Hoppers Creek-Melton Farm Stream Restoration Project

Year 3 Monitoring Report

McDowell County, North Carolina

NCEEP Project Number – 92251

Project Info:
Monitoring Year: 3 of 5
Year of Data Collection: 2014
Year of Completed Construction: 2011
NCEEP Project Manager: Mathew Reid
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Year 3 Monitoring Report

McDowell County, North Carolina

Report Prepared and Submitted by Michael Baker Engineering, Inc.

NC Professional Engineering License # F-1048

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Appendices

1.0 EXECUTIVE SUMMARY

The Hoppers Creek-Melton Farm Restoration Project (Project) was restored by Michael Baker Engineering, Inc. (Baker) through an on-call design and construction services contract with the North Carolina Ecosystem Enhancement Program (NCEEP). This report documents and presents Year 3 monitoring data as required during the five-year monitoring period.

The specific goals for the Project were as follows:

- Create geomorphically stable conditions on the Project site,
- Improve and restore hydrologic connections between the streams and their floodplains,
- Improve water quality in the South Fork Hoppers Creek watershed,
- Protect the South Fork Hoppers Creek watershed from nearby rapid development,
- Restore wetlands along South Fork Hoppers Creek in the Project area, and
- Improve aquatic and terrestrial habitat along the Project corridor.

To accomplish these goals the following objectives were implemented:

- Stabilize eroding channel banks by implementing a combination of Priority I Restoration and Enhancement II approaches,
- Increase floodplain connectivity to restore historic floodplain wetlands,
- Incorporate bedform diversity with varied in-stream structures to provide a variety of aquatic habitats,
- Reestablish a riparian buffer with native vegetation to improve terrestrial habitat and eliminate excessive sedimentation from erosion,
- Restore and enhance existing floodplain wetlands, where feasible, and
- Eliminate livestock access to the channel to improve water quality and reduce erosion from hoof shear.

The Project site is located approximately 10 miles southeast of Marion in McDowell County, North Carolina, as shown in Figure 1 in Appendix A. The Project is situated in the Catawba River Basin, within the North Carolina Division of Water Quality (NCDWQ) sub-basin 03-08-30 and United States Geologic Survey (USGS) hydrologic unit 03050101040-020. Directions to the Project site can be found in Figure 1 of Appendix A.

South Fork Hoppers Creek lies within the Piedmont physiographic province. Its watershed is predominately forested, supporting some isolated rural residential housing, chicken farms, agricultural lands, nurseries, and several small rural residential developments. The land surrounding the Project site has been used historically for agriculture but was recently used as pasture land for livestock grazing. Some forest land is located in the upstream extents of UT1, UT2, and UT3.

South Fork Hoppers Creek and its tributaries had been impacted by livestock and were incised and eroded. Channel incision along South Fork Hoppers Creek resulted in the lowering of the water table; thereby, dewatering floodplain wetlands. The Project involved the restoration or enhancement of 3,550 linear feet (LF) of stream along South Fork Hoppers Creek, and portions of UT1 and UT2 using Rosgen Priority 1 restoration and Level II enhancement approaches. An additional 1,071 LF of stream along portions of UT1 and UT3 was placed in preservation. The Project also included the restoration and enhancement of 1.56 acres of riparian wetland abutting South Fork Hoppers Creek and UT1 of which 1.23 acres comprised restoration

and 0.33 acres comprised enhancement. The Priority 1 channel design approach entailed raising the elevation of the channel to establish greater connectivity to the floodplain and to restore the hydrologic relationship between South Fork Hoppers Creek, its tributaries and riparian wetland areas in the Project area. Channel pattern was re-established to dissipate flow velocities in meander bends. In-stream habitat was created using riffle-pool sequences and the strategic placement of in-stream structures. Approximately 5.7 acres of associated riparian buffer were restored/enhanced throughout the Project area and a conservation easement consisting of 10.1 acres will protect and preserve all stream reaches, wetland areas, and riparian buffers in perpetuity.

Vegetation conditions for South Fork Hoppers Reaches 1 and 2, and UT1, Reach B were good and performing close to 100% for both the planted acreage and invasive/encroachment area categories. Two bare areas or vegetation problem areas (VPAs), VPA1-1 and VPA1-2, were documented in the wetland area located on the right floodplain along South Fork Hoppers Reach 1. The combined total area for these VPAs was 0.12 acres, or 2.8% of the planted acreage for this assessment tract. These two VPAs were identified in the Year 1 monitoring period and carried over through Year 3. Four small areas with invasive plants were of concern and were identified for a combined total area of 0.04 acres or 0.5% of the easement acreage. A more detailed summary of the results for the vegetation condition assessment can be found in Appendix B which includes a technical memorandum, current condition planview (CCPV) figures, supporting data tables, and photo logs. The contents of Appendix B were submitted to NCEEP in May 2014 and served as the interim visual site assessment report.

The success criteria or survival threshold of 320 stems per acre by the end of Year 3 was met for 8 out of the 12 vegetation monitoring plots. The average density of total planted stems or tract mean (including volunteers) is 668 stems per acre. Though the majority of the Project site is on track for meeting the final success criteria of 260 trees per acre by the end of Year 5, it should be noted that most vegetation plots exhibiting a lower planted stem density count have been offset by the presence of thriving volunteer species. Volunteers will continue to be included in each plot's stem count per acre throughout the monitoring period and will likely aid in the Project's ability to meet its Year 5 final success criteria; however, additional riparian plantings may be needed in areas where lower stem densities have been documented. Vegetation stem counts are summarized in Tables 7 and 9 of Appendix C.

Tables 5a through 5d (Appendix B) indicate the Project site has remained geomorphically stable overall and performing at 100% for the majority of parameters evaluated within the lateral/vertical stability and in-stream structure performance categories. The sub-categories receiving scores of less than 100% are namely due to small localized areas of bank scour and/or piping under structures. Stream problem areas (SPAs) correlating with these areas of instability for the project reaches were documented and summarized in Table 5e of Appendix B. A total of eight SPAs were identified in Year 1 and Year 2 monitoring periods and were carried over through Year 3. No new SPAs were identified for the Year 3 assessment. A more detailed summary of the results for the visual stream stability assessment can be found in Appendix B.

The six permanent cross-sections along the Project site show that there has been little adjustment to stream dimension overall within the Project reach since construction. The adjustments that have occurred have primarily been observed in riffle cross-sections that are exhibiting signs of narrowing. Based on field observation, this narrowing can be attributed to herbaceous vegetation becoming well established over the second year. At this time, cross-sectional measurements do not indicate any stream bank or channel stability issues. The longitudinal profiles show that bed features are stable. Pools are well maintained, and they have increased in depth in many areas. Grade control structures (constructed riffles, cross vanes and log sills) continue to help maintain the overall profile desired. Visual observations and a review of pebble count data collected during Year 3 monitoring did not yield any signs that sediment transport functions have been hampered by the mitigation project. The pebble count data for South Fork Hoppers Creek and UT1B indicate that the stream is moving fines through the system and larger pebbles are making up a greater percentage of

the bed material. The site was found to have had at least one bankfull event based on crest gauge readings. Information on these events is provided in Table 12 of Appendix E.

Based on the third growing season following site construction (March 30, 2013-November 2, 2013), all four wetland areas met the success criteria for Monitoring Year 3. Groundwater conditions at all Gauges indicated saturated conditions existed for 100% of the growing season. A summary plot of wetland gauge data as it relates to monthly precipitation is provided in Figure 7 of Appendix E; wetland areas and corresponding gauges are illustrated in the CCPV sheets (Figure2) in Appendix B.

Summary information/data related to the occurrence of items such as beaver or encroachment, 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 (formerly Mitigation Plan) and in the Mitigation Plan (formerly Restoration Plan) documents available on EEP's website. *It should be noted that the Baseline Monitoring Report and Mitigation Plan for this Project site is included with the summary of constructed design approaches for the South Muddy Creek Restoration Project (EEP Project No. 737), a nearby project site that was designed and constructed in conjunction with the Hoppers Creek-Melton Farm Stream Restoration Project as part of the same EEP on-call design and construction services contract*. All raw data supporting the tables and figures in the appendices is available from EEP upon request.

2.0 METHODOLOGY

The five-year monitoring plan for the Project site includes criteria to evaluate the success of the vegetation, stream, and wetland components of the project. The methodology and report template used to evaluate these three components adheres to the EEP monitoring guidance document dated November 7, 2011, which will continue to serve as the template for subsequent monitoring years. The specific locations of monitoring features, such as vegetation plots, permanent cross-sections, reference photo stations and wetland/crest gauges, are shown on the CCPV sheets found in Figure 2 of Appendix B.

The majority of Year 3 monitoring data was collected in May 2014 and August 2014. All visual site assessment data was collected on April 16, 2014. Vegetation monitoring plot data was collected on November 4, 2014. All stream survey (channel dimension and profile) and sediment data were collected September 4, 2014. Stream survey data was collected using a Topcon GRS-1 network Rover GPS unit which collects point data with an accuracy of less than one tenth of a foot.

2.1 Stream Assessment

Geomorphic monitoring of restored stream reaches is being conducted for five years to evaluate the effectiveness of the restoration practices installed. Monitored stream parameters include channel dimension (cross-sections), profile (longitudinal survey), bed composition, bank and channel stability, bankfull flows, and reference sites documented by photographs. A crest gauge, as well as high flow marks, will be used to document the occurrence of bankfull events. The methods used and any related success criteria are described below for each parameter. For monitoring stream success criteria, 6 permanent cross-sections, 1 crest gauge, and 39 photo identification points were installed.

2.1.1 Morphologic Parameters and Channel Stability

2.1.1.1 Dimension

Six permanent cross-sections were installed throughout the entire project area. Cross-sections selected for monitoring were located in representative riffle and pool facets and each cross-section was marked on both banks with permanent pins to establish the exact transect used. Each of the three restored Project reaches, Reaches 1 and 2 of South Fork Hoppers Creek and UT1B, contains one riffle and one pool cross-section. A common benchmark is being used for cross-sections and consistently referenced to facilitate comparison of year-to-year data. The cross-sectional surveys will include points measured at major breaks in slope, including top of bank, bankfull, inner berm, edge of water, and thalweg, if the features are present. Riffle cross-sections were classified using the Rosgen Stream Classification System (Rosgen, 1994), and all monitored cross-sections should fall within the quantitative parameters defined for channels of the design stream type.

There should be little change in as-built cross-sections. If changes do take place, they will be evaluated to determine if they represent a movement toward a more unstable condition (e.g., down-cutting or erosion) or a movement toward increased stability (e.g., settling, vegetative changes, deposition along the banks, or decrease in width/depth ratio). Cross-sectional data is presented in Figure 3 of Appendix D.

2.1.1.2 Longitudinal Profile

Longitudinal profiles were surveyed for the entire restored lengths of Reaches 1 and 2 of South Fork Hoppers Creek and UT1B, and are provided in Figure 4 of Appendix D. Longitudinal profiles will be replicated annually during the five year monitoring period.

Measurements taken during longitudinal profiles include thalweg, water surface, and the top of low bank. All measurements were taken at the head of each feature (e.g., riffle, run, pool, glide) and the maximum pool depth. Elevations of grade control structures were also included in the longitudinal profiles surveyed. Surveys were tied to a permanent benchmark.

The pools should remain relatively deep with flat water surface slopes, and the riffles should remain steeper and shallower than the pools. Bed form observations should be consistent with those observed for channels of the design stream type as well as other design information.

2.1.1.3 Substrate and Sediment Transport

Bed load material analysis consists of a pebble count taken in the same constructed riffle during annual geomorphic surveys of the Project site. One sample was collected at the riffle cross-section corresponding with each of the three restored Project reaches for a total of three sediment samples (cross-sections X5, X7, X9). These samples, combined with evidence provided by changes in cross-section and profile data will reveal changes in sediment gradation that occur over time as the stream adjusts to upstream sediment loads. Significant changes in sediment gradation will be evaluated with respect to stream stability and watershed changes. Bed material distribution data are located in Figure 5 of Appendix D.

2.1.2 Hydrology

2.1.2.1 Streams

The occurrence of bankfull events within the monitoring period will be documented by the use of crest gauges and photographs. One crest gauge was installed on the floodplain at the bankfull elevation along the right top of bank at station 15+10. The bottom of the crest gauge coincides with the top of bank (bankfull) elevation. The crest gauges record the highest watermark between site visits, and are checked at each site visit to determine if a bankfull event has occurred. Photographs

are used to document the occurrence of debris lines and sediment deposition on the floodplain during monitoring site visits.

Two bankfull flow events must be documented at the crest gauge within the 5-year monitoring period. The two bankfull events must occur in separate years; otherwise, the stream monitoring will continue until two bankfull events have been documented in separate years or until the monitoring period ends. If two bankfull events have not been documented at the end of 5 years the Interagency Review Team (IRT) will have to decide on an appropriate course of action.

2.1.3 Photographic Documentation of Site

Photographs will be used to document restoration success visually. Reference stations were photographed during the as-built survey; this will be repeated for at least five years following construction. Reference photos are taken once a year, from a height of approximately five to six feet. Permanent markers will ensure that the same locations (and view directions) are utilized during each monitoring period. Selected site photographs are shown in Appendix B.

2.1.3.1 Lateral Reference Photos

Reference photo transects were taken of the right and left banks at each permanent cross-section. A survey tape was captured in most photographs which represents the cross-section line located perpendicular to the channel flow. The water line was located in the lower edge of the frame in order to document bank and riparian conditions. Photographers will make an effort to consistently maintain the same area in each photo over time.

2.1.3.2 Structure Photos

Photographs of primary grade control structures (i.e. vanes and weirs), along the restored streams are included within the photographs taken at reference photo stations. Photographers will make every effort to consistently maintain the same area in each photo over time.

Lateral and structure photographs are used to evaluate channel aggradation or degradation, bank erosion, success of riparian vegetation, structure function, and stability, and effectiveness of erosion control measures subjectively. Lateral photos should not indicate excessive erosion or degradation of the banks. A series of photos over time should indicate successive maturation of riparian vegetation and consistent structure function.

2.1.4 Visual Stream Morphological Stability Assessment

The visual stream morphological stability assessment involves the qualitative evaluation of lateral and vertical channel stability, and the integrity and overall performance of in-stream structures throughout the Project reach as a whole. Habitat parameters, such as riffle embeddedness and pool depth maintenance, are also measured and scored. The entire project reach was walked, noting geomorphic conditions of the stream bed profile (riffle/pool facets), both stream banks, and engineered in-stream structures. Photos were taken at every stream photo reference station as discussed in the previous section, and in locations of potential SPAs which were documented in the field for subsequent mapping on the CCPV figures. A more detailed summary of the methodology and results for the visual stream stability assessment can be found in Appendix B which includes a technical memorandum, supporting data tables, and SPA photos.

2.2 Vegetation Assessment

Successful restoration of the vegetation on a mitigation site is dependent upon hydrologic restoration, active planting of preferred canopy species, and volunteer regeneration of the native plant community. In order to determine if the criteria are achieved, twelve vegetation monitoring quadrants were installed across the Project site, which included one wetland vegetation plot. The total number of quadrants was calculated using

the CVS-NCEEP Entry Tool Database version 2.2.7 (CVS-NCEEP, 2007). The size of individual quadrants varies from 100-square meters for tree species to 1-square meter for herbaceous vegetation. Level 1 CVS vegetation monitoring will occur in spring, after leaf-out has occurred, or in the fall prior to leaf fall. At the end of the first growing season during baseline surveys, species composition, density, and survival were evaluated. Individual quadrant data provided during subsequent monitoring events will include diameter, height, density, and coverage quantities. Relative values will be calculated, and importance values will be determined. Individual seedlings will be marked to ensure that they can be found in succeeding monitoring years. Mortality will be determined from the difference between the previous year's living, planted seedlings and the current year's living, planted seedlings.

The interim measure of vegetative success for the site is the survival of at least 320, 3-year old, planted trees per acre at the end of Year 3 of the monitoring period. The final vegetative success criteria is the survival of 260, 5-year old, planted trees per acre at the end of Year 5 of the monitoring period.

Photographs are used to visually document vegetation success in sample plots. Reference photos of tree and herbaceous condition within plots are taken at least once per year. As part of the visual site assessment conducted on April 16, 2014, the vegetation condition of planted vegetation along stream banks, floodplains (wetlands), and terraces were qualitatively evaluated for performance; this also included the documentation of invasive species and potential VPAs which were recorded in the field for subsequent mapping on the CCPV figures. A more detailed summary of the methodology and results for the vegetation condition assessment can be found in Appendix B which includes a technical memorandum, supporting data tables, and photo logs.

2.3 Wetland Assessment

Four groundwater monitoring stations were installed in restored/enhanced wetland areas to document hydrologic conditions at the Project site. These four wetland gauges are depicted on the CCPV figures found in Appendix B. Installation and monitoring of the groundwater stations have been conducted in accordance with the USACE standard methods outlined in WRP Technical Notes ERDC TN-WRAP-00-02 (July 2000). Precipitation data from a nearby meteorological station (NC-MD-2) will also be downloaded annually for the five years of groundwater monitoring conducted post-construction; this station is located in close proximity to Marion, NC. This data will be obtained from the State's Climate Office website (CRONOS 2012).

Baker used DRAINMOD (Version 5.1) to develop hydrologic simulation models that represented conditions at a variety of locations across the Project site. DRAINMOD indicated wetland hydrology would occur for approximately 6-12% of the growing season. Based on these findings, it was determined that success criteria for wetland hydrology will be met when each wetland site is saturated within 12 inches of the soil surface for at least 9% of the growing season, or 19 consecutive days.

3.0 REFERENCES

Carolina Vegetation Survey (CVS) and NC Ecosystem Enhancement Program (NCEEP). 2007. CVS-NCEEP Data Entry Tool v. 2.2.7. University of North Carolina, Raleigh, NC.

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

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

US Army Corps of Engineers, WRP, July 2000. Technical Notes ERDC TN-WRAP-00-02.

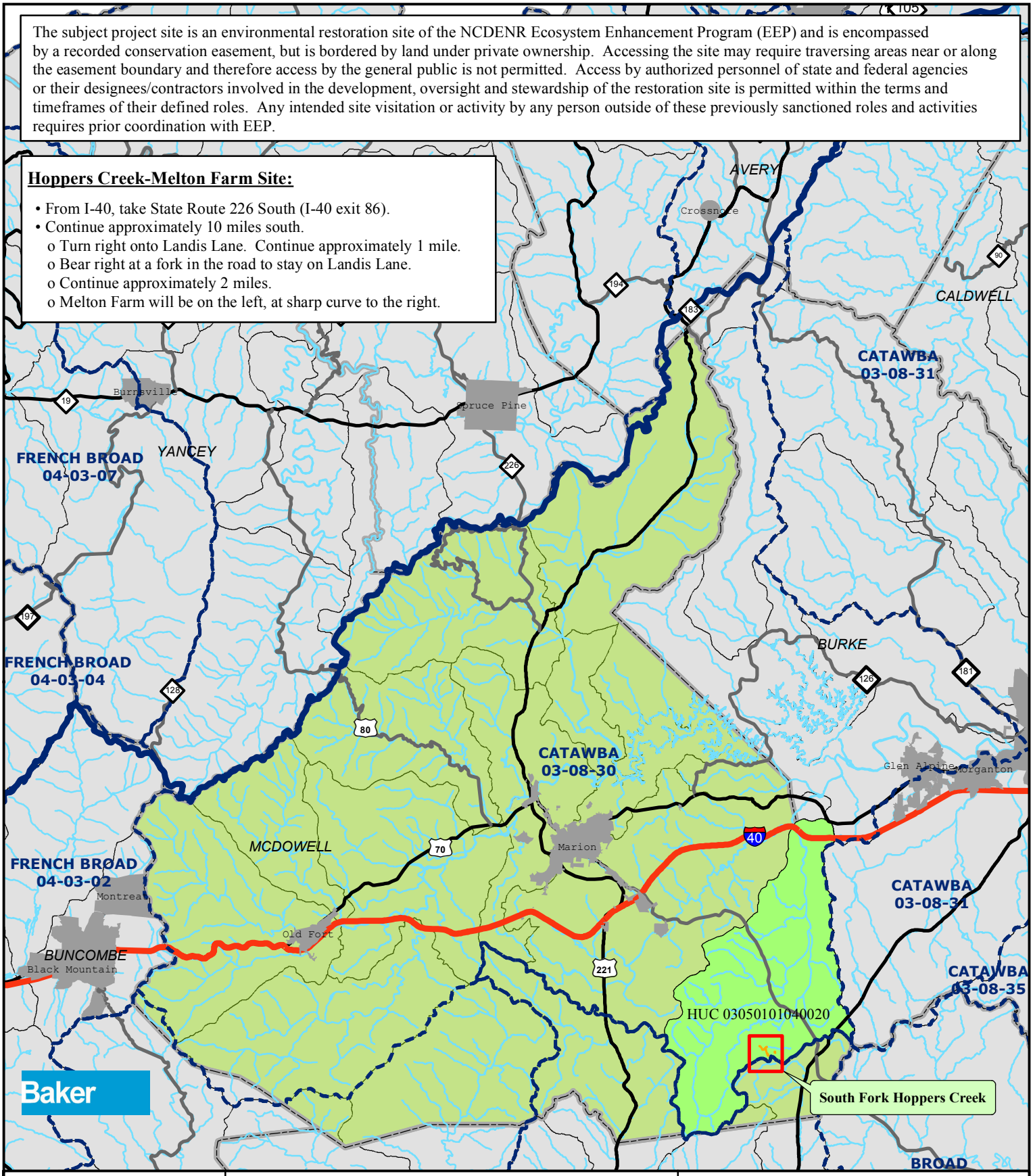
APPENDIX A

PROJECT VICINITY MAP AND BACKGROUND TABLES

The subject project site is an environmental restoration site of the NCDENR Ecosystem Enhancement Program (EEP) 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 EEP.

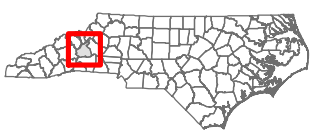
Hoppers Creek-Melton Farm Site:

- From I-40, take State Route 226 South (I-40 exit 86).
- Continue approximately 10 miles south.
  - Turn right onto Landis Lane. Continue approximately 1 mile.
  - Bear right at a fork in the road to stay on Landis Lane.
  - Continue approximately 2 miles.
  - Melton Farm will be on the left, at sharp curve to the right.



Baker

Map Vicinity



McDowell County, NC

Figure 1. Vicinity Map

Hoppers Creek-Melton Farm Stream Restoration Project

McDowell County, NC

Ecosystem Enhancement Program

NCEEP Project No.: 92251

LEGEND:

- Project Area
- NCDWQ Sub-basin
- Counties
- USGS Hydrologic Unit

0 2.5 5 Miles

Table 1. Project Components
South Fork Hoppers Creek Mitigation Plan: EEP Project No. 92251

Project Segment or Reach ID	Existing Feet/Acres*	Mitigation Type	Approach	Linear Footage or Acreage*	Mitigation Ratio	Mitigation Units	Stationing	Comment
South Fork Hoppers Creek - Reach 1	1,350	R	P1	783	1:1	783	10+00 - 17+83	Installed in-stream structures to control grade, reduce bank erosion, and provide habitat. Priority I was implemented to reestablish stream pattern and relocate the channel onto the historic floodplain.
South Fork Hoppers Creek - Reach 2		R	P1	445	1:1	445	17+83 - 22+48**	Installed in-stream structures to control grade, reduce bank erosion, and provide habitat. Priority I was implemented to reestablish stream pattern and relocate the channel onto the historic floodplain.
UT1 - Reach A	782	P	-	722	5:1	144	-	Preservation. A 30 - 100 foot conservation easement was implemented to on right and left stream banks.
		EII	P4	60	2.5:1	24	7+86 - 8+46***	Regraded right bank to create a bankfull bench and implemented riparian plantings to improve stability and reduce erosion.
UT1 - Reach B	970	P	-	51	5:1	10	9+49 - 10+00***	Preservation. A 30 - 100 foot conservation easement was implemented to on right and left stream banks.
		R	P1	1,065	1:1	1065	10+00 - 20+85**	Installed in-stream structures to increase habitat diversity. Installed fencing to restrict cattle access. Priority I was implemented to restore dimension, pattern, and profile.
UT2 - Reach A	366	EII	P4	379	2.5:1	152	10+00 - 13+79	Regraded banks and implemented a step-pool channel where feasible. Implemented fencing to restrict hog access.
UT2 - Reach B	802	EII	P4	818	2.5:1	327	13+79 - 22+17**	Regraded banks and implemented riparian plantings to improve reach stability and reduce erosion
UT3	298	P	-	298	5:1	60	-	Preservation. A 30 - 100 foot conservation easement was implemented to on right and left stream banks.
Ephermal drainage in left floodplain of South Fork Hoppers Creek	348	-	-	497	-		-	Stabilized ephemeral drainage from adjacent pasture by creating a flat bottom swale. Swale was matted and seeded. Not being sough for mitigation credit.
Ephermal drainage near the upstream extend of UT2	80	-	-	80	-		-	Stabilized ephemeral drainage with boulder sill structures and armored channel bed. Areas outside the channel were mulched and planted. Not being sought for mitigation credit.
Ephemeral drainage at Station 16+75 of UT2	15	-	-	15	-		-	Stabilized ephemeral drainage by regrading, rematting, and armoring with riprap. Not being sought for mitigation.
Wetland	0.33	E	-	0.33	2:1	.165	-	Regraded the wetland boundary to improve hydrologic imputs and maximize surface storage.
		R	-	1.23	1:1	1.23	-	Restored wetland hydrology to the original stream alignment.

* Existing reach breaks and design reach breaks varied based on initial geomorphic differences and design requirements.
** Stationing includes 20 ft. stream crossing, but is not reflected in the reach length
***During construction enhancement slated to occur between 9+49 and 10+00 of UT1B was shifted upstream into UT1A per conversations with EEP and CEC. The section slated for enhancement at the top of UT1B (9+49 to 10+(became presevation upon the field change.

Component Summations

Restoration Level	Stream (LF)	Riparian Wetland (Ac)				Non-Ripar (Ac)	Upland (Ac)
		Riverine	Non-Riverine				
Restoration	2,293	1.23	-			-	-
Enhancement		0.33	-			-	-
Enhancement I	-						
Enhancement II	1,257						
Creation		-	-			-	-
Preservation	1,071	-	-			-	-
HQ Preservation	-	-	-			-	-
		1.56	0.00				
Totals	4,621	1.56					
Total Mitigation Units	3010 SMU	1.40 WMU					
= Non - Applicable							

Table 2. Project Activity and Reporting History
South Fork Hoppers Creek Mitigation Plan: EEP Project No. 92251

Elapsed Time Since Grading/Planting Complete: 2 year 8 Months
Number of Reporting Years: 3

Activity or Report	Scheduled Completion	Data Collection Complete	Actual Completion or Delivery
Restoration Plan Prepared	N/A	N/A	Jul-07
Restoration Plan Amended	N/A	N/A	Jan-08
Restoration Plan Approved	N/A	N/A	Aug-08
Final Design – (at least 90% complete)	N/A	N/A	Jun-09
Construction Begins	Jun-10	N/A	Jun-10
Temporary S&E mix applied to entire project area	N/A	N/A	N/A
Permanent seed mix applied to entire project area	Nov-10	N/A	Jan-11
Planting of live stakes	Mar-11	N/A	Mar-11
Planting of bare root trees	Mar-11	N/A	Mar-11
End of Construction	Mar-11	N/A	Jun-11
Survey of As-built conditions (Year 0 Monitoring-baseline)	Nov-10	N/A	Jun-11
Year 1 Monitoring	Dec-12	Sep-12	Nov-12
Invasive Treatment	NA	NA	Aug-13
Year 2 Monitoring	Dec-13	Sep-13	Dec-13
Year 3 Monitoring	Dec-14	Sep-14	Dec-14
Year 4 Monitoring	Dec-15	N/A	N/A
Year 5 Monitoring	Dec-16	N/A	N/A

Table 3. Project Contacts Table South Fork Hoppers Creek Mitigation Plan: EEP Project No. 92251	
Designer	
Michael Baker Engineering, Inc.	797 Haywood Rd., Suite 201 Asheville, NC 28806 Contact: Chris Tomsic, Tel. 828-350-1408, Ext. 2007
Construction Contractor	
Carolina Environmental Contracting, Inc.	150 Pine Ridge Road Mount Airy, NC 27030 Contact: Joanne Cheatham, Tel. 336-320-3849
Planting Contractor	
Carolina Environmental Contracting, Inc.	150 Pine Ridge Road Mount Airy, NC 27030 Contact: Joanne Cheatham, Tel. 336-320-3849
Sedding Contractor	
Carolina Environmental Contracting, Inc.	150 Pine Ridge Road Mount Airy, NC 27030 Contact: Joanne Cheatham, Tel. 336-320-3849
Seed Mix Sources	Green Resources, Tel. 336-855-6363
Nursery Stock Suppliers	Foggy Mountain Nursery, Tel. 336-384-5323
Profession Land Surveyor	
Turner Land Survey, PLLC.	3201 Glenridge Drive Raleigh, NC 27604 Contact:
Profession Land Surveyor	David Turner, Tel. 919-875-1378
As-Built Plan Set Production	Lissa Turner, Tel. 919-875-1378
Monitoring Performers	
Michael Baker Engineering, Inc.	797 Haywood Rd., Suite 201 Asheville, NC 28806 Contact:
Stream Monitoring Point of Contact:	Chris Tomsic, Tel. 828-350-1408, Ext. 2007
Vegetation Monitoring Point of Contact:	Chris Tomsic, Tel. 828-350-1408, Ext. 2007
Wetland Monitoring Point of Contact:	Chris Tomsic, Tel. 828-350-1408, Ext. 2007

Table 4. Project Attribute Table
South Fork Hoppers Creek Mitigation Plan: EEP Project No. 92251

Project County	McDowell County, NC
Physiographic Region	Piedmont
Ecoregion	Inner Piedmon Belt
Project River Basin	Catawba
USGS HUC for Project and Reference sites	Project: 03050101040020; References: 03040103050 -090 (Spencer Creek), -080 (Barnes Creek); 03030002060 -070 (Morgan Creek); 03020201080 -020 (Sal's Branch)
NCDWQ Sub-basin for Project and Reference	Project: 03-08-30; References: 03-07-09 (Spencer Creek and Barnes Creek); 03-06-06 (Morgan Creek); 03-04-02 (Sal's Branch)
Within extent of EEP Watershed Plan ?	Muddy Creek Local Watershed Plan (LWP), 2003
WRC Class (Warm, Cool, Cold)	Warm
% of project easement fenced or demarcated	100%
Beaver activity observed during design phase ?	None

Restoration Component Attribute Table

	South Fork Hoppers - Reach 1	South Fork Hoppers - Reach 2	UT1 - Reach A (Preservation)	UT1 - Reach A (Enhancement 2)	UT1 - Reach B (Preservation)	UT1 - Reach B	UT2 - Reach A	UT2 - Reach B	UT3
Drainage area (sq. mi.)	0.48	0.52	0.06	0.06	0.08	0.08	0.04	0.07	0.02
Stream order	2nd	2nd	1st	1st	1st	1st	0	0	0
Restored length	783	445	722	60	51	1,065	379	818	298
Perennial or Intermittent	Perennial	Perennial	Perennial	Perennial	Perennial	Perennial	Perennial	Perennial	Intermittent
Watershed type (Rural, Urban, Developing etc.)	Rural	Rural	Rural	Rural	Rural	Rural	Rural	Rural	Rural
Watershed LULC Distribution (e.g.)									
Developed Low-Medium Intensity	-		-	-	-	-	-	-	-
Ag-Cultivated Crops	1.5		-	-	-	-	-	-	-
Ag-Pasture/Hay	15.3		-	-	-	-	-	-	-
Forested	60.8		-	-	-	-	-	-	-
Other (Open water, Grassland, Etc.)	22.4		-	-	-	-	-	-	-
Watershed impervious cover (%)	U	U	U	U	U	U	U	U	U
NCDWQ AU/Index number	03-08-30	03-08-30	03-08-30	03-08-30	03-08-30	03-08-30	03-08-30	03-08-30	03-08-30
NCDWQ classification	C	C	C	C	C	C	C	C	C
303d listed ?	No	No	No	No	No	No	No	No	No
Upstream of a 303d listed segment?	No	No	No	No	No	No	No	No	No
Reasons for 303d listing or stressor	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Total acreage of easment	10.1								
Total planted arceage as part of the restoration	5.7								
Rosgen classification of pre-existing	G5c	C4/1	-	-	E5	E5	G5	G5c	-
Rosgen classification of As-built	C5	C5	B	B	C5	C5	G5/B5	G5c	B
Valley type	Alluvial	Alluvial	-	-	Alluvial	Alluvial	Alluvial	Alluvial	-
Valley slope	0.0115ft/ft	0.0115 ft/ft	-	-	0.023 ft/ft	0.023 ft/ft	0.034 ft/ft	0.023 ft/ft	-
Valley side slope range (e.g. 2-3%)	U	U	-	-	U	U	U	U	-
Valley toe slope range (e.g. 2-3%)	U	U	-	-	U	U	U	U	-
Cowardin classification									
Trout waters designation	No	No	No	No	No	No	No	No	No
Species of concern, endangered etc.? (Y?N)	No	No	No	No	No	No	No	No	No
Dominant soil series and characteristics									
Series	IoA	IoA	EwE	EwE	IoA	IoA	HeD	HeD / IoA	EwE
Depth	10	10	5	6	10	10	5, 8	5,8 / 10	5
Clay %	18	18	25,20	25,20	18	18	25	25 / 18	25,20
K	0.15	0.15	0.17, 0.10	0.17, 0.10	0.15	0.15	0.24, 0.17	0.24, 0.17 / 0.15	0.17, 0.10
T	5	5	3 / 5	3 / 5	5	5	5	5 / 5	3 / 5

APPENDIX B

VISUAL ASSESSMENT DATA

Site Assessment Report – Monitoring Year 3

Hoppers Creek-Melton Farm Stream Restoration Project
McDowell County, North Carolina
May 2014

Submitted To: NCDENR - Ecosystem Enhancement Program
1625 Mail Service Center
Raleigh, NC 27699
NCDENR Contract ID No. 004518

Submitted By: Michael Baker Engineering, Inc.
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1. Introduction

1.1 Purpose

This report summarizes overall stream and vegetation conditions as part of an interim site assessment conducted in conjunction with the Year 3 monitoring services for the Hoppers Creek-Melton Farm Stream Restoration Project site located in McDowell County, NC. This site assessment will be included as part of a more comprehensive annual monitoring report to be completed and submitted later this year (fall 2014). The report describes project objectives, discusses the assessment methodology, summarizes assessment results, and documents potential stream and vegetation problem areas (SPAs and VPAs respectively).

1.2 Objectives

The objectives of the site assessment were to:

- provide a general overview of stream morphological stability;
- provide a general overview of vegetation conditions;
- identify and document potential SPAs and VPAs.

1.3 Supporting Data

Supporting data and information are provided following the narrative portion of this report and include:

- current condition plan view (CCPV) figures (Figure 2, sheets 1 through 3);
- visual stream morphology stability assessment table (Tables 5a through 5d);
- SPA inventory table (Table 5e);
- vegetation condition assessment table (Tables 6a and 6b);
- VPA inventory table (Table 6c);
- stream station photos;
- SPA photos;
- VPA photos.

2 Methodology

The methodology used for assessing overall stream and vegetation conditions at the Hoppers Creek-Melton Farm Stream Restoration Project site adhered to the most recent NCEEP monitoring guidance documents (dated November 7, 2011). The site assessment was comprised of two components, a visual stream morphology stability assessment and a vegetation condition assessment, both of which are described in more detail in the following sections of this report. The assessment was strictly qualitative. Vegetation monitoring plot counts were excluded from this assessment but will be conducted after July 2014; this data

will be summarized in Appendix C and the CCPV figure of the Year 3 annual monitoring report to be submitted in late November of this year.

The Hoppers Creek-Melton Farm Stream Restoration Project site was evaluated as four separate project reaches for the visual stream morphology stability assessment as they were for the Final Baseline Monitoring Document/As-Built Report: South Fork Hoppers Creek (SFHC) Reaches 1 and 2, UT1 Reach B, and UT2 (Reaches A and B). SFHC Reaches 1 and 2 are delineated by the confluence of UT1 Reach B where SFHC Reach 1 is located upstream of the confluence and SFHC Reach 2 is located downstream of the confluence. UT2 Reach A extends from the upstream limits located within the conservation easement boundary to the downstream limits of the constructed step-pool channel, and UT2 Reach B includes the remaining corridor located downstream of the step-pool channel until its confluence with SFHC Reach 1.

Due to expected performance issues related to the persistence of invasive species on UT2 (Reaches A and B), vegetation conditions for it were assessed independently from the remainder of the Hoppers Creek-Melton Farm Stream Restoration Project site which exhibited uniform conditions, and thus resulted in two distinct vegetation assessment tracts. Vegetation conditions for both tracts are reported in Tables 6a and 6b. Baker performed the visual site assessment on April 16, 2014.

2.1 Visual Stream Morphology Stability Assessment

The visual stream morphology stability assessment involved the evaluation of lateral and vertical channel stability, and the integrity and overall performance of in-stream structures throughout each of the four project stream reaches. Habitat parameters, such as riffle embeddedness and pool depth maintenance, were also measured and scored. Each stream reach was walked, noting geomorphic conditions of the stream bed profile (riffle/pool facets), both stream banks, and engineered in-stream structures. Photos were taken at every existing stream photo point (from the as-built) and in locations of potential SPAs which were recorded in the field for subsequent mapping on the CCPV figures.

2.2 Vegetation Condition Assessment

The vegetation condition assessment involved the evaluation of vegetation within the 10.1 acre conservation easement and included assessing the performance of planted vegetation along stream banks, floodplains, and terraces as well as the documentation of invasive species. The assessment of planted vegetation was confined to the 5.7 acres of riparian buffer planting zones located within the easement boundary as part of the restoration design; whereas, invasive vegetation and encroachment areas of invasive species were evaluated for the entire 10.1 acre easement boundary. Photos were recorded in locations of potential VPAs throughout the easement, such as areas exhibiting sparse or slow growth/vigor, low stem density, and invasive areas of concern.

2.3 Post-processing of Field Data

The post-processing of field data consisted of the download and organization of photos into respective photo logs (stream and vegetation), creating the CCPV figures in GIS and AutoCAD using the field-mapped SPAs and VPAs, populating the SPA and VPA tables, and finally scoring the performance of the four stream reaches and two vegetation tracts in terms of stream morphological stability and vegetation condition using assessment forms provided by NCEEP.

3 Summary of Results

3.1 Visual Stream Morphology Stability Assessment

Tables 5a through 5d summarize the performance of each of the four project stream reaches mentioned above for the Hoppers Creek-Melton Farm Stream Restoration Project in terms of lateral (stream bank) and vertical (channel bed) stability while evaluating the functionality and integrity of in-stream structures. Engineered in-stream structures evaluated for the assessment of this project reach consisted of constructed riffles, log sills (drops), cross vanes, log vanes, root wads, geolifts, and brush mattresses. Constructed riffles were justified for inclusion in the evaluation of structures since they are the predominant grade control structure used throughout the site; however, they were only assessed for the 'overall integrity' and 'grade control' parameter categories in Tables 5a through 5d.

As Tables 5a through 5d indicate, the Hoppers Creek-Melton Farm Stream Restoration Project site was geomorphically stable overall and performing at 100 percent as the design intended for the majority of parameters evaluated within the lateral/vertical stability and in-stream structure performance categories. UT1 Reach B was functioning at the highest level geomorphically out of all the stream project reaches, performing at 100 percent for all sub-categories except for 'Riffle Condition'—two riffles located within the upstream project limits (at stations 10+00 and 12+00) were covered in fines from an upstream sediment source but the coarse riffle substrate appeared intact beneath the fines. SFHC Reach 1 received the lowest performance scores (for all 3 major morphological channel categories) in terms of lateral, vertical, and in-stream structural stability out of all the project stream reaches followed by SFHC Reach 2 and UT2 (Reaches A and B). SFHC Reaches 1 and 2, and UT2 (Reaches A and B) had more than one sub-category receiving scores of less than 100 percent namely due to one or more of the following issues: localized areas of lateral instability or bank erosion from bank scour and bank slumping, and the piping or failure of engineered in-stream structures; SPAs correlating with these issues for these three project reaches were documented and summarized in Table 5e.

There were a total of 8 SPAs documented, 4 of which were identified during the Year 1 visual assessment and 4 that were identified during the Year 2 assessment. No new SPAs were identified for the Year 3 assessment. SPAs documented in previous years were included in this assessment since they have persisted to date.

The first number in the SPA naming convention (in Table 5e) references the monitoring year in which the SPA was identified during the visual assessment. A brief description of the SPAs reported from previous year's assessment is discussed below. The SPAs have remained unchanged in condition and scale when observed during this assessment, but they still remain problem areas and should be monitored. All are included in the scoring of morphological performance categories in Tables 5a through 5d, and are also summarized in Table 5e, Figure 2 (CCPV), and the SPA photolog.

Two SPAs identified in previous years (SPA1-3 and SPA2-5) have been removed from the SPA list. These two areas consisted of in stream structures that were exhibiting piping. SPA1-3 involved piping through both vane arms and under the second sill of a boulder cross vane at station 19+23 on SFHC Reach 2. SPA2-5 involved piping under a log sill at station 12+90 on UT2 Reach A. Both structures have been successfully repaired and are functioning correctly.

SPA1-1 and SPA1-2 are characterized by small localized areas of bank scour and are located across the channel from one another on SFHC Reach 1; SPA1-1 is located along the left bank and SPA1-2 is located along the right bank a little further downstream. The invert along these two sills are sloped to one side (slanted) and oriented within the channel such that flow is being directed toward the bank immediately downstream of where the log sill ties into the bank, causing bank erosion. Banks of both SPAs are vertical and exposed, and warrant stabilizing to prevent the spread of lateral instability further downstream.

SPA1-5 consists of the piping of flow through a log sill structure in UT2 Reach A. The structure is vertically and laterally stable and should seal over time.

The heavily armored, ephemeral drainage located near the upstream extents of UT2 Reach A was inspected for overall structural integrity and stability even though the short reach is not being sought for mitigation credit. Upon inspection, the channel bed of the downstream riffle cascade had eroded (SPA1-6). Coarse riprap material has been deposited downstream atop the lowest elevation boulder sill, exposing the underlying filter fabric as a result.

SPA2-1 and SPA2-2 are located in close proximity to each other on opposite banks downstream of a meander bend between stations 15+95 and 16+32 on SFHC Reach 1. SPA2-1 is characterized by a failing rootwad associated with the erosion and undercutting of the left bank located immediately downstream of a log sill around station 16+25. The invert along the upstream log sill is sloped to one side (slanted toward the left bank) and is oriented within the channel such that flow is being directed toward the left bank immediately downstream of where the log sill ties into the bank, causing bank erosion. Erosion along the left bank appears to have migrated further downstream over time, scouring the upstream portion of the rootwad and the channel toe beneath it, eventually undermining the structure. The rootwad has separated from the left bank, has slumped into the channel, and is no longer affording erosion protection of the left bank.

SPA2-2 is located across the channel and just upstream from SPA2-1 on the right bank, and consists of a slumping bank situated along the downstream portion of an outer meander bend.

The 15 LF section of calved right bank has separated but not yet slumped into the channel. Flow behind the separated bank threatens to continue to erode and expose the parent bank which is vertical and devoid of stabilizing vegetation. Bank slumping of SPA2-2 may be a result of poor soil compaction during construction and/or the unconsolidated nature of the soil matrix within the bank, which without adequate vegetation to help reinforce or stabilize the bank is easily eroded. This is evident as the mass wasting along the right bank extends about 15 LF downstream along one continuous fissure to the log sill associated with SPA2-1. The tie-in of the log sill along the right bank around station 16+10 is slightly exposed as a result; the sill appears to be fully functional as grade control, but may become structurally compromised if scour behind the slumped bank material extends over time.

SPA2-3 involves localized scour along the left bank of a riffle located upstream of the easement crossing between stations 18+75 and 18+87. Flow has scoured out and eroded a small portion of the left bank behind a cluster of well rooted, native vegetation that is thriving at the bank. The vegetation is comprised primarily of Willow Oak, Tag Alder, and Soft Rush. Matting along the bank is generally intact but has separated from the bank in areas due to erosion over time that has caused the bank to recede. The left bank is vertical, exposed, and devoid of vegetation resulting in no surface protection. The thalweg along the riffle where SPA2-3 is located appears to be centered; but velocity vectors, and thus flow, may have been temporarily redirected toward the left bank during past storm events from slight temporal shifts in aggraded riffle material within the riffle, thereby increasing stress along the left bank making the bank more susceptible to subsequent erosion.

SPA2-4 is located on UT2 Reach B and is a steep portion of left bank located across from vegetation plot 13 that is slumping and separating from the top of terrace. This bank was originally stabilized during construction by a combination of bank grading, temporary/permanent seeding, the installation of staked matting, and the planting of live-stake vegetation. The graded bank began to slump before construction was completed and was re-stabilized before demobilization and project closeout. The cause of the recurrent bank instability at SPA2-4 may potentially be a result of poor soil compaction and overland storm flow seepage that appears to be occurring at the top of terrace which may be undermining the re-graded bank.

SPA2-5 consists of the piping of flow through a riffle cascade (log sill) structure at station 12+90 in UT2 Reach A. The structure is vertically and laterally stable. Some water was observed flowing over the log sill invert; the log sill should re-seal over time.

Log sills associated with deep scour pools on UT1 Reach B were inspected and assessed for vertical stability per EEP's request during the Year 2 assessment and reassessed during the Year 3 assessment. EEP's concern was that the depth of some of these scour pools could potentially pose a threat and undermine the structural integrity and grade control function to their upstream log sill counterpart considering the small channel dimensions associated with this stream reach. Pools for UT1 Reach B were designed to have a maximum pool depth (d_{pool}) ranging between 1.0 and 2.0 feet and a ratio of pool depth to average bankfull depth (d_{pool}/d_{bkf}) ranging between 2.0 and 4.0 (as cited in Table 7.2 from the South Muddy Creek Stream Restoration Plan). EEP's monitoring guidance (dated November 7, 2011) for

defining 'sufficient depth' for meander pool condition suggests that a pool should have a d_{pool}/d_{bkf} ratio greater than or equal to 1.6, which in this case for UT1 Reach B translates to a d_{pool} of 0.8 feet in depth or greater. All log sill scour pools on UT1 Reach B had d_{pool}/d_{bkf} ratios exceeding 1.6 and thus fulfilled EEP's monitoring guidance criteria for sufficient depth for meander pool condition for this current visual morphological assessment. The deepest of these pools were those three log sill scour pools located downstream of the easement crossing between stations 19+00 and 19+50. The upstream most log sill remains the deepest of the three and had a d_{pool} value and d_{pool}/d_{bkf} ratio of 2.2 feet and 4.4 respectively. This marks a slight decrease in d_{pool} value and d_{pool}/d_{bkf} ratio of 2.5 feet and 5.0 recorded in the Year 2 Assessment. Even though the d_{pool} value of 2.2 feet exceeds that specified for the proposed design (by 0.2 feet), it still meets EEP's monitoring guidance criteria for the assessment. These log sill structures were constructed with a header and footer log. The footer log at this particular log sill was still buried below the elevation of the scour pool, affording protection from undermining and helping to hold the entire structure firmly in place. Like other pools throughout the project site, the depth of this pool should fluctuate and fill in with sediment over time in between storm events. These log sills/scour pools will continue to be monitored in subsequent years.

3.2 Vegetation Condition Assessment

Tables 6a and 6b summarize the vegetation conditions of the Hoppers Creek-Melton Farm Stream Restoration site. Table 6a references the vegetation assessment tract associated with SFHC Reaches 1 and 2, and UT1 Reach B; Table 6b references the vegetation assessment tract associated with UT2 (Reaches A and B). There were a total of 6 VPAs, 2 of which were identified during the Year 1 visual assessment and 4 that were identified during the Year 2 assessment. Bare floodplain conditions account for 2 of the VPAs, and the presence of invasive species accounts for the remaining 4 VPAs. A NCEEP licensed contractor conducted exotic invasive plant control over nine days between June 20 and August 14, 2013. This treatment was effective in reducing the total number of VPAs from 10 in Year 2 to 6 in Year 3. As a result of the treatment, no new VPAs were identified in the Year 3 assessment. The VPAs remaining as a result of invasive species show signs of treatment and are less dense though some re-sprouting has occurred. As with the SPAs, the first number in the VPA naming convention references the monitoring year in which the VPA was identified during the visual assessment. A brief description of the VPAs reported from previous year's assessment is discussed below. All VPAs are included in the scoring of easement acreage performance categories in Tables 6a and 6b, and are also summarized in Table 6c, Figure 2 (CCPV), and the VPA photolog.

VPA1-1 and VPA1-2 are the two bare areas that were documented in the wetland area located in the right floodplain along SFHC Reach 1. The combined total area for these VPAs is 0.12 acres, or 2.8% of the planted area acreage for this assessment tract. The two VPAs have remained somewhat bare since construction was completed. This could possibly be due to standing water from frequent inundation and/or the washing away of dispersed seeds by frequent overbank flows.

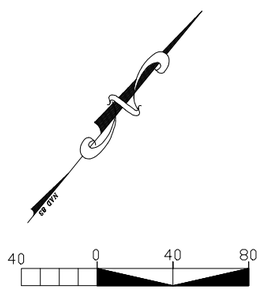
VPA2-2 is a small area of invasive species located on the left floodplain of SFHC Reach 2. The primary invasive is multiflora rose (*Rosa multiflora*) and privet (*Ligustrum sinense*). VPA2-2 appears to have been caused by a combination of invasives persisting after treatment and from intact seed sources contained within the existing tree stand in which VPA2-2 is situated. The three VPAs reported within UT1 Reach B (VPA2-2, VPA2-5, and VPA2-6) are all located in the right floodplain or terrace and are composed primarily of multiflora rose (*Rosa multiflora*) that seems to have persisted after prior treatment. VPA2-4 is located on the eastern periphery of vegetation monitoring plot 22 and may have proliferated from seed sources contained within the existing tree stand located just outside the vegetation plot. The combined total area for these 4 VPAs is 0.04 acres, or 0.5% of the planted area acreage for this assessment tract.

CONSERVATION EASEMENT
ASBUILT CENTERLINE
ASBUILT TOP OF BANK
ASBUILT CHANNEL
FENCE
CROSS SECTION
PHOTO ID POINT
VEGETATION PLOT
WETLAND ENHANCEMENT/RESTORATION

VEGETATION PROBLEM AREA (VPA) INVASIVE SPECIES PRESENT
VEGETATION PROBLEM AREA (VPA) BARE FLOOD PLAIN AREA
VEGETATION PLOT NOT MEETING CRITERIA
WETLAND GAGE

STREAM PROBLEM AREA (SPA) BANKS WITH EVIDENT SCOUR/EROSION
STREAM PROBLEM AREA (SPA) DEGRADATION
STREAM PROBLEM AREA (SPA) STRUCTURE PROBLEM
STREAM PROBLEM AREA (SPA) UNDERCUT BANKS
STREAM PROBLEM AREA (SPA) BANK SLUMPING/CALVING/COLLAPSE

IMAGE SOURCE: NC STATEWIDE ORTHOIMAGERY, 2010



SOUTH FORK HOPPERS CREEK
CURRENT CONDITION PLAN VIEW
YEAR 3 MONITORING
STA. 10+00-22+48

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HOPPERS CREEK - MELTON FARM
STREAM RESTORATION PROJECT
MCDOWELL COUNTY, NORTH CAROLINA

FIGURE 2

Ecosystem Enhancement Program

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EEP Project No.
92251
Baker Project No.
128244
Date:
12/2/2014
DESIGNED: ---
DRAWN: CAT
APPROVED: WSH
Monitoring Year:
3 of 5
Sheet:
1 of 3

CE CONSERVATION EASEMENT

ASBUILT CENTERLINE

TB ASBUILT TOP OF BANK

ASBUILT CHANNEL

FENCE

X–# CROSS SECTION

PHOTO ID POINT

VP VEGETATION PLOT

WETLAND ENHANCEMENT/RESTORATION

VEGETATION PROBLEM AREA (VPA) INVASIVE SPECIES PRESENT

VEGETATION PROBLEM AREA (VPA) BARE FLOOD PLAIN AREA

VEGETATION PLOT NOT MEETING CRITERIA

STREAM PROBLEM AREA (SPA) BANKS WITH EVIDENT SCOUR/EROSION

STREAM PROBLEM AREA (SPA) DEGRADATION

STREAM PROBLEM AREA (SPA) STRUCTURE PROBLEM

STREAM PROBLEM AREA (SPA) UNDERCUT BANKS

STREAM PROBLEM AREA (SPA) BANK SLUMPING/CALVING/COLLAPSE

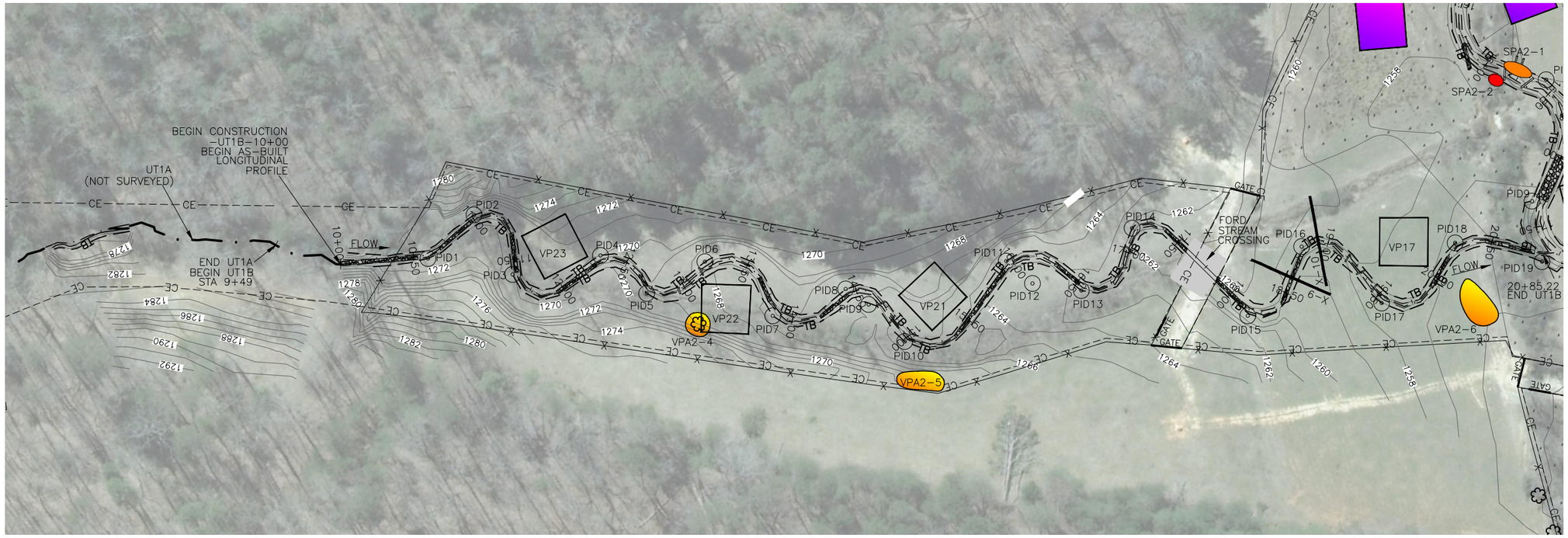
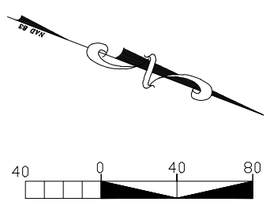


IMAGE SOURCE: NC STATEWIDE ORTHOIMAGERY, 2010

UT1–B
CURRENT CONDITION PLAN VIEW
YEAR 3 MONITORING
STA. 10+00–22+85



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Sheet:	2 of 3

CONSERVATION EASEMENT
ASBUILT CENTERLINE
ASBUILT TOP OF BANK
ASBUILT CHANNEL
FENCE
CROSS SECTION
PHOTO ID POINT
VEGETATION PLOT
WETLAND ENHANCEMENT/RESTORATION

VEGETATION PROBLEM AREA (VPA) INVASIVE SPECIES PRESENT
VEGETATION PROBLEM AREA (VPA) BARE FLOOD PLAIN AREA

STREAM PROBLEM AREA (SPA) BANKS WITH EVIDENT SCOUR/EROSION
STREAM PROBLEM AREA (SPA) DEGRADATION
STREAM PROBLEM AREA (SPA) STRUCTURE PROBLEM
STREAM PROBLEM AREA (SPA) UNDERCUT BANKS
STREAM PROBLEM AREA (SPA) BANK SLUMPING/CALVING/COLLAPSE

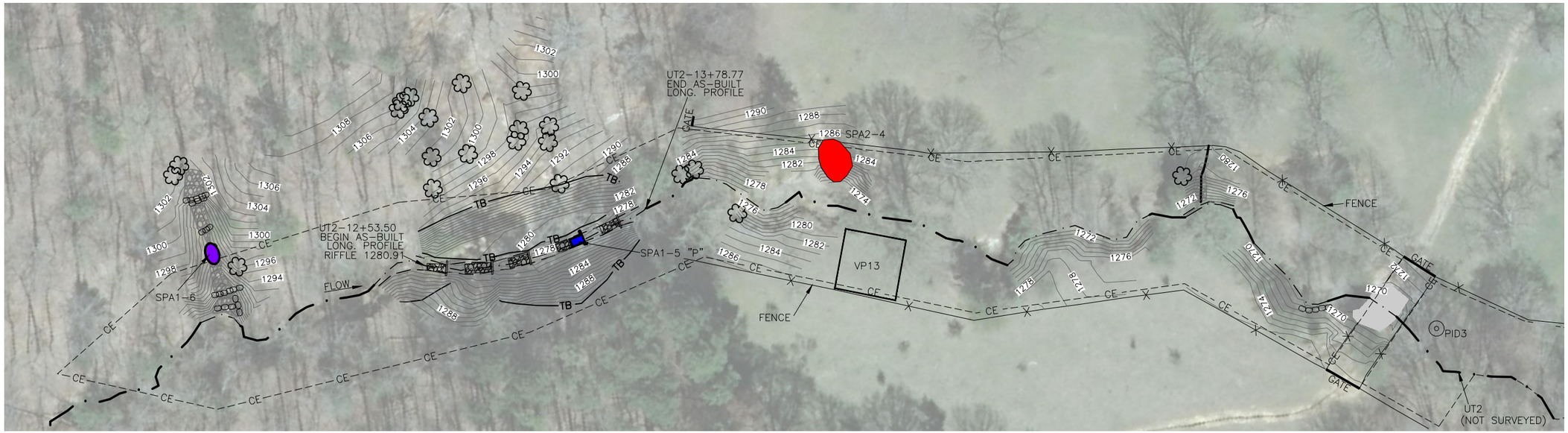

IMAGE SOURCE: NC STATEWIDE ORTHOIMAGERY, 2010

UT2
CURRENT CONDITION PLAN VIEW
YEAR 3 MONITORING
STA. 12+54–13+79

60 0 30 60

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HOPPERS CREEK - MELTON FARM
STREAM RESTORATION PROJECT
MCDOWELL COUNTY, NORTH CAROLINA

FIGURE 2

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EEP Project No.
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Baker Project No.
128244
Date:
12/2/2014
DESIGNED: ---
DRAWN: CAT
APPROVED: WSH
Monitoring Year:
3 of 5
Sheet:
3 of 3

Table 5a. **Visual Stream Morphology Stability Assessment**

Reach ID **South Fork Hoppers Creek Reach 1**

Assessed Length (LF) **783**

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	6			83%			
	3. Meander Pool Condition	1. Depth	12	13			92%			
		2. Length	8	8			100%			
	4. Thalweg position	1. Thalweg centering at upstream of meander bend (Run)	8	8			100%			
		2. Thalweg centering at downstream of meander (Glide)	7	7			100%			
2. Bank	1. Scoured/Eroding	Bank lacking vegetative cover resulting simply from poor growth and/or scour and erosion			2	16	99%	0	0	99%
	2. Undercut	Banks undercut/overhanging to the extent that mass wasting appears likely			1	20	99%	0	0	99%
	3. Mass Wasting	Bank slumping, calving, or collapse			1	15	99%	0	0	99%
				Totals	4	51	97%	0	0	97%
3. Engineering Structures	1. Overall Integrity	Structures physically intact with no dislodged boulders or logs	23	24			96%			
	2. Grade Control	Grade control structures exhibiting maintenance of grade across the sill.	11	11			100%			
	2a. Piping	Structures lacking any substantial flow underneath sills or arms	9	9			100%			
	3. Bank Protection	Bank erosion within the structures extent of influence does not exceed 15%	12	13			92%			
	4. Habitat	Pool forming structures maintaining ~ Max Pool Depth	11	11			100%			

Table 5b. **Visual Stream Morphology Stability Assessment**

Reach ID **South Fork Hoppers Creek Reach 2**

Assessed Length (LF) **445**

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	10	10			100%			
		2. Length	3	3			100%			
	4. Thalweg position	1. Thalweg centering at upstream of meander bend (Run)	3	3			100%			
		2. Thalweg centering at downstream of meander (Glide	4	4			100%			
2. Bank	**1. Scoured/Eroding**	Bank lacking vegetative cover resulting simply from poor growth and/or scour and erosion			1	12	99%	0	0	99%
	2. Undercut	Banks undercut/overhanging to the extent that mass wasting appears likely			0	0	100%	0	0	100%
	3. Mass Wasting	Bank slumping, calving, or collapse			0	0	100%	0	0	100%
				Totals	1	12	99%	0	0	99%
3. Engineering Structures	**1. Overall Integrity**	Structures physically intact with no dislodged boulders or logs	19	19			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 sills or arms	8	8			100%			
	3. Bank Protection	Bank erosion within the structures extent of influence does not exceed 15%	10	10			100%			
	4. Habitat	Pool forming structures maintaining ~ Max Pool Depth	14	14			100%			

Table 5c. **Visual Stream Morphology Stability Assessment**

Reach ID **UT1 Reach B**

Assessed Length (LF) **1065**

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	12			83%			
	3. Meander Pool Condition	1. Depth	26	26			100%			
		2. Length	16	16			100%			
	4. Thalweg position	1. Thalweg centering at upstream of meander bend (Run)	16	16			100%			
		2. Thalweg centering at downstream of meander (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	Bank slumping, calving, 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	38	38			100%			
	2. Grade Control	Grade control structures exhibiting maintenance of grade across the sill.	22	22			100%			
	2a. Piping	Structures lacking any substantial flow underneath sills or arms	10	10			100%			
	3. Bank Protection	Bank erosion within the structures extent of influence does not exceed 15%	16	16			100%			
	4. Habitat	Pool forming structures maintaining ~ Max Pool Depth	10	10			100%			

Table 5d. **Visual Stream Morphology Stability Assessment**

Reach ID **UT2 (Reaches A and B)**

Assessed Length (LF) **1197**

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	5	5			100%			
		2. Length	N/A	N/A			N/A			
	4. Thalweg position	1. Thalweg centering at upstream of meander bend (Run)	5	5			100%			
		2. Thalweg centering at downstream of meander (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	Bank slumping, calving, or collapse			1	15	99%	0	0	99%
				Totals	1	15	99%	0	0	99%
3. Engineering Structures	1. Overall Integrity	Structures physically intact with no dislodged boulders or log	10	10			100%			
	2. Grade Control	Grade control structures exhibiting maintenance of grade across the sill.	5	5			100%			
	2a. Piping	Structures lacking any substantial flow underneath sills or arms	4	5			80%			
	3. Bank Protection	Bank erosion within the structures extent of influence does not exceed 15%	5	5			100%			
	4. Habitat	Pool forming structures maintaining ~ Max Pool Depth	5	5			100%			

Table 5e. Stream Problem Areas Hoppers Creek-Melton Farm Stream Restoration Project: Project No. 92251			
South Fork Hoppers Creek (SFHC) Reach 1			
Feature Issue	**Station No.**	**Suspected Cause**	**Photo Number***
Bank Scour	14+20 to 14+26	Scour eroding the left bank immediately downstream of log sill invert/left bank tie-in. Appears to be a localized area of high near bank stress caused by flow (velocity vector) directed at the left bank by log sill orientation.	SPA1-1
	14+40 to 14+50	Scour eroding the right bank immediately downstream of log sill invert/right bank tie-in. Appears to be a localized area of high near bank stress caused by flow (velocity vector) directed at the left bank by log sill orientation.	SPA1-2
Engineering structures - Rootwad Failure	16+12 to 16+32	Rootwad failure and undercut banks along the left bank immediately downstream of log sill invert/left bank tie-in. Appears to be caused by bank scour upstream and beneath the rootwad resulting from flow (velocity vector) directed at the left bank by log sill orientation which eventually undermined the rootwad, to where it separated from the left bank, slumping into the channel.	SPA2-1
Bank Slumping	15+95 to 16+10	Slumping of right bank along downstream portion of outer meander bend due poor soil compaction and a lack of woody root mass to hold and stabilize the bank in place.	SPA2-2
SFHC Reach 2			
Feature Issue	**Station No.**	**Suspected Cause**	**Photo Number**
Bank Scour	18+75 to 18+87	Localized scour along the left bank behind well-rooted bank vegetation thriving at the toe of channel causing erosion in between the left bank and the well-rooted vegetation (primarily comprised of Willow Oak, Tag Alder, and Soft Rush).	SPA2-3
UT2 Reach A			
Feature Issue	**Station No.**	**Suspected Cause**	**Photo Number**
Piping	13+40	Flow piping within riffle cascade and around downstream log sill due to possible tear in filter fabric or lack of sealing from re-sorting of alluvial material and silt.	SPA1-5
UT2 Reach B			
Feature Issue	**Station No.**	**Suspected Cause**	**Photo Number**
Bank Slumping	Upstream reach limits along left bank (across channel from Veg. Monitoring Plot 13)	Steep re-graded portion of left bank is slumping and separating from the top of terrace, possibly due to poor soil compaction and overland storm flow seepage along at the top of terrace that may be undermining the re-graded portion of bank.	SPA2-4
Ephemeral Drainage (near upstream extents of UT2)**			
Feature Issue	**Station No.**	**Suspected Cause**	**Photo Number**
Bed Scour/Degradation	Riffle cascade downstream of second boulder sill	Scour of riffle cascade from large storm events over time has eroded the channel bed, depositing the coarse riffle substrate downstream, and exposed the underlying filter fabric.	SPA1-6

*Note: The first digit in the Photo Number column references the monitoring year and the second digit references the problem area or photo (which would be identical to a prior years problem area/photo number when persisting from a previous monitoring year).

**Not being sought for mitigation

Table 6a. **Vegetation Condition Assessment**

Reach ID **SFHC Reaches 1 and 2; UT1 Reach B**

Planted Acreage **4.3**

Vegetation Category	Definitions	Mapping Threshold	CCPV Depiction	Number of Polygons	Combined Acreage	% of Planted Acreage
1. Bare Areas	Very limited cover of both woody and herbaceous material.	0.1 acres	see figure	2	0.12	2.8%
2. Low Stem Density Areas	Woody stem densities clearly below target levels based on MY3, 4, or 5 stem count criteria.	0.1 acres	NA	0	0.00	0.0%
			Total	2	0.12	2.8%
3. Areas of Poor Growth Rates or Vigor	Areas with woody stems of a size class that are obviously small given the monitoring year.	0.25 acres	NA	0	0.00	0.0%
			Cumulative Total	2	0.12	2.8%

Easement Acreage **8.6**

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 SF	NA	4	0.04	0.5%
5. Easement Encroachment Areas	Areas or points (if too small to render as polygons at map scale).	none	NA	0	0.00	0.0%

Table 6b. **Vegetation Condition Assessment**

Reach ID **UT2 Reaches A and B**

Planted Acreage **1.4**

Vegetation Category	Definitions	Mapping Threshold	CCPV Depiction	Number of Polygons	Combined Acreage	% of Planted Acreage
1. Bare Areas	Very limited cover of both woody and herbaceous material.	0.1 acres	NA	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 acres	NA	0	0.00	0.0%
			Total	0	0	0.0%
3. Areas of Poor Growth Rates or Vigor	Areas with woody stems of a size class that are obviously small given the monitoring year.	0.25 acres	NA	0	0.00	0.0%
			Cumulative Total	0	0	0.0%

Easement Acreage **1.5**

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 SF	see figure	0	0.00	0.0%
5. Easement Encroachment Areas	Areas or points (if too small to render as polygons at map scale).	none	NA	0	0.00	0.0%

Table 6c. Vegetation Problem Areas Hoppers Creek-Melton Farm Stream Restoration Project: Project No. 92251			
SFHC Reach 1			
Feature Issue	**Station No.**	**Suspected Cause**	**Photo Number***
Bare Floodplain	See Plan View Figure	Standing water from frequent inundation	VPA1-1
		Unknown	VPA1-2
SFHC Reach 2			
Feature Issue	**Station No.**	**Suspected Cause**	**Photo Number**
Invasive/Exotic Populations	See Plan View Figure	*Rosa multiflora* and *Ligustrum sinense* : persisting after treatment within existing tree stand	VPA2-2
UT1 Reach B			
Feature Issue	**Station No.**	**Suspected Cause**	**Photo Number**
Invasive/Exotic Populations	See Plan View Figure	*Rosa multiflora* and *Lonicera japonica* : persisting after treatment from existing tree stand	VPA2-4
		Rosa multiflora: persisting after treatment	VPA2-5
		Rosa multiflora: persisting after treatment	VPA2-6
UT2 Reach B			
Feature Issue	**Station No.**	**Suspected Cause**	**Photo Number**

*Note: The first digit in the Photo Number column references the monitoring year and the second digit references the problem area or photo (which would be identical to a prior years problem area/photo number when persisting from a previous monitoring year).

South Fork Hoppers Creek (SFHC)
Stream Station Photos

SFHC P1D 1– Constructed Riffle

SFHC PID 2 – Constructed Riffle

SFHC PID 3 – Log vane in constructed pool

SFHC PID 4 – Constructed Riffle

SFHC PID 5 – Constructed Riffle

SFHC PID 6 – Log Sills and Root Wad

SFHC PID 7 – Constructed Riffle

SHFC PID 8 – Log Sills & Root Wad

SFHC PID 9 – Constructed Riffle

SFHC PID 10 – Confluence of UT1

SFHC PID 11 – Constructed Riffle

SFHC PID 12 – Double Drop Cross Vane below crossing

SFHC PID 13 – Log Sills & Root Wad

SFHC PID 14 – Log Sills & Root Wad

SFHC PID 15 – Log Sills & Root Wads

SFHC PID 16 – Log Vane & Matted Bank

SFHC PID 17 – Constructed Riffle at downstream terminus of project

South Fork Hoppers Creek (SFHC)
Stream Station Photos

UT1 P1D 1– Constructed Riffle

UT1 PID 2 – Constructed Riffle

UT1 PID 3 – Constructed Riffle

UT1 PID 4 – Constructed Riffle

UT1 PID 5 – Constructed Riffle

UT1 PID 6 – Log Sills

UT1 PID 7 – Constructed Riffle

UT1 PID 8 – Constructed Riffle

UT1 PID 9 – Ephemeral Pool in Right Floodplain

UT1 PID 10 – Log Sills

UT1 PID 11 – Constructed Riffle

UT1 PID 12 – Ephemeral Pool in Right Floodplain

UT1 PID 13 – Constructed Riffle

UT1 PID 14 – Log Sill

UT1 PID 15 – Constructed Riffle below stream crossing

UT1 PID 16 – Constructed Riffle

UT1 PID 17 – Log Sills

UT1 PID 18 – Constructed Riffle

UT1 PID 19 – Constructed Riffle

South Fork Hoppers Creek (SFHC)
Stream Station Photos

UT2 PID 1 – Constructed Riffle & Log Sill

UT2 PID 2 – Constructed Riffles & Log Sills

UT2 PID 3 – Stream crossing

South Fork Hoppers Creek (SFHC)
Stream Problem Area (SPA) Photos

SPA1-1 – SFHC Reach 1 Left bank scour

SPA1-2 – SFHC Reach 1 Right bank scour

SPA1-5 – UT2 Reach A Piping within riffle cascade around log sill

SPA1-6 – Ephemeral drainage channel bed erosion

SPA2-1 – SFHC Reach 1 Rootwad failure along left bank due to undercutting along bank

SPA2-2 – SFHC Reach 1 Right bank slumping

SPA2-3 – SFHC Reach 2 Left bank scour

SPA2-4 – UT2 Reach B Left bank slumping

South Fork Hoppers Creek (SFHC)
Vegetation Problem Area (VPA) Photos

VPA1-1 – SFHC Reach 1 Bare Floodplain Area

VPA1-2 – UT2 Reach 1 Bare Floodplain Area

VPA2-2 – SFHC Reach 2 Multiflora Rose

VPA2-4 – UT1B Multiflora Rose and Japanese Honeysuckle

VPA2-5 – UT1B Multiflora Rose

VPA2-6 – UT1B Multiflora Rose

South Fork Hoppers Creek (SFHC)
Vegetation Plot Photos

South Fork Hoppers Creek Project Area
Year 3 Monitoring - Vegetation Plot Photo Log

11/4/2014 - Veg Plot 13

11/4/2014 - Veg Plot 14

11/4/2014 - Veg Plot 15

11/4/2014 - Veg Plot 16

11/4/2014 - Veg Plot 17

11/4/2014 - Veg Plot 18

South Fork Hoppers Creek Project Area
Year 3 Monitoring - Vegetation Plot Photo Log

11/4/2014 - Veg Plot 19

11/4/2014 - Veg Plot 20

11/4/2014 - Veg Plot 21

11/4/2014 - Veg Plot 22

11/4/2014 - Veg Plot 23

11/4/2014 - Veg Plot WLP1

APPENDIX C

VEGETATION PLOT DATA

Table 7. Vegetation Plot Criteria Attainment Hoppers Creek-Melton Farm Mitigation Plan: EEP Project No. 92251			
Vegetation Plot ID	**Vegetation Survival Threshold Met?**	**Total/Planted Stem Count**	**Tract Mean**
13	Y	1174/76928	668
14	Y	1093/809	
15	N	202/202	
16	N	283/283	
17	Y	647/567	
18	Y	364/364	
19	N	283/283	
20	Y	567/567	
21	Y	1457/1052	
22	Y	971/647	
23	Y	688/688	
WLP1	N	283/283	

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

Table 8. CVS Vegetation Plot Metadata Hoppers Creek-Melton Farm Mitigation Plan: EEP Project No. 92251	
Report Prepared By	Kristi Suggs
Date Prepared	11/24/2014 13:33
Database name	cvs-eep-entrytool-v2.3.1_Asheville.mdb
Database location	C:\CVS\Asheville
Computer name	CHABLKSUGGS
File size	65089536
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.
PROJECT SUMMARY	
Project Code	92251
Project Name	South Muddy Cr. Stream Restoration
Description	This mitigation project consists of 7,389 LF of stream restoration and preservation efforts on South Muddy Creek and South Fork Hoppers (including 1 unnamed tributary) at the Melton Farm.
River Basin	Catawba
Length(ft)	7389
Stream-to-edge width (ft)	120
Area (sq m)	164733.86
Required Plots (calculated)	24
Sampled Plots	12

Table 9. CVS Stem Count Total and Planted by Plot and Species (with Annual Means)
Hoppers Creek-Melton Farm Mitigation Plan: EEP Project No. 92251

Tree Species	Common Name	Type	Current Data (MY3 2014)																						Annual Means									
			Plot 13		Plot 14		Plot 15		Plot 16		Plot 17		Plot 18		Plot 19		Plot 20		Plot 21		Plot 22		Plot 23		Plot WLP1		Current Mean		AB (2011)		MY1 (2012)		MY2 (2013)		MY4 (2015)		MY5 (2016)	
			P	T	P	T	P	T	P	T	P	T	P	T	P	T	P	T	P	T	P	T	P	T	P	T	P	T	P	T	P	T	P	T	P	T
Acer rubrum	Red Maple	Tree																							2	3	2	3								
Alnus serrulata	Hazel Alder	Tree					2	2	3	3			1	1									8	8	1	1	3	3				1	0	0		
Betula nigra	River Birch	Tree			1	1			1	1	3	3	2	2			3	3	4	4	3	3	3	3			3	3	2	3	3	2	2	2		
Celtis laevigata	Sugarberry	Tree	4	4															2	2							3	3	1	1	1	2	1	1		
Cornus amomum	Silky Dogwood	Shrub															1	1			1	1	2	2			1	1								
Diospyros virginiana	Persimmon	Tree	7	7	16	16	1	1					1	1	1	1	1	1	3	3							4	4	1	1	1	4	1	1		
Fraxinus pennsylvanica	Green Ash	Tree			1	1	1	1	2	2	6	6	1	1	3	3	2	2	4	4	3	3					3	3	2	3	3	3	2	3		
Juglans nigra	Black Walnut	Tree			2	2											3	3									3	3	2	2	2	3	2	2		
Liriodendron tulipfera	Tulip Poplar	Tree	7	7							1	1			2	2			1	1	4	4	1	1			3	3	3	3	3	3	3	3		
Nyssa sylvatica	Blackgum	Tree									1	1															1	1	2	2	2	2	2	2		
Platanus occidentalis	Sycamore	Tree							1	1	1	1	1	1	1	1	2	2	3	3			2	2	5	5	2	2	2	3	3	2	2	2		
Quercus sp.	Oak	Tree																			1	1					1	1								
Quercus palustris	Pin Oak	Tree									1	1	1	1					7	7	2	2			1	1	2	2	3	4	4	2	3	3		
Quercus phellos	Willow Oak	Tree											2	2			1	1									2	2	3	4	4	2	3	3		
Quercus rubra	N. Red Oak	Shrub	1	1							1	1					1	1	2	2	2	2					1	1	2	4	4	2	2	2		
Salix nigra	Black Willow	Tree																					1	1			1	1								
Salix sericea	Silky Willow	Tree					1	1																			1	1	1	1	1	1	0	0		
	Unknown																												2	2	2	1	1	1		
Volunteers																																				
Acer rubrum	Red Maple	Tree																		5		5						5				7		10		
Alnus serrulata	Hazel Alder	Tree																														2		0		
Cornus amomum	Silky Dogwood	Shrub																				2					2									
Betula nigra	River Birch	Tree										1															1					1		0		
Diospyros virginiana	Persimmon	Tree		5																							5					10		5		
Juglans nigra	Black Walnut	Tree																																0		
Liriodendron tulipfera	Tulip Poplar	Tree		5		5						1								5		1					3.4					5		4		
Platanus occidentalis	Sycamore	Tree																														1		2		
Quercus rubra	N. Red Oak	Tree																														1		0		
Salix sericea	Silky Willow	Tree				2																					2									
Salix spp.	Willow	Tree																														12		7		
	Plot area (acres)		0.025		0.025		0.025		0.025		0.025		0.025		0.025		0.025		0.025		0.025		0.025		0.025											
	Species Count		4	4	4	4	4	4	4	4	7	7	7	7	4	4	8	8	8	8	7	7	6	6	3	3	6	6	7	7	7	8	6	7		
P=Planted	Stems/Plot		19	29	20	27	5	5	7	7	14	16	9	9	7	7	14	14	26	36	16	24	17	17	7	7	13	17	19	19	19	29	13	21		
T=Total	Stems Per Acre		769	1174	809	1093	202	202	283	283	567	647	364	364	283	283	567	567	1052	1457	647	971	688	688	283	283	543	668	772	772	772	614	540	850		
	Total Stems Per Acre		1174		1093		202		283		647		364		283		567		1457		971		688		283		668		772	772	1184		850			

Notes: CVS Level 1 Survey performed. In most cases, the volunteers observed were approximately 30 - 100 cm in height. The information presented is purely for providing information about the species of trees that may occupy the riparian area that were not planted. In Plot 13, multiple tulip poplar and persimmon seedlings were noted but only 5 counted; in Plot 14, numerous tulip poplar saplings were noted but only 5 counted; in Plot 21, numerous tulip poplar and red maples were noted but only 5 counted; in Plot 22, numerous red maples were noted but only 5 were counted.

APPENDIX D

STREAM SURVEY DATA

South Fork Hoppers Creek - Reach 1

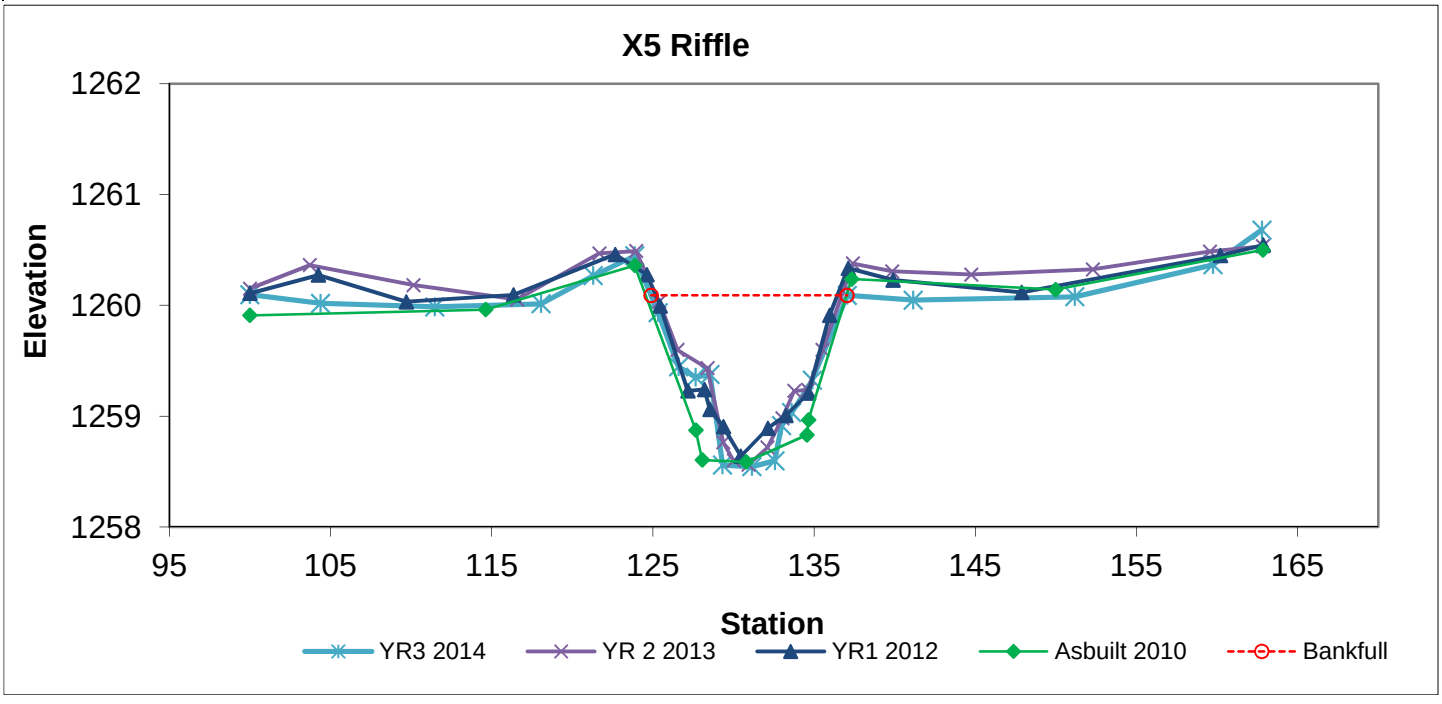
Permanent Cross Section X5

(Year 3 Monitoring - August 2014)

LEFT BANK

RIGHT BANK

Feature	Stream Type	BKF Area	BKF Width	BKF Depth	Max BKF Depth	W/D	BH Ratio	ER	BKF Elev	TOB Elev
Riffle	C	11	12.15	0.9	1.54	13.48	1	5.2	1260.24	1260.38



South Fork Hoppers Creek - Reach 1

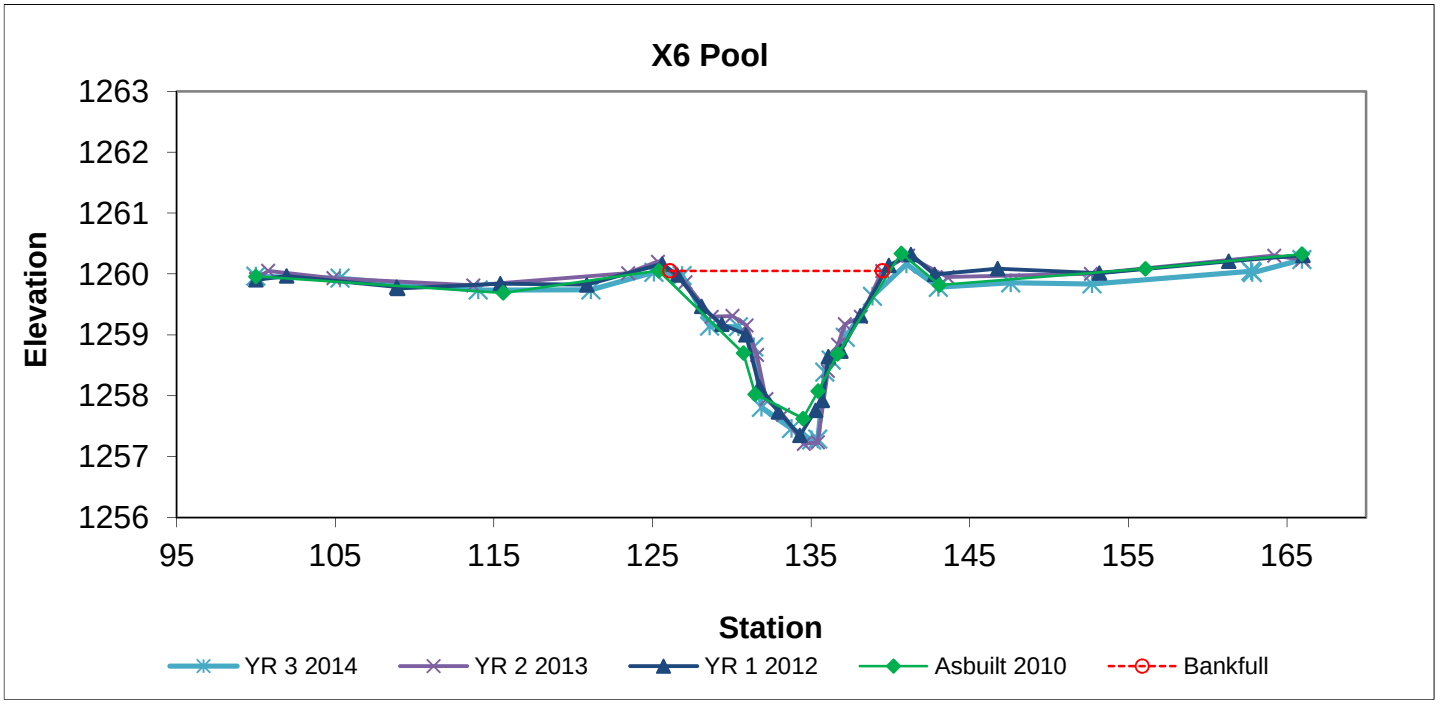
Permanent Cross Section X6

(Year 3 Monitoring - August 2014)

LEFT BANK

RIGHT BANK

Feature	Stream Type	BKF Area	BKF Width	BKF Depth	Max BKF Depth	W/D	BH Ratio	ER	BKF Elev	TOB Elev
Pool		16.8	13.39	1.26	2.7	10.65	1	4.9	1260.05	1260.2



South Fork Hoppers Creek - Reach 2

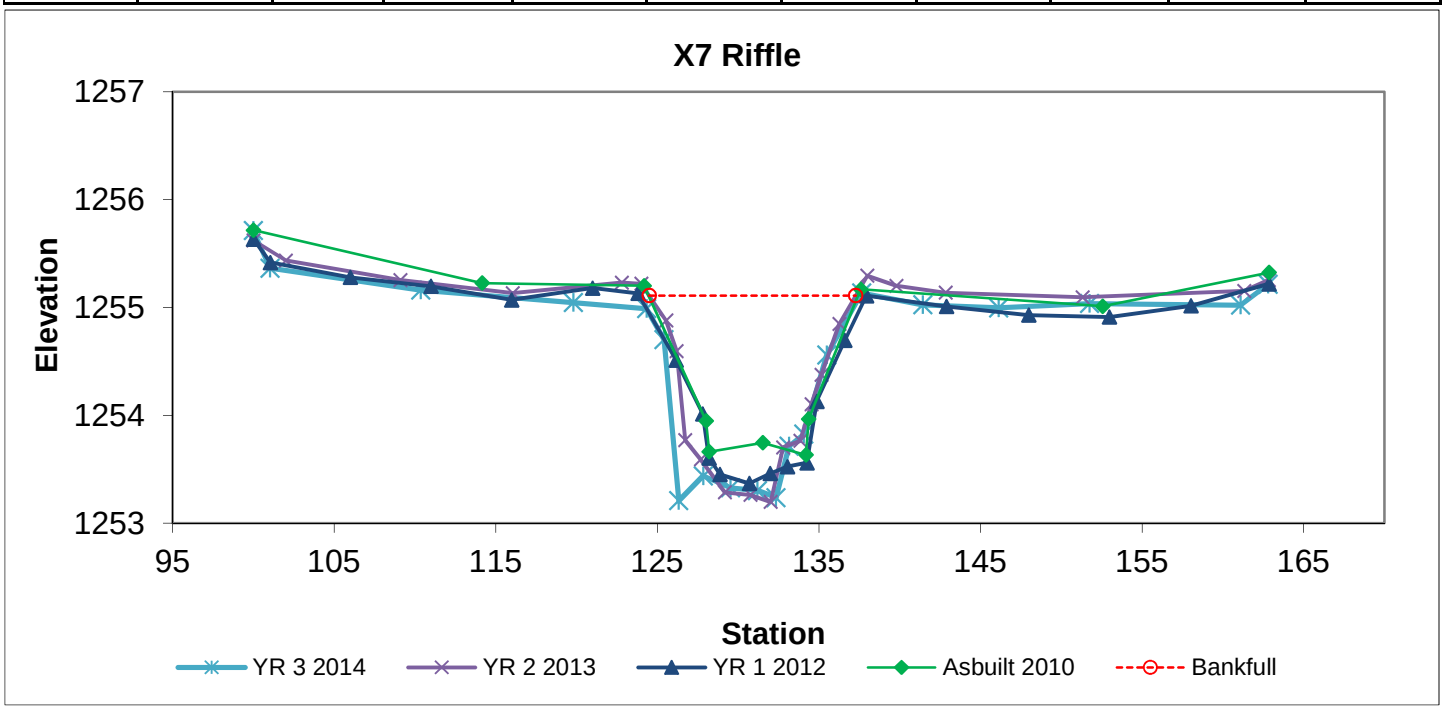
Permanent Cross Section X7

(Year 3 Monitoring - August 2014)

LEFT BANK

RIGHT BANK

Feature	Stream Type	BKF Area	BKF Width	BKF Depth	Max BKF Depth	W/D	BH Ratio	ER	BKF Elev	TOB Elev
Riffle	C	14.8	12.7	1.17	1.77	10.89	1	4.9	1255.11	1255.22



South Fork Hoppers Creek - Reach 2

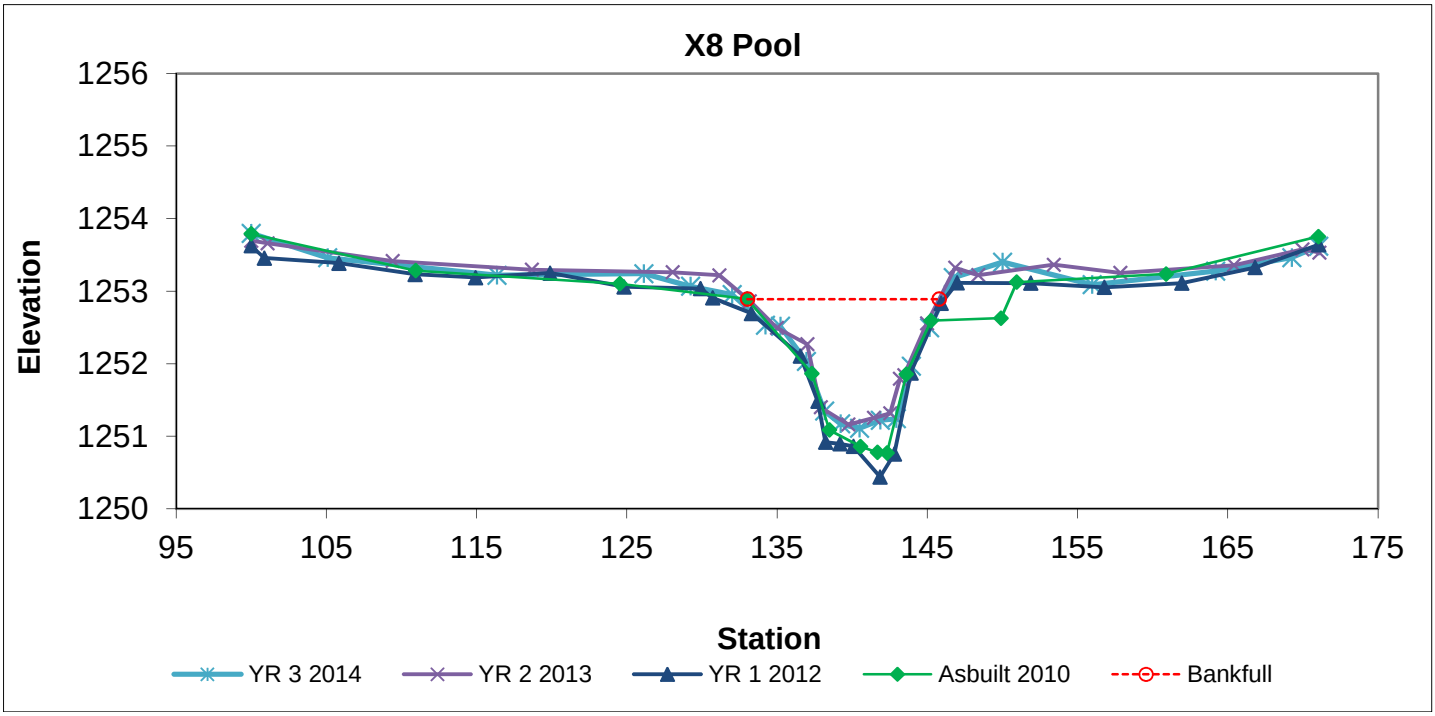
Permanent Cross Section X8

(Year 3 Monitoring - August 2014)

LEFT BANK

RIGHT BANK

Feature	Stream Type	BKF Area	BKF Width	BKF Depth	Max BKF Depth	W/D	BH Ratio	ER	BKF Elev	TOB Elev
Pool		13.6	13.72	0.99	1.78	13.85	1.2	5.2	1252.89	1253.22



UT1

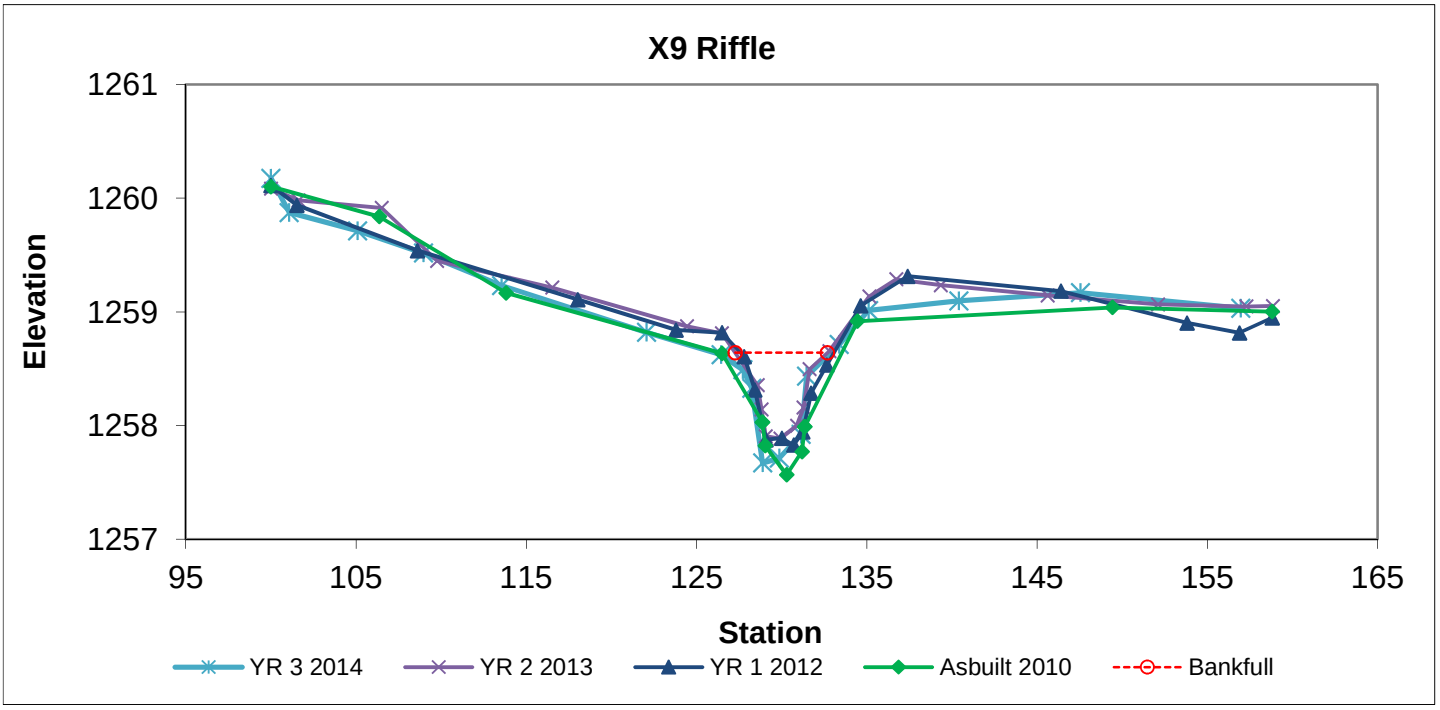
Permanent Cross Section X9

(Year 3 Monitoring - August 2014)

LEFT BANK

RIGHT BANK

Feature	Stream Type	BKF Area	BKF Width	BKF Depth	Max BKF Depth	W/D	BH Ratio	ER	BKF Elev	TOB Elev
Riffle	C	2.9	6.79	0.43	0.97	15.85	1	7.3	1258.64	1258.81



UT1

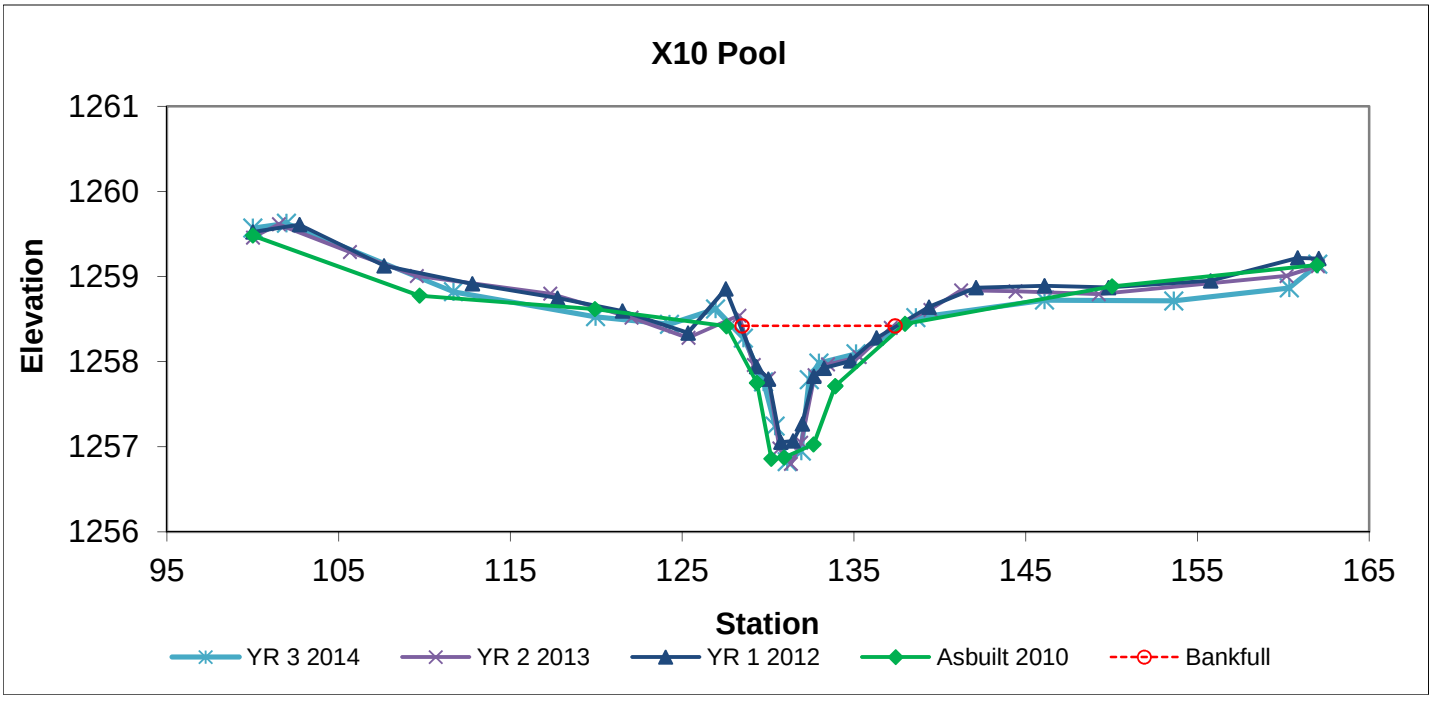
Permanent Cross Section X10

(Year 3 Monitoring - August 2014)

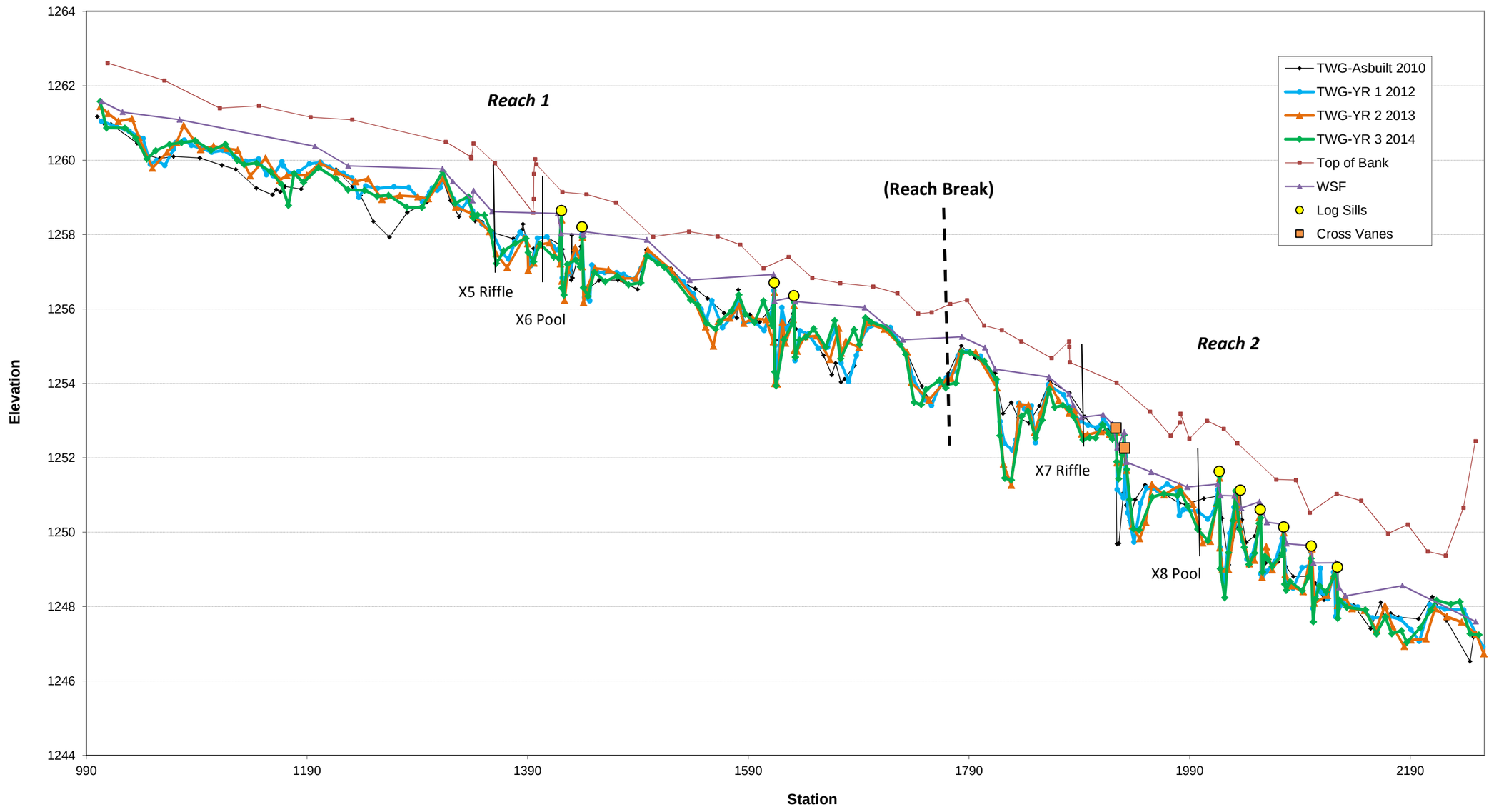
LEFT BANK

RIGHT BANK

Feature	Stream Type	BKF Area	BKF Width	BKF Depth	Max BKF Depth	W/D	BH Ratio	ER	BKF Elev	TOB Elev
Pool		5.4	9.94	0.55	1.6	18.19	1.1	6.2	1258.42	1258.54



South Fork Hoppers Creek (Reaches 1 and 2)
Profile Chart
Year 3 Monitoring- August 2014



South Fork Hoppers Creek - UT1B
Profile Chart
Year 3 Monitoring- August 2014

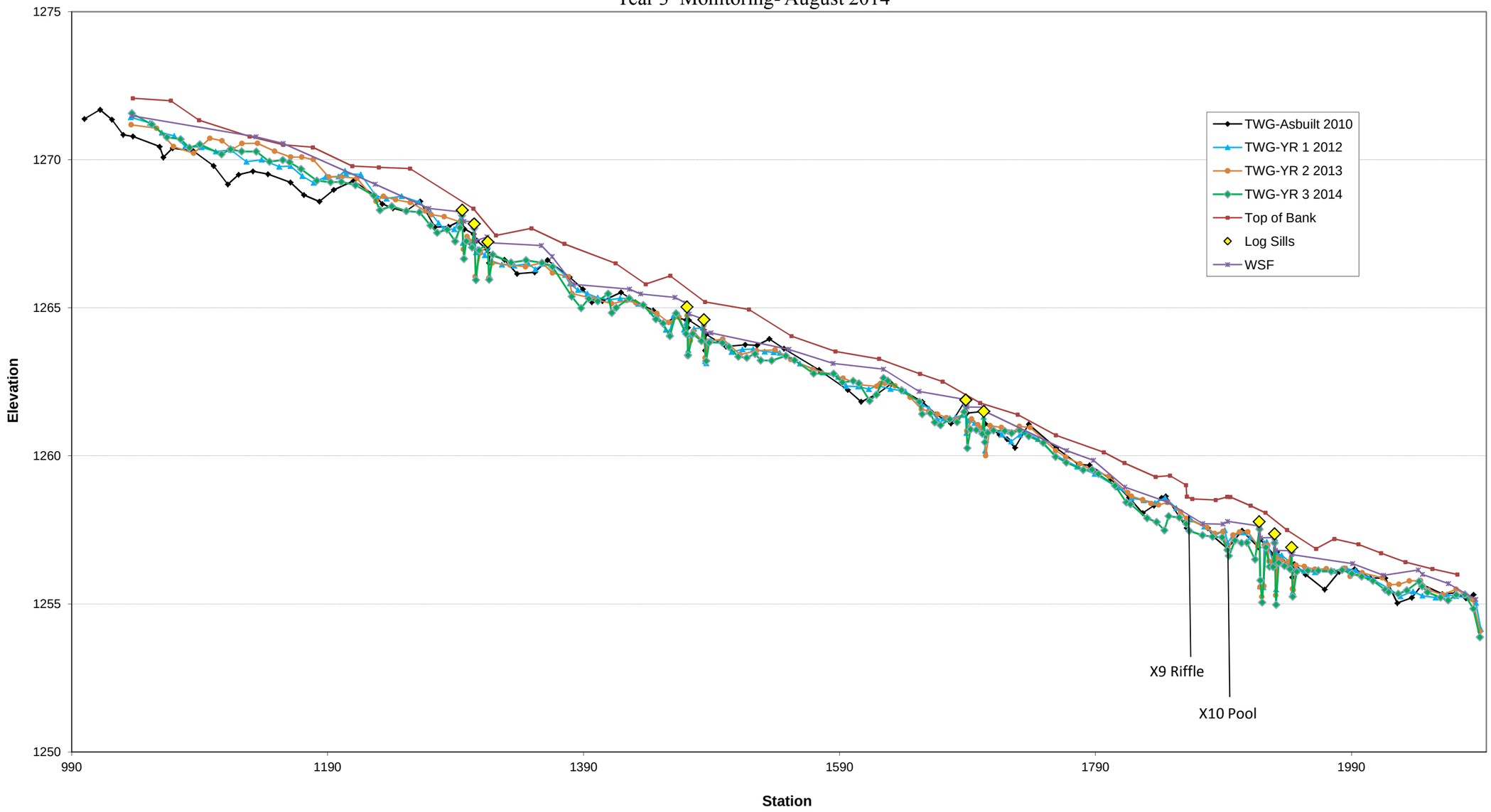
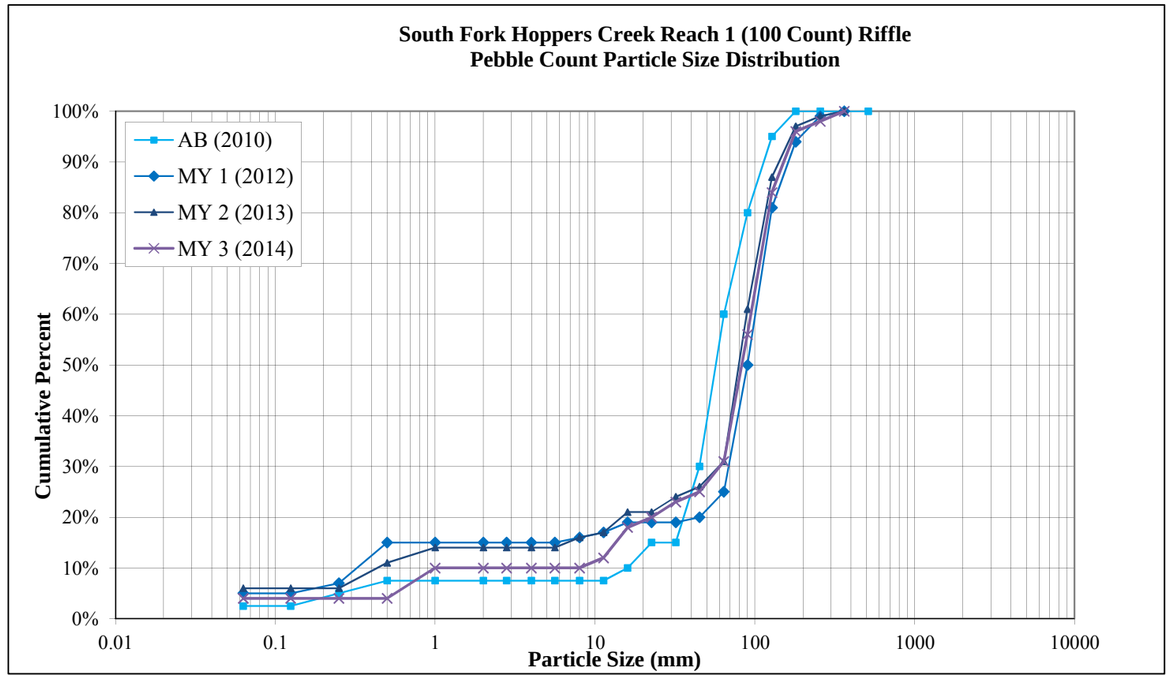


Figure 5a. Riffle Pebble Count Size Class Distribution with Annual Overlays

	BAKER PROJECT NO. 128244
SITE OR PROJECT:	Hoppers Creek-Melton Farm Stream Restoration Project
REACH/LOCATION:	Reach 1 - Cross-section 5 (Riffle)
DATE COLLECTED:	5-Sep-14
FIELD COLLECTION BY:	MDR
DATA ENTRY BY:	MDR

			PARTICLE CLASS COUNT	Summary	
MATERIAL	PARTICLE	SIZE (mm)	Riffle	Class %	% Cum
SILT/CLAY	Silt / Clay	< .063	4	4%	4%
SAND	Very Fine	.063 - .125			4%
	Fine	.125 - .25			4%
	Medium	.25 - .50			4%
	Coarse	.50 - 1.0	6	6%	10%
	Very Coarse	1.0 - 2.0			10%
GRAVEL	Very Fine	2.0 - 2.8			10%
	Very Fine	2.8 - 4.0			10%
	Fine	4.0 - 5.6			10%
	Fine	5.6 - 8.0			10%
	Medium	8.0 - 11.0	2	2%	12%
	Medium	11.0 - 16.0	6	6%	18%
	Coarse	16.0 - 22.6	2	2%	20%
	Coarse	22.6 - 32	3	3%	23%
	Very Coarse	32 - 45	2	2%	25%
	Very Coarse	45 - 64	6	6%	31%
COBBLE	Small	64 - 90	25	25%	56%
	Small	90 - 128	28	28%	84%
	Large	128 - 180	12	12%	96%
	Large	180 - 256	2	2%	98%
BOULDER	Small	256 - 362	2	2%	100%
	Small	362 - 512			
	Medium	512 - 1024			
	Large-Very Large	1024 - 2048			
BEDROCK	Bedrock	> 2048			
		Total	100	100%	100%

Cummulative	
Channel materials (mm)	
D_{16} =	14.12
D_{35} =	67.59
D_{50} =	82.93
D_{84} =	128.00
D_{95} =	174.96
D_{100} =	256-362



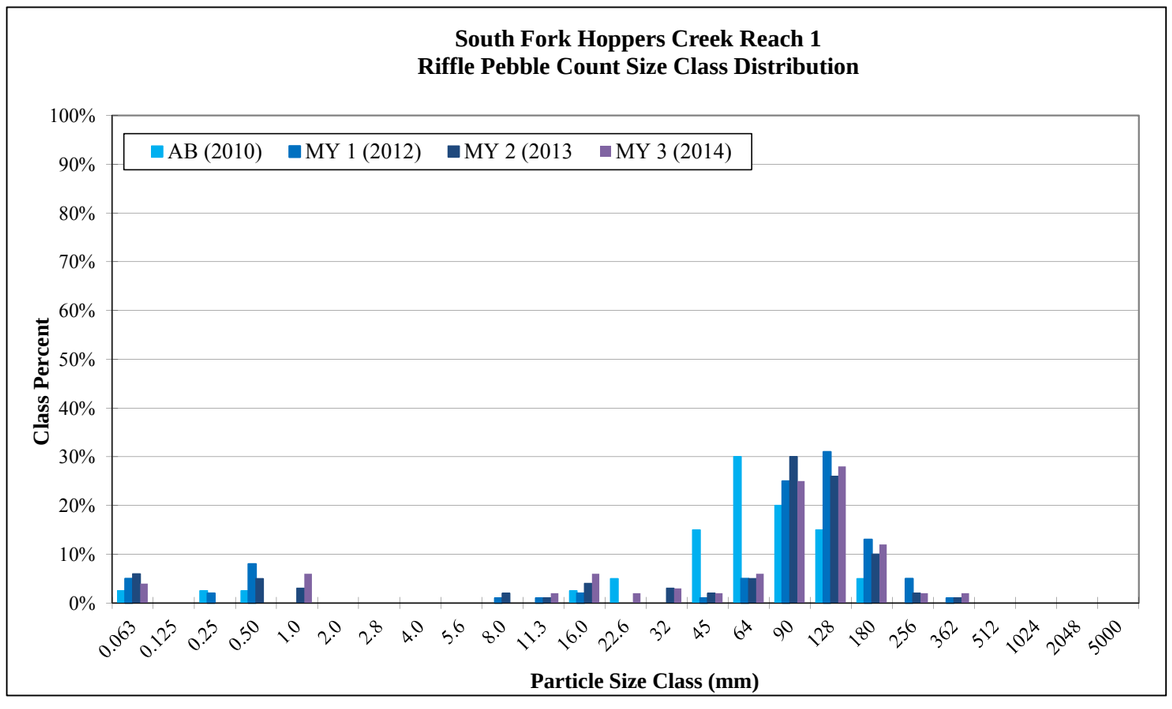
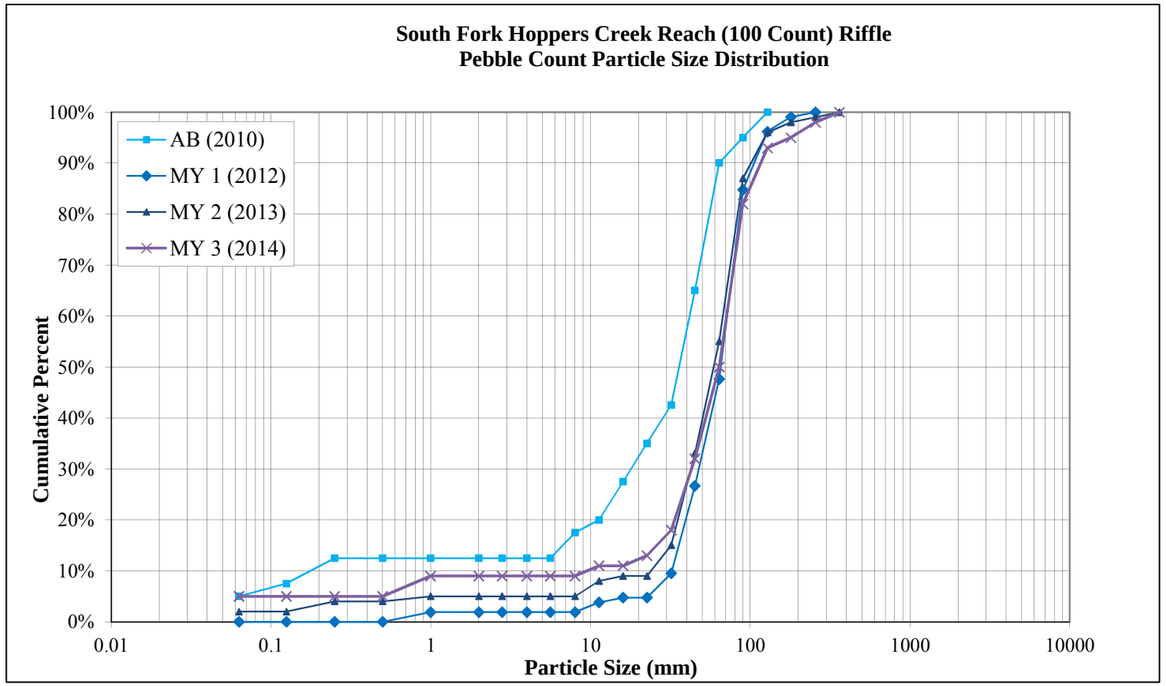


Figure 5b. Riffle Pebble Count Size Class Distribution with Annual Overlays

	BAKER PROJECT NO. 128244
SITE OR PROJECT:	Hoppers Creek-Melton Farm Stream Restoration Project
REACH/LOCATION:	Reach 2 - Cross-section 7 (Riffle)
DATE COLLECTED:	5-Sep-14
FIELD COLLECTION BY:	MDR
DATA ENTRY BY:	MDR

			PARTICLE CLASS COUNT	Summary	
MATERIAL	PARTICLE	SIZE (mm)	Riffle	Class %	% Cum
SILT/CLAY	Silt / Clay	< .063	5	5%	5%
SAND	Very Fine	.063 - .125			5%
	Fine	.125 - .25			5%
	Medium	.25 - .50			5%
	Coarse	.50 - 1.0	4	4%	9%
	Very Coarse	1.0 - 2.0			9%
GRAVEL	Very Fine	2.0 - 2.8			9%
	Very Fine	2.8 - 4.0			9%
	Fine	4.0 - 5.6			9%
	Fine	5.6 - 8.0			9%
	Medium	8.0 - 11.0	2	2%	11%
	Medium	11.0 - 16.0			11%
	Coarse	16.0 - 22.6	2	2%	13%
	Coarse	22.6 - 32	5	5%	18%
	Very Coarse	32 - 45	14	14%	32%
	Very Coarse	45 - 64	18	18%	50%
COBBLE	Small	64 - 90	32	32%	82%
	Small	90 - 128	11	11%	93%
	Large	128 - 180	2	2%	95%
	Large	180 - 256	3	3%	98%
BOULDER	Small	256 - 362	2	2%	100%
	Small	362 - 512			
	Medium	512 - 1024			
	Large-Very Large	1024 - 2048			
BEDROCK	Bedrock	> 2048			
		Total	100	100%	100%

Cummulative	
Channel materials (mm)	
D_{16} =	28.79
D_{35} =	48.71
D_{50} =	65.03
D_{84} =	104.02
D_{95} =	251.53
D_{100} =	256 - 362



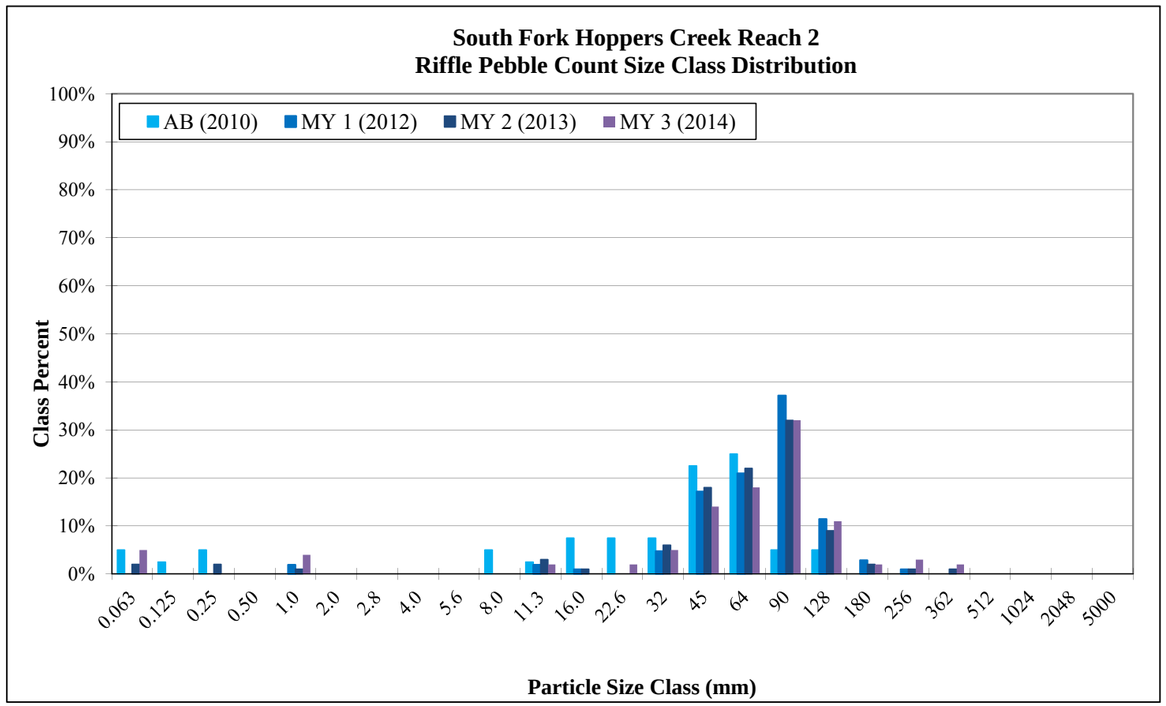
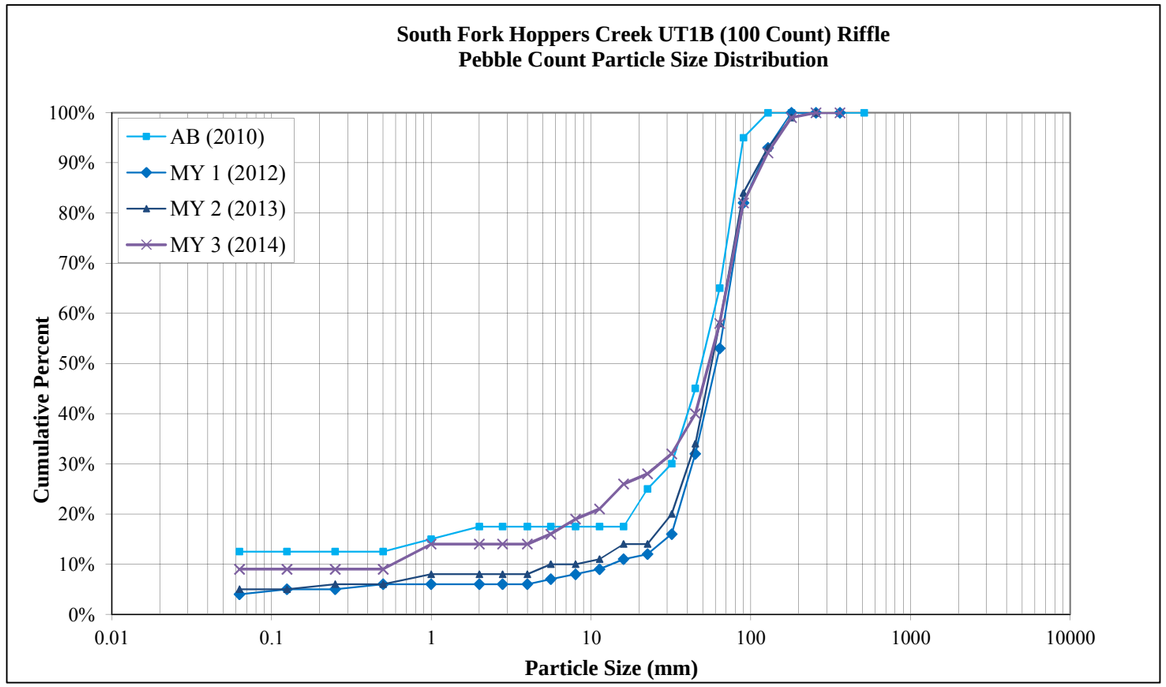


Figure 5c. Riffle Pebble Count Size Class Distribution with Annual Overlays

	BAKER PROJECT NO. 128244
SITE OR PROJECT:	Hoppers Creek-Melton Farm Stream Restoration Project
REACH/LOCATION:	UT1B - Cross-section 9 (Riffle)
DATE COLLECTED:	5-Sep-14
FIELD COLLECTION BY:	MDR
DATA ENTRY BY:	MDR

			PARTICLE CLASS COUNT	Summary	
MATERIAL	PARTICLE	SIZE (mm)	Riffle	Class %	% Cum
SILT/CLAY	Silt / Clay	< .063	9	9%	9%
SAND	Very Fine	.063 - .125			9%
	Fine	.125 - .25			9%
	Medium	.25 - .50			9%
	Coarse	.50 - 1.0	5	5%	14%
	Very Coarse	1.0 - 2.0			14%
GRAVEL	Very Fine	2.0 - 2.8			14%
	Very Fine	2.8 - 4.0			14%
	Fine	4.0 - 5.6	2	2%	16%
	Fine	5.6 - 8.0	3	3%	19%
	Medium	8.0 - 11.0	2	2%	21%
	Medium	11.0 - 16.0	5	5%	26%
	Coarse	16.0 - 22.6	2	2%	28%
	Coarse	22.6 - 32	4	4%	32%
	Very Coarse	32 - 45	8	8%	40%
	Very Coarse	45 - 64	18	18%	58%
COBBLE	Small	64 - 90	24	24%	82%
	Small	90 - 128	10	10%	92%
	Large	128 - 180	7	7%	99%
	Large	180 - 256	1	1%	100%
BOULDER	Small	256 - 362			
	Small	362 - 512			
	Medium	512 - 1024			
	Large-Very Large	1024 - 2048			
BEDROCK	Bedrock	> 2048			
		Total	100	100%	100%

Cummulative	
Channel materials (mm)	
D_{16} =	5.60
D_{35} =	36.36
D_{50} =	54.73
D_{84} =	96.57
D_{95} =	148.14
D_{100} =	180 - 256



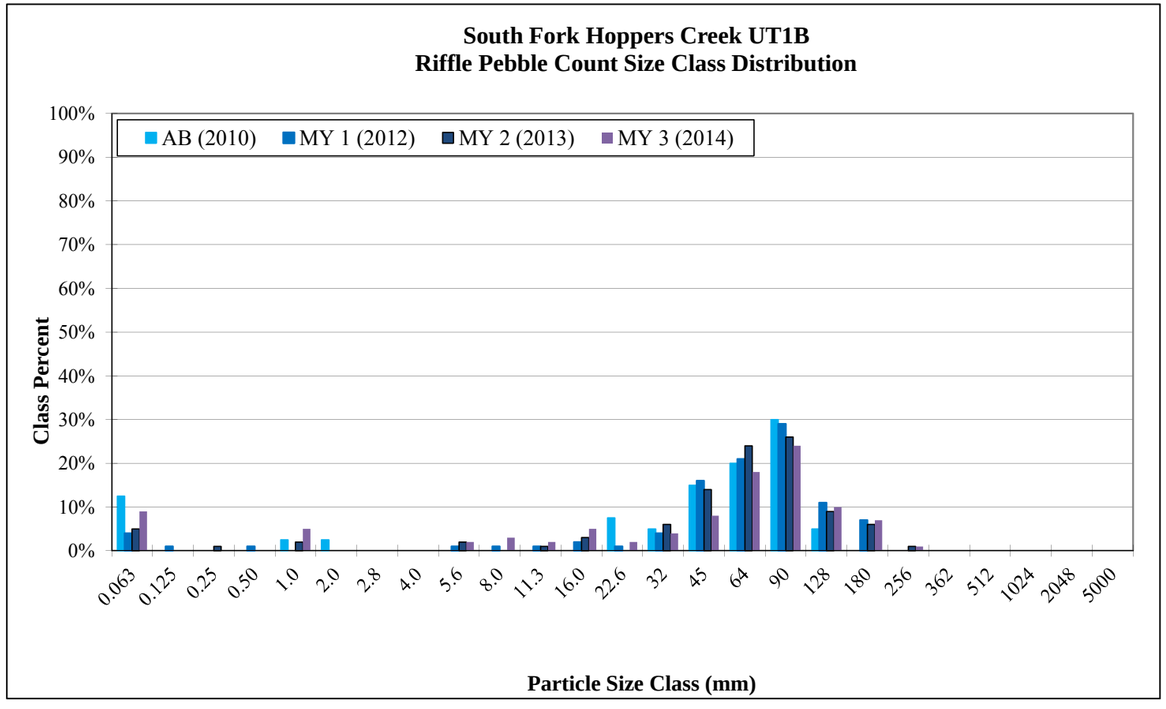


Table 10. Baseline Stream Summary
Hoppers Creek-Melton Farm Mitigation Plan: EEP Project No. 92251

South Fork Hoppers Creek Reach 1 (783 LF)

Parameter	USGS Gauge		Regional Curve Interval (Harman et al, 1999)[1]			Pre-Existing Condition						Reference Reach(es) Data Sal's Branch						Reference Reach(es) Data Spencer Creek Downstream						Design						As-built					
	Jacob	Norwood	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	Min	Mean	Med	Max	SD	n
Dimension and Substrate - Riffle																																			
BF Width (ft)	61.3	32	5.0	20.0	8.7	7.4	10.5	-----	14.4	-----	3	-----	8.7	-----	-----	-----	1	-----	10.7	-----	-----	-----	1	-----	13.2	-----	-----	-----	1	-----	13.1	-----	-----	-----	1
Floodprone Width (ft)	96.3	-----	-----	-----	-----	16.8	26.2	-----	33.0	-----	3	-----	163.0	-----	-----	-----	1	-----	60.0	-----	-----	-----	1	-----	50+	-----	-----	-----	8	-----	62.9	-----	-----	-----	1
BF Mean Depth (ft)	4.7	3.1	0.7	2.0	1.2	1.0	1.2	-----	1.6	-----	3	-----	1.2	-----	-----	-----	1	-----	1.6	-----	-----	-----	1	-----	1.0	-----	-----	-----	1	-----	1.1	-----	-----	-----	1
BF Max Depth (ft)	5.8	-----	-----	-----	-----	1.7	1.9	-----	2.0	-----	3	-----	2.4	-----	-----	-----	1	-----	2.1	-----	-----	-----	1	-----	1.3	-----	-----	-----	1	-----	1.7	-----	-----	-----	1
BF Cross-sectional Area (ft^2)	290.3	99	6.0	26.0	13.0	7.4	12.5	-----	15.6	-----	3	-----	10.4	-----	-----	-----	1	-----	17.8	-----	-----	-----	1	-----	13.8	-----	-----	-----	1	-----	15.0	-----	-----	-----	1
Width/Depth Ratio	13	10.3	-----	-----	-----	6.1	9.3	-----	14.4	-----	3	-----	7.3	-----	-----	-----	1	-----	5.7	-----	-----	-----	1	-----	13.2	-----	-----	-----	1	-----	11.5	-----	-----	-----	1
Entrenchment Ratio	1.6	-----	-----	-----	-----	2.0	2.6	-----	3.4	-----	3	-----	18.7	-----	-----	-----	1	-----	5.5	-----	-----	-----	1	-----	3.8+	-----	-----	-----	8	-----	4.8	-----	-----	-----	1
Bank Height Ratio	1.3	-----	-----	-----	-----	1.3	2.2	-----	2.6	-----	5+	-----	1.2	-----	-----	-----	1	-----	1.0	-----	-----	-----	1	-----	1.0	-----	-----	-----	1	-----	1.0	-----	-----	-----	1
d50 (mm)	-----	-----	-----	-----	-----	-----	0.7	-----	-----	-----	1	-----	9.5	-----	-----	-----	-----	-----	8.8	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Pattern																																			
Channel Beltwidth (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	10	-----	-----	16	-----	4	38.3	-----	-----	40.8	-----	2	54.0	-----	-----	78.0	-----	8	40.0	62.1	62.0	87.0	14.0	7
Radius of Curvature (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	13.1	-----	-----	29.6	-----	4	10.9	-----	-----	14.6	-----	5	37.0	-----	-----	53.0	-----	8	34.0	39.9	39.0	47.0	5.4	7
Rc:Bankfull width (ft/ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	4.4	-----	-----	5.2	-----	3	1.3	-----	-----	1.4	-----	5	2.8	-----	-----	4.0	-----	8	2.6	3.0	3.0	3.6	0.4	7
Meander Wavelength (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	38	-----	-----	45	-----	3	46	-----	-----	48	-----	2	130.0	-----	-----	177.0	-----	6	146.0	162.0	158.0	184.0	15.7	6
Meander Width Ratio	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	1.2	-----	-----	1.8	-----	4	3.4	-----	-----	3.6	-----	2	4.1	-----	-----	5.9	-----	8	3.1	4.7	4.7	6.6	1.1	7
Profile																																			
Riffle Length (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	30.0	36.0	37.0	45.0	6.4	6
Riffle Slope (ft/ft)	-----	-----	-----	-----	-----	0.015	0.025	-----	0.035	-----	15	0.03	-----	-----	0.04	-----	4	-----	0.013	-----	-----	-----	2	0.013	-----	-----	0.0305	-----	6	0.01	0.02	0.02	0.03	0.01	6
Pool Length (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Pool Spacing (ft)	-----	-----	-----	-----	-----	27.0	66.0	-----	161.0	-----	14	35.5	-----	-----	47	-----	3	-----	71	-----	-----	-----	5	82.0	-----	-----	118.0	-----	7	74.0	103.0	100.0	129.0	18.0	7
Pool Max Depth (ft)	-----	-----	-----	-----	-----	2.1	2.2	-----	2.4	-----	3	-----	3.1	-----	-----	-----	1	-----	3.3	-----	-----	-----	1	-----	2.0	-----	-----	-----	9	-----	2.4	-----	-----	-----	1
Pool Volume (ft^3)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Substrate and Transport Parameters																																			
Ri% / Ru% / P% / G% / S%	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
SC% / Sa% / G% / B% / Be%	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
d16 / d35 / d50 / d84 / d95	-----	-----	-----	-----	-----			<0.2 / 0.38 / 0.69 /26 / 67						48 / N/A / 9.5/ 30 / N/A						<0.062 / 3 / 8.8 / 42 / 90						-----	-----	-----	-----	-----	-----			33 / 46 / 57 / 100 / 128			
Reach Shear Stress (competency) lb/f²	-----	-----	-----	-----	-----	0.5	-----	-----	0.76	-----	3	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	0.4	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Max part size (mm) mobilized at bankfull (Rosgen Curve)	-----	-----	-----	-----	-----	-----	200.0	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	100.0	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Stream Power (transport capacity) W/m²	-----	-----	-----	-----	-----	27.9	-----	-----	48.8	-----	3	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	22.9	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Additional Reach Parameters																																			
Drainage Area (SM)	25.7	7.2	-----	-----	-----	-----	-----	-----	0.5	-----	-----	-----	-----	-----	0.2	-----	-----	-----	-----	-----	1.0	-----	-----	-----	-----	-----	0.52	-----	-----	-----	-----	-----	0.52	-----	-----
Impervious cover estimate (%)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Rosgen Classification	C4	E	-----	-----	-----	-----	G5c	-----	-----	-----	-----	-----	E4	-----	-----	-----	-----	-----	E4	-----	-----	-----	-----	-----	C5	-----	-----	-----	-----	-----	E5/C5	-----	-----	-----	-----
BF Velocity (fps)[2]	3.9	2.6	-----	-----	-----	3.2	-----	-----	6.8	-----	3	-----	-----	-----	-----	-----	-----	-----	5.4	-----	-----	-----	-----	-----	3.6	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
BF Discharge (cfs)	1140	254	18.0	160.0	52.4	-----	50	-----	-----	-----	3	-----	-----	-----	-----	-----	-----	-----	97.0	-----	-----	-----	-----	-----	50.0	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Valley Length (ft)	-----	-----	-----	-----	-----	-----	1016.0	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	619.0	-----	-----	-----	-----
Channel length (ft)	850	-----	-----	-----	-----	-----	1016.0	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	783.0	-----	-----	-----	-----
Sinuosity	1.06	-----	-----	-----	-----	-----	1.14	-----	-----	-----	-----	-----	1.19	-----	-----	-----	-----	-----	2.30	-----	-----	-----	-----	-----	1.20	-----	-----	-----	-----	1.26	-----	-----	-----	-----
Water Surface Slope (Channel) (ft/ft)	-----	-----	-----	-----	-----	-----	0.0101	-----	-----	-----	-----	-----	0.0109	-----	-----	-----	-----	-----	0.0047	-----	-----	-----	-----	-----	0.0077	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
BF slope (ft/ft)	0.0025	0.0008	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Bankfull Floodplain Area (acres)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
BEHI VL% / L% / M% / H% / VH% / E%	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Channel Stability or Habitat Metric	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Biological or Other	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----

1. The rural region curve by Harman, etal. 1999 was used for these parameters.
2. An insufficent amount of water surface data was collected along this reach which resulted in not being able to accurately calculate water surface and bankfull velocity.

South Fork Hoppers Creek Reach 2 (445 LF)

Parameter	USGS Gauge		Regional Curve Interval (Harman et al, 1999)[1]			Pre-Existing Condition						Reference Reach(es) Data Sal's Branch						Reference Reach(es) Data Spencer Creek Downstream						Design						As-built					
	Jacob	Norwood	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	Min	Mean	Med	Max	SD	n
Dimension - Riffle																																			
BF Width (ft)	61.3	32	5.3	21.0	9.0	7.4	10.5	-----	14.4	-----	3	-----	8.7	-----	-----	-----	1	-----	10.7	-----	-----	-----	1	-----	14.2	-----	-----	-----	1	-----	13.3	-----	-----	-----	1
Floodprone Width (ft)	96.3	-----	-----	-----	-----	16.8	26.2	-----	33.0	-----	3	-----	163.0	-----	-----	-----	1	-----	60.0	-----	-----	-----	1	-----	50+	-----	-----	-----	2	-----	62.9	-----	-----	-----	1
BF Mean Depth (ft)	4.7	3.1	0.75	2	1.2	1.0	1.2	-----	1.6	-----	3	-----	1.2	-----	-----	-----	1	-----	1.6	-----	-----	-----	1	-----	0.9	-----	-----	-----	1	-----	1.0	-----	-----	-----	1
BF Max Depth (ft)	5.8	-----	-----	-----	-----	1.7	`	-----	2.0	-----	3	-----	2.4	-----	-----	-----	1	-----	2.1	-----	-----	-----	1	-----	1.2	-----	-----	-----	1	-----	1.5	-----	-----	-----	1
BF Cross-sectional Area (ft^2)	290.3	99	6.0	27.0	13.7	7.4	12.5	-----	15.6	-----	3	-----	10.4	-----	-----	-----	1	-----	17.8	-----	-----	-----	1	-----	12.7	-----	-----	-----	1	-----	13.5	-----	-----	-----	1
Width/Depth Ratio	13	10.3	-----	-----	-----	6.1	9.3	-----	14.4	-----	3	-----	7.3	-----	-----	-----	1	-----	5.7	-----	-----	-----	1	-----	15.8	-----	-----	-----	1	-----	13.1	-----	-----	-----	1
Entrenchment Ratio	1.6	-----	-----	-----	-----	2.0	2.6	-----	3.4	-----	3	-----	18.7	-----	-----	-----	1	-----	5.5	-----	-----	-----	1	-----	3.8+	-----	-----	-----	1	-----	4.7	-----	-----	-----	1
Bank Height Ratio	1.3	-----	-----	-----	-----	1.3	2.2	-----	2.6	-----	5+	-----	1.2	-----	-----	-----	1	-----	1.0	-----	-----	-----	1	-----	1.0	-----	-----	-----	1	-----	1.0	-----	-----	-----	1
d50 (mm)	-----	-----	-----	-----	-----	-----	0.7	-----	-----	-----	1	-----	9.5	-----	-----	-----	-----	-----	8.8	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Pattern																																			
Channel Beltwidth (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	10	-----	-----	16	-----	4	38.3	-----	-----	40.8	-----	2	62.0	-----	-----	62.0	-----	3	62.0	62.5	62.5	63.0	-----	2
Radius of Curvature (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	13.1	-----	-----	29.6	-----	4	10.9	-----	-----	14.6	-----	5	45.0	-----	-----	87.0	-----	3	36.0	55.7	62.0	69.0	17..39	3
Rc:Bankfull Width (ft/ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	4.4	-----	-----	5.2	-----	3	1.3	-----	-----	1.4	-----	5	3.2	-----	-----	6.1	-----	3	2.5	3.9	4.4	4.9	1.2	3
Meander Wavelength (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	38	-----	-----	45	-----	3	46	-----	-----	48	-----	2	179.0	-----	-----	313.0	-----	2	178.0	246.5	246.5	315.0	-----	2
Meander Width Ratio	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	1.2	-----	-----	1.8	-----	4	3.4	-----	-----	3.6	-----	2	4.4	-----	-----	4.4	-----	3	4.4	4.4	4.4	4.4	-----	2
Profile																																			
Riffle Length (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	31	37	37	43	6	3
Riffle Slope (ft/ft)	-----	-----	-----	-----	-----	0.015	0.025	-----	0.035	-----	15	0.03	-----	-----	0.04	-----	4	-----	0.013	-----	-----	-----	2	0.0275	-----	-----	0.0330	-----	3	0.024	0.029	0.028	0.032	0.004	3
Pool Length (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Pool Spacing (ft)	-----	-----	-----	-----	-----	27.0	66.0	-----	161.0	-----	14	35.5	-----	-----	47	-----	3	-----	71	-----	-----	-----	5	138.0	-----	-----	176.0	-----	2	92	155	155	218	-----	2
Pool Max Depth (ft)	-----	-----	-----	-----	-----	2.1	2.2	-----	2.4	-----	3	-----	3.1	-----	-----	-----	1	-----	3.3	-----	-----	-----	1	2.5	-----	-----	2.7	-----	3	-----	2.1	-----	-----	-----	2
Pool Volume (ft^3)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Substrate and Transport Parameters																																			
Ri% / Ru% / P% / G% / S%	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
SC% / Sa% / G% / B% / Be%	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
d16 / d35 / d50 / d84 / d95	-----	-----	-----	-----	-----			<0.2 / 0.38 / 0.69 /26 / 67						48 / N/A / 9.5/ 30 / N/A						<0.062 / 3 / 8.8 / 42 / 90						-----	-----	-----	-----	-----	-----			7 / 22.6 / 36 / 60 / 90			
Reach Shear Stress (competency) lb/f²	-----	-----	-----	-----	-----	0.5	-----	-----	0.76	-----	3	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	0.8	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Max part size (mm) mobilized at bankfull (Rosgen Curve)	-----	-----	-----	-----	-----	-----	200.0	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	175.0	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Stream Power (transport capacity) W/m²	-----	-----	-----	-----	-----	27.9	-----	-----	48.8	-----	3	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	44	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Additional Reach Parameters																																			
Drainage Area (SM)	25.7	7.2	-----	-----	-----	-----	-----	-----	0.5	-----	-----	-----	-----	-----	0.2	-----	-----	-----	-----	-----	1.0	-----	-----	-----	-----	-----	0.52	-----	-----	-----	-----	-----	0.52	-----	-----
Impervious cover estimate (%)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Rosgen Classification	C4	E	-----	-----	-----	-----	G5c	-----	-----	-----	-----	-----	E4	-----	-----	-----	-----	-----	E4	-----	-----	-----	-----	-----	C5	-----	-----	-----	-----	-----	C5	-----	-----	-----	-----
BF Velocity (fps)[2]	3.9	2.6	-----	-----	-----	3.2	-----	-----	6.8	-----	3	-----	-----	-----	-----	-----	-----	-----	5.4	-----	-----	-----	-----	-----	3.9	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
BF Discharge (cfs)	1140	254	19.0	175.0	55.5	-----	50	-----	-----	-----	3	-----	-----	-----	-----	-----	-----	-----	97.0	-----	-----	-----	-----	-----	50.0	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Valley Length (ft)	-----	-----	-----	-----	-----	-----	1016.0	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	405	-----	-----	-----	-----
Channel length (ft)	850	-----	-----	-----	-----	-----	1016.0	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	415	-----	-----	-----	-----
Sinuosity	1.06	-----	-----	-----	-----	-----	1.14	-----	-----	-----	-----	-----	1.19	-----	-----	-----	-----	-----	2.30	-----	-----	-----	-----	-----	1.10	-----	-----	-----	-----	1.02	-----	-----	-----	-----
Water Surface Slope (Channel) (ft/ft)	-----	-----	-----	-----	-----	-----	0.0101	-----	-----	-----	-----	-----	0.0109	-----	-----	-----	-----	-----	0.0047	-----	-----	-----	-----	-----	0.0016	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
BF Slope (ft/ft)	0.0025	0.0008	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Banfull Floodplain Area (Acres)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
BEHI VL% / L% / M% / H% / VH% / E%	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Channel Stability or Habitat Metric	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Biological or Other	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----

1. The rural region curve by Harman, etal. 1999 was used for these parameters.
2. An insufficent amount of water surface data was collected along this reach which resulted in not being able to accurately calculate water surface and bankfull velocity.

Table 10. Baseline Stream Summary
Hoppers Creek-Melton Farm Mitigation Plan: EEP Project No. 92251

UT1B (1,065 LF)																													
Parameter	**USGS Gauge**	**Regional Curve Interval**			**Pre-Existing Condition**						**Reference Reach(es) Data Sal's Branch**						**Reference Reach(es) Data Spencer Creek Downstream**						**Design**						**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	Min	Mean	Med	Max	SD	n
Dimension - Riffle																																	
BF Width (ft)	-----	-----	-----	-----	3.4	4.6	-----	5.7	-----	2.0	-----	8.7	-----	-----	-----	1	-----	10.7	-----	-----	-----	1	-----	7.0	-----	-----	-----	1	-----	7.0	-----	-----	-----	1
Floodprone Width (ft)	-----	-----	-----	-----	9.8	51.1	-----	92.5	-----	2.0	-----	163.0	-----	-----	-----	1	-----	60.0	-----	-----	-----	1	-----	30+	-----	-----	-----	16	-----	51.0	-----	-----	-----	1
BF Mean Depth (ft)	-----	-----	-----	-----	0.6	0.8	-----	1.0	-----	2.0	-----	1.2	-----	-----	-----	1	-----	1.6	-----	-----	-----	1	-----	0.5	-----	-----	-----	1	-----	0.5	-----	-----	-----	1
BF Max Depth (ft)	-----	-----	-----	-----	1.3	1.4	-----	1.6	-----	2.0	-----	2.4	-----	-----	-----	1	-----	2.1	-----	-----	-----	1	-----	0.8	-----	-----	-----	1	-----	1.1	-----	-----	-----	1
BF Cross-sectional Area (ft^2)	-----	-----	-----	-----	3.4	3.5	-----	3.5	-----	2.0	-----	10.4	-----	-----	-----	1	-----	17.8	-----	-----	-----	1	-----	3.6	-----	-----	-----	1	-----	3.7	-----	-----	-----	1
Width/Depth Ratio	-----	-----	-----	-----	3.4	6.5	-----	9.5	-----	2.0	-----	7.3	-----	-----	-----	1	-----	5.7	-----	-----	-----	1	-----	13.8	-----	-----	-----	1	-----	13.3	-----	-----	-----	1
Entrenchment Ratio	-----	-----	-----	-----	2.9	9.5	-----	16.2	-----	2.0	-----	18.7	-----	-----	-----	1	-----	5.5	-----	-----	-----	1	-----	4.3+	-----	-----	-----	1	-----	7.3	-----	-----	-----	1
Bank Height Ratio	-----	-----	-----	-----	1.1	2.0	-----	4.5	-----	5+	-----	1.2	-----	-----	-----	1	-----	1.0	-----	-----	-----	1	-----	1.0	-----	-----	-----	1	-----	1.0	-----	-----	-----	1
d50 (mm)	-----	-----	-----	-----	-----	0.46	-----	-----	-----	-----	-----	9.5	-----	-----	-----	-----	-----	8.8	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Pattern																																	
Channel Beltwidth (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	10	-----	-----	16	-----	4	38.3	-----	-----	40.8	-----	2	32.0	-----	-----	59.0	-----	16	28.0	43.5	41.5	57.0	8.9	14
Radius of Curvature (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	13.1	-----	-----	29.6	-----	4	10.9	-----	-----	14.6	-----	5	14.0	-----	-----	24.0	-----	16	12.0	19.4	19.0	27.0	4.0	15
Rc:Bankfull Width (ft/ft)	-----	-----	-----	-----			-----	-----	-----	-----	4.4	-----	-----	5.2	-----	3	1.3	-----	-----	1.4	-----	5	2.0	-----	-----	3.4	-----	16	1.7	2.8	2.7	3.9	0.6	15
Meander Wavelength (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	38	-----	-----	45	-----	3	46	-----	-----	48	-----	2	58.0	-----	-----	134.0	-----	13	76.0	97.9	94.0	120.0	14.1	13
Meander Width Ratio	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	1.2	-----	-----	1.8	-----	4	3.4	-----	-----	3.6	-----	2	4.6	-----	-----	8.4	-----	16	4.0	6.2	5.9	8.1	1.3	14
Profile																																	
Riffle Length (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	17.0	27.0	30.0	47.0	8.0	11
Riffle Slope (ft/ft)	-----	-----	-----	-----	0.033	0.127	-----	0.564	-----	19	0.03	-----	-----	0.04	-----	4	-----	0.013	-----	-----	-----	2	0.0198	-----	-----	0.0371	-----	12	0.010	0.030	0.020	0.040	0.009	11
Pool Length (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Pool Spacing (ft)	-----	-----	-----	-----	14.0	52.0	-----	110.0	-----	9	35.5	-----	-----	47	-----	3	-----	71	-----	-----	-----	5	42.0	-----	-----	105.0	-----	15	49	63	69	106	20	14
Pool Max Depth (ft)	-----	-----	-----	-----	1.3	1.5	-----	1.6	-----	2	-----	3.1	-----	-----	-----	1	-----	3.3	-----	-----	-----	1	1.0	-----	-----	2.0	-----	16	-----	1.6	-----	-----	-----	1
Pool Volume (ft^3)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Substrate and Transport Parameters																																	
Ri% / Ru% / P% / G% / S%	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
SC% / Sa% / G% / B% / Be%	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
d16 / d35 / d50 / d84 / d95	-----	-----	-----	-----				0.17 / 0.33 / 0.46 / 22 / 56						48 / N/A / 9.5/ 30 / N/A						<0.062 / 3 / 8.8 / 42 / 90			-----	-----	-----	-----	-----	-----				1.25 / 35 / 49 / 80 / 90		
Reach Shear Stress (competency) lb/f²	-----	-----	-----	-----	0.61	-----	-----	0.77	-----	2	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	0.4	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Max Part Size (mm) mobilized at bankfull (Rosgen Curve)	-----	-----	-----	-----	-----	200.0	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	20.0	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Stream Power (transport capacity) W/m²	-----	-----	-----	-----	34.5	-----	-----	45.5	-----	2	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	22.8	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Additional Reach Parameters																																	
Drainage Area (SM)	-----	-----	-----	-----	-----	-----	-----	0.1	-----	-----	-----	-----	-----	0.2	-----	-----	-----	-----	-----	1.0	-----	-----	-----	-----	-----	0.08	-----	-----	-----	-----	-----	0.08	-----	-----
Impervious cover estimate (acres	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Rosgen Classification	-----	-----	-----	-----	-----	E5	-----	-----	-----	-----	-----	E4	-----	-----	-----	-----	-----	E4	-----	-----	-----	-----	-----	C5	-----	-----	-----	-----	-----	C5	-----	-----	-----	-----
Bankfull Velocity (fps)[2]	-----	-----	-----	-----	4	-----	-----	4.1	-----	2	-----	-----	-----	-----	-----	-----	-----	5.4	-----	-----	-----	-----	-----	4.2	-----	-----	-----	1.0	-----	-----	-----	-----	-----	-----
BF Discharge (cfs)	-----	-----	-----	-----	-----	14	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	97.0	-----	-----	-----	-----	-----	14.0	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Valley Length (ft)	-----	-----	-----	-----	-----	822	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	816.0	-----	-----	-----	-----
Channel length (ft)	-----	-----	-----	-----	-----	970	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	1035	-----	-----	-----	-----
Sinuosity	-----	-----	-----	-----	-----	1.18	-----	-----	-----	-----	-----	1.19	-----	-----	-----	-----	-----	2.30	-----	-----	-----	-----	-----	1.60	-----	-----	-----	-----	-----	1.27	-----	-----	-----	-----
Water Surface Slope (Channel) (ft/ft)	-----	-----	-----	-----	-----	0.0193	-----	-----	-----	-----	-----	0.0109	-----	-----	-----	-----	-----	0.0047	-----	-----	-----	-----	-----	0.0144	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
BF slope (ft/ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Bankfull Floodplain Area (acres)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
BEHI VL% / L% / M% / H% / VH% / E%	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Channel Stablibity or Habitat Metric	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Biological or Other	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----

2. An insufficent amount of water surface data was collected along this reach which resulted in not being able to accurately calculate water surface and bankfull velocity.

Table 11a. Cross-section Morphology Data Table												
Hoppers Creek-Melton Farm Mitigation Plan: EEP Project No. 92251												
South Fork Hoppers Creek Reach 1 (783 LF)												
	Cross-section 5 (Riffle)						Cross-section 6 (Pool)					
Dimension and substrate	Base	MY1	MY2	MY3	MY4	MY5	Base	MY1	MY2	MY3	MY4	MY5
Based on fixed baseline bankfull elevation												
Record Elevation (Datum) Used (ft)	1260.2	1260.2	1260.2	1260.2			1260.1	1260.1	1260.1	1260.1		
BF Width (ft)	13.1	12.1	12.3	12.2			14.6	13.5	13.4	13.4		
BF Mean Depth (ft)	1.1	1.0	0.9	0.9			1.2	1.3	1.3	1.3		
Width/Depth Ratio	11.5	12.5	13.1	13.5			11.8	10.7	10.7	10.7		
BF Cross-sectional Area (ft²)	15.0	11.8	11.6	11.0			18.0	17.1	16.7	16.8		
BF Max Depth (ft)	1.7	1.6	1.7	1.5			2.4	2.7	2.8	2.7		
Width of Floodprone Area (ft)	62.9	62.9	62.8	62.8			65.9	66.0	66.0	65.9		
Entrenchment Ratio	4.8	5.2	5.1	5.2			N/A	N/A	N/A	N/A		
Bank Height Ratio	1.0	1.0	1.1	1.0			1.0	1.0	1.1	1.0		
Wetted Perimeter (ft)	15.4	14.1	14.2	14.0			17.1	16.0	15.9	15.9		
Hydraulic Radius (ft)	1.0	0.8	0.8	0.8			1.1	1.1	1.1	1.1		

South Fork Hoppers Creek Reach 2 (445 LF)												
	Cross-section 7 (Riffle)						Cross-section 8 (Pool)					
Dimension and substrate	Base	MY1	MY2	MY3	MY4	MY5	Base	MY1	MY2	MY3	MY4	MY5
Based on fixed baseline bankfull elevation												
Record Elevation (Datum) Used (ft)	1255.17	1255.1*	1255.1	1255.1			1252.9	1252.9	1252.9	1252.9		
BF Width (ft)	13.3	14.1	12.8	12.7			17.5	15.2	12.8	13.7		
BF Mean Depth (ft)	1.0	1.1	1.2	1.2			0.9	1.1	1.0	1.0		
Width/Depth Ratio	13.1	13.3	11.1	10.9			19.0	13.9	13.3	13.9		
BF Cross-sectional Area (ft²)	13.5	14.8	14.8	14.8			16.0	16.6	12.3	13.6		
BF Max Depth (ft)	1.5	1.7	1.9	1.8			2.1	2.5	1.7	1.8		
Width of Floodprone Area (ft)	62.9	62.9	62.9	62.8			71.0	71.1	71.1	71.1		
Entrenchment Ratio	4.7	4.5	4.9	4.9			N/A	N/A	N/A	N/A		
Bank Height Ratio	1.0	1.0	1.1	1.0			1.0	1.0	1.2	1.2		
Wetted Perimeter (ft)	15.4	16.2	15.1	15.0			19.3	17.4	14.7	15.7		
Hydraulic Radius (ft)	0.9	0.9	1.0	1.0			0.8	1.0	0.8	0.9		

* A lower bankfull elevation datum was used in calulating bankful dimension values for MY1 instead of using the baseline bankfull elevation datum which normalized the data between the two monitoring periods thereby reducing data anomalies and enabled a more accurate representation and comparison of dimension parameters.

UT1B (1,065 LF)												
	Cross-section 9 (Riffle)						Cross-section 10 (Pool)					
Dimension and substrate	Base	MY1	MY2	MY3	MY4	MY5	Base	MY1	MY2	MY3	MY4	MY5
Based on fixed baseline bankfull elevation												
Record Elevation (Datum) Used (ft)	1258.6	1258.6	1258.6	1258.6			1258.4	1258.4	1258.4	1258.4		
BF Width (ft)	7.0	5.5	5.4	6.8			10.2	9.1	8.9	9.9		
BF Mean Depth (ft)	0.5	0.5	0.4	0.4			0.8	0.6	0.61	0.55		
Width/Depth Ratio	13.3	11.4	13.6	15.9			13.3	16.3	14.5	18.2		
BF Cross-sectional Area (ft²)	3.7	2.6	2.2	2.9			7.9	5.1	5.5	5.4		
BF Max Depth (ft)	1.1	0.8	0.8	1.0			1.6	1.4	1.6	1.6		
Width of Floodprone Area (ft)	51.0	51.0	47.5	49.8			62.0	62.0	62.0	62.0		
Entrenchment Ratio	7.3	8.8	8.8	7.3			N/A	N/A	N/A	N/A		
Bank Height Ratio	1.0	1.2	1.2	1.0			1.0	1.3	1.1	1.1		
Wetted Perimeter (ft)	8.1	6.4	6.2	7.7			11.8	10.2	10.1	11.0		
Hydraulic Radius (ft)	0.5	0.4	0.4	0.4			0.7	0.5	0.5	0.5		

Table 11b. Stream Reach Morphology
Hoppers Creek-Melton Farm Mitigation Plan: EEP Project No. 92251

South Fork Hoppers Creek Reach 1 (783 LF)

Parameter	Monitoring Baseline (As-built)						MY-1						MY-2						MY-3						MY-4						MY-5					
Dimension and Substrate - Riffle	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n
BF Width (ft)	-----	13.1	-----	-----	-----	1	-----	12.1	-----	-----	-----	1	-----	12.3	-----	-----	-----	1	-----	12.2	-----	-----	-----	1												
Floodprone Width (ft)	-----	62.9	-----	-----	-----	1	-----	62.9	-----	-----	-----	1	-----	62.8	-----	-----	-----	1	-----	62.8	-----	-----	-----	1												
BF Mean Depth (ft)	-----	1.1	-----	-----	-----	1	-----	1.0	-----	-----	-----	1	-----	0.9	-----	-----	-----	1	-----	0.9	-----	-----	-----	1												
BF Max Depth (ft)	-----	1.7	-----	-----	-----	1	-----	1.6	-----	-----	-----	1	-----	1.7	-----	-----	-----	1	-----	1.5	-----	-----	-----	1												
BF Cross-sectional Area (ft²)	-----	15.0	-----	-----	-----	1	-----	11.8	-----	-----	-----	1	-----	11.6	-----	-----	-----	1	-----	11.0	-----	-----	-----	1												
Width/Depth Ratio	-----	11.5	-----	-----	-----	1	-----	12.5	-----	-----	-----	1	-----	13.1	-----	-----	-----	1	-----	13.5	-----	-----	-----	1												
Entrenchment Ratio	-----	4.8	-----	-----	-----	1	-----	5.2	-----	-----	-----	1	-----	5.1	-----	-----	-----	1	-----	5.2	-----	-----	-----	1												
Bank Height Ratio	-----	1.0	-----	-----	-----	1	-----	1.0	-----	-----	-----	1	-----	1.1	-----	-----	-----	1	-----	1.0	-----	-----	-----	1												
d50 (mm)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----												
Pattern																																				
Channel Beltwidth (ft)	40.0	62.1	62.0	87.0	14.0	7																														
Radius of Curvature (ft)	34.0	39.9	39.0	47.0	5.4	7																														
Rc:Bankfull width (ft/ft)	2.6	3.0	3.0	3.6	0.4	7																														
Meander Wavelength (ft)	146.0	162.0	158.0	184.0	15.7	6																														
Meander Width Ratio	3.1	4.7	4.7	6.6	1.1	7																														
Profile																																				
Riffle Length (ft)	30.0	36.0	37.0	45.0	6.4	6	31	41	37	60	11.34	5	36	42	42	49	4.94	5	34	43	43	51	5.96	5												
Riffle Slope (ft/ft)	0.01	0.02	0.02	0.03	0.01	6	0.02	0.02	0.02	0.03	0.003	5	0.02	0.02	0.02	0.03	0.004	5	0.02	0.02	0.02	0.03	0.004	5												
Pool Length (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----												
Pool Spacing (ft)	74.0	103.0	100.0	129.0	18.0	7	79.0	102	110	127	19.5	5	75	101	106	118	18.4	5	77	102	104	119	15.9	5												
Substrate and Transport Parameters																																				
d16 / d35 / d50 / d84 / d95			33 / 46 / 57 / 100 / 128						8 / 73 / 89 / 138 / 192						8 / 67 / 79.4 / 122.9 / 168.1						14.1 / 67.6 / 82.9 / 128.0 / 175.0													
Reach Shear Stress (competency) lb/f²	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----												
Stream Power (transport capacity) W/m²	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----												
Additional Reach Parameters																																				
Drainage Area (SM)	-----	-----	-----	0.52	-----	-----	-----	-----	-----	0.52	-----	-----	-----	-----	-----	0.52	-----	-----	-----	-----	-----	0.52	-----	-----												
Rosgen Classification	-----	E5/C5	-----	-----	-----	-----	-----	E5/C5	-----	-----	-----	-----	-----	E5/C5	-----	-----	-----	-----	-----	E5/C5	-----	-----	-----	-----												
BF Velocity (fps)1	-----	3.6	-----	-----	-----	-----	-----	3.6	-----	-----	-----	-----	-----	3.6	-----	-----	-----	-----	-----	3.6	-----	-----	-----	-----												
BF Discharge (cfs)	-----	54.1	-----	-----	-----	-----	-----	42.5	-----	-----	-----	-----	-----	41.8	-----	-----	-----	-----	-----	39.6	-----	-----	-----	-----												
Valley Length (ft)	-----	619.0	-----	-----	-----	-----	-----	619.0	-----	-----	-----	-----	-----	619.0	-----	-----	-----	-----	-----	619.0	-----	-----	-----	-----												
Channel length (ft)	-----	783.0	-----	-----	-----	-----	-----	783.0	-----	-----	-----	-----	-----	783.0	-----	-----	-----	-----	-----	783.0	-----	-----	-----	-----												
Sinuosity	-----	1.26	-----	-----	-----	-----	-----	1.26	-----	-----	-----	-----	-----	1.26	-----	-----	-----	-----	-----	1.26	-----	-----	-----	-----												
Water Surface Slope (Channel) (ft/ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	0.01	-----	-----	-----	-----	-----	0.01	-----	-----	-----	-----												
BF slope (ft/ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----												

South Fork Hoppers Creek Reach 2 (445 LF)

Parameter	Monitoring Baseline (As-built)						MY-1						MY-2						MY-3						MY-4						MY-5					
Dimension and Substrate - Riffle	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n
BF Width (ft)	-----	13.3	-----	-----	-----	1	-----	14.0	-----	-----	-----	1	-----	12.8	-----	-----	-----	1	-----	12.7	-----	-----	-----	1												
Floodprone Width (ft)	-----	62.9	-----	-----	-----	1	-----	62.9	-----	-----	-----	1	-----	62.9	-----	-----	-----	1	-----	62.8	-----	-----	-----	1												
BF Mean Depth (ft)	-----	1.0	-----	-----	-----	1	-----	1.1	-----	-----	-----	1	-----	1.2	-----	-----	-----	1	-----	1.2	-----	-----	-----	1												
BF Max Depth (ft)	-----	1.5	-----	-----	-----	1	-----	1.7	-----	-----	-----	1	-----	1.9	-----	-----	-----	1	-----	1.8	-----	-----	-----	1												
BF Cross-sectional Area (ft²)	-----	13.5	-----	-----	-----	1	-----	14.8	-----	-----	-----	1	-----	14.8	-----	-----	-----	1	-----	14.8	-----	-----	-----	1												
Width/Depth Ratio	-----	13.1	-----	-----	-----	1	-----	13.3	-----	-----	-----	1	-----	11.1	-----	-----	-----	1	-----	10.9	-----	-----	-----	1												
Entrenchment Ratio	-----	4.7	-----	-----	-----	1	-----	4.5	-----	-----	-----	1	-----	4.9	-----	-----	-----	1	-----	4.9	-----	-----	-----	1												
Bank Height Ratio	-----	1.0	-----	-----	-----	1	-----	1.0	-----	-----	-----	1	-----	1.1	-----	-----	-----	1	-----	1.0	-----	-----	-----	1												
d50 (mm)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----												
Pattern																																				
Channel Beltwidth (ft)	62.0	62.5	62.5	63.0	-----	2																														
Radius of Curvature (ft)	36.0	55.7	62.0	69.0	17..39	3																														
Rc:Bankfull Width (ft/ft)	2.5	3.9	4.4	4.9	1.2	3																														
Meander Wavelength (ft)	178.0	246.5	246.5	315.0	-----	2																														
Meander Width Ratio	4.4	4.4	4.4	4.4	-----	2																														
Profile																																				
Riffle Length (ft)	31.0	37.0	37.0	43.0	6	3	29.9	38	34	50	8.6	3	32	44	44	54	11.10	3	34	44	45	52	9.18	3												
Riffle Slope (ft/ft)	0.024	0.029	0.028	0.032	0.004	3	0.018	0.025	0.026	0.031	0.005	3	0.019	0.025	0.027	0.029	0.005	3	0.021	0.026	0.027	0.029	0.004	3												
Pool Length (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----												
Pool Spacing (ft)	92	155	155	218	-----	2	73.0	88	81	110	15.9	3	72	80	75	92	10.78	3	74	81	77	91	9.073	3												
Substrate and Transport Parameters																																				
d16 / d35 / d50 / d84 / d95			7 / 22.6 / 36 / 60 / 90						36 / 51.8 / 65.4 / 89.4 / 123.4						32.6 / 46.5 / 59.1 / 87.2 / 123.1						28.8 / 48.7 /65.0 / 104.0 / 251.5													
Reach Shear Stress (competency) lb/f²	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----												
Stream Power (transport capacity) W/m²	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----												
Additional Reach Parameters																																				
Drainage Area (SM)	-----	-----	-----	0.52	-----	-----	-----	-----	-----	0.52	-----	-----	-----	-----	-----	0.52	-----	-----	-----	-----	-----	0.52	-----	-----												
Rosgen Classification	-----	C5	-----	-----	-----	-----	-----	C5	-----	-----	-----	-----	-----	C5	-----	-----	-----	-----	-----	C5	-----	-----	-----	-----												
BF Velocity (fps)1	-----	3.9	-----	-----	-----	-----	-----	3.9	-----	-----	-----	-----	-----	3.9	-----	-----	-----	-----	-----	3.9	-----	-----	-----	-----												
BF Discharge (cfs)	-----	52.767	-----	-----	-----	-----	-----	57.681	-----	-----	-----	-----	-----	57.72	-----	-----	-----	-----	-----	57.72	-----	-----	-----	-----												
Valley Length (ft)	-----	405	-----	-----	-----	-----	-----	405	-----	-----	-----	-----	-----	405	-----	-----	-----	-----	-----	405	-----	-----	-----	-----												
Channel length (ft)	-----	415	-----	-----	-----	-----	-----	415	-----	-----	-----	-----	-----	415	-----	-----	-----	-----	-----	415	-----	-----	-----	-----												
Sinuosity	-----	1.02	-----	-----	-----	-----	-----	1.02	-----	-----	-----	-----	-----	1.02	-----	-----	-----	-----	-----	1.02	-----	-----	-----	-----												
Water Surface Slope (Channel) (ft/ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	0.02	-----	-----	-----	-----	-----	0.02	-----	-----	-----	-----												
BF Slope (ft/ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----												

Table 11b. Stream Reach Morphology
Hoppers Creek-Melton Farm Mitigation Plan: EEP Project No. 92251

UT1B (1,065 LF)																																		
Parameter	**Monitoring Baseline (As-built)**						**MY-1**						**MY-2**						**MY-3**						**MY-4**						**MY-5**					
Dimension and Substrate - Riffle	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n
BF Width (ft)	-----	7.0	-----	-----	-----	1	-----	7.0	-----	-----	-----	1	-----	5.4	-----	-----	-----	1	-----	6.8	-----	-----	-----	1												
Floodprone Width (ft)	-----	51.0	-----	-----	-----	1	-----	51.0	-----	-----	-----	1	-----	47.5	-----	-----	-----	1	-----	49.8	-----	-----	-----	1												
BF Mean Depth (ft)	-----	0.5	-----	-----	-----	1	-----	0.5	-----	-----	-----	1	-----	0.4	-----	-----	-----	1	-----	0.4	-----	-----	-----	1												
BF Max Depth (ft)	-----	1.1	-----	-----	-----	1	-----	1.1	-----	-----	-----	1	-----	0.8	-----	-----	-----	1	-----	1.0	-----	-----	-----	1												
BF Cross-sectional Area (ft²)	-----	3.7	-----	-----	-----	1	-----	3.7	-----	-----	-----	1	-----	2.2	-----	-----	-----	1	-----	2.9	-----	-----	-----	1												
Width/Depth Ratio	-----	13.3	-----	-----	-----	1	-----	13.3	-----	-----	-----	1	-----	13.6	-----	-----	-----	1	-----	15.9	-----	-----	-----	1												
Entrenchment Ratio	-----	7.3	-----	-----	-----	1	-----	7.3	-----	-----	-----	1	-----	8.8	-----	-----	-----	1	-----	7.3	-----	-----	-----	1												
Bank Height Ratio	-----	1.0	-----	-----	-----	1	-----	1.0	-----	-----	-----	1	-----	1.2	-----	-----	-----	1	-----	1.0	-----	-----	-----	1												
d50 (mm)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----												
Pattern																																				
Channel Beltwidth (ft)	28.0	43.5	41.5	57.0	8.9	14																														
Radius of Curvature (ft)	12.0	19.4	19.0	27.0	4.0	15																														
Rc:Bankfull Width (ft/ft)	1.7	2.8	2.7	3.9	0.6	15																														
Meander Wavelength (ft)	76.0	97.9	94.0	120.0	14.1	13																														
Meander Width Ratio	4.0	6.2	5.9	8.1	1.3	14																														
Profile																																				
Riffle Length (ft)	17.0	27.0	30.0	47.0	8.0	11	17.0	33	42	53	12.2	7	16	38	43	52	14.34	5	15	39	46	51	14.88	5												
Riffle Slope (ft/ft)	0.010	0.030	0.020	0.040	0.009	11	0.022	0.024	0.025	0.027	0.002	7	0.019	0.024	0.024	0.029	0.003	5	0.018	0.023	0.024	0.029	0.004	5												
Pool Length (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----												
Pool Spacing (ft)	49.0	63.0	69.0	106.0	20.0	14.0	51.0	73	67	105	17.4	7	48	76	80	102	20.7	5	50	78	83	102	19.99	5												
Substrate and Transport Parameters																																				
d16 / d35 / d50 / d84 / d95	1.25 / 35 / 49 / 80 / 90						32 / 47.3 / 60.9 / 96 / 141.1						25.4 / 45.7 / 56.9 / 90 / 143.4						5.6 / 36.4 / 55.7 / 96.7 / 148.1																	
Reach Shear Stress (competency) lb/F	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----												
Stream Power (transport capacity) W/m²	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----												
Additional Reach Parameters																																				
Drainage Area (SM)	-----	-----	-----	0.08	-----	-----	-----	-----	-----	0.08	-----	-----	-----	-----	-----	0.08	-----	-----	-----	-----	-----	0.08	-----	-----												
Rosgen Classification	-----	C5	-----	-----	-----	-----	-----	C5	-----	-----	-----	-----	-----	C5	-----	-----	-----	-----	-----	C5	-----	-----	-----	-----												
Bankfull Velocity (fps)1	-----	4.2	-----	-----	-----	-----	-----	4.2	-----	-----	-----	-----	-----	4.2	-----	-----	-----	-----	-----	4.2	-----	-----	-----	-----												
BF Discharge (cfs)	-----	15.6	-----	-----	-----	-----	-----	15.6	-----	-----	-----	-----	-----	9.2	-----	-----	-----	-----	-----	12.2	-----	-----	-----	-----												
Valley Length (ft)	-----	816.0	-----	-----	-----	-----	-----	816.0	-----	-----	-----	-----	-----	816.0	-----	-----	-----	-----	-----	816.0	-----	-----	-----	-----												
Channel length (ft)	-----	1035	-----	-----	-----	-----	-----	1035	-----	-----	-----	-----	-----	1035	-----	-----	-----	-----	-----	1035	-----	-----	-----	-----												
Sinuosity	-----	1.27	-----	-----	-----	-----	-----	1.27	-----	-----	-----	-----	-----	1.27	-----	-----	-----	-----	-----	1.27	-----	-----	-----	-----												
Water Surface Slope (Channel) (ft/ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	0.02	-----	-----	-----	-----	-----	0.02	-----	-----	-----	-----												
BF slope (ft/ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----												

APPENDIX E

HYDROLOGIC DATA

Table 12. Verification of Bankfull or Greater than Bankfull Events
South Fork Hoppers Creek Mitigation Plan: EEP Project No. 92251

Date of Data Collection	Date of Event	Method of Data Collection	Gauge Watermark Height (feet above bankfull)
April 16, 2014	May 1, 2013 - April 16, 2014	Gauge measurement	0.6
May 1, 2013	December 31, 2012 - May 1, 2013	Gauge measurement	0.10
December 31, 2012	August 1, 2012 - December 31, 2012*	Gauge measurement	0.55
August 1, 2012	May 30, 2012 - August 1, 2012*	Gauge measurement	0.10

* Date of event(s) occurred sometime between the date range specified.

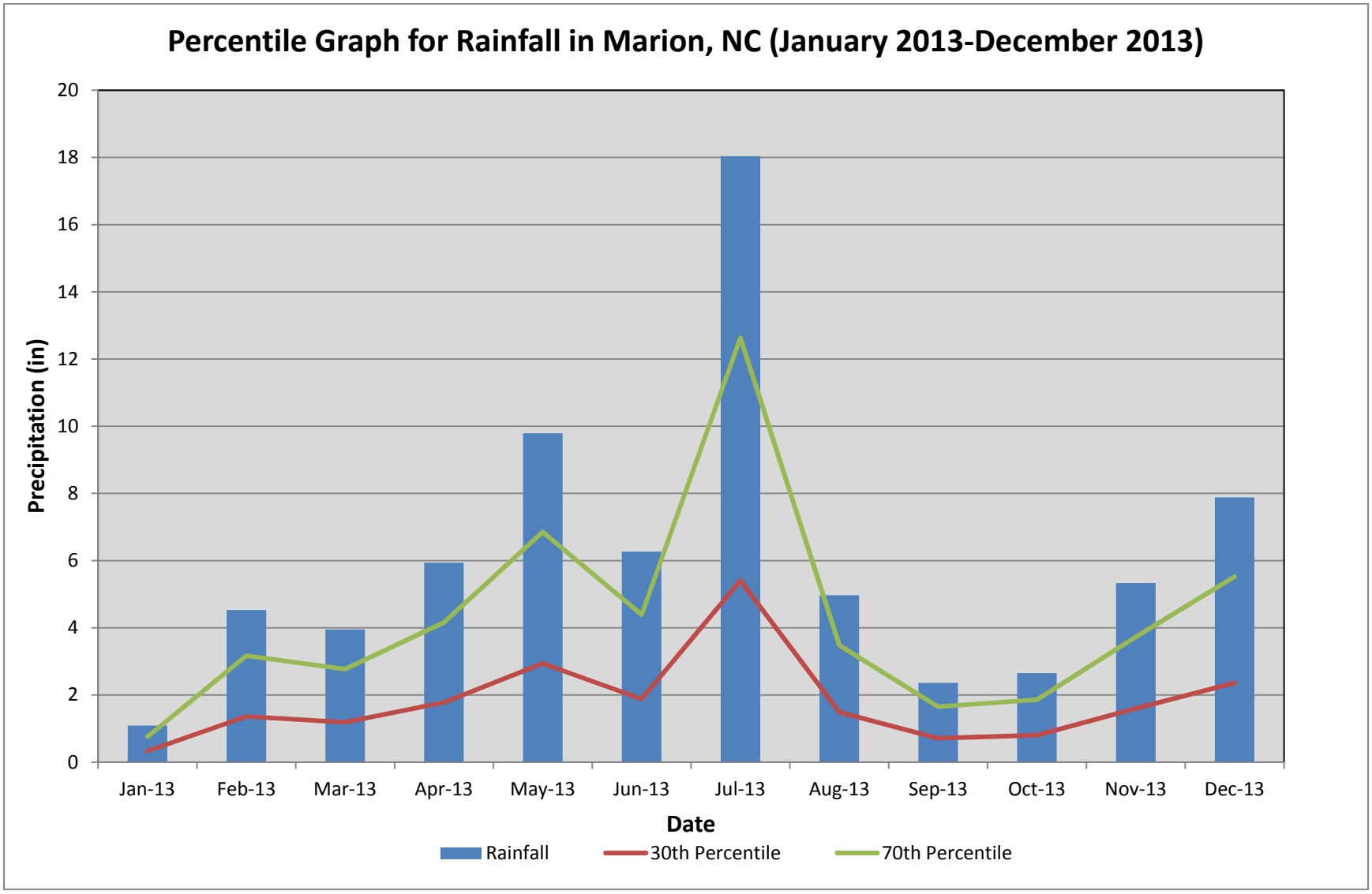


Figure 6. Monthly Rainfall Data

Hoppers Creek-Melton Farm Mitigation Plan: EEP Project No. 92251

Assessment of Wetland Gauge Data for 2013 Growing Season
3/30/13-11/2/13

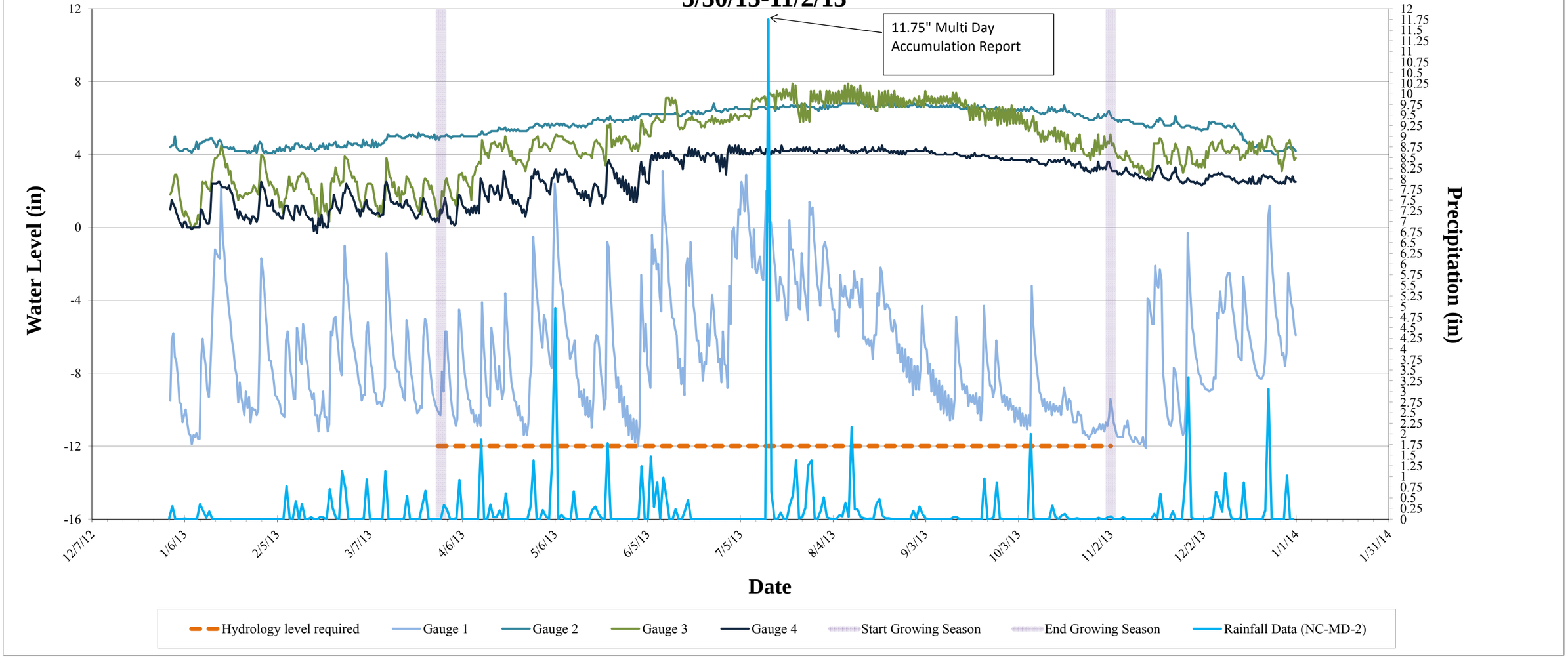


Table 13. Wetland Gauge Attainment Data
South Fork Hoppers Creek Mitigation Plan: EEP Project No. 92251

Summary of Groundwater Gauge Results for MY1-MY5					
Gauge	**Success Criteria Achieved/Max Consecutive Days During Growing Season (Percentage)**				
	MY 1 (2011)	**MY2 (2012)**	**MY3 (2013)**	**MY4 (2014)**	**MY5 (2015)**
Gauge 1	No/10 days (5%)	Yes/25 days (12%)	Yes/218 days (100%)		
Gauge 2	Yes/218 days (100%)	Yes/218 days (100%)	Yes/218 days (100%)		
Gauge 3	Yes/188 days (86%)	Yes/218 days (100%)	Yes/218 days (100%)		
Gauge 4	Yes/200 days (92%)	Yes/218 days (100%)	Yes/218 days (100%)		