Year 3 Monitoring Report

Bear Swamp Stream & Wetland Mitigation Project

Robeson County, North Carolina

Monitoring Year 3

Data Collection Period:	**Submission Date:**
October & November 2023	January 2024

NCDEQ Contract No. 7516
DMS RFP No. 16-007337
DMS ID No. 100054
USACE Action ID No. SAW-2018-01154
NCDWR ID: 20180782
Lumber River Basin
HUC 03040203

Prepared For:

NC Department of Environmental Quality
Division of Mitigation Services
1652 Mail Service Center
Raleigh, NC 27603

Prepared By:

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Ms. Emily Dunnigan
NCDEQ – Division of Mitigation Services
217 W. Jones St.
Raleigh, NC 27603

February 5, 2024

RE: Response to Draft MY3 Monitoring Report Comments dated January 9, 2024
Bear Swamp Stream and Wetland Mitigation Site
Lumber River Basin – CU# 03040203 - Robeson County, North Carolina
NCDMS Project # 100054, Contract # 7516

Dear Ms. Dunnigan,

Ecosystem Planning and Restoration (EPR) has reviewed the Division of Mitigation Services (DMS) comments on the Draft MY3 Monitoring Report provided to DMS November 30, 2023, as well as comments from the DMS boundary inspection. The comments have been addressed as described below and the Final MY3 Report and electronic deliverables have been revised in response to this review.

Report Comments

- ***Pg. 9, Section 2.3 –*** *According to the report gauges BS2, BS3, and BS4 were calibrated. Should all the wells be calibrated? Is this calibration something that EPR plans to complete regularly? Please describe in the narrative.*
    - **All wells were assessed with the calibration effort. Calibration was only required for the 3 wells noted – the other wells indicated that they were reporting correctly. This will be re-evaluated every year going forward.**

- ***IRT MY3 Site Visit –*** *During the IRT site visit an additional gauge was requested in Wetland B to provide more detail of hydrology. Given BS4 did not meet criteria for the 3rd year in a row, installing an additional gauge(s) here would be necessary to determine any potential wetland credits at risk in MY4.*
    - **An additional gage will be installed near BS4 prior to the growing season in MY4. This request has been added to the report in Section 2.3.**

- ***Appendix C, Figure 3 –*** *Please update rainfall data to include monthly rainfall through December 2023.*
    - **Figure 3 has been updated through December 2023 using totals from the WCON7 weather station in Lumberton, as there was a data collection error with the rain**

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gage, likely resulting from debris in the funnel (cleared out 1/2/2024). A discussion of the rainfall data has also been updated in report Section 2.3.

- ***IRT MY3 Site Visit –*** *During the MY3 site visit multiple privet and privet resprouts were noted in the southern section (wetland A and surrounding areas). Please ensure EPR will continue invasive treatments before and after replanting is complete.*
    - **Additional chemical treatment of Chinese privet in wetland A and surrounding areas was completed on 1/11/2024. The date of treatment was also added to the report in Section 2.2.2. EPR will continue to treat these areas as necessary.**

- ***Section 2.2.2 –*** *The report states the invasive area will be planted in December 2023. During the site visit on December 21st, the planting did not appear to have been completed. Please plant this area as soon as possible with species from the approved mitigation plan. Since the project is now in MY4, DMS requires planting with containerized trees to increase the likelihood of survival.*
    - **Planting occurred in the invasive area on 1/2/2024—details have been added to Appendix B. Taller bare-root specimens (many 3 ft.) were used, as this area only has one growing-season worth of vegetation growth due to being completely mulched in fall 2022. Planting density was also above MY3 stem density requirements to allow for some degree of mortality (400 stems per acre). The report has been updated, as well as the photolog.**

<u>Boundary Inspection Comments</u>

- *Remove all old debris from within the conservation easement area. See KML where areas were noted on this field visit. It is possible other areas exist. Make every effort to get all the trash and scrap metal debris out of the CE.*
    - **All trash and scrap metal debris will be removed in the winter or early spring 2024.**

- *Cease all the documented mowing and farming from within the CE immediately. Communicate this to the landowner using a certified letter and copy in the PM. Assess the potential vegetation damage caused by both activities at the locations shown on the KML. Develop and implement a plan in coordination with the landowner to prevent any future impacts to the understory. These areas should be planted with large container sized plants and protected from future mowing or farming violations. Where the farming was noted inside of the CE additional marking is required. Add t-posts, 10' conduit and horse tape to communicate to the farm operator to stay out of the easement aera. Coordinate this activity*

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with the DMS PM and property specialist to ensure that the remediation meets the program's expectations.

- **EPR coordinated with DMS on a certified letter to the landowner that will be sent by DMS in early February 2024. This letter requires a remediation plan to be developed by EPR in coordination with the landowner within 90 days of receipt, including additional boundary marking activities. Encroachment areas were planted with bare root stock on 1/2/2024 and details have been added to the report in Appendix B. Mortality of these specimens will be monitored, and any replacement trees will be containerized.**

- *The conservation area signs were fastened to the T-posts using UV protected zip ties. This was a recommended technique; however, the zip ties have resulted in an unacceptable short life. Before the signs are lost to failing fasteners it is strongly recommended to replace the plastic zip ties with stainless steel zip tie fasteners.*
  - **EPR will evaluate different sign fastener materials for use in MY4.**

- *Several locations had very dense vegetation and we were unable to locate the witness post. These areas are noted on the KML and require follow-up to ensure the witness posts are in place. If they are not located, add them.*
  - **EPR will locate the witness posts and replace them if needed.**

- *In the northernmost CE polygon there is a line that experienced some farm scalloping over time. Attempts have been made to add t-post to this line to make more clear the boundary between the easement and farm. Some of these added t-posts do not appear to be on-line but rather slightly inside of the CE boundary. Make certain that the added t-posts are in line with the actual CE boundary and are properly signed and with 10' conduit to adequately communicate this line to the farm equipment operator.*
  - **EPR will double check placement of these t-posts and add signs and 10' conduit (PVC) as needed.**

<u>Digital Deliverables</u>

- *Please include a shapefile for the encroachment areas.*
  - **A shapefile with just the encroachment areas has been added to the digital deliverable.**

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If you have any questions regarding the MY3 Monitoring Report or responses provided herein, please contact me at 919-623-5411 or via email at ajames@eprusa.net.

Sincerely,

Amy James, PWS

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1.0 PROJECT SUMMARY

Ecosystem Planning and Restoration, PLLC (EPR) implemented the Bear Swamp Stream and Wetland Mitigation Project (Project; Site) for the North Carolina Division of Mitigation Services (NCDMS) to provide 2,220 stream mitigation credits (SMCs) and 2.6 riparian wetland mitigation credits (WMCs) in the Lumber River Basin, Hydrologic Unit Code (HUC) 03040203 (Figure 1). The Project was instituted via NCDEQ-DMS RFP # 16-007337. The Project restored 2,222 linear feet (LF) of an intermittent unnamed tributary to Bear Swamp and restored or preserved 2.88 acres of riparian wetland within a 15.3-acre conservation easement. The easement provides a minimum 50-foot buffer on either side of the stream and is well over 100 feet wide in most areas. Mitigation assets are listed in Table 1.

The Site is located in DMS Targeted Local Watershed (TLW) 03040203050010. The Site was utilized for intensive row crop production, including soybeans, cotton, and corn. As such, streams and existing wetlands in the Project area were adversely impacted by agricultural activities, removal of riparian buffers, and stream channelization. The Site is situated in a WS-IV watershed that is approximately 61% agricultural land, 27% forest, and 13% low density residential development (Table 3). Prior to construction activities, the Project stream was channelized and straightened, and adjacent headwater wetlands were not functioning due to drainage and removal of native vegetation. Photos and a more detailed description of Site conditions before restoration are available in the Mitigation Plan (final version submitted March 2020).

1.1 Goals and Objectives

The Project goals were established based on an assessment of Site conditions and restoration potential with careful consideration of the stressors identified in the Lumber River Basin Restoration Priorities (RBRP; NCEEP, 2008) and the Bear Swamp Local Watershed Plan (NCEEP, 2013). These goals and objectives are presented in Table 2.

Site construction and the as-built survey were completed in November 2020; planting, and baseline vegetation data collection was completed in March 2021. A detailed timeline of the Project activity and reporting history is provided in Appendix D.

1.2 Performance Criteria

Project success criteria were established in accordance with the *NCDMS Mitigation Plan Template* (ver. 06/2017), and *U.S. Army Corps of Engineers – Wilmington District Public Notice: Notification of Issuance of Guidance for Compensatory Stream and Wetland Mitigation Conducted for Wilmington District* (October 24, 2016). The monitoring plan for the Site follows the guidance *NCDMS Annual Monitoring Report Format, Data, and Content Requirements* (October 2020). Table 2 details the United States Army Corps of Engineers (USACE) success criteria that evaluate whether project goals have been met throughout the monitoring period.

Table 1. Project Mitigation Quantities and Credits

Project Component (reach or wetland ID, etc.)	Original Mitigation Plan (ft/ac)	As-built (ft/ac)	Mitigation Category (Thermal Regime; Wetland Type)	Original Restoration Level[1]	Original Mitigation Ratio (X:1)	Mitigation Credits	Notes/Comments
UT to Bear Swamp	2,222.000	2,331.120	Warm	R[2]	1.00000	2,220.000	Full Channel Restoration, Planted Buffer, and Permanent Conservation Easement.
Wetland A	0.417[4]	0.417	Riparian	P	10.00000	0.042	Protect with Permanent Conservation Easement
Wetland B	2.490	2.490	Riparian	R	1.00000	2.490	Restore wetland indicators (vegetation, hydrology, and soil), as defined by the USACE.
Wetland C	0.348	0.348	Riparian	R	1.00000	0.348	
				Total Assets Summary:			**2,220.000 SMCs 2.88 WMCs**

Length and Area Summations by Mitigation Category			
Restoration Level	Stream (linear feet)	Riparian Wetland (acres)	Non-riparian Wetland (acres)
Restoration	2,220.000	2.838	
Enhancement			
Enhancement I			
Enhancement II			
Rehabilitation			
Preservation		0.417	
High Quality Pres			

Overall Assets Summary	
Asset Category	**Overall Credits**
Stream	**2,220.000**
Riparian Wetland	**2.880[3]**

[1] R=Restoration; P=Preservation

[2] Headwater (or Valley) Stream Restoration

[3] Contracted amount of riparian wetland credits is 2.600 acres; any surplus credits will not be realized by EPR

[4] Only includes part of existing Wetland A being claimed as preservation

Table 2. Summary: Goals, Performance and Results

Goal	Objective/Treatment	Likely Functional Uplift	Performance Criteria	Measurements	Cumulative Monitoring Results
Replace riparian buffers	▪ Restore minimum 50-foot riparian buffers to filter runoff.	▪ Restored riparian buffers will provide woody debris and detritus for aquatic organisms, reduced water temperatures, and increased dissolved oxygen concentrations, as well as shade and diverse aquatic and terrestrial habitats that are appropriate for the ecoregion and setting.	▪ Vegetation success criteria of 320 native stems/acre in Year 3, 260 stems/acre in Year 5 and 210 native stems/acre in Year 7. ▪ Trees must average 7 feet in height at Year 5, and 10 feet in height at Year 7.	<u>Permanent and Annual Random Vegetation Plots</u> 5 permanent vegetation plots and 5 randomly selected vegetation plots 0.02 acre in size, surveyed during As-built, Years 1, 2, 3, 5, and 7 between July 1st and leaf drop. Data collection includes species, height, planted vs. volunteer, and age.	In MY3, all permanent and random vegetation plots exceeded the performance standard as indicated for stem density in Year 3 (320 stems/acre). Permanent plots had an average of 526 stems/acre while random plots had an average of 494 stems/acre. No plots exceeded the 50% species requirement. Average plot height across all plots was 5.8 ft.
Repair channelized streams	▪ Restore appropriate bed form diversity, headwater stream/wetland form, and install in-stream structures to provide appropriate habitat. ▪ Restore self-sustaining stream/wetland headwaters.	▪ Functional uplift will be achieved by reducing the impact of adjacent agriculture and restoring natural riparian vegetation, appropriate stream form, and adjacent headwater wetlands.	▪ Continuous surface flow within the valley or crenulation must be documented each year for at least 30 consecutive days.	<u>Stream Hydrology Monitoring</u> 2 pressure transducers and a rain gauge will record precipitation and streamflow data continuously through the monitoring period.	Flow gauge data from MY3 indicate that the Project stream met the established success criteria of 30 days or more of consecutive flow throughout the year in MY3.
Preserve existing resources	▪ Place a conservation easement on existing riparian headwater stream/ wetland system at southern end of the Project.		▪ Documentation of field indicators of channel formation and an ordinary high-water mark using photographs and applicable data sheets.	<u>Channel Formation</u> Documentation of applicable field indicators using photography and data sheets	Sediment deposition, presence of litter/debris, vegetation matted down, leaf litter washed away, and multiple observed flow events were the main channel formation indicators observed in MY3.
Improve Water Quality Where Degraded by Pollutant Inputs	▪ Restore and preserve riparian wetland systems. ▪ Restore riparian buffer vegetation to filter runoff and provide organic matter and shade. ▪ Remove cropland from active production.	▪ The addition of in-stream structures will provide greater bedform diversity, enhancing aquatic habitat for native species.	▪ Visual documentation of stream stability during annual monitoring.	<u>Visual Assessment</u> Conducted yearly for restored wetlands, stream channels, and in-stream habitat and grade control structures (debris jams and woody riffle).	Stream photo points and visual assessment indicate that the restored channel and in-stream structures are performing as intended. No stream problem areas were observed.

Table 2. Summary: Goals, Performance and Results

Goal	Objective/Treatment	Likely Functional Uplift	Performance Criteria	Measurements	Cumulative Monitoring Results
Improve Functions Degraded by Loss of Channel-Riparian Zone Connection	▪ Restore self-sustaining stream/wetland headwaters. ▪ Restore minimum 50-foot riparian buffers that will include riparian wetlands and terrestrial edges.	▪ Functional uplift will occur by restoring the stream to its historic valley, raising the streambed, and connecting it to adjacent wetlands at lower flows.	▪ Water table gauges and wells document high water table conditions. ▪ Wetland hydrology success criteria of saturation or inundation for 12 percent of the growing season.	<u>Wetland Hydrology Monitoring</u> 5 pressure transducers (4 in restored wetland areas and 1 reference) will record groundwater levels continuously throughout the monitoring period.	Based on consecutive successful days within the growing season, BS1 (wetter reference), BS2, BS3, and BS7 exceeded the 12% hydroperiod performance standard. BS4 was just under the performance standard at 10%. BS8 was installed as a reference well in a drier part of the existing wetland in February 2023. However, due to logger error, readings were not taken until mid-April; therefore, while this well only demonstrated 9% hydroperiod, the number of consecutive days was likely greater given Site conditions in March and April.
Protect Against Future Threats	▪ Place a permanent conservation easement on the Project area.		▪ Recordation and protection of a conservation easement meeting NCDMS guidelines	<u>Observations of Easement Encroachment</u> Document any encroachments into easement from adjoining land use	Encroachment areas identified in MY2 along the western boundary of the easement had additional t-posts installed in June 2023 to deter mowing in these areas. Easement signs were also re-affixed to posts where ties were loose, or the sign had fallen. Encroachment areas (2) adjacent to the crop fields have not been disturbed by mowing since additional posts were installed. Mowing by the renter in the SW was more persistent, though negotiations are occurring that will hopefully allow a permanent resolution to be reached. All noted MY2 encroachment areas were planted on 1/2/2024.

Table 3. Project Attribute Table

Project Background Information			
Project Name		Bear Swamp Stream and Wetland Restoration Project	
County		Robeson	
Project Area (acres)		15.3	
Project Coordinates (latitude and longitude)		latitude 34 deg 40' 549" N, longitude 79 deg 9' 19" W	
Planted Acreage (Acres of Woody Stems Planted)		12.07	
Project Watershed Summary Information			
Physiographic Province		Coastal Plain	
River Basin		Lumber	
USGS Hydrologic Unit 8-digit	03040203	USGS Hydrologic Unit 14-digit	03040203050010
Project Drainage Area (Acres and Sq. Mi.)		59.2 acres/ 0.09 Sq.Mi. (Total)	
Project Stream Thermal Regime		Warm	
Project Drainage Area Percentage of Impervious Area		<1%	
CGIA Land Use Classification		Agriculture/Pasture 61%, Forest 27%, 13% Residential/Developed	

Reach Summary Information			
Parameters	**UT1**		
Length of reach (linear feet)	2,432 (original length)		
Valley confinement (Confined, moderately confined, unconfined)	Unconfined		
Drainage area (Acres and Square Miles)	0.09 Sq.Mi., 59.2 Ac		
Perennial, Intermittent, Ephemeral	Intermittent (25.5)		
NCDWR Water Quality Classification	WS-IV; Sw		
Stream Classification (existing)	G5/B5c		
Stream Classification (proposed)	most similar to DA		
Evolutionary trend (Simon)	II		
FEMA classification	X		

Wetland Summary Information			
Parameters	**Wetland A**	**Wetland B**	**Wetland C**
Pre-project (acres)	0.417	0.00	0.00
Post-project (acres)	0.417	2.49	0.348
Wetland Type (non-riparian, riparian)	Riparian	Riparian	Riparian
Mapped Soil Series	Johnston	Bibb	Norfolk loamy sand
Soil Hydric Status	Hydric	Hydric	Hydric[1]

Regulatory Considerations			
Parameters	**Applicable?**	**Resolved?**	**Supporting Docs?**
Water of the United States - Section 404	Yes	Yes	USACE NWP 27 - ID# SAW-2018-01154
Water of the United States - Section 401	Yes	Yes	DWR 401 WQC No. 4134 -- ID # 18-0782
Division of Land Quality (Erosion and Sediment Control)	Yes	Yes	General Permit NCG010000 ID # ROBES-2020-028
Endangered Species Act	No	Yes	Categorical Exclusion Document; Appendix 6 in Mitigation Plan
Historic Preservation Act	No	Yes	
Coastal Zone Management Act	No	N/A	N/A
FEMA Floodplain Compliance	No	N/A	N/A
Essential Fisheries Habitat	No	N/A	N/A

[1]: This soil unit is not considered hydric by the NRCS, but detailed field investigations found soils meeting hydric criteria (as presented in the Mitigation Plan).

2.0 MONITORING DATA ASSESSMENT

Monitoring Year 3 (MY3) data was collected in October and November 2023. Current Site conditions and monitoring data are described in the following sections to evaluate whether the Project is meeting the success criteria established in the mitigation plan.

2.1 Stream Monitoring

Stream monitoring involves field data collection to assess the hydrologic and geomorphic functions of UT1. Monitored parameters, methods, schedule/frequency, and extent are summarized in Table 2. These monitoring parameters follow USACE guidance but will also allow for monitoring of other parameters to document Site performance related to the project goals listed in Table 2. The locations of the stream gauges and photo points are shown in Figure 2 Current Condition Plan View (CCPV).

2.1.1 Valley Profile

Because this Project utilizes valley restoration, a full longitudinal profile was not required per the mitigation plan. A small pilot channel was dug along the low point of the valley during construction to route flow; the thalweg of this channel is shown on the CCPV (Figure 2). No significant movement of this channel was noted during MY3.

2.1.2 Channel Formation

Headwater stream (or valley) restoration requires that evidence of channel formation be documented during each monitoring year. Applicable field indicators of channel formation are found in RGL 05-05 and outlined in the 2016 USACE Guidance; these indicators change based on monitoring year. The main channel formation indicators applicable to Monitoring Years 1-4 observed in MY3 are shown in Table 9 in Appendix C; this table will be updated in additional monitoring years. Representative photos of the observed indicators in MY3 are found in the photolog in Appendix A.

2.1.3 Channel Stability

Channel stability is assessed on a yearly basis using photographs to visually document the condition of the restored Project stream. Photographs are typically taken from the same location in the same direction each year, though locations may change if the pilot channel moves laterally. Twelve (12) photo points were established during baseline monitoring and are shown in Appendix A. The locations of each permanent photo point are shown in the CCPV (Figure 2). Visual assessments of channel stability and in-stream structure condition were also made regularly throughout MY3.

Stream photo points and visual assessments indicate that the restored channel and in-stream structures are in good condition and performing as intended. Along much of the alignment outside the forested area, the channel is full of hydrophytic vegetation (e.g., *Persicaria* spp., *Juncus effusus*) and the riparian area is also densely vegetated. This vegetation, as well as the low energy nature of the system, likely prevents instability in the channel and adjacent riparian area.

2.1.4 Stream Hydrology

Two (2) pressure transducers were installed in UT1 to document days of continuous stream flow during the monitoring year. The locations of these gauges are shown in the CCPV (Figure 2).

This Project utilizes a tipping bucket rain gauge to accurately document rainfall at the Site. The rainfall data can be compared to the flow gauge data to verify that high flows at the Site are correlated with rainfall events. The monitoring gauges were downloaded regularly throughout MY3. Monthly rainfall

summary data are presented in Figure 3; the precipitation and water level hydrographs are included in Appendix C.

Flow gauge data from MY3 indicates that the Project stream met the established success criteria of 30 days or more of consecutive flow throughout the year. According to the upstream gauge for the UT to Bear Swamp (BS5), the stream had 118 days of consecutive flow, while the downstream gauge (BS6) showed 108 days of consecutive flow.

2.2 Riparian and Wetland Vegetation Monitoring

Riparian and wetland vegetation monitoring evaluates the growth and development of planted and volunteer vegetation across the Site. Monitored parameters, methods, schedule/frequency, and extent are summarized in Table 2. These monitoring parameters follow USACE guidance but will also allow for monitoring of other parameters to document Site performance related to the project goals listed in Table 2.

2.2.1 Vegetation Monitoring Data

Five (5) permanent (or fixed) vegetation monitoring plots were assessed across the Site. The corners of the permanent vegetation plots were marked using steel t-posts and the location of each plot was surveyed during the as-built survey. The individual trees within each permanent plot were marked with pin flags to facilitate monitoring efforts in future years. In addition to the 5 permanent plots, 5 randomly placed vegetation plots are established each vegetation monitoring year, and the location of these plots is recorded using GPS. All vegetation plots for MY3 are shown in the CCPV (Figure 2). Annual vegetation data was compiled and summarized using the latest version of the DMS Vegetation Data Table Tool (see Tables 6 and 7 in Appendix B).

MY3 vegetation monitoring occurred on October 18, 2023. Stem counts for the vegetation plots (fixed and random) ranged from 9 trees per plot (364 stems per acre) in FP-1 (Fixed) to 16 trees per plot (648 stems per acre) in FP-2 (Fixed). The average stem density from all 10 vegetation plots (fixed and random) was 13 trees per plot (526 stems per acre). Therefore, the vegetation plot data indicates that planted trees on the Site are exceeding the interim success criteria in MY3 of 320 stems/acre. No plots exceeded the 50% species threshold.

The average plot height is 5.8 feet across both fixed and random plots, with an overall average tree height of 5.6 feet. These numbers and the steady overall increase in stem heights from MY1 to MY3 indicate the Project is on a trajectory towards meeting the requirement of average tree height of 7 ft. in MY5.

In MY2, mowing encroachment was observed in 3 areas along the western boundary of the easement. Two of these are adjacent to the active crop fields and were being mowed inadvertently. More t-posts were added to these areas in June 2023 to deter further mowing and supplemental planting occurred on January 2, 2024, with trees from the approved mitigation plan. Planting details are provided in Appendix B. The remaining mowing encroachment is the result of intentional mowing by an adjacent property renter along the southwest easement boundary and was not planted during the construction phase. After discussions with the property renter and landowner, this area was also planted with trees from the approved mitigation plan on January 2, 2024 (see Appendix B). While these areas were planted with large bare root stock, any unsuccessful specimens will be replaced with containerized trees.

Three additional encroachment areas were noted during the MY3 boundary survey completed by DMS; these areas are estimated on the MY3 CCPV and will be planted in late winter or early spring 2024.

2.2.2 Invasive Species

Chinese privet (*Ligustrum sinense*) was the most common non-native invasive species found within the forested section of the easement. Several other non-native invasive species were identified along the field edge of the forested section, including Japanese privet (*Ligustrum japonicum*) and Chinaberry (*Melia azedarach*); however, these species were not as prevalent as Chinese privet. During construction, most of the forested area was left intact; therefore, much of the privet remained, mostly along the southeast border of the easement, but also scattered throughout the southwest section, and totaled approximately 1.3 acre. All privet was either cut by hand and treated with Vastlan™ (Triclopyr choline) in 2021 or mechanically cut and mulched in 2022. The area treated in 2021 was planted in late winter 2022 with surplus stems taken from a nearby section of easement, which were planted originally for this purpose. The area that was mechanically cleared in 2022 was planted with species from the mitigation plan on January 2, 2024, at a density of 400 stems per acre (see Appendix B for details). Vegetation transects will be run in this area in MY4 at the request of the IRT.

Some re-sprouting of privet was observed in the easement in MY3—spot herbicide treatments occurred in June 2023 and January 2024.

2.3 Wetland Hydrology

Four (4) groundwater wells were installed in restored wetland areas (2 each in Wetlands B and C) to document percent hydroperiod during the growing season. In addition, a fifth groundwater well was installed in the existing wetland area as a reference. Because the reference well is in a wetter, more downstream location than wells in the restored wetlands, another reference well was installed within the easement towards the top of the existing forested area. This well should better reflect reference conditions in the restored wetlands. The locations of all wells are shown in the CCPV (Figure 2). Based on the soils mapped in the restored wetland areas, the target growing season hydroperiod is 12%. This Project also utilizes a tipping bucket rain gauge to accurately document rainfall at the Site. The rainfall data can be compared to the well data to verify that high water table conditions at the Site are correlated with rainfall events. The monitoring gauges were downloaded regularly throughout MY3.

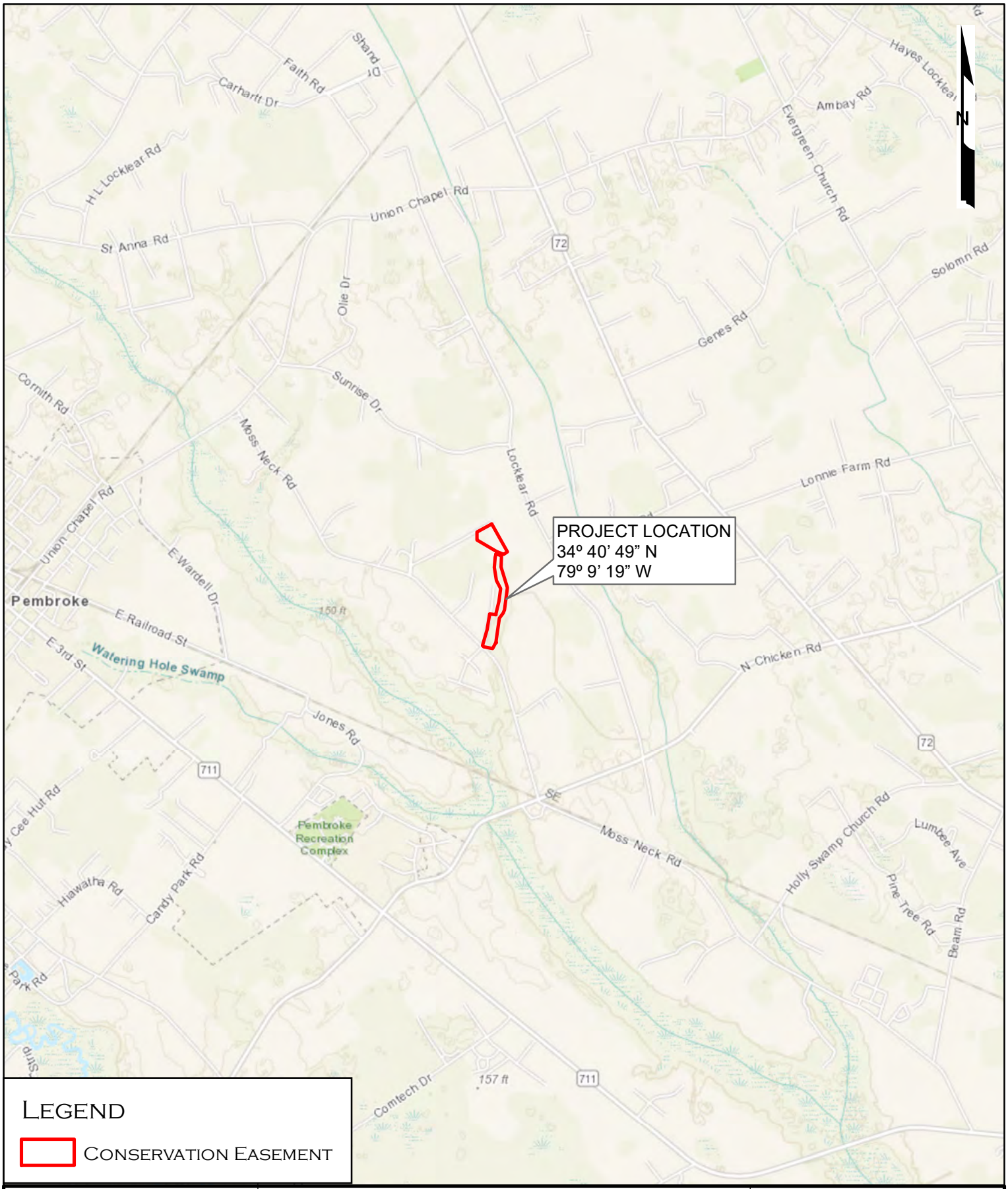
The growing season for this Project, based on WETS data tables for Robeson County, was given as March 15 – November 15 in the mitigation plan. However, based on readings of soil temperature at 20 inches (> 41° F) and observation of bud burst on March 1 (see photolog in Appendix A), it is proposed that the beginning growing season date be moved to March 1. Trees with dropped leaves were observed on November 20 (see photolog in Appendix A), so the end of the growing season was kept at November 15. Twelve (12) percent (target hydroperiod) of this duration (March 1 – November 15) is 31 days.

Monthly rainfall totals over the growing season are shown on Figure 3 (Appendix C), including an overlay of WETS-derived 30th and 70th percentile monthly rain totals. In MY1, the 30th and 70th percentiles were based on data from 1920-2019. Starting in MY2, the 30th and 70th percentiles are based on data from 1971-2022, to better reflect current conditions. In MY3, rainfall was in the normal or above normal range between January-April, June-August, and November-December, while the remaining months (May, September, and October) were below normal. The rain total for the year was in the normal range for the first time since monitoring began, largely due to above average rainfall in December. Between November 20 and December 31, it should be noted that rainfall data was obtained from the WCON7

weather station in Lumberton, as data collection from the on-site rain gage was interrupted, likely from an obstruction in the funnel (cleaned out 1/2/2024).

Of the four wells in restored wetland areas, all but one met or exceeded the 12% target hydroperiod during the growing season using the consecutive number of days where the water table was within 12 inches of the surface (Appendix C, Table 8). The maximum number of consecutive days were all in March and April, which is typical of this Site. It should be noted that, based on observation of well hydrographs during this time, EPR adjusted the sensor to ground measurements for BS2, BS3, and BS4 in the well spreadsheets (0.35 inches or less). These adjustments were undertaken to calibrate the well readings to onsite measurements of saturated/standing water conditions observed in the field. Potential reasons why well calibration was needed may include well subsidence and/or microtopographic variation introduced during construction. That is, the well may have been placed on slightly higher microtopographic relief than the average ground surface in the restored wetland area; therefore, while water in the wetland is reaching ground surface, the well may not be recording the reading accurately prior to calibration. The one well still not meeting hydroperiod was BS4, in the middle of Wetland B at the northern end of the easement. Per the IRT MY3 field visit, another well will be placed nearby before the growing season commences in MY4 to determine whether this outcome is an anomaly and to aid in credit release decisions.

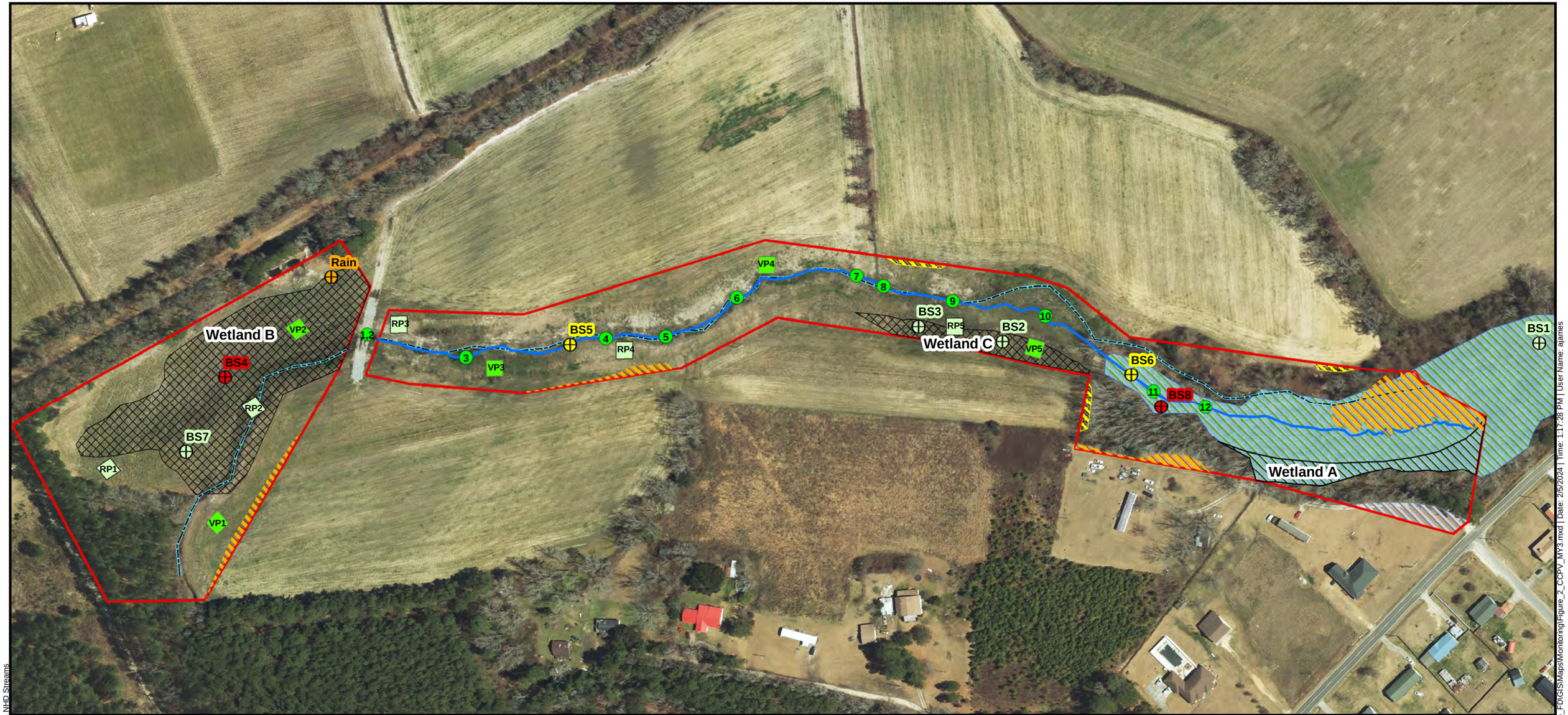
An additional reference well (BS8) was installed as a 'drier' reference comparison at the edge of the existing wetland in February 2023. Due to logger error, no data was collected between installation and April 13, missing the first 44 days of the growing season. Based on data collected, this well had a 9% hydroperiod; however, given conditions during March and April, it likely would have had a higher consecutive day total if the logger error did not occur.



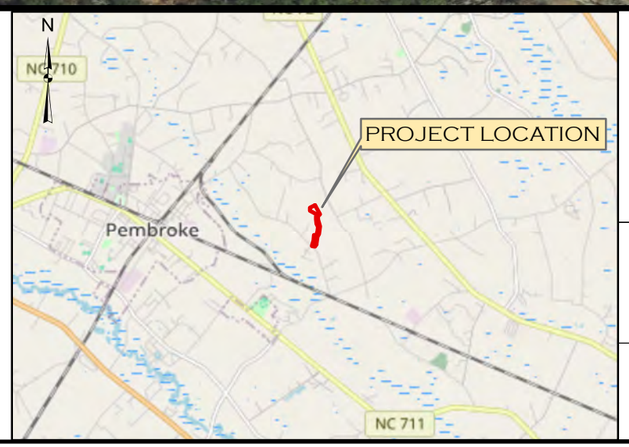
Legend

Conservation Easement

0 0.25 0.5 Miles	BEAR SWAMP STREAM & WETLAND RESTORATION VICINITY MAP	PREPARED FOR: NCDEQ Division of Mitigation Services
FIGURE 1	ROBESON COUNTY, NC	PREPARED BY: Ecosystem Planning & Restoration



MY3 Encroachment Areas (Estimated)
Supplemental Planting Areas (1/2/2024)
Rain Gage
Stream Gage - Successful
Wetland Gage - Not Successful
Wetland Gage - Successful
Photo Points
Stream - Restoration
Pre-Existing Stream
Wetland - Preservation
Wetland - Restoration
Existing Wetlands
Conservation Easement
Easement Exception
Vegetation Plots
Permanent - Successful
Random - Successful



Bear Swamp Stream and Wetland Restoration Site

Current Condition Plan View: Asset Map
MY3: 2023

Robeson County, NC

Prepared for: NC Mitigation Services

Prepared by: Ecosystem Planning & Restoration

N

0 90 180 Feet

1 inch = 183 feet

FIGURE 2

DATE:
February 2024

Sources: ESRI Aerial Imagery 2017, ESRI Topography, TIGER Roads, USGS NHD Streams

Path: L:\Projects\000_Projects_Old\Raleigh\RDU00101_NCDEQ_Bear Swamp_FD\GIS\Maps\Monitoring\Figure_2_CCPV_MY3.mxd | Date: 2/5/2024 | Time: 1:17:28 PM | User Name: ajames

3.0 REFERENCES

Environmental Laboratory. 1987. Corps of Engineers Wetlands Delineation Manual. Technical Report Y-87-1, U.S. Army Engineer Waterways Experiment Station, Vicksburg, Miss.

North Carolina Department of Environmental Quality, Division of Mitigation Services (DMS). DMS Vegetation Data Entry Tool, March 2022. https://ncdms.shinyapps.io/Veg_Table_Tool/

North Carolina Department of Environmental Quality, Division of Mitigation Services (DMS). Annual Monitoring Report Format, Data, and Content Requirements, October 2020.

U.S. Army Corps of Engineers. October 2016. Wilmington District Public Notice: Notification of Issuance of Guidance for Compensatory Stream and Wetland Mitigation Conducted for Wilmington District.

Appendix A

Visual Assessment Data

Table 4. Visual Stream Morphology Stability Assessment Table

Table 5. Vegetation Condition Assessment Table

Vegetation Photo Log

Photo Log

Table 4. Visual Stream Morphology Stability Assessment Table
Bear Swamp Stream and Wetland Mitigation Project (DMS No.100054)

Reach ID	**UT1**
Assessed Stream Length (ft)	**2,220**
Assessed Bank Length (ft)	**4440**
Assessment Date	**11/20/2023**

Major Channel Category		Metric	Number Stable, Performing as Intended	Total Number in As-built	Amount of Unstable Footage	% Stable, Performing as Intended
Bank	**Surface Scour/Bare Bank**	Bank lacking vegetative cover resulting simply from poor growth and/or surface scour			0	100%
	Toe Erosion	Bank toe eroding to the extent that bank failure appears likely. Does NOT include undercuts that are modest, appear sustainable and are providing habitat.			0	100%
	Bank Failure	Fluvial and geotechnical - rotational, slumping, calving, or collapse			0	100%
				Totals	0	100%
Structure	**Grade Control**	Grade control structures exhibiting maintenance of grade.	5	5		100%
	Bank Protection	Bank erosion within the structures extent of influence does not exceed 15%. (See guidance for this table in DMS monitoring guidance document)	22	22		100%
	Habitat	Debris jams/rootwads remain in contact with baseflow and provide cover	17	17		100%

Table 5. Vegetation Condition Assessment Table
Bear Swamp Stream and Wetland Mitigation Project (DMS No.100054)

Planted Acreage **10.58**
Assessment Date **11/20/2023 & 1/2/2024**

Vegetation Category	Definitions	Mapping Threshold	Combined Acreage	% of Planted Acreage
Bare Areas	Very limited cover of both woody and herbaceous material.	0.1 acres	0.00	0.0%
Low Stem Density Areas	Woody stem densities clearly below target levels based on current MY stem count criteria.	0.1 acres	0.00	0.0%
		Total	0.00	0.0%
Areas of Poor Growth Rates	Planted areas where average height is not meeting current MY Performance Standard.	0.25 acres	0.00	0.0%
		Cumulative Total	0.00	0.0%

Easement Acreage **15.3**

Vegetation Category	Definitions	Mapping Threshold	Combined Acreage	% of Easement Acreage
Invasive Areas of Concern	Invasives may occur outside of planted areas and within the easement and will therefore be calculated against the total easement acreage. Include species with the potential to directly outcompete native, young, woody stems in the short-term or community structure for existing communities. Species included in summation above should be identified in report summary.	0.1 acres	0.00	0.0%
Easement Encroachment Areas	Encroachment may be point, line, or polygon. Encroachment to be mapped consists of any violation of restrictions specified in the conservation easement. Common encroachments are mowing, cattle access, vehicular access. Encroachment has no threshold value and will need to be addressed regardless of impact area.	None	All mowing encroachments identified in MY2 have been planted and additional t-posts have been installed. Additional encroachments identified during the MY3 boundary survey will be marked and planted in MY4.	

Bear Swamp Stream and Wetland Mitigation Project
Monitoring Year 3 (October 2023) - Vegetation Photo Log

Veg Plot 1 F – East Corner (10/18/2023)

Veg Plot 2 F – East Corner (10/18/2023)

Veg Plot 3 F – SE Corner (10/18/2023)

Veg Plot 4 F – SE Corner (10/18/2023)

Veg Plot 5 F – SE Corner (10/18/2023)

Veg Plot 1 R – SW Corner (10/18/2023)

Veg Plot 2 R – SE Corner (10/18/2023)

Veg Plot 3 R – SE Corner (10/18/2023)

Veg Plot 4 R – NE Corner (10/18/2023)

Veg Plot 5 R – SE Corner (10/18/2023)

Bear Swamp Stream and Wetland Mitigation Project
Monitoring Year 3 (February, April, September, and November 2023; January 2024) Photo Log

Photo Point 1 – Sta. 10+00
Facing Upstream Towards Wetland B (11/20/2023)

Photo Point 2 – Sta. 10+00
Facing Downstream (11/20/2023)

Photo Point 3 – Sta. 11+75
Facing Downstream (11/20/2023)

Photo Point 4 – Sta. 14+60
Facing Upstream (11/20/2023)

Photo Point 5 – Sta. 15+90
Facing Downstream (11/20/2023)

Photo Point 6 – Sta. 17+45
Facing Upstream (11/20/2023)

Photo Point 7 – Sta. 20+00
Facing Downstream (11/20/2023)

Photo Point 8 – Sta. 20+50
Looking Upstream at Ditch from Stream (11/20/2023)

Photo Point 9 – Sta. 21+90
Facing Upstream (11/20/2023)

Photo Point 10 – UT1 Reach 3, Sta. 23+80
Facing Downstream (11/20/2023)

Photo Point 11 – Sta. 26+50
Facing Upstream, Towards BS6 (11/20/2023)

Photo Point 12 – Sta. 27+50
Facing Downstream (11/20/2023)

Permanent Ford Crossing
Facing East (4/24/2023)

Evidence of channel formation: sediment deposition in channel (11/20/2023)

Evidence of channel formation: vegetation matted down (11/20/2023)

Evidence of channel formation: presence of litter and debris; also note algae in channel (2/23/2023)

Evidence of channel formation: leaf litter washed away after Tropical Storm Idalia (9/2/2023)

Soil temperature reading at 20 inches on 2/23/2023

Bud burst observed on 2/23/2023

Bud burst observed on 2/23/2023

Mechanically cleared privet area (4/24/2023)

Former encroachment area showing extra posts and grown-up vegetation (11/20/2023)

Evidence of leaf fall (11/20/2023)

Supplemental planting (orange flags) in encroachment area along field (1/2/2024)

Planting in mechanically mulched Chinese privet area, along old channel (orange flags; 1/2/2024)

Planting in mechanically mulched Chinese privet area (orange flags; 1/2/2024)

Appendix B

Vegetation Plot Data

Table 6. Vegetation Plot Data

Table 7. Vegetation Performance Standards Summary Table

Supplemental Planting Information

Planted Acreage	10.2
Date of Initial Plant	2021-03-19
Date(s) of Supplemental Plant(s)	Planned December 2023
Date(s) Mowing	NA
Date of Current Survey	2023-10-18
Plot size (ACRES)	0.0247

	Scientific Name	Common Name	Tree/ Shrub	Indicator Status	Veg Plot 1 F		Veg Plot 2 F		Veg Plot 3 F		Veg Plot 4 F		Veg Plot 5 F		Veg Plot 1 R	Veg Plot 2 R	Veg Plot 3 R	Veg Plot 4 R	Veg Plot 5 R
					Planted	Total	Planted	Total	Planted	Total	Planted	Total	Planted	Total	Total	Total	Total	Total	Total
Species Included in Approved Mitigation Plan	Betula nigra	river birch	Tree	FACW	1	1			2	2	1	1			2		3	2	
	Diospyros virginiana	common persimmon	Tree	FAC			1	1								3			
	Liriodendron tulipifera	tuliptree	Tree	FACU				2							1				1
	Magnolia virginiana	sweetbay	Tree	FACW	1	1	4	5	3	3	1	1	3	3		4			
	Nyssa sylvatica	blackgum	Tree	FAC	1	1					1	1				1	1	1	1
	Quercus laurifolia	laurel oak	Tree	FACW			1	1							1			3	
	Quercus lyrata	overcup oak	Tree	OBL	2	2			2	2	5	5	5	5	3	2	3		6
	Quercus pagoda	cherrybark oak	Tree	FACW	3	3	1	1	4	4	3	3	2	3	2		4	4	1
	Taxodium distichum	bald cypress	Tree	OBL	1	1	6	6	4	4	2	2	4	4	1	5	2	1	3
	Ulmus americana	American elm	Tree	FAC							1	1							
Sum	Performance Standard				9	9	13	16	15	15	14	14	14	15	10	15	13	11	12
Post Mitigation Plan Species	*Carya tomentosa*	*mockernut hickory*	*Tree*			*1*												*1*	*1*
	Salix nigra	*black willow*	*Tree*	*OBL*												*1*			
Sum	Proposed Standard				9	9	13	16	15	15	14	14	14	15	10	15	13	11	12
Mitigation Plan Performance Standard	Current Year Stem Count					9		16		15		14		15	10	15	13	11	12
	Stems/Acre					364		648		607		567		607	405	607	526	445	486
	Species Count					6		6		5		7		4	6	5	5	5	5
	Dominant Species Composition (%)					33		38		27		36		33	30	31	31	33	46
	Average Plot Height (ft.)					6		3		5		5		5	9	5	8	6	6
	% Invasives					0		0		0		0		0	0	0	0	0	0
Post Mitigation Plan Performance Standard	Current Year Stem Count					9		16		15		13		14	10	15	13	11	12
	Stems/Acre					364		648		607		567		607	405	607	526	445	486
	Species Count					6		6		5		7		4	6	5	5	5	5
	Dominant Species Composition (%)					30		38		27		36		33	30	31	31	33	46
	Average Plot Height (ft.)					6		3		5		5		5	9	5	8	6	6
	% Invasives					0		0		0		0		0	0	0	0	0	0

1). Bolded species are proposed for the current monitoring year, italicized species are not approved, and a regular font indicates that the species has been approved.
2). The "Species Included in Approved Mitigation Plan" section contains only those species that were included in the original approved mitigation plan. The "Post Mitigation Plan Species" section includes species that are being proposed through a mitigation plan addendum for the current monitoring year (bolded) , species that have been approved in prior monitoring years through a mitigation plan addendum (regular font), and species that are not approved (italicized).
3). The "Mitigation Plan Performance Standard" section is derived only from stems included in the original mitigation plan, whereas the "Post Mitigation Plan Performance Standard" includes data from mitigation plan approved, post mitigation plan approved, and proposed stems.

Vegetation Performance Standards Summary Table

	Veg Plot 1 F				Veg Plot 2 F				Veg Plot 3 F			
	Stems/Ac.	Av. Ht. (ft)	# Species	% Invasives	Stems/Ac.	Av. Ht. (ft)	# Species	% Invasives	Stems/Ac.	Av. Ht. (ft)	# Species	% Invasives
Monitoring Year 7												
Monitoring Year 5												
Monitoring Year 3	364		6	0	648		6	0	607		5	0
Monitoring Year 2	364		6	0	526		6	0	607		5	0
Monitoring Year 1	486		7	0	486		5	0	648		6	0
Monitoring Year 0	445		7	0	486		5	0	688		6	0
	Veg Plot 4 F				Veg Plot 5 F				Veg Plot Group 1 R			
	Stems/Ac.	Av. Ht. (ft)	# Species	% Invasives	Stems/Ac.	Av. Ht. (ft)	# Species	% Invasives	Stems/Ac.	Av. Ht. (ft)	# Species	% Invasives
Monitoring Year 7												
Monitoring Year 5												
Monitoring Year 3	567		7	0	607		4	0	405		6	0
Monitoring Year 2	486		6	0	567		4	0				
Monitoring Year 1	445		6	0	526		4	0				
Monitoring Year 0	486		7	0	567		5	0				
	Veg Plot Group 2 R				Veg Plot Group 3 R				Veg Plot Group 4 R			
	Stems/Ac.	Av. Ht. (ft)	# Species	% Invasives	Stems/Ac.	Av. Ht. (ft)	# Species	% Invasives	Stems/Ac.	Av. Ht. (ft)	# Species	% Invasives
Monitoring Year 7												
Monitoring Year 5												
Monitoring Year 3	607		5	0	526		5	0	445		5	0
Monitoring Year 2												
Monitoring Year 1												
Monitoring Year 0												

	Veg Plot Group 5 R			
	Stems/Ac.	Av. Ht. (ft)	# Species	% Invasives
Monitoring Year 7				
Monitoring Year 5				
Monitoring Year 3	486		5	0
Monitoring Year 2				
Monitoring Year 1				
Monitoring Year 0				

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

Bear Swamp 2024 Supplemental Planting Species List

Date(s) Planted:	1/2/2024	Planter(s):	TB, AB, AJ
Acre(s) Planted:	0.65	Planting Density (Stems/Ac):	436
Site Conditions:	32-50 F, light winds	Number of Trees Needed:	284
Tree Specifications:	24-30" tall, bare root	Planting Locations:	See attached pdf

Tree Species used for Supplemental Planting

Common Name	Scientific Name	Planting Zones	Actual Tree Order
American Elm	*Ulmus americana*	Zone 1 & Upland	65
Bald Cypress	*Taxodium distichum*	Zones 1 & 2	100
Black Gum	*Nyssa sylvatica*	Upland	15
Cherrybark Oak	*Quercus pagoda*	Zones 1 & 2	100
Persimmon	*Diospryos virginiana*	Zone 2	50
Swamp Chestnut Oak	*Quercus michauxii*	Zones 1 & 2	100
			430

Planting Areas and Trees Planted

Planting Areas	Planting Area (Ac)	Planting Zones	Total Trees Planted
Encroachment 1	0.07	Zone 1	8
Encroachment 2	0.05	Zone 1	24
Encroachment 3	0.07	Upland / Zone 1	20
Invasive Removal 1	0.46	Zones 1 & 2	225
Totals	**0.65**		277

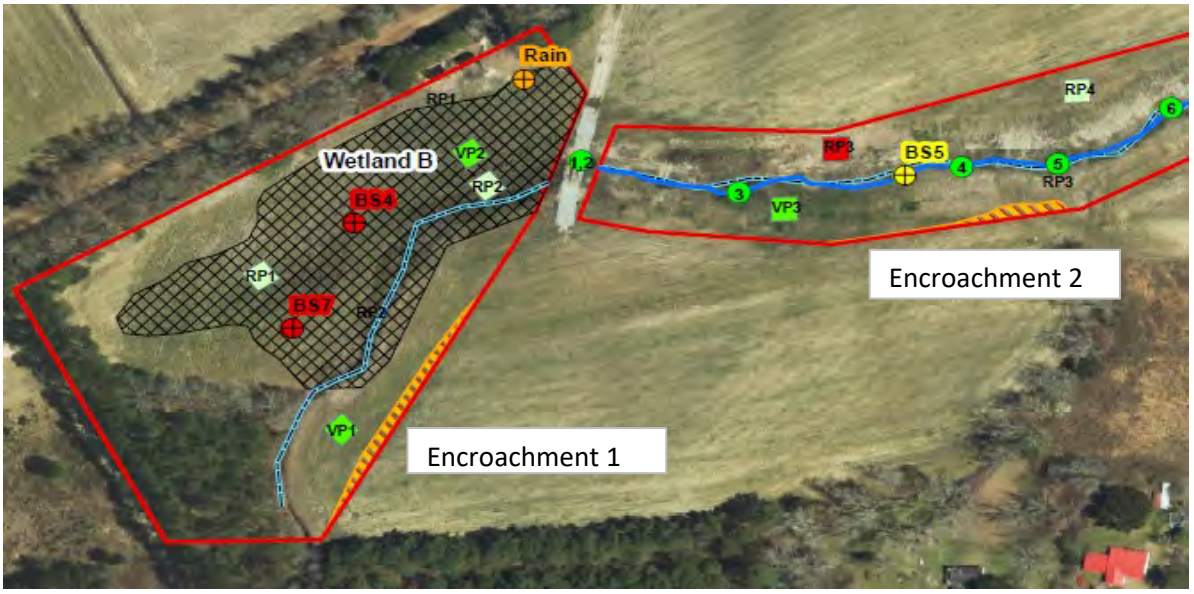
Planting Notes

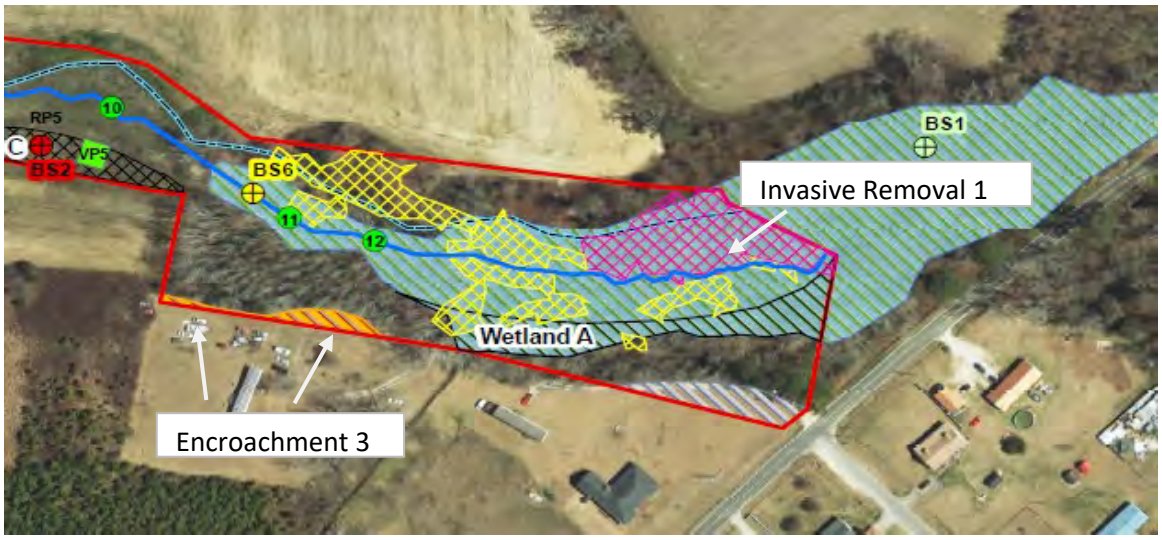
Encroachment Area 1 - This area contained more original trees than expected, so trees were only added where gaps were present.

Encroachment Area 2 - The maximum number of trees were planted in this area. Very few of the original trees were present.

Encroachment Area 3 - Trees were planted a minimum of 8-feet away from the access path and the existing forest to allow for future growth. Fewer trees were needed as a result.

Invasive Removal 1 - Trees were planted at a slightly higher density in this area.


Rain
RP1
Wetland B
VP2
RP2
BS4
RP1
BS7
VP1
1,2
RP3
BS5
4
3
VP3
RP4
6
5
RP3
Encroachment 2
Encroachment 1


RP5
10
C
VP5
BS2
BS6
11
12
BS1
Invasive Removal 1
Wetland A
Encroachment 3

Appendix C

Hydrologic Data

Table 8. Wetland Gage Summary

Table 9. Indicators of Headwater Channel Formation

Figure 3. Monthly Rainfall Summary Data

Precipitation and Water Level Hydrographs

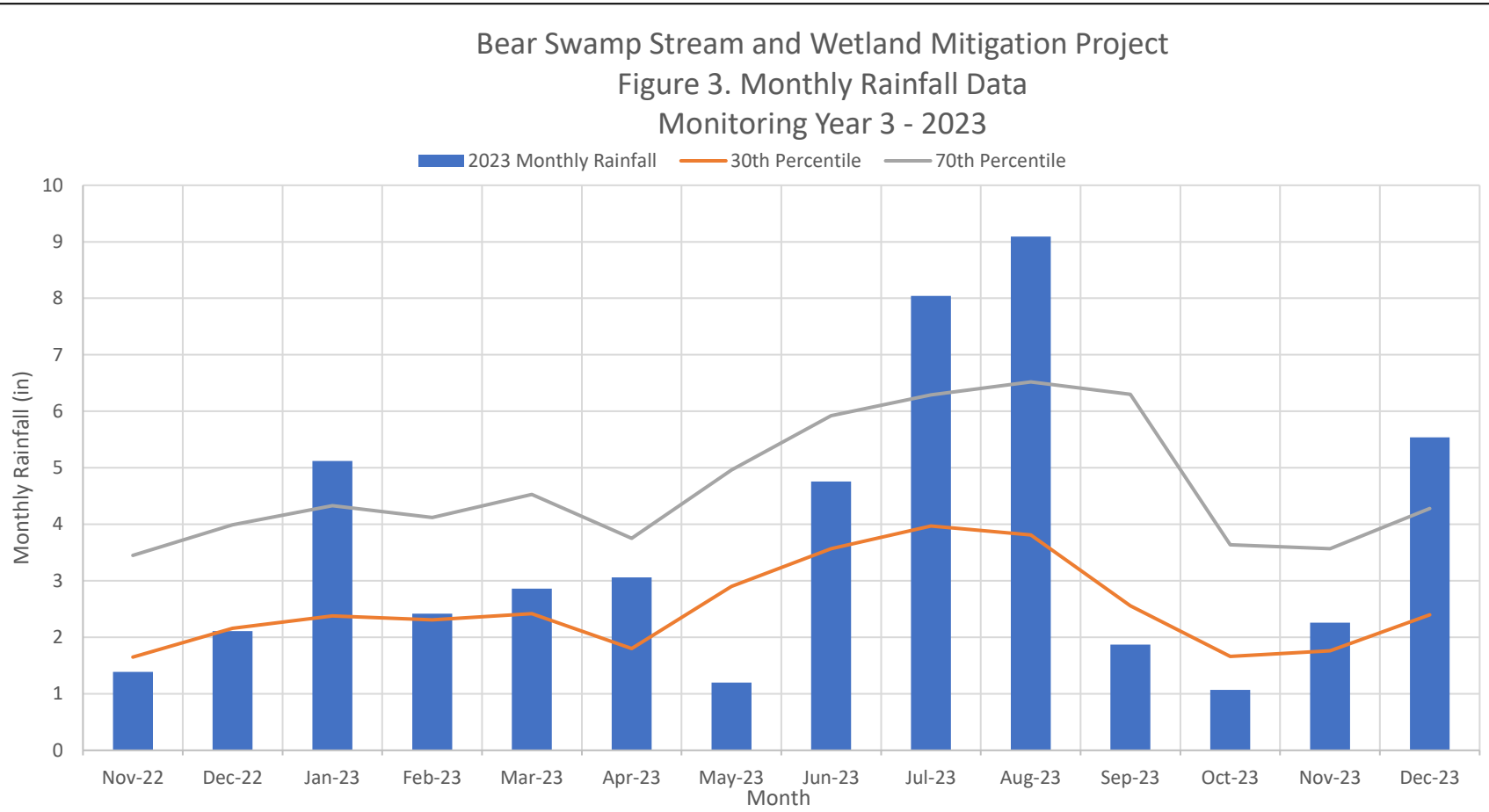
Table 8. Bear Swamp Wetland Gage Summary

Monitoring Gauge	Performance Standard: **12 %** WETS Station: **Lumberton, NC** Growing Season: **3/1 to 11/15 (258 days)**						
	Max. Consecutive Hydroperiod (%)						
	2021	**2022**	**2023**	**2024**	**2025**	**2026**	**2027**
BS-GW1 (reference)	23	24	30				
BS-GW2	7	7	20				
BS-GW3	15	7	25				
BS-GW4	3	5	10				
BS-GW7	8	7	17				
BS-GW8* (reference)	--	--	9				

* Installed in February 2023; however, gage did not record data between 2/23-4/13/2023 due to logger error

Table 9. Indicators of Headwater Channel Formation (UT to Bear Swamp)

Indicators	Year 1 (2021)	Year 2 (2022)	Year 3 (2023)	Year 4 (2024)	Year 5 (2025)	Year 6 (2026)	Year 7 (2027)
Years 1-7							
Multiple observed flow events (max consecutive days)	Yes (BS 5: 105; BS 6: 107)	Yes (BS 5: 108; BS6: 89)	Yes (BS5: 118; BS6: 108)				
Scour	No	No	No				
Sediment deposition	Yes	Yes	Yes				
Sediment sorting	Yes	Yes	No				
Destruction of terrestrial vegetation	No	No	No				
Presence of litter and other debris	No	Yes	Yes				
Wracking	No	Yes	No				
Vegetation matted down, bent, or absent	Yes	No	Yes				
Leaf litter disturbed or washed away	No	No	Yes				
Years 5-7 Only (OHWM Development)							
Bed and banks							
Natural line impressed on bank							
Shelving of sediment depositions							
Water staining of rooted vegetation							
Change in plant community							
Changes in character of soil (texture and/or chroma)							



Note: Percentiles calculated using historic rainfall data from WETS Station: Lumberton, NC, 1971-2022. Project rainfall data from HOBO Tipping Bucket Rain Gauge located on-site.

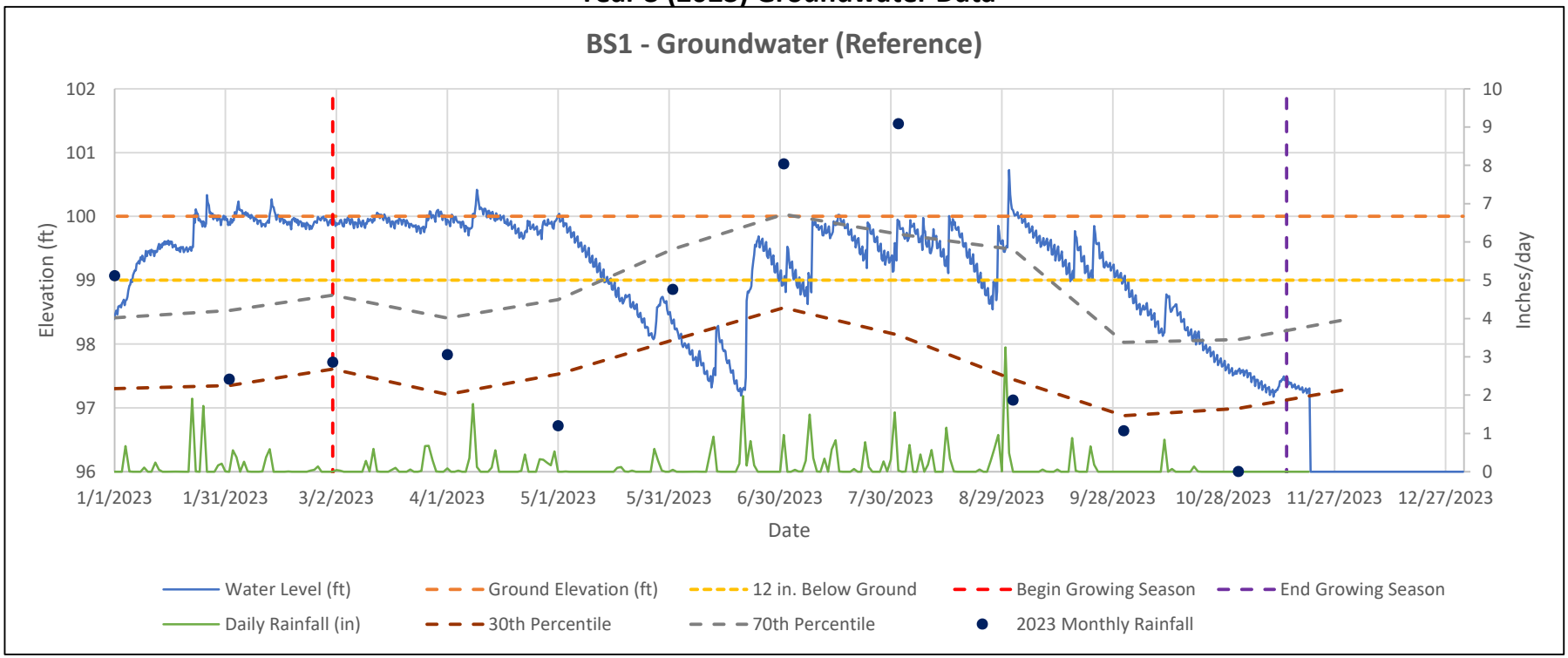
Rainfall Summary							
	2021*	**2022^**	**2023+**	**2024**	**2025**	**2026**	**2027**
Recorded Precip Total	28.26	36.20	47.29	-	-	-	-
WETS 30th Percentile	30.64	44.79	44.79	-	-	-	-
WETS 70th Percentile	56.69	52.96	52.96	-	-	-	-
Normal	N	N	Y	-	-	-	-

*Total recorded only includes March-December 2021. On-site rain gage not functional January and February 2021.

^ Gage stopped recording in December 2022, likely due to extreme cold. Total taken from WCON7 weather station (similar to December 2021 total).

+ Due to rain gage data collection error, total between 11/21/2023 and 12/31/2023 taken from WCON7 weather station.

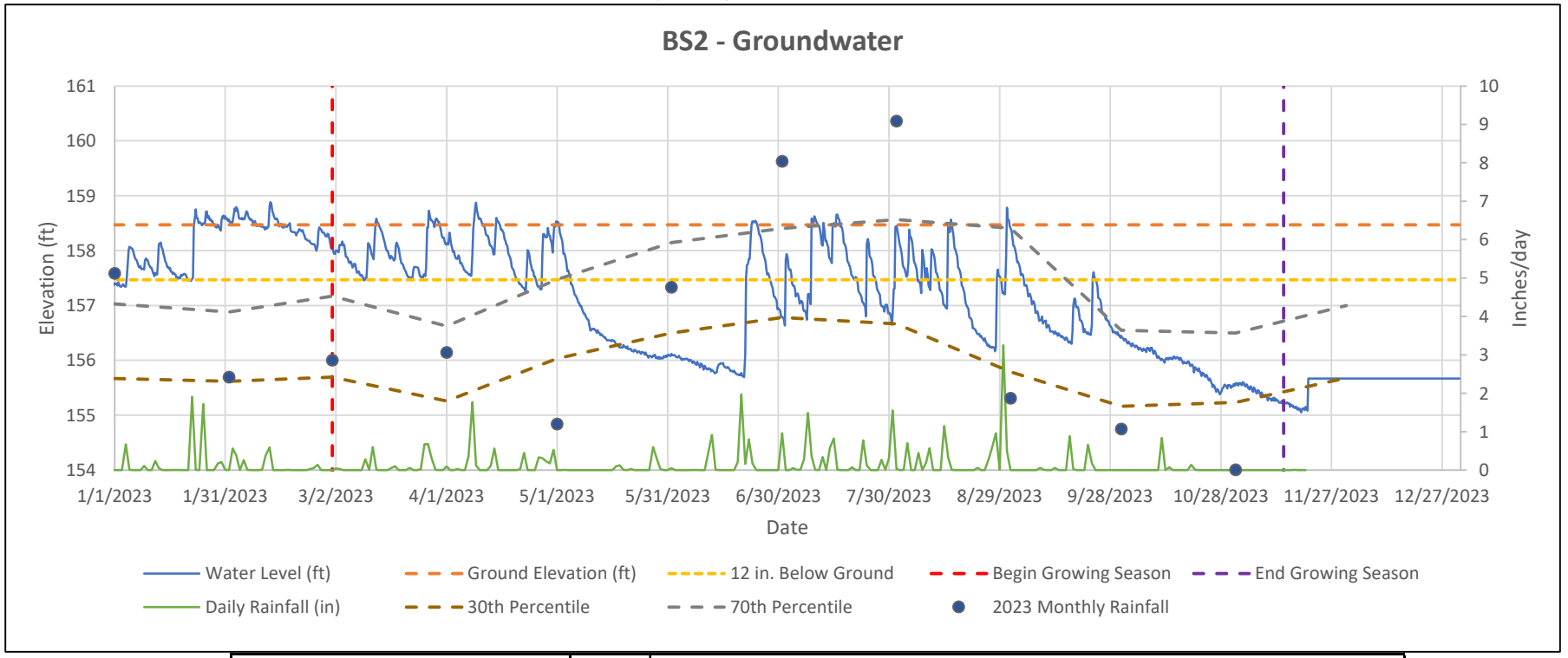
Bear Swamp
Year 3 (2023) Groundwater Data



Site Info (Year 3)	
Site	Bear Swamp
Begin Date	1/1/2023
End Date	12/31/2023
Total Days of Well Data	728

Growing Season Information (Year 3 - 2023)		
Site		Bear Swamp
Gauge ID		BS1 - Groundwater
Serial #		20452191
Growing Season Start Date		3/1/2023
Growing Season End Date		11/14/2023
Total Growing Season Days		258
NRCS Soil Series		Johnston
Success Criteria		
12.0%	Growing Season (Days)	31
Most Consecutive Successful Days Within Growing Season		76
Percent of Growing Season with Consecutive Successful Days		29.5%
Average Water Level Elevation During Growing Season (ft)		99.03
Total Cumulative Successful Days Within Growing Season		173

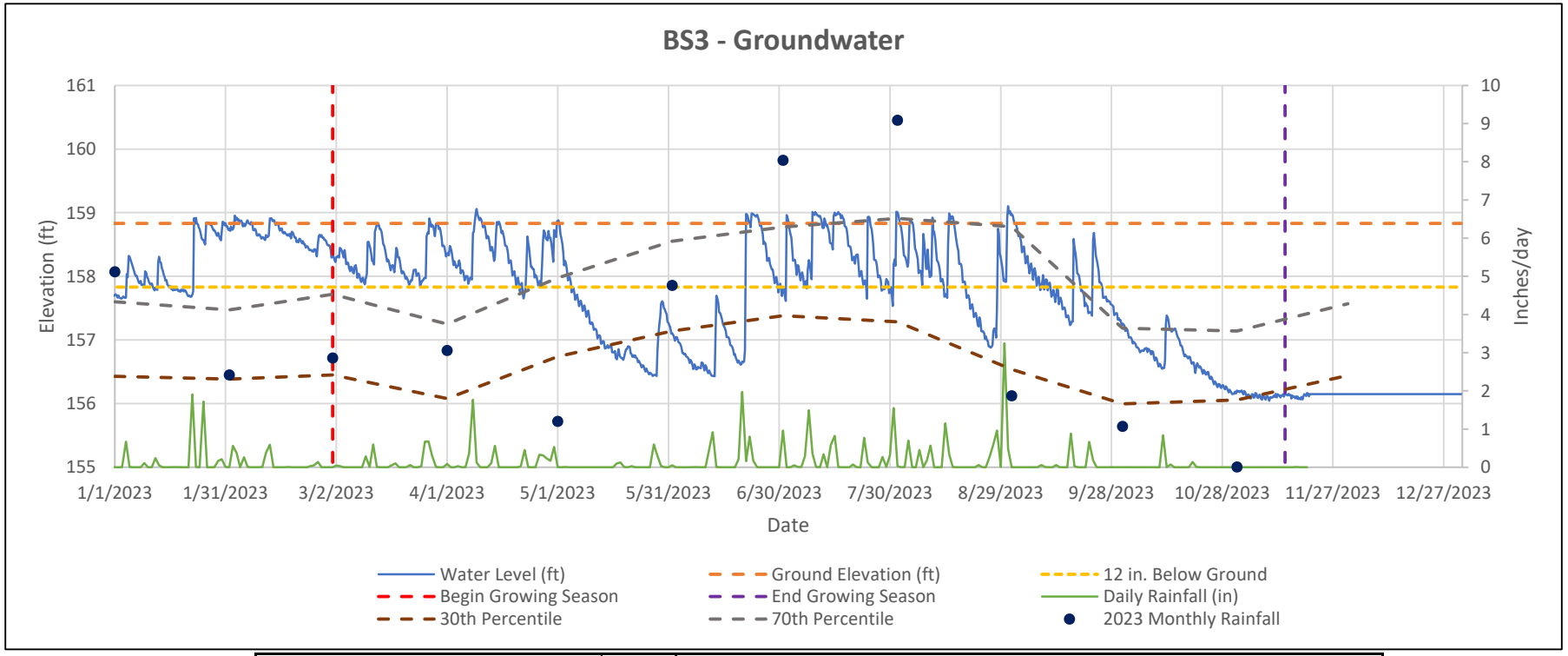
Bear Swamp
Year 3 (2023) Groundwater Data



Site Info (Year 3)	
Site	Bear Swamp
Begin Date	1/1/2023
End Date	12/31/2023
Total Days of Well Data	364

Growing Season Information (Year 3 - 2023)		
Site		Bear Swamp
Gauge ID		BS2 - Groundwater
Serial #		20452193
Growing Season Start Date		3/1/2023
Growing Season End Date		11/14/2023
Total Growing Season Days		258
NRCS Soil Series		Johnston
Success Criteria		
12.0%	Growing Season (Days)	31
Most Consecutive Successful Days Within Growing Season		51
Percent of Growing Season with Consecutive Successful Days		19.8%
Average Water Level Elevation During Growing Season (ft)		157.02
Total Cumulative Successful Days Within Growing Season		114

Bear Swamp
Year 3 (2023) Groundwater Data

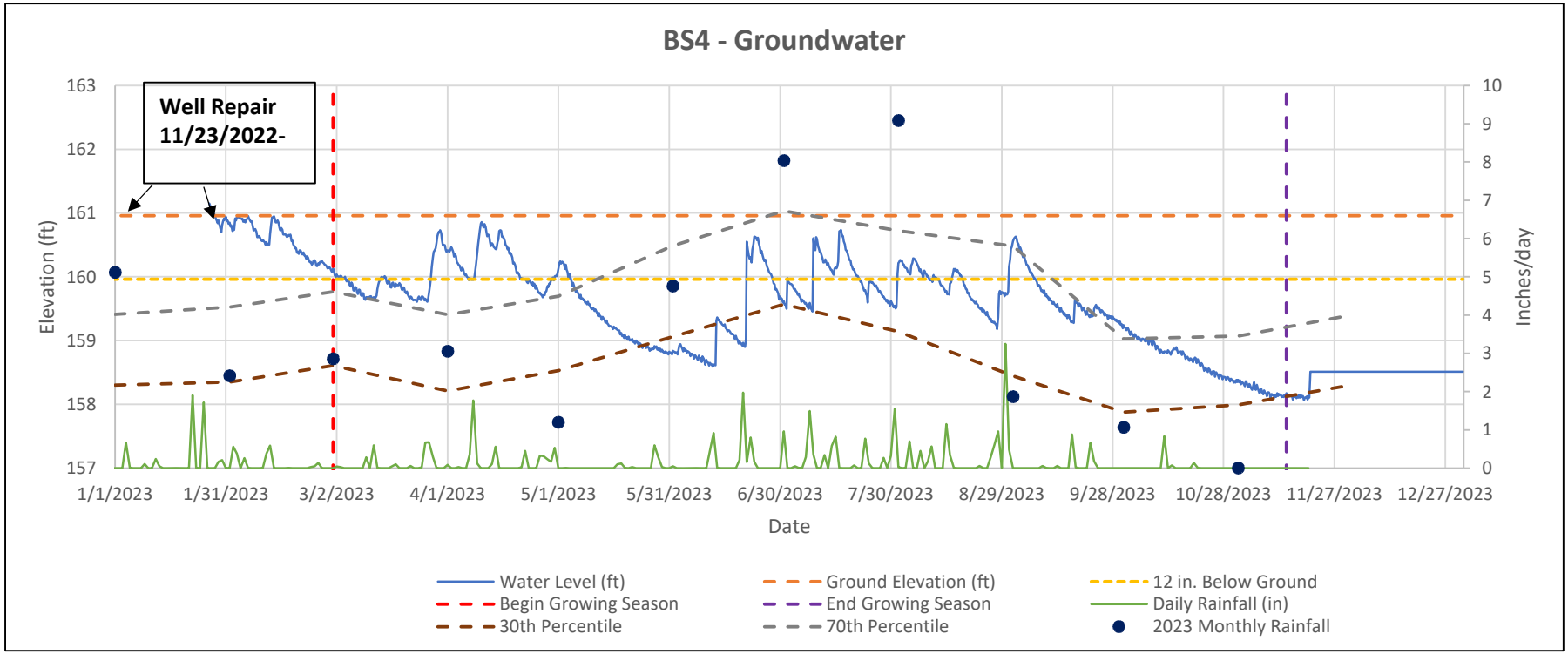


Site Info (Year 3)	
Site	Bear Swamp
Begin Date	1/1/2023
End Date	12/31/2023
Total Days of Well Data	121

-Rainfall data from HOBO Tipping Bucket Rain Gauge located at the Bear Swamp Stream and Wetland
-Percentile lines in reference to WETS historic monthly Rainfall data for Lumberton, NC

Growing Season Information (Year 3 - 2023)		
Site		Bear Swamp
Gauge ID		BS3 - Groundwater
Serial #		20452194
Growing Season Start Date		3/1/2023
Growing Season End Date		11/14/2023
Total Growing Season Days		258
NRCS Soil Series		Johnston
Success Criteria		
12.0%	Growing Season (Days)	31
Most Consecutive Successful Days Within Growing Season		65
Percent of Growing Season with Consecutive Successful Days		25.2%
Average Water Level Elevation During Growing Season (ft)		157.69
Total Cumulative Successful Days Within Growing Season		145

Bear Swamp
Year 3 (2023) Groundwater Data



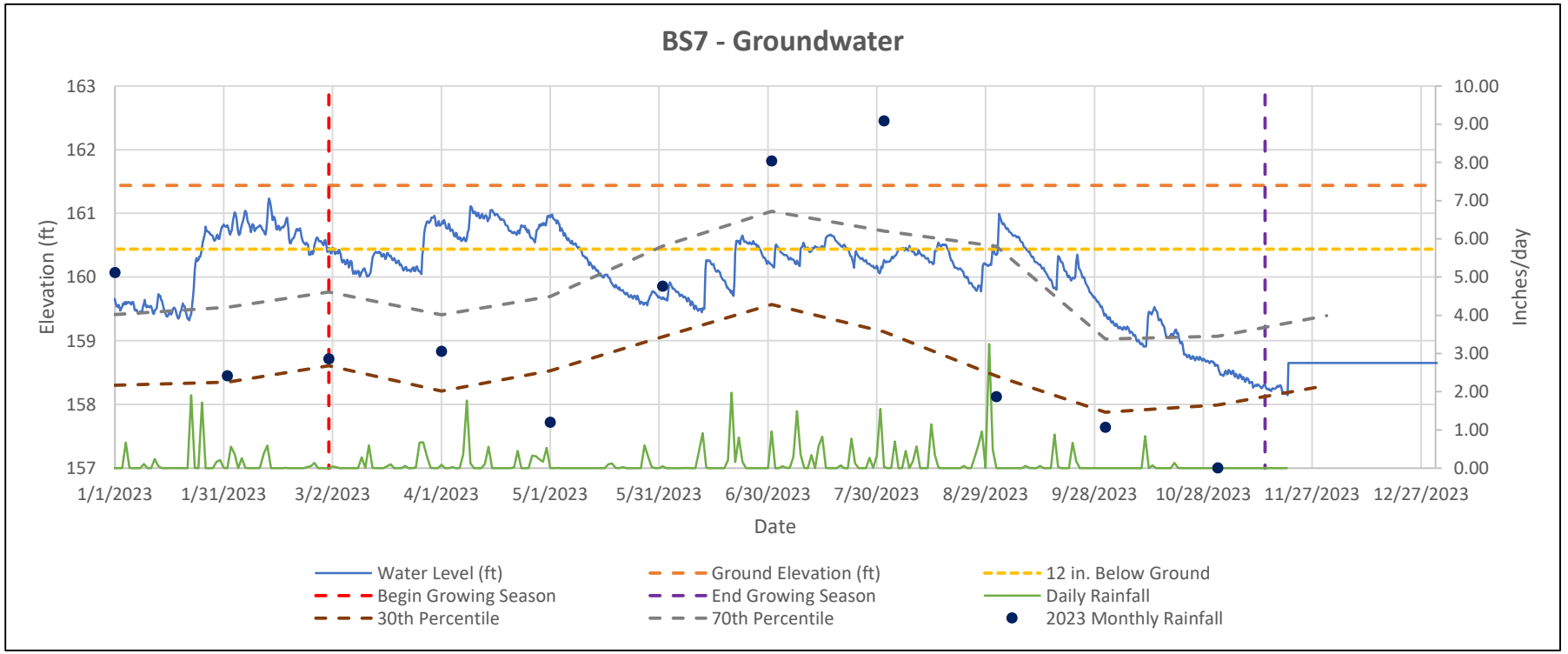
Site Info (Year 3)	
Site	Bear Swamp
Begin Date	1/1/2023
End Date	12/31/2023
Total Days of Well Data	728

-Rainfall data from HOBO Tipping Bucket Rain Gauge located at the Bear Swamp Stream and Wetland Mitigation Project

*Percentile lines in reference to WETS historic monthly rainfall data

Growing Season Information (Year 3 - 2023)		
Site		Bear Swamp
Gauge ID		BS4 - Groundwater
Serial #		20452199
Growing Season Start Date		3/1/2023
Growing Season End Date		11/14/2023
Total Growing Season Days		258
NRCS Soil Series		Bibb
Success Criteria		
12.0%	Growing Season (Days)	31
Most Consecutive Successful Days Within Growing Season		26
Percent of Growing Season with Consecutive Successful Days		10.1%
Average Water Level Elevation During Growing Season (ft)		159.54
Total Cumulative Successful Days Within Growing Season		86

Bear Swamp
Year 3 (2023) Groundwater Data

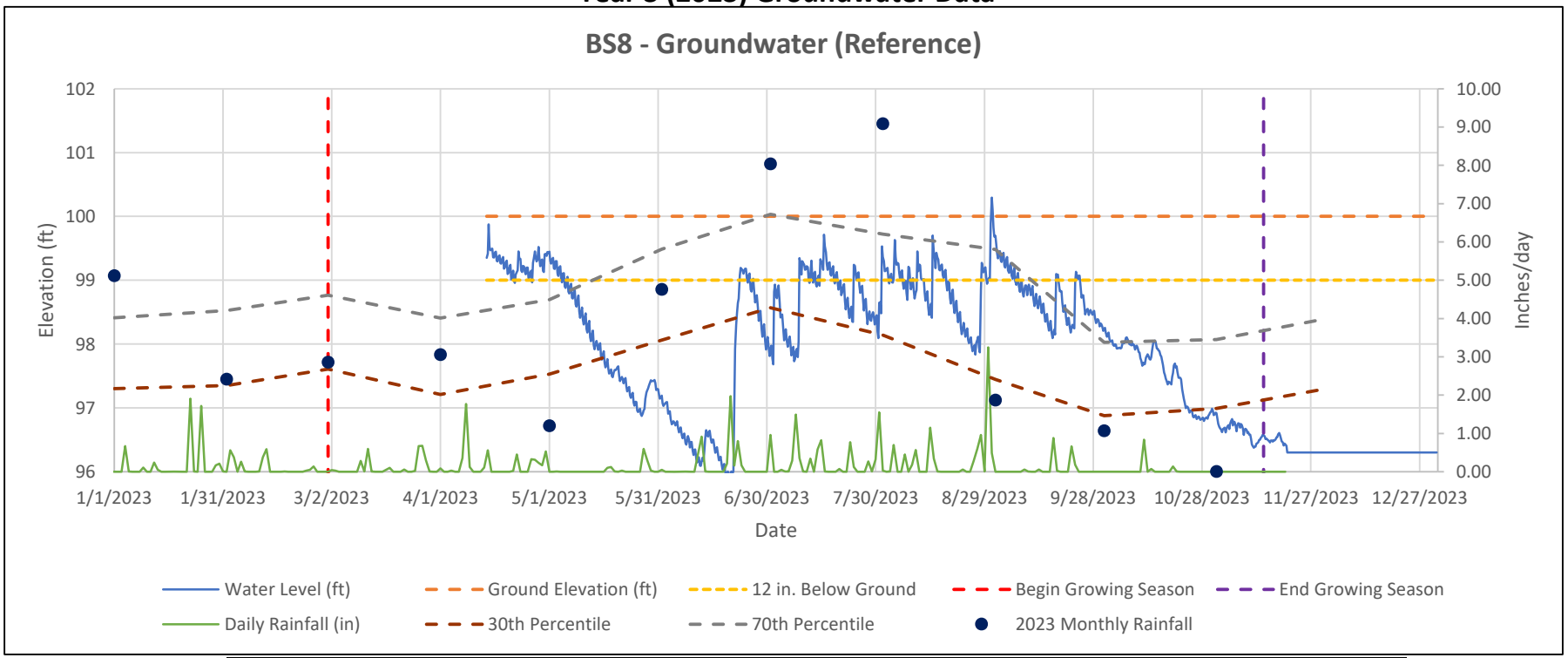


Site Info (Year 3)	
Site	Bear Swamp
Begin Date	1/1/2023
End Date	12/31/2023
Total Days of Well Data	364

-Rainfall data from HOBO Tipping Bucket Rain Gauge located at the Bear Swamp Stream and Wetland
-Percentile lines in reference to WETS historic monthly Rainfall data for Lumberton, NC

Growing Season Information (Year 3 - 2023)		
Site		Bear Swamp
Gauge ID		BS7 - Groundwater
Serial #		20859909
Growing Season Start Date		3/1/2023
Growing Season End Date		11/14/2023
Total Growing Season Days		258
NRCS Soil Series		Bibb
Success Criteria		
12.0%	Growing Season (Days)	31
Most Consecutive Successful Days Within Growing Season		44
Percent of Growing Season with Consecutive Successful Days		17.1%
Average Water Level Elevation During Growing Season (ft)		160.04
Total Cumulative Successful Days Within Growing Season		87

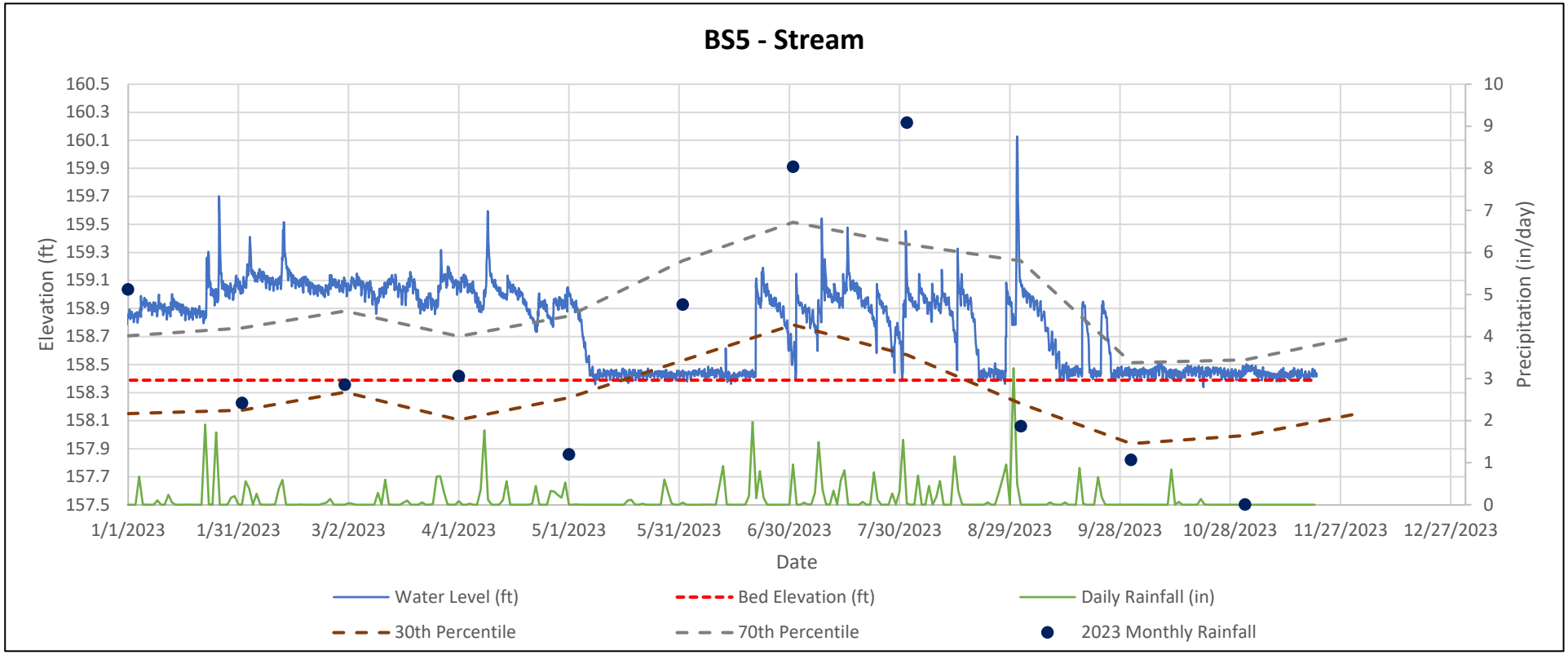
Bear Swamp
Year 3 (2023) Groundwater Data



Site Info (Year 3)	
Site	Bear Swamp
Begin Date	4/13/2023
End Date	12/31/2023
Total Days of Well Data	523

Growing Season Information (Year 3 - 2023)		
Site		Bear Swamp
Gauge ID		BS8 - Groundwater
Serial #		20331489
Growing Season Start Date		3/1/2023
Growing Season End Date		11/14/2023
Total Growing Season Days		258
NRCS Soil Series		Norfolk Loamy Sand
Success Criteria		
12.0%	Growing Season (Days)	31
Most Consecutive Successful Days Within Growing Season		22
Percent of Growing Season with Consecutive Successful Days		8.5%
Average Water Level Elevation During Growing Season (ft)		98.16
Total Cumulative Successful Days Within Growing Season		73

Bear Swamp
Year 3 (2023) Streamflow Data



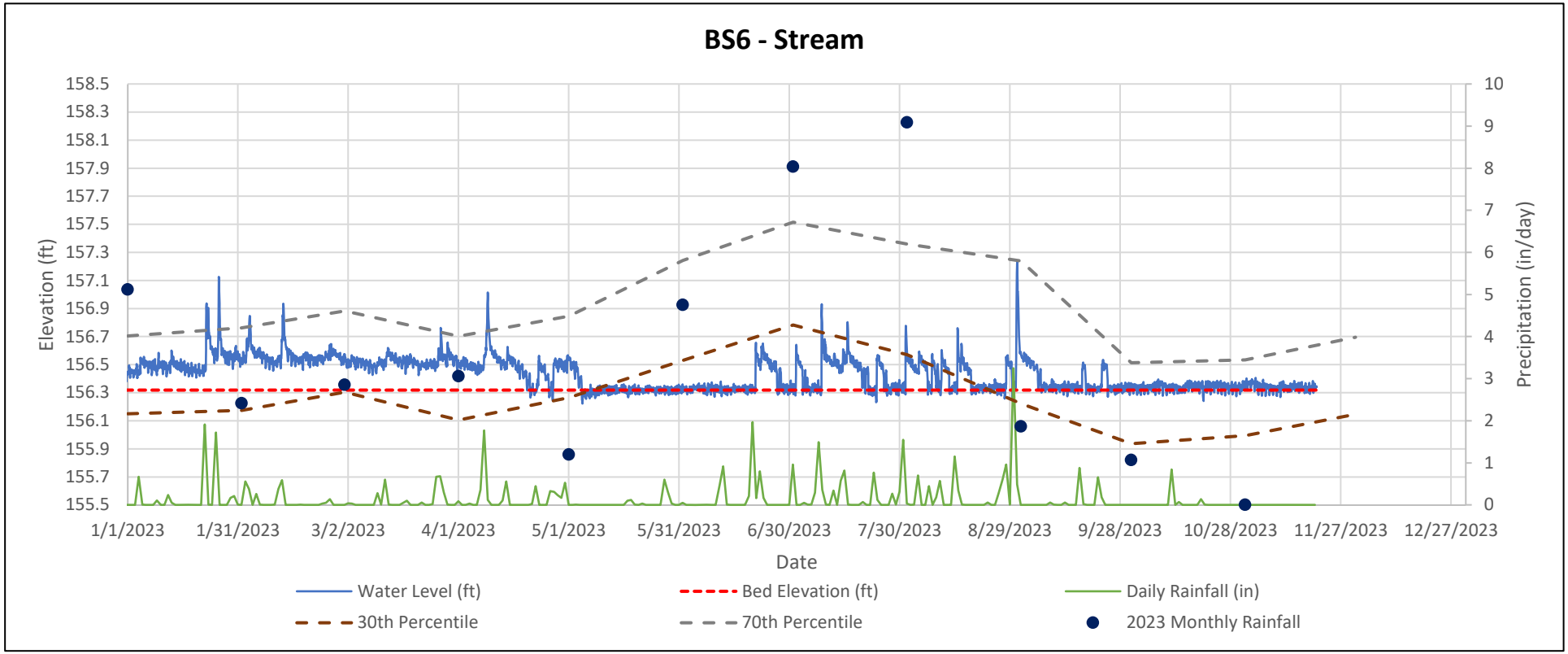
Site Info	
Stream	Bear Swamp
Reach	Bear Swamp
Date Installed	11/9/2020
Serial Number	20452196
Reach Type	Intermittent

-Rainfall data from HOBO Tipping Bucket Rain Gauge located at the Bear Swamp Stream and Wetland Mitigation Project

-Percentile lines in reference to WETS historic monthly rainfall data for Lumberton, NC

Year 3 (2023) Streamflow Data	
Gauge ID	BS5 - Stream
Start Date	1/1/2023
End Date	12/31/2023
Flow Criteria (Days)	30
Recordings Per Day	24
Logger Elevation (ft)	158.39
Controlling Grade Elevation (ft)	158.39
Bankfull Elevation (ft)	158.89
Most Consecutive Days of Flow	126
Total Days of Flow	218
Meets Success Criteria	Yes

Bear Swamp
Year 3 (2023) Streamflow Data



Site Info	
Stream	Bear Swamp
Reach	0
Date Installed	11/9/2020
Serial Number	20452197
Reach Type	Intermittent

-Rainfall data from HOBO Tipping Bucket Rain Gauge located at the Bear Swamp Stream and Wetland Mitigation Project.
-Percentile lines in reference to WETS historic monthly rainfall data for Lumberton, NC

Year 3 (2023) Streamflow Data	
Gauge ID	BS6 - Stream
Start Date	1/1/2023
End Date	12/31/2023
Flow Criteria (Days)	30
Recordings Per Day	24
Logger Elevation (ft)	156.32
Controlling Grade Elevation (ft)	156.32
Bankfull Elevation (ft)	156.82
Most Consecutive Days of Flow	108
Total Days of Flow	193
Meets Success Criteria	Yes

Appendix D

Project Timeline and Contact Information

Table 10. Project Activity and Reporting History

Table 11. Project Contacts Table

Table 10. Project Activity and Reporting History
Bear Swamp Stream and Wetland Mitigation Project (NCDMS Project No. 100054)

Elapsed Time Since grading complete:	**3 yrs 0 months**
Elapsed Time Since planting complete:	**2 yrs 8 months**
Number of reporting Years:	**3**

Activity or Deliverable	Data Collection Complete	Completion or Delivery
Institution Date	--	Jun-18
404 permit date	--	Apr-20
Final Mitigation Plan	2018 - 2019	Mar-20
Final Design – Construction Plans	--	Oct-20
Site Earthwork	October - November 2020	Nov-20
Bare-root plantings	--	Mar-21
As-built Survey	Nov-20	Nov-20
As-built Baseline Monitoring Report	Apr-21	Jul-21
Year 1 Monitoring	October - November 2021	Jan-22
Year 2 Monitoring	October - November 2022	Jan-23
Year 3 Monitoring	October - November 2023	Nov-23
Year 4 Monitoring	2024	Nov-24
Year 5 Monitoring	2025	Nov-25
Year 6 Monitoring	2026	Nov-26
Year 7 Monitoring	2027	Nov-27

Table 11. Project Activity and Reporting History
Bear Swamp Stream and Wetland Mitigation Project (NCDMS Project No. 100054)

Designer Primary project design POC	Ecosystem Planning and Restoration, PLLC 1150 SE Maynard Rd. Suite 140, Cary NC 27511 Kevin Tweedy
Construction Contractor Construction contractor POC	Land Mechanics Design, Inc. 126 Circle G Lane, Willow Spring, NC 27592 Charles Hill
Survey Contractor Survey contractor POC	Kinder Land Surveying 203 W. Lebanon St., Mount Airy, NC 27030 Frank Kinder (336) 783-4200
Planting Contractor Planting contractor POC	Bruton Natural Systems Post Office Box 1197, Fremont, NC 27830 Charlie Bruton
Invasive Species Contractor Contractor POC	Land Mechanics Design, Inc. 126 Circle G Lane, Willow Spring, NC 27592 Cole Glover
Seed Mix Source	
Nursery Stock Supplier	Dykes and Son Nursery McMinnville, TN 37110 931-668-8833
	Mellow Marsh Farm Siler City, NC 27344 919-742-1200
Monitoring Performers	Ecosystem Planning and Restoration, PLLC
Monitoring POC	Amy James, EPR (919) 623-5411

Appendix E

IRT Correspondence

Field Meeting Notes – IRT Credit Release Meeting July 2023

ECOSYSTEM PLANNING & RESTORATION

Ecosystem Planning and Restoration, LLC
1150 S.E. Maynard Road, Suite 140
Cary, North Carolina 27511
(919) 388-0787
www.EPRUSA.net

July 17, 2023

Ms. Emily Dunnigan
Division of Mitigation Services
217 West Jones St.
Raleigh, NC 27603

RE: Field Meeting Notes - IRT Credit Release Site Visit on 7/12/2023
Bear Swamp Full Delivery Site
DMS Project # 100054
USACE Action ID#: SAW-2018-01154
NC DWR #: 2018-0782
NC DEQ Contract #7516

Dear Ms. Dunnigan,

This letter is being provided as meeting minutes to a field meeting that occurred at the Bear Swamp Full Delivery Site (Site) on July 12, 2023. The Site is currently in MY3 (2023). The meeting was conducted to review the current Site conditions and compliance with approved performance standards with IRT members and to receive approval for the project's MY2 (2022) DMS credit release. The Site is located off Moss Neck Road in Robeson County and is proposed to provide 2,220.000 stream mitigation credits and 2.6 wetland mitigation credits within the Lumber River Basin 03040203.

Attendees:

Emily Dunnigan – NCDMS
Todd Tugwell – USACE
Erin Davis – USACE
Maria Polizzi – DWR
Mac Haupt -- DWR
Emmett Perdue – EPR
Amy James – EPR
Brittany Cunningham -- EPR

The meeting began at approximately 12:30 PM. There was a brief overview of the site's history, remedial actions performed to date, and a summary of wetland well hydroperiod performance for 2023 (through 6/2/2023). Remedial actions include treatment of a large area of Chinese privet in November 2022 and placement of additional t-posts along the field area boundary where mowing encroachments are occurring in June 2023. Most of the non-reference wetland wells have not met the target hydroperiod of 12% in MY1 or MY2 (except for BS-3 in MY1), which may have been largely due to drought conditions and timing of precipitation during the hotter months. So far in MY3 (from data collected through 6/2/2023), well data has shown that all but one of the non-reference wells **are** meeting the target 12% hydroperiod; the one not meeting target is BS-4 in the middle of Wetland B, which is currently at 10% hydroperiod. Due to the nature of the Site and precipitation patterns, it is unlikely that this well will meet the target goal for MY3.

The group first walked to the location of BS-4, in the middle of Wetland B. It was discussed whether the well measurements may need some adjustments due to the relatively large microtopographic variation constructed in the restored wetland areas. The IRT members were

open to this suggestion as long as the well data were still accurately representing on-site conditions. The IRT stated that it might be useful to place another well in the interior of Wetland B to provide more detail and paint a fuller hydrologic picture. An augured soil sample taken near the well location still showed hydric soils (sandy dark surface). As for vegetation, the IRT commented (here, and elsewhere) that the planted trees appeared to be thriving, but to monitor the emergence of young pine (and potentially sweetgum), as it can tend to crowd out planted vegetation on these types of sites.

The group then walked just below the ford crossing to see where the stream crediting starts; while there is no engineered channel, a pilot 'channel' had been cut in along the lowest point of the valley during construction and contained 2-3 inches of standing water (likely due to a storm the night before). Here, and at BS-5 (upper stream gage), the IRT were somewhat concerned that a 'pilot' channel may discourage meandering and the formation of a stream-wetland complex; however, as the performance standards for a headwater restoration still require the formation of an ordinary high-water mark to receive stream credit, it was unknown how to rectify this concern in the relatively short monitoring timeframe.

The group continued down the western easement boundary, where they observed the added t-posts to discourage further mowing encroachment. The farmer had mowed since the installation and the posts appeared to have done their job—this area will be planted in fall 2023. Though not visited, there is another encroachment issue along the southwestern easement boundary (at the end of Previa Dr.), where the adjacent landowner's tenant continues to mow into the easement to the existing tree line. DMS has spoken with the tenant in the past, and EPR has spoken with both the landowner and the tenant to try and resolve the situation. Currently, the situation is at an impasse and some sort of legal action may be necessary. EPR hopes to plant this area in the fall of 2023, depending on whether resolution can be reached.

The group continued downstream, crossing over the stream at the forested edge, to the mulched privet treatment area along the southeastern easement boundary. Privet has now been largely eradicated from the easement; spot treatments will continue through the monitoring period, as needed. Bare-root plantings will be installed in fall 2023; the IRT requests that vegetation transects be completed in MY4 in this area.

The group then walked back to the initial meeting location. The IRT agreed that MY2 (2022) credits could be released as proposed.

The meeting concluded at approximately 2:00 PM.