Brown Creek Tributaries Restoration Project
FINAL Year 7 Monitoring Report/Closeout Report

Anson County, North Carolina

DMS Project ID No. 95351
DEQ Contract No. 004641
USACE Action ID: SAW-2012-01108
DWR Project #14-0345
RFP #16-004108 (Issued 6/20/2011)
Yadkin River Basin: 03040104-061030

Project Info:	Monitoring Year: 7 of 7 Year of Data Collection: 2021 Year of Completed Construction: 2015 Submission Date: February 2022
Submitted To:	NC DEQ – Division of Mitigation Services 1652 Mail Service Center Raleigh, NC 27699

Michael Baker
INTERNATIONAL

Michael Baker Engineering, Inc.
8000 Regency Parkway, Ste. 600 | Cary, North Carolina 27518
Office: 919.463.5488 | Fax: 919.463.5490

February 24, 2022

Kelly Phillips, Project Manager
NCDEQ – Division of Mitigation Services
610 East Center Avenue – Suite 301
Mooresville, NC 28115
919-723-7565

Subject: Response to DMS Comments for Task 13 Deliverables: Year 7 Monitoring Report
Brown Creek Tributaries Restoration Project, Anson County, Yadkin River Basin – CU# 03040104,
DEQ Contract No. 004641, USACE AID SAW-2012-01108, DMS Project #95351

Mr. Phillips:

Please find below our responses to the NC Division of Mitigation Services' (DMS) review comments letter dated January 19, 2022 in reference to the Brown Creek Tributaries Restoration Project in Anson County, NC. We have subsequently revised the Draft version of the Year 7 Monitoring Report in response to the review comments as outlined below:

The following are our [DMS] comments on the DRAFT report:

General:

- Review the closeout report requirements as you produce the Final Report.
  Response: The report has been reviewed for any additional closeout requirements. Of particular note, an additional project vegetation summary table (Table 9e) was included in Appendix C as per DMS request.

- Section 1.0 Executive Summary: Reference that the pine/sweetgum thinning and invasive treatments were actions taken consistent with the May 2021 Credit Release Meeting Notes. Also reference the three Stream Problem Areas (SPAs) discussed in the meeting and describe how they were resolved.
  Response: This section was revised as requested.

- Section 1.0 Executive Summary & 2.1.2 Hydrology: Thank you for providing the supportive flow data from the in-stream gages and including it in the Hydrology discussion.
  Response: Thank you, we appreciate the positive feedback.

- Section 1.0 Executive Summary: Please update the upcoming corrective actions to be taken for resolution of the encroachment/logging issues in the final report.
  Response: This section has been revised as requested to include a discussion of the recent logging encroachment resolution.

- Section 2.1 Stream Assessment: Please add discussion regarding the three stream problem areas identified in the May 2021 Credit Release Meeting Notes and add to the CCPVs is applicable.

Michael Baker
INTERNATIONAL

Michael Baker Engineering, Inc.
8000 Regency Parkway, Ste. 600 | Cary, North Carolina 27518
Office: 919.463.5488 | Fax: 919.463.5490

Response: Section 2 of the report is the Methodology section and is generally reserved for a more detailed discussion of the specific monitoring procedures and protocols. As such, Baker would prefer to keep the description of the stream problem areas in the Executive Summary to reduce redundancy within the report text.

Tables and Figures:

- Figure 2D: Thank you for adding the callout to show the area of pine harvesting within the easement.
  Response: We appreciate the positive feedback.

Digital files:

- Please submit the bank repair feature as a line rather than a point.
  Response: The bank repair feature was converted to a line shapefile for GIS and provided in the revised e-file submission. Please note that these features are quite small as they were drawn as close to scale as possible and thus are only 3 or 4-ft in length.

- Please submit monitoring gauge and additional photographs.
  Response: Additional photographs (as JPEGs) have been provided in the revised e-file submission.

As requested, two hardcopies of the final version of the monitoring report are being provided with this submission along with a USB thumb drive with the revised final e-submission digital files. Please do not hesitate to contact me should you have any questions regarding our response submittal.

Sincerely,

Scott King, LSS, PWS
Project Manager

Brown Creek Tributaries Restoration Project
FINAL Year 7 Monitoring Report/Closeout Report

Anson County, North Carolina

DMS Project ID No. 95351, DEQ Contract No. 004641

USACE Action ID: SAW-2012-01108, DWR Project #14-0345

Yadkin River Basin: 03040104-061030, RFP #16-004108 (Issued 6/20/2011)

Report Prepared and Submitted by Michael Baker Engineering, Inc.

NC Professional Engineering License # F-1084

TABLE OF CONTENTS

APPENDICES

1.0 EXECUTIVE SUMMARY

Michael Baker Engineering, Inc. (Baker) restored 8,213 linear feet (LF) of perennial stream, enhanced 2,481 LF of stream, and preserved 511 LF of stream along Hurricane Creek (HC) and unnamed tributaries (UT4) to Brown Creek, a 303(d) listed stream that flows through the Pee Dee National Wildlife Refuge. All of these stream features are in the warm-temperature thermal regime. Baker also planted approximately 33 acres of native riparian vegetation along the restored and enhanced reaches (Reaches HC-R1, HC-R2, and HC-R3 on the Hurricane Creek portion of the project, and UT4-R1a, UT4-R1b, UT4-R2, UT4-R3, UT4-R4a, UT4-R4b, UT4-R5a, and UT4-R5b on the unnamed tributary (UT4) portion of the project). A recorded conservation easement consisting of 43.3 acres protects and preserves all stream reaches, existing wetland areas, and riparian buffers in perpetuity. The Brown Creek Tributaries Restoration Project (Site) is located in Anson County, approximately four miles southeast of the Town of Ansonville (Figure 1). The Site is located in the NC Division of Water Resources (NCDWR) subbasin 03-07-10 and the NC Division of Mitigation Services (DMS) Targeted Local Watershed (TLW) 03040104-061030 of the Yadkin River Basin. The project involved the restoration and enhancement of a rural piedmont stream system, which had been impaired due to past agricultural conversion and cattle grazing.

Based on the DMS 2009 Lower Yadkin-Pee Dee River Basin Restoration Priority (RBRP) Plan, the Brown Creek Tributaries Restoration Project area is located in an existing Targeted Local Watershed (TLW) within the Yadkin River Basin, although it is not located in a Local Watershed Planning (LWP) area. The TLW selection criteria for the Yadkin Basin specifically targets projects that will address water resource impacts from nonpoint source (NPS) pollution. The restoration strategy for the Yadkin River Basin as a whole targets projects which focus on restoring stream functions by maintaining and enhancing water quality, restoring hydrology, and improving fish and wildlife habitat.

The primary goals of the project were to improve ecologic functions to the impaired areas as described in the DMS 2009 Lower Yadkin-Pee Dee RBRP as identified below:

- Create geomorphically stable conditions along the unnamed tributaries across the site,
- Implement agricultural BMPs to reduce NPS inputs to receiving waters,
- Protect and improve water resources by reducing stream bank erosion, and nutrient and sediment inputs,
- Restore stream and floodplain interaction by connecting historic flow paths and promoting natural flood processes, and
- Restore and protect riparian buffer functions and corridor habitat in perpetuity by establishing a permanent conservation easement.

To accomplish these goals, the following objectives were identified:

- Restore existing incised, eroding, and channelized streams by providing them access to their relic floodplains,
- Prevent cattle from accessing the conservation easement boundary by installing permanent fencing and thus reduce excessive stream bank erosion and undesired nutrient inputs,
- Increase aquatic habitat value by providing more bedform diversity, creating natural scour pools and reducing sediment from accelerated stream bank erosion,
- Plant native species riparian buffer vegetation along stream bank and floodplain areas, protected by a permanent conservation easement, to increase stormwater runoff filtering capacity, improve stream bank stability and riparian habitat connectivity, and shade the stream to decrease water temperature,

- Improve aquatic and terrestrial habitat through improved substrate and in-stream cover, addition of woody debris, and reduction of water temperature, and
- Control invasive species vegetation within the project area and, if necessary, continue treatments during the monitoring period.

The Year 7 monitoring survey data of the fifteen cross-sections indicates that those stream sections are stable and any minor fluctuations in their geometry from previous years are within the lateral/vertical performance range. All reaches are geomorphically stable and performing as designed, as confirmed by the visual stability assessment. All stream riffle beds are vertically stable, the pools are maintaining depth, stream banks are stable and vegetating, and in-stream structures are physically intact and performing as designed. No Stream Problem Areas (SPAs) were identified. Additionally, two pebble counts were conducted in the Year 7 Monitoring, one each in riffles located along HC-R2 and UT4-R4b. Both show that the bed material size distribution has remained relatively stable as compared to all previous years, with only normal fluctuations observed (though UT4 appears to have slightly coarsened over time). This indicates that sediment is moving through the system and the channels are stable and experiencing neither degradation nor aggradation. Pebble count data can be found in Appendix D.

Based on the Year 7 vegetation plot monitoring data collected during August and September of 2021, the average planted stem density is 556 stems per acre, with individual plots varying between 324 and 728 stems per acre. Thus, the vegetation data demonstrate that the project as a whole has met the minimum success criteria of 210 trees per acre by the end of Year 7.

Stream flow for the restored channels was recorded for 2021 through the use of three in-stream flow gauges (pressure transducers) located along reaches UT4-R4b (gauge BTFL1), UT4-R1b (gauge BTFL2), and HC-R1 (gauge HCFL1). The flow gauges documented seasonal flow for Year 7 in these reaches of 92, 118, and 131 consecutive days respectively as shown in Figure 5 and Table 12 in Appendix E. The flow gauges demonstrated similar flow events relative to recorded rainfall events as demonstrated in the gauge graphs in Appendix E. As Figure 6 shows, rainfall for the previous year totaled 33.3 in, which is well below the historic average (46.7 in) but above the 30% probable (29.3 in) for Anson County. Based on visual observations of each of these reaches during field visits throughout the monitoring phase (especially during the winter and spring) along with the in-stream flow data and the flow camera photographs from UT4-R4, Baker has every confidence that these reaches transport substantial seasonal flow and should certainly qualify as jurisdictional streams.

Two bankfull crest gauges are located in the floodplains along UT4-R2 and HC-R2. During Year 7 monitoring, the crest gauge on HC-R2 documented one post-construction bankfull event of 1.65 ft on 3/28/21, as corroborated by the HCFL1 flow gauge recorded on that same date. The crest gauge on UT4-R2 also documented one bankfull event of 1.75 ft on 2/15/21. The two in-stream flow gauges located on UT4-R4 and UT4-R1 corroborate this finding as well. Complete project crest gauge readings are presented in Table 13 in Appendix E, as are the corroborating flow gauge graphs. As Table 13 details, the project has documented a total of 11 bankfull events at Hurricane Creek (with at least one occurring in each of the 7 monitoring years) and 9 bankfull events at UT4 (occurring within 6 of the monitoring years). Thus, the project has more than met the stated performance criteria of 2 bankfull events in separate years.

Previously during MY6 site inspections in November 2020, several beaver dams were discovered on both portions of the project. A professional beaver wildlife specialist was employed to trap the beaver prior to his demolition of each of the dams with explosives and hand raking to remove the debris in March 2021 (see photographs in Appendix B). Fortunately, the vast majority of the vegetation used for the dams was the adjacent black willow, which is present in abundance and naturally regrows well. Subsequent field inspections revealed that no further beaver activity has been noted since that time.

A few areas of previously identified invasive Chinese privet (*Ligustrum sinsense*) were also treated at Hurricane Creek in March of 2021. The areas of scattered privet totaled approximately 0.41 acres and were found along the upper right buffer of HC-R1 and upper left buffer of HC-R3 as shown in the CCPV. However, additional scattered resprouts were observed during September and November 2021 field inspections, and a Vegetation Problem Area is reported for Year 7 consisting of three areas totaling 0.57 acres of privet. Much of these areas overlap with previously treated areas. In some cases, new resprouts were observed, but it mostly appears that previously treated privet has survived. Poor weather following the treatment likely reduced the impact of the treatment. These areas will be fully treated again in the spring of 2022 prior to project closeout.

Previously during MY6 site inspections in 2020, notable numbers of loblolly pine (*Pinus taeda*) and sweetgum (*Liquidambar styraciflua*) were observed scattered throughout portions of the left buffer of UT4-R3 and upper left buffer of UT4-R2, totaling roughly 0.9 acres. In March and November 2021, the pines and sweetgum in these areas were substantially thinned, in accordance with the May 2021 Credit Release meeting notes. Please see the CCPV in Appendix B for the locations of all these areas. Future field inspections prior to closeout will continue to note any significant locations of pines and sweetgum and thin as needed.

There were also two areas of easement encroachment identified during the Year 7 inspection as shown on the CCPV. The first is a small area (0.05 ac) along the outer buffer of UT4-R2 where an adjacent landowner's logging operation went one row two far into the Conservation Easement in August 2021 before spotting the posted signage and painted trees. The loggers cut down roughly seven large pine trees and five smaller trees (simply to access the pines) that were part of the existing mature woods within the easement along a sliver roughly 100-ft long by 20-ft wide (at the widest point). Upon spotting the signs, they contacted landowners who eventually directed them to Baker. After an extensive discussion and field meeting and follow up communications with the company's boundary marking staff, it appears that while the property plat they were using was correct (as per the assessment of Brad Kee of Kee Mapping and Surveying), when they physically marked the logging boundary in the field prior to cutting they just repainted over old markings from many years ago. These old markings were accurate along the easternmost edge of the common parcel boundary, but it slowly veered off from the correct boundary, eventually leading to a roughly 20-ft variance within the easement. They appeared to have followed an old fenceline on the assumption that it followed the entire length of the parcel boundary precisely, which it clearly did not. This conclusion has been accepted by all parties, and a written statement was received from the adjacent landowner and their timber company representative acknowledging that the boundary as marked in the field is correct and stating that this area will be not be timbered in the future (a copy of which is in Appendix A). The State Property Office (SPO) was made aware of this issue during their site walkover in October 2021 and our proposed rectification was made with their input and approval. This section of the easement boundary was marked with several more posts and signs in January 2022 and was replanted with 20, 7-gal hardwood trees consisting of 10 white oaks (*Quercus alba*), 5 willow oaks (*Quercus phellos*), and 5 northern red oaks (*Quercus rubra*) in February of 2022. Additionally, the SPO sent a certified letter to the landowners of the easement upon which the logging encroachment occurred explaining the situation to them and outlining the corrective measures to be taken by Baker, though it should be noted that they were not the party responsible for the logging. Photographs of the encroachment and replanting can be found in Appendix B and a copy of the SPO certified letter to the landowner can be found in Appendix A.

The second encroachment was a hunting stand (roughly 8-ft by 8-ft at the base) placed just inside the easement on upper UT4-R5b. This stand was subsequently removed in January of 2022, after the Draft MY7 report had already been submitted. Photographs of the stand and its removal can be found in Appendix B.

Additionally, there were three small areas of bank erosion/scour on the UT4 portion of the project noted in the previous MY6 report that were repaired in the fall of 2021 and done in accordance with the May 2021 Credit Release meeting discussion of the areas. Two were short sections of bank (~4-ft long) on lower UT4-R2 below

log vane structures where it appeared storms had impacted the established herbaceous vegetation growing along the bank leaving exposed bare soil. These two sections had erosion control matting installed over the bare areas and livestakes placed within them. The third area was a section of bank (~3-ft long) beside a log weir on lower UT4-R1b where bank scour had resulted in bypass flow around the structure. The scoured area was backfilled with soil, filter fabric was installed over the soil, and larger rocks were placed on top to secure the repair. To be clear, these were small repair efforted that were all entirely completed by hand so no machinery had to be brought onto the site. Subsequent inspections in January 2022 revealed that these areas appeared be stable and functioning well.

In summation, the past 7 monitoring years have demonstrated that the Brown Creek Tributaries project has met the performance standards and success criteria for vegetation, stream flow, and channel stability. The vegetation plot data shows that over the 7 years there has been overall consistent vegetation density, height, and vigor throughout the site. The only areas of concern noted during the monitoring phase were over a relatively small portion of the total project buffer and have been successfully ameliorated. The as-built stem density averaged 804 stems/acre and after 7 years the stem density averaged 556 stems/acre. This meets the closeout success criteria and demonstrates that the site has established good vegetation within its riparian buffer. The stream flow gauges on HC-R1, UT4-R1b, and UT4-R4b have demonstrated substantial seasonal flow throughout the monitoring phase. Finally, the cross-sections throughout the 7 monitoring years show channel stability with no incision/erosion or aggradation, with all their final morphological parameters within an appropriate performance range. Additional photographs have also been provided in Appendix B for both Hurricane Creek and UT4 showing photographs from As-Built and MY7 for historic comparisons. They show stream stability and vegetation establishment.

Summary information/data related to the Site and statistics related to performance of various project and monitoring elements can be found in the tables and figures in the report Appendices. Narrative background and supporting information formerly found in these reports can be found in the Baseline Monitoring Report and in the Mitigation Plan available on the North Carolina Division of Mitigation Services (DMS) website. Any raw data supporting the tables and figures in the Appendices are available from DMS upon request.

2.0 METHODOLOGY

The seven-year monitoring plan for the Site includes criteria to evaluate the success of the stream and vegetation components of the project. The methodology and report template used to evaluate these components adheres to the DMS monitoring report template guidance document Version 1.3 (dated January 15, 2010), which will continue to serve as the template for subsequent monitoring years. The vegetation monitoring quadrants follow CVS-DMS monitoring levels 1 and 2 in accordance with CVS-DMS Protocol for Recording Vegetation, Version 4.1 (2007).

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. This survey system collects point data with an accuracy of less than one tenth of a foot.

The specific locations of monitoring features, such as permanent vegetation plots, permanent cross-sections, flow gauges, and crest gauges are shown on the CCPV (Figure 2) found in Appendix B.

The Year 7 vegetation data was collected in August and September of 2021, while the cross-section survey data was collected in September of 2021. Visual site assessment data found in Appendix B was primarily collected in March, September, and November of 2021, unless noted otherwise.

2.1 Stream Assessment

The project involved the restoration and enhancement of a rural piedmont stream system, which had been impaired due to past agricultural conversion and cattle grazing. Restoration practices involved raising the existing streambed and reconnecting the stream to the relic floodplain to restore natural flood regimes to the system. The existing channels abandoned within the restoration areas were partially to completely filled to decrease surface and subsurface drainage and to raise the local water table. Permanent cattle exclusion fencing was provided around all proposed reaches and riparian buffers in which cattle previously had access.

2.1.1 Morphologic Parameters and Channel Stability

A longitudinal profile was surveyed for the entire length of each channel after construction to document the as-built baseline monitoring conditions (Year 0) only. Annual longitudinal profiles will not be conducted during subsequent monitoring years unless channel instability has been documented or remedial actions/repairs are required by the US Army Corps of Engineers (USACE) or DMS.

Cross-sections were classified using the Rosgen Stream Classification System (Rosgen 1994) and all monitored cross-sections fall within the quantitative parameters defined for channels of their design stream type. Cross-sections were also compared to all previous cross-section survey data to evaluate changes between construction and the current condition. Morphological survey data is presented in Appendix D.

Particle size distribution assessments (pebble counts) were conducted using the modified Wolman method as described in Applied River Morphology (Rosgen, 1996). Two pebble counts were conducted in MY7 and can be found in Appendix D.

2.1.2 Hydrology

To document seasonal flow in restored intermittent channels, two in-stream automated flow gauges (pressure transducers) were installed on the UT4 site (in UT4-R1b and UT4-R4b), and one was installed on the HC site (in HC-R1). Success criteria are established in the mitigation plan and all flow and photographic data collected on site are considered supportive data. The recorded flow data and observed rainfall graphs for each gauge, along with the flow gauge success summary table are all located in Appendix E.

The occurrence of bankfull events within the monitoring period are documented by the use of two cork crest gauges, water level readings from the three installed flow gauges, flow camera photographs, as well as by any visual evident observed in the floodplains. One cork crest gauge is installed at bankfull elevation along on HC-R2 and a second cork crest gauge is installed along UT4-R2. The flow camera is installed on UT4-R4b at the in-stream flow gauge location along that reach. The Flow camera photographs and any visual evidence of bankfull events are found in Appendix B, while all project crest gauge readings are presented in Table 13 in Appendix E.

2.1.3 Photographic Documentation

Reference photograph transects were taken at each permanent cross-section during the survey work in September 2021. The survey tape was centered in the photographs of the bank. The water line was located in the lower edge of the frame, and as much of the bank as possible is included in each photograph.

Representative photographs for the Year 7 monitoring were taken during site visits for the Hurricane Creek and UT4 portions of the project in March 2021. Vegetation plot photographs were taken at the time of their sampling in August and September 2021.

A stream flow camera is located along UT4-R4b at the location of the in-stream flow gauge to provide further documentation of seasonal flow and photographs show water in the channel throughout the winter and spring of 2021, confirming the results collected from the in-stream flow gauge found in the same location.

The photographs of all stream reaches, flow camera photos, monitoring gauges (both crest and flow gauges), stream and/or vegetation problem areas (if applicable), as well as photos of any previous stream or vegetation maintenance issues are all located in Appendix B.

2.2 Vegetation Assessment

In order to determine if the criteria are achieved, vegetation-monitoring quadrants were installed and are monitored across the restoration site in accordance with the CVS-DMS Protocol for Recording Vegetation, Version 4.1 (Lee et. al. 2007) and the CVS-DMS data entry tool v 2.3.1 (CVS 2012). The vegetation monitoring plots were established randomly throughout the planted riparian buffer areas of UT4 and HC as per Monitoring Levels 1 and 2. The size of each individual quadrants are 100 square meters for woody tree species.

Based on the Year 7 vegetation plot monitoring data collected during August and September of 2021, the average planted stem density is 556 stems per acre. Thus, the vegetation data demonstrate that the project as a whole is meeting the minimum success criteria of 210 trees per acre by the end of Year 7.

Complete Year 7 vegetation assessment information is provided in Appendix C.

3.0 REFERENCES

Carolina Vegetation Survey (CVS) and NC Division of Mitigation Services (NCDMS). 2012. CVS-NCDMS Data Entry Tool v. 2.3.1. University of North Carolina, Raleigh, NC.

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

North Carolina Division of Mitigation Services (DMS). 2011. Monitoring Requirements and Performance Standards for Stream and/or Wetland Mitigation. November 7, 2011.

North Carolina Division of Mitigation Services (DMS). 2010. Procedural Guidance and Content Requirements for DMS Annual Monitoring Reports. Version 1.3 (1/15/2010)

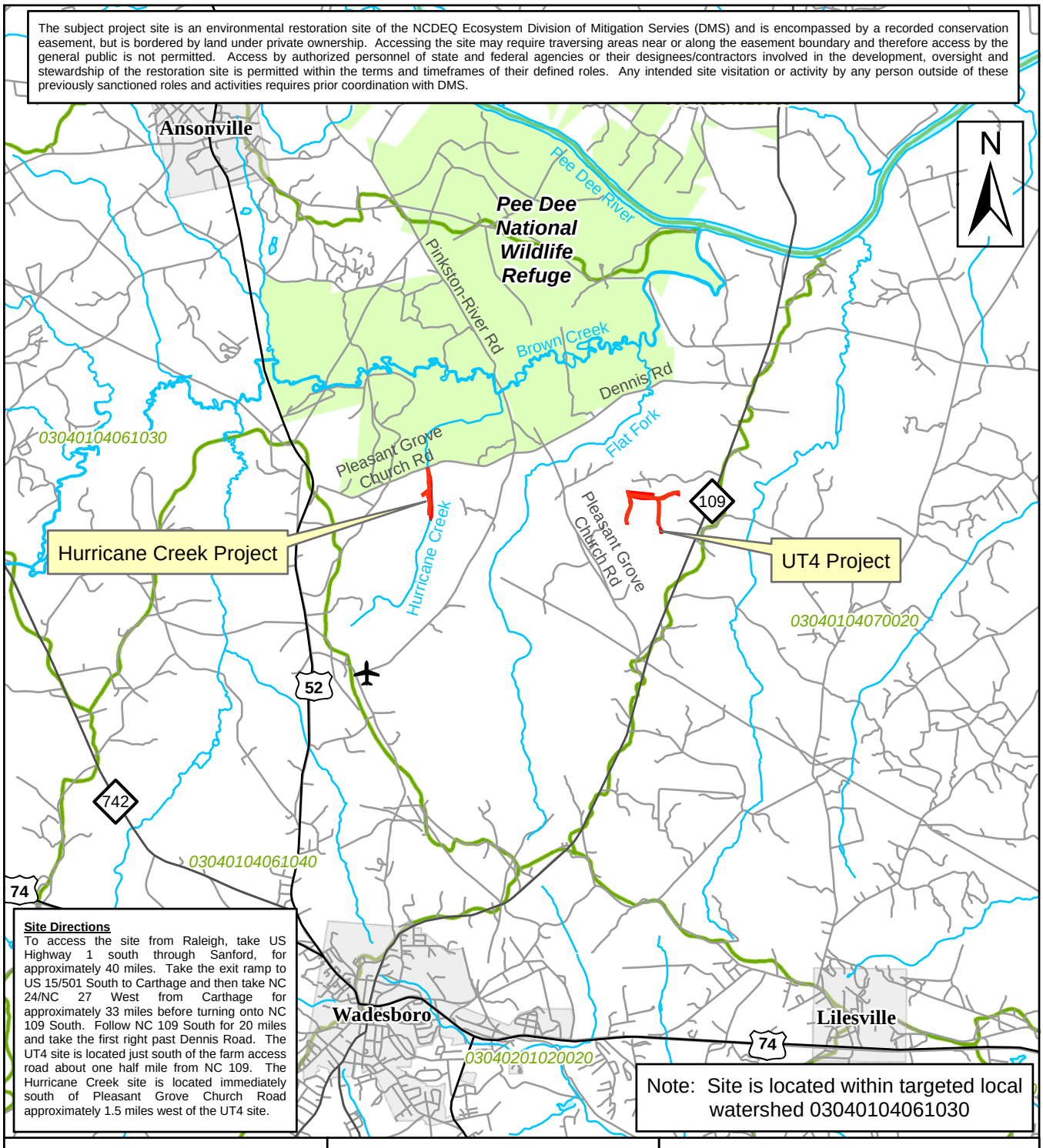
North Carolina Division of Mitigation Services (DMS). 2009. Lower Yadkin-Pee Dee River Basin Restoration Priorities (RBRP) Plan. Updated January 2009.

Rosgen, D.L. 1996. Applied River Morphology. Wildlands Hydrology. Pagosa Springs, CO.

Appendix A

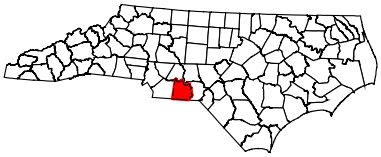
Project Vicinity Map, Background Tables and Files

The subject project site is an environmental restoration site of the NCDEQ Ecosystem Division of Mitigation Servies (DMS) and is encompassed by a recorded conservation easement, but is bordered by land under private ownership. Accessing the site may require traversing areas near or along the easement boundary and therefore access by the general public is not permitted. Access by authorized personnel of state and federal agencies or their designees/contractors involved in the development, oversight and stewardship of the restoration site is permitted within the terms and timeframes of their defined roles. Any intended site visitation or activity by any person outside of these previously sanctioned roles and activities requires prior coordination with DMS.



Site Directions
To access the site from Raleigh, take US Highway 1 south through Sanford, for approximately 40 miles. Take the exit ramp to US 15/501 South to Carthage and then take NC 24/NC 27 West from Carthage for approximately 33 miles before turning onto NC 109 South. Follow NC 109 South for 20 miles and take the first right past Dennis Road. The UT4 site is located just south of the farm access road about one half mile from NC 109. The Hurricane Creek site is located immediately south of Pleasant Grove Church Road approximately 1.5 miles west of the UT4 site.

Note: Site is located within targeted local watershed 03040104061030



Anson County

Figure 1
Project Vicinity Map
Brown Creek Tributaries

NCDEQ -
Division of Mitigation Services

Michael Baker
INTERNATIONAL

0 0.5 1 2
Miles

Table 1. Project Components and Mitigation Credits (Warm Thermal Regime)

Brown Creek Tributaries Restoration Project: DMS Project No ID. 95351

Mitigation Credits

	Stream (Warm)		Riparian Wetland		Non-riparian Wetland		Buffer	Nitrogen Nutrient Offset	Phosphorus Nutrient Offset
Type	R	RE							
Totals	9,663.266	102.200							

Project Components

Project Component or Reach ID	Stationing/ Location [1]	Existing Footage/ Acreage (LF)	Approach	Restoration/ Restoration Equivalent Credits (SMU) from Mitigation Plan[2]	As-Built Restoration Footage or Acreage (LF)	Mitigation Ratio
HC-R1	10+00 - 30+43	1,896	Restoration	2,035.000	2,043	1:1
HC-R2	30+43 - 30+52 & 30+82 - 44+67	1,288	Restoration	1,366.000	1,394	1:1
HC-R3	10+36 - 16+00	579	Enhancement Level II	231.600	564	2.5:1
UT4-R1a	10+00 - 15+18	511	Preservation	102.200	511	5:1
UT4-R1b	11+07 - 19+64	906	Restoration	849.000	858	1:1
UT4-R2	19+64 - 21+11 & 21+42 - 38+23	1,673	Restoration	1,827.000	1,828	1:1
UT4-R3	28+92 - 31+42	244	Restoration	227.000	250	1:1
UT4-R4a	10+00 - 13+96	395	Restoration	395.000	396	1:1
UT4-R4b	14+28 - 25+23 & 25+43 - 28+92	1,392	Restoration	1,452.000	1,444	1:1
UT4-R5a	09+44 - 13+35	386	Enhancement Level I	257.333	391	1.5:1
UT4-R5b	14+40 - 30+22	1,535	Enhancement Level I	1,023.333	1,582	1.5:1

Component Summation

Restoration Level	Stream (LF)	Riparian Wetland (AC)		Non-riparian Wetland (AC)	Buffer (SF)	Upland (AC)
		Riverine	Non-Riverine			
Restoration	8,213					
Enhancement I	1,973					
Enhancement II	564					
Preservation	511					

BMP Elements

Element		Location	Purpose/Function	Notes

BMP Elements: BR= Bioretention Cell; SF= Sand Filter; SW= Stormwater Wetland; WDP= Wet Detention Pond; DDP= Dry Detention Pond; FS= Filter Strip; S= Grassed Swale; LS= Level Spreader; NI=Natural Infiltration Area

[1] All powerline easements and cattle/vehicular crossings were excluded from the conservation easement boundary and so no credit reductions are associated with those features.

[2] The SMU credit numbers used here were taken indirectly from the mitigation plan as per DMS/IRT instruction, and vary from those presented in earlier monitoring reports. Although these decimal values were not directly presented in the mitigation plan (which only used rounded, whole numbers), the spreadsheet originally created to determine those credits was used to generate these decimal values. The mitigation plan credit numbers were used here to address the differences between the anticipated credits found in the mitigation plan and the final credits reported in the baseline/as-built report, obstensibly a result of survey differences between the use of stream centerline versus thalweg values.

Table 2. Project Activity and Reporting History			
Brown Creek Tributaries Restoration Project: DMS Project No ID. 95351			
Activity or Report	**Scheduled Completion**	**Data Collection Complete**	**Actual Completion or Delivery**
Mitigation Plan Prepared	N/A	N/A	Jan-14
Mitigation Plan Amended	N/A	N/A	Mar-14
Mitigation Plan Approved	Nov-13	N/A	Jun-14
Final Design – (at least 90% complete)	N/A	N/A	Jun-14
Construction Begins	Sep-13	N/A	Nov-14
Temporary S&E mix applied to entire project area	Jul-14	N/A	May-15
Permanent seed mix applied to entire project area	Jul-14	N/A	May-15
Planting of live stakes	Jul-14	N/A	May-15 [1]
Planting of bare root trees	Jul-14	N/A	May-15 [1]
End of Construction	Jul-14	N/A	May-15
Survey of As-built conditions (Year 0 Monitoring-baseline)	Jul-14	Jul-15	Jul-15
Baseline Monitoring Report	Feb-15	Jul-15	Nov-16 [2]
Year 1 Monitoring	Dec-15	Feb-16 [3]	Jan-17
Year 2 Monitoring	Dec-16	Nov-16	Jan-17
Privet treated: HC-R3	Treated September 2016		
Stream repairs: Crossing rebuilt on lower UT4-R4b, 3 riffles rebuilt along UT4-R2, J-hook replacement on UT4-R3, bank maintenance/repair on UT4-R2, UT4-R3, and UT4-R5a	Repairs made in June 2016		
Year 3 Monitoring	Dec-17	Nov-17	Nov-17
Stream repairs: Eroding banks regraded & geolifts rebuilt on UT4-R2 (Station 31+75), and on UT4-R4b (Station 23+20)	Repairs made March 2017		
Supplemental planting on upper UT4-R4b	Replanted in January 2017		
Privet treated: HC-R3	Treated January 2017		
Year 4 Monitoring	Dec-18	Oct-18	Dec-18
Supplemental planting on upper HC-R2, UT4-R2	Conducted in March 2018		
Privet treated on upper HC-R1 and lower UT4-R4b	Treated March 2018		
Pines/sweetgum thinned on UT4-R4b and UT4-R2	Thinned in June 2018		
Year 5 Monitoring	Dec-19	Nov-19	Feb-20 (Final)
Low vigor planted stems fertilized on HC-R1	Fertilized in March and October 2019		
Year 6 Monitoring	Dec-20	Nov-20	Jan-21 (Final)
Low vigor planted stems fertilized on HC-R1	Fertilized in April and October 2020		
Pines thinned on HC-R1 and UT4-R2	Thinned in April 2020		
Supplemental planting on HC-R2, UT4-R2, & UT4-R4	Conducted in February 2020		
Year 7 Monitoring	Dec-21	Sep-21	Feb-22 (Final)
Privet treated on Upper HC-R1 and HC-R3	Treated in March 2021		
Repairs made to sections of unstable bank at UT4	Repairs made in September 2021		
Pines/sweetgum thinned on UT4-R2 and UT4-R3	Thinned in March and November 2021		

[1] All of HC and Reaches R1, R2, and R5 for UT4 were planted in March 2015, while Reaches R3 and R4 were planted in mid-May 2015 for UT4.

[2] As-built / Baseline Report submission was delayed due to conservation easement adjustment issues.

[3] Veg plot monitoring was conducted in Nov 2015, while survey data was collected in Feb 2016 to ensure 180 days between the As-Built and MY1 surveys.

Table 3. Project Contacts **Brown Creek Tributaries Restoration Project: DMS Project ID No. 95351**	
Designer	
Michael Baker Engineering, Inc.	797 Haywood Rd, Suite 201 Asheville, NC 28806 Contact: Scott King, Tel. 828-412-6102
Construction Contractor	
River Works, Inc.	114 W. Main St. Clayton, NC 27520 Contact: Stephen Carroll, Tel. 919-428-8368
Planting Contractor	
River Works, Inc.	114 W. Main St. Clayton, NC 27520 Contact: Stephen Carroll, Tel. 919-428-8368
Seeding Contractor	
River Works, Inc.	114 W. Main St. Clayton, NC 27520 Contact: Stephen Carroll, Tel. 919-428-8368
Seed Mix Sources Nursery Stock Suppliers	Green Resources, Tel. 336-855-6363 Mellow Marsh Farm, 919-742-1200 ArborGen, 843-528-3204
Monitoring Performers	
Michael Baker Engineering, Inc.	797 Haywood Rd, Suite 201 Asheville, NC 28806
Stream Monitoring Point of Contact Vegetation Monitoring Point of Contact	Contact: Scott King, Tel. 828-412-6102 Scott King, Tel. 828-412-6102

Table 4a. Project Attribute Information - Hurricane Creek (Pre-Construction) Brown Creek Tributaries Restoration Project Stream Mitigation Plan - DMS Project No. 95351			
Project Information			
Project Name	Brown Creek Tributaries Restoration Project – Hurricane Creek		
County	Anson		
Project Area (acres)	14.1		
Project Coordinates (latitude and longitude)	35.0498 N, -80.0665 W		
Watershed Summary Information			
Physiographic Province	Piedmont		
Geologic Unit	Triassic Basin		
River Basin	Yadkin		
USGS Hydrologic Unit 8-digit and 14-digit	03040104 / 03040104061030		
NCDWR Sub-basin	03-07-10		
Project Drainage Area (acres)	1,383		
Project Drainage Area Percentage Impervious	2%		
CGIA / NCEEP Land Use Classification	2.01.01.01, 2.03.01, 2.99.01, 3.02 / Forest (69%) Agriculture (15%) Impervious Cover (2%)		
Stream Reach Summary Information			
Parameters	**HC-R1**	**HC-R2**	**HC-R3**
Length of Reach (linear feet)	1,347	1,384	546
Valley Classification (Rosgen)	VII	VII	VII
Drainage Area (acres)	1,077	1,383	119
NCDWR Stream Identification Score	26.5	31	23
NCDWR Water Resources Classification	Class C		
Morphological Description (Rosgen stream type)	Incised E	Incised E	G/Incised Bc
Evolutionary Trend	Incised	Incised E→G→F	Incised B → G → F
Underlying Mapped Soils	ChA	ChA	CrB
Drainage Class	Somewhat poorly drained	Somewhat poorly drained	Moderately well drained
Soil Hydric Status	Hydric	Hydric	Non-Hydric
Average Channel Slope (ft/ft)	0.0035	0.0024	0.0108
FEMA Classification	Zone AE	Zone AE	Zone AE
Native Vegetation Community	Piedmont Small Stream		
Percent Composition of Exotic/Invasive Vegetation	<5%	<5%	<5%
Regulatory Considerations			
Regulation	**Applicable**	**Resolved**	**Supporting Documentation**
Waters of the United States – Section 404	Yes	Yes	Categorical Exclusion (Appendix B)
Waters of the United States – Section 401	Yes	Yes	Categorical Exclusion (Appendix B)
Endangered Species Act	No	N/A	Categorical Exclusion (Appendix B)
Historic Preservation Act	No	N/A	Categorical Exclusion (Appendix B)
Coastal Area Management Act (CAMA)	No	N/A	Categorical Exclusion (Appendix B)
FEMA Floodplain Compliance	Yes	Yes	Categorical Exclusion (Appendix B)
Essential Fisheries Habitat	No	N/A	Categorical Exclusion (Appendix B)

Table 4b. Project Attribute Information - UT4 (Pre-Construction)
Brown Creek Tributaries Restoration Project Stream Mitigation Plan - DMS Project No. 95351

Project Information					
Project Name	Brown Creek Tributaries Restoration Project – UT4				
County	Anson				
Project Area (acres)	29.2				
Project Coordinates (latitude and longitude)	35.0477 N, -80.0274 W				
Watershed Summary Information					
Physiographic Province	Piedmont				
River Basin	Yadkin				
USGS Hydrologic Unit 8-digit and 14-digit	03040104 / 03040104061030				
DWR Sub-basin	03-07-10				
Project Drainage Area (acres)	974				
Project Drainage Area Percent Impervious	<2%				
CGIA / NCEEP Land Use Classification	2.01.01.01, 2.03.01, 2.99.01, 3.02 / Forest (69%) Agriculture (15%) Impervious Cover (<2%)				
Stream Reach Summary Information					
Parameters	**UT4-R1**	**UT4-R2**	**UT4-R3**	**UT4-R4**	**UT4-R5**
Length of Reach (linear feet)	1,417	1,627	242	1,716	1,564
Valley Classification (Rosgen)	VII	VII	VII	VII	VII
Drainage Area (acres)	218	706	974	267	452
NCDWR Stream Identification Score	28.5	29	32	26	23.5
NCDWR Water Resources Classification	Class C				
Morphological Description (Rosgen stream type)	F/G	Incised E	G	G	Incised Bc / C
Evolutionary Trend	Incised E → Gc → F	Bc → G → F	Bc→G→F	Incised E → G → F	Incised E → G → F
Underlying Mapped Soils	ChA	ChA	ChA	ChA, MaB	ChA
Drainage Class	Somewhat poorly drained	Somewhat poorly drained	Somewhat poorly drained	Somewhat poorly drained	Moderately well drained
Soil Hydric Status	Hydric	Hydric	Hydric	Hydric	Hydric
Average Channel Slope (ft/ft)	0.0077	0.0053	0.0009	0.0073	0.0038
FEMA Classification	N/A	Zone AE	Zone AE	Zone AE	N/A
Native Vegetation Community	Piedmont Small Stream				
Percent Composition of Exotic/Invasive Vegetation	<5%	<5%	<5%	<5%	<5%

Regulatory Considerations			
Regulation	**Applicable**	**Resolved**	**Supporting Documentation**
Waters of the United States – Section 404	Yes	Yes	Categorical Exclusion (Appendix B)
Waters of the United States – Section 401	Yes	Yes	Categorical Exclusion (Appendix B)
Endangered Species Act	No	N/A	Categorical Exclusion (Appendix B)
Historic Preservation Act	No	N/A	Categorical Exclusion (Appendix B)
Coastal Area Management Act (CAMA)	No	N/A	Categorical Exclusion (Appendix B)
FEMA Floodplain Compliance	Yes	Yes	Categorical Exclusion (Appendix B)

Timber Encroachment Documents

BTG Pactual Asset Management US, LLC
1038 Wildewood Centre Dr., Suite A
Columbia, SC 29229
PH 803-788-6256 | FAX 803-788-6923

February 7, 2021

Mr. Scott King
Michael Baker International
Ecosystem Restoration Group
797 Haywood Road, Suite 201
Asheville, North Carolina 28806

Mr. King:

After thorough investigation by my field manager, Milliken Advisors, we acknowledge that the southern boundary line of my Client's property (CNC 6632, Anson County, North Carolina) was incorrectly painted. This error of six or seven feet resulted in our logger cutting several trees across the actual line during a recent timber harvest.

Thank you for installing new fence posts and signs along the line that we have agreed upon. We will endevour to respect this correctly marked line and not log across it in the future.

Our current timber type map is attached with the subject line noted.

Sincerely,

Scott T. Ashworth

Scott T. Ashworth
Asset Manager

cc: Matt Kearse; Milliken Advisors

IMAGE MAP

Client: OEP2-BTG Pactual OEF Property 2		**Tract:**	T.J. Jr. & Helen Ingram
PU:	CNC	**Tract Number:**	6632_1
Acres:	146.9	**County:**	Anson, NC
Consultant:	Milliken Forestry	**Asset Manager:**	Scott Ashworth

Map Produced: 1/5/2022

0 295 590 Feet

AMERICAN FOREST MANAGEMENT

Description = Origin+Land Class+Species Code+Year Established

Stand	Description	Ownership	Thin Year	Acres
1	OUCO-2021	Fee Simple	0	69.2
3	NBHW-1950	Fee Simple	0	4.6
4	PULB-1991	Fee Simple	2013	72.6
901	ONUD-0	Fee Simple	0	0.5

SUBJECT BOUNDARY LINE

ROY COOPER
Governor
ELIZABETH S. BISER
Secretary
MARC RECKTENWALD
Director

NORTH CAROLINA
Environmental Quality

NOTICE OF VIOLATION

January 28, 2022

VIA CERTIFIED MAIL # 7009 2250 0000 8087 7551
Email to: Scott.King@mbakerintl.com

Linda Hatem
1500 Turtlewood Drive
Waxhaw, NC 28173

Re: Trespass and Injury to Conservation Easement
95351 Brown Creek Tributaries Project
Anson County

Dear Ms. Hatem,

In December 2013 the State of North Carolina acquired a conservation easement on your property for the purposes of protecting streams, wetlands, and forested riparian buffers. This easement protects the State's interest in the 95351 Brown Creek Tributaries mitigation site and restricts certain activities on the property. For reference the easement and plat are recorded in the Anson County Register of Deeds:

Original Owner	Reference	Date	SPO File No.
Louis Edward Hatem et al (Now listed at Anson County Tax office as HATEM CARLTON LINDA)	Deed Book 1054, Page 122-134	12/19/2013	04-B
	Plat Book 300, Page 9-12	12/19/2013	

During a routine site inspection on or around October 14, 2021, the State's Division of Mitigation staff observed approximately 0.05 acres of timber had been harvested within the easement area. The conservation easement recorded with the Anson County Register of Deeds describes prohibited and restricted activities in *Section II. Grantors Reserved Uses and Restricted Activities*. Specifically, the following activities are restricted or prohibited:

- per *paragraph C. Vegetative Cutting* – Except as related to the removal of diseased or damaged trees and vegetation that obstructs, destabilizes or renders unsafe the Easement Area to persons or natural habitat. All cutting, removal, mowing, harming or destruction of any trees and vegetation in the Easement Area is prohibited.
- Per *paragraph N. Disturbance of Natural Features* – Any change, disturbance, alteration or impairment of the natural features of the Easement Area or any intentional introduction of non-native plants, trees and/or animal species is prohibited.

As the landowner of the property subject to this conservation easement, it is your responsibility to ensure all easement requirements and restrictions are adhered to. **If you do not cease and desist performing or allowing**

these activities in the conservation easement area, legal action may be instituted to enjoin ongoing or future violations and to seek recovery of damages incurred as a result of these violations.

On 01/05/2022 a contractor for the NC Division of Mitigation Services, Baker Engineering, sent an email to us acknowledging the timber encroachment and proposed an outline of remedial activities. These remedial actions are based on the conversations Baker held with Matt Kearse of Milliken Forestry Co working for American Timberland II, LLC. We understand a resolution in principle has been discussed and encourage a consensual remediation by all parties. We further support the leadership of this effort by our contractor representative, Scott King, with Baker Engineering. If Milliken Forestry Co agrees to work with Baker Engineering at a cost agreed by the two parties to remedy damages, we will consider this resolved. To be clear, you are the landowner and responsible for realizing the successful implementation of the outlined proposal below:

1. Michael Baker International will develop a planting and remediation plan to ensure the impacted area is reforested consistent with the surrounding natural vegetation. Please see references cited at the end of this letter for more information on this topic. Baker Engineering will draft the plan which will be reviewed and approved by the DMS project manager.
2. The plants shall consist of 5 or 7 gallon specimens.
3. Michael Baker International will improve the marking along the boundary line to prevent any future similar occurrence. Spacing of the marking shall not exceed 100 ft and will adhere to the current standards of boundary marking for DMS.

I appreciate your cooperation in respecting the State's property rights enumerated in the conservation easement and the State's right to restrict agricultural activities within the easement area. Per conservation easement *Section IV. Enforcement and Remedies, paragraph A. Enforcement,* you have 90 days from the date of this letter to remedy this violation.
You may contact me by email or phone if you have any questions regarding this letter or would like to discuss this matter in more detail.

Sincerely,

Melonie Allen

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

Phone: 919- 368-9352
Melonie.Allen@ncdenr.gov

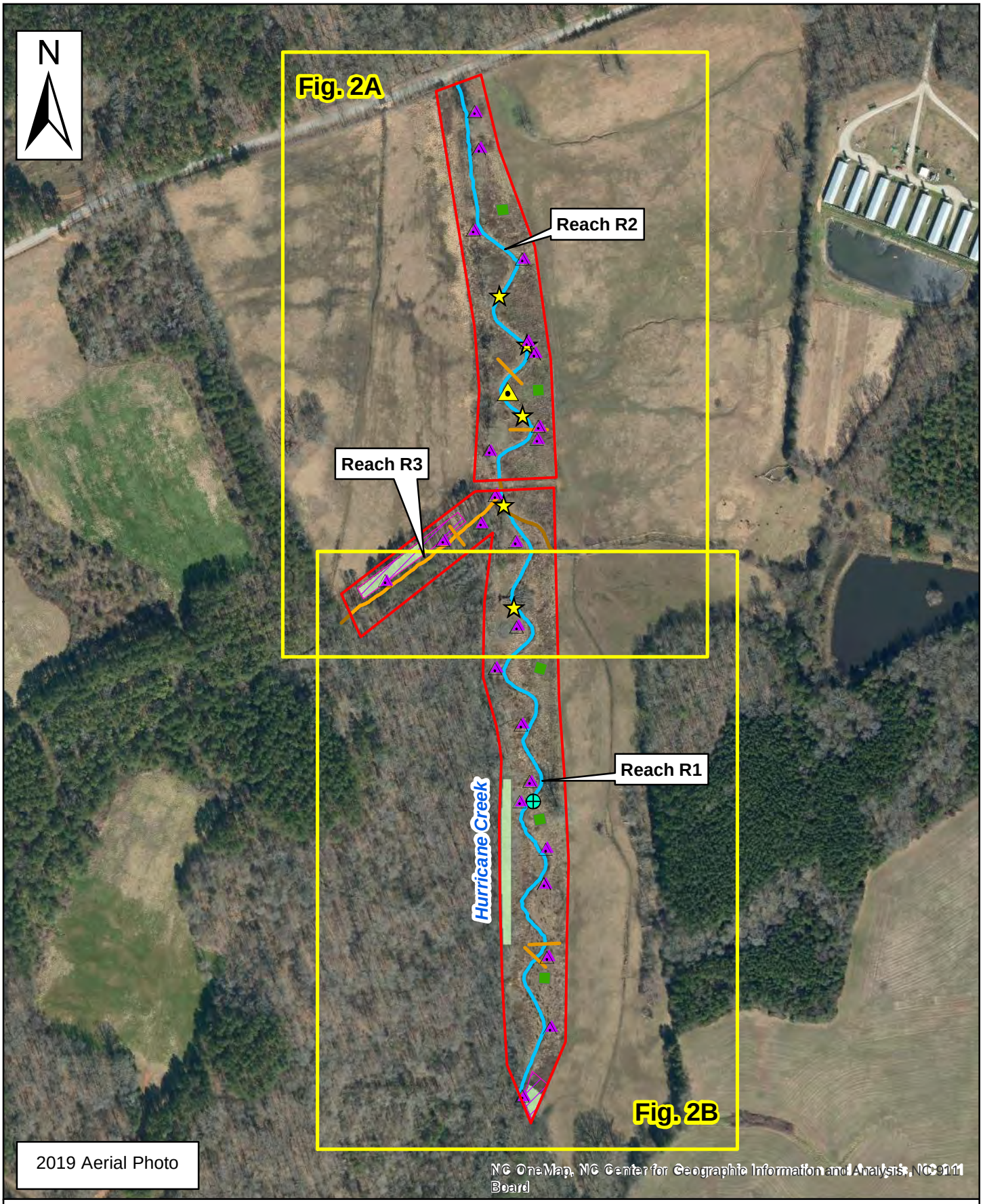
References:

- Preventing Timber Trespass and Theft in North Carolina, NC State University Cooperative Extension https://content.ces.ncsu.edu/preventing-timber-trespass-and-theft
- NC State Board of Registration for Foresters http://www.ncbrf.org/index.htm
- N.C. Gen. Stat. 14-135
- N.C. Gen. Stat. 1-539.1

cc: Douglas Ansel, Assistant General Counsel, NCDEQ
Blane Rice, State Property Office, NCDOA
Marc Recktenwald, NC DMS
Jeffrey Horton, NC DMS
Scott King, Michael Baker International
Eddie Hatem, Resident

Appendix B

Visual Assessment Data

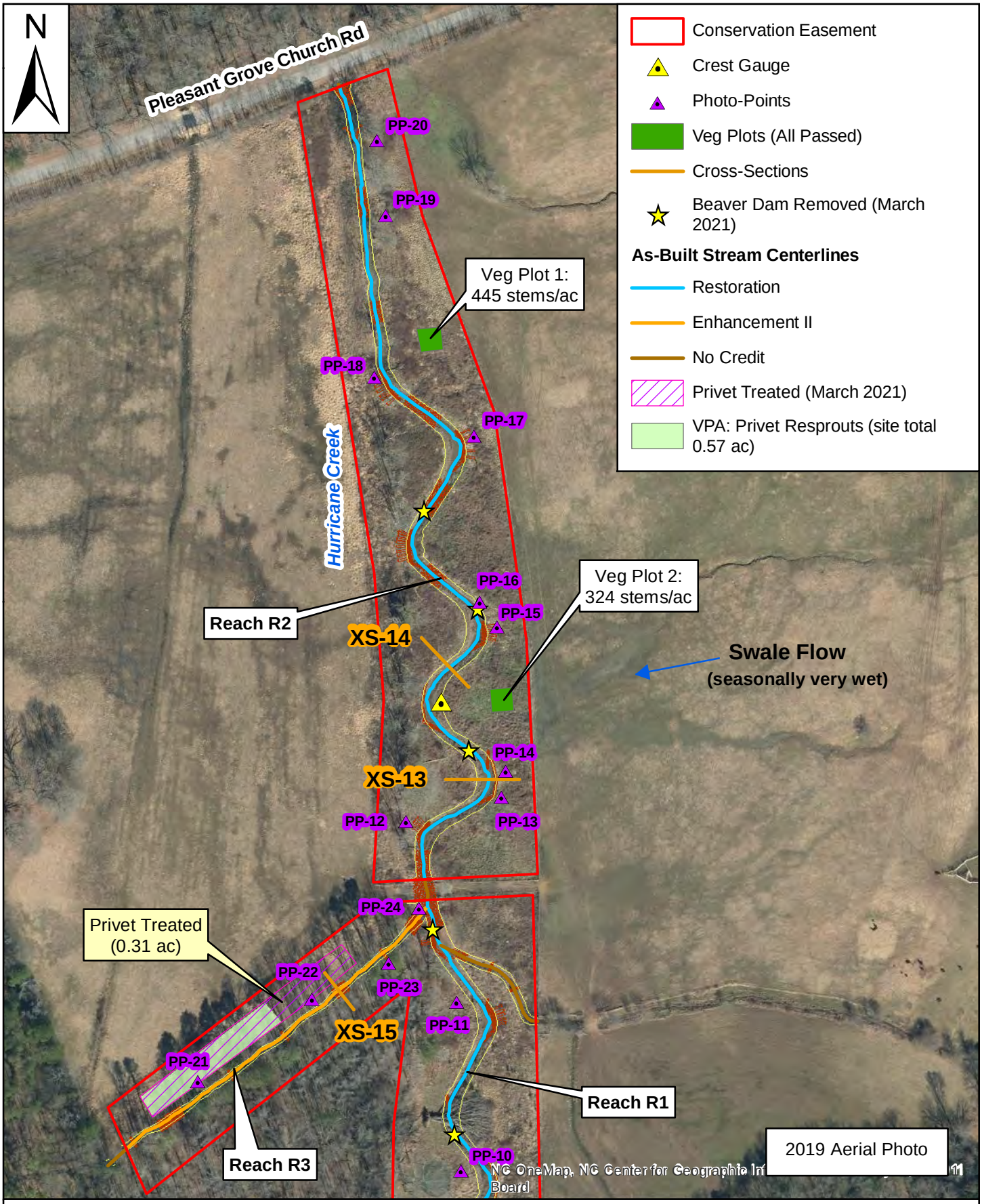


Michael Baker INTERNATIONAL

0 250 500 Feet

DMS Project #95351

Figure 2: Overview Map 1
Current Conditions Plan View
Monitoring Year 7
Hurricane Creek Site

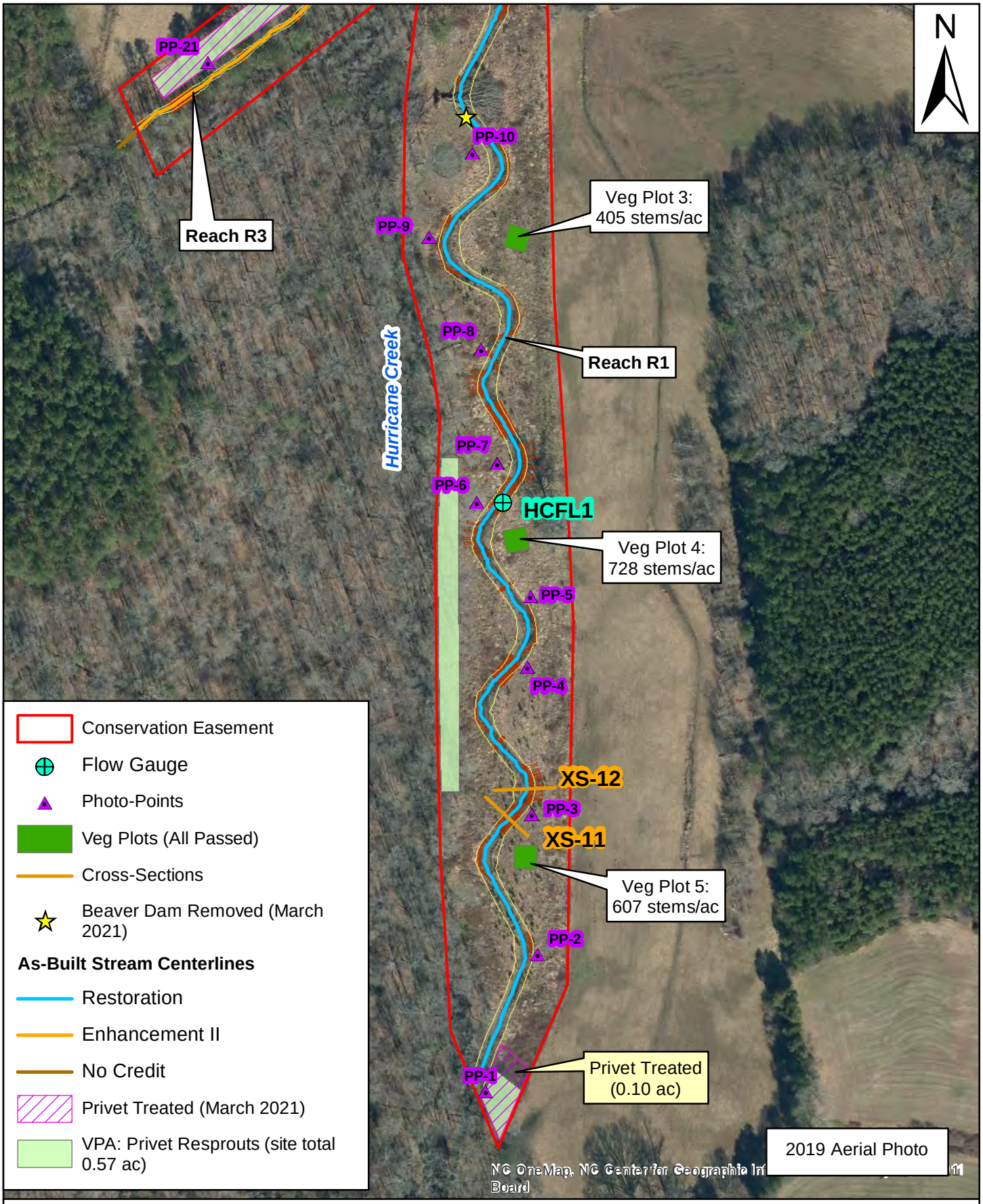


Michael Baker INTERNATIONAL

0 100 200 300 Feet

DMS Project #95351

Figure 2A
Current Conditions Plan View
Monitoring Year 7
Hurricane Creek Site

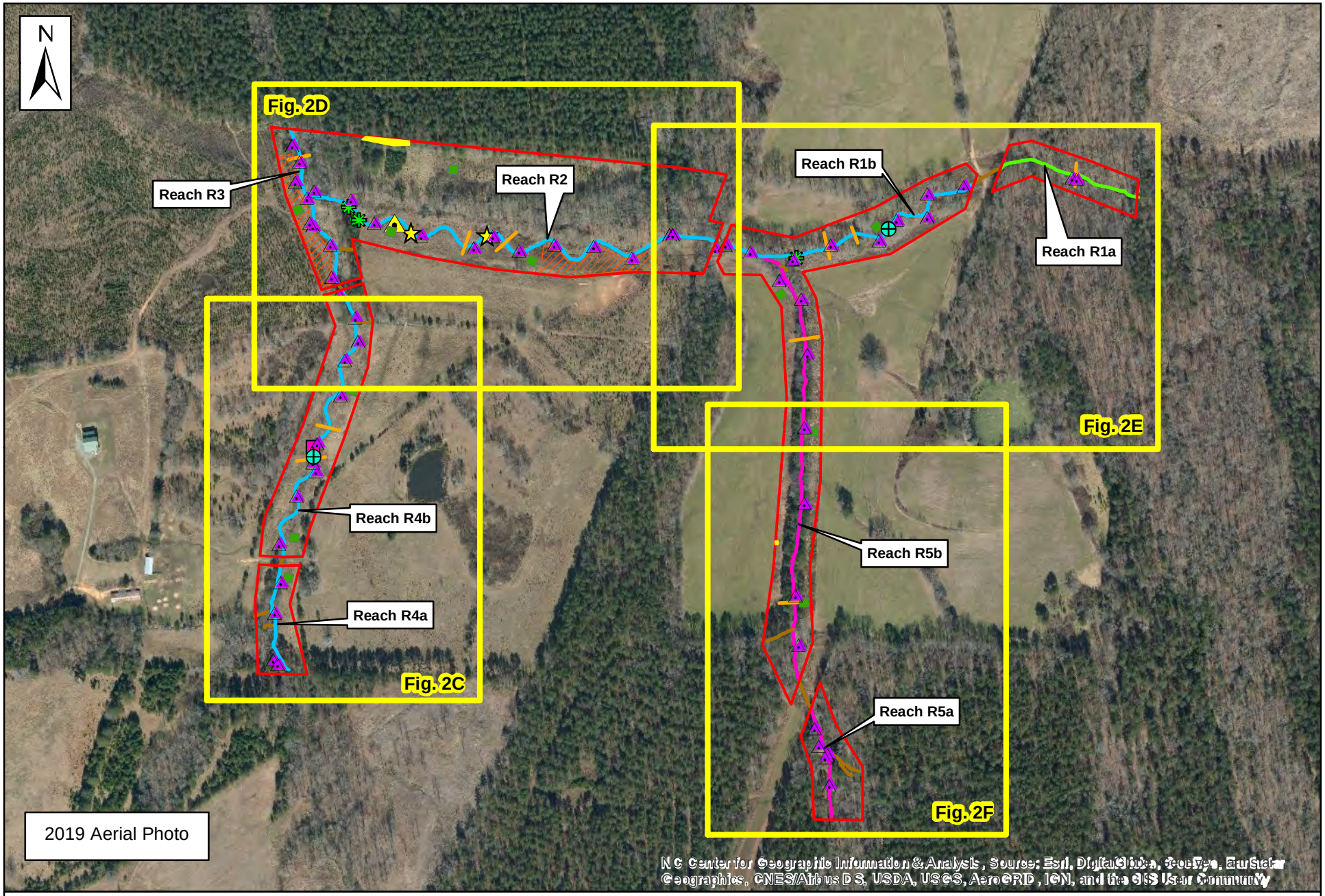


Michael Baker INTERNATIONAL

0 100 200 300 Feet

DMS Project #95351

Figure 2B
Current Conditions Plan View
Monitoring Year 7
Hurricane Creek Site

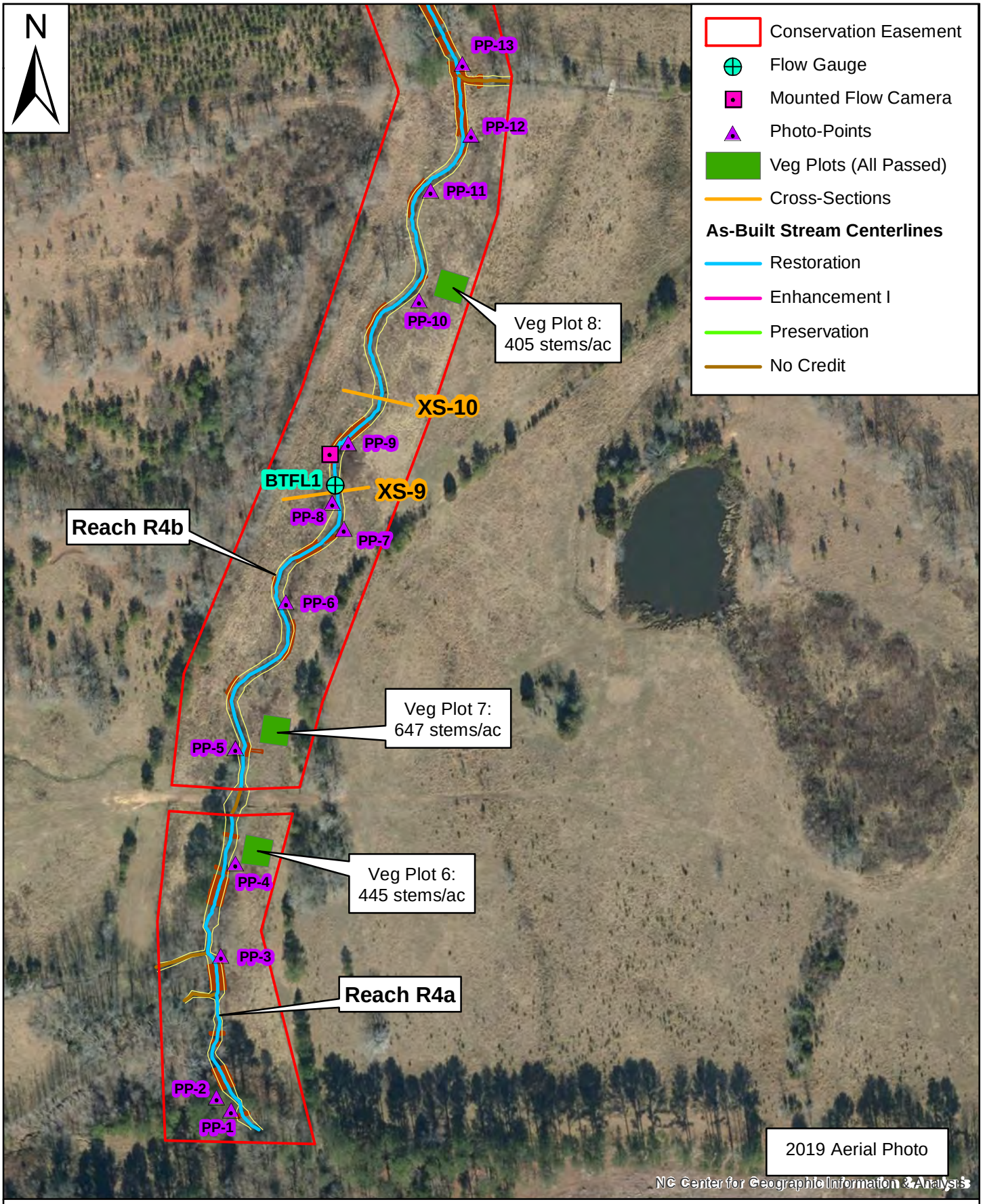


Michael Baker INTERNATIONAL

0 250 500 750 1,000 Feet

DMS Project #95351

Figure 2: Overview Map 2
Current Condition Plan View
Monitoring Year 7
Brown Creek Tribs: UT4 Site

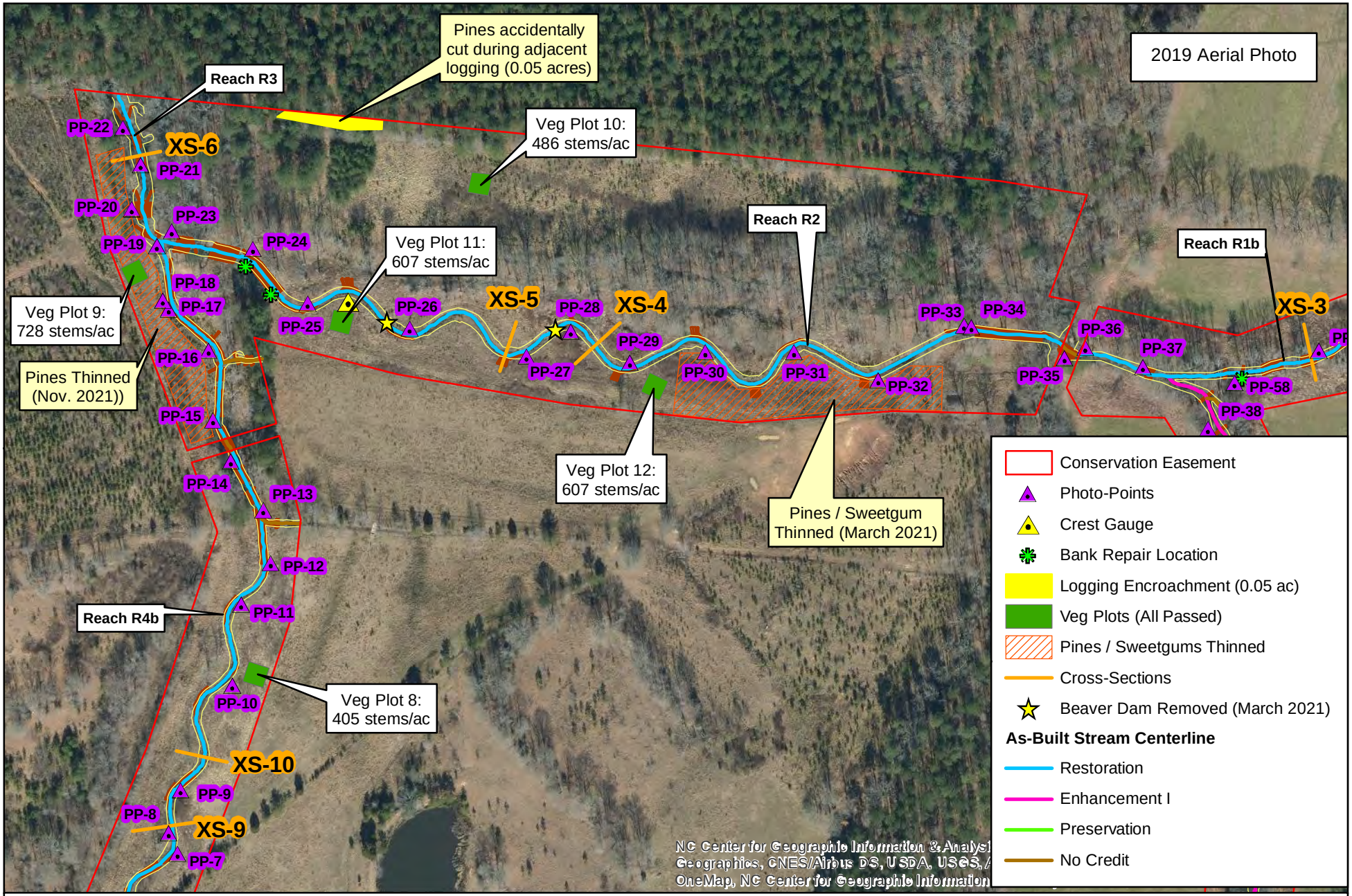


Michael Baker INTERNATIONAL

0 100 200 300 Feet

DMS Project #95351

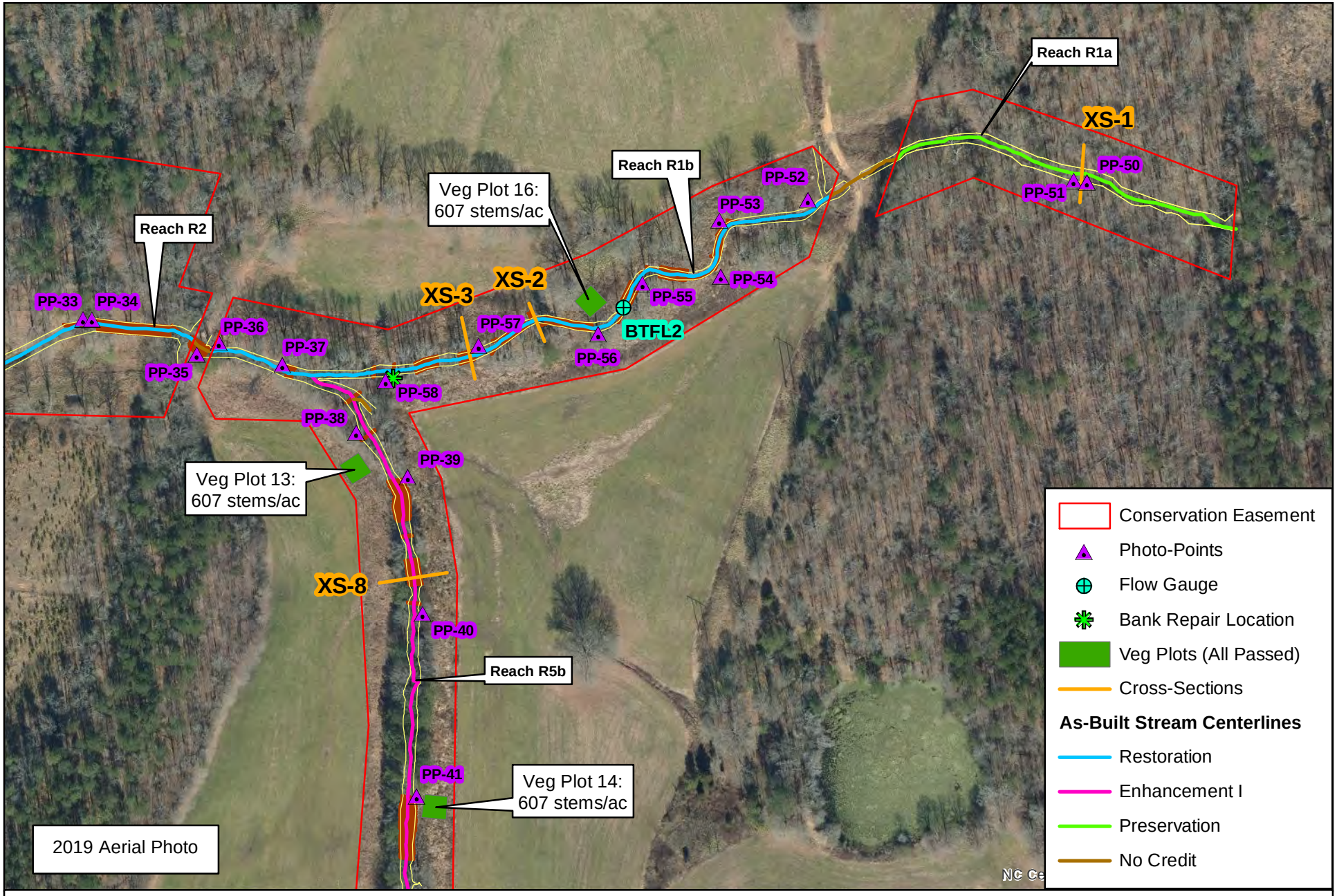
Figure 2C
Current Condition Plan View
Monitoring Year 7
Brown Creek Tribs: UT4 Site



Michael Baker INTERNATIONAL

DMS Project #95351

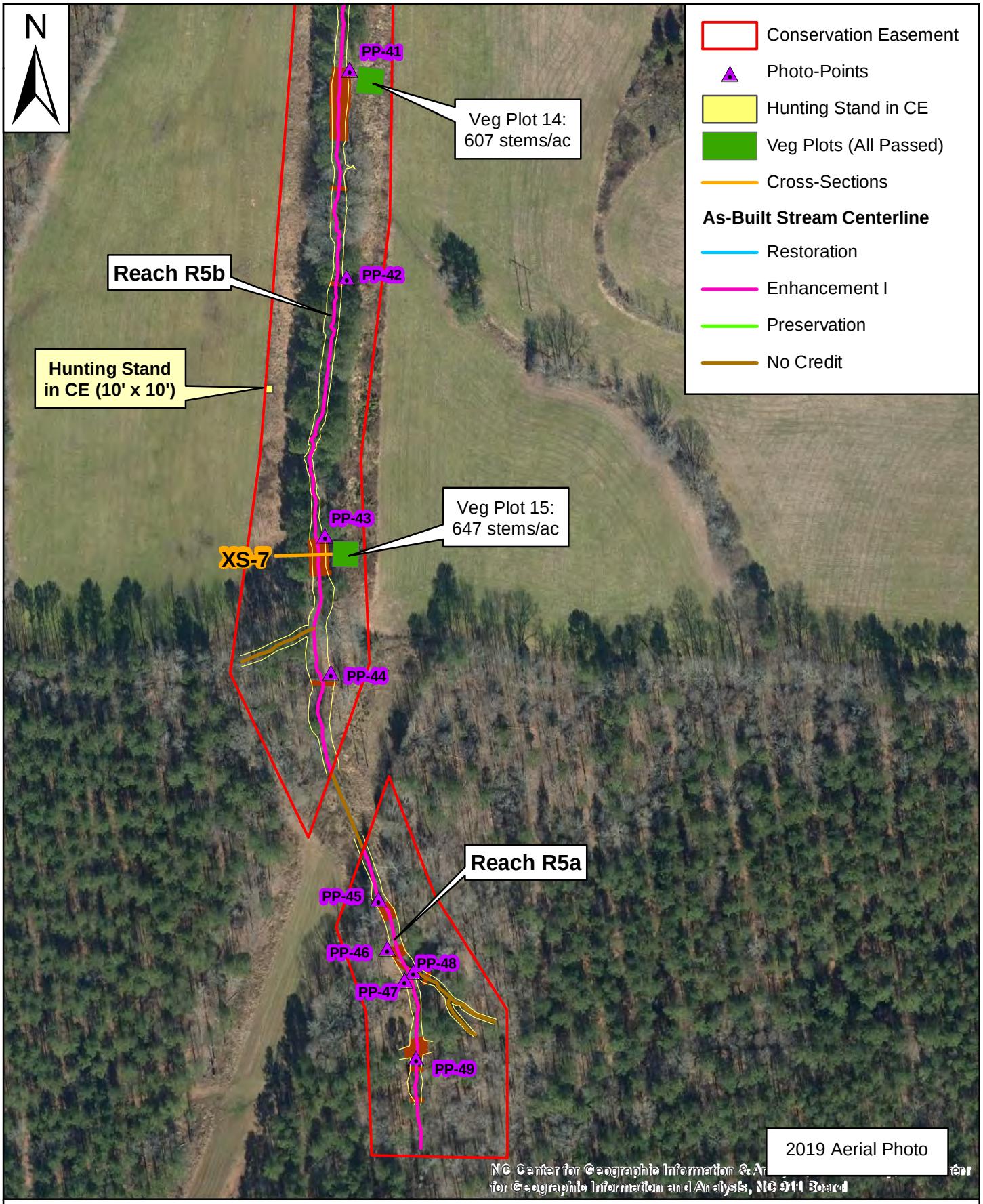
Figure 2D
Current Condition Plan View
Monitoring Year 7
Brown Creek Tribs: UT4 Site



Michael Baker INTERNATIONAL

DMS Project #95351

Figure 2E
Current Condition Plan View
Monitoring Year 7
Brown Creek Tribs: UT4 Site



Michael Baker INTERNATIONAL

0 100 200 300 Feet

DMS Project #95351

Figure 2F
Current Condition Plan View
Monitoring Year 7
Brown Creek Tribs: UT4 Site

Table 5a. Visual Stream Morphology Stability Assessment
Brown Creek Tributaries Restoration Project: DMS Project ID No. 95351
Reach ID: HC-R1
Assessed Length (LF): 2,043

Major Channel Category	Channel Sub-Category	Metric	Number Stable (Performing as Intended)	Total Number per As-built	Number of Unstable Segments	Amount of Unstable Footage	% Stable, Performing as Intended	Number with Stabilizing Woody Veg.	Footage with Stabilizing Woody Veg.	Adjusted % for Stabilizing Woody Veg.
1. Bed	1.Vertical Stability	1. Aggradation			0	0	100%			
		2. Degradation			0	0	100%			
	2. Riffle Condition	1. Texture Substrate	15	15			100%			
	3. Meander Pool Condition	1. Depth	14	14			100%			
		2. Length	14	14			100%			
	4. Thalweg Position	1. Thalweg centering at upstream of meander bend (Run)	15	15			100%			
		2. Thalweg centering at downstream of meander bend (Glide)	14	14			100%			
2. Bank	1. Scoured/Eroding	Bank lacking vegetative cover resulting simply from poor growth and/or scour and erosion			0	0	100%	0	0	100%
	2. Undercut	Banks undercut/overhanging to the extent that mass wasting appears likely			0	0	100%	0	0	100%
	3. Mass Wasting	Banks slumping, caving or collapse			0	0	100%	0	0	100%
		Totals			0	0	100%	0	0	100%
3. Engineering Structures	1. Overall Integrity	Structures physically intact with no dislodged boulders or logs	37	37			100%			
	2. Grade Control	Grade control structures exhibiting maintenance of grade across the sill	13	13			100%			
	2a. Piping	Structures lacking any substantial flow underneath sill or arms	18	18			100%			
	3. Bank Position	Bank erosion within the structures extent of influence does not exceed 15%	37	37			100%			
	4. Habitat	Pool forming structures maintaining - Max Pool Depth, Rootwads/logs providing some cover at low flow	27	27			100%			

Table 5a. Visual Stream Morphology Stability Assessment
Brown Creek Tributaries Restoration Project: DMS Project ID No. 95351
Reach ID: HC-R2
Assessed Length (LF): 1,394

Major Channel Category	Channel Sub-Category	Metric	Number Stable (Performing as Intended)	Total Number per As-built	Number of Unstable Segments	Amount of Unstable Footage	% Stable, Performing as Intended	Number with Stabilizing Woody Veg.	Footage with Stabilizing Woody Veg.	Adjusted % for Stabilizing Woody Veg.
1. Bed	1.Vertical Stability	1. Aggradation			0	0	100%			
		2. Degradation			0	0	100%			
	2. Riffle Condition	1. Texture Substrate	10	10			100%			
	3. Meander Pool Condition	1. Depth	9	9			100%			
		2. Length	9	9			100%			
	4. Thalweg Position	1. Thalweg centering at upstream of meander bend (Run)	10	10			100%			
		2. Thalweg centering at downstream of meander bend (Glide)	9	9			100%			
2. Bank	1. Scoured/Eroding	Bank lacking vegetative cover resulting simply from poor growth and/or scour and erosion			0	0	100%	0	0	100%
	2. Undercut	Banks undercut/overhanging to the extent that mass wasting appears likely			0	0	100%	0	0	100%
	3. Mass Wasting	Banks slumping, caving or collapse			0	0	100%	0	0	100%
		Totals			0	0	100%	0	0	100%
3. Engineering Structures	1. Overall Integrity	Structures physically intact with no dislodged boulders or logs	22	22			100%			
	2. Grade Control	Grade control structures exhibiting maintenance of grade across the sill	8	8			100%			
	2a. Piping	Structures lacking any substantial flow underneath sill or arms	7	7			100%			
	3. Bank Position	Bank erosion within the structures extent of influence does not exceed 15%	22	22			100%			
	4. Habitat	Pool forming structures maintaining - Max Pool Depth, Rootwads/logs providing some cover at low flow	13	13			100%			

Table 5a. Visual Stream Morphology Stability Assessment
Brown Creek Tributaries Restoration Project: DMS Project ID No. 95351
Reach ID: HC-R3
Assessed Length (LF): 564

Major Channel Category	Channel Sub-Category	Metric	Number Stable (Performing as Intended)	Total Number per As-built	Number of Unstable Segments	Amount of Unstable Footage	% Stable, Performing as Intended	Number with Stabilizing Woody Veg.	Footage with Stabilizing Woody Veg.	Adjusted % for Stabilizing Woody Veg.
1. Bed	1.Vertical Stability	1. Aggradation			0	0	100%			
		2. Degradation			0	0	100%			
	2. Riffle Condition	1. Texture Substrate	5	5			100%			
	3. Meander Pool Condition	1. Depth	6	6			100%			
		2. Length	6	6			100%			
	4. Thalweg Position	1. Thalweg centering at upstream of meander bend (Run)	5	5			100%			
		2. Thalweg centering at downstream of meander bend (Glide)	6	6			100%			
2. Bank	1. Scoured/Eroding	Bank lacking vegetative cover resulting simply from poor growth and/or scour and erosion			0	0	100%	0	0	100%
	2. Undercut	Banks undercut/overhanging to the extent that mass wasting appears likely			0	0	100%	0	0	100%
	3. Mass Wasting	Banks slumping, caving or collapse			0	0	100%	0	0	100%
				Totals	0	0	100%	0	0	100%
3. Engineering Structures	1. Overall Integrity	Structures physically intact with no dislodged boulders or logs	7	7			100%			
	2. Grade Control	Grade control structures exhibiting maintenance of grade across the sill	7	7			100%			
	2a. Piping	Structures lacking any substantial flow underneath sill or arms	7	7			100%			
	3. Bank Position	Bank erosion within the structures extent of influence does not exceed 15%	7	7			100%			
	4. Habitat	Pool forming structures maintaining - Max Pool Depth, Rootwads/logs providing some cover at low flow	3	3			100%			

Table 5a. Visual Stream Morphology Stability Assessment
Brown Creek Tributaries Restoration Project: DMS Project ID No. 95351
Reach ID: UT4-R1
Assessed Length (LF): 1,376

Major Channel Category	Channel Sub-Category	Metric	Number Stable (Performing as Intended)	Total Number per As-built	Number of Unstable Segments	Amount of Unstable Footage	% Stable, Performing as Intended	Number with Stabilizing Woody Veg.	Footage with Stabilizing Woody Veg.	Adjusted % for Stabilizing Woody Veg.
1. Bed	1.Vertical Stability	1. Aggradation			0	0	100%			
		2. Degradation			0	0	100%			
	2. Riffle Condition	1. Texture Substrate	9	9			100%			
	3. Meander Pool Condition	1. Depth	10	10			100%			
		2. Length	10	10			100%			
	4. Thalweg Position	1. Thalweg centering at upstream of meander bend (Run)	9	9			100%			
		2. Thalweg centering at downstream of meander bend (Glide)	10	10			100%			
2. Bank	1. Scoured/Eroding	Bank lacking vegetative cover resulting simply from poor growth and/or scour and erosion			0	0	100%	0	0	100%
	2. Undercut	Banks undercut/overhanging to the extent that mass wasting appears likely			0	0	100%	0	0	100%
	3. Mass Wasting	Banks slumping, caving or collapse			0	0	100%	0	0	100%
				Totals	0	0	100%	0	0	100%
3. Engineering Structures	1. Overall Integrity	Structures physically intact with no dislodged boulders or logs	18	18			100%			
	2. Grade Control	Grade control structures exhibiting maintenance of grade across the sill	10	10			100%			
	2a. Piping	Structures lacking any substantial flow underneath sill or arms	12	12			100%			
	3. Bank Position	Bank erosion within the structures extent of influence does not exceed 15%	18	18			100%			
	4. Habitat	Pool forming structures maintaining - Max Pool Depth, Rootwads/logs providing some cover at low flow	9	9			100%			

Table 5a. Visual Stream Morphology Stability Assessment
Brown Creek Tributaries Restoration Project: DMS Project ID No. 95351
Reach ID: UT4-R2
Assessed Length (LF): 1,828

Major Channel Category	Channel Sub-Category	Metric	Number Stable (Performing as Intended)	Total Number per As-built	Number of Unstable Segments	Amount of Unstable Footage	% Stable, Performing as Intended	Number with Stabilizing Woody Veg.	Footage with Stabilizing Woody Veg.	Adjusted % for Stabilizing Woody Veg.
1. Bed	1.Vertical Stability	1. Aggradation			0	0	100%			
		2. Degradation			0	0	100%			
	2. Riffle Condition	1. Texture Substrate	15	15			100%			
	3. Meander Pool Condition	1. Depth	16	16			100%			
		2. Length	16	16			100%			
	4. Thalweg Position	1. Thalweg centering at upstream of meander bend (Run)	15	15			100%			
		2. Thalweg centering at downstream of meander bend (Glide)	16	16			100%			
2. Bank	1. Scoured/Eroding	Bank lacking vegetative cover resulting simply from poor growth and/or scour and erosion			0	0	100%	0	0	100%
	2. Undercut	Banks undercut/overhanging to the extent that mass wasting appears likely			0	0	100%	0	0	100%
	3. Mass Wasting	Banks slumping, caving or collapse			0	0	100%	0	0	100%
				Totals	0	0	100%	0	0	100%
3. Engineering Structures	1. Overall Integrity	Structures physically intact with no dislodged boulders or logs	27	27			100%			
	2. Grade Control	Grade control structures exhibiting maintenance of grade across the sill	3	3			100%			
	2a. Piping	Structures lacking any substantial flow underneath sill or arms	23	23			100%			
	3. Bank Position	Bank erosion within the structures extent of influence does not exceed 15%	23	23			100%			
	4. Habitat	Pool forming structures maintaining - Max Pool Depth, Rootwads/logs providing some cover at low flow	23	23			100%			

Table 5a. Visual Stream Morphology Stability Assessment
Brown Creek Tributaries Restoration Project: DMS Project ID No. 95351
Reach ID: UT4-R3
Assessed Length (LF): 250

Major Channel Category	Channel Sub-Category	Metric	Number Stable (Performing as Intended)	Total Number per As-built	Number of Unstable Segments	Amount of Unstable Footage	% Stable, Performing as Intended	Number with Stabilizing Woody Veg.	Footage with Stabilizing Woody Veg.	Adjusted % for Stabilizing Woody Veg.
1. Bed	1.Vertical Stability	1. Aggradation			0	0	100%			
		2. Degradation			0	0	100%			
	2. Riffle Condition	1. Texture Substrate	3	3			100%			
	3. Meander Pool Condition	1. Depth	4	4			100%			
		2. Length	4	4			100%			
	4. Thalweg Position	1. Thalweg centering at upstream of meander bend (Run)	3	3			100%			
		2. Thalweg centering at downstream of meander bend (Glide)	4	4			100%			
2. Bank	1. Scoured/Eroding	Bank lacking vegetative cover resulting simply from poor growth and/or scour and erosion			0	0	100%	0	0	100%
	2. Undercut	Banks undercut/overhanging to the extent that mass wasting appears likely			0	0	100%	0	0	100%
	3. Mass Wasting	Banks slumping, caving or collapse			0	0	100%	0	0	100%
				Totals	0	0	100%	0	0	100%
3. Engineering Structures	1. Overall Integrity	Structures physically intact with no dislodged boulders or logs	6	6			100%			
	2. Grade Control	Grade control structures exhibiting maintenance of grade across the sill	3	3			100%			
	2a. Piping	Structures lacking any substantial flow underneath sill or arms	3	3			100%			
	3. Bank Position	Bank erosion within the structures extent of influence does not exceed 15%	6	6			100%			
	4. Habitat	Pool forming structures maintaining - Max Pool Depth, Rootwads/logs providing some cover at low flow	3	3			100%			

Table 5a. Visual Stream Morphology Stability Assessment
Brown Creek Tributaries Restoration Project: DMS Project ID No. 95351
Reach ID: UT4-R4
Assessed Length (LF): 1,840

Major Channel Category	Channel Sub-Category	Metric	Number Stable (Performing as Intended)	Total Number per As-built	Number of Unstable Segments	Amount of Unstable Footage	% Stable, Performing as Intended	Number with Stabilizing Woody Veg.	Footage with Stabilizing Woody Veg.	Adjusted % for Stabilizing Woody Veg.
1. Bed	1.Vertical Stability	1. Aggradation			0	0	100%			
		2. Degradation			0	0	100%			
	2. Riffle Condition	1. Texture Substrate	22	22			100%			
	3. Meander Pool Condition	1. Depth	23	23			100%			
		2. Length	23	23			100%			
	4. Thalweg Position	1. Thalweg centering at upstream of meander bend (Run)	22	22			100%			
		2. Thalweg centering at downstream of meander bend (Glide)	23	23			100%			
2. Bank	1. Scoured/Eroding	Bank lacking vegetative cover resulting simply from poor growth and/or scour and erosion			0	0	100%	0	0	100%
	2. Undercut	Banks undercut/overhanging to the extent that mass wasting appears likely			0	0	100%	0	0	100%
	3. Mass Wasting	Banks slumping, caving or collapse			0	0	100%	0	0	100%
				Totals	0	0	100%	0	0	100%
3. Engineering Structures	1. Overall Integrity	Structures physically intact with no dislodged boulders or logs	47	47			100%			
	2. Grade Control	Grade control structures exhibiting maintenance of grade across the sill	28	28			100%			
	2a. Piping	Structures lacking any substantial flow underneath sill or arms	29	29			100%			
	3. Bank Position	Bank erosion within the structures extent of influence does not exceed 15%	47	47			100%			
	4. Habitat	Pool forming structures maintaining - Max Pool Depth, Rootwads/logs providing some cover at low flow	28	28			100%			

Table 5a. Visual Stream Morphology Stability Assessment
Brown Creek Tributaries Restoration Project: DMS Project ID No. 95351
Reach ID: UT4-R5
Assessed Length (LF): 1,973

Major Channel Category	Channel Sub-Category	Metric	Number Stable (Performing as Intended)	Total Number per As-built	Number of Unstable Segments	Amount of Unstable Footage	% Stable, Performing as Intended	Number with Stabilizing Woody Veg.	Footage with Stabilizing Woody Veg.	Adjusted % for Stabilizing Woody Veg.
1. Bed	1.Vertical Stability	1. Aggradation			0	0	100%			
		2. Degradation			0	0	100%			
	2. Riffle Condition	1. Texture Substrate	6	6			100%			
	3. Meander Pool Condition	1. Depth	5	5			100%			
		2. Length	5	5			100%			
	4. Thalweg Position	1. Thalweg centering at upstream of meander bend (Run)	6	6			100%			
		2. Thalweg centering at downstream of meander bend (Glide)	5	5			100%			
2. Bank	1. Scoured/Eroding	Bank lacking vegetative cover resulting simply from poor growth and/or scour and erosion			0	0	100%	0	0	100%
	2. Undercut	Banks undercut/overhanging to the extent that mass wasting appears likely			0	0	100%	0	0	100%
	3. Mass Wasting	Banks slumping, caving or collapse			0	0	100%	0	0	100%
				Totals	0	0	100%	0	0	100%
3. Engineering Structures	1. Overall Integrity	Structures physically intact with no dislodged boulders or logs	16	16			100%			
	2. Grade Control	Grade control structures exhibiting maintenance of grade across the sill	15	15			100%			
	2a. Piping	Structures lacking any substantial flow underneath sill or arms	14	14			100%			
	3. Bank Position	Bank erosion within the structures extent of influence does not exceed 15%	16	16			100%			
	4. Habitat	Pool forming structures maintaining - Max Pool Depth, Rootwads/logs providing some cover at low flow	10	10			100%			

Table 5b. Stream Problem Areas (SPAs)
Brown Creek Tributaries Restoration Project: DMS Project ID No. 95351

SPA #	Feature Issue	Reach ID, Station Number	Suspected Cause	Photo in Photo Log
-	No Issues in Year 7	-	-	-

Notes:

Table 6a. Vegetation Conditions Assessment
Brown Creek Tributaries Restoration Project: DMS Project ID No. 95351

Planted Acreage:	**33.5**					
Vegetation Category	**Definitions**	**Mapping Threshold (acres)**	**CCPV Depiction**	**Number of Polygons**	**Combined Acreage**	**% of Planted Acreage**
1. Bare Areas	Very limited cover both woody and herbaceous material.	0.1	N/A	0	0.00	0.0%
2. Low Stem Density Areas	Woody stem densities clearly below target levels based on MY3, 4 or 5 stem count criteria.	0.1	N/A	0	0.00	0.0%
			Total	**0**	**0.00**	**0.0%**
3. Areas of Poor Growth Rates or Vigor	Areas with woody stems or a size class that are obviously small given the monitoring year.	0.25	N/A	0	0.00	0.0%
			Cumulative Total	**0**	**0.00**	**0.0%**
Easement Acreage:	**43.3**					
Vegetation Category	**Definitions**	**Mapping Threshold**	**CCPV Depiction**	**Number of Polygons**	**Combined Acreage**	**% of Easement Acreage**
4. Invasive Areas of Concern	Areas or points (if too small to render as polygons at map scale)	1000 ft²	Green Polygons	3	0.57	1.3%
5. Easement Encroachment Areas	Areas or points (if too small to render as polygons at map scale)	none	Yellow polygons	2	0.050	0.12%

Table 6b. Vegetation Problem Areas (VPAs)
Brown Creek Tributaries Restoration Project: DMS Project ID No. 95351

Feature Issue	Station Number	Area	Suspected Cause
Privet *(Ligustrum sinense)*	Hurricane Creek: R1 Right bank (Station 10+00 to 10+50) & Left bank (Station 15+00 to 20+00), and R3 Left bank (Station 11+00 to 13+00)	Combined ~0.57 acres	Scattered resprouts
Notes: These areas overlap with previously treated locations			

MY7 Stream Station Photo-Points: Hurricane Creek Site (taken 3/19/2021)

PP-1: HC Reach 1, view downstream at Station 10+00

PP-2: HC Reach 1, view downstream at Station 11+80

PP-3: HC Reach 1, view downstream at Station 14+50

PP-4: HC Reach 1, view upstream at Station 17+50

PP-5: HC Reach 1, view downstream at Station 18+00

PP-6: HC Reach 1, view upstream at Station 19+50

MY7 Stream Station Photo-Points: Hurricane Creek Site (taken 3/19/2021)

PP-7: HC Reach 1, view downstream at Station 19+75

PP-8: HC Reach 1, view upstream at Station 22+40

PP-9: HC Reach 1, view downstream at Station 24+00

PP-10: HC Reach 1, vernal pool at Station 26+25

PP-11: HC Reach 1, view downstream at Station 29+30

PP-12: HC Reach 2, view upstream at Station 31+40

MY7 Stream Station Photo-Points: Hurricane Creek Site (taken 3/19/2021)

PP-13: HC Reach 2, view upstream at Station 32+75

PP-14: HC Reach 2, view downstream at Station 33+00

PP-15: HC Reach 2, view upstream at Station 35+70

PP-16: HC Reach 2, view downstream at Station 36+00

PP-17: HC Reach 2, view downstream at Station 39+10

PP-18: HC Reach 2, view downstream at Station 40+75

MY7 Stream Station Photo-Points: Hurricane Creek Site (taken 3/19/2021)

PP-19: HC Reach 2, view upstream at Station 43+75

PP-20: HC Reach 2, view downstream at Station 44+25

PP-21: HC Reach 3, view upstream at Station 11+40

PP-22: HC Reach 3, view downstream at Station 14+00

PP-23: HC Reach 3, view downstream at Station 15+50

PP-24: HC Reach 3, view upstream at Station 15+90

MY7 Stream Station Photo-Points (Supplemental): Hurricane Creek Site (Taken 11/22/21)

HC-R2: Photo showing normal flow restored and maintained after beaver dams removed in the spring.

HC-R2: Photo showing normal flow restored and maintained after beaver dams removed in the spring.

HC-R2: Photo showing normal flow restored and maintained after beaver dams removed in the spring.

HC-R2: Photo showing normal flow restored and maintained after beaver dams removed in the spring.

HC-R2: Photo showing normal flow restored and maintained after beaver dams removed in the spring.

HC-R1: Photo showing normal flow restored and maintained after beaver dams removed in the spring.

MY7 Stream Station Photo-Points (Supplemental): Hurricane Creek Site (Taken 11/22/21)

HC-R1: Photo showing normal flow restored and maintained after beaver dams removed in the spring.

HC-R1: Photo showing normal flow restored and maintained after beaver dams removed in the spring.

HC-R1: Photo showing normal flow restored and maintained after beaver dams removed in the spring.

HC-R1: Photo showing normal flow restored and maintained after beaver dams removed in the spring.

HC-R1: Photo showing normal flow restored and maintained after beaver dams removed in the spring.

MY7 Stream Station Photo-Points: UT4 Site (taken 3/8/21)

PP-1: Reach UT4-R4a – View upstream, Station 11+50

PP-2: Reach UT4-R4a – View downstream, Station 12+40

PP-3: Reach UT4-R4a – View upstream, Station 13+20

PP-4: Reach UT4-R4a – View upstream, Station 14+00

PP-5: Reach UT4-R4b – View downstream, Station 14+75

PP-6: Reach UT4-R4b – View downstream, Station 17+00

MY7 Stream Station Photo-Points: UT4 Site (taken 3/8/21)

PP-7: Reach UT4-R4b – View upstream, Station 18+20

PP-8: Reach UT4-R4b – View downstream, Station 18+90

PP-9: Reach UT4-R4b – View downstream, Station 19+00

PP-10: Reach UT4-R4b – View downstream, Station 21+00

PP-11: Reach UT4-R4b – View upstream at Station 22+50

PP-12: Reach UT4-R4b – View downstream, Station 23+25

MY7 Stream Station Photo-Points: UT4 Site (taken 3/8/21)

PP-13: Reach UT4-R4b – View downstream, Station 24+00

PP-14: Reach UT4-R4b – View upstream, Station 25+00

PP-15: Reach UT4-R4b – View downstream, Station 25+75

PP-16: Reach UT4-R4b – View upstream, Station 27+00

PP-17: Reach UT4-R4b – View upstream, Station 28+00

PP-18: Reach UT4-R4b – View downstream, Station 28+00

MY7 Stream Station Photo-Points: UT4 Site (taken 3/8/21)

PP-19: Reach UT4-R3 – View downstream, Station 29+00

PP-20: Reach UT4-R3 – View downstream, Station 29+50

PP-21: Reach UT4-R3 – View downstream, Station 30+25

PP-22: Reach UT4-R3 – View downstream, Station 31+00

PP-23: Reach UT4-R2 – View upstream at Station 37+50

PP-24: Reach UT4-R2 – View upstream, Station 37+00

MY7 Stream Station Photo-Points: UT4 Site (taken 3/8/21)

PP-25: Reach UT4-R2 – View upstream, Station 35+50

PP-26: Reach UT4-R2 – View downstream, Station 33+50

PP-27: Reach UT4-R2 – View upstream, Station 31+50

PP-28: Reach UT4-R2 – View upstream, Station 30+50

PP-29: Reach UT4-R2 – View upstream at Station 29+00

PP-30: Reach UT4-R2 – View upstream, Station 28+00

MY7 Stream Station Photo-Points: UT4 Site (taken 3/8/21)

PP-31: Reach UT4-R2 – View upstream, Station 26+00

PP-32: Reach UT4-R2 – View upstream, Station 24+50

PP-33: Reach UT4-R2 – View downstream, Station 23+00

PP-34: Reach UT4-R2 – View upstream, Station 23+00

PP-35: Reach UT4-R2 – View downstream, Station 20+40

PP-36: Reach UT4-R2 – View upstream, Station 21+00

MY7 Stream Station Photo-Points: UT4 Site (taken 3/8/21)

PP-37: Reach UT4-R2 – View upstream, Station 20+00

PP-38: Reach UT4-R5b – View upstream, Station 29+00

PP-39: Reach UT4-R5b – View upstream, Station 28+25

PP-40: Reach UT4-R5b – View downstream, Station 26+40

PP-41: Reach UT4-R5b – View upstream, Station 23+50

PP-42: Reach UT4-R5b – View upstream, Station 20+75

MY7 Stream Station Photo-Points: UT4 Site (taken 3/8/21)

PP-43: Reach UT4-R5b – View upstream, Station 17+50

PP-44: Reach UT4-R5b – View upstream, Station 15+50

PP-45: Reach UT4-R5a – View upstream, Station 12+75

PP-46: Reach UT4-R5a – View upstream, Station 12+00

PP-47: Reach UT4-R5a – Side tributary at Station 11+75

PP-48: Reach UT4-R5a – View upstream, Station 11+50

MY7 Stream Station Photo-Points: UT4 Site (taken 3/8/21)

PP-49: Reach UT4-R5a – View upstream, Station 10+75

PP-50: Reach UT4-R1a – View upstream, Station 12+40

PP-51: Reach UT4-R1a – View downstream, Station 12+40

PP-52: Reach UT4-R1b – View downstream, Station 11+25

PP-53: Reach UT4-R1b – View downstream, Station 12+75

PP-54: Reach UT4-R1b – View downstream, Station 13+25

MY7 Stream Station Photo-Points: UT4 Site (taken 3/8/21)

PP-55: Reach UT4-R1b – View downstream, Station 14+25

PP-56: Reach UT4-R1b – View downstream, Station 15+25

PP-57: Reach UT4-R1b – View downstream, Station 17+50

PP-58: Reach UT4-R1b – View upstream, Station 19+00

Photographs for Historic Comparisons from As-Built to MY7: Hurricane Creek

Hurricane Creek R1, As-Built (2015)

Hurricane Creek R1, MY7 (2021)

Hurricane Creek R1, As-Built (2015)

Hurricane Creek R1, MY7 (2021)

Hurricane Creek R1, As-Built (2015)

Hurricane Creek R1, MY7 (2021)

Photographs for Historic Comparisons from As-Built to MY7: Hurricane Creek

Hurricane Creek R1, vernal pool at As-Built (2015)

Hurricane Creek R1, vernal pool at MY7 (2021)

Hurricane Creek R2, As-Built (2015)

Hurricane Creek R2, MY7 (2021)

Hurricane Creek R2, As-Built (2015)

Hurricane Creek R2, MY7 (2021)

Photographs for Historic Comparisons from As-Built to MY7: Hurricane Creek

Hurricane Creek R2, As-Built (2015)

Hurricane Creek R2, MY7 (2021)

Hurricane Creek R3, As-Built (2015)

Hurricane Creek R3, MY7 (2021)

Hurricane Creek R3, As-Built (2015)

Hurricane Creek R3, MY7 (2021)

Photographs for Historic Comparisons from As-Built to MY7: UT4 Site

UT4-R1, As-Built (2015)

UT4-R1, MY7 (2021)

UT4-R1, As-Built (2015)

UT4-R1, MY7 (2021)

UT4-R2, As-Built (2015)

UT4-R1, MY7 (2021)

Photographs for Historic Comparisons from As-Built to MY7: UT4 Site

UT4-R2, As-Built (2015)

UT4-R1, MY7 (2021)

UT4-R2, As-Built (2015)

UT4-R1, MY7 (2021)

UT4-R3, As-Built (2015)

UT4-R3, MY7 (2021)

Photographs for Historic Comparisons from As-Built to MY7: UT4 Site

UT4-R4, As-Built (2015)

UT4-R4, MY7 (2021)

UT4-R4, As-Built (2015)

UT4-R4, MY7 (2021)

UT4-R4, As-Built (2015)

UT4-R4, MY7 (2021)

Photographs for Historic Comparisons from As-Built to MY7: UT4 Site

UT4-R5, As-Built (2015)

UT4-R5, MY7 (2021)

UT4-R5, As-Built (2015)

UT4-R5, MY7 (2021)

MY7 Vegetation Plot Photographs

Vegetation Plot 1 – HC-R2

Vegetation Plot 2 – HC-R2

Vegetation Plot 3 – HC-R1

Vegetation Plot 4 – HC-R1

Vegetation Plot 5– HC-R1

Vegetation Plot 6 – UT4-R4

MY7 Vegetation Plot Photographs

Vegetation Plot 7 – UT4-R4

Vegetation Plot 8 – UT4-R4

Vegetation Plot 9 – UT4-R3

Vegetation Plot 10 – UT4-R2

Vegetation Plot 11 – UT4-R2

Vegetation Plot 12 – UT4-R2

MY7 Vegetation Plot Photographs

Vegetation Plot 13 – UT4-R5

Vegetation Plot 14 – UT4-R5

Vegetation Plot 15 – UT4-R5

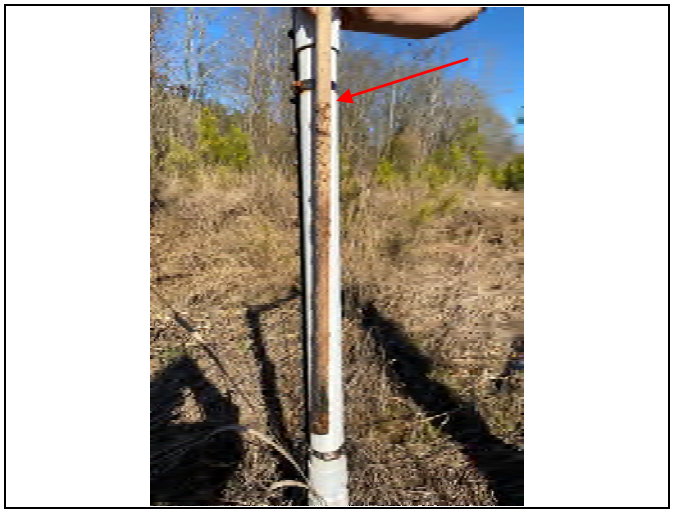
Vegetation Plot 16 – UT4-R1

MY7 Monitoring Gauge Photographs

Reach UT4-R1b: Evidence of overbank event
(photo from 3/8/21)

Reach UT4-R2: Evidence of overbank event
(photo from 3/8/21)

Reach UT4-R4b: Evidence of overbank event
(photo from 3/8/21)



Crest Gauge Reach UT4-R2: Overbank event of 1.75'
(photo from 3/8/21)

Crest Gauge Reach UT4-R2: Close up of gauge reading
(photo from 3/8/21)

Crest Gauge Reach HC-R1: Overbank event of 1.65'
(photo from 7/22/21)

MY7 Monitoring Gauge Photographs

Crest Gauge Reach HC-R1: Close-up of gauge reading of 1.65’ (photo from 7/22/21)

Flow Gauge in upper Reach HC-R1 (photo 11/23/21)

Flow Gauge in Reach UT4-R4b (photo 3/8/21) with flow camera attached at the top

Flow Gauge in Reach UT4-R2 (photo 11/23/21)

Reach UT4-R4: Flow Camera Photo

Reach UT4-R4: Flow Camera Photo

MY7 Monitoring Gauge Photographs

Reach UT4-R4: Flow Camera Photo

Reach UT4-R4: Flow Camera Photo

Reach UT4-R4: Flow Camera Photo

Reach UT4-R4: Flow Camera Photo

Reach UT4-R4: Flow Camera Photo

Reach UT4-R4: Flow Camera Photo

MY7 Monitoring Gauge Photographs

Reach UT4-R4: Flow Camera Photo

Reach UT4-R4: Flow Camera Photo

Reach UT4-R4: Flow Camera Photo

Reach UT4-R4: Flow Camera Photo

Reach UT4-R4: Flow Camera Photo

Reach UT4-R4: Flow Camera Photo (flow gauge indicates that channel is no longer flowing, though water remains in channel)

Brown Creek Tributaries: MY7 Additional Project Photographs

UT4-R2, SPA #1 Bank Repair (Left bank stabilized with matting, Sept.2021)

UT4-R2, SPA #1 Bank Repair (Right bank stabilized with matting, Sept.2021)

UT4-R2, SPA #1 Bank Repair (Right bank stabilized with matting, Close-up, Sept.2021)

UT4-R2, Additional Bank Repair near SPA #1 (Stabilized with matting, Sept.2021)

UT4-R2, SPA #2 Bank Repair (Stabilized with matting, Sept.2021)

UT4-R1b, SPA #3 Bank Repair (Scour filled-in with soil, matting and rock/logs installed on top, Sept. 2021)

Brown Creek Tributaries: MY7 Additional Project Photographs

UT4-R1b, SPA #3 Bank Repair (scour filled-in with soil, matting and rock/logs installed on top, Sept. 2021)

SPA #1: UT4-R2 (Nov. 2021)

SPA #1: UT4-R2 (Nov. 2021)

SPA #1: UT4-R2 (Nov. 2021)

SPA #2: UT4-R2 (Nov. 2021)

SPA #3: UT4-R1b (Nov. 2021)

Brown Creek Tributaries: MY7 Additional Project Photographs

UT4-R2: Beaver dam removed (Mar. 2021)

UT4-R2: Beaver dam removed (Mar. 2021)

UT4-R2: Beaver dam removed (Mar. 2021)

HC-R1: Beaver dam removed in Mar. 2021
(photo from July 2021)

HC-R2: Beaver dam removed in Mar. 2021
(photo from July 2021)

HC-R2: Beaver dam removed in Mar. 2021
(photo from July 2021)

Brown Creek Tributaries: MY7 Additional Project Photographs

HC-R2: Beaver dam removed in Mar. 2021
(photo from July 2021)

UT4: Pine/Sweetgum thinning, BEFORE (Nov. 2021)

UT4: Pine/Sweetgum thinning, BEFORE (Nov. 2021)

UT4: Pine/Sweetgum thinning, BEFORE (Nov. 2021)

UT4: Pine/Sweetgum thinning, AFTER (Nov. 2021)

UT4: Pine/Sweetgum thinning, AFTER (Nov. 2021)

Brown Creek Tributaries: MY7 Additional Project Photographs

UT4: Pine/Sweetgum thinning, AFTER (Nov. 2021)

UT4: Pine/Sweetgum thinning, AFTER (Nov. 2021)

UT4: Pine/Sweetgum thinning, AFTER (Nov. 2021)

UT4: Pine/Sweetgum thinning, AFTER (Nov. 2021)

UT4: Accidental logging encroachment in July 2021 of about 12 mature pine trees in an 0.05-ac area (photo from Aug. 2021)

UT4: CE boundary line conflict of 20-ft at the greatest extent (photo Aug. 2021)

Brown Creek Tributaries: MY7 Additional Project Photographs

UT4: Outer row of mature pines cut along a narrow 100-ft long sliver (photo Aug. 2021)

UT4-R5: Deer-stand within the CE (photo Mar. 2021)

UT4-R5: Deer-stand removed in Jan. 2022 (red arrow indicates former location)

Encroachment area replanted with 20, 7-gal oaks in February 2022 (red line is CE boundary)

Encroachment area replanted with 20, 7-gal oaks in February 2022 (red line is CE boundary)

Encroachment area replanted with 20, 7-gal oaks in February 2022 (red line is CE boundary)

Appendix C

Vegetation Plot Data

Table 7. Vegetation Plot Criteria Attainment
Brown Creek Tributaries Restoration Project: DMS Project ID No. 95351

Plot ID	Vegetation Survival Threshold Met?	Total/Planted Stem Count*	Tract Mean
1	Y	445/648	556
2	Y	324/688	
3	Y	405/607	
4	Y	728/931	
5	Y	607/769	
6	Y	445/809	
7	Y	647/728	
8	Y	405/688	
9	Y	728/809	
10	Y	486/890	
11	Y	607/728	
12	Y	607/769	
13	Y	607/607	
14	Y	607/809	
15	Y	647/809	
16	Y	607/809	

Note: *Total/Planted Stem Count reflects the changes in stem density based on the total current density of planted stems (Total), and the density of stems at the time of the As-Built Survey (Planted).

Table 8. CVS Vegetation Metadata
Brown Creek Tributaries Restoration Project: DMS Project ID No. 95351

Report Prepared By	Andrew Powers
Date Prepared	09/27/2021 13:26
database name	MichaelBaker_2021_BrownCrkTribs_95351.mdb
database location	R:\128975\Monitoring\Veg Plots\Year 7_2021
computer name	CARYLAPOWERS1
file size	45858816
DESCRIPTION OF WORKSHEETS IN THIS DOCUMENT----------	
Metadata	Description of database file, the report worksheets, and a summary of project(s) and project data.
Proj, planted	Each project is listed with its PLANTED stems per acre, for each year. This excludes live stakes.
Proj, total stems	Each project is listed with its TOTAL stems per acre, for each year. This includes live stakes, all planted stems, and all natural/volunteer stems.
Plots	List of plots surveyed with location and summary data (live stems, dead stems, missing, etc.).
Vigor	Frequency distribution of vigor classes for stems for all plots.
Vigor by Spp	Frequency distribution of vigor classes listed by species.
Damage	List of most frequent damage classes with number of occurrences and percent of total stems impacted by each.
Damage by Spp	Damage values tallied by type for each species.
Damage by Plot	Damage values tallied by type for each plot.
Planted Stems by Plot and Spp	A matrix of the count of PLANTED living stems of each species for each plot; dead and missing stems are excluded.
ALL Stems by Plot and spp	A matrix of the count of total living stems of each species (planted and natural volunteers combined) for each plot; dead and missing stems are excluded.
PROJECT SUMMARY----------	
Project Code	95351
project Name	Brown Creek Tributaries
Description	
River Basin	Yadkin-Pee Dee
length(ft)	3716
stream-to-edge width (ft)	50
area (sq m)	34519.28
Required Plots (calculated)	10
Sampled Plots	16

Table 9a. CVS Stem Count of Planted Stems by Plot and Species
Brown Creek Tributaries Restoration Project: DMS Project ID No. 95351

	Comment	Species	SpType	CommonName	Total Planted Stems	# plots	avg# stems	plot 95351-01-0001-year:7	plot 95351-01-0002-year:7	plot 95351-01-0003-year:7	plot 95351-01-0004-year:7	plot 95351-01-0005-year:7	plot 95351-01-0006-year:7	plot 95351-01-0007-year:7	plot 95351-01-0008-year:7	plot 95351-01-0009-year:7	plot 95351-01-0010-year:7	plot 95351-01-0011-year:5	plot 95351-01-0012-year:7	plot 95351-01-0013-year:7	plot 95351-01-0014-year:7	plot 95351-01-0015-year:7	plot 95351-01-0016-year:7
		Alnus serrulata	Shrub Tree	hazel alder	5	4	1.25			1		2				1			1			
		Asimina triloba	Shrub Tree	pawpaw	2	2	1														1	1
		Betula nigra	Tree	river birch	35	13	2.69	4	2	3	2	1		4	5	3	2	1		3	2	3
		Carpinus caroliniana	Shrub Tree	American hornbeam	5	4	1.25	1										2		1	1	
		Cornus amomum	Shrub	silky dogwood	1	1	1			1												
		Diospyros virginiana	Tree	common persimmon	15	9	1.67		1	3		2		1	3		1			1	2	1
		Fraxinus pennsylvanica	Tree	green ash	49	15	3.27	3	3	1	3	4	5	2	5	2		6	2	2	2	3
		Hamamelis virginiana	Shrub Tree	American witchhazel	6	3	2										2		2		2	
		Itea virginica	Shrub	Virginia sweetspire	1	1	1							1								
		Liriodendron tulipifera	Tree	tuliptree	3	3	1			1							1		1			
		Nyssa sylvatica	Tree	blackgum	13	7	1.86									1	4	1	1	2	2	2
		Platanus occidentalis	Tree	American sycamore	29	14	2.07		1	1	2	2	1	6	2	1	2	2	4	3	1		1
		Quercus alba	Tree	white oak	14	11	1.27	1		1		2	1	2		1	2		1	1	1	1	
		Quercus lyrata	Tree	Overcup oak	2	2	1		1							1							
		Quercus michauxii	Tree	swamp chestnut oak	15	8	1.88	1			1	1		3		1				4	3		1
		Quercus nigra	Tree	water oak	1	1	1			1													
		Quercus phellos	Tree	willow oak	8	7	1.14	1		1	2	1				1		1					1
		Viburnum dentatum	Shrub Tree	southern arrowwood	16	7	2.29				3	4					1	2			1	3	2
TOT:	**0**	**18**	**18**	**18**	**220**	**18**		**11**	**8**	**10**	**18**	**15**	**11**	**16**	**10**	**18**	**12**	**15**	**15**	**15**	**15**	**16**	**15**

Table 9b. Total Stem Counts for Each Species Arranged by Plot
Brown Creek Tributaries Restoration Project: DMS Project ID No. 95351

Botanical Name	Common Name	Plots																
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	
Tree Species																		
Betula nigra	river birch	4	2		3	2	1		4	5	3	2	1		3	2	3	
Fraxinus pennsylvanica	green ash	3	3	6	1	3	4	5	2	5	2		6	2	2	2	3	
Liriodendron tulipfera	tulip poplar				1							1		1				
Nyssa sylvatica	blackgum										1	4	1	1	2	2	2	
Plantanus occidentalis	sycamore		1	1	2	2	1	6	2	1	2	2	4	3	1		1	
Quecus alba	white oak	1		1		2	1	2		1	2		1	1	1	1		
Quercus lyrata	overcup oak		1							1								
Quercus michauxii	swamp chestnut oak	1			1	1		3		1				4	3		1	
Quercus nigra	water oak			1														
Quercus phellos	willow oak	1		1	2	1				1		1					1	
Shrub Species																		
Alnus serrulata	hazel alder				1		2				1			1				
Asimina triloba	paw paw															1	1	
Carpinus caroliniana	ironwood	1											2		1	1		
Cornus ammomum	silkly dogwood				1													
Diospyros virginiana	persimmon		1		3		2		1	3		1			1	2	1	
Hamamelis virginiana	witch hazel											2		2		2		
Itea virginica	Virginia sweetspire								1									
Viburnum dentatum	arrowwood viburnum				3	4					1	2			1	3	2	
Total Stems Per Plot Year 7 (September 2021)		**11**	**8**	**10**	**18**	**15**	**11**	**16**	**10**	**18**	**12**	**15**	**15**	**15**	**15**	**16**	**15**	
Total Stems/Acre Year 7 (September 2021)		**445**	**324**	**405**	**728**	**607**	**445**	**647**	**405**	**728**	**486**	**607**	**607**	**607**	**607**	**647**	**607**	**556**
Total Stems/Acre Year 5 (October 2019)		486	324	1012	1012	728	850	971	405	728	486	850	809	1012	607	567	1457	769
Total Stems/Acre Year 3* (September 2017)		567	243	445	809	607	567	728	567	688	648	648	486	850	648	728	769	625
Total Stems/Acre Year 2 (November 2016)		486	364	405	850	688	567	202	486	647	769	647	607	607	688	728	728	592
Total Stems/Acre Year 1 (November 2015)		648	567	607	931	728	769	405	688	809	850	728	769	607	769	809	769	716
Total Stems/ Acre for Year 0 As-Built (Baseline Data)		648	688	607	931	769	809	728	688	809	890	728	769	607	809	809	809	756

*Note: Volunteer species data was first fully collected and reported here beginning in MY3 (2017), whereas the first two monitoring years only reported planted species data.

Table 9c. Yearly Density Per Plot

DMS Project Code 95351. Project Name: Brown Creek Tributaries

Current Plot Data (MY7 2021)

Scientific Name	Common Name	Species Type	95351-01-0001			95351-01-0002			95351-01-0003			95351-01-0004			95351-01-0005			95351-01-0006			95351-01-0007			95351-01-0008			95351-01-0009		
			P	V	T	P	V	T	P	V	T	P	V	T	P	V	T	P	V	T	P	V	T	P	V	T	P	V	T
Acer negundo	boxelder	Tree					1	1																					
Acer rubrum	red maple	Tree																											
Alnus serrulata	hazel alder	Shrub										1		1				2		2									
Asimina triloba	pawpaw	Tree																											
Baccharis	baccharis	Shrub								3	3																		
Betula nigra	river birch	Tree	4		4	2		2				3		3	2		2	1		1				4		4	5		5
Carpinus caroliniana	American hornbeam	Tree	1		1																								
Cornus amomum	silky dogwood	Shrub										1		1															
Diospyros virginiana	common persimmon	Tree		1	1	1		1				3		3		1	1	2	1	3				1		1	3		3
Fraxinus pennsylvanica	green ash	Tree	3	3	6	3	1	4	6		6	1		1	3	3	6	4	2	6	5	8	13	2	5	7	5		5
Hamamelis virginiana	American witchhazel	Tree																											
Itea virginica	Virginia sweetspire	Shrub																						1		1			
Lindera benzoin	northern spicebush	Shrub																											
Liquidambar styraciflua	sweetgum	Tree								6	6		4	4			6		1	1					1	1			
Liriodendron tulipifera	tuliptree	Tree										1		1															
Nyssa sylvatica	blackgum	Tree																											
Pinus taeda	loblolly pine	Tree								1	1											2	2					6	6
Platanus occidentalis	American sycamore	Tree				1		1	1		1	2		2	2		2	1		1	6		6	2		2	1		1
Populus deltoides	eastern cottonwood	Tree																											
Quercus alba	white oak	Tree	1		1				1		1				2		2	1		1	2		2				1		1
Quercus falcata	southern red oak	Tree											1	1															
Quercus lyrata	overcup oak	Tree				1		1																			1		1
Quercus michauxii	swamp chestnut oak	Tree	1		1		1	1				1		1	1		1				3		3				1		1
Quercus nigra	water oak	Tree							1		1																		
Quercus phellos	willow oak	Tree	1		1				1		1	2		2	1		1										1		1
Rhus copallinum	flameleaf sumac	shrub																	2	2		1	1					3	3
Salix nigra	black willow	Tree																	2	2									
Ulmus alata	winged elm	Tree		1	1					4	4		6	6		9	9		2	2									
Viburnum dentatum	southern arrowwood	Shrub										3		3	4		4												
Stem count			11	5	16	8	3	11	10	14	24	18	11	29	15	13	34	11	10	21	16	11	27	10	6	16	18	9	27
Size (ares)			1			1			1			1			1			1			1			1			1		
Size (ACRES)			0.02			0.02			0.02			0.02			0.02			0.02			0.02			0.02			0.02		
Species count			6	3	8	5	3	7	5	4	9	10	3	13	7	3	10	6	6	10	4	3	6	5	2	6	8	2	10
Stems per ACRE			445.2	202.3	647.5	323.7	121.4	445.2	404.7	566.6	971.2	728.4	445.2	1174	607	526.1	1376	445.2	404.7	849.8	647	445	1093	405	243	647.5	728	364	1093

Color Key

Exceeds success requirements

Includes Volunteer species

P = Planted stems

V = Volunteer stems

T = Total stems

Current Plot Data (MY7 2021) | **Annual Means**

Scientific Name	Common Name	Species Type	95351-01-0010			95351-01-0011			95351-01-0012			95351-01-0013			95351-01-0014			95351-01-0015			95351-01-0016			MY7 (2021)			MY5 (2019)			MY3 (2017)*			MY2 (2016)			MY1 (2015)		
			P	V	T	P	V	T	P	V	T	P	V	T	P	V	T	P	V	T	P	V	T	P	V	T	P	V	T	P	V	T	P	V	T	P	V	T
Acer negundo	boxelder	Tree														1	1								2	2												
Acer rubrum	red maple	Tree																	2	2		3	3		5	5											
Alnus serrulata	hazel alder	Shrub	1		1							1	1	1										5		5	5		5	5		5	5		5	6		6
Asimina triloba	pawpaw	Tree																1		1	1		1	2		2	2		2	2		2	2		2	3		3
Baccharis	baccharis	Shrub																							3	3											
Betula nigra	river birch	Tree	3		3	2		2	1		1				3		3	2		2	3		3	35		35	39	1	40	37		37	42		42	66		66
Carpinus caroliniana	American hornbeam	Tree							2		2				1		1	1		1				5		5	6		6	5		5	5		5	6		6
Cornus amomum	silky dogwood	Shrub																						1		1	1	1	2	1		1	1		1	1		1
Diospyros virginiana	common persimmon	Tree		5	5	1	7	8							1	5	6	2		2	1		1	15	20	35	11	6	17	12	3	15	15		15	13		13
Fraxinus pennsylvanica	green ash	Tree	2		2				6	10	16	2	7	9	2	4	6	2		2	3	2	5	49	45	94	45	35	80	44	8	52	41		41	49		49
Hamamelis virginiana	American witchhazel	Tree				2		2				2		2				2		2				6		6	4		4	4		4	4		4	5		5
Itea virginica	Virginia sweetspire	Shrub																						1		1	1		1	2		2	2		2	1		1
Lindera benzoin	northern spicebush	Shrub																												1		1	1		1	1		1
Liquidambar styraciflua	sweetgum	Tree		3	3		5	5								5	5								31	31											
Liriodendron tulipifera	tuliptree	Tree				1		1				1		1										3		3	4		4	4		4	4		4	5		5
Nyssa sylvatica	blackgum	Tree	1		1	4		4	1		1	1		1	2		2	2		2	2		2	13		13	13		13	13	1	14	16		16	18		18
Pinus taeda	loblolly pine	Tree		9	9								1	1		4	4		4	4				27	27											
Platanus occidentalis	American sycamore	Tree	2		2	2	1	3	4		4	3		3	1		1				1		1	29	1	30	29		29	29	4	33	26		26	34		34
Populus deltoides	eastern cottonwood	Tree																				2	2		2	2											
Quercus alba	white oak	Tree	2		2				1		1	1	1	2	1		1	1		1				14	1	15	12		12	14	1	15	19		19	23		23
Quercus falcata	southern red oak	Tree																							1	1											
Quercus lyrata	overcup oak	Tree																						2		2	1		1								
Quercus michauxii	swamp chestnut oak	Tree										4		4	3		3				1		1	15	1	16	19		19	20	2	22	20		20	20		20
Quercus nigra	water oak	Tree																						1		1	1		1	1		1	1		1	1		1
Quercus phellos	willow oak	Tree				1		1								3	3				1		1	8	3	11	10	6	16	11		11	11		11	13		13
Rhus copallinum	flameleaf sumac	shrub																	2	2					8	8					2	2					
Salix nigra	black willow	Tree														2	2		4	4					8	8											
Ulmus alata	winged elm	Tree		10	10		7	7		2	2		7	7		3	3		2	2		4	4		57	57		35	35		5	5					
Viburnum dentatum	southern arrowwood	Shrub	1		1	2		2							1		1	3		3	2		2	16		16	17		17	19		19	19		19	18		18
Stem count			12	27	39	15	20	35	15	12	27	15	17	31	15	27	42	16	14	30	15	11	26	220	215	435	220	84	304	224	26	250	234	0	234	283	0	283
Size (ares)			1			1			1			1			1			1			1			16			16			16			16			16		
Size (ACRES)			0.02			0.02			0.02			0.02			0.02			0.02			0.02			0.40			0.40			0.40			0.40			0.40		
Species count			7	4	11	8	4	10	6	2	7	8	5	10	9	8	15	9	5	14	9	4	12	18	16	28	18	6	19	18	8	20	18	0	18	18	0	18
Stems per ACRE			486	1093	1578	607	809	1416	607	486	1093	607	688	1255	607	1093	1700	647	567	1214	607	445	1052	556	544	1100	556	212	769	567	65.8	632.3	592	0	592	716	0	716

*Note: Volunteer species data was first fully collected and reported here beginning in MY3 (2017), whereas the first two monitoring years only reported planted species data.

Table 9d. Vegetation Summary and Totals
Brown Creek Tributaries Restoration Project: DMS Project ID No. 95351

Year 7 (27-Sept-2021)
Vegetation Plot Summary Information

Plot #	Riparian Buffer Stems[1]	Stream/ Wetland Stems[2]	Live Stakes	Invasives	Volunteers[3]	Total[4]	Unknown Growth Form
1	n/a	11	0	0	5	**16**	0
2	n/a	8	0	0	3	**11**	0
3	n/a	10	0	0	14	**24**	0
4	n/a	18	0	0	11	**29**	0
5	n/a	15	0	0	19	**34**	0
6	n/a	11	0	0	10	**21**	0
7	n/a	16	0	0	11	**27**	0
8	n/a	10	0	0	6	**16**	0
9	n/a	18	0	0	9	**27**	0
10	n/a	12	0	0	27	**39**	0
11	n/a	15	0	0	20	**35**	0
12	n/a	15	0	0	12	**27**	0
13	n/a	15	0	0	16	**31**	0
14	n/a	15	0	0	27	**42**	0
15	n/a	16	0	0	14	**30**	0
16	n/a	15	0	0	11	**26**	0

Wetland/Stream Vegetation Totals (per acre)

Plot #	Stream/ Wetland Stems[2]	Volunteers[3]	Total[4]	Success Criteria Met?
1	445	202	647	Yes
2	324	121	445	Yes
3	405	567	971	Yes
4	728	445	1174	Yes
5	607	769	1376	Yes
6	445	405	850	Yes
7	647	445	1093	Yes
8	405	243	647	Yes
9	728	364	1093	Yes
10	486	1093	1578	Yes
11	607	809	1416	Yes
12	607	486	1093	Yes
13	607	647	1255	Yes
14	607	1093	1700	Yes
15	647	567	1214	Yes
16	607	445	1052	Yes
Project Avg	**556**	**544**	**1100**	**Yes**

Stem Class	Characteristics
[1]Buffer Stems	Native planted hardwood trees. Does NOT include shrubs. No pines. No vines.
[2]Stream/ Wetland Stems	Native planted woody stems. Includes shrubs, does NOT include live stakes. No vines
[3]Volunteers	Native woody stems. Not planted. No vines.
[4]Total	Planted + volunteer native woody stems. Includes live stakes. Excl. exotics. Excl. vines.

Color Key
Exceeds success requirements

Table 9e. Stems Per Plot Across All Years
Brown Creek Tributaries Restoration Project: DMS Project ID No. 95351

	MY7-2021			MY5-2019			MY3-2017			MY2-2016			MY1-2015			MY0-2014		
Plot	Planted Stems	Total Stems	Total Stems/Ac	Planted Stems	Total Stems	Total Stems/Ac	Planted Stems	Total Stems	Total Stems/Ac	Planted Stems	Total Stems	Total Stems/Ac	Planted Stems	Total Stems	Total Stems/Ac	Planted Stems	Total Stems	Total Stems/Ac
1	11	16	647	10	12	486	10	14	567	12	12	486	16	16	647	16	16	648
2	8	11	445	7	8	324	5	6	243	9	9	364	14	14	567	17	17	688
3	10	24	971	10	25	1012	10	11	445	10	10	405	15	15	607	15	15	607
4	18	29	1174	19	25	1012	19	20	809	21	21	850	23	23	931	23	23	931
5	15	34	1376	14	18	728	17	18	728	17	17	688	18	18	728	19	19	769
6	11	21	850	12	21	850	12	14	567	14	14	567	19	19	769	20	20	809
7	16	27	1093	18	24	971	18	18	728	5	5	202	10	10	405	18	18	728
8	10	16	647	10	10	405	12	14	567	12	12	486	17	17	688	17	17	688
9	18	27	1093	18	18	728	16	17	688	16	16	647	20	20	809	20	20	809
10	12	39	1578	12	12	486	13	16	647	19	19	769	21	21	850	22	22	890
11	15	35	1416	15	21	850	16	16	647	16	16	647	18	18	728	18	18	728
12	15	27	1093	15	20	809	12	12	486	15	15	607	19	19	769	19	19	769
13	15	31	1255	15	25	1012	15	21	850	15	15	607	15	15	607	15	15	607
14	15	42	1700	15	15	607	16	16	647	17	17	688	19	19	769	20	20	809
15	16	30	1214	14	14	567	16	18	728	18	18	728	20	20	809	20	20	809
16	15	26	1052	16	36	1457	17	19	769	18	18	728	19	19	769	20	20	809

Note: Veg data was not collected in MY4 and MY6 in accordance with the Mitigation Plan monitoring schedule.

Appendix D

Stream Assessment Data

Figure 3. Cross-Sections with Annual Overlays

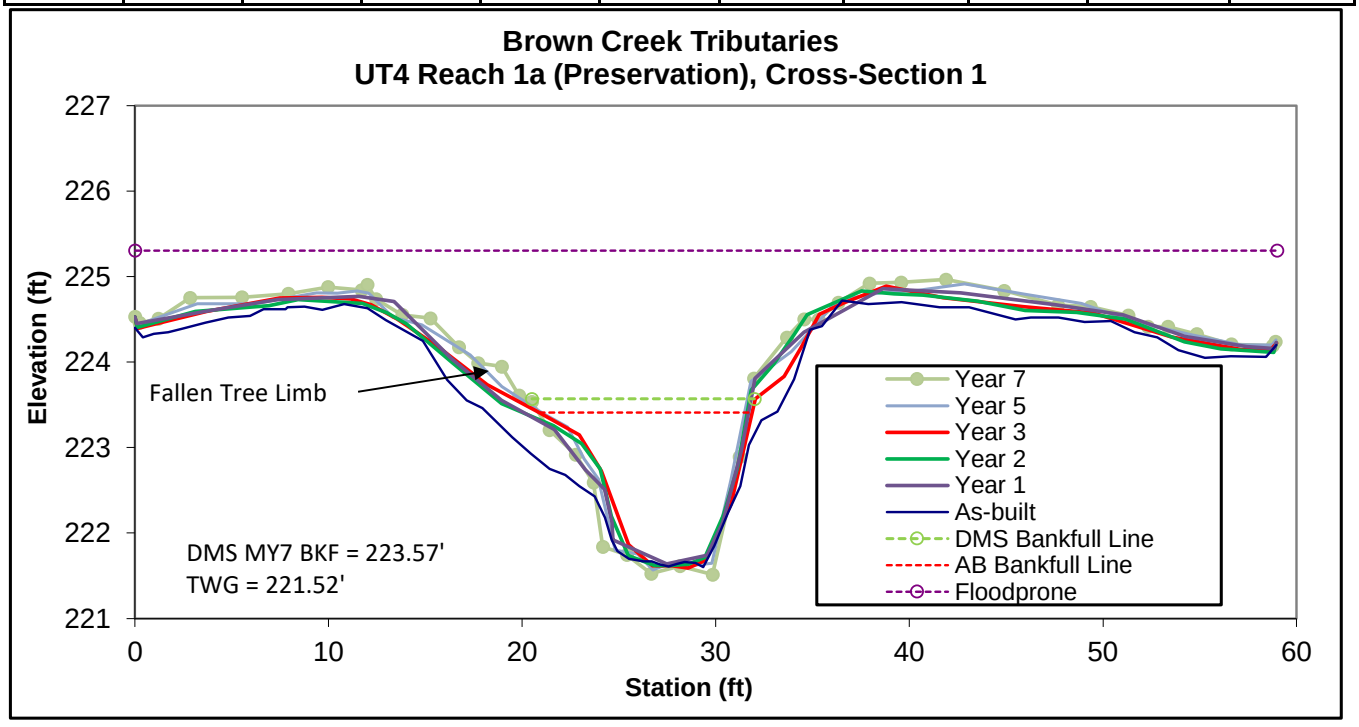
Permanent Cross-Section 1

Year 7 Data - Collected September 2021

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	AB BKF Elev	TOB Elev
Riffle	E	13.6	10.8	1.3	1.9	8.6	1.0	5.5	223.41	223.54



Note: Per DMS/IRT request, bank height ratio for MY7 has been calculated using the bankfull elevation as determined from the as-built bankfull area. All other values were calculated using the as-built bankfull elevation, as was done for previous monitoring reports.

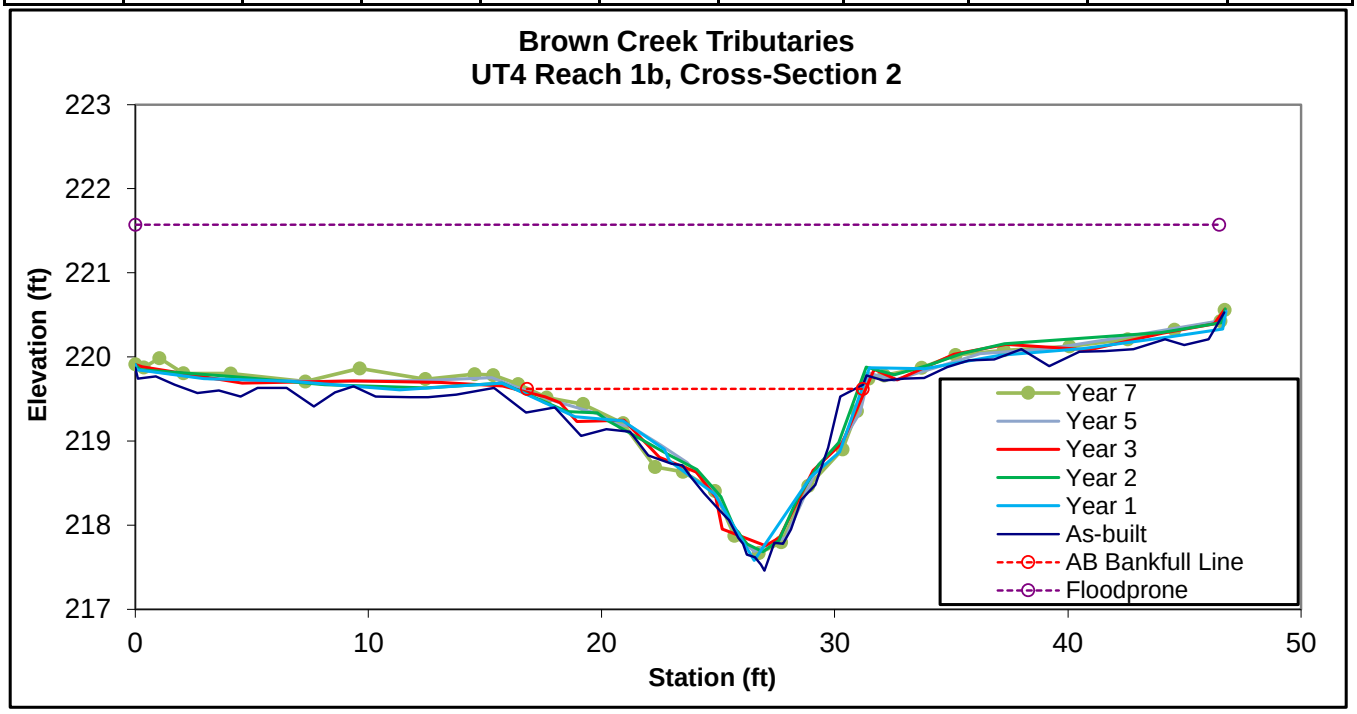
Permanent Cross-Section 2

Year 7 Data - Collected September 2021

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	AB BKF Elev	TOB Elev
Pool	--	12.8	14.4	0.9	2.0	16.3	--	--	219.62	219.74



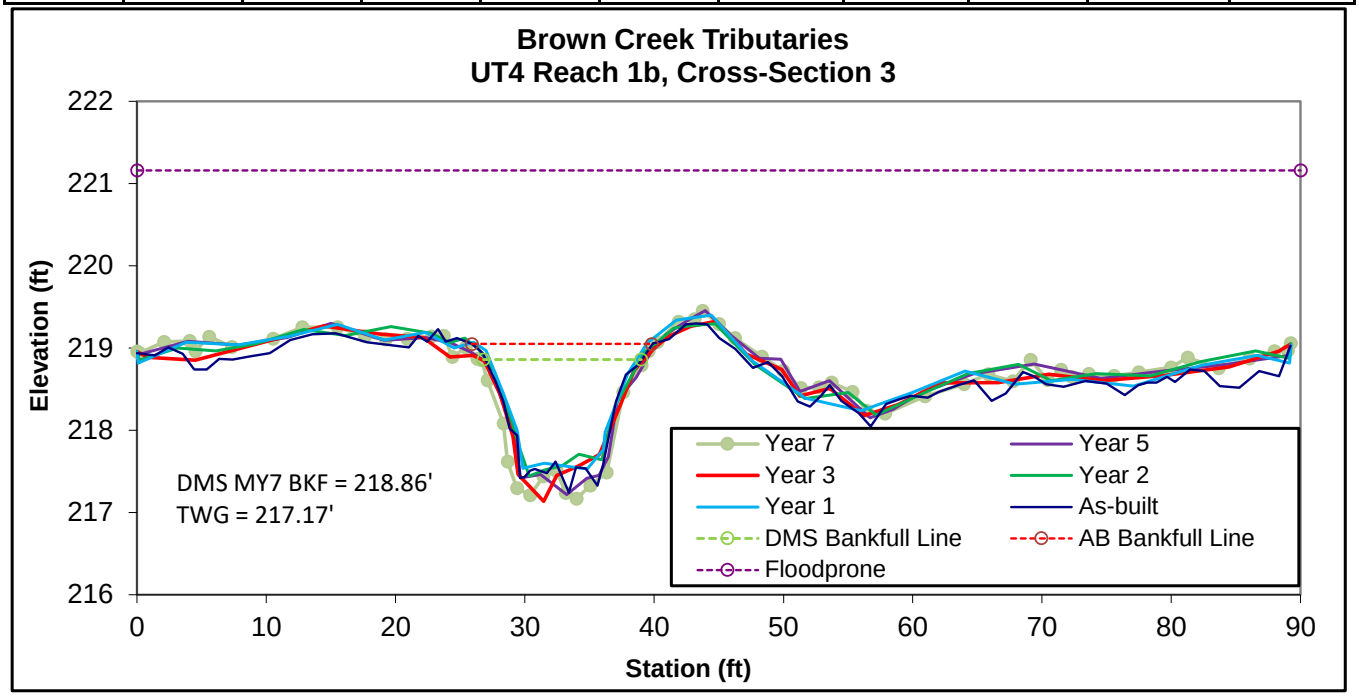
Permanent Cross-Section 3

Year 7 Data - Collected September 2021

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	AB BKF Elev	TOB Elev
Riffle	C	16.9	16.1	1.0	1.9	15.4	1.0	5.5	219.05	218.85



Note: Per DMS/IRT request, bank height ratio for MY7 has been calculated using the bankfull elevation as determined from the as-built bankfull area. All other values were calculated using the as-built bankfull elevation, as was done for previous monitoring reports.

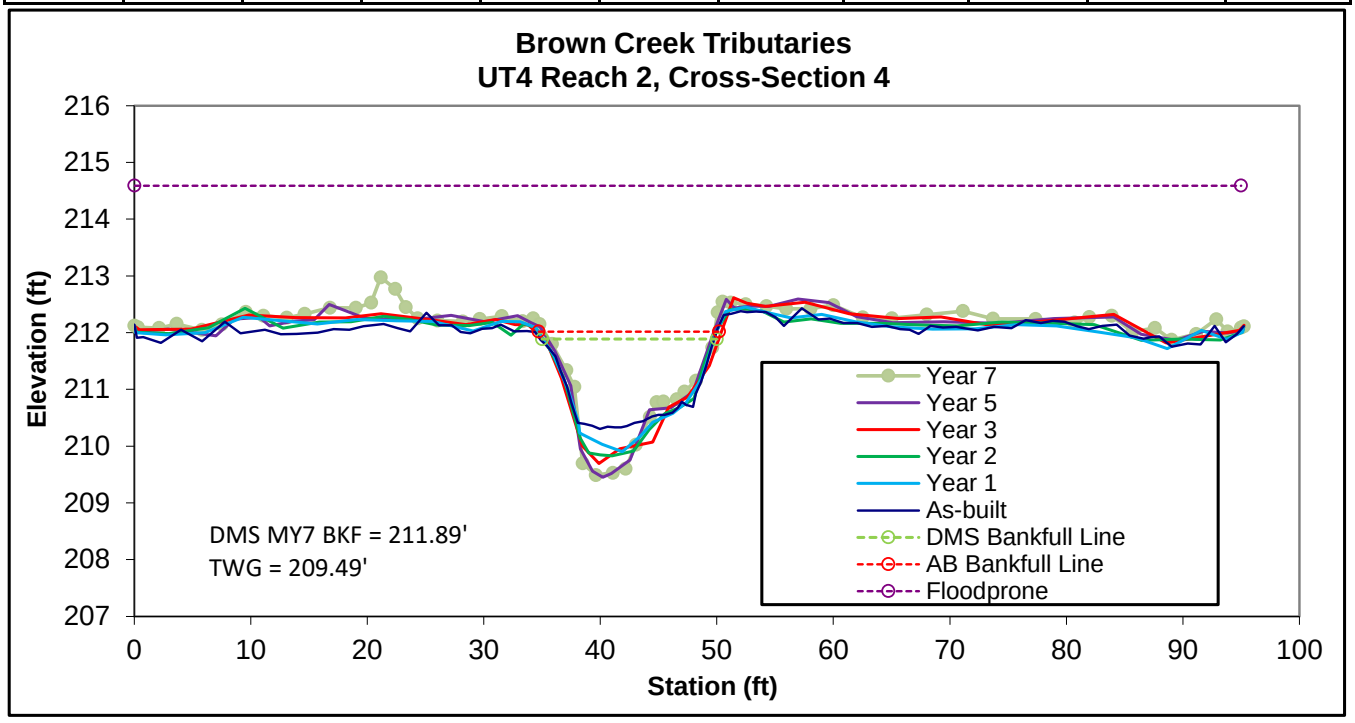
Permanent Cross-Section 4

Year 7 Data - Collected September 2021

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	AB BKF Elev	TOB Elev
Riffle	C	21.0	14.6	1.4	2.5	10.2	1.1	6.5	212.02	212.15



Note: Per DMS/IRT request, bank height ratio for MY7 has been calculated using the bankfull elevation as determined from the as-built bankfull area. All other values were calculated using the as-built bankfull elevation, as was done for previous monitoring reports.

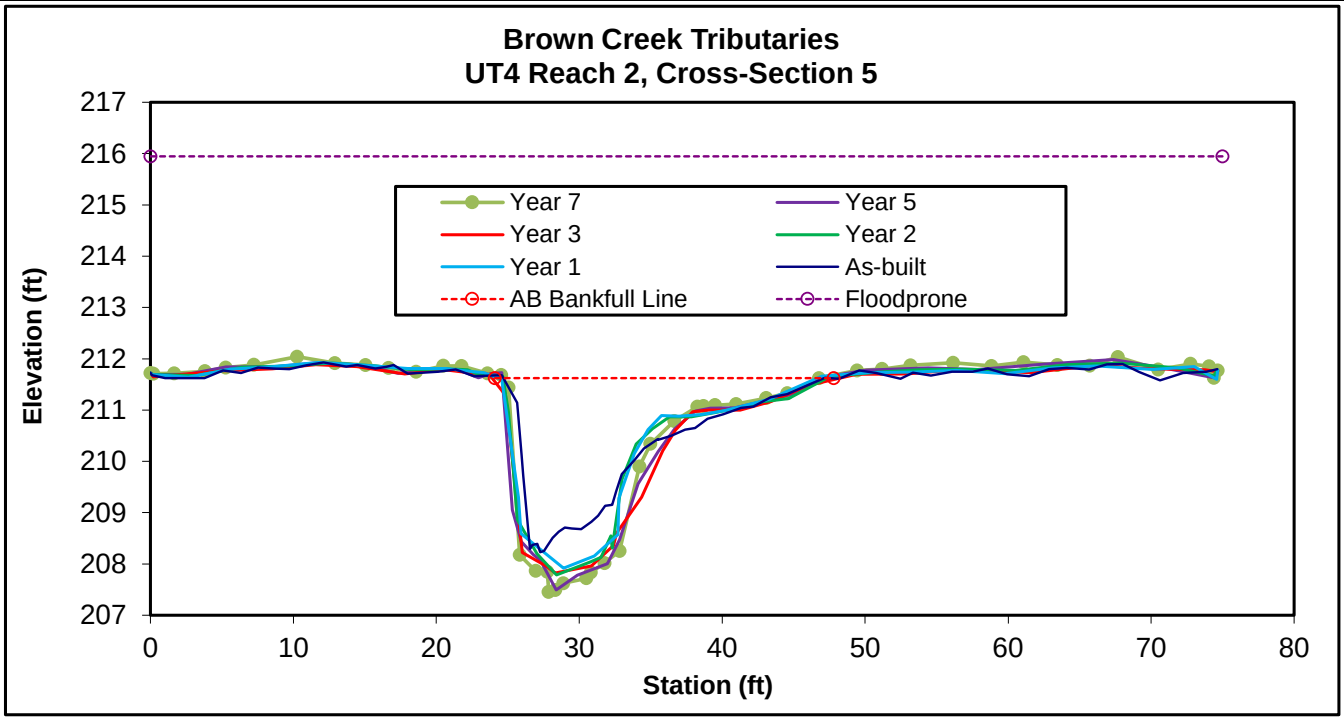
Permanent Cross-Section 5

Year 7 Data - Collected September 2021

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	AB BKF Elev	TOB Elev
Pool	--	38.7	22.1	1.8	4.2	12.6	--	--	211.62	211.075



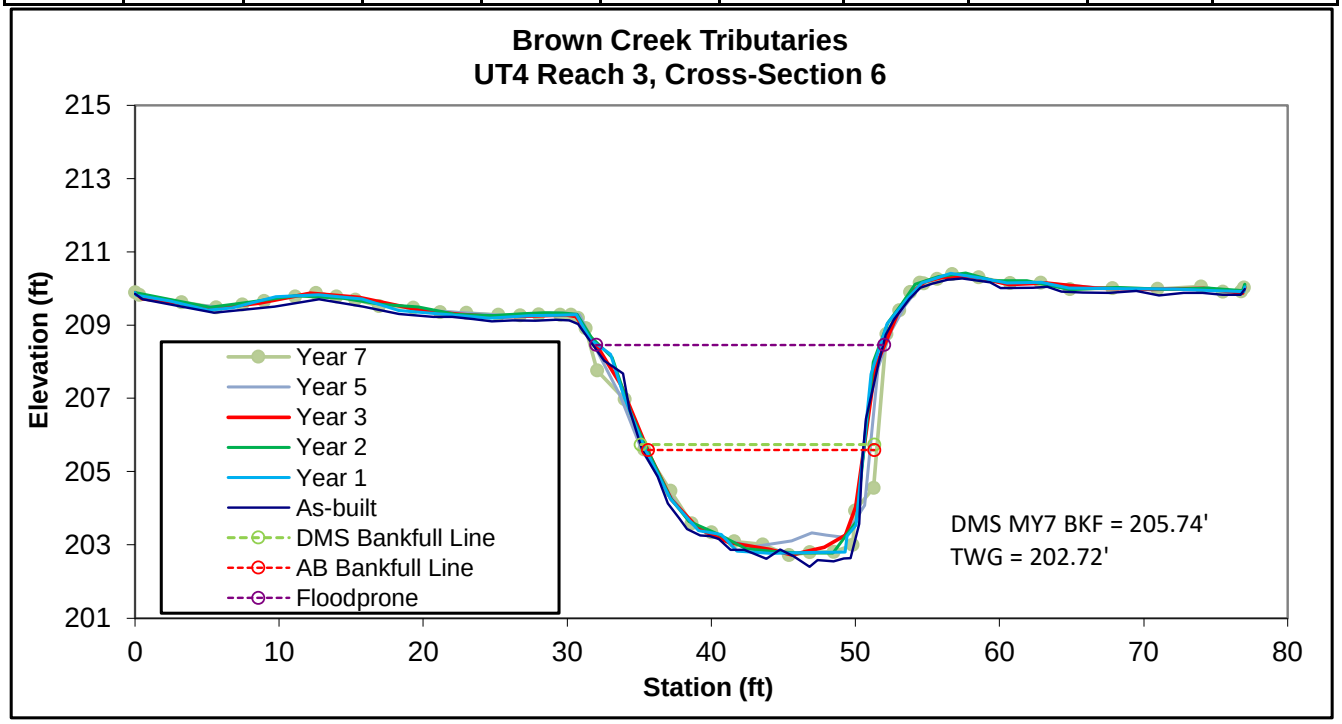
Permanent Cross-Section 6

Year 7 Data - Collected September 2021

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	AB BKF Elev	TOB Elev
Riffle	G	34.4	16.1	2.1	2.9	7.6	2.1	1.3	205.59	209.19



Note: Per DMS/IRT request, bank height ratio for MY7 has been calculated using the bankfull elevation as determined from the as-built bankfull area. All other values were calculated using the as-built bankfull elevation, as was done for previous monitoring reports.

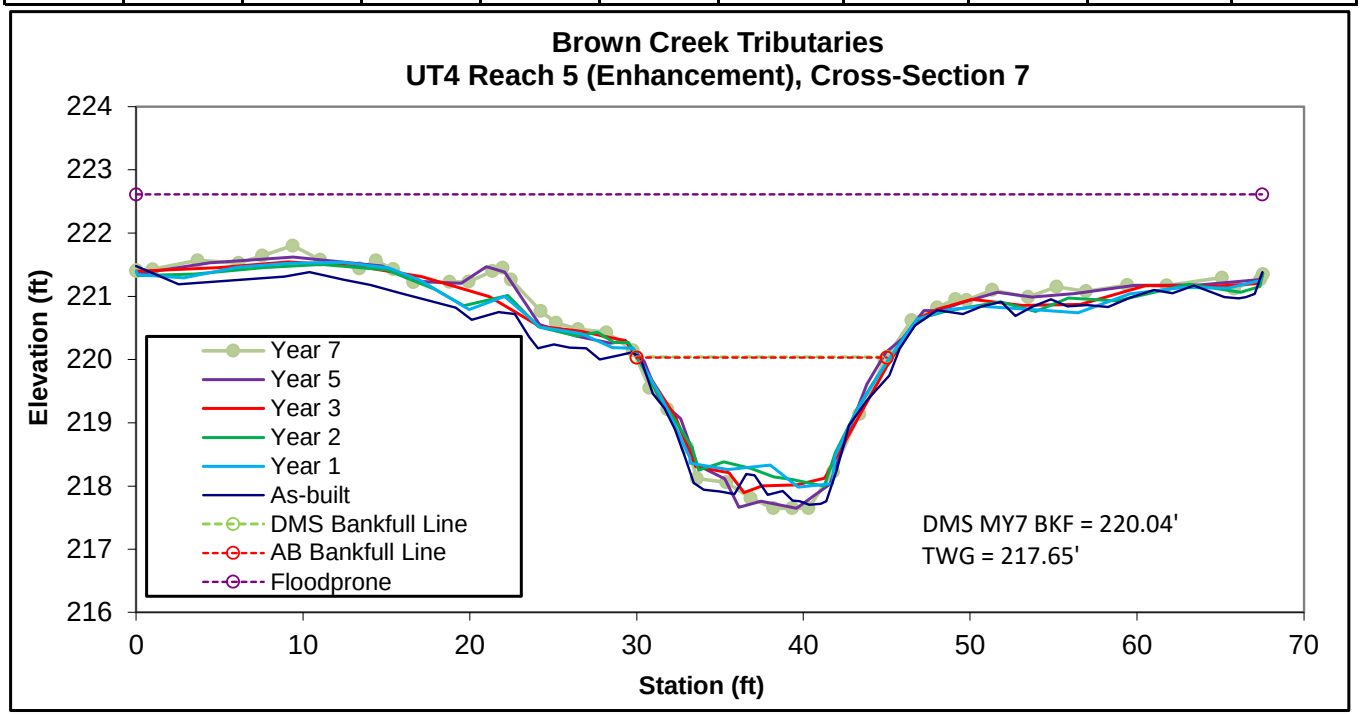
Permanent Cross-Section 7

Year 7 Data - Collected September 2021

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	AB BKF Elev	TOB Elev
Riffle	E	23.8	15.0	1.6	2.4	9.5	1.0	4.5	220.03	220.15



Note: Per DMS/IRT request, bank height ratio for MY7 has been calculated using the bankfull elevation as determined from the as-built bankfull area. All other values were calculated using the as-built bankfull elevation, as was done for previous monitoring reports.

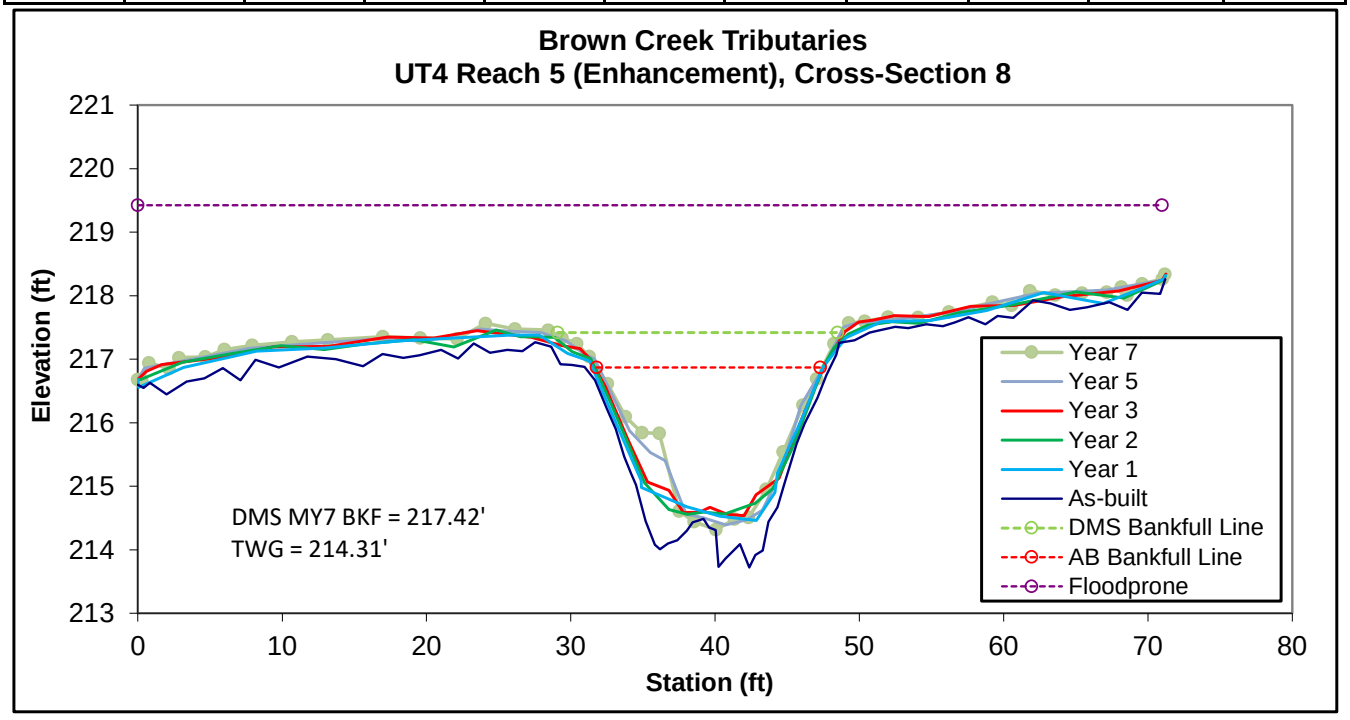
Permanent Cross-Section 8

Year 7 Data - Collected September 2021

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	AB BKF Elev	TOB Elev
Riffle	E	23.2	15.6	1.5	2.6	10.5	1.0	4.6	216.87	217.459



Note: Per DMS/IRT request, bank height ratio for MY7 has been calculated using the bankfull elevation as determined from the as-built bankfull area. All other values were calculated using the as-built bankfull elevation, as was done for previous monitoring reports.

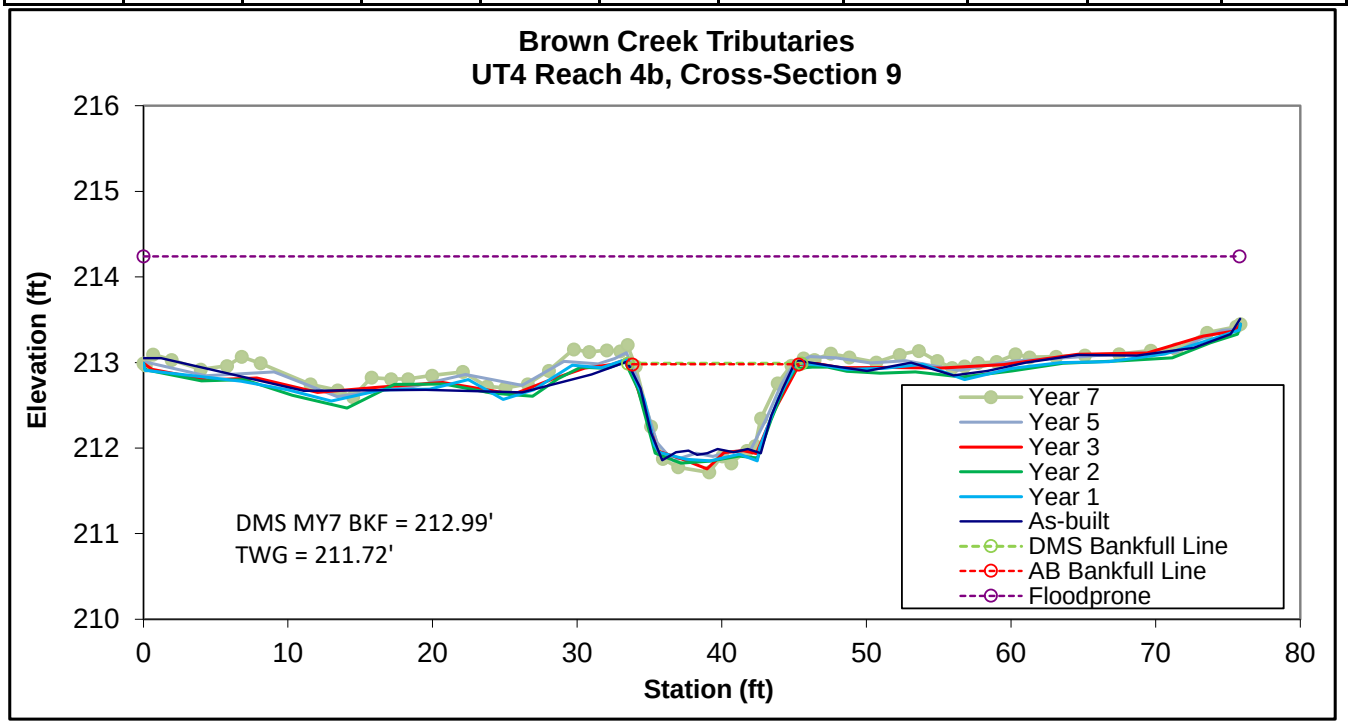
Permanent Cross-Section 9

Year 7 Data - Collected September 2021

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	AB BKF Elev	TOB Elev
Riffle	C	9.4	11.0	0.9	1.3	12.8	1.0	6.9	212.98	213.05



Note: Per DMS/IRT request, bank height ratio for MY7 has been calculated using the bankfull elevation as determined from the as-built bankfull area. All other values were calculated using the as-built bankfull elevation, as was done for previous monitoring reports.

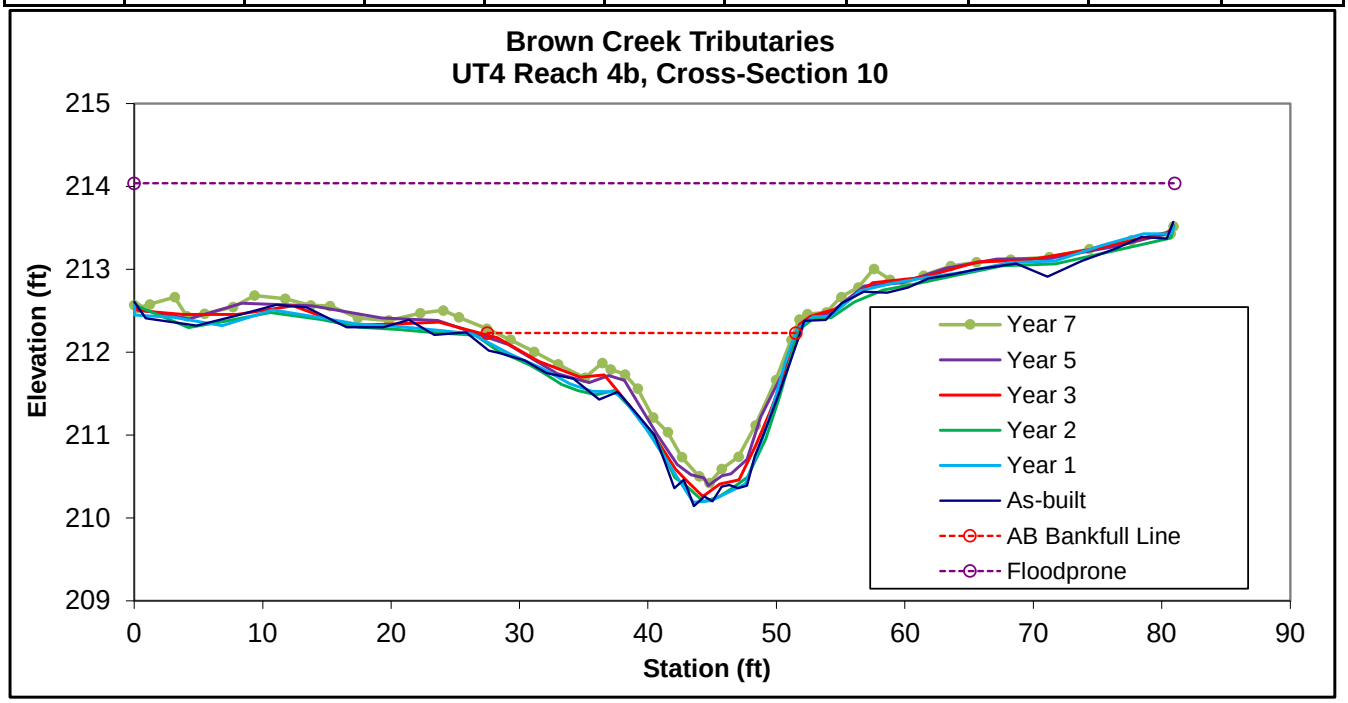
Permanent Cross-Section 10

Year 7 Data - Collected September 2021

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	AB BKF Elev	TOB Elev
Pool	--	18.3	23.3	0.8	1.8	29.4	--	--	212.23	212.40



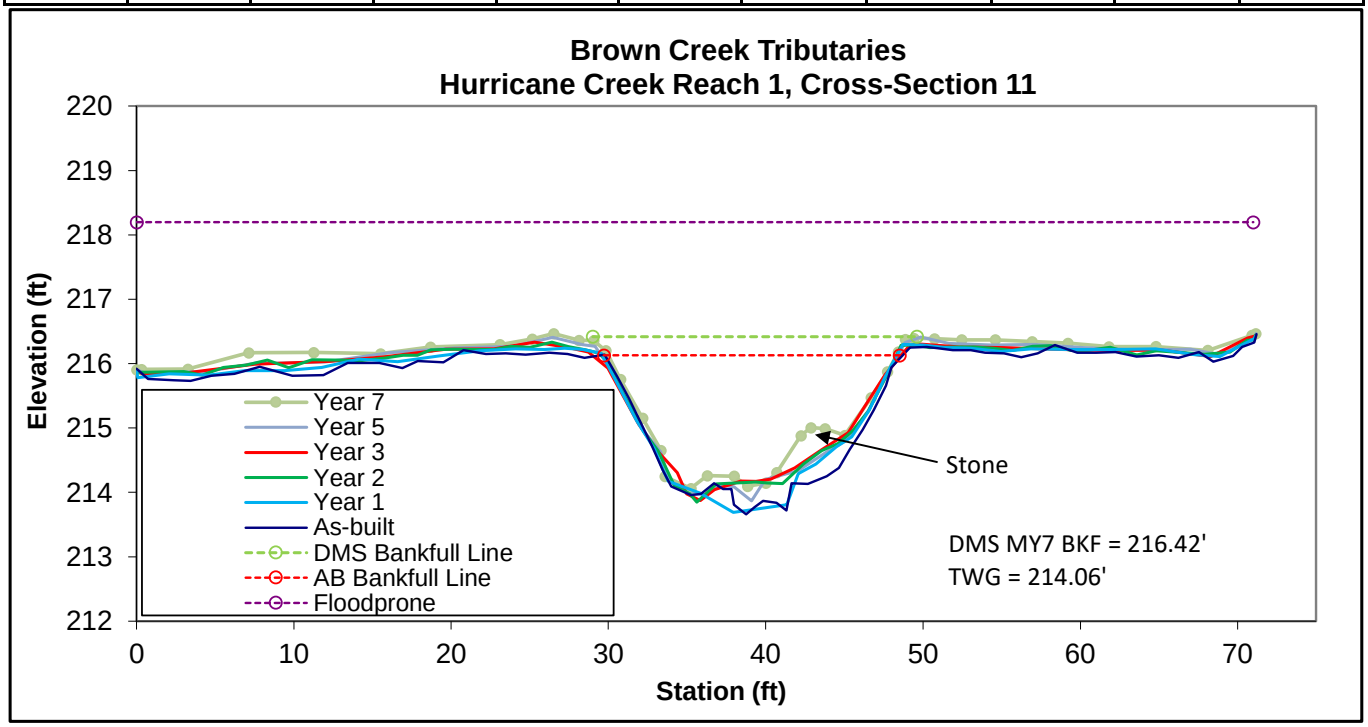
Permanent Cross-Section 11

Year 7 Data - Collected September 2021

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	AB BKF Elev	LTOB Elev
Riffle	C	24.6	18.3	1.3	2.1	13.7	1.0	3.9	216.13	216.36



Note: Per DMS/IRT request, bank height ratio for MY7 has been calculated using the bankfull elevation as determined from the as-built bankfull area. All other values were calculated using the as-built bankfull elevation, as was done for previous monitoring reports.

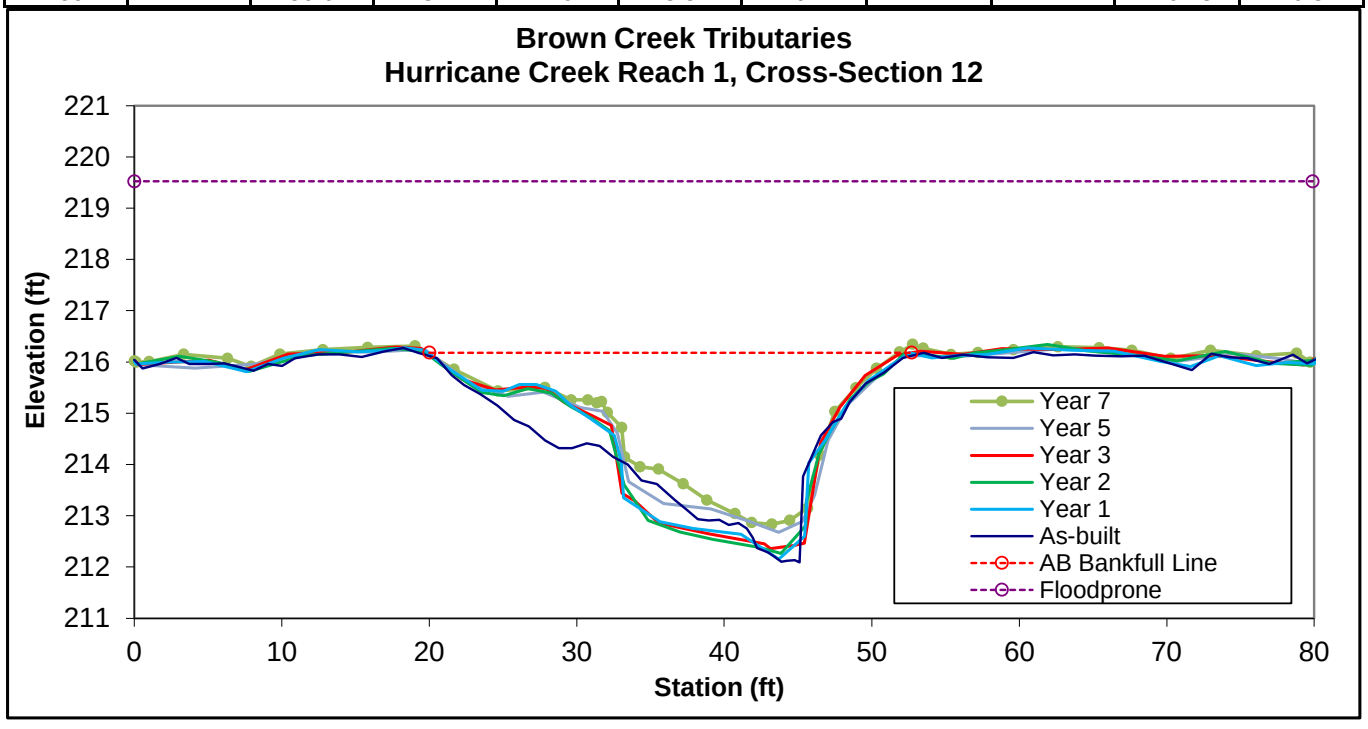
Permanent Cross-Section 12

Year 7 Data - Collected September 2021

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	AB BKF Elev	TOB Elev
Pool	--	50.6	32	1.6	3.3	20.2	--	--	216.18	216.34



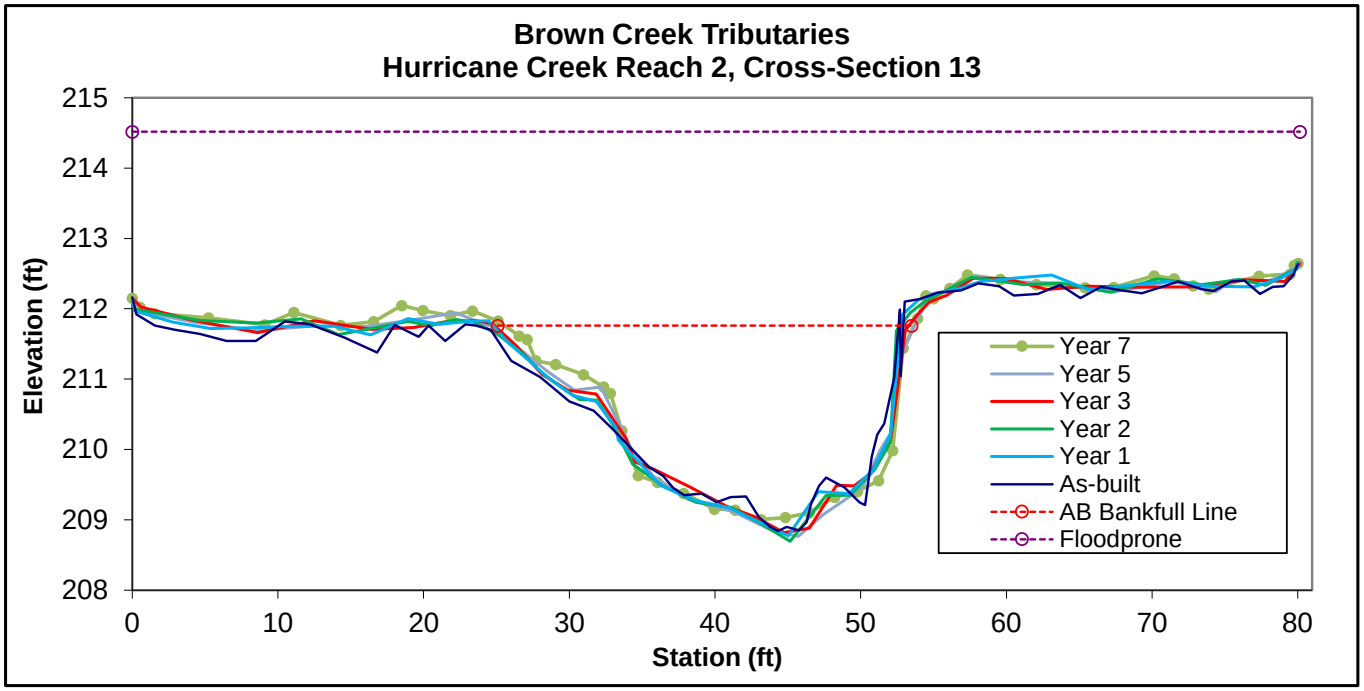
Permanent Cross-Section 13

Year 7 Data - Collected September 2021

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	AB BKF Elev	TOB Elev
Pool	--	50.9	28.1	1.8	2.8	15.5	--	--	211.76	211.56



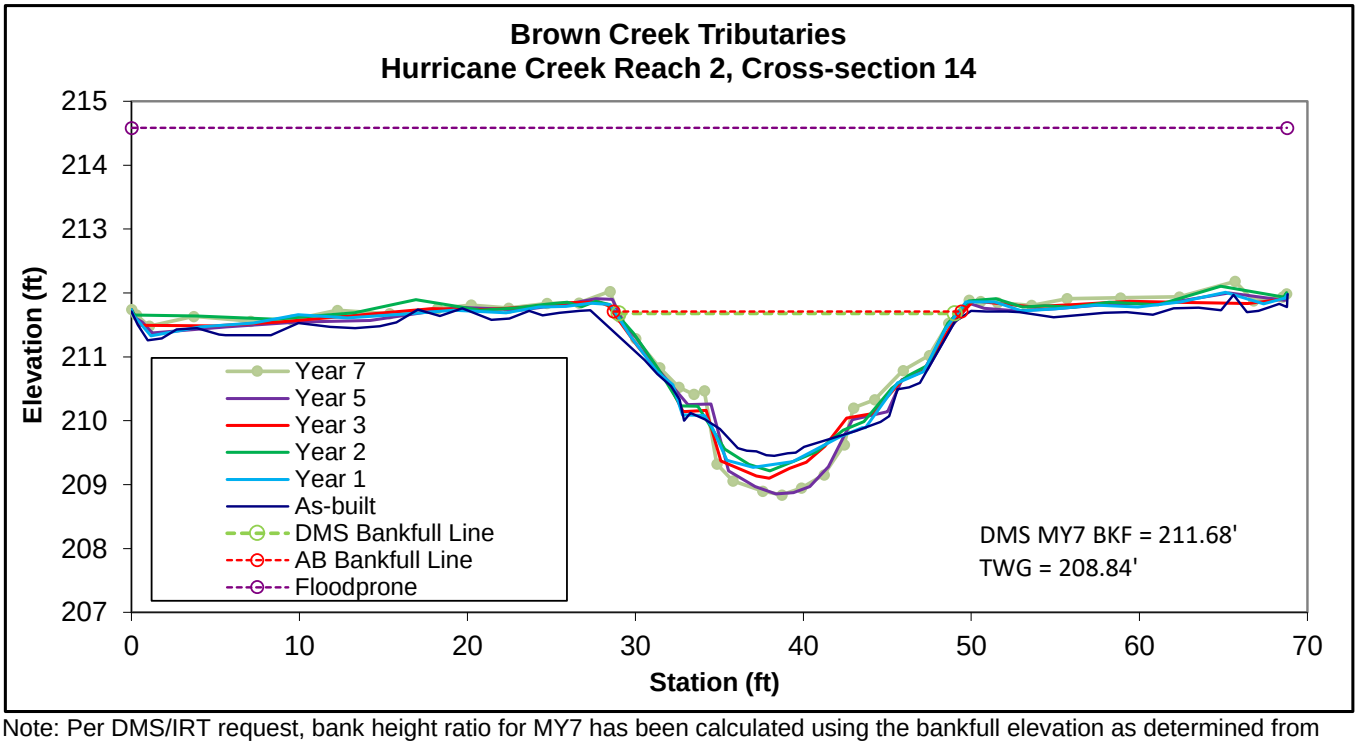
Permanent Cross-Section 14

Year 7 Data - Collected September 2021

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	AB BKF Elev	TOB Elev
Riffle	C	32.3	20.4	1.6	2.9	12.9	1.1	3.4	211.71	211.89



Note: Per DMS/IRT request, bank height ratio for MY7 has been calculated using the bankfull elevation as determined from the as-built bankfull area. All other values were calculated using the as-built bankfull elevation, as was done for previous monitoring reports.

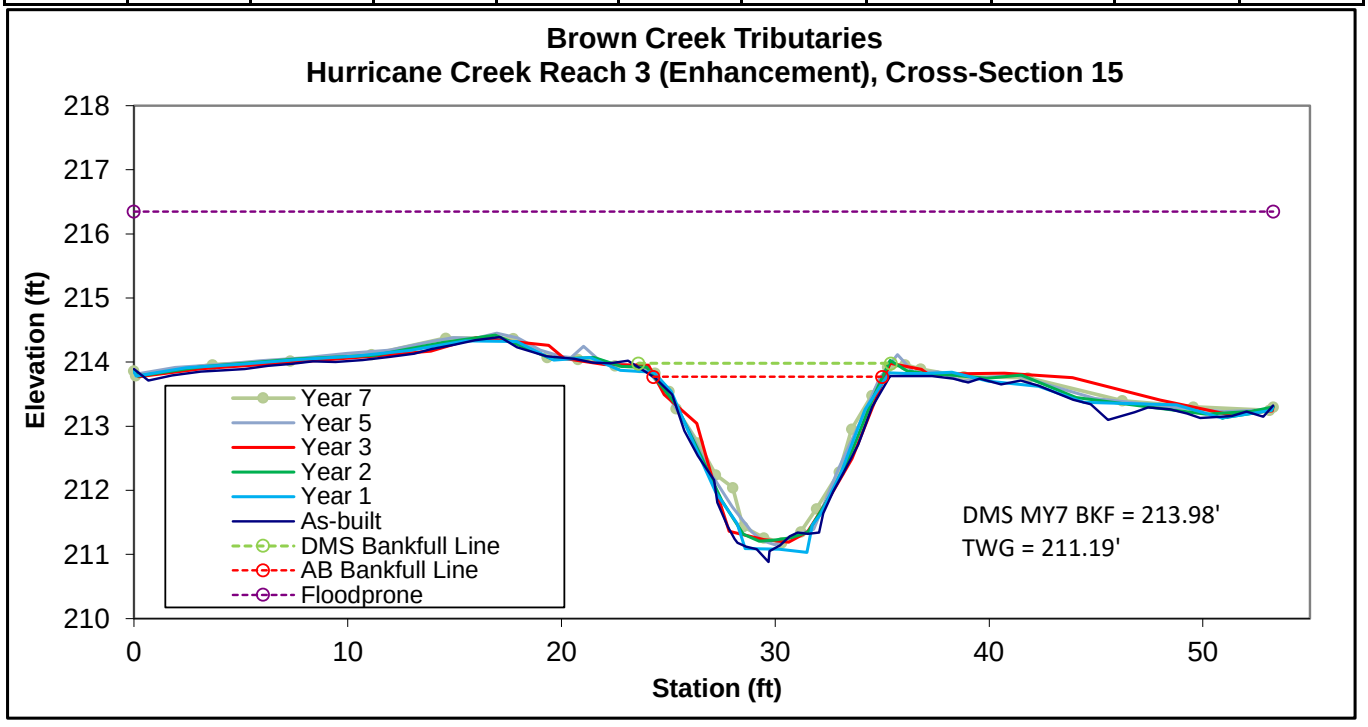
Permanent Cross-Section 15

Year 7 Data - Collected September 2021

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	AB BKF Elev	TOB Elev
Riffle	C	15.8	10.5	1.5	2.6	7.0	0.9	5.1	213.77	213.83



Note: Per DMS/IRT request, bank height ratio for MY7 has been calculated using the bankfull elevation as determined from the as-built bankfull area. All other values were calculated using the as-built bankfull elevation, as was done for previous monitoring reports.

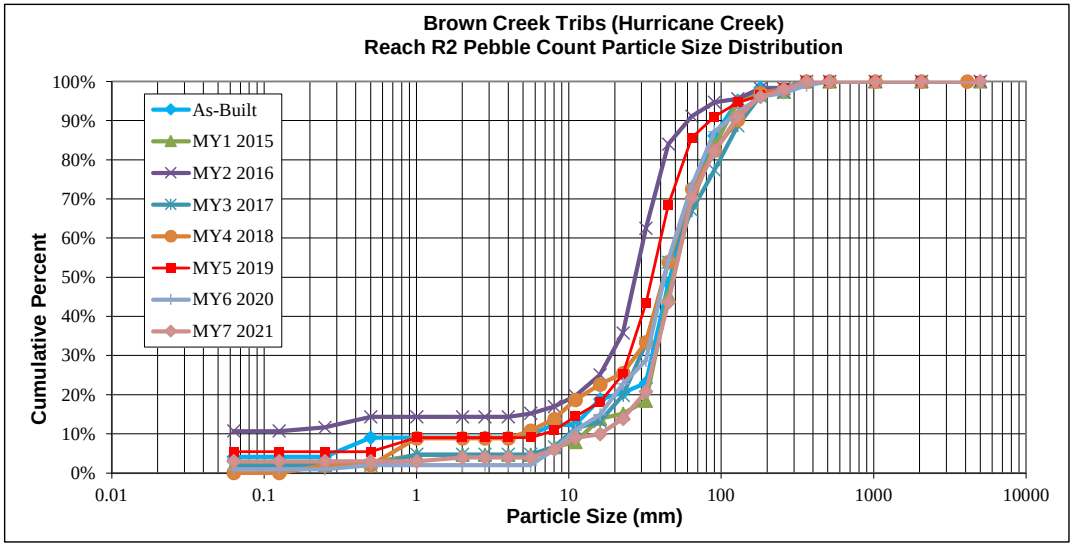
Figure 4.
Pebble Count - Monitoring Year 7
Brown Creek Tribs Mitigation Project, DMS# 95351

SITE OR PROJECT:	Brown Creek Tribs (Hurricane Creek)
REACH/LOCATION:	Reach R2 (Station 38+00)
FEATURE:	Rock Riffle
DATE:	15-Sep-21

			MY7 2021			Distribution
MATERIAL	**PARTICLE**	**SIZE (mm)**	**Total**	**Class %**	**% Cum**	**Plot Size (mm)**
Silt/Clay	Silt / Clay	< .063	3	3%	3%	0.063
Sand	Very Fine	.063 - .125			3%	0.125
	Fine	.125 - .25			3%	0.25
	Medium	.25 - .50			3%	0.50
	Coarse	.50 - 1.0			3%	1.0
	Very Coarse	1.0 - 2.0	1	1%	4%	2.0
Gravel	Very Fine	2.0 - 2.8			4%	2.8
	Very Fine	2.8 - 4.0			4%	4.0
	Fine	4.0 - 5.6			4%	5.6
	Fine	5.6 - 8.0	2	2%	6%	8.0
	Medium	8.0 - 11.0	3	3%	9%	11.0
	Medium	11.0 - 16.0	1	1%	10%	16.0
	Coarse	16 - 22.6	4	4%	14%	22.6
	Coarse	22.6 - 32	7	7%	21%	32
	Very Coarse	32 - 45	23	23%	44%	45
	Very Coarse	45 - 64	27	27%	70%	64
Cobble	Small	64 - 90	12	12%	82%	90
	Small	90 - 128	9	9%	91%	128
	Large	128 - 180	5	5%	96%	180
	Large	180 - 256	2	2%	98%	256
Boulder	Small	256 - 362	2	2%	100%	362
	Small	362 - 512			100%	512
	Medium	512 - 1024			100%	1024
	Large-Very Large	1024 - 2048			100%	2048
Bedrock	Bedrock	> 2048			100%	5000
Total % of whole count			101	100%		

Largest particle= 256-362

Summary Data			
Channel materials			
D16 =	13.0	D84 =	61.9
D35 =	27.3	D95 =	138.2
D50 =	35.1	D100 =	256 - 362



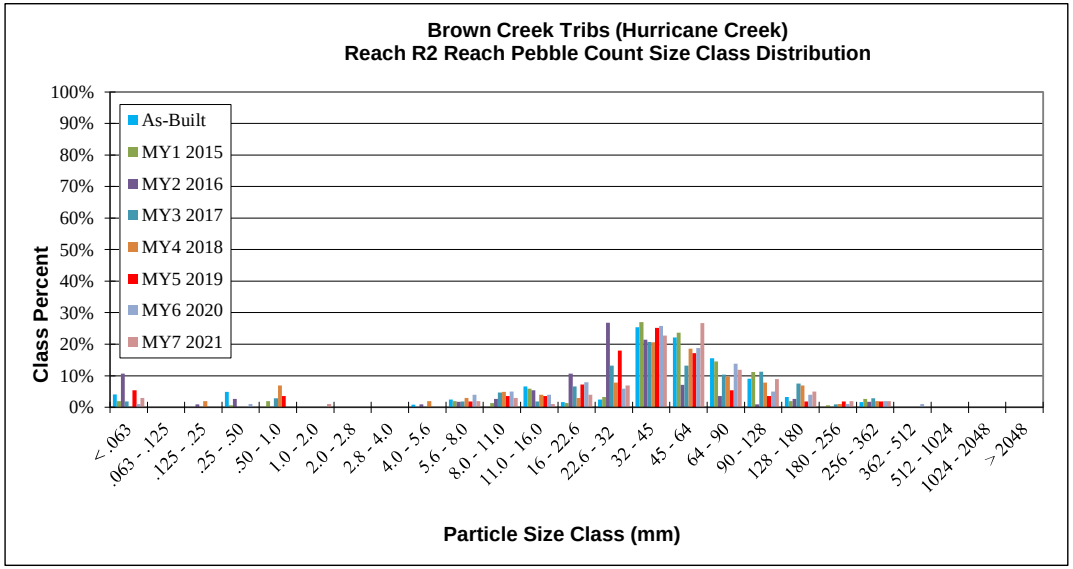


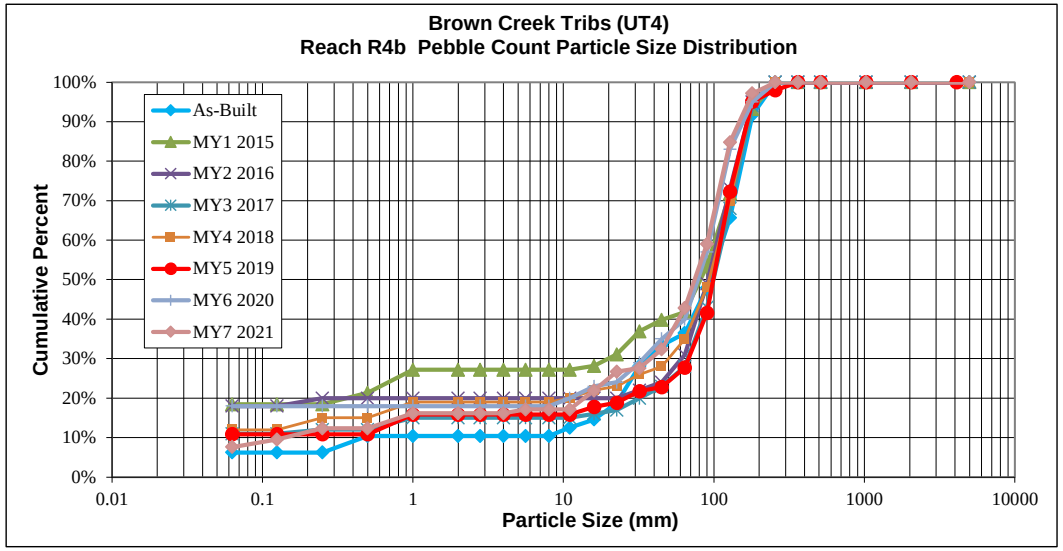
Figure 4.
Pebble Count - Monitoring Year 7
Brown Creek Tribs Mitigation Project, DMS# 95351

SITE OR PROJECT:	Brown Creek Tribs (UT4)
REACH/LOCATION:	Reach R4b (Station 19+25)
FEATURE:	Rock Riffle
DATE:	16-Sep-21

			MY7 2021			Distribution
MATERIAL	**PARTICLE**	**SIZE (mm)**	**Total**	**Class %**	**% Cum**	**Plot Size (mm)**
Silt/Clay	Silt / Clay	< .063	8	8%	8%	0.063
Sand	Very Fine	.063 - .125	2	2%	10%	0.125
	Fine	.125 - .25	3	3%	12%	0.25
	Medium	.25 - .50			12%	0.50
	Coarse	.50 - 1.0	4	4%	16%	1.0
	Very Coarse	1.0 - 2.0			16%	2.0
Gravel	Very Fine	2.0 - 2.8			16%	2.8
	Very Fine	2.8 - 4.0			16%	4.0
	Fine	4.0 - 5.6	1	1%	17%	5.6
	Fine	5.6 - 8.0			17%	8.0
	Medium	8.0 - 11.0			17%	11.0
	Medium	11.0 - 16.0	5	5%	22%	16.0
	Coarse	16 - 22.6	5	5%	27%	22.6
	Coarse	22.6 - 32	1	1%	28%	32
	Very Coarse	32 - 45	5	5%	32%	45
	Very Coarse	45 - 64	11	10%	43%	64
Cobble	Small	64 - 90	17	16%	59%	90
	Small	90 - 128	27	26%	85%	128
	Large	128 - 180	13	12%	97%	180
	Large	180 - 256	3	3%	100%	256
Boulder	Small	256 - 362			100%	362
	Small	362 - 512			100%	512
	Medium	512 - 1024			100%	1024
	Large-Very Large	1024 - 2048			100%	2048
Bedrock	Bedrock	> 2048			100%	5000
Total % of whole count			105	100%		

Largest particle= 180-256

Summary Data			
Channel materials			
D16 =	11.3	D84 =	152.6
D35 =	76.5	D95 =	179.9
D50 =	99.1	D100 =	180-256



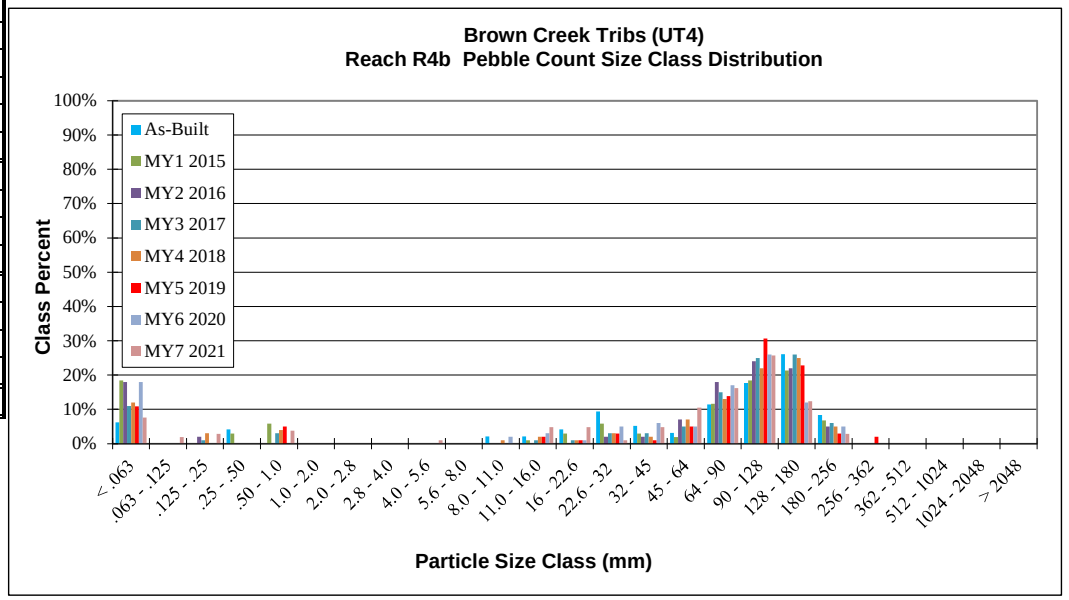


Table 10. Baseline Stream Summary
Brown Creek Tributaries Restoration Project: DMS Project ID No. 95351

Hurricane Creek (Reach 1) Length 2,043 ft

Parameter	USGS Gauge	Regional Curve			Pre-Existing Condition[1]						Reference Reach(es) Data[3] Richland Creek (Moore County)						Design[4]						As-built					
		LL	UL	Eq.	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n
Dimension and Substrate - Riffle																												
BF Width (ft)	-----	14.8	14.9	-----	-----	-----	-----	13.5	-----	-----	16.2	-----	-----	16.7	-----	-----	-----	19.1	-----	-----	-----	-----	-----	18.9	-----	-----	-----	-----
Floodprone Width (ft)	-----	-----	-----	-----	-----	-----	-----	106.0	-----	-----	50.0	-----	-----	53.0	-----	-----	45.0	-----	-----	79.0	-----	-----	-----	71.2	-----	-----	-----	-----
BF Mean Depth (ft)	-----	1.3	1.8	-----	-----	-----	-----	2.2	-----	-----	0.9	-----	-----	0.9	-----	-----	-----	1.5	-----	-----	-----	-----	-----	1.6	-----	-----	-----	-----
BF Max Depth (ft)	-----	-----	-----	-----	-----	-----	-----	2.8	-----	-----	1.4	-----	-----	1.5	-----	-----	-----	1.8	-----	-----	-----	-----	-----	2.5	-----	-----	-----	-----
BF Cross-sectional Area (ft^2)	-----	22.5	30.5	-----	-----	-----	-----	30.0	-----	-----	15.0	-----	-----	15.5	-----	-----	-----	28.0	-----	-----	-----	-----	-----	30.4	-----	-----	-----	-----
Width/Depth Ratio	-----	-----	-----	-----	-----	-----	-----	6.0	-----	-----	18.0	-----	-----	18.6	-----	-----	-----	13.0	-----	-----	-----	-----	-----	11.8	-----	-----	-----	-----
Entrenchment Ratio	-----	-----	-----	-----	-----	-----	-----	7.9	-----	-----	3.0	-----	-----	3.3	-----	-----	-----	>2.2	-----	-----	-----	-----	-----	3.8	-----	-----	-----	-----
Bank Height Ratio	-----	-----	-----	-----	-----	-----	-----	1.7	-----	-----	1.6	-----	-----	1.7	-----	-----	-----	1.0	-----	-----	-----	-----	-----	1.0	-----	-----	-----	-----
d50 (mm)	-----	-----	-----	-----	-----	-----	-----	0.6	-----	-----	-----	45.0	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	0.9	-----	-----	-----	-----
Pattern																												
Channel Beltwidth (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	69	-----	-----	140	-----	-----	-----	93.0	-----	-----	-----	-----
Radius of Curvature (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	14.3	-----	-----	26.1	-----	-----	39.0	-----	-----	55.0	-----	-----	-----	55.0	-----	-----	-----	-----
Rc / Bankfull width (ft/ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	5.5	-----	-----	5.7	-----	-----	2.0	-----	-----	3.0	-----	-----	-----	2.9	-----	-----	-----	-----
Meander Wavelength (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	90	-----	-----	94	-----	-----	130.0	-----	-----	230.0	-----	-----	-----	227.0	-----	-----	-----	-----
Meander Width Ratio	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	1.5	-----	-----	2.4	-----	-----	3.5	-----	-----	6.5	-----	-----	-----	4.9	-----	-----	-----	-----
Profile																												
Riffle Length (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	N/P	-----	-----	-----	-----	-----	-----	-----	-----	-----	48.0	-----	-----	-----	-----
Riffle Slope (ft/ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	0.013	-----	-----	0.0413	-----	-----	-----	0.0170	-----	-----	-----	-----	-----	0.0102	-----	-----	-----	-----
Pool Length (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	N/P	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Pool to Pool Spacing (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	37.3	-----	-----	95.8	-----	-----	80.0	-----	-----	138.0	-----	-----	-----	133.0	-----	-----	-----	-----
Pool Max Depth (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	2.3	-----	-----	2.5	-----	-----	-----	3.0	-----	-----	-----	-----	-----	4.0	-----	-----	-----	-----
Pool Volume (ft^3)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	N/P	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Substrate and Transport Parameters																												
Ri% / Ru% / P% / G% / S%	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----
SC% / Sa% / G% / B% / Be%	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----
[2] d16 / d35 / d50 / d84 / d95	-----	-----	-----	-----			0.13 / 0.33 / 0.6 / 4.5 / 14.1						6.0 / NP,/ 45.0 / 125.0 / NP				-----	-----	-----	-----	-----	-----						
Reach Shear Stress (competency) lb/f^2	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Max part size (mm) mobilized at bankfull (Rosgen Curve)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Stream Power (transport capacity) W/m^2	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Additional Reach Parameters																												
Drainage Area (SM)	-----	-----	-----	-----	-----	-----	-----	1.68	-----	-----	-----	-----	-----	1.00	-----	-----	-----	-----	-----	1.68	-----	-----	-----	-----	-----	1.68	-----	-----
Impervious cover estimate (%)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Rosgen Classification	-----	-----	-----	-----	-----	-----	-----	E	-----	-----	-----	-----	-----	C4	-----	-----	-----	-----	-----	E5/C5	-----	-----	-----	-----	-----	C5	-----	-----
BF Velocity (fps)	-----	2.9	3.9	-----	-----	-----	-----	4.3	-----	-----	-----	-----	-----	N/P	-----	-----	-----	3.9	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
BF Discharge (cfs)	-----	87.4	129.5	194.3	-----	-----	-----	129.5	-----	-----	-----	-----	-----	N/P	-----	-----	-----	110	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Valley Length	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	1745.5	-----	-----
Channel length (ft)[2]	-----	-----	-----	-----	-----	-----	-----	1896	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	2043.0	-----	-----
Sinuosity	-----	-----	-----	-----	-----	-----	-----	1.07	-----	-----	-----	-----	-----	1.20	-----	-----	-----	1.2	-----	-----	-----	-----	-----	-----	-----	1.2	-----	-----
Water Surface Slope (Channel) (ft/ft)	-----	-----	-----	-----	-----	-----	-----	0.0023	-----	-----	-----	0.0136	-----	-----	-----	-----	-----	0.0120	-----	-----	-----	-----	-----	0.0029	-----	-----	-----	-----
BF slope (ft/ft)	-----	-----	-----	-----	-----	-----	-----	0.0025	-----	-----	-----	0.0133	-----	-----	-----	-----	-----	0.0023	-----	-----	-----	-----	-----	0.0034	-----	-----	-----	-----
Bankfull Floodplain Area (acres)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
BEHI VL% / L% / M% / H% / VH% / E%	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Channel Stability or Habitat Metric	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Biological or Other	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----

[1] Existing conditions survey data was compiled for each reach of Hurricane Creek and UT4 respectively
[2] Bulk samples taken for pre-existing condition and pebble counts taken for as-built and annual monitoring
[3] Reference reach data for Richland Creek in Moore County from the NC DOT reference reach database was used in the design
[4] Values were chosen based on previous sand-bed reference reach data and past project evaluations

Table 10. Baseline Stream Summary (continued)
Brown Creek Tributaries Restoration Project: DMS Project ID No. 95351

Hurricane Creek (Reach 2) Length 1,394 ft

Parameter	USGS Gauge	Regional Curve			Pre-Existing Condition[1]						Reference Reach(es) Data[3] Richland Creek (Moore County)						Design[4]						As-built					
		LL	UL	Eq.	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n
Dimension and Substrate - Riffle																												
BF Width (ft)	-----	14.8	14.9	-----	-----	-----	-----	16.0	-----	-----	16.2	-----	-----	16.7	-----	-----	-----	20.1	-----	-----	-----	-----	-----	22.5	-----	-----	-----	-----
Floodprone Width (ft)	-----	-----	-----	-----	-----	-----	-----	162.0	-----	-----	50.0	-----	-----	53.0	-----	-----	49.0	-----	-----	85.0	-----	-----	-----	69.0	-----	-----	-----	-----
BF Mean Depth (ft)	-----	1.3	1.8	-----	-----	-----	-----	2.2	-----	-----	0.9	-----	-----	0.9	-----	-----	-----	1.6	-----	-----	-----	-----	-----	1.4	-----	-----	-----	-----
BF Max Depth (ft)	-----	-----	-----	-----	-----	-----	-----	3.5	-----	-----	1.4	-----	-----	1.5	-----	-----	-----	2.0	-----	-----	-----	-----	-----	2.3	-----	-----	-----	-----
BF Cross-sectional Area (ft^2)	-----	22.5	30.5	-----	-----	-----	-----	34.6	-----	-----	15.0	-----	-----	15.5	-----	-----	-----	31.0	-----	-----	-----	-----	-----	31.6	-----	-----	-----	-----
Width/Depth Ratio	-----	-----	-----	-----	-----	-----	-----	7.4	-----	-----	18.0	-----	-----	18.6	-----	-----	-----	13.0	-----	-----	-----	-----	-----	16.1	-----	-----	-----	-----
Entrenchment Ratio	-----	-----	-----	-----	-----	-----	-----	10.1	-----	-----	3.0	-----	-----	3.3	-----	-----	-----	>2.2	-----	-----	-----	-----	-----	3.1	-----	-----	-----	-----
Bank Height Ratio	-----	-----	-----	-----	-----	-----	-----	1.3	-----	-----	1.6	-----	-----	1.7	-----	-----	-----	1.0	-----	-----	-----	-----	-----	1.0	-----	-----	-----	-----
d50 (mm)	-----	-----	-----	-----	-----	-----	-----	0.3	-----	-----	-----	45.0	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	0.9	-----	-----	-----	-----
Pattern																												
Channel Beltwidth (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	74	-----	-----	150	-----	-----	-----	100.0	-----	-----	-----	-----
Radius of Curvature (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	14.3	-----	-----	26.1	-----	-----	40.0	-----	-----	60.0	-----	-----	-----	55.0	-----	-----	-----	-----
Rc / Bankfull width (ft/ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	5.5	-----	-----	5.7	-----	-----	2.0	-----	-----	3.0	-----	-----	-----	2.4	-----	-----	-----	-----
Meander Wavelength (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	90	-----	-----	94	-----	-----	140.0	-----	-----	250.0	-----	-----	-----	230.0	-----	-----	-----	-----
Meander Width Ratio	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	1.5	-----	-----	2.4	-----	-----	3.5	-----	-----	6.5	-----	-----	-----	4.4	-----	-----	-----	-----
Profile																												
Riffle Length (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	N/P	-----	-----	-----	-----	-----	-----	-----	-----	-----	54.0	-----	-----	-----	-----
Riffle Slope (ft/ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	0.013	-----	-----	0.0413	-----	-----	-----	0.0170	-----	-----	-----	-----	-----	0.0080	-----	-----	-----	-----
Pool Length (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	N/P	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Pool to Pool Spacing (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	37.3	-----	-----	95.8	-----	-----	85.0	-----	-----	149.0	-----	-----	-----	149.0	-----	-----	-----	-----
Pool Max Depth (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	2.3	-----	-----	2.5	-----	-----	-----	3.2	-----	-----	-----	-----	-----	2.9	-----	-----	-----	-----
Pool Volume (ft^3)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	N/P	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Substrate and Transport Parameters																												
Ri% / Ru% / P% / G% / S%	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----
SC% / Sa% / G% / B% / Be%	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----
[2] d16 / d35 / d50 / d84 / d95	-----	-----	-----	-----			0.11 / 0.23 / 0.3 / 1.4 / 4.0						6.0 / NP,/ 45.0 / 125.0 / NP				-----	-----	-----	-----	-----	-----			13.6 / 37.6 / 46.2 / 86.0 / 127.6			
Reach Shear Stress (competency) lb/ft^2	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Max part size (mm) mobilized at bankfull (Rosgen Curve)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Stream Power (transport capacity) W/m^2	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Additional Reach Parameters																												
Drainage Area (SM)	-----	-----	-----	-----	-----	-----	-----	2.16	-----	-----	-----	-----	-----	1.00	-----	-----	-----	-----	-----	2.16	-----	-----	-----	-----	-----	2.16	-----	-----
Impervious cover estimate (%)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Rosgen Classification	-----	-----	-----	-----	-----	-----	-----	E	-----	-----	-----	-----	-----	C4	-----	-----	-----	-----	-----	E5/C5	-----	-----	-----	-----	-----	C5	-----	-----
BF Velocity (fps)	-----	2.9	3.9	-----	-----	-----	-----	4.4	-----	-----	-----	-----	-----	N/P	-----	-----	-----	4.2	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
BF Discharge (cfs)	-----	87.4	129.5	194.3	-----	-----	-----	155.0	-----	-----	-----	-----	-----	N/P	-----	-----	-----	130	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Valley Length	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	1159.0	-----	-----
Channel length (ft)[2]	-----	-----	-----	-----	-----	-----	-----	1288	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	1393.0	-----	-----
Sinuosity	-----	-----	-----	-----	-----	-----	-----	1.07	-----	-----	-----	-----	-----	1.20	-----	-----	-----	1.2	-----	-----	-----	-----	-----	-----	-----	1.2	-----	-----
Water Surface Slope (Channel) (ft/ft)	-----	-----	-----	-----	-----	-----	-----	0.0023	-----	-----	-----	0.0136	-----	-----	-----	-----	-----	0.0120	-----	-----	-----	-----	-----	0.0029	-----	-----	-----	-----
BF slope (ft/ft)	-----	-----	-----	-----	-----	-----	-----	0.0025	-----	-----	-----	0.0133	-----	-----	-----	-----	-----	0.0023	-----	-----	-----	-----	-----	0.0034	-----	-----	-----	-----
Bankfull Floodplain Area (acres)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
BEHI VL% / L% / M% / H% / VH% / E%	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Channel Stability or Habitat Metric	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Biological or Other	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----

[1] Existing conditions survey data was compiled for each reach of Hurricane Creek and UT4 respectively
[2] Bulk samples taken for pre-existing condition and pebble counts taken for as-built and annual monitoring
[3] Reference reach data for Richland Creek in Moore County from the NC DOT reference reach database was used in the design
[4] Values were chosen based on previous sand-bed reference reach data and past project evaluations

Table 10. Baseline Stream Summary (continued)
Brown Creek Tributaries Restoration Project: EEP Project ID No. 95351

Hurricane Creek (Reach 3) Length 564 ft

Parameter	USGS Gauge	Regional Curve			Pre-Existing Condition[1]						Reference Reach(es) Data[3] Richland Creek (Moore County)						Design[4]						As-built					
		LL	UL	Eq.	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n
Dimension and Substrate - Riffle																												
BF Width (ft)	-----	16.6	16.6	-----	-----	-----	-----	5.7	-----	-----	16.2	-----	-----	16.7	-----	-----	-----	9.1	-----	-----	-----	-----	-----	5.9	-----	-----	-----	-----
Floodprone Width (ft)	-----	-----	-----	-----	-----	-----	-----	9.1	-----	-----	50.0	-----	-----	53.0	-----	-----	21.0	-----	-----	36.0	-----	-----	-----	10.0	-----	-----	-----	-----
BF Mean Depth (ft)	-----	1.4	1.9	-----	-----	-----	-----	1.0	-----	-----	0.9	-----	-----	0.9	-----	-----	-----	0.8	-----	-----	-----	-----	-----	0.8	-----	-----	-----	-----
BF Max Depth (ft)	-----	-----	-----	-----	-----	-----	-----	1.2	-----	-----	1.4	-----	-----	1.5	-----	-----	-----	1.0	-----	-----	-----	-----	-----	1.3	-----	-----	-----	-----
BF Cross-sectional Area (ft^2)	-----	26.8	36.2	-----	-----	-----	-----	5.8	-----	-----	15.0	-----	-----	15.5	-----	-----	-----	6.9	-----	-----	-----	-----	-----	4.7	-----	-----	-----	-----
Width/Depth Ratio	-----	-----	-----	-----	-----	-----	-----	5.6	-----	-----	18.0	-----	-----	18.6	-----	-----	-----	12.0	-----	-----	-----	-----	-----	7.3	-----	-----	-----	-----
Entrenchment Ratio	-----	-----	-----	-----	-----	-----	-----	1.6	-----	-----	3.0	-----	-----	3.3	-----	-----	1.8	-----	-----	2.2	-----	-----	-----	1.6	-----	-----	-----	-----
Bank Height Ratio	-----	-----	-----	-----	-----	-----	-----	2.0	-----	-----	1.6	-----	-----	1.7	-----	-----	-----	1.0	-----	-----	-----	-----	-----	2.3	-----	-----	-----	-----
d50 (mm)	-----	-----	-----	-----	-----	1.0	-----	-----	-----	-----	-----	45.0	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Pattern																												
Channel Beltwidth (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Radius of Curvature (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	14.3	-----	-----	26.1	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Rc / Bankfull width (ft/ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	5.5	-----	-----	5.7	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Meander Wavelength (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	90	-----	-----	94	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Meander Width Ratio	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	1.5	-----	-----	2.4	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Profile																												
Riffle Length (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	N/P	-----	-----	-----	-----	-----	-----	-----	-----	-----	79.0	-----	-----	-----	-----
Riffle Slope (ft/ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	0.013	-----	-----	0.0413	-----	-----	-----	0.0050	-----	-----	-----	-----	-----	0.0046	-----	-----	-----	-----
Pool Length (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	N/P	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Pool to Pool Spacing (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	37.3	-----	-----	95.8	-----	-----	18.0	-----	-----	50.0	-----	-----	-----	80.0	-----	-----	-----	-----
Pool Max Depth (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	2.3	-----	-----	2.5	-----	-----	-----	2.0	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Pool Volume (ft^3)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	N/P	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Substrate and Transport Parameters																												
Ri% / Ru% / P% / G% / S%	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
SC% / Sa% / G% / B% / Be%	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
[2] d16 / d35 / d50 / d84 / d95	-----	-----	-----	-----			(0.29/ 0.63 / 1.0/ 3.4 / 6.7)						6.0 / NP,/ 45.0 / 125.0 / NP				-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Reach Shear Stress (competency) lb/f^2	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Max part size (mm) mobilized at bankfull (Rosgen Curve)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Stream Power (transport capacity) W/m^2	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Additional Reach Parameters																												
Drainage Area (SM)	-----	-----	-----	-----	-----	-----	-----	0.19	-----	-----	-----	-----	-----	1.00	-----	-----	-----	-----	-----	0.19	-----	-----	-----	-----	-----	0.19	-----	-----
Impervious cover estimate (%)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Rosgen Classification	-----	-----	-----	-----	-----	-----	-----	E	-----	-----	-----	-----	-----	C4	-----	-----	-----	-----	-----	B5c	-----	-----	-----	-----	-----	B5c	-----	-----
BF Velocity (fps)	-----	3.0	4.4	-----	-----	-----	-----	4.5	-----	-----	-----	-----	-----	N/P	-----	-----	-----	3.2	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
BF Discharge (cfs)	-----	106.1	155.0	231.8	-----	-----	-----	26.5	-----	-----	-----	-----	-----	N/P	-----	-----	-----	22	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Valley Length	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	559.0	-----	-----
Channel length (ft)[2]	-----	-----	-----	-----	-----	-----	-----	579	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	564.0	-----	-----
Sinuosity	-----	-----	-----	-----	-----	-----	-----	1.02	-----	-----	-----	-----	-----	1.20	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	1.01	-----	-----
Water Surface Slope (Channel) (ft/ft)	-----	-----	-----	-----	-----	-----	-----	0.0078	-----	-----	-----	0.0136	-----	-----	-----	-----	-----	0.0160	-----	-----	-----	-----	-----	0.0047	-----	-----	-----	-----
BF slope (ft/ft)	-----	-----	-----	-----	-----	-----	-----	0.008	-----	-----	-----	0.0133	-----	-----	-----	-----	-----	0.0025	-----	-----	-----	-----	-----	0.0047	-----	-----	-----	-----
Bankfull Floodplain Area (acres)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
BEHI VL% / L% / M% / H% / VH% / E%	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Channel Stability or Habitat Metric	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Biological or Other	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----

[1] Existing conditions survey data was compiled for each reach of Hurricane Creek and UT4 respectively
[2] Bulk samples taken for pre-existing condition and pebble counts taken for as-built and annual monitoring
[3] Reference reach data for Richland Creek in Moore County from the NC DOT reference reach database was used in the design
[4] Values were chosen based on previous sand-bed reference reach data and past project evaluations

Table 10. Baseline Stream Summary (continued)
Brown Creek Tributaries Restoration Project: EEP Project ID No. 95351

UT4 (Reach 1) Length 1,376 ft

Parameter	USGS Gauge	Regional Curve			Pre-Existing Condition[1]						Reference Reach(es) Data[3] Richland Creek (Moore County)						Design[4]						As-built					
		LL	UL	Eq.	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n
Dimension and Substrate - Riffle																												
BF Width (ft)	-----	7.1	7.5	-----	8.6	-----	-----	11.7	-----	-----	16.2	-----	-----	16.7	-----	-----	-----	11.4	-----	-----	-----	-----	-----	14.0	-----	-----	-----	-----
Floodprone Width (ft)	-----	-----	-----	-----	12.7	-----	-----	15.6	-----	-----	50.0	-----	-----	53.0	-----	-----	26.0	-----	-----	46.0	-----	-----	-----	89.2	-----	-----	-----	-----
BF Mean Depth (ft)	-----	0.9	1.1	-----	0.9	-----	-----	1.3	-----	-----	0.9	-----	-----	0.9	-----	-----	-----	0.9	-----	-----	-----	-----	-----	1.0	-----	-----	-----	-----
BF Max Depth (ft)	-----	-----	-----	-----	1.2	-----	-----	1.9	-----	-----	1.4	-----	-----	1.5	-----	-----	-----	1.1	-----	-----	-----	-----	-----	1.8	-----	-----	-----	-----
BF Cross-sectional Area (ft^2)	-----	7.4	10.3	-----	10.5	-----	-----	11.3	-----	-----	15.0	-----	-----	15.5	-----	-----	-----	10.0	-----	-----	-----	-----	-----	14.1	-----	-----	-----	-----
Width/Depth Ratio	-----	-----	-----	-----	6.5	-----	-----	13.2	-----	-----	18.0	-----	-----	18.6	-----	-----	-----	13	-----	-----	-----	-----	-----	13.8	-----	-----	-----	-----
Entrenchment Ratio	-----	-----	-----	-----	1.3	-----	-----	1.5	-----	-----	3.0	-----	-----	3.3	-----	-----	-----	>2.2	-----	-----	-----	-----	-----	6.4	-----	-----	-----	-----
Bank Height Ratio	-----	-----	-----	-----	2.1	-----	-----	2.4	-----	-----	1.6	-----	-----	1.7	-----	-----	-----	1.0	-----	-----	-----	-----	-----	1.0	-----	-----	-----	-----
d50 (mm)	-----	-----	-----	-----	-----	2.1	-----		-----	-----	-----	45.0	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Pattern																												
Channel Beltwidth (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	40.0	-----	-----	80.0	-----	-----	-----	60.0	-----	-----	-----	-----
Radius of Curvature (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	14.3	-----	-----	26.1	-----	-----	23.0	-----	-----	34.0	-----	-----	-----	40.0	-----	-----	-----	-----
Rc / Bankfull width (ft/ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	5.5	-----	-----	5.7	-----	-----	2.0	-----	-----	3.0	-----	-----	-----	2.9	-----	-----	-----	-----
Meander Wavelength (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	90	-----	-----	94	-----	-----	70.0	-----	-----	90.0	-----	-----	-----	146.0	-----	-----	-----	-----
Meander Width Ratio	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	1.5	-----	-----	2.4	-----	-----	3.5	-----	-----	7.0	-----	-----	-----	4.3	-----	-----	-----	-----
Profile																												
Riffle Length (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	N/P	-----	-----	-----	-----	-----	-----	-----	-----	-----	37.2	-----	-----	-----	-----
Riffle Slope (ft/ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	0.013	-----	-----	0.0413	-----	-----	-----	0.0078	-----	-----	-----	-----	-----	0.0153	-----	-----	-----	-----
Pool Length (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	N/P	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Pool to Pool Spacing (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	37.3	-----	-----	95.8	-----	-----	39	-----	-----	80	-----	-----	-----	78.0	-----	-----	-----	-----
Pool Max Depth (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	2.3	-----	-----	2.5	-----	-----	-----	2.4	-----	-----	-----	-----	-----	2.2	-----	-----	-----	-----
Pool Volume (ft^3)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	N/P	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Substrate and Transport Parameters																												
Ri% / Ru% / P% / G% / S%	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----
SC% / Sa% / G% / B% / Be%	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----
[2] d16 / d35 / d50 / d84 / d95	-----	-----	-----	-----	0.06 / 0.34 / 2.12 / 36.6 / 101.8 (R2)						6.0 / NP,/ 45.0 / 125.0 / NP						-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----
Reach Shear Stress (competency) lb/f^2	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Max part size (mm) mobilized at bankfull (Rosgen Curve)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Stream Power (transport capacity) W/m^2	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Additional Reach Parameters																												
Drainage Area (SM)	-----	-----	-----	-----	-----	-----	-----	0.34	-----	-----	-----	-----	-----	1.00	-----	-----	-----	-----	-----	0.34	-----	-----	-----	-----	-----	0.34	-----	-----
Impervious cover estimate (%)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Rosgen Classification	-----	-----	-----	-----	G	-----	-----	F	-----	-----	-----	-----	-----	C4	-----	-----	-----	-----	-----	C5/B5	-----	-----	-----	-----	-----	C5	-----	-----
BF Velocity (fps)	-----	2.4	3.9	-----	3.6	-----	-----	3.9	-----	-----	-----	-----	-----	N/P	-----	-----	-----	3.7	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
BF Discharge (cfs)	-----	25.2	40.9	63.0	-----	-----	-----	41.0	-----	-----	-----	-----	-----	N/P	-----	-----	-----	37	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Valley Length	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	784	-----	-----
Channel length (ft)[2]	-----	-----	-----	-----	-----	-----	-----	1,417	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	858	-----	-----
Sinuosity	-----	-----	-----	-----	-----	-----	-----	1.15	-----	-----	-----	-----	-----	1.20	-----	-----	-----	1.11	-----	-----	-----	-----	-----	-----	-----	1.09	-----	-----
Water Surface Slope (Channel) (ft/ft)	-----	-----	-----	-----	-----	-----	-----	0.0058	-----	-----	-----	0.0136	-----	-----	-----	-----	-----	0.0058	-----	-----	-----	-----	-----	0.0101	-----	-----	-----	-----
BF slope (ft/ft)	-----	-----	-----	-----	-----	-----	-----	0.0067	-----	-----	-----	0.0133	-----	-----	-----	-----	-----	0.0067	-----	-----	-----	-----	-----	0.0113	-----	-----	-----	-----
Bankfull Floodplain Area (acres)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
BEHI VL% / L% / M% / H% / VH% / E%	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Channel Stability or Habitat Metric	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Biological or Other	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----

[1] Existing conditions survey data was compiled for each reach of Hurricane Creek and UT4 respectively
[2] Bulk samples taken for pre-existing condition and pebble counts taken for as-built and annual monitoring
[3] Reference reach data for Richland Creek in Moore County from the NC DOT reference reach database was used in the design
[4] Values were chosen based on previous sand-bed reference reach data and past project evaluations

Table 10. Baseline Stream Summary (continued)
Brown Creek Tributaries Restoration Project: EEP Project ID No. 95351

UT4 (Reach 2) Length 1,828 ft

Parameter	USGS Gauge	Regional Curve			Pre-Existing Condition[1]						Reference Reach(es) Data[3] Richland Creek (Moore County)						Design[4]						As-built					
		LL	UL	Eq.	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n
Dimension and Substrate - Riffle																												
BF Width (ft)	-----	12.2	12.4	-----	-----	-----	-----	13.8	-----	-----	16.2	-----	-----	16.7	-----	-----	-----	16.5	-----	-----	-----	-----	-----	15.9	-----	-----	-----	-----
Floodprone Width (ft)	-----	-----	-----	-----	-----	-----	-----	36.6	-----	-----	50.0	-----	-----	53.0	-----	-----	38.0	-----	-----	66.0	-----	-----	-----	95.2	-----	-----	-----	-----
BF Mean Depth (ft)	-----	1.6	1.2	-----	-----	-----	-----	1.7	-----	-----	0.9	-----	-----	0.9	-----	-----	-----	1.3	-----	-----	-----	-----	-----	1.2	-----	-----	-----	-----
BF Max Depth (ft)	-----	-----	-----	-----	-----	-----	-----	2.5	-----	-----	1.4	-----	-----	1.5	-----	-----	-----	1.6	-----	-----	-----	-----	-----	1.7	-----	-----	-----	-----
BF Cross-sectional Area (ft^2)	-----	16.7	22.9	-----	-----	-----	-----	23.8	-----	-----	15.0	-----	-----	15.5	-----	-----	-----	21.0	-----	-----	-----	-----	-----	19.0	-----	-----	-----	-----
Width/Depth Ratio	-----	-----	-----	-----	-----	-----	-----	8.0	-----	-----	18.0	-----	-----	18.6	-----	-----	-----	13	-----	-----	-----	-----	-----	13.3	-----	-----	-----	-----
Entrenchment Ratio	-----	-----	-----	-----	-----	-----	-----	2.7	-----	-----	3.0	-----	-----	3.3	-----	-----	-----	>2.2	-----	-----	-----	-----	-----	6.0	-----	-----	-----	-----
Bank Height Ratio	-----	-----	-----	-----	-----	-----	-----	1.5	-----	-----	1.6	-----	-----	1.7	-----	-----	-----	1.0	-----	-----	-----	-----	-----	1.0	-----	-----	-----	-----
d50 (mm)	-----	-----	-----	-----	-----	2.1	-----	-----	-----	-----	-----	45.0	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Pattern																												
Channel Beltwidth (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	60.0	-----	-----	100.0	-----	-----	-----	75.0	-----	-----	-----	-----
Radius of Curvature (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	14.3	-----	-----	26.1	-----	-----	33.0	-----	-----	50.0	-----	-----	-----	46.3	-----	-----	-----	-----
Rc / Bankfull width (ft/ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	5.5	-----	-----	5.7	-----	-----	2.0	-----	-----	3.0	-----	-----	-----	2.9	-----	-----	-----	-----
Meander Wavelength (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	90	-----	-----	94	-----	-----	115.0	-----	-----	180.0	-----	-----	-----	173.0	-----	-----	-----	-----
Meander Width Ratio	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	1.5	-----	-----	2.4	-----	-----	3.5	-----	-----	6.0	-----	-----	-----	10.9	-----	-----	-----	-----
Profile																												
Riffle Length (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	N/P	-----	-----	-----	-----	-----	-----	-----	-----	-----	51.0	-----	-----	-----	-----
Riffle Slope (ft/ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	0.013	-----	-----	0.0413	-----	-----	-----	0.0040	-----	-----	-----	-----	-----	0.0043	-----	-----	-----	-----
Pool Length (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	N/P	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Pool to Pool Spacing (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	37.3	-----	-----	95.8	-----	-----	32	-----	-----	65	-----	-----	-----	105.0	-----	-----	-----	-----
Pool Max Depth (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	2.3	-----	-----	2.5	-----	-----	-----	1.8	-----	-----	-----	-----	-----	3.3	-----	-----	-----	-----
Pool Volume (ft^3)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	N/P	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Substrate and Transport Parameters																												
Ri% / Ru% / P% / G% / S%	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----
SC% / Sa% / G% / B% / Be%	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----
[2] d16 / d35 / d50 / d84 / d95	-----	-----	-----	-----	0.06 / 0.34 / 2.12 / 36.6 / 101.8 (R2)						6.0 / NP,/ 45.0 / 125.0 / NP						-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----
Reach Shear Stress (competency) lb/f^2	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Max part size (mm) mobilized at bankfull (Rosgen Curve)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Stream Power (transport capacity) W/m^2	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Additional Reach Parameters																												
Drainage Area (SM)	-----	-----	-----	-----	-----	-----	-----	1.10	-----	-----	-----	-----	-----	1.00	-----	-----	-----	-----	-----	1.10	-----	-----	-----	-----	-----	1.10	-----	-----
Impervious cover estimate (%)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Rosgen Classification	-----	-----	-----	-----	-----	-----	-----	F	-----	-----	-----	-----	-----	C4	-----	-----	-----	-----	-----	C5	-----	-----	-----	-----	-----	C5	-----	-----
BF Velocity (fps)	-----	2.6	4.0	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	N/P	-----	-----	-----	3.8	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
BF Discharge (cfs)	-----	62.8	95.6	144.3	-----	-----	-----	95.6	-----	-----	-----	-----	-----	N/P	-----	-----	-----	80.0	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Valley Length	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	1590.34	-----	-----
Channel length (ft)[2]	-----	-----	-----	-----	-----	-----	-----	1,673	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	1827	-----	-----
Sinuosity	-----	-----	-----	-----	-----	-----	-----	1.15	-----	-----	-----	-----	-----	1.20	-----	-----	-----	1.19	-----	-----	-----	-----	-----	-----	-----	1.15	-----	-----
Water Surface Slope (Channel) (ft/ft)	-----	-----	-----	-----	-----	-----	-----	0.0058	-----	-----	-----	0.0136	-----	-----	-----	-----	-----	0.0034	-----	-----	-----	-----	-----	0.0034	-----	-----	-----	-----
BF slope (ft/ft)	-----	-----	-----	-----	-----	-----	-----	0.0067	-----	-----	-----	0.0133	-----	-----	-----	-----	-----	0.0063	-----	-----	-----	-----	-----	0.0039	-----	-----	-----	-----
Bankfull Floodplain Area (acres)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
BEHI VL% / L% / M% / H% / VH% / E%	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Channel Stability or Habitat Metric	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Biological or Other	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----

[1] Existing conditions survey data was compiled for each reach of Hurricane Creek and UT4 respectively
[2] Bulk samples taken for pre-existing condition and pebble counts taken for as-built and annual monitoring
[3] Reference reach data for Richland Creek in Moore County from the NC DOT reference reach database was used in the design
[4] Values were chosen based on previous sand-bed reference reach data and past project evaluations

Table 10. Baseline Stream Summary (continued)
Brown Creek Tributaries Restoration Project: EEP Project ID No. 95351

UT4 (Reach 3) Length 250 ft

Parameter	USGS Gauge	Regional Curve			Pre-Existing Condition[1]						Reference Reach(es) Data[3] Richland Creek (Moore County)						Design[4]						As-built[5]					
		LL	UL	Eq.	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n
Dimension and Substrate - Riffle																												
BF Width (ft)	-----	14.1	14.2	-----	-----	-----	-----	13.1	-----	-----	16.2	-----	-----	16.7	-----	-----	-----	19.8	-----	-----	-----	-----	-----	15.4	-----	-----	-----	-----
Floodprone Width (ft)	-----	-----	-----	-----	-----	-----	-----	18.3	-----	-----	50.0	-----	-----	53.0	-----	-----	44.0	-----	-----	76.0	-----	-----	-----	21.0	-----	-----	-----	-----
BF Mean Depth (ft)	-----	1.3	1.7	-----	-----	-----	-----	2.2	-----	-----	0.9	-----	-----	0.9	-----	-----	-----	1.4	-----	-----	-----	-----	-----	2.4	-----	-----	-----	-----
BF Max Depth (ft)	-----	-----	-----	-----	-----	-----	-----	3.2	-----	-----	1.4	-----	-----	1.5	-----	-----	-----	1.7	-----	-----	-----	-----	-----	3.2	-----	-----	-----	-----
BF Cross-sectional Area (ft^2)	-----	21.0	28.5	-----	-----	-----	-----	28.7	-----	-----	15.0	-----	-----	15.5	-----	-----	-----	28.0	-----	-----	-----	-----	-----	36.8	-----	-----	-----	-----
Width/Depth Ratio	-----	-----	-----	-----	-----	-----	-----	6.0	-----	-----	18.0	-----	-----	18.6	-----	-----	-----	13	-----	-----	-----	-----	-----	6.4	-----	-----	-----	-----
Entrenchment Ratio	-----	-----	-----	-----	-----	-----	-----	1.4	-----	-----	3.0	-----	-----	3.3	-----	-----	1.8	-----	-----	2.2	-----	-----	-----	1.4	-----	-----	-----	-----
Bank Height Ratio	-----	-----	-----	-----	-----	-----	-----	2.3	-----	-----	1.6	-----	-----	1.7	-----	-----	-----	1.0	-----	-----	-----	-----	-----	1.7	-----	-----	-----	-----
d50 (mm)	-----	-----	-----	-----	-----	0.48	-----	-----	-----	-----	-----	45.0	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Pattern																												
Channel Beltwidth (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	N/A	-----	-----	N/A	-----	-----	-----	-----	-----	-----	-----	-----
Radius of Curvature (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	14.3	-----	-----	26.1	-----	-----	N/A	-----	-----	N/A	-----	-----	-----	-----	-----	-----	-----	-----
Rc / Bankfull width (ft/ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	5.5	-----	-----	5.7	-----	-----	2.0	-----	-----	3.0	-----	-----	-----	-----	-----	-----	-----	-----
Meander Wavelength (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	90	-----	-----	94	-----	-----	N/A	-----	-----	N/A	-----	-----	-----	-----	-----	-----	-----	-----
Meander Width Ratio	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	1.5	-----	-----	2.4	-----	-----	N/A	-----	-----	N/A	-----	-----	-----	-----	-----	-----	-----	-----
Profile																												
Riffle Length (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	N/P	-----	-----	-----	-----	-----	-----	-----	-----	-----	20.0	-----	-----	-----	-----
Riffle Slope (ft/ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	0.013	-----	-----	0.0413	-----	-----	-----	0.0130	-----	-----	-----	-----	-----	0.0153	-----	-----	-----	-----
Pool Length (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	N/P	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Pool to Pool Spacing (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	37.3	-----	-----	95.8	-----	-----	45	-----	-----	80	-----	-----	-----	50.0	-----	-----	-----	-----
Pool Max Depth (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	2.3	-----	-----	2.5	-----	-----	-----	3.5	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Pool Volume (ft^3)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	N/P	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Substrate and Transport Parameters																												
Ri% / Ru% / P% / G% / S%	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----
SC% / Sa% / G% / B% / Be%	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----
[2] d16 / d35 / d50 / d84 / d95	-----	-----	-----	-----	0.06 / 0.15 / 0.48 / 10.3 / 130.2						6.0 / NP,/ 45.0 / 125.0 / NP						-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----
Reach Shear Stress (competency) lb/f^2	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Max part size (mm) mobilized at bankfull (Rosgen Curve)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Stream Power (transport capacity) W/m^2	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Additional Reach Parameters																												
Drainage Area (SM)	-----	-----	-----	-----	-----	-----	-----	1.52	-----	-----	-----	-----	-----	1.00	-----	-----	-----	-----	-----	1.52	-----	-----	-----	-----	-----	1.52	-----	-----
Impervious cover estimate (%)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Rosgen Classification	-----	-----	-----	-----	-----	-----	-----	G	-----	-----	-----	-----	-----	C4	-----	-----	-----	-----	-----	B5c	-----	-----	-----	-----	-----	G5c	-----	-----
BF Velocity (fps)	-----	2.8	4.1	-----	-----	-----	-----	4.1	-----	-----	-----	-----	-----	N/P	-----	-----	-----	3.7	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
BF Discharge (cfs)	-----	80.7	120.5	181.1	-----	-----	-----	120.5	-----	-----	-----	-----	-----	N/P	-----	-----	-----	103.0	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Valley Length	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	237	-----	-----
Channel length (ft)[2]	-----	-----	-----	-----	-----	-----	-----	244	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	250	-----	-----
Sinuosity	-----	-----	-----	-----	-----	-----	-----	1.15	-----	-----	-----	-----	-----	1.20	-----	-----	-----	N/A	-----	-----	-----	-----	-----	-----	-----	1.05	-----	-----
Water Surface Slope (Channel) (ft/ft)	-----	-----	-----	-----	-----	-----	-----	0.0058	-----	-----	-----	0.0136	-----	-----	-----	-----	-----	0.0078	-----	-----	-----	-----	-----	0.0056	-----	-----	-----	-----
BF slope (ft/ft)	-----	-----	-----	-----	-----	-----	-----	0.0067	-----	-----	-----	0.0133	-----	-----	-----	-----	-----	0.0080	-----	-----	-----	-----	-----	0.0058	-----	-----	-----	-----
Bankfull Floodplain Area (acres)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
BEHI VL% / L% / M% / H% / VH% / E%	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Channel Stability or Habitat Metric	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Biological or Other	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----

[1] Existing conditions survey data was compiled for each reach of Hurricane Creek and UT4 respectively
[2] Bulk samples taken for pre-existing condition and pebble counts taken for as-built and annual monitoring
[3] Reference reach data for Richland Creek in Moore County from the NC DOT reference reach database was used in the design
[4] Values were chosen based on previous sand-bed reference reach data and on past project evaluations
[5] Ultimately, a Rosgen "G" stream type was maintained for this reach due to its stable location with mature trees eastablished along its banks

Table 10. Baseline Stream Summary (continued)
Brown Creek Tributaries Restoration Project: EEP Project ID No. 95351

UT4 (Reach 4) Length 1,840 ft

Parameter	USGS Gauge	Regional Curve			Pre-Existing Condition[1]						Reference Reach(es) Data[3] Richland Creek (Moore County)						Design[4]						As-built					
		LL	UL	Eq.	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n
Dimension and Substrate - Riffle																												
BF Width (ft)	-----	7.8	8.2	-----	-----	-----	-----	7.7	-----	-----	16.2	-----	-----	16.7	-----	-----	-----	12.0	-----	-----	-----	-----	-----	11.6	-----	-----	-----	-----
Floodprone Width (ft)	-----	-----	-----	-----	-----	-----	-----	10.9	-----	-----	50.0	-----	-----	53.0	-----	-----	28.0	-----	-----	48.0	-----	-----	-----	75.9	-----	-----	-----	-----
BF Mean Depth (ft)	-----	0.9	1.1	-----	-----	-----	-----	1.6	-----	-----	0.9	-----	-----	0.9	-----	-----	-----	0.9	-----	-----	-----	-----	-----	0.8	-----	-----	-----	-----
BF Max Depth (ft)	-----	-----	-----	-----	-----	-----	-----	2.1	-----	-----	1.4	-----	-----	1.5	-----	-----	-----	1.1	-----	-----	-----	-----	-----	1.1	-----	-----	-----	-----
BF Cross-sectional Area (ft^2)	-----	8.5	11.8	-----	-----	-----	-----	12	-----	-----	15.0	-----	-----	15.5	-----	-----	-----	11.0	-----	-----	-----	-----	-----	9.5	-----	-----	-----	-----
Width/Depth Ratio	-----	-----	-----	-----	-----	-----	-----	5.0	-----	-----	18.0	-----	-----	18.6	-----	-----	-----	13	-----	-----	-----	-----	-----	14.1	-----	-----	-----	-----
Entrenchment Ratio	-----	-----	-----	-----	-----	-----	-----	1.1	-----	-----	3.0	-----	-----	3.3	-----	-----	-----	>2.2	-----	-----	-----	-----	-----	6.5	-----	-----	-----	-----
Bank Height Ratio	-----	-----	-----	-----	-----	-----	-----	3.1	-----	-----	1.6	-----	-----	1.7	-----	-----	-----	1.0	-----	-----	-----	-----	-----	1.0	-----	-----	-----	-----
d50 (mm)	-----	-----	-----	-----	-----	1.50	-----	-----	-----	-----	-----	45.0	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	0.3	-----	-----	-----	-----
Pattern																												
Channel Beltwidth (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	40	-----	-----	70	-----	-----	-----	55.0	-----	-----	-----	-----
Radius of Curvature (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	14.3	-----	-----	26.1	-----	-----	24.0	-----	-----	36.0	-----	-----	-----	48.3	-----	-----	-----	-----
Rc / Bankfull width (ft/ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	5.5	-----	-----	5.7	-----	-----	2.0	-----	-----	3.0	-----	-----	-----	4.2	-----	-----	-----	-----
Meander Wavelength (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	90	-----	-----	94	-----	-----	84.0	-----	-----	140.0	-----	-----	-----	150.0	-----	-----	-----	-----
Meander Width Ratio	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	1.5	-----	-----	2.4	-----	-----	7.0	-----	-----	12.0	-----	-----	-----	13.0	-----	-----	-----	-----
Profile																												
Riffle Length (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	N/P	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Riffle Slope (ft/ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	0.013	-----	-----	0.0413	-----	-----	-----	0.0100	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Pool Length (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	N/P	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Pool to Pool Spacing (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	37.3	-----	-----	95.8	-----	-----	42	-----	-----	82	-----	-----	-----	-----	-----	-----	-----	-----
Pool Max Depth (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	2.3	-----	-----	2.5	-----	-----	-----	2.2	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Pool Volume (ft^3)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	N/P	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Substrate and Transport Parameters																												
Ri% / Ru% / P% / G% / S%	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----
SC% / Sa% / G% / B% / Be%	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----
[2] d16 / d35 / d50 / d84 / d95	-----	-----	-----	-----			0.13 / 0.43 / 1.5 / 14.2 / 22.6						6.0 / NP,/ 45.0 / 125.0 / NP				-----	-----	-----	-----	-----	-----			11.1 / 23.8 / 36.6 / 60.1 / 126.3			
Reach Shear Stress (competency) lb/f^2	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Max part size (mm) mobilized at bankfull (Rosgen Curve)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Stream Power (transport capacity) W/m^2	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Additional Reach Parameters																												
Drainage Area (SM)	-----	-----	-----	-----	-----	-----	-----	0.42	-----	-----	-----	-----	-----	1.00	-----	-----	-----	-----	-----	0.42	-----	-----	-----	-----	-----	0.42	-----	-----
Impervious cover estimate (%)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Rosgen Classification	-----	-----	-----	-----	-----	-----	-----	G	-----	-----	-----	-----	-----	C4	-----	-----	-----	-----	-----	C5/B5c	-----	-----	-----	-----	-----	C5	-----	-----
BF Velocity (fps)	-----	2.5	3.9	-----	-----	-----	-----	3.9	-----	-----	-----	-----	-----	N/P	-----	-----	-----	3.6	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
BF Discharge (cfs)	-----	29.5	47.3	73.4	-----	-----	-----	47.4	-----	-----	-----	-----	-----	N/P	-----	-----	-----	40.0	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Valley Length	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	1657	-----	-----
Channel length (ft)[2]	-----	-----	-----	-----	-----	-----	-----	1,787	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	1840	-----	-----
Sinuosity	-----	-----	-----	-----	-----	-----	-----	1.15	-----	-----	-----	-----	-----	1.20	-----	-----	-----	1.12	-----	-----	-----	-----	-----	-----	-----	1.11	-----	-----
Water Surface Slope (Channel) (ft/ft)	-----	-----	-----	-----	-----	-----	-----	0.0058	-----	-----	-----	0.0136	-----	-----	-----	-----	-----	0.0063	-----	-----	-----	-----	-----	0.0054	-----	-----	-----	-----
BF slope (ft/ft)	-----	-----	-----	-----	-----	-----	-----	0.0067	-----	-----	-----	0.0133	-----	-----	-----	-----	-----	0.0069	-----	-----	-----	-----	-----	0.0062	-----	-----	-----	-----
Bankfull Floodplain Area (acres)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
BEHI VL% / L% / M% / H% / VH% / E%	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Channel Stability or Habitat Metric	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Biological or Other	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----

[1] Existing conditions survey data was compiled for each reach of Hurricane Creek and UT4 respectively
[2] Bulk samples taken for pre-existing condition and pebble counts taken for as-built and annual monitoring
[3] Reference reach data for Richland Creek in Moore County from the NC DOT reference reach database was used in the design
[4] Values were chosen based on previous sand-bed reference reach data and past project evaluations

Table 10. Baseline Stream Summary (continued)
Brown Creek Tributaries Restoration Project: EEP Project ID No. 95351

UT4 (Reach 5) Length 1,973 ft

Parameter	USGS Gauge	Regional Curve			Pre-Existing Condition[1]						Reference Reach(es) Data[3] Richland Creek (Moore County)						Design[4]						As-built					
		LL	UL	Eq.	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n
Dimension and Substrate - Riffle																												
BF Width (ft)	-----	9.9	10.2	-----	16.8	-----	-----	23.5	-----	-----	16.2	-----	-----	16.7	-----	-----	-----	13.9	-----	-----	-----	-----	-----	16.2	-----	-----	-----	-----
Floodprone Width (ft)	-----	-----	-----	-----	33.6	-----	-----	94.3	-----	-----	50.0	-----	-----	53.0	-----	-----	32.0	-----	-----	55.0	-----	-----	-----	69.4	-----	-----	-----	-----
BF Mean Depth (ft)	-----	1.0	1.3	-----	0.7	-----	-----	0.7	-----	-----	0.9	-----	-----	0.9	-----	-----	-----	1.2	-----	-----	-----	-----	-----	1.8	-----	-----	-----	-----
BF Max Depth (ft)	-----	-----	-----	-----	1.3	-----	-----	2.4	-----	-----	1.4	-----	-----	1.5	-----	-----	-----	1.5	-----	-----	-----	-----	-----	2.7	-----	-----	-----	-----
BF Cross-sectional Area (ft^2)	-----	12.3	16.9	-----	11.2	-----	-----	15.4	-----	-----	15.0	-----	-----	15.5	-----	-----	-----	16.0	-----	-----	-----	-----	-----	28.4	-----	-----	-----	-----
Width/Depth Ratio	-----	-----	-----	-----	25.2	-----	-----	36.0	-----	-----	18.0	-----	-----	18.6	-----	-----	-----	12	-----	-----	-----	-----	-----	9.3	-----	-----	-----	-----
Entrenchment Ratio	-----	-----	-----	-----	2.0	-----	-----	4.0	-----	-----	3.0	-----	-----	3.3	-----	-----	-----	>2.2	-----	-----	-----	-----	-----	4.3	-----	-----	-----	-----
Bank Height Ratio	-----	-----	-----	-----	1.0	-----	-----	1.7	-----	-----	1.6	-----	-----	1.7	-----	-----	-----	1.0	-----	-----	-----	-----	-----	1.0	-----	-----	-----	-----
d50 (mm)	-----	-----	-----	-----	-----	1.30	-----	-----	-----	-----	-----	45.0	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Pattern																												
Channel Beltwidth (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	N/A	-----	-----	N/A	-----	-----	-----	-----	-----	-----	-----	-----
Radius of Curvature (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	14.3	-----	-----	26.1	-----	-----	N/A	-----	-----	N/A	-----	-----	-----	-----	-----	-----	-----	-----
Rc / Bankfull width (ft/ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	5.5	-----	-----	5.7	-----	-----	N/A	-----	-----	N/A	-----	-----	-----	-----	-----	-----	-----	-----
Meander Wavelength (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	90	-----	-----	94	-----	-----	N/A	-----	-----	N/A	-----	-----	-----	-----	-----	-----	-----	-----
Meander Width Ratio	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	1.5	-----	-----	2.4	-----	-----	N/A	-----	-----	N/A	-----	-----	-----	-----	-----	-----	-----	-----
Profile																												
Riffle Length (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	N/P	-----	-----	-----	-----	-----	-----	-----	-----	-----	46.0	-----	-----	-----	-----
Riffle Slope (ft/ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	0.013	-----	-----	0.0413	-----	-----	-----	0.0050	-----	-----	-----	-----	-----	0.0086	-----	-----	-----	-----
Pool Length (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	N/P	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Pool to Pool Spacing (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	37.3	-----	-----	95.8	-----	-----	50	-----	-----	90	-----	-----	-----	101.0	-----	-----	-----	-----
Pool Max Depth (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	2.3	-----	-----	2.5	-----	-----	-----	2.4	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Pool Volume (ft^3)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	N/P	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Substrate and Transport Parameters																												
Ri% / Ru% / P% / G% / S%	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----
SC% / Sa% / G% / B% / Be%	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----
[2] d16 / d35 / d50 / d84 / d95	-----	-----	-----	-----			0.30 / 0.70 / 1.3 / 5.5 / 8.4						6.0 / NP,/ 45.0 / 125.0 / NP				-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----
Reach Shear Stress (competency) lb/f^2	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Max part size (mm) mobilized at bankfull (Rosgen Curve)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Stream Power (transport capacity) W/m^2	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Additional Reach Parameters																												
Drainage Area (SM)	-----	-----	-----	-----	-----	-----	-----	0.71	-----	-----	-----	-----	-----	1.00	-----	-----	-----	-----	-----	0.71	-----	-----	-----	-----	-----	0.71	-----	-----
Impervious cover estimate (%)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Rosgen Classification	-----	-----	-----	-----	-----	-----	-----	E/Bc	-----	-----	-----	-----	-----	C4	-----	-----	-----	-----	-----	C5/E5	-----	-----	-----	-----	-----	E5	-----	-----
BF Velocity (fps)	-----	2.9	4.5	-----	-----	-----	-----	4.5	-----	-----	-----	-----	-----	N/P	-----	-----	-----	3.8	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
BF Discharge (cfs)	-----	44.4	69.2	106.1	-----	-----	-----	69.3	-----	-----	-----	-----	-----	N/P	-----	-----	-----	60.0	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Valley Length	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	1838	-----	-----
Channel length (ft)[2]	-----	-----	-----	-----	-----	-----	-----	1,921	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	1916	-----	-----
Sinuosity	-----	-----	-----	-----	-----	-----	-----	1.08	-----	-----	-----	-----	-----	1.20	-----	-----	-----	N/A	-----	-----	-----	-----	-----	-----	-----	1.04	-----	-----
Water Surface Slope (Channel) (ft/ft)	-----	-----	-----	-----	-----	-----	-----	0.0033	-----	-----	-----	0.0136	-----	-----	-----	-----	-----	0.0033	-----	-----	-----	-----	-----	0.0053	-----	-----	-----	-----
BF slope (ft/ft)	-----	-----	-----	-----	-----	-----	-----	0.0035	-----	-----	-----	0.0133	-----	-----	-----	-----	-----	0.0035	-----	-----	-----	-----	-----	0.0061	-----	-----	-----	-----
Bankfull Floodplain Area (acres)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
BEHI VL% / L% / M% / H% / VH% / E%	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Channel Stability or Habitat Metric	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Biological or Other	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----

[1] Existing conditions survey data was compiled for each reach of Hurricane Creek and UT4 respectively
[2] Bulk samples taken for pre-existing condition and pebble counts taken for as-built and annual monitoring
[3] Reference reach data for Richland Creek in Moore County from the NC DOT reference reach database was used in the design
[4] Values were chosen based on previous sand-bed reference reach data and past project evaluations

Table 11. Cross-section Morphology Data

Brown Creek Tributaries Restoration Project: DMS Project ID No. 95351

Stream Reach	UT4 Reach 1 (1,482 LF)																			
	Cross-section X-1 (Riffle)							Cross-section X-2 (Pool)							Cross-section X-3 (Riffle)							
Dimension and substrate	Base	MY1	MY2	MY3	MY5	MY7	MY+	Base	MY1	MY2	MY3	MY5	MY7	MY+	Base	MY1	MY2	MY3	MY5	MY7	MY+	
BF Width (ft)	14.9	11.6	11.6	11.0	10.5	10.8	-	15.4	14.9	14.7	15.1	14.8	14.4	-	14.0	13.2	14.2	15.9	15.8	16.1	-	
BF Mean Depth (ft)	1.0	1.1	1.0	1.1	1.2	1.3	-	0.9	0.8	0.8	0.8	0.8	0.9	-	1.0	1.0	0.9	0.8	1.0	1.0	-	
Width/Depth Ratio	14.6	11.0	11.2	10.3	9.0	8.6	-	17.7	18.0	18.0	18.2	17.9	16.3	-	13.8	13.6	15.2	18.1	16.1	15.4	-	
BF Cross-sectional Area (ft²)	15.3	12.4	12.0	11.8	12.2	13.6	-	13.4	12.3	12.1	12.5	12.2	12.8	-	14.1	12.7	13.1	13.3	15.4	16.9	-	
BF Max Depth (ft)	1.8	1.8	1.8	1.8	1.8	1.9	-	2.2	2.0	1.9	1.9	1.9	2.0	-	1.8	1.5	1.6	1.8	1.8	1.9	-	
Width of Floodprone Area (ft)	59	59	59	59	59	59	-	47	47	47	47	47	47	-	89	89	89	89	89	89	-	
Entrenchment Ratio	3.9	5.1	5.1	5.4	5.6	5.5	-	-	-	-	-	-	-	-	6.4	6.8	6.3	5.9	5.7	5.5	-	
*Bank Height Ratio	1.0	1.1	1.1	1.0	1.0	1.0	-	-	-	-	-	-	-	-	1.0	1.0	1.0	1.0	1.0	1.0	-	
Wetted Perimeter (ft)	17.0	13.8	13.7	12.0	11.7	12.2	-	17.2	16.6	16.4	15.9	15.5	15.2	-	16.0	15.1	16.0	16.6	16.6	17.2	-	
Hydraulic Radius (ft)	0.9	0.9	0.9	1.0	1.0	1.1	-	0.8	0.7	0.7	0.8	0.8	0.8	-	0.9	0.8	0.8	0.8	0.9	1.0	-	
d50 (mm)	-							-							-							
Stream Reach	**UT4 Reach 2 (1,859 LF)**														**UT4 Reach 3 (250 LF)**							
	Cross-section X-4 (Riffle)							Cross-section X-5 (Pool)							Cross-section X-6 (Riffle)							
Dimension and substrate	Base	MY1	MY2	MY3	MY5	MY7	MY+	Base	MY1	MY2	MY3	MY5	MY7	MY+	Base	MY1	MY2	MY3	MY5	MY7	MY+	
BF Width (ft)	15.9	15.3	15.3	16.0	14.7	14.6	-	22.4	22.4	22.7	24.4	22.2	22.1	-	15.4	15.1	15.0	15.0	15.8	16.1	-	
BF Mean Depth (ft)	1.19	1.4	1.4	1.4	1.5	1.4	-	1.39	1.6	1.6	1.6	1.8	1.8	-	2.4	2.3	2.2	2.2	2.0	2.1	-	
Width/Depth Ratio	13.3	11.3	10.8	11.5	10.1	10.2	-	16.1	14.4	14.4	14.9	12.3	12.6	-	6.4	6.7	6.8	6.8	7.8	7.6	-	
BF Cross-sectional Area (ft²)	19.0	20.7	21.6	22.2	21.4	21.0	-	31.2	34.8	35.9	39.9	40.2	38.7	-	36.8	34.2	33.5	32.8	32.3	34.4	-	
BF Max Depth (ft)	1.7	2.1	2.2	2.3	2.6	2.5	-	3.4	3.7	3.8	3.8	4.1	4.2	-	3.2	2.8	2.8	2.9	2.6	2.9	-	
Width of Floodprone Area (ft)	95	95	95	95	95	95	-	75	75	75	75	75	75	-	21	19	19	20	20	20	-	
Entrenchment Ratio	6.0	6.2	6.2	6.0	6.5	6.5	-	-	-	-	-	-	-	-	1.3	1.3	1.3	1.3	1.3	1.3	-	
*Bank Height Ratio	1.0	1.0	1.0	1.1	1.1	1.1	-	-	-	-	-	-	-	-	2.1	2.3	2.3	2.3	2.2	2.1	-	
Wetted Perimeter (ft)	18.3	18.0	18.1	17.0	16.1	16.2	-	25.2	25.5	25.9	27.4	22.5	26.1	-	18.5	17.9	19.5	17.1	17.9	18.5	-	
Hydraulic Radius (ft)	1.0	1.1	1.2	1.3	1.3	1.3	-	1.2	1.4	1.4	1.5	1.6	1.5	-	2.0	1.9	1.7	1.9	1.8	1.9	-	
d50 (mm)	-							-							-							

*Note: Per DMS/IRT request, bank height ratio has been calculated using the bankfull elevation as determined from the as-built bankfull area. All other values were calculated using the as-built bankfull elevation.

Table 11 continued. Cross-section Morphology Data

Brown Creek Tributaries Restoration Project: DMS Project ID No. 95351

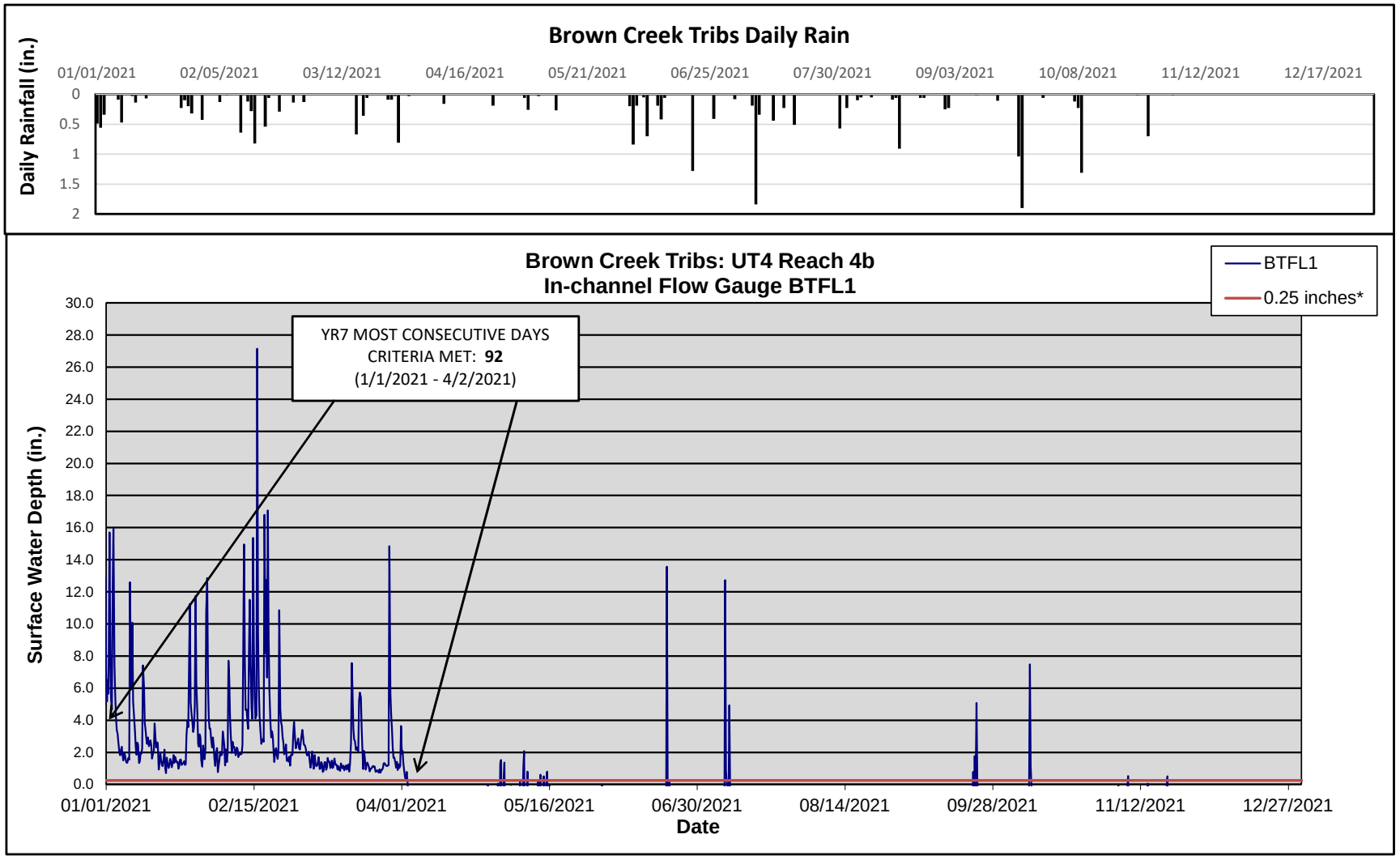
Stream Reach	UT4 Reach 5 (2,022 LF)														UT4 Reach 4 (1,892 LF)													
	Cross-section X-7 (Riffle)							Cross-section X-8 (Riffle)							Cross-section X-9 (Riffle)							Cross-section X-10 (Pool)						
Dimension and substrate	Base	MY1	MY2	MY3	MY5	MY7	MY+	Base	MY1	MY2	MY3	MY5	MY7	MY+	Base	MY1	MY2	MY3	MY5	MY7	MY+	Base	MY1	MY2	MY3	MY5	MY7	MY+
BF Width (ft)	15.9	15.5	15.2	15.3	14.5	15.0	-	17.0	16.0	15.8	15.9	15.6	15.6	-	11.6	11.6	12.3	12.0	11.3	11.0	-	25.9	25.7	27.6	24.7	25.3	23.3	-
BF Mean Depth (ft)	1.6	1.4	1.3	1.4	1.6	1.6	-	1.9	1.7	1.7	1.6	1.5	1.5	-	0.8	0.8	0.8	0.8	0.8	0.9	-	1.0	1.0	0.9	0.9	0.8	0.8	-
Width/Depth Ratio	10.1	11.0	11.4	10.9	9.3	9.5	-	8.8	9.6	9.6	10.0	1.0	10.5	-	14.1	13.8	15.7	14.6	14.3	12.8	-	27.1	27.1	30.5	27.4	30.7	29.4	-
BF Cross-sectional Area (ft²)	25.0	21.8	20.3	21.6	22.8	23.8	-	32.8	26.5	26.0	25.1	24.1	23.2	-	9.6	9.7	9.7	9.9	9.2	9.4	-	24.8	24.4	25.0	22.2	20.9	18.3	-
BF Max Depth (ft)	2.4	2.1	2.0	2.1	2.4	2.4	-	3.2	1.7	2.3	2.3	2.5	2.6	-	1.1	1.1	1.1	1.2	1.1	1.3	-	2.1	2.0	2.0	2.0	1.8	1.8	-
Width of Floodprone Area (ft)	68	68	68	68	68	68	-	71	71	71	71	71	71	-	76	76	76	76	76	76	-	81	81	81	81	81	81	-
Entrenchment Ratio	4.3	4.4	4.4	4.4	4.6	4.5	-	4.2	4.5	4.5	4.5	4.6	4.6	-	6.6	6.6	6.2	6.3	6.7	6.9	-	-	-	-	-	-	-	-
*Bank Height Ratio	1.0	1.0	1.1	1.1	1.1	1.0	-	1.0	1.0	1.1	1.1	1.0	1.0	-	1.0	1.0	1.0	1.0	1.0	1.0	-	-	-	-	-	-	-	-
Wetted Perimeter (ft)	19.0	18.3	17.9	16.2	15.7	16.2	-	20.9	19.3	19.1	16.9	16.7	16.8	-	13.2	13.3	13.9	12.4	11.8	11.5	-	27.9	27.6	29.4	25.2	25.8	23.6	-
Hydraulic Radius (ft)	1.3	1.2	1.1	1.3	1.4	1.5	-	1.6	1.4	1.4	1.5	1.4	1.4	-	0.7	0.7	0.7	0.8	0.8	0.8	-	0.9	0.9	0.9	0.9	0.8	0.8	-
d50 (mm)	-							-							-							-						
Stream Reach	**Hurricane Creek Reach 1 (2,043 LF)**														**Hurricane Creek Reach 2 (1,424 LF)**													
	Cross-section X-11 (Riffle)							Cross-section X-12 (Pool)							Cross-section X-13 (Pool)							Cross-section X-14 (Riffle)						
Dimension and substrate	Base	MY1	MY2	MY3	MY5	MY7	MY+	Base	MY1	MY2	MY3	MY5	MY7	MY+	Base	MY1	MY2	MY3	MY5	MY7	MY+	Base	MY1	MY2	MY3	MY5	MY7	MY+
BF Width (ft)	18.9	18.7	18.5	19.9	18.9	18.3	-	34.3	32.7	37.3	33.2	33.3	32.0	-	29.0	28.0	28.8	28.5	29.2	28.1	-	22.5	20.5	20.5	20.9	20.6	20.4	-
BF Mean Depth (ft)	1.6	1.6	1.5	1.3	1.5	1.3	-	1.8	1.9	1.7	1.8	1.7	1.6	-	1.8	1.9	1.8	1.8	1.8	1.8	-	1.4	1.5	1.5	1.5	1.6	1.6	-
Width/Depth Ratio	11.8	11.8	12.5	14.8	12.9	13.7	-	18.6	17.6	22.3	18.1	19.6	20.2	-	16.4	15.1	15.8	15.7	16.3	15.5	-	16.1	13.4	13.7	13.8	12.7	12.9	-
BF Cross-sectional Area (ft²)	30.4	29.8	27.3	26.6	27.6	24.6	-	63.2	60.6	62.5	60.8	56.5	50.6	-	51.5	52.0	52.7	51.5	52.3	50.9	-	31.6	31.3	30.6	31.7	33.4	32.3	-
BF Max Depth (ft)	2.5	2.4	2.3	2.3	2.3	2.1	-	4.1	4.0	3.9	3.8	3.5	3.3	-	2.9	3.0	3.1	2.9	3.0	2.8	-	2.3	2.4	2.5	2.6	2.9	2.9	-
Width of Floodprone Area (ft)	71	71	71	71	71	71	-	80	80	80	80	80	80	-	80	80	80	80	80	80	-	69	69	69	69	70	70	-
Entrenchment Ratio	3.8	3.8	3.9	3.6	3.8	3.9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3.1	3.4	3.4	3.3	3.3	3.4	-
*Bank Height Ratio	1.0	1.0	1.1	1.0	1.0	1.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1.0	1.0	1.0	0.9	1.1	1.1	-
Wetted Perimeter (ft)	22.1	21.9	21.5	20.6	19.7	19.3	-	38.0	36.4	40.7	36.7	34.9	33.7	-	32.6	31.7	32.5	29.8	30.4	29.7	-	25.3	23.5	23.5	21.9	21.8	21.8	-
Hydraulic Radius (ft)	1.4	1.4	1.3	1.3	1.4	1.3	-	1.7	1.7	1.5	1.7	1.6	1.5	-	1.6	1.6	1.6	1.7	1.7	1.7	-	1.2	1.3	1.3	1.5	1.5	1.5	-
d50 (mm)	-							-							-							-						
Stream Reach	**Hurricane Creek Reach 3 (600 LF)**																											
	Cross-section X-15 (Riffle)																											
Dimension and substrate	Base	MY1	MY2	MY3	MY5	MY7	MY+																					
BF Width (ft)	11.1	10.7	10.7	10.8	12.2	10.5	-																					
BF Mean Depth (ft)	1.7	1.6	1.6	1.6	1.4	1.5	-																					
Width/Depth Ratio	6.7	6.5	6.7	6.8	9.0	7.0	-																					
BF Cross-sectional Area (ft²)	18.2	17.6	17.1	17.1	16.6	15.8	-																					
BF Max Depth (ft)	2.9	2.7	2.6	2.6	2.6	2.6	-																					
Width of Floodprone Area (ft)	53	53	53	53	53	53	-																					
Entrenchment Ratio	4.8	5.0	5.0	5.0	4.4	5.1	-																					
*Bank Height Ratio	1.0	1.0	1.0	1.1	1.0	0.9	-																					
Wetted Perimeter (ft)	14.4	14.0	13.9	12.2	13.7	12.0	-																					
Hydraulic Radius (ft)	1.3	1.3	1.2	1.4	1.2	1.3	-																					
d50 (mm)	-																											

*Note: Per DMS/IRT request, bank height ratio has been calculated using the bankfull elevation as determined from the as-built bankfull area. All other values were calculated using the as-built bankfull elevation.

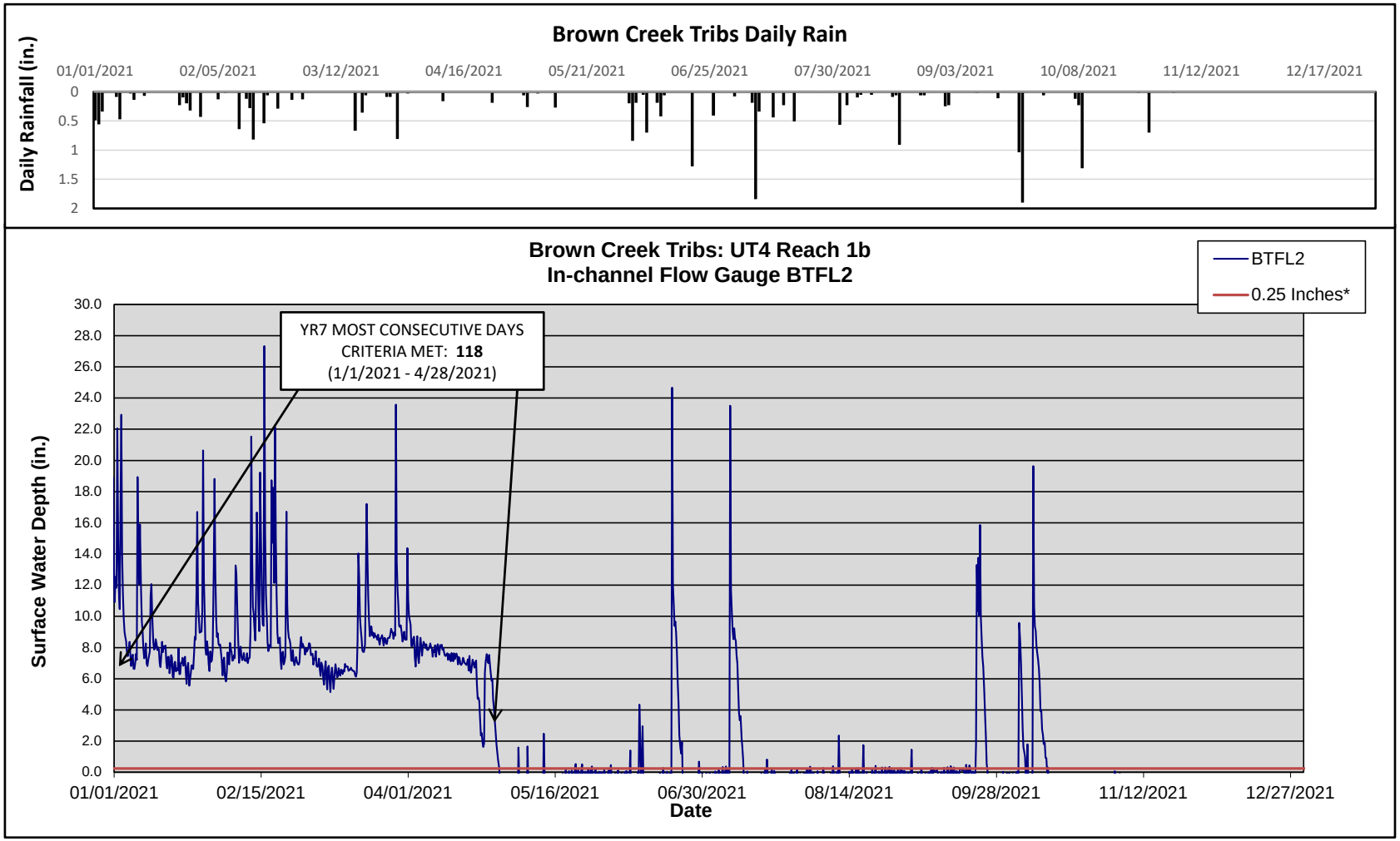
Appendix E

Hydrologic Data

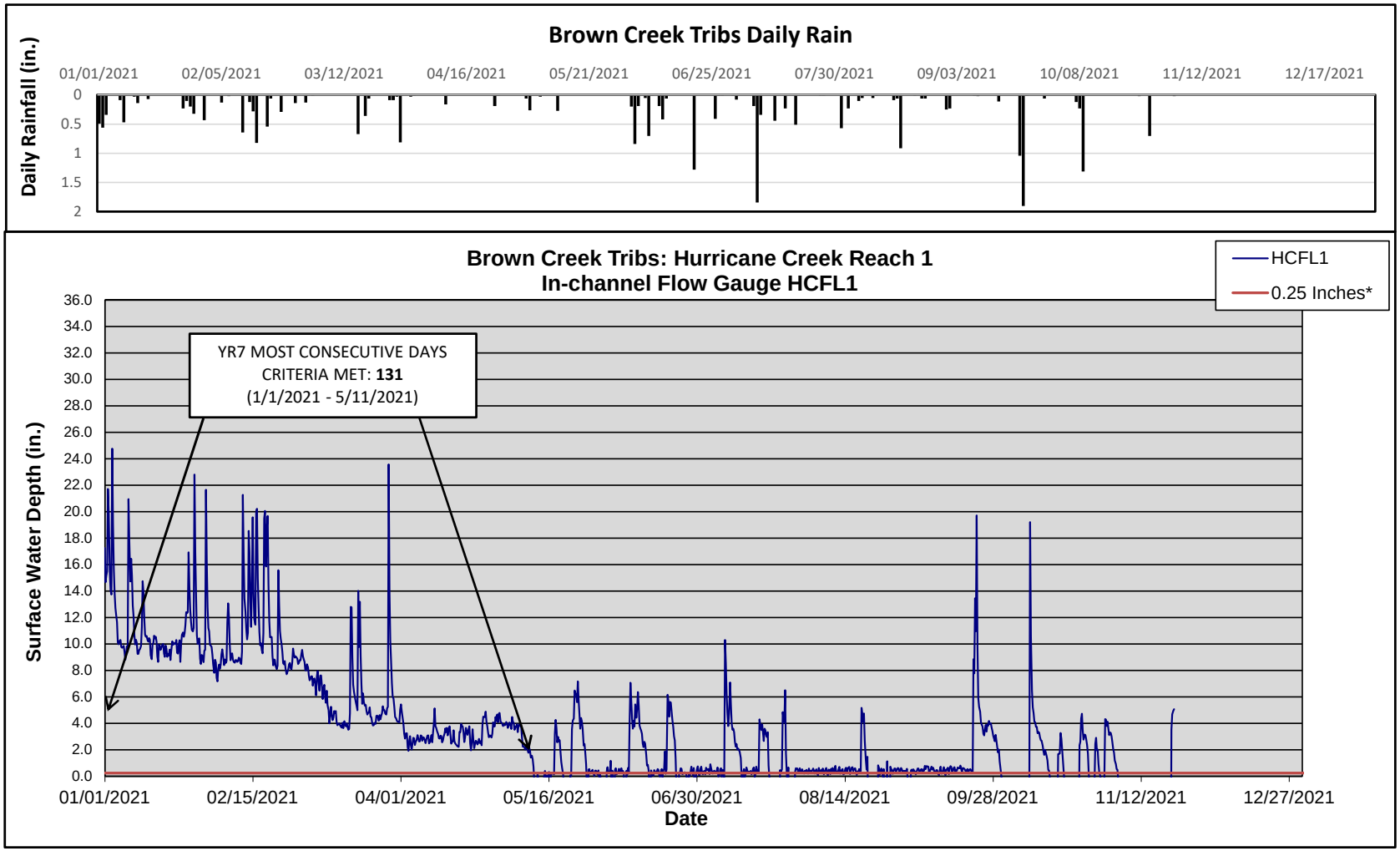
Figure 5. Flow Gauge Graphs



* Surface water flow is estimated to have occurred when the pressure transducer reading is equal to or above 0.25 inches in depth.

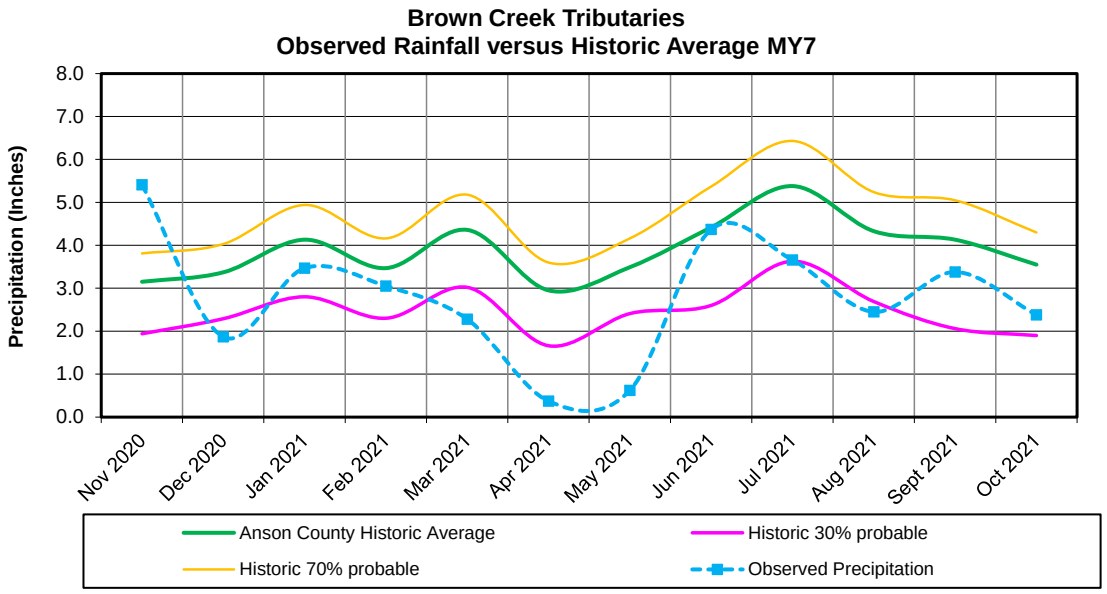


* Surface water flow is estimated to have occurred when the pressure transducer reading is equal to or above 0.25 inches in depth.

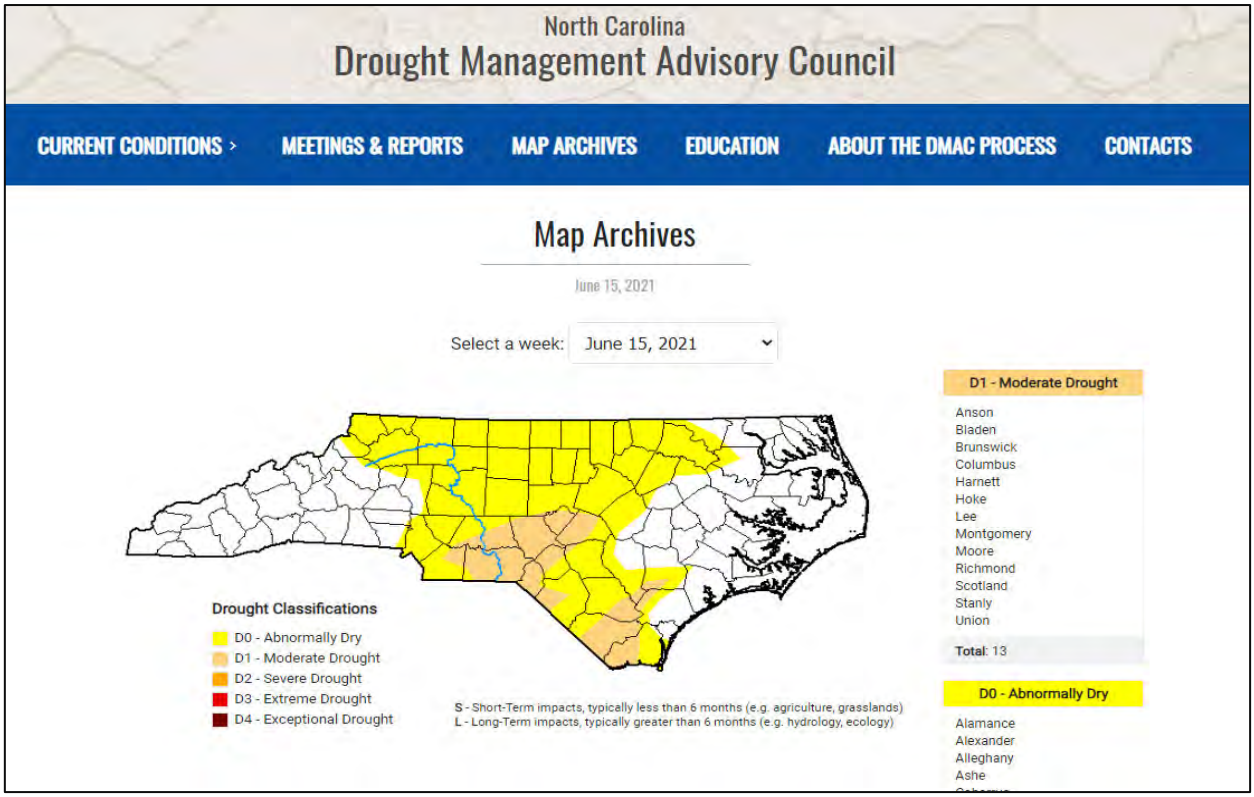


* Surface water flow is estimated to have occurred when the pressure transducer reading is equal to or above 0.25 inches in depth.

Figure 6. Observed Rainfall versus Historic Average



Note: Historic average annual rainfall for Anson County is 46.74", while a total of 33.31" was recorded over the previous 12 months.



Note: Beginning in April, Anson County experienced various levels of drought conditions throughout MY7, culminating in a D1-Moderate Drought in June (www.ncdrought.org).

Table 12. Flow Gauge Success
Brown Creek Tributaries Restoration Project: DMS Project ID No. 95351

Flow Gauge ID	Most Consecutive Days Meeting Criteria[1]							Cumulative Days Meeting Criteria[2]						
	Year 1 (2015)	Year 2 (2016)	Year 3 (2017)	Year 4 (2018)	Year 5 (2019)	Year 6 (2020)	Year 7 (2021)	Year 1 (2015)	Year 2 (2016)	Year 3 (2017)	Year 4 (2018)	Year 5 (2019)	Year 6 (2020)	Year 7 (2021)
UT4 Flow Gauges (Installed July 17, 2015)														
BTFL[1]	37	77	58	94	50	93	92	37	77	152	185	129	119	106
BTFL[2]	92	106	34	63	121	131	118	92	106	113	135	180	195	143
Hurricane Creek Flow Gauge (Installed July 19, 2016)														
HCFL1[3]	N/A	12	64	113	116	93	131	N/A	12	154	186	156	214	228

Notes:
[1]Indicates the single greatest number of consecutive days within the monitoring year where flow was measured.
[2]Indicates the total number of days within the monitoring year where flow was measured.
[3]The Hurricane Creek Flow Gauge (HCFL1) was installed in Reach HC-R1 on July 19, 2016 to document in-channel stream flow.

Table 13. Verification of Bankfull Events
Brown Creek Tributaries Restoration Project: DMS Project ID No. 95351

Date of Data Collection	Estimated Occurrence of Bankfull Event	Method of Data Collection	Crest Gauge Reading (Hurricane Creek-R2)	Crest Gauge Reading (UT4-R2)
MY1 (2015)				
10/29/2015	10/03/2015	Crest Gauge	0.94'	
11/04/2015	10/03/2015	Crest Gauge		0.83'
MY2 (2016)				
02/17/2016	02/03/2016	Crest Gauge	1.05'	
07/19/2016	06/29/2016	Crest Gauge	0.19'	0.28'
11/03/2016	10/08/2016	Crest Gauge	1.1'	0.97'
MY3 (2017)				
09/19/2017	07/18/2017	Crest Gauge	0.33'	
MY4 (2018)				
06/05/2018	06/02/2018	Crest Gauge		0.50'
10/03/2018	09/17/2018	Crest Gauge	0.67'	
10/15/2018	09/17/2018	Crest Gauge		2.26'
10/15/2018	10/11/2018	Crest Gauge		0.68'
MY5 (2019)				
04/11/2019	03/21/2019	Crest Gauge		1.09'
04/12/2019	03/03/2019	Crest Gauge	1.72'	
08/08/2019	05/12/2019	Crest Gauge	0.60'	
10/16/2019	08/03/2019	Crest Gauge		0.58'
MY6 (2020)				
02/24/2020	02/07/2020	Crest Gauge		0.47'
04/16/2020	03/25/2020	Crest Gauge	0.65'	
08/12/2020	05/21/2020	Crest Gauge		1.86'
11/10/2020	10/12/2020	Crest Gauge	1.98'	
MY7 (2021)				
03/08/2021	02/15/2021*	Crest Gauge		1.75'
07/22/2021	03/28/2021*	Crest Gauge	1.65'	

* See flow gauge graphs in Appendix E for corresponding flow depth spikes on these dates.