Annual Monitoring Report

Monitoring Year 3 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: January – November 2017
Date Submitted: January 2018

Submitted to:

North Carolina Division of Mitigation Services

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January 31, 2018

Paul Wiesner
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5 Ravenscroft Drive, Suite 102
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RE: 601 East Stream Restoration Site: MY3 Monitoring Report (NCDMS ID 95756)

Listed below are comments provided by DMS on January 12, 2018 regarding the 601 East Stream Restoration Site: Year 3 Monitoring Report and RES' responses.

Cover: Please include the USACE Permit Action ID and the DWR Project Number on the report cover page.
Done.

General: Encroachment has been an issue on the 601 East site since MY1 (2015). EBX/ RES indicated in both 2015 and 2016 that the encroachment would be eliminated by working with the landowner, installing additional signage, and providing an alternate tractor crossing. The encroachment on the site needs to be resolved in 2018. In the revised report, please document 2015-2017 efforts to resolve the encroachment. Please also provide a firm 2018 date for the installation of these additional measures on the project site. DMS property staff is willing to provide assistance enforcing the recorded conservation easement if requested.
Done.

General: As noted in the report text; 601 East is one of the projects that the IRT has requested be reverted to the Mitigation Plan asset totals prior to the 2018 credit release. Total stream assets will be reduced to 3,681.67 SMUs per the approved mitigation plan. Please note that the approved mitigation plan had a minor rounding error. The project will provide 3,638.67 Stream Mitigation Units (SMUs) (R) and 43 SMUs (RE). Please update and QA/QC the report accordingly.

Contract 004925 stipulates a total of 3,576 SMUs so this update will not affect the current invoicing payment schedule.

Section 1.2 – Success Criteria: The success criteria documented in the monitoring report should be the same (verbatim) as the success criteria in the IRT approved mitigation plan. Please update this section accordingly.
Done.

Section 1.4.1 - Vegetation: Invasive species were noted in the report verbiage and the CCPV mapping. In the report verbiage, please indicate if an invasive treatment is planned for the site in MY4 (2018). Cattails and Parrot Feather are reported on the site; will these species be treated

during the remaining monitoring efforts? Please include this information and update the report text accordingly.
The following was added to the report: RES does not plan to treat cattails and parrot feather this monitoring year nor in future monitoring years as long as the populations continue to decrease. RES believes as the riparian vegetation grows, the cattails and parrot feather will be shaded out.

As reported in Table 7, please report the MY3 (2017) estimated average planted stem tree height observed (in feet) in the report verbiage.
Done.

Section 1.4.2 – Stream Geomorphology: Please note that beaver should be trapped and the associated dams removed from the project site for the entirety of the monitoring term. This should be completed as early as possible in MY4 (2018).
Beavers were trapped in May 2017 and dams will be removed in early 2018. This has been added to the report.

Were any dry channels observed on the site in the MY3 monitoring period on Reach 1 or Reach 2? Please update the text accordingly as this is a DMS project concern.
The following was added to the report: According to notes and photos, both reaches had seasonal flow during MY3. Both reaches had flow in April, lower Reach 1 and Reach 2 had flow in July, but both were dry in November. Dry conditions in the fall can be attributed to drought conditions in the area. According to rainfall data in Monroe, between August and November this area received 9.22 inches of rain compared to the average of 16.48 inches.

Section 2 Methods – Please briefly describe the methodology for selecting the three (3) random temporary vegetation plots and the associated data collection methods in this section.
The methodology for selecting temporary vegetation plot location and data collection was added to this section.

Table 1: Please revert Table 1 back to the totals found in the Mitigation Plan. Please note that the approved mitigation plan had a minor rounding error. The project will provide 3,638.67 Stream Mitigation Units (SMUs) (R) and 43 SMUs (RE) for a total of 3,681.67 SMUs. Add a note at bottom of the table to acknowledge communications with the IRT regarding the change. Suggested table 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: Please list all invasive-exotic treatments and supplemental plantings in Table 2. Please also remove the guidance notes below the table.
The guidance has been removed and the table remains the same as no invasive-exotic treatments have occurred since construction and the only supplemental planting is listed.

Cross Sections / Cross Section Tables – A couple of methods are currently being utilized to calculate the BHR from year to year. To compare subsequent monitoring years to the As-built condition one can hold the bankfull depth static (denominator) while allowing the Low TOB max depth (numerator) to vary. Another method that has been proposed and is being evaluated is to hold the As-built cross sectional area static within each year's new cross section and allow that to determine the max bankfull depth for each year. However; if there are large changes in the W/D ratio either method can make for somewhat distorted BHR values depending upon the

direction and magnitude of the change in the W/D ratio. Please update the calculations to reflect changes observed in the overlays and explain in detail as a table footnote how the calculations were made. Be prepared to defend the method used for the 2018 credit release and justify through context whether or not any changes observed in a cross section represent an issue.
Starting in MY3, BHR was calculated on riffles using the baseline bankfull elevation. This method was used because the dimension of the channels has not changed enough to alter the bankfull elevation. None of the riffle cross sections exceeded a 1.2 BHR. This has been added to the text and to Table 11a.

Table 14: Please provide estimated dates for the bankfull events reported in the table and provide the data collection dates. Were the gauges checked three times during MY3 to determine that 3 bankfull events occurred at each reach?
Done. Yes, the gauges were checked three times during MY3 showing three separate bankfull events on each gauge.

Prepared by:

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Raleigh, North Carolina 27605

Contents

1.0 PROJECT SUMMARY 5
1.1. Goals and Objectives 5
1.2. Success Criteria 5
1.3. Project Setting and Background 7
1.4. Project Performance 8
2.0 METHODS 9
3.0 REFERENCES 10

Appendices

Appendix A. General Tables and Figures

Table 1. Project Components and Mitigation Credits
Table 2. Project Activity and Reporting History
Table 3. Project Contacts
Table 4. Project Information
Figure 1. Vicinity Map
Figures 2a-d. Current Conditions Plan View Maps

Appendix B. Visual Assessment Data

Table 5. Vegetation Condition Assessment
Table 6. Visual Stream Morphology Stability Assessment
Figure 3. 2017 Photo Station Photos
Figure 4. 2017 Problem Area Photos

Appendix C. Vegetation Plot Data

Table 7. Vegetation Plot Mitigation Success Summary
Table 8. CVS Vegetation Metadata
Table 9. Total Planted Stem Counts
Figure 5. Vegetation Plot Photos

Appendix D. Stream Geomorphology Data

Table 10. Baseline Stream Data Summary
Table 11a. Dimensional Morphology Summary
Table 11b. Stream Reach Data Summary
Figure 6. Cross Section Plots
Table 12. Pebble Count Data Summary
Charts 1-5. MY3 Stream Reach Substrate Composition Charts
Table 13. Bank Pin Array Summary

Appendix E. Hydrology Data

Table 14. Verification of Bankfull Events
Figure 7. Photo Verification of Bankfull Events
Table 15. 2017 Rainfall Summary
Figure 8. 2017 601 East Site Precipitation Data

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 crosssectional 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 3 (MY3) data was collected from April to October 2017. Monitoring activities included visual assessment of all reaches and the surrounding easement, 20 permanent photo stations, 10 permanent vegetation monitoring plots, three temporary vegetation plots, 18 cross-sections, nine pebble counts, and nine bankpin arrays. Summary information and data related to the occurrence of items such as beaver activity or encroachment and statistics related to performance of various project and monitoring elements can be found in the tables and figures in the report appendices. A visual overview of the site can be seen in the Current Conditions Plan View Maps (**Figure 2**). Photographs taken at permanent stations throughout the project site also display general site conditions (**Figure 3).** Narrative background and supporting information formerly found in these reports can be found in the Baseline Monitoring Report (formerly Mitigation Plan) and in the Mitigation Plan (formerly Restoration Plan) documents available on the NCDMS website (http://portal.ncdenr.org/web/eep). 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 that with the exception of a few bare areas, totaling 0.06 acres, vegetation is becoming well established throughout the easement. The number and size of the bare areas has decreased as the vegetation continues to establish. These areas will be monitored in subsequent site visits. Invasive populations have remained stable at the site. There are eight invasive species areas on site totaling 0.44 acres. The invasive species include Chinse privet (*Ligustrum sinense*), Parrot Feather (*Myriophyllum aquaticum*), and Cattails (*Typha angustifolia*). Japanese honeysuckle (*Lonicera japonica*) was also noted on site but is not considered a problem in MY3 as it is not hindering the growth of the trees. While no treatments were performed during MY3, treatment of these areas will be scheduled as needed in coming monitoring years. Easement encroachment was noted in two areas on Reach 3. The first area, near Vegetation Plot 5, appears as if a tractor has been cutting the corner continually forming a new road as well as herbicide spraying with some drifting into the easement and damaging the trees. The second area is at the end of Reach 3 where a thin strip has been cleared in between easement markers. Encroachment problem area photos can be found in **Figure 4**. RES plans to repair the crossing built near the first encroachment area so the farmer can access his fields without cutting through the easement. RES will be installing additional signage marking the easement boundary as well as replanting the affected areas. RES plans to have this work completed by the end of April 2018.

Monitoring of the 10 permanent vegetation plots was completed during October 2017. Summary tables and photographs associated with MY3 monitoring are located in **Appendix C (Table 7, 8 & 9; Figure 5)**. Stem densities for MY3 ranged from 405 to 1,012 stems per acre with a mean of 635 stems per acre across all plots. When volunteer stems are included, the annual mean increases to 919 stems per acre. A total of 17 species were documented within the monitoring plots. The average planted stem height observed in the plots was 141 cm (4.6 ft). Three temporary random plots were set up to monitor the effects of the re-planting, one on Reach 1 (Plot 1), Reach 2 (Plot 2), and Reach 3 (Plot 3). In each temporary plot, all of the woody stems located within the plot were counted to determine stem densities. Temporary plot 1 had 33 stems, temporary plot 2 had 23 stems, and temporary plot 3 had 47 stems which led to 1336, 931, and 1902 stems/acre, respectively in each plot.

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)**. Previously reported stream problem areas were visited again in MY3 and all are stable and no longer problems. The problems noted in MY3 include an erosion feature downcutting through the floodplain near Cross-section 8 and two beaver dams on

Reach 4 (**Figure 2; Figure 4**). Beaver management was performed in May 2017 but did not include dam removal. The erosional feature needs livestakes and the beaver dams will be removed in early 2018.

Geomorphic data for MY3 was collected during July 2017. 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 MY2 and MY3 data collection efforts (**Table 11a; Figure 6**), as well as minimal change in overall reach dimensions (**Table 11b**). Starting in MY3, BHR was calculated on riffles using the baseline bankfull elevation. This method was used because the dimension of the channels has not changed enough to alter the bankfull elevation. None of the riffle cross sections exceeded a 1.2 BHR.

Substrate monitoring was performed during MY3. Pebble count D_{50} was coarse gravel for Reach 1, medium gravel for Reach 2, small cobble for Reach 3, and medium 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 with the exception the array at Cross-section 17. Field observations indicated that there was localized erosion around these two pins due to a beaver dam being built a few feet downstream and changing the hydrology in that area (**Table 13**).

1.4.3. Stream Hydrology

During MY3 bankfull events were documented on both the Reach 2 and Reach 3 crest gauges (**Table 14; Figure 7**). Project site precipitation data can be found in **Table 15 and Figure 8**. 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 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 is being monitored using 10 permanent monitoring plots. Vegetation monitoring followed CVS-EEP Level 1 Protocol for MY1 and is following Level 2 Protocol Version 4.2 for monitoring years 2-7 (Lee et al. 2008). Level 2 Protocol includes analysis of species composition and density of planted species. Data is processed using the CVS data entry tool. In the field, the four corners of each plot were permanently marked with rebar and photos of each plot taken from the origin each monitoring year. The locations of the three temporary plots surveyed in Years 2 and 3 were randomly

selected within the replant areas. The plots were surveyed by pulling tapes to form 10 x 10 meter plots then counting all woody stems within the plots.

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

3.0 REFERENCES

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

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

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

Appendix A

General Tables and Figures

Table 1. Project Components and Mitigation Credits
Table 2. Project Activity and Reporting History
Table 3. Project Contacts
Table 4. Project Information and Attributes
Figure 1. Project Vicinity Map
Figure 2a-c. Current Conditions Plan View Maps

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	Mitigation 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

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
Year 4 Monitoring		
Year 5 Monitoring		
Year 6 Monitoring		
Year 7 Monitoring		

Table 3. Project Contact Table

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) 302 Jefferson Street, Suite 110 Raleigh, NC 27605
Stream Monitoring POC	Ryan Medric (919) 741-6268
Vegetation Monitoring POC	Ryan Medric (919) 741-6268

Table 4. Project Baseline Information and Attributes

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 portion 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

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	

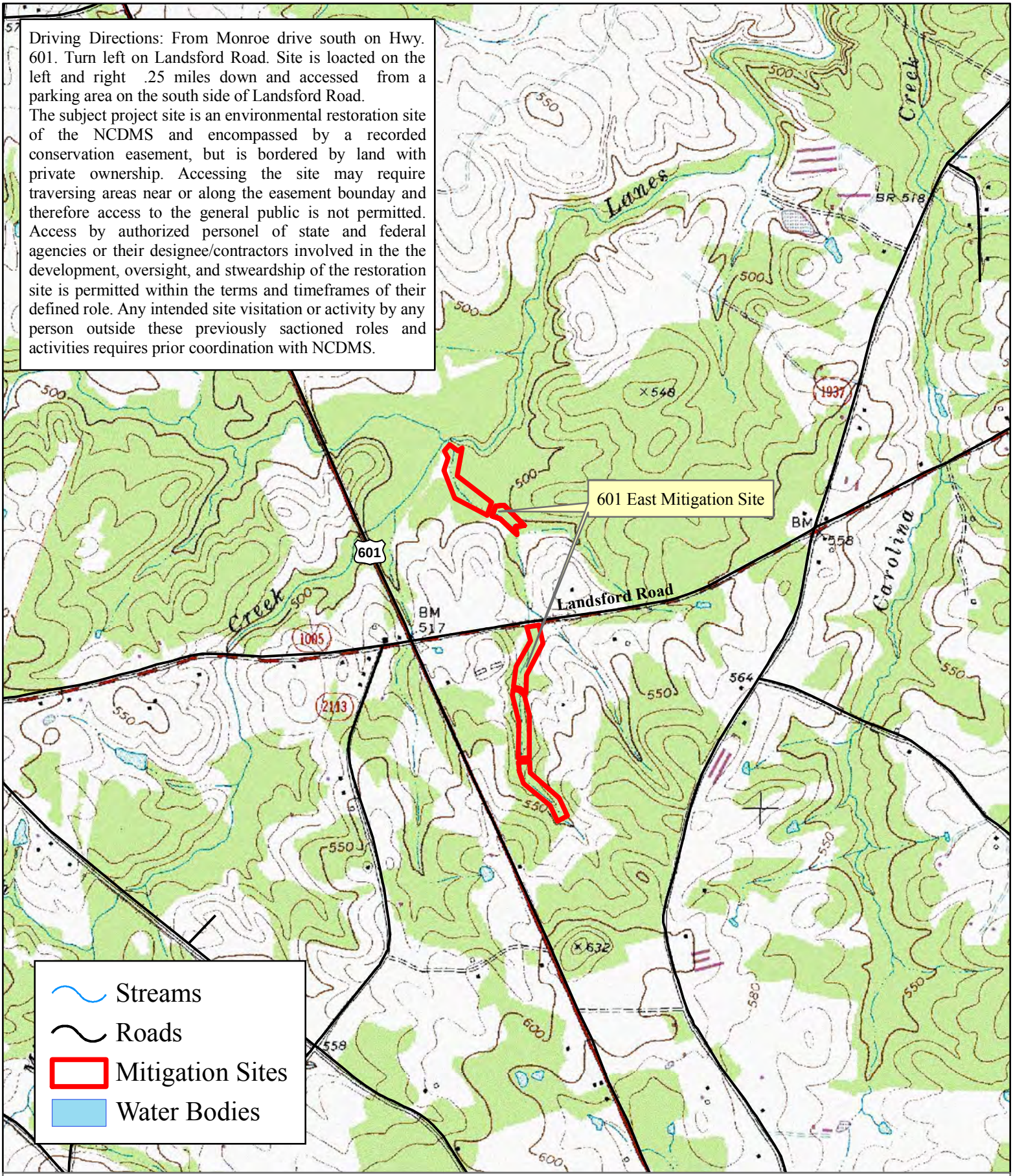
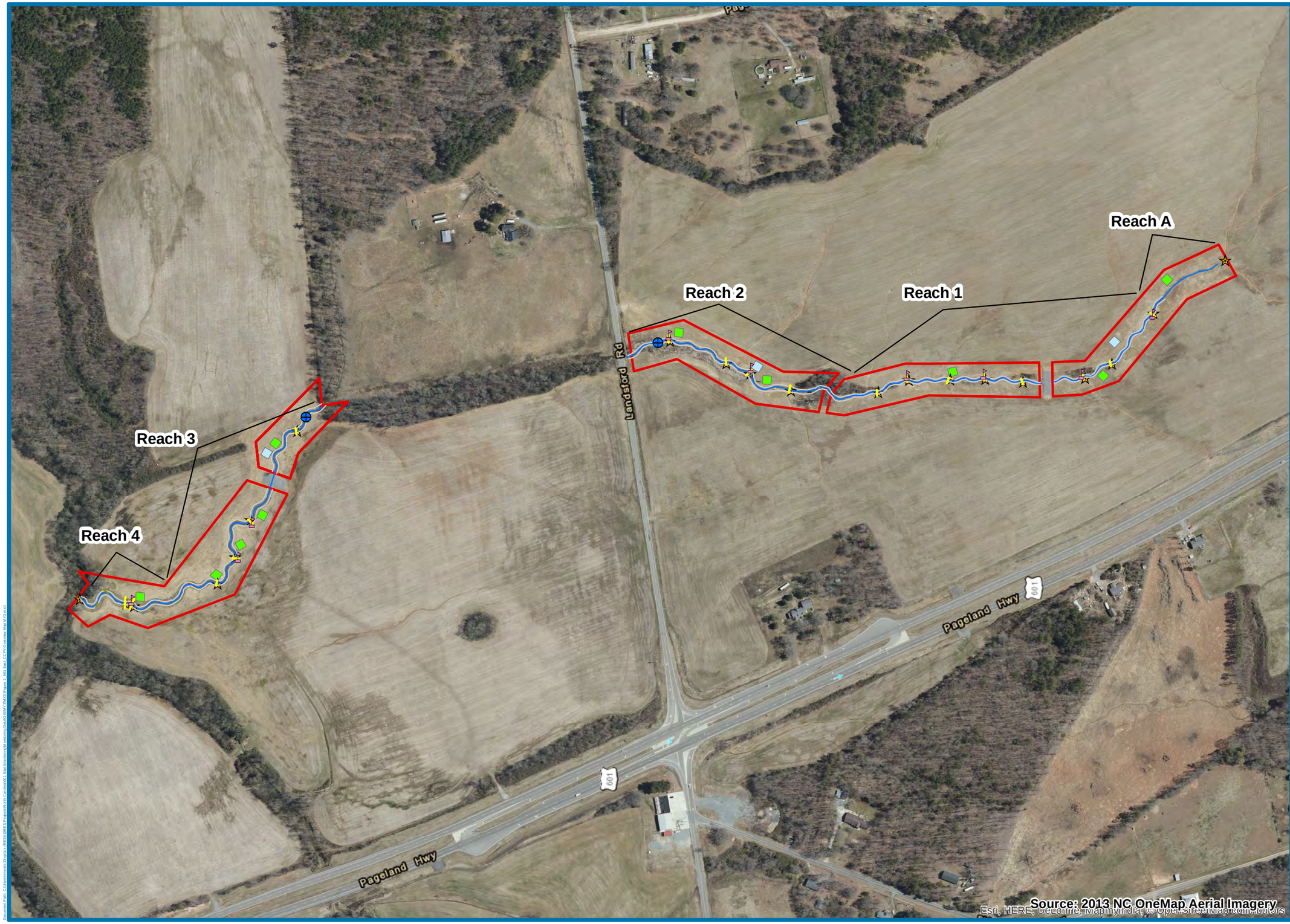


Figure 1
601 East Mitigation Site
Project Vicinity Map



res

0 175 350
Feet

1 inch = 350 feet

Figure 2a

601 East Stream Restoration Project MY3 2017

Current Conditions Overview Map

Date: 12/8/2017	Drawn by: RTM

LEGEND

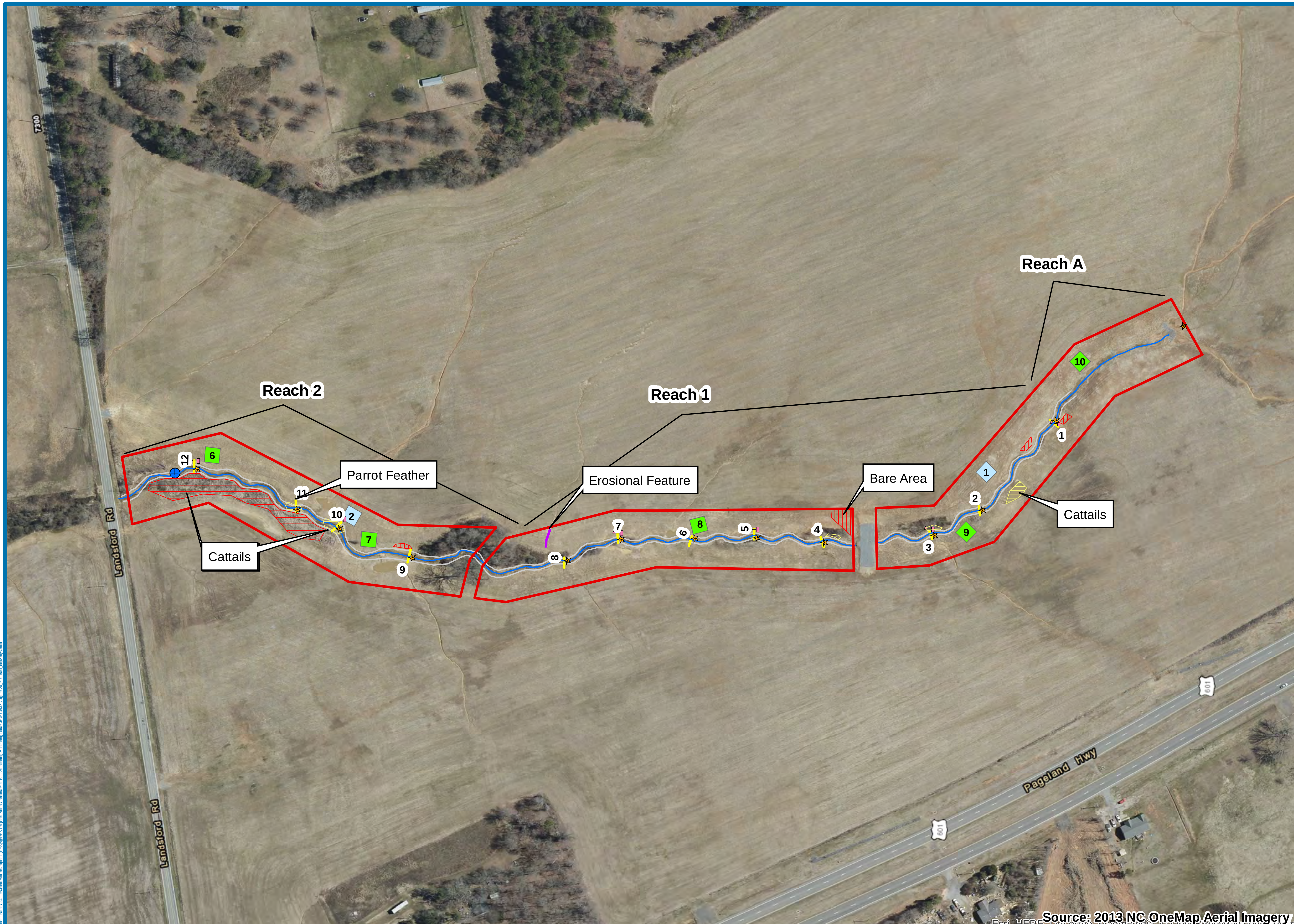
- Conservation Easement
- Bankpin Array
- Cross Section
- Crest Gauge
- Structure
- Top of Bank
- Thalweg
- Photo Station

Vegetation Success

- Criteria Met
- Temporary Plot

Riparian Buffer Conditions

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



0 100 200
Feet

1 inch = 200 feet

Figure 2b

601 East Stream Restoration Project MY3 2017

Current Conditions Plan View

Date: 12/5/2017	Drawn by: RTM

LEGEND

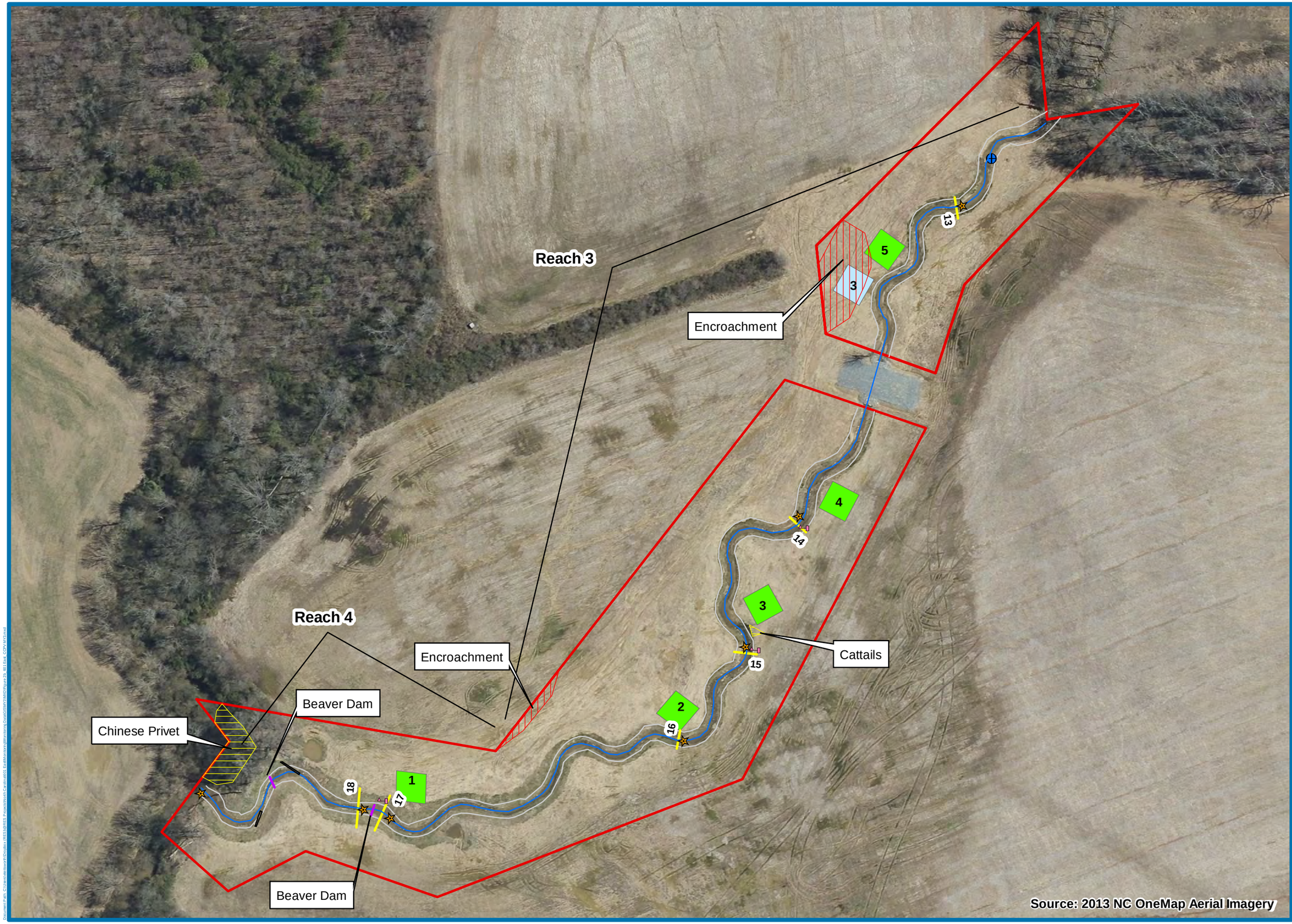
- Conservation Easement
- Photo Station
- Stream
- Bankpin Array
- Cross Section
- Crest Gauge
- Structure
- Top of Bank
- MY3 SPAs

Vegetation Success

- Criteria Met
- Temporary Plot

Riparian Buffer Conditions

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



res

N E S W

0 50 100

Feet

1 inch = 100 feet

Figure 2c

601 East Stream Restoration Project MY3 2017

Current Conditions Plan View

Date: 12/5/2017	Drawn by: RTM

LEGEND

- Conservation Easement
- Stream
- Photo Station
- Top of Bank
- Cross Section
- Structure
- MY3 SPAs
- Bankpin Array
- Crest Gauge

Vegetation Success

- Criteria Met
- Temporary Plot

Riparian Buffer Conditions

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

Appendix B

Visual Assessment Data

Table 5. Vegetation Condition Assessment
Table 6. Visual Stream Morphology Stability Assessment
Figure 3. 2017 Photo Station Photos
Figure 4. 2017 Problem Area Photos

Table 5. 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 Vertical Lines	4	0.06	0%
2. Low Stem Density Areas	Woody stem densities clearly below target levels based on MY3, 4, or 5 stem count criteria.	N/A	0	0.00	0%
		Totals	4	0.06	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.	N/A	0	0.00	0%
		Cumulative Totals	4	0.06	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).	Horizontal Lines (Red - Dense/Yellow - Present)	8	0.44	3%
5. Easement Encroachment Areas	Areas or points (if too small to render as polygons at map scale).	Red Vertical Lines	2	0.13	1%

N/A - Item does not apply.

Table 6. Visual Stream Morphology Stability Assessment

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 does NOT 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			

N/A - Item does not apply.

Table 6 con't. Visual Stream Morphology Stability Assessment

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 does NOT 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			

N/A - Item does not apply.

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 does NOT 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			

N/A - Item does not apply.

Table 6 con't. Visual Stream Morphology Stability Assessment

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 does NOT 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%			

N/A - Item does not apply.

Figure 3. 2017 Photo Station Photos

Reach 1 – Permanent Photo Station 1
Top of Project – Looking Downstream
October 17, 2017

Reach 1 – Permanent Photo Station 2
Cross Section 1 – Looking Downstream
July 20, 2017

Reach 1 – Permanent Photo Station 3
Cross Section 2 – Looking Downstream
July 20, 2017

Reach 1 – Permanent Photo Station 4
Cross Section 3 – Looking Downstream
July 20, 2017

Reach 1 – Permanent Photo Station 5
Cross Section 4 – Looking Downstream
July 20, 2017

Reach 1 – Permanent Photo Station 6
Cross Section 5 – Looking Downstream
July 20, 2017

Reach 1 – Permanent Photo Station 7
Cross Section 6 – Looking Downstream
July 20, 2017

Reach 1 – Permanent Photo Station 8
Cross Section 7 – Looking Downstream
July 20, 2017

Reach 1 – Permanent Photo Station 9
Cross Section 8 – Looking Downstream
July 20, 2017

Reach 2 – Permanent Photo Station 10
Cross Section 9 – Looking Downstream
July 20, 2017

Reach 2 – Permanent Photo Station 11
Cross Section 10 – Looking Downstream
July 20, 2017

Reach 2 – Permanent Photo Station 12
Cross Section 11 – Looking Downstream
July 20, 2017

Reach 2 – Permanent Photo Station 13
Cross Section 12 – Looking Downstream
July 20, 2017

Reach 3 – Permanent Photo Station 14
Cross Section 13 – Looking Downstream
July 19, 2017

Reach 3 – Permanent Photo Station 15
Cross Section 14 – Looking Downstream
July 19, 2017

Reach 3 – Permanent Photo Station 16
Cross Section 15 – Looking Downstream
July 19, 2017

Reach 3 – Permanent Photo Station 17
Cross Section 16 – Looking Downstream
July 19, 2017

Reach 4 – Permanent Photo Station 18
Cross Section 17 – Looking Downstream
July 19, 2017

Reach 4 – Permanent Photo Station 19
Cross Section 18 – Looking Downstream
July 19, 2017

Reach 4 – Permanent Photo Station 20
Bottom of Project – Looking Upstream
October 17, 2017

Figure 4. 2017 Problem Area Photos

Reach 1 Right Bank – Bare Area

Reach 1 Right Bank – Bare Area

Reach 1 – Erosional Feature entering from farm field

Reach 3 – Easement Encroachment

Reach 3 – Easement Encroachment

Reach 4 – Beaver Dam

Reach 4 – Beaver Dam

Appendix C

Vegetation Plot Data

Table 7. Vegetation Plot Mitigation Success Summary
Table 8. CVS Vegetation Metadata
Table 9. Total Planted Stem Counts
Figure 5. Vegetation Plot Photos

Table 7. MY3 Vegetation Plot Criteria Attainment

Plot #	Planted Stems/Acre	Volunteer Stems/Acre	Total Stems/Acre	Success Criteria Met?	Average Tree Height (cm)*
1	607	1416	2023	Yes	197
2	971	283	1295	Yes	110
3	526	445	1255	Yes	212
4	607	81	688	Yes	102
5	567	0	567	Yes	176
6	567	0	567	Yes	121
7	405	0	405	Yes	131
8	526	40	567	Yes	79
9	688	162	850	Yes	96
10	850	121	971	Yes	186
Project Avg	**631**	**255**	**919**	**Yes**	141

* Only the tallest eight trees were averaged, as this is the amount that represents 320 stems/acre.

Table 8. CVS Vegetation Plot Metadata

Table 8: CVS Vegetation Plot Metadata 601 East Stream and Wetland Restoration Site	
Report Prepared By	Eric Teitsworth
Date Prepared	10/20/2017 15:14
database name	RES-MY3_2017-601East.mdb
database location	C:\Users\eteitsworth\Dropbox (RES)\@RES Projects\North Carolina\601 East\Monitoring\Monitoring Data\MY3_2017\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

Table 9. Planted Total Stem Counts (Species by Plot) 601E Stream Restoration Site																																		
			Current Plot Data (MY3 2017)																																	
		Species	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	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			25																													
Asimina triloba	Pawpaw	Tree																																
Betula nigra	River Birch	Tree	2	2	2	1	1	1				6	6	6	1	1	1	5	5	5	1	1	1	2	2	2	6	6	7					
Celtis occidentalis	Common Hackberry	Tree									2			2																				
Cephalanthus occidental	Common Buttonbush	Shrub																1	1	1	1	1	1							2	2	2		
Cercis canadensis var. c	Eastern Redbud	Tree						1																										
Fraxinus pennsylvanica	Green Ash	Tree										3	3	3	3	3	3	4	4	4	3	3	3	6	6	6	8	8	8	2	2	2		
Liquidambar styraciflua	Sweetgum	Tree			9			6			2																							
Liriodendron tulipifera v	Tulip-tree, Yellow Po	Tree	1	1	1	1	1	1	2	2	2	1	1	1							1	1	1							6	6	7		
Nyssa sylvatica	Blackgum	Tree													2	2	2										1	1	1					
Platanus occidentalis var	Sycamore, Plane-tree	Tree	8	8	8	14	14	14	10	10	10	4	4	4	5	5	5	2	2	2				3	3	4	1	1	1	8	8	9		
Populus deltoides var. de	Eastern Cottonwood					1	1	1		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				6	6	6	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	2	2	2				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 var. co	Flameleaf Sumac	shrub									7																		1			1		
Salix nigra	Black Willow	Tree								6	6																1	1	3					
Ulmus americana	American Elm	Tree			1																													
Ulmus rubra	Slippery Elm	Tree																																
Stem count			15	15	50	25	25	32	13	20	31	15	15	17	14	14	14	14	14	14	10	10	10	13	13	14	17	17	21	21	21	24		
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	8	6	6	8	3	5	8	5	5	6	6	6	6	5	5	5	7	7	7	5	5	5	5	5	6	6	6	7		
Stems per ACRE			607	607	2023	1012	1012	1295	526	809	1255	607	607	688	567	567	567	567	567	567	405	405	405	526	526	567	688	688	850	850	850	971		

Table 9 Con't. Planted Total Stem Count (Annual Means)
601 Stream Restoration Site

			Annual Means											
		Species	MY3 (2017)			MY2 (2016)			MY1 (2015)			MY0 (2015)		
Scientific Name	Common Name	Type	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T
Acer negundo	Boxelder	Tree			25			31						
Asimina triloba	Pawpaw	Tree				2	2	2	1	1	1	2	2	2
Betula nigra	River Birch	Tree	24	24	25	33	33	33	14	14	14	24	24	24
Celtis occidentalis	Common Hackberry	Tree			4									
Cephalanthus occidental	Common Buttonbush	Shrub	4	4	4	5	5	5	4	4	4	6	6	6
Cercis canadensis var. c	Eastern Redbud	Tree			1									
Fraxinus pennsylvanica	Green Ash	Tree	29	29	29	27	27	28	3	3	3	3	3	3
Liquidambar styraciflua	Sweetgum	Tree			17			16						
Liriodendron tulipifera v	Tulip-tree, Yellow Po	Tree	12	12	13	20	20	21	16	16	16	30	30	30
Nyssa sylvatica	Blackgum	Tree	3	3	3	3	3	3	3	3	3	18	18	18
Platanus occidentalis va	Sycamore, Plane-tree	Tree	55	55	57	59	59	59	47	47	47	58	58	58
Populus deltoides var. d	Eastern Cottonwood		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									
Quercus michauxii	Swamp Chestnut Oak	Tree	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	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 var. co	Flameleaf Sumac	shrub			9			9						
Salix nigra	Black Willow	Tree	1	7	9	1	6	13		5	5			
Ulmus americana	American Elm	Tree			1									
Ulmus rubra	Slippery Elm	Tree						1						
Stem count			157	164	227	178	184	250	116	123	123	200	207	207
size (ares)			10			10			10			10		
size (ACRES)			0.25			0.25			0.25			0.25		
Species count			11	11	17	15	15	19	13	14	14	11	11	11
Stems per ACRE			635	664	919	720	745	1012	469	498	498	800	828	828

Color for Density

- Exceeds requirements by 10%
- Exceeds requirements, but by less than 10%
- Fails to meet requirements, by less than 10%
- Fails to meet requirements by more than 10%
- Recruit Stems

Figure 5. 2017 Vegetation Plot Photos

601 East - Vegetation Monitoring Plot 1
October 17, 2017

601 East - Vegetation Monitoring Plot 2
October 17, 2017

601 East - Vegetation Monitoring Plot 3
October 17, 2017

601 East - Vegetation Monitoring Plot 4
October 17, 2017

601 East - Vegetation Monitoring Plot 5
October 17, 2017

601 East - Vegetation Monitoring Plot 6
October 17, 2017

601 East - Vegetation Monitoring Plot 7
October 17, 2017

601 East - Vegetation Monitoring Plot 8
October 17, 2017

601 East - Vegetation Monitoring Plot 9
October 17, 2017

601 East - Vegetation Monitoring Plot 10
October 17, 2017

Appendix D

Stream Geomorphology Data

Table 10. Baseline Stream Data Summary
Table 11a. Dimensional Morphology Summary
Table 11b. Stream Reach Data Summary
Figure 6. Cross Section Plots
Table 12. Pebble Count Data Summary
Charts 1-5. MY3 Stream Reach Substrate Composition Charts
Table 13. Bank Pin Array Summary

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/f^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/df^p/di^{op} (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/df^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**
Record elevation (datum) used	544.82	544.82	544.82	544.82					540.40	540.40	540.40	540.40					537.87	537.87	537.87	537.87					533.69	533.69	533.69	533.69				
Bankfull Width (ft)	13.6	15.1	15.1	14.7					15.1	14.7	15.2	15.2					9.4	9.5	9.3	9.2					8.8	9.1	9.4	9.2				
Floodprone Width (ft)	45.0	>45.0	>45.0	>45.0					77.0	>77.0	>77.0	>77.0					154.0	>154.0	>154.0	>154.0					75.0	>75.0	>75.0	>75.0				
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)	2.1	2.2	2.2	2.1					1.2	1.2	1.2	1.1					1.8	1.7	1.8	1.8					0.9	0.9	1.1	1.0				
Bankfull Cross Sectional Area (ft^2)	14.1	13.7	14.3	13.4					9.0	8.0	8.0	8.8					8.7	8.5	8.8	8.5					4.5	4.8	5.8	5.1				
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					9.3	>5.2	>5.1	>5.1					14.9	>14.6	>16.6	N/A					15.9	>8.3	>8.0	>8.2				
Bankfull Bank Height Ratio	1.0	1.0	1.0	N/A					1.0	1.0	1.0	0.7					1.0	1.0	1.0	N/A					0.9	1.0	1.0	0.7				
d50 (mm)	N/A	N/A	N/A	N/A					N/A	8.3	0.062	0.062					N/A	N/A	N/A	N/A					N/A	22.0	17.0	28.0				
	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**
Record elevation (datum) used	530.49	530.49	530.49	530.49					528.11	528.11	528.11	528.11					525.02	525.02	525.02	525.02					522.48	522.48	522.48	522.48				
Bankfull Width (ft)	12.9	12.1	12.0	13.2					11.3	11.3	11.3	11.1					10.3	11.4	10.3	10.8					10.1	8.8	9.2	9.0				
Floodprone Width (ft)	61.0	>61.0	>61.0	>61.0					80.0	>80.0	>80.0	>80.0					63.0	>63.0	>63.0	>63.0					40.0	>40.0	>40.0	>40.0				
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)	2.0	1.8	1.8	1.9					1.3	1.3	1.4	1.3					2.0	2.0	2.1	1.9					1.0	1.0	1.0	1.0				
Bankfull Cross Sectional Area (ft^2)	12.8	11.0	11.2	12.8					6.6	6.6	7.2	6.9					12.3	11.2	10.4	9.9					6.2	5.6	5.8	5.9				
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					9.7	>7.1	>7.1	>7.2					10.7	>5.5	>6.1	N/A					10.9	>4.5	>4.3	>4.5				
Bankfull Bank Height Ratio	0.9	1.0	1.0	N/A					1.0	1.0	1.0	0.9					1.0	1.0	1.0	N/A					1.0	1.0	1.0	0.8				
d50 (mm)	N/A	N/A	N/A	N/A					N/A	26.0	2.6	4.0					N/A	N/A	N/A	N/A					N/A	0.062	0.062	70.0				

N/A - Information Not Available

[1] MY0 Bankfull Entrennchment Ratios Updated to Reflect Calculated Values

Note: Starting in MY3, Bankfull Bank Height Ratio was calculated on riffles using the baseline bankfull elevation. This method was used because the dimension of the channels has not changed enough to alter the bankfull elevation.

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**
Record elevation (datum) used	517.50	517.50	517.50	517.50					516.22	516.22	516.22	516.22					515.16	515.16	515.16	515.16					513.68	513.68	513.68	513.68				
Bankfull Width (ft)	24.2	24.3	24.4	23.0					19.2	19.7	19.7	20.8					15.5	15.8	14.1	17.3					20.0	20.6	20.6	20.7				
Floodprone Width (ft)	62.0	>62.0	>62.0	>62.0					132.0	>132.0	>132.0	>132.0					73.0	>73.0	>73.0	>73.0					168.0	>168.0	>168.0	>168.0				
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)	1.5	1.4	1.4	1.4					2.5	2.6	2.6	2.0					1.5	1.3	1.5	1.3					2.5	2.4	2.6	2.8				
Bankfull Cross Sectional Area (ft^2)	17.7	16.5	17.5	15.2					25.3	24.4	23.1	20.1					9.4	8.6	8.3	9.8					21.3	21.4	23.1	24.5				
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					11.7	>6.7	>6.7	N/A					7.1	>4.6	>5.2	>4.2					7.0	>8.1	>8.2	N/A				
Bankfull Bank Height Ratio	1.0	1.0	1.0	1.0					1.0	1.0	1.0	N/A					0.9	1.0	1.0	0.7					0.9	1.0	1.0	N/A				
d50 (mm)	N/A	0.062	5.8	2.3					N/A	N/A	N/A	N/A					N/A	0.062	0.062	17					N/A	N/A	N/A	N/A				

Note: Starting in MY3, Bankfull Bank Height Ratio was calculated on riffles using the baseline bankfull elevation. This method was used because the dimension of the channels has not changed enough to alter the bankfull elevation.

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**
Record elevation (datum) used	497.88	497.88	497.88	497.88					495.50	495.50	495.50	495.50					494.42	494.42	494.42	494.42					493.73	493.73	493.73	493.73				
Bankfull Width (ft)	15.9	16.9	17.5	17.1					17.6	18.4	17.9	18.2					19.6	21.1	20.5	19.4					17.7	17.5	18.3	16.7				
Floodprone Width (ft)	75.0	>75.0	>75.0	>75.0					350.0	>350.0	>350.0	>350					350.0	>350.0	>350.0	>350.0					150.0	>150.0	150.0	>150.0				
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)	1.6	1.7	1.8	1.8					3.4	3.1	3.4	3.5					3.4	3.3	3.3	3.3					1.6	1.6	1.7	1.6				
Bankfull Cross Sectional Area (ft^2)	12.8	13.6	12.2	12.6					28.2	28.0	28.7	29.7					36.1	34.4	31.5	32.4					14.1	12.9	14.8	14.0				
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					12.8	>19.1	>19.6	N/A					5.6	>16.6	>17.1	N/A					7.9	>8.5	>8.2	>9.0				
Bankfull Bank Height Ratio	1.0	1.0	1.0	1.0					1.0	1.0	1.0	N/A					1.0	1.0	1.0	N/A					1.0	1.0	1.0	0.8				
d50 (mm)	N/A	20	9.1	85.0					N/A	N/A	N/A	N/A					N/A	N/A	N/A	N/A					N/A	31.0	3.3	62.0				

N/A - Information Not Available

[1] MY0 Bankfull Entrennchment Ratios Updated to Reflect Calculated Values

Note: Starting in MY3, Bankfull Bank Height Ratio was calculated on riffles using the baseline bankfull elevation. This method was used because the dimension of the channels has not changed enough to alter the bankfull elevation.

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**
Record elevation (datum) used	489.11	489.11	489.11	489.11					490.01	490.01	490.01	490.01				
Bankfull Width (ft)	16.9	17.2	17.2	18.1					14.9	14.6	14.1	14.6				
Floodprone Width (ft)	42.0	>42.0	>42.0	>42.0					30.4	>31.0	>31.0	>31.0				
Bankfull Mean Depth (ft)	1.8	1.7	1.7	1.7					1.0	1.0	1.0	1				
Bankfull Max Depth (ft)	2.7	2.9	2.9	2.9					1.5	1.6	1.7	1.8				
Bankfull Cross Sectional Area (ft^2)	29.8	29.1	28.7	31.3					14.7	14.5	14.0	15				
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					2.0	>2.1	>2.2	>2.1				
Bankfull Bank Height Ratio	1.2	1.1	1.1	N/A					1.0	1.0	1.0	0.8				
d50 (mm)	N/A	N/A	N/A	N/A					N/A	47	4.2	12.0				

N/A - Information Not Available

[1] MY0 Bankfull Entrennchment Ratios Updated to Reflect Calculated Values

Note: Starting in MY3, Bankfull Bank Height Ratio was calculated on riffles using the baseline bankfull elevation. This method was used because the dimension of the channels has not changed enough to alter the bankfull elevatio

Table 11b. Stream Reach Data Summary

Table 11b. Monitoring Data - Stream Reach Data Summary
601 East - Reach 1 (1393 feet)

Parameter	Baseline[1]						MY - 1[2]						MY - 2[2]						MY - 3[2]						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)	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																								
Floodprone Width (ft)	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																								
Bankfull Mean Depth (ft)	0.5	0.8	0.8	1.2	0.3	8	0.5	0.6	0.6	0.6	0.1	4	0.5	0.6	0.6	0.6	0.0	4	0.6	0.6	0.6	0.7	0.1	4																								
Bankfull Max Depth (ft)	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																								
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																								
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	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																								
Bank Height Ratio	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																								
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
[1] Based on riffle and pool dimensions
[2] Based solely on riffle dimensions

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

Parameter	Baseline[1]						MY - 1[2]						MY - 2[2]						MY - 3[2]						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)	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																								
Floodprone Width (ft)	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																								
Bankfull Mean Depth (ft)	0.6	0.9	0.9	1.3	0.3	4	0.5	0.6	0.6	0.7	0.1	2	0.6	0.7	0.7	0.7	0.1	2	0.6	0.7	0.7	0.7	0.1	2																								
Bankfull Max Depth (ft)	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																								
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																								
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	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																								
Bank Height Ratio	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																								
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
[1] Based on riffle and pool dimensions
[2] Based solely on riffle dimensions

Table 11b con't. Stream Reach Data Summary

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

Parameter	Baseline[1]						MY - 1[2]						MY - 2[2]						MY - 3[2]						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)	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																								
Floodprone Width (ft)	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																								
Bankfull Mean Depth (ft)	0.8	1.3	1.2	1.8	0.5	4	0.7	0.8	0.8	0.8	0.1	2	0.7	0.8	0.8	0.8	0.1	2	0.7	0.8	0.8	0.8	0.1	2																								
Bankfull Max Depth (ft)	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																								
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																								
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																								
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																								
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
[1] Based on riffle and pool dimensions
[2] Based solely on riffle dimensions

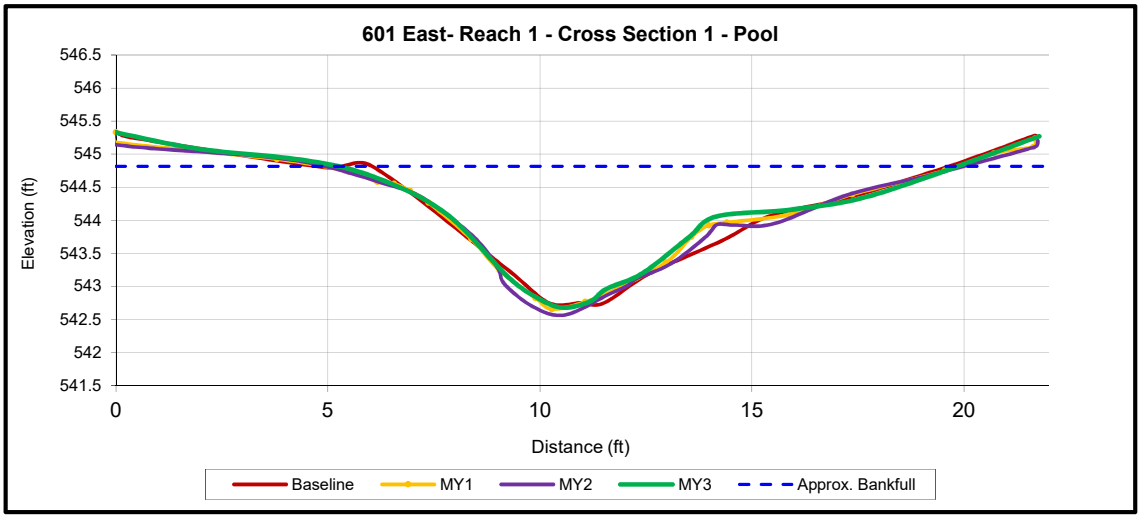
Table 11b cont'd. Monitoring Data - Stream Reach Data Summary
601 East - Reach 4 (495 feet)

Parameter	Baseline[1]						MY - 1[2]						MY - 2[2]						MY - 3[2]						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)	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																								
Floodprone Width (ft)	30.4	36.2	36.2	42.0	8.2	2	-	31.0	-	-	N/A	1	-	31.0	-	-	N/A	1	-	31.0	-	-	N/A	1																								
Bankfull Mean Depth (ft)	1.0	1.4	1.4	1.8	0.5	2	-	1.0	-	-	N/A	1	-	1.0	-	-	N/A	1	-	1.0	-	-	N/A	1																								
Bankfull Max Depth (ft)	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																								
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																								
Width/Depth Ratio	9.6	12.4	12.4	15.2	3.9	2	-	15.6	-	-	N/A	1	-	14.2	-	-	N/A	1	-	14.3	-	-	N/A	1																								
Entrenchment Ratio	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																								
Bank Height Ratio	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																								
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
[1] Based on riffle and pool dimensions
[2] Based solely on riffle dimensions

Upstream

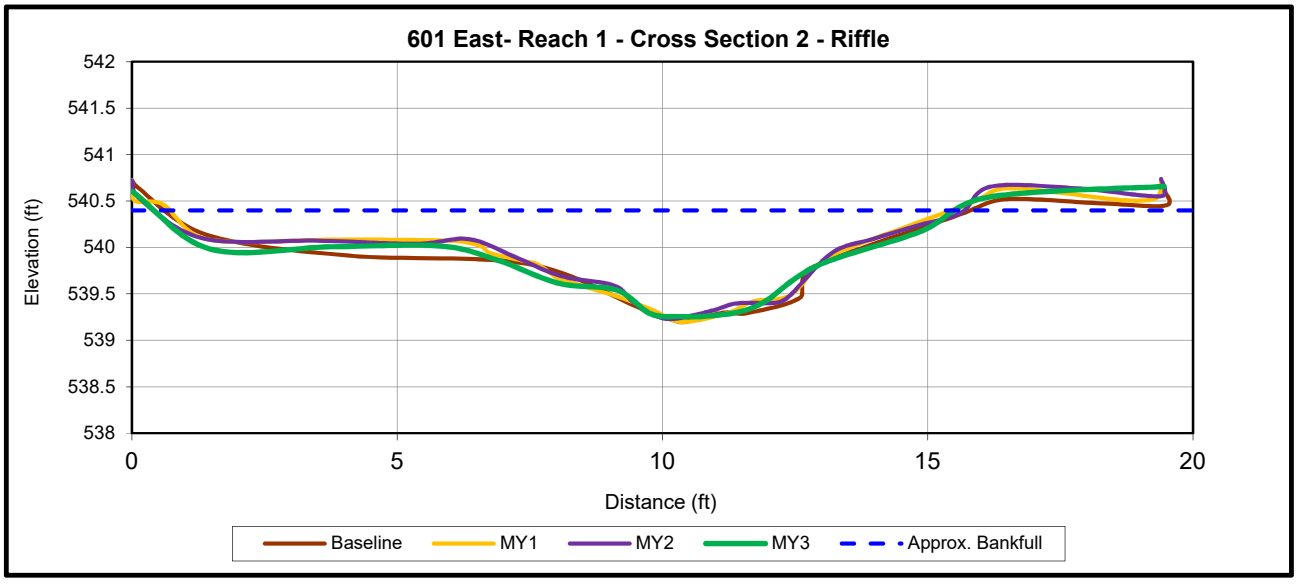
Downstream



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

Upstream

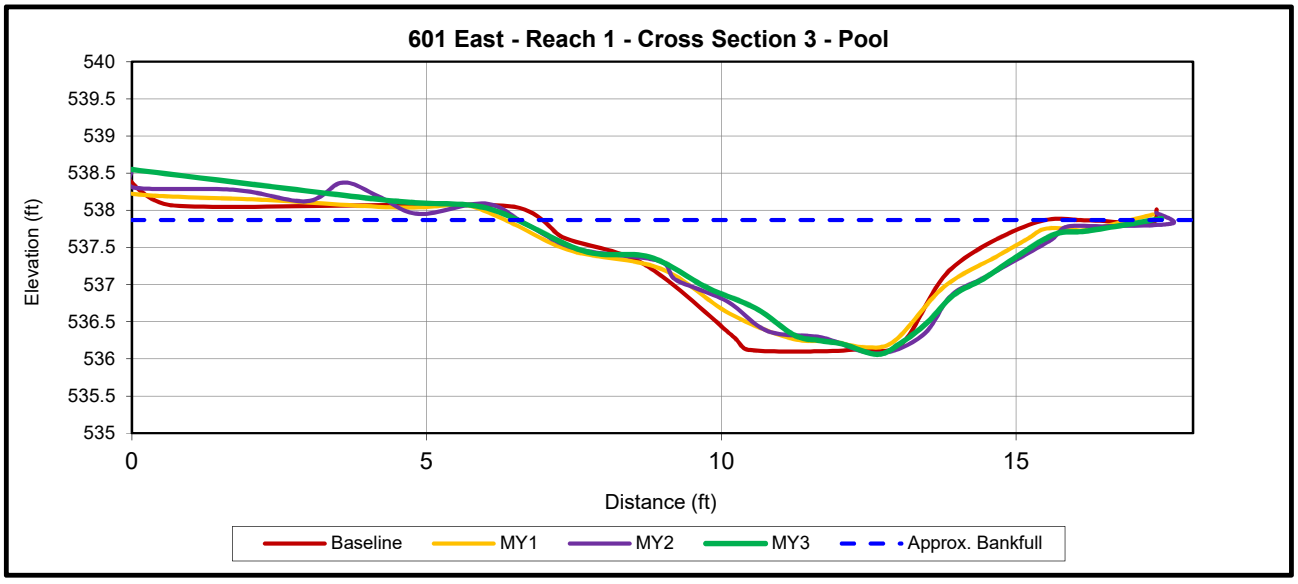
Downstream



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

Upstream

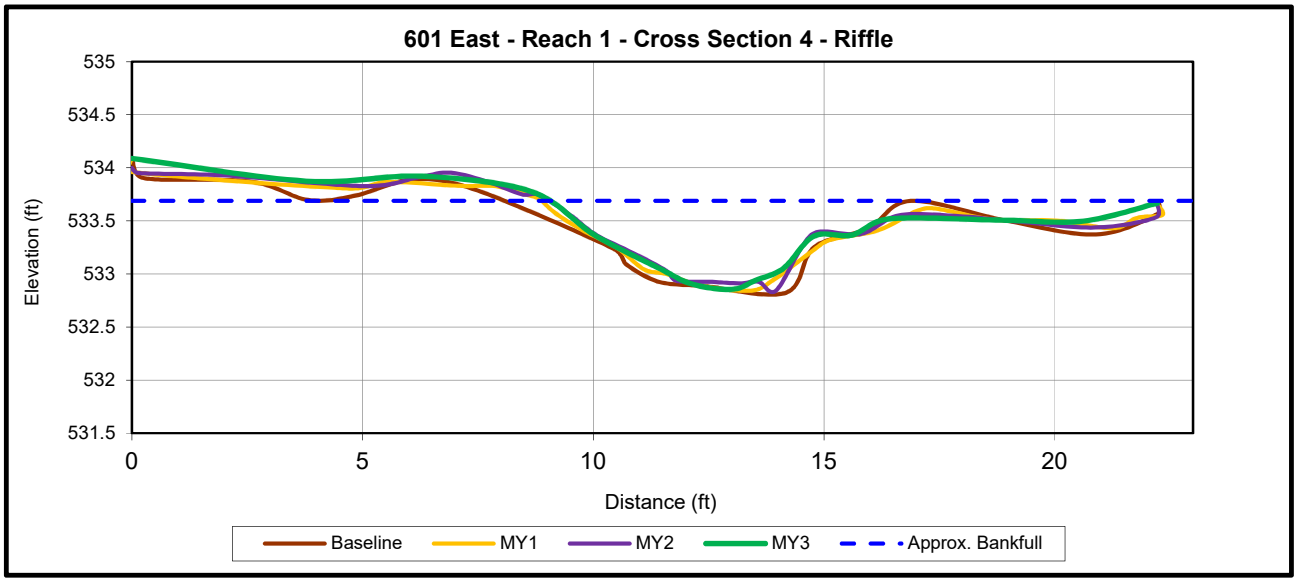
Downstream



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

Upstream

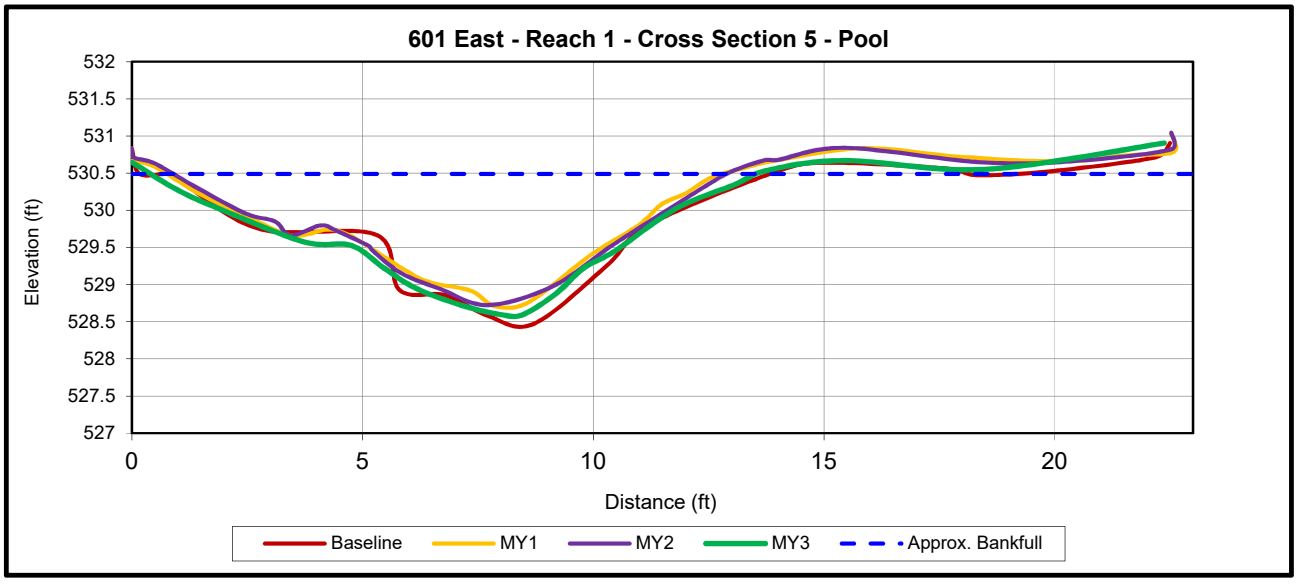
Downstream



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

Upstream

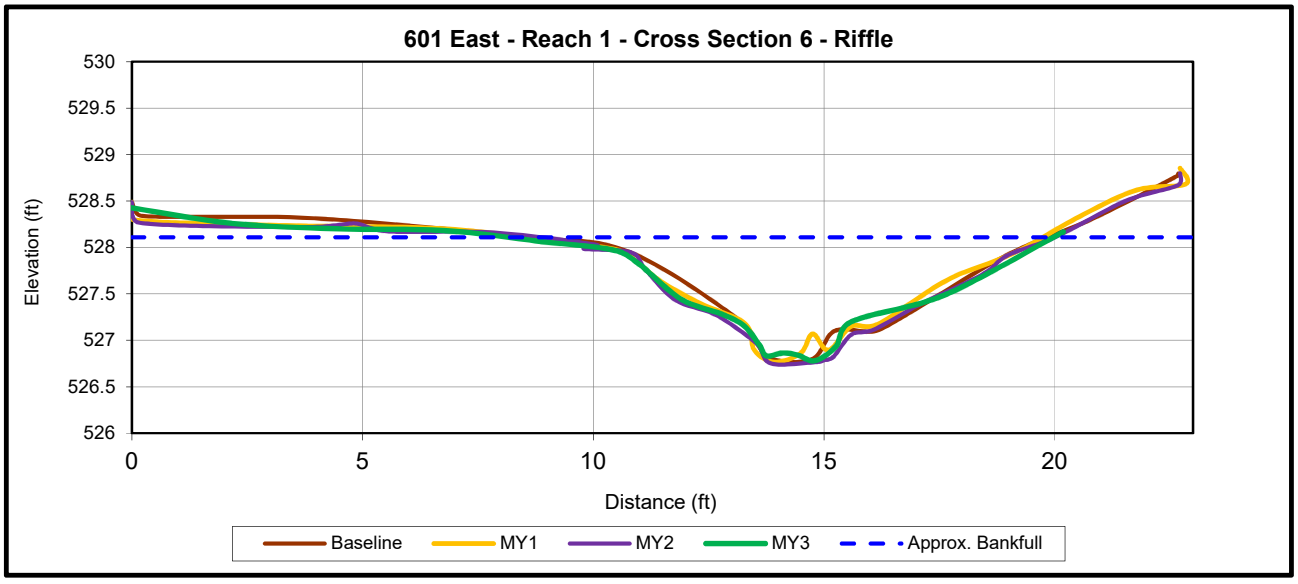
Downstream



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

Upstream

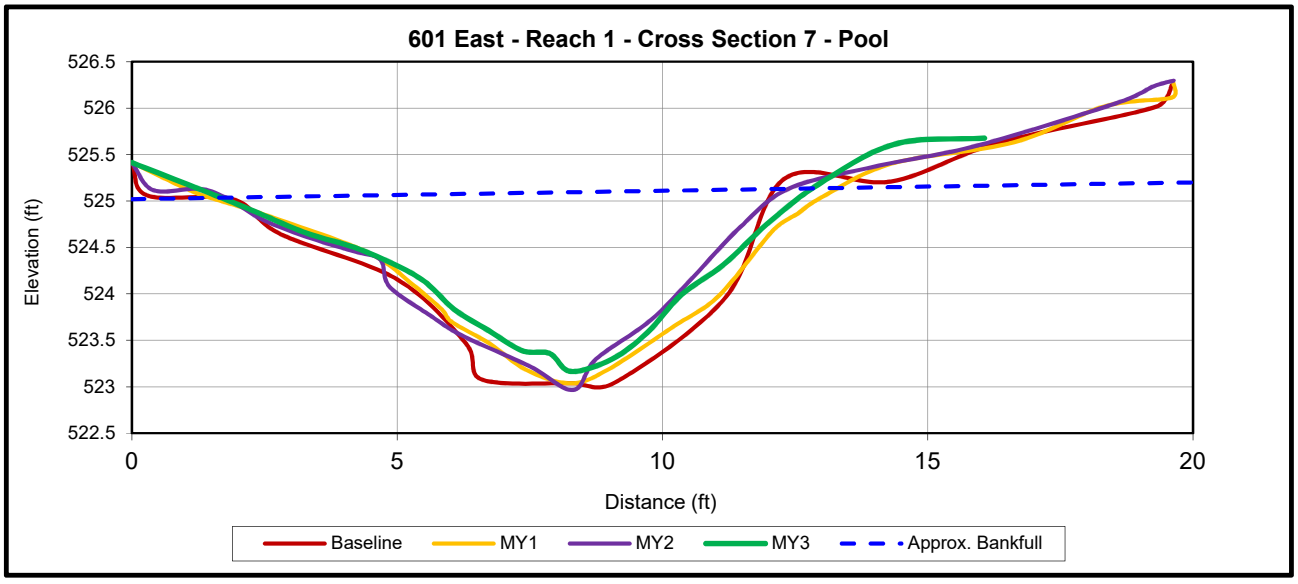
Downstream



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

Upstream

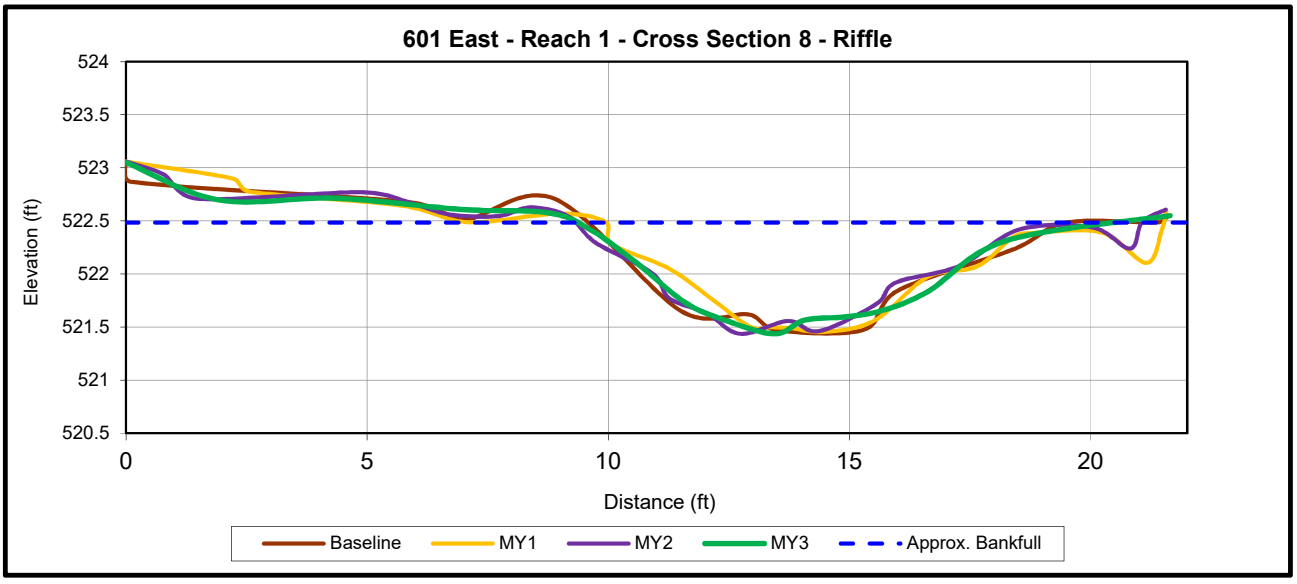
Downstream



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

Upstream

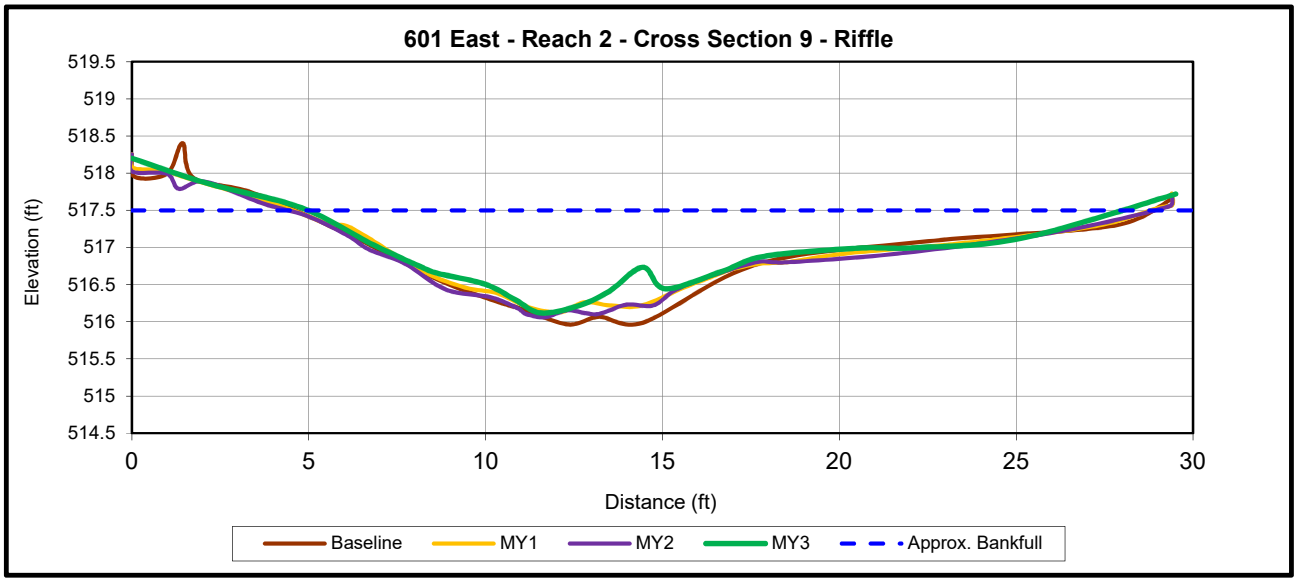
Downstream



DIMENSIONS SUMMARY	MY0	MY1	MY2	MY3	MY4	MY5	MY6	MY7
Bankful Width (ft)	10.1	8.8	9.2	9.0	-	-	-	-
Floodprone Width (ft)	40.0	40.0	40.0	40.0	-	-	-	-
Bankfull Mean Depth (ft)	0.6	0.6	0.6	0.7	-	-	-	-
Bankfull Max Depth (ft)	1.0	1.0	1.0	1.0	-	-	-	-
Bankfull Cross-Sectional Area (ft2)	6.2	5.6	5.8	5.9	-	-	-	-
Width/Depth Ratio	16.6	13.9	14.7	13.7	-	-	-	-
Entrenchment Ratio	10.9	4.5	4.3	4.5	-	-	-	-
Bank Height Ratio	1.0	1.0	1.0	0.8	-	-	-	-

Upstream

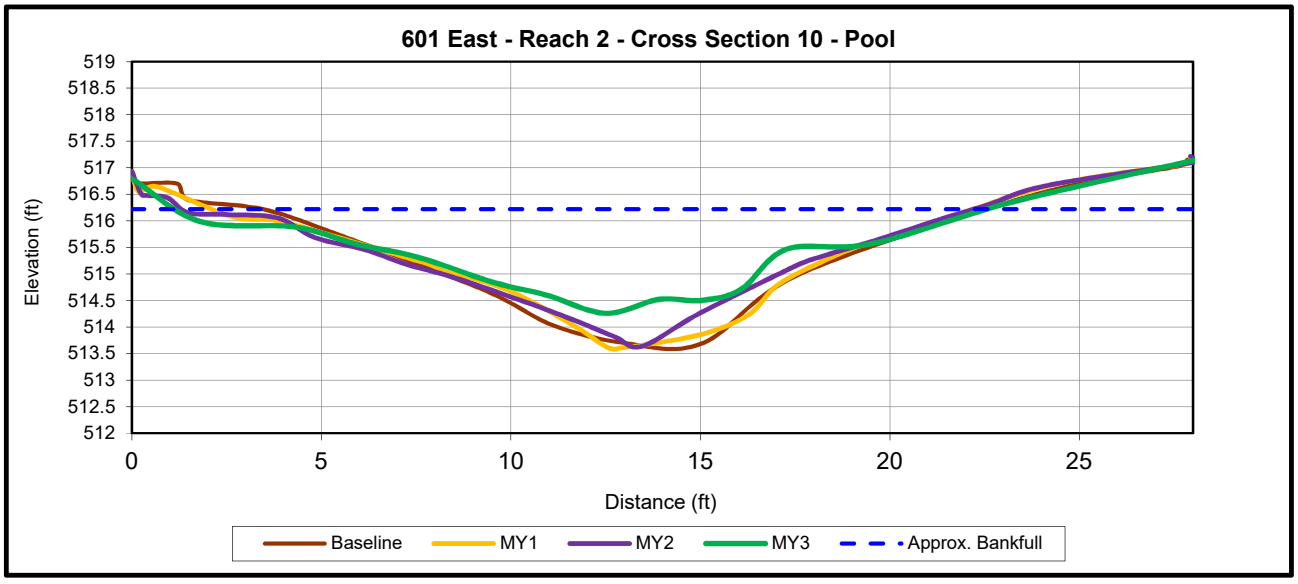
Downstream



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

Upstream

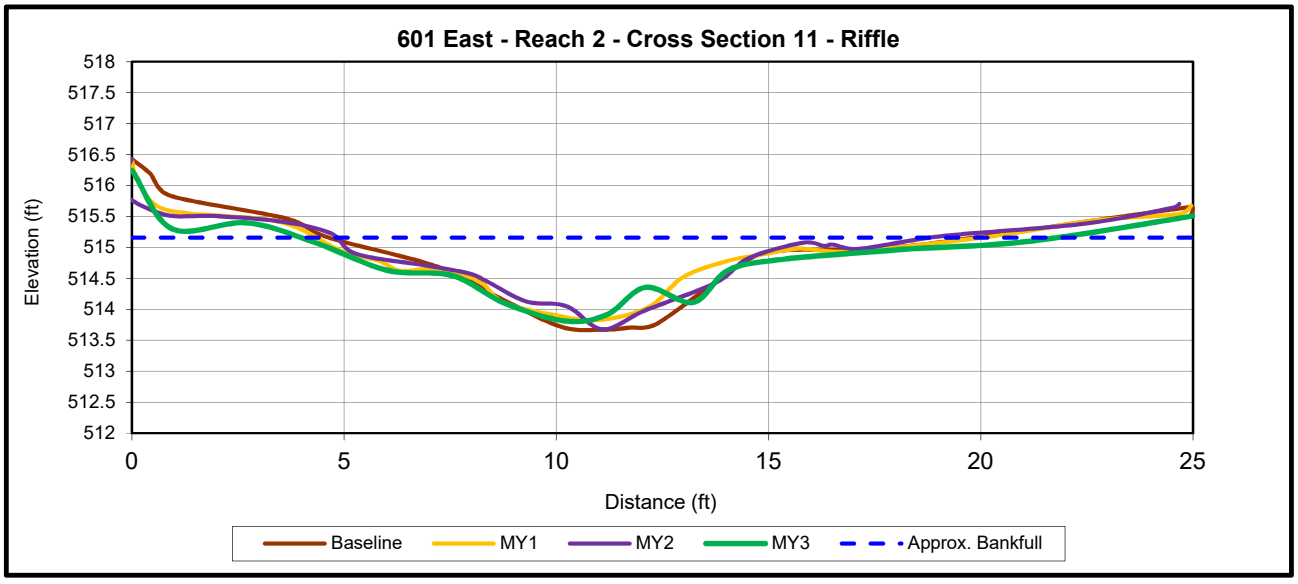
Downstream



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

Upstream

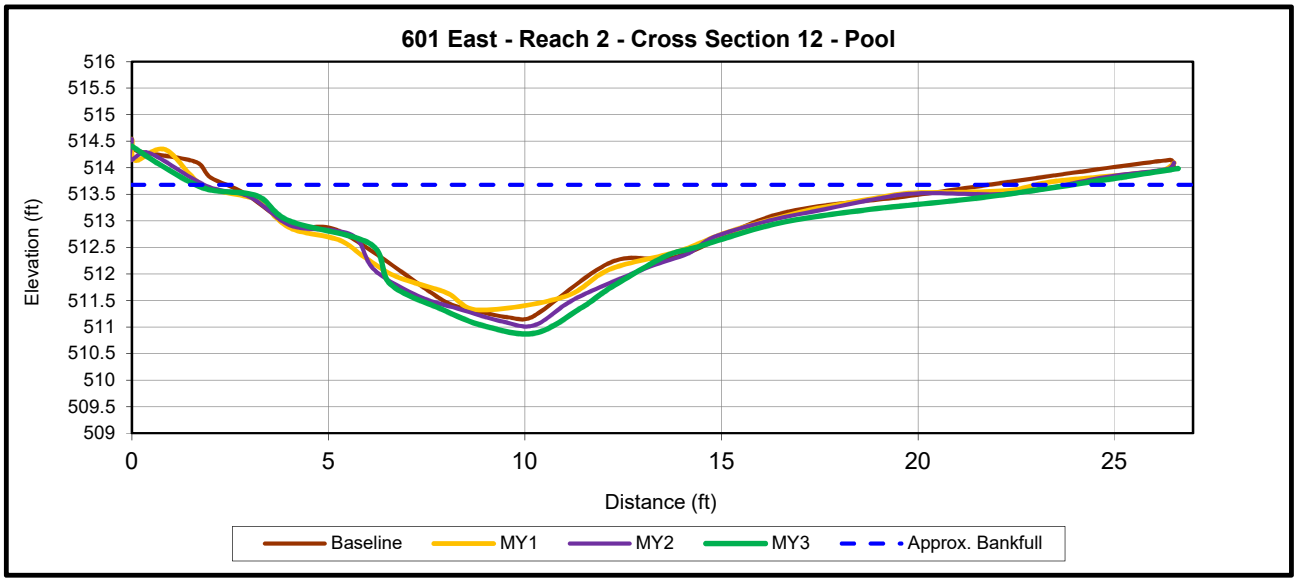
Downstream



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

Upstream

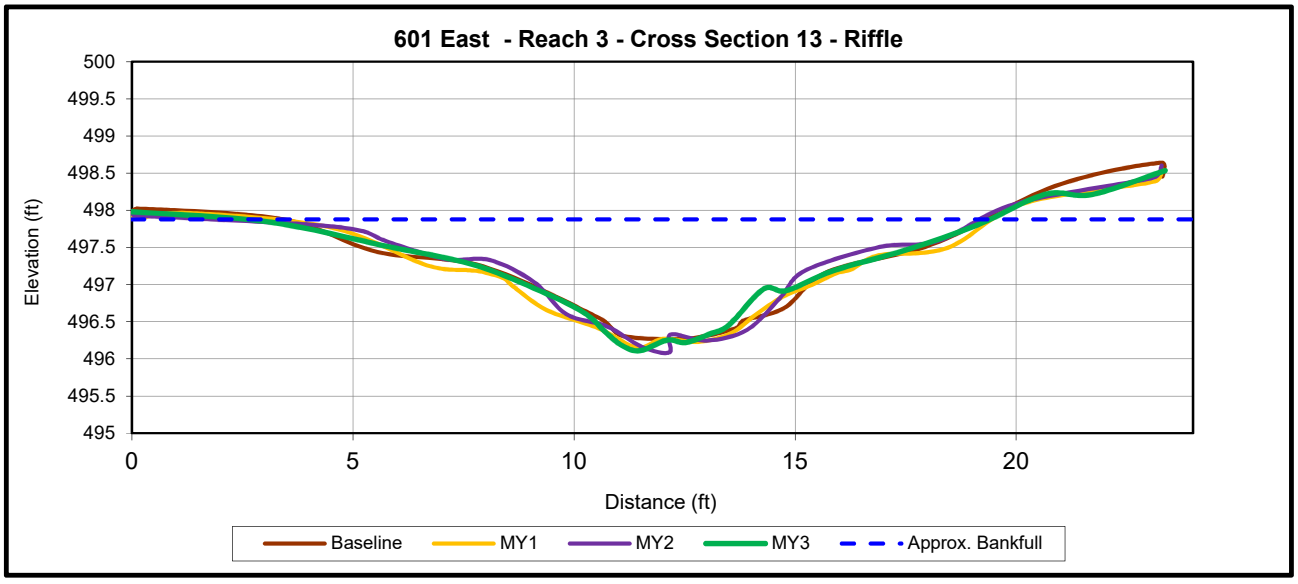
Downstream



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

Upstream

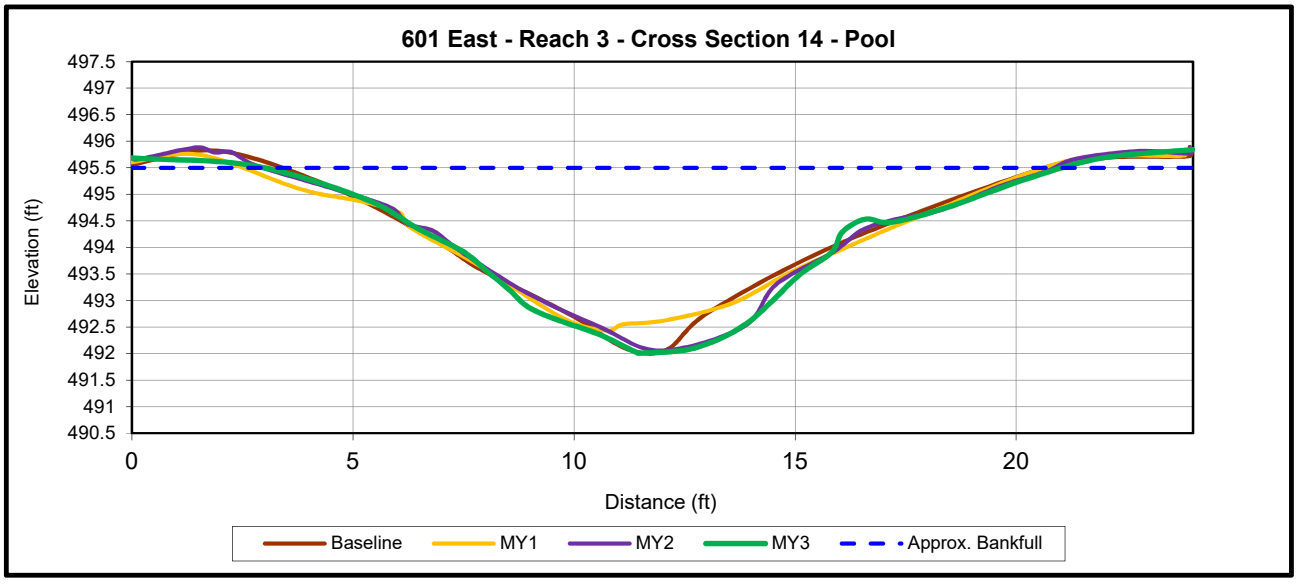
Downstream



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

Upstream

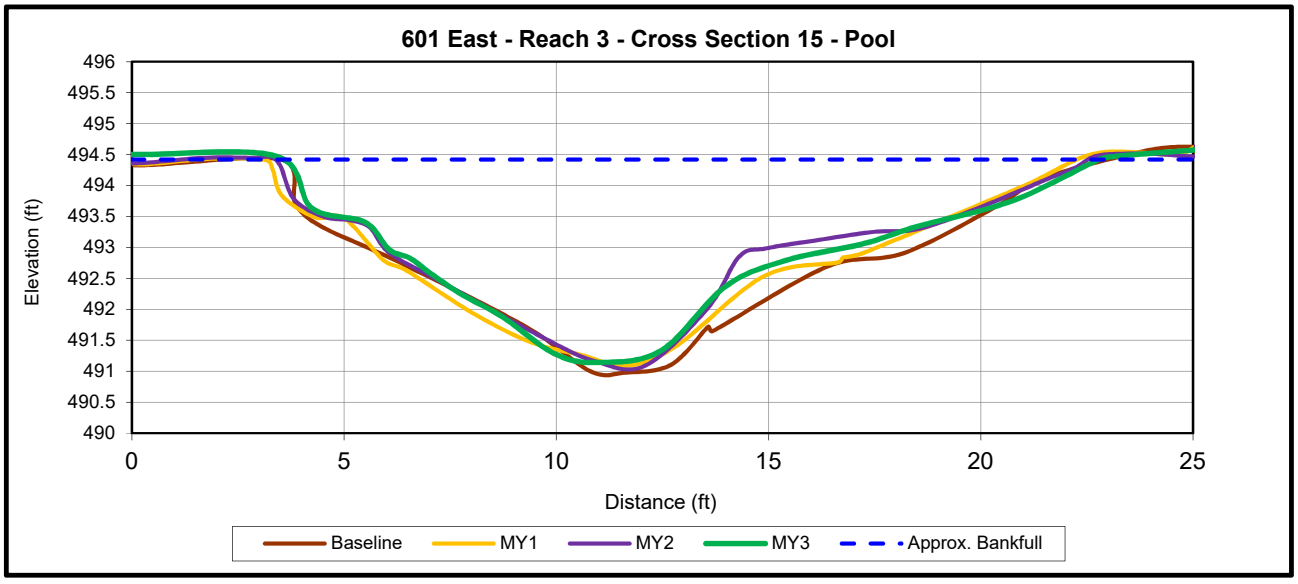
Downstream



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

Upstream

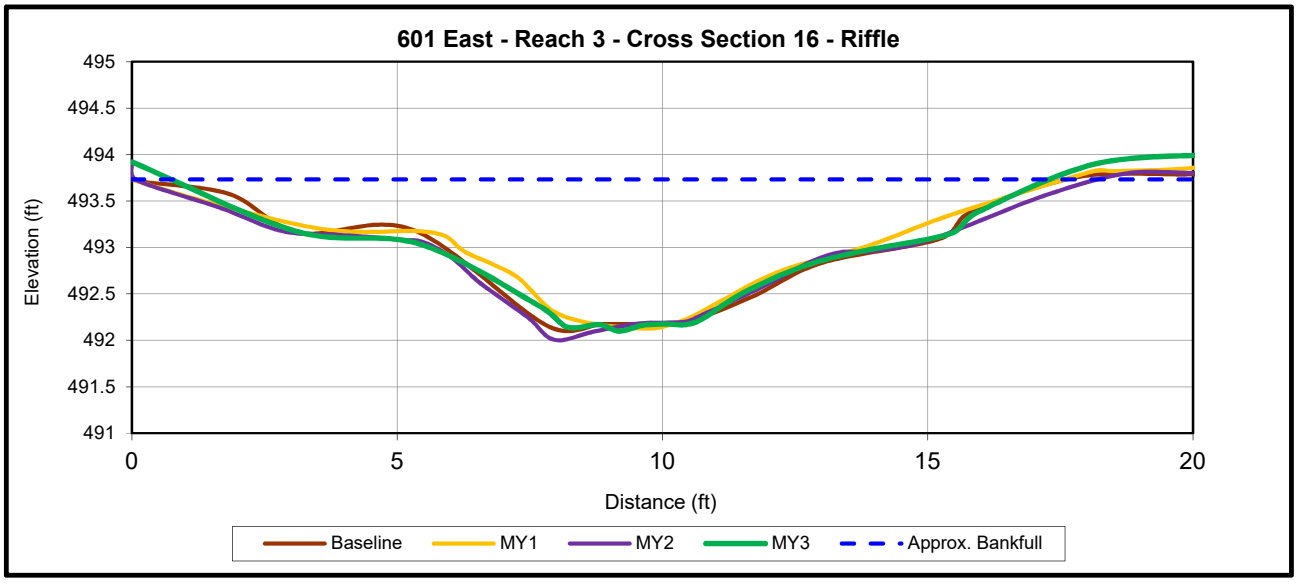
Downstream



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

Upstream

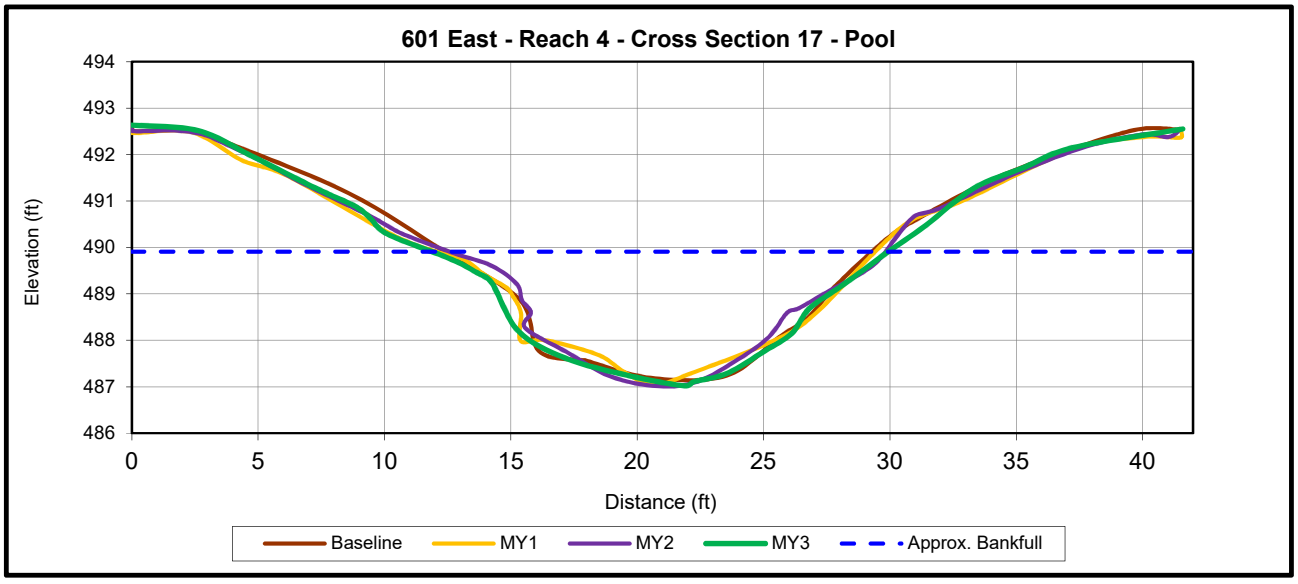
Downstream



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

Upstream

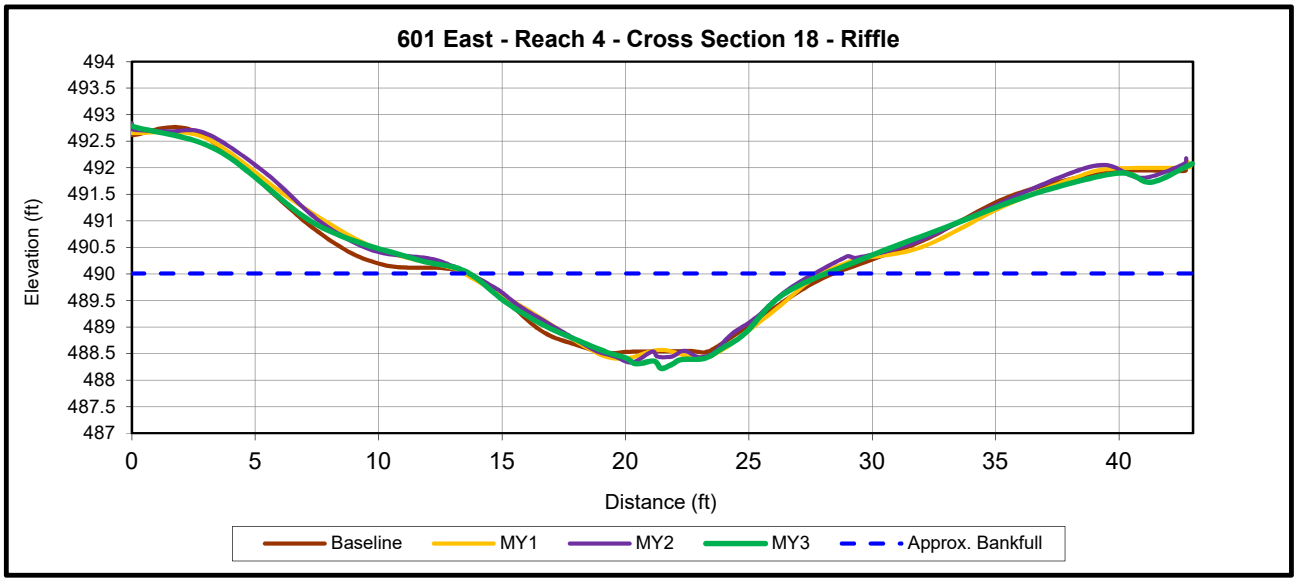
Downstream



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

Upstream

Downstream



DIMENSIONS SUMMARY	MY0	MY1	MY2	MY3	MY4	MY5	MY6	MY7
Bankful Width (ft)	14.9	14.6	14.1	14.6	-	-	-	-
Floodprone Width (ft)	30.4	31.0	31.0	31.0	-	-	-	-
Bankfull Mean Depth (ft)	1.0	1.0	1.0	1.0	-	-	-	-
Bankfull Max Depth (ft)	1.5	1.6	1.7	1.8	-	-	-	-
Bankfull Cross-Sectional Area (ft2)	14.7	14.5	14.0	15.0	-	-	-	-
Width/Depth Ratio	15.2	14.6	14.2	14.3	-	-	-	-
Entrenchment Ratio	2.1	2.1	2.2	2.1	-	-	-	-
Bank Height Ratio	1.0	1.0	1.0	0.8	-	-	-	-

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								
Reach 2	0.062	61	2.9	34.1	9.7	20								
Reach 3	27	79.5	6.2	39.5	73.5	140								
Reach 4	47	110	4.2	66	12	95								

Charts 1-5. MY3 Stream Reach Substrate Composition Charts

Chart 1.

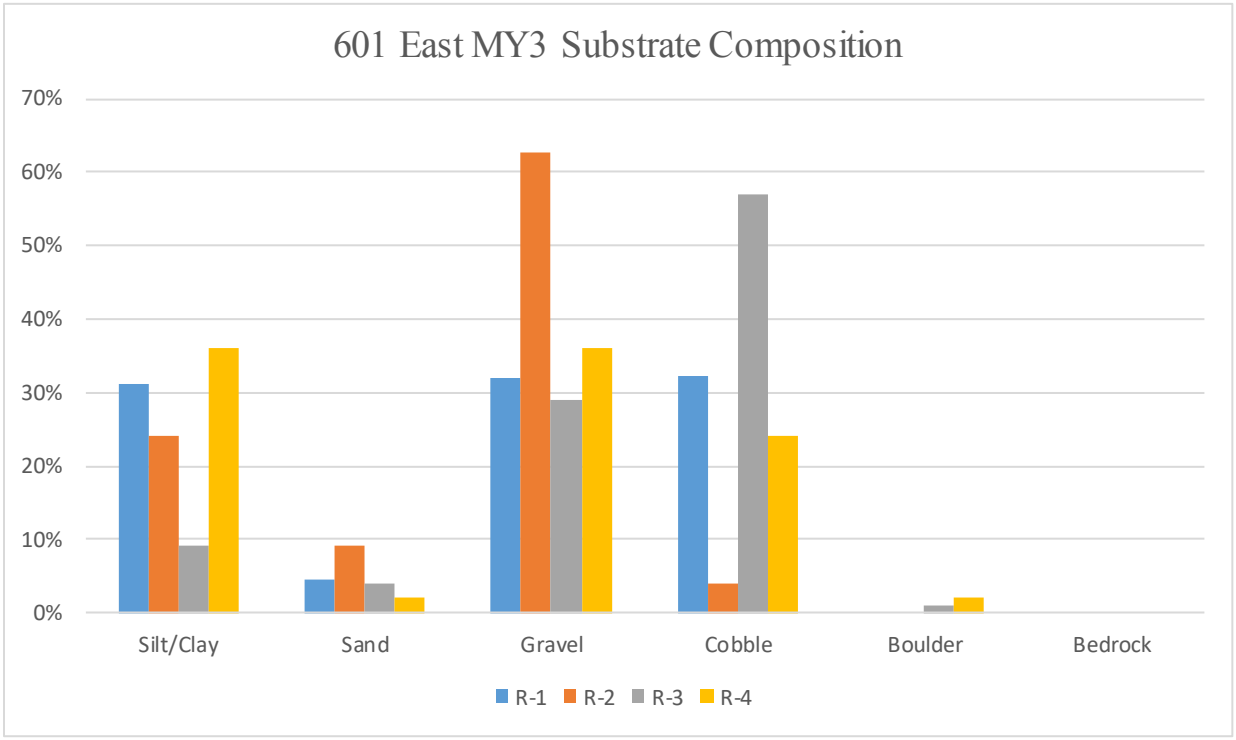


Chart 2.

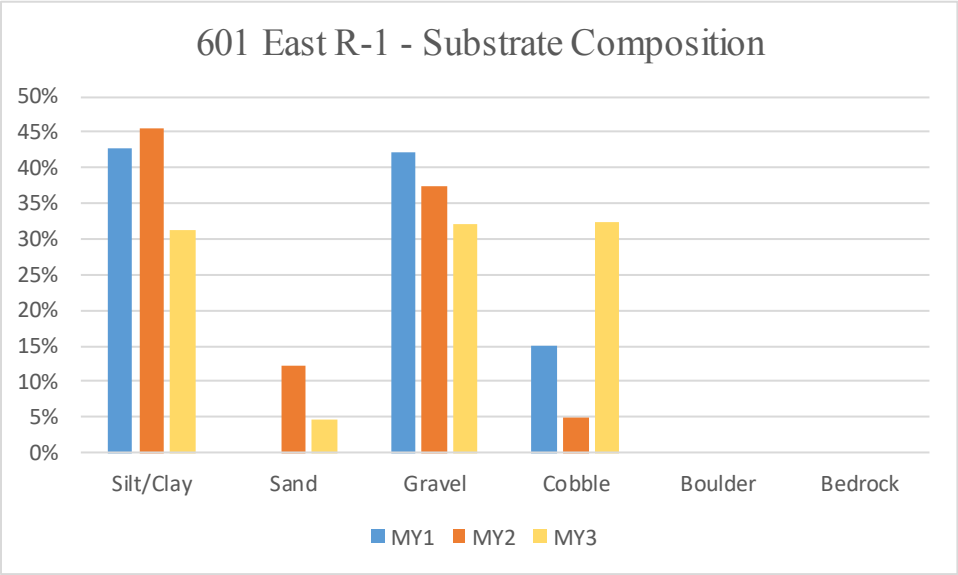


Chart 3.

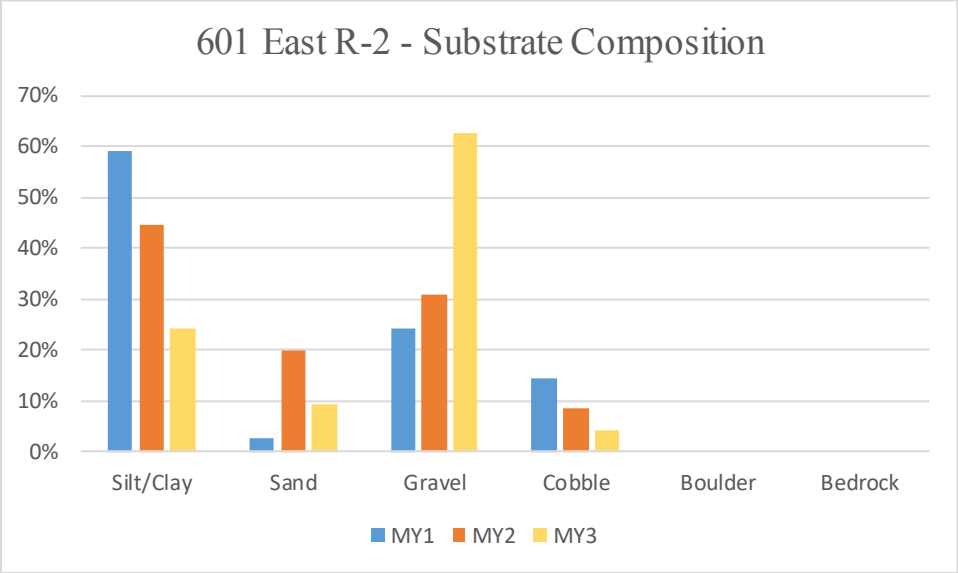


Chart 4.

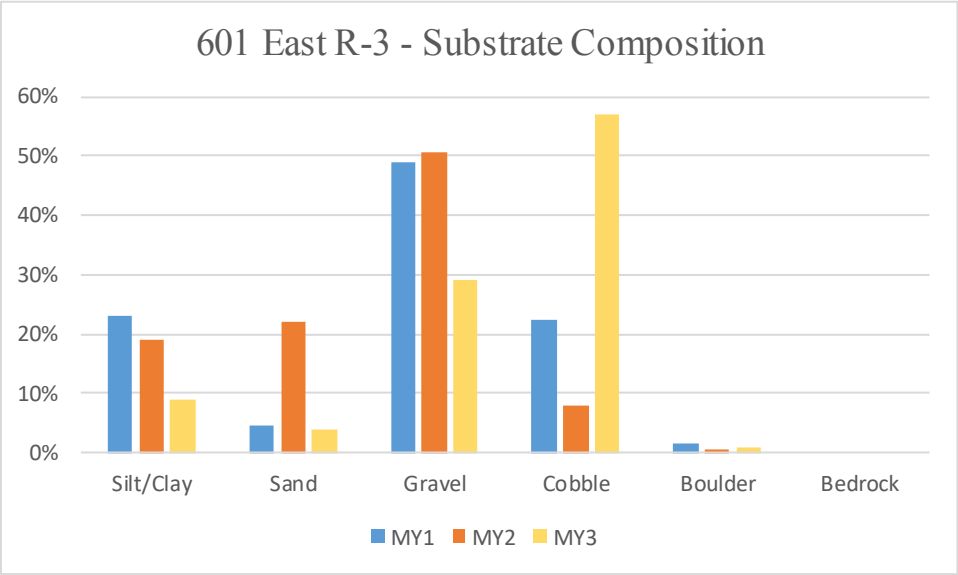


Chart 5.

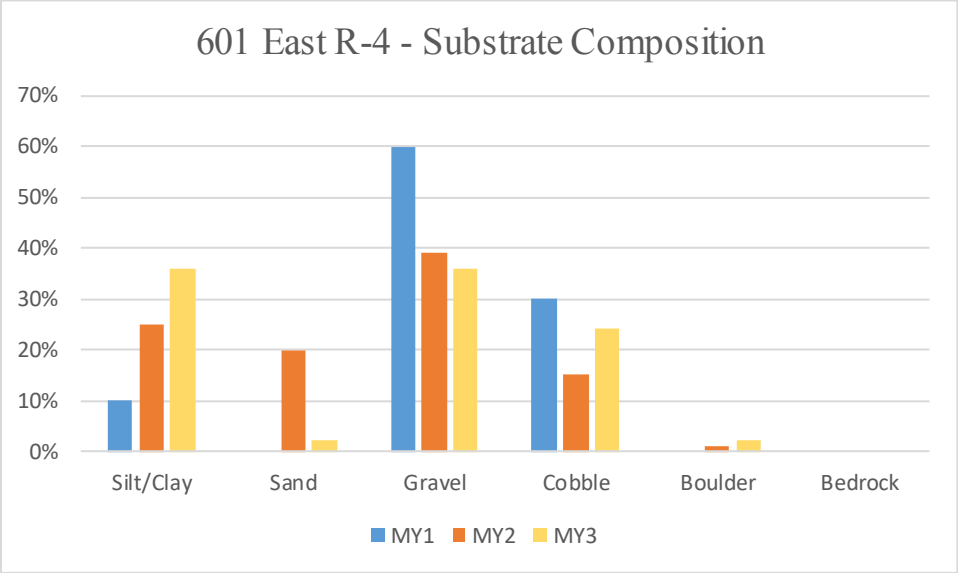


Table 13. Bank Pin Array Summary

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)
XS-1	Upstream	0.0	35.6	0.0
	At Cross-Section	0.0	0.0	0.0
	Downstream	0.0	0.0	0.0
XS-3	Upstream	0.0	0.0	0.0
	At Cross-Section	0.0	0.0	0.0
	Downstream	0.0	0.0	0.0
XS-5	Upstream	0.0	0.0	0.0
	At Cross-Section	0.0	0.0	0.0
	Downstream	0.0	0.0	0.0
XS-7	Upstream	0.0	0.0	0.0
	At Cross-Section	0.0	0.0	0.0
	Downstream	12.7	0.0	0.0
XS-10	Upstream	0.0	0.0	0.0
	At Cross-Section	0.0	0.0	0.0
	Downstream	0.0	0.0	0.0
XS-12	Upstream	0.0	0.0	0.0
	At Cross-Section	0.0	0.0	0.0
	Downstream	0.0	0.0	0.0
XS-14	Upstream	0.0	0.0	0.0
	At Cross-Section	0.0	0.0	0.0
	Downstream	0.0	0.0	0.0
XS-15	Upstream	0.0	0.0	0.0
	At Cross-Section	0.0	0.0	0.0
	Downstream	0.0	0.0	0.0
XS-17	Upstream	0.0	0.0	50.8*
	At Cross-Section	0.0	0.0	0.0
	Downstream	0.0	0.0	177.8*

*Beaver dam directly downstream of XS-17 caused unusually high water and localized bank erosion.

Appendix E

Hydrology Data

Table 14. Verification of Bankfull Events
Figure 7. Photo Verification of Bankfull Events
Table 15. 2017 Rainfall Summary
Figure 8. 2017 601 East Site Precipitation Data

Table 14. Verification of Bankfull Events

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

Figure 7. Photo Verification of Bankfull Events

Crest Gauge @ Reach 2 – 30 in. (2.5 ft.)

Crest Gauge @ Reach 3 – 16.75 in. (1.4 ft.)

Table 15. Rainfall Summary

Month	Average	Normal Limits		Monroe Station Precipitation
		30 Percent	70 Percent	
Jan	3.9	2.68	4.65	5.51
Feb	3.29	2.45	3.85	1.31
Mar	4.22	3.02	4.98	2.62
Apr	3.29	2.01	3.98	6.27
May	3.25	1.99	3.93	5.87
Jun	4.66	2.84	5.65	8.08
Jul	4.34	2.83	5.21	5.49
Aug	4.76	3	5.75	2.67
Sep	4.46	2.4	5.44	3.95
Oct	3.88	1.89	4.66	1.87
Nov	3.38	1.86	4.12	0.05
Dec	3.6	2.58	4.25	---
Total	47.03	29.55	56.47	43.69

Figure 8. 2017 Precipitation Data Compared to Average 30th and 70th Percentiles, Union County