Upper Silver Creek Restoration Project
Year 5 Monitoring Report

Burke County, North Carolina

NCDMS Project ID Number – 94645

Catawba River Basin: 03050101-050050

SAW ID: 2010-02157, DWR # 13-0595

Project Info:	Monitoring Year: 5 of 5 Year of Data Collection: 2019 Year of Completed Construction: 2015 Submission Date: February 2020
Submitted To:	NCDEQ – Division of Mitigation Services 5 Ravenscroft Drive, Suite 102 Asheville, NC 28801 NCDEQ Contract ID No. 003270

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February 12, 2020

NC Division of Mitigation Services (NCDMS)
Attn: Mr. Matthew Reid, Western Project Manager
5 Ravenscroft Drive, Suite 102
Asheville, NC 28801

Subject: Response to DMS comments on the Year 5 Monitoring Report Review for the Upper Silver Creek Stream and Wetland Restoration Project; Catawba River Basin - CU# 03050101; Burke County, North Carolina; NCEEP Project # 94645; Contract No. 003270

Dear Mr. Reid,

Please find enclosed the final Upper Silver Creek Year 5 Monitoring Report. I have addressed the comments that you submitted on the draft report. My responses to your comments are the following:

Executive Summary

- Page 2: Text indicates "142 volunteer stems" and "802 stems per acre". These numbers are slightly off compared to totals on Table 5 and Table 7. I assume this may be a rounding issue, but please verify and adjust so all totals are correctly shown.

  There were two volunteer plants that were not entered in the correct column, so that Table 5 was correct but the volunteer stems per acre for the year in Table 7 was incorrect. Table 7 has been corrected. The total of 802 stems per acre in the text should have read 801. This has been corrected.

- Page 2: Invasive discussion is unclear where area is within the site and is also not shown on CCPV. Please update description and include on CCPV.

  Location of invasive plant growth has been updated in the narrative and the CCPV map has been modified as well.

- Please be aware that the IRT has discouraged the use of hand tools to clean out channel sediment or vegetation from channels. It is possible that these actions can result in increased monitoring time to determine if the stream design is successful. Please quantify the length and/or areas and locations of debris/obstruction and sediment removal that occurred. Please add these locations to the CCPV as well.

  Wording of this section has been modified to include details and the location of maintenance activities have been added to the CCPV.

- Please elaborate on the equipment malfunction discussion that resulted in the data gap for all gauges. Have the gauges been repaired, and are they all functioning as of now?

  Additional information was included to explain equipment or software malfunctions.

CCPV

- In the legend, please add a year to the "Repaired Stream Bank" entry to clarify when this work was completed.

797 Haywood Road| Suite 201| Asheville NC 28806
Office: 828.412.6100 | Fax: 828.350.1409

Stream Bank was repaired in March 2016 and this date has been added.

- Please add the locations of the debris/obstruction removal and sediment removal that occurred in 2019.
  Location of debris/obstruction removal has been added.
- Please add stationing to the CCPV and Figure 3.
  Stationing has been added.
- Include invasive polygons.
  Invasive locations discussed in the text have been added.

Table 2

- Add debris/obstruction and sediment removal to Table 2.
  Statement added to Table 2.

Table 8

- Many of the reaches are 100% for every category. The IRT has commented in the past that this is not the case when they conduct site visits. Can Baker verify that these reaches are performing 100% as designed for all metrics? For example, profiles and cross sections reveal aggradation on some reaches, but the table shows 0 unstable segments for this metric.
  We have reviewed this table and revisited the site in order to evaluate each described metric again. For the most part this site is performing as designed; however, some minor adjustments have been made to this table. It was observed that the reach lengths on the mainstem were not corresponding to the two reaches described in the AB plan sheets but did correspond to the correct number of meanders and riffles, so we adjusted the lengths to conform with what was evaluated. Some other minor adjustments were made but for the most part few modifications were needed.

Table 8a

- Executive summary indicates that CPA3 has not changed and has revegetated since MY3, but Table 8a says it is "still unstable". Recommend updating text to indicate that the meander has stabilized through vegetation and has not degraded further or something similar.
  We have modified the description in the Executive summary and in Table 8a and have added an additional photo to the table. We have attempted to indicate in both locations that the meander bend has improved, and vegetation is beginning to grow there; however, we would not consider it completely stable at this point.

Digital Files Review

- Stream spatial features and the riverine wetland restoration feature do not match reported values in asset table. Please provide features that characterize the creditable assets that have been reported, ensuring that features are segmented and attributed as they are in the asset table and that feature lengths/areas match the linear feet/acreage reported.

DMS has commented that they would like the GIS shapefiles for all projects and noted that for some projects the lengths were not matching with the credit/asset table. Baker spoke with DMS Science and Analysis staff about this issue. We are happy to provide processed shapefiles derived from the as-built survey CAD files for all project features. That is, we have taken the final as-built CAD files, converted them into GIS, and modified them so that each feature segment is combined or split by reach or wetland type and that the attribute table is clear and has a length or acre value approximate to the credit/asset table. But due both to rounding issues in length and credit calculations, as well as to inherent program differences between CAD and GIS, some small differences may exist between the two. The as-built CAD files used to create the PE/PLS signed/sealed plan sheets are the legal standard by which we determine all our credits/assets. The GIS shapefiles are secondary files we derive from the CAD to more easily make maps in our reports. While small differences between the two (of a few feet here or there) are likely to occur on some reaches, particularly longer ones and ones with breaks such as for crossings, Baker has not regarded this as of particular importance. The CAD files are what have generated all official feature measurements. DMS accepted that small differences would be acceptable for the creditable features but did want the processed as-built shapefiles for each project and Baker has agreed to provide them.

- MY5 spatial features provided for CCPV will not render in Arcmap. It appears these files are corrupted. Please check to see if these features will populate your Arcmap environment, and if not, provide DMS with a new set of MY5 CCPV features.

  We are providing updated CCPV features in response to the previous comment; however, we have had no problems using these files.

- CVS entry tool is missing vigor, x y coordinates, or x y coordinates are outside the bounds of the selected plot for monitoring years throughout the lifetime of the project. DMS is uploading these data to a database, and for completeness, we need these errors resolved.

  That X/Y portion of the CVS entry tool has always been used for internal purposes at Baker and over the 5 years of monitoring this is the first time that this has been questioned. We have used it to identify the plant plot and individual tree number (e.g. 4-15 means plot 4, plant 15) and not for internal plant location, as CVS does not otherwise provide an easy way to carry over clear plant ID numbering from year to year. Thus, the plot dimensions recorded in CVS are correct for each veg plot, though we understand that may have been confusing when looking at our X/Y entry data. But using the X/Y coordinate entry this way saves Baker significant time each year during monitoring and helps eliminate errors by reducing confusion. We have long regarded it as a mild flaw in the CVS tool but have found this easy workaround to be a perfectly suitable rectification. Baker spoke with DMS Science and Analysis staff about this issue. They have allowed that for our existing projects we may continue to use the X/Y entry tool for our own purposes but for future projects ask that we enter the X/Y grid plot coordinates as the CVS program originally intended. We will also provide DMS with a copy of our plot maps showing individual plant locations within each plot. And to be clear, the CVS field protocol is being followed throughout our projects with the sole exception of this X/Y grid plot entry tool. All planted stems are identified and marked (and mapped internally) at the as-built stage and tracked and assessed throughout the monitoring phase. We have checked the CVS entry tool submitted to DMS in MY5 and vigor is reported for each year, for each plot and for each plant; it is unclear to us why this comment was made.

General

- Please include responses to comments in front of final report.
  This will be done.

If you have any questions or find any issues that need to be addressed, please contact me directly at (828) 412-6100. I am submitting an invoice for this task to Ms. Debby Davis in the Raleigh DMS Office and will be providing you an email copy.

Sincerely,

Micky Clemmons

Micky Clemmons,
Project Manager
Michael Baker Engineering, Inc.

Upper Silver Creek Restoration Project
Year 5 Monitoring Report

Burke County, North Carolina

NCDMS Project ID Number – 94645

Report Prepared and Submitted by Michael Baker Engineering, Inc.
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APPENDICES

1.0 EXECUTIVE SUMMARY

Michael Baker Engineering, Inc. (Baker) restored or enhanced 5,186 linear feet (LF) of perennial stream channel along Silver Creek and three unnamed tributaries (UT1, UT2, and UT3); and additionally restored, enhanced or created approximately 9.14 acres of wetlands that had been previously disturbed in Burke County, NC, (Appendix A). The Upper Silver Creek Stream and Wetland Restoration Project (Site) is located southeast of Morganton, NC, approximately 11 miles southeast of the intersection of Highway 64 and I-40 and to the north of the intersection of Highway 64 and Goldmine Road. The Site is located in the NC Division of Water Resources (NCDWR) sub-basin 03-08-31 and the NCDEQ Division of Mitigation Services (NCDMS) Targeted Local Watershed (TLW) 03050101-050050 of the Catawba River Basin. The project involved the restoration and enhancement of a Piedmont/Mountain Mixed Bottomland Hardwood Forest system (Schafale and Weakley 1990) from impairments within the project area due to past agricultural conversion, cattle grazing, gold mining and draining of floodplain wetlands by ditching activities.

The project goals directly addressed stressors identified in the Catawba River Basin Restoration Priority (RBRP) Plan such as degraded riparian conditions, channel modification, and excess sediment and nutrient inputs. The primary restoration goals, as outlined in the approved mitigation plan, are described below:

- Create geomorphically stable stream channels within the Upper Silver Creek project area including headwater tributaries in the Catawba River basin;
- Restore, enhance, and expand wetland functions across the Site;
- Improve and restore hydrologic connections between streams and degraded riparian wetland areas and overall ecosystem functionality;
- Improve water quality within the Upper Silver Creek project area through reduction of bank erosion, improved nutrient and sediment removal, and stabilization of streambanks; and
- Improve aquatic and terrestrial habitat.

To accomplish these goals, the following actions are recommended:

- Restore the existing incised, eroding, and channelized stream by creating a stable channel that has access to its floodplain;
- Improve water quality by establishing buffers for nutrient removal from runoff and by stabilizing stream banks to reduce bank erosion;
- Improve in-stream habitat by providing a more diverse bedform with riffles and pools, creating deeper pools, developing areas that increase oxygenation, providing woody debris for habitat, and reducing bank erosion; and
- Improve terrestrial habitat by planting riparian areas with native vegetation and protecting these areas with a permanent conservation easement. The riparian area will increase storm water runoff filtering capacity, improve bank stability, provide shading to decrease water temperature and improve habitat.

During 2019 there were at least three high flow events that inundated the floodplain, with wrack lines visible on the floodplain. These events were documented on 6/11/2019, 9/4/2019, and 10/17/2019, and do not appear to have negatively impacted constructed banks or structures.

Year 5 monitoring found that all vegetation was in good condition with no bank, bench or floodplain areas having significant bare spots. All vegetation monitoring quadrants indicated that most planted trees were

growing and in good condition. The average density of planted stems following the Year 5 growing season was 659 stems per acre. There was also an average of 142 volunteer stems per acre, composed of 12 different tree or shrub species. The total average density of both planted and volunteer stems was 801 stems per acre. With an average density of 659 planted stems per acre, the Site is on track to meet the final success criteria of 260 stems per acre by the end of Year 5.

The areas of invasive privet (*Ligustrum sp.*) and multiflora rose (*Rosa multiflora*) vegetation that was treated in previous years did not exhibit significant regrowth during MY5. Scattered single stems of privet and multiflora rose were found throughout the southern portion of the project, with the majority of occurrences located in wetland areas between vegetation plot 6 and 12 (See figure 2A&B). Stems were either treated with foliar spray or herbicide was applied to the cut stem during April 2019. An area with privet growth was also identified southeast of UT2 in a wetland area. This vegetation is primarily outside of the easement boundary. Only invasive stems within the easement area were treated with herbicides. The invasive vegetation will continue to be treated with herbicide, to control new growth, until project closeout. The native plant swamp rose, (*Rosa palustris*), is found scattered throughout the site and should not be confused with multi-flora rose. No other areas of concern regarding vegetation were observed along Silver Creek or the tributaries. Year 5 vegetation assessment information is provided in Appendix C.

Stream geomorphological stability and performance during MY5 was assessed by surveying sixteen cross-sections, a profile of each channel, evaluating the bed particle size with five riffle pebble counts and by replicating channel location photographs. Cross-sections of all the channels were similar to past years, although a few indicated some aggradation along the banks (XS1 XS8, and XS16). In each of these cases deposition of sand was on the floodplain above bankfull and extended down the bank to the toe of slope; this was then stabilized by thick vegetation. This is a natural condition and one of the functions of the floodplain. The effect on the cross-section is to reduce the cross-sectional area, mostly as a function of decreasing width, and raises the Top of Bank elevation at the cross-section. While this indicates a change in bank height ratio, as defined by the IRT, it indicates a movement towards stability and is a typical condition for an E channel. This is a sand bed stream upstream of the project site and sand has moved through the project since construction. Pool cross-sections indicate the presence of this high sand load as it deposits on the point bars. We believe that this material will continue to move through the system and will not cause long-term problems. In late winter and early spring of 2019, channels were inspected and where natural sediment transport processes were being interrupted by woody debris, obstructions were removed. There have been minor changes to channel profiles since construction, but profiles of each channel do not indicate instability issues. The profile surveys indicate the high sand load moving through the project with the depth of pools fluctuating with sediment transport. Profiles also indicate the deposition of sand and a rise in channel elevation as the channel adapts. This happens within the channel and across the floodplain. The best example is on UT2 where the floodplain is inundated by floodwaters from the main channel regularly, this results in sand being deposited and a small rise in the floodplain elevation. This modifies the channel elevation, but the channel dimension, pattern and profile are maintained. This observation is verified by stream reference photographs of the channel, replicated yearly. In general, all four reaches are maintaining bedform diversity, sequestering sediment on the floodplain and transporting sediment down the channel as intended.

The Visual Morphological Stability Assessment indicates that the Site is stable and no new channel problem areas (CPAs) were identified in MY5. Two instances of structures that were piping were noted in previous reports and these continue with this condition in MY5; however, they are not unstable and are not causing bank instability but are still serving the intended function of redirecting the thalweg away from the outer bank and providing improved habitat. These are the structures at CPA-1 and CPA-2 as called out in the CCPV. The one instance of bank erosion that was noted previously is growing vegetation and is in better condition than in the past but is not completely recovered at the end of MY5. The locations, descriptions, and photos of these areas are included in the Stream Problem Areas Table in Appendix D and in the MY5 data electronic file. Overall, channel morphology is responding as designed and meeting project goals.

Pebble count data for MY5 indicates that the shift to smaller particles on the Silver Creek mainstem has stabilized at sizes like what was seen in previous years. Pebble counts from UT2 and UT3 indicate that there is still sand and fine sediment present in the channel in MY5, as was seen in previous years. This is likely a natural condition for these channels, both of which have sources of sandy material upstream of the project area. Both channels are transporting this fine material effectively over time as intended. Overall, the pebble data indicates a properly functioning system, as there were no mid-channel bars or other significant sediment transport issues.

The crest gauge on Silver Creek recorded two bankfull events of 1.35 feet (documented on 6/11/2019), and 0.33 feet (documented on 9/4/2019). The highest rainfall events recorded by the on-site rain gauge that likely resulted in these bankfull flows occurred on 6/8/2019 (2.9 inches), 9/13/2019 (2.05 inches), and 10/30/2019 (2.06 inches). The site has now recorded eight total bankfull events since construction and has met the success criteria. Physical indicators of bankfull flows, such as wrack lines and debris on the floodplain, were also observed throughout the reach but it is difficult to determine which bankfull event was responsible. Crest gauge readings are presented in Appendix D.

Wetland monitoring during MY5 demonstrated that all thirteen groundwater monitoring wells located on the Site met the wetland success criteria as stated in the Site Mitigation Plan. Well 6 malfunctioned on April 24, 2019, two days after data was downloaded and stopped recording data. Well 6 met success criteria for 23 consecutive days at this time (11%) and was last recorded at -2.37 inches below ground level. Had the well continued to function it would have exceeded the 12% criteria (25 days). This well was replaced on October 11, 2019. The gauges demonstrated consecutive hydroperiods of 12 percent or greater, ranging from 13.9 to 100 percent of the growing season. A software malfunction resulted in a gap in the recording of well data between August 21 and October 14, 2019; however, all wells met the wetland success criteria earlier in the growing season. The malfunction was based on a software incompatibility issue between Win-situ sync and Windows 10 and resulted in Michael Baker changing to VanEssen Instruments gauges which are compatible with Windows10 and are regularly, automatically updated. The onsite rain gauge indicates two large rain events of 0.62 inches on 23 August and 2.05 inches on September 13, each of which fall within time periods when bankfull flows were recorded at the site. This rain gauge was installed at the Site in 2017 and is functioning and providing accurate rainfall data that is shown on the well data sheets.

Summary information and data related to the Site and statistics related to performance of various project and monitoring elements can be found in the tables and figures in the report Appendices. Narrative background and supporting information formerly found in these reports can be found in the Baseline Monitoring Report and in the Mitigation Plan available on the NCDMS website. All raw data supporting the tables and figures in the appendices are available from NCDMS upon request.

2.0 METHODOLOGY

The monitoring plan for the Site includes criteria to evaluate the success of the stream, wetland and vegetation components of the project. The methodology and report template used to evaluate these components adheres to the NCDMS monitoring guidance document dated December 1, 2009 and other mitigation guidance (NCEEP 2009 and USACE 2003), which will continue to serve as the template for subsequent monitoring years. The specific locations of monitoring features: vegetation plots, permanent cross-sections, monitoring wells, flow gauges, and the crest gauge, are shown on the CCPV sheets found in Appendix A.

The Year 5 monitoring data and site photographs were collected in October 2019.

2.1 Vegetation Assessment

To determine if vegetation success criteria are achieved, vegetation monitoring quadrants (veg plots) were installed and monitored across the Site in accordance with the CVS-NCDMS Protocol for Recording Vegetation, Version 4.1 (CVS 2007 and Lee, Peet, Roberts and Wentworth 2007). The vegetation monitoring plots are a minimum of two percent of the planted portion of the Site with 14 plots established randomly within the planted riparian buffer and wetland area, per CVS Monitoring Level 2. No veg plots were established within the undisturbed wooded areas along the right bank of Silver Creek. The size of individual quadrants is 100 square meters for woody (tree) species and 1 square meter for herbaceous vegetation. Herbaceous quadrants were established in one corner of the larger woody plots and are monitored by comparing photographs taken year to year.

2.2 Stream Assessment

The Upper Silver Creek Site approach was restoration of a stable morphology that allows for the transport of water and sediment through the Site and allows stream flows larger than bankfull flows to spread onto the floodplain. Stream monitoring efforts focus on visual observations, a crest gauge to document bankfull flooding events, surveying established stream cross-sections and channel profiles to assess channel stability and pebble counts to assess if proper sediment transport is taking place.

Stream survey data was collected to a minimum of Class C Vertical and Class A Horizontal Accuracy using Leica TS06 Total Station and was georeferenced to the NAD83 State Plane Coordinate System, FIPS3200 in US Survey Feet, which was derived from the As-built Survey.

2.2.1 Morphologic Parameters and Channel Stability

Cross-sections were classified using the Rosgen Stream Classification System (Rosgen 1994) and all cross-sections were evaluated to determine if they meet design expectations. Cross-sections were also compared to the baseline cross-section plots to evaluate change between construction and the MY5 survey. Morphological survey data is presented in Appendix D.

A longitudinal profile was surveyed for the entire length of each channel to document changes from the as-built baseline conditions during the first year of monitoring. The survey was tied to a permanent benchmark and measurements included thalweg, water surface, and top of low bank. Each of these measurements was taken at the head of each feature (e.g., riffle, pool) and at the maximum pool depth.

Stream geomorphological stability and performance during MY5 was assessed by surveying sixteen (16) cross-sections (7 on Silver Creek, 2 on UT1, 2 on UT2 and 5 on UT3) and a profile of these channels as described above. The bed particle size was evaluated with five riffle pebble counts (2 on Silver Creek and 1 on each of the tributaries) and by observation and replicating channel location photographs.

2.2.2 Hydrology

Two crest gauges were installed on the floodplain at this site, at the bankfull elevation. One is located along the left top of bank on Silver Creek, at approximately Station 19+00, and the second is on the left top of bank of UT3, at approximately Station 9+50.

2.2.3 Photographic Documentation

Reference transects were photographed at each permanent cross-section. The survey tape was centered in the photograph of the bank. Photographs were also taken at specific photo points established along each channel during baseline reporting. Photographs from these points will be

replicated each year and used to document changes along the channel. Points were selected to include grade control structures as well as other structural components installed during construction. Annual photographs from the established photo points are shown in Appendix D and do not indicate any stability issues at the site and no failing structures with the exception of minor piping at two structures as previously noted.

2.3 Wetland Assessment

Thirteen automated groundwater-monitoring stations were installed in the wetland restoration area to document the hydrologic conditions during the monitoring period. The installations followed USACE protocols (USACE 1997). Groundwater data collected during Year 5 monitoring are located in Appendix E.

To meet the hydrologic success criteria, the monitoring gauge data must show that, for each normal rainfall year within the monitoring period, the Site has been inundated or saturated for a certain hydroperiod. Criteria have been met when the wetland is saturated within 12 inches of the soil surface for 12 percent of the growing season when rainfall amounts approximate normal conditions. Alternatively, when dry conditions prevail, fourteen (14) or more consecutive days during the growing season when antecedent precipitation has been drier than normal for a minimum frequency of 5 years in 10 to 50 percent of the monitoring period becomes the success criteria (USACE, 1987 and 2005).

Visual monitoring of wetland areas will be conducted annually. Photographs will be used to visually document system performance and identify areas of low stem density, invasive species vegetation, beaver activity, or other areas of concern. Reference stations will be photographed each year for a minimum of five years following construction. Photographs will be taken from a height of approximately five to six feet. Permanent well markers were established and used to ensure that the same locations (and view directions) on the Site are documented in each monitoring period.

An on-site recording rain gauge was installed at the site in August 2017. Data from this gauge will be used to measure local precipitation in the future to eliminate reliance on the nearby CRONOS stations. These stations often show a high level of variance across a small geographic area, which makes it difficult to determine the actual amount of rain the site receives. Having direct access to this data will allow accurate precipitation data to be collected and presented in future monitoring years.

3.0 REFERENCES

Carolina Vegetation Survey (CVS) and NC Ecosystem Enhancement Program (NCEEP). 2007. CVS-NCEEP Data Entry Tool v. 2.3.1. University of North Carolina, Raleigh, NC.

Lee, M., Peet R., Roberts, S., Wentworth, T. 2007. CVS-NCEEP Protocol for Recording Vegetation, Version 4.1.

North Carolina Ecosystem Enhancement Program (NCEEP). 2009. Guidance and Content Requirements for EEP Monitoring Reports Version 1.2.1. December 1, 2009.

North Carolina Ecosystem Enhancement Program (NCEEP). 2009. Upper Catawba River Basin Restoration Priorities 2009.

Rosgen, D. L. 1994. A Classification of Natural Rivers. Catena 22:169-199.

Schafale, M. P., and A. S. Weakley. 1990. Classification of the natural communities of North Carolina, third approximation. North Carolina Natural Heritage Program. Division of Parks and Recreation, NCDENR. Raleigh, NC.

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____. 1997. Corps of Engineers Wetlands Research Program. Technical Note VN-rs-4.1. Environmental Laboratory. U.S. Army Engineer Waterways Experiment Station. Vicksburg, MS.

____. 2003. Stream Mitigation Guidelines, April 2003, U.S. Army Corps of Engineers. Wilmington District.

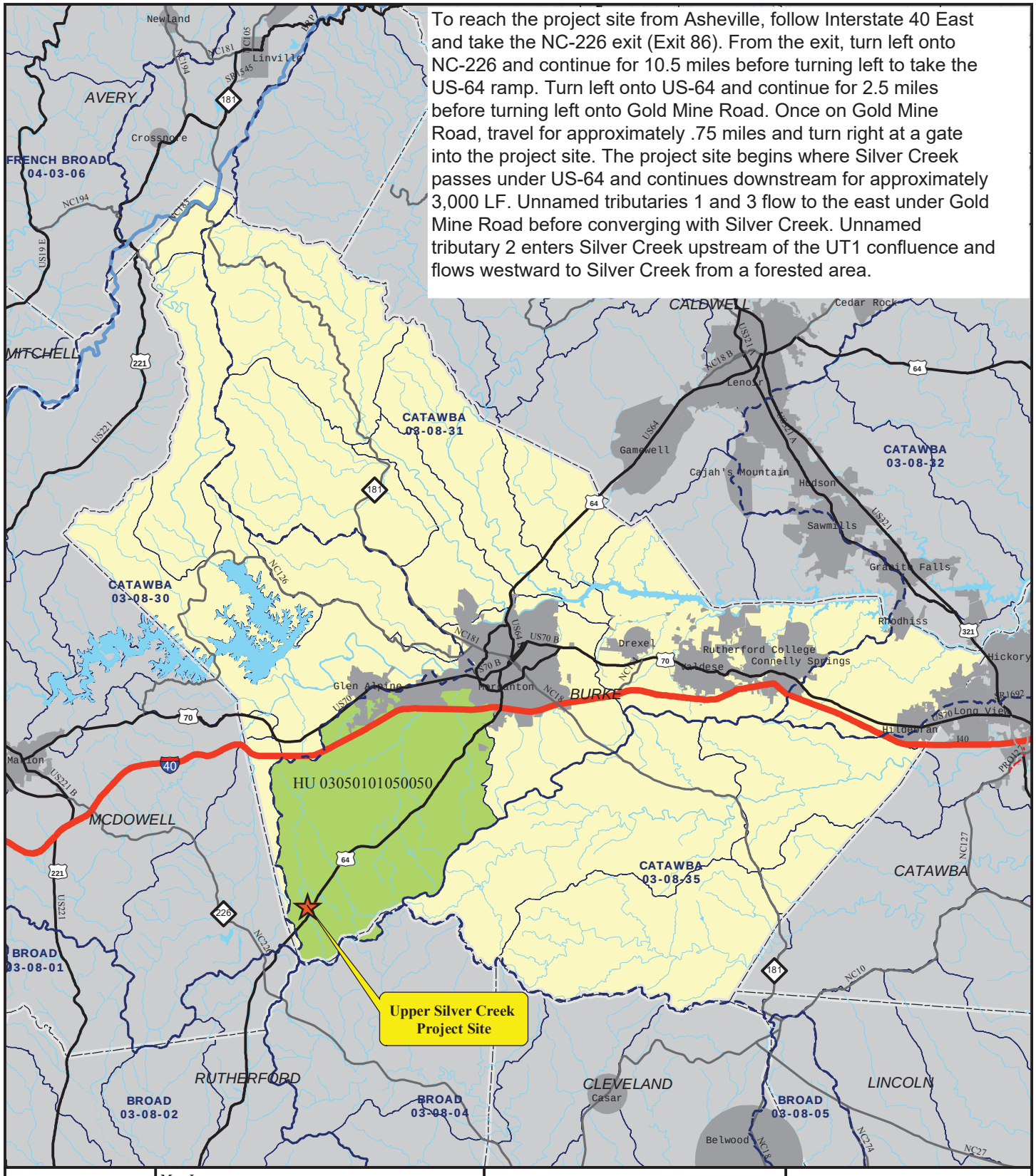
____. 2005. "Technical Standard for Water-Table Monitoring of Potential Wetland Sites," WRAP Technical Notes Collection (ERDC TN-WRAP-05-2), U.S. Army Engineer Research and Development Center. Vicksburg, MS.

Appendix A

General Figures and Plan Views

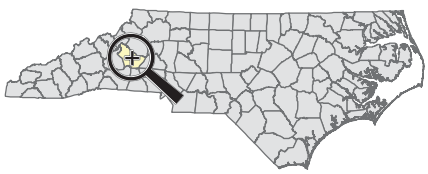
Includes:

Figure 1. Project Vicinity Map and Directions
Figure 2. Current Condition Plan View (CCPV) – Overview Map
Figure 2A. CCPV North half of Project
Figure 2B. CCPV South half of Project



Division of Mitigation Services

Map Inset



Burke County, NC

LEGEND:

- NCDWQ Sub-basin
- Counties
- USGS Hydrologic Unit
- Project Hydrologic Unit
- Burke County

0 1 2 4 Miles

Figure 1. Project Vicinity Map

Upper Silver Creek
NCDMWS Project #94645
Monitoring Year 5 Report
Burke County, NC

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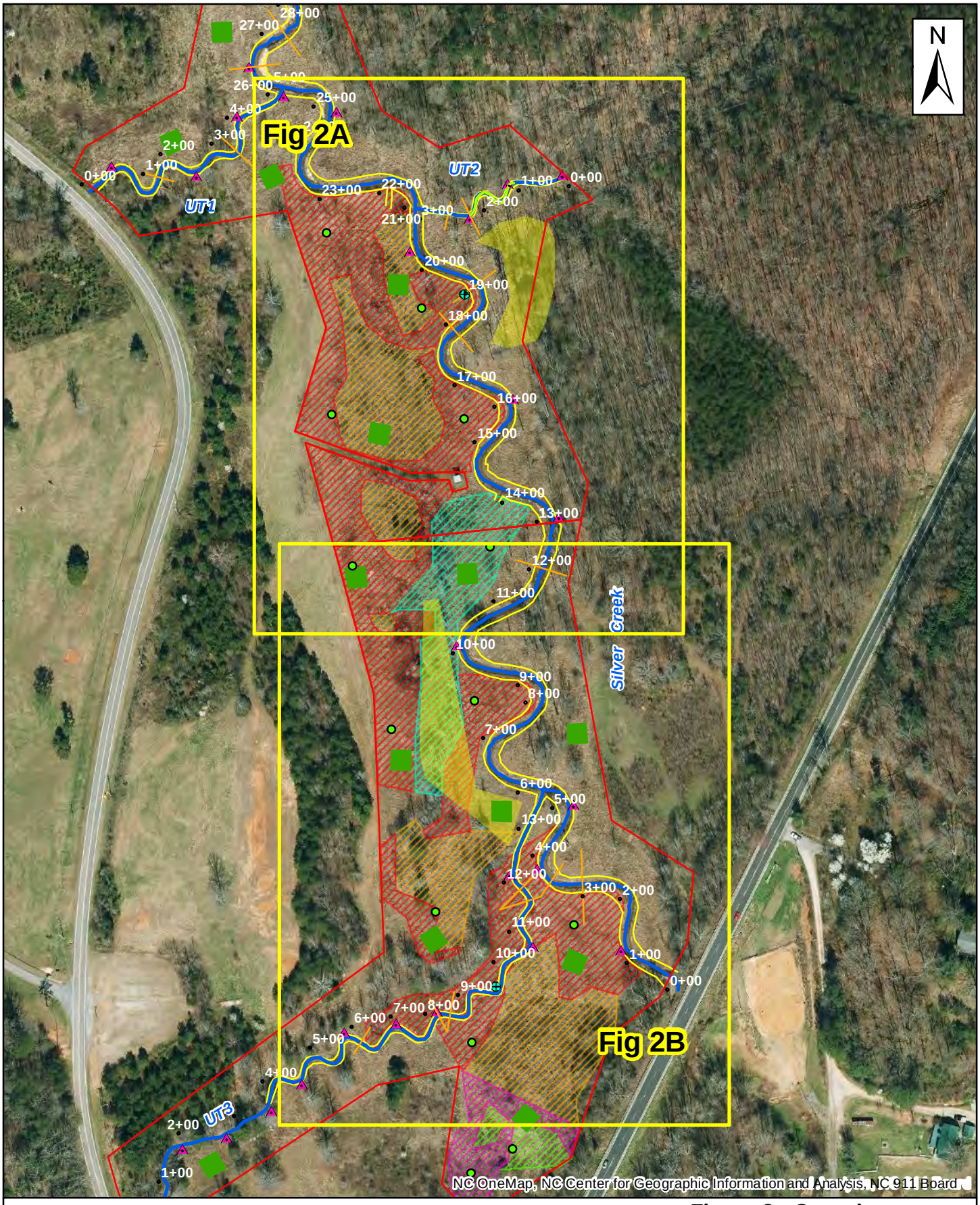

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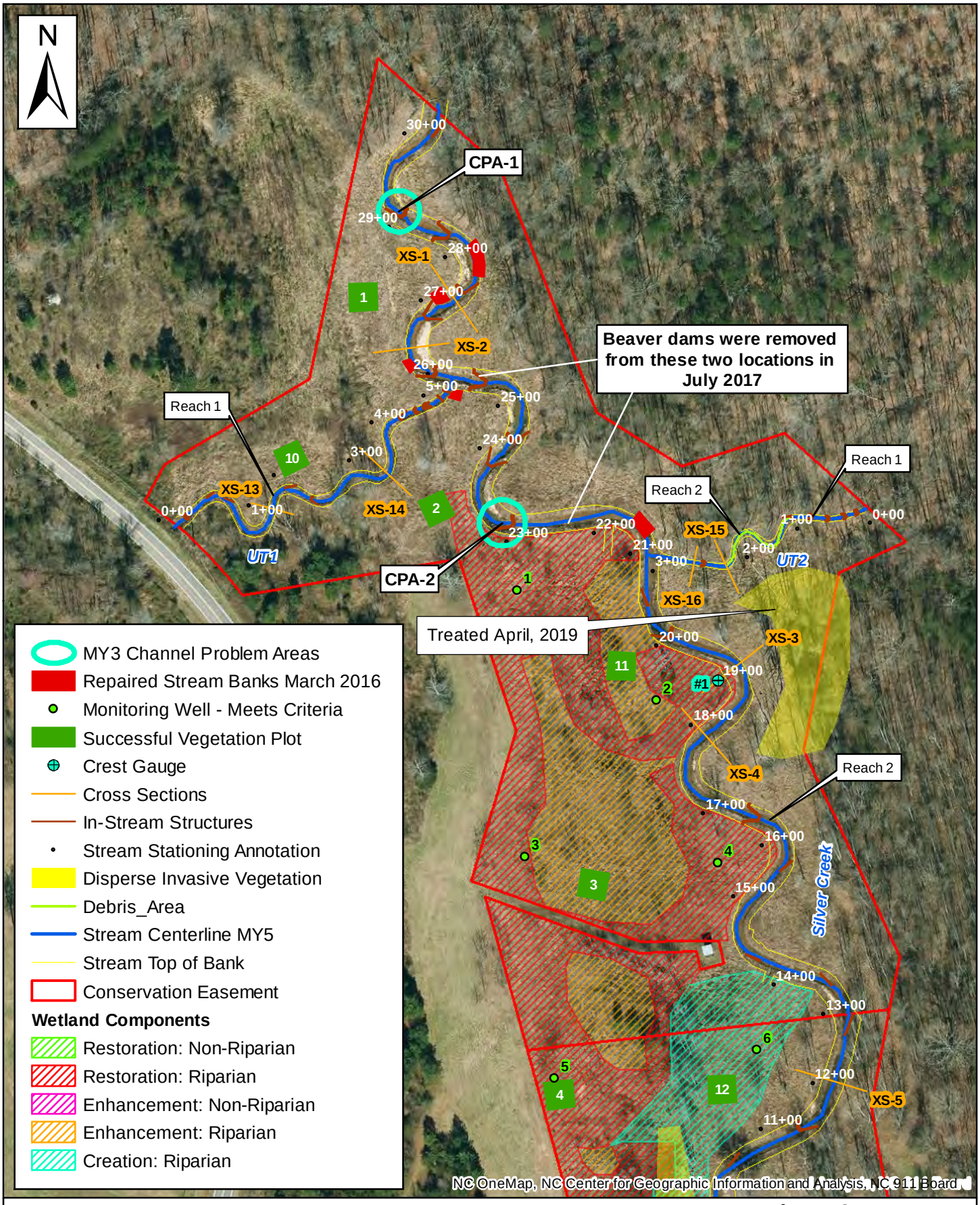
0 220 440 Feet

1 inch = 300 feet

DMS Project # 94645

Figure 2 - Overview
Current Conditions Plan View
Monitoring Year 5
Upper Silver Creek Site



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0 150 300 Feet

1 inch = 150 feet

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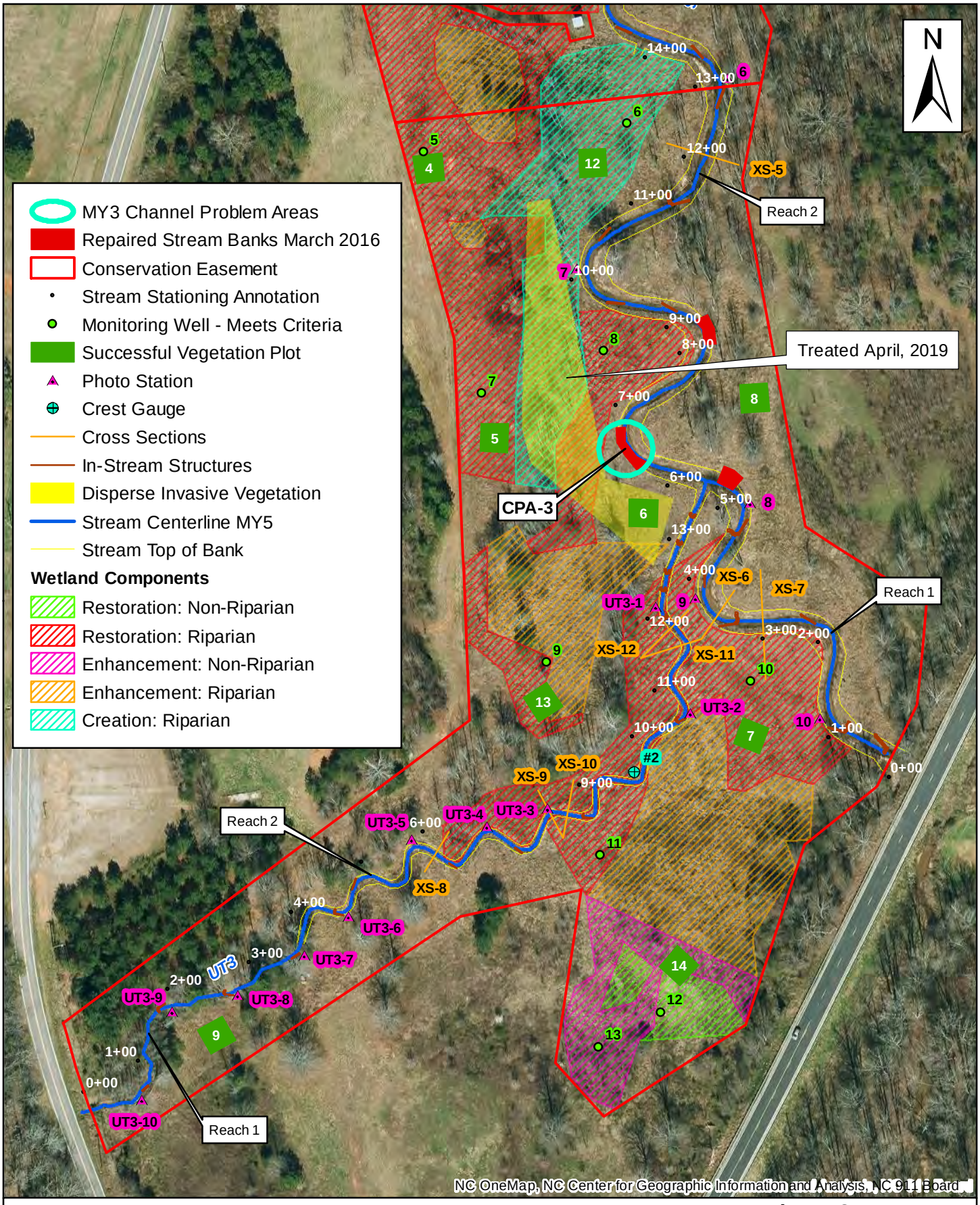
Figure 2A
Current Conditions Plan View
Monitoring Year 5
Upper Silver Creek Site



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0 150 300 Feet

1 inch = 150 feet

DMS Project # 94645

Figure 2B
Current Conditions Plan View
Monitoring Year 5
Upper Silver Creek Site

Appendix B

General Project Tables

Includes:

Table 1. Project Components and Mitigation Credits

Figure 3. U. Silver Cr. Project Asset Map

Table 2. Project Activity and Reporting History

Table 3. Project Contacts

Table 4. Project Attributes

Table 1. Project Components and Mitigation Credits
Upper Silver Creek Restoration Project: DMS Project ID No. 94645

Mitigation Credits

	Stream		Riparian Wetland			Non-riparian Wetland			Buffer	Nitrogen Nutrient Offset	Phosphorus Nutrient Offset
Type	R	EII	R	E	C	R	E	C			
Totals	4,843 SMU	137 SMU	4.67 WMU	1.43 WMU	0.33 WMU	0.21 WMU	0.21 WMU				

Project Components

Project Component or Reach ID	Stationing/ Location	Existing Footage/ Acreage	Approach	Restoration/ Restoration Equivalent	Restoration Footage or Acreage	Mitigation Ratio
STREAMS						
Silver Creek		2643 LF				
Reach 1	0+32 to 8+70		Restoration - PII	838 SMU	838 LF	1:1
Reach 2	8+70 to 30+48		Restoration - PI	2,178 SMU	2178 LF	1:1
UT1		478 LF				
Reach 1	0+07 to 5+02		Restoration - PI	495 SMU	495 LF	1:1
UT2		187 LF				
Reach 1	0+00 to 1+03		Restoration - PI	103 SMU	103 LF	1:1
Reach 2	1+03 to 3+10		Restoration - PI	207 SMU	207 LF	1:1
UT3		1,162 LF				
Reach 1	0+00 to 3+43		Enhancement I	137 SMU	343 LF	2.5:1
Reach 2	3+43 to 13+65		Restoration - PI	1,022 SMU	1,022 LF	1:1
WETLANDS	See plan sheets					
JDW1a (NR)		0.42 AC	Enhancement	0.21 WMU	0.42 AC	2:1
JDW1b (Ri)		1.01 AC	Enhancement	0.51 WMU	1.01 AC	2:1
JDW2 (Ri)		0.51 AC	Enhancement	0.25 WMU	0.51 AC	2:1
JDW3 (Ri)		0.03 AC	Enhancement	0.02 WMU	0.03 AC	2:1
JDW4 (Ri)		0.24 AC	Enhancement	0.12 WMU	0.24 AC	2:1
JDW5 (Ri)		0.81 AC	Enhancement	0.40 WMU	0.81 AC	2:1
JDW6 (Ri)		0.25 AC	Enhancement	0.13 WMU	0.25 AC	2:1
R1A (NR)		0	Restoration	0.06 WMU	0.06 AC	1:1
R1B (NR)		0	Restoration	0.15 WMU	0.15 AC	1:1
R2 (Ri)		0	Restoration	1.22 WMU	1.22 AC	1:1
R3 (Ri)		0	Restoration	0.18 WMU	0.18 AC	1:1
R4 (Ri)		0	Restoration	0.44 WMU	0.44 AC	1:1
R5 (Ri)		0	Restoration	1.29 WMU	1.29 AC	1:1
R6 (Ri)		0	Restoration	1.54 WMU	1.54 AC	1:1
C1 (Ri)		0	Creation	0.33 WMU	0.99 AC	3:1

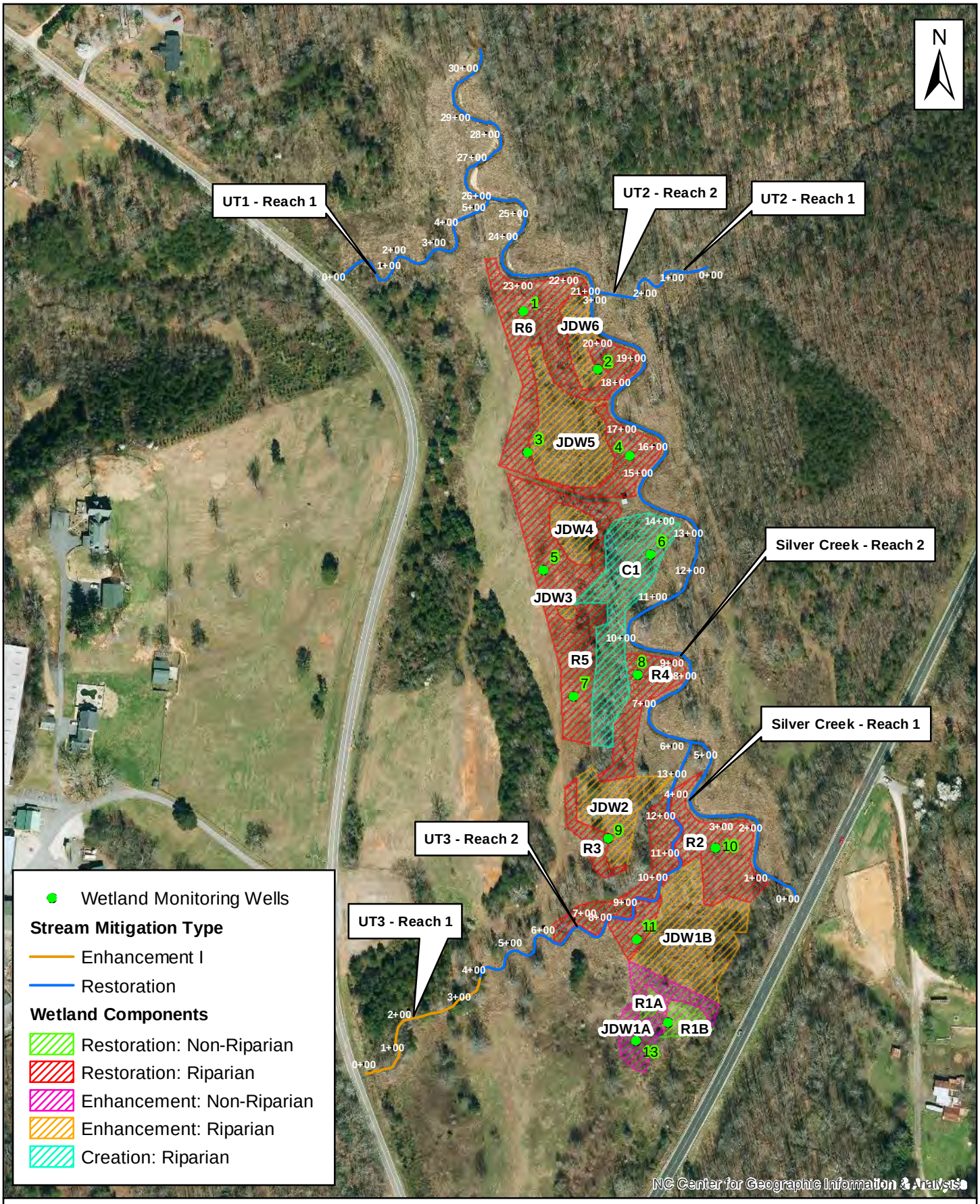
Component Summation

Restoration Level	Stream (LF)	Riparian Wetland (AC)		Non-riparian Wetland (AC)	Buffer (SF)	Upland (AC)
		Riverine	Non-Riverine			
Restoration	4,843	4.67		0.21		
Enhancement I		2.85		0.42		
Enhancement II	343					
Creation		0.99				
Preservation						
High Quality Preservation						

BMP Elements

Element		Location	Purpose/Function	Notes

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



Michael Baker INTERNATIONAL

0 250 500 Feet

DMS Project # 94645

Figure 3
U. Silver Cr. Project Asset Map
Upper Silver Creek Site

Table 2. Project Activity and Reporting History
Upper Silver Creek Restoration Project: DMS Project ID No. 94645

Activity or Report	Scheduled Completion	Data Collection Complete	Actual Completion or Delivery
Mitigation Plan Prepared	Jan-13	N/A	Jan-13
Mitigation Plan Amended	Sep-13	N/A	Sep-13
Mitigation Plan Approved	Oct-13	N/A	Oct-13
Final Design – (at least 90% complete)	N/A	N/A	May-14
Construction Begins	N/A	N/A	May-14
Temporary S&E mix applied to entire project area	N/A	N/A	Dec-14
Permanent seed mix applied to entire project area	N/A	N/A	Dec-14
Planting of live stakes	Winter 2015	N/A	Feb-15
Planting of bare root trees	N/A	N/A	Feb-15
End of Construction	N/A	N/A	Dec-14
Survey of As-built conditions (Year 0 Monitoring-baseline)	N/A	Mar-15	Jul-15
Repair of 3 piping structures	N/A	N/A	Aug-15
Mitigation Plan Addendum	N/A	N/A	Dec-15
Year 1 Monitoring	Dec-15	Dec-15	Apr-16
Repair of channel problem areas resulting from flooding	N/A	N/A	Mar-16
Year 2 Monitoring	Dec-16	Nov-16	Dec-16
Invasive vegetation treatment	N/A	N/A	Jun-17
Beaver dam removal	N/A	N/A	Jul-17
Year 3 Monitoring	Dec-17	Oct-17	Dec-17
Year 4 Monitoring	Dec-18	Nov-18	Dec-18
Vegetation Monitoring		Oct-18	
Stream Monitoring		Nov-18	
Year 5 Monitoring	Dec-19	Nov-19	Dec-19
Removed vegetation and debris causing aggradation			Apr-19
Vegetation Monitoring		Aug-19	Dec-19
Stream Monitoring		Oct-19	Dec-19

Table 3. Project Contacts	
Upper Silver Creek Restoration Project: DMS Project ID No. 94645	
Designer	
Michael Baker Engineering, Inc.	797 Haywood Rd Suite 201 Asheville, NC 28806 Contact: Micky Clemmons, Tel. 828-412-6100
Construction Contractor	
River Works, Inc.	6105 Chapel Hill Road Raleigh, NC 27607 Contact: Stephen Carroll, Tel. 919-428-8368
Planting Contractor	
River Works, Inc.	6105 Chapel Hill Road Raleigh, NC 27607 Contact: Stephen Carroll, Tel. 919-428-8368
Seeding Contractor	
River Works, Inc.	6105 Chapel Hill Road Raleigh, NC 27607 Contact: Stephen Carroll, Tel. 919-428-8368
Seed Mix Sources	Green Resources (seed), Tel. 336-855-6363
Nursery Stock Suppliers	Mellow Marsh Farm (trees), 919-742-1200 ArborGen Inc. (trees), 843-528-3204 Dykes and Son (trees), 931-668-8833
Monitoring Performers	
Michael Baker Engineering, Inc.	797 Haywood Rd Suite 201 Asheville, NC 28806
	Contact:
Stream Monitoring Point of Contact	Micky Clemmons, Tel. 828-412-6100
Vegetation Monitoring Point of Contact	Micky Clemmons, Tel. 828-412-6100
Wetland Monitoring Point of Contact	Micky Clemmons, Tel. 828-412-6100

Table 4. Project Attributes			
Upper Silver Creek Restoration Project: DMS Project ID No. 94645			
Project Information			
Project Name	Upper Silver Creek Mitigation Project		
County	Burke		
Project Area (acres)	22.0		
Project Coordinates (latitude and longitude)	35.6078 N, -81.81742 W		
Watershed Summary Information			
Physiographic Province	Blue Ridge (borders Piedmont)		
River Basin	Catawba		
USGS Hydrologic Unit 8-digit and 14-digit	03050101 / 03050101050050		
DWR Sub-basin	03-08-31		
Project Drainage Area (AC)	Mainstem 2.7 - 3.3, UT1 0.28, UT2 0.05, UT3 0.17		
Project Drainage Area Percentage of Impervious Area	<2%		
USGA Land Use Classification	Deciduous Forest (64%)	Woody Wetlands (1%)	
	Evergreen Forest (3%)	Developed, Open Space (5%)	
	Shrub/Scrub (5%)	Pasture/Hay (14%)	
	Grassland/Herbaceous (6%)		
NCDMS Land Use Classification for Silver Creek Watershed	Forest (59%)		
	Agriculture (23%)		
	Impervious Cover (2.9%)		
Stream Reach Summary Information			
Parameters	**Mainstem - Reach 1**	**Mainstem - Reach 2**	
Length of Reach (LF)	838	2,178	
Valley Classification (Rosgen)	VIII	VIII	
Drainage Area (AC)	1,746	2,147	
NCDWR Stream Identification Score	49.5	49.5	
NCDWR Water Quality Classification	C	C	
Morphological Description (Rosgen stream type)	E	E	
	Incised channel, little connection to floodplain	Incised channel, little connection to floodplain	
Evolutionary Trend	E→G, E→C/F	E→G, E→C/F	
Underlying Mapped Soils	AaA, FnA, UnB	AaA, FnA, UnB	
Drainage Class	Somewhat poorly to well drained	Somewhat poorly to well drained	
Soil Hydric Status	Site-specific	Site-specific	
Average Channel Slope (ft/ft)	0.004	0.004	
FEMA Classification	Zone AE	Zone AE	
Native Vegetation Community	Piedmont/Mtn. Mixed Bottomland Hardwoods	Piedmont/Mtn. Mixed Bottomland Hardwoods	
Percent Composition of Exotic/Invasive Vegetation	10%	5%	
Parameters	**UT1 - Reach 1**	**UT2 - Reach 1**	**UT2 - Reach 2**
Length of Reach (LF)	495	103	207
Valley Classification (Rosgen)	III	III	III
Drainage Area (AC)	177	32	32
NCDWR Stream Identification Score	47.5	45	45
NCDWR Water Quality Classification	C	C	C
Morphological Description (Rosgen stream type)	Gc	channelized B	channelized B
	Incised channel, little connection to floodplain	channelized/ditched channel	channelized/ditched channel
Evolutionary Trend	Gc→F	B→F→C	B→F→C
Underlying Mapped Soils	AaA, FnA	UnB	UnB, FnA
Drainage Class	Somewhat poorly to well drained	Somewhat poorly to well drained	Somewhat poorly to well drained
Soil Hydric Status	Site-specific	Site-specific	Site-specific
Average Channel Slope (ft/ft)	0.016	0.037	0.037
FEMA Classification	N/A	N/A	N/A
Native Vegetation Community	Piedmont Dry-Mesic Oak and Hardwoods to Mixed Bottomland Hardwoods	Piedmont/Mtn. Mixed Bottomland Hardwoods	Piedmont/Mtn. Mixed Bottomland Hardwoods
Percent Composition of Exotic/Invasive Vegetation	5%	2%	2%

Parameters	UT3 - Reach 1	UT3 - Reach 2
Length of Reach (LF)	342	1,022 [6]
Valley Classification (Rosgen)	III	III
Drainage Area (AC)	123	123
NCDWR Stream Identification Score	49.75	49.75
NCDWR Water Quality Classification	C	C
Morphological Description (Rosgen stream type)	B/E	E
	Aggrading at upper end then stable to incising at lower end	Incised channel, little connection to floodplain
Evolutionary Trend	B/E→G	E→G
Underlying Mapped Soils	AaA	AaA, FnA
Drainage Class	Somewhat poorly to well drained	Somewhat poorly to well drained
Soil Hydric Status	Site-specific	Site-specific
Average Channel Slope (ft/ft)	0.015	0.015
FEMA Classification	N/A	N/A
Native Vegetation Community	Piedmont Dry-Mesic Oak and Hardwoods	Piedmont/Mtn. Mixed Bottomland Hardwoods
Percent Composition of Exotic/Invasive Vegetation	2%	2%

Wetland Summary Information

Parameters	JDW1	JDW2	JDW3	JDW4	JDW5	JDW6
Size of Wetland (AC)	1.43	0.51	0.03	0.24	0.81	0.3
Wetland Type	Riparian	Riparian	Riparian	Riparian	Riparian	Riparian
Mapped Soil Series	FnA	FnA	FnA	FnA	FnA	FnA
Drainage Class	Somewhat poorly to well drained	Somewhat poorly to well drained	Somewhat poorly to well drained	Somewhat poorly to well drained	Somewhat poorly to well drained	Somewhat poorly to well drained
Soil Hydric Status	Site-specific	Site-specific	Site-specific	Site-specific	Site-specific	Site-specific
Source of Hydrology	Hillslope seepage; Baseflow; Overbank Flooding	Hillslope seepage; Baseflow; Overbank Flooding	Hillslope seepage; Baseflow; Overbank Flooding	Hillslope seepage; Baseflow; Overbank Flooding	Hillslope seepage; Baseflow; Overbank Flooding	Hillslope seepage; Baseflow; Overbank Flooding
Hydrologic Impairment	Partially	Yes	No	Partially	Partially	Partially
Native Vegetation Community	Piedmont/Mountain Mixed Bottomland Hardwood Forest. Successional Deciduous Forest Land was once also present near Wetlands 2 & 5.					
Percent Composition of Exotic/Invasive Vegetation	~30%	~55%	~10%	~40%	~55%	~35%

Regulatory Considerations

Regulation	Applicable	Resolved	Supporting Documentation
Waters of the United States – Section 404	Yes	Yes	Categorical Exclusion
Waters of the United States – Section 401	Yes	Yes	Categorical Exclusion
Endangered Species Act	Yes	Yes	Categorical Exclusion
Historic Preservation Act	Yes	Yes	Categorical Exclusion
Coastal Zone Management Act (CZMA)/ Coastal Area Management Act (CAMA)	No	N/A	N/A
FEMA Floodplain Compliance	Yes	Yes	Categorical Exclusion
Essential Fisheries Habitat	No	N/A	N/A

Notes:
1. See Figure 2.3 of Mitigation Plan for key to soil series symbols.
2. All wetlands had been disturbed to some degree at the time the project was initiated. As a result, only remnants of native vegetative communities exist in the wetland areas.
3. Fescue is considered as invasive vegetation; it and other field grasses were the dominant nonnative wetland vegetation observed.
4. USGS Land Use Data (2001) used rather than CGIA Land Use Classification data which is more outdated (1996).
5. Source: Upper Catawba River Basin Restoration Priorities (NCEEP 2009) (https://deq.nc.gov/about/divisions/mitigation-services/dms-planning/watershed-planning-documents/catawba-river-basin).
6. This number has been corrected in this MY5 report and is incorrect in previous reports. It is correct in Table 1 and on the As-built plan sheets.

Appendix C

Vegetation Assessment Data

Includes:

Table 5. Vegetation Plot Mitigation Success Summary

Table 6. Vegetation Metadata

Table 7. Stem Count Arranged by Plot

Figure 4. Vegetation Monitoring Plot Photos

Table 5. Vegetation Plot Mitigation Success Summary (per acre)				
Plot #	**Stream/ Wetland Stems[1]**	**Volunteers[2]**	**Total[3]**	**Success Criteria Met?**
1	1012	162	1174	Yes
2	1093	324	1416	Yes
3	364	81	445	Yes
4	607	40	647	Yes
5	607	0	607	Yes
6	647	243	890	Yes
7	567	121	688	Yes
8	567	405	971	Yes
9	364	40	405	Yes
10	769	243	1012	Yes
11	728	81	809	Yes
12	688	81	769	Yes
13	647	40	688	Yes
14	567	121	688	Yes
Project Avg	**659**	**142**	**801**	

Stem Class	**characteristics**
[1]Stream/ Wetland Stems	Native planted woody stems. Includes shrubs, does NOT include live stakes. No vines
[2]Volunteers	Native woody stems. Not planted. No vines.
[3]Total	Planted + volunteer native woody stems. Includes live stakes. Excl. exotics. Excl. vines.

Exceeds requirements by 10%

Table 6. Vegetation Metadata	
Upper Silver Creek Stream and Wetland Restoration - Project 94645	
Report Prepared By	Holland Youngman
Date Prepared	9/30/2019 14:10
database name	MY5_94645_UpperSilver_cvs-eep-entrytool-v2.3.1.mdb
database location	L:\projects\120598-Upr-Silver-FD\Monitoring\YR5 Monitoring\2.0 Monitoring Data\App C - Vegetation Data
computer name	ASHELHYOUNGMAN
file size	75890688
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	94645
project Name	Upper Silver Creek
Description	Full Delivery stream and wetland restoration site
River Basin	Broad
length(ft)	5,169'
stream-to-edge width (ft)	Minimum of 30 ft
area (sq m)	62,321 sq. m.
Required Plots (calculated)	14
Sampled Plots	14

Table 7. Stem Count Arranged By Plot
Project: Upper Silver Creek, DMS Project #94645

			Current Plot Data (MY5 2019)																												
			94645-01-0001			94645-01-0002			94645-01-0003			94645-01-0004			94645-01-0005			94645-01-0006			94645-01-0007			94645-01-0008			94645-01-0009			94645-01-0010		
Scientific Name	Common Name	Species Type	P	V	T	P	V	T	P	V	T	P	V	T	P	V	T	P	V	T	P	V	T	P	V	T	P	V	T	P	V	T
Acer rubrum	red maple	Tree				6		6				2	1	3								1	1	3		3					1	1
Alnus sp.	alder	Shrub																													1	1
Alnus serrulata	hazel alder	Shrub																														
Betula nigra	river birch	Tree							2		2							1		1	2	2	4							1		1
Carpinus caroliniana	American hornbeam	Tree	1		1	3		3				2		2							1		1				1		1	1		1
Cornus sp.	dogwood	Shrub or Tree					1	1																								
Cornus amomum	silky dogwood	Shrub							1		1	1		1	5		5	4		4	2		2									
Corylus cornuta	beaked hazelnut	Shrub or Tree																1		1												
Diospyros virginiana	common persimmon	Tree	1		1							1		1										1		1						
Fraxinus pennsylvanica	green ash	Tree							2		2				7		7	1		1	1		1									
Liquidambar styraciflua	sweetgum	Tree																														
Liriodendron tulipifera	tuliptree	Tree				1		1				1		1					1	1				2	5	7		1	1	2	2	4
Platanus occidentalis	American sycamore	Tree	8	4	12	4		4	1	2	3	4		4	2		2	3	5	8	5		5	4	5	9	2		2	5		5
Populus deltoides	eastern cottonwood	Tree					1	1																								
Quercus	oak	Tree																														
Quercus lyrata	overcup oak	Tree																														
Quercus michauxii	swamp chestnut oak	Tree				5	2	7				2		2	1		1	3		3	3		3	2		2						
Quercus nigra	water oak	Tree							3		3																					
Quercus pagoda	cherrybark oak	Tree																														
Quercus phellos	willow oak	Tree	1		1	4	4	8				2		2				3		3							5		5	10		10
Rhus	sumac	Shrub																													1	1
Unknown		Shrub or Tree																														
Vaccinium corymbosum	highbush blueberry	Shrub				1		1																								
Viburnum	viburnum	Shrub																													1	1
Viburnum dentatum	southern arrowwood	Shrub	14		14	3		3																2		2	1		1			
		Stem count	25	4	29	27	8	35	9	2	11	15	1	16	15	0	15	16	6	22	14	3	17	14	10	24	9	1	10	19	6	25
		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	1	5	8	4	10	5	1	5	8	1	8	4	0	4	7	2	8	6	2	7	6	2	6	4	1	5	5	5	9
		Stems per ACRE	1012	162	1174	1093	324	1416	364	81	445	607	40	647	607	0	607	647	243	890	567	121	688	567	405	971	364	40	405	769	243	1012

Table 7. Stem Count Arranged By Plot, Continued
Project: Upper Silver Creek, DMS Project #94645

			Current Plot Data (MY5 2019)												Annual Means																	
			94645-01-0011			94645-01-0012			94645-01-0013			94645-01-0014			MY5 (2019)			MY4 (2018)			MY3 (2017)			MY2 (2016)			MY1 (2015)			MY0 (2015)*		
Scientific Name	Common Name	Species Type	P	V	T	P	V	T	P	V	T	P	V	T	P	V	T	P	V	T	P	V	T	P	V	T	P	V	T	P	V	T
Acer rubrum	red maple	Tree				1		1					1	1	12	4	16	13	1	14	12	1	13	13	1	14	14		14	12		12
Alnus sp.	alder	Shrub														1	1															
Alnus serrulata	hazel alder	Shrub	1		1	1		1							2		2	2		2	2		2		1	1	1		1	1		1
Betula nigra	river birch	Tree	3		3	5		5	3		3	1		1	18	2	20	19		19	20		20	19		19	21		21	8		8
Carpinus caroliniana	American hornbeam	Tree				1		1							10		10	10		10	10	1	11	11	1	12	11		11	9		9
Cornus	dogwood	Sbrub or Tree														1	1															
Cornus amomum	silky dogwood	Shrub	11		11	3	1	4	2		2				29	1	30	30	2	32	30		30	32	5	37	32		32	16		16
Corylus cornuta	beaked hazelnut	Shrub or Tree													1		1	1		1	1		1	1		1	1		1	1		1
Diospyros virginiana	common persimmon	Tree													3		3	3	1	4	3		3	3		3	3		3	3		3
Fraxinus pennsylvanica	green ash	Tree		2	2	2		2				4		4	17	2	19	18		18	18		18	18	1	19	19		19	12		12
Liquidambar styraciflua	sweetgum	Tree																				3	3		1	1						
Liriodendron tulipifera	tuliptree	Tree					1	1		1	1		1	1	6	12	18	6	4	10	6	7	13	7	1	8	11		11	10		10
Platanus occidentalis	American sycamore	Tree	1		1	2		2	3		3	2		2	46	16	62	50	7	57	53	9	62	54	5	59	60		60	48		48
Populus deltoides	eastern cottonwood	Tree														1	1															
Quercus	oak	Tree																						1		1	2		2			
Quercus lyrata	overcup oak	Tree				1		1					1	1	1	1	2	1		1	1		1	1		1	1		1			
Quercus michauxii	swamp chestnut oak	Tree	1		1				8		8	4		4	29	2	31	33		33	34	1	35	32		32	33		33	20		20
Quercus nigra	water oak	Tree													3		3	3		3	3		3	3		3	4		4	4		4
Quercus pagoda	cherrybark oak	Tree										1		1	1		1	1		1	1		1									
Quercus phellos	willow oak	Tree	1		1	1		1				2		2	29	4	33	31		31	32		32	32		32	32		32	17		17
1	sumac	Shrub														1	1															
Unknown		Shrub or Tree																			2		2	7		7	10		10	6		6
Vaccinium corymbosum	highbush blueberry	Shrub													1		1	1		1	1		1	1		1	1		1	1		1
Viburnum sp.	viburnum	Shrub														1	1															
Viburnum dentatum	southern arrowwood	Shrub													20		20	21		21	20		20	21		21	21		21	21		21
		Stem count	18	2	20	17	2	19	16	1	17	14	3	17	228	49	277	243	15	258	249	22	271	256	16	272	277	0	277	189	0	189
		size (ares)		1			1			1			1			14			14			14			14			14			9	
		size (ACRES)		0.02			0.02			0.02			0.02			0.35			0.35			0.35			0.35			0.35			0.22	
		Species count	6	1	7	9	2	10	4	1	5	6	3	9	17	14	22	17	5	17	18	6	19	17	8	19	18	0	18	16	0	16
		Stems per ACRE	728	81	809	688	81	769	647	40	688	567	121	688	659	142	801	702	43	746	720	64	783	740	46	786	801	0	801	850	0	850

P = Planted — This color indicates that the number includes volunteer stems.
V = Volunteer — Indicates that the stems per acre exceeds requirements by 10%
T = Total — Indicates that the stems per acre exceeds requirements, but by less than 10%

*MY0 included 9 vegetation plots. However, upon review, it was discovered that we needed to have 14 plots to meet guidelines. Five additional plots were added in the Fall of 2015 and the MY1 and later means include these additional plots

Figure 4. Vegetation Monitoring Plot Photos
Upper Silver Creek - DMS Project #94645

Photo 1. Vegetation Plot 1 – Tree photo (August 21, 2019).

Photo 2. Vegetation Plot 1 – Herbaceous photo (August 21, 2019).

Photo 3. Vegetation Plot 2 – Tree photo (August 21, 2019).

Photo 4. Vegetation Plot 2 – Herbaceous photo (August 21, 2019).

Photo 5. Vegetation Plot 3 – Tree photo (August 21, 2019).

Photo 6. Vegetation Plot 3 – Herbaceous photo (August 21, 2019).

Photo 7. Vegetation Plot 4 – Tree photo (August 21, 2019).

Photo 8. Vegetation Plot 4 – Herbaceous photo (August 21, 2019).

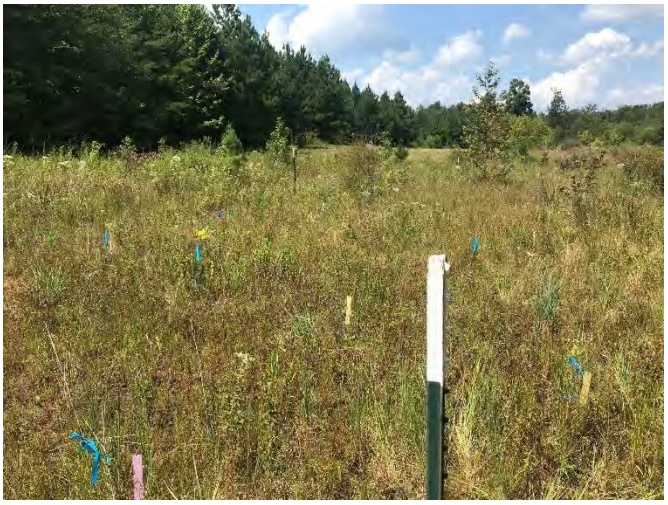


Photo 9. Vegetation Plot 5 – Tree photo (August 21, 2019).

Photo Point 10, Vegetation Plot 5 – Herbaceous photo (August 21, 2019).

Photo 11. Vegetation Plot 6 – Tree photo (August 21, 2019).

Photo 12. Vegetation Plot 6 – Herbaceous photo (August 21, 2019).

Photo 13. Vegetation Plot 7 – Tree photo (August 21, 2019).

Photo 14. Vegetation Plot 7 – Herbaceous photo (August 21, 2019).

Photo 15. Vegetation Plot 8 – Tree photo (August 21, 2019).

Photo 16. Vegetation Plot 8 – Herbaceous photo (August 21, 2019).

Photo 17. Vegetation Plot 9 – Tree photo (August 21, 2019).

Photo 18. Vegetation Plot 9 – Herbaceous photo (August 21, 2019).

Photo 19. Vegetation Plot 10 – Tree photo (August 21, 2019).

Photo 20. Vegetation Plot 10 – Herbaceous photo (August 21, 2019).

Photo 21. Vegetation Plot 11 – Tree photo (August 21, 2019).

Photo 22. Vegetation Plot 11 – Herbaceous photo (August 21, 2019).

Photo 23. Vegetation Plot 12 – Tree photo (August 21, 2019).

Photo 24. Vegetation Plot 12 – Herbaceous photo (August 21, 2019).

Photo 25. Vegetation Plot 13 – Tree photo (August 21, 2019).

Photo 26. Vegetation Plot 13 – Herbaceous photo (August 21, 2019).

Photo 27. Vegetation Plot 14 – Tree photo (August 21, 2019).

Photo 28. Vegetation Plot 14 – Herbaceous photo (August 21, 2019).

Appendix D

Stream Assessment Data

Includes:

Figure 5. Stream Photos by Channel and Station

Table 8. Visual Morphological Stability Assessment

Table 8a Stream Problem Areas

Table 9. Verification of Bankfull or Greater than Bankfull Events

Figure 6. Cross-Sections with Annual Overlays

Figure 7. Longitudinal Profiles with Annual Overlays

Figure 8. Pebble Count Plots with Annual Overlays

Table 10. Monitoring Year 5 Stream Summary

Table 11. Morphology and Hydraulic Monitoring Summary

Figure 5. Stream Photos by Channel and Station – MY5 (2019)

Photo 1. Mainstem Photo Point 1 – Station 29+26
(October 17, 2019) downstream view from left bank.

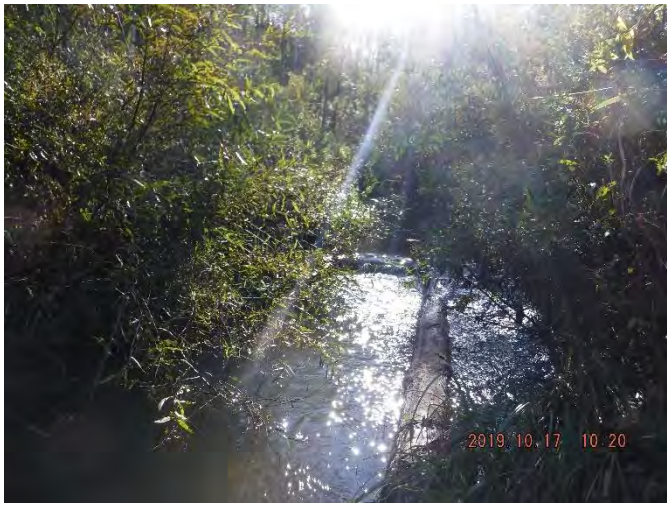


Photo 2. Mainstem Photo Point 1 – Station 29+26
(October 17, 2019) upstream view from left bank.

Photo 3. Mainstem Photo Point 2 – Station 26+44
(October 17, 2019) downstream view from left bank.

Photo 4. Mainstem Photo Point 2 – Station 26+44
(October 17, 2019) upstream from left bank.

Photo 5. Mainstem Photo Point 3 – Station 24+70
(October 17, 2019) upstream from right bank.

Photo 6. Mainstem Photo Point 3 – Station 24+70
(October 17, 2019) downstream from right bank.

Photo 7. Mainstem Photo Point 4 (PP4) – Station 20+30 (October 17, 2019) downstream from left bank.

Photo 8. Mainstem Photo Point 4 (PP4) – Station 20+30 (October 17, 2019) upstream from left bank.

Photo 9. Mainstem Photo Point 5 – Station 16+03 (October 17, 2019) upstream from right bank.

Photo 10, Mainstem Photo Point 5 – Station 16+03 (October 17, 2019) downstream from right bank.

Photo 11. Mainstem Photo Point 6 – Station 13+03 (October 17, 2019) upstream from right bank.

Photo 12. Mainstem Photo Point 6 – Station 13+03 (October 17, 2019) downstream from right bank.

Photo 13. Mainstem Photo Point 7 – Station 10+11 (October 17, 2019) downstream from left bank.

Photo 14. Mainstem Photo Point 7 – Station 10+11 (October 17, 2019) upstream from left bank.

Photo 15. Mainstem Photo Point 8 – Station 5+06 (October 17, 2019) upstream from right bank.

Photo 16. Mainstem Photo Point 8 – Station 5+06 (October 17, 2019) downstream from right bank.

Photo 17. Mainstem Photo Point 9 – Station 3+87 (October 17, 2019) downstream from left bank.

Photo 18. Mainstem Photo Point 9 – Station 3+87 (October 17, 2019) upstream from left bank.

Photo 19. Mainstem Photo Point 10 – Stat. 1+22 (October 17, 2019) downstream from left bank.

Photo 20. Mainstem Photo Point 10 – Stat. 1+22 (October 17, 2019) upstream from left bank.

Unnamed Tributary 1 - Monitoring Year 5 (2019)

Photo 21. UT1 Photo Point 1 – Station 4+82 (November 5, 2019) upstream from left bank.

Intentionally Left Blank

Photo 22. UT1 Photo Point 2 – Station 4+07 (November 5, 2019) downstream from left bank.

Photo 23. UT1 Photo Point 2 – Station 4+07 (November 5, 2019) upstream from left bank.

Photo 24. UT1 Photo Point 3 – Station 2+55
(November 5, 2019) upstream from right bank.

Photo 25. UT1 Photo Point 3 – Station 2+55
(November 5, 2019) downstream from right bank.

Photo 26. UT1 Photo Point 4 – Station 0+55
(November 5, 2019) downstream from left bank.

Photo 27. UT1 Photo Point 4 – Station 0+55
(November 5, 2019) upstream from left bank.

Unnamed Tributary 2 – Monitoring Year 5 (2019)

Photo 28. UT2 Photo Point 1 – Station 2+15
(November 5, 2019) downstream from left bank.

Photo 29. UT2 Photo Point 1 – Station 2+15
(November 5, 2019) upstream from left bank.

Photo 30. UT2 Photo Point 2 – Station 0+96
(November 5, 2019) upstream from right bank.

Photo 31. UT2 Photo Point 2 – Station 0+96
(November 5, 2019) downstream from right bank.

Photo 32. UT2 Photo Point 3 – Station 0+02
(November 5, 2019) downstream from right bank.

Photo 33. UT2 Photo Point 3 – Station 0+02
(November 5, 2019) upstream from right bank.

Unnamed Tributary 3 – Monitoring Year 5 (2019)

Photo 34. UT3 Photo Point 1 – Station 12+10
(October 17, 2019) downstream from left bank.

Photo 35. UT3 Photo Point 1 – Station 12+10
(October 17, 2019) upstream from left bank.

Photo 36. UT3 Photo Point 2 – Station 10+66
(October 17, 2019) upstream from right bank.

Photo 37. UT3 Photo Point 2 – Station 10+66
(October 17, 2019) downstream from right bank.

Photo 38. UT3 Photo Point 3 – Station 8+10
(October 17, 2019) downstream from left bank.

Photo 39. UT3 Photo Point 3 – Station 8+10
(October 17, 2019) upstream from left bank.

Photo 40. UT3 Photo Point 4 – Station 7+05
(October 17, 2019) downstream from left bank.

Photo 41. UT3 Photo Point 4 – Station 7+05
(October 17, 2019) upstream from left bank.

Photo 42. UT3 Photo Point 5 – Station 5+95
(October 17, 2019) downstream from left bank.

Photo 43. UT3 Photo Point 5 – Station 5+95
(October 17, 2019) upstream from left bank.

Photo 44. UT3 Photo Point 6 – Station 4+55
(October 17, 2019) upstream from right bank.

Photo 45. UT3 Photo Point 6 – Station 4+55
(October 17, 2019) downstream from right bank.

Photo 46. UT3 Photo Point 7 – Station 3+60
(October 17, 2019) upstream to structure.

Photo 47. UT3 Photo Point 8 – Station 2+70
(October 17, 2019) upstream to structure.

Photo 48. UT3 Photo Point 9 – Station 1+90 (October 17, 2019) upstream to structure.

Photo 49. UT3 Photo Point 10 – Station 0+60 (October 17, 2019) downstream to structure.

Table 8. Visual Morphological Stability Assessment
Upper Silver Creek Restoration Project: DMS Project ID No. 94645

Silver Creek, Reach 1 (528 LF)*						
Feature Category	Metric (per As-Built and reference baselines)	(# Stable) Number Performing as Intended	Total number per As-Built	Total Number / feet in unstable state	% Performing in Stable Condition	Feature Perfomance Mean or Total
A. Riffles	1. Present?	4	4	0	100	
	2. Armor stable (e.g. no displacement)?	4	4	0	100	
	3. Facet grades appears stable?	4	4	0	100	
	4. Minimal evidence of embedding/fining?	4	4	0	100	
	5. Length appropriate?	4	4	0	100	**100%**
B. Pools	1. Present? (e.g. not subject to severe aggradation or migration?)	4	4	0	100	
	2. Sufficiently deep (Max Pool D:Mean Bkf >1.6?)	4	4	0	100	
	3. Length appropriate?	4	4	0	100	**100%**
C. Thalweg	1. Upstream of pool (structure) centering? (%)	100	100	0	100	
	2. Downstream of pool (structure) centering? (%)	100	100	0	100	**100%**
D. Meanders	1. Outer bend in state of limited/controlled erosion?	4	4	0	100	
	2. Of those eroding, # w/concomitant point bar formation?	4	4	0	100	
	3. Apparent Rc within spec?	4	4	0	100	
	4. Sufficient floodplain access and relief?	4	4	0	100	**100%**
E. Bed General	1. General channel bed aggradation areas (bar formation)	528'*	528'*	0	100	
	2. Channel bed degradation - areas of increasing down-cutting or head cutting?	528'*	528'*	0	100	**100%**
F. Vanes, Rock/Log Drop Structures	1. Free of back or arm scour?	6	6	0	100	
	2. Height appropriate?	6	6	0	100	
	3. Angle and geometry appear appropriate?	6	6	0	100	
	4. Free of piping or other structural failures?	6	6	0	100	**100%**
G. Wads/ Boulders	1. Free of scour?	4	4	0	100	
	2. Footing stable?	4	4	0	100	**100%**

Silver Creek, Reach 2 (2,488 LF)*						
Feature Category	Metric (per As-Built and reference baselines)	(# Stable) Number Performing as Intended	Total number per As-Built	Total Number / feet in unstable state	% Performing in Stable Condition	Feature Perfomance Mean or Total
A. Riffles	1. Present?	21	21	0	100	
	2. Armor stable (e.g. no displacement)?	21	21	0	100	
	3. Facet grades appears stable?	21	21	0	100	
	4. Minimal evidence of embedding/fining?	21	21	0	100	
	5. Length appropriate?	21	21	0	100	**100%**
B. Pools	1. Present? (e.g. not subject to severe aggradation or migration?)	20	20	0	100	
	2. Sufficiently deep (Max Pool D:Mean Bkf >1.6?)	20	20	0	100	
	3. Length appropriate?	20	20	0	100	**100%**
C. Thalweg	1. Upstream of pool (structure) centering? (%)	100	100	0	100	
	2. Downstream of pool (structure) centering? (%)	100	100	0	100	**100%**
D. Meanders	1. Outer bend in state of limited/controlled erosion?	19	20	1/15'	95	
	2. Of those eroding, # w/concomitant point bar formation?	20	20	0	100	
	3. Apparent Rc within spec?	20	20	0	100	
	4. Sufficient floodplain access and relief?	20	20	0	100	**99%**
E. Bed General	1. General channel bed aggradation areas (bar formation)	2,488'*	2,488'*	0	100	
	2. Channel bed degradation - areas of increasing down-cutting or head cutting?	2,488'*	2,488'*	0	100	**100%**
F. Vanes, Rock/Log Drop Structures	1. Free of back or arm scour?	21	21	0	100	
	2. Height appropriate?	21	21	0	100	
	3. Angle and geometry appear appropriate?	21	21	0	100	
	4. Free of piping or other structural failures?	20	21	0	95	**99%**
G. Wads/ Boulders	1. Free of scour?	14	14	0	100	
	2. Footing stable?	14	14	0	100	**100%**

*Please note that a mistake was made in the lengths stated in this table in previous reports and these are the accurate lengths for these reaches.

Table 8. Visual Morphological Stability Assessment - Continued
Upper Silver Creek Restoration Project: DMS Project ID No. 94645

UT1 (502 LF)						
Feature Category	Metric (per As-Built and reference baselines)	(# Stable) Number Performing as Intended	Total number per As-Built	Total Number / feet in unstable state	% Performing in Stable Condition	Feature Perfomance Mean or Total
A. Riffles	1. Present?	7	7	0	100	
	2. Armor stable (e.g. no displacement)?	7	7	0	100	
	3. Facet grades appears stable?	7	7	0	100	
	4. Minimal evidence of embedding/fining?	7	7	0	100	
	5. Length appropriate?	7	7	0	100	**100%**
B. Pools	1. Present? (e.g. not subject to severe aggradation or migration?)	10	10	0	100	
	2. Sufficiently deep (Max Pool D:Mean Bkf >1.6?)	10	10	0	100	
	3. Length appropriate?	10	10	0	100	**100%**
C. Thalweg[1]	1. Upstream of pool (structure) centering? (%)	100	100	0	100	
	2. Downstream of pool (structure) centering? (%)	100	100	0	100	**100%**
D. Meanders	1. Outer bend in state of limited/controlled erosion?	7	7	0	100	
	2. Of those eroding, # w/concomitant point bar formation?	7	7	0	100	
	3. Apparent Rc within spec?	7	7	0	100	
	4. Sufficient floodplain access and relief?	7	7	0	100	**100%**
E. Bed General	1. General channel bed aggradation areas (bar formation)	502'	502'	0	100	
	2. Channel bed degradation - areas of increasing down-cutting or head cutting?	502'	502'	0	100	**100%**
F. Vanes, Rock/Log Drop Structures	1. Free of back or arm scour?	11	11	0	100	
	2. Height appropriate?	11	11	0	100	
	3. Angle and geometry appear appropriate?	11	11	0	100	
	4. Free of piping or other structural failures?	11	11	0	100	**100%**
G. Wads/ Boulders	1. Free of scour?	N/A	N/A	N/A	N/A	
	2. Footing stable?	N/A	N/A	N/A	N/A	~~**100%**~~

UT2, Reach 1 (103 LF)						
Feature Category	Metric (per As-Built and reference baselines)	(# Stable) Number Performing as Intended	Total number per As-Built	Total Number / feet in unstable state	% Performing in Stable Condition	Feature Perfomance Mean or Total
A. Riffles	1. Present?	4	4	0	100	
	2. Armor stable (e.g. no displacement)?	4	4	0	100	
	3. Facet grades appears stable?	4	4	0	100	
	4. Minimal evidence of embedding/fining?	4	4	0	100	
	5. Length appropriate?	4	4	0	100	**100%**
B. Pools	1. Present? (e.g. not subject to severe aggradation or migration?)	5	5	0	100	
	2. Sufficiently deep (Max Pool D:Mean Bkf >1.6?)	5	5	0	100	
	3. Length appropriate?	5	5	0	100	**100%**
C. Thalweg	1. Upstream of pool (structure) centering? (%)	100	100	0	100	
	2. Downstream of pool (structure) centering? (%)	100	100	0	100	**100%**
D. Meanders	1. Outer bend in state of limited/controlled erosion?	N/A	N/A	N/A	~~100~~	
	2. Of those eroding, # w/concomitant point bar formation?	N/A	N/A	N/A	100	
	3. Apparent Rc within spec?	N/A	N/A	N/A	100	
	4. Sufficient floodplain access and relief?	N/A	N/A	N/A	100	~~**100%**~~
E. Bed General	1. General channel bed aggradation areas (bar formation)	103'	103'	0	100	
	2. Channel bed degradation - areas of increasing down-cutting or head cutting?	103'	103'	0	100	**100%**
F. Vanes, Rock/Log Drop Structures	1. Free of back or arm scour?	5	5	0	100	
	2. Height appropriate?	5	5	0	100	
	3. Angle and geometry appear appropriate?	5	5	0	100	
	4. Free of piping or other structural failures?	5	5	0	100	**100%**
G. Wads/ Boulders	1. Free of scour?	N/A	N/A	N/A	N/A	
	2. Footing stable?	N/A	N/A	N/A	N/A	**N/A**

Table 8. Visual Morphological Stability Assessment - Continued
Upper Silver Creek Restoration Project: DMS Project ID No. 94645

UT2, Reach 2 (207 LF)

Feature Category	Metric (per As-Built and reference baselines)	(# Stable) Number Performing as Intended	Total number per As-Built	Total Number / feet in unstable state	% Performing in Stable Condition	Feature Perfomance Mean or Total
A. Riffles	1. Present?	4	4	0	100	
	2. Armor stable (e.g. no displacement)?	4	4	0	100	
	3. Facet grades appears stable?	4	4	0	100	
	4. Minimal evidence of embedding/fining?	4	4	0	100	
	5. Length appropriate?	4	4	0	100	**100%**
B. Pools	1. Present? (e.g. not subject to severe aggradation or migration?)	3	3	0	100	
	2. Sufficiently deep (Max Pool D:Mean Bkf >1.6?)	3	3	0	100	
	3. Length appropriate?	3	3	0	100	**100%**
C. Thalweg	1. Upstream of pool (structure) centering? (%)	100	100	0	100	
	2. Downstream of pool (structure) centering? (%)	100	100	0	100	**100%**
D. Meanders	1. Outer bend in state of limited/controlled erosion?	3	3	0	100	
	2. Of those eroding, # w/concomitant point bar formation?	3	3	0	100	
	3. Apparent Rc within spec?	3	3	0	100	
	4. Sufficient floodplain access and relief?	3	3	0	100	**100%**
E. Bed General	1. General channel bed aggradation areas (bar formation)*	82'	207'	125'*	#VALUE!	
	2. Channel bed degradation - areas of increasing down-cutting or head cutting?	207'	207'	0	#~~VALUE!~~	**~~#VALUE!~~**
F. Vanes, Rock/Log Drop Structures	1. Free of back or arm scour?	1	1	0	100	
	2. Height appropriate?	1	1	0	100	
	3. Angle and geometry appear appropriate?	1	1	0	100	
	4. Free of piping or other structural failures?	1	1	0	100	**100%**
G. Wads/ Boulders	1. Free of scour?	N/A	N/A	N/A	N/A	
	2. Footing stable?	N/A	N/A	N/A	N/A	**N/A**

*Approximately 125 feet of this reach has aggraded to some degree from the As-built, but it is not in an unstable condition.

Table 8. Visual Morphological Stability Assessment - Continued
Upper Silver Creek Restoration Project: DMS Project ID No. 94645

UT3 Reach 1 (343 LF) (Enhancement II reach)

Feature Category	Metric (per As-Built and reference baselines)	(# Stable) Number Performing as Intended	Total number per As-Built	Total Number / feet in unstable state	% Performing in Stable Condition	Feature Perfomance Mean or Total
A. Riffles	1. Present?	N/A	N/A	N/A	N/A	
	2. Armor stable (e.g. no displacement)?	N/A	N/A	N/A	N/A	
	3. Facet grades appears stable?	N/A	N/A	N/A	N/A	
	4. Minimal evidence of embedding/fining?	N/A	N/A	N/A	N/A	
	5. Length appropriate?	N/A	N/A	N/A	N/A	**N/A**
B. Pools	1. Present? (e.g. not subject to severe aggradation or migration?)	N/A	N/A	N/A	N/A	
	2. Sufficiently deep (Max Pool D:Mean Bkf >1.6?)	N/A	N/A	N/A	N/A	
	3. Length appropriate?	N/A	N/A	N/A	N/A	**N/A**
C. Thalweg	1. Upstream of pool (structure) centering? (%)	N/A	N/A	N/A	N/A	
	2. Downstream of pool (structure) centering? (%)	N/A	N/A	N/A	N/A	**N/A**
D. Meanders	1. Outer bend in state of limited/controlled erosion?	N/A	N/A	N/A	N/A	
	2. Of those eroding, # w/concomitant point bar formation?	N/A	N/A	N/A	N/A	
	3. Apparent Rc within spec?	N/A	N/A	N/A	N/A	
	4. Sufficient floodplain access and relief?	N/A	N/A	N/A	N/A	**N/A**
E. Bed General	1. General channel bed aggradation areas (bar formation)	343'	343'	0	#VALUE!	
	2. Channel bed degradation - areas of increasing down-cutting or head cutting?	343'	343'	0	#VALUE!	**~~#VALUE!~~**
F. Vanes, Rock/Log Drop Structures	1. Free of back or arm scour?	3	3	0	100	
	2. Height appropriate?	3	3	0	100	
	3. Angle and geometry appear appropriate?	3	3	0	100	
	4. Free of piping or other structural failures?	3	3	0	100	**100%**
G. Wads/ Boulders	1. Free of scour?	N/A	N/A	N/A	N/A	
	2. Footing stable?	N/A	N/A	N/A	N/A	**N/A**

Table 8. Visual Morphological Stability Assessment - Continued
Upper Silver Creek Restoration Project: DMS Project ID No. 94645

UT3 Reach 2 (1,022 LF)						
Feature Category	Metric (per As-Built and reference baselines)	(# Stable) Number Performing as Intended	Total number per As-Built	Total Number / feet in unstable state	% Performing in Stable Condition	Feature Perfomance Mean or Total
A. Riffles	1. Present?	22	22	0	100	
	2. Armor stable (e.g. no displacement)?	22	22	0	100	
	3. Facet grades appears stable?	22	22	0	100	
	4. Minimal evidence of embedding/fining?	18	22	4/80'	82	
	5. Length appropriate?	22	22	0	100	**96%**
B. Pools	1. Present? (e.g. not subject to severe aggradation or migration?)	21	21	0	100	
	2. Sufficiently deep (Max Pool D:Mean Bkf >1.6?)	21	21	0	100	
	3. Length appropriate?	21	21	0	100	**100%**
C. Thalweg	1. Upstream of pool (structure) centering?	100	100	0	100	
	2. Downstream of pool (structure) centering?	100	100	0	100	**100%**
D. Meanders	1. Outer bend in state of limited/controlled erosion?	17	17	0	100	
	2. Of those eroding, # w/concomitant point bar formation?	17	17	0	100	
	3. Apparent Rc within spec?	17	17	0	100	
	4. Sufficient floodplain access and relief?	17	17	0	100	**100%**
E. Bed General	1. General channel bed aggradation areas (bar formation)	1022'	1022'	0	#VALUE!	
	2. Channel bed degradation - areas of increasing down-cutting or head cutting?	1022'	1022'	0	100	**~~#VALUE!~~**
F. Vanes, Rock/Log Drop Structures	1. Free of back or arm scour?	15	15	0	100	
	2. Height appropriate?	15	15	0	100	
	3. Angle and geometry appear appropriate?	15	15	0	100	
	4. Free of piping or other structural failures?	15	15	0	100	**100%**
G. Wads/ Boulders	1. Free of scour?	4	4	0	100	
	2. Footing stable?	4	4	0	100	**100%**

Table 8a. Stream Problem Areas
Upper Silver Creek Mitigation Project, NCDMS Project No. 94645

Sink Hole Creek and Uts			
Feature Issue	**Station No.**	**Suspected Cause**	**Photo Number**
J-hook Arm Piping.	23+00	Loss of back fill and fabric that seals the arm. This problem area was first noted in MY3 and has continued during MY5. While not fully functioning as a vane it is providing good habitat, is turning water to the thalweg and is stable.	Photo #1
Bank Erosion	6 + 50	Bank erosion along outside of menader bend. Not completely stable but significantly better than first noted in MY3 and gradually revegetating.	Photo #2 & #3

Photo #1

Photo #2: April of 2019.

Photo #3: More stable bank, January of 2020.

Table 9. Verification of Bankfull or Greater than Bankfull Events
Upper Silver Creek Restoration Project: DMS Project ID No. 94645

Date of Data Collection	Approximate Date of Event	Method of Data Collection	Gauge Watermark Height (inches)[1]	
			Silver Creek Station 19+00	UT3 Station 8+10
MY2				
2/29/2016	Unknown	Crest gauge	15.0	5.0
MY3				
5/2/2017	Unknown	Crest Gauge	5.4	3.0
MY4				
4/2/2018	2/11/2018	Crest Gauge	14.28	0 [2]
5/8/2018	4/15/2018	Crest Gauge	12.96	0 [2]
10/3/2018	9/16/2018	Crest Gauge	10.56	0 [2]
10/18/2018	10/11/2018	Crest Gauge	19.68	0 [2]
MY5				
6/11/2019	6/8/2019	Crest Gauge	7.25	0 [2]
9/4/2019	Unknown	Crest Gauge	4.25	0 [2]
10/17/2019	9/13/2019	Crest Gauge	0	2.5

[1] Height indicates the highest position of cork shavings on the dowel and the height above bankfull, as 0" on the dowel is set at bankfull

[2] Crest gauge along UT3 was impacted by an ant hill and did not record all bankful events. The crest gauge was cleaned out repeatedly and refilled with cork in 2019 but the ant hill was rebuilt from cork from the crest gauge, so the events documented on 6/11/2019 and 9/4/2019 at the mainstem guage, were not recorded on this gauge.

~~Photo 1. Silver~~ Creek mainstem crest gauge staff showing cork deposition in red circle at 7.25" above the bottom of the staff, which is at the bankfull elevation (6/11/2019)

Photo 2. Silver Creek mainstem crest gauge staff showing cork deposition in red circle at 4.25" above the bottom of the staff, which is at the bankfull elevation (9/4/2019)

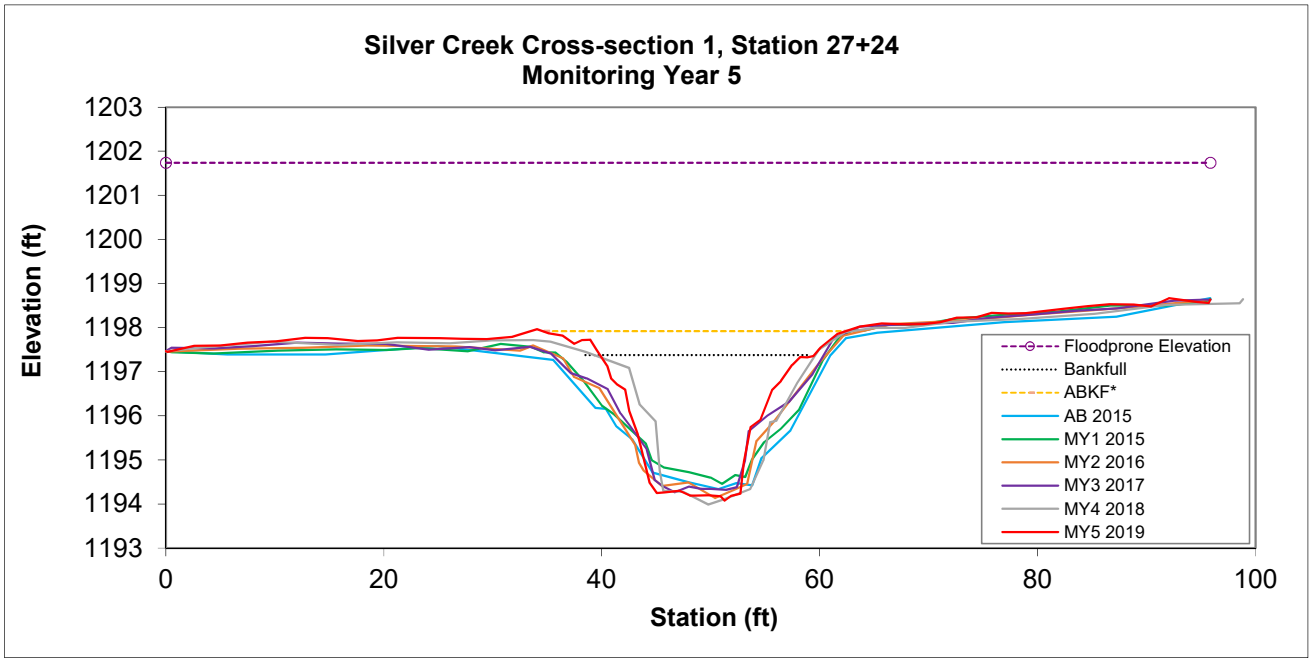
Photo 3. UT3 crest gauge staff showing cork deposition in red circle at 2.5" above the bottom of the staff, which is at the bankfull elevation (10/17/2019)

Figure 6. Cross-sections with Annual Overlays

Permanent Cross-section 1
(MY5 Data - collected October, 2019)

Based on fixed baseline BKF

Feature	Stream Type	BKF Area	BKF Width	BKF Depth	Max BKF Depth	W/D	BH Ratio	ER	BKF Elev	TOB Elev	Low TOB Depth
Riffle	E	37.37	19.64	1.9	3.3	10.34	0.85	4.88	1197.38	1197.34	3.26



Looking at the Left Bank

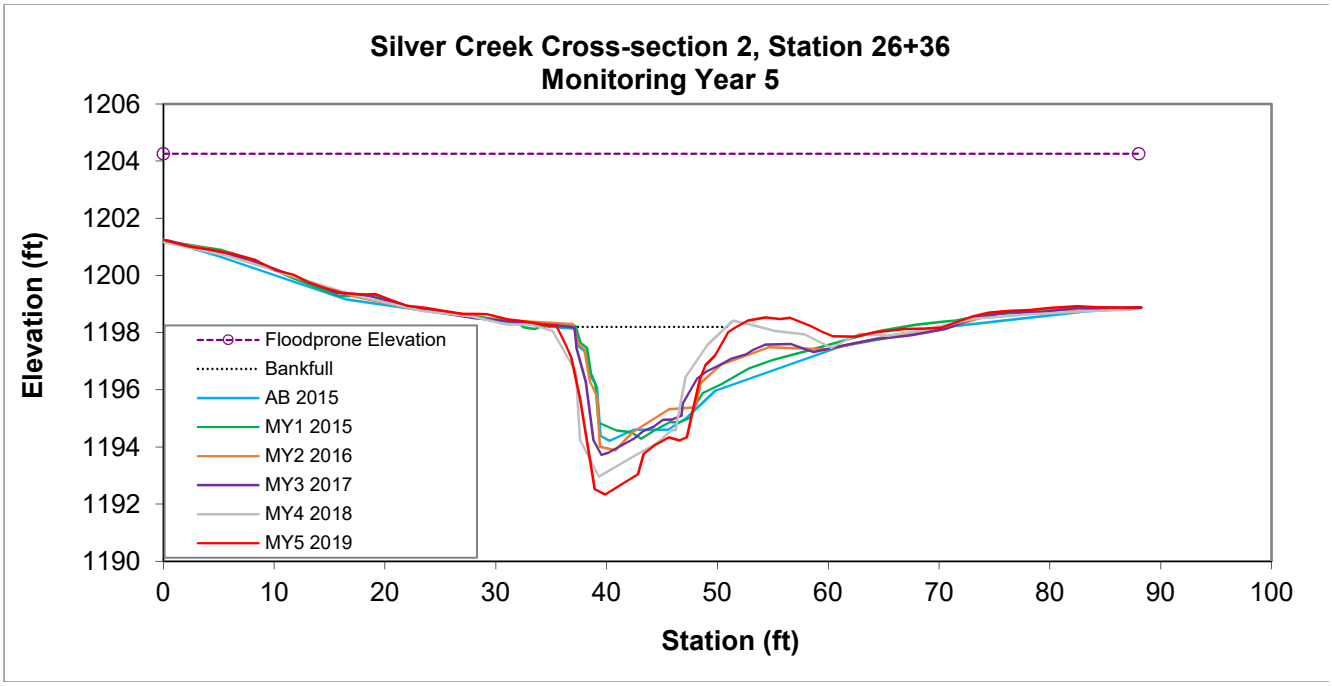
Looking at the Right Bank

Note: *ABKF stands for as-built bankfull which represents the bankfull line held at the as-built cross sectional area.

Permanent Cross-section 2
(MY5 Data - collected October, 2019)

Based on fixed baseline BKF

Feature	Stream Type	BKF Area	BKF Width	BKF Depth	Max BKF Depth	W/D	BH Ratio	ER	BKF Elev	TOB Elev	Low TOB Depth
Pool	-	53.39	16.19	3.30	5.86	4.91		5.45	1198.20	1198.24	5.90



Looking at the Left Bank

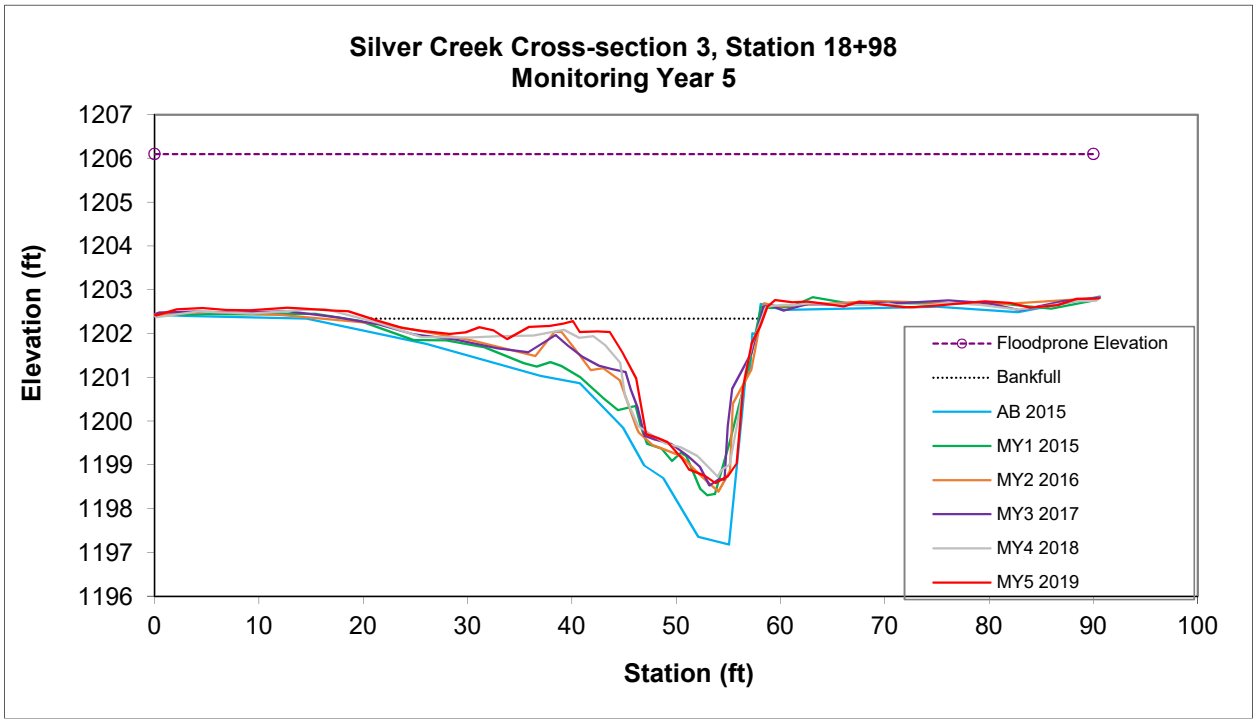
Looking at the Right Bank

Note: *ABKF stands for as-built bankfull which represents the bankfull line held at the as-built cross sectional area.

Permanent Cross-section 3
(MY5 Data - collected October, 2019)

Based on fixed baseline BKF

Feature	Stream Type	BKF Area	BKF Width	BKF Depth	Max BKF Depth	W/D	BH Ratio	ER	BKF Elev	TOB Elev	Low TOB Depth
Pool	-	40.54	37.53	1.08	3.76	34.75		2.41	1202.34	1202.51	3.92



Looking at the Left Bank

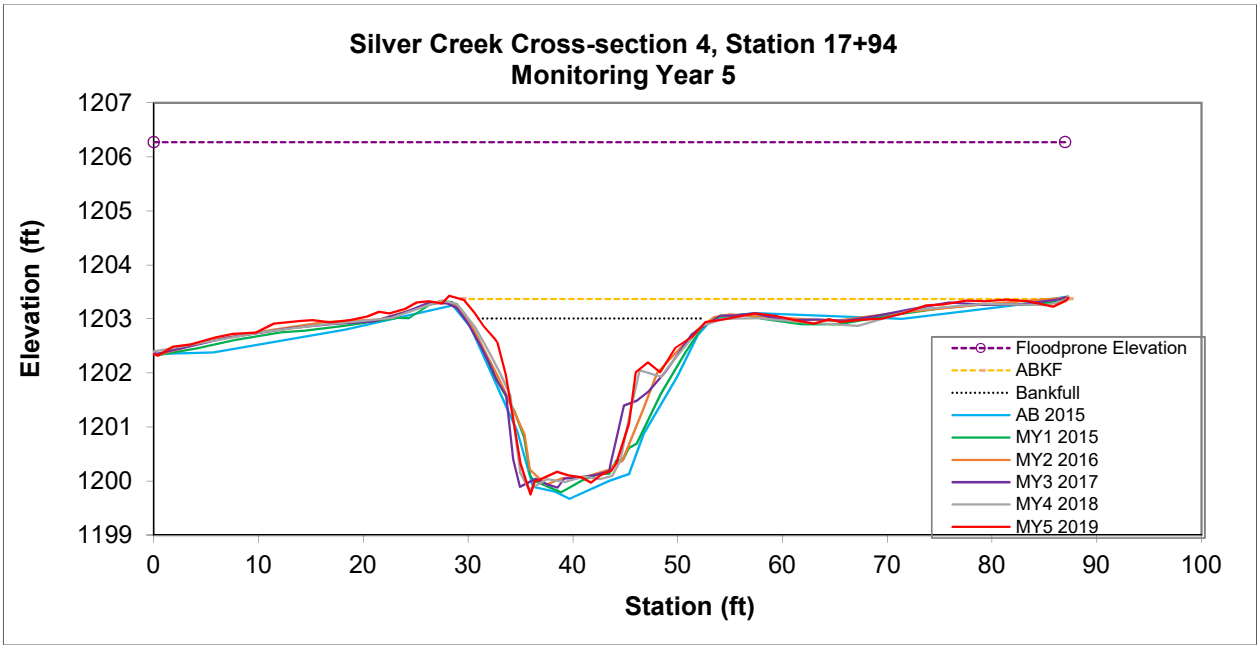
Looking at the Right Bank

Note: *ABKF stands for as-built bankfull which represents the bankfull line held at the as-built cross sectional area.

Permanent Cross-section 4
(MY5 Data - collected October, 2019)

Based on fixed baseline BKF

Feature	Stream Type	BKF Area	BKF Width	BKF Depth	Max BKF Depth	W/D	BH Ratio	ER	BKF Elev	TOB Elev	Low TOB Depth
Riffle	C	38.42	23.87	1.61	3.26	14.83	0.93	3.66	1203.01	1203.10	3.35



Looking at the Left Bank

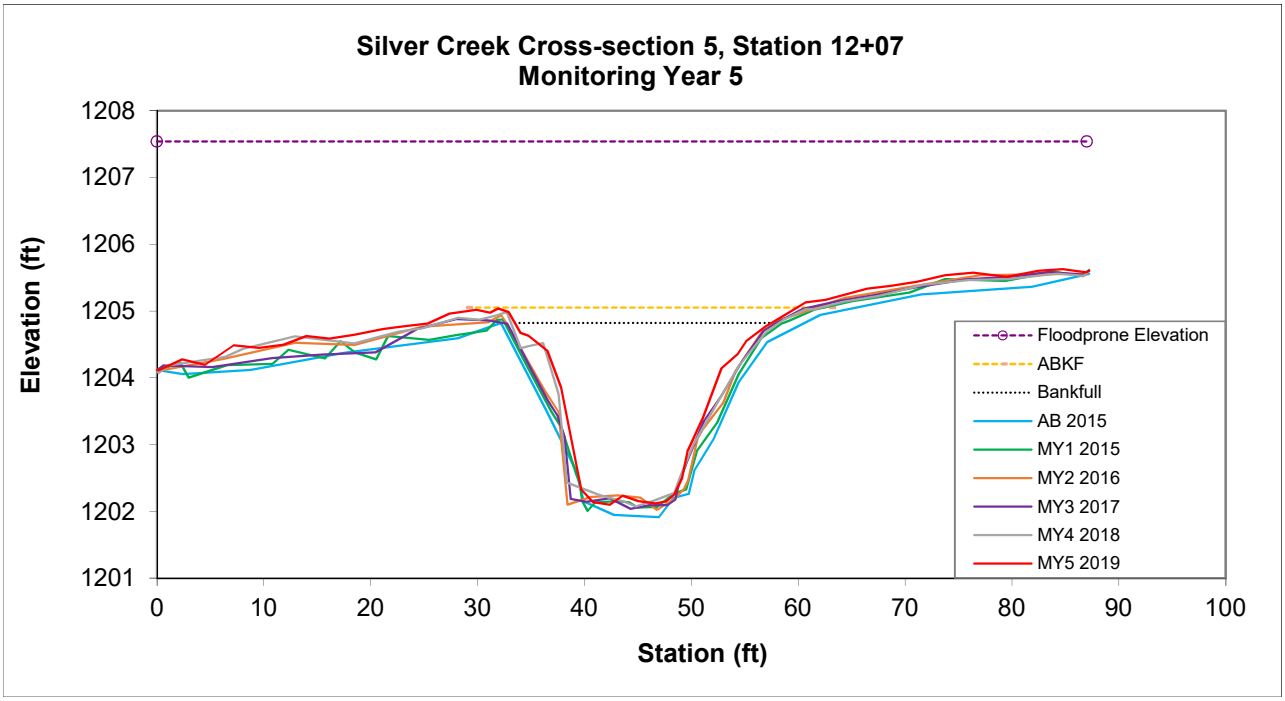
Looking at the Right Bank

Note: *ABKF stands for as-built bankfull which represents the bankfull line held at the as-built cross sectional area.

Permanent Cross-section 5
(MY5 Data - collected October, 2019)

Based on fixed baseline BKF

Feature	Stream Type	BKF Area	BKF Width	BKF Depth	Max BKF Depth	W/D	BH Ratio	ER	BKF Elev	TOB Elev	Low TOB Depth
Riffle	C	36.5	24.0	1.52	2.72	15.8	1.00	3.64	1204.82	1205.04	2.94



Looking at the Left Bank

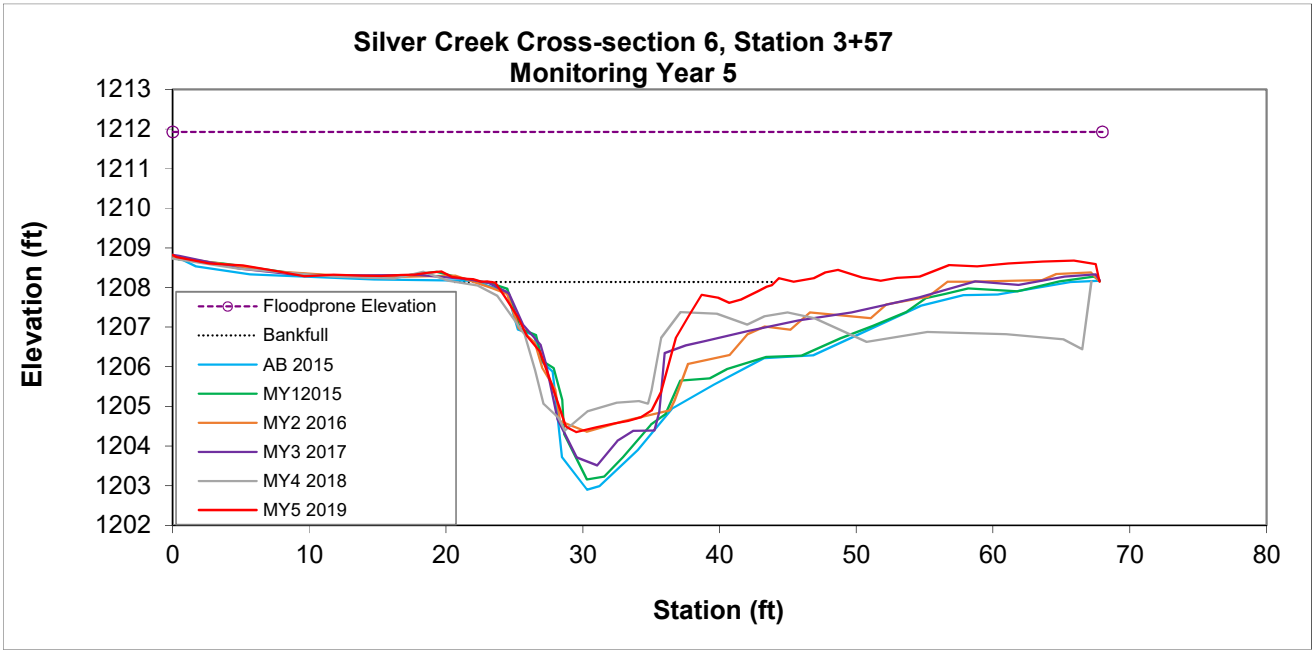
Looking at the Right Bank

Note: *ABKF stands for as-built bankfull which represents the bankfull line held at the as-built cross sectional area.
** Previously reported years had the transect orientation backwards. We are correcting this with this report.

Permanent Cross-section 6
(MY5 Data - collected October, 2019)

Based on fixed baseline BKF

Feature	Stream Type	BKF Area	BKF Width	BKF Depth	Max BKF Depth	W/D	BH Ratio	ER	BKF Elev	TOB Elev	Low TOB Depth
Pool	-	38.32	20.71	1.85	3.79	11.19		3.27	1208.14	1208.14	3.77



Looking at the Left Bank

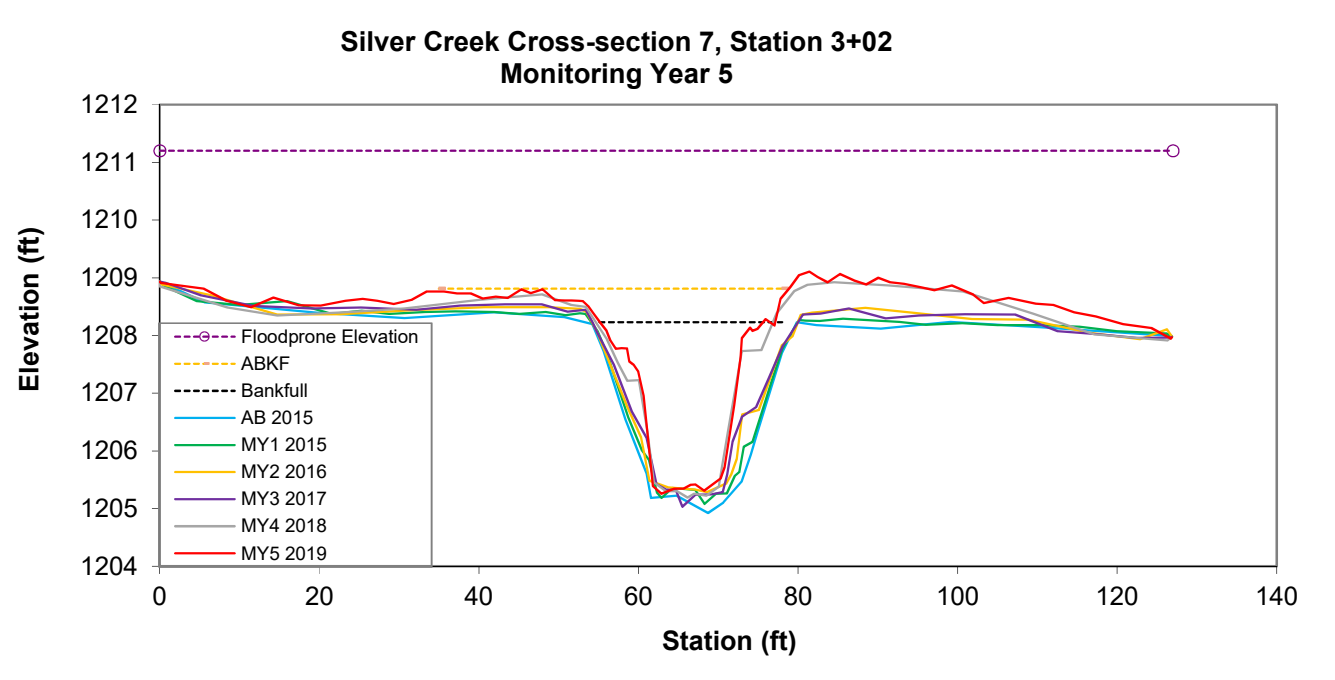
Looking at the Right Bank

Note: *ABKF stands for as-built bankfull which represents the bankfull line held at the as-built cross sectional area.

Permanent Cross-section 7
(MY5 Data - collected October, 2019)

Based on fixed baseline BKF

Feature	Stream Type	BKF Area	BKF Width	BKF Depth	Max BKF Depth	W/D	BH Ratio	ER	BKF Elev	TOB Elev	Low TOB Depth
Riffle	C	35.28	28.21	1.25	2.97	22.57	0.94	4.50	1208.23	1208.59	3.28



Looking at the Left Bank

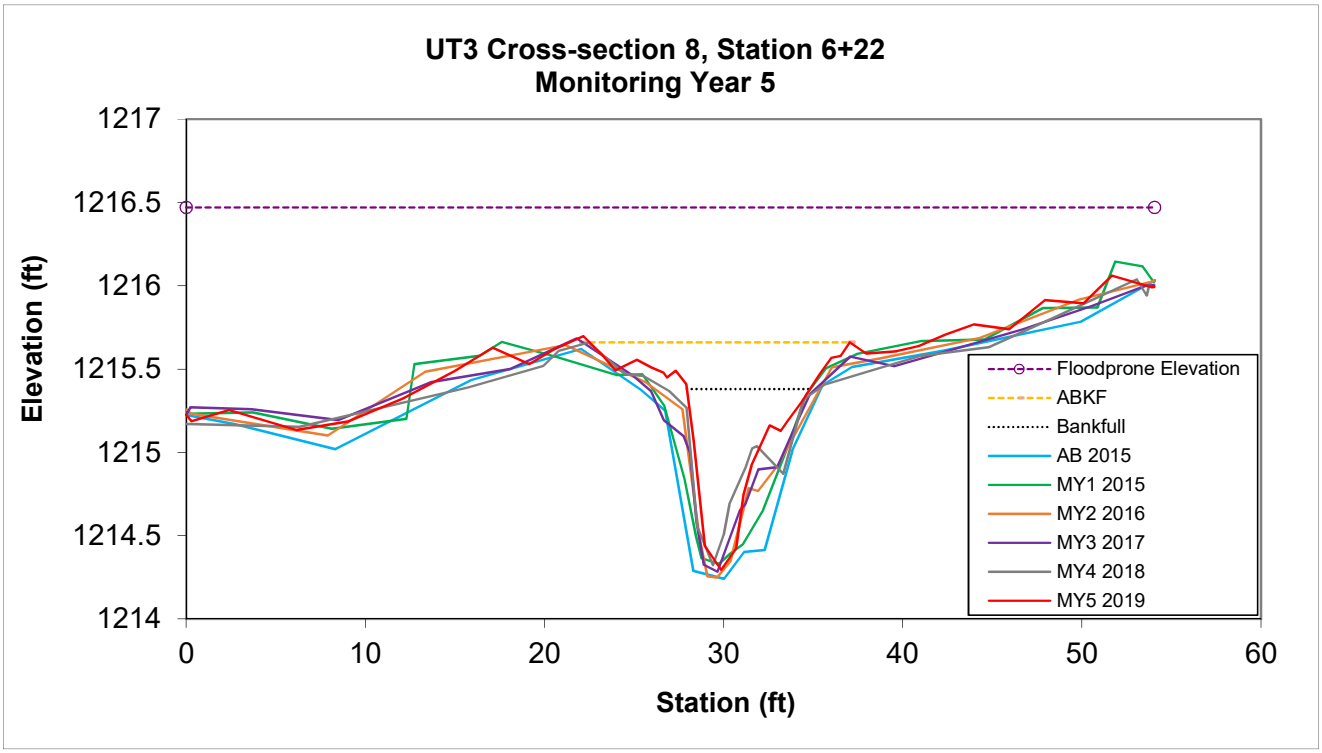
Looking at the Right Bank

Note: *ABKF stands for as-built bankfull which represents the bankfull line held at the as-built cross sectional area.

Permanent Cross-section 8
(MY5 Data - collected October, 2019)

Based on fixed baseline BKF

Feature	Stream Type	BKF Area	BKF Width	BKF Depth	Max BKF Depth	W/D	BH Ratio	ER	BKF Elev	TOB Elev	Low TOB Depth
Riffle	C	3.49	6.87	0.51	1.09	13.47	0.88	7.87	1215.38	1215.49	1.19



Looking at the Left Bank

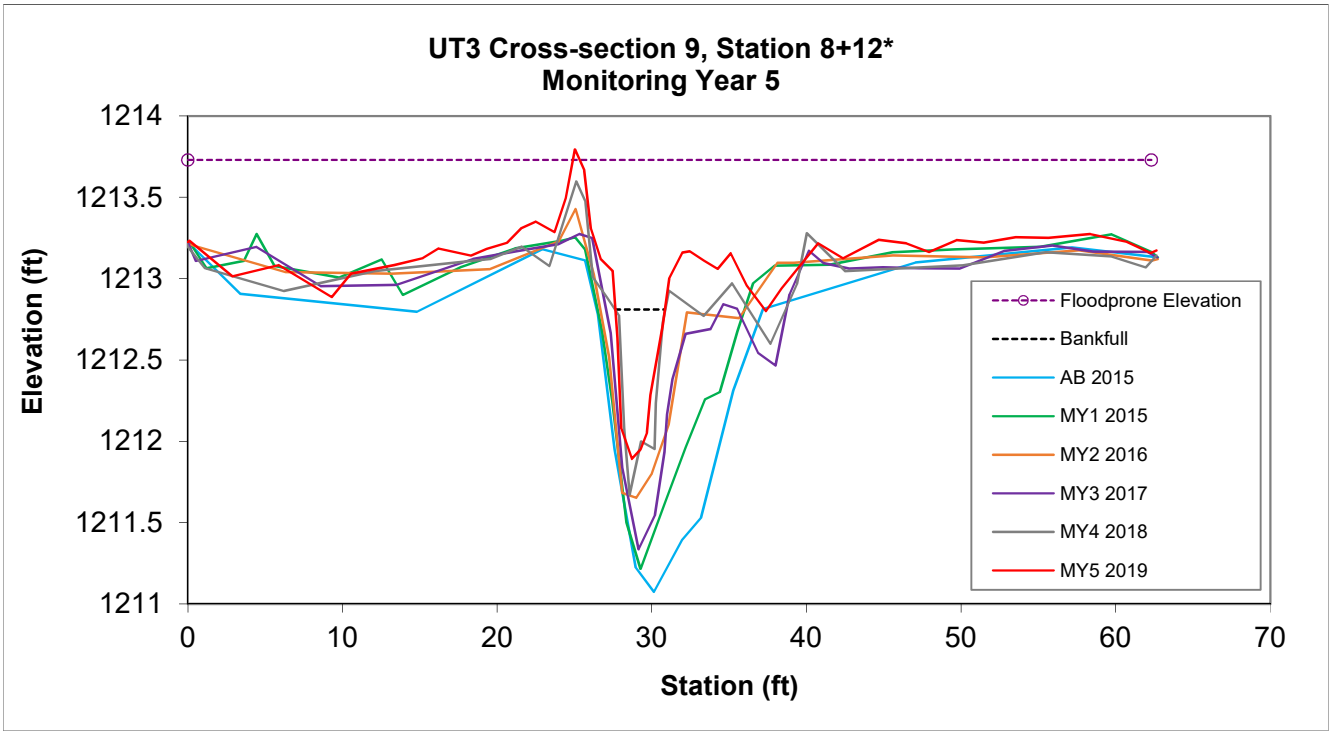
Looking at the Right Bank

* Note: ABKF stands for as-built bankfull which represents the bankfull line held at the as-built cross sectional area.

Permanent Cross-section 9
(MY5 Data - collected October, 2019)

Based on fixed baseline BKF

Feature	Stream Type	BKF Area	BKF Width	BKF Depth	Max BKF Depth	W/D	BH Ratio	ER	BKF Elev	TOB Elev	Low TOB Depth
Pool	-	1.92	3.2	0.6	0.92	5.33		19.42	1212.81	1213.16	1.27



Looking at the Left Bank

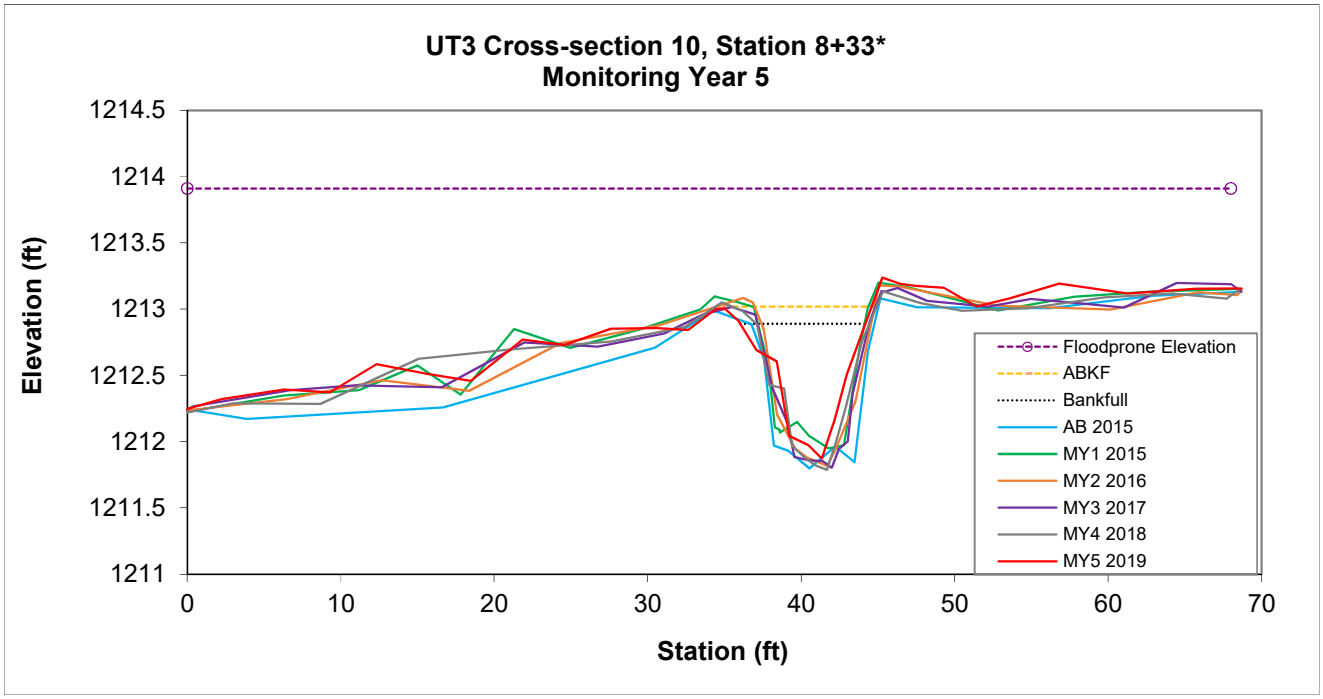
Looking at the Right Bank

* Note: ABKF stands for as-built bankfull which represents the bankfull line held at the as-built cross sectional area.

Permanent Cross-section 10
(MY5 Data - collected October, 2019)

Based on fixed baseline BKF

Feature	Stream Type	BKF Area	BKF Width	BKF Depth	Max BKF Depth	W/D	BH Ratio	ER	BKF Elev	TOB Elev	Low TOB Depth
Riffle	C	4.21	8.14	0.52	1.02	15.65	0.99	8.44	1212.89	1213.01	1.14



Looking at the Left Bank

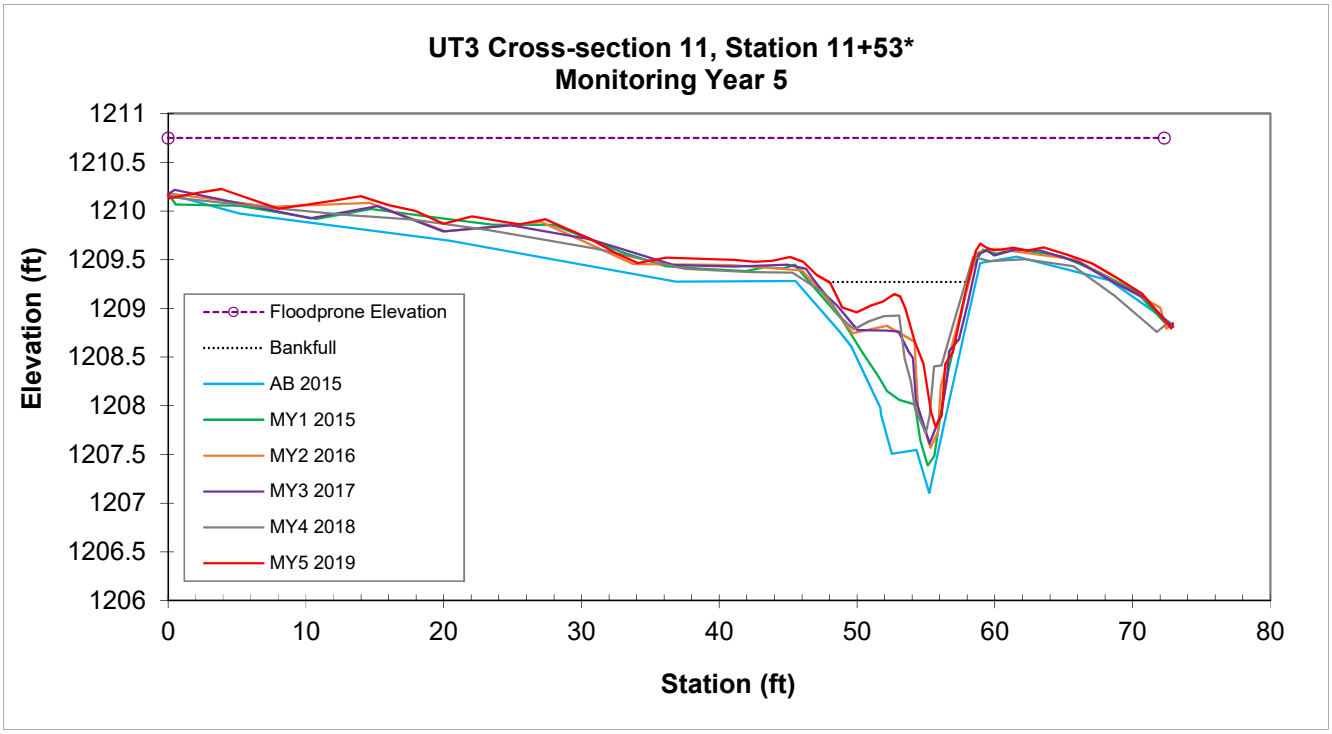
Looking at the Right Bank

* Note: ABKF stands for as-built bankfull which represents the bankfull line held at the as-built cross sectional area.

Permanent Cross-section 11
(MY5 Data - collected October, 2019)

Based on fixed baseline BKF

Feature	Stream Type	BKF Area	BKF Width	BKF Depth	Max BKF Depth	W/D	BH Ratio	ER	BKF Elev	TOB Elev	Low TOB Depth
Pool	-	4.74	10.13	0.47	1.48	21.55		7.2	1209.27	1209.27	1.47



Looking at the Left Bank

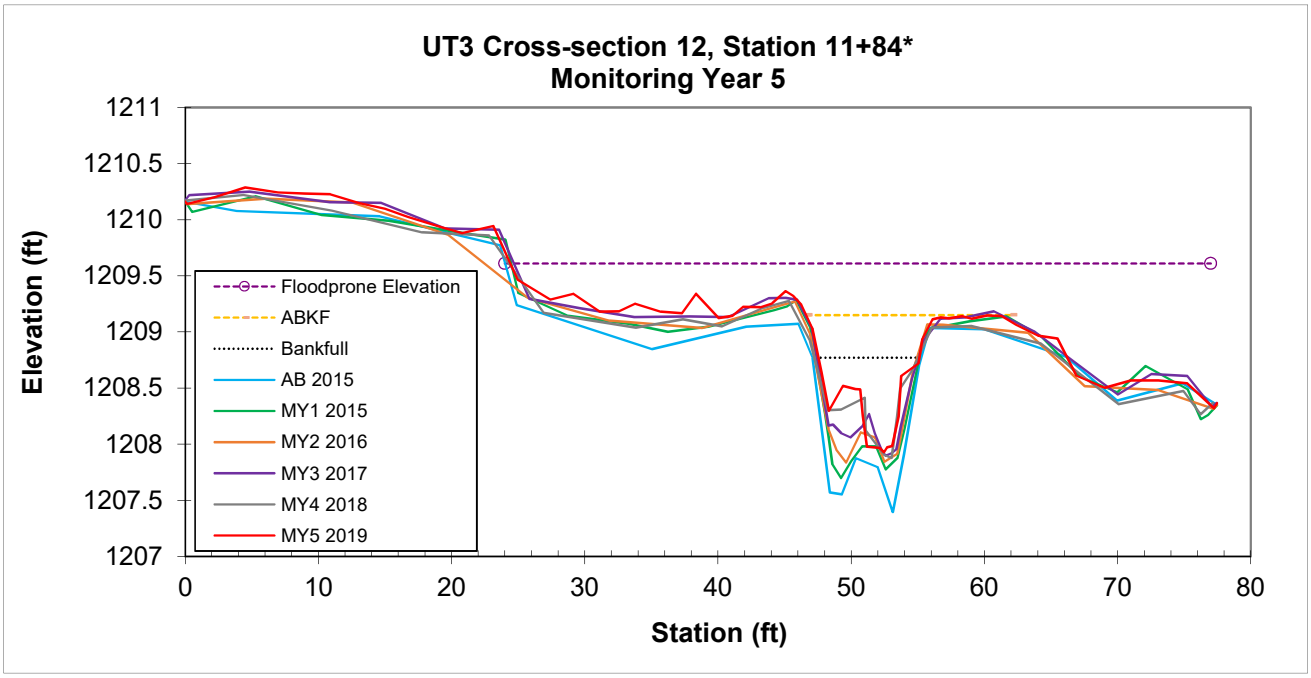
Looking at the Right Bank

Note: *Stationing for Cross-section 11 is being changed to 11+53 which is the surveyed location for the

Permanent Cross-section 12
(MY5 Data - collected October, 2019)

Based on fixed baseline BKF

Feature	Stream Type	BKF Area	BKF Width	BKF Depth	Max BKF Depth	W/D	BH Ratio	ER	BKF Elev	TOB Elev	Low TOB Depth
Riffle	C	3.24	7.56	0.43	0.84	17.58	0.97	7.02	1208.77	1209.11	1.23



Looking at the Left Bank

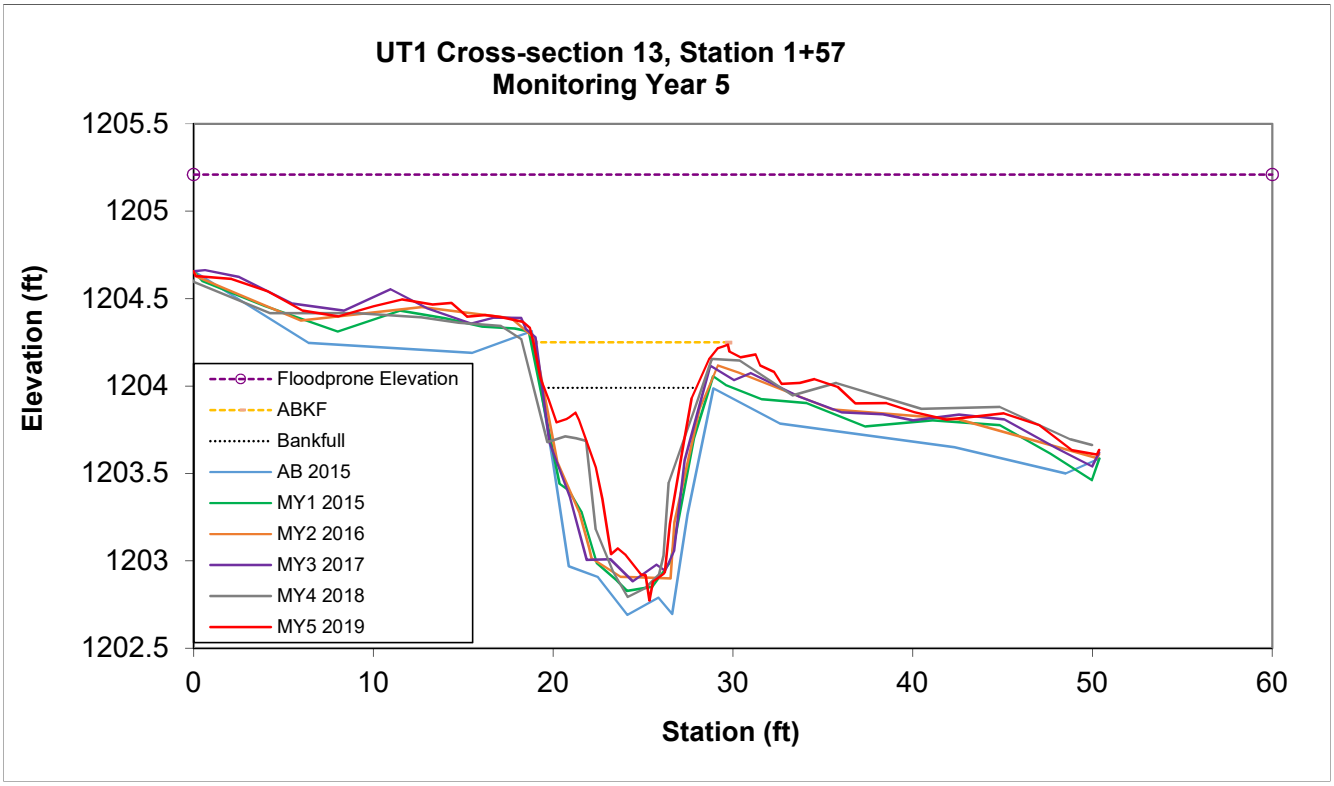
Looking at the Right Bank

Note: *Stationing for Cross-section 11 is being changed to 11+53 which is the surveyed location ~~for the~~

Permanent Cross-section 13
(MY5 Data - collected October, 2019)

Based on fixed baseline bankfull

Feature	Stream Type	BKF Area	BKF Width	BKF Depth	Max BKF Depth	W/D	BH Ratio	ER	BKF Elev	TOB Elev	Low TOB Depth
Riffle	C	5.03	8.47	0.59	1.22	14.36	0.98	5.95	1203.99	1204.22	1.45



Looking at the Left Bank

Looking at the Right Bank

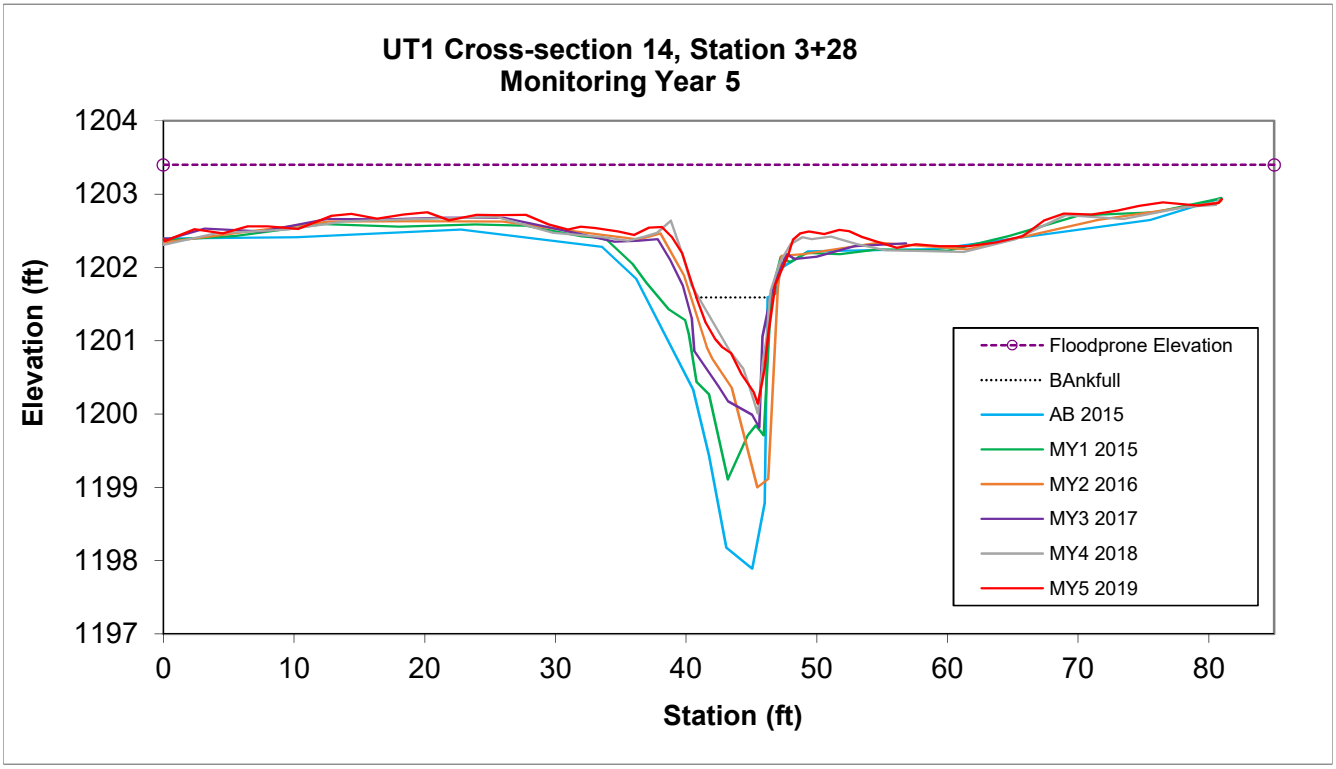
Note: *ABKF stands for as-built bankfull which represents the bankfull line held at the as-built cross sectional area.

Permanent Cross-section 14

(MY5 Data - collected October, 2019)

Based on fixed baseline bankfull

Feature	Stream Type	BKF Area	BKF Width	BKF Depth	Max BKF Depth	W/D	BH Ratio	ER	BKF Elev	TOB Elev	Low TOB Depth
Pool	-	4.45	5.89	0.76	1.45	7.75		13.45	1201.59	1202.46	2.32



Looking at the Left Bank

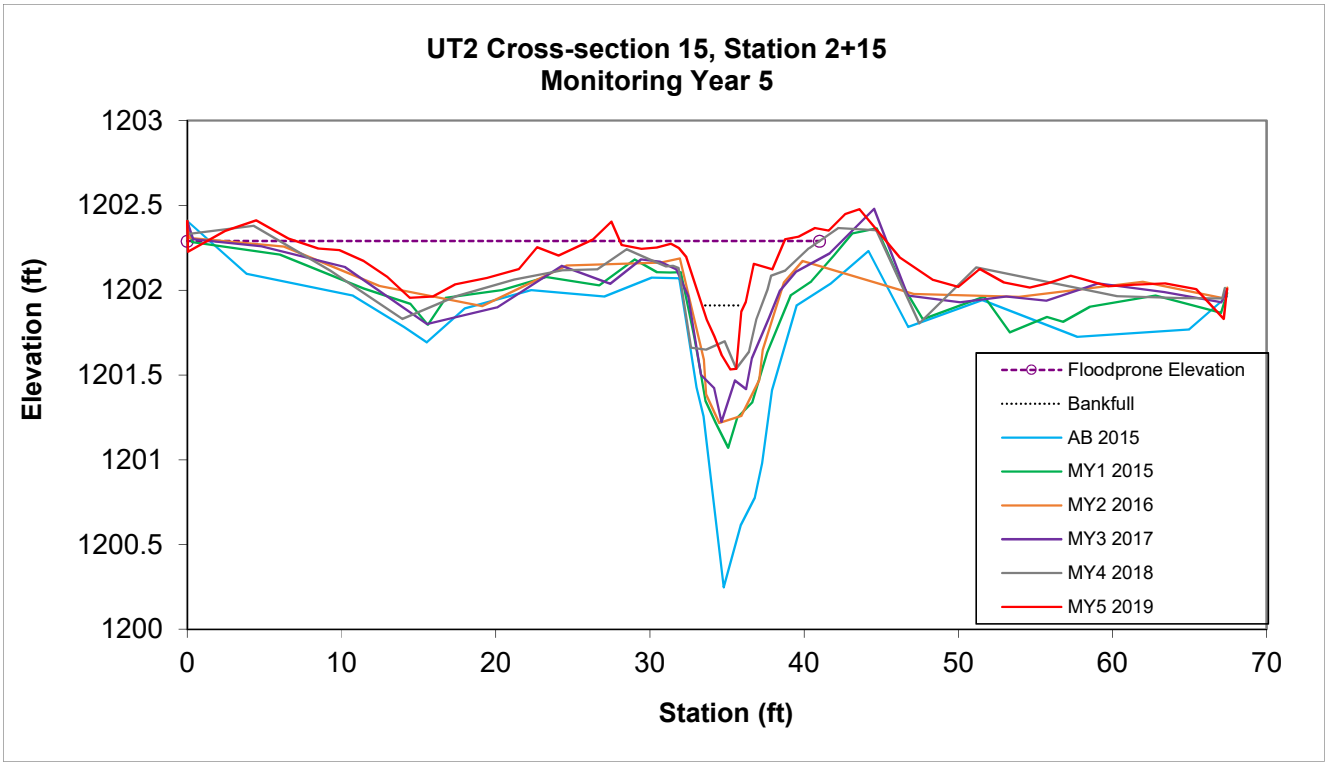
Looking at the Right Bank

Note: *ABKF stands for as-built bankfull which represents the bankfull line held at the as-built cross sectional area.

Permanent Cross-section 15
(MY4 Data - collected October, 2019)

Based on fixed baseline BKF

Feature	Stream Type	BKF Area	BKF Width	BKF Depth	Max BKF Depth	W/D	BH Ratio	ER	BKF Elev	TOB Elev	Low TOB Depth
Pool	-	0.59	2.73	0.22	0.38	12.41		19.36	1201.91	1202.27	0.74



Looking at the Left Bank

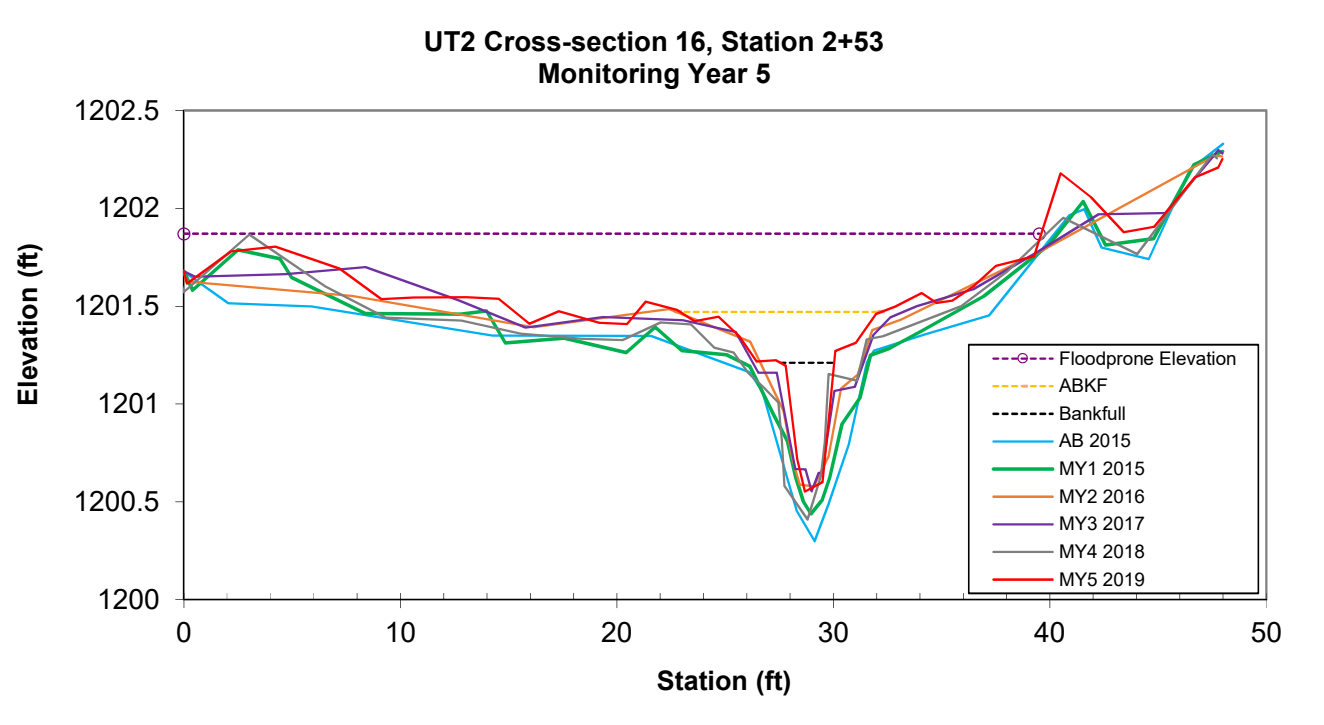
Looking at the Right Bank

Note: *ABKF stands for as-built bankfull which represents the bankfull line held at the as-built cross sectional area.

Permanent Cross-section 16
(MY5 Data - collected October, 2019)

Based on fixed baseline BKF

Feature	Stream Type	BKF Area	BKF Width	BKF Depth	Max BKF Depth	W/D	BH Ratio	ER	BKF Elev	TOB Elev	Low TOB Depth
Riffle	E	1.03	2.48	0.41	0.66	6.05	0.70	15.98	1201.21	1201.19	0.64

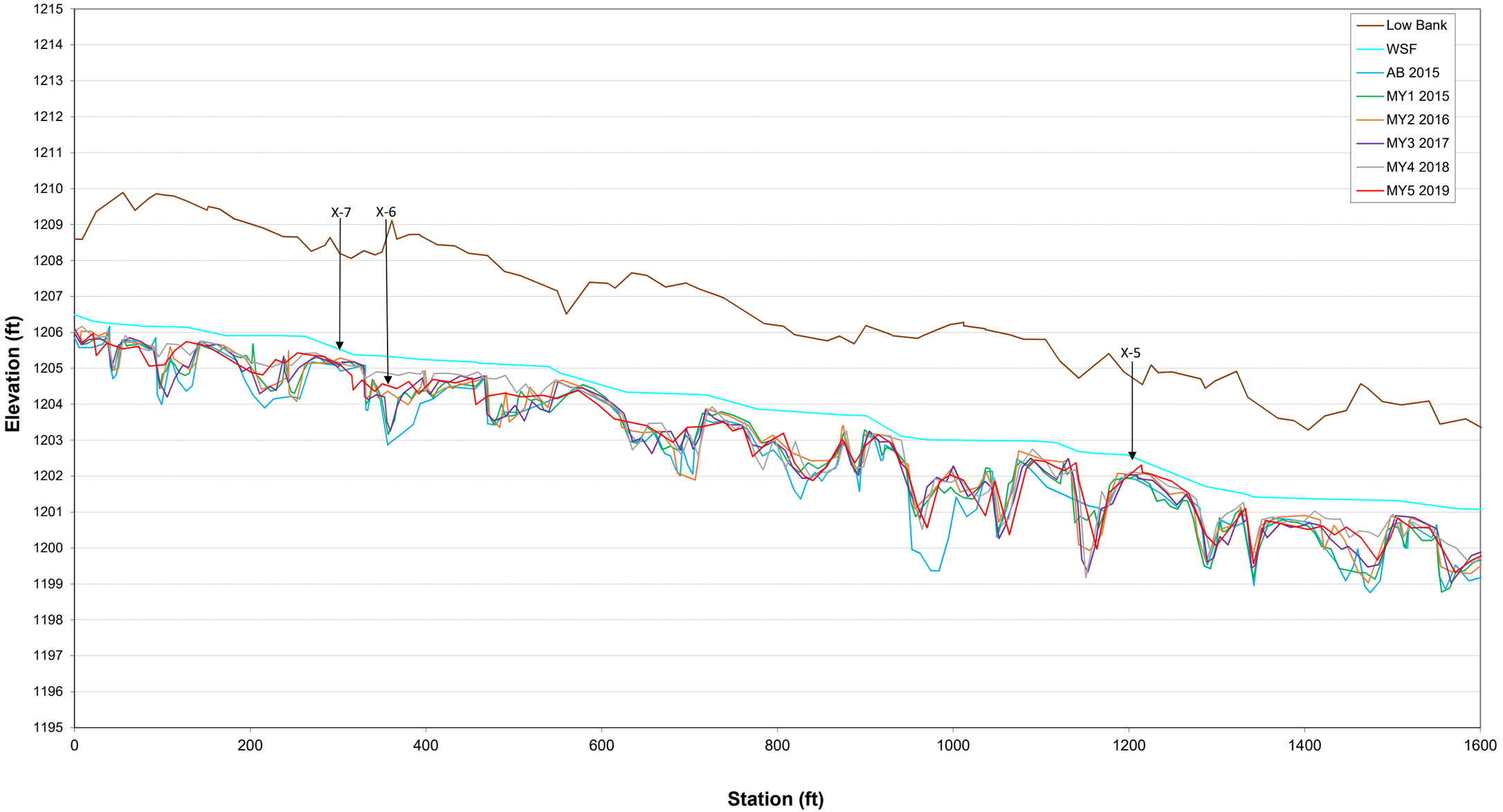


Looking at the Left Bank

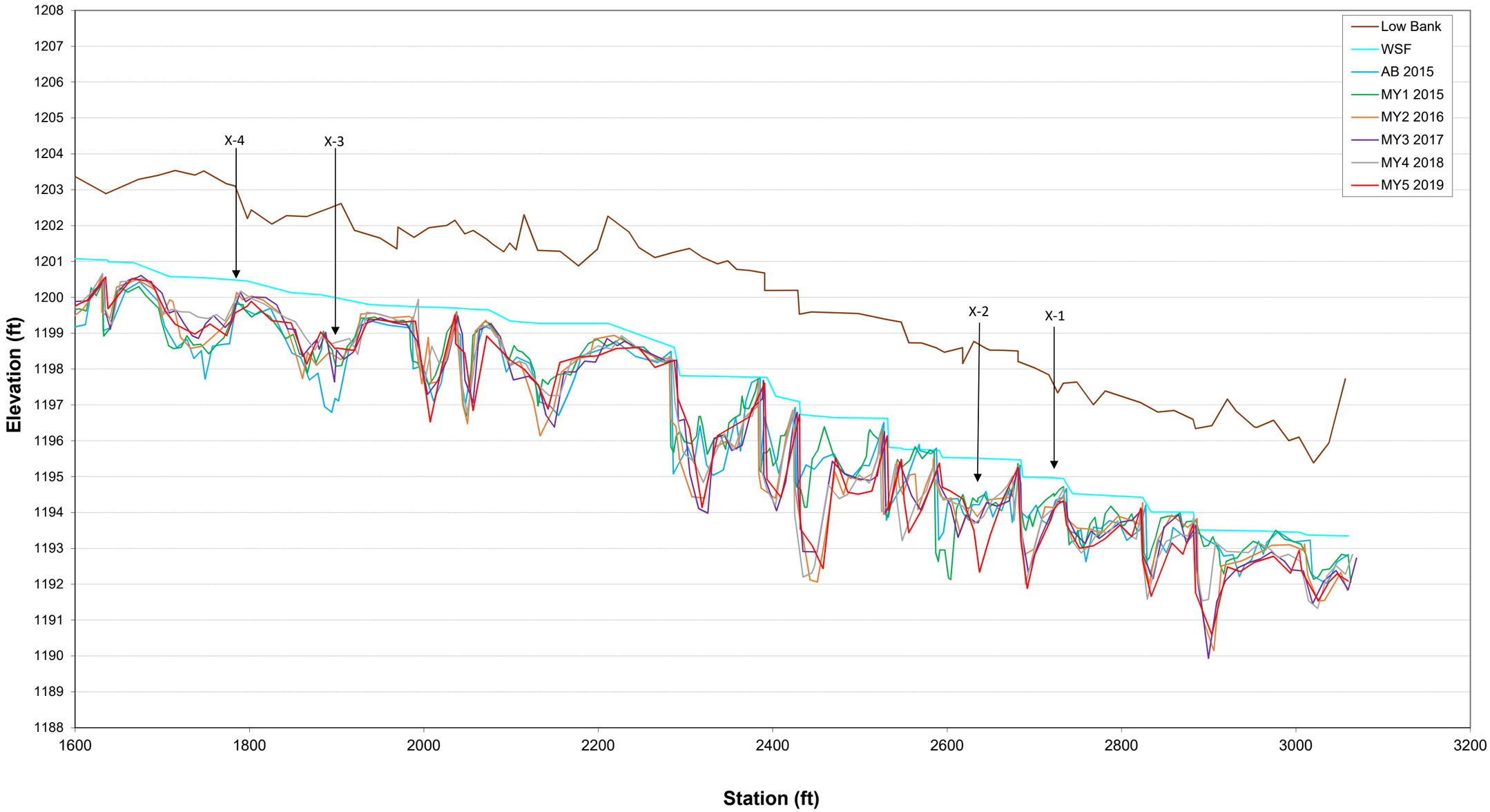
Looking at the Right Bank

Note: *ABKF stands for as-built bankfull which represents the bankfull line held at the as-built cross sectional area.

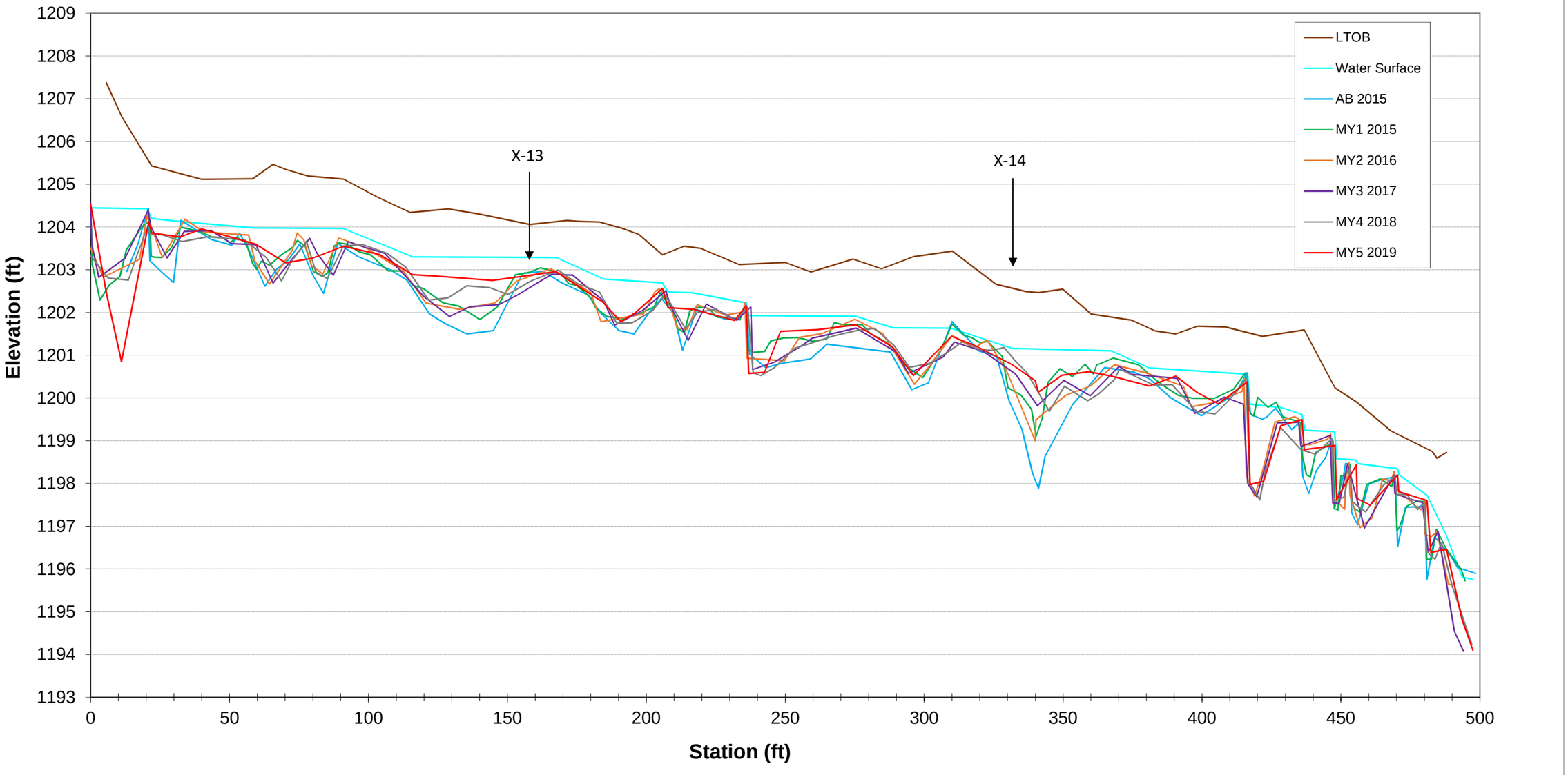
Monitoring Year 5 Profile of U. Silver Creek, Station 0+00 to 16+00
Data collected October, 2019



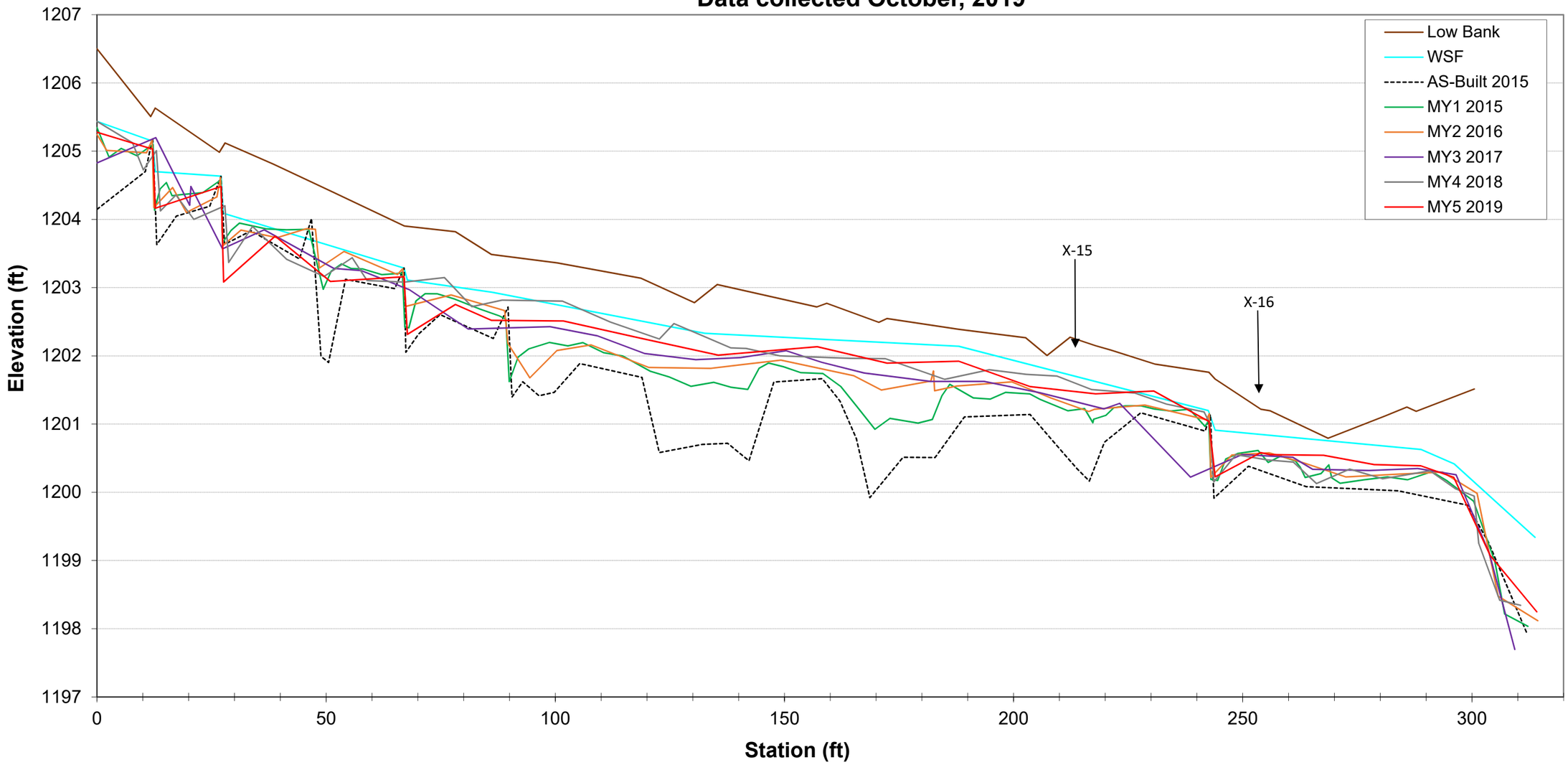
Monitoring Year 5 Profile of U. Silver Creek, Station 16+00 to 32+00
Data collected October, 2019



Monitoring Year 5, Profile of UT1, Station 0+00 to 5+00
Data collected October, 2019



Monitoring Year 5 Profile of UT2, Station 0+00 to 3+20
Data collected October, 2019



Monitoring Year 5, Profile of UT3, Station 0+00 to 14+00
Data collected October 2019

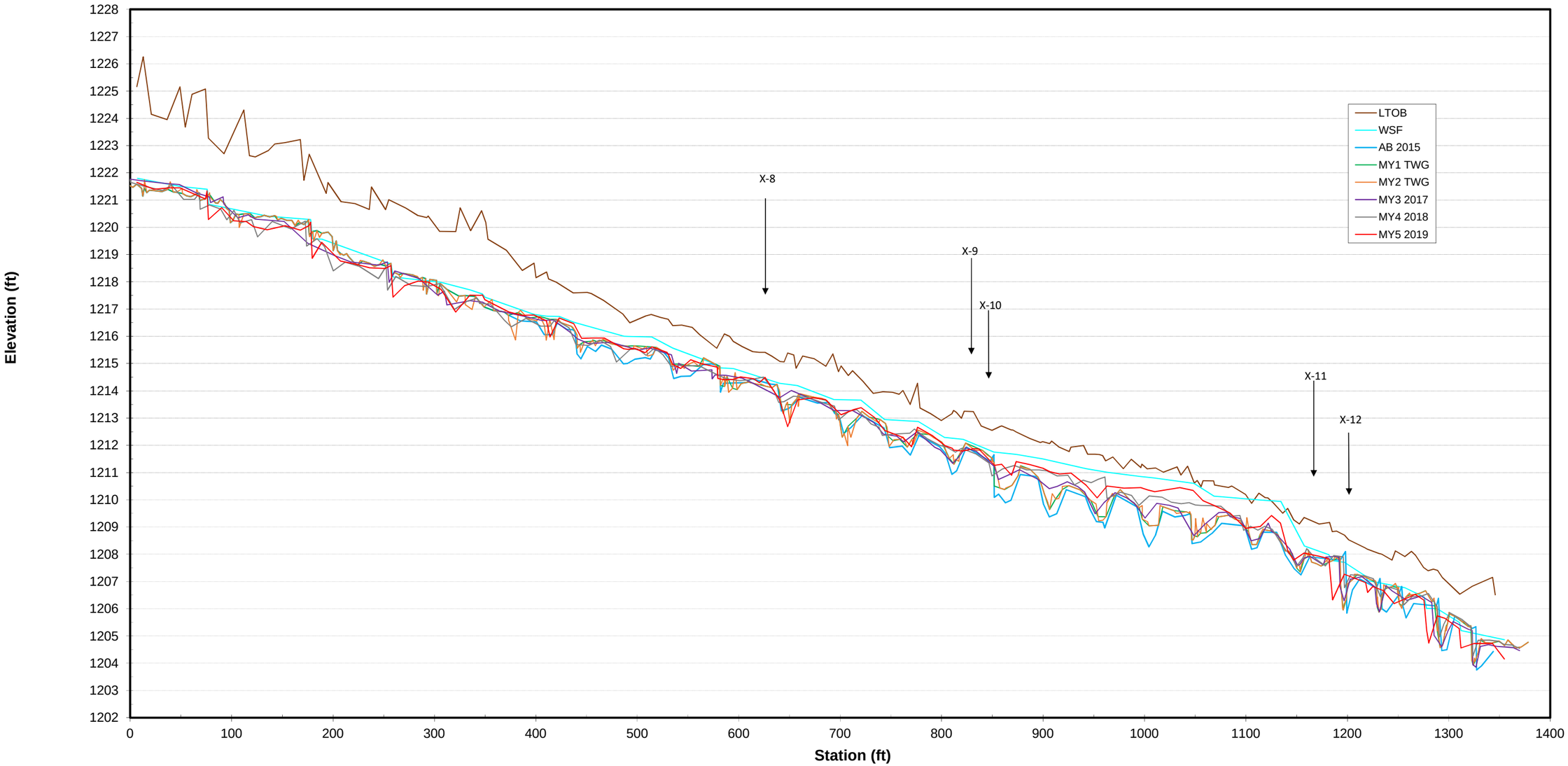


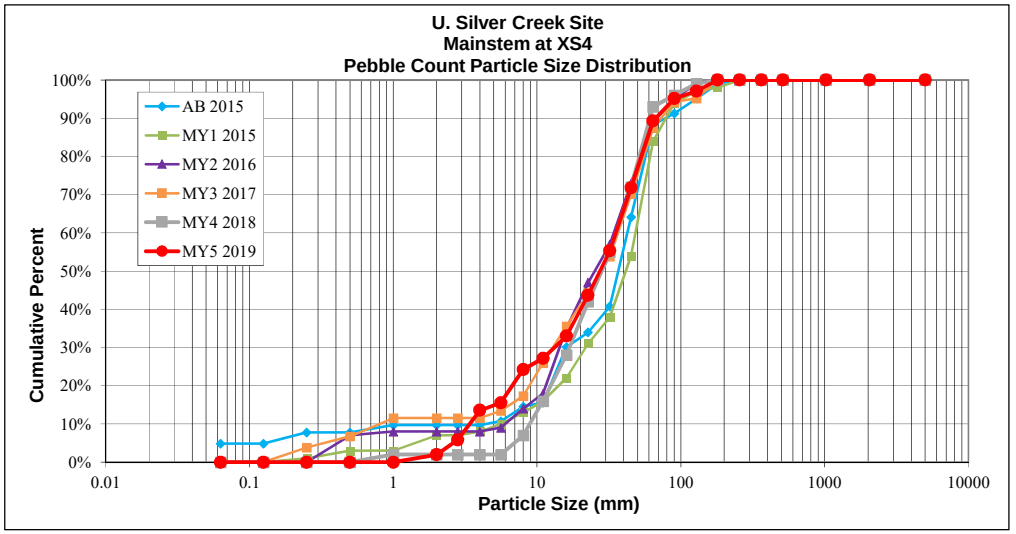
Figure 8. Pebble Count Plots with Annual Overlays

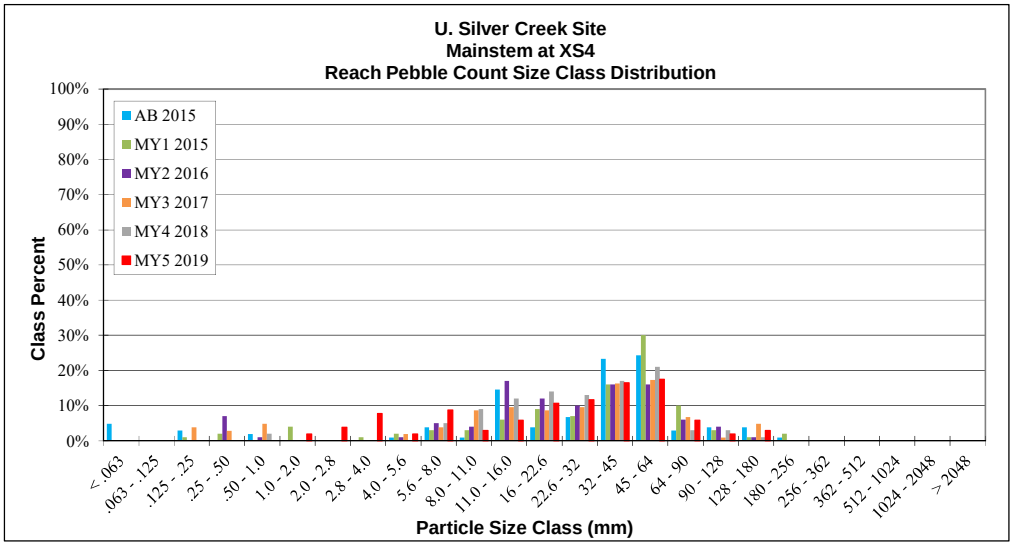
Cross-Section Pebble Count; Monitoring Year 5
U. Silver Creek Mitigation Project, DMS# 94645

SITE OR PROJECT:	U. Silver Cr
REACH/LOCATION:	Riffle at XS4
FEATURE:	Riffle
DATE:	17-Oct-19

			MY5 2019			Distribution
MATERIAL	PARTICLE	SIZE (mm)	Total	Class %	% Cum	Plot Size (mm)
Silt/Clay	Silt / Clay	< .063			0%	0.063
Sand	Very Fine	.063 - .125			0%	0.125
	Fine	.125 - .25			0%	0.25
	Medium	.25 - .50			0%	0.50
	Coarse	.50 - 1.0			0%	1.0
	Very Coarse	1.0 - 2.0	2	2%	2%	2.0
Gravel	Very Fine	2.0 - 2.8	4	4%	6%	2.8
	Very Fine	2.8 - 4.0	8	8%	14%	4.0
	Fine	4.0 - 5.6	2	2%	16%	5.6
	Fine	5.6 - 8.0	9	9%	24%	8.0
	Medium	8.0 - 11.0	3	3%	27%	11.0
	Medium	11.0 - 16.0	6	6%	33%	16.0
	Coarse	16 - 22.6	11	11%	44%	22.6
	Coarse	22.6 - 32	12	12%	55%	32
	Very Coarse	32 - 45	17	17%	72%	45
	Very Coarse	45 - 64	18	17%	89%	64
Cobble	Small	64 - 90	6	6%	95%	90
	Small	90 - 128	2	2%	97%	128
	Large	128 - 180	3	3%	100%	180
	Large	180 - 256			100%	256
Boulder	Small	256 - 362			100%	362
	Small	362 - 512			100%	512
	Medium	512 - 1024			100%	1024
	Large-Very Large	1024 - 2048			100%	2048
Bedrock	Bedrock	> 2048			100%	5000
Total % of whole count			103	100%		

Summary Data			
Channel materials			
D16 =	5.7	D84 =	57.5
D35 =	17.1	D95 =	89.2
D50 =	27.3	D100 =	128 - 180



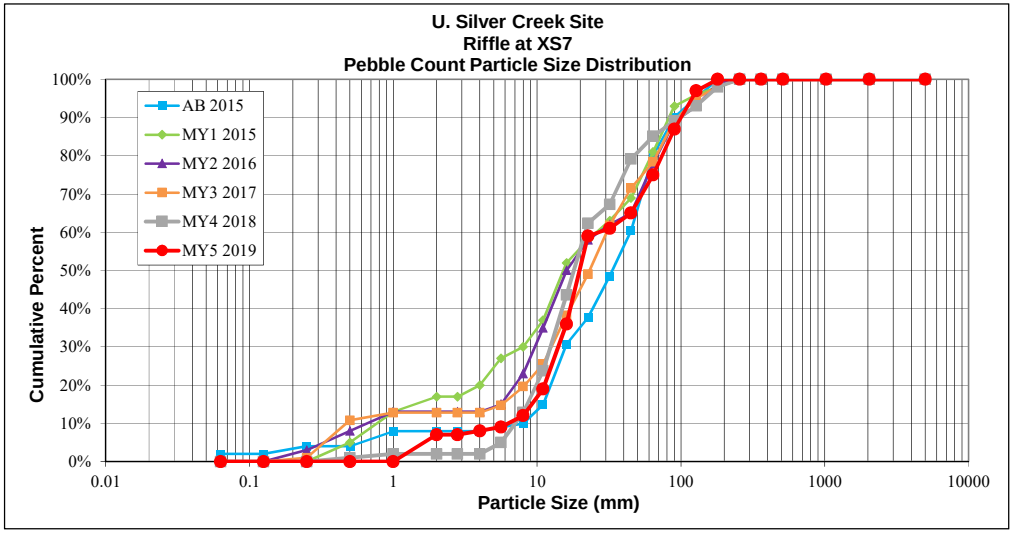


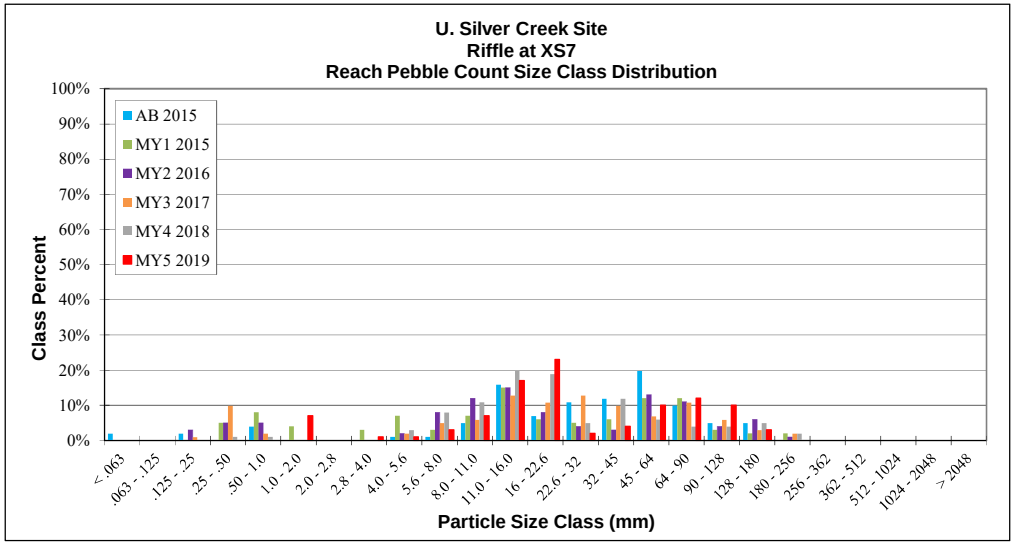
Cross-Section Pebble Count; Monitoring Year 5
U. Silver Creek Mitigation Project, DMS# 94645

SITE OR PROJECT:	U. Silver Cr
REACH/LOCATION:	Riffle at XS7
FEATURE:	Riffle
DATE:	17-Oct-19

			MY5 2019			Distribution
MATERIAL	PARTICLE	SIZE (mm)	Total	Class %	% Cum	Plot Size (mm)
Silt/Clay	Silt / Clay	< .063			0%	0.063
Sand	Very Fine	.063 - .125			0%	0.125
	Fine	.125 - .25			0%	0.25
	Medium	.25 - .50			0%	0.50
	Coarse	.50 - 1.0			0%	1.0
	Very Coarse	1.0 - 2.0	7	7%	7%	2.0
Gravel	Very Fine	2.0 - 2.8			7%	2.8
	Very Fine	2.8 - 4.0	1	1%	8%	4.0
	Fine	4.0 - 5.6	1	1%	9%	5.6
	Fine	5.6 - 8.0	3	3%	12%	8.0
	Medium	8.0 - 11.0	7	7%	19%	11.0
	Medium	11.0 - 16.0	17	17%	36%	16.0
	Coarse	16 - 22.6	23	23%	59%	22.6
	Coarse	22.6 - 32	2	2%	61%	32
	Very Coarse	32 - 45	4	4%	65%	45
	Very Coarse	45 - 64	10	10%	75%	64
Cobble	Small	64 - 90	12	12%	87%	90
	Small	90 - 128	10	10%	97%	128
	Large	128 - 180	3	3%	100%	180
	Large	180 - 256			100%	256
Boulder	Small	256 - 362			100%	362
	Small	362 - 512			100%	512
	Medium	512 - 1024			100%	1024
	Large-Very Large	1024 - 2048			100%	2048
Bedrock	Bedrock	> 2048			100%	5000
Total % of whole count			100	100%		

Summary Data			
Channel materials			
D16 =	9.6	D84 =	82.6
D35 =	15.7	D95 =	119.3
D50 =	19.7	D100 =	128 - 180



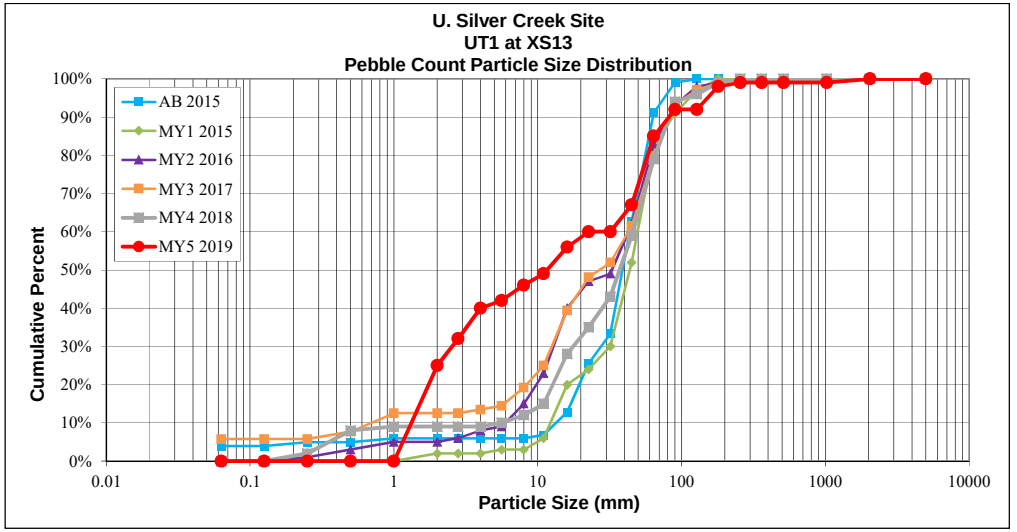


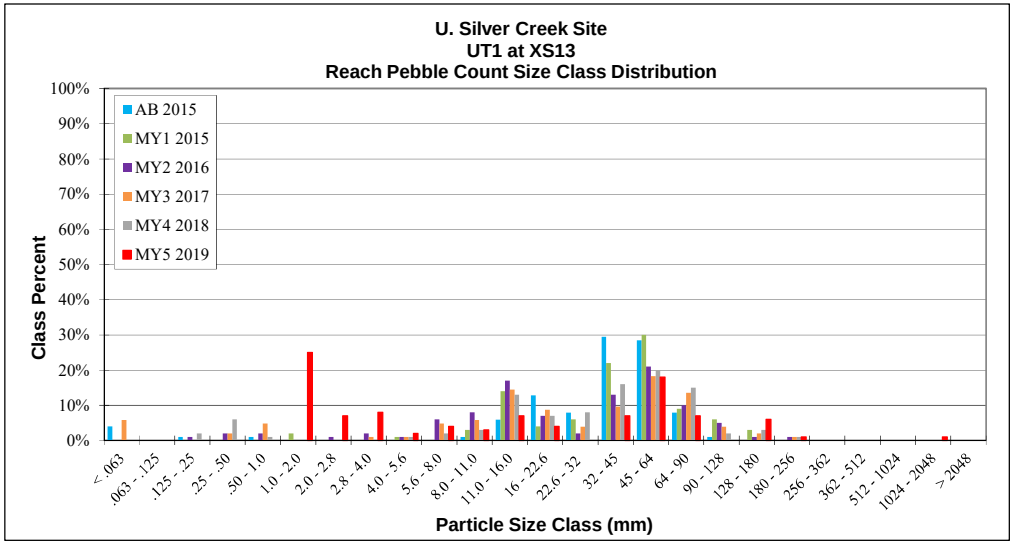
Cross-Section Pebble Count; Monitoring Year 5
U. Silver Creek Mitigation Project, DMS# 94645

SITE OR PROJECT:	U. Silver Cr
REACH/LOCATION:	UT1 XS13
FEATURE:	Riffle
DATE:	17-Oct-19

			MY5 2019			Distribution
MATERIAL	PARTICLE	SIZE (mm)	Total	Class %	% Cum	Plot Size (mm)
Silt/Clay	Silt / Clay	< .063			0%	0.063
Sand	Very Fine	.063 - .125			0%	0.125
	Fine	.125 - .25			0%	0.25
	Medium	.25 - .50			0%	0.50
	Coarse	.50 - 1.0			0%	1.0
	Very Coarse	1.0 - 2.0	25	25%	25%	2.0
Gravel	Very Fine	2.0 - 2.8	7	7%	32%	2.8
	Very Fine	2.8 - 4.0	8	8%	40%	4.0
	Fine	4.0 - 5.6	2	2%	42%	5.6
	Fine	5.6 - 8.0	4	4%	46%	8.0
	Medium	8.0 - 11.0	3	3%	49%	11.0
	Medium	11.0 - 16.0	7	7%	56%	16.0
	Coarse	16 - 22.6	4	4%	60%	22.6
	Coarse	22.6 - 32			60%	32
	Very Coarse	32 - 45	7	7%	67%	45
	Very Coarse	45 - 64	18	18%	85%	64
Cobble	Small	64 - 90	7	7%	92%	90
	Small	90 - 128			92%	128
	Large	128 - 180	6	6%	98%	180
	Large	180 - 256	1	1%	99%	256
Boulder	Small	256 - 362			99%	362
	Small	362 - 512			99%	512
	Medium	512 - 1024			99%	1024
	Large-Very Large	1024 - 2048	1	1%	100%	2048
Bedrock	Bedrock	> 2048			100%	5000
Total % of whole count			100	100%		

Summary Data			
Channel materials			
D16 =	1.6	D84 =	62.8
D35 =	3.2	D95 =	151.8
D50 =	11.6	D100 =	1024 - 2048



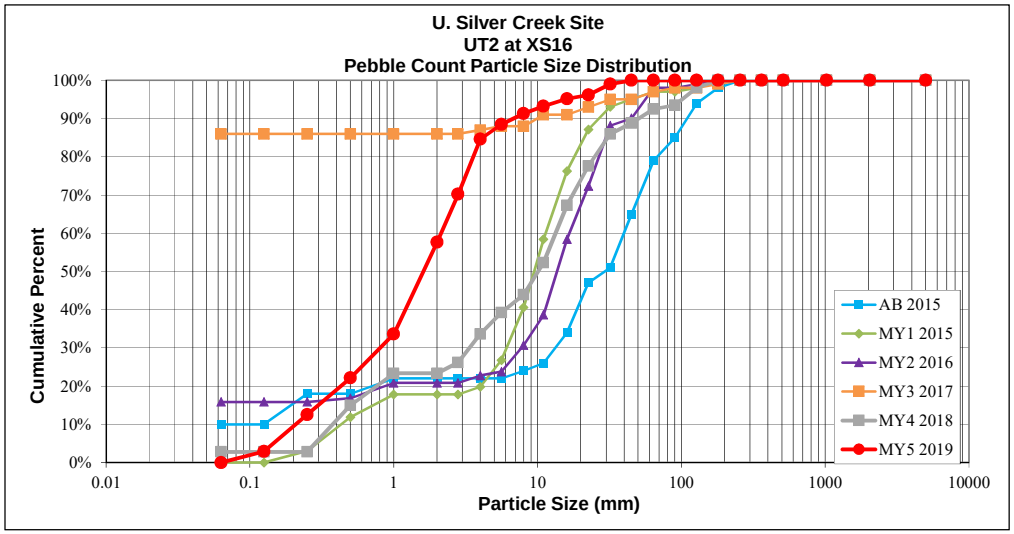


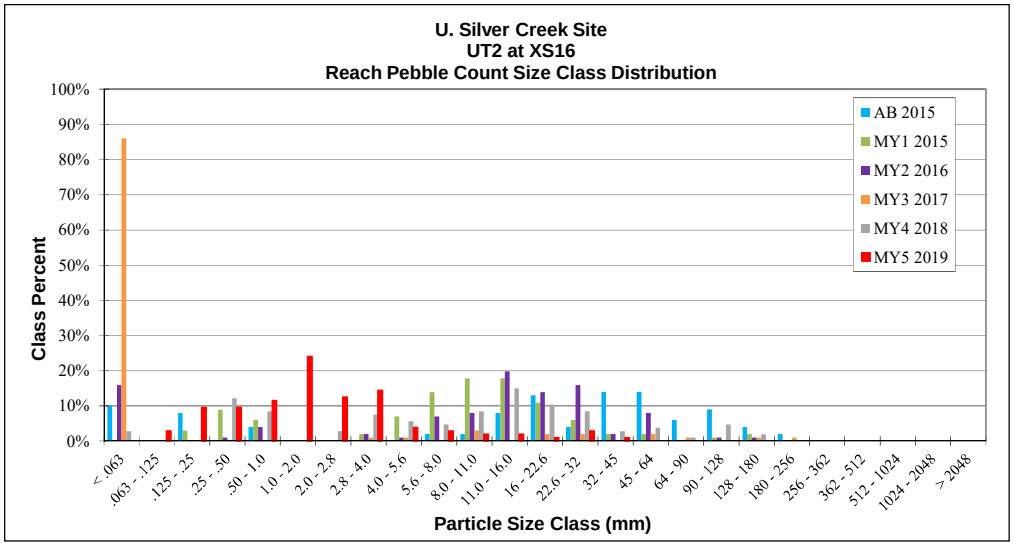
Cross-Section Pebble Count; Monitoring Year 5
U. Silver Creek Mitigation Project, DMS# 94645

SITE OR PROJECT:	U. Silver Cr
REACH/LOCATION:	UT2 XS16
FEATURE:	Riffle
DATE:	17-Oct-19

			MY5 2019			Distribution
MATERIAL	PARTICLE	SIZE (mm)	Total	Class %	% Cum	Plot Size (mm)
Silt/Clay	Silt / Clay	< .063			0%	0.063
Sand	Very Fine	.063 - .125	3	3%	3%	0.125
	Fine	.125 - .25	10	10%	13%	0.25
	Medium	.25 - .50	10	10%	22%	0.50
	Coarse	.50 - 1.0	12	12%	34%	1.0
	Very Coarse	1.0 - 2.0	25	24%	58%	2.0
Gravel	Very Fine	2.0 - 2.8	13	13%	70%	2.8
	Very Fine	2.8 - 4.0	15	14%	85%	4.0
	Fine	4.0 - 5.6	4	4%	88%	5.6
	Fine	5.6 - 8.0	3	3%	91%	8.0
	Medium	8.0 - 11.0	2	2%	93%	11.0
	Medium	11.0 - 16.0	2	2%	95%	16.0
	Coarse	16 - 22.6	1	1%	96%	22.6
	Coarse	22.6 - 32	3	3%	99%	32
	Very Coarse	32 - 45	1	1%	100%	45
	Very Coarse	45 - 64			100%	64
Cobble	Small	64 - 90			100%	90
	Small	90 - 128			100%	128
	Large	128 - 180			100%	180
	Large	180 - 256			100%	256
Boulder	Small	256 - 362			100%	362
	Small	362 - 512			100%	512
	Medium	512 - 1024			100%	1024
	Large-Very Large	1024 - 2048			100%	2048
Bedrock	Bedrock	> 2048			100%	5000
Total % of whole count			104	100%		

Summary Data			
Channel materials			
D16 =	0.3	D84 =	3.9
D35 =	1.0	D95 =	15.4
D50 =	1.60	D100 =	32 - 45



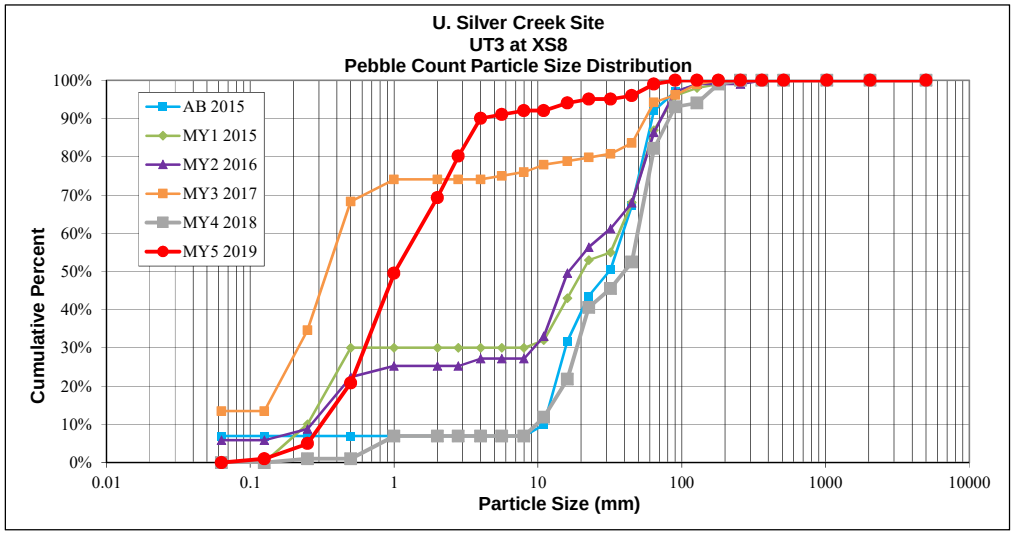


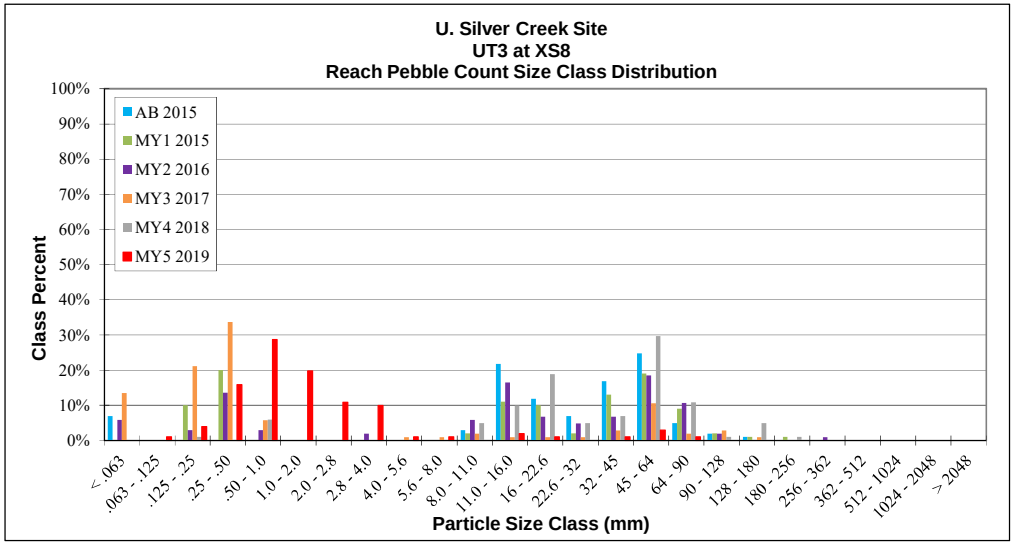
Cross-Section Pebble Count; Monitoring Year 5
U. Silver Creek Mitigation Project, DMS# 94645

SITE OR PROJECT:	U. Silver Cr
REACH/LOCATION:	UT3 XS8
FEATURE:	Riffle
DATE:	17-Oct-19

			MY5 2019			Distribution
MATERIAL	PARTICLE	SIZE (mm)	Total	Class %	% Cum	Plot Size (mm)
Silt/Clay	Silt / Clay	< .063			0%	0.063
Sand	Very Fine	.063 - .125	1	1%	1%	0.125
	Fine	.125 - .25	4	4%	5%	0.25
	Medium	.25 - .50	16	16%	21%	0.50
	Coarse	.50 - 1.0	29	29%	50%	1.0
	Very Coarse	1.0 - 2.0	20	20%	69%	2.0
Gravel	Very Fine	2.0 - 2.8	11	11%	80%	2.8
	Very Fine	2.8 - 4.0	10	10%	90%	4.0
	Fine	4.0 - 5.6	1	1%	91%	5.6
	Fine	5.6 - 8.0	1	1%	92%	8.0
	Medium	8.0 - 11.0			92%	11.0
	Medium	11.0 - 16.0	2	2%	94%	16.0
	Coarse	16 - 22.6	1	1%	95%	22.6
	Coarse	22.6 - 32			95%	32
	Very Coarse	32 - 45	1	1%	96%	45
	Very Coarse	45 - 64	3	3%	99%	64
Cobble	Small	64 - 90	1	1%	100%	90
	Small	90 - 128			100%	128
	Large	128 - 180			100%	180
	Large	180 - 256			100%	256
Boulder	Small	256 - 362			100%	362
	Small	362 - 512			100%	512
	Medium	512 - 1024			100%	1024
	Large-Very Large	1024 - 2048			100%	2048
Bedrock	Bedrock	> 2048			100%	5000
Total % of whole count			101	100%		

Summary Data			
Channel materials			
D16 =	0.41	D84 =	3.21
D35 =	0.70	D95 =	22.21
D50 =	1.02	D100 =	64 - 90





~~Table 10. Monitoring Year 5 Stream Summary~~

Upper Silver Creek Restoration Project: DMS Project ID No. 94645

Silver Creek Mainstem

Parameter	USGS Gauge	Regional Curve Interval [1,2]			Pre-Existing Condition[1]						Reference Reach Data – Morgan Creek						Design						As-built						MY1						MY2						MY3						MY4						MY5					
Dimension and Substrate - Riffle		NC Mtn.	NC Pied.	Rural	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	Min	Mean	Med	Max	SD	n
BF Width (ft)	-	29.0	19.0	-	18.5	-	-	21.2	-	7	33.2	-	-	33.5	-	-	-	26.0	-	-	-	-	23.8	27.0	27.5	29.1	2.04	4	23.5	25.0	25.2	26.1	1.05	4	23.5	24.9	25.1	25.8	0.84	4	24.0	24.9	25.0	25.8	0.62	4	20.3	26.3	23.5	37.7	6.83	4	19.6	23.7	23.5	28.2	3.05	4
Floodprone Width (ft)	-	-	-	-	397.0	-	-	453.0	-	7	77.5	-	-	86.8	-	-	397	-	-	453.0	-	-	-	>300	-	-	-	-	-	>300	-	-	-	-	-	>300	-	-	-	-	-	>300	-	-	-	-	-	>300	-	-	-	-	-	>300	-	-	-	-
BF Mean Depth (ft)	-	1.6	2.1	-	2.3		-	2.9	-	7	2.3	-	-	2.4	-	-	-	2.2	-	-	-	-	1.7	1.9	1.9	2.1	0.18	4	1.7	1.8	1.8	2.0	0.11	4	1.7	1.8	1.8	1.8	0.06	4	1.7	1.7	1.7	1.8	0.06	4	1.1	1.6	1.6	1.9	0.28	4	0.3	1.3	1.6	1.9	0.62	4
BF Max Depth (ft)	-	-	-	-	3.3	-	-	3.9	-	7	2.8	-	-	2.9	-	-	-	3.0	-	-	-	-	2.9	3.1	3.2	3.3	0.18	4	2.8	3.0	3.0	3.2	0.17	4	2.8	3.0	3.0	3.2	0.16	4	2.8	3.1	3.1	3.2	0.17	4	2.8	3.1	3.1	3.4	0.23	4	2.8	3.1	3.1	3.3	0.22	4
BF Cross-sectional Area (ft^2)	-	46.0	45.0	-	46.3	-	-	55.2	-	7	75.1	-	-	79.8	-	-	-	56.0	-	-	-	-	46.9	49.7	48.6	54.5	2.92	4	43.4	45.4	43.8	50.6	3.02	4	41.1	44.0	43.7	47.6	2.51	4	41.6	42.9	41.9	46.2	1.93	4	36.5	39.0	38.9	41.8	1.94	4	35.3	37.2	37.6	38.4	1.17	4
Width/Depth Ratio	-	-	-	-	7.4	-	-	8.8	-	7	14.1	-	-	14.7	-	-	-	12	-	-	-	-	11.8	14.8	15.1	17.3	2.44	4	12.4	13.8	13.6	15.7	1.20	4	13.5	14.1	13.9	15.0	0.59	4	13.7	14.5	14.6	15.1	0.52	4	10.7	18.5	14.5	34.0	9.15	4	9.1	19.0	16.5	34.0	9.24	4
Entrenchment Ratio	-	-	-	-	19.6	-	-	24.0	-	7	2.3	-	-	2.6	-	-	15.3	-	-	17.4	-	-	3.1	3.7	3.5	4.8	0.66	4	3.3	4.0	3.8	4.9	0.59	4	3.5	4.0	3.8	4.9	0.54	4	3.5	4.0	3.7	4.9	0.57	4	2.3	4.1	4.2	5.8	1.32	4	3.7	4.2	4.1	4.9	0.51	4
Bank Height Ratio	-	-	-	-	1.1	-	-	1.5	-	7	1.0	-	-	1.0	-	-	1.0	-	-	1.1	-	-	1.0	1.0	1.0	1.1	0.04	4	1.00	1.00	1.00	1.00	0.00	4	1.00	1.00	1.00	1.00	0.43	4	1.01	1.03	1.03	1.06	0.02	4	0.95	0.98	0.99	1.00	0.02	4	0.85	0.93	0.94	1.00	0.05	4
d50 (mm)	-	-	-	-	-	17.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Pattern																																																											
Channel Beltwidth (ft)	-	-	-	-	45	-	-	106	-	-	-	-	-	-	-	-	104	-	-	208	-	-	99.0	133.3	137.7	157.9	19.24	13	99.0	133.3	137.7	157.9	19.24	13	99.0	133.3	137.7	157.9	19.24	13	99.0	133.3	137.7	157.9	19.24	13	99.0	133.3	137.7	157.9	19.24	13	99.0	133.3	137.7	157.9	19.24	13
Radius of Curvature (ft)	-	-	-	-	16.0	-	-	62.0	-	-	-	-	-	-	-	-	47.0	-	-	73.0	-	-	52.6	57.2	55.0	67.9	5.03	8	52.6	57.2	55.0	67.9	5.03	8	52.6	57.2	55.0	67.9	5.03	8	52.6	57.2	55.0	67.9	5.03	8	52.6	57.2	55.0	67.9	5.03	8	52.6	57.2	55.0	67.9	5.03	8
Rc:Bankfull width (ft/ft)	-	-	-	-	1.0	-	-	3.1	-	-	-	-	-	-	-	-	1.8	-	-	2.8	-	-	1.95	2.12	2.04	2.51	0.19	8	1.95	2.12	2.04	2.51	0.19	8	1.95	2.12	2.04	2.51	0.19	8	1.95	2.12	2.04	2.51	0.19	8	1.95	2.12	2.04	2.51	0.19	8	1.95	2.12	2.04	2.51	0.19	8
Meander Wavelength (ft)	-	-	-	-	59	-	-	139	-	-	-	-	-	-	-	-	182	-	-	312	-	-	172.0	225.4	201.7	310.0	49.34	8	172.0	225.4	201.7	310.0	49.3	8	172.0	225.4	201.7	310.0	49.34	8	172.0	225.4	201.7	310.0	49.3	8	172.0	225.4	201.7	310.0	49.34	8	172.0	225.4	201.7	310.0	49.34	8
Meander Width Ratio	-	-	-	-	2.3	-	-	5.4	-	-	-	-	-	-	-	-	7.0	-	-	12.0	-	-	6.4	8.3	7.5	11.5	1.83	8	6.4	8.3	7.5	11.5	1.8	8	6.4	8.3	7.5	11.5	1.83	8	6.4	8.3	7.5	11.5	1.8	8	6.4	8.3	7.5	11.5	1.83	8	6.4	8.3	7.5	11.5	1.83	8
Profile																																																											
Riffle Length (ft)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	36.7	50.3	44.7	89.4	15.10	10.0	12.1	50.0	47.6	83.8	17.0	16	27.3	56.3	57.2	86.5	16.72	15	22.7	53.3	51.1	79.5	15.7	15	32.4	54.8	49.9	85.3	16.60	15	36.0	54.8	46.6	92.2	16.97	15
Riffle Slope (ft/ft)	-	-	-	-	0.001	-	-	0.108	-	-	0.014	-	-	0.024	-	-	0.005	-	-	0.008	-	-	0.001	0.008	0.007	0.015	0.004	10.0	0.000	0.008	0.006	0.023	0.007	16	0.001	0.006	0.005	0.013	0.004	15	0.000	0.007	0.008	0.013	0.005	15	0.000	0.008	0.009	0.014	0.004	15	0.001	0.009	0.007	0.023	0.007	15
Pool Length (ft)	-	-	-	-	15	-	-	135	-	-	-	-	-	-	-	-	78	-	-	137	-	-	50.4	97.1	94.0	136.6	20.40	16.0	42.7	80.3	87.7	116.8	22.6	14	16.7	80.0	83.7	126.0	26.74	19	11.9	81.5	84.2	160.7	34.4	19	21.0	80.3	82.2	149.1	31.40	19	15.1	82.9	81.8	145.9	32.80	16
Pool Spacing (ft)	-	-	-	-	40	-	-	162	-	-	46	-	-	277	-	-	104	-	-	182	-	-	113.7	145.8	140.1	210.4	29.60	15	42.8	115.2	120.5	191.4	36.6	19	48.1	113.6	116.6	202.2	42.03	20	50.5	118.9	111.9	193.5	39.1	20	50.2	113.8	117.1	184.7	34.10	20	42.9	114.7	116.0	223.9	43.30	20
Pool Max Depth (ft)	-	-	-	-	4.0	-	-	4.1	-	-	4.1	-	-	4.1	-	-	5.5	-	-	7.7	-	-	4.0	4.8	5.2	5.3	0.58	3	3.9	4.3	4.0	5.0	0.48	3	3.8	4.0	4.0	4.3	0.23	3	1.1	2.0	1.7	4.2	0.86	20	0.8	1.8	1.7	3.5	0.76	20	0.2	1.3	1.2	3.5	0.86	20
Pool Volume (ft^3)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Substrate and Transport Parameters																																																											
Ri% / Ru% / P% / G% / S%	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SC% / Sa% / G% / B% / Be%	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
d16 / d35 / d50 / d84 / d95	-	-	-	-	1.0 / 8.4 / 17 / 43 / 57						- / 1.2 / 3.0 / 77 / 800						-						mean 11.2 / 21.8 / 35.0 / 66.6 /126.9					2	mean 6.4 / 18.8 / 28.3 / 66.9 /107.5					2	mean 7.7 / 13.5 / 20.6 / 67.2 /116.7					2	mean 6.7 / 15.1 / 25.5 / 68.0 / 123					2	mean 9.9 / 16.3 / 23 / 57.4 / 113.25					2	mean 7.7 / 16.4 / 23.5 / 70.1 / 104.3					2
Reach Shear Stress (competency) lb/f²	-	-	-	-	0.035	-	-	1.13	-	-	-	-	-	-	-	-	-	0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Max part size (mm) mobilized at bankfull (Rosgen Curve)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Stream Power (transport capacity) W/m²	-	-	-	-	34	-	-	40	-	-	-	-	-	-	-	-	29	-	-	35	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Additional Reach Parameters																																																											
Drainage Area (SM)	-		3.0		2.73	-	-	3.35	-	-	-	8.4	-	-	-	-	2.73	-	-	3.35	-	-	2.73	-	-	3.35	-	-	2.73	-	-	3.35	-	-	2.73	-	-	3.35	-	-	2.73	-	-	3.35	-	-	2.73	-	-	3.35	-	-	2.73	-	-	3.35	-	-
Impervious cover estimate (%)	-	-	-	-	-	<5%	-	-	-	-	-	-	-	-	-	-	-	<5%	-	-	-	-	-	<5%	-	-	-	-	-	<5%	-	-	-	-	-	<5%	-	-	-	-	-	<5%	-	-	-	-	-	<5%	-	-	-	-	-	<5%	-	-	-	-
Rosgen Classification	-	-	-	-	-	E	-	-	-	-	-	C4	-	-	-	-	-	C	-	-	-	-	-	C	-	-	-	-	-	C	-	-	-	-	-	C	-	-	-	-	-	C	-	-	-	-	-	C	-	-	-	-	-	C	-	-	-	-
BF Velocity (fps)	-	-	-	-	2.8	-	-	4.9	-	7	-	7	-	-	-	-	-	4.20	-	-	-	-	-	4.27	-	-	-	-	-	4.21	-	-	-	-	-	4.21	-	-	-	-	-	4.21	-	-	-	-	-	4.21	-	-	-	-	-	4.21	-	-	-	-
BF Discharge (cfs)	-	232.0	196.0	213.2	180	-	-	240	-	-	-	524	-	-	-	-	-	230.0	-	-	-	-	-	212.2	-	-	-	-	-	229.3	-	-	-	-	-	229.3	-	-	-	-	-	229.3	-	-	-	-	-	229.3	-	-	-	-	-	229.3	-	-	-	-
Valley Length	-	-	-	-	-	1947	-	-	-	-	-	-	-	-	-	-	-	1947.0	-	-	-	-	-	1947.0	-	-	-	-	-	1947.0	-	-	-	-	-	1947.0	-	-	-	-	-	1947.0	-	-	-	-	-	1947.0	-	-	-	-	-	1947.0	-	-	-	-
Channel length (ft)[2]	-	-	-	-	-	3179	-	-	-	-	-	-	-	-	-	-	-	3068	-	-	-	-	-	3016	-	-	-	-	-	3016	-	-	-	-	-	3016	-	-	-	-	-	3016	-	-	-	-	-	3016	-	-	-	-	-	3016	-	-	-	-
Sinuosity	-	-	-	-	-	1.63	-	-	-	-	-	-	-	-	-	-	-	1.58	-	-	-	-	-	1.55	-	-	-	-	-	1.55	-	-	-	-	-	1.55	-	-	-	-	-	1.55	-	-	-	-	-	1.55	-	-	-	-	-	1.55	-	-	-	-
Water Surface Slope (Channel) (ft/ft)	-	-	-	-	-	0.004	-	-	-	-	-	0.007	-	-	-	-	0.003	-	-	0.004	-	-	-	0.004	-	-	-	-	-	0.004	-	-	-	-	-	0.004	-	-	-	-	-	0.004	-	-	-	-	-	0.004	-	-	-	-	-	0.004	-	-	-	-
BF slope (ft/ft)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.003	-	-	0.008	-	-	-	0.004	-	-	-	-	-	0.004	-	-	-	-	-	0.004	-	-	-	-	-	0.004	-	-	-	-	-	0.004	-	-	-	-	-	0.004	-	-	-	-
Bankfull Floodplain Area (acres)	-	-	-	-	-	2.1	-	-	-	-	-	-	-	-	-	-	-	5.2	-	-	-	-	-	5.2	-	-	-	-	-	5.2	-	-	-	-	-	5.2	-	-	-	-	-	5.2	-	-	-	-	-	5.2	-	-	-	-	-	5.2	-	-	-	-
BEHI VL% / L% / M% / H% / VH% / E%	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Channel Stability or Habitat Metric	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Biological or Other	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

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UT1

Parameter	USGS Gauge	Regional Curve Interval [1,2]			Pre-Existing Condition[1]						Reference Reach Data – UT3 upstream of Gold Mine Road						Design						As-built						MY1						MY2						MY3						MY4						MY5					
Dimension and Substrate - Riffle		NC Mtn.	NC Pied.	Rural	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	Min	Mean	Med	Max	SD	n
BF Width (ft)	-	11.9	6.9	-	6.1	-	-	9.3	-	4	6.3	-	-	7.9	-	-	-	9.5	-	-	-	-	-	9.6	-	-	-	1	-	9.3	-	-	-	1	-	9.2	-	-	-	1	-	9.0	-	-	-	1	-	11.5	-	-	-	1	-	8.5	-	-	-	1
Floodprone Width (ft)	-	-	-	-	10.9	-	-	60.5	-	4	15.0	-	-	19.0	-	-	10.9	-	-	60.5	-	-	-	>150	-	-	-	1	-	>150	-	-	-	1	-	>150	-	-	-	1	-	>150	-	-	-	1	-	>150	-	-	-	1	-	>150	-	-	-	1
BF Mean Depth (ft)	-	0.70	1.00	-	0.97	-	-	1.50	-	4	0.70	-	-	0.90	-	-	-	0.95	-	-	-	-	-	0.93	-	-	-	1	-	0.8	-	-	-	1	-	0.8	-	-	-	1	-	0.8	-	-	-	1	-	0.5	-	-	-	1	-	0.6	-	-	-	1
BF Max Depth (ft)	-	-	-	-	1.37	-	-	2.1	-	4	1.0	-	-	1.4	-	-	-	1.2	-	-	-	-	-	1.3	-	-	-	1	-	1.1	-	-	-	1	-	1.1	-	-	-	1	-	1.1	-	-	-	1	-	1.2	-	-	-	1	-	1.2	-	-	-	1
BF Cross-sectional Area (ft^2)	-	9.1	9.0	-	9.0	-	-	9.1	-	4	5.5	-	-	6.5	-	-	-	9.0	-	-	-	-	-	8.9	-	-	-	1	-	7.0	-	-	-	1	-	7.0	-	-	-	1	-	7.0	-	-	-	1	-	5.9	-	-	-	1	-	5.0	-	-	-	1
Width/Depth Ratio	-	-	-	-	4.0	-	-	9.6	-	4	7.3	-	-	11.7	-	-	-	10	-	-	-	-	-	10.3	-	-	-	1	-	12.3	-	-	-	1	-	12.2	-	-	-	1	-	11.7	-	-	-	1	-	22.5	-	-	-	1	-	14.4	-	-	-	1
Entrenchment Ratio	-	-	-	-	1.2	-	-	10.0	-	4	1.9	-	-	3.0	-	-	1.1	-	-	6.4	-	-	-	5.3	-	-	-	1	-	5.2	-	-	-	1	-	5.5	-	-	-	1	-	5.6	-	-	-	1	-	4.4	-	-	-	1	-	6.0	-	-	-	1
Bank Height Ratio	-	-	-	-	1.5	-	-	3.0	-	4	1.0	-	-	1.0	-	-	1.0	-	-	1.0	-	-	-	1.00	-	-	-	1	-	1.00	-	-	-	1	-	1.10	-	-	-	1	-	1.10	-	-	-	1	-	0.99	-	-	-	1	-	1.09	-	-	-	1
d50 (mm)	-	-	-	-	-	18.0	-	-	-	-	-	3.0	-	-	-	-	-	-	-	-	-	-	-	38.8	-	-	-	-	-	43.6	-	-	-	-	-	32.9	-	-	-	1	-	26.9	-	-	-	1	-	37.1	-	-	-	1	-	11.6	-	-	-	1
Pattern																																																											
Channel Beltwidth (ft)	-	-	-	-	30.0	-	-	60.0	-	-	-	-	-	-	-	-	33.0	-	-	76.0	-	-	33.3	49.6	44.6	70.1	13.1	5	33.3	49.6	44.6	70.1	13.1	5	33.3	49.6	44.6	70.1	13.1	5	33.3	49.6	44.6	70.1	13.1	5	33.3	49.6	44.6	70.1	13.1	5	33.3	49.6	44.6	70.1	13.1	5
Radius of Curvature (ft)	-	-	-	-	9.0	-	-	21.0	-	-	-	-	-	-	-	-	17.0	-	-	27.0	-	-	21.4	23.0	22.6	25.6	1.63	5	21.4	23.0	22.6	25.6	1.6	5	21.4	23.0	22.6	25.6	1.6	5	21.4	23.0	22.6	25.6	1.6	5	21.4	23.0	22.6	25.6	1.6	5	21.4	23.0	22.6	25.6	1.6	5
Rc:Bankfull width (ft/ft)	-	-	-	-	1.2	-	-	2.7	-	-	-	-	-	-	-	-	1.8	-	-	2.8	-	-	2.2	2.4	2.4	2.7	0.2	5	2.2	2.4	2.4	2.7	0.2	5	2.2	2.4	2.4	2.7	0.2	5	2.2	2.4	2.4	2.7	0.2	5	2.2	2.4	2.4	2.7	0.2	5	2.2	2.4	2.4	2.7	0.2	5
Meander Wavelength (ft)	-	-	-	-	92.0	-	-	138.0	-	-	45.0	-	-	75.0	-	-	67.0	-	-	114.0	-	-	69.6	74.4	72.0	81.6	5.2	3	69.6	74.4	72.0	81.6	5.2	3	69.6	74.4	72.0	81.6	5.2	3	69.6	74.4	72.0	81.6	5.2	3	69.6	74.4	72.0	81.6	5.2	3	69.6	74.4	72.0	81.6	5.2	3
Meander Width Ratio	-	-	-	-	12.0	-	-	18.0	-	-	1.2	-	-	1.2	-	-	7.0	-	-	12.0	-	-	7.3	7.8	7.5	8.5	0.5	3	7.3	7.8	7.5	8.5	0.5	3	7.3	7.8	7.5	8.5	0.5	3	7.3	7.8	7.5	8.5	0.5	3	7.3	7.8	7.5	8.5	0.5	3	7.3	7.8	7.5	8.5	0.5	3
Profile																																																											
Riffle Length (ft)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	16.1	20.2	19.9	24.9	4.1	4	9.9	18.5	18.1	30.5	6.3	7	9.9	19.2	21.3	30.8	7.2	8	9.8	21.4	21.4	30.9	7.0	8	6.7	14.3	14.0	22.5	4.5	8	9.0	16.1	15.2	24.9	5.3	8
Riffle Slope (ft/ft)	-	-	-	-	0.018	-	-	0.039	-	-	0.013	-	-	0.054	-	-	0.017	-	-	0.022	-	-	0.019	0.030	0.027	0.050	0.012	4	0.010	0.021	0.020	0.039	0.011	7	0.010	0.032	0.030	0.064	0.016	8	0.008	0.020	0.017	0.033	0.009	8	0.006	0.028	0.021	0.062	0.020	8	0.005	0.025	0.023	0.042	0.012	8
Pool Length (ft)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	26.1	33.8	35.1	41.7	6.6	5	8.6	26.9	32.2	40.6	10.9	9	10.8	25.4	21.8	56.3	13.4	11	12.3	27.4	22.4	60.4	15.4	11	10.0	25.8	23.5	51.6	13.9	11	11.8	27.8	21.5	51.5	11.2	11
Pool Spacing (ft)	-	-	-	-	15.0	-	-	50.0	-	-	39.9	-	-	62.3	-	-	38.0	-	-	66.5	-	-	23.4	46.0	51.6	60.1	13.3	7	21.9	41.7	40.9	60.7	14.6	9	19.2	36.2	36.8	56.1	12.7	12	11.5	34.2	26.9	59.5	14.8	14	6.5	32.3	26.9	67.6	17.3	14	11.3	33.7	25.9	74.3	19.6	14
Pool Max Depth (ft)	-	-	-	-	2.0	-	-	2.4	-		1.8	-	-	1.8	-	-	1.9	-	-	3.3	-	-	-	1.4	-	-	-	1	-	2.5	-	-	-	1	-	2.6	-	-	-	1	-	1.2	-	-	-	1	0.5	1.1	1.0	2.1	0.4	9	0.1	0.6	0.5	1.4	1.7	14
Pool Volume (ft^3)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Substrate and Transport Parameters																																																											
Ri% / Ru% / P% / G% / S%	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SC% / Sa% / G% / B% / Be%	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
d16 / d35 / d50 / d84 / d95	-	-	-	-	4.0 / 12 / 18 / 49 / 85						-	-	-	-	-	-	-	-	-	-	-	-	17.5 / 32.6 / 38.8 / 58.6 / 75.6						14.4/ 34.6 / 43.6 / 69.0 / 113.8						8.3/ 14.3 / 32.9 / 66.2 / 103.6						6.3/ 14.3 / 26.9 / 71.2 / 105.5						11.3 / 22.6 / 37.1 / 71.7 / 107.3						1.6 / 3.2 / 11.6 / 62.8 / 151.8					
Reach Shear Stress (competency) lb/f²	-	-	-	-	0.1	-	-	1.0	-	-	0.2	-	-	0.6	-	-	-	0.5 - 0.6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Max part size (mm) mobilized at bankfull (Rosgen Curve)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Stream Power (transport capacity) W/m²	-	-	-	-	-	32.0	-	-	-	-	6.5	-	-	28.5	-	-	-	30	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Additional Reach Parameters																																																											
Drainage Area (SM)	-		0.28			-	-	0.28	-	-	-	0.12	-	-	-	-	0.28	-	-	0.28	-	-	2.73	-	-	3.35	-	-	2.73	-	-	3.35	-	-	2.73	-	-	3.35	-	-	2.73	-	-	3.35	-	-	2.73	-	-	3.35	-	-	2.73	-	-	3.35	-	-
Impervious cover estimate (%)	-	-	-	-	-	<5%	-	-	-	-	-	<5%	-	-	-	-	-	<5%	-	-	-	-	-	<5%	-	-	-	-	-	<5%	-	-	-	-	-	<5%	-	-	-	-	-	<5%	-	-	-	-	-	<5%	-	-	-	-	-	<5%	-	-	-	-
Rosgen Classification	-	-	-	-	-	E, Gc, Bc	-	-	-	-	-	E/Bc	-	-	-	-	-	E (high W/D	-	-	-	-	-	C	-	-	-	-	-	C	-	-	-	-	-	C	-	-	-	-	-	C	-	-	-	-	-	C	-	-	-	-	-	C	-	-	-	-
BF Velocity (fps)	-	-	-	-	3.4	-	-	4.6	-		2.1	-	3.4	-	-	-	-	3.7	-	-	-	-	-	3.81	-	-	-	-	-	3.48	-	-	-	-	-	3.48	-	-	-	-	-	3.48	-	-	-	-	-	3.48	-	-	-	-	-	3.48	-	-	-	-
BF Discharge (cfs)	-	38.0	36.0	-	31	-	-	41	-	-	-	18	-	-	-	-	-	33.5	-	-	-	-	-	33.9	-	-	-	-	-	24.4	-	-	-	-	-	24.4	-	-	-	-	-	24.4	-	-	-	-	-	24.4	-	-	-	-	-	24.4	-	-	-	-
Valley Length	-	-	-	-	-	371	-	-	-	-	-	-	-	-	-	-	-	367.0	-	-	-	-	-	367.0	-	-	-	-	-	367.0	-	-	-	-	-	367.0	-	-	-	-	-	367.0	-	-	-	-	-	367.0	-	-	-	-	-	367.0	-	-	-	-
Channel length (ft)[2]	-	-	-	-	-	524	-	-	-	-	-	134.5	-	-	-	-	-	373	-	-	-	-	-	495	-	-	-	-	-	495	-	-	-	-	-	495	-	-	-	-	-	495	-	-	-	-	-	495	-	-	-	-	-	495	-	-	-	-
Sinuosity	-	-	-	-	-	1.41		-	-	-	-	1.05	-	-	-	-	-	1.35		-	-	-	-	1.36		-	-	-	-	1.36		-	-	-	-	1.36		-	-	-	-	1.36		-	-	-	-	1.36		-	-	-	-	1.36		-	-	-
Water Surface Slope (Channel) (ft/ft)	-	-	-	-	-	0.0160	-	-	-	-	-	0.0189	-	-	-	-	-	0.0150	-	-	-	-		0.0162	-		-	-		0.0162	-		-	-		0.0162	-		-	-		0.0162	-		-	-		0.0162	-		-	-		0.0162	-		-	-
BF slope (ft/ft)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.011	-	-	-	-		0.0161	-		-	-		0.0161	-		-	-		0.0161	-		-	-		0.0161	-		-	-		0.0161	-		-	-		0.0161	-		-	-
Bankfull Floodplain Area (acres)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	5.2	-	-	-	-	-	5.2	-	-	-	-	-	5.2	-	-	-	-	-	5.2	-	-	-	-	-	5.2	-	-	-	-	-	5.2	-	-	-	-
BEHI VL% / L% / M% / H% / VH% / E%	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Channel Stability or Habitat Metric	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Biological or Other	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

1 . Harman, W.A., G.D. Jennings, J.M. Patterson, D.R. Clinton, L.O. Slate, A.G. Jessup, J.R. Everhart, and R.E. Smith. 1999. Bankfull hydraulic geometry relationships for North Carolina streams. Wildland Hydrology. AWRA Symposium Proceedings. D.S. Olsen and J.P. Potyondy, eds. American Water Resources Association. June 30-July 2, 1999. Bozeman, MT.
2. Harman, W.A., D.E Wise, M.A. Walker, R. Morris, MA Cantrell, M. Clemmons, G.D. Jennings, D.R. Clinton, J.M. Patterson. 2000. Bankfull Regional Curves for North Carolina Mountain Streams. In: AWRA Conference Proceedings, D.L. Kane, editor. American Water Resources Specialty Conference on Water Resources in Extreme Environments. Anchorage, Alaska.

Table 10. Monitoring Year 5 Stream Summary

Upper Silver Creek Restoration Project: DMS Project ID No. 94645

UT2

Parameter	USGS Gauge	Regional Curve Interval [1,2]			Pre-Existing Condition[1]						Reference Reach Data Morgan Creek					
Dimension and Substrate - Riffle		NC Mtn.	NC Pied.	Rural	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n
BF Width (ft)	-	6.0	3.1	-	3.1	-	-	3.4	-	2	6.3	-	-	7.9	-	-
Floodprone Width (ft)	-	-	-	-	5.1	-	-	6.4	-	2	15.0	-	-	19.0	-	-
BF Mean Depth (ft)	-	0.40	0.60	-	0.84	-	-	0.90	-	2	0.70	-	-	0.90	-	-
BF Max Depth (ft)	-	-	-	-	1.1	-	-	1.4	-	2	1.0	-	-	1.35	-	-
BF Cross-sectional Area (ft²)	-	2.6	2.6	-	2.8	-	-	2.9	-	2	5.5	-	-	6.5	-	-
Width/Depth Ratio	-	-	-	-	3.5	-	-	4.0	-	2	7.3	-	-	11.7	-	-
Entrenchment Ratio	-	-	-	-	1.6	-	-	1.9	-	2	1.9	-	-	3.0	-	-
Bank Height Ratio	-	-	-	-	2.2	-	-	2.4	-	2	-	-	-	-	-	-
d50 (mm)	-	-	-	-	-	18.0	-	-	-	-	-	3.0	-	-	-	-
Pattern																
Channel Beltwidth (ft)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Radius of Curvature (ft)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Rc:Bankfull width (ft/ft)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Meander Wavelength (ft)	-	-	-	-	-	-	-	-	-	-	45.0	-	-	75.0	-	-
Meander Width Ratio	-	-	-	-	-	-	-	-	-	-	1.2	-	-	1.2	-	-
Profile																
Riffle Length (ft)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Riffle Slope (ft/ft)	-	-	-	-	0.014	-	-	0.057	-	-	0.013	-	-	0.054	-	-
Pool Length (ft)	-	-	-	-	5.2	-	-	12.7	-	-	-	-	-	-	-	-
Pool Spacing (ft)	-	-	-	-	9.5	-	-	51.0	-	-	39.9	-	-	62.3	-	-
Pool Max Depth (ft)	-	-	-	-	-	-	-	-	-	-	-	1.8	-	-	-	-
Pool Volume (ft³)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Substrate and Transport Parameters																
Ri% / Ru% / P% / G% / S%	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SC% / Sa% / G% / B% / Be%	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
d16 / d35 / d50 / d84 / d95	-	-	-	-	5.6 / 13 / 18 / 43 / 60						-	-	-	-	-	-
Reach Shear Stress (competency) lb/f²	-	-	-	-	-	-	-	-	-	-	0.2	-	-	0.6	-	-
Max part size (mm) mobilized at bankfull (Rosgen Curve)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Stream Power (transport capacity) W/m²	-	-	-	-	45.0	-	-	51.0	-	-	6.5	-	-	28.5	-	-
Additional Reach Parameters																
Drainage Area (SM)	-	0.05			-	0.05	-	-	-	-	-	0.12	-	-	-	-
Impervious cover estimate (%)	-	-	-	-	-	<5%	-	-	-	-	-	<5%	-	-	-	-
Rosgen Classification	-	-	-	-	-	G/B[3]	-	-	-	-	-	E/Bc	-	-	-	-
BF Velocity (fps)	-	-	-	-	3.2	-	-	3.9	-	-	2.1	-	3.4	-	-	-
BF Discharge (cfs)	-	-	9.5	-	9	-	-	11	-	-	-	18	-	-	-	-
Valley Length	-	-	-	-	-	194	-	-	-	-	-	-	-	-	-	-
Channel length (ft)[2]	-	-	-	-	-	209	-	-	-	-	-	134.5	-	-	-	-
Sinuosity	-	-	-	-	-	1.08	-	-	-	-	-	1.05	-	-	-	-
Water Surface Slope (Channel) (ft/ft)	-	-	-	-	0.01	-	-	0.17	-	-	-	0.0197	-	-	-	-
BF slope (ft/ft)	-	-	-	-	-	0.024	-	-	-	-	-	-	-	-	-	-
Bankfull Floodplain Area (acres)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BEHI VL% / L% / M% / H% / VH% / E%	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Channel Stability or Habitat Metric	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Biological or Other	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Parameter	Design						As-built						MY1					
Dimension and Substrate - Riffle	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n
BF Width (ft)	-	6.0	-	-	-	-	-	6.6	-	-	-	1	-	5.8	-	-	-	1
Floodprone Width (ft)	60.0		-	120.0	-	-	-	>100	-	-	-	1	-	>100	-	-	-	1
BF Mean Depth (ft)	-	0.50	-	-	-	-	-	0.41	-	-	-	1	-	0.4	-	-	-	1
BF Max Depth (ft)	-	0.6	-	-	-	-	-	0.9	-	-	-	1	-	0.8	-	-	-	1
BF Cross-sectional Area (ft²)	-	3.0	-	-	-	-	-	2.7	-	-	-	1	-	2.2	-	-	-	1
Width/Depth Ratio	-	12.0	-	-	-	-	-	16.0	-	-	-	1	-	15.7	-	-	-	1
Entrenchment Ratio	10.0	-	-	20.0	-	-	-	7.0	-	-	-	1	-	7.1	-	-	-	1
Bank Height Ratio	-	1.1	-	-	-	-	-	1.2	-	-	-	1	-	1.0	-	-	-	1
d50 (mm)	-	-	-	-	-	-	-	29.3	-	-	-	-	-	9.5	-	-	-	-
Pattern																		
Channel Beltwidth (ft)	22.0	-	-	30.0	-	-	30.4	32.6	32.2	35.3	2.02	3	30.4	32.6	32.2	35.3	2.02	3
Radius of Curvature (ft)	12.0	-	-	18.0	-	-	14.3	15.5	14.4	17.7	1.58	3	14.3	15.5	14.4	17.7	1.58	3
Rc:Bankfull width (ft/ft)	2.0	-	-	3.0	-	-	2.17	2.34	2.18	2.68	0.24	3	2.17	2.34	2.18	2.68	0.24	3
Meander Wavelength (ft)	42.0	-	-	72.0	-	-	52.1	54.9	54.9	57.6	2.8	2	52.1	54.9	54.9	57.6	2.8	2
Meander Width Ratio	7.0	-	-	12.0	-	-	7.9	8.3	8.3	8.7	0.4	2	7.9	8.3	8.3	8.7	0.4	2
Profile																		
Riffle Length (ft)	-	-	-	-	-	-	13.6	20.8	14.3	47.8	13.5	5	8.7	14.5	15.1	17.6	2.6	9
Riffle Slope (ft/ft)	0.014	-	-	0.033	-	-	0.0000	0.0131	0.0147	0.0214	0.0081	5	0.0000	0.0130	0.0129	0.0230	0.0072	9
Pool Length (ft)	17.4	-	-	26.0	-	-	7.5	17.3	15.6	28.8	8.0	8	2.9	11.9	9.5	25.7	8.1	9
Pool Spacing (ft)	9.0	-	-	30.0	-	-	14.8	28.8	25.2	47.9	11.5	8	14.8	32.9	22.8	73.4	18.9	7
Pool Max Depth (ft)	-	1.4	-	-	-	-	-	1.7	-	-	-	1	-	0.8	-	-	-	1
Pool Volume (ft³)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Substrate and Transport Parameters																		
Ri% / Ru% / P% / G% / S%	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SC% / Sa% / G% / B% / Be%	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
d16 / d35 / d50 / d84 / d95	-	-	-	-	-	-	0.2 / 16.4 / 29.3 / 85.0 / 139.4						0.8 / 6.9 / 9.5 / 20.5 / 44.6					
Reach Shear Stress (competency) lb/f²	-	0.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Max part size (mm) mobilized at bankfull (Rosgen Curve)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Stream Power (transport capacity) W/m²	-	33.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Additional Reach Parameters																		
Drainage Area (SM)	0.05	-	-	0.05	-	-	2.73	-	-	3.35	-	-	2.73	-	-	3.35	-	-
Impervious cover estimate (%)	-	<5%	-	-	-	-	-	<5%	-	-	-	-	-	<5%	-	-	-	-
Rosgen Classification	-	Cb, C	-	-	-	-	-	C	-	-	-	-	-	C	-	-	-	-
BF Velocity (fps)	-	3.50	-	-	-	-	-	2.98	-	-	-	-	-	2.92	-	-	-	-
BF Discharge (cfs)	-	10.0	-	-	-	-	-	8.0	-	-	-	-	-	6.4	-	-	-	-
Valley Length	-	248.0	-	-	-	-	-	248.0	-	-	-	-	-	248.0	-	-	-	-
Channel length (ft)[2]	-	333	-	-	-	-	-	310	-	-	-	-	-	310	-	-	-	-
Sinuosity	-	1.34	-	-	-	-	-	1.2	-	-	-	-	-	1.2	-	-	-	-
Water Surface Slope (Channel) (ft/ft)	0.0070	0.02		0.0310	-	-	0.0101	0.0198	-	0.0295	-	-	-	0.0241	-	-	-	-
BF slope (ft/ft)		0.02			-	-	0.0077	0.0175	-	0.0272	-	-	-	0.0203	-	-	-	-
Bankfull Floodplain Area (acres)	-	-	-	-	-	-	-	5.2	-	-	-	-	-	5.2	-	-	-	-
BEHI VL% / L% / M% / H% / VH% / E%	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Channel Stability or Habitat Metric	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Biological or Other	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Parameter	MY2						MY3						MY4						MY5					
Dimension and Substrate - Riffle	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n
BF Width (ft)	-	4.7	-	-	-	1	-	5.5	-	-	-	1	-	5.6	-	-	-	1	-	2.5	-	-	-	1
Floodprone Width (ft)	-	>100	-	-	-	1	-	>100	-	-	-	1	-	>100	-	-	-	1	-	>40	-	-	-	1
BF Mean Depth (ft)	-	0.3	-	-	-	1	-	0.4	-	-	-	1	-	0.3	-	-	-	1	-	0.4	-	-	-	1
BF Max Depth (ft)	-	0.6	-	-	-	1	-	0.7	-	-	-	1	-	0.8	-	-	-	1	-	0.7	-	-	-	1
BF Cross-sectional Area (ft²)	-	1.5	-	-	-	1	-	2.0	-	-	-	1	-	1.7	-	-	-	1	-	1.0	-	-	-	1
Width/Depth Ratio	-	14.5	-	-	-	1	-	14.8	-	-	-	1	-	17.9	-	-	-	1	-	6.1	-	-	-	1
Entrenchment Ratio	-	8.7	-	-	-	1	-	12.3	-	-	-	1	-	8.3	-	-	-	1	-	16.0	-	-	-	1
Bank Height Ratio	-	1.2	-	-	-	1	-	1.30	-	-	-	1	-	1.0	-	-	-	1	-	0.7	-	-	-	1
d50 (mm)	-	13.6	-	-	-	1	-	-	-	-	-	1	-	10.1	-	-	-	1	-	1.6	-	-	-	1
Pattern																								
Channel Beltwidth (ft)	30.4	32.6	32.2	35.3	2.02	3	30.4	32.6	32.2	35.3	2.02	3	30.4	32.6	32.2	35.3	2.02	3	30.4	32.6	32.2	35.3	2.02	3
Radius of Curvature (ft)	14.3	15.5	14.4	17.7	1.58	3	14.3	15.5	14.4	17.7	1.58	3	14.3	15.5	14.4	17.7	1.58	3	14.3	15.5	14.4	17.7	1.58	3
Rc:Bankfull width (ft/ft)	2.17	2.34	2.18	2.68	0.24	3	2.17	2.34	2.18	2.68	0.24	3	2.2	2.3	2.2	2.7	0.24	3	2.2	2.3	2.2	2.7	0.24	3
Meander Wavelength (ft)	52.1	54.9	54.9	57.6	2.8	2	52.1	54.9	54.9	57.6	2.8	2	52.1	54.9	54.9	57.6	2.75	2	52.1	54.9	54.9	57.6	2.75	2
Meander Width Ratio	7.9	8.3	8.3	8.7	0.4	2	7.9	8.3	8.3	8.7	0.4	2	7.9	8.3	8.3	8.7	0.42	2	7.9	8.3	8.3	8.7	0.42	2
Profile																								
Riffle Length (ft)	8.5	21.0	13.2	57.3	16.3	8	7.2	15.8	11.6	42.8	12.3	6	7.7	19.0	14.5	46.9	13.0	6	4.4	18.3	12.9	42.3	12.1	7
Riffle Slope (ft/ft)	0.0000	0.0132	0.0152	0.0235	0.0068	8	0.0013	0.0279	0.0120	0.1117	0.0381	6	0.00	0.01	0.01	0.02	0.01	6	0.01	0.02	0.02	0.05	0.01	7
Pool Length (ft)	4.5	11.0	11.0	20.5	5.5	8	7.2	22.5	23.0	38.7	8.5	8	5.2	15.4	12.4	42.8	11.7	8	10.9	15.8	14.7	25.6	4.4	9
Pool Spacing (ft)	11.7	25.6	26.0	50.7	10.9	9	7.7	34.4	29.5	72.6	18.9	9	7.6	28.4	25.3	58.7	14.9	9	15.2	28.9	27.4	49.1	11.6	8
Pool Max Depth (ft)	-	0.8	-	-	-	1	-	0.6	-	-	-	8	0.2	0.5	0.5	0.8	0.2	9	0.3	0.5	0.5	1.0	0.2	9
Pool Volume (ft³)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Substrate and Transport Parameters																								
Ri% / Ru% / P% / G% / S%	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SC% / Sa% / G% / B% / Be%	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
d16 / d35 / d50 / d84 / d95	0.3 / 9.5 / 13.6 / 29.2 / 56.0						- / - / - / - / 45						.5 / 4.3 / 10.1 / 29.5 / 101.1						0.3 / 1.0 / 1.6 / 3.9 / 15.4					
Reach Shear Stress (competency) lb/f²	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Max part size (mm) mobilized at bankfull (Rosgen Curve)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Stream Power (transport capacity) W/m²	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Additional Reach Parameters																								
Drainage Area (SM)	2.73	-	-	3.35	-	-	2.73	-	-	3.35	-	-	2.73	-	-	3.35	-	-	2.73	-	-	3.35	-	-
Impervious cover estimate (%)	-	<5%	-	-	-	-	-	<5%	-	-	-	-	-	<5%	-	-	-	-	-	<5%	-	-	-	-
Rosgen Classification	-	C	-	-	-	-	-	C	-	-	-	-	-	C	-	-	-	-	-	E	-	-	-	-
BF Velocity (fps)	-	2.92	-	-	-	-	-	2.92	-	-	-	-	-	2.92	-	-	-	-	-	2.92	-	-	-	-
BF Discharge (cfs)	-	6.4	-	-	-	-	-	6.4	-	-	-	-	-	6.4	-	-	-	-	-	6.4	-	-	-	-
Valley Length	-	248.0	-	-	-	-	-	248.0	-	-	-	-	-	248.0	-	-	-	-	-	248.0	-	-	-	-
Channel length (ft)[2]	-	310	-	-	-	-	-	310	-	-	-	-	-	310	-	-	-	-	-	310	-	-	-	-
Sinuosity	-	1.2	-	-	-	-	-	1.2	-	-	-	-	-	1.2	-	-	-	-	-	1.2	-	-	-	-
Water Surface Slope (Channel) (ft/ft)	-	0.0241	-	-	-	-	-	0.0241	-	-	-	-	-	0.0241	-	-	-	-	-	0.0241	-	-	-	-
BF slope (ft/ft)	-	0.0203	-	-	-	-	-	0.0203	-	-	-	-	-	0.0203	-	-	-	-	-	0.0203	-	-	-	-
Bankfull Floodplain Area (acres)	-	5.2	-	-	-	-	-	5.2	-	-	-	-	-	5.2	-	-	-	-	-	5.2	-	-	-	-
BEHI VL% / L% / M% / H% / VH% / E%	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Channel Stability or Habitat Metric	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Biological or Other	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

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UT3

Parameter	USGS Gauge	Regional Curve Interval [1,2]			Pre-Existing Condition[1]						Reference Reach Data Morgan Creek					
Dimension and Substrate - Riffle		NC Mtn.	NC Pied.	Rural	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n
BF Width (ft)	-	9.8	5.5	-	3.7	-	-	5.3	-	2	0.1	-	-	0.1	-	-
Floodprone Width (ft)	-	-	-	-	7.7	-	-	48.0	-	-	15.0	-	-	19.0	-	-
BF Mean Depth (ft)	-	0.6	0.8	-	1.05	-	-	1.57	-	-	0.70	-	-	0.90	-	-
BF Max Depth (ft)	-	-	-	-	1.7	-	-	2.0	-	-	1.0	-	-	1.4	-	-
BF Cross-sectional Area (ft²)	-	6.4	6.3	-	5.56	-	-	5.93	-	-	5.5	-	-	6.5	-	-
Width/Depth Ratio	-	-	-	-	2.4	-	-	5	-	-	7.3	-	-	11.7	-	-
Entrenchment Ratio	-	-	-	-	2.1	-	-	9.1	-	-	1.9	-	-	3.0	-	-
Bank Height Ratio	-	-	-	-	1.0	-	-	2.4	-	-	-	-	-	-	-	-
d50 (mm)	-	-	-	-	-	16.0	-	-	-	-	-	-	-	-	-	-
Pattern																
Channel Beltwidth (ft)	-	-	-	-	44.0	-	-	94.0	-	-	-	-	-	-	-	-
Radius of Curvature (ft)	-	-	-	-	11.0	-	-	30.0	-	-	-	-	-	-	-	-
Rc:Bankfull width (ft/ft)	-	-	-	-	2.5	-	-	6.7	-	-	-	-	-	-	-	-
Meander Wavelength (ft)	-	-	-	-	49.0	-	-	72.0	-	-	45.0	-	-	75.0	-	-
Meander Width Ratio	-	-	-	-	10.9	-	-	12.8	-	-	6.4	-	-	10.5	-	-
Profile																
Riffle Length (ft)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Riffle Slope (ft/ft)	-	-	-	-	0.005	-	-	0.031	-	-	0.013	-	-	0.054	-	-
Pool Length (ft)	-	-	-	-	25.0	-	-	65.0	-	-	17.4	-	-	26	-	-
Pool Spacing (ft)	-	-	-	-	40.0	-	-	140.0	-	-	39.9	-	-	62.3	-	-
Pool Max Depth (ft)	-	-	-	-	1.8	-	-	1.8	-		1.8	-	-	1.8	-	-
Pool Volume (ft³)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Substrate and Transport Parameters																
Ri% / Ru% / P% / G% / S%	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SC% / Sa% / G% / B% / Be%	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
d16 / d35 / d50 / d84 / d95	-	-	-	-	1.0 / 8.4 / 17 / 43 / 57						- / 1.2 / 3.0 / 77 / 800					
Reach Shear Stress (competency) lb/f²	-	-	-	-	0.55	-	-	0.8	-	-	-	-	-	-	-	-
Max part size (mm) mobilized at bankfull (Rosgen Curve)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Stream Power (transport capacity) W/m²	-	-	-	-	25.0	-	-	45.0	-	-	6.5	-	-	28.5	-	-
Additional Reach Parameters																
Drainage Area (SM)	-	0.17			0.14	-	-	0.17	-	-	-	0.12	-	-	-	-
Impervious cover estimate (%)	-	-	-	-	-	<5%	-	-	-	-	-	-	-	-	-	-
Rosgen Classification	-	-	-	-	-	E	-	-	-	-	-	E/Bc	-	-	-	-
BF Velocity (fps)	-	-	-	-	3.9	-	-	4.9	-	-	2.1	-	3.4	-	-	-
BF Discharge (cfs)	-	26.0	24.0	-	20	-	-	25	-	-	-	15	-	-	-	-
Valley Length	-	-	-	-	-	1002	-	-	-	-	-	-	-	-	-	-
Channel length (ft)[2]	-	-	-	-	-	1210	-	-	-	-	-	135	-	-	-	-
Sinuosity	-	-	-	-	-	1.21	-	-	-	-	-	1.05	-	-	-	-
Water Surface Slope (Channel) (ft/ft)	-	-	-	-	-	0.015	-	-	-	-	-	0.020	-	-	-	-
BF slope (ft/ft)	-	-	-	-	-	0.012	-	-	-	-	-	-	-	-	-	-
Bankfull Floodplain Area (acres)	-	-	-	-	-	0.2	-	-	-	-	-	-	-	-	-	-
BEHI VL% / L% / M% / H% / VH% / E%	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Channel Stability or Habitat Metric	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Biological or Other	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Parameter	Design						As-built						MY1					
Dimension and Substrate - Riffle	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n
BF Width (ft)	-	8.0	-	-	-	-	8.1	8.8	8.2	10.1	0.91	3	7.0	7.9	7.8	8.8	0.76	3
Floodprone Width (ft)	-	-	-	-	-	-		>150	-	-	-	-	-	>150	-	-	-	-
BF Mean Depth (ft)	-	0.8	-	-	-	-	0.7	0.8	0.8	0.9	0.10	3	0.6	0.7	0.7	0.7	0.05	3
BF Max Depth (ft)	1.0	-	-	1.1	-	-	1.1	1.2	1.1	1.4	0.13	3	0.9	1.0	1.1	1.1	0.06	3
BF Cross-sectional Area (ft²)	-	6.0	-	-	-	-	6.3	6.7	6.5	7.3	0.43	3	4.8	5.3	5.3	5.8	0.41	3
Width/Depth Ratio	-	8.9	-	-	-	-	9.1	11.6	10.3	15.5	2.75	3	10.2	11.8	10.6	14.5	1.97	3
Entrenchment Ratio	-	-	-	-	-	-	5.4	7.8	8.5	9.4	1.71	3	6.1	7.7	7.0	9.9	1.62	3
Bank Height Ratio	1.0	-	-	1.0	-	-	1.0	1.1	1.1	1.2	0.08	3	1.1	1.2	1.2	1.3	0.08	3
d50 (mm)	-	-	-	-	-	-	-	31.2	-	-	-	-	-	20.4	-	-	-	-
Pattern																		
Channel Beltwidth (ft)	25.0	-	-	56.0	-	-	36.4	47.0	48.4	57.7	7.21	7	36.4	47.0	48.4	57.7	7.21	7
Radius of Curvature (ft)	13.0	-	-	21.0	-	-	14.0	18.8	19.4	25.1	3.72	7	14.0	18.8	19.4	25.1	3.72	7
Rc:Bankfull width (ft/ft)	1.8	-	-	3.0	-	-	1.6	2.1	2.2	2.9	0.42	7	1.6	2.1	2.2	2.9	0.42	7
Meander Wavelength (ft)	49.0	-	-	84.0	-	-	63.5	74.9	71.7	94.2	10.30	7	63.5	74.9	71.7	94.2	10.30	7
Meander Width Ratio	7.0	-	-	12.0	-	-	7.2	8.5	8.1	10.7	1.17	7	7.2	8.5	8.1	10.7	1.17	7
Profile																		
Riffle Length (ft)	-	-	-	-	-	-	13.1	21.1	20.6	28.2	4.50	11	10.8	24.3	21.0	65.2	12.20	15
Riffle Slope (ft/ft)	0.016	-	-	0.022	-	-	0.004	0.016	0.017	0.025	0.01	11	0.007	0.022	0.019	0.038	0.010	15
Pool Length (ft)	20.0	-	-	40.0	-	-	18.4	26.4	25.8	33.5	5.00	11	15.0	25.6	26.1	39.9	7.30	17
Pool Spacing (ft)	18.0	-	-	42.0	-	-	36.3	49.0	47.7	60.7	7.30	15	32.7	52.2	48.6	95.3	13.6	17
Pool Max Depth (ft)	1.6	-	-	2.8	-	-	1.7	2.0	2.0	2.2	0.21	2	1.6	1.7	1.7	1.9	0.15	2.0
Pool Volume (ft³)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Substrate and Transport Parameters																		
Ri% / Ru% / P% / G% / S%	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SC% / Sa% / G% / B% / Be%	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
d16 / d35 / d50 / d84 / d95	-						12.2 / 17.6 / 31.2 / 57.0 / 78.3						0.3 / 12.2 / 20.4 / 60.5 / 86.7					
Reach Shear Stress (competency) lb/f²	-	0.6	-	-	-	-	0.2	-	-	0.6	-	-	-	-	-	-	-	-
Max part size (mm) mobilized at bankfull (Rosgen Curve)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Stream Power (transport capacity) W/m²	-	37.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Additional Reach Parameters																		
Drainage Area (SM)	0.14	-	-	0.17	-	-	0.14	-	-	0.17	-	-	0.14	-	-	0.17	-	-
Impervious cover estimate (%)	-	<5%	-	-	-	-	-	<5%	-	-	-	-	-	<5%	-	-	-	-
Rosgen Classification	-	E	-	-	-	-	-	E	-	-	-	-	-	E	-	-	-	-
BF Velocity (fps)	-	3.3	-	-	-	-	-	3.43	-	-	-	-	-	3.17	-	-	-	-
BF Discharge (cfs)	-	21.7	-	-	-	-	-	23	-	-	-	-	-	16.8	-	-	-	-
Valley Length	-	1015	-	-	-	-	-	1015	-	-	-	-	-	1015	-	-	-	-
Channel length (ft)[2]	-	1332	-	-	-	-	-	1348	-	-	-	-	-	1348	-	-	-	-
Sinuosity	-	1.31	-	-	-	-	-	1.33	-	-	-	-	-	1.33	-	-	-	-
Water Surface Slope (Channel) (ft/ft)	-	0.013	-	-	-	-	-	0.013	-	-	-	-	-	0.0128	-	-	-	-
BF slope (ft/ft)	-	0.013	-	-	-	-	-	0.013	-	-	-	-	-	0.013	-	-	-	-
Bankfull Floodplain Area (acres)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BEHI VL% / L% / M% / H% / VH% / E%	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Channel Stability or Habitat Metric	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Biological or Other	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Parameter	MY2						MY3						MY4						MY5					
Dimension and Substrate - Riffle	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n
BF Width (ft)	7.2	8.1	7.8	9.2	0.85	3	7.3	8.1	7.6	9.3	0.87	3	7.3	7.9	7.8	8.5	0.48	3	6.9	7.5	7.6	8.1	0.52	3
Floodprone Width (ft)	-	>150	-	-	-	3	-	>150	-	-	-	3	-	>150	-	-	-	3	-	>150	-	-	-	3
BF Mean Depth (ft)	0.5	0.7	0.7	0.7	0.11	3	0.5	0.6	0.6	0.7	0.09	3	0.4	0.5	0.5	0.7	0.10	3	0.4	0.5	0.5	0.5	0.04	3
BF Max Depth (ft)	1.1	1.1	1.1	1.1	0.03	3	0.9	1.0	1.1	1.1	0.11	3	0.9	1.0	1.1	1.1	0.09	3	0.8	1.0	1.0	1.1	0.11	3
BF Cross-sectional Area (ft²)	4.7	5.3	5.3	5.8	0.45	3	4.4	4.8	4.6	5.3	0.37	3	3.6	4.1	3.7	4.9	0.56	3	3.2	3.6	3.5	4.2	0.41	3
Width/Depth Ratio	9.7	12.8	10.6	18.1	3.75	3	10.1	13.9	13.1	18.6	3.49	3	11.1	15.8	16.9	19.3	3.44	3	13.5	15.6	15.7	17.6	1.68	3
Entrenchment Ratio	5.9	7.5	7.0	9.6	1.55	3	5.8	7.4	6.9	9.4	1.50	3	6.3	7.5	6.8	9.4	1.32	3	7.0	7.8	7.9	8.4	0.58	3
Bank Height Ratio	1.0	1.1	1.1	1.3	0.12	3	1.1	1.1	1.2	1.2	0.05	3	0.9	0.9	1.0	1.0	0.05	3	0.9	0.9	1.0	1.0	0.05	3
d50 (mm)	-	16.4	-	-	-	-	-	0.3	-	-	-	-	-	39.8	-	-	-	-	-	1.0	-	-	-	-
Pattern																								
Channel Beltwidth (ft)	36.4	47.0	48.4	57.7	7.21	7	36.4	47.0	48.4	57.7	7.21	7	36.4	47.0	48.4	57.7	7.21	7	36.4	47.0	48.4	57.7	7.21	7
Radius of Curvature (ft)	14.0	18.8	19.4	25.1	3.72	7	14.0	18.8	19.4	25.1	3.72	7	14.0	18.8	19.4	25.1	3.72	7	14.0	18.8	19.4	25.1	3.72	7
Rc:Bankfull width (ft/ft)	1.6	2.1	2.2	2.9	0.42	7	1.6	2.1	2.2	2.9	0.42	7	1.6	2.1	2.2	2.9	0.42	7	1.6	2.1	2.2	2.9	0.42	7
Meander Wavelength (ft)	63.5	74.9	71.7	94.2	10.30	7	63.5	74.9	71.7	94.2	10.30	7	63.5	74.9	71.7	94.2	10.30	7	63.5	74.9	71.7	94.2	10.30	7
Meander Width Ratio	7.2	8.5	8.1	10.7	1.17	7	7.2	8.5	8.1	10.7	1.17	7	7.2	8.5	8.1	10.7	1.17	7	7.2	8.5	8.1	10.7	1.17	7
Profile																								
Riffle Length (ft)	11.4	27.2	26.7	64.5	11.8	18	10.3	25.9	21.6	58.5	11.6	17	8.8	21.5	22.0	40.5	10.6	17	8.4	25.4	24.2	53.9	11.1	15
Riffle Slope (ft/ft)	0.007	0.021	0.017	0.070	0.014	18	0.000	0.016	0.013	0.051	0.014	17	0.005	0.020	0.018	0.055	0.015	17	0.002	0.018	0.013	0.074	0.018	15
Pool Length (ft)	13.5	22.8	23.5	34.4	6.2	17	7.6	28.5	28.8	60.5	13.9	17	7.4	22.1	19.4	44.5	9.1	17	12.6	26.3	23.0	56.9	10.8	15
Pool Spacing (ft)	22.6	50.0	48.5	94.5	15.0	17	33.6	50.3	48.1	86.2	13.2	17	18.8	48.0	39.9	117.5	23.8	17	32.0	52.6	52.3	84.5	14.9	14
Pool Max Depth (ft)	1.2	1.4	1.4	1.7	0.27	2	0.3	0.9	0.8	1.6	0.40	17	0.4	0.6	0.6	0.8	0.1	17	0.4	0.9	0.8	1.6	11.1	15
Pool Volume (ft³)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Substrate and Transport Parameters																								
Ri% / Ru% / P% / G% / S%	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SC% / Sa% / G% / B% / Be%	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
d16 / d35 / d50 / d84 / d95	0.4 / 11.5 / 16.4 / 61.1 / 84.2						0.14 / .25 / .34 / 45.52 / 73.35						12.86 / 20.39 / 39.84 / 67.76 / 136.57						0.4 / 0.7 / 1.0 / 3.2 / 22.2					
Reach Shear Stress (competency) lb/f²	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Max part size (mm) mobilized at bankfull (Rosgen Curve)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Stream Power (transport capacity) W/m²	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Additional Reach Parameters																								
Drainage Area (SM)	0.14	-	-	0.17	-	-	0.14	-	-	0.17	-	-	0.14	-	-	0.17	-	-	0.14	-	-	0.17	-	-
Impervious cover estimate (%)	-	<5%	-	-	-	-	-	<5%	-	-	-	-	-	<5%	-	-	-	-	-	<5%	-	-	-	-
Rosgen Classification	-	E	-	-	-	-	-	E	-	-	-	-	-	E	-	-	-	-	-	E	-	-	-	-
BF Velocity (fps)	-	3.17	-	-	-	-	-	3.17	-	-	-	-	-	3.17	-	-	-	-	-	3.17	-	-	-	-
BF Discharge (cfs)	-	16.8	-	-	-	-	-	16.8	-	-	-	-	-	16.8	-	-	-	-	-	16.8	-	-	-	-
Valley Length	-	1015	-	-	-	-	-	1015	-	-	-	-	-	1015	-	-	-	-	-	1015	-	-	-	-
Channel length (ft)[2]	-	1348	-	-	-	-	-	1348	-	-	-	-	-	1348	-	-	-	-	-	1348	-	-	-	-
Sinuosity	-	1.33	-	-	-	-	-	1.33	-	-	-	-	-	1.33	-	-	-	-	-	1.33	-	-	-	-
Water Surface Slope (Channel) (ft/ft)	-	0.0128	-	-	-	-	-	0.0128	-	-	-	-	-	0.0128	-	-	-	-	-	0.0128	-	-	-	-
BF slope (ft/ft)	-	0.013	-	-	-	-	-	0.013	-	-	-	-	-	0.013	-	-	-	-	-	0.013	-	-	-	-
Bankfull Floodplain Area (acres)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BEHI VL% / L% / M% / H% / VH% / E%	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Channel Stability or Habitat Metric	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Biological or Other	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

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2. Harman, W.A., D.E Wise, M.A. Walker, R. Morris, MA Cantrell, M. Clemmons, G.D. Jennings, D.R. Clinton, J.M. Patterson. 2000. Bankfull Regional Curves for North Carolina Mountain Streams. In: AWRA Conference Proceedings, D.L. Kane, editor. American Water Resources Specialty Conference on Water Resources in Extreme Environments. Anchorage, Alaska.

~~Table 11. Morphology and Hydraulic Monitoring Summary~~

Upper Silver Creek Restoration Project: DMS Project ID No. 94645

Silver Creek (3,016 LF)																										
	Cross-section X-1, Station 2724.3 (Riffle)							Cross-section X-2, Station 2636.7 (Pool)							Cross-section X-3, Station 1898.2 (Pool)							Cross-section X-4, Station 1793.8 (Riffle)						
Dimension and substrate	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4*	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4*	MY5	MY+
Based on fixed baseline bankfull elevation																												
BF Width (ft)	29.06	24.58	24.91	24.91	20.28	19.64		35.67	29.50	34.01	34.54	16.88	16.19		43.45	39.50	42.01	39.84	38.31	37.53		23.81	23.50	23.52	24.00	26.14	23.87	
BF Mean Depth (ft)	1.69	1.76	1.81	1.68	1.89	1.90		1.63	1.76	1.46	1.51	2.77	3.30		1.72	1.45	1.19	1.17	1.14	1.08		2.01	1.89	1.75	1.75	1.57	1.61	
Width/Depth Ratio	17.16	13.90	13.77	14.83	10.73	10.34		21.82	16.76	23.30	22.87	6.09	4.91		25.20	27.30	35.15	34.05	33.61	34.75		11.82	12.44	13.46	13.71	16.65	14.83	
BF Cross-sectional Area (ft²)	49.20	43.40	45.00	41.90	38.27	37.37		58.30	51.90	49.60	52.03	46.75	53.39		74.90	57.30	50.20	46.81	43.51	40.54		48.00	44.20	41.10	41.90	40.97	38.42	
BF Max Depth (ft)	3.04	2.92	3.24	3.11	3.39	3.30		3.98	3.92	4.32	4.48	5.24	5.86		5.16	4.00	3.95	3.81	3.61	3.76		3.34	3.22	3.08	3.13	3.17	3.26	
Width of Floodprone Area (ft)	>300	>300	>300	>300	>300	>300		>300	>300	>300	>300	>300	>300		>300	>300	>300	>300	>300	>300		>300	>300	>300	>300	>300	>300	
Entrenchment Ratio	3.30	3.90	3.80	3.85	4.87	4.88		2.50	3.00	2.60	2.55	5.23	5.45		2.10	2.30	2.20	2.27	2.36	2.41		3.70	3.70	3.70	3.63	3.34	3.66	
Bank Height Ratio	1.10	1.00	1.10	1.06	1.00	0.85		1.00	1.00	1.00	1.00	0.97	1.01		0.70	0.70	0.90	1.07	0.93	1.00		1.00	1.00	1.00	1.02	0.96	0.93	
Wetted Perimeter (ft)	32.44	28.10	28.53	28.27	22.63	23.44		38.93	33.02	36.93	37.56	37.84	22.79		46.89	42.40	44.39	42.18	40.59	39.69		27.83	27.28	27.02	27.50	29.28	27.09	
Hydraulic Radius (ft)	1.52	1.54	1.58	1.48	1.69	1.59		1.50	1.57	1.34	1.39	1.24	2.34		1.60	1.35	1.13	1.11	1.07	1.02		1.72	1.62	1.52	1.52	1.05	1.42	
Fixed baseline bankfull elevation	1197.40	1197.40	1197.40	1197.38	1197.38	1197.38		1198.20	1198.20	1198.20	1198.20	1198.20	1198.20		1202.34	1202.34	1202.34	1202.34	1202.34	1202.34		1203.00	1203.00	1203.01	1203.01	1203.01	1203.01	
Based on current/developing bankfull feature								*MY4 data has been corrected with this report.														*MY4 data has been corrected with this report.						
BF Width (ft)	29.06	26.22	26.20	-	-	-		35.67	29.50	35.29	-	-	-		43.45	42.55	42.01	-	-	-		23.81	23.50	23.52	-	-	-	
BF Mean Depth (ft)	1.69	1.72	1.82	-	-	-		1.63	1.76	1.50	-	-	-		1.72	1.45	1.19	-	-	-		2.01	1.89	1.75	-	-	-	
Width/Depth Ratio	17.16	15.23	14.40	-	-	-		21.82	16.76	23.50	-	-	-		25.20	29.31	35.15	-	-	-		11.82	12.44	13.46	-	-	-	
BF Cross-sectional Area (ft²)	49.20	45.10	47.60	-	-	-		58.30	51.90	53.09	-	-	-		74.90	61.80	50.20	-	-	-		48.00	44.20	41.10	-	-	-	
BF Max Depth (ft)	3.04	2.99	3.34	-	-	-		3.98	3.92	4.42	-	-	-		5.16	4.15	3.95	-	-	-		3.34	3.22	3.08	-	-	-	
Width of Floodprone Area (ft)	>300	>300	>300	-	-	-		>300	>300	>300	-	-	-		>300	>300	>300	-	-	-		>300	87.26	>300	-	-	-	
Entrenchment Ratio	3.30	3.70	>3.70	-	-	-		2.50	3.00	>2.50	-	-	-		2.10	2.10	2.20	-	-	-		3.70	3.70	3.70	-	-	-	
Bank Height Ratio	1.10	1.00	1.00	-	-	-		1.00	1.00	1.00	-	-	-		0.70	0.70	0.90	-	-	-		1.00	1.00	1.00	-	-	-	
Wetted Perimeter (ft)	32.44	29.66	29.84	-	-	-		38.93	33.02	38.29	-	-	-		46.89	45.45	44.39	-	-	-		27.83	27.28	27.02	-	-	-	
Hydraulic Radius (ft)	1.52	1.52	1.60	-	-	-		1.50	1.57	1.39	-	-	-		1.60	1.36	1.13	-	-	-		1.72	1.62	1.52	-	-	-	
Cross Sectional Area between end pins (ft²)	-	-	-	-	-	-		-	-	-	-	-	-		-	-	-	-	-	-		-	-	-	-	-	-	
d50 (mm)	-	-	-	-	-	-		-	-	-	-	-	-		-	-	-	-	-	-		36.60	41.30	25.10	27.80	28.00	27.28	

* Corrected from baseline report.

	Cross-section X-5, Station 1206.9 (Riffle)							Cross-section X-6, Station 357.2 (Pool)							Cross-section 7, Station 302.5 (Riffle)													
Dimension and substrate	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+
Based on fixed baseline bankfull elevation																												
BF Width (ft)	28.43	26.08	25.21	25.01	25.02	23.98		43.48	41.92	34.57	35.96	44.93	20.71		26.61	25.90	25.80	25.75	22.23	28.21								
BF Mean Depth (ft)	1.65	1.66	1.68	1.66	1.58	1.52		1.84	1.75	1.69	1.59	1.53	1.85		2.05	1.95	1.84	1.80	1.67	1.25								
Width/Depth Ratio	17.25	15.69	15.04	15.07	15.84	15.78		23.59	23.92	20.50	22.62	29.37	11.19		12.98	13.26	14.00	14.31	13.31	22.57								
BF Cross-sectional Area (ft²)	46.90	43.40	42.30	41.56	39.53	36.53		80.10	73.50	58.30	57.16	68.54	38.32		54.50	50.60	47.60	46.23	37.16	35.28								
BF Max Depth (ft)	2.91	2.81	2.80	2.77	2.75	2.72		5.25	4.98	3.78	4.63	3.75	3.79		3.30	3.15	2.95	3.20	3.04	2.97								
Width of Floodprone Area (ft)	>300	>300	>300	>300	>300	>300		>300	>300	>300	>300	>300	>300		>300	>300	>300	>300	>300	>300								
Entrenchment Ratio	3.10	3.30	3.50	3.48	3.49	3.64		1.60	1.60	2.00	1.89	1.51	3.27		4.80	4.90	4.90	4.93	5.71	4.50								
Bank Height Ratio	1.00	1.00	1.00	1.01	0.97	1.00		1.00	0.90	1.00	1.01	0.94	1.00		1.00	1.00	1.00	1.04	1.00	0.94								
Wetted Perimeter (ft)	31.73	29.40	28.57	28.33	26.42	27.02		47.16	45.42	37.95	39.14	48.74	24.41		30.71	29.80	29.48	29.35	24.01	30.71								
Hydraulic Radius (ft)	1.48	1.48	1.48	1.47	1.50	1.35		1.70	1.70	1.54	1.46	1.41	1.57		1.77	1.70	1.61	1.58	1.55	1.15								
Fixed baseline bankfull elevation	1208.80	1208.80	1208.80	1208.82	1204.82	1204.82		1208.14	1208.14	1208.14	1208.14	1208.14	1208.14		1208.23	1208.23	1208.23	1208.23	1208.23	1208.23								
Based on current/developing bankfull feature																												
BF Width (ft)	28.43	26.08	25.75	-	-	-		43.48	41.92	34.57	-	-	-		26.61	25.90	26.80	-	-	-								
BF Mean Depth (ft)	1.65	1.66	1.68	-	-	-		1.84	1.75	1.69	-	-	-		2.05	1.95	1.84	-	-	-								
Width/Depth Ratio	17.25	15.69	15.30	-	-	-		23.59	23.92	20.50	-	-	-		12.98	13.26	14.10	-	-	-								
BF Cross-sectional Area (ft²)	46.90	43.40	43.29	-	-	-		80.10	73.50	58.30	-	-	-		54.50	50.60	50.98	-	-	-								
BF Max Depth (ft)	2.91	2.81	2.84	-	-	-		5.25	4.98	3.78	-	-	-		3.30	3.15	3.08	-	-	-								
Width of Floodprone Area (ft)	>300	>300	>300	-	-	-		>300	>300	>300	-	-	-		>300	>300	>300	-	-	-								
Entrenchment Ratio	3.10	3.30	>3.40	-	-	-		1.60	1.60	2.00	-	-	-		4.80	4.90	>4.70	-	-	-								
Bank Height Ratio	1.00	1.00	1.00	-	-	-		1.00	0.90	1.00	-	-	-		1.00	1.00	1.00	-	-	-								
Wetted Perimeter (ft)	31.73	29.40	29.11	-	-	-		47.16	45.42	37.95	-	-	-		30.71	29.80	30.48	-	-	-								
Hydraulic Radius (ft)*	1.48	1.48	1.49	-	-	-		1.70	1.70	1.54	-	-	-		1.77	1.70	1.67	-	-	-								
Cross Sectional Area between end pins (ft²)	-	-	-	-	-	-		-	-	-	-	-	-		-	-	-	-	-	-								
d50 (mm)	-	-	-	-	-	-		-	-	-	-	-	-		33.40	15.20	16.00	23.20	18.00	19.74								

Note: Per DMS/IRT request, the bank height ratio for MY4 and MY 5 have been calculated using the as-built bankfull area. All other values were calculated using the as-built bankfull elevation, as was done for previous monitoring reports.

Table 11. Morphology and Hydraulic Monitoring Summary

Upper Silver Creek Restoration Project: DMS Project ID No. 94645

UT1 (495 LF)																													
	Cross-section X-13, Station 1+57 (Riffle)							Cross-section X-14, Station 3+28 (Pool)																					
Dimension and substrate	Base	MY1	MY2	MY3	MY4*	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+
Based on fixed baseline bankfull elevation																													
BF Width (ft)	9.59	9.28	9.20	9.02	9.31	8.47		9.32	8.59	6.59	6.43	5.46	5.89																
BF Mean Depth (ft)	0.93	0.75	0.76	0.77	0.62	0.59		1.98	1.27	1.36	1.09	0.72	0.76																
Width/Depth Ratio	10.33	12.32	12.15	11.71	15.02	14.36		4.71	6.75	4.84	5.90	7.58	7.75																
BF Cross-sectional Area (ft^2)	8.90	7.00	7.00	6.96	5.73	5.03		18.50	10.90	9.00	7.01	3.91	4.45																
BF Max Depth (ft)	1.30	1.13	1.09	1.11	1.19	1.22		3.70	2.48	2.59	1.76	1.58	1.45																
Width of Floodprone Area (ft)	>150	>150	>150	>150	>150	>150		>150	>150	>150	>150	>150	>150																
Entrenchment Ratio	5.30	5.40	5.50	5.59	5.41	5.95		8.70	9.40	12.30	12.59	14.83	13.45																
Bank Height Ratio	1.00	1.10	1.10	1.10	1.00	1.09		1.10	1.20	1.20	1.34	0.92	1.56																
Wetted Perimeter (ft)	11.45	10.78	10.72	10.56	12.13	9.65		13.28	11.13	9.31	8.61	6.69	7.41																
Hydraulic Radius (ft)	0.78	0.65	0.65	0.66	0.48	0.52		1.39	0.98	0.97	0.81	0.59	0.60																
Fixed baseline bankfull elevation	1203.99	1203.99	1203.99	1203.99	1203.99	1203.99		1201.60	1201.60	1201.60	1201.59	1201.59	1201.59																
Based on current/developing bankfull feature	*MY4 data has been corrected with this report.																												
BF Width (ft)	9.59	9.75	9.96	-	-	-		9.30	10.96	8.31	-	-	-																
BF Mean Depth (ft)	0.93	0.81	0.82	-	-	-		1.98	1.36	1.58	-	-	-																
Width/Depth Ratio	10.33	12.04	12.11	-	-	-		4.71	8.03	5.26	-	-	-																
BF Cross-sectional Area (ft^2)	8.90	7.90	8.20	-	-	-		18.50	15.00	13.10	-	-	-																
BF Max Depth (ft)	1.30	1.23	1.22	-	-	-		3.70	2.89	3.16	-	-	-																
Width of Floodprone Area (ft)	>150	>150	>150	-	-	-		>150	>150	>150	-	-	-																
Entrenchment Ratio	5.30	5.20	5.10	-	-	-		8.70	7.40	9.70	-	-	-																
Bank Height Ratio	1.00	1.00	1.00	-	-	-		1.10	1.00	1.00	-	-	-																
Wetted Perimeter (ft)	11.45	11.37	11.60	-	-	-		13.26	13.68	11.47	-	-	-																
Hydraulic Radius (ft)	0.78	0.69	0.71	-	-	-		1.40	1.10	1.14	-	-	-																
Cross Sectional Area between end pins (ft^2)	-	-	-	-	-	-		-	-	-	-	-	-																
d50 (mm)	38.80	43.60	32.90	26.90	37.10	11.60		-	-	-	-	-	-																

UT2 (310 LF)																													
	Cross-section X-15, Station 2+15 (Pool)							Cross-section X-16, Station 2+53 (Riffle)																					
Dimension and substrate	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+
Based on fixed baseline bankfull elevation																													
BF Width (ft)	7.33	6.42	5.55	5.46	5.01	2.73		6.60	5.82	4.68	5.11	5.55	2.48																
BF Mean Depth (ft)	0.83	0.46	0.45	0.37	0.23	0.22		0.41	0.37	0.32	0.27	0.31	0.41																
Width/Depth Ratio	8.88	13.87	12.28	14.76	21.78	12.41		15.99	15.71	14.47	18.93	17.90	6.05																
BF Cross-sectional Area (ft^2)	6.10	3.00	2.50	2.02	1.17	0.59		2.70	2.20	1.50	1.37	1.72	1.03																
BF Max Depth (ft)	1.66	0.84	0.69	0.69	0.37	0.38		0.91	0.77	0.63	0.66	0.80	0.66																
Width of Floodprone Area (ft)	>100	>100	>100	>100	>100	11.00		>100	>100	>100	>100	>100	>40																
Entrenchment Ratio	9.20	10.50	12.10	12.34	11.39	19.36		7.00	7.10	8.70	7.97	8.29	15.98																
Bank Height Ratio	1.10	1.20	1.40	1.30	0.92	1.94		1.20	1.00	1.20	1.23	0.97	0.70																
Wetted Perimeter (ft)	8.99	7.34	6.45	6.20	5.14	3.17		7.42	6.56	5.32	5.65	6.15	3.30																
Hydraulic Radius (ft)	0.68	0.41	0.39	0.33	0.23	0.19		0.36	0.34	0.28	0.24	0.28	0.31																
Fixed baseline bankfull elevation	1201.90	1201.90	1201.90	1201.91	1201.91	1201.91		1201.21	1201.21	1201.21	1201.21	1201.21	1201.21																
Based on current/developing bankfull feature																													
BF Width (ft)	7.33	8.35	6.43	-	-	-		6.60	5.82	5.46	-	-	-																
BF Mean Depth (ft)	0.83	0.46	0.52	-	-	-		0.41	0.37	0.38	-	-	-																
Width/Depth Ratio	8.88	13.87	12.33	-	-	-		15.99	15.71	14.50	-	-	-																
BF Cross-sectional Area (ft^2)	6.10	4.00	3.30	-	-	-		2.70	2.20	2.10	-	-	-																
BF Max Depth (ft)	1.66	0.98	0.83	-	-	-		0.91	0.77	0.74	-	-	-																
Width of Floodprone Area (ft)	>100	>100	>100	-	-	-		>100	>100	>100	-	-	-																
Entrenchment Ratio	9.20	8.10	10.50	-	-	-		7.00	7.10	8.10	-	-	-																
Bank Height Ratio	1.10	1.10	1.10	-	-	-		1.20	1.00	1.10	-	-	-																
Wetted Perimeter (ft)	8.99	9.27	7.47	-	-	-		7.42	6.56	6.22	-	-	-																
Hydraulic Radius (ft)	0.68	0.43	0.44	-	-	-		0.36	0.34	0.34	-	-	-																
Cross Sectional Area between end pins (ft^2)	-	-	-	-	-	-		-	-	-	-	-	-		-							-						
d50 (mm)	-	-	-	-	-	-		29.30	9.50	13.60	-	10.10	10.07		-							-						

Note: Per DMS/IRT request, the bank height ratio for MY4 and MY5 have been calculated using the as-built bankfull area. All other values were calculated using the as-built bankfull elevation, as was done for previous monitoring reports.

Table 11. Morphology and Hydraulic Monitoring Summary

Upper Silver Creek Restoration Project: DMS Project ID No. 94645

UT3 (1,348 LF)																										
	Cross-section X-8, Station 6+22 (Riffle)							Cross-section X-9, Station 8+12 (Pool)							Cross-section X-10, Station 8+33 (Riffle)							Cross-section X-11, Station 11+53 (Pool)						
Dimension and substrate	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+
Based on fixed baseline bankfull elevation																												
BF Width (ft)	10.05	8.81	9.22	9.28	8.50	6.87		10.73	9.50	9.36	10.57	6.54	6.87		8.1	6.95	7.19	7.29	7.34	8.14		13.03	11.53	11.35	11.35	11.51	10.00	
BF Mean Depth (ft)	0.65	0.61	0.51	0.50	0.44	0.51		1.02	0.82	0.46	0.50	0.37	0.57		0.8	0.68	0.74	0.72	0.66	0.52		1.01	0.85	0.61	0.63	0.53	0.47	
Width/Depth Ratio	15.46	14.53	18.05	18.56	19.32	13.47		10.53	11.64	20.37	21.14	17.68	5.89		10.3	10.16	9.70	10.13	11.12	15.65		12.80	13.65	18.73	18.02	21.72	21.28	
BF Cross-sectional Area (ft^2)	6.50	5.30	4.70	4.61	3.74	3.49		10.90	7.80	4.30	5.30	2.40	3.49		6.3	4.80	5.31	5.27	4.85	4.21		13.22	9.70	6.90	7.12	6.12	4.73	
BF Max Depth (ft)	1.13	1.05	1.13	1.10	1.06	1.09		1.74	1.59	1.16	1.47	1.14	1.09		1.1	0.94	1.08	1.09	1.10	1.02		2.17	1.88	1.70	1.65	1.56	1.48	
Width of Floodprone Area (ft)	>150	>150	>150	>150	>150	>150		>150	>150	>150	>150	>150	>150		>150	>150	>150	>150	>150	>150		>150	>150	>150	>150	>150	>150	
Entrenchment Ratio	5.40	6.10	5.90	5.83	6.32	7.87		5.80	6.60	6.70	5.93	9.59	18.49		8.5	9.90	9.60	9.42	9.35	8.44		5.60	6.30	6.40	6.43	6.34	7.29	
Bank Height Ratio	1.00	1.10	1.00	1.18	0.86	0.99		1.00	1.20	1.20	1.24	1.02	1.38		1.10	1.20	1.10	1.06	0.99	1.04		1.00	1.10	1.10	1.10	0.92	0.99	
Wetted Perimeter (ft)	11.35	10.03	10.24	10.28	9.09	7.89		12.77	11.14	10.28	11.57	7.73	8.01		9.6	8.31	8.67	8.73	7.85	9.18		15.05	13.23	12.57	12.61	12.48	10.94	
Hydraulic Radius (ft)	0.57	0.53	0.46	0.45	0.41	0.44		0.85	0.70	0.42	0.46	0.31	0.44		0.7	0.58	0.61	0.60	0.62	0.46		0.88	0.73	0.55	0.56	0.49	0.43	
Fixed baseline bankfull elevation	1215.38	1215.38	1215.38	1215.38	1215.38	1215.38		1212.81	1212.81	1212.81	1212.81	1212.81	1212.81		1212.89	1212.89	1212.89	1212.89	1212.89	1212.89		1209.27	1209.27	1209.27	1209.27	1209.27	1209.27	
Based on current/developing bankfull feature																												
BF Width (ft)	10.10	11.68	12.21	-	-	-		10.70	12.10	12.07	-	-	-		8.10	7.47	7.99	-	-	-		13.00	13.02	12.34	-	-	-	
BF Mean Depth (ft)	0.65	0.53	0.50	-	-	-		1.02	0.87	0.61	-	-	-		0.78	0.76	0.81	-	-	-		1.01	0.92	0.67	-	-	-	
Width/Depth Ratio	15.46	22.03	24.49	-	-	-		10.53	13.84	19.78	-	-	-		10.34	9.83	9.89	-	-	-		12.80	14.21	18.43	-	-	-	
BF Cross-sectional Area (ft^2)	6.50	6.20	6.10	-	-	-		10.90	10.60	7.40	-	-	-		6.30	5.70	6.40	-	-	-		13.22	11.90	8.30	-	-	-	
BF Max Depth (ft)	1.13	1.14	1.26	-	-	-		1.74	1.86	1.44	-	-	-		1.09	1.07	1.23	-	-	-		2.17	2.06	1.82	-	-	-	
Width of Floodprone Area (ft)	>150	>150	>150	-	-	-		>150	>150	>150	-	-	-		>150	>150	>150	-	-	-		>150	>150	>150	-	-	-	
Entrenchment Ratio	5.40	4.60	4.40	-	-	-		5.80	5.20	5.20	-	-	-		8.50	9.20	8.60	-	-	-		5.60	5.60	5.90	-	-	-	
Bank Height Ratio	1.00	1.00	1.00	-	-	-		1.00	1.00	1.00	-	-	-		1.10	1.10	1.00	-	-	-		1.00	1.00	1.00	-	-	-	
Wetted Perimeter (ft)	11.40	12.74	13.21	-	-	-		12.74	13.84	13.29	-	-	-		9.66	8.99	9.61	-	-	-		15.02	14.86	13.68	-	-	-	
Hydraulic Radius (ft)	0.57	0.49	0.46	-	-	-		0.86	0.77	0.56	-	-	-		0.65	0.63	0.67	-	-	-		0.88	0.80	0.61	-	-	-	
Cross Sectional Area between end pins (ft^2)	-	-	-	-	-	-		-	-	-	-	-	-		-	-	-	-	-	-		-	-	-	-	-	-	
d50 (mm)	31.20	20.40	16.40	0.34	39.84	1.02		-	-	-	-	-	-		-	-	-	-	-	-		-	-	-	-	-	-	

	Cross-section X-12, Station 11+84 (Riffle)																											
Dimension and substrate	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+
Based on fixed baseline bankfull elevation																												
BF Width (ft)	8.17	7.80	7.69	7.62	7.79	7.29																						
BF Mean Depth (ft)	0.90	0.74	0.66	0.58	0.46	0.44																						
Width/Depth Ratio	9.12	10.57	11.72	13.14	16.93	16.57																						
BF Cross-sectional Area (ft^2)	7.30	5.80	5.00	4.40	3.59	3.22																						
BF Max Depth (ft)	1.38	1.07	0.93	0.87	0.89	0.84																						
Width of Floodprone Area (ft)	>150	>150	>150	>150	>150	>150																						
Entrenchment Ratio	9.40	7.00	7.30	6.94	6.83	7.28																						
Bank Height Ratio	1.20	1.30	1.30	1.17	0.95	1.01																						
Wetted Perimeter (ft)	9.97	9.28	9.01	8.78	8.41	8.17																						
Hydraulic Radius (ft)	0.73	0.63	0.55	0.50	0.43	0.39																						
Fixed baseline bankfull elevation	1208.77	1208.77	1208.77	1208.77	1208.77	1208.77																						
Based on current/developing bankfull feature																												
BF Width (ft)	8.20	9.13	9.15	-	-	-																						
BF Mean Depth (ft)	0.90	0.87	0.82	-	-	-																						
Width/Depth Ratio	9.12	10.45	11.11	-	-	-																						
BF Cross-sectional Area (ft^2)	7.30	8.00	7.50	-	-	-																						
BF Max Depth (ft)	1.38	1.34	1.23	-	-	-																						
Width of Floodprone Area (ft)	>150	>150	>150	-	-	-																						
Entrenchment Ratio	9.40	8.50	8.50	-	-	-																						
Bank Height Ratio	1.20	1.00	1.00	-	-	-																						
Wetted Perimeter (ft)	10.00	10.87	10.79	-	-	-																						
Hydraulic Radius (ft)	0.73	0.74	0.70	-	-	-																						
Cross Sectional Area between end pins (ft^2)	-	-	-	-	-	-																						
d50 (mm)	-	-	-	-	-	-																						

Note: Per DMS/IRT request, the bank height ratio for MY4 and MY5 have been calculated using the as-built bankfull area. All other values were calculated using the as-built bankfull elevation, as was done for previous monitoring reports.

Appendix E

Wetland Assessment Data

Includes:

Figure 9. Observed Rainfall vs Historical Average

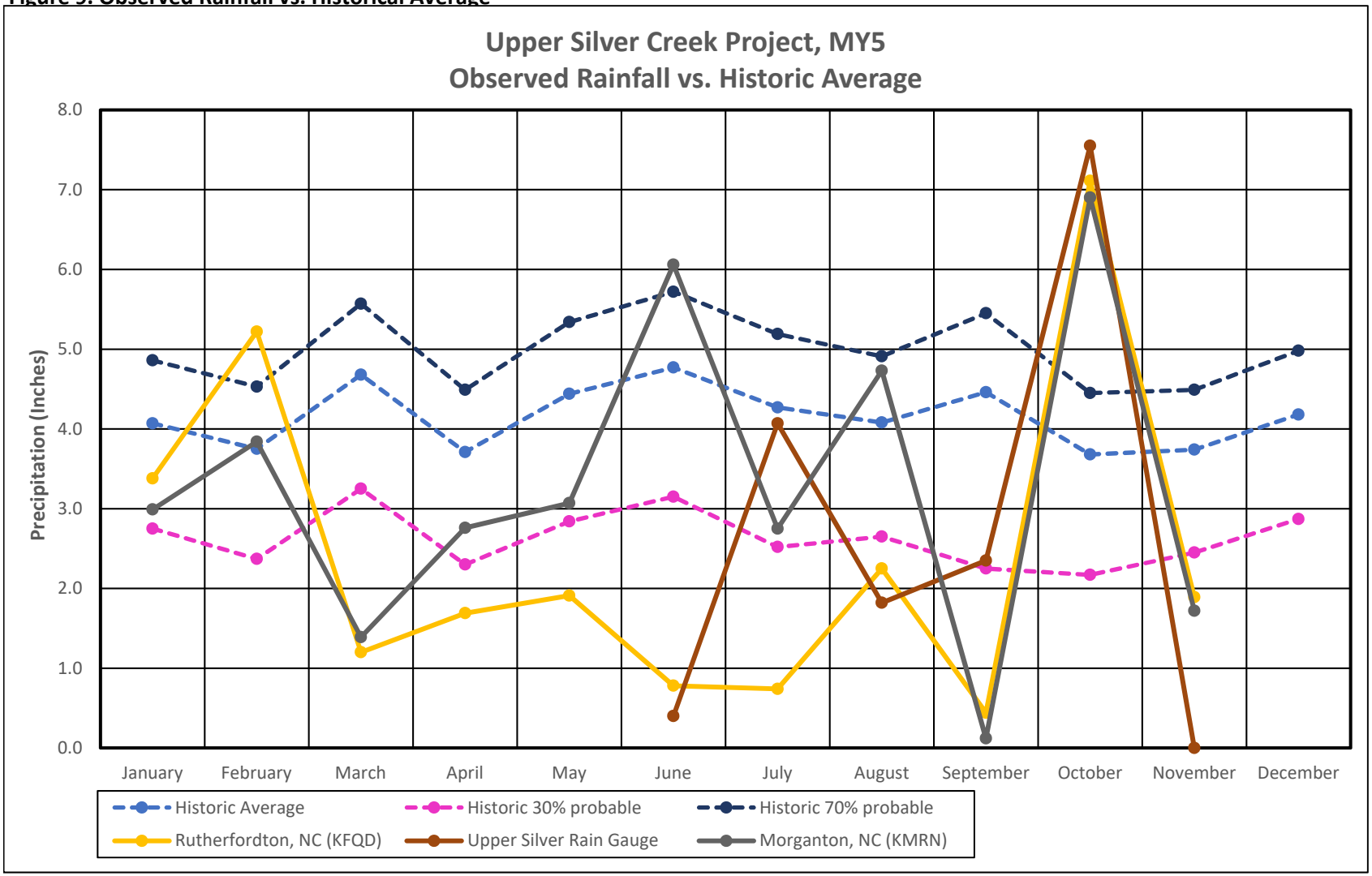
Figure 10. Wetland Gauge Graphs

Table 12. Wetland Gauge Attainment data

Table 12a. Wetland Restoration Area Well Success

Figure 11. Wetland Photo Log

Figure 9. Observed Rainfall vs. Historical Average



1. Upper Silver Rain Gauge malfunctioned and began recording on 6-10. KMRN gauge accounts for rainfall prior to June 10.
2. Historic rainfall data from Burke County Soil Survey, NRCS, pg. 420
3. Rainfall data source for Upper Silver Rain Gauge: Onsite HOBO tipping bucket rain gauge with Pendant Data Logger
4. Rainfall data source for Rutherfordton, NC: http://climate.ncsu.edu/cronos?station=KFQD&temporal=hourly
5. Rainfall data source for Morganton, NC: http://climate.ncsu.edu/cronos?station=KMRN&temporal=hourly
6. Rainfall data source for historic averages: Morganton, NC WETS Table (1971-2016)

Figure 10. Wetland gauge graphs, showing depth to groundwater and rainfall during MY5.

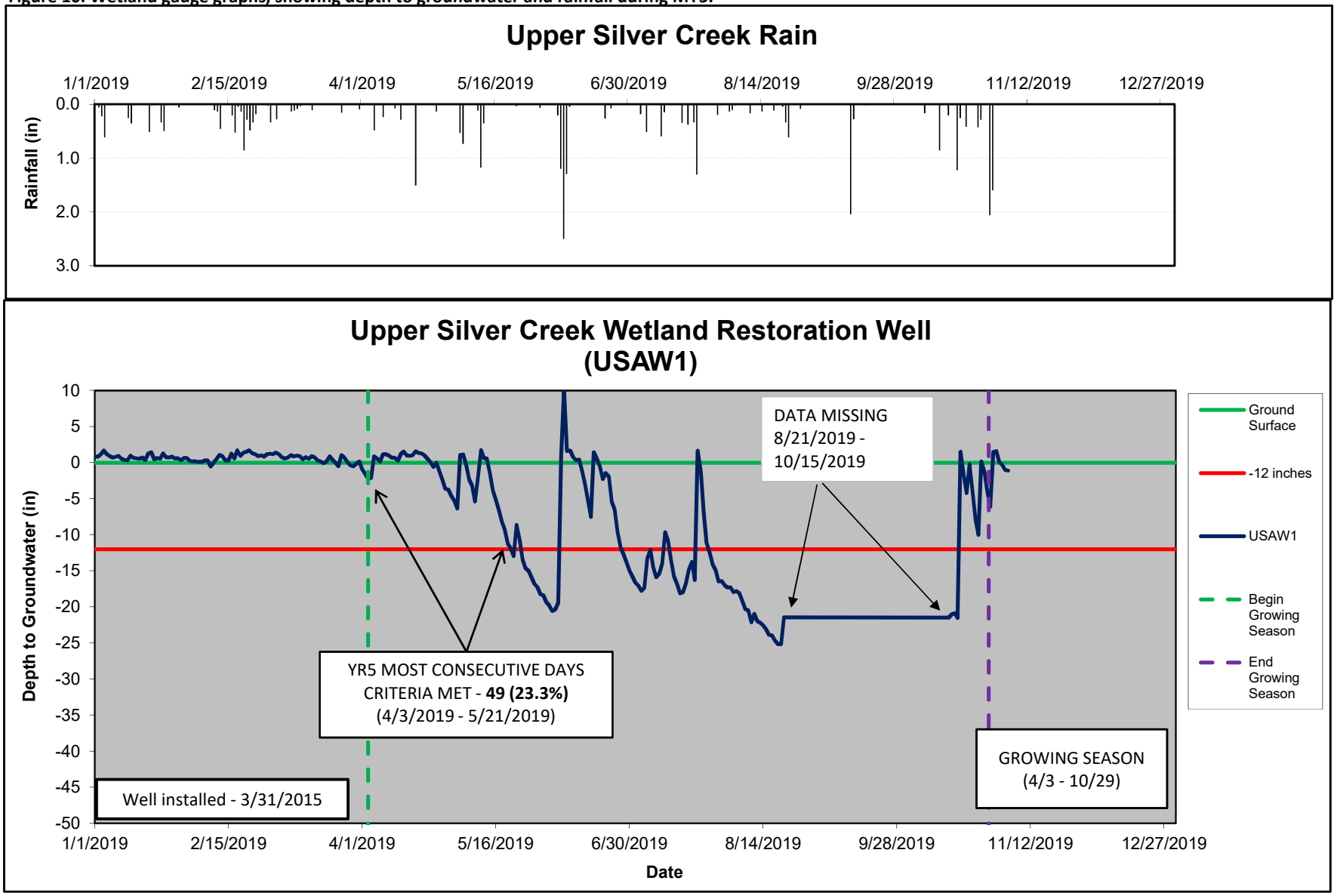


Figure 10. Wetland gauge graphs (continued)

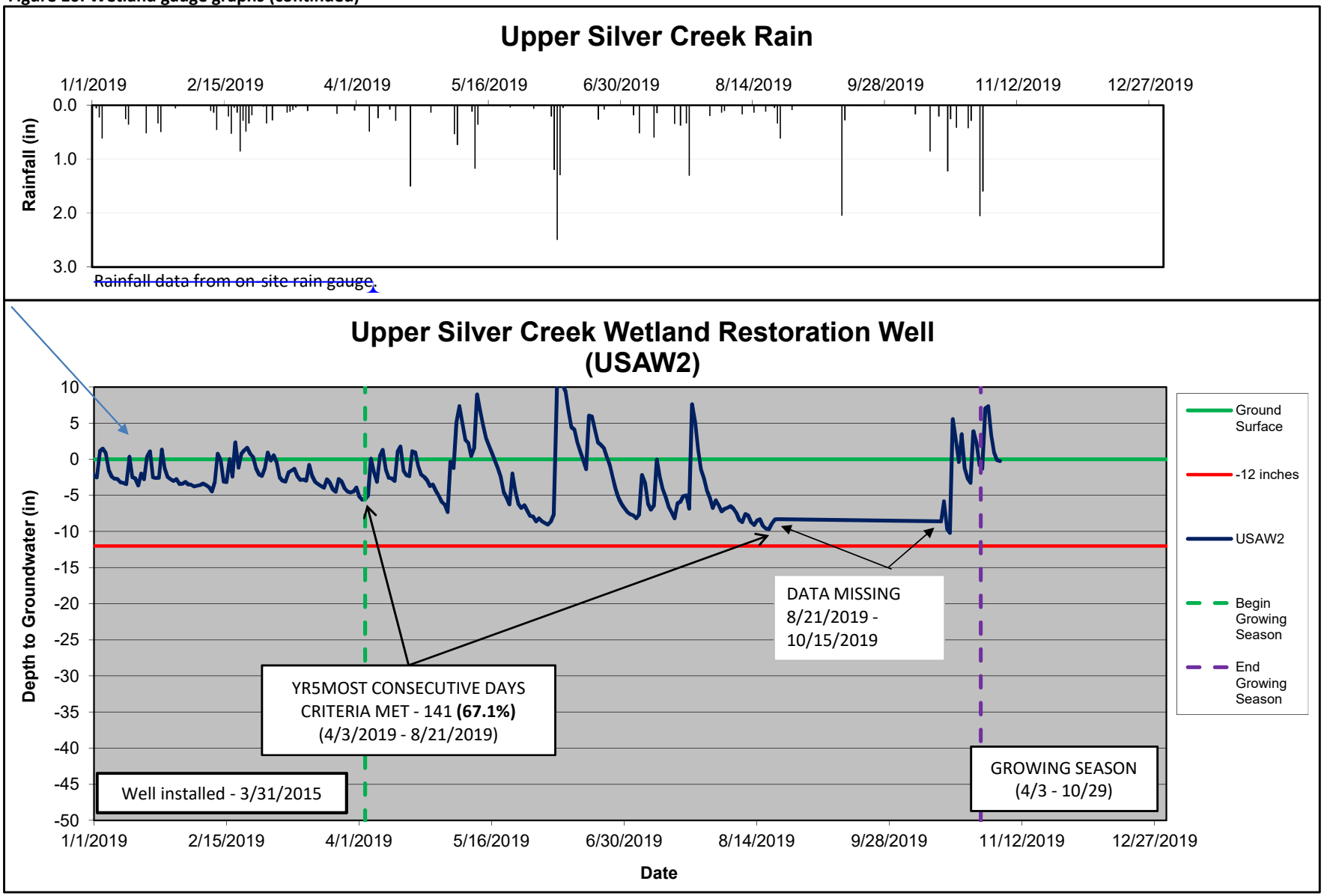


Figure 10. Wetland gauge graphs (continued)

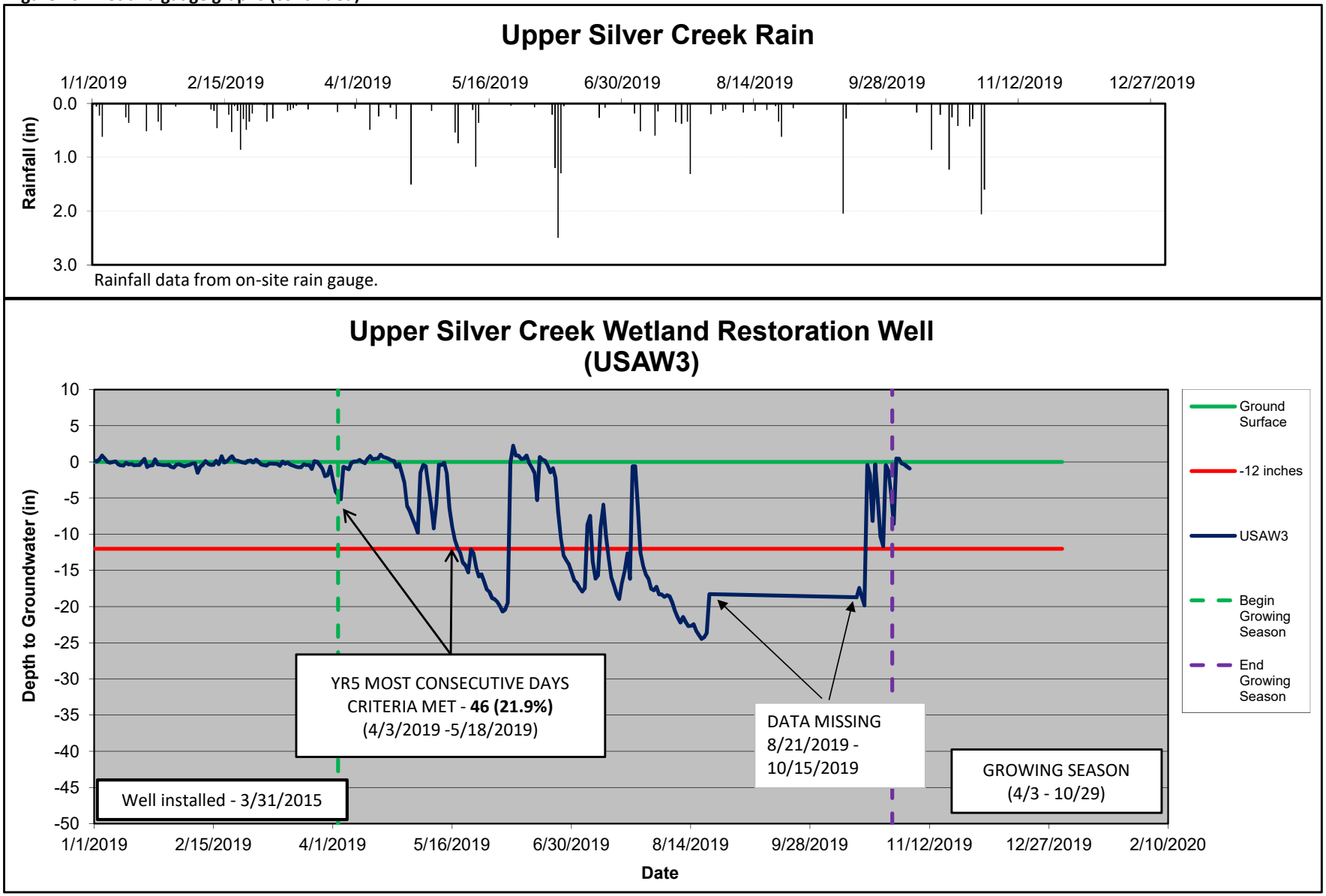
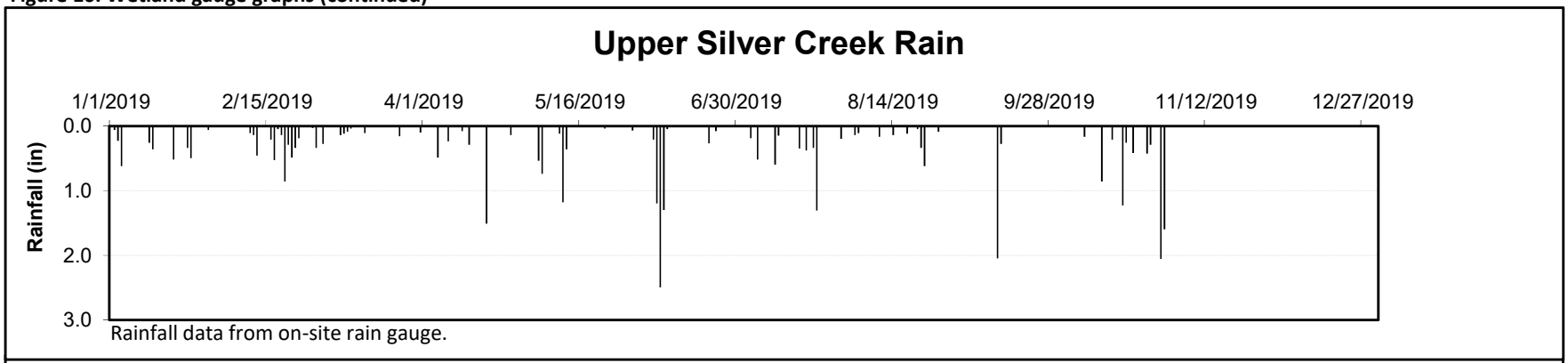


Figure 10. Wetland gauge graphs (continued)



Rainfall data from on-site rain gauge.

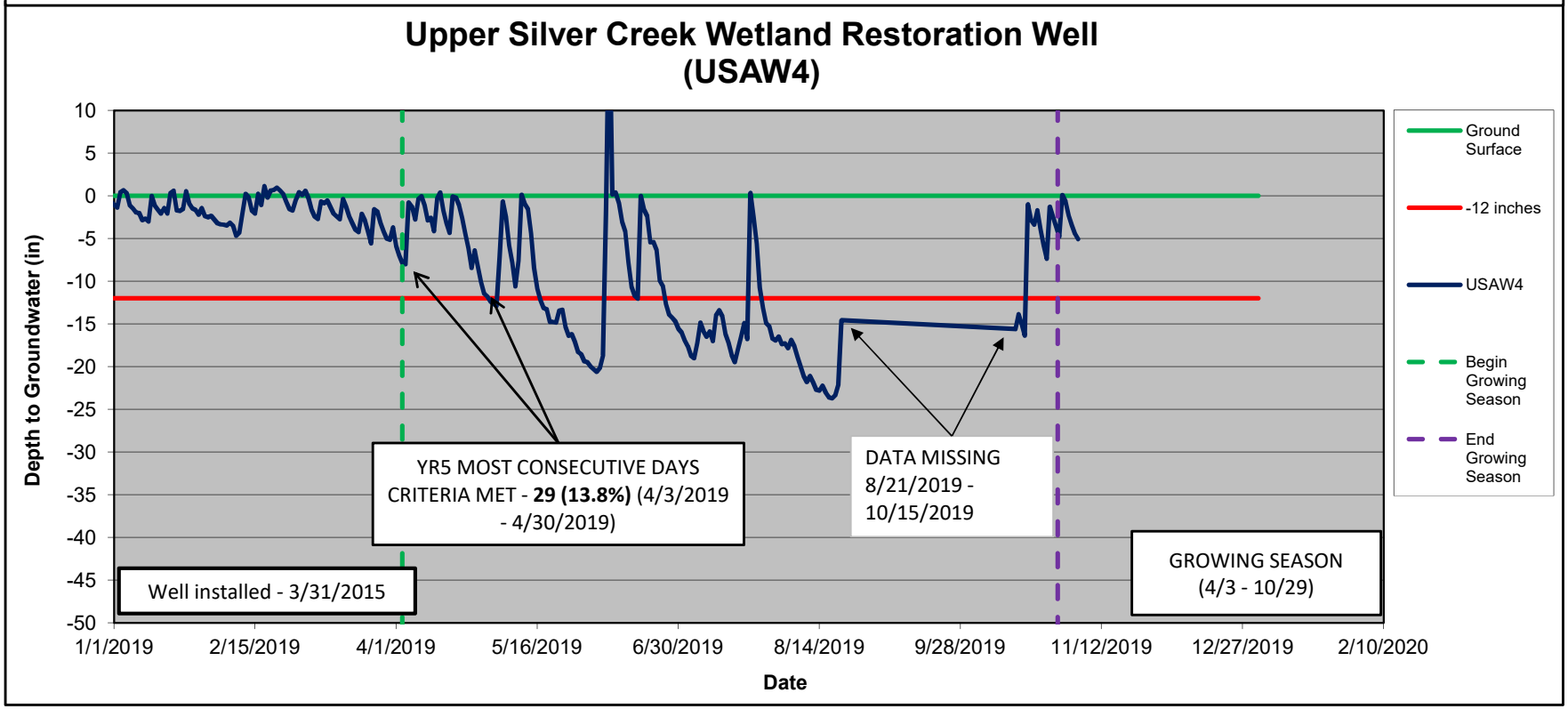


Figure 10. Wetland gauge graphs (continued)

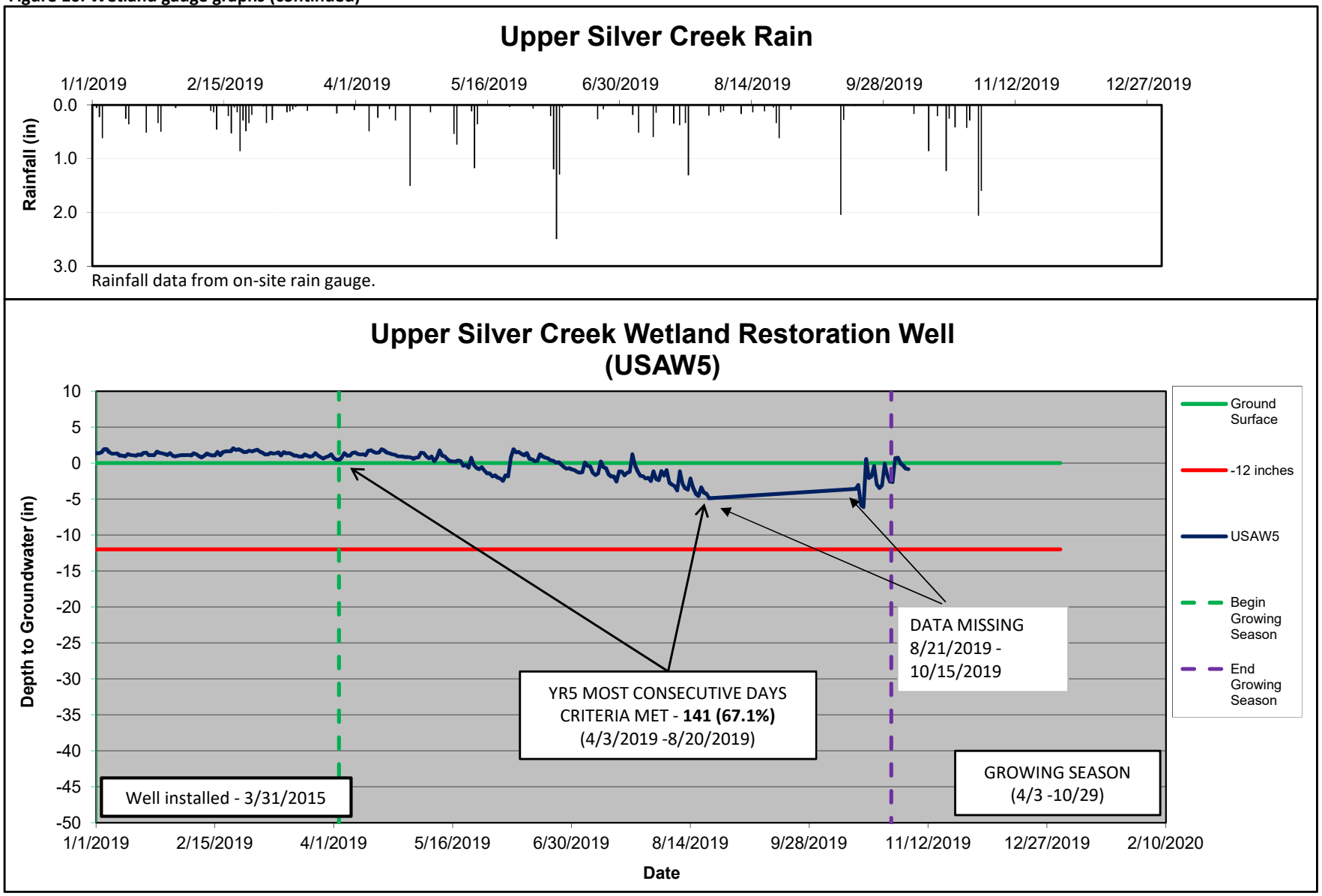


Figure 10. Wetland gauge graphs (continued)

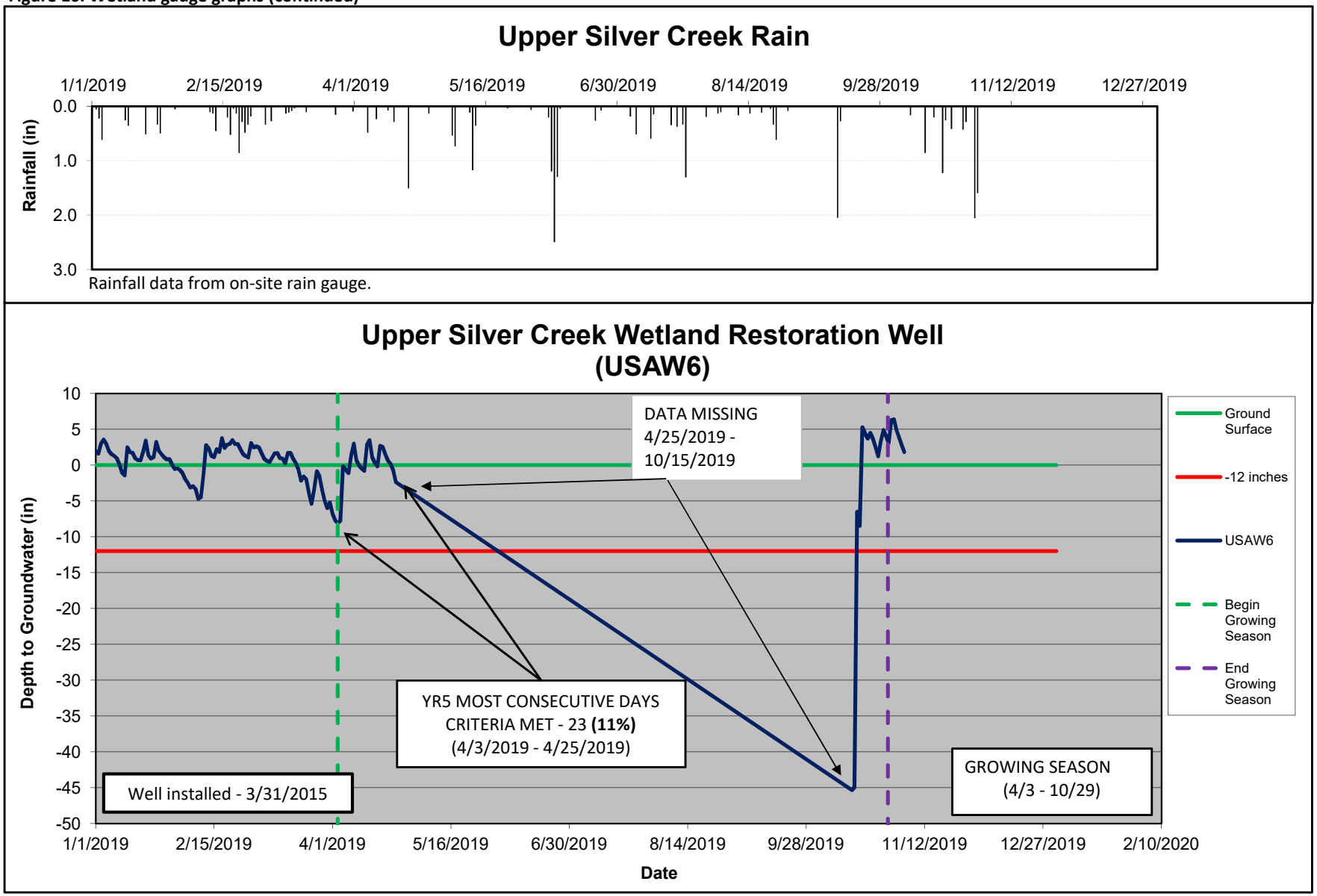
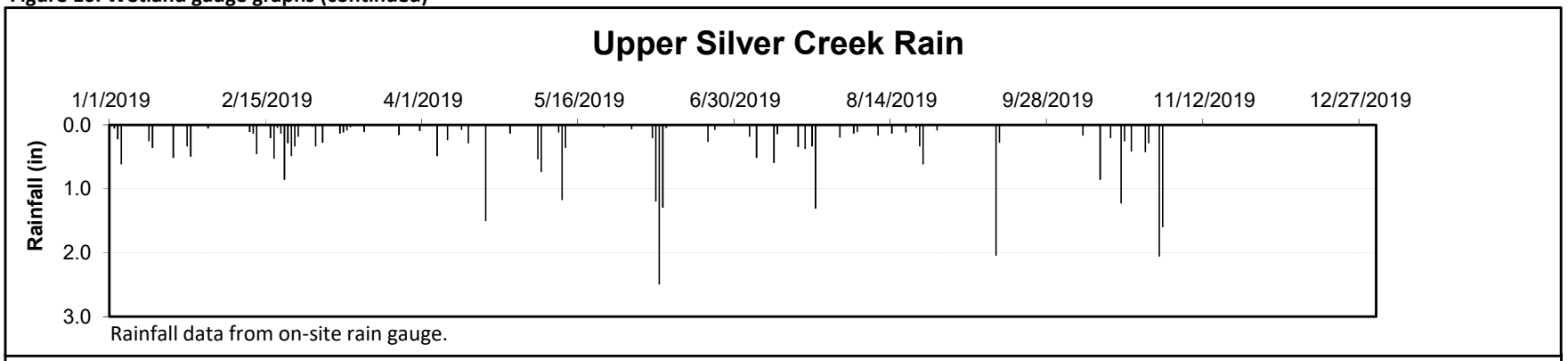


Figure 10. Wetland gauge graphs (continued)



Rainfall data from on-site rain gauge.

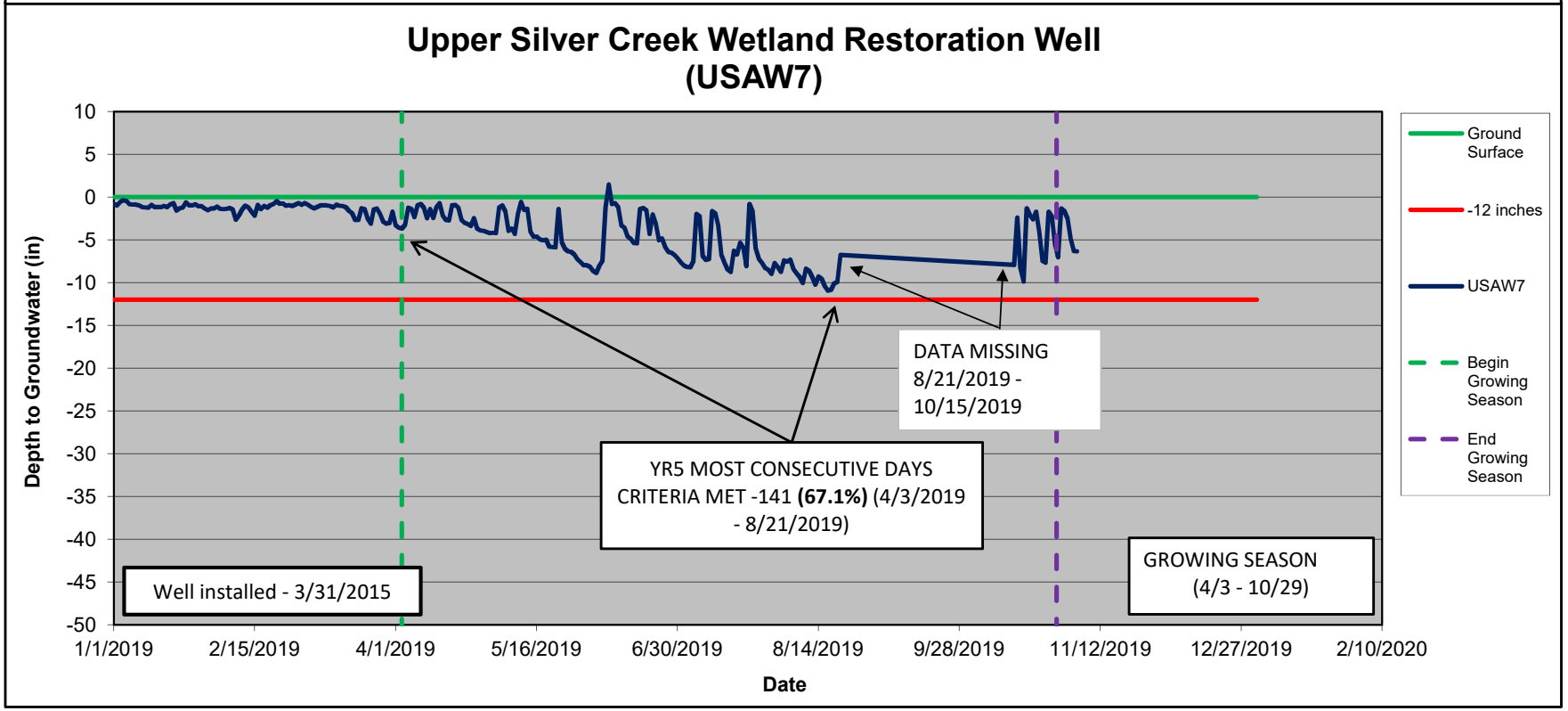


Figure 10. Wetland gauge graphs (continued)

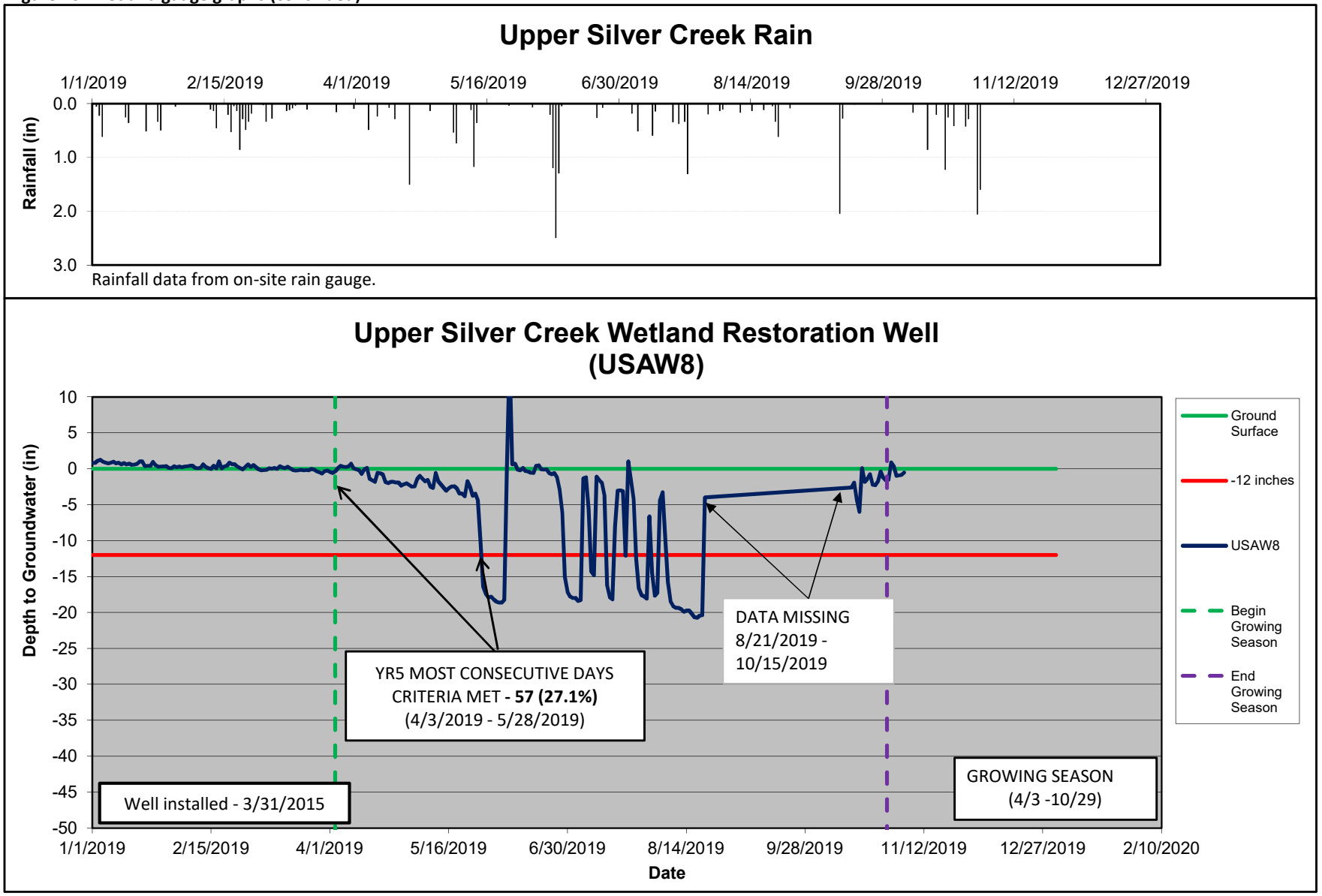


Figure 10. Wetland gauge graphs (continued)

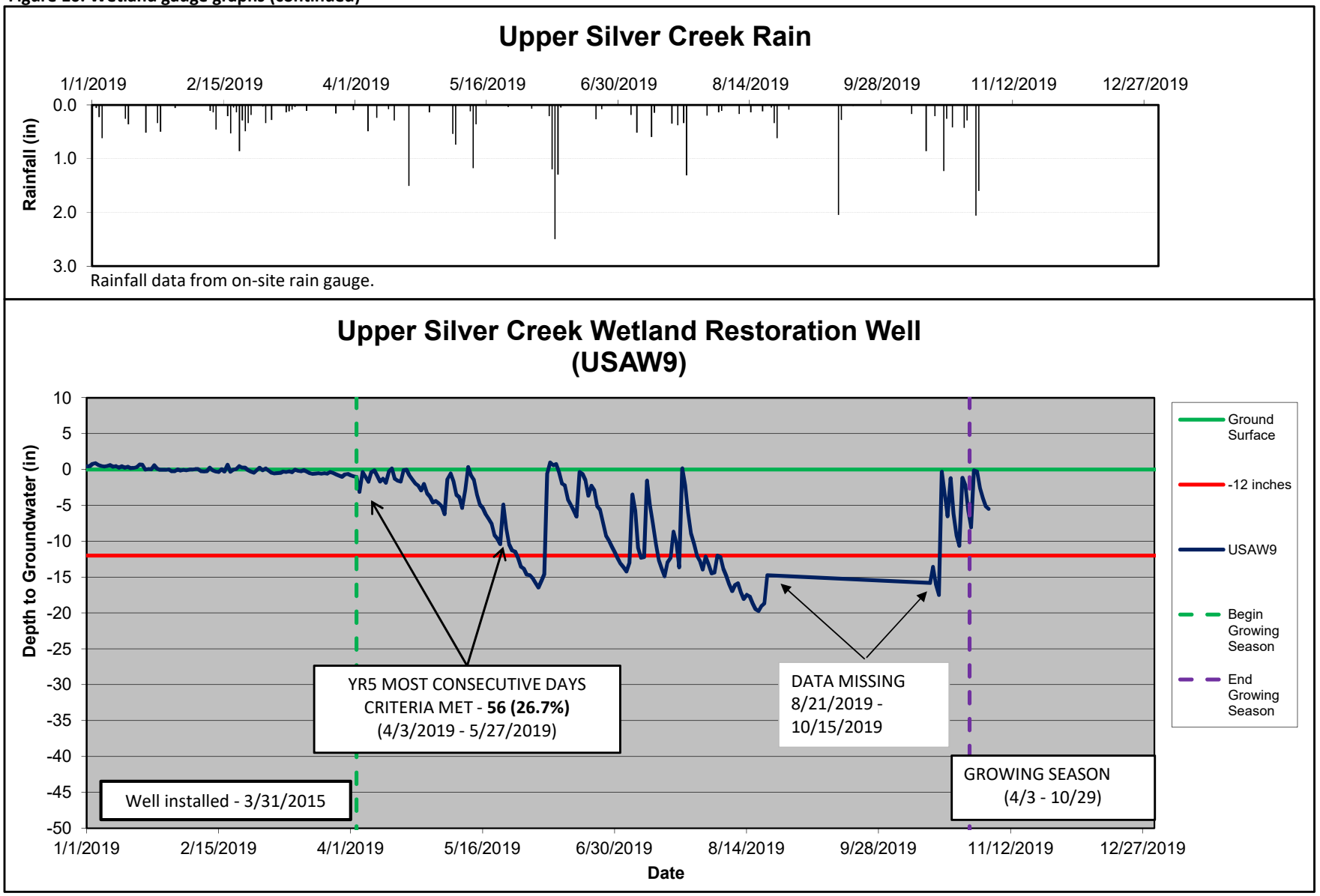


Figure 10. Wetland gauge graphs (continued)

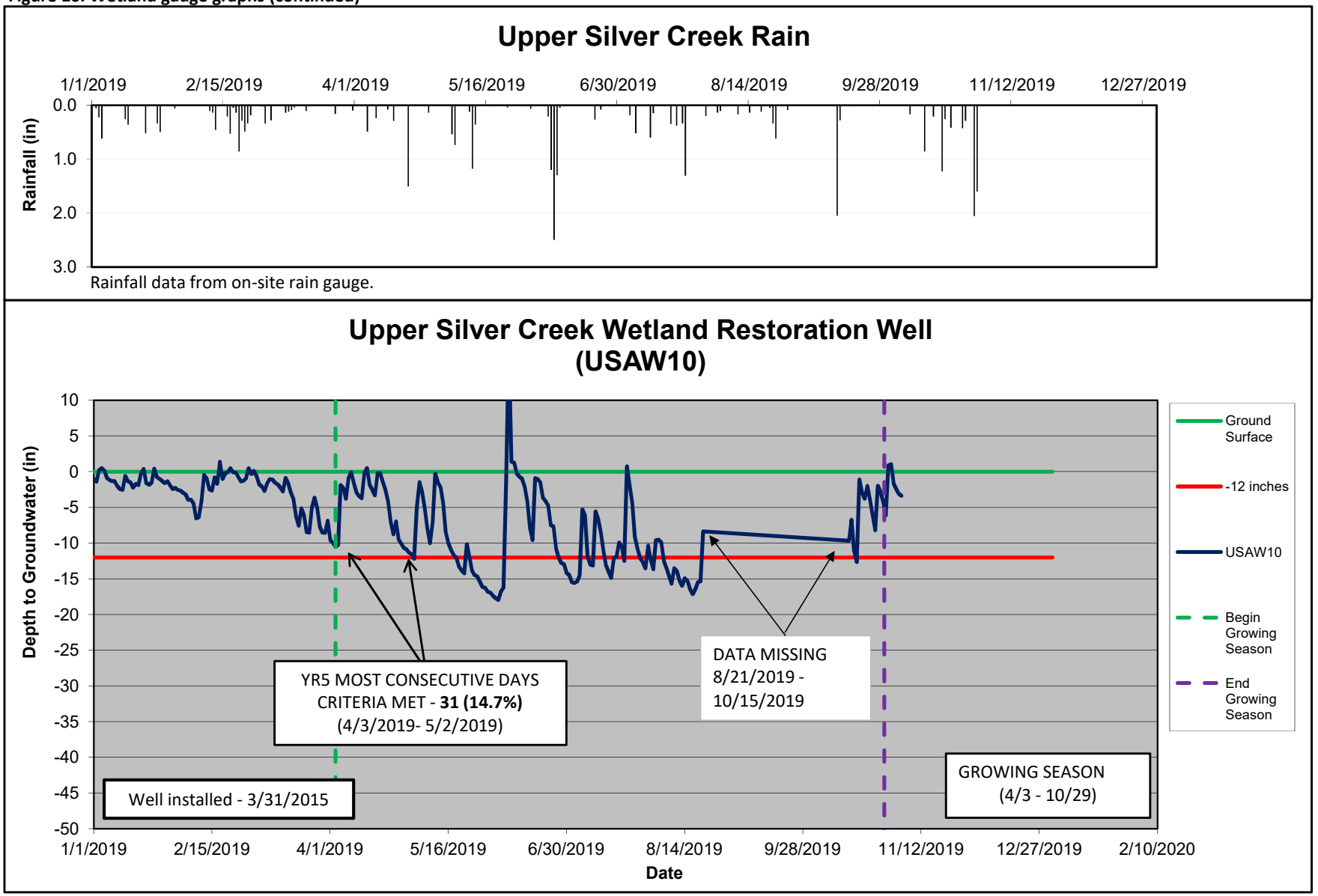


Figure 10. Wetland gauge graphs (continued)

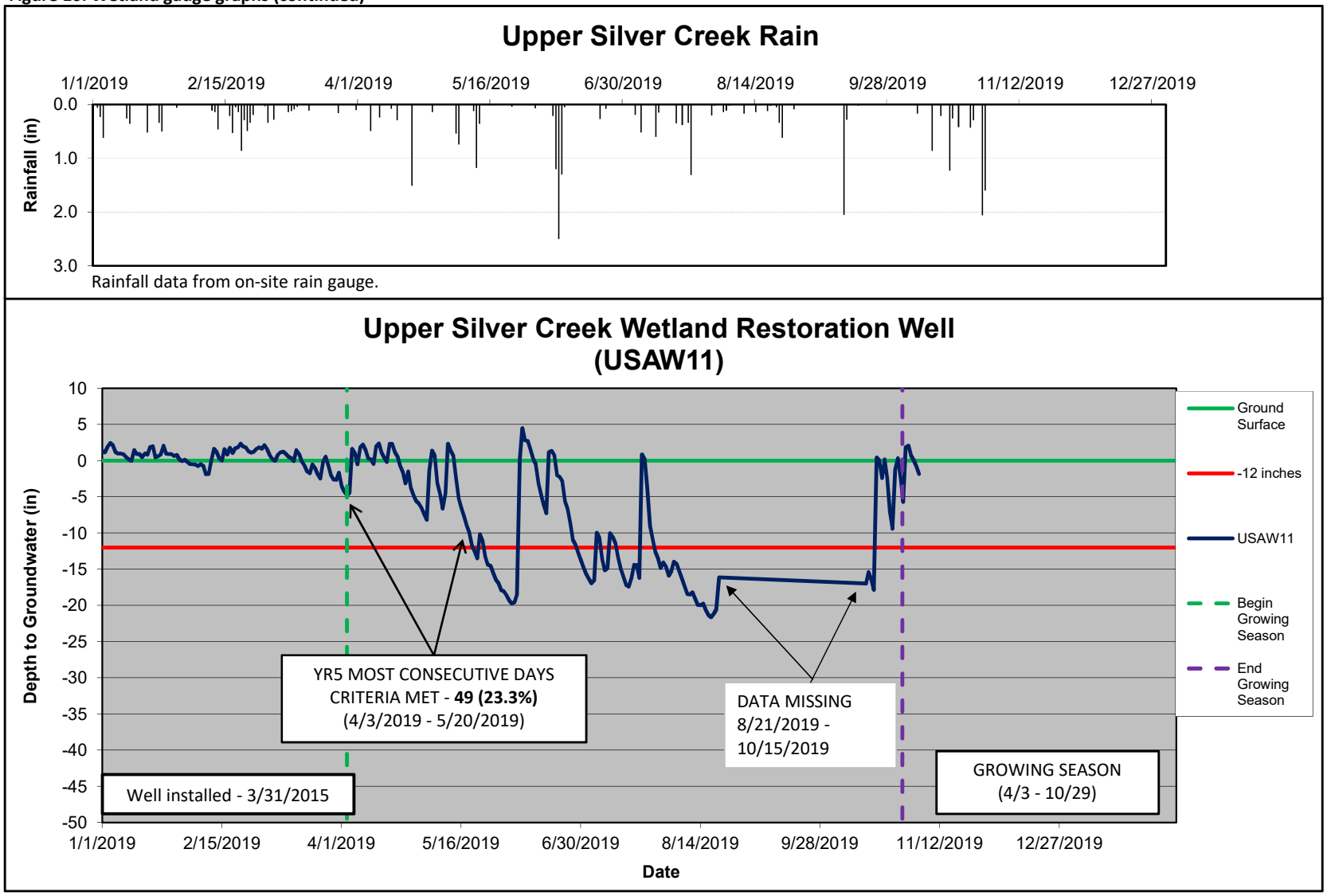


Figure 10. Wetland gauge graphs (continued)

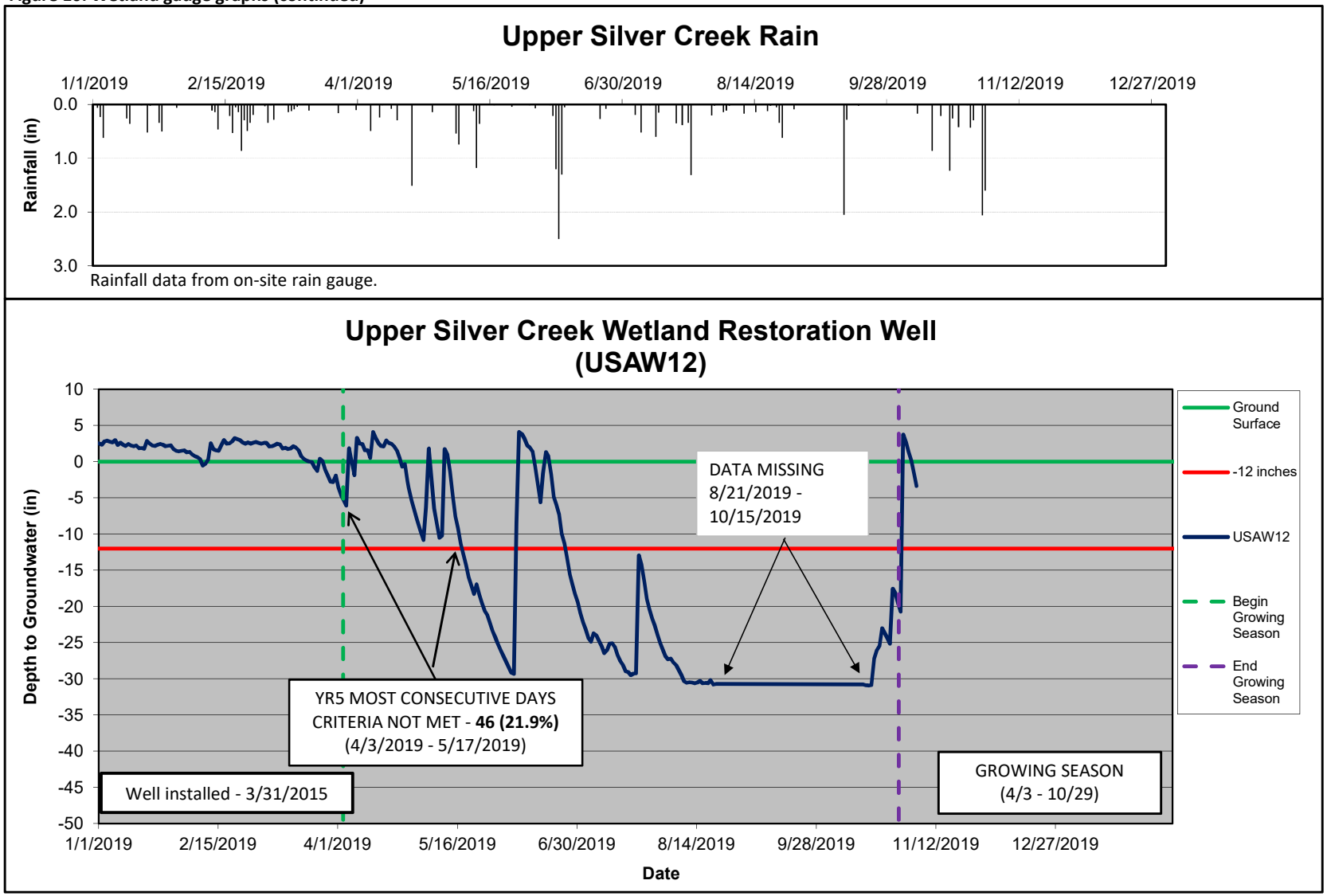


Figure 10. Wetland gauge graphs (continued)

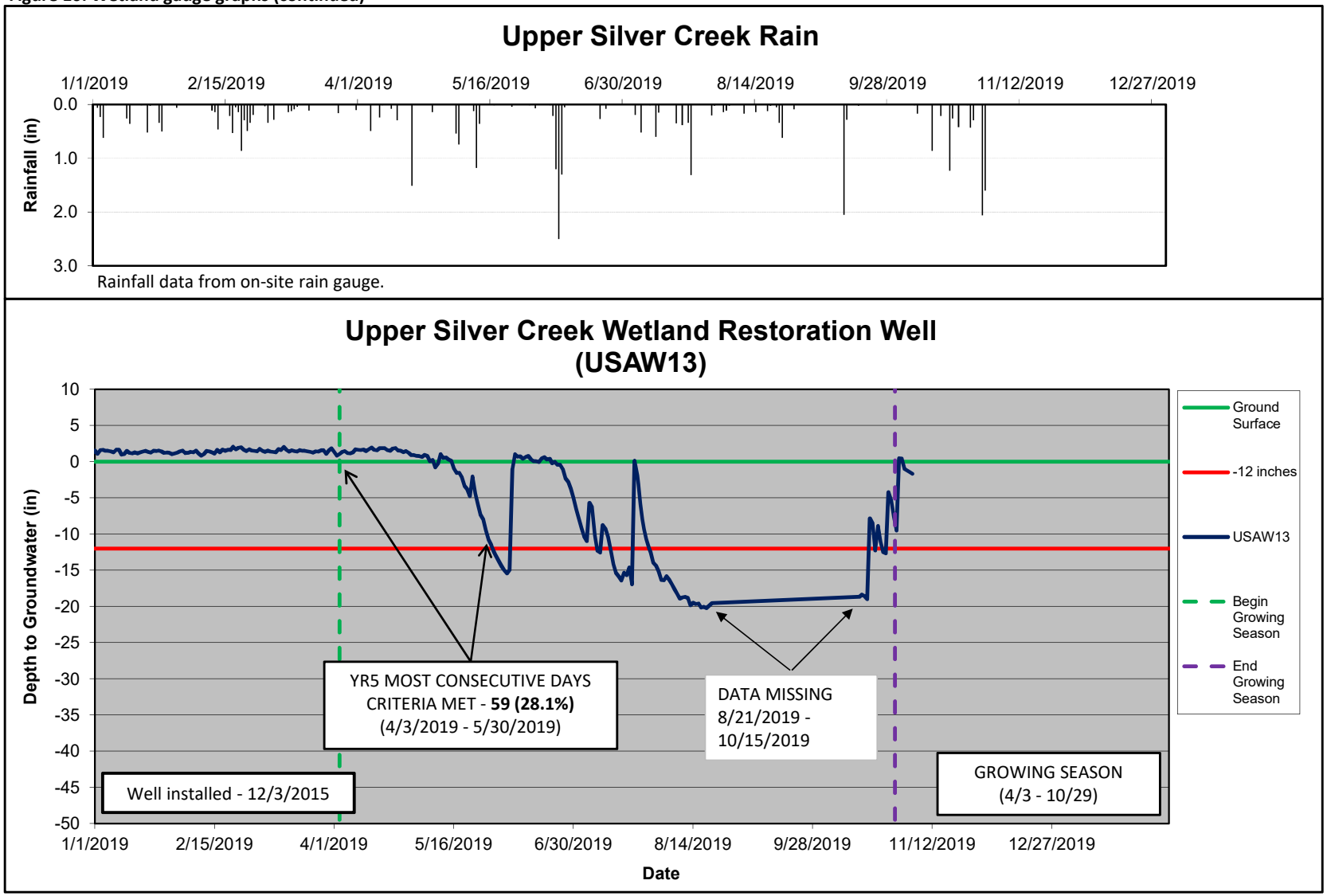


Table 12. Wetland gauge attainment data, summary of groundwater gauge results for MY 1 through 5 at the U. Silver Creek Project Site, DMS Project #94645.

Gauge	Success Criteria Achieved/Max Consecutive Days During Growing Season (Percentage)				
	Monitoring Year 1 (2015)	Monitoring Year 2 (2016)	Monitoring Year 3 (2017)	Monitoring Year 4 (2018)	Monitoring Year 5 (2019)
USAW1	Yes/36.5 days (17.5 %)	No/9.5 days (4.6%)	Yes/44 days (21.2%)	Yes/42 days (20.2%)	Yes/49 days (23.3%)
USAW2	No/21.8 days (10.5 %)	No/12.3 days (5.9%)	Yes/71 days (34.1%)	Yes/38 days (18.3%)	Yes/141 days (67.1%)
USAW3	No/20.3 days (9.7 %)	No/7 days (3.4%)	No/21 days (10.1%)	Yes/41 days (19.7%)	Yes/46 days (21.9%)
USAW4	No/5.5 days (2.6 %)	No/5 days (2.4%)	No/11 days (5.3%)	Yes/34 days (16.3%)	Yes/29 days (13.8%)
USAW5	Yes/80.5 days (38.7 %)	Yes/77.5 days (37.3 %)	Yes/119 days (57.2%)	Yes/208 days (100.0%)	Yes/ 141 days (67.1%)
USAW6	No/19.5 days (9.4 %)	No/7 days (3.4 %)	No/16 days (7.7 %)	Yes/98 days (47.1%)	Yes/23 days (11%)*
USAW7	Yes/74.5 days (35.8 %)	Yes/72.5 days (34.9 %)	Yes/110 days (52.9%)	Yes/208 days (100.0%)	Yes/ 141 days (67.1%)
USAW8	No/2.5 days (1.2 %)	No/5.8 days (2.8 %)	Yes/46 days (22.1%)	Yes/44 days (21.2%)	Yes/57 days (27.1%)
USAW9	Yes/35.5 days (17.1 %)	No/13.5 days (6.5 %)	Yes/44 days (21.2%)	Yes/80 days (38.5%)	Yes/56 days (26.7%)
USAW10	No/19.8 days (9.5 %)	No/9.8 days (4.7 %)	Yes/44 days (21.2%)	Yes/36 days (17.3%)	Yes/31 days (14.7%)
USAW11	No/18.5 days (8.9 %)	No/11.5 days (5.5 %)	Yes/44 days (21.2%)	Yes/42 days (20.2%)	Yes/49 days (23.3%)
USAW12	No/17.5 days (8.4 %)	No/7.3 days (3.5 %)	No/20 days (9.6%)	Yes/40 days (19.2%)	Yes/46 days (21.9%)
USAW13		Yes/55.5 days (26.7 %)	Yes/87 days (41.8%)	Yes/94 days (45.2%)	Yes/59 days (28.1%)

* This well malfunctioned on day 24 of a needed 25 with saturated conditions within 2.67 inches of the ground surface, see discussion of USAW6 in report.

Table 12a. Wetland Restoration Area Well Success					
Upper Silver Creek Restoration Project: Project ID No. 94645					
Well ID[5]	*Percentage of Consecutive Days <12 inches from Ground Surface[1]	Most Consecutive Days Meeting Criteria[2]	*Percentage of Cumulative Days <12 inches from Ground Surface[1]	Cumulative Days Meeting Criteria[3]	Number of Instances where Water Table is 12 inches from Ground Surface[4]
Cross-sectional Well Arrays					
USAW1	24.0	50.0	42.8	89.0	6
USAW2	75.0	156.0	75.0	156.0	1
USAW3	22.6	47.0	40.9	85.0	6
USAW4	13.9	29.0	35.6	74.0	6
USAW5	100.0	208.0	75.0	156.0	1
USAW6	~~11.5~~	24.0	17.3	36.0	2
USAW7	100.0	208.0	75.0	156.0	1
USAW8	27.4	57.0	53.8	112.0	9
USAW9	26.9	56.0	51.0	106.0	8
USAW10	14.9	31.0	48.1	100.0	12
USAW11	23.6	49.0	44.7	93.0	7
USAW12	22.1	46.0	31.3	65.0	2
USAW13	28.4	59.0	51.4	107.0	7

Notes:

[1]Indicates the percentage of most consecutive number of days within the monitored growing season with a water 12 inches or less from the soil surface.

[2]Indicates the most consecutive number of days within the monitored growing season with a water table 12 inches or less from the soil surface.

[3]Indicates the cumulative number of days within the monitored growing season with a water table 12 inches or less from the soil surface.

[4]Indicates the number of instances within the monitored growing season when the water table rose to 12 inches or less from the soil surface.

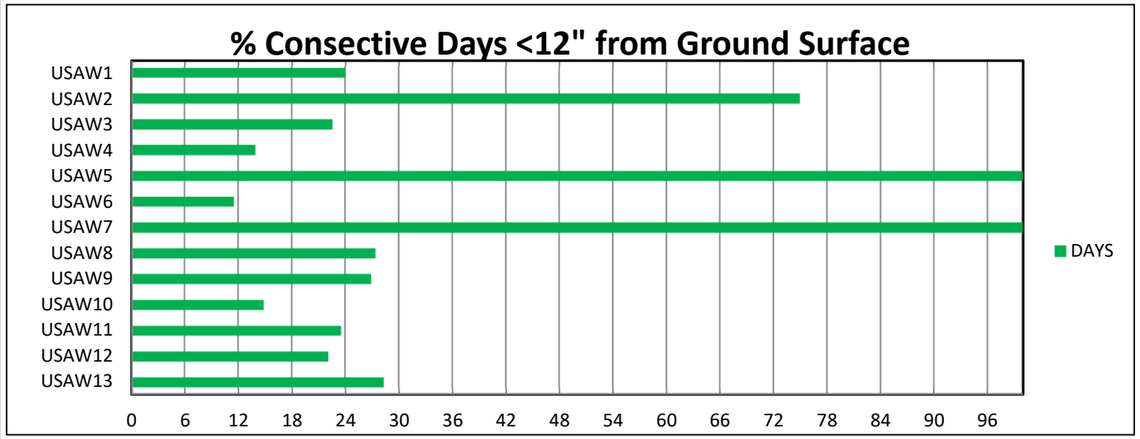
[5]USAW13 was installed in December of 2015.

Growing season for Burke County is from April 3 to October 29 and is 208 days long.

Growing season percentage for success is 12% of 208 days = 25 days; where water table is 12 inches or less from the ground surface

HIGHLIGHTED indicates wells that *did not* meet the success criteria for the most consecutive number of days within the monitored growing season with a water 12 inches or less from the soil surface. Following Year 3 of wetland monitoring, ten of thirteen wells did not exhibit a hyrdroperiod of 12% or greater during the growing season. These wells will be observed closely throughout monitoring Year 3.

12 In-Situ groundwater monitoring dataloggers (1-12) were installed on 3/17/2015. Installation of the dataloggers was completed following construction in spring 2015 when groundwater levels are normally closer to the ground surface. USAW13 was installed in December of 2015



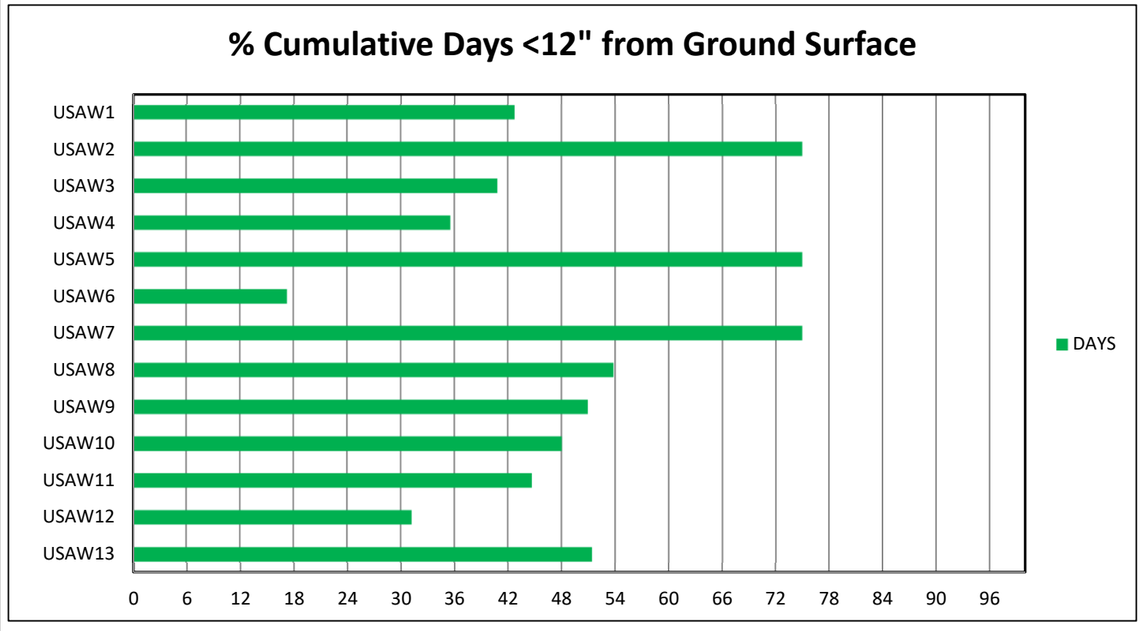


Figure 11. Wetland Photo Log, MY5 (2019)

Photo 1. Wetland Photo Point – W1, replicates photo 50 in Baseline Report (November 5, 2019).

Photo 2. Wetland Photo Point – W2, replicates photo 51 in Baseline Report (November 5, 2019).

Photo 3. Wetland Photo Point – W3 replicates photo 52 in Baseline Report (November 5, 2019).

Photo 4. Wetland Photo Point – W4, replicates photo 53 in Baseline Report (November 5, 2019).

Photo 5. Wetland Photo Point – W5, replicates photo 54 in Baseline Report (November 5, 2019).

Photo 6. Wetland Photo Point – W6, replicates photo 55 in Baseline Report (November 5, 2019).

Photo 7. Wetland Photo Point – W7, replicates photo 56 in Baseline Report (November 5, 2019).

Photo 8. Wetland Photo Point – W8, replicates photo 57 in Baseline Report (November 5, 2019).

Photo 9. Wetland Photo Point – W9, replicates photo 58 in Baseline Report (November 5, 2019).

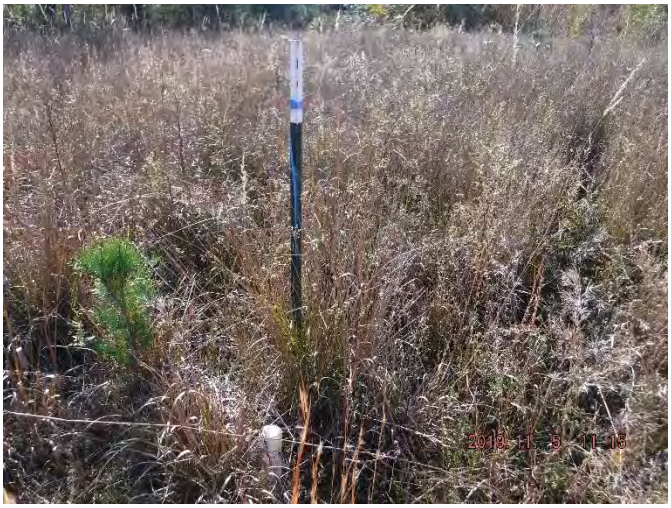


Photo 10. Wetland Photo Point – W10, replicates photo 59 in Baseline Report (November 5, 2019).

Photo 11. Wetland Photo Point – W11, replicates photo 60 in Baseline Report (November 5, 2019).

Photo 12. Wetland Photo Point – W12, replicates photo 61 in Baseline Report (November 5, 2019).

Photo 13. Wetland Photo Point – W13 added between time of baseline and MY1 survey, (November 5, 2019)