South Fork Hoppers Creek - Melton Farm Stream Restoration Project
Year 4 Monitoring Report

McDowell County, North Carolina

NCDMS Project Number – 92251

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Year of Data Collection: 2015
Year of Completed Construction: 2011
NCDMS Project Manager: Matthew Reid
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FINAL

South Fork Hoppers Creek - Melton Farm Stream Restoration Project
Year 4 Monitoring Report

McDowell County, North Carolina

Report Prepared and Submitted by Michael Baker Engineering, Inc.

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INTERNATIONAL

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Table of Contents

1.0 EXECUTIVE SUMMARY 1

2.0 METHODOLOGY 4

2.1 Stream Assessment 4
2.1.1 Morphologic Parameters and Channel Stability 4
2.1.2 Hydrology 5
2.1.3 Photographic Documentation of Site 5
2.1.4 Visual Stream Morphological Stability Assessment 6

2.2 Vegetation Assessment 6

2.3 Wetland Assessment 7

3.0 REFERENCES 8

Appendices

Appendix A *Project Vicinity Map and Background Tables*
Figure 1 Vicinity Map and Directions
Table 1 Project Components
Table 2 Project Activity and Reporting History
Table 3 Project Contacts Table
Table 4 Project Attribute Table

Appendix B *Visual Assessment Data*
Technical Memorandum – Site Assessment Report
Figure 2 Current Condition Plan View (CCPV)
Tables 5a-d Visual Stream Morphology Stability Assessment Table
Table 5e Stream Problem Areas (SPAs)
Tables 6a-b Vegetation Condition Assessment Table
Table 6c Vegetation Problem Areas (VPAs)
Stream Station Photos
Stream Problem Area Photos
Vegetation Plot Photos
Vegetation Problem Area Photos

Appendix C *Vegetation Plot Data*
Table 7 Vegetation Plot Criteria Attainment
Table 8 CVS Vegetation Plot Metadata
Table 9 CVS Stem Count Total and Planted by Plot and Species

Appendix D *Stream Survey Data*

Appendices

	Figure	3	Cross-sections with Annual Overlays
	Figure	4	Longitudinal Profiles with Annual Overlays
	Figure	5	Riffle Pebble Count Size Class Distribution with Annual Overlays
	Table	10	Baseline Stream Data Summary Tables
	Table	11a	Cross-section Morphology Data Table
	Table	11b	Stream Reach Morphology Data Table
Appendix E	*Hydrologic Data*		
	Table	12	Verification of Bankfull Events
	Figure	6a-b	Monthly Rainfall Data
	Figures	7a-b	Precipitation and Water Level Plots
	Table	13	Wetland Hydrology Criteria Attainment

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 Division of Mitigation Services (NCDMS). This report documents and presents Year 4 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 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, 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 I 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 I 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 0.15 acres, or 3.4% of the planted acreage for this assessment tract. These two VPAs were identified in the Year 1 monitoring period and carried over through Year 4. Six small areas with invasive plants were identified during the May 2015 assessment for a combined total area of 0.11 acres or 1.3% of the easement acreage. Invasive species were treated throughout the conservation easement in September 2015. Kudzu, multi-flora rose, privet, mimosa, autumn olive, trifoliate orange, tree of heaven, and Bradford pear were treated using cut-stump, foliar, hand pull, and hand digging methods. Additional treatment will be performed if invasive species persist. 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 plan view (CCPV) figures, supporting data tables, and photo logs. The contents of Appendix B were submitted to NCDMS in May 2015 and served as the interim visual site assessment report.

The average density of total planted stems per plot ranges from 283 – 971 stems per acre with a tract mean (including volunteers) of 890 stems per acre. Volunteer species continue to thrive throughout the vegetation plots. The Project site is on track for meeting the final success criteria of 260 trees per acre by the end of Year 5. 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 92 to 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 erosion around 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 six SPAs that were identified in Year 1 and Year 2 monitoring periods were carried over through Year 4. No new SPAs were identified for the Year 3 assessment; however, three new SPAs were identified in Year 4. SPA4-1 and SPA4-2 are located on SFHC Reach 1 around stations 16+25 and 20+75, respectively. Both SPAs are characterized by failing rootwads associated with the erosion and undercutting of the bank tie-in just downstream of a log sill. SPA4-3 is located on UT2 Reach A between stations 12+36 to 12+53. The left bank in this location has scoured out due to the combination of high near bank stress during bankfull flows on the outside of a meander bend and topographic relief which has exacerbated the issue, but appears to be localized and not progressing downstream. 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. 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 with only minor filling in the upstream sections of Reach 1 and UT1B, which is most likely due to the natural movement of sediment through the system. 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 4 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 three bankfull events based on crest gauge readings. Information on these events is provided in Table 12 of Appendix E.

Based on the fourth growing season following site construction (March 30, 2013 - November 2, 2015), all four wetland areas met the success criteria for wetland hydrology during Monitoring Year 4. Groundwater conditions indicated saturated conditions existed throughout 100% of the growing season for Gauges 2, 3, and 4, and 81% of the growing season for Gauge 1. 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 DMS'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 (DMS 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 DMS on-call design and construction services contract.* All raw data supporting the tables and figures in the appendices is available from DMS 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 DMS 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 4 monitoring data was collected in May 2015 and September 2015. All visual site assessment data was collected on May 6, 2015. Vegetation monitoring plot data was collected on September 21 and 24, 2015. All stream survey (channel dimension and profile) and sediment data were collected from September 21 - 23, 2015. Stream survey data was collected to a minimum of Class C Vertical and Class A Horizontal Accuracy using Leica TS06 Total Station and was geo-referenced to the NAD83 State Plane Coordinate System, FIPS3200 in US Survey Feet, which was derived from the South Muddy Creek As-built Survey.

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 2.3.1 (CVS-NCEEP, 2012). 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 May 6, 2015, the vegetation condition of planted vegetation along stream banks, floodplains (wetlands), and terraces were qualitatively evaluated for performance. This assessment 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 U.S. Geological Survey rain gauge near Morganton, NC (USGS 354353081410545) was used for comparison to post-construction groundwater monitoring conducted during the Year 4 growing season. This data was obtained from the USGS "waterdata" website (USGS 2015).

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). 2012. CVS-NCEEP Data Entry Tool v. 2.3.1. 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.

US Geological Survey, 2015. USGS 354353081410545. Morganton, NC. Retrieved: 2015-11-19 13:59:59 EST
http://waterdata.usgs.gov/nc/nwis/uv/?site_no=354353081410545&PARAmeter_cd=00045

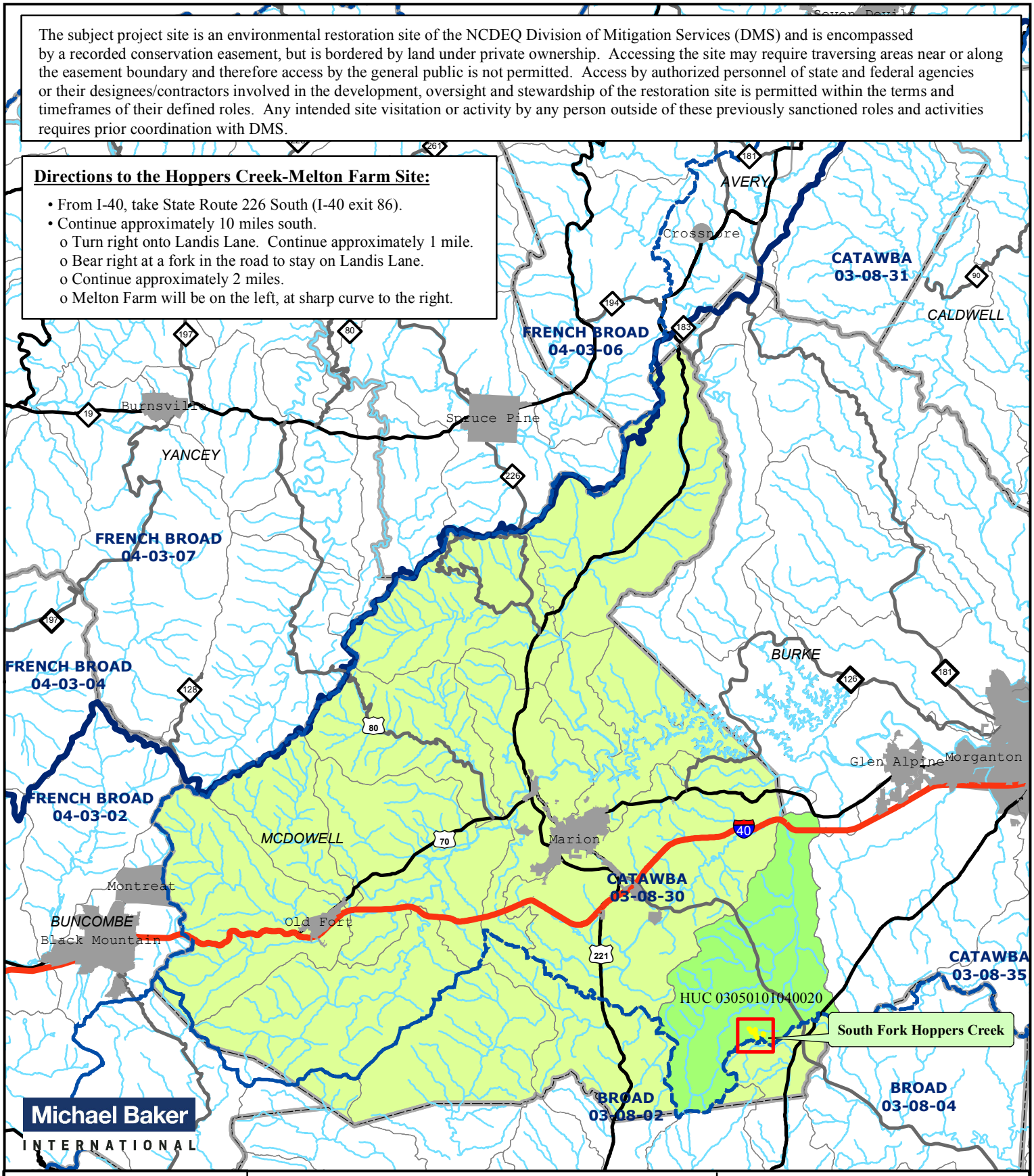
APPENDIX A

PROJECT VICINITY MAP AND BACKGROUND TABLES

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

Directions to the Hoppers Creek-Melton Farm Site:

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



Map Vicinity

McDowell County, NC

Figure 1. Vicinity Map

South Fork Hoppers Creek - Melton Farm

McDowell County, NC

NCDMS Project No.: 92251
December 2015

LEGEND:

- Project Boundary
- NC River Basins
- USGS Hydrologic Unit
- Counties

0 2.5 5 Miles

Table 1. Project Components
South Fork Hoppers Creek - Melton Farm Restoration Project: DMS 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 sought 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 DMS and CEC. The section slated for enhancement at the top of UT1B (9+49 to 10+00) 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 - Melton Farm Restoration Project: DMS Project No. 92251

Elapsed Time Since Grading/Planting Complete: 4 Years 6 Months
Number of Reporting Years: 4

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	N/A	N/A	Aug-13
Year 2 Monitoring	Dec-13	Sep-13	Dec-13
Year 3 Monitoring	Dec-14	Sep-14	Dec-14
Invasive Treatment	N/A	N/A	Sep-15
Year 4 Monitoring	Dec-15	Sep-15	Dec-15
Year 5 Monitoring	Dec-16	N/A	N/A

Table 3. Project Contacts Table South Fork Hoppers Creek - Melton Farm Restoration Project: DMS Project No. 92251	
Designer	
Michael Baker Engineering, Inc.	5550 Seventy-Seven Center Dr., Suite 320 Charlotte, NC 28217 Contact: Kristi Suggs, Tel. 704-665-2206
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
Seeding 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:
Professional 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.	5550 Seventy-Seven Center Dr., Suite 320 Charlotte, NC 28217 Contact:
Stream Monitoring Point of Contact:	Kristi Suggs, Tel. 704-665-2206
Vegetation Monitoring Point of Contact:	Kristi Suggs, Tel. 704-665-2206
Wetland Monitoring Point of Contact:	Kristi Suggs, Tel. 704-665-2206

Table 4. Project Attribute Table
South Fork Hoppers Creek - Melton Farm Restoration Project: DMS 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	B	B	E5	E5	G5	G5c	B
Rosgen classification of As-built	C5	C5	B	B	C5	C5	G5/B5	G5c	B
Valley type	Alluvial	Alluvial	Alluvial	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 4

South Fork Hoppers Creek-Melton Farm Restoration Project
McDowell County, North Carolina
May 2015

Submitted To: NCDEQ – Division of Mitigation Services
1625 Mail Service Center
Raleigh, NC 27699
NCDEQ Contract ID No. 004518

Submitted By: Michael Baker Engineering, Inc.
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Michael Baker
INTERNATIONAL

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 4 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 2015). 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, and
- 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, and
- 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 NCDEQ DMS 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 2015. This data

will be summarized in Appendix C and the CCPV figure of the Year 4 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; therefore, resulting 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 May 6, 2015.

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 NCDEQ DMS.

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 nine SPAs documented, four of which were identified during the Year 1 visual assessment, two that were identified during the Year 2 assessment, and three that were identified during the Year 4 assessment. SPAs documented in previous years were included in this assessment since they have persisted to date. Any SPAs that have been documented in previous reports, but were not indicated as problems during the Year 4 assessment will not be described.

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 this year and persisting from previous years is discussed below. The SPAs from previous years noted in this report have generally 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.

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, but are slowly stabilizing with native well rooted vegetation. Stabilization is critical 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) and the right upper bank has eroded. Coarse riprap material has been deposited downstream atop the lowest elevation boulder sill, exposing the underlying filter fabric as a result.

SPA2-1 is located 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 subsided, but has scoured the upstream portion of the rootwad and the channel toe beneath it, 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. Native herbaceous and woody vegetation are starting to colonize the problem area. This area should be continually monitored to document and prevent any further bank degradation

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 and exposed, but vegetation is starting to provide 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 and making the bank more susceptible to subsequent erosion.

SPA4-1 is located downstream of a log step on SFHC Reach 1. SPA4-1 is characterized by a failing rootwad associated with the erosion and undercutting of the right 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 right bank) and is oriented within the channel such that flow is being directed toward the right bank immediately downstream of where the log sill ties into the bank, causing bank erosion. The rootwad has separated from the right bank, has slumped into the channel, but is still providing erosion protection of the right bank. Native herbaceous and woody vegetation are present and are providing some stability to the bank. This area should be continually monitored to document and prevent any further bank degradation.

SPA4-2 is located downstream of a log step on SFHC Reach 1. SPA4-2 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 20+75. 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. There is erosion immediately upstream of the rootwad potentially compromising the structure, but the rootwad is still providing some bank protection. Native herbaceous and woody vegetation are present and are providing some stability to the bank. This area should be continually monitored to document and prevent any further bank degradation

SPA4-3 is located on UT2 Reach A between stations 12+36 to 12+53. The left bank in this location has scoured out due to the combination of high near bank stress during bankfull flows on the outside of a meander bend and topographic relief which has exacerbated the issue. This area is localized and does not appear to be progressing downstream.

Log sills associated with deep scour pools on UT1 Reach B were inspected and assessed for vertical stability per DMS' request during the Year 2 assessment and reassessed during the Year 4 assessments. DMS' 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). DMS' 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 DMS' monitoring guidance criteria for sufficient depth for meander pool condition for this current visual morphological assessment. The deepest of these pools were the 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 2.8 feet and 5.2 respectively. This marks a slight increase in d_{pool} value and d_{pool}/d_{bkf} ratio of 2.2 feet and 4.4 recorded in the Year 3 Assessment. Even though the d_{pool} value of 2.8 feet exceeds that specified for the proposed design (by 0.8 feet), it still meets DMS' 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. Fine sediment was noted in this pool and other pools throughout the reach reinforcing pool depth filling and fluctuation. 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 fourteen VPAs, two of which were identified during the Year 1 visual assessment, three that were identified during the Year 2 assessment, and nine that were identified during the Year 4 assessment. Bare floodplain conditions account for two of the VPAs, and the presence of invasive species accounts for the remaining twelve VPAs. A DMS licensed contractor conducted exotic invasive plant control over nine days between June 20 and August 14, 2013. No additional treatments have been conducted since these treatments. As a result several new VPAs were identified in the Year 4 assessment. 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 persisting VPAs reported from previous year's assessment, as well as Year 4's VPAs are 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 Year 1 Assessment in the wetland area located in the right floodplain along SFHC Reach 1. 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. The combined total area for these VPAs is 0.15 acres or 3.4% of the planted area acreage for this assessment tract.

One VPA reported during the Year 2 Assessment within SFHC Reach 2 (VPA2-2) still persists. It is located around a patch of trees in the left floodplain and is composed of

multiflora rose. The combined total area for this VPA is 0.019 acres or 0.4% of the planted area acreage for this assessment tract.

Two VPAs were reported within SFHC Reach 2 (VPA4-1 and VPA4-2,) during the Year 4 Assessment. They are located in the left and right terrace. These VPAs are composed primarily of multiflora rose and Japanese honeysuckle and continue to persist after prior treatment. Both VPAs appear to be the result of encroachment from outside the easement. The combined total acreage for these seven VPAs is 0.035 acres or 0.8% of the planted area acreage for this assessment tract.

Two VPAs reported during the Year 2 Assessment within UT1 Reach B (VPA2-4 and VPA2-5) still persist. They are located on the right terrace/floodplain and are composed primarily of multiflora rose and Japanese honeysuckle that continue to persist after prior treatment. VPA2-4 is located in vegetation monitoring plot 22 and has grown in size from previous year's assessment. The VPA may have proliferated from seed sources contained within the existing tree stand located just outside the vegetation plot. The combined total area for these two VPAs is 0.04 acres or 0.9% of the planted area acreage for this assessment tract.

One VPA was reported within UT1B (VPA4-9) during the Year 4 Assessment. This problem area is located on the right terrace. This VPA is composed of Japanese honeysuckle that has persisted after treatment as result of encroachment from outside the easement. The combined total acreage for these four VPAs is 0.02 acres or 0.4% of the planted area acreage for this assessment tract.

Six VPAs were reported within UT2 (VPA4-3, VPA4-4, VPA4-5, VPA4-6, VPA 4-7, and VPA4-8) during the Year 4 Assessment. All are located in the left floodplain or terrace except for VPA4-4, which is located in the right terrace. These VPAs are composed primarily of multiflora rose and Japanese honeysuckle that continue to persist after prior treatment. The combined total acreage for these six VPAs is 0.11 acres or 8.1% of the planted area acreage for this assessment tract.

CE CONSERVATION EASMENT

ASBUILT CENTERLINE

TB ASBUILT TOP OF BANK

ASBUILT CHANNEL

X FENCE

X - # CROSS SECTION

PHOTO ID POINT

VP VEGETATION PLOT

VEGETATION PROBLEM AREA (VPA)
INVASIVE SPECIES PRESENT

VEGETATION PROBLEM AREA (VPA)
BARE FLOOD PLAIN AREA

WETLAND ENHANCEMENT / RESTORATION

CREST GAUGE

WETLAND GAUGE

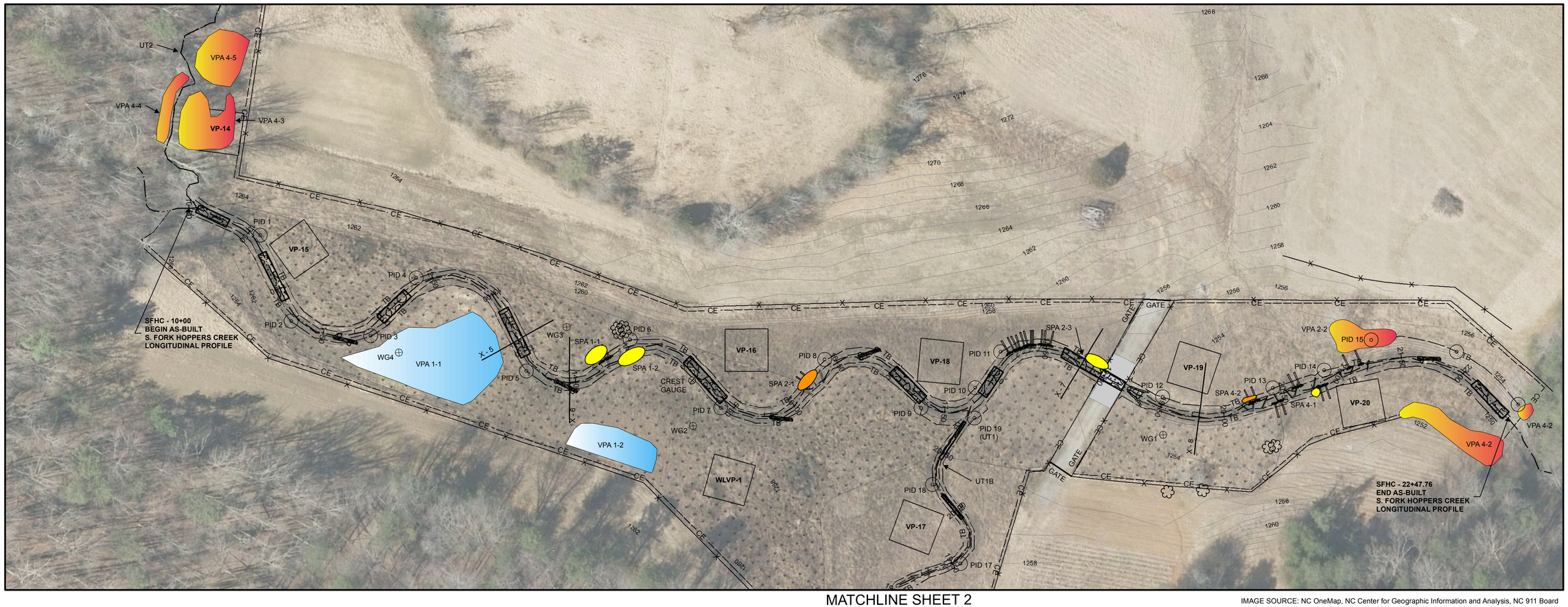
STREAM PROBLEM AREAS (SPA)
BANKS WITH EVIDENT SCOUR / EROSION

STREAM PROBLEM AREAS (SPA)
DEGRADATION

STREAM PROBLEM AREAS (SPA)
STRUCTURE PROBLEM

STREAM PROBLEM AREAS (SPA)
UNDERCUT BANKS

MATCHLINE SHEET 3



MATCHLINE SHEET 2

IMAGE SOURCE: NC OneMap, NC Center for Geographic Information and Analysis, NC 911 Board

SOUTH FORK HOPPERS CREEK
CURRENT CONDITION PLAN VIEW
YEAR 4 MONITORING
STA. 10+00 - 22+48

40 0 40 80 Feet

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

FIGURE 2

Prepared For:
North Carolina Department of Environmental Quality
Division of Mitigation Services
1625 Mail Service Center
Raleigh, NC 27699
Phone: 919-707-8976

DMS Project No.	92251
Baker Project No.	128244
Date:	12/22/2015
DESIGNED:	------
DRAWN:	KLS
APPROVED:	JB
Monitoring Year:	4 of 5
Sheet:	1 of 3

CE CE — CROSS SECTION

CONSERVATION EASMENT

TB TB — ASBUILT TOP OF BANK

ASBUILT CHANNEL

X X — ASBUILT CENTERLINE

X - # — FENCE

PHOTO ID POINT

VP — VEGETATION PLOT

VEGETATION PROBLEM AREA (VPA)
INVASIVE SPECIES PRESENT

VEGETATION PROBLEM AREA (VPA)
BARE FLOOD PLAIN AREA

WETLAND ENHANCEMENT / RESTORATION

CREST GAUGE

WETLAND GAUGE

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

STREAM PROBLEM AREAS (SPA)
DEGRADATION

STREAM PROBLEM AREAS (SPA)
STRUCTURE PROBLEM

STREAM PROBLEM AREAS (SPA)
UNDERCUT BANKS

MATCHLINE SHEET 1

IMAGE SOURCE: NC OneMap, NC Center for Geographic Information and Analysis, NC 911 Board

UT1 - B
CURRENT CONDITION PLAN VIEW
YEAR 4 MONITORING
STA. 10+00 - 22+48

40 0 40 80 Feet

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

FIGURE 2

Prepared For:
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Phone: 919-707-8976

DMS Project No. 92251

Baker Project No. 128244

Date: 12/22/2015

DESIGNED: ------
DRAWN: KLS
APPROVED: JB

Monitoring Year: 4 of 5

Sheet: 2 of 3

CE CE — CROSS SECTION

— CONSERVATION EASMENT

TB TB — ASBUILT TOP OF BANK

— ASBUILT CHANNEL

X X — ASBUILT CENTERLINE

X - # — FENCE

PHOTO ID POINT

VP — VEGETATION PLOT

VEGETATION PROBLEM AREA (VPA)
INVASIVE SPECIES PRESENT

VEGETATION PROBLEM AREA (VPA)
BARE FLOOD PLAIN AREA

WETLAND ENHANCEMENT / RESTORATION

CREST GAUGE

WETLAND GAUGE

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

STREAM PROBLEM AREAS (SPA)
DEGRADATION

STREAM PROBLEM AREAS (SPA)
STRUCTURE PROBLEM

STREAM PROBLEM AREAS (SPA)
UNDERCUT BANKS

IMAGE SOURCE: NC OneMap, NC Center for Geographic Information and Analysis, NC 911 Board

NAD 83

30 0 30 60 Feet

UT2
CURRENT CONDITION PLAN VIEW
YEAR 4 MONITORING
STA. 12+54 - 13+79

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SOUTH FORK HOPPERS CREEK - FIGURE 2
MELTON FARM RESTORATION PROJECT
MCDOWELL COUNTY, NORTH CAROLINA

Prepared For:
North Carolina Department of Environmental Quality
Division of Mitigation Services
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Raleigh, NC 27699
Phone: 919-707-8976

DMS Project No.	92251
Baker Project No.	128244
Date:	12/22/2015
DESIGNED:	-----
DRAWN:	KLS
APPROVED:	JB
Monitoring Year:	4 of 5
Sheet:	3 of 3

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

South Fork Hoppers Creek - Melton Farm Restoration Project: DMS Project No. 92251

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	6	6			100%			
	3. Meander Pool Condition	1. Depth	13	13			100%			
		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	19	99%	0	0	99%
	2. Undercut	Banks undercut/overhanging to the extent that mass wasting appears likely			1	10	99%	0	0	99%
	3. Mass Wasting	Bank slumping, calving, or collapse			0	0	100%	0	0	100%
				Totals	3	29	98%	0	0	98%
3. Engineering Structures	1. Overall Integrity	Structures physically intact with no dislodged boulders or logs	24	24			100%			
	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**

South Fork Hoppers Creek - Melton Farm Restoration Project: DMS Project No. 92251

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			3	35	96%	0	0	96%
	2. Undercut	Banks undercut/overhanging to the extent that mass wasting appears likely			1	12	99%	0	0	99%
	3. Mass Wasting	Bank slumping, calving, or collapse			0	0	100%	0	0	100%
				Totals	4	47	95%	0	0	95%
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**

South Fork Hoppers Creek - Melton Farm Restoration Project: DMS Project No. 92251

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**

South Fork Hoppers Creek - Melton Farm Restoration Project: DMS Project No. 92251

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			1	17	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	17	99%	0	0	99%
3. Engineering Structures	1. Overall Integrity	Structures physically intact with no dislodged boulders or logs	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 South Fork Hoppers Creek - Melton Farm Restoration Project: DMS 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
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
Engineering structures - Rootwad Failure	20+25	Rootwad failure along right bank due to undercutting along bank. Appears to be caused by high near bank stress caused by flood flow stream energy vectors being directed at bank.	SPA4-1
	20+75	Rootwad failure along left bank due to undercutting along bank. Appears to be caused by high near bank stress caused by flood flow stream energy vectors being directed at bank.	SPA4-2
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
Bank Scour	12+36.50 to 12+53.50	Left bank scour on outside bend. Appears to be caused by high near bank stress during bankfull storm events.	SPA4-3
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**

South Fork Hoppers Creek - Melton Farm Restoration Project: DMS Project No. 92251

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; Sheet 1	2	0.15	3.4%
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	0.148	3.4%
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	0.148	3.4%

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	See Figure 2; Sheets 1 & 2	6	0.11	1.3%
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**

South Fork Hoppers Creek - Melton Farm Restoration Project: DMS Project No. 92251

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	Figure 2; Sheets 1 & 3	6	0.11	7.3%
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
South Fork Hoppers Creek - Melton Farm Restoration Project: DMS 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
		Standing water from frequent inundation	VPA1-2
SFHC Reach 2			
Feature Issue	**Station No.**	**Suspected Cause**	**Photo Number**
Invasive/Exotic Populations	See Plan View Figure	*Rosa multiflora* : persisting after treatment within existing tree stand	VPA2-2
		Rosa multiflora: persisting after treatment and encroaching from outside easement	VPA4-1
		Lonicera japonica: persisting after treatment and encroaching from outside easement	VPA4-2
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	VPA2-4
		Rosa multiflora and *Lonicera japonica:*	VPA2-5
		Lonicera japonica: persisting after treatment and encroaching from outside easement .	VPA4-9
UT2 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.	VPA4-3
		Rosa multiflora: persisting after treatment	VPA4-4
		Lonicera japonica: persisting after treatment.	VPA4-5
		Lonicera japonica: persisting after treatment.	VPA4-6
		Lonicera japonica: persisting after treatment.	VPA4-7
		Rosa multiflora: persisting after treatment	VPA4-8

*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

UT1 to South Fork Hoppers Creek
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

UT2 to South Fork Hoppers Creek
Stream Station Photos

UT2 PID 1 – Constructed riffle & log sill

UT2 PID 2 – Constructed riffles & log sills

T2 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.

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

SPA2-3 – SFHC Reach 2: Left bank scour.

SPA4-1– SFHC Reach 2: Rootwad failure along right bank due to undercutting along bank.

SPA4-2– SFHC Reach 2: Rootwad failure along left bank due to undercutting along bank.

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

SPA1-6 – UT2: Bed erosion on ephemeral drainage channel.

SPA4-3 – UT2 Reach A: Small area of erosion along the left bank.

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 and Japanese honeysuckle

VPA4-1 – SFHC Reach 2: Multiflora rose

VPA4-2 – SFHC Reach 2: Japanese honeysuckle

VPA4-3 – UT2: Mulitflora rose and Japanese honeysuckle

VPA4-4 – UT2: Mulitflora rose on RTB

VPA4-5 – UT2: Japanese honeysuckle in left floodplain

VPA4-6 – UT2: Japanese honeysuckle in left floodplain

VPA4-7 – UT2: Japanese honeysuckle in left floodplain

VPA4-8 – UT2: Mulitflora rose in left floodplain

VPA4-9 – UT1B: Japanese honeysuckle on right terrace

South Fork Hoppers Creek (SFHC)
Vegetation Plot Photos

South Fork Hoppers Creek – Melton Farm Restoration Project
Year 4 Monitoring – Vegetation Plot Photo Log

Veg Plot 13 - 9/24/2015

Veg Plot 14 – 9/24/2015

Veg Plot 15 – 9/24/2015

Veg Plot 16 – 9/24/2015

Veg Plot 17 – 9/21/2015

Veg Plot 18 – 9/21/2015

South Fork Hoppers Creek – Melton Farm Restoration Project
Year 4 Monitoring – Vegetation Plot Photo Log

Veg Plot 19 – 9/21/2015

Veg Plot 20 – 9/21/2015

Veg Plot 21 – 9/21/2015

Veg Plot 22 – 9/24/2015

Veg Plot 23 – 9/21/2015

Veg Plot WPL1 – 9/24/2015

APPENDIX C

VEGETATION PLOT DATA

Table 7. Vegetation Plot Criteria Attainment South Fork Hoppers Creek - Melton Farm Restoration Project: DMS Project No. 92251			
Vegetation Plot ID	**Vegetation Survival Threshold Met?**	**Planted/Total Stem Count**	**Tract Mean**
13	Y	769/1578	610/890
14	Y	890/1457	
15	Y	486/809	
16	Y	283/364	
17	Y	607/607	
18	Y	567/567	
19	Y	364/364	
20	Y	728/728	
21	Y	971/971	
22	Y	567/850	
23	Y	647/1902	
WLP1	Y	445/486	
Note: *Planted/Total 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 South Fork Hoppers Creek - Melton Farm Restoration Project: DMS Project No. 92251	
Report Prepared By	Kristi Suggs
Date Prepared	11/11/2015 11:21
Database name	92251_SFH_Yr2-5_cvs-eep-entrytool-v2.3.1.mdb
Database location	C:\CVS
Computer name	CHABLKSUGGS
File size	46829568
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 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 Fork Hoppers Creek
Description	This mitigation project consists of 4,621 LF of stream restoration and preservation efforts on South Fork Hoppers Creek at the Melton Farm.
River Basin	Catawba
Length(ft)	3550
Stream-to-edge width (ft)	120
Area (sq m)	40873.25
Required Plots (calculated)	11
Sampled Plots	12

Table 9. CVS Stem Count Total and Planted by Plot and Species (with Annual Means)
South Fork Hoppers Creek - Melton Farm Restoration Project: DMS Project No. 92251

Tree Species	Common Name	Type	Current Data (MY4 2015)																						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)		MY3 (2014)		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											3	3											4	4	3.5	3.5							2	3		
Alnus serrulata	Hazel Alder	Tree					4	4	3	3			1	1									8	8	1	1	3.4	3.4				1	0	0	3	3		
Betula nigra	River Birch	Tree			1	1			1	1	3	3	2	2			3	3	3	3	2	2	3	3			2	2	2	3	3	2	2	2	3	3		
Celtis laevigata	Sugarberry	Tree	4	4															2	2							3	3	1	1	1	2	1	1	3	3		
Cornus amomum	Silky Dogwood	Shrub									1	1					1	1			1	1	2	2			1	1							1	1		
Diospyros virginiana	Persimmon	Tree	8	8	19	19	1	1					2	2	2	2	4	4	5	5	1	1					5	5	1	1	1	4	1	1	4	4		
Fraxinus pennsylvanica	Green Ash	Tree			1	1	1	1	2	2	7	7	1	1	3	3	3	3	4	4	3	3					3	3	2	3	3	3	2	3	3	3		
Juglans nigra	Black Walnut	Tree			1	1											2	2									2	2	2	2	2	3	2	2	3	3		
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	3	3		
Nyssa sylvatica	Blackgum	Tree					1	1			1	1	1	1							1	1					1	1	2	2	2	2	2	2	1	1		
Platanus occidentalis	Sycamore	Tree					3	3	1	1	1	1	1	1	1	1	4	4	3	3			2	2	5	5	2	2	2	3	3	2	2	2	2	2		
Quercus sp.	Oak	Tree																	1	1							1	1							1	1		
Quercus falcata	S. Red Oak	Tree									1	1															1	1	3	4	4	2	3	3	2	2		
Quercus palustris	Pin Oak	Tree											2	2					5	5	1	1			1	1	2	2	3	4	4	2	3	3	2	2		
Quercus phellos	Willow Oak	Tree															1	1									1	1	3	4	4	2	3	3	1	1		
Quercus rubra	N. Red Oak	Shrub																			1	1					1	1	2	4	4	2	2	2	1	1		
Salix nigra	Black Willow	Tree					1	1					1	1													1	1							1	1		
Salix sericea	Silky Willow	Tree					1	1																			1	1	1	1	1	1	0	0				
Ulmus americana	American Elm	Tree													1	1											1	1	2	2	2	1	1	1				
Volunteers																																						
Acer rubrum	Red Maple	Tree								1												2		10				4				7		10		5		
Alnus serrulata	Hazel Alder	Tree						5		1												3		10		1		4				2		0				
Cornus amomum	Silky Dogwood	Shrub				1																						1								2		
Betula nigra	River Birch	Tree				1																						1				1		0		1		
Diospyros virginiana	Persimmon	Tree				1																	1					1				10		5		5		
Fraxinus pennsylvanica	Green Ash	Tree																				1						1						0				
Juglans nigra	Black Walnut	Tree																																0				
Liriodendron tulipfera	Tulip Poplar	Tree		20		9																	10				13				5		4		3.4		
Platanus occidentalis	Sycamore	Tree						1																			1				1		2				
Quercus rubra	N. Red Oak	Tree																														1		0		2		
Salix sericea	Silky Willow	Tree				2		2																			2											
Salix nigra	Black Willow	Tree																			1						1				12		7					
	Plot area (ares)		1		1		1		1		1		1		1		1		1		1		1		1													
P=Planted T=Total	Species Count		3	3	4	7	7	7	4	5	7	7	9	9	5	5	7	7	8	8	8	11	5	7	4	4	6	7	7	7	7	8	6	7	6	6		
	Stems/Plot		19	39	22	36	12	20	7	9	15	15	14	14	9	9	18	18	24	24	14	21	16	47	11	12	15	22	19	19	19	29	13	21	13	17		
	Stems Per Acre		769	1578	890	1457	486	809	283	364	607	607	567	567	364	364	728	728	971	971	567	850	647	1902	445	486	610	890	772	772	772	614	540	850	543	668		
	Total Stems Per Acre (including		1578		1457		809		364		607		567		364		728		971		850		1902		486		890		772		1184		850		668			

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.

APPENDIX D

STREAM SURVEY DATA

South Fork Hoppers Creek - Reach 1

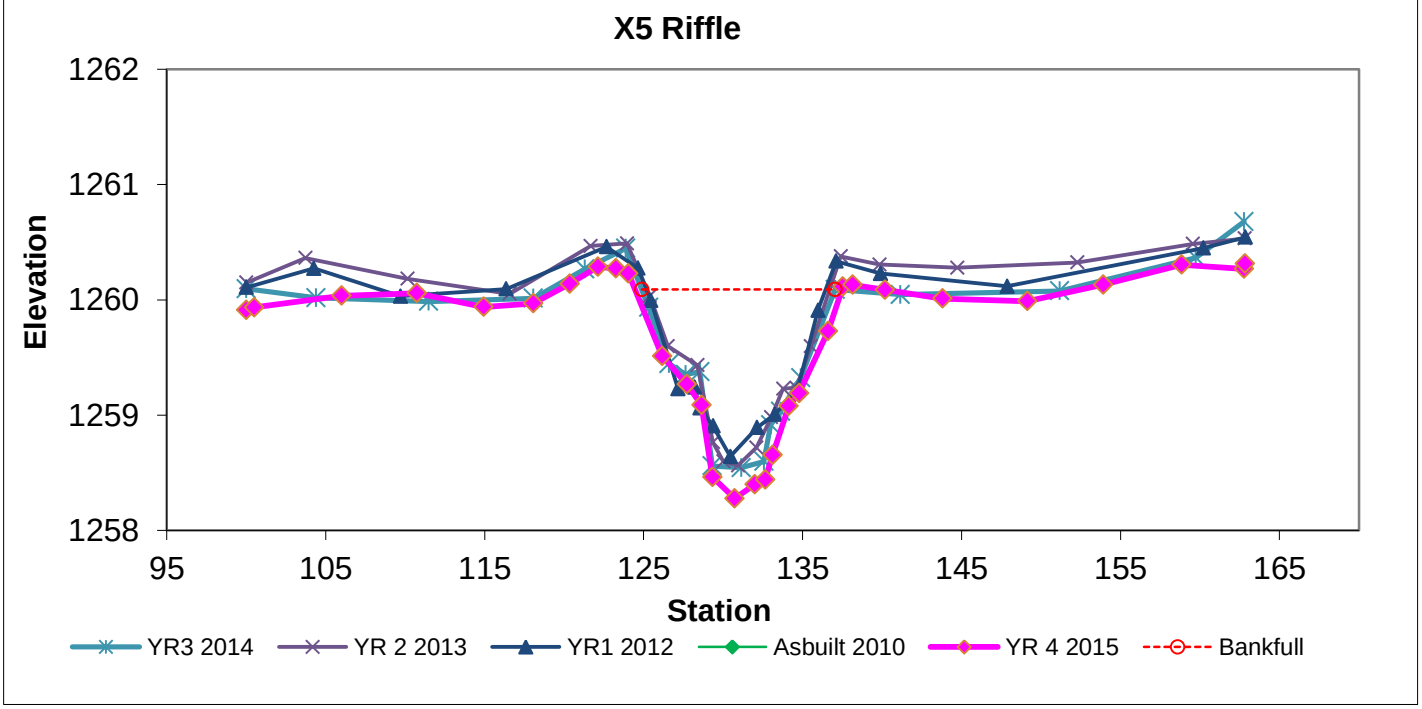
Permanent Cross Section X5

(Year 4 Monitoring - September 2015)

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	13.2	13.15	1.01	1.84	13.06	1	4.8	1260.11	1260.11



South Fork Hoppers Creek - Reach 1

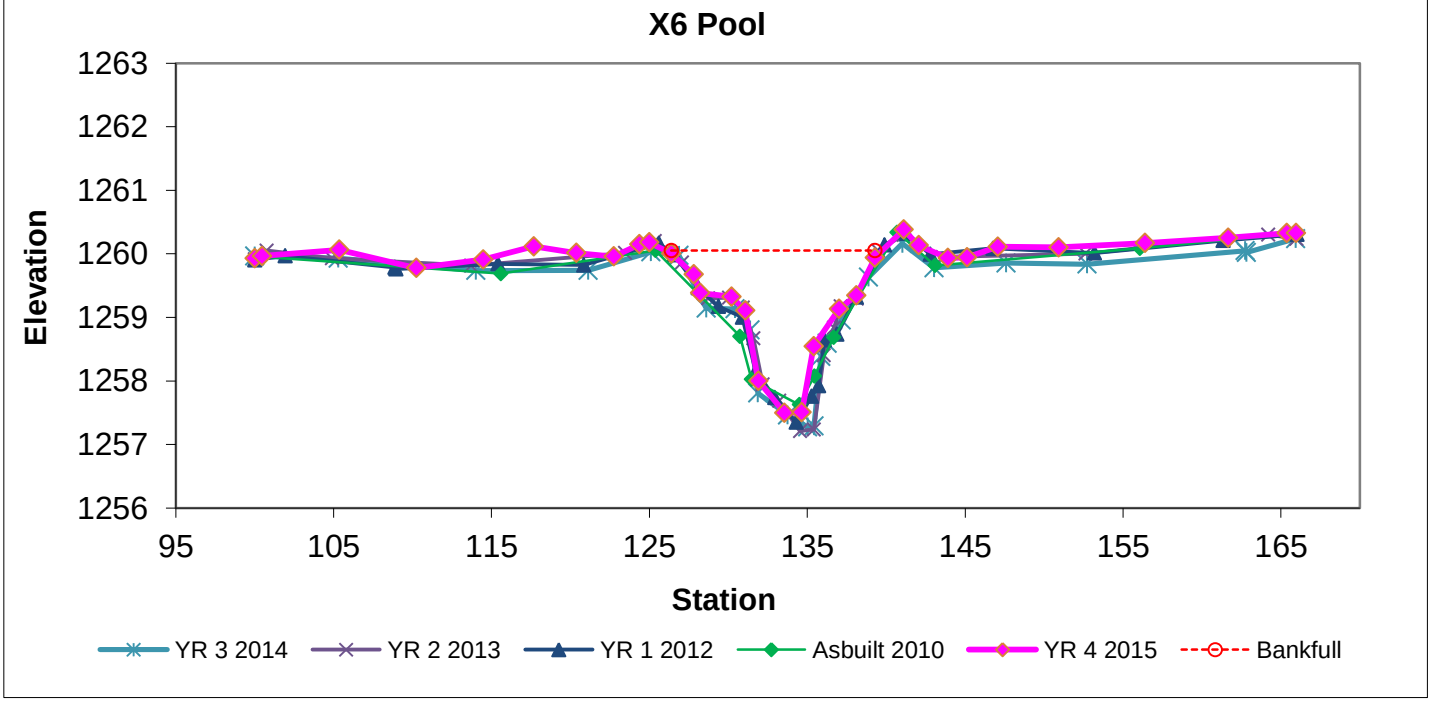
Permanent Cross Section X6

(Year 4 Monitoring - September 2015)

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		11.2	11.21	1	2.22	11.2	1.1	5.9	1260.05	1260.179



South Fork Hoppers Creek - Reach 2

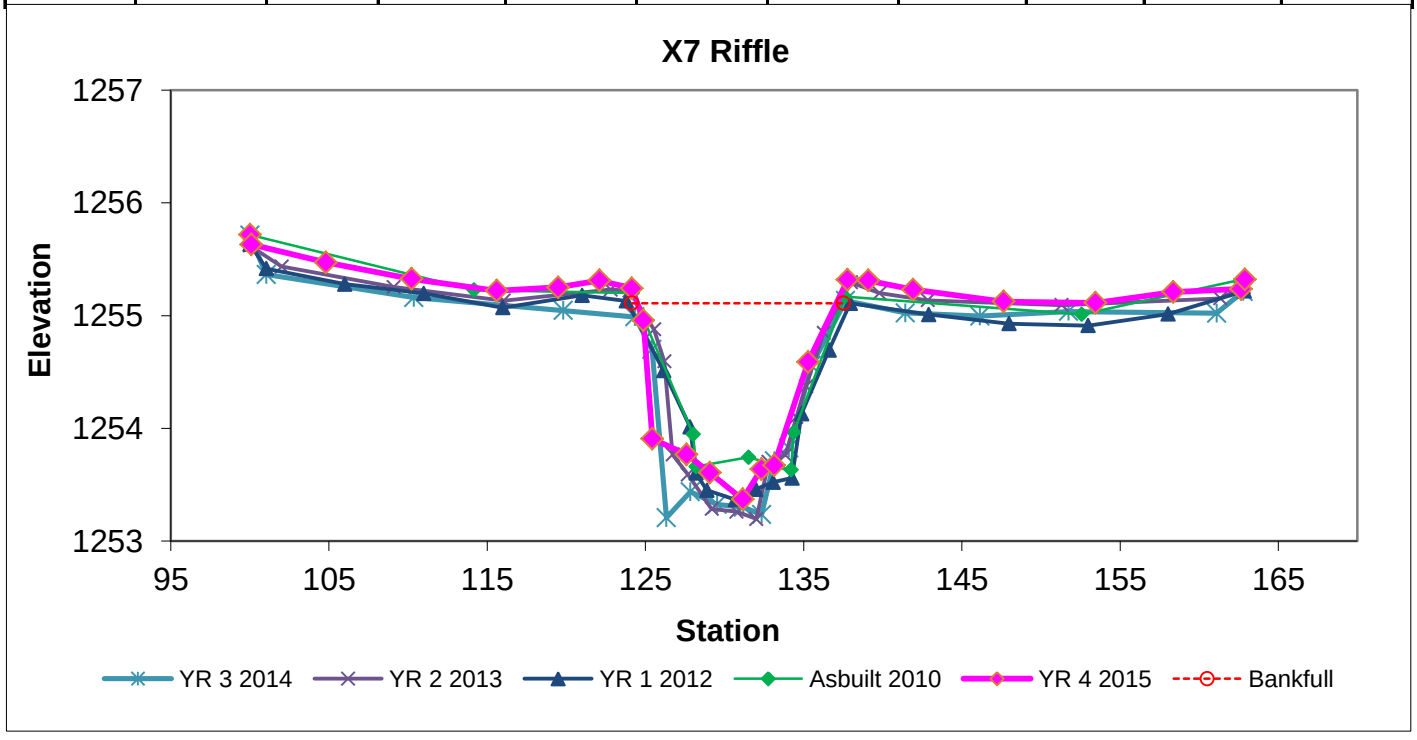
Permanent Cross Section X7

(Year 4 Monitoring - September 2015)

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	E	16	13.37	1.2	1.87	11.19	1.0	4.7	1255.11	1255.24



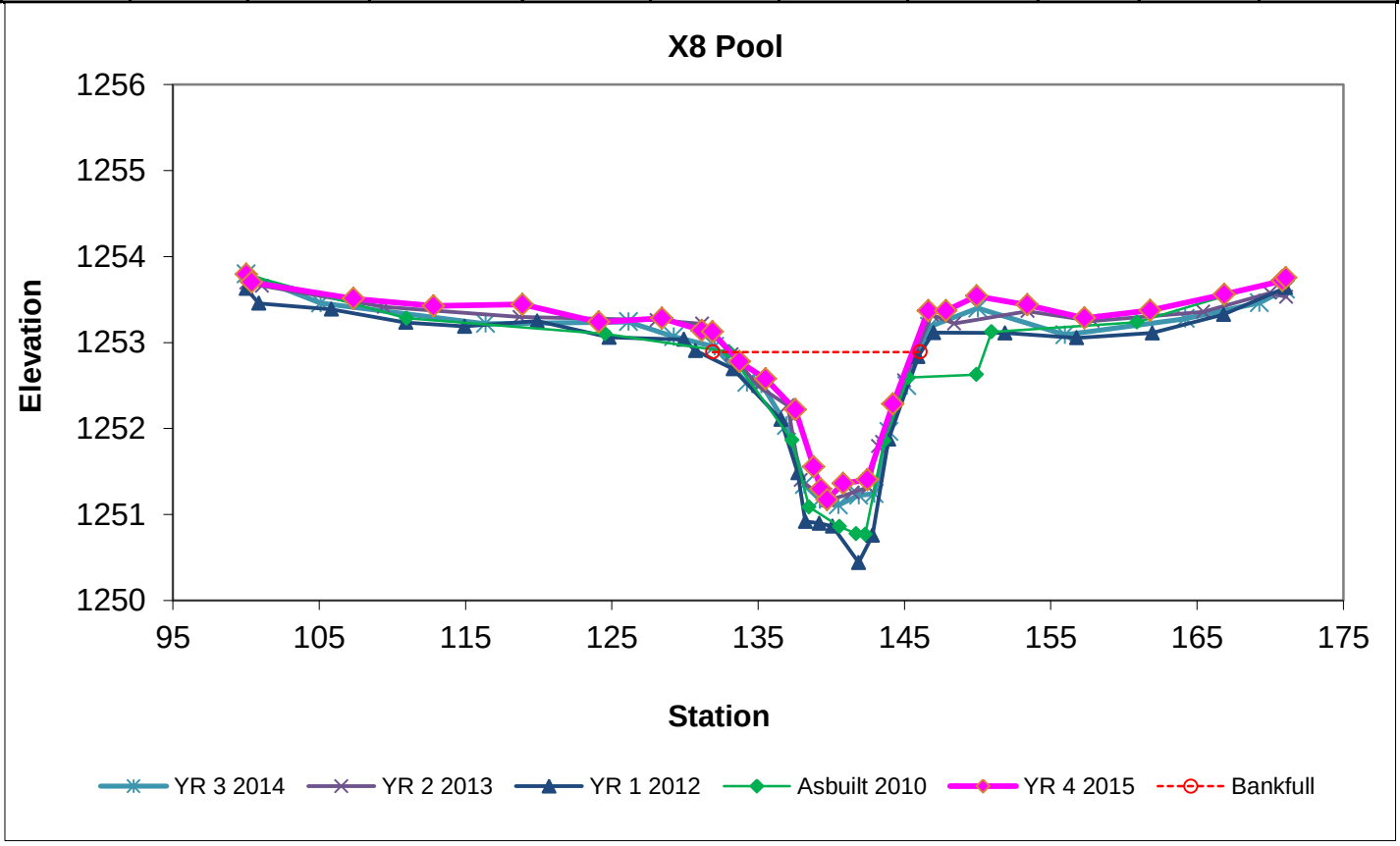
South Fork Hoppers Creek - Reach 2

Permanent Cross Section X8

(Year 4 Monitoring - October 2015)

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		13.7	14.18	0.96	1.95	14.72	1.0	5	1253.12	1253.12



UT1

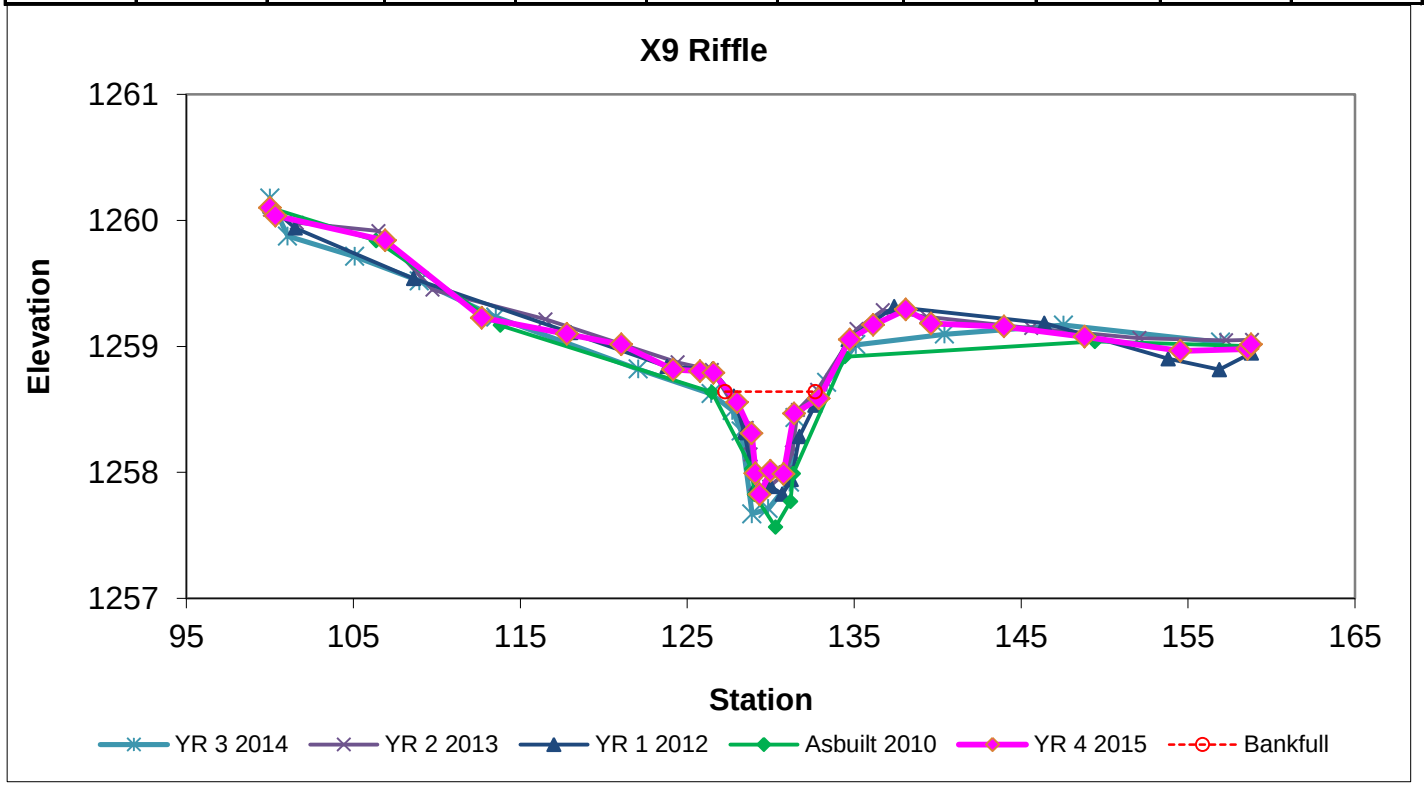
Permanent Cross Section X9

(Year 4 Monitoring - October 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	2.8	7.1	0.4	0.96	17.75	1	7.2	1258.79	1258.79



UT1

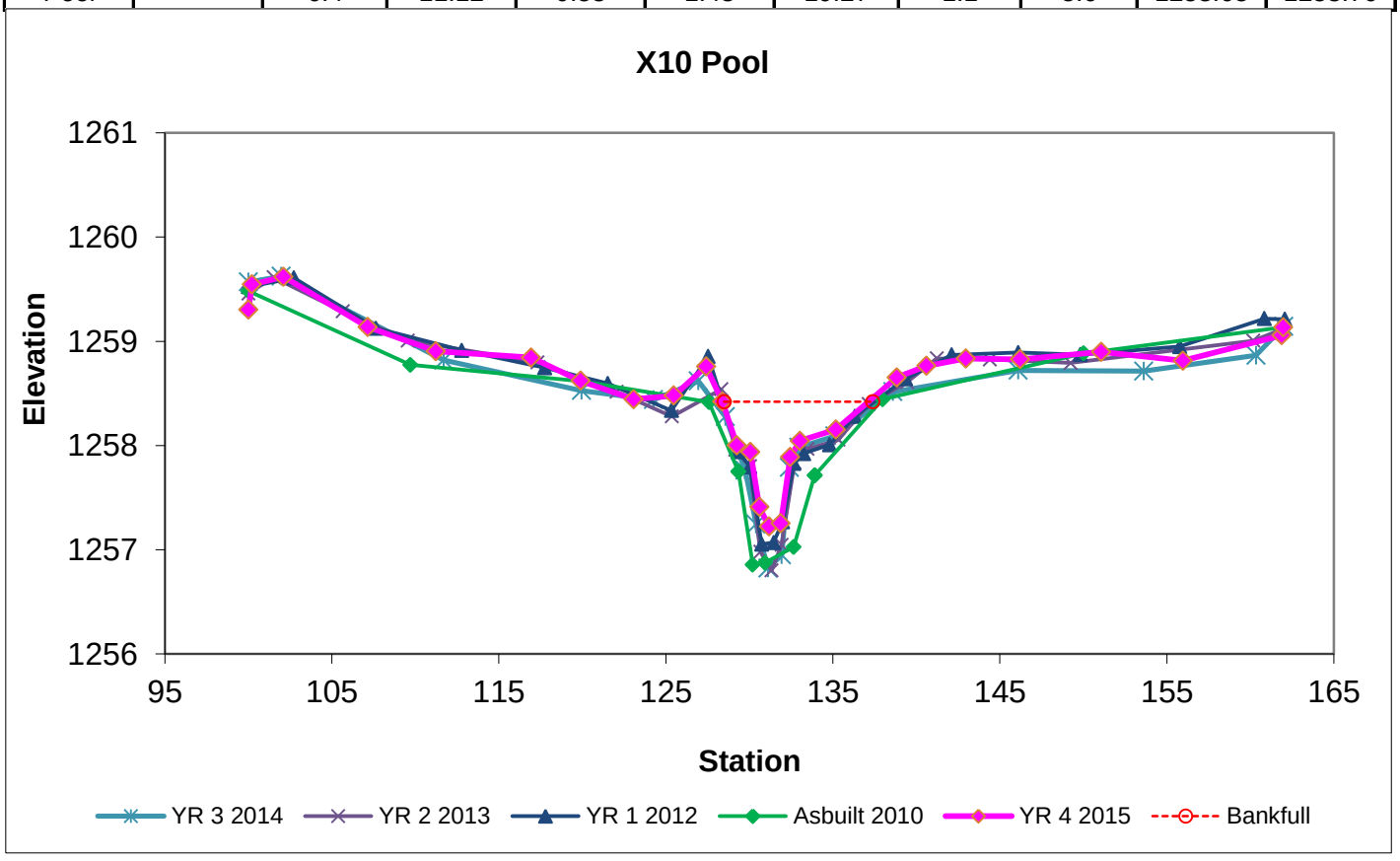
Permanent Cross Section X10

(Year 4 Monitoring - October 2015)

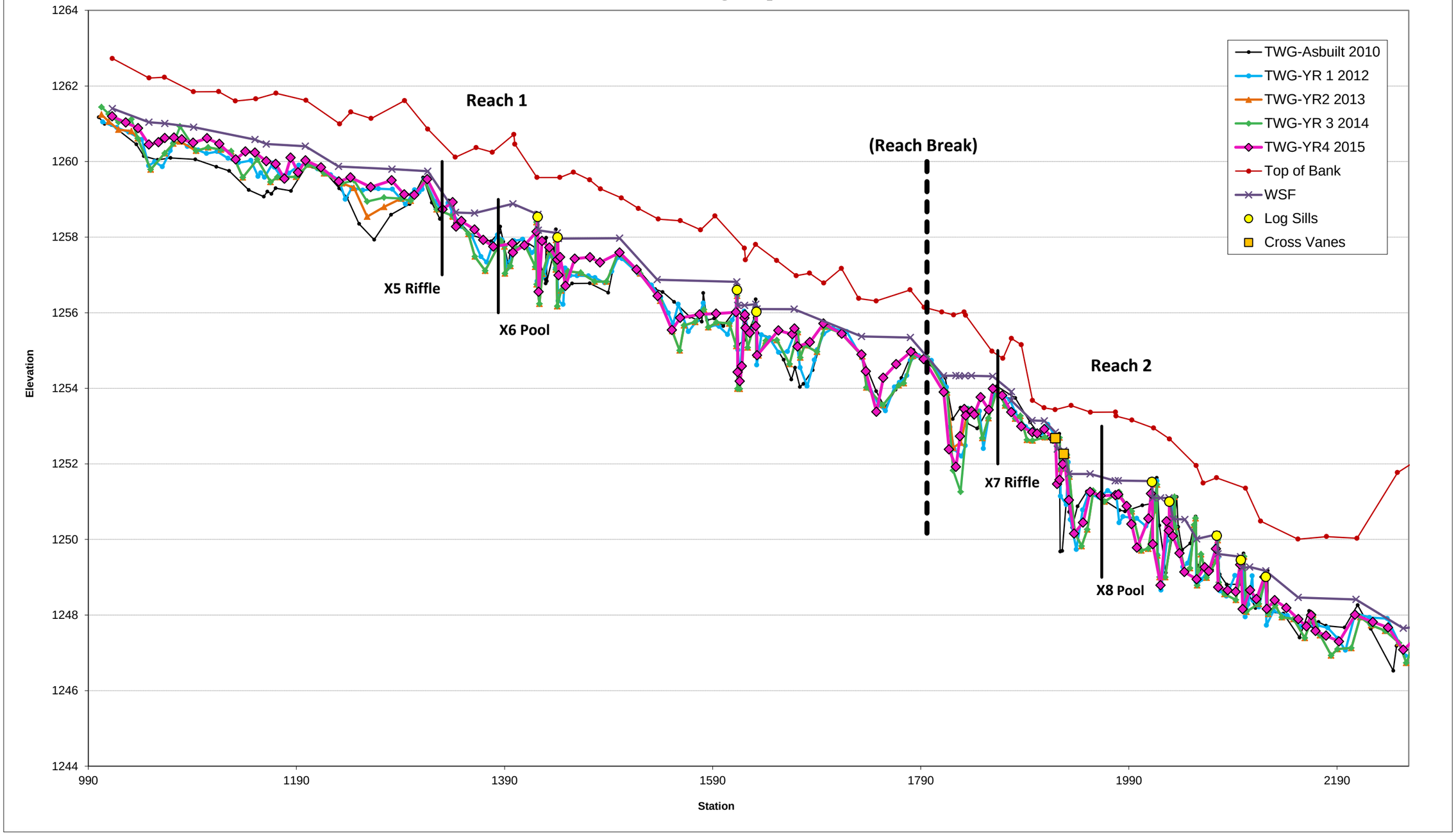
LEFT BANK

RIGHT BANK

Feature	Stream Type	BKF Area	BKF Width	BKF Depth	Max BKF Depth	W/D	BH Ratio	ER	BKF Elev	TOB Elev
Pool		6.4	11.12	0.58	1.43	19.27	1.1	5.6	1258.65	1258.76



South Fork Hoppers Creek (Reaches 1 and 2)
Profile Chart
Year 4 Monitoring - September 2015



South Fork Hoppers Creek - UT1B
Profile Chart
Year 4 Monitoring - September 2015

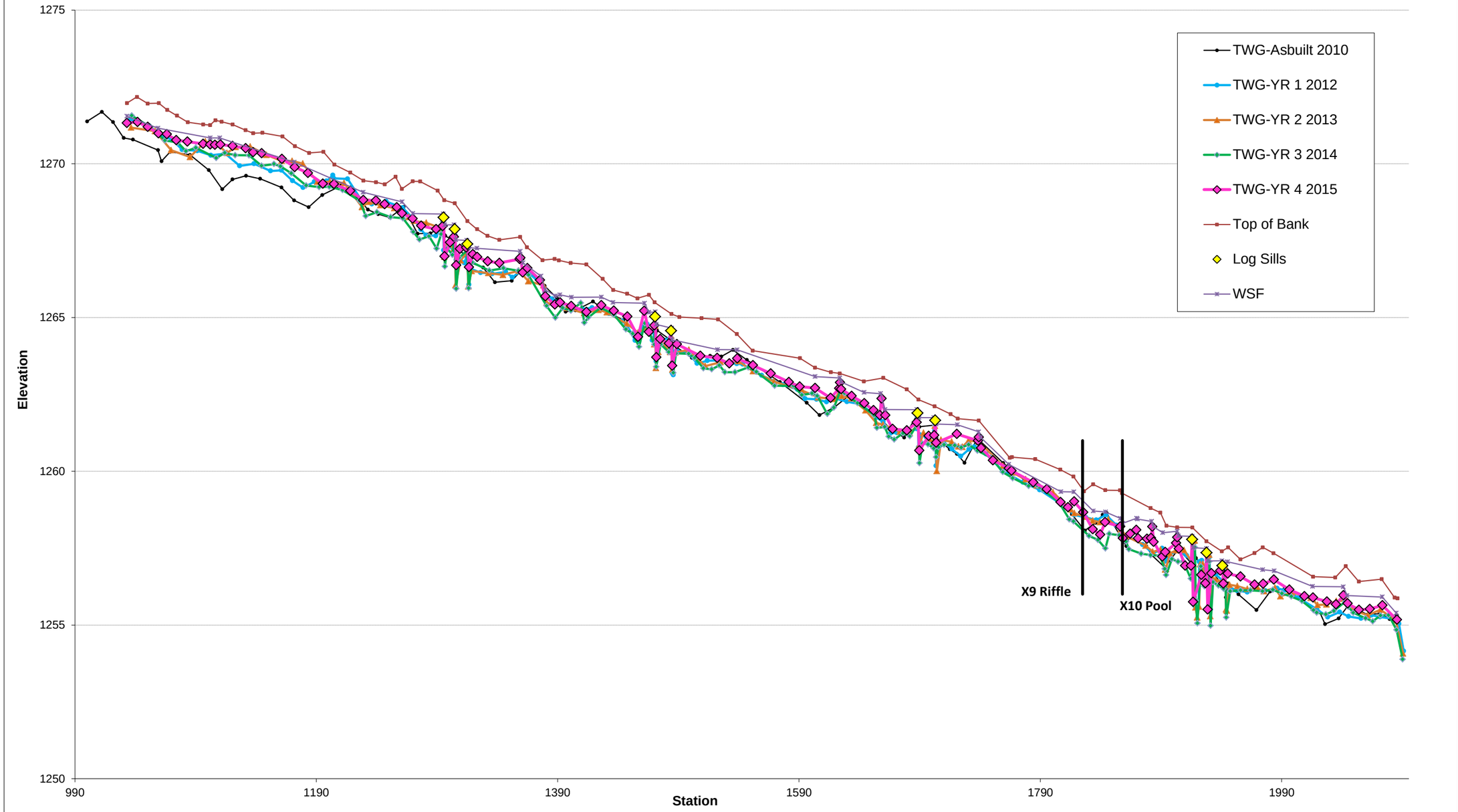
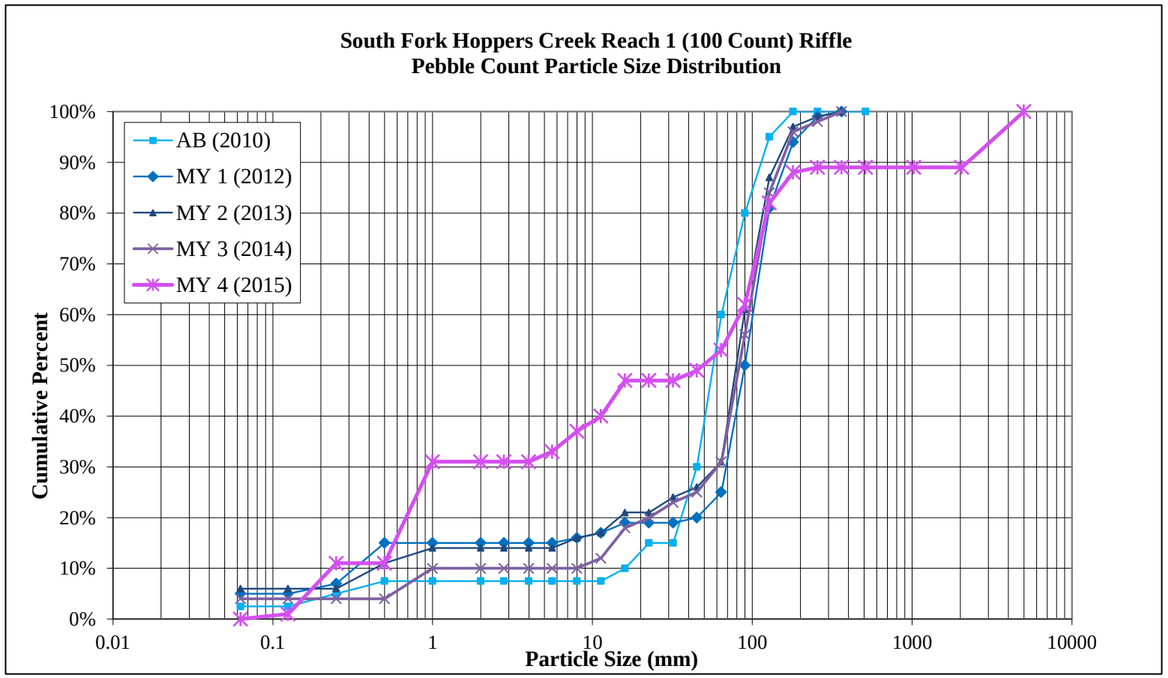


Figure 5a. Riffle Pebble Count Size Class Distribution with Annual Overlays
South Fork Hoppers Creek - Melton Farm Restoration Project: DMS Project No. 92251

BAKER PROJECT NO.	128244
SITE OR PROJECT:	South Fork Hoppers Creek - Melton Farm Restoration Project
REACH/LOCATION:	Reach 1 - Cross-section 5 (Riffle)
DATE COLLECTED:	23-Sep-15
FIELD COLLECTION BY:	CB & JN
DATA ENTRY BY:	KLS

			PARTICLE CLASS COUNT	Summary	
MATERIAL	PARTICLE	SIZE (mm)	Riffle	Class %	% Cum
SILT/CLAY	Silt / Clay	< .063			0%
SAND	Very Fine	.063 - .125	1	1%	1%
	Fine	.125 - .25	10	10%	11%
	Medium	.25 - .50			11%
	Coarse	.50 - 1.0	20	20%	31%
	Very Coarse	1.0 - 2.0			31%
GRAVEL	Very Fine	2.0 - 2.8			31%
	Very Fine	2.8 - 4.0			31%
	Fine	4.0 - 5.6	2	2%	33%
	Fine	5.6 - 8.0	4	4%	37%
	Medium	8.0 - 11.0	3	3%	40%
	Medium	11.0 - 16.0	7	7%	47%
	Coarse	16.0 - 22.6			47%
	Coarse	22.6 - 32			47%
	Very Coarse	32 - 45	2	2%	49%
	Very Coarse	45 - 64	4	4%	53%
COBBLE	Small	64 - 90	9	9%	62%
	Small	90 - 128	20	20%	82%
	Large	128 - 180	6	6%	88%
	Large	180 - 256	1	1%	89%
BOULDER	Small	256 - 362			89%
	Small	362 - 512			89%
	Medium	512 - 1024			89%
	Large-Very Large	1024 - 2048			89%
BEDROCK	Bedrock	> 2048	11	11%	100%
		Total	**100**	**100%**	**100%**

Cummulative	
Channel materials (mm)	
D_{16} =	0.8
D_{35} =	6.9
D_{50} =	49.0
D_{84} =	160.0
D_{95} =	3100.0
D_{100} =	5000.0



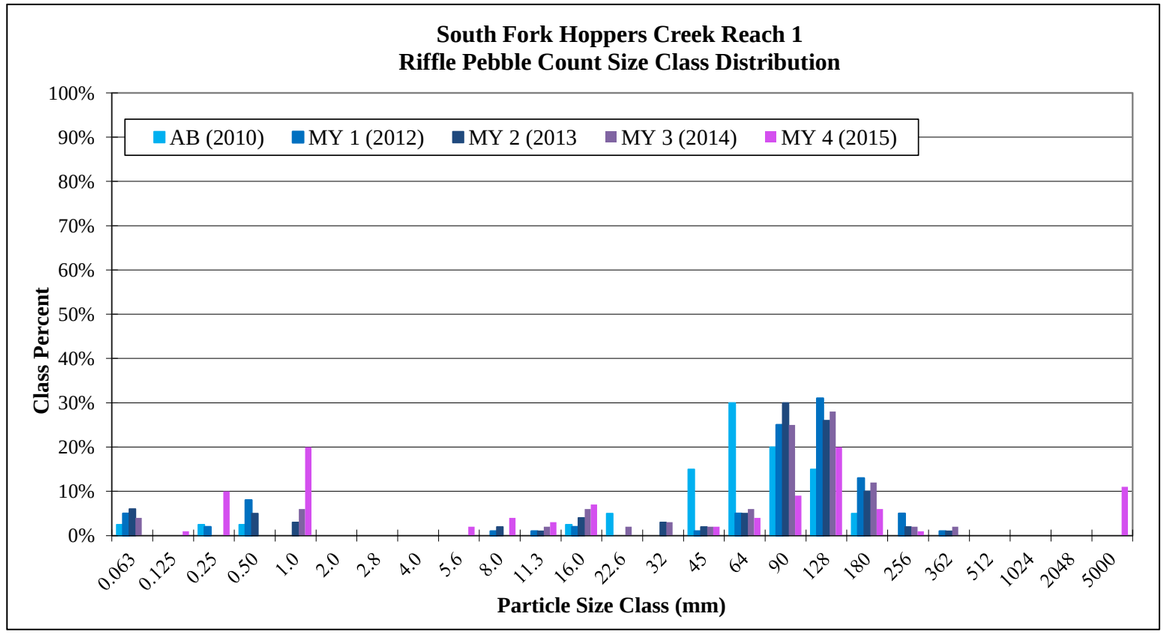
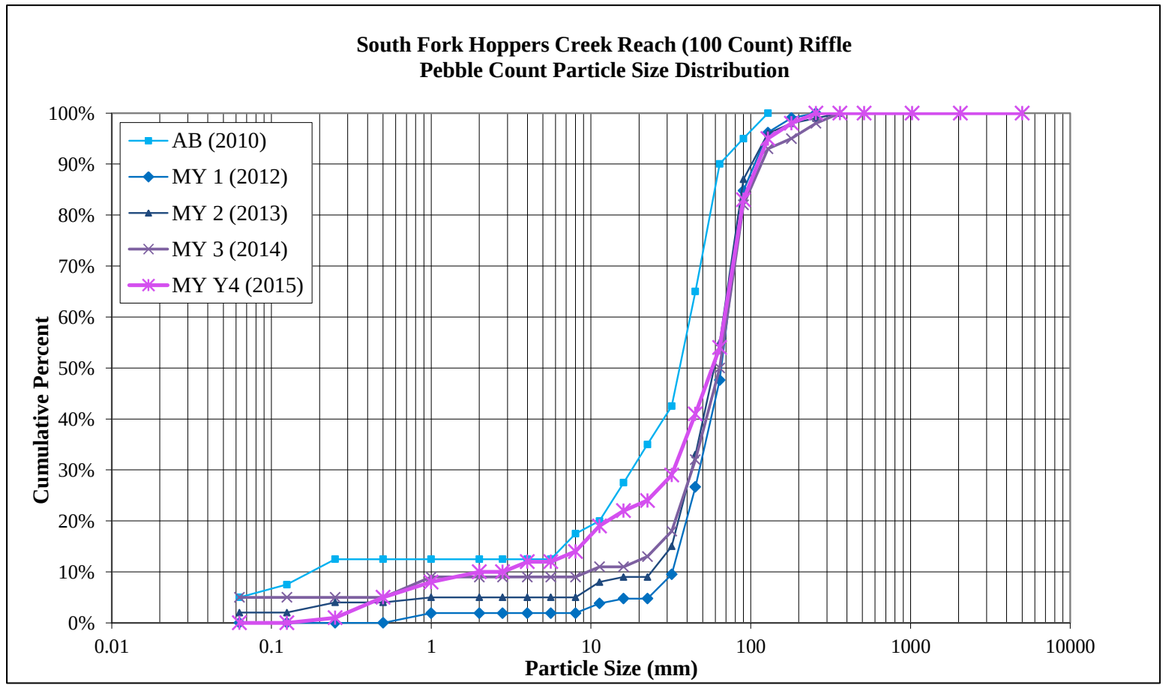


Figure 5b. Riffle Pebble Count Size Class Distribution with Annual Overlays
South Fork Hoppers Creek - Melton Farm Restoration Project: DMS Project No. 92251

BAKER PROJECT NO.	128244
SITE OR PROJECT:	South Fork Hoppers Creek-Melton Farm Restoration Project
REACH/LOCATION:	Reach 2 - Cross-section 7 (Riffle)
DATE COLLECTED:	9/29/2015
FIELD COLLECTION BY:	CB & JN
DATA ENTRY BY:	KLS

			PARTICLE CLASS COUNT	Summary	
MATERIAL	PARTICLE	SIZE (mm)	Riffle	Class %	% Cum
SILT/CLAY	Silt / Clay	< .063			0%
SAND	Very Fine	.063 - .125			0%
	Fine	.125 - .25	1	1%	1%
	Medium	.25 - .50	4	4%	5%
	Coarse	.50 - 1.0	3	3%	8%
	Very Coarse	1.0 - 2.0	2	2%	10%
GRAVEL	Very Fine	2.0 - 2.8			10%
	Very Fine	2.8 - 4.0	2	2%	12%
	Fine	4.0 - 5.6			12%
	Fine	5.6 - 8.0	2	2%	14%
	Medium	8.0 - 11.0	5	5%	19%
	Medium	11.0 - 16.0	3	3%	22%
	Coarse	16.0 - 22.6	2	2%	24%
	Coarse	22.6 - 32	5	5%	29%
	Very Coarse	32 - 45	12	12%	41%
	Very Coarse	45 - 64	13	13%	54%
COBBLE	Small	64 - 90	29	29%	83%
	Small	90 - 128	12	12%	95%
	Large	128 - 180	3	3%	98%
	Large	180 - 256	2	2%	100%
BOULDER	Small	256 - 362			100%
	Small	362 - 512			100%
	Medium	512 - 1024			100%
	Large-Very Large	1024 - 2048			100%
BEDROCK	Bedrock	> 2048			100%
		Total	100	100%	100%

Cummulative	
Channel materials (mm)	
D_{16} =	7.4
D_{35} =	37.0
D_{50} =	57.0
D_{84} =	95.0
D_{95} =	125.0
D_{100} =	250.0



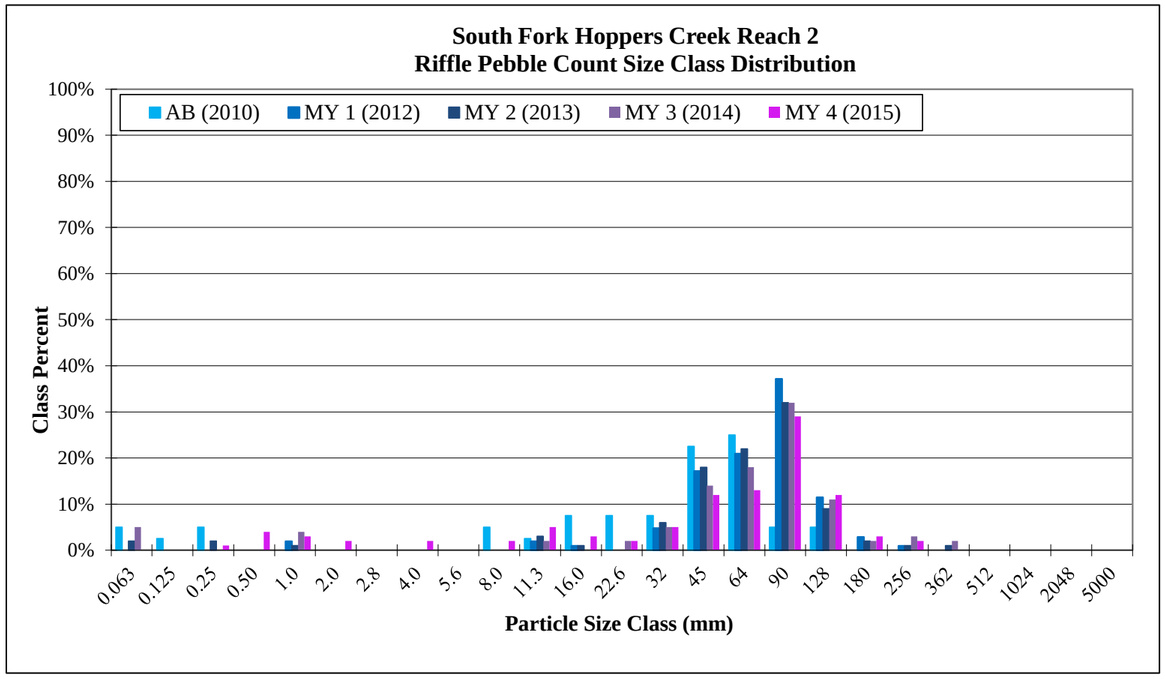
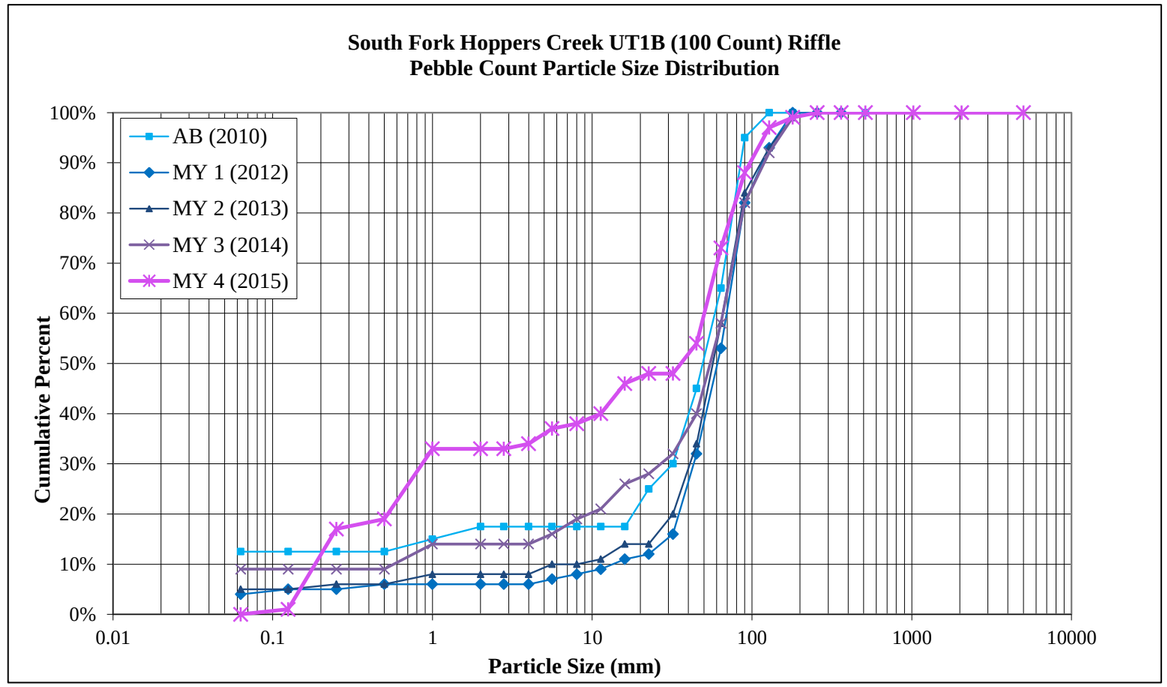


Figure 5c. Riffle Pebble Count Size Class Distribution with Annual Overlays
South Fork Hoppers Creek - Melton Farm Restoration Project: DMS Project No. 92251

	BAKER PROJECT NO. 128244
SITE OR PROJECT:	South Fork Hoppers Creek - Melton Farm Restoration Project
REACH/LOCATION:	UT1B - Cross-section 9 (Riffle)
DATE COLLECTED:	23-Sep-15
FIELD COLLECTION BY:	CB & JN
DATA ENTRY BY:	KLS

			PARTICLE CLASS COUNT	Summary	
MATERIAL	PARTICLE	SIZE (mm)	Riffle	Class %	% Cum
SILT/CLAY	Silt / Clay	< .063			0%
SAND	Very Fine	.063 - .125	1	1%	1%
	Fine	.125 - .25	16	16%	17%
	Medium	.25 - .50	2	2%	19%
	Coarse	.50 - 1.0	14	14%	33%
	Very Coarse	1.0 - 2.0			33%
GRAVEL	Very Fine	2.0 - 2.8			33%
	Very Fine	2.8 - 4.0	1	1%	34%
	Fine	4.0 - 5.6	3	3%	37%
	Fine	5.6 - 8.0	1	1%	38%
	Medium	8.0 - 11.0	2	2%	40%
	Medium	11.0 - 16.0	6	6%	46%
	Coarse	16.0 - 22.6	2	2%	48%
	Coarse	22.6 - 32			48%
	Very Coarse	32 - 45	6	6%	54%
	Very Coarse	45 - 64	19	19%	73%
COBBLE	Small	64 - 90	15	15%	88%
	Small	90 - 128	9	9%	97%
	Large	128 - 180	2	2%	99%
	Large	180 - 256	1	1%	100%
BOULDER	Small	256 - 362			100%
	Small	362 - 512			100%
	Medium	512 - 1024			100%
	Large-Very Large	1024 - 2048			100%
BEDROCK	Bedrock	> 2048			100%
		Total	100	100%	100%

Cummulative	
Channel materials (mm)	
D_{16} =	0.2
D_{35} =	4.7
D_{50} =	36.0
D_{84} =	73.0
D_{95} =	125.0
D_{100} =	215.0



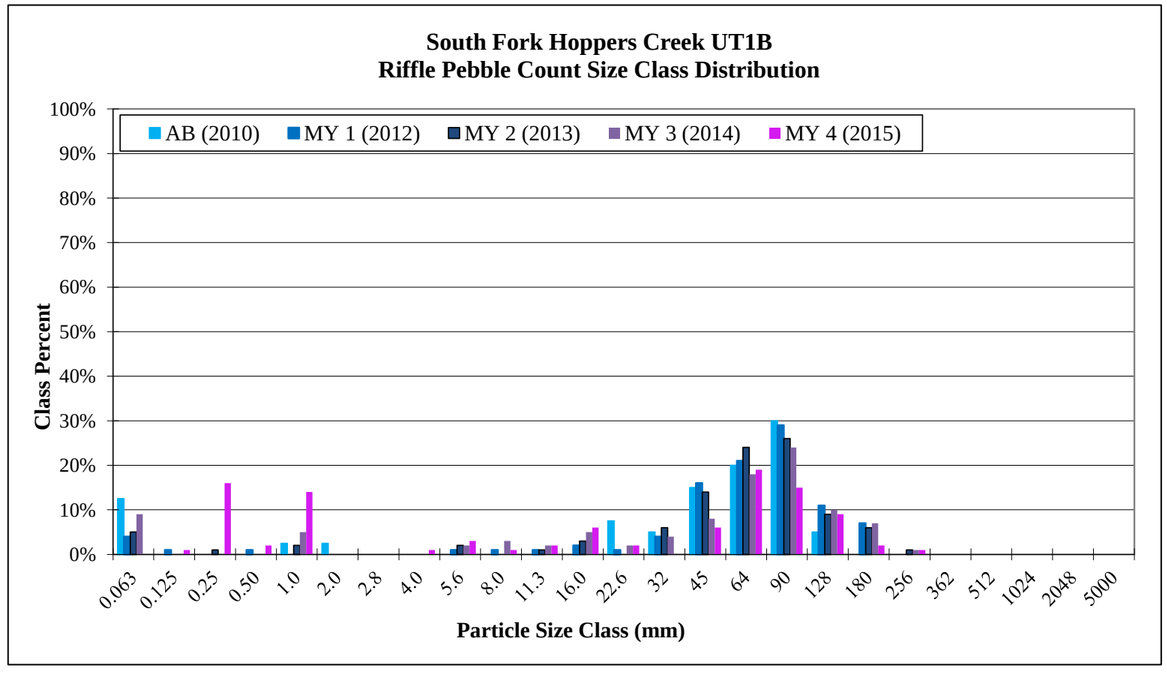


Table 10. Baseline Stream Summary
South Fork Hoppers Creek - Melton Farm Restoration Project: DMS Project No. 92251

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/ft^2	-----	-----	-----	-----	-----	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/m^2	-----	-----	-----	-----	-----	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.

Table 10. Baseline Stream Summary
South Fork Hoppers Creek - Melton Farm Restoration Project: DMS Project No. 92251

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 (ft²)	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 (ft³)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
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
South Fork Hoppers Creek - Melton Farm Restoration Project: DMS 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/ft^2	-----	-----	-----	-----	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/m^2	-----	-----	-----	-----	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	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----

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 11a. Cross-section Morphology Data Table

South Fork Hoppers Creek - Melton Farm Restoration Project: DMS 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	1260.2		1260.1	1260.1	1260.1	1260.1	1260.1	
BF Width (ft)	13.1	12.1	12.3	12.2	13.2		14.6	13.5	13.4	13.4	11.2	
BF Mean Depth (ft)	1.1	1.0	0.9	0.9	1.0		1.2	1.3	1.3	1.3	1.0	
Width/Depth Ratio	11.5	12.5	13.1	13.5	13.1		11.8	10.7	10.7	10.7	11.2	
BF Cross-sectional Area (ft²)	15.0	11.8	11.6	11.0	13.2		18.0	17.1	16.7	16.8	11.2	
BF Max Depth (ft)	1.7	1.6	1.7	1.5	1.8		2.4	2.7	2.8	2.7	2.2	
Width of Floodprone Area (ft)	62.9	62.9	62.8	62.8	62.8		65.9	66.0	66.0	65.9	66.0	
Entrenchment Ratio	4.8	5.2	5.1	5.2	4.8		N/A	N/A	N/A	N/A	N/A	
Bank Height Ratio	1.0	1.0	1.1	1.0	1.0		1.0	1.0	1.1	1.0	1.0	
Wetted Perimeter (ft)	15.4	14.1	14.2	14.0	15.2		17.1	16.0	15.9	15.9	13.2	
Hydraulic Radius (ft)	1.0	0.8	0.8	0.8	0.9		1.1	1.1	1.1	1.1	0.8	

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	1255.2		1252.9	1252.9	1252.9	1252.9	1252.9	
BF Width (ft)	13.3	14.1	12.8	12.7	13.4		17.5	15.2	12.8	13.7	14.2	
BF Mean Depth (ft)	1.0	1.1	1.2	1.2	1.2		0.9	1.1	1.0	1.0	1.0	
Width/Depth Ratio	13.1	13.3	11.1	10.9	11.2		19.0	13.9	13.3	13.9	14.7	
BF Cross-sectional Area (ft²)	13.5	14.8	14.8	14.8	16.0		16.0	16.6	12.3	13.6	13.7	
BF Max Depth (ft)	1.5	1.7	1.9	1.8	1.9		2.1	2.5	1.7	1.8	2.0	
Width of Floodprone Area (ft)	62.9	62.9	62.9	62.8	62.9		71.0	71.1	71.1	71.1	71.1	
Entrenchment Ratio	4.7	4.5	4.9	4.9	4.7		N/A	N/A	N/A	N/A	N/A	
Bank Height Ratio	1.0	1.0	1.1	1.0	1.0		1.0	1.0	1.2	1.2	1.0	
Wetted Perimeter (ft)	15.4	16.2	15.1	15.0	15.8		19.3	17.4	14.7	15.7	16.1	
Hydraulic Radius (ft)	0.9	0.9	1.0	1.0	1.0		0.8	1.0	0.8	0.9	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	1258.6		1258.4	1258.4	1258.4	1258.4	1258.4	
BF Width (ft)	7.0	5.5	5.4	6.8	7.1		10.2	9.1	8.9	9.9	11.1	
BF Mean Depth (ft)	0.5	0.5	0.4	0.4	0.4		0.8	0.6	0.6	0.6	0.6	
Width/Depth Ratio	13.3	11.4	13.6	15.9	17.8		13.3	16.3	14.5	18.2	19.3	
BF Cross-sectional Area (ft²)	3.7	2.6	2.2	2.9	2.8		7.9	5.1	5.5	5.4	6.4	
BF Max Depth (ft)	1.1	0.8	0.8	1.0	1.0		1.6	1.4	1.6	1.6	1.4	
Width of Floodprone Area (ft)	51.0	51.0	47.5	49.8	51.0		62.0	62.0	62.0	62.0	62.0	
Entrenchment Ratio	7.3	8.8	8.8	7.3	7.2		N/A	N/A	N/A	N/A	N/A	
Bank Height Ratio	1.0	1.2	1.2	1.0	1.0		1.0	1.3	1.1	1.1	1.0	
Wetted Perimeter (ft)	8.1	6.4	6.2	7.7	7.9		11.8	10.2	10.1	11.0	12.3	
Hydraulic Radius (ft)	0.5	0.4	0.4	0.4	0.4		0.7	0.5	0.5	0.5	0.5	

Table 11b. Stream Reach Morphology
South Fork Hoppers Creek - Melton Farm Restoration Project: DMS 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	-----	13.2	-----	-----	-----	1						
Floodprone Width (ft)	-----	62.9	-----	-----	-----	1	-----	62.9	-----	-----	-----	1	-----	62.8	-----	-----	-----	1	-----	62.8	-----	-----	-----	1	-----	62.8	-----	-----	-----	1						
BF Mean Depth (ft)	-----	1.1	-----	-----	-----	1	-----	1.0	-----	-----	-----	1	-----	0.9	-----	-----	-----	1	-----	0.9	-----	-----	-----	1	-----	1.0	-----	-----	-----	1						
BF Max Depth (ft)	-----	1.7	-----	-----	-----	1	-----	1.6	-----	-----	-----	1	-----	1.7	-----	-----	-----	1	-----	1.5	-----	-----	-----	1	-----	1.8	-----	-----	-----	1						
BF Cross-sectional Area (ft²)	-----	15.0	-----	-----	-----	1	-----	11.8	-----	-----	-----	1	-----	11.6	-----	-----	-----	1	-----	11.0	-----	-----	-----	1	-----	13.2	-----	-----	-----	1						
Width/Depth Ratio	-----	11.5	-----	-----	-----	1	-----	12.5	-----	-----	-----	1	-----	13.1	-----	-----	-----	1	-----	13.5	-----	-----	-----	1	-----	13.1	-----	-----	-----	1						
Entrenchment Ratio	-----	4.8	-----	-----	-----	1	-----	5.2	-----	-----	-----	1	-----	5.1	-----	-----	-----	1	-----	5.2	-----	-----	-----	1	-----	4.8	-----	-----	-----	1						
Bank Height Ratio	-----	1.0	-----	-----	-----	1	-----	1.0	-----	-----	-----	1	-----	1.1	-----	-----	-----	1	-----	1.0	-----	-----	-----	1	-----	1.0	-----	-----	-----	1						
d50 (mm)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	49.0	-----	-----	-----	1						
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	27	44	36	70	18.3	6						
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	0.01	0.03	0.02	0.05	0.02	6						
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	51	100	104	130	26.3	6						
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						0.8 / 6.9 / 49.0/ 160.0 / 3100 / 5000											
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	-----	-----	----	----	----	0.52	----	----						
Rosgen Classification	-----	E5/C5	-----	-----	-----	-----	-----	E5/C5	-----	-----	-----	-----	-----	E5/C5	-----	-----	-----	-----	-----	E5/C5	-----	-----	-----	-----	----	C5	----	----	----	----						
BF Velocity (fps)1	-----	3.6	-----	-----	-----	-----	-----	3.6	-----	-----	-----	-----	-----	3.6	-----	-----	-----	-----	-----	3.6	-----	-----	-----	-----	----	3.6	----	----	----	----						
BF Discharge (cfs)	-----	54.1	-----	-----	-----	-----	-----	42.5	-----	-----	-----	-----	-----	41.8	-----	-----	-----	-----	-----	39.6	-----	-----	-----	-----	----	47.5	----	----	----	----						
Valley Length (ft)	-----	619.0	-----	-----	-----	-----	-----	619.0	-----	-----	-----	-----	-----	619.0	-----	-----	-----	-----	-----	619.0	-----	-----	-----	-----	----	619.0	----	----	----	----						
Channel length (ft)	-----	783.0	-----	-----	-----	-----	-----	783.0	-----	-----	-----	-----	-----	783.0	-----	-----	-----	-----	-----	783.0	-----	-----	-----	-----	----	796.0	----	----	----	----						
Sinuosity	-----	1.26	-----	-----	-----	-----	-----	1.26	-----	-----	-----	-----	-----	1.26	-----	-----	-----	-----	-----	1.26	-----	-----	-----	-----	----	1.29	----	----	----	----						
Water Surface Slope (Channel) (ft/ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	0.01	-----	-----	-----	-----	-----	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	----	13.4	----	----	----	1						
Floodprone Width (ft)	-----	62.9	-----	-----	-----	1	-----	62.9	-----	-----	-----	1	-----	62.9	-----	-----	-----	1	-----	62.8	-----	-----	-----	1	----	62.9	----	----	----	1						
BF Mean Depth (ft)	-----	1.0	-----	-----	-----	1	-----	1.1	-----	-----	-----	1	-----	1.2	-----	-----	-----	1	-----	1.2	-----	-----	-----	1	----	1.2	----	----	----	1						
BF Max Depth (ft)	-----	1.5	-----	-----	-----	1	-----	1.7	-----	-----	-----	1	-----	1.9	-----	-----	-----	1	-----	1.8	-----	-----	-----	1	----	1.9	----	----	----	1						
BF Cross-sectional Area (ft²)	-----	13.5	-----	-----	-----	1	-----	14.8	-----	-----	-----	1	-----	14.8	-----	-----	-----	1	-----	14.8	-----	-----	-----	1	----	16.0	----	----	----	1						
Width/Depth Ratio	-----	13.1	-----	-----	-----	1	-----	13.3	-----	-----	-----	1	-----	11.1	-----	-----	-----	1	-----	10.9	-----	-----	-----	1	----	11.2	----	----	----	1						
Entrenchment Ratio	-----	4.7	-----	-----	-----	1	-----	4.5	-----	-----	-----	1	-----	4.9	-----	-----	-----	1	-----	4.9	-----	-----	-----	1	----	4.7	----	----	----	1						
Bank Height Ratio	-----	1.0	-----	-----	-----	1	-----	1.0	-----	-----	-----	1	-----	1.1	-----	-----	-----	1	-----	1.0	-----	-----	-----	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	11	31	32	45	12.6	5						
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	0.017	0.028	0.031	0.045	0.012	5						
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	57	92	87	137	34.7	4						
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						7.4 / 37.0 / 57.0 / 95.0 / 125.0											
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	-----	-----	----	----	----	0.52	----	----						
Rosgen Classification	-----	C5	-----	-----	-----	-----	-----	C5	-----	-----	-----	-----	-----	C5	-----	-----	-----	-----	-----	C5	-----	-----	-----	-----	----	E5/C5	----	----	----	----						
BF Velocity (fps)1	-----	3.9	-----	-----	-----	-----	-----	3.9	-----	-----	-----	-----	-----	3.9	-----	-----	-----	-----	-----	3.9	-----	-----	-----	-----	----	3.9	----	----	----	----						
BF Discharge (cfs)	-----	52.767	-----	-----	-----	-----	-----	57.681	-----	-----	-----	-----	-----	57.72	-----	-----	-----	-----	-----	57.72	-----	-----	-----	-----	----	62.4	----	----	----	----						
Valley Length (ft)	-----	405	-----	-----	-----	-----	-----	405	-----	-----	-----	-----	-----	405	-----	-----	-----	-----	-----	405	-----	-----	-----	-----	----	405	----	----	----	----						
Channel length (ft)	-----	415	-----	-----	-----	-----	-----	415	-----	-----	-----	-----	-----	415	-----	-----	-----	-----	-----	415	-----	-----	-----	-----	----	453	----	----	----	----						
Sinuosity	-----	1.02	-----	-----	-----	-----	-----	1.02	-----	-----	-----	-----	-----	1.02	-----	-----	-----	-----	-----	1.02	-----	-----	-----	-----	----	1.12	----	----	----	----						
Water Surface Slope (Channel) (ft/ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	0.02	-----	-----	-----	-----	-----	0.02	-----	-----	-----	-----	----	0.01	----	----	----	----						
BF Slope (ft/ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	----	----	----	----	----						

Table 11b. Stream Reach Morphology
South Fork Hoppers Creek - Melton Farm Restoration Project: DMS 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	----	7.1	----	----	----	1						
Floodprone Width (ft)	-----	51.0	-----	-----	-----	1	-----	51.0	-----	-----	-----	1	-----	47.5	-----	-----	-----	1	-----	49.8	-----	-----	-----	1	----	51.0	----	----	----	1						
BF Mean Depth (ft)	-----	0.5	-----	-----	-----	1	-----	0.5	-----	-----	-----	1	-----	0.4	-----	-----	-----	1	-----	0.4	-----	-----	-----	1	----	0.4	----	----	----	1						
BF Max Depth (ft)	-----	1.1	-----	-----	-----	1	-----	1.1	-----	-----	-----	1	-----	0.8	-----	-----	-----	1	-----	1.0	-----	-----	-----	1	----	1.0	----	----	----	1						
BF Cross-sectional Area (ft²)	-----	3.7	-----	-----	-----	1	-----	3.7	-----	-----	-----	1	-----	2.2	-----	-----	-----	1	-----	2.9	-----	-----	-----	1	----	2.8	----	----	----	1						
Width/Depth Ratio	-----	13.3	-----	-----	-----	1	-----	13.3	-----	-----	-----	1	-----	13.6	-----	-----	-----	1	-----	15.9	-----	-----	-----	1	----	17.8	----	----	----	1						
Entrenchment Ratio	-----	7.3	-----	-----	-----	1	-----	7.3	-----	-----	-----	1	-----	8.8	-----	-----	-----	1	-----	7.3	-----	-----	-----	1	----	7.2	----	----	----	1						
Bank Height Ratio	-----	1.0	-----	-----	-----	1	-----	1.0	-----	-----	-----	1	-----	1.2	-----	-----	-----	1	-----	1.0	-----	-----	-----	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	9.0	33.0	26.0	68.0	21.9	12						
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	0.009	0.023	0.018	0.045	0.013	12						
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	23	62	56	116	27	12						
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						0.2 / 4.7 / 36.0 / 73.0 / 125.0									
Reach Shear Stress (competency) lb/f²	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	----	----	----	----	----						
Stream Power (transport capacity) W/m²	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	----	----	----	----	----						
Additional Reach Parameters																																				
Drainage Area (SM)	-----	-----	-----	0.08	-----	-----	-----	-----	-----	0.08	-----	-----	-----	-----	-----	0.08	-----	-----	-----	-----	-----	0.08	-----	-----	----	----	----	0.08	----	----						
Rosgen Classification	-----	C5	-----	-----	-----	-----	-----	C5	-----	-----	-----	-----	-----	C5	-----	-----	-----	-----	-----	C5	-----	-----	-----	-----	----	C5	----	----	----	----						
Bankfull Velocity (fps)1	-----	4.2	-----	-----	-----	-----	-----	4.2	-----	-----	-----	-----	-----	4.2	-----	-----	-----	-----	-----	4.2	-----	-----	-----	-----	----	4.2	----	----	----	----						
BF Discharge (cfs)	-----	15.6	-----	-----	-----	-----	-----	15.6	-----	-----	-----	-----	-----	9.2	-----	-----	-----	-----	-----	12.2	-----	-----	-----	-----	----	11.8	----	----	----	----						
Valley Length (ft)	-----	816.0	-----	-----	-----	-----	-----	816.0	-----	-----	-----	-----	-----	816.0	-----	-----	-----	-----	-----	816.0	-----	-----	-----	-----	----	816.0	----	----	----	----						
Channel length (ft)	-----	1035	-----	-----	-----	-----	-----	1035	-----	-----	-----	-----	-----	1035	-----	-----	-----	-----	-----	1035	-----	-----	-----	-----	----	1052	----	----	----	----						
Sinuosity	-----	1.27	-----	-----	-----	-----	-----	1.27	-----	-----	-----	-----	-----	1.27	-----	-----	-----	-----	-----	1.27	-----	-----	-----	-----	----	1.34	----	----	----	----						
Water Surface Slope (Channel) (ft/ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	0.02	-----	-----	-----	-----	-----	0.02	-----	-----	-----	-----	----	0.02	----	----	----	----						
BF slope (ft/ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	----	----	----	----	----						

APPENDIX E

HYDROLOGIC DATA

Table 12. Verification of Bankfull Events			
South Fork Hoppers Creek - Melton Farm Restoration Project: DMS Project No. 92251			
Date of Data Collection	Date of Event*	Method of Data Collection	Gauge Watermark Height (feet above bankfull)
November 16, 2015	9/24/2015 - 11/16/2015	Gauge Measurement	0.20
September 24, 2015	5/6/2015 - 9/24/2015	Gauge Measurement	0.25
May 6, 2015	4/16/2014 - 5/6/2015	Gauge Measurement	0.25
April 16, 2014	5/1/2013 - 4/16/2014	Gauge Measurement	0.60
May 1, 2013	12/31/2012 - 5/1/2013	Gauge Measurement	0.10
December 31, 2012	8/1/2012 - 12/31/2012	Gauge Measurement	0.55
August 1, 2012	5/30/2012 - 8/1/2012	Gauge Measurement	0.10
* Date of event(s) occurred sometime between the date range specified.			

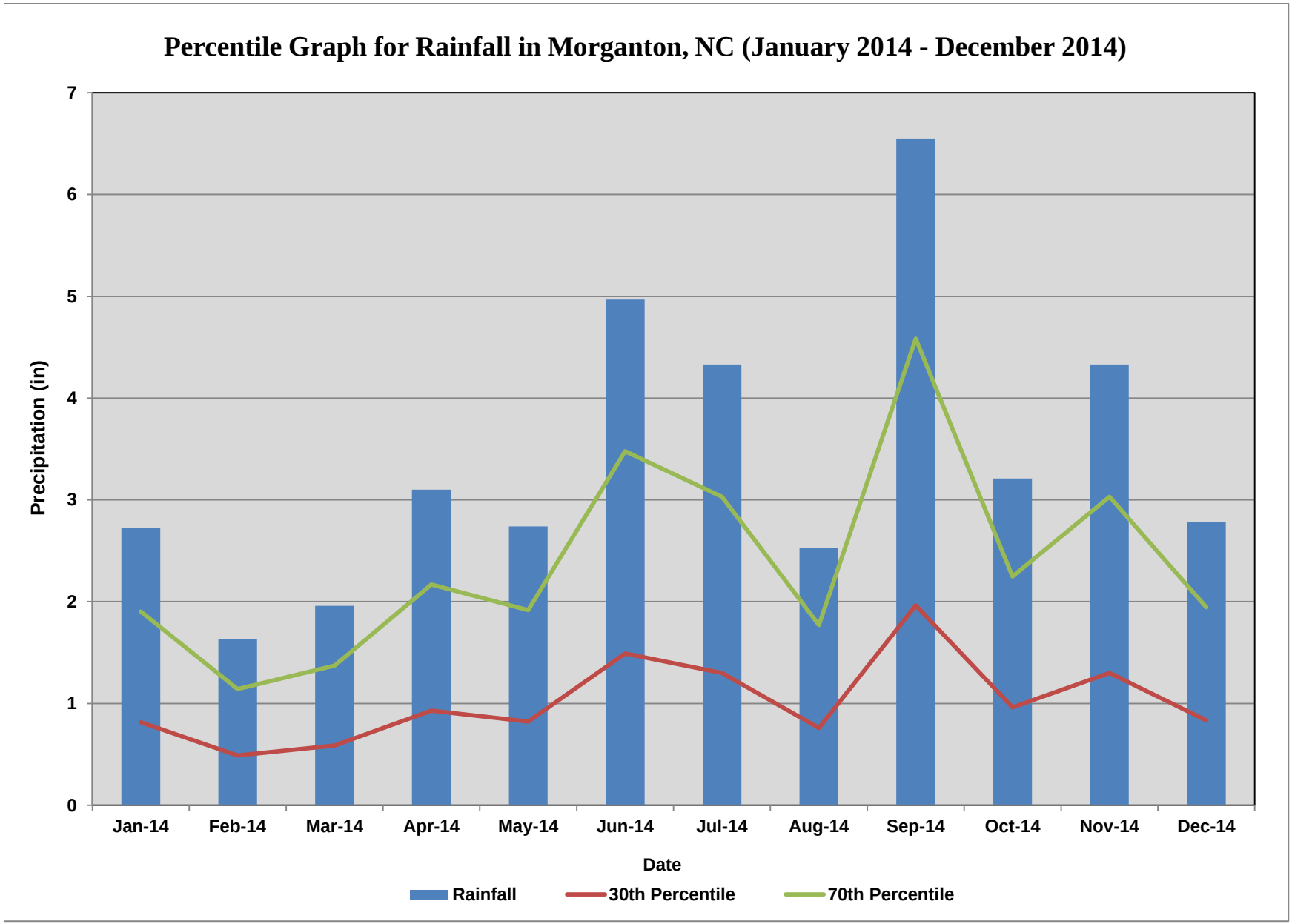


Figure 6a. Monthly Rainfall Data

South Fork Hoppers Creek-Melton Farm Restoration Project: DMS Project No. 99251

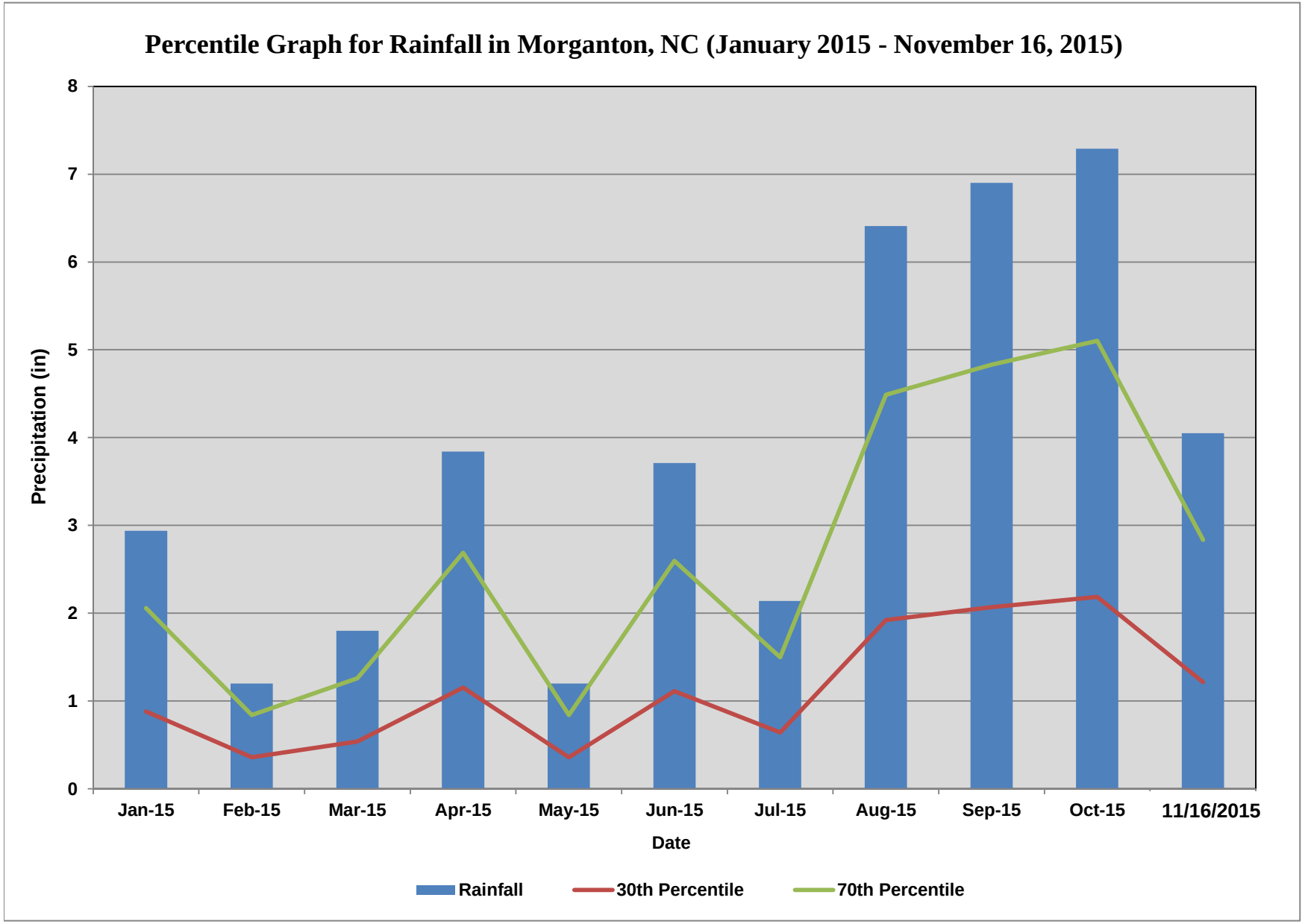


Figure 6b. Monthly Rainfall Data

South Fork Hoppers Creek-Melton Farm Restoration Project: DMS Project No. 99251

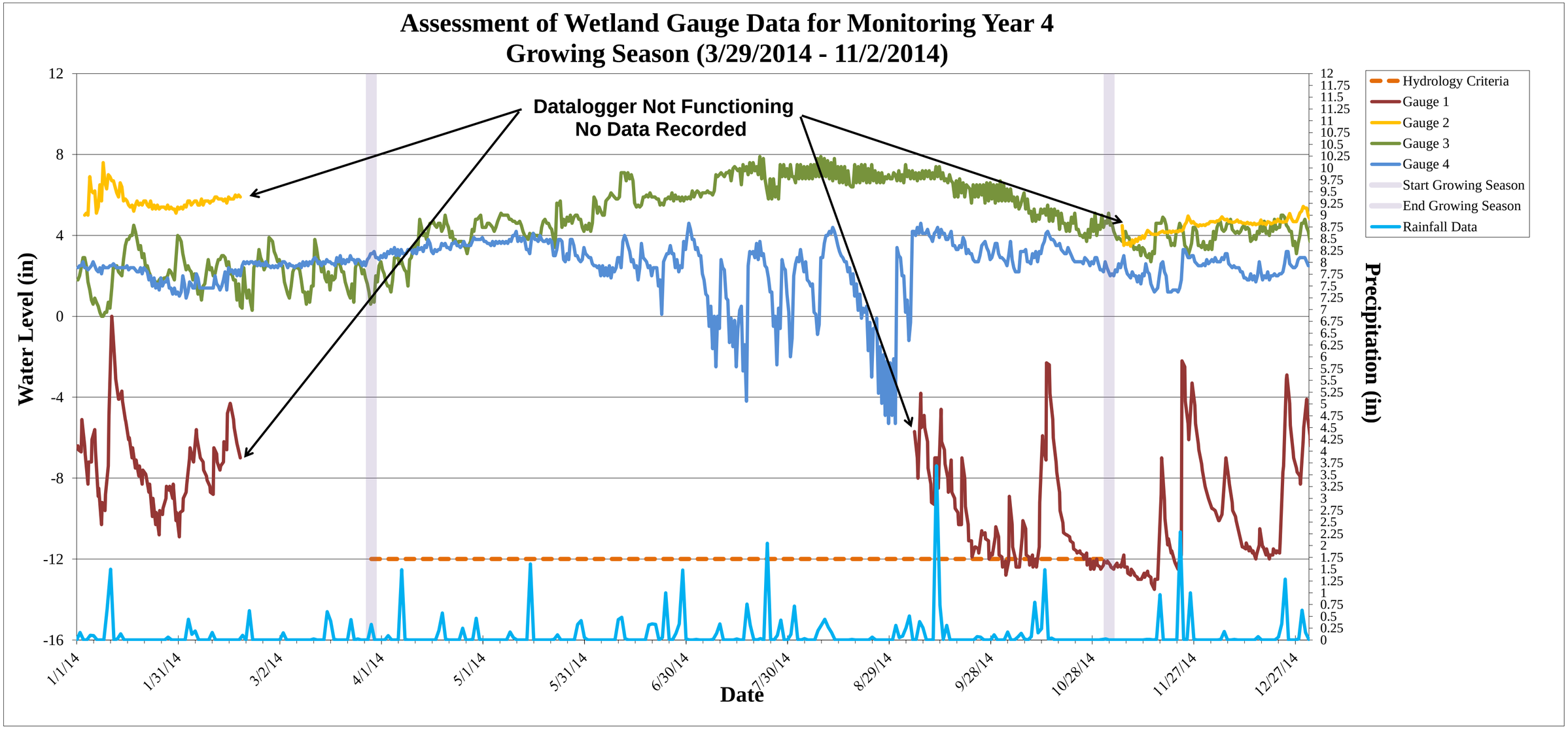


Figure 7a. Precipitation and Water Level Plots
South Fork Hoppers Creek - Melton Farm Restoration Project: DMS Project No. 92251

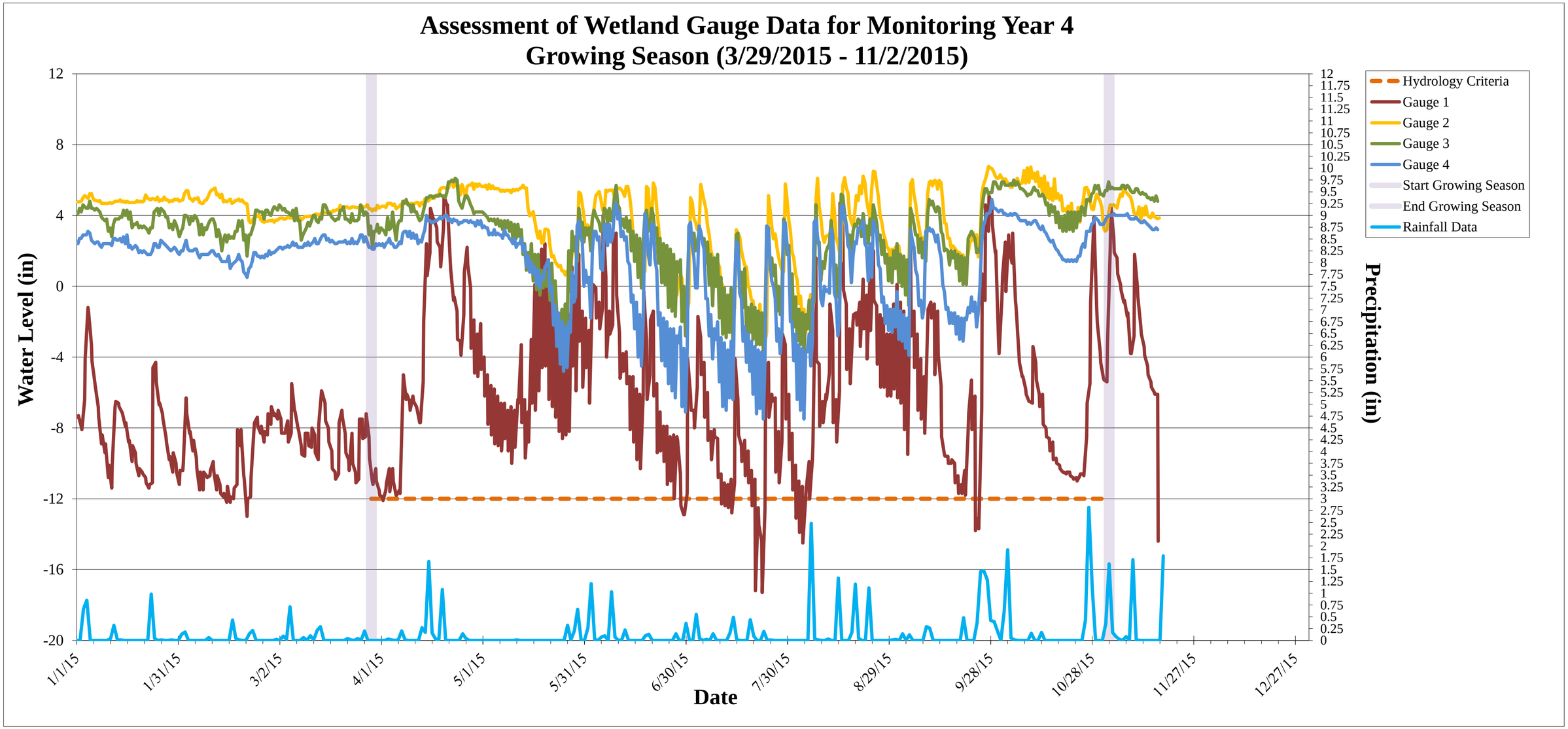


Figure 7b. Precipitation and Water Level Plots
South Fork Hoppers Creek - Melton Farm Restoration Project: DMS Project No. 92251

Table 13. Wetland Gauge Attainment Data

South Fork Hoppers Creek Mitigation Plan: DMS 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)**	**MY4 (2015)**	**MY5 (2016)**
Gauge 1	No/10 days (5%)	Yes/25 days (12%)	Yes/218 days (100%)	Yes/27 days (12%)*	Yes/176 days (81%)	
Gauge 2	Yes/218 days (100%)	Yes/218 days (100%)	Yes/218 days (100%)	N/A**	Yes/218 days (100%)	
Gauge 3	Yes/188 days (86%)	Yes/218 days (100%)	Yes/218 days (100%)	Yes/218 days (100%)	Yes/218 days (100%)	
Gauge 4	Yes/200 days (92%)	Yes/218 days (100%)	Yes/218 days (100%)	Yes/218 days (100%)	Yes/218 days (100%)	

*Gauge 1 was not working properly during much of the 2014 growing season.

**Gauge 2 was not working properly throughout the 2014 growing season.