Year 3 Monitoring Report

FINAL

UT WEST BRANCH ROCKY RIVER RESTORATION SITE

NCDMS Project #92684 (Contract # WBRR010521)
USACE Action ID: SAW-2017-00342 | NCDWR Project #18-1696

Mecklenburg County, North Carolina
Yadkin River Basin | HUC 03040105

Provided by:

Resource Environmental Solutions, LLC
For Environmental Banc & Exchange, LLC

Provided for:
NC Department of Environmental Quality
Division of Mitigation Services

January 2024

3600 Glenwood Avenue, Suite 100
Raleigh, NC 27612

Corporate Headquarters
6575 W Loop S #300
Bellaire, TX 77401
Main: 713.520.5400

January 11, 2024

Harry Tsomides
NC DEQ Division of Mitigation Services
5 Ravenscroft Drive, Suite 102
Asheville, NC 28801

RE: UT West Branch Rocky River Project: Year 2 Monitoring Report

Listed below are comments provided by DMS on January 4th, 2024, regarding the UT West Branch Rocky River Project: Year 3 Monitoring Report and RES' responses.

Comments:

1. Each bankfull event should be listed as a separate line item with reach, date of occurrence (month/day/year), and measurement device/method.
   Table 13 has been updated to include all bankfull events from 2022 and 2023.

2. Assessed dates on the visual assessment tables need to be updated.
   Table 5 and Table 6 have been updated with the correct date assessed.

3. Table 2 – Invasives treatments and other project activities should be listed under each year during which they occurred (month/year).
   Table 2 has been updated to include invasive treatments dates to each specific monitoring year.

4. Thank you for discussing the ongoing and upcoming maintenance activities that DMS is implementing (invasives, fencing removals, scoured area repair, and channel live staking), and including details in the Appendix. Please also mention in the write up that the live stakes along the stream are intended to help provide shade so that in-stream vegetation will reduce over time.
   In Section 1.8 a sentence stating "Along the banks of UTWB 600 livestakes will be planted where necessary along the stream to help provide shade to reduce in-stream vegetation over time" was added.

Digital Support Files:

5. The visual stream and vegetation tables were missing from the submission; please submit a complete set of digitals with the finals.
   Table 5 and Table 6 are now included within Folder 2: Visual Assessment Data within the digital files.

Table of Contents

1.0 Project Summary

1.1 Project Location and Description

The UT West Branch Rocky River Restoration Site (UTWBRR) is a stream mitigation project for the North Carolina Division of Mitigation Services (DMS) within the Yadkin River Basin (Hydrologic Unit Code 03040105) in Mecklenburg County, North Carolina. The project provides compensatory mitigation credits for the NCDMS ILF Program to offset impacts to waters of the United States within the US Army Corps of Engineers Wilmington District. The project site exists within the Southern Outer Piedmont Level IV Ecoregion in the Piedmont physiographic province.

The project site is located approximately 4.7 miles east of Davidson, NC in Mecklenburg County as seen in **Figure 1**. The project streams consist of UT West Branch Rocky River (UTWB), Unnamed Tributary 1 (UT1), and Unnamed Tributary 2 (UT2). The project lies to the east of Fisher Road along the eastern boundary of the Town of Davidson's Fisher Farm Park. A conservation easement for the project has already been recorded and measures 58.9 acres. The original conservation easement (April 2010) did not allow enough room for the designed restoration of this project. A negotiated modification (2014) resulted in adding additional land needed to complete the stream restoration while allowing for a partial release of the original easement to allow the gas utility to complete their line. The Tarheel Trail Blazers maintain approximately 5.2 miles of single-track mountain bike trails throughout Fisher Farm Park, and some trails exist within the conservation easement per the conservation easement deed allowance. Bike trails do not impact the stream project, and are maintained in most locations more than 50 feet off the constructed channel.

1.2 Project Goals and Objectives

Goals	Objective	Functional Level	Function-Based Parameter Effects	Monitoring Measurement Tool
Restore an incised stream to a C-type channel with an active floodplain	Relocated streams to a meandering landscape position to capture hillside seepage	Hydraulics	Floodplain Connectivity	Flood Frequency Bank Height Ratio and Entrenchment Ratio
	Installed a cross-section sized to the bankfull discharge	Geomorphology	Bank Migration/Lateral Stability	Cross-Sectional Survey Visual Inspection of Bank Stability
	Created bedform diversity with pools, riffles, and habitat structures	Geomorphology	Bed Form Diversity	Visual Inspection of Feature Maintenance
Restore a forested riparian buffer to provide bank stability and shading	Planted the site with native trees and shrubs	Geomorphology	Vegetation	Density Species Composition/Diversity

1.3 Performance Criteria

Monitoring of the UT West Branch Site shall occur for a minimum of seven years following construction. The following performance standards for stream mitigation are based on the Wilmington District Stream and Wetland Compensatory Mitigation Update (NCIRT 2016) and the Approved Mitigation Plan (11/28/20218) and will be used to judge site success.

Vegetation Performance

The site must achieve a woody stem density of 260 stems/acre after five years and 210 stems/acre after seven years to be considered successful. Trees in each plot must average 7 feet in height at Year 5 and 10 feet at Year 7. A single species may not account for more than 50% of the required number of stems within any plot. Volunteers must be present for a minimum of two growing seasons before being included performance standards in Year 5 and Year 7. If monitoring indicates that any of these standards are not being met, corrective actions will take place.

Stream Hydrologic Performance

During the monitoring period, a minimum of four bankfull events must be recorded within the seven-year monitoring period. These bankfull events must occur in separate monitoring years. Bankfull events will be verified using a minimum of one automatic stream monitoring gauge on UTWB to record daily stream depth readings. Any Qgs flows at the project during the monitoring period will also be measured. In addition, continuous surface water flow must be documented for at least 30 consecutive days during the calendar year. Additional monitoring may be required if surface water flow cannot be documented due to abnormally dry conditions.

Stream Geomorphology Performance

The site's geomorphology will be monitored per the NRIRT 2016 monitoring guidelines. The bank height ratio (BHR) must not exceed 1.2 and the entrenchment ratio (ER) should be at least 2.2 for C channels. BHR and ER at any measured riffle cross-section should not change by more than 10% from the baseline condition during any given monitoring interval (e.g., no more than 10% between years 1 and 2, 2 and 3, 3 and 5, or 5 and 7). Adjustment and lateral movement following construction and as the channel settles over the monitoring period are to be expected. Geomorphological measurements of cross-sections will be used to determine if any adjustments that occur are out of the range typically expected for this type of stream.

1.4 Project Monitoring

Monitoring of UTWBRR consists of the collection and analysis of stream hydrology, stability, and vegetation survivability data to support the evaluation of the project in meeting established performance criteria described above. Vegetation plot and cross section monitoring will take place

in Years 1, 2, 3, 5, and 7 and hydrology and visual monitoring will take place annually. **Figure 2** shows the locations of monitoring features described below:

UT West Branch Restoration Site				
Required	**Parameter**	**Quantity**	**Frequency**	**Notes**
Yes	Pattern and Profile	UTWB-1, UTWB-2, UTWB-3, UT1-2, UT2-2	Once, during as-built survey	Additional measurements in later years may be taken, as necessary.
Yes	Stream Dimension	14 cross-sections (7 riffles, 7 pools)	Monitoring Years 1, 2, 3, 5, and 7	
Yes	Stream Hydrology	3 monitoring devices	Annual – throughout year	1 pressure transducer gauge on middle UTWB-3 and two other monitoring devices (gauge or camera) on UT-1 and UT-2.
Yes	Vegetation	12 vegetation monitoring plots	Monitoring Years 1, 2, 3, 5, and 7	6 permanently fixed, 6 randomly located each monitoring visit
Yes	Visual	14 photo stations	Annual	Crossings, confluences, and general photos
Yes	Exotic and nuisance vegetation		Annual	Locations of invasive vegetation will be mapped
Yes	Project boundary		Semi-annual	Locations of vegetation damage, boundary encroachments, etc. will be mapped

1.5 Project Components

The proposed streams include an Unnamed Tributary to West Branch Rocky River (UTWB), Unnamed Tributary 1 (UT1), and Unnamed Tributary 2 (UT2). UTWB is divided into three reaches - UTWB-1, UTWB-2, and UTWB-3. Reaches UTWB-1, 2, and 3 were improved through a combination of Priority 1 and Priority 2 stream restoration over 3,612 linear feet of proposed single-thread channel. For UT1, 143 linear feet of stream was improved through Enhancement II and Priority I stream restoration. UT2 has 304 linear feet that underwent Enhancement I and restoration. The table below summarizes the project mitigation credits.

Stream Mitigation			
Mitigation Approach	**Creditable Linear Feet**	**Ratio**	**SMU**
Restoration	3,837	1	3,837.000
Enhancement I	45	1.5	30.000
Enhancement II	49	2.5	19.600
Total	**3,931**		**3,886.600**

1.6 Stream Design/Approach

<u>UT West Branch Rocky River (UTWB)</u>

For UTWB-1, restoration was used on the first-order, single-thread stream, starting at the northern end of the conservation easement. UTWB-1 serves as a transitional Priority 2/1 reach as it begins at the upstream incised channel and connects downstream to the Priority 1 restoration on UTWB-2. The designed stream has a width/depth ratio of 16.3, entrenchment ratio of > 2.2, and a slope of 1.4%. At the upper end of UTWB-1, floodplain grading was completed to ensure a smooth transition from the upstream top of bank elevations into a restored floodprone channel with

entrenchment ratios of 2.2 or greater. The designed stream for this reach incorporated riffle-pool sequences with the goal of attaining improved habitat diversity within the system due to the addition of varying flow regimes and depths. Many of the riffles are constructed riffles to provide stability in the higher gradient riffles. Step pools were avoided as much as possible since they are not as typical in this type of stream but were necessary in four locations with single step pools. Woody debris harvested onsite was added to the channel along selected outside meander bends for increased stability and in-stream habitat. Channel plugs were utilized within the abandoned channel in the areas where the old channel intersects the designed stream to prevent any re-channelization of the old channel. Existing spoil piles lining the old channel were removed and used as fill material in the abandoned channel. Incoming flowpaths, which are currently inducing erosion along the existing stream, were incorporated into the restored stream system. Channel design through this reach included working around desirable, mature trees already existing within the valley, but site grading necessitated by the Priority 2 transition required the removal of certain mature trees.

UTWB-2 begins approximately 78 linear feet upstream of the confluence with UT-1 and continues to the confluence with UT-2. The design approach was similar to UTWB-1, except for that the design consisted of Priority 1 Restoration for the majority of the reach with a bankfull elevation matching the existing historic floodplain as much as feasible. Then the final stretch of UTWB-2 was used as a transition to Priority 2 Restoration in the final reach (UTWB-3). The designed stream has a width/depth ratio of 16.3, entrenchment ratio of > 2.2, and a slope of 1.6%. The planform utilized the full extent of the valley floor as much as feasible and the resultant sinuosity for the reach is 1.2. An existing trail crossing was relocated slightly to the east. The existing culvert at the crossing was replaced with a 48″ corrugated metal pipe embedded 1 foot below grade.

UTWB-3 begins at the confluence of UT-2 and continues to the end of the project at an existing gas easement crossing and used a Priority 2 approach. In particular, downstream of the second culverted crossing, a new stream valley was excavated to accommodate a floodplain wide enough for a C-type channel. In this reach, the riffle slopes of 3% or less. The excavated material generated by the Priority 2 Restoration was used to backfill the highly incised existing channel throughout the site. The designed stream has a width/depth ratio of 16.0, entrenchment ratio of >2.2, and a slope of 1.3%, typical of a Rosgen C-type channel. The resultant sinuosity for this reach is 1.3. The reach has riffle-pool sequences installed to create bedform diversity, and the stream incorporated woody debris along selected outside meander bends. Channel plugs were utilized to prevent re-channelization of the existing channel. Similar to the previous reach, many of the riffles are constructed riffles to ensure stability in the higher gradient areas. An existing stream crossing used for recreation trails and utility easement access was relocated slightly. The existing culvert at the crossing was replaced with two 48″ corrugated metal pipes embedded 1 foot below the thalweg.

UTWB-2 begins as Priority 1 but transitions to Priority 2. The cross-section connects to the existing bank elevations at the upper portions of the reach, but as the stream moves further downstream, an excavated floodplain was necessary. UTWB-3 was entirely Priority 2. A new floodplain was constructed at the channel elevation with enough capacity to accommodate out-of-bank flows without inducing elevated shear stresses on the newly constructed valley side slopes. At the end

of UTWB-3, a series of soil lifts constructed at approximately 45 degrees toward the upstream transition the restoration floodplain into the existing stream valley downstream of the project.

Unnamed Tributary 1 (UT1)

UT1 enters UTWB approximately 400 linear feet downstream of the beginning of the UTWB-1. Enhancement II was used for the beginning at the top of the tributary (UT1-1), and continuing to a headcut located at an existing fence running perpendicular to the channel. Approximately 46 lf of Priority 1 Restoration (UT1-2) was used, beginning at the headcut/fence line and ending at the newly located confluence with UTWB-2. Priority 1 Restoration included stabilizing the existing headcut with a step pool structure and establishing a bankfull elevation equal to the historic floodplain. A channel block was utilized in the area where UT1 intersected the old UTWB to prevent any re-channelization of the old channel. The channel has a width/depth ratio of 16.1, entrenchment ratio of > 2.2, and a slope of 1.6%.

Unnamed Tributary 2 (UT2)

UT2 is the larger of the two tributaries entering UTWB, approximately 2,200 lf downstream of the beginning of the project. UT2 begins at an existing fence line that lies perpendicular to the current stream and flows southwest until converging with UTWB. Enhancement I was used for the top 45 linear feet (UT2-1) of the stream, which begins at an existing fence line. Priority 1/2 Restoration was used for the remaining section (UT2-2) with the purpose of addressing stream bank instability and bed degradation. The channel has a width/depth ratio of 15.6, entrenchment ratio of > 2.2, and a slope of 1.8%, which are typical for C-type channels. Channel incision was the main deficiency; therefore, increasing the bed elevation and adjusting the designed bankfull elevation to match the historic floodplain reduces stress on the stream bed and improved stability in the reach. The designed stream has riffle-pool sequences that created bedform variation that this reach currently lacks. Constructed riffles were utilized for additional stability in higher gradient riffles. Wood toe structures were added along selected outside meander bends for increased stability and aquatic habitat. The existing culverted crossing for the bike trail was moved slightly south of its current location and replaced with a 48″ corrugated metal pipe embedded 1′ below the thalweg elevation.

The designed stream abandoned the old channel location after UT2-1, and meanders adjacent to an existing electric utility easement before entering UTWB. Channel plugs were utilized in the abandoned channel to prevent any re-channelization of the old channel.

1.7 Construction and As-Built Conditions

Stream construction was completed on February 12, 2021 and planting was completed on March 5, 2021. The UTWBRR project was built to design plans and guidelines. Minor changes to the design plans were made during construction and are outlined in the table below and in the record drawings in **Appendix E**.

The only planting plan change was the removal of green ash (*Fraxinus pennsylvanica*). Quantities of the other species on the planting list were increased to compensate for the removal of green ash. The only minor monitoring device location change was VP6 was moved slightly upstream to avoid backwater influence from West Branch Rocky River. The other locations and quantities remained as proposed in the Approved Final Mitigation Plan.

Project Segment	Creditable Mitigation Plan Footage	As-Built Footage or Acreage	Difference between MP and As built	Comments
UTWB-1	423	426	3	Slight increase due to differences between proposed center line and as-built surveyed thalweg.
UTWB-2	1747	1786	39	Minor difference in surveyed location of UTWB-UT2 confluence added approx. 5'. Other increases due to differences between proposed center line and as-built surveyed thalweg.
UTWB-3	1314	1327	13	Increase due to differences between proposed center line and as-built surveyed thalweg.
UT1-1	49	49	0	No difference
UT1-2	94	90	-4	Slight decrease in as-built length due to adjustment in pool just upstream of confluence with UTWB.
UT2-1	45	45	0	No difference
UT2-2	259	268	9	Minor difference in surveyed location of UTWB-UT2 confluence added approx. 3'. Remaining increase due to differences between proposed center line and as-built surveyed thalweg.

1.8 Monitoring Performance (MY3)

The UTWBRR Year 3 monitoring activities were performed in May and October 2023. All Year 3 monitoring data is present below and in the appendices. The Project is on track to meeting interim success criteria and the easement boundary is intact with no encroachments present.

Vegetation

Monitoring of six fixed vegetation plots and six random vegetation plots were completed in October 2023. Vegetation data can be found in **Appendix C**, associated photos are in **Appendix B,** and plot locations are in **Appendix B**. MY3 monitoring data indicates that all plots are exceeding the interim success criteria of 320 planted stems per acre. Planted stem densities ranged from 445 to 971 planted stems per acre with a mean of 620 planted stems per acre across all plots. Volunteer stems were found in all of the fixed vegetation plots with an average of 378 stems per acre. The average stem height in the plots was 2.7 feet. A total of 13 species were documented within the plots.

Visual assessment of vegetation outside of the monitoring plots indicates that the herbaceous vegetation has become well established throughout the project. Invasive species treatments were performed in February through November of 2021 and April/October of 2023. Treatments consisted of cut spray method and were largely effective. There are still sections of the existing wooded areas that need to be treated for invasives. The invasive species in this area consist mostly of large autumn olive (*Elaeagnus umbellata*) shrubs and Chinese privet (*Ligustrum sinense*) mixed in. These areas with notable invasive vegetation density total 4.79 acres (**Figure 2**). There is also an area of approximately 1,000 square feet of kudzu outside the easement boundary. Further invasive species treatment will take place in early 2024. An invasive vegetation management contactor has been retained by NCDMS through June 2028 to treat any new or previously treated invasive vegetation communities on site. The invasive areas treated in 2023 and further information regarding upcoming maintenance can be found in **Appendix F.**

There is approximately 1,000 feet of relic barbed wire fencing within the easement which will be removed in early 2024. There is approximately 1,000 square feet of surface erosion area along the right bank near the southeastern boundary of the easement. This area will be reseeded and planted with bareroots. Along the banks of UTWB 600 livestakes will be planted where necessary along the stream to help provide shade to reduce in-stream vegetation over time. The location of the fencing and side slope repair is in **Figure 2** and further details regarding these maintenance items can be found in **Appendix F**.

Stream Geomorphology

Cross section monitoring took place in May 2023. Summary tables and cross section overlay plots are in **Appendix D**. Overall the cross sections relatively match the baseline conditions. The as-built conditions show that shear stress and velocities have been reduced for the restoration reach. The reach was designed as a gravel bed channel and remains classified as a gravel bed channel post-construction.

Along UT1-2 there is approximately 20 feet of aggradation and on UT2-2 there is approximately 40 feet of aggradation that has been noted. In-stream vegetation throughout may contribute to this aggradation, removal of the excessive vegetation could help the aggradation in these channels. Four structures were found to be piping with two on UTWB-1 and two on UTWB-2. Structures #2 and #4 have been hand repaired and are now functioning properly. Structures #1 and #3 will be repaired in January 2024. The aggradation and structures will continue to be monitored in the future. Pictures of the aggradation area, piping structures can be found in **Appendix B** and locations of these areas can be found on **Figure 2.**

Visual assessment of the stream channel was performed to document signs of instability, such as eroding banks, structural instability, or excessive sedimentation. Overall, the channel is transporting sediment as designed and will continue to be monitored for other instances of aggradation and degradation. In MY3 all stream cross sections are stable and show no signs of any major alteration. Pictures and data of the cross sections can be found in **Appendix D**.

Stream Hydrology

One stage recorder and two flow gauges were installed on April 15, 2021. The stage recorder was installed on UTWB-2 and the flow gauges were installed on UT1-2 and UT2-2. In MY3, the stage recorder logged five bankfull events with the maximum event being on June 19th, 2023. FG UT1 recorded 277 consecutive days of flow and GF UT2 recorded 276 consecutive days of flow. The MY2 SR data was updated to include the October through December of 2022 data. The gauge locations can be found on **Figure 2**, photos are in **Appendix B**, and associated data is in **Appendix E**.

2.0 Methods

Stream profile and cross section monitoring was conducted using a Topcon GTS-312 Total Station. Three-dimensional coordinates associated with cross-section data were collected in the field (NAD83 State Plane feet FIPS 3200). Morphological data were collected at 14 cross-sections. Survey data were imported into CAD, ArcGIS®, and Microsoft Excel® for data processing and analysis. The stage recorders include an automatic pressure transducer placed in PVC casing in a pool. The elevation of the bed and top of bank at each stage recorder are used to detect bankfull events.

Vegetation success is being monitored at six fixed monitoring plots and six random monitoring plots. Vegetation plot monitoring follows the CVS-EEP Level 2 Protocol for Recording Vegetation, version 4.2 (Lee et al. 2008) and includes analysis of species composition and density of planted species. Data are processed using the CVS data entry tool. In the field, the four corners of each plot were permanently marked with PVC at the origin and metal conduit at the other corners. Photos of each plot are to be taken from the origin each monitoring year. The random plot is to be collected in locations where there are no permanent vegetation plots. Random plot will most likely be collected in the form of 100 square meter belt transects with variable dimensions. Tree species and height will be recorded for each planted stem and the transects will be mapped and new locations will be monitored in subsequent years.

Permanent photo stations were established at 14 locations. The photo stations are marked with metal conduit in the field. Each photo station is intended to visually monitor crossings, confluences, reaches entering and exiting the project, and other general areas on site.

3.0 References

Griffith, G.E., J.M.Omernik, J.A. Comstock, M.P. Schafale, W.H.McNab, D.R.Lenat, T.F.MacPherson, J.B. Glover, and V.B. Shelburne. (2002). Ecoregions of North Carolina and South Carolina, (color Poster with map, descriptive text, summary tables, and photographs): Reston, Virginia, U.S. Geological Survey (map scale 1:1,500,000).

KCI Associates of North Carolina (2018). UT West Branch Rocky River Restoration Site Final Mitigation Plan.

Lee Michael T., Peet Robert K., Roberts Steven D., and Wentworth Thomas R., 2008. *CVS-EEP Protocol for Recording Vegetation Level*. Version 4.2

Peet, R.K., Wentworth, T.S., and White, P.S. (1998), *A flexible, multipurpose method for recording vegetation composition and structure*. Castanea 63:262-274

Rosgen, D.L. 1994. A Classification of Natural Rivers. Catena 22: 169-199.

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

Schafale, M.P. 2012. Guide to the Natural Communities of North Carolina, Fourth Approximation. North Carolina Natural Heritage Program, Division of Parks and Recreation, NCDENR, Raleigh, NC.

USACE. (2016). Wilmington District Stream and Wetland Compensatory Mitigation Update. NC: Interagency Review Team (IRT).

Appendix A

Background

Tables

Table 1. UT West Branch Rocky River Restoration Site (ID-92684) - Mitigation Assets and Components

Project Segment	Existing Footage or Acreage	Creditable Mitigation Plan Footage	Mitigation Category	Restoration Level	Priority Level	Mitigation Ratio (X:1)	Mitigation Plan Credits		As-Built Footage or Acreage	Comments
UTWB-1	364	423	Warm	R	1/2	1.00000	423.000		426	PII transition at top, then PI
UTWB-2	1512	1747	Warm	R	1	1.00000	1747.000		1786	Exludes 20' for piped bike path crossing
UTWB-3	1144	1314	Warm	R	1/2	1.00000	1314.000		1327	No credit for 108' of stream length in utility easement
UT1-1	49	49	Warm	EII	NA	2.50000	19.600		49	
UT1-2	46	94	Warm	R	1	1.00000	94.000		90	
UT2-1	45	45	Warm	EI	NA	1.50000	30.000		45	
UT2-2	274	259	Warm	R	1	1.00000	259.000		268	Excludes 20' for piped bike path crossing

Project Credits

Restoration Level	Stream			Riparian Wetland	Non-rip Wetland	Coastal Marsh
	Warm	Cool	Cold			
Restoration	3837.000					
Re-establishment						
Rehabilitation						
Enhancement						
Enhancement I	30.000					
Enhancement II	19.600					
Creation						
Preservation						
TOTALS	**3,886.600**					

Table 2. Project Activity and Reporting History
UT West Branch Rocky River Restoration Site

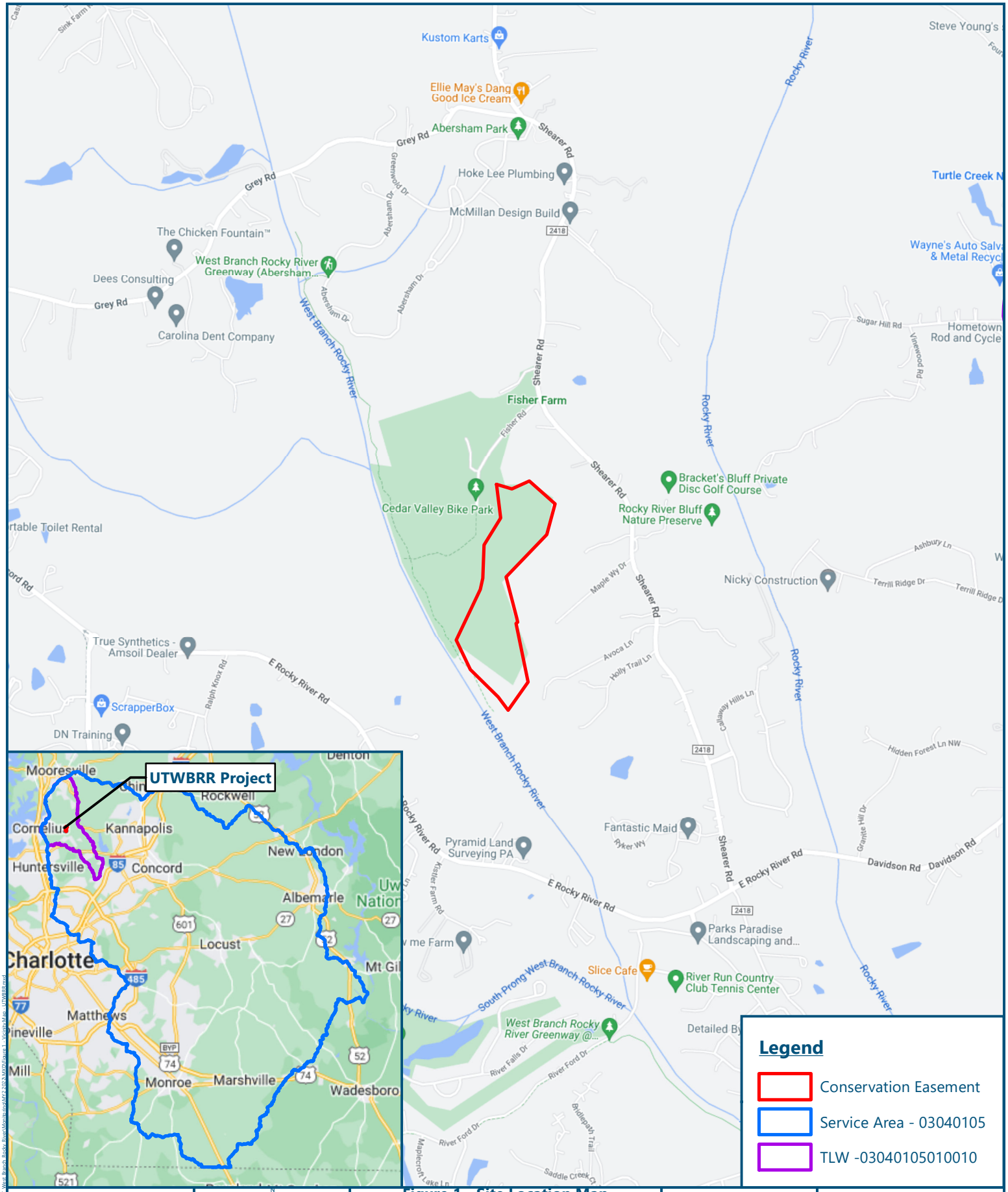
Elapsed Time Since grading complete: 2 year 6 months
Elapsed Time Since planting complete: 2 year 6 months
Number of reporting Years[1]: 3

Activity or Deliverable	Data Collection Complete	Completion or Delivery
Restoration Plan	---	11/28/2018
Final Design – Construction Plans	---	2/5/2020
Stream Construction	---	2/12/2021
Site Planting	---	3/5/2021
As-built (Year 0 Monitoring – baseline)	VP: 4/14/2021 XS/LP: 4/15/2021	6/2/2021
Invasive Species Treatment	---	2/2021 - 11/2021 4/2023 & 10/2023
Year 1 Monitoring	XS: 10/19/2021 VP: 10/19/2021	MR: 11/20/2021 Invasives: 2/2021 - 11/2021
Year 2 Monitoring	XS: 06/02/2022 VP: 09/10/2022	MR:11/22/2022
Year 3 Monitoring	XS: 05/11/2023 VP: 10/04/2023	MR: 12/19/2023 Invasives: 4/2023 & 10/2023
Year 4 Monitoring		
Year 5 Monitoring		
Year 6 Monitoring		
Year 7 Monitoring		

1 = The number of reports or data points produced excluding the baseline

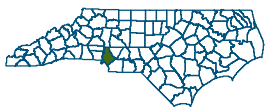
Table 3. Project Contacts Table UT West Branch Rocky River Restoration Site	
Designer Primary project design POC	KCI Associates of North Carolina, PC / 4505 Falls of Neuse Road, Suite 400, Raleigh, NC 27609 Kristin Knight, PE
Construction Contractor Construction contractor POC	CEC (RES) / 150 Pine Ridge Road, Mt. Airy, NC 27030 Joanne Cheatham
Survey Contractor Survey contractor POC	Turner Land Surveying / P.O. Box 148, Swannanoa, NC 28778 David Turner, PLS
Planting Contractor Planting contractor POC	HARP / 301 McCullough Drive, Suite 400, Charlotte, NC 28262 Alan Peoples
Monitoring Performers	RES / 3600 Glenwood Ave, Suite 100, Raleigh, NC 27612
Monitoring POC	Hannah Gadai (704) 516-5170 & Ryan Medric (919) 741-6268

Table 4. Project Background Information				
Project Name		UT West Branch Rocky River		
County		Mecklenburg		
Project Area (acres)		58.86		
Project Coordinates (latitude and longitude)		352914.45 N, -804754.81 W		
Planted Acreage (Acres of Woody Stems Planted)		11.6		
Project Watershed Summary Information				
Physiographic Province		Piedmont		
River Basin		Yadkin		
USGS Hydrologic Unit 8-digit	3040105	USGS Hydrologic Unit 14-digit	3040105010010	
DWR Sub-basin		03-04-11		
Project Drainage Area (Acres)		167		
Project Drainage Area Percentage of Impervious Area		2%		
CGIA Land Use Classification		Forest, Open/Grassland, Utility Easement, Roads		
Reach Summary Information				
Parameters		**UTWB**	**UT1**	**UT2**
Length of reach (linear feet)		3,028	94	319
Valley confinement (Confined, moderately confined, unconfined)		Confined		
Drainage area (Acres)		167	4	75.1
Perennial, Intermittent, Ephemeral		Perennial	Intermittent	Perennial
NCDWR Water Quality Classification		C		
Stream Classification (existing)		G5	G5	G5
Evolutionary trend (Simon)		Stage III		
FEMA classification		Zone X		



Legend

- Conservation Easement
- Service Area - 03040105
- TLW -03040105010010



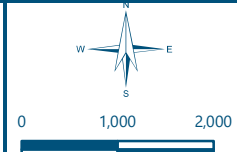


Figure 1 - Site Location Map

UT West Branch Rocky River Mitigation Project

Mecklenburg County, North Carolina

Date: 10/31/2022	
Drawn by: GDS	
Checked by: RTM	
1 inch = 2,000 feet	

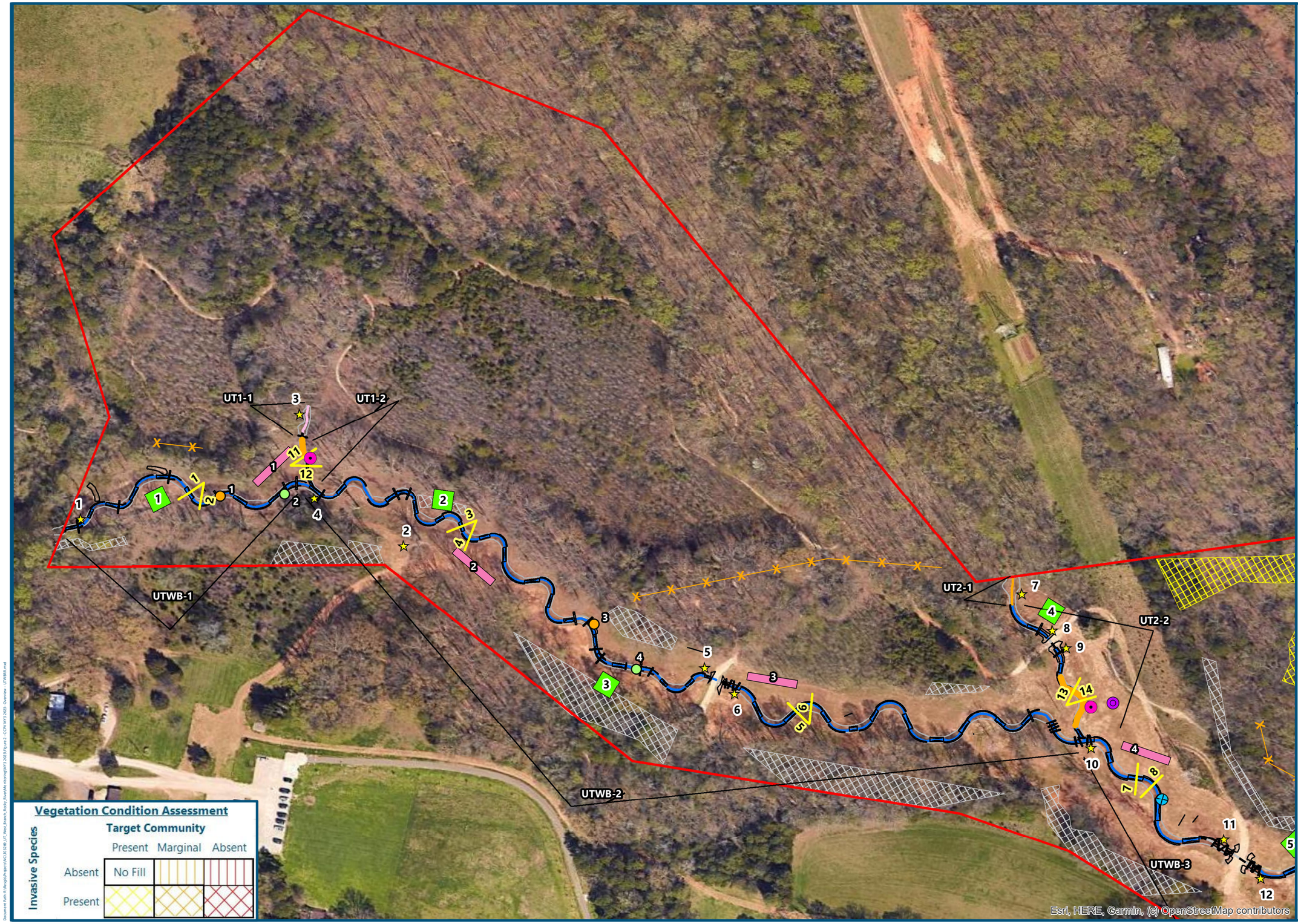
res

Restoring a resilient earth for a modern world

Appendix B

Visual Assessment

Data



res

Restoring a resilient earth for a modern world

N E S W

0 50 100

Feet

Figure 2 - CCPV MY3

UT West Branch Rocky River Mitigation Project

Mecklenburg County, North Carolina

Date: 12/19/2023	Drawn by: HG
1 in = 150 feet	Checked by: RM

Legend

- Conservation Easement
- Existing Wetland
- Random Vegetation Plot
- Fixed Vegetation Plot
- Invasives Area
- Invasives Treated (2023)
- Side Slope Repair Needed
- Aggradation Area
- Barbed Wire Fencing

Stream Mitigation

- Restoration
- Enhancement I
- Enhancement II
- No Credit
- Cross Section
- Structure
- Top of Bank

Structures

- Piping Structures
- Repaired Structures

Monitoring Devices

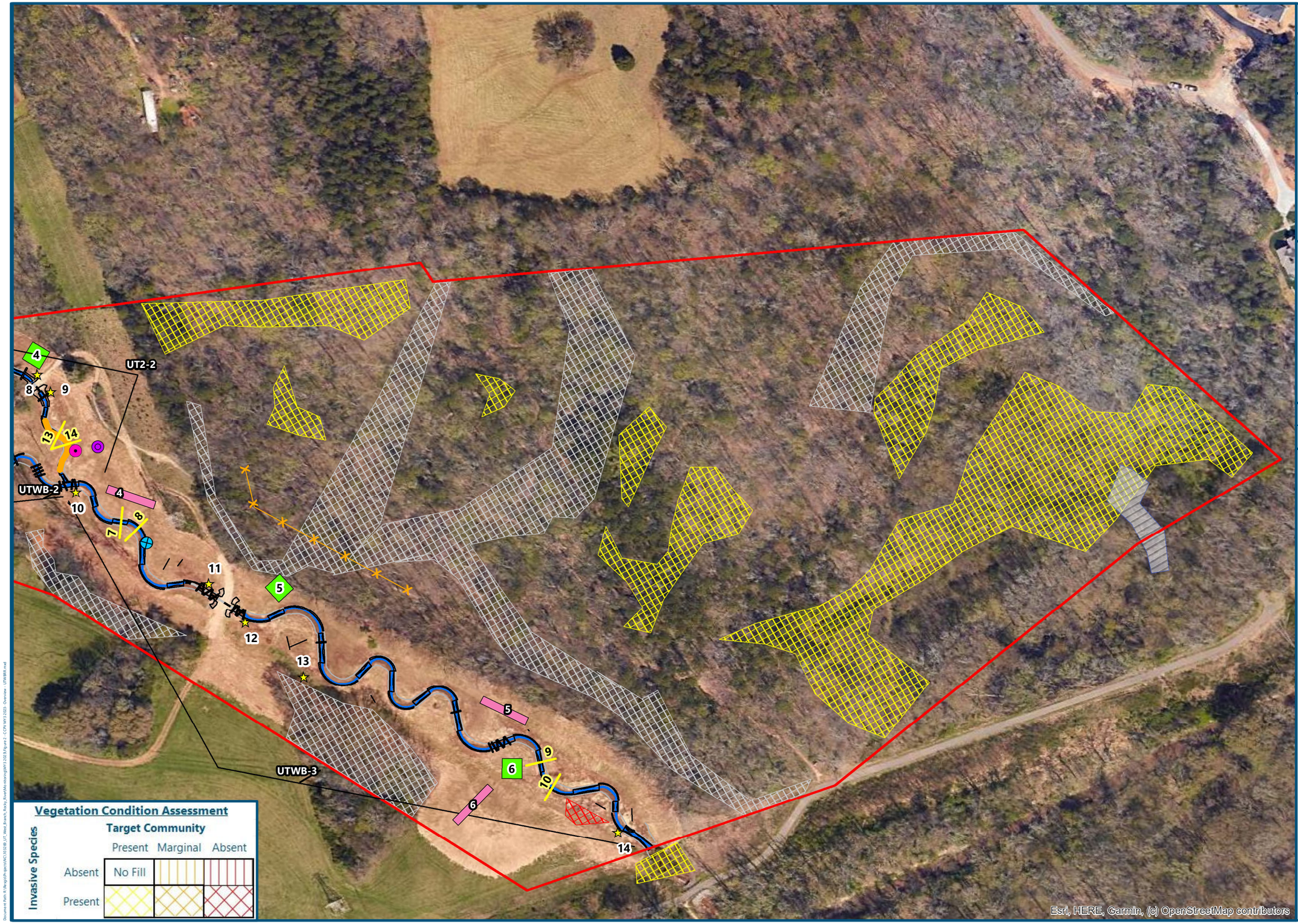
- Stage Recorder
- Flow Gauge
- Ambient/Rain Gauge
- Photo Station

Vegetation Condition Assessment

Target Community

Invasive Species	Present	Marginal	Absent
Absent	No Fill		
Present			

Document Path: K:\Projects\NC\10328\Jif_UT_West_Branch_Rocky_RiverMitigation\MY3 2023\Figure 2 - CCPV MY3 2023- Overview - UTWB#4.mxd



res

Restoring a resilient earth for a modern world

N E S W

0 50 100

Feet

Figure 2 - CCPV MY3

UT West Branch Rocky River Mitigation Project

Mecklenburg County, North Carolina

Date: 12/19/2023	Drawn by: HG
1 in = 150 feet	Checked by: RM

Legend

- Conservation Easement
- Existing Wetland
- Random Vegetation Plot
- Fixied Vegetation Plot
- Invasives Area
- Invasives Treated (2023)
- Side Slope Repair Needed
- Aggradation Area
- Barbed Wire Fencing

Stream Mitigation

- Restoration
- Enhancement I
- Enhancement II
- No Credit
- Cross Section
- Structure
- Top of Bank

Structures

- Piping Structures
- Repaired Structures

Monitoring Devices

- Stage Recorder
- Flow Gauge
- Ambient/Rain Gauge
- Photo Station

Table 5. Visual Stream Stability Assessment

Reach	UTWB-1
Assessed Stream Length	423
Assessed Bank Length	846
Date Assessed	12/5/2023

Major Channel Category		Metric	Number Stable, Performing as Intended	Total Number in As-built	Amount of Unstable Footage	% Stable, Performing as Intended
Bank	**Surface Scour/Bare Bank**	Bank lacking vegetative cover resulting simply from poor growth and/or surface scour			0	100%
	Toe Erosion	Bank toe eroding to the extent that bank failure appears likely. Does NOT include undercuts that are modest, appear sustainable and are providing habitat.			0	100%
	Bank Failure	Fluvial and geotechnical - rotational, slumping, calving, or collapse			0	100%
Totals					0	100%
Structure	**Grade Control**	Grade control structures exhibiting maintenance of grade across the sill.	3	4		75%
	Bank Protection	Bank erosion within the structures extent of influence does not exceed 15%. (See guidance for this table in DMS monitoring guidance document)	8	8		100%

Table 5. Visual Stream Stability Assessment

Reach	UTWB-2
Assessed Stream Length	1747
Assessed Bank Length	3494
Date Assessed	12/5/2023

Major Channel Category		Metric	Number Stable, Performing as Intended	Total Number in As-built	Amount of Unstable Footage	% Stable, Performing as Intended
Bank	**Surface Scour/Bare Bank**	Bank lacking vegetative cover resulting simply from poor growth and/or surface scour			0	100%
	Toe Erosion	Bank toe eroding to the extent that bank failure appears likely. Does NOT include undercuts that are modest, appear sustainable and are providing habitat.			0	100%
	Bank Failure	Fluvial and geotechnical - rotational, slumping, calving, or collapse			0	100%
Totals					0	100%
Structure	**Grade Control**	Grade control structures exhibiting maintenance of grade across the sill.	14	15		93%
	Bank Protection	Bank erosion within the structures extent of influence does not exceed 15%. (See guidance for this table in DMS monitoring guidance document)	29	29		100%

Table 5. Visual Stream Stability Assessment

Reach	UTWB-3
Assessed Stream Length	1314
Assessed Bank Length	2628
Date Assessed	12/5/2023

Major Channel Category		Metric	Number Stable, Performing as Intended	Total Number in As-built	Amount of Unstable Footage	% Stable, Performing as Intended
Bank	**Surface Scour/Bare Bank**	Bank lacking vegetative cover resulting simply from poor growth and/or surface scour			0	100%
	Toe Erosion	Bank toe eroding to the extent that bank failure appears likely. Does NOT include undercuts that are modest, appear sustainable and are providing habitat.			0	100%
	Bank Failure	Fluvial and geotechnical - rotational, slumping, calving, or collapse			0	100%
Totals					0	100%
Structure	**Grade Control**	Grade control structures exhibiting maintenance of grade across the sill.	5	5		100%
	Bank Protection	Bank erosion within the structures extent of influence does not exceed 15%. (See guidance for this table in DMS monitoring guidance document)	16	16		100%

Table 5. Visual Stream Stability Assessment

Reach	UT1
Assessed Stream Length	94
Assessed Bank Length	188
Date Assessed	12/5/2023

Major Channel Category		Metric	Number Stable, Performing as Intended	Total Number in As-built	Amount of Unstable Footage	% Stable, Performing as Intended
Bank	**Surface Scour/Bare Bank**	Bank lacking vegetative cover resulting simply from poor growth and/or surface scour			0	100%
	Toe Erosion	Bank toe eroding to the extent that bank failure appears likely. Does NOT include undercuts that are modest, appear sustainable and are providing habitat.			0	100%
	Bank Failure	Fluvial and geotechnical - rotational, slumping, calving, or collapse			20	89%
Totals					20	89%
Structure	**Grade Control**	Grade control structures exhibiting maintenance of grade across the sill.	4	4		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)	0	0		N/A

Table 5. Visual Stream Stability Assessment

Reach	UT2
Assessed Stream Length	259
Assessed Bank Length	518
Date Assessed	12/5/2023

Major Channel Category		Metric	Number Stable, Performing as Intended	Total Number in As-built	Amount of Unstable Footage	% Stable, Performing as Intended
Bank	**Surface Scour/Bare Bank**	Bank lacking vegetative cover resulting simply from poor growth and/or surface scour			0	100%
	Toe Erosion	Bank toe eroding to the extent that bank failure appears likely. Does NOT include undercuts that are modest, appear sustainable and are providing habitat.			0	100%
	Bank Failure	Fluvial and geotechnical - rotational, slumping, calving, or collapse			50	90%
Totals					50	90%
Structure	**Grade Control**	Grade control structures exhibiting maintenance of grade across the sill.	6	6		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)	4	4		100%

Table 6 Vegetation Condition Assessment

Date Assessed **12/5/2023**

Planted Acreage[1] **11.6**

Vegetation Category	Definitions	Mapping Threshold	CCPV Depiction	Number of Polygons	Combined Acreage	% of Planted Acreage
1. Bare Areas	Very limited cover of both woody and herbaceous material.	0.1 acres	Red Simple Hatch	1	0.02	0.2%
2. Low Stem Density Areas	Woody stem densities clearly below target levels based on MY3, 4, or 5 stem count criteria.	0.1 acres	Orange Simple Hatch	0	0.00	0.0%
			Total			0.0%
3. Areas of Poor Growth Rates or Vigor	Areas with woody stems of a size class that are obviously small given the monitoring year.	0.25 acres	Orange Simple Hatch	0	0.00	0.0%
			Cumulative Total			0.0%

Easement Acreage[2] **58.86**

Vegetation Category	Definitions	Mapping Threshold	CCPV Depiction	Number of Polygons	Combined Acreage	% of Easement Acreage
4. Invasive Areas of Concern[4]	Areas or points (if too small to render as polygons at map scale).	1000 SF	Yellow Crosshatch	7	4.79	8.1%
5. Easement Encroachment Areas[3]	Areas or points (if too small to render as polygons at map scale).	none	Red Simple Hatch	0	0.00	0.0%

1 = Enter the planted acreage within the easement. This number is calculated as the easement acreage minus any existing mature tree stands that were not subject to supplemental planting of the understory, the channel acreage, crossings or any other elements not directly planted as part of the project effort.

2 = The acreage within the easement boundaries.

3 = Encroachment may occur within or outside of planted areas and will therefore be calculated against the overall easement acreage. In the event a polygon is cataloged into items 1, 2 or 3 in the table and is the result of encroachment, the associated acreage should be tallied in the relevant item (i.e., item 1,2 or 3) as well as a parallel tally in item 5.

4 = Invasives may occur in or out of planted areas, but still within the easement and will therefore be calculated against the overall easement acreage. Invasives of concern/interest are listed below. The list of high concern spcies are those with the potential to directly outcompete native, young, woody stems in the short-term (e.g. monitoring period or shortly thereafter) or affect the community structure for existing, more established tree/shrub stands over timeframes that are slightly longer (e.g. 1-2 decades). The low/moderate concern group are those species that generally do not have this capacity over the timeframes discussed and therefore are not expected to be mapped with regularity, but can be mapped, if in the judgement of the observer their coverage, density or distribution is suppressing the viability, density, or growth of planted woody stems. Decisions as to whether remediation will be needed are based on the integration of risk factors by EEP such as species present, their coverage, distribution relative to native biomass, and the practicality of treatment. For example, even modest amounts of Kudzu or Japanese Knotweed early in the projects history will warrant control, but potentially large coverages of Microstegium in the herb layer will not likley trigger control because of the limited capacities to impact tree/shrub layers within the timeframes discussed and the potential impacts of treating extensive amounts of ground cover. Those species with the "watch list" designator in gray shade are of interest as well, but have yet to be observed across the state with any frequency. Those in *red italics* are of particular interest given their extreme risk/threat level for mapping as points where isolated specimens are found, particularly ealry in a projects monitoring history. However, areas of discreet, dense patches will of course be mapped as polygons. The symbology scheme below was one that was found to be helpful for symbolzing invasives polygons, particulalry for situations where the conditon for an area is somewhere between isolated specimens and dense, discreet patches. In any case, the point or polygon/area feature can be symbolized to describe things like high or low concern and species can be listed as a map inset, in legend items if the number of species are limited or in the narrative section of the executive summary.

UTWBRR MY3 Fixed Vegetation Monitoring Plot Photos (10/4/2023)

Vegetation Plot 1

Vegetation Plot 2

Vegetation Plot 3

Vegetation Plot 4

Vegetation Plot 5

Vegetation Plot 6

UTWBRR MY3 Random Vegetation Monitoring Plot Photo (10/4/2023)

Random Vegetation Plot 1

Random Vegetation Plot 2

Random Vegetation Plot 3

Random Vegetation Plot 4

Random Vegetation Plot 5

Random Vegetation Plot 6

UTWBRR Monitoring Device Photos

Stage Recorder UTWB-3 (10/4/2023)

Flow Gauge UT1-2 (5/11/2023)

Flow Guage UT2-2 (5/11/2023)

Ambient (10/4/2023)

UTWBRR Crossing Photos

UTWB-2 Downstream (5/11/2023)

UTWB-2 Upstream (5/11/2023)

UT2-2 Downstream (5/11/2023)

UT2-2 Upstream (5/11/2023)

UTWB-3 Downstream (5/11/2023)

UTWB-3 Upstream (5/11/2023)

UTWBRR Maintenance & General Photos

Side Slope Repair Area (10/10/2022)

Invasives Treated (10/4/1023)

Aggradation on UT2-2 (5/11/2023)

Aggradation on UT2-2 (12/3/2023)

Piping Structure #1 - Unrepaired (12/3/2023)

Piping Structure #2 - Repaired (12/3/2023)

Piping Structure #3 - Unrepaired (12/3/2023)

Piping Structure #4 - Repaired (12/3/2023)

UT1-2 (12/3/2023)

UT2-2 (12/3/2023)

UTWBRR Photo Station Photos (5/11/2023)

Photo Station 1
UTWB-1 entering the project area

Photo Station 2
UTWB-2 looking downstream

Photo Station 3
UT1-1 entering the project area

Photo Station 4
Confluence of UTWB-1 and UT1-2

Photo Station 5
Crossing on UTWB-2 looking downstream

Photo Station 6
Crossing on UTWB-2 looking upstream

Photo Station 7
UT2-1 entering the project area

Photo Station 8
Crossing on UT2-2 looking downstream

Photo Station 9
Crossing on UT2-2 looking upstream

Photo Station 10
Confluence of UTWB-2 and UT2-2

Photo Station 11
Crossing on UTWB-3 looking downstream

Photo Station 12
Crossing on UTWB-3 looking upstream

Photo Station 13
UTWB-3 looking downstream

Photo Station 14
UTWB-3 exiting the project area

Appendix C

Vegetation Plot

Data

Table 7. Planted Species Summary

Common Name	Scientific Name	Mitigation Plan %	As-Built %	Total Stems Planted
River Birch	*Betula nigra*	9	11	1,050
American Sycamore	*Platanus occidentalis*	9	12	1,150
Willow Oak	*Quercus phellos*	10	10	900
Flowering Dogwood	*Cornus florida*	5	6	550
American Witchhazel	*Hamamelis virginiana*	5	4	400
White Oak	*Quercus alba*	10	9	800
Swamp Chestnut Oak	*Quercus michauxii*	10	9	800
American Hornbeam	*Carpinus caroliniana*	9	9	800
Tulip Poplar	*Liriodendron tulipifera*	9	12	1,150
American Elm	*Ulumus americana*	10	10	900
Hazel Alder	*Alnus serrulata*	5	8	750
Green Ash	*Fraxinus pennyslvanica*	9	0	0
			Total	9,250
			Planted Area	11.6
			As-built Planted Stems/Acre	671

Table 8. Vegetation Plot Mitigation Success Summary

Wetland/Stream Vegetation Totals (per acre)					
Plot #	**Planted Stems/Acre**	**Volunteers Stems/Acre**	**Total Stems/Acre**	**Success Criteria Met?**	**Average Planted Stem Height (ft)**
1	647	1214	1862	Yes	2.0
2	445	1093	1538	Yes	2.3
3	971	162	1133	Yes	3.7
4	445	445	890	Yes	3.6
5	850	445	1295	Yes	2.1
6	607	1174	1781	Yes	1.2
R1	445	0	445	Yes	2.3
R2	769	0	769	Yes	3.7
R3	567	0	567	Yes	4.3
R4	607	0	607	Yes	1.9
R5	647	0	647	Yes	2.6
R6	526	0	526	Yes	2.5
Project Avg	**620**	**378**	**996**	**Yes**	**2.7**

Table 9. Stem Count Total and Planted by Plot Species

UTWBRR			Current Plot Data (MY3 2023)																																
			92684-01-0001			92684-01-0002			92684-01-0003			92684-01-0004			92684-01-0005			92684-01-0006			R1			R2			R3			R4			R5			R6		
Scientific Name	Common Name	Species Type	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T
Acer rubrum	red maple	Tree																																			
Alnus serrulata	hazel alder	Shrub													1	1	1																				
Betula nigra	river birch	Tree	5	5	5	4	4	4	4	4	4	2	2	2	9	9	9				4	4	4	3	3	3	1	1	1	3	3	3				1	1	1
Carpinus caroliniana	American hornbeam	Tree																3	3	3				1	1	1												
Cornus florida	flowering dogwood	Tree										2	2	2	1	1	1	1	1	1										4	4	4	1	1	1	1	1	1
Diospyros virginiana	common persimmon	Tree																																			
Elaeagnus	elaeagnus	Exotic																																			
Hamamelis virginiana	American witchhaze	Tree	2	2	2				1	1	1				2	2	3	3	3	3				4	4	4	2	2	2	3	3	3				2	2	2
Liquidambar styraciflua	sweetgum	Tree			30			25			2			10			6																				
Liriodendron tulipifera	tuliptree	Tree	3	3	3							1	1	1	4	4	5				2	2	2	1	1	1							1	1	1			
Platanus occidentalis	American sycamore	Tree				1	1	1	8	8	8	4	4	4	2	2	4			29	1	1	1	8	8	8	8	8	8	4	4	4	10	10	10	5	5	5
Quercus alba	white oak	Tree	1	1	1	2	2	2	6	6	6	1	1	1	1	1	1				3	3	3													2	2	2
Quercus michauxii	swamp chestnut oak	Tree							2	2	2	1	1	1	1	1	1							1	1	1							1	1	1			
Quercus phellos	willow oak	Tree	5	5	5	4	4	4	2	2	2										1	1	1	1	1	1	3	3	3	1	1	1	3	3	3			
Quercus rubra	northern red oak	Tree															1																				
Ulmus alata	winged elm	Tree																																			
Ulmus americana	American elm	Tree						2	1	1	3			1				8	8	8																		
		Stem count	16	16	46	11	11	38	24	24	28	11	11	22	21	21	32	15	15	44	11	11	11	19	19	19	14	14	14	15	15	15	16	16	16	13	13	13
		size (ares)	1			1			1			1			1			1			1			1			1			1			1			1		
		size (ACRES)	0.02			0.02			0.02			0.02			0.02			0.02			0.02			0.02			0.02			0.02			0.02			0.02		
		Species count	5	5	6	4	4	6	7	7	8	6	6	8	8	8	10	4	4	5	5	5	5	7	7	7	4	4	4	5	5	5	5	5	5	6	6	6
		Stems per ACRE	647	647	1862	445	445	1538	971	971	1133	445	445	890	850	850	1295	607	607	1781	445	445	445	769	769	769	567	567	567	607	607	607	647	647	647	526	526	526

UTWBRR			Annual Means											
			MY3 (2023)			MY2 (2022)			MY1 (2021)			MY0 (2021)		
Scientific Name	Common Name	Species Type	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T
Acer rubrum	red maple	Tree									10			
Alnus serrulata	hazel alder	Shrub	1	1	1	1	1	1	2	2	2	2	2	2
Betula nigra	river birch	Tree	36	36	36	37	37	37	31	31	31	25	25	25
Carpinus caroliniana	American hornbeam	Tree	4	4	4	9	9	9	7	7	7	6	6	6
Cornus florida	flowering dogwood	Tree	10	10	10	3	3	3	1	1	1	10	10	10
Diospyros virginiana	common persimmon	Tree				3	3	3	8	8	8			
Elaeagnus	elaeagnus	Exotic						1	8	8	8			
Hamamelis virginiana	American witchhaze	Tree	19	19	20			1				9	9	9
Liquidambar styraciflua	sweetgum	Tree			73	18	18	18	22	22	22			
Liriodendron tulipifera	tuliptree	Tree	12	12	13			4			30	7	7	7
Platanus occidentalis	American sycamore	Tree	51	51	82	11	11	11	11	11	26	15	15	15
Quercus alba	white oak	Tree	16	16	16	58	58	58	46	46	58	10	10	10
Quercus michauxii	swamp chestnut oak	Tree	6	6	6	18	18	18	24	24	24	4	4	4
Quercus phellos	willow oak	Tree	20	20	20	5	5	5	4	4	4	18	18	18
Quercus rubra	northern red oak	Tree			1	21	21	21	24	24	24			
Ulmus alata	winged elm	Tree							1	1	16			
Ulmus americana	American elm	Tree	11	11	16	9	9	9	20	20	20	8	8	8
		Stem count	186	186	298	193	193	199	209	209	291	114	114	114
		size (ares)	12			12			12			6		
		size (ACRES)	0.30			0.30			0.30			0.15		
		Species count	11	11	13	12	12	15	14	14	16	11	11	11
		Stems per ACRE	620	620	993	643	643	663	697	697	970	769	769	769

Appendix D

Stream Measurement and Geomorphology Data

Appendix D. Table 11 - Monitoring Data - Dimensional Morphology Summary (Dimensional Parameters – Cross Sections)

Project Name/Number: UT West Branch Rocky River #92684

	Cross Section 1 (Riffle)							Cross Section 2 (Pool)							Cross Section 3 (Riffle)							Cross Section 4 (Pool)							Cross Section 5 (Riffle)						
	Base	MY1	MY2	MY3	MY5	MY7	MY+	Base	MY1	MY2	MY3	MY5	MY7	MY+	Base	MY1	MY2	MY3	MY5	MY7	MY+	Base	MY1	MY2	MY3	MY5	MY7	MY+	Base	MY1	MY2	MY3	MY5	MY7	MY+
Bankfull Elevation (ft) - Based on AB-XSA[1]	704.6	704.6	704.6	704.6				704.2	704.1	704.2	704.3				694.2	694.2	694.4	694.3				694.1	694.1	694.2	694.3				682.1	682.1	682.1	682.1			
Bankfull Width (ft)[1]	9.8	9.9	10.4	9.7				NA	NA	NA	NA				8.9	6.9	7.5	6.6				NA	NA	NA	NA				7.0	7.0	7.7	9.3			
Floodprone Width (ft)[1]	>49.2	>49.1	>49.2	>49.2				NA	NA	NA	NA				>49.3	>49.3	>49.1	>49.3				NA	NA	NA	NA				>48.2	>49.1	>49.1	>49			
Bankfull Max Depth (ft)[2]	0.9	0.9	0.8	0.9				2.2	2.1	2.0	1.7				0.8	0.8	0.8	0.8				2.2	1.8	1.7	1.7				0.8	0.8	0.7	0.8			
Low Bank Elevation (ft)	704.56	704.6	704.5	704.6				704.2	704.1	704.1	704.0				694.2	694.2	694.3	694.2				694.1	694.1	694.1	694.2				682.1	682.1	682.0	682.0			
Bankfull Cross Sectional Area (ft^2)[2]	5.7	5.5	4.3	5.3				11.5	11.5	11.1	8.5				4.5	4.2	4.3	4.0				10.4	10.2	9.7	9.6				4.1	4.1	3.8	3.6			
Bankfull Entrenchment Ratio[1]	>5	>5	>4.7	>5.1				NA	NA	NA	NA				>5.6	>7.1	>6.6	>7.4				NA	NA	NA	NA				>6.9	>7	>6.3	>5.3			
Bankfull Bank Height Ratio[1]	1.0	1.0	0.9	0.9				NA	NA	NA	NA				1.0	1.0	1.0	0.9				NA	NA	NA	NA				1.0	1.0	0.9	0.9			

	Cross Section 6 (Pool)							Cross Section 7 (Riffle)							Cross Section 8 (Pool)							Cross Section 9 (Riffle)							Cross Section 10 (Pool)						
	Base	MY1	MY2	MY3	MY5	MY7	MY+	Base	MY1	MY2	MY3	MY5	MY7	MY+	Base	MY1	MY2	MY3	MY5	MY7	MY+	Base	MY1	MY2	MY3	MY5	MY7	MY+	Base	MY1	MY2	MY3	MY5	MY7	MY+
Bankfull Elevation (ft) - Based on AB-XSA[1]	681.6	681.6	681.5	681.7				672.3	672.3	672.4	672.4				672.1	672.1	672.2	672.3				659.1	659.2	659.1	659.3				658.2	658.3	658.3	658.3			
Bankfull Width (ft)[1]	NA	NA	NA	NA				11.0	10.1	10.3	12.2				NA	NA	NA	NA				16.5	15.4	17.3	13.9				NA	NA	NA	NA			
Floodprone Width (ft)[1]	NA	NA	NA	NA				>49.2	>49.2	>49	>49.3				NA	NA	NA	NA				>49	>49.1	>49	>49				NA	NA	NA	NA			
Bankfull Max Depth (ft)[2]	2.3	2.1	1.9	2.0				1.0	1.0	0.9	1.1				1.5	2.0	1.1	1.4				1.3	1.4	1.3	1.1				2.1	2.0	1.7	1.6			
Low Bank Elevation (ft)	681.6	681.7	681.6	681.6				672.3	672.2	672.3	672.4				672.1	672.2	671.6	672.1				659.1	659.1	659.0	659.0				658.2	658.0	658.2	658.1			
Bankfull Cross Sectional Area (ft^2)[2]	11.2	12.5	11.8	10.3				7.5	6.9	6.6	8.0				12.3	13.8	5.4	9.2				12.7	12.5	11.5	9.0				10.8	8.1	9.2	8.6			
Bankfull Entrenchment Ratio[1]	NA	NA	NA	NA				>4.5	>4.9	>4.8	>4				NA	NA	NA	NA				>3.0	>3.2	>2.8	>3.5				NA	NA	NA	NA			
Bankfull Bank Height Ratio[1]	NA	NA	NA	NA				1.0	0.9	0.9	1.0				NA	NA	NA	NA				1.0	1.0	0.9	0.8				NA	NA	NA	NA			

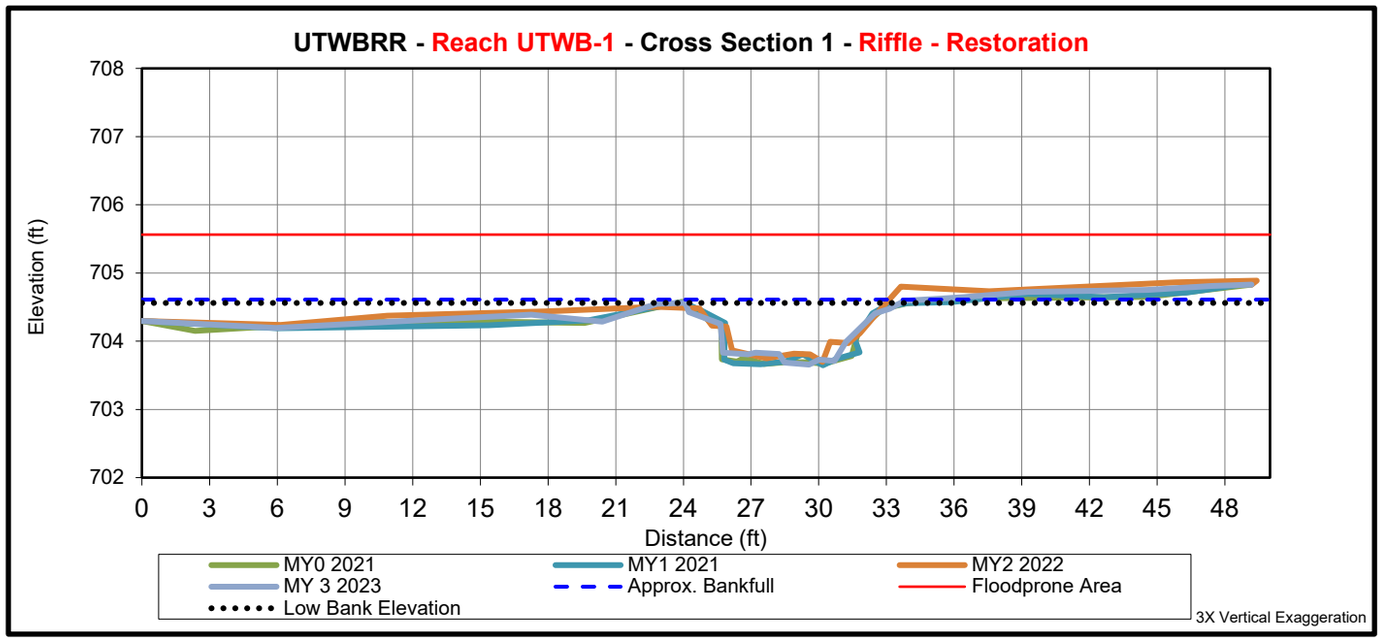
	Cross Section 11 (Pool)							Cross Section 12 (Riffle)							Cross Section 13 (Riffle)							Cross Section 14 (Pool)						
	Base	MY1	MY2	MY3	MY5	MY7	MY+	Base	MY1	MY2	MY3	MY5	MY7	MY+	Base	MY1	MY2	MY3	MY5	MY7	MY+	Base	MY1	MY2	MY3	MY5	MY7	MY+
Bankfull Elevation (ft) - Based on AB-XSA[1]	700.3	700.3	700.4	700.4				700.2	700.2	700.3	700.3				675.0	675.0	675.1	675.8				674.9	674.9	675.1	675.5			
Bankfull Width (ft)[1]	NA	NA	NA	NA				5.3	5.1	5.4	4.6				9.8	9.0	12.0	4.8				NA	NA	NA	NA			
Floodprone Width (ft)[1]	NA	NA	NA	NA				36.7	37.7	37.7	39.1				>41.8	>43.5	>42.4	>49				NA	NA	NA	NA			
Bankfull Max Depth (ft)[2]	1.6	1.5	1.3	1.4				0.6	0.6	0.5	0.5				0.8	0.8	0.7	0.6				1.0	0.9	1.0	0.8			
Low Bank Elevation (ft)	700.3	700.2	700.4	700.3				700.2	700.2	700.3	700.2				675.0	675.0	675.0	675.1				674.9	674.9	675.0	675.0			
Bankfull Cross Sectional Area (ft^2)[2]	7.5	6.9	7.0	6.9				2.1	2.0	1.7	1.5				5.3	5.0	4.3	1.8				7.0	6.6	6.8	3.3			
Bankfull Entrenchment Ratio[1]	NA	NA	NA	NA				7.0	7.4	7.0	8.4				>4.3	>4.8	>3.5	>10.1				NA	NA	NA	NA			
Bankfull Bank Height Ratio[1]	NA	NA	NA	NA				1.0	1.0	0.9	0.8				1.0	1.0	0.9	0.5				NA	NA	NA	NA			

1 - Uses the as-built cross sectional area as the basis for adjusting each subsequent years bankfull elevation

2 - Uses the current years low top of bank as the basis for adjusting each subsequent years bankfull elevation

Upstream

Downstream

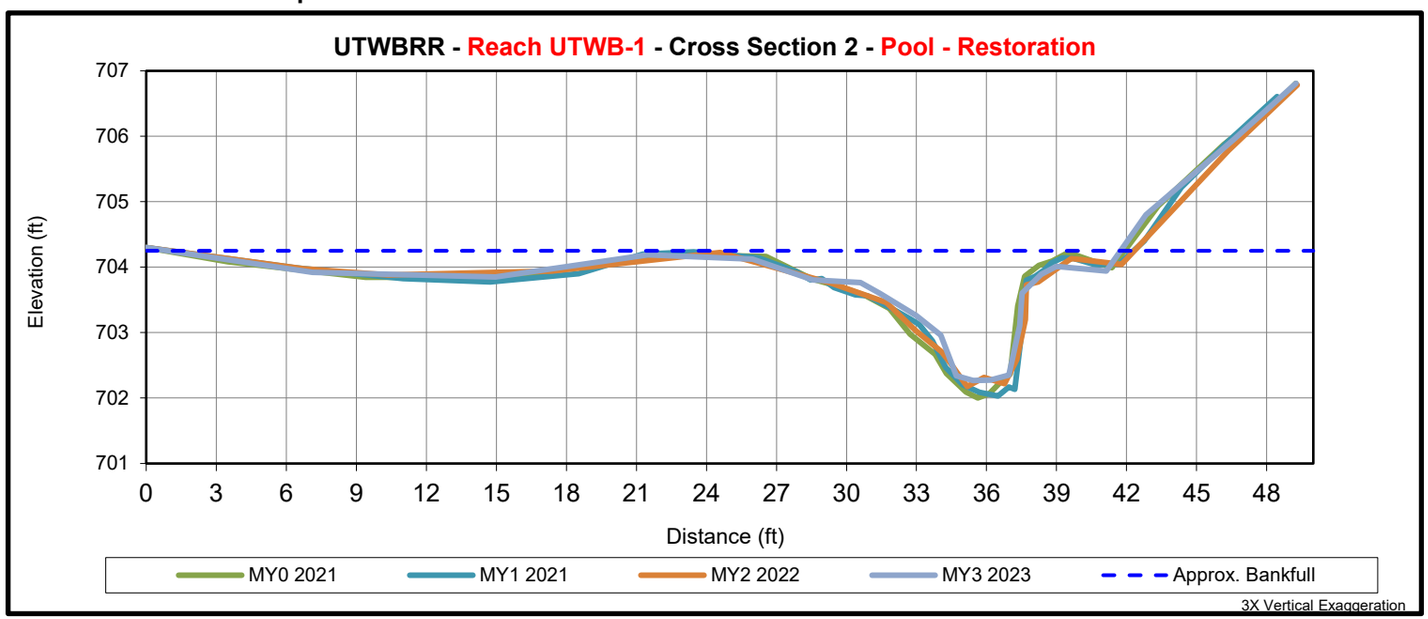


	Cross Section 1 (Riffle)						
	MY0	MY1	MY2	MY3	MY5	MY7	MY+
Bankfull Elevation (ft) - Based on AB-XSA[1]	704.56	704.6	704.6	704.6			
Bankfull Width (ft)[1]	9.8	9.9	10.4	9.7			
Floodprone Width (ft)[1]	>49.2	>49.1	>49.2	>49.2			
Bankfull Max Depth (ft)[2]	0.9	0.9	0.8	0.9			
Low Bank Elevation (ft)	704.56	704.6	704.5	704.6			
Bankfull Cross Sectional Area (ft^2)[2]	5.7	5.5	4.3	5.3			
Bankfull Entrenchment Ratio[1]	>5	>5	>4.7	>5.1			
Bankfull Bank Height Ratio[1]	1.0	1.0	0.9	0.9			

1 - Uses the as-built cross sectional area as the basis for adjusting each subsequent years bankfull elevation
2 - Uses the current years low top of bank as the basis for adjusting each subsequent years bankfull elevation

Upstream

Downstream

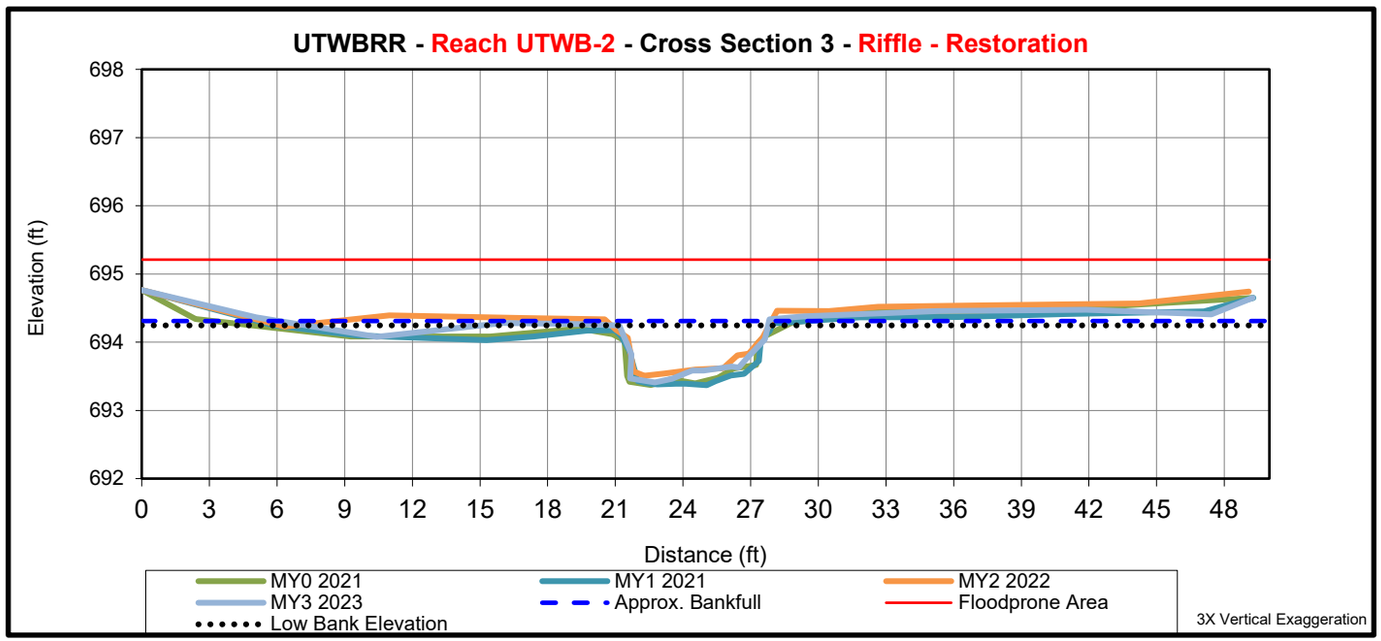


	Cross Section 2 (Pool)						
	MY0	MY1	MY2	MY3	MY5	MY7	MY+
Bankfull Elevation (ft) - Based on AB-XSA[1]	704.16	704.1	704.2	704.3			
Bankfull Width (ft)[1]	NA	NA	NA	NA			
Floodprone Width (ft)[1]	NA	NA	NA	NA			
Bankfull Max Depth (ft)[2]	2.2	2.1	2.0	1.7			
Low Bank Elevation (ft)	704.16	704.1	704.1	704.0			
Bankfull Cross Sectional Area (ft^2)[2]	11.5	11.5	11.1	8.5			
Bankfull Entrenchment Ratio[1]	NA	NA	NA	NA			
Bankfull Bank Height Ratio[1]	NA	NA	NA	NA			

1 - Uses the as-built cross sectional area as the basis for adjusting each subsequent years bankfull elevation
2 - Uses the current years low top of bank as the basis for adjusting each subsequent years bankfull elevation

Upstream

Downstream

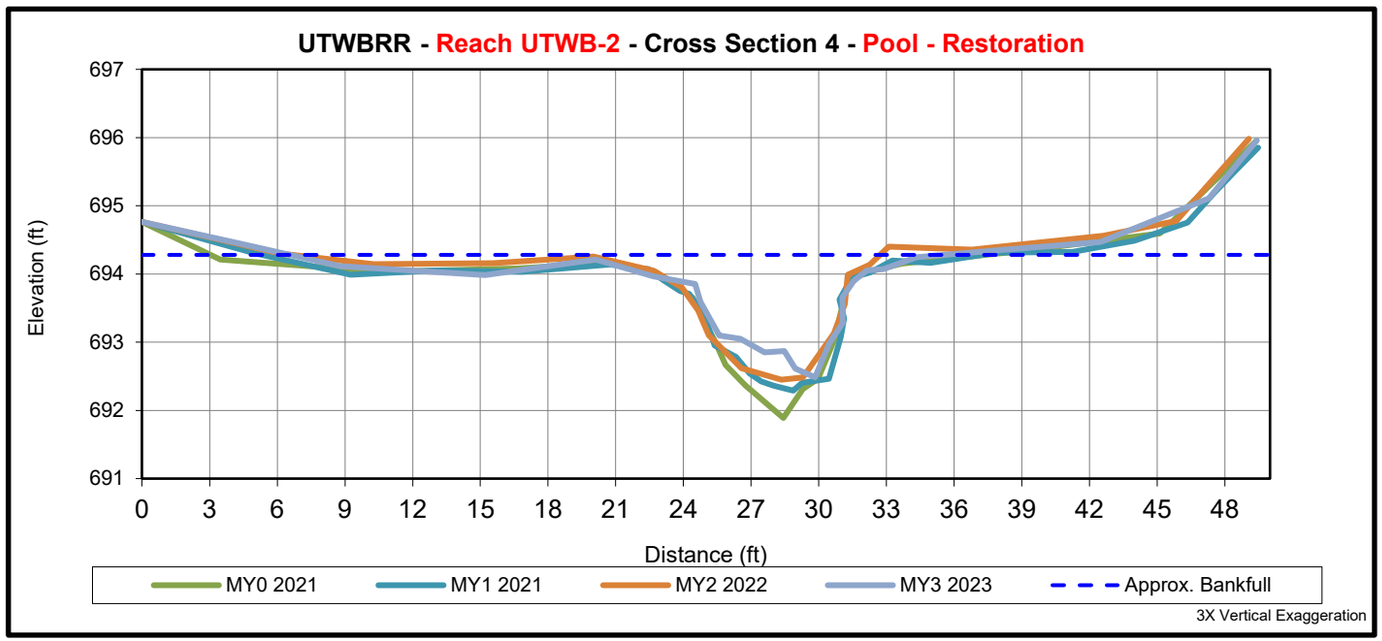


	Cross Section 3 (Riffle)						
	MY0	MY1	MY2	MY3	MY5	MY7	MY+
Bankfull Elevation (ft) - Based on AB-XSA[1]	694.20	694.2	694.4	694.3			
Bankfull Width (ft)[1]	8.9	6.9	7.5	6.6			
Floodprone Width (ft)[1]	>49.3	>49.3	>49.1	>49.3			
Bankfull Max Depth (ft)[2]	0.8	0.8	0.8	0.8			
Low Bank Elevation (ft)	694.20	694.2	694.3	694.2			
Bankfull Cross Sectional Area (ft^2)[2]	4.5	4.2	4.3	4.0			
Bankfull Entrenchment Ratio[1]	>5.6	>7.1	>6.6	>7.4			
Bankfull Bank Height Ratio[1]	1.0	1.0	1.0	0.9			

1 - Uses the as-built cross sectional area as the basis for adjusting each subsequent years bankfull elevation
2 - Uses the current years low top of bank as the basis for adjusting each subsequent years bankfull elevation

Upstream

Downstream

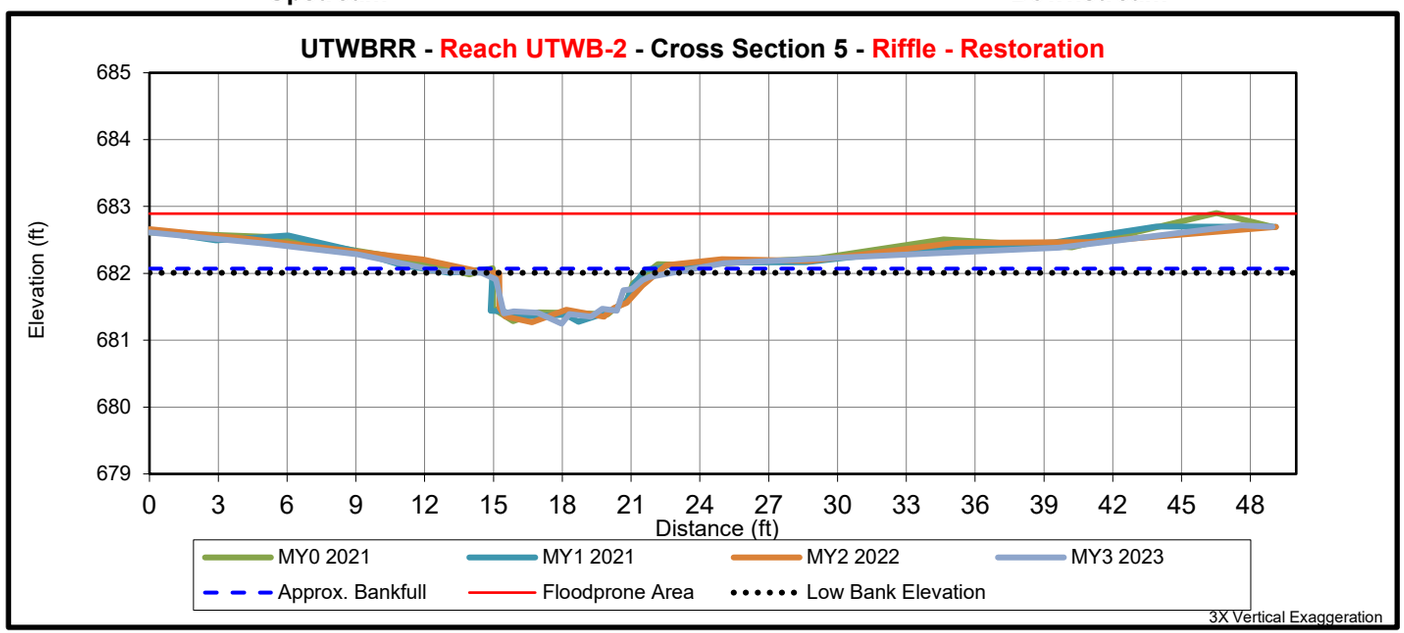


	Cross Section 4 (Pool)						
	MY0	MY1	MY2	MY3	MY5	MY7	MY+
Bankfull Elevation (ft) - Based on AB-XSA[1]	694.05	694.1	694.2	694.3			
Bankfull Width (ft)[1]	NA	NA	NA	NA			
Floodprone Width (ft)[1]	NA	NA	NA	NA			
Bankfull Max Depth (ft)[2]	2.2	1.8	1.7	1.6			
Low Bank Elevation (ft)	694.05	694.1	694.1	694.1			
Bankfull Cross Sectional Area (ft^2)[2]	10.4	10.2	9.7	7.8			
Bankfull Entrenchment Ratio[1]	NA	NA	NA	NA			
Bankfull Bank Height Ratio[1]	NA	NA	NA	NA			

1 - Uses the as-built cross sectional area as the basis for adjusting each subsequent years bankfull elevation
2 - Uses the current years low top of bank as the basis for adjusting each subsequent years bankfull elevation

Upstream

Downstream

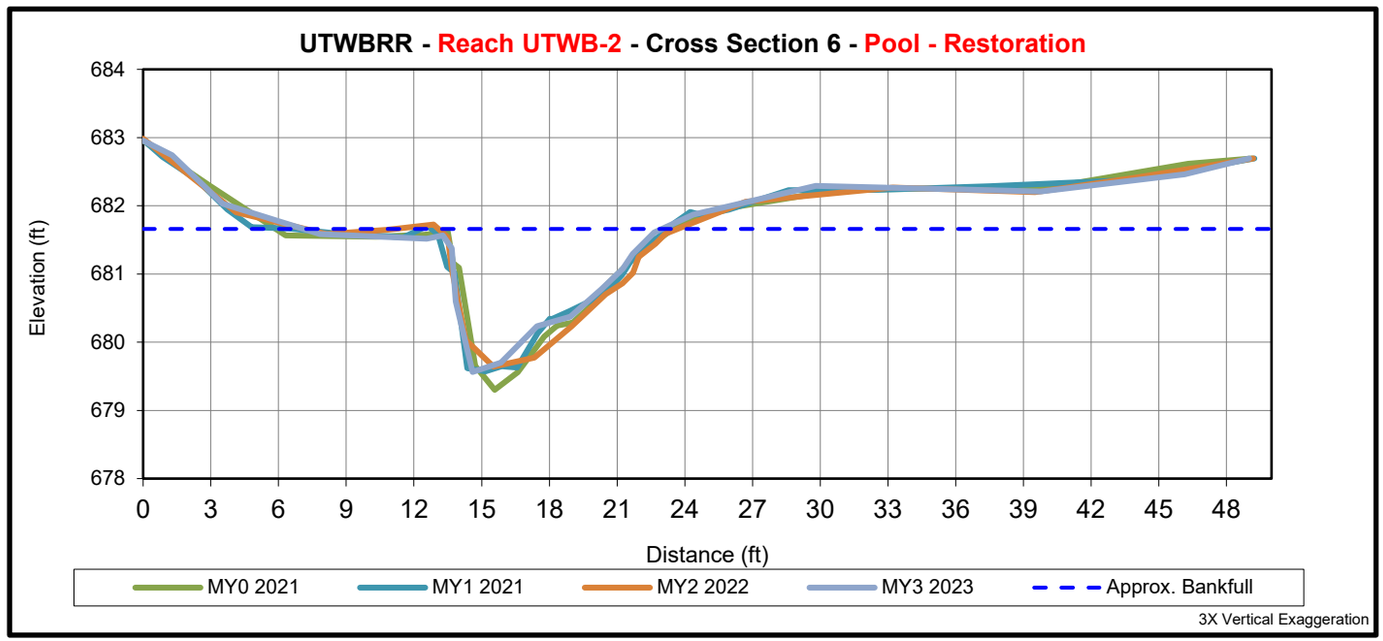


	Cross Section 5 (Riffle)						
	MY0	MY1	MY2	MY3	MY5	MY7	MY+
Bankfull Elevation (ft) - Based on AB-XSA[1]	682.08	682.1	682.1	682.1			
Bankfull Width (ft)[1]	7.0	7.0	7.7	9.3			
Floodprone Width (ft)[1]	>48.2	>49.1	>49.1	>49			
Bankfull Max Depth (ft)[2]	0.8	0.8	0.7	0.8			
Low Bank Elevation (ft)	682.08	682.1	682.0	682.0			
Bankfull Cross Sectional Area (ft^2)[2]	4.1	4.1	3.8	3.6			
Bankfull Entrenchment Ratio[1]	>6.9	>7	>6.3	>5.6			
Bankfull Bank Height Ratio[1]	1.0	1.0	0.9	0.9			

1 - Uses the as-built cross sectional area as the basis for adjusting each subsequent years bankfull elevation
2 - Uses the current years low top of bank as the basis for adjusting each subsequent years bankfull elevation

Upstream

Downstream

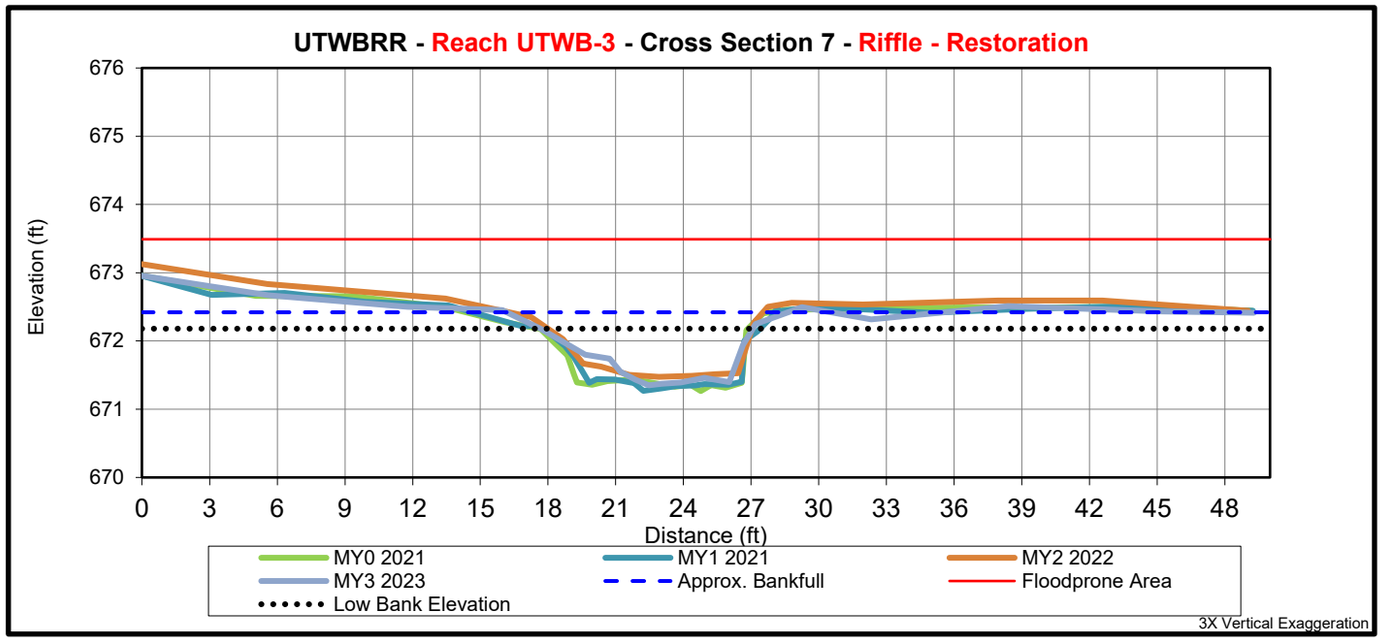


	Cross Section 6 (Pool)						
	MY0	MY1	MY2	MY3	MY5	MY7	MY+
Bankfull Elevation (ft) - Based on AB-XSA[1]	681.58	681.6	681.5	681.7			
Bankfull Width (ft)[1]	NA	NA	NA	NA			
Floodprone Width (ft)[1]	NA	NA	NA	NA			
Bankfull Max Depth (ft)[2]	2.3	2.1	1.9	2.0			
Low Bank Elevation (ft)	681.58	681.7	681.6	681.6			
Bankfull Cross Sectional Area (ft^2)[2]	11.2	12.5	11.8	10.3			
Bankfull Entrenchment Ratio[1]	NA	NA	NA	NA			
Bankfull Bank Height Ratio[1]	NA	NA	NA	NA			

1 - Uses the as-built cross sectional area as the basis for adjusting each subsequent years bankfull elevation
2 - Uses the current years low top of bank as the basis for adjusting each subsequent years bankfull elevation

Upstream

Downstream

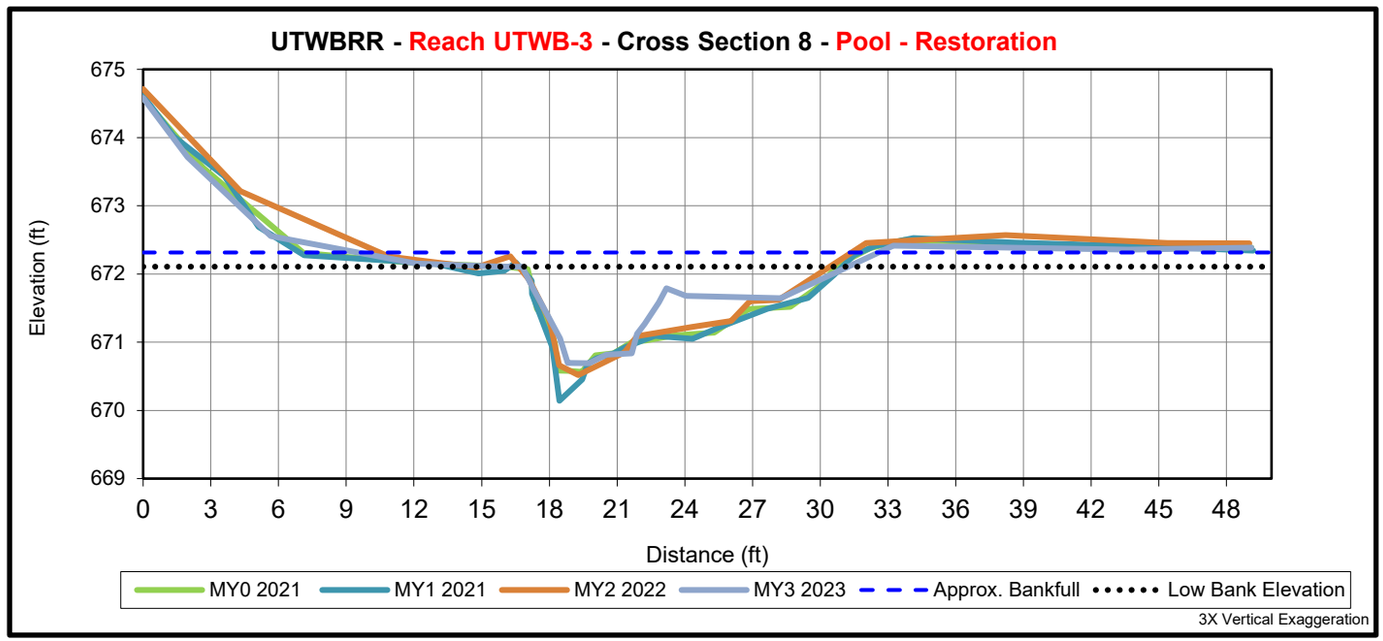


	Cross Section 7 (Riffle)						
	MY0	MY1	MY2	MY3	MY5	MY7	MY+
Bankfull Elevation (ft) - Based on AB-XSA[1]	672.28	672.3	672.4	672.4			
Bankfull Width (ft)[1]	11.0	10.1	10.3	12.5			
Floodprone Width (ft)[1]	>49.2	>49.2	>49	>49.3			
Bankfull Max Depth (ft)[2]	1.0	1.0	0.9	0.8			
Low Bank Elevation (ft)	672.28	672.2	672.3	672.2			
Bankfull Cross Sectional Area (ft^2)[2]	7.5	6.9	6.6	5.1			
Bankfull Entrenchment Ratio[1]	>4.5	>4.9	>4.8	>3.9			
Bankfull Bank Height Ratio[1]	1.0	0.9	0.9	0.8			

1 - Uses the as-built cross sectional area as the basis for adjusting each subsequent years bankfull elevation
2 - Uses the current years low top of bank as the basis for adjusting each subsequent years bankfull elevation

Upstream

Downstream

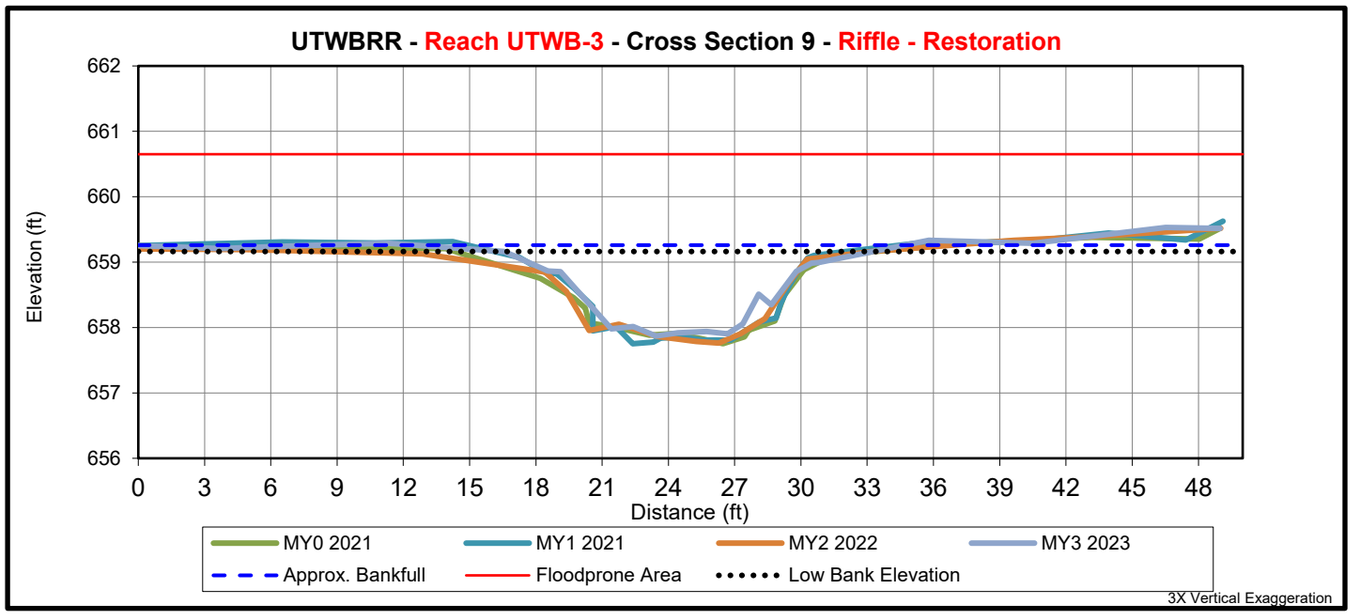


	Cross Section 8 (Pool)						
	MY0	MY1	MY2	MY3	MY5	MY7	MY+
Bankfull Elevation (ft) - Based on AB-XSA[1]	672.11	672.1	672.2	672.3			
Bankfull Width (ft)[1]	NA	NA	NA	NA			
Floodprone Width (ft)[1]	NA	NA	NA	NA			
Bankfull Max Depth (ft)[2]	1.5	2.0	1.7	1.4			
Low Bank Elevation (ft)	672.11	672.2	672.3	672.1			
Bankfull Cross Sectional Area (ft^2)[2]	12.3	13.8	13.5	9.2			
Bankfull Entrenchment Ratio[1]	NA	NA	NA	NA			
Bankfull Bank Height Ratio[1]	NA	NA	NA	NA			

1 - Uses the as-built cross sectional area as the basis for adjusting each subsequent years bankfull elevation
2 - Uses the current years low top of bank as the basis for adjusting each subsequent years bankfull elevation

Upstream

Downstream

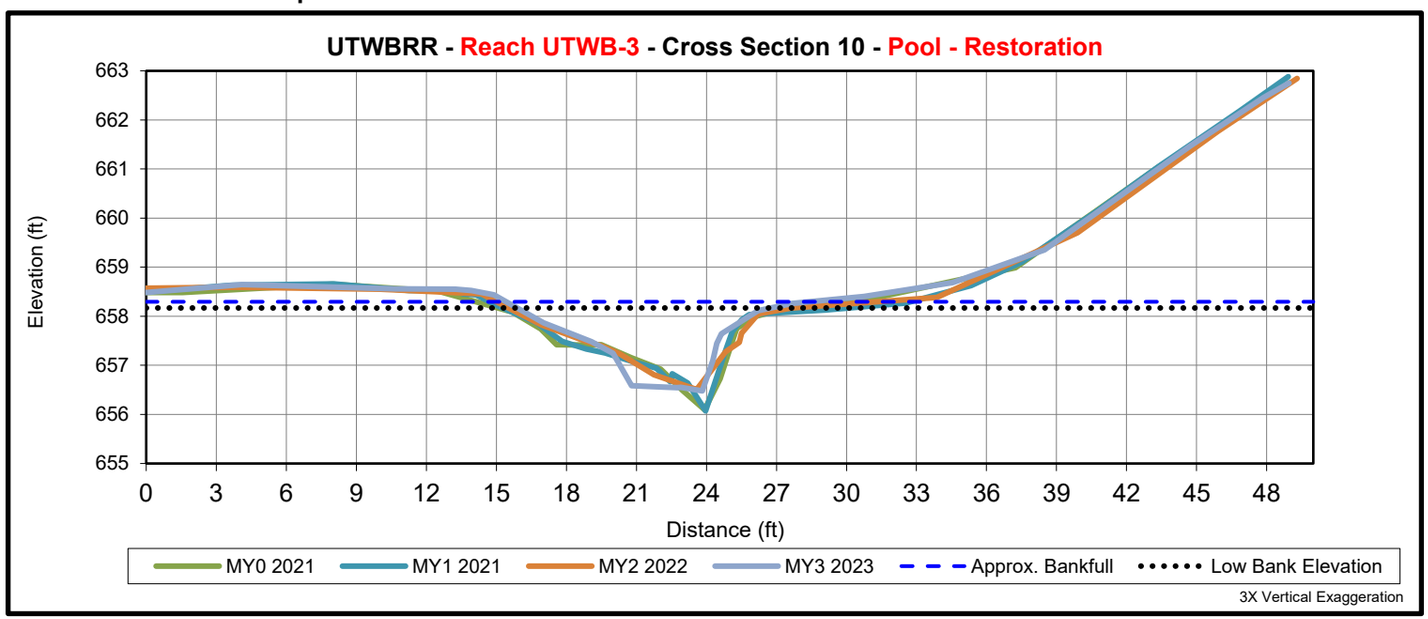


	Cross Section 9 (Riffle)						
	MY0	MY1	MY2	MY3	MY5	MY7	MY+
Bankfull Elevation (ft) - Based on AB-XSA[1]	659.10	659.2	659.1	659.3			
Bankfull Width (ft)[1]	16.5	15.4	17.3	13.9			
Floodprone Width (ft)[1]	>49	>49.1	>49	>49			
Bankfull Max Depth (ft)[2]	1.3	1.4	1.3	1.3			
Low Bank Elevation (ft)	659.10	659.1	659.0	659.2			
Bankfull Cross Sectional Area (ft^2)[2]	12.7	12.5	11.5	11.6			
Bankfull Entrenchment Ratio[1]	>3.0	>3.2	>2.8	>3.5			
Bankfull Bank Height Ratio[1]	1.0	1.0	0.9	0.9			

1 - Uses the as-built cross sectional area as the basis for adjusting each subsequent years bankfull elevation
2 - Uses the current years low top of bank as the basis for adjusting each subsequent years bankfull elevation

Upstream

Downstream



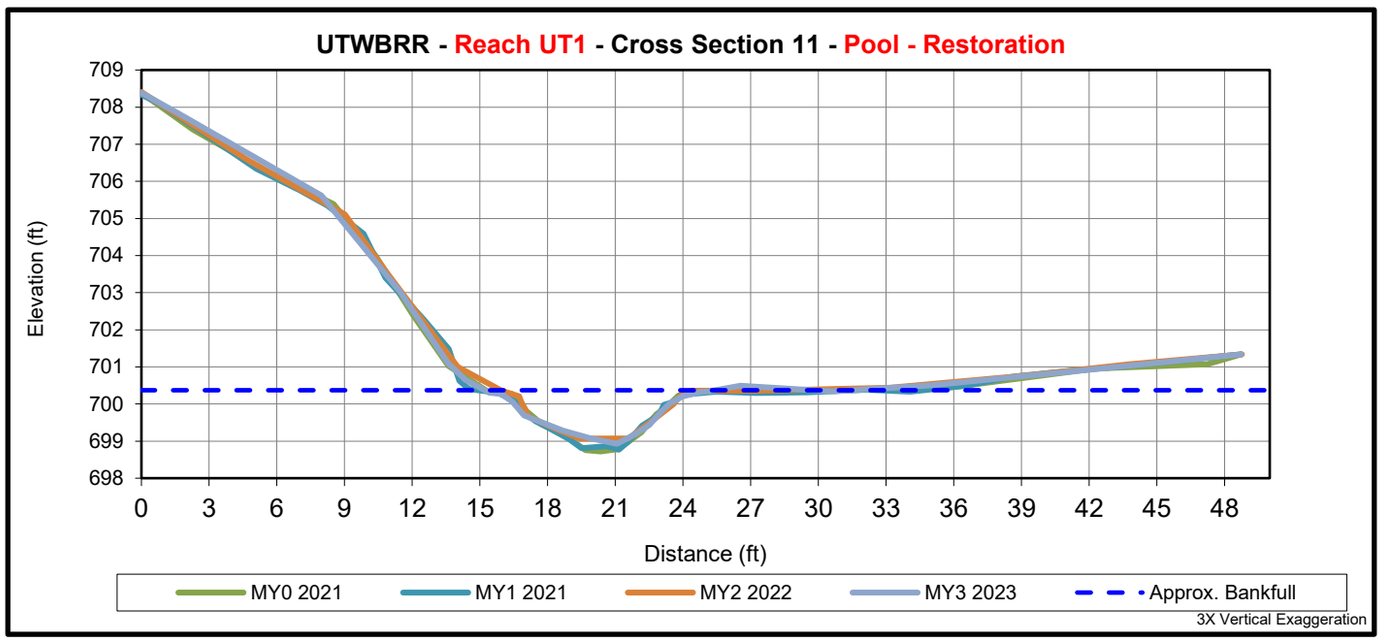
	Cross Section 10 (Pool)						
	MY0	MY1	MY2	MY3	MY5	MY7	MY+
Bankfull Elevation (ft) - Based on AB-XSA[1]	658.23	658.3	658.3	658.3			
Bankfull Width (ft)[1]	NA	NA	NA	NA			
Floodprone Width (ft)[1]	NA	NA	NA	NA			
Bankfull Max Depth (ft)[2]	2.1	2.0	1.7	1.6			
Low Bank Elevation (ft)	658.23	658.0	658.2	658.1			
Bankfull Cross Sectional Area (ft^2)[2]	10.8	8.1	9.2	8.6			
Bankfull Entrenchment Ratio[1]	NA	NA	NA	NA			
Bankfull Bank Height Ratio[1]	NA	NA	NA	NA			

1 - Uses the as-built cross sectional area as the basis for adjusting each subsequent years bankfull elevation

2 - Uses the current years low top of bank as the basis for adjusting each subsequent years bankfull elevation

Upstream

Downstream

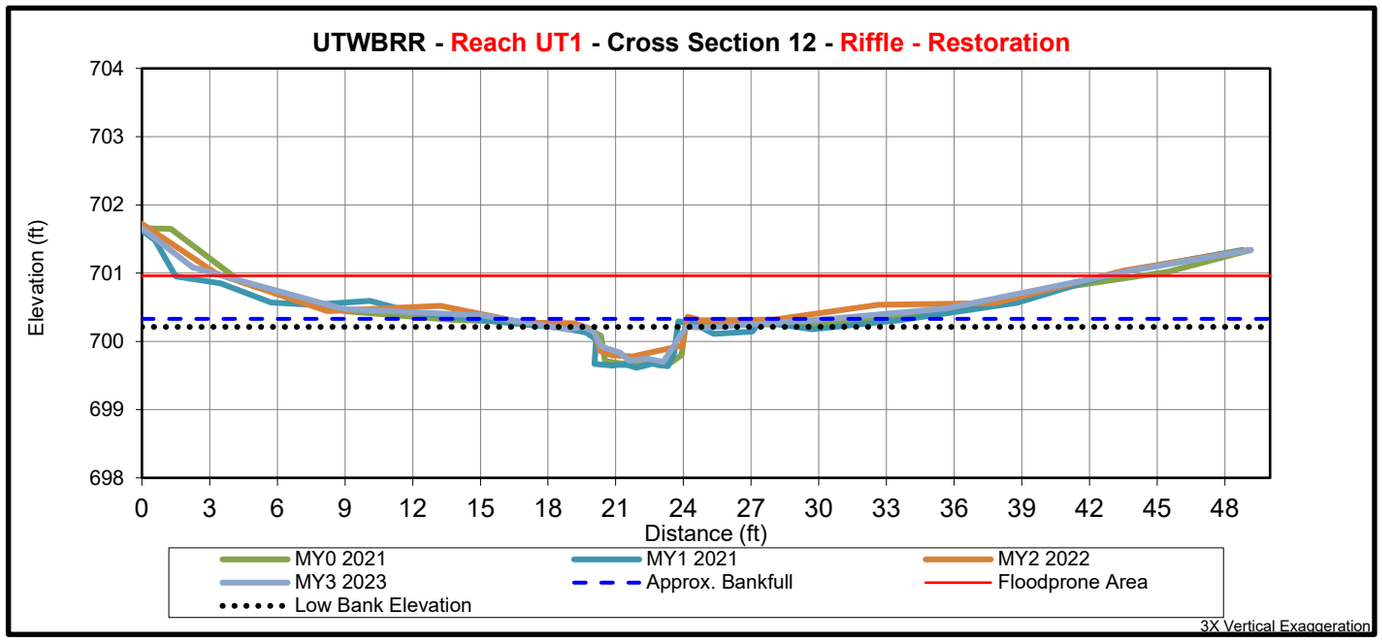


	Cross Section 11 (Pool)						
	MY0	MY1	MY2	MY3	MY5	MY7	MY+
Bankfull Elevation (ft) - Based on AB-XSA[1]	700.32	700.3	700.4	700.4			
Bankfull Width (ft)[1]	NA	NA	NA	NA			
Floodprone Width (ft)[1]	NA	NA	NA	NA			
Bankfull Max Depth (ft)[2]	1.6	1.5	1.3	1.4			
Low Bank Elevation (ft)	700.32	700.2	700.4	700.3			
Bankfull Cross Sectional Area (ft^2)[2]	7.5	6.9	7.0	6.9			
Bankfull Entrenchment Ratio[1]	NA	NA	NA	NA			
Bankfull Bank Height Ratio[1]	NA	NA	NA	NA			

1 - Uses the as-built cross sectional area as the basis for adjusting each subsequent years bankfull elevation
2 - Uses the current years low top of bank as the basis for adjusting each subsequent years bankfull elevation

Upstream

Downstream

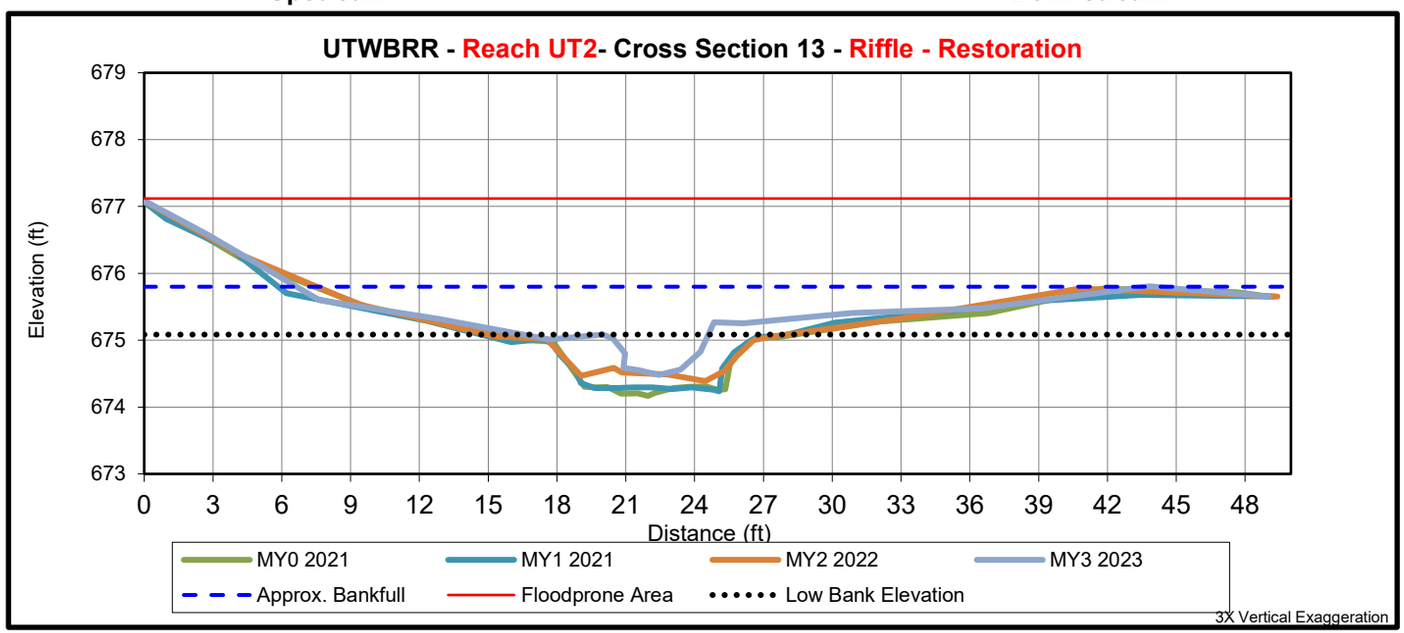


	Cross Section 12 (Riffle)						
	MY0	MY1	MY2	MY3	MY5	MY7	MY+
Bankfull Elevation (ft) - Based on AB-XSA[1]	700.24	700.2	700.3	700.3			
Bankfull Width (ft)[1]	5.3	5.1	5.4	4.6			
Floodprone Width (ft)[1]	36.7	37.7	37.7	39.1			
Bankfull Max Depth (ft)[2]	0.6	0.6	0.5	0.5			
Low Bank Elevation (ft)	700.24	700.2	700.3	700.2			
Bankfull Cross Sectional Area (ft^2)[2]	2.1	2.0	1.7	1.5			
Bankfull Entrenchment Ratio[1]	7.0	7.4	7.0	8.4			
Bankfull Bank Height Ratio[1]	1.0	1.0	0.9	0.8			

1 - Uses the as-built cross sectional area as the basis for adjusting each subsequent years bankfull elevation
2 - Uses the current years low top of bank as the basis for adjusting each subsequent years bankfull elevation

Upstream

Downstream

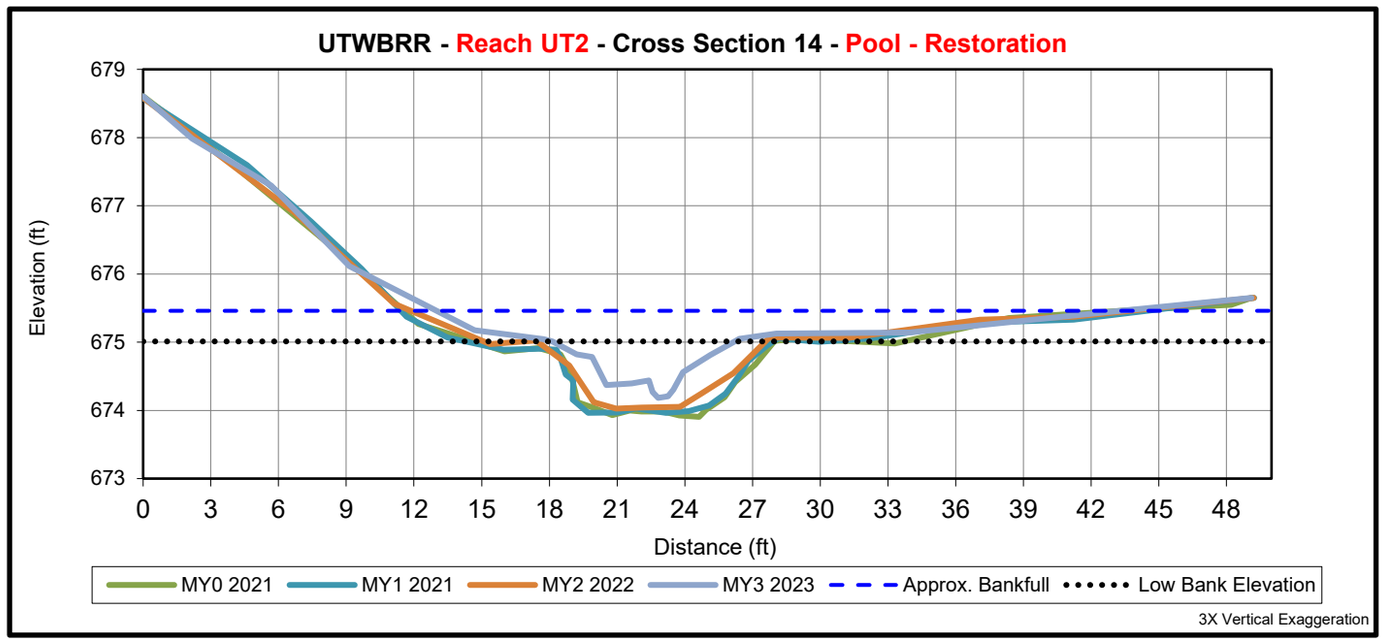


	Cross Section 13 (Riffle)						
	MY0	MY1	MY2	MY3	MY5	MY7	MY+
Bankfull Elevation (ft) - Based on AB-XSA[1]	675.00	675.0	675.1	675.8			
Bankfull Width (ft)[1]	9.8	9.0	12.0	4.8			
Floodprone Width (ft)[1]	>41.8	>43.5	>42.4	>49			
Bankfull Max Depth (ft)[2]	0.8	0.8	0.7	0.6			
Low Bank Elevation (ft)	675.00	675.0	675.0	675.1			
Bankfull Cross Sectional Area (ft^2)[2]	5.3	5.0	4.3	1.8			
Bankfull Entrenchment Ratio[1]	>4.3	>4.8	>3.5	>10.1			
Bankfull Bank Height Ratio[1]	1.0	1.0	0.9	0.5			

1 - Uses the as-built cross sectional area as the basis for adjusting each subsequent years bankfull elevation
2 - Uses the current years low top of bank as the basis for adjusting each subsequent years bankfull elevation

Upstream

Downstream



	Cross Section 14 (Pool)						
	MY0	MY1	MY2	MY3	MY5	MY7	MY+
Bankfull Elevation (ft) - Based on AB-XSA[1]	674.91	674.9	675.1	675.5			
Bankfull Width (ft)[1]	NA	NA	NA	NA			
Floodprone Width (ft)[1]	NA	NA	NA	NA			
Bankfull Max Depth (ft)[2]	1.0	0.9	1.0	0.8			
Low Bank Elevation (ft)	674.91	674.9	675.0	675.0			
Bankfull Cross Sectional Area (ft^2)[2]	7.0	6.6	6.8	3.3			
Bankfull Entrenchment Ratio[1]	NA	NA	NA	NA			
Bankfull Bank Height Ratio[1]	NA	NA	NA	NA			

1 - Uses the as-built cross sectional area as the basis for adjusting each subsequent years bankfull elevation
2 - Uses the current years low top of bank as the basis for adjusting each subsequent years bankfull elevation

Appendix E

Hydrology

Data

Table 12. 2022 - 2023 Rainfall Summary

Month	Average	Normal Limits		2022-2023 Mecklenburg County Precipitation*
		30 Percent	70 Percent	
October	3.50	2.01	4.26	2.26
November	3.59	1.82	4.39	3.49
December	3.94	2.73	4.69	3.73
January	3.24	2.33	3.83	4.27
February	3.35	2.41	3.95	1.60
March	3.73	2.67	4.41	3.33
April	4.08	2.80	4.86	6.63
May	4.30	2.71	5.18	2.05
June	4.55	3.08	5.44	2.59
July	5.63	4.13	6.61	0.75
August	5.04	3.24	6.06	6.31
September	3.62	1.50	4.40	0.10
October	3.17	1.85	3.86	0.90
November	3.50	1.76	4.27	0.47
December	3.89	2.67	4.64	2.81
Total Annual *	48.10	31.15	57.51	31.81

Above Normal Limits	Below Normal Limits

WETS Station: Concord, NC. Approximately 12 miles SE from the site.

*Project Location Precipitation is a location-weighted average of surrounding gauged data retrieved by the USACE Antecedent Precipitation Tool. Gauges used include Concord 1.8 ENE, Concord 4.5 SW, and Concord

**Total Annual represents the average total precipitation, annually, as calculated by the 30-year period.

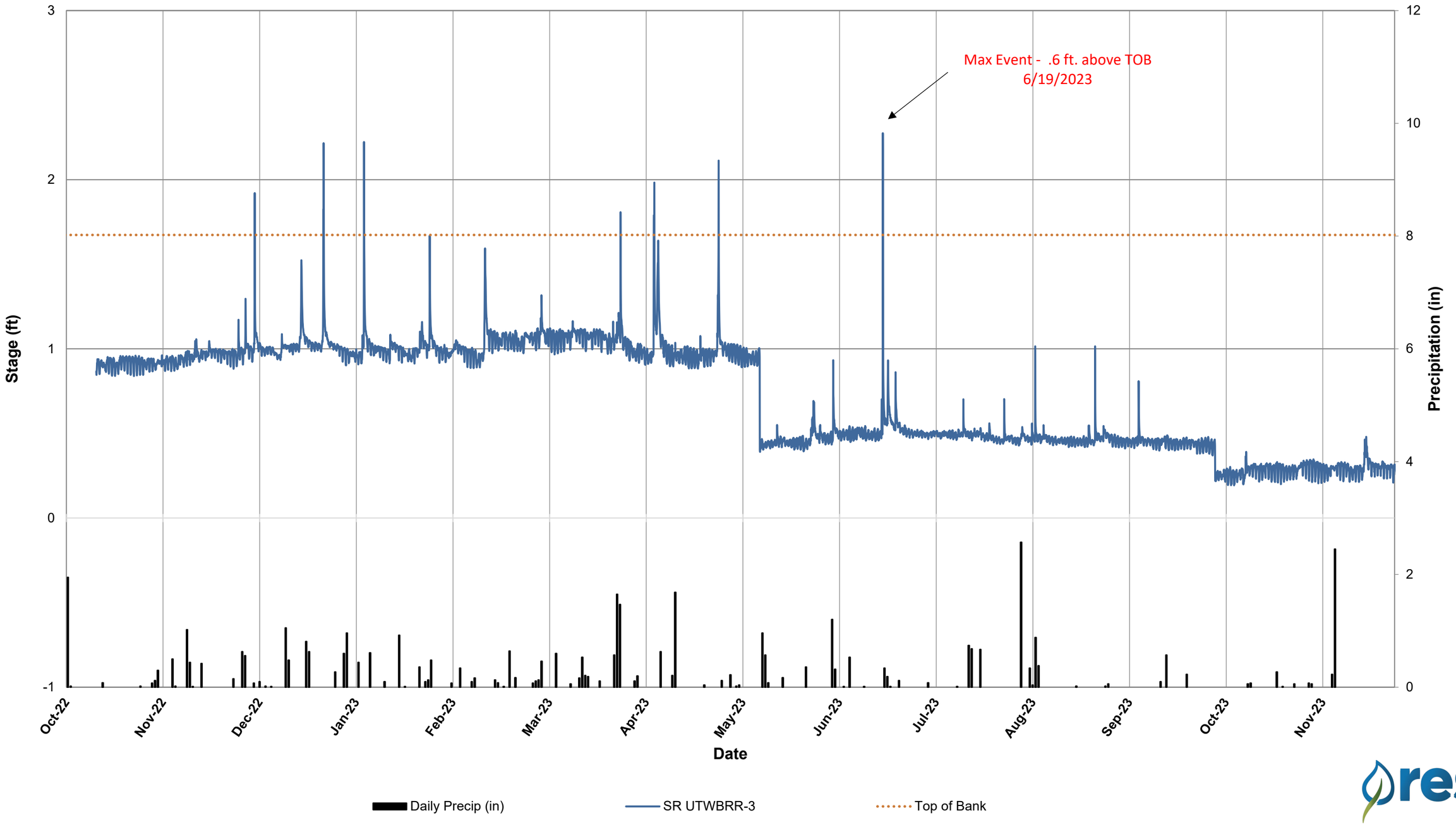
Table 13. Documentation of Geomorphically Significant Flow Events

Year	Bankfull Height (ft)	Date of Bankfull Event
Stage Recorder UTWB-3		
MY1 2021	N/A	N/A
MY2 2022*	0.14	7/13/2022
	0.32	11/30/2022
	0.54	12/22/2022
MY3 2023	0.55	1/4/2023
	0.14	3/27/2023
	0.31	4/7/2023
	0.44	4/28/2023
	0.60	6/19/2023

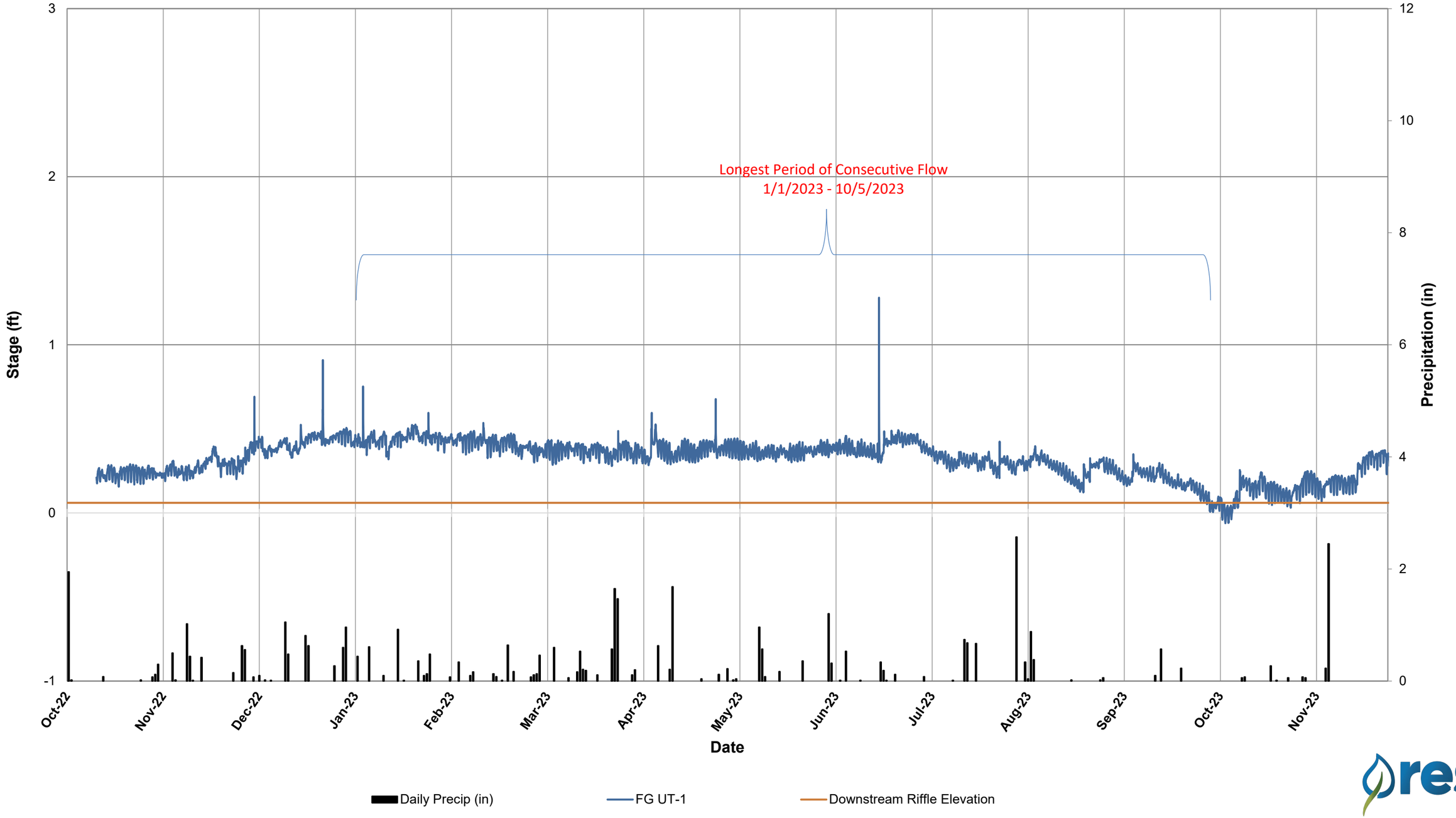
Year	Number of Flow Events	Maximum Consecutive Flow Days	Maximum Cummlative Flow Days	Maximum Consecutive Flow Date Range
Flow Gauge UT1				
MY1 2021	1	243	243	4/16/2021 - 12/15/2021
MY2 2022	1	299	299	12/15/2021 - 10/10/2022
MY3 2023	3	277	333	1/1/2023 - 10/5/2023
Flow Gauge UT2				
MY1 2021	1	243	243	4/16/2021 - 12/15/2021
MY2 2022	1	299	299	12/15/2021 - 10/10/2022
MY3 2023	2	276	277	1/1/2023 - 10/4/2023

*MY2 SR UTWB-3 data updated based on additional data collected.

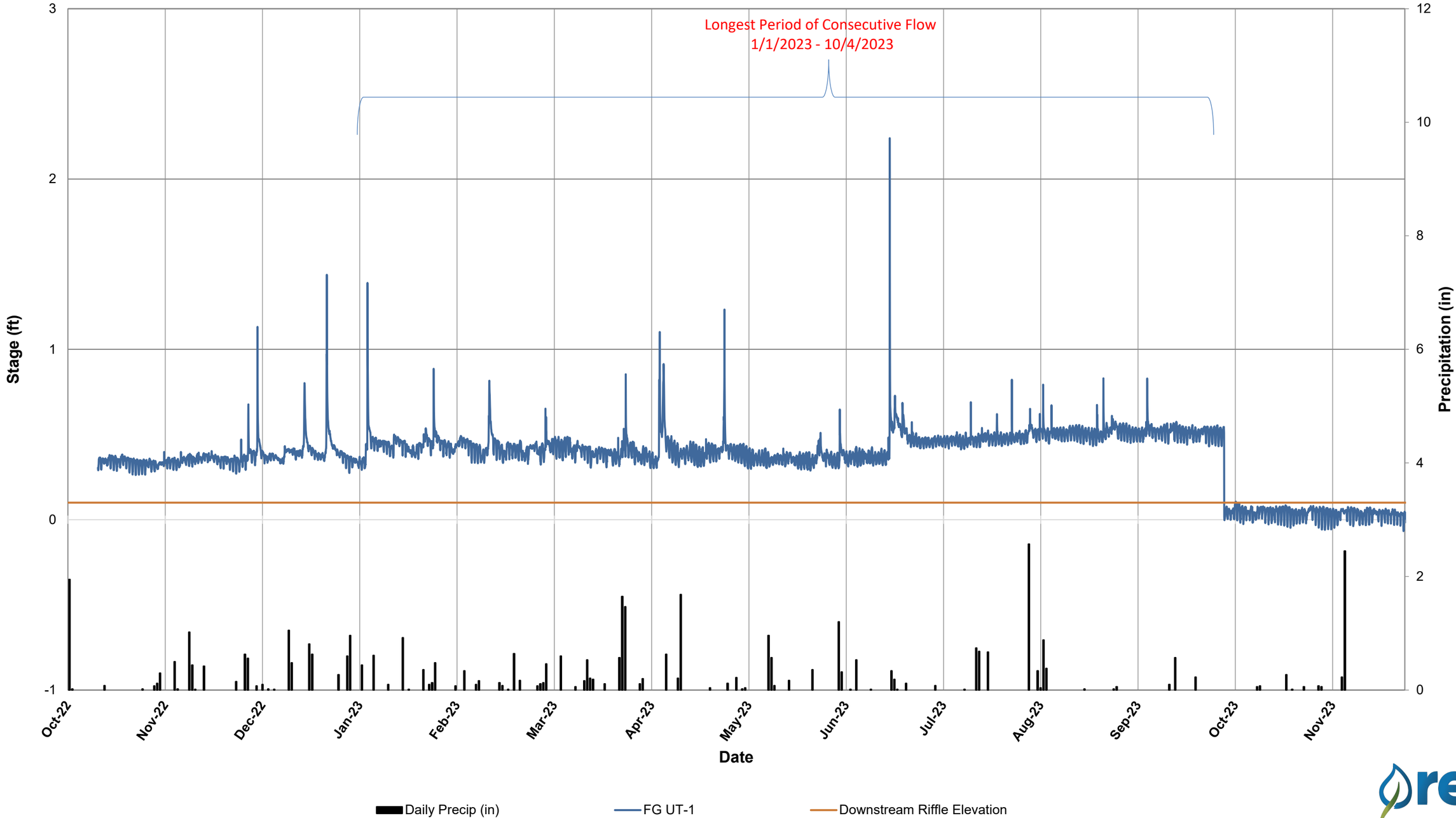
MY3 UTWBRR-3 Stage Recorder Graph



MY3 UTWBRR UT-1 Flow Gauge Graph



MY3 UTWBRR UT-2 Flow Gauge Graph



Appendix F

Adaptive

Management

2023-24 Maintenance Work Plan Contract Summary
UT West Branch Rocky River Project
Yadkin River Basin 03040105: Mecklenburg County, NC
USACE Action ID 2017-00342
DWR # 2018-1696 v.1
DMS Project Number 92684

Contract is in progress for fence removal in the conservation easement, stream side live-staking along some riffles and eroded outer bends, repairing side slope area of surface erosion, and treating a small area of kudzu at the lower end of the project at the greenway. Following are the final maintenance items planned and scoped, along with location maps, for completion in late 2023 and early 2024:

SCOPE OF WORK:

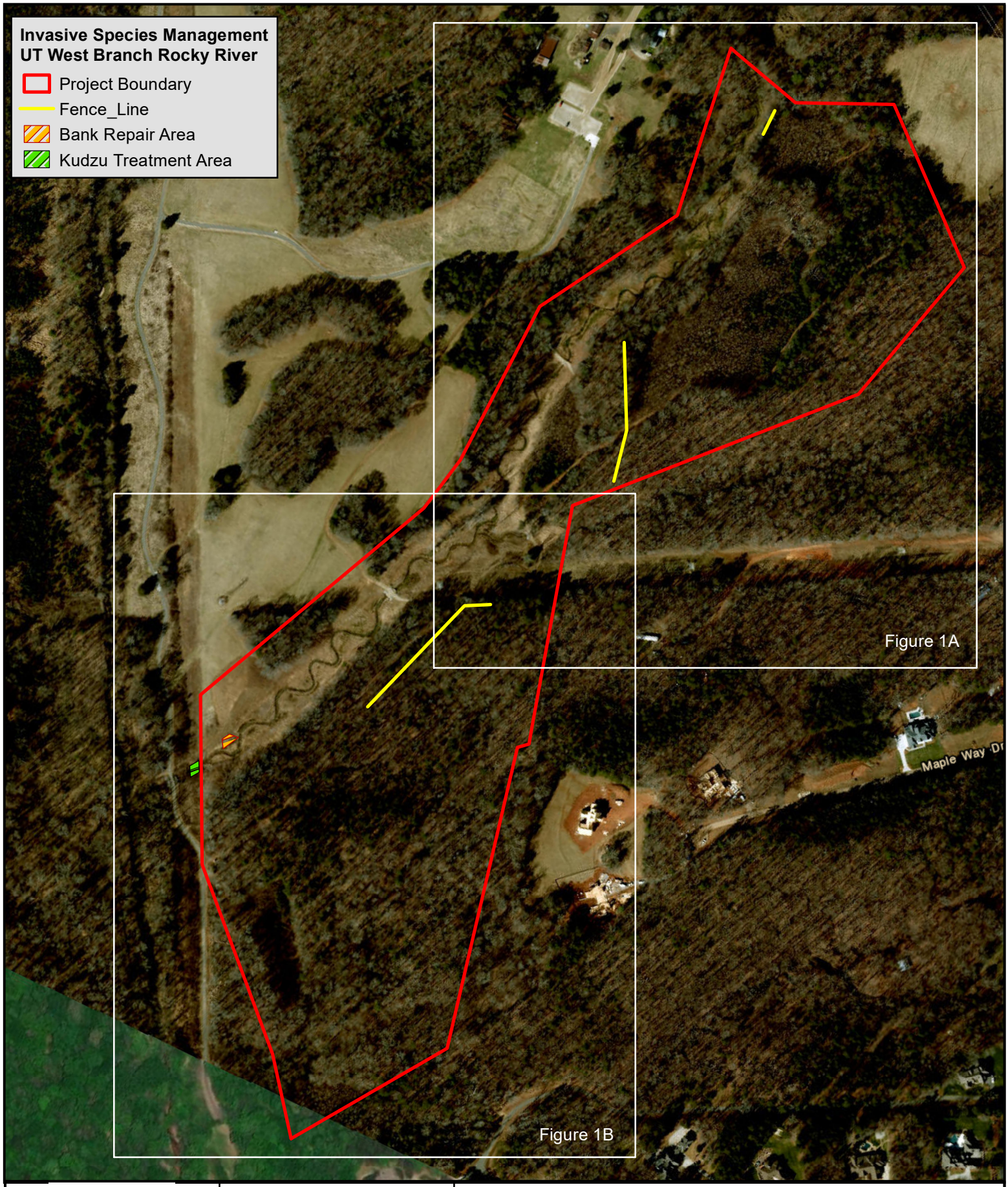
Task 1 –Planting Livestakes:
Includes planting 600 livestakes using mixture of 200 black willow (*Salix nigra*), 200 Ninebark (*Physocarpus opulfolius*), and 200 Silky dogwood (*Cornus amomum*) on approximately 900 feet of stream bank along UTWB.

Task 2 –Fence Removal:
Includes removal and disposal of approximately 1000 feet of relic barbed wire fencing within the easement boundaries. DRG will remove all metal fence posts along relic fence lines within the easement boundary. Wooden fence posts will remain in place. Approximate locations are depicted in Figures 1-1B (Appendix A).

Task 3 –Side Slope Repair:
Includes repairing approximately 1,000 square feet of surface erosion along the right bank, roughly 75 feet above the southeastern boundary of the easement. Repairs will involve raking and smoothing the area, reseeding with a temporary seed mix and a permanent native seed mix, and stabilized using natural fiber straw jute matting, anchored with wooden stakes. A total of 15 bareroots will be replanted in the disturbed area utilizing River birch (*Betula nigra*), Tulip poplar (*Liriodendron tulipafera*), and Water oak (*Quercus nigra*). Approximate location is depicted in Figures 1-1B.

Task 4 –Kudzu Herbicide Treatment:
Includes treating approximately 1,000 square feet of kudzu outside the easement boundary above the West Branch Rocky River Greenway. Approximate location is depicted in Figures 1-1B (Appendix A).

Note – Of the four piping riffles discussed at the 8/30/2023 IRT site meeting, two have been hand-repaired (photos are provided in the MY3/2023 monitoring report) and two have similar repairs planned for December 2023-January 2024.



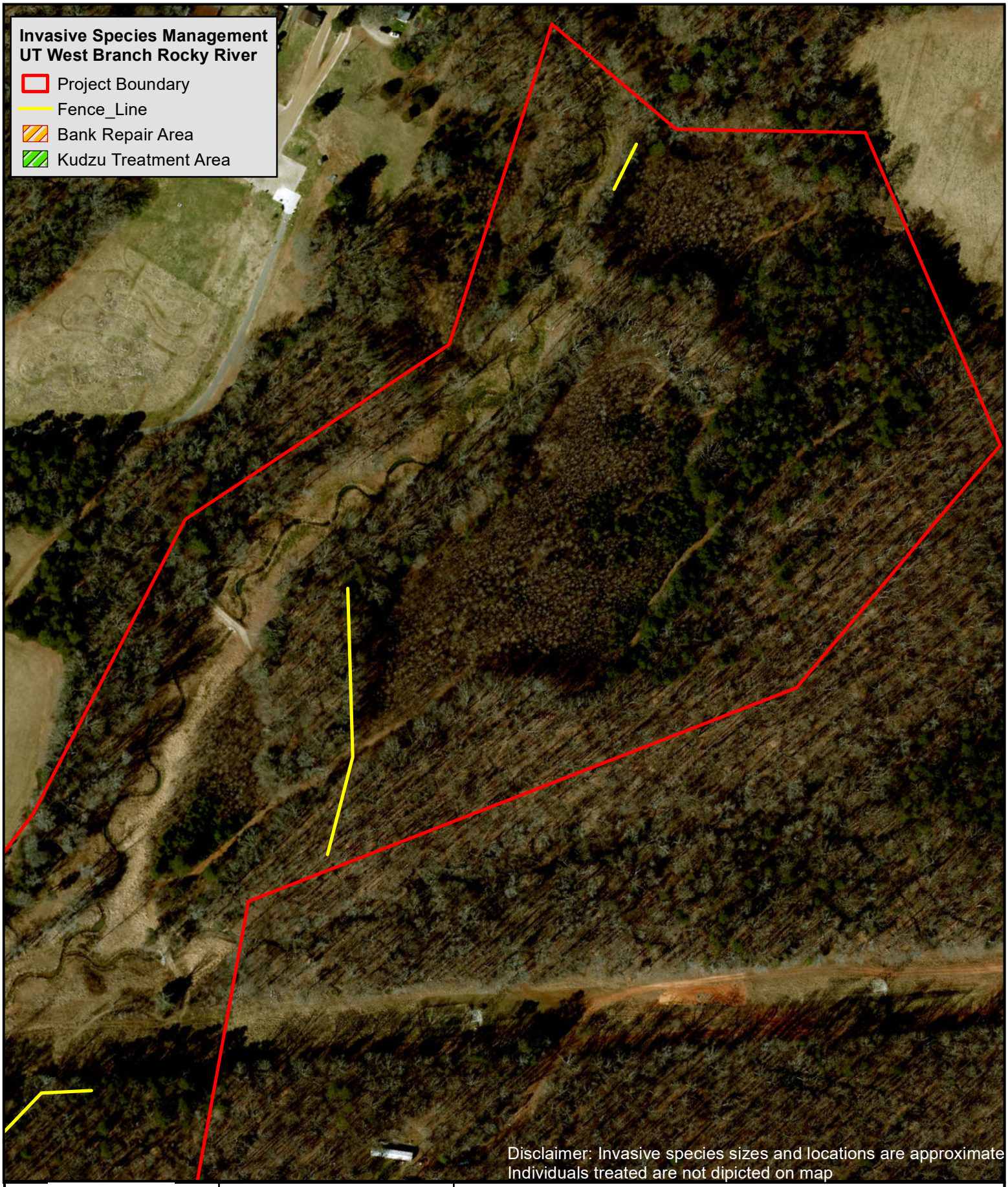
DAVEY Resource Group

3101 Poplarwood Ct, Suite 120
Raleigh, NC 27604

Figure 1: Repair Locations Map

0 220 440 880 1,320 Feet

N



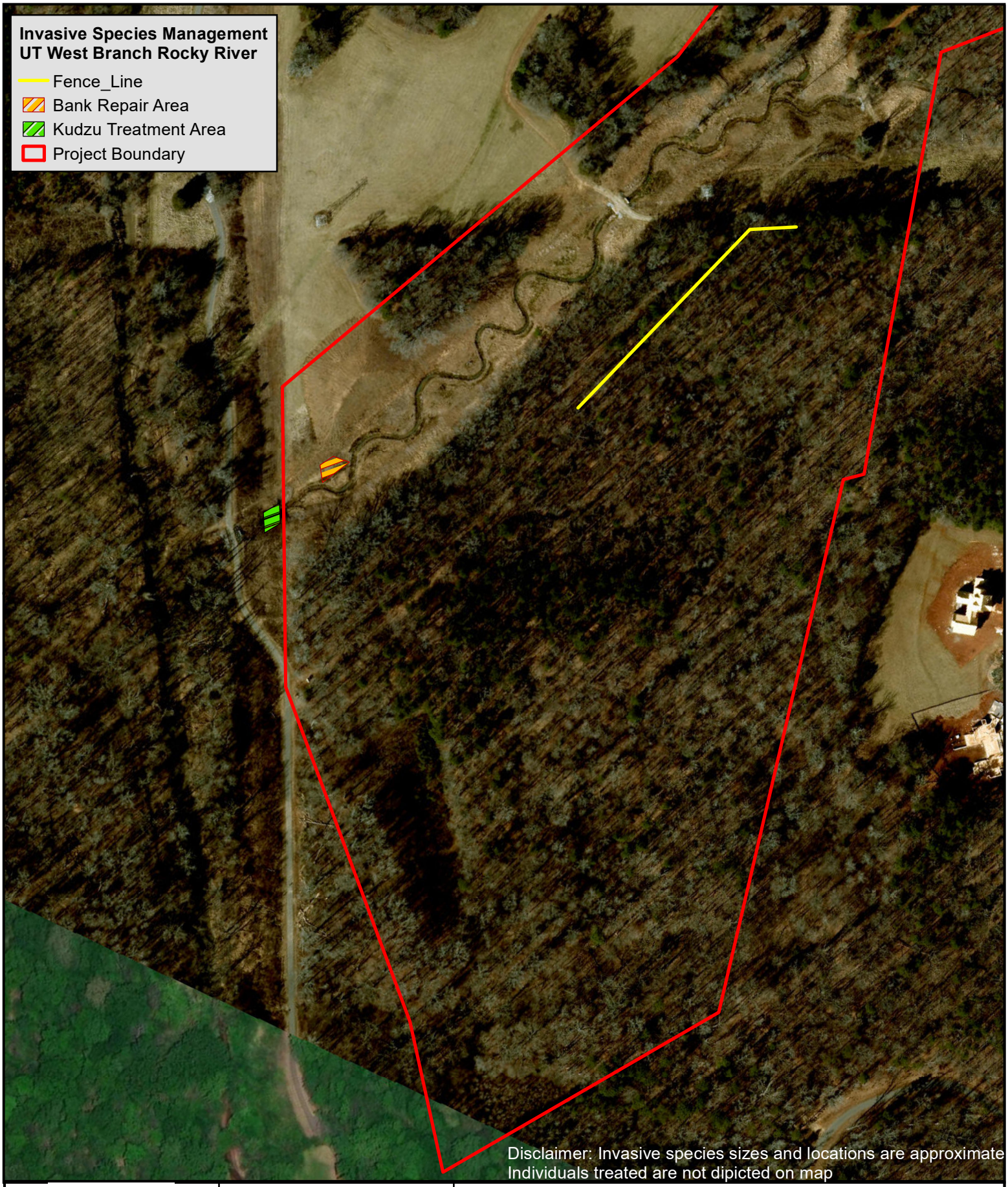
DAVEY Resource Group

3101 Poplarwood Ct, Suite 120
Raleigh, NC 27604

Figure 1A: Repair Locations Map

0 115 230 460 690 Feet

N



DAVEY Resource Group

3101 Poplarwood Ct, Suite 120
Raleigh, NC 27604

Figure 1B: Repair Locations Map

0 125 250 500 750 Feet

N

DAVEY
Resource Group

Maintenance Report—November 2023
Davey Resource Group
Invasive Vegetation Maintenance for UT West Branch Rocky River
DMS Number: 92684
Contract Number: WBRR4769
Submittal Date: 28 November 2023

Contents

Figures

Appendices

1.0 Project Summary

1.1 Location

UT West Branch Rocky River is located within Fisher Farm Park at 21215 Shearer Rd. Davidson, NC. Follow I-77 to NC-1100/Brawley School Rd in Mooresville. Take exit 35 from I-77; Continue on NC-1100/Brawley School Rd. Take Timber Rd. & Shearer Rd. to Fisher Rd.

1.2 Background

UT West Branch Rocky River Mitigation Site (Site) encompasses approximately 59 acres of area within a 200 acre park in Mecklenburg County, North Carolina. Davey Resource Group (DRG) was contracted by the Department of Environmental Quality (NCDEQ), Division of Mitigation Services (DMS) in January 2023 to perform invasive vegetation management across the entirety of the 59 acre area. Approximate locations of invasive species located on Site are depicted in Figures 1-Figure 1B located in Appendix A.

1.3 Targeted Species

Nuisance/Invasive/Non-Native Species		
Common Name	**Scientific Name**	**Habitat**
Tree of Heaven	*Ailanthus altissima*	tree
Mimosa	*Albizia julibrissin*	tree
Princess Tree	*Paulownia tomentosa*	tree
China Berry	*Melia azedarach*	tree
Callery Pear	*Pyrus calleryana*	tree
White Mulberry	*Morus alba*	tree
Japanese Privet	*Ligustrum japonicum*	shrub
Glossy Privet	*Ligustrum lucidum*	shrub
Chinese Privet	*Ligustrum sinensis*	shrub
Olive	*Eleagnus spp.*	shrub
Trifoliate Orange	*Citrus trifoliata, Poncirus trifoliata*	shrub/tree
Japanese Knotweed	*Reynoutria japonica*	shrub
Multiflora rose	*Multiflora rosa*	Shrub
Cat tails	*Typha latifolia*	grass/forb
Phragmites	*Phragmites australis*	grass/forb
Dog fennel	*Eupatorium capillifolium*	grass/forb
Chinese Silvergrass	*Miscanthus sinensis*	grass/forb
Bamboo	*Phyllostachys spp.*	grass/forb
Sericea lespedeza	*Sericea lespedeza*	grass/forb
Lespedeza cuneata	*Lespedeza cuneata*	Grass/forb
Johnson Grass	*Sorghum halepense*	grass/forb
Fescue	*Festuca spp.*	grass/forb
Morning glories	*Ipomoea spp.*	vine
Kudzu	*Pueraria montana*	vine
Porcelain Berry	*Ampelopsis brevipedunculata*	vine
Japanese Hops	*Humulus japonicus*	vine
Wisteria	*Wisteria spp.*	vine
Oriental Bittersweet	*Celastrus orbiculatus*	vine
Winter Creeper	*Euonymus fortunei*	vine
Japanese honeysuckle	*Lonicera japonica*	vine
English Ivy	*Hedera helix*	vine

2.0 Annual Treatments

2.1 Treatment Methods

DRG completed the first herbicide treatment in April 2023. The second herbicide treatment was completed October 4, 2023 as described below.

A foliar application using a 6% aquatic glyphosate solution was utilized to treat invasive vine species and invasive shrubs within the easement boundary. A total of 48 gallons of glyphosate mixture was utilized, translating to 3 gallons of aquatic glyphosate used. Herbicide Application Logs are provided in Appendix B.

2.2 Results and Discussion

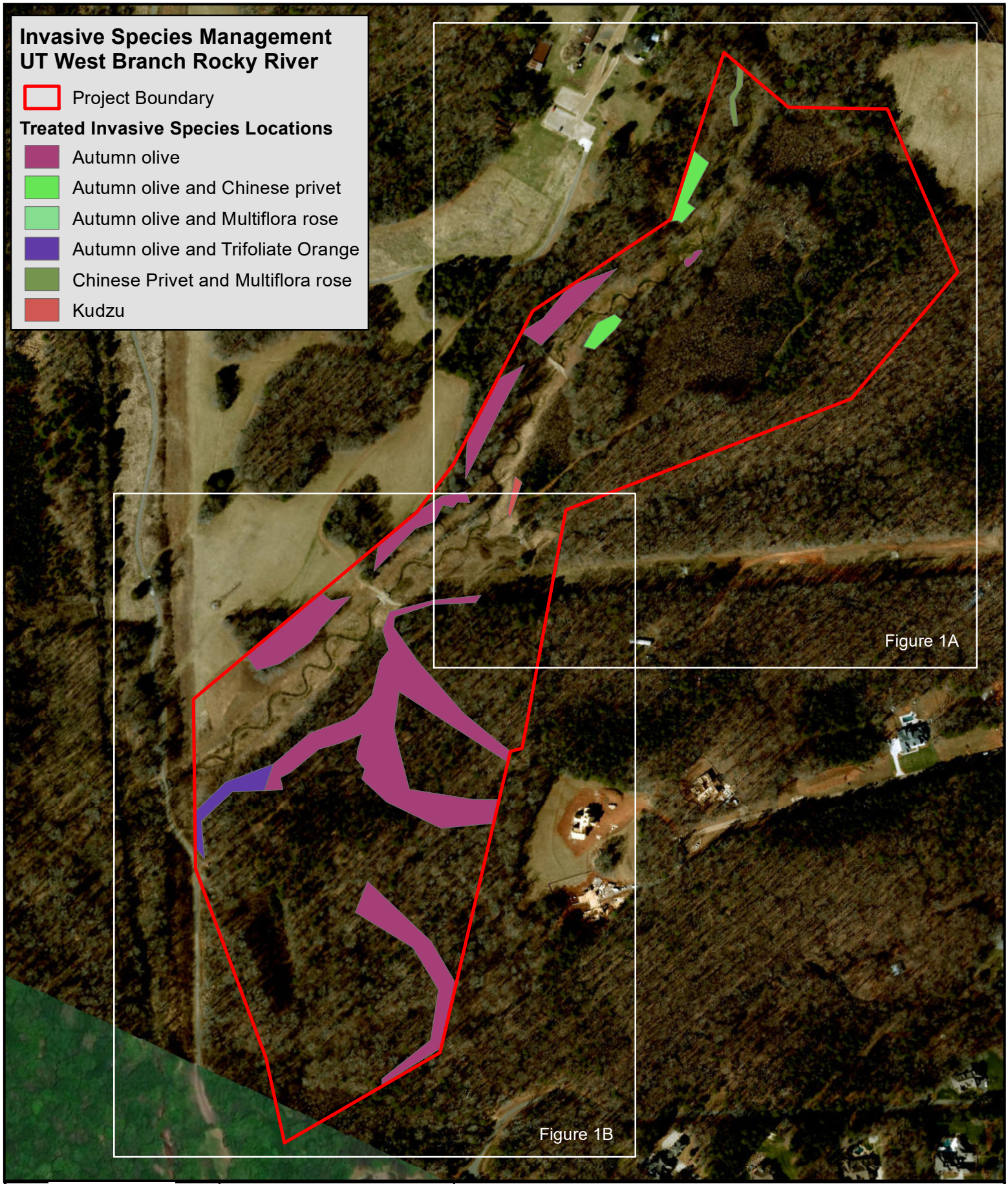
Approximately 6.0 acres of invasive species were treated. Primary species treated on-site included Chinese privet, autumn olive, and multiflora rose. Several individuals of trifoliate orange were observed and treated within the easement boundary. DRG also observed and treated two areas of kudzu on-site. Both trifoliate orange and kudzu were treated with the same 6% solution used to treat other invasive species on-site. Locations of invasive species treated can be seen in Figures 1A and 1B.

It was reported that approximately 14.0 acres of invasive species were treated in the spring. This was a result of a mathematical error made in the spring report. Based on the gallons of mixture applied the corrected areas treated equates to 7.0 acres. An updated herbicide log has been included in Appendix B.

3.0 Maintenance and Adaptive Management Plans

DRG plans on treating the Site twice during 2024. The first treatment will occur between March and April of 2024. The second treatment will occur between September and October 2024.

Appendix A – Site Overview and Invasive Species Location Maps



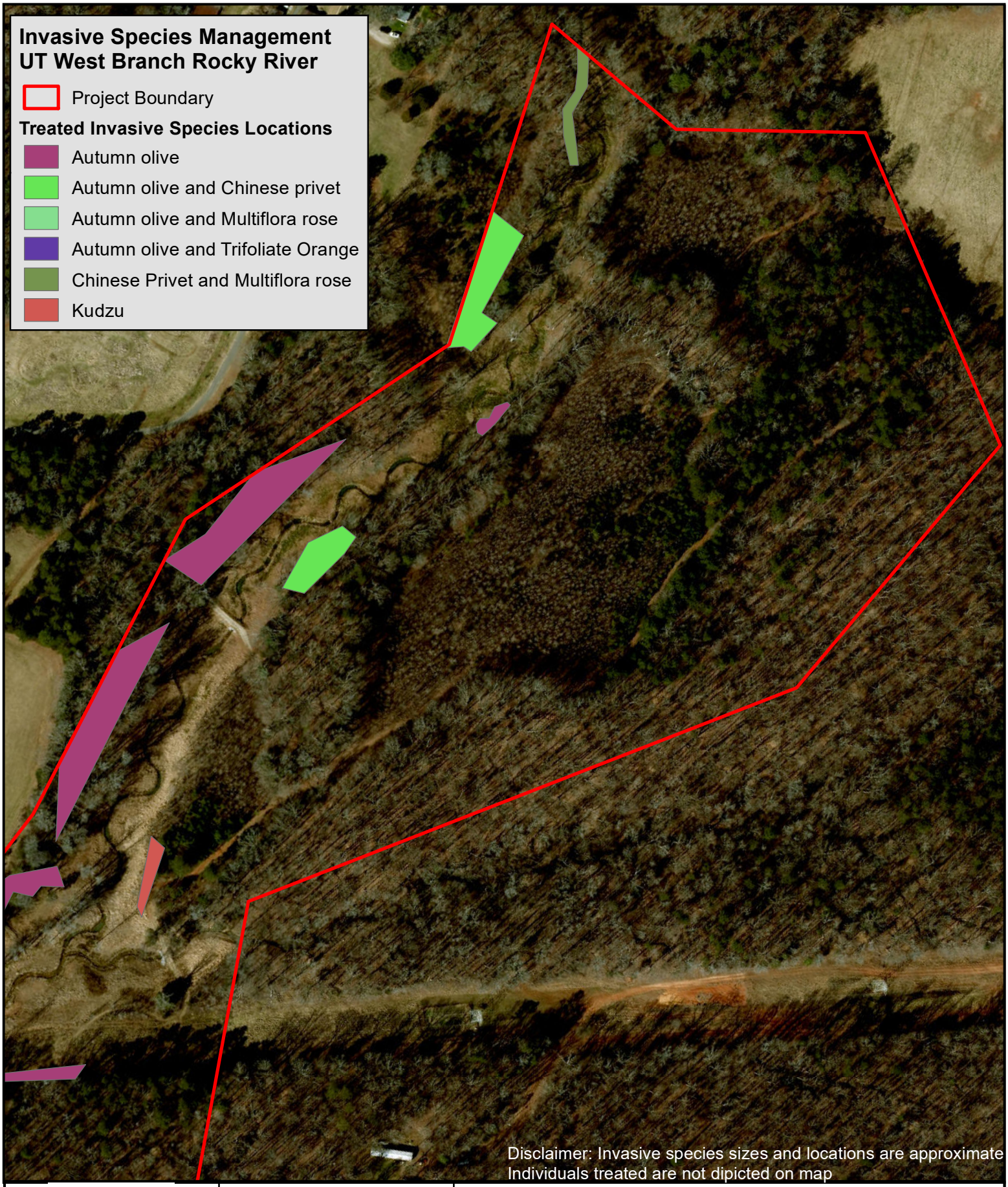
DAVEY Resource Group

3101 Poplarwood Ct, Suite 120
Raleigh, NC 27604

Figure 1: Site Overview Map

0 220 440 880 1,320 Feet

N



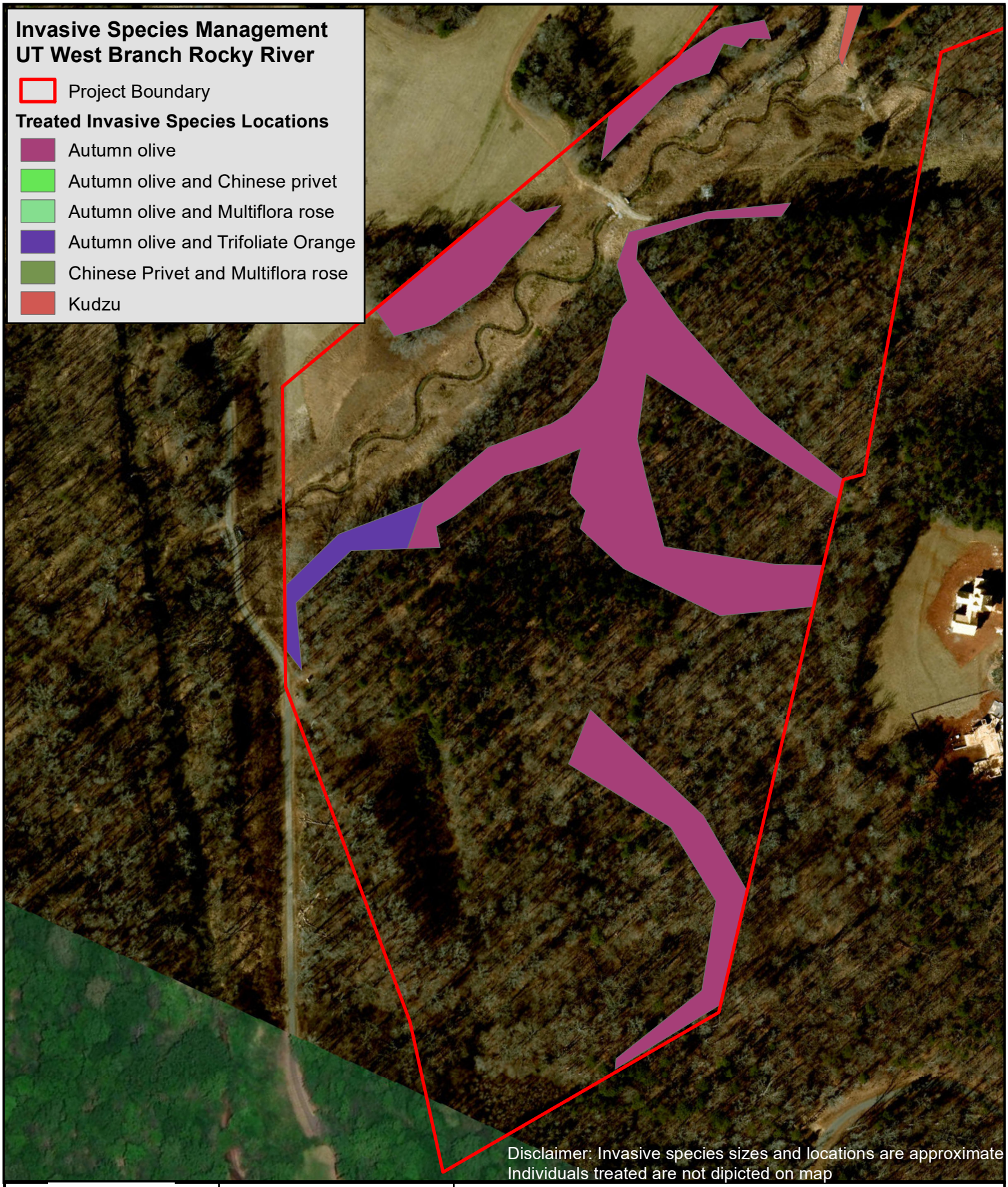
DAVEY Resource Group

3101 Poplarwood Ct, Suite 120
Raleigh, NC 27604

Figure 1A: Invasive Species Map

0 115 230 460 690 Feet

N



DAVEY Resource Group

3101 Poplarwood Ct, Suite 120
Raleigh, NC 27604

Figure 1B: Invasive Species Map

0 125 250 500 750 Feet

N

Appendix B – Herbicide Application Log

Herbicide Application Record

Client, Project Name:	Division of Mitigation Services (DMS) Invasive Species Management for UT West Branch Rocky River						
Site Address:	21215 Shearer Rd. Davidson, NC						
Category:	Riparian Habitat						Other:

PRODUCT APPLIED and SITE CONDITIONS

Date	Occurrence Site Name	Species controlled	Mix Code	Quantity of Mix Applied	End Use Concentrate	Air Temp	Wind Speed	Wind Direct	Start Time	End Time	Equip. Code	MoA Code	Acres Treated & Comments
10/4/2023	UT West Branch Rocky River	Chinese Privet, Kudzu, Autumn Olive, Trifoliate Orange, Multiflora Rose	1	48 GAL	6%	75°F	<5 MPH	NE	8:00 AM	4:00 PM	B	i	6

STAFF

Employee Name	Pesticide License #	Hours	Comments	Employee Name	Pesticide License #	Hours	Comments
Michael Foster (NC)	NC#026-38079	8					
William Bailey		8					

MATERIAL and EQUIPMENT

Herbicide/Adjuvant Information					Equipment Information			
Mix Code	EPA Reg. No.	Brand Name	Manufacturer	Mix Description	Equip. Code	Equipment Description	MoA Code	Mode of Application (MoA)
1	524-343	Roundup Custom	Bayer	6% Solution Roundup Custom	A	Engine Sprayer	i	Foliar
2					B	Backpack Sprayer	ii	Basal Bark
3					C	Wicking Device	iii	Hack-and-Squirt
4					D	Injector	iv	Aerial

ADDITIONAL DATA REQUESTED BY CLIENT

Herbicide Application Record

Client, Project Name:	Division of Mitigation Services (DMS) Invasive Species Management for UT West Branch Rocky River						
Site Address:	21215 Shearer Rd. Davidson, NC						
Category:	Riparian Habitat						Other:

PRODUCT APPLIED and SITE CONDITIONS

Date	Occurrence Site Name	Species controlled	Mix Code	Quantity of Mix Applied	End Use Concentrate	Air Temp	Wind Speed	Wind Direct	Start Time	End Time	Equip. Code	MoA Code	Acres Treated & Comments
4/17/2023- 4/19/2023	UT West Branch Rocky River	Japanese Honeysuckle, Chinese Privet, Autumn Olive, Trifoliate Orange	1	56 gal	6%	71°F	7 MPH	SW	7:30 AM	3:30 PM	B	i	7
4/17/2023- 4/19/2024	UT West Branch Rocky River	Japanese Honeysuckle, Chinese Privet, Autumn Olive, Trifoliate Orange	2	36 Gal	5%	71°F	7 MPH	SW	7:30 AM	3:30 PM	B	i	4.5

STAFF

Employee Name	Pesticide License #	Hours	Comments	Employee Name	Pesticide License #	Hours	Comments
Michael Foster	NC#026-38079	18					
Miguel Mattox	NC#026-38535	18					

MATERIAL and EQUIPMENT

Herbicide/Adjuvant Information					Equipment Information			
EPA Reg. No.	Brand Name	Manufacturer	Mix Code	Mix Description	Equip. Code	Equipment Description	MoA Code	Mode of Application (MoA)
524-343	Roundup Custom	Bayer	1	6% Solution Roundup Custom	A	Engine Sprayer	i	Foliar
81927-13	Triclopyr 3	Alligare	2	5 % Solution Triclopyr 3	B	Backpack Sprayer	ii	Basal Bark
			3		C	Wicking Device	iii	Hack-and-Squirt
			4		D	Injector	iv	Aerial

ADDITIONAL DATA REQUESTED BY CLIENT

Appendix G

IRT Correspondence

ROY COOPER
Governor
ELIZABETH S. BISER
Secretary
MARC RECKTENWALD
Director

NORTH CAROLINA
Environmental Quality

MEMORANDUM

MEETING: IRT Monitoring Year 3 Site Visit Meeting Summary
UT West Branch Rocky River Project
Yadkin River Basin 03040105: Mecklenburg County, NC
USACE Action ID 2017-00342
DWR # 2018-1696 v.1
DMS Project Number 92684

MEETING DATE: August 30, 2023

ATTENDEES: Kim Isenhour, USACE
Erin Davis, USACE
Dave McHenry, NCWRC
Harry Tsomides, NCDMS
Paul Wiesner, NCDMS
Matthew Reid, NCDMS

NCDMS and the IRT met on site to field review and discuss the monitoring progress of the mitigation site. The site is currently in Monitoring Year 3 (2023).

The group met in the gravel parking lot in the Town of Davidson's Fisher farm Park and discussed the site in general. Harry summarized the site history including ongoing invasives treatments, boundary compliance, the positive project partnership with the Town of Davidson, and overall site performance challenges so far during the monitoring period. In general the site is reflective of the most recent deliverable, *UT West Branch Rocky River Project - Year 2 Monitoring Report* (January 2023). The CCPVs from the report are attached with this memo.

The group walked towards the downstream limits of the project near the greenway and Piedmont Natural Gas (PNG) underground gas line. Harry pointed out that the project limits are just upstream from the PNG right-of-way. The easement boundary is well marked in the area and the wooden posts along this line were pointed out. Before beginning the stream walk in an upstream direction, a small kudzu infestation was pointed out along the greenway. Harry noted that, while the project area is currently under contract (throughout the project lifetime) for invasives treatments, the kudzu is outside the boundary and therefore the contractor is not required to treat this area; however all agreed that it would be prudent to treat the area and Harry agreed to look into ways to accomplish this, including inquiring with the Town Parks staff, as well as with the project manager with Mecklenburg County, who are implementing another stream restoration project along the greenway (upstream on West Branch Rocky River).

The group began to walk upstream, noting the project culvert installation at the downstream end. There was evidence of some deposition and minor bank erosion/rilling (right side floodplain facing downstream). Harry noted that backwaters from flooding events along West Branch Rocky River main stem regularly back into this general area of the project, creating occasional depositions and high water. Kim asked that some seeding and mulching be performed on the area that showed rilling. Harry noted that the mounded portion on the park side of the stream came from excess excavation dirt from the project, which was approved by the Town of Davidson for wasting in that area.

The group continued to walk upstream, noting stream and vegetation conditions. Harry pointed out some floodplain areas along the lower reach (UTWB-3) that were treated for significant autumn olive infestation. The group then came to the large concrete box culvert beneath the Duke power line. The culvert was functioning well. Dave inspected it and indicated that culvert type is preferable to a typical pipe culvert. Harry noted that DMS worked with the designer during the design phase to include this type of culvert. It was noted that the area underneath the Duke power line (the entire right-of-way) has been excluded from credit. The question came up whether the powerline and culvert crossing were excluded from the easement survey. Since the meeting, Harry has confirmed that there is no easement 'cutout' at this location, and the easement area and plat includes the crossing, with notations about the power line and culvert.

From the powerline crossing, the group walked up the bike path towards UT2. The area around the UT2 culvert crossing were observed. Dave inspected the culvert and noted some sedimentation within the culvert. Harry explained that there were large gullies farther upstream on UT2 (outside the project area) that are the likely sediment source acting as a stressor on UT2. On balance, UT2 appears to be transporting incoming sediments but there is evidence of some aggradation along this reach. Harry noted that it has been worse in the past; and that DMS had removed large masses of juncus by hand in this area during MY1 and MY2. Kim asked for a more thorough mapping of aggraded areas on the project. Harry indicated he would reach out to RES (monitoring consultant) to provide that moving forward.

As the group walked from this area into and along UTWB-2 in an upstream direction, it became clear that wetland-type vegetation is favoring the stream (*Juncus and Sagittaria sp.).* Despite sometimes heavy aquatic vegetation, perennial, single thread flow through all project reaches was observed. Adding streamside live stakes was discussed as a potential longer term solution, to increase shading and reduce in-stream vegetation. The possibility of in-stream invasives treatment was briefly discussed and it was agreed that this was not feasible and would only work in the short term. As the group walked upstream and into UTWB-1, Harry noted two piping riffle-step structures that were not fully functional with accumulated herbaceous vegetation on top. Dave and Harry peeled back the geotextile fabric on a couple of the structures and it was immediately evident that most of the stream flows were escaping down small 'sink holes' along the stream bank in the rock material that had been used to construct the riffles. All told, the group noted four structures with similar conditions that had lost at least some of their functionality, although they were not negatively impacting overall stability. The group consensus was that some focused repositioning of rock and fabric might be just as effective and less of an impact (and less costly) as rebuilding the entire structures. Harry and DMS will evaluate and explore the most effective way to move forward with this issue and provide an update in the MY3 annual monitoring report.

The group walked upstream into and along UTWB-1. More wetland type vegetation as observed as this area has some side slope seepage into the streamside areas. UT1 was observed and looked fine. Harry noted an area along the uppermost segment of UTWB-1 where a floodplain rock outlet had been restored recently by hand (by DMS), keeping storm flows off a small eroding side slope. This seemed to be functioning well following a recent heavy rain event. Some old barb wire fencing was observed near UT1, and it was agreed that DMS would remove old fencing and T-posts within the easement. Some scattered kudzu were noted at the upstream limits of the project. Kim noted that sweet gum was volunteering around the UTWB-1 reach area in large numbers. The group then walked to the upstream limit of the project and walked back towards the parking lot where the meeting adjourned. Wrap-up discussion/summary points are as follows:

- The project area will continue to be treated as needed throughout MY7 for invasive vegetation, including kudzu, autumn olive resprouting, and other invasives as observed. The small patch of kudzu just beyond the project downstream limit will be further investigated and treatment options explored with community stakeholders. Invasives status within the project, and any external treatments, will be updated and reported in annual monitoring reports moving forward.

- The minor rilling/erosion along UTWB-3 right floodplain near the mounded area will be reseeded, mulched, and included in monitoring reporting moving forward.

- DMS plans to add some stream side livestakes on the project site in strategic locations to provide additional stream stability and stream shading to reduce instream vegetation.

- Kim asked if some winter photos could be included in the annual monitoring reports. Efforts will be made to include winter photos which might capture stream conditions more effectively.

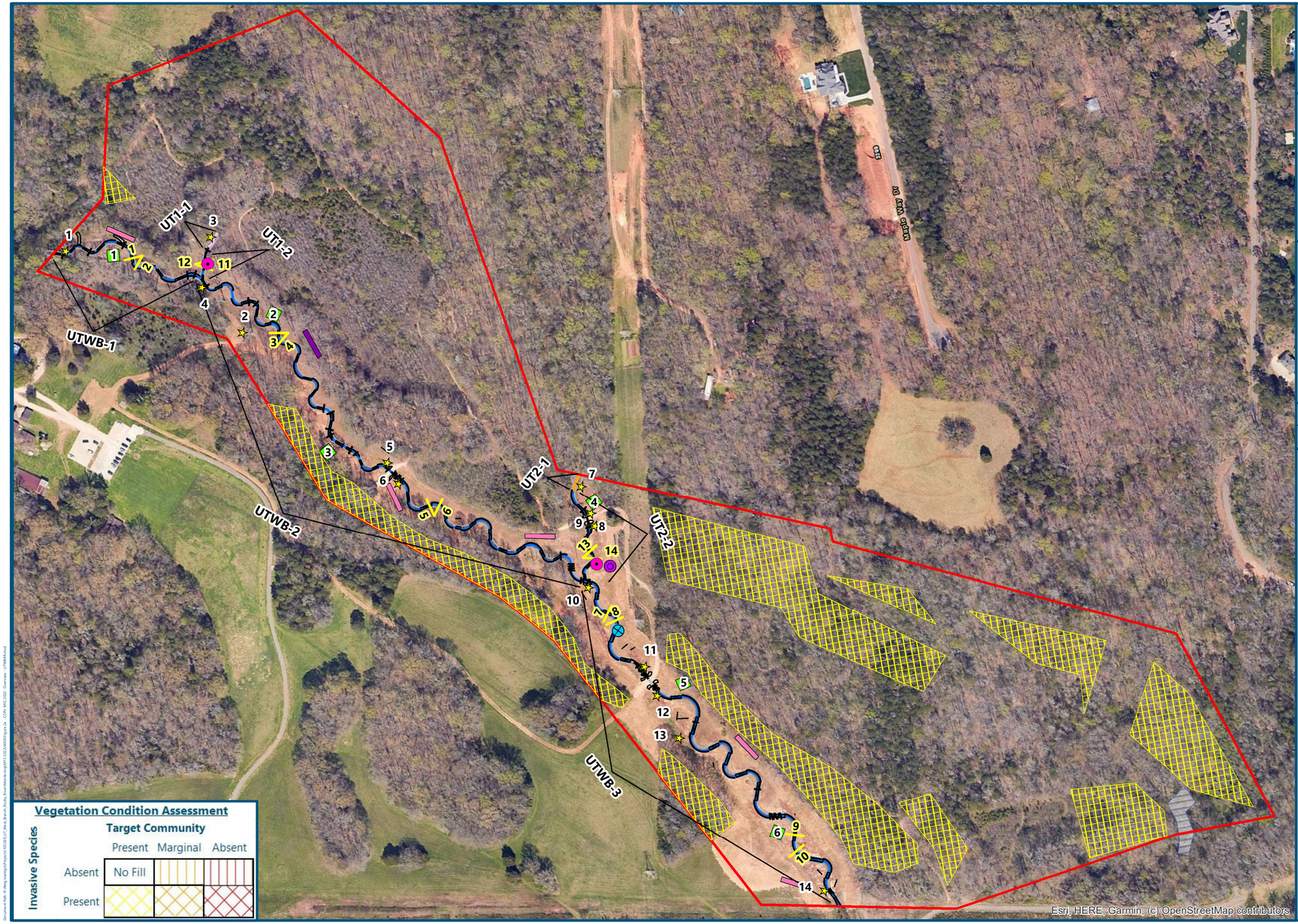
- Some monitoring features will need updating from MY2 to MY3; specifically, excessively aggraded segments will be mapped to a greater resolution; the invasives polygons in the monitoring report will be field verified and updated for MY3, since several treatments have occurred since the MY2 report was completed; and piping structures will be updated and mapped on the CCPVs. The small area of rilling/erosion along UTWB-3 will be monitored and mapped.

- DMS committed to removing some relict barbed wire and metal T-Posts (internal to the easement) prior to transfer to DEQ Stewardship.

- Moving forward, UT2 will be mapped in annual monitoring reports in more detail for excessive aggradation.

- The four piping structures will be addressed with restorative work (to be determined) and reported/updated in annual monitoring reports moving forward.

- This memo will be included as an Appendix in the Monitoring Year 3 Report.



res

Restoring a resilient earth for a modern world

N E S W

0 125 250

Feet

Figure 2a - CCPV MY2 Overview

UT West Branch Rocky River Mitigation Project

Mecklenburg County, North Carolina

Date: 11/23/2022	Drawn by: GDS
1 in = 250 feet	Checked by: DGD

Vegetation Condition Assessment

Invasive Species	Target Community: Present	Target Community: Marginal	Target Community: Absent
Absent	No Fill		
Present			

Legend

- Conservation Easement
- Existing Wetland

Fixed Vegetation Plot

- >320 stems/acre

Random Vegetation Plot

- >320 stems/acre
- <320 stems/acre

Stream Mitigation

- Restoration
- Enhancement I
- Enhancement II
- No Credit
- Cross Section
- Structure
- Top of Bank

Monitoring Devices

- Stage Recorder
- Flow Gauge
- Ambient/Rain Gauge
- Photo Station

res

Restoring a resilient earth for a modern world

N E S W

0 50 100

Feet

Figure 2b - CCPV MY2

UT West Branch Rocky River Mitigation Project

Mecklenburg County, North Carolina

Date: 11/23/2022	Drawn by: DGD
1 in = 100 feet	Checked by: xxx

UT1-1

UT1-2

UTWB-1

UTWB-2

Fisher Rd

Piping Structure

Piping Structure

1 2 3 4 5 6 11 12

1 2 3

Vegetation Condition Assessment

Target Community

Invasive Species	Present	Marginal	Absent
Absent	No Fill		
Present			

- Conservation
- Existing

Fixed Vegetation

- >320

MY2 RVP > 320

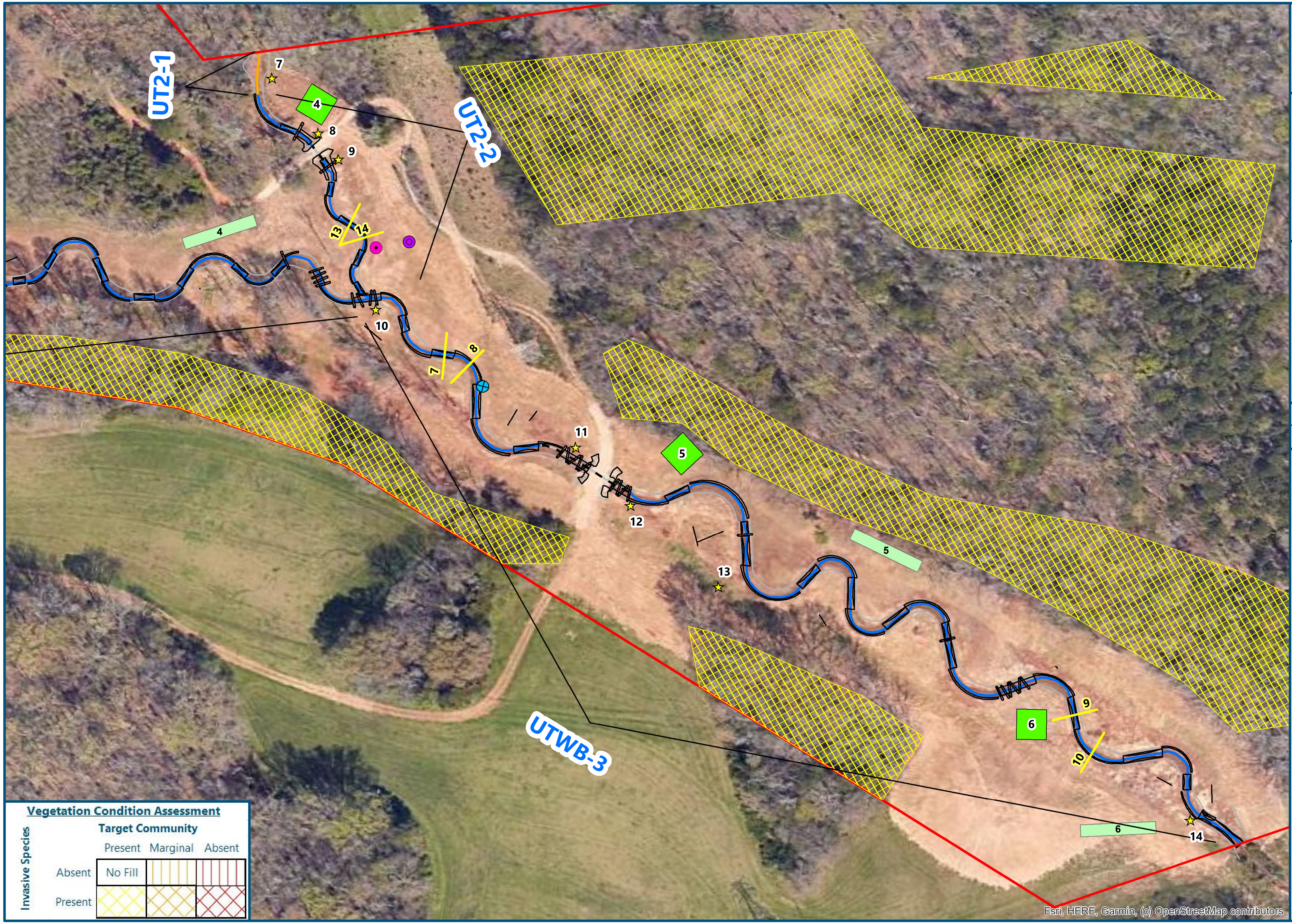
- Yes

Stream

- Enhancement I
- Enhancement II
- No
- Cross
- Top of

Monitoring Devices

- Stage
- Flow
- Ambient/Rain
- Photo



res
Restoring a resilient earth for a modern world

0 50 100
Feet

Figure 2b - CCPV MY2

UT West Branch Rocky River Mitigation Project

Mecklenburg County, North Carolina

Date: 11/23/2022	Drawn by: DGD
1 in = 100 feet	Checked by: xxx

Conservation
Existing
Fixed Vegetation
>320
MY2 RVP > 320
Yes
Stream
Enhancement I
Enhancement II
No
Cross
Top of
Monitoring Devices
Stage
Flow
Ambient/Rain
Photo