

Union County, NC

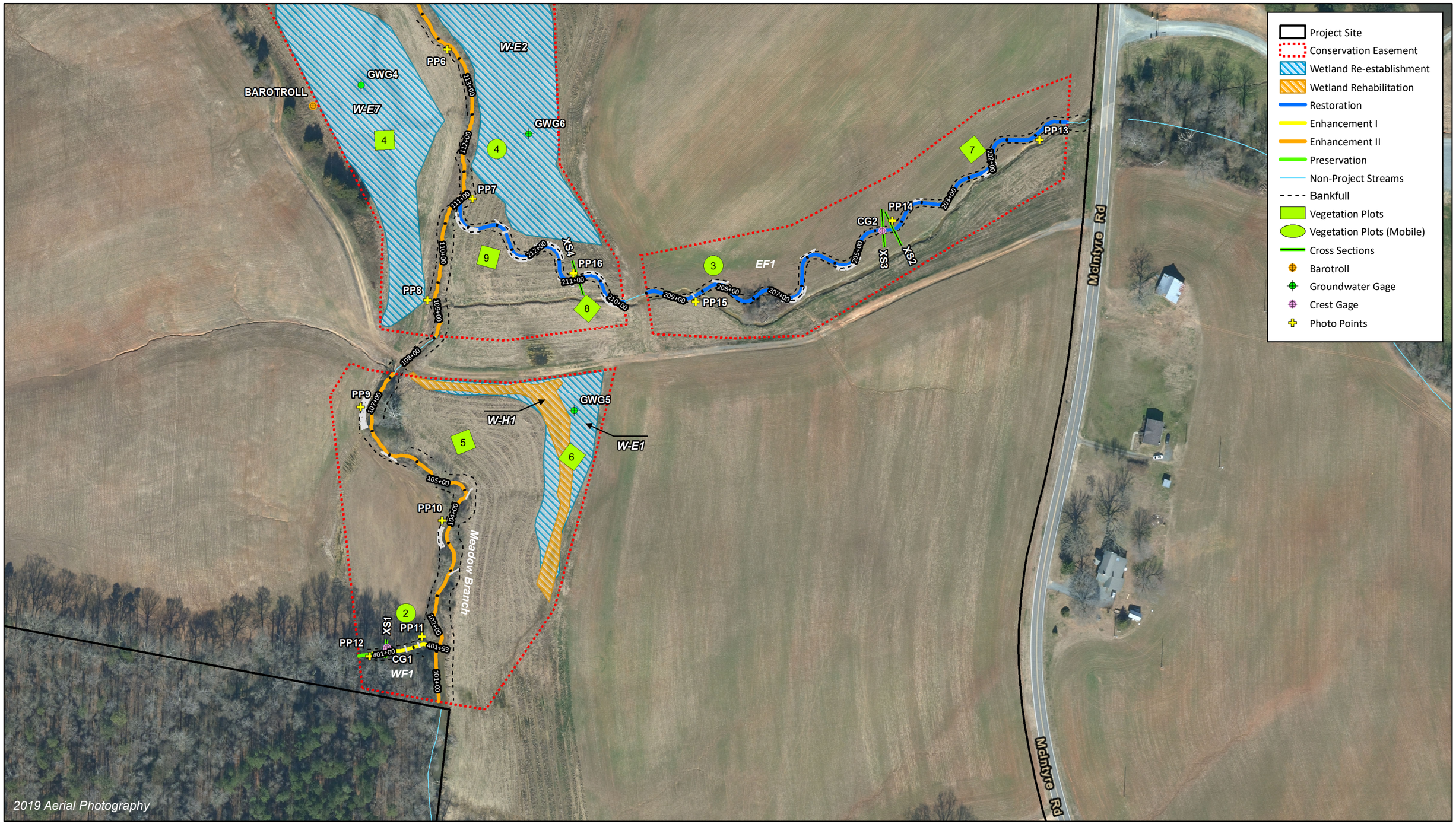


Figure 3.2 As-Built Monitoring Plan View
Deep Meadow Mitigation Site
DMS Project No. 97131
Monitoring Year 0 - 2020

Union County, NC

MEETING NOTES

MEETING:	Post-Contract IRT Site Walk **DEEP MEADOW Mitigation Site** Yadkin 03040105; Union County, NC DEQ Contract No. 6887 Wildlands Project No. 005-02162
DATE:	Wednesday, July 20, 2016 @ 10:00 AM – 12:00 PM
LOCATION:	McIntyre Road Wingate, NC 28174

Attendees

Todd Tugwell, USACE
David Shaeffer, USACE
Harry Tsomides, DMS Project Manager
Paul Wiesner, DMS
Shawn Wilkerson, Wildlands Engineering
John Hutton, Wildlands Engineering
Eric Neuhaus, Wildlands Engineering Assistant Project Manager

Materials

- Wildlands Engineering Technical Proposal dated 3/15/2016 in response to DMS RFP 16-006785

Meeting Notes

1. Overview of project from farm road entrance off of McIntyre Road in Wingate, NC.
2. Discussed proposed project approach for both wetland rehabilitation and re-establishment and stream enhancement and restoration. Site includes stream enhancement on Meadow Branch and UT3, stream restoration on UT1 and UT2, and wetland re-establishment and rehabilitation in the floodplain of Meadow Branch.
3. There was general discussion about the Hydric Soil Investigation done for the proposal stage by Michael Wood and Three Oaks Engineering. Soil units including hydric, hydric over hydric, non-hydric over hydric, and non-hydric were defined for potential wetland restoration areas on-site. IRT agreed with the overall information presented in the report and Wildlands noted this information would be used to guide overburden removal and delineation of wetland restoration areas during design.
4. The field walk began at the existing ford crossing along Meadow Branch. The group crossed Meadow Branch at the existing ford and observed high flow in the reach from precipitation the night before the meeting. The overall condition of Meadow Branch was discussed as well as the proposed enhancement. Wildlands noted that more significant bank repair work than might be typical of an enhancement two approach may be necessary on Meadow Branch.

5. The Meadow Branch floodplain was planted in corn approximately 8 to 10 feet tall. Wildlands extended an invitation to the IRT to set up another site visit in the fall after the corn in the floodplain has been harvested.
6. Wildlands was asked about the potential for drain tiles on the site. Currently it is difficult to tell with the floodplain in corn, but this winter after the corn is harvested a detailed inspection will be done for drain tiles.
7. The group continued along the perimeter farm road that follows the western proposed easement boundary to get an overview of topography and landscape position of the wetland restoration areas.
8. The group stopped at the upstream easement boundary for UT2 (just before the stream enters the active corn field) to look at the flow and overall condition of the channel. Todd, Shawn, and Harry walked upstream of project limits to look at the condition of UT2 in the wooded area upstream of the agricultural fields. UT2 had steady flow in the channel the day of the meeting.
9. There was general discussion around intermittent channels and swales. The IRT prefers that these do not comprise more than 20% of mitigation sites. Wildlands discussed our approach on limiting the amount of intermittent channels in projects, but also noted the benefit of including these areas if there is potential to eliminate major water quality stressors.
10. The field walk continued north along the western boundary of the proposed easement. The group looked at the current ditch network and area proposed for wetland re-establishment in the left floodplain of Meadow Branch. It was noted by both Wildlands and IRT that the ditch at the toe of slope is negatively effecting wetland hydrology in this area.
11. The group entered the corn field in the left floodplain of Deep Meadow and took a soil boring to look at in-situ soils and the possibility for wetland restoration. Overall, it was agreed upon by Wildlands and IRT that the soil in wetland 1 was hydric and that the proposed approach of wetland re-establishment is valid based on the existing ditch network, landscape position, and soil classification.
12. Overall the soils on-site are mapped as Chewacla but wetter areas are indicative of wehadkee inclusions.
13. The group continued into the potential reference wetland area on the parcel north of the proposed project parcel in the left floodplain of Meadow Branch (PIN 09043010). Wildlands plans to install a groundwater monitoring gage in this area for use during wetland design and monitoring but is waiting on landowner approval. The group observed established vegetation and in-situ soils and confirmed that the area was suitable for use as a reference wetland area for the project. The IRT noted that Meadow Branch in this area was not in a reference condition. Wildlands agreed and maintained that the stream would not be used as a reference for design.
14. Within the reference wetland area, there was general discussion about wetland design approach. Wildlands noted that hydrology performance criteria will be set based on an iterative process using a DRAINMOD hydrologic model and hydrology data from the proposed wetland reference area. Additionally, Wildlands noted one other potential reference wetland upstream of the project that will be considered as additional information for establishing hydrology performance criteria. The range of wetland hydroperiod for performance criteria was listed between 7.5% and 12% in the proposal documentation. Todd stated that the IRT would likely expect a higher hydroperiod for the proposed project area.
15. There was general discussion about the use of soil temperature probes to set the growing season for wetland hydroperiod. Wildlands and IRT agreed that the use of soil temperature probes can be valuable for obtaining information about the growing season, however, regardless of recorded soil temperatures, the beginning of the growing season should be set at a minimum of March 1.
16. Todd asked about anticipated grading for the removal of overburden material for wetland restoration. Wildlands noted that hydrology data will affect the amount of overburden removal, but it is anticipated that overburden removal would be required in wetland 1 (wetland in left floodplain at the downstream end of the project) but that grading in depressional wetland areas such as wetland 2 would not be

necessary. Generally, depressional wetland areas will not be graded but ditch networks will be plugged and depressional topography left. Corn growth in isolated depressional areas was stunted indicating a high water table.

17. The group walked back over to the east side of the site to observe the current condition of UT1. On the day of the site walk, UT1 had steady flow. Wildlands discussed why restoration was proposed on UT1 and it was agreed that this approach was appropriate. Wildlands noted that in some areas along UT1 the proposed channel may tie to the exiting channel to take advantage of existing grade control.
18. There was general discussion about the use of wood in slate belt streams, and how low flows could affect the longevity of grade control. Wildlands noted the concern and will consider this issue during design.
19. It was noted that easement breaks will remain at existing crossing locations along Meadow Branch and UT1.
20. David Shaeffer noted that Wildlands needs to ensure that Landowner Authorization forms are submitted with Jurisdictional Determination requests to ensure that USACE has all the proper paperwork for right of entry prior to site review. Additionally, it was discussed that the JD requests should be submitted via hardcopy to the Asheville office and that the Asheville office will pass it on to David within 7 to 10 business days. Once David receives the package from the Asheville office, a time and date for site review will be sent to Wildlands via email.

APPENDIX 2. Morphological Summary Data and Plots

Table 6. Baseline Stream Data Summary
Deep Meadow Mitigation Site
DMS Project No. 97131
Monitoring Year 0 - 2020

		Pre-Restoration Condition						Design						As-Built/Baseline					
Parameter	**Gage**	**WF1**		**WF2**		**EF1**		**WF1**		**WF2**		**EF1**		**WF1**		**WF2**		**EF1**	
		Min	**Max**	**Min**	**Max**	**Min**	**Max**	**Min**	**Max**	**Min**	**Max**	**Min**	**Max**	**Min**	**Max**	**Min**	**Max**	**Min**	**Max**
Dimension and Substrate - Riffle																			
Bankfull Width (ft)	N/A	4.9		6.1		8.2		8.1		8.9		10.2		9.3		9.8		10.3	13.1
Floodprone Width (ft)		6.0		>82		29	>39	18	36	26	70	30	68	13.3		64.5		57.0	64.9
Bankfull Mean Depth (ft)		0.7		0.9		1.5		0.9		0.7		0.8		0.4		0.7		0.5	0.6
Bankfull Max Depth (ft)		1.1		1.1		1.6		0.5	0.9	0.8	1.2	1.0	1.3	0.7		1.2		0.8	1.0
Bankfull Cross-sectional Area (ft^2)[1]		3.2		5.1		8.4		4.4		6.6		8.7		4.0		7.1		5.0	7.9
Width/Depth Ratio		7.3		7.5		8.0		15.0		12.7		12.0		21.3		13.6		21.3	21.9
Entrenchment Ratio[3]		1.3		12.0		3.8		2.2		6.0		5.0		1.4		6.6		4.9	5.5
Bank Height Ratio		3.4		1.4		1.4		1.0		1.0		1.0		1.0		1.0		1.0	
D_{50} (mm)		---		SC		16.0	41.3	---		---		---		24.4		37.5		37.4	51.8
Profile																			
Riffle Length[1] (ft)	N/A																		
Riffle Slope (ft/ft)[1]		---		---	---	---	---	---	---	0.014	0.036	0.007	0.031	---	---	0.00963	0.04802	0.00191	0.07879
Pool Length (ft)																			
Pool Max Depth (ft)		N/A		N/A		2.2		---		1.4	2.6	1.4	2	---		1.5	2.8	1.3	2.3
Pool Spacing (ft)		N/A		34	53	42	81	---	---	22	69	41	75	---	---	57	87	38	73
Pool Volume (ft^3)[1]																			
Pattern																			
Channel Beltwidth (ft)	N/A	---		---		---		N/A[2]		23	56	23	57	N/A[2]		23	56	23	57
Radius of Curvature (ft)		---		---		---		N/A[2]		18	27	20	35	N/A[2]		18	27	20	35
Rc/Bankfull Width		---		---		---		N/A[2]		2.1	3.1	2.3	4.0	N/A[2]		2.1	3.1	2.3	4.0
Meander Length (ft)		---		---		---		N/A[2]		73	135	93	146	N/A[2]		73	135	93	146
Meander Width Ratio		---		---		---		N/A[2]		2.7	6.5	2.7	6.5	N/A[2]		2.7	6.5	2.7	6.5
Substrate, Bed and Transport Parameters																			
Ri%/Ru%/P%/G%/S%	N/A																		
SC%/Sa%/G%/C%/B%/Be%																			
$D_{16}/D_{35}/D_{50}/D_{84}/D_{95}/D_{100}$		---		SC/SC/SC/36.7/78.5/180.0		SC/10.5/19.7/68.5/>2048/>2048		---		---		---		0.1/18.0/35.9/98.3/160.7/256.0		SC/0.2/8.0/67.2/128.0/256.0		SC/0.3/12.1/81.3/137.0/256.0	
Reach Shear Stress (Competency) lb/ft^2		---		---		---		---		0.59		0.49		0.68		0.59		0.24	0.29
Max part size (mm) mobilized at bankfull		---		---		---		---		103		90		---		---		---	
Stream Power (Capacity) W/m^2																			
Additional Reach Parameters																			
Drainage Area (SM)	N/A	0.09		0.20		0.35		0.09		0.20		0.35		0.09		0.20		0.35	
Watershed Impervious Cover Estimate (%)		4%						4%						4%					
Rosgen Classification		G4		E4		E4		C4b		E4		E4		B4		C4		C3/4	
Bankfull Velocity (fps)		4.1		4.5		4.1		3.3		3.2		3.4		3.3		3.4		2.1	2.3
Bankfull Discharge (cfs)		10		20		30		10		20		30		13		24		10	18
Q-NFF regression (2-yr)																			
Q-USGS extrapolation (1.2-yr)		---		---		---		13		24		36		---		---		---	
Max Q-Mannings		---		---		---		126		44		97		---		---		---	
Valley Slope (ft/ft)		0.0166		0.0170		0.0094		0.0167		0.0183		0.0124		---		---		---	
Channel Thalweg Length (ft)		136		391		1,201		136		458		1,322		136		458		1,322	
Sinuosity		1.00		1.00		1.04		1.00		1.40		1.30		---		1.40		1.30	
Bankfull/Channel Slope[1] (ft/ft)		0.0192		0.0168		0.0101		0.0160		0.0133		0.0095		0.0274		0.0135		0.0078	

1. As-Built/ Baseline channel slope (ft/ft) was measured from channel bed rather than water surface slope due to a dry channel during survey data collection
2. Pattern data is not applicable for A-type and B-type channels
3. ER is based on the width of the cross-section, in lieu of assuming the width across the floodplain.
SC: Silt/Clay <0.062 mm diameter particles
(---): Data was not provided
N/A: Not Applicable

Table 7. Reference Reach Data Summary

Deep Meadow Mitigation Site

DMS Project No. 97131

Monitoring Year 0 - 2020

		Reference Reach Data											
Parameter	**Gage**	**UT to Richland Creek**		**UT to Cane Creek**		**Spencer Creek 3**		**UT to Rocky Creek**		**Foust Creek US**		**Long Branch**	
		Min	**Max**	**Min**	**Max**	**Min**	**Max**	**Min**	**Max**	**Min**	**Max**	**Min**	**Max**
Dimension and Substrate - Riffle													
Bankfull Width (ft)	N/A	8.8	10.4	11.5	12.3	6.3	9.3	12.2		18.5	19.4	14.8	18.6
Floodprone Width (ft)		28.0	31.0	31.0		14.0	125.0	72.4		55.0	101.0	>50.0	
Bankfull Mean Depth		0.8	0.9	0.8	1.0	0.8	1.0	1.3		1.2	1.3	1.3	2.1
Bankfull Max Depth		1.1	1.3	1.2	1.6	1.0	1.2	1.8		1.8	2.1	1.9	2.9
Bankfull Cross-sectional Area (ft^2)		7.8	8.5	8.9	12.2	6.6	8.7	16.3		23.9	24.1	34.6	
Width/Depth Ratio		10.0	12.8	12.3	14.4	7.9	9.3	9.1		14.3	15.7	7.9	13.8
Entrenchment Ratio		2.5	4.0	2.5	2.7	1.7	4.3	6.0		2.9	5.3	>3.4	
Bank Height Ratio		1.4	2.1	1.4	2.5	1.0		1.0		---	---	1.2	1.5
D50 (mm)		---		27.8		11.0		22.6		61.0		41.6	
Profile													
Riffle Length (ft)	N/A	---		---		---		---		---		---	
Riffle Slope (ft/ft)		0.018	0.036	0.015	0.035	0.018	0.034	0.061	0.089	---	---	0.012	0.013
Pool Length (ft)		---		---		---		---		---		---	
Pool Max Depth (ft)		14.7	16.0	2.5	2.9	1.2	1.8	2.2		2.5	2.9	2.2	
Pool Spacing (ft)		33	93	49	91	9	46	26	81	---	---	50	105
Pool Volume (ft^3)		---		---		---		---		---		---	
Pattern													
Channel Beltwidth (ft)	N/A	---		102		10	50	---		---		60	
Radius of Curvature (ft)		---		23	38	12	85	---		---		16	87
Rc/Bankfull Width		---		2.0	3.1	1.9	9.1	---		---		1.1	4.7
Meander Length (ft)		---		---		53	178	---		---		---	---
Meander Width Ratio		---		8.3	8.9	1.6	5.4	---		---		3.2	4.1
Substrate, Bed and Transport Parameters													
Ri%/Ru%/P%/G%/S%	N/A												
SC%/Sa%/G%/C%/B%/Be%													
d16/d35/d50/d84/d95/d100		---		0.6/12.2/27.8/74.5/128		1.9/8.9/11/64/128		<0.063/2.4/22.6/120/256		9.6/37/61/130/1100		8.1/26.6/41.6/124.8/225.5	
Reach Shear Stress (Competency) lb/ft^2													
Max part size (mm) mobilized at bankfull													
Stream Power (Capacity) W/m^2													
Additional Reach Parameters													
Drainage Area (SM)	N/A	0.28		0.29		0.37		1.05		1.40		1.49	
Watershed Impervious Cover Estimate (%)		---		---		---		---		---		---	
Rosgen Classification		C4/E4		E4		E4		E4b		C4		C/E4	
Bankfull Velocity (fps)		4.1		3.8		5.0	5.6	5.5		4.0		4.0	
Bankfull Discharge (cfs)		32		40		35		85		95		124	
Q-NFF regression (2-yr)													
Q-USGS extrapolation (1.2-yr)													
Q-Mannings													
Valley Length (ft)		---		---		---		---		---		---	
Channel Thalweg Length (ft)		---		---		---		---		---		---	
Sinuosity		1.00		1.40		1.00	1.30	1.10		---		1.30	
Water Surface Slope (ft/ft)		---		---		---		---		---		---	
Bankfull/Channel Slope (ft/ft)		0.0131	0.0178	0.0150		0.0190	0.0220	0.0240		0.0090		0.0040	

SC: Silt/Clay <0.062 mm diameter particles

(---): Data was not provided N/A: Not Applicable

Table 8. Morphology and Hydraulic Summary (Dimensional Parameters - Cross-Section)
Deep Meadow Mitigation Site
DMS Project No. 97131
Monitoring Year 0 - 2020

	WF1 Cross-Section 1, Riffle								EF1 Cross-Section 2, Pool							
Dimension and Substrate	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**MY6**	**MY7**	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**MY6**	**MY7**
bankfull elevation	485.90								491.66							
Bankfull Width (ft)	9.3								11.6							
Floodprone Width (ft)	13.3								N/A							
Bankfull Mean Depth (ft)	0.4								1.0							
Bankfull Max Depth (ft)	0.7								1.8							
Bankfull Cross-Sectional Area (ft^2)	4.0								11.1							
Bankfull Width/Depth Ratio	21.3								12.1							
Bankfull Entrenchment Ratio[1]	1.4								N/A							
Bankfull Bank Height Ratio	1.0								N/A							
	EF1 Cross-Section 3, Riffle								**EF1 Cross-Section 4, Riffle**							
Dimension and Substrate	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**MY6**	**MY7**	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**MY6**	**MY7**
bankfull elevation	491.48								487.26							
Bankfull Width (ft)	10.3								13.1							
Floodprone Width (ft)	57.0								64.9							
Bankfull Mean Depth (ft)	0.5								0.6							
Bankfull Max Depth (ft)	0.8								1.0							
Bankfull Cross-Sectional Area (ft^2)	5.0								7.9							
Bankfull Width/Depth Ratio	21.3								21.9							
Bankfull Entrenchment Ratio[1]	5.5								4.9							
Bankfull Bank Height Ratio	1.0								1.0							
	WF2 Cross-Section 5, Pool								**WF2 Cross-Section 6, Riffle**							
Dimension and Substrate	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**MY6**	**MY7**	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**MY6**	**MY7**
bankfull elevation	485.68								485.50							
Bankfull Width (ft)	11.3								9.8							
Floodprone Width (ft)	N/A								64.5							
Bankfull Mean Depth (ft)	0.9								0.7							
Bankfull Max Depth (ft)	1.8								1.2							
Bankfull Cross-Sectional Area (ft^2)	9.9								7.1							
Bankfull Width/Depth Ratio	13.0								13.6							
Bankfull Entrenchment Ratio[1]	N/A								6.6							
Bankfull Bank Height Ratio	N/A								1.0							

1. ER is based on the width of the cross-section, in lieu of assuming the width across the floodplain.
N/A: Not Applicable

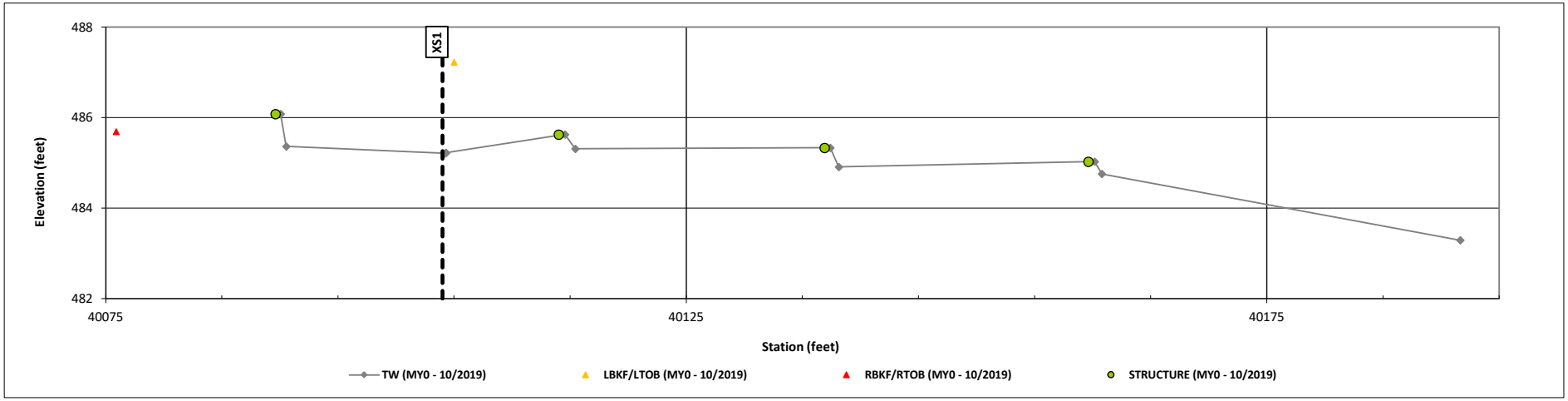
Longitudinal Profile Plots

Deep Meadow Mitigation Site

DMS Project No. 97131

Monitoring Year 0 - 2020

WF1 (STA 400+75 to 401+95)



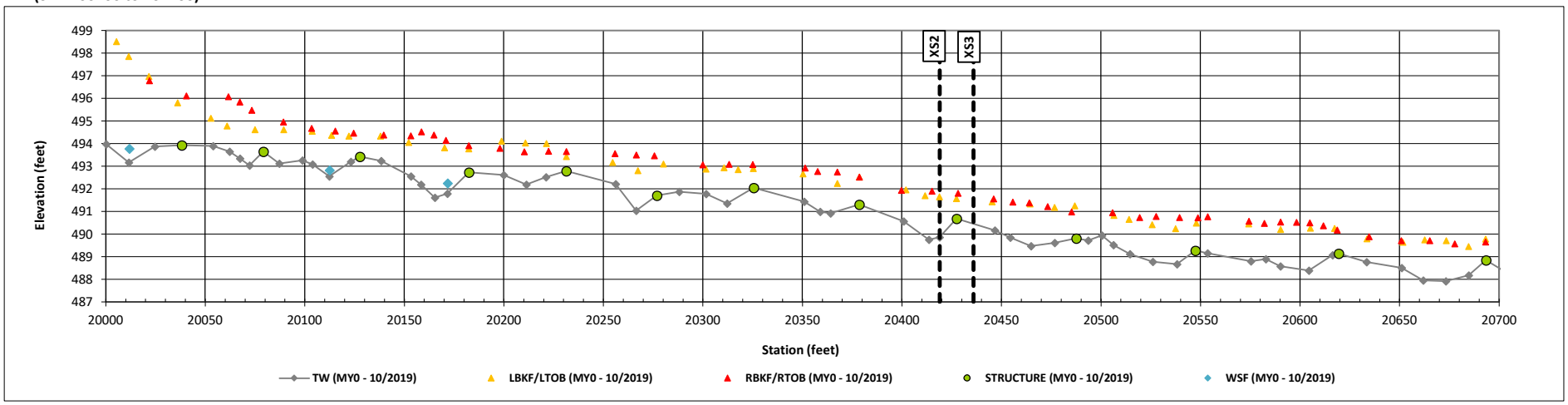
Longitudinal Profile Plots

Deep Meadow Mitigation Site

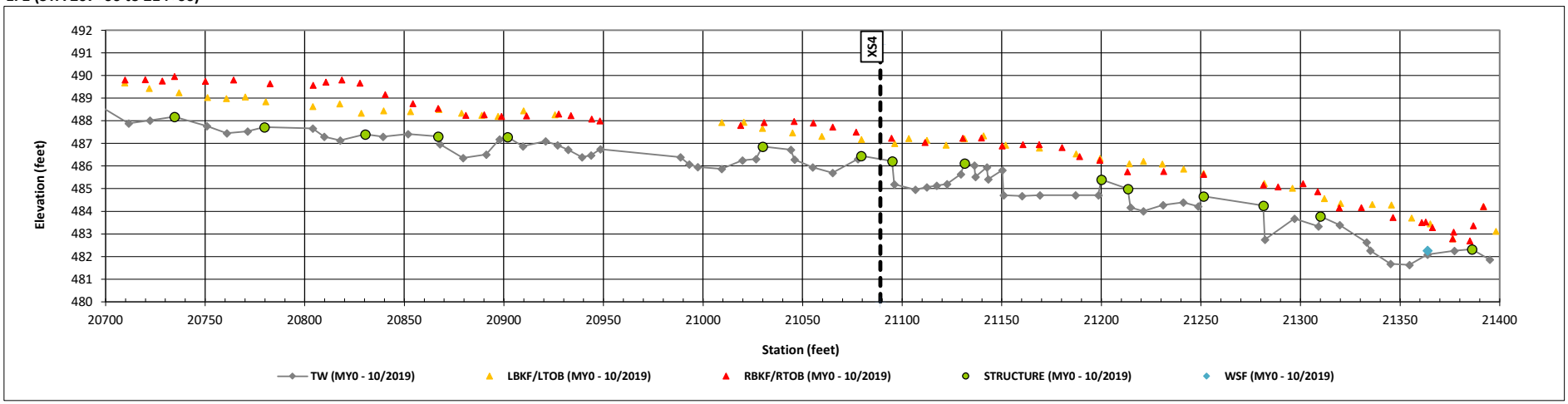
DMS Project No. 97131

Monitoring Year 0 - 2020

EF1 (STA 200+00 to 207+00)



EF1 (STA 207+00 to 214+00)



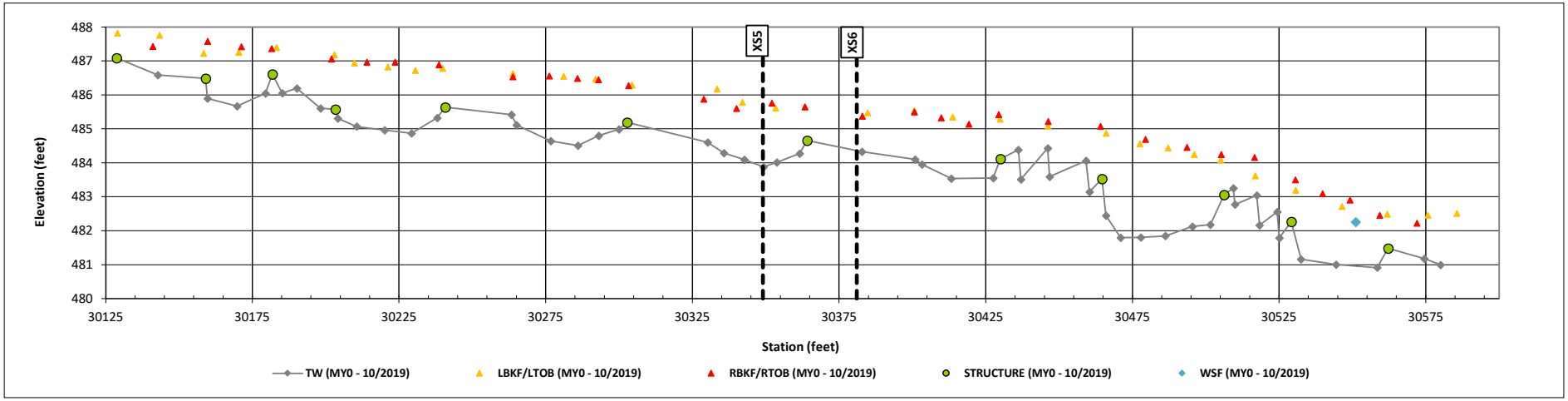
Longitudinal Profile Plots

Deep Meadow Mitigation Site

DMS Project No. 97131

Monitoring Year 0 - 2020

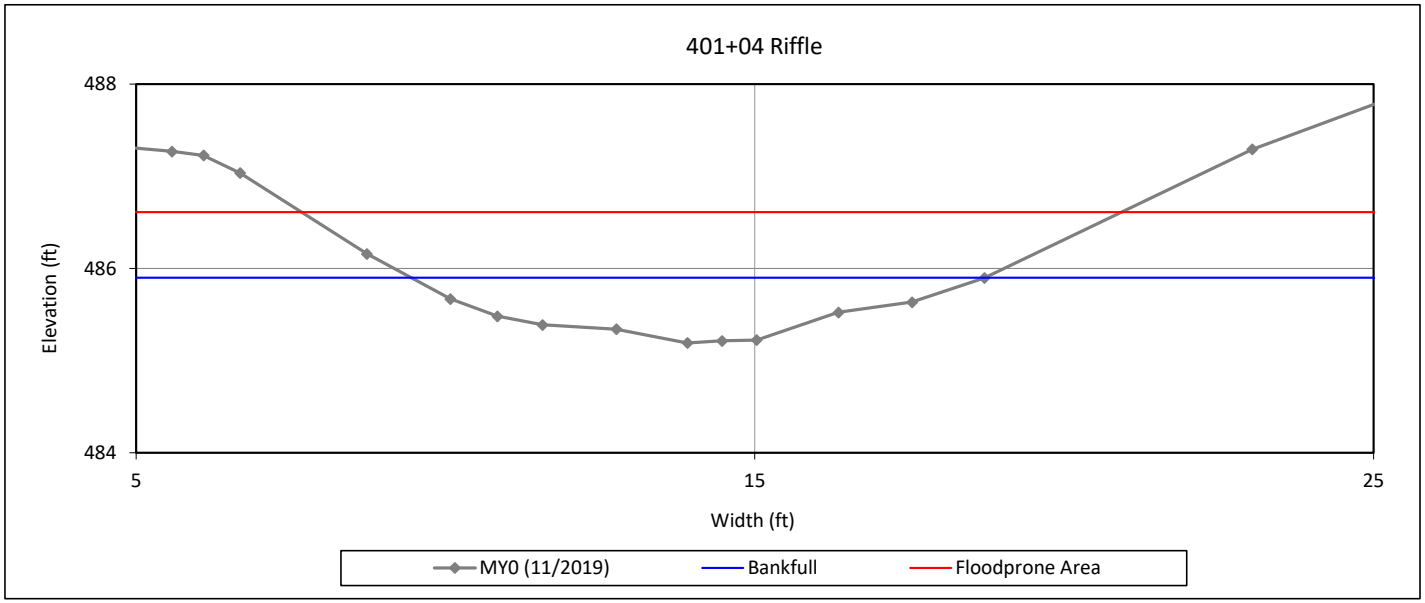
WF2 (STA 301+25 to 305+75)



Cross-Section Plots

Deep Meadow Mitigation Site
NCDMS Project No. 97131
Monitoring Year 0 - 2020

Cross-Section 1 - WF1



Bankfull Dimensions	
4.0	x-section area (ft.sq.)
9.3	width (ft)
0.4	mean depth (ft)
0.7	max depth (ft)
9.4	wetted perimeter (ft)
0.4	hydraulic radius (ft)
21.3	width-depth ratio
13.3	W flood prone area (ft)
1.4	entrenchment ratio
1.0	low bank height ratio

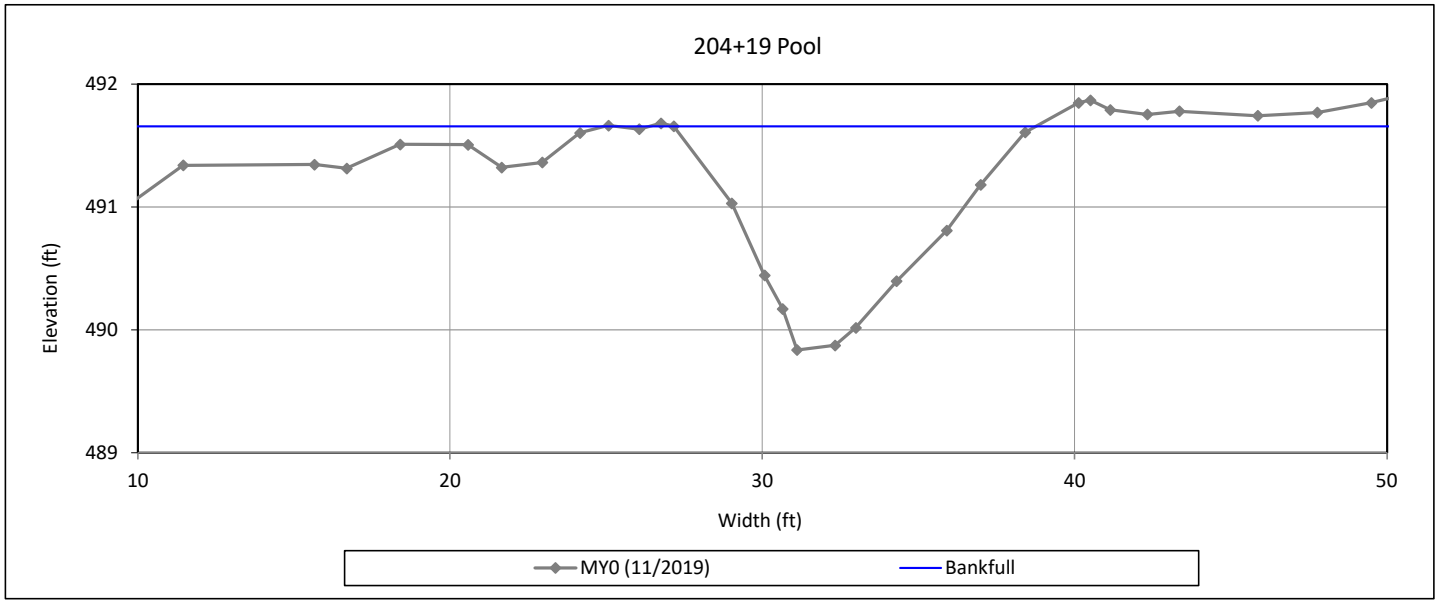
Survey Date: 11/2019
Field Crew: Kee

View Downstream

Cross-Section Plots

Deep Meadow Mitigation Site
NCDMS Project No. 97131
Monitoring Year 0 - 2020

Cross-Section 2 - EF1



Bankfull Dimensions	
11.1	x-section area (ft.sq.)
11.6	width (ft)
1.0	mean depth (ft)
1.8	max depth (ft)
12.3	wetted perimeter (ft)
0.9	hydraulic radius (ft)
12.1	width-depth ratio

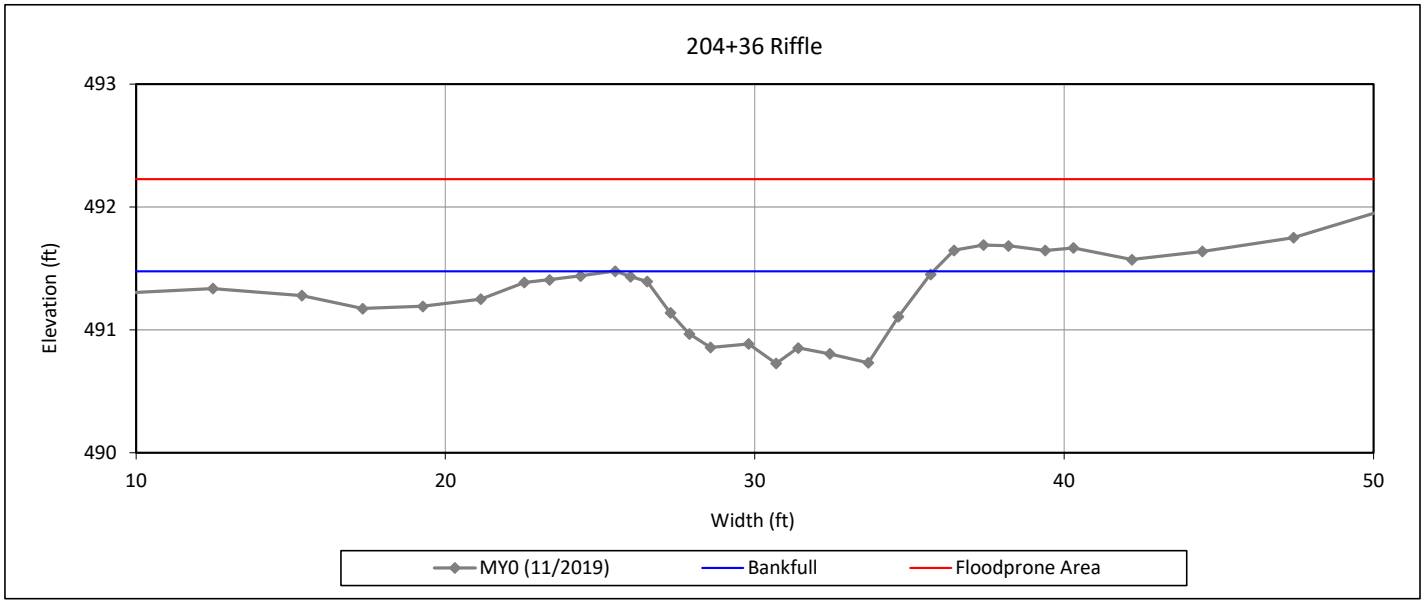
Survey Date: 11/2019
Field Crew: Kee

View Downstream

Cross-Section Plots

Deep Meadow Mitigation Site
NCDMS Project No. 97131
Monitoring Year 0 - 2020

Cross-Section 3 - EF1



Bankfull Dimensions	
5.0	x-section area (ft.sq.)
10.3	width (ft)
0.5	mean depth (ft)
0.8	max depth (ft)
10.5	wetted perimeter (ft)
0.5	hydraulic radius (ft)
21.3	width-depth ratio
57.0	W flood prone area (ft)
5.5	entrenchment ratio
1.0	low bank height ratio

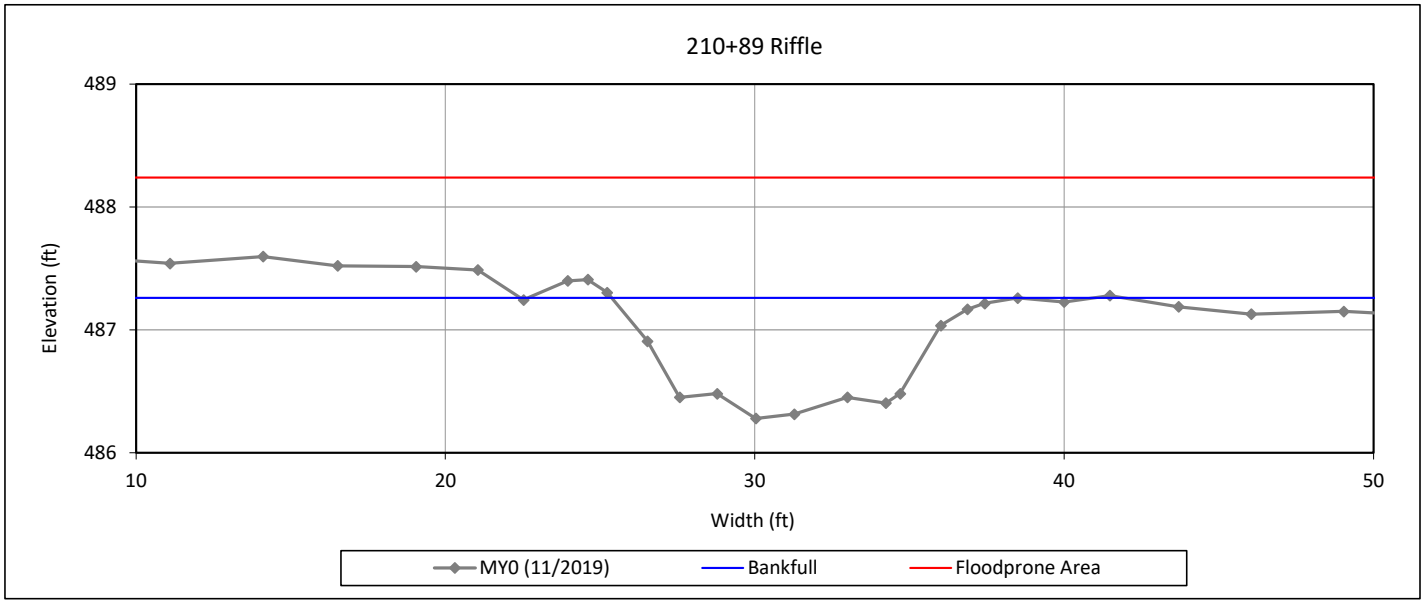
Survey Date: 11/2019
Field Crew: Kee

View Downstream

Cross-Section Plots

Deep Meadow Mitigation Site
NCDMS Project No. 97131
Monitoring Year 0 - 2020

Cross-Section 4 - EF1



Bankfull Dimensions	
7.9	x-section area (ft.sq.)
13.1	width (ft)
0.6	mean depth (ft)
1.0	max depth (ft)
13.4	wetted perimeter (ft)
0.6	hydraulic radius (ft)
21.9	width-depth ratio
64.9	W flood prone area (ft)
4.9	entrenchment ratio
1.0	low bank height ratio

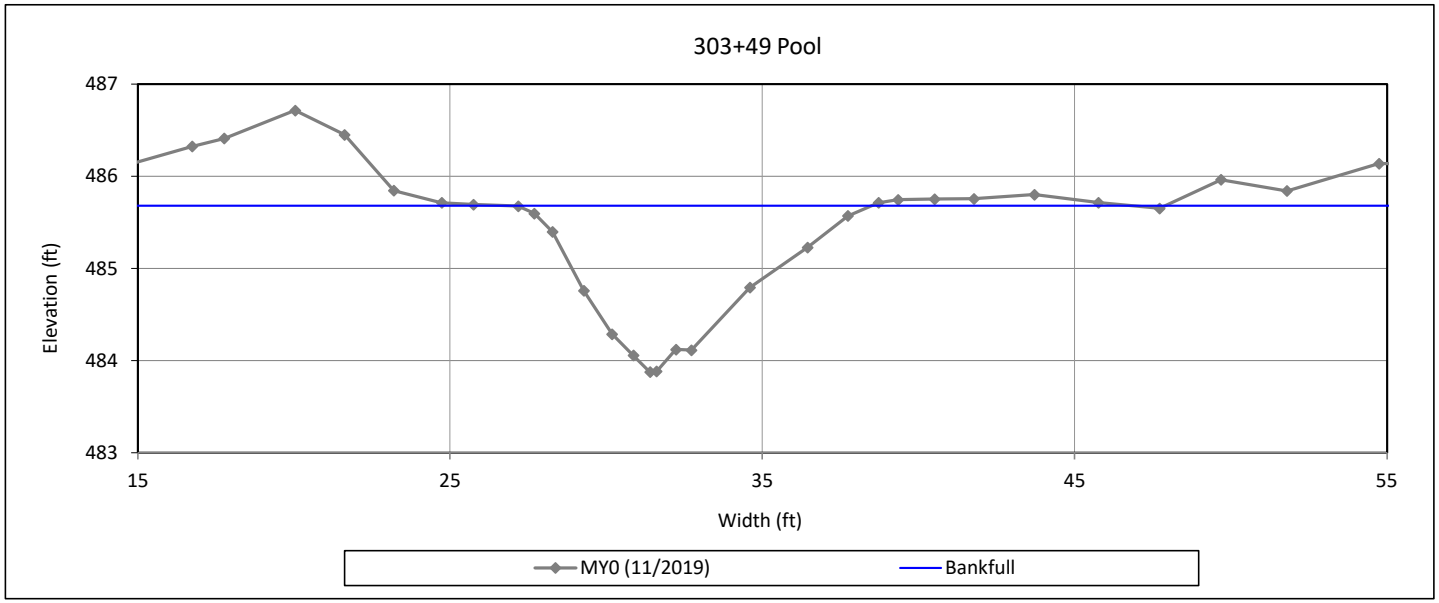
Survey Date: 11/2019
Field Crew: Kee

View Downstream

Cross-Section Plots

Deep Meadow Mitigation Site
NCDMS Project No. 97131
Monitoring Year 0 - 2020

Cross-Section 5 - WF2



Bankfull Dimensions	
9.9	x-section area (ft.sq.)
11.3	width (ft)
0.9	mean depth (ft)
1.8	max depth (ft)
12.0	wetted perimeter (ft)
0.8	hydraulic radius (ft)
13.0	width-depth ratio

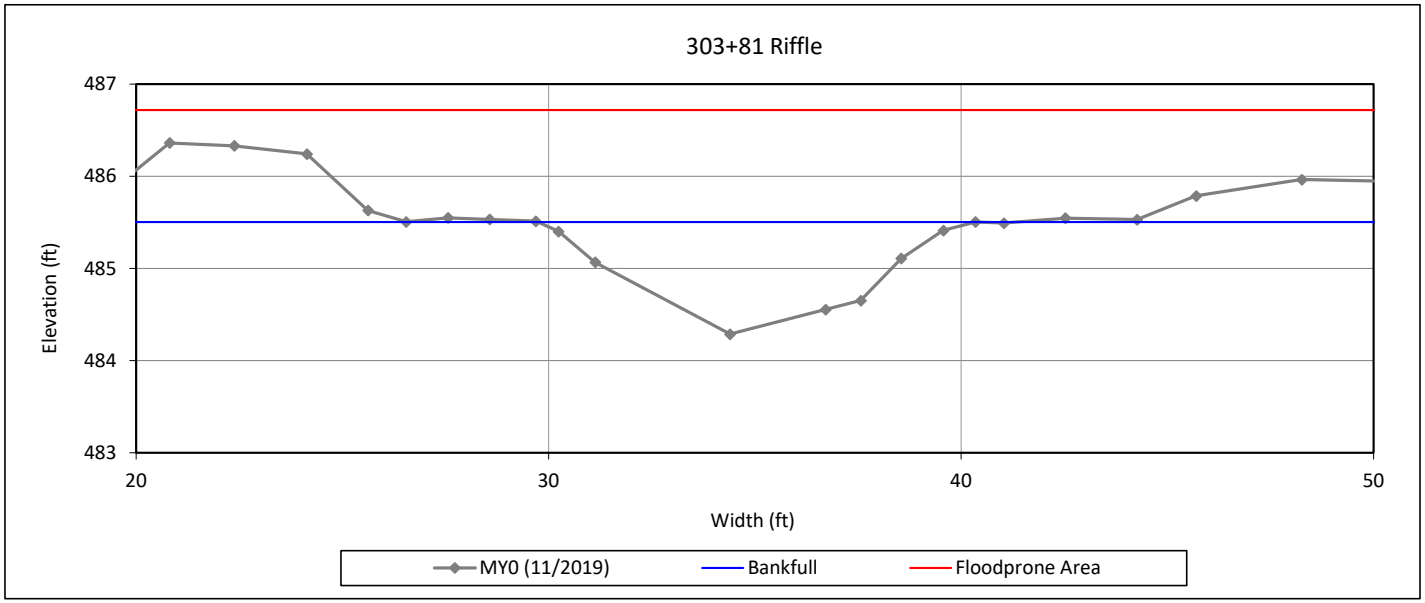
Survey Date: 11/2019
Field Crew: Kee

View Downstream

Cross-Section Plots

Deep Meadow Mitigation Site
NCDMS Project No. 97131
Monitoring Year 0 - 2020

Cross-Section 6 - WF2



Bankfull Dimensions	
7.1	x-section area (ft.sq.)
9.8	width (ft)
0.7	mean depth (ft)
1.2	max depth (ft)
10.2	wetted perimeter (ft)
0.7	hydraulic radius (ft)
13.6	width-depth ratio
64.5	W flood prone area (ft)
6.6	entrenchment ratio
1.0	low bank height ratio

Survey Date: 11/2019
Field Crew: Kee

View Downstream

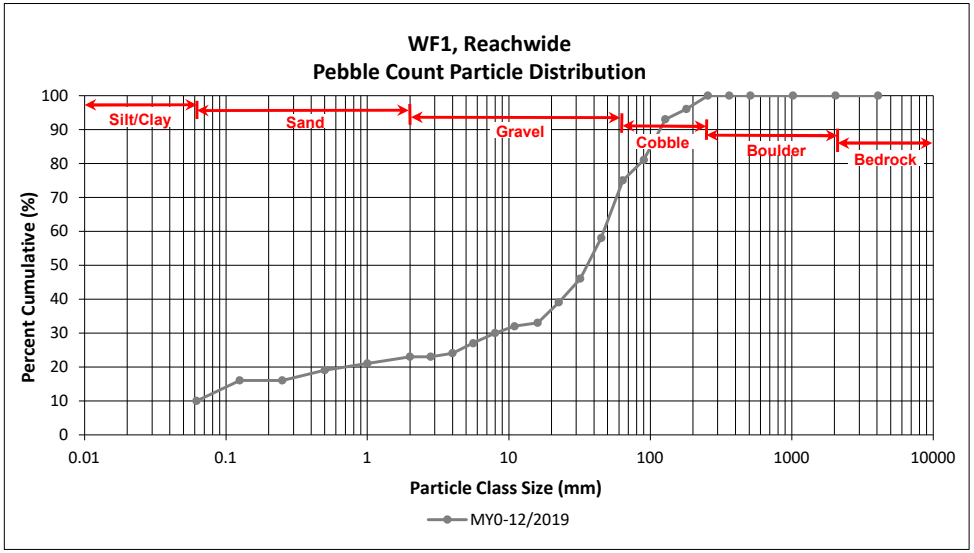
Reachwide Pebble Count Plots

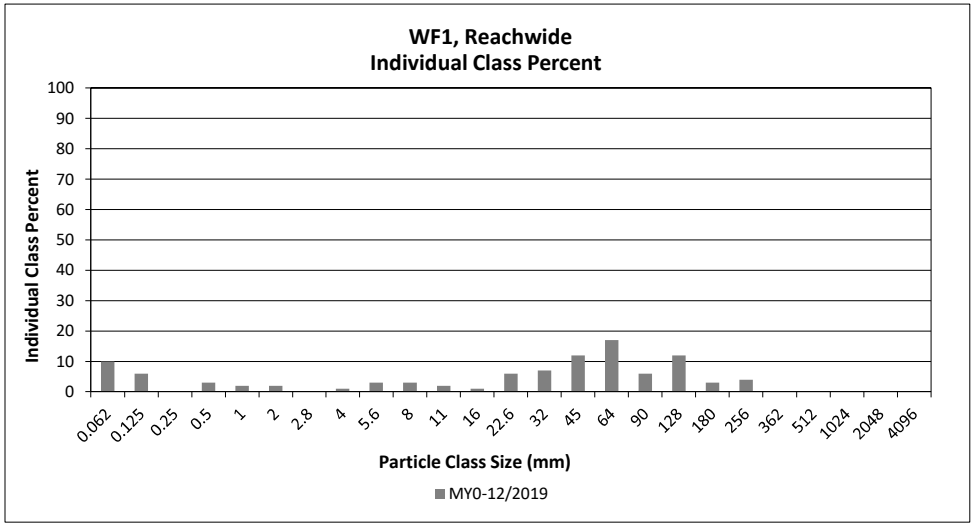
Deep Meadow Mitigation Site
DMS Project No. 97131
Monitoring Year 0 - 2020

WF1, Reachwide

Particle Class		Diameter (mm)		Particle Count			Reach Summary	
		min	max	Riffle	Pool	Total	Class Percentage	Percent Cumulative
SILT/CLAY	Silt/Clay	0.000	0.062	5	5	10	10	10
SAND	Very fine	0.062	0.125	2	4	6	6	16
	Fine	0.125	0.250					16
	Medium	0.25	0.50	1	2	3	3	19
	Coarse	0.5	1.0	1	1	2	2	21
	Very Coarse	1.0	2.0	1	1	2	2	23
GRAVEL	Very Fine	2.0	2.8					23
	Very Fine	2.8	4.0	1		1	1	24
	Fine	4.0	5.6	2	1	3	3	27
	Fine	5.6	8.0	1	2	3	3	30
	Medium	8.0	11.0		2	2	2	32
	Medium	11.0	16.0		1	1	1	33
	Coarse	16.0	22.6	3	3	6	6	39
	Coarse	22.6	32	1	6	7	7	46
	Very Coarse	32	45	7	5	12	12	58
	Very Coarse	45	64	7	10	17	17	75
COBBLE	Small	64	90	4	2	6	6	81
	Small	90	128	8	4	12	12	93
	Large	128	180	3		3	3	96
	Large	180	256	3	1	4	4	100
BOULDER	Small	256	362					100
	Small	362	512					100
	Medium	512	1024					100
	Large/Very Large	1024	2048					100
BEDROCK	Bedrock	2048	>2048					100
			Total	**50**	**50**	**100**	**100**	**100**

Reachwide	
Channel materials (mm)	
D_{16} =	0.1
D_{35} =	18.0
D_{50} =	35.9
D_{84} =	98.3
D_{95} =	160.7
D_{100} =	256.0





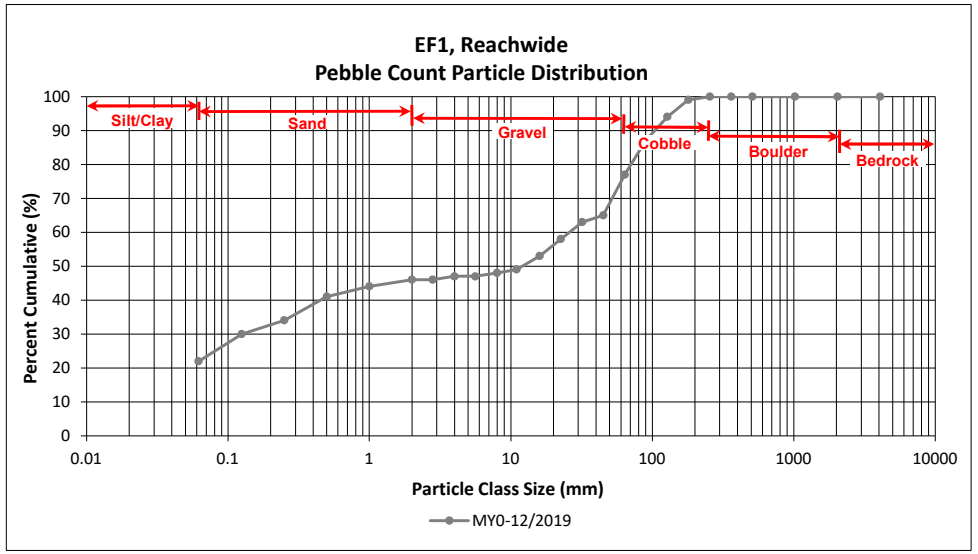
Reachwide Pebble Count Plots

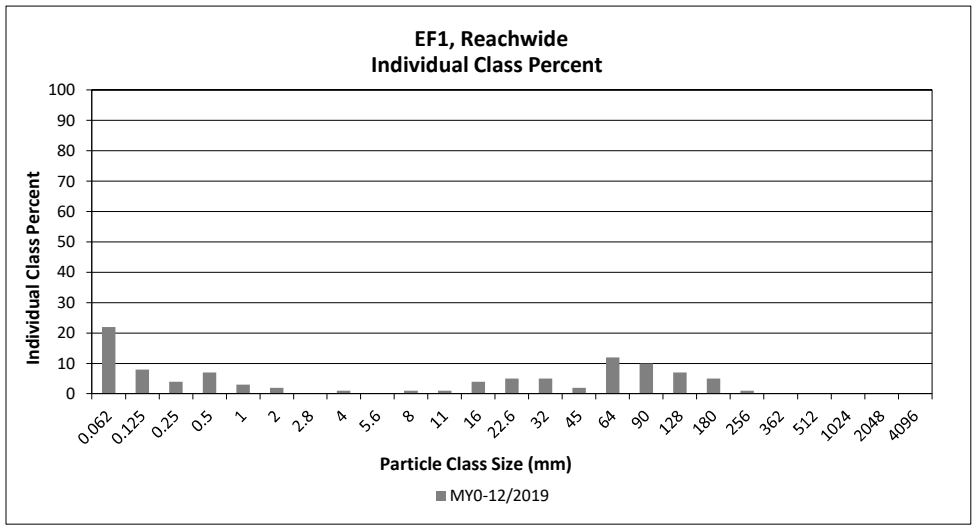
Deep Meadow Mitigation Site
DMS Project No. 97131
Monitoring Year 0 - 2020

EF1, Reachwide

Particle Class		Diameter (mm)		Particle Count			Reach Summary	
		min	max	Riffle	Pool	Total	Class Percentage	Percent Cumulative
SILT/CLAY	Silt/Clay	0.000	0.062	1	21	22	22	22
SAND	Very fine	0.062	0.125		8	8	8	30
	Fine	0.125	0.250		4	4	4	34
	Medium	0.25	0.50	1	6	7	7	41
	Coarse	0.5	1.0		3	3	3	44
	Very Coarse	1.0	2.0		2	2	2	46
GRAVEL	Very Fine	2.0	2.8					46
	Very Fine	2.8	4.0		1	1	1	47
	Fine	4.0	5.6					47
	Fine	5.6	8.0	1		1	1	48
	Medium	8.0	11.0	1		1	1	49
	Medium	11.0	16.0	3	1	4	4	53
	Coarse	16.0	22.6	3	2	5	5	58
	Coarse	22.6	32	5		5	5	63
	Very Coarse	32	45	2		2	2	65
	Very Coarse	45	64	12		12	12	77
COBBLE	Small	64	90	9	1	10	10	87
	Small	90	128	6	1	7	7	94
	Large	128	180	5		5	5	99
	Large	180	256	1		1	1	100
BOULDER	Small	256	362					100
	Small	362	512					100
	Medium	512	1024					100
	Large/Very Large	1024	2048					100
BEDROCK	Bedrock	2048	>2048					100
			Total	**50**	**50**	**100**	**100**	**100**

Reachwide	
Channel materials (mm)	
D_{16} =	Silt/Clay
D_{35} =	0.3
D_{50} =	12.1
D_{84} =	81.3
D_{95} =	137.0
D_{100} =	256.0





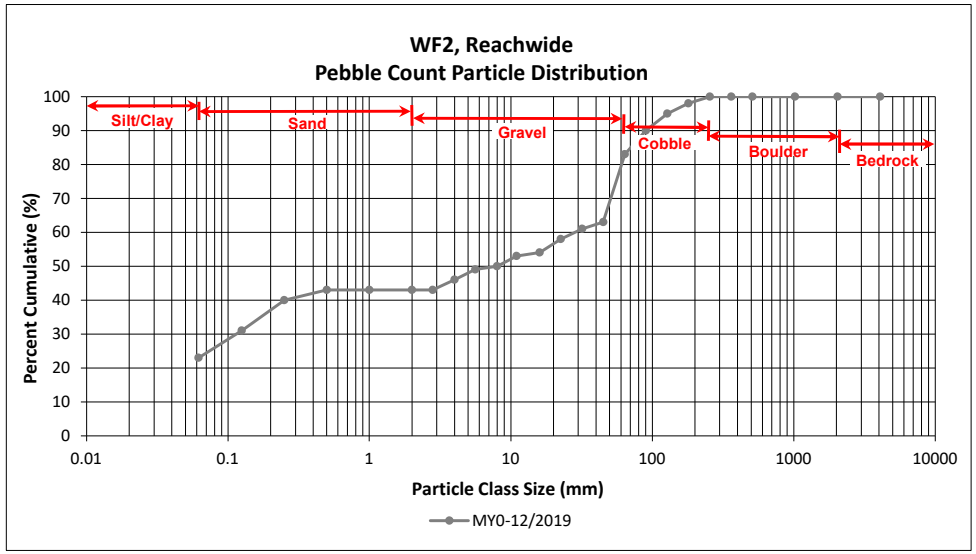
Reachwide Pebble Count Plots

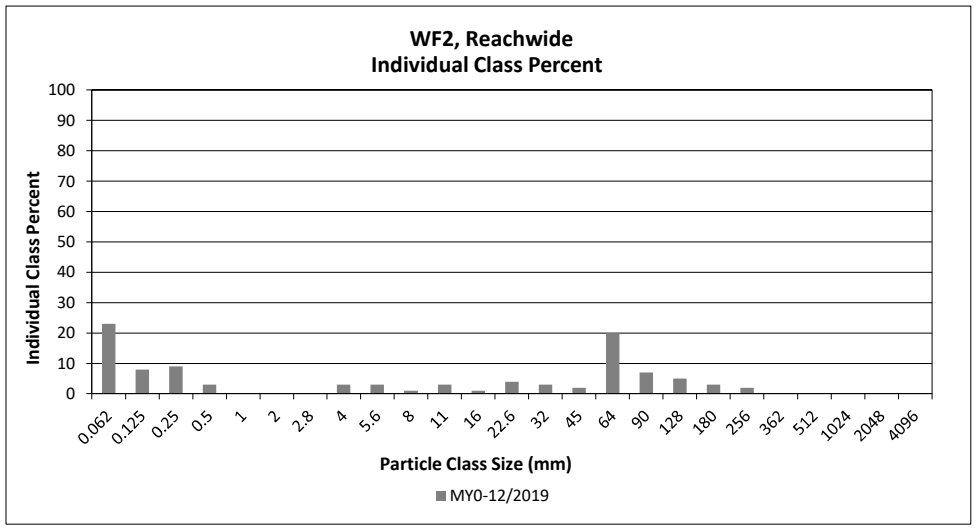
Deep Meadow Mitigation Site
DMS Project No. 97131
Monitoring Year 0 - 2020

WF2, Reachwide

Particle Class		Diameter (mm)		Particle Count			Reach Summary	
		min	max	Riffle	Pool	Total	Class Percentage	Percent Cumulative
SILT/CLAY	Silt/Clay	0.000	0.062	2	21	23	23	23
SAND	Very fine	0.062	0.125		8	8	8	31
	Fine	0.125	0.250	1	8	9	9	40
	Medium	0.25	0.50		3	3	3	43
	Coarse	0.5	1.0					43
	Very Coarse	1.0	2.0					43
GRAVEL	Very Fine	2.0	2.8					43
	Very Fine	2.8	4.0	1	2	3	3	46
	Fine	4.0	5.6		3	3	3	49
	Fine	5.6	8.0		1	1	1	50
	Medium	8.0	11.0	2	1	3	3	53
	Medium	11.0	16.0		1	1	1	54
	Coarse	16.0	22.6	3	1	4	4	58
	Coarse	22.6	32	2	1	3	3	61
	Very Coarse	32	45	2		2	2	63
	Very Coarse	45	64	20		20	20	83
COBBLE	Small	64	90	7		7	7	90
	Small	90	128	5		5	5	95
	Large	128	180	3		3	3	98
	Large	180	256	2		2	2	100
BOULDER	Small	256	362					100
	Small	362	512					100
	Medium	512	1024					100
	Large/Very Large	1024	2048					100
BEDROCK	Bedrock	2048	>2048					100
			Total	**50**	**50**	**100**	**100**	**100**

Reachwide	
Channel materials (mm)	
D_{16} =	Silt/Clay
D_{35} =	0.2
D_{50} =	8.0
D_{84} =	67.2
D_{95} =	128.0
D_{100} =	256.0





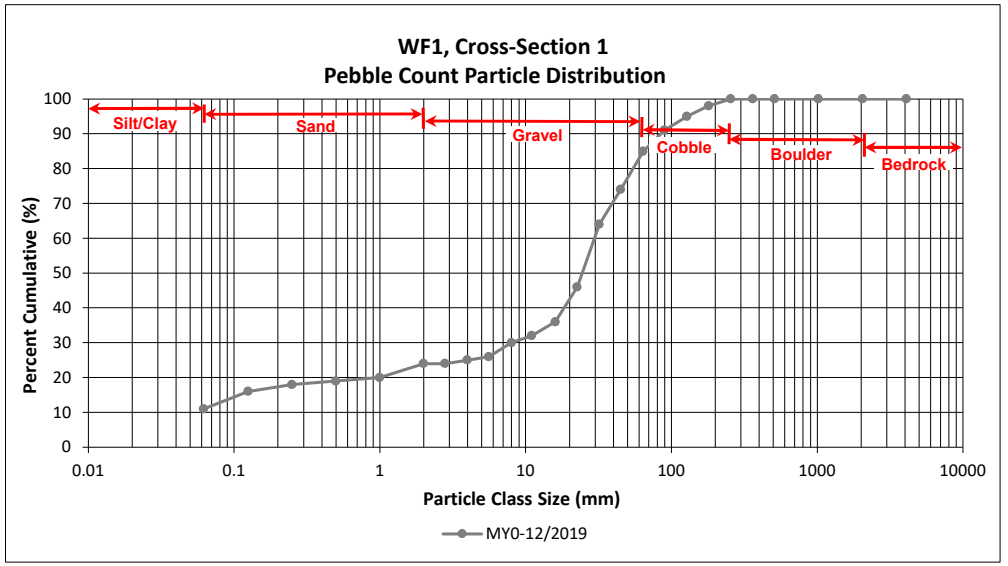
Cross-Section Pebble Count Plots

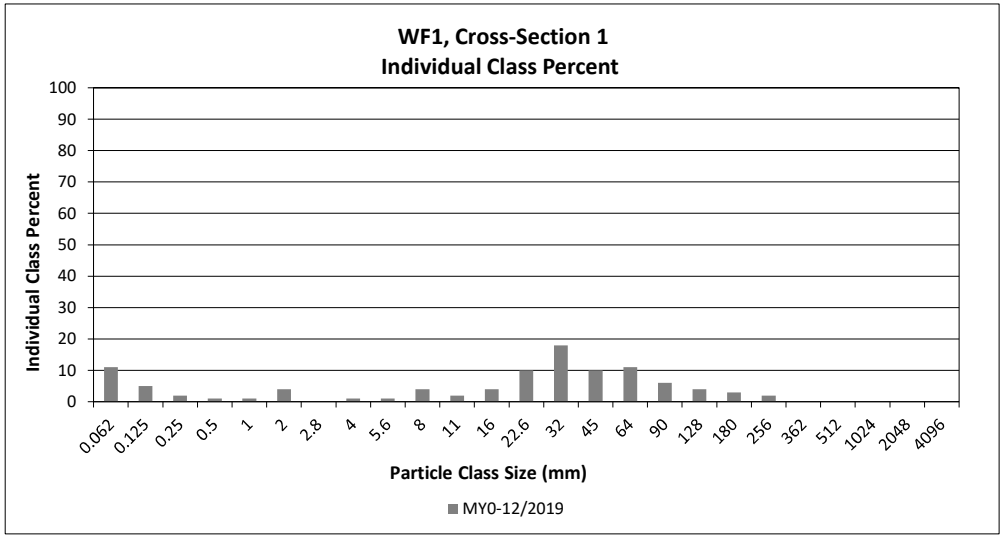
Deep Meadow Mitigation Site
DMS Project No. 97131
Monitoring Year 0 - 2020

WF1, Cross-Section 1

Particle Class		Diameter (mm)		Riffle 100-Count	Summary	
		min	max		Class Percentage	Percent Cumulative
SILT/CLAY	Silt/Clay	0.000	0.062	11	11	11
SAND	Very fine	0.062	0.125	5	5	16
	Fine	0.125	0.250	2	2	18
	Medium	0.25	0.50	1	1	19
	Coarse	0.5	1.0	1	1	20
	Very Coarse	1.0	2.0	4	4	24
GRAVEL	Very Fine	2.0	2.8			24
	Very Fine	2.8	4.0	1	1	25
	Fine	4.0	5.6	1	1	26
	Fine	5.6	8.0	4	4	30
	Medium	8.0	11.0	2	2	32
	Medium	11.0	16.0	4	4	36
	Coarse	16.0	22.6	10	10	46
	Coarse	22.6	32	18	18	64
	Very Coarse	32	45	10	10	74
	Very Coarse	45	64	11	11	85
COBBLE	Small	64	90	6	6	91
	Small	90	128	4	4	95
	Large	128	180	3	3	98
	Large	180	256	2	2	100
BOULDER	Small	256	362			100
	Small	362	512			100
	Medium	512	1024			100
	Large/Very Large	1024	2048			100
BEDROCK	Bedrock	2048	>2048			100
			Total	**100**	**100**	**100**

Cross-Section 1	
Channel materials (mm)	
D_{16} =	0.1
D_{35} =	14.6
D_{50} =	24.4
D_{84} =	62.0
D_{95} =	128.0
D_{100} =	256.0





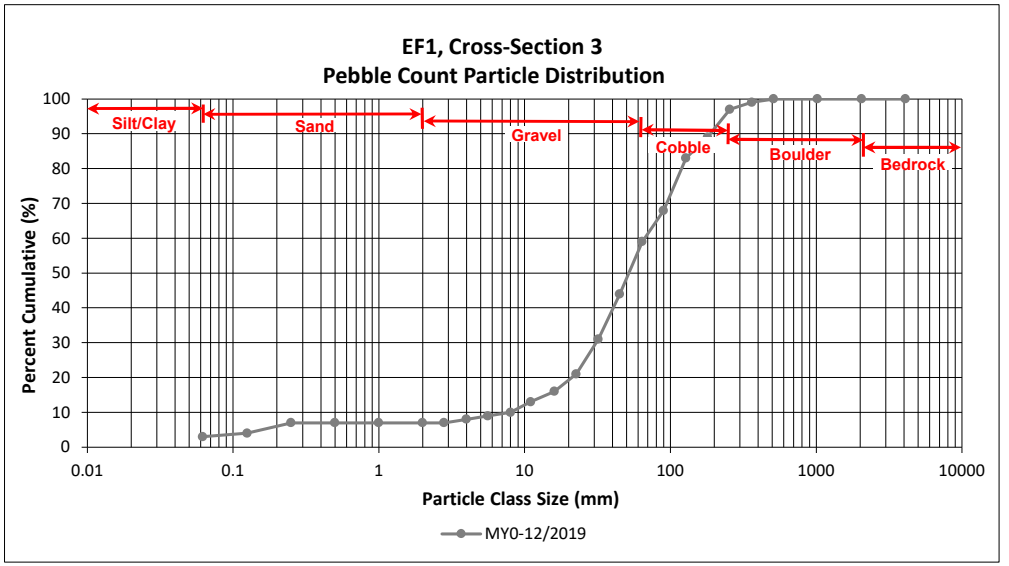
Cross-Section Pebble Count Plots

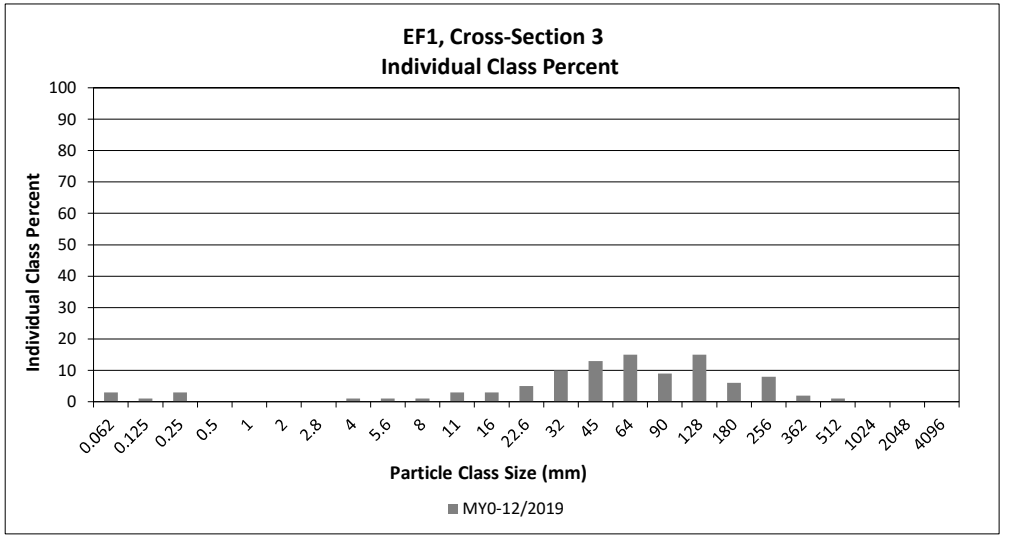
Deep Meadow Mitigation Site
DMS Project No. 97131
Monitoring Year 0 - 2020

EF1, Cross-Section 3

Particle Class		Diameter (mm)		Riffle 100-Count	Summary	
		min	max		Class Percentage	Percent Cumulative
SILT/CLAY	Silt/Clay	0.000	0.062	3	3	3
SAND	Very fine	0.062	0.125	1	1	4
	Fine	0.125	0.250	3	3	7
	Medium	0.25	0.50			7
	Coarse	0.5	1.0			7
	Very Coarse	1.0	2.0			7
GRAVEL	Very Fine	2.0	2.8			7
	Very Fine	2.8	4.0	1	1	8
	Fine	4.0	5.6	1	1	9
	Fine	5.6	8.0	1	1	10
	Medium	8.0	11.0	3	3	13
	Medium	11.0	16.0	3	3	16
	Coarse	16.0	22.6	5	5	21
	Coarse	22.6	32	10	10	31
	Very Coarse	32	45	13	13	44
	Very Coarse	45	64	15	15	59
COBBLE	Small	64	90	9	9	68
	Small	90	128	15	15	83
	Large	128	180	6	6	89
	Large	180	256	8	8	97
BOULDER	Small	256	362	2	2	99
	Small	362	512	1	1	100
	Medium	512	1024			100
	Large/Very Large	1024	2048			100
BEDROCK	Bedrock	2048	>2048			100
			Total	**100**	**100**	**100**

Cross-Section 3	
Channel materials (mm)	
D_{16} =	16.0
D_{35} =	35.5
D_{50} =	51.8
D_{84} =	135.5
D_{95} =	234.4
D_{100} =	512.0





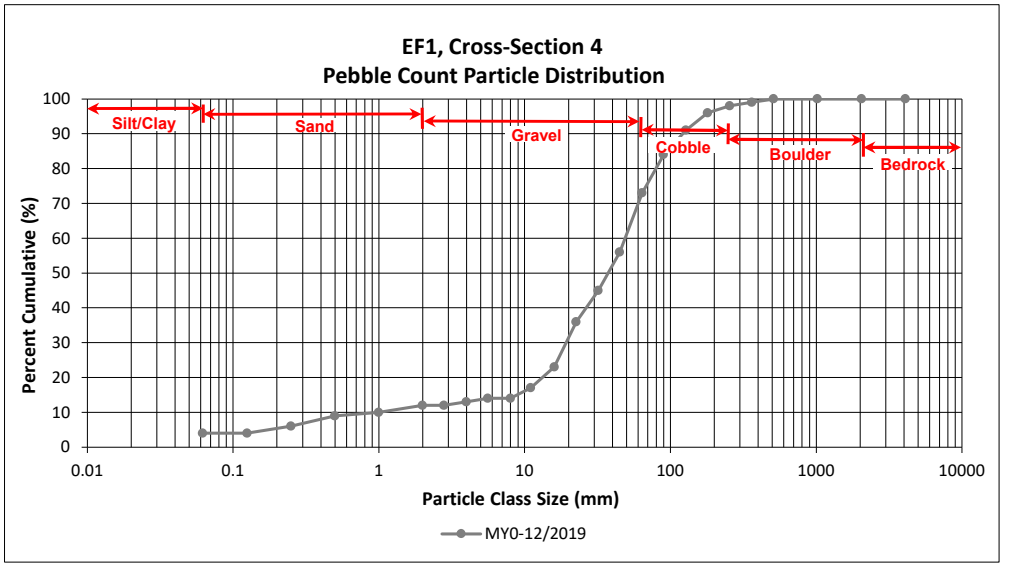
Cross-Section Pebble Count Plots

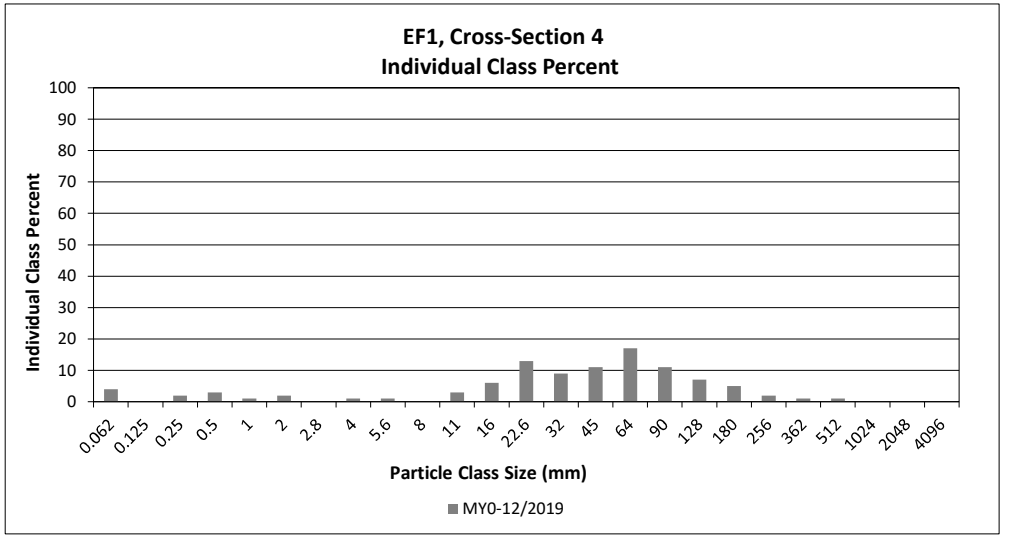
Deep Meadow Mitigation Site
DMS Project No. 97131
Monitoring Year 0 - 2020

EF1, Cross-Section 4

Particle Class		Diameter (mm) min	Diameter (mm) max	Riffle 100-Count	Summary: Class Percentage	Summary: Percent Cumulative
SILT/CLAY	Silt/Clay	0.000	0.062	4	4	4
SAND	Very fine	0.062	0.125			4
	Fine	0.125	0.250	2	2	6
	Medium	0.25	0.50	3	3	9
	Coarse	0.5	1.0	1	1	10
	Very Coarse	1.0	2.0	2	2	12
GRAVEL	Very Fine	2.0	2.8			12
	Very Fine	2.8	4.0	1	1	13
	Fine	4.0	5.6	1	1	14
	Fine	5.6	8.0			14
	Medium	8.0	11.0	3	3	17
	Medium	11.0	16.0	6	6	23
	Coarse	16.0	22.6	13	13	36
	Coarse	22.6	32	9	9	45
	Very Coarse	32	45	11	11	56
	Very Coarse	45	64	17	17	73
COBBLE	Small	64	90	11	11	84
	Small	90	128	7	7	91
	Large	128	180	5	5	96
	Large	180	256	2	2	98
BOULDER	Small	256	362	1	1	99
	Small	362	512	1	1	100
	Medium	512	1024			100
	Large/Very Large	1024	2048			100
BEDROCK	Bedrock	2048	>2048			100
			Total	**100**	**100**	**100**

Cross-Section 4	
Channel materials (mm)	
D_{16} =	9.9
D_{35} =	22.0
D_{50} =	37.4
D_{84} =	90.0
D_{95} =	168.1
D_{100} =	512.0





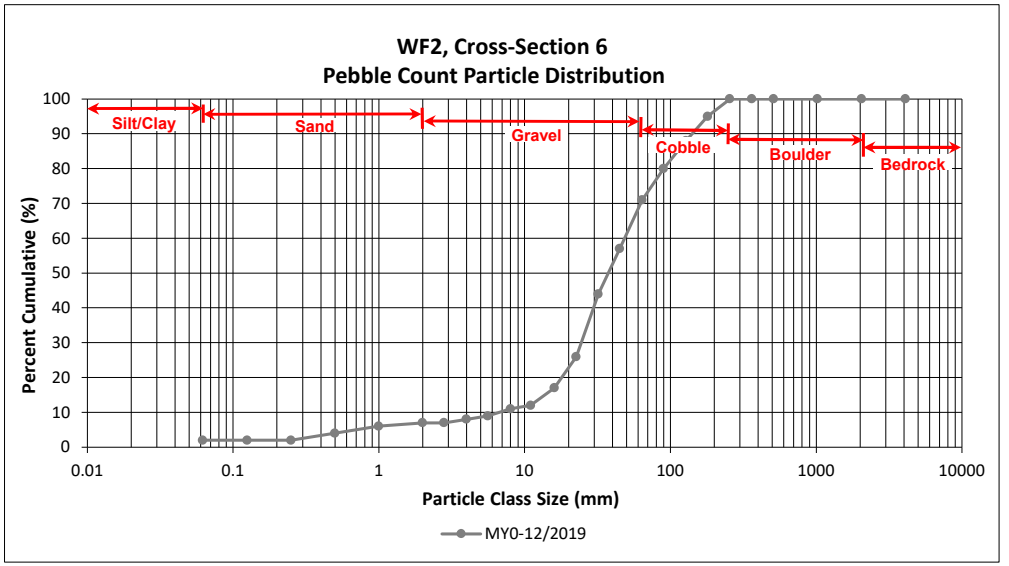
Cross-Section Pebble Count Plots

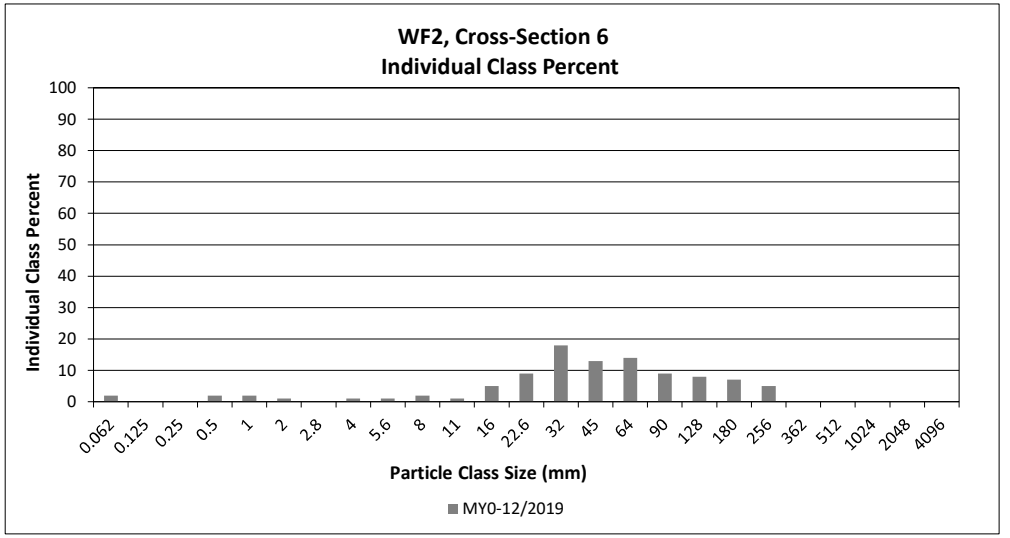
Deep Meadow Mitigation Site
DMS Project No. 97131
Monitoring Year 0 - 2020

WF2, Cross-Section 6

Particle Class		Diameter (mm)		Riffle 100-Count	Summary	
		min	max		Class Percentage	Percent Cumulative
SILT/CLAY	Silt/Clay	0.000	0.062	2	2	2
SAND	Very fine	0.062	0.125			2
	Fine	0.125	0.250			2
	Medium	0.25	0.50	2	2	4
	Coarse	0.5	1.0	2	2	6
	Very Coarse	1.0	2.0	1	1	7
GRAVEL	Very Fine	2.0	2.8			7
	Very Fine	2.8	4.0	1	1	8
	Fine	4.0	5.6	1	1	9
	Fine	5.6	8.0	2	2	11
	Medium	8.0	11.0	1	1	12
	Medium	11.0	16.0	5	5	17
	Coarse	16.0	22.6	9	9	26
	Coarse	22.6	32	18	18	44
	Very Coarse	32	45	13	13	57
	Very Coarse	45	64	14	14	71
COBBLE	Small	64	90	9	9	80
	Small	90	128	8	8	88
	Large	128	180	7	7	95
	Large	180	256	5	5	100
BOULDER	Small	256	362			100
	Small	362	512			100
	Medium	512	1024			100
	Large/Very Large	1024	2048			100
BEDROCK	Bedrock	2048	>2048			100
			Total	**100**	**100**	**100**

Cross-Section 6	
Channel materials (mm)	
D_{16} =	14.8
D_{35} =	26.9
D_{50} =	37.5
D_{84} =	107.3
D_{95} =	180.0
D_{100} =	256.0





Stream Photographs
Monitoring Year 0

Photo Point 1 – W-E10, North *(12/16/2019)*

Photo Point 1 – W-E10, South *(12/16/2019)*

Photo Point 1 – W-E10, East *(12/16/2019)*

Photo Point 1 – W-E10, West *(12/16/2019)*

Photo Point 2 – MB, view upstream *(12/16/2019)*

Photo Point 2 – MB, view downstream *(12/16/2019)*

Photo Point 3 – Meadow Branch, view upstream *(12/16/2019)*

Photo Point 3 – Meadow Branch, view downstream *(12/16/2019)*

Photo Point 4 – Meadow Branch, view upstream *(12/16/2019)*

Photo Point 4 – Meadow Branch, view downstream *(12/16/2019)*

Photo Point 4 – WF2 Confluence, view upstream *(12/16/2019)*

	
Photo Point 5 – Meadow Branch, view upstream *(12/16/2019)*	**Photo Point 5** – Meadow Branch, view downstream *(12/16/2019)*
	
Photo Point 6 – Meadow Branch, view upstream *(12/16/2019)*	**Photo Point 6** – Meadow Branch, view downstream *(12/16/2019)*
	
Photo Point 7 – MB/EF1 confluence, view upstream *(12/16/2019)*	**Photo Point 7** – Meadow Branch, view downstream *(12/16/2019)*

	
Photo Point 8 – Meadow Branch, view upstream *(12/16/2019)*	**Photo Point 8** – Meadow Branch, view downstream *(12/16/2019)*
	
Photo Point 9 – Meadow Branch, view upstream *(12/16/2019)*	**Photo Point 9** – Meadow Branch, view downstream *(12/16/2019)*
	
Photo Point 10 – MB, view upstream *(12/16/2019)*	**Photo Point 10** – MB, view downstream *(12/16/2019)*

Photo Point 11 – MB, view upstream *(12/16/2019)*

Photo Point 11 –MB, view downstream *(12/16/2019)*

Photo Point 11 –WF1 Confluence, view upstream *(12/18/2019)*

Photo Point 12 – WF1, view upstream *(12/16/2019)*

Photo Point 12 – WF1, view downstream *(12/16/2019)*

	
Photo Point 13 – EF1, view upstream *(12/16/2019)*	**Photo Point 13** – EF1, view downstream *(12/16/2019)*
	
Photo Point 14 – EF1, view upstream *(12/16/2019)*	**Photo Point 14** – EF1, view downstream *(12/16/2019)*
	
Photo Point 15 – EF1, view upstream *(12/16/2019)*	**Photo Point 15** – EF1, view downstream *(12/16/2019)*

Photo Point 16 – EF1, view upstream *(12/16/2019)*

Photo Point 16 – EF1, view downstream *(12/16/2019)*

Photo Point 17 – WF2, view upstream *(12/16/2019)*

Photo Point 17 – WF2, view downstream *(12/16/2019)*

Photo Point 18 – WF2, view upstream *(12/16/2019)*

Photo Point 18 – WF2, view downstream *(12/16/2019)*

APPENDIX 3. Vegetation Plot Data

Table 9. Vegetation Plot Criteria Attainment

Deep Meadow Mitigation Site
DMS Project No. 97131
Monitoring Year 0 - 2020

Permanent Vegetation Plot	MY0 Success Criteria Met (Y/N)	Tract Mean (MY0 - 2020)	
1	Y	100%	100%
2	Y		
3	Y		
4	Y		
5	Y		
6	Y		
7	Y		
8	Y		
9	Y		
10	Y		
11	Y		
12	Y		
Mobile Vegetation Plot	**MY0 Success Criteria Met (Y/N)**		
1	Y	100%	
2	Y		
3	Y		
4	Y		

Table 10. CVS Permanent Vegetation Plot Metadata

Deep Meadow Mitigation Site

DMS Project No. 97131

Monitoring Year 0 - 2020

Report Prepared By	Jeffrey Turner
Date Prepared	12/19/2019 13:27
Database Name	cvs-eep-entrytool-v2.5.0_Deep Meadow (MY0).mdb
Database Location	Q:\ActiveProjects\005-02162 Deep Meadow\Monitoring\Baseline Monitoring\Vegetation Assessment
Computer Name	JEFF-PC
File Size	76288000
DESCRIPTION OF WORKSHEETS IN THIS DOCUMENT----------	
Metadata	Description of database file, the report worksheets, and a summary of project(s) and project data.
Proj, planted	Each project is listed with its PLANTED stems per acre, for each year. This excludes live stakes.
Proj, total stems	Each project is listed with its TOTAL stems per acre, for each year. This includes live stakes, all planted stems, and all natural/volunteer stems.
Plots	List of plots surveyed with location and summary data (live stems, dead stems, missing, etc.).
Vigor	Frequency distribution of vigor classes for stems for all plots.
Vigor by Spp	Frequency distribution of vigor classes listed by species.
Damage	List of most frequent damage classes with number of occurrences and percent of total stems impacted by each.
Damage by Spp	Damage values tallied by type for each species.
Damage by Plot	Damage values tallied by type for each plot.
Planted Stems by Plot and Spp	A matrix of the count of PLANTED living stems of each species for each plot; dead and missing stems are excluded.
ALL Stems by Plot and spp	A matrix of the count of total living stems of each species (planted and natural volunteers combined) for each plot; dead and missing stems are excluded.
PROJECT SUMMARY----------	
Project Code	97131
Project Name	Deep Meadow Mitigation Site
Description	Stream and wetland mitigation project in Union County, NC.
Sampled Plots	12

Table 11a. Planted and Total Stem Counts
Deep Meadow Mitigation Site
DMS Project No. 97131
Monitoring Year 0 - 2020

Current Permanent Vegetation Plot Data (MY0 2020)														
Scientific Name	**Common Name**	**Species Type**	**Permanent Plot 1**			**Permanent Plot 2**			**Permanent Plot 3**			**Permanent Plot 4**		
			PnoLS	**P-all**	**T**	**PnoLS**	**P-all**	**T**	**PnoLS**	**P-all**	**T**	**PnoLS**	**P-all**	**T**
Alnus serrulata	Tag Alder, Smooth Alder, Hazel Alder	Shrub Tree							2	2	2			
Betula nigra	River Birch, Red Birch	Tree	1	1	1	3	3	3	2	2	2	1	1	1
Cephalanthus occidentalis	Buttonbush	Shrub Tree				1	1	1				1	1	1
Cornus amomum	Silky Dogwood	Shrub Tree	2	2	2	1	1	1				2	2	2
Diospyros virginiana	American Persimmon, Possumwood	Tree	2	2	2	1	1	1				2	2	2
Fraxinus pennsylvanica	Green Ash, Red Ash	Tree							3	3	3			
Lindera benzoin	Northern Spicebush	Shrub Tree	3	3	3	2	2	2				1	1	1
Liriodendron tulipifera	Tulip Poplar	Tree							2	2	2			
Platanus occidentalis	Sycamore, Plane-tree	Tree	2	2	2	3	3	3	1	1	1	2	2	2
Populus deltoides	Eastern Cottonwood	Tree	2	2	2	2	2	2				2	2	2
Quercus michauxii	Basket Oak, Swamp Chestnut Oak	Tree	2	2	2	1	1	1	3	3	3	2	2	2
Quercus pagoda	Cherrybark Oak, Swamp Spanish Oak	Tree												
Quercus phellos	Willow Oak	Tree	1	1	1	1	1	1	2	2	2	2	2	2
		Stem count	15	15	15	15	15	15	15	15	15	15	15	15
		size (ares)		1			1			1			1	
		size (ACRES)		0.02			0.02			0.02			0.02	
		Species count	8	8	8	9	9	9	7	7	7	9	9	9
		Stems per ACRE	607	607	607	607	607	607	607	607	607	607	607	607

Current Permanent Vegetation Plot Data (MY0 2020)														
Scientific Name	**Common Name**	**Species Type**	**Permanent Plot 5**			**Permanent Plot 6**			**Permanent Plot 7**			**Permanent Plot 8**		
			PnoLS	**P-all**	**T**	**PnoLS**	**P-all**	**T**	**PnoLS**	**P-all**	**T**	**PnoLS**	**P-all**	**T**
Alnus serrulata	Tag Alder, Smooth Alder, Hazel Alder	Shrub Tree	1	1	1				1	1	1	2	2	2
Betula nigra	River Birch, Red Birch	Tree	3	3	3	2	2	2	3	3	3	3	3	3
Cephalanthus occidentalis	Buttonbush	Shrub Tree				2	2	2						
Cornus amomum	Silky Dogwood	Shrub Tree				2	2	2						
Diospyros virginiana	American Persimmon, Possumwood	Tree				2	2	2						
Fraxinus pennsylvanica	Green Ash, Red Ash	Tree	1	1	1				1	1	1	1	1	1
Lindera benzoin	Northern Spicebush	Shrub Tree				2	2	2						
Liriodendron tulipifera	Tulip Poplar	Tree	3	3	3				5	5	5	3	3	3
Platanus occidentalis	Sycamore, Plane-tree	Tree	2	2	2	2	2	2	3	3	3	2	2	2
Populus deltoides	Eastern Cottonwood	Tree				2	2	2						
Quercus michauxii	Basket Oak, Swamp Chestnut Oak	Tree	2	2	2							2	2	2
Quercus pagoda	Cherrybark Oak, Swamp Spanish Oak	Tree							1	1	1			
Quercus phellos	Willow Oak	Tree	3	3	3	1	1	1	1	1	1	2	2	2
		Stem count	15	15	15	15	15	15	15	15	15	15	15	15
		size (ares)		1			1			1			1	
		size (ACRES)		0.02			0.02			0.02			0.02	
		Species count	7	7	7	8	8	8	7	7	7	7	7	7
		Stems per ACRE	607	607	607	607	607	607	607	607	607	607	607	607

Color for Density

Exceeds requirements by 10%
Exceeds requirements, but by less than 10%
Fails to meet requirements, by less than 10%
Fails to meet requirements by more than 10%
Volunteer species included in total

PnoLS: Number of planted stems excluding live stakes
P-all: Number of planted stems including live stakes
T: Total stems

Table 11b. Planted and Total Stem Counts
Deep Meadow Mitigation Site
DMS Project No. 97131
Monitoring Year 0 - 2020

Current Permanent Vegetation Plot Data (MY0 2020)														
Scientific Name	**Common Name**	**Species Type**	**Permanent Plot 9**			**Permanent Plot 10**			**Permanent Plot 11**			**Permanent Plot 12**		
			PnoLS	**P-all**	**T**	**PnoLS**	**P-all**	**T**	**PnoLS**	**P-all**	**T**	**PnoLS**	**P-all**	**T**
Alnus serrulata	Tag Alder, Smooth Alder, Hazel Alder	Shrub Tree												
Betula nigra	River Birch, Red Birch	Tree	2	2	2	3	3	3	3	3	3			
Cephalanthus occidentalis	Buttonbush	Shrub Tree							2	2	2	2	2	2
Cornus amomum	Silky Dogwood	Shrub Tree							1	1	1	2	2	2
Diospyros virginiana	American Persimmon, Possumwood	Tree							2	2	2	4	4	4
Fraxinus pennsylvanica	Green Ash, Red Ash	Tree	1	1	1									
Lindera benzoin	Northern Spicebush	Shrub Tree				1	1	1	1	1	1	2	2	2
Liriodendron tulipifera	Tulip Poplar	Tree	4	4	4									
Platanus occidentalis	Sycamore, Plane-tree	Tree	3	3	3	5	5	5	2	2	2			
Populus deltoides	Eastern Cottonwood	Tree				2	2	2	1	1	1	2	2	2
Quercus michauxii	Basket Oak, Swamp Chestnut Oak	Tree	4	4	4	1	1	1	1	1	1			
Quercus pagoda	Cherrybark Oak, Swamp Spanish Oak	Tree												
Quercus phellos	Willow Oak	Tree	1	1	1	3	3	3	2	2	2	3	3	3
		Stem count	15	15	15	15	15	15	15	15	15	15	15	15
		size (ares)		1			1			1			1	
		size (ACRES)		0.02			0.02			0.02			0.02	
		Species count	6	6	6	6	6	6	9	9	9	6	6	6
		Stems per ACRE	607	607	607	607	607	607	607	607	607	607	607	607

Permanent Vegetation Plot Annual Mean					
Scientific Name	**Common Name**	**Species Type**	**MY0 (2020)**		
			PnoLS	**P-all**	**T**
Alnus serrulata	Tag Alder, Smooth Alder, Hazel Alder	Shrub Tree	6	6	6
Betula nigra	River Birch, Red Birch	Tree	26	26	26
Cephalanthus occidentalis	Buttonbush	Shrub Tree	8	8	8
Cornus amomum	Silky Dogwood	Shrub Tree	10	10	10
Diospyros virginiana	American Persimmon, Possumwood	Tree	13	13	13
Fraxinus pennsylvanica	Green Ash, Red Ash	Tree	7	7	7
Lindera benzoin	Northern Spicebush	Shrub Tree	12	12	12
Liriodendron tulipifera	Tulip Poplar	Tree	17	17	17
Platanus occidentalis	Sycamore, Plane-tree	Tree	27	27	27
Populus deltoides	Eastern Cottonwood	Tree	13	13	13
Quercus michauxii	Basket Oak, Swamp Chestnut Oak	Tree	18	18	18
Quercus pagoda	Cherrybark Oak, Swamp Spanish Oak	Tree	1	1	1
Quercus phellos	Willow Oak	Tree	22	22	22
		Stem count	180	180	180
		size (ares)		12	
		size (ACRES)		0.30	
		Species count	13	13	13
		Stems per ACRE	607	607	607

Color for Density
Exceeds requirements by 10%
Exceeds requirements, but by less than 10%
Fails to meet requirements, by less than 10%
Fails to meet requirements by more than 10%
Volunteer species included in total

PnoLS: Number of planted stems excluding live stakes
P-all: Number of planted stems including live stakes
T: Total stems

Table 11c. Planted and Total Stem Counts
Deep Meadow Mitigation Site
DMS Project No. 97131
Monitoring Year 0 - 2020

Current Mobile Vegetation Plot (MP) Data (MY0 2020)							Annual Mean
Scientific Name	**Common Name**	**Species Type**	**MP1**	**MP2**	**MP3**	**MP4**	**MY0 (2020)**
			PnoLS	**PnoLS**	**PnoLS**	**PnoLS**	**PnoLS**
Alnus serrulata	Tag Alder, Smooth Alder, Hazel Alder	Shrub Tree	1				1
Betula nigra	River Birch, Red Birch	Tree		1	7	1	9
Cephalanthus occidentalis	Buttonbush	Shrub Tree	2				2
Cornus amomum	Silky Dogwood	Shrub Tree				1	1
Fraxinus pennsylvanica	Green Ash, Red Ash	Tree	1		2		3
Lindera benzoin	Northern Spicebush	Shrub Tree	1				1
Liriodendron tulipifera	Tulip Poplar	Tree			2	3	5
Platanus occidentalis	Sycamore, Plane-tree	Tree	4	9	4	3	20
Populus deltoides	Eastern Cottonwood	Tree	1	2		1	4
Quercus michauxii	Basket Oak, Swamp Chestnut Oak	Tree				2	2
Quercus pagoda	Cherrybark Oak, Swamp Spanish Oak	Tree	1	4			5
Quercus phellos	Willow Oak	Tree	5	1	1	2	9
		Stem count	16	17	16	13	62
		size (ares)	1	1	1	1	4
		size (ACRES)	0.02	0.02	0.02	0.02	0.10
		Species count	8	5	5	7	12
		Stems per ACRE	647	688	647	526	627

Overall Site Annual Mean			
Scientific Name	**Common Name**	**Species Type**	**MY0 (2020)**
			PnoLS
Alnus serrulata	Tag Alder, Smooth Alder, Hazel Alder	Shrub Tree	7
Betula nigra	River Birch, Red Birch	Tree	35
Cephalanthus occidentalis	Buttonbush	Shrub Tree	10
Cornus amomum	Silky Dogwood	Shrub Tree	11
Diospyros virginiana	American Persimmon, Possumwood	Tree	13
Fraxinus pennsylvanica	Green Ash, Red Ash	Tree	10
Lindera benzoin	Northern Spicebush	Shrub Tree	13
Liriodendron tulipifera	Tulip Poplar	Tree	22
Platanus occidentalis	Sycamore, Plane-tree	Tree	47
Populus deltoides	Eastern Cottonwood	Tree	17
Quercus michauxii	Basket Oak, Swamp Chestnut Oak	Tree	20
Quercus pagoda	Cherrybark Oak, Swamp Spanish Oak	Tree	6
Quercus phellos	Willow Oak	Tree	31
		Stem count	242
		size (ares)	16
		size (ACRES)	0.40
		Species count	13
		Stems per ACRE	612

Color for Density
Exceeds requirements by 10%
Exceeds requirements, but by less than 10%
Fails to meet requirements, by less than 10%
Fails to meet requirements by more than 10%
Volunteer species included in total

PnoLS: Number of planted stems excluding live stakes
P-all: Number of planted stems including live stakes
T: Total stems

Vegetation Photographs
Monitoring Year 0

Vegetation Plot 1 - *(12/18/2019)*

Vegetation Plot 2 - *(12/16/2019)*

Vegetation Plot 3 - *(12/16/2019)*

Vegetation Plot 4 - *(12/16/2019)*

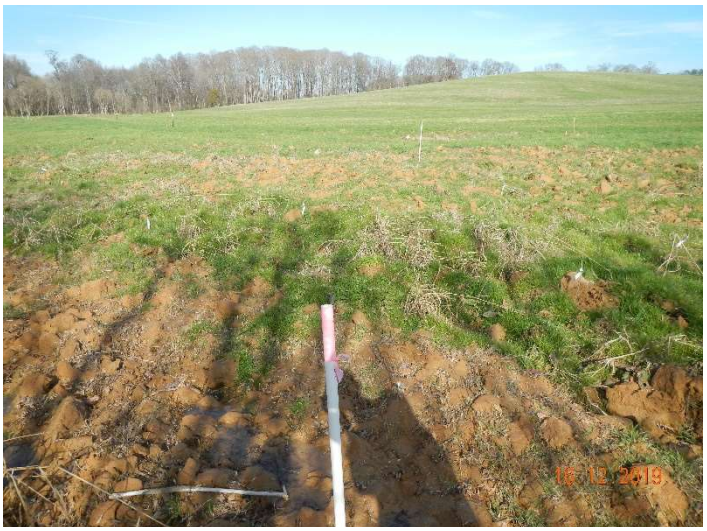
Vegetation Plot 5 - *(12/16/2019)*

Vegetation Plot 6 - *(12/16/2019)*

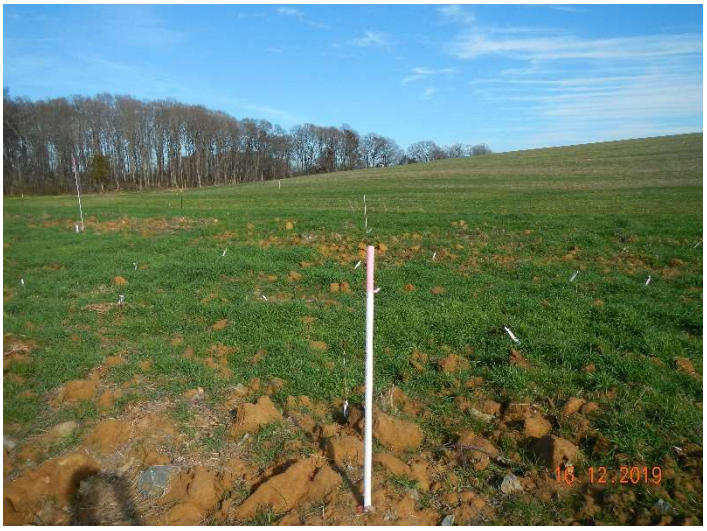
Vegetation Plot 7 - *(12/16/2019)*

Vegetation Plot 8 - *(12/16/2019)*

Vegetation Plot 9 - *(12/16/2019)*



Vegetation Plot 10 - *(12/16/2019)*



Vegetation Plot 11 - *(12/16/2019)*

Vegetation Plot 12 - *(12/16/2019)*

Mobile Vegetation Plot Photographs
Monitoring Year 0

	
Mobile Vegetation Plot 1 - North *(01/10/2020)*	**Mobile Vegetation Plot 2** – North *(01/10/2020)*
	
Mobile Vegetation Plot 3 - North *(12/16/2019)*	**Mobile Vegetation Plot 4** - North *(12/16/2019)*