CHARLES WILLIAMS STREAM, WETLAND, AND BUFFER SITE
DMS Project No. 80

MONITORING YEAR 3 (2015)
Construction Completed February 2013
Planting Completed February 2014

Randolph County, NC
State Construction Project No. 07-07125-01A

Prepared for the
NC Department of Environmental Quality
Division of Mitigation Services

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Environmental Quality

FINAL REPORT November 2015

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SUNGATE DESIGN GROUP

This assessment and report are consistent with NCDENR Division of Mitigation Services Template Version 1.4 (11/07/11) for Monitoring Reports.

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1.0 EXECUTIVE SUMMARY/ PROJECT ABSTRACT

The Charles Williams Stream, Wetland and Buffer Site, hereinafter referred to as the "Project Site" or "Site," is located in Randolph County, North Carolina, within US Geological Survey (USGS) 8-digit Hydrologic Unit Code (HUC) 03030003 and NC Division of Water Resources (NCDWR) sub-basin 03-06-09 of the Cape Fear River Basin (Figure 1). The project involved the enhancement of 1,850 linear feet of an unnamed tributary (UT) to Sandy Creek, 2.2 acres of wetlands and 8.8 acres of riparian buffer. The Site is protected for perpetuity under a conservation easement purchased from Mr. Charles Williams in 2006. Project restoration components, activity and reporting history, contacts and attribute data are all provided in Appendix A.

1.1 Goals and Objectives

The Project's goals were to:

- reduce nutrient and sediment water quality stressors;
- provide for uplift in water quality functions;
- improve instream and wetland aquatic habitats, including riparian terrestrial habitats; and,
- provide for greater overall instream and wetland habitat complexity and quality.

Stream enhancement, the primary component, served as the dominant input for achieving this goal.

No restoration goals were identified in the Cape Fear River Basinwide Management Plan (NCDWQ, 2005) with regard to the Sandy Creek watershed. There were no sources or stressors listed for the watershed area associated with the Project Site. The NC Department of Environment and Natural Resources (NCDENR) Division of Mitigation Services (DMS) develops River Basin Restoration Priorities (RBRP) to guide its restoration activities within each of the state's 54 cataloging units. RBRPs delineate specific watersheds that exhibit both the need and opportunity for wetland, stream and riparian buffer restoration. These watersheds are called Targeted Local Watersheds (TLWs) and receive priority for DMS planning and restoration project funds. The 2009 Draft Cape Fear River RBRP identified HUC 03030003020010, which includes the Project Site, as a Targeted Local Watershed. The following information is taken directly from the RBRP. "…This is a largely rural hydrologic unit (HU). The main stream, Sandy Creek, flows through Randolph County to Sandy Creek Reservoir, a drinking water supply for Ramseur and Franklinville. As of 2006, the HU had no streams on DWQ's list of impaired waters; however, the reservoir shows indications of high nutrient levels, likely related to the large number of animal operations in the HU. The HU is a Water Supply Watershed and a long portion of Sandy Creek is recognized by the State's Natural Heritage Program as a Significant Natural Heritage Area. DMS has been active in the HU with five projects that include components of preserving wetlands (3 acres) and streams (5,100 linear feet) and restoring wetlands (15 acres) and streams (15,000 linear feet). Piedmont Land Conservancy has also been active in protecting streamside buffers in the HU. Continued implementation of practices to reduce nutrient inputs to Sandy Creek Reservoir is recommended for this HU."

1.2 Background Summary

The Project Site is situated in northeastern Randolph County, approximately four miles west of Liberty and six miles north of Ramseur (Figure 1). It is bordered to the north and west by undeveloped land, to the east by SR 2442 (Ramseur-Julian Road), and to the south by Sandy Creek. Northeastern Randolph Middle School is on the property opposite of Sandy Creek, to the south. The Project Site can be accessed by using the following directions from US Highway 64.

- Turn north on US 421 in Siler City, towards the Town of Liberty.
- Proceed approximately 9.5 miles and turn south (left) onto NC 49.
- Proceed approximately 0.7 miles along NC 49 and turn north (right) onto SR 2459 (Sandy Creek Church Road).
- Follow Sandy Creek Church Road approximately 4.5 miles until it intersects with Ramseur-Julian Road and turn north (right),
- Follow Ramseur-Julian Road approximately 0.3 miles, crossing over Sandy Creek. The Charles Williams Site is on the west (left) side of the roadway, immediately north of Sandy Creek.

Situated in the Piedmont physiographic province and the Cape Fear River Basin, the Project Site encompasses 18 acres of former pasture and existing riparian forest. Elevations across the Site range between approximately 550 and 560 feet above Mean Sea Level. The following chart depicts pre-implementation existing condition information regarding the Site.

Pre-Implementation Existing Conditions Summary

Physiographic Province	Piedmont	**County**	Randolph
River Basin Name	Cape Fear	**Property Owner Name**	Charles Williams
USGS 8-digit HUC	03030003		
USGS 14-digit HUC	03030002020010	**Stream #1 Name**	UT to Sandy Creek
NCDWQ Subbasin	03-06-09	**Drainage Area**	4.9 sq. mi.
Underlying Mapped Soil(s)	Chewacla loam	**NCDWQ Score**	(Perennial)
Drainage Class	Somewhat poorly drained	**Rosgen Classification**	C5
Hydric Status	B		
Slope	0-2 %		
Available Water Capacity	Moderate to High		
FEMA Classification	Zone AE		
Invasive Vegetation Observed	Multiflora rose (*Rosa multiflora*) Chinese privet (*Ligustrum sinense*)		

1.3 Vegetation Condition and Comparison to Success Criteria

Vegetation success criteria are consistent with the US Army Corps of Engineers (USACE) Wilmington Regulatory District's guidance for stream and wetland mitigation and the NCDENR's guidance for riparian buffer credit. The USACE guidance requires the survival of a minimum of 320 planted woody stems/acre after Monitoring Year 3 (MY3). A mortality rate of 10% is allowed after MY4 assessments (288 stems/acre) and, correspondingly, after MY5 assessments (260 stems/acre). The NCDENR guidance requires survival of at least 320 native, planted, hardwood stems/acre (trees only) at the end of the MY 5 to successfully earn riparian buffer credit.

Vegetation is currently being assessed using plot layouts consistent with the Carolina Vegetation Survey (CVS) Level II Vegetation Protocol. Stem count data is ascertained from 12 permanently placed 10-meter^2 vegetation plots (Figures 3a and 3b). Assessments include counts of both planted and natural stems. Due to low stem counts during MY2, supplemental planting of species in the original planting list at approximately 300 stems per acre was performed between December 2014 and March 2015. Based on the current monitoring effort, 12 of 12 vegetation plots met the minimum success criteria established for MY3 stream/wetland mitigation criteria and 12 of 12 plots met the criteria for riparian buffer credit. Appendices B and C depict more detailed information regarding the vegetation condition, including annual photograph comparisons and additional information regarding the proposed supplemental planting.

Due to the random placement of vegetation plots, only one of the eight plots associated with stream/wetland credit is currently placed within the wetland enhancement area (Vegetation Plot #6). The remaining seven plots are situated in non-wetland areas; however, based on current site conditions, three plots (Vegetation Plots #3, #7, and #8) may likely be in wetland areas by the time MY4 assessments are performed. The wetland status of the current plots will be reassessed during MY4 activities.

1.4 Stream Stability/Condition and Comparison to Success Criteria

Enhancement (Level I) of the UT utilized natural channel design methodologies consistent with Priority Level IV stream restoration protocols. These protocols specifically include the stabilization of the existing channel in place. To document successful stabilization, a minimum of two bankfull events must be documented within the standard five-year monitoring period. In order for the hydrology-based monitoring to be considered complete, the two events must occur in separate monitoring years.

A bankfull event was actively observed on April 17th, 2015 during a rainfall event. Additional evidence of this and other subsequent bankfull events was documented on June 30, 2015. Evidence consisted of wrack material and sediment staining above the bankfull indicators along the channel and alluvial deposits outside the channel. The crest gauge was checked in June 2015, but could not be successfully read due to a large aggregation of ants within the gauge. Annual photograph comparisons of the stream channel are depicted in Appendix B and hydrologic data associated with this year's monitoring assessment are provided in Appendix E.

1.5 Wetland Condition and Performance Relative to Success Criteria

Wetland enhancement work was performed throughout the existing wetland areas. Prior to enhancement, these wetlands were severely degraded as a result of continuous soil compaction and grazing from livestock. The enhancement work included livestock removal via exclusion fencing and supplemental plantings. Benefits of the enhancement include water quality improvement by trapping nutrients such as nitrogen and phosphorous, toxic substances, and disease-causing microorganisms. Wetlands also slow and intercept surface runoff, protect stream banks from erosion, protect upland areas from flooding, and provide valuable habitat for wildlife.

1.6 Other Information

Summary information/data related to the occurrence of items such as beaver dams 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 the Restoration Plan) documents available on the DMS website. All raw data supporting the tables and figures in the appendices is available from DMS upon request.

Boundary marking along the conservation easement using signage consistent with DMS guidelines was performed by Ecological Engineering on December 8, 2014, and is considered completed.

During MY2 monitoring, a recently constructed beaver dam was observed within the channel at approximately station 14+34.75. In May of 2015 during MY3 monitoring, another recently constructed beaver dam was observed immediately upstream of the culverted road crossing at approximately station 19+51.50. During June of 2015, these dams were removed by hand and beaver trapping was

conducted by APHIS. As of June 30, 2015, no additional beaver activity was observed within the easement area. Please refer to Appendix B for representative photographs.

Based on comments received pertaining to the stream stability monitoring, additional detail was collected during the MY3 longitudinal profile survey. Pattern and profile data was collected to represent the current state of the UT from the upstream, northern easement boundary downstream to the southern easement boundary. Please refer to Appendix D for a comparison of MY3 data with previous monitoring data. It is important to note that, because longitudinal profile survey shots were taken at different channel locations across the monitoring years, it is not possible to fully assess stream bed stability based on the current longitudinal profile comparison. Subsequent survey data in future monitoring years will be collected to the level of detail represented in MY3 data, which will allow an ongoing comparison of stream bed stability. An additional Appendix F is provided to depict the detailed longitudinal profile of the channel thalweg. For ease of comparison, this appendix consists of four sheets, each showing a reach of the channel thalweg at a larger scale than the chart in Appendix D.

2.0 METHODOLOGY

This monitoring report follows methodology consistent with DMS's Procedural Guidance and Content Requirements for Monitoring Reports (Version 1.4, dated 11/07/11), available at the DMS website (http://portal.ncdenr.org/web/eep).

All surveys were performed via total station and survey grade Global Positioning System (GPS). Each survey point has three-dimensional coordinates and is tied to survey control points. Longitudinal profile stationing was originally developed based on the design stationing, and follows the UT from the northern to the southern property boundary (upstream to downstream) as depicted on the survey plat. Based on comments from DMS during the review of the draft MY2 monitoring report, the MY3 longitudinal profile survey incorporated more detailed data collection to more accurately represent changes in channel morphology over time. As the MY3 survey is a more complete longitudinal profile, channel stationing is more accurate than that shown in previous longitudinal profiles. In order to compensate for differences in stationing, channel survey shots from previous monitoring years were viewed in plan view and compared to MY3 channel stations. Stationing of previous years' shots was adjusted to reflect the more accurate MY3 channel stationing. Appendix D includes an overlay of channel survey data based on this adjusted stationing. Subsequent surveys will continue to collect the level of detail represented in the MY3 survey.

Particle size distribution protocols followed the Wolman Pebble Count Procedure, which requires an observer with a metric ruler to measure particles based on their intermediate axis. This information is correlated into a graph depicting a particle size analysis of the cross section.

Vegetation assessments were conducted using the CVS protocol (Version 4.2). As part of this protocol, vegetation is assessed using 100-meter^2 plots, or modules. The scientific method requires that measurements be as unbiased as possible, and that they be repeatable. Plots are designed to achieve both of these objectives; in particular, different people should be able to inventory the same plot and produce similar data (Lee et. al., 2006). According to Lee et. al. (2006), there are many different goals in recording vegetation, and both time and resources for collecting plot data are extremely variable. To provide appropriate flexibility in project design, the CVS protocol supports five distinct types of vegetation plot records, which are referred to as levels in recognition of the increasing level of detail and complexity across the sequence. The lower levels require less detail and fewer types of information about both vegetation and environment, and thus are generally sampled with less time and effort (Lee et. al., 2006). Level 1 (Planted Stem Inventory Plots) and Level 2 (Total Woody Stem Inventory Plots) inventories were completed on all 12 of the vegetation plots at the Project Site.

A crest gauge was installed near the downstream end of the Site along the UT to verify the on-site occurrences of bankfull events. In addition to the crest gauge, observations of recently deposited overbank wrack and/or sediment serve to validate gauge observations, as necessary. Documentation of the highest stage during the monitoring interval is assessed during each site visit and the gauge is reset. The data related to bankfull verification are summarized in each year's report. Based on the elevation of the crest gauge, any readings observed higher than 22 inches on the gauge reflect a bankfull or above bankfull event.

3.0 REFERENCES

Lee, Michael T., R.K. Peet, S.D. Roberts and T.R. Wentworth, 2006. CVS Protocol for Recording Vegetation, Version 4.0 (http://cvs.bio.unc.edu/methods.htm).

NCDENR Division of Water Quality (NCDWQ) , 2005. Cape Fear River Basinwide Management Plan. Available at: http://portal.ncdenr.org/web/wq/ps/bpu/basin/capefear.

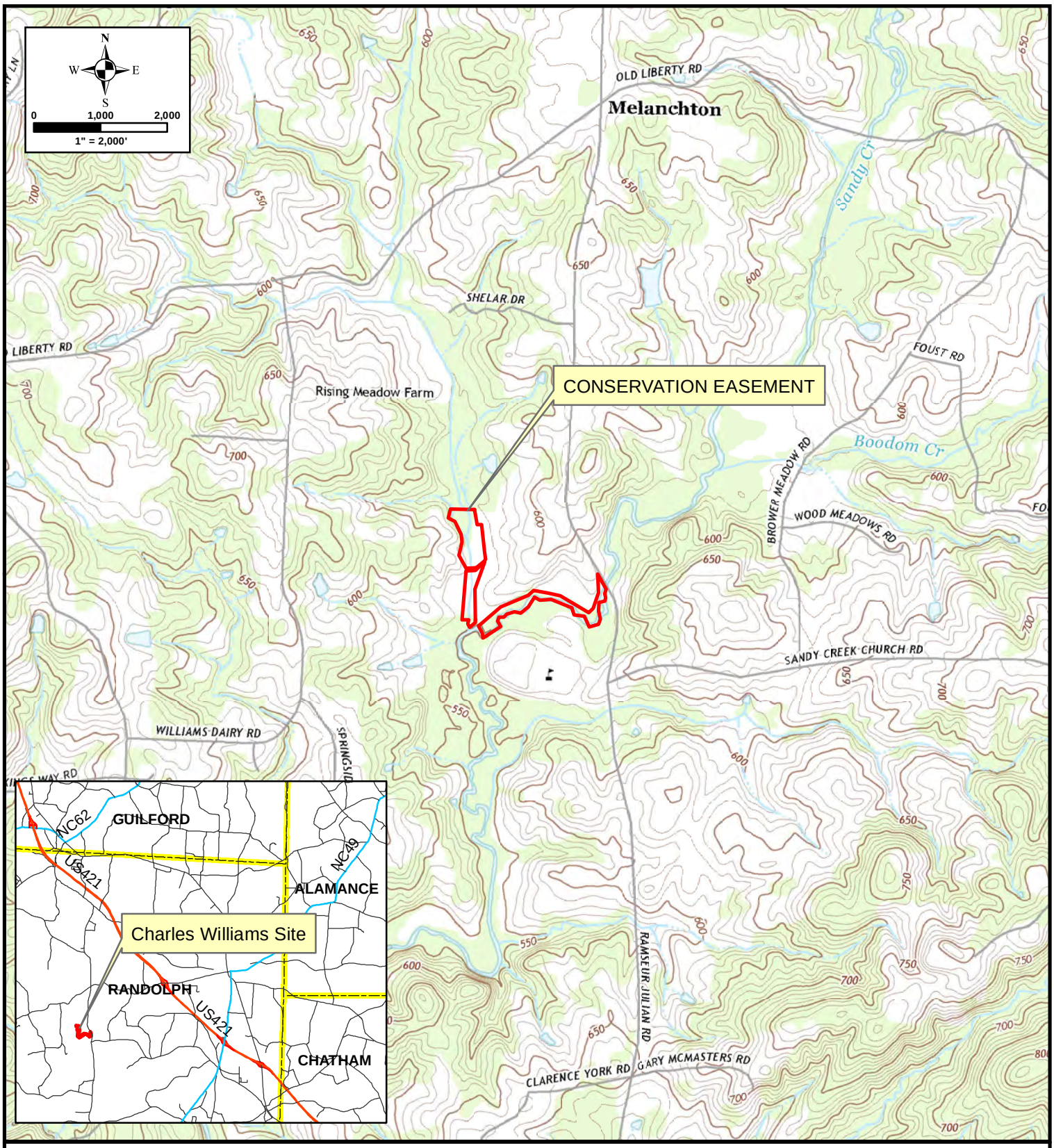
NCDENR Ecosystem Enhancement Program, 2013. Charles Williams Stream, Wetland, and Buffer Site Baseline Monitoring Document and As-built Baseline Report. Prepared by Ecological Engineering, LLP.

NC State Climate Office, 2014. Daily Precipitation Data from Siler City Airport (SILR), Chatham County (www.nc-climate.ncsu.edu).

US Army Corps of Engineers, US Environmental Protection Agency, NC Wildlife Resources Commission and NC Department of Environment Division of Water Quality, 2003. Stream Mitigation Guidelines.

APPENDIX A

Project Vicinity Map and Background Tables



DIRECTIONS FROM US HWY 64 IN SILER CITY, NC: Turn north on US 421 in Siler City, towards the Town of Liberty. Proceed approximately 9.5 miles, then turn left onto NC 49. Proceed approximately 0.7 miles, then turn right onto SR 2459 (Sandy Creek Church Road). Proceed approximately 4.5 miles, then turn right onto SR 2442 (Ramseur-Julian Road). Proceed approixmately 0.3 miles, crossing over Sandy Creek. The Charles Williams site is on the west (left) side of the roadway, immediately north of Sandy Creek.

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PROJECT SITE VICINITY MAP
Charles Williams Site - DMS Project No. 80

Randolph Co., NC

November 2015

Map Source:

2013 Grays Chapel and Liberty USGS Quadrangles

FIGURE 1

Table 1. Project Components and Mitigation Credits

Charles Williams Stream, Wetland and Buffer Site / 80

Mitigation Credits

	Stream		Riparian Wetland		Non-riparian wetland		Buffer	Nitrogen Nutrient Offset	Phosphorus Nutrient Offset
Type	**R**	**RE**	**R**	**RE**	**R**	**RE**			
Totals		1,233		1.1			336,430		

Project Components

Project Component	Stationing/Location	Existing Footage/ Acreage	Approach	Restoration or Restoration Equivalent	Restoration Footage or Acreage	Mitigation Ratio
Stream Enhancement	10+00 to 27+53	1,850 linear feet	EI	RE	1,233	1.5 : 1
Riparian Wetland Enhancement	areas east and west of UT to Sandy Creek	2.2 acres	E	RE	1.1	2 : 1
Buffer Restoration (TOB - 50')	Sandy Creek and UT to Sandy Creek	201,481 square feet	R	R	201,481	1 : 1
Buffer Restoration (50' - 100')	Sandy Creek and UT to Sandy Creek	119,203 square feet	R	R	119,203	1 : 1
Buffer Restoration (101' - 200')	Sandy Creek and UT to Sandy Creek	63,704 square feet	R	R	15,926	4 : 1

Component Summation

Restoration Level	Stream (linear feet)	Riparian Wetland (acres)		Non-riparian Wetland (acres)	Buffer (square feet)	Upland (acres)
		Riverine	Non-riverine			
Restoration					384,208	
Enhancement		2.2				
Enhancement I	1,850					
Enhancement II						
Creation						
Preservation						
HQ Preservation						

BMP Elements

Element	Location	Purpose/Function	Notes

BMP Elements

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

Table 2. Project Activity and Reporting History

Charles Williams Stream Wetland and Buffer Site / 80

Elapsed Time Since Grading Complete (Feb 2013): 2 years, 9 months

Elapsed Time Since Planting Complete (Feb 2014): 1 year, 9 months

Number of Reporting Years: 3

Activity or Report	Data Collection Complete	Completion or Delivery
Mitigation Plan	September-08	May-09
Final Design - Construction Plans	November-09	April-12
Construction		February-13
Temporary S&E Mix Applied to Entire Project Area		January-13
Permanent Seed Mix Applied to Entire Project Area		January-13
Live Stake Plantings Applied		January-13
Baseline Monitoring Document	June-13	July-13
Bare-rooted Planting Applied		February-14
Year 1 Monitoring	March-14	May-14
Year 2 Monitoring	September-14	November-14
Year 3 Monitoring	June-15	November-15
Year 4 Monitoring		
Year 5 Monitoring		
Year 6 Monitoring (vegetation only)		

Table 3. Project Contact Table

Charles Williams Stream Wetland and Buffer Site / 80

Designer	**Firm Information/ Address**
Ecological Engineering, LLP	1151 SE Cary Parkway, Suite 101, Cary, NC 27518
Jenny S. Fleming, PE	(919) 557-0929
Construction Contractor	**Firm Information/ Address**
Riverworks, Inc.	8000 Regency Parkway, Suite 800, Cary, NC 27518
Bill Wright	(919) 459-9001
Hauling Contractor	**Firm Information/ Address**
Strader Fencing, Inc.	5434 Amick Road, Julian, NC 27283
	(336) 697-7005
Planting Contractor(s)	**Firm Information/ Address**
Carolina Silvics, Inc. (bare-rooted & containerized)	908 Indian Trail Road, Edenton, NC 27932
Mary-Margaret S. McKinney, RF, PWS	(252) 482.8491
Riverworks, Inc. (livestakes only)	8000 Regency Parkway, Suite 800, Cary, NC 27518
George Morris	(919) 459-9001
Seeding Contractor	**Firm Information/ Address**
Strader Fencing, Inc.	5434 Amick Road, Julian, NC 27283
Kenneth L. Strader	(336) 697-7005
Seed Mix Sources	Green Resource, LLC (336) 855-6363
Nursery Stock Suppliers (live stakes only)	Native Roots Nursery (910) 385-8385 NC Forest Service Tree Nursery (919) 731-7988 Foggy Mountain Nursery (336) 384-5323 Mellow Marsh Farm (919) 742-1200
Monitoring Performer	**Firm Information/ Address**
Ecological Engineering, LLP	1151 SE Cary Parkway, Suite 101, Cary, NC 27518
David Cooper, Heather Smith, Lane Sauls (stream, vegetation & wetland)	(919) 557-0929

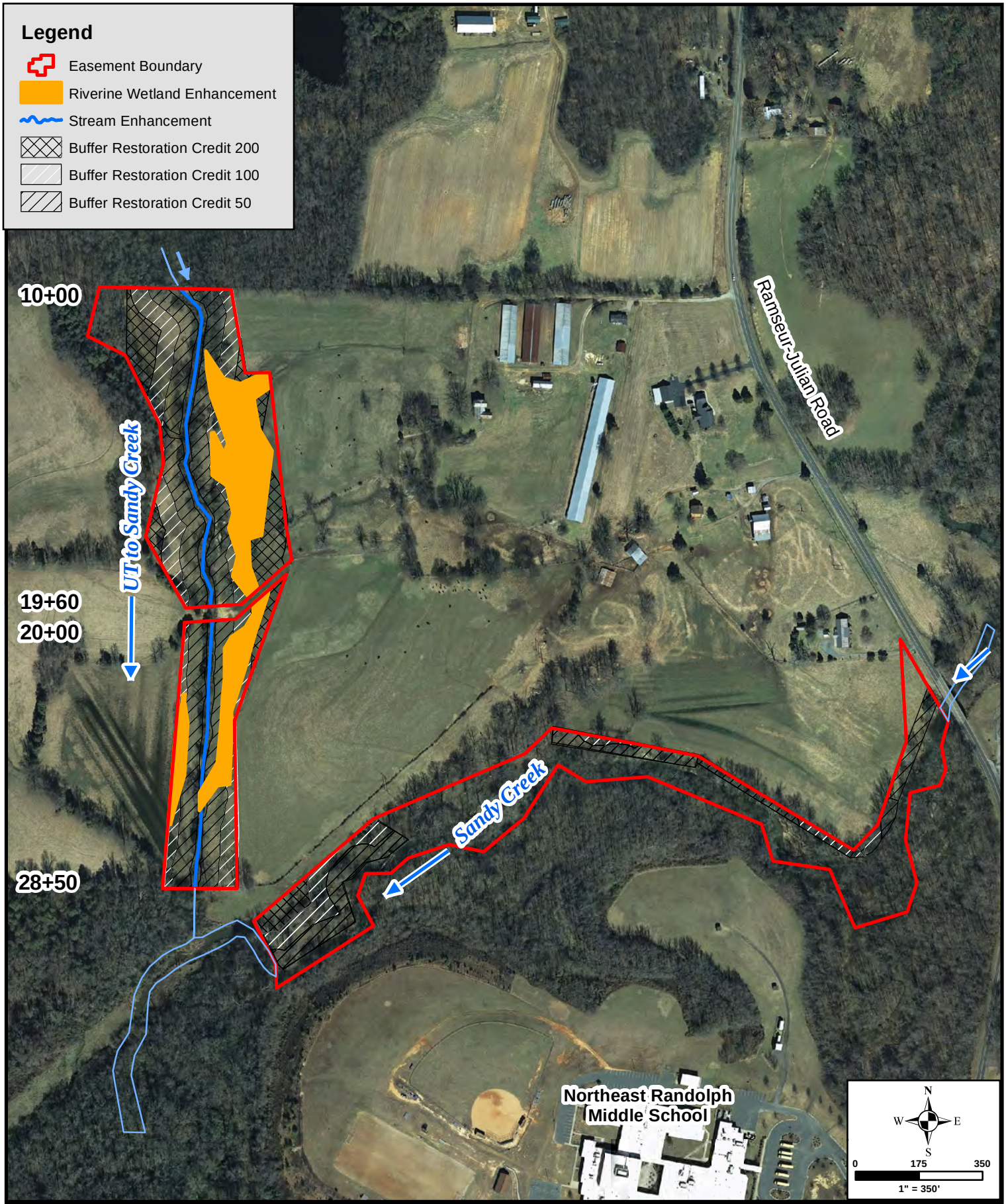
Table 4. Project Baseline Information and Attributes

Charles Williams Stream Wetland and Buffer Site / 80

Project Information			
Project Name		Charles Williams Stream Wetland and Buffer Site	
County		Randolph	
Project Area		18 acres	
Project Coordinates (latitude and longitude)		35°49'31.95" North/ 79°39'02.64" West	
Project Watershed Summary Information			
Physiographic Province		Piedmont	
River Basin		Cape Fear	
USGS Hydrologic Unit 8-digit	03030003	**USGS Hydrologic Unit 14-digit**	03030003020010
DWQ Subbasin		03-06-09	
Project Drainage Area		4.9 sq. mi.	
Project Drainage Area Percentage of Impervious Area		5 to 6%	
CGIA Land Use Classification		Agricultural Land	
Reach Summary Information			
Length of Reach		1,850 linear feet	
Valley Classification		Valley Type VIII	
Drainage Area		4.9 sq. mi.	
NCDWQ Stream ID Score		>50	
NCDWQ Water Quality Classification		WS-III	
Morphological Description (stream type)		C5	
Evolutionary Trend		C-G-F-E-C	
Underlying Mapped Soils		Chewacla loam	
Drainage Classification		Poorly drained	
Soil Hydric Status		Hydric B	
Slope		0 to 2%	
FEMA Classification		Zone AE	
Native Vegetation Community		Piedmont Alluvial Forest	
Percent Composition of Exotic Invasive Species		Less than 5%	
Wetland Summary Information			
Size of Wetland		1.96 acres	
Wetland Type		Riverine	
Mapped Soil Series		Chewacla loam	
Drainage Classification		Somewhat poorly drained	
Soil Hydric Status		Hydric B	
Source of Hydrology		Overbank flooding	
Hydrologic Impairment		None	
Native Vegetation Community		Piedmont Alluvial Forest	
Percent Composition of Exotic Invasive Species		Less than 5%	
Regulatory Considerations			
Waters of the United States - Section 404		Resolved	
Waters of the United States - Section 401		Resolved	
Endangered Species Act		Resolved	
Historic Preservation Act		Resolved	
Coastal Zone/Area Management Acts (CZMA/CAMA)		Not Applicable	
FEMA Floodplain Compliance		Resolved	
Essential Fisheries Habitat		Not Applicable	

APPENDIX B

Visual Assessment Data



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MITIGATION COMPONENTS
Charles Williams Site -
DMS Project No. 80

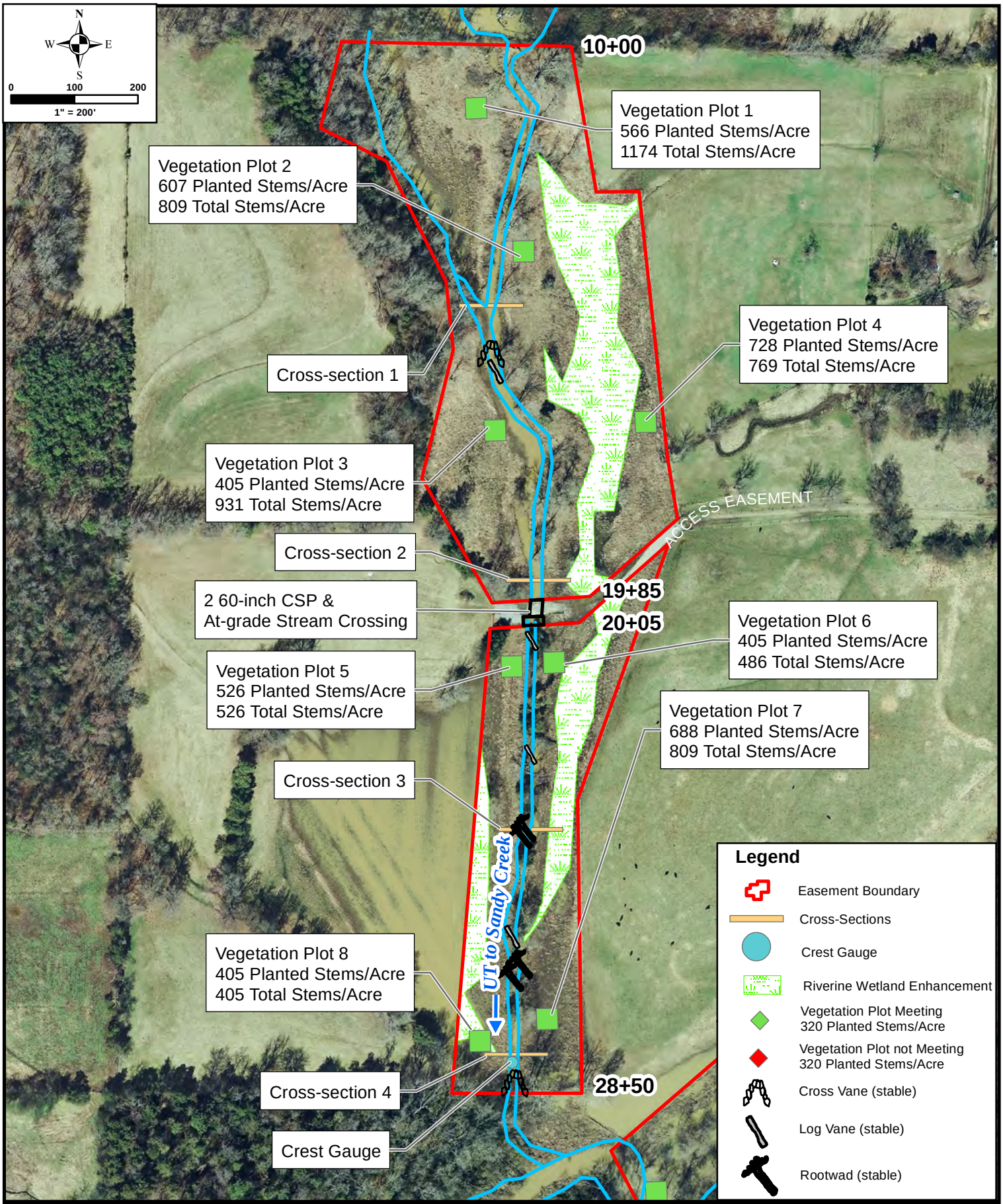
Randolph Co., NC

November 2015

Map Source:

2010 Aerial from NCOneMap.com

FIGURE 2



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CURRENT CONDITIONS PLAN VIEW
Charles Williams Site -
DMS Project No. 80

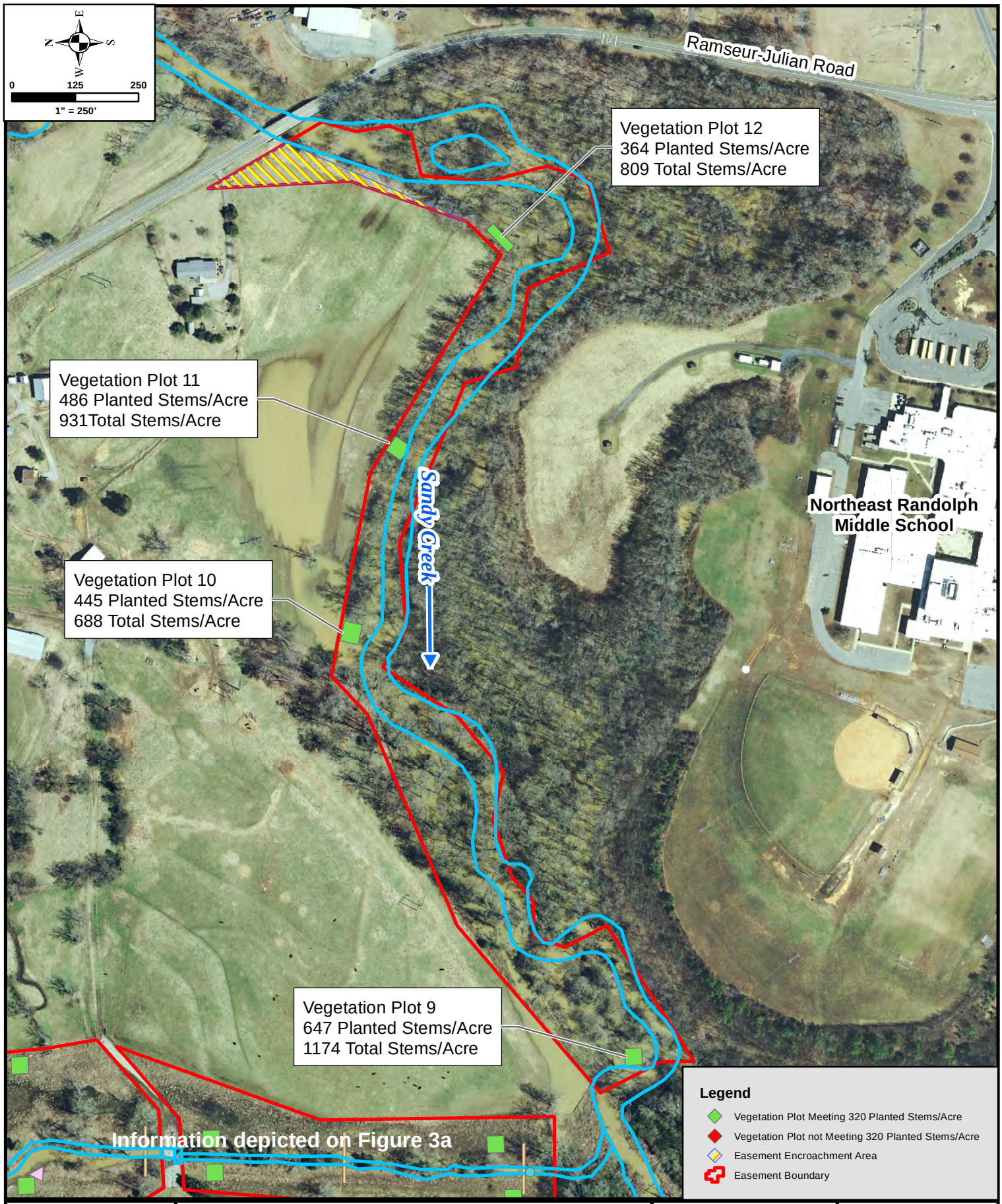
Randolph Co., NC

November 2015

Map Source:

2014 Aerial from NCOneMap.com

FIGURE 3a



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CURRENT CONDITIONS PLAN VIEW
Charles Williams Site -
DMS Project No. 80

Randolph Co., NC

November 2015

Map Source:

2014 Aerial from NCOneMap.com

FIGURE 3b

Table 5. Visual Stream Morphology Assessment

Assessed Length: 1,850 linear feet

Charles Williams Stream, Wetland, and Buffer Site / 80

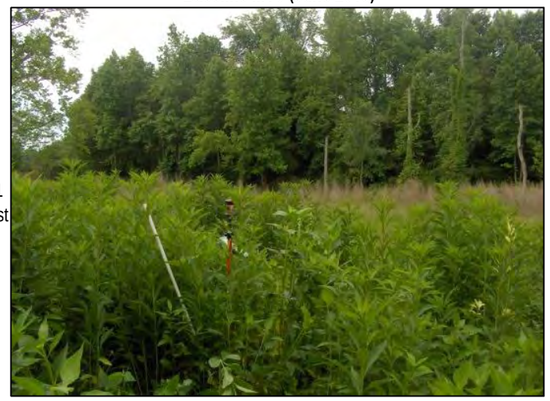
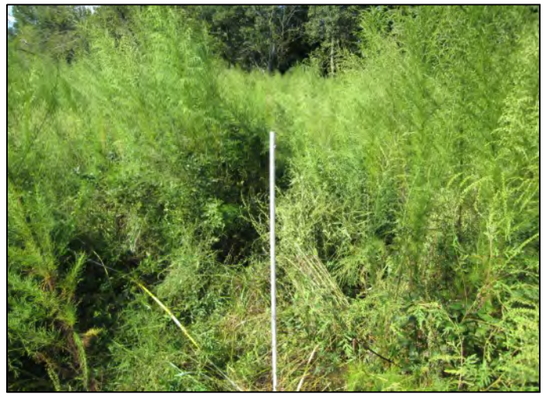
Major Channel Category	Channel Sub-Category	Metric	Number Stable, Performing as Intended	Total Number in As-Built	Number of Unstable Segments	Amount of Unstable Footage	% Stable, Performing as Intended	Number with Stabilizing Woody Vegetation	Footage with Stabilizing Woody Vegetation	Adjusted % for Stabilizing Woody Vegetation
Bed	Vertical Stability	Aggradation - Bar formation/growth sufficient to significantly deflect flow laterally (not to include point bars).			0	0	100			
		Degradation - Evidence of down-cutting.			0	0	100			
	Riffle Condition	Texture/Substrate - Riffle maintains coarser substrate.			0	0	100			
	Meander Pool Condition	Depth - Sufficient (Max. Pool Depth : Mean Bankfull Depth ratio ≥ 1.6).	4	5			80			
		Length - Appropriate (>30% of centerline distance between tail of upstream riffle and head of downstream riffle).	4	5			80			
	Thalweg Position	Thalweg centering at upstream of meander bend (run).	8	8			100			
		Thalweg centering at downstream of meander bend (glide).	7	8			88			
Bank	Scoured/Eroding	Bank lacking vegetative cover resulting simply from poor growth and/or scour and erosion.			0	0	100	none	none	n/a
	Undercut	Banks undercut/overhanging to the extent that mass wasting appears likely. Does NOT include undercuts that are modest, appear sustainable and are providing habitat.			0	0	100	none	none	n/a
	Mass Wasting	Bank slumping, calving, or collapse.			0	0	100	none	none	n/a
				Totals	0	0	93	n/a	n/a	n/a
Engineered Structures	Overall Integrity	Structures physically intact with no dislodged boulders or logs.	8	8			8			
	Grade Control	Grade control structures exhibiting maintenance of grade across the sill.	3	3			3			
	Piping	Structures lacking any substantial flow underneath sills or arms.	8	8			8			
	Bank Protection	Bank erosion with the structures extent of influence does NOT exceed 15% .	8	8			8			
	Habitat	Pool forming structures maintaining - Max. Pool Depth : Mean Bankfull Depth ratio ≥ 1.6. Rootwads/logs providing some cover at base-flow.	3	3			3			

Table 6. Vegetation Condition Assessment

Charles Williams Stream, Wetland, and Buffer Site / 80

Planted Acreage:	16 acres					
Vegetation Category	**Definitions**	**Mapping Threshold**	**CCPV Depiction**	**Number of Polygons**	**Combined Acreage**	**% of Planted Acreage**
Bare Areas	Very limited cover of both woody and herbaceous material.	0.1 acres	n/a	n/a	n/a	n/a
Low Stem Density Areas	Woody stem densities clearly below target levels based on MY 3, 4, or 5 stem count criteria.	0.1 acres	n/a	0	n/a	n/a
			Total	n/a	n/a	n/a
Areas of Poor Growth Rates or Vigor	Areas with woody stems of a size class that is obviously small given the monitoring year.	0.25 acres	n/a	n/a	n/a	n/a
			Cumulative Total	n/a	n/a	n/a
Estimated Acreage:	**18 acres**					
Vegetation Category	**Definitions**	**Mapping Threshold**	**CCPV Depiction**	**Number of Polygons**	**Combined Acreage**	**% of Planted Acreage**
Invasive Areas of Concern	Areas or points (if too small to render as polygons at map scale).	1,000 SF	Not depicted – invasives are found singly throughout easement after treatment	0	<.1 acres	<1 %
Easement Encroachment Areas	Areas or points (if too small to render as polygons at map scale).	1,000 SF	See CCPV	1	0.3 acres	<1%

Charles Williams Stream, Wetland, and Buffer Site / 80 - Annual Photograph Comparison

	Baseline MY0 (June 2013)	MY1 (March 2014)	MY2 (September 2014)	MY3 (June 2015)
Vegetation Plot 1 Facing Southwest				
Vegetation Plot 2 Facing Southwest				
Vegetation Plot 3 Facing Southwest				

	Baseline MY0 (June 2013)	MY1 (March 2014)	MY2 (September 2014)	MY3 (June 2015)
Vegetation Plot 4 Facing Southwest				
Vegetation Plot 5 Facing Southwest				
Vegetation Plot 6 Facing Southwest				

	Baseline MY0 (June 2013)	MY1 (March 2014)	MY2 (September 2014)	MY3 (June 2015)
Vegetation Plot 7 Facing Southwest				
Vegetation Plot 8 Facing Southwest				
Vegetation Plot 9 Facing Southwest				

	Baseline MY0 (June 2013)	MY1 (March 2014)	MY2 (September 2014)	MY3 (June 2015)
Vegetation Plot 10 Facing Southwest				
Vegetation Plot 11 Facing Southwest				
Vegetation Plot 12 Facing Southwest				

	Baseline MY0 (June 2013)	MY1 (March 2014)	MY2 (September 2014)	MY3 (June 2015)
Cross Section 1 Facing West				
Cross Section 1 Facing Downstream				

	Baseline MY0 (June 2013)	MY1 (March 2014)	MY2 (September 2014)	MY3 (June 2015)
Cross Section 2 Facing West				
Cross Section 2 Facing Downstream				
Cross Section 3 Facing West				

	Baseline MY0 (June 2013)	MY1 (March 2014)	MY2 (September 2014)	MY3 (June 2015)
Cross Section 3 Facing Downstream				
Cross Section 4 Facing West				
Cross Section 4 Facing Downstream				

Overbank Events
MY3

1. Overbank Event Observed 17 April 2015

2. Alluvial Deposits Documented 30 June 2015

3. Wrack Documented 30 June 2015

4. Sediment Staining Documented 30 June 2015

Beaver Dams
MY3

1. Beaver Dam, 3 June 2015

2. Breached Beaver Dam, 23 June 2015

3. Breached Beaver Dam, 30 June 2015

APPENDIX C

Vegetation Plot Data

Planted Vegetation Summary

During MY3 monitoring, new stems were documented from a supplemental planting performed by Carolina Silvics in early 2015. Stem density was observed to be adequate in 12 of the 12 vegetation plots. Please refer to the letter and tables below.

Proposed Supplemental Planting Letter

CAROLINA SILVICS
Natural Resources Professionals

October 6, 2014

Mr. Jeff Schaffer
NC Ecosystem Enhancement Program
217 West Jones Street, Suite 3000A
Raleigh, North Carolina 27603

Re: D13002S
Site: Sandy Creek (Charlie Williams), EEP# 80
Randolph County, NC

Dear Mr. Schaffer:

This letter serves as our Site Maintenance Report the above referenced project site and proposes replanting activities at the site.

Messrs. William Skinner and Perry Sugg of Carolina Silvics, Inc. last visited the project site on September 9, 2014. Herbicide applications were performed at this time to control privet (*Ligustrum* spp.) and air yam (*Dioscorea bulbifera*). While on-site they observed many areas of the site where herbaceous vegetation was extremely thick and possibly outcompeting the planted stems. They also observed many dead stems and that the tops of many planted stems appeared to have died-back but were resprouting.

The Fall monitoring data and baseline monitoring data that you have provided shows approximately 65% survival at this site and correlates with what we observed on-site.

Carolina Silvics, Inc. proposes to replant the site between December 15, 2014 and March 15, 2015 with approximately 3,450 stems (an average of 300 stems per acre) from the original planting list for the site. These stems will distributed throughout the site as needed based upon the Fall monitoring report and observed conditions on site. Seedling orders are being finalized now and will be forwarded to you for approval within the next week.

Since survival percentage of stems is less than we would like, we feel that both soil amelioration and competition control measures are needed at this site. Within portions of the site where competition seems particularly heavy, we will manually cut paths several feet wide low to the ground in the existing herbaceous competition and apply Oust® XP (sulfometuron methyl) herbicide to the paths. Herbicide will not be applied to areas of standing water or areas along the channel. Stems

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Web: www.carolinasilvics.com

CAROLINA SILVICS
Natural Resources Professionals

will then be replanted into these paths. Conversely, in areas where general vegetative growth is sparse, we will apply a slow release fertilizer at time of planting to improve general soil fertility in those areas.

We will notify you in advance of our replanting and maintenance activities on this site. We request that a member of your staff be onsite with us as we begin these actives so that proper distribution of the seedlings can be agreed-upon in the field by all parties.

Please know that Carolina Silvics, Inc. is committed to the success of this project and will take the measures necessary to ensure that we remain in contract compliance. If you have any questions regarding this report or our proposed replanting and maintenance activities, please contact me at (252) 482-8491 or mary-margaret@carolinasilvics.com.

Respectfully,

CAROLINA SILVICS, INC.

Mary-Margaret McKinney, RF
President

Office: 252-482-8491
Fax: 252-482-8491
Web: www.carolinasilvics.com

Original Planting List from DMS

Sandy Creek (Charles Williams)

Species	Type	Riparian		Wetland		Nursery
		Qty	%	Qty	%	
Betula nigra	2-0 BR	300	10%	100	11%	NCFS
Carya glabra	2-0 BR	100	3%			NCFS
Carya tomentosa	2-0 BR	200	7%			NCFS
Fraxinus pennsylvanica	2-0 BR	275	9%	100	11%	NCFS
Liriodendron tulipifera	2-0 BR	400	13%			NCFS
Platanus occidentalis	2-0 BR	225	7%	200	23%	NCFS
Quercus falcata var. pagodiafolia	2-0 BR	300	10%	100	11%	NCFS
Quercus nigra	2-0 BR			100	11%	NCFS
Quercus phellos	2-0 BR	600	20%	200	23%	NCFS
Quercus rubra	2-0 BR	300	10%			NCFS
Amelanchier arborea	1-gal	25	1%			Native Roots
Carpinus caroliniana	1-gal	85	3%			Native Roots
Chionanthus virginicus	1-gal	64	2%			Native Roots
Diospyros virginiana	2-0 BR	200	7%			NCFS
Ilex verticillata	1-gal			37	4%	Native Roots
Magnolia virginiana	1-gal			38	4%	Native Roots
		3,074	100%	875	100%	

Table 7. Vegetation Plot Criteria Attainment

Charles Williams Stream, Wetland, and Buffer Site / 80

Vegetation Plot ID	Stream/Wetland Vegetation Survival Threshold Met?	Buffer Vegetation Survival Threshold Met?	Tract Mean
1	Yes	Yes	Stream/Wetland Veg. = 100% Buffer Veg. = 100%
2	Yes	Yes	
3	Yes	Yes	
4	Yes	Yes	
5	Yes	Yes	
6	Yes	Yes	
7	Yes	Yes	
8	Yes	Yes	
9	n/a	Yes	
10	n/a	Yes	
11	n/a	Yes	
12	n/a	Yes	

Notes:
Supplemental planting at approximately 300 stems per acre was performed between December 2014 and March 2015.

Table 8. CVS Vegetation Plot Metadata

Charles Williams Stream, Wetland, and Buffer Site / 80

Report Prepared By	David Cooper
Date Prepared	10/19/2015 11:00
database name	SandyCreekCharlesWilliams_80_RandolphCounty_Year 3.mdb
database location	P:\10000 Consultants\10227 Sungate\10227-017_Charles Williams Monitoring\CVS Database
computer name	WKST6
file size	63438848
DESCRIPTION OF WORKSHEETS IN THIS DOCUMENT	
Metadata	Description of database file, the report worksheets, and a summary of project(s) and project data.
Proj, planted	Each project is listed with its PLANTED stems per acre, for each year. This excludes live stakes.
Proj, total stems	Each project is listed with its TOTAL stems per acre, for each year. This includes live stakes, all planted stems, and all natural/volunteer stems.
Plots	List of plots surveyed with location and summary data (live stems, dead stems, missing, etc.).
Vigor	Frequency distribution of vigor classes for stems for all plots.
Vigor by Spp	Frequency distribution of vigor classes listed by species.
Damage	List of most frequent damage classes with number of occurrences and percent of total stems impacted by each.
Damage by Spp	Damage values tallied by type for each species.
Damage by Plot	Damage values tallied by type for each plot.
Planted Stems by Plot and Spp	A matrix of the count of PLANTED living stems of each species for each plot; dead and missing stems are excluded.
ALL Stems by Plot and spp	A matrix of the count of total living stems of each species (planted and natural volunteers combined) for each plot; dead and missing stems are excluded.
PROJECT SUMMARY	
Project Code	80
project Name	Sandy Creek - Charles Williams
Description	Stream, Wetland and Buffer
River Basin	Cape Fear
length(ft)	1,850
stream-to-edge width (ft)	5 to 12
area (sq m)	1,302
Required Plots (calculated)	12
Sampled Plots	12

Table 9. Planted and Total Stem Counts (Species by Plot with Annual Means)

Charles Williams Stream, Wetland, and Buffer Site (80)

			Current Plot Data (MY2 2015)																																					Annual Means								
			080-01-0001			080-01-0002			080-01-0003			080-01-0004			080-01-0005			080-01-0006			080-01-0007			080-01-0008			080-01-0009			080-01-0010			080-01-0011			080-01-0012			MY2 (2015)			MY1 (2014)			MY0 (2014)		
Scientific Name	**Common Name**	**Species Type**	**PnoLS**	**P-all**	**T**	**PnoLS**	**P-all**	**T**	**PnoLS**	**P-all**	**T**	**PnoLS**	**P-all**	**T**	**PnoLS**	**P-all**	**T**	**PnoLS**	**P-all**	**T**	**PnoLS**	**P-all**	**T**	**PnoLS**	**P-all**	**T**	**PnoLS**	**P-all**	**T**	**PnoLS**	**P-all**	**T**	**PnoLS**	**P-all**	**T**	**PnoLS**	**P-all**	**T**	**PnoLS**	**P-all**	**T**	**PnoLS**	**P-all**	**T**	**PnoLS**	**P-all**	**T**	**PnoLS**	**P-all**	**T**
Acer negundo	boxelder	Tree																										10			6			6			6			28			17			13
Betula nigra	river birch	Tree							1	1	1				2	2	2	1	1	1	3	3	3	2	2	2	2	2	2				2	2	2				13	13	13	2	2	2	11	11	11
Carpinus caroliniana	American hornbeam	Tree			1																						1	1	1	1	1	1							2	2	3	1	1	5	2	2	2
Carya	hickory	Tree													2	2	2							1	1	1	1	1	1						4			3	4	4	11	5	5	5	4	4	4
Celtis laevigata	sugarberry	Tree																										2									2			4								
Diospyros virginiana	common persimmon	Tree			2	1	1	2							1	1	1				1	1	1				3	3	3							1	1	1	7	7	10	4	4	4	1	1	1
Fraxinus pennsylvanica	green ash	Tree	14	14	20	4	4	7	2	2	6	5	5	6	2	2	2	3	3	3	6	6	9	1	1	1				2	2	2	2	2	2				41	41	58	24	24	33	33	33	33
Ilex decidua	possumhaw	shrub																										1												1								
Juglans nigra	black walnut	Tree			1			1																																2								
Liquidambar styraciflua	sweetgum	Tree			5																													1						6			4			5
Liriodendron tulipifera	tuliptree	Tree				2	2	2	2	2	2	1	1	1							1	1	1	3	3	3	1	1	1							3	3	3	13	13	13	3	3	3	3	3	3
Magnolia virginiana	sweetbay	Tree																2	2	2																			2	2	2	2	2	2	2	2	2
Nyssa sylvatica	blackgum	Tree				1	1	1													2	2	2	2	2	2	2	2	2	1	1	1							8	8	8						
Platanus occidentalis	American sycamore	Tree										1	1	1				1	1	1							1	1	1	2	2	2	3	3	3	1	1	1	9	9	9	2	2	2			2
Quercus	oak	Tree										1	1	1				1	1	1							1	1	1	2	2	2	2	2	2	3	3	3	10	10	10	10	10	10	30	30	30
Quercus laurifolia	laurel oak	Tree										2	2	2																									2	2	2	2	2	2			
Quercus lyrata	overcup oak	Tree				3	3	3	1	1	1	4	4	4	3	3	3				1	1	1				2	2	2											14	14	14						
Quercus michauxii	swamp chestnut oak	Tree				1	1	1				1	1	1	1	1	1							1	1	1				3	3	3	2	2	2				9	9	9						
Quercus phellos	willow oak	Tree				2	2	2	4	4	4	2	2	2	2	2	2	2	2	2	2	2	2				2	2	2				1	1	1	1	1	1	18	18	18	9	9	9			
Quercus rubra	northern red oak	Tree										1	1	1																									1	1	1	1	1	2			
Salix nigra	black willow	Tree									9									2																					11			10			18
Unknown		Shrub or Tree				1	1	1													1	1	1																2	2	2				27	27	27
		Stem count	14	14	29	15	15	20	10	10	23	18	18	19	13	13	13	10	10	12	17	17	20	10	10	10	16	16	29	11	11	17	12	12	23	9	9	20	155	155	235	65	65	110	113	113	151
		size (ares)	1			1			1			1			1			1			1			1			1			1			1			1			12			12			12		
		size (ACRES)	0.02			0.02			0.02			0.02			0.02			0.02			0.02			0.02			0.02			0.02			0.02			0.02			0.30			0.30			0.30		
		Species count	1	1	5	8	8	9	5	5	6	9	9	9	7	7	7	6	6	7	8	8	8	6	6	6	10	10	13	6	6	7	6	6	9	5	5	8	16	16	22	12	12	15	9	9	13
		Stems per ACRE	566.6	566.6	1174	607	607	809.4	404.7	404.7	930.8	728.4	728.4	768.9	526.1	526.1	526.1	404.7	404.7	485.6	688	688	809.4	404.7	404.7	404.7	647.5	647.5	1174	445.2	445.2	688	485.6	485.6	930.8	364.2	364.2	809.4	522.7	522.7	792.5	219.2	219.2	371	381.1	381.1	509.2

Color for Density

Exceeds requirements by 10%

Exceeds requirements, but by less than 10%

Fails to meet requirements, by less than 10%

Fails to meet requirements by more than 10%

APPENDIX D

Stream Survey Data

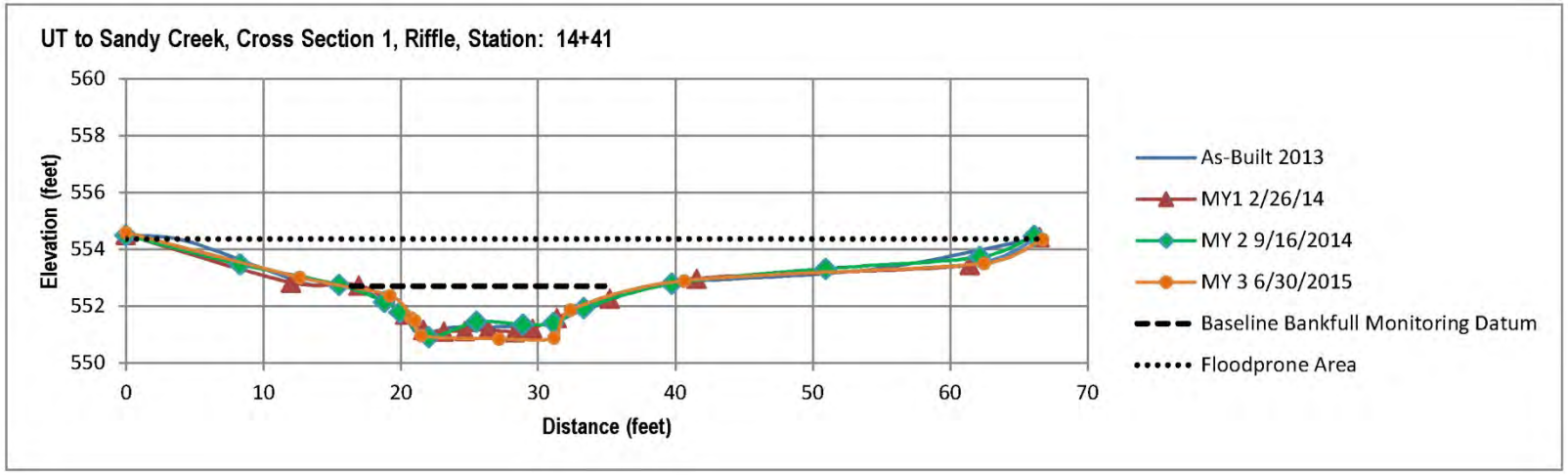
Cross Section Plot Exhibits

River Basin:	Cape Fear
Watershed:	UT Sandy Creek, MY-03
XS ID:	XS 1, Riffle, STA. 14+41
Drainage Area (sq mi):	4.9
Date:	6/30/2015
Field Crew:	D. Cooper, W. Turner

SUMMARY DATA	
Bankfull Elevation:	552.8
Bankfull Cross Sectional Area:	22.7
Bankfull Width:	23.9
Flood Prone Area Elevation:	554.7
Flood Prone Width:	66.1
Max. Depth at Bankfull:	1.8
Mean Depth at Bankfull:	0.9
Width/Depth Ratio:	25.2
Entrenchment Ratio:	2.8
Bank Height Ratio:	1.0

Station	Elevation
0	554.5842
12.64313342	553.0197
19.20612366	552.3719
20.73073232	551.6025
21.04358106	551.4844
21.48797822	550.9628
27.1559592	550.8588
31.14895008	550.8926
32.35542039	551.8748
40.61124176	552.9014
62.45288018	553.5114
66.69010636	554.352

Stream Type:	C5	Photograph facing downstream @ XS 1

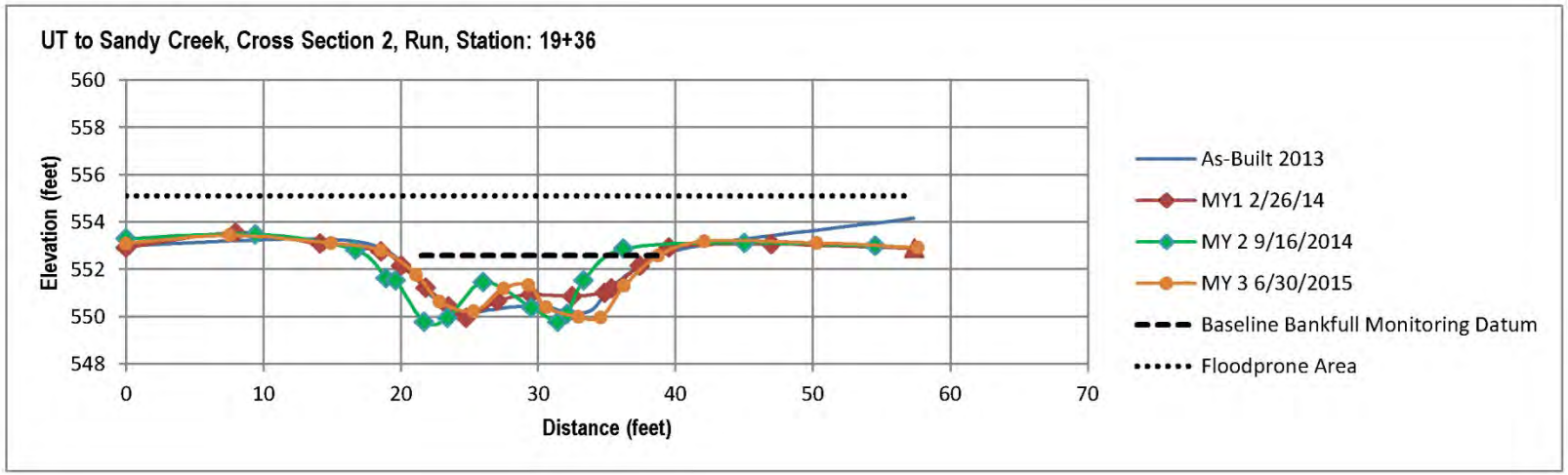


River Basin:	Cape Fear
Watershed:	UT Sandy Creek, MY-03
XS ID:	XS 2, Glide, STA. 19+36
Drainage Area (sq mi):	4.9
Date:	6/30/2015
Field Crew:	D. Cooper, W. Turner

SUMMARY DATA	
Bankfull Elevation:	552.83
Bankfull Cross Sectional Area:	35.3
Bankfull Width:	19.4
Flood Prone Area Elevation:	555.9
Flood Prone Width:	200+
Max. Depth at Bankfull:	3.1
Mean Depth at Bankfull:	1.8
Width/Depth Ratio:	10.7
Entrenchment Ratio:	>10
Bank Height Ratio:	1.0

Station	Elevation
0	553.1129
7.498599542	553.4577
14.89017108	553.1176
18.54548553	552.8048
21.11487294	551.793
22.80641802	550.6561
25.29597687	550.246
27.47741099	551.2045
29.2846512	551.3461
30.58496766	550.4141
32.91156085	550.0085
34.54440527	549.9817
36.25796515	551.3227
38.70280836	552.5882
42.08259291	553.1983
50.25421586	553.1271
57.6294972	552.9435

Stream Type:	C5	Photograph facing downstream @ XS 2

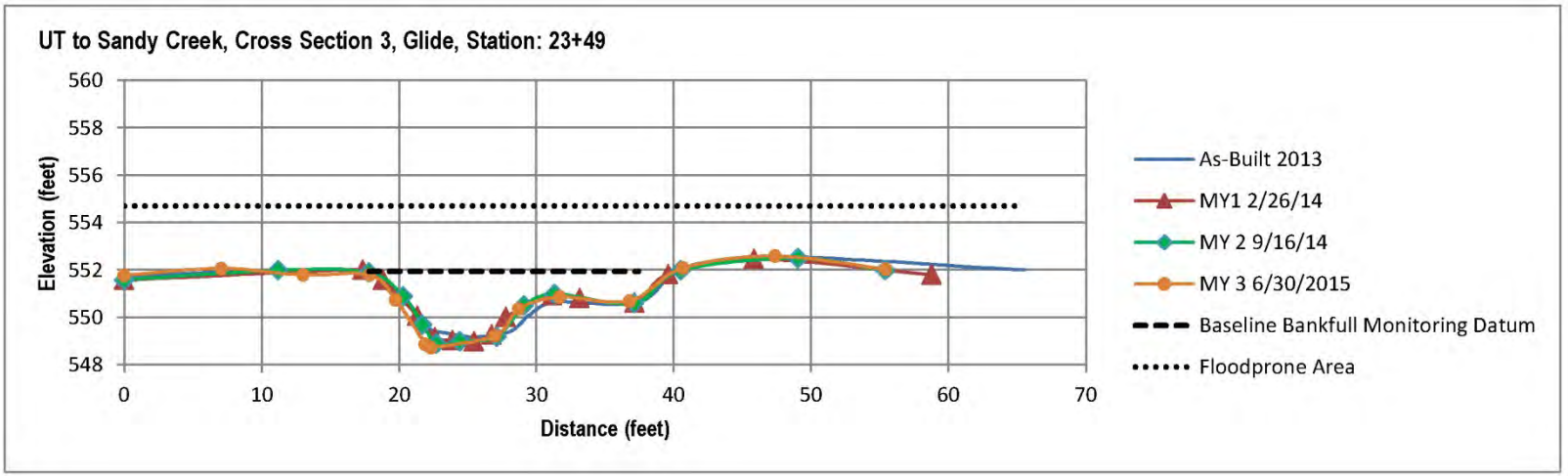


River Basin:	Cape Fear
Watershed:	UT Sandy Creek, MY-03
XS ID:	XS 3, Run, STA. 23+49
Drainage Area (sq mi):	4.9
Date:	6/30/2015
Field Crew:	D. Cooper, W. Turner

SUMMARY DATA	
Bankfull Elevation:	551.9
Bankfull Cross Sectional Area:	33.5
Bankfull Width:	20.1
Flood Prone Area Elevation:	554.9
Flood Prone Width:	200+
Max. Depth at Bankfull:	3.0
Mean Depth at Bankfull:	1.7
Width/Depth Ratio:	12.1
Entrenchment Ratio:	>8
Bank Height Ratio:	1.0

Station	Elevation
0	551.7932
7.060604978	552.0749
13.0195833	551.8018
17.84884778	551.801
19.74872363	550.7398
21.91007305	548.8784
22.30229536	548.7459
26.96011331	549.2365
28.72692038	550.377
31.68155784	550.8726
36.76392137	550.7061
40.67402283	552.1051
47.3746635	552.5945
55.41166688	552.0505

Stream Type:	C5	Photograph facing downstream @ XS 3

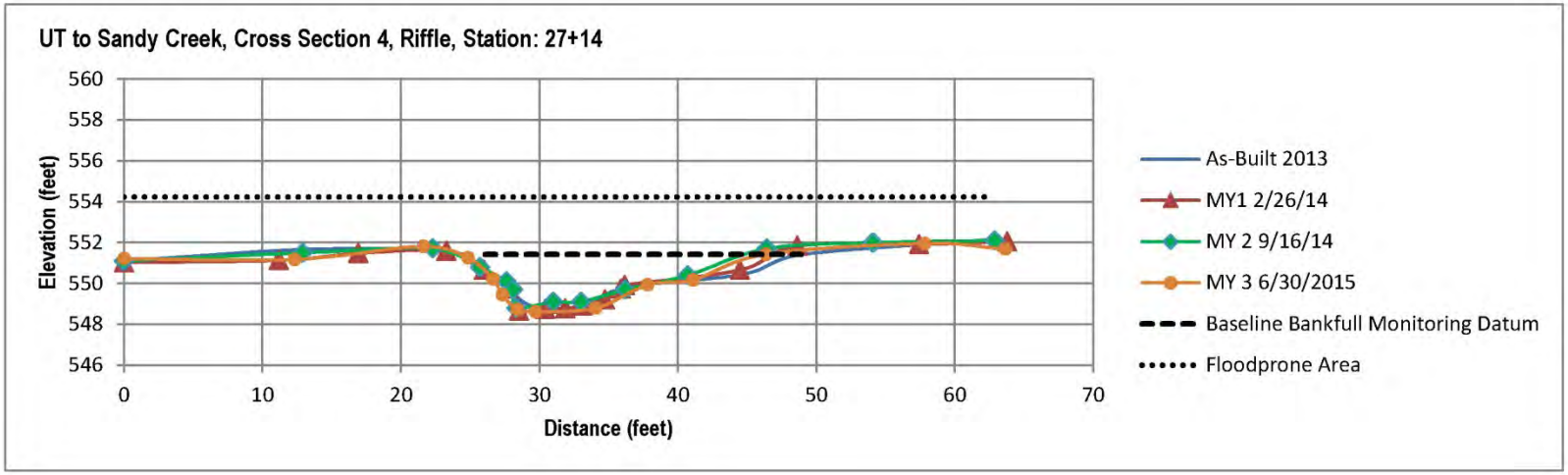


River Basin:	Cape Fear
Watershed:	UT Sandy Creek, MY-03
XS ID:	XS 4, Riffle, STA. 27+14
Drainage Area (sq mi):	4.9
Date:	6/30/2015
Field Crew:	D. Cooper, W. Turner

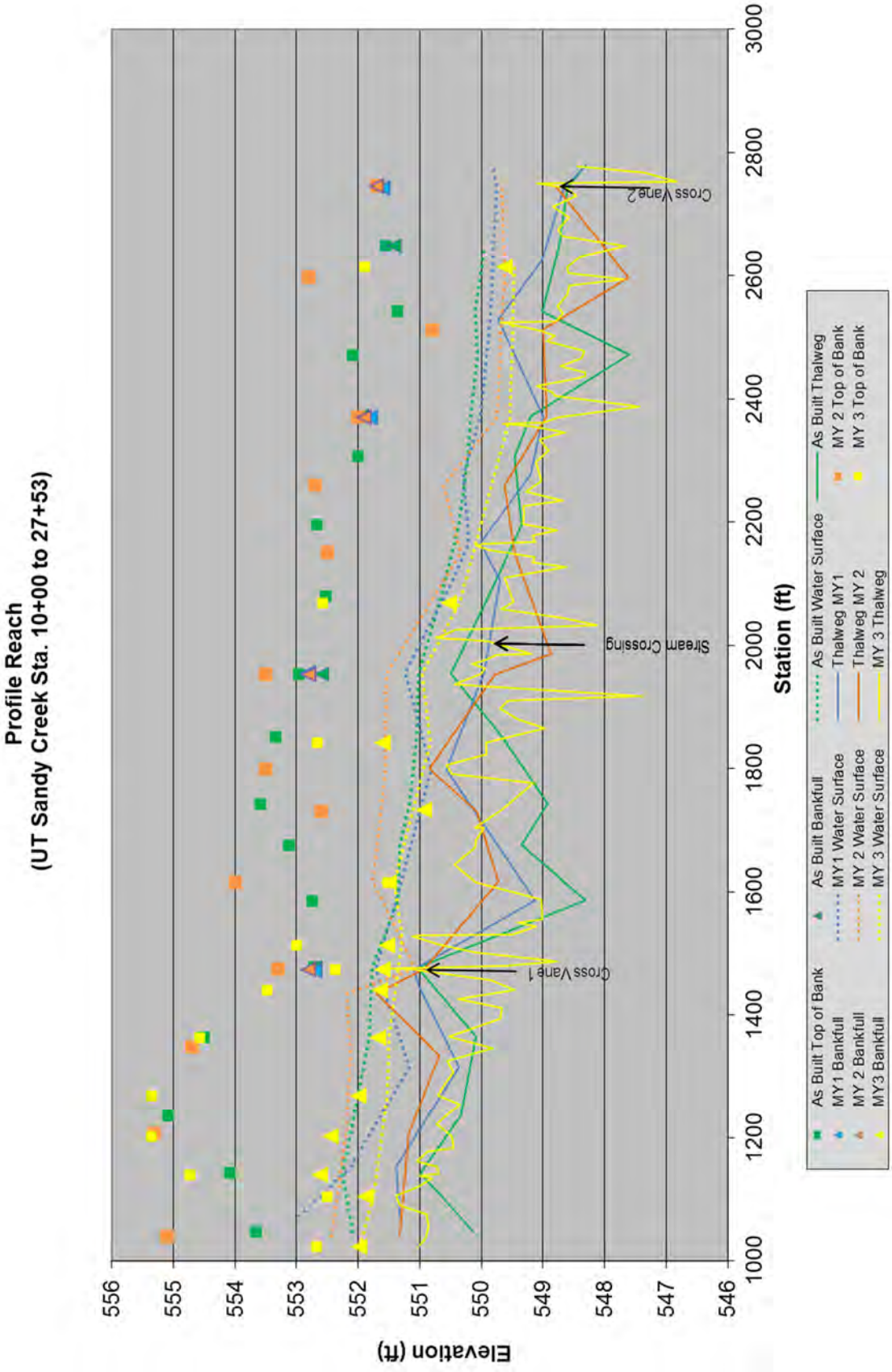
SUMMARY DATA	
Bankfull Elevation:	551.7
Bankfull Cross Sectional Area:	37.1
Bankfull Width:	24.1
Flood Prone Area Elevation:	554.6
Flood Prone Width:	200+
Max. Depth at Bankfull:	2.9
Mean Depth at Bankfull:	1.5
Width/Depth Ratio:	15.6
Entrenchment Ratio:	>8.0
Bank Height Ratio:	1.0

Station	Elevation
0	551.214
12.31517996	551.1788
21.62155571	551.818
24.84730894	551.259
26.6409003	550.2282
27.32591903	549.45
28.41591915	548.733
29.73289806	548.6223
34.05138193	548.7937
37.80627267	549.9341
41.10714938	550.1818
46.37340305	551.4333
57.83209713	551.9596
63.66095468	551.687

Stream Type:	C5	Photograph facing downstream @ XS 4



Longitudinal Profile Plot Exhibit

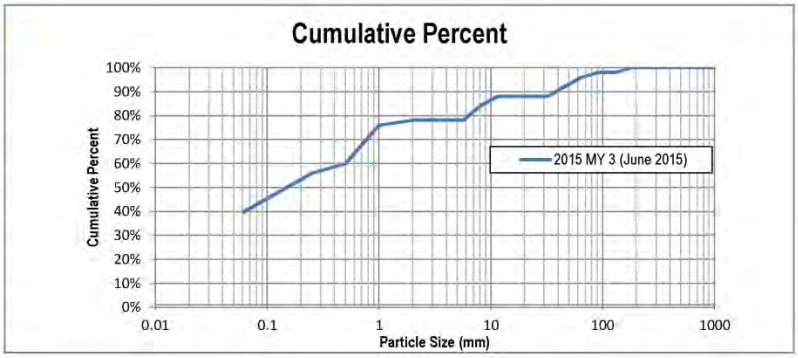


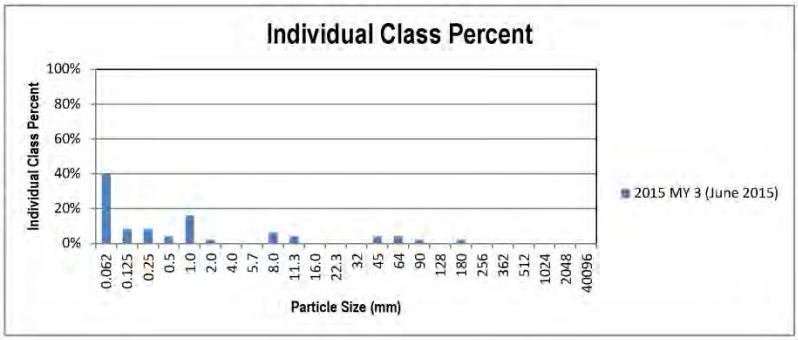
Cross Section Pebble Count Exhibits

Charles Williams Stream, Wetland, and Buffer Site / 80
Cross Section: 1
Feature: Riffle

			2015 MY 3 (June 2015)		
Description	Material	Size (mm)	Total #	Item %	Cum %
Silt/Clay	silt/clay	0.062	20	40%	40%
Sand	very fine sand	0.125	4	8%	48%
	fine sand	0.25	4	8%	56%
	medium sand	0.5	2	4%	60%
	coarse sand	1.0	8	16%	76%
	very coarse sand	2.0	1	2%	78%
Gravel	very fine gravel	4.0	0	0%	78%
	fine gravel	5.7	0	0%	78%
	fine gravel	8.0	3	6%	84%
	medium gravel	11.3	2	4%	88%
	medium gravel	16.0	0	0%	88%
	coarse gravel	22.3	0	0%	88%
	coarse gravel	32	0	0%	88%
	very coarse gravel	45	2	4%	92%
	very coarse gravel	64	2	4%	96%
Cobble	small cobble	90	1	2%	98%
	medium cobble	128	0	0%	98%
	large cobble	180	1	2%	100%
	very large cobble	256	0	0%	100%
Boulder	small boulder	362	0	0%	100%
	small boulder	512	0	0%	100%
	medium boulder	1024	0	0%	100%
	large boulder	2048	0	0%	100%
Bedrock	bedrock	40096	0	0%	100%
	TOTAL % of whole count		50	100%	

Summary Data	
D50	0.15 mm
D84	8.0 mm
D95	64 mm

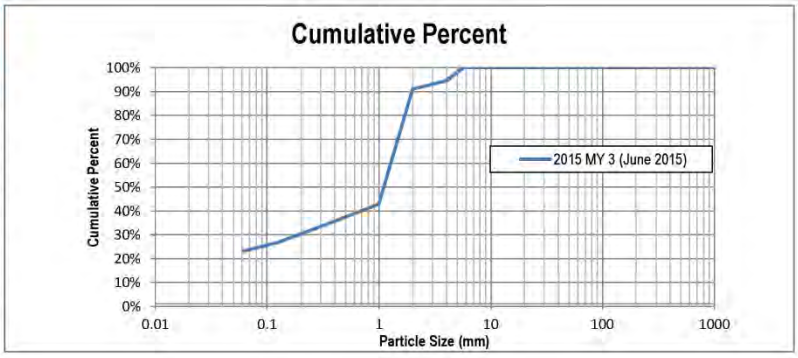


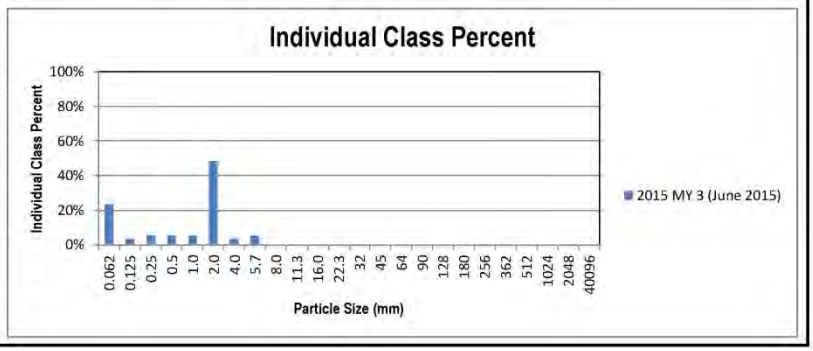


Charles Williams Stream, Wetland, and Buffer Site / 80
Cross Section: 2
Feature: Glide

			2015 MY 3 (June 2015)		
Description	Material	Size (mm)	Total #	Item %	Cum %
Silt/Clay	silt/clay	0.062	13	23%	23%
Sand	very fine sand	0.125	2	4%	27%
	fine sand	0.25	3	5%	32%
	medium sand	0.5	3	5%	38%
	coarse sand	1.0	3	5%	43%
	very coarse sand	2.0	27	48%	91%
Gravel	very fine gravel	4.0	2	4%	95%
	fine gravel	5.7	3	5%	100%
	fine gravel	8.0	0	0%	100%
	medium gravel	11.3	0	0%	100%
	medium gravel	16.0	0	0%	100%
	coarse gravel	22.3	0	0%	100%
	coarse gravel	32	0	0%	100%
	very coarse gravel	45	0	0%	100%
	very coarse gravel	64	0	0%	100%
Cobble	small cobble	90	0	0%	100%
	medium cobble	128	0	0%	100%
	large cobble	180	0	0%	100%
	very large cobble	256	0	0%	100%
Boulder	small boulder	362	0	0%	100%
	small boulder	512	0	0%	100%
	medium boulder	1024	0	0%	100%
	large boulder	2048	0	0%	100%
Bedrock	bedrock	40096	0	0%	100%
	TOTAL % of whole count		56	100%	

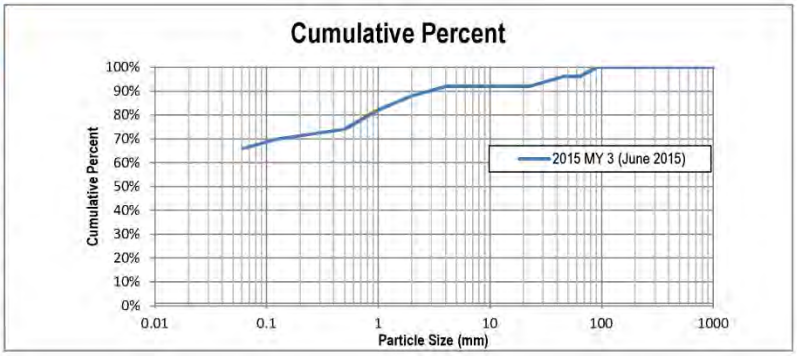
Summary Data	
D50	1.20 mm
D84	1.70 mm
D95	4.0 mm

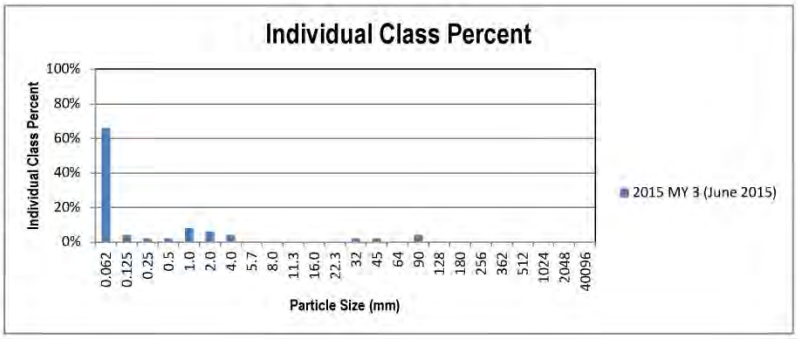




Charles Williams Stream, Wetland, and Buffer Site / 80 Cross Section: 3 Feature: Run					
			2015 MY 3 (June 2015)		
Description	Material	Size (mm)	Total #	Item %	Cum %
Silt/Clay	silt/clay	0.062	33	66%	66%
Sand	very fine sand	0.125	2	4%	70%
	fine sand	0.25	1	2%	72%
	medium sand	0.5	1	2%	74%
	coarse sand	1.0	4	8%	82%
	very coarse sand	2.0	3	6%	88%
Gravel	very fine gravel	4.0	2	4%	92%
	fine gravel	5.7	0	0%	92%
	fine gravel	8.0	0	0%	92%
	medium gravel	11.3	0	0%	92%
	medium gravel	16.0	0	0%	92%
	coarse gravel	22.3	0	0%	92%
	coarse gravel	32	1	2%	94%
	very coarse gravel	45	1	2%	96%
	very coarse gravel	64	0	0%	96%
Cobble	small cobble	90	2	4%	100%
	medium cobble	128	0	0%	100%
	large cobble	180	0	0%	100%
	very large cobble	256	0	0%	100%
Boulder	small boulder	362	0	0%	100%
	small boulder	512	0	0%	100%
	medium boulder	1024	0	0%	100%
	large boulder	2048	0	0%	100%
Bedrock	bedrock	40096	0	0%	100%
TOTAL % of whole count			50	100%	

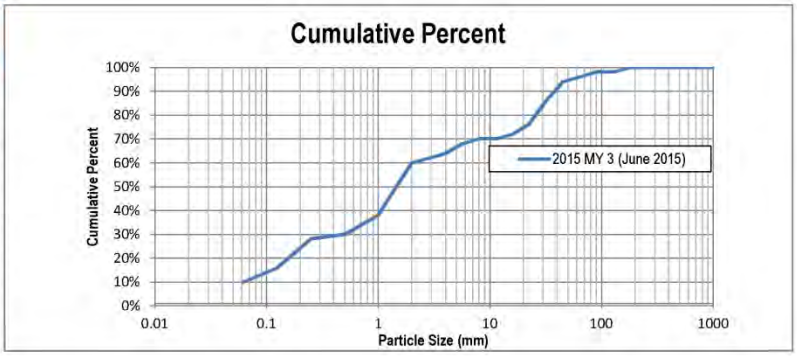
Summary Data	
D50	<0.06 mm
D84	1.50 mm
D95	33.65 mm





Charles Williams Stream, Wetland, and Buffer Site / 80 Cross Section: 4 Feature: Riffle					
			2015 MY 3 (June 2015)		
Description	Material	Size (mm)	Total #	Item %	Cum %
Silt/Clay	silt/clay	0.062	5	10%	10%
Sand	very fine sand	0.125	3	6%	16%
	fine sand	0.25	6	12%	28%
	medium sand	0.5	1	2%	30%
	coarse sand	1.0	4	8%	38%
	very coarse sand	2.0	11	22%	60%
Gravel	very fine gravel	4.0	2	4%	64%
	fine gravel	5.7	2	4%	68%
	fine gravel	8.0	1	2%	70%
	medium gravel	11.3	0	0%	70%
	medium gravel	16.0	1	2%	72%
	coarse gravel	22.3	2	4%	76%
	coarse gravel	32	5	10%	86%
	very coarse gravel	45	4	8%	94%
	very coarse gravel	64	1	2%	96%
Cobble	small cobble	90	1	2%	98%
	medium cobble	128	0	0%	98%
	large cobble	180	1	2%	100%
	very large cobble	256	0	0%	100%
Boulder	small boulder	362	0	0%	100%
	small boulder	512	0	0%	100%
	medium boulder	1024	0	0%	100%
	large boulder	2048	0	0%	100%
Bedrock	bedrock	40096	0	0%	100%
TOTAL % of whole count			50	100%	

Summary Data	
D50	1.51 mm
D84	30.0 mm
D95	55.0 mm



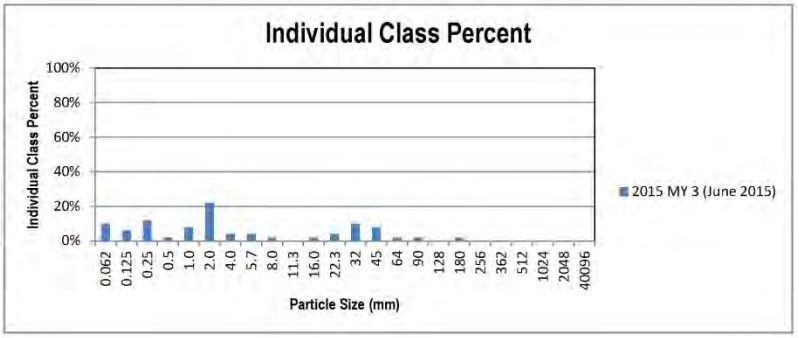


Table 10a. Baseline Stream Data Summary

Charles Williams Stream, Wetland, and Buffer Site / 80 - UT to Sandy Creek: 1,850 linear feet

Parameter	Gauge[2]	Regional Curve			Pre-Existing Condition						Reference Reach(es) Data						Design			Monitoring Baseline					
Dimension and Substrate - Riffle Only		LL	UL	Eq.	Min	Mean	Med	Max	SD[5]	n	Min	Mean	Med	Max	SD[5]	n	Min	Med	Max	Min	Mean	Med	Max	SD[5]	n
Bankfull Width (ft)						25.2				1								25.2		22	23.5	24.9	24.9		2
Floodprone Width (ft)						>300				1								>300		63	>131	200+	200+		2
Bankfull Mean Depth (ft)						1.58				1								1.59		1	1.3	1.5	1.5		2
[1]Bankfull Max Depth (ft)						2.6				1								2.6		1.7	2.3	2.8	2.8		2
Bankfull Cross Sectional Area (ft^2)						40.0				1								40		21.7	28.9	36.1	36.1		2
Width/Depth Ratio						15.8				1								15.8		>15	>15	>15	>15		2
Entrenchment Ratio						>15				1								>15		2.9	7.5	8.4	>8		2
[1]Bank Height Ratio						1.0				1								1.0		1.0	1.0	1.0	1.0		2
Profile																									
Riffle Length (ft)																				39	51.5	51.5	64		2
Riffle Slope (ft/ft)						0.013				1								0.013		0.26	0.28	0.28	0.3		2
Pool Length (ft)					8.3	30.5		63.7										30.5		168	198	196	232	27.5	4
Pool Max depth (ft)						3.4				1								3.4		3.1	3.5	3.4	4.25		4
Pool Spacing (ft)					56.0	116.0		94.0										116.4		158	372	239	719		3
Pattern																									
Channel Beltwidth (ft)					31.7	44.9		62.3									31.7	44.9	62.3	40	74.5	78.5	101	24.8	4
Radius of Curvature (ft)					15.0	37.8		95.0									15	37.8	95	19	60.5	58	107	31.5	4
Rc:Bankfull width (ft/ft)					0.6	1.5		3.8									0.6	1.5	3.8	0.9	2.7	2.6	4.8	1.4	4
Meander Wavelength (ft)					73.0	133.8		216.0									73	133.8	216	86	149.25	121.5	268	70.1	4
Meander Width Ratio					2.9	5.3		8.6									1.3	1.8	2.5	3.9	6.7	5.5	12	3.1	4
Transport parameters																									
Reach Shear Stress (competency) lb/f^2					0.1425															0.07					
Max part size (mm) mobilized at bankfull					2.0															2.0					
Stream Power (transport capacity) W/m^2																									
Additional Reach Parameters																									
Rosgen Classification					C5												C5			C5					
Bankfull Velocity (fps)					3.9												3.75			3.05					
Bankfull Discharge (cfs)					150.0																				
Valley length (ft)					1961																				
Channel Thalweg length (ft)					1850												1850			1850					
Sinuosity (ft)					1.06												1.06			1.06					
Water Surface Slope (Channel) (ft/ft)					0.0014												0.0014			0.0013					
BF slope (ft/ft)																	0.0013			0.0013					
[3]Bankfull Floodplain Area (acres)																									
[4]% of Reach with Eroding Banks																									
Channel Stability or Habitat Metric																									
Biological or Other																									

Shaded cells indicate that these will typically not be filled in.

1 = The distributions for these parameters can include information from both the cross-section surveys and the longitudinal profile. 2 = For projects with a proximal USGS gauge in-line with the project reach (added bankfull verification - rare).

3. Utilizing survey data produce an estimate of the bankfull floodplain area in acres, which should be the area from the top of bank to the toe of the terrace riser/slope.

4 = Proportion of reach exhibiting banks that are eroding based on the visual survey for comparison to monitoring data; 5. Of value/needed only if the n exceeds 3

Table 10b. Baseline Stream Data Summary (Substrate, Bed, Bank, and Hydrologic Containment Parameter Distributions)

Charles Williams Stream, Wetland, and Buffer Site / 80 - UT to Sandy Creek: 1,850 linear feet

Parameter	Pre-Existing Condition							Reference Reach(es) Data							Design							As-built/Baseline						
[1]Ri% / Ru% / P% / G% / S%	1%	84%	4%	11%	0%																	11%	60%	14%	15%	0%		
[1]SC% / Sa% / G% / C% / B% / Be%	7%	83%	10%	0%	0%	0%																						
[1]d16 / d35 / d50 / d84 / d95 / di^{p} / di^{sp} (mm)	0.12	0.34	0.55	1.70	3.60	<2.0	<2.0																					
[2]Entrenchment Class <1.5 / 1.5-1.99 / 2.0-4.9 / 5.0-9.9 / >10	0	0	0	0	1850																	0	0	200	0	1650		
[3]Incision Class <1.2 / 1.2-1.49 / 1.5-1.99 / >2.0	1850	0	0	0																		1850	0	0	0			

Shaded cells indicate that these will typically not be filled in.

1 = Riffle, Run, Pool, Glide, Step; Silt/Clay, Sand, Gravel, Cobble, Boulder, Bedrock; dip = max pave, disp = max subpave

2 = Entrenchment Class - Assign/bin the reach footage into the classes indicated and provide the percentage of the total reach footage in each class in the table. This will result from the measured cross-sections as well as visual estimates

3 = Assign/bin the reach footage into the classes indicated and provide the percentage of the total reach footage in each class in the table. This will result from the measured cross-sections as well as the longitudinal profile

Table 11a. Monitoring Data - Dimensional Morphology Summary (Dimensional Parameters - Cross Sections)

Charles Williams Stream, Wetland, and Buffer Site / 80 - UT to Sandy Creek: 1,850 linear feet

	Cross Section 1 (Riffle)							Cross Section 2 (Glide)							Cross Section 3 (Run)							Cross Section 4 (Riffle)						
Based on fixed baseline bankfull elevation[1]	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+
Record elevation (datum) used																												
Bankfull Width (ft)	22.0	22.6	23.9	24.0				19.6	20.5	19.4	21.8				22.6	18.8	20.1	22.4				24.9	24.5	24.1	24.2			
Floodprone Width (ft)	63.0	65.4	66.1	66.1				200+	200+	200+	200+				200+	200+	200+	200+				200+	200+	200+	200+			
Bankfull Mean Depth (ft)	1.0	1.0	0.9	1.1				1.7	1.6	1.8	1.7				1.6	1.5	1.7	1.6				1.5	1.5	1.5	1.8			
Bankfull Max Depth (ft)	1.7	1.6	1.8	1.9				2.5	2.8	3.1	2.8				2.8	2.8	3	3.16				2.8	2.9	2.9	3.1			
Bankfull Cross Sectional Area (ft^2)	21.7	22.5	22.7	25.6				33.4	32.8	35.3	36.7				36.4	29.0	33.5	36.5				36.1	37.8	37.1	42.7			
Bankfull Width/Depth Ratio	22.3	22.7	25.2	22.6				11.5	12.9	10.7	12.9				14.0	12.2	12.1	13.7				16.6	15.8	15.6	13.7			
Bankfull Entrenchment Ratio	2.9	2.9	2.8	2.8				>10.0	>10.0	>10	>10				>8.0	>8.0	>8.0	>8.0				>8.0	>8.0	>8.0	>8.0			
Bankfull Bank Height Ratio	1.0	1.0	1.0	1.0				1.1	1.1	1.0	1.0				1.0	1.0	1.0	1.0				1.0	1.0	1.0	1.0			
Based on current/developing bankfull feature[2]																												
Record elevation (datum) used																												
Bankfull Width (ft)																												
Floodprone Width (ft)																												
Bankfull Mean Depth (ft)																												
Bankfull Max Depth (ft)																												
Bankfull Cross Sectional Area (ft^2)																												
Bankfull Width/Depth Ratio																												
Bankfull Entrenchment Ratio																												
Bankfull Bank Height Ratio																												
Cross Sectional Area between end pins (ft^2)																												
d50 (mm)																												

These cells may or may not require population in any given year. See footnote 2 below

1 = Widths and depths for monitoring resurvey will be based on the baseline bankfull datum regardless of dimensional/depositional development. Input the elevation used as the datum, which should be consistent and based on the baseline datum established. If the performer has inherited the project and cannot acquire the datum used for prior years this must be discussed with EEP. If this cannot be resolved in time for a given years report submission a footnote in this should be included that states: "It is uncertain if the monitoring datum has been consistent over the monitoring history, which may influence calculated values. Additional data from a prior performer is being acquired to provide confirmation. Values will be recalculated in a future submission based on a consistent datum if determined to be necessary."

2 = Based on the elevation of any dominant depositional feature that develops and is observed at the time of survey. If the baseline datum remains the only significant depositional feature then these two sets of dimensional parameters will be equal, however, if another depositional feature of significance develops above or below the baseline bankfull datum then this should be tracked and quantified in these cells.

Table 11b. Monitoring Data - Stream Reach Data Summary

Charles Williams Stream, Wetland, and Buffer Site / 80 - UT to Sandy Creek: 1,850 linear feet

Parameter	Baseline						MY-1						MY-2						MY- 3						MY- 4						MY- 5					
Dimension and Substrate - Riffle only	Min	Mean	Med	Max	SD[4]	n	Min	Mean	Med	Max	SD[4]	n	Min	Mean	Med	Max	SD[4]	n	Min	Mean	Med	Max	SD[4]	n	Min	Mean	Med	Max	SD[4]	n	Min	Mean	Med	Max	SD[4]	n
Bankfull Width (ft)	22	23.5	24.9	24.9		2	22.6	23.5	24.5	24.5		2	23.9	24.0	24.0	24.1		2	24.0	24.1	24.2	24.2		2												
Floodprone Width (ft)	63	>131	200+	200+		2	65.4	>132.7	200+	200+		2	66.1	>133	200+	200+		2	66.1	>133	200+	200+		2												
Bankfull Mean Depth (ft)	1	1.3	1.5	1.5		2	1.0	1.3	1.5	1.5		2	0.9	1.2	1.2	1.5		2	1.1	1.45	1.8	1.8		2												
[1]Bankfull Max Depth (ft)	1.7	2.3	2.8	2.8		2	1.6	2.5	2.9	2.9		2	1.8	2.35	2.35	2.9		2	1.9	2.5	3.1	3.1		2												
Bankfull Cross Sectional Area (ft^2)	21.7	28.9	36.1	36.1		2	22.5	30.5	37.8	37.8		2	22.7	29.9	29.9	37.1		2	25.6	34.15	42.7	42.7		2												
Width/Depth Ratio	>15	>15	>15	>15		2	>15	>15	>15	>15		2	>15	>15	>15	>15		2	13.7	18.15	22.6	22.6		2												
Entrenchment Ratio	2.9	7.5	8.4	>8		2	2.9	>5.4	>8	>8		2	2.8	>5.4	>8	>8		2	2.8	>5.4	>8	>8		2												
[1]Bank Height Ratio	1.0	1.0	1.0	1.0		2	1.0	1.0	1.0	1.0		2	1.0	1.0	1.0	1.0		2	1.0	1.0	1.0	1.0		2												
Profile																																				
Riffle Length (ft)	39.0	51.5	51.5	64.0		2	53.13	75.34	78.7	91	14.5	6	88.9	127.7	123.7	160.1	26.9	5	88.9	127.7	123.7	160.0	26.88	5												
Riffle Slope (ft/ft)	0.003	0.003	0.003	0.003		2	0.003	0.003	0.003	0.003	0.0	6	0.004	0.008	0.007	0.016	0.004	5	0.000	0.0012	0.001	0.003	0.001	5												
Pool Length (ft)	168.0	198.0	196.0	232.0	27.5	4	283.6	283.6	283.6	283.6		2	115.8	127.7	127.7	139.6		2	115.8	127.7	127.7	139.6		2												
Pool Max depth (ft)	3.1	3.5	3.4	4.3		4	0.8	1.5	1.5	2.3		2	2.0	2.0	2.0	2.0		2	1.4	1.65	1.88	1.88		2												
Pool Spacing (ft)	158.0	372.0	239.0	719.0		3	283.6	283.6	283.6	283.6		1	975.2	975.2	975.2	975.2		1	975.2	975.2	975.2	975.2		1												
Pattern																																				
Channel Beltwidth (ft)	40.0	74.5	78.5	101.0	24.8	4																														
Radius of Curvature (ft)	19.0	60.5	58.0	107.0	31.5	4																														
Rc:Bankfull width (ft/ft)	0.9	2.7	2.6	4.8	1.4	4																														
Meander Wavelength (ft)	86.0	149.3	121.5	268.0	70.1	4																														
Meander Width Ratio	3.9	6.7	5.5	12.0	3.1	4																														
Additional Reach Parameters																																				
Rosgen Classification	C5						C5						C5						C5																	
Channel Thalweg length (ft)	1748						1748						1748						1748																	
Sinuosity (ft)	1.06						1.06						1.06						1.06																	
Water Surface Slope (Channel) (ft/ft)	0.0013						0.0013						0.0018						0.0017																	
BF slope (ft/ft)	0.0013						0.0013						0.0010						0.0015																	
[3]Ri% / Ru% / P% / G% / S%	5%	80%	15%				5%	80%	15%				5%	80%	15%				5%	80%	15%															
[3]SC% / Sa% / G% / C% / B% / Be%																																				
[3]d16 / d35 / d50 / d84 / d95 /																																				
[2]% of Reach with Eroding Banks	0						0						0						0																	
Channel Stability or Habitat Metric																																				
Biological or Other																																				

Pattern data will not typically be collected unless visual data, dimensional data or profile data indicate significant shifts from baseline

Shaded cells indicate that these will typically not be filled in.

1 = The distributions for these parameters can include information from both the cross-section surveys and the longitudinal profile.

2 = Proportion of reach exhibiting banks that are eroding based on the visual survey from visual assessment table

3 = Riffle, Run, Pool, Glide, Step; Silt/Clay, Sand, Gravel, Cobble, Boulder, Bedrock; dip = max pave, disp = max subpave

4. = Of value/needed only if the n exceeds 3

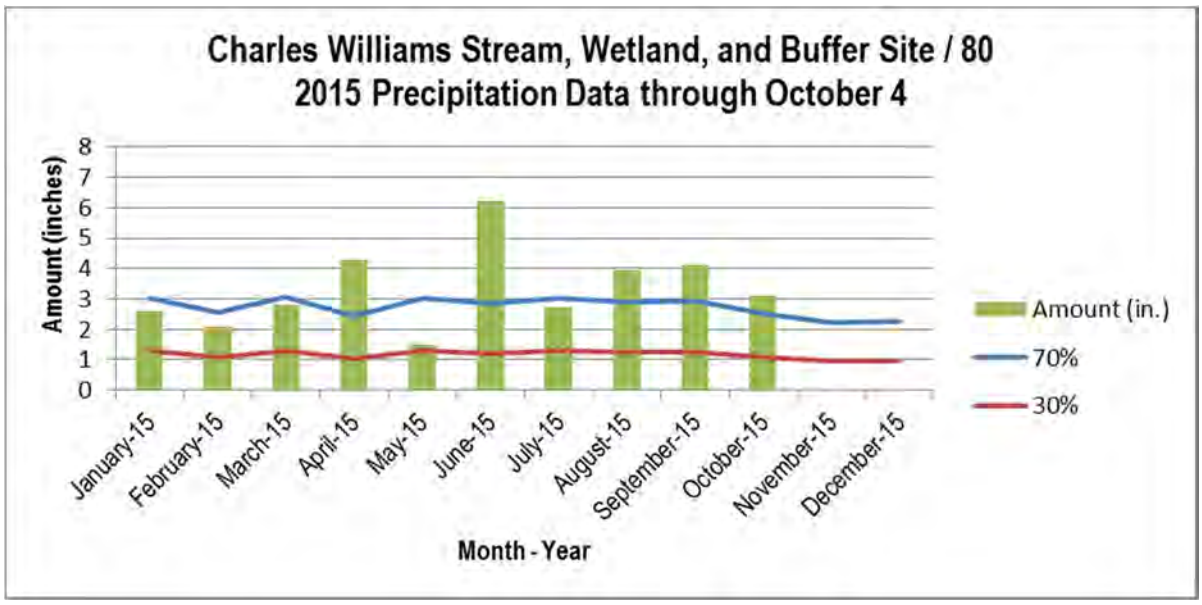
APPENDIX E

Hydrology Data

Table 12. Verification of Bankfull Events

Charles Williams Stream, Wetland, and Buffer Site / 80 - UT to Sandy Creek: 1,850 linear feet

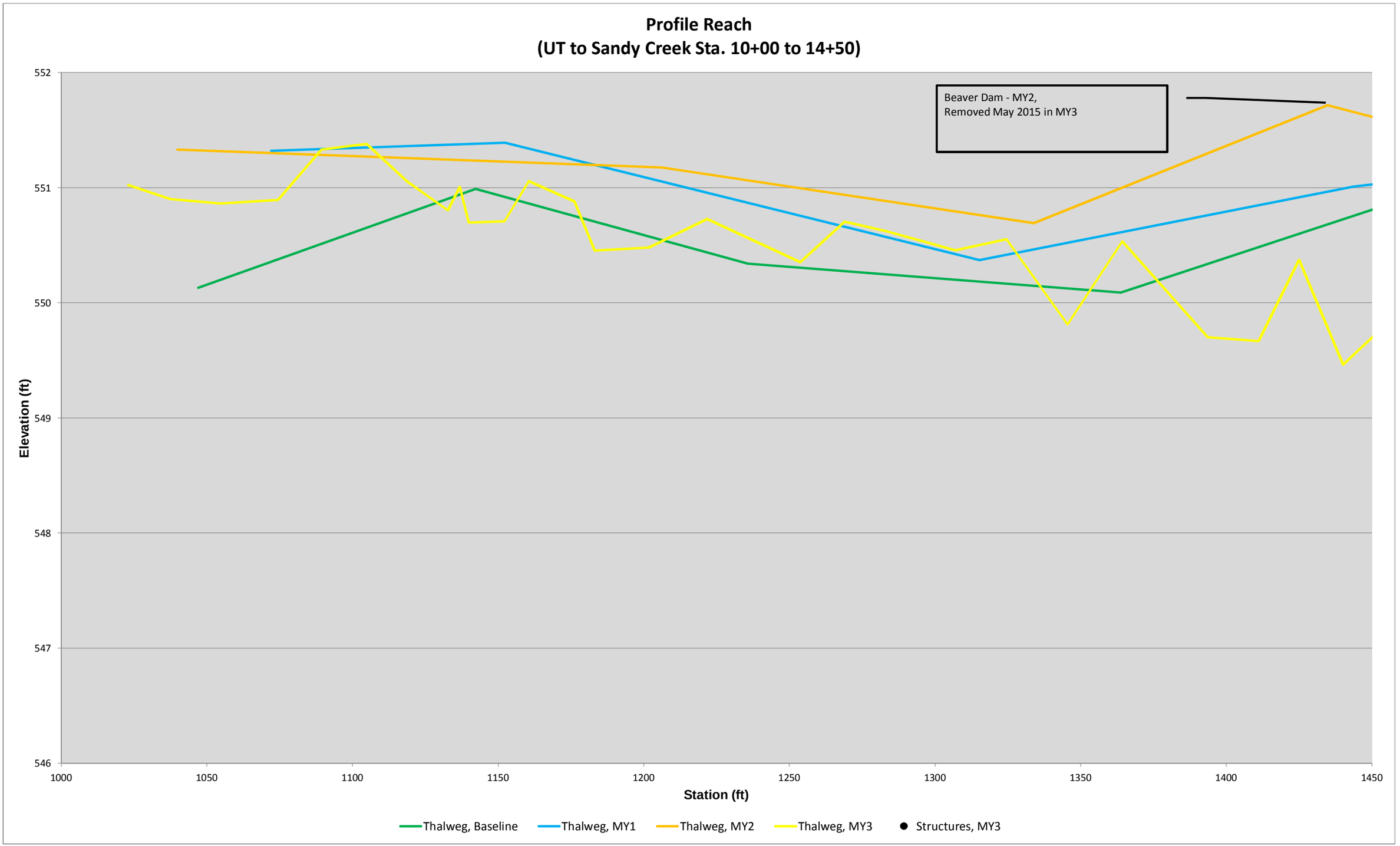
Date of Data Collection	Date of Occurrence	Method	Photo # (if available)
11/6/2013	unknown	Crest Gauge	Not Available
3/6/2014	unknown	Visual On-site (wrack)	Not Available
9/16/2014	unknown	Crest Gauge	Not Available
4/17/2015	4/17/2015	Visual On-site (active overbank event)	Overbank 1
6/30/2015	unknown	Visual On-site (wrack, sediment staining, alluvial deposits)	Overbank 2, 3, 4

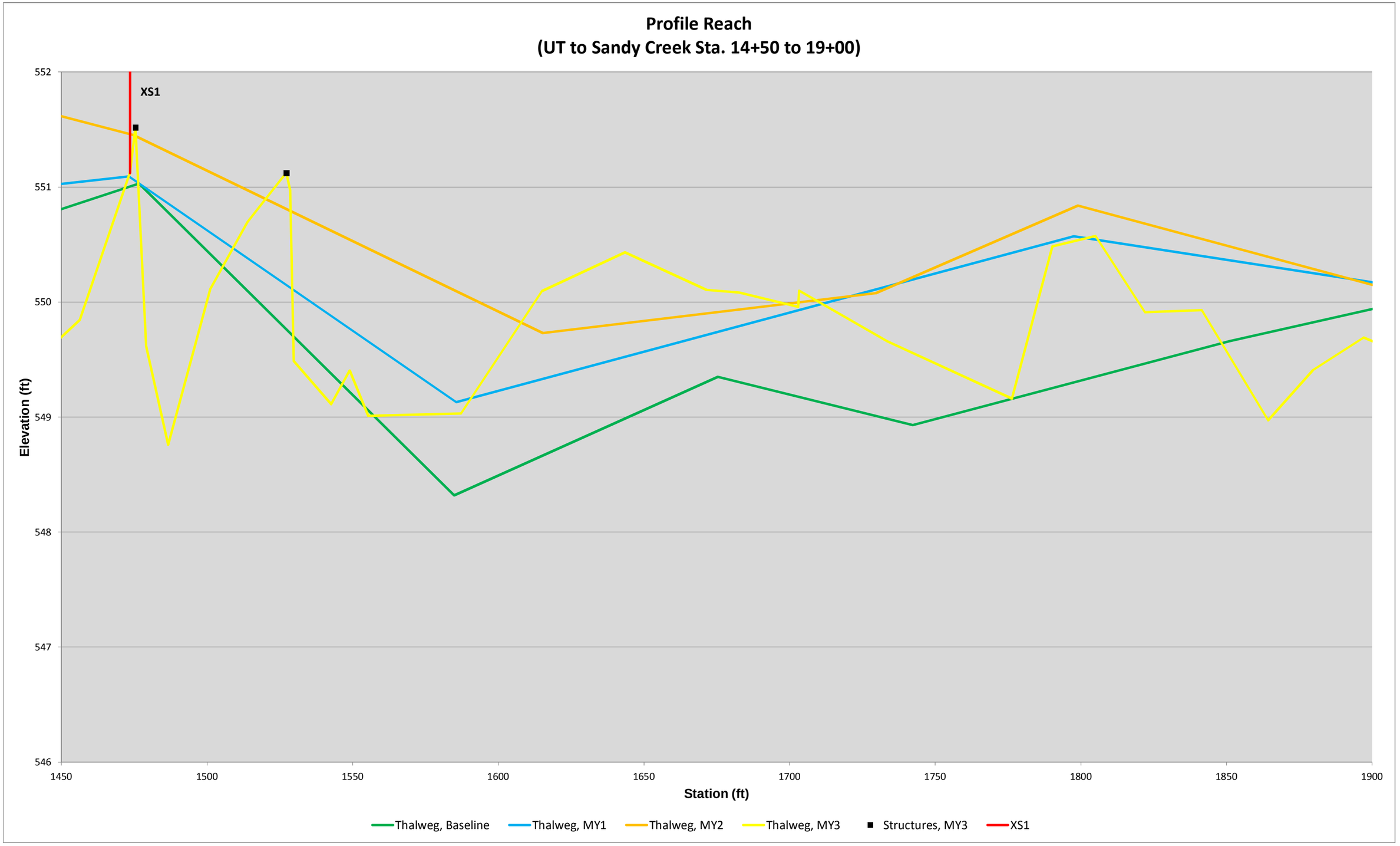


APPENDIX F

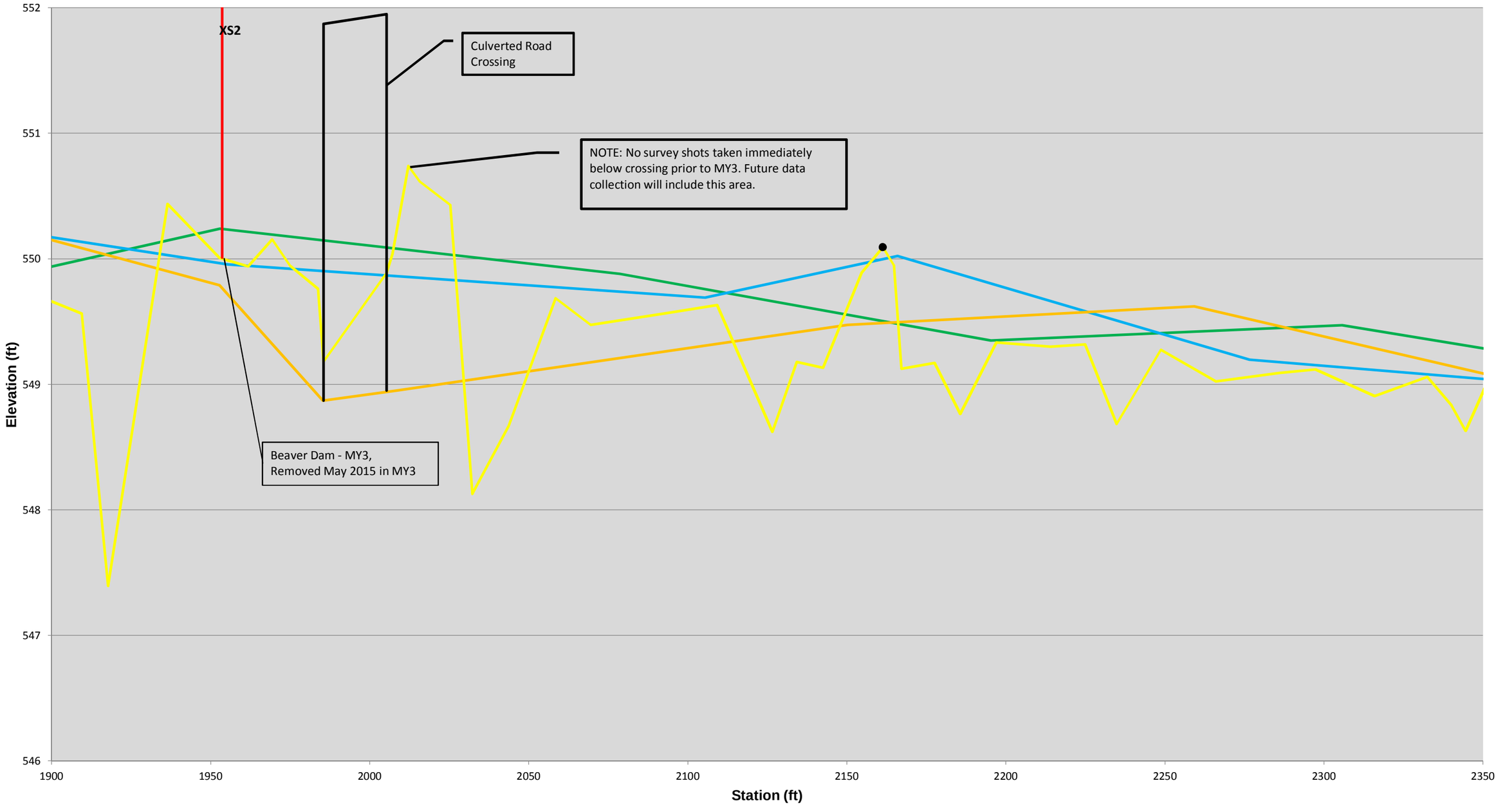
Detailed Thalweg Profile

Profile Reach
(UT to Sandy Creek Sta. 10+00 to 14+50)




Profile Reach
(UT to Sandy Creek Sta. 14+50 to 19+00)
XS1
552
551
550
549
548
547
546
Elevation (ft)
1450
1500
1550
1600
1650
1700
1750
1800
1850
1900
Station (ft)
Thalweg, Baseline
Thalweg, MY1
Thalweg, MY2
Thalweg, MY3
Structures, MY3
XS1

Profile Reach
(UT to Sandy Creek Sta. 19+00 to 23+50)



Profile Reach
(UT to Sandy Creek Sta. 23+50 to 28+00