Annual Monitoring Report

Monitoring Year 6 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: November 2020
Date Submitted: January 2021

Submitted to:

North Carolina Division of Mitigation Services

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January 12, 2021

Paul Wiesner
NC DEQ Division of Mitigation Services
5 Ravenscroft Drive, Suite 102
Asheville, NC 28801

RE: 601 East Stream Restoration Site: MY5 Monitoring Report (NCDMS ID 95756)

Listed below are comments provided by DMS on December 17, 2020 regarding the 601 East Stream Restoration Site: Year 6 Monitoring Report and RES' responses.

General/ Report Text (Section 1.4 Project Performance): As noted in the 6/11/2020 IRT site visit meeting minutes in Appendix F; "*The IRT also observed missing easement signage and small areas of easement scalloping/encroachment. RES agreed to repair any easement scalloping/encroachment and agreed to ensure all required easement marking and signage are updated and present by the end of MY6 (2020) monitoring.*" In the report text, please briefly discuss how the encroachment observed during the June 2020 IRT site visit was addressed in MY6 (2020). Please also discuss easement marking and signage repair and updates that were conducted in MY6 (2020) as requested by the IRT. Lastly, please discuss any unresolved easement encroachment (if any) observed during the November 2020 RES site assessment.
In January 2021, RES inspected the entire easement boundary and replaced all missing easement signage. This was added to Section 1.4.1.

Section 1.4.1 Vegetation: This section notes that one area of encroachment was observed and repaired in June 2020. This area is also shown on the CCPV map/s. Please briefly discuss how this encroachment was addressed/ repaired. Was additional permanent marking and/ or signage added to the area to avoid future encroachment? Please also indicate when this area was replanted and approximately how many plants (include species) were installed.
The encroachment repair included installing t-posts, horse tape, and easement signage along the easement boundary as well as planting 60 three-gallon container trees. The planting was done in June 2020 and species included sycamore, river birch, and willow oak. This has been added to Section 1.4.1.

Section 1.4.2 Stream Geomorphology: The report text and CCPV maps indicate that two (2) beaver dams were removed in June 2020 and two (2) beaver dams were removed in November 2020. Beaver have been a persistent issue on the site. Were beaver also trapped as part of the dam removal efforts? Please update the text accordingly.

In the report text, please also report how often the project site is inspected for beaver/ beaver dams. DMS recommends removing beaver and beaver dams as soon as possible to avoid potential irregular monitoring data, project damage and additional project maintenance.
The beaver dams were no longer active therefore beavers were not trapped in 2020. RES inspects sites quarterly and will perform beaver management (dam removal and trapping) as necessary throughout the remainder of the monitoring period. This was added to Section 1.4.2.

Table 5 - Vegetation Condition Assessment & Table 6 – Visual Stream Morphology Stability Assessment: Please confirm that no invasive areas of concern or current easement encroachment areas above the mapping thresholds exist and 100% of the project streams are functioning as intended (as reported in the tables).
Confirmed.

Appendix E – Flow Gauge Graph: DMS recommends showing the start and end points of the 58 days of consecutive flow reported.
Done.

Digital Support File Comments:
Please produce features that characterize the encroachment, beaver dam, stream areas of concern, and vegetation areas of concern. Include these in the CCPV and as part of the digital submittal and ensure that these areas are reflected in the visual assessment tables (if applicable).
Done. Areas were not entered into the visual assessment tables because they have been repaired.

Please include photos from photo stations as JPEGs.
Done.

Note that the data in the flow gauge figure is not plotted correctly in excel. Use the scatter plot (x,y) chart type, then add a line, rather than selecting the line chart type.
The line chart type has been changed to the scatter plot chart type.

Prepared by:

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Raleigh, North Carolina 27605

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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
Reach A	Buffer Establishment	215	5:1	43	43
Reach 1a	P1 Restoration	350	1:1	350	350
Reach 1b	Enhancement I	85	1.5:1	56	57
Reach 1c	Enhancement I	155	1.5:1	103	103
Reach 1d	P1 Restoration	800	1:1	800	803
Reach 2a	Enhancement I	40	1.5:1	26	30
Reach 2b	Enhancement I	120	1.5:1	80	85
Reach 2c	P1 Restoration	724	1:1	724	730
Reach 3a	P1 Restoration	368	1:1	368	369
Reach 3b	P1 Restoration	650	1:1	650	649
Reach 3c	P3 Restoration	480	1:1	480	495
	Total	**3,987**		**3,680**	**3,714**

*P1=Priority 1, P3=Priority 3

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

1.4. Project Performance

Monitoring Year 6 (MY6) data was collected in November 2020. Year 6 monitoring activities included visual assessment of all reaches and the surrounding easement and 20 permanent photo stations. Per the approved Mitigation Plan, cross section and vegetation monitoring was not collected in MY6, however MY5 data is presented below and in the appendices for reference.

On June 1, 2020, RES, DMS, and IRT had a site visit. The main topics of discussion were the potential flow issues, beaver dams, and encroachment. Details regarding this site visit can be found in **Appendix F**.

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. One area of encroachment was observed and repaired in June 2020. The encroachment repair included installing t-posts, horse tape, and easement signage along the easement boundary as well as planting 60 three-gallon container trees. The planting was done in June 2020 and species included sycamore, river birch, and willow oak. In January 2021, RES inspected the entire easement boundary and replaced all missing easement signage. Invasive species including Chinese privet and parrotfeather were treated in August 2020. 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 permanent vegetation plots was not performed in MY6 per the approved Mitigation Plan. MY5 vegetation monitoring data is included in this report for reference. 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 was addressed by stabilizing the headcut with rock and adding coir logs along the feature. RES also removed remnant beaver dam on Reach 2 in June 2020 and on Reach 3 and 4 in November 2020. The beaver dams were no longer active therefore beavers were not trapped in 2020. RES inspects sites quarterly and will perform beaver management (dam removal and trapping) as necessary throughout the remainder of the monitoring period.

Geomorphic data collection was not performed in MY6 per the approved Mitigation Plan. MY5 geomorphic monitoring data is included in this report for reference. 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

As of December 2020, 11 bankfull events have been recorded on Reach 2 and 13 on Reach 3. In MY5, both crest gauges failed due to ant infestations. In MY6, HOBOs were installed and used in place of cork gauges. Project site precipitation data can be found in **Table 15**. A flow gauge was installed on April 30, 2020 and moved on June 3, 2020 upstream on Reach 1 per IRT request. The flow gauge recorded 58 days of consecutive flow and 113 total days of flow in MY6. 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. In MY6, RES replaced the cork-line crest gauges with HOBO stage recorde

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
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	E1	85	1 :1.5	56.7
Reach 1c Perennial	11+95 – 13+50	136	Enhancement	E1	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	E1	40	1 : 1.5	26.7
Reach 2b Perennial	22+80 - 24+00	125	Enhancement	E1	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.

Table 2. Project Activity and Reporting History 601 East Stream Restoration Site		
Activity or Deliverable	**Data Collection Complete**	**Completion or Delivery**
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
Beaver Dam Removal, Encroachment Repair, Erosional Rill Repair	-	June 2020
Invasive Treatment and Beaver Dam Removal	-	Nov 2020
Year 6 Monitoring	Nov 2020	Dec 2020
Year 7 Monitoring		

Table 3. Project Contact Table 601 East Stream Restoration Site	
Designer Primary project design POC	Ward Consulting Engineers, P.C. (WCE) 4805 Green Road, Suite 100, Raleigh, NC 27616 Becky Ward (919) 870-0526
Construction Contractor Construction contractor POC	Wright Contracting P.O. Box 545, Siler City, NC 27344 Joseph Wright (919) 663-0810
Planting Contractor Planting contractor POC	H & J Forest Services 1416 Ocean Boulevard, Holly Ridge, NC 28445 (910) 512-6754
Construction Survey Contractor Survey contractor POC	Turner Land Survey, PLLC 3719 Benson Drive, Raleigh, NC 27629 Elizabeth Turner (919) 827-0745
Seeding Contractor Construction contractor POC	Wright Contracting P.O. Box 545, Siler City, NC 27344 Andrew Dimmette (919) 663-0810
Seed Mix Sources	Green Resource - Raleigh, NC As Purchased by EBX (919) 829-9909 x 213
Nursery Stock Suppliers	Arbor Gen - Blenheim, SC (800) 222-1290
	NC Forest Service Nursery - Goldsboro, NC (888) 628-7337
[Baseline] Monitoring Performers	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 Environemntal Solutions (RES) 3600 Glenwood Ave, Suite 100 Raleigh, NC 27610
Stream Monitoring POC	Ryan Medric (919) 741-6268
Vegetation Monitoring POC	Ryan Medric (919) 741-6268

Table 4. Project Baseline Information and Attributes 601 East Stream Restoration Site				
Project Information				
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			
Project Watershed Summary Information				
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			
Reach Summary Information				
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 Perrenial: 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

Table 4 con't. Project Baseline Information and Attributes 601 East Stream Restoration Site			
Wetland Summary Information			
Parameters	**Wetland 1**		
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	**Herbaceous-**Vegetation is domninated by herbaceous vegetation such as Cattail (*Typha latifolia*), Bulrush (*Scirpus cyperinus*), Common Rush (*Juncus effuses*). Some tree species such as Black Willow (*Salix nigra*), and Red Maple (*Acer rubrum*) are present in the wetland margins.		
Percent composition of exotic invasive vegetation	**95%** -The invasive Parrot Feather (*Miriophyllum aquaticum*) is dominant throughout the wetland where there is standing water.		
Regulatory Considerations			
Regulation	**Applicable?**	**Resolved?**	**Supporting Documentation**
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 loacted 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 bounday and therefore access to the general public is not permitted. Access by authorized personel of state and federal agencies or their designee/contractors involved in the the development, oversight, and stweardship 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 sactioned roles and activities requires prior coordination with NCDMS.

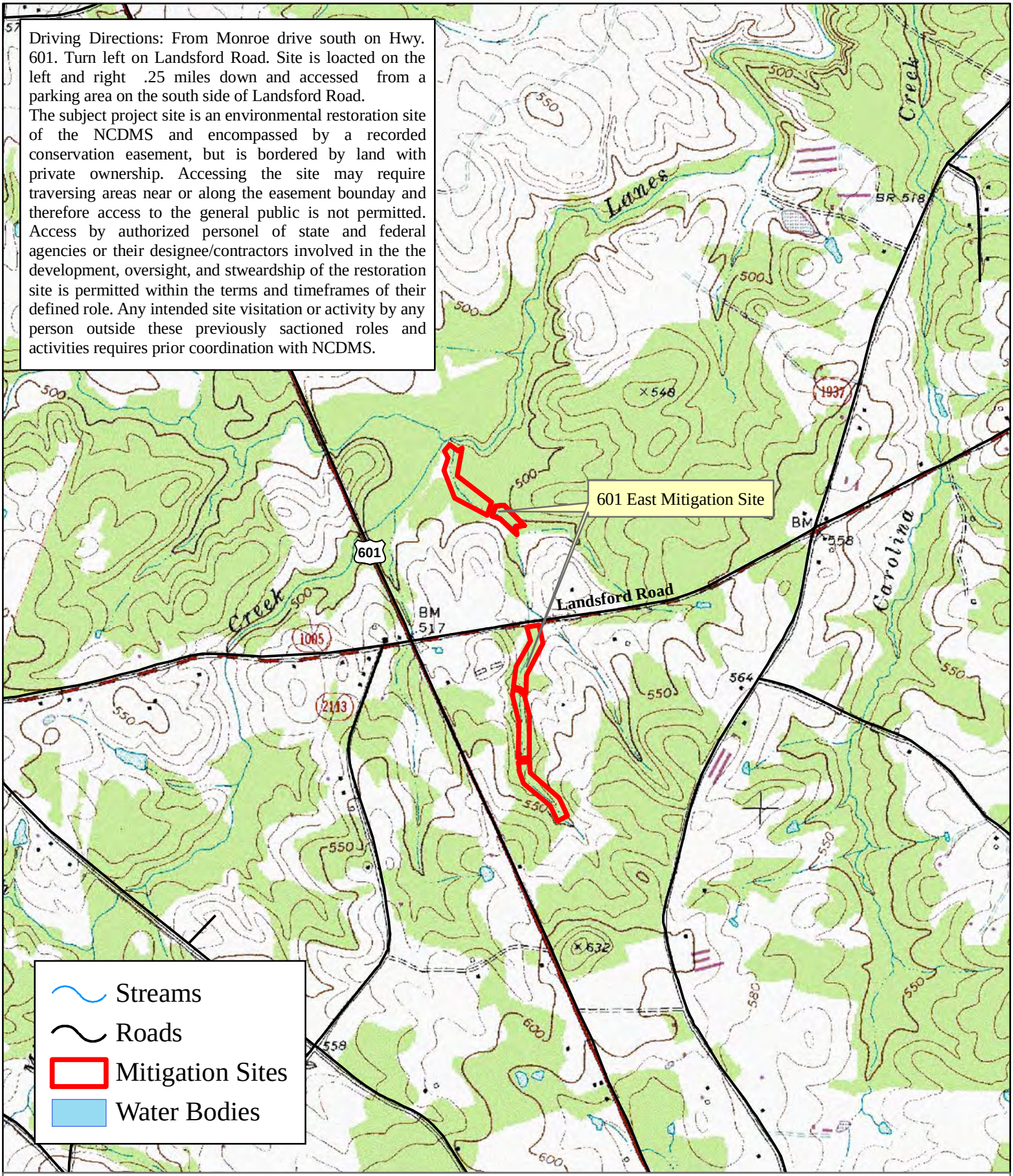
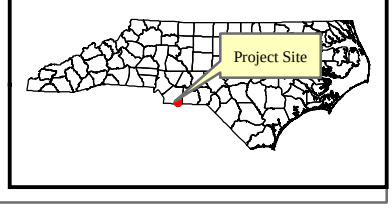


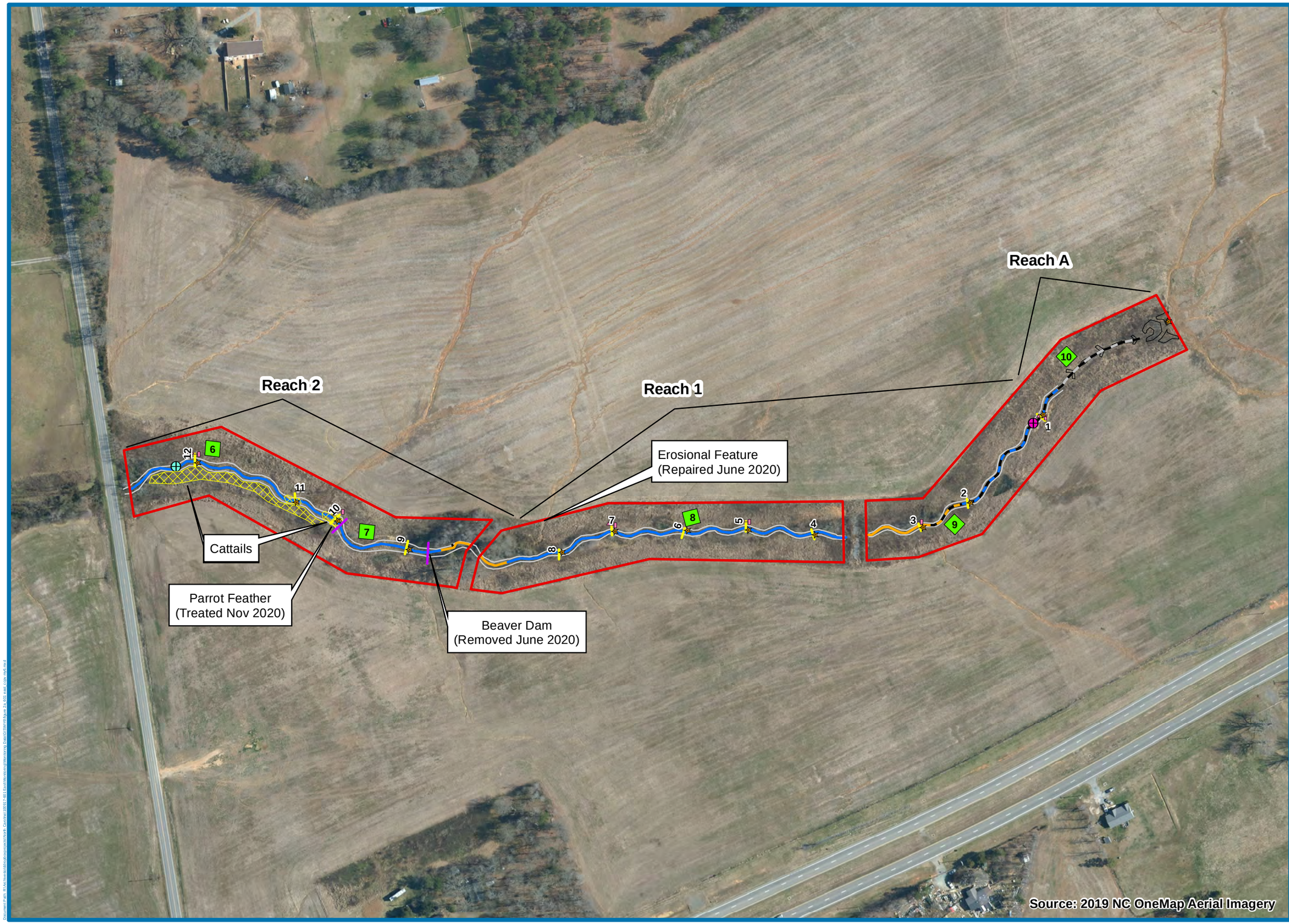
Figure 1
601 East Mitigation Site
Project Vicinity Map



0 0.25 0.5 1 Miles

Appendix B

Visual Assessment Data



res

N E S W

0 100 200

Feet

1 inch = 200 feet

Figure 2a

601 East Stream Restoration Project MY6 2020

Current Conditions Plan View

Date: 1/12/2021	Drawn by: RTM

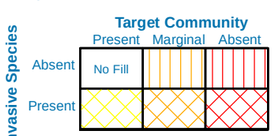
LEGEND

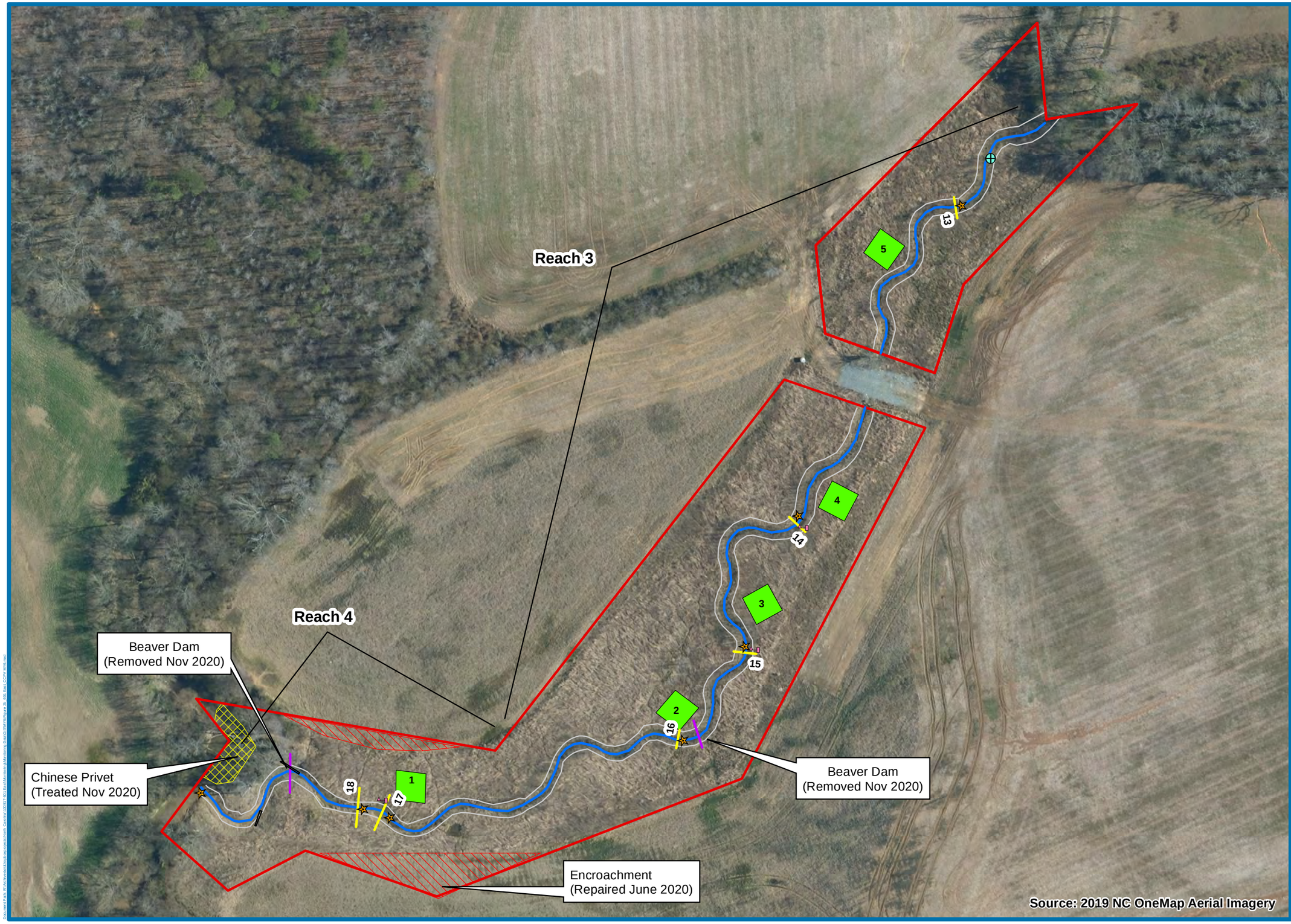
- Conservation Easement
- Vegetation Plot
- Structure

Stream Treatment

- BMP (Ephemeral)
- Restoration (Intermittent)
- EI (Intermittent)
- Restoration (Perennial)
- EI (Perennial)
- Cross Section
- Structure
- Top of Bank
- Beaver Dam
- Bankpin Array
- Photo Station
- Stage Recorder
- Flow Gauge

Vegetation Condition Assessment





res

N E S W

0 50 100

Feet

1 inch = 100 feet

Figure 2b

601 East Stream Restoration Project MY6 2020

Current Conditions Plan View

Date: 1/12/2021	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
- Bankpin Array
- Photo Station
- Stage Recorder
- Flow Gauge

Vegetation Condition Assessment

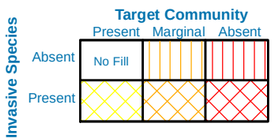


Table 5. Vegetation Condition Assessment
601 East Stream Restoration Site
Planted Acreage 12.8
Easement Acreage 12.8

Vegetation Category	Definitions	CCPV Depiction	Number of Polygons	Combined Acreage	% of Planted Acreage
1. Bare Areas	Very limited cover of both woody and herbaceous material.	Red Simple Hatch	0	0.00	0%
2. Low Stem Density Areas	Woody stem densities clearly below target levels based on MY3, 4, or 5 stem count criteria.	Orange Simple Hatch	0	0.00	0%
		Totals	0	0.00	0%
3. Areas of Poor Growth Rates or Vigor	Areas with woody stems of a size class that are obviously small given the monitoring year.	Orange Simple Hatch	0	0.00	0%
		Cumulative Totals	0	0.00	0%

Vegetation Category	Definitions	CCPV Depiction	Number of Polygons	Combined Acreage	% of Easement Acreage
4. Invasive Areas of Concern	Areas or points (if too small to render as polygons at map scale).	Yellow Crosshatch	0	0.00	0%
5. Easement Encroachment Areas	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. Aggradation - Bar formation/growth sufficient to significantly deflect flow laterally (not to include point bars).			0	0	100%			
		2. Degradation - Evidence of downcutting.			0	0	100%			
	2. Riffle Condition	1. Texture/Substrate - Riffle maintains coarser substrate.	32	32			100%			
	3. Meander Pool Condition	1. Depth Sufficient (Max Pool Depth : Mean Bankfull Depth≥ 1.6).	33	33			100%			
		2. Length appropriate (>30% of centerline distance between tail of upstream riffle and head of downstream riffle).	33	33			100%			
	4. Thalweg Position	1. Thalweg centering at upstream of meander bend (Run).	33	33			100%			
		2. Thalweg centering at downstream of meander bend (Glide).	33	33			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 NOT 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
				Totals	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 doesNOT 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 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. Aggradation - Bar formation/growth sufficient to significantly deflect flow laterally (not to include point bars).			0	0	100%			
		2. Degradation - Evidence of downcutting.			0	0	100%			
	2. Riffle Condition	1. Texture/Substrate - Riffle maintains coarser substrate.	16	16			100%			
	3. Meander Pool Condition	1. Depth Sufficient (Max Pool Depth : Mean Bankfull Depth≥ 1.6).	17	17			100%			
		2. Length 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 NOT 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
				Totals	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 doesNOT 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. Aggradation - Bar formation/growth sufficient to significantly deflect flow laterally (not to include point bars).			0	0	100%			
		2. Degradation - Evidence of downcutting.			0	0	100%			
	2. Riffle Condition	1. Texture/Substrate - Riffle maintains coarser substrate.	18	18			100%			
	3. Meander Pool Condition	1. Depth Sufficient (Max Pool Depth : Mean Bankfull Depth≥ 1.6).	18	18			100%			
		2. Length 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 NOT 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
				Totals	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 doesNOT 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. Aggradation - Bar formation/growth sufficient to significantly deflect flow laterally (not to include point bars).			0	0	100%			
		2. Degradation - Evidence of downcutting.			0	0	100%			
	2. Riffle Condition	1. Texture/Substrate - Riffle maintains coarser substrate.	9	9			100%			
	3. Meander Pool Condition	1. Depth Sufficient (Max Pool Depth : Mean Bankfull Depth≥ 1.6).	9	9			100%			
		2. Length appropriate (>30% of centerline distance between tail of upstream riffle and head of downstream riffle).	9	9			100%			
	4. Thalweg Position	1. Thalweg centering at upstream of meander bend (Run).	9	9			100%			
		2. Thalweg centering at downstream of meander bend (Glide).	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 NOT 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
				Totals	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 doesNOT 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. 2020 Photo Station Photos

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

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

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 Upstream

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

Appendix C

Vegetation Plot Data

(MY5 2019)

Table 7. MY5 Vegetation Plot Criteria Attainment

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

Table 8. CVS Vegetation Plot Metadata

Table 8: CVS Vegetation Plot Metadata 601 East Stream and Wetland Restoration Site	
Report Prepared By	Ryan Medric
Date Prepared	10/21/2019 15:14
database name	RES-MY5_2019-601East.mdb
database location	C:\Users\rmedric\Dropbox (RES)\@RES Projects\North Carolina\601 East\Monitoring\Monitoring Data\MY5_2019\Vegetation Data
computer name	D4V0KGH2
file size	48533504
DESCRIPTION OF WORKSHEETS IN THIS DOCUMENT	
Metadata	Description of database file, the report worksheets, and a summary of project(s) and project data.
Proj, planted	Each project is listed with its PLANTED stems per acre, for each year. This excludes live stakes.
Proj, total stems	Each project is listed with its TOTAL stems per acre, for each year. This includes live stakes, all planted stems, and all natural/volunteer stems.
Plots	List of plots surveyed with location and summary data (live stems, dead stems, missing, etc.).
Vigor	Frequency distribution of vigor classes for stems for all plots.
Vigor by Spp	Frequency distribution of vigor classes listed by species.
Damage	List of most frequent damage classes with number of occurrences and percent of total stems impacted by each.
Damage by Spp	Damage values tallied by type for each species.
Damage by Plot	Damage values tallied by type for each plot.
Planted Stems by Plot and Spp	A matrix of the count of PLANTED living stems of each species for each plot; dead and missing stems are excluded.
ALL Stems by Plot and spp	A matrix of the count of total living stems of each species (planted and natural volunteers combined) for each plot; dead and missing stems are excluded.
PROJECT SUMMARY	
Project Code	95756
project Name	601 East
Description	
River Basin	Yadkin-Pee Dee
length(ft)	
stream-to-edge width (ft)	
area (sq m)	
Required Plots (calculated)	
Sampled Plots	10

Table 9. Total Planted Stem Counts

601 East			Current Plot Data (MY5 2019)																												
			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		
Scientific Name	Common Name	Species Type	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T
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. canad	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.	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. oc	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. deltc	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				2	2	2
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. copalli	flameleaf sumac	shrub																													
Salix nigra	black willow	Tree								6	6																1	1	2			
Ulmus alata	winged elm	Tree																					1									
Ulmus americana	American elm	Tree																													
Ulmus rubra	slippery elm	Tree																													
		Stem count	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
		size (ares)	1			1			1			1			1			1			1			1			1			1		
		size (ACRES)	0.02			0.02			0.02			0.02			0.02			0.02			0.02			0.02			0.02			0.02		
		Species count	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
		Stems per ACRE	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														
			MY5 (2019)			MY3 (2017)			MY2 (2016)			MY1 (2015)			MY0 (2015)		
Scientific Name	Common Name	Species Type	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T
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. canad	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.	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. oc	Sycamore	Tree	55	55	55	55	55	59	59	59	59	47	47	47	58	58	58
Populus deltoides var. delto	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. copalli	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						
Stem count			150	157	216	157	164	243	178	184	263	116	123	123	200	207	207
size (ares)			10			10			10			10					
size (ACRES)			0.25			0.25			0.25			0.25			0.25		
Species count			10	11	18	11	11	17	15	15	19	13	14	14	11	11	11
Stems per ACRE			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
(MY5 2019)

Table 10. Baseline Stream Data Sumary

Table 10. Baseline Stream Data Summary
601 East Stream Restoration Site - Reach 1 (1,393 feet)

Parameter	Gauge	Regional Curve			Pre- Existing Conditions						Reference Reach(es) Data						Design			As-built / Baseline					
Dimension and Substrate - Riffle		LL	UL	Eq.	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n	Min	Med	Max	Min	Mean	Med	Max	SD	n
Bankfull Width (ft)					7	21		60			7.42	9.88		11.61				10		8.82	11.45	10.77	15.13	2.23	8
Floodprone Width (ft)					8	60		101			18.51	26.43		33.59			22	28	35	40.00	74.38	69.00	154.00	35.32	8
Bankfull Mean Depth (ft)					0.2	0.5		0.9			0.68	0.79		0.97				0.72		0.50	0.81	0.77	1.20	0.26	8
Bankfull Max Depth (ft)					0.7	1		1.4			1.28	1.78		2.16				1.2		0.87	1.53	1.54	2.07	0.49	8
Bankfull Cross Sectional Area (ft^2)					8	1		1.4			0.97	1.39		1.82				7.2		4.45	9.27	8.85	14.07	3.48	8
Width/Depth Ratio					1.1	27		47			8.14	12.95		16.82				13.9		8.56	15.45	14.89	25.33	5.40	8
Entrenchment Ratio					0.4	2.4		9.5			2.02	2.4		3.24			2.2	2.8	3.5	3.30	6.90	5.62	16.40	4.19	8
Bank Height Ratio						0.34		2			0.97	1.39		1.82				1		0.93	0.98	1.00	1.00	0.03	8
d50 (mm)																									
Profile																									
Riffle Length (ft)					2.7	24.9		107.3			5.97	11.26		26.78			14	23	90	10.04	22.09	18.54	95.26	14.52	32
Riffle Slope (ft/ft)					0.0007	1.7		40			0.015	0.031		0.05			0.021	0.036	0.046	0.015	0.034	0.032	0.064	0.012	32
Pool Length (ft)					9.03	16.89		56.86			13.6	20.13		31.74			14	22	29	13.38	24.28	21.23	65.67	11.47	33
Pool Max depth (ft)					1	2.4		3.9			1.4	1.83		2.2				2.2		1.16	2.19	2.17	3.15	0.38	33
Pool Spacing (ft)					15.5	50		128			23.5	36.2		57.4			24	36.7	58	31.42	44.63	40.18	116.51	16.87	32
Pool Volume (ft^3)																									
Pattern																									
Channel Beltwidth (ft)					10	19.6		25			13	17.33		20			13	18	21	13		18	21		
Radius of Curvature (ft)					14.5	84		118			16	33		53			16	32.1	52	16		32.1	52		
Rc: Bankfull width (ft/ft)					1.7	4.6		11.5			4.35	6.04		8.9			4.3	6.1	8.9	4.3		6.1	8.9		
Meander Wavelength (ft)					36	96		240			43	59.67		88			43	61	89	43		61	89		
Meander Width Ratio					0.5	0.94		1.7			1.32	1.76		2.03			1.3	1.8	2.1	1.3		1.8	2.1		
Substrate, bed and transport parameters																									
Ri%/Ru%/P%/G%/S%					45.5%		53.6%		0.0%		26.8%	17.2%	47.9%	8.1%	0.0%					44.3%		55.7%		0.0%	
SC%/Sa%/G%/C%/B%/Be%					4.1%	27.3%	67.6%	1.0%	0.0%	0.0%															
d16/d35/d50/d84/d95/di^p/di^{sp} (mm)					2.71	6.72	10.56	24.89	38.23																
Reach Shear Stress (competency) lb/ft^2																									
Max part size (mm) Mobilized at bankfull																									
Stream Power (transport capacity) W/m^2																									
Additional Reach Parameters																									
Drainage Area (SM)								0.166						0.144											
Impervious cover estimate (%)																									
Rosgen Classification								G4/B4/C4b						B4/C4				B4/C4b					B4/C4b		
Bankfull Velocity (fps)								3.2										3.2							
Bankfull Discharge (cfs)								24																	
Valley length (ft)								1,425						378											
Channel Thalweg length (ft)								1,479						440				1,438					1,438		
Sinuosity (ft)								1.04						1.16				1.17					1.17		
Water Surface Slope (Channel) (ft/ft)								0.0196										0.017					0.017		
BF slope (ft/ft)																		0.017					0.017		
Bankfull Floodplain Area (acres)																									
Proportion over wide (%)																									
Entenchment Class (ER Range)																									
Incision Class (BHR Range)																									
BEHI VL%/L%/M%/H%/VH%/E%																									
Channel Stability or Habitat Metric																									
Biological or Other																									

Table 10. Baseline Stream Data Summary
601 East Stream Restoration Site - Reach 2 (902 feet)

Parameter	Gauge	Regional Curve			Pre- Existing Conditions						Reference Reach(es) Data						Design			As-built / Baseline					
Dimension and Substrate - Riffle		LL	UL	Eq.	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n	Min	Med	Max	Min	Mean	Med	Max	SD	n
Bankfull Width (ft)					7	19		21			10	12.2		14.3				12		15.50	19.73	19.63	24.18	3.56	4
Floodprone Width (ft)					40	214		60			42	77		11			48	91.5	135	62.00	108.75	102.50	168.00	50.05	4
Bankfull Mean Depth (ft)					0.5	1.33		0.5			0.92	1.12		1.34				0.9		0.61	0.93	0.90	1.31	0.32	4
Bankfull Max Depth (ft)					0.7	1.9		1			1.2	1.6		2.2				1.5		1.49	2.01	2.02	2.53	0.58	4
Bankfull Cross Sectional Area (ft^2)					6	21		1			12.2	13		13.4				10.7		9.43	18.42	19.49	25.26	6.75	4
Width/Depth Ratio					6.1	38		27			7.7	11.3		15.6				13.3		14.64	23.00	22.13	33.10	8.07	4
Entrenchment Ratio					2.2	10		2.4			2.9	6.5		8.6			3.6	7.6	10	2.56	5.63	5.79	8.39	2.54	4
Bank Height Ratio					0.9	1.7		0.34			1.1	1.5		1.7				1		0.90	0.96	0.96	1.00	0.05	4
d50 (mm)																									
Profile																									
Riffle Length (ft)					10.9	24.9		19.7			4.03	14.18		13.61			14	23	90	12.13	23.38	18.96	50.22	10.70	18
Riffle Slope (ft/ft)					0.00	1.7		0.04			0.006	0.02		0.05			0.021	0.036	0.046	0.004	0.02	0.02	0.04	0.01	17
Pool Length (ft)					11.1	16.89		525.4			18.51	32.11		58.03			14	22	29	15.06	32.87	29.14	74.26	14.68	17
Pool Max depth (ft)					1.9	2.4		4.2			1.7	2.47		3.1				2.5		1.91	2.87	2.67	4.03	0.59	17
Pool Spacing (ft)					20	50		512			29	48		84			38	57	85	32.94	55.57	47.60	110.28	20.48	17
Pool Volume (ft^3)																									
Pattern																									
Channel Beltwidth (ft)					12	32		42			25	40		65			25	40	65	25		40	65		
Radius of Curvature (ft)					68	75		77			20	31		65			38	47	58	38		47	58		
Rc: Bankfull width (ft/ft)					5.2	5.7		5.9			3.2	3.9		4.8			3.2	3.9	4.8	3.2		3.9	4.8		
Meander Wavelength (ft)					46	70		97			61	84		97			61	84	97	61		84	97		
Meander Width Ratio					0.9	2.4		3.2			2.1	3.3		5.4			2.1	3.3	5.4	2.1		3.3	5.4		
Substrate, bed and transport parameters																									
Ri%/Ru%/P%/G%/S%					12.6%		87.4%		0.0%		27.2%	3.7%	61.5%	7.6%	0%					39.5%		60.5%		0.0%	
SC%/Sa%/G%/C%/B%/Be%					0.0%	33.7%	66.3%	0.0%	0.0%	0.0%															
d16/d35/d50/d84/d95/di^p/di^{sp} (mm)					0.90	4.57	8.92	24.42	47.93																
Reach Shear Stress (competency) lb/f^2																									
Max part size (mm) Mobilized at bankfull																									
Stream Power (transport capacity) W/m^2																									
Additional Reach Parameters																									
Drainage Area (SM)								0.212						0.5											
Impervious cover estimate (%)																									
Rosgen Classification								C4/E4/DA						C4			C4/E4					C4/E4		
Bankfull Velocity (fps)								2.1									2.6								
Bankfull Discharge (cfs)								27																	
Valley length (ft)								830						378											
Channel Thalweg length (ft)								1,479						440			945					945			
Sinuosity (ft)								1.01						1.1			1.34					1.34			
Water Surface Slope (Channel) (ft/ft)																	0.0069					0.0069			
BF slope (ft/ft)																	0.0069					0.0069			
Bankfull Floodplain Area (acres)																									
Proportion over wide (%)																									
Entenchment Class (ER Range)																									
Incision Class (BHR Range)																									
BEHI VL%/L%/M%/H%/VH%/E%																									
Channel Stability or Habitat Metric																									
Biological or Other																									

Table 10. Baseline Stream Data Summary
601 East Stream RestorationSite - Reach 3 (1,018 feet)

Parameter	Gauge	Regional Curve			Pre- Existing Conditions						Reference Reach(es) Data						Design			As-built / Baseline					
Dimension and Substrate - Riffle		LL	UL	Eq.	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n	Min	Med	Max	Min	Mean	Med	Max	SD	n
Bankfull Width (ft)					65	15.7		29			10	12.2		14.3				17		15.86	17.69	17.66	19.58	1.52	4
Floodprone Width (ft)					150	200		2601.26			42	77		11			150	200	300	75.00	231.25	250.00	350.00	140.50	4
Bankfull Mean Depth (ft)					0.5	0.9		2.1			0.92	1.12		1.34				1.18		0.79	1.26	1.21	1.84	0.54	4
Bankfull Max Depth (ft)					1.28	1.7		19.4			1.2	1.6		2.2				2		1.58	2.51	2.52	3.44	1.06	4
Bankfull Cross Sectional Area (ft^2)					10.5	14.5		31			12.2	13		13.4				21		12.85	22.79	21.12	36.08	11.26	4
Width/Depth Ratio					12.8	17.5		16.5			7.7	11.3		15.6				14.4		10.62	15.88	15.27	22.36	5.98	4
Entrenchment Ratio					9.6	12.7		4			2.9	6.5		8.6			8.8	11.8	17.6	4.73	12.74	13.17	19.90	7.31	4
Bank Height Ratio					1.3	2.2		1.7			1.1	1.5		1.7				1		0.99	1.00	1.00	1.00	0.01	4
d50 (mm)																									
Profile																									
Riffle Length (ft)					0.97	10.58		23.77			4.03	14.18		13.61			15	25	103	10.12	24.10	16.77	110.25	22.07	19
Riffle Slope (ft/ft)					0	0.2		0.6			0.006	0.02		0.05			0.008	0.018	0.03	0.00	0.02	0.02	0.04	0.01	17
Pool Length (ft)					7.83	20.87		64.91			18.51	32.11		58.03			25	35	50	27.38	35.18	35.18	49.71	6.68	18
Pool Max depth (ft)					1.8	2.7		3.4			1.7	2.47		3.1				3.4		1.93	2.91	2.98	3.50	0.36	18
Pool Spacing (ft)					8	48		125			29	48		84			39	66	117	41.11	58.55	54.44	137.89	20.86	18
Pool Volume (ft^3)																									
Pattern																									
Channel Beltwidth (ft)					13	41		58			25	40		65			35	56	92	35		56	92		
Radius of Curvature (ft)					22.5	49.7		78			20	31		65			27	43	63	27		43	63		
Rc: Bankfull width (ft/ft)					1.4	3.2		4.9			3.2	3.9		4.8			1.6	2.5	3.7	1.6		2.5	3.7		
Meander Wavelength (ft)					32	57		89			61	84		97			87	119	134	87		119	134		
Meander Width Ratio					1.3	2.6		3.7			2.1	3.3		5.4			2.1	3.3	5.4	2.1		3.3	5.4		
Substrate, bed and transport parameters																									
Ri%/Ru%/P%/G%/S%					38.0%		62.0%		0.0%		27.2%	3.7%	61.5%	7.6%	0.0%					43.0%		57.0%		0.0%	
SC%/Sa%/G%/C%/B%/Be%					4.0%	51.9%	44.1%	0.0%	0.0%	0%															
d16/d35/d50/d84/d95/di^p/di^{sp} (mm)					0.8	3.5	5.4	12.8	19.6																
Reach Shear Stress (competency) lb/f^2																									
Max part size (mm) Mobilized at bankfull																									
Stream Power (transport capacity) W/m^2																									
Additional Reach Parameters																									
Drainage Area (SM)					0.52						0.5														
Impervious cover estimate (%)																									
Rosgen Classification					C4-G4						E4/C4						C4			C4					
Bankfull Velocity (fps)					3.2												3			3					
Bankfull Discharge (cfs)					55																				
Valley length (ft)																									
Channel Thalweg length (ft)																	1,064			1,064					
Sinuosity (ft)					1.05						1.2						1.2			1.2					
Water Surface Slope (Channel) (ft/ft)																	0.0056			0.0056					
BF slope (ft/ft)																	0.0056			0.0056					
Bankfull Floodplain Area (acres)																									
Proportion over wide (%)																									
Entenchment Class (ER Range)																									
Incision Class (BHR Range)																									
BEHI VL%/L%/M%/H%/VH%/E%																									
Channel Stability or Habitat Metric																									
Biological or Other																									

Table 10. Baseline Stream Data Summary
601 East Stream Restoration Site - Reach 4 (495 feet)

Parameter	Gauge	Regional Curve			Pre- Existing Conditions						Reference Reach(es) Data						Design			As-built / Baseline					
Dimension and Substrate - Riffle		LL	UL	Eq.	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n	Min	Med	Max	Min	Mean	Med	Max	SD	n
Bankfull Width (ft)					5.2	11.6		20			7.42	9.88		11.61				16		14.93	15.92	15.92	16.91	1.40	2
Floodprone Width (ft)					16	20		25			18.51	26.43		33.59			30	35	40	30.39	36.19	36.19	42.00	8.21	2
Bankfull Mean Depth (ft)					0.76	0.9		1.1			0.68	0.79		0.97				0.98		0.98	1.37	1.37	1.76	0.55	2
Bankfull Max Depth (ft)					.	1.2		1.33			1.28	1.78		2.16				1.8		1.49	2.11	2.11	2.72	0.87	2
Bankfull Cross Sectional Area (ft^2)					12.3	15		16			0.97	1.39		1.82				15.7		14.70	22.25	22.25	29.81	10.68	2
Width/Depth Ratio					7	12.9		18			8.14	12.95		16.82				16.3		9.60	12.38	12.38	15.16	3.93	2
Entrenchment Ratio					1.4	1.7		2.2			2.02	2.4		3.24			1.9	2.2	2.5	2.04	2.26	2.26	2.48	0.32	2
Bank Height Ratio					3.3	3.5		4.2			0.97	1.39		1.82				1		1.00	1.10	1.10	1.20	0.14	2
d50 (mm)																									
Profile																									
Riffle Length (ft)					0.79	10.58		23.7			5.97	11.26		26.78			15	23	103	15.84	20.829	18.18	28.96	4.77639	9
Riffle Slope (ft/ft)					0	0.02		0.06			0.015	0.031		0.05			0.021	0.036	0.03	0.018	0.0274	0.0298	0.0382	0.00676	9
Pool Length (ft)					7.83	20.7		64.91			13.6	20.13		31.74			14	22	42	30.82	35.01	35.78	38.85	3.12426	9
Pool Max depth (ft)					2	2.5		3.2			1.4	1.83		2.2				2.2		1.997	2.8154	2.753	3.392	0.39095	9
Pool Spacing (ft)					12	29		55			23.5	36.2		57.4			38	59	93	49.77	56.111	54.805	69.26	6.24406	8
[3]Pool Volume (ft^3)																									
Pattern																									
Channel Beltwidth (ft)					12	32		82			13	17.33		20			21	28	32	21		28	32		
Radius of Curvature (ft)					18	34.9		61			16	33		53			26	52	84	26		52	84		
Rc: Bankfull width (ft/ft)					1.6	3		5.3			4.35	6.04		8.9			162	3.25	5.25	162		3.25	5.25		
Meander Wavelength (ft)					30	56		113			43	59.67		88			69	97	142	69		97	142		
Meander Width Ratio					1.1	2.8		7.2			1.32	1.76		2.03			1.32	1.76	2.03	1.32		1.76	2.03		
Substrate, bed and transport parameters																									
Ri%/Ru%/P%/G%/S%					19.9%		80.1%		0.0%		26.8%	17.2%	47.9%	8.1%	0.0%					39.1%		65.6%		0.0%	
SC%/Sa%/G%/C%/B%/Be%																									
d16/d35/d50/d84/d95/di^p/di^{sp} (mm)																									
Reach Shear Stress (competency) lb/f^2																									
Max part size (mm) Mobilized at bankfull																									
Stream Power (transport capacity) W/m^2																									
Additional Reach Parameters																									
Drainage Area (SM)							0.56						0.144												
Impervious cover estimate (%)																									
Rosgen Classification							G4						B4/C4				B4					B4			
Bankfull Velocity (fps)							4										3.27					3.27			
Bankfull Discharge (cfs)							55																		
Valley length (ft)													378												
Channel Thalweg length (ft)													440				465					465			
Sinuosity (ft)							1.04						1.16				1.13					1.13			
Water Surface Slope (Channel) (ft/ft)																	0.0114					0.0114			
BF slope (ft/ft)																	0.0114					0.0114			
Bankfull Floodplain Area (acres)																									
Proportion over wide (%)																									
Entenchment Class (ER Range)																									
Incision Class (BHR Range)																									
BEHI VL%/L%/M%/H%/VH%/E%																									
Channel Stability or Habitat Metric																									
Biological or Other																									

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[1]	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)[1]	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)[1]	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)[2]	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^2)[2]	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[1]	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[1]	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[1]	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)[1]	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)[1]	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)[2]	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^2)[2]	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[1]	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[1]	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 [1] were calculated using the as-built cross sectional area as the basis for adjusting the bankfull elevation and the parameters denoted with [2] 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

	Cross-Section 9 Riffle								Cross-Section 10 Pool								Cross-Section 11 Riffle								Cross-Section 12 Pool							
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[1]	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)[1]	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)[1]	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)[2]	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^2)[2]	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[1]	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[1]	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 [1] were calculated using the as-built cross sectional area as the basis for adjusting the bankfull elevation and the parameters denoted with [2] 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

	Cross-Section 13 Riffle								Cross-Section 14 Pool								Cross-Section 15 Pool								Cross-Section 16 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[1]	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)[1]	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)[1]	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)[2]	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^2)[2]	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[1]	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[1]	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 [1] were calculated using the as-built cross sectional area as the basis for adjusting the bankfull elevation and the parameters denoted with [2] 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

	Cross-Section 17 Pool								Cross-Section 18 Riffle							
Dimension	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**MY6**	**MY7**	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**MY6**	**MY7**
Bankfull Elevation (ft) - Based on AB-XSA[1]	489.11	489.11	489.11	489.11		N/A			490.01	490.01	490.01	490.01		489.99		
Bankfull Width (ft)[1]	16.9	17.2	17.2	18.1		N/A			14.9	14.6	14.1	14.6		14.3		
Floodprone Width (ft)[1]	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)[2]	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^2)[2]	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[1]	2.5	>2.4	>2.4	N/A		N/A			2.0	>2.1	>2.2	>2.1		>2.2		
Bankfull Bank Height Ratio[1]	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 [1] were calculated using the as-built cross sectional area as the basis for adjusting the bankfull elevation and the parameters denoted with [2] 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					
Dimension & Substrate - Riffle	**Min**	**Mean**	**Med**	**Max**	**SD**	**n**	**Min**	**Mean**	**Med**	**Max**	**SD**	**n**	**Min**	**Mean**	**Med**	**Max**	**SD**	**n**	**Min**	**Mean**	**Med**	**Max**	**SD**	**n**	**Min**	**Mean**	**Med**	**Max**	**SD**	**n**	**Min**	**Mean**	**Med**	**Max**	**SD**	**n**	**Min**	**Mean**	**Med**	**Max**	**SD**	**n**	**Min**	**Mean**	**Med**	**Max**	**SD**	**n**
Bankfull Width (ft)[1]	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)[1]	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)[1]	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)[2]	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)[2]	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[3]	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[1]	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												
Profile																																															
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																																									
Pattern																																															
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	-	-																																									
Additional Reach Parameters																																															
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[1] were calculated using the as-built cross sectional area as the basis for adjusting the bankfull elevation and the parameters denoted wit[c] 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					
Dimension & Substrate - Riffle	**Min**	**Mean**	**Med**	**Max**	**SD**	**n**	**Min**	**Mean**	**Med**	**Max**	**SD**	**n**	**Min**	**Mean**	**Med**	**Max**	**SD**	**n**	**Min**	**Mean**	**Med**	**Max**	**SD**	**n**	**Min**	**Mean**	**Med**	**Max**	**SD**	**n**	**Min**	**Mean**	**Med**	**Max**	**SD**	**n**	**Min**	**Mean**	**Med**	**Max**	**SD**	**n**	**Min**	**Mean**	**Med**	**Max**	**SD**	**n**
Bankfull Width (ft)[1]	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)[1]	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)[2]	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)[2]	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)[2]	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[1]	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[1]	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												
Profile																																															
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																																									
Pattern																																															
Channel Belt Width (ft)	25.0	-	40.0	65.0	-	-																																									
Radius of Curvature (ft)	38.0	-	47.0	58.0	-	-																																									
Rc: 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	-	-																																									
Additional Reach Parameters																																															
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[1] were calculated using the as-built cross sectional area as the basis for adjusting the bankfull elevation and the parameters denoted with[2] 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					
Dimension & Substrate - Riffle	**Min**	**Mean**	**Med**	**Max**	**SD**	**n**	**Min**	**Mean**	**Med**	**Max**	**SD**	**n**	**Min**	**Mean**	**Med**	**Max**	**SD**	**n**	**Min**	**Mean**	**Med**	**Max**	**SD**	**n**	**Min**	**Mean**	**Med**	**Max**	**SD**	**n**	**Min**	**Mean**	**Med**	**Max**	**SD**	**n**	**Min**	**Mean**	**Med**	**Max**	**SD**	**n**	**Min**	**Mean**	**Med**	**Max**	**SD**	**n**
Bankfull Width (ft)[1]	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)[1]	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)[1]	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)[1]	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)[2]	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	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	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												
Profile																																															
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																																									
Pattern																																															
Channel Belt Width (ft)	35.0	-	56.0	92.0	-	-																																									
Radius of Curvature (ft)	27.0	-	43.0	63.0	-	-																																									
Rc: 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	-	-																																									
Additional Reach Parameters																																															
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[1] were calculated using the as-built cross sectional area as the basis for adjusting the bankfull elevation and the parameters denoted with[2] 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

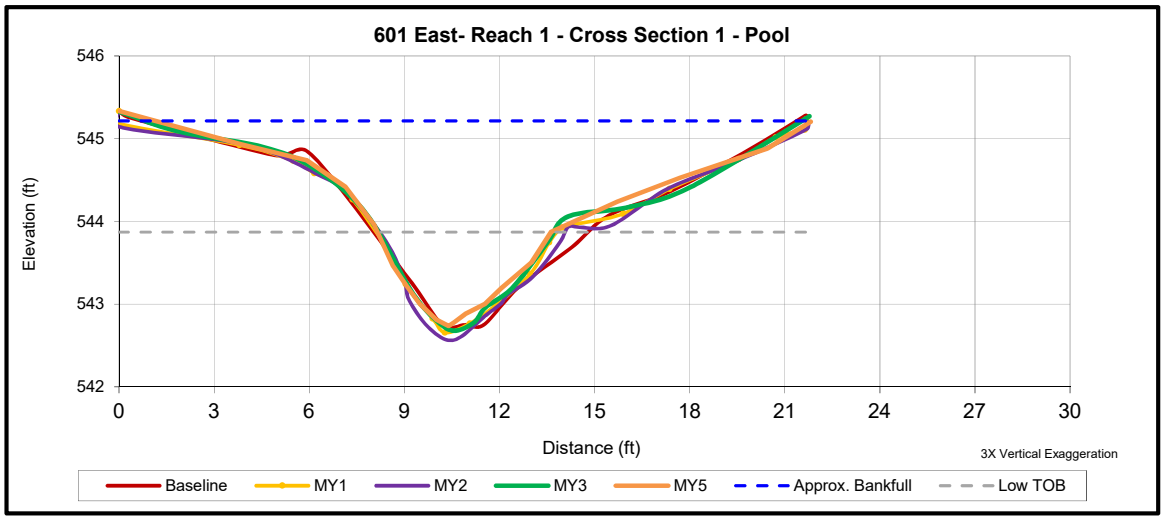
Parameter	Baseline						MY - 1						MY - 2						MY - 3						MY - 4						MY - 5						MY - 6						MY - 7					
Dimension & Substrate - Riffle	**Min**	**Mean**	**Med**	**Max**	**SD**	**n**	**Min**	**Mean**	**Med**	**Max**	**SD**	**n**	**Min**	**Mean**	**Med**	**Max**	**SD**	**n**	**Min**	**Mean**	**Med**	**Max**	**SD**	**n**	**Min**	**Mean**	**Med**	**Max**	**SD**	**n**	**Min**	**Mean**	**Med**	**Max**	**SD**	**n**	**Min**	**Mean**	**Med**	**Max**	**SD**	**n**	**Min**	**Mean**	**Med**	**Max**	**SD**	**n**
Bankfull Width (ft)[1]	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	1.0												
Floodprone Width (ft)[1]	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							-	>32.1	-	-	N/A	1.0												
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							-	---	-	-	N/A	1.0												
Bankfull Max Depth (ft)[2]	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)[2]	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							-	---	-	-	N/A	1.0												
Entrenchment Ratio[1]	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[1]	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												
Profile																																															
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																																									
Pattern																																															
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	-	-																																									
Additional Reach Parameters																																															
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[1] were calculated using the as-built cross sectional area as the basis for adjusting the bankfull elevation and the parameters denoted with[2] 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

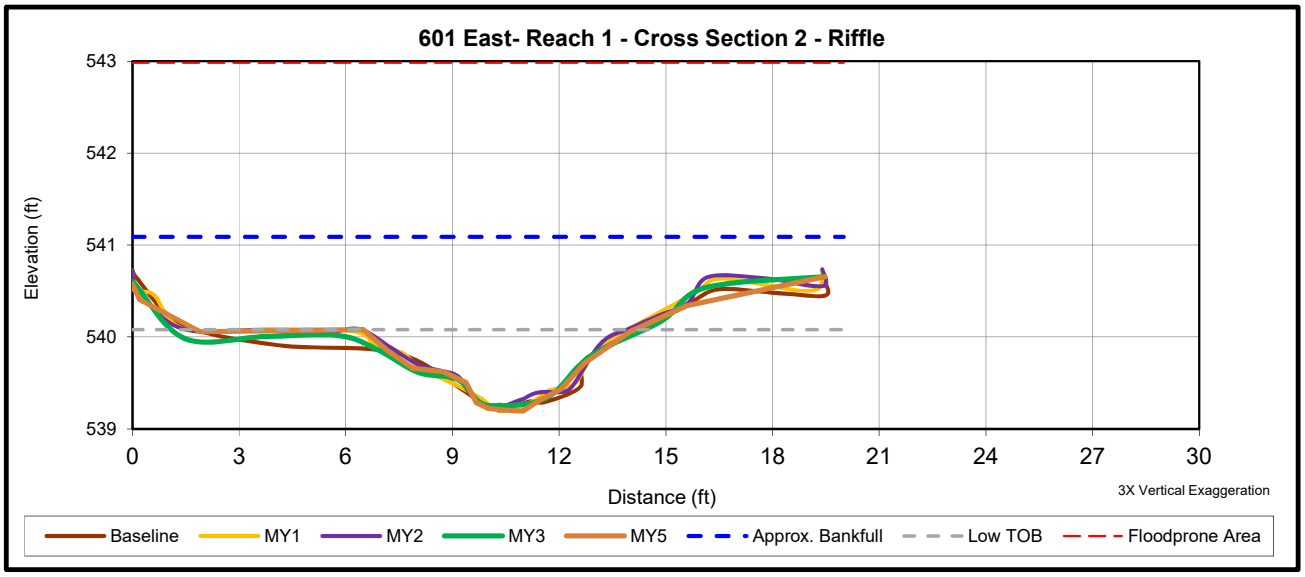


DIMENSIONS SUMMARY	MY0	MY1	MY2	MY3	MY4	MY5	MY6	MY7
Bankful Width (ft)[1]	13.6	15.1	15.1	14.7	-	N/A	-	-
Floodprone Width (ft)[1]	45.0	45.0	45.0	45.0	-	N/A	-	-
Bankfull Mean Depth (ft)	1.0	0.9	0.9	0.9	-	---	-	-
Bankfull Max Depth (ft)[2]	2.1	2.2	2.2	2.1	-	1.1	-	-
Bankfull Cross-Sectional Area (ft2)[2]	14.1	13.7	14.3	13.4	-	3.7	-	-
Width/Depth Ratio	13.2	16.6	15.9	16.2	-	---	-	-
Entrenchment Ratio[1]	10.3	3.0	3.0	N/A	-	N/A	-	-
Bank Height Ratio[1]	1.0	1.0	1.0	N/A	-	N/A	-	-

Note: Starting in MY5, the parameters denoted with [1] were calculated using the as-built cross sectional area as the basis for adjusting the bankfull elevation and the parameters denoted with [2] 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

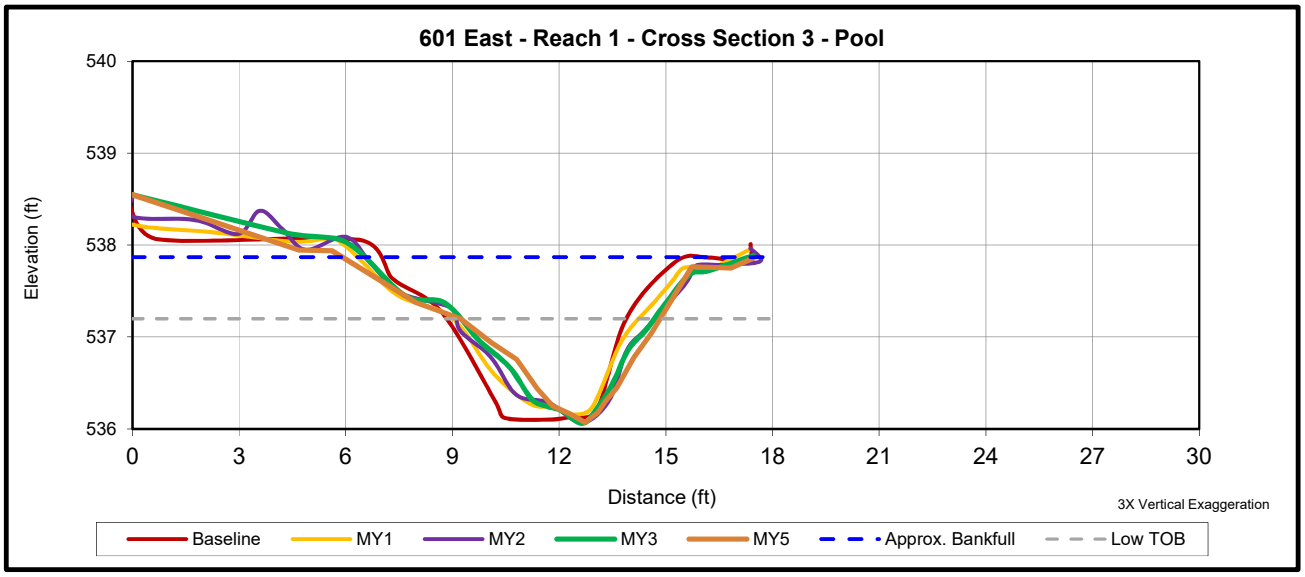


DIMENSIONS SUMMARY	MY0	MY1	MY2	MY3	MY4	MY5	MY6	MY7
Bankful Width (ft)[1]	15.1	14.7	15.2	15.2	-	5.6	-	-
Floodprone Width (ft)[1]	77.0	77.0	77.0	77.0	-	>19.5	-	-
Bankfull Mean Depth (ft)	0.6	0.5	0.5	0.6	-	---	-	-
Bankfull Max Depth (ft)[2]	1.2	1.2	1.2	1.1	-	0.9	-	-
Bankfull Cross-Sectional Area (ft2)[2]	9.0	8.0	8.0	8.8	-	3.4	-	-
Width/Depth Ratio	25.3	27.0	28.9	26.2	-	---	-	-
Entrenchment Ratio[1]	9.3	5.2	5.1	5.1	-	>3.5	-	-
Bank Height Ratio[1]	1.0	1.0	1.0	0.7	-	<1	-	-

Note: Starting in MY5, the parameters denoted with [1] were calculated using the as-built cross sectional area as the basis for adjusting the bankfull elevation and the parameters denoted with [2] 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

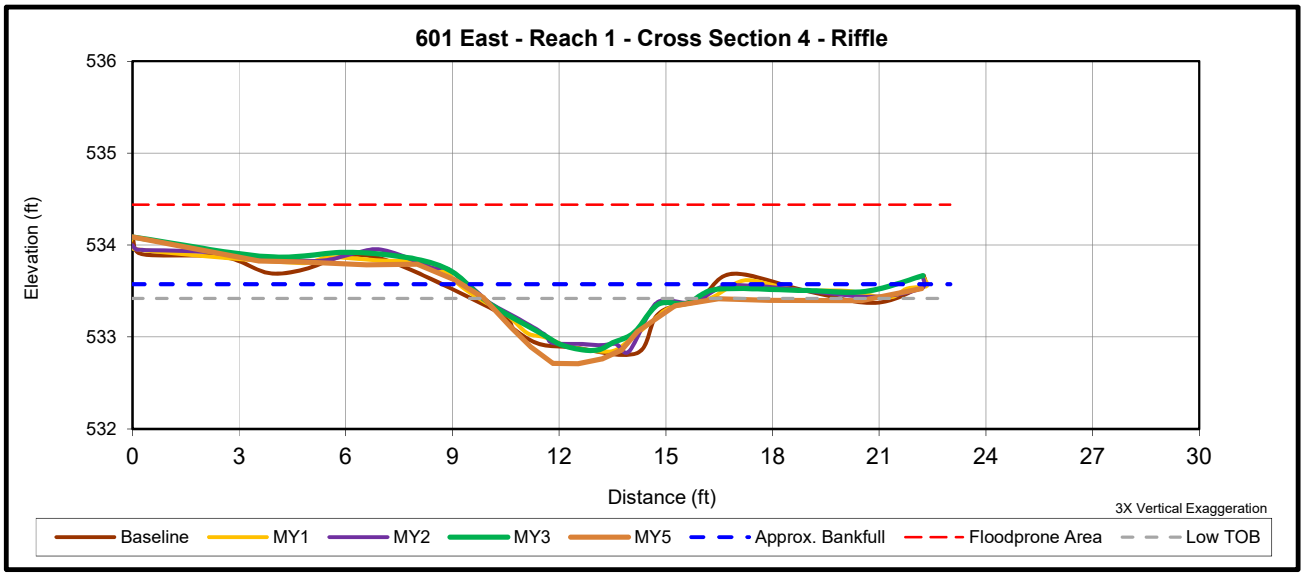


DIMENSIONS SUMMARY	MY0	MY1	MY2	MY3	MY4	MY5	MY6	MY7
Bankful Width (ft)[1]	9.4	9.5	9.3	9.2	-	N/A	-	-
Floodprone Width (ft)[1]	154.0	154.0	154.0	154.0	-	N/A	-	-
Bankfull Mean Depth (ft)	0.9	0.9	0.9	0.9	-	---	-	-
Bankfull Max Depth (ft)[2]	1.8	1.7	1.8	1.8	-	1.1	-	-
Bankfull Cross-Sectional Area (ft2)[2]	8.7	8.5	8.8	8.5	-	3.3	-	-
Width/Depth Ratio	10.2	10.7	9.8	9.9	-	---	-	-
Entrenchment Ratio[1]	14.9	14.6	16.6	N/A	-	N/A	-	-
Bank Height Ratio[1]	1.0	1.0	1.0	N/A	-	N/A	-	-

Note: Starting in MY5, the parameters denoted with [1] were calculated using the as-built cross sectional area as the basis for adjusting the bankfull elevation and the parameters denoted with [2] 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

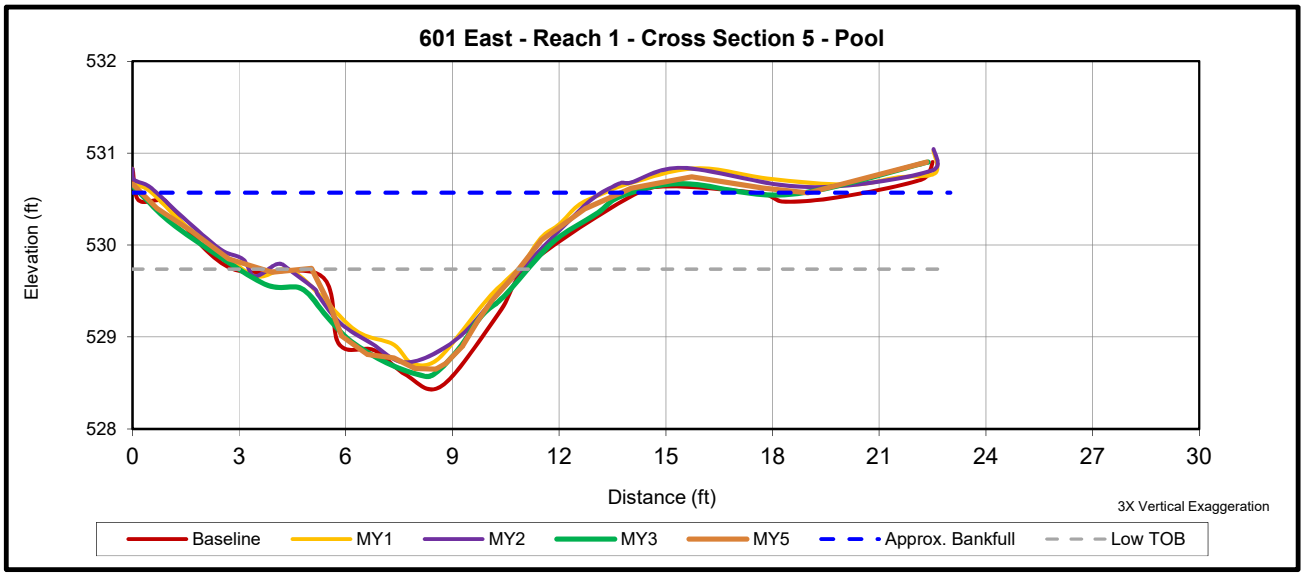


DIMENSIONS SUMMARY	MY0	MY1	MY2	MY3	MY4	MY5	MY6	MY7
Bankful Width (ft)[1]	8.8	9.1	9.4	9.2	-	12.9	-	-
Floodprone Width (ft)[1]	75.0	75.0	75.0	75.0	-	>22.2	-	-
Bankfull Mean Depth (ft)	0.5	0.5	0.6	0.6	-	---	-	-
Bankfull Max Depth (ft)[2]	0.9	0.9	1.1	1.0	-	0.7	-	-
Bankfull Cross-Sectional Area (ft2)[2]	4.5	4.8	5.8	5.1	-	2.6	-	-
Width/Depth Ratio	17.5	17.1	15.3	16.7	-	---	-	-
Entrenchment Ratio[1]	15.9	8.3	8.0	8.2	-	1.7	-	-
Bank Height Ratio[1]	1.0	1.0	1.0	0.7	-	<1	-	-

Note: Starting in MY5, the parameters denoted with [1] were calculated using the as-built cross sectional area as the basis for adjusting the bankfull elevation and the parameters denoted with [2] 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

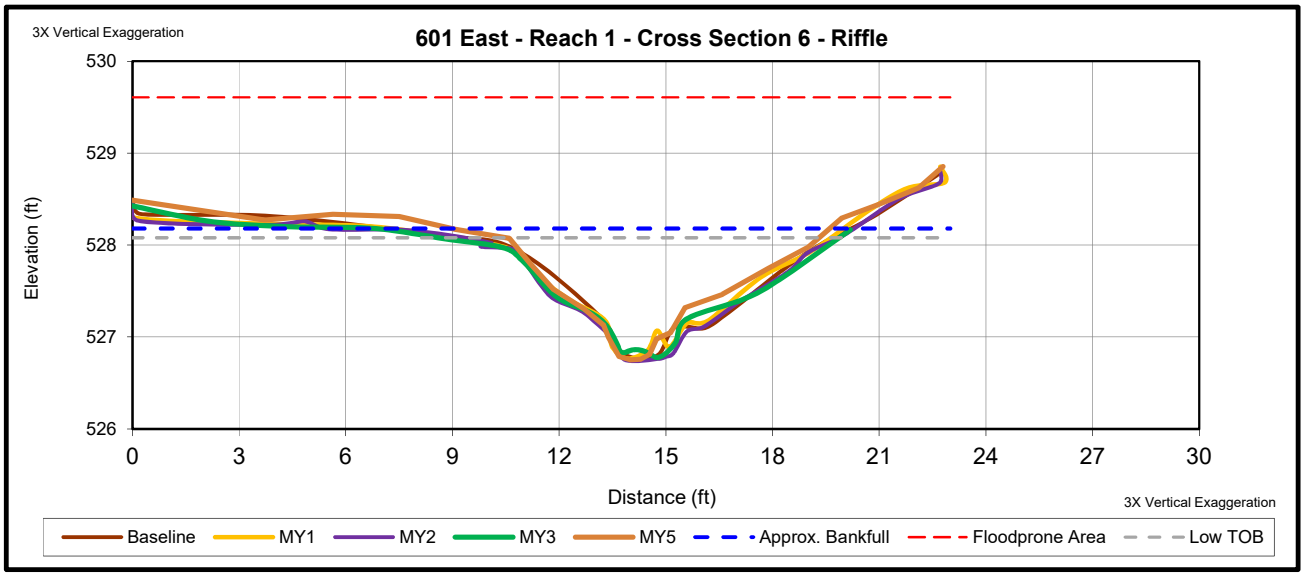


DIMENSIONS SUMMARY	MY0	MY1	MY2	MY3	MY4	MY5	MY6	MY7
Bankful Width (ft)[1]	12.9	12.1	12.0	13.2	-	N/A	-	-
Floodprone Width (ft)[1]	61.0	61.0	61.0	61.0	-	N/A	-	-
Bankfull Mean Depth (ft)	1.0	0.9	0.9	1.0	-	---	-	-
Bankfull Max Depth (ft)[2]	2.0	1.8	1.8	1.9	-	1.1	-	-
Bankfull Cross-Sectional Area (ft2)[2]	12.8	11.0	11.2	12.8	-	4.2	-	-
Width/Depth Ratio	13.0	13.2	12.9	13.6	-	---	-	-
Entrenchment Ratio[1]	17.4	5.1	5.1	N/A	-	N/A	-	-
Bank Height Ratio[1]	1.0	1.0	1.0	N/A	-	N/A	-	-

Note: Starting in MY5, the parameters denoted with [1] were calculated using the as-built cross sectional area as the basis for adjusting the bankfull elevation and the parameters denoted with [2] 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

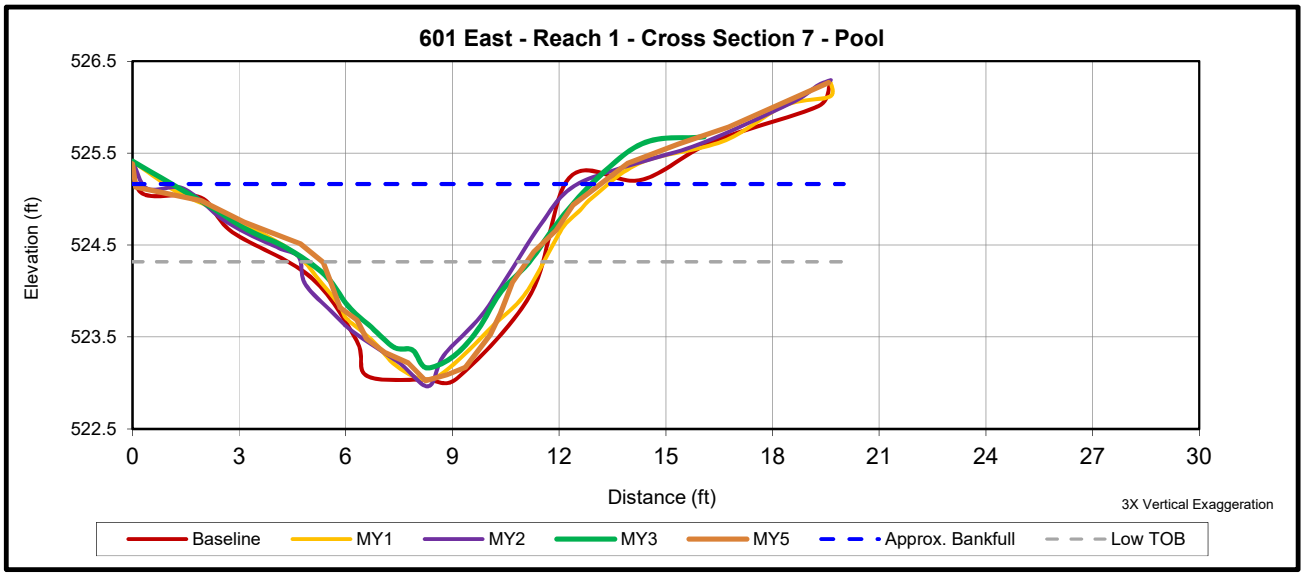


DIMENSIONS SUMMARY	MY0	MY1	MY2	MY3	MY4	MY5	MY6	MY7
Bankful Width (ft)[1]	11.3	11.3	11.3	11.1	-	10.5	-	-
Floodprone Width (ft)[1]	80.0	80.0	80.0	80.0	-	>22.8	-	-
Bankfull Mean Depth (ft)	0.6	0.6	0.6	0.6	-	---	-	-
Bankfull Max Depth (ft)[2]	1.3	1.3	1.4	1.3	-	1.3	-	-
Bankfull Cross-Sectional Area (ft2)[2]	6.6	6.6	7.2	6.9	-	5.6	-	-
Width/Depth Ratio	19.3	19.5	17.9	17.9	-	---	-	-
Entrenchment Ratio[1]	9.7	7.1	7.1	7.2	-	>2.2	-	-
Bank Height Ratio[1]	1.0	1.0	1.0	0.9	-	<1	-	-

Note: Starting in MY5, the parameters denoted with [1] were calculated using the as-built cross sectional area as the basis for adjusting the bankfull elevation and the parameters denoted with [2] 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

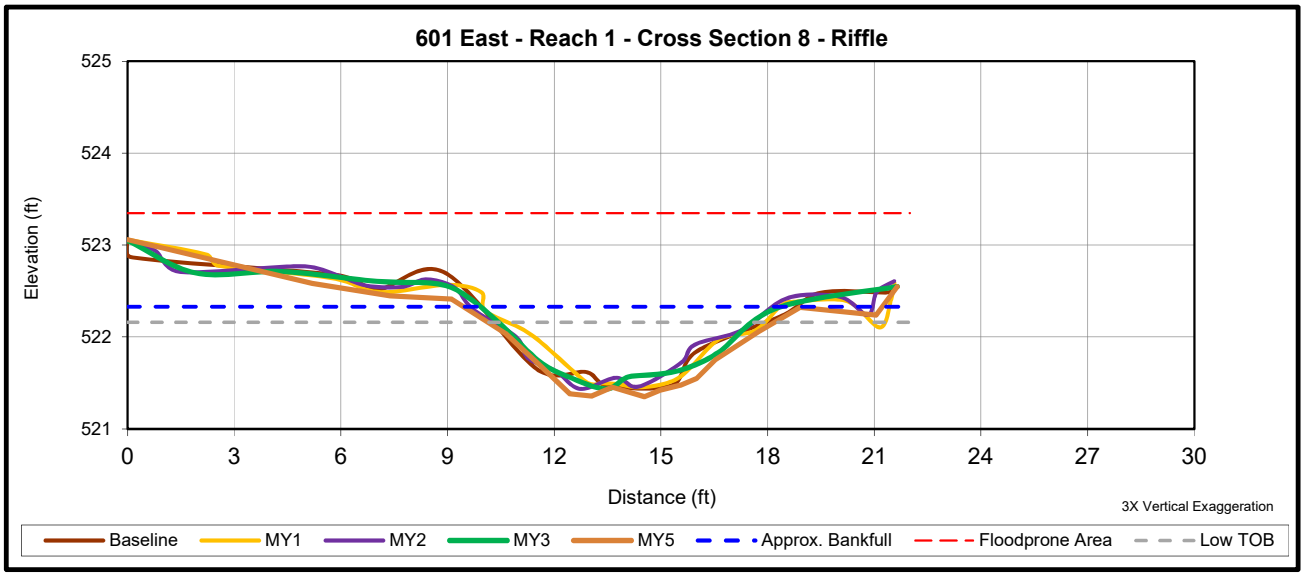


DIMENSIONS SUMMARY	MY0	MY1	MY2	MY3	MY4	MY5	MY6	MY7
Bankful Width (ft)[1]	10.3	11.4	10.3	10.8	-	N/A	-	-
Floodprone Width (ft)[1]	63.0	63.0	63.0	63.0	-	N/A	-	-
Bankfull Mean Depth (ft)	1.2	1.0	1.0	1.0	-	---	-	-
Bankfull Max Depth (ft)[2]	2.0	2.0	2.1	1.9	-	1.3	-	-
Bankfull Cross-Sectional Area (ft2)[2]	12.3	11.2	10.4	9.9	-	4.7	-	-
Width/Depth Ratio	8.6	11.5	10.3	11.8	-	---	-	-
Entrenchment Ratio[1]	10.7	5.5	6.1	N/A	-	N/A	-	-
Bank Height Ratio[1]	1.0	1.0	1.0	N/A	-	N/A	-	-

Note: Starting in MY5, the parameters denoted with [1] were calculated using the as-built cross sectional area as the basis for adjusting the bankfull elevation and the parameters denoted with [2] 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.

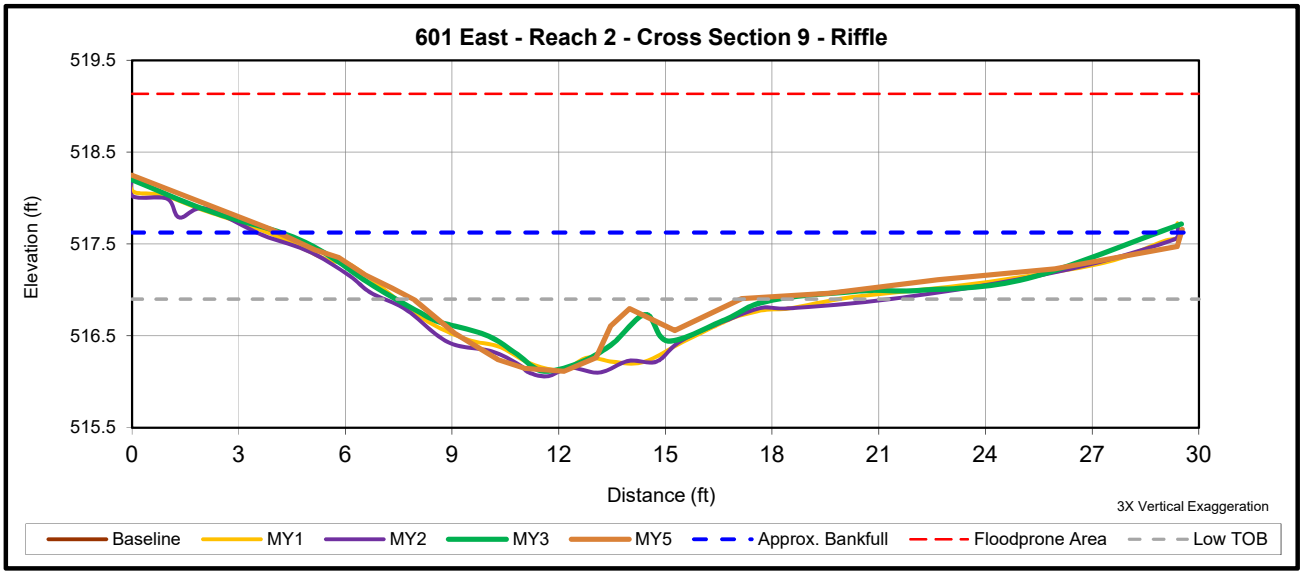
Upstream

Downstream



DIMENSIONS SUMMARY	MY0	MY1	MY2	MY3	MY4	MY5	MY6	MY7
Bankful Width (ft)[1]	10.1	8.8	9.2	9.0	-	9.5	-	-
Floodprone Width (ft)[1]	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)[2]	1.0	1.0	1.0	1.0	-	0.8	-	-
Bankfull Cross-Sectional Area (ft2)[2]	6.2	5.6	5.8	5.9	-	4.6	-	-
Width/Depth Ratio	16.6	13.9	14.7	13.7	-	---	-	-
Entrenchment Ratio[1]	10.9	4.5	4.3	4.5	-	>2.3	-	-
Bank Height Ratio[1]	1.0	1.0	1.0	0.8	-	<1	-	-

Note: Starting in MY5, the parameters denoted with [1] were calculated using the as-built cross sectional area as the basis for adjusting the bankfull elevation and the parameters denoted with [2] 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.

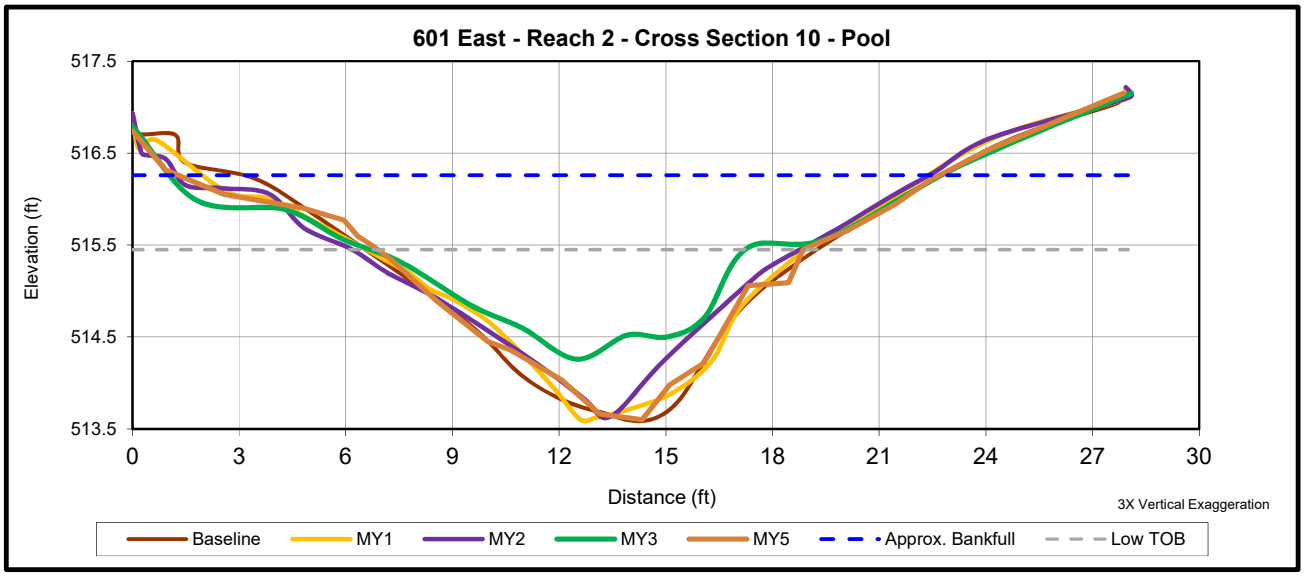


DIMENSIONS SUMMARY	MY0	MY1	MY2	MY3	MY4	MY5	MY6	MY7
Bankful Width (ft)[1]	24.2	24.3	24.4	23.0	-	25.4	-	-
Floodprone Width (ft)[1]	62.0	62.0	62.0	62.0	-	>29.5	-	-
Bankfull Mean Depth (ft)	0.7	0.7	0.7	0.7	-	---	-	-
Bankfull Max Depth (ft)[2]	1.5	1.4	1.4	1.4	-	0.8	-	-
Bankfull Cross-Sectional Area (ft2)[2]	17.7	16.5	17.5	15.2	-	3.8	-	-
Width/Depth Ratio	33.1	35.6	34.2	34.8	-	---	-	-
Entrenchment Ratio[1]	5.8	2.6	2.5	2.7	-	>1.2	-	-
Bank Height Ratio[1]	1.0	1.0	1.0	1.0	-	<1	-	-

Note: Starting in MY5, the parameters denoted with [1] were calculated using the as-built cross sectional area as the basis for adjusting the bankfull elevation and the parameters denoted with [2] 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

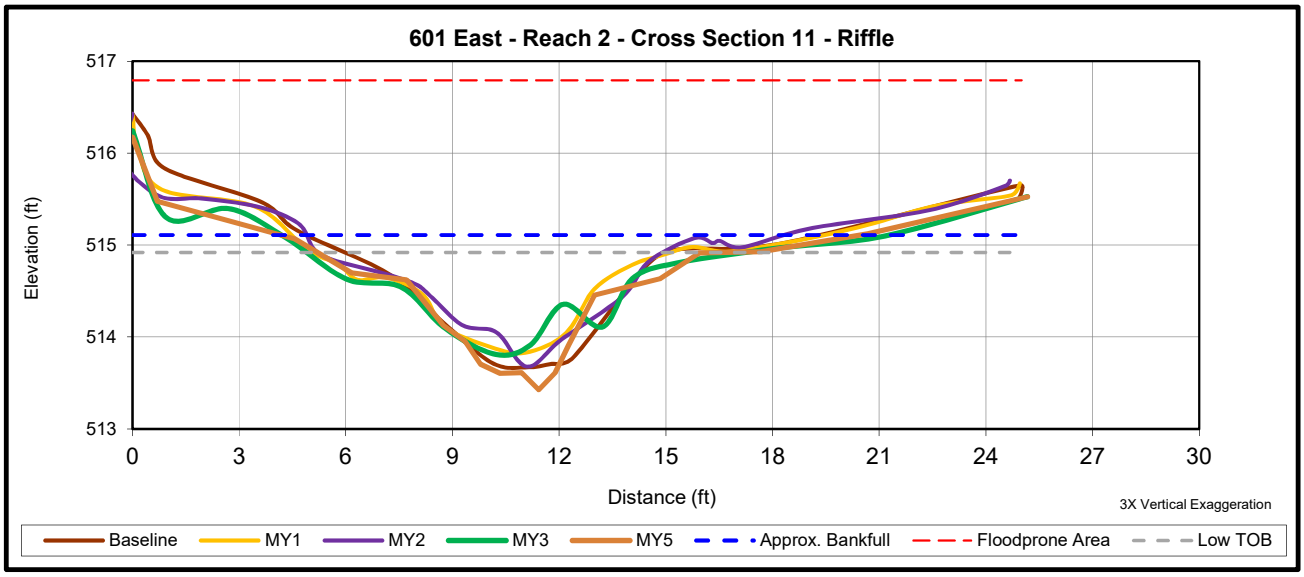


DIMENSIONS SUMMARY	MY0	MY1	MY2	MY3	MY4	MY5	MY6	MY7
Bankful Width (ft)[1]	19.2	19.7	19.7	20.8	-	N/A	-	-
Floodprone Width (ft)[1]	132.0	132.0	132.0	132.0	-	N/A	-	-
Bankfull Mean Depth (ft)	1.3	1.2	1.2	1.0	-	---	-	-
Bankfull Max Depth (ft)[2]	2.5	2.6	2.6	2.0	-	1.9	-	-
Bankfull Cross-Sectional Area (ft2)[2]	25.3	24.4	23.1	20.1	-	12.1	-	-
Width/Depth Ratio	14.6	16.0	16.8	21.5	-	---	-	-
Entrenchment Ratio[1]	11.7	6.7	6.7	N/A	-	N/A	-	-
Bank Height Ratio[1]	1.0	1.0	1.0	N/A	-	N/A	-	-

Note: Starting in MY5, the parameters denoted with [1] were calculated using the as-built cross sectional area as the basis for adjusting the bankfull elevation and the parameters denoted with [2] 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

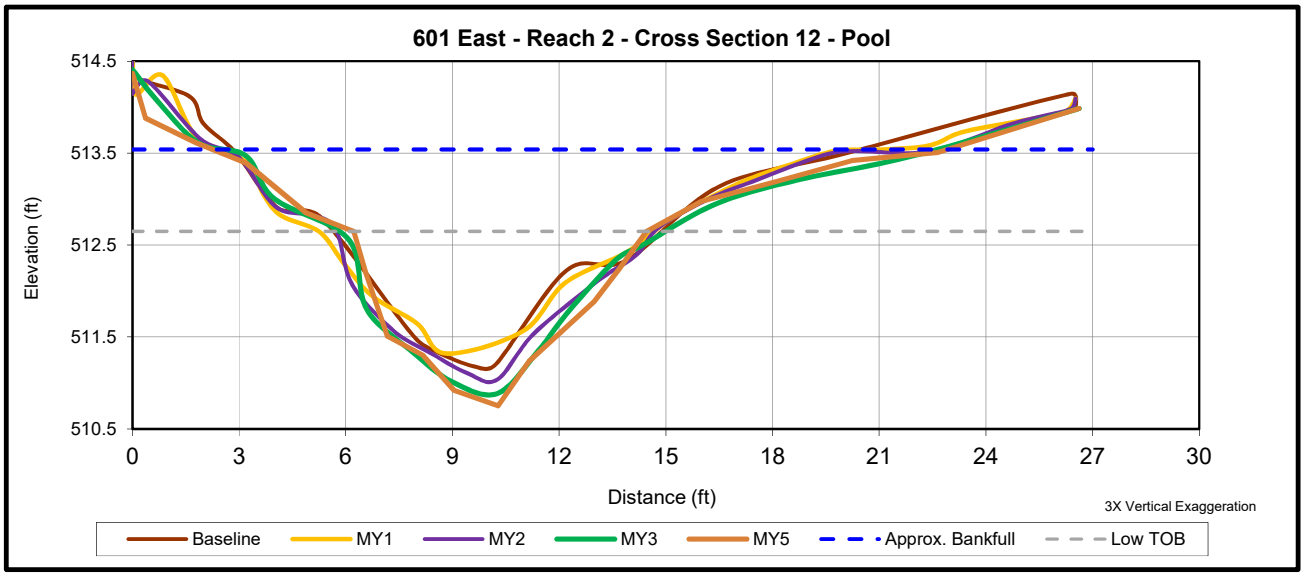


DIMENSIONS SUMMARY	MY0	MY1	MY2	MY3	MY4	MY5	MY6	MY7
Bankful Width (ft)[1]	15.5	15.8	14.1	17.3	-	16.3	-	-
Floodprone Width (ft)[1]	73.0	73.0	73.0	73.0	-	>25.2	-	-
Bankfull Mean Depth (ft)	0.6	0.5	0.6	0.6	-	---	-	-
Bankfull Max Depth (ft)[2]	1.5	1.3	1.5	1.3	-	1.5	-	-
Bankfull Cross-Sectional Area (ft2)[2]	9.4	8.6	8.3	9.8	-	6.7	-	-
Width/Depth Ratio	25.5	28.9	23.8	30.5	-	---	-	-
Entrenchment Ratio[1]	7.1	4.6	5.2	4.2	-	>1.5	-	-
Bank Height Ratio[1]	0.9	1.0	1.0	0.7	-	<1	-	-

Note: Starting in MY5, the parameters denoted with [1] were calculated using the as-built cross sectional area as the basis for adjusting the bankfull elevation and the parameters denoted with [2] 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

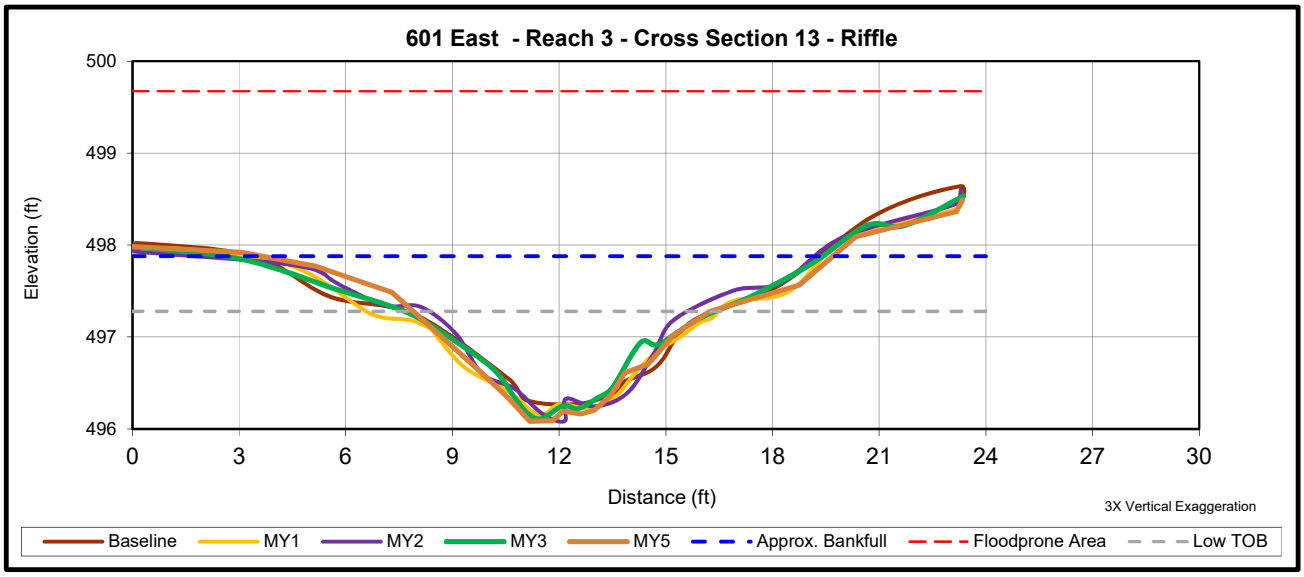


DIMENSIONS SUMMARY	MY0	MY1	MY2	MY3	MY4	MY5	MY6	MY7
Bankful Width (ft)[1]	20.0	20.6	20.6	20.7	-	N/A	-	-
Floodprone Width (ft)[1]	168.0	168.0	168.0	168.0	-	N/A	-	-
Bankfull Mean Depth (ft)	1.1	1.0	1.1	1.2	-	---	-	-
Bankfull Max Depth (ft)[2]	2.5	2.4	2.6	2.8	-	1.9	-	-
Bankfull Cross-Sectional Area (ft2)[2]	21.3	21.4	23.1	24.5	-	9.4	-	-
Width/Depth Ratio	18.8	19.9	18.4	17.4	-	---	-	-
Entrenchment Ratio[1]	7.0	8.1	8.2	N/A	-	N/A	-	-
Bank Height Ratio[1]	0.9	1.0	1.0	N/A	-	N/A	-	-

Note: Starting in MY5, the parameters denoted with [1] were calculated using the as-built cross sectional area as the basis for adjusting the bankfull elevation and the parameters denoted with [2] 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

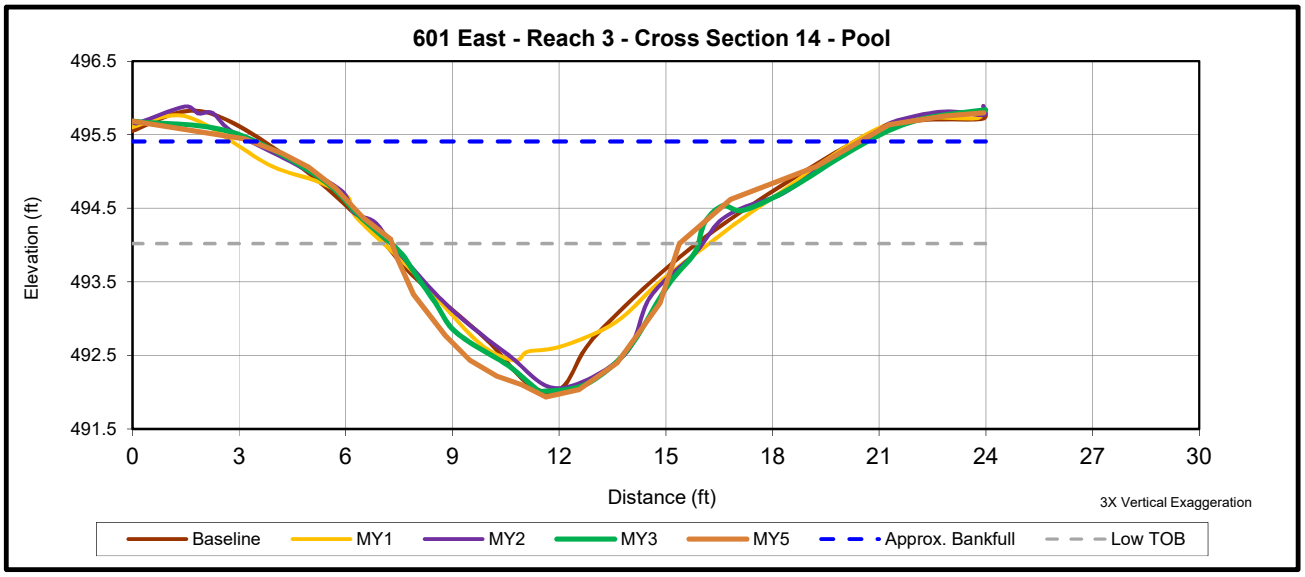


DIMENSIONS SUMMARY	MY0	MY1	MY2	MY3	MY4	MY5	MY6	MY7
Bankful Width (ft)[1]	15.9	16.9	17.5	17.1	-	16.0	-	-
Floodprone Width (ft)[1]	75.0	75.0	75.0	75.0	-	>23.3	-	-
Bankfull Mean Depth (ft)	0.8	0.8	0.7	0.7	-	---	-	-
Bankfull Max Depth (ft)[2]	1.6	1.7	1.8	1.8	-	1.2	-	-
Bankfull Cross-Sectional Area (ft2)[2]	12.8	13.6	12.2	12.6	-	5.6	-	-
Width/Depth Ratio	19.6	21.0	25.0	23.1	-	---	-	-
Entrenchment Ratio[1]	8.8	4.4	4.3	4.4	-	>1.5	-	-
Bank Height Ratio[1]	1.0	1.0	1.0	1.0	-	<1	-	-

Note: Starting in MY5, the parameters denoted with [1] were calculated using the as-built cross sectional area as the basis for adjusting the bankfull elevation and the parameters denoted with [2] 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

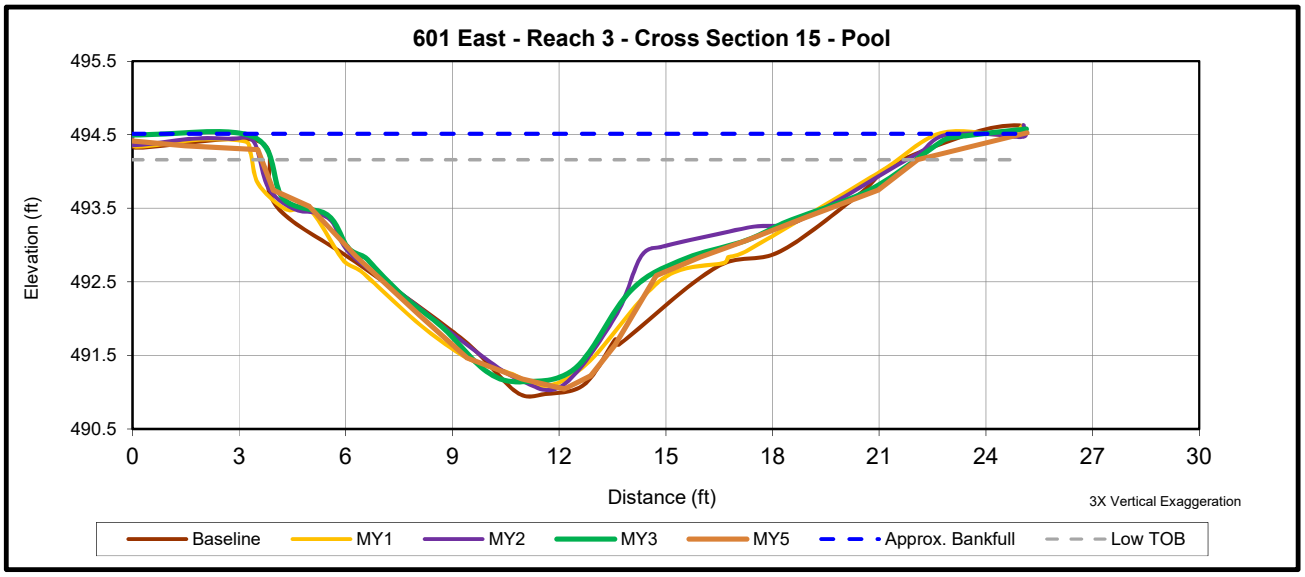


DIMENSIONS SUMMARY	MY0	MY1	MY2	MY3	MY4	MY5	MY6	MY7
Bankful Width (ft)[1]	17.5	18.4	17.9	18.2	-	N/A	-	-
Floodprone Width (ft)[1]	350.0	350.0	350.0	350.0	-	N/A	-	-
Bankfull Mean Depth (ft)	1.6	1.5	1.6	1.6	-	---	-	-
Bankfull Max Depth (ft)[2]	3.4	3.1	3.4	3.5	-	2.1	-	-
Bankfull Cross-Sectional Area (ft2)[2]	28.2	28.0	28.7	29.7	-	11.5	-	-
Width/Depth Ratio	11.0	12.0	11.2	11.2	-	---	-	-
Entrenchment Ratio[1]	12.8	19.1	19.6	N/A	-	N/A	-	-
Bank Height Ratio[1]	1.0	1.0	1.0	N/A	-	N/A	-	-

Note: Starting in MY5, the parameters denoted with [1] were calculated using the as-built cross sectional area as the basis for adjusting the bankfull elevation and the parameters denoted with [2] 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

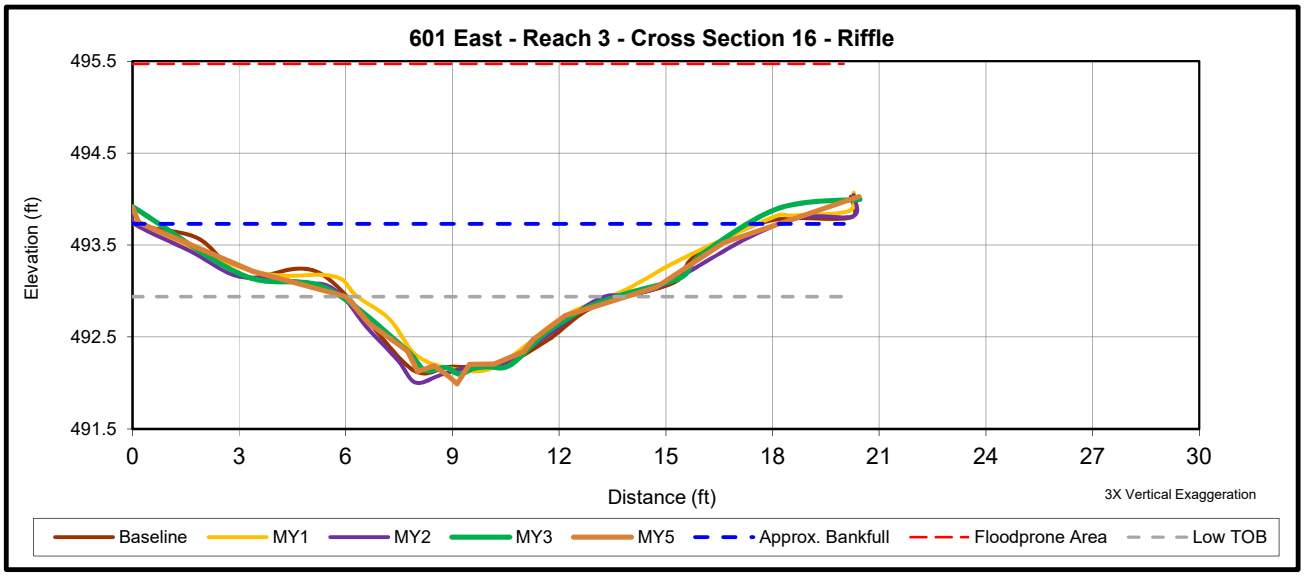


DIMENSIONS SUMMARY	MY0	MY1	MY2	MY3	MY4	MY5	MY6	MY7
Bankful Width (ft)[1]	19.6	21.1	20.5	19.4	-	N/A	-	-
Floodprone Width (ft)[1]	350.0	350.0	350.0	350.0	-	N/A	-	-
Bankfull Mean Depth (ft)	1.8	1.6	1.5	1.7	-	---	-	-
Bankfull Max Depth (ft)[2]	3.4	3.3	3.3	3.3	-	3.1	-	-
Bankfull Cross-Sectional Area (ft2)[2]	36.1	34.4	31.5	32.4	-	29.0	-	-
Width/Depth Ratio	10.6	13.0	13.3	11.6	-	---	-	-
Entrenchment Ratio[1]	5.6	16.6	17.1	N/A	-	N/A	-	-
Bank Height Ratio[1]	1.0	1.0	1.0	N/A	-	N/A	-	-

Note: Starting in MY5, the parameters denoted with [1] were calculated using the as-built cross sectional area as the basis for adjusting the bankfull elevation and the parameters denoted with [2] 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

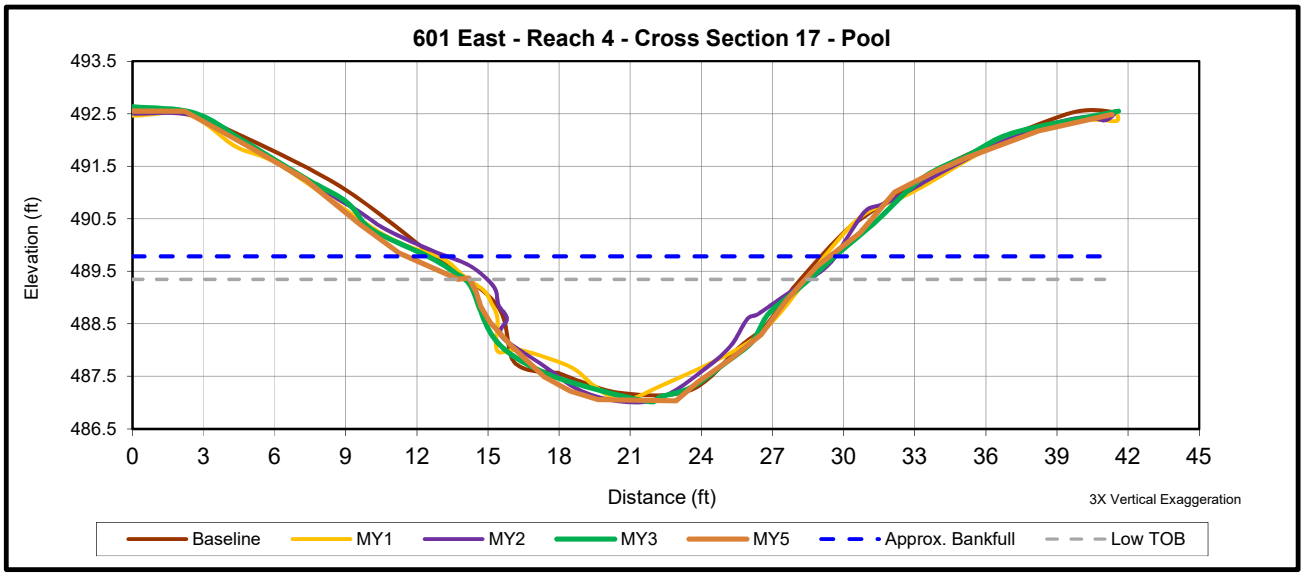


DIMENSIONS SUMMARY	MY0	MY1	MY2	MY3	MY4	MY5	MY6	MY7
Bankful Width (ft)[1]	17.7	17.5	18.3	16.7	-	17.9	-	-
Floodprone Width (ft)[1]	150.0	150.0	150.0	150.0	-	>20.4	-	-
Bankfull Mean Depth (ft)	0.8	0.7	0.8	0.8	-	---	-	-
Bankfull Max Depth (ft)[2]	1.6	1.6	1.7	1.6	-	0.9	-	-
Bankfull Cross-Sectional Area (ft2)[2]	14.1	12.9	14.8	14.0	-	3.7	-	-
Width/Depth Ratio	22.4	23.8	22.5	19.8	-	---	-	-
Entrenchment Ratio[1]	7.9	8.5	8.2	9.0	-	>1.1	-	-
Bank Height Ratio[1]	1.0	1.0	1.0	0.8	-	<1	-	-

Note: Starting in MY5, the parameters denoted with [1] were calculated using the as-built cross sectional area as the basis for adjusting the bankfull elevation and the parameters denoted with [2] 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

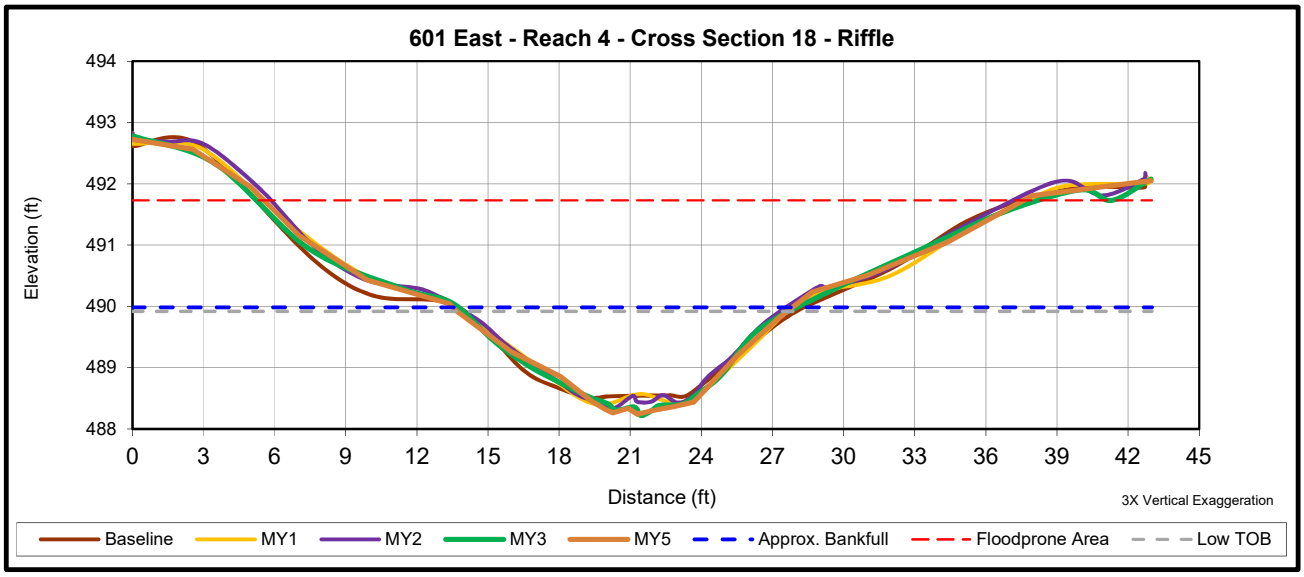


DIMENSIONS SUMMARY	MY0	MY1	MY2	MY3	MY4	MY5	MY6	MY7
Bankful Width (ft)[1]	16.9	17.2	17.2	18.1	-	N/A	-	-
Floodprone Width (ft)[1]	42.0	42.0	42.0	42.0	-	N/A	-	-
Bankfull Mean Depth (ft)	1.8	1.7	1.7	1.7	-	---	-	-
Bankfull Max Depth (ft)[2]	2.7	2.9	2.9	2.9	-	2.3	-	-
Bankfull Cross-Sectional Area (ft2)[2]	29.8	29.1	28.7	31.3	-	22.8	-	-
Width/Depth Ratio	9.6	10.2	10.3	10.4	-	---	-	-
Entrenchment Ratio[1]	2.5	2.4	2.4	N/A	-	N/A	-	-
Bank Height Ratio[1]	1.2	1.1	1.1	N/A	-	N/A	-	-

Note: Starting in MY5, the parameters denoted with [1] were calculated using the as-built cross sectional area as the basis for adjusting the bankfull elevation and the parameters denoted with [2] 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)[1]	14.9	14.6	14.1	14.6	-	14.3	-	-
Floodprone Width (ft)[1]	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)[2]	1.5	1.6	1.7	1.8	-	1.7	-	-
Bankfull Cross-Sectional Area (ft2)[2]	14.7	14.5	14.0	15.0	-	13.7	-	-
Width/Depth Ratio	15.2	14.6	14.2	14.3	-	---	-	-
Entrenchment Ratio[1]	2.1	2.1	2.2	2.1	-	>2.2	-	-
Bank Height Ratio[1]	1.0	1.0	1.0	0.8	-	1.0	-	-

Note: Starting in MY5, the parameters denoted with [1] were calculated using the as-built cross sectional area as the basis for adjusting the bankfull elevation and the parameters denoted with [2] 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_{50} (mm)	D_{84} (mm)	D_{50} (mm)	D_{84} (mm)	D_{50} (mm)	D_{84} (mm)	D_{50} (mm)	D_{84} (mm)	D_{50} (mm)	D_{84} (mm)	D_{50} (mm)	D_{84} (mm)	D_{50} (mm)	D_{84} (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.

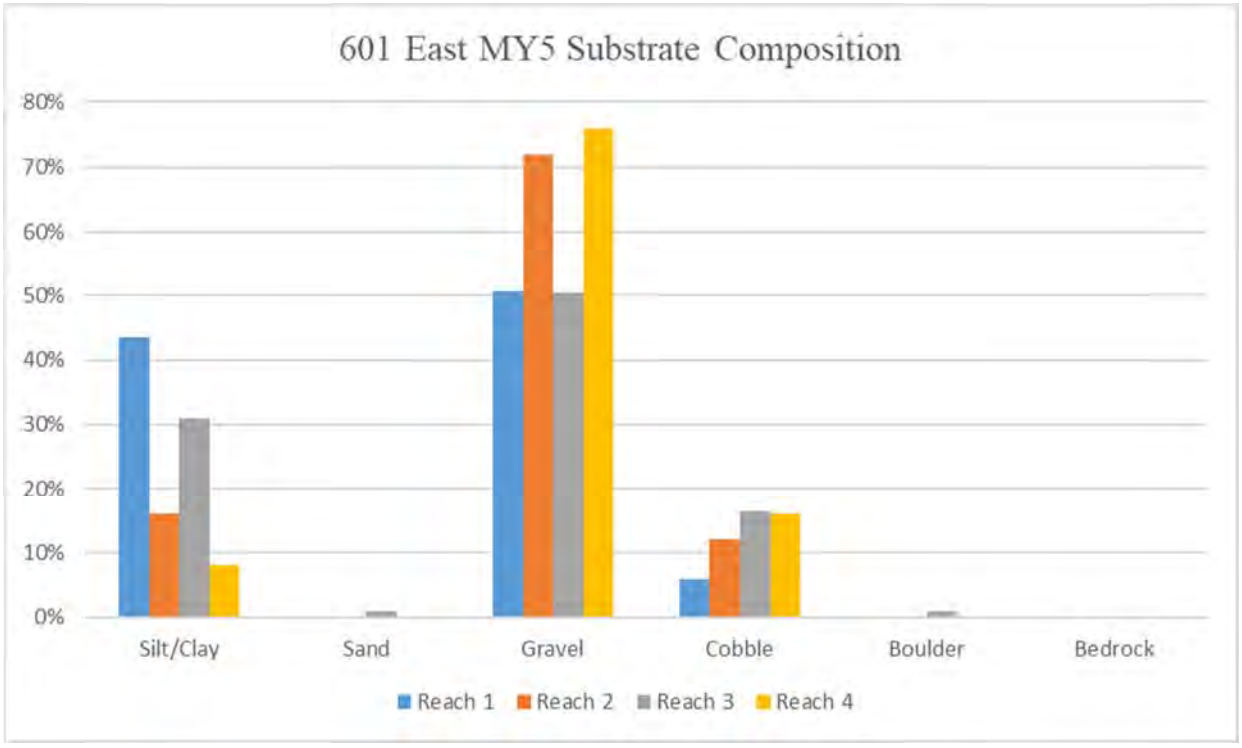


Chart 2.

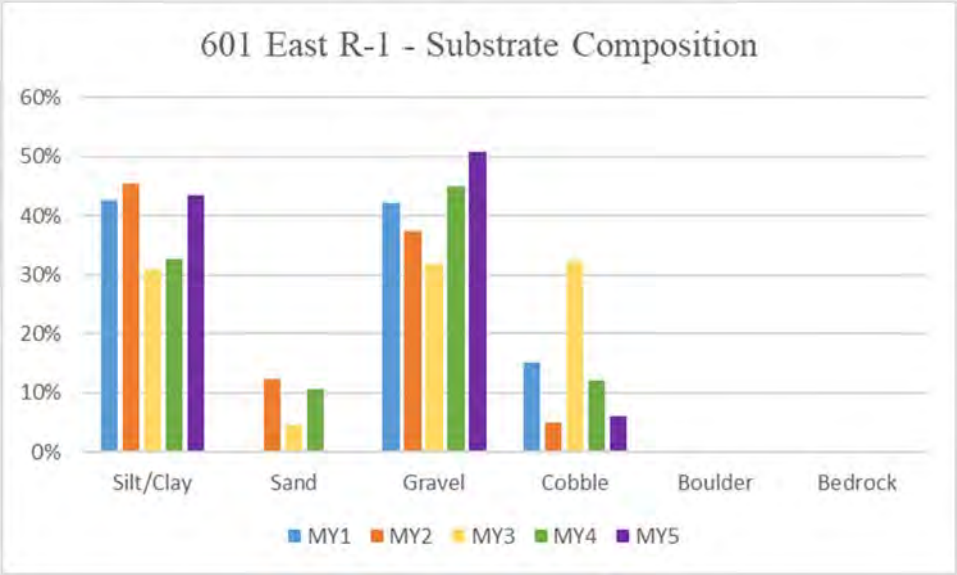


Chart 3.

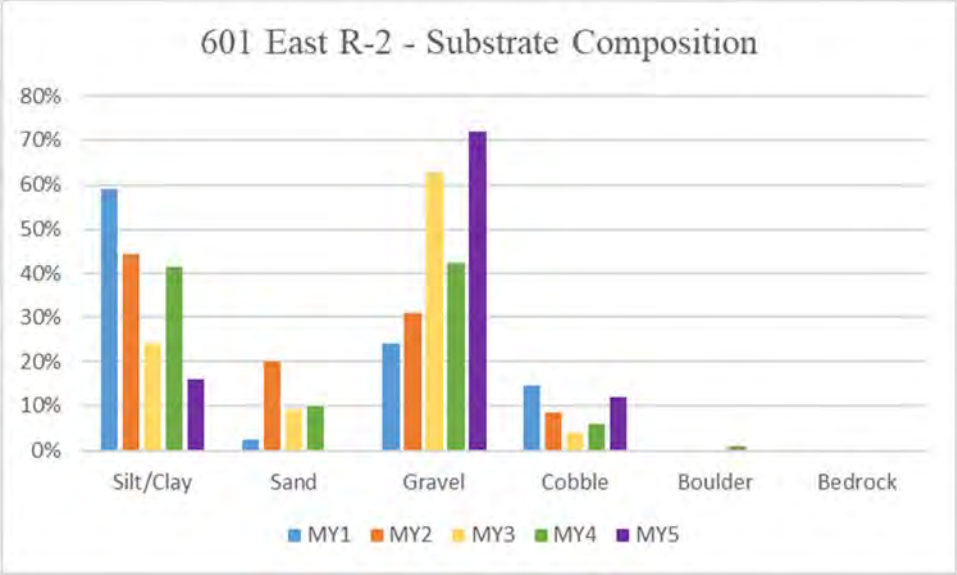


Chart 4.

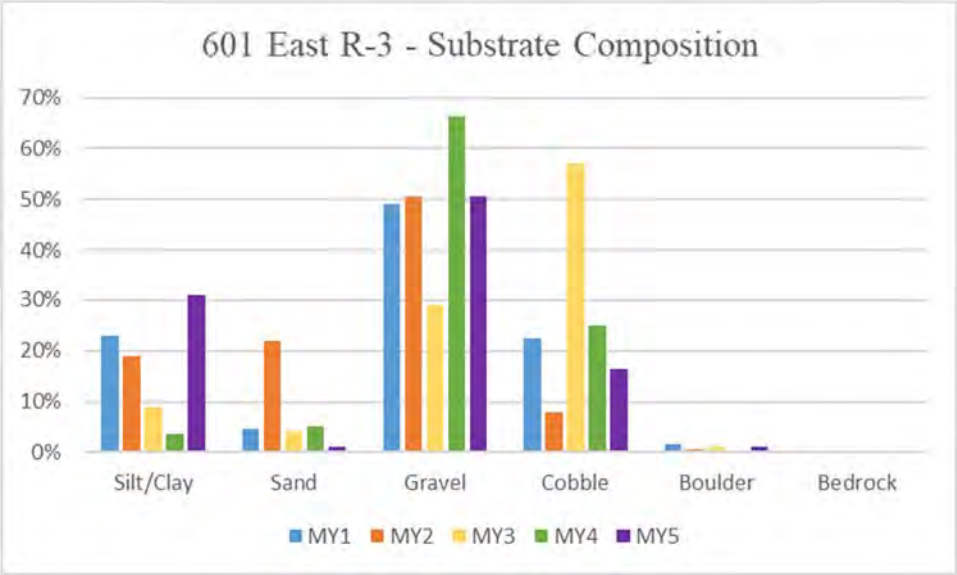


Chart 5.

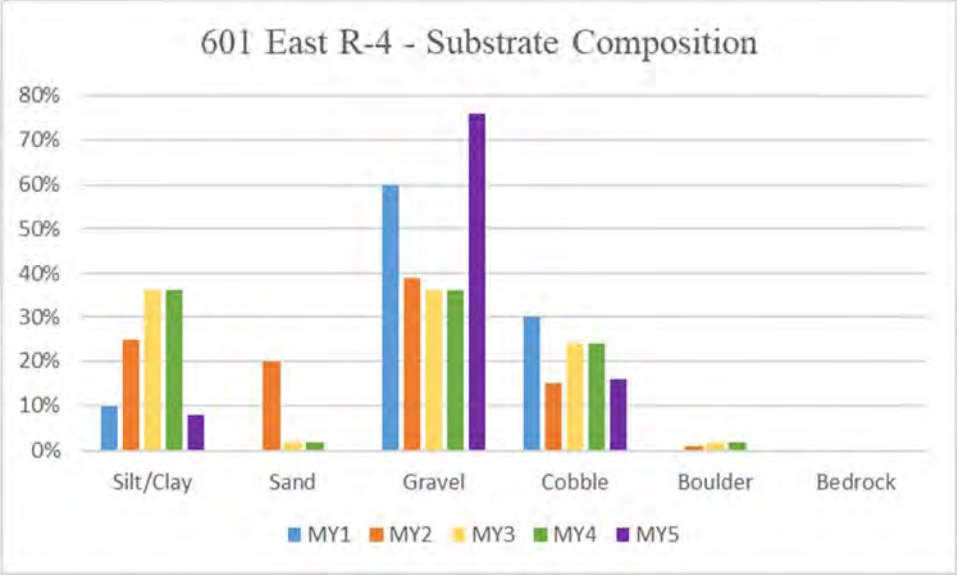


Table 13. Bank Pin Array Summary 601 E Stream Mitigattion Site						
Bank Pin Location	**Position**	**Year 1 Reading (mm)**	**Year 2 Reading (mm)**	**Year 3 Reading (mm)**	**Year 4 Reading (mm)**	**Year 5 Reading (mm)**
XS-1	Upstream	0.0	35.6	0.0	0.0	0.0
	At Cross-Section	0.0	0.0	0.0	0.0	0.0
	Downstream	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 and Stream Flow Events
Table 15. 2020 Rainfall Summary

Table 14. Verification of Bankfull and Stream Flow Events

Year	Number of Bankfull Events	Maximum Bankfull Height (ft)	Date of Occurrence
SR Reach 2			
MY1 2015	1	Unknown	9/30/2015
MY2 2016	1	1.40	2/16/2016
MY3 2017	3	2.50	4/24/2017
MY4 2018	1	0.66	9/16/2018
MY5 2019	NA	NA	NA
MY6 2020	5	1.82	5/27/2020
SR Reach 3			
MY1 2015	0	---	---
MY2 2016	1	0.20	Unknown
MY3 2017	3	1.40	6/20/2017
MY4 2018	1	0.79	9/16/2018
MY5 2019	NA	NA	NA
MY6 2020	8	0.95	5/27/2020

MY5 gauges failed due to ant infestations

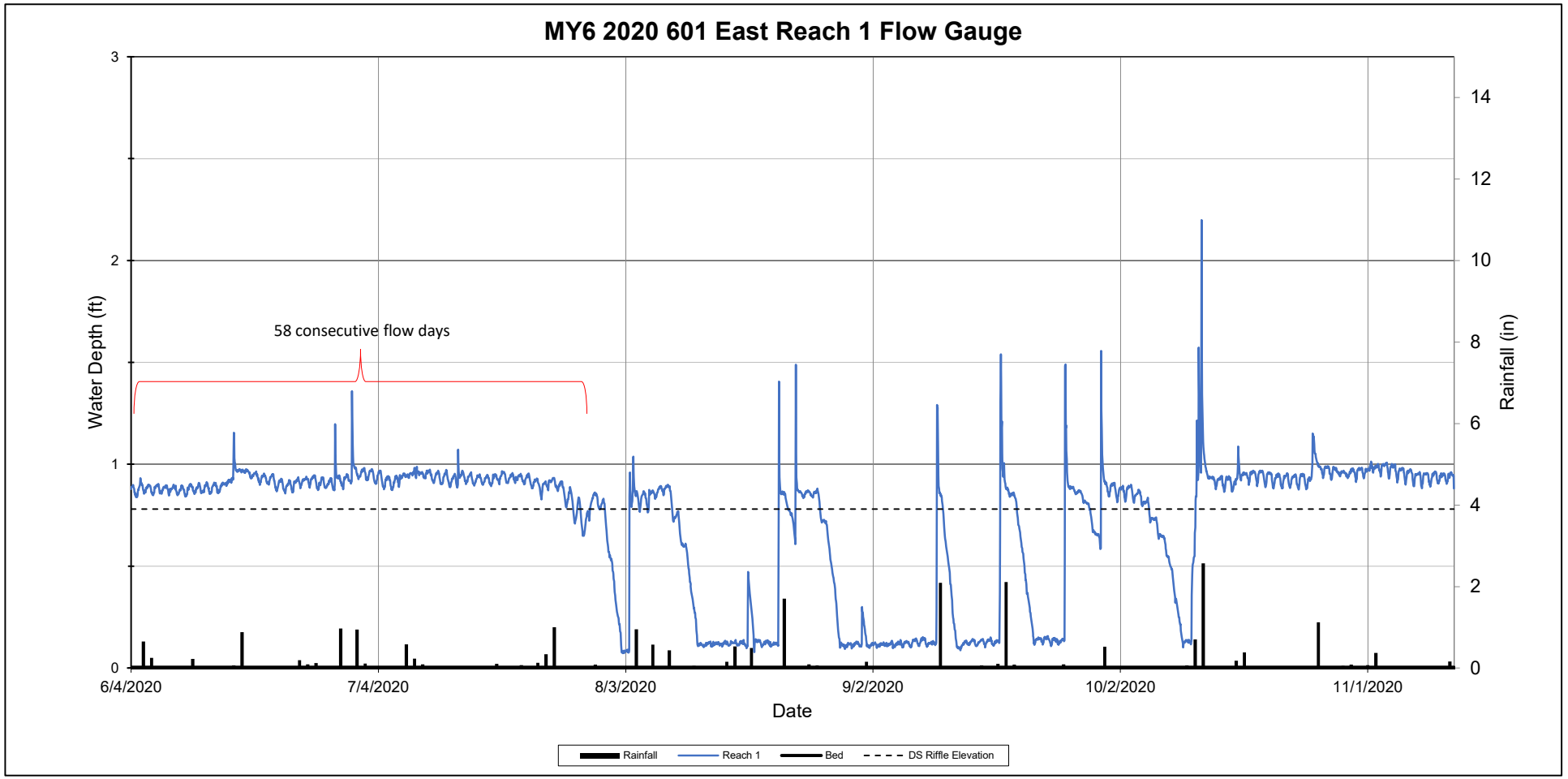
MY6 HOBOs were installed and used in place of cork gauges

Year	Consecutive Flow Days	Total Flow Days	Number of Flow Events
FG Reach 1			
MY6 2020	58	113	7

FG installed on 6/3/2020

Table 15. Rainfall Summary

Month	Average	Normal Limits		Pageland Station Precipitation
		30 Percent	70 Percent	
January	4.07	2.74	4.87	4.87
February	3.49	2.39	4.17	3.45
March	4.45	3.10	5.29	3.62
April	3.07	1.82	3.72	4.24
May	3.47	2.22	4.18	11.77
June	4.57	2.91	5.50	3.47
July	4.50	2.90	5.42	3.68
August	4.71	2.78	5.18	5.15
September	4.24	2.02	5.18	5.25
October	3.81	2.00	4.57	5.17
November	3.33	1.90	4.05	0.88
December	3.85	2.56	4.62	---
Total	47.56	29.34	56.75	51.55


MY6 2020 601 East Reach 1 Flow Gauge
Water Depth (ft)
Rainfall (in)
58 consecutive flow days
3
2
1
0
14
12
10
8
6
4
2
0
6/4/2020
7/4/2020
8/3/2020
9/2/2020
10/2/2020
11/1/2020
Date
Rainfall
Reach 1
Bed
DS Riffle Elevation

Appendix F

601 East MY5 (2019) IRT Credit Release Site Visit Memo

M E M O R A N D U M

3600 Glenwood Avenue, Suite 100 Raleigh, North Carolina 27612 919.209.1052 tel. 919.829.9913 fax

TO: Paul Wiesner - DMS

FROM: Ryan Medric - RES

DATE: 6/11/2020

RE: 601 East MY5 (2019) IRT Credit Release Site Visit

Attendees:
IRT: Todd Tugwell (USACE), Mac Haupt (NCDWR), Erin Davis (NCDWR)
DMS: Paul Wiesner
RES: Brad Breslow, Ryan Medric

Site Visit Date: June 1, 2020

The IRT, DMS, and RES had a site visit at the 601 East Stream Restoration Site to discuss the Monitoring Year 5 (2019) credit release. The main topics of discussion were the potential flow issues, beaver dams, and encroachment. Details are bulleted below:

- Flow was observed throughout all project reaches, however, the IRT requested the flow gauge on Reach 1 be moved further upstream towards the ephemeral reach. On 6/3/2020 RES moved the flow gauge from XS2 up to XS1.
- The IRT observed beaver dams on Reach 2 and 3 and encroachment along Reach 4. RES addressed these items on 6/2/2020 (photos attached). The IRT noted that RES needs to be timelier when addressing maintenance issues.
- The IRT also observed missing easement signage and small areas of easement scalloping/encroachment. RES agreed to repair any easement scalloping/encroachment and agreed to ensure all required easement marking and signage are updated and present by the end of MY6 (2020) monitoring.
- Reach 2 showed far less parrotfeather than previously observed. RES will continue observing/treating the parrotfeather as necessary.
- General site vegetation was above average in height, especially along the channel. A few small bare herbaceous areas were noted likely due to bench cutting during construction.
- At the end of the meeting, the IRT agreed to release 2019 project credit as proposed by DMS.

Beaver dam removal and livestaking

Easement marking and planting

Headcut repair with seeding and coir logs