MY2 Monitoring Report

Owen Farms Mitigation Site
Transylvania County, NC

French Broad River Basin
Cataloging Unit 06010105

NCDMS Project No. 100064
NCDMS Contract No. 7532
NCDMS RFP No. 16-007334
(Issued 9/8/2017)

USACE ID: SAW-2018-01165

DWR ID: 20181033

Data Collected: August 2022

Prepared for:

NC Department of Environmental Quality
Division of Mitigation Services
1652 Mail Service Center
Raleigh, NC 27699-1652

Prepared by:

HDR Engineering, Inc. of the Carolinas
555 Fayetteville Street, Suite 900
Raleigh, NC 27601-3034
DRG Contributing Staff: Ben Furr, Ryan Smith, Alex DiGeronimo, Yvette Mariotte, evin Williams, Michael Foster, William Bailey

This Year 2 Monitoring Report has been written in conformance with the requirements of the following:

- Federal rule for compensatory mitigation project sites as described in the Federal Register, Title 33 Navigation and Navigable Waters, Volume 3, Chapter 2, Section § 332.8, paragraphs (c)(2) through (c)(14).
- NCDEQ Division of Mitigation Services IN-Lieu Fee instrument signed and dated July 28, 2010.

DAVEY Resource Group

February 27, 2023

Paul Wiesner
Western Regional Supervisor
North Carolina Department of Environmental Quality
Division of Mitigation Services, Asheville Regional Office
2090 U.S. 70 Highway
Swannanoa, NC 28778-8211

Re: MY2 Monitoring Report Comments
Owen Farms Stream and Wetland Mitigation Site
French Broad River Basin; CU# 06010105 – Transylvania County
DMS Project ID No. 100064
Contract No. 7532
SAW-2018-01165

Mr. Wiesner,

As per your letter concerning the Owen Farms Stream and Wetland Mitigation Site MY2 Report, we have updated the reviewed and addressed your comments as follows:

Response to DMS Comments

1: General: Most of the storm damage reported along the West Fork French Broad River appears to be associated with streambanks and floodplain areas that have poor vegetative and woody stem coverage. During the May 10, 2022 on-site meeting, the IRT suggested that additional planting along channel banks may be warranted in future years if density doesn't improve. Other than the repair areas that will be planted in the 2022/ 2023 dormant season, is any additional supplemental planting or live staking planned for the project site? HDR does not anticipate supplemental planting outside of the repaired areas, at this time. Visual assessment data in subsequent monitoring years will guide the necessity for supplemental planting.

2: General: Potential Wetland Expansion Areas: The proposed areas are detailed in Appendix H – Wetland Expansion Area Letter to USACE and are located on the CCPV maps. It is likely that the IRT will require additional groundwater well data in the proposed wetland creation areas (WA & WB). Random vegetation plots should also be located within the wetland expansion areas over the course of monitoring term to document vegetative success. DMS recommends continued discussion and correspondence with the IRT if the potential wetland expansion areas will be pursued by HDR. Noted: At this time, HDR does not intend to install gauges in WA and WB. In addition, WB is situated in an area where bedrock is located approximately 12 inches below ground surface and groundwater seeps into this wetland from a hillside seep. Groundwater data is not necessary to validate wetland hydrology in WB. One gauge (G6) has been added in the WC expansion area along the left bank of UT5 (Figure 2.2 and Figure 8.4). This data will continue to be presented in subsequent monitoring reports. A random vegetation plot will be sampled in these areas in subsequent monitoring years.

3: General & Table 8 – Visual Vegetation Condition: Please confirm that the entire conservation easement boundary was walked as part of the monitoring assessment and no encroachment was observed or reported in MY2 (2022). In the response letter and the report text, please discuss the repair status of the ford crossing and the kissing gates as they were observed and discussed at the May 10, 2022, IRT site visit and documented in the meeting notes. As presented in Figure 3.34, fencing at the ford crossing has been repaired. No easement encroachment was observed or reported in MY2 (2022).

4: General/ Section 2.2.2 – Vegetation: In the report text, please discuss the bare roots and live stakes that were planted in MY2 (February 2022). Please provide a MY2 (2022) planting list and planting map in the report appendices. Please include the wetland indicator status for the species in the planting list. The dormant season 2022/2023 supplemental planting should be documented in the MY3 (2023) report. A planting list and map for the February 2022 replant has been added to Appendix F (Repair Plan).

5: Section 2.2.1 – Stream Stability: "*While the banks of UT 5 remain stable, a beaver dam was discovered at station 18+25 and was removed. Despite the storm event in May 2022 the stabilization materials observed in MY1 has not progressed through the system as expected. The beaver dam may be influencing the streams ability to move sediment through the system."* What are the referenced stabilization materials? If the beaver dam was removed, how can is still be influencing the stream? When was the beaver dam removed? Please review and revise this portion of the report text for clarity. The stabilization materials referenced were discussed in MY1 Report. DOT stabilization materials (gravel) were transported from upstream of the project boundary. The beaver dam was not removed until August 2022, after the Geomorph Survey was conducted. Text was added to Section 2.2.1 for clarity.

6: Section 2.2.4 – Wetland Hydrology: Per the IRT approved mitigation plan, the final performance criteria for wetland hydrology is a groundwater level within 12 inches of the soil surface for a minimum of 12% (25 consecutive days) of the growing season (April 7 through October 30, 206 days). Please update the report text to also include the percentage of the growing season based on the growing season dates established. Once the gauge data for the entire growing season has been added to the graphs (as noted in the DRAFT), please review, and update the report text accordingly. The report text in Section 2.2.4 has been updated as requested.

7: Section 2.2.4 – Wetland Hydrology: "*During a site visit with the NC DEQ Western Regional Supervisor in March 2022, it was agreed that the gauge in the re-establishment area (Gauge 5) would be moved outside of this localized region of W5.*" Please also note that the IRT reviewed and approved the relocated well during their May 10, 2022, site visit. Noted, this information has been added to Section 2.2.4.

8: Section 2.2.2 – Vegetation: The IRT approved mitigation plan vegetation success criteria notes; **"***Volunteers must be present for a minimum of two growing seasons before being included in performance standards in Year 5 and Year 7. For any tree stem to count toward success, it may be either planted or volunteer, but it must be a species from the approved planting list included in the Mitigation Plan. Other species not included on the planting list or in the stated documentation may be considered by the IRT on a case-by case basis. Additionally, any single species can only account for up to 50% of the required number of stems within any vegetation plot."* Please review and confirm that the results reported in the DRAFT

text and Appendix C conform with the project's established success criteria and update the report as necessary. Based on discussion with Melonie Allen (DMS), the vegetation tool that generates Tables 9 and 10 will not reflect success criteria thresholds until Year 3.

9: Section 2.2.2 – Vegetation: During the May 10, 2022, IRT site visit, cattails were observed in UT 5 and UT 7. Davey Resource Group, Inc. noted that cattails would be treated later in 2022 as part of the invasive treatment plan for the site. Were cattails treated as part of the MY2 (2022) invasive treatment effort? Please update the report text accordingly. Cattails were not treated during the initial herbicide application. A cattail shapefile has been added to the CCPV and cattail will be treated in these areas in spring 2023, prior to seed out.

10: Section 3.0 Maintenance and Adaptive Management Plans: The report text notes that sod mats harvested from dense herbaceous growth within the easement boundary were installed as part of the November 2022 repair effort. Is fescue in the sod mats installed, and if so, does Davey Resource Group, Inc. believe the fescue will have an impact on planted and/ or supplementally planted woody stems? Are any ring sprays around woody vegetation in the vicinity of the sod mats planned in future monitoring years? Please address and discuss in the response letter and revised report text. Sod mats that were utilized for repairing eroded areas consisted primarily of common rush and various sedge species. Areas dominated by fescue were avoided when harvesting sod matting. Ring spraying in the vicinity of sod mats is not planned at this time.

11: Table 2 – Project Goals, Performance Criteria, and Functional Improvements: "*All but one wetland is meeting performance criteria.*" Is this still accurate based on the MY2 (2022) monitoring results? Please review and update the table as necessary. Table 2 has been updated based on MY2 data. All wetlands are currently meeting criteria.

12: Table 4 – Project Attributes: Please include the project stream's thermal regime (Cold) in the table. Table 4 has been updated to include thermal regime.

13: Table 5. Project Activity and Reporting History: Please include all project repair, planting, and maintenance activities in the table. As an example, repairs and planting were completed in February 2022 but it is not included in the DRAFT table. Table has been updated to include repairs and planting made in 2022.

14: CCPV Maps: Please label the potential wetland expansion areas as identified in Appendix H – Wetland Expansion Area Letter to USACE. The CCPV has been updated to reflect labels on wetland expansion areas.

15: CCPV Maps: The random vegetation plots (11, 16, 19) should be identified as random plots on the CCPV Maps and legend. Were any the project's random plots located in MY1 replant areas as discussed with the IRT? Please discuss in the response letter and update the report text accordingly. Vegetation Plot 11 was located within the replant area. The CCPV has been updated to reflect random, permanent, meeting and not meeting.

16: Figures 4.1 – 4.14 Cross Section Photos: Please include the photo dates taken in the photo captions. Dates have been added.

17: Figure 7.1- 7.4: Flow depth graphs: Please update the graphs to include all of the data from the MY2 (2022) growing season. Data has been added.

18: Figure 8.1- 8.6: Groundwater gauge data graphs: Please update the graphs to include all of the data from the MY2 (2022) growing season. Please also update each graph to include the percentage of the growing season based on the growing season dates established. Data has been updated. Percentages were added to graphs and can be viewed in Table 14: Wetland Hydrology Summary.

19: Table 14 – Wetland Hydrology Summary: The table indicates that it is reporting "Max. Consecutive Hydroperiod (%)" but reports the maximum consecutive days. Please update the table to also include the percentage of the growing season based on the growing season dates established. Table has been updated to reflect percentages.

20: Appendix G – 2022 Credit Release IRT Meeting Minutes – Please review the meeting minutes provided and confirm that all IRT requests and discussion points have been addressed in the revised MY2 (2022) report. Meeting minutes were reviewed, and discussion points have been addressed in MY2 report.

Digital Support File Comments:

21: In the revised digital submittal, please ensure that all photos associated with required photo monitoring stations have been submitted and the point and photo(s) are labeled. Monitoring photo directions have been labeled within the shapefile accordingly.

22: Please submit the visual vegetation and stream assessment tables and any associated spatial features identified in the tables if not included in the currently submitted shapefiles. This data is in the support package that was submitted in January 2023.

23: Please submit the x-section graphs in the revised digital submittal. X-section graphs have been added to "Geomorph" folder in the digital submittal.

If you have any questions or need additional information, please do not hesitate to give me a call (919.588.9663).

Sincerely,

Davey Resource Group, Inc.

Ben Furr

Contents

Figures

Tables

Appendices

1.0 Project Summary

1.1 Location and Setting

The Owen Farms Mitigation Site (Site) is located approximately 3 miles north of Lake Toxaway in Transylvania County, NC.

Directions from Asheville, NC:

From Asheville, NC: Travel on I-26 east to exit 40 (NC-280 W/Airport Road) and merge on to NC-280 W, continue for 15.9 miles; continue straight onto US-64 W (NC-280 W becomes US-64 W), go 3.9 miles; turn right to stay on US-64 W; continue on US-64 W for 14.9 miles; turn right on Blue Ridge Road, continue for 5.4 miles and the Site entrance will be on the left.

The Site is located in the Blue Ridge Belt Physiographic Province of North Carolina.

1.2 Background

In October 2020 HDR|ICA restored approximately 3,180 linear feet of stream, enhanced approximately 5,172 linear feet of stream (125 linear feet of Enhancement I; 5,047 linear feet of Enhancement II), and preserved 423 linear feet of stream at the Owen Farms Mitigation Site. Additionally, 1.396 acres of wetlands have been enhanced, 0.35 acres of wetlands have been re-established, and 0.97 acres of wetlands have been rehabilitated at the Site. The Site provides many ecological functional uplifts within the French Broad River Basin. Project goals were established based on the French Broad RBRP (NCEEP 2009), and on-Site data collected during the existing conditions survey. Site specific goals and objectives were developed to provide the highest practical potential for functional uplift based on NC SAM and NC WAM analyses of streams and wetlands on Site.

1.3 Preconstruction Conditions

Streams

The Site was cleared prior to 1951 and has been utilized for agricultural purposes including pasture and row crops. Prior to construction cattle had access to the majority of streams on Site. The streams on Site exhibited the following conditions prior to construction:

- Portions of WFFBR had been straightened to maximize agricultural practices on the property. The channel exhibited actively eroding banks due to cattle hoof shear and many of the channel's riffles and pools had experienced significant deposition of fine material from the eroded channel banks. The large majority of the channel displayed little to no deeply rooted bank or riparian vegetation. Where a woody buffer had been present, it was commonly only one tree wide, with vegetation typically sparse at best. Many of the trees within the one-tree buffer had been undercut because the channel had incised below the rooting depth.
- UT 5 was dammed and ponded immediately downstream of a culvert passing under Silverstein Road. Downstream of the pond, UT 5 had been straightened and channelized to its confluence with the West Fork French Broad River (WFFBR).
- With the exception of the upstream most 248 feet, UT 7 had an absent to minimal buffer. The downstream half of UT 7 appeared to have been modified for agricultural practices and ditched along the edge of the valley as evidenced by an incised channel and spoil piles adjacent to the banks.

- UT 8 was fairly stable except for the downstream most 40 feet of the reach which experienced down cutting to match the invert elevation of WFFBR at the confluence. In the downstream portion of the reach there was little to no deeply rooted vegetation along the banks. The banks had been lined with old bricks by the landowner in an attempt to prevent further mass wasting as the channel continues to incise and undercut the banks.
- UT 4a was significantly incised due to a headcut approximately 20 feet upstream of its confluence with UT 4.
- UT 1, UT 2, UT 2a, UT 3, UT 2b, UT 4, UT 4b, UT 6, UT 6a, UT 7a, and UT 7b are all first or second order, spring fed, perennial tributaries which exhibited mild to moderate instability due to cattle hoof shear and limited buffer presence in some areas before construction and planting activities.

Wetlands

Prior to construction cattle had access to all of the wetlands on Site. The wetlands on Site exhibited the following conditions prior to construction:

- Wetland W3 is the largest wetland within the Site (1.8 acres) and is divided into two distinct wetland types: Riverine Swamp Forest and Floodplain Pool. The Riverine Swamp Forest portion of W3 had a significantly altered vegetative community compared to reference condition. This portion of W3 consisted solely of herbaceous vegetation which was dominated by common rush and served as a cattle pasture. Fecal matter and cattle tracks were present throughout the wetland. The Floodplain Pool portion of W3 formed in a relic meander scroll of WFFBR. UT 5 flowed through the eastern portion of the Floodplain Pool prior to its confluence with WFFBR. Cattle had unrestricted access to the entirety of W3
- Wetland W5 was a relic Headwater Forest wetland area adjacent to UT 7. Prior to construction the channelization and placement of spoil along the floodplain made it so W5 no longer supported wetland hydrology. Cattle access also altered the vegetative structure and ground surface condition.
- Wetland W1 is a Riverine Swamp Forest that is heavily influenced by beaver. Prior to construction activities, cattle had full access to W1.
- Wetlands W2, W4, W6, W6A, W7, W8, and W9 are all headwater wetlands that had experienced alterations to the vegetative structure and significant fecal matter inputs due to cattle access.

2.0 Annual Monitoring

2.1 Monitoring

Table 3 in Appendix A outlines all the monitoring components, methods, quantity, and frequency of data to be collected for the Site. A visual representation of all monitoring devices can be found in the MY2 Current Conditions Plan View (CCPV) (Figures 2.1 – 2.9). Monitoring and data collection occurred between August 15 and August 19, 2022.

2.2 Results and Discussion

This section documents the conditions observed in Year 2 monitoring. As reported in the Year 1 Monitoring Report, the Site experienced a 200-year storm event between August 15-17, 2021, that caused several areas of severe floodplain scour and bank erosion along WFFBR. Repairs to correct the storm damage took place in February 2022 and included re-grading of channel banks, installation of soil lifts, cobble toe installation, and widening and re-grading of select areas of the WFFBR floodplain. Repair plans

for work completed in February 2022 were provided in the MY1 Report. Photos of select areas after the repairs in February 2022 can be found in Figures 3.31-3.50.

Following completion of the repairs in February 2022, on-site rain data recorded 6.65 inches of rain within a 24 hour period on May 25th-26th that led to additional areas of erosion in need of repair. Due to the heavy rainfall, flooding events, and isolated sections of stream bank with little to no vegetative cover several areas of bank and toe erosion developed along WFFB:

1. Erosion along the right bank between STA 10+00 to STA 10+40
2. Erosion along the right bank from STA 10+70 to STA 11+25
3. Erosion along the right bank from STA 13+90 to STA 14+50
4. Erosion along the right toe from STA 15+35 to STA 15+65
5. Erosion along the left bank from STA 16+10 to STA 16+75
6. Erosion along the right toe from STA 22+35 to STA 22+95
7. Erosion along the right toe from STA 25+15 to STA 25+50

Areas of minor to severe bank and toe erosion were repaired in November 2022. Repair activities included re-grading eroded banks and installing boulder toe protection. Repaired banks were topped with sod mats harvested within the easement boundary to provide immediate vegetative stabilization. Photographs of select areas before and after repairs can be found in Figures 3.31 – 3.50 and Appendix F. Detailed repair plans and email correspondence with the IRT regarding repair activities are provided in Appendix F.

2.2.1 Stream Stability

With the exception of the areas listed in the section above, the vast majority of WFFBR has been stable over the past monitoring year. Cross section geometry along WFFBR has remained consistent with the As-Built condition with the exception of Cross Section 2 which experienced severe erosion along the right bank during the storm event in May 2022, which led to lateral migration of the cross section. Evidence of this can be seen in Figure 4.2 and Figure 5.3. It is worth noting that Cross Section 2 was surveyed prior to the repair activities in November 2022 where the right bank was built back closer to the As-Built condition and stabilized using sod mats.

During the 200-year storm event of 2021, Cross Section 3 experienced significant erosion along the right bank that led to mass wasting and widening of the riffle. As part of the repairs that took place in February 2022, the riffle through this section was repaired and restored to dimensions consistent with As-Built survey. The right bank was stabilized using double soil lifts and the floodplain in the left overbank area was widened to alleviate stress along the right side of the channel during overbank flow events.

UT 8 has remained stable over the past monitoring year. Cross Section 7 depicts minor deposition along UT 8 as a result of the storm event in May 2022. Photo representation in Figure 4.7 (Appendix D) shows that a significant amount of gravel and debris has been deposited through Cross Section 7.

While the banks of UT 5 remain stable, a beaver dam was discovered at station 18+25 and was removed in August 2022. Despite the storm event in May 2022 the DOT stabilization materials (gravel) observed in MY1 have not progressed through the system as expected. The beaver dam that was removed after geomorph surveys were conducted may have influenced the stream's ability to move sediment through the system.

Cross sections along UT 7 remain largely unchanged over the last monitoring year. The restored reach appears stable and functioning as intended.

In addition to the beaver dam located on UT 5, two large dams on UT 2 were also identified. All dams located were broken on August 18, 2022. A beaver trapper was contracted to remove the beavers and was on site October 29 through November 6 but was unsuccessful in trapping any beaver. However, the trapper reported no active or additional beaver activity. Beaver activity will continue to be monitored and prevented from impacting creditable streams on-site.

2.2.2 Vegetation

Year 2 vegetation plot data can be found in Table 9 of Appendix C. The average density of planted stems across the site is 522 stems per acre, which exceeds Year 3 success criteria of 320 planted stems per acre. Stem density in Plot 12 remained the same between MY 1 and MY 2 monitoring and is currently not meeting Year 3 criteria due to a dense herbaceous vegetative layer outcompeting the planted bare roots. It is worth noting that Plot 12 is located in the Swamp Bog Complex planting area, and it is not uncommon for this community to be dominated by shrubby and herbaceous species. Plot 12 exhibited 100 percent herbaceous coverage dominated by species such as common rush (*Juncus effusus*), various sedges (*Carex* spp.), knotweed (*Polygonum* spp.), and golden rod (*Solidago* sp.). It was anticipated in the Mitigation Plan that this community may exhibit a lower stem density than the rest of the Site. Plot 12 will be re-assessed during Year 3 monitoring to determine if any of the missing stems can be accounted for after an additional year of growth. DRG plans to locate one of the random vegetation plots in the Swamp Bog complex during Year 3 monitoring period.

Many of the planted stems and volunteers in Vegetation Plot 3 observed during MY1 were dead as a result of flooding from the beaver dam on UT2; however, when including remaining volunteer stems, Plot 3 meets Year 3 success criteria (320 stems per acre) at 486 stems per acre. Volunteers stems of hazel alder comprise 64% of species diversity in Plot 3, mostly in the areas affected by beaver dam flooding. DRG anticipates that resprouting planted stems and volunteers will normalize the composition of Plot 3 in MY3 following the impediment of beaver activity.

Repairs were made to the floodplain along the left and right bank of West Fork French Broad River because of the damaged caused by the storm event between August 15 and 17 of 2021. In February of 2022 DRG replanted approximately 733 bareroot stems within the repaired and disturbed areas. Vegetation plot 11, one of the three random vegetation plots across the Site, was located within this area during MY2 vegetation monitoring. Results of the MY2 monitoring survey indicate that this area has a stem density of 405 stems per acre. Species and stem densities planted in February 2022 can be seen in Table 1 of the Repair Plan in Appendix F. Replanted areas are depicted in Figure 2 of the Repair Plan found in Appendix F. Temporary seed was also sown on terraced slopes and bare areas during monitoring in August 2022.

Multiflora rose (*Rosa multiflora*) and Chinese privet (*Ligustrum sinense*) were observed within the easement boundary along the floodplain of West Fork French Broad, UT1, UT2, and UT7. Multiflora rose and Chinese privet were treated using a combination of Roundup Custom © and Alligare Triclopyr 3 in August 2022. Cattail was not treated in the fall but will be treated in the spring of 2023. Invasive species will be monitored and treated as needed throughout the remainder of the monitoring period.

2.2.3 Stream Hydrology

All monitored streams have experienced continuous flow within tributaries and has been documented for at least 30 consecutive days. Stream flow gauge data indicates that each of the constructed stream

channels, with the exception of UT5, has experienced at least 2 bankfull events during the monitoring period. While flow gauge data from UT5 does not indicate any bankfull events, the data does show increased water depth following rain events; therefore, UT5 most likely reached bankfull for a short period of time between readings. Stream hydrologic data can be seen in Figures 7.1 - 7.4 (Appendix E).

2.2.4 Wetland Hydrology

Wetland W3 re-establishment and rehabilitation areas are exceeding success criteria, experiencing groundwater levels within 12 inches of the soil surface for at least 27% of the growing season, or 57 consecutive days over the Year 2 monitoring period (Figures 8.1-8.3, Appendix E). A new gauge was installed on May 2, 2022 to provide hydrologic data for areas extending beyond the delineated boundaries of W3. Gauge data indicate that ground water has remained within 12 inches of the soil surface for 69% of the growing season, or 144 consecutive days over the Year 2 monitoring period (Figure 8.4, Appendix E).

Potential wetland expansion areas were discussed during the IRT site visit in May 2022 and are depicted on the CCPV Figures in Appendix B. DRG also provided a letter to the United States Army Corps of Engineers on February 11, 2022 describing existing conditions within wetland expansion areas and a proposed monitoring strategy (Appendix H).

Gauge 4, located within the enhancement area of W5, was installed to serve as a reference for the re-establishment area of W5. Gauge 4 data shows water levels within 12 inches of the soil surface for 42% of the growing season, or 88 consecutive days during the Year 2 monitoring period (Figure 8.5, Appendix E). The re-establishment area of W5 was not meeting success criteria in Year 1. Based on soil and localized vegetation it was determined that hydrologic failure of W5 was confined to the small area where the gauge was installed. During a site visit with the NC DEQ Western Regional Supervisor in March 2022, it was agreed that the gauge in the re-establishment area (Gauge 5) would be moved outside of this localized region of W5. The IRT subsequently reviewed and approved the relocated well during their May 10, 2022 site visit. Gauge 5 data now shows groundwater levels within 12 inches of the soil surface for approximately 13% of the growing season, or 28 consecutive days over the Year 2 monitoring period (Figure 8.6, Appendix E).

3.0 Maintenance and Adaptive Management Plans

The Repair Plan in Appendix F provides the detailed strategy approved by the IRT to mend damage the Site received during the storm event in May 2022. Temporary seed was also sown on terraced slopes and bare areas during monitoring in August 2022. Repairs took place November 7-11, 2022 and re-planting of repaired areas is anticipated to take place January 2023. Areas identified as minor or moderate bank erosion were repaired by re-grading the banks and topping with sod mats harvested from dense herbaceous growth within the easement boundary. Areas identified as severe bank or toe erosion were repaired by installing approximately 185 linear feet of boulder toes, regrading banks to approximate design specifications, and topping graded soil with sod mats.

4.0 References

HDR Engineering, Inc. of the Carolinas 2020. Mitigation Plan Owen Farms Mitigation Site. Transylvania County, North Carolina. January 31, 2020.

NCDENR. Division of Mitigation Services (DMS). 2013. *Survey Requirements for Full Delivery Projects*. https://ncdenr.s3.amazonaws.com/s3fspublic/Mitigation_Services/Document_Management_Library/Guidance_and_Template_Documents/2013_08_13_FD_SurveySpecs.pdf

NCDEQ. Division of Mitigation Services (DMS). 2020. *Annual Monitoring Report Format, Data, and Content Requirements October 2020*. https://files.nc.gov/ncdeq/Mitigation%20Services/Document%20Management%20Library/Guidance%20and%20Template%20Documents/DMSMonitoringReportTemplateOct2020.pdf

North Carolina Geological Survey (NCGS), 1985. Geologic Map of North Carolina.

North Carolina Wetland Functional Assessment Team (WFAT). 2016. N.C. Wetland Assessment Method (NC WAM) User Manual, Version 5.0 (February 2016). 290 pp

North Carolina Stream Functional Assessment Team (SFAT). 2015. N. C. Stream Assessment Method (NC SAM) User Manual, Version 2.1 (August 2015). 350 pp

Rosgen, David. 1996. Applied River Morphology. Wildland Hydrology, Pagosa Springs Colorado.

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

The Applied Climate Information System (ACIS). 2022. *WETS Station: Brevard, NC*. http://agacis.rcc-acis.org/?fips=37175

US Army Corps of Engineers (USACE), North Carolina Interagency Review Team (NCIRT). 2016. *Wilmington District Stream and Wetland Compensatory Mitigation Update*.

United States Geological Survey (USGS), 1984. Lake Toxaway Quadrangle, North Carolina, 7.5 Minute Series (Topographic). Washington, D. C.

Appendix A – General Project Information

Table 1. Owen Farms Mitigation Site (DMS Project No. 100064) Project Mitigation Quantities and Credits

Project Segment	Original Mitigation Plan Ft/Ac	As-Built Ft/Ac	Original Mitigation Category	Original Restoration Level	Original Mitigation Ratio (X:1)	Credits	Comments
Stream							
West Fork French Broad River (WFFBR)*	1799.000	1799.000	Cold	R	1.00000	1,799.000	Full channel Restoration, buffer planting, livestock exclusion, permanent easement
West Fork French Broad River (WFFBR)	705.000	705.000	Cold	EII	2.50000	282.000	Bank stabilization along the left bank, buffer planting, livestock exclusion, and permanent easement
UT 1*	764.000	764.000	Cold	EII	4.00000	191.000	Buffer planting, livestock exclusion, and permanent easement
UT 2	923.000	923.000	Cold	EII	3.50000	263.714	Buffer planting, livestock exclusion, and permanent easement
UT 2A*	546.000	546.000	Cold	EII	2.50000	218.400	Buffer planting, livestock exclusion, and permanent easement
UT 2B	75.000	75.000	Cold	EII	2.50000	30.000	Buffer planting, livestock exclusion, and permanent easement
UT 3	125.000	125.000	Cold	EI	1.50000	83.333	Stabilization of channel dimension and profile, buffer planting, livestock exclusion, and permanent easement
UT 4*	809.000	809.000	Cold	EII	2.50000	323.600	Buffer planting, livestock exclusion, and permanent easement
UT 4A	472.000	472.000	Cold	EII	2.30000	205.217	Stabilization of channel dimension and profile near confluence with UT 4, buffer planting, livestock exclusion, and permanent easement
UT 4B	178.000	178.000	Cold	EII	4.00000	44.500	Buffer planting, livestock exclusion, and permanent easement
UT 5*	827.000	827.000	Cold	R	1.00000	827.000	Full channel Restoration, buffer planting, livestock exclusion, permanent easement
UT 6	114.000	114.000	Cold	P	10.00000	11.400	Preservation
UT 6A	206.000	206.000	Cold	P	10.00000	20.600	Preservation
UT 7	417.000	417.000	Cold	R	1.00000	417.000	Full channel Restoration, buffer planting, livestock exclusion, permanent easement
UT 7	439.000	439.000	Cold	EII	3.50000	125.429	Buffer planting, livestock exclusion, and permanent easement
UT 7A	103.000	103.000	Cold	P	10.00000	10.300	Preservation
UT 7B	136.000	136.000	Cold	EII	2.50000	54.400	Buffer planting, livestock exclusion, and permanent easement
UT 8	137.000	137.000	Cold	R	1.00000	137.000	Full channel Restoration near confluence with WFFBR, buffer planting, livestock exclusion, permanent easement
					Total:	**5,043.893**	
Wetland							
Wetland Group 1 (W1-W9)	1.540	1.396	R	E	2.00000	0.770	Planting, livestock exclusion, permanent easement
Wetland Group 2 (W3 and W5)	0.350	0.350	R	REE	1.00000	0.350	Raising invert of adjacent tributaries and filling abandoned channels; livestock exclusion, planting, and removal of spoil
Wetland Group 3 (W3)	0.970	0.970	R	RH	1.50000	0.647	Planting, livestock exclusion, permanent easement; restoring adjacent tributaries to increase frequency of floodwaters accessing wetland
					Total:	**1.767**	

*Length of streams flowing through utility easements or agricultural crossings has been deducted from As-Built and Original Mitigation Plan footage and credits

Project Credits

	Stream			Riparian	Non-Rip	Coastal
Restoration Level	Warm	Cool	Cold	Wetland	Wetland	Marsh
Restoration	N/A	N/A	3,180.000	N/A	N/A	N/A
Re-establishment				0.350	N/A	N/A
Rehabilitation				0.647	N/A	N/A
Enhancement				0.770	N/A	N/A
Enhancement I	N/A	N/A	83.333			
Enhancement II	N/A	N/A	1,738.260			
Creation				N/A	N/A	N/A
Preservation	N/A	N/A	42.300	N/A	N/A	
Totals	**N/A**	**N/A**	**5,043.893**	**1.767**	**N/A**	**N/A**

Total Stream Credit **5,043.893**
Total Wetland Credit **1.767**

0 Feet 1,400

PROJECT ASSET MAP

OWEN FARMS MITIGATION SITE

FIGURE 1.0

OWEN FARMS AS-BUILT REPORT

Table 2. Project Goals, Performance Criteria, and Functional Improvements

Goal	Treatment	Functional Uplift	Performance Criteria	Measurements	Monitoring Results
Restore/enhance streams within the Site so that they are neither aggrading nor degrading	Restore a stable dimension, pattern, and profile. Install fencing to exclude cattle.	Reduction of nutrients and sediment to downstream locations, reduction of shear stress, and improved hydraulic function.	Entrenchment Ratios should be ≥ 2.2. BHR should not exceed 1.2. BHR should not change more than 10% in any given monitoring interval. Riffle section W/D ratios should remain within the range of the appropriate stream type.	Cross-section monitoring and visual inspections.	Cross sectional profiles indicate aggradation of deposited material from 200 year storm event. All cross sections BHR≤1.
Provide/ enhance flood attenuation.	Restore several existing streams as primarily a Priority I restoration where bankfull and larger flows can access the floodplain. Construct floodplain bench on WFFBR.	Increase attenuation of floodwaters, increase biogeochemical cycling and recharge riparian wetlands.	Four bankfull events in separate monitoring years.	Flow gauges (Pressure transducers), and visual inspection.	All monitored reaches have experienced 2 bankfull events.
Restore/enhance aquatic, semi-aquatic, and riparian habitat.	Restore native vegetation to the stream channel banks, wetlands, and the adjacent riparian corridor.	Treatment of nutrient enriched surface runoff from adjacent pastureland, increased bank stability and increased habitat.	Minimum of 320 stems/ac present at MY-3. Minimum of 260 stems/ac present at MY-5. Minimum of 210 stems/ac present at MY-7. Trees should average 6 feet in height at MY-5 and 8 feet in height at MY-7. Bog Complex communities may exhibit lower stem density and height.	Vegetation plots will be monitored annually between July 1st and leaf fall using the CVS protocol.	19/20 plots meeting performance criteria. Plot 12 is currently not meeting MY3 standards.
Restore/Enhance Wetlands within the Site to remove hydrologic impairments	Reconstruct above bankfull stream channel flows to riparian wetlands and re-grade topography to remove spoil and overburden material.	Restoration of riparian habitat, treatment of nutrient enriched runoff from adjacent pastureland, increased flood attenuation.	Groundwater elevation within 12 inches of the ground surface for at least 12% of the growing season (April 7 - October 30).	Groundwater monitoring gauges.	All wetlands are meeting performance criteria
Restore and connect riparian habitat with adjacent natural communities.	Conservation easement establishment.	Protect Site from encroachment in conservation easement.	Prevent Easement Encroachment.	Visual inspection.	No encroachment into the conservation easement.

Table 3. Monitoring Plan Components

Parameter	Monitoring Method	Quantity	Frequency	Notes
Dimension	Riffle Cross Sections	UT5 (2) UT7 (1) UT8 (1) WFFBR (4)	Years 1, 2, 3, 5 & 7	
	Pool Cross Sections	UT5 (2) UT7 (1) UT 8 (1) WFFBR (2)	Years 1, 2, 3, 5 & 7	Bank pins may be installed in areas of concern.
Pattern	Visual	None	twice per year	Bank pins may be installed in areas of concern
Profile	Visual	None	twice per year	Additional profile measurements may be required if problems are identified during the monitoring period
Substrate	Visual	None	Annual	There should be an absence of any significant trend in the aggradational or depositional potential of the channel
Surface Water Hydrology	Flow Gage (Pressure Transducer)	UT5 (1) UT7 (1) UT8 (1) WFFBR (1)	twice per year	Measuring devices will be inspected/downloaded at each site visit to document occurrence of bankfull events and ensure device function
Groundwater Hydrology	Groundwater Gages	5 Site gauges, 2 Reference Gauges	Annual	Data will be downloaded at each site visit.
Vegetation	CVS Level 2	Vegetation plots will be placed on ~2% of the planted area (17 permanent, 10x10 meter plots; 3 random plots of equal size)	Years 1, 2, 3, 5 & 7	Vegetation will be monitored using the Carolina Vegetation Survey (CVS) protocols. GPS coordinates and orientation of random plots will be provided in the annual monitoring reports and plot locations will be depicted on the Current Condition Plan View maps.
Invasive and nuisance vegetation	Visual		twice per year	Locations of exotic and nuisance vegetation and the occurrence of beaver dams and approximate inundation limits will be mapped
Project Boundary	Visual		twice per year	Fence damage, vegetation damage, boundary encroachments, etc. will be mapped
Culverts and Crossings	Visual		Twice per year	Blockages and/or erosion around culverts and crossings will be mapped and noted in monitoring reports.

Table 4. Project Attributes

Project Attribute Table				
Project Name	Owen Farms Mitigation Site			
County	Transylvania			
Project Area (acres)	25			
Project Coordinates (latitude and longitude decimal degrees)	35.183902, -82.937970			
Project Watershed Summary Information				
Physiographic Province	Blue Ridge Mountains			
River Basin	French Broad			
USGS Hydrologic Unit 8-	06010105	USGS Hydrologic Unit 14-digit	06010105010020	
DWR Sub-basin	0601010501			
Project Drainage Area (acres)	3,795			
Project Drainage Area Percentage of Impervious Area	2			
Land Use Classification	Agricultural/Pasture			
Reach Summary Information				
Parameters	**WFFB**	**UT 4**	**UT 5**	**UT 6**
Pre-project length (feet)	1,975	731	652	114
Post-project (feet)	1,799	809	827	114
Valley confinement (Confined, moderately confined,	Unconfined	Confined	Confined	Confined
Drainage area (acres)	3,795	30.6	45.2	21.7
Perennial, Intermittent, Ephemeral	Perennial	Perennial	Perennial	Perennial
NCDWR Water Quality Classification	B; Tr	B	B	B
Dominant Stream Classification (existing)	B4	B4	B4	B4
Dominant Stream Classification (proposed)	C4	C4	C4	C4
Dominant Evolutionary class (Simon) if applicable				
Thermal Regime	**Cold**	**Cold**	**Cold**	**Cold**
Reach Summary Information Continued				
Parameters	**UT 7**	**UT 8**	**UT 1**	**UT 2**
Pre-project length (feet)	372	49	764	923
Post-project (feet)	417	137	764	923
Valley confinement (Confined, moderately confined,	Confined	Confined	Confined	Confined
Drainage area (acres)	32.1	41	19.5	18.6
Perennial, Intermittent, Ephemeral	Perennial	Perennial	Perennial	Perennial
NCDWR Water Quality Classification	B	B	B	B
Dominant Stream Classification (existing)	B4	B4	B4	B4
Dominant Stream Classification (proposed)	C4	C4	B4	B4
Dominant Evolutionary class (Simon) if applicable				
Thermal Regime	**Cold**	**Cold**	**Cold**	**Cold**
Reach Summary Information Continued				
Parameters	**UT 3**			
Pre-project length (feet)	125			
Post-project (feet)	125			
Valley confinement (Confined, moderately confined,	Confined			
Drainage area (acres)	<1			
Perennial, Intermittent, Ephemeral	Intermittent			
NCDWR Water Quality Classification	B			
Dominant Stream Classification (existing)	E4			
Dominant Stream Classification (proposed)	E4			
Dominant Evolutionary class (Simon) if applicable				
Thermal Regime	**Cold**			
Wetland Summary Information				
Parameters	**Wetland Group 1 (W1-W9)**	**Wetland Group 2 (W3 & W5)**	**Wetland Group 3 (W3)**	
Pre-project (acres)	1.54	0.35	0.97	
Post-project (acres)	1.54	0.35	0.97	
Wetland Type (non-riparian, riparian)	Riparian Riverine	Riparian Riverine	Riparian Riverine	
Mapped Soil Series	Ela	Ela	Ela	
Soil Hydric Status	A7, F3, F6	F3, F6	F3, F6	
Regulatory Considerations				
Parameters	**Applicable?**	**Resolved?**	**Supporting Docs?**	
Water of the United States - Section 404	Yes	Yes	PCN	
Water of the United States - Section 401	Yes	Yes	PCN	
Endangered Species Act	Yes	Yes	CE	
Historic Preservation Act	Yes	Yes	CE	
Coastal Zone Management Act (CZMA or CAMA)	No	N/A	N/A	
Essential Fisheries Habitat	No	N/A	N/A	

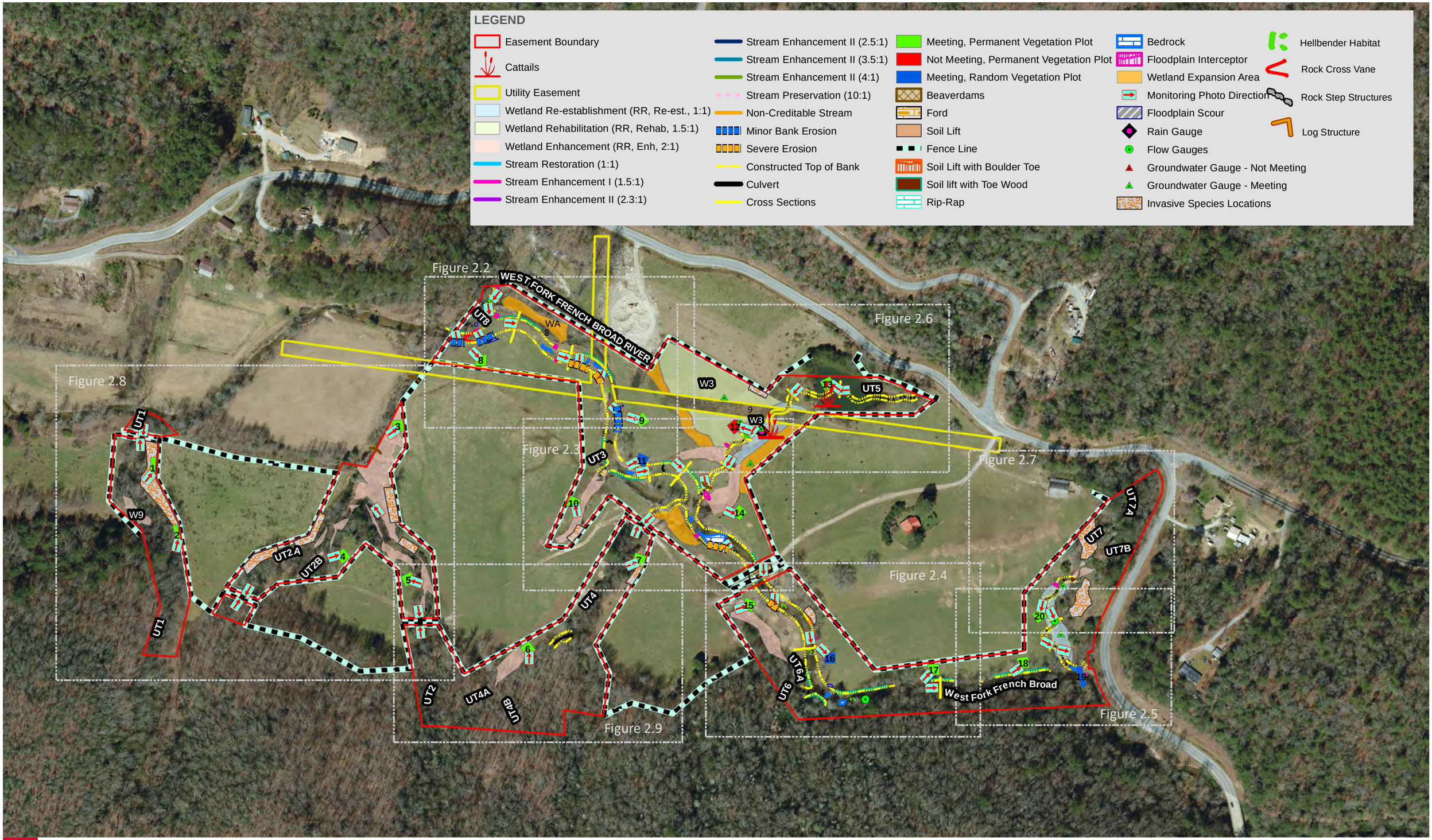
Table 5. Project Activity and Reporting History

Activity or Report	Data Collection Complete	Completion or Delivery
Mitigation Plan	Jan-20	Jan-20
Final Design – Planting and Construction Plans	Jan-20	Feb-20
Construction	---	7-Oct-20
Repair Activities Complete	---	15-Jan-21
Bare Root and Livestake Plantings for Entire Project Area	---	22-Jan-21
Mitigation Plan/As-built (Year 0 Monitoring-Baseline)	25-Feb-21	31-Mar-21
Year 1 Monitoring	29-Sep-21	
Repair Activities Complete		24-Jan-22
Year 2 Monitoring	19-Aug-22	
Invasive Species Herbicide Treatment		15-Aug-22
Repair Activities Complete		3-Feb-2022 1-Nov-2022
Year 3 Monitoring		
Year 4 Monitoring		
Year 5 Monitoring		

Table 6. Project Contacts Table

Designer Primary project design POC	HDR Engineering 555 Fayetteville Street, Suite 900 Raleigh, North Carolina 27601-3034 Vickie Miller (919) 232-6600
Construction Contractor Construction Contractor POC	Land Mechanics Design, Inc. 126 Circle G Lane Willow Spring, NC 27592 Lloyd Glover (919) 639-6132
Planting Contractor Planting Contractor POC	Land Mechanics Design, Inc. 126 Circle G Lane Willow Spring, NC 27592 Lloyd Glover (919) 639-6132
Monitoring Performers	Davey Resource Group 3101 Poplarwood Court Raleigh, North Carolina 27604
Stream Monitoring POC	Davey Resource Group 3101 Poplarwood Court Raleigh, North Carolina 27604 Alex DiGeronimo (843) 830-1536
Vegetation Monitoring POC	Davey Resource Group 3101 Poplarwood Court Raleigh, North Carolina 27604 Alex DiGeronimo (843) 830-1536

Appendix B – Visual Assessment Data

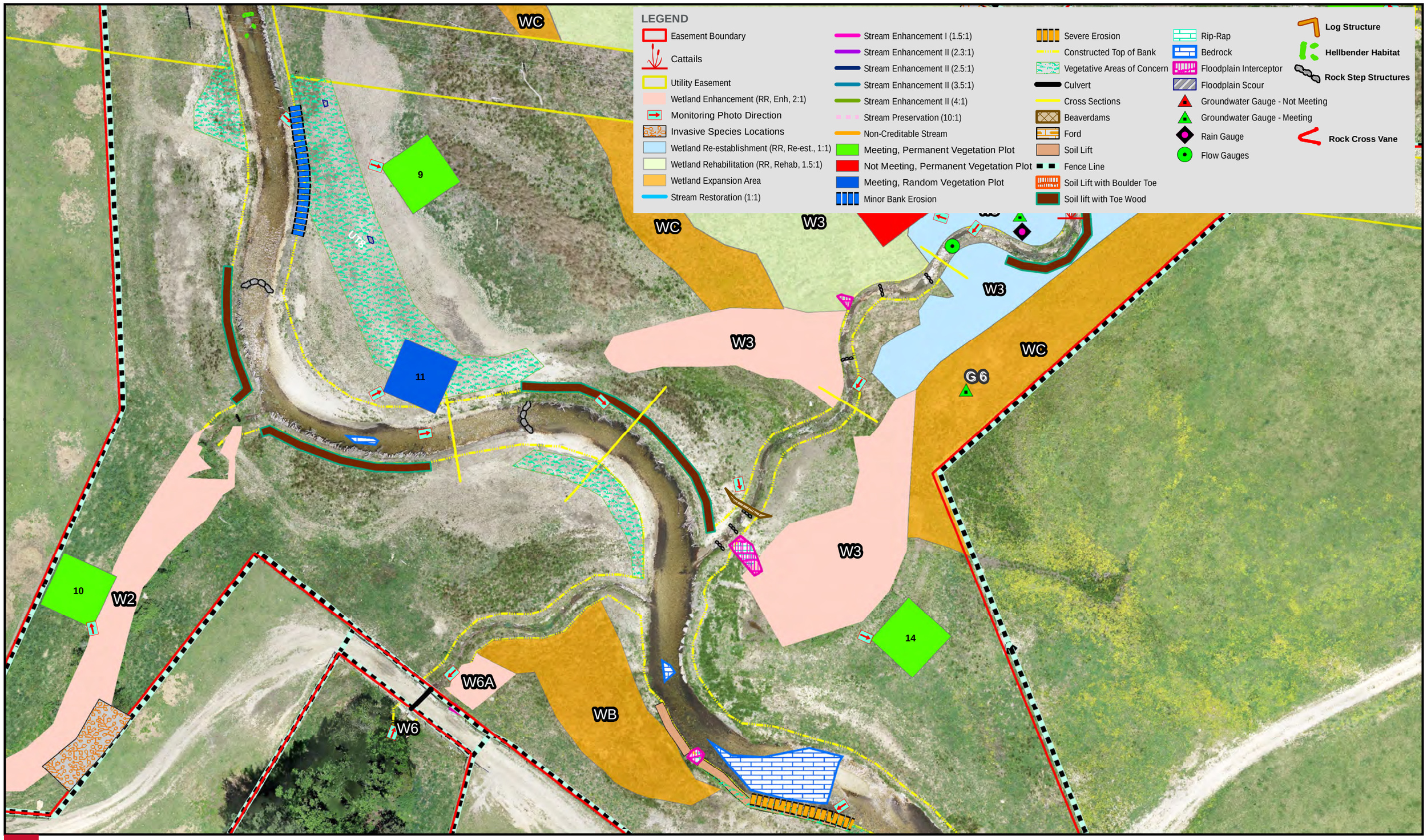


0 Feet 1,800

CURRENT CONDITIONS PLAN VIEW

OWEN FARMS MITIGATION SITE

FIGURE 2.1



0 Feet 375

CURRENT CONDITIONS PLAN VIEW

OWEN FARMS MITIGATION SITE

FIGURE 2.2

WEST FORK FRENCH BROAD RIVER

UT3
UT4
UT5
XS3
XS4
XS11
XS12
W2
W3
W6
W6A
WB
WC
G1
G6
10
11
12
14
7

LEGEND

- Easement Boundary
- Cattails
- Utility Easement
- Wetland Enhancement (RR, Enh, 2:1)
- Wetland Re-establishment (RR, Re-est., 1:1)
- Monitoring Photo Direction
- Invasive Species Locations
- Wetland Rehabilitation (RR, Rehab, 1.5:1)
- Wetland Expansion Area
- Meeting, Permanent Vegetation Plot
- Not Meeting, Permanent Vegetation Plot
- Meeting, Random Vegetation Plot
- Minor Bank Erosion
- Severe Erosion
- Groundwater Gauge - Not Meeting
- Groundwater Gauge - Meeting
- Constructed Top of Bank
- Culvert
- Vegetative_Areas_of_Concern
- Cross Sections
- Fence Line
- Beaverdams
- Ford
- Soil Lift

Streams

Approach

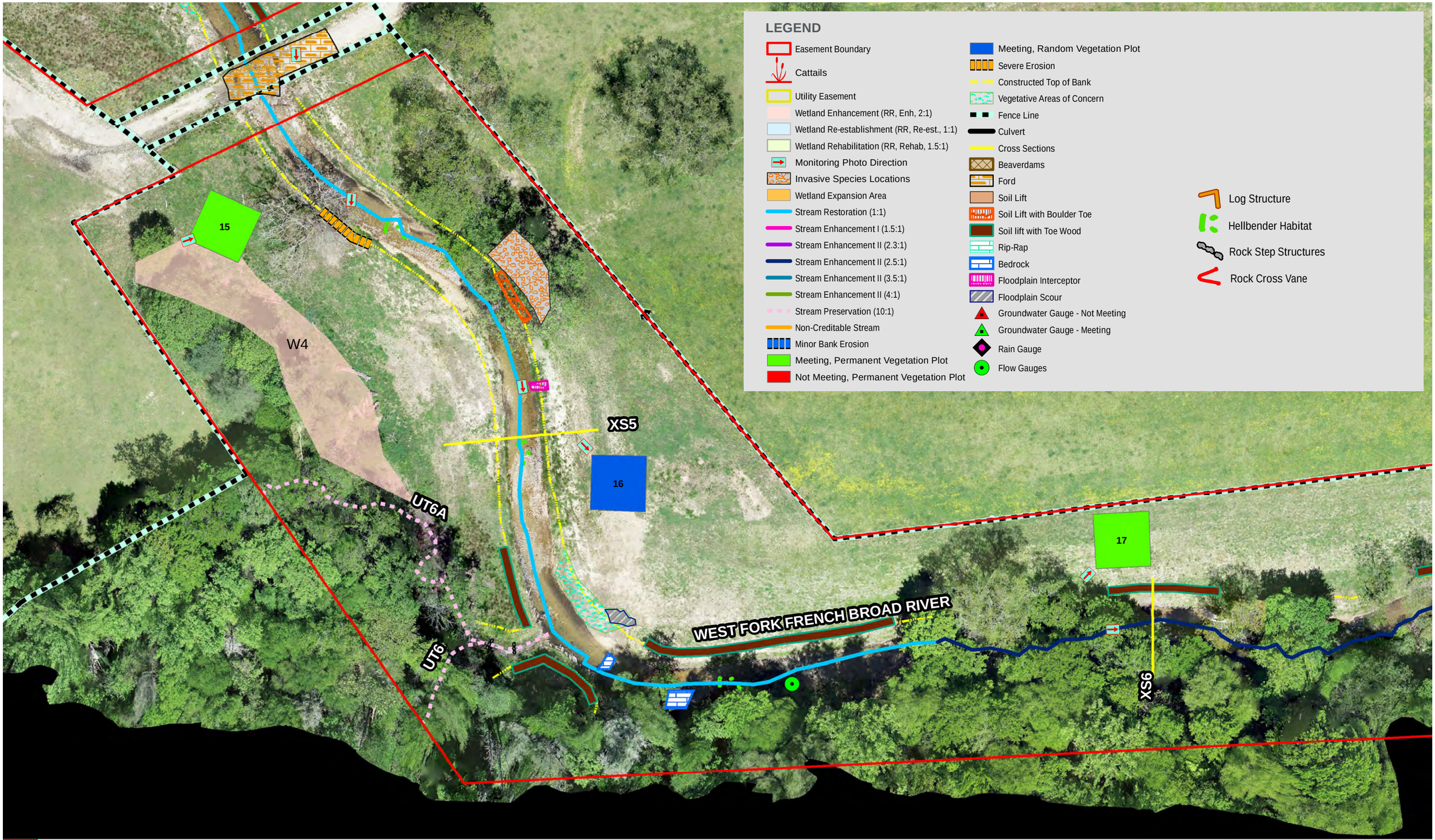
- Stream Restoration (1:1)
- Stream Enhancement I (1.5:1)
- Stream Enhancement II (2.3:1)
- Stream Enhancement II (2.5:1)
- Stream Enhancement II (3.5:1)
- Stream Enhancement II (4:1)
- Stream Preservation (10:1)
- Non-Creditable Stream
- Soil Lift with Boulder Toe
- Soil lift with Toe Wood
- Rip-Rap
- Bedrock
- Floodplain Interceptor
- Floodplain Scour
- Rain Gauge
- Flow Gauges
- Log Structure
- Hellbender Habitat
- Rock Step Structures
- Rock Cross Vane

0 Feet 375

CURRENT CONDITIONS PLAN VIEW

OWEN FARMS MITIGATION SITE

FIGURE 2.3



LEGEND

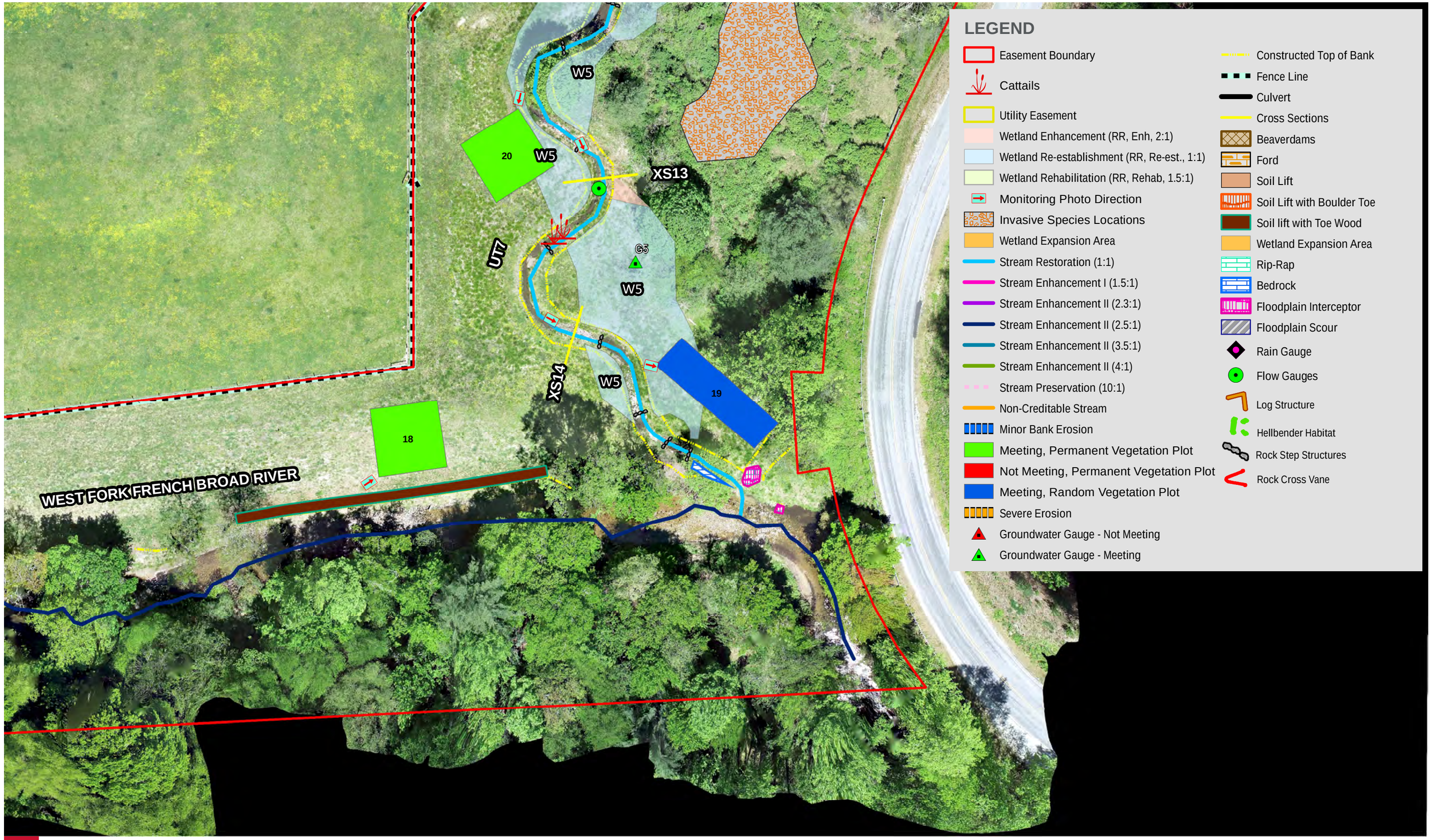
- Easement Boundary
- Cattails
- Utility Easement
- Wetland Enhancement (RR, Enh, 2:1)
- Wetland Re-establishment (RR, Re-est., 1:1)
- Wetland Rehabilitation (RR, Rehab, 1.5:1)
- Monitoring Photo Direction
- Invasive Species Locations
- Wetland Expansion Area
- Stream Restoration (1:1)
- Stream Enhancement I (1.5:1)
- Stream Enhancement II (2.3:1)
- Stream Enhancement II (2.5:1)
- Stream Enhancement II (3.5:1)
- Stream Enhancement II (4:1)
- Stream Preservation (10:1)
- Non-Creditable Stream
- Minor Bank Erosion
- Meeting, Permanent Vegetation Plot
- Not Meeting, Permanent Vegetation Plot
- Meeting, Random Vegetation Plot
- Severe Erosion
- Constructed Top of Bank
- Vegetative Areas of Concern
- Fence Line
- Culvert
- Cross Sections
- Beaverdams
- Ford
- Soil Lift
- Soil Lift with Boulder Toe
- Soil lift with Toe Wood
- Rip-Rap
- Bedrock
- Floodplain Interceptor
- Floodplain Scour
- Groundwater Gauge - Not Meeting
- Groundwater Gauge - Meeting
- Rain Gauge
- Flow Gauges
- Log Structure
- Hellbender Habitat
- Rock Step Structures
- Rock Cross Vane

0 Feet 390

CURRENT CONDITIONS PLAN VIEW

OWEN FARMS MITIGATION SITE

FIGURE 2.4



LEGEND

- Easement Boundary
- Cattails
- Utility Easement
- Wetland Enhancement (RR, Enh, 2:1)
- Wetland Re-establishment (RR, Re-est., 1:1)
- Wetland Rehabilitation (RR, Rehab, 1.5:1)
- Monitoring Photo Direction
- Invasive Species Locations
- Wetland Expansion Area
- Stream Restoration (1:1)
- Stream Enhancement I (1.5:1)
- Stream Enhancement II (2.3:1)
- Stream Enhancement II (2.5:1)
- Stream Enhancement II (3.5:1)
- Stream Enhancement II (4:1)
- Stream Preservation (10:1)
- Non-Creditable Stream
- Minor Bank Erosion
- Meeting, Permanent Vegetation Plot
- Not Meeting, Permanent Vegetation Plot
- Meeting, Random Vegetation Plot
- Severe Erosion
- Groundwater Gauge - Not Meeting
- Groundwater Gauge - Meeting
- Constructed Top of Bank
- Fence Line
- Culvert
- Cross Sections
- Beaverdams
- Ford
- Soil Lift
- Soil Lift with Boulder Toe
- Soil lift with Toe Wood
- Wetland Expansion Area
- Rip-Rap
- Bedrock
- Floodplain Interceptor
- Floodplain Scour
- Rain Gauge
- Flow Gauges
- Log Structure
- Hellbender Habitat
- Rock Step Structures
- Rock Cross Vane

0 Feet 310

CURRENT CONDITIONS PLAN VIEW

OWEN FARMS MITIGATION SITE

FIGURE 2.5

LEGEND

- Easement Boundary
- Cattails
- Utility Easement
- Wetland Enhancement (RR, Enh, 2:1)
- Wetland Re-establishment (RR, Re-est., 1:1)
- Monitoring Photo Direction
- Invasive Species Locations
- Wetland Rehabilitation (RR, Rehab, 1.5:1)
- Wetland Expansion Area
- Minor Bank Erosion
- Meeting, Permanent Vegetation Plot
- Not Meeting, Permanent Vegetation Plot
- Meeting, Random Vegetation Plot
- Severe Erosion
- Groundwater Gauge - Not Meeting
- Groundwater Gauge - Meeting
- Constructed Top of Bank
- Culvert
- Cross Sections
- Beaverdams
- Fence Line
- Ford
- Soil Lift

Streams

Approach

- Stream Restoration (1:1)
- Stream Enhancement I (1.5:1)
- Stream Enhancement II (2.3:1)
- Stream Enhancement II (2.5:1)
- Stream Enhancement II (3.5:1)
- Stream Enhancement II (4:1)
- Stream Preservation (10:1)
- Non-Creditable Stream
- Soil Lift with Boulder Toe
- Soil lift with Toe Wood
- Log Structure
- Rip-Rap
- Bedrock
- Floodplain Interceptor
- Floodplain Scour
- Rain Gauge
- Flow Gauges
- Hellbender Habitat
- Rock Step Structures
- Rock Cross Vane

W3 W3 W3 W3 W3 W3 W3 WC WC

12 13

G1 G2 G3 G6

XS4 XS9 XS10 XS11 XS12 UT5

0 Feet 375

CURRENT CONDITIONS PLAN VIEW

OWEN FARMS MITIGATION SITE

FIGURE 2.6

LEGEND

- Cattails
- Easement Boundary
- Utility Easement
- Wetland Enhancement (RR, Enh, 2:1)
- Monitoring Photo Direction
- Invasive Species Locations
- Wetland Re-establishment (RR, Re-est., 1:1)
- Wetland Rehabilitation (RR, Rehab, 1.5:1)
- Wetland Expansion Area
- Meeting, Permanent Vegetation Plot
- Not Meeting, Permanent Vegetation Plot
- Meeting, Random Vegetation Plot
- Groundwater Gauge - Not Meeting
- Groundwater Gauge - Meeting
- Minor Bank Erosion
- Severe Erosion
- Constructed Top of Bank
- Fence Line
- Culvert
- Cross Sections
- Beaverdams
- Ford

Streams

Approach

- Stream Restoration (1:1)
- Stream Enhancement I (1.5:1)
- Stream Enhancement II (2.3:1)
- Stream Enhancement II (2.5:1)
- Stream Enhancement II (3.5:1)
- Stream Enhancement II (4:1)
- Stream Preservation (10:1)
- Non-Creditable Stream
- Soil Lift
- Soil Lift with Boulder Toe
- Soil lift with Toe Wood
- Rip-Rap
- Bedrock
- Wetland Expansion Area
- Floodplain Interceptor
- Floodplain Scour
- Rain Gauge
- Flow Gauges
- Log Structure
- Hellbender Habitat
- Rock Step Structures
- Rock Cross Vane

FENCE LINE TIES INTO EXISTING FENCING
UT7A
UT7
UT7B
W5
UT7
W5
G4
W5
W5
W5
20
W5B
W5

0 Feet 375

CURRENT CONDITIONS PLAN VIEW

OWEN FARMS MITIGATION SITE

FIGURE 2.7

LEGEND

- Cattails
- Easement Boundary
- Utility Easement
- Wetland Enhancement (RR, Enh, 2:1)
- Monitoring Photo Direction
- Invasive Species Locations
- Wetland Re-establishment (RR, Re-est., 1:1)
- Wetland Rehabilitation (RR, Rehab, 1.5:1)
- Wetland Expansion Area
- Meeting, Permanent Vegetation Plot
- Not Meeting, Permanent Vegetation Plot
- Meeting, Random Vegetation Plot
- Groundwater Gauge - Not Meeting
- Groundwater Gauge - Meeting
- Minor Bank Erosion
- Severe Erosion
- Constructed Top of Bank
- Fence Line
- Culvert
- Cross Sections
- Beaverdams
- Ford
- Soil Lift
- Soil Lift with Boulder Toe

Streams

Approach

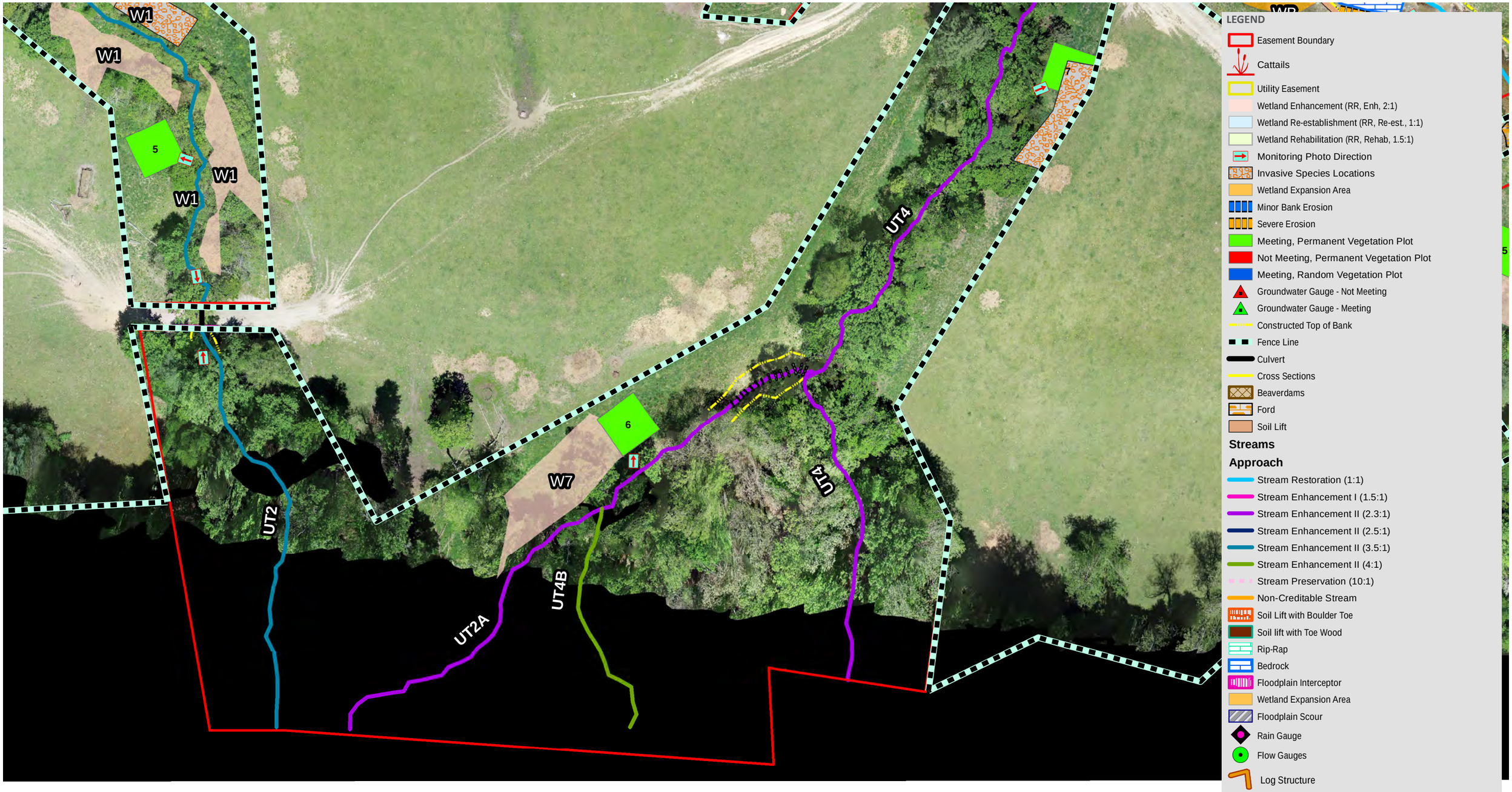
- Stream Restoration (1:1)
- Stream Enhancement I (1.5:1)
- Stream Enhancement II (2.3:1)
- Stream Enhancement II (2.5:1)
- Stream Enhancement II (3.5:1)
- Stream Enhancement II (4:1)
- Stream Preservation (10:1)
- Non-Creditable Stream
- Soil lift with Toe Wood
- Rip-Rap
- Bedrock
- Wetland Expansion Area
- Floodplain Scour
- Rain Gauge
- Flow Gauges
- Log Structure
- Hellbender Habitat
- Rock Step Structures
- Rock Cross Vane

0 Feet 630

CURRENT CONDITIONS PLAN VIEW

OWEN FARMS MITIGATION SITE

FIGURE 2.8



LEGEND

- Easement Boundary
- Cattails
- Utility Easement
- Wetland Enhancement (RR, Enh, 2:1)
- Wetland Re-establishment (RR, Re-est., 1:1)
- Wetland Rehabilitation (RR, Rehab, 1.5:1)
- Monitoring Photo Direction
- Invasive Species Locations
- Wetland Expansion Area
- Minor Bank Erosion
- Severe Erosion
- Meeting, Permanent Vegetation Plot
- Not Meeting, Permanent Vegetation Plot
- Meeting, Random Vegetation Plot
- Groundwater Gauge - Not Meeting
- Groundwater Gauge - Meeting
- Constructed Top of Bank
- Fence Line
- Culvert
- Cross Sections
- Beaverdams
- Ford
- Soil Lift

Streams

Approach

- Stream Restoration (1:1)
- Stream Enhancement I (1.5:1)
- Stream Enhancement II (2.3:1)
- Stream Enhancement II (2.5:1)
- Stream Enhancement II (3.5:1)
- Stream Enhancement II (4:1)
- Stream Preservation (10:1)
- Non-Creditable Stream
- Soil Lift with Boulder Toe
- Soil lift with Toe Wood
- Rip-Rap
- Bedrock
- Floodplain Interceptor
- Wetland Expansion Area
- Floodplain Scour
- Rain Gauge
- Flow Gauges
- Log Structure
- Hellbender Habitat
- Rock Step Structures
- Rock Cross Vane

0 Feet 500

CURRENT CONDITIONS PLAN VIEW

OWEN FARMS MITIGATION SITE

FIGURE 2.9

Table 7.1 Visual Stream Stability Assessment

Reach	WFFB
Assessed Stream Length	1799
Assessed Bank Length	3598
Date Assessed:	8/16/2022

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			170	95%
	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.			185	95%
	Bank Failure	Fluvial and geotechnical - rotational, slumping, calving, or collapse			0	100%
				Totals	355	90%
Structure	**Grade Control**	Grade control structures exhibiting maintenance of grade across the sill.	16	16		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)	16	16		100%

Table 7.2 Visual Stream Stability Assessment

Reach	UT4
Assessed Stream Length	809
Assessed Bank Length Date	1618
Assessed	8/16/2022

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 across the sill.	14	14		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)	14	14		100%

Table 7.3 Visual Stream Stability Assessment

Reach	UT5
Assessed Stream Length	827
Assessed Bank Length Date	1654
Assessed	8/16/2022

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 across the sill.	23	23		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)	23	23		100%

Table 7.4 Visual Stream Stability Assessment

Reach	UT6
Assessed Stream Length	114
Assessed Bank Length Date	228
Assessed	8/16/2022

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 across the sill.	2	2		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)	2	2		100%

Table 7.5 Visual Stream Stability Assessment

Reach	UT7
Assessed Stream Length	417
Assessed Bank Length	834
Date Assessed	8/16/2022

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 across the sill.	10	10		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)	10	10		100%

Table 7.6 Visual Stream Stability Assessment

Reach	UT8
Assessed Stream Length	137
Assessed Bank Length	274
Date Assessed	8/16/2022

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 across the sill.	3	3		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)	3	3		100%

Table 8. Visual Vegetation Condition Assessment

Visual Vegetation Assessment

Planted acreage **14.26**
Data Assessed **8/16/2022**

Vegetation Category	Definitions	Mapping Threshold	Combined Acreage	% of Planted Acreage
Bare Areas	Very limited cover of both woody and herbaceous material.	0.10 acres	0.00	0.0%
Low Stem Density Areas	Woody stem densities clearly below target levels based on current MY stem count criteria.	0.10acres	0.10	0.7%
		Total	0.10	0.7%
Areas of Poor Growth Rates	Planted areas where average height is not meeting current MY Performance Standard.	0.10 acres	0.40	2.8%
		Cumulative Total	0.50	3.5%

Easement Acreage **25.0**

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.	0.10 acres	0.68	2.8%
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 as will need to be addressed regardless of impact area.	0	0.00	

Appendix C – Vegetation Plot Data

Table 9. Vegetation Plot Data

Planted Acreage	14.26
Date of Initial Plant	2021-01-22
Date(s) of Supplemental Plant(s)	2022-02-03
Date(s) Mowing	#N/A
Date of Current Survey	2022-08-16
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 6 F		Veg Plot 7 F		Veg Plot 8 F		Veg Plot 9 F		Veg Plot 10 F		Veg Plot 12 F		Veg Plot 13 F		Veg Plot 14 F		Veg Plot 15 F		Veg Plot 17 F		Veg Plot 18 F		Veg Plot 20 F		Veg Plot 11 R	Veg Plot 16 R	Veg Plot 19 R
					Planted	Total	Planted	Total	Planted	Total	Planted	Total	Planted	Total	Planted	Total	Planted	Total	Planted	Total	Planted	Total	Planted	Total	Planted	Total	Planted	Total	Planted	Total	Planted	Total	Planted	Total	Planted	Total	Planted	Total	Total	Total	Total
Species Included in Approved Mitigation Plan	Alnus serrulata	hazel alder	Tree	OBL						9																				1										
	Aronia arbutifolia	red chokeberry	Shrub	FACW																					1	1														
	Betula alleghaniensis	yellow birch	Tree	FAC	1	1			1	1													1	1			2	2	1	1									1	
	Betula lenta	sweet birch	Tree	FACU																							2	2												
	Betula nigra	river birch	Tree	FACW	3	3	2	2	1	1							1	1	3	3		3					6	6	1	1	3	3	1	1	2	2			5	3	3
	Carya cordiformis	bitternut hickory	Tree	FACU															1	1	1	1							4	5			2	2					1	
	Carya ovata	shagbark hickory	Tree	FACU		1					1	1										1							1	1	4	4			1	1			4		
	Cephalanthus occidentalis	common buttonbush	Shrub	OBL																					1	1		1												
	Cornus amomum	silky dogwood	Shrub	FACW																									1	1										
	Cornus florida	flowering dogwood	Tree	FACU															2	2		1											4	4	1	1				
	Hamamelis virginiana	American witchhazel	Tree	FACU			3	3			2	2	1	1	4	4	1	1					3	3				1												
	Lindera benzoin	northern spicebush	Tree	FAC																					3	3														
	Liriodendron tulipifera	tuliptree	Tree	FACU	2	2	3	4	1	1	3	3	3	3	1	1	1	1	1	3	1	4	2	2			2	2	4	5	1	1	1	1	4	5			2	3	6
	Platanus occidentalis	American sycamore	Tree	FACW	3	3	1	1					6	6	5	5	4	5	4	4	1	1	2	2					1	1	6	6	2	2	4	4	4	4	5	3	2
	Quercus alba	white oak	Tree	FACU	1	1	1	1	1	1	2	4	4	4	6	6	2	2					7	7			5	5									5	5			
	Sambucus canadensis	American black elderberry	Tree	*FACW*																						1														
	Ulmus americana	American elm	Tree	FACW			3	3	1	1																					2	2					1	1	
Sum	Performance Standard				10	11	13	14	5	14	8	10	14	14	16	16	9	10	11	13	3	11	15	15	5	6	17	19	13	15	16	17	10	10	12	13	10	10	16	11	11
Post Mitigation Plan Species	*Acer rubrum*	*red maple*	*Tree*	*FAC*		*1*																																		
	Ilex opaca	*American holly*	*Tree*	*FACU*		*1*																																		
	Sassafras sp.							*1*																																
Sum	Proposed Standard				10	11	13	14	5	14	8	10	14	14	16	16	9	10	11	13	3	11	15	15	5	6	17	19	13	15	16	17	10	10	12	13	10	10	16	11	11
Mitigation Plan Performance Standard	Current Year Stem Count					13		14		14		10		14		16		10		13		11		15		6		19		15		17		10		13		10	16	11	11
	Stems/Acre					526		567		486		405		567		648		405		526		445		607		243		769		607		688		405		526		405	648	445	405
	Species Count					8		6		6		4		4		4		5		5		6		5		4		7		7		6		5		5		3	4	5	3
	Dominant Species Composition (%)					23		27		64		40		43		38		50		31		36		47		50		32		33		35		40		38		50	31	27	55
	Average Plot Height (ft.)					2		2		2		4		5		4		6		3		2		3		2		2		3		3		2		2		3	1	3	2
	% Invasives					0		0		0		0		0		0		0		0		0		0		0		0		0		0		0		0		0	0	0	0
Post Mitigation Plan Performance Standard	Current Year Stem Count					11		14		14		10		14		16		10		13		11		15		6		19		15		17		10		13		10	16	11	11
	Stems/Acre					445		567		486		405		567		648		405		526		445		607		243		769		607		688		405		526		405	648	445	405
	Species Count					6		6		6		4		4		4		5		5		6		5		4		7		7		6		5		5		3	4	5	3
	Dominant Species Composition (%)					23		27		64		40		43		38		50		31		36		47		50		32		33		35		40		38		50	31	27	55
	Average Plot Height (ft.)					2		2		2		4		5		4		6		3		2		3		2		2		3		3		2		2		3	1	3	2
	% Invasives					0		0		0		0		0		0		0		0		0		0		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.

Meeting Success Criteria
Not Meeting Success Criteria

Table 10 Vegetation Performance Standards Summary Table

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												
Monitoring Year 2	526		8	0	607		6	0	486		6	0
Monitoring Year 1	526		7	0	567		6	7	1012		7	0
Monitoring Year 0	526		6	0	526		6	0	445		5	0
	Veg Plot 4 F				Veg Plot 5 F				Veg Plot 6 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												
Monitoring Year 2	405		4	0	567		4	0	648		4	0
Monitoring Year 1	445		5	0	607		4	0	648		4	0
Monitoring Year 0	445		5	0	607		4	0	648		4	0
	Veg Plot 7 F				Veg Plot 8 F				Veg Plot 9 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												
Monitoring Year 2	405		5	0	526		5	0	445		6	0
Monitoring Year 1	445		6	0	688		6	0	607		6	0
Monitoring Year 0	445		6	0	648		6	0	607		6	0
	Veg Plot 10 F				Veg Plot 12 F				Veg Plot 13 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												
Monitoring Year 2	607		5	0	243		4	0	769		7	0
Monitoring Year 1	607		5	0	243		4	0	648		5	0
Monitoring Year 0	607		5	0	243		4	0	769		5	0
	Veg Plot 14 F				Veg Plot 15 F				Veg Plot 17 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												
Monitoring Year 2	607		7	0	688		6	0	405		5	0
Monitoring Year 1	567		7	0	688		5	0	526		5	0
Monitoring Year 0	850		8	0	769		5	0	526		5	0
	Veg Plot 18 F				Veg Plot 20 F				Veg Plot Group 11 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												
Monitoring Year 2	526		5	0	405		3	0	648		4	0
Monitoring Year 1	567		5	0	445		3	0				
Monitoring Year 0	648		5	0	648		4	0				
	Veg Plot Group 16 R				Veg Plot Group 19 R							
	Stems/Ac.	Av. Ht. (ft)	# Species	% Invasives	Stems/Ac.	Av. Ht. (ft)	# Species	% Invasives				
Monitoring Year 7												
Monitoring Year 5												
Monitoring Year 3												
Monitoring Year 2	445		5	0	405		3	0				
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.

Figures 3.1 – 3.50: Vegetation Plot Photographs and Site Aerial Photographs

3.1 Vegetation Plot 1 : 8/16/2022

3.2 Vegetation Plot 2 : 8/16/2022

3.3 Vegetation Plot 3 : 8/16/2022

3.4 Vegetation Plot 4 : 8/16/2022

3.5 Vegetation Plot 5 : 8/16/2022

3.6 Vegetation Plot 6 : 8/16/2022

Figures 3.1 – 3.50: Vegetation Plot Photographs and Site Aerial Photographs

3.7 Vegetation Plot 7 : 8/16/2022

3.8 Vegetation Plot 8 : 8/16/2022

3.9 Vegetation Plot 9: 8/16/2022

3.10 Vegetation Plot 10 : 8/16/2022

3.11 Vegetation Plot 11 : 8/16/2022

3.12 Vegetation Plot 12 : 8/16/2022

Figures 3.1 – 3.50: Vegetation Plot Photographs and Site Aerial Photographs

3.13 Vegetation Plot 13 : 8/16/2022

3.14 Vegetation Plot 14 : 3/16/2022

3.15 Vegetation Plot 15 : 8/16/2022

3.16 Vegetation Plot 16 : 8/16/2022

3.17 Vegetation Plot 17 : 8/16/2022

3.18 Vegetation Plot 18 : 8/16/2022

Figures 3.1 – 3.50: Vegetation Plot Photographs and Site Aerial Photographs

3.19 Vegetation Plot 19 : 8/16/2022

3.20 Vegetation Plot 20 : 8/16/2022

3.21 Aerial overview of West Fork French Broad River looking downstream, 5/10/2022

3.22 Aerial overview of the of UT8 and West Fork French Broad River confluence, 5/10/2022

3.23 Aerial overview of UT3 and West Fork French Broad River confluence, 5/10/2022

3.24 Aerial overview of UT4, UT5 and West Fork French Broad River confluence, 5/10/2022

Figures 3.1 – 3.54: Vegetation Plot Photographs and Site Aerial Photographs

3.25 Aerial overview of the UT7 West Fork French Broad River confluence, 5/10/2022

3.26 Aerial overview of UT5 looking downstream, 5/10/2022

3.27 UT1 Culvert looking downstream, 8/15/2022

3.28 UT1 Culvert looking upsream, 8/15/2022

3.29 UT2A Culvert looking downstream, 8/15/2022

3.30 UT2A Culvert looking uptream, 8/15/2022

Figures 3.1 – 3.54: Vegetation Plot Photographs and Site Aerial Photographs

3.31 UT2 Culvert looking downstream, 8/15/2022

3.32 UT2 Culvert looking upstream, 1/20/2023

3.33 UT4 Culvert looking downstream, 8/15/2022

3.34 UT4 Culvert looking upstream, 1/20/2023

3.35 Repaired fence at ford crossing of West Fork French Borad River, 8/17/2022

3.36 Beaver dam on non-creditable portion of UT2, 5/10/2022

Figures 3.1 – 3.54: Vegetation Plot Photographs and Site Aerial Photographs

3.37 Beaver dam on UT5 at STA 18+75, 8/17/2022

3.38 Floodplain scour repair at right overbank near STA 12+50, 2/1/2022

3.39 Repaired left bank near XS 3 WFFBR, 2/1/2022

3.40 Repaired right bank using double soil lifts at XS 3 WFFBR, 2/1/2022

3.41 Expanded left floodplain near STA 17+00 WFFBR, 2/1/2022

3.42 Repaired left floodplain scour at STA 28 +00 WFFBR, 2/1/2022

Figures 3.1 – 3.54: Vegetation Plot Photographs and Site Aerial Photographs

3.43 Bank erosion from STA 10+00 to STA 10+40 WFFBR, 8/15/2022

3.44 Bank erosion repair using sod mats from STA 10+00 to STA 10+40 WFFBR, 11/11/2022

3.45 Bank erosion at STA 10+70 to 11+25 WFFBR, 8/15/2022

3.46 Bank erosion repair using sod mats from STA 10+70 to STA 11+25 WFFBR, 11/11/2022

3.47 Bank Erosion between STA 13+90 and STA 14+50 WFFBR, 8/15/2022

3.48 Bank erosion repair using sod mats from STA 13+90 to STA 14+50 WFFBR, 11/11/2022

Figures 3.1 – 3.54: Vegetation Plot Photographs and Site Aerial Photographs

3.49 Bank erosion between STA 16+10 and STA 16+75 WFFBR, 8/15/2022

3.50 Bank erosion repair using sod mats from STA 16+10 to STA 16+75 WFFBR, 11/11/2022

3.51 Toe erosion between STA 22+35 and STA 22+95 WFFBR, 8/15/2022

3.52 Toe erosion repair using boulder toe and sod mats from STA 22+35 to STA 22+95 WFFBR, 11/11/2022

3.53 Toe erosion between STA 25+15 and STA 25+50 WFFBR, 8/15/2022

3.54 Toe erosion repair using boulder toe and sod mats from STA 25+15 to STA 25+50 WFFBR, 11/11/2022

Figures 3.1 – 3.54: Vegetation Plot Photographs and Site Aerial Photographs

3.54 UT2 Single thread channel, 1/20/2022

Appendix D – Stream Geomorphology Data

Figures 4.1 – 4.14 Cross Section Photos

4.1 West Fork French Broad Cross Section 1: 8/18/2022

4.2 West Fork French Broad Cross Section 2: 8/18/2022

4.3 West Fork French Broad Cross Section 3: 8/18/2022

4.4 West Fork French Broad Cross Section 4: 8/18/2022

4.5 West Fork French Broad Cross Section 5: 8/18/2022

4.6 West Fork French Broad Cross Section 6: 8/18/2022

4.7 UT 8 Cross Section 7: 8/18/2022

4.8 UT 8 Cross Section 8: 8/18/2022

4.9 UT 5 Cross Section 9: 8/18/2022

4.10 UT 5 Cross Section 10: 8/18/2022

4.11 UT 5 Cross Section 11: 8/18/2022

4.12 UT 5 Cross Section 12: 8/18/2022

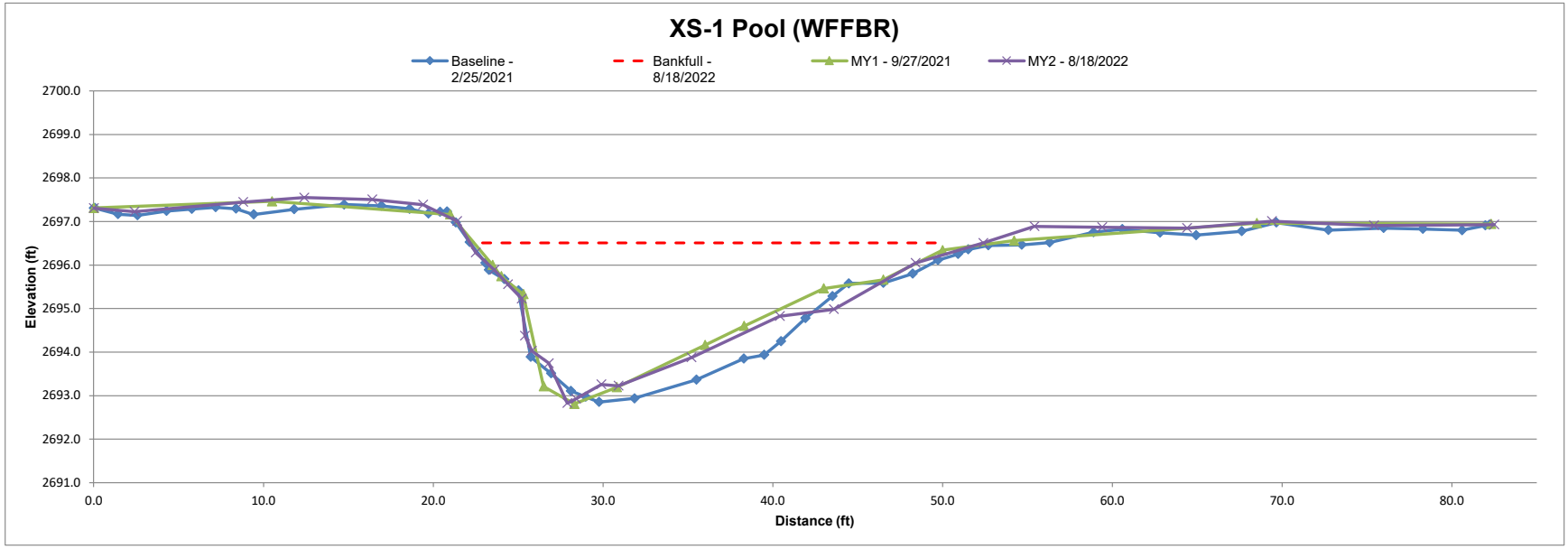
4.13 UT 7 Cross Section 13: 8/18/2022

4.14 UT 7 Cross Section 14: 8/18/2022

Figures 5.1 – 5.14 Monitoring Cross Section Plots

Figure 5.1 Cross Section 1

River Basin	French Broad
Watershed	06010105010020
XS ID	XS 1 (WFFBR)
Drainage Area (Acres)	3,795
Date	8/18/2022
Field Crew	MAF, WDB

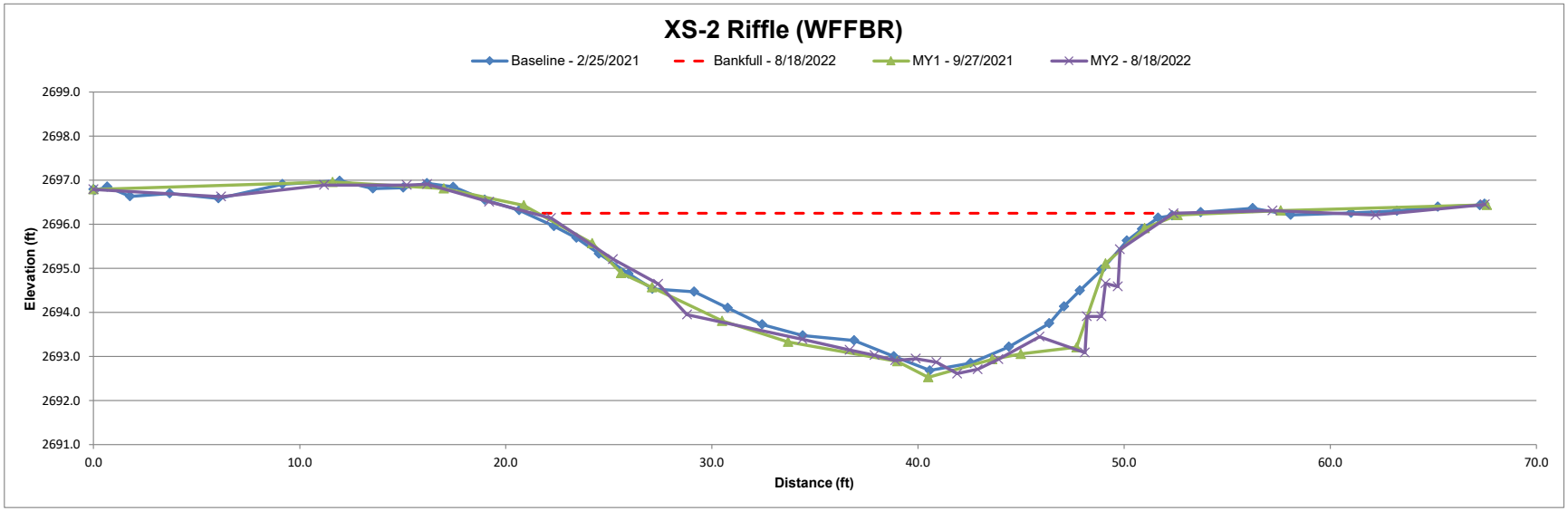


Bankfull elevation adjusted to current monitoring year's low top of bank elevation

	Cross Section 1 (Pool)					
Dimensions	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**
Bankfull Elevation (ft) - Based on As Built-Bankfull Area	--	--	--			
Bank Height Ratio	--	--	--			
Thalweg Elevation	2692.85	2692.81	2692.83			
Low Top Of Bank Elevation	2696.45	2696.34	2696.51			
Low Top of Bank Max Depth (ft)	3.60	3.53	3.68			
Low Top Of Bank Cross Sectional Area (ft^2)	58.72	46.68	54.47			

Figure 5.2 Cross Section 2

River Basin	French Broad
Watershed	06010105010020
XS ID	XS 2 (WFFBR)
Drainage Area (Acres)	3,795
Date	8/18/2022
Field Crew	MAF, WDB

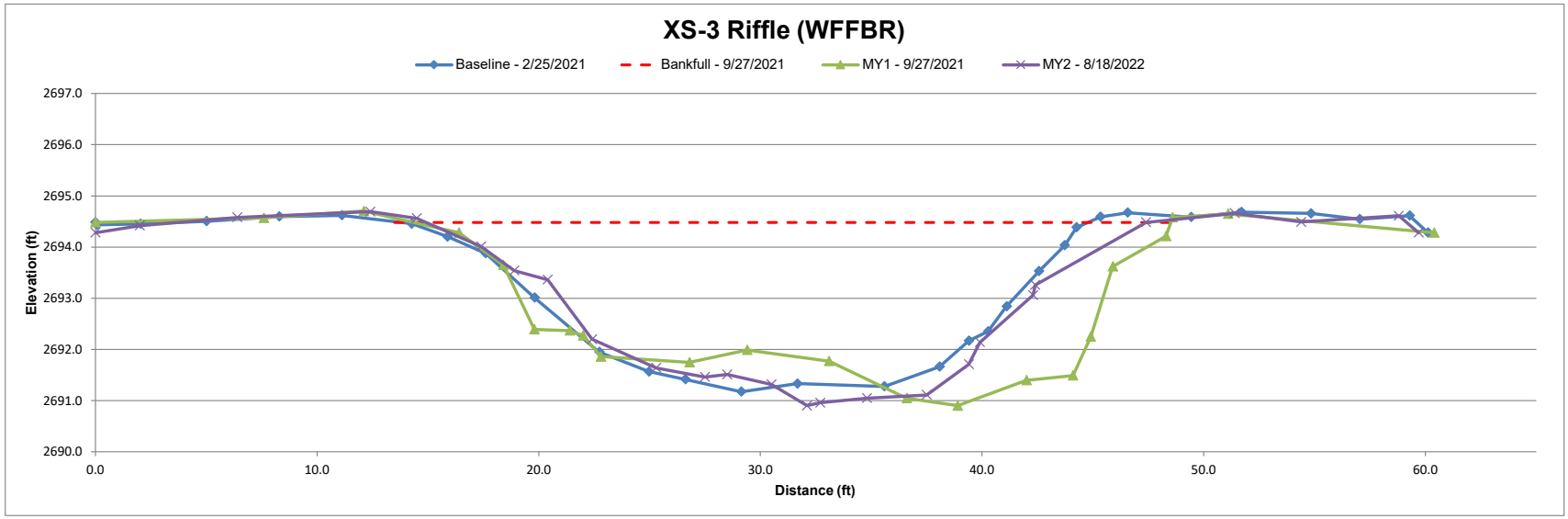


Bankfull elevation adjusted to current monitoring year's low top of bank elevation

	Cross Section 2 (Riffle)					
Dimensions	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**
Bankfull Elevation (ft) - Based on As Built-Bankfull Area	2696.15	2695.96	2696.25			
Bank Height Ratio	1.00	1.07	1.00			
Thalweg Elevation	2692.68	2692.53	2692.61			
Low Top Of Bank Elevation	2696.15	2696.21	2696.25			
Low Top of Bank Max Depth (ft)	3.47	3.68	3.54			
Low Top Of Bank Cross Sectional Area (ft^2)	61.32	69.39	70.16			

Figure 5.3 Cross Section 3

River Basin	French Broad
Watershed	06010105010020
XS ID	XS 3 (WFFBR)
Drainage Area (Acres)	3,795
Date	8/18/2022
Field Crew	MAF, WDB

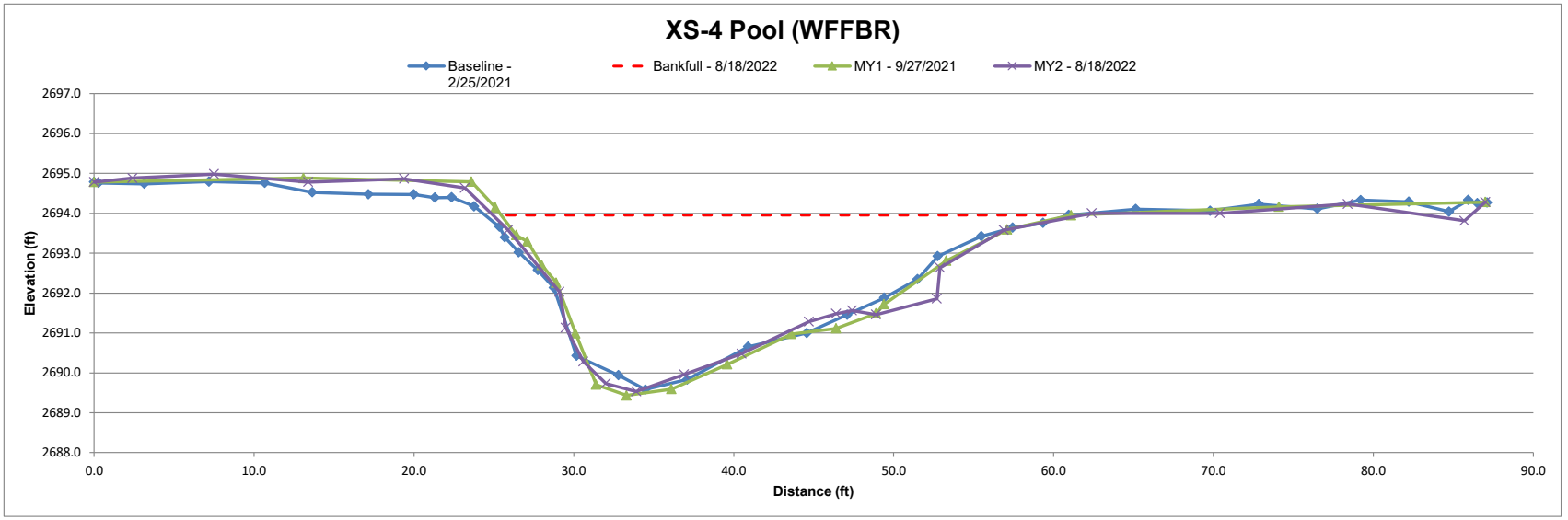


Bankfull elevation adjusted to current monitoring year's low top of bank elevation

	Cross Section 3 (Riffle)					
Dimensions	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**
Bankfull Elevation (ft) - Based on As Built-Bankfull Area	2694.46	2694.11	2694.48			
Bank Height Ratio	1.00	1.15	1.00			
Thalweg Elevation	2691.17	2690.90	2690.90			
Low Top Of Bank Elevation	2694.46	2694.58	2694.48			
Low Top of Bank Max Depth (ft)	3.29	3.68	3.58			
Low Top Of Bank Cross Sectional Area (ft^2)	65.45	80.97	68.38			

Figure 5.4 Cross Section 4

River Basin	French Broad
Watershed	06010105010020
XS ID	XS 4 (WFFBR)
Drainage Area (Acres)	3,795
Date	8/18/2022
Field Crew	MAF, WDB

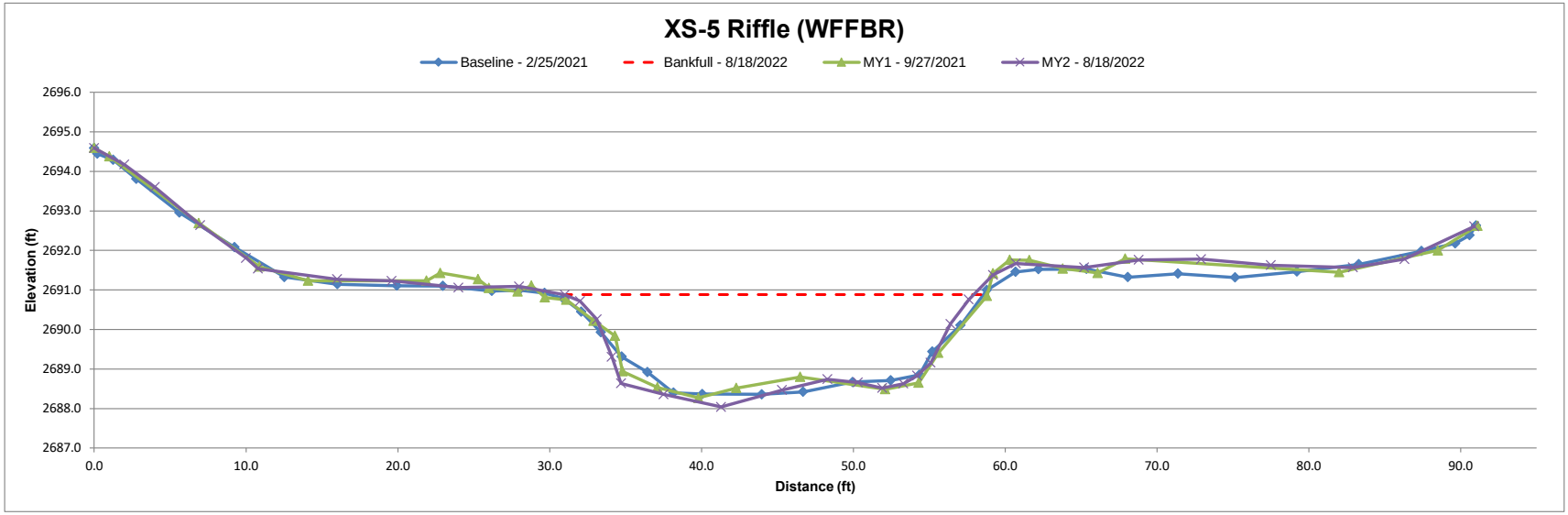


Bankfull elevation adjusted to current monitoring year's low top of bank elevation

	Cross Section 4 (Pool)					
Dimensions	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**
Bankfull Elevation (ft) - Based on As Built-Bankfull Area	--	--	--			
Bank Height Ratio	--	--	--			
Thalweg Elevation	2689.58	2689.43	2689.53			
Low Top Of Bank Elevation	2693.64	2693.95	2693.95			
Low Top of Bank Max Depth (ft)	4.06	4.52	4.42			
Low Top Of Bank Cross Sectional Area (ft^2)	71.83	84.77	84.93			

Figure 5.5 Cross Section 5

River Basin	French Broad
Watershed	06010105010020
XS ID	XS 5 (WFFBR)
Drainage Area (Acres)	3,795
Date	8/18/2022
Field Crew	MAF, WDB

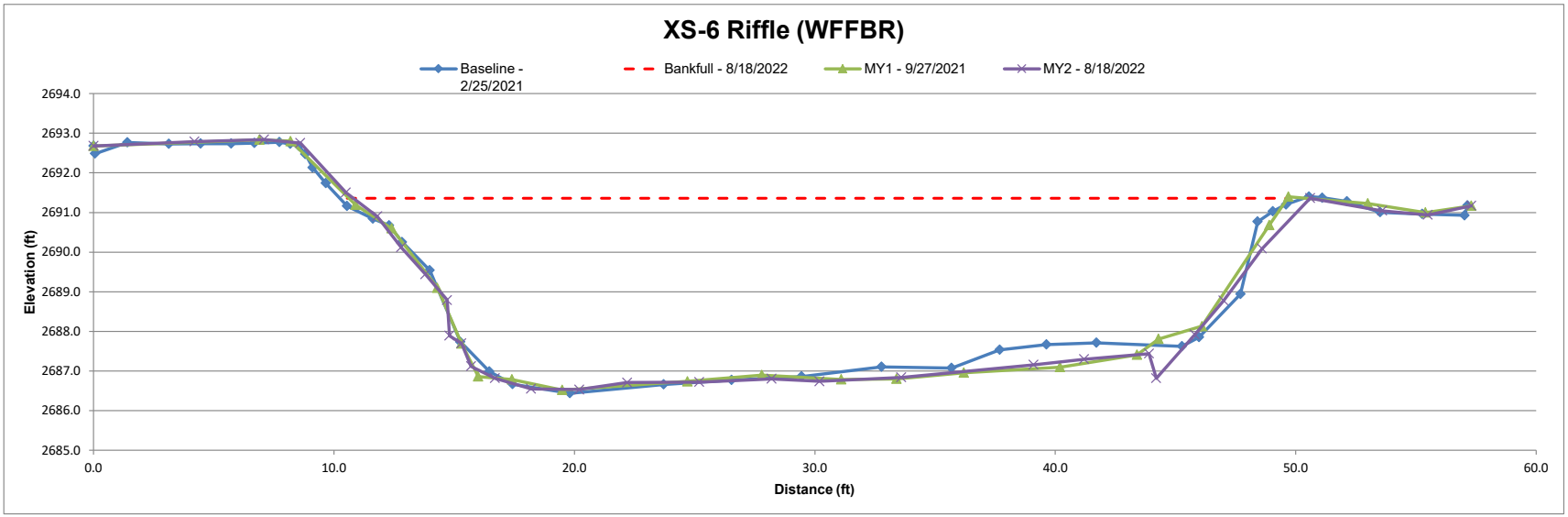


Bankfull elevation adjusted to current monitoring year's low top of bank elevation

	Cross Section 5 (Riffle)					
Dimensions	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**
Bankfull Elevation (ft) - Based on As Built-Bankfull Area	2690.79	2690.79	2690.88			
Bank Height Ratio	1.00	1.01	1.00			
Thalweg Elevation	2688.36	2688.27	2688.04			
Low Top Of Bank Elevation	2690.79	2690.81	2690.88			
Low Top of Bank Max Depth (ft)	2.43	2.54	2.84			
Low Top Of Bank Cross Sectional Area (ft^2)	49.82	50.32	53.99			

Figure 5.6 Cross Section 6

River Basin	French Broad
Watershed	06010105010020
XS ID	XS 6 (WFFBR)
Drainage Area (Acres)	3,795
Date	8/18/2022
Field Crew	MAF, WDB

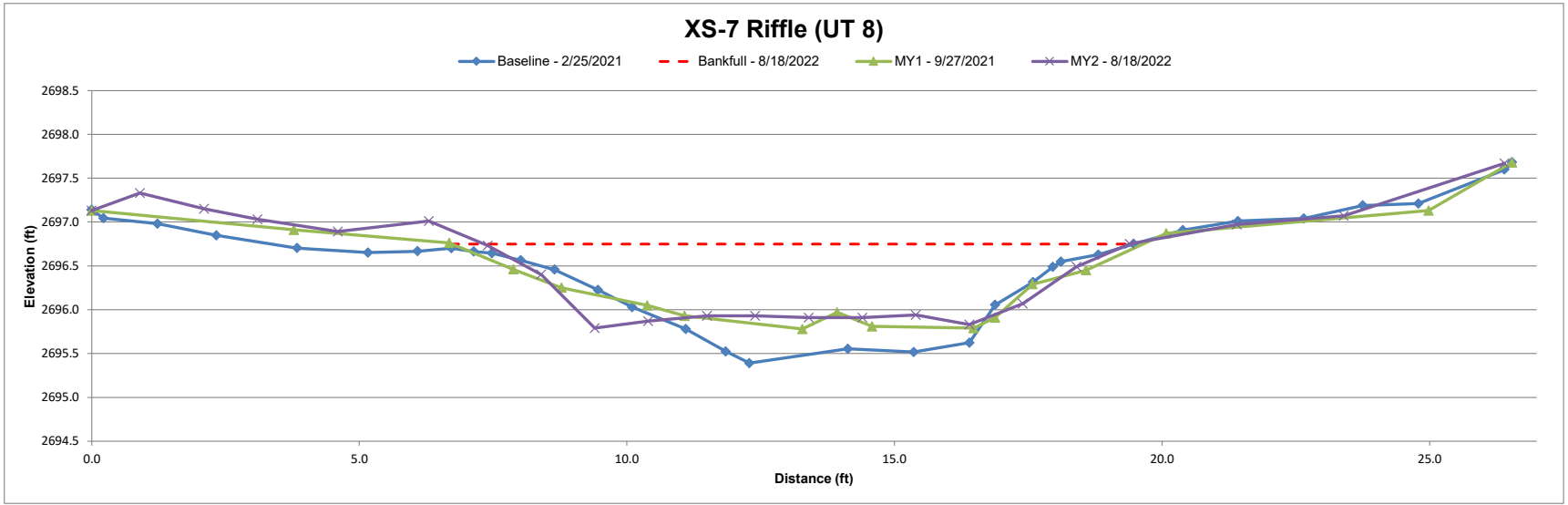


Bankfull elevation adjusted to current monitoring year's low top of bank elevation

	Cross Section 6 (Riffle)					
Dimensions	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**
Bankfull Elevation (ft) - Based on As Built-Bankfull Area	2691.20	2691.11	2691.36			
Bank Height Ratio	1.00	1.06	1.00			
Thalweg Elevation	2686.44	2686.52	2686.53			
Low Top Of Bank Elevation	2691.20	2691.40	2691.36			
Low Top of Bank Max Depth (ft)	4.76	4.88	4.83			
Low Top Of Bank Cross Sectional Area (ft^2)	138.26	149.49	150.40			

Figure 5.7 Cross Section 7

River Basin	French Broad
Watershed	06010105010020
XS ID	XS 7 (UT 8)
Drainage Area (Acres)	41
Date	8/18/2022
Field Crew	MAF, WDB

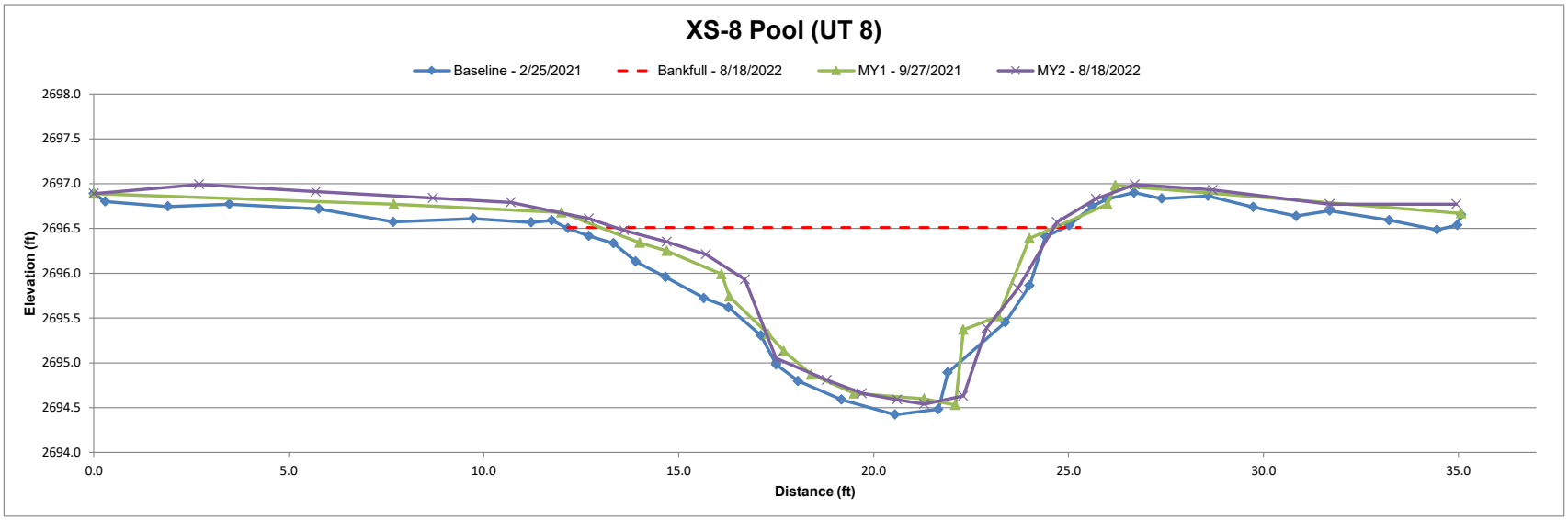


Bankfull elevation adjusted to current monitoring year's low top of bank elevation

	Cross Section 7 (Riffle)					
Dimensions	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**
Bankfull Elevation (ft) - Based on As Built-Bankfull Area	2696.64	2696.74	2696.75			
Bank Height Ratio	1.00	1.02	1.00			
Thalweg Elevation	2695.39	2695.78	2695.79			
Low Top Of Bank Elevation	2696.64	2696.76	2696.75			
Low Top of Bank Max Depth (ft)	1.25	0.98	0.96			
Low Top Of Bank Cross Sectional Area (ft^2)	8.14	8.40	8.19			

Figure 5.8 Cross Section 8

River Basin	French Broad
Watershed	06010105010020
XS ID	XS 8 (UT 8)
Drainage Area (Acres)	41
Date	8/18/2022
Field Crew	MAF, WDB

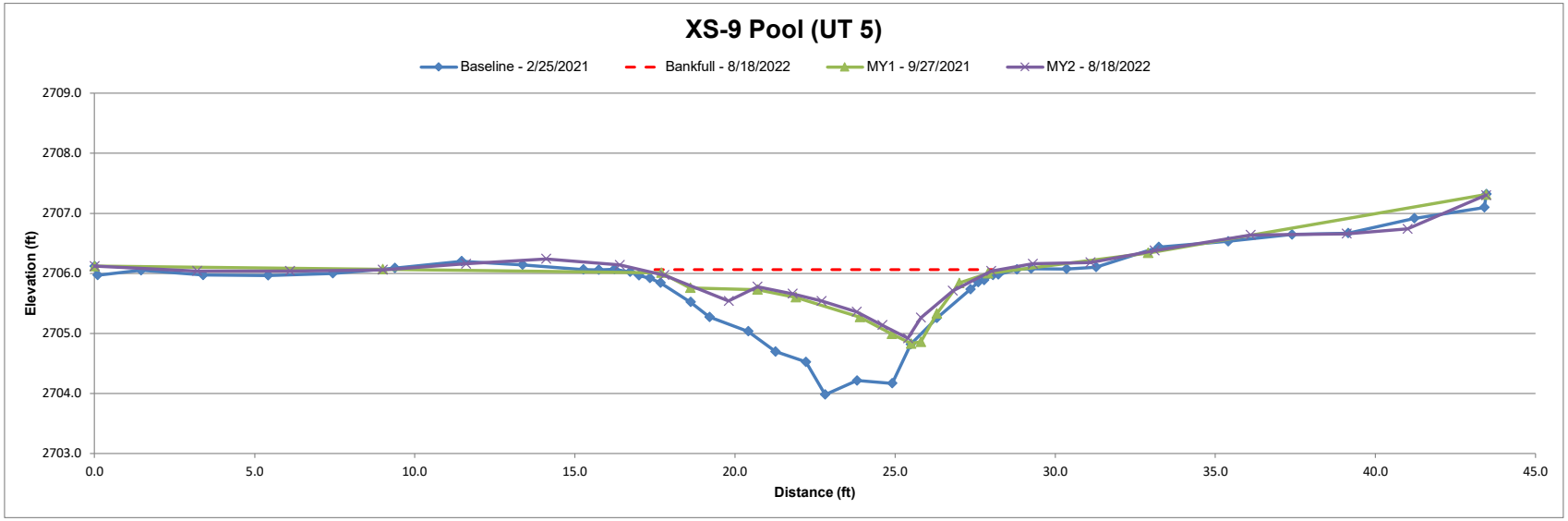


Bankfull elevation adjusted to current monitoring year's low top of bank elevation

	Cross Section 8 (Pool)					
Dimensions	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**
Bankfull Elevation (ft) - Based on As Built-Bankfull Area	--	--	--			
Bank Height Ratio	--	--	--			
Thalweg Elevation	2694.42	2694.53	2694.54			
Low Top Of Bank Elevation	2696.50	2696.68	2696.51			
Low Top of Bank Max Depth (ft)	2.08	1.97	1.97			
Low Top Of Bank Cross Sectional Area (ft^2)	14.19	11.96	11.94			

Figure 5.9 Cross Section 9

River Basin	French Broad
Watershed	06010105010020
XS ID	XS 9 (UT 5)
Drainage Area (Acres)	45.2
Date	8/18/2022
Field Crew	MAF, WDB

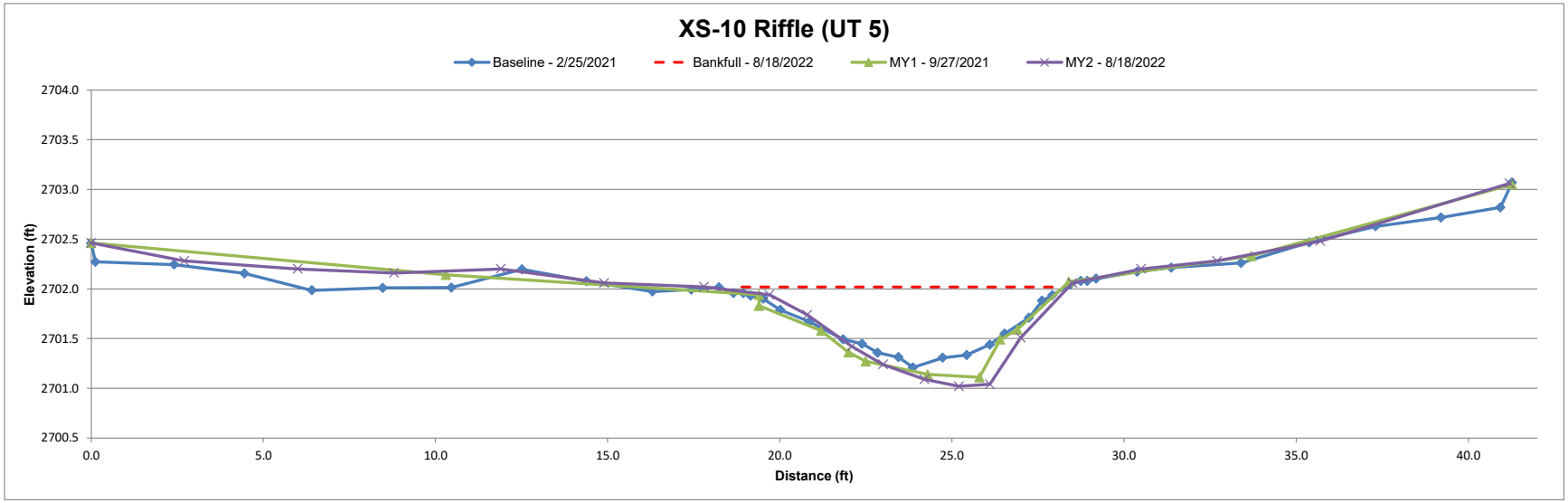


Bankfull elevation adjusted to current monitoring year's low top of bank elevation

	Cross Section 9 (Pool)					
Dimensions	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**
Bankfull Elevation (ft) - Based on As Built-Bankfull Area	--	--	--			
Bank Height Ratio	--	--	--			
Thalweg Elevation	2703.98	2704.83	2704.92			
Low Top Of Bank Elevation	2705.97	2706.01	2706.04			
Low Top of Bank Max Depth (ft)	1.99	1.18	1.12			
Low Top Of Bank Cross Sectional Area (ft^2)	10.89	4.96	4.90			

Figure 5.10 Cross Section 10

River Basin	French Broad
Watershed	06010105010020
XS ID	XS 10 (UT 5)
Drainage Area (Acres)	45.2
Date	8/18/2022
Field Crew	MAF, WDB

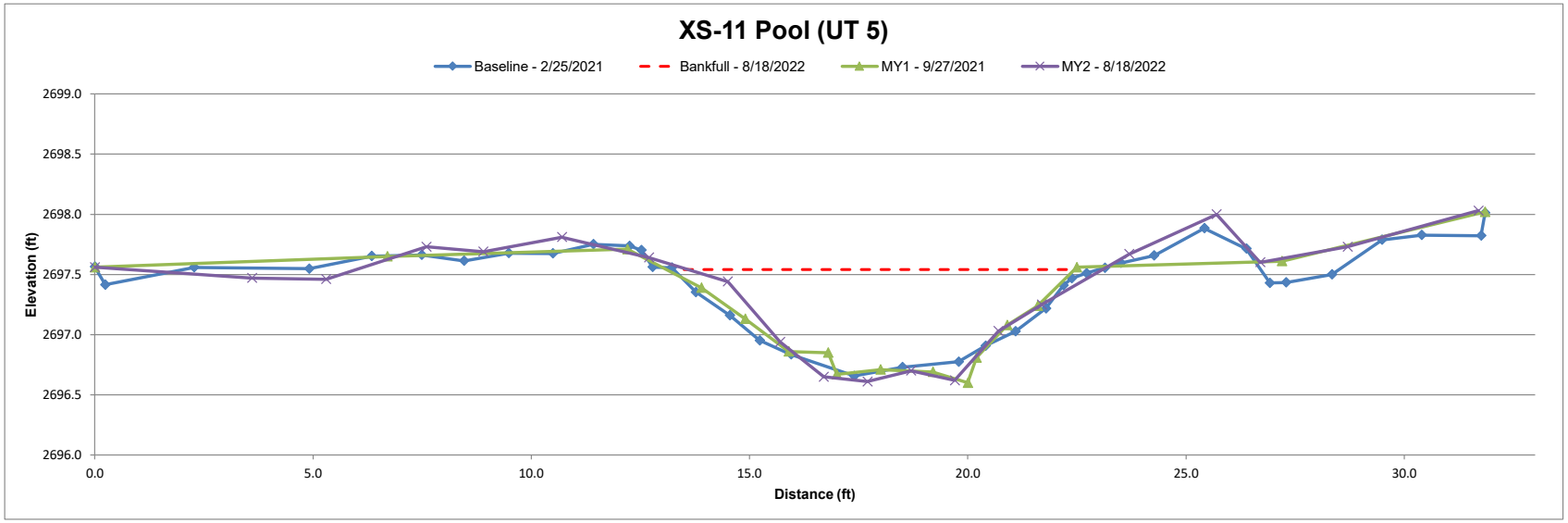


Bankfull elevation adjusted to current monitoring year's low top of bank elevation

	Cross Section 10 (Riffle)					
Dimensions	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**
Bankfull Elevation (ft) - Based on As Built-Bankfull Area	2702.02	2701.93	2701.91			
Bank Height Ratio	1.00	1.01	1.12			
Thalweg Elevation	2701.21	2701.11	2701.02			
Low Top Of Bank Elevation	2702.02	2701.94	2702.02			
Low Top of Bank Max Depth (ft)	0.81	0.83	1.00			
Low Top Of Bank Cross Sectional Area (ft^2)	4.37	4.43	5.37			

Figure 5.11 Cross Section 11

River Basin	French Broad
Watershed	06010105010020
XS ID	XS 11 (UT 5)
Drainage Area (Acres)	45.2
Date	8/18/2022
Field Crew	MAF, WDB

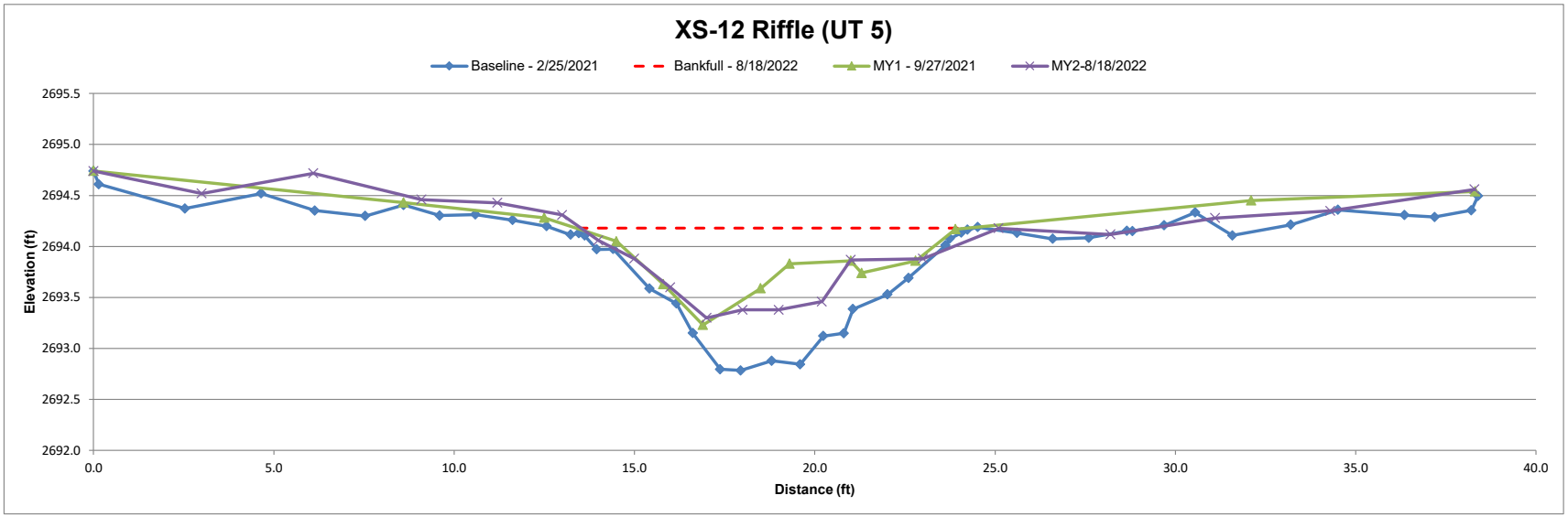


Bankfull elevation adjusted to current monitoring year's low top of bank elevation

	Cross Section 11 (Pool)					
Dimensions	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**
Bankfull Elevation (ft) - Based on As Built-Bankfull Area	--	--	--			
Bank Height Ratio	--	--	--			
Thalweg Elevation	2696.66	2996.60	2696.61			
Low Top Of Bank Elevation	2697.47	2697.56	2697.54			
Low Top of Bank Max Depth (ft)	0.81	0.96	0.83			
Low Top Of Bank Cross Sectional Area (ft^2)	4.75	5.40	4.32			

Figure 5.12 Cross Section 12

River Basin	French Broad
Watershed	06010105010020
XS ID	XS 12 (UT 5)
Drainage Area (Acres)	45.2
Date	8/18/2022
Field Crew	MAF, WDB

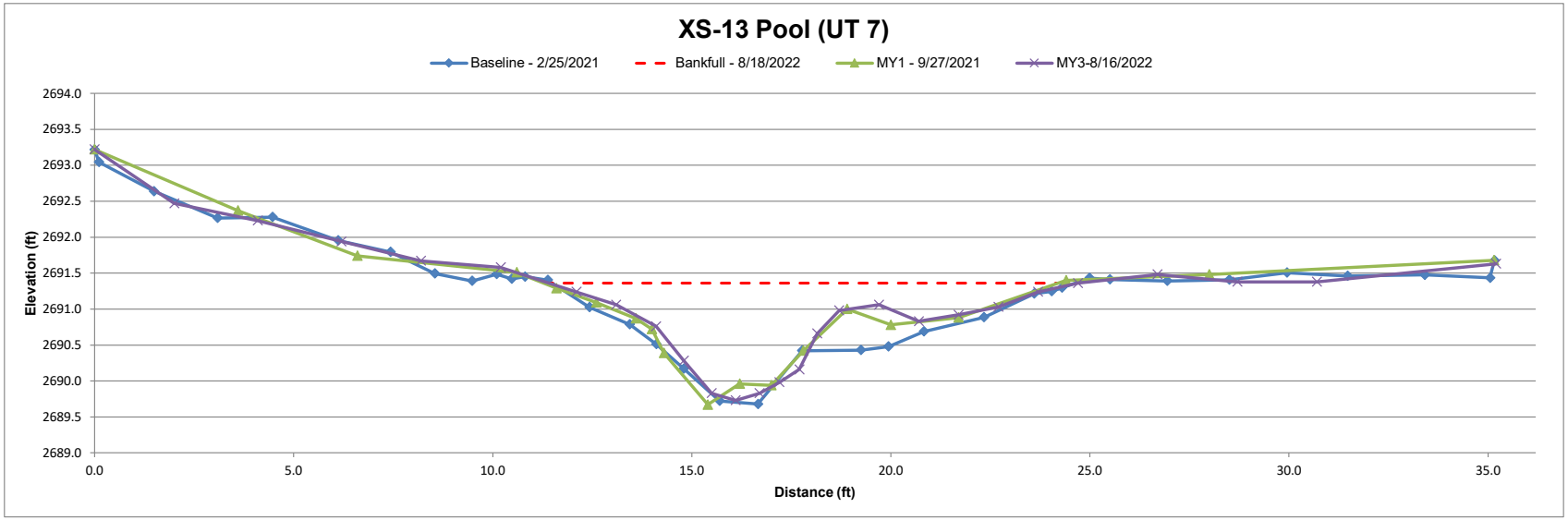


Bankfull elevation adjusted to current monitoring year's low top of bank elevation

	Cross Section 12 (Riffle)					
Dimensions	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**
Bankfull Elevation (ft) - Based on As Built-Bankfull Area	2694.13	2694.49	2694.18			
Bank Height Ratio	1.00	0.75	1.00			
Thalweg Elevation	2692.78	2693.23	2693.30			
Low Top Of Bank Elevation	2694.13	2694.17	2694.18			
Low Top of Bank Max Depth (ft)	1.35	0.95	0.88			
Low Top Of Bank Cross Sectional Area (ft^2)	7.83	4.28	5.30			

Figure 5.13 Cross Section 13

River Basin	French Broad
Watershed	06010105010020
XS ID	XS 13 (UT 7)
Drainage Area (Acres)	32.1
Date	8/18/2022
Field Crew	MAF, WDB

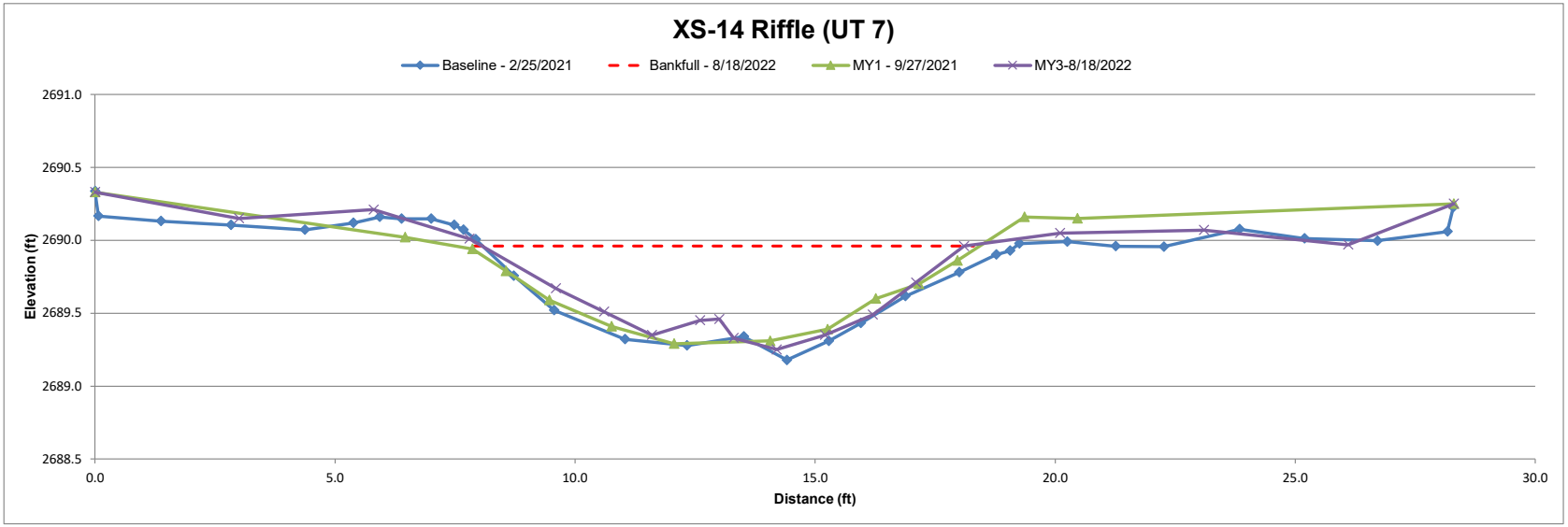


Bankfull elevation adjusted to current monitoring year's low top of bank elevation

	Cross Section 13 (Pool)					
Dimensions	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**
Bankfull Elevation (ft) - Based on As Built-Bankfull Area	--	--	--			
Bank Height Ratio	--	--	--			
Thalweg Elevation	2689.68	2689.67	2689.73			
Low Top Of Bank Elevation	2691.25	2691.40	2691.36			
Low Top of Bank Max Depth (ft)	1.57	1.73	1.63			
Low Top Of Bank Cross Sectional Area (ft^2)	8.77	9.06	8.10			

Figure 5.14 Cross Section 14

River Basin	French Broad
Watershed	06010105010020
XS ID	XS 14 (UT 7)
Drainage Area (Acres)	32.1
Date	8/18/2022
Field Crew	MAF, WDB



Bankfull elevation adjusted to current monitoring year's low top of bank elevation

	Cross Section 14 (Riffle)					
Dimensions	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**
Bankfull Elevation (ft) - Based on As Built-Bankfull Area	2689.90	2689.95	2689.96			
Bank Height Ratio	1.00	0.98	1.00			
Thalweg Elevation	2689.18	2689.29	2689.25			
Low Top Of Bank Elevation	2689.90	2689.94	2689.96			
Low Top of Bank Max Depth (ft)	0.72	0.65	0.71			
Low Top Of Bank Cross Sectional Area (ft^2)	4.56	4.45	4.31			

Table 11. Monitoring Year 2 Stream Data Summary

Owen Farms Mitigation Site / DMS: 100064 - West Fork French Broad River (WFFBR), UT 5, UT 7, UT 8																														
	West Fork French Broad River																UT 5													
Parameter	Pre-Existing Condition (applicaple)					Design		Monitoring Baseline (MY0)			Monitoring (MY1)			Monitoring (MY2)			Pre-Existing Condition (applicaple)					Design		Monitoring Baseline (MY0)			Monitoring (MY1)			Monitoring (MY2)		
Riffle Only	Min	Mean	Med	Max	n	Min	Max	Min	Max	n	Min	Max	n	Min	Max	n	Min	Mean	Med	Max	n	Min	Max	Min	Max	n	Min	Max	n	Min	Max	n
Bankfull Width (ft)	28.78	38.38	38.47	47.90	3	30.00	30.00	27.52	39.11	4	28.5	42.58	4	26.94	39.81	4	4.38	4.38	4.38	4.38	1	8.50	8.50	8.94	10.08	2	7.46	12.48	2	8.10	10.59	2
Floodprone Width (ft)	47.89	56.15	51.56	69.00	3	93.00	93.00	96.35	430.60	4	96.35	430.6	4	96.35	430.60	4	8.00	8.00	8.00	8.00	1	100.00	100.00	60.41	491.41	2	60.41	491.41	2	60.41	491.41	2
Bankfull Mean Depth (ft)	1.89	2.12	2.07	2.41	3	2.14	2.14	1.81	3.54	4	1.75	3.34	4	2.00	3.78	4	0.66	0.66	0.66	0.66	1	0.63	0.63	0.43	0.53	2	0.42	0.42	2	0.51	0.58	2
Bankfull Max Depth (ft)	2.93	3.14	3.20	3.28	3	2.63	2.63	2.43	4.76	4	2.52	4.68	4	2.84	4.83	4	0.95	0.95	0.95	0.95	1	0.76	0.76	0.81	0.81	2	0.69	0.91	2	1.00	1.06	2
Bankfull Cross Sectional Area (ft^2)	69.31	79.83	79.56	90.63	3	69.60	69.60	49.82	138.26	4	49.74	142.14	4	53.99	150.36	4	2.90	2.90	2.90	2.90	1	5.00	5.00	4.37	4.75	2	3.12	5.28	2	5.37	6.55	2
Width/Depth Ratio	11.94	18.62	18.58	25.34	3	14.00	14.00	11.05	15.20	4	12.75	19.14	4	7.91	15.39	4	6.64	6.64	6.64	6.64	1	13.50	13.50	16.87	23.44	2	17.76	29.71	2	19.57	20.76	2
Entrenchment Ratio	1.25	1.49	1.44	1.79	3	3.10	3.10	3.50	14.23	4	3.38	14.2	4	3.24	14.11	4	1.83	1.83	1.83	1.83	1	11.80	11.80	5.99	54.94	2	4.84	65.91	2	5.70	43.28	2
Bank Height Ratio	1.70	1.90	1.80	2.19	3	1.00	1.00	1.00	1.00	**4**	1			1.00	1.02	4	1.20	1.20	1.20	1.20	1	1.00	1.00	1.00	1.00	2	1.00	1.00	2	1.00	1.00	2
Max part size (mm) mobilized at bankfull	83					83		83									40					40		40			40					
Rosgen Classification	B4 / F4					C4		C4									B4					C4		C4			C4					
Bankfull Discharge (cfs)	300					300		300									10					10		10			10					
Sinuosity (ft)	1.06					1.12		1.14									1.08					1.14		1.14			1.14					
Water Surface Slope (Channel) (ft/ft)	0.0034					0.0034		0.0036									0.012					0.006		0.007			0.007					

	UT 7																UT 8													
Parameter	Pre-Existing Condition (applicaple)					Design		Monitoring Baseline (MY0)			Monitoring (MY1)			Monitoring (MY2)			Pre-Existing Condition (applicaple)					Design		Monitoring Baseline (MY0)			Monitoring (MY1)			Monitoring (MY2)		
Riffle Only	Min	Mean	Med	Max	n	Min	Max	Min	Max	n	Min	Max	n	Min	Max	n	Min	Mean	Med	Max	n	Min	Max	Min	Max	n	Min	Max	n	Min	Max	n
Bankfull Width (ft)	4.71	4.71	4.71	4.71	1	9.00	9.00	10.50	10.50	1	10.47	10.47	1	10.04	10.04	1	11.60	11.60	11.60	11.60	1	12.00	12.00	11.37	11.37	1	12.10	12.10	1	12.08	12.08	1
Floodprone Width (ft)	12.80	12.80	12.80	12.80	1	130.00	130.00	71.78	71.78	1	71.78	71.78	1	71.78	71.78	1	17.00	17.00	17.00	17.00	1	30.00	30.00	422.23	422.23	1	422.23	422.23	1	422.23	422.23	1
Bankfull Mean Depth (ft)	0.57	0.57	0.57	0.57	1	0.67	0.67	0.43	0.43	1	0.43	0.43	1	0.43	0.43	1	0.70	0.70	0.70	0.70	1	0.92	0.92	0.72	0.72	1	0.57	0.57	1	0.68	0.68	1
Bankfull Max Depth (ft)	0.74	0.74	0.74	0.74	1	0.80	0.80	0.72	0.72	1	0.65	0.65	1	0.71	0.71	1	0.97	0.97	0.97	0.97	1	1.11	1.11	1.25	1.25	1	0.86	0.86	1	0.96	0.96	1
Bankfull Cross Sectional Area (ft^2)	2.69	2.69	2.69	2.69	1	5.60	5.60	4.56	4.56	1	4.45	4.45	1	4.31	4.31	1	8.19	8.19	8.19	8.19	1	10.30	10.30	8.14	8.14	1	6.90	6.90	1	8.19	8.19	1
Width/Depth Ratio	8.26	8.26	8.26	8.26	1	13.50	13.50	24.42	24.42	1	24.35	24.35	1	23.35	23.35	1	16.30	16.30	16.30	16.30	1	13.00	13.00	15.79	15.79	1	21.23	21.23	1	17.76	17.76	1
Entrenchment Ratio	2.71	2.71	2.71	2.71	1	14.40	14.40	6.84	6.84	1	6.85	6.85	1	7.15	7.15	1	1.47	1.47	1.47	1.47	1	2.50	2.50	37.14	37.14	1	34.90	34.90	1	34.96	34.96	1
Bank Height Ratio	3.40	3.40	3.40	3.40	1	1.00	1.00	1.00	1.00	**1**	1			1.00	1.00	1	2.79	2.79	2.79	2.79	1	1.00	1.00	1.00	1.00	1	1.00	1.00	1	1.00	1.00	1
Max part size (mm) mobilized at bankfull	61.7					61.7		61.7									76.8					76.8		76.8			77.8					
Rosgen Classification	B4					C4		C4									B4					C4		C4			C4					
Bankfull Discharge (cfs)	13					13		13									45					45		45			45					
Sinuosity (ft)	1.00					1.24		1.26									1.03					1.09		1.10			1.10					
Water Surface Slope (Channel) (ft/ft)	0.0246					0.0054		0.0057									0.0379					0.0110		0.0112			0.0112					

Table 12. Cross Section Morphology Monitoring Summary

Owen Farms Mitigation Site / DMS: 100064 - West Fork French Broad River (WFFBR), UT 5, UT 7, UT 8																																					
	Cross Section 1 (Pool - WFFBR)							Cross Section 2 (Riffle - WFFBR)							Cross Section 3 (Riffle - WFFBR)							Cross Section 4 (Pool - WFFBR)							Cross Section 5 (Riffle - WFFBR)						
	MY0	MY1	MY2	MY3	MY5	MY7	MY+	MY0	MY1	MY2	MY3	MY5	MY7	MY+	MY0	MY1	MY2	MY3	MY5	MY7	MY+	MY0	MY1	MY2	MY3	MY5	MY7	MY+	MY0	MY1	MY2	MY3	MY5	MY7	MY+
Bankfull Elevation (ft) - Based on AB-Bankfull[1] Area	--	--	--					2696.25	2695.96	2696.25					2694.46	2694.11	2694.48					--	--	--					2690.79	2690.79	2690.88				
Bank Height Ratio_Based on AB Bankfull[1] Area	--	--	--					0.97	1.07	1.00					1.00	1.15	1.00					--	--	--					1.00	1.01	1.00				
Thalweg Elevation	2692.85	2692.81	2692.83					2692.68	2692.53	2692.68					2691.17	2690.90	2690.90					2689.58	2689.43	2689.53					2688.36	2688.27	2688.04				
LTOB[2] Elevation	2696.45	2696.34	2696.45					2696.15	2696.21	2696.25					2694.46	2694.58	2694.48					2693.64	2693.95	2693.95					2690.79	2690.81	2690.88				
LTOB[2] Max Depth (ft)	3.60	3.53	3.68					3.47	3.68	3.54					3.29	3.68	3.58					4.06	4.52	4.42					2.43	2.54	2.84				
LTOB[2] Cross Sectional Area (ft^2)	58.72	46.68	54.47					61.32	69.39	70.16					65.45	80.97	68.38					71.83	84.77	84.93					49.82	50.32	49.79				
	Cross Section 6 (Riffle - WFFBR)							Cross Section 7 (Riffle - UT 8)							Cross Section 8 (Pool - UT 8)							Cross Section 9 (Pool - UT 5)							Cross Section 10 (Riffle - UT 5)						
	MY0	MY1	MY2	MY3	MY5	MY7	MY+	MY0	MY1	MY2	MY3	MY5	MY7	MY+	MY0	MY1	MY2	MY3	MY5	MY7	MY+	MY0	MY1	MY2	MY3	MY5	MY7	MY+	MY0	MY1	MY2	MY3	MY5	MY7	MY+
Bankfull Elevation (ft) - Based on AB-Bankfull[1] Area	2691.20	2691.11	2691.36					2696.64	2696.74	2696.75					--	--	--					--	--	--					2702.02	2701.93	2702.02				
Bank Height Ratio_Based on AB Bankfull[1] Area	1.00	1.06	1.00					1.00	1.02	1.00					--	--	--					--	--	--					1.00	1.01	1.00				
Thalweg Elevation	2686.44	2686.52	2686.53					2695.39	2695.78	2695.79					2694.42	2694.53	2694.54					2703.98	2704.83	2704.92					2701.21	2701.11	2701.02				
LTOB[2] Elevation	2691.20	2691.40	2691.36					2696.64	2696.76	2696.75					2696.50	2696.68	2696.51					2705.97	2706.01	2706.04					2702.02	2701.94	2702.02				
LTOB[2] Max Depth (ft)	4.76	4.88	4.83					1.25	0.98	0.96					2.08	1.97	1.97					1.99	1.18	1.12					0.81	0.83	1.00				
LTOB[2] Cross Sectional Area (ft^2)	138.26	149.49	150.40					8.14	8.40	8.19					14.19	11.96	11.94					10.89	4.96	4.90					4.37	4.43	5.37				
	Cross Section 11 (Pool - UT 5)							Cross Section 12 (Riffle - UT 5)							Cross Section 13 (Pool - UT 7)							Cross Section 14 (Riffle - UT 7)													
	MY0	MY1	MY2	MY3	MY5	MY7	MY+	MY0	MY1	MY2	MY3	MY5	MY7	MY+	MY0	MY1	MY2	MY3	MY5	MY7	MY+	MY0	MY1	MY2	MY3	MY5	MY7	MY+							
Bankfull Elevation (ft) - Based on AB-Bankfull[1] Area	--	--	--					2694.13	2694.49	2694.31					--	--	--					2689.90	2689.95	2689.98											
Bank Height Ratio_Based on AB Bankfull[1] Area	--	--	--					1.00	0.75	0.87					--	--	--					1.00	0.98	0.97											
Thalweg Elevation	2696.66	2996.60	2696.61					2692.78	2693.23	2693.30					2689.68	2689.67	2689.73					2689.18	2689.29	2689.25											
LTOB[2] Elevation	2697.47	2697.56	2697.67					2694.13	2694.17	2694.18					2691.25	2691.40	2691.36					2689.90	2689.94	2689.96											
LTOB[2] Max Depth (ft)	0.81	0.96	1.06					1.35	0.95	1.01					1.57	1.73	1.63					0.72	0.65	0.71											
LTOB[2] Cross Sectional Area (ft^2)	4.75	5.40	6.55					7.83	4.38	7.67					8.77	9.06	8.01					4.56	4.45	4.31											

The above morphology parameters reflect the 2018 guidance that arose from the mitigation technical workgroup consisting of DMS, the IRT and industry mitigation providers/practitioners. The outcome resulted in the focus on three primary morphological parameters of interest for the purposes of tracking channel change moving forward. They are the bank height ratio using a constant As-built bankfull area and the cross sectional area and max depth based on each years low top of bank. These are calculated as follows:
1 - Bank Height Ratio (BHR) takes the As-built bankful area as the basis for adjusting each subsequent years bankfull elevation. For example if the As-built bankfull area was 10 ft2, then the MY1 bankfull elevation would be adjusted until the calculated bankfull area within the MY1 cross section survey = 10 ft2. The BHR would then be calculated with the difference between the low top of bank (LTOB) elevation for MY1 and the thalweg elevation for MY1 in the numerator with the difference between the MY1 bankfull elevation and the MY1 thalweg elevation in the denominator. This same process is then carried out in each successive year.
2 - LTOB Area and Max depth - These are based on the LTOB elevation for each years survey (The same elevation used for the LTOB in the BHR calculation). Area below the LTOB elevation will be used and tracked for each year as above. The difference between the LTOB elevation and the thalweg elevation (same as in the BHR calculation) will be recroded and tracked above as LTOB max depth.

Appendix E – Hydrologic Data

Figure 6. Monthly Precipitation Data

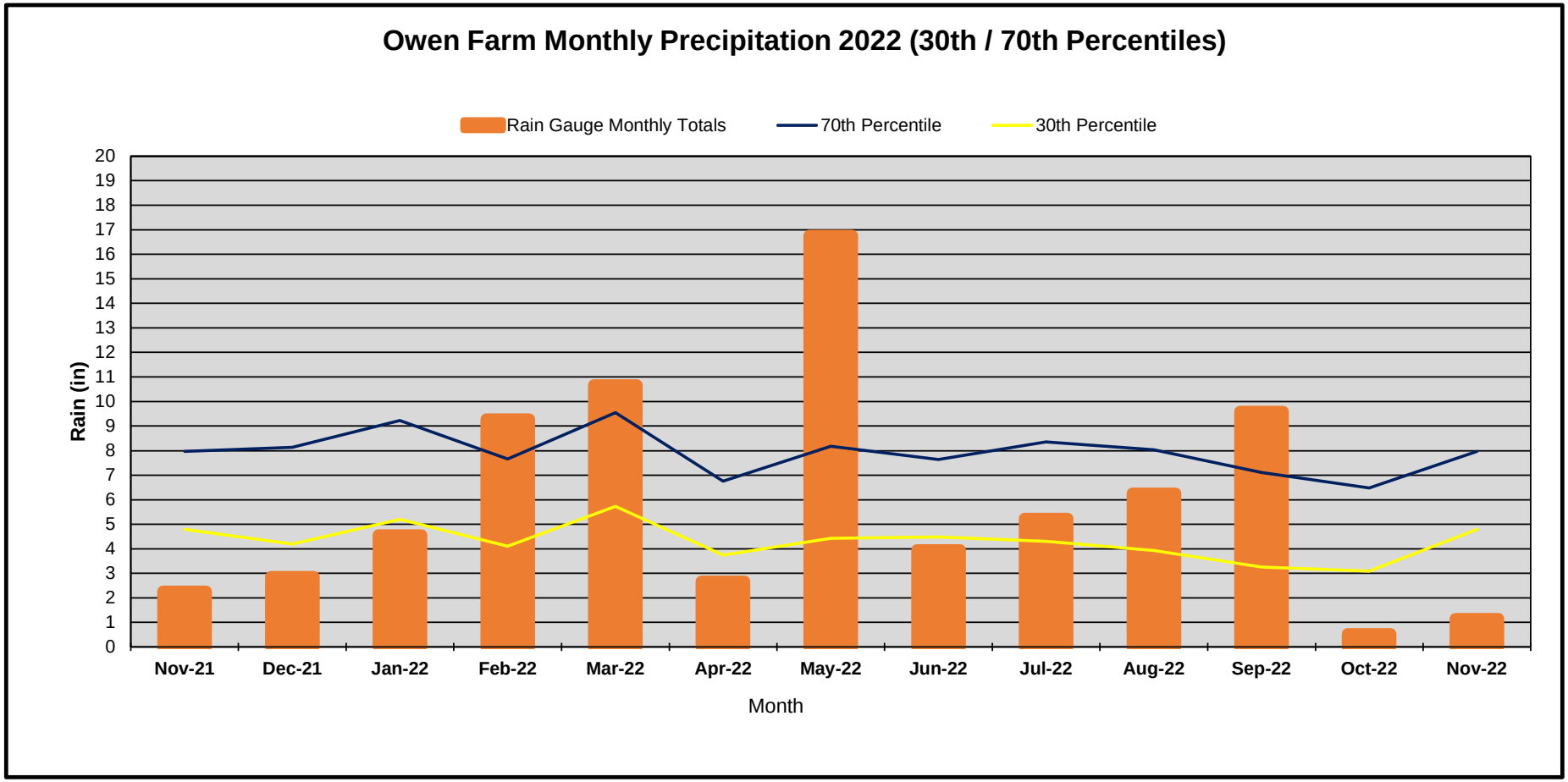


Figure 7.1 West Fork French Broad River
Flow Depth

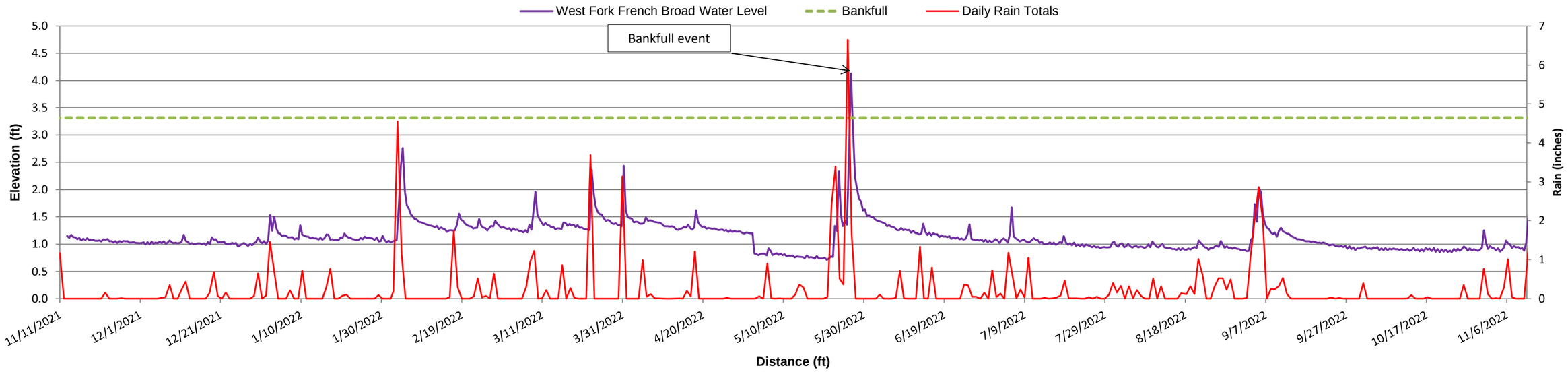


Figure 7.2 UT 5 Flow Depth

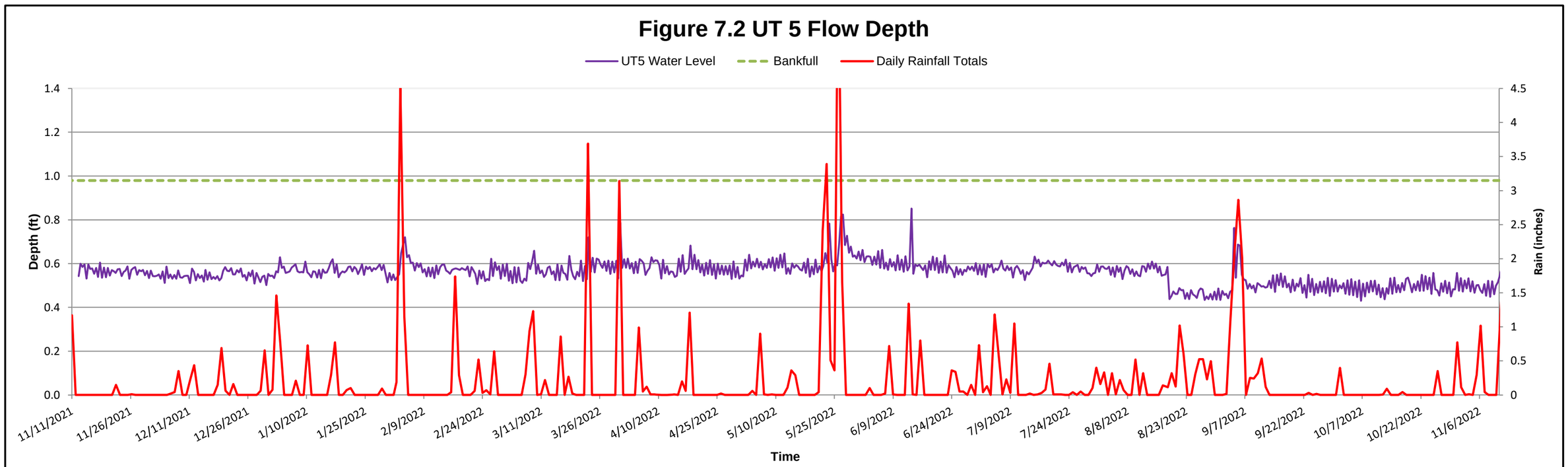
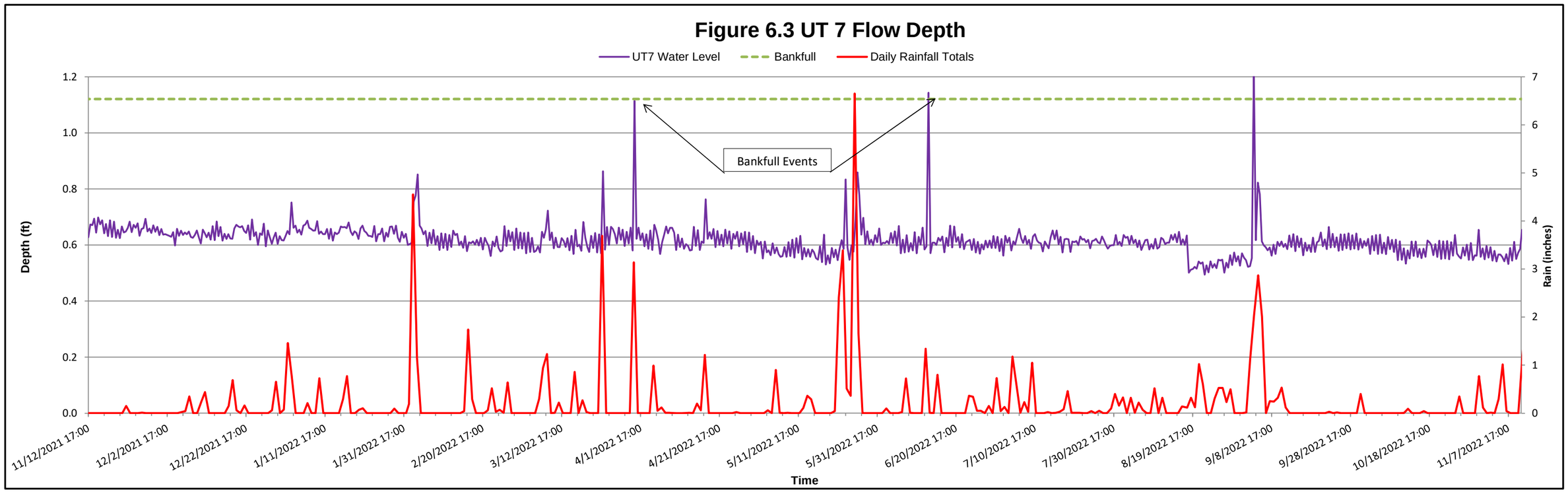


Figure 6.3 UT 7 Flow Depth



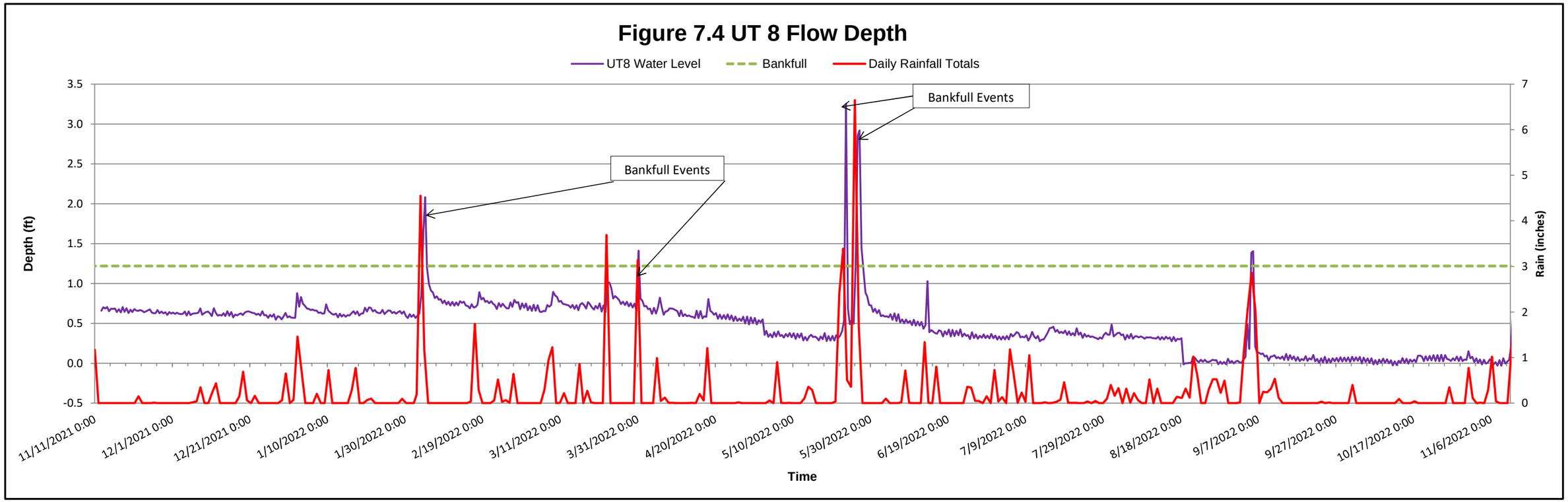


Figure 7.4 UT 8 Flow Depth
UT8 Water Level
Bankfull
Daily Rainfall Totals
Bankfull Events
Bankfull Events
Depth (ft)
Rain (inches)
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
-0.5
7
6
5
4
3
2
1
0
11/11/2021 0:00
12/1/2021 0:00
12/21/2021 0:00
1/10/2022 0:00
1/30/2022 0:00
2/19/2022 0:00
3/11/2022 0:00
3/31/2022 0:00
4/20/2022 0:00
5/10/2022 0:00
5/30/2022 0:00
6/19/2022 0:00
7/9/2022 0:00
7/29/2022 0:00
8/18/2022 0:00
9/7/2022 0:00
9/27/2022 0:00
10/17/2022 0:00
11/6/2022 0:00
Time

Table 13. Bankfull Events Summary

Overbank Events							
Gauge ID	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**MY6**	**MY7**
West Fork French Broad	8/16/2021, 8/18/2021, 9/1/2021	2/5/2022 5/26/2022					
UT 5	8/16/2021, 8/8/2021, 10/30/2021						
UT 7	8/16/2021, 8/18/2021	4/1/2022 6/12/2022 9/04/2022					
UT 8	8/16/2021, 8/18/2021, 8/31/2021, 10/7/2021	2/5/2022 3/21/2022 5/53/2022 5/26/2022 9/05/2022					

Figures 8.1 - 8.5 Wetland Groundwater Gauge Data

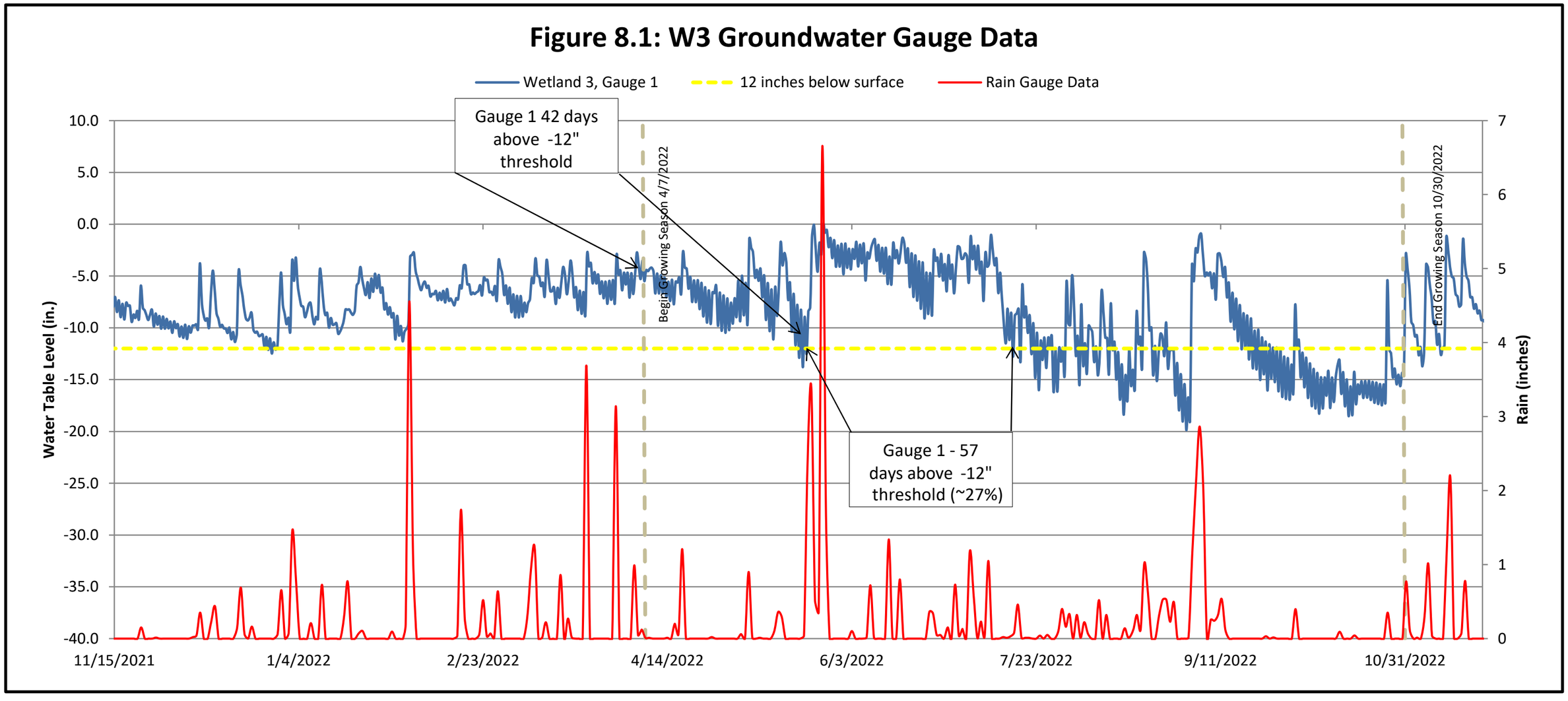


Figure 8.2: W3 Groundwater Gauge Data

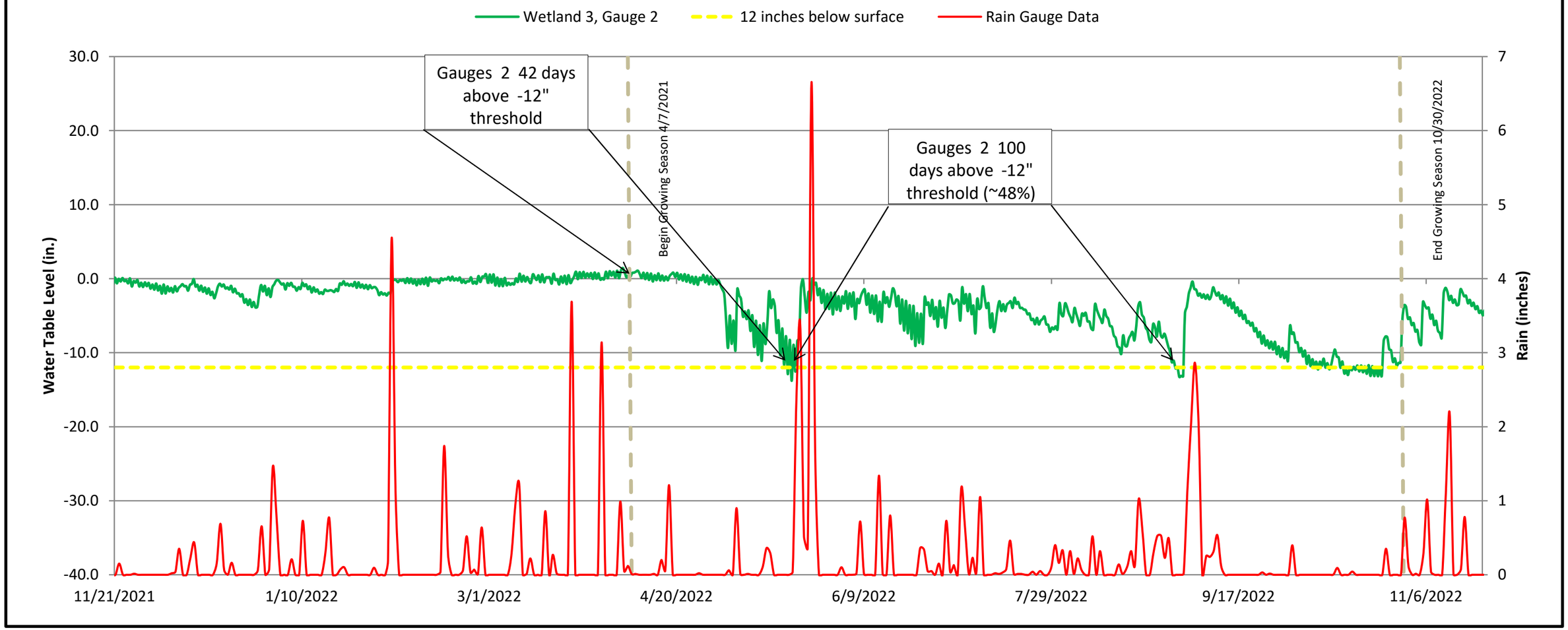


Figure 8.3: W3 Groundwater Gauge Data

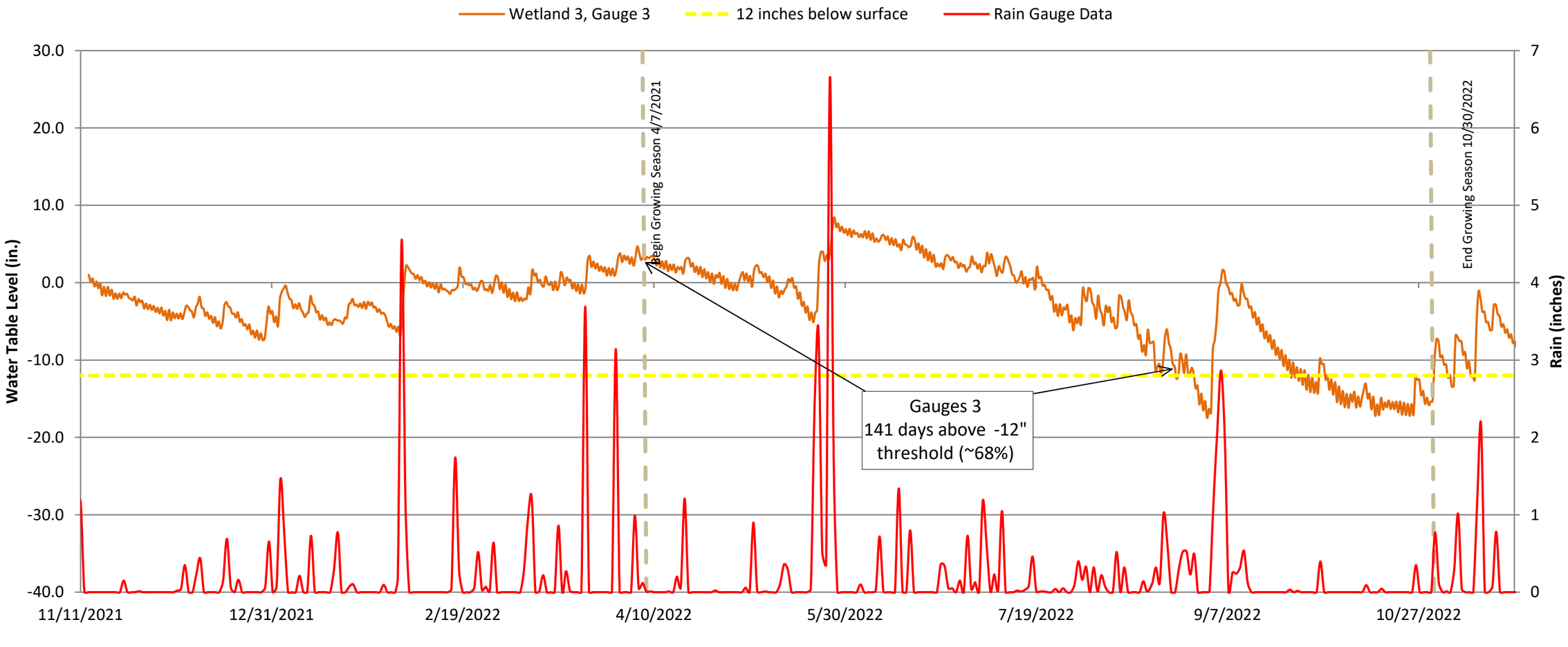


Figure 8.4: W3 Groundwater Gauge Data

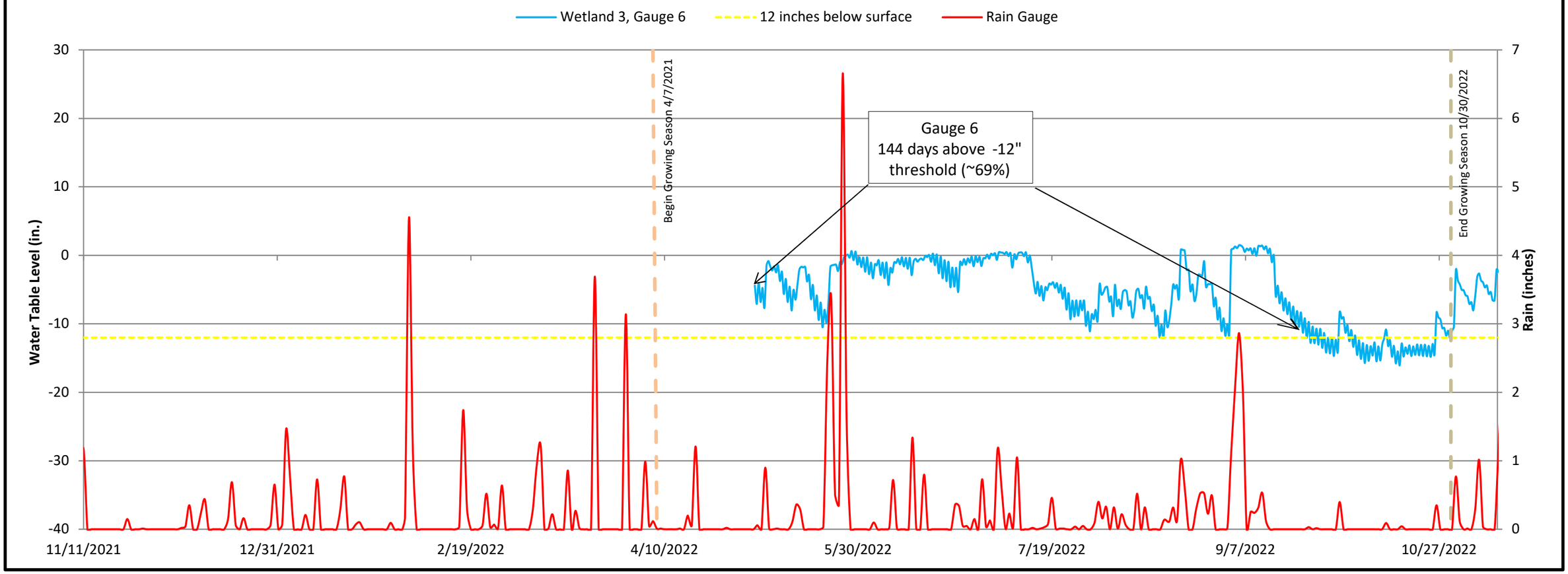


Figure 8.5: W5 Groundwater Gauge Data (Reference)

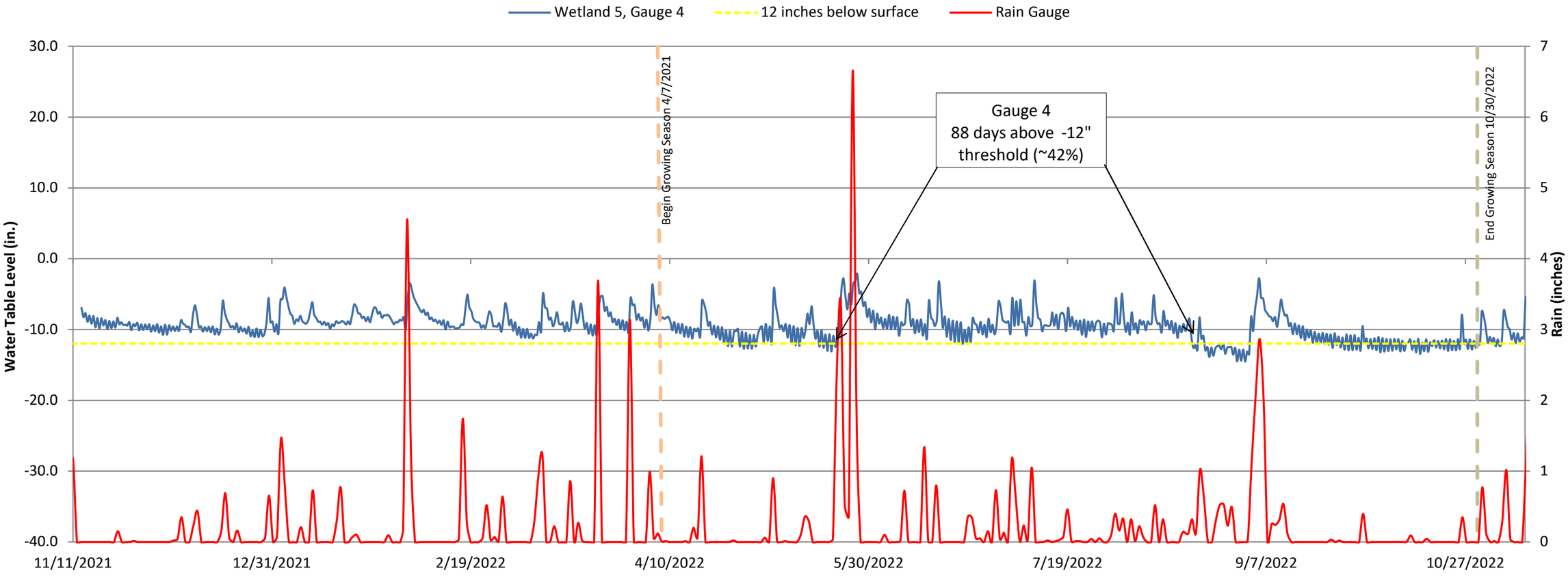


Figure 8.6: W5 Groundwater Gauge Data

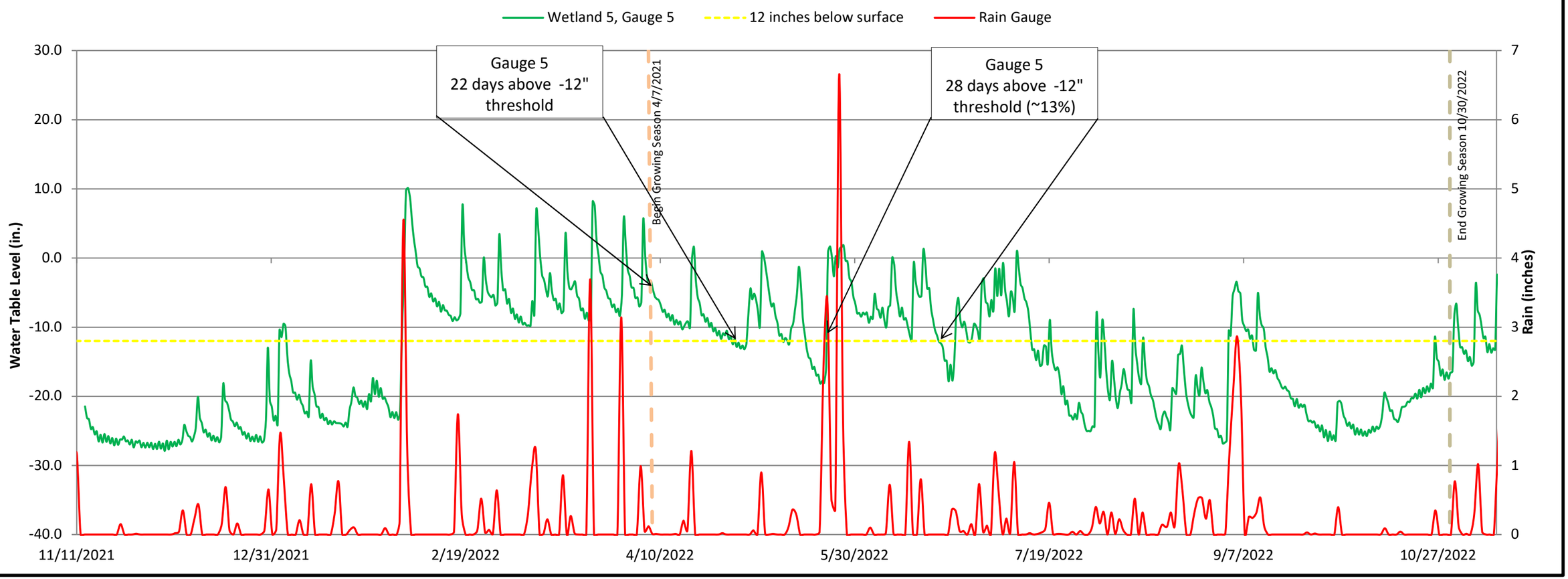


Table 14. Wetland Hydrology Summary

Monitoring Gauge	Performance Standard: **25 Consecutive Days** WETS Station: **Brevard, NC** Growing Season: **04/07 to 10/30 (206 days)**						
	Max. Consecutive Hydroperiod (%)						
	MY1 2021	**MY2 2022**	**MY3 2023**	**MY4 2024**	**MY5 2025**	**MY6 2026**	**MY7 2027**
W3-1	36	27					
W3-2	36	48					
W3-3	36	68					
W5-4 (reference)	42	42					
W5-5	3	13					
W3-6	n/a	69					

Appendix F – 2022 Repair Plan Submittal to IRT

DAVEY

Digeronimo, Alex <alex.digeronimo@davey.com>

Owen Farms Repairs (SAW-2018-01165)

2 messages

Furr, Benjamin <Ben.Furr@davey.com> Fri, Sep 16, 2022 at 8:53 AM
To: "Kimberly.D.Browning@usace.army.mil" <Kimberly.D.Browning@usace.army.mil>
Cc: Alex Digeronimo <Alex.Digeronimo@davey.com>, Kevin Williams <KWilliams@davey.com>, "Tisdale, Jessica" <jessica.tisdale@hdrinc.com>, "andrea.leslie@ncwildlife.org" <andrea.leslie@ncwildlife.org>, "erin.davis@ncdenr.gov" <erin.davis@ncdenr.gov>, Paul <paul.wiesner@ncdenr.gov>

Kim

Per our conversation last week, I wanted to provide you with a summary of our plan to complete additional bank repairs at the Owen Farms Mitigation Site this fall/winter. Erosion is primarily occurring on streambanks that have poor vegetative coverage. We plan to repair/stabilize approximately 355 LF of stream bank through the use of sod mats and boulder toe. Standard construction equipment will be used to complete the repairs (i.e. excavator and off-road hauler). The attached figure depicts the strategy that will be used at each bank repair location. A photo log is also attached that shows current conditions at each repair location. Sod mats will be collected from on-site within the existing easement. Areas where sod mats are collected and other areas disturbed during construction will be seeded and replanted. We estimate needing a total of ~100 sq. yds. of sod mat.

This work will be completed under the existing Nationwide Permit 27 and Erosion Control Permit for the Site. We are currently coordinating with a construction contractor to determine the repair schedule. Once finalized, we will submit a written request for a waiver of the trout moratorium from WRC for purposes of completing repair work and minimizing erosion on-site.

Thank you and please let me know if you have any questions or comments.

Benjamin Furr | Senior Consultant
Davey Resource Group, Inc.
3101 Poplarwood Court, Suite 120, Raleigh, NC 27604
P: 919.645.4350 ext. 4354 | M: 919.588.9663

DAVEY Resource Group

Visit our local office page

2 attachments

Owen Farms 2022 Repair Photo Log.pdf
2468K

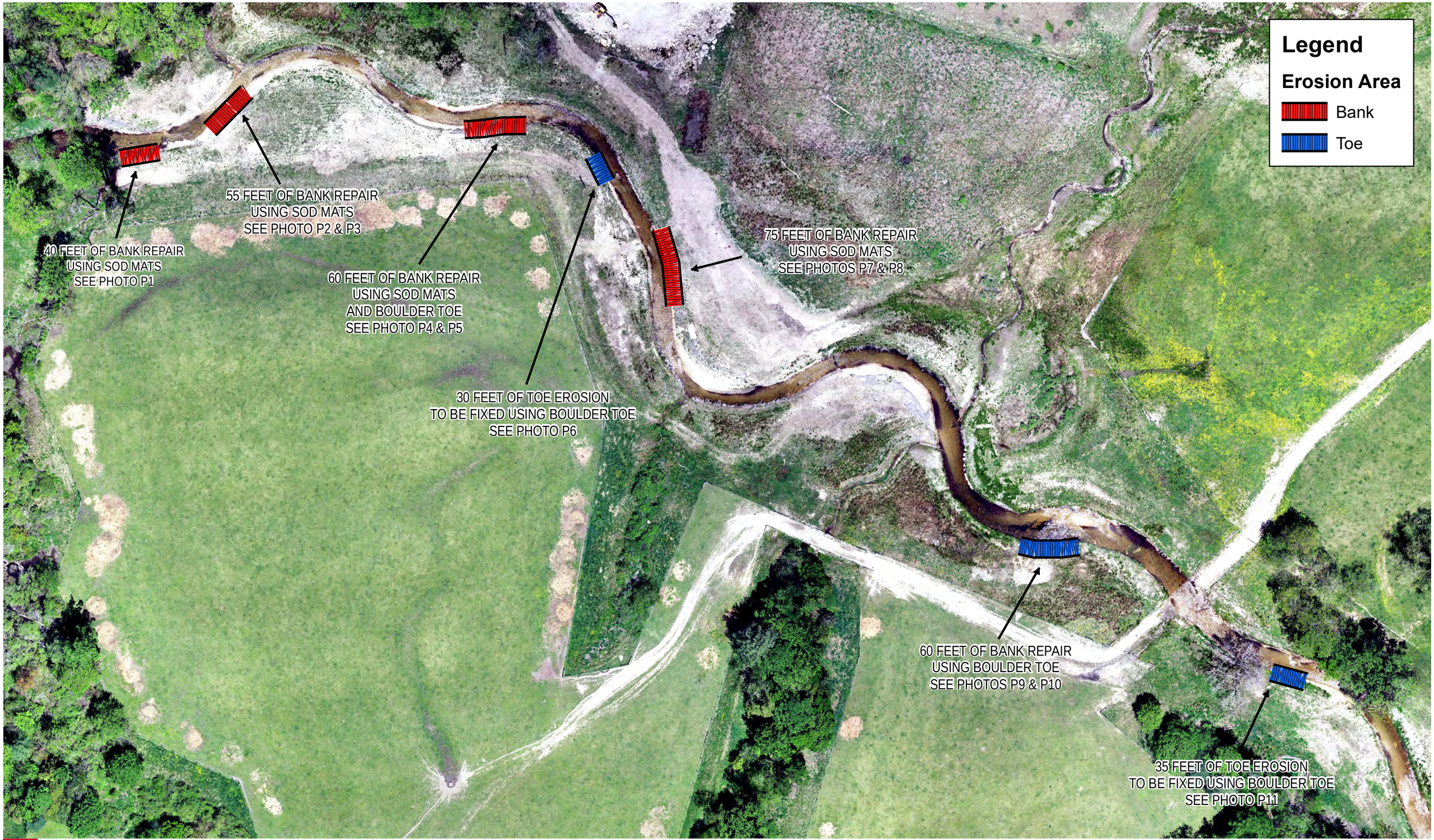
Owen Farms 2022 Repair Figure.pdf
995K

Williams, Kevin <KWilliams@davey.com> Mon, Sep 19, 2022 at 8:19 AM
To: Ryan Smith <Ryan.Smith@davey.com>, Alex Digeronimo <Alex.Digeronimo@davey.com>

[Quoted text hidden]

2 attachments

Owen Farms 2022 Repair Photo Log.pdf
2468K



0 Feet 630

REPAIR PLAN MAP

OWEN FARMS MITIGATION SITE

FIGURE 1

MAP DATE: 09-15-2022

OWEN FARM REPLANTING AREA

OWEN FARMS MITIGATION SITE

Table 1: Repair Plan Replant List

Scientific Name	Stem Densities	Indicator Status
Liriodendron tulipafera	146	FACU
Betula nigra	146	FACW
Platanus occidentalis	146	FACW
Carya ovata	40	FACU
Ulmus americana	146	FACW
Cornus florida	109	FACU

P1: Bank erosion between Station 10+00 and 10+50

P2: Looking upstream at eroded right bank near Station 11+00

P3: Bank erosion slightly upstream from P2

P4: Looking downstream at eroded right bank by Station 14+00

P5: Looking downstream at eroded right bank shown in P4

P6: Toe erosion on right bank near Station 15+50

P7: Looking downstream at scour/bank erosion on left bank near Station 16+50

P8: Looking upstream at scour/bank erosion shown in P7

P9: Bank looking upstream at bank erosion on right bank near Station 22+50

P10: Bank erosion on right bank shown in P9

P11: Looking downstream at toe erosion on right bank near Station 25+50

Appendix G – 2022 Credit Release IRT Meeting Minutes

Meeting Minutes

Project:	Owen Farms Stream and Wetland Mitigation Site (DMS # 100064, USACE: SAW-2018-01165, DWR: 2018-1033v1)	
Subject:	IRT Credit Release Meeting	
Date:	Tuesday, May 10, 2022	
Location:	On-site (Silverstein Rd, Lake Toxaway, NC)	
Attendees:	Matthew Reid (DMS)	Ben Furr (DRG)
	Paul Wiesner (DMS)	Dave McHenry (WRC)
	Casey Haywood (USACE)	Erin Davis (DWR)
	Kim Browning (USACE)	

An on-site IRT meeting was held at 9:30am on Tuesday, May 10, 2022 (Monitoring Year 2) to review the condition of the Owen Farms Stream and Wetland Mitigation Site. The following represents highlights of discussions that occurred during the meeting:

1. IRT suggested that HDR note percent cover and herbaceous species diversity within the Swamp Forest Bog wetland complex (noting that woody stem density and height may be lower within the bog complex than in other areas on-site).
2. IRT requested that HDR map out all areas of invasive species on-site and develop a treatment plan for areas of invasive species identified within the entire conservation easement. DRG noted that invasives would be treated late summer/early fall 2022.
3. IRT requested that the wetland expansion area surrounding W3 (as well as the new groundwater gauge that was installed in the expansion area) be depicted and discussed in the MY2 report. DRG also noted that random vegetation plots would be located within the wetland expansion area over the course of monitoring to document vegetative success.
4. Cattails were observed in UT 5 and UT 7. DRG noted that cattail would be treated later this year as part of the invasive treatment plan for the Site.
5. IRT suggested that some of the random vegetation plots be located in replant areas during MY2.
6. IRT noted that woody vegetation along West Fork French Broad River was lacking. DRG indicated that additional bare roots and live stakes were planted in February 2022. IRT suggested that additional planting along channel banks may be warranted in future years if density doesn't improve.

7. IRT reviewed culvert crossings on UT 2 and UT 4. IRT requested that photos of all project crossings be included in each annual monitoring report. Crossing photos should be taken to show upstream and downstream sides of crossings to document crossing stability and potential for aquatic passage.
8. IRT requested that a photo point be added on UT 2 to verify that a stream channel is present and active, given the beaver activity that was observed downstream of the easement.
9. Fencing was down at the ford crossing on WFFBR. IRT and DMS requested that the fencing be repaired as soon as possible. IRT and DMS agreed that spring fencing could be installed across the river that would allow the property owner to connect fencing when moving cattle across ford and remove fencing when not in use to avoid large flows from continuing to damage fence in this area. IRT also noted that additional rock could be placed on the ford to stabilize crossing and minimize erosion.
10. Kissing gates were observed and discussed during the meeting. DRG noted that calves had been able to access the easement through the kissing gates but are currently excluded by placement of wooden pallets and metal posts. DMS suggested that a long-term solution be discussed with the property owner to ensure cattle exclusion following the monitoring phase of the project. DRG indicated that they would discuss a long-term solution with the property owner, which may include nailing wooden slats across the kissing gates.
11. DRG showed DMS and IRT the beaver dam on UT 6. UT 6 was flowing under the beaver dam during the site visit and the system was still functioning as a stream. IRT agreed that the beaver dam could be left in place as long as UT 6 continues functioning as a stream (i.e. as long as the beaver dam doesn't create a significant backwater effect on the channel). Any other active beaver dams and beaver within the conservation easement should be removed during the monitoring period.
12. DRG explained why the groundwater gauge in W5 was moved and that the groundwater gauge at the upstream extents of the wetland was intended to serve as a reference gauge which is why it was installed in the wetland enhancement area. IRT requested that the reference gauge be identified as such in future monitoring reports.
13. IRT noted that some terrace side slopes were bare and rill erosion was observed in these areas. DRG stated that additional temporary seeding would be placed in bare areas during late summer/early fall 2022, if necessary.

Appendix H – Wetland Expansion Area Letter to USACE

February 11, 2022

Ms. Kim Browning
United States Army Corps of Engineers
3331 Heritage Trade Drive, Suite 105
Wake Forest, North Carolina 27587

Subject: Owen Farms (SAW-2018-01165) Wetland Expansion Areas

Ms. Browning,

HDR Engineering of the Carolinas, Inc. (HDR) has contracted Davey Resource Group, Inc. (DRG) to provide monitoring services for the Owen Farms Mitigation Site (Site). The purpose of this letter is to inform you of wetland areas that have been identified outside the original wetland mitigation boundaries proposed in the Mitigation Plan. Wetland A (WA) has formed in the footprint of the filled, abandoned river channel just downstream of UT 8. Wetland B (WB) was created by excavating a floodplain bench adjacent to the river, downstream of UT 4, which tapped into a shallow groundwater hillside seep. Wetland C (WC) developed adjacent to W3 and is simply an expansion of existing wetland restoration areas. WA, WB, and WC were delineated on February 2, 2022 and exhibited hydric soils, wetland hydrology, and hydrophytic vegetation. Soil profiles were collected in each new wetland area and are summarized in Table 1. Soft rush (*Juncus effusus*) was the dominant vegetative component of each wetland and hydrology indicators included high water table, saturated soils, surface water, and FAC neutral test. Figure 1 (attached) depicts the original wetland polygons and wetland expansion areas.

Table 1. Soil Profile Summary

Depth (in)	**Matrix**		**Redox Features**		**Texture**
WA	Color	%	Color	%	
0-3	7.5YR 3/1	100	--	--	Sandy loam
3-14	10YR 3/1	97	10YR 3/4	3	Sandy loam
WB					
0-15	10YR 3/1	90	10YR 3/6	10	Sandy loam
WC					
0-6	10YR 3/1	100	--	--	Sandy loam
6-17	10YR 3/1	95	10YR 3/6	5	Sandy loam

HDR proposes to install a new groundwater gauge in Wetland C to document groundwater hydrology throughout the remainder of the monitoring period. Random vegetation plots will also be located within wetland expansion areas throughout monitoring to document vegetative success. At this time, HDR is not requesting additional wetland credits for WA, WB, or WC.

Daveyresourcegroup.com/Carolinas • Phone: 919.645.4350
3101 Poplarwood Court, Suite 120, Raleigh, NC 27604

However, HDR would like to document their presence on-site. In addition, HDR proposes to move the groundwater gauge in W5 approximately 15 feet northeast because the gauge is currently installed on a higher spot along the wetland edge and is not representative of the majority of W5 (based on soils and vegetation observed at the current gauge location compared to soils and vegetation observed in other areas of W5). Table 2 provides a summary of wetlands on-site.

Table 2. Wetland Summary

Project Component	Area	Mitigation Type/Ratio	Credits (WMU)
Wetlands as Proposed in Mitigation Plan			
Wetland Group 1 (W1-W9)	1.54	Enhancement (2:1)	0.77
Wetland Group 2 (W3 and W5)	0.35	Re-establishment (1:1)	0.35
Wetland Group 3 (W3)	0.97	Rehabilitation (1.5:1)	0.64
Total	**2.86**	**--**	**1.76**
Wetland Expansion Areas			
WA	0.16	Creation (3:1)	0.05
WB	0.14	Creation (3:1)	0.05
WC	0.38	Re-establishment (1:1)	0.38
Total	**0.68**	**--**	**0.48***

*HDR is not requesting additional wetland credit for credits generated from wetland expansion areas at this time.

Repair work, described in a previous letter dated November 16, 2021, was completed on January 28, 2022 and disturbed areas were replanted February 1-2, 2022. Please let me know if you have any concerns or questions related to the information provided in this letter. You can reach me via email at ben.furr@davey.com or by phone at 919.588.9663.

Thank you,

Ben Furr, PWS
Davey Resource Group

Cc: Jessica Tisdale (HDR), Paul Wiesner (NCDMS), Andrea Leslie (NCWRC), Todd Tugwell (USACE), Erin Davis (NCDWR), Casey Haywood (USACE)

Daveyresourcegroup.com/Carolinas • Phone: 919.645.4350
3101 Poplarwood Court, Suite 120, Raleigh, NC 27604

0 Feet 950

FIGURE 1 - WETLAND EXPANSION AREAS

OWEN FARMS MITIGATION SITE