Monitoring Report
Year 2
FINAL
Little Buffalo Creek Stream Mitigation Project

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Cabarrus County

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Environmental Quality

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1.0 Executive Summary

1.1 Project Setting and Background

The Little Buffalo Creek Stream Mitigation site is located in Cabarrus County, North Carolina, two miles southwest of the Town of Gold Hill, and 12 miles east of Kannapolis. The site encompasses approximately 47 acres of former cattle pasture, crop land and riparian forest along Little Buffalo Creek and portions of seven unnamed tributaries (Figures 1 and 2). Little Buffalo Creek is located within the Yadkin River Basin (03040105; 03040105020060). Historic land use at the site had consisted primarily of ranching activities that had allowed cattle access to the stream and riparian zone. Several reaches of the stream have bedrock in their streambed and vertical migration of the stream has been confined to a small percentage of the project site.

1.2 Project Goals and Objectives

The goals of the Little Buffalo Creek Stream Restoration project include, but are not limited to, the enhancement of water quality and aquatic/terrestrial habitat, stream stability improvement, and erosion reduction. The uplift of these stream functions specifically requires:

- Protecting and improving water quality through the removal or minimization of the biological, chemical, and physical stressors:
  - Reducing sediment input into the stream from erosion;
  - Reducing non-point pollutant impacts by removing livestock access (including restoring forested buffer;
  - Protecting headwater springs.
- Improving aquatic and terrestrial wildlife habitat:
  - Moderating stream water temperatures by improving canopy coverage over the channel;
  - Restoring, enhancing, reconnecting, and protecting valuable wildlife habitat.
- Restore floodplain connectivity:
  - Reestablishing floodplain connection thereby dissipating energy associated with flood flows.

In addition to the ecological uplift that the project will provide to the Site through the improvement of the stream functions, this project establishes the following environmentally advantageous goals:

- Providing a water source for livestock removed from the stream and riparian corridor;
- Reducing the number of locations that livestock are able to cross the stream;
- Providing a safe and environmentally appropriate stream crossing point for livestock.

In order to achieve the project goals, Berger proposes to accomplish the following objectives:

- Fence the cattle out of the stream and riparian corridor;
- Remove invasive vegetative species from the riparian corridor;
- Restore and enhance unstable portions of the stream;
- Preserve the stream channel and banks through a conservation easement;
- Plant the riparian corridor with native tree and shrub vegetation.

The expected ecological benefits and goals associated with the Little Buffalo Creek site mitigation plan serve to meet objectives consistent with the resource protection objectives detailed in the Yadkin-Pee Dee River Basinwide Water Quality Plan, 2008.

1.3 Project Success Criteria

Streams
For stream hydrology, a minimum of two bankfull events must be documented within the standard 5-year monitoring period. In order for the monitoring to be considered complete, the two verification events must occur in separate monitoring years. All of the morphologic and channel stability parameters will be evaluated in the context of hydrologic events to which the system is exposed.

- Dimension – General maintenance of a stable cross-section and hydrologic access to the floodplain features over the course of the monitoring period will generally represent success in dimensional stability. For stream dimension, cross-sectional overlays and key parameters such as cross-sectional area, and the channel's width to depth ratios should demonstrate relative stability in order to be deemed successful.
- Pattern – Pattern features should show little adjustment over the standard 5 year monitoring period. Rates of lateral migration need to be moderate.
- Profile – For the channels' profile, the reach under assessment should not demonstrate any trends in thalweg aggradation or degradation over any significant continuous portion of its length. Over the monitoring period, the profile should also demonstrate the maintenance or development of bedform (facets) more in keeping with reference level diversity and distributions for the stream type in question. It should also provide a meaningful contrast in terms of bedform diversity against the pre-existing condition. Bedform distributions, riffle/pool lengths and slopes will vary, but should do so with maintenance around design distributions. This requires that the majority of pools are maintained at greater depths with lower water surface slopes and riffles are shallow with greater water surface slopes.
- Substrate and Sediment Transport – Substrate measurements should indicate progression towards, or maintenance of the known distributions from the design phase. Sediment Transport should be deemed successful in by absence of any significant trend in the aggradation or depositional potential of the channel.

Vegetation
Survival of woody species planted at mitigation sites should be at least 320 stems/acre through year three. A 10 percent mortality rate will be accepted in year four (288 stems/acre) and another 10 percent in year five resulting in a required survival rate of 260 trees/acre through year five. This is consistent with Wilmington District (1993) guidance for wetland mitigation (USACE 2003).

1.4 Mitigation Components and Design
The Little Buffalo Creek Site consists of six reaches along the mainstem and seven unnamed tributaries (UTs). The mainstem of Little Buffalo Creek as well as UT 4 and UT 7 are perennial streams. The remainders of the UTs are intermittent streams associated with groundwater seeps. This stream mitigation project includes reaches of restoration, enhancement, and preservation along the mainstem and the associated UTs. In total, the Site will provide 13,362 linear feet of restoration, enhancement, and preservation (Tables 1 & 4). A summary of restoration and enhancement activity and reporting history can be found in Table 2.

Restoration activities have established a new, stable stream channel with the appropriate dimension, pattern and profile to transport perennial flow and sediment and have re-connected the stream to its floodplain. Reestablishment of native riparian forest vegetation and installation of cattle exclusion fencing were also performed as part of the restoration activities. Enhancement activities included reestablishing native riparian vegetation within a 50-foot easement along each bank of the stream corridor and excluding cattle with fencing. In the case of enhancement level I the activities included reshaping or relocating the bed and

banks and riparian forest planting. Preservation was conducted within portions of the stream corridors that have intact riparian forests and stable stream reaches and included excluding cattle with fencing. At a 1:1 ratio for restoration, 1.5:1 for enhancement level I, 2.5:1 for enhancement level II, and a 5:1 ratio for preservation, the DMS will receive, as of January 2017, approximately 6,411 stream mitigation units from the Site (Table 1). In addition, approximately 47 acres of riparian buffer have been protected within a conservation easement. This stream credit generation has the potential to increase to 6,450 stream mitigation units as a result of additional enhancement level I work conducted in the fall of 2016 within a portion of UT3. This area, previously assessed as enhancement level II, had additional entrenched portions of the tributary graded to re-connect the channel with its floodplain and the riparian zone replanted.

1.5 Monitoring Year 2 Conditions Assessment

1.5.1 Vegetation Assessment

In Year 2 of monitoring, four vegetation monitoring plots are exceeding requirements by 10% (436 to 823 stems/acre), two vegetation monitoring plots are exceeding requirements by less than 10% (each 339 stems/acre), two vegetation monitoring plots fail to meet requirements by less than 10% (each 290 stems/acre), and four vegetation monitoring plots are failing to meet requirements by over 10% (97 to 242 stems/acre). Recruitment of native plant seedlings was recorded in 11 of 12 monitoring plots (Tables 6, 7, 8, and 9). The current average estimate of 395 planted stems per acre for the site is exceeding the required success criteria of 320 stems per acre. Uplift in previously poor performing areas is due to the additional planting of approximately 3,000 trees within 7 riparian areas covering 7.6 acres that took place in February 2016. Any deficiencies are primarily associated with the areas around the six monitoring plots failing to meet requirements. The likely cause of the poor performance in these areas, as well as lower than expected survival in some replanted areas, is due mostly to an incident where a herd of cattle were allowed back into the easement for an extended period of time. The intruding cattle grazed some of the planted stems and trampled a small number of them as well. Additional planting of approximately 3,500 trees within 9 riparian areas covering approximately 8.5 acres will take place in March 2017. Tree establishment and survival will continue to be monitored.

Significant growth was observed in planted American sycamore (*Platanus occidentalis*), green ash (*Fraxinus pennsylvanica*), hazel alder (*Alnus serrulata*), and black willow (*Salix nigra*) trees. This is most likely due to more normal precipitation levels in 2016 (NOAA Historical Palmer Drought Indices) and less grazing by cattle on these specific plant species. Tree establishment and survival will continue to be monitored.

Black willow and silky dogwood (*Cornus amomum*) live stakes throughout the restoration areas are doing well and very few have been observed to be dead. Surviving stakes are growing quickly and are already contributing to bank stability. Soft rush (*Juncus effusus*) has become established on parts of the stream bank and is adding additional stability to sections of UT7 and UT3. Additional stability is being provided by grasses and sedges that have become established on banks throughout the site. Volunteer crop cover is no longer present and has been outcompeted by other species such as goldenrods (*Solidago*), asters (*Aster*), jimsonweed (*Datura*), and native grasses.

Previously there were areas within the riparian buffer that were having low success in establishing herbaceous vegetation cover due to drought and sections of bank scour. These areas included approximately 300 feet along the mainstem of Reach 1, approximately 130 feet along the mainstem of Reach 4, and approximately 530 feet of UT 3. These problem areas were reseeded with annual ryegrass and native forbs in February 2016. Reseeded areas total approximately 1.8 acres and make up 53% of E1 areas and 20% of restoration areas.

The herbaceous cover in the 300 foot length of Reach 1 has improved since reseeding. The herbaceous cover in the 130 foot section along the mainstem of reach 4 has improved slightly since reseeding, and the herbaceous cover in the 530 foot section of UT3 is somewhat improved though sections have been affected by scour and cattle grazing. Despite a period of cattle intrusion, overall herbaceous cover throughout the site has greatly increased. This is most likely the result of more normal precipitation levels following a drought year (NOAA Historical Palmer Drought Indices). Additional native grass and forb seeding will be performed in the spring of 2017 to address any remaining areas with poor herbaceous cover establishment.

Past treatment and removal of privet (*Ligustrum*), multiflora rose (*Rosa multiflora*), and tree-of-heaven (*Ailanthus altissima*) from riparian areas has been mostly successful, though a few problem areas remain and follow up treatment will be performed. Through site inspections, tree-of-heaven is still established at the upstream ends of both UT 2 (approx. 450ft) and UT 7 (approx. 400ft), as well as four large trees between UT4 and UT3 (Figure 2). The larger trees at UT7 have been treated with herbicide and at time of monitoring were either dead or dying. However, they still produced seeds or root sprouts and will require further control. The UT 2 area was treated but will require further treatment as well. Privet continues to be present in various areas throughout the site, particularly on the upper portion of UT2 and the lower portion of UT7. Privet and tree-of-heaven were removed by hand from areas along UT 7 and UT 2 in February of 2016. During the Year 2 monitoring event in September of 2016 tree-of-heaven and princess tree were removed by hand from areas along UT 7, UT 2, Reach 3, and Reach 1. Both privet and tree-of-heaven will be treated with herbicide application again in spring of 2017 in accordance with NC Department of Agriculture (NCDA) rules and regulations.

1.5.2 Stream Assessment

For most of the site there has been very little change from the Year 1 monitoring survey completed in September 2015 in regards to stream stability and conditions. The primary issue identified in Year 2 monitoring has been damage to multiple reaches and tributaries due to the intrusion by cattle. UT2 and UT3, as smaller tributaries with soft clay soils, took the most observable damage. Cattle crossing and grazing within the inner channel of the lower stem of UT2, near the confluence of Little Buffalo Creek, and all of UT3 enhancement level I and restoration work, has formed areas with deep divots. Despite this damage, the tops of banks remain stable and in good condition. Based on the soil types of these tributaries and sediment load, it is believed that the damage can be reversed naturally through a significant flow events that will re-deposit sediment within the depressions in the channel. UT4 and Reach 3 and 4 of Little Buffalo Creek all showed minor damage to the channels due to cattle, and all in isolated spots of each segment. With the exception of Reach 3, it is believed all damage can be reversed naturally through a significant storm event. During the spring 2017 maintenance work, the damaged areas will be re-evaluated to determine if signs of recovery area present, such as recent deposition. If it is evident that the stream segments cannot recover in a short period without intervention, action will be taken to fix the sections accordingly.

In early winter 2016, DENR representatives conducted a site visit to observe site conditions following a significant flow event. As part of this visit, a segment of UT3 was identified with a severe entrenchment and headcut in a portion of enhancement level II. Additionally, the restoration section in Reach 3 showed aggradation in both the riffle and pool sections connecting the restored channel to the existing channel at the upstream and downstream connection points. In spring of 2016, Louis Berger staff observed signs of an overflow chute forming in the Reach 3 restoration section as a result of the aggradation and high backwater caused at the upstream connection to the existing channel.

As part of the September 2016 maintenance and monitoring work, the aggradation was removed on both the upstream and downstream connections of the restoration portion of Reach 3. The material removed was placed on the left bank to fill in the overflow chute, and the more extreme backwater condition immediately upstream of the site work was reduced to a more suitable level. This work simultaneously patched the minor cattle damage caused in the Reach 3 work area. Additionally, the entrenched banks identified in a portion

of UT3 were graded to remove entrenchment and reconnect the channel to the floodplain and plant the riparian zone. This action is consistent with enhancement level I work, and creates the potential to raise the enhancement level from EII to EI in this 146 feet reach.

A sinuous low flow channel within the areas of restoration in Reach 1, Reach 3 and UT 7 continue to develop as expected. The development of this sinuous channel at base flow conditions is important to providing adequate riffle-pool systems needed at base flow to provide in-stream habitat areas for fish, amphibians, and aquatic insects. In addition, the stream bedload was observed to continue to be sorted and finer material has either moved to the stream bank edges or moved downstream and a courser bed material is present within the channel. However, despite 2016 being a non-drought year, the months of June, July and September were below average rainfall months and stretches of the main channel were dry during the September monitoring. The pebble count recorded a higher percentage of silts deposited during the receding flow. As a result of exceptionally high silt deposits, pebble count surveys were not conducted in the following cross sections during the 2016 monitoring event: UT2-1R, UT3-1R, UT3-1P, UT3-2R, UT3-3R, and UT7-1P. This is expected to be a temporary condition.

In-stream structures have generally maintained their stability and performance within the site, with the exception of the step-pool system on UT 7 near the confluence with the mainstem. Due to the backflow conditions generated in storm events in this area, bed material settlement was observed within the step-pools. This was first identified within the Year 1 monitoring. Larger sediment material has filled the lower two step pools, generating a longer riffle into the confluence of Little Buffalo Creek, and decreased the max depth to mean depth ratio of less than 1.6 for habitat suitability in the upper pools. Although the step pools have filled greater than desired with larger material, they still provide adequate fish passage during low flow events when the channel is not dry. As the intent of the structures is to provide the head drop from the higher floodplain of UT7 to Little Buffalo Creek in a stable manner, while still providing fish passage within the tributary, no action to reshape the pools is proposed. This conclusion is also generated based on the understanding that the larger sediment source comes from immediately upstream of the culverts at Old Mine Road as part of the passage dissipation reinforcement, and that any attempt to remove the larger cobble sediment will likely only result in the pools to refill from the same sediment source supply. In addition to the lower step pools infilling, one rock vane step pool was identified for potential piping in the September 2016 site assessment. As the channel was dry, it could not be verified that the structure is allowing seepage beneath the vane. This will be observed in the Spring 2017 maintenance work and corrective action taken to fix the structure if it indeed is allowing seepage beneath the vane.

Future channel maintenance may include chinking of in-stream structures to prevent piping, securing of loose coir matting, and supplemental installations of live stakes and other target vegetation along the channel bank. Areas where storm water and floodplain flows intercept the channel may also require maintenance to prevent bank failures and head- cutting.

The stream restoration and enhancement areas are relatively stable and will continue to adjust somewhat in response to storm events. Gage data throughout the site supports four different bankfull events during the Year 2 monitoring period which are supported by observations of rack debris outside of the top of bank and in the floodplain of UT7 and the mainstem. The stream channel is beginning to develop the desired sinuosity and in-stream structures are remaining stable and functioning as designed; the exception being the step-pool system in UT-7 as noted above. No work is planned on these pools as of now but may occur during the 2017 maintenance period if needed.

Two groundwater monitoring wells were installed at the top and bottom of UT3 in February of 2016 to provide additional hydrological data to demonstrate groundwater connectivity to the stream channel of UT3. The cross-section and longitudinal profiles were conducted during the dry season, resulting in water

surface elevations that were indistinguishable from the thalweg elevations at that time. Distinct water surface elevations are included in the longitudinal profiles where water was flowing within the channel.

1.5.3 Site Boundary Assessment

A number of site boundary issues were discovered during the Year 2 monitoring and maintenance period. A corner of fence where UT 3 joins the mainstem was found to be cut and reassembled, presumably by the land owner to remove escaped cattle. The electric wire of the cattle crossing fence in Reach 5 was broken, likely due to storm debris and flows, and no longer providing an electrical charge. The larger portions of the cattle crossing fence are up and functioning and the gates to the crossing are closed. The fence next to the northwestern gate of the cattle crossing has also been cut and hastily repaired as well as a corner of fence where UT 2 meets the mainstem. These damages are also likely the result of landowners moving cattle into or from the easement. The barbed wire has been broken on a small section of fence along the northeast edge of UT 7, possibly due to a tree fall in that area. The fence at the top of UT 1 has been completely knocked down due to the accumulation of vegetation and log debris from the adjacent fields causing enough force to push it over during a flood event.

At a point in between the February and September maintenance work of 2016, unknown persons installed barbed wire and a woven metal fence "flood gate" across the easement along the downstream side of Old Mine Road to close off access to Reach 2. This may have been installed by the landowner with the intention of placing and keeping cattle within the easement. A team of surveyors discovered the cattle in early September and they were removed within days of their first observation. At the time of Year 2 monitoring, four cattle were observed in the easement and were removed the same day. Louis Berger is currently assessing the level and cost of damage and working to identify those responsible.

Discussions with the landowner regarding maintenance of the crossing, fencing and encroachments into the easement is ongoing. In the fall of 2016 additional fencing was installed along the mainstem at Old Mine Road to prevent access to the easement at these locations and the barbed wire across Little Buffalo Creek at Old Mine Road has also been removed. All other major fence repairs and the installation of conservation easement boundary signs was also completed in the fall of 2016.

Summary information/data related to occurrence of items such as encroachment by landowners or evidence of cattle intrusion 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 As-Built Baseline Monitoring Report and in the Mitigation Plan documents available on NCDEQ's website. All raw data supporting the tables and figures in the appendices is available from NCDEQ upon request.

2.0 Methodology

Monitoring for stream stability, stream hydrology, and vegetation will be monitored annually for five years following the initial Baseline and As-Built Report. Annual monitoring requirements are based on the U.S. Army Corps of Engineers *Stream Mitigation Guidelines* document (USACE 2003) and supplemental requirements listed in the DMS *Stream and Wetland Mitigation Monitoring Guidelines* dated February 2014 (NCEEP 2014). Establishment, collection, and summarization of data collected was in accordance with the NCDEQ guidance document *EEP Annual Monitoring Report Format, Data Requirements, and Content Guidance* (April 2015).

2.1 Geomorphology

Surveys for Year 2 monitoring were conducted by Louis Berger in September 2016 using a Trimble M3 Total Station, geo referenced to North Carolina State Plane (NAD83-State Plane Feet-FIPS3200) with vertical datum North American Vertical Datum of 1988 (Feet NAVD88).

2.2 Longitudinal Profiles

A total of approximately 2950 feet of channel along 8 longitudinal profiles is being surveyed annually. This includes 335 feet on LBC Reach 1, 225 feet on LBC Reach 3, 112 feet on LBC Reach 4, 51 feet on UT 2, 771 feet on UT 3, 411 feet on UT 4, 977 on UT 7 and 62 feet on UT 8. Data collected from annual monitoring is being compared with the as-built conditions to document the current state of the channel and any trends in the stream profile occurring throughout the monitoring period. The start and finish locations of each cross-section and longitudinal profile are collected using a Total Station.

2.3 Cross Sections & Particle Size Distribution

A total of 15 cross-sections, including 9 riffles and 6 pools were installed upon completion of construction and are being monitored annually. Two additional cross-sections were added within the step-pool portion of UT 7 in monitoring Year 2. The total number of cross-sections includes five on the mainstem of Little Buffalo Creek, one on UT 2, four on UT 3, two on UT 4, and five on UT 7.

Pebble count surveys were conducted at each cross section. Moving from bank to bank, particles were picked up blindly and at random and measured in millimeters. Enough samples were taken to get a representative sample of particle size distribution for each cross section. Sample size ranged from 50 in pool areas dominated by fines to 100 in flowing riffle areas with a diversity of particle sizes.

2.4 Vegetation Monitoring

The CVS-DMS entry tool database was used to calculate the number of monitoring plots needed based on project acreage. Louis Berger established twelve vegetation monitoring plots across all reaches and tributaries of the project area based on guidance given in the *CVS-DMS Protocol for Recording Vegetation Version 4.2* (Lee et al. 2008). Each plot measures approximately 0.025 acres individually and is staked out with bright orange painted rebar and marked with two upright sections of PVC pipe. Photos were taken of each plot and Year 2 monitoring data was entered into the CVS-DMS database under the Little Buffalo Creek Stream Mitigation Project (Project ID 94147). Additional PVC markers were added to plot corners during Year 2 in order to make corner stakes easier to find among the increasing herbaceous cover.

For a monitoring event, yellow rope is tied around the four corner stakes to mark out the plot. In Year 0, a GPS was used to collect coordinates of each stem and their position was measured in relation to the X and Y axis of the plot. Additionally, each stem was marked with pink flagging to make them easy to locate and identify during the next monitoring event. Flagging is re-applied each year. Planted stems were identified,

measured, and given a vigor score ranging from 0 to 4 based on the CVS-DMS database. Naturally recruited stems were identified and tallied only if alive. These stems were not measured or given a vigor score.

2.5 Hydrological Monitoring

A total of eight water level gages were installed on site. The gages are being monitored biannually to document highest stage for the monitoring interval and verify occurrences of bankfull and geomorphically significant flow events. In addition, observations of wrack and depositional features in the floodplain, if present, are being documented with photos. In February of 2016 two groundwater monitoring wells were installed at the top and bottom of UT 3 to provide additional hydrological data to demonstrate groundwater connectivity to the stream channel.

2.6 Photo Points & Visual Assessment

Permanent photo stations were established at each cross-section to digitally document annual conditions of the left and right banks. Each vegetation monitoring plot includes a photo station taken diagonally from a plot corner towards the opposite plot corner. Additional permanent photo locations have been established throughout the project area and can be found on the CCPV maps in Appendix A. Visual stream assessments are conducted during annual monitoring to summarize performance percentages of morphological and structural features. Visual vegetation assessments are also occurring to catalog the extent and type of vegetation issue areas as compared to the total planted acreage within the project site.

3.0 References

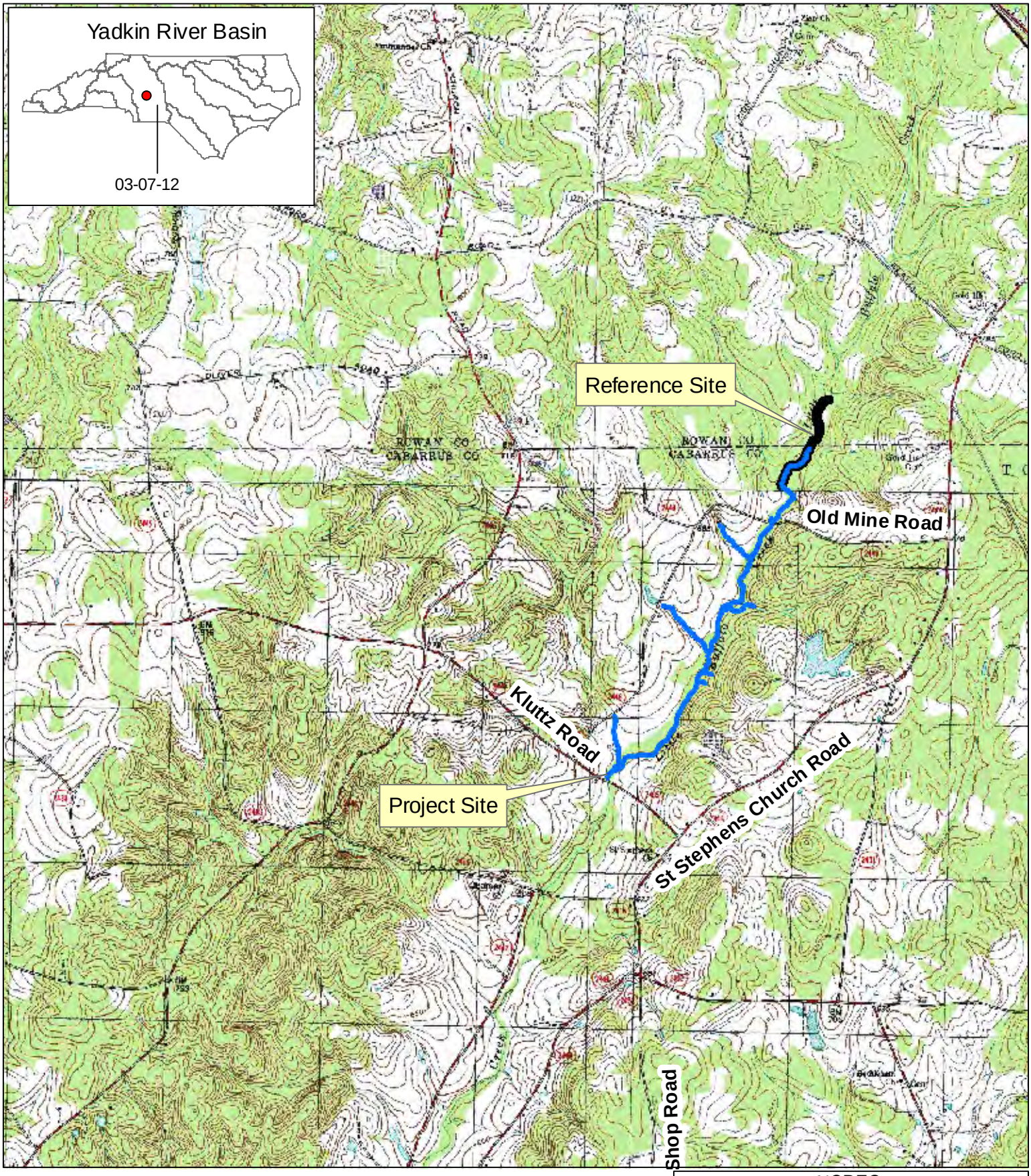
Lee, Michael T., R.K. Peet, S.D. Roberts, and T.R. Wentworth. 2008. CVS-DMS Protocol for Recording Vegetation, Version 4.2 (http://cvs.bio.unc.edu/methods.htm).

National Oceanic and Atmospheric Administration. Historical Palmer Drought Indices. December 2014 through November 2015. http://www.ncdc.noaa.gov/temp-and-precip/drought/historical-palmers/psi/201412-201511/. Accessed October 2016.

North Carolina Ecosystem Enhancement Program 2014. *Stream and Wetland Mitigation Monitoring Guidelines*. February 2014. 7pp.

USACE 2003. Stream Mitigation Guidelines. Prepared by: USACE, NCDWQ, USEPA, NCWRC.

Appendix A – Project Vicinity Map & Background Tables



Legend

- Project Stream Segments
- Reference Reach

N

0 0.5 1 Miles

Source: USGS Topographic Quads: Gold Hill, Rockwell, Richfield, and Mount Pleasant, NC

NCDEQ
Division of Mitigation Services

Little Buffalo Creek Creek
Stream Restoration, Cabarrus County, NC
DMS Project # 94147

Project Location Map

THE LOUIS BERGER GROUP
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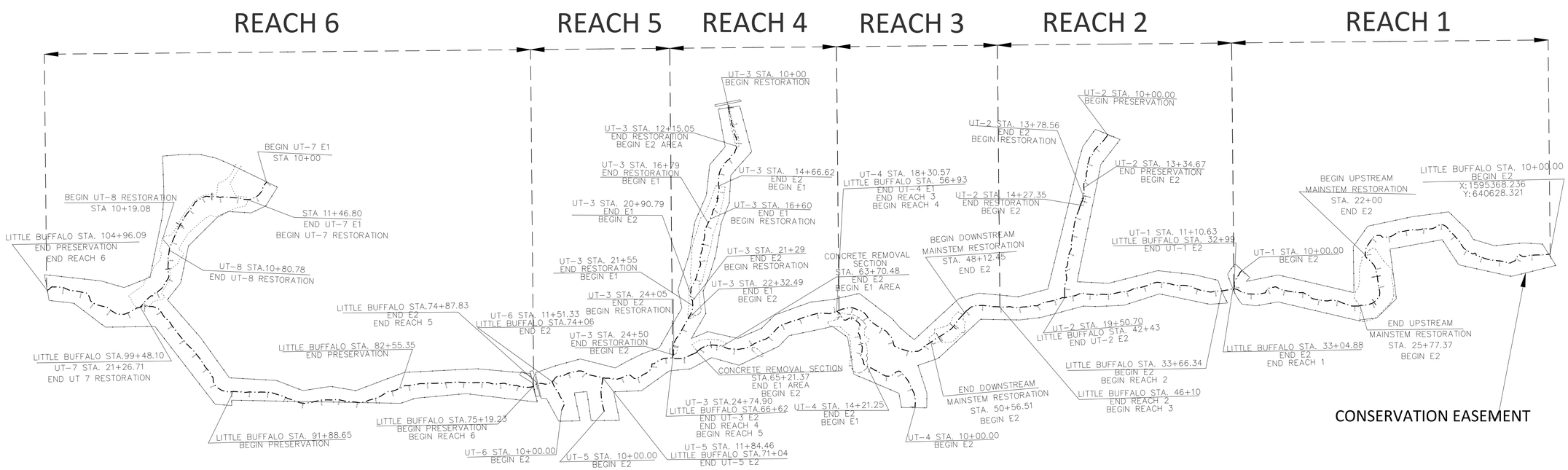
Figure 1

November 2016



MAINSTEM RESTORATION PLAN INDEX

ALIGNMENT	MITIGATION ACTIVITY	START STATION	END STATION
MAINSTEM	ENHANCEMENT LEVEL 2	10+00	22+00.00
	RESTORATION	22+00.00	25+77.37
	ENHANCEMENT LEVEL 2	25+77.37	33+04.88
	ENHANCEMENT LEVEL 2	33+66.34	48+12.45
	RESTORATION	48+12.45	50+56.51
	ENHANCEMENT LEVEL 2	50+56.51	63+70.48
	ENHANCEMENT LEVEL 1	63+70.48	65+21.37
	ENHANCEMENT LEVEL 2	65+21.37	74+87.83
	PRESERVATION	75+19.23	82+55.35
	PRESERVATION	91+88.65	104+96.09

MITIGATION ACTIVITY	GENERAL DESCRIPTION
RESTORATION	CHANNEL RE-ALIGNMENT AND CREATION. DITCH PLUG INSTALLATION. IN-STREAM STRUCTURE INSTALLATION, INCLUDING LOG VANES, ROCK CROSS VANES, STEP POOLS AND ROOT WADS. STREAM BANK RE-GRADING. PLANTING AND INVASIVE PLANT REMOVAL.
ENHANCEMENT LEVEL I (E1)	STREAM BANK GRADING. MINOR CHANNEL REGRADING. CONCRETE REMOVAL FROM CHANNEL. PLANTING AND INVASIVE PLANT REMOVAL.
ENHANCEMENT LEVEL 2 (E2)	PLANTING AND INVASIVE PLANT REMOVAL.

TRIBUTARY RESTORATION PLAN INDEX

ALIGNMENT	MITIGATION ACTIVITY	START STATION	END STATION
UT-1	ENHANCEMENT LEVEL 2	10+00	11+10.63
UT-2	PRESERVATION	10+00	13+34.67
UT-2	ENHANCEMENT LEVEL 2	13+34.67	13+78.56
UT-2	RESTORATION	13+78.56	14+27.35
UT-2	ENHANCEMENT LEVEL 2	14+27.35	19+50.70
UT-3	RESTORATION	10+00	12+15.05
UT-3	ENHANCEMENT LEVEL 2	12+15.05	14+66.62
UT-3	ENHANCEMENT LEVEL 1	14+66.62	16+60
UT-3	RESTORATION	16+60	16+79
UT-3	ENHANCEMENT LEVEL 1	16+79	20+90.79
UT-3	ENHANCEMENT LEVEL 2	20+90.79	21+29
UT-3	RESTORATION	21+29	21+55
UT-3	ENHANCEMENT LEVEL 1	21+55	22+32.49
UT-3	ENHANCEMENT LEVEL 2	22+32.49	24+05
UT-3	RESTORATION	24+05	24+50
UT-3	ENHANCEMENT LEVEL 2	24+50	24+74.90
UT-4	ENHANCEMENT LEVEL 2	10+00	14+21.25
UT-4	ENHANCEMENT LEVEL 1	14+21.25	18+30.57
UT-5	ENHANCEMENT LEVEL 2	10+00	11+84.46
UT-6	ENHANCEMENT LEVEL 2	10+00	11+51.33
UT-7	ENHANCEMENT LEVEL 1	10+00	11+46.80
UT-7	RESTORATION	11+46.80	21+26.71
UT-8	RESTORATION	10+19.08	10+80.78

NCDEQ-DMS

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LITTLE BUFFALO CREEK
STREAM RESTORATION PROJECT
CABARRUS COUNTY
DIVISION OF MITIGATION SERVICES

TABLE 1 STREAM MITIGATION BY REACH

DATE FEBRUARY 2016
PROJECT NO. 94147
FIGURE A1

NO. | REVISIONS | DRN. CHK | DATE

Filename: V:\Operations\121\1008 - Little Buffalo Creek\Deliverables\Drawings\Monitoring Reports_Restoration Stationing Figure\Restoration Summary Figure.dwg

Table 1. Project Components and Mitigation Credits
Little Buffalo Creek Stream Mitigation Project
DMS Project No. 94147

Mitigation Credit Summations

	Stream	Riparian Wetland	Non-riparian Wetland	Buffer	Nitrogen Nutrient Offset	Phosphorus Nutrient Offset			
Overall Mitigation Units	6,411	0	0						

Project Components

Reach ID	Stationing	Existing Feet (linear feet)	Restoration Footage or Acreage	Restoration Level	Restoration or Rest Equiv.	Mitigation Ratio	Stream Mitigation Units	Notes
Reach 1	10+00 to 33+05	2,305	377 R 1928 EII	Restoration Enhancement Level II	N/A	Restoration 1:1 Enhancement Level II 2.5:1	1148	
Reach 2	33+66 to 46+10	1,244	1244 EII	Enhancement Level II	N/A	Enhancement Level II 2.5:1	498	
Reach 3	46+10 to 56+93	1,083	244 R 839 EII	Restoration Enhancement Level II	N/A	Restoration 1:1 Enhancement Level II 2.5:1	580	
Reach 4	56+93 to 66+62	969	151 EI 818 EII	Enhancement Level I Enhancement Level II	N/A	Enhancement Level I 1.5:1 Enhancement Level II 2.5:1	428	
Reach 5	66+62 to 74+88	826	826 EII	Enhancement Level II	N/A	Enhancement Level II 2.5:1	330	
Reach 6	75+19 to 82+55; 91+89 to 104+96	2,043	2,043 P	Preservation	N/A	Preservation 5:1	409	
UT 1	10+00 to 11+11	111	111 EII	Enhancement Level II	N/A	Enhancement Level II 2.5:1	44	
UT 2	10+00 to 19+51	951	49 R 567 EII 335 P	Restoration Enhancement Level II Preservation	N/A	Restoration 1:1 Enhancement Level II 2.5:1 Preservation 5:1	343	
UT 3	10+00 to 24+75	1,475	305 R; 536 EI 634 EII	Restoration Enhancement Level I Enhancement Level II	N/A	Restoration 1:1 Enhancement Level I 1.5:1 Enhancement Level II 2.5:1	916	Potential to increase mitigation units after conversion of an EII area to EI
UT 4	100+00 to 18+31	831	410 EI 421 EII	Enhancement Level I Enhancement Level II	N/A	Enhancement Level I 1.5:1 Enhancement Level II 2.5:1	442	
UT 5	10+00 to 11+84	184	184 EII	Enhancement Level II	N/A	Enhancement Level II 2.5:1	74	
UT 6	10+00 to 11+51	151	151 EII	Enhancement Level II	N/A	Enhancement Level II 2.5:1	60	
UT 7	10+00 to 21+27	1,127	980 R 147 EI	Restoration Enhancement Level I	N/A	Restoration 1:1 Enhancement Level I 1.5:1	1078	
UT 8	10+19 to 10+81	62	62 R	Restoration	N/A	Restoration 1:1	62	

Note: Due to rounding some of the values when added may appear to be 1' short of total, this is purely a product of values being rounded to nearest linear foot

Length and Area Summations

Restoration Level	Stream (linear feet)	Riparian Wetland (acres)		Non-riparian Wetland (acres)	Buffer (square feet)	Upland (acres)
		Riverine	Non-riverine			
Restoration	2,017	N/A	N/A	N/A	201,700	N/A
Enhancement	N/A	N/A	N/A	N/A	N/A	N/A
Enhancement I	1,244	N/A	N/A	N/A	124,400	N/A
Enhancement II	7,723	N/A	N/A	N/A	772,300	N/A
Creation	N/A	N/A	N/A	N/A	N/A	N/A
Preservation	2,378	N/A	N/A	N/A	237,800	N/A
High Quality Preservation	N/A	N/A	N/A	N/A	N/A	N/A

BMP Elements

Element	Location	Purpose/Function	Notes

Table 2: Project Activity and Reporting History		
Little Buffalo Creek Stream Mitigation Project		
DMS Project No. 94147		
Activity or Report	**Data Collection Complete**	**Completion or Delivery**
Technical Proposal	June 2009	August 2008
Categorical Exclusion	February 2010	March 2010
Secure Conservation Easement	March 2010	July 2012
Mitigation Plan	August 2010	April 2014
Final Design – Construction Plans	N/A	May 2014
Construction	June 2014	December 2014
Fencing Installation	June 2014	December 2014
Native Species Planting	December 2014	December 2014
Mitigation Plan / As-built (Year 0 Monitoring – Baseline)	March 2015	June 2015
Year 1 Monitoring	September 2015	December 2015
Replanting & Reseeding	N/A	February 2016
Year 2 Monitoring	September 2016	January 2017
Replanting & Reseeding	N/A	March 2017
Invasive Treatment	N/A	March 2017
Fence Repairs	N/A	December 2016
Construction Repairs	N/A	September 2016
Year 3 Monitoring		
Year 4 Monitoring		
Year 5 Monitoring		

Table 3: Project Contact Table Little Buffalo Creek Stream Mitigation Project DMS Project No. 94147	
Designer Primary Project Design POC	The Louis Berger Group, Inc. 1001 Wade Avenue, Suite 400 Raleigh, NC 27605 Edward Samanns (973) 407-1468
Construction Contractor **Construction contractor POC**	Backwater Environmental, Doug Smith P.O. Box 1107 Eden, NC 27289
Fencing Contractor Fencing Contractor POC	Strader Fencing Inc 5434 Amick Road Julian, NC 27283
Planting Contractor Planting Contract POC	Carolina Sylvics 908 Indian Trail Edenton, NC 27932
Nursery Stock Suppliers	Mellow Marsh 1312 Woody Store Rd. Siler City, NC 27344 919-742-1200 ArborGen Inc. 2011 Broadbank Court Ridgeville, SC 29472 843-851-4129 Superior Trees Inc. 12493 US-90 Lee, FL 32059 850-971-5159
Monitoring Performers	The Louis Berger Group, Inc. 1001 Wade Avenue, Suite 400 Raleigh, NC 27605
Stream Monitoring POC	Louis Berger Group, Inc., Ed Samanns, CE, PWS (973-407-1468)
Vegetation Monitoring POC	Louis Berger Group, Inc.

Table 4 Project Information							
Project Name	Little Buffalo Creek Stream Mitigation Project						
County	Cabarrus County						
Project Area (acres)	12						
Project Coordinates (latitude and longitude)	35.491041°N, . -80.366698° W.						
Project Watershed Summary Information							
Physiographic Province	Piedmont						
River Basin	Yadkin-Pee Dee River						
USGS Hydrologic Unit 8-digit	3040105	USGS Hydrologic Unit 14-digit		3040105020060			
DWQ Sub-basin	03-07-12						
Project Drainage Area (acres)	4,039						
Project Drainage Area Percentage of Impervious Area	5%						
CGIA Land Use Classification	Rural						
Reach Summary Information (Mainstem)							
Parameters	Reach 1	Reach 2	Reach 3	Reach 4	Reach 5	Reach 6	
Length of reach (linear feet)	2,305	1,244	1,083	969	826	2,043	
Valley classification	Type 8	Type 8	Type 8	Type 8	Type 8	Type 8	
Drainage area (acres)	1914	2146	2446	2568	2632	4039	
NCDWQ stream identification score	37.5	37.5	37.5	37.5	37.5	37.5	
NCDWQ Water Quality Classification	C	C	C	C	C	C	
Morphological Description (stream type)	C4/F4	C4/E4	C4/F4	C4	C4/D4b	C4	
Design Rosgen Stream Type	C4	C4	C4	C4	C4	C4	
Evolutionary Trend							
Design Approach (P1, P2, P3, E, etc)	R; EII	EII	R; EII	EI; EII	EII	P	
Underlying mapped soils	Chewacla/ Goldston	Chewacla	Chewacla	Chewacla	Chewacla	Chewacla	
Drainage class	Mod. Well Drained - Well Drained	Mod. Well Drained - Well Drained	Mod. Well Drained - Well Drained	Mod. Well Drained - Well Drained	Mod. Well Drained - Well Drained	Mod. Well Drained - Well Drained	
Soil Hydric status	Non-hydric	Non-hydric	Non-hydric	Non-hydric	Non-hydric	Non-hydric	
Slope	0.48%	0.38%	0.51%	0.39%	0.47%	0.43%	
FEMA classification	N/A	N/A	N/A	N/A	N/A	N/A	
Native vegetation community	Pasture	Pasture	Pasture	Pasture	Pasture	Pasture	
Percent composition of exotic invasive vegetation							

Reach Summary Information (Unnamed Tributaries)							
Parameters	UT 1	UT 2	UT 3	UT 4	UT 5	UT 6	UT 7/UT 8
Length of reach (linear feet)	111	951	1,475	831	184	151	1,127
Valley classification	N/A	Type 2	Type 2	Type 2	N/A	N/A	Type 8
Drainage area (acres)	293	193	62	254	8	16	1222
NCDWQ stream identification score	21	20	26.5	36.5	27.5	24.8	36.5
NCDWQ Water Quality Classification	C	C	C	C	C	C	C
Morphological Description (stream type)	N/A	B6	B6/G6	B4c	N/A	N/A	F4
Design Rosgen Stream Type	No Restoration	B6	B6	B4c	No Restoration	No Restoration	C4
Evolutionary Trend							
Design Approach (P1, P2, P3, E, etc)	EII	R; EII, P	R; EI; EII	EI; EII	EII	EII	R; EI
Underlying mapped soils	Chewacla	Chewacla	Badin/Georgeville	Goldston	Goldston	Goldston	Chewacla
Drainage class	Mod. Well Drained - Well Drained	Mod. Well Drained - Well Drained	Mod. Well Drained - Well Drained	Mod. Well Drained - Well Drained	Mod. Well Drained - Well Drained	Mod. Well Drained - Well Drained	Mod. Well Drained - Well Drained
Soil Hydric status	Non-hydric	Non-hydric	Non-hydric	Non-hydric	Non-hydric	Non-hydric	Non-hydric
Slope	N/A	2.45%	2.35%	2.17%	N/A	N/A	0.96%
FEMA classification	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Native vegetation community	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Percent composition of exaotic invasive vegetation	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Wetland Summary Information			
Parameters	**Wetland 1**	**Wetland 2**	**Wetland 3**
Size of Wetland (acres)	N/A	N/A	N/A
Wetland Type (non-riparian, riparian riverine or riparian	N/A	N/A	N/A
Mapped Soil Series	N/A	N/A	N/A
Drainage class	N/A	N/A	N/A
Soil Hydric Status	N/A	N/A	N/A
Source of Hydrology	N/A	N/A	N/A
Hydrologic Impairment	N/A	N/A	N/A
Native vegetation community	N/A	N/A	N/A
Percent composition of exotic invasive vegetation	N/A	N/A	N/A

Regulatory Considerations			
Regulation	**Applicable?**	**Resolved?**	**Supporting Documentation**
Waters of the United States – Section 404	Y	Y	Permit 2014-00386
Waters of the United States – Section 401	Y	Y	Letter from NCDENR dated February 24, 2015 Nationwide Permit Number 27
Endangered Species Act	Y	Y	Letter to USFWS dated November 16, 2009
Historic Preservation Act	Y	Y	Letter from NC SHPO dated February 2, 2010
Coastal Zone Management Act (CZMA)/ Coastal Area Management	N	N/A	N/A
FEMA Floodplain Compliance	Y	Y	FEMA Floodplain Checklist Restoration Plan Appendix 9
Essential Fisheries Habitat	N	N/A	N/A

Appendix B – Visual Assessment Data

Figures 2a-j – Integrated Current Condition Plan View-MY2

LEGEND:

- THALWEG
- AS-BUILT TOP OF BANK
- CONSERVATION EASEMENT
- CONSERVATION FENCE
- CONSTRUCTED RIFFLE
- BEDROCK
- ROOTWADS
- CONTROL POINT
- STREAM GAGE
- H — VISUAL MORPHIC ASSESSMENT POOR HABITAT
- P — VISUAL MORPHIC ASSESSMENT STRUCTURE SEEPAGE
- VEGPLOT – EXCEEDS REQUIREMENTS BY >10%
- VEGPLOT – EXCEEDS REQUIREMENTS BY <10%
- VEGPLOT – FAILS REQUIREMENTS BY <10%
- VEGPLOT – FAILS REQUIREMENTS BY >10%
- PHOTO LOCATION
- BANK SCOUR/ERODING
- AGGREGATION
- ENCROACHMENT/COW PRINTS

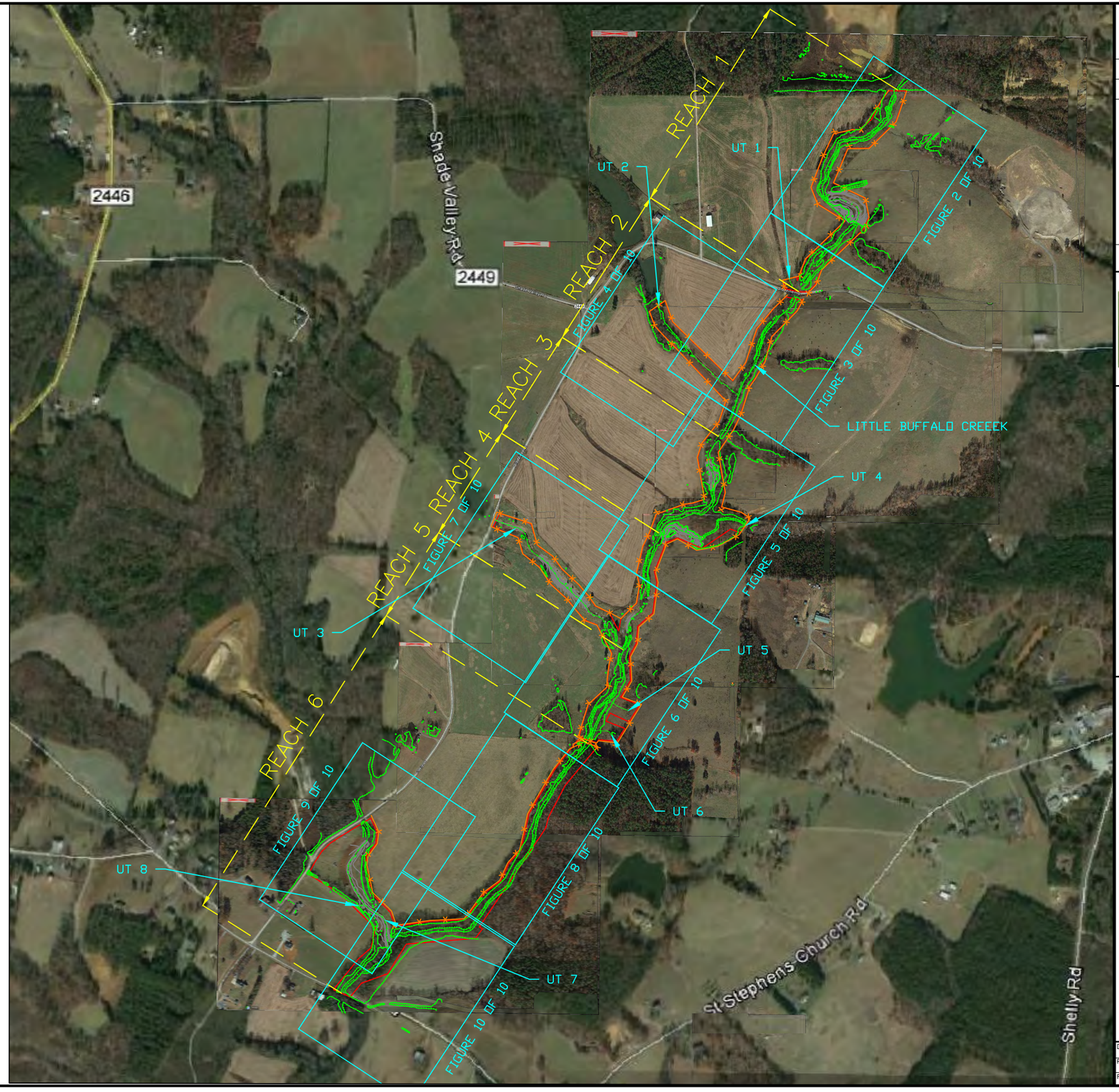
VEGETATION COVERAGE

INVASIVE SPECIES	PRESENT (>75%)	POOR (75%-40%)	ABSENT (<40%)
ABSENT	NO FILL		
PRESENT			
COMMON			

AERIAL SOURCE: GOOGLE EARTH IMAGE 11/30/14

0' 800' 1600'

SCALE: 1"= 800'



NO.	REVISIONS	DRN	CHK	DATE

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THE LOUIS BERGER GROUP, Inc.
1001 Wade Avenue
Raleigh, North Carolina 27605

LITTLE BUFFALO CREEK
STREAM RESTORATION PROJECT
CABARRUS COUNTY
DIVISION OF MITIGATION SERVICES

CURRENT CONDITIONS PLAN VIEW -MY2-

DATE JANUARY 2017
PROJECT NO. 94147
FIGURE 1 OF 10

Filename: V:\Operations\121\1008 - Little Buffalo Creek\Deliverables\Drawings\LBC CCPV\LITTLE BUFFALO CREEK_CCPV.dwg

BEGIN UPSTREAM
MAINSTEM RESTORATION
STA. 22+00
END E2

GAGE 1

BEGIN BEDROCK
EL: 638.68

END BEDROCK
EL: 638.56

VEGPLOT 12

PL 13

GATE

LITTLE BUFFALO STA. 10+00.00
BEGIN E2
X:1595368.236
Y:640628.321

CROSS SECTION MS-1P

LITTLE BUFFALO CREEK

BEGIN BEDROCK
EL: 638.03

END BEDROCK
EL: 637.97

VEGPLOT 11

PL 12

CROSS SECTION MS-1R

END UPSTREAM
MAINSTEM RESTORATION
STA. 25+77.37
BEGIN E2

0' 100' 200'

SCALE: 1"= 100'

AERIAL SOURCE: GOOGLE EARTH IMAGE 11/30/14

LEGEND:

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VEGETATION COVERAGE

INVASIVE SPECIES	PRESENT (>75%)	POOR (75%–40%)	ABSENT (<40%)
ABSENT	NO FILL		
PRESENT			
COMMON			

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CURRENT CONDITIONS PLAN VIEW –MY2–

DATE JANUARY 2017
PROJECT NO. 94147
FIGURE 2 OF 10

Filename: V:\Operations\121\1008 – Little Buffalo Creek\Deliverables\Drawings\BC CCPV\LITTLE BUFFALO CREEK_CCPV.dwg

0’ 100’ 200’

SCALE: 1”= 100’

AERIAL SOURCE: GOOGLE EARTH IMAGE 11/30/14

LEGEND:

- THALWEG
- AS-BUILT TOP OF BANK
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- CONSERVATION FENCE
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VEGETATION COVERAGE

INVASIVE SPECIES	PRESENT (>75%)	POOR (75%–40%)	ABSENT (<40%)
ABSENT	NO FILL		
PRESENT			
COMMON			

RESTORATION

UT-2 STA. 13+34.67
END PRESERVATION
BEGIN E2

UT-2 STA. 14+27.35
END RESTORATION
BEGIN E2

CROSS SECTION UT2-1R

VEGPLOT 8

UT 2

GAGE 3

PI 10

VEGPLOT 9

LITTLE BUFFALO CREEK

UT-2 STA. 19+50.70
LITTLE BUFFALO STA. 42+43
END UT-2 E2

UT-1 STA. 11+10.63
LITTLE BUFFALO STA. 32+99
END UT-1 E2

OLD MINE RD

16 SOIL

BOULDERS

LITTLE BUFFALO STA. 33+66.34
BEGIN E2
BEGIN REACH 2

UT 1

BEGIN UT-1 STA. 10+00.00
BEGIN E2

PI 11

GATE

VEGPLOT 10

LITTLE BUFFALO STA. 33+04.88
END E2

Filename: V:\Operations\121\0008 – Little Buffalo Creek\Deliverables\Drawings\LBC_CCPV\LITTLE BUFFALO CREEK_CCPV.dwg

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CURRENT CONDITIONS PLAN VIEW –MY2–

DATE JANUARY 2017
PROJECT NO. 94147
FIGURE 3 OF 10

LEGEND:

- THALWEG
- AS-BUILT TOP OF BANK
- CONSERVATION EASEMENT
- CONSERVATION FENCE
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VEGETATION COVERAGE

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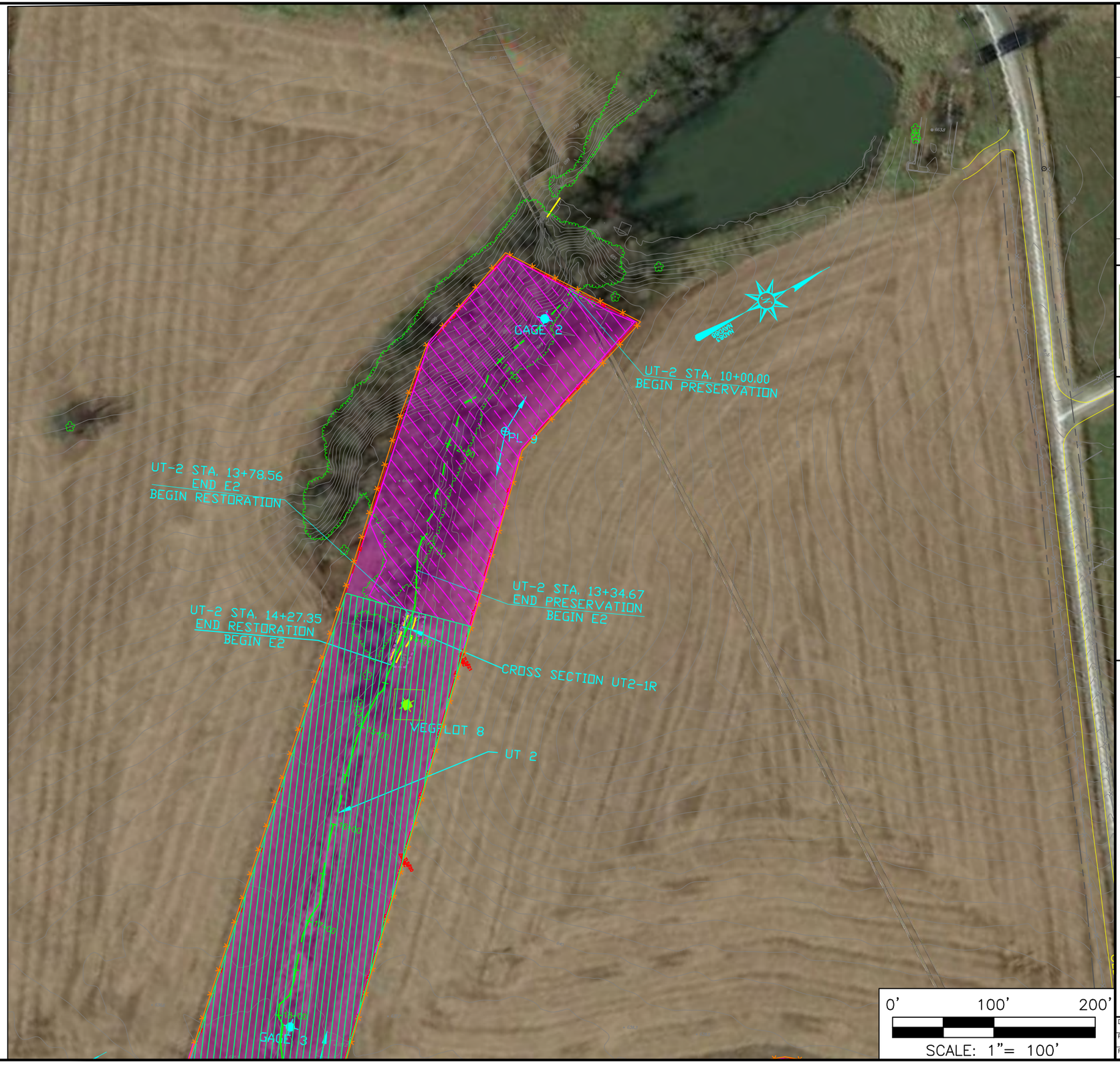
ABSENT	NO FILL		
PRESENT			
COMMON			

AERIAL SOURCE: GOOGLE EARTH IMAGE 11/30/14



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CABARRUS COUNTY
DIVISION OF MITIGATION SERVICES

CURRENT CONDITIONS PLAN VIEW –MY2–

DATE JANUARY 2017
PROJECT NO. 94147
FIGURE 4 OF 10

Filename: V:\Operations\121\1008 – Little Buffalo Creek\Deliverables\Drawings\LBC_CCPV\LITTLE BUFFALO CREEK_CCPV.dwg

UT-4 STA. 18+30.57
LITTLE BUFFALO STA. 56+93
END UT-4 E1

CROSS SECTION UT4-1R

BEGIN BEDROCK
EL: 624.94

END BEDROCK
EL: 624.30

PL 7

VEGPLOT 4

GATE

VEGPLOT 5

GAGE 4

CROSS SECTION
UT4-1P

UT 4

UT-4 STA. 14+21.25
END E2
BEGIN E1

UT-4 STA. 10+00.00
BEGIN E2

LITTLE BUFFALO CREEK

LITTLE BUFFALO STA. 46+10
END REACH 2
BEGIN REACH 3

PL 8

VEGPLOT 7

VEGPLOT 6

BEGIN DOWNSTREAM
MAINSTEM RESTORATION
STA. 48+12.45
END E2

CROSS SECTION MS-2R

CROSS SECTION MS-2P

END DOWNSTREAM
MAINSTEM RESTORATION
STA. 50+56.51
BEGIN E2

AERIAL SOURCE: GOOGLE EARTH IMAGE 11/30/14

0' 100' 200'

SCALE: 1"= 100'

LEGEND:

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- VEGPLOT – FAILS REQUIREMENTS BY >10%
- PHOTO LOCATION

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- ENCROACHMENT/COW PRINTS

VEGETATION COVERAGE

INVASIVE SPECIES	PRESENT (>75%)	POOR (75%–40%)	ABSENT (<40%)
ABSENT	NO FILL		
PRESENT			
COMMON			

NO.	REVISIONS	DRN.	CHK.	DATE

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LITTLE BUFFALO CREEK
STREAM RESTORATION PROJECT
CABARRUS COUNTY
DIVISION OF MITIGATION SERVICES

CURRENT CONDITIONS PLAN VIEW -MY2-

DATE JANUARY 2017
PROJECT NO. 94147
FIGURE 5 OF 10

Filename: V:\Operations\121\1008 - Little Buffalo Creek\Deliverables\Drawings\LBC CCPV\LITTLE BUFFALO CREEK_CCPV.dwg

LEGEND:

- THALWEG
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- VEGPLOT – FAILS REQUIREMENTS BY >10%
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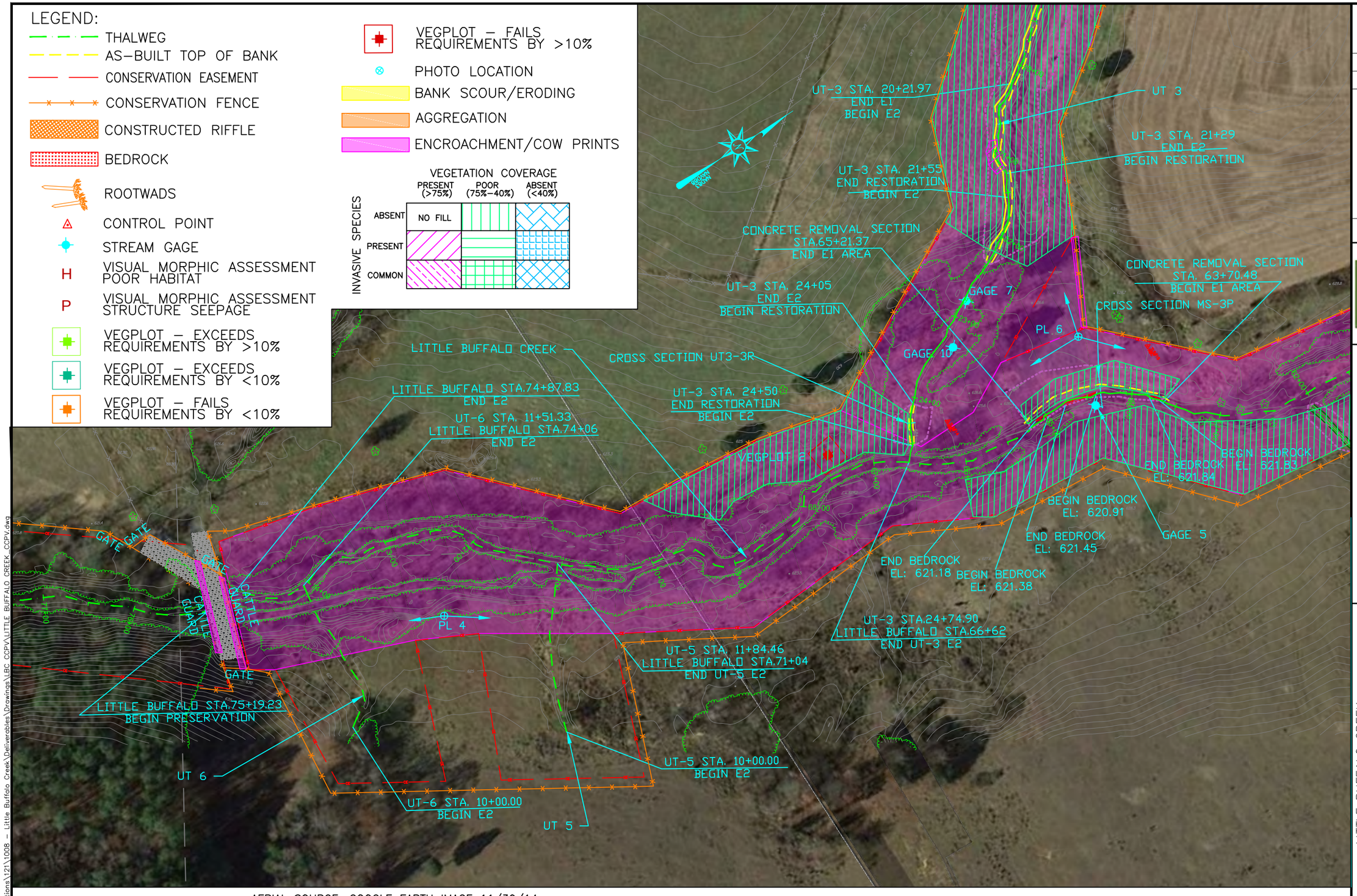
- BANK SCOUR/ERODING
- AGGREGATION
- ENCROACHMENT/COW PRINTS

VEGETATION COVERAGE

INVASIVE SPECIES	PRESENT (>75%)	POOR (75%–40%)	ABSENT (<40%)
ABSENT	NO FILL		
PRESENT			
COMMON			



0' 100' 200'

SCALE: 1"= 100'

AERIAL SOURCE: GOOGLE EARTH IMAGE 11/30/14

Filename: V:\Operations\121\1008 - Little Buffalo Creek\Deliverables\Drawings\LBC CCPV\LITTLE BUFFALO CREEK_CCPV.dwg

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LITTLE BUFFALO CREEK
STREAM RESTORATION PROJECT
CABARRUS COUNTY
DIVISION OF MITIGATION SERVICES

CURRENT CONDITIONS PLAN VIEW –MY2–

DATE JANUARY 2017
PROJECT NO. 94147
FIGURE 6 OF 10

0’ 100’ 200’

SCALE: 1”= 100’

AERIAL SOURCE: GOOGLE EARTH IMAGE 11/30/14

LEGEND:

- THALWEG
- AS-BUILT TOP OF BANK
- CONSERVATION EASEMENT
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- VEGPLOT – FAILS REQUIREMENTS BY <10%
- VEGPLOT – FAILS REQUIREMENTS BY >10%
- PHOTO LOCATION
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- ENCROACHMENT/COW PRINTS

VEGETATION COVERAGE

INVASIVE SPECIES	PRESENT (>75%)	POOR (75%–40%)	ABSENT (<40%)
ABSENT	NO FILL		
PRESENT			
COMMON			

NO.	REVISIONS	DRN	CHK	DATE

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LITTLE BUFFALO CREEK
STREAM RESTORATION PROJECT
CABARRUS COUNTY
DIVISION OF MITIGATION SERVICES

CURRENT CONDITIONS PLAN VIEW –MY2–

DATE JANUARY 2017
PROJECT NO. 94147
FIGURE 7 OF 10

Filename: V:\Operations\121\1008 – Little Buffalo Creek\Deliverables\Drawings\BC_CCPV\LITTLE BUFFALO CREEK_CCPV.dwg

LEGEND:

- THALWEG
- AS-BUILT TOP OF BANK
- CONSERVATION EASEMENT
- CONSERVATION FENCE
- CONSTRUCTED RIFFLE
- BEDROCK
- ROOTWADS
- CONTROL POINT
- STREAM GAGE
- H — VISUAL MORPHIC ASSESSMENT POOR HABITAT
- P — VISUAL MORPHIC ASSESSMENT STRUCTURE SEEPAGE
- VEGPLOT – EXCEEDS REQUIREMENTS BY >10%
- VEGPLOT – EXCEEDS REQUIREMENTS BY <10%
- VEGPLOT – FAILS REQUIREMENTS BY <10%
- VEGPLOT – FAILS REQUIREMENTS BY >10%
- PHOTO LOCATION
- BANK SCOUR/ERODING
- AGGREGATION
- ENCROACHMENT/COW PRINTS

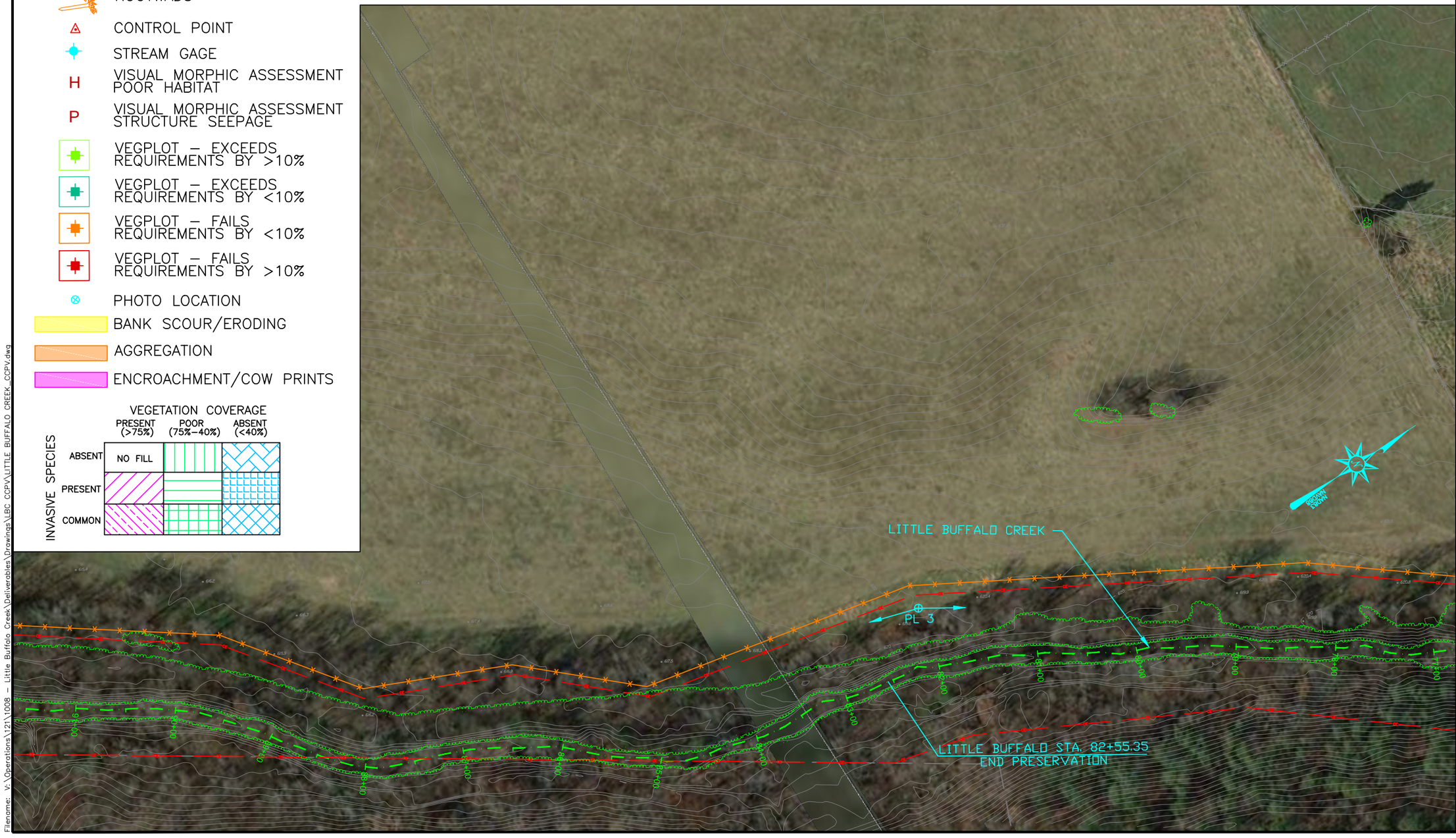
VEGETATION COVERAGE

INVASIVE SPECIES	PRESENT (>75%)	POOR (75%–40%)	ABSENT (<40%)
ABSENT	NO FILL		
PRESENT			
COMMON			

0’ 100’ 200’

SCALE: 1”= 100’

AERIAL SOURCE: GOOGLE EARTH IMAGE 11/30/14



NO.	REVISIONS	DRN	CHK	DATE

NCDEQ-DMS

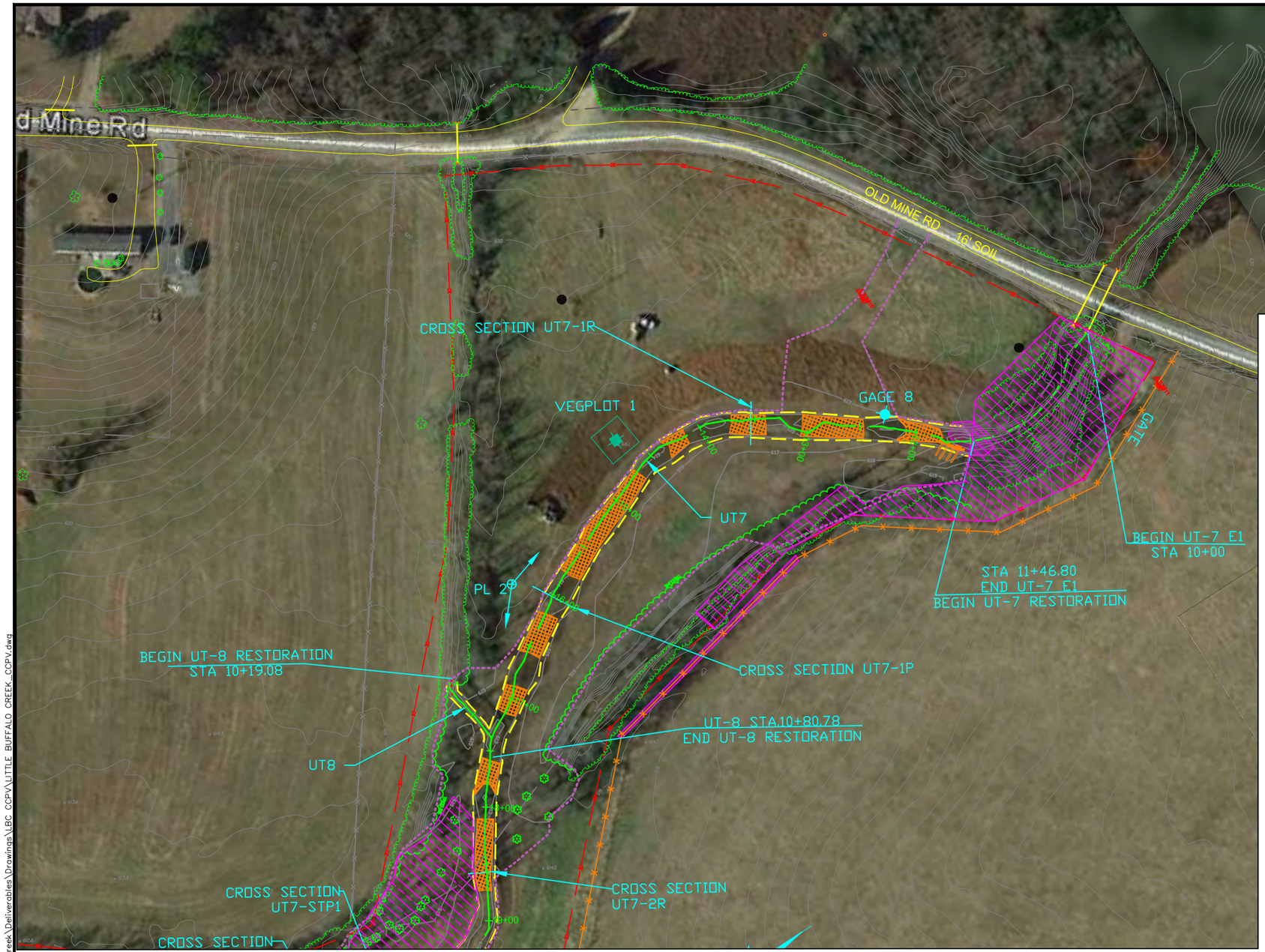
THE LOUIS BERGER GROUP, Inc.
1001 Wade Avenue
Raleigh, North Carolina 27605

LITTLE BUFFALO CREEK
STREAM RESTORATION PROJECT
CABARRUS COUNTY
DIVISION OF MITIGATION SERVICES

CURRENT CONDITIONS PLAN VIEW –MY2–

DATE JANUARY 2017
PROJECT NO. 94147
FIGURE 8 OF 10

Filename: V:\Operations\121\1008 – Little Buffalo Creek\Deliverables\Drawings\LBC_CCPV\LITTLE BUFFALO CREEK_CCPV.dwg



LEGEND:

- THALWEG
- AS–BUILT TOP OF BANK
- CONSERVATION EASEMENT
- CONSERVATION FENCE
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- VEGPLOT – FAILS REQUIREMENTS BY <10%
- VEGPLOT – FAILS REQUIREMENTS BY >10%
- PHOTO LOCATION
- BANK SCOUR/ERODING
- AGGREGATION
- ENCROACHMENT/COW PRINTS

VEGETATION COVERAGE

INVASIVE SPECIES	PRESENT (>75%)	POOR (75%–40%)	ABSENT (<40%)
ABSENT	NO FILL		
PRESENT			
COMMON			

0' 100' 200'

SCALE: 1"= 100'

AERIAL SOURCE: GOOGLE EARTH IMAGE 11/30/14

NO.	REVISIONS	DRN	CHK	DATE

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LITTLE BUFFALO CREEK
STREAM RESTORATION PROJECT
CABARRUS COUNTY
DIVISION OF MITIGATION SERVICES

CURRENT CONDITIONS PLAN VIEW –MY2–

DATE JANUARY 2017
PROJECT NO. 94147
FIGURE 9 OF 10

Filename: V:\Operations\121\1008 – Little Buffalo Creek\Deliverables\Drawings\LBC_CCPV\LITTLE BUFFALO CREEK_CCPV.dwg

LITTLE BUFFALO STA. 104+96.09
END PRESERVATION

CROSS SECTION
UT7-STP1

CROSS SECTION
UT7-STP2

CROSS SECTION
UT7-2R

KLUTTZ RD 16' BST

KLUTTZ RD

PL 1

UT 7

LITTLE BUFFALO STA.99+48.10
UT-7 STA. 21+26.71
END UT 7 RESTORATION

LITTLE BUFFALO CREEK

LITTLE BUFFALO STA. 91+88.65
BEGIN PRESERVATION

LEGEND:

- THALWEG
- AS-BUILT TOP OF BANK
- CONSERVATION EASEMENT
- CONSERVATION FENCE
- CONSTRUCTED RIFFLE
- BEDROCK
- ROOTWADS
- CONTROL POINT
- STREAM GAGE
- H — VISUAL MORPHIC ASSESSMENT POOR HABITAT
- P — VISUAL MORPHIC ASSESSMENT STRUCTURE SEEPAGE
- VEGPLOT – EXCEEDS REQUIREMENTS BY >10%
- VEGPLOT – EXCEEDS REQUIREMENTS BY <10%
- VEGPLOT – FAILS REQUIREMENTS BY <10%
- VEGPLOT – FAILS REQUIREMENTS BY >10%
- PHOTO LOCATION
- BANK SCOUR/ERODING
- AGGREGATION
- ENCROACHMENT/COW PRINTS

VEGETATION COVERAGE

INVASIVE SPECIES	PRESENT (>75%)	POOR (75%–40%)	ABSENT (<40%)
ABSENT	NO FILL		
PRESENT			
COMMON			

AERIAL SOURCE: GOOGLE EARTH IMAGE 11/30/14

0' 100' 200'

SCALE: 1"= 100'

NO.	REVISIONS	DRN.	CHK.	DATE

NCDEQ-DMS

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Raleigh, North Carolina 27605

LITTLE BUFFALO CREEK
STREAM RESTORATION PROJECT
CABARRUS COUNTY
DIVISION OF MITIGATION SERVICES

CURRENT CONDITIONS PLAN VIEW -MY2-

DATE JANUARY 2017
PROJECT NO. 94147
FIGURE 10 OF 10

Filename: V:\Operations\121\1008 - Little Buffalo Creek\Deliverables\Drawings\BC_CCPV\LITTLE BUFFALO CREEK_CCPV.dwg

Tables 5a-g – Visual Stream Morphology Assessment

Table 5 **Visual Stream Morphology Stability Assessment**
Reach ID **Reach 1**
Assessed Length **381**

Major Channel Category	Channel Sub-Category	Metric	Number Stable, Performing as Intended	Total Number in As-built	Number of Unstable Segments	Amount of Unstable Footage	% Stable, Performing as Intended	Number with Stabilizing Woody Vegetation	Footage with Stabilizing Woody Vegetation	Adjusted % for Stabilizing Woody Vegetation
1. Bed	1. Vertical Stability	1. Aggradation - No visual aggradation			0	0	100%			
		2. Degradation - No visual degradation			0	0	100%			
	2. Riffle Condition	1. Texture/Substrate - Riffle maintains as-built substrate	6	6			100%			
	3. Meander Pool Condition	1. Depth Sufficient (Max Pool Depth : Mean Bankfull Depth > 1.6)	3	3			100%			
		2. Length appropriate?	3	3			100%			
	4. Thalwag Position	1. Thalweg centering at upstream of meander bend (Run)?	3	3			100%			
		2. Thalweg centering at downstream of meander bend (Glide)?	3	3			100%			
1. Bank	1. Scoured/Eroding	Bank lacking vegetative cover resulting simply from poor growth and/or scour and erosion			0	0	100%	0	0	100%
	2. Undercut	Banks undercut/overhanging to the extent that mass wasting appears likely. Does NOT include undercuts that are modest, appear sustainable and are providing habitat.			0	0	100%	0	0	100%
	3. Mass Wasting	Bank slumping, calving, or collapse			0	0	100%	0	0	100%
				Totals	0	0	100%	0	0	100%
2. Engineered Structures	Log Vane structures installed incorrectly during construction, final as-built developed inner berm material overtop structures to bury the log vanes and have no structures within this reach.									

Reach ID Reach 3
Assessed Length 261

Major Channel Category	Channel Sub-Category	Metric	Number Stable, Performing as Intended	Total Number in As-built	Number of Unstable Segments	Amount of Unstable Footage	% Stable, Performing as Intended	Number with Stabilizing Woody Vegetation	Footage with Stabilizing Woody Vegetation	Adjusted % for Stabilizing Woody Vegetation
1. Bed	1. Vertical Stability	1. Aggradation - No visual aggradation			2	72	86%			
		2. Degradation - No visual degradation			0	0	100%			
	2. Riffle Condition	1. Texture/Substrate - Riffle maintains as-built substrate	3	3			100%			
1. Bank	1. Scoured/Eroding	Bank lacking vegetative cover resulting simply from poor growth and/or scour and erosion			0	0	100%	0	0	100%
	2. Undercut	Banks undercut/overhanging to the extent that mass wasting appears likely. Does NOT include undercuts that are modest, appear sustainable and are providing habitat.			1	20	96%	1	20	100%
	3. Mass Wasting	Bank slumping, calving, or collapse			0	0	100%	0	0	100%
				Totals	1	20	96%	1	20	100%
2. Engineered Structures	1. Overall Integrity	Structures physically intact with no dislodged boulders or logs.	2	2			100%			
	2. Bank Protection	Bank erosion within the structures extent of influence does not exceed 15%. (See guidance for this table in DMS monitoring guidance document)	2	2			100%			
	3. Habitat	Pool forming structures maintaining ~ Max Pool Depth : Mean Bankfull Depth ratio ≥ 1.6 Rootwads/logs providing some cover at base-flow.	2	2			100%			

Reach ID **Reach 4**
Assessed Length **200**

Major Channel Category	Channel Sub-Category	Metric	Number Stable, Performing as Intended	Total Number in As-built	Number of Unstable Segments	Amount of Unstable Footage	% Stable, Performing as Intended	Number with Stabilizing Woody Vegetation	Footage with Stabilizing Woody Vegetation	Adjusted % for Stabilizing Woody Vegetation
1. Bed	**1. Vertical Stability**	1. Aggradation - No visual aggradation			0	0	100%			
		2. Degradation - No visual degradation			0	0	100%			
	2. Riffle Condition	1. Texture/Substrate - Riffle maintains as-built substrate	3	3			100%			
2. Bank	**1. Scoured/Eroding**	Bank lacking vegetative cover resulting simply from poor growth, no scouring occurred of bank			1	200	50%	0	0	74%
	2. Undercut	Banks undercut/overhanging to the extent that mass wasting appears likely. Does NOT include undercuts that are modest, appear sustainable and are providing habitat.			0	0	100%	0	0	100%
	3. Mass Wasting	Bank slumping, calving, or collapse			0	0	100%	0	0	100%
				Totals	1	200	50%	0	0	74%

Reach ID UT 2
Assessed Length 49

Major Channel Category	Channel Sub-Category	Metric	Number Stable, Performing as Intended	Total Number in As-built	Number of Unstable Segments	Amount of Unstable Footage	% Stable, Performing as Intended	Number with Stabilizing Woody Vegetation	Footage with Stabilizing Woody Vegetation	Adjusted % for Stabilizing Woody Vegetation
1. Bed	1. Vertical Stability	1. Aggradation - No visual aggradation			0	0	100%			
		2. Degradation - No visual degradation			0	0	100%			
	2. Riffle Condition	1. Texture/Substrate - Riffle maintains as-built substrate	0	1			0%			
2. Bank	1. Scoured/Eroding	Bank lacking vegetative cover resulting simply from poor growth and/or scour and erosion			0	0	100%	0	0	100%
	2. Undercut	Banks undercut/overhanging to the extent that mass wasting appears likely. Does NOT include undercuts that are modest, appear sustainable and are providing habitat.			0	0	100%	0	0	100%
	3. Mass Wasting	Bank slumping, calving, or collapse			0	0	100%	0	0	100%
				Totals	0	0	100%	0	0	100%

Reach ID UT 3
Assessed Length 898

Major Channel Category	Channel Sub-Category	Metric	Number Stable, Performing as Intended	Total Number in As-built	Number of Unstable Segments	Amount of Unstable Footage	% Stable, Performing as Intended	Number with Stabilizing Woody Vegetation	Footage with Stabilizing Woody Vegetation	Adjusted % for Stabilizing Woody Vegetation
1. Bed	1. Vertical Stability	1. Aggradation - No visual aggradation			0	0	100%			
		2. Degradation - No visual degradation			0	0	100%			
	2. Riffle Condition	1. Texture/Substrate - Riffle maintains as-built substrate	8	8			100%			
2. Bank	1. Scoured/Eroding	Bank lacking vegetative cover resulting simply from poor growth and/or scour and erosion			1	276	85%	0	0	85%
	2. Undercut	Banks undercut/overhanging to the extent that mass wasting appears likely. Does NOT include undercuts that are modest, appear sustainable and are providing habitat.			0	0	100%	0	0	100%
	3. Mass Wasting	Bank slumping, calving, or collapse			0	0	100%	0	0	100%
				Totals	1	276	85%	0	0	85%

Reach ID UT 4
Assessed Length 410

Major Channel Category	Channel Sub-Category	Metric	Number Stable, Performing as Intended	Total Number in As-built	Number of Unstable Segments	Amount of Unstable Footage	% Stable, Performing as Intended	Number with Stabilizing Woody Vegetation	Footage with Stabilizing Woody Vegetation	Adjusted % for Stabilizing Woody Vegetation
1. Bed	1. Vertical Stability	1. Aggradation - No visual aggradation			0	0	100%			
		2. Degradation - No visual degradation			0	0	100%			
	2. Riffle Condition	1. Texture/Substrate - Riffle maintains as-built substrate	8	8			100%			
	3. Meander Pool Condition	1. Depth Sufficient (Max Pool Depth : Mean Bankfull Depth > 1.6)	3	3			100%			
		2. Length appropriate?	3	3			100%			
	4. Thalwag Position	1. Thalweg centering at upstream of meander bend (Run)?	3	3			100%			
		2. Thalweg centering at downstream of meander bend (Glide)?	3	3			100%			
2. Bank	1. Scoured/Eroding	Bank lacking vegetative cover resulting simply from poor growth			0	0	100%	0	0	100%
	2. Undercut	Banks undercut/overhanging to the extent that mass wasting appears likely. Does NOT include undercuts that are modest, appear sustainable and are providing habitat.			1	10	99%	1	10	100%
	3. Mass Wasting	Bank slumping, calving, or collapse			0	0	100%	0	0	100%
				Totals	1	10	99%	1	10	100%

Reach ID UT 7/8
Assessed Length 1189

Major Channel Category	Channel Sub-Category	Metric	Number Stable, Performing as Intended	Total Number in As-built	Number of Unstable Segments	Amount of Unstable Footage	% Stable, Performing as Intended	Number with Stabilizing Woody Vegetation	Footage with Stabilizing Woody Vegetation	Adjusted % for Stabilizing Woody Vegetation
1. Bed	1. Vertical Stability	1. Aggradation - No visual aggradation			0	0	100%			
		2. Degradation - degradation in last curve pool before step pool system			1	40	98%			
	2. Riffle Condition	1. Texture/Substrate - Riffle maintains as-built substrate	11	11			100%			
	3. Meander Pool Condition	1. Depth Sufficient (Max Pool Depth : Mean Bankfull Depth > 1.6)	3	4			75%			
		2. Length appropriate?	4	4			100%			
	4. Thalwag Position	1. Thalweg centering at upstream of meander bend (Run)?	4	4			100%			
		2. Thalweg centering at downstream of meander bend (Glide)?	4	4			100%			
2. Bank	1. Scoured/Eroding	Bank lacking vegetative cover resulting simply from poor growth and/or scour and erosion			0	0	100%	0	0	100%
	2. Undercut	Banks undercut/overhanging to the extent that mass wasting appears likely. Does NOT include undercuts that are modest, appear sustainable and are providing habitat.			0	0	100%	0	0	100%
	3. Mass Wasting	Bank slumping, calving, or collapse			0	0	100%	0	0	100%
				Totals	0	0	100%	0	0	100%
3. Engineered Structures	1. Overall Integrity	Structures physically intact with no dislodged boulders or logs.	9	9			100%			
	2. Grade Control	Grade control structures exhibiting maintenance of grade across the sill.	9	9			100%			
	2a. Piping	Structures lacking any substantial flow underneath sills or arms. - Possible piping under one rock vane step pool spotted in september field work, but no water to observe if actually happening	8	9			89%			
	3. Bank Protection	Bank erosion within the structures extent of influence does not exceed 15%. (See guidance for this table in DMS monitoring guidance document)	9	9			100%			
	4. Habitat	Pool forming structures maintaining ~ Max Pool Depth : Mean Bankfull Depth ratio ≥ 1.6 Rootwads/logs providing some cover at base-flow.- step pools filled with large boulders from upstream of site, maintains small pools at low flow, but <1.6 Max to Mean Deptj	3	9			33%			

Tables 6a-i – Vegetation Condition Assessment Table

Table 6 Vegetation Condition Assessment

Reach 1

Planted Acreage[1] 5.47

Vegetation Category	Definitions	Mapping Threshold	CCPV Depiction	Number of Polygons	Combined Acreage	% of Planted Acreage
1. Bare Areas	Very limited cover of both woody and herbaceous material.	0.1 acres	Pattern and Color	0	0.00	0.0%
2. Low Stem Density Areas	Woody stem densities clearly below target levels based on MY3, 4, or 5 stem count criteria.	0.1 acres	Pattern and Color	3	1.15	21.0%
			Total	0	0.00	0.0%
3. Areas of Poor Growth Rates or Vigor	Areas with woody stems of a size class that are obviously small given the monitoring year.	0.25 acres	Pattern and Color	0	0.00	0.0%
			Cumulative Total	3	1.15	21.0%

Easement Acreage[2] 7.29

Vegetation Category	Definitions	Mapping Threshold	CCPV Depiction	Number of Polygons	Combined Acreage	% of Easement Acreage
4. Invasive Areas of Concern[4]	Japenese Honeysuckle, Adult Princess Tree	1000 SF	Pattern and Color	2	0.20	2.8%
5. Easement Encroachment Areas[3]	Fence down due to storm debris, not cut. Will be replaced.	none	Pattern and Color	1	0.02	0.3%

Reach 2

Planted Acreage[1] 2.85

Vegetation Category	Definitions	Mapping Threshold	CCPV Depiction	Number of Polygons	Combined Acreage	% of Planted Acreage
1. Bare Areas	Very limited cover of both woody and herbaceous material.	0.1 acres	Pattern and Color	0	0.00	0.0%
2. Low Stem Density Areas	Woody stem densities clearly below target levels based on MY3, 4, or 5 stem count criteria.	0.1 acres	Pattern and Color	1	0.95	33.3%
			Total	0	0.00	0.0%
3. Areas of Poor Growth Rates or Vigor	Areas with woody stems of a size class that are obviously small given the monitoring year.	0.25 acres	Pattern and Color	0	0.00	0.0%
			Cumulative Total	1	0.95	33.3%

Easement Acreage[2] 3.73

Vegetation Category	Definitions	Mapping Threshold	CCPV Depiction	Number of Polygons	Combined Acreage	% of Easement Acreage
4. Invasive Areas of Concern[4]	Areas or points (if too small to render as polygons at map scale).	1000 SF	Pattern and Color	0	0.00	0.0%
5. Easement Encroachment Areas[3]	Cows in Easement, heavy grazing and barb wire fence with woven gate installed across channel at old mill road to keep cattle from escaping.	none	Pattern and Color	1	3.73	100.0%

Reach 3

Planted Acreage[1] **2.65**

Vegetation Category	Definitions	Mapping Threshold	CCPV Depiction	Number of Polygons	Combined Acreage	% of Planted Acreage
1. Bare Areas	Very limited cover of both woody and herbaceous material.	0.1 acres	Pattern and Color	0	0.00	0.0%
2. Low Stem Density Areas	Woody stem densities clearly below target levels based on MY3, 4, or 5 stem count criteria.	0.1 acres	Pattern and Color	1	0.89	33.8%
			Total	0	0.00	0.0%
3. Areas of Poor Growth Rates or Vigor	Areas with woody stems of a size class that are obviously small given the monitoring year.	0.25 acres	Pattern and Color	0	0.00	0.0%
			Cumulative Total	1	0.89	33.8%

Easement Acreage[2] **3.83**

Vegetation Category	Definitions	Mapping Threshold	CCPV Depiction	Number of Polygons	Combined Acreage	% of Easement Acreage
4. Invasive Areas of Concern[4]	Princess Tree	1000 SF	Pattern and Color	1	0.17	4.3%
5. Easement Encroachment Areas[3]	Cows in easement, heavy grazing in restoration reach with damage channel. Channel reworked as part of MY2 maintenance for aggradation and damage.	none	Pattern and Color	1	3.83	100.0%

Reach 4

Planted Acreage[1] **2.26**

Vegetation Category	Definitions	Mapping Threshold	CCPV Depiction	Number of Polygons	Combined Acreage	% of Planted Acreage
1. Bare Areas	Very limited cover of both woody and herbaceous material.	0.1 acres	Pattern and Color	1	0.10	4.3%
2. Low Stem Density Areas	Woody stem densities clearly below target levels based on MY3, 4, or 5 stem count criteria.	0.1 acres	Pattern and Color	1	1.02	45.2%
			Total	1	0.10	4.3%
3. Areas of Poor Growth Rates or Vigor	Areas with woody stems of a size class that are obviously small given the monitoring year.	0.25 acres	Pattern and Color	0	0.00	0.0%
			Cumulative Total	2	1.12	49.5%

Easement Acreage[2] **3.1**

Vegetation Category	Definitions	Mapping Threshold	CCPV Depiction	Number of Polygons	Combined Acreage	% of Easement Acreage
4. Invasive Areas of Concern[4]	Japenese Honeysuckle in small patch near vegplot 4	1000 SF	Pattern and Color	1	0.02	0.6%
5. Easement Encroachment Areas[3]	Heavy grazing and cows in easement, cow tracks through channel at area of E1	none	Pattern and Color	1	3.10	100.0%

Reach 5

Planted Acreage[1] **2.05**

Vegetation Category	Definitions	Mapping Threshold	CCPV Depiction	Number of Polygons	Combined Acreage	% of Planted Acreage
1. Bare Areas	Very limited cover of both woody and herbaceous material.	0.1 acres	Pattern and Color	0	0.00	0.0%
2. Low Stem Density Areas	Woody stem densities clearly below target levels based on MY3, 4, or 5 stem count criteria.	0.1 acres	Pattern and Color	1	0.34	16.6%
			Total	0	0.00	0.0%
3. Areas of Poor Growth Rates or Vigor	Areas with woody stems of a size class that are obviously small given the monitoring year.	0.25 acres	Pattern and Color	0	0.00	0.0%
			Cumulative Total	1	0.34	16.6%

Easement Acreage[2] **2.74**

Vegetation Category	Definitions	Mapping Threshold	CCPV Depiction	Number of Polygons	Combined Acreage	% of Easement Acreage
4. Invasive Areas of Concern[4]	Areas or points (if too small to render as polygons at map scale).	1000 SF	Pattern and Color	0	0.00	0.0%
5. Easement Encroachment Areas[3]	Electric wire on cattle crossing fence broken on both sides of crossing. Gates to crossing closed. Cows in easement, woven wire fence cut at corner of cattle crossing.	none	Pattern and Color	3	2.74	100.0%

UT 2

Planted Acreage[1] **1.25**

Vegetation Category	Definitions	Mapping Threshold	CCPV Depiction	Number of Polygons	Combined Acreage	% of Planted Acreage
1. Bare Areas	Very limited cover of both woody and herbaceous material.	0.1 acres	Pattern and Color	0	0.00	0.0%
2. Low Stem Density Areas	Woody stem densities clearly below target levels based on MY3, 4, or 5 stem count criteria.	0.1 acres	Pattern and Color	1	1.25	100.0%
			Total	0	0.00	0.0%
3. Areas of Poor Growth Rates or Vigor	Areas with woody stems of a size class that are obviously small given the monitoring year.	0.25 acres	Pattern and Color	0	0.00	0.0%
			Cumulative Total	1	1.25	100.0%

Easement Acreage[2] **2.65**

Vegetation Category	Definitions	Mapping Threshold	CCPV Depiction	Number of Polygons	Combined Acreage	% of Easement Acreage
4. Invasive Areas of Concern[4]	Privet, tree of heaven	1000 SF	Pattern and Color	1	1.03	38.9%
5. Easement Encroachment Areas[3]	Cattle prints heavy in channel/damage, mostly in lower 300 feet of channel, grazing heavy in lower portion of trib, not as bad in the upstream portion. Corner of Fence cut.	none	Pattern and Color	1	2.65	100.0%

UT 3

Planted Acreage[1] **3.21**

Vegetation Category	Definitions	Mapping Threshold	CCPV Depiction	Number of Polygons	Combined Acreage	% of Planted Acreage
1. Bare Areas	Very limited cover of both woody and herbaceous material.	0.1 acres	Pattern and Color	1	0.08	2.4%
2. Low Stem Density Areas	Woody stem densities clearly below target levels based on MY3, 4, or 5 stem count criteria.	0.1 acres	Pattern and Color	2	3.21	100.0%
			Total	1	0.08	2.4%
3. Areas of Poor Growth Rates or Vigor	Areas with woody stems of a size class that are obviously small given the monitoring year.	0.25 acres	Pattern and Color	0	0.00	0.0%
			Cumulative Total	3	3.29	102.4%

Easement Acreage[2] **4.11**

Vegetation Category	Definitions	Mapping Threshold	CCPV Depiction	Number of Polygons	Combined Acreage	% of Easement Acreage
4. Invasive Areas of Concern[4]	Privet patch	1000 SF	Pattern and Color	1	0.01	0.2%
5. Easement Encroachment Areas[3]	Cows in easement, heavy grazing, damage throughout channel bottom.	none	Pattern and Color	1	4.11	100.0%

UT 4

Planted Acreage[1] **1.43**

Vegetation Category	Definitions	Mapping Threshold	CCPV Depiction	Number of Polygons	Combined Acreage	% of Planted Acreage
1. Bare Areas	Top of bank area bare where sheet flow washed seeding into channel	0.1 acres	Pattern and Color	1	0.02	1.5%
2. Low Stem Density Areas	Woody stem densities clearly below target levels based on MY3, 4, or 5 stem count criteria.	0.1 acres	Pattern and Color	0	0.00	0.0%
			Total	1	0.02	1.5%
3. Areas of Poor Growth Rates or Vigor	Areas with woody stems of a size class that are obviously small given the monitoring year.	0.25 acres	Pattern and Color	0	0.00	0.0%
			Cumulative Total	1	0.02	1.5%

Easement Acreage[2] **2.01**

Vegetation Category	Definitions	Mapping Threshold	CCPV Depiction	Number of Polygons	Combined Acreage	% of Easement Acreage
4. Invasive Areas of Concern[4]	Privet spotted in small patch	1000 SF	Pattern and Color	1	0.04	1.9%
5. Easement Encroachment Areas[3]	Cows within the easement, prints and trail formed through thicker vegetation, minor damage to channel at the top of the restoration work (damage can recover naturally)	none	Pattern and Color	2	2.01	100.0%

UT 7

Planted Acreage[1] **2.63**

Vegetation Category	Definitions	Mapping Threshold	CCPV Depiction	Number of Polygons	Combined Acreage	% of Planted Acreage
1. Bare Areas	Very limited cover of both woody and herbaceous material.	0.1 acres	Pattern and Color	0	0.00	0.0%
2. Low Stem Density Areas	Woody stem densities clearly below target levels based on MY3, 4, or 5 stem count criteria.	0.1 acres	Pattern and Color	0	0.00	0.0%
			Total	0	0.00	0.0%
3. Areas of Poor Growth Rates or Vigor	Areas with woody stems of a size class that are obviously small given the monitoring year.	0.25 acres	Pattern and Color	0	0.00	0.0%
			Cumulative Total	0	0.00	0.0%

Easement Acreage[2] **6.07**

Vegetation Category	Definitions	Mapping Threshold	CCPV Depiction	Number of Polygons	Combined Acreage	% of Easement Acreage
4. Invasive Areas of Concern[4]	Japenese Honeysuckle, Tree of Heaven, Chinese Privet	1000 SF	Pattern and Color	3	0.86	14.1%
5. Easement Encroachment Areas[3]	Cow prints located in easement areas and have trampled soil. Fence partially broken due to trees falling	none	Pattern and Color	2	0.04	0.7%

Photo Appendices

Photo Appendix A: Vegetation Monitoring

Veg Plot 1

Veg Plot 2

Veg Plot 3

Veg Plot 4

Veg Plot 5

Veg Plot 6

Veg Plot 7

Veg Plot 8

Veg Plot 9

Veg Plot 10

Veg Plot 11

Veg Plot 12

Photo Appendix B: Cross Sections

Cross Section MS-1P Downstream

Cross Section MS-1P Upstream

Cross Section MS-1R Downstream

Cross Section MS-1R Upstream

Cross Section MS-2P Downstream

Cross Section MS-2P Upstream

Cross Section MS-2R Downstream

Cross Section MS-2R Upstream

Cross Section MS-3P Downstream

Cross Section MS-3P Upstream

Cross Section UT2-1R Downstream

Cross Section UT2-1R Upstream

Cross Section UT3-1P Downstream

Cross Section UT3-1P Upstream

Cross Section UT3-1R Downstream

Cross Section UT3-1R Upstream

Cross Section UT3-2R Downstream

Cross Section UT3-2R Upstream

Cross Section UT4-1P Downstream

Cross Section UT4-1P Upstream

Cross Section UT4-1R Downstream

Cross Section UT4-1R Upstream

Cross Section UT7-1P Downstream

Cross Section UT7-1P Upstream

Cross Section UT7-1R Downstream

Cross Section UT7-1R Upstream

Cross Section UT7-2R Downstream

Cross Section UT7-2R Upstream

Photo Appendix C: Photo Stations

Photo Location 1-A – Mainstem Upstream

Photo Location 1-B – Mainstem Downstream

Photo Location 1-C – UT7 Upstream

Photo Location 2-A – UT7 Upstream

Photo Location 2-B – UT7 Downstream

Photo Location 3-A - Upstream

Photo Location 3-B - Upstream

Photo Location 4-A – Upstream

Photo Location 4-B - Downstream

Photo Location 5-A - Downstream

Photo Location 5-B – Upstream

Photo Location 6-A – Mainstem Downstream

Photo Location 6-B – Mainstem Upstream

Photo Location 6-C – UT3 Upstream

Photo Location 7-A – Mainstem Downstream

Photo Location 7-B – UT4 Downstream

Photo Location 7-C – Mainstem Upstream

Photo Location 7-D – UT4 Upstream

Photo Location 9-A - Downstream

Photo Location 9-B – Upstream

Photo Location 10-A – Mainstem Downstream

Photo Location 10-B – Mainstem Upstream

Photo Location 10-C – UT2 Upstream

Photo Location 11-A –Downstream

Photo Location 11-B - Upstream

Photo Location 12-A - Downstream

Photo Location 12-B – Upstream

Photo Appendix D: Problem Areas

Barbed wire fence installed at Old Mine Rd.

Fence installed across mainstem at Old Mine Rd. has since been removed. Upstream view.

UT2 – Damage done by cattle crossing stream at bottom of trib.

UT2 – Lower trib filled in with mud due to cattle trampling.
Downstream view.

UT2 – Lower trib filled in with mud due to cattle trampling. Upstream view.

Headcut forming on bank in the middle mainstem. Downstream view.

Fill in middle mainstem due to cattle trampling. Upstream view.

UT4 – Minor undercut in toe of bank. Upstream view.

Damage from cattle crossing lower mainstem.

UT3 – Large headcut forming in bank.
Heavy cattle damage in streambed. Upstream view.

UT3 – Heavy cattle damage in streambed. Upstream view.

UT3 – Cattle damage crossing bottom of trib. Upstream view.

Wires cut leaving slack in cattle crossing. Fence not electrified.

Fence has been cut and hastily repaired adjacent to cattle crossing.

UT7 – Barbed wire broken. Cattle jump over the fence.

UT7 – Cow prints in banks and streambed.

UT7 – Water beginning to move under stone blocks in step pools.

Heavy grazing by cattle along reach 3. Upstream View.
Herbaceous vegetation and planted trees affected.

UT4 – Cow path and grazing at top of trib. Upstream view.

UT3 – Cow path and heavy grazing along UT3. Downstream view.

Photo Appendix E: Significant Flow Events

UT7 – Lower step pool section. Rock debris in floodplain. February 2016.

UT7 – Lower section before step pools. Rack deposits after bankfull event. February 2016.

UT7 – Rack deposits in Veg Plot 1 after bankfull event. February 2016.

Mainstem – Concrete removal section, vegetation above bankfull bent to direction of flow. February 2016.

Mainstem – Upstream restoration area. Area flooded after bankfull event. February 2016.

Appendix C – Vegetation Plot Data

Table 7 – Vegetation Plot Criteria Attainment

Plot	MY1 Success Criteria Met (Y/N)	Tract Mean
1	Y	50%
2	N	
3	N	
4	Y	
5	Y	
6	Y	
7	N	
8	Y	
9	Y	
10	N	
11	N	
12	N	

Table 8 - CVS Vegetation Plot Metadata

Report Prepared By	Gregory A. Russo
Date Prepared	10/11/2016 16:01
database name	cvs-eep-entrytool-v2.3.1.mdb
database location	C:\Users\grrusso\Desktop
computer name	MTN-GRRUSSO
file size	61444096

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	94147
project Name	Little Buffalo Creek Stream Mitigation Project
Description	Louis Berger is restoring the Little Buffalo Creek Stream Mitigation Site in Cabarrus County, North Carolina for the North Carolina Ecosystem Enhancement Program. Berger will be planting the riparian corridor with native tree and shrub vegetation.
River Basin	Yadkin-Pee Dee
length(ft)	
stream-to-edge width (ft)	
area (sq m)	48265.23781
Required Plots (calculated)	12
Sampled Plots	12

Table 9 - Planted and Total Stem Counts

DMS Project Code 94147. Project Name: Little Buffalo Creek Stream Mitigation Project

			Current Plot Data (MY2 2016)																																			Annual Means								
			94147-01-0001			94147-01-0002			94147-01-0003			94147-01-0004			94147-01-0005			94147-01-0006			94147-01-0007			94147-01-0008			94147-01-0009			94147-01-0010			94147-01-0011			94147-01-0012			MY2 (2016)			MY1 (2015)			MY0 (2014)		
Scientific Name	Common Name	Species Type	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T
Acer negundo	boxelder	Tree																					2																								
Acer rubrum	red maple	Tree																																		3			3			4					
Alnus serrulata	hazel alder	Shrub										2	2	2	1	1	1															2	2	2				5	5	5	5	5	5	13	13	13
Carpinus caroliniana	American hornbeam	Tree													1	1	1	4	4	4														2	2	2	1	1	1	8	8	8	14	14	14	11	11	11
Celtis laevigata	sugarberry	Tree	1	1	1				2	2	2										2	2	2				8	8	8										13	13	13	4	4	4	29	29	29
Cercis canadensis	eastern redbud	Tree	1	1	1	1	1	1	1	1	1				1	1	1							1	1	1	2	2	2										7	7	7	4	4	4	13	13	13
Fraxinus pennsylvanica	green ash	Tree	1	1	1	3	3	3							5	5	5	4	4	4	1	1	1																14	14	14	7	7	7	14	14	14
Juglans nigra	black walnut	Tree			1						1						2			1																		1			6							
Juniperus virginiana	eastern redcedar	Tree						2																														1			3			1				
Liquidambar styraciflua	sweetgum	Tree															73			3						5								24			3			108			254				
Liriodendron tulipifera	tuliptree	Tree							1	1	1	2	2	2			2										2	2	2										5	5	7	10	10	13	19	19	19
Pinus rigida	pitch pine	Tree																																2			1			3							
Pinus virginiana	Virginia pine	Tree																																								1					
Platanus occidentalis	American sycamore	Tree													3	3	10	2	2	8							3	3	3	2	2	2	1	1	3	1	1	1	12	12	27	10	10	52	16	16	16
Quercus falcata	southern red oak	Tree	2	2	2							2	2	4				4	4	4	1	1	1	7	7	9	1	1	1							3	3	3	20	20	24	4	4	6	7	7	7
Quercus michauxii	swamp chestnut oak	Tree	2	2	2	1	1	1										1	1	1	1	1	1	1	1	1	1	1	1							1	1	1	8	8	8	6	6	6	10	10	10
Sambucus	elderberry	Shrub																					8																		8							
Ulmus rubra	slippery elm	Tree																														1								1							
Viburnum dentatum	southern arrowwood	Shrub							1	1	1	1	1	1	3	3	3																1	1	1				6	6	6	6	6	6	11	11	11
Stem count			7	7	8	5	5	7	5	5	6	7	7	9	14	14	98	15	15	25	5	5	15	9	9	16	17	17	17	2	2	3	6	6	34	6	6	15	98	98	253	70	70	377	143	143	143
size (ares)			0.83613			0.83613			0.83613			0.83613			0.83613			0.83613			0.83613			0.83613			0.83613			0.83613			0.83613			0.83613			10.03356			10.03356			10.03356		
size (ACRES)			0.02			0.02			0.02			0.02			0.02			0.02			0.02			0.02			0.02			0.02			0.02			0.02			0.25			0.25			0.25		
Species count			5	5	6	3	3	4	4	4	5	4	4	4	6	6	9	5	5	7	4	4	6	3	3	4	6	6	6	1	1	2	4	4	6	4	4	9	10	10	18	10	10	14	10	10	10
Stems per ACRE			339	339	387	242	242	339	242	242	290	339	339	436	678	678	4743	726	726	1210	242	242	726	436	436	774	823	823	823	96.8	96.8	145	290	290	1646	290	290	726	395	395	1020	282	282	1521	577	577	577

Color for Density

Exceeds requirements by 10%

Exceeds requirements, but by less than 10%

Fails to meet requirements, by less than 10%

Fails to meet requirements by more than 10%

Appendix D – Stream Measurement & Geomorphology Data

Table 10a. Baseline Stream Data Summary
Little Buffalo Creek (94147) - Segment/Reach: Mainstem Reach 1 (2,305 feet)

Parameter	Gauge[2]	Regional Curve			Pre-Existing Condition						Reference Reach(es) Data						Design			Monitoring Baseline					
Dimension and Substrate - Riffle Only		LL	UL	Eq.	Min	Mean	Med	Max	SD[5]	n	Min	Mean	Med	Max	SD[5]	n	Min	Med	Max	Min	Mean	Med	Max	SD[5]	n
Bankfull Width (ft)					45.55	56.61	52.02	82.98	14.98	5	43.1	52.2	50.6	64.4	8.8	4	36	36	36	35.21	35.21	35.21	35.21		1
Floodprone Width (ft)					67.73	106.5	96.36	177.3	43.15	5	54.9	75.3	74.3	98	15.4	4	>88	>88	>88	>80	>80	>80	>80		1
Bankfull Mean Depth (ft)					0.65	1.18	1.24	1.6	0.35	5	0.98	1.16	1.1	1.38	0.18	4	0.96	0.96	0.96	1.23	1.23	1.23	1.23		1
[1]Bankfull Max Depth (ft)					2.54	3.04	2.8	3.83	0.58	5	2.17	2.41	2.5	2.5	0.14	4	1.5	1.5	1.5	1.79	1.79	1.79	1.79		1
Bankfull Cross Sectional Area (ft^2)					53.58	63.29	59.12	83.09	11.52	5	55.4	59.3	58.7	64.5	3.36	4	34.38	34.38	34.38	43.15	43.15	43.15	43.15		1
Width/Depth Ratio					32.51	56.56	40.56	127.7	40.14	5	31.3	47	46.2	64.4	14.35	4	37.5	37.5	37.5	28.73	28.73	28.73	28.73		1
Entrenchment Ratio					1.49	1.84	1.92	2.17	0.33	5	1.1	1.5	1.5	1.8	0.3	4	>2.2	>2.2	>2.2	>2.2	>2.2	>2.2	>2.2		1
[1]Bank Height Ratio					**0.91**	**1.09**		**1.37**								**4**	**1**	**1**	**1**	**1**	**1**	**1**	**1**		**1**
Profile																									
Riffle Length (ft)											7	28.8	27.5	52	13	8	35	40	50	7.73	23.71	22.04	38.44		
Riffle Slope (ft/ft)											0.009	0.02	0.018	0.422	0.01	8	0.003	0.014	0.028	0	0.026	0.022	0.076		
Pool Length (ft)											16	76.4	39.5	79	17.32	13	10	20	20	4.21	25.43	17.55	83.2		
Pool Max depth (ft)											2.9	3.2	3.3	3.5	0.24	13	1.5	1.81	1.81	1.96	2.71	2.48	3.76		
Pool Spacing (ft)											36	76.4	74	111	26.26	7	80	125	170	29.95	48.64	39.06	91.87		
Pattern																									
Channel Beltwidth (ft)																	84	84	84	59.64	105.8	92.68	165.2		
Radius of Curvature (ft)																	57.62	79.3	101	72.97	83.15	79.01	97.49		
Rc:Bankfull width (ft/ft)																	**35.24**	**36**	**69.62**	**27.95**	**35.6**	**36.13**	**46.36**		
Meander Wavelength (ft)																									
Meander Width Ratio																	1.21	2.33	2.38	1.29	3.04	2.57	5.91		
Transport parameters																									
Reach Shear Stress (competency) lb/ft^2							0.334											0.32				0.322			
Max part size (mm) mobilized at bankfull																									
Stream Power (transport capacity) W/m^2																									
Additional Reach Parameters																									
Rosgen Classification							C4						C4					C4				C4			
Bankfull Velocity (fps)							1.82											4.36				3.48			
Bankfull Discharge (cfs)							115																		
Valley length (ft)																									
Channel Thalweg length (ft)													932					2293.33				2299.79			
Sinuosity (ft)							1.05						1.25					1.05				1.05			
Water Surface Slope (Channel) (ft/ft)													0.38												
BF slope (ft/ft)													**0.38**												
[3]Bankfull Floodplain Area (acres)																		**0.45**				**0.3959**			
[4]% of Reach with Eroding Banks																									
Channel Stability or Habitat Metric																									
Biological or Other																									

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

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

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

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

Table 10a. Baseline Stream Data Summary
Little Buffalo Creek (94147) - Segment/Reach: Mainstem Reach 3 (1,083 feet)

Parameter	Gauge[2]	Regional Curve			Pre-Existing Condition						Reference Reach(es) Data						Design			Monitoring Baseline					
Dimension and Substrate - Riffle Only		LL	UL	Eq.	Min	Mean	Med	Max	SD[5]	n	Min	Mean	Med	Max	SD[5]	n	Min	Med	Max	Min	Mean	Med	Max	SD[5]	n
Bankfull Width (ft)					34.42	41.48	41.54	48.48	7.03	3	43.1	52.2	50.6	64.4	8.8	4	40	40	40	38.31	38.31	38.31	38.31		1
Floodprone Width (ft)					258.2	265.4	265.4	272.6	7.21	3	54.9	75.3	74.3	98	15.4	4	>88	>88	>88	>90	>90	>90	>90		1
Bankfull Mean Depth (ft)					1.2	1.47	1.42	1.8	0.3	3	0.98	1.16	1.1	1.38	0.18	4	1.58	1.58	1.58	1.26	1.26	1.26	1.26		1
[1]Bankfull Max Depth (ft)					2.47	2.78	2.79	3.09	0.31	3	2.17	2.41	2.5	2.5	0.14	4	2	2	2	1.9	1.9	1.9	1.9		1
Bankfull Cross Sectional Area (ft^2)					58.33	59.79	58.96	62.09	2.01	3	55.4	59.3	58.7	64.5	3.36	4	63	63	63	48.23	48.23	48.23	48.23		1
Width/Depth Ratio					19.12	29.59	29.25	40.4	10.64	3	31.3	47	46.2	64.4	14.35	4	39.87	39.87	39.87	30.43	30.43	30.43	30.43		1
Entrenchment Ratio					5.33	6.53	6.56	7.71	1.19	3	1.1	1.5	1.5	1.8	0.3	4	>2.2	>2.2	>2.2	>2.2	>2.2	>2.2	>2.2		1
[1]Bank Height Ratio					**1.94**	**2.19**		**2.43**								**4**	**1**	**1**	**1**	**0.94**	**0.94**	**0.94**	**0.94**		**1**
Profile																									
Riffle Length (ft)											7	28.8	27.5	52	13	8	15	30	65	11.3	18.65	20.99	21.31		
Riffle Slope (ft/ft)											0.009	0.02	0.018	0.422	0.01	8	0.017	0.027	0.033	0.018	0.05	0.024	0.134		
Pool Length (ft)											16	76.4	39.5	79	17.32	13	10	15	20	6.32	12.33	10.63	21.53		
Pool Max depth (ft)											2.9	3.2	3.3	3.5	0.24	13	2	2.25	2.5	0.5	1.13	1.26	1.69		
Pool Spacing (ft)											36	76.4	74	111	26.26	7	70	70	70	36.04	45.42	46.77	53.33		
Pattern																									
Channel Beltwidth (ft)																				58.77	58.77	58.77	58.77		
Radius of Curvature (ft)																				83.8	83.8	83.8	83.8		
Rc:Bankfull width (ft/ft)																				**4.58**	**15.65**	**16.52**	**23.05**		
Meander Wavelength (ft)																									
Meander Width Ratio																				2.55	5.2	3.56	12.83		
Transport parameters																									
Reach Shear Stress (competency) lb/ft^2							0.619											0.516				0.199			
Max part size (mm) mobilized at bankfull																									
Stream Power (transport capacity) W/m^2																									
Additional Reach Parameters																									
Rosgen Classification							C4						C4					C4				C4			
Bankfull Velocity (fps)							2.73											3.03				3.96			
Bankfull Discharge (cfs)							163																		
Valley length (ft)																									
Channel Thalweg length (ft)													932					1030.85				1079.45			
Sinuosity (ft)							1.13						1.25					1.05				1.01			
Water Surface Slope (Channel) (ft/ft)													0.38												
BF slope (ft/ft)													**0.38**												
[3]Bankfull Floodplain Area (acres)																		**0.49**				**0.074**			
[4]% of Reach with Eroding Banks																									
Channel Stability or Habitat Metric																									
Biological or Other																									

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

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

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

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

Table 10a. Baseline Stream Data Summary
Little Buffalo Creek (94147) - Segment/Reach: UT 2 (951 feet)

Parameter	Gauge[2]	Regional Curve			Pre-Existing Condition						Reference Reach(es) Data						Design			Monitoring Baseline					
Dimension and Substrate - Riffle Only		LL	UL	Eq.	Min	Mean	Med	Max	SD[5]	n	Min	Mean	Med	Max	SD[5]	n	Min	Med	Max	Min	Mean	Med	Max	SD[5]	n
Bankfull Width (ft)																	4	4	4	3.52	3.52	3.52	3.52		1
Floodprone Width (ft)																	7	7	7	8.34	8.34	8.34	8.34		1
Bankfull Mean Depth (ft)																	0.47	0.47	0.47	0.52	0.52	0.52	0.52		1
[1]Bankfull Max Depth (ft)																	0.75	0.75	0.75	0.72	0.72	0.72	0.72		1
Bankfull Cross Sectional Area (ft^2)																	1.88	1.88	1.88	1.82	1.82	1.82	1.82		1
Width/Depth Ratio																	8.51	8.51	8.51	6.82	6.82	6.82	6.82		1
Entrenchment Ratio																	1.75	1.75	1.75	2.37	2.37	2.37	2.37		1
[1]Bank Height Ratio																	**1**	**1**	**1**	**1.01**	**1.01**	**1.01**	**1.01**		**1**
Profile																									
Riffle Length (ft)																	51.74	51.74	51.74	6.98	13.52	13.52	20.07		
Riffle Slope (ft/ft)																	0.024	0.024	0.024	0.01	0.013	0.013	0.016		
Pool Length (ft)																				12.76	12.76	12.76	12.76		
Pool Max depth (ft)																				0.89	0.89	0.89	0.89		
Pool Spacing (ft)																				30.63	30.63	30.63	30.63		
Pattern																									
Channel Beltwidth (ft)																									
Radius of Curvature (ft)																									
Rc:Bankfull width (ft/ft)																									
Meander Wavelength (ft)																									
Meander Width Ratio																									
Transport parameters																									
Reach Shear Stress (competency) lb/ft^2																	0.571			0.249					
Max part size (mm) mobilized at bankfull																									
Stream Power (transport capacity) W/m^2																									
Additional Reach Parameters																									
Rosgen Classification																	B6			B6					
Bankfull Velocity (fps)																				1.66					
Bankfull Discharge (cfs)																									
Valley length (ft)																									
Channel Thalweg length (ft)																	951			951.37					
Sinuosity (ft)																				0.96					
Water Surface Slope (Channel) (ft/ft)																									
BF slope (ft/ft)																									
[3]Bankfull Floodplain Area (acres)																									
[4]% of Reach with Eroding Banks																									
Channel Stability or Habitat Metric																									
Biological or Other																									

Shaded cells indicate that these will typically not be filled in.
1 = The distributions for these parameters can include information from both the cross-section measurements and the longitudinal profile. 2 = For projects with a proximal USGS gauge in-line with the project reach (added bankfull verification - rare).
3. Utilizing XS measurement data produce an estimate of the bankfull floodplain area in acres, which should be the area from the top of bank to the toe of the terrace riser/slope.
4 = Proportion of reach exhibiting banks that are eroding based on the visual survey for comparison to monitoring data; 5. Of value/needed only if the n exceeds 3

Table 10a. Baseline Stream Data Summary
Little Buffalo Creek (94147) - Segment/Reach: UT 3 (1,475 feet)

Parameter	Gauge[2]	Regional Curve			Pre-Existing Condition						Reference Reach(es) Data						Design			Monitoring Baseline					
Dimension and Substrate - Riffle Only		LL	UL	Eq.	Min	Mean	Med	Max	SD[5]	n	Min	Mean	Med	Max	SD[5]	n	Min	Med	Max	Min	Mean	Med	Max	SD[5]	n
Bankfull Width (ft)																	4	4	4	3.5	4.38	3.73	5.91		3
Floodprone Width (ft)																	7	7	7	6.35	14.65	13.14	24.45		3
Bankfull Mean Depth (ft)																	0.47	0.47	0.47	0.2	0.34	0.29	0.53		3
[1]Bankfull Max Depth (ft)																	0.75	0.75	0.75	0.31	0.58	0.61	0.82		3
Bankfull Cross Sectional Area (ft^2)																	1.88	1.88	1.88	0.75	1.43	1.69	1.84		3
Width/Depth Ratio																	8.51	8.51	8.51	6.66	15.31	18.61	20.67		3
Entrenchment Ratio																	1.75	1.75	1.75	1.7	3.64	2.22	6.99		3
[1]Bank Height Ratio																	**1**	**1**	**1**	**0.54**	**0.64**	**0.64**	**0.74**		**3**
Profile																									
Riffle Length (ft)																	197.1	355.9	514.7	57.25	107.8	89.01	215.1		
Riffle Slope (ft/ft)																	0.006	0.012	0.044	0.011	0.017	0.014	0.029		
Pool Length (ft)																				1.5	12.97	6.04	31.37		
Pool Max depth (ft)																				4.14	4.46	4.61	4.62		
Pool Spacing (ft)																				114.3	133.6	143.3	143.3		
Pattern																									
Channel Beltwidth (ft)																	50.42	59.15	61.2	13.4	34.2	42.73	46.46		
Radius of Curvature (ft)																				21.64	35.62	35.15	50.55		
Rc:Bankfull width (ft/ft)																				**2.38**	**15.62**	**14.63**	**30.84**		
Meander Wavelength (ft)																									
Meander Width Ratio																				0.43	5.37	2.44	19.52		
Transport parameters																									
Reach Shear Stress (competency) lb/ft^2																	0.285			0.29					
Max part size (mm) mobilized at bankfull																									
Stream Power (transport capacity) W/m^2																									
Additional Reach Parameters																									
Rosgen Classification																	B6			B6					
Bankfull Velocity (fps)																				1.47					
Bankfull Discharge (cfs)																									
Valley length (ft)																									
Channel Thalweg length (ft)																	1475			1469.07					
Sinuosity (ft)																				0.95					
Water Surface Slope (Channel) (ft/ft)																				0.019					
BF slope (ft/ft)																				**0.019**					
[3]Bankfull Floodplain Area (acres)																				**0.84**					
[4]% of Reach with Eroding Banks																									
Channel Stability or Habitat Metric																									
Biological or Other																									

Shaded cells indicate that these will typically not be filled in.
1 = The distributions for these parameters can include information from both the cross-section measurements and the longitudinal profile. 2 = For projects with a proximal USGS gauge in-line with the project reach (added bankfull verification - rare).
3. Utilizing XS measurement data produce an estimate of the bankfull floodplain area in acres, which should be the area from the top of bank to the toe of the terrace riser/slope.
4 = Proportion of reach exhibiting banks that are eroding based on the visual survey for comparison to monitoring data; 5. Of value/needed only if the n exceeds 3

Table 10a. Baseline Stream Data Summary
Little Buffalo Creek (94147) - Segment/Reach: UT 4 (831 feet)

Parameter	Gauge[2]	Regional Curve			Pre-Existing Condition						Reference Reach(es) Data						Design			Monitoring Baseline					
Dimension and Substrate - Riffle Only		LL	UL	Eq.	Min	Mean	Med	Max	SD[5]	n	Min	Mean	Med	Max	SD[5]	n	Min	Med	Max	Min	Mean	Med	Max	SD[5]	n
Bankfull Width (ft)																				13.32	13.32	13.32	13.32		1
Floodprone Width (ft)																				>50	>50	>50	>50		1
Bankfull Mean Depth (ft)																				0.91	0.91	0.91	0.91		1
[1]Bankfull Max Depth (ft)																				1.71	1.71	1.71	1.71		1
Bankfull Cross Sectional Area (ft^2)																				12.13	12.13	12.13	12.13		1
Width/Depth Ratio																				14.63	14.63	14.63	14.63		1
Entrenchment Ratio																				>2.2	>2.2	>2.2	>2.2		1
[1]Bank Height Ratio																				**0.6**	**0.6**	**0.6**	**0.6**		**1**
Profile																									
Riffle Length (ft)																				4.74	19.81	21.81	30.73		
Riffle Slope (ft/ft)																				0.012	0.027	0.018	0.074		
Pool Length (ft)																				6.99	12.56	9.1	26.02		
Pool Max depth (ft)																				1.89	2.28	2.32	2.7		
Pool Spacing (ft)																				50.06	56.72	55.31	68.08		
Pattern																									
Channel Beltwidth (ft)																				80.13	98.47	98.47	116.8		
Radius of Curvature (ft)																				36.7	47.23	49.01	56.95		
Rc:Bankfull width (ft/ft)																				**16.34**	**19.23**	**18.89**	**23.76**		
Meander Wavelength (ft)																				221.95	221.95	221.95	221.95		
Meander Width Ratio																				3.37	5.19	4.91	7.15		
Transport parameters																									
Reach Shear Stress (competency) lb/ft^2																				1.35					
Max part size (mm) mobilized at bankfull																									
Stream Power (transport capacity) W/m^2																									
Additional Reach Parameters																									
Rosgen Classification																				C4b					
Bankfull Velocity (fps)																				4.23					
Bankfull Discharge (cfs)																									
Valley length (ft)																									
Channel Thalweg length (ft)																				830.01					
Sinuosity (ft)																				0.806					
Water Surface Slope (Channel) (ft/ft)																									
BF slope (ft/ft)																									
[3]Bankfull Floodplain Area (acres)																				**0.03**					
[4]% of Reach with Eroding Banks																									
Channel Stability or Habitat Metric																									
Biological or Other																									

Shaded cells indicate that these will typically not be filled in.
1 = The distributions for these parameters can include information from both the cross-section measurements and the longitudinal profile. 2 = For projects with a proximal USGS gauge in-line with the project reach (added bankfull verification - rare).
3. Utilizing XS measurement data produce an estimate of the bankfull floodplain area in acres, which should be the area from the top of bank to the toe of the terrace riser/slope.
4 = Proportion of reach exhibiting banks that are eroding based on the visual survey for comparison to monitoring data; 5. Of value/needed only if the n exceeds 3

Table 10a. Baseline Stream Data Summary
Little Buffalo Creek (94147) - Segment/Reach: UT 7 (1,127 feet)

Parameter	Gauge[2]	Regional Curve			Pre-Existing Condition						Reference Reach(es) Data						Design			Monitoring Baseline					
Dimension and Substrate - Riffle Only		LL	UL	Eq.	Min	Mean	Med	Max	SD[5]	n	Min	Mean	Med	Max	SD[5]	n	Min	Med	Max	Min	Mean	Med	Max	SD[5]	n
Bankfull Width (ft)					20.47	26.07	26.81	30.18	4.06	4	43.1	52.2	50.6	64.4	8.8	4	25	25	25	18.58	19.65	19.65	20.71		2
Floodprone Width (ft)					39.2	54.4	43.82	90.77	24.57	4	54.9	75.3	74.3	98	15.4	4	>55	>55	>55	>80			>100		2
Bankfull Mean Depth (ft)					0.85	1	1	1.17	0.13	4	0.98	1.16	1.1	1.38	0.18	4	0.98	0.98	0.98	0.96	1.07	1.07	1.17		2
[1]Bankfull Max Depth (ft)					1.79	2.16	1.94	2.95	0.54	4	2.17	2.41	2.5	2.5	0.14	4	1.13	1.13	1.13	1.17	1.43	1.43	1.69		2
Bankfull Cross Sectional Area (ft^2)					19.96	26.07	26.67	31	5.47	4	55.4	59.3	58.7	64.5	3.36	4	24.44	24.44	24.44	19.93	20.81	20.81	21.68		2
Width/Depth Ratio					20.89	26.33	26.3	31.81	5.33	4	31.3	47	46.2	64.4	14.35	4	25.51	25.51	25.51	15.92	18.72	18.72	21.52		2
Entrenchment Ratio					1.45	2.07	1.92	3.01	0.75	4	1.1	1.5	1.5	1.8	0.3	4	>2.2	>2.2	>2.2	>2.2	>2.2	>2.2	>2.2		2
[1]Bank Height Ratio																**4**	**1**	**1**	**1**	**0.78**	**0.85**	**0.85**	**0.92**		**2**
Profile																									
Riffle Length (ft)											7	28.8	27.5	52	13	8	10	35	60	9.79	36.53	37.12	54.31		
Riffle Slope (ft/ft)											0.009	0.02	0.018	0.422	0.01	8	0.008	0.01	0.01	0.001	0.014	0.013	0.039		
Pool Length (ft)											16	76.4	39.5	79	17.32	13	10	10	20	8.16	15.87	13.77	28.95		
Pool Max depth (ft)											2.9	3.2	3.3	3.5	0.24	13	1.5	2	2	1	2.05	2.04	2.85		
Pool Spacing (ft)											36	76.4	74	111	26.26	7	15	55	100	13.27	54.36	56.47	130.7		
Pattern																									
Channel Beltwidth (ft)																	201	201	201	154.6	209.3	209.3	264		
Radius of Curvature (ft)																	50	137.5	686	90.88	194.3	125.7	434.9		
Rc:Bankfull width (ft/ft)																	**28**	**31.5**	**31**	**15.71**	**20.53**	**21.99**	**22.62**		
Meander Wavelength (ft)																	720	720	720	687.9	687.9	687.9	687.9		
Meander Width Ratio																	6.48	6.38	7.18	9.838	10.19	9.514	11.67		
Transport parameters																									
Reach Shear Stress (competency) lb/ft^2							0.479											0.407				0.358			
Max part size (mm) mobilized at bankfull																									
Stream Power (transport capacity) W/m^2																									
Additional Reach Parameters																									
Rosgen Classification							F4/C4						C4					C4				C4			
Bankfull Velocity (fps)							3.7											3.93				4.61			
Bankfull Discharge (cfs)							96																		
Valley length (ft)																									
Channel Thalweg length (ft)													932					1110.53				1126.71			
Sinuosity (ft)													1.25					1.21				1.23			
Water Surface Slope (Channel) (ft/ft)													0.38					0.006				0.006			
BF slope (ft/ft)													**0.38**					**0.006**				**0.005**			
[3]Bankfull Floodplain Area (acres)																		**0.459**				**5.35**			
[4]% of Reach with Eroding Banks																									
Channel Stability or Habitat Metric																									
Biological or Other																									

Shaded cells indicate that these will typically not be filled in.
1 = The distributions for these parameters can include information from both the cross-section measurements and the longitudinal profile. 2 = For projects with a proximal USGS gauge in-line with the project reach (added bankfull verification - rare).
3. Utilizing XS measurement data produce an estimate of the bankfull floodplain area in acres, which should be the area from the top of bank to the toe of the terrace riser/slope.
4 = Proportion of reach exhibiting banks that are eroding based on the visual survey for comparison to monitoring data; 5. Of value/needed only if the n exceeds 3

Table 10b. Baseline Stream Data Summary (Substrate, Bed, Banks, and Hydrologic Containment Parameter Distribution)
Little Buffalo Creek (94147) Segment/Reach: Mainstem Reach 1 (2,305 feet)

Parameter	Pre-Existing Condition							Reference Reach(es) Data							Design							As-built/Baseline						
[1]Ri% / Ru% / P% / G% / S%															41.8	25.4	19.4	13.4	0			30.5	14.7	36.8	18	0		
[1]SC% / Sa% / G% / C% / B% / Be%	26	22.1	51.9	0	0	0		10.2	20.4	59.2	0	0	10.2															
[1]d16 / d35 / d50 / d84 / d95 / di^{p} / di^{sp} (mm)	0.04	0.69	2.33	10.3	21.3			0.24	2.96	6.85	26.8	bedrock																
[2]Entrenchment Class <1.5 / 1.5-1.99 / 2.0-4.9 / 5.0-9.9 / >10																						0	0	100	0	0		
[3]Incision Class <1.2 / 1.2-1.49 / 1.5-1.99 / >2.0																						100	0	0	0			

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

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

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

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

Footnotes 2,3 - These classes are loosley built around the Rosgen classification and hazard ranking breaks, but were adjusted slightly to make for easier assignment to somewhat coarser bins based on visual estimates in the field such that measurement of every segment for ER would not be necessary.

The intent here is to provide the reader/consumer of design and monitoring information with a good general sense of the extent of hydrologic containment in the pre-existing and the rehabilitated states as well as comparisons to the reference distributions.

ER and BHR have been addressed in prior submissions as a subsample (cross-sections as part of the design measurements), however, these subsamples have often focused entirely on facilitating design without providing a thorough pre-construtions distribution of these parameters, leaving the reader/consumer with a sample that is weighted heavily on the stable sections of the reach. This means that the distributions for these parameters should include data from both the cross-section measurements and the longitudinal profile and in the case of ER, visual estimates. For example, the typical longitudinal profile permits sampling of the BHR at riffles beyond those subject to cross-sections and therefore can be readily integrated and provide a more complete sample distribution for these parameters, thereby providing the distribution/coverage necessary to provide meaningful comparisons.

Table 10b. Baseline Stream Data Summary (Substrate, Bed, Banks, and Hydrologic Containment Parameter Distribution)
Little Buffalo Creek (94147) Segment/Reach: Mainstem Reach 3 (1,083 feet)

Parameter	Pre-Existing Condition							Reference Reach(es) Data							Design							As-built/Baseline						
[1]Ri% / Ru% / P% / G% / S%															41.3	13	13	32.7	0			25.8	20.2	26	28	0		
[1]SC% / Sa% / G% / C% / B% / Be%	17	20	41	22	0	0		10.2	20.4	59.2	0	0	10.2															
[1]d16 / d35 / d50 / d84 / d95 / di^{p} / di^{sp} (mm)	0.06	0.9	12.5	94.2	159			0.24	2.96	6.85	26.8	bedrock																
[2]Entrenchment Class <1.5 / 1.5-1.99 / 2.0-4.9 / 5.0-9.9 / >10																						0	5	95	0	0		
[3]Incision Class <1.2 / 1.2-1.49 / 1.5-1.99 / >2.0																						98	2	0	0			

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

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

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

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

Footnotes 2,3 - These classes are loosley built around the Rosgen classification and hazard ranking breaks, but were adjusted slightly to make for easier assignment to somewhat coarser bins based on visual estimates in the field such that measurement of every segment for ER would not be necessary.

The intent here is to provide the reader/consumer of design and monitoring information with a good general sense of the extent of hydrologic containment in the pre-existing and the rehabilitated states as well as comparisons to the reference distributions.

ER and BHR have been addressed in prior submissions as a subsample (cross-sections as part of the design measurements), however, these subsamples have often focused entirely on facilitating design without providing a thorough pre-construtions distribution of these parameters, leaving the reader/consumer with a sample that is weighted heavily on the stable sections of the reach. This means that the distributions for these parameters should include data from both the cross-section measurements and the longitudinal profile and in the case of ER, visual estimates. For example, the typical longitudinal profile permits sampling of the BHR at riffles beyond those subject to cross-sections and therefore can be readily integrated and provide a more complete sample distribution for these parameters, thereby providing the distribution/coverage necessary to provide meaningful comparisons.

Table 10b. Baseline Stream Data Summary (Substrate, Bed, Banks, and Hydrologic Containment Parameter Distribution)
Little Buffalo Creek (94147) Segment/Reach: Mainstem Reach 4 (969 feet)

Parameter	Pre-Existing Condition							Reference Reach(es) Data							Design							As-built/Baseline						
[1]Ri% / Ru% / P% / G% / S%	40.9	28.8	11.7	18.6	0																	40.9	28.8	11.7	18.6	0		
[1]SC% / Sa% / G% / C% / B% / Be%	24.8	21	28.6	2.9	1	21.9		10.2	20.4	59.2	0	0	10.2															
[1]d16 / d35 / d50 / d84 / d95 / di^{p} / di^{sp} (mm)	0.04	0.74	2.75	bedroc	bedrock			0.24	2.96	6.85	26.8	bedrock																
[2]Entrenchment Class <1.5 / 1.5-1.99 / 2.0-4.9 / 5.0-9.9 / >10																						0	0	100	0	0		
[3]Incision Class <1.2 / 1.2-1.49 / 1.5-1.99 / >2.0																						100	0	0	0			

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

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

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

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

Footnotes 2,3 - These classes are loosley built around the Rosgen classification and hazard ranking breaks, but were adjusted slightly to make for easier assignment to somewhat coarser bins based on visual estimates in the field such that measurement of every segment for ER would not be necessary.

The intent here is to provide the reader/consumer of design and monitoring information with a good general sense of the extent of hydrologic containment in the pre-existing and the rehabilitated states as well as comparisons to the reference distributions.

ER and BHR have been addressed in prior submissions as a subsample (cross-sections as part of the design measurements), however, these subsamples have often focused entirely on facilitating design without providing a thorough pre-construtions distribution of these parameters, leaving the reader/consumer with a sample that is weighted heavily on the stable sections of the reach. This means that the distributions for these parameters should include data from both the cross-section measurements and the longitudinal profile and in the case of ER, visual estimates. For example, the typical longitudinal profile permits sampling of the BHR at riffles beyond those subject to cross-sections and therefore can be readily integrated and provide a more complete sample distribution for these parameters, thereby providing the distribution/coverage necessary to provide meaningful comparisons.

Table 10b. Baseline Stream Data Summary (Substrate, Bed, Banks, and Hydrologic Containment Parameter Distribution)
Little Buffalo Creek (94147) Segment/Reach: UT2 (951 feet)

Parameter	Pre-Existing Condition							Reference Reach(es) Data							Design							As-built/Baseline						
[1]Ri% / Ru% / P% / G% / S%															100	0	0	0	0			90	2	6	2	0		
[1]SC% / Sa% / G% / C% / B% / Be%								10.2	20.4	59.2	0	0	10.2															
[1]d16 / d35 / d50 / d84 / d95 / di^{p} / di^{sp} (mm)								0.24	2.96	6.85	26.8	bedrock																
[2]Entrenchment Class <1.5 / 1.5-1.99 / 2.0-4.9 / 5.0-9.9 / >10																						0	90	10	0	0		
[3]Incision Class <1.2 / 1.2-1.49 / 1.5-1.99 / >2.0																						90	10	0	0			

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

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

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

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

Footnotes 2,3 - These classes are loosley built around the Rosgen classification and hazard ranking breaks, but were adjusted slightly to make for easier assignment to somewhat coarser bins based on visual estimates in the field such that measurement of every segment for ER would not be necessary.

The intent here is to provide the reader/consumer of design and monitoring information with a good general sense of the extent of hydrologic containment in the pre-existing and the rehabilitated states as well as comparisons to the reference distributions.

ER and BHR have been addressed in prior submissions as a subsample (cross-sections as part of the design measurements), however, these subsamples have often focused entirely on facilitating design without providing a thorough pre-construtions distribution of these parameters, leaving the reader/consumer with a sample that is weighted heavily on the stable sections of the reach. This means that the distributions for these parameters should include data from both the cross-section measurements and the longitudinal profile and in the case of ER, visual estimates. For example, the typical longitudinal profile permits sampling of the BHR at riffles beyond those subject to cross-sections and therefore can be readily integrated and provide a more complete sample distribution for these parameters, thereby providing the distribution/coverage necessary to provide meaningful comparisons.

Table 10b. Baseline Stream Data Summary (Substrate, Bed, Banks, and Hydrologic Containment Parameter Distribution)
Little Buffalo Creek (94147) Segment/Reach: UT3 (1,475 feet)

Parameter	Pre-Existing Condition							Reference Reach(es) Data							Design							As-built/Baseline						
[1]Ri% / Ru% / P% / G% / S%															100	0	0	0	0			83.7	3.2	5.5	7.6	0		
[1]SC% / Sa% / G% / C% / B% / Be%								10.2	20.4	59.2	0	0	10.2															
[1]d16 / d35 / d50 / d84 / d95 / di^{p} / di^{sp} (mm)								0.24	2.96	6.85	26.8	bedrock																
[2]Entrenchment Class <1.5 / 1.5-1.99 / 2.0-4.9 / 5.0-9.9 / >10																						0	50	30	20	0		
[3]Incision Class <1.2 / 1.2-1.49 / 1.5-1.99 / >2.0																						80	18	2	0			

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

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

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

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

Footnotes 2,3 - These classes are loosley built around the Rosgen classification and hazard ranking breaks, but were adjusted slightly to make for easier assignment to somewhat coarser bins based on visual estimates in the field such that measurement of every segment for ER would not be necessary.

The intent here is to provide the reader/consumer of design and monitoring information with a good general sense of the extent of hydrologic containment in the pre-existing and the rehabilitated states as well as comparisons to the reference distributions.

ER and BHR have been addressed in prior submissions as a subsample (cross-sections as part of the design measurements), however, these subsamples have often focused entirely on facilitating design without providing a thorough pre-construtions distribution of these parameters, leaving the reader/consumer with a sample that is weighted heavily on the stable sections of the reach. This means that the distributions for these parameters should include data from both the cross-section measurements and the longitudinal profile and in the case of ER, visual estimates. For example, the typical longitudinal profile permits sampling of the BHR at riffles beyond those subject to cross-sections and therefore can be readily integrated and provide a more complete sample distribution for these parameters, thereby providing the distribution/coverage necessary to provide meaningful comparisons.

Table 10b. Baseline Stream Data Summary (Substrate, Bed, Banks, and Hydrologic Containment Parameter Distribution)
Little Buffalo Creek (94147) Segment/Reach: UT4 (831 feet)

Parameter	Pre-Existing Condition							Reference Reach(es) Data							Design							As-built/Baseline						
[1]Ri% / Ru% / P% / G% / S%																						43.1	21.2	19.7	16	0		
[1]SC% / Sa% / G% / C% / B% / Be%	10.2	20.4	59.2	0	0	10.2		10.2	20.4	59.2	0	0	10.2															
[1]d16 / d35 / d50 / d84 / d95 / di^{p} / di^{sp} (mm)	0.24	2.96	6.85	26.8	bedrock			0.24	2.96	6.85	26.8	bedrock																
[2]Entrenchment Class <1.5 / 1.5-1.99 / 2.0-4.9 / 5.0-9.9 / >10																						0	0	100	0	0		
[3]Incision Class <1.2 / 1.2-1.49 / 1.5-1.99 / >2.0																						100	0	0	0			

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

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

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

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

Footnotes 2,3 - These classes are loosley built around the Rosgen classification and hazard ranking breaks, but were adjusted slightly to make for easier assignment to somewhat coarser bins based on visual estimates in the field such that measurement of every segment for ER would not be necessary.

The intent here is to provide the reader/consumer of design and monitoring information with a good general sense of the extent of hydrologic containment in the pre-existing and the rehabilitated states as well as comparisons to the reference distributions.

ER and BHR have been addressed in prior submissions as a subsample (cross-sections as part of the design measurements), however, these subsamples have often focused entirely on facilitating design without providing a thorough pre-construtions distribution of these parameters, leaving the reader/consumer with a sample that is weighted heavily on the stable sections of the reach. This means that the distributions for these parameters should include data from both the cross-section measurements and the longitudinal profile and in the case of ER, visual estimates. For example, the typical longitudinal profile permits sampling of the BHR at riffles beyond those subject to cross-sections and therefore can be readily integrated and provide a more complete sample distribution for these parameters, thereby providing the distribution/coverage necessary to provide meaningful comparisons.

Table 10b. Baseline Stream Data Summary (Substrate, Bed, Banks, and Hydrologic Containment Parameter Distribution)
Little Buffalo Creek (94147) Segment/Reach: UT7 (1,127 feet)

Parameter	Pre-Existing Condition							Reference Reach(es) Data							Design							As-built/Baseline						
[1]Ri% / Ru% / P% / G% / S%															40.7	18.9	15.6	15.1	9.7			34.9	26.1	12.1	18.2	8.7		
[1]SC% / Sa% / G% / C% / B% / Be%	24.3	19.4	50.5	5.8	0	0		10.2	20.4	59.2	0	0	10.2															
[1]d16 / d35 / d50 / d84 / d95 / di^{p} / di^{sp} (mm)	0.04	0.78	3.3	14.3	75.1			0.24	2.96	6.85	26.8	bedrock																
[2]Entrenchment Class <1.5 / 1.5-1.99 / 2.0-4.9 / 5.0-9.9 / >10																						0	0	0	15	85		
[3]Incision Class <1.2 / 1.2-1.49 / 1.5-1.99 / >2.0																						95	5	0	0			

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

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

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

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

Footnotes 2,3 - These classes are loosley built around the Rosgen classification and hazard ranking breaks, but were adjusted slightly to make for easier assignment to somewhat coarser bins based on visual estimates in the field such that measurement of every segment for ER would not be necessary.

The intent here is to provide the reader/consumer of design and monitoring information with a good general sense of the extent of hydrologic containment in the pre-existing and the rehabilitated states as well as comparisons to the reference distributions.

ER and BHR have been addressed in prior submissions as a subsample (cross-sections as part of the design measurements), however, these subsamples have often focused entirely on facilitating design without providing a thorough pre-construtions distribution of these parameters, leaving the reader/consumer with a sample that is weighted heavily on the stable sections of the reach. This means that the distributions for these parameters should include data from both the cross-section measurements and the longitudinal profile and in the case of ER, visual estimates. For example, the typical longitudinal profile permits sampling of the BHR at riffles beyond those subject to cross-sections and therefore can be readily integrated and provide a more complete sample distribution for these parameters, thereby providing the distribution/coverage necessary to provide meaningful comparisons.

Table 11a. Monitoring Data - Dimensional Morphology Summary (Dimensional Parameters – Cross Sections)
Little Buffalo Creek (94147) Segment/Reach: Mainstem Reach 1 (2,305 feet)

	Cross Section 1 (Riffle)-1R							Cross Section 2 (Pool)-1P						
Based on fixed baseline bankfull elevation[1]	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+
Record elevation (datum) used	640.21	640.21	640.21	640.21	640.21	640.21		640.24	640.24	640.24	640.24	640.24	640.24	
Bankfull Width (ft)	35.21	36.55	37.70					35.77	36.90	36.53				
Floodprone Width (ft)	>80	125.20	135.20					>80	127.00	158.50				
Bankfull Mean Depth (ft)	1.23	1.16	1.15					1.11	0.97	1.15				
Bankfull Max Depth (ft)	1.79	1.78	1.96					2.48	2.03	2.52				
Bankfull Cross Sectional Area (ft^2)	43.15	42.32	43.25					39.80	35.60	42.08				
Bankfull Width/Depth Ratio	28.73	31.56	32.87					32.15	38.17	31.71				
Bankfull Entrenchment Ratio	>2.2	3.43	3.59					>2.2	3.44	4.34				
Bankfull Bank Height Ratio	1.00	0.98	0.99					0.73	1.07	0.93				
Cross Sectional Area between end pins (ft^2)	77.79	86.15	88.38					85.42	81.10	88.9				
d50 (mm)	15.90	21.00	22.00					5.00	16.00	11				

NOTE: MY1 Data modified to use same bankfull elevation as baseline data.

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

Table 11a. Monitoring Data - Dimensional Morphology Summary (Dimensional Parameters – Cross Sections)
Little Buffalo Creek (94147) Segment/Reach: Mainstem Reach 3 (1,083 feet)

	Cross Section 1 (Riffle)-2R							Cross Section 2 (Pool)-2P						
Based on fixed baseline bankfull elevation[1]	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+
Record elevation (datum) used	630.92	630.92	630.92	630.92	630.92	630.92		629.80	629.80	629.80	629.80	629.80	629.80	
Bankfull Width (ft)	38.31	41.03	38.35					39.59	26.70	33.35				
Floodprone Width (ft)	>90	419.00	488.00					>90	350.00	368.00				
Bankfull Mean Depth (ft)	1.26	1.25	1.37					1.11	1.59	1.00				
Bankfull Max Depth (ft)	1.90	2.18	2.97					2.44	2.20	2.26				
Bankfull Cross Sectional Area (ft^2)	48.23	51.15	52.43					43.79	42.50	33.19				
Bankfull Width/Depth Ratio	30.43	32.91	28.05					35.79	16.77	33.52				
Bankfull Entrenchment Ratio	>2.2	10.21	12.73					>2.2	13.11	11.03				
Bankfull Bank Height Ratio	0.94	0.92	0.88					0.69	0.80	0.91				
Cross Sectional Area between end pins (ft^2)	116.34	104.46	103.94					89.91	77.86	68.32				
d50 (mm)	31.00	29.00	13.5					6.70	9.00	14.50				

NOTE: MY1 Data modified to use same bankfull elevation as baseline data.
XS 2R and 2P reshaped as part of MY2 to remove backwater and overflow conditions

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

Table 11a. Monitoring Data - Dimensional Morphology Summary (Dimensional Parameters – Cross Sections)
Little Buffalo Creek (94147) Segment/Reach: Mainstem Reach 4 (969 feet)

	Cross Section 1 (Pool)-3P						
Based on fixed baseline bankfull elevation[1]	Base	MY1	MY2	MY3	MY4	MY5	MY+
Record elevation (datum) used	624.26	624.26	624.26	624.26	624.26	624.26	
Bankfull Width (ft)	29.35	25.94	24.64				
Floodprone Width (ft)	>65	438.00	435.00				
Bankfull Mean Depth (ft)	1.87	2.38	2.36				
Bankfull Max Depth (ft)	3.12	3.38	3.32				
Bankfull Cross Sectional Area (ft^2)	54.90	61.79	58.25				
Bankfull Width/Depth Ratio	15.69	10.89	10.42				
Bankfull Entrenchment Ratio	>2.2	16.89	17.65				
Bankfull Bank Height Ratio	0.70	0.61	0.68				
Cross Sectional Area between end pins (ft^2)	106.25	112.61	110.74				
d50 (mm)	3.40	13.00	19.50				

NOTE: MY1 Data modified to use same bankfull elevation as baseline data.

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

Table 11a. Monitoring Data - Dimensional Morphology Summary (Dimensional Parameters – Cross Sections)
Little Buffalo Creek (94147) Segment/Reach: UT 2 (951 feet)

	Cross Section 1 (Riffle)-1R						
Based on fixed baseline bankfull elevation[1]	Base	MY1	MY2	MY3	MY4	MY5	MY+
Record elevation (datum) used	639.34	639.34	639.34	639.34	639.34	639.34	
Bankfull Width (ft)	3.52	6.23	4.31				
Floodprone Width (ft)	8.34	31.10	40.80				
Bankfull Mean Depth (ft)	0.52	0.42	0.80				
Bankfull Max Depth (ft)	0.72	0.96	1.03				
Bankfull Cross Sectional Area (ft^2)	1.82	2.65	3.43				
Bankfull Width/Depth Ratio	6.82	14.65	5.42				
Bankfull Entrenchment Ratio	2.37	5.00	9.46				
Bankfull Bank Height Ratio	1.01	0.65	0.84				
Cross Sectional Area between end pins (ft^2)	20.73	21.69	20.37				
d50 (mm)	5.00	silt/clay	silt/clay				

NOTE: MY1 Data modified to use same bankfull elevation as baseline data.

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

Table 11a. Monitoring Data - Dimensional Morphology Summary (Dimensional Parameters – Cross Sections)
Little Buffalo Creek (94147) Segment/Reach: UT3 (1,475 feet)

	Cross Section 1 (Riffle)-1R							Cross Section 2 (Riffle)-2R							Cross Section 3 (Riffle)-3R							Cross Section 4 (Pool)-1P						
Based on fixed baseline bankfull elevation[1]	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+
Record elevation (datum) used	647.14	647.14	647.14	647.14	647.14	647.14		632.79	633.69	633.69	633.69	633.69	633.69		622.92	623.77	623.77	623.77	623.77	623.77		638.72	639.22	639.22	639.22	639.22	639.22	
Bankfull Width (ft)	3.50	5.20	5.42					5.91	11.93	8.65					3.73	7.17	8.16					4.06	8.51	6.87				
Floodprone Width (ft)	24.45	29.60	27.50					13.14	31.20	30.20					6.35	>100	>100					8.28	20.40	15.30				
Bankfull Mean Depth (ft)	0.53	0.30	5.42					0.29	0.99	1.19					0.20	0.48	0.58					0.25	0.58	0.46				
Bankfull Max Depth (ft)	0.82	0.78	0.60					0.61	1.62	1.56					0.31	1.05	1.08					0.46	1.19	0.79				
Bankfull Cross Sectional Area (ft^2)	1.84	1.55	1.80					1.69	11.79	10.31					0.75	3.41	4.75					1.01	4.90	3.14				
Bankfull Width/Depth Ratio	6.66	17.47	16.31					20.67	12.06	7.25					18.61	15.08	14.02					16.32	8.51	15.06				
Bankfull Entrenchment Ratio	6.99	5.70	5.07					2.22	2.62	3.49					1.70	>2.2	>2.2					2.04	2.40	2.23				
Bankfull Bank Height Ratio	0.74	1.08	0.94					0.57	0.35	0.56					0.71	1.00	1.00					0.54	0.47	0.97				
Cross Sectional Area between end pins (ft^2)	13.50	13.86	15.62					26.63	32.12	30.79					15.64	14.90	15.72					27.61	28.88	24.81				
d50 (mm)	silt/clay	silt/clay	silt/clay					4.50	0.19	silt/clay					0.11	silt/clay	silt/clay					silt/clay	silt/clay	silt/clay				

NOTE: MY1 Data modified to use same bankfull elevation as baseline data for 1R. MY1 Bankfull for 2R, 3R and 1P established as baseline bankfull as the original bankfull only had slope indications to identify, where MY1 provided more thorough evidence of bankfull.

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

Table 11a. Monitoring Data - Dimensional Morphology Summary (Dimensional Parameters – Cross Sections)
Little Buffalo Creek (94147) Segment/Reach: UT 4 (831 feet)

	Cross Section 1 (Riffle)-1R							Cross Section 2 (Pool)-1P						
Based on fixed baseline bankfull elevation[1]	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+
Record elevation (datum) used	627.41	627.41	627.41	627.41	627.41	627.41		629.84	629.84	629.84	629.84	629.84	629.84	
Bankfull Width (ft)	13.32	13.94	14.33					20.38	17.20	19.45				
Floodprone Width (ft)	>50	>100	>100					>100	>100	>100				
Bankfull Mean Depth (ft)	0.91	0.89	0.73					1.34	1.35	1.22				
Bankfull Max Depth (ft)	1.71	1.65	1.74					2.71	2.53	2.94				
Bankfull Cross Sectional Area (ft^2)	12.13	12.35	10.42					27.37	23.29	23.75				
Bankfull Width/Depth Ratio	14.63	15.73	19.70					15.18	12.71	15.93				
Bankfull Entrenchment Ratio	>2.2	>2.2	>2.2					>2.2	>2.2	>2.2				
Bankfull Bank Height Ratio	0.60	1.03	1.14					0.63	0.91	0.99				
Cross Sectional Area between end pins (ft^2)	29.20	32.81	31.19					54.73	53.60	54.93				
d50 (mm)	8.90	6.90	10.00					7.00	0.18	10.00				

NOTE: MY1 Data modified to use same bankfull elevation as baseline data.

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

Table 11a. Monitoring Data - Dimensional Morphology Summary (Dimensional Parameters – Cross Sections)
Little Buffalo Creek (94147) Segment/Reach: UT 7 (1,127 feet)

	Cross Section 1 (Riffle)-1R							Cross Section 2 (Riffle)-2R							Cross Section 3 (Pool)-1P							Cross Section 4 (Step Pool)-STP1							Cross Section 5 (Step Pool)-STP2						
Based on fixed baseline bankfull elevation[1]	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+
Record elevation (datum) used	615.87	615.87	615.87	615.87	615.87	615.87		613.60	613.60	613.60	613.60	613.60	613.60		614.93	614.93	614.93	614.93	614.93	614.93				612.87	612.87	612.87	612.87				610.22	610.22	610.22	610.22	
Bankfull Width (ft)	20.71	21.76	21.47					18.58	21.20	21.61					27.10	29.90	23.14							28.17							20.56				
Floodprone Width (ft)	>100	>100	>100					>80	>100	>100					>80	>100	>100							>100							>100				
Bankfull Mean Depth (ft)	0.96	0.75	0.98					1.17	1.02	1.21					0.96	0.81	1.24							1.86							1.66				
Bankfull Max Depth (ft)	1.17	0.92	1.29					1.69	1.82	2.04					1.29	1.25	1.53							2.55							2.32				
Bankfull Cross Sectional Area (ft^2)	19.93	16.42	21.15					21.68	21.71	26.11					25.98	24.19	28.70							52.44							34.22				
Bankfull Width/Depth Ratio	21.52	28.86	21.80					15.92	20.70	17.89					28.27	36.96	18.65							15.13							12.35				
Bankfull Entrenchment Ratio	>2.2	>2.2	>2.2					>2.2	>2.2	>2.2					>2.2	>2.2	>2.2							>2.2							>2.2				
Bankfull Bank Height Ratio	0.78	1.06	0.87					0.92	1.16	0.93					0.67	1.26	0.67							0.92							0.78				
Cross Sectional Area between end pins (ft^2)	66.61	65.98	73.43					52.17	56.85	61.51					76.83	80.07	90.25							149.86							200.48				
d50 (mm)	23.00	11.00	18.00					0.50	0.50	20.00					silt/clay	silt/clay	silt/clay							49.00							30.00				

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

NOTE: MY1 Data modified to use same bankfull elevation as baseline data.

Exhibit Table 11b. Monitoring Data - Stream Reach Data Summary
Little Buffalo Creek (94147) - Segment/Reach: Mainstem Reach 1 (2,305 feet)

Parameter	Baseline						MY-1						MY-2						MY- 3						MY- 4						MY- 5					
Dimension and Substrate - Riffle only	Min	Mean	Med	Max	SD[4]	n	Min	Mean	Med	Max	SD[4]	n	Min	Mean	Med	Max	SD[4]	n	Min	Mean	Med	Max	SD[4]	n	Min	Mean	Med	Max	SD[4]	n	Min	Mean	Med	Max	SD[4]	n
Bankfull Width (ft)	35.21	35.21	35.21	35.21		1	36.55	36.55	36.55	36.55		1	37.7	37.7	37.7	37.7		1																		
Floodprone Width (ft)	>80	>80	>80	>80		1	125.20	125.20	125.20	125.20		1	135.2	135.2	135.2	135.2		1																		
Bankfull Mean Depth (ft)	1.23	1.23	1.23	1.23		1	1.16	1.16	1.16	1.16		1	1.15	1.15	1.15	1.15		1																		
[1]Bankfull Max Depth (ft)	1.79	1.79	1.79	1.79		1	1.78	1.78	1.78	1.78		1	1.96	1.96	1.96	1.96		1																		
Bankfull Cross Sectional Area (ft^2)	43.15	43.15	43.15	43.15		1	42.32	42.32	42.32	42.32		1	43.25	43.25	43.25	43.25		1																		
Width/Depth Ratio	28.73	28.73	28.73	28.73		1	31.56	31.56	31.56	31.56		1	32.87	32.87	32.87	32.87		1																		
Entrenchment Ratio	>2.2	>2.2	>2.2	>2.2		1	3.43	3.43	3.43	3.43		1	3.59	3.59	3.59	3.59		1																		
[1]Bank Height Ratio	**1**	**1**	**1**	**1**		**1**	**0.98**	**0.98**	**0.98**	**0.98**		**1**	**0.99**	**0.99**	**0.99**	**0.99**		**1**																		
Profile																																				
Riffle Length (ft)	7.73	23.71	22.04	38.44			5.02	14.18	9.18	31.54			8.88	15.73	16.57	20.64																				
Riffle Slope (ft/ft)	0.00	0.026	0.022	0.076			0.001	0.015	0.007	0.044			0.004	0.016	0.006	0.062																				
Pool Length (ft)	4.21	25.43	17.55	83.2			2.96	7.07	6.1	14.54			6.82	22.35	21.04	39.29																				
Pool Max depth (ft)	1.96	2.71	2.48	3.76			1.96	2.63	2.43	3.42			2.10	2.53	2.37	3.75																				
Pool Spacing (ft)	29.95	48.64	39.06	91.87			14.66	32.47	23.01	54.64			21.81	33.95	34.70	46.54																				
Pattern																																				
Channel Beltwidth (ft)	59.64	105.83	92.68	165.18																																
Radius of Curvature (ft)	72.965	83.153	79.01	97.485																																
Rc:Bankfull width (ft/ft)	**27.95**	**35.603**	**36.13**	**46.36**																																
Meander Wavelength (ft)																																				
Meander Width Ratio	1.2865	3.037	2.5652	5.9098																																

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

Additional Reach Parameters																																				
Rosgen Classification	C4						C4c-						C4																							
Channel Thalweg length (ft)	2299.79						2318.86						2306.75																							
Sinuosity (ft)	1.05						1.05						1.05																							
Water Surface Slope (Channel) (ft/ft)							NA (DRY)						NA (DRY/STAGNET WATER)																							
BF slope (ft/ft)							**0.0007**						**0.0014**																							
[3]Ri% / Ru% / P% / G% / S%	**30.5**	**14.7**	**36.8**	**18**	**0**		**35.2**	**19.6**	**19.5**	**25.6**	**0**		**25.7**	**12.3**	**36.5**	**25.5**	**0**																			
[3]SC% / Sa% / G% / C% / B% / Be%													**0**	**0**	**76.6**	**0**	**0**	**23.4**																	
[3]d16 / d35 / d50 / d84 / d95 /													**0.78**	**10**	**17.5**	**45**	**Bed**																		
[2]% of Reach with Eroding Banks							**0**																													
Channel Stability or Habitat Metric																																				
Biological or Other																																				

Shaded cells indicate that these will typically not be filled in.
1 = The distributions for these parameters can include information from both the cross-section measurements and the longitudinal profile.
2 = Proportion of reach exhibiting banks that are eroding based on the visual survey from visual assessment table
3 = Riffle, Run, Pool, Glide, Step; Silt/Clay, Sand, Gravel, Cobble, Boulder, Bedrock; dip = max pave, disp = max subpave
4. = Of value/needed only if the n exceeds 3

Exhibit Table 11b. Monitoring Data - Stream Reach Data Summary
Little Buffalo Creek (94147) - Segment/Reach: Mainstem Reach 3 (1,083 feet)

Parameter	Baseline						MY-1						MY-2						MY- 3						MY- 4						MY- 5					
Dimension and Substrate - Riffle only	Min	Mean	Med	Max	SD[4]	n	Min	Mean	Med	Max	SD[4]	n	Min	Mean	Med	Max	SD[4]	n	Min	Mean	Med	Max	SD[4]	n	Min	Mean	Med	Max	SD[4]	n	Min	Mean	Med	Max	SD[4]	n
Bankfull Width (ft)	38.31	38.31	38.31	38.31		1	41.03	41.03	41.03	41.03		1	38.35	38.35	38.35	38.35		1																		
Floodprone Width (ft)	>90	>90	>90	>90		1	419.00	419.00	419.00	419.00		1	488	488	488	488		1																		
Bankfull Mean Depth (ft)	1.26	1.26	1.26	1.26		1	1.25	1.25	1.25	1.25		1	1.37	1.37	1.37	1.37		1																		
[1]Bankfull Max Depth (ft)	1.9	1.9	1.9	1.9		1	2.18	2.18	2.18	2.18		1	2.97	2.97	2.97	2.97		1																		
Bankfull Cross Sectional Area (ft[2])	48.23	48.23	48.23	48.23		1	51.15	51.15	51.15	51.15		1	52.43	52.43	52.43	52.43		1																		
Width/Depth Ratio	30.43	30.43	30.43	30.43		1	32.91	32.91	32.91	32.91		1	28.05	28.05	28.05	28.05		1																		
Entrenchment Ratio	>2.2	>2.2	>2.2	>2.2		1	10.21	10.21	10.21	10.21		1	12.73	12.73	12.73	12.73		1																		
[1]Bank Height Ratio	**0.94**	**0.94**	**0.94**	**0.94**		**1**	**0.92**	**0.92**	**0.92**	**0.92**		**1**	**0.88**	**0.88**	**0.88**	**0.88**		**1**																		
Profile																																				
Riffle Length (ft)	11.3	18.65	20.99	21.31			10.65	25.52	26.64	38.18			6.30	20.06	16.55	40.86																				
Riffle Slope (ft/ft)	0.0182	0.0502	0.0241	0.1345			0.007	0.013	0.008	0.027			0.008	0.022	0.022	0.037																				
Pool Length (ft)	6.32	12.33	10.63	21.53			7.42	17.75	21.33	24.51			2.19	20.09	4.60	68.96																				
Pool Max depth (ft)	0.5	1.13	1.26	1.69			1.75	2.81	1.87	4.81			2.70	2.88	2.79	3.23																				
Pool Spacing (ft)	36.04	45.42	46.77	53.33			48.94	61.06	51.44	82.8			16.88	40.66	30.84	84.05																				
Pattern																																				
Channel Beltwidth (ft)	58.77	58.77	58.77	58.77																																
Radius of Curvature (ft)	83.8	83.8	83.8	83.8																																
Rc:Bankfull width (ft/ft)	**4.58**	**15.654**	**16.52**	**23.05**																																
Meander Wavelength (ft)																																				
Meander Width Ratio	2.5497	5.1978	3.5575	12.832																																

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

Additional Reach Parameters																																				
Rosgen Classification	C4						C4						C4																							
Channel Thalweg length (ft)	1079.45						1069.58						1074.38																							
Sinuosity (ft)	1.01						1.01						1.01																							
Water Surface Slope (Channel) (ft/ft)							NA (DRY)						0.002																							
BF slope (ft/ft)							**0.0138**						**0.0084**																							
[3]Ri% / Ru% / P% / G% / S%	**25.8**	**20.2**	**26**	**28**	**0**		**42**	**14.4**	**21.9**	**21.7**	**0**		**33**	**9.9**	**33.1**	**24**	**0**																				
[3]SC% / Sa% / G% / C% / B% / Be%													**13.7**	**0**	**78.7**	**0**	**0**	**7.6**																		
[3]d16 / d35 / d50 / d84 / d95 /													**2.5**	**9**	**14**	**25**	**38**																			
[2]% of Reach with Eroding Banks																																				
Channel Stability or Habitat Metric																																				
Biological or Other																																				

Shaded cells indicate that these will typically not be filled in.
1 = The distributions for these parameters can include information from both the cross-section measurements and the longitudinal profile.
2 = Proportion of reach exhibiting banks that are eroding based on the visual survey from visual assessment table
3 = Riffle, Run, Pool, Glide, Step; Silt/Clay, Sand, Gravel, Cobble, Boulder, Bedrock; dip = max pave, disp = max subpave
4. = Of value/needed only if the n exceeds 3

Exhibit Table 11b. Monitoring Data - Stream Reach Data Summary
Little Buffalo Creek (94147) - Segment/Reach: UT 2 (951 feet)

Parameter	Baseline						MY-1						MY-2						MY- 3						MY- 4						MY- 5					
Dimension and Substrate - Riffle only	Min	Mean	Med	Max	SD[4]	n	Min	Mean	Med	Max	SD[4]	n	Min	Mean	Med	Max	SD[4]	n	Min	Mean	Med	Max	SD[4]	n	Min	Mean	Med	Max	SD[4]	n	Min	Mean	Med	Max	SD[4]	n
Bankfull Width (ft)	3.52	3.52	3.52	3.52		1	6.23	6.23	6.23	6.23		1	4.31	4.31	4.31	4.31		1																		
Floodprone Width (ft)	8.34	8.34	8.34	8.34		1	31.10	31.10	31.10	31.10		1	40.8	40.8	40.8	40.8		1																		
Bankfull Mean Depth (ft)	0.52	0.52	0.52	0.52		1	0.42	0.42	0.42	0.42		1	0.8	0.8	0.8	0.8		1																		
[1]Bankfull Max Depth (ft)	0.72	0.72	0.72	0.72		1	0.96	0.96	0.96	0.96		1	1.03	1.03	1.03	1.03		1																		
Bankfull Cross Sectional Area (ft^2)	1.82	1.82	1.82	1.82		1	2.65	2.65	2.65	2.65		1	3.43	3.43	3.43	3.43		1																		
Width/Depth Ratio	6.82	6.82	6.82	6.82		1	14.65	14.65	14.65	14.65		1	5.42	5.42	5.42	5.42		1																		
Entrenchment Ratio	2.37	2.37	2.37	2.37		1	5.00	5.00	5.00	5.00		1	9.46	9.46	9.46	9.46		1																		
[1]Bank Height Ratio	**1.01**	**1.01**	**1.01**	**1.01**		**1**	**0.65**	**0.65**	**0.65**	**0.65**		**1**	**0.84**	**0.84**	**0.84**	**0.84**		**1**																		
Profile																																				
Riffle Length (ft)	6.98	13.52	13.52	20.07			35.95	35.95	35.95	35.95			18.87	20.43	20.43	21.99																				
Riffle Slope (ft/ft)	0.01	0.013	0.013	0.016			0.008	0.008	0.008	0.008			0.019	0.022	0.022	0.026																				
Pool Length (ft)	12.76	12.76	12.76	12.76			NA	NA	NA	NA			7.71	11.145	11.145	14.58																				
Pool Max depth (ft)	0.89	0.89	0.89	0.89			NA	NA	NA	NA			0.725	1.0875	1.0875	1.45																				
Pool Spacing (ft)	30.63	30.63	30.63	30.63			NA	NA	NA	NA			36.22	36.22	36.22	36.22																				
Pattern																																				
Channel Beltwidth (ft)																																				
Radius of Curvature (ft)																																				
Rc:Bankfull width (ft/ft)																																				
Meander Wavelength (ft)																																				
Meander Width Ratio																																				

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

Additional Reach Parameters																																				
Rosgen Classification	B6						B6						B6																							
Channel Thalweg length (ft)	951.37						951.54						952.31																							
Sinuosity (ft)	0.96						0.96						0.96																							
Water Surface Slope (Channel) (ft/ft)							NA (DRY)						NA (DRY)																							
BF slope (ft/ft)							**0.0482**						**0.0209**																							
[3]Ri% / Ru% / P% / G% / S%	**90**	**2**	**6**	**2**	**0**		**100**	**0**	**0**	**0**	**0**		**47.1**	**22.5**	**25.7**	**4.7**	**0**																			
[3]SC% / Sa% / G% / C% / B% / Be%													**14.7**	**53.9**	**0**	**0**	**0**	**31.4**																		
[3]d16 / d35 / d50 / d84 / d95 /													**Silt/Clay**	**Silt/Clay**	**Silt/Clay**	**Silt/Clay**	**Silt/Clay**																			
[2]% of Reach with Eroding Banks																																				
Channel Stability or Habitat Metric																																				
Biological or Other																																				

Shaded cells indicate that these will typically not be filled in.
1 = The distributions for these parameters can include information from both the cross-section measurements and the longitudinal profile.
2 = Proportion of reach exhibiting banks that are eroding based on the visual survey from visual assessment table
3 = Riffle, Run, Pool, Glide, Step; Silt/Clay, Sand, Gravel, Cobble, Boulder, Bedrock; dip = max pave, disp = max subpave
4. = Of value/needed only if the n exceeds 3

Exhibit Table 11b. Monitoring Data - Stream Reach Data Summary
Little Buffalo Creek (94147) - Segment/Reach: UT 3 (1,475 feet)

Parameter	Baseline						MY-1						MY-2						MY- 3						MY- 4						MY- 5					
Dimension and Substrate - Riffle only	Min	Mean	Med	Max	SD[4]	n	Min	Mean	Med	Max	SD[4]	n	Min	Mean	Med	Max	SD[4]	n	Min	Mean	Med	Max	SD[4]	n	Min	Mean	Med	Max	SD[4]	n	Min	Mean	Med	Max	SD[4]	n
Bankfull Width (ft)	3.5	4.38	3.73	5.91		3	5.20	8.10	7.17	11.93		3	5.42	7.41	8.16	8.65		3																		
Floodprone Width (ft)	6.35	14.65	13.14	24.45		3	29.60	30.40	30.40	>100		3	27.5	28.85	28.85	>100		3																		
Bankfull Mean Depth (ft)	0.2	0.34	0.29	0.53		3	0.30	0.59	0.48	0.99		3	0.58	2.396667	1.19	5.42		3																		
[1]Bankfull Max Depth (ft)	0.31	0.58	0.61	0.82		3	0.78	1.15	1.05	1.62		3	0.6	1.08	1.08	1.56		3																		
Bankfull Cross Sectional Area (ft^2)	0.75	1.43	1.69	1.84		3	1.55	5.58	3.41	11.79		3	1.8	5.62	4.75	10.31		3																		
Width/Depth Ratio	6.66	15.31	18.61	20.67		3	12.06	14.87	15.08	17.47		3	7.25	12.52667	14.02	16.31		3																		
Entrenchment Ratio	1.7	3.64	2.22	6.99		3	2.62	4.16	4.16	5.70		3	3.49	4.28	4.28	5.07		3																		
[1]Bank Height Ratio	**0.57**	**0.67**	**0.71**	**0.74**		**3**	**0.35**	**0.81**	**1.00**	**1.08**		**3**	**0.56**	**0.833333**	**0.94**	**1**		**3**																		
Profile																																				
Riffle Length (ft)	57.25	107.81	89.01	215.05			31.91	81.09	72.62	143.24			Not Identifiable due to cattle damage																							
Riffle Slope (ft/ft)	0.011	0.017	0.014	0.029			0.001	0.016	0.016	0.03																										
Pool Length (ft)	1.5	12.97	6.04	31.37			6.73	16.17	12.09	33.76																										
Pool Max depth (ft)	4.14	4.46	4.61	4.62			0.63	1.48	1.48	2.31																										
Pool Spacing (ft)	114.27	133.63	143.31	143.31			125.06	186.72	186.72	248.38																										
Pattern																																				
Channel Beltwidth (ft)	13.4	34.2	42.73	46.46																																
Radius of Curvature (ft)	21.64	35.62	35.15	50.55												Pattern data will not typically be collected unless visual data, dimensional data or profile data indicate significant shifts from baseline																			
Rc:Bankfull width (ft/ft)	**2.38**	**15.62**	**14.63**	**30.84**																																
Meander Wavelength (ft)																																				
Meander Width Ratio	0.43	5.37	2.44	19.52																																
Additional Reach Parameters																																				
Rosgen Classification	B6						B6c						B6																							
Channel Thalweg length (ft)	1469.07						1467.05						1471.15																							
Sinuosity (ft)	0.95						0.95						0.95																							
Water Surface Slope (Channel) (ft/ft)	0.019						NA (DRY)						NA (DRY)																							
BF slope (ft/ft)	**0.019**						**0.0198**						**0.0249**																							
[3]Ri% / Ru% / P% / G% / S%	**83.7**	**3.2**	**5.5**	**7.6**	**0**		**83.2**	**4.2**	**7.4**	**4.9**	**0.3**		**Not Identifiable due to cattle damage**																							
[3]SC% / Sa% / G% / C% / B% / Be%													**92.3**	**4.7**	**1.6**	**0**	**0**	**1.4**																	
[3]d16 / d35 / d50 / d84 / d95 /													**Silt/Clay**	**Silt/Clay**	**Silt/Clay**	**Silt/Clay**	**Silt/Clay**																		
[2]% of Reach with Eroding Banks																																				
Channel Stability or Habitat Metric																																				
Biological or Other																																				

Shaded cells indicate that these will typically not be filled in.
1 = The distributions for these parameters can include information from both the cross-section measurements and the longitudinal profile.
2 = Proportion of reach exhibiting banks that are eroding based on the visual survey from visual assessment table
3 = Riffle, Run, Pool, Glide, Step; Silt/Clay, Sand, Gravel, Cobble, Boulder, Bedrock; dip = max pave, disp = max subpave
4. = Of value/needed only if the n exceeds 3

Exhibit Table 11b. Monitoring Data - Stream Reach Data Summary
Little Buffalo Creek (94147) - Segment/Reach: UT 4 (831 feet)

Parameter	Baseline						MY-1						MY-2						MY- 3						MY- 4						MY- 5					
Dimension and Substrate - Riffle only	Min	Mean	Med	Max	SD[4]	n	Min	Mean	Med	Max	SD[4]	n	Min	Mean	Med	Max	SD[4]	n	Min	Mean	Med	Max	SD[4]	n	Min	Mean	Med	Max	SD[4]	n	Min	Mean	Med	Max	SD[4]	n
Bankfull Width (ft)	13.32	13.32	13.32	13.32		1	13.94	13.94	13.94	13.94		1	14.32691	14.32691	14.32691	14.32691		1																		
Floodprone Width (ft)	>50	>50	>50	>50		1	>100	>100	>100	>100		1	>100	>100	>100	>100		1																		
Bankfull Mean Depth (ft)	0.91	0.91	0.91	0.91		1	0.89	0.89	0.89	0.89		1	0.73	0.73	0.73	0.73		1																		
[1]Bankfull Max Depth (ft)	1.71	1.71	1.71	1.71		1	1.65	1.65	1.65	1.65		1	1.738	1.738	1.738	1.738		1																		
Bankfull Cross Sectional Area (ft^2)	12.13	12.13	12.13	12.13		1	12.35	12.35	12.35	12.35		1	10.42	10.42	10.42	10.42		1																		
Width/Depth Ratio	14.63	14.63	14.63	14.63		1	15.73	15.73	15.73	15.73		1	19.7	19.7	19.7	19.7		1																		
Entrenchment Ratio	>2.2	>2.2	>2.2	>2.2		1	>2.2	>2.2	>2.2	>2.2		1	>2.2	>2.2	>2.2	>2.2		1																		
[1]Bank Height Ratio	**0.6**	**0.6**	**0.6**	**0.6**		**1**	**1.03**	**1.03**	**1.03**	**1.03**		**1**	**1.14**	**1.14**	**1.14**	**1.14**		**1**																		
Profile																																				
Riffle Length (ft)	4.74	19.81	21.81	30.73			11.72	23.29	21.67	36.64			4.04	13.83	11.615	30.23																				
Riffle Slope (ft/ft)	0.012	0.027	0.018	0.074			0.013	0.025	0.024	0.037			0.005	0.036	0.035	0.070																				
Pool Length (ft)	6.99	12.56	9.1	26.02			6.8	9.62	8.54	15.58			3.41	6.15	5.915	10.44																				
Pool Max depth (ft)	1.89	2.28	2.32	2.7			1.71	2.42	2.52	2.88			1.835	2.679833	2.731	3.385																				
Pool Spacing (ft)	50.06	56.72	55.31	68.08			22.59	37.51	42.3	46.92			7.58	27.92818	26.45	52																				
Pattern																																				
Channel Beltwidth (ft)	80.13	98.47	98.47	116.81																																
Radius of Curvature (ft)	36.7	47.23	49.01	56.95																																
Rc:Bankfull width (ft/ft)	**16.34**	**19.23**	**18.89**	**23.76**																																
Meander Wavelength (ft)	221.95	221.95	221.95	221.95																																
Meander Width Ratio	3.37	5.19	4.91	7.15																																

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

Additional Reach Parameters																																				
Rosgen Classification	C4b						C4						C4																								
Channel Thalweg length (ft)	830.01						837.13						838.29																								
Sinuosity (ft)	0.81						0.81						0.81																								
Water Surface Slope (Channel) (ft/ft)							NA (DRY)						0.0138																								
BF slope (ft/ft)							**0.0123**						**0.0123**																								
[3]Ri% / Ru% / P% / G% / S%	**43.1**	**21.2**	**19.7**	**16**	**0**		**52.2**	**9.8**	**19.2**	**18.8**	**0**		**34**	**17.9**	**18.1**	**30**	**0**																				
[3]SC% / Sa% / G% / C% / B% / Be%													**0**	**1.7**	**98.3**	**0**	**0**	**0**																		
[3]d16 / d35 / d50 / d84 / d95 /													**0.38**	**5**	**10**	**30**	**64**																			
[2]% of Reach with Eroding Banks																																				
Channel Stability or Habitat Metric																																				
Biological or Other																																				

Shaded cells indicate that these will typically not be filled in.
1 = The distributions for these parameters can include information from both the cross-section measurements and the longitudinal profile.
2 = Proportion of reach exhibiting banks that are eroding based on the visual survey from visual assessment table
3 = Riffle, Run, Pool, Glide, Step; Silt/Clay, Sand, Gravel, Cobble, Boulder, Bedrock; dip = max pave, disp = max subpave
4. = Of value/needed only if the n exceeds 3

Exhibit Table 11b. Monitoring Data - Stream Reach Data Summary
Little Buffalo Creek (94147) - Segment/Reach: UT 7 (1,127 feet)

Parameter	Baseline						MY-1						MY-2						MY- 3						MY- 4						MY- 5					
Dimension and Substrate - Riffle only	Min	Mean	Med	Max	SD[4]	n	Min	Mean	Med	Max	SD[4]	n	Min	Mean	Med	Max	SD[4]	n	Min	Mean	Med	Max	SD[4]	n	Min	Mean	Med	Max	SD[4]	n	Min	Mean	Med	Max	SD[4]	n
Bankfull Width (ft)	18.58	19.65	19.65	20.71		2	21.20	21.48	21.48	21.76		2	21.47	21.54	21.54	21.61		2																		
Floodprone Width (ft)	>80			>100		2	>100	>100	>100	>100		2	>100	>100	>100	>100		2																		
Bankfull Mean Depth (ft)	0.96	1.07	1.07	1.17		2	0.75	0.89	0.89	1.02		2	0.98	1.10	1.10	1.21		2																		
[1]Bankfull Max Depth (ft)	1.17	1.43	1.43	1.69		2	0.92	1.37	1.37	1.82		2	1.29	1.67	1.67	2.04		2																		
Bankfull Cross Sectional Area (ft^2)	19.93	20.81	20.81	21.68		2	16.42	19.07	19.07	21.71		2	21.15	23.63	23.63	26.11		2																		
Width/Depth Ratio	15.92	18.72	18.72	21.52		2	20.70	24.78	24.78	28.86		2	17.89	19.85	19.85	21.80		2																		
Entrenchment Ratio	>2.2	>2.2	>2.2	>2.2		2	>2.2	>2.2	>2.2	>2.2		2	>2.2	>2.2	>2.2	>2.2		2																		
[1]Bank Height Ratio	**0.78**	**0.85**	**0.85**	**0.92**		**2**	**1.06**	**1.11**	**1.11**	**1.16**		**2**	**0.87**	**0.90**	**0.90**	**0.93**		**2**																		
Profile																																				
Riffle Length (ft)	9.79	36.53	37.12	54.31			9.14	29.70	30.63	67.19			8.10	26.04	26.01	42.49																				
Riffle Slope (ft/ft)	0.001	0.014	0.013	0.039			0.001	0.013	0.010	0.051			0.0005	0.012	0.010	0.022																				
Pool Length (ft)	8.16	15.87	13.77	28.95			4.08	13.77	14.49	22.02			5.80	16.74	14.35	34.69																				
Pool Max depth (ft)	1	2.05	2.04	2.85			1.19	1.94	2.00	2.62			1.61	2.25	2.15	3.11																				
Pool Spacing (ft)	13.27	54.36	56.47	130.67			13.50	54.60	58.53	94.06			32.29	56.33	54.12	82.92																				
Pattern																																				
Channel Beltwidth (ft)	154.56	209.27	209.27	263.98																																
Radius of Curvature (ft)	90.88	194.28	125.65	434.94																																
Rc:Bankfull width (ft/ft)	**15.71**	**20.53**	**21.99**	**22.62**																																
Meander Wavelength (ft)	687.9	687.9	687.9	687.9																																
Meander Width Ratio	9.8383	10.191	9.5145	11.67																																

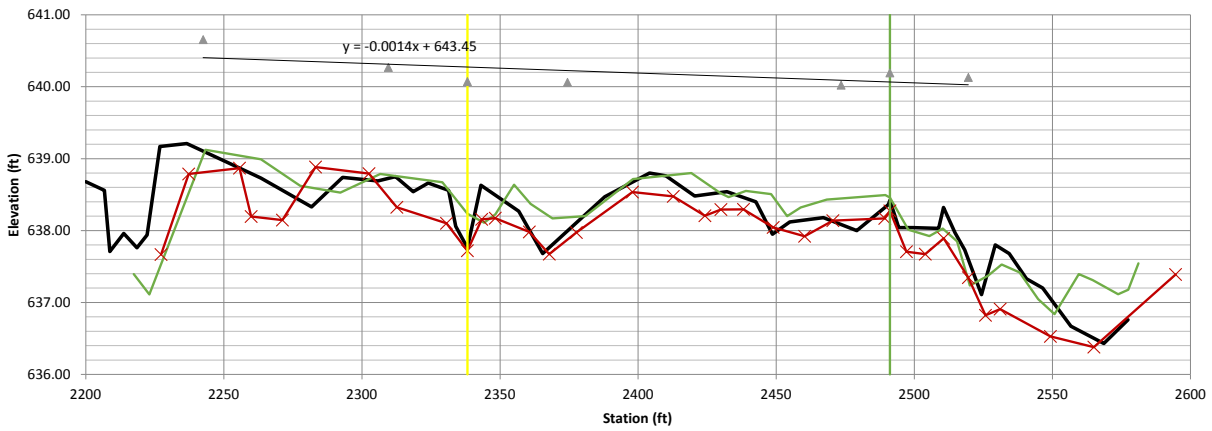
Pattern data will not typically be collected unless visual data, dimensional data or profile data indicate significant shifts from baseline

Additional Reach Parameters																																				
Rosgen Classification	C4						C4						C4																								
Channel Thalweg length (ft)	1126.71						1140.94						1154.67																								
Sinuosity (ft)	1.23						1.23						1.23																								
Water Surface Slope (Channel) (ft/ft)	0.006						NA (DRY)						NA (DRY)																								
BF slope (ft/ft)	**0.005**						**0.0053**						**0.0068**																								
[3]Ri% / Ru% / P% / G% / S%	**34.9**	**26.1**	**12.1**	**18.2**	**8.7**		**41.1**	**13.7**	**17.6**	**17.4**	**10.2**		**30.1**	**14.3**	**24.7**	**25.1**	**5.8**																				
[3]SC% / Sa% / G% / C% / B% / Be%													**21.8**	**17.9**	**45.5**	**12.5**	**1.7**	**0.6**																		
[3]d16 / d35 / d50 / d84 / d95 /													**N/A**	**8**	**17.5**	**50**	**100**																			
[2]% of Reach with Eroding Banks																																				
Channel Stability or Habitat Metric																																				
Biological or Other																																				

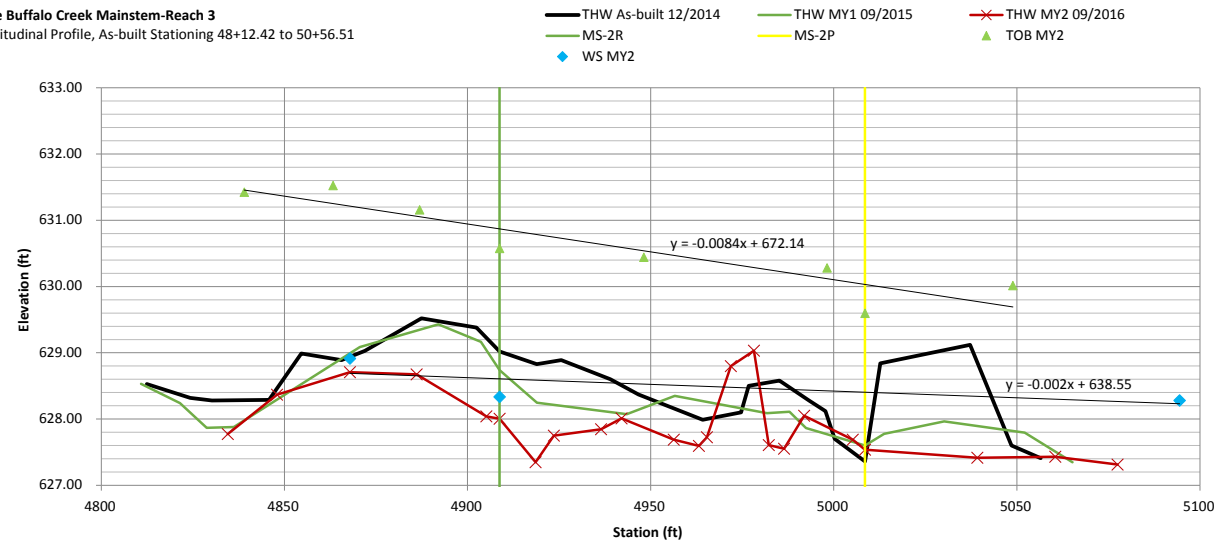
Shaded cells indicate that these will typically not be filled in.
1 = The distributions for these parameters can include information from both the cross-section measurements and the longitudinal profile.
2 = Proportion of reach exhibiting banks that are eroding based on the visual survey from visual assessment table
3 = Riffle, Run, Pool, Glide, Step; Silt/Clay, Sand, Gravel, Cobble, Boulder, Bedrock; dip = max pave, disp = max subpave
4. = Of value/needed only if the n exceeds 3

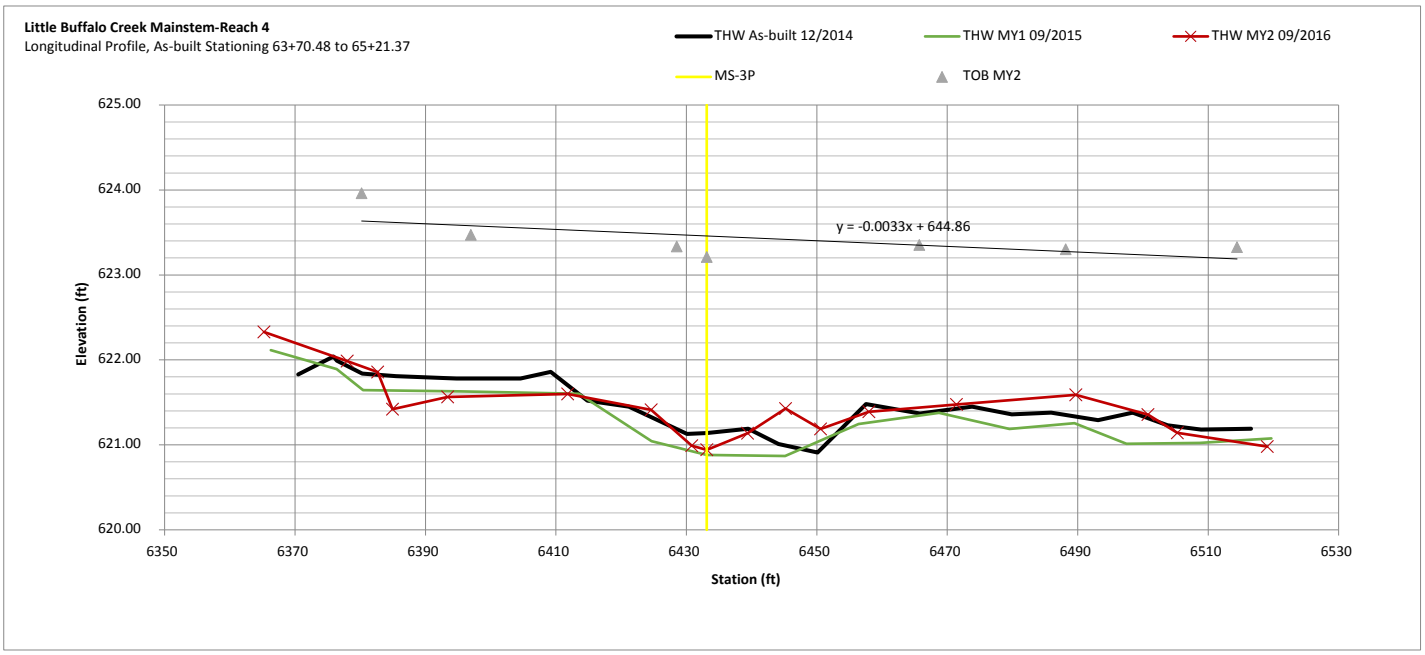
Figures 3a-k – Longitudinal Profile Plots

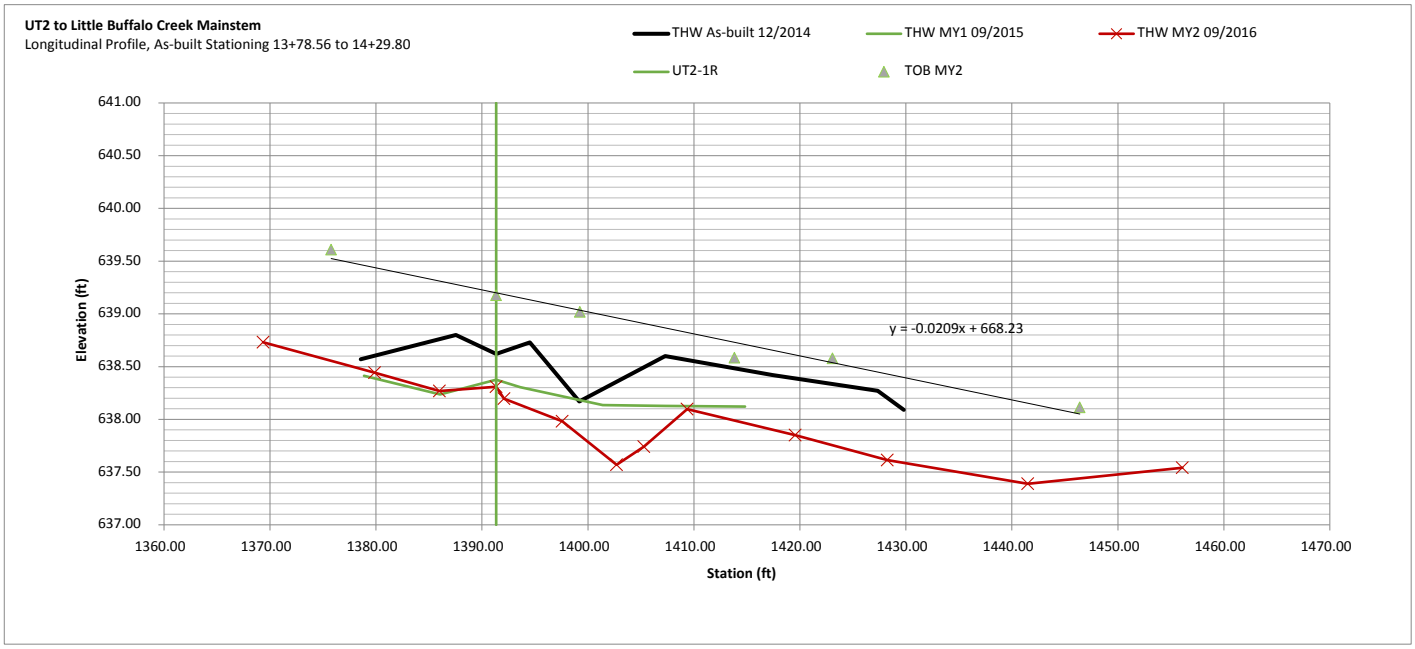
Little Buffalo Creek Mainstem-Reach 1
Longitudinal Profile, As-built Stationing 22+00 to 25+77.37

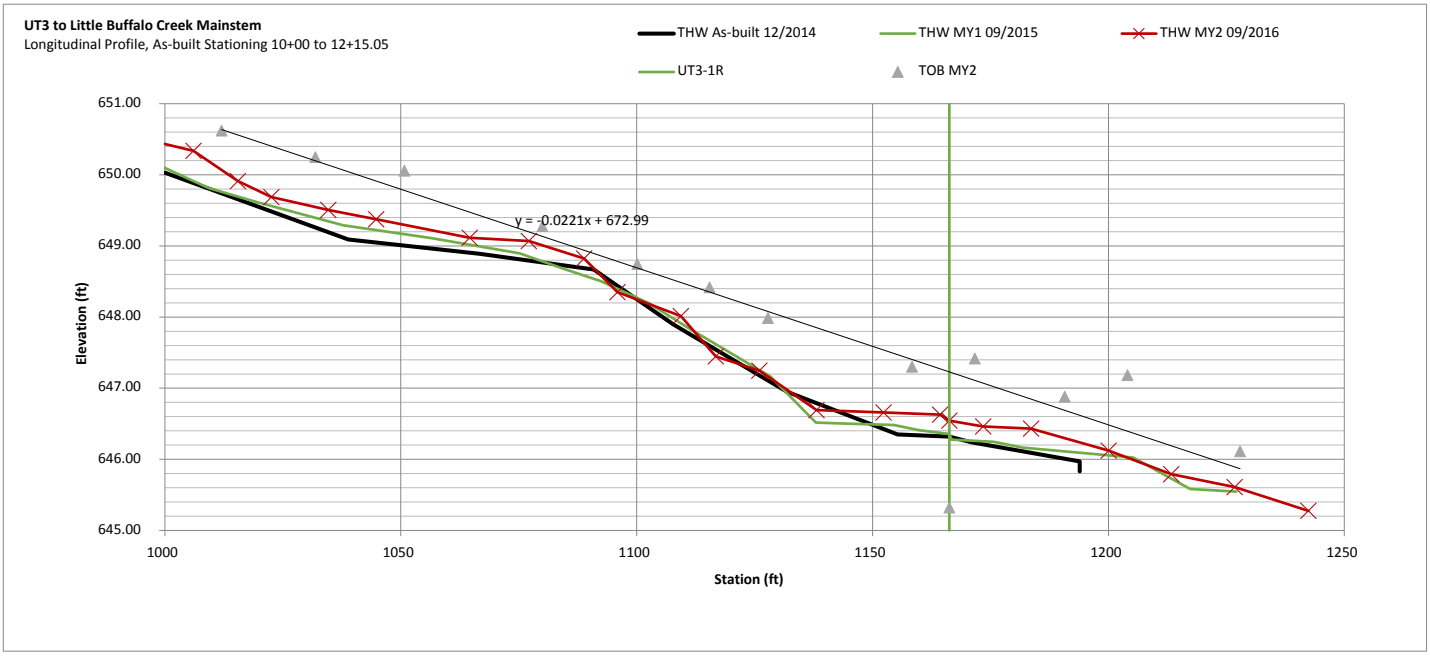


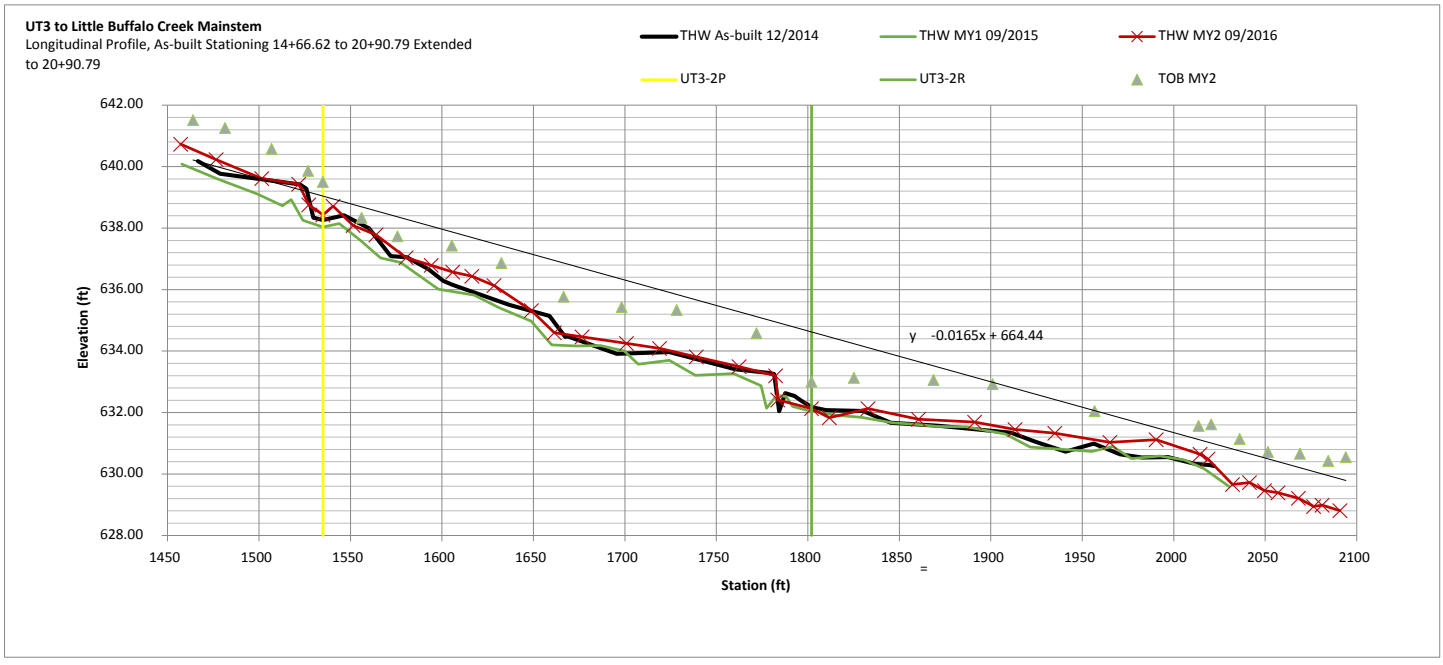
Little Buffalo Creek Mainstem-Reach 3
Longitudinal Profile, As-built Stationing 48+12.42 to 50+56.51



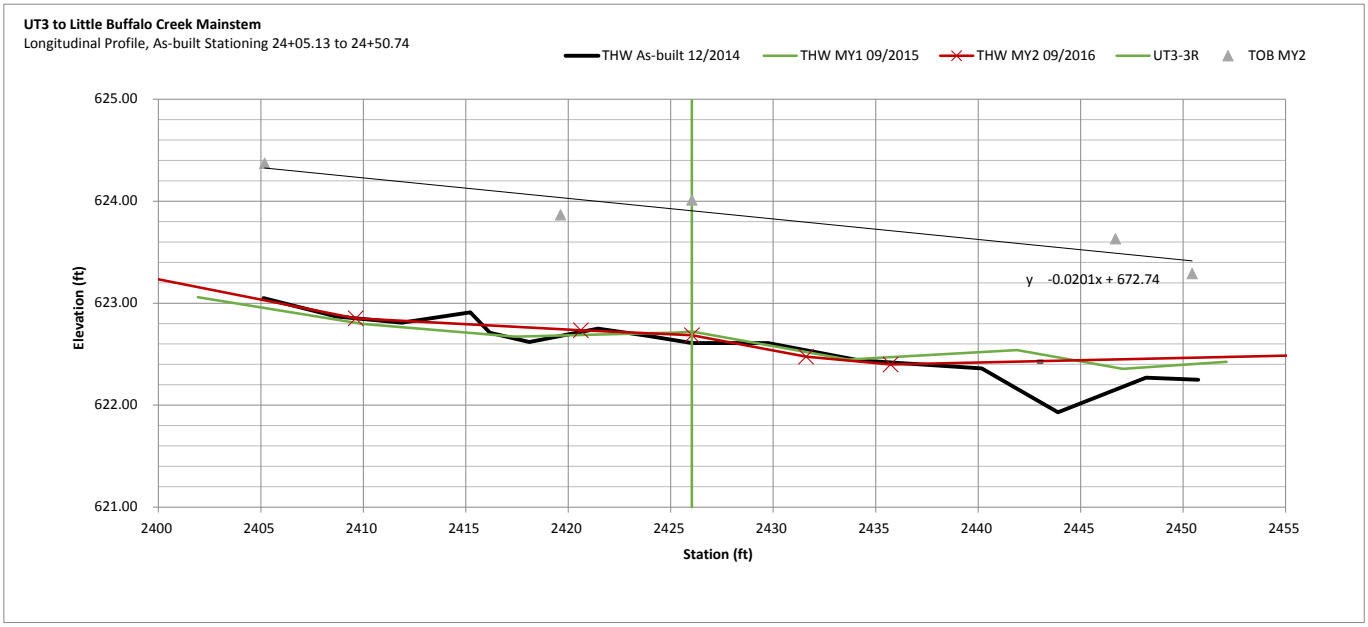

Little Buffalo Creek Mainstem-Reach 4
Longitudinal Profile, As-built Stationing 63+70.48 to 65+21.37
THW As-built 12/2014
THW MY1 09/2015
THW MY2 09/2016
MS-3P
TOB MY2
y = -0.0033x + 644.86
625.00
624.00
623.00
622.00
621.00
620.00
Elevation (ft)
6350
6370
6390
6410
6430
6450
6470
6490
6510
6530
Station (ft)

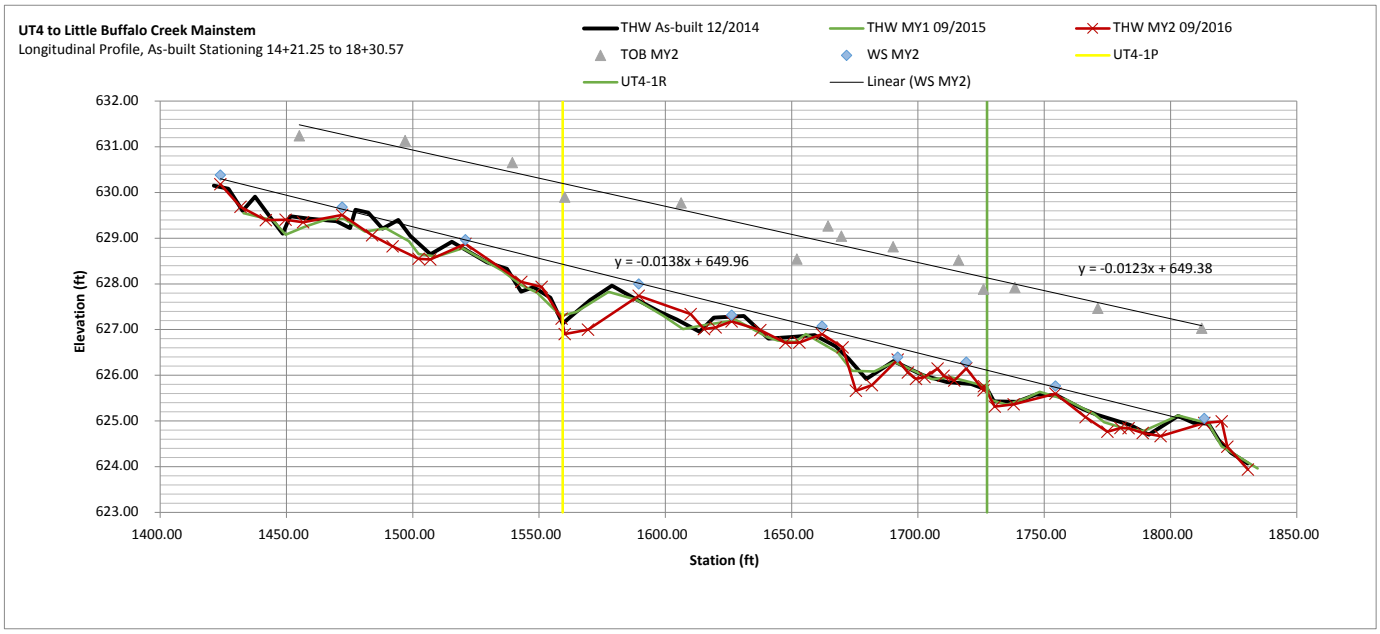

UT2 to Little Buffalo Creek Mainstem
Longitudinal Profile, As-built Stationing 13+78.56 to 14+29.80
THW As-built 12/2014
THW MY1 09/2015
THW MY2 09/2016
UT2-1R
TOB MY2
y = -0.0209x + 668.23
641.00
640.50
640.00
639.50
639.00
638.50
638.00
637.50
637.00
Elevation (ft)
1360.00
1370.00
1380.00
1390.00
1400.00
1410.00
1420.00
1430.00
1440.00
1450.00
1460.00
1470.00
Station (ft)

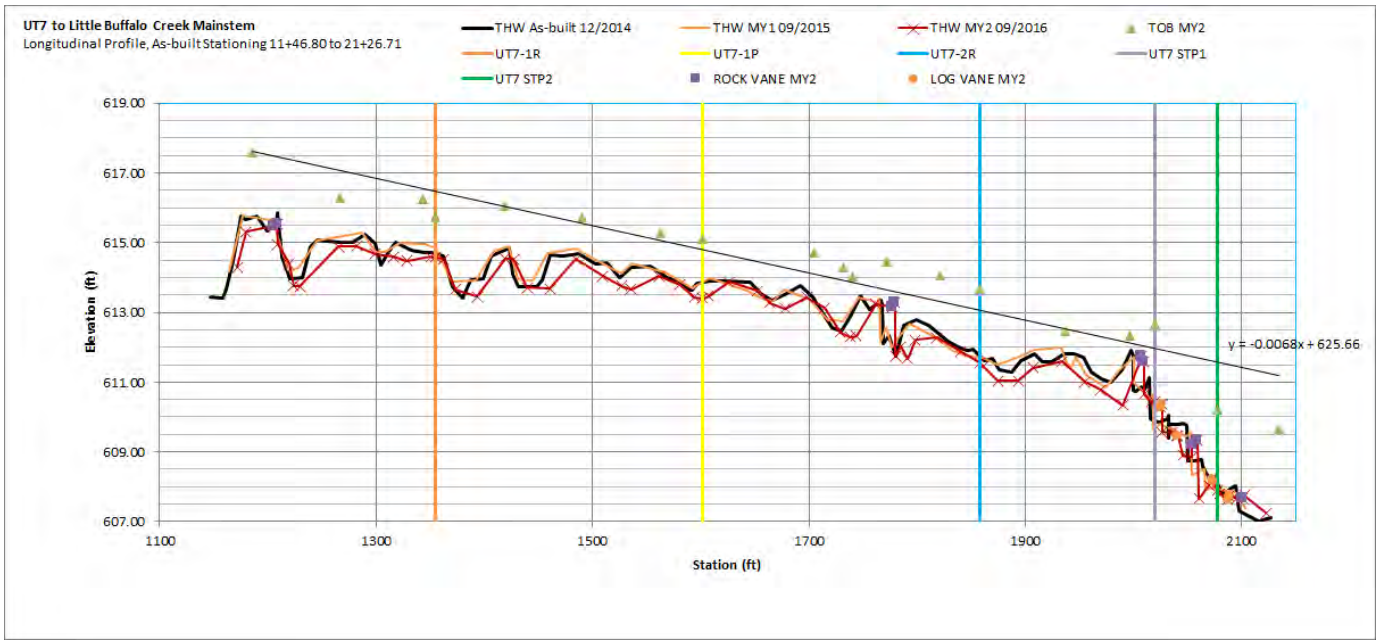

UT3 to Little Buffalo Creek Mainstem
Longitudinal Profile, As-built Stationing 10+00 to 12+15.05
THW As-built 12/2014
THW MY1 09/2015
THW MY2 09/2016
UT3-1R
TOB MY2
y = -0.0221x + 672.99
Elevation (ft)
Station (ft)
651.00
650.00
649.00
648.00
647.00
646.00
645.00
1000
1050
1100
1150
1200
1250


UT3 to Little Buffalo Creek Mainstem
Longitudinal Profile, As-built Stationing 14+66.62 to 20+90.79 Extended to 20+90.79
THW As-built 12/2014
THW MY1 09/2015
THW MY2 09/2016
UT3-2P
UT3-2R
TOB MY2
y -0.0165x + 664.44
Elevation (ft)
Station (ft)
642.00
640.00
638.00
636.00
634.00
632.00
630.00
628.00
1450
1500
1550
1600
1650
1700
1750
1800
1850
1900
1950
2000
2050
2100


UT3 to Little Buffalo Creek Mainstem
Longitudinal Profile, As-built Stationing 21+29 to 22+32.49;
Extended to Station 22+32.49
THW As-built 12/2014
THW MY1 09/2015
THW MY2 09/2016
TOB MY2
630.00
629.00
628.00
627.00
626.00
625.00
624.00
623.00
Elevation (ft)
2125
2135
2145
2155
2165
2175
2185
2195
2205
2215
2225
2235
Station (ft)
y = -0.0362x + 706.13

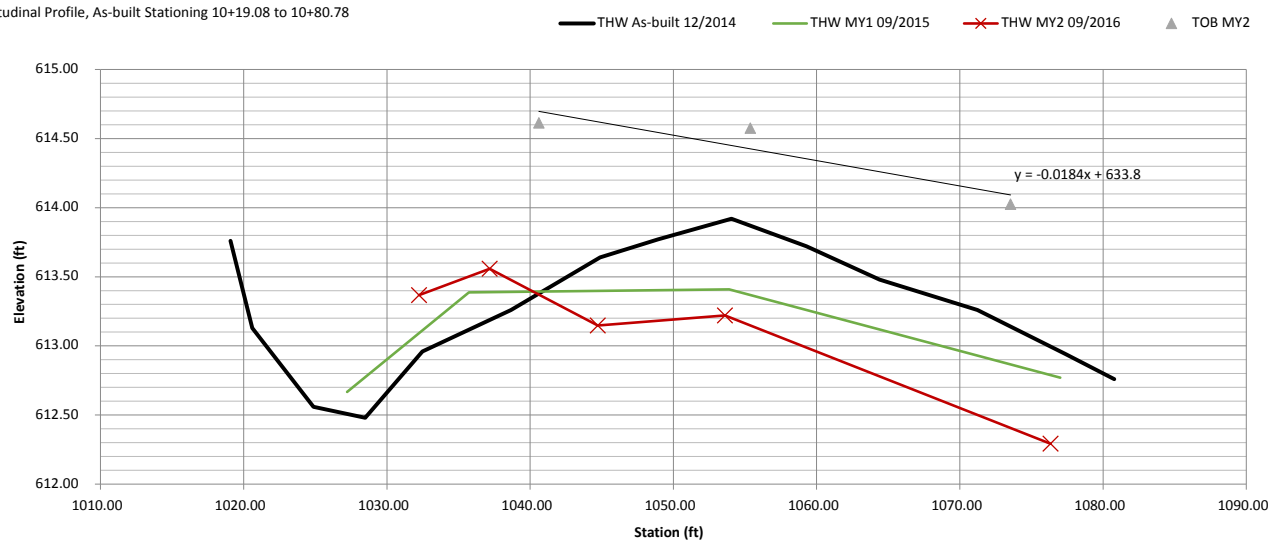

UT3 to Little Buffalo Creek Mainstem
Longitudinal Profile, As-built Stationing 24+05.13 to 24+50.74
THW As-built 12/2014
THW MY1 09/2015
THW MY2 09/2016
UT3-3R
TOB MY2
625.00
624.00
623.00
622.00
621.00
Elevation (ft)
2400
2405
2410
2415
2420
2425
2430
2435
2440
2445
2450
2455
Station (ft)
y -0.0201x + 672.74


UT4 to Little Buffalo Creek Mainstem
Longitudinal Profile, As-built Stationing 14+21.25 to 18+30.57
THW As-built 12/2014
THW MY1 09/2015
THW MY2 09/2016
TOB MY2
WS MY2
UT4-1P
UT4-1R
Linear (WS MY2)
y = -0.0138x + 649.96
y = -0.0123x + 649.38
Elevation (ft)
Station (ft)
632.00
631.00
630.00
629.00
628.00
627.00
626.00
625.00
624.00
623.00
1400.00
1450.00
1500.00
1550.00
1600.00
1650.00
1700.00
1750.00
1800.00
1850.00


UT7 to Little Buffalo Creek Mainstem
Longitudinal Profile, As-built Stationing 11+46.80 to 21+26.71
THW As-built 12/2014
THW MY1 09/2015
THW MY2 09/2016
TOB MY2
UT7-1R
UT7-1P
UT7-2R
UT7 STP1
UT7 STP2
ROCK VANE MY2
LOG VANE MY2
y = -0.0068x + 625.66
Elevation (ft)
Station (ft)
619.00
617.00
615.00
613.00
611.00
609.00
607.00
1100
1300
1500
1700
1900
2100

UT8 to UT7

Longitudinal Profile, As-built Stationing 10+19.08 to 10+80.78



Figures 4a-q – Cross-section Plot Exhibits

Cross Section Plot Exhibit

River Basin:	Yadkin-Pee Dee River
Watershed:	Little Buffalo Creek
XS ID:	MS-1P
Drainage Area (sq mi):	2.99
Date:	9/19/2016
Field Crew:	Matthew Holthaus, Greg Russo: Louis Berger

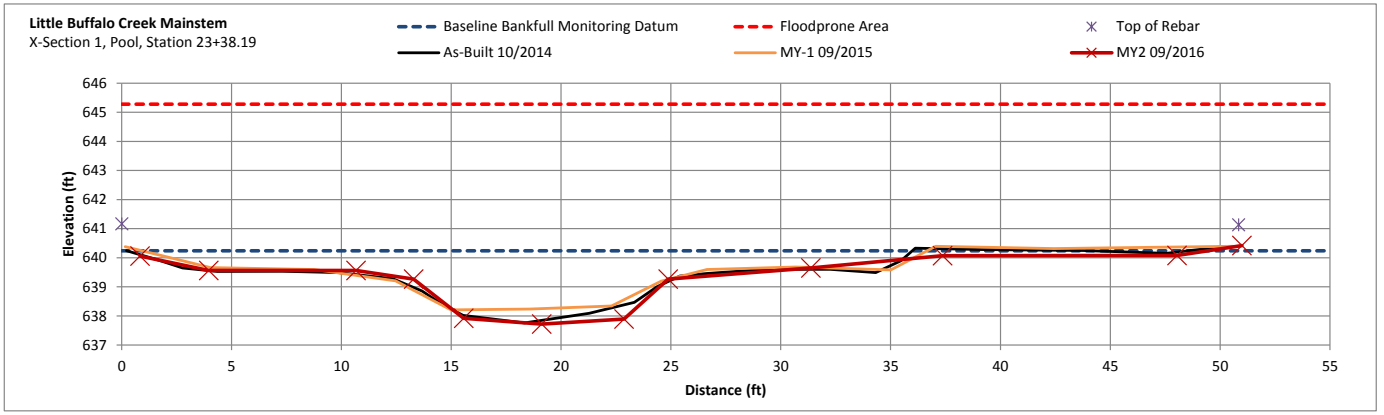
Station	Elevation
0.00	640.91
0.84	640.06
3.97	639.56
10.66	639.56
13.28	639.27
15.56	637.92
19.11	637.72
22.86	637.89
24.88	639.26
31.37	639.65
37.37	640.07
48.03	640.08
50.99	640.42

SUMMARY DATA	
Bankfull Elevation:	640.24
Bankfull Cross-Sectional Area:	42.08
Bankfull Width:	36.53
Flood Prone Area Elevation:	645.28
Flood Prone Width:	158.50
Max Depth at Bankfull:	2.52
Mean Depth at Bankful:	1.15
W/D Ratio:	31.71
Entrenchment Ratio:	4.34
Bank Height Ratio:	0.93

Stream Type	C4

Station and description	23+38.19 MS-1P Looking Upstream

23+38.19 MS-1P Looking Downstream



Cross Section Plot Exhibit

River Basin:	Yadkin-Pee Dee River
Watershed:	Little Buffalo Creek
XS ID:	MS-1R
Drainage Area (sq mi):	2.99
Date:	9/19/2016
Field Crew:	Matthew Holthaus, Greg Russo: Louis Berger

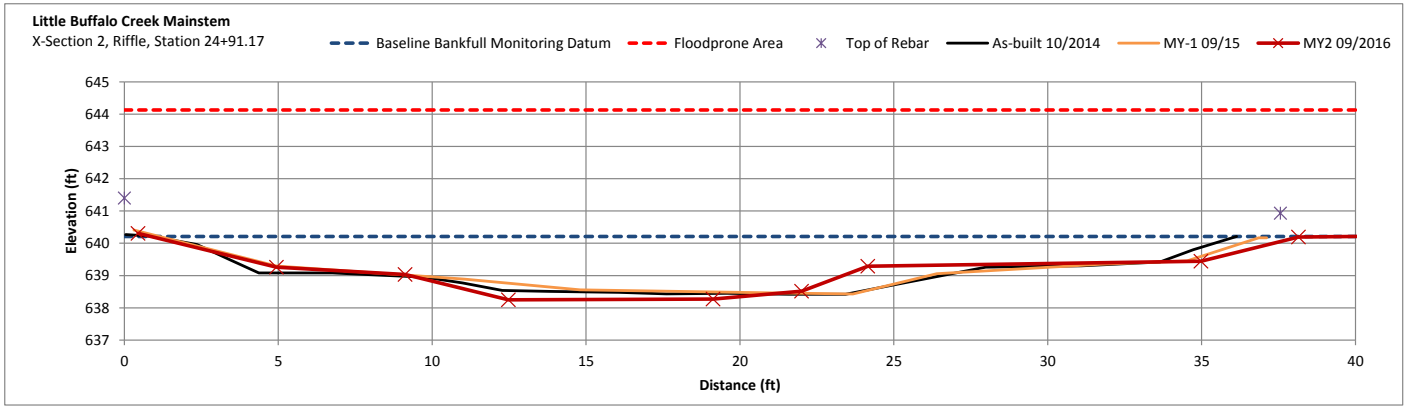
Station	Elevation
0.00	640.20
0.45	640.31
4.94	639.26
9.12	639.04
12.48	638.25
19.13	638.27
22.00	638.51
24.16	639.29
34.98	639.44
38.15	640.19
44.17	640.26
55.03	640.16

SUMMARY DATA	
Bankfull Elevation:	640.21
Bankfull Cross-Sectional Area:	43.25
Bankfull Width:	37.70
Flood Prone Area Elevation:	644.13
Flood Prone Width:	135.20
Max Depth at Bankfull:	1.96
Mean Depth at Bankful:	1.15
W/D Ratio:	32.87
Entrenchment Ratio:	3.59
Bank Height Ratio:	0.99

Stream Type	C4

Station and description	24+91.17 MS-1R Looking Upstream

24+91.17 MS-1R Looking Downstream



Cross Section Plot Exhibit

River Basin:	Yadkin-Pee Dee River
Watershed:	Little Buffalo Creek
XS ID:	MS-2R
Drainage Area (sq mi):	2.82
Date:	9/19/2016
Field Crew:	Matthew Holthaus, Greg Russo: Louis Berger

Station	Elevation
0.00	632.20
0.30	631.34
0.54	631.21
3.65	630.42
9.84	629.66
15.83	629.62
18.77	628.83
20.63	628.10
21.87	628.01
23.88	627.95
24.51	628.34
27.08	629.28
29.15	629.45
31.69	629.93
36.51	630.03
38.89	630.57
41.61	631.04
43.73	631.66
44.34	632.89

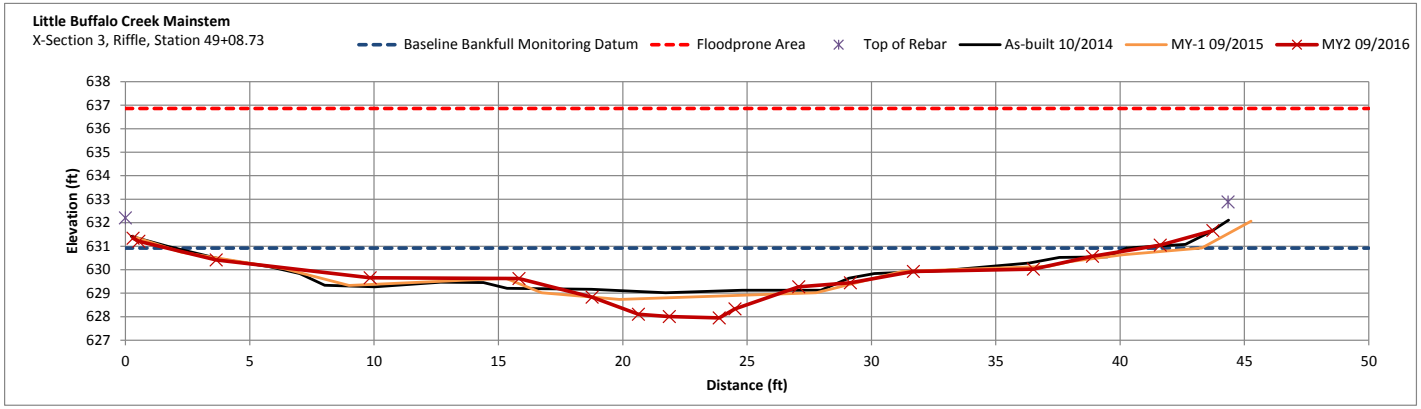
Note: Inner Channel reworked to eliminate larger backwater effect upstream. MY2 and Summary Data shows new baseline monitoring post re-grading.

SUMMARY DATA	
Bankfull Elevation:	630.92
Bankfull Cross-Sectional Area:	52.43
Bankfull Width:	38.35
Flood Prone Area Elevation:	636.86
Flood Prone Width:	488.00
Max Depth at Bankfull:	2.97
Mean Depth at Bankful:	1.37
W/D Ratio:	28.05
Entrenchment Ratio:	12.73
Bank Height Ratio:	0.88

Stream Type	C4

Station and description	4908.73 MS-2R Looking Upstream

4908.73 MS-2R Looking Downstream



Cross Section Plot Exhibit

River Basin:	Yadkin-Pee Dee River
Watershed:	Little Buffalo Creek
XS ID:	MS-2P
Drainage Area (sq mi):	2.82
Date:	9/15/2015
Field Crew:	Matthew Holthaus, Greg Russo: Louis Berger

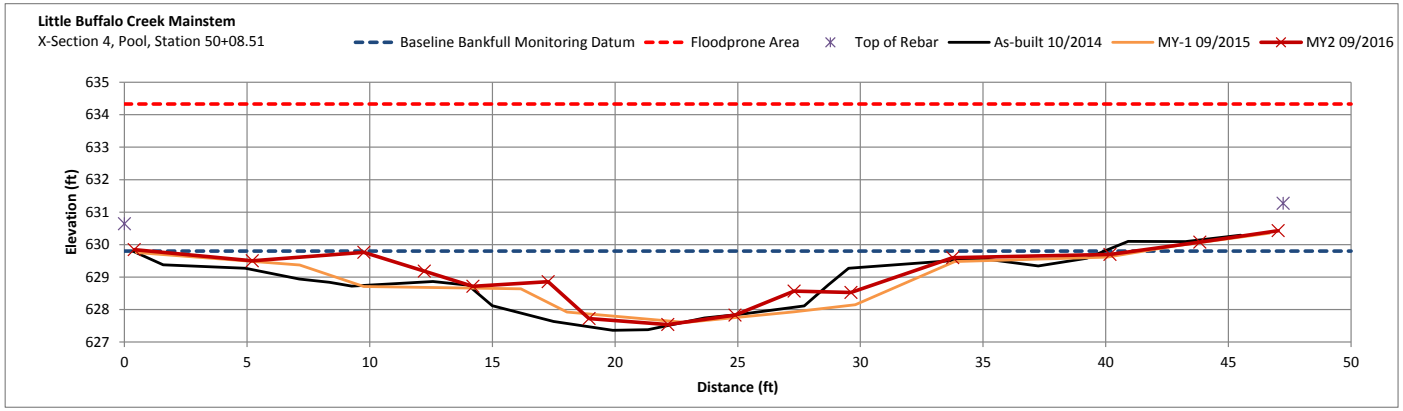
Station	Elevation
0.00	630.64
0.40	629.85
5.21	629.50
9.76	629.76
12.22	629.18
14.21	628.72
17.27	628.86
18.94	627.72
22.15	627.54
24.89	627.83
27.29	628.56
29.61	628.53
33.76	629.60
40.17	629.69
43.83	630.07
47.03	630.43
47.23	631.27

SUMMARY DATA	
Bankfull Elevation:	629.80
Bankfull Cross-Sectional Area:	33.19
Bankfull Width:	33.35
Flood Prone Area Elevation:	634.33
Flood Prone Width:	368.00
Max Depth at Bankfull:	2.26
Mean Depth at Bankful:	1.00
W/D Ratio:	33.52
Entrenchment Ratio:	11.03
Bank Height Ratio:	0.91

Stream Type	C4

Station and description	5008.51 MS-2P Looking Upstream

5008.51 MS-2P Looking Downstream



Cross Section Plot Exhibit

River Basin:	Yadkin-Pee Dee River
Watershed:	Little Buffalo Creek
XS ID:	MS-3P
Drainage Area (sq mi):	4.01
Date:	9/19/2016
Field Crew:	Matthew Holthaus, Greg Russo: Louis Berger

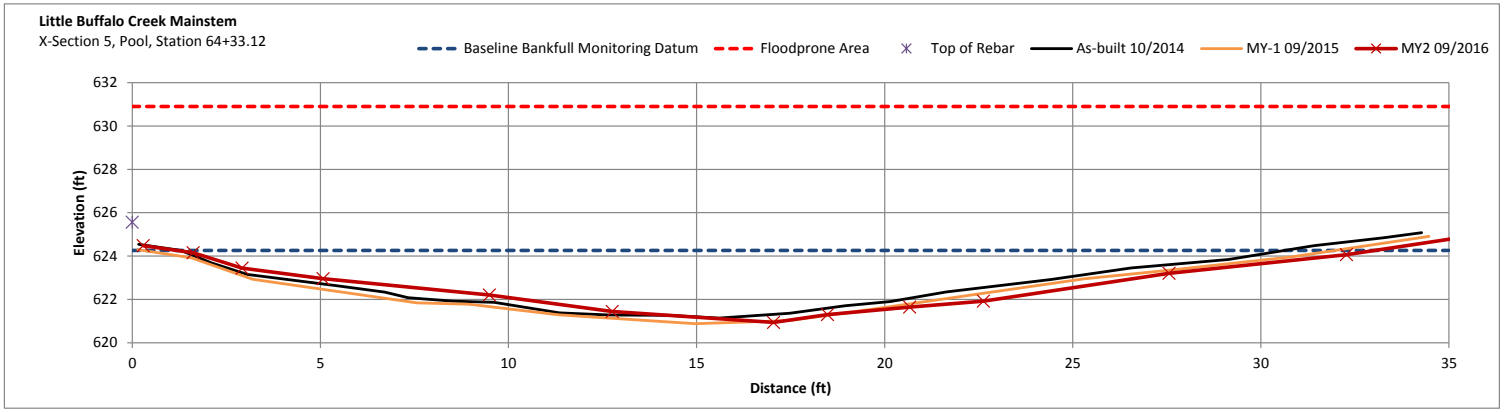
Station	Elevation
0.00	625.57
0.29	624.49
1.62	624.15
2.92	623.44
5.07	622.96
9.49	622.20
12.76	621.44
17.05	620.94
18.48	621.30
20.66	621.64
22.63	621.92
27.56	623.21
32.27	624.06
36.28	625.11
36.70	625.97

SUMMARY DATA	
Bankfull Elevation:	624.26
Bankfull Cross-Sectional Area:	58.25
Bankfull Width:	24.64
Flood Prone Area Elevation:	630.90
Flood Prone Width:	435.00
Max Depth at Bankfull:	3.32
Mean Depth at Bankful:	2.36
W/D Ratio:	10.42
Entrenchment Ratio:	17.65
Bank Height Ratio:	0.68

Stream Type	C4

Station and description	6433.12 MS-3P Looking Upstream

6433.12 MS-3P Looking Downstream



Cross Section Plot Exhibit

River Basin:	Yadkin-Pee Dee River
Watershed:	Little Buffalo Creek
XS ID:	UT2-1R
Drainage Area (sq mi):	0.3
Date:	9/19/2016
Field Crew:	Matthew Holthaus, Greg Russo: Louis Berger

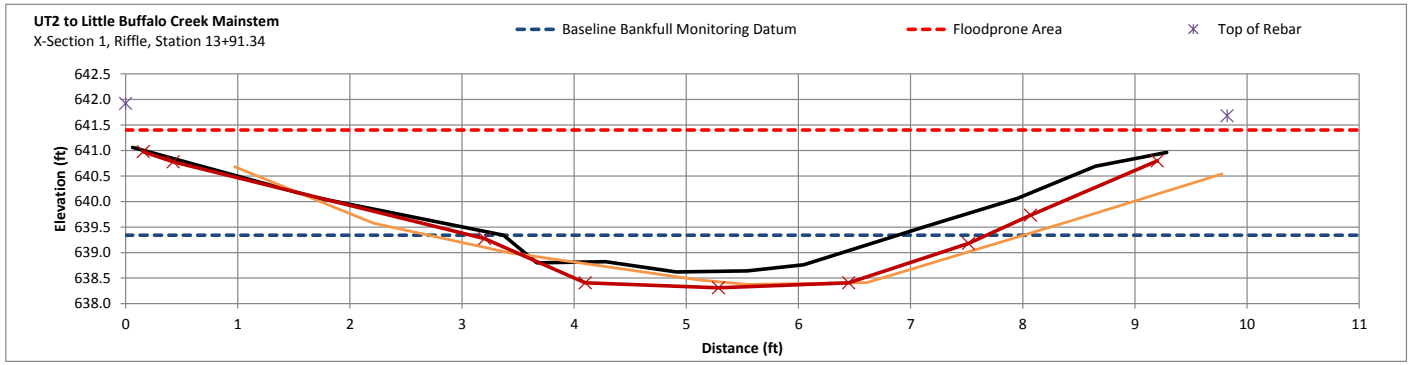
Station	Elevation
0.00	641.92
0.16	640.98
0.42	640.78
3.20	639.27
4.10	638.41
5.29	638.31
6.45	638.41
7.52	639.18
8.07	639.73
9.20	640.80
9.82	641.68

SUMMARY DATA	
Bankfull Elevation:	639.34
Bankfull Cross-Sectional Area:	3.43
Bankfull Width:	4.31
Flood Prone Area Elevation:	641.40
Flood Prone Width:	40.80
Max Depth at Bankful:	1.03
Mean Depth at Bankful:	0.80
W/D Ratio:	5.42
Entrenchment Ratio:	9.46
Bank Height Ratio:	0.84

Stream Type	B6

Station and description	1391.34 UT2-1R Looking Upstream

1391.34 UT2-1R Looking Downstream



Cross Section Plot Exhibit

River Basin:	Yadkin-Pee Dee River
Watershed:	Little Buffalo Creek
XS ID:	UT3-1R
Drainage Area (sq mi):	0.097
Date:	9/19/2016
Field Crew:	Matthew Holthaus, Greg Russo: Louis Berger

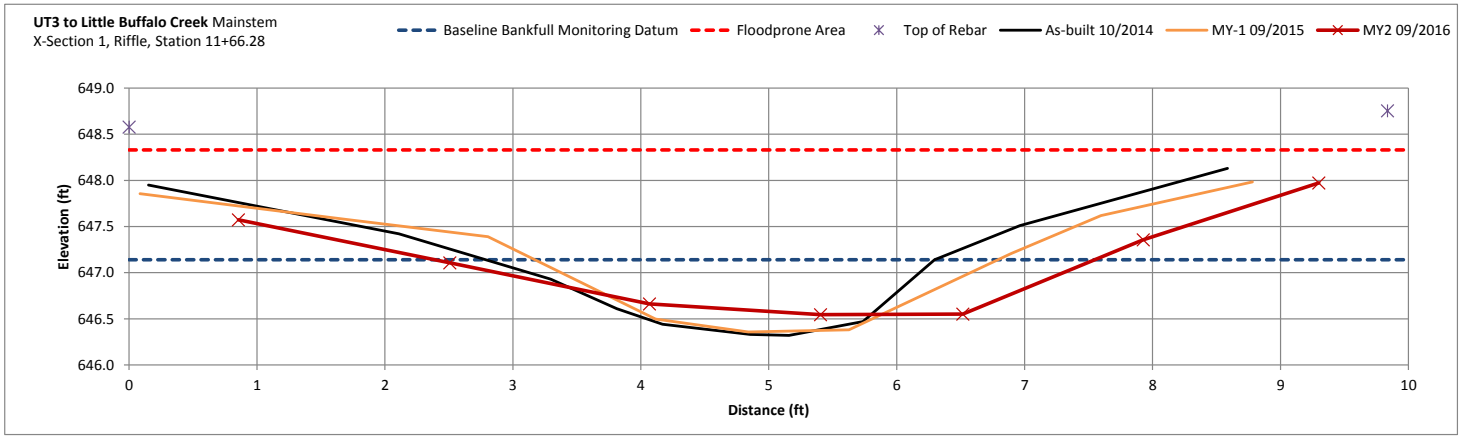
Station	Elevation
0.00	648.58
0.86	647.57
2.51	647.11
4.07	646.66
5.41	646.55
6.52	646.55
7.93	647.36
9.30	647.97
9.84	648.76

SUMMARY DATA	
Bankfull Elevation:	647.14
Bankfull Cross-Sectional Area:	1.80
Bankfull Width:	5.42
Flood Prone Area Elevation:	648.33
Flood Prone Width:	27.50
Max Depth at Bankfull:	0.60
Mean Depth at Bankful:	5.42
W/D Ratio:	16.31
Entrenchment Ratio:	5.07
Bank Height Ratio:	0.94

Stream Type	B6

Station and description	1166.28 UT3-1R Looking Upstream

1166.28 UT3-1R Looking Downstream



Cross Section Plot Exhibit

River Basin:	Yadkin-Pee Dee River
Watershed:	Little Buffalo Creek
XS ID:	UT3-1P
Drainage Area (sq mi):	0.097
Date:	9/19/2016
Field Crew:	Matthew Holthaus, Greg Russo: Louis Berger

Station	Elevation
0.00	641.50
0.25	640.65
3.94	639.19
4.56	638.71
6.94	638.44
8.95	638.64
10.81	639.51
12.74	640.08
13.04	641.12

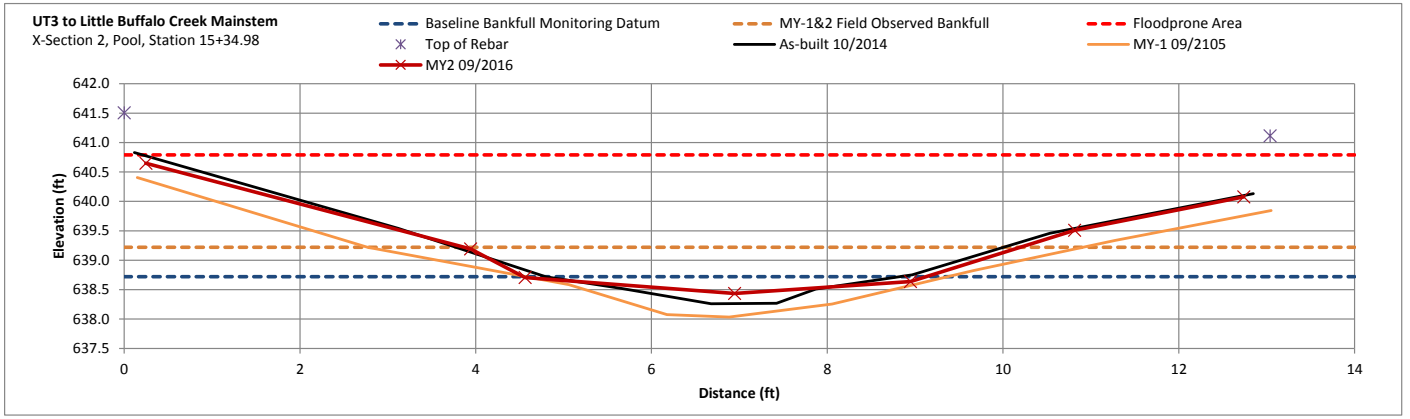
Note: No change in BKF elevation from MY1 to MY2. Using calculated BKF from MY1 and MY2 in Summary Data for shift after construction from Baseline

SUMMARY DATA	
Bankfull Elevation:	639.22
Bankfull Cross-Sectional Area:	3.14
Bankfull Width:	6.87
Flood Prone Area Elevation:	640.79
Flood Prone Width:	15.30
Max Depth at Bankfull:	0.79
Mean Depth at Bankful:	0.46
W/D Ratio:	15.06
Entrenchment Ratio:	2.23
Bank Height Ratio:	0.97

Stream Type	B6

Station and description	1534.98 UT3-1P Looking Upstream

1534.98 UT3-1P Looking Downstream



Cross Section Plot Exhibit

River Basin:	Yadkin-Pee Dee River
Watershed:	Little Buffalo Creek
XS ID:	UT3-2R
Drainage Area (sq mi):	0.097
Date:	9/19/2016
Field Crew:	Matthew Holthaus, Greg Russo: Louis Berger

Station	Elevation
0.00	635.18
0.40	634.45
3.51	633.21
5.78	632.52
7.25	632.13
10.32	632.61
12.16	633.01
15.97	634.08

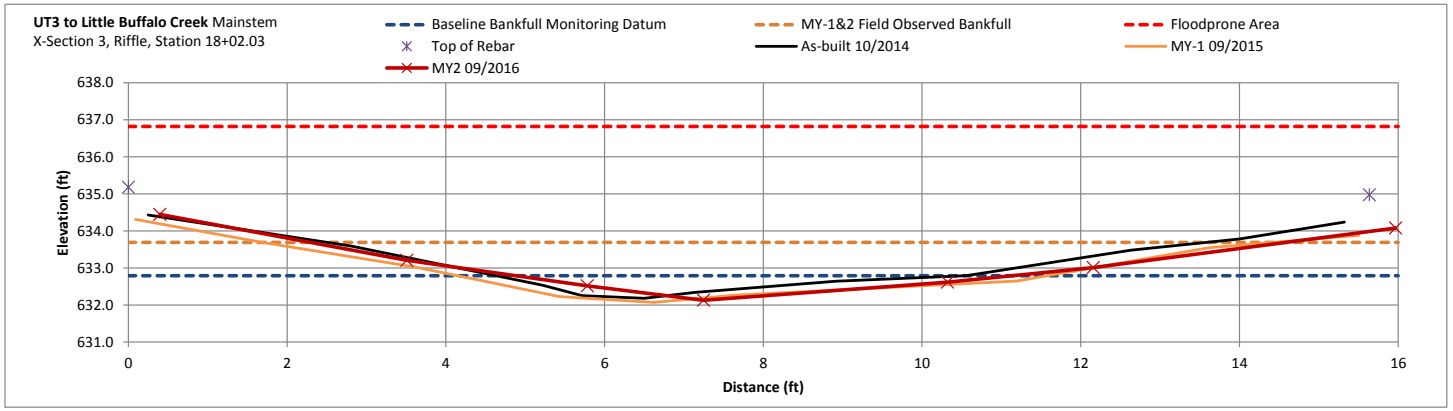
Note: No change in BKF elevation from MY1 to MY2. Using calculated BKF from MY1 and MY2 in Summary Data for shift after construction from Baseline

SUMMARY DATA	
Bankfull Elevation:	633.69
Bankfull Cross-Sectional Area:	10.31
Bankfull Width:	8.65
Flood Prone Area Elevation:	636.82
Flood Prone Width:	30.20
Max Depth at Bankfull:	1.56
Mean Depth at Bankful:	1.19
W/D Ratio:	7.25
Entrenchment Ratio:	3.49
Bank Height Ratio:	0.56

Stream Type	B6

Station and description	1802.03 UT3-2R Looking Upstream

1802.03 UT3-2R Looking Downstream



Cross Section Plot Exhibit

River Basin:	Yadkin-Pee Dee River
Watershed:	Little Buffalo Creek
XS ID:	UT3-3R
Drainage Area (sq mi):	0.097
Date:	9/19/2016
Field Crew:	Matthew Holthaus, Greg Russo: Louis Berger

Station	Elevation
0.00	624.86
0.24	623.77
2.51	623.21
3.25	622.95
4.21	622.73
5.00	622.69
6.13	622.76
6.96	623.11
8.40	624.01
9.02	624.07
9.25	624.87

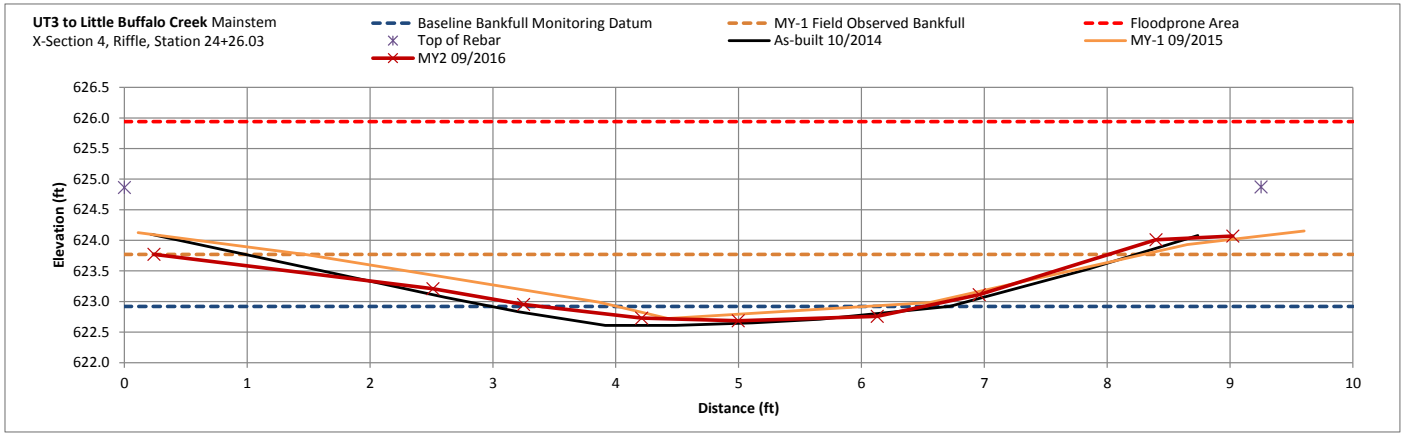
Note: No change in BKF elevation from MY1 to MY2. Using calculated BKF from MY1 and MY2 in Summary Data for shift after construction from Baseline

SUMMARY DATA	
Bankfull Elevation:	623.77
Bankfull Cross-Sectional Area:	4.75
Bankfull Width:	8.16
Flood Prone Area Elevation:	625.94
Flood Prone Width:	>100
Max Depth at Bankfull:	1.08
Mean Depth at Bankful:	0.58
W/D Ratio:	14.02
Entrenchment Ratio:	>2.2
Bank Height Ratio:	1.00

Stream Type	B6

Station and description	2426.03 UT3-3R Looking Upstream

2426.03 UT3-3R Looking Downstream



Cross Section Plot Exhibit

River Basin:	Yadkin-Pee Dee River
Watershed:	Little Buffalo Creek
XS ID:	UT4-1P
Drainage Area (sq mi):	0.4
Date:	9/19/2016
Field Crew:	Matthew Holthaus, Greg Russo: Louis Berger

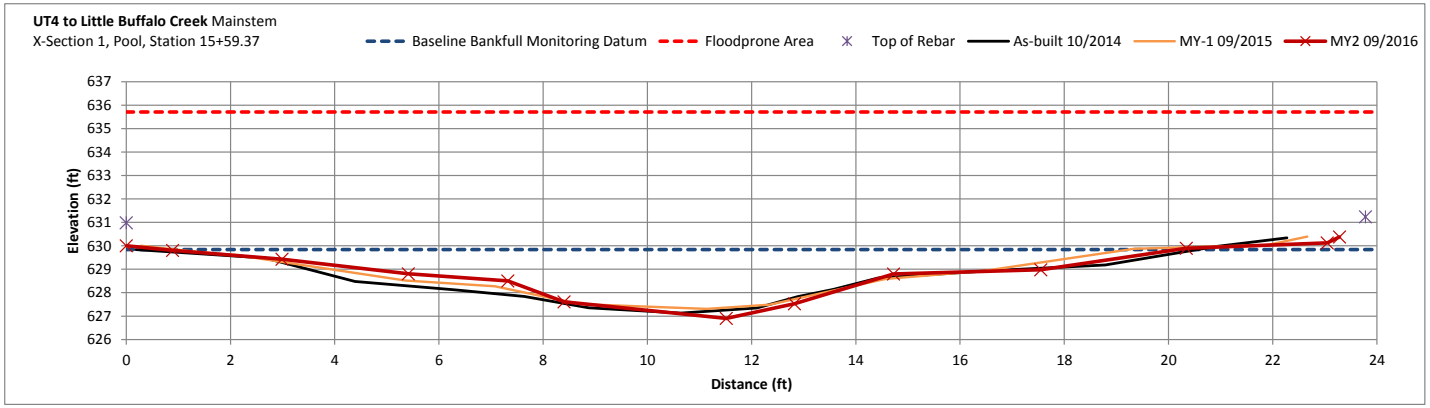
Station	Elevation
0.00	630.99
0.00	630.00
0.89	629.81
2.99	629.43
5.41	628.81
7.32	628.51
8.40	627.61
11.51	626.90
12.82	627.53
14.73	628.80
17.55	628.98
20.34	629.90
23.05	630.13
23.28	630.38
23.78	631.24

SUMMARY DATA	
Bankfull Elevation:	629.84
Bankfull Cross-Sectional Area:	23.75
Bankfull Width:	19.45
Flood Prone Area Elevation:	635.71
Flood Prone Width:	>100
Max Depth at Bankfull:	2.94
Mean Depth at Bankful:	1.22
W/D Ratio:	15.93
Entrenchment Ratio:	>2.2
Bank Height Ratio:	0.99

Stream Type	C4

Station and description	1559.37 UT4-1P Looking Upstream

1559.37 UT4-1P Looking Downstream



Cross Section Plot Exhibit

River Basin:	Yadkin-Pee Dee River
Watershed:	Little Buffalo Creek
XS ID:	UT4-1R
Drainage Area (sq mi):	0.4
Date:	9/19/2016
Field Crew:	Matthew Holthaus, Greg Russo: Louis Berger

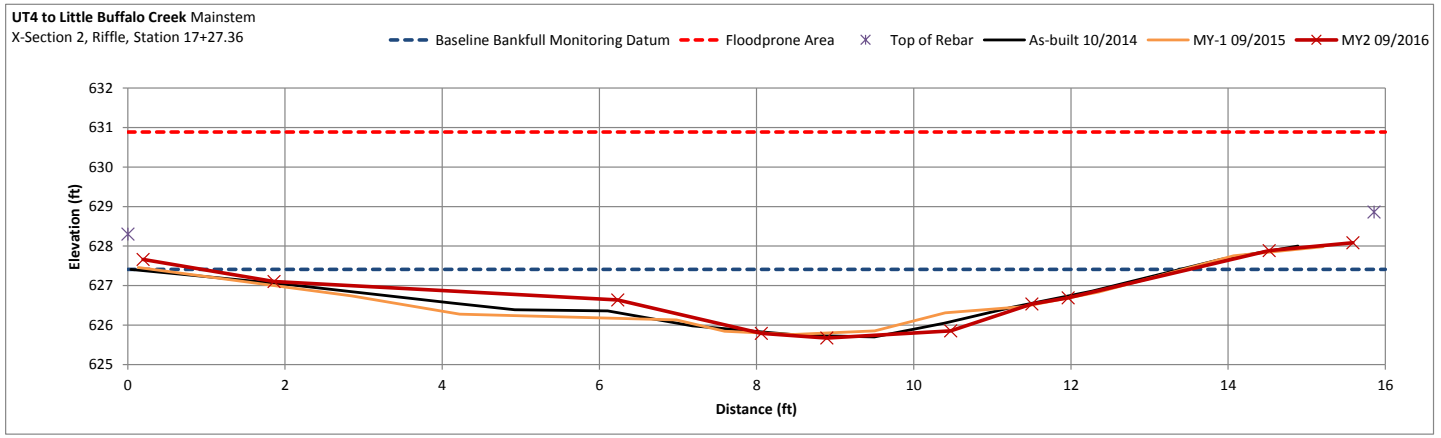
Station	Elevation
0.00	628.30
0.19	627.66
1.86	627.10
6.23	626.64
8.06	625.79
8.89	625.67
10.47	625.85
11.50	626.53
11.96	626.69
14.52	627.89
15.59	628.08
15.85	628.86

SUMMARY DATA	
Bankfull Elevation:	627.41
Bankfull Cross-Sectional Area:	10.42
Bankfull Width:	14.33
Flood Prone Area Elevation:	630.89
Flood Prone Width:	>100
Max Depth at Bankfull:	1.74
Mean Depth at Bankful:	0.73
W/D Ratio:	19.70
Entrenchment Ratio:	>2.2
Bank Height Ratio:	1.14

Stream Type	C4

Station and description	1727.36 UT4-1R Looking Upstream

1727.36 UT4-1R Looking Downstream



Cross Section Plot Exhibit

River Basin:	Yadkin-Pee Dee River
Watershed:	Little Buffalo Creek
XS ID:	UT7-1R
Drainage Area (sq mi):	1.91
Date:	9/19/2016
Field Crew:	Matthew Holthaus, Greg Russo: Louis Berger

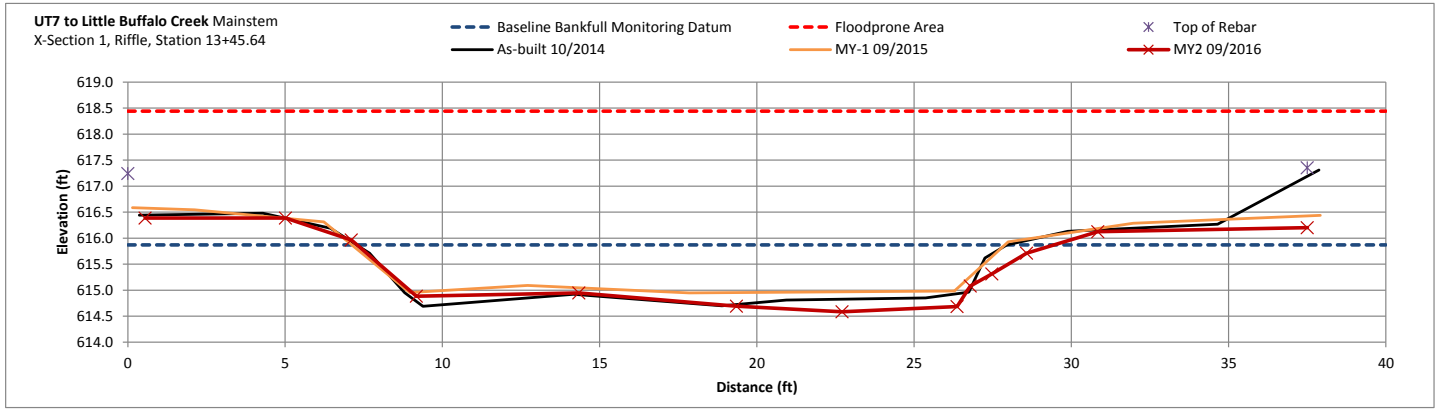
Station	Elevation
0.00	617.24
0.55	616.39
5.01	616.39
7.10	615.97
9.17	614.89
14.34	614.95
19.35	614.69
22.71	614.58
26.37	614.69
26.79	615.08
27.47	615.31
28.57	615.71
30.84	616.13
37.51	616.20
37.51	617.35

SUMMARY DATA	
Bankfull Elevation:	615.87
Bankfull Cross-Sectional Area:	21.15
Bankfull Width:	21.47
Flood Prone Area Elevation:	618.44
Flood Prone Width:	>100
Max Depth at Bankfull:	1.29
Mean Depth at Bankful:	0.98
W/D Ratio:	21.80
Entrenchment Ratio:	>2.2
Bank Height Ratio:	0.87

Stream Type	C4

Station and description	1345.64 UT7-1R Looking Upstream

1345.64 UT7-1R Looking Downstream



Cross Section Plot Exhibit

River Basin:	Yadkin-Pee Dee River
Watershed:	Little Buffalo Creek
XS ID:	UT7-1P
Drainage Area (sq mi):	1.91
Date:	9/19/2016
Field Crew:	Matthew Holthaus, Greg Russo: Louis Berger

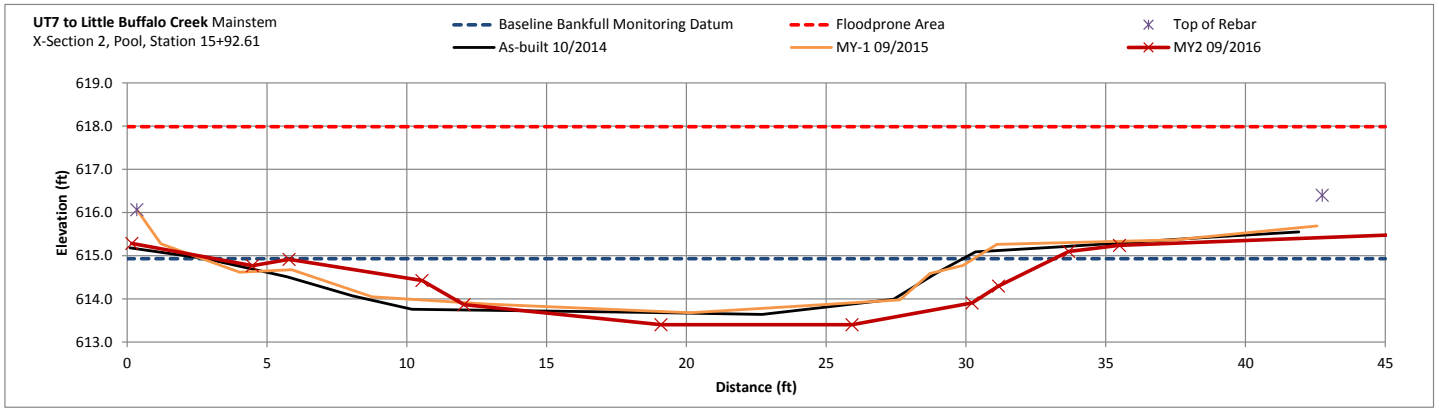
Station	Elevation
0.00	615.95
0.17	615.28
4.48	614.77
5.79	614.92
10.55	614.43
12.05	613.87
19.09	613.40
25.93	613.40
30.22	613.91
31.17	614.30
33.68	615.10
35.49	615.24
45.18	615.48
45.21	616.27

SUMMARY DATA	
Bankfull Elevation:	614.93
Bankfull Cross-Sectional Area:	28.70
Bankfull Width:	23.14
Flood Prone Area Elevation:	617.99
Flood Prone Width:	>100
Max Depth at Bankfull:	1.53
Mean Depth at Bankfull:	1.24
W/D Ratio:	18.65
Entrenchment Ratio:	>2.2
Bank Height Ratio:	0.67

Stream Type	C4

Station and description	1592.61 UT7-1P Looking Upstream

1592.61 UT7-1P Looking Downstream



Cross Section Plot Exhibit

River Basin:	Yadkin-Pee Dee River
Watershed:	Little Buffalo Creek
XS ID:	UT7-2R
Drainage Area (sq mi):	1.91
Date:	9/19/2016
Field Crew:	Matthew Holthaus, Greg Russo: Louis Berger

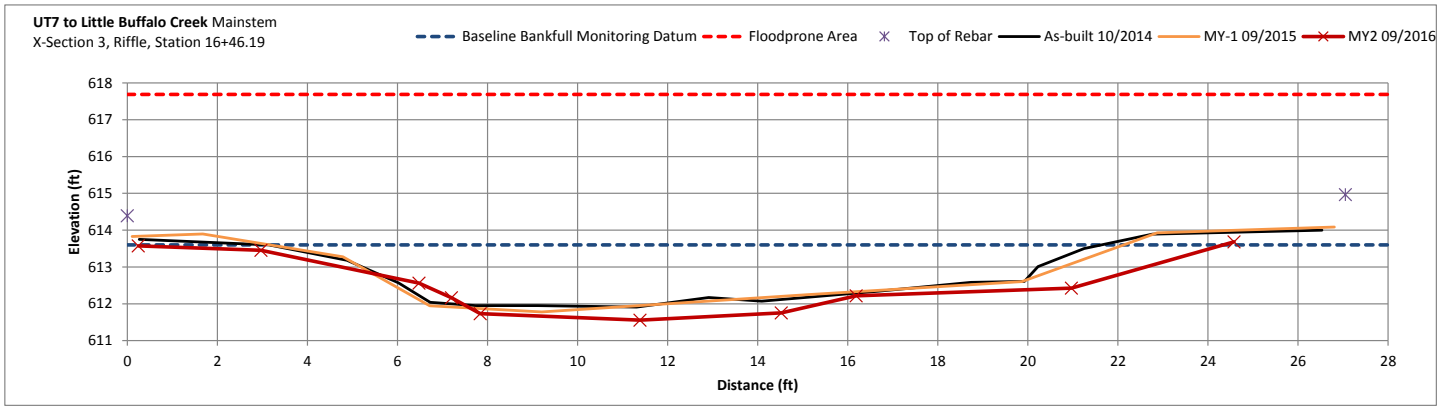
Station	Elevation
0.00	614.39
0.24	613.57
2.97	613.45
6.48	612.56
7.20	612.17
7.84	611.73
11.39	611.56
14.53	611.76
16.19	612.22
20.97	612.42
24.58	613.68

SUMMARY DATA	
Bankfull Elevation:	613.60
Bankfull Cross-Sectional Area:	26.11
Bankfull Width:	21.61
Flood Prone Area Elevation:	617.69
Flood Prone Width:	>100
Max Depth at Bankfull:	2.04
Mean Depth at Bankful:	1.21
W/D Ratio:	17.89
Entrenchment Ratio:	>2.2
Bank Height Ratio:	0.93

Stream Type	C4

Station and description	1846.19 UT7-2R Looking Upstream

1846.19 UT7-2R Looking Downstream



Cross Section Plot Exhibit

River Basin:	Yadkin-Pee Dee River
Watershed:	Little Buffalo Creek
XS ID:	UT7-STP1
Drainage Area (sq mi):	1.91
Date:	9/19/2016
Field Crew:	Matthew Holthaus, Greg Russo: Louis Berger

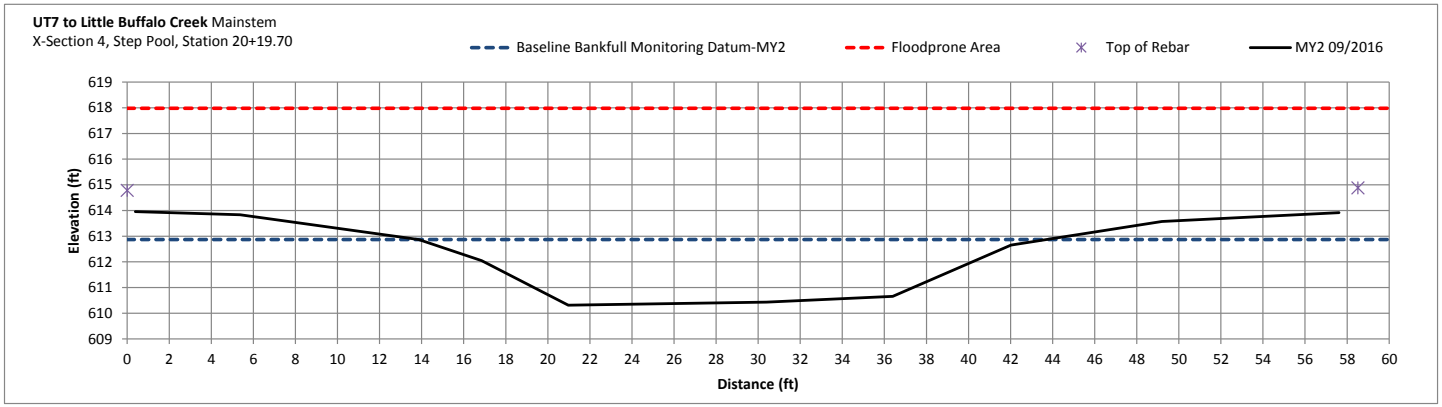
Station	Elevation
0.00	614.79
0.39	613.96
5.37	613.83
13.86	612.87
16.85	612.05
20.97	610.31
30.40	610.44
36.40	610.66
42.02	612.66
49.19	613.57
57.61	613.92
58.52	614.88

SUMMARY DATA	
Bankfull Elevation:	612.87
Bankfull Cross-Sectional Area:	52.44
Bankfull Width:	28.17
Flood Prone Area Elevation:	617.98
Flood Prone Width:	>100
Max Depth at Bankfull:	2.55
Mean Depth at Bankful:	1.86
W/D Ratio:	15.13
Entrenchment Ratio:	>2.2
Bank Height Ratio:	0.92

Stream Type	C4b

Station and description	2019.70 UT7-STP1 Looking Upstream

2019.70 UT7-STP1 Looking Downstream



Cross Section Plot Exhibit

River Basin:	Yadkin-Pee Dee River
Watershed:	Little Buffalo Creek
XS ID:	UT7-STP2
Drainage Area (sq mi):	1.91
Date:	9/19/2016
Field Crew:	Matthew Holthaus, Greg Russo: Louis Berger

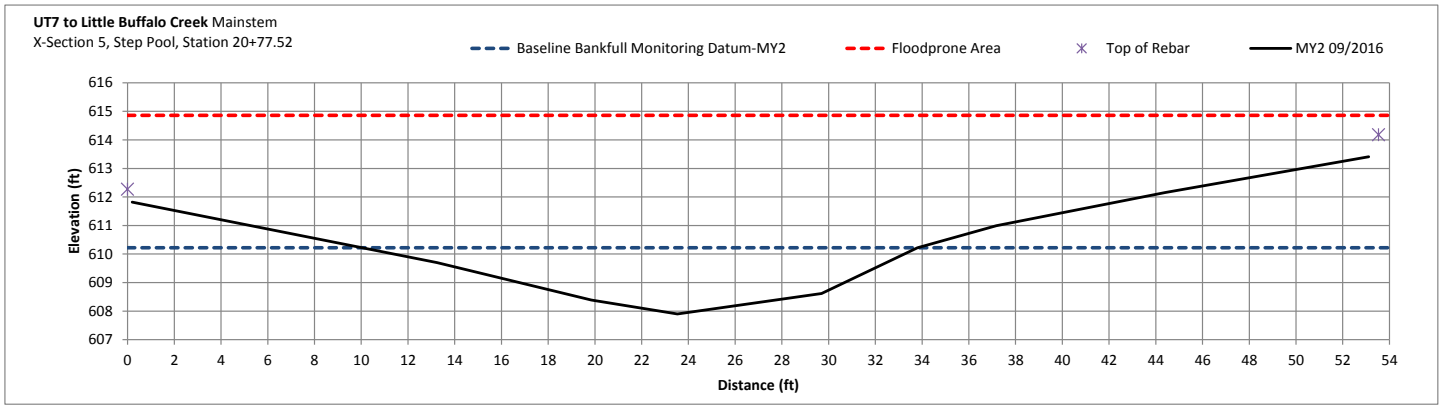
Station	Elevation
0.00	612.27
0.20	611.82
13.24	609.70
19.85	608.39
23.53	607.90
29.70	608.62
33.80	610.22
37.18	610.99
44.41	612.16
53.11	613.41
53.53	614.18

SUMMARY DATA	
Bankfull Elevation:	610.22
Bankfull Cross-Sectional Area:	34.22
Bankfull Width:	20.56
Flood Prone Area Elevation:	614.86
Flood Prone Width:	>100
Max Depth at Bankfull:	2.32
Mean Depth at Bankful:	1.66
W/D Ratio:	12.35
Entrenchment Ratio:	>2.2
Bank Height Ratio:	0.78

Stream Type	C4b

Station and description	2077.52 UT7-STP1 Looking Upstream

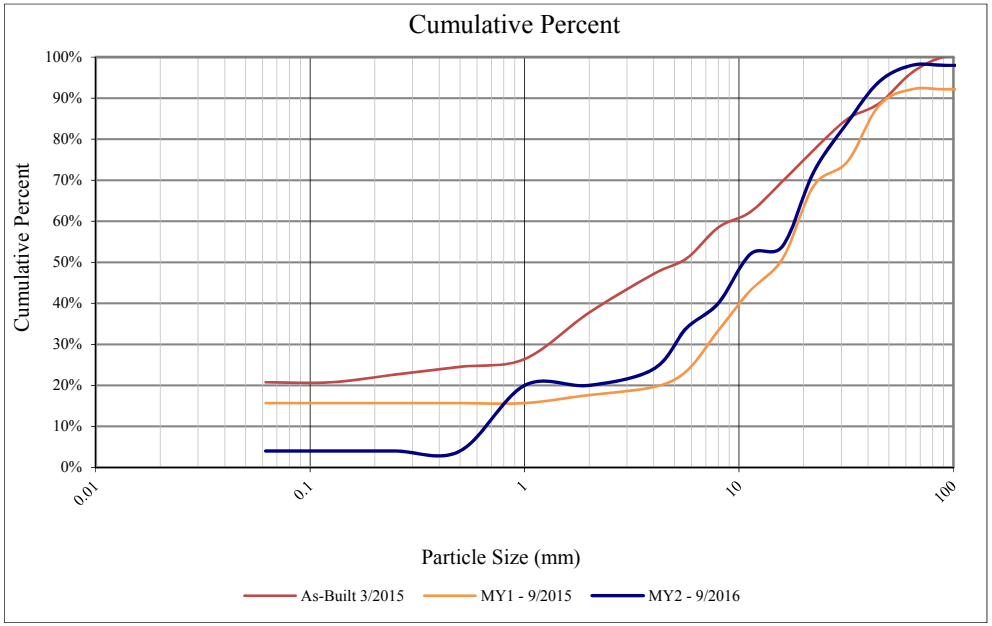
2077.52 UT7-STP1 Looking Downstream

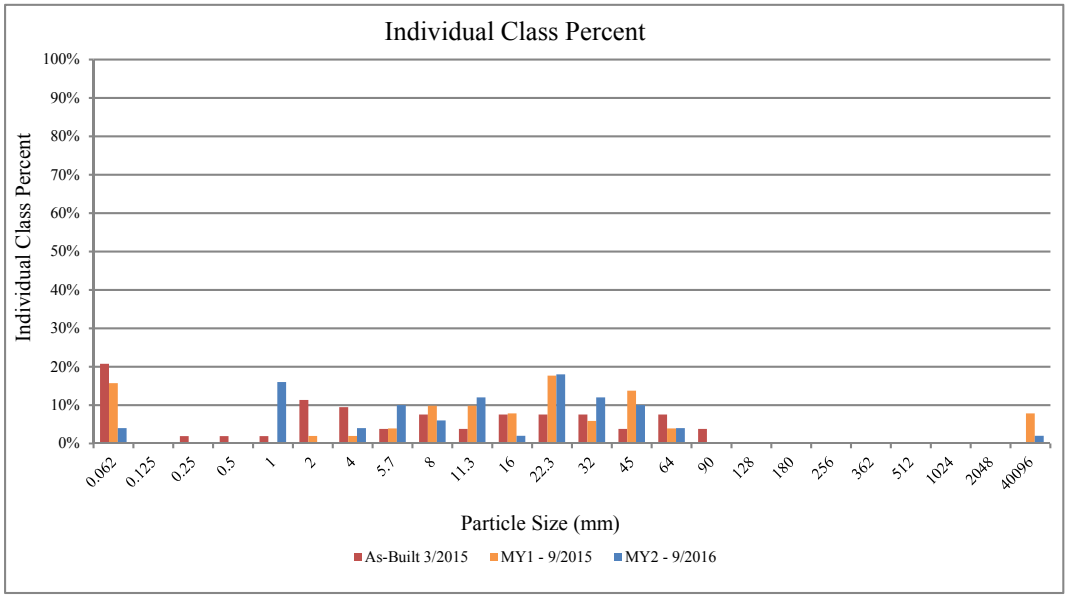


Figures 5a-q – Pebble Count Plots

Project Name: Little Buffalo Creek					
Cross-Section: MS-1P					
Feature: Pool					
			2016		
Description	Material	Size (mm)	Total #	Item %	Cum %
Silt/Clay	silt/clay	0.062	2	4%	4%
Sand	very fine sand	0.125	0	0%	4%
	fine sand	0.250	0	0%	4%
	medium sand	0.50	0	0%	4%
	coarse sand	1.00	8	16%	20%
	very coarse sand	2.0	0	0%	20%
Gravel	very fine gravel	4.0	2	4%	24%
	fine gravel	5.7	5	10%	34%
	fine gravel	8.0	3	6%	40%
	medium gravel	11.3	6	12%	52%
	medium gravel	16.0	1	2%	54%
	coarse gravel	22.3	9	18%	72%
	coarse gravel	32.0	6	12%	84%
	very coarse gravel	45	5	10%	94%
	very coarse gravel	64	2	4%	98%
Cobble	small cobble	90	0	0%	98%
	medium cobble	128	0	0%	98%
	large cobble	180	0	0%	98%
	very large cobble	256	0	0%	98%
Boulder	small boulder	362	0	0%	98%
	small boulder	512	0	0%	98%
	medium boulder	1024	0	0%	98%
	large boulder	2048	0	0%	98%
Bedrock	bedrock	40096	1	2%	100%
TOTAL % of whole count			50	100%	100%

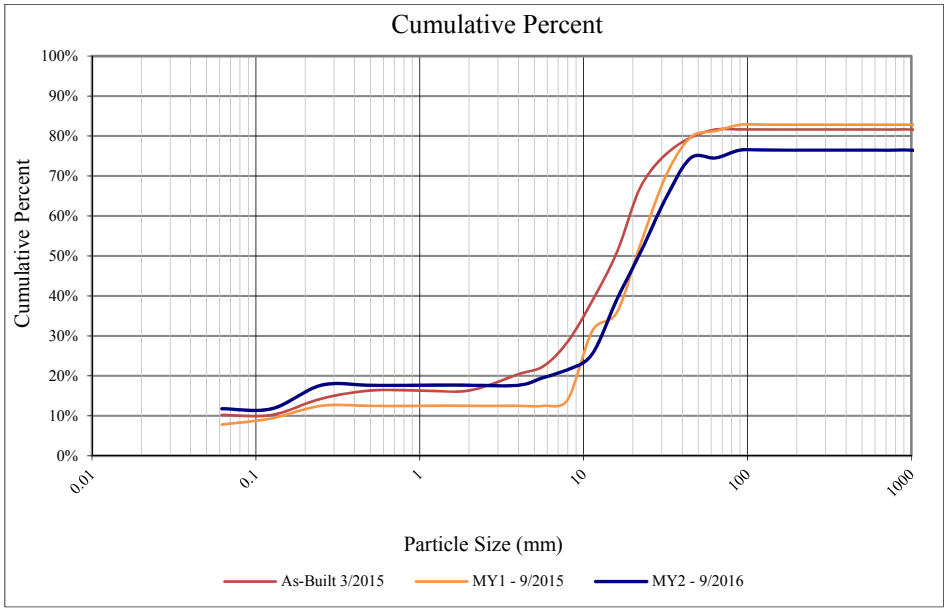
Summary Data	
D16	0.8
D35	5.9
D50	11
D84	32
D95	46
D100	Bedrock

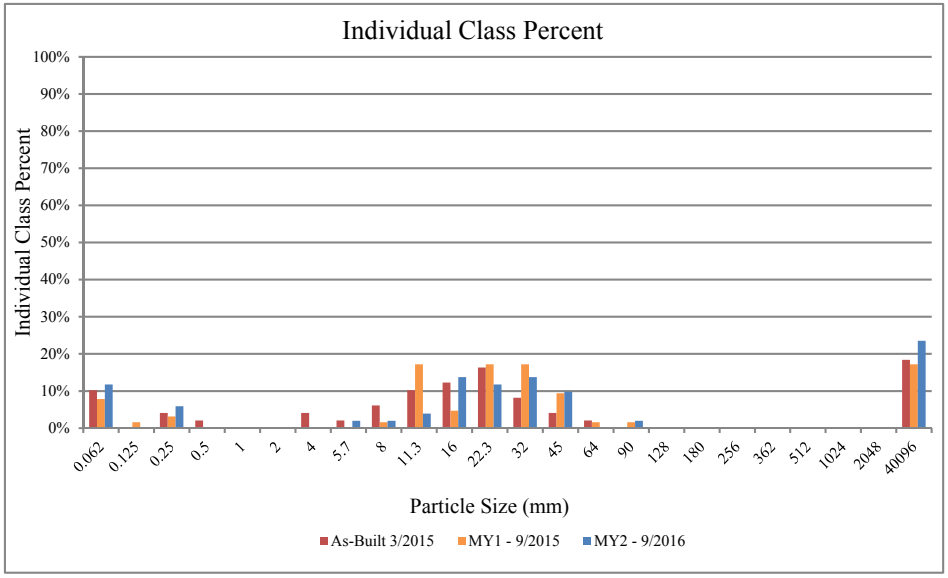




Project Name: Little Buffalo Creek					
Cross-Section: MS-1R					
Feature: Riffle					
			2016		
Description	Material	Size (mm)	Total #	Item %	Cum %
Silt/Clay	silt/clay	0.062	6	12%	12%
Sand	very fine sand	0.125	0	0%	12%
	fine sand	0.250	3	6%	18%
	medium sand	0.50	0	0%	18%
	coarse sand	1.00	0	0%	18%
	very coarse sand	2.0	0	0%	18%
Gravel	very fine gravel	4.0	0	0%	18%
	fine gravel	5.7	1	2%	20%
	fine gravel	8.0	1	2%	22%
	medium gravel	11.3	2	4%	25%
	medium gravel	16.0	7	14%	39%
	coarse gravel	22.3	6	12%	51%
	coarse gravel	32.0	7	14%	65%
	very coarse gravel	45	5	10%	75%
	very coarse gravel	64	0	0%	75%
Cobble	small cobble	90	1	2%	76%
	medium cobble	128	0	0%	76%
	large cobble	180	0	0%	76%
	very large cobble	256	0	0%	76%
Boulder	small boulder	362	0	0%	76%
	small boulder	512	0	0%	76%
	medium boulder	1024	0	0%	76%
	large boulder	2048	0	0%	76%
Bedrock	bedrock	40096	12	24%	100%
TOTAL % of whole count			51	100%	100%

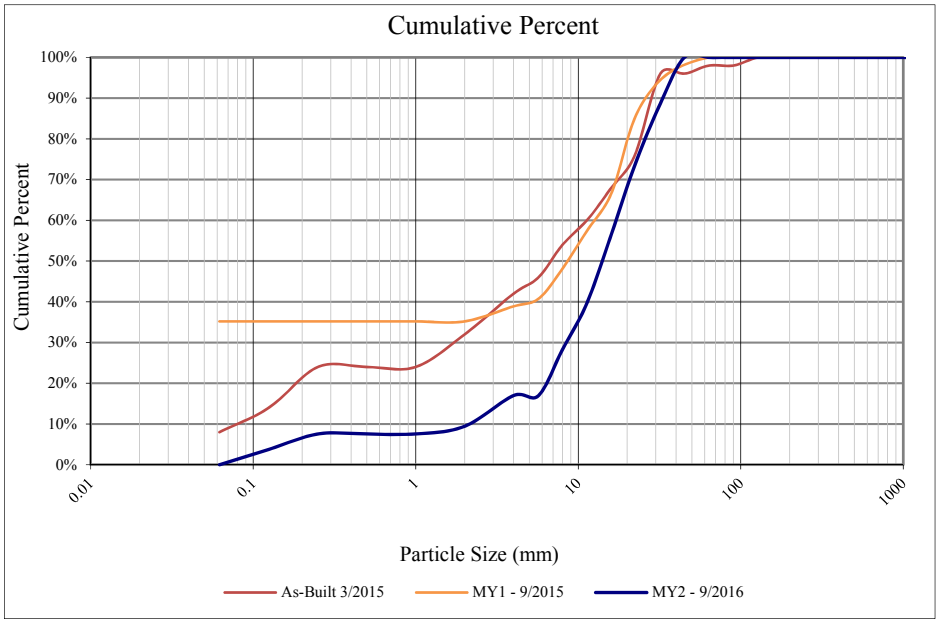
Summary Data	
D16	0.18
D35	15.00
D50	22.00
D84	Bedrock
D95	Bedrock
D100	Bedrock

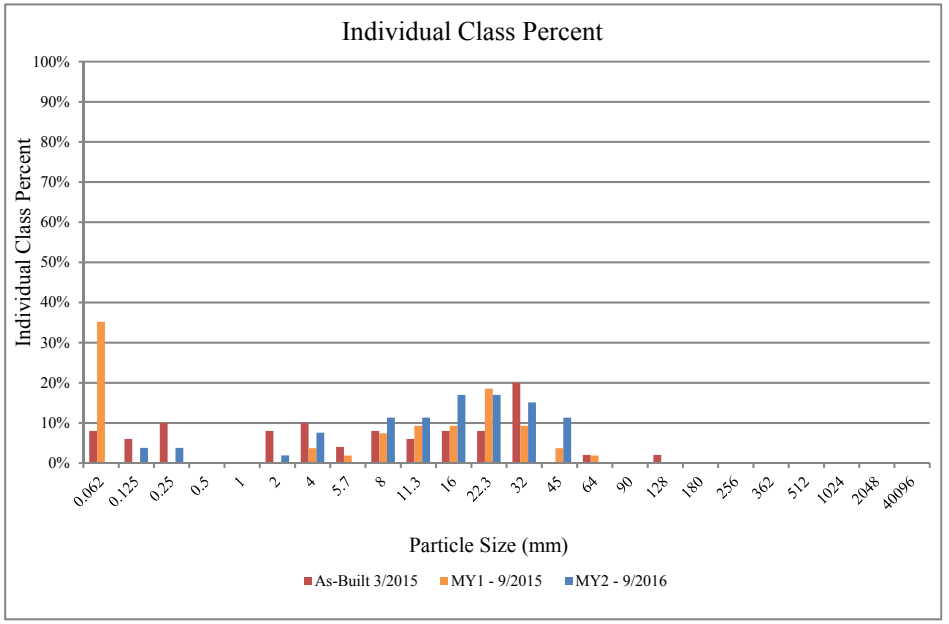




Project Name: Little Buffalo Creek					
Cross-Section: MS-2P					
Feature: Pool					
			2016		
Description	Material	Size (mm)	Total #	Item %	Cum %
Silt/Clay	silt/clay	0.062	0	0%	0%
Sand	very fine sand	0.125	2	4%	4%
	fine sand	0.250	2	4%	8%
	medium sand	0.50	0	0%	8%
	coarse sand	1.00	0	0%	8%
	very coarse sand	2.0	1	2%	9%
Gravel	very fine gravel	4.0	4	8%	17%
	fine gravel	5.7	0	0%	17%
	fine gravel	8.0	6	11%	28%
	medium gravel	11.3	6	11%	40%
	medium gravel	16.0	9	17%	57%
	coarse gravel	22.3	9	17%	74%
	coarse gravel	32.0	8	15%	89%
	very coarse gravel	45	6	11%	100%
	very coarse gravel	64	0	0%	100%
Cobble	small cobble	90	0	0%	100%
	medium cobble	128	0	0%	100%
	large cobble	180	0	0%	100%
	very large cobble	256	0	0%	100%
Boulder	small boulder	362	0	0%	100%
	small boulder	512	0	0%	100%
	medium boulder	1024	0	0%	100%
	large boulder	2048	0	0%	100%
Bedrock	bedrock	40096	0	0%	100%
TOTAL % of whole count			53	100%	100%

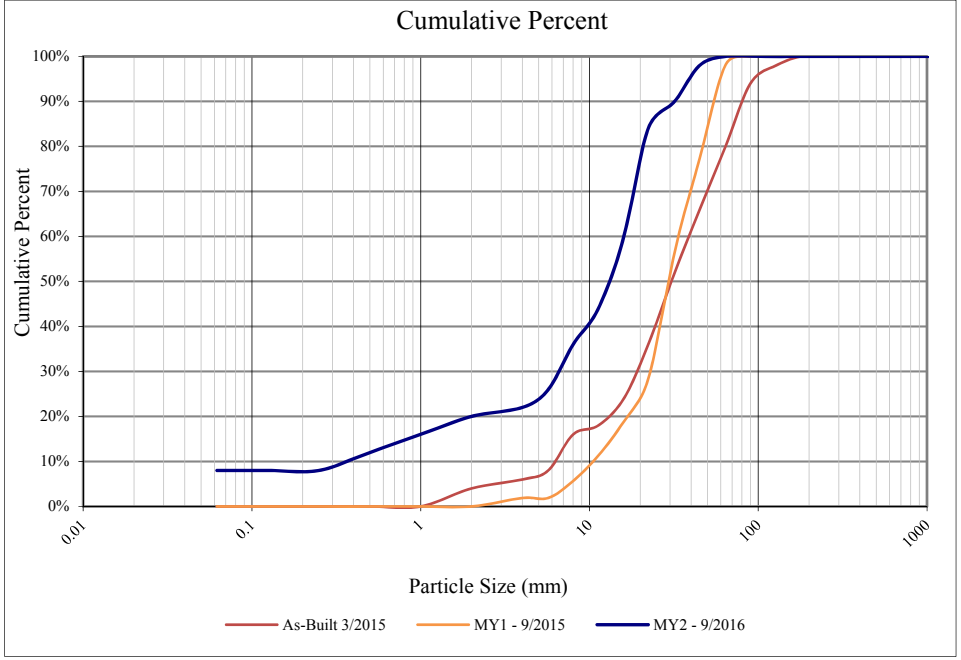
Summary Data	
D16	3.75
D35	10.00
D50	14.50
D84	28.00
D95	38.00
D100	45.00

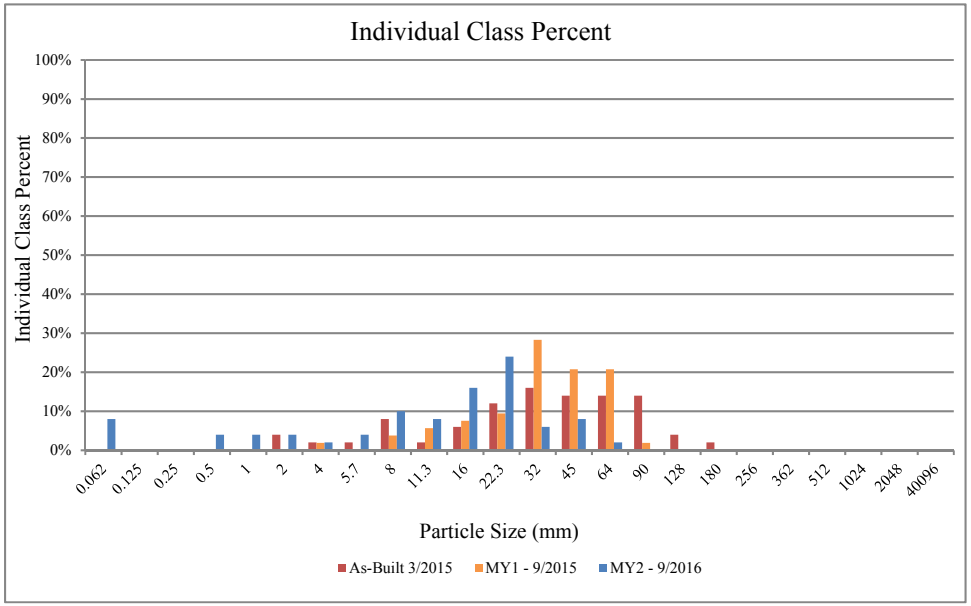




Project Name: Little Buffalo Creek					
Cross-Section: MS-2R					
Feature: Riffle					
			2016		
Description	Material	Size (mm)	Total #	Item %	Cum %
Silt/Clay	silt/clay	0.062	4	8%	8%
Sand	very fine sand	0.125	0	0%	8%
	fine sand	0.250	0	0%	8%
	medium sand	0.50	2	4%	12%
	coarse sand	1.00	2	4%	16%
	very coarse sand	2.0	2	4%	20%
Gravel	very fine gravel	4.0	1	2%	22%
	fine gravel	5.7	2	4%	26%
	fine gravel	8.0	5	10%	36%
	medium gravel	11.3	4	8%	44%
	medium gravel	16.0	8	16%	60%
	coarse gravel	22.3	12	24%	84%
	coarse gravel	32.0	3	6%	90%
	very coarse gravel	45	4	8%	98%
	very coarse gravel	64	1	2%	100%
Cobble	small cobble	90	0	0%	100%
	medium cobble	128	0	0%	100%
	large cobble	180	0	0%	100%
	very large cobble	256	0	0%	100%
Boulder	small boulder	362	0	0%	100%
	small boulder	512	0	0%	100%
	medium boulder	1024	0	0%	100%
	large boulder	2048	0	0%	100%
Bedrock	bedrock	40096	0	0%	100%
TOTAL % of whole count			50	100%	100%

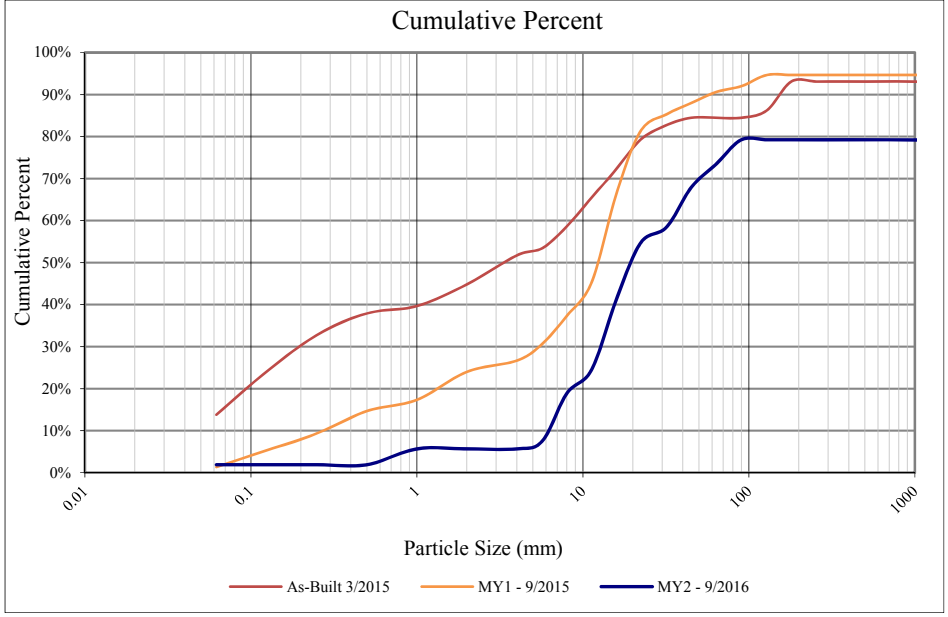
Summary Data	
D16	1
D35	7.8
D50	13.5
D84	23
D95	38.5
D100	64

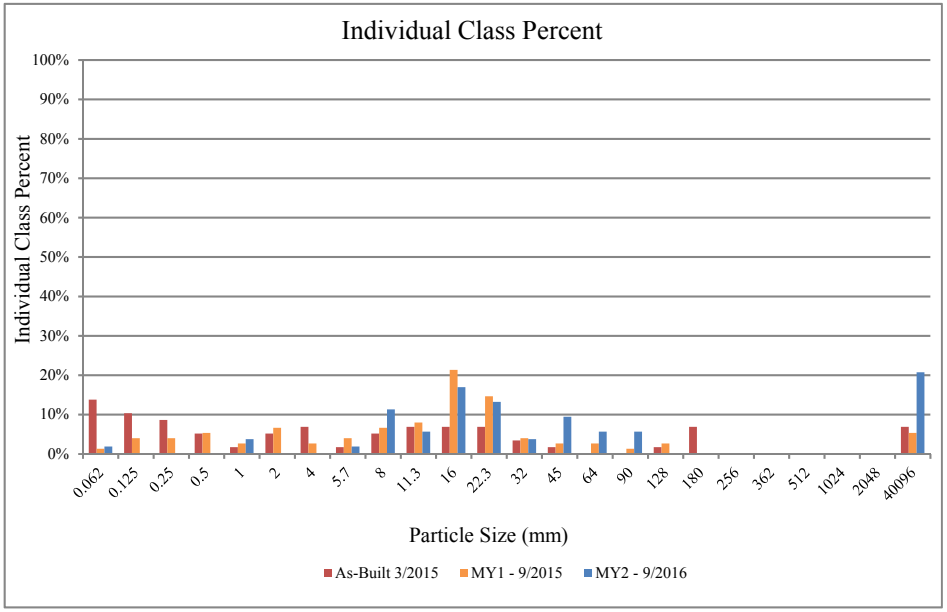




Project Name: Little Buffalo Creek					
Cross-Section: MS-3P					
Feature: Pool					
			2016		
Description	Material	Size (mm)	Total #	Item %	Cum %
Silt/Clay	silt/clay	0.062	1	2%	2%
Sand	very fine sand	0.125	0	0%	2%
	fine sand	0.250	0	0%	2%
	medium sand	0.50	0	0%	2%
	coarse sand	1.00	2	4%	6%
	very coarse sand	2.0	0	0%	6%
Gravel	very fine gravel	4.0	0	0%	6%
	fine gravel	5.7	1	2%	8%
	fine gravel	8.0	6	11%	19%
	medium gravel	11.3	3	6%	25%
	medium gravel	16.0	9	17%	42%
	coarse gravel	22.3	7	13%	55%
	coarse gravel	32.0	2	4%	58%
	very coarse gravel	45	5	9%	68%
	very coarse gravel	64	3	6%	74%
Cobble	small cobble	90	3	6%	79%
	medium cobble	128	0	0%	79%
	large cobble	180	0	0%	79%
	very large cobble	256	0	0%	79%
Boulder	small boulder	362	0	0%	79%
	small boulder	512	0	0%	79%
	medium boulder	1024	0	0%	79%
	large boulder	2048	0	0%	79%
Bedrock	bedrock	40096	11	21%	100%
TOTAL % of whole count			53	100%	100%

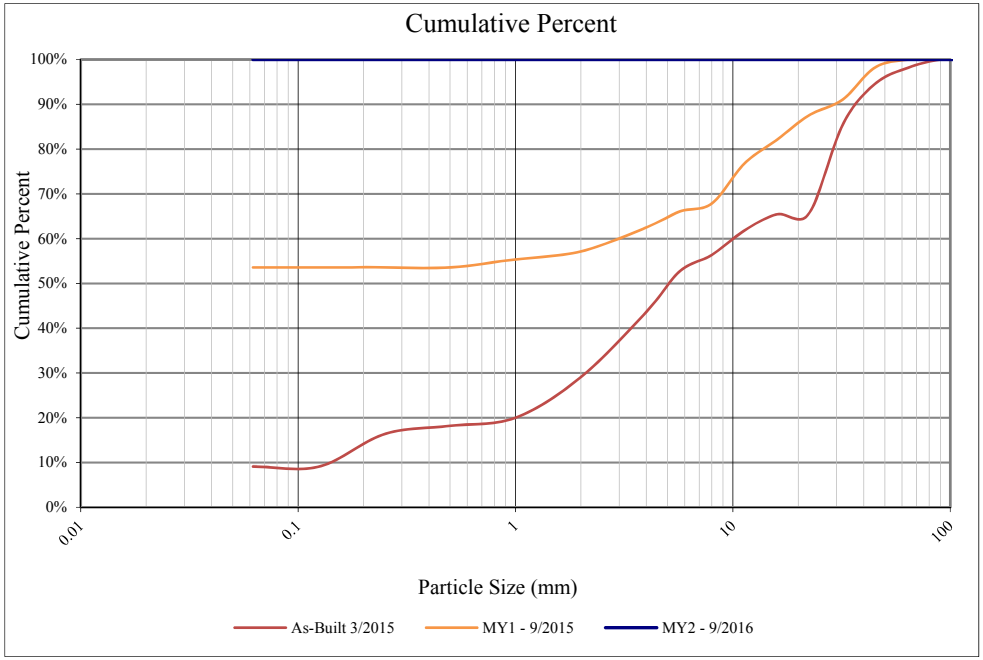
Summary Data	
D16	7.2
D35	15
D50	19.5
D84	Bedrock
D95	Bedrock
D100	Bedrock

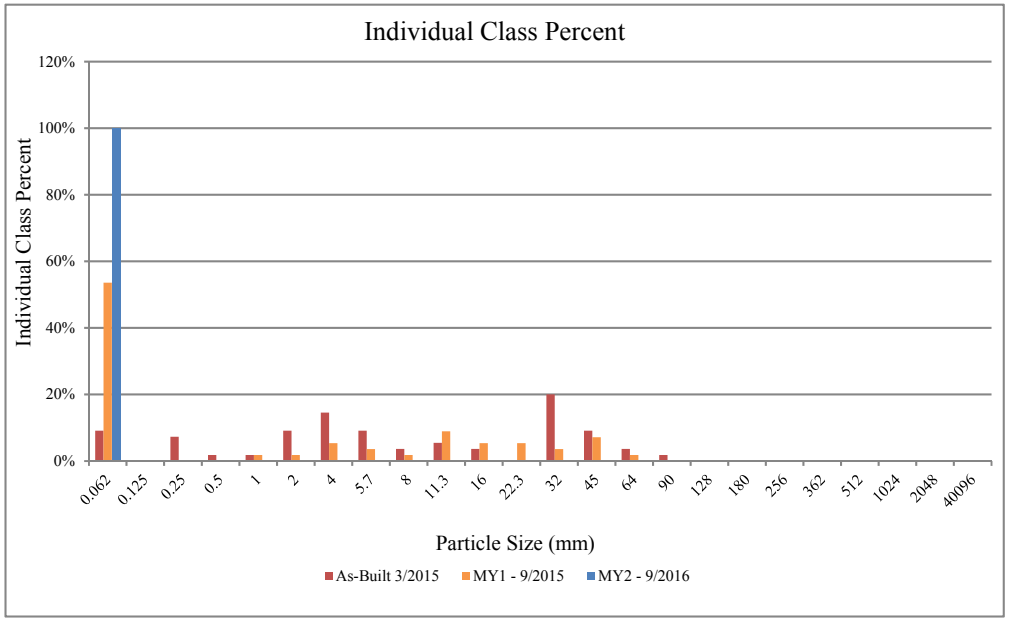




Project Name: Little Buffalo Creek					
Cross-Section: UT2-1R					
Feature: Riffle					
Visually silt/clay/organic No Sample			2016		
Description	Material	Size (mm)	Total #	Item %	Cum %
Silt/Clay	silt/clay	0.062	50	100%	100%
Sand	very fine sand	0.125	0	0%	100%
	fine sand	0.250	0	0%	100%
	medium sand	0.50	0	0%	100%
	coarse sand	1.00	0	0%	100%
	very coarse sand	2.0	0	0%	100%
Gravel	very fine gravel	4.0	0	0%	100%
	fine gravel	5.7	0	0%	100%
	fine gravel	8.0	0	0%	100%
	medium gravel	11.3	0	0%	100%
	medium gravel	16.0	0	0%	100%
	coarse gravel	22.3	0	0%	100%
	coarse gravel	32.0	0	0%	100%
	very coarse gravel	45	0	0%	100%
	very coarse gravel	64	0	0%	100%
Cobble	small cobble	90	0	0%	100%
	medium cobble	128	0	0%	100%
	large cobble	180	0	0%	100%
	very large cobble	256	0	0%	100%
Boulder	small boulder	362	0	0%	100%
	small boulder	512	0	0%	100%
	medium boulder	1024	0	0%	100%
	large boulder	2048	0	0%	100%
Bedrock	bedrock	40096	0	0%	100%
TOTAL % of whole count			50	100%	100%

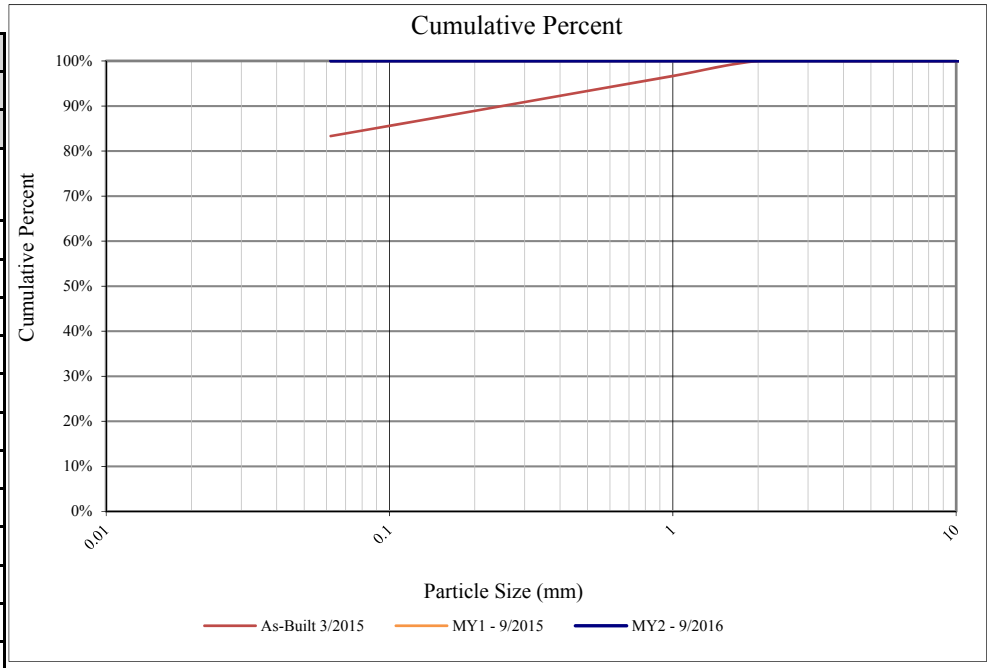
Summary Data	
D16	0
D35	0
D50	0
D84	0
D95	0
D100	0

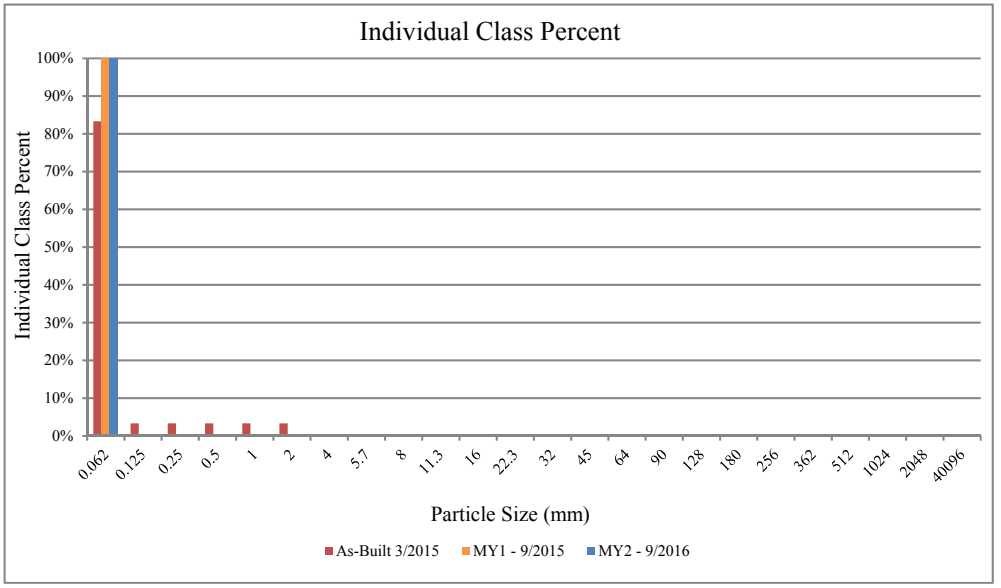




Project Name: Little Buffalo Creek					
Cross-Section: UT3-1R					
Feature: Riffle					
Damaged by cows visually silt/clay/organic			2016		
Description	Material	Size (mm)	Total #	Item %	Cum %
Silt/Clay	silt/clay	0.062	20	100%	100%
Sand	very fine sand	0.125	0	0%	100%
	fine sand	0.250	0	0%	100%
	medium sand	0.50	0	0%	100%
	coarse sand	1.00	0	0%	100%
	very coarse sand	2.0	0	0%	100%
Gravel	very fine gravel	4.0	0	0%	100%
	fine gravel	5.7	0	0%	100%
	fine gravel	8.0	0	0%	100%
	medium gravel	11.3	0	0%	100%
	medium gravel	16.0	0	0%	100%
	coarse gravel	22.3	0	0%	100%
	coarse gravel	32.0	0	0%	100%
	very coarse gravel	45	0	0%	100%
	very coarse gravel	64	0	0%	100%
Cobble	small cobble	90	0	0%	100%
	medium cobble	128	0	0%	100%
	large cobble	180	0	0%	100%
	very large cobble	256	0	0%	100%
Boulder	small boulder	362	0	0%	100%
	small boulder	512	0	0%	100%
	medium boulder	1024	0	0%	100%
	large boulder	2048	0	0%	100%
Bedrock	bedrock	40096	0	0%	100%
TOTAL % of whole count			20	100%	100%

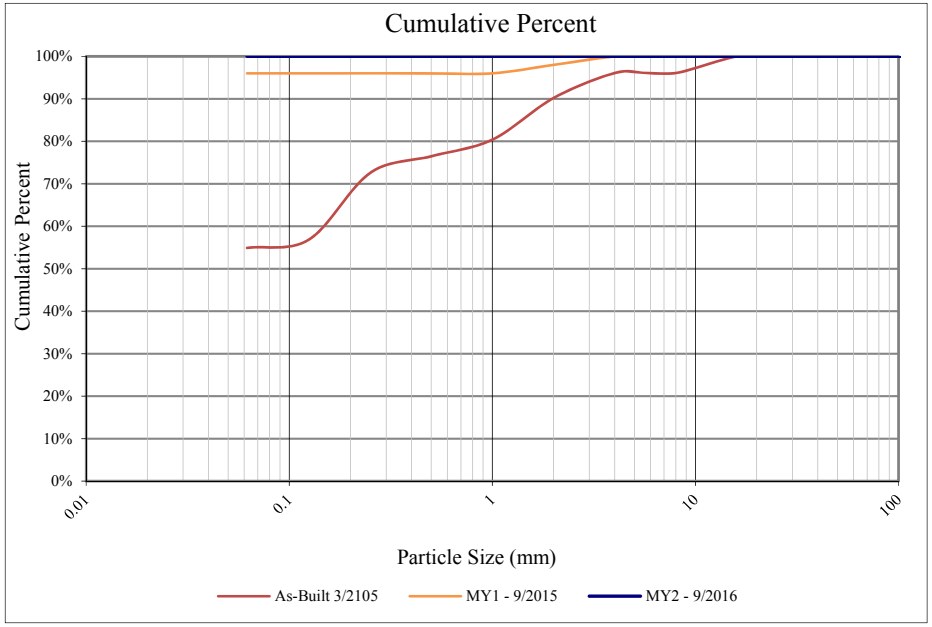
Summary Data	
D16	0.00
D35	0.00
D50	0.00
D84	0.00
D95	0.00
D100	0.00

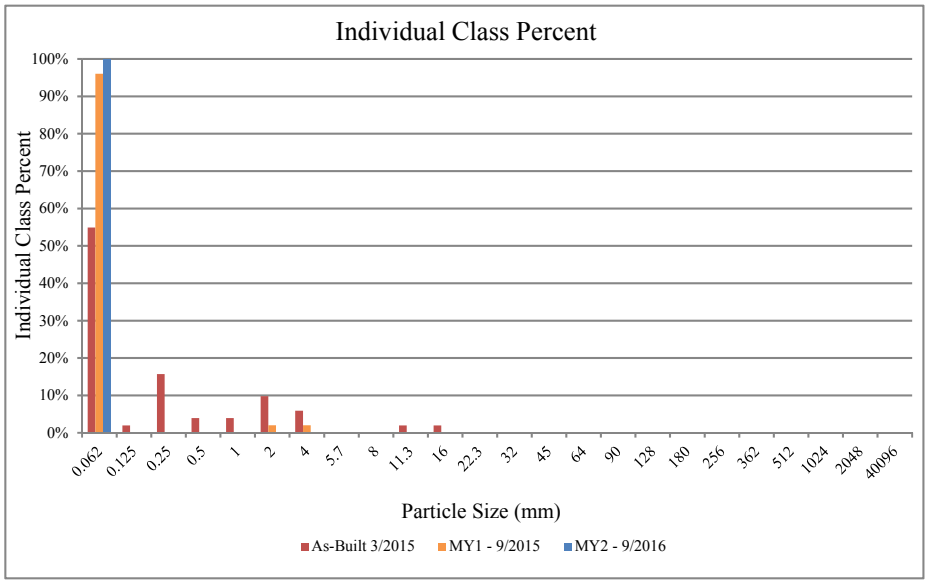




Project Name: Little Buffalo Creek					
Cross-Section: UT3-1P					
Feature: Pool					
Damaged by cows visually silt/clay/organic			2016		
Description	Material	Size (mm)	Total #	Item %	Cum %
Silt/Clay	silt/clay	0.062	50	100%	100%
Sand	very fine sand	0.125	0	0%	100%
	fine sand	0.250	0	0%	100%
	medium sand	0.50	0	0%	100%
	coarse sand	1.00	0	0%	100%
	very coarse sand	2.0	0	0%	100%
Gravel	very fine gravel	4.0	0	0%	100%
	fine gravel	5.7	0	0%	100%
	fine gravel	8.0	0	0%	100%
	medium gravel	11.3	0	0%	100%
	medium gravel	16.0	0	0%	100%
	coarse gravel	22.3	0	0%	100%
	coarse gravel	32.0	0	0%	100%
	very coarse gravel	45	0	0%	100%
	very coarse gravel	64	0	0%	100%
Cobble	small cobble	90	0	0%	100%
	medium cobble	128	0	0%	100%
	large cobble	180	0	0%	100%
	very large cobble	256	0	0%	100%
Boulder	small boulder	362	0	0%	100%
	small boulder	512	0	0%	100%
	medium boulder	1024	0	0%	100%
	large boulder	2048	0	0%	100%
Bedrock	bedrock	40096	0	0%	100%
TOTAL % of whole count			50	100%	100%

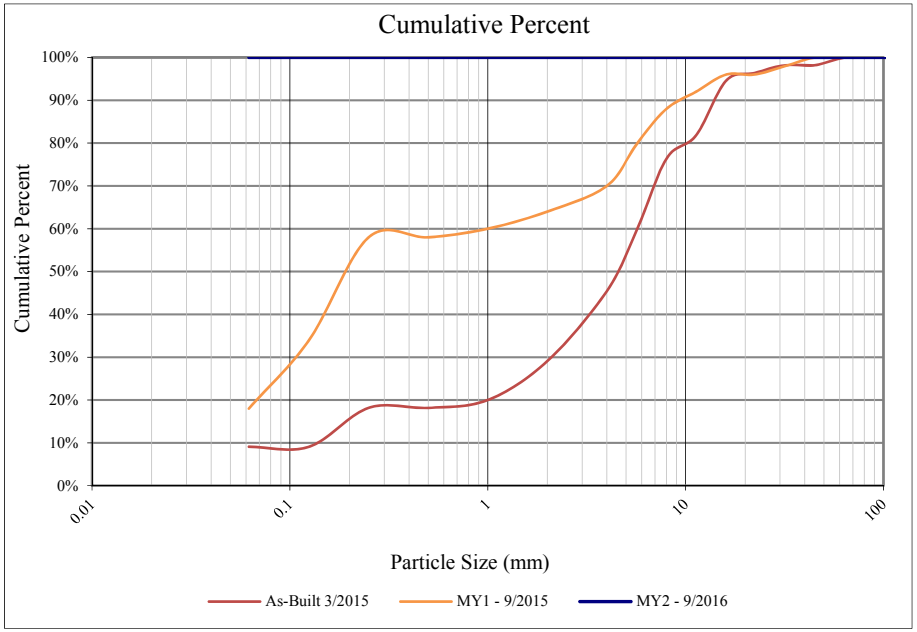
Summary Data	
D16	0.00
D35	0.00
D50	0.00
D84	0.00
D95	0.00
D100	0.00

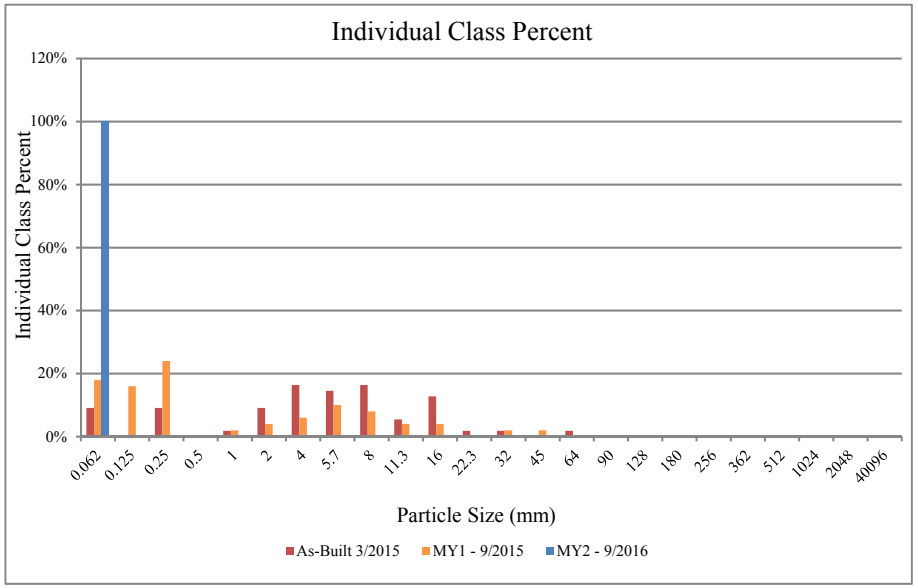




Project Name: Little Buffalo Creek					
Cross-Section: UT3-2R					
Feature: Riffle					
Damaged by cows visually silt/clay/organic			2016		
Description	Material	Size (mm)	Total #	Item %	Cum %
Silt/Clay	silt/clay	0.062	50	100%	100%
Sand	very fine sand	0.125	0	0%	100%
	fine sand	0.250	0	0%	100%
	medium sand	0.50	0	0%	100%
	coarse sand	1.00	0	0%	100%
	very coarse sand	2.0	0	0%	100%
Gravel	very fine gravel	4.0	0	0%	100%
	fine gravel	5.7	0	0%	100%
	fine gravel	8.0	0	0%	100%
	medium gravel	11.3	0	0%	100%
	medium gravel	16.0	0	0%	100%
	coarse gravel	22.3	0	0%	100%
	coarse gravel	32.0	0	0%	100%
	very coarse gravel	45	0	0%	100%
	very coarse gravel	64	0	0%	100%
Cobble	small cobble	90	0	0%	100%
	medium cobble	128	0	0%	100%
	large cobble	180	0	0%	100%
	very large cobble	256	0	0%	100%
Boulder	small boulder	362	0	0%	100%
	small boulder	512	0	0%	100%
	medium boulder	1024	0	0%	100%
	large boulder	2048	0	0%	100%
Bedrock	bedrock	40096	0	0%	100%
TOTAL % of whole count			50	100%	100%

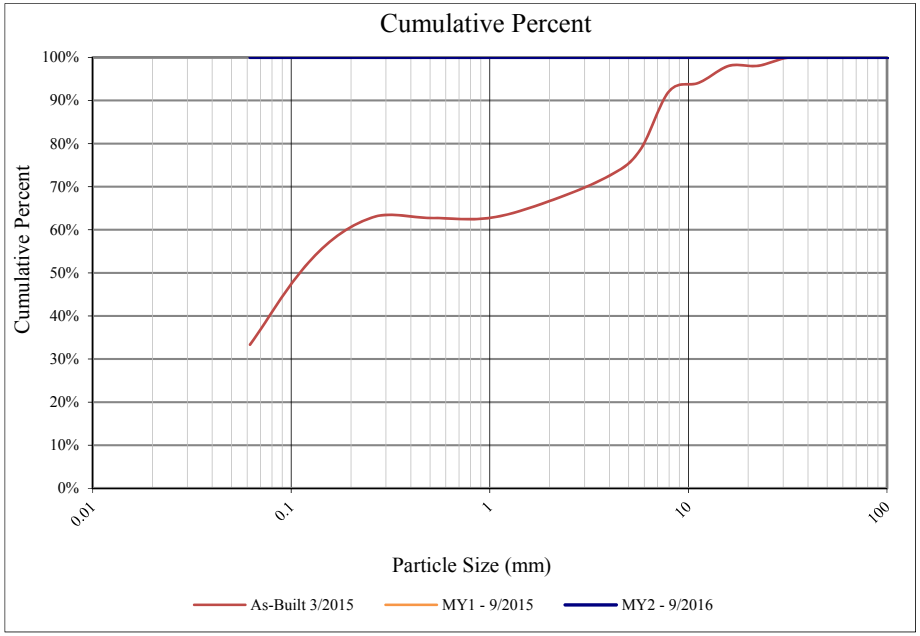
Summary Data	
D16	0.00
D35	0.00
D50	0.00
D84	0.00
D95	0.00
D100	0.00

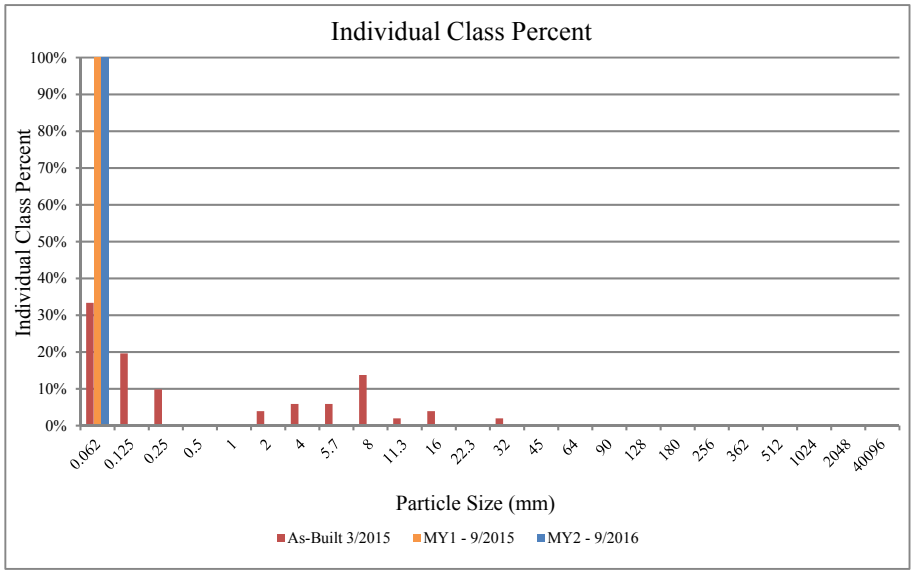




Project Name: Little Buffalo Creek					
Cross-Section: UT3-3R					
Feature: Riffle					
Visually Silt/Clay/Organics, no sample			2016		
Description	Material	Size (mm)	Total #	Item %	Cum %
Silt/Clay	silt/clay	0.062	50	100%	100%
Sand	very fine sand	0.125	0	0%	100%
	fine sand	0.250	0	0%	100%
	medium sand	0.50	0	0%	100%
	coarse sand	1.00	0	0%	100%
	very coarse sand	2.0	0	0%	100%
Gravel	very fine gravel	4.0	0	0%	100%
	fine gravel	5.7	0	0%	100%
	fine gravel	8.0	0	0%	100%
	medium gravel	11.3	0	0%	100%
	medium gravel	16.0	0	0%	100%
	coarse gravel	22.3	0	0%	100%
	coarse gravel	32.0	0	0%	100%
	very coarse gravel	45	0	0%	100%
	very coarse gravel	64	0	0%	100%
Cobble	small cobble	90	0	0%	100%
	medium cobble	128	0	0%	100%
	large cobble	180	0	0%	100%
	very large cobble	256	0	0%	100%
Boulder	small boulder	362	0	0%	100%
	small boulder	512	0	0%	100%
	medium boulder	1024	0	0%	100%
	large boulder	2048	0	0%	100%
Bedrock	bedrock	40096	0	0%	100%
TOTAL % of whole count			50	100%	100%

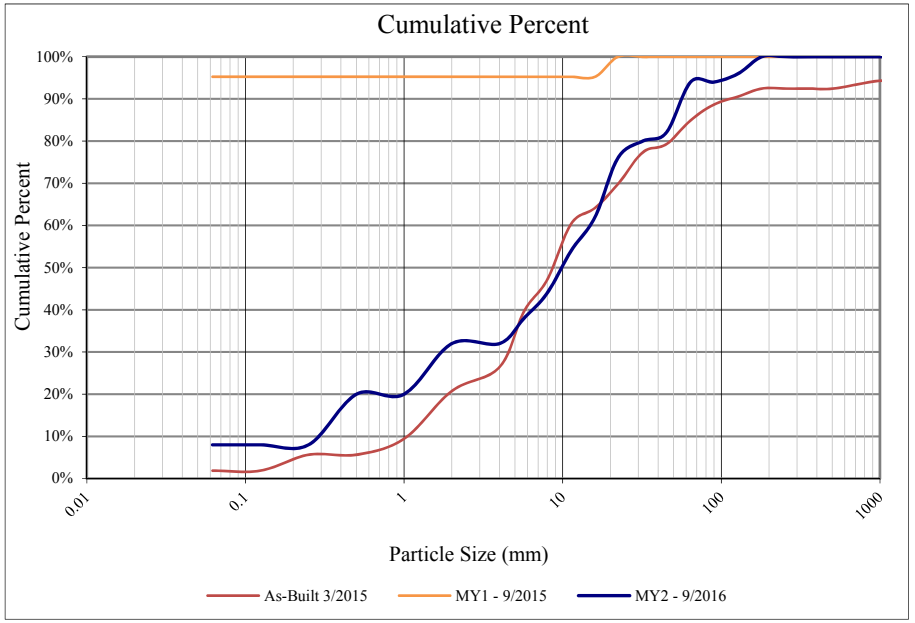
Summary Data	
D16	0.00
D35	0.00
D50	0.00
D84	0.00
D95	0.00
D100	0.00

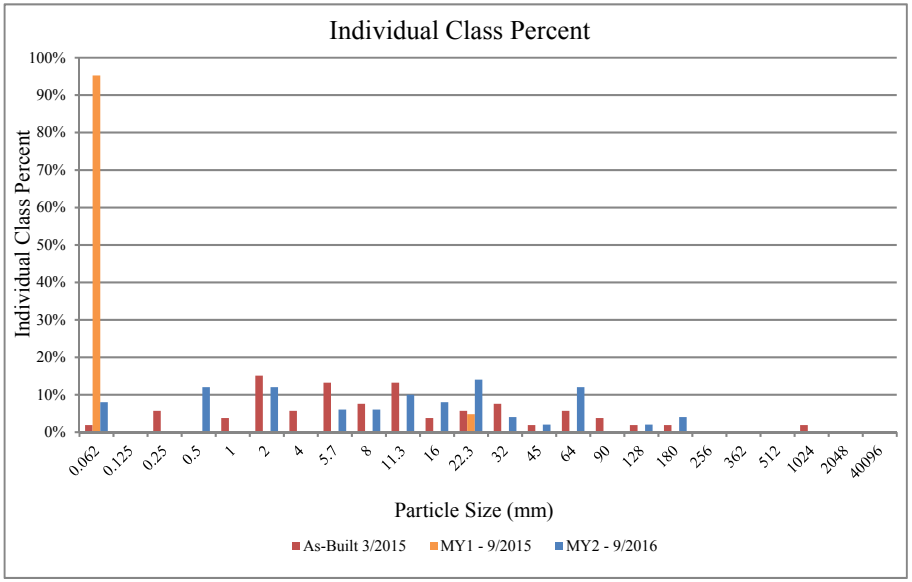




Project Name: Little Buffalo Creek					
Cross-Section: UT4-1P					
Feature: Pool					
			2016		
Description	Material	Size (mm)	Total #	Item %	Cum %
Silt/Clay	silt/clay	0.062	4	8%	8%
Sand	very fine sand	0.125	0	0%	8%
	fine sand	0.250	0	0%	8%
	medium sand	0.50	6	12%	20%
	coarse sand	1.00	0	0%	20%
	very coarse sand	2.0	6	12%	32%
Gravel	very fine gravel	4.0	0	0%	32%
	fine gravel	5.7	3	6%	38%
	fine gravel	8.0	3	6%	44%
	medium gravel	11.3	5	10%	54%
	medium gravel	16.0	4	8%	62%
	coarse gravel	22.3	7	14%	76%
	coarse gravel	32.0	2	4%	80%
	very coarse gravel	45	1	2%	82%
	very coarse gravel	64	6	12%	94%
Cobble	small cobble	90	0	0%	94%
	medium cobble	128	1	2%	96%
	large cobble	180	2	4%	100%
	very large cobble	256	0	0%	100%
Boulder	small boulder	362	0	0%	100%
	small boulder	512	0	0%	100%
	medium boulder	1024	0	0%	100%
	large boulder	2048	0	0%	100%
Bedrock	bedrock	40096	0	0%	100%
TOTAL % of whole count			50	100%	100%

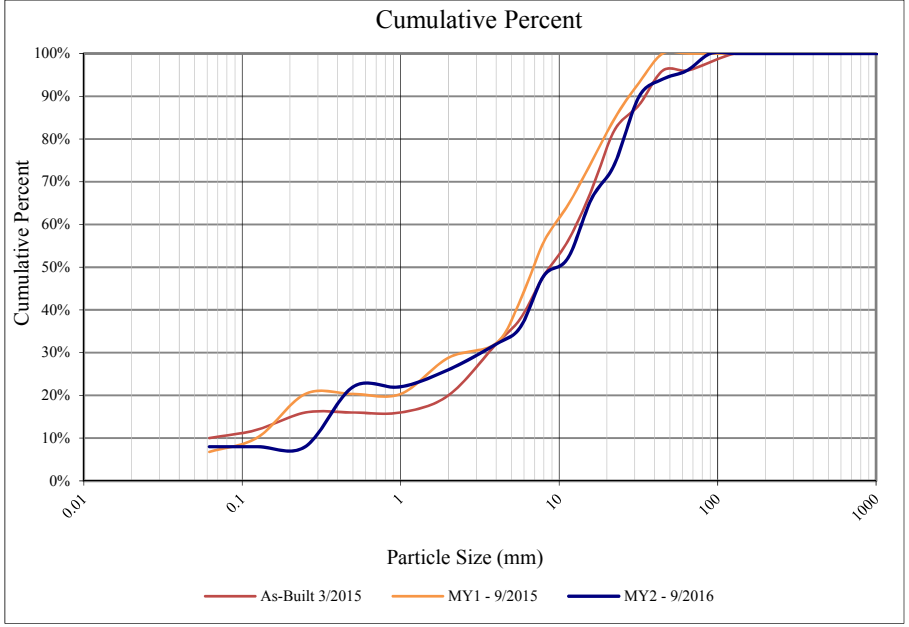
Summary Data	
D16	0.38
D35	5.00
D50	10.00
D84	39.00
D95	70.00
D100	175.00

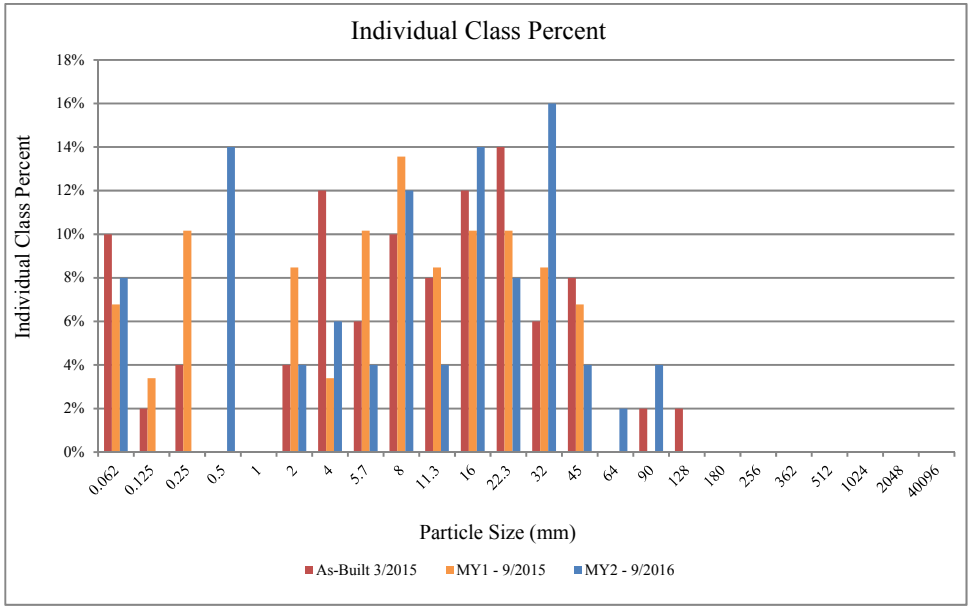




Project Name: Little Buffalo Creek					
Cross-Section: UT4-1R					
Feature: Riffle					
			2016		
Description	Material	Size (mm)	Total #	Item %	Cum %
Silt/Clay	silt/clay	0.062	4	8%	8%
Sand	very fine sand	0.125	0	0%	8%
	fine sand	0.250	0	0%	8%
	medium sand	0.50	7	14%	22%
	coarse sand	1.00	0	0%	22%
	very coarse sand	2.0	2	4%	26%
Gravel	very fine gravel	4.0	3	6%	32%
	fine gravel	5.7	2	4%	36%
	fine gravel	8.0	6	12%	48%
	medium gravel	11.3	2	4%	52%
	medium gravel	16.0	7	14%	66%
	coarse gravel	22.3	4	8%	74%
	coarse gravel	32.0	8	16%	90%
	very coarse gravel	45	2	4%	94%
	very coarse gravel	64	1	2%	96%
Cobble	small cobble	90	2	4%	100%
	medium cobble	128	0	0%	100%
	large cobble	180	0	0%	100%
	very large cobble	256	0	0%	100%
Boulder	small boulder	362	0	0%	100%
	small boulder	512	0	0%	100%
	medium boulder	1024	0	0%	100%
	large boulder	2048	0	0%	100%
Bedrock	bedrock	40096	0	0%	100%
TOTAL % of whole count			50	100%	100%

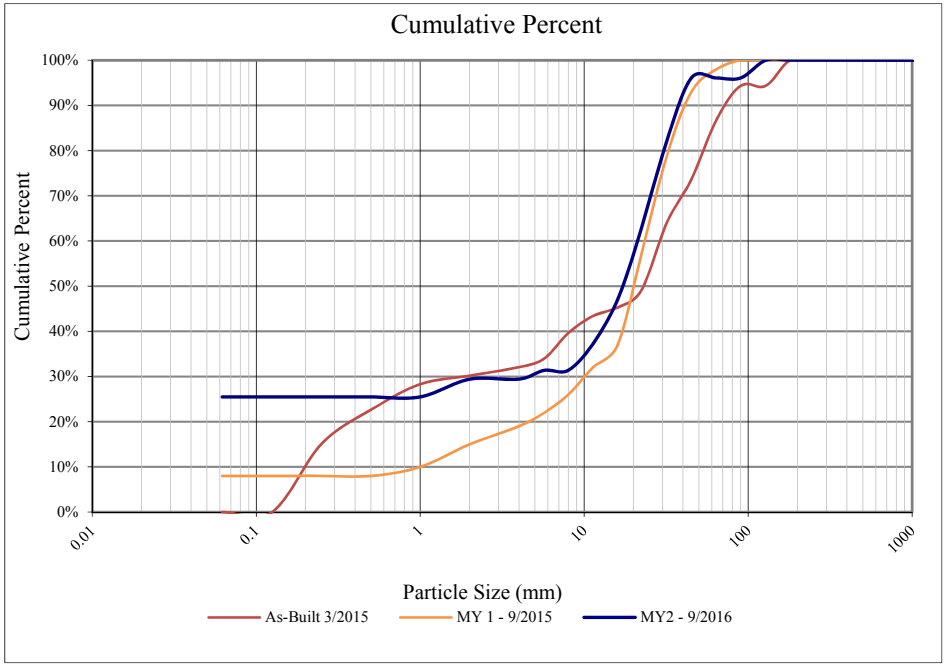
Summary Data	
D16	3.70
D35	5.50
D50	10.00
D84	26.00
D95	51.00
D100	90.00

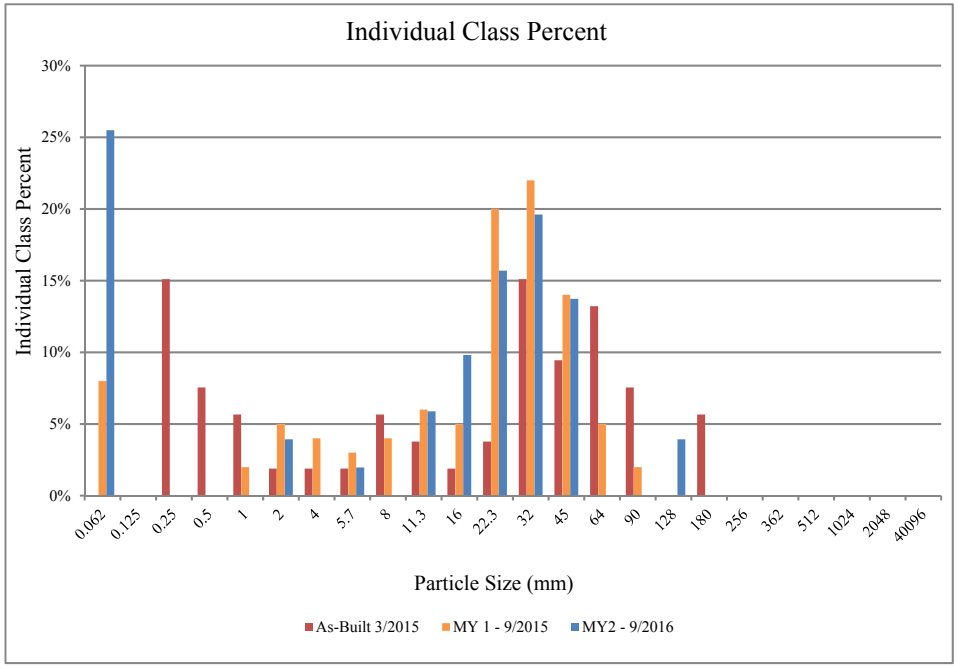




Project Name: Little Buffalo Creek					
Cross-Section: UT7-1R					
Feature: Riffle					
			2016		
Description	Material	Size (mm)	Total #	Item %	Cum %
Silt/Clay	silt/clay	0.062	13	25%	25%
Sand	very fine sand	0.125	0	0%	25%
	fine sand	0.250	0	0%	25%
	medium sand	0.50	0	0%	25%
	coarse sand	1.00	0	0%	25%
	very coarse sand	2.0	2	4%	29%
Gravel	very fine gravel	4.0	0	0%	29%
	fine gravel	5.7	1	2%	31%
	fine gravel	8.0	0	0%	31%
	medium gravel	11.3	3	6%	37%
	medium gravel	16.0	5	10%	47%
	coarse gravel	22.3	8	16%	63%
	coarse gravel	32.0	10	20%	82%
	very coarse gravel	45	7	14%	96%
	very coarse gravel	64	0	0%	96%
Cobble	small cobble	90	0	0%	96%
	medium cobble	128	2	4%	100%
	large cobble	180	0	0%	100%
	very large cobble	256	0	0%	100%
Boulder	small boulder	362	0	0%	100%
	small boulder	512	0	0%	100%
	medium boulder	1024	0	0%	100%
	large boulder	2048	0	0%	100%
Bedrock	bedrock	40096	0	0%	100%
TOTAL % of whole count			51	100%	100%

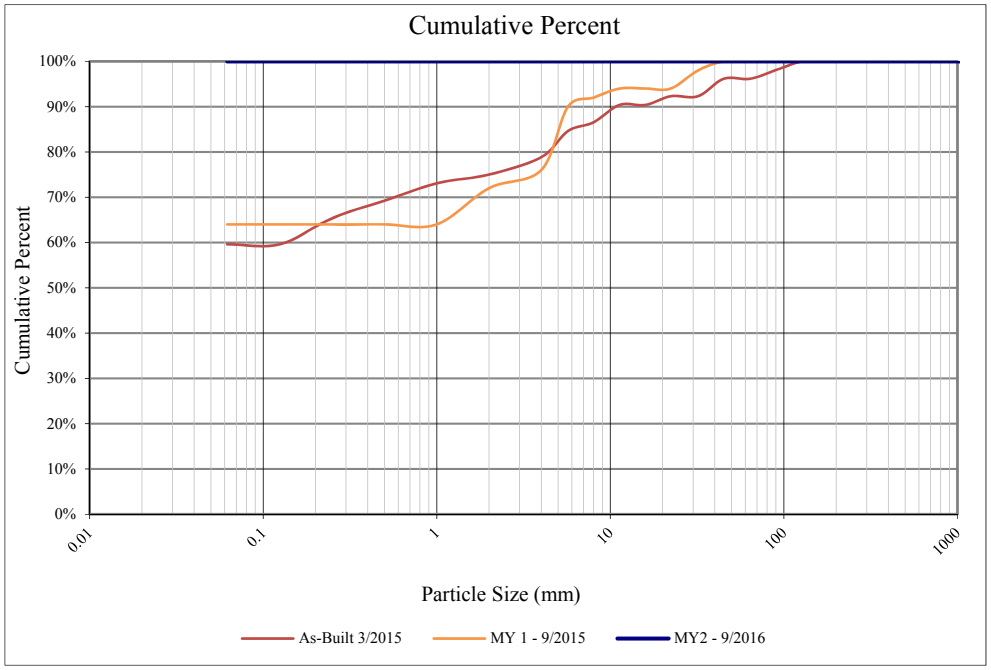
Summary Data	
D16	0.00
D35	11.00
D50	18.00
D84	33.00
D95	44.00
D100	128.00

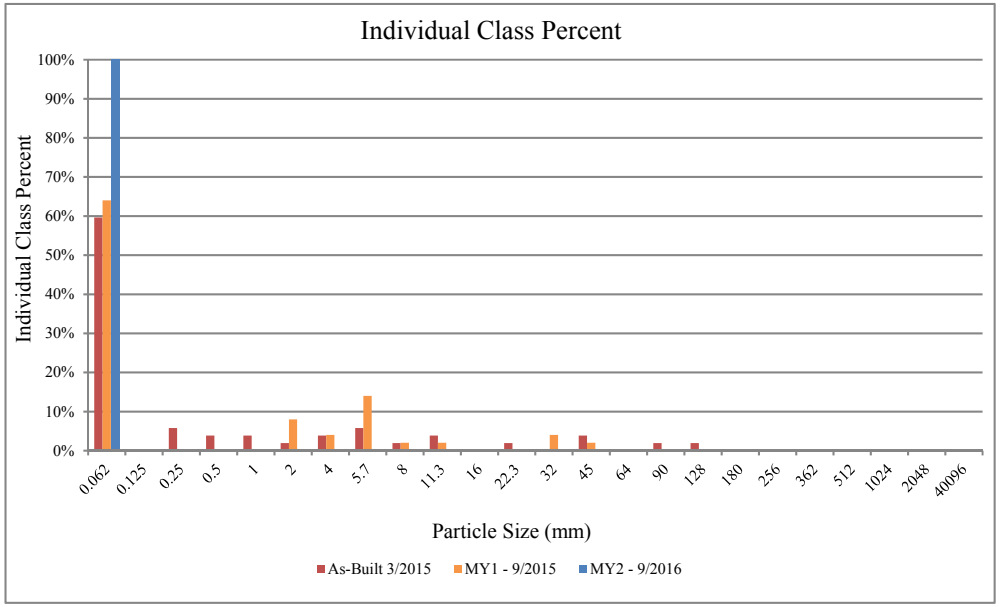




Project Name: Little Buffalo Creek					
Cross-Section: UT7-1P					
Feature: Pool					
Visually dry Silt/Clay, no sample			2016		
Description	Material	Size (mm)	Total #	Item %	Cum %
Silt/Clay	silt/clay	0.062	50	100%	100%
Sand	very fine sand	0.125	0	0%	100%
	fine sand	0.250	0	0%	100%
	medium sand	0.50	0	0%	100%
	coarse sand	1.00	0	0%	100%
	very coarse sand	2.0	0	0%	100%
Gravel	very fine gravel	4.0	0	0%	100%
	fine gravel	5.7	0	0%	100%
	fine gravel	8.0	0	0%	100%
	medium gravel	11.3	0	0%	100%
	medium gravel	16.0	0	0%	100%
	coarse gravel	22.3	0	0%	100%
	coarse gravel	32.0	0	0%	100%
	very coarse gravel	45	0	0%	100%
	very coarse gravel	64	0	0%	100%
Cobble	small cobble	90	0	0%	100%
	medium cobble	128	0	0%	100%
	large cobble	180	0	0%	100%
	very large cobble	256	0	0%	100%
Boulder	small boulder	362	0	0%	100%
	small boulder	512	0	0%	100%
	medium boulder	1024	0	0%	100%
	large boulder	2048	0	0%	100%
Bedrock	bedrock	40096	0	0%	100%
TOTAL % of whole count			50	100%	100%

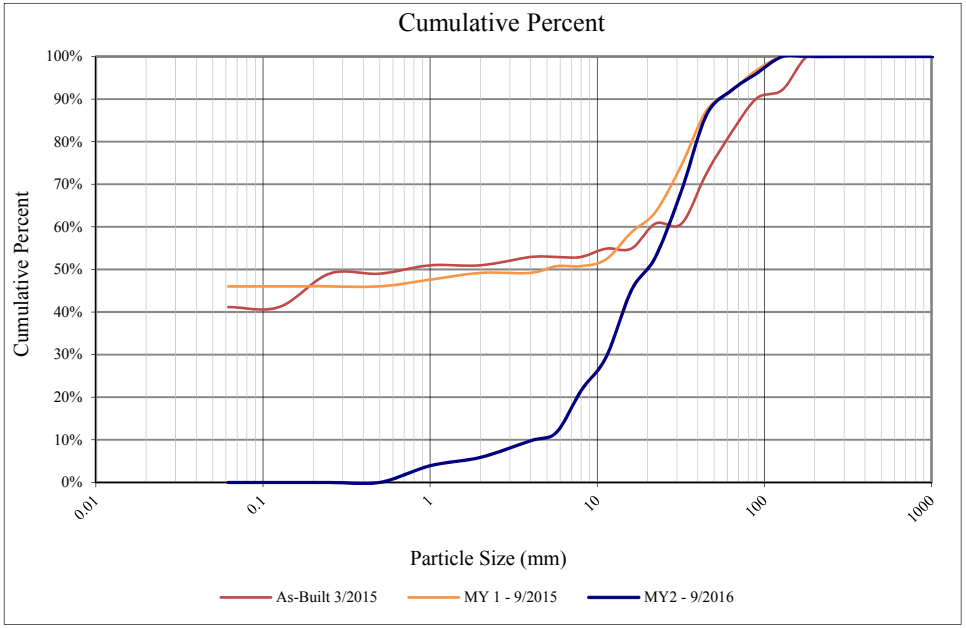
Summary Data	
D16	0.00
D35	0.00
D50	0.00
D84	0.00
D95	0.00
D100	0.00

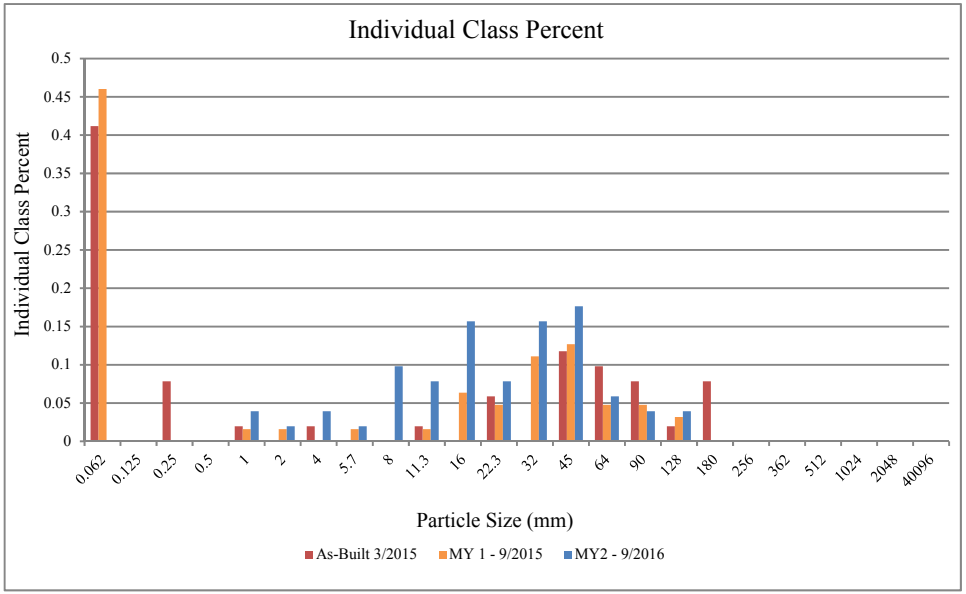




Project Name: Little Buffalo Creek					
Cross-Section: UT7-2R					
Feature: Riffle					
			2016		
Description	Material	Size (mm)	Total #	Item %	Cum %
Silt/Clay	silt/clay	0.062	0	0%	0%
Sand	very fine sand	0.125	0	0%	0%
	fine sand	0.250	0	0%	0%
	medium sand	0.50	0	0%	0%
	coarse sand	1.00	2	4%	4%
	very coarse sand	2.0	1	2%	6%
Gravel	very fine gravel	4.0	2	4%	10%
	fine gravel	5.7	1	2%	12%
	fine gravel	8.0	5	10%	22%
	medium gravel	11.3	4	8%	29%
	medium gravel	16.0	8	16%	45%
	coarse gravel	22.3	4	8%	53%
	coarse gravel	32.0	8	16%	69%
	very coarse gravel	45	9	18%	86%
	very coarse gravel	64	3	6%	92%
Cobble	small cobble	90	2	4%	96%
	medium cobble	128	2	4%	100%
	large cobble	180	0	0%	100%
	very large cobble	256	0	0%	100%
Boulder	small boulder	362	0	0%	100%
	small boulder	512	0	0%	100%
	medium boulder	1024	0	0%	100%
	large boulder	2048	0	0%	100%
Bedrock	bedrock	40096	0	0%	100%
TOTAL % of whole count			51	100%	100%

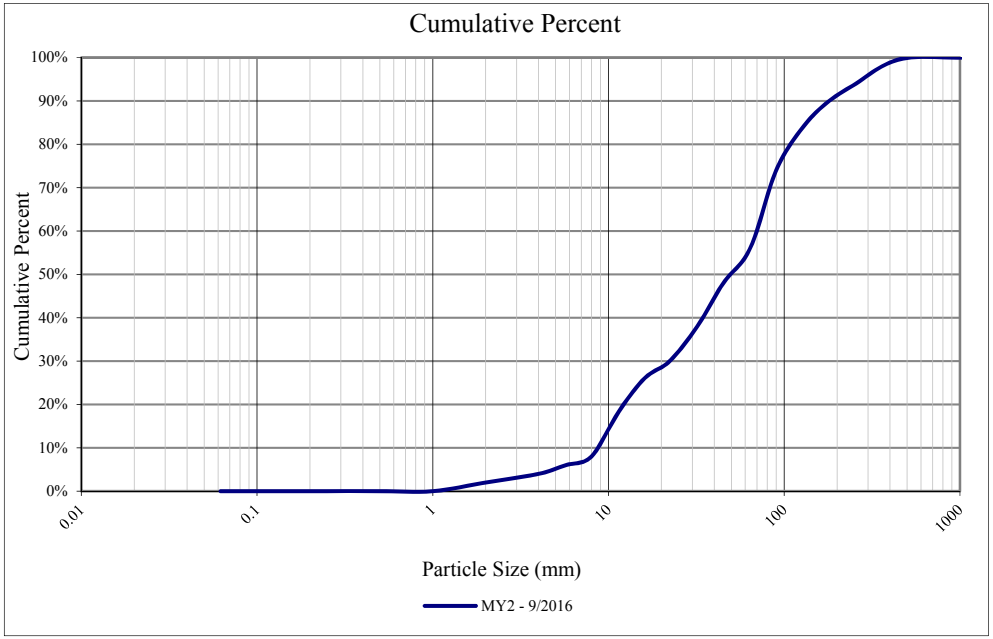
Summary Data	
D16	6.70
D35	14.00
D50	20.00
D84	43.00
D95	80.00
D100	128.00

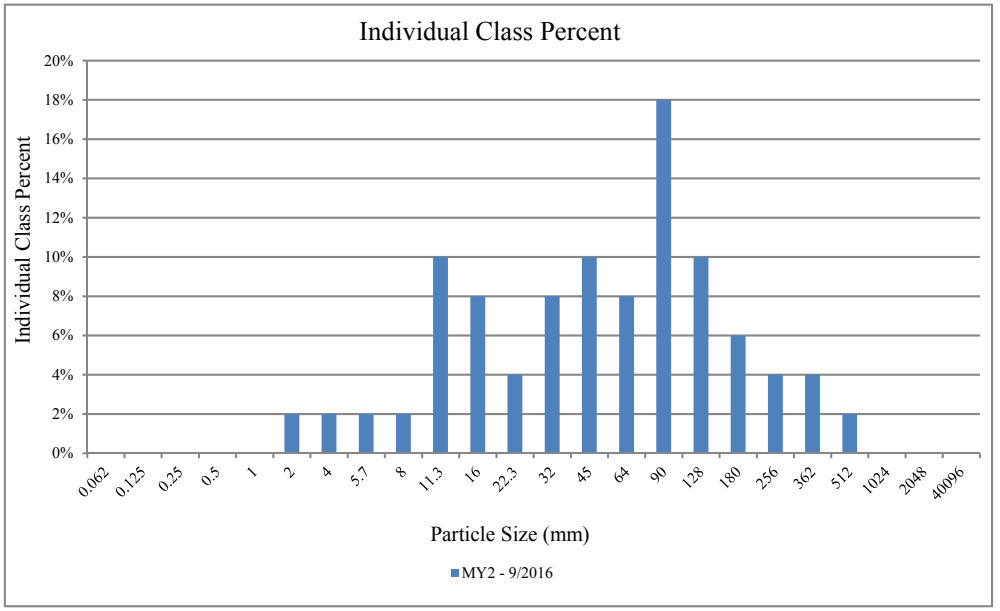




Project Name: Little Buffalo Creek					
Cross-Section: UT7-STP1					
Feature: Step Pool					
			2016		
Description	Material	Size (mm)	Total #	Item %	Cum %
Silt/Clay	silt/clay	0.062	0	0%	0%
Sand	very fine sand	0.125	0	0%	0%
	fine sand	0.250	0	0%	0%
	medium sand	0.50	0	0%	0%
	coarse sand	1.00	0	0%	0%
	very coarse sand	2.0	1	2%	2%
Gravel	very fine gravel	4.0	1	2%	4%
	fine gravel	5.7	1	2%	6%
	fine gravel	8.0	1	2%	8%
	medium gravel	11.3	5	10%	18%
	medium gravel	16.0	4	8%	26%
	coarse gravel	22.3	2	4%	30%
	coarse gravel	32.0	4	8%	38%
	very coarse gravel	45	5	10%	48%
	very coarse gravel	64	4	8%	56%
Cobble	small cobble	90	9	18%	74%
	medium cobble	128	5	10%	84%
	large cobble	180	3	6%	90%
	very large cobble	256	2	4%	94%
Boulder	small boulder	362	2	4%	98%
	small boulder	512	1	2%	100%
	medium boulder	1024	0	0%	100%
	large boulder	2048	0	0%	100%
Bedrock	bedrock	40096	0	0%	100%
TOTAL % of whole count			50	100%	100%

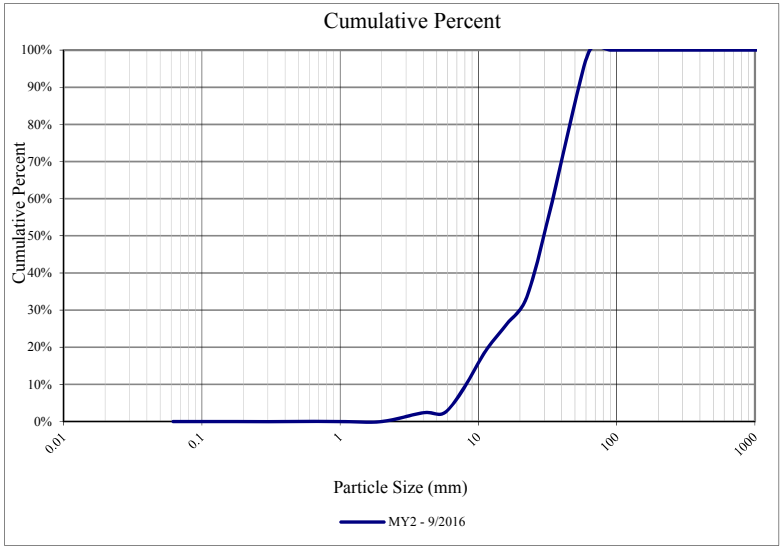
Summary Data	
D16	11.00
D35	28.00
D50	49.00
D84	128.00
D95	257.00
D100	512.00

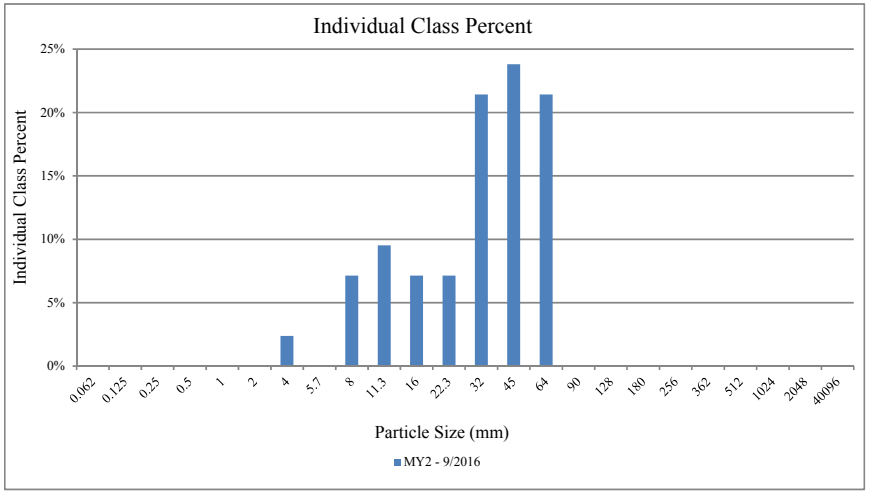




Project Name: Little Buffalo Creek					
Cross-Section: UT7-STP2					
Feature: Step Pool					
			2016		
Description	Material	Size (mm)	Total #	Item %	Cum %
Silt/Clay	silt/clay	0.062	0	0%	0%
Sand	very fine sand	0.125	0	0%	0%
	fine sand	0.250	0	0%	0%
	medium sand	0.50	0	0%	0%
	coarse sand	1.00	0	0%	0%
	very coarse sand	2.0	0	0%	0%
Gravel	very fine gravel	4.0	1	2%	2%
	fine gravel	5.7	0	0%	2%
	fine gravel	8.0	3	7%	10%
	medium gravel	11.3	4	10%	19%
	medium gravel	16.0	3	7%	26%
	coarse gravel	22.3	3	7%	33%
	coarse gravel	32.0	9	21%	55%
	very coarse gravel	45	10	24%	79%
	very coarse gravel	64	9	21%	100%
Cobble	small cobble	90	0	0%	100%
	medium cobble	128	0	0%	100%
	large cobble	180	0	0%	100%
	very large cobble	256	0	0%	100%
Boulder	small boulder	362	0	0%	100%
	small boulder	512	0	0%	100%
	medium boulder	1024	0	0%	100%
	large boulder	2048	0	0%	100%
Bedrock	bedrock	40096	0	0%	100%
TOTAL % of whole count			42	100%	100%

Summary Data	
D16	10.00
D35	24.00
D50	30.00
D84	49.00
D95	57.00
D100	64.00



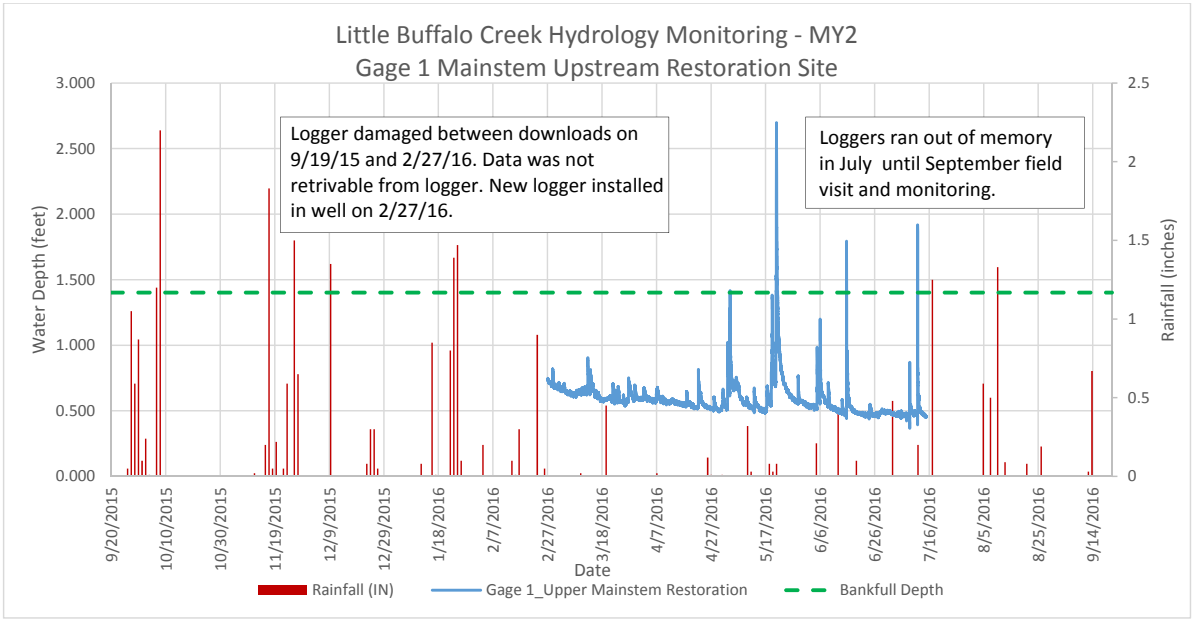


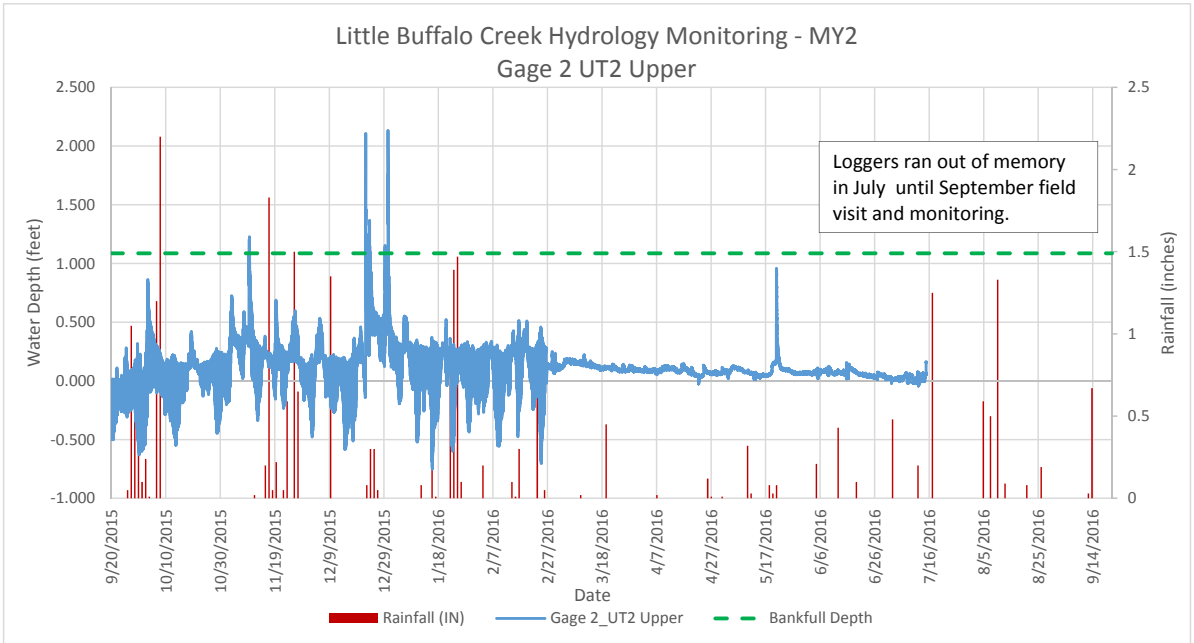
Appendix E – Hydrologic Data

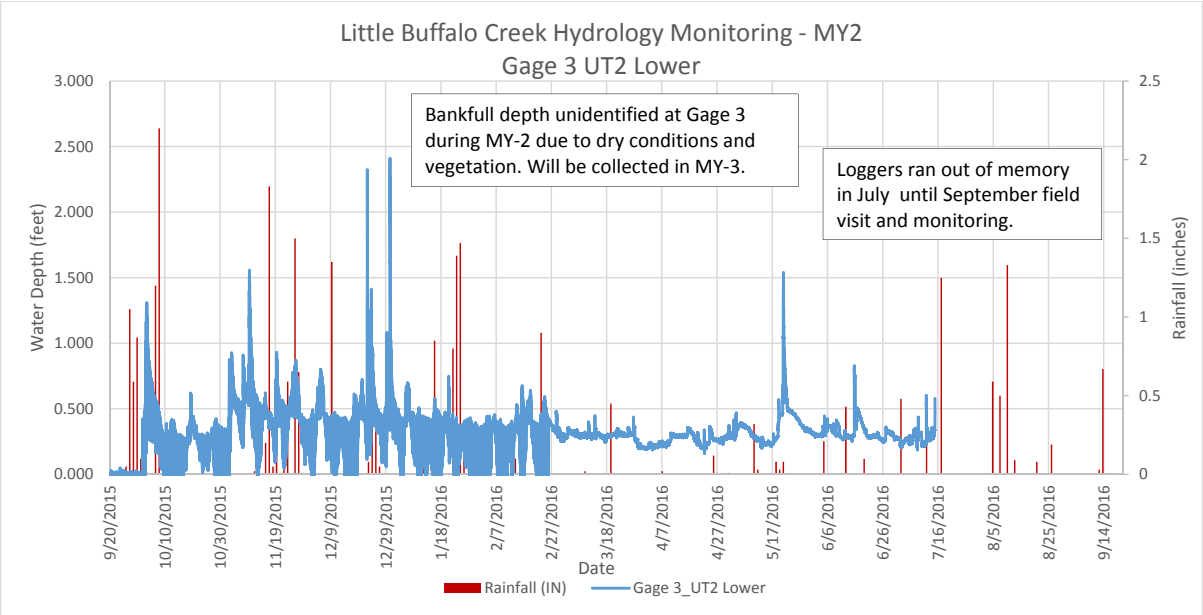
Table 12. Documentation of Geomorphologically Significant Flow Events					
Date of Observation	**Date of Occurrence**	**Method**	**Greater than Qgs = Q2*0.66 stage?[1]**	**Greater than Qbkf Stage?**	**Notes**
2/27/2016	11/9/2015	Surface Water Transducer	Yes	Yes	Water level gages at multiple stations recorded elevations over surveyed bankful stage elevations
2/27/2016	12/22/2015	Surface Water Transducer	Yes	Yes	Water level gages at multiple stations recorded elevations over surveyed bankful stage elevations
2/27/2016	12/30/2015	Surface Water Transducer Rack Lines	Yes	Yes	Water level gages at multiple stations recorded elevations over surveyed bankful stage elevations. See Photo Appendix.
9/19/2016	5/20/2016	Surface Water Transducer	Yes	Yes	Water level gages at multiple stations recorded elevations over surveyed bankful stage elevations

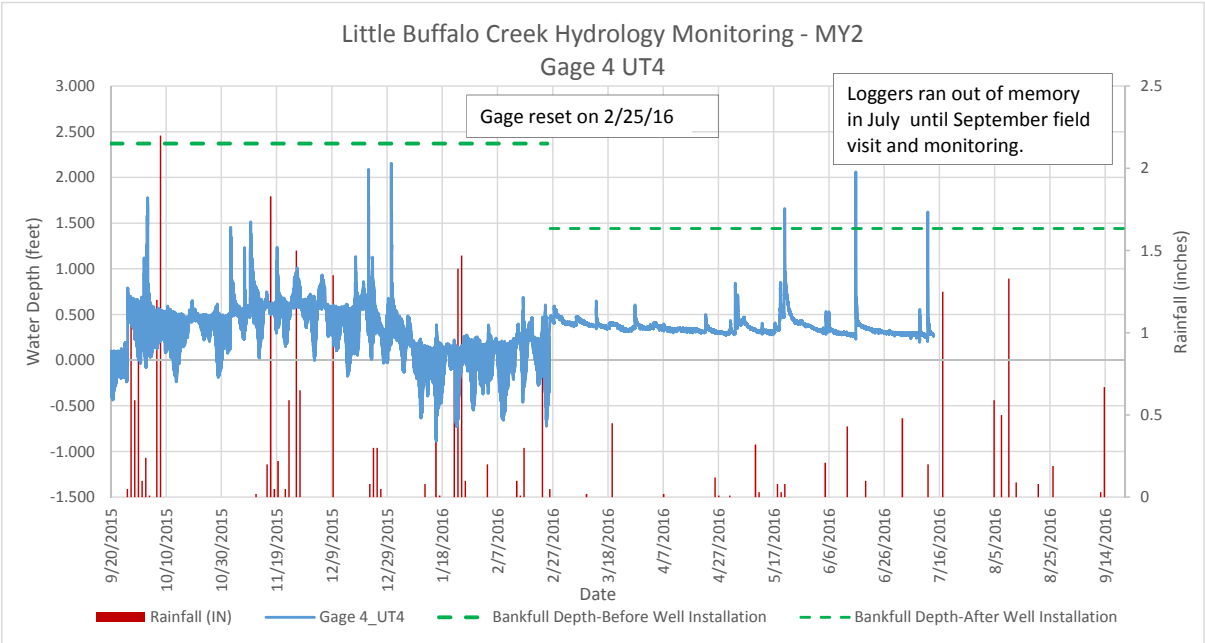
1) As stage relationships have not been calculated for the Qgs event, it is assumed that an event that has surpassed the identified bankfull stage on site also passed the Qgs event

Figures 6a-e – Water Level and Rainfall Plots

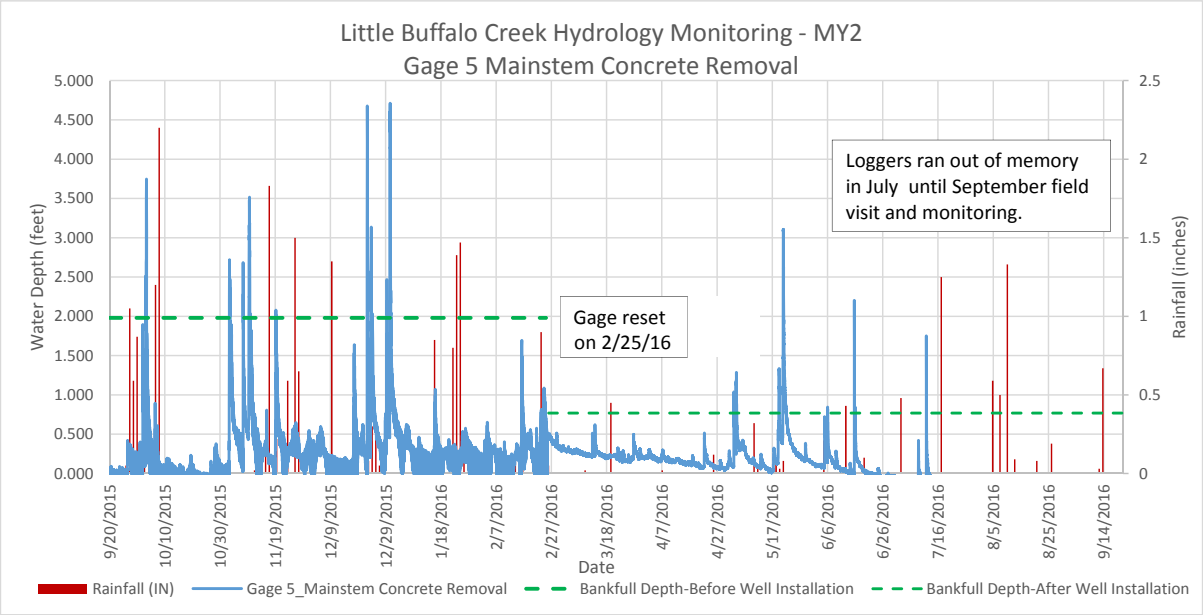

Little Buffalo Creek Hydrology Monitoring - MY2
Gage 1 Mainstem Upstream Restoration Site
Logger damaged between downloads on 9/19/15 and 2/27/16. Data was not retrivable from logger. New logger installed in well on 2/27/16.
Loggers ran out of memory in July until September field visit and monitoring.
Water Depth (feet)
Rainfall (inches)
3.000
2.500
2.000
1.500
1.000
0.500
0.000
2.5
2
1.5
1
0.5
0
9/20/2015
10/10/2015
10/30/2015
11/19/2015
12/9/2015
12/29/2015
1/18/2016
2/7/2016
2/27/2016
3/18/2016
4/7/2016
4/27/2016
5/17/2016
6/6/2016
6/26/2016
7/16/2016
8/5/2016
8/25/2016
9/14/2016
Date
Rainfall (IN)
Gage 1_Upper Mainstem Restoration
Bankfull Depth


Little Buffalo Creek Hydrology Monitoring - MY2
Gage 2 UT2 Upper
Loggers ran out of memory in July until September field visit and monitoring.
Water Depth (feet)
Rainfall (inches)
2.500
2.000
1.500
1.000
0.500
0.000
-0.500
-1.000
2.5
2
1.5
1
0.5
0
9/20/2015
10/10/2015
10/30/2015
11/19/2015
12/9/2015
12/29/2015
1/18/2016
2/7/2016
2/27/2016
3/18/2016
4/7/2016
4/27/2016
5/17/2016
6/6/2016
6/26/2016
7/16/2016
8/5/2016
8/25/2016
9/14/2016
Date
Rainfall (IN)
Gage 2_UT2 Upper
Bankfull Depth

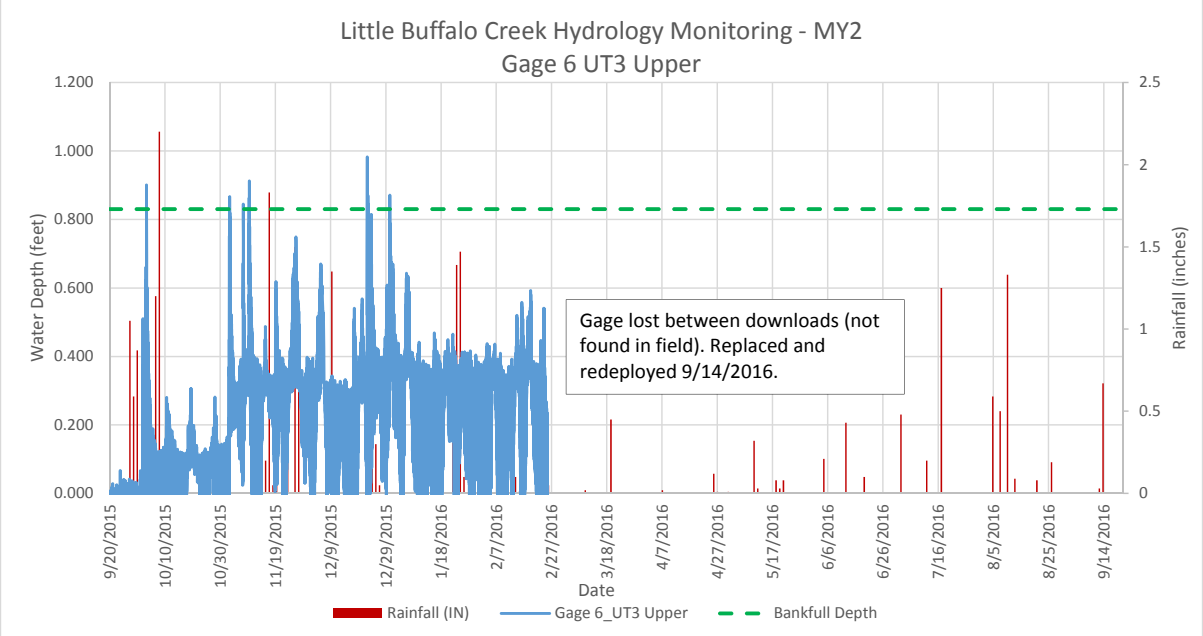


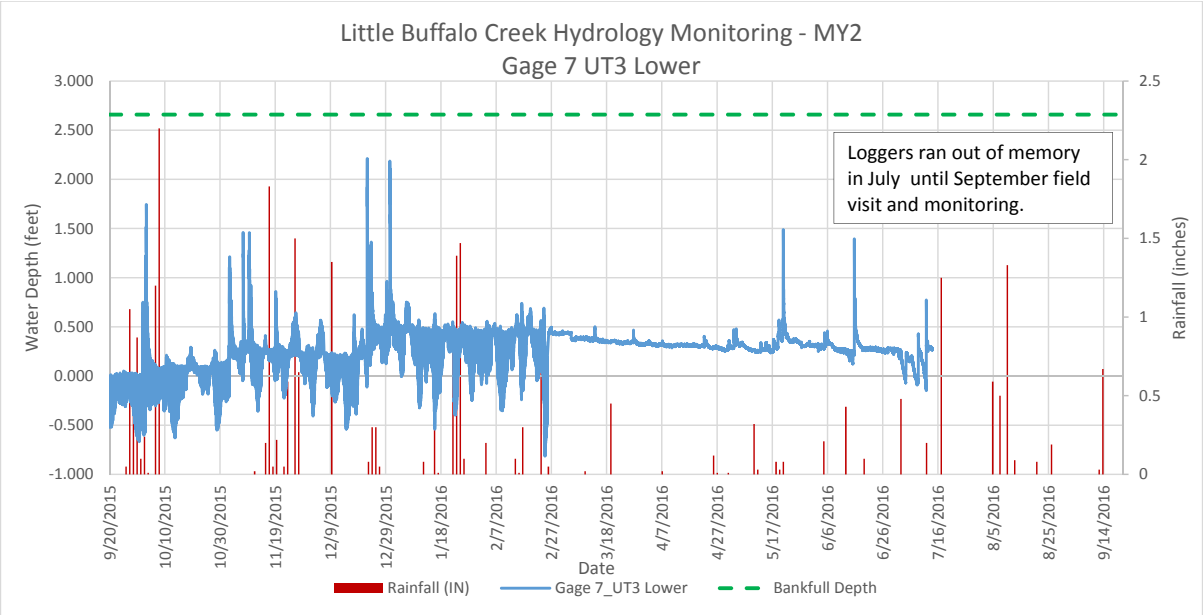


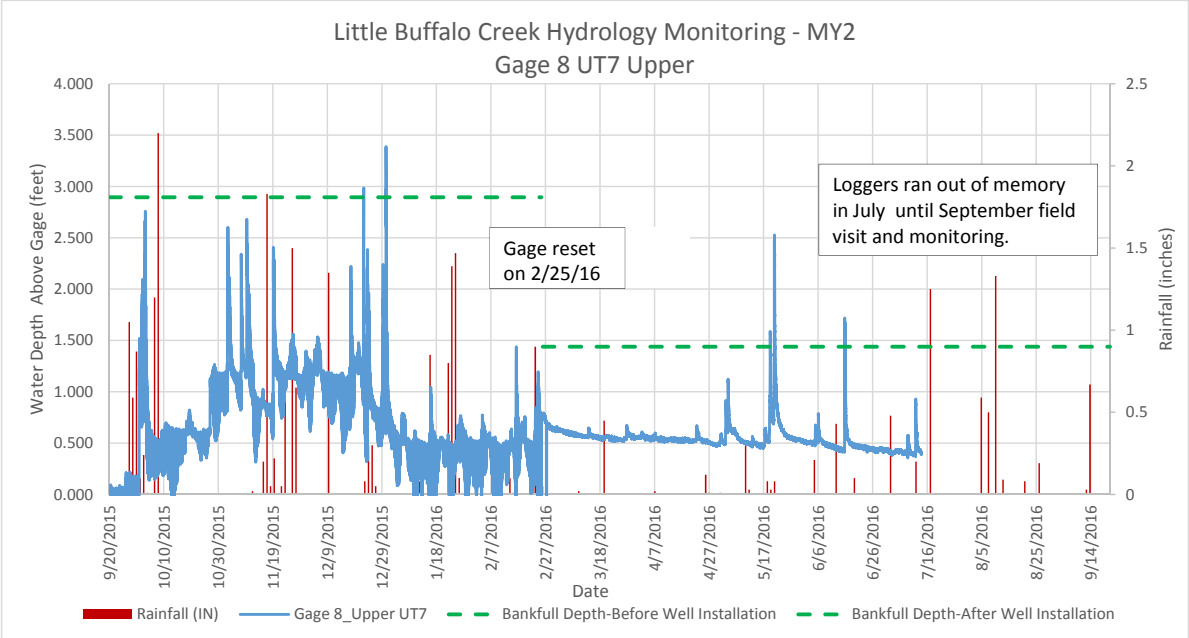
*Bankfull line represents depth from bankfull to gage. This depth changed when gages were reset.



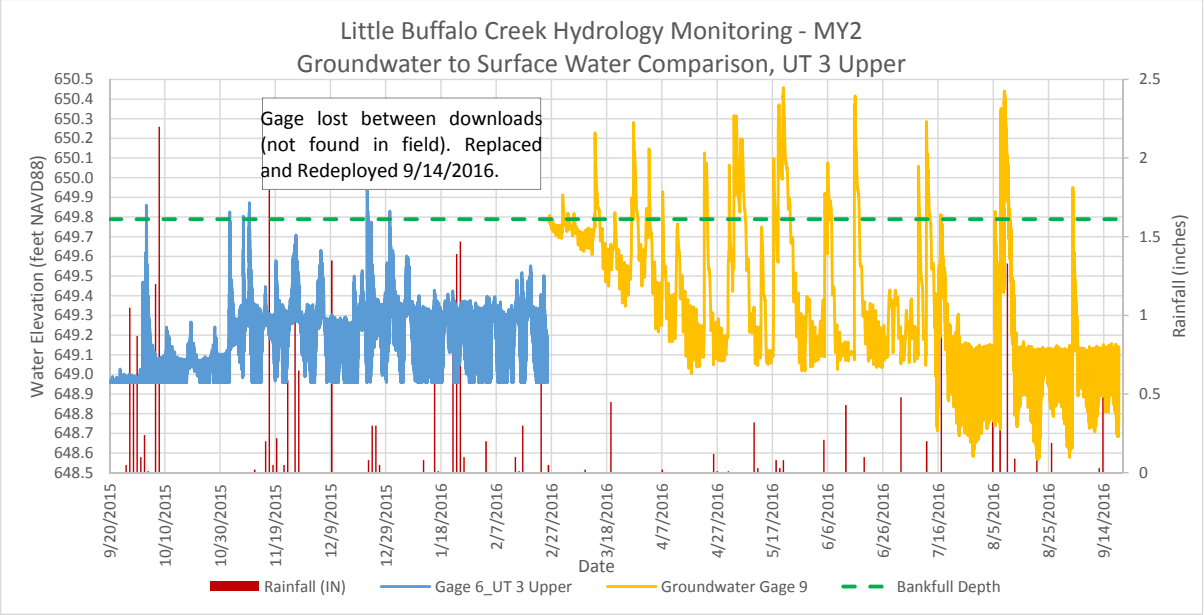
*Bankfull line represents depth from bankfull to gage. This depth changed when gages were reset.

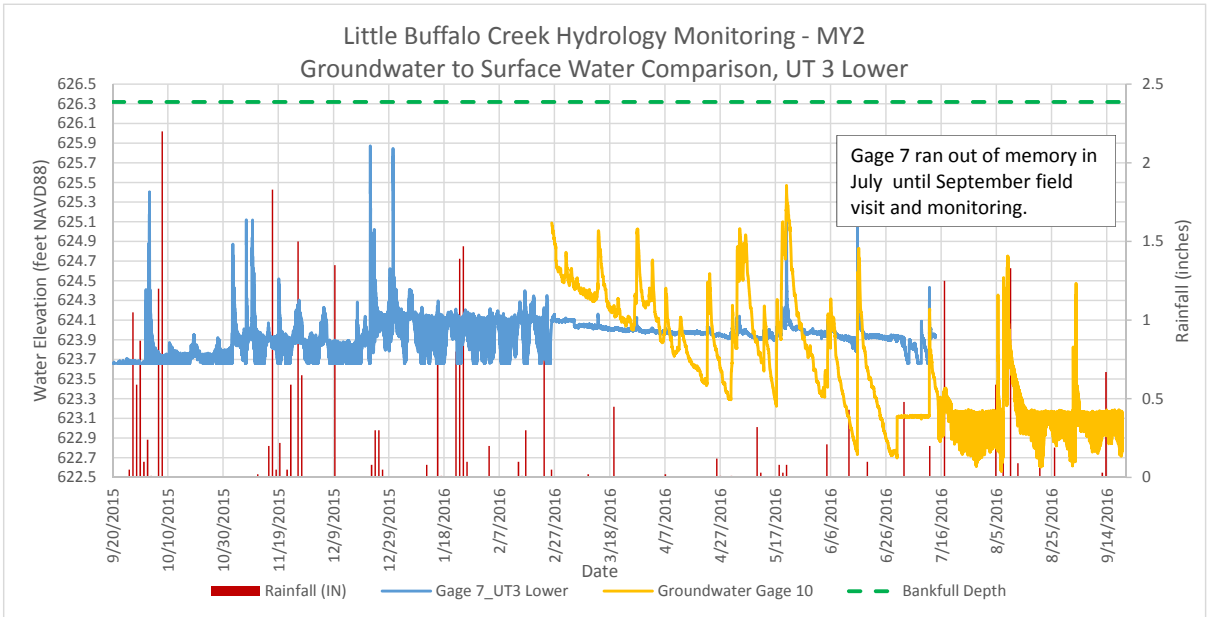






*Bankfull line represents depth from bankfull to gage. This depth changed when gages were reset.


Little Buffalo Creek Hydrology Monitoring - MY2
Groundwater to Surface Water Comparison, UT 3 Upper
Gage lost between downloads (not found in field). Replaced and Redeployed 9/14/2016.
Water Elevation (feet NAVD88)
Rainfall (inches)
650.5
650.4
650.3
650.2
650.1
650.0
649.9
649.8
649.7
649.6
649.5
649.4
649.3
649.2
649.1
649.0
648.9
648.8
648.7
648.6
648.5
2.5
2
1.5
1
0.5
0
9/20/2015
10/10/2015
10/30/2015
11/19/2015
12/9/2015
12/29/2015
1/18/2016
2/7/2016
2/27/2016
3/18/2016
4/7/2016
4/27/2016
5/17/2016
6/6/2016
6/26/2016
7/16/2016
8/5/2016
8/25/2016
9/14/2016
Date
Rainfall (IN)
Gage 6_UT 3 Upper
Groundwater Gage 9
Bankfull Depth


Little Buffalo Creek Hydrology Monitoring - MY2
Groundwater to Surface Water Comparison, UT 3 Lower
Gage 7 ran out of memory in July until September field visit and monitoring.
Water Elevation (feet NAVD88)
Rainfall (inches)
626.5
626.3
626.1
625.9
625.7
625.5
625.3
625.1
624.9
624.7
624.5
624.3
624.1
623.9
623.7
623.5
623.3
623.1
622.9
622.7
622.5
2.5
2
1.5
1
0.5
0
9/20/2015
10/10/2015
10/30/2015
11/19/2015
12/9/2015
12/29/2015
1/18/2016
2/7/2016
2/27/2016
3/18/2016
4/7/2016
4/27/2016
5/17/2016
6/6/2016
6/26/2016
7/16/2016
8/5/2016
8/25/2016
9/14/2016
Date
Rainfall (IN)
Gage 7_UT3 Lower
Groundwater Gage 10
Bankfull Depth