

# **Annual Monitoring Report**

Monitoring Year 5 of 7

**FINAL**

601 East Stream Restoration Project  
NCDMS Contract No.: 004925  
NCDMS Project No.: 95756  
USACE Permit Action ID: 2013-00265  
DWR Project No.: 14-0547

Union County, NC  
Data Collected: July/October 2019  
Date Submitted: January 2020



Submitted to:

**North Carolina Division of Mitigation Services**  
NCDEQ-DMS, 1652 Mail Service Center Raleigh NC 27699-1652





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January 24, 2020

Paul Wiesner  
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5 Ravenscroft Drive, Suite 102  
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RE: 601 East Stream Restoration Site: MY5 Monitoring Report (NCDMS ID 95756)

Listed below are comments provided by DMS on December 2, 2019 regarding the 601 East Stream Restoration Site: Year 5 Monitoring Report and RES' responses.

**Section 1.4.2:** Please notify DMS when the erosional area has been fixed and the reported beaver dams have been removed. DMS recommends removing beaver dams as soon as possible to avoid potential project damage and additional maintenance.

[RES will notify DMS when these problem areas are repaired.](#)

**Section 1.4.3:** The report indicates that both crest gauges malfunctioned and no bankfull events were recorded in MY5. Although two (2) bankfull events have been recorded in separate years, please continue to repair equipment and document bankfull events for the remainder of the monitoring period.

This section also reports dry channel above the crossing on Reach 1 during RES site visits in July and October 2019. RES should consider adding a stream flow gauge (pressure transducer) or a field camera to document at least 30 days of continuous flow on the intermittent portions of the reach.

[RES will add a flow gauge to the intermittent section of Reach 1 to document at least 30 days of continuous flow and replace the crest gauges with pressure transducers to avoid future maintenance.](#)

**Table 6:** The table reports 100% of all projects reaches visually assessed are stable and performing as intended. Please confirm that this is an accurate reflection of the MY5 project conditions.

[Even with the beaver dams and parrot feather in the channel, RES believes the project streams are stable and performing as intended.](#)



**Digital Support File and General Report Comments:**

1. Please provide visual assessment excel tables.

Done.

2. Please provide CVS entry tool data.

Done.

3. CCPV needs to be segmented to match asset table and restoration types need to be symbolized in map and legend.

Done.

4. Please provide segmented GIS to match comment 3.

Segmented GIS is provided to the best of RES' ability. RES does not possess any CAD or GIS data from the mitigation plan/design (which the asset table is based off of).

5. XS Morphology Table - The direction of change in BHR calculations were correct using the fixed AB XSA method, but the magnitude appeared to differ in some cases from independent runs for a subset of riffle cross sections using a modified Mecklenburg spreadsheet (see attached). Please check. Alternatively, "<1" can be used if BHR is below 1. Calculation of XSA and Max depth are to be completed using TOB in keeping with methods specified in the Industry Technical Work group memorandum. Please include the Bankfull and LTOB elevations used in years 3 and 5. For clarity make sure the reader is aware that these methods are being employed. Include a footnote:

"Bank Height Ratio is calculated based on the As-built (MY0) cross-sectional area as described in the Standard Measurement of the BHR Monitoring Parameter document provided by NCIRT and NCDMS (9/2018). The remainder of the bankfull dimensions are calculated based on the current year's low bank height."

Done.

Prepared by:



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## **1.0 PROJECT SUMMARY**

### **1.1. Goals and Objectives**

The project goals address stressors identified in the TLW and include the following:

- Reduce water quality stressors originating in and around the project area affecting the project reaches and downstream watercourses, which include population of the Savannah Lilliput (*Toxolasma pullus*) and the Carolina Creekshell (*Vilosa vaughiana*), both listed species of concern. Specifically involving:
  - Reducing turbidity and sediment loading
  - Input reductions of nutrients and crop protection chemicals
  - Improving thermoregulation
- Improving aquatic habitat quality and diversity within project reaches
- Improving recruitment of instream fine organic matter (FOM) in the near term and both FOM and large wood in the long term
- Improving terrestrial habitat diversity and quality in the vicinity of project reaches
- Establishing habitat continuity between the reach headwaters and Lanes Creek
- Improving flood flow attenuation and floodplain interaction

The project goals are addressed through the following project objectives:

- Restore or enhance reach pattern, dimension, and profile
- Stabilize eroding stream banks
- Install stream structures to maintain grade and improve bed form complexity
- Implement BMP detention devices on lateral agricultural drainages
- Install diverse native riparian buffer
- Removal of invasive exotic plant species
- Secure a protective conservation easement and establish fencing as needed

### **1.2. Success Criteria**

The success criteria for the 601 East Stream Restoration Site follows accepted and approved success criteria presented in the USACE Stream Mitigation Guidelines and subsequent NCDMS and agency guidance. Specific success criteria components are presented below.

#### **1.2.1. Stream Restoration**

**Morphologic Parameters and Channel Stability** – Restored and enhanced streams should demonstrate morphologic stability to be considered successful. Stability does not equate to an absence of change, but rather to sustainable rates of change or stable patterns of variation. Restored streams often demonstrate some level of initial adjustment in the period that follows construction and some subsequent change/variation is also to be expected. However, the observed change should not be unidirectional such that it represents a robust trend. If some trend is evident, it should be modest or indicate migration to another stable form. Annual variation is to be expected, but over time this should demonstrate equilibrium on the reach scale with the maintenance of or even a reduction in the amplitude of variation. Lastly, all of this must be evaluated in the context of hydrologic events to which the system is exposed and the design type/intent (i.e. threshold versus free form alluvial channels).

**Dimension** – General maintenance of a stable cross-section and hydrologic access to the floodplain features over the course of the monitoring period will generally represent success in dimensional stability. However, some change is natural and expected and can even indicate that the design was



successful and appropriate for the hydrologic and sediment regime. Examples include depositional processes resulting in the development of constructive features on the banks and floodplain such as an inner berm, a slightly narrower channel, modest natural levees, and general floodplain deposition.

For stream dimension, cross-sectional overlays and key parameters such as cross-sectional area, and the channel's width to depth ratios should demonstrate modest overall change and patterns of variation.

Significant widening of the channel cross-section or trends of increase in the cross-sectional area generally represent concern, although some adjustment in this direction is acceptable if the process is arrested after a period of modest adjustment. In the case of riffle cross sections, maintenance of depths that represent small changes to target competence (e.g. consistently low BHRs <1.2) would also reflect stability. Although a pool cross-section may experience periodic infilling due to watershed activity and the timing of events relative to monitoring, the majority of pools within a project stream reach/component should demonstrate maintenance of greater depths and low water surface slopes over time. Rates of lateral migration need to be moderate. Bank pins will be installed to monitor rates of erosion.

**Pattern and Profile** – Pool depths may vary from year to year, however the majority of pools should maintain depths that are distinct in the profile and are readily observed. Pattern measurement will not be collected unless observations indicate a detectable change based on observations and/or dimension measurements.

**Substrate** – Generally it is anticipated that the bed materials will coarsen over time. The majority of riffle pebble counts should indicate maintenance or coarsening of the substrate. The D50 and D84 of the substrate should show a coarser distribution of bed materials in riffles and finer size class distribution in pools.

**Sediment Transport** – Depositional features should be consistent with a stable stream that is effectively managing its sediment load. Point Bar and inner berm features should develop without excessive encroachment of the restored channel. Trends in the development of systemic robust mid-channel or alternating bar features will be considered a destabilizing condition and may require intervention.

The tributaries outside of the conservation easement will be observed yearly and the monitoring report will document the function of the upstream basins in capturing excess sediment produced by observed degradation in the narrative. A specific performance standard has not been added.

### 1.2.2. Surface Water Hydrology

Monitoring of stream water stages through a staff gauge should show recurrence of bankfull flow on average every 1 to 2 years. Throughout the monitoring period, the surface water stage should achieve bankfull or greater elevations at least twice. The bankfull events must occur during separate monitoring years.

### 1.2.3. Vegetation

The vegetation monitoring will be conducted according to the Carolina Vegetation Survey (CVS) – EEP protocol Version 4.2 (Lee et al 2008). Vegetation monitoring plots will be 100 square meters in size and will be conducted according to the Level I protocol which has a focus on planted stems only. The purpose of this level of monitoring is to determine the pattern of installation of plant material with respect to species, spacing, density, and to monitor the survival and growth of those installed species. The success criteria for the preferred species in the restoration areas will be based on annual and cumulative survival and growth over seven (7) years. Survival on preferred species must be at a minimum 320 stems/acre at the end of the three years of monitoring and 260 stems/acre after five years. At year 7, density must be no less than 210 seven-year-old planted stems/acre. Level II of the CVS protocol, which includes natural stems and planted stems, will be followed for the monitoring year 2 and subsequent years until the project close out year.

### 1.3. Project Setting and Background

The 601 East Stream Restoration Site is located in Union County, approximately 13 miles south of Monroe, NC (**Figure 1**). The site encompasses 12.8 acres of formerly agricultural land and includes portions of Tanyard Branch, a tributary of Lanes Creek. The Site is located within the Yadkin River Basin, United States Geological Survey (USGS) 14-digit Hydrologic Unit 03040105081010 and the North Carolina Division of Water Resources (NCDWR) sub-basin 03-04-14. The drainage area of Tanyard Branch at the downstream end of the site is 0.56 square mile (354 acres). Land use within the watershed is predominately agriculture with the remaining land use composed of low density residential and forested areas.

Following 2016 monitoring the NCIRT requested a review of the differential between the Approved Mitigation Plan and Baseline Monitoring Report. The table below details the discrepancies by reach. The primary cause of increased baseline SMUs is survey methodology (thalweg vs. centerline). The Mitigation Plan lengths were based on centerline. Additionally, there were likely minor field adjustments during construction.

Reach	Mitigation Type*	Proposed Length (LF)	Mitigation Ratio	Proposed SMUs	Baseline SMUs
<b>Reach A</b>	Buffer Establishment	215	5:1	43	43
<b>Reach 1a</b>	P1 Restoration	350	1:1	350	350
<b>Reach 1b</b>	Enhancement I	85	1.5:1	56	57
<b>Reach 1c</b>	Enhancement I	155	1.5:1	103	103
<b>Reach 1d</b>	P1 Restoration	800	1:1	800	803
<b>Reach 2a</b>	Enhancement I	40	1.5:1	26	30
<b>Reach 2b</b>	Enhancement I	120	1.5:1	80	85
<b>Reach 2c</b>	P1 Restoration	724	1:1	724	730
<b>Reach 3a</b>	P1 Restoration	368	1:1	368	369
<b>Reach 3b</b>	P1 Restoration	650	1:1	650	649
<b>Reach 3c</b>	P3 Restoration	480	1:1	480	495
<b>Total</b>		<b>3,987</b>		<b>3,680</b>	<b>3,714</b>

\*P1=Priority 1, P3=Priority 3

\*\*The contracted amount of credits for this Site was 3,576 SMUs

## 1.4. Project Performance

Monitoring Year 5 (MY5) data was collected in July and October 2019. Monitoring activities included visual assessment of all reaches and the surrounding easement, 10 vegetation plots, 18 cross sections, 20 permanent photo stations, nine pebble counts, and nine bankpin arrays. Summary information and data related to the occurrence of items such as beaver activity 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. A visual overview of the site can be seen in the Current Conditions Plan View Maps (**Figure 2**). Photographs taken at permanent stations throughout the project site also display general site conditions (**Figure 3**). 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 the NCDMS website. All raw data supporting the tables and figures in the appendices is available from DMS upon request.

### 1.4.1. Vegetation

Visual assessment of the easement (**Table 5; Figure 2**) indicates vegetation is well established throughout the easement. There was no encroachment observed in MY5. The parrotfeather areas were treated in 2018 and were still present in MY5 though some were dying back with the dry conditions observed in October. The areas of cattails are still present but only in localized wetland areas. Invasive areas will continue to be monitored and treated as necessary throughout the monitoring period.

Monitoring of the 10 permanent vegetation plots was completed during October 2019. Summary tables and photographs associated with MY5 monitoring are located in **Appendix C**. Stem densities for MY5 ranged from 364 to 971 stems per acre with a mean of 607 stems per acre across all plots. When volunteer stems are included, the annual mean increases to 874 stems per acre. A total of 17 species were documented within the monitoring plots. The average planted stem height observed in the plots was 8.6 feet.

### 1.4.2. Stream Geomorphology

Visual assessment of the stream was performed to document signs of instability, such as eroding banks, structural instability, or excessive sedimentation (**Table 6**). The erosional feature noted in the right buffer of Reach 1 is a headcut is in need of repair. RES will stabilize the headcut with rock and add coir logs along the feature. The major stream problem areas from MY5 were two beaver dams on Reach 4 and three beaver dams on Reach 2. These dams and beavers will be removed in 2020.

Geomorphic data for MY5 was collected during July 2019. Summary tables and cross-section plots related to stream morphology are located in **Appendix D**. Baseline stream summary data for reference can be found in **Table 10**. Cross-sectional overlays showed minimal dimensional change between MY3 and MY5 data collection efforts (**Table 11a; Figure 6**), as well as minimal change in overall reach dimensions (**Table 11b**). None of the riffle cross sections exceeded a 1.2 BHR.

Substrate monitoring was performed during MY5. Pebble count  $D_{50}$  was medium gravel for Reach 1, coarse gravel for Reach 2, medium gravel for Reach 3, and coarse gravel for Reach 4 (**Table 12; Charts 1-5**). The channel substrate will be monitored in future years for shifts in particle size distributions.

The bank pin arrays indicate that no erosion is taking place in the pools at cross-sections (**Table 13**).

### 1.4.3. Stream Hydrology

During MY5, no bankfull events were documented. Both crest gauges had become infested with ants and will be replaced in MY6. Project site precipitation data can be found in **Table 15**. No dry channels were observed in April but the reaches above the crossing on Reach 1 were dry in July and October. RES plans to add a flow gauge to the intermittent section of Reach 1 to document at least 30 days of consecutive flow. Photo documentation of the stream is in **Appendix B**.

Summary information/data related to the 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 NCDMS' website. All raw data supporting the tables and figures in the appendices is available from NCDMS upon request.

## 2.0 METHODS

Visual assessments of the project were performed at the beginning and end of the monitoring year. Permanent photo station photos were collected during vegetation monitoring. Additional photos of vegetation or stream problem areas were documented with photographs throughout the project area.

Geomorphic measurements (MY0, MY1, MY2, MY3, MY5, MY7) were taken during low flow conditions using a Topcon GTS-312 Total Station. Three-dimensional coordinates associated with cross-section and profile data were collected in the field and geo-referenced (NAD83 State Plane feet FIPS 3200). Morphological data was limited to 18 cross-sections. Survey data was imported into CAD, ArcGIS, and Excel for data processing and analysis. Channel substrate was characterized using a Wolman Pebble Count as outlined in Harrelson et al. (1994) and processed using Microsoft Excel.

Vegetation success (MY0, MY1, MY2, MY3, MY5, MY7) is being monitored using 10 permanent monitoring plots. Vegetation monitoring followed CVS-EEP Level 1 Protocol for MY1 and is following Level 2 Protocol Version 4.2 for monitoring years 2-7 (Lee et al. 2008). Level 2 Protocol includes analysis of species composition and density of planted species. Data is processed using the CVS data entry tool. In the field, the four corners of each plot were permanently marked with rebar and photos of each plot taken from the origin each monitoring year. The locations of the three temporary plots surveyed in Years 2 and 3 were randomly selected within the replant areas. The plots were surveyed by pulling tapes to form 10 x 10 meter plots then counting all woody stems within the plots.

Precipitation data was reported from the NCCRONOS station number 315771 in Monroe, NC. Two crest gauges were installed on the mainstem channel, one upstream of Lansford Road in Reach 2 and another downstream of Lansford Road in Reach 3. During quarterly visits to the site, the height of the cork-line was recorded.

### **3.0 REFERENCES**

Resource Environmental Solutions, LLC. 2015. 601 East Stream Restoration, Baseline Monitoring Document and As-Built Baseline Report Final, Union County, North Carolina. NCEEP Project No. 95756

Harrelson, Cheryl, C. Rawlins and J. Potyondy. 1994. Stream Channel Reference Sites: An Illustrated Guide to Field Technique. Gen. Tech. Rep. RM-245. Rocky Mountain Forest and Range Experiment Station. USDA Forest Service. Fort Collins, Colorado

Lee, M.T., R.K. Peet, S.D. Roberts, and T.R. Wentworth. 2008. CVS-EEP Protocol for Recording Vegetation. Version 4.2. <http://cvs.bio.unc.edu/methods.htm>; accessed November 2008.

# **Appendix A**

## **General Tables and Figures**

Table 1. Project Components and Mitigation Credits

Table 2. Project Activity and Reporting History

Table 3. Project Contacts

Table 4. Project Information and Attributes

Figure 1. Project Vicinity Map

Figure 2. Current Conditions Plan View Map

Appendix A – General Tables and Figures

Table 1: Project Components and Mitigation Credits									
601 East Stream Restoration Site									
Mitigation Credits									
	Stream		Riparian Wetland		Non-riparian Wetland		Buffer	Nitrogen Nutrient Offset	Phosphorous Nutrient Offset
Type	R	RE	R	RE	R	RE			
Totals	3638.67	43							
Project Components									
Project Component - or- Reach ID	Stationing/Location		Existing Footage/Acreage		Approach (PI, PII etc.)	Restoration -or- Restoration Equivalent	Restoration Footage or Acreage	Mitigation	
								Ratio	Credits
Reach A Ephemeral	5+45 – 7+60		215			Buffer establishment and BMP sediment import reduction	215	1 : 5	43
Reach 1a Intermittent	7+60 – 11+10		336		P1	R	350	1 : 1	350
Reach 1b Intermittent	11+10 – 11+95		85		Enhancement	EI	85	1 : 1.5	56.7
Reach 1c Perennial	11+95 – 13+50		136		Enhancement	EI	155	1 : 1.5	103.3
Reach 1d Perennial	14+00 – 22+00		790		P1	R	800	1 : 1	800
Reach 2a Perennial	22+00 – 22+40		40		Enhancement	EI	40	1 : 1.5	26.7
Reach 2b Perennial	22+80 – 24+00		125		Enhancement	EI	120	1 : 1.5	80
Reach 2c Perennial	24+00 – 31+24		669		P1	R	724	1 : 1	724
Reach 3a Perennial	43+06 – 46+60		80' active channel 112' relic channel		P1	R	368	1 : 1	368
Reach 3b Perennial	47+20 – 53+70		502' relic channel		P1	R	650	1 : 1	650
Reach 4 Perennial	53+70 – 58+50		470' relic channel		P3	R	480	1 : 1	480
Component Summation									
Restoration Level	Stream (linear feet)		Riparian Wetland (acres)		Non-riparian Wetland (acres)	Buffer (square feet)	Upland (acres)	Mitigation Credits	
			Riverine	Non-Riverine					
Restoration	3372								3372
Enhancement									
Enhancement I	400								266.6
Enhancement II									
Creation									
Preservation/Other	215								43
HQ Preservation									
BMP Elements									
Element			Location			Purpose/Function		Notes	
FB, LS, S, FS			Ephemeral Channel 5+45 – 7+60			Slowing the water down for settling and filtering excess sediment		Sediment expected from future degradation upstream	
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 Spread; NI = Natural Infiltration Area; FB = Forested Buffer									

Note: Stream credit calculations were originally calculated along the as-built thalweg. Based on the April 3, 2017 IRT Credit Release Meeting, these stream credits have been reverted back to the amounts in the IRT approved mitigation plan.

<b>Table 2. Project Activity and Reporting History 601 East Stream Restoration Site</b>		
<b>Activity or Deliverable</b>	<b>Data Collection Complete</b>	<b>Completion or Delivery</b>
Restoration Plan	May 2013	Jan 2014
Final Design – Construction Plans	Sept 2013	Jan 2014
Construction	-	Dec 2014
Containerized, bare root and B&B plantings	-	Jan 2015
Mitigation Plan / As-built (Year 0 Monitoring – baseline)	Feb 2015	Feb 2015
Year 1 Monitoring	Nov 2015	Nov 2015
Supplemental Planting (Entire Site)	-	Apr 2016
Year 2 Monitoring	Sept 2016	Oct 2016
Year 3 Monitoring	Stream - July 2017 Vegetation - Oct 2017	Jan 2018
Supplemental Planting, Encroachment Blocking, Beaver Removal, Invasive Treatment	-	Mar 2018
Invasive Treatment	-	Sept 2018
Year 4 Monitoring	Nov 2018	Jan 2019
Year 5 Monitoring	Stream - July 2019 Vegetation - Oct 2019	Jan 2020
Year 6 Monitoring		
Year 7 Monitoring		



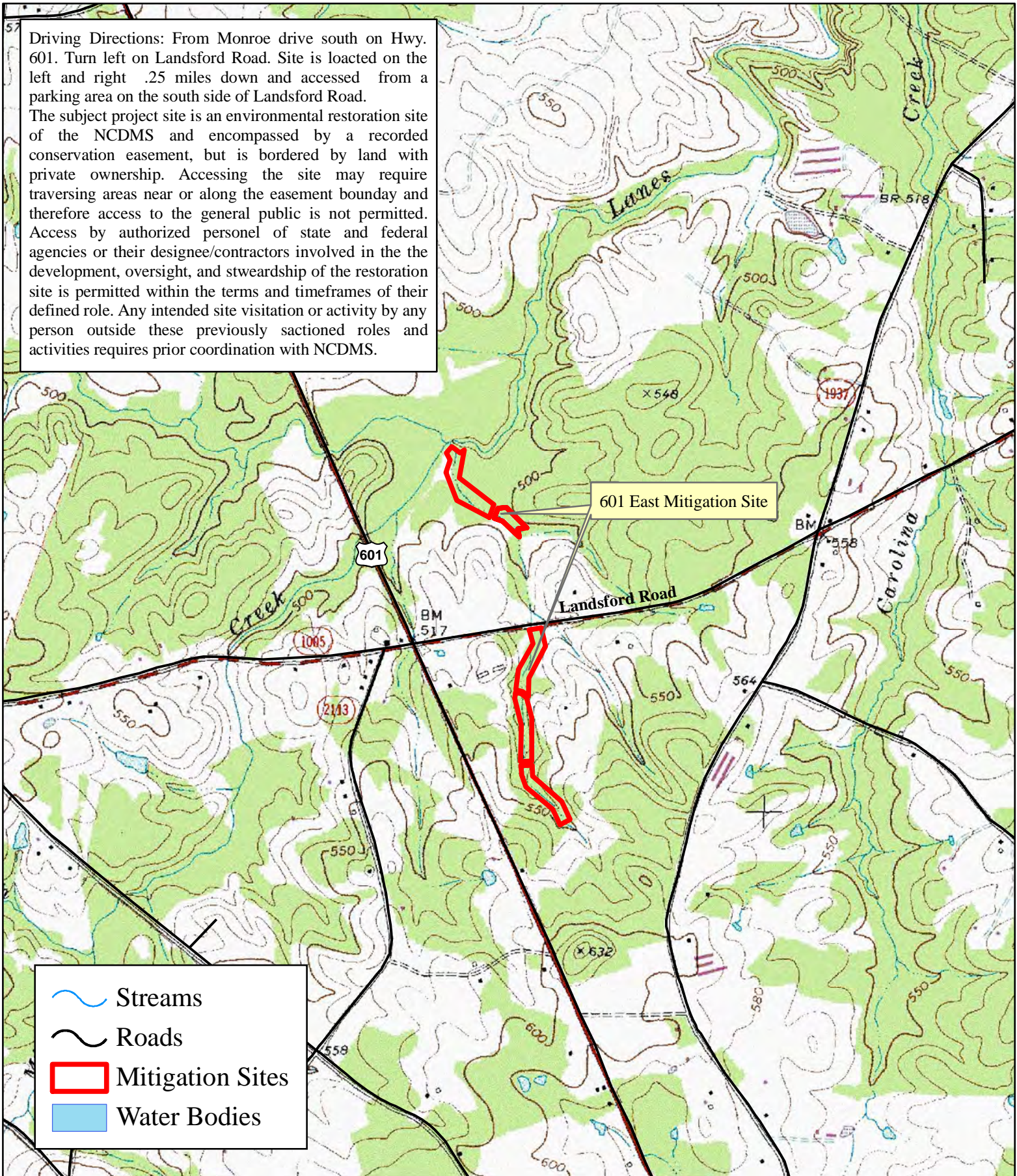
<b>Table 3. Project Contact Table 601 East Stream Restoration Site</b>	
<b>Designer</b> Primary project design POC	Ward Consulting Engineers, P.C. (WCE) 4805 Green Road, Suite 100, Raleigh, NC 27616 Becky Ward (919) 870-0526
<b>Construction Contractor</b> Construction contractor POC	Wright Contracting P.O. Box 545, Siler City, NC 27344 Joseph Wright (919) 663-0810
<b>Planting Contractor</b> Planting contractor POC	H & J Forest Services 1416 Ocean Boulevard, Holly Ridge, NC 28445 (910) 512-6754
<b>Construction Survey Contractor</b> Survey contractor POC	Turner Land Survey, PLLC 3719 Benson Drive, Raleigh, NC 27629 Elizabeth Turner (919) 827-0745
<b>Seeding Contractor</b> Construction contractor POC	Wright Contracting P.O. Box 545, Siler City, NC 27344 Andrew Dimmette (919) 663-0810
<b>Seed Mix Sources</b>	Green Resource - Raleigh, NC As Purchased by EBX (919) 829-9909 x213
<b>Nursery Stock Suppliers</b>	Arbor Gen - Blenheim, SC (800) 222-1290 NC Forest Service Nursery - Goldsboro, NC (888) 628-7337
<b>[Baseline] Monitoring Performers</b>	Ward Consulting Engineers, P.C. 4805 Green Road, Suite 100, Raleigh, NC 27616
Stream Monitoring POC	Rachael Zigler - WCE - (919) 870-0526
Vegetation Monitoring POC	Chris Sheats - The Cantena Group - (919) 732-1300
Monitoring Performers (MY1-MY2) 2015-2016	Equinox 37 Haywood Street, Suite 100 Asheville, NC 28801
Stream Monitoring POC	Drew Alderman (828) 253-6856
Vegetation Monitoring POC	Drew Alderman (828) 253-6856
Monitoring Performers (MY3+)	Resource Environmental Solutions (RES) 302 Jefferson Street, Suite 110 Raleigh, NC 27605
Stream Monitoring POC	Ryan Medric (919) 741-6268
Vegetation Monitoring POC	Ryan Medric (919) 741-6268

<b>Table 4. Project Baseline Information and Attributes</b>				
<b>601 East Stream Restoration Site</b>				
<b>Project Information</b>				
Project Name		601 East Stream Restoration Site		
County		Union County		
Project Area (acres)		12.78		
Project Coordinates (latitude and longitude)		34° 50' 21.62" N, 80° 25' 32.26"N		
<b>Project Watershed Summary Information</b>				
Physiographic Province		Piedmont		
River Basin		Yadkin River Basin		
USGS Hydrologic Unit 8-Digit		USGS Hydrologic Unit 14-digit	3040105081010	
DWQ Sub-basin		3/4/2014		
Project Drainage Area (acres)		361.33		
Project drainage Area Percentage of Impervious Area		2%		
CGIA Land Use Classification		2.01.01.07 Annual Row Crop Rotation		
<b>Reach Summary Information</b>				
Parameters	Reach 1	Reach 2	Reach 3	Reach 4
Length of reach (LF)	1,418; 1,393 LF Restored	906; 902 LF Restored	1,080; 1,018 LF Restored	Relic Channel, 495 LF Restored
Valley Classification	II	II	VIII	VIII
Drainage area (acres)	109	135	333	359
NCDWQ stream identification score	Intermittent: 19.5 Perennial: 33.5	33.5	33.5	33.5
NCDWQ Water Quality Classification	13-17-40-(1)	13-17-40-(1)	13-17-40-(1)	13-17-40-(1)
Morphological Description (stream type)	G4/B4/C4b	C4/E4/DA	C4/G4	G4
Evolutionary trend (reference channel evolution model used)	G	C/DA	G	G
Underlying mapped soils	Intermittent: Tatum gravelly silty Perennial: Cid channery silt loam	Cid channery silt loam, Tatum gravelly silt loam	Chewacla silt loam	Chewacla silt loam
Drainage class	Well Drained	Moderately Well Drained	Somewhat Poorly Drained	Somewhat Poorly Drained
Soil Hydric status	Non Hydric	Non Hydric	Non Hydric	Non Hydric
Slope	2%	0.84%	0.67%	1.25%
FEMA classification	N/A	N/A	N/A	N/A
Native vegetation community	Agriculture along upstream  The remaining stream buffer within this reach is composed of Willow Oak, Red Maple, River Birch, Black Willow, Elderberry, and Blackberry.	Canopy species include Willow Red Maple, Sweetgum, Eastern  Wetland A is composed of Cattails, spike rush arrow-arum, and duckweed.	Canopy species include Red Maple, Hackberry, Willow Oak, and Sweetgum. The presence of Chinese privet outcompete any shrub and herb layer.	Canopy species include Red Maple, Hackberry, Willow oak, and Sweetgum. The presence of Chinese privet outcompete any shrub and herb layer.
Percent composition of exotic invasive vegetation	0%	50% of Parrot feather	5% of Japanese stilt grass, 80% Chinese privet, and kudzu	80% Chinese privet

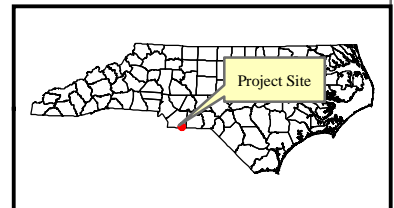
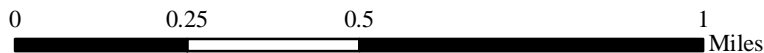
<b>Table 4 con't. Project Baseline Information and Attributes 601 East Stream Restoration Site</b>			
<b>Wetland Summary Information</b>			
<b>Parameters</b>	<b>Wetland 1</b>		
Size of Wetland (acres)	0.43 ac		
Wetland Type (non-riparian, riparian riverine,	Non-Tidal Freshwater Marsh		
Mapped Soil Series	Cid channery Silt Loam		
Drainage class	Moderately Well Drained to Somewhat Poorly Drained		
Soil Hydric Status	Non-Hydric		
Source of Hydrology	Tanyard Branch headwaters, groundwater, and adjacent runoff		
Hydrologic Impairment	Wetland A formed from accumulating sediments filling the channel resulting in a braided channel system through the wetland.		
Native vegetation community	<b>Herbaceous</b> -Vegetation is dominated by herbaceous vegetation such as Cattail ( <i>Typha latifolia</i> ), Bulrush ( <i>Scirpus cyperinus</i> ), Common Rush ( <i>Juncus effuses</i> ). Some tree species such as Black Willow ( <i>Salix nigra</i> ), and Red Maple ( <i>Acer rubrum</i> ) are present in the wetland margins.		
Percent composition of exotic invasive vegetation	<b>95%</b> -The invasive Parrot Feather ( <i>Miriophyllum aquaticum</i> ) is dominant throughout the wetland where there is standing water.		
<b>Regulatory Considerations</b>			
<b>Regulation</b>	<b>Applicable?</b>	<b>Resolved?</b>	<b>Supporting Documentation</b>
Waters of the United States-Section 404	Yes	SAW 2013-00265; EEP IMS #95756	
Waters of the United States – Section 401	Yes	DWR# 14-0547	
Endangered Species Act	No	Yes	ERTR
Historic Preservation Act	No	Yes	ERTR
Coastal Zone Management Act (CZMA)/Costal Area Management Act (CAMA)	No	N/A	
FEMA Floodplain Compliance	No	N/A	
Essential Fisheries Habitat	No	N/A	

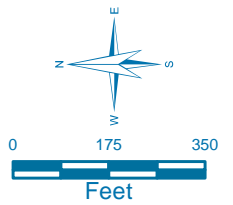
Driving Directions: From Monroe drive south on Hwy. 601. Turn left on Landsford Road. Site is located on the left and right .25 miles down and accessed from a parking area on the south side of Landsford Road.

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



**Figure 1**  
**601 East Mitigation Site**  
**Project Vicinity Map**





1 inch = 350 feet

**Figure 2a**

**601 East Stream  
Restoration Project  
MY5 2019**

**Current Conditions  
Overview Map**

Date: 1/21/2020

Drawn by: RTM

**LEGEND**

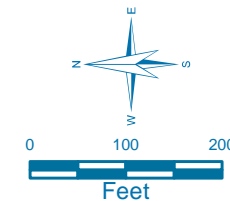
- ▭ Conservation Easement
- ▭ Vegetation Plot
- Structure
- Stream Treatment
- BMP (Ephemeral)
- Restoration (Intermittent)
- EI (Intermittent)
- Restoration (Perennial)
- EI (Perennial)
- Cross Section
- Structure
- Top of Bank
- Beaver Dam
- ⊕ Crest Gauge
- ⊕ Bankpin Array
- ★ Photo Station

**Vegetation Condition Assessment**

		Target Community		
		Present	Marginal	Absent
Invasive Species	Absent			
	Present			

Source: 2019 NC OneMap Aerial Imagery

Document Path: R:\GIS\Projects\601 East Stream\MapDocs\MapDocs\Figures\Figure 2a\_601\_East\_Stream\_CDDP\Overview\_Map\_MY5.mxd



1 inch = 200 feet

Figure 2b

**601 East Stream  
Restoration Project  
MY5 2019**

**Current Conditions  
Plan View**

Date: 1/21/2020

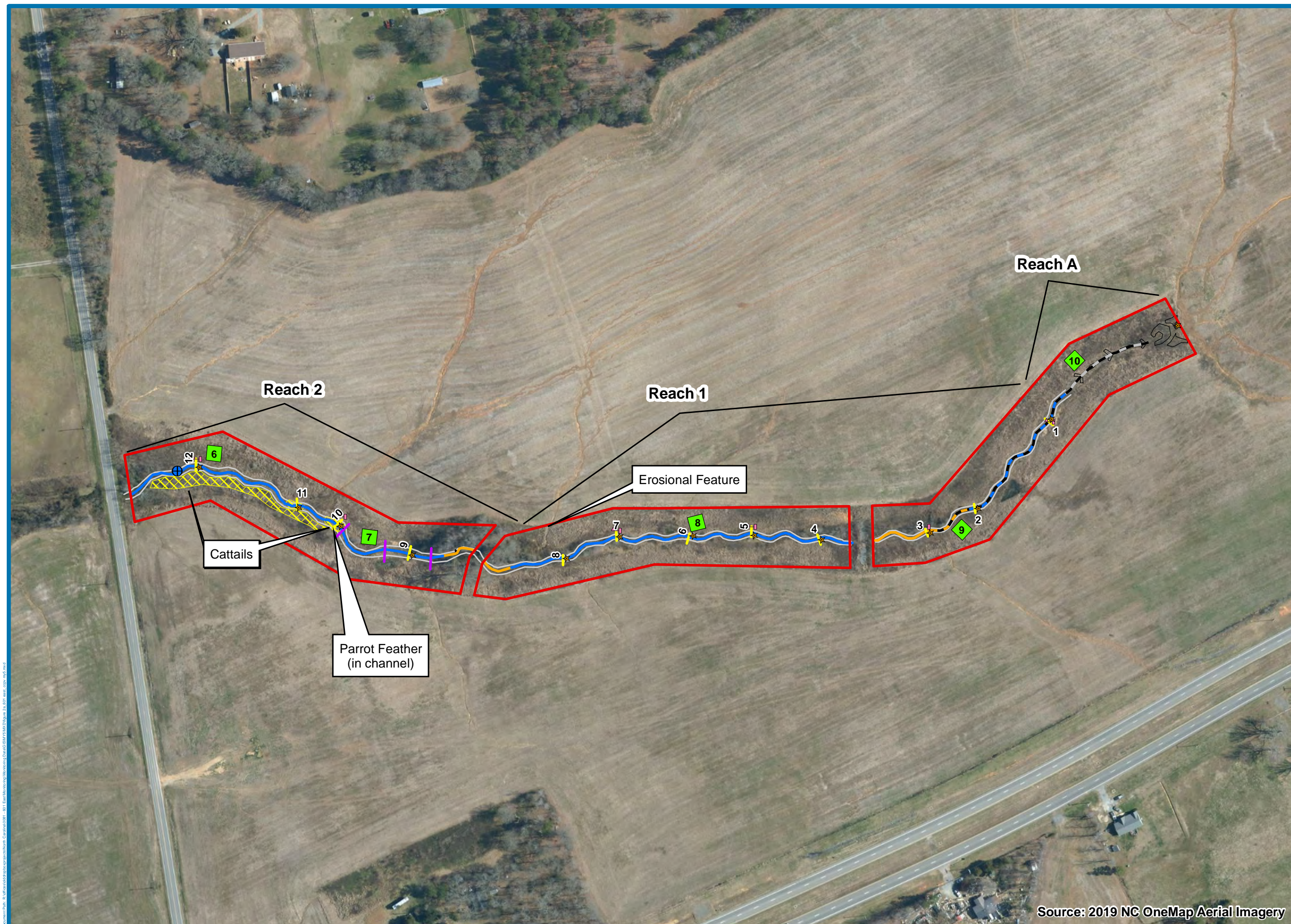
Drawn by: RTM

**LEGEND**

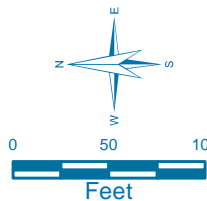
- █ Conservation Easement
- █ Vegetation Plot
- Structure
- Stream Treatment**
- BMP (Ephemeral)
- Restoration (Intermittent)
- EI (Intermittent)
- Restoration (Perennial)
- EI (Perennial)
- Cross Section
- Structure
- Top of Bank
- Beaver Dam
- ⊕ Crest Gauge
- ▬ Bankpin Array
- ★ Photo Station

**Vegetation Condition Assessment**

		Target Community		
		Present	Marginal	Absent
Invasive Species	Absent	No Fill		
	Present	X X X X X	X X X X X	X X X X X



Source: 2019 NC OneMap Aerial Imagery



1 inch = 100 feet

Figure 2c

601 East Stream  
Restoration Project  
MY5 2019

Current Conditions  
Plan View

Date: 1/21/2020

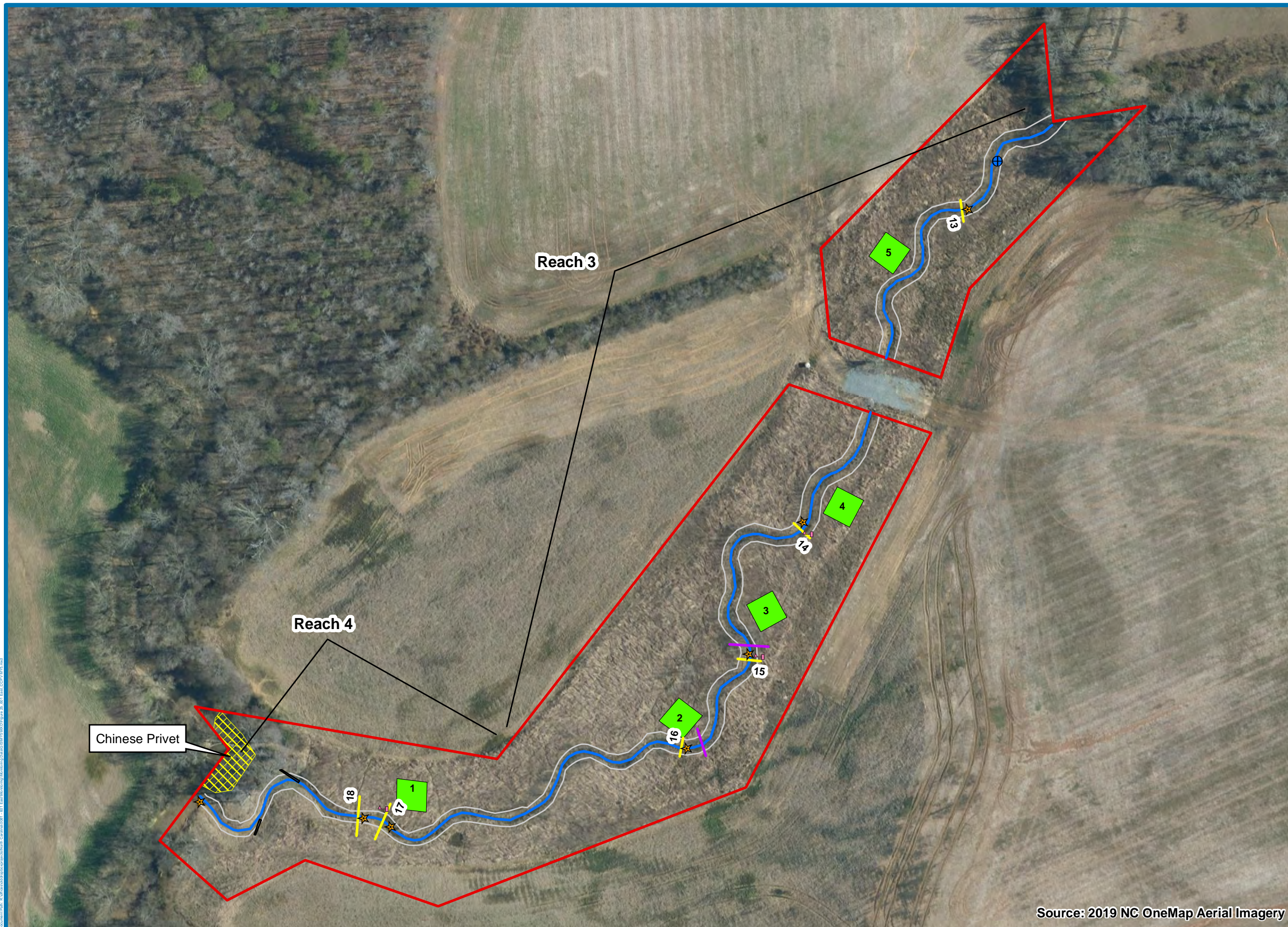
Drawn by: RTM

LEGEND

- ▭ Conservation Easement
- Vegetation Plot
- Stream Treatment**
- BMP (Ephemeral)
- Restoration (Intermittent)
- EI (Intermittent)
- Restoration (Perennial)
- EI (Perennial)
- Cross Section
- Structure
- Top of Bank
- Beaver Dam
- ⊕ Crest Gauge
- ☆ Bankpin Array
- ★ Photo Station

Vegetation Condition Assessment

		Target Community		
		Present	Marginal	Absent
Invasive Species	Absent	No Fill	No Fill	No Fill
	Present	No Fill	No Fill	No Fill



Source: 2019 NC OneMap Aerial Imagery

Document Path: R:\Data\GIS\Projects\601 East Stream\Map\601 East Stream CCPV MY5.mxd

# **Appendix B**

## **Visual Assessment Data**

Table 5. Vegetation Condition Assessment

Table 6. Visual Stream Morphology Stability Assessment

Figure 3. 2019 Photo Station Photos

Figure 4. 2019 Problem Area Photos



**Table 5. Vegetation Condition Assessment  
601 East Stream Restoration Site  
Planted Acreage 12.8  
Easement Acreage 12.8**

Vegetation Category	Definitions	CCPV Depiction	Number of Polygons	Combined Acreage	% of Planted Acreage
<b>1. Bare Areas</b>	Very limited cover of both woody and herbaceous material.	Red Simple Hatch	0	0.00	0%
<b>2. Low Stem Density Areas</b>	Woody stem densities clearly below target levels based on MY3, 4 or 5 stem count criteria.	Orange Simple Hatch	0	0.00	0%
<b>Totals</b>			0	0.00	0%
<b>3. Areas of Poor Growth Rates or Vigor</b>	Areas with woody stems of a size class that are obviously small given the monitoring year.	Orange Simple Hatch	0	0.00	0%
<b>Cumulative Totals</b>			0	0.00	0%
Vegetation Category	Definitions	CCPV Depiction	Number of Polygons	Combined Acreage	% of Easement Acreage
<b>4. Invasive Areas of Concern</b>	Areas or points (if too small to render as polygons at map scale).	Yellow Crosshatch	4	0.27	2%
<b>5. Easement Encroachment Areas</b>	Areas or points (if too small to render as polygons at map scale).	Red Simple Hatch	0	0.00	0%

N/A - Item does not apply.

**Table 6. Visual Stream Morphology Stability Assessment  
601 East Stream Restoration Site - Reach 1  
Assessed Length 1,393 feet**

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
1. Bed	1. Vertical Stability (Riffle and Run Units)	1. <u>Aggradation</u> - Bar formation/growth sufficient to significantly deflect flow laterally (not to include point bars).			0	0	100%			
		2. <u>Degradation</u> - Evidence of downcutting.			0	0	100%			
	2. Riffle Condition	1. <u>Texture/Substrate</u> - Riffle maintains coarser substrate.	32	32			100%			
		3. Meander Pool Condition	1. <u>Depth</u> Sufficient (Max Pool Depth : Mean Bankfull Depth $\geq$ 1.6).	33			33			
	4. Thalweg Position		2. <u>Length</u> appropriate (>30% of centerline distance between tail of upstream riffle and head of downstream riffle).	33			33			
		4. Thalweg Position	1. Thalweg centering at upstream of meander bend (Run).	33			33			
4. Thalweg Position	2. Thalweg centering at downstream of meander bend (Glide).		33	33			100%			
	2. Bank	1. <u>Scoured / Eroding</u>	Bank lacking vegetative cover resulting simply from poor growth and/or scour and erosion.					0	0	100%
2. <u>Undercut</u>		Banks undercut/overhanging to the extent that mass wasting appears likely. Does <u>NOT</u> include undercuts that are modest, appear sustainable and are providing habitat.	0		0	100%		N/A	N/A	N/A
3. <u>Mass Wasting</u>		Bank slumping, calving, or collapse.	0		0	100%		N/A	N/A	N/A
<b>Totals</b>					0	0	100%	N/A	N/A	N/A
3. Engineered Structures	1. <u>Overall Integrity</u>	Structures physically intact with no dislodged boulders or logs.	N/A	N/A			N/A			
	2. <u>Grade Control</u>	Grade control structures exhibiting maintenance of grade across the sill.	N/A	N/A			N/A			
	2a. <u>Piping</u>	Structures lacking any substantial flow underneath sills or arms.	N/A	N/A			N/A			
	3. <u>Bank Protection</u>	Bank erosion within the structures extent of influence does <u>NOT</u> exceed 15%.	N/A	N/A			N/A			
	4. <u>Habitat</u>	Pool forming structures maintaining ~ Max Pool Depth : Mean Bankfull Depth Ratio $\geq$ 1.6. Rootwads/logs providing some cover at base-flow.	N/A	N/A			N/A			

**Table 6 cont'd. Visual Stream Morphology Stability Assessment  
601 East Stream Restoration Site - Reach 2  
Assessed Length 902 feet**

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
1. Bed	1. Vertical Stability (Riffle and Run Units)	1. <u>Aggradation</u> - Bar formation/growth sufficient to significantly deflect flow laterally (not to include point bars).			0	0	100%			
		2. <u>Degradation</u> - Evidence of downcutting.			0	0	100%			
	2. Riffle Condition	1. <u>Texture/Substrate</u> - Riffle maintains coarser substrate.	16	16			100%			
	3. Meander Pool Condition	1. <u>Depth</u> Sufficient (Max Pool Depth : Mean Bankfull Depth ≥ 1.6).	17	17			100%			
		2. <u>Length</u> appropriate (>30% of centerline distance between tail of upstream riffle and head of downstream riffle).	17	17			100%			
	4. Thalweg Position	1. Thalweg centering at upstream of meander bend (Run).	17	17			100%			
		2. Thalweg centering at downstream of meander bend (Glide).	17	17			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. Does <b>NOT</b> include undercuts that are modest, appear sustainable and are providing habitat.			0	0	100%	N/A	N/A	N/A
	3. Mass Wasting	Bank slumping, calving, or collapse.			0	0	100%	N/A	N/A	N/A
	<b>Totals</b>				0	0	100%	N/A	N/A	N/A
3. Engineered Structures	1. Overall Integrity	Structures physically intact with no dislodged boulders or logs.	N/A	N/A			N/A			
	2. Grade Control	Grade control structures exhibiting maintenance of grade across the sill.	N/A	N/A			N/A			
	2a. Piping	Structures lacking any substantial flow underneath sills or arms.	N/A	N/A			N/A			
	3. Bank Protection	Bank erosion within the structures extent of influence does <b>NOT</b> exceed 15%.	N/A	N/A			N/A			
	4. Habitat	Pool forming structures maintaining ~ Max Pool Depth : Mean Bankfull Depth Ratio ≥ 1.6. Rootwads/logs providing some cover at base-flow.	N/A	N/A			N/A			

**Table 6 cont'd. Visual Stream Morphology Stability Assessment  
601 East Stream Restoration Site - Reach 3  
Assessed Length 1,018 feet**

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
1. Bed	1. Vertical Stability (Riffle and Run Units)	1. <u>Aggradation</u> - Bar formation/growth sufficient to significantly deflect flow laterally (not to include point bars).			0	0	100%			
		2. <u>Degradation</u> - Evidence of downcutting.			0	0	100%			
	2. Riffle Condition	1. <u>Texture/Substrate</u> - Riffle maintains coarser substrate.	18	18		100%				
	3. Meander Pool Condition	1. <u>Depth</u> Sufficient (Max Pool Depth : Mean Bankfull Depth ≥ 1.6).	18	18		100%				
		2. <u>Length</u> appropriate (>30% of centerline distance between tail of upstream riffle and head of downstream riffle).	18	18		100%				
	4. Thalweg Position	1. Thalweg centering at upstream of meander bend (Run).	18	18		100%				
		2. Thalweg centering at downstream of meander bend (Glide).	18	18		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. Does <u>NOT</u> include undercuts that are modest, appear sustainable and are providing habitat.			0	0	100%	N/A	N/A	N/A
	3. Mass Wasting	Bank slumping, calving, or collapse.			0	0	100%	N/A	N/A	N/A
	<b>Totals</b>				0	0	100%	N/A	N/A	N/A
3. Engineered Structures	1. Overall Integrity	Structures physically intact with no dislodged boulders or logs.	N/A	N/A			N/A			
	2. Grade Control	Grade control structures exhibiting maintenance of grade across the sill.	N/A	N/A			N/A			
	2a. Piping	Structures lacking any substantial flow underneath sills or arms.	N/A	N/A			N/A			
	3. Bank Protection	Bank erosion within the structures extent of influence does <u>NOT</u> exceed 15%.	N/A	N/A			N/A			
	4. Habitat	Pool forming structures maintaining ~ Max Pool Depth : Mean Bankfull Depth Ratio ≥ 1.6. Rootwads/logs providing some cover at base-flow.	N/A	N/A			N/A			

**Table 6 cont'd. Visual Stream Morphology Stability Assessment  
601 East Stream Restoration Site - Reach 4  
Assessed Length 495 feet**

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		
1. Bed	1. Vertical Stability (Riffle and Run Units)	1. <u>Aggradation</u> - Bar formation/growth sufficient to significantly deflect flow laterally (not to include point bars).			0	0	100%					
		2. <u>Degradation</u> - Evidence of downcutting.			0	0	100%					
	2. Riffle Condition	1. <u>Texture/Substrate</u> - Riffle maintains coarser substrate.	9	9			100%					
		3. Meander Pool Condition	1. <u>Depth</u> Sufficient (Max Pool Depth : Mean Bankfull Depth ≥ 1.6).	9			9				100%	
	4. Thalweg Position		2. <u>Length</u> appropriate (>30% of centerline distance between tail of upstream riffle and head of downstream riffle).	9			9				100%	
		1. Thalweg centering at upstream of meander bend (Run).	9	9			100%					
			2. Thalweg centering at downstream of meander bend (Glide).	9			9				100%	
2. Bank	1. Scoured / Eroding	Bank lacking vegetative cover resulting simply from poor growth and/or scour and erosion.					0	0	100%	0	0	100%
	2. Undercut	Banks undercut/overhanging to the extent that mass wasting appears likely. Does <u>NOT</u> include undercuts that are modest, appear sustainable and are providing habitat.					0	0	100%	N/A	N/A	N/A
	3. Mass Wasting	Bank slumping, calving, or collapse.			0	0	100%	N/A	N/A	N/A		
	<b>Totals</b>				0	0	100%	N/A	N/A	N/A		
3. Engineered Structures	1. Overall Integrity	Structures physically intact with no dislodged boulders or logs.	2	2			100%					
	2. Grade Control	Grade control structures exhibiting maintenance of grade across the sill.	2	2			100%					
	2a. Piping	Structures lacking any substantial flow underneath sills or arms.	2	2			100%					
	3. Bank Protection	Bank erosion within the structures extent of influence does <u>NOT</u> exceed 15%.	2	2			100%					
	4. Habitat	Pool forming structures maintaining ~ Max Pool Depth : Mean Bankfull Depth Ratio ≥ 1.6. Rootwads/logs providing some cover at base-flow.	2	2			100%					

Figure 3. 2019 Photo Station Photos



Reach 1 – Permanent Photo Station 1  
Top of Project – Looking Downstream



Reach 1 – Permanent Photo Station 2  
Cross Section 1 – Looking Downstream



Reach 1 – Permanent Photo Station 3  
Cross Section 2 – Looking Downstream



Reach 1 – Permanent Photo Station 4  
Cross Section 3 – Looking Downstream



Reach 1 – Permanent Photo Station 5  
Cross Section 4 – Looking Downstream



Reach 1 – Permanent Photo Station 6  
Cross Section 5 – Looking Downstream





Reach 1 – Permanent Photo Station 7  
Cross Section 6 – Looking Downstream



Reach 1 – Permanent Photo Station 8  
Cross Section 7 – Looking Downstream



Reach 1 – Permanent Photo Station 9  
Cross Section 8 – Looking Downstream



Reach 2 – Permanent Photo Station 10  
Cross Section 9 – Looking Downstream



Reach 2 – Permanent Photo Station 11  
Cross Section 10 – Looking Downstream



Reach 2 – Permanent Photo Station 12  
Cross Section 11 – Looking Downstream



Reach 2 – Permanent Photo Station 13  
Cross Section 12 – Looking Downstream



Reach 3 – Permanent Photo Station 14  
Cross Section 13 – Looking Downstream



Reach 3 – Permanent Photo Station 15  
Cross Section 14 – Looking Downstream



Reach 3 – Permanent Photo Station 16  
Cross Section 15 – Looking Downstream



Reach 3 – Permanent Photo Station 17  
Cross Section 16 – Looking Downstream



Reach 4 – Permanent Photo Station 18  
Cross Section 17 – Looking Downstream



Reach 4 – Permanent Photo Station 19  
Cross Section 18 – Looking Downstream



Reach 4 – Permanent Photo Station 20  
Bottom of Project – Looking Upstream

Figure 4. 2019 Problem Area Photos

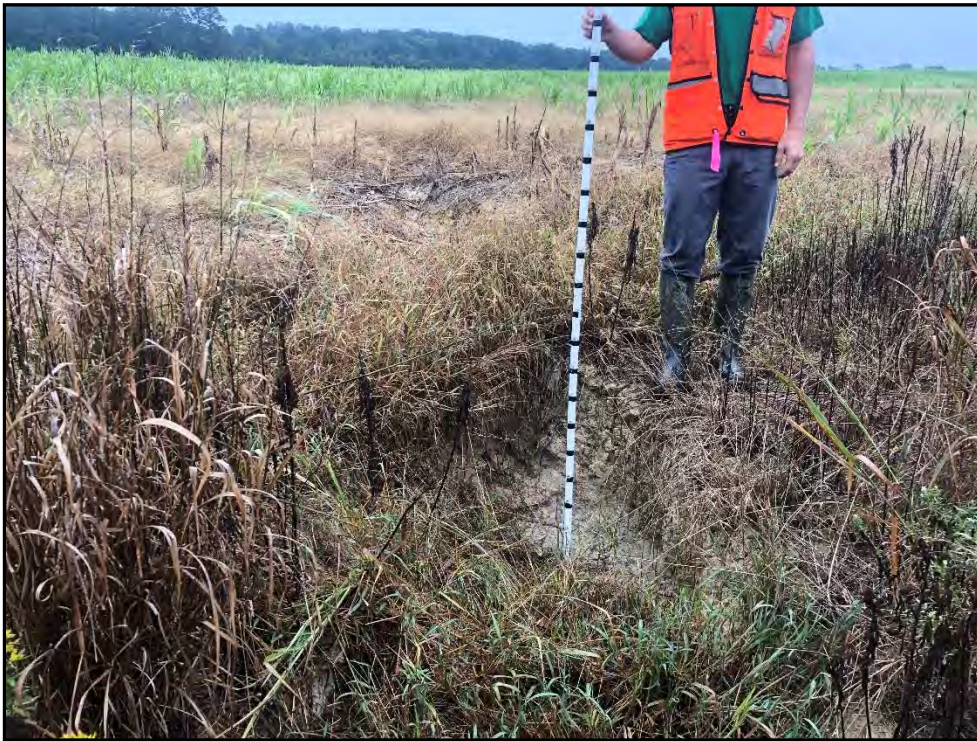


Reach 2 – Beaver Dam



Reach 4 – Beaver Dam





Reach 2 – Erosional Feature



Reach 2 – Parrotfeather

# **Appendix C**

## Vegetation Plot Data

**Table 7. MY5 Vegetation Plot Criteria Attainment**

<b>Plot #</b>	<b>Planted Stems/Acre</b>	<b>Volunteer Stems/Acre</b>	<b>Total Stems/Acre</b>	<b>Success Criteria Met?</b>	<b>Average Planted Stem Height (ft)</b>
<b>1</b>	607	647	1255	Yes	12.3
<b>2</b>	971	324	1295	Yes	5.5
<b>3</b>	567	486	1335	Yes	11.2
<b>4</b>	526	81	607	Yes	6.2
<b>5</b>	526	243	769	Yes	9.2
<b>6</b>	567	202	769	Yes	9.1
<b>7</b>	364	121	486	Yes	8.9
<b>8</b>	526	40	567	Yes	5.1
<b>9</b>	688	162	850	Yes	5.8
<b>10</b>	728	81	809	Yes	12.1
<b>Project Avg</b>	<b>607</b>	<b>239</b>	<b>874</b>	<b>Yes</b>	<b>8.6</b>

Table 8. CVS Vegetation Plot Metadata

<b>Table 8: CVS Vegetation Plot Metadata 601 East Stream and Wetland Restoration Site</b>	
<b>Report Prepared By</b>	Ryan Medic
<b>Date Prepared</b>	10/21/2019 15:14
<b>database name</b>	RES-MYS_2019-601East.mdb
<b>database location</b>	C:\Users\medric\Dropbox (RES)\@RES Projects\North Carolina\601 East\Monitoring\Monitoring Data\MYS_2019\Vegetation Data
<b>computer name</b>	D4VOKGH2
<b>file size</b>	48533504
<b>DESCRIPTION OF WORKSHEETS IN THIS DOCUMENT</b>	
<b>Metadata</b>	Description of database file, the report worksheets, and a summary of project(s) and project data.
<b>Proj. planted</b>	Each project is listed with its PLANTED stems per acre, for each year. This excludes live stakes.
<b>Proj. total stems</b>	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.
<b>Plots</b>	List of plots surveyed with location and summary data (live stems, dead stems, missing, etc.).
<b>Vigor</b>	Frequency distribution of vigor classes for stems for all plots.
<b>Vigor by Spp</b>	Frequency distribution of vigor classes listed by species.
<b>Damage</b>	List of most frequent damage classes with number of occurrences and percent of total stems impacted by each.
<b>Damage by Spp</b>	Damage values tallied by type for each species.
<b>Damage by Plot</b>	Damage values tallied by type for each plot.
<b>Planted Stems by Plot and Spp</b>	A matrix of the count of PLANTED living stems of each species for each plot; dead and missing stems are excluded.
<b>ALL Stems by Plot and spp</b>	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.
<b>PROJECT SUMMARY</b>	
<b>Project Code</b>	95756
<b>project Name</b>	601 East
<b>Description</b>	
<b>River Basin</b>	Yadkin-Pee Dee
<b>length(ft)</b>	
<b>stream-to-edge width (ft)</b>	
<b>area (sq m)</b>	
<b>Required Plots (calculated)</b>	
<b>Sampled Plots</b>	10

Table 9. Total Planted Stem Counts

601 East			Current Plot Data (MY5 2019)																															
Scientific Name	Common Name	Species Type	001-01-0001			001-01-0002			001-01-0003			001-01-0004			001-01-0005			001-01-0006			001-01-0007			001-01-0008			001-01-0009			001-01-0010				
			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			16																													
Asimina triloba	pawpaw	Tree																																
Betula nigra	river birch	Tree	2	2	2	1	1	1				5	5	5	1	1	1	5	5	5	1	1	1	2	2	2	6	6	6					
Celtis laevigata	sugarberry	Tree									1		1																					
Celtis occidentalis	common hackberry	Tree																																
Cephalanthus occidentalis	buttonbush	Shrub															1	1	1	1	1	1								1	1	1		
Cercis canadensis var. canadensis	eastern redbud	Tree																																
Fraxinus pennsylvanica	green ash	Tree										3	3	3	2	2	8	4	4	9	3	3	3	6	6	6	8	8	8	2	2	2		
Liquidambar styraciflua	sweetgum	Tree						8		5												2												
Liriodendron tulipifera var. tulipifera	Tulip-tree	Tree	1	1	1	1	1	1	2	2	2																		4	4	4			
Nyssa sylvatica	blackgum	Tree												1	1	1											1	1	1					
Pinus taeda	loblolly pine	Tree								1																			3					
Platanus occidentalis	American sycamore	Tree																								1						1		
Platanus occidentalis var. occidentalis	Sycamore	Tree	8	8	8	14	14	14	10	10	10	4	4	4	5	5	5	2	2	2				3	3	3	1	1	1	8	8	8		
Populus deltoides var. deltoides	eastern cottonwood									1	1																							
Quercus	oak	Tree																																
Quercus lyrata	overcup oak	Tree	1	1	1	2	2	2														1	1	1										
Quercus michauxii	swamp chestnut oak	Tree				5	5	5	1	1	1				1	1	1	2	2	2	1	1	1	1	1	1	1	1	1	1	1	1	1	
Quercus nigra	water oak	Tree																																
Quercus phellos	willow oak	Tree	3	3	3	1	1	1	1	1	1	1	1	1	3	3	3				2	2	2	1	1	1			1	1	1			
Quercus rubra	northern red oak	Tree																																
Quercus stellata	post oak	Tree																																
Quercus velutina	black oak	Tree																																
Rhus copallinum	flameleaf sumac	shrub									5		1																				1	
Rhus copallinum var. copallinum	flameleaf sumac	shrub																																
Salix nigra	black willow	Tree								6	6															1	1	2						
Ulmus alata	winged elm	Tree																																
Ulmus americana	American elm	Tree																																
Ulmus rubra	slippery elm	Tree																																
<b>Stem count</b>			15	15	31	24	24	32	14	21	33	13	13	15	13	13	19	14	14	19	9	9	12	13	13	14	17	17	21	18	18	20		
<b>size (ares)</b>			1			1			1			1			1			1			1			1			1			1				
<b>size (ACRES)</b>			0.02			0.02			0.02			0.02			0.02			0.02			0.02			0.02			0.02			0.02				
<b>Species count</b>			5	5	6	6	6	7	4	6	10	4	4	6	6	6	6	5	5	5	6	6	8	5	5	6	5	5	6	6	6	8		
<b>Stems per ACRE</b>			607	607	1255	971	971	1295	567	850	1335	526	526	607	526	526	769	567	567	769	364	364	486	526	526	567	688	688	850	728	728	809		

601 East			Annual Means														
Scientific Name	Common Name	Species Type	MY5 (2019)			MY3 (2017)			MY2 (2016)			MY1 (2015)			MY0 (2015)		
			PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T
Acer negundo	boxelder	Tree			16			26			33						
Asimina triloba	pawpaw	Tree							2	2	2	1	1	1	2	2	2
Betula nigra	river birch	Tree	23	23	23	24	24	26	33	33	33	14	14	14	24	24	24
Celtis laevigata	sugarberry	Tree			2												
Celtis occidentalis	common hackberry	Tree						6									
Cephalanthus occidentalis	buttonbush	Shrub	3	3	3	4	4	4	5	5	5	4	4	4	6	6	6
Cercis canadensis var. canadensis	eastern redbud	Tree						2									
Fraxinus pennsylvanica	green ash	Tree	28	28	39	29	29	29	27	27	29	3	3	3	3	3	3
Liquidambar styraciflua	sweetgum	Tree			15			20			19						
Liriodendron tulipifera var. tulipifera	Tulip-tree	Tree	8	8	8	12	12	14	20	20	22	16	16	16	30	30	30
Nyssa sylvatica	blackgum	Tree	2	2	2	3	3	3	3	3	3	3	3	3	18	18	18
Pinus taeda	loblolly pine	Tree			4												
Platanus occidentalis	American sycamore	Tree			2												
Platanus occidentalis var. occidentalis	Sycamore	Tree	55	55	55	55	55	59	59	59	59	47	47	47	58	58	58
Populus deltoides var. deltoides	eastern cottonwood			1	1	1	2	2	1	2	2	1	3	3	1	8	8
Quercus	oak	Tree										9	9	9	12	12	12
Quercus lyrata	overcup oak	Tree	4	4	4	4	4	4									
Quercus michauxii	swamp chestnut oak	Tree	13	13	13	14	14	14	14	14	14	10	10	10	20	20	20
Quercus nigra	water oak	Tree							2	2	2	1	1	1			
Quercus phellos	willow oak	Tree	13	13	13	10	10	10	8	8	8	5	5	5	26	26	26
Quercus rubra	northern red oak	Tree							1	1	1						
Quercus stellata	post oak	Tree							1	1	1						
Quercus velutina	black oak	Tree							1	1	1	2	2	2			
Rhus copallinum	flameleaf sumac	shrub			7												
Rhus copallinum var. copallinum	flameleaf sumac	shrub						12			11						
Salix nigra	black willow	Tree	1	7	8	1	7	10	1	6	16		5	5			
Ulmus alata	winged elm	Tree			1												
Ulmus americana	American elm	Tree						2									
Ulmus rubra	slippery elm	Tree									2						
<b>Stem count</b>			150	157	216	157	164	243	178	184	263	116	123	123	200	207	207
<b>size (ares)</b>			10			10			10			10					
<b>size (ACRES)</b>			0.25			0.25			0.25			0.25			0.25		
<b>Species count</b>			10	11	18	11	11	17	15	15	19	13	14	14	11	11	11
<b>Stems per ACRE</b>			607	635	874	635	664	983	720	745	1064	469	498	498	809	838	838

**Color Key**

Exceeds requirements
Fails to meet requirements
Volunteer stems

Figure 5. 2019 Vegetation Plot Photos



601 East - Vegetation Monitoring Plot 1



601 East - Vegetation Monitoring Plot 2



601 East - Vegetation Monitoring Plot 3



601 East - Vegetation Monitoring Plot 4





601 East - Vegetation Monitoring Plot 5



601 East - Vegetation Monitoring Plot 6



601 East - Vegetation Monitoring Plot 7



601 East - Vegetation Monitoring Plot 8



601 East - Vegetation Monitoring Plot 9



601 East - Vegetation Monitoring Plot 10

# **Appendix D**

## **Stream Geomorphology Data**

Table 10. Baseline Stream Data Summary

Table 11a. Dimensional Morphology Summary

Table 11b. Stream Reach Data Summary

Figure 6. Cross Section Plots

Table 12. Pebble Count Data Summary

Charts 1-5. MY5 Stream Reach Substrate Composition Charts

Table 13. Bank Pin Array Summary











**Table 11a. Dimensional Morphology Summary  
(Dimensional Parameters - Cross Sections)  
601 East Stream Restoration Site - Reach 1**

	Cross-Section 1 Pool								Cross-Section 2 Riffle								Cross-Section 3 Pool								Cross-Section 4 Riffle							
Dimension	Base	MY1	MY2	MY3	MY4	MY5	MY6	MY7	Base	MY1	MY2	MY3	MY4	MY5	MY6	MY7	Base	MY1	MY2	MY3	MY4	MY5	MY6	MY7	Base	MY1	MY2	MY3	MY4	MY5	MY6	MY7
Bankfull Elevation (ft) - Based on AB-XSA <sup>1</sup>	544.82	544.82	544.82	544.82		N/A			540.40	540.40	540.40	540.40		541.09			537.87	537.87	537.87	537.87		N/A			533.69	533.69	533.69	533.69		533.58		
Bankfull Width (ft) <sup>1</sup>	13.6	15.1	15.1	14.7		N/A			15.1	14.7	15.2	15.2		5.6			9.4	9.5	9.3	9.2		N/A			8.8	9.1	9.4	9.2		12.9		
Floodprone Width (ft) <sup>1</sup>	45.0	>45.0	>45.0	>45.0		N/A			77.0	>77.0	>77.0	>77.0		>19.5			154.0	>154.0	>154.0	>154.0		N/A			75.0	>75.0	>75.0	>75.0		>22.2		
Bankfull Mean Depth (ft)	1.0	0.9	0.9	0.9		---			0.6	0.5	0.5	0.6		---			0.9	0.9	0.9	0.9		---			0.5	0.5	0.6	0.6		---		
Bankfull Max Depth (ft) <sup>2</sup>	2.1	2.2	2.2	2.1		1.1			1.2	1.2	1.2	1.1		0.9			1.8	1.7	1.8	1.8		1.1			0.9	0.9	1.1	1.0		0.7		
Bankfull Cross Sectional Area (ft <sup>2</sup> ) <sup>2</sup>	14.1	13.7	14.3	13.4		3.7			9.0	8.0	8.0	8.8		3.4			8.7	8.5	8.8	8.5		3.3			4.5	4.8	5.8	5.1		2.6		
Bankfull Width/Depth Ratio	13.2	16.6	15.9	16.2		---			25.3	27.0	28.9	26.2		---			10.2	10.7	9.8	9.9		---			17.5	17.1	15.3	16.7		---		
Bankfull Entrenchment Ratio <sup>1</sup>	10.3	>3.0	>3.0	N/A		N/A			9.3	>5.2	>5.1	>5.1		>3.5			14.9	>14.6	>16.6	N/A		N/A			15.9	>8.3	>8.0	>8.2		1.7		
Bankfull Bank Height Ratio <sup>1</sup>	1.0	1.0	1.0	N/A		N/A			1.0	1.0	1.0	0.7		<1			1.0	1.0	1.0	N/A		N/A			0.9	1.0	1.0	0.7		<1		
d50 (mm)	N/A	N/A	N/A	N/A		N/A			N/A	8.3	0.062	0.062		0.062			N/A	N/A	N/A	N/A		N/A			N/A	22.0	17.0	28.0		22.0		
	Cross-Section 5 Pool								Cross-Section 6 Riffle								Cross-Section 7 Pool								Cross-Section 8 Riffle							
Dimension	Base	MY1	MY2	MY3	MY4	MY5	MY6	MY7	Base	MY1	MY2	MY3	MY4	MY5	MY6	MY7	Base	MY1	MY2	MY3	MY4	MY5	MY6	MY7	Base	MY1	MY2	MY3	MY4	MY5	MY6	MY7
Bankfull Elevation (ft) - Based on AB-XSA <sup>1</sup>	530.49	530.49	530.49	530.49		N/A			528.11	528.11	528.11	528.11		528.18			525.02	525.02	525.02	525.02		N/A			522.48	522.48	522.48	522.48		522.33		
Bankfull Width (ft) <sup>1</sup>	12.9	12.1	12.0	13.2		N/A			11.3	11.3	11.3	11.1		10.5			10.3	11.4	10.3	10.8		N/A			10.1	8.8	9.2	9.0		9.5		
Floodprone Width (ft) <sup>1</sup>	61.0	>61.0	>61.0	>61.0		N/A			80.0	>80.0	>80.0	>80.0		>22.8			63.0	>63.0	>63.0	>63.0		N/A			40.0	>40.0	>40.0	>40.0		>21.6		
Bankfull Mean Depth (ft)	1.0	0.9	0.9	1.0		---			0.6	0.6	0.6	0.6		---			1.2	1.0	1.0	1.0		---			0.6	0.6	0.6	0.7		---		
Bankfull Max Depth (ft) <sup>2</sup>	2.0	1.8	1.8	1.9		1.1			1.3	1.3	1.4	1.3		1.3			2.0	2.0	2.1	1.9		1.3			1.0	1.0	1.0	1.0		0.8		
Bankfull Cross Sectional Area (ft <sup>2</sup> ) <sup>2</sup>	12.8	11.0	11.2	12.8		4.2			6.6	6.6	7.2	6.9		5.6			12.3	11.2	10.4	9.9		4.7			6.2	5.6	5.8	5.9		4.6		
Bankfull Width/Depth Ratio	13.0	13.2	12.9	13.6		---			19.3	19.5	17.9	17.9		---			8.6	11.5	10.3	11.8		---			16.6	13.9	14.7	13.7		---		
Bankfull Entrenchment Ratio <sup>1</sup>	17.4	>5.1	>5.1	N/A		N/A			9.7	>7.1	>7.1	>7.2		>2.2			10.7	>5.5	>6.1	N/A		N/A			10.9	>4.5	>4.3	>4.5		>2.3		
Bankfull Bank Height Ratio <sup>1</sup>	0.9	1.0	1.0	N/A		N/A			1.0	1.0	1.0	0.9		<1			1.0	1.0	1.0	N/A		N/A			1.0	1.0	1.0	0.8		<1		
d50 (mm)	N/A	N/A	N/A	N/A		N/A			N/A	26.0	2.6	4.0		0.062			N/A	N/A	N/A	N/A		N/A			N/A	0.062	0.062	70.0		26.0		

Note: Starting in MY5, the parameters denoted with <sup>1</sup> were calculated using the as-built cross sectional area as the basis for adjusting the bankfull elevation and the parameters denoted with <sup>2</sup> were calculated using the current years low top of bank as the bankfull elevation. These changes reflect the 2018 guidance that arose from the mitigation technical workgroup consisting of DMS, the IRT, and industry mitigation providers.

**Table 11a cont'd. Dimensional Morphology Summary  
(Dimensional Parameters - Cross Sections)  
601 East Stream Restoration Site - Reach 2**

Dimension	Cross-Section 9 Riffle								Cross-Section 10 Pool								Cross-Section 11 Riffle								Cross-Section 12 Pool							
	Base	MY1	MY2	MY3	MY4	MY5	MY6	MY7	Base	MY1	MY2	MY3	MY4	MY5	MY6	MY7	Base	MY1	MY2	MY3	MY4	MY5	MY6	MY7	Base	MY1	MY2	MY3	MY4	MY5	MY6	MY7
Bankfull Elevation (ft) - Based on AB-XSA <sup>1</sup>	517.50	517.50	517.50	517.50		517.63			516.22	516.22	516.22	516.22		N/A			515.16	515.16	515.16	515.16		514.92			513.68	513.68	513.68	513.68		N/A		
Bankfull Width (ft) <sup>1</sup>	24.2	24.3	24.4	23.0		25.4			19.2	19.7	19.7	20.8		N/A			15.5	15.8	14.1	17.3		16.3			20.0	20.6	20.6	20.7		N/A		
Floodprone Width (ft) <sup>1</sup>	62.0	>62.0	>62.0	>62.0		>29.5			132.0	>132.0	>132.0	>132.0		N/A			73.0	>73.0	>73.0	>73.0		>25.2			168.0	>168.0	>168.0	>168.0		N/A		
Bankfull Mean Depth (ft)	0.7	0.7	0.7	0.7		---			1.3	1.2	1.2	1.0		---			0.6	0.5	0.6	0.6		---			1.1	1.0	1.1	1.2		---		
Bankfull Max Depth (ft) <sup>2</sup>	1.5	1.4	1.4	1.4		0.8			2.5	2.6	2.6	2.0		1.9			1.5	1.3	1.5	1.3		1.5			2.5	2.4	2.6	2.8		1.9		
Bankfull Cross Sectional Area (ft <sup>2</sup> ) <sup>2</sup>	17.7	16.5	17.5	15.2		3.8			25.3	24.4	23.1	20.1		12.1			9.4	8.6	8.3	9.8		6.7			21.3	21.4	23.1	24.5		9.4		
Bankfull Width/Depth Ratio	33.1	35.6	34.2	34.8		---			14.6	16.0	16.8	21.5		---			25.5	28.9	23.8	30.5		---			18.8	19.9	18.4	17.4		---		
Bankfull Entrenchment Ratio <sup>1</sup>	5.8	>2.6	>2.5	>2.7		>1.2			11.7	>6.7	>6.7	N/A		N/A			7.1	>4.6	>5.2	>4.2		>1.5			7.0	>8.1	>8.2	N/A		N/A		
Bankfull Bank Height Ratio <sup>1</sup>	1.0	1.0	1.0	1.0		<1			1.0	1.0	1.0	N/A		N/A			0.9	1.0	1.0	0.7		<1			0.9	1.0	1.0	N/A		N/A		
d50 (mm)	N/A	0.062	5.8	2.3		N/A			N/A	N/A	N/A	N/A		N/A			N/A	0.062	0.062	17		16.0			N/A	N/A	N/A	N/A		N/A		

**Note:** Starting in MY5, the parameters denoted with <sup>1</sup> were calculated using the as-built cross sectional area as the basis for adjusting the bankfull elevation and the parameters denoted with <sup>2</sup> were calculated using the current years low top of bank as the bankfull elevation. These changes reflect the 2018 guidance that arose from the mitigation technical workgroup consisting of DMS, the IRT, and industry mitigation providers.

**Table 11a cont'd. Dimensional Morphology Summary  
(Dimensional Parameters - Cross Sections)  
601 East Stream Restoration Site -Reach 3**

Dimension	Cross-Section 13 Riffle								Cross-Section 14 Pool								Cross-Section 15 Pool								Cross-Section 16 Riffle							
	Base	MY1	MY2	MY3	MY4	MY5	MY6	MY7	Base	MY1	MY2	MY3	MY4	MY5	MY6	MY7	Base	MY1	MY2	MY3	MY4	MY5	MY6	MY7	Base	MY1	MY2	MY3	MY4	MY5	MY6	MY7
Bankfull Elevation (ft) - Based on AB-XSA <sup>1</sup>	497.88	497.88	497.88	497.88		497.88			495.50	495.50	495.50	495.50		N/A			494.42	494.42	494.42	494.42		N/A			493.73	493.73	493.73	493.73			493.73	
Bankfull Width (ft) <sup>1</sup>	15.9	16.9	17.5	17.1		16			17.6	18.4	17.9	18.2		N/A			19.6	21.1	20.5	19.4		N/A			17.7	17.5	18.3	16.7			17.9	
Floodprone Width (ft) <sup>1</sup>	75.0	>75.0	>75.0	>75.0		>23.3			350.0	>350.0	>350.0	>350		N/A			350.0	>350.0	>350.0	>350.0		N/A			150.0	>150.0	150.0	>150.0			>20.4	
Bankfull Mean Depth (ft)	0.8	0.8	0.7	0.7		---			1.6	1.5	1.6	1.6		---			1.8	1.6	1.5	1.7		---			0.8	0.7	0.8	0.8			---	
Bankfull Max Depth (ft) <sup>2</sup>	1.6	1.7	1.8	1.8		1.2			3.4	3.1	3.4	3.5		2.1			3.4	3.3	3.3	3.3		3.1			1.6	1.6	1.7	1.6			0.9	
Bankfull Cross Sectional Area (ft <sup>2</sup> )	12.8	13.6	12.2	12.6		5.6			28.2	28.0	28.7	29.7		11.5			36.1	34.4	31.5	32.4		29			14.1	12.9	14.8	14.0			3.7	
Bankfull Width/Depth Ratio	19.6	21.0	25.0	23.1		---			11.0	12.0	11.2	11.2		---			10.6	13.0	13.3	11.6		---			22.4	23.8	22.5	19.8			---	
Bankfull Entrenchment Ratio <sup>1</sup>	8.8	>4.4	>4.3	>4.4		>1.5			12.8	>19.1	>19.6	N/A		N/A			5.6	>16.6	>17.1	N/A		N/A			7.9	>8.5	>8.2	>9.0			>1.1	
Bankfull Bank Height Ratio <sup>1</sup>	1.0	1.0	1.0	1.0		<1			1.0	1.0	1.0	N/A		N/A			1.0	1.0	1.0	N/A		N/A			1.0	1.0	1.0	0.8			<1	
d50 (mm)	N/A	20	9.1	85.0		10.0			N/A	N/A	N/A	N/A		N/A			N/A	N/A	N/A	N/A		N/A			N/A	31.0	3.3	62.0			9.4	

**Note:** Starting in MY5, the parameters denoted with <sup>1</sup> were calculated using the as-built cross sectional area as the basis for adjusting the bankfull elevation and the parameters denoted with <sup>2</sup> were calculated using the current years low top of bank as the bankfull elevation. These changes reflect the 2018 guidance that arose from the mitigation technical workgroup consisting of DMS, the IRT, and industry mitigation providers.

**Table 11a cont'd. Dimensional Morphology Summary  
(Dimensional Parameters - Cross Sections)  
601 East Stream Restoration Site -Reach 4**

Dimension	Cross-Section 17 Pool								Cross-Section 18 Riffle							
	Base	MY1	MY2	MY3	MY4	MY5	MY6	MY7	Base	MY1	MY2	MY3	MY4	MY5	MY6	MY7
Bankfull Elevation (ft) - Based on AB-XSA <sup>1</sup>	489.11	489.11	489.11	489.11		N/A			490.01	490.01	490.01	490.01		489.99		
Bankfull Width (ft) <sup>1</sup>	16.9	17.2	17.2	18.1		N/A			14.9	14.6	14.1	14.6		14.3		
Floodprone Width (ft) <sup>1</sup>	42.0	>42.0	>42.0	>42.0		N/A			30.4	>31.0	>31.0	>31.0		>32.1		
Bankfull Mean Depth (ft)	1.8	1.7	1.7	1.7		---			1.0	1.0	1.0	1		---		
Bankfull Max Depth (ft) <sup>2</sup>	2.7	2.9	2.9	2.9		2.3			1.5	1.6	1.7	1.8		1.7		
Bankfull Cross Sectional Area (ft <sup>2</sup> ) <sup>2</sup>	29.8	29.1	28.7	31.3		22.8			14.7	14.5	14.0	15		13.7		
Bankfull Width/Depth Ratio	9.6	10.2	10.3	10.4		---			15.2	14.6	14.2	14.3		---		
Bankfull Entrenchment Ratio <sup>1</sup>	2.5	>2.4	>2.4	N/A		N/A			2.0	>2.1	>2.2	>2.1		>2.2		
Bankfull Bank Height Ratio <sup>1</sup>	1.2	1.1	1.1	N/A		N/A			1.0	1.0	1.0	0.8		1.0		
d50 (mm)	N/A	N/A	N/A	N/A		N/A			N/A	47	4.2	12.0		17.0		

**Note:** Starting in MY5, the parameters denoted with <sup>1</sup> were calculated using the as-built cross sectional area as the basis for adjusting the bankfull elevation and the parameters denoted with <sup>2</sup> were calculated using the current years low top of bank as the bankfull elevation. These changes reflect the 2018 guidance that arose from the mitigation technical workgroup consisting of DMS, the IRT, and industry mitigation providers.

**Table 11b. Monitoring Data - Stream Reach Data Summary  
601 East - Reach 1 (1393 feet) XS 2, 4, 6, 8**

Parameter	Baseline					MY - 1					MY - 2					MY - 3					MY - 4					MY - 5					MY - 6					MY - 7												
	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	Min	Mean	Med	Max	SD	n						
Dimension & Substrate - Riffle																																																
Bankfull Width (ft) <sup>1</sup>	8.8	11.4	10.8	15.1	2.2	8	9.1	11.3	10.8	14.7	2.4	4	9.2	11.3	10.4	15.2	2.8	4	9.0	11.1	10.2	15.2	2.9	4							5.6	9.6	10.0	12.9	3.0	4												
Floodprone Width (ft) <sup>1</sup>	40.0	74.4	69.0	154.0	35.3	8	40.0	68.0	76.0	80.0	18.8	4	40.0	68.0	76.0	80.0	18.8	4	40.0	68.0	76.0	80.0	18.8	4							19.5	21.5	21.9	22.8	1.4	4												
Bankfull Mean Depth (ft)	0.5	0.8	0.8	1.2	0.3	8	0.5	0.6	0.6	0.6	0.1	4	0.5	0.6	0.6	0.6	0.0	4	0.6	0.6	0.6	0.7	0.1	4							-	-	-	-	-	-												
Bankfull Max Depth (ft) <sup>2</sup>	0.9	1.5	1.5	2.1	0.5	8	0.9	1.1	1.1	1.3	0.2	4	1.0	1.2	1.1	1.4	0.1	4	1.0	1.1	1.1	1.3	0.1	4							0.7	0.9	0.9	1.3	0.3	4												
Bankfull Cross-Sectional Area (ft) <sup>2</sup>	4.5	9.3	8.9	14.1	3.5	8	4.8	6.3	6.2	8.0	1.4	4	5.8	6.7	6.5	8.0	1.1	4	5.1	6.7	6.4	8.8	1.6	4							2.6	4.1	4.0	5.6	1.3	4												
Width/Depth Ratio	8.6	15.4	14.9	25.3	5.4	8	17.1	20.5	18.9	27.0	4.5	4	14.7	19.2	16.6	28.9	6.6	4	9.9	18.6	17.3	26.2	5.4	4							-	-	-	-	-	-												
Entrenchment Ratio <sup>3</sup>	3.3	6.9	5.6	16.4	4.2	8	3.9	6.1	6.2	8.3	2.0	4	4.3	6.1	6.1	8.0	1.7	4	4.5	6.3	6.2	8.2	1.7	4							1.7	2.4	2.3	3.5	0.8	4												
Bank Height Ratio <sup>3</sup>	0.9	1.0	1.0	1.0	0.0	8	1.0	1.0	1.0	1.0	0.0	4	1.0	1.0	1.0	1.0	0.0	4	0.7	0.8	0.8	0.9	0.1	4							1.0	1.0	1.0	1.0	0.0	4												
<b>Profile</b>																																																
Riffle Length (ft)	10.0	22.1	18.5	95.3	14.5	32																																										
Riffle Slope (ft/ft)	0.015	0.034	0.032	0.064	0.0	32																																										
Pool Length (ft)	13.4	24.3	21.2	65.7	11.5	33																																										
Pool Max Depth (ft)	1.2	2.2	2.2	3.2	0.4	33																																										
Pool Spacing (ft)	31.4	44.6	40.2	116.5	16.9	32																																										
<b>Pattern</b>																																																
Channel Belt Width (ft)	13.0	-	18.0	21.0	-	-																																										
Radius of Curvature (ft)	16.0	-	32.1	52.0	-	-																																										
Rc: Bankfull Width (ft/ft)	4.30	-	6.10	8.90	-	-																																										
Meander Wavelength (ft)	43.0	-	61.0	89.0	-	-																																										
Meander Width Ratio	1.3	-	1.8	2.1	-	-																																										
<b>Additional Reach Parameters</b>																																																
Rosgen Classification	B4/C4b																																															
Channel Thalweg Length (ft)	1,438																																															
Sinuosity (ft)	1.17																																															
Water Surface Slope (Channel) (ft/ft)	0.0170																																															
Bankfull Slope (ft/ft)	0.0170																																															
Ri% / Ru% / P% / G% / S%	44.3%	-	55.7%	-	-																																											

N/A - Information does not apply

Ri = Riffle / Ru = Run / P = Pool / G = Glide / S = Step

Baseline based on riffle and pool dimensions - MY1-7 based solely on riffle dimension

Note: Starting in MY5, the parameters denoted with 'w' were calculated using the as-built cross sectional area as the basis for adjusting the bankfull elevation and the parameters denoted with 'wif' were calculated using the current years low top of bank as the bankfull elevation. These changes reflect the 2018 guidance that arose from the mitigation technical workgroup consisting of DMS, the IRT, and industry mitigation provid

**Table 11b cont'd. Monitoring Data - Stream Reach Data Summary  
601 East - Reach 2 (902 feet) XS 9, 10**

Parameter	Baseline						MY - 1						MY - 2						MY - 3						MY - 4						MY - 5						MY - 6						MY - 7																	
	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	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n												
Bankfull Width (ft) <sup>1</sup>	15.5	19.7	19.6	24.2	3.6	4	15.8	20.1	20.1	24.3	6.0	2	14.1	19.2	19.2	24.4	7.3	2	17.3	20.2	20.2	23.0	4.0	2							16.3	20.9	20.9	25.4	6.4	2																								
Floodprone Width (ft) <sup>1</sup>	62.0	108.8	102.5	168.0	50.0	4	62.0	67.5	67.5	73.0	7.8	2	62.0	67.5	67.5	73.0	7.8	2	62.0	67.5	67.5	73.0	7.8	2							25.2	27.4	27.4	29.5	3.0	2																								
Bankfull Mean Depth (ft)	0.6	0.9	0.9	1.3	0.3	4	0.5	0.6	0.6	0.7	0.1	2	0.6	0.7	0.7	0.7	0.1	2	0.6	0.7	0.7	0.7	0.1	2							-	-	-	-	-	-																								
Bankfull Max Depth (ft) <sup>2</sup>	1.5	2.0	2.0	2.5	0.6	4	1.3	1.4	1.4	1.4	0.1	2	1.4	1.5	1.5	1.5	0.0	2	1.3	1.4	1.4	1.4	0.1	2							0.8	1.2	1.2	1.5	0.5	2																								
Bankfull Cross-Sectional Area (ft <sup>2</sup> )	9.4	18.4	19.5	25.3	6.7	4	8.6	12.6	12.6	16.5	5.6	2	8.3	12.9	12.9	17.5	6.5	2	9.8	12.5	12.5	15.2	3.8	2							3.8	5.3	5.3	6.7	2.1	2																								
Width/Depth Ratio	14.6	23.0	22.1	33.1	8.1	4	28.9	32.3	32.3	35.6	4.7	2	23.8	29.0	29.0	34.2	7.4	2	30.5	32.7	32.7	34.8	3.0	2							-	-	-	-	-	-																								
Entrenchment Ratio <sup>1</sup>	2.6	5.6	5.8	8.4	2.5	4	2.6	3.6	3.6	4.6	1.4	2	2.5	3.9	3.9	5.2	1.9	2	2.7	3.5	3.5	4.2	1.1	2							1.2	1.4	1.4	1.5	0.2	2																								
Bank Height Ratio <sup>1</sup>	0.9	1.0	1.0	1.0	0.0	4	1.0	1.0	1.0	1.0	0.0	2	1.0	1.0	1.0	1.0	0.0	2	0.7	0.9	0.9	1.0	0.2	2							1.0	1.0	1.0	1.0	0.0	2																								
<b>Profile</b>																																																												
Riffle Length (ft)	12.1	23.4	19.0	50.2	10.7	18																																																						
Riffle Slope (ft/ft)	0.004	0.019	0.015	0.036	0.010	17																																																						
Pool Length (ft)	15.1	32.9	29.1	74.3	14.7	17																																																						
Pool Max Depth (ft)	1.9	2.9	2.7	4.0	0.6	17																																																						
Pool Spacing (ft)	32.9	55.6	47.6	110.3	20.5	17																																																						
<b>Pattern</b>																																																												
Channel Belt Width (ft)	25.0	-	40.0	65.0	-	-																																																						
Radius of Curvature (ft)	38.0	-	47.0	58.0	-	-																																																						
Re: Bankfull Width (ft/ft)	3.20	-	3.90	4.80	-	-																																																						
Meander Wavelength (ft)	61.0	-	84.0	97.0	-	-																																																						
Meander Width Ratio	2.1	-	3.3	5.4	-	-																																																						
<b>Additional Reach Parameters</b>																																																												
Rosgen Classification	C4/E4																																																											
Channel Thalweg Length (ft)	945																																																											
Sinuosity (ft)	1.34																																																											
Water Surface Slope (Channel) (ft/ft)	0.0069																																																											
Bankfull Slope (ft/ft)	0.0069																																																											
Ri% / Ru% / P% / G% / S%	39.5%	-	60.5%	-	-																																																							

N/A - Information does not apply.

Ri = Riffle / Ru = Run / P = Pool / G = Glide / S = Step

Baseline based on riffle and pool dimensions - MY1-7 based solely on riffle dimensions

Note: Starting in MY5, the parameters denoted with <sup>1</sup> were calculated using the as-built cross sectional area as the basis for adjusting the bankfull elevation and the parameters denoted with <sup>2</sup> were calculated using the current years low top of bank as the bankfull elevation. These changes reflect the 2018 guidance that arose from the mitigation technical workgroup consisting of DMS, the IRT, and industry mitigation providers.

**Table 11b cont'd. Monitoring Data - Stream Reach Data Summary  
601 East - Reach 3 (1018 feet) XS 13, 16**

Parameter	Baseline						MY - 1						MY - 2						MY - 3						MY - 4						MY - 5						MY - 6						MY - 7											
	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	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n						
Dimension & Substrate - Riffle																																																						
Bankfull Width (ft) <sup>1</sup>	15.9	17.7	17.7	19.6	1.5	4	16.9	17.2	17.2	17.5	0.4	2	17.5	17.9	17.9	18.3	0.6	2	16.7	16.9	16.9	17.1	0.3	2							16.0	17.0	17.0	17.9	1.3	2																		
Floodprone Width (ft) <sup>1</sup>	75.0	231.3	250.0	350.0	140.5	4	75.0	112.5	112.5	150.0	53.0	2	75.0	112.5	112.5	150.0	53.0	2	75.0	112.5	112.5	150.0	53.0	2							20.4	21.9	21.9	23.3	2.1	2																		
Bankfull Mean Depth (ft)	0.8	1.3	1.2	1.8	0.5	4	0.7	0.8	0.8	0.8	0.1	2	0.7	0.8	0.8	0.8	0.1	2	0.7	0.8	0.8	0.8	0.1	2							-	-	-	-	-	-																		
Bankfull Max Depth (ft) <sup>2</sup>	1.6	2.5	2.5	3.4	1.1	4	0.7	0.8	0.8	0.8	0.1	2	1.7	1.8	1.8	1.8	0.0	2	1.6	1.7	1.7	1.8	0.1	2							0.9	1.1	1.1	1.2	0.2	2																		
Bankfull Cross-Sectional Area (ft) <sup>2</sup>	12.8	22.8	21.1	36.1	11.3	4	12.9	13.3	13.3	13.6	0.5	2	12.2	13.5	13.5	14.8	1.8	2	12.6	13.3	13.3	14.0	1.0	2							3.7	4.7	4.7	5.6	1.3	2																		
Width/Depth Ratio	10.6	15.9	15.3	22.4	6.0	4	21.0	22.4	22.4	23.8	2.0	2	22.5	23.8	23.8	25.0	1.8	2	19.8	21.5	21.5	23.1	2.3	2							-	-	-	-	-	-																		
Entrenchment Ratio <sup>3</sup>	4.7	12.7	13.2	19.9	7.3	4	4.4	6.5	6.5	8.5	2.9	2	4.3	6.3	6.3	8.2	2.8	2	4.4	6.7	6.7	9.0	3.3	2							1.1	1.3	1.3	1.5	0.3	2																		
Bank Height Ratio <sup>3</sup>	1.0	1.0	1.0	1.0	0.0	4	1.0	1.0	1.0	1.0	0.0	2	1.0	1.0	1.0	1.0	0.0	2	0.8	0.9	0.9	1.0	0.1	2							1.0	1.0	1.0	1.0	0.0	2																		
<b>Profile</b>																																																						
Riffle Length (ft)	10.1	24.1	16.8	110.3	22.1	19																																																
Riffle Slope (ft/ft)	0.00	0.018	0.015	0.041	0.011	17																																																
Pool Length (ft)	27.4	35.2	35.2	49.7	6.7	18																																																
Pool Max Depth (ft)	1.9	2.9	3.0	3.5	0.4	18																																																
Pool Spacing (ft)	41.1	58.5	54.4	137.9	20.9	18																																																
<b>Pattern</b>																																																						
Channel Belt Width (ft)	35.0	-	56.0	92.0	-	-																																																
Radius of Curvature (ft)	27.0	-	43.0	63.0	-	-																																																
Re: Bankfull Width (ft/ft)	1.6	-	2.5	3.7	-	-																																																
Meander Wavelength (ft)	87.0	-	119.0	134.0	-	-																																																
Meander Width Ratio	2.1	-	3.3	5.4	-	-																																																
<b>Additional Reach Parameters</b>																																																						
Rosgen Classification				C4																																																		
Channel Thalweg Length (ft)				1064																																																		
Sinuosity (ft)				1.2																																																		
Water Surface Slope (Channel) (ft/ft)				0.0056																																																		
Bankfull Slope (ft/ft)				0.0056																																																		
Ri% / Ru% / P% / G% / S%	43.0%	-	57.0%	-	-																																																	

N/A - Information does not apply.

Ri = Riffle / Ru = Run / P = Pool / G = Glide / S = Step

Baseline based on riffle and pool dimensions - MY1-7 based solely on riffle dimensions

Note: Starting in MY5, the parameters denoted with <sup>1</sup> were calculated using the as-built cross sectional area as the basis for adjusting the bankfull elevation and the parameters denoted with <sup>2</sup> were calculated using the current years low top of bank as the bankfull elevation. These changes reflect the 2018 guidance that arose from the mitigation technical workgroup consisting of DMS, the IRT, and industry mitigation providers.

Table 11b cont'd. Monitoring Data - Stream Reach Data Summary  
601 East - Reach 4 (495 feet) XS 18

Parameter	Baseline						MY - 1					MY - 2					MY - 3					MY - 4					MY - 5					MY - 6					MY - 7					
	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	Min	Mean	Med	Max	SD	n
Dimension & Substrate - Riffle																																										
Bankfull Width (ft) <sup>1</sup>	14.9	15.9	15.9	16.9	1.4	2	-	14.6	-	-	N/A	1	-	14.1	-	-	N/A	1	-	14.6	-	-	N/A	1	-	14.3	-	-	N/A	1	-	>32.1	-	-	N/A	1.0						
Floodprone Width (ft) <sup>1</sup>	30.4	36.2	36.2	42.0	8.2	2	-	31.0	-	-	N/A	1	-	31.0	-	-	N/A	1	-	31.0	-	-	N/A	1	-	-	-	-	-	-	-	-	-	-	-	-						
Bankfull Mean Depth (ft)	1.0	1.4	1.4	1.8	0.5	2	-	1.0	-	-	N/A	1	-	1.0	-	-	N/A	1	-	1.0	-	-	N/A	1	-	-	-	-	-	-	-	-	-	-	-	-						
Bankfull Max Depth (ft) <sup>2</sup>	1.5	2.1	2.1	2.7	0.9	2	-	1.6	-	-	N/A	1	-	1.7	-	-	N/A	1	-	1.8	-	-	N/A	1	-	1.70	-	-	N/A	1.0	-	-	-	-	-	-						
Bankfull Cross-Sectional Area (ft) <sup>2</sup>	14.7	22.3	22.3	29.8	10.7	2	-	14.5	-	-	N/A	1	-	14.0	-	-	N/A	1	-	15.0	-	-	N/A	1	-	13.7	-	-	N/A	1.0	-	-	-	-	-	-						
Width/Depth Ratio	9.6	12.4	12.4	15.2	3.9	2	-	15.6	-	-	N/A	1	-	14.2	-	-	N/A	1	-	14.3	-	-	N/A	1	-	-	-	-	-	-	-	-	-	-	-	-						
Entrenchment Ratio <sup>1</sup>	2.0	2.3	2.3	2.5	0.3	2	-	2.1	-	-	N/A	1	-	2.2	-	-	N/A	1	-	2.1	-	-	N/A	1	-	>2.2	-	-	N/A	1.0	-	-	-	-	-	-						
Bank Height Ratio <sup>1</sup>	1.0	1.1	1.1	1.2	0.1	2	-	1.0	-	-	N/A	1	-	1.0	-	-	N/A	1	-	0.8	-	-	N/A	1	-	1.00	-	-	N/A	1.0	-	-	-	-	-	-						
<b>Profile</b>																																										
Riffle Length (ft)	15.8	20.8	18.2	29.0	4.8	9																																				
Riffle Slope (ft/ft)	0.018	0.027	0.030	0.038	0.007	9																																				
Pool Length (ft)	30.8	35.0	35.8	38.8	3.1	9																																				
Pool Max Depth (ft)	2.0	2.8	2.8	3.4	0.4	9																																				
Pool Spacing (ft)	49.8	56.1	54.8	69.3	6.2	8																																				
<b>Pattern</b>																																										
Channel Belt Width (ft)	21.0	-	28.0	32.0	-	-																																				
Radius of Curvature (ft)	26.0	-	52.0	84.0	-	-																																				
Rc: Bankfull Width (ft/ft)	162.0	-	3.3	5.3	-	-																																				
Meander Wavelength (ft)	69.0	-	97.0	142.0	-	-																																				
Meander Width Ratio	1.3	-	1.8	2.0	-	-																																				
<b>Additional Reach Parameters</b>																																										
Rosgen Classification				B4																																						
Channel Thalweg Length (ft)				465																																						
Sinuosity (ft)				1.13																																						
Water Surface Slope (Channel) (ft/ft)				0.0114																																						
Bankfull Slope (ft/ft)				0.0114																																						
Ri% / Ru% / P% / G% / S%	39.1%	-	65.6%	-	-																																					

N/A - Information does not apply

Ri = Riffle / Ru = Run / P = Pool / G = Glide / S = Step

Baseline based on riffle and pool dimensions - MY1-7 based solely on riffle dimension

Note: Starting in MY5, the parameters denoted with ' were calculated using the as-built cross sectional area as the basis for adjusting the bankfull elevation and the parameters denoted with were calculated using the current years low top of bank as the bankfull elevation. These changes reflect the 2018 guidance that arose from the mitigation technical workgroup consisting of DMS, the IRT, and industry mitigation providers.

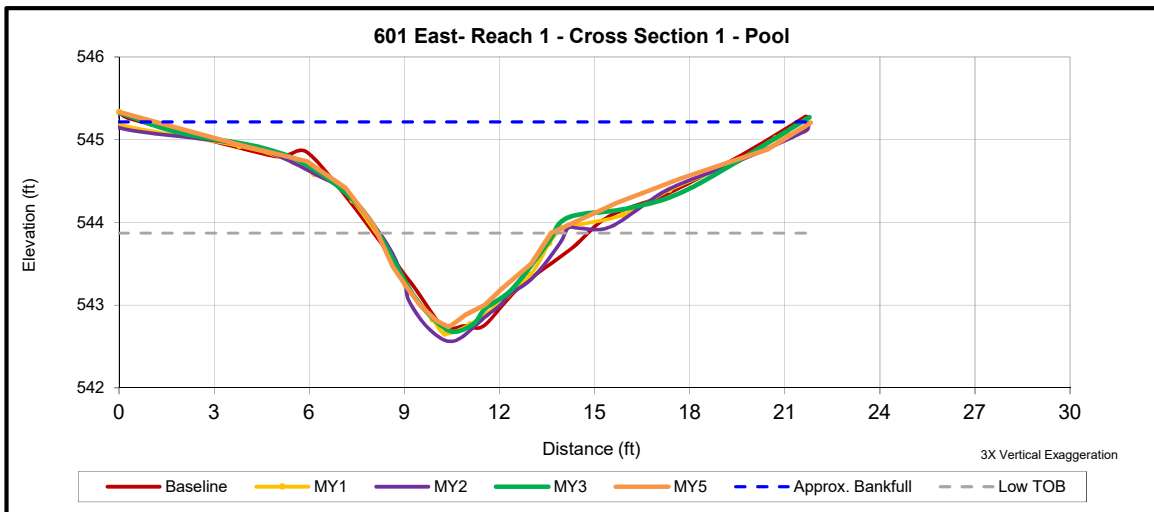




Upstream



Downstream



DIMENSIONS SUMMARY	MY0	MY1	MY2	MY3	MY4	MY5	MY6	MY7
Bankful Width (ft) <sup>1</sup>	13.6	15.1	15.1	14.7	-	N/A	-	-
Floodprone Width (ft) <sup>1</sup>	45.0	45.0	45.0	45.0	-	N/A	-	-
Bankfull Mean Depth (ft)	1.0	0.9	0.9	0.9	-	---	-	-
Bankfull Max Depth (ft) <sup>2</sup>	2.1	2.2	2.2	2.1	-	1.1	-	-
Bankfull Cross-Sectional Area (ft <sup>2</sup> ) <sup>2</sup>	14.1	13.7	14.3	13.4	-	3.7	-	-
Width/Depth Ratio	13.2	16.6	15.9	16.2	-	---	-	-
Entrenchment Ratio <sup>1</sup>	10.3	3.0	3.0	N/A	-	N/A	-	-
Bank Height Ratio <sup>1</sup>	1.0	1.0	1.0	N/A	-	N/A	-	-

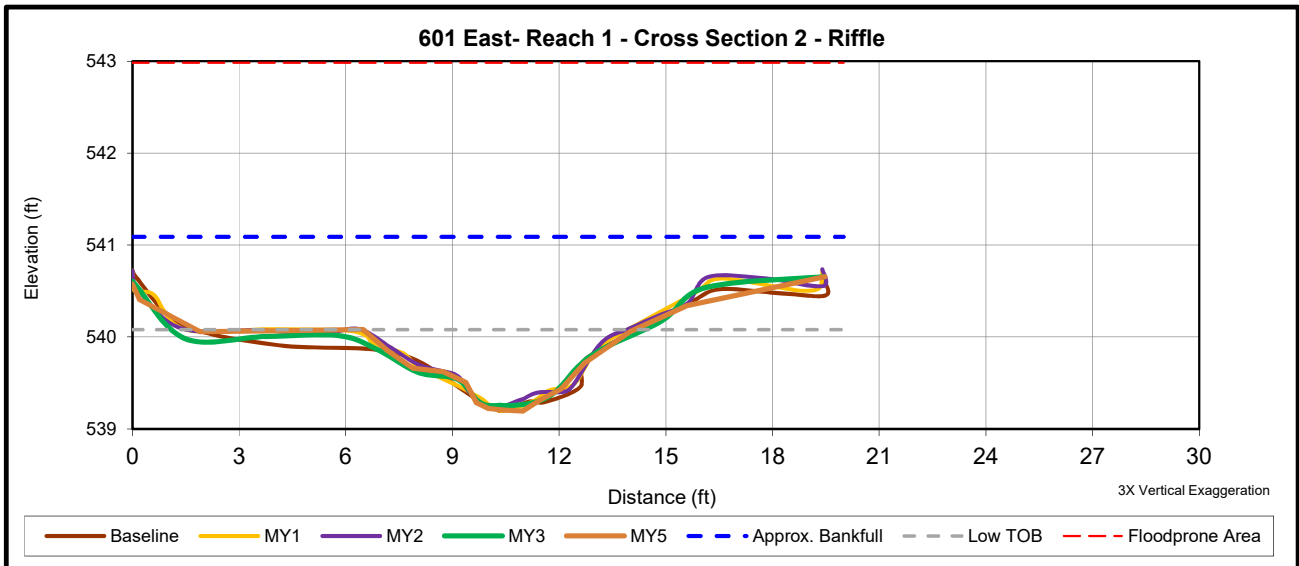
**Note:** Starting in MY5, the parameters denoted with <sup>1</sup> were calculated using the as-built cross sectional area as the basis for adjusting the bankfull elevation and the parameters denoted with <sup>2</sup> were calculated using the current years low top of bank as the bankfull elevation. These changes reflect the 2018 guidance that arose from the mitigation technical workgroup consisting of DMS, the IRT, and industry mitigation providers.



Upstream



Downstream



DIMENSIONS SUMMARY	MY0	MY1	MY2	MY3	MY4	MY5	MY6	MY7
Bankfull Width (ft) <sup>1</sup>	15.1	14.7	15.2	15.2	-	5.6	-	-
Floodprone Width (ft) <sup>1</sup>	77.0	77.0	77.0	77.0	-	>19.5	-	-
Bankfull Mean Depth (ft)	0.6	0.5	0.5	0.6	-	---	-	-
Bankfull Max Depth (ft) <sup>2</sup>	1.2	1.2	1.2	1.1	-	0.9	-	-
Bankfull Cross-Sectional Area (ft <sup>2</sup> ) <sup>2</sup>	9.0	8.0	8.0	8.8	-	3.4	-	-
Width/Depth Ratio	25.3	27.0	28.9	26.2	-	---	-	-
Entrenchment Ratio <sup>1</sup>	9.3	5.2	5.1	5.1	-	>3.5	-	-
Bank Height Ratio <sup>1</sup>	1.0	1.0	1.0	0.7	-	<1	-	-

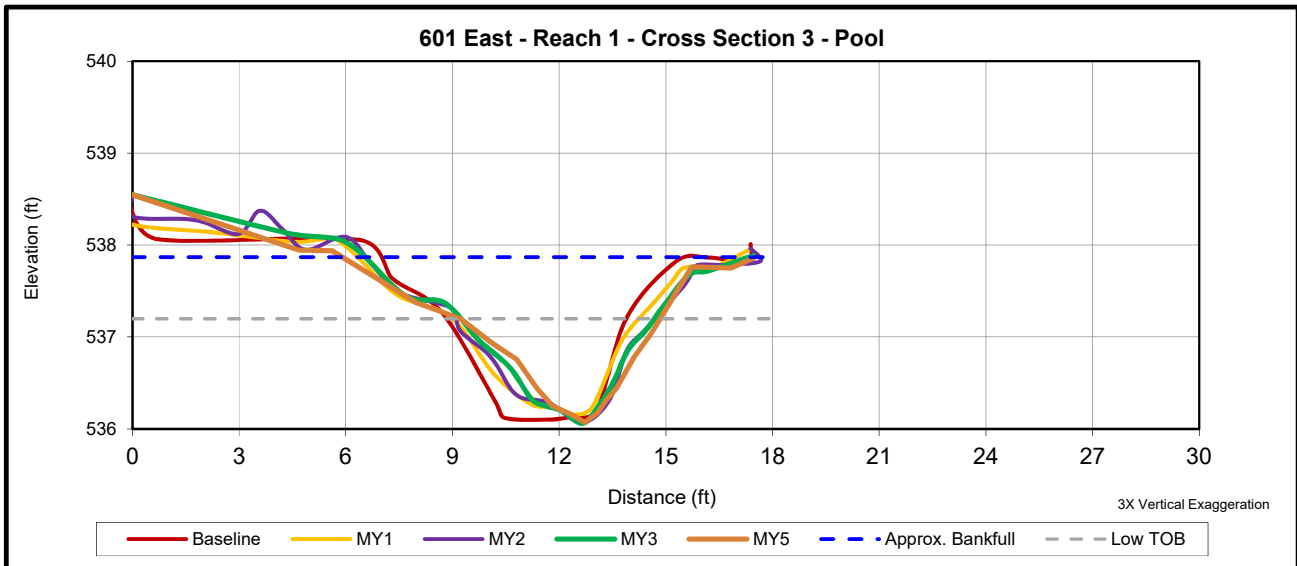
**Note:** Starting in MY5, the parameters denoted with <sup>1</sup> were calculated using the as-built cross sectional area as the basis for adjusting the bankfull elevation and the parameters denoted with <sup>2</sup> were calculated using the current years low top of bank as the bankfull elevation. These changes reflect the 2018 guidance that arose from the mitigation technical workgroup consisting of DMS, the IRT, and industry mitigation providers.



Upstream



Downstream



DIMENSIONS SUMMARY	MY0	MY1	MY2	MY3	MY4	MY5	MY6	MY7
Bankful Width (ft) <sup>1</sup>	9.4	9.5	9.3	9.2	-	N/A	-	-
Floodprone Width (ft) <sup>1</sup>	154.0	154.0	154.0	154.0	-	N/A	-	-
Bankfull Mean Depth (ft)	0.9	0.9	0.9	0.9	-	---	-	-
Bankfull Max Depth (ft) <sup>2</sup>	1.8	1.7	1.8	1.8	-	1.1	-	-
Bankfull Cross-Sectional Area (ft <sup>2</sup> ) <sup>2</sup>	8.7	8.5	8.8	8.5	-	3.3	-	-
Width/Depth Ratio	10.2	10.7	9.8	9.9	-	---	-	-
Entrenchment Ratio <sup>1</sup>	14.9	14.6	16.6	N/A	-	N/A	-	-
Bank Height Ratio <sup>1</sup>	1.0	1.0	1.0	N/A	-	N/A	-	-

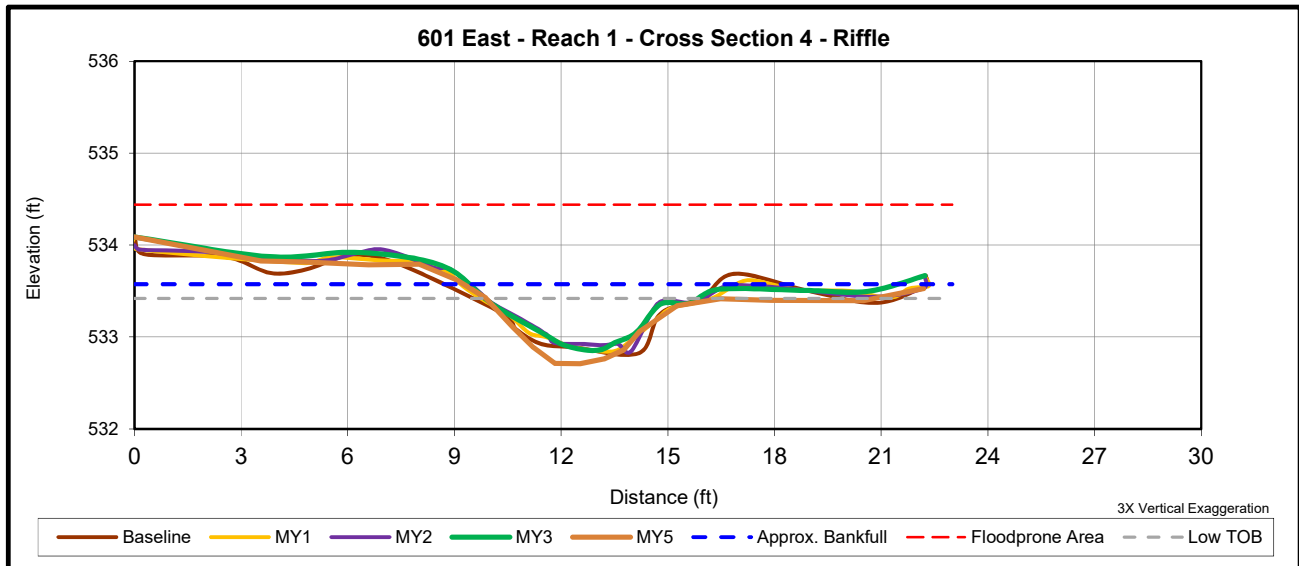
**Note:** Starting in MY5, the parameters denoted with <sup>1</sup> were calculated using the as-built cross sectional area as the basis for adjusting the bankfull elevation and the parameters denoted with <sup>2</sup> were calculated using the current years low top of bank as the bankfull elevation. These changes reflect the 2018 guidance that arose from the mitigation technical workgroup consisting of DMS, the IRT, and industry mitigation providers.



Upstream



Downstream



DIMENSIONS SUMMARY	MY0	MY1	MY2	MY3	MY4	MY5	MY6	MY7
Bankful Width (ft) <sup>1</sup>	8.8	9.1	9.4	9.2	-	12.9	-	-
Floodprone Width (ft) <sup>1</sup>	75.0	75.0	75.0	75.0	-	>22.2	-	-
Bankfull Mean Depth (ft)	0.5	0.5	0.6	0.6	-	---	-	-
Bankfull Max Depth (ft) <sup>2</sup>	0.9	0.9	1.1	1.0	-	0.7	-	-
Bankfull Cross-Sectional Area (ft <sup>2</sup> ) <sup>2</sup>	4.5	4.8	5.8	5.1	-	2.6	-	-
Width/Depth Ratio	17.5	17.1	15.3	16.7	-	---	-	-
Entrenchment Ratio <sup>1</sup>	15.9	8.3	8.0	8.2	-	1.7	-	-
Bank Height Ratio <sup>1</sup>	1.0	1.0	1.0	0.7	-	<1	-	-

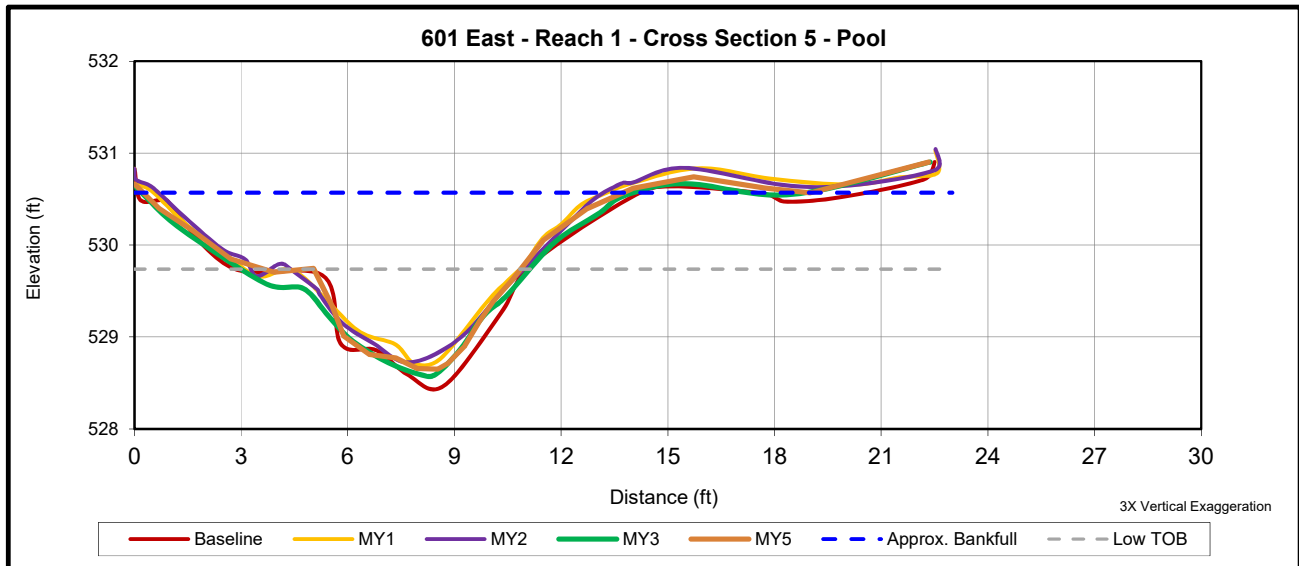
**Note:** Starting in MY5, the parameters denoted with <sup>1</sup> were calculated using the as-built cross sectional area as the basis for adjusting the bankfull elevation and the parameters denoted with <sup>2</sup> were calculated using the current years low top of bank as the bankfull elevation. These changes reflect the 2018 guidance that arose from the mitigation technical workgroup consisting of DMS, the IRT, and industry mitigation providers.



Upstream



Downstream



DIMENSIONS SUMMARY	MY0	MY1	MY2	MY3	MY4	MY5	MY6	MY7
Bankful Width (ft) <sup>1</sup>	12.9	12.1	12.0	13.2	-	N/A	-	-
Floodprone Width (ft) <sup>1</sup>	61.0	61.0	61.0	61.0	-	N/A	-	-
Bankfull Mean Depth (ft)	1.0	0.9	0.9	1.0	-	---	-	-
Bankfull Max Depth (ft) <sup>2</sup>	2.0	1.8	1.8	1.9	-	1.1	-	-
Bankfull Cross-Sectional Area (ft <sup>2</sup> ) <sup>2</sup>	12.8	11.0	11.2	12.8	-	4.2	-	-
Width/Depth Ratio	13.0	13.2	12.9	13.6	-	---	-	-
Entrenchment Ratio <sup>1</sup>	17.4	5.1	5.1	N/A	-	N/A	-	-
Bank Height Ratio <sup>1</sup>	1.0	1.0	1.0	N/A	-	N/A	-	-

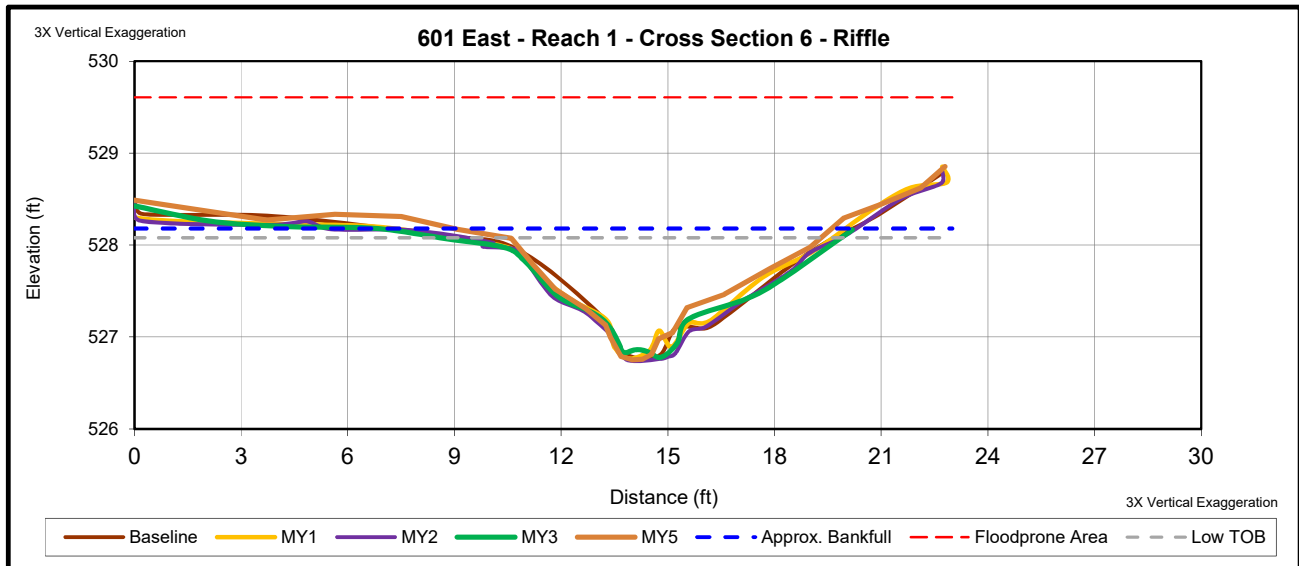
**Note:** Starting in MY5, the parameters denoted with <sup>1</sup> were calculated using the as-built cross sectional area as the basis for adjusting the bankfull elevation and the parameters denoted with <sup>2</sup> were calculated using the current years low top of bank as the bankfull elevation. These changes reflect the 2018 guidance that arose from the mitigation technical workgroup consisting of DMS, the IRT, and industry mitigation providers.



Upstream



Downstream



DIMENSIONS SUMMARY	MY0	MY1	MY2	MY3	MY4	MY5	MY6	MY7
Bankfull Width (ft) <sup>1</sup>	11.3	11.3	11.3	11.1	-	10.5	-	-
Floodprone Width (ft) <sup>1</sup>	80.0	80.0	80.0	80.0	-	>22.8	-	-
Bankfull Mean Depth (ft)	0.6	0.6	0.6	0.6	-	---	-	-
Bankfull Max Depth (ft) <sup>2</sup>	1.3	1.3	1.4	1.3	-	1.3	-	-
Bankfull Cross-Sectional Area (ft <sup>2</sup> ) <sup>2</sup>	6.6	6.6	7.2	6.9	-	5.6	-	-
Width/Depth Ratio	19.3	19.5	17.9	17.9	-	---	-	-
Entrenchment Ratio <sup>1</sup>	9.7	7.1	7.1	7.2	-	>2.2	-	-
Bank Height Ratio <sup>1</sup>	1.0	1.0	1.0	0.9	-	<1	-	-

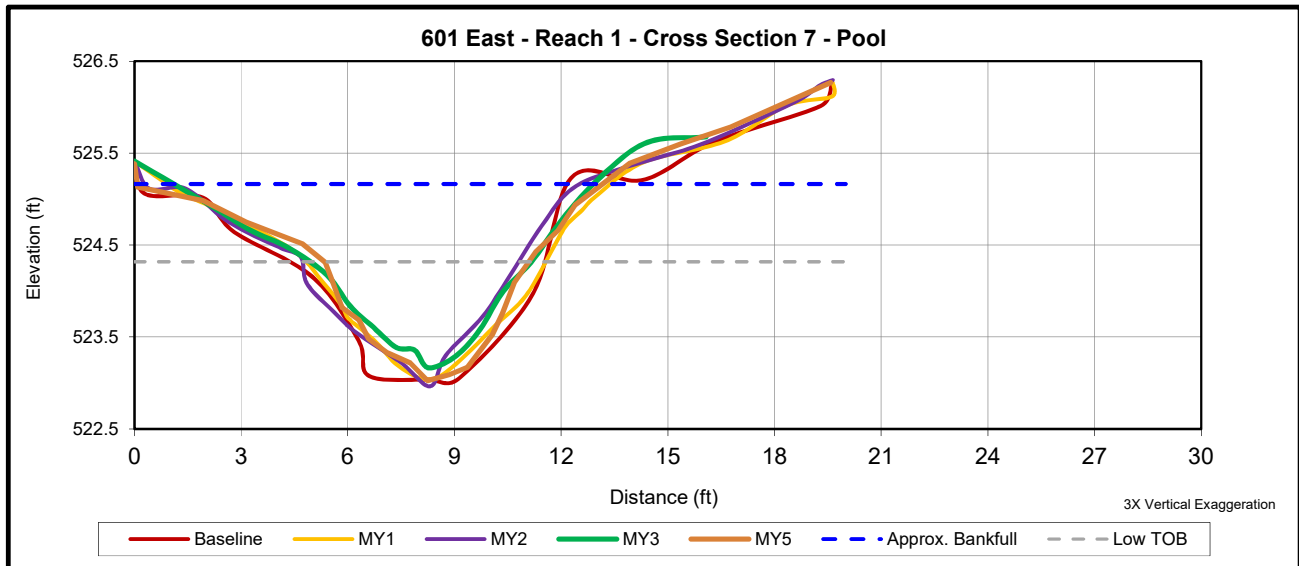
**Note:** Starting in MY5, the parameters denoted with <sup>1</sup> were calculated using the as-built cross sectional area as the basis for adjusting the bankfull elevation and the parameters denoted with <sup>2</sup> were calculated using the current years low top of bank as the bankfull elevation. These changes reflect the 2018 guidance that arose from the mitigation technical workgroup consisting of DMS, the IRT, and industry mitigation providers.



Upstream



Downstream



DIMENSIONS SUMMARY	MY0	MY1	MY2	MY3	MY4	MY5	MY6	MY7
Bankful Width (ft) <sup>1</sup>	10.3	11.4	10.3	10.8	-	N/A	-	-
Floodprone Width (ft) <sup>1</sup>	63.0	63.0	63.0	63.0	-	N/A	-	-
Bankfull Mean Depth (ft)	1.2	1.0	1.0	1.0	-	---	-	-
Bankfull Max Depth (ft) <sup>2</sup>	2.0	2.0	2.1	1.9	-	1.3	-	-
Bankfull Cross-Sectional Area (ft <sup>2</sup> ) <sup>2</sup>	12.3	11.2	10.4	9.9	-	4.7	-	-
Width/Depth Ratio	8.6	11.5	10.3	11.8	-	---	-	-
Entrenchment Ratio <sup>1</sup>	10.7	5.5	6.1	N/A	-	N/A	-	-
Bank Height Ratio <sup>1</sup>	1.0	1.0	1.0	N/A	-	N/A	-	-

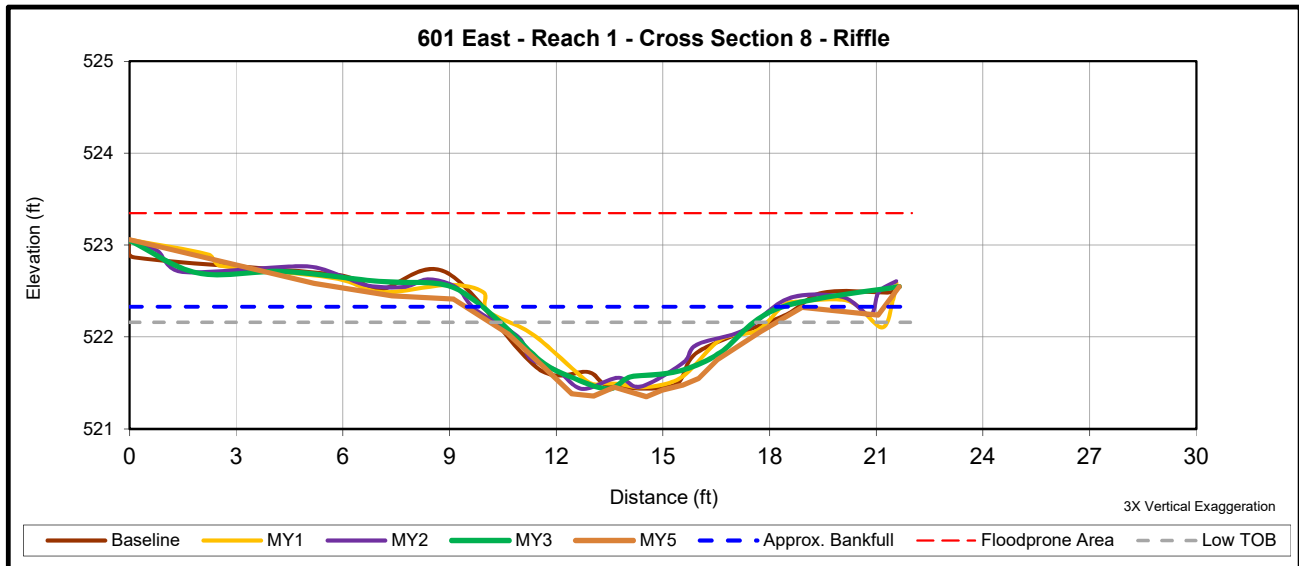
**Note:** Starting in MY5, the parameters denoted with <sup>1</sup> were calculated using the as-built cross sectional area as the basis for adjusting the bankfull elevation and the parameters denoted with <sup>2</sup> were calculated using the current years low top of bank as the bankfull elevation. These changes reflect the 2018 guidance that arose from the mitigation technical workgroup consisting of DMS, the IRT, and industry mitigation providers.



Upstream



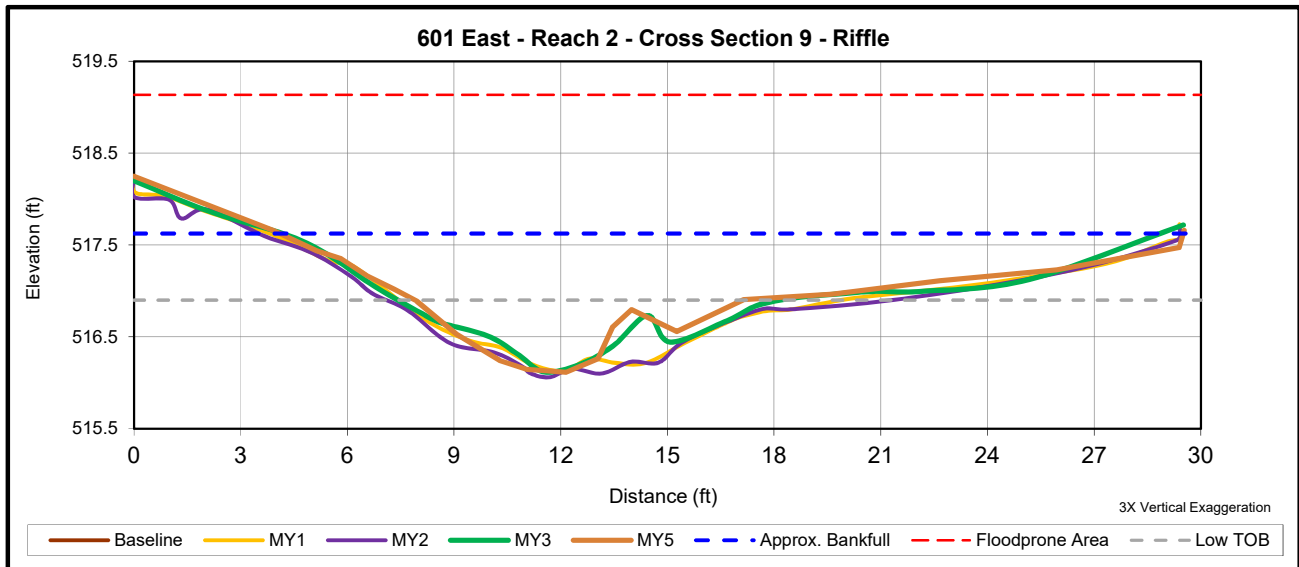
Downstream



DIMENSIONS SUMMARY	MY0	MY1	MY2	MY3	MY4	MY5	MY6	MY7
Bankfull Width (ft) <sup>1</sup>	10.1	8.8	9.2	9.0	-	9.5	-	-
Floodprone Width (ft) <sup>1</sup>	40.0	40.0	40.0	40.0	-	>21.6	-	-
Bankfull Mean Depth (ft)	0.6	0.6	0.6	0.7	-	---	-	-
Bankfull Max Depth (ft) <sup>2</sup>	1.0	1.0	1.0	1.0	-	0.8	-	-
Bankfull Cross-Sectional Area (ft <sup>2</sup> ) <sup>2</sup>	6.2	5.6	5.8	5.9	-	4.6	-	-
Width/Depth Ratio	16.6	13.9	14.7	13.7	-	---	-	-
Entrenchment Ratio <sup>1</sup>	10.9	4.5	4.3	4.5	-	>2.3	-	-
Bank Height Ratio <sup>1</sup>	1.0	1.0	1.0	0.8	-	<1	-	-

**Note:** Starting in MY5, the parameters denoted with <sup>1</sup> were calculated using the as-built cross sectional area as the basis for adjusting the bankfull elevation and the parameters denoted with <sup>2</sup> were calculated using the current years low top of bank as the bankfull elevation. These changes reflect the 2018 guidance that arose from the mitigation technical workgroup consisting of DMS, the IRT, and industry mitigation providers.





DIMENSIONS SUMMARY	MY0	MY1	MY2	MY3	MY4	MY5	MY6	MY7
Bankful Width (ft) <sup>1</sup>	24.2	24.3	24.4	23.0	-	25.4	-	-
Floodprone Width (ft) <sup>1</sup>	62.0	62.0	62.0	62.0	-	>29.5	-	-
Bankfull Mean Depth (ft)	0.7	0.7	0.7	0.7	-	---	-	-
Bankfull Max Depth (ft) <sup>2</sup>	1.5	1.4	1.4	1.4	-	0.8	-	-
Bankfull Cross-Sectional Area (ft <sup>2</sup> ) <sup>2</sup>	17.7	16.5	17.5	15.2	-	3.8	-	-
Width/Depth Ratio	33.1	35.6	34.2	34.8	-	---	-	-
Entrenchment Ratio <sup>1</sup>	5.8	2.6	2.5	2.7	-	>1.2	-	-
Bank Height Ratio <sup>1</sup>	1.0	1.0	1.0	1.0	-	<1	-	-

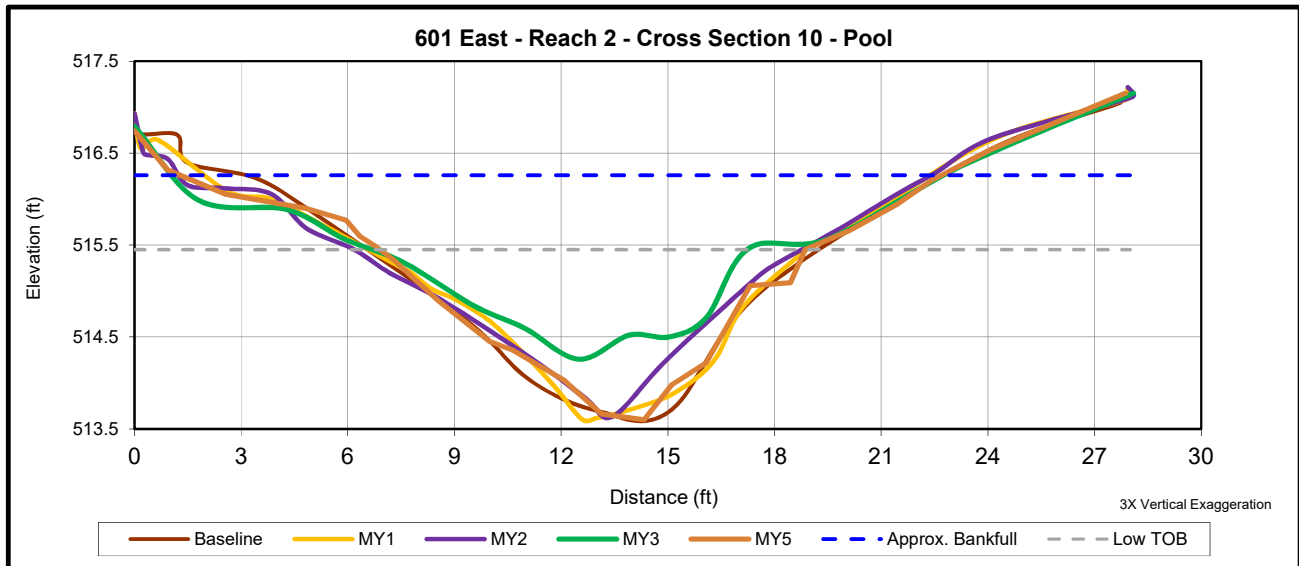
**Note:** Starting in MY5, the parameters denoted with <sup>1</sup> were calculated using the as-built cross sectional area as the basis for adjusting the bankfull elevation and the parameters denoted with <sup>2</sup> were calculated using the current years low top of bank as the bankfull elevation. These changes reflect the 2018 guidance that arose from the mitigation technical workgroup consisting of DMS, the IRT, and industry mitigation providers.



Upstream



Downstream



DIMENSIONS SUMMARY	MY0	MY1	MY2	MY3	MY4	MY5	MY6	MY7
Bankful Width (ft) <sup>1</sup>	19.2	19.7	19.7	20.8	-	N/A	-	-
Floodprone Width (ft) <sup>1</sup>	132.0	132.0	132.0	132.0	-	N/A	-	-
Bankfull Mean Depth (ft)	1.3	1.2	1.2	1.0	-	---	-	-
Bankfull Max Depth (ft) <sup>2</sup>	2.5	2.6	2.6	2.0	-	1.9	-	-
Bankfull Cross-Sectional Area (ft <sup>2</sup> ) <sup>2</sup>	25.3	24.4	23.1	20.1	-	12.1	-	-
Width/Depth Ratio	14.6	16.0	16.8	21.5	-	---	-	-
Entrenchment Ratio <sup>1</sup>	11.7	6.7	6.7	N/A	-	N/A	-	-
Bank Height Ratio <sup>1</sup>	1.0	1.0	1.0	N/A	-	N/A	-	-

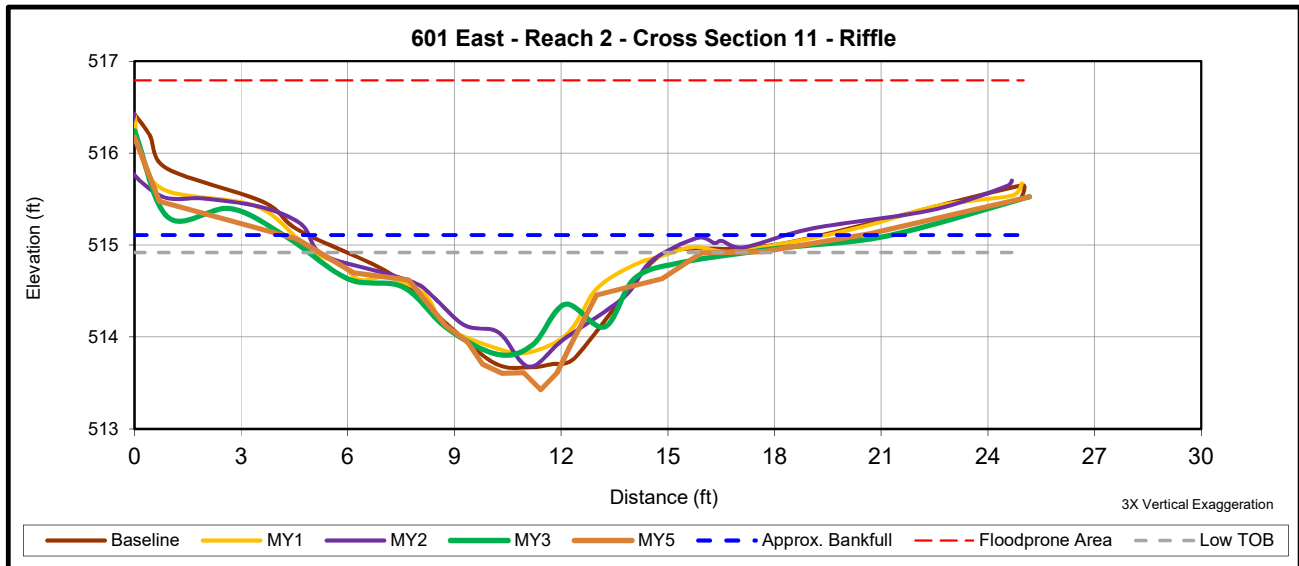
**Note:** Starting in MY5, the parameters denoted with <sup>1</sup> were calculated using the as-built cross sectional area as the basis for adjusting the bankfull elevation and the parameters denoted with <sup>2</sup> were calculated using the current years low top of bank as the bankfull elevation. These changes reflect the 2018 guidance that arose from the mitigation technical workgroup consisting of DMS, the IRT, and industry mitigation providers.



Upstream



Downstream



DIMENSIONS SUMMARY	MY0	MY1	MY2	MY3	MY4	MY5	MY6	MY7
Bankful Width (ft) <sup>1</sup>	15.5	15.8	14.1	17.3	-	16.3	-	-
Floodprone Width (ft) <sup>1</sup>	73.0	73.0	73.0	73.0	-	>25.2	-	-
Bankfull Mean Depth (ft)	0.6	0.5	0.6	0.6	-	---	-	-
Bankfull Max Depth (ft) <sup>2</sup>	1.5	1.3	1.5	1.3	-	1.5	-	-
Bankfull Cross-Sectional Area (ft <sup>2</sup> ) <sup>2</sup>	9.4	8.6	8.3	9.8	-	6.7	-	-
Width/Depth Ratio	25.5	28.9	23.8	30.5	-	---	-	-
Entrenchment Ratio <sup>1</sup>	7.1	4.6	5.2	4.2	-	>1.5	-	-
Bank Height Ratio <sup>1</sup>	0.9	1.0	1.0	0.7	-	<1	-	-

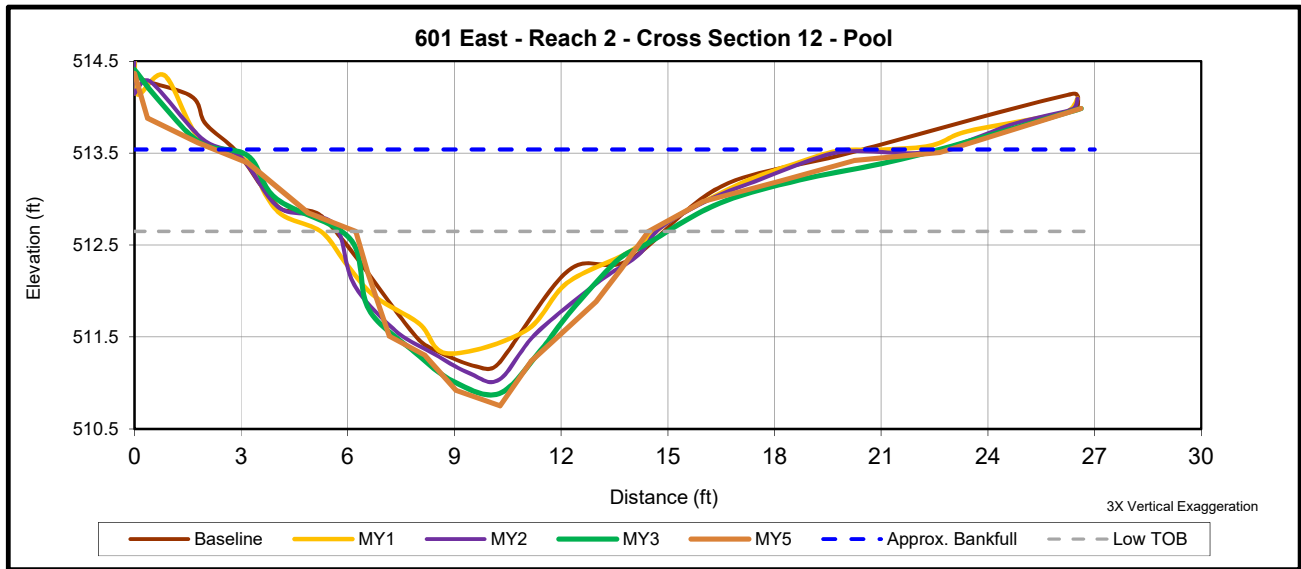
**Note:** Starting in MY5, the parameters denoted with <sup>1</sup> were calculated using the as-built cross sectional area as the basis for adjusting the bankfull elevation and the parameters denoted with <sup>2</sup> were calculated using the current years low top of bank as the bankfull elevation. These changes reflect the 2018 guidance that arose from the mitigation technical workgroup consisting of DMS, the IRT, and industry mitigation providers.



Upstream



Downstream



DIMENSIONS SUMMARY	MY0	MY1	MY2	MY3	MY4	MY5	MY6	MY7
Bankful Width (ft) <sup>1</sup>	20.0	20.6	20.6	20.7	-	N/A	-	-
Floodprone Width (ft) <sup>1</sup>	168.0	168.0	168.0	168.0	-	N/A	-	-
Bankfull Mean Depth (ft)	1.1	1.0	1.1	1.2	-	---	-	-
Bankfull Max Depth (ft) <sup>2</sup>	2.5	2.4	2.6	2.8	-	1.9	-	-
Bankfull Cross-Sectional Area (ft <sup>2</sup> ) <sup>2</sup>	21.3	21.4	23.1	24.5	-	9.4	-	-
Width/Depth Ratio	18.8	19.9	18.4	17.4	-	---	-	-
Entrenchment Ratio <sup>1</sup>	7.0	8.1	8.2	N/A	-	N/A	-	-
Bank Height Ratio <sup>1</sup>	0.9	1.0	1.0	N/A	-	N/A	-	-

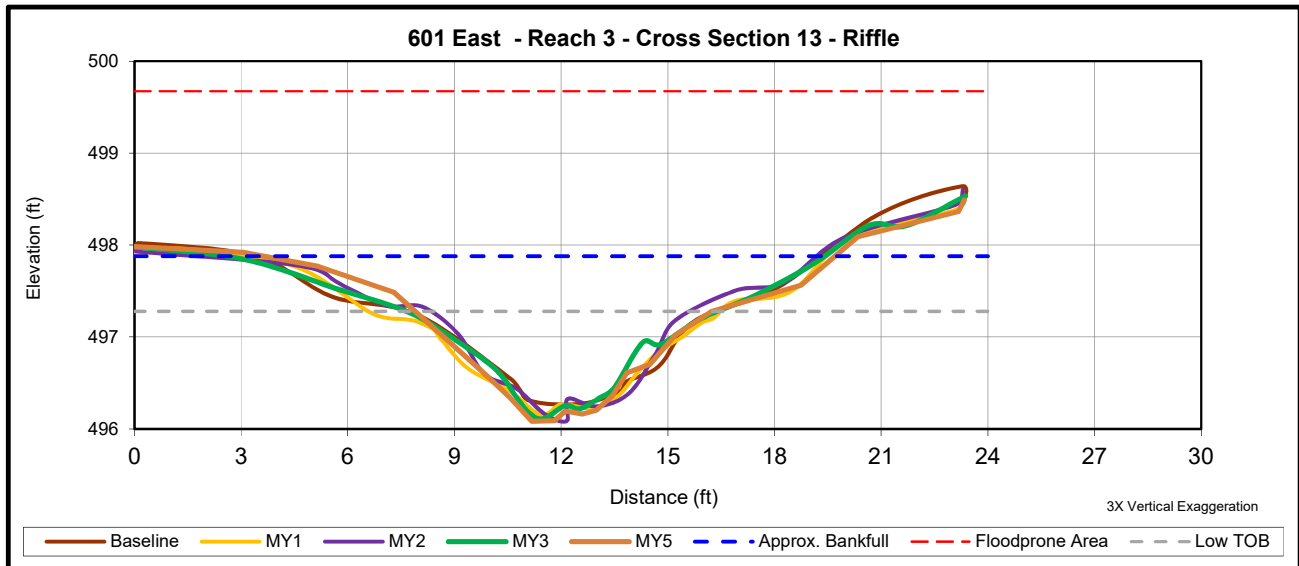
**Note:** Starting in MY5, the parameters denoted with <sup>1</sup> were calculated using the as-built cross sectional area as the basis for adjusting the bankfull elevation and the parameters denoted with <sup>2</sup> were calculated using the current years low top of bank as the bankfull elevation. These changes reflect the 2018 guidance that arose from the mitigation technical workgroup consisting of DMS, the IRT, and industry mitigation providers.



Upstream



Downstream



DIMENSIONS SUMMARY	MY0	MY1	MY2	MY3	MY4	MY5	MY6	MY7
Bankfull Width (ft) <sup>1</sup>	15.9	16.9	17.5	17.1	-	16.0	-	-
Floodprone Width (ft) <sup>1</sup>	75.0	75.0	75.0	75.0	-	>23.3	-	-
Bankfull Mean Depth (ft)	0.8	0.8	0.7	0.7	-	---	-	-
Bankfull Max Depth (ft) <sup>2</sup>	1.6	1.7	1.8	1.8	-	1.2	-	-
Bankfull Cross-Sectional Area (ft <sup>2</sup> ) <sup>2</sup>	12.8	13.6	12.2	12.6	-	5.6	-	-
Width/Depth Ratio	19.6	21.0	25.0	23.1	-	---	-	-
Entrenchment Ratio <sup>1</sup>	8.8	4.4	4.3	4.4	-	>1.5	-	-
Bank Height Ratio <sup>1</sup>	1.0	1.0	1.0	1.0	-	<1	-	-

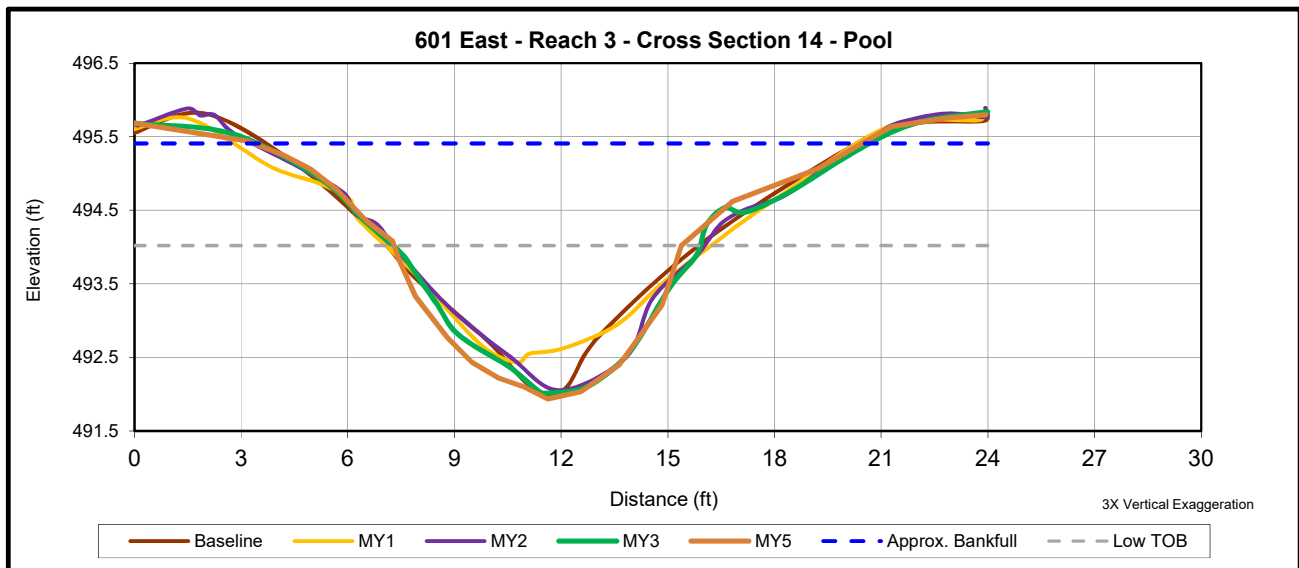
**Note:** Starting in MY5, the parameters denoted with <sup>1</sup> were calculated using the as-built cross sectional area as the basis for adjusting the bankfull elevation and the parameters denoted with <sup>2</sup> were calculated using the current years low top of bank as the bankfull elevation. These changes reflect the 2018 guidance that arose from the mitigation technical workgroup consisting of DMS, the IRT, and industry mitigation providers.



Upstream



Downstream



DIMENSIONS SUMMARY	MY0	MY1	MY2	MY3	MY4	MY5	MY6	MY7
Bankful Width (ft) <sup>1</sup>	17.5	18.4	17.9	18.2	-	N/A	-	-
Floodprone Width (ft) <sup>1</sup>	350.0	350.0	350.0	350.0	-	N/A	-	-
Bankfull Mean Depth (ft)	1.6	1.5	1.6	1.6	-	---	-	-
Bankfull Max Depth (ft) <sup>2</sup>	3.4	3.1	3.4	3.5	-	2.1	-	-
Bankfull Cross-Sectional Area (ft <sup>2</sup> ) <sup>2</sup>	28.2	28.0	28.7	29.7	-	11.5	-	-
Width/Depth Ratio	11.0	12.0	11.2	11.2	-	---	-	-
Entrenchment Ratio <sup>1</sup>	12.8	19.1	19.6	N/A	-	N/A	-	-
Bank Height Ratio <sup>1</sup>	1.0	1.0	1.0	N/A	-	N/A	-	-

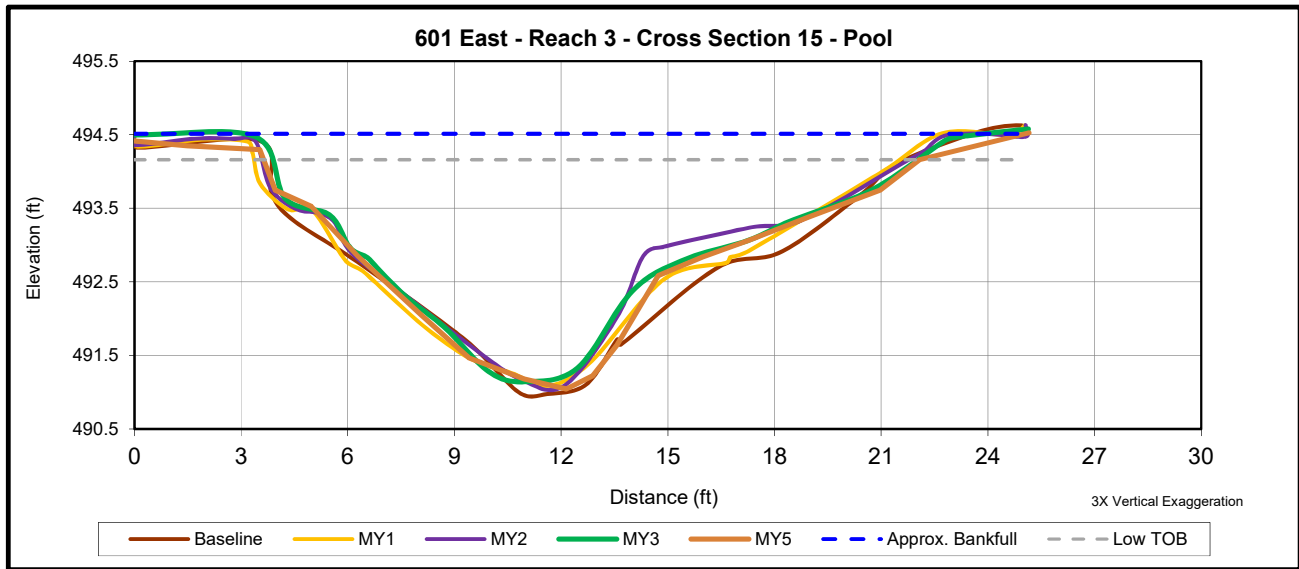
**Note:** Starting in MY5, the parameters denoted with <sup>1</sup> were calculated using the as-built cross sectional area as the basis for adjusting the bankfull elevation and the parameters denoted with <sup>2</sup> were calculated using the current years low top of bank as the bankfull elevation. These changes reflect the 2018 guidance that arose from the mitigation technical workgroup consisting of DMS, the IRT, and industry mitigation providers.



Upstream



Downstream



DIMENSIONS SUMMARY	MY0	MY1	MY2	MY3	MY4	MY5	MY6	MY7
Bankful Width (ft) <sup>1</sup>	19.6	21.1	20.5	19.4	-	N/A	-	-
Floodprone Width (ft) <sup>1</sup>	350.0	350.0	350.0	350.0	-	N/A	-	-
Bankfull Mean Depth (ft)	1.8	1.6	1.5	1.7	-	---	-	-
Bankfull Max Depth (ft) <sup>2</sup>	3.4	3.3	3.3	3.3	-	3.1	-	-
Bankfull Cross-Sectional Area (ft <sup>2</sup> ) <sup>2</sup>	36.1	34.4	31.5	32.4	-	29.0	-	-
Width/Depth Ratio	10.6	13.0	13.3	11.6	-	---	-	-
Entrenchment Ratio <sup>1</sup>	5.6	16.6	17.1	N/A	-	N/A	-	-
Bank Height Ratio <sup>1</sup>	1.0	1.0	1.0	N/A	-	N/A	-	-

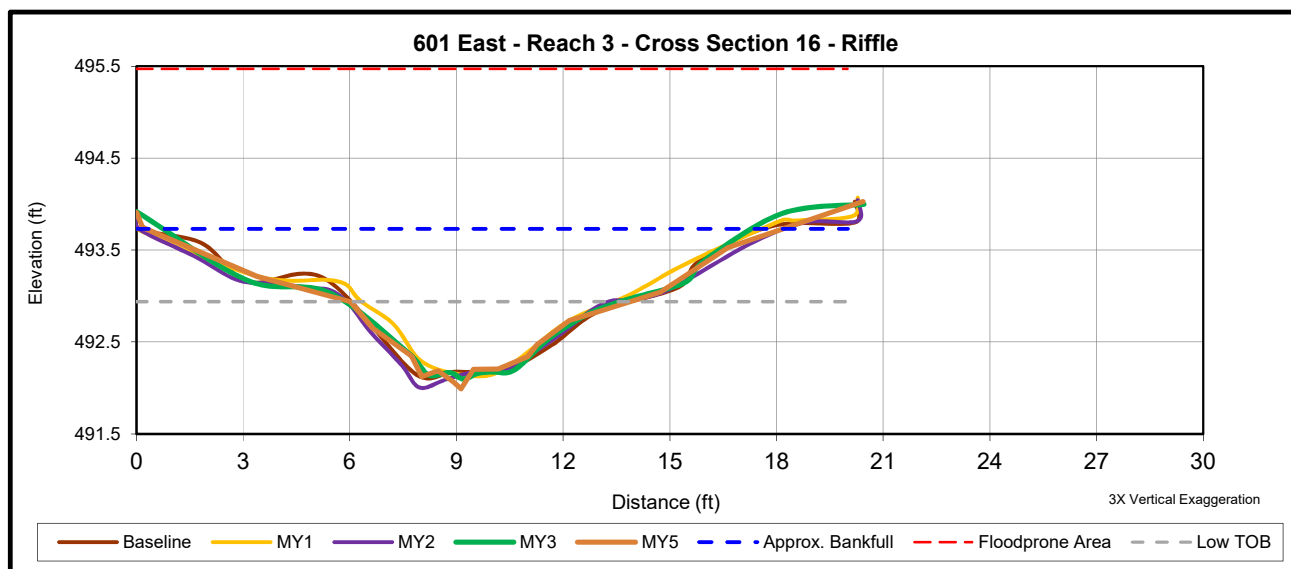
**Note:** Starting in MY5, the parameters denoted with <sup>1</sup> were calculated using the as-built cross sectional area as the basis for adjusting the bankfull elevation and the parameters denoted with <sup>2</sup> were calculated using the current years low top of bank as the bankfull elevation. These changes reflect the 2018 guidance that arose from the mitigation technical workgroup consisting of DMS, the IRT, and industry mitigation providers.



Upstream



Downstream



DIMENSIONS SUMMARY	MY0	MY1	MY2	MY3	MY4	MY5	MY6	MY7
Bankful Width (ft) <sup>1</sup>	17.7	17.5	18.3	16.7	-	17.9	-	-
Floodprone Width (ft) <sup>1</sup>	150.0	150.0	150.0	150.0	-	>20.4	-	-
Bankfull Mean Depth (ft)	0.8	0.7	0.8	0.8	-	---	-	-
Bankfull Max Depth (ft) <sup>2</sup>	1.6	1.6	1.7	1.6	-	0.9	-	-
Bankfull Cross-Sectional Area (ft <sup>2</sup> ) <sup>2</sup>	14.1	12.9	14.8	14.0	-	3.7	-	-
Width/Depth Ratio	22.4	23.8	22.5	19.8	-	---	-	-
Entrenchment Ratio <sup>1</sup>	7.9	8.5	8.2	9.0	-	>1.1	-	-
Bank Height Ratio <sup>1</sup>	1.0	1.0	1.0	0.8	-	<1	-	-

**Note:** Starting in MY5, the parameters denoted with <sup>1</sup> were calculated using the as-built cross sectional area as the basis for adjusting the bankfull elevation and the parameters denoted with <sup>2</sup> were calculated using the current years low top of bank as the bankfull elevation. These changes reflect the 2018 guidance that arose from the mitigation technical workgroup consisting of DMS, the IRT, and industry mitigation providers.

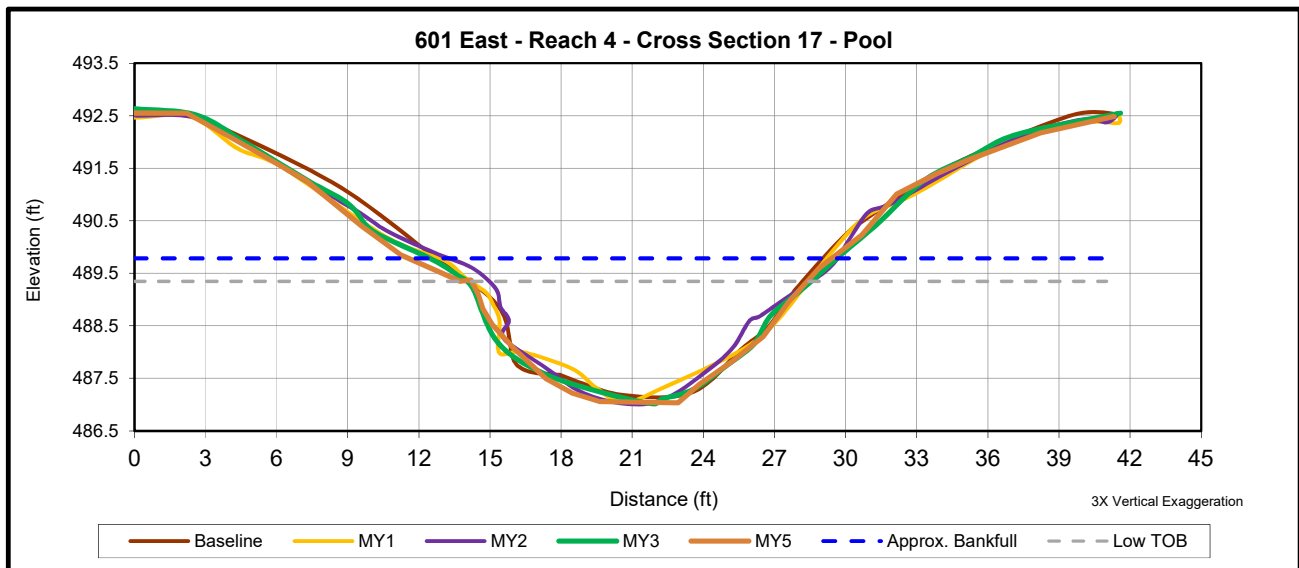




Upstream



Downstream



DIMENSIONS SUMMARY	MY0	MY1	MY2	MY3	MY4	MY5	MY6	MY7
Bankfull Width (ft) <sup>1</sup>	16.9	17.2	17.2	18.1	-	N/A	-	-
Floodprone Width (ft) <sup>1</sup>	42.0	42.0	42.0	42.0	-	N/A	-	-
Bankfull Mean Depth (ft)	1.8	1.7	1.7	1.7	-	---	-	-
Bankfull Max Depth (ft) <sup>2</sup>	2.7	2.9	2.9	2.9	-	2.3	-	-
Bankfull Cross-Sectional Area (ft <sup>2</sup> ) <sup>2</sup>	29.8	29.1	28.7	31.3	-	22.8	-	-
Width/Depth Ratio	9.6	10.2	10.3	10.4	-	---	-	-
Entrenchment Ratio <sup>1</sup>	2.5	2.4	2.4	N/A	-	N/A	-	-
Bank Height Ratio <sup>1</sup>	1.2	1.1	1.1	N/A	-	N/A	-	-

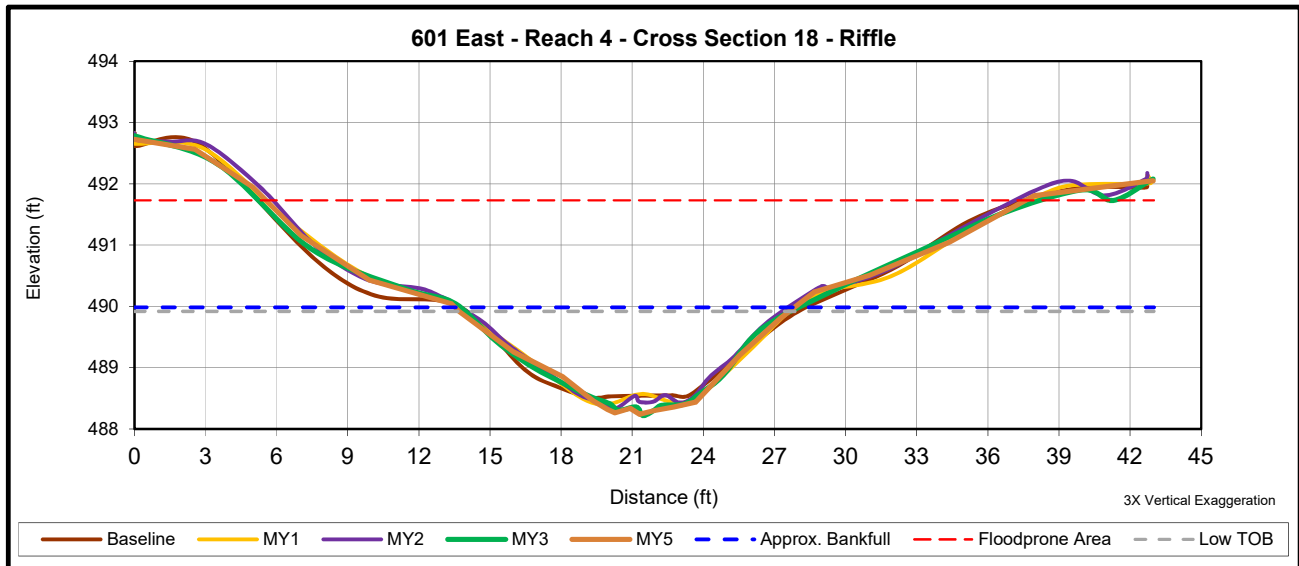
**Note:** Starting in MY5, the parameters denoted with <sup>1</sup> were calculated using the as-built cross sectional area as the basis for adjusting the bankfull elevation and the parameters denoted with <sup>2</sup> were calculated using the current years low top of bank as the bankfull elevation. These changes reflect the 2018 guidance that arose from the mitigation technical workgroup consisting of DMS, the IRT, and industry mitigation providers.



Upstream



Downstream



DIMENSIONS SUMMARY	MY0	MY1	MY2	MY3	MY4	MY5	MY6	MY7
Bankfull Width (ft) <sup>1</sup>	14.9	14.6	14.1	14.6	-	14.3	-	-
Floodprone Width (ft) <sup>1</sup>	30.4	31.0	31.0	31.0	-	>32.1	-	-
Bankfull Mean Depth (ft)	1.0	1.0	1.0	1.0	-	---	-	-
Bankfull Max Depth (ft) <sup>2</sup>	1.5	1.6	1.7	1.8	-	1.7	-	-
Bankfull Cross-Sectional Area (ft <sup>2</sup> ) <sup>2</sup>	14.7	14.5	14.0	15.0	-	13.7	-	-
Width/Depth Ratio	15.2	14.6	14.2	14.3	-	---	-	-
Entrenchment Ratio <sup>1</sup>	2.1	2.1	2.2	2.1	-	>2.2	-	-
Bank Height Ratio <sup>1</sup>	1.0	1.0	1.0	0.8	-	1.0	-	-

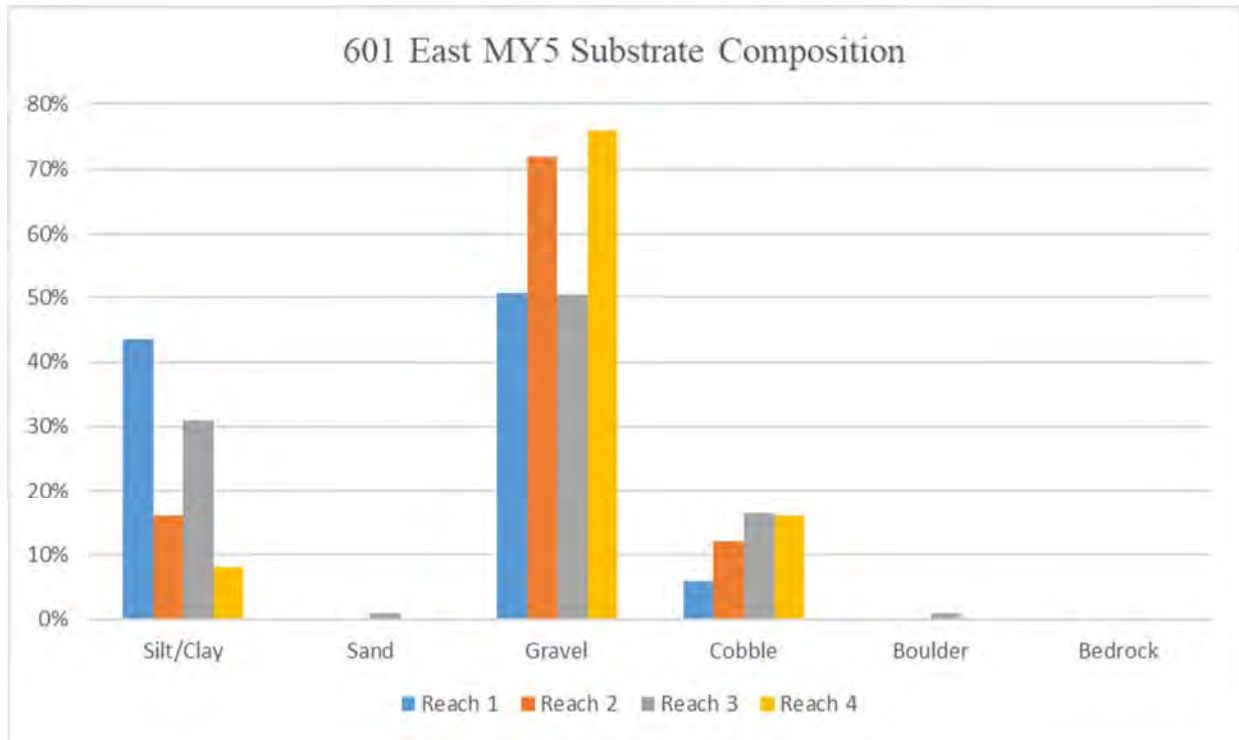
**Note:** Starting in MY5, the parameters denoted with <sup>1</sup> were calculated using the as-built cross sectional area as the basis for adjusting the bankfull elevation and the parameters denoted with <sup>2</sup> were calculated using the current years low top of bank as the bankfull elevation. These changes reflect the 2018 guidance that arose from the mitigation technical workgroup consisting of DMS, the IRT, and industry mitigation providers.

**Table 12. Pebble County Data Summary**

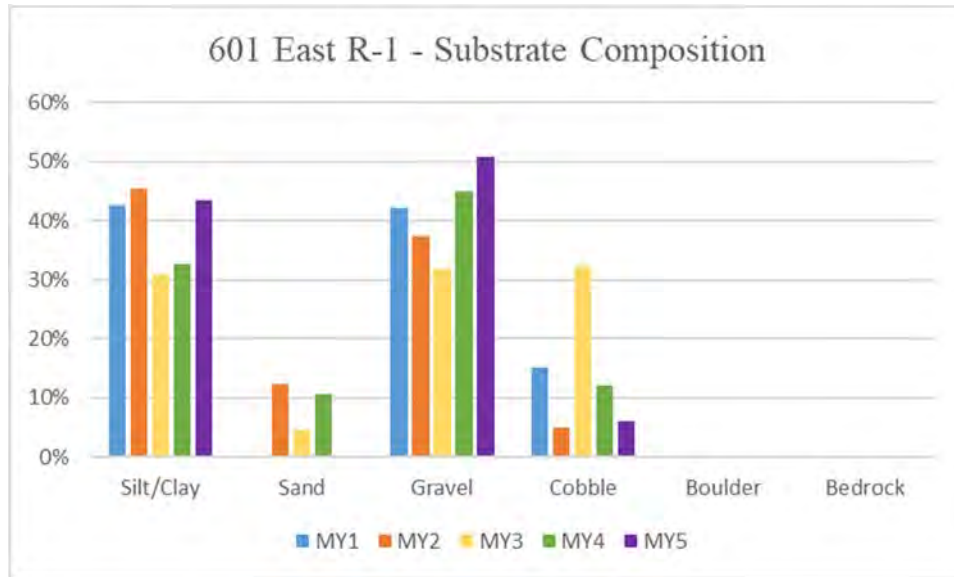
Table 12. Pebble Count Data Summary 601 East														
Stream Reach	MY1 - 2015		MY2 - 2016		MY3 - 2017		MY4 - 2018		MY5 - 2019		MY6 - 2020		MY7 - 2021	
	Pebble Count		Pebble Count		Pebble Count		Pebble Count		Pebble Count		Pebble Count		Pebble Count	
	D <sub>50</sub> (mm)	D <sub>84</sub> (mm)	D <sub>50</sub> (mm)	D <sub>84</sub> (mm)	D <sub>50</sub> (mm)	D <sub>84</sub> (mm)	D <sub>50</sub> (mm)	D <sub>84</sub> (mm)	D <sub>50</sub> (mm)	D <sub>84</sub> (mm)	D <sub>50</sub> (mm)	D <sub>84</sub> (mm)	D <sub>50</sub> (mm)	D <sub>84</sub> (mm)
Reach 1	14.1	48.8	4.9	25.6	25.5	87.3	4.8	48.3	12.0	28.8				
Reach 2	0.062	61	2.9	34.1	9.7	20	5.5	30.9	16.0	58.0				
Reach 3	27	79.5	6.2	39.5	73.5	140	26.5	72.0	9.7	70.5				
Reach 4	47	110	4.2	66	12	95	12.0	95.0	17.0	63.0				

**Charts 1-5. MY5 Stream Reach Substrate Composition Charts**

**Chart 1.**



**Chart 2.**



**Chart 3.**

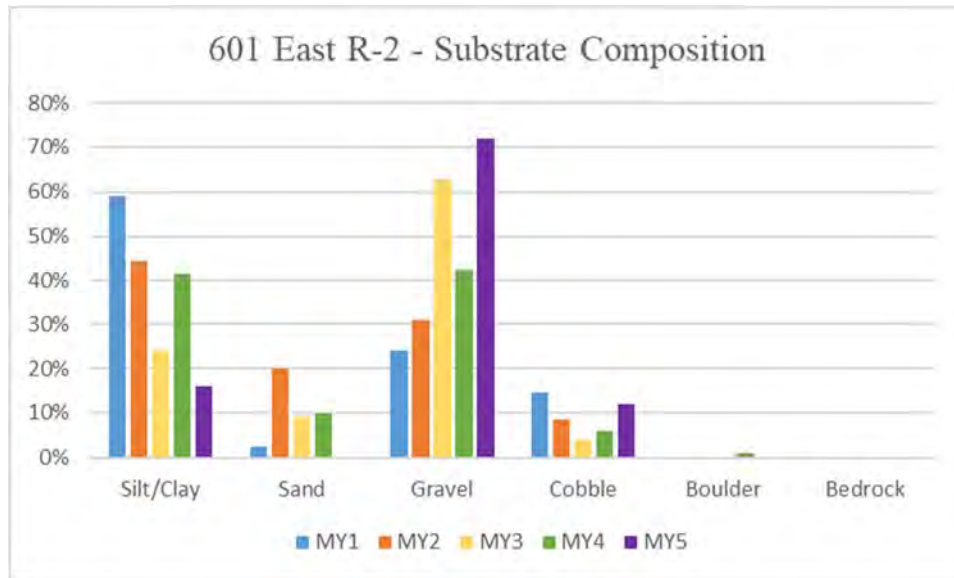


Chart 4.

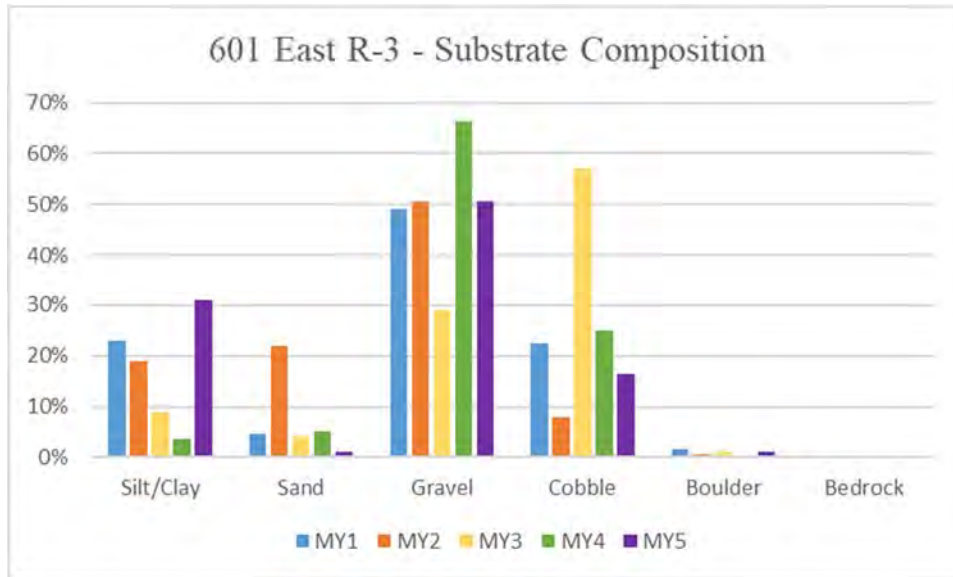
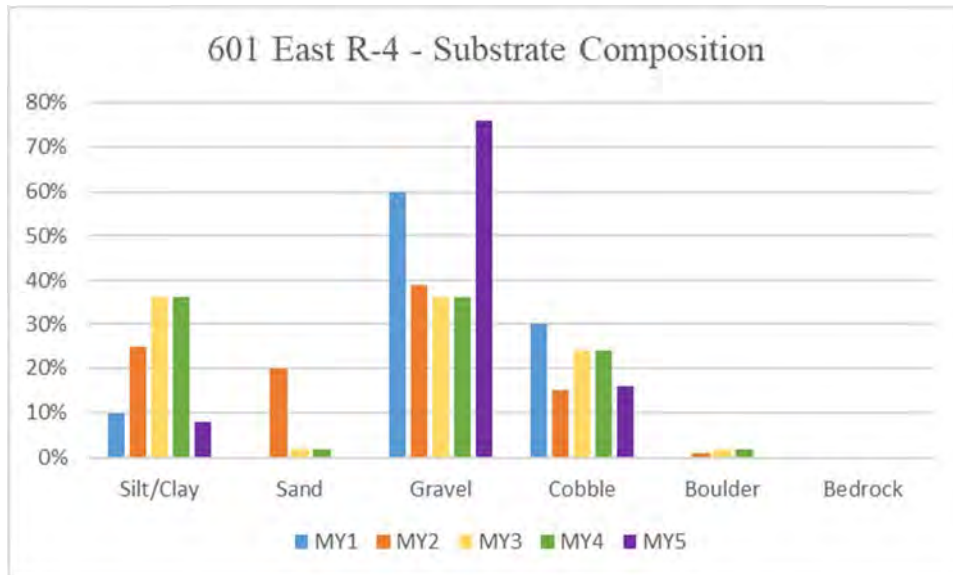


Chart 5.



<b>Table 13. Bank Pin Array Summary 601 E Stream Mitigattion Site</b>						
<b>Bank Pin Location</b>	<b>Position</b>	<b>Year 1 Reading (mm)</b>	<b>Year 2 Reading (mm)</b>	<b>Year 3 Reading (mm)</b>	<b>Year 4 Reading (mm)</b>	<b>Year 5 Reading (mm)</b>
XS-1	Upstream	0.0	35.6	0.0	0.0	0.0
	At Cross-Section	0.0	0.0	0.0	0.0	0.0
	Downstream	0.0	0.0	0.0	0.0	0.0
XS-3	Upstream	0.0	0.0	0.0	0.0	0.0
	At Cross-Section	0.0	0.0	0.0	0.0	0.0
	Downstream	0.0	0.0	0.0	0.0	0.0
XS-5	Upstream	0.0	0.0	0.0	0.0	0.0
	At Cross-Section	0.0	0.0	0.0	0.0	0.0
	Downstream	0.0	0.0	0.0	0.0	0.0
XS-7	Upstream	0.0	0.0	0.0	0.0	0.0
	At Cross-Section	0.0	0.0	0.0	0.0	0.0
	Downstream	12.7	0.0	0.0	0.0	0.0
XS-10	Upstream	0.0	0.0	0.0	0.0	0.0
	At Cross-Section	0.0	0.0	0.0	0.0	0.0
	Downstream	0.0	0.0	0.0	0.0	0.0
XS-12	Upstream	0.0	0.0	0.0	0.0	0.0
	At Cross-Section	0.0	0.0	0.0	0.0	0.0
	Downstream	0.0	0.0	0.0	0.0	0.0
XS-14	Upstream	0.0	0.0	0.0	0.0	0.0
	At Cross-Section	0.0	0.0	0.0	0.0	0.0
	Downstream	0.0	0.0	0.0	0.0	0.0
XS-15	Upstream	0.0	0.0	0.0	0.0	0.0
	At Cross-Section	0.0	0.0	0.0	0.0	0.0
	Downstream	0.0	0.0	0.0	0.0	0.0
XS-17	Upstream	0.0	0.0	50.8*	0.0	0.0
	At Cross-Section	0.0	0.0	0.0	0.0	0.0
	Downstream	0.0	0.0	177.8*	0.0	0.0

\*A beaver dam directly downstream caused unusually high water and localized bank erosion.

# **Appendix E**

## **Hydrology Data**

Table 14. Verification of Bankfull Events

Table 15. 2019 Rainfall Summary

Figure 7. Photo Verification of Bankfull Events

**Table 14. Verification of Bankfull Events**

Date of Data Collection	Estimated Date of Occurrence	Method	Maximum Bankfull Height (ft)	Photo #
<b>Reach 2</b>				
11/1/2015	9/30/2015	Wrack Lines	Unknown	---
3/1/2016	2/16/2016	Crest Gauge	1.4	MY2
4/25/2017	4/24/2017	Crest Gauge	2.5	MY3
7/19/2017	6/20/2017	Crest Gauge	1.3	---
10/17/2017	9/12/2017	Crest Gauge	0.7	---
11/7/2018	9/16/2018	Wrack Lines	0.66	MY5
<b>Reach 3</b>				
3/1/2016	Unknown	Crest Gauge	0.2	MY2
4/25/2017	4/24/2017	Crest Gauge	0.3	---
7/19/2017	6/20/2017	Crest Gauge	1.4	MY3
10/17/2017	9/12/2017	Crest Gauge	0.9	---
11/7/2018	9/16/2018	Wrack Lines	0.79	MY5

**Note:** No bankfull events were recorded in MY5 2019 due to ant infestations in the crest gauges.

**Table 15. Rainfall Summary**

Month	Average	Normal Limits		Monroe Station Precipitation
		30 Percent	70 Percent	
Jan	3.90	2.68	4.65	4.59
Feb	3.29	2.45	3.85	3.70
Mar	4.22	3.02	4.98	3.94
Apr	3.29	2.01	3.98	4.84
May	3.25	1.99	3.93	3.41
Jun	4.66	2.84	5.65	4.14
Jul	4.34	2.83	5.21	1.87
Aug	4.76	3.00	5.75	6.45
Sep	4.46	2.4	5.44	0.66
Oct	3.88	1.89	4.66	3.33
Nov	3.38	1.86	4.12	0.35
Dec	3.60	2.58	4.25	---
<b>Total</b>	47.03	29.55	56.47	37.28



**Figure 7. Photo Verification of Bankfull Events**

N/A