

Tar River Headwaters Wetland Restoration Site

Person County NC -- Tar-Pamlico River HUC# 03020101-0102

MY-4 (2020) Annual Fall Monitoring Report

NC-DEQ Division of Mitigation Services: DMS Project # 97071
DEQ Contract #6746 DWR # 2016-0233 ACE #SAW-2016-01101
Data Collected: Sep-Nov 2020 Draft Report: December 2020



Submitted To:
N.C. Department of Environmental Quality
DEQ Division of Mitigation Services
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DMS Project Manager: Lindsay Crocker
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Mitigation Project Name	Tar River Headwaters Wetland Restoration Site	USACE Action ID	N/A
DMS ID	97071	DWR Permit	N/A
River Basin	Tar-Pamlico	Date Project Instituted	2/8/2016
Cataloging Unit	03020101	Date Prepared	4/21/2020
County	Person	Stream/Wet. Service Area	Tar-Pamlico 03020101

Todd J. [Signature] 9/21/2020

Signature & Date of Official Approving Credit Release

- 1 - For NCDMS, no credits are released during the first milestone
- 2 - For NCDMS projects, the initial credit release milestone occurs automatically when the as-built report (baseline monitoring report) has been made available to the IRT by posting it to the DMS portal, provided the following have been met:
- 1) Approved of Final Mitigation Plan
 - 2) Recordation of the preservation mechanism, as well as a title opinion acceptable to the USACE covering the property.
 - 3) Completion of all physical and biological improvements to the mitigation site pursuant to the mitigation plan.
 - 4) Receipt of necessary DA permit authorization or written DA approval for projects where DA permit issuance is not required.
- 3 - A 10% reserve of credits is to be held back until the bankfull event performance standard has been met.

Credit Release Milestone	Riparian Credits						
	Scheduled Releases %	Proposed Releases %	Proposed Released #	Not Approved # Releases	Approved Credits	Anticipated Release	Actual Release
1 - Site Establishment	N/A	N/A	N/A	N/A	N/A	N/A	N/A
2 - Year 0 / As-Built	30.00%	30.00%	2.183	0.000	2.183	2017	4/26/2017
3 - Year 1 Monitoring	10.00%	10.00%	0.728	0.000	0.728	2018	4/25/2018
4 - Year 2 Monitoring	10.00%	10.00%	0.728	0.000	0.728	2019	4/26/2019
5 - Year 3 Monitoring	15.00%	15.00%	1.092	0.000	1.092	2020	4/21/2020
6 - Year 4 Monitoring	5.00%					2021	
7 - Year 5 Monitoring	15.00%					2022	
8 - Year 6 Monitoring	5.00%					2023	
9 - Year 7 Monitoring	10.00%					2024	
Stream Bankfull Standard	N/A	N/A	N/A	N/A	N/A	N/A	N/A
			Totals	0.000	4.731		

Total Gross Credits	7.277
Total Unrealized Credits to Date	0.000
Total Released Credits to Date	4.731
Total Percentage Released	65.01%
Remaining Unreleased Credits	2.546

Notes

Contingencies (if any)

Project Quantities

Mitigation Type	Restoration Type	Physical Quantity
Riparian	Restoration	7.650

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1.0. Project Background Summary

1.1. Project Location and Setting

The Tar River Headwaters Wetland Restoration Site (TRHWR) is a full-delivery wetland mitigation project located in eastern Person County, between Roxboro and Oxford, North Carolina, within the Piedmont Physiographic Province (Figure 1). The easement comprises 9.98 acres, most of which is drained and degraded wetlands or former wetlands with hydric soil indicators. The remaining areas include non-hydric soils, drainage ditches, and a 570-foot long riparian corridor along a ditch and intermittent stream connecting the TRHWR site to the adjacent Tar River Headwaters Riparian Buffer and Nutrient Offset Mitigation Bank project. Both projects are implemented by Mogensen Mitigation, Inc. (MMI), and are located on a 228-acre farm owned by Roy and Joyce Huff, in the Tar-Pamlico River Basin 12-digit HUC # 03020101-0102. The Huff Farm property is located at 333 Bunnie Huff Road, Oxford NC 27565. The access road into the TRHWR site is at Latitude = 36.3913, Longitude = -78.8171.

1.2. Pre-Restoration Conditions

The TRHWR site was cleared and ditched for pasture use in the 1940s according to the owner, and was used for grazing cattle until January 2017 when the conservation easement fence was installed. The project involves plugging drainage ditches to restore wetland hydrology, fencing to exclude livestock, and planting native trees and shrubs to restore a Headwater Forest wetland ecosystem similar to what occurred prior to site clearing and drainage. Remnant native trees left for shade, hydrophytic groundcover plants mixed among the pasture grasses, and plant species recorded in adjacent natural forests (on the same soil mapping unit) provided data for the planting plan.

The project will restore approximately 7.65 acres of headwater riparian wetland (6.53 acres reestablishment plus 1.12 acres rehabilitation) and will generate an estimated 7.28 or more riparian wetland mitigation credits. Approximately 1.27 acres with non-hydric soils in the southeast corner of the mitigation site will also be reforested, and a 100-foot wide by 570-ft long riparian corridor (1.06 acre) extending southeastward along the ditch will connect the TRHWR site to MMI's adjacent stream restoration and nutrient buffer bank project to the south. Total acreage of the wetland mitigation site and riparian connector is 9.98 acres.

Restoration activities including tree planting, surface flow dispersal, and cattle exclusion will reduce soil erosion and nutrient-enriched runoff from adjacent pasture and cropland within its watershed, and help retain agricultural chemicals used on these lands. It is expected to improve water quality and habitat in the receiving tributary and reduce fine sediment loading which will enhance the overall watershed particularly in the adjacent stream and nutrient mitigation bank.

1.3. Mitigation Goals and Performance Criteria

The subject watershed HUC #03020101-0102 is designated by NCDEQ as a Targeted Local Watershed (TLW) for water quality improvement projects, and the Tar River reach within and downstream of this local HUC is recognized as a Significant Natural Heritage Area (SNHA) for its high diversity of aquatic life including protected species of river mussels and fishes. The TRHWR project is intended to support

these TLW and SNHA designations by improving water quality and habitat on the property and downstream. Specific project goals and objectives as identified in the TRHWR Final Mitigation Plan (December 2016) include:

GOALS:

- Restore the natural jurisdictional wetland hydro-period to five or more acres of forested wetland within a nine-acre site;
- Restore forested wetland habitat and improve habitat connectivity between Denny Store Gabbro Forest (NHP Natural Heritage Area) to the north and the Tar River tributaries;
- Buffer storm water runoff from fecal and other cattle-related pollutants and fertilizer.

OBJECTIVES:

- Plug existing ditches and create sheet flows throughout the site. Aerate soils to reduce compaction, improve infiltration, and create micro-topography to retain surface flows;
- Preserve the remnant mature Swamp White Oaks (a regionally rare species) for seed source. Plant appropriate native hardwood trees at a sufficient frequency to establish a diverse bottomland wetland forest. Treat and/or remove invasive species which may cause problems for site restoration, including Chinese privet and multi-flora rose;
- Install fencing to exclude cattle and establish a conservation easement to provide permanent protection on the site.

PERFORMANCE STANDARDS and MONITORING:

GOAL	OBJECTIVE	PERFORMANCE STANDARD	MONITORING APPROACH
Restore natural hydro-period for headwater forest wetland.	Plug existing ditches and create sheet flow throughout the site. Aerate soils to reduce compaction, improve infiltration, and create micro-topography to retain surface flows.	Water must be on or within 12 inches of the surface for 10% of the growing season. Hydrographs will indicate jurisdictional hydrology.	Use 11 shallow groundwater self-reading gauges throughout the site at a frequency of about one per acre. Visual inspection of ponding duration.
Restore forested wetland habitat and improve habitat connectivity with existing forests.	Preserve mature swamp white oak trees for seed source. Plant appropriate native hardwood trees at 10-ft average spacing (435 stems/ac) Treat invasive species.	Survival of 320 stems per acre at year 3, 260 stems per acre at year 5 and 210 stems per acre at MY 7.	Monitor vegetation plots annually and calculate densities of surviving planted & volunteer stems.
Buffer storm water runoff from fecal and other cattle-related nutrient inputs.	Plant trees, fence perimeter and establish a permanent conservation easement.	Insure the integrity of the cattle exclusion fencing for the life of the contract.	Visual inspection will note fence condition through site pictures. Observations will be included in annual monitoring reports.

1.4. Mitigation Approach

Prior to restoration, the TRHWR project area contained 6.53 acres of former riparian wetland (ditched and drained, grazed pasture) with redoximorphic soil characteristics indicating hydric soils, but lacking adequate wetland hydrology based on groundwater gauge data and field observations during 2015-2016. Although the drainage ditches are shallow, they have effectively reduced water retention across much of the site over the past 70 years due to the slow infiltration rate, rapid runoff, and shallow hardpan in these soils. The project will re-establish jurisdictional wetlands in this area by plugging the drainage ditches to increase rainfall retention and dispersal, fencing out livestock, controlling invasive species, and planting suitable native tree species. These 6.53 acres of wetland restoration will generate riparian wetland credits at 1:1 ratio, yielding 6.53 WMU.

Another 1.12 acres in the TRHWR project area has been less effectively drained by the ditches, and still has sufficient hydrology to meet jurisdictional wetland criteria, based on groundwater gauge data and field observations during 2015-2016. The project will rehabilitate these areas of degraded jurisdictional wetland (grazed pasture with reduced hydrology) by plugging ditches to increase hydrology, fencing out livestock, and planting suitable native tree species. These 1.12 acres of wetland rehabilitation will generate riparian wetland credits at 1.5:1 ratio, yielding 0.75 WMU. TRHWR project components and mitigations assets are summarized in Table 1, matching the proposed assets in the Mitigation Plan.

2.0. Monitoring Methods

Vegetation plots are monitored annually in accordance with current DMS monitoring guidance (June 2017). The nine installed CVS vegetation plots, each 10 x 10 meters, represents 2.8 percent of the planted mitigation area. Vegetation monitoring will occur between September and early November, prior to the loss of leaves. The vegetation success criteria are specified in the Performance Standards above. If success criteria are not met, site maintenance and monitoring will continue until the success criteria are met.

The twelve onsite groundwater monitoring gauges (RDS and Hobo) and one offsite reference wetland gauge are downloaded and maintained at least quarterly. Gauge data in the mitigation credit areas are plotted and evaluated for success based on the mitigation plan performance standard of continuous saturation within 12 inches of the ground surface for 10 percent of the growing season. Growing season based on air temperature at a weather station east of Roxboro is from March 28 to November 3, which is 221 days (from USDA WETS table). MMI installed a Hobo dual-probe soil temperature logger near the middle of the TRHWR site (beside GW-H) in late January 2017. Soil temperature on the site remained above 41 F at both 10-inch and 20-inch depths throughout February and March 2017. The lowest temperatures recorded were 42.7 F at 10 inches and 45.4 F at 20 inches. Based on soil temperatures remaining above the USDA-designated temperature for plant physiological activity, March 1 is used as the start of the growing season, based on field discussions with DMS and USACE. The revised growing season length is thus 248 days, and the groundwater hydrology success criterion is 25 days. Subsequent data from 2018 to 2020 confirm that soil temperature has remained above 42 F after the end of February each year. These data along with late-February bud swelling on *Acer*, *Betula*, and *Salix*, plus new growth of groundcover plants (*Lamium*, *Cardamine*, *Lactuca*, *Allium*, *Bromus*, *Alopecurus*, *Ranunculus*, *Senecio*, *Geranium*, *Plantago*, *Viola*, and *Persicaria*) support the use of March 1 as the growing season start date.

The conservation easement perimeter fence and ditch plug integrity will be monitored visually and documented with photo points.

3.0. Current Conditions Summary

Groundwater gauge data for 2020 were collected from January 1 through November 5; CVS vegetation plot data and photos were collected in late September and early October. MMI scientists made several visits to the TRHWR site between February and November 2020 to collect gauge data and evaluate the condition of the ditches, ditch plugs, and planted and volunteer trees. Eight of the nine CVS plots had 7 or more surviving planted trees and exceeded the 260 stems per acre success criteria based on planted stems alone (Tables 6 and 7). Plot VP-24 had five surviving planted stems plus five volunteer stems of planted species, and met the 260 stems per acre based on planted plus volunteer stems. Outside of the CVS plots, planted stem survival looks generally good throughout the site, with an estimated 10 to 20 percent apparent mortality. Leader die-back is common on many of the taller seedlings, especially on tulip poplar and river birch, but many of the trees exhibiting leader die-back also had vigorous basal sprouts. There are scattered small areas with tree densities less than 260 stems per acre, but only one area exceeding the “problem area” size threshold, mapped as a “low stem density” area in Figure 2 and Table 5. No “invasive exotic” problem areas were identified this year. Groundcover vegetation is excellent throughout, with both treated areas (non-wetland and drained wetland) and non-treated areas (existing wetland) showing dense and diverse herbaceous cover. Small unflagged trees outside of the CVS plots remain difficult to see in summer and fall due to the dense groundcover.

All ditch plugs appear to be stable and performing as designed. Survival of planted trees, live-stakes, and herbaceous cover on the plug slopes and tops appears to be providing good protection; no erosion on the plugs was observed. Most of the ditches are now obscured by vegetation. Ponding behind each ditch plug was evident during spring and early summer, but was intermittently absent during late summer and fall.

Twelve groundwater gauges (A through L) on the project site are roughly arranged in four transects perpendicular to the main ditch, as recommended by mitigation plan reviewers during field meetings (Figure 2). Three gauges (A, H and J) are within existing wetland rehabilitation areas, seven gauges (D, E, F, G, I, L, and K) are within the drained wetland reestablishment areas, and two gauges (B and C) are downslope from ditch plug #4 in areas not expected to generate wetland credits. Wetland hydrology success for the TRHWR site is based on saturation within 12 inches of the ground surface for 10% of the 248-day growing season (March 1 to November 3). The gauges measure the free water table depth and do not account for capillary fringe saturation which can extend above the free water table in fine-textured soils (<https://vernonjames.ces.ncsu.edu/eleventh-annual-on-site/soil-wetness/>). Manual water table measurements were also collected at each well one or more times during the year, and depth data were adjusted accordingly to fit the actual measurements.

Rainfall in 2020, relative to the 30-year normal values (30th to 70th percentiles), was normal to high during all months except March and July, which were below the 30th percentiles (Figure 5). All 13 gauges (ten in the mitigation credit area, two outside the credit area, and one off-site reference gauge) exceeded the minimum of 25 consecutive days for hydrologic success during the early part of the growing season, with consecutive day saturation periods ranging from 36 to 78 days (Table 8). In the gauge with the shortest hydroperiod (gauge K = 36 days) the water table dipped below 12 inches for two days, then rose and

remained above 12 inches for another 31 days. The duration of these two periods combined are similar to the other wells.

Soil temperature data for 2020 support the accepted growing season start date of March 1. The lowest recorded soil temperature at 10 inches deep was 40.2 F on January 24. From March 1 forward the soil temperature remained above 41 F; the lowest temperature on or after March 1 was 42.3 F.

4.0. References

Lee, Michael T., Peet, Robert K., Roberts, Steven D., Wentworth, Thomas R. (2008). *CVS-EEP Protocol for Recording Vegetation version 4.2, October 2008*. Retrieved September 2011, from: <http://cvs.bio.unc.edu/methods.htm>

LeGrand, Harry E. Jr. (2007) Natural Areas Inventory of Person County, NC. NC Natural Heritage Program, Raleigh NC.

NC Division of Mitigation Services. (2017). *NC-DMS Annual Monitoring Report Format, Data Requirements, and Content Guidance, June 2017*. <http://portal.ncdenr.org/web/eep/dbb-resources>

Schafale, M.P., Weakley, A.S. 1990. Classification of the Natural Communities of North Carolina, Third Approximation. NC Natural Heritage Program, Raleigh, NC.

Sink, Larry T. (1995). *Soil Survey of Person County, North Carolina*. USDA Soil Conservation Service (Natural Resources Conservation Service), Raleigh, NC.

United States Department of Agriculture, Natural Resources Conservation Service, 2016. Web Soil Survey. Available: <http://websoilsurvey.nrcs.usda.gov/app/>

APPENDIX A. Project Background Data

Figure 1. Project Vicinity Map

Table 1. Project Components and Mitigation Credits

Table 2. Project Activity and Reporting History

Table 3. Project Contacts Table

Table 4. Project Attributes



Figure 1. Project Vicinity Map: Tar River Headwaters Wetland Restoration Site and related mitigation projects on the Huff Farm property, Person County NC, Tar-Pamlico River HUC# 03020101-0102. DIRECTIONS: From US-158 in Berea, Granville County NC, turn right (northwest) on Old Roxboro Rd, which becomes Denny Store Rd where it crosses into Person County. Turn right (north) on Bunnie Huff Rd, go 0.4 mile, and turn left into the driveway just past the Huff Homeplace sign. Proceed through the gate at end of driveway to the project sites.

Table 1. Project Components and Mitigation Credits								
Tar River Headwaters Wetland Restoration Site, DMS Project # 97071								
Mitigation Credits								
	Stream		Riparian Wetland		Non-riparian Wetland		Buffer	Nitrogen Nutrient Offset
Type	R	RE	R	RE	R	RE		
Acres			7.650					
Credits			7.270					
TOTAL CREDITS			7.277					
Project Components								
Project Component or Reach ID	Stationing/ Location		Existing Footage or Acreage	Approach (PI, PII etc.)	Restoration or Restoration Equivalent	Restoration Footage or Acreage		
Drained Wetland	--		6.530	Restore Hydrology, Fence & Plant	R (Reestablish)	6.530 ac		
Grazed Wetland	--		1.120	Fence & Plant	R (Rehabilitate)	1.120 ac		
Component Summation								
Restoration Level	Stream (lin. feet)	Riparian Wetland (acres)		Non-Riparian Wetland (acres)	Buffer (sq. feet)	Upland (acres)		
		Riverine	Non-Riverine					
Re-establishment (1: 1.0)			6.530 ac					
Rehabilitation (1: 1.5)			1.120 ac					
Enhancement I								
Enhancement II								
Creation								
Preservation								
High Quality Preservation								
TOTAL feet or acres	-	-	7.650 ac					
TOTAL WMU	-	-	7.277					

Table 2. Project Activity & Reporting History		
Tar River Headwaters Wetland Restoration Site, DMS Project# 97071		
Activity or Report	Data Collection Complete	Actual Completion or Delivery
Mitigation Plan		Dec 2016
Final Construction Plans		Dec 2016
Construction		Jan 2017
Planting		Feb 2017
Baseline Monitoring/Report	Feb 2017	Apr 2017
Year 1 Monitoring	Nov 2017	Dec 2017
Year 2 Monitoring	Nov 2018	Dec 2018
Year 3 Monitoring	Nov 2019	Jan 2020
Year 4 Monitoring	Nov 2020	Dec 2020
Year 5 Monitoring		

Table 3. Project Contacts Table	
Tar River Headwaters Wetland Restoration Site, DMS Project # 97071	
Designer	Ecological Engineering, Raleigh NC Heather Smith: 919-557-0929
Construction Contractor	KBS Earthworks, Greensboro NC Kory Strader & Brett Strader: 336-685-4339
Survey Contractor	Michael T. Brandon, PLS, Roxboro NC Michael Brandon: 336-597-8673
Fence Contractor	Strader Fencing, Inc., Julian NC Kenneth Strader: 336-314-2935
Herbicide and Seeding	KBS Earthworks, Greensboro NC Kory Strader & Brett Strader: 336-685-4339
Planting Contractor	Mogensen Mitigation Inc, Charlotte NC Rich Mogensen: 704-576-1111; Gerald Pottern: 919-556-8845
Nursery Stock Suppliers	Mellowmarsh Farms, Siler City NC Joanie McLean: 919-742-1200
Monitoring Performers	Mogensen Mitigation Inc, Charlotte NC Rich Mogensen: 704-576-1111; Gerald Pottern: 919-556-8845

Table 4. Project Attributes			
Tar River Headwaters Wetland Restoration Site, DMS Project # 97071			
Project Name	Tar River Headwaters Wetland Restoration Site		
County	Person County		
Project Area (acres)	9.9 acres (Wetland + Buffer Easement combined)		
Project Coordinates (lat. and long.)	36.3895, -78.8153		
Project Watershed Summary Information			
Physiographic Province	Piedmont, Carolina Slate Belt		
River Basin	Tar-Pamlico River-01		
USGS Hydrologic Unit 8-digit	3020101	USGS Hydrologic Unit 12-digit	-0102
DWQ Sub-basin	Tar-Pam-01		
Project Drainage Area (acres)	60		
Project Drainage Area Percentage of Impervious Area	0%		
CGIA Land Use Classification	Pasture, Crop, and Deciduous Forest		
Wetland Summary Information (Post-Restoration)			
Parameters	Wetland Area		
Size of Wetland (acres)	1.12 ac existing + 6.53 ac drained = 7.65 ac		
Wetland Type (non-riparian, riparian riverine or riparian non-riverine)	Riparian non-riverine (Headwater)		
Mapped Soil Series	Iredell Loam (IrB)		
Drainage class	Iredell = moderately well; Hydric inclusions = poorly		
Soil Hydric Status	Drained Hydric		
Source of Hydrology	Shallow ponding; perched on shallow aquitard		
Hydrologic Impairment	Drainage ditches (1940s)		
Native vegetation community	Headwater depression wetland forest (prior to pasture conversion)		
Percent composition exotic invasive vegetation	20% Fescue (sprayed)		
Regulatory Considerations			
Regulation	Applicable?	Resolved?	Supporting Documentation
Waters of the United States – Section 404	Yes	Yes	Prelim JD
Waters of the United States – Section 401	Yes	Yes	Prelim JD
Endangered Species Act	No	N/A	US FWS Letter
Historic Preservation Act	No	N/A	NC SHPO Letter
Coastal Zone Management Act (CZMA)	No	N/A	N/A
Coastal Area Management Act (CAMA)	No	N/A	N/A
FEMA Floodplain Compliance	No	N/A	NC Floodmaps Data
Essential Fisheries Habitat	No	N/A	N/A

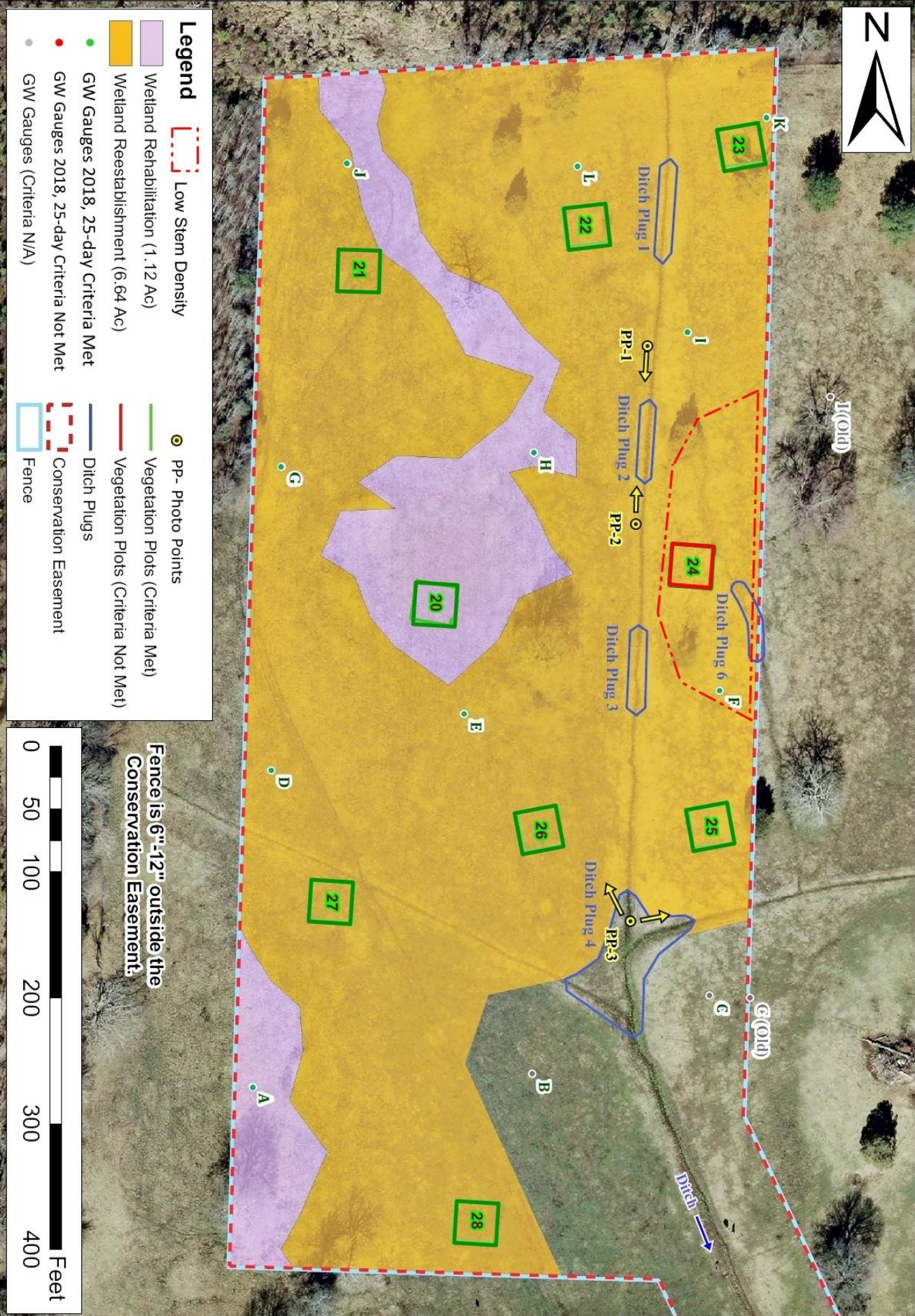
APPENDIX B. Visual Assessment Data

Figure 2. Current Conditions Plan View

Table 5. Vegetation Conditions Assessment

Figure 3. Vegetation Plot Photos

Figure 4. Photo Point Photos



Legend

- Low Stem Density
- Wetland Rehabilitation (1.12 Ac)
- Wetland Reestablishment (6.64 Ac)
- GW Gauges 2018, 25-day Criteria Met
- GW Gauges 2018, 25-day Criteria Not Met
- GW Gauges (Criteria N/A)
- PP- Photo Points
- Vegetation Plots (Criteria Met)
- Vegetation Plots (Criteria Not Met)
- Ditch Plugs
- Conservation Easement
- Fence

Fence is 6"-12" outside the Conservation Easement.

0 50 100 200 300 400 Feet

CURRENT CONDITIONS PLAN VIEW MY4 (2020)
 TAR RIVER HEADWATERS WETLAND RESTORATION SITE
 DMS PROJECT #97071

PERSON COUNTY
 NORTH CAROLINA



Mogensen Mitigation, Inc.
 P. O. Box 690429
 Charlotte, NC 28227
 (704) 576-1111



FIGURE 2

Table 5: Vegetation Condition Assessment Table -- MY-4 (2020)						
Tar River Headwaters Wetland Restoration #97071. Person County HUC #03020101-0102						
Planted Acreage =		7.65				
Vegetation Problem Category	Definitions	Mapping Threshold (acres)	CCPV Depiction	Number of Polygons	Combined Acreage	% of Planted Acreage
Bare Areas	Very limited cover of both woody and herbaceous material	0.10	N/A	0	0	0%
Low Stem Density Areas	Woody stem densities clearly below target levels based on MY3, 4, or 5 stem count criteria.	0.10	N/A	1	0.38	5%
Total				0		5%
Areas of Poor Growth Rates or Vigor *	Areas with woody stems of a size class that are obviously small given the monitoring year.	0.25	N/A	0	0	0%
Cumulative Total				0	0	0%
Easement Acreage =		9.98				
Vegetation Problem Category	Definitions	Mapping Threshold (SF)	CCPV Depiction	Number of Polygons	Combined Acreage	% of Easement Acreage
Invasive Areas of Concern	Areas or points (if too small to render as polygons at map scale).	1000	N/A	0	0	0%
Easement Encroachment Areas	Areas or points (if too small to render as polygons at map scale).	none	N/A	0	0	0%

Figure 3. Vegetation Plots: Tar River Headwaters Wetland Restoration Site #97071 MY-4 (Oct 2020)



Veg Plot 20: 23 Feb 2017

CVS VegPlot-20: MY-0 Spring 2017



28 Sept 2020 -- VP-20

CVS VegPlot-20: MY-4 Sep-Oct 2020



Veg Plot 21: 23 Feb 2017

CVS VegPlot-21: MY-0 Spring 2017



04 OCT 2020 -- VP21

CVS VegPlot-21: MY-4 Sep-Oct 2020

Figure 3. Vegetation Plots: Tar River Headwaters Wetland Restoration Site #97071 MY-4 (Oct 2020)



CVS VegPlot-22: MY-0 Spring 2017



CVS VegPlot-22: MY-4 Sep-Oct 2020



CVS VegPlot-23: MY-0 Spring 2017

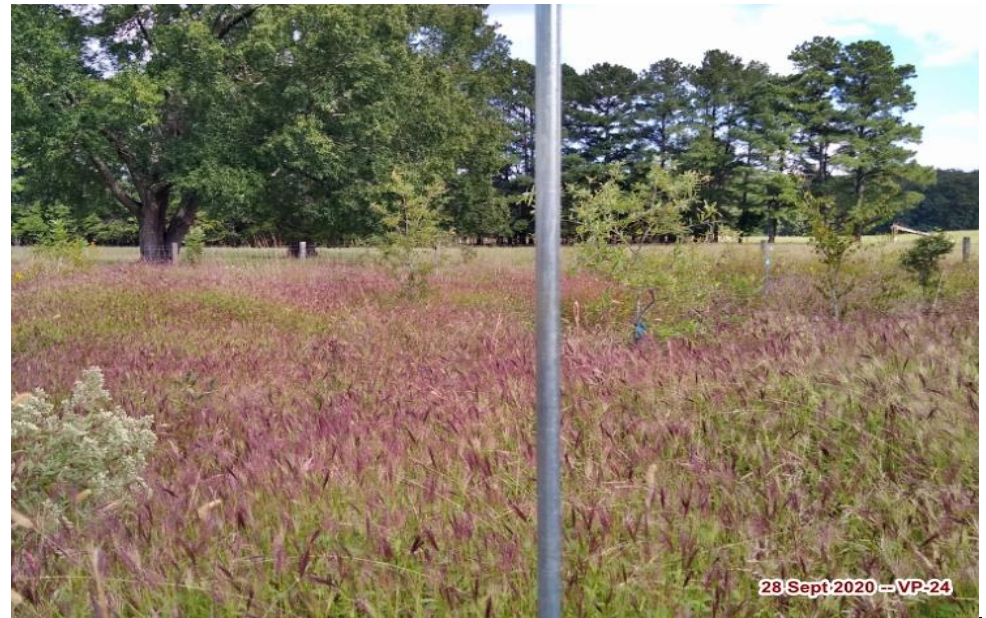


CVS VegPlot-23: MY-4 Sep-Oct 2020

Figure 3. Vegetation Plots: Tar River Headwaters Wetland Restoration Site #97071 MY-4 (Oct 2020)



CVS VegPlot-24: MY-0 Spring 2017



CVS VegPlot-24: MY-4 Sep-Oct 2020



CVS VegPlot-25: MY-0 Spring 2017



CVS VegPlot-25: MY-4 Sep-Oct 2020

Figure 3. Vegetation Plots: Tar River Headwaters Wetland Restoration Site #97071 MY-4 (Oct 2020)



CVS VegPlot-26: MY-0 Spring 2017



CVS VegPlot-26: MY-4 Sep-Oct 2020



CVS VegPlot-27: MY-0 Spring 2017



CVS VegPlot-27: MY-4 Sep-Oct 2020

Figure 3. Vegetation Plots: Tar River Headwaters Wetland Restoration Site #97071 MY-4 (Oct 2020)



CVS VegPlot-28: MY-0 Spring 2017



CVS VegPlot-28: MY-4 Sep-Oct 2020

Figure 4. Photo Points: Tar River Headwaters Wetland Restoration Site #97071 MY-4 (Oct 2020)



Photo Point 1: MY-0 Spring 2017



Photo Point 1: MY-4 Oct 2020



Photo Point 2: MY-0 Spring 2017



Photo Point 2: MY-4 Oct 2020

Figure 4. Photo Points: Tar River Headwaters Wetland Restoration Site #97071 MY-4 (Oct 2020)



Photo Point 3: MY-0 Spring 2017

Photo Point 3: MY-4 Oct 2020



Photo Point 3: MY-0 Spring 2017

Photo Point 3: MY-4 Oct 2020

APPENDIX C. Vegetation Plot Data

Table 6. Vegetation Plot Success Summary

Table 7. Vegetation Plot Stem Count Data

**Tar River Headwaters Wetland Restoration (TRHWR) Project, DMS # 97071.
Monitoring Year 4 (Sept 2020) -- Person County NC. Tar-Pam HUC# 03020101**

Table 6. CVS Plot Stem Density and Success Summary

CVS Plot #	Wetland Planted Stems		Planted + Volunteer Stems		Invasive Woody Stems	Success Criteria Met?
	per plot	per acre	per plot	per acre		
97071- 20	8	324	15	607	0	Yes
97071- 21	7	283	13	526	0	Yes
97071- 22	8	324	19	769	0	Yes
97071- 23	12	486	20	809	0	Yes
97071- 24	5	202	10	405	0	No
97071- 25	9	364	10	405	0	Yes
97071- 26	9	364	12	486	0	Yes
97071- 27	8	324	11	445	0	Yes
97071- 28	10	405	12	486	0	Yes
Project Avg	8.4	342	13.6	549	0	Yes

Success Criteria = 320 planted + volunteer stems per acre at MY3, 260 planted + volunteer stems at MY5, and 210 planted + volunteer stems per acre at MY7 (planted species only).

Color codes for Success
Exceeds criteria by 10% or more
Exceeds criteria by less than 10%
Fails criteria by less than 10%
Fails criteria by more than 10%

MY4 to MY5
(287 or more)
(260 - 286)
(234 - 259)
(258 or less)

Table 7. CVS Plot Stem Counts and Density by Species.

Scientific Name	Common Name	Growth Type	Current Plot Data (MY4 - Sept 2020)													
			97071-20		97071-21		97071-22		97071-23		97071-24		97071-25		97071-26	
			Plant	Total	Plant	Total	Plant	Total	Plant	Total	Plant	Total	Plant	Total	Plant	Total
<i>Baccharis halimifolia</i>	Groundsel-tree	Shrub														
<i>Betula nigra</i>	River Birch	Tree (P)	4	4	3	3	2	2	4	4					7	7
<i>Carpinus caroliniana</i>	Musclewood	Tree (P)														
<i>Cornus amomum</i>	Silky dogwood	Shrub (P)	1	1												
<i>Diospyros virginiana</i>	Persimmon	Tree (P)	1	4		2		2				3		1		
<i>Fraxinus pennsylvanica</i>	Green Ash	Tree (P)		2	1	3	3	10	2	7	1	2				3
<i>Ilex vomitoria</i>	Yaupon holly	Shrub (P)										1				
<i>Liquidambar styraciflua</i>	Sweetgum	Tree		1		7		1		2						
<i>Liriodendron tulipifera</i>	Tulip Poplar	Tree (P)			2	2										
<i>Nyssa biflora</i>	Swamp Blackgum	Tree (P)														
<i>Pinus taeda</i>	Loblolly pine	Tree								3						
<i>Platanus occidentalis</i>	Sycamore	Tree (P)	2	2			2	2								
<i>Quercus bicolor</i> *	Swamp White Oak	Tree (P)									1	1	1	1		
<i>Quercus michauxi</i> *	Swp Chestnut Oak	Tree (P)							2	2						
<i>Quercus phellos</i> *	Water Oak	Tree (P)														
<i>Quercus nigra</i> *	Willow Oak	Tree (P)					1	1	4	4	2	2	8	8	2	2
<i>Rosa palustris</i>	Swamp rose	Shrub				5		4		5						
<i>Ulmus alata</i>	Winged Elm	Tree						2								
<i>Ulmus americana</i>	American Elm	Tree (P)		2	1	3		2		3	1	1				
Planted & Total Stem count			8	15	7	13	8	19	12	20	5	10	9	10	9	12
ares			1	1	1	1	1	1	1	1	1	1	1	1	1	1
acres			0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025
Species count			4	7	4	7	4	9	4	8	4	6	2	3	2	3
Stems per ACRE			324	607	283	526	324	769	486	810	202	405	364	405	364	486

(P) = planted species

Scientific Name	Common Name	Growth Type	Plot Data (MY4 Sep 2020)				Annual Means 2017 - 2020										
			97071-27		97071-28		MY0 (2017)		MY1 (2017)		MY2 (2018)		MY3 (2019)		MY4 (2020)		
			Plant	Total	Plant	Total	Plant	Total	Plant	Total	Plant	Total	Plant	Total	Plant	Total	
<i>Baccharis halimifolia</i>	Groundsel-tree	Shrub		1		1											2
<i>Betula nigra</i>	River Birch	Tree (P)			2	2	23	23	23	23	22	22	22	22	22	22	22
<i>Carpinus caroliniana</i>	Musclewood	Tree (P)	2	2	4	4	6	6	6	6	6	6	6	6	6	6	6
<i>Cornus amomum</i>	Silky dogwood	Tree										1		1	1	1	1
<i>Diospyros virginiana</i>	Persimmon	Tree (P)				1	2	2			1	3	1	4	1	13	13
<i>Fraxinus pennsylvanica</i>	Green Ash	Tree (P)	1	3	2	2	9	9	10	10	10	17	10	23	10	32	32
<i>Ilex vomitoria</i>	Yaupon holly	Shrub (P)															1
<i>Liquidambar styraciflua</i>	Sweetgum	Tree		1													12
<i>Liriodendron tulipifera</i>	Tulip Poplar	Tree (P)					12	12	6	6	1	2	2	2	2	2	2
<i>Nyssa biflora</i>	Swamp Blackgum	Tree (P)					1	1									
<i>Pinus taeda</i>	Loblolly pine	Tree										3		1			3
<i>Platanus occidentalis</i>	Sycamore	Tree (P)	1	1			5	5	5	5	5	5	5	5	5	5	5
<i>Quercus bicolor</i> *	Swamp White Oak	Tree (P)					3	3	3	3	4	4	2	2	2	2	2
<i>Quercus michauxi</i> *	Swp Chestnut Oak	Tree (P)											2	2	2	2	2
<i>Quercus phellos</i> *	Willow Oak	Tree (P)			2	2	14	14	1	1	18	19	19	19	19	19	19
<i>Quercus nigra</i> *	Water Oak	Tree (P)					6	6	17	17							
<i>Rosa palustris</i>	Swamp rose	Shrub															14
<i>Ulmus alata</i>	Winged Elm	Tree													4		2
<i>Ulmus americana</i>	American Elm	Tree (P)	4	5		1	10	10	11	14	5	18	8	18	6	17	17
Planted & Total Stem count			8	11	10	12	91	91	82	85	72	97	77	104	76	122	122
ares			1	1	1	1	9	9	9	9	9	9	9	9	9	9	9
acres			0.025	0.025	0.025	0.025	0.222	0.222	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.22
Species count			4	5	4	6	11	11	11	11	9	11	10	13	11	16	16
Stems per ACRE			324	445	405	486	409	409	369	382	324	436	346	468	342	549	549

Plant = Planted Stems; Total = Planted + Volunteer Stems of planted species only.

Red = volunteer non-planted species, NOT counted in totals or density.

Blue highlight = Totals that include 1 or more volunteer stems of planted species.

* *Quercus* seedlings misidentified in 2017 were corrected in 2018-2019, thus the changes in names and numbers

Color codes for Plot Density & Success

Exceeds criteria by 10% or more
Exceeds criteria by less than 10%
Fails criteria by less than 10%
Fails criteria by more than 10%

MY1 to MY3
(352 or more)
(320 - 351)
(289 - 319)
(288 or less)

MY4 to MY5
(287 or more)
(260 - 286)
(234 - 259)
(258 or less)

MY6 to MY7
(232 or more)
(210 - 231)
(189 - 209)
(188 or less)

APPENDIX D. Hydrologic Data

Figure 5. Monthly Rainfall Plot with Percentiles

Figure 6. Groundwater Gauge and Rainfall Data

Table 8. Hydrologic Success Attainment

Figure 5. Monthly Rainfall Totals (2020) with 30th and 70th Percentiles.
 From USDA WETS table, 30-year historical data (1981-2010) at ROXBORO 7 ESE, NC

Month	Total	30th %	70th %
Jan-20	4.03	2.45	4.46
Feb-20	6.71	2.58	3.82
Mar-20	2.70	2.99	5.32
Apr-20	5.23	2.18	4.21
May-20	8.84	2.51	4.04
Jun-20	4.09	2.15	4.45
Jul-20	1.88	3.38	5.44
Aug-20	5.39	2.57	4.9
Sep-20	6.11	1.94	4.85
Oct-20	4.10	2.65	4.72
Nov-20	5.10	1.89	4.42
Dec-20		2.56	4.52

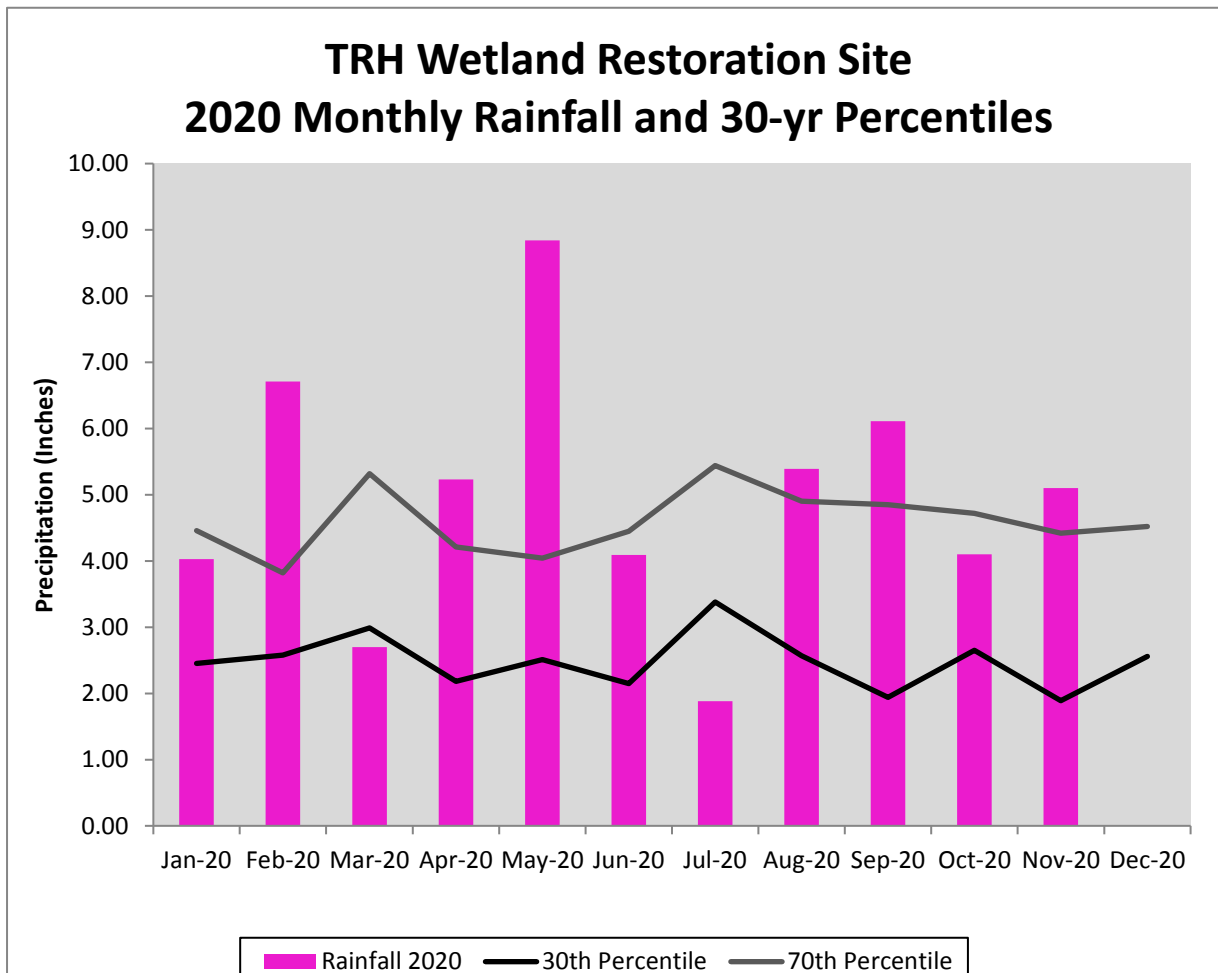


Figure 6A. Groundwater Gauges and Rainfall Data Plots 2020 -- Tar River Headwaters Wetland Restoration # 97071

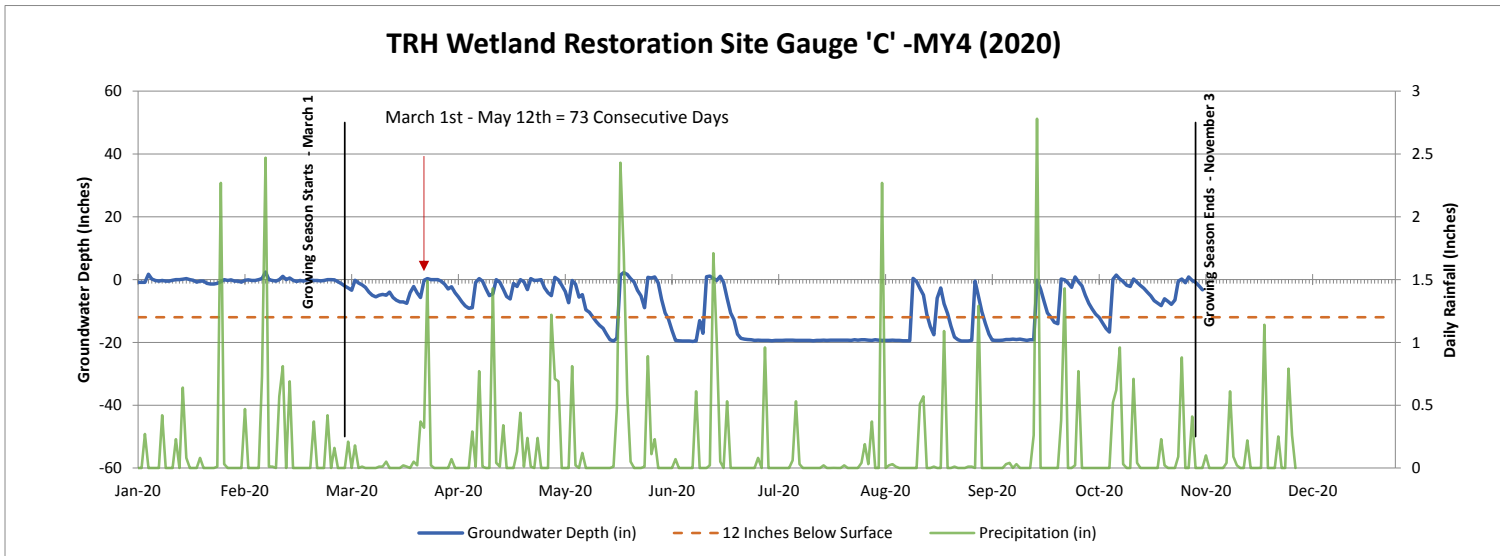
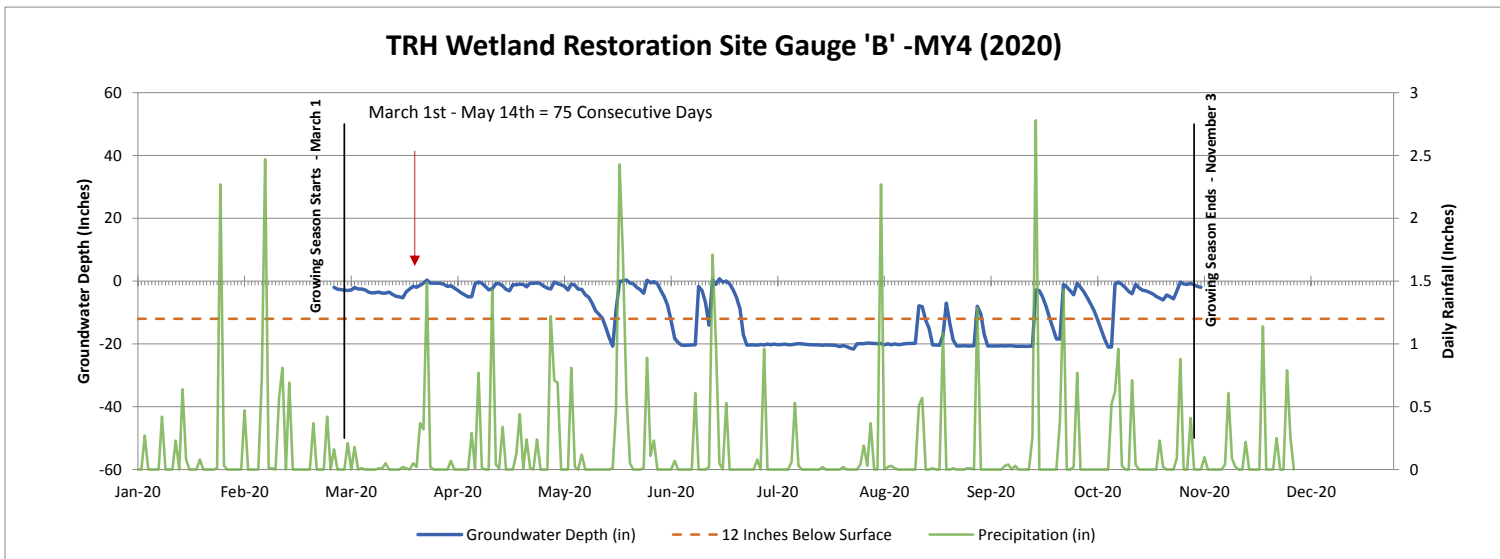
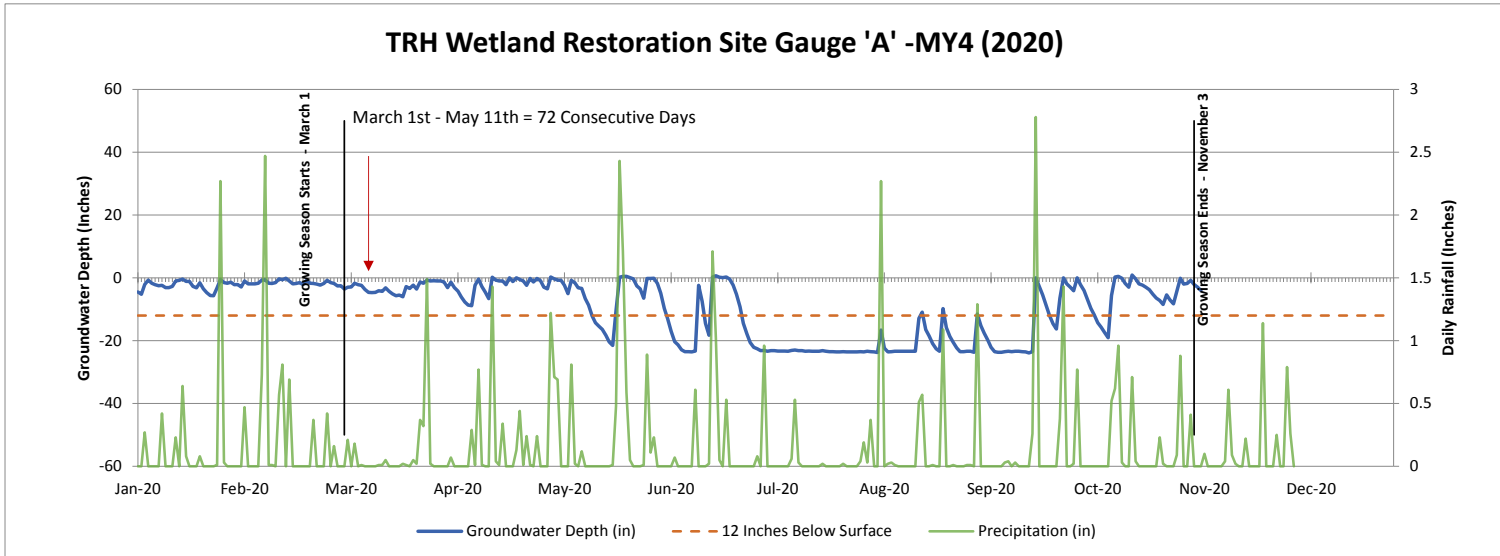


Figure 6B. Groundwater Gauges and Rainfall Data Plots 2020 -- Tar River Headwaters Wetland Restoration # 97071

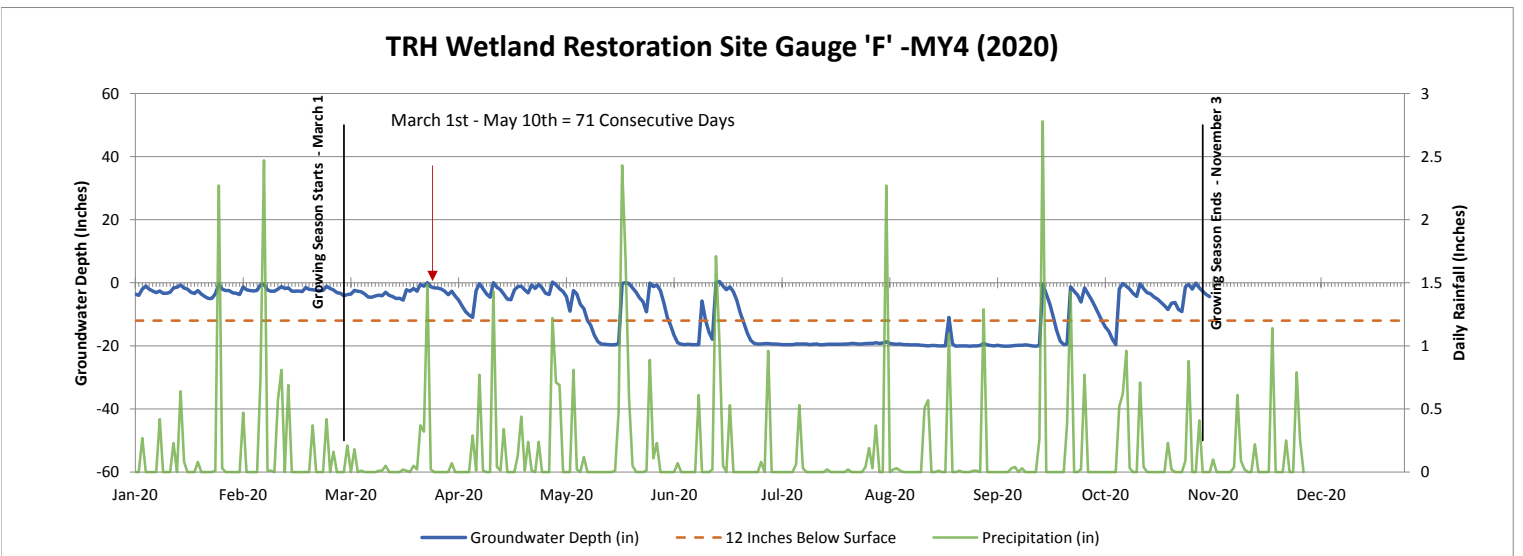
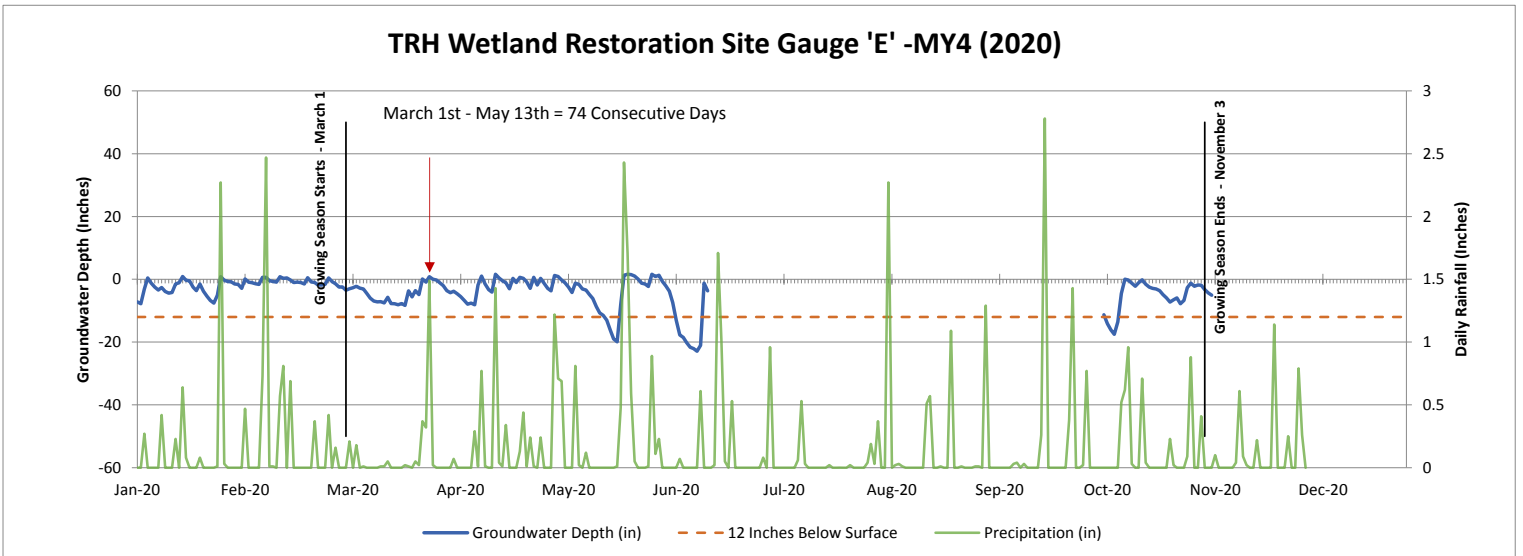
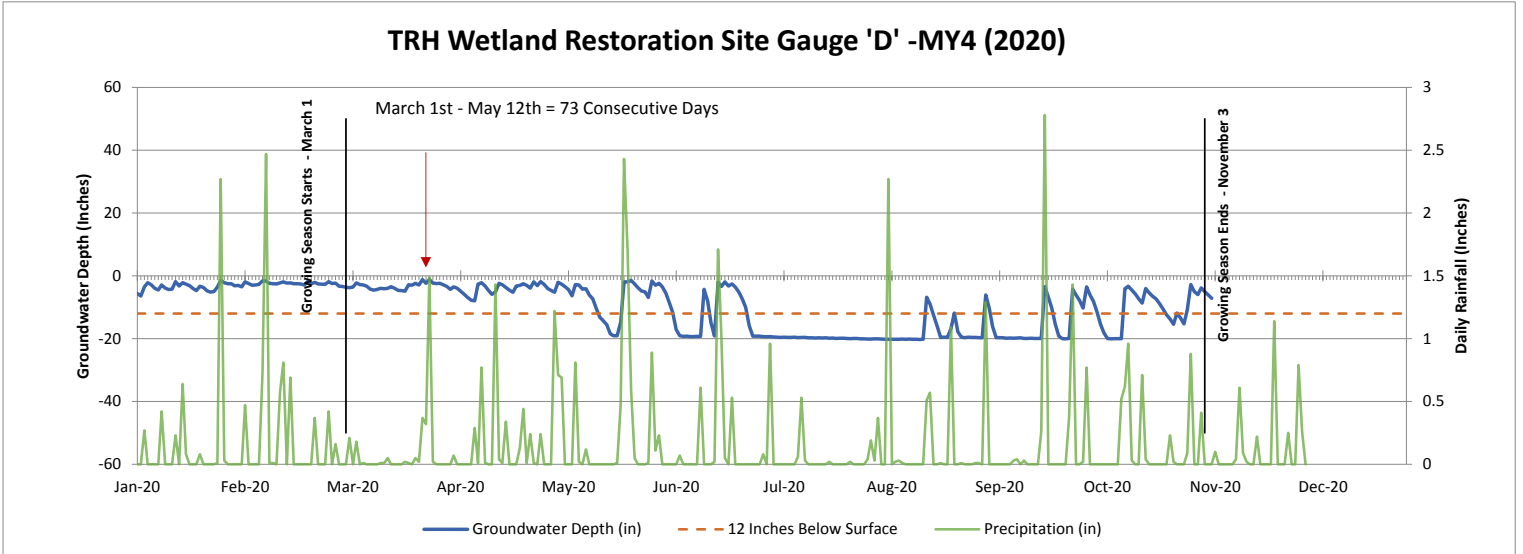


Figure 6C. Groundwater Gauges and Rainfall Data Plots 2020 -- Tar River Headwaters Wetland Restoration # 97071

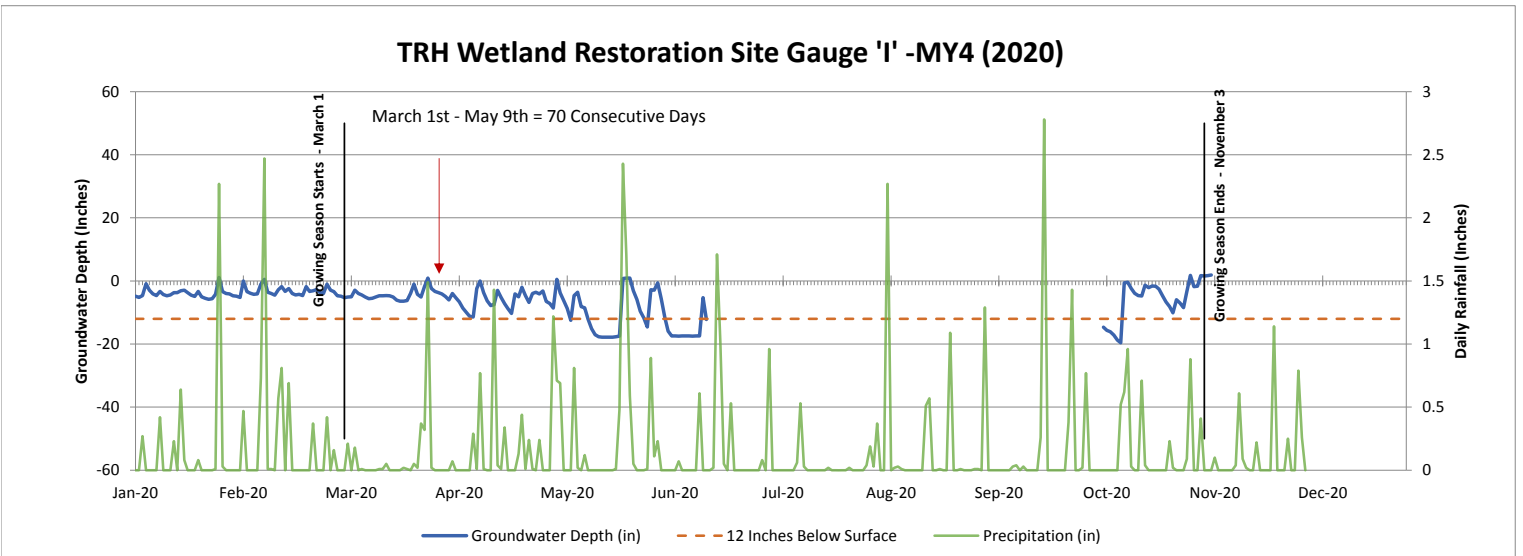
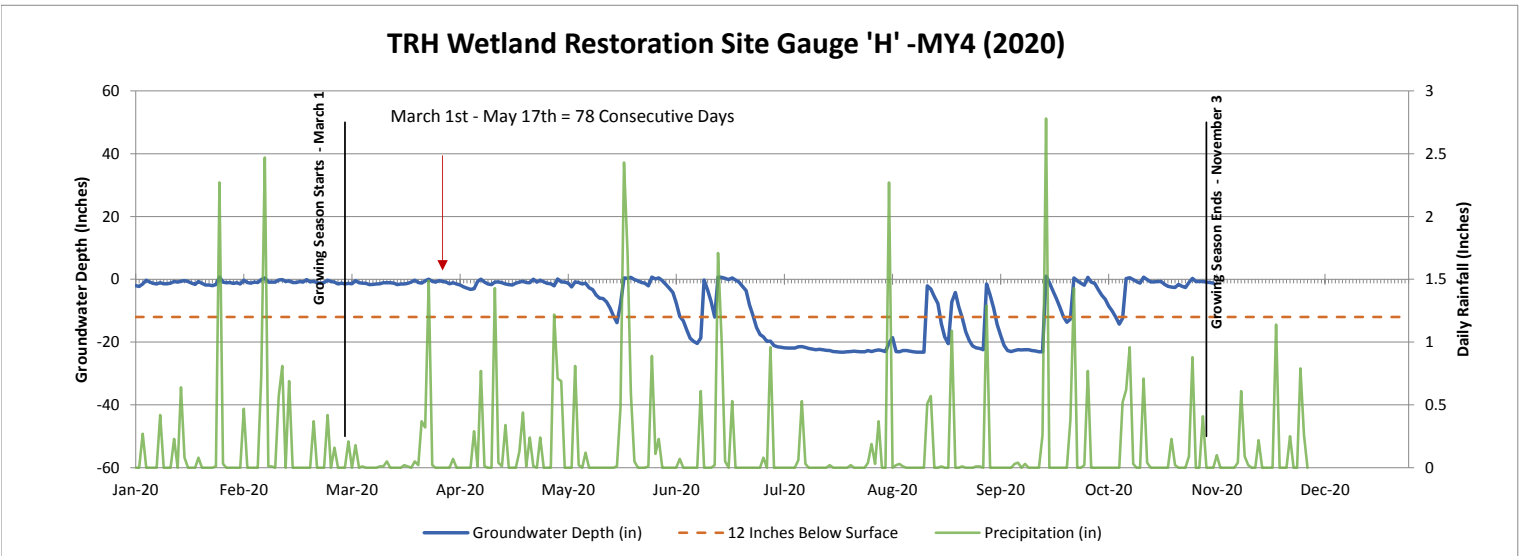
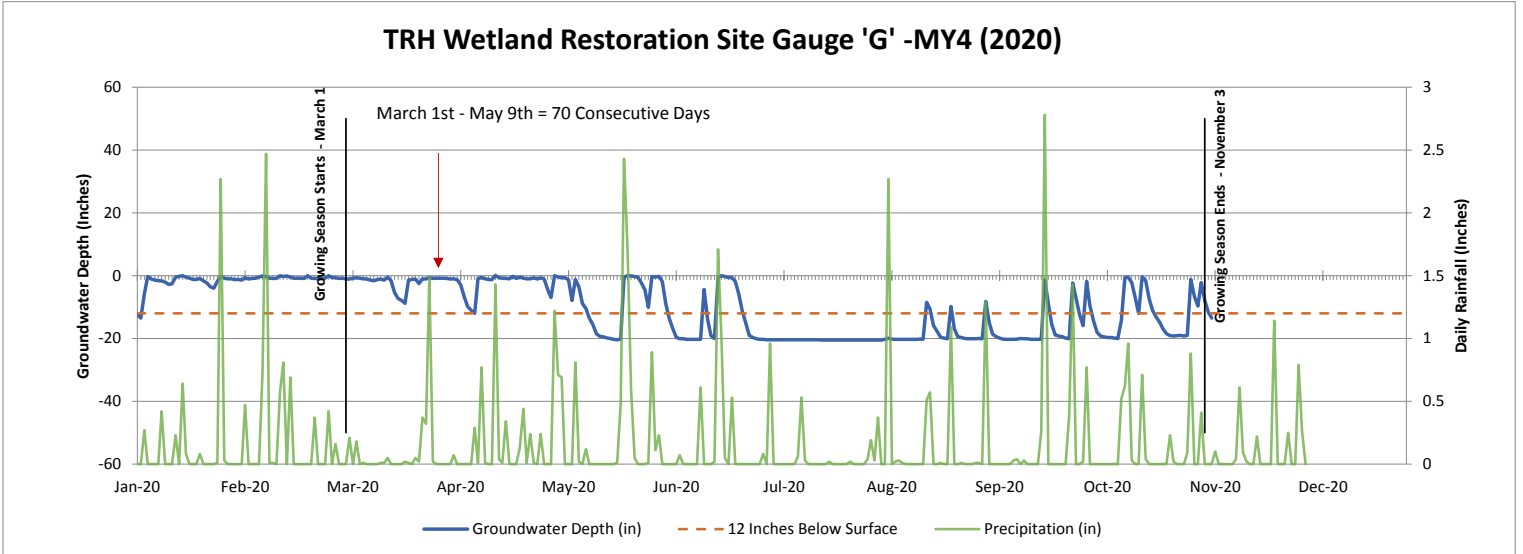


Figure 6D. Groundwater Gauges and Rainfall Data Plots 2020 -- Tar River Headwaters Wetland Restoration # 97071

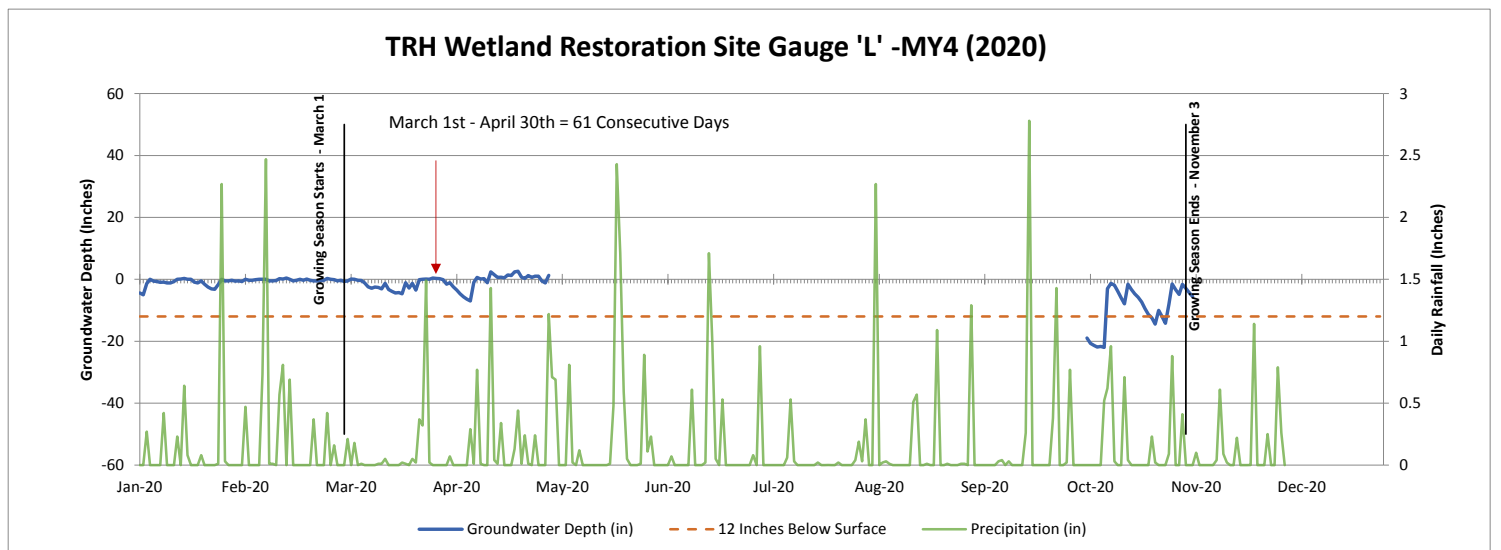
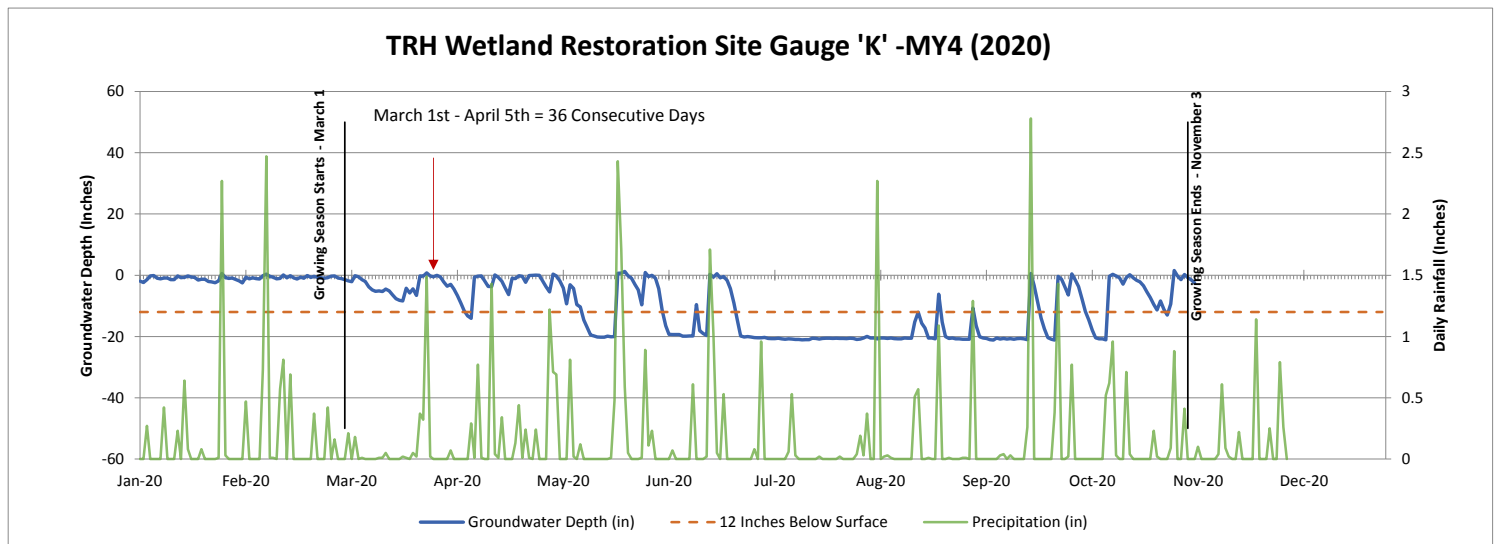
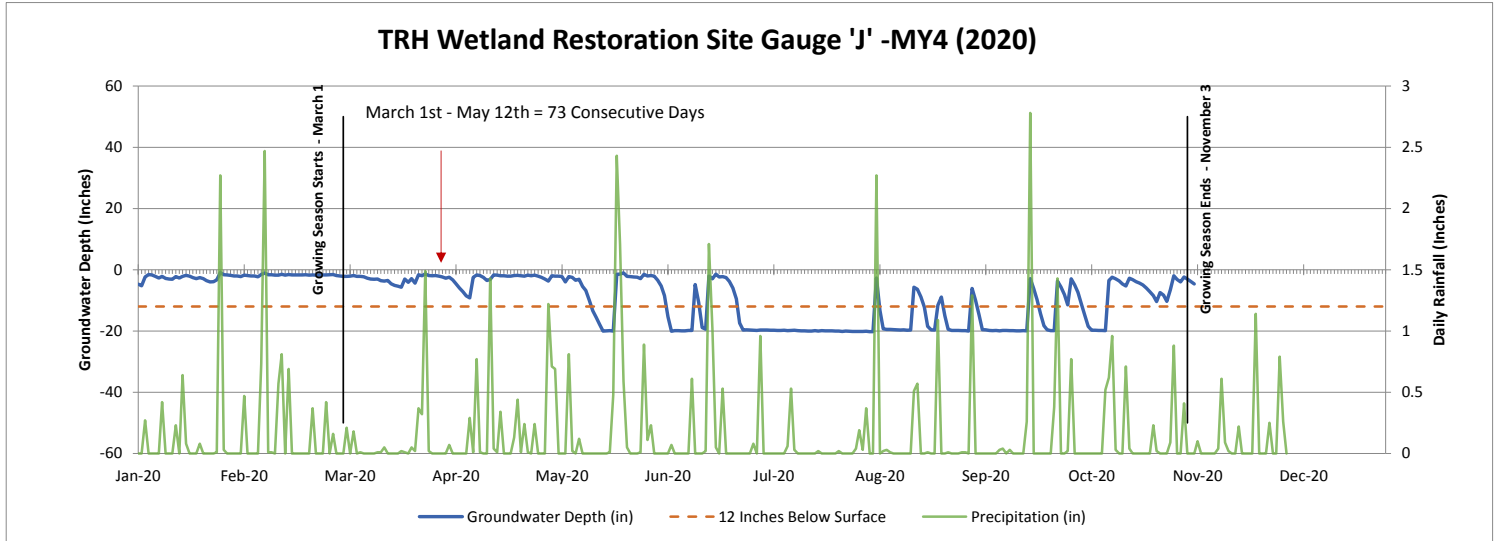


Figure 6E. Groundwater Gauges and Rainfall Data Plots 2020 -- Tar River Headwaters Wetland Restoration # 97071

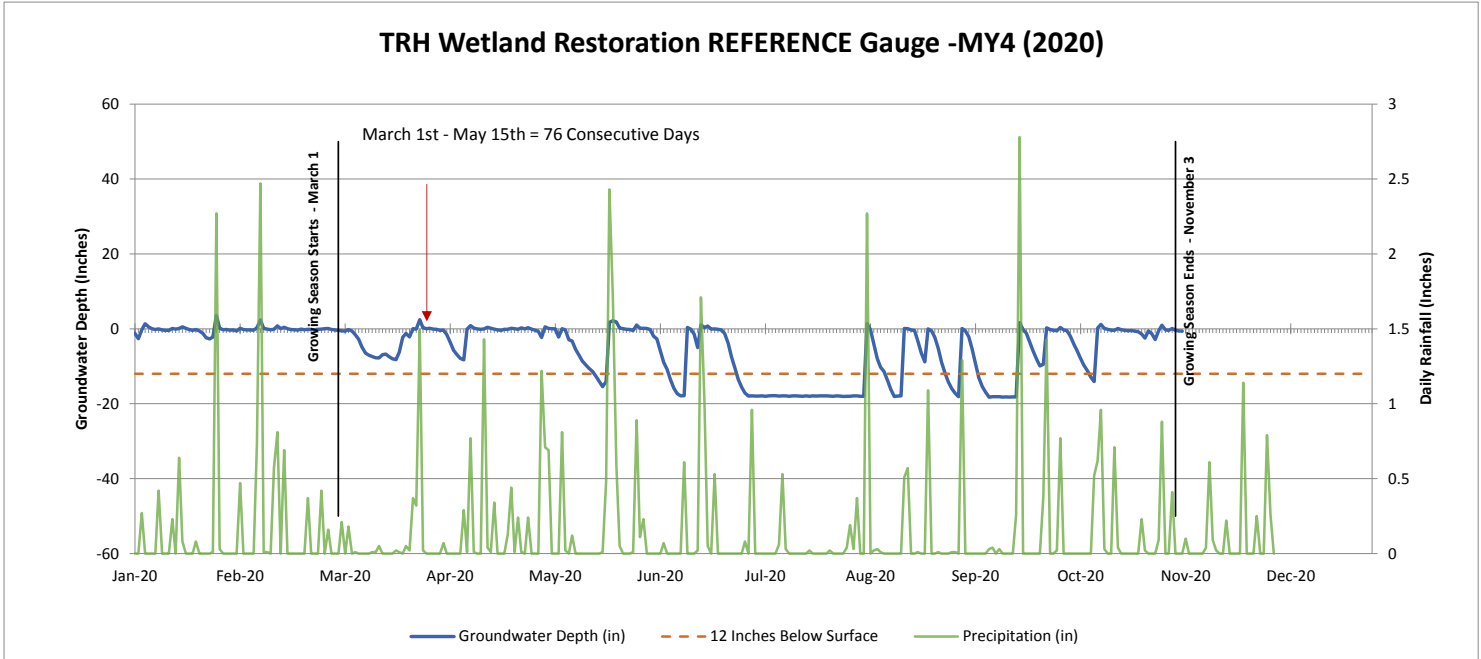


Table 8. Hydrologic Success Attainment 2016 - 2020, Groundwater Wells
Tar River Headwaters Wetland Mitigation Site # 97071.

Groundwater Gauges -- Maximum Consecutive Days in Growing Season with Water Table above -12.0 inches																				
WELL	2016				2017				2018				2019				2020			
	start	end	days	% GS	start	end	days	% GS	start	end	days	% GS	start	end	days	% GS	start	end	days	% GS
A	4/27	5/27	31	12	4/23	5/16	24	10	3/1	5/4	65	26	3/1	4/3	34	14	3/1	5/11	72	29
B *	4/28	5/9	12	5	4/23	5/16	24	10	3/1	6/7	99	40	3/1	5/1	62	25	3/1	5/14	75	30
C *	6/23	7/11	19	8	4/23	5/21	29	12	3/1	5/14	75	30	3/1	4/24	55	22	3/1	5/12	73	29
D	4/27	5/16	20	8	3/13	4/11	30	12	3/1	5/12	73	29	3/1	4/30	61	25	3/1	5/12	73	29
E	4/23	6/2	41	17	4/24	5/17	24	10	3/1	5/3	64	26	3/1	4/30	61	25	3/1	5/13	74	30
F	3/1	3/20	20	8	3/31	4/10	11	4	3/1	5/3	64	26	3/1	4/25	56	23	3/1	5/10	71	29
G	4/27	5/15	19	8	3/31	4/13	14	6	3/1	5/9	70	28	3/1	4/28	59	24	3/1	5/09	70	28
H	3/1	4/7	38	15	4/23	5/17	25	10	3/1	6/9	101	41	3/1	5/4	65	26	3/1	5/17	78	31
I	4/22	5/12	21	8	4/23	5/20	28	11	3/1	5/3	64	26	3/1	4/24	55	22	3/1	5/09	70	28
J	4/28	5/16	19	8	5/22	6/2	12	5	3/1	5/12	73	29	3/1	5/1	62	25	3/1	5/12	73	29
K	4/27	5/11	15	6	3/31	4/10	11	4	3/1	5/2	63	25	3/1	4/25	56	23	3/1	4/05	36	15
L	na	na	na	na	3/1	6/10	102	41	3/1	6/15	107	43	3/1	5/1	62	25	3/1	4/30	61	25
Ref	4/1	6/14	75	30	3/1	6/9	101	41	3/1	5/14	75	30	3/1	5/14	75	30	3/1	5/15	76	31

Growing Season based on USDA 30-yr air temp data at Roxboso ESE gauge is Mar 28 to Nov 3 (221 Days).

Adjusted Growing Season based on on-site soil temperature > 41° F is Mar 1 to Nov 3 (248 Days).

Mitigation Plan success criterion is 10% of growing season (25 consecutive days WT < 12" below surface).

Blue = Gauge meets hydrologic success. Brown = Gauge does not meet hydrologic success

* Gauges B and C are in non-credit areas and do not contribute to project success evaluation.

Yellow = Gauge failure; actual end of hydroperiod may have been later.

