As-built Baseline Monitoring Report FINAL
UT to Rush Fork Stream Mitigation Project

Haywood County, North Carolina

French Broad River Basin: 06010106

DMS Project ID No. 100068

DMS RFP #16-007335 (Issued 9/8/2017)

DEQ Contract No. 7535

USACE Action ID No. SAW-2018-01171

DWR# 2018-1034

Baseline Data Collection Period:
March 2022

Submitted to/Prepared for:

NC Department of Environmental Quality
Division of Mitigation Services (DMS)
1652 Mail Service Center
Raleigh, North Carolina 27699-1652

Michael Baker
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Submission Date: August 2022

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August 8, 2022

Paul Wiesner, PM
NCDENR, Division of Mitigation Services
5 Ravenscroft Dr. – Suite 102
Asheville, NC 28801

Subject: Response to DMS Comments (June 24, 2022) for Draft As-Built Baseline Monitoring Report.
UT to Rush Fork Stream Mitigation Project, Haywood County
French Broad River Basin: 06010106
DMS Project #100068

Dear Mr. Wiesner,

Please find below our responses to the NC Division of Mitigation Services (DMS) review comments dated June 24, 2022 in reference to the Rush Fork Stream Mitigation Project's As-Built Baseline Monitoring Report. We have revised the Draft document in response to review comments as outlined below.

- Cover Page: Please update the cover page to; UT to Rush Fork Stream Mitigation Project, so the project name matches the DMS accounting system (CRM) and the project's Credit Ledger. Please update the project name report wide as necessary.
  RESPONSE: Revision made as requested.

- Section 1.1 Project Description: This section notes; "*Michael Baker Engineering, Inc. (Michael Baker) restored approximately 2,865 linear feet and enhanced an additional 1,185 linear feet of stream along seven reaches of unnamed tributaries (UT) to Rush Fork creek.*" These footages do not appear to match Table 1. Please review and update the report accordingly. Please also review and confirm the uncredited wetland acreage noted in the report.
  RESPONSE: Revisions and review made as requested.

- Section 1.6 Design Change Deviations: In this section, please also note and discuss any monitoring device location changes from the IRT approved mitigation plan.
  RESPONSE: Two monitoring changes were noted: the addition of a flow gauge on UT4 and the relocation of one vegetation plot from the right floodplain to the left floodplain on UT1-R4.

- General: Based on recent IRT feedback and requests, DMS recommends including upstream and downstream project crossing photos in all future monitoring reports (MY1-MY7).

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RESPONSE: Additional photos of upstream and downstream project crossings will be included in future monitoring reports (MY1-MY7).

- Appendix E: This appendix should be labeled "Record Drawing Plan Sheets".

RESPONSE: Revision made as requested.

- Appendix E - Record Drawing Sheet 5: Sheet 5 shows a portion of the crossing infrastructure (pipe and headwall) installed inside the conservation easement. This infrastructure encroachment was confirmed in the field by DMS and Baker on 6/14/2022. The crossing infrastructure should be moved outside of the recorded conservation easement, or a conservation easement modification will be required. Any conservation easement modification costs will be the responsibility of the full delivery provider (Baker). Please discuss a proposed resolution in the comment responses. The proposed resolution will need to be reviewed and approved by the IRT as part of the MY0/ As-built IRT review prior to implementation.

RESPONSE: Baker has worked with the contractor to move the crossing infrastructure just upstream of the CE line. This modification was completed on July 25, 2022.

- Appendix E - Record Drawing Sheet 7: Please confirm that the pre-existing soil road shown within the conservation easement has been either moved or extinguished as part of the project construction. In the revised record drawings, the sheet should be updated to show the soil road relocation area or a call out should be provided noting that the soil road was extinguished as part of project construction and implementation.

RESPONSE: We acknowledge the soil road is shown on Sheet 7; however, this is only intended to describe a topographical and historic feature on the landscape. The road has long been abandoned for any use and is currently vegetated with mature trees and lacks any connection to any usable roadways. Moreover, there is no existing Right of Way, and the old roadbed was not used during construction of this project.

- Appendix E - Record Drawing Sheet 8: Sheet 8 shows a portion of the project BMP located within the conservation easement and a portion of the BMP located outside of the conservation easement. Please explain why the BMP is partially located in the conservation easement and indicate if BMP maintenance will be required in the monitoring term or in long term Stewardship. If a conservation easement modification is required based on the comment above and IRT review, DMS and DEQ Stewardship highly recommend including the entire BMP and associated infrastructure inside the modified conservation easement. Please discuss a proposed resolution. As noted above, this should be reviewed and approved by the IRT as part of the MY0/ As-built IRT review prior to implementation.

RESPONSE: The capacity of the designed BMP needed to increase to function as intended. This design was implemented after the establishment of the conservation easement,

resulting in a portion of the BMP being located outside the conservation easement boundary. It should be noted that livestock fencing surrounds the entire BMP with permission and cooperation from the landowner. This arrangement was shown in the approved Mitigation Plan on Sheet 9 of the included project plans, thus review and approvals have already taken place. Functionality of the BMP will be assessed in future monitoring years to determine if maintenance will be required; although no maintenance outside the conservation easement boundary is anticipated.

DMS conducted a field visit on June 14, 2022. The following comments/observations are a result of that visit:

- Areas of multiflora rose were noted within the conservation easement at the upstream portion of UT3. Please treat the existing invasives within the entire conservation easement during MY1 (2022) and through the monitoring term. Please provide invasive treatment details in the MY1 (2022) report.

  RESPONSE: Multiflora rose was treated on June 29th, 2022, at the upstream portion of UT3 and invasive plants will continue to be treated as needed in future monitoring years. Details of these treatments will be included in all monitoring reports.

- The conservation easement corners along the unfenced section of UT1-R4 from stations 24+00 – 28+00 (soil farm road) are not currently marked. Each conservation easement corner must be marked with a durable witness post and signage. Conservation easement corners greater than 200 feet in distance or stretches that cannot be seen by direct line of sight should be supplementally marked between the easement corners. All conservation easement marking must be complete prior to approval and payment for Task 6 (MY0).

  RESPONSE: Signs were added to these posts on June 29, 2022. Additional durable witness posts were added on August 16, 2022.

- Signed durable wooden posts mark the conservation easement corners on reach UT1-R4 (stations 31+00 – 38+00). Metal t-posts are installed between conservation easement corners but are not currently signed. DMS recommends adding signs to the t-posts to clearly mark the conservation easement boundary. While not required, Baker should consider adding PVC poles on this reach to avoid easement encroachment and easement scalloping.

  RESPONSE: Signs were added to these t-posts on June 29, 2022. Additional signage and/or t-posts may be added along with PVC poles to clearly delineate the conservation easement boundary.

Digital Deliverable Comments:

- The MY0 2022 Background Tables file - Table 5 vegetation table, is incorrect/ not complete.

The data sheets and individual vegetation tables submitted appear to be complete and accurate. Please verify that Table 5 should be deleted from this submission or submit a revised and accurate Table 5 with data as presented in vegetation data files.
RESPONSE: This revision has been made as requested. Table 5 has been changed to Table 6 due to the addition of the new Table 2, Summary: Goals, Performances and Results and is in the Background Tables file. The blank file has been deleted. An accurate Table 6 is included in the vegetation data files.

- The cross-section morphology table used is not the current version of the template and is missing attributes required for baseline morphology summary, please see the current (2020) version of the DMS Monitoring Table templates and include all missing attributes noted on the morph table template.
  RESPONSE: The cross-section morphology table has been updated to the current DMS monitoring template and missing attributes have been added. The revised table is Table 8 in Appendix D.

- The goals table (table 2 of DMS template) is missing from the submission.
  RESPONSE: The goals table has been included as Table 2 in Appendix A.

- The cross section and longitudinal profile raw data is incomplete, please refer to the DMS monitoring digital data templates, XS Raw Survey and Raw Long Pro Data, for features requiring annotation and revise the submission to include missing features.
  RESPONSE: Grade control structures have been added to the profile and a note has been added to the XS graphs indicating the location of the left and right pins. A table has been added to the Geomorphology folder in the digital deliverables indicating the type of structure, it's stationing and elevation by reach.

- Photo Point 58 is missing from the RushFork_As_Photo_Points file. Please update accordingly.
  RESPONSE: Photo Point 58 is included the Stream Station Photo Points within the As Built report and is also included in the digital submission files under Support Files – 2 Visual Assessment – Photos – Stream. Photo Point 58 is the last file in this folder.

- Please provide a .PDF of the standalone PLS sealed project as-built drawings in the revised digital submittal.
  RESPONSE: A standalone copy of the PLS sealed project as-built drawings has been included as requested.

- Please verify the soil road indicated as having been relocated on the As-built and the fencing previously identified in the conservation easement plat in the vicinity of veg plot 3 have both been relocated outside the conservation easement.

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RESPONSE: Both the soil road and the fencing previously identified in the conservation easement have been relocated outside of the conservation easement in these areas.

As requested, one hardcopy of the revised Final As-Built Baseline Monitoring report has been included with this response. A full electronic copy with support files is also included on a USB drive. Please do not hesitate to contact me should you have any questions regarding our response submittal.

Sincerely,

Jason York
Environmental Scientist

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APPENDICES

1.0 PROJECT SUMMARY

1.1 Project Description

Michael Baker Engineering, Inc. (Michael Baker) restored approximately 2,843.58 linear feet and enhanced an additional 1160.43 linear feet of stream along seven reaches of unnamed tributaries (UT) to Rush Fork creek. Additionally, 0.996 uncredited acres of adjacent riparian wetlands were enhanced and protected within the conservation easement of the project. The project lies within the French Broad River Basin, Hydrologic Unit Code (HUC) 06010106-020010 (named the Pigeon River/Crabtree Creek Watershed), which is identified as a Targeted Local Watershed (TLW) in the NC Division of Mitigation Services' (DMS 2009) *French Broad River Basin Restoration Priorities* (RBRP) report. The project is located in the Blue Ridge Physiographic Region, within the Southern Crystalline and Mountains Level IV ecoregion. The project watershed drains into Rush Fork Creek, which flows for approximately 2.8 miles to its confluence with Crabtree Creek which continues for approximately 0.7 miles where it flows into the Pigeon River. These tributaries and streams are designated as Class C waters by the surface water classification system of the NC Division of Water Resources (DWR).

The UT to Rush Fork Stream Mitigation Project (project) is located on two adjacent parcels of an active cattle farm in Haywood County, North Carolina, halfway between the unincorporated communities of Crabtree and Fines Creek as shown on the Project Vicinity Map (Figure 1). The project site entrance is 5.9 miles down Route 209 from exit 24 off of I-40, on the right at 9503 Rush Fork Road. Coordinates for the approximate center of the project are 35.644607 N Latitude, -82.940170 W Longitude. Current agricultural use on the project site is predominantly livestock pasture; however, past use may have included row crops and apple production. These activities have negatively impacted both water quality and streambank stability along the project stream reaches. The resulting observed stressors include streambank erosion, sedimentation, excess nutrient input, channel modification, and the loss of riparian buffers.

The project is being conducted as part of the DMS Full Delivery In-Lieu Fee Program and is anticipated to generate a total of 3,533.610 cold-water stream mitigation credits and the site will be protected by an 8.26-acre permanent conservation easement (Appendix B).

1.2 Goals and Objectives

The goals of this project are identified below:

- Reconnect stream reaches to their floodplains,
- Improve stream stability,
- Improve aquatic habitat,
- Reestablish forested riparian buffers, and
- Permanently protect the project in a conservation easement.

To accomplish these goals, the following objectives were identified:

- To restore appropriate bankfull dimensions, and/or raise channel beds, by utilizing either a Priority I Restoration approach or an Enhancement Level I approach.
- Stabilize eroding channel banks and arrest incision by utilizing an Enhancement Level II approach.
- To construct streams of appropriate dimensions, pattern, and profile in restored reaches, slope stream banks and provide bankfull benches on enhanced reaches and utilize bio-engineering to provide long-term stability.

- Construct the correct channel morphology along all stream channels, increasing the number and depth of pools utilizing structures including geo-lifts with brush toe, log vanes/weirs, root wads, and/or J-hooks.
- Establish riparian buffers at a 30 foot minimum width along all stream reaches, planted with native tree and shrub species.
- Establish a permanent conservation easement restricting land use in perpetuity. This will prevent site disturbance and allow the project to mature and stabilize.

1.3 Project Success Criteria

The success criteria and performance standards for the project will follow the NCDMS's templates As-Built Baseline Monitoring Report Format, Data Requirements, and Content Guidance (June 2017), and the Annual Monitoring Report Format, Data Requirements, and Content Guidance (June 2017), and as described in Section 7 of the approved Mitigation Plan. All specific monitoring activities will follow those outlined in detail in Section 8 of the approved Mitigation Plan and will be conducted for a period of 7 years unless otherwise noted.

1.4 Mitigation Component Summary

The project involved the restoration or enhancement of seven reaches, all unnamed tributaries to Rush Fork. Reach UT1-R1, is a steep, 206-foot long perennial reach that had been impacted historically through the removal of riparian vegetation, channelization, and agricultural activities (most recently livestock). The channel had been experiencing active erosion on over 50 percent of the streambank upstream of a degraded old ford crossing. An Enhancement Level 1 approach was implemented on this reach, which involved rebuilding new, stable channel dimensions as a B-type stream, raising the channel elevation to allow floodplain access, installing in-stream structures, and building a stable culverted crossing just upstream of the old, degraded ford.

Reach UT1-R2 is a steep, roughly 275-ft reach that was not as impacted by the historic land use as the reaches above and below it. A narrow line of established walnut trees growing along the banks of this reach provide greater stability to this section. As a result, the channel is not deeply incised here, and bank erosion along R2 was minimal in spite of the fact that livestock had access to the reach. As such, an Enhancement Level II approach was implemented here. This involved the reestablishment of a full riparian buffer, the rebuilding of new channel dimensions along most of the reach (stabilizing the few sections of eroding banks), and the installation of three in-stream structures. Some of the black walnut trees were removed in the buffer to reduce their impact on other vegetation and an abandoned cabin within the conservation easement was also removed.

Reach UT1-R3 is a steep, roughly 601-ft reach that had been impacted historically through the removal of riparian vegetation, channelization, and agricultural activities (most recently livestock). As a result, the channel is experiencing active erosion for well over 50 percent of the streambank length, and the absence of woody vegetation along the banks also contributes to the instability. An Enhancement Level I approach was selected for this reach, which involved rebuilding new, stable channel dimensions as a B-type stream, raising the channel elevation to allow floodplain access, and installing in-stream structures, several of which act as grade control features. Additionally, areas of multiflora rose (*Rosa multiflora)* were removed and treated during and after construction. There is also a 40-ft conservation easement break for a powerline right-of-way located near the top of this reach. Stream enhancement work was conducted through this break, though no trees were planted here.

Reach UT1-R4 is a steep, roughly 1,530-ft long perennial channel, though only 1,224-ft are located within the conservation easement due to the break from NC Route 209 and associated utility lines. The reach had been quite incised and had exhibited bank scour ranging from 50-60% over its length, and mass wasting

along an additional 15-20%, with numerous headcuts present. Reach R4 was accessed by livestock and had little or no vegetated buffer with only a few scattered trees found along the stream, predominantly Chinese privet (*Ligustrum sinense*). A Priority Level I Restoration approach was implemented on R4 in order to fully restore the stream and its associated buffer functions. A channel of appropriate dimensions was constructed and was raised to reconnect the reach to its historic sloping floodplain as a B-type stream. This will promote more frequent overbank flooding thus reducing erosive stream energies during storm events greater than the bankfull discharge and will also improve adjacent groundwater hydrology. Numerous in-stream structures were installed along the reach to promote bank stability, improve habitat, and provide grade control. A full, 30-ft riparian buffer of native species was planted, and the Chinese privet was removed and treated during and after construction. The reach also has extensive wetland areas on the right bank above Route 209, which are now protected within the conservation easement. Livestock have subsequently been excluded from this reach. A fence encroachment was corrected after the As Built survey was completed.

Reach UT2 a roughly 78-ft intermittent channel that flows into UT1-R3 from a culvert that carries drainage from a small field and the hill slope to the east of R3. It had been incised in the lower portion as the channel cut down to meet R3 and it had a pronounced hydrologic disconnect at the culvert outlet. The channel also lacked a full riparian buffer, especially an herbaceous layer, due to livestock impacts. An Enhancement Level II approach was selected for this reach. A full buffer of native species was planted, and the channel was raised in the lowermost section to ensure a stable tie-in with R3. Additionally, areas of multiflora rose were removed and treated during and after construction.

Reach UT3 is a steep, roughly 1,577-ft perennial channel that begins as a series of springs just upstream of the project boundary. It had been impacted historically through the removal of riparian vegetation, channelization, and agricultural activities (most recently livestock). UT3 had been incised over most of its length, with varying degrees of bank scour, including sections of mass wasting where the stream flowed up against a steep bank or where cattle trails crossed the stream. The reach only had a few pools primarily associated with headcuts in the channel. The uppermost section of UT3 began with a partially buffered forested area, mostly along the left bank, consisting of a narrow row of crabapple (*Malus* sp.) trees. However, the vast majority of the reach buffer consisted primarily of herbaceous pasture grasses. A Priority Level I Restoration approach was implemented on UT3 in order to fully restore the stream and its associated buffer functions. A new channel with the appropriate dimensions was constructed and was raised to reconnect the reach to its historic sloping floodplain as a B-type stream. This will promote more frequent overbank flooding thus reducing erosive stream energies during storm events greater than the bankfull discharge and will also improve adjacent groundwater hydrology. Numerous in-stream structures were installed along the reach to promote bank stability, improve habitat, and provide grade control. A full, 30-ft riparian buffer of native species was planted, and the pasture grasses were treated around the planted stems after construction (ring-spraying) to help with tree establishment. A degraded ford crossing was also rebuilt as a stable culvert crossing and relocated to coincide with an existing powerline easement, thus allowing for only one CE break on this reach. UT3 also has extensive wetland areas along both banks, which are now protected within the CE and livestock have been fully excluded.

Reach UT4 is a roughly 42-ft intermittent channel that begins from an existing culvert flowing under and then paralleling Route 209 before turning through a culvert under the access road and onto the project tying into UT1-R4. This short section of channel was nevertheless highly degraded, mostly due to the presence of livestock. It was incised as it cut down to meet the similarly incised UT1-R4, had eroding banks, and lacked a riparian buffer. As such, Restoration was implemented on this reach, wherein a new channel was built of appropriate dimensions, which was also raised to meet the restored R4 channel. A full buffer of native species was planted along the reach. And while only the lowermost section is included within the project easement, the upper portion between the access road culvert and Highway 209, also had fencing installed to exclude livestock, thus protecting the entire reach.

Additionally, a small BMP was installed at the top of UT3 to capture and treat the runoff from a vegetated swale (an old abandoned roadbed) that had conveyed stormwater from its 4.3-acre drainage area directly into the reach. The BMP was sized for a 1-inch design storm and has been planted with native shrub and herbaceous vegetation to ensure stability. It also has a stable rock outlet feature to convey overflow into UT3.

1.5 Project Timeline

The Rush Fork Mitigation Project was instituted in April 2018. The Mitigation Plan was approved by the IRT in April 2021. Project construction of the streams was initiated in October 2021 and completed in February 2022. Planting of live stakes and bareroot stems was completed in February 2022 and the vegetation plots were installed in March 2022. The As-Built survey was completed in March of 2022. All monitoring devices including 18 cross-sections, 3 crest gauges, and 3 flow gauges were installed in March 2022. All crest gauges and flow gauges are continuous logging Van Essen DIVER gauges. Livestock exclusion fencing and gates were fully installed by March 2022. The CE pins were located and the boundary fully marked by March 2022 as well. Monitoring Year 1 is on schedule for 2022 as shown in Table 2.

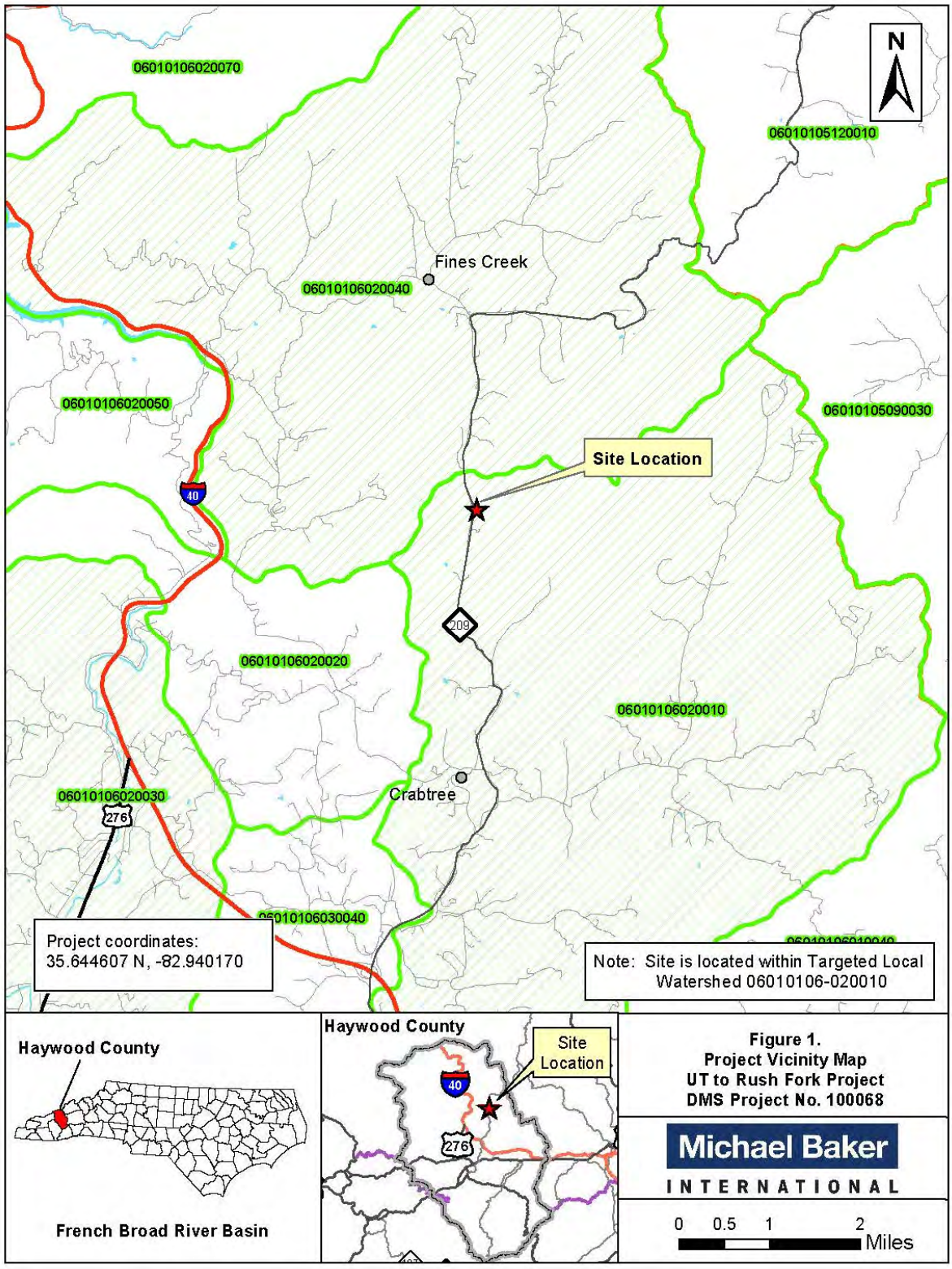
1.6 Design Change Deviations

During project construction, there were a few, relatively minor deviations from the original design plans as marked in red in the as-built plans (Appendix E). Primarily these were a few substitutions made on in-stream structures replacing log structures with rock/boulder structures due to material availability. In two cases, an additional structure was added to the channel not originally in the plans. Additionally, the sizing of several of the crossing and access gates were changed from the proposed due to landowner preference, and a few extra gates were installed for improved easement access.

There were a few minor deviations from the approved planting plan due to lack of species availability. American basswood (*Tilia americana*), rosebay (*Rhododendron maximum*), and umbrella tree (*Magnolia tripetala*) were unavailable and were replaced by planting additional stems of several other species on the approved list; yellow buckeye (*Aesculus flava*), persimmon (*Diospyros virginiana*), winterberry (*Ilex verticillata*), American hornbeam (*Carpinus caroliniana*), and Carolina silverbell (*Halesia carolina*).

One additional flow gauge was added to UT4 following the IRT approval of the mitigation plan. Additionally, a vegetation monitoring plot shown on the right floodplain of UT1-R4 in the approved mitigation plan was moved to the left floodplain of UT1-R4.

1.7 Vicinity Map



1.8 Technical and Methodological Descriptions and References

Stream survey data was collected to a minimum of Class C Vertical and Class A Horizontal Accuracy using a Leica TS06 Total Station and was georeferenced to the NAD83 State Plane Coordinate System, FIPS3200 in US Survey Feet, which was derived from the As-built Survey. The survey data from the permanent project cross-sections were collected and classified using the Rosgen Stream Classification System to confirm design stream type (Rosgen 1994).

The six permanent vegetation-monitoring quadrants (plots) were installed across the site in accordance with the CVS-DMS Protocol for Recording Vegetation, Version 4.1 (Lee 2007) and the data collected from each was input into the DMS Veg Table Production Tool (2021).

All of the crest gauges and flow gauges are Van Essen brand Baro-Diver data loggers.

References:

Lee, M., Peet R., Roberts, S., Wentworth, T. 2007. CVS-DMS Protocol for Recording Vegetation, Version 4.1.

North Carolina Division of Water Resources. 2011 French Broad River Basin Classification Schedule. NC Department of Environmental Quality. Raleigh, NC. Available at: https://deq.nc.gov/river-basin-classification-schedule

North Carolina Division of Mitigation Services. 2021. DMS Vegetation Table Production Tool. NC Department of Environmental Quality. Raleigh, NC.

North Carolina Division of Mitigation Services. 2009. French Broad River Basin Restoration Priorities. NC Department of Environmental Quality. Raleigh, NC.

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

___. 1996. Applied River Morphology. Wildland Hydrology Books, Pagosa Springs, Colo.

APPENDIX A

Background Tables and Figures

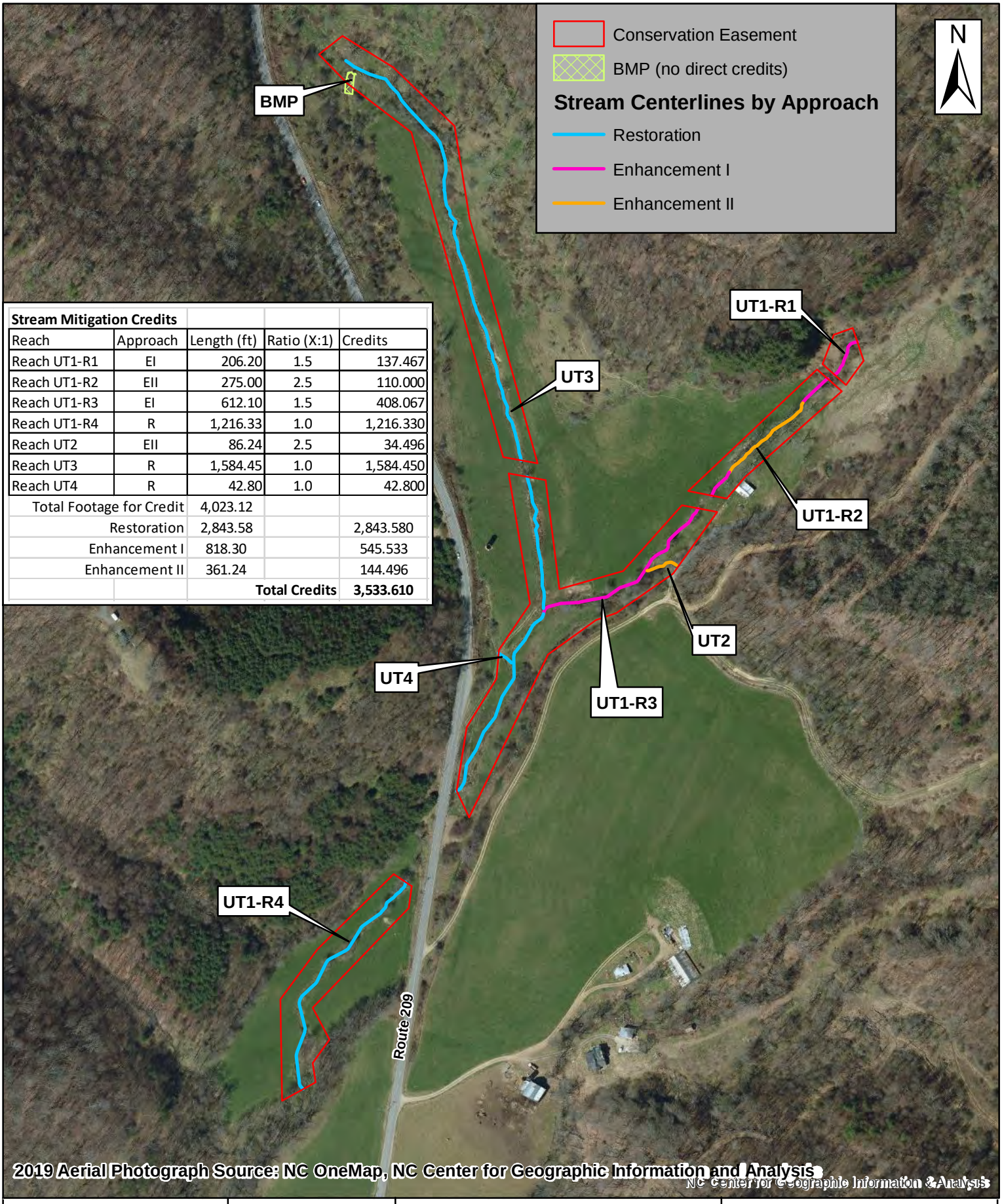
Table 1. Project Mitigation Quantities and Credits
UT to Rush Fork Stream Mitigation Project - NCDMS Project No. 100068

Project Segment	Original Mitigation Plan* Ft/Ac	As-Built Ft/Ac	Original Mitigation Category	Original Restoration Level	Original Mitigation Ratio (X:1)	Credits
Stream						
Reach UT1-R1	206.20	206.410	Cold	EI	1.5	137.467
Reach UT1-R2	275.00	275.000	Cold	EII	2.5	110.000
Reach UT1-R3	612.10	600.860	Cold	EI	1.5	408.067
Reach UT1-R4	1,216.33	1,224.370	Cold	R	1.0	1,216.330
Reach UT2	86.24	78.160	Cold	EII	2.5	34.496
Reach UT3	1,584.45	1,577.530	Cold	R	1.0	1,584.450
Reach UT4	42.80	41.900	Cold	R	1.0	42.800
					Total:	**3,533.610**
Wetland						
N/A	0.996	0.996	-	E	-	-
					Total:	**N/A**

*The lengths shown for each reach are the creditable lengths and were calculated after all exclusions were accounted for, such as easement breaks, utility impacts, stream crossings, etc.

Project Credits

Restoration Level	Stream			Riparian	Non-Rip	Coastal
	Warm	Cool	Cold	Wetland	Wetland	Marsh
Restoration	-	-	2,843.580	-	-	-
Re-establishment				-	-	-
Rehabilitation				-	-	-
Enhancement				-	-	-
Enhancement I	-	-	545.534			
Enhancement II	-	-	144.496			
Creation				-	-	-
Preservation	-	-	-	-	-	
Totals			**3,533.610**			



Stream Mitigation Credits				
Reach	Approach	Length (ft)	Ratio (X:1)	Credits
Reach UT1-R1	EI	206.20	1.5	137.467
Reach UT1-R2	EII	275.00	2.5	110.000
Reach UT1-R3	EI	612.10	1.5	408.067
Reach UT1-R4	R	1,216.33	1.0	1,216.330
Reach UT2	EII	86.24	2.5	34.496
Reach UT3	R	1,584.45	1.0	1,584.450
Reach UT4	R	42.80	1.0	42.800
Total Footage for Credit		4,023.12		
Restoration		2,843.58		2,843.580
Enhancement I		818.30		545.533
Enhancement II		361.24		144.496
			Total Credits	**3,533.610**

Michael Baker INTERNATIONAL

North Carolina Division of Mitigation Services
DMS Proj. No. 100068

0 125 250 500 Feet

Figure 2. Project Asset and Credit Map
UT to Rush Fork Project
Haywood County

Table 2. Summary: Goals, Performances and Results
UT to Rush Fork Stream Mitigation Project - NCDMS Project No. 100068

Goals	Objectives	Functional Level	Performance Criteria	Monitoring Measurement Tool	Cumulative Monitoring Results
Reconnect stream channels to their floodplains	To raise channel beds and/or slope stream banks which serve as floodplains as is appropriate for a B stream type by utilizing either a Priority I Restoration approach or an Enhancement Level I approach.	Hydraulics	Four bankfull events within monitoring period.	Stage recorders loacated upstream on UT3, UT1-R1, and middle of UT1-R4. Supplemental data from flow gauges on UT3, UT2, UT4.	N/A
Improve stream stability	To construct streams with the appropriate dimension, pattern, and profile in Restored reaches or dimension and profile on Enhanced I reaches. Also slope stream banks, install grade control structures with plunge pools, and utilize bio-engineering to provide long term stability.	Geomorphology	Restored streams will maintain bank-height ratios of less than 1.2 and entrenchment ratios greater than 1.4 (B-type) or 2.2 (C-type) provided visual inspections also reveal stabilization.	Cross-Sectional Survey Visual Inspection	N/A
Improve aquatic habitat	Increase the heterogeniety of habitat by increasing the number and depth of pools, increasing the amount of woody debris, utilizing structures including geo- lifts with brush toe, log vanes/weirs, cross-vanes, and/or J-hooks.	Geomorphology	Inventory comparisons of in-stream structures and features from existing conditions and as-built project surveys and assessments. Increased number of pools and woody structures and debris compared to the existing conditions.	Profile Survey Visual Inspection	N/A
Reestablish forested riparian buffers	Establish riparian buffers at a 30-ft minimum width along all stream reaches, planted with native tree, shrub and herbaceous species.	Geomorphology	Survival rate of 320 stems per acre at MY3, 260 planted stems per acre at MY5, and 210 stems per acre at MY7.	Vegetation Plots Visual Inspection	N/A
Permanently protect the project	Establish a permanent conservation easement restricting land use in perpetuity. This will prevent site disturbance and allow the project to mature and stabilize.	Biology	Conservation Easement documents. Visual inspections to confirm no encroachments into CE.	Visual Inspection	N/A

Table 3. Project Activity and Reporting History
UT to Rush Fork Stream Mitigation Project - NCDMS Project No. 100068

Grading Completed in	**February 2022**
Elapsed Time Since grading complete:	**3 months**
All Planting Completed in	**February 2022**
Elapsed Time Since planting complete:	**3 months**
Number of Reporting Years[1]:	**0**

Activity or Deliverable	Data Collection Complete	Completion or Delivery
Project Institution Date	N/A	April 2018
Mitigation Plan Approved by IRT	N/A	April 2021
Final Design – Construction Plans	N/A	October 2021
Construction Grading Completed	N/A	February 2022
Livestake and Bareroot Planting Completed	N/A	February 2022
As-Built Baseline Monitoring Report (MY0)	March 2022	June 2022
As-Built Strream Survey	March 2022	N/A
As-Built Vegetation Monitoring	March 2022	N/A
Year 1 Monitoring	-------	-------
Year 2 Monitoring	-------	-------
Year 3 Monitoring	-------	-------
Year 4 Monitoring	-------	-------
Year 5 Monitoring	-------	-------
Year 6 Monitoring	-------	-------
Year 7 Monitoring	-------	-------

[1] = The number of monitoring reports excluding the as-built/baseline report

Table 4. Project Contacts
UT to Rush Fork Stream Mitigation Project - NCDMS Project No. 100068

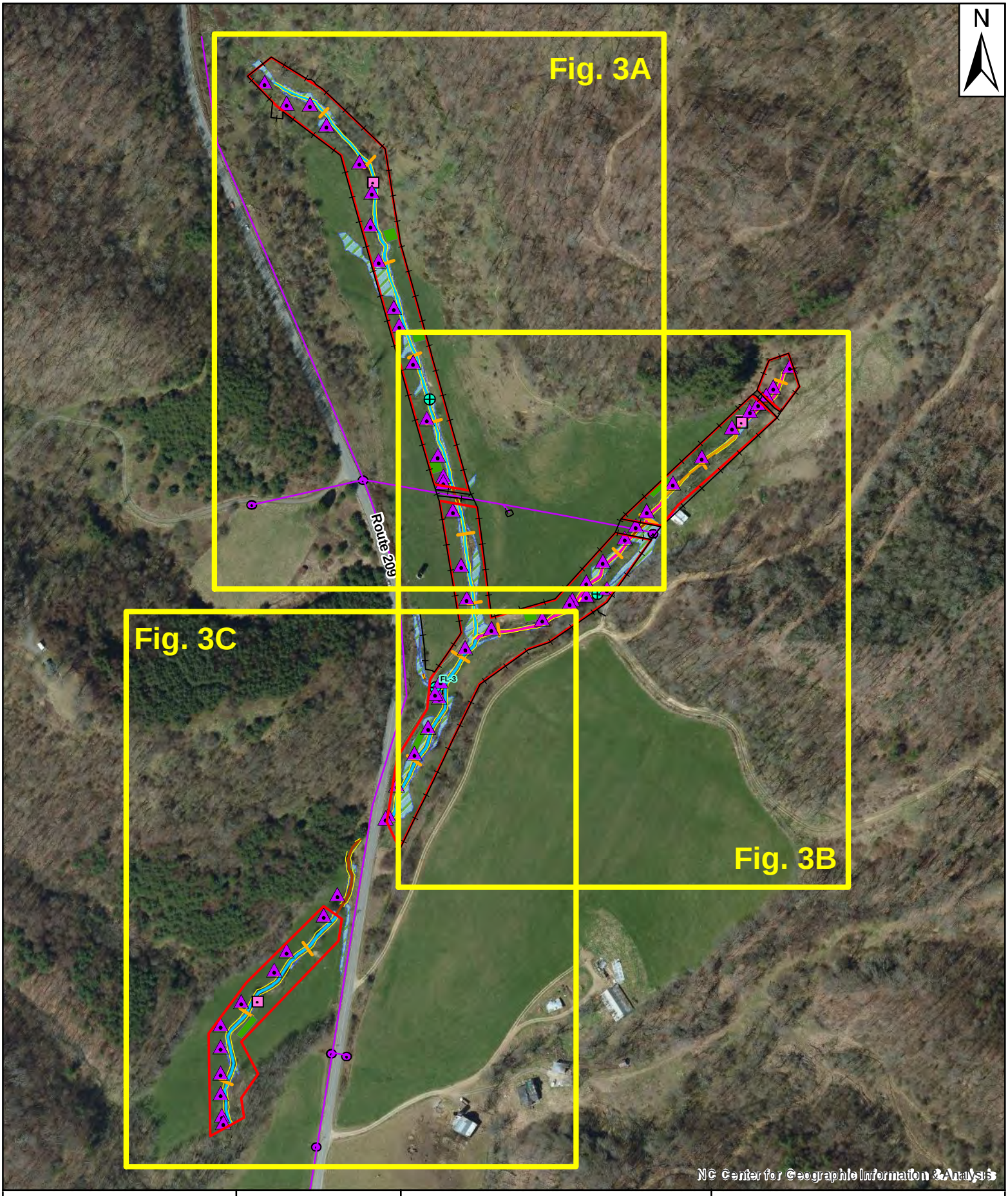
Designer	
Michael Baker Engineering, Inc.	8000 Regency Parkway, Suite 600 Cary, NC 27518 Contact: Katie McKeithan, Tel. 919-481-5703
Construction Contractor	
Baker Grading & Landscaping, Inc.	1000 Bat Cave Road, Old Fort, NC 28762 Contact: Charles Baker, Tel. 828-668-5060 x. 11
Survey Contractor	
Kee Mapping and Surveying	88 Central Avenue Asheville, NC 28801 Contact: Brad Kee, Tel. 828-575-9021
Planting Contractor	
Baker Grading & Landscaping, Inc.	1000 Bat Cave Road, Old Fort, NC 28762 Contact: Charles Baker, Tel. 828-668-5060 x. 11
Seeding Contractor	
Baker Grading & Landscaping, Inc.	1000 Bat Cave Road, Old Fort, NC 28762 Contact: Charles Baker, Tel. 828-668-5060 x. 11
Seed Mix Sources	
Roundstone Native Seed, LLC	9764 Raider Hollow Road, Upton, KY 42784 Telephone: 270-531-3034
Nursery Stock Suppliers	
Foggy Mountain Nursery (livestakes)	797 Helton Creek Road, Lansing, NC 28643 Telephone: 336-384-5323
Dykes and Son Nursery	825 Maude Etter Road, McMinnville, TN 37110 Telephone: 843-528-3204
Monitoring Performers	
Michael Baker Engineering, Inc.	8000 Regency Parkway, Suite 600 Cary, NC 27518
Stream Monitoring POC	Katie McKeithan, Tel. 919-481-5703
Vegetation Monitoring POC	Katie McKeithan, Tel. 919-481-5703

Table 5. Project Baseline Information and Attributes
UT to Rush Fork Stream Mitigation Project - NCDMS Project No. 100068

Table 4. Project Background Information					
Project Name	UT to Rush Fork Stream Mitigation Project				
County	Haywood County				
Project Area (acres)	8.26				
Project Coordinates (latitude and longitude)	35.644607 N, -82.940170 W				
Planted Acreage (Acres of Woody Stems Planted)	7.3				
Project Watershed Summary Information					
Physiographic Province	Blue Ridge				
River Basin	French Broad				
USGS Hydrologic Unit 8-digit	6010106	USGS Hydrologic Unit 14-digit	06010106-020010		
DWR Sub-basin	04-03-05				
Project Drainage Area (Acres and Square Miles)	308 acres/0.48 square miles (at downstream end of UT1)				
Project Drainage Area Percentage of Impervious Area	0.18% impervious area				
CGIA Land Use Classification	79,8% forested, 17.1% hay/pasture, and 2.9% developed (open space).				
Reach Summary Information					
Parameters	**UT1**	**UT2**	**UT3**	**UT4**	
Length of reach (linear feet)	2,464	99	1,618	18	
Valley confinement (Confined, moderately confined, unconfined)	Moderately Confined	Unconfined	Moderately Confined	Unconfined	
Drainage area (Acres)	308	24	98	27	
Perennial, Intermittent, Ephemeral	Perennial	Intermittent	Perennial	Intermittent	
NCDWR Water Quality Classification	C	C	C	C	
Stream Classification (existing)	B4a	B	A to B4	B	
Stream Classification (proposed)	B4a	B	A to B4	Cb	
Evolutionary trend (Simon)	IV – Degradation and Widening	III – Degrading	IV – Degradation and Widening	III – Degrading	
FEMA classification	Zone X	Zone X	Zone X	Zone X	
Regulatory Considerations					
Parameters	**Applicable?**	**Resolved?**	**Supporting Docs?**		
Water of the United States - Section 404	Yes	No	PCN		
Water of the United States - Section 401	Yes	No	PCN		
Endangered Species Act	Yes	Yes	Categorical Exclusion		
Historic Preservation Act	Yes	Yes	Categorical Exclusion		
Coastal Zone Management Act (CZMA or CAMA)	No	N/A	N/A		
FEMA Floodplain Compliance	No	N/A	N/A		
Essential Fisheries Habitat	No	N/A	N/A		
Notes:					
[1] Source: USGS National Land Cover Database (NLCD) for 2016					

APPENDIX B

Visual Assessment Data

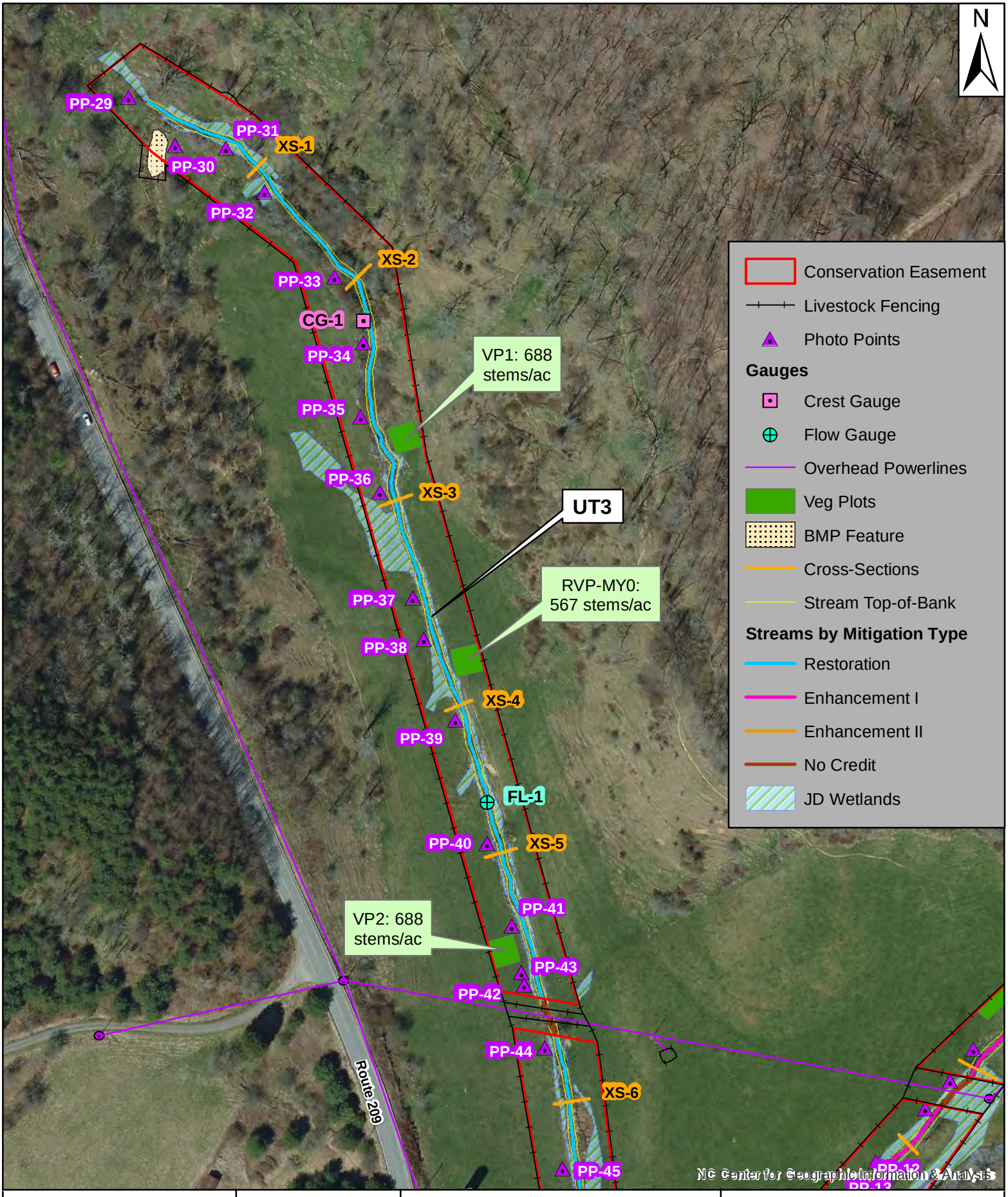


Michael Baker INTERNATIONAL

North Carolina Division of Mitigation Services
DMS Proj. No. 100068

0 250 500 Feet

Overview Map: Current Condition Plan View (CCPV) MY0
UT to Rush Fork Project
Haywood County

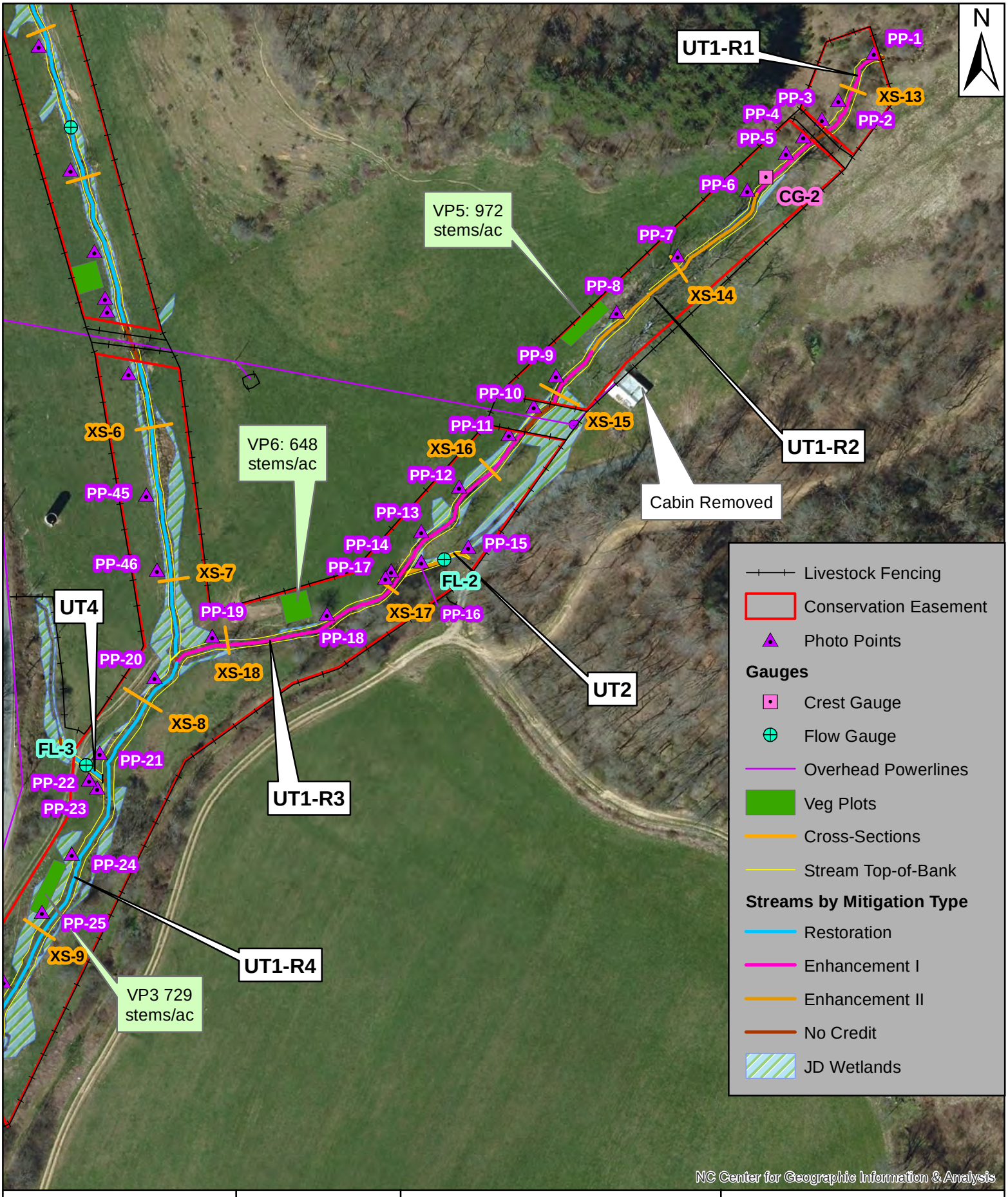


Michael Baker INTERNATIONAL

North Carolina Division of Mitigation Services
DMS Proj. No. 100068

0 125 250 Feet

Figure 3A. Current Condition Plan View (CCPV) MY0
UT to Rush Fork Project
Haywood County

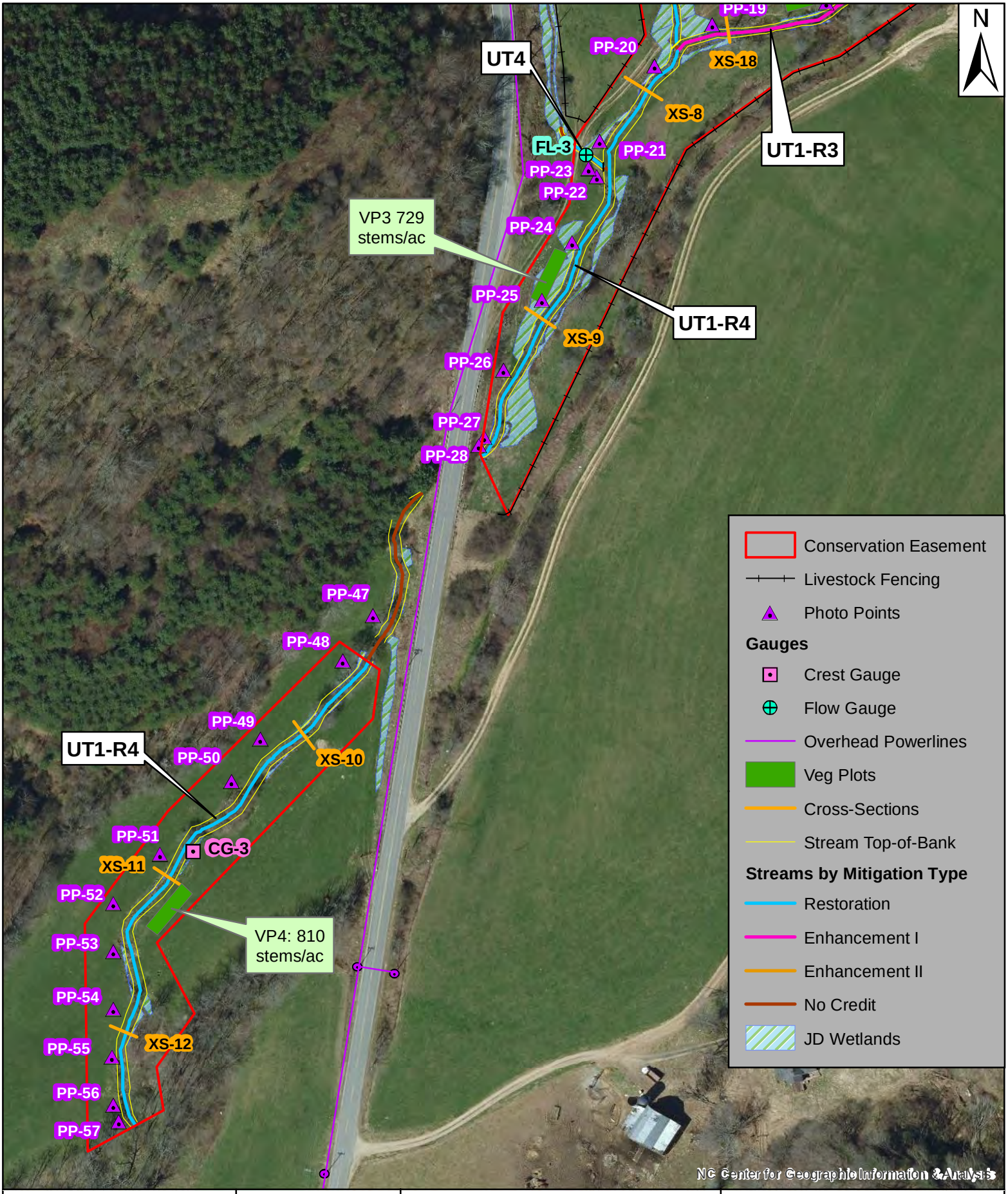


Michael Baker INTERNATIONAL

North Carolina Division of Mitigation Services
DMS Proj. No. 100068

0 125 250 Feet

Figure 3B. Current Condition Plan View (CCPV) MY0
UT to Rush Fork Project
Haywood County



Michael Baker INTERNATIONAL

North Carolina Division of Mitigation Services
DMS Proj. No. 100068

0 125 250 Feet

Figure 3C. Current Condition Plan View (CCPV) MY0
UT to Rush Fork Project
Haywood County

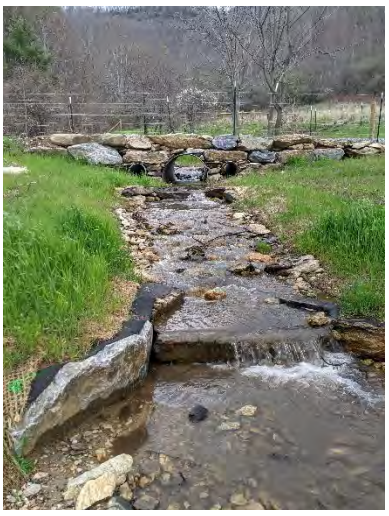
Figure 4: Rush Fork: MY0 As-Built Stream Station Photo-Points
NCDMS Project No. #100068

PP-1: UT1, Reach 1, Station 11+00. Facing Upstream.

PP-2: UT1, Reach 1, Station 11+80. Facing Upstream.

PP-3: UT1, Reach 1, Station 12+10 Facing Downstream

PP-4: UT1, Reach 1, Station 12+33 Facing Downstream



PP-6: UT1, Reach 2, Station 13+25. Facing Upstream.

PP-7: UT1, Reach 2, Station 14+60. Facing Upstream.

All Photos taken on April 13, 2022.

Figure 4: Rush Fork: MY0 As-Built Stream Station Photo-Points
NCDMS Project No. #100068

PP-7: UT1, Reach 2, Station 14+60. Facing Upstream.

PP-8: UT1, Reach 2, Station 15+50. Facing Upstream.

PP-9: UT1, Reach 3, Station 16+50. Facing Upstream.

PP-10: UT1, Reach 3, 16+80. Facing Upstream.

P-11: UT1, Reach 3, Station 17+35. Facing Upstream.

PP-12: UT1, Reach 3, Station 18+25. Facing Upstream.

All Photos taken on April 13, 2022.

Figure 4: Rush Fork: MY0 As-Built Stream Station Photo-Points
NCDMS Project No. #100068

PP-13: UT1, Reach 3, Station 18+90. Facing Upstream.

PP-14: UT1 Reach 3, Station 19+55. Facing Upstream.

PP-15: UT2, Station 10+15. Facing Upstream.

PP-16: UT2, Station 10+85. Facing Upstream.

PP-17: UT1, Reach3, Station 19+70. Facing Upstream.

PP-18: UT1, Reach 3, Station 20+60. Facing Upstream.

All Photos taken on April 13, 2022.

Figure 4: Rush Fork: MY0 As-Built Stream Station Photo-Points
NCDMS Project No. #100068

PP-19: UT1, Reach 3, Station 22+00. Facing Upstream.

PP-20: UT1, Reach 4, Station 22+75. Facing Upstream.

PP-21: UT1, Reach 4, Station 23+90. Facing Upstream.

PP-22: UT1, Reach 4, Station 24+20. Facing Upstream.

PP-23: UT4, Station 10+50. Facing Upstream.

PP-24: UT1, Reach 4, Station 25+25. Facing Upstream.

All Photos taken on April 13, 2022.

Figure 4: Rush Fork: MY0 As-Built Stream Station Photo-Points
NCDMS Project No. #100068

PP-25: UT1, Reach 4, Station 26+00. Facing Upstream.

PP-26: UT1, Reach 4, Station 27+00. Facing Upstream.

PP-27: UT1, Reach 4, Station 27+75. Facing Upstream.

PP-28: UT1, Reach 4, Station 27+90. Facing Downstream.

PP-29: BMP at Top of UT3.

PP-30: UT3, Station 10+00. Facing Upstream.

All Photos taken on April 13, 2022.

Figure 4: Rush Fork: MY0 As-Built Stream Station Photo-Points
NCDMS Project No. #100068

PP-31: UT3, Station 11+10. Facing Upstream.

PP-32: UT3, Station 11+75. Facing Upstream.

PP-33: UT3, Station 13+15. Facing Upstream.

PP-34: UT3, Station 14+15. Facing Upstream.

PP-35: UT3, Station 14+85. Facing Upstream.

PP-36: UT3, Station 15+95. Facing Upstream.

All Photos taken on April 13, 2022.

Figure 4: Rush Fork: MY0 As-Built Stream Station Photo-Points
NCDMS Project No. #100068

PP-37: UT3, Station 17+35. Facing Upstream.

PP-38: UT3, Station 17+65. Facing Upstream.

PP-39: UT3, Station 18+75. Facing Upstream.

PP-40: UT3, Station 20+40. Facing Upstream.

PP-41: UT3, Station 21+20. Facing Upstream.

PP-42: UT3, Station 22+10. Facing Upstream.

All Photos taken on April 13, 2022.

Figure 4: Rush Fork: MY0 As-Built Stream Station Photo-Points
NCDMS Project No. #100068

PP-43: UT3, Station 22+15. Facing Downstream.

PP-44: UT3, Station 23+15 Facing Upstream.

PP-45: UT3, Station 24+40. Facing Upstream.

PP-46: UT3, Station 25+35. Facing Upstream.

PP-47: UT3, Station 26+30. Facing Upstream at confluence.

PP-48: UT1, Reach 4, Station 30+50. Facing Downstream.

All Photos taken on April 13, 2022.

Figure 4: Rush Fork: MY0 As-Built Stream Station Photo-Points
NCDMS Project No. #100068

PP-49: UT1, Reach 4, Station 31+20. Facing Upstream.

PP-50: UT1, Reach 4, Station 32+50. Facing Upstream.

PP-51: UT1, Reach 4, Station 33+10. Facing Upstream.

PP-52: UT1, Reach 4, Station 34+30. Facing Upstream.

PP-53: UT1, Reach 4, Station 35+00. Facing Upstream.

PP-54: UT1, Reach 4, Station 35+60. Facing Upstream.

All Photos taken on April 13, 2022.

Figure 4: Rush Fork: MY0 As-Built Stream Station Photo-Points
NCDMS Project No. #100068

PP-55: UT1, Reach 4, Station 36+15. Facing Upstream

PP-56: UT1, Reach 4, Station 37+00. Facing Upstream.

PP-57: UT1, Reach 4, Station 37+50. Facing Upstream.

PP-58: UT1, Reach 4, Station 37+60. Facing Downstream. End of Project.

All Photos taken on April 13, 2022.

Figure 5: Rush Fork: MY0 As-Built Vegetation Photo Log
NCDMS Project No. 100068

Vegetation Plot #1: Photo 3-17-22

Vegetation Plot #2: Photo 3-17-22

Vegetation Plot #3: Photo 3-22-22

Vegetation Plot #4: Photo 3-17-22

Vegetation Plot #5: Photo 3-22-22

Vegetation Plot #6: Photo 3-17-22

Figure 5: Rush Fork: MY0 As-Built Vegetation Photo Log
NCDMS Project No. 100068

Random Vegetation Plot #1: Photo 3-17-22

Figure 6: Rush Fork: MY0 As-Built Monitoring Device Photo Log

Crest Gauge #1, UT3

Crest Gauge #2, UT1 Reach 2

Crest Gauge #3, UT1 Reach 4

Flow Gauge #1, UT3

Flow Gauge #2, UT2

Flow Gauge #3, UT4

Photos taken April 13, 2022.

APPENDIX C

Vegetation Plot Data

TABLE 6. PLANTED STEM COUNTS BY PLOT AND SPECIES

Planted Acreage	7.3
Date of Initial Plant	2022-02-23
Date(s) of Supplemental Plant(s)	NA
Date(s) Mowing	2022-03-22
Date of Current Survey	2022-03-22
Plot size (ACRES)	0.0247

	Scientific Name	Common Name	Tree/Shrub	Indicator Status	Veg Plot 1 F		Veg Plot 2 F		Veg Plot 3 F		Veg Plot 4 F		Veg Plot 5 F		Veg Plot 6 F		Veg Plot 1 R
					Planted	Total	Planted	Total	Planted	Total	Planted	Total	Planted	Total	Planted	Total	Total
Species Included in Approved Mitigation Plan	Acer negundo	boxelder	Tree	FAC									1	1			
	Aesculus flava	yellow buckeye	Tree	FACU							1	1	1	1	2	2	2
	Betula lenta	sweet birch	Tree	FACU	1	1	1	1	4	4	3	3	2	2	1	1	1
	Betula nigra	river birch	Tree	FACW	2	2	3	3	2	2	3	3	8	8	4	4	2
	Carpinus caroliniana	American hornbeam	Tree	FAC			2	2	1	1	1	1	1	1	1	1	
	Cephalanthus occidentalis	common buttonbush	Shrub	OBL					2	2							1
	Cornus amomum	silky dogwood	Shrub	FACW			3	3	2	2	3	3	1	1	1	1	
	Diospyros virginiana	common persimmon	Tree	FAC			1	1	1	1							
	Fraxinus americana	white ash	Tree	FACU	2	2	1	1			1	1	1	1			1
	Fraxinus pennsylvanica	green ash	Tree	FACW	3	3											
	Halesia carolina	Carolina silverbell	Tree	FAC	1	1			1	1					2	2	
	Ilex verticillata	common winterberry	Tree	FACW	2	2											
	Liriodendron tulipifera	tuliptree	Tree	FACU	2	2	2	2					3	3			2
	Nyssa sylvatica	blackgum	Tree	FAC									1	1			2
	Platanus occidentalis	American sycamore	Tree	FACW							4	4	2	2	2	2	
	Quercus alba	white oak	Tree	FACU					2	2	1	1	2	2	2	2	1
	Quercus imbricaria	shingle oak	Tree	FAC	3	3	1	1	1	1	1	1					
	Sambucus canadensis	American black elderberry	Tree				1	1							1	1	1
	Ulmus americana	American elm	Tree	FACW	1	1	2	2	2	2	2	2					1
	Xanthorhiza simplicissima	yellowroot	Shrub	FACW									1	1			
Sum	Performance Standard				17	17	17	17	18	18	20	20	24	24	16	16	14
Post Mitigation	*Prunus serotina*	*black cherry*	*Tree*	*FACU*				*1*									
Sum	Proposed Standard				17	17	17	17	18	18	20	20	24	24	16	16	14
Mitigation Plan Performance Standard	Current Year Stem Count					17		17		18		20		24		16	14
	Stems/Acre					688		688		729		810		972		648	567
	Species Count					9		10		10		10		12		9	10
	Dominant Species Composition (%)					18		17		22		20		33		25	14
	Average Plot Height (ft.)					2		2		2		2		2		2	2
	% Invasives					0		0		0		0		0		0	0
Post Mitigation Plan Performance Standard	Current Year Stem Count					17		17		18		20		24		16	14
	Stems/Acre					688		688		729		810		972		648	567
	Species Count					9		10		10		10		12		9	10
	Dominant Species Composition (%)					18		17		22		20		33		25	14
	Average Plot Height (ft.)					2		2		2		2		2		2	2
	% Invasives					0		0		0		0		0		0	0

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

Vegetation Performance Standards Summary Table												
	Veg Plot 1 F				Veg Plot 2 F				Veg Plot 3 F			
	Stems/Ac.	Av. Ht. (ft)	# Species	% Invasives	Stems/Ac.	Av. Ht. (ft)	# Species	% Invasives	Stems/Ac.	Av. Ht. (ft)	# Species	% Invasives
Monitoring Year 7												
Monitoring Year 5												
Monitoring Year 3												
Monitoring Year 2												
Monitoring Year 1												
Monitoring Year 0	688		9	0	688		10	0	729		10	0
	Veg Plot 4 F				Veg Plot 5 F				Veg Plot 6 F			
	Stems/Ac.	Av. Ht. (ft)	# Species	% Invasives	Stems/Ac.	Av. Ht. (ft)	# Species	% Invasives	Stems/Ac.	Av. Ht. (ft)	# Species	% Invasives
Monitoring Year 7												
Monitoring Year 5												
Monitoring Year 3												
Monitoring Year 2												
Monitoring Year 1												
Monitoring Year 0	810		10	0	972		12	0	648		9	0
	Veg Plot Group 1 R											
	Stems/Ac.	Av. Ht. (ft)	# Species	% Invasives								
Monitoring Year 7												
Monitoring Year 5												
Monitoring Year 3												
Monitoring Year 2												
Monitoring Year 1												
Monitoring Year 0	567		10	0								

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

APPENDIX D

Stream Measurement and

Geomorphology Data

Table 7. Baseline Stream Data Summary
Rush Fork Stream Mitigation Project: DMS Project No ID. 100068
UT1 - Reach 1-3 (Enhancement)

Parameter	Pre-Existing Condition				Reference Reach(es) Data Composite				Design				As-built			
Dimension and Substrate - Riffle	Min	Mean	Med	Max	Min	Mean	Med	Max	Min	Mean	Med	Max	Min	Mean	Med	Max
BF Width (ft)	7.1000	9.65	-----	12.2000	9.90	11.39	-----	12.88	9.00	9.50	-----	10.00	7.79	9.28	9.28	10.76
Floodprone Width (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	15.09	27.03	15.09	38.96
BF Mean Depth (ft)	0.2700	0.58	-----	0.8900	0.55	0.86	-----	1.16	0.65	0.68	-----	0.70	0.59	0.65	0.65	0.70
BF Max Depth (ft)	-----	-----	-----	-----	-----	-----	-----	-----	0.80	0.90	-----	1.00	0.96	0.98	0.98	0.99
BF Cross-sectional Area (ft^2)	3.3300	4.85	-----	6.4	5.4	8.76	-----	12.1	5.9	6.45	-----	7.00	5.44	5.90	5.90	6.36
Width/Depth Ratio	7.9800	26.62	-----	45.2600	8.97	13.49	-----	18.00	13.80	14.05	-----	14.30	11.13	14.69	14.69	18.24
Entrenchment Ratio	1.1500	1.43	-----	1.7100	1.70	1.67	-----	1.63	1.40	-----	-----	2.20	1.94	2.78	2.78	3.62
Bank Height Ratio	1.0000	1.43	-----	1.8600	1.00	1.19	-----	1.38	1.10		-----	1.10	1.00	1.00	1.00	1.00
d50 (mm)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	----	----	----
Pattern																
Channel Beltwidth (ft)	-----	N/A	-----	-----	-----	N/A	-----	-----	-----	N/A	-----	-----	----	N/A	----	----
Radius of Curvature (ft)	-----	N/A	-----	-----	-----	N/A	-----	-----	-----	N/A	-----	-----	----	N/A	----	----
Rc/Bankfull width (ft/ft)	-----	N/A	-----	-----	-----	N/A	-----	-----	-----	N/A	-----	-----	----	N/A	----	----
Meander Wavelength (ft)	-----	N/A	-----	-----	-----	N/A	-----	-----	-----	N/A	-----	-----	----	N/A	----	----
Meander Width Ratio	-----	N/A	-----	-----	-----	N/A	-----	-----	-----	N/A	-----	-----	----	N/A	----	----
Profile																
Riffle Length (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	4.30	14.60	15.40	20.50
Riffle Slope (ft/ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-0.0950	-0.0680	-0.0630	-0.0400
Pool Length (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	2.00	9.50	10.00	14.00
Pool to Pool Spacing (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	14.00	42.10	35.00	240.00
Pool Max Depth (ft)	----	----	----	----	-----	-----	-----	-----	1.50	1.75	-----	2.00	2.33	2.46	2.47	2.55
Substrate and Transport Parameters																
SC% / Sa% / G% / C% / Bo%	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	----	----	----
d16 / d35 / d50 / d84 / d95	-----	168.14/256/80	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	----	----	----
Additional Reach Parameters																
Drainage Area (SM)	-----	0.21	-----	-----	0.15	0.32	-----	0.49	0.15	-----	-----	0.21	0.15	----	----	0.21
Impervious cover estimate (%)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	----	----	----
Rosgen Classification	-----	B4a	-----	-----		B4a - B4 - Ba	-----	-----	-----	B4a	-----	-----	----	B	----	----
BF Velocity (fps)	3.00	3.82	-----	4.64	3.42	5.11	-----	6.80	2.15	3.58	-----	5.00	----	----	----	----
BF Discharge (cfs)	10.00	19.75	-----	29.50	23.90	31.16	-----	38.41	12.60	14.95	-----	17.30	----	----	----	----
Valley Length	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	----	----	----
Channel Length (ft)	-----	1,164	-----	-----	-----	-----	-----	-----	-----	1,093.30	-----	-----	----	1,082.27	----	----
Sinuosity	1.06	1.07	-----	1.07	1.02	1.08	-----	1.14	-----	1.05	-----	-----	----	----	----	----

Table 7. Baseline Stream Data Summary

Rush Fork Stream Mitigation Project: DMS Project No ID. 100068

UT1 - Reach 4 (Restoration)

Parameter	Pre-Existing Condition				Reference Reach(es) Data Composite				Design				As-built			
Dimension and Substrate - Riffle	Min	Mean	Med	Max	Min	Mean	Med	Max	Min	Mean	Med	Max	Min	Mean	Med	Max
BF Width (ft)	8.7300	11.07	-----	13.4000	9.90	11.39	-----	12.88	12.50	12.75	-----	13.00	12.93	14.21	13.36	15.90
Floodprone Width (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	21.96	30.86	24.30	46.32
BF Mean Depth (ft)	0.7300	1.01	-----	1.2800	0.55	0.86	-----	1.16	0.90	0.93	-----	0.95	0.69	0.71	0.87	1.11
BF Max Depth (ft)	-----	-----	-----	-----	-----	-----	-----	-----	1.20	1.25	-----	1.30	1.35	1.46	1.43	1.60
BF Cross-sectional Area (ft²)	9.8600	10.48	-----	11.1	5.4	8.76	-----	12.1	11.3	11.70	-----	12.10	11.01	13.27	14.33	14.48
Width/Depth Ratio	6.8200	12.59	-----	18.3600	8.97	13.49	-----	18.00	12.00	15.00	-----	18.00	11.65	15.94	13.13	13.13
Entrenchment Ratio	1.4800	2.45	-----	3.4200	1.70	1.67	-----	1.63	1.40	1.80	-----	2.20	1.59	2.13	1.88	1.88
Bank Height Ratio	1.0000	1.31	-----	1.6200	1.00	1.19	-----	1.38	1.00	----	-----	1.62	1.00	1.00	1.00	1.00
d50 (mm)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	----	----	----
Pattern																
Channel Beltwidth (ft)	-----	N/A	-----	-----	-----	N/A	-----	-----	-----	N/A	-----	-----	----	N/A	----	----
Radius of Curvature (ft)	-----	N/A	-----	-----	-----	N/A	-----	-----	-----	N/A	-----	-----	----	N/A	----	----
Rc/Bankfull width (ft/ft)	-----	N/A	-----	-----	-----	N/A	-----	-----	-----	N/A	-----	-----	----	N/A	----	----
Meander Wavelength (ft)	-----	N/A	-----	-----	-----	N/A	-----	-----	-----	N/A	-----	-----	----	N/A	----	----
Meander Width Ratio	-----	N/A	-----	-----	-----	N/A	-----	-----	-----	N/A	-----	-----	----	N/A	----	----
Profile																
Riffle Length (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	12.30	19.30	17.70	19.30
Riffle Slope (ft/ft)	-----	-----	-----	-----	-----	-----	-----	-----	----	-----	-----	----	-0.5800	-0.0220	-0.0377	-0.0790
Pool Length (ft)	-----	-----	-----	-----	-----	-----	-----	-----	----	-----	-----	----	2.00	13.40	14.00	22.00
Pool to Pool Spacing (ft)	-----	-----	-----	-----	-----	-----	-----	-----	----	-----	-----	----	18.00	44.80	40.00	117.00
Pool Max Depth (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	2.50	-----	-----	2.55	2.72	2.72	2.89
Substrate and Transport Parameters																
SC% / Sa% / G% / C% / Bo%	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	----	----	----
d16 / d35 / d50 / d84 / d95	-----	156/180/100.3	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	----	----	----
Additional Reach Parameters																
Drainage Area (SM)	-----	0.48	-----	-----	0.15	0.32	-----	0.49			-----		----	----		----
Impervious cover estimate (%)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	----	----	----
Rosgen Classification	-----	B4	-----	-----		B4a - B4 - Ba	-----	-----	-----	B4	-----	-----	----	B4	----	----
BF Velocity (fps)	3.17	3.61	-----	4.04	3.42	5.11	-----	6.80	4.00	5.00	-----	6.00	----	----	----	----
BF Discharge (cfs)	31.24	38.03	-----	44.81	23.90	-----	-----	38.41	37.88	38.13	-----	38.37	----	----	----	----
Valley Length	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	----	----	----
Channel Length (ft)	-----	1,300.00	-----	-----	-----	-----	-----	-----	-----	1,216.33	-----	-----	----	1,224.37	----	----
Sinuosity	1.08	1.11	-----	1.14	1.02	1.08	-----	1.14	1.10	1.15	-----	1.20	----	----	----	----

Table 7. Baseline Stream Data Summary

Rush Fork Stream Mitigation Project: DMS Project No ID. 100068

UT3 - Restoration

Parameter	Pre-Existing Condition				Reference Reach(es) Data				Design				As-built			
					Composite											
Dimension and Substrate - Riffle	Min	Mean	Med	Max	Min	Mean	Med	Max	Min	Mean	Med	Max	Min	Mean	Med	Max
BF Width (ft)	-----	6.58	-----	-----	9.90	11.39	-----	12.88	7.50	8.00	-----	8.50	7.04	8.29	7.60	10.92
Floodprone Width (ft)	-----		-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	11.96	15.37	14.41	20.71
BF Mean Depth (ft)	-----	0.82	-----	-----	0.55	0.86	-----	1.16	0.57	0.61	-----	0.65	0.52	0.61	0.58	0.77
BF Max Depth (ft)	-----		-----	-----	-----	-----	-----	-----	0.70	0.78	-----	0.85	0.71	0.89	0.89	1.07
BF Cross-sectional Area (ft²)	-----	5.4	-----	-----	5.4	8.76	-----	12.1	4.6	5.30	-----	6.00	3.64	5.05	5.16	6.23
Width/Depth Ratio	-----	8.02	-----	-----	8.97	13.49	-----	18.00	-----	13.10	-----	-----	10.32	13.88	13.02	19.16
Entrenchment Ratio	-----	2.17	-----	-----	1.70	1.67	-----	1.63	1.40	1.80	-----	2.20	1.70	1.85	1.86	1.97
Bank Height Ratio	-----	1.83	-----	-----	1.00	1.19	-----	1.38	-----	1.00	-----	-----	1.00	1.00	1.00	1.00
d50 (mm)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	----	----	----
Pattern																
Channel Beltwidth (ft)	-----	N/A	-----	-----	-----	N/A	-----	-----	-----	N/A	-----	-----	----	N/A	----	----
Radius of Curvature (ft)	-----	N/A	-----	-----	-----	N/A	-----	-----	-----	N/A	-----	-----	----	N/A	----	----
Rc/Bankfull width (ft/ft)	-----	N/A	-----	-----	-----	N/A	-----	-----	-----	N/A	-----	-----	----	N/A	----	----
Meander Wavelength (ft)	-----	N/A	-----	-----	-----	N/A	-----	-----	-----	N/A	-----	-----	----	N/A	----	----
Meander Width Ratio	-----	N/A	-----	-----	-----	N/A	-----	-----	-----	N/A	-----	-----	----	N/A	----	----
Profile																
Riffle Length (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	10.20	18.70	16.90	37.20
Riffle Slope (ft/ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-0.1400	-0.0660	-0.0649	-0.0330
Pool Length (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	2.00	5.70	6.00	12.00
Pool to Pool Spacing (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	10.00	37.00	34.00	70.00
Pool Max Depth (ft)	-----	-----	-----	-----	-----	-----	-----	-----	1.70	1.75	-----	1.80	2.16	2.54	2.53	2.94
Substrate and Transport Parameters																
SC% / Sa% / G% / C% / Bo%	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	----	----	----
d16 / d35 / d50 / d84 / d95	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	----	----	----
Additional Reach Parameters																
Drainage Area (SM)	-----	0.15	-----	-----	0.15	0.32	-----	0.49	-----	0.15	-----	-----	----	0.15	----	----
Impervious cover estimate (%)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	----	----	----
Rosgen Classification	-----	Ba	-----	-----		B4a - B4 - Ba	-----	-----	-----	Ba	-----	-----	----	B4	----	----
BF Velocity (fps)	-----	3.48	-----	-----	3.42	5.11	-----	6.80	4.42	4.71	-----	5.00	----	----	----	----
BF Discharge (cfs)	-----	18.8	-----	-----	23.90	31.16	-----	38.41	19.00	24.50	-----	30.00	----	----	----	----
Valley Length	-----	1,541	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	----	----	----
Channel Length (ft)	-----	1,618	-----	-----	-----	-----	-----	-----	-----	1,584.45	-----	-----	----	1,577.53	----	----
Sinuosity	-----	1.05	-----	-----	1.02	1.08	-----	1.14	-----	1.02	-----	-----	----	----	----	----

Table 8. Cross-Section Morphology Data Summary
UT to Rush Fork Restoration Project: DMS Project No ID. 100068

Stream Reach	UT3																									
	Cross-section X-1 (Riffle)							Cross-section X-2 (Pool)							Cross-section X-3 (Riffle)							Cross-section X-4 (Pool)						
Dimension and substrate	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+
Based on fixed baseline bankfull elevation																												
Bankfull Elevation (ft) - Based on AB-Bankfull[1] Area	3063.86							3048.03							3028.13							3010.84						
Bank Height Ratio_Based on AB Bankfull[1] Area	1.00							1.00							1.00							1.00						
Thalweg Elevation	3062.99							3045.87							3027.42							3007.90						
LTOB[2] Elevation	3063.86							3048.03							3028.13							3010.84						
LTOB[2] Max Depth (ft)	0.87							2.16							0.71							2.94						
LTOB[2] Cross Sectional Area (ft^2)	4.20							11.12							3.64							15.11						

Stream Reach	UT3																					UT 1 Reach 4						
	Cross-section X-5 (Riffle)							Cross-section X-6 (Pool)							Cross-section X-7 (Riffle)							Cross-section X-8 (Riffle)						
Dimension and substrate	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+
Based on fixed baseline bankfull elevation																												
Bankfull Elevation (ft) - Based on AB-Bankfull[1] Area	2998.75							2985.03							2976.51							2970.37						
Bank Height Ratio_Based on AB Bankfull[1] Area	1.00							1.00							1.00							1.00						
Thalweg Elevation	2997.84							2982.50							2975.44							2969.02						
LTOB[2] Elevation	2998.75							2985.03							2976.51							2970.37						
LTOB[2] Max Depth (ft)	0.91							2.53							1.07							1.35						
LTOB[2] Cross Sectional Area (ft^2)	6.23							15.51							6.11							11.01						

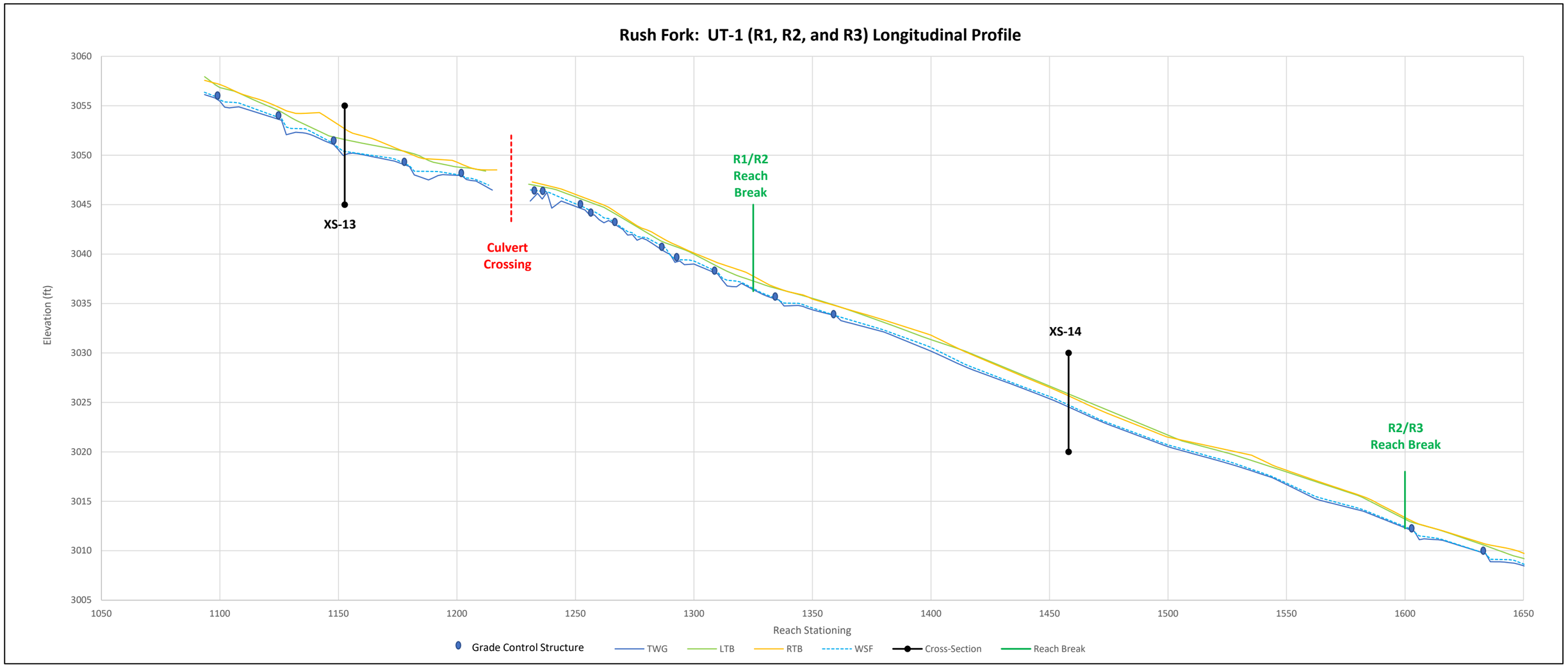
Stream Reach	UT1 Reach 4																									
	Cross-section X-9 (Pool)							Cross-section X-10 (Riffle)							Cross-section X-11 (Pool)							Cross-section X-12 (Riffle)						
Dimension and substrate	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+
Based on fixed baseline bankfull elevation																												
Bankfull Elevation (ft) - Based on AB-Bankfull[1] Area	2954.14							2922.10							2913.15							2904.41						
Bank Height Ratio_Based on AB Bankfull[1] Area	1.00							1.00							1.00							1.00						
Thalweg Elevation	2951.59							2920.67							2910.26							2902.81						
LTOB[2] Elevation	2954.14							2922.10							2913.15							2904.41						
LTOB[2] Max Depth (ft)	2.55							1.43							2.89							1.60						
LTOB[2] Cross Sectional Area (ft^2)	27.56							14.50							31.24							14.33						

Table 8. Cross-Section Morphology Data Summary
UT to Rush Fork Restoration Project: DMS Project No ID. 100068

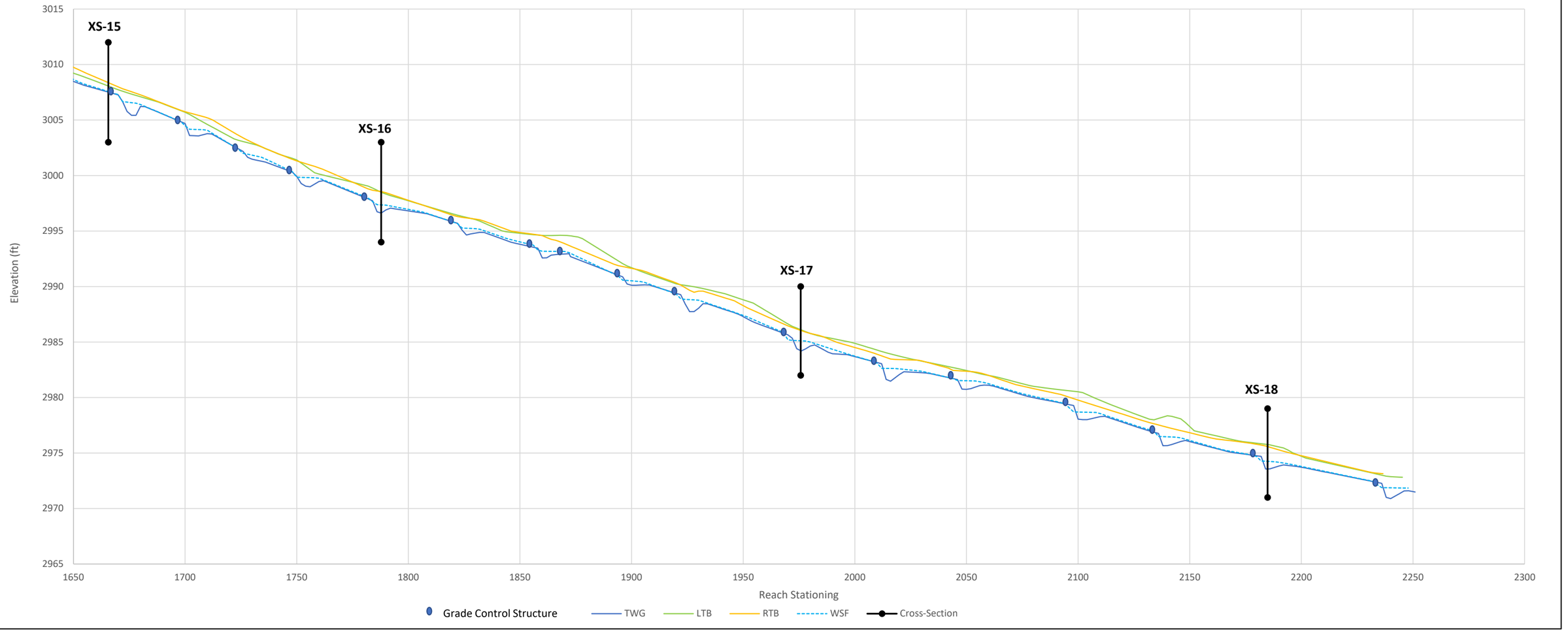
Stream Reach	UT1 Reach 1							UT1 Reach 2							UT1 Reach 3													
	Cross-section X-13 (Pool)							Cross-section X-14 (Riffle)							Cross-section X-15 (Riffle)							Cross-section X-16 (Pool)						
Dimension and substrate	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+
Based on fixed baseline bankfull elevation																												
Bankfull Elevation (ft) - Based on AB-Bankfull[1] Area	3051.49							3025.48							3008.35							2998.87						
Bank Height Ratio_Based on AB Bankfull[1] Area	1.00							1.00							1.00							1.00						
Thalweg Elevation	3049.01							3024.52							3007.37							2996.54						
LTOB[2] Elevation	3051.49							3025.48							3008.35							2998.87						
LTOB[2] Max Depth (ft)	2.48							0.96							0.98							2.33						
LTOB[2] Cross Sectional Area (ft^2)	12.13							5.44							6.36							12.06						

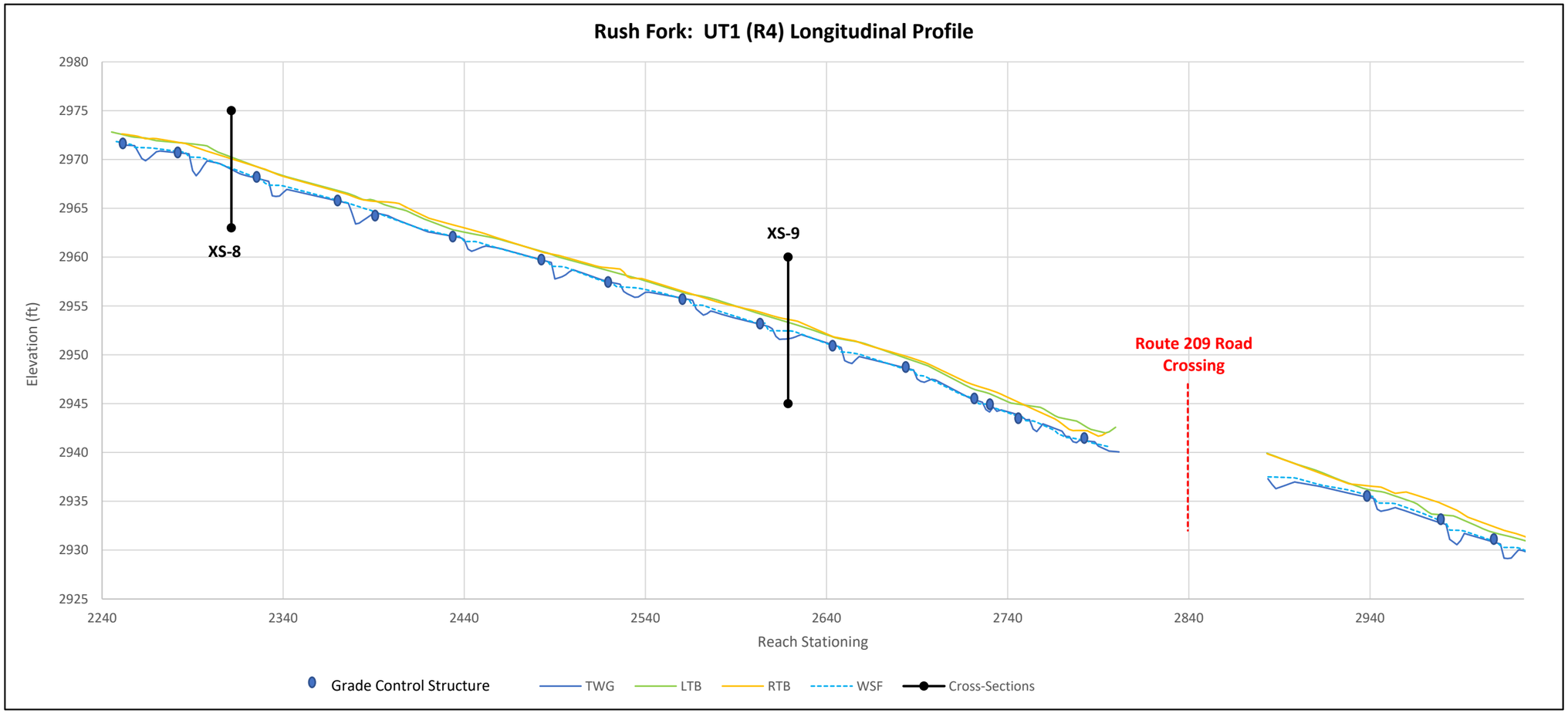
Stream Reach	UT1 Reach 3													
	Cross-section X-17 (Pool)							Cross-section X-18 (Pool)						
Dimension and substrate	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+
Based on fixed baseline bankfull elevation														
Bankfull Elevation (ft) - Based on AB-Bankfull[1] Area	2986.75							2976.03						
Bank Height Ratio_Based on AB Bankfull[1] Area	1.00							1.00						
Thalweg Elevation	2984.29							2973.48						
LTOB[2] Elevation	2986.75							2976.03						
LTOB[2] Max Depth (ft)	2.46							2.55						
LTOB[2] Cross Sectional Area (ft^2)	17.60							17.29						

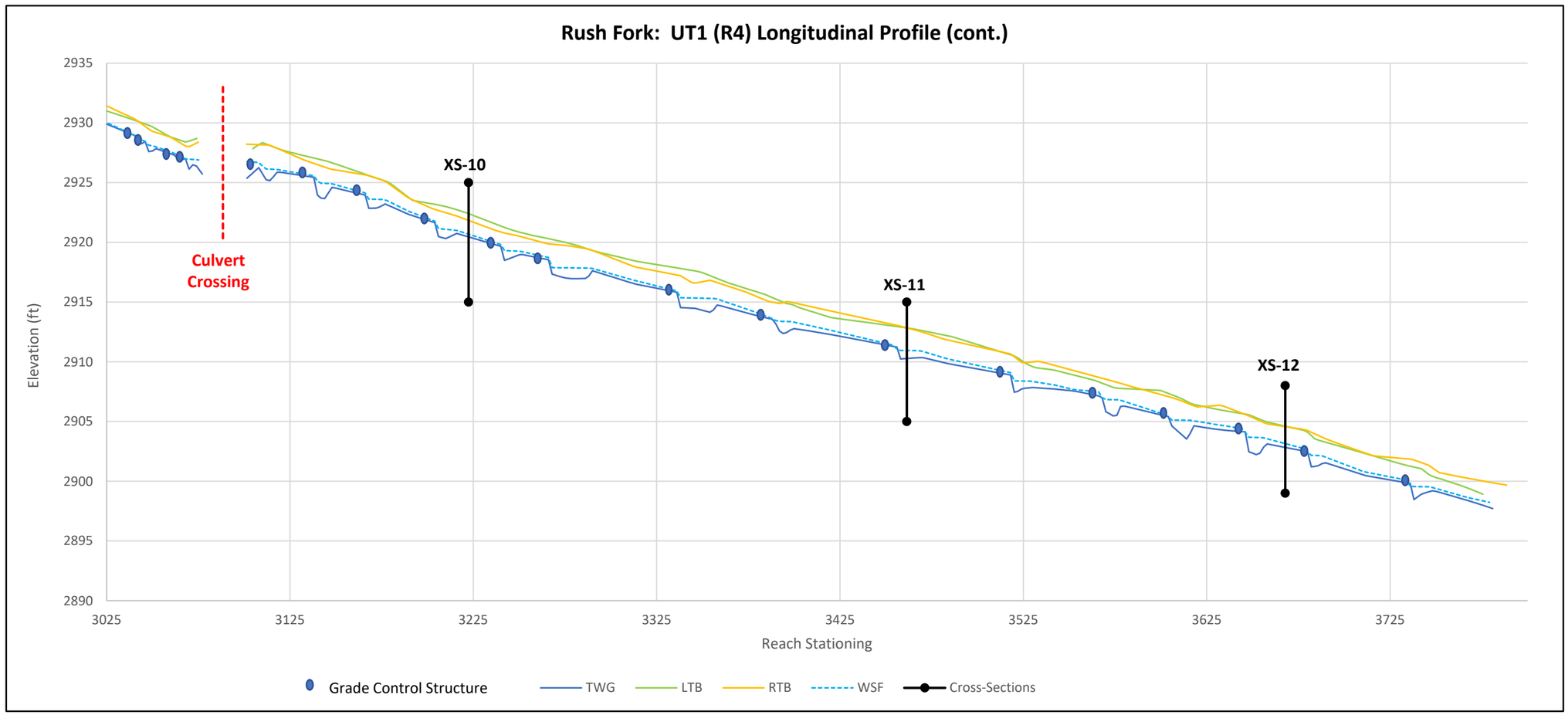
Figure 7. Longitudinal Profiles

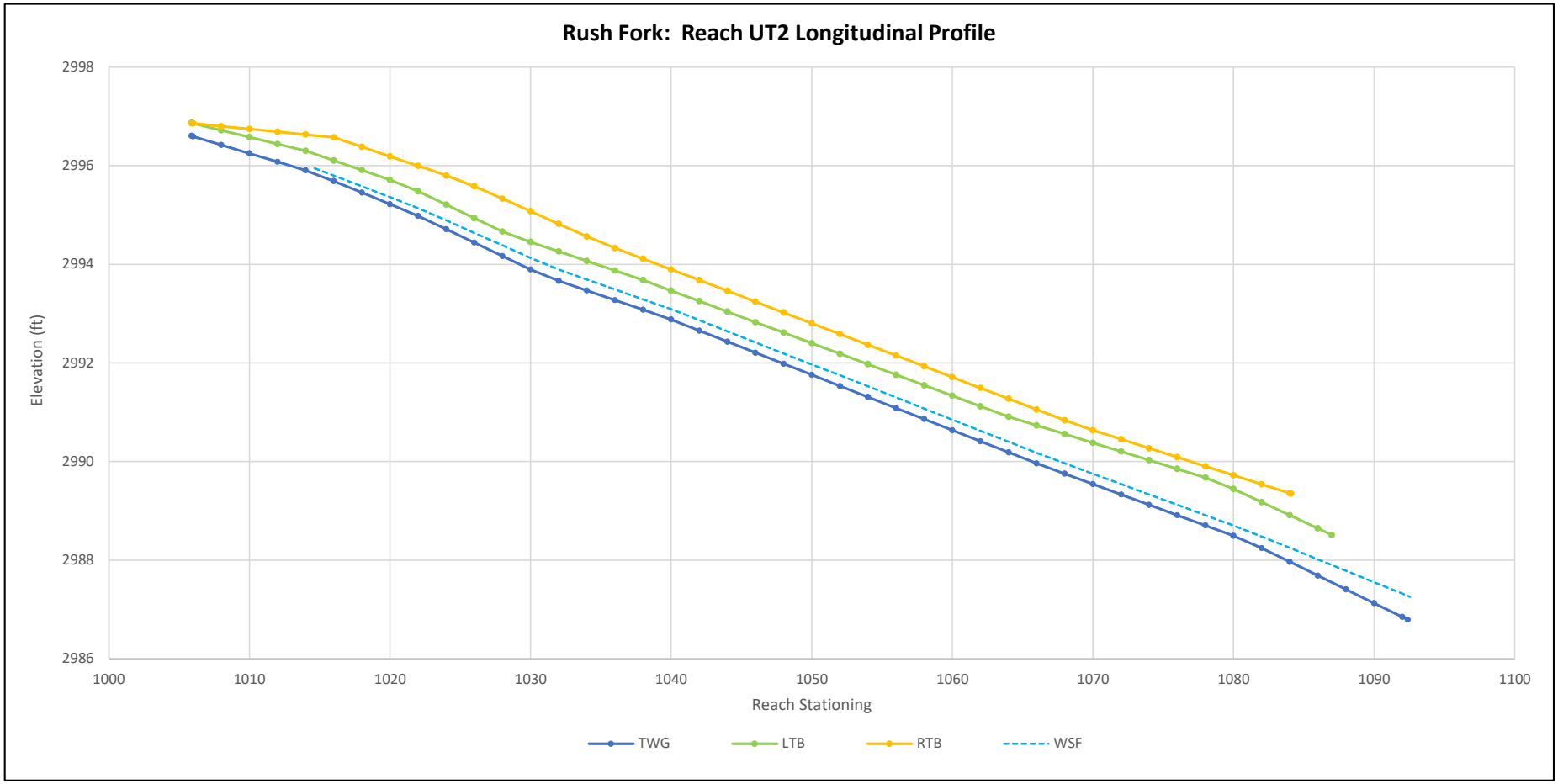


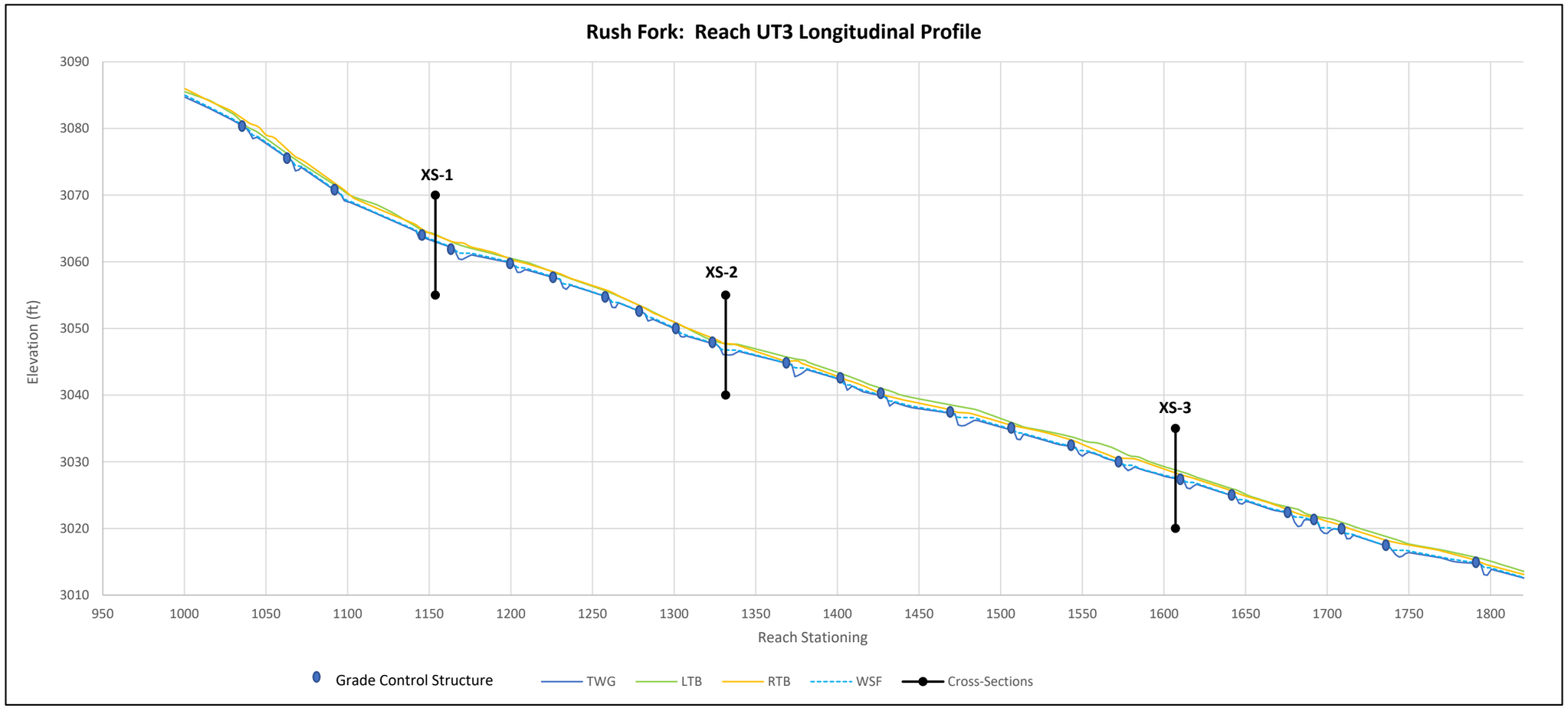
Rush Fork: UT-1 (R1, R2, and R3) Longitudinal Profile (cont.)

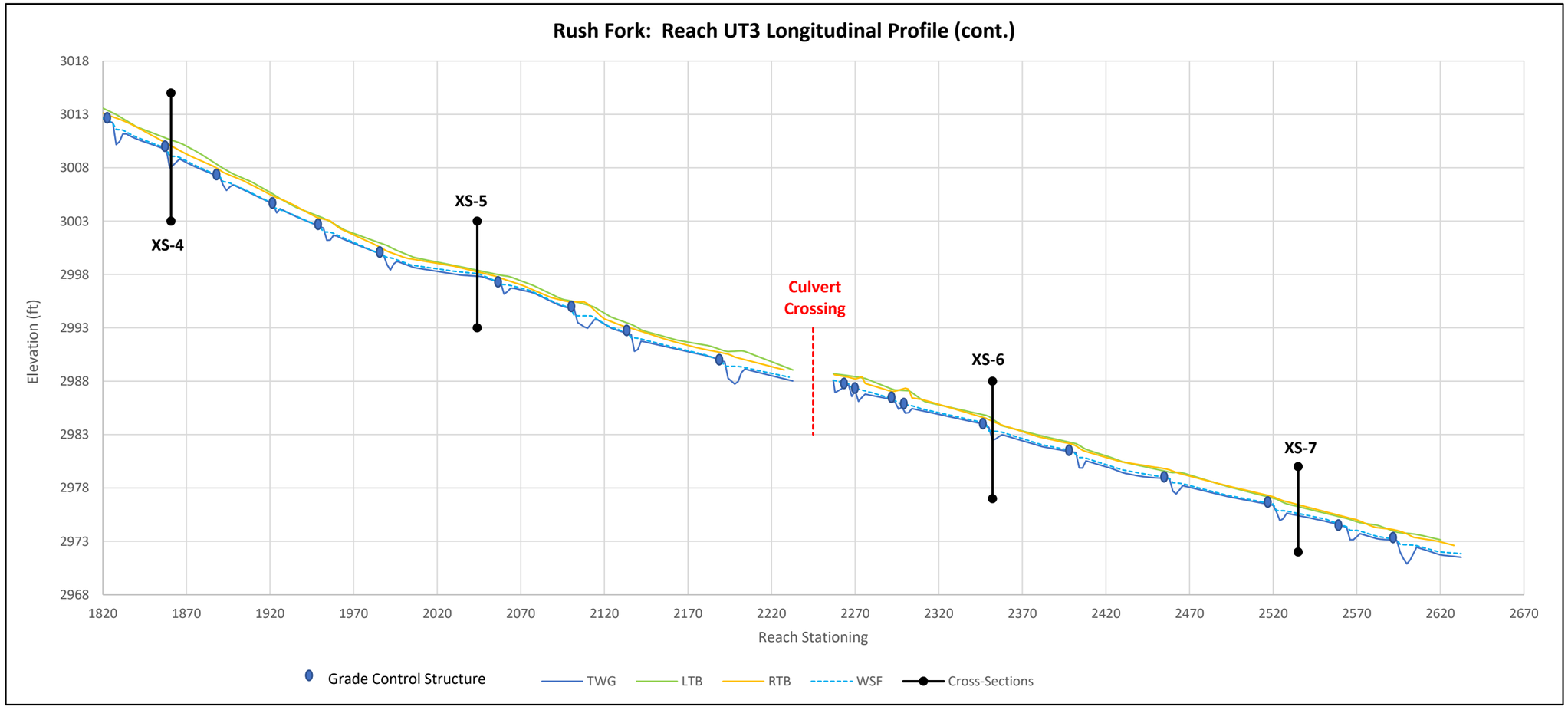


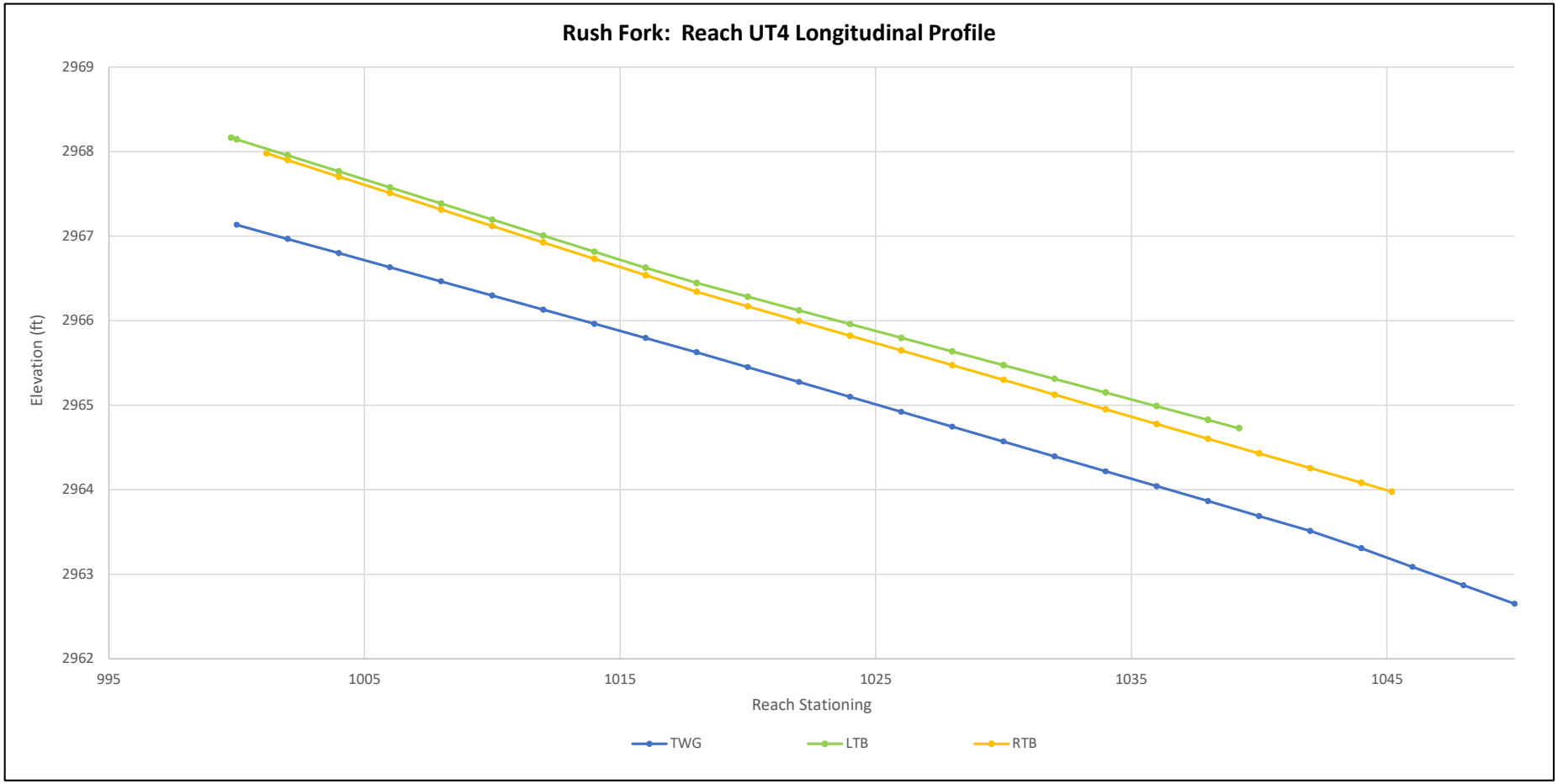

Rush Fork: UT1 (R4) Longitudinal Profile
Elevation (ft)
2980
2975
2970
2965
2960
2955
2950
2945
2940
2935
2930
2925
2240
2340
2440
2540
2640
2740
2840
2940
Reach Stationing
XS-8
XS-9
Route 209 Road Crossing
Grade Control Structure
TWG
LTB
RTB
WSF
Cross-Sections


Rush Fork: UT1 (R4) Longitudinal Profile (cont.)
Elevation (ft)
2935
2930
2925
2920
2915
2910
2905
2900
2895
2890
3025
3125
3225
3325
3425
3525
3625
3725
Reach Stationing
XS-10
XS-11
XS-12
Culvert Crossing
Grade Control Structure
TWG
LTB
RTB
WSF
Cross-Sections


Rush Fork: Reach UT2 Longitudinal Profile
Elevation (ft)
2998
2996
2994
2992
2990
2988
2986
1000
1010
1020
1030
1040
1050
1060
1070
1080
1090
1100
Reach Stationing
TWG
LTB
RTB
WSF


Rush Fork: Reach UT3 Longitudinal Profile
Elevation (ft)
3090
3080
3070
3060
3050
3040
3030
3020
3010
950
1000
1050
1100
1150
1200
1250
1300
1350
1400
1450
1500
1550
1600
1650
1700
1750
1800
Reach Stationing
XS-1
XS-2
XS-3
Grade Control Structure
TWG
LTB
RTB
WSF
Cross-Sections


Rush Fork: Reach UT3 Longitudinal Profile (cont.)
Elevation (ft)
3018
3013
3008
3003
2998
2993
2988
2983
2978
2973
2968
1820
1870
1920
1970
2020
2070
2120
2170
2220
2270
2320
2370
2420
2470
2520
2570
2620
2670
Reach Stationing
XS-4
XS-5
XS-6
XS-7
Culvert Crossing
Grade Control Structure
TWG
LTB
RTB
WSF
Cross-Sections


Rush Fork: Reach UT4 Longitudinal Profile
2969
2968
2967
2966
2965
2964
2963
2962
Elevation (ft)
995
1005
1015
1025
1035
1045
Reach Stationing
TWG
LTB
RTB

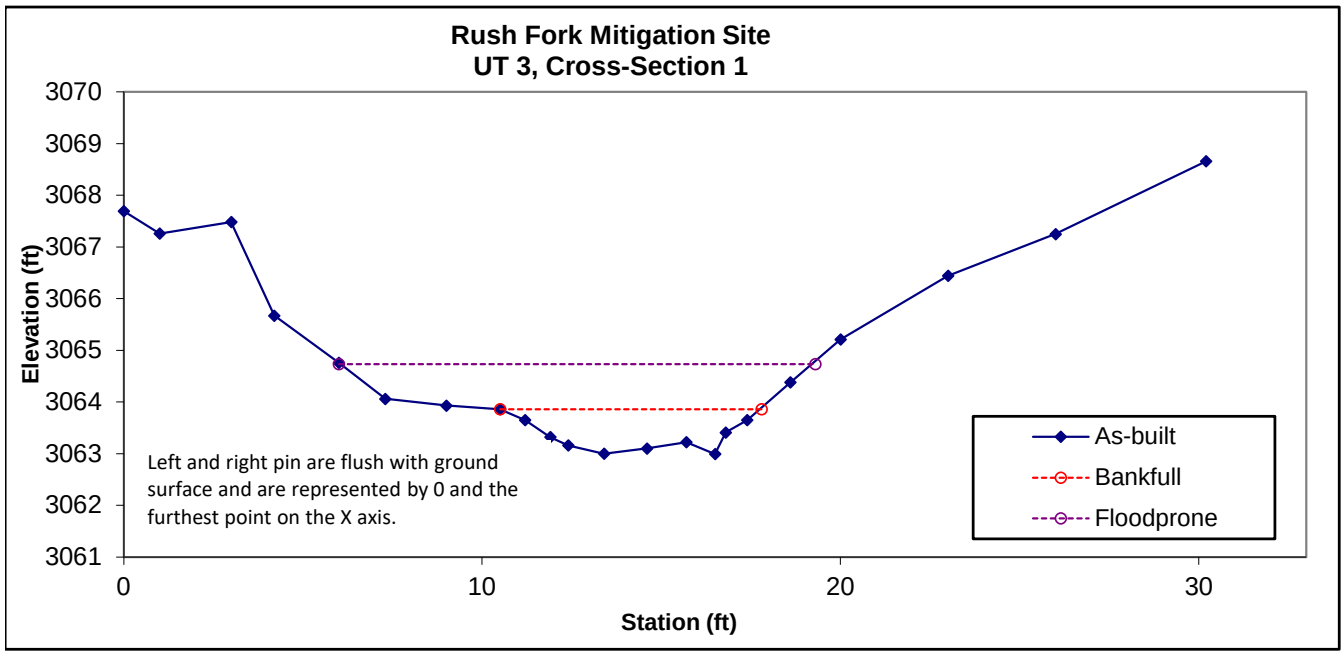
Permanent Cross-Section 1

(As-built Survey Data Collected: March 2022)
Restoration

Looking at the Left Bank

Looking at the Right Bank

Feature	Stream Type	BKF Area	BKF Width	BKF Depth	Max BKF Depth	W/D	BH Ratio	ER	BKF Elev	TOB Elev
Riffle	B	4.2	7.25	0.58	0.87	12.5	1.0	1.81	3063.86	3063.86



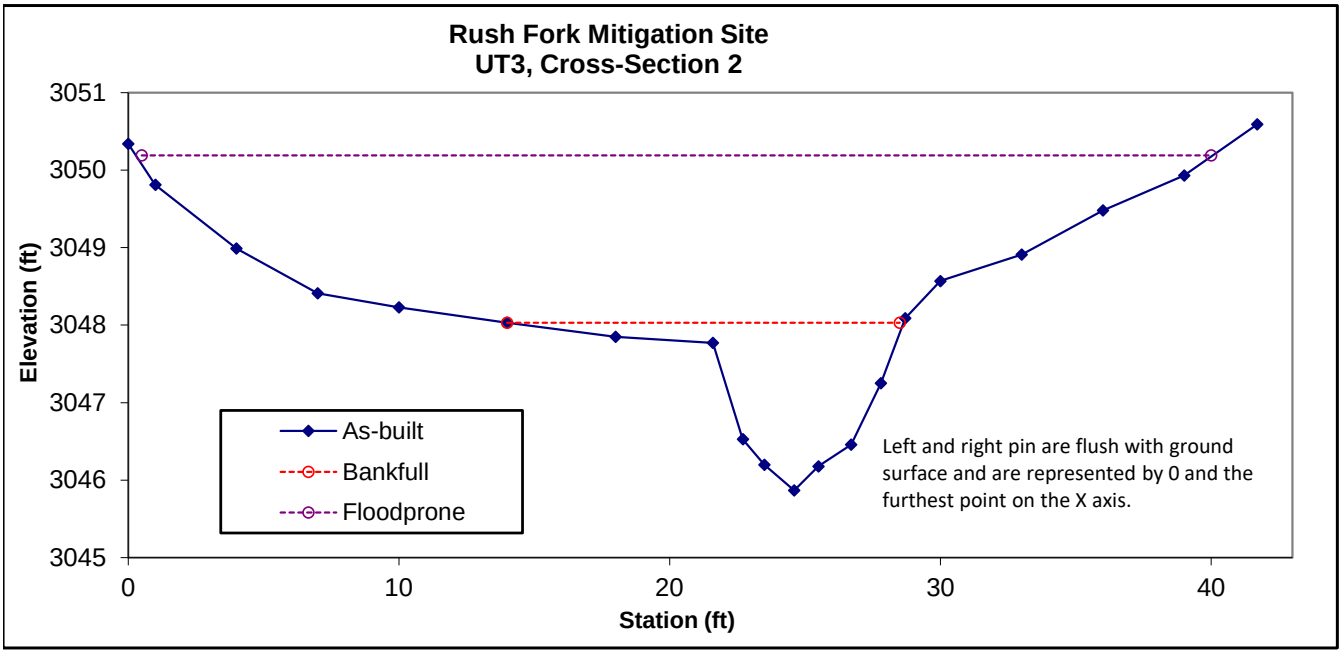
Permanent Cross-Section 2

(As-built Survey Data Collected: March 2022)
Restoration

Looking at the Left Bank

Looking at the Right Bank

Feature	Stream Type	BKF Area	BKF Width	BKF Depth	Max BKF Depth	W/D	BH Ratio	ER	BKF Elev	TOB Elev
Pool	C	11.12	14.64	0.76	2.16	19.26	----	----	3048.03	3048.03



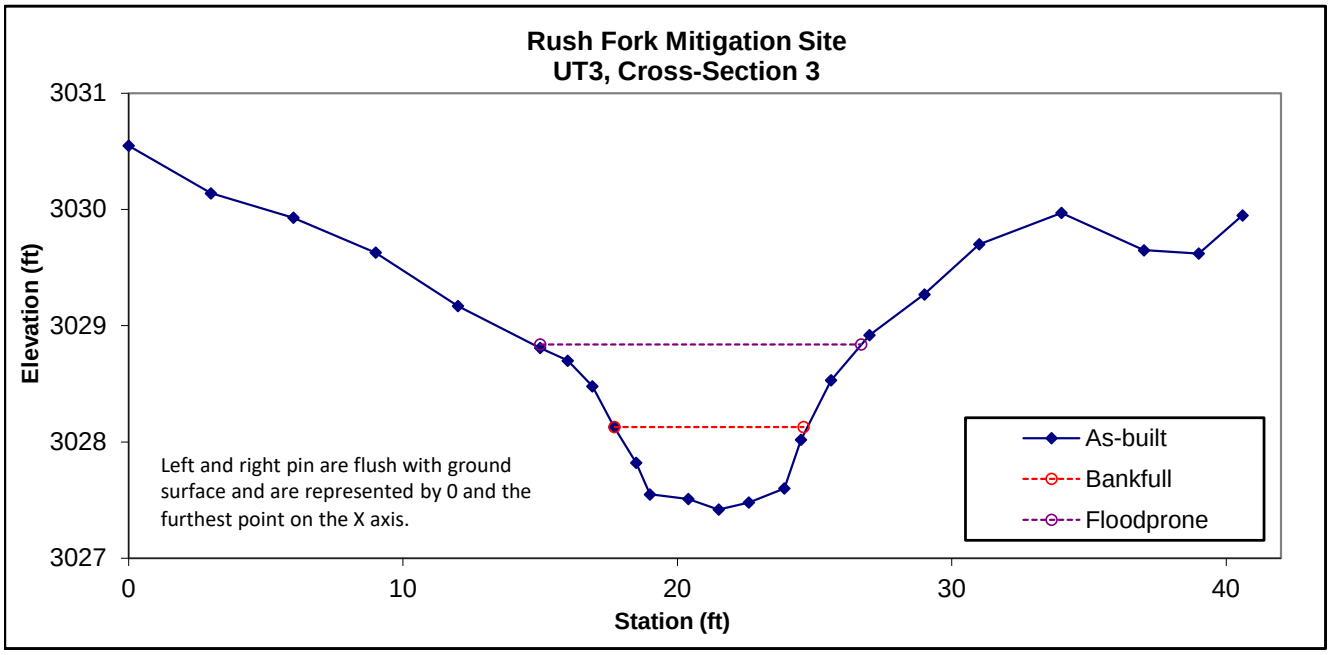
Permanent Cross-Section 3

(As-built Survey Data Collected: March 2022)
Restoration

Looking at the Left Bank

Looking at the Right Bank

Feature	Stream Type	BKF Area	BKF Width	BKF Depth	Max BKF Depth	W/D	BH Ratio	ER	BKF Elev	TOB Elev
Riffle	B	3.64	7.04	0.52	0.71	13.54	1.0	1.7	3028.13	3028.13



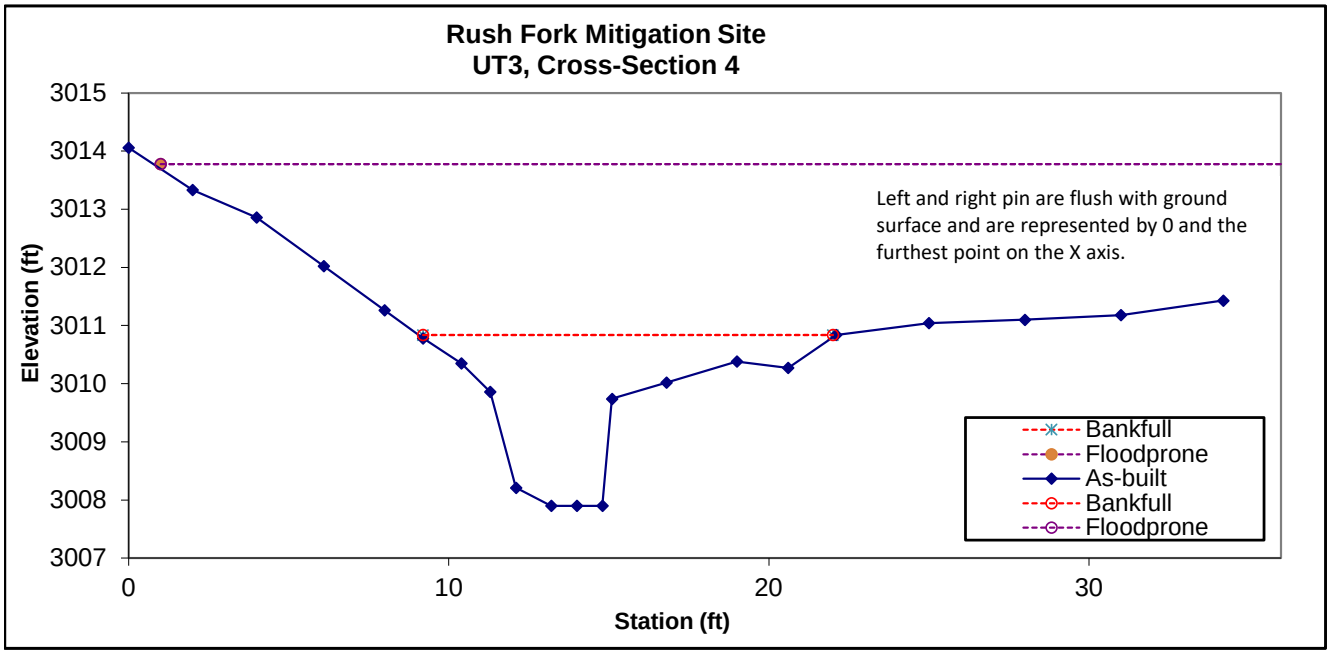
Permanent Cross-Section 4

(As-built Survey Data Collected: March 2022)
Restoration

Looking at the Left Bank

Looking at the Right Bank

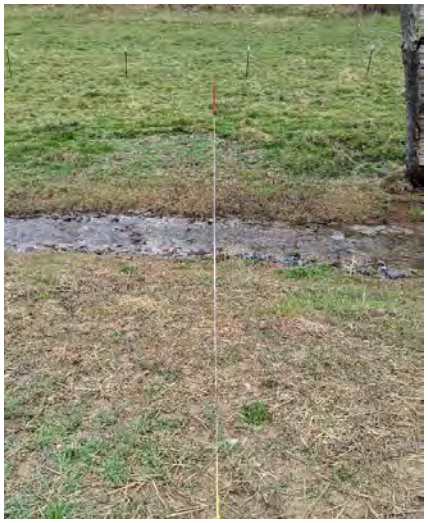
Feature	Stream Type	BKF Area	BKF Width	BKF Depth	Max BKF Depth	W/D	BH Ratio	ER	BKF Elev	TOB Elev
Pool	E	15.11	13.05	1.16	2.94	11.25	----	----	3010.84	3010.84



Permanent Cross-Section 5

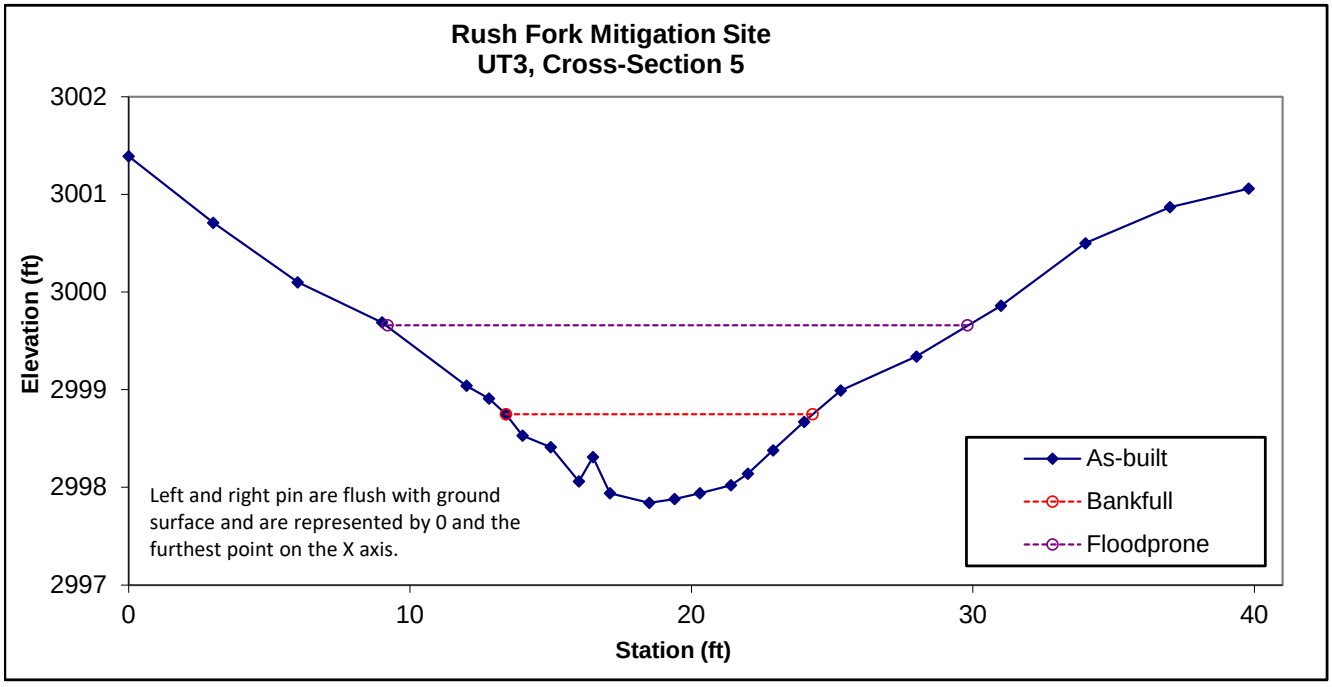
(As-built Survey Data Collected: March 2022)
Restoration

Looking at the Left Bank



Looking at the Right Bank

Feature	Stream Type	BKF Area	BKF Width	BKF Depth	Max BKF Depth	W/D	BH Ratio	ER	BKF Elev	TOB Elev
Riffle	B	6.23	10.92	0.57	0.91	19.16	1.0	1.9	2998.75	2998.75



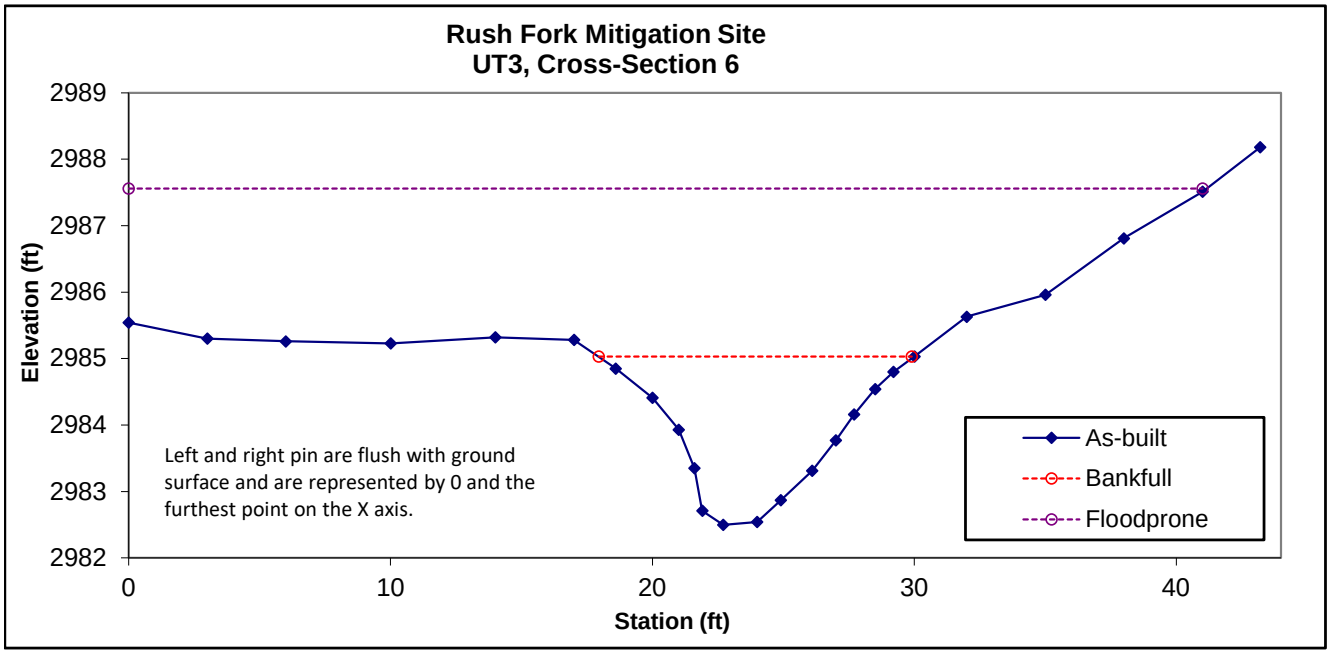
Permanent Cross-Section 6

(As-built Survey Data Collected: March 2022)
Restoration

Looking at the Left Bank

Looking at the Right Bank

Feature	Stream Type	BKF Area	BKF Width	BKF Depth	Max BKF Depth	W/D	BH Ratio	ER	BKF Elev	TOB Elev
Pool	E	15.51	12.07	1.29	2.53	9.36	----	----	2985.03	2985.03



Permanent Cross-Section 7

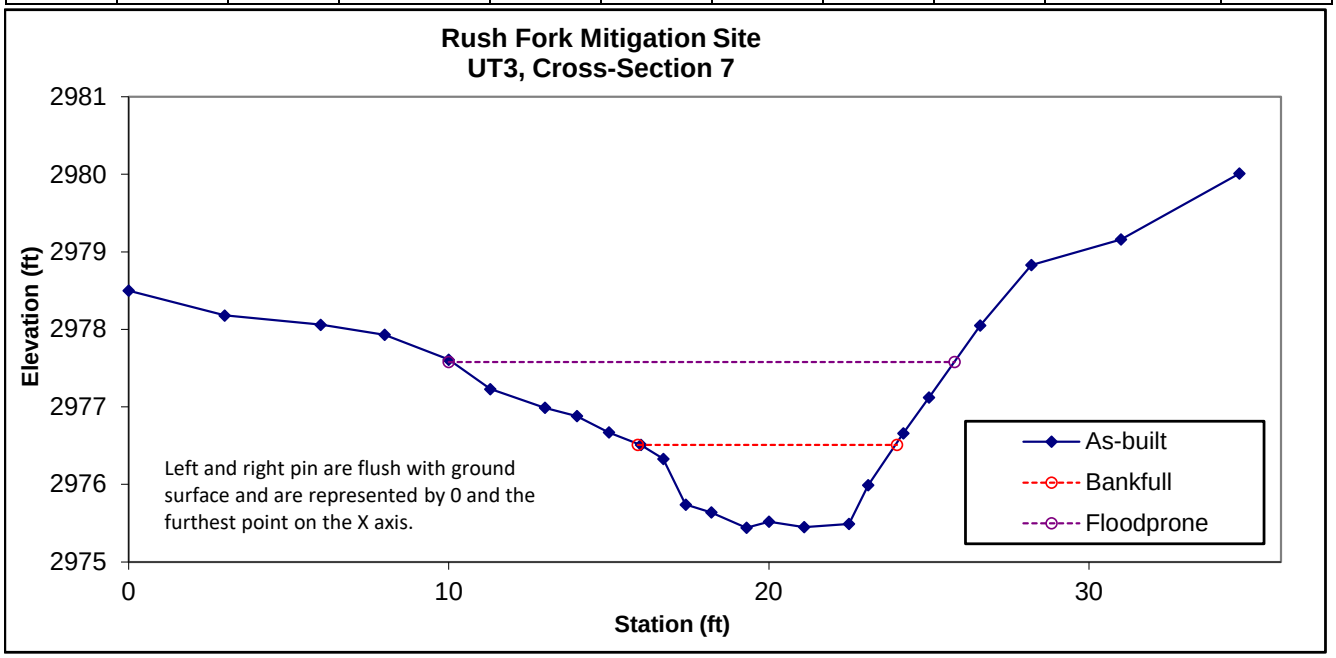
(As-built Survey Data Collected: March 2022)

Restoration

Looking at the Left Bank

Looking at the Right Bank

Feature	Stream Type	BKF Area	BKF Width	BKF Depth	Max BKF Depth	W/D	BH Ratio	ER	BKF Elev	TOB Elev
Riffle	B	6.11	7.95	0.77	1.07	10.32	1.0	1.97	2976.51	2976.51



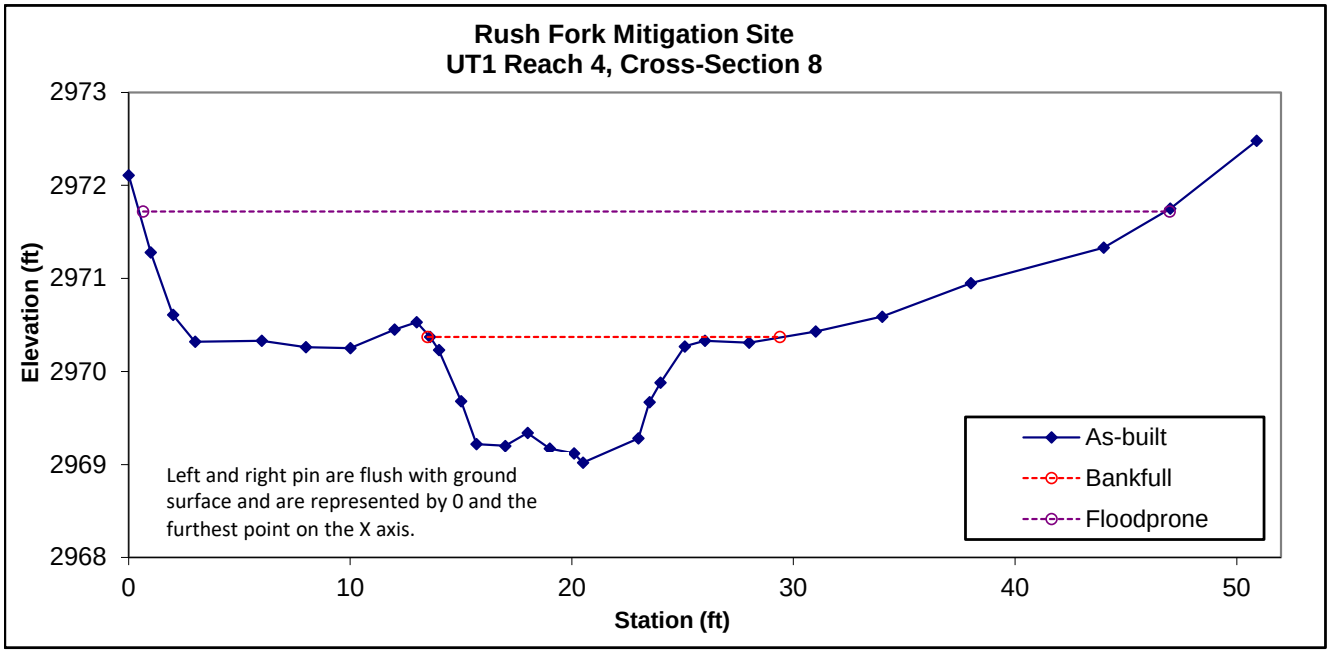
Permanent Cross-Section 8

(As-built Survey Data Collected: March 2022)
Restoration

Looking at the Left Bank

Looking at the Right Bank

Feature	Stream Type	BKF Area	BKF Width	BKF Depth	Max BKF Depth	W/D	BH Ratio	ER	BKF Elev	TOB Elev
Riffle	C	11.01	15.9	0.69	1.35	23.04	1.0	2.91	2970.37	2970.37



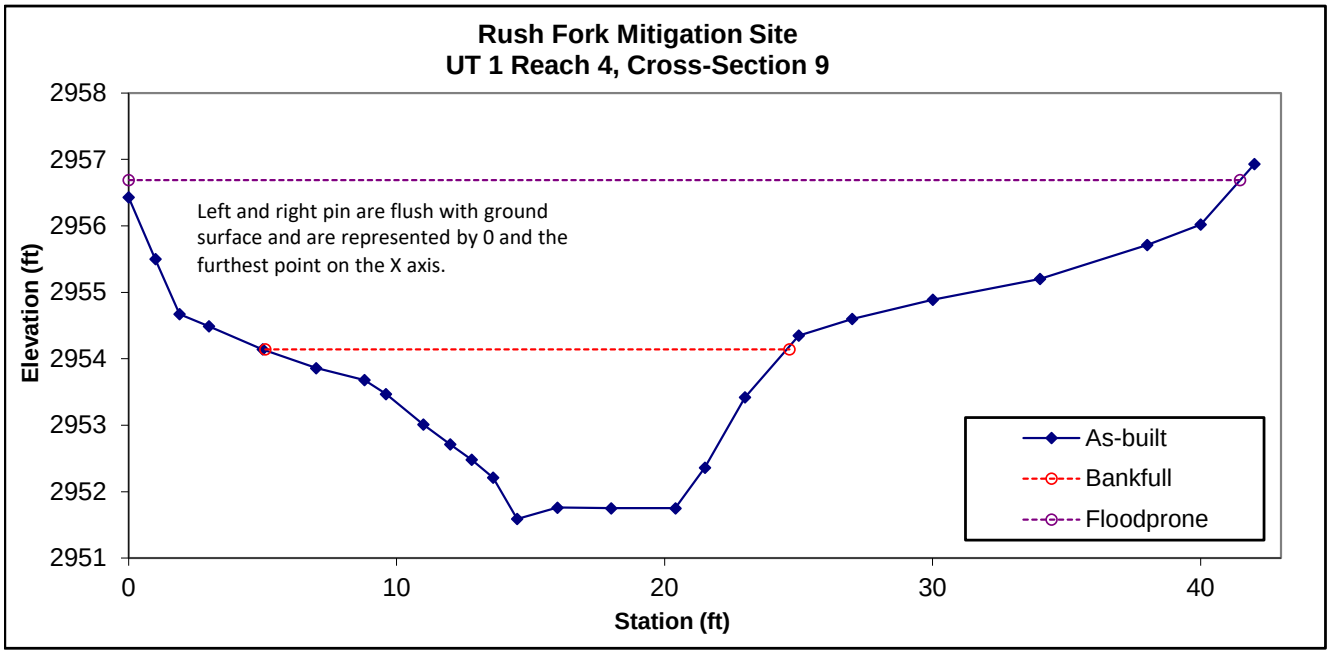
Permanent Cross-Section 9

(As-built Survey Data Collected: March 2022)
Restoration

Looking at the Left Bank

Looking at the Right Bank

Feature	Stream Type	BKF Area	BKF Width	BKF Depth	Max BKF Depth	W/D	BH Ratio	ER	BKF Elev	TOB Elev
Pool	B	27.56	19.55	1.41	2.55	13.87	----	----	2954.14	2954.14



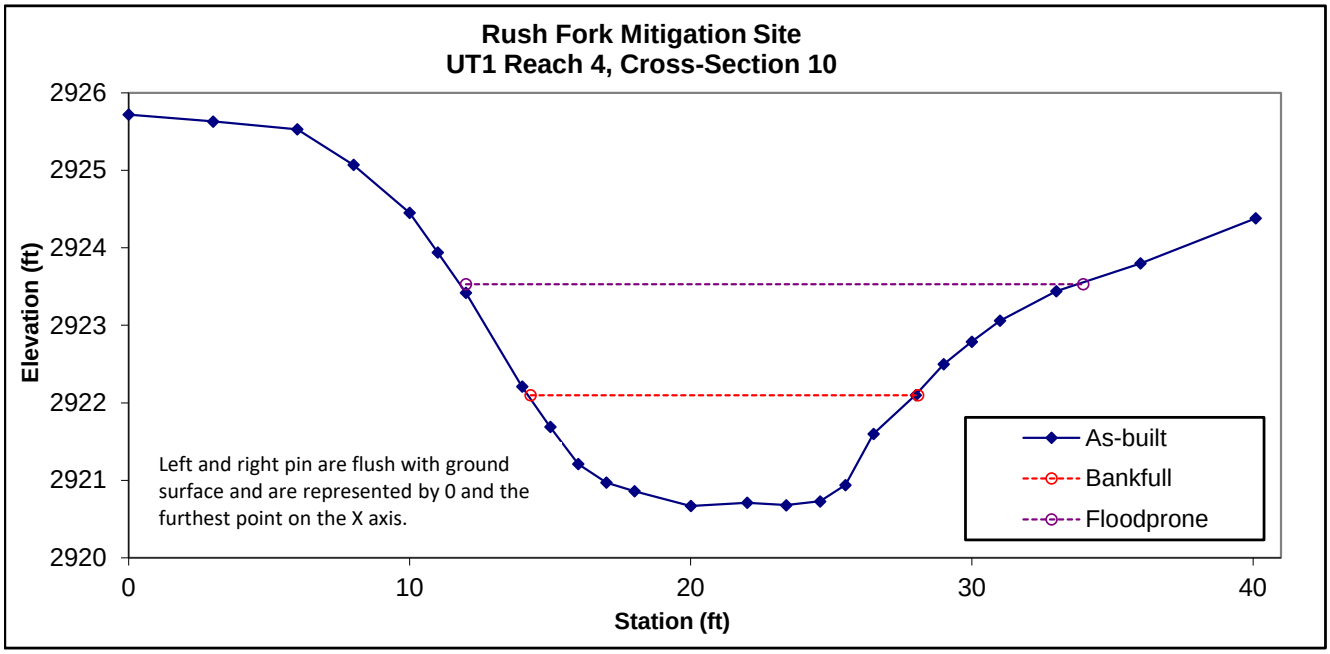
Permanent Cross-Section 10

(As-built Survey Data Collected: March 2022)
Restoration

Looking at the Left Bank

Looking at the Right Bank

Feature	Stream Type	BKF Area	BKF Width	BKF Depth	Max BKF Depth	W/D	BH Ratio	ER	BKF Elev	TOB Elev
Riffle	B	14.5	13.79	1.05	1.43	13.13	1.0	1.59	2922.1	2922.1



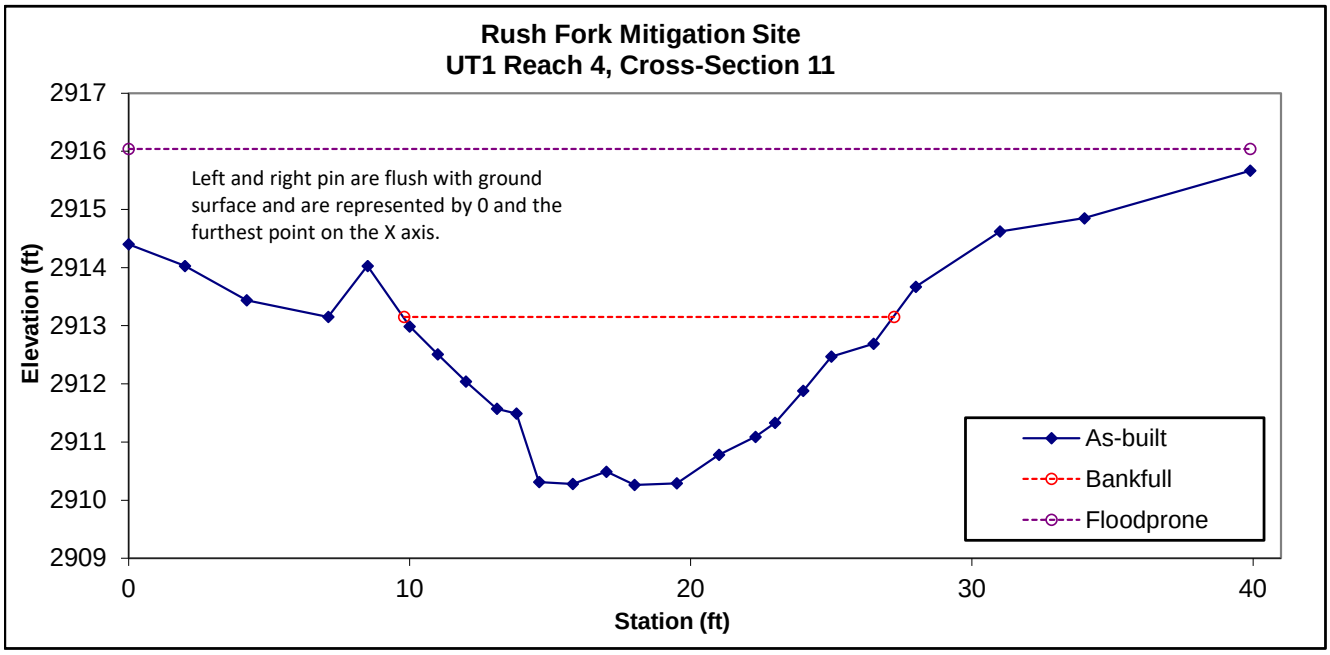
Permanent Cross-Section 11

(As-built Survey Data Collected: March 2022)
Restoration

Looking at the Left Bank

Looking at the Right Bank

Feature	Stream Type	BKF Area	BKF Width	BKF Depth	Max BKF Depth	W/D	BH Ratio	ER	BKF Elev	TOB Elev
Pool	E	31.24	17.43	1.79	2.89	9.74	----	----	2913.15	2913.15



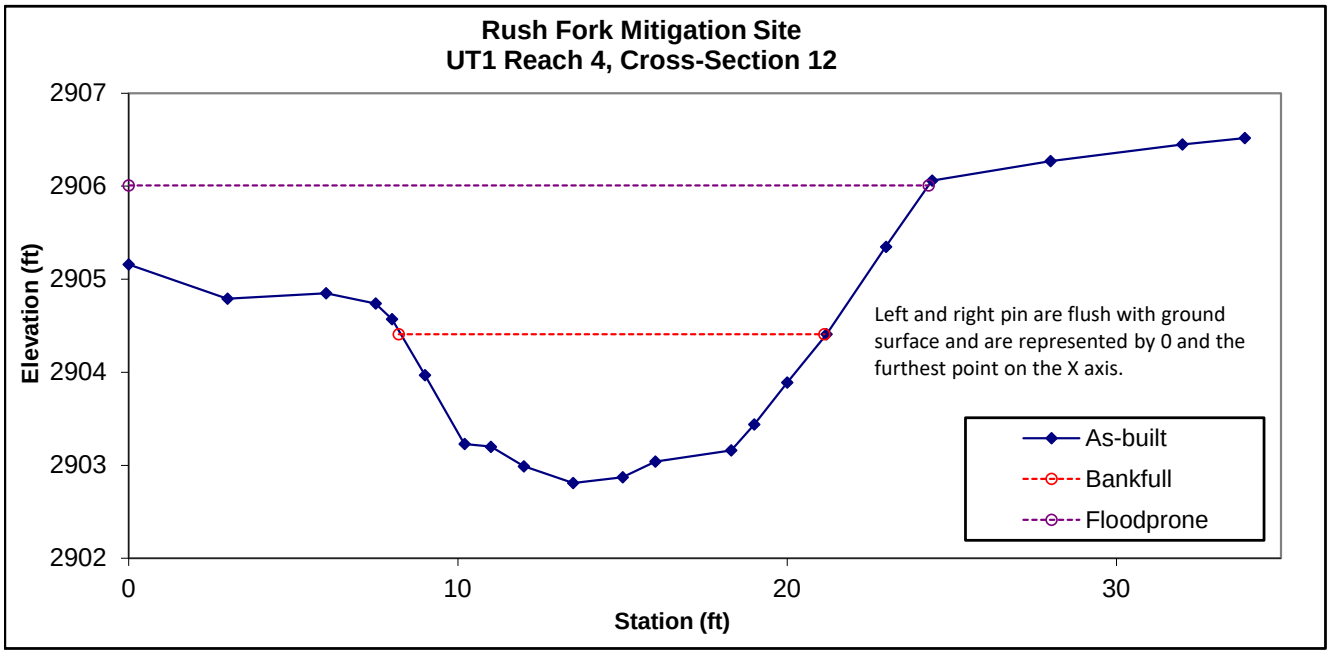
Permanent Cross-Section 12

(As-built Survey Data Collected: March 2022)
Restoration

Looking at the Left Bank

Looking at the Right Bank

Feature	Stream Type	BKF Area	BKF Width	BKF Depth	Max BKF Depth	W/D	BH Ratio	ER	BKF Elev	TOB Elev
Riffle	B	14.33	12.93	1.11	1.6	11.65	1.0	1.88	2904.41	2904.41



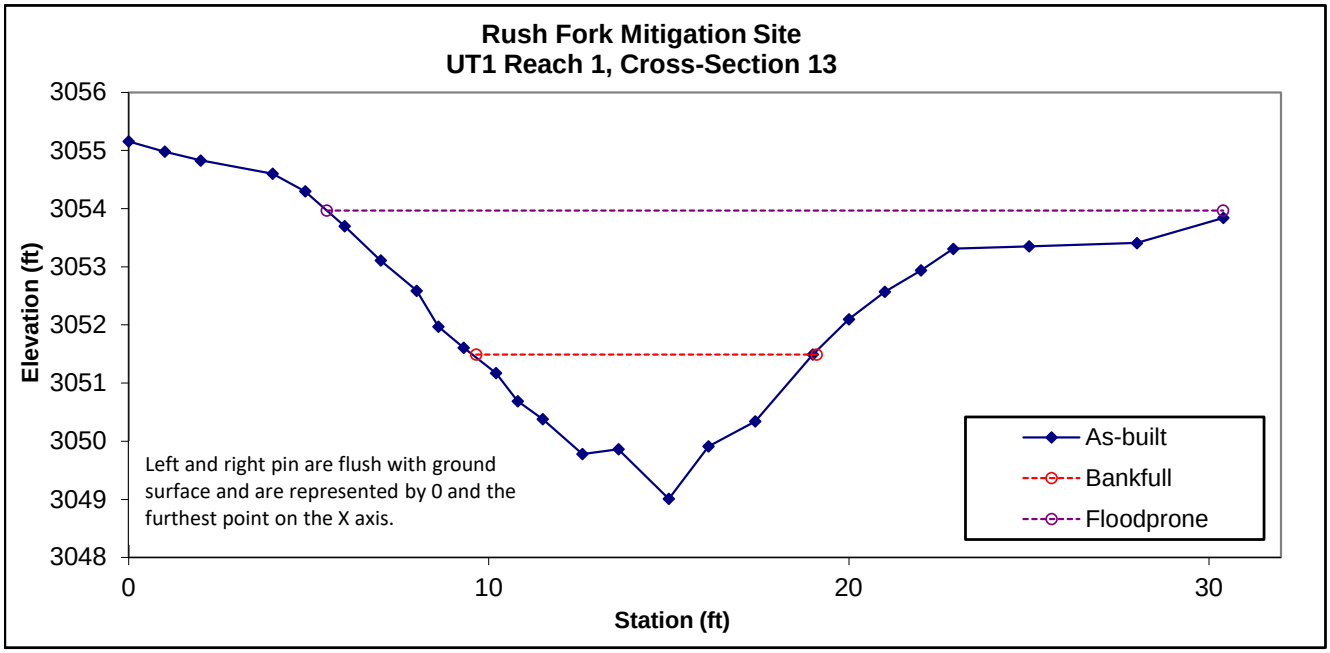
Permanent Cross-Section 13

(As-built Survey Data Collected: March 2022)
Enhancement

Looking at the Left Bank

Looking at the Right Bank

Feature	Stream Type	BKF Area	BKF Width	BKF Depth	Max BKF Depth	W/D	BH Ratio	ER	BKF Elev	TOB Elev
Pool	E	12.13	9.45	1.28	2.48	7.38	----	----	3051.49	3051.49



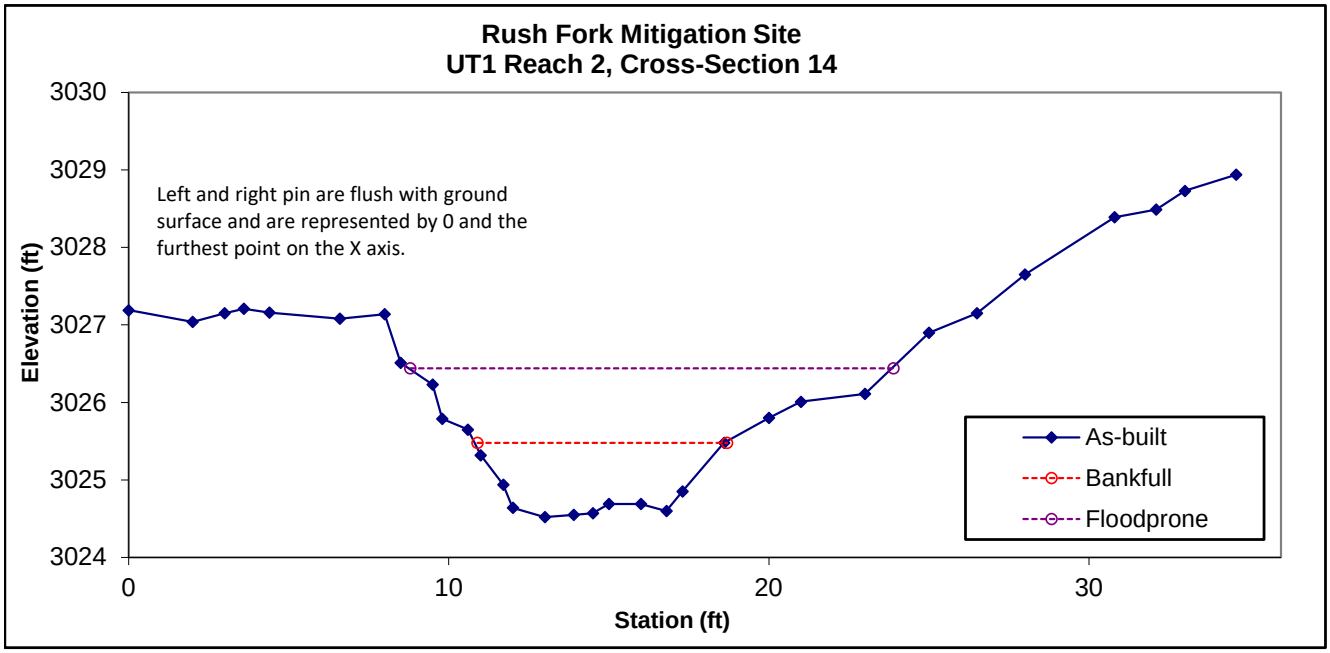
Permanent Cross-Section 14

(As-built Survey Data Collected: March 2022)
Enhancement

Looking at the Left Bank

Looking at the Right Bank

Feature	Stream Type	BKF Area	BKF Width	BKF Depth	Max BKF Depth	W/D	BH Ratio	ER	BKF Elev	TOB Elev
Riffle	B	5.44	7.79	0.7	0.96	11.13	1.0	1.94	3025.48	3025.48



Permanent Cross-Section 15

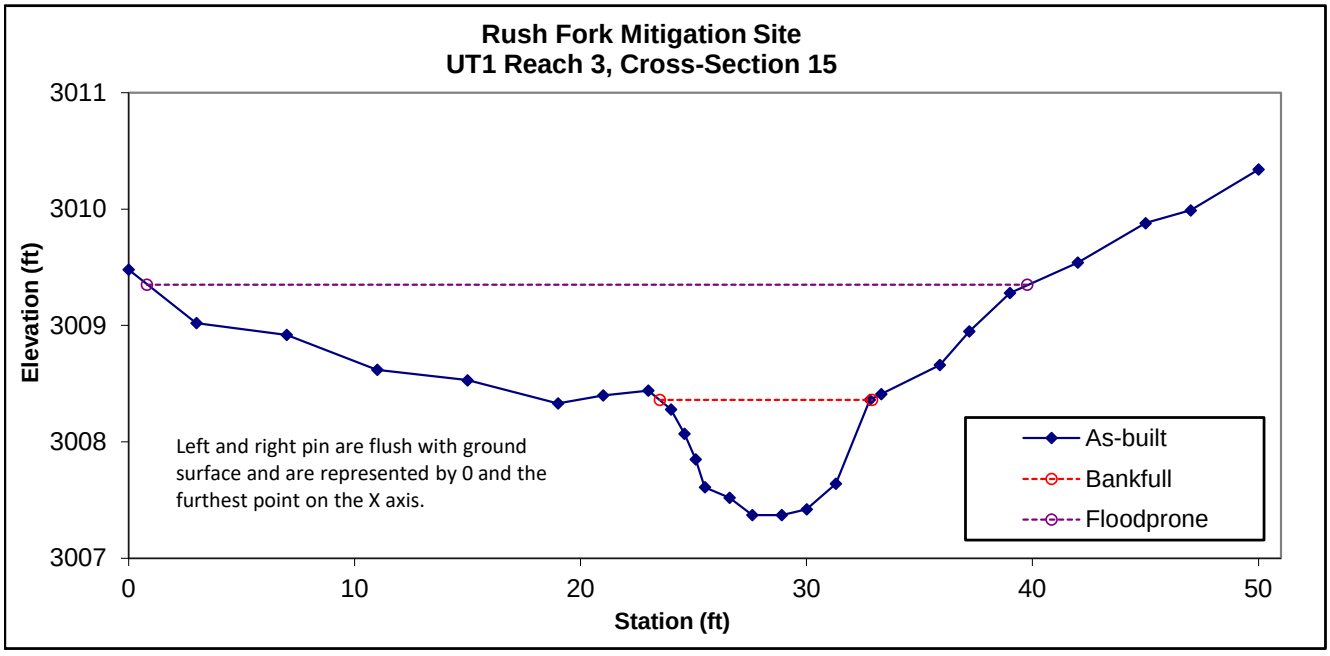
(As-built Survey Data Collected: March 2022)

Enhancement

Looking at the Left Bank

Looking at the Right Bank

Feature	Stream Type	BKF Area	BKF Width	BKF Depth	Max BKF Depth	W/D	BH Ratio	ER	BKF Elev	TOB Elev
Riffle	C	6.36	10.76	0.6	0.99	18.24	1.0	3.62	3008.35	3008.35



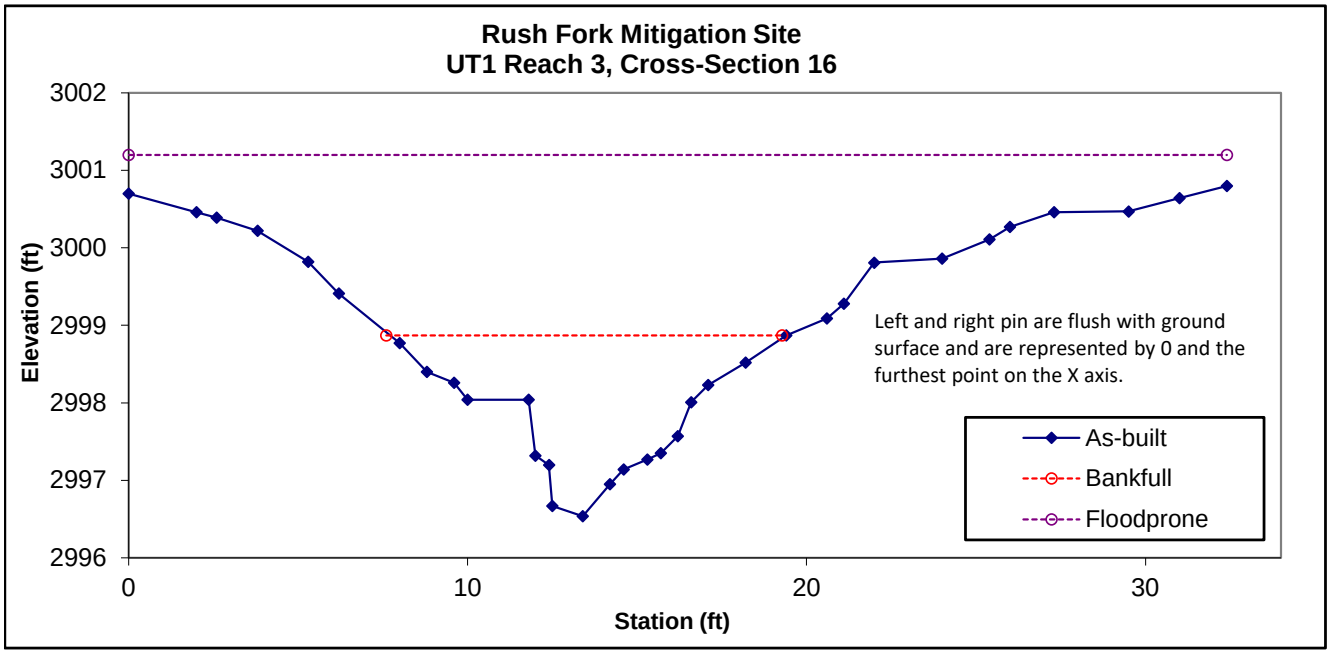
Permanent Cross-Section 16

(As-built Survey Data Collected: March 2022)
Enhancement

Looking at the Left Bank

Looking at the Right Bank

Feature	Stream Type	BKF Area	BKF Width	BKF Depth	Max BKF Depth	W/D	BH Ratio	ER	BKF Elev	TOB Elev
Pool	--	12.06	11.68	1.03	2.33	11.34	--	--	2998.87	2998.87



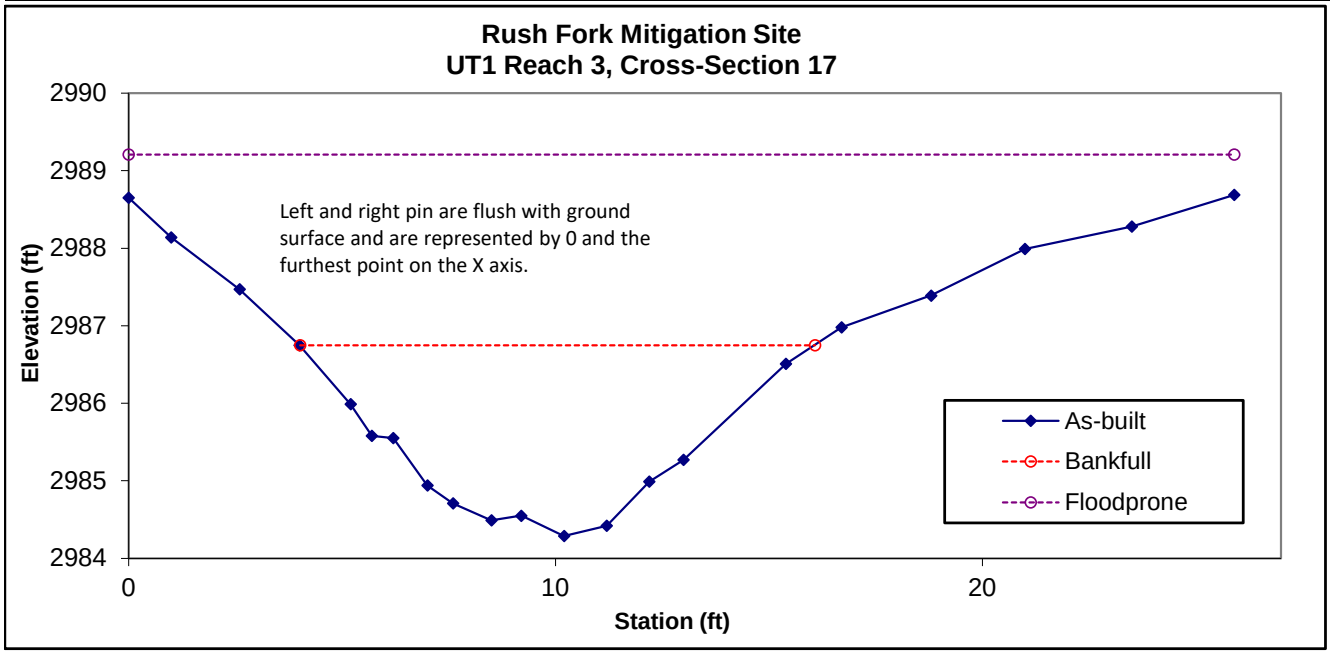
Permanent Cross-Section 17

(As-built Survey Data Collected: March 2022)
Enhancement

Looking at the Left Bank

Looking at the Right Bank

Feature	Stream Type	BKF Area	BKF Width	BKF Depth	Max BKF Depth	W/D	BH Ratio	ER	BKF Elev	TOB Elev
Pool	B	17.6	12.06	1.5	2.46	8.26	----	----	2986.75	2986.75



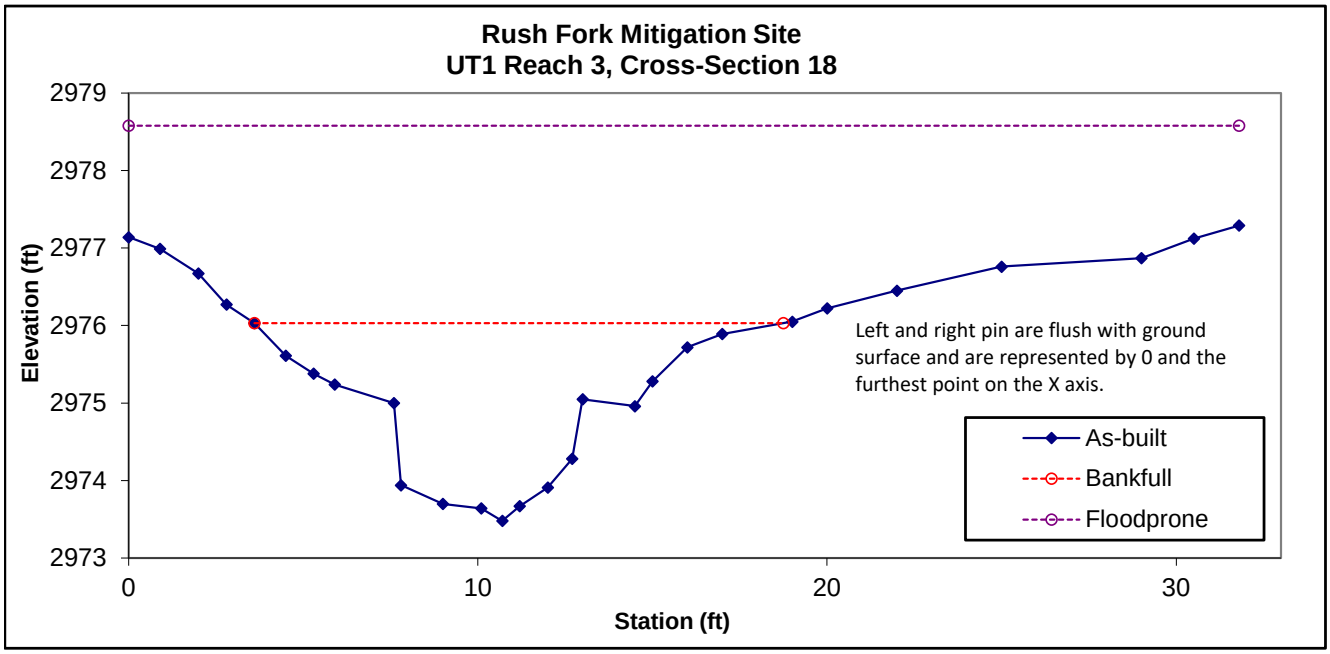
Permanent Cross-Section 18

(As-built Survey Data Collected: March 2022)
Enhancement

Looking at the Left Bank

Looking at the Right Bank

Feature	Stream Type	BKF Area	BKF Width	BKF Depth	Max BKF Depth	W/D	BH Ratio	ER	BKF Elev	TOB Elev
Pool	B	17.29	15.15	1.14	2.55	13.29	----	----	2976.03	2976.03



APPENDIX E

Record Drawing Plan Sheets

STATE	BAKER PROJECT REFERENCE NO.	SHEET NO.	TOTAL SHEETS
NC	166680	1	24

NORTH CAROLINA
DIVISION OF MITIGATION SERVICES

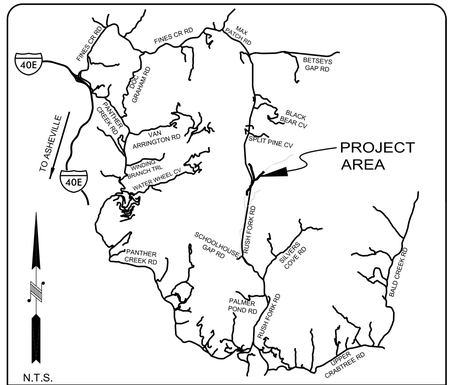
HAYWOOD COUNTY

LOCATION: FROM EXIT 24 ON INTERSTATE 40, TRAVEL NORTH FOR 5.75 MILES ON NC HWY 209 RUSH FORK ROAD

TYPE OF WORK: RECORD DRAWINGS

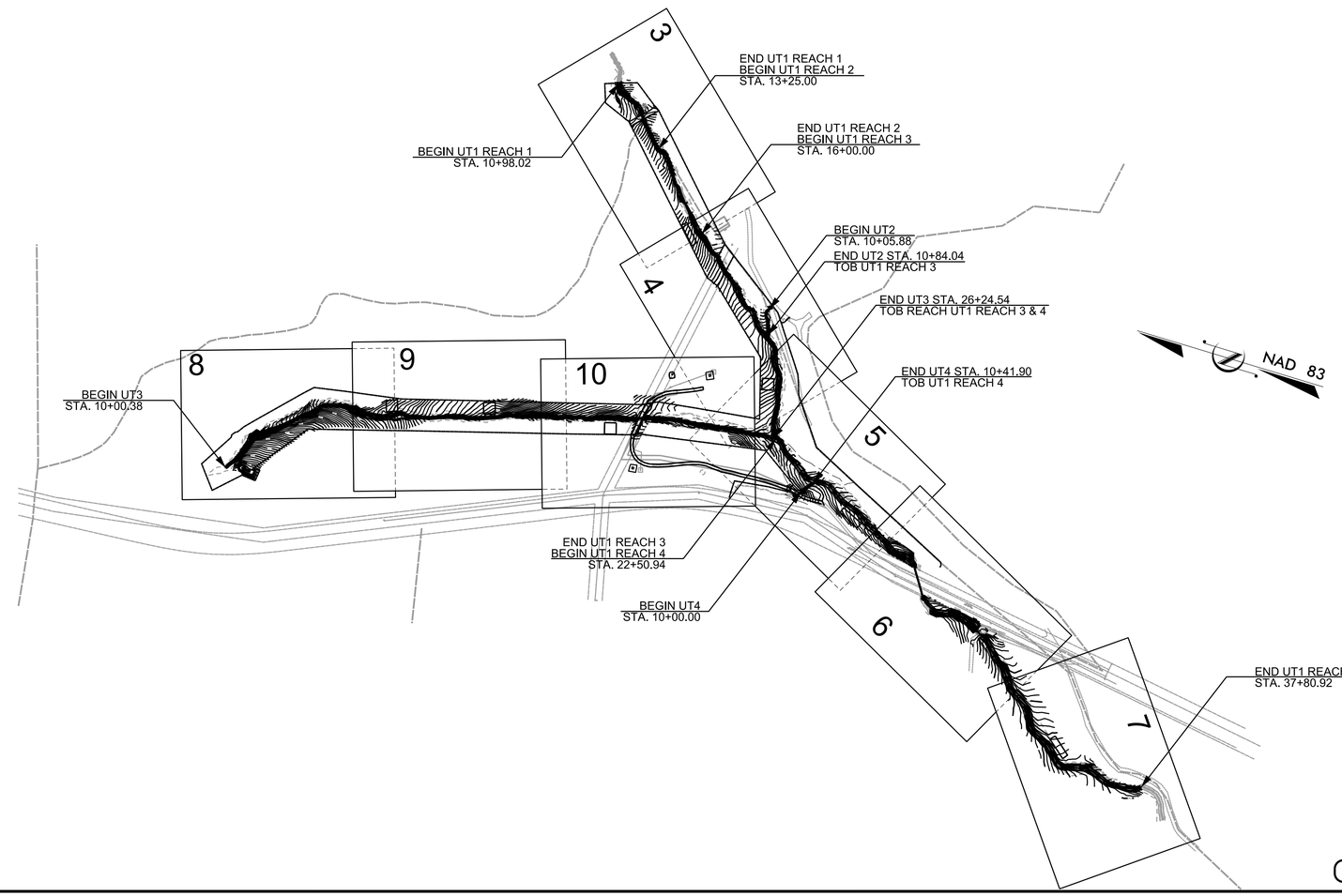
PROJECT: 166680

UT to RUSH FORK



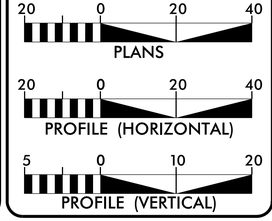
VICINITY MAP

INDEX OF SHEETS



NCDMS ID NO. 100068

GRAPHIC SCALES



MITIGATION SUMMARY

REACH	STREAM RESTORATION	STREAM ENHANCEMENT I	STREAM ENHANCEMENT II
UT1 R1	0	206.41	0
UT1 R2	0	0	275.00
UT1 R3	0	600.86	0
UT1 R4	1224.37	0	0
UT2	0	0	78.16
UT3	1577.53	0	0
UT4	41.90	0	0
TOTAL	2843.80	807.27	353.16

PREPARED FOR THE OFFICE OF:

NCDEQ
NC DIVISION OF MITIGATION SERVICES
217 WEST JONES STREET, SUTIE 3000a
RALEIGH, NC 27603

CONTACT: PAUL WIESNER
PROJECT MANAGER

Michael Baker INTERNATIONAL
Michael Baker Engineering Inc.
8000 Regency Parkway, Suite 600
Cary, NORTH CAROLINA 27518
Phone: 919.463.5488
Fax: 919.463.5490
License #: F-1084

LETTING DATE:

KATHLEEN M. MCKEITHAN, PE
PROJECT ENGINEER

PROJECT ENGINEER

NORTH CAROLINA PROFESSIONAL SEAL 028432 ENGINEER KATHLEEN M. MCKEITHAN

SIGNATURE: *P.E.*

2/26/03

STREAM CONVENTIONAL SYMBOLS

SUPERCEDES SHEET 1-B

- J-HOOK VANE
- GRADE CONTROL J-HOOK VANE
- ROCK VANE
- OUTLET PROTECTION
- ROCK CROSS VANE
- DOUBLE DROP ROCK CROSS VANE
- LOG AND ROCK STEP / POOL
- TEMPORARY ROCK DAM
- ROOT WAD
- LOG J-HOOK VANE
- GRADE CONTROL LOG J-HOOK VANE
- LOG VANE
- LOG STEP
- LOG CROSS VANE
- LOG ROLLER
- CONSTRUCTED RIFFLE
- BOULDER CLUSTER
- BOULDER STEP
- SAFETY FENCE
- TF — TAPE FENCE
- WLB — JURISDICTIONAL WETLAND BOUNDARY

- FP — 100 YEAR FLOOD PLAIN
- CE — CONSERVATION EASEMENT
- 435 — EXISTING MAJOR CONTOUR
- EXISTING MINOR CONTOUR
- LIMITS OF DISTURBANCE
- PROPERTY LINE
- FOOT BRIDGE
- TEMPORARY STREAM CROSSING
- PERMANENT STREAM CROSSING
- TRANSPLANTED VEGETATION
- TREE REMOVAL
- TREE PROTECTION
- DITCH PLUG
- CHANNEL FILL
- SOD MAT WITH WOOD TOE
- GEOLIFT WITH BRUSH TOE
- ROOT WAD REVETMENT WITH LIVE BRUSH
- BOULDER TOE PROTECTION
- PROPOSED WETLAND RE-ESTABLISHMENT
- PROPOSED WETLAND ENHANCEMENT
- PROPOSED WETLAND REHABILITATION

- MONITORING WELL
- RAIN GAUGE
- CREST GAUGE
- IN STREAM FLOW GAUGE

**NOTE: ALL ITEMS ABOVE MAY NOT BE USED ON THIS PROJECT

STANDARD SPECIFICATIONS

NORTH CAROLINA
EROSION AND SEDIMENT CONTROL PLANNING AND DESIGN MANUAL
MARCH 2009 (REV 2013)

6.06 TEMPORARY GRAVEL CONSTRUCTION ENTRANCE
6.24 RIPARIAN AREA SEEDING
6.60 TEMPORARY SEDIMENT TRAP
6.62 TEMPORARY SILT FENCE
6.63 TEMPORARY ROCK DAM
6.70 TEMPORARY STREAM CROSSING

PROJECT REFERENCE NO.	SHEET NO.
166680	1-A

PROJECT ENGINEER

NORTH CAROLINA PROFESSIONAL SEAL 028432 ENGINEER KATHLEEN M MCKETHAN

APPROVED BY:

DATE:

Michael Baker INTERNATIONAL
Michael Baker Engineering Inc.
8000 Regency Parkway, Suite 600
Cary, NORTH CAROLINA 27518
Phone: 919.463.5488
Fax: 919.463.5490
License #: F-1084

NCDMS ID NO. 100068

GENERAL NOTES

1. THE CONTRACTOR IS REQUIRED TO INSTALL IN-STREAM STRUCTURES USING A TRACK HOE WITH A HYDRAULIC THUMB OF SUFFICIENT SIZE TO PLACE BOULDERS (3'x2'x2'), LOGS AND ROOTWADS.
2. WORK IS BEING PERFORMED AS AN ENVIRONMENTAL RESTORATION PLAN. THE CONTRACTOR SHOULD MAKE ALL REASONABLE EFFORTS TO REDUCE SEDIMENT LOSS AND MINIMIZE DISTURBANCE OF THE SITE WHILE PERFORMING THE CONSTRUCTION WORK.
3. CONSTRUCTION IS SCHEDULED FOR THE SPRING OF 2020.
4. CONTRACTOR SHOULD CALL NORTH CAROLINA "ONE-CALL" BEFORE EXCAVATION STARTS. (1-800-632-4949)
5. BOULDER SIZES FOR IN-STREAM STRUCTURES SHALL BE A MINIMUM OF 3'x2'x1' AND CAN BE CHANGED PER STRUCTURE OR THE DIRECTION OF THE ENGINEER.
6. ALL ON-SITE ALLUVIUM SHALL BE HARVESTED AND STOCKPILED PRIOR TO FILLING ABANDONED CHANNELS.
7. TOPSOIL SHALL BE EXCAVATED TO A DEPTH OF 8" AND STOCKPILED SEPARATELY FROM UNDERCUT SOIL. 8" OF TOPSOIL SHALL BE PLACED ON ALL BANKFULL BENCHES AND AS DIRECTED BY THE ENGINEER.
8. ALL DISTURBED EMBANKMENTS SHALL BE MATTED WITH COIR FIBER MATTING OR AS DIRECTED BY THE ENGINEER.
9. ALL STREAM BANKS SHALL BE LIVE STAKED.
10. UNLESS THE ALIGNMENT IS BEING ALTERED, THE EXISTING CHANNEL DIMENSIONS ARE TO REMAIN UNLESS OTHERWISE NOTED.
11. CONTRACTOR WILL ENSURE THAT FENCING IS INSTALLED ON OR OUTSIDE THE CONSERVATION EASEMENT AS SHOWN ON THE PLANS BUT NO MORE THAN 1' OUTSIDE.
12. WHERE PROPOSED FENCE CROSSES EXISTING STREAMS, THE CONTRACTOR SHALL UTILIZE A SECTION OF BREAK AWAY FENCE, A FLOOD GATE, OR ELECTRIFIED CHAINS AS DIRECTED BY THE ENGINEER.
13. ANY BORROW OR WASTE ASSOCIATED WITH THIS PROJECT MUST COME FROM OR GO TO A PERMITTED SITE AND/OR FACILITY.

VEGETATION SELECTION

Proposed Bare-Root and Live Stake Species
UT to Rush Fork Mitigation Project - NCDMS Project No. 100068

Botanical Name	Common Name	% Planted by Species	Wetland Tolerance
All Buffer Plantings at 680 stems/acre using 8' X 8' spacing			
General Riparian Zone – Overstory/Canopy Species			
Betula nigra	River Birch	10%	FACW
Platanus occidentalis	Sycamore	10%	FACW
Liriodendron tulipifera	Tulip Poplar	10%	FACU
Betula lenta	Sweet Birch	10%	FAC
Quercus alba	White Oak	10%	FACU
Tilia americana	American Basswood	0%	FACU
Aesculus flava	Yellow Buckeye	7.5%	FACU
Nyssa sylvatica	Blackgum	5%	FAC
Fraxinus americana	White Ash	5%	FACU
Diospyros virginiana	Persimmon	7.5%	FAC
Ulmus americana	American Elm	5%	FACW
General Riparian Zone – Understory/Shrub Species			
Rhododendron maximum	Rosebay	0%	FAC
Lindera benzoin	Spicebush	2.5%	FAC
Ilex verticillata	Winterberry	5%	FACW
Carpinus caroliniana	American Hornbeam	5%	FAC
Sambucus canadensis	Elderberry	2.5%	FAC
Magnolia tripetala	Umbrella Tree	0%	FACU
Halesia carolina	Carolina Silverbell	5%	FAC

Wetland Zone – Overstory/Canopy Species			
Betula nigra	River Birch	15%	FACW
Platanus occidentalis	Sycamore	15%	FACW
Betula alleghaniensis	Yellow Birch	10%	FAC
Quercus imbricaria	Shingle Oak	5%	FAC
Nyssa sylvatica	Blackgum	5%	FAC
Acer negundo	Box Elder	5%	FAC
Fraxinus pennsylvanica	Green Ash	5%	FACW
Ulmus americana	American Elm	5%	FACW
Wetland Zone – Understory/Shrub Species			
Alnus serrulata	Tag Alder	15%	OBL
Ilex verticillata	Winterberry	5%	FACW
Lindera benzoin	Spicebush	5%	FAC
Cephalanthus occidentalis	Buttonbush	2.5%	OBL
Cornus amomum	Silky Dogwood	2.5%	FACW
Xanthorhiza simplicissima	Yellow-root	2.5%	FACW
Aronia arbutifolia	Red Chokeberry	2.5%	FACW
Streambank Live Stake Plantings			
Salix sericea	Silky Willow	25%	OBL
Sambucus canadensis	Elderberry	20%	FACW
Cephalanthus occidentalis	Buttonbush	10%	OBL
Cornus amomum	Silky Dogwood	25%	FACW
Salix nigra	Black Willow	20%	OBL

Proposed Permanent Seed Mixture
UT to Rush Fork Stream Mitigation Project – NCDMS Project No. 100068

Botanical Name	Common Name	% Planted by Species	Density (lbs/ac)	Wetland Tolerance
Agrostis perennans	Autumn Bentgrass	10%	1.5	FACU
Elymus virginicus	Virginia Wildrye	15%	2.25	FACW
Panicum virgatum	Switchgrass	15%	2.25	FAC
Tripsacum dactyloides	Eastern Gamma Grass	5%	0.75	FACW
Polygonum pennsylvanicum	Pennsylvania Smartweed	5%	0.75	FACW
Schizachyrium scoparium	Little Blue Stem	5%	0.75	FACU
Juncus effusus	Soft Rush	5%	0.75	FACW
Bidens frondosa (or aristosa)	Beggars Tick	5%	0.75	FACW
Coreopsis lanceolata	Lance-Leaved Tick Seed	10%	1.5	FACU
Dichanthelium clandestinum	Tioga Deer Tongue	15%	2.25	FAC
Andropogon gerardii	Big Blue Stem	5%	0.75	FAC
Sorghastrum nutans	Indian Grass	5%	0.75	FACU
	Total	**100%**	**15**	

Note: Final species selection may change due to refinement of site conditions or to availability at the time of planting. If species substitution is required, the planting Contractor will submit a revised planting list to Baker for approval prior to the procurement of plant stock.

PERCETAGES SHOWN IN RED ARE THE CONSTRUCTED PLANTED PERCENTATGE.

6/6/2022
K:\projects\166680_Rush_Fork\Design\As-Built\Plans\166680_ASB-PSH_01A.dgn
mcarey

2/26/03

PROJECT REFERENCE NO.	SHEET NO.
166680	1-B
NCDMS ID NO. 100068	

NORTH CAROLINA PROFESSIONAL SEAL 039201 ENGINEER JACOB M BYERS

APPROVED BY:

DATE:

*S.U.E = SUBSURFACE UTILITY ENGINEER

STATE OF NORTH CAROLINA
DIVISION OF HIGHWAYS

CONVENTIONAL SYMBOLS

BOUNDARIES AND PROPERTY:

- State Line
- County Line
- Township Line
- City Line
- Reservation Line
- Property Line
- Existing Iron Pin — EIP
- Property Corner
- Property Monument — ECM
- Parcel/Sequence Number — 123
- Existing Fence Line
- Proposed Woven Wire Fence
- Proposed Chain Link Fence
- Proposed Barbed Wire Fence
- Existing Wetland Boundary — WLB
- Proposed Wetland Boundary — WLB
- Existing Endangered Animal Boundary — EAB
- Existing Endangered Plant Boundary — EPB

BUILDINGS AND OTHER CULTURE:

- Gas Pump Vent or U/G Tank Cap
- Sign — S
- Well — W
- Small Mine
- Foundation
- Area Outline
- Cemetery
- Building
- School
- Church
- Dam

HYDROLOGY:

- Stream or Body of Water
- Hydro, Pool or Reservoir
- Jurisdictional Stream — JS
- Buffer Zone 1 — BZ 1
- Buffer Zone 2 — BZ 2
- Flow Arrow
- Disappearing Stream
- Spring
- Wetland
- Proposed Lateral, Tail, Head Ditch — FLOW
- False Sump

RAILROADS:

- Standard Gauge — CSX TRANSPORTATION
- RR Signal Milepost — MILEPOST 35
- Switch — SWITCH
- RR Abandoned
- RR Dismantled

RIGHT OF WAY:

- Baseline Control Point
- Existing Right of Way Marker
- Existing Right of Way Line
- Proposed Right of Way Line — RW
- Proposed Right of Way Line with Iron Pin and Cap Marker — RW
- Proposed Right of Way Line with Concrete or Granite Marker — RW
- Existing Control of Access — CA
- Proposed Control of Access — CA
- Existing Easement Line — E
- Proposed Temporary Construction Easement — E
- Proposed Temporary Drainage Easement — TDE
- Proposed Permanent Drainage Easement — PDE
- Proposed Permanent Utility Easement — PUE
- Proposed Temporary Utility Easement — TUE
- Proposed Permanent Easement with Iron Pin and Cap Marker

ROADS AND RELATED FEATURES:

- Existing Edge of Pavement
- Existing Curb
- Proposed Slope Stakes Cut — C
- Proposed Slope Stakes Fill — F
- Proposed Wheel Chair Ramp — WCR
- Existing Metal Guardrail
- Proposed Guardrail
- Existing Cable Guiderail
- Proposed Cable Guiderail
- Equality Symbol
- Pavement Removal

VEGETATION:

- Single Tree
- Single Shrub
- Hedge
- Woods Line
- Orchard
- Vineyard — Vineyard

EXISTING STRUCTURES:

MAJOR:

- Bridge, Tunnel or Box Culvert — CONC
- Bridge Wing Wall, Head Wall and End Wall — CONC WW

MINOR:

- Head and End Wall — CONC HW
- Pipe Culvert
- Footbridge
- Drainage Box: Catch Basin, DI or JB — CB
- Paved Ditch Gutter
- Storm Sewer Manhole — S
- Storm Sewer — S

UTILITIES:

POWER:

- Existing Power Pole
- Proposed Power Pole
- Existing Joint Use Pole
- Proposed Joint Use Pole
- Power Manhole — P
- Power Line Tower
- Power Transformer
- U/G Power Cable Hand Hole — HH
- H-Frame Pole
- Recorded U/G Power Line — P
- Designated U/G Power Line (S.U.E.*) — P

TELEPHONE:

- Existing Telephone Pole
- Proposed Telephone Pole
- Telephone Manhole — T
- Telephone Booth
- Telephone Pedestal — T
- Telephone Cell Tower
- U/G Telephone Cable Hand Hole — HH
- Recorded U/G Telephone Cable — T
- Designated U/G Telephone Cable (S.U.E.*) — T
- Recorded U/G Telephone Conduit — TC
- Designated U/G Telephone Conduit (S.U.E.*) — TC
- Recorded U/G Fiber Optics Cable — T FO
- Designated U/G Fiber Optics Cable (S.U.E.*) — T FO

WATER:

- Water Manhole — W
- Water Meter
- Water Valve
- Water Hydrant
- Recorded U/G Water Line — W
- Designated U/G Water Line (S.U.E.*) — W
- Above Ground Water Line — A/G Water

TV:

- TV Satellite Dish
- TV Pedestal — C
- TV Tower
- U/G TV Cable Hand Hole — HH
- Recorded U/G TV Cable — TV
- Designated U/G TV Cable (S.U.E.*) — TV
- Recorded U/G Fiber Optic Cable — TV FO
- Designated U/G Fiber Optic Cable (S.U.E.*) — TV FO

GAS:

- Gas Valve
- Gas Meter
- Recorded U/G Gas Line — G
- Designated U/G Gas Line (S.U.E.*) — G
- Above Ground Gas Line — A/G Gas

SANITARY SEWER:

- Sanitary Sewer Manhole
- Sanitary Sewer Cleanout
- U/G Sanitary Sewer Line — SS
- Above Ground Sanitary Sewer — A/G Sanitary Sewer
- Recorded SS Forced Main Line — FSS
- Designated SS Forced Main Line (S.U.E.*) — FSS

MISCELLANEOUS:

- Utility Pole
- Utility Pole with Base
- Utility Located Object
- Utility Traffic Signal Box — S
- Utility Unknown U/G Line — ?UTL
- U/G Tank; Water, Gas, Oil
- A/G Tank; Water, Gas, Oil
- U/G Test Hole (S.U.E.*)
- Abandoned According to Utility Records — AATUR
- End of Information — E.O.I.

5/24/2022
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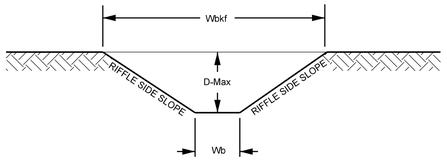
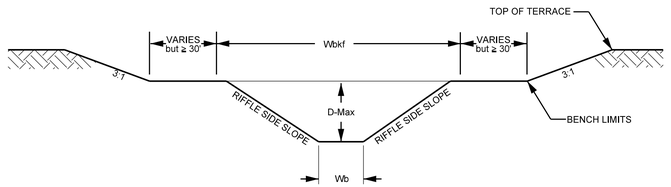
2/26/03

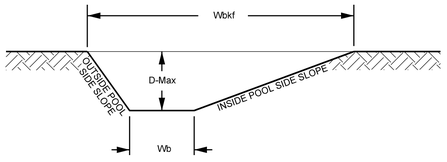
TYPICAL RIFFLE, POOL, AND BANKFULL BENCH CROSS SECTIONS



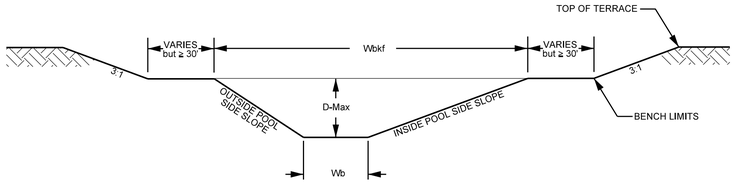
RIFFLE or PLUNGE POOL



RIFFLE WITH BANKFULL BENCH



POOL (MEANDER)



POOL WITH BANKFULL BENCH

	UT1 R1, R2, & R3 UPPER 10+00 - 19+50		UT1 R3 LOWER 19+50 - 22+61		UT1 R4 UPPER 22+61 - 28+00		UT1 R4 LOWER 28+00 - 37+95		UT2		UT3 UPPER 11+50 - 16+50		UT3 LOWER 16+50 - 26+45		UT4	
	RIFFLE	POOL	RIFFLE	POOL	RIFFLE	POOL	RIFFLE	POOL	RIFFLE	POOL	RIFFLE	POOL	RIFFLE	POOL	RIFFLE	POOL
WIDTH OF BANKFULL (Wbkf)	9.00	11.50	10.00	12.50	12.50	16.50	13.00	17.50	4.50	6.60	7.50	10.00	8.50	12.00	5.80	7.50
AVERAGE DEPTH	0.65	1.11	0.70	1.40	0.90	1.70	0.95	1.80	0.45	0.70	0.57	1.10	0.65	1.30	0.45	0.70
MAXIMUM DEPTH (Dmax)	0.80	1.50	1.00	2.00	1.20	2.50	1.30	2.50	0.60	1.00	0.70	1.70	0.85	1.80	0.50	1.00
W/D (Wbkf/Dbkf)	13.80	10.40	14.30	9.20	13.90	9.50	13.70	9.80	13.00	9.50	13.10	8.90	13.10	9.50	12.90	10.30
BANKFULL AREA (Abkf)	5.90	12.80	7.00	17.00	11.30	28.80	12.10	31.30	2.20	4.60	4.30	11.20	6.00	15.10	2.60	5.50
BOTTOM WIDTH (Wb)	5.80	5.50	5.00	4.50	8.10	6.50	8.50	7.50	4.00	2.60	4.70	3.20	4.90	4.80	3.60	3.50
RIFFLE SIDE SLOPE (X:1)	2.00	N/A	2.00	N/A	2.00	N/A	2.00	N/A	2.00	N/A	2.00	N/A	2.00	N/A	2.00	N/A
INSIDE POOL SIDE SLOPE	N/A	2.00	N/A	2.00	N/A	2.00	N/A	2.00	N/A	2.00	N/A	2.00	N/A	2.00	N/A	2.00
OUTSIDE POOL SIDE SLOPE	N/A	2.00	N/A	2.00	N/A	2.00	N/A	2.00	N/A	2.00	N/A	2.00	N/A	2.00	N/A	2.00

PROJECT REFERENCE NO.	SHEET NO.
166680	2

PROJECT ENGINEER

NORTH CAROLINA PROFESSIONAL SEAL 028432 ENGINEER KATHLEEN M MCKENNA

APPROVED BY:

DATE:

Michael Baker INTERNATIONAL

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Phone: 919.463.5488
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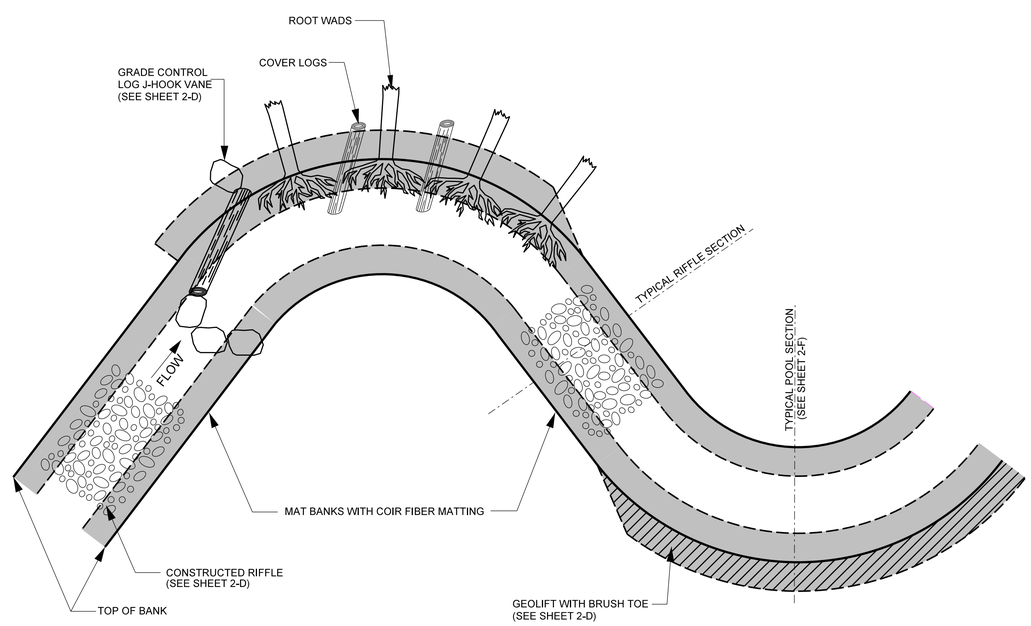
License #: F-1084

NCDMS ID NO. 100068

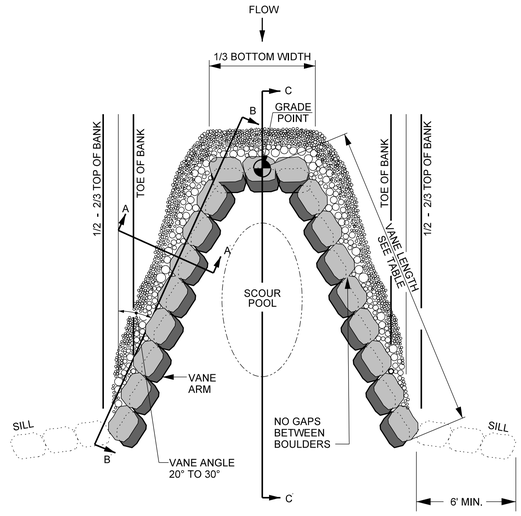
TYPICAL STRUCTURE PLACEMENT



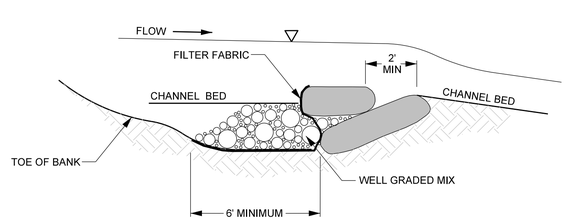
STRUCTURE NOTES:

1. GENERALLY CONSTRUCTED RIFFLES, ROOT WADS, LOG VANES AND COIR FIBER MATTING WILL BE INSTALLED IN THE LOCATION AND SEQUENCE AS SHOWN.
2. ANY CHANGES TO NUMBER OR LOCATION OF STRUCTURES DURING CONSTRUCTION MUST BE APPROVED BY THE DESIGN ENGINEER.
3. COIR FIBER MATTING TO BE INSTALLED ON ALL RESTORED STREAMBANKS, FLOODPLAIN BENCHING, AND TERRACE SLOPES AS DESCRIBED IN THE TECHNICAL SPECIFICATIONS.
4. ROOTWADS MAY BE REPLACED WITH GEOLIFT.

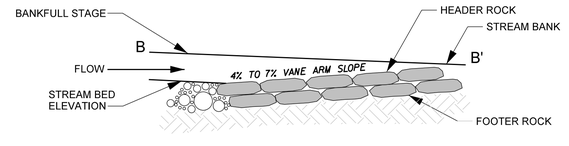
ROCK CROSS VANE



PLAN VIEW



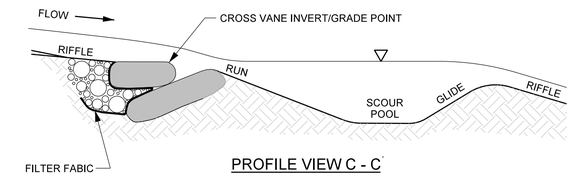
SECTION A - A'



PROFILE VIEW B - B'
VANE ARM

NOTES FOR ALL VANE STRUCTURES:

1. DIG A TRENCH BELOW THE BED FOR FOOTER ROCKS.
2. START AT BANK AND PLACE FOOTER ROCKS FIRST AND THEN HEADER (TOP) ROCK.
3. CONSTRUCT ANGLE AND SLOPE SPECIFICATIONS AS SHOWN.
4. AN EXTRA ROCK CAN BE PLACED IN SCOUR POOL FOR HABITAT IMPROVEMENT.
5. USE HAND PLACED STONE TO FILL GAPS ON UPSTREAM SIDE OF HEADER AND FOOTER ROCKS.
6. INSTALL GEOTEXTILE FABRIC BEGINNING AT THE TOP OF THE HEADER ROCKS AND EXTEND DOWNWARD TO THE DEPTH OF THE BOTTOM FOOTER ROCK, AND THEN UPSTREAM TO A MINIMUM OF SIX FEET.
7. AFTER ALL STONE BACKFILL HAS BEEN PLACED, FILL IN THE UPSTREAM SIDE OF THE STRUCTURE WITH WELL GRADED MIX OF CLASS B, CLASS A, & #57 STONE TO THE ELEVATION 2"-4" BELOW THE THE HEADER ROCK. INCORPORATE ON-SITE ALLUVIUM WHERE AVAILABLE. FILL SHOULD BE CONCAVE BEHIND THE VANE ARM TO ALLOW POOLING OF FLOW.
8. ON-SITE ALLUVIUM SHALL BE INCORPORATED INTO THE STONE BACKFILL WHERE AVAILABLE.
9. START SLOPE AT 2/3 TO 3/4 TIMES THE BANKFULL STAGE.
10. ALL REACHES, BOULDER SIZE 1' x 2' x 3' TO 2' x 2' x 4'.



PROFILE VIEW C - C'

2/26/03

PROJECT REFERENCE NO.	SHEET NO.
166680	2A

PROJECT ENGINEER

NORTH CAROLINA PROFESSIONAL SEAL 039201 ENGINEER JACOB M RYERS

APPROVED BY:

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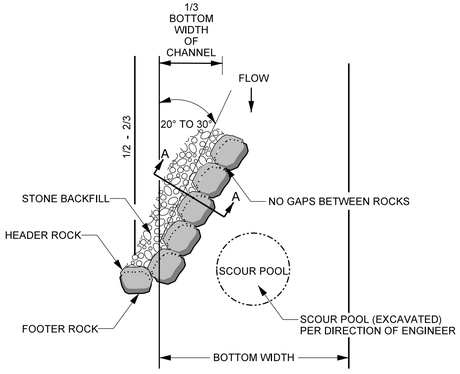
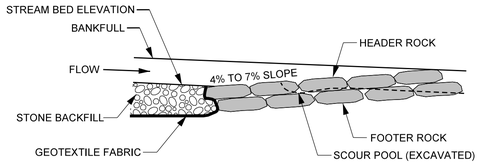
License #: F-1084

NCDMS ID NO. 100068

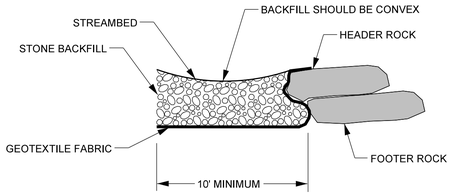
ROCK VANE



PLAN VIEW



PROFILE VIEW

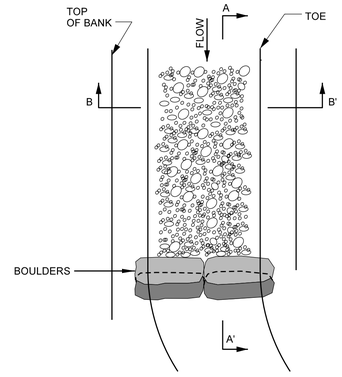


SECTION A - A

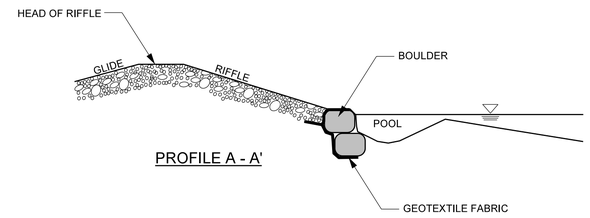
NOTES FOR ALL VANE STRUCTURES:

1. DIG A TRENCH BELOW THE BED FOR FOOTER ROCKS.
2. START AT BANK AND PLACE FOOTER ROCKS FIRST AND THEN HEADER (TOP) ROCK.
3. CONTINUE WITH STRUCTURE, FOLLOWING ANGLE AND SLOPE SPECIFICATIONS.
4. AN EXTRA ROCK CAN BE PLACED IN SCOUR POOL FOR HABITAT IMPROVEMENT.
5. USE HAND PLACED STONE TO FILL GAPS ON UPSTREAM SIDE OF HEADER AND FOOTER ROCKS.
6. INSTALL GEOTEXTILE FABRIC BEGINNING AT THE TOP OF THE HEADER ROCKS AND EXTEND DOWNWARD TO THE DEPTH OF THE BOTTOM FOOTER ROCK, AND THEN UPSTREAM TO A MINIMUM OF SIX FEET.
7. AFTER ALL STONE BACKFILL HAS BEEN PLACED, FILL IN THE UPSTREAM SIDE OF THE STRUCTURE WITH WELL GRADED MIX OF CLASS B, CLASS A, & #57 STONE TO THE ELEVATION 2"-4" BELOW THE THE HEADER ROCK. INCORPORATE ON-SITE ALLUVIUM WHERE AVAILABLE. FILL SHOULD BE CONCAVE BEHIND THE VANE ARM TO ALLOW POOLING OF FLOW.
8. START SLOPE AT 2/3 TO 3/4 TIMES THE BANKFULL STAGE.
9. ALL REACHES, BOULDER SIZE 1' x 2' x 3' TO 2' x 2' x 4'.

BOULDER STEP



PLAN VIEW

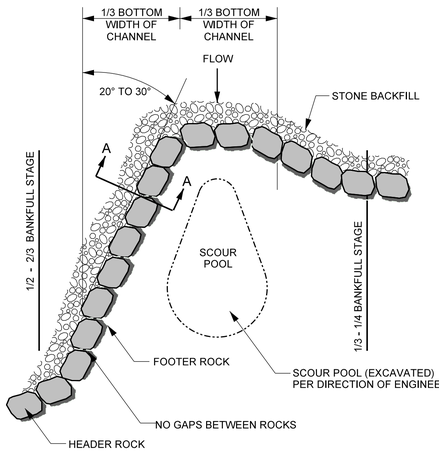


PROFILE A - A'

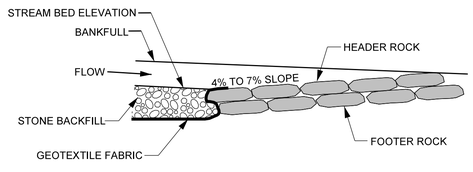
NOTES:

1. HEADER AND FOOTER BOULDERS MUST BE AT LEAST 1' X 2' X 3'.
2. FOOTERS SHALL BE INSTALLED SUCH THAT 1/4 TO 1/3 OF THE LENGTH IS DOWNSTREAM OF THE HEADER.
3. SOIL SHALL BE WELL COMPACTED AROUND BURIED PORTION OF FOOTERS WITH THE BUCKET OF EXCAVATOR.
4. INSTALL NON-WOVEN FILTER FABRIC UNDERNEATH FOOTER BOULDERS.
5. UNDERCUT THE RIFFLE ELEVATION 12 INCHES TO ALLOW FOR A LAYER OF STONE.
6. INSTALL EROSION CONTROL MATTING ALONG COMPLETED BANKS SUCH THAT THE EROSION CONTROL MATTING AT THE TOE OF THE BANK EXTENDS DOWN TO THE UNDERCUT ELEVATION.
7. FILL TRENCH WITH GRADED MIX OF CLASS A, CLASS B, AND #57 STONE TO THE BED ELEVATION OF THE CHANNEL.
8. BOULDER STEPS MUST BE EXTENDED TO A MINIMUM OF 2' INTO THE BANK. USE SILL BOULDERS IF NECESSARY.
9. THALWEG AND STEP INVERT WILL BE CONCAVE AND SHAPED PER DIRECTION OF THE DESIGNER.
10. ALL REACHES, BOULDER SIZE 1' x 2' x 3' TO 2' x 2' x 4'.

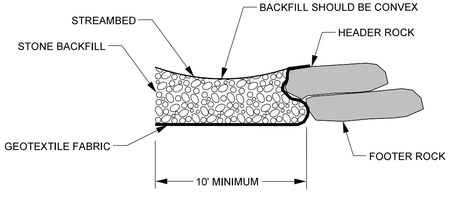
GRADE CONTROL ROCK J-HOOK VANE



PLAN VIEW



PROFILE VIEW

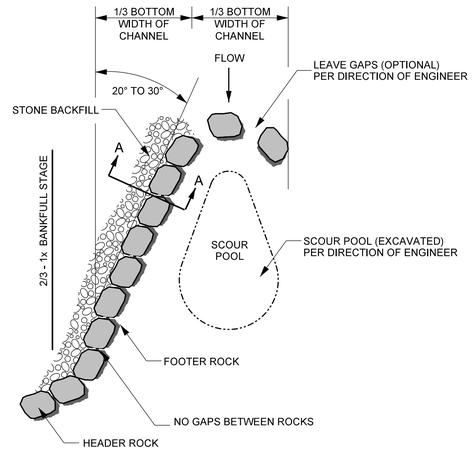


SECTION A - A

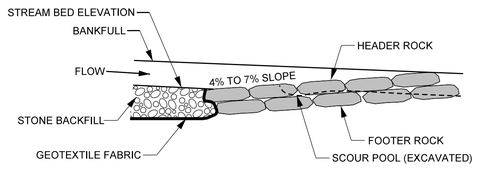
NOTES FOR ALL VANE STRUCTURES:

1. DIG A TRENCH BELOW THE BED FOR FOOTER ROCKS.
2. START AT BANK AND PLACE FOOTER ROCKS FIRST AND THEN HEADER (TOP) ROCK.
3. CONTINUE WITH STRUCTURE, FOLLOWING ANGLE AND SLOPE SPECIFICATIONS.
4. AN EXTRA ROCK CAN BE PLACED IN SCOUR POOL FOR HABITAT IMPROVEMENT.
5. USE HAND PLACED STONE TO FILL GAPS ON UPSTREAM SIDE OF HEADER AND FOOTER ROCKS.
6. INSTALL GEOTEXTILE FABRIC BEGINNING AT THE TOP OF THE HEADER ROCKS AND EXTEND DOWNWARD TO THE DEPTH OF THE BOTTOM FOOTER ROCK, AND THEN UPSTREAM TO A MINIMUM OF SIX FEET.
7. AFTER ALL STONE BACKFILL HAS BEEN PLACED, FILL IN THE UPSTREAM SIDE OF THE STRUCTURE WITH WELL GRADED MIX OF CLASS B, CLASS A, & #57 STONE TO THE ELEVATION 2"-4" BELOW THE THE HEADER ROCK. INCORPORATE ON-SITE ALLUVIUM WHERE AVAILABLE. FILL SHOULD BE CONCAVE BEHIND THE VANE ARM TO ALLOW POOLING OF FLOW.
8. START SLOPE AT 2/3 TO 3/4 TIMES THE BANKFULL STAGE.
9. ALL REACHES, BOULDER SIZE 1' x 2' x 3' TO 2' x 2' x 4'.

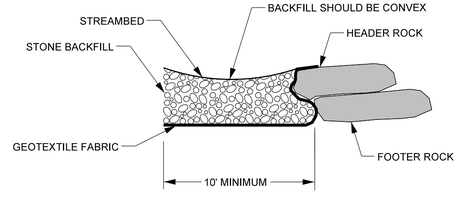
ROCK J-HOOK VANE



PLAN VIEW



PROFILE VIEW



SECTION A - A

NOTES FOR ALL VANE STRUCTURES:

1. DIG A TRENCH BELOW THE BED FOR FOOTER ROCKS.
2. START AT BANK AND PLACE FOOTER ROCKS FIRST AND THEN HEADER (TOP) ROCK.
3. CONTINUE WITH STRUCTURE, FOLLOWING ANGLE AND SLOPE SPECIFICATIONS.
4. AN EXTRA ROCK CAN BE PLACED IN SCOUR POOL FOR HABITAT IMPROVEMENT.
5. USE HAND PLACED STONE TO FILL GAPS ON UPSTREAM SIDE OF HEADER AND FOOTER ROCKS.
6. INSTALL GEOTEXTILE FABRIC BEGINNING AT THE TOP OF THE HEADER ROCKS AND EXTEND DOWNWARD TO THE DEPTH OF THE BOTTOM FOOTER ROCK, AND THEN UPSTREAM TO A MINIMUM OF SIX FEET.
7. AFTER ALL STONE BACKFILL HAS BEEN PLACED, FILL IN THE UPSTREAM SIDE OF THE STRUCTURE WITH WELL GRADED MIX OF CLASS B, CLASS A, & #57 STONE TO THE ELEVATION 2"-4" BELOW THE THE HEADER ROCK. INCORPORATE ON-SITE ALLUVIUM WHERE AVAILABLE. FILL SHOULD BE CONCAVE BEHIND THE VANE ARM TO ALLOW POOLING OF FLOW.
8. START SLOPE AT 2/3 TO 3/4 TIMES THE BANKFULL STAGE.
9. ALL REACHES, BOULDER SIZE 1' x 2' x 3' TO 2' x 2' x 4'.

5/24/2022
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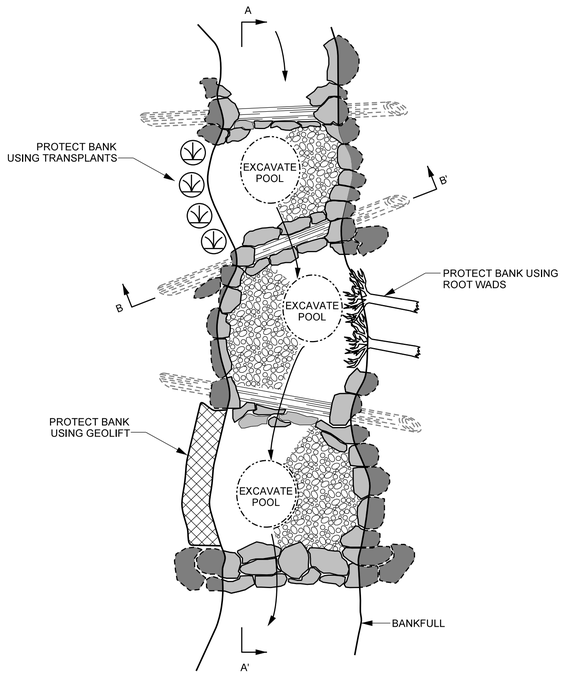
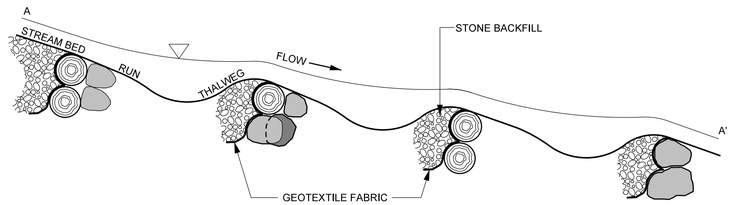
mcrain

2/26/03

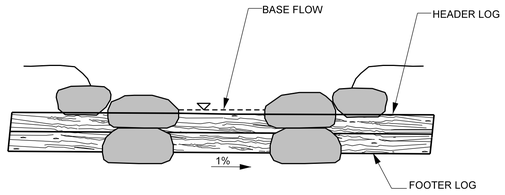
LOG AND ROCK STEP / POOL



PLAN VIEW



SECTION A - A'



SECTION B - B'

NOTES:

1. LOGS SHOULD BE AT LEAST 8" IN DIAMETER, RELATIVELY STRAIGHT, HARDWOOD, AND RECENTLY HARVESTED AND EXTENDING INTO THE BANK 3' ON EACH SIDE.
2. SOIL SHOULD BE COMPACTED WELL AROUND BURIED PORTIONS OF LOG.
3. GEOTEXTILE FABRIC SHOULD BE NAILED TO THE LOG BELOW THE BACKFILL.
4. BOULDERS SHOULD BE 1' X 2' X 3' AND PLACED ON TOP OF HEADER LOG FOR ANCHORING.
5. TOEWOOD OR TRANSPLANTS CAN BE USED INSTEAD OF BOUDERS, PER DIRECTION OF ENGINEER.
6. AFTER ALL STONE BACKFILL HAS BEEN PLACED, FILL IN THE UPSTREAM SIDE OF THE STRUCTURE WITH WELL GRADED MIX OF CLASS B, CLASS A, & #57 STONE TO THE ELEVATION OF THE TOP OF THE HEADER ROCK. INCORPORATE ON-SITE ALLUVIUM WHERE AVAILABLE.

PROJECT REFERENCE NO.	SHEET NO.
166680	2B

PROJECT ENGINEER

NORTH CAROLINA PROFESSIONAL SEAL 039201 ENGINEER JACOB M RYERS

APPROVED BY:

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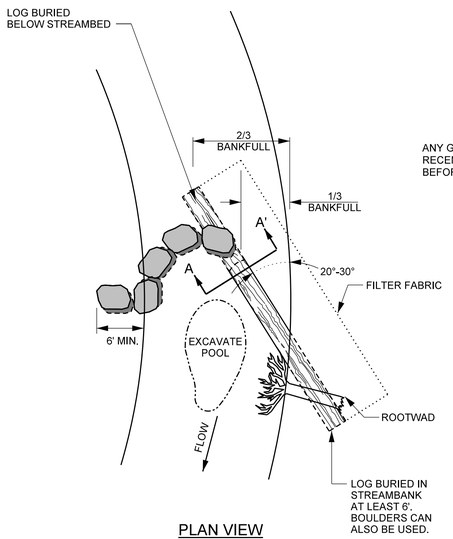
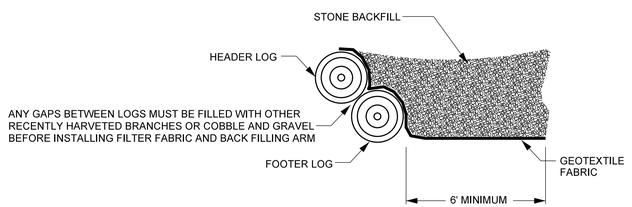
License #: F-1084

NCDMS ID NO. 100068

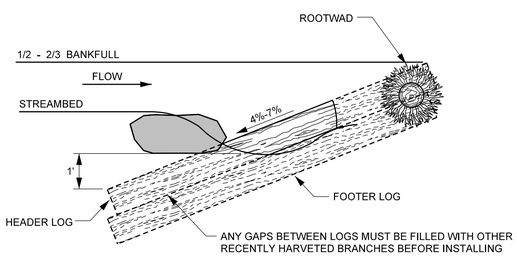
GRADE CONTROL LOG J-HOOK VANE



PLAN VIEW



SECTION A - A'

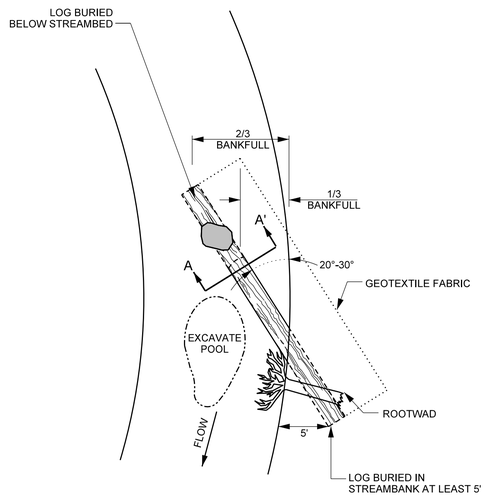


PROFILE VIEW

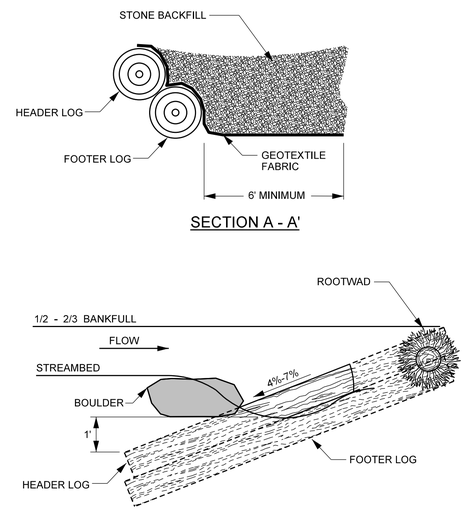
NOTES:

1. LOGS SHOULD BE AT LEAST 10" IN DIAMETER, RELATIVELY STRAIGHT, HARDWOOD, RECENTLY HARVESTED, AND FOOTERED.
2. BOULDERS MUST BE AT LEAST 2' x 2' x 1'.
3. SOIL SHOULD BE COMPACTED WELL AROUND BURIED PORTIONS OF LOG.
4. ROOTWADS SHOULD BE PLACED BENEATH THE HEADER LOG AND PLACED SO THAT IT LOCKS THE HEADER LOG INTO THE BANK, SEE ROOTWAD DETAIL.
5. BOULDERS SHOULD BE PLACED ON TOP OF HEADER LOG FOR ACHORING.
6. HEADER BOULDERS TO BE PLACED 0.5 TO 0.75 FEET APART.
7. FILTER FABRIC SHOULD BE NAILED TO THE LOG BELOW THE BACKFILL.
8. TRANSPLANTS OR BOULDERS CAN BE USED INSTEAD OF ROOWADS, PER DIRECTION OF ENGINEER.
9. BOULDER SILL MUST BE A MINIMUM OF 6'.
10. AFTER ALL STONE BACKFILL HAS BEEN PLACED, FILL IN THE UPSTREAM SIDE OF THE STRUCTURE WITH WELL GRADED MIX OF CLASS B, CLASS A, & #57 STONE TO THE ELEVATION OF THE TOP OF THE HEADER ROCK. INCORPORATE ON-SITE ALLUVIUM WHERE AVAILABLE.

LOG VANE



PLAN VIEW



SECTION A - A'

PROFILE VIEW

NOTES:

1. LOGS SHOULD BE AT LEAST 10" IN DIAMETER, RELATIVELY STRAIGHT, HARDWOOD, AND RECENTLY HARVESTED.
2. BOULDERS MUST BE OF SUFFICIENT SIZE TO ANCHOR LOGS.
3. SOIL SHOULD BE COMPACTED WELL AROUND BURIED PORTIONS OF LOGS.
4. ROOTWADS SHOULD BE PLACED BENEATH THE HEADER LOG AND PLACED SO THAT IT LOCKS THE HEADER LOG INTO THE BANK, SEE ROOTWAD DETAIL.
5. BOULDER SHOULD BE PLACED ON TOP OF HEADER LOG FOR ANCHORING.
6. GEOTEXTILE FABRIC SHOULD BE NAILED TO THE LOG BELOW THE BACKFILL.
7. TOEWOOD OR TRANSPLANTS CAN BE USED INSTEAD OF ROOTWADS, PER DIRECTION OF ENGINEER.
8. AFTER ALL STONE BACKFILL HAS BEEN PLACED, FILL IN THE UPSTREAM SIDE OF THE STRUCTURE WITH WELL GRADED MIX OF CLASS B, CLASS A, & #57 STONE TO THE ELEVATION OF THE TOP OF THE HEADER ROCK. INCORPORATE ON-SITE ALLUVIUM WHERE AVAILABLE.

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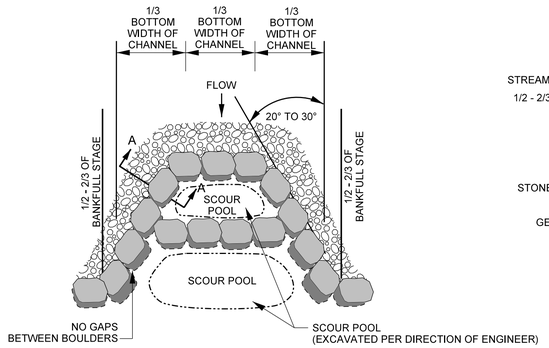
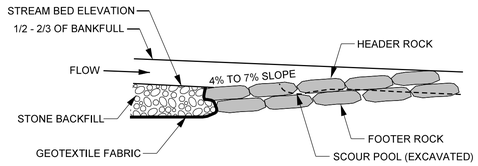
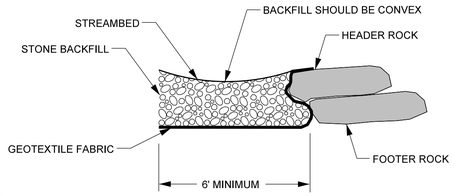
ROCK DOUBLE DROP CROSS VANE



PLAN VIEW



PROFILE VIEW

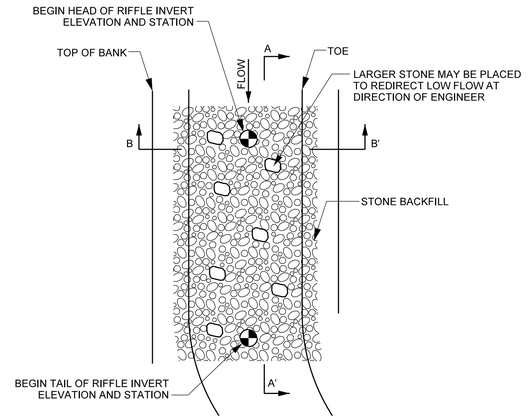


SECTION A - A

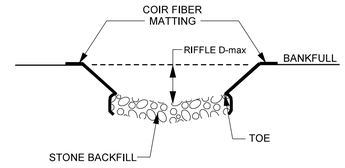
NOTES FOR ALL VANE STRUCTURES:

1. DIG A TRENCH BELOW THE BED FOR FOOTER ROCKS.
2. START AT BANK AND PLACE FOOTER ROCKS FIRST AND THEN HEADER (TOP) ROCK.
3. CONTINUE WITH STRUCTURE, FOLLOWING ANGLE AND SLOPE SPECIFICATIONS.
4. AN EXTRA ROCK CAN BE PLACED IN SCOUR POOL FOR HABITAT IMPROVEMENT.
5. USE HAND PLACED STONE TO FILL GAPS ON UPSTREAM SIDE OF HEADER AND FOOTER ROCKS.
6. INSTALL GEOTEXTILE FABRIC BEGINNING AT THE TOP OF THE HEADER ROCKS AND EXTEND DOWNWARD TO THE DEPTH OF THE BOTTOM FOOTER ROCK, AND THEN UPSTREAM TO A MINIMUM OF SIX FEET.
7. AFTER ALL STONE BACKFILL HAS BEEN PLACED, FILL IN THE UPSTREAM SIDE OF THE STRUCTURE WITH WELL GRADED MIX OF CLASS B, CLASS A, & #57 STONE TO THE ELEVATION 2"-4" BELOW THE THE HEADER ROCK. INCORPORATE ON-SITE ALLUVIUM WHERE AVAILABLE. FILL SHOULD BE CONCAVE BEHIND THE VANE ARM TO ALLOW POOLING OF FLOW.
8. START SLOPE AT 2/3 TO 3/4 TIMES THE BANKFULL STAGE.
9. ALL REACHES, BOULDER SIZE 1' x 2' x 3' TO 2' x 2' x 4'.

CONSTRUCTED RIFFLE



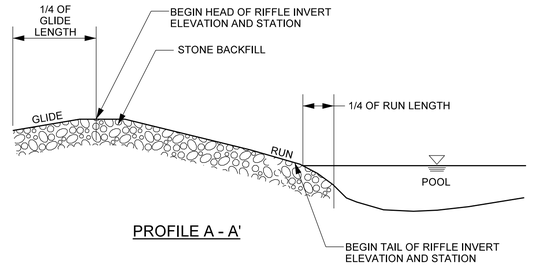
PLAN VIEW



SECTION B - B'

NOTES:

1. UNDERCUT CHANNEL BED ELEVATION AS NEEDED TO ALLOW FOR LAYERS OF STONE TO ACHIEVE FINAL GRADE.
2. INSTALL COIR FIBER MATTING ALONG COMPLETED BANKS SUCH THAT THE EROSION CONTROL MATTING AT THE TOE OF THE BANK EXTENDS DOWN TO THE UNDERCUT ELEVATION.
3. INSTALL STONE BACKFILL, COMPACTED TO GRADE.
4. FINAL CHANNEL BED SHAPE SHOULD HAVE THE ELEVATION OF THE BED 0.2 FT DEEPER IN THE CENTER THAN AT THE EDGES.
5. STONE BACKFILL SHALL CONSIST OF 10% CLASS I, 20% CLASS B, 40% CLASS A, AND 30% ON-SITE ALLUVIUM BY VOLUME OR #57 STONE.
6. CONSTRUCTED RIFFLES SHALL BE 12" THICK.
7. LARGER CLASS I & B STONES MAY EXTEND ABOVE THE BED SURFACE, BUT NO HIGHER THAN HALF BANKFULL AND SHOULD PROVIDE A "NATURAL LOOK". ENGINEER SHALL HAVE FINAL APPROVAL OF EXTENDING ROCK.
8. SATURATED WOODY DEBRIS THAT IS EXISTING WITHIN THE CHANNEL CAN BE RELOCATED INTO THE NEW RIFFLE AREAS.



PROFILE A - A'

PROJECT REFERENCE NO.	SHEET NO.
166680	2C

PROJECT ENGINEER

NORTH CAROLINA PROFESSIONAL SEAL 028432 ENGINEER KATHLEEN M WICKENHEISER

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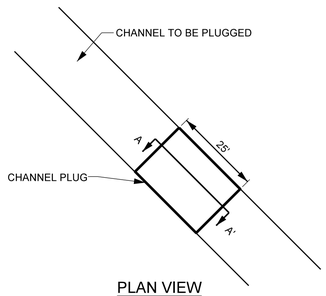
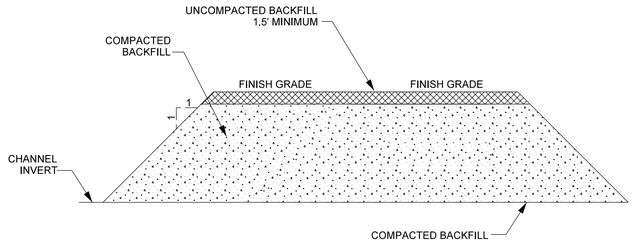
CHANNEL PLUG



PLAN VIEW

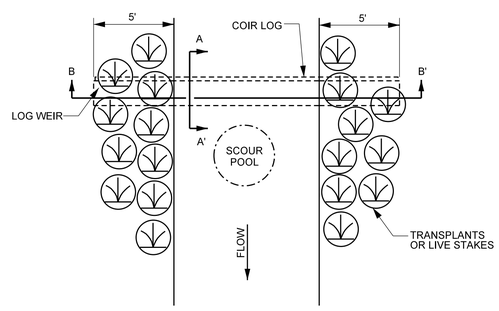
NOTES:

1. COMPACT BACKFILL USING ON-SITE HEAVY EQUIPMENT IN 10 INCH LIFTS.
2. BACKFILL OF PLUGS SHOULD INCORPORATE ANY OF-SITE CLAY AVAILABLE.

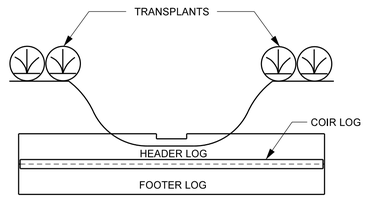


SECTION A - A'

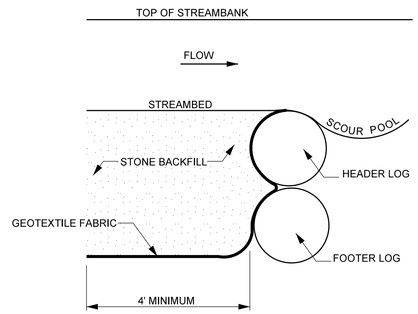
LOG DROP



PLAN VIEW



CROSS SECTION VIEW B - B'



SECTION A - A'

NOTES:

1. LOGS SHOULD BE AT LEAST 10 INCHES IN DIAMETER, RELATIVELY STRAIGHT, HARDWOOD, AND RECENTLY HARVESTED.
2. TOP OF HEADER LOG SHOULD BE SET AT SAME ELEVATION AS THE STREAMBED.
3. USE GEOTEXTILE FABRIC WITH COIR LOGS TO SEAL GAPS BETWEEN LOGS.
4. PLACE TRANSPLANTS ALONG BANKS TO PROTECT AGAINST BANK EROSION.
5. THE HEADER LOG SHOULD BE NOTCHED 2 - 3 INCHES DEEP IN THE CENTER AND FOR 20 - 30% OF THE CHANNEL WIDTH.

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PROJECT REFERENCE NO.	SHEET NO.
166680	2D

PROJECT ENGINEER

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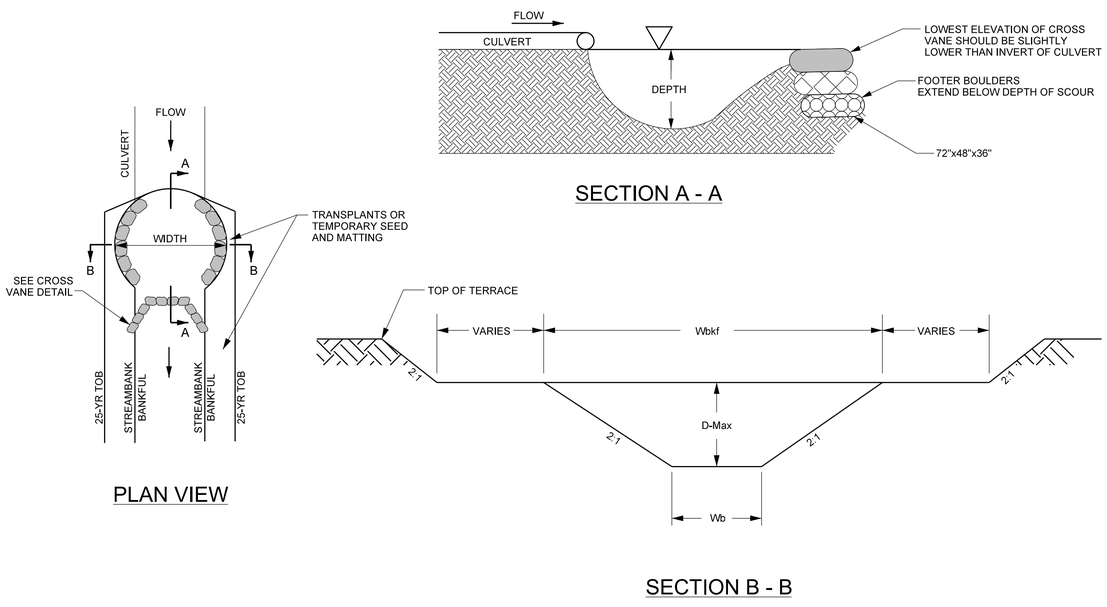
License #: F-1084

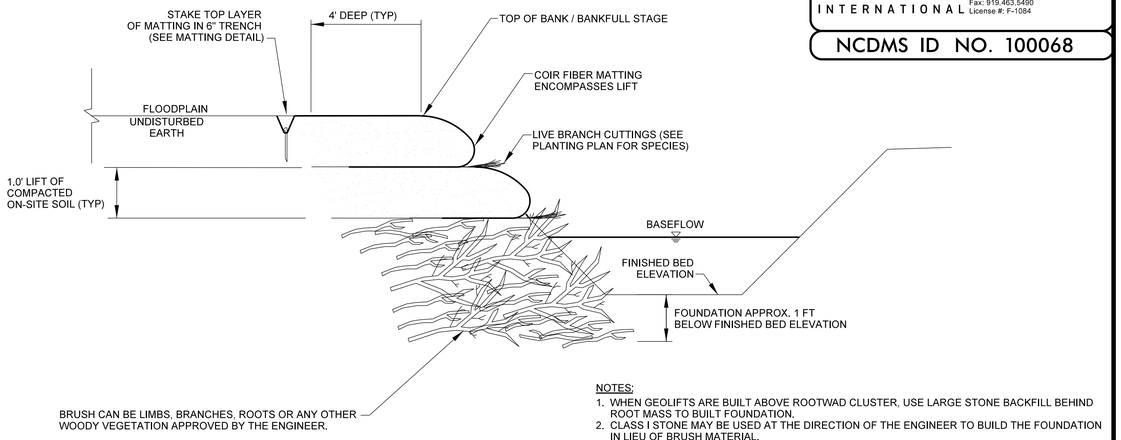
NCDMS ID NO. 100068

PLUNGE POOL



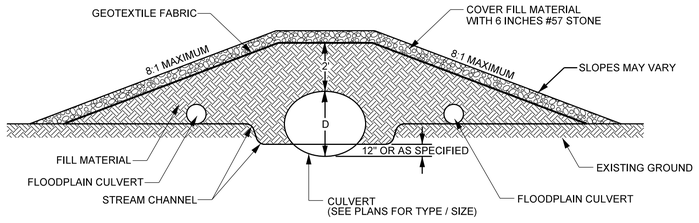
GEOLIFT WITH BRUSH TOE

NOTES:
1. LIVE BRANCH CUTTINGS SHALL BE THE SAME SPECIES AS THE LIVE STAKES AND SHALL BE INSTALLED DURING VEGETATION DORMANCY.
2. LIVE BRANCH CUTTINGS SHALL BE INSTALLED AT A DENSITY OF 20-30 CUTTINGS PER LINEAR FOOT AND A MAXIMUM DIAMETER OF 2.5 INCHES.
3. NUMBER OF SOIL LIFTS MAY VARY. IN GENERAL LIFTS SHALL EXTEND TO THE TOP OF BANK OR BANKFULL STAGE.



NOTES:
1. WHEN GEOLIFTS ARE BUILT ABOVE ROOTWAD CLUSTER, USE LARGE STONE BACKFILL BEHIND ROOT MASS TO BUILT FOUNDATION.
2. CLASS I STONE MAY BE USED AT THE DIRECTION OF THE ENGINEER TO BUILD THE FOUNDATION IN LIEU OF BRUSH MATERIAL.

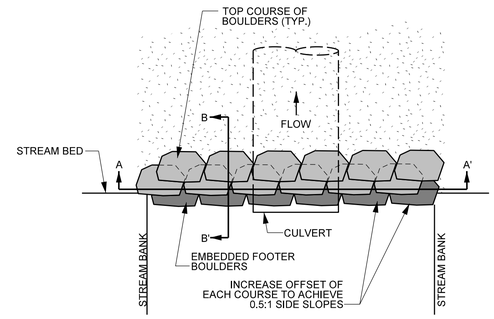
PERMANENT STREAM CROSSING

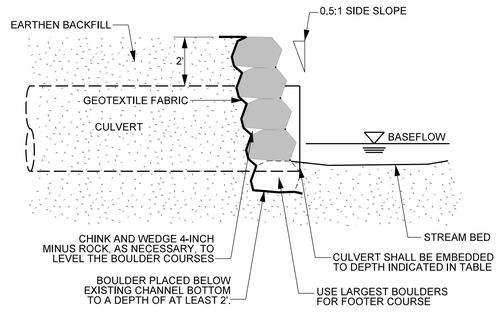


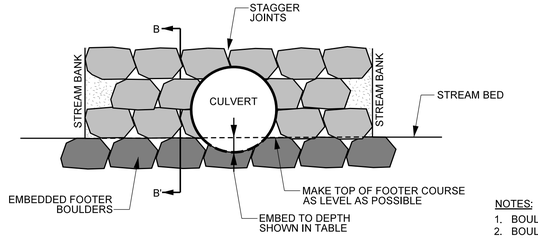
CROSS SECTION VIEW

NOTES:
1. SIZE DIMENSIONS SHOWN ON PLANS.
2. APPLY SUFFICIENT FILL (2' MIN) OVER CULVERT TO PREVENT COLLAPSE.
3. STABILIZE SIDE SLOPES WITH EROSION CONTROL MATTING AND FILL AROUND CULVERTS WITH CLASS II STONE.
4. INSTALL HEADWALLS AND ENDWALLS AS SHOWN ON THE PLANS AND IN THE DETAILS.
5. PRIMARY CULVERT SHOULD BE INSTALLED 12" OR AS SPECIFIED BELOW CHANNEL ELEVATION.

BOULDER HEADWALL / ENDWALL







REACH	BOULDER SIZE	CULVERT SIZE	EMBEDMENT
UT1-R1	1'x2'x2'	4 FT	12 IN
UT1-R4	1'x2'x2'	5 FT	12 IN
UT3	1'x2'x2'	4 FT	9.6 IN
UT4	1'x1'x1'	3 FT	12 IN

NOTES:
1. BOULDERS SHALL BE TOUCHING SO THAT VOID SPACE IS MINIMIZED.
2. BOULDERS SHOULD EXTEND BELOW SCOUR DEPTH. FOOTER BOULDERS SHALL BE AT LEAST 2' BELOW THE EXISTING BED
3. GEOTEXTILE MATTING SHOULD BE PLACED BETWEEN BOULDERS AND SOIL.
4. BOULDERS SHOULD BE BACKFILLED AND COMPACTED. VOID SPACE BETWEEN FABRIC AND BOULDER OR ROCK FILL MATERIAL, SHOULD BE MINIMIZED.
5. BOULDERS SHOULD NOT BE HIGHER THAN THE TOP OF CROSSING ELEVATION.
6. FILTER FABRIC SHOULD BE PLACED BEHIND BOULDERS, BURIED BELOW BOULDER DEPTH, AND EXTEND INTO THE BANK.

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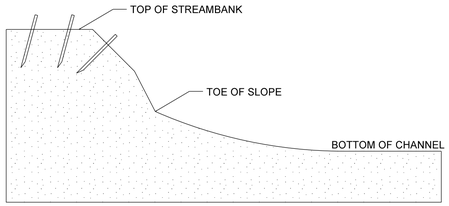
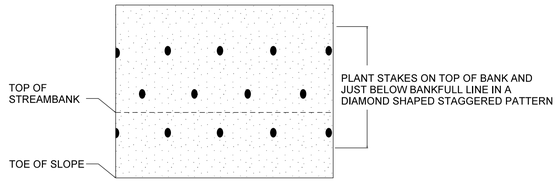
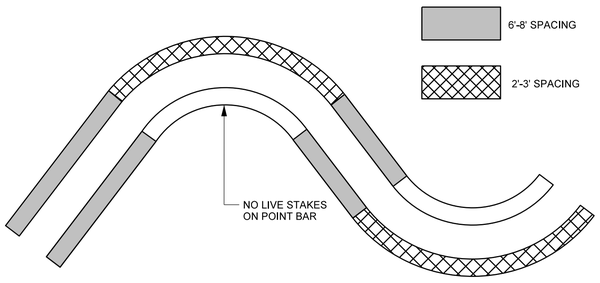
LIVE STAKING



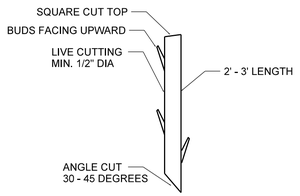
CROSS SECTION VIEW



PLAN VIEW



PLAN VIEW

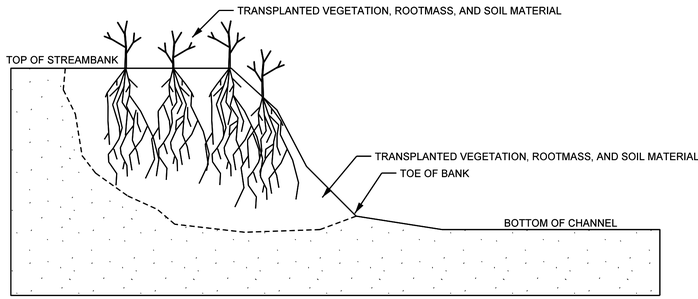


LIVE STAKE DETAIL

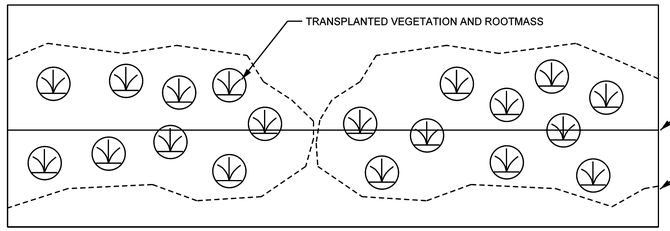
NOTES:

1. STAKES SHOULD BE CUT AND INSTALLED ON THE SAME DAY.
2. DO NOT INSTALL STAKES THAT HAVE BEEN SPLIT.
3. STAKES MUST BE INSTALLED WITH BUDS POINTING UPWARDS.
4. STAKES SHOULD BE INSTALLED PERPENDICULAR TO BANK.
5. STAKES SHOULD BE 1/2 TO 2 INCHES IN DIAMETER AND 2 TO 3 FT LONG.
6. STAKES SHOULD BE INSTALLED LEAVING 1/5 OF STAKE ABOVE GROUND.

TRANSPLANTED VEGETATION



CROSS SECTION VIEW



PLAN VIEW

NOTES:

1. EXCAVATE A HOLE IN THE BANK TO BE STABILIZED THAT WILL ACCOMMODATE THE SIZE OF TRANSPLANT TO BE PLACED. BEGIN EXCAVATION AT THE TOE OF THE BANK.
2. EXCAVATE TRANSPLANT USING A FRONT END LOADER. EXCAVATE THE ENTIRE ROOT MASS AND AS MUCH ADDITIONAL SOIL MATERIAL AS POSSIBLE. IF ENTIRE ROOT MASS CAN NOT BE EXCAVATE IN ONE BUCKET LOAD, THE TRANSPLANT IS TOO LARGE AND ANOTHER SHOULD BE SELECTED.
3. PLACE TRANSPLANT IN THE BANK TO BE STABILIZED SO THAT VEGETATION IS ORIENTATED VERTICALLY.
4. FILL IN ANY HOLES AROUND THE TRANSPLANT AND COMPACT.
5. ANY LOOSE SOIL LEFT IN THE STREAM SHOULD BE REMOVED.
6. PLACE MULTIPLE TRANSPLANTS CLOSE TOGETHER SUCH THAT THEY TOUCH.

PROJECT REFERENCE NO.	SHEET NO.
166680	2E

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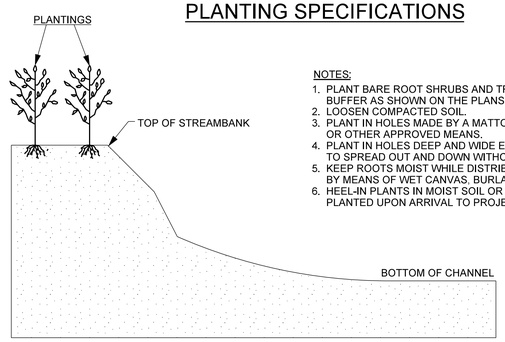
NCDMS ID NO. 100068

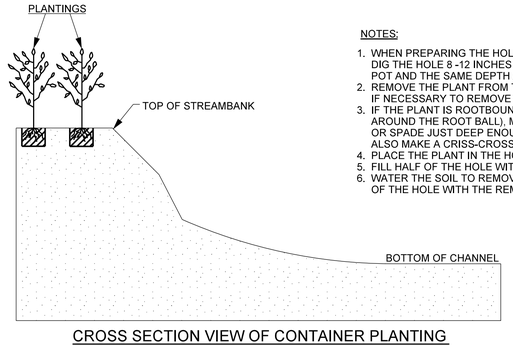
PLANTING SPECIFICATIONS



CROSS SECTION VIEW OF BARE ROOT PLANTING

NOTES:

1. PLANT BARE ROOT SHRUBS AND TREES TO THE WIDTH OF THE BUFFER AS SHOWN ON THE PLANS.
2. LOOSEN COMPACTED SOIL.
3. PLANT IN HOLES MADE BY A MATTOCK, DIBBLE, PLANTING BAR, OR OTHER APPROVED MEANS.
4. PLANT IN HOLES DEEP AND WIDE ENOUGH TO ALLOW THE ROOTS TO SPREAD OUT AND DOWN WITHOUT J-ROOTING.
5. KEEP ROOTS MOIST WHILE DISTRIBUTING OR WAITING TO PLANT BY MEANS OF WET CANVAS, BURLAP, OR STRAW.
6. HEEL-IN PLANTS IN MOIST SOIL OR SAWDUST IF NOT PROMPTLY PLANTED UPON ARRIVAL TO PROJECT SITE.

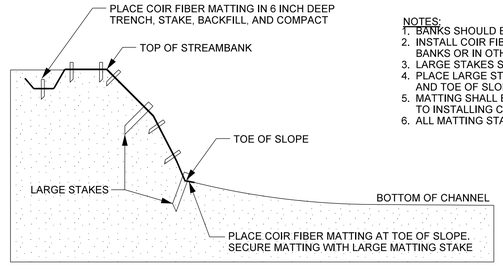


CROSS SECTION VIEW OF CONTAINER PLANTING

NOTES:

1. WHEN PREPARING THE HOLE FOR A POTTED PLANT OR SHRUB DIG THE HOLE 8 -12 INCHES LARGER THAN THE DIAMETER OF THE POT AND THE SAME DEPTH AS THE POT.
2. REMOVE THE PLANT FROM THE POT. LAY THE PLANT ON ITS SIDE IF NECESSARY TO REMOVE THE POT.
3. IF THE PLANT IS ROOTBOUND (ROOTS GROWING IN A SPIRAL AROUND THE ROOT BALL), MAKE VERTICAL CUTS WITH A KNIFE OR SPADE JUST DEEP ENOUGH TO CUT THE NET OF ROOTS. ALSO MAKE A CRISS-CROSS CUT ACROSS THE BOTTOM OF THE BALL.
4. PLACE THE PLANT IN THE HOLE.
5. FILL HALF OF THE HOLE WITH SOIL (SAME SOIL REMOVED FOR BACKFILL).
6. WATER THE SOIL TO REMOVE AIR POCKETS AND FILL THE REST OF THE HOLE WITH THE REMAINING SOIL.

COIR FIBER MATTING



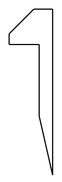
CROSS SECTION VIEW

NOTES:

1. BANKS SHOULD BE SEEDED PRIOR TO PLACEMENT OF MATTING.
2. INSTALL COIR FIBER MATTING PER SPECIFICATIONS ALONG STREAM BANKS OR IN OTHERS LOCATIONS SPECIFIED BY ENGINEER.
3. LARGE STAKES SHOULD NOT BE SPACED FURTHER THAN 36" APART.
4. PLACE LARGE STAKES ALONG ALL SEAMS, IN THE CENTER OF BANK, AND TOE OF SLOPE.
5. MATTING SHALL BE PLACED ON BANKS, STAKED, AND TRENCHED PRIOR TO INSTALLING CONSTRUCTED RIFFLE MATERIAL.
6. ALL MATTING STAKES MUST BE 100% BIODEGRADABLE.

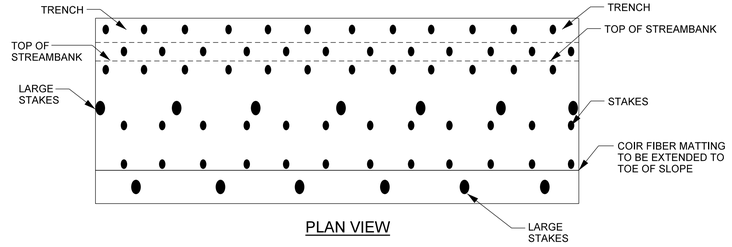
TYPICAL LARGE MATTING STAKE

LEG LENGTH	17.00 IN (43.18 CM) (TAPERED TO POINT)
WIDTH	1.5 IN (3.81 CM)
THICKNESS	1.5 IN (3.81 CM)



TYPICAL SMALL MATTING STAKE

LEG LENGTH	11.00 IN (27.94 CM)
HEAD WIDTH	1.25 IN (3.18 CM)
HEAD THICKNESS	0.40 IN (1.02 CM)
LEG WIDTH	0.60 IN (1.52 CM) (TAPERED TO POINT)
LEG THICKNESS	0.40 IN (1.02 CM)
TOTAL LENGTH	12.00 IN (30.48 CM)

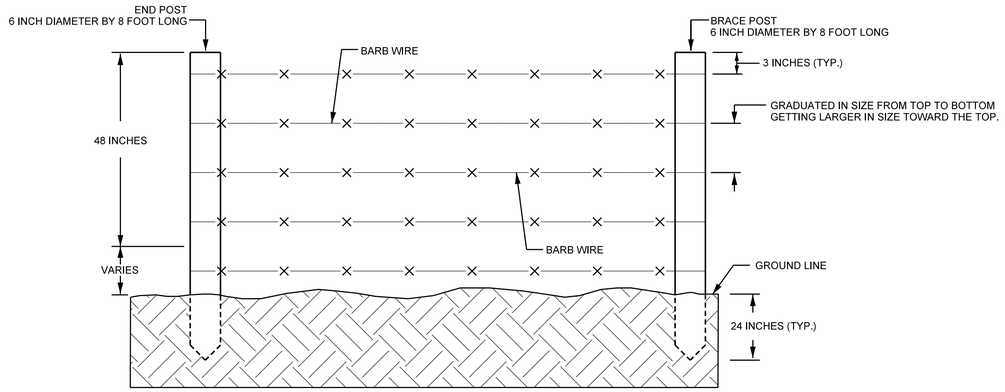


PLAN VIEW

5/24/2022
N:\Projects\166680_Rush_Fork\Design\As-Built\Plans\166680_ASB-PSH_02E.dgn
mcspadden

2/26/03

BARB WIRE FIELD FENCE

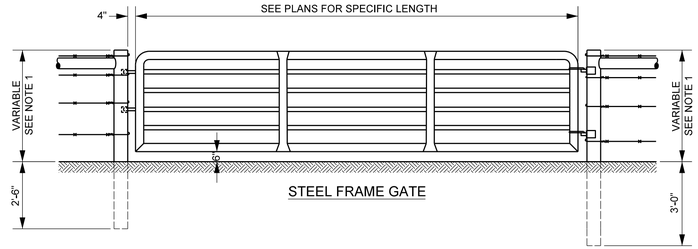


NOTE:

1. END POSTS SHALL BE INSTALLED AT A SPACING OF 10-15 FEET.

2. ALL FENCING AND FENCE POSTS SHOULD BE SET 1-2 FEET OUTSIDE OF THE CONSERVATION EASEMENT FOR FENCE LINE MAINTENANCE (LIKE HERBICIDE SPRAYING).

STEEL GATES



STEEL FRAME GATE

NOTES:

1. POST HEIGHT DIMENSION SHALL BE THE SAME AS REQUIRED FOR THE ADJACENT FENCE.
2. CONSTRUCT AN END OR STRESS PANEL, AS REQUIRED IN THE SPECIFICATION, ON EACH SIDE OF GATE.
3. HINGES AND LOCKS SHALL BE INSTALLED AS SPECIFIED BY GATE MANUFACTURER.

PROJECT REFERENCE NO.	SHEET NO.
166680	2F

PROJECT ENGINEER

NORTH CAROLINA PROFESSIONAL SEAL 028432 ENGINEER KATHLEEN M MCKENNA

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Fax: 919.463.5490
License #: F-1084

NCDMS ID NO. 100068

5/24/2022
K:\Projects\166680_Rush_Fork\Design\As-Built\Plans\166680_ASB-PSH_02F.dgn

2/26/03

BAKER PROJECT REFERENCE NO.	SHEET NO.
166680	3

PROJECT ENGINEER

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License #: F-1084

NCDMS ID NO. 100068

NAD 83

2 - 8' GATES INSTALLED IN PLACE OF 16' GATE

WE KIRK
FARMS NORTH, LLC
PIN: 8731-33-5998
DB: 838 PG: 400, TRACT IV
REFERENCE: DB: 562 PG: 286, TRACT II
AND DB: 158 PG: 305
PC: C SL: 6260

BEGIN UT1 REACH 1
STA. 10+98.02

18" CMP
INV IN: 3048.07'
INV OUT: 3046.94'

48" CMP
INV IN: 3046.47'
INV OUT: 3045.36'

END UT1 REACH 1
BEGIN UT1 REACH 2
STA. 13+25.00

BARBED WIRE FENCE (TYP.)

AS-BUILT
THALWEG (TYP.)

CONTROL POINT #305
GROUND COORDINATES
N: 713456.03'
E: 830566.09'
ELEV: 3065.15'

STA. 12+12.58

STA. 12+33.15

BOULDER
STEP (TYP.)

ROCK DOUBLE DROP
CROSS VANE (TYP.)

LOG AND ROCK
STEP POOL (TYP.)

10+00

12+00

13+00

14+00

15+00

ROCK CROSS VANE (TYP.)

4' GATE

18" CMP
INV IN: 3047.95'
INV OUT: 3046.90'

4' GATE

CREST GAUGE #2

DESIGN
THALWEG (TYP.)

AS-BUILT
TOP OF BANK (TYP.)

VEG
PLOT 5

MATCH LINE – SEE SHEET 4

GRADE CONTROL ROCK
J-HOOK VANE (TYP.)

BOULDER STEP INSTALLED
IN PLACE OF LOG DROP

2 - 8' GATES INSTALLED
IN PLACE OF 16' GATE

WE KIRK
FARMS NORTH, LLC
PIN: 8731-33-5998
DB: 838 PG: 400, TRACT IV
REFERENCE: DB: 562 PG: 286, TRACT II
AND DB: 158 PG: 305
PC: C SL: 6260

CONTROL POINT #304
GROUND COORDINATES
N: 713312.24'
E: 830259.50'
ELEV: 3038.02'

ANNE PALMER
FAMILY PROPERTIES, L.P.
PIN: 8721-72-6837
DB: 489 PG: 1683

RECORD DRAWING LEGEND

- PROPOSED DESIGN
- AS-BUILT SURVEY BY KEE MAPPING & SURVEYING 4/14/22
- RED LINE VARIATIONS FROM ORIGINAL DESIGN SUBMITTED WITH THE MITIGATION PLAN

FILL EXISTING CHANNEL

CHANNEL PLUG

UT to RUSH FORK
UT1
RECORD DRAWING

20 0 20 40
SCALE (FT)

5/24/2022
K:\Projects\166680_Rush_Fork\Design\As-Built\Plans\166680_ASB-PSH_03.dgn
mcarey

2/26/03

BAKER PROJECT REFERENCE NO.	SHEET NO.
166680	4

PROJECT ENGINEER

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NCDMS ID NO. 100068

NAD 83

WE KIRK
FARMS NORTH, LLC
PIN: 8731-33-5998
DB: 838 PG: 400, TRACT IV
REFERENCE: DB: 562 PG: 286, TRACT II
AND DB: 158 PG: 305
PC: C SL: 6260

WE KIRK
PIN: 8730-09-3258
DB: 838 PG: 404
REFERENCE: DB: 562 PG: 286, TRACT II
AND DB: 158 PG: 305
PC: C SL: 6260 & PC: C SL: 7314

SOUTHERN APPALACHIAN
HIGHLANDS CONSERVANCY
(CONSERVATION EASEMENT)
DB: 917 PG: 978
PC: C SL: 7314

BEGIN UT2
STA. 10+05.88
12" CMP
INV IN: 2997.97'
15" CPP
INV OUT: 2996.61'

EXISTING GATE REHUNG
IN THIS LOCATION
NOT IN ORIGINAL DESIGN

END UT2 STA. 10+84.04
TOB UT1 REACH 3

AS-BUILT
THALWEG (TYP.)

BARBED WIRE FENCE (TYP.)

ROCK SILL INSTALLED
IN PLACE OF LOG DROP

12' GATE

STA. 16+78.69

STA. 17+28.77

LOG AND ROCK STEP POOL (TYP.)

IN STREAM
FLOW GAUGE #2

BOULDER STEP (TYP.)

LOG DROP (TYP.)

MATCH LINE – SEE SHEET 3

MATCH LINE STA. – SEE SHEET 5

VEG
PLOT 5

VEG
PLOT
6

END UT1 REACH 2
BEGIN UT1 REACH 3
STA. 16+00.00

4' GATE

AS-BUILT
TOP OF BANK (TYP.)

ROCK CROSS VANE (TYP.)

4' GATE INSTALLED
NOT IN ORIGINAL
DESIGN

ANNE PALMER
FAMILY PROPERTIES, L.P.
PIN: 8721-72-6837
DB: 489 PG: 1683

GRADE CONTROL ROCK
J-HOOK VANE (TYP.)

CONFLUENCE STATION
UT1 REACH3 STA.19+54.61=
UT2 STA. 10+92.40

4' GATE

BARBED WIRE FENCE (TYP.)

RECORD DRAWING LEGEND

- PROPOSED DESIGN
- AS-BUILT SURVEY BY KEE MAPPING & SURVEYING 4/14/22
- RED LINE VARIATIONS FROM ORIGINAL DESIGN SUBMITTED WITH THE MITIGATION PLAN

FILL EXISTING CHANNEL

CHANNEL PLUG

UT to RUSH FORK
UT1
RECORD DRAWING

20 0 20 40
SCALE (FT)

5/31/2022
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2/26/03

BAKER PROJECT REFERENCE NO.	SHEET NO.
166680	5

PROJECT ENGINEER

NORTH CAROLINA PROFESSIONAL SEAL 028432 ENGINEER KATHLEEN W MCKITHAN

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NCDMS ID NO. 100068

WE KIRK
PIN: 8730-09-3258
DB: 838 PG: 404
REFERENCE: DB: 562 PG: 286, TRACT II
AND DB: 158 PG: 305
PC: C SL: 6260 & PC: C SL: 7314

SOUTHERN APPALACHIAN
HIGHLANDS CONSERVANCY
(CONSERVATION EASEMENT)
DB: 917 PG: 978
PC: C SL: 7314

NAD 83

MATCH LINE – SEE SHEET 4

VEG PLOT 6

ROCK SILL INSTALLED
IN PLACE OF LOG DROP

ROCK CROSS VANE (TYP.)

AS-BUILT THALWEG (TYP.)

CONFLUENCE STATION
UT1 REACH 4 STA. 24+19.91=
UT4 STA. 10+50.55

END UT1 REACH 3
BEGIN UT1 REACH 4
STA. 22+50.94 =
CONFLUENCE STATION
UT3 STA. 26+33.50

LOG DROP INSTALLED
NOT IN ORIGINAL DESIGN

BOULDER STEP (TYP.)

END UT4 STA. 10+41.90
TOB UT1 REACH 4

BARBED WIRE FENCE (TYP.)

LOG DROP (TYP.)

ROCK VANE (TYP.)

GRADE CONTROL ROCK
J-HOOK VANE (TYP.)

VEG PLOT 3

PIN: 8721-72-6837

BEGIN UT4
STA. 10+00.00

AS-BUILT
TOP OF BANK (TYP.)

IN STREAM FLOW GAUGE #3
INV IN: 2967.76'
INV OUT: 2965.26'
(BROKEN)

36" CMP
INV IN: 2969.41'
INV OUT: 2967.17'

2 - 8' GATES INSTALLED
IN PLACE OF 16' GATE

END UT3 STA. 26+24.54
TOB REACH UT1 REACH 3 & 4

BARBED WIRE FENCE (TYP.)

ANNE PALMER
FAMILY
PROPERTIES, L.P.
PIN: 8721-72-6837
DB: 489 PG: 1683

CONTROL POINT #500
STATE PLANE COORDINATES
N: 712855.04'
E: 829608.53'
ELEV: 2989.63'

RELOCATED ACCESS ROAD

NCDOT R/W

NC HWY 209
RUSH FORK ROAD

ELECTRIC FENCE

MATCH LINE – SEE SHEET 6

MATCH LINE – SEE SHEET 10

FILL EXISTING CHANNEL

CHANNEL PLUG

RECORD DRAWING LEGEND

- PROPOSED DESIGN
- AS-BUILT SURVEY BY KEE MAPPING & SURVEYING 4/14/22
- RED LINE VARIATIONS FROM ORIGINAL DESIGN SUBMITTED WITH THE MITIGATION PLAN

UT to RUSH FORK
UT1 & UT4
RECORD DRAWING

20 0 20 40
SCALE (FT)

5/31/2022
N:\projects\166680_Rush_Fork\Design\As-Built\Plans\166680_ASB-PSH_05.dgn
mcgarr

2/26/03

BAKER PROJECT REFERENCE NO.	SHEET NO.
166680	6

PROJECT ENGINEER

NORTH CAROLINA PROFESSIONAL SEAL 028432 ENGINEER KATHLEEN W MCKITHAN

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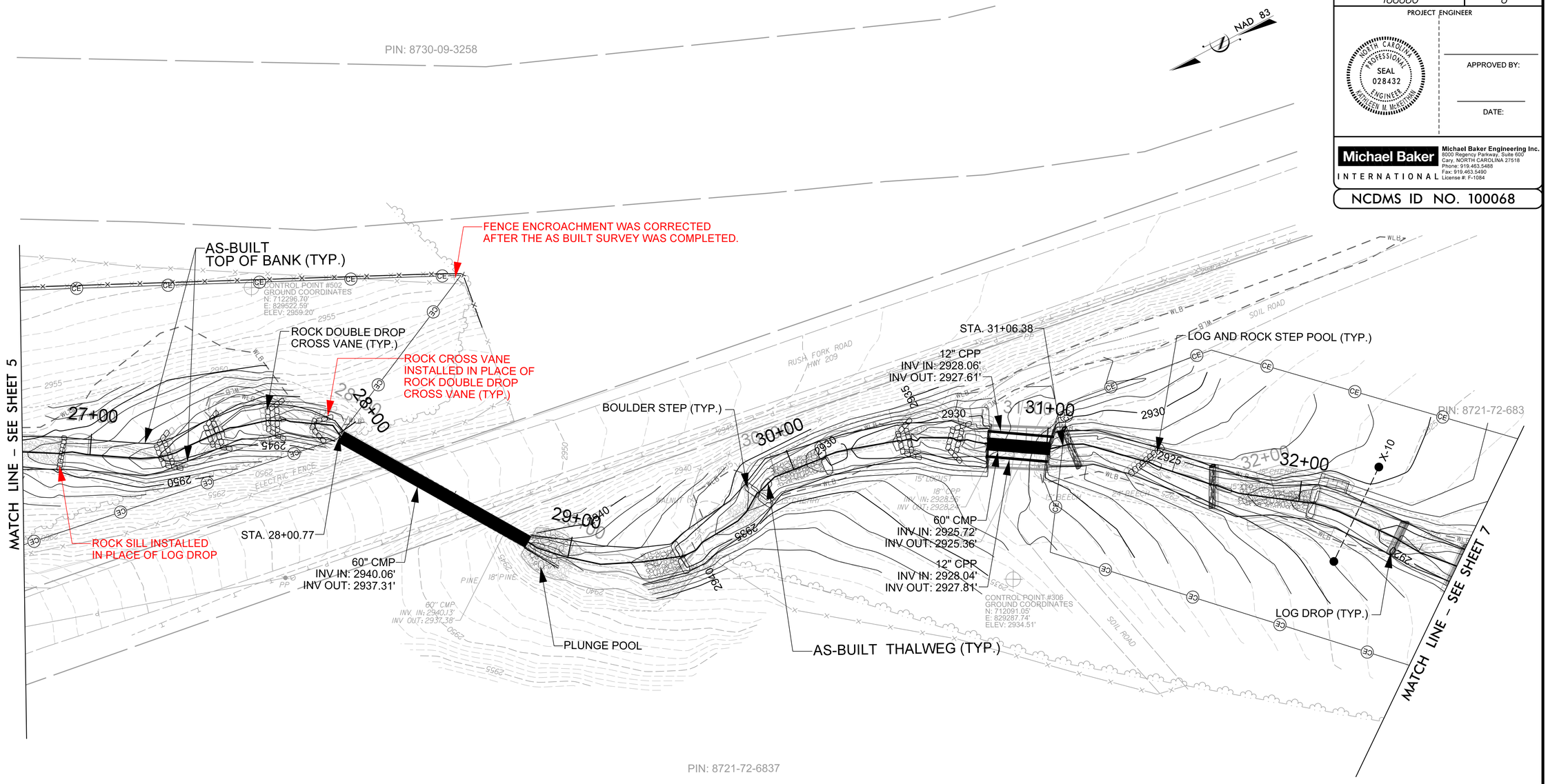
Fax: 919.463.5490
License #: F-1084

NCDMS ID NO. 100068



PIN: 8721-72-6837

RECORD DRAWING LEGEND

- PROPOSED DESIGN
- AS-BUILT SURVEY BY KEE MAPPING & SURVEYING 4/14/22
- RED LINE VARIATIONS FROM ORIGINAL DESIGN SUBMITTED WITH THE MITIGATION PLAN

- FILL EXISTING CHANNEL
- CHANNEL PLUG

UT to RUSH FORK
UT1
RECORD DRAWING

20 0 20 40
SCALE (FT)

5/31/2022
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2/26/03

BAKER PROJECT REFERENCE NO.	SHEET NO.
166680	7

PROJECT ENGINEER

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Fax: 919.463.5490
License #: F-1084

NCDMS ID NO. 100068

NAD 83

END UT1 REACH 4
STA. 37+80.92

WE KIRK
PIN: 8730-09-3258
DB: 838 PG: 404
REFERENCE: DB: 562 PG: 286, TRACT II
AND DB: 158 PG: 305
PC: C SL: 6260 & PC: C SL: 7314

SOUTHERN APPALACHIAN
HIGHLANDS CONSERVANCY
(CONSERVATION EASEMENT)
DB: 917 PG: 978
PC: C SL: 7314

Soil road extinguished.

PIN: 8721-72-6837

PIN: 8721-72-6837

NCDOT R/W

SOIL ROAD

LOG DROP (TYP.)

ROCK CROSS VANE (TYP.)

LOG J-HOOK VANE INSTALLED
IN PLACE OF GRADE CONTROL
ROCK J-HOOK VANE

AS-BUILT
TOP OF BANK (TYP.)

ROCK VANE (TYP.)

VEG PLOT
4

AS-BUILT THALWEG (TYP.)

ROCK J-HOOK VANE (TYP.)

CREST
GAUGE #3

LOG VANE (TYP.)

BOULDER STEP (TYP.)

MATCH LINE – SEE SHEET 6

CONTROL POINT #308
GROUND COORDINATES
N: 711505.47'
E: 828898.77'
ELEV: 2918.81'

CONTROL POINT #307
GROUND COORDINATES
N: 711819.21'
E: 829041.22'
ELEV: 2917.97'

RECORD DRAWING LEGEND

- PROPOSED DESIGN
- AS-BUILT SURVEY BY KEE MAPPING & SURVEYING 4/14/22
- RED LINE VARIATIONS FROM ORIGINAL DESIGN SUBMITTED WITH THE MITIGATION PLAN

FILL EXISTING CHANNEL

CHANNEL PLUG

UT to RUSH FORK UTI RECORD DRAWING

20 0 20 40
SCALE (FT)

5/24/2022
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2/26/03

BAKER PROJECT REFERENCE NO.	SHEET NO.
166680	8

PROJECT ENGINEER

NORTH CAROLINA PROFESSIONAL SEAL 028432 ENGINEER KATHLEEN W MCKITHAN

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NCDMS ID NO. 100068

NAD 83

ANNE PALMER
FAMILY PROPERTIES, L.P.
PIN: 8721-72-6837
DB: 489 PG: 1683

BARBED WIRE FENCE (TYP.)

ROCK J-HOOK VANE (TYP.)

BOULDER STEP (TYP.)

CREST GAUGE #1

LOG DROP (TYP.)

BOULDER BANK PROTECTION INSTALLED NOT IN ORIGINAL DESIGN

ROCK CROSS VANE (TYP.)

ROCK SILL INSTALLED IN PLACE OF LOG DROP

AS-BUILT TOP OF BANK (TYP.)

BEGIN UT3
STA. 10+00.38

STONE LINED OVERFLOW CHANNEL FOR BMP

10+00

11+00

12+00

13+00

14+00

15+

X-1

X-2

4' GATE

AS-BUILT THALWEG (TYP.)

BARBED WIRE FENCE (TYP.)

CONTROL POINT #303
GROUND COORDINATES
N: 714230.87'
E: 829121.90'
ELEV: 3097.41'

CONTROL POINT #302
GROUND COORDINATES
N: 713975.07'
E: 829341.61'
ELEV: 3058.92'

ANNE PALMER
FAMILY PROPERTIES, L.P.
PIN: 8721-72-6837
DB: 489 PG: 1683

MATCH LINE – SEE SHEET 9

RECORD DRAWING LEGEND

- PROPOSED DESIGN
- AS-BUILT SURVEY BY KEE MAPPING & SURVEYING 4/14/22
- RED LINE VARIATIONS FROM ORIGINAL DESIGN SUBMITTED WITH THE MITIGATION PLAN

FILL EXISTING CHANNEL

CHANNEL PLUG

UT to RUSH FORK
UT3
RECORD DRAWING

20 0 20 40
SCALE (FT)

5/24/2022
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mpeal

2/26/03

BAKER PROJECT REFERENCE NO.	SHEET NO.
166680	9

PROJECT ENGINEER

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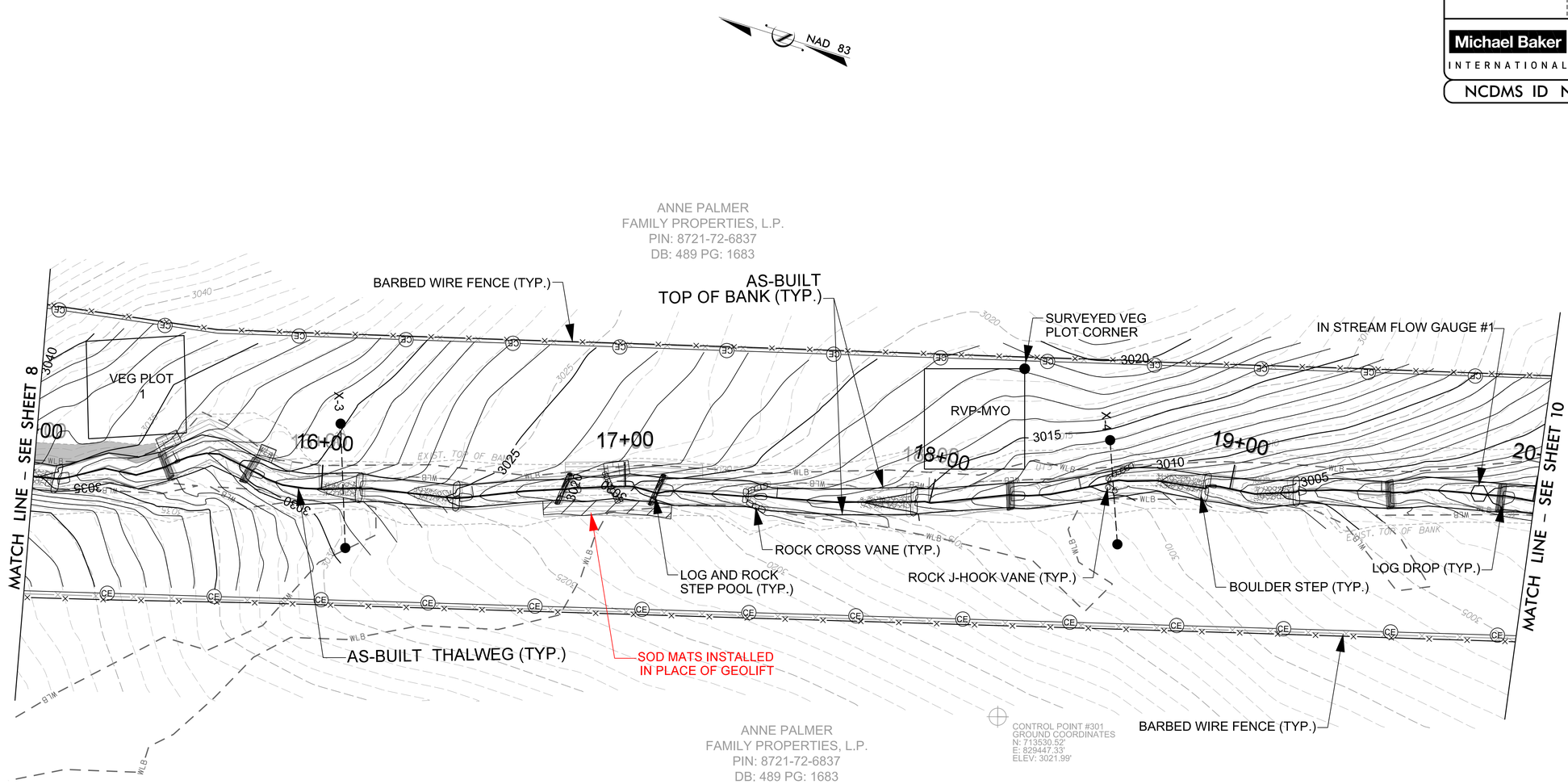
License #: F-1084

NCDMS ID NO. 100068



RECORD DRAWING LEGEND

- PROPOSED DESIGN
- AS-BUILT SURVEY BY KEE MAPPING & SURVEYING 4/14/22
- RED LINE VARIATIONS FROM ORIGINAL DESIGN SUBMITTED WITH THE MITIGATION PLAN

- FILL EXISTING CHANNEL
- CHANNEL PLUG

UT to RUSH FORK
UT3
RECORD DRAWING

20 0 20 40
SCALE (FT)

6/6/2022
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2/26/03

BAKER PROJECT REFERENCE NO.	SHEET NO.
166680	10

PROJECT ENGINEER

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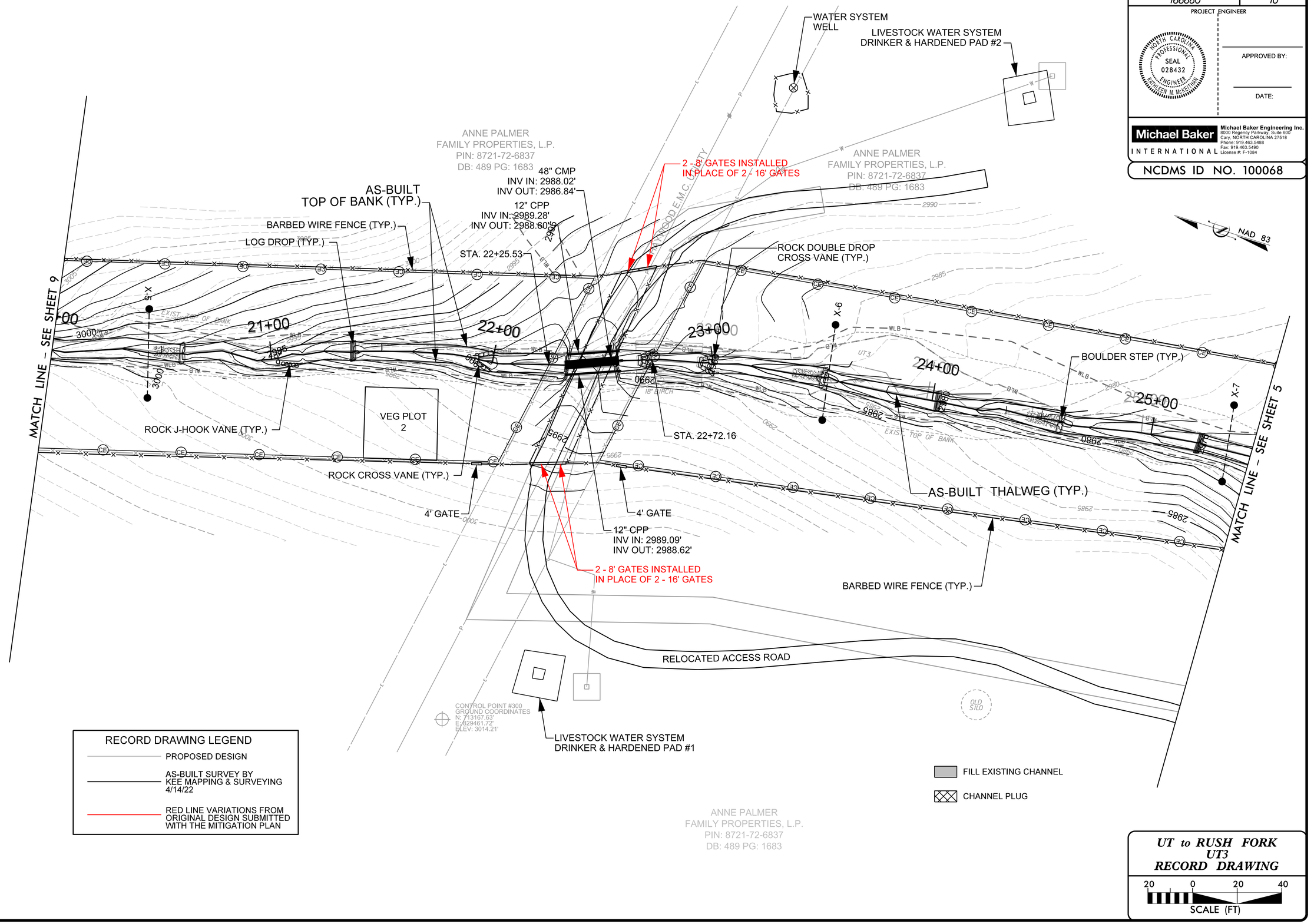
NCDMS ID NO. 100068



RECORD DRAWING LEGEND

- PROPOSED DESIGN
- AS-BUILT SURVEY BY KEE MAPPING & SURVEYING 4/14/22
- RED LINE VARIATIONS FROM ORIGINAL DESIGN SUBMITTED WITH THE MITIGATION PLAN

ANNE PALMER
FAMILY PROPERTIES, L.P.
PIN: 8721-72-6837
DB: 489 PG: 1683

UT to RUSH FORK UT3 RECORD DRAWING

SCALE (FT) 20 0 20 40

5/24/2022
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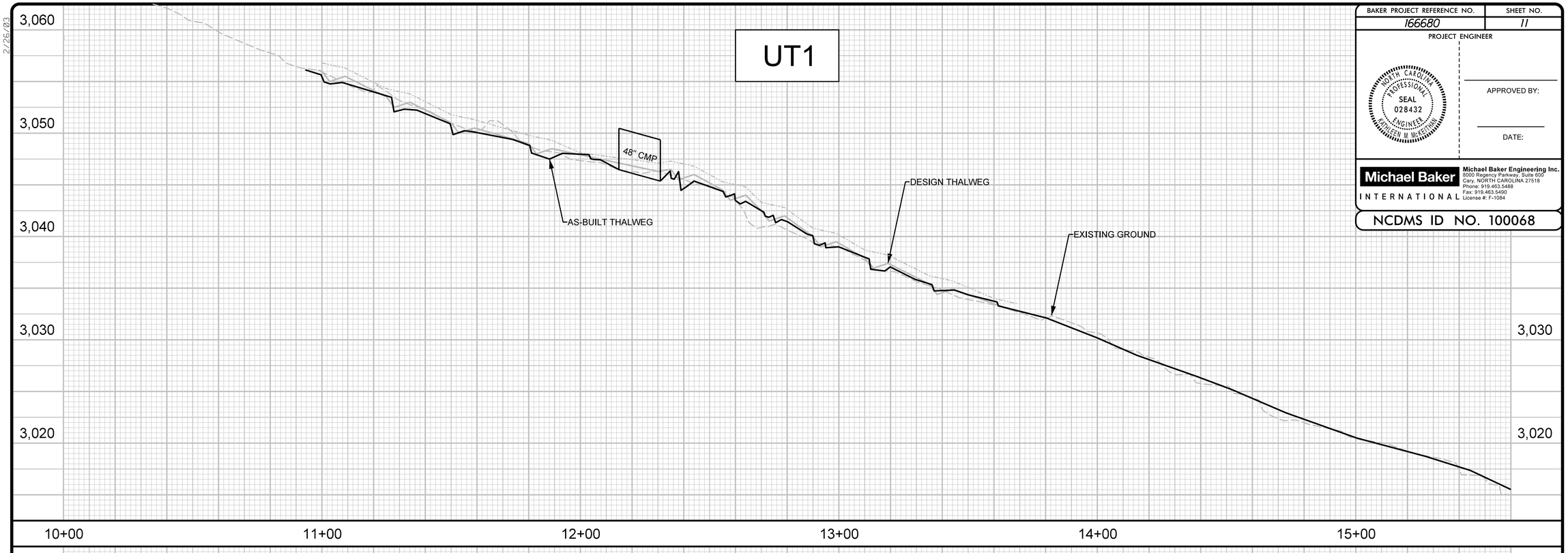
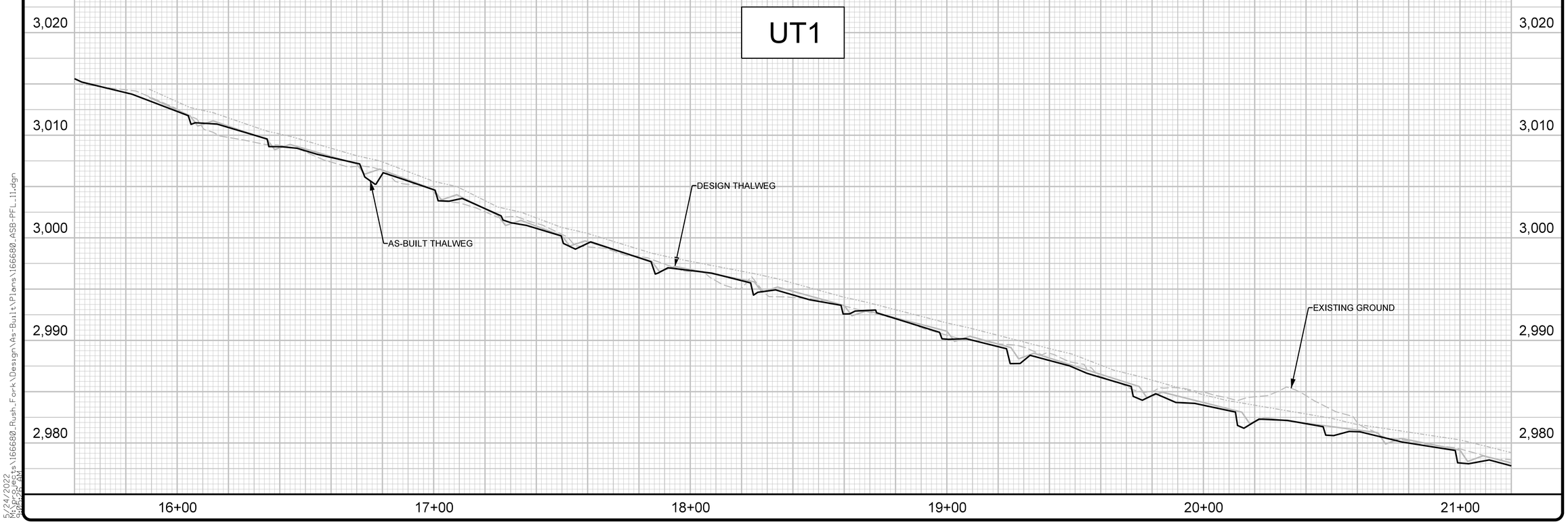
mcbride

2/26/03

UT1



UT1



BAKER PROJECT REFERENCE NO.	SHEET NO.
166680	11

PROJECT ENGINEER

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License #: F-1084

NCDMS ID NO. 100068

5/24/2022
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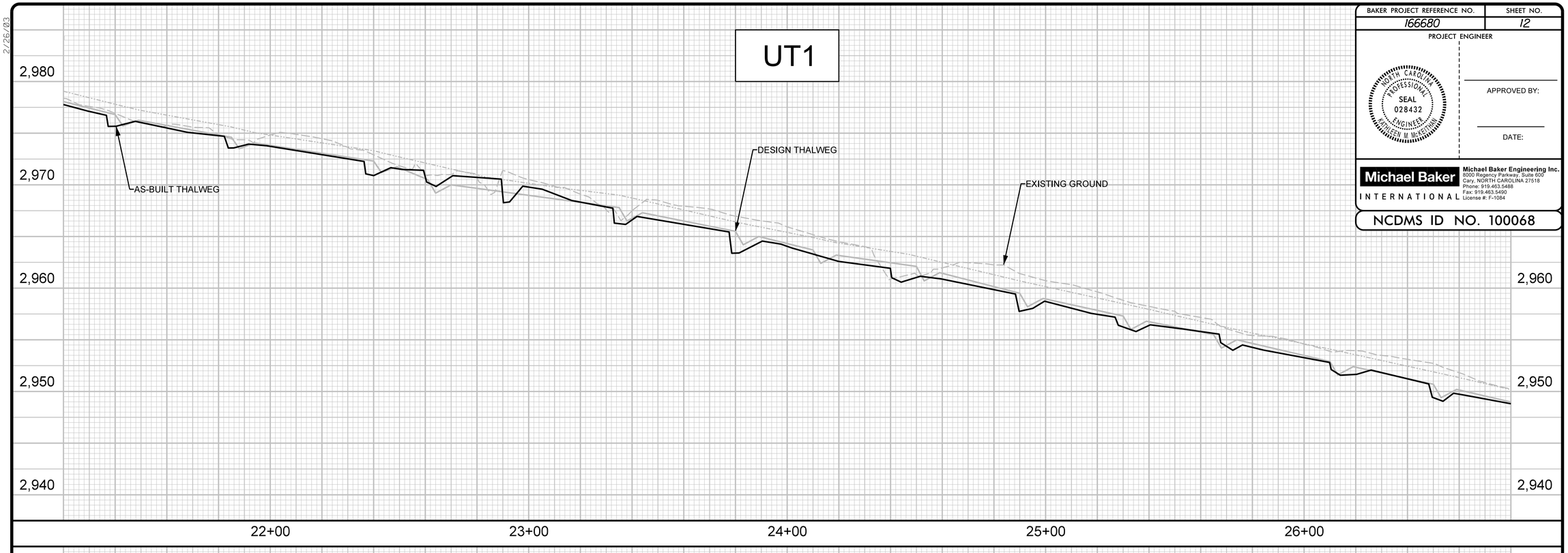
2/26/03

UT1



BAKER PROJECT REFERENCE NO.	SHEET NO.
166680	12

PROJECT ENGINEER

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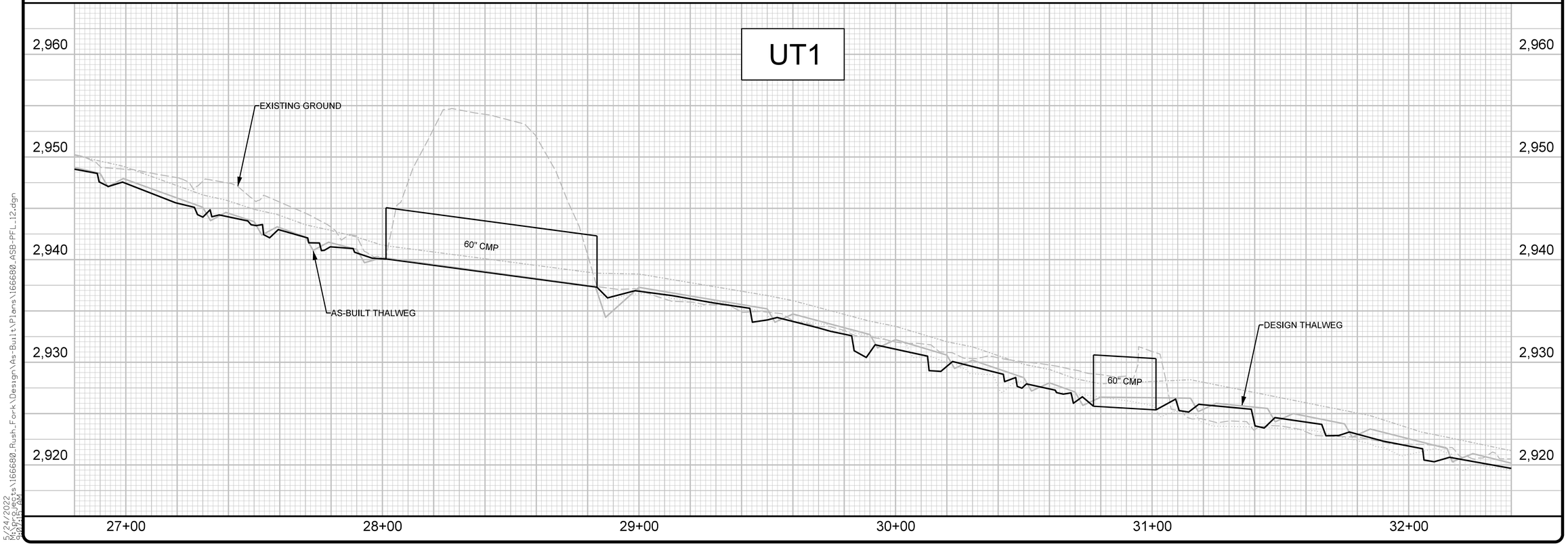
NCDMS ID NO. 100068



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gdavis
8:07:15 AM

2/26/03

UT1

BAKER PROJECT REFERENCE NO.	SHEET NO.
166680	13

PROJECT ENGINEER

NORTH CAROLINA PROFESSIONAL SEAL 028432 ENGINEER KATHLEEN M McKEITHAN

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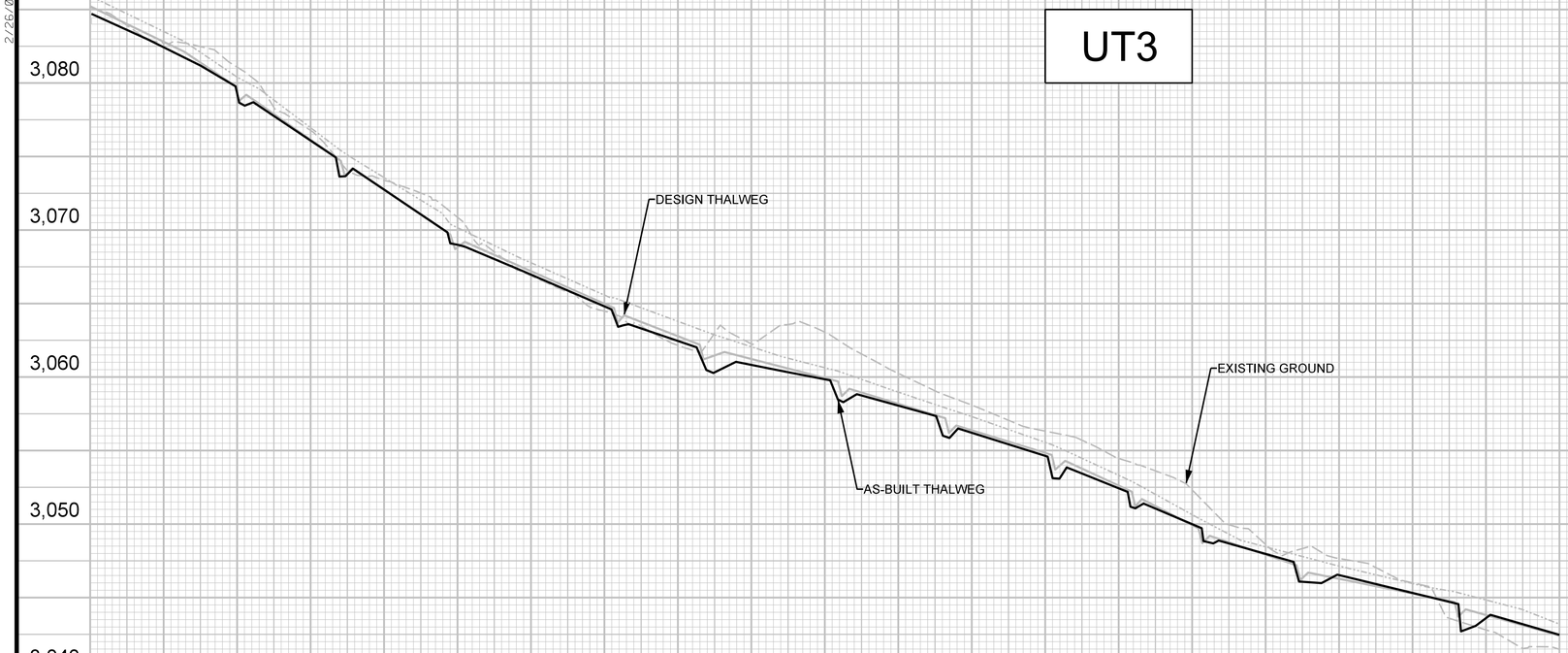
License #: F-1084

NCDMS ID NO. 100068

5/24/2022
M:\projects\166680_Rush_Fork\Design\As-Built\Plans\166680_ASB-PFL_13.dgn
gjohnson
10:19 AM

2/26/03

UT3



BAKER PROJECT REFERENCE NO.	SHEET NO.
166680	14

PROJECT ENGINEER

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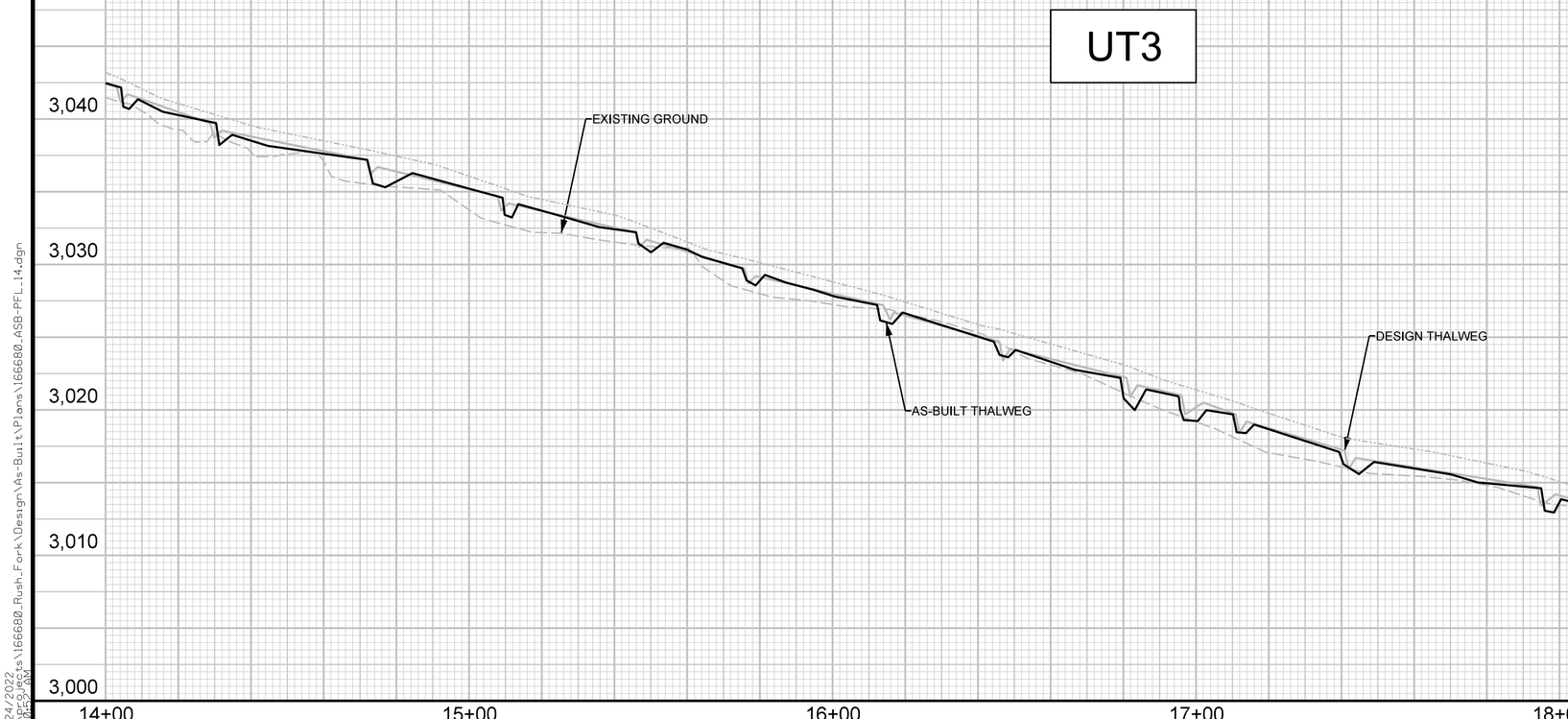
NCDMS ID NO. 100068

UT3



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BAKER PROJECT REFERENCE NO.	SHEET NO.
166680	15

PROJECT ENGINEER

NORTH CAROLINA PROFESSIONAL SEAL 028432 ENGINEER KATHLEEN M. McKEITHAN

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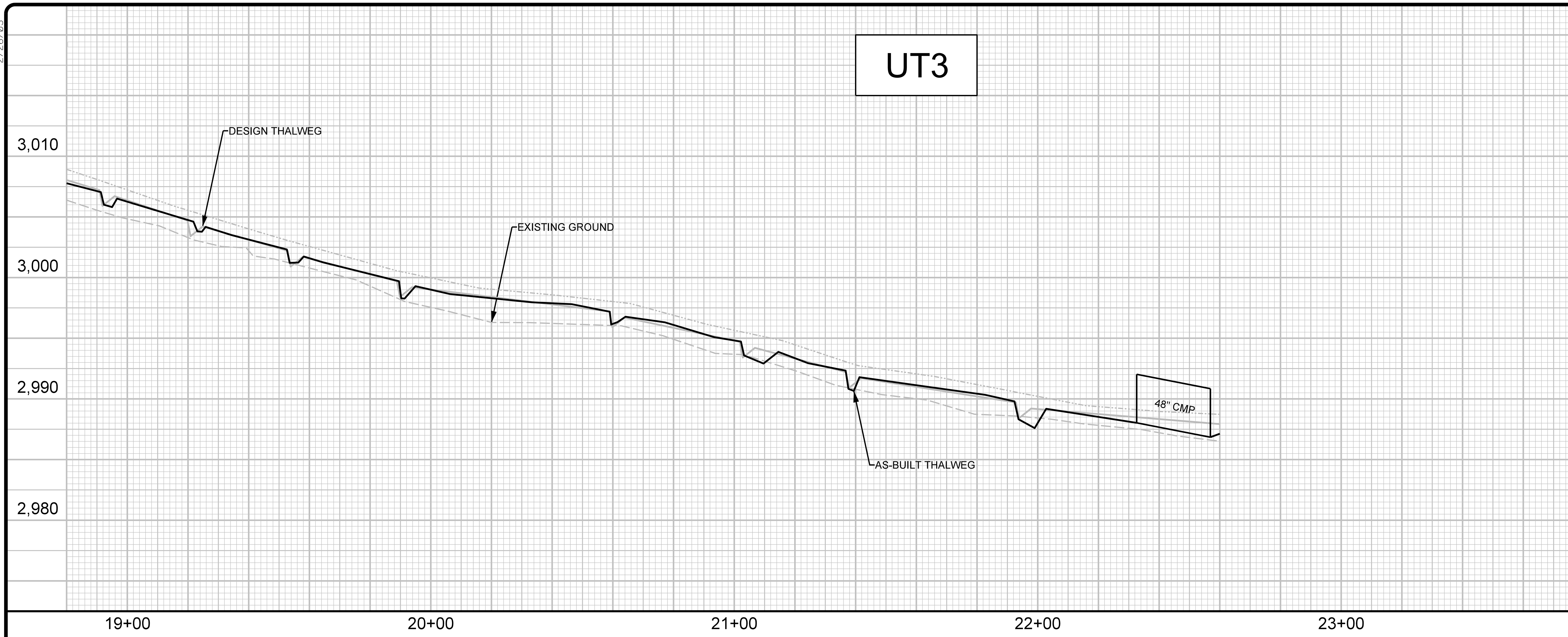

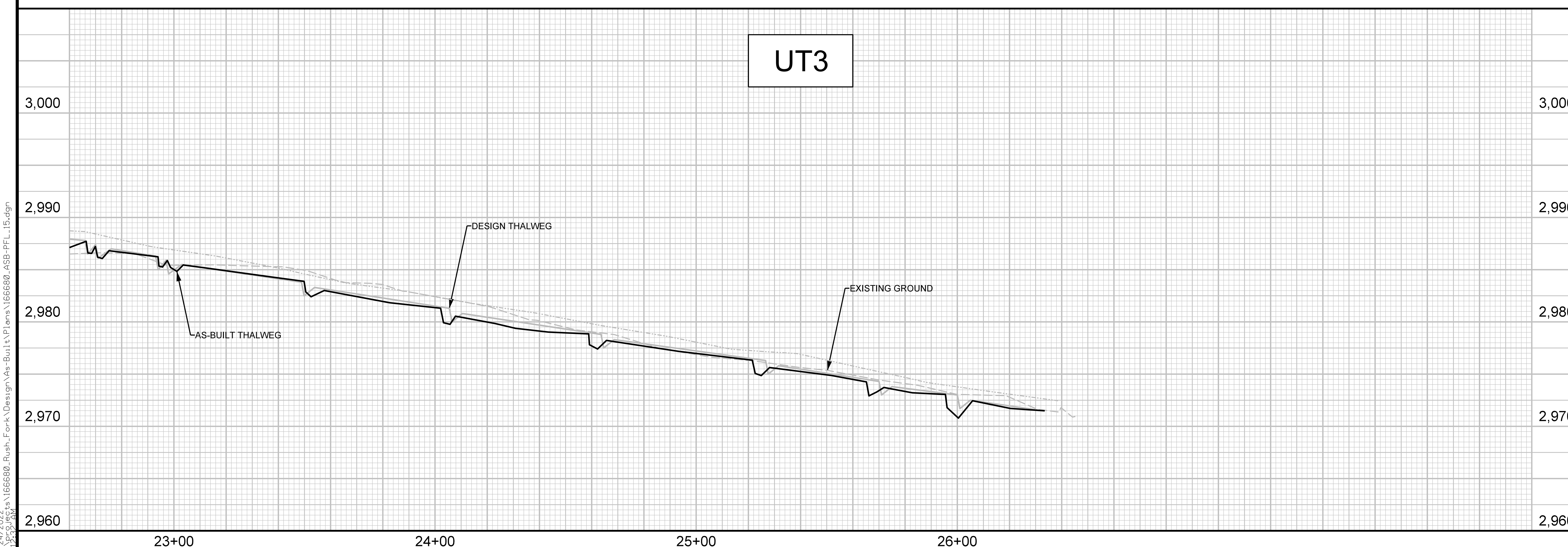

2/26/03

BAKER PROJECT REFERENCE NO. 166680 | SHEET NO. 16

PROJECT ENGINEER

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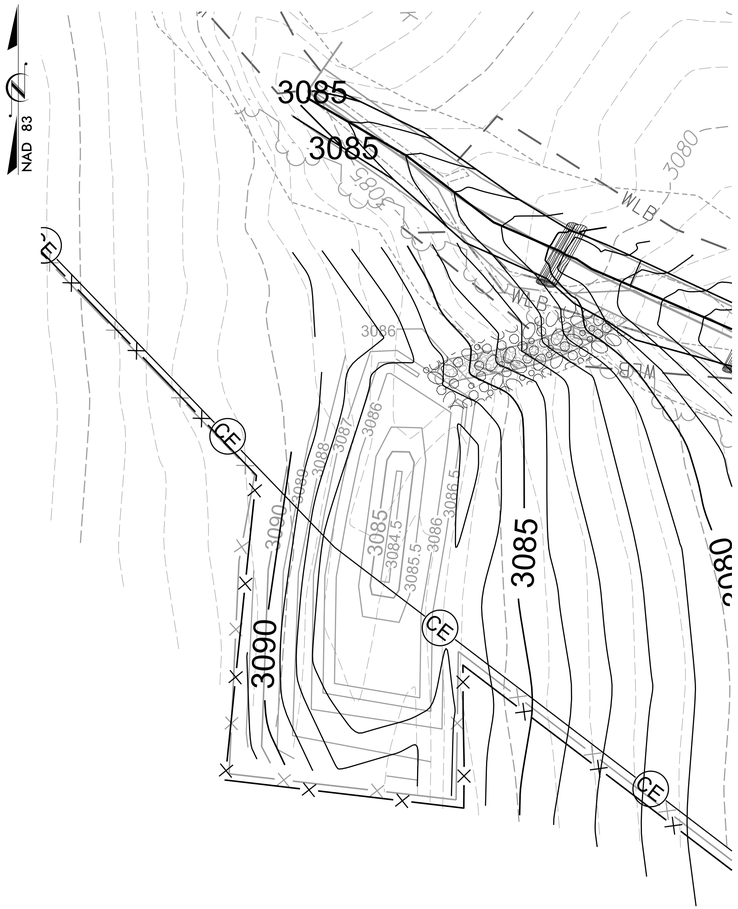

Proposed BMP Planted Species
UT to Rush Fork Mitigation Project - NCDMS Project No. 100068

Botanical Name	Common Name	% Planted by Species	Wetland Tolerance
Shallow Water Zone (50 Herbaceous Plants per 200 ft^2)			
Juncus effusus	Common Rush	10%	FACW
Peltandra virginica	Arrow Arum	10%	OBL
Pontederia cordata	Pickerelweed	10%	OBL
Sagittaria latifolia	Broadleaf Arrowhead	10%	OBL
Saururus cernuus	Lizard's Tail	10%	OBL
Scirpus cyperinus	Woolgrass	10%	FACW
Carex vulpinoidea	Fox Sedge	10%	OBL
Sparganium americanum	Bur-reed	10%	FAC
Carex lurida	Shallow Sedge	10%	OBL
Polygonum pensylvanicum	Smartweed	10%	FACW
Temporary Inundation Zone (8 shrubs per 200 ft^2)			
Alnus serrulata	Tag Alder	10%	OBL
Cephalanthus occidentalis	Buttonbush	10%	OBL
Cornus amomum	Silky Dogwood	10%	FACW
Ilex verticillata	Winterberry	10%	FACW
Rhododendron viscosum	Swamp Azalea	10%	FACW
Physocarpus opulifolius	Ninebark	10%	FACW
Sambucus canadensis	Elderberry	10%	FACW
Leucothoe fontanesiana	Highland Doghobble	10%	FACW
Vaccinium corymbosum	Highbush Blueberry	10%	FACW
Xanthorhiza simplicissima	Yellowroot	10%	FACW

Notes: -Final species selection may change due to refinement of site conditions or to availability at the time of planting. If species substitution is required, the planting Contractor will submit a revised planting list to Baker for approval prior to the procurement of plant stock.

-Shallow Water planting zone is from basin bottom to elevation 3085.5' while Temporary Inundation planting zone is from elevation 3085.5' to 3086.5'.

-Embankments and perimeter fill slopes will be planted with non-clumping turf grasses (no trees or woody shrubs).

UT to RUSH FORK AS - BUILT RECORD DRAWING

10 0 10 20
SCALE (FT)

5/24/2022
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mpeyton