




MONITORING YEAR 4 ANNUAL REPORT
Final

NORKETT BRANCH STREAM MITIGATION SITE
Union County, NC
DEQ Contract 004673
DMS Project Number 95360

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EXECUTIVE SUMMARY

Wildlands Engineering (Wildlands) restored and enhanced a total of 10,706 linear feet (LF) of stream on a full-delivery mitigation site in Union County, NC. The project streams consist of Norkett Branch, a third order stream, two unnamed first order tributaries to Norkett Branch (UT1 and UT2), and two intermittent tributaries to Norkett Branch (UT2A and UT3). Water quality treatment Best Management Practices (BMPs) were installed to treat water quality on the non-jurisdictional headwaters of UT3 and an adjacent ephemeral drainage feature. The project is expected to provide 10,098 stream mitigation units (SMUs).

The Norkett Branch Stream Mitigation Site (Site) is located in southeastern Union County, NC, approximately ten miles southeast of the City of Monroe and five miles north of the South Carolina state line. The Site is located in the Yadkin River Basin; eight-digit Cataloging Unit (CU) 03040105 and the 14-digit Hydrologic Unit Code (HUC) 03040105081020 (Figure 1). This CU was identified as a targeted local watershed in the *2009 Lower Yadkin- Pee Dee River Basin Restoration Priority* (RBRP) plan. This plan identifies agricultural practices and runoff as the probable major sources of water quality impairment in the Middle Lanes Creek watershed. The 2008 North Carolina Division of Water Resources' (NCDWR) Basinwide Water Quality Plan (BWQP) lists turbidity and nutrient concentrations of nitrogen and phosphorus as specific concerns in the Rocky River watershed portion of the Yadkin- Pee Dee River basin. Other pollutants of concern cited in this report are fecal coliform bacteria, iron, and copper. The project reaches flow off-site, directly into Lanes Creek, which is included on the NCDWR 303d list of impaired streams. The section of Lanes Creek downstream of the project Site is listed as impaired due to turbidity (NCDWR, 2012). The project goals established in the Mitigation Plan (Wildlands, 2013) were completed with careful consideration of goals and objectives that were described in the RBRP and NCDWR BWQR and to meet the North Carolina Division of Mitigation Services (DMS) mitigation needs while maximizing the ecological and water quality uplift within the watershed.

The following project goals were established to address the watershed and project Site stressors:

- Improve aquatic and terrestrial habitat within the riparian corridor and provide habitat corridor extension from adjacent downstream forested habitat;
- Improve additional water quality aspects within stream channels on Site;
- Decrease sediment inputs to the stream channels and decrease turbidity in receiving Lanes Creek; and
- Decrease phosphorus, nitrogen, and fecal coliform inputs to the stream channels.

Stream restoration and enhancement, water quality treatment BMP construction, and planting efforts were completed between November 2013 and April 2014. Baseline as-built monitoring activities were completed between April and May 2014. A conservation easement is in place on the 31.6 acres of riparian corridor and stream resources to protect them in perpetuity.

Overall, the Site has met the required stream and vegetation mitigation success criteria for MY4. The average planted stem density for the site is 419 stems per acre and is on track to meet upcoming density criteria. Visual assessment revealed a decrease in areas with poor herbaceous cover; however, bare banks and invasive plant populations persist. Adaptive management in the upcoming monitoring year will address areas of concern. Geomorphically, the stability of each restored and enhanced stream remains in good standing, with cross section dimensions falling within the range of parameters for the appropriate Rosgen (1996) stream type. Visual assessment suggests the channels show little sign of instability within the bed, bank, or engineered structures, except isolated instances of bank erosion. The Site met final hydrological success criteria after MY3. During MY4, two of the restored reaches (Norkett Branch and UT2) recorded at least one bankfull or greater event. Water quality monitoring results indicate continued pollutant removal capacity of both storm water BMPs.

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Section 1: PROJECT OVERVIEW

The Site is located in southeastern Union County, NC, approximately ten miles southeast of the City of Monroe and five miles north of the South Carolina state line. The Site is located in the Yadkin River Basin; eight-digit Cataloging Unit (CU) 03040105 and the 14-digit Hydrologic Unit Code (HUC) 03040105081020 (Figure 1). The Site is located in the Carolina Slate Belt of the Piedmont physiographic province (USGS, 1998). The project watershed consists primarily of agricultural land, pasture, and forest. A conservation easement was recorded on 31.6 acres within the seven parcels (Deed Book 06095, Pages 0530-0589).

The Site is located within the North Carolina Division of Water Resources (NCDWR) subbasin 03-07-14. The project streams consist of Norkett Branch, a third order stream, two unnamed first order tributaries to Norkett Branch (UT1 and UT2), and two intermittent tributaries to Norkett Branch (UT2A and UT3). Norkett Branch (DWQ Index No. 13-17-40-8) is the main tributary of the project and is classified as WS-V waters. Class WS-V waters are protected as water supplies draining to Class WS-IV waters or waters used by industry to supply drinking water or waters formerly used as water supply, and are protected for secondary recreation, fishing, wildlife and aquatic life, maintenance of biotic integrity, and agriculture. The drainage area for the project Site is 2,034 acres (3.18 sq mi) at the lower end of Norkett Branch Reach 2.

Mitigation work at the Site included restoration on Norkett Branch, UT1, and UT2. Enhancement II was implemented on UT2A and UT3. Water quality treatment BMPs were also implemented to treat agricultural drainage upstream of UT3 and agricultural drainage in the right floodplain of Norkett Branch Reach 2. All onsite riparian areas were planted with native species. Construction and planting activities were completed in April 2014. Directions and a map of the Site are provided in Figure 1 and project components are illustrated in Figure 2.

1.1 Project Goals and Objectives

Prior to construction activities, the streams were routinely maintained to provide drainage for agricultural purposes. Impacts to the stream included straightening and ditching, eroding banks, and a lack of stabilizing riparian vegetation. The streams were used as a water source for cattle in some areas, resulting in over-widened, unstable trampled banks. Algal blooms, presumably from agricultural nutrient loading, were observed during Site visits. Trampled stream banks, over-widened channels, and banks illustrating signs of instability were a common occurrence throughout the Site. The alterations of the Site to promote farming resulted in impairment of the ecological function of Site's streams. Specific functional losses at the Site include degraded aquatic habitat, altered hydrology, and reduction of quality of in-stream and riparian wetland habitats and related water quality benefits. Table 4 in Appendix 1 and Tables 11 a-c in Appendix 4 present the Site's pre-restoration conditions in detail.

The mitigation project is intended to provide numerous ecological benefits such as pollutant removal and improved aquatic and terrestrial habitat. Expected improvements to water quality and ecological processes are outlined below as project goals and objectives. The agricultural stressors and pollutants have been specifically addressed by the Site design. The major goals of the stream mitigation project are to provide ecological and water quality enhancements to the Norkett Branch, Lane's Creek, Rocky River and Yadkin River Basins while creating a functional riparian corridor at the Site level and restoring a Piedmont Bottomland Forest as described by Schafale and Weakley (1990). These project goals were established with careful consideration of goals and objectives that were described in the RBRP and to meet the North Carolina Division of Mitigation Services (DMS) mitigation needs while maximizing the ecological and water quality uplift within the watershed.

The following project goals and objectives were established and listed in the Mitigation Plan (Wildlands, 2013) to address the effects listed above:

- *Improve aquatic and terrestrial habitat within the riparian corridor and provide habitat corridor extension from adjacent downstream forested habitat.* By restoring appropriate channel cross section and profile, including riffle and pool sequences, coarse substrate zones for macroinvertebrates and deep pool habitat for fish will also be restored. Introduction of large woody debris, rock structures, brush toe, and native stream bank vegetation will provide additional habitat and cover for both fish and macroinvertebrates. Adjacent buffer areas will be restored by planting native vegetation which will provide habitat and forage for terrestrial species. These areas will be allowed to receive more regular inundating flows, and vernal pools may develop over time increasing habitat diversity. A watershed approach, restoring riparian corridor functions on multiple interconnected tributaries as well as treating agricultural drainage from headwater features with Best Management Practices (BMPs), will allow for large-scale riparian corridor connectivity.
- *Improve additional water quality aspects within stream channels on Site.* Riffle/pool sequences will be restored to provide re-aeration allowing for oxygen levels to be maintained in the perennial reaches. Creation of deep pool zones will lower temperature, helping to maintain dissolved oxygen concentrations. Establishment and maintenance of riparian buffers will create long-term shading of the stream to minimize thermal heating. Water quality BMPs situated in the headwaters upstream of jurisdictional streams will treat agricultural runoff before it reaches project streams.
- *Decrease sediment inputs to the stream channels and decrease turbidity in receiving Lanes Creek.* Cattle will be fenced out of the riparian corridor, eliminating bank trampling. Sediment input from eroding stream banks will be reduced by bioengineering and installing in-stream structures while creating a stable channel form using geomorphic design principles. Sediment from off-site sources will be captured by deposition on restored floodplain areas where native vegetation will slow overland flow velocities. By allowing for more overbank flooding and by increasing channel roughness, in-channel velocities can be reduced. This will lower bank shear stress and decrease bank erosion.
- *Decrease phosphorus, nitrogen, and fecal coliform inputs to the stream channels.* Nitrogen and phosphorus chemical fertilizers, pesticides, and cattle waste will be decreased by buffering adjacent agricultural operations from the restored channels. Cattle will be fenced out to eliminate in-channel fecal pollution. Off-site nutrient input will be absorbed on-site by filtering flood flows through restored floodplain areas, water quality BMPs, and vernal pools positioned to treat concentrated overland flow. Flood flows will be allowed to disperse through native vegetation across the reconnected floodplain. Increased surface water residency time will provide contact treatment time and groundwater recharge potential.

1.2 Monitoring Year 4 Data Assessment

Annual monitoring was conducted between April and October 2017 to assess the condition of the project. The stream restoration success criteria for the Site follows the approved success criteria presented in the Mitigation Plan (Wildlands, 2013).

1.2.1 Vegetative Assessment

A total of 26 vegetation plots were established during the baseline monitoring within the project easement area using standard 10 meter by 10-meter vegetation monitoring plots. Plots were randomly established within planted portions of the stream restoration and enhancement areas to capture the heterogeneity of the designed vegetative communities. The plot corners were marked and are recoverable either through field identification or with the use of a GPS unit. Reference photographs were taken at the plot origin looking diagonally across the plot to the opposite corner to capture the same reference photograph locations as the as-built. The final vegetative success criteria will be the survival of 210 planted stems per acre in the riparian corridor along restored and enhanced reaches at the end of the seventh year of monitoring (MY7). Planted vegetation must average 10 feet in height in each plot by MY7. The interim measure of vegetative success for the Site will be the survival of at least 320 planted stems per acre at the end of the third year of monitoring (MY3) and at least 260 stems per acre at the end of the fifth year of monitoring (MY5). If this performance standard is met by MY5 and stem density is trending towards success (i.e., no less than 260 five-year-old stems per acre), monitoring of vegetation on the Site may be terminated provided written approval is provided by the USACE in consultation with the NC Interagency Review Team.

The MY4 vegetation survey was completed in August 2017 and resulted in 23 out of 26 vegetation plots meeting the year five interim success criteria (260 stems per acre). Overall, the Site's average planted stem density resulted in 419 stems per acre which exceeds the year five interim success criteria. The average woody stem density of the Site with volunteers included is 506 stems per acre. Supplemental planting added 6,000 stems (37% of the MY1 stem total) on reaches east of Philadelphia Church Road in February 2015. The supplemental planting was in response to low stem vigor of many plots and high bare root mortality between the as-built and MY1 which is attributed to dry site conditions, soil fertility, scouring flows shortly after installation, insects, and disease. Some of the monitoring plots showed an increase in planted stem densities in MY2 as a result of this supplemental planting. Although the Site meets the overall stem density requirement, two vegetation plots (plot 5 and 10) have stem densities of 243 stems per acre and another vegetation plot (plot 7) has a stem density of 202 stems per acre. Plots 5 and 10 do not meet the interim success criteria for MY5 and plot 7 does not meet the MY7 final success criteria. In MY4, planted stems heights averaged 5.2 feet which is a 67% increase in height compared to the MY3 stem height average of 3.1 feet. A majority of woody stems (67%) had a vigor rating of 3 or more (indicating that the stem is healthy and more likely to survive) during MY4. Continued stem growth and maintenance of stem health (vigor) indicate drought and plant stress observed in previous monitoring years is becoming less of a factor in vegetative success.

Refer to Appendix 3 for vegetation summary tables and raw data tables and Appendix 2 for vegetation plot photographs, the Current Condition Plan View (CCPV) maps, and the vegetation condition assessment table.

1.2.2 Vegetation Problem Areas

During the late winter/early spring of MY4, several areas previously identified as "Bare/Poor Herbaceous Cover" were addressed through a combination of reseeding and the installation of hügelkultur (hugel) beds. The hugel beds provide additional organic matter and aid in moisture retention to encourage herbaceous growth in bare areas. Hugel bed installation involved the excavation of small floodplain trenches that were backfilled with organic matter, covered in a mixture of soil and brush, and planted

with live whips, live stakes and seeded. The live stakes and whips were planted to anchor the beds. As the woody species establish they will help diffuse the energy of out of bank events and trap additional organic matter. During the MY4 visual assessment, bare areas were significantly smaller than previously mapped in MY1 through MY3. The total area designated as "Bare/Poor Herbaceous Cover" in MY4 is approximately 0.4 acres or 1% of the planted area of the Site, compared to approximately 1.9 acres or 6% reported in MY3. The MY4 vegetation monitoring and visual assessment identified areas of "Bare/Poor Herbaceous Cover" which are noted in the Figures 3.0-3.6 and in Table 7.

Several areas of the groundsel tree (*Baccharis halimifolia)*; an aggressive coastal plain native evergreen shrub, were mechanically and chemically treated during MY4. This species is not typically considered a species of high concern for DMS-required monitoring; however, the high density of this shrub layer is competing with planted woody and herbaceous vegetation in the areas of infestation. Other areas of undesirable species were noted on site including: cattail (*Typha latifolia*), parrot feather (*Myriophyllum aquaticum*), Chinese privet (*Ligustrum sinense*), and Chinaberry tree (*Melia azedarach*). During the summer (June – July) and fall (November) of 2017, cut/spray techniques were used to address areas of dense groundsel tree infestation.

Adaptive Management

If warranted future adaptive management activities may be employed to continue to improve herbaceous vegetative cover and improve the growth rates of planted woody stems such as soil amendments in targeted areas. Supplemental planting of container plants proposed for early 2017 was postponed to early 2018 due to unseasonably warm weather during the scheduled planting period. The supplemental planting will involve approximately 100 stems (less than one percent of the MY4 stem total) over 2 acres to improve the standing stock of diverse, healthy, woody stems. Areas noted with invasive plant populations will be treated in accordance with herbicide, not to exceed label prescribed application rates. If necessary, cut/spray techniques and/or application of a broadleaf-selective herbicide may be used to control groundsel tree.

1.2.3 Stream Assessment

A total of 20 cross-sections were installed along the stream restoration reaches. One permanent cross-section was installed per 20 bankfull widths along stream restoration reaches, with riffle and pool sections in proportion to DMS guidance. Each cross-section was permanently marked with pins to establish its location. Annual cross-section survey includes points measured at all breaks in slope, including top of bank, bankfull, edge of water, and thalweg. Photographs were taken looking upstream and downstream at cross-section. Stream photographs were also taken at 51 permanent photograph reference points throughout the project area. A reach-wide pebble count was conducted in all restoration reaches (Norkett Branch Reach 1, Norkett Branch Reach 2, UT1, UT2 Reach 1, UT2 Reach 2, UT2 Reach 3A, and UT2 Reach 3B) for classification purposes. A wetted perimeter pebble count was conducted at each permanent riffle cross-section to characterize the pavement.

Riffle cross-sections on the restoration reaches should be stable and should show little change in bankfull area, maximum depth ratio, and width-to-depth ratio. All riffle cross-sections should fall within the parameters defined for channels of the appropriate Rosgen stream type. If any changes do occur, these changes will be evaluated to assess whether the stream channel is showing signs of instability. Indicators of instability include a vertically incising thalweg or eroding channel banks. Changes in the channel that indicate a movement toward stability or enhanced habitat include a decrease in the width-to-depth ratio in meandering channels or an increase in pool depth. Substrate materials in the restoration reaches should indicate a progression towards or the maintenance of coarser materials in the riffle features and smaller particles in the pool features.

Morphological surveys for MY4 were conducted in August 2017. All streams within the Site appear stable and have met the success criteria for MY4. Riffle cross-sections surveyed along the restoration reaches appear stable and typically show little change in the bankfull area, maximum depth ratio, or width-to-depth ratio. Slight downcutting observed during MY3 on the left channel edge of riffle cross section 15 on UT2 Reach 2 was observed to have stabilized and not progressed in MY4. The minor adjustment is not currently an area of concern. All surveyed riffle cross-section dimensions fell within the parameters defined for channels of the appropriate Rosgen stream type (Rosgen 1996). In-stream structures used to enhance channel habitat and stability on the outside bank of meander bends; such as brush toe, are providing stability and habitat as designed. Pattern data will be completed in MY7 only if there are indicators from the dimensions that significant geomorphic adjustments have occurred. No changes were observed that indicated a change in the radius of curvature or channel belt width; therefore, pattern data is not collected or included in the MY4 report. Visual assessment during MY4 revealed few isolated instances of bank scour and eroding banks. These are discussed in more detail in section 1.2.4.

In general, substrate materials in the restoration reaches indicate maintenance of coarser materials in the riffle features and finer particles in the pool features. Increases in the silt/clay particle size class were observed in reachwide counts for UT2 Reaches 1, Reach 2, and Reach 3A as well as riffle 100-counts conducted on Norkett Branch Reach 1 (Cross-section 5), Norkett Branch Reach 2 (Cross-section 7), and UT2 Reach 1 (Cross-section 12). The increases may be a result of low flow conditions reducing transport capacity during the monitoring year. Increased fines in riffle cross-section may also be the result of low-flow conditions which allow in-stream vegetation to establish and accumulate a thin layer of fines on top of coarser substrate.

Please refer to Appendix 2 for the stream visual assessment tables, the CCPV maps, and stream reference photographs. Refer to Appendix 4 for the morphological data and plots.

1.2.4 Stream Problem Areas

During MY4, isolated areas of stream bank erosion were repaired on Norkett Branch Reach 1 and 2. Specific locations include: the left bank of Norkett Branch Reach 1 between station 119+00 and 119+50, the right bank of Norkett Branch Reach 1 between 120+00 and 120+50, and along the right bank of Norkett Branch Reach 2 between stations 132+50 and 133+00. Work included the installation of soil lifts and live whips which were seeded with temporary and perennial seed mixes. Live whips were also installed along the left toe of bank of Norkett Branch Reach 2 between stations 132+25 and 132+75. All repairs were stable during the MY4 visual assessment.

Isolated areas of bare bank were noted during the MY4 visual assessment along Norkett Branch Reach 1.

Adaptive Management

Any areas noted with bare or eroding banks will be watched for advancement in the upcoming monitoring years. Refer to Appendix 2 for the stream visual assessment tables, the CCPV maps, reference photographs, and photographs of the stream problem areas.

1.2.5 Hydrology Assessment

Hydrologic monitoring was accomplished using both manual crest gage readings and In-situ Rugged Troll 100 pressure transducers installed at three surveyed cross-sections throughout the site (XS6 on Norkett Branch Reach 2, XS9 on UT1, and XS18 on UT2 Reach 3a). Rainfall amounts were measured by an Onset HOBO rain gauge located at the site. To meet hydrological success criteria, two or more bankfull events must occur in separate years within the restored reaches by the end of MY7. The success criteria have already been met for the seven-year monitoring period after MY3. During MY4, at least one bankfull or

greater event was recorded along Norkett Branch and UT2. Please refer to Appendix 5 for hydrology data.

1.2.6 Water Quality BMPs

Water quality grab samples were collected during the monitoring period to assess the functionality of the Step Pool Storm Conveyance BMP (SPSC BMP) and the Pocket Wetland BMP (PW BMP). This sampling is not part of the success criteria for the project. The following expected rates for pollutant removal were established in the Mitigation Plan (Wildlands, 2013) and in accordance with published rates of removal from similar BMP approaches. The SPSC BMP is expected to provide similar pollutant removal rates as the published removal rates of a bioretention area with internal water storage (NCDWQ, 2007), which are 85% TSS removal, 40% TN removal, and 40% TP removal. The PW BMP is expected to provide 60% TSS removal, 20% TN removal, and 45% TP removal, which is similar to extended detention wetlands (Center for Watershed Protection, 2000 and United States Environmental Protection Agency, 2012).

The monitoring plan calls for quarterly sampling; however, samples were unable to be obtained during Q1 or Q3 due to the timing and intensity of rain events. During Q2, inflow and outflow was sampled at each BMP after storm events on 4/4/2017 and 5/23/2017. First flush style sample bottles were used to capture stormflow, which filled during the rain event at a pre-determined stage height, and were retrieved within 24 hours. In MY4, samples were analyzed for total suspended solids (TSS), phosphorus as total phosphorus (TP), nitrogen as total nitrogen (TN), Nitrate/Nitrite (NO_x), and Total Kjeldahl Nitrogen (TKN), by Prism Laboratories Inc. A nearby weather station at the Monroe, NC Airport (KEQY) recorded rainfall of 0.59 inches on 4/4/17. The on-site rain gage recorded 0.87 inches on 5/23/2017. Refer to in Appendix 6 for water quality sampling results and pollutant removal rates.

The SPSC BMP provided pollutant removal of TN in both sampling events with removal ranging from 33% to 46%. TP removal could not be calculated on the 4/4/2017 event but on 5/23/2017 TP removal of 29% was estimated. TSS removal was not available on the 4/4/2017 event. TSS increased 20% between the inlet and outlet samples on 5/23/2017.

The PW BMP provided reductions in TP in both 2017 sampling events ranging from 13% to 50%. TP reduction could not be calculated in the April samples while May sampling indicated an increase between inlet and outlet samples of 89%. TSS was reduced during both sampling events with reduction rates of 82% and 83%, respectively.

1.2.7 Existing Wetland Monitoring

A permanent photo station (photo point #16) was established in the stream-to-wetland conversion area in Norkett Branch Reach 1 near station 104+00 on the left floodplain. The former channel area appears to be maintaining wetland hydrology and supports a wetland plant community composition. The photo point (#16) is included in the Stream Photographs section of Appendix 2.

1.3 Monitoring Year 4 Summary

Overall, the Site has met the required stream and vegetation mitigation success criteria for MY4. The average planted stem density for the site is 419 stems per acre and is on track to meet upcoming density criteria. The MY4 average stem height was 5.2 feet which is a 67% increase from the MY3 average stem height of 3.1 feet. Visual assessment indicated that vegetative adaptive management efforts completed in March 2017 (reseeding and hugel bed installation) have reduced areas of bare or poor herbaceous cover. Areas of low density of planted stems and invasive plant populations persist in MY4. Planned management in the upcoming monitoring year will address these areas of concern. Geomorphically, the stability of each restored and enhanced stream remains in good standing, with cross section dimensions falling within the range of parameters for the appropriate Rosgen (1996) stream type. Visual assessment

indicates the channels show little sign of instability within the bed, bank, or engineered structures. Short segments of soil lifts installed in 150 LF of banks in MY4 remain stable. Norkett Branch and UT2 recorded at least one bankfull or greater event during MY4. The MY7 hydrological success criteria for the Site was achieved after MY3. Water quality monitoring results indicate continued pollutant removal capacity of both storm water BMPs.

Summary information/data related to various project and monitoring elements can be found in the tables and figures in the report appendices. Narrative background and supporting data can be found in the Mitigation Plan documents available on the DMS website. All raw data supporting the tables and figures in the appendices are available upon request.

Section 2: METHODOLOGY

Geomorphic data collected followed the standards outlined in *The Stream Channel Reference Site: An Illustrated Guide to Field Techniques* (Harrelson et al., 1994) and in the *Stream Restoration: A Natural Channel Design Handbook* (Doll et al., 2003). Longitudinal and cross-sectional data were collected using a total station and were georeferenced to established benchmarks and NC State Plane coordinates. Morphological surveys were conducted using a total station tied to these geo-referenced (control) points. Reachwide pebble counts were conducted along each restored reach for channel classification. Cross-section substrate analyses conducted in each surveyed riffle followed the 100 count wetted perimeter methodology to characterize pavement. All CCPV mapping was recorded using a Trimble handheld GPS with sub-meter accuracy and processed using was Pathfinder and ArcView. Crest gauges were installed during the baseline monitoring period in surveyed riffle cross-sections and are monitored quarterly. Hydrology attainment installation and monitoring methods are in accordance with the USACE (2003) standards. Vegetation monitoring protocols followed the Carolina Vegetation Survey-NCEEP Level 2 Protocol (Lee et al., 2008).

Section 3: REFERENCES

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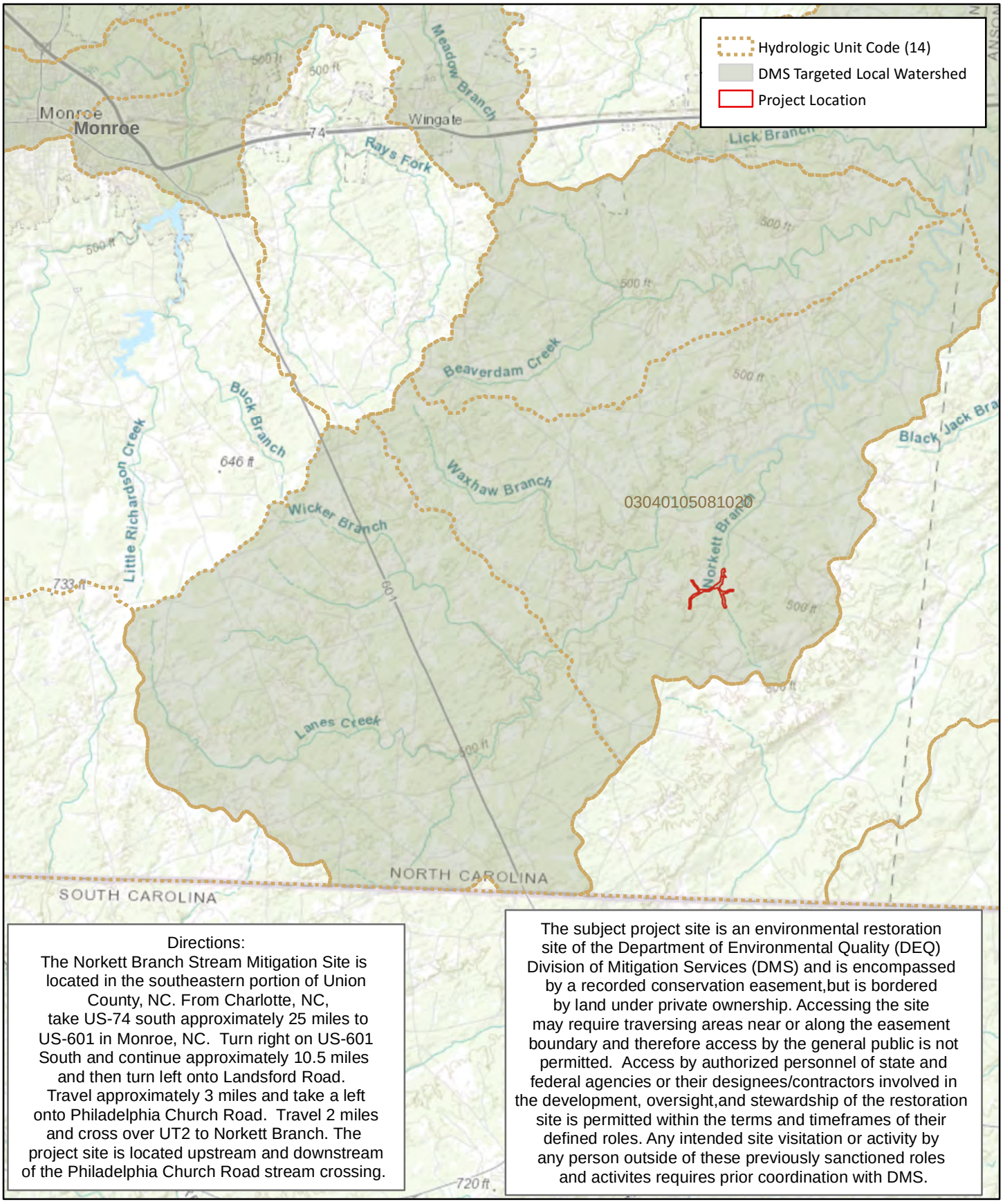
APPENDIX 1. General Figures and Tables



Directions:
The Norkett Branch Stream Mitigation Site is located in the southeastern portion of Union County, NC. From Charlotte, NC, take US-74 south approximately 25 miles to US-601 in Monroe, NC. Turn right on US-601 South and continue approximately 10.5 miles and then turn left onto Landsford Road. Travel approximately 3 miles and take a left onto Philadelphia Church Road. Travel 2 miles and cross over UT2 to Norkett Branch. The project site is located upstream and downstream of the Philadelphia Church Road stream crossing.

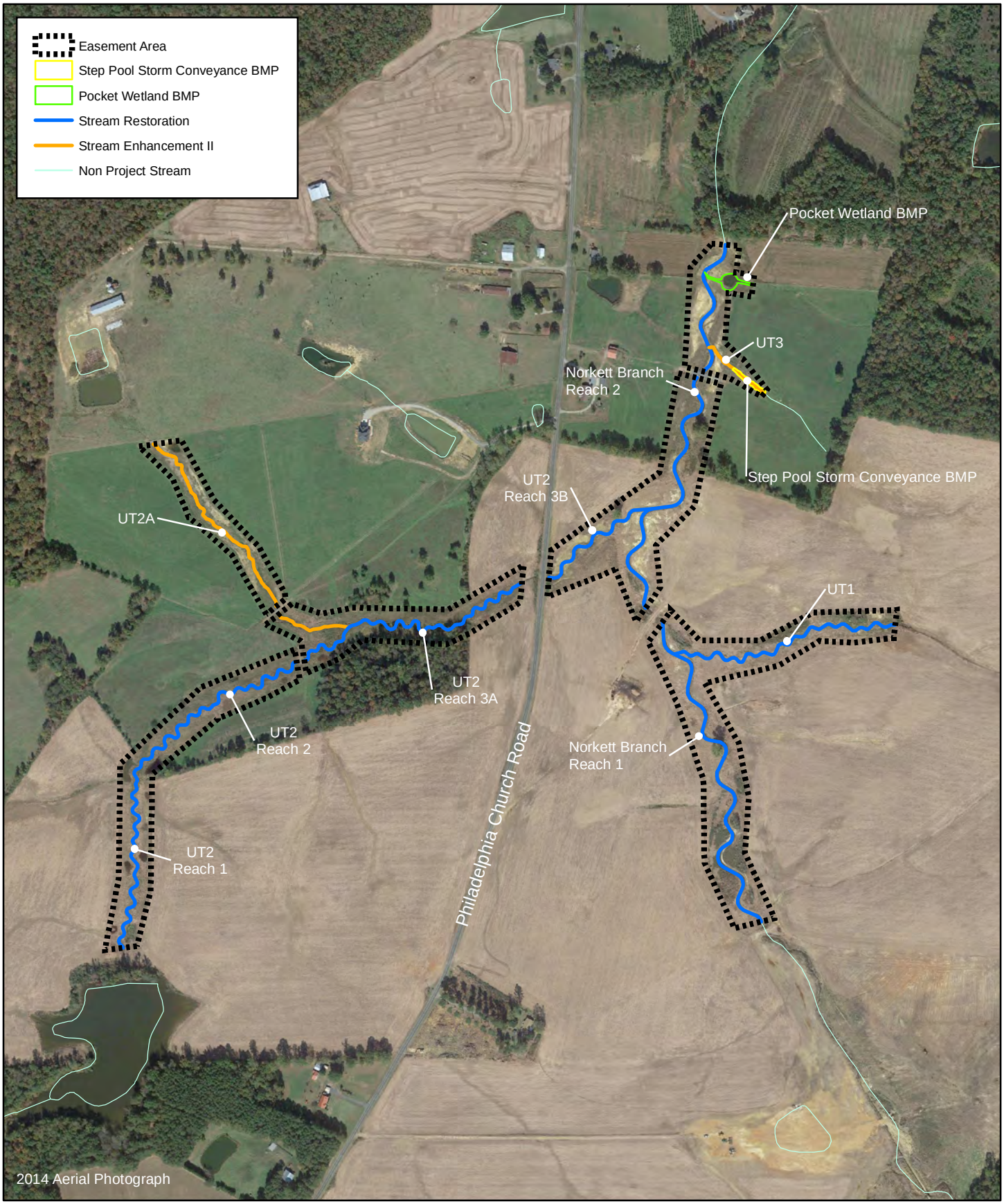
The subject project site is an environmental restoration site of the Department of Environmental Quality (DEQ) Division of Mitigation Services (DMS) and is encompassed by a recorded conservation easement,but is bordered by land under private ownership. Accessing the site may require traversing areas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

WILDLANDS ENGINEERING

0 1 2 Miles

N

Figure 1 Project Vicinity Map
Norkett Branch Stream Mitigation Site
DMS Project No. 95360
Monitoring Year 4 - 2017
Union County, NC



WILDLANDS ENGINEERING

0 300 600 Feet

N

Figure 2 Project Component/Asset Map
Norkett Branch Stream Mitigation Site
DMS Project No. 95360
Monitoring Year 5 - 2017
Union County, NC

Table 1. Project Components and Mitigation Credits

Norkett Branch Stream Mitigation Site

DMS Project No. 95360

Monitoring Year 4 - 2017

Mitigation Credits										
	Stream		Riparian Wetland		Non-Riparian Wetland		Buffer	Nitrogen Nutrient Offset	Phosphorous Nutrient Offset	
Type	R	RE	R	RE	R	RE				
Totals	9,196	902	N/A	N/A	N/A	N/A	N/A	N/A	N/A	

Project Components							
Reach ID	As-Built Stationing[1]	Existing Footage/ Acreage	Approach	Restoration or Restoration Equivalent	Restoration Footage/ Acreage[2]	Mitigation Ratio	Credits (SMU)[2]
STREAMS							
Norkett Branch Reach 1	100+31-117+60 & 118+60-124+00	1,980 LF	P1	R	2,313	1:1	2,313
Norkett Branch Reach 2	124+00-131+84 & 132+25-138+99	1,505 LF	P1	R	1,513	1:1	1,513
UT1	200+00-211+98	840 LF	P1	R	1,212	1:1	1,212
UT2 Reach 1	300+41-310+80	820 LF	P1	R	1,033	1:1	1,033
UT2 Reach 2	310+80-321+71 & 322+06-325+20	1,272 LF	P1	R	1,416	1:1	1,416
UT2 Reach 3A	325+20-335+58	923 LF	P1	R	1,041	1:1	1,041
UT2 Reach 3B	336+90-343+48	380 LF	P1/2	R	668	1:1	668
UT2A	401+53-411+46 & 411+84-415+31	1,296 LF	EII	EII	1,340	2.5:1	536
UT3	505+42-507+12	163 LF	EII	EII	170	2.5:1	68
SPSC BMP	Upstream of UT3 intermittent drainage		Step Pool Storm Conveyance	WQ BMP	29.7 ac treated	1:8	238[3]
PW BMP	non-jurisdictional drainage in eastern Norkett Branch floodplain		Pocket Wetland	WQ BMP	19.9 ac treated	1:3	60[3]

Component Summation						
Restoration Level	Stream (LF)	Riparian Wetland (acres)		Non-Riparian Wetland	Buffer (square feet)	Upland (acres)
Restoration	9,196					
Enhancement						
Enhancement I						
Enhancement II	1,510					
Creation						
Preservation						
High Quality Preservation						
Alternative Mitigation	49.6 ac treated					

N/A: not applicable

1. Stationing based off of centerline as-built alignment which matched with the design alignment.
2. Credits are based off of the as-built thalweg alignment.
3. Credits determined for the BMPs were established in the mitigation plan (2013).

Table 2. Project Activity and Reporting History
Norkett Branch Stream Mitigation Site
DMS Project No. 95360
Monitoring Year 4 - 2017

Activity or Report	Data Collection Complete	Completion or Scheduled Delivery
Mitigation Plan	July 2012 - October 2012	July 2013
Final Design - Construction Plans	July 2013 - November 2013	November 2013
Construction	December 2013 - April 2014	April 2014
Temporary S&E mix applied to entire project area[1]	December 2013 - April 2014	April 2014
Permanent seed mix applied to reach/segments	December 2013 - April 2014	April 2014
Bare root and live stake plantings for reach/segments	March 2014 - April 2014	April 2014
Baseline Monitoring Document (Year 0)	April 2014 - May 2014	June 2014
Year 1 Monitoring	September 2014 - October 2014	December 2014
Stream Assessment	October 2014	December 2014
Vegetation Assessment	September 2014	
Maintenance and Replanting	October 2014 - January 2014	February 2015
Year 2 Monitoring	April 2015 - October 2015	December 2015
Stream Assessment	April 2015	December 2015
Vegetation Assessment	September 2015	
Year 3 Monitoring	April 2016 - October 2016	December 2016
Stream Assessment	April 2016	December 2016
Vegetation Assessment	June 2016	
Invasive Treatment	July 2016	December 2016
Bank repairs and hugel bed installation in bare areas	March 2017	Spring 2017
Year 4 Monitoring	April 2017 - November 2017	December 2017
Stream Assessment	August 2017	December 2017
Vegetation Assessment	August 2017	
Invasive Treatment	June - July, November 2017	N/A
Year 5 Monitoring	2018	December 2018
Year 6 Monitoring	2019	December 2019
Year 7 Monitoring	2020	December 2020

[1]Seed and mulch is added as each section of construction is completed.

Table 3. Project Contact Table
Norkett Branch Stream Mitigation Site
DMS Project No.95360
Monitoring Year 4 - 2017

Designer Emily Reinicker, PE, CFM	**Wildlands Engineering, Inc.** 1430 S Mint St. Suite 104 Charlotte, NC 28203 704.332.7754
Construction Contractor	**Land Mechanic Designs, Inc.** 126 Circle G Lane Willow Spring, NC 27592
Planting Contractor	**Bruton Natural Systems, Inc** P.O. Box 1197 Fremont, NC 27830
Seeding Contractor	**Bruton Natural Systems, Inc** P.O. Box 1197 Fremont, NC 27830
Seed Mix Sources	**Green Resource, Colfax, NC**
Nursery Stock Suppliers **Bare Roots** **Live Stakes**	**Bruton Natural Systems, Inc** **Dykes and Son Nursery, McMinnville, TN** **Foggy Bottom Nursery, Lansing, NC**
Monitoring Performers	**Wildlands Engineering, Inc.**
Monitoring, POC	Kirsten Gimbert 704.332.7754, ext. 110

Table 4. Project Information and Attributes

Norkett Branch Stream Mitigation Site
DMS Project No. 95360
Monitoring Year 4 - 2017

Project Information						
Project Name	Norkett Branch Stream Mitigation Site					
County	Union County					
Project Area (acres)	31.6					
Project Coordinates (latitude and longitude)	34°52'47.56"N, 80°22'9.19"W					
Project Watershed Summary Information						
Physiographic Province	Carolina Slate Belt of the Piedmont Physiographic Province					
River Basin	Yadkin					
USGS Hydrologic Unit 8-digit	03040105					
USGS Hydrologic Unit 14-digit	03040105081020					
DWQ Sub-basin	03-07-14					
Project Drainage Area (acres)	2,034					
Project Drainage Area Percentage of Impervious Area	<1%					
CGIA Land Use Classification	43% forested, 29% managed herbaceous cover, 28% cultivated land					
Reach Summary Information						
Parameters	**Norkett Branch Reach 1**	**Norkett Branch Reach 2**	**UT1**	**UT2**	**UT2A**	**UT3**
Length of reach (linear feet) - Post-Restoration[1]	2,369	1,499	1,198	4,175	1,378	170
Drainage area (acres)	1490	2034	48	457	72	28
Drainage area (sqmi)	2.3	3.2	0.08	0.72	0.11	0.04
NCDWQ stream identification score	43.75	41.5	32.25	35.75	23;30.75	25.75
NCDWQ Water Quality Classification	WS-V					
Morphological Desription (stream type)	P	P	P	P	I	I
Evolutionary trend (Simon's Model) - Pre- Restoration	III	III/IV	II/III	II, IV	IV	II/ III
Underlying mapped soils	Floodplain Soil Types for Site					
	Badin channery silt loam		Badin channery silt clay loam		Cid channery silt loam	Secrest-Cid complex
Drainage class	well-drained		well-drained		well-drained with moderate shrink-swell potential	well-drained
Soil Hydric status	N		N		N	Y
Slope	2-8%		2-8%		1-5%	0-3%
FEMA classification	AE	AE	N/A	N/A	N/A	N/A
Native vegetation community	Piedmont Bottomland Forest					
Percent composition exotic invasive vegetation - Post-Restoration	0%					

Regulatory Considerations			
Regulation	**Applicable?**	**Resolved?**	**Supporting Documentation**
Waters of the United States - Section 404	X	X	USACE Nationwide Permit No.27 and DWQ 401 Water Quality Certification No. 3885.
Waters of the United States - Section 401	X	X	
Division of Land Quality (Dam Safety)	N/A	N/A	N/A
Endangered Species Act	X	X	Norkett Branch Mitigation Plan; Wildlands determined "no effect" on Union County listed endangered species.
Historic Preservation Act	X	X	No historic resources were found to be impacted (letter from SHPO dated 8/20/2012).
Coastal Zone Management Act (CZMA)/Coastal Area Management Act (CAMA)	N/A	N/A	N/A
FEMA Floodplain Compliance	X	X	CLOMR and LOMR Approved
Essential Fisheries Habitat	N/A	N/A	N/A

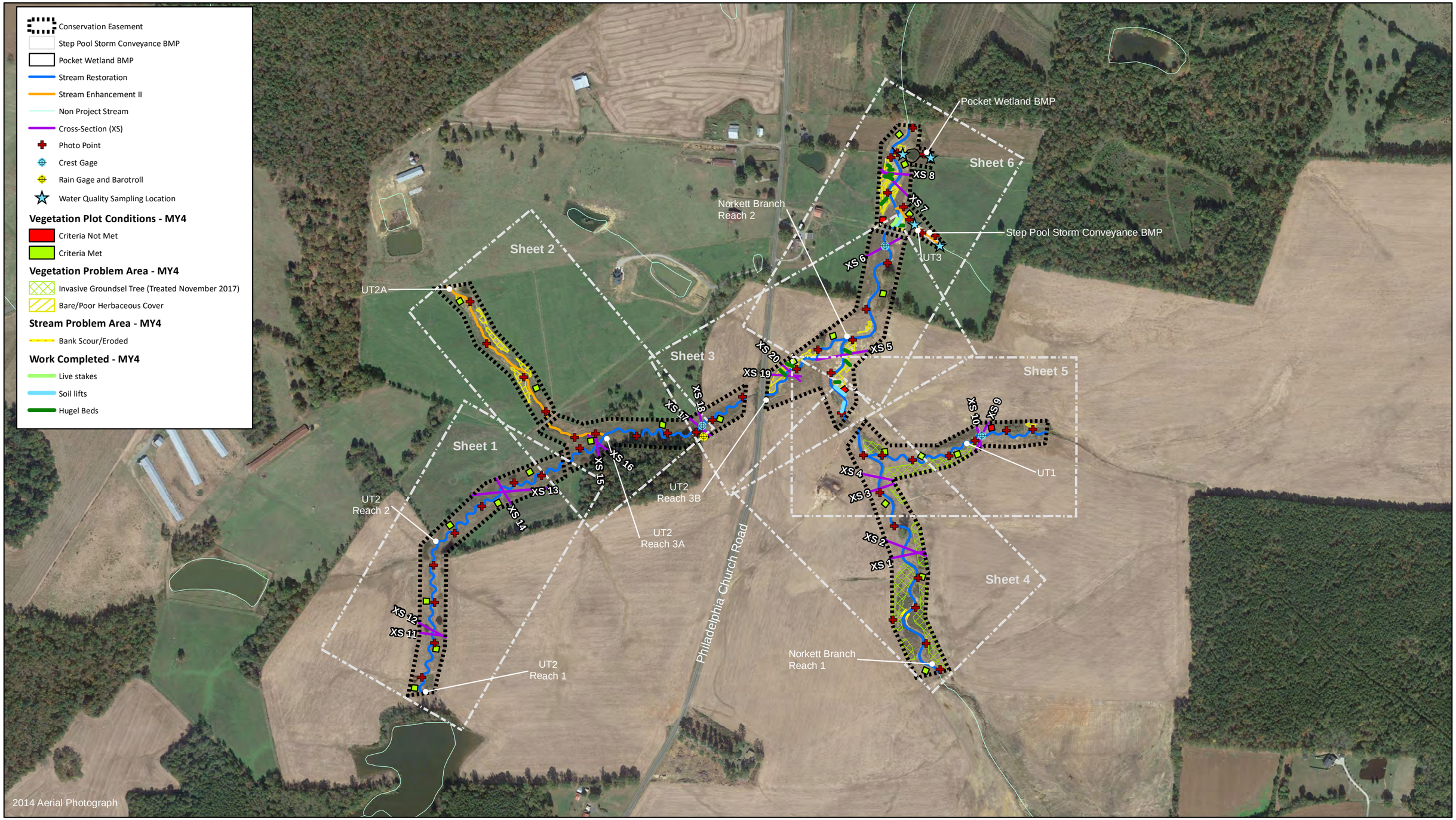
1. Total stream length does not exclude easement crossings.

Table 5. Monitoring Component Summary
Norkett Branch Stream Mitigation Site
DMS Project No. 95360
Monitoring Year 4 - 2017

Parameter	Monitoring Feature	Quantity/ Length by Reach									Frequency
		Norkett Branch Reach 1	Norkett Branch Reach 2	UT1	UT2 Reach 1	UT2 Reach 2	UT2 Reach 3A	UT2 Reach 3B	UT3	Storm Water BMPs	
	Riffle Cross Section	3	2	1	1	2	1	1	N/A	N/A	Annual
	Pool Cross Section	2	1	1	1	2	1	1	N/A	N/A	
Pattern	Pattern	N/A									N/A
Profile	Longitudinal Profile	N/A									N/A
Substrate	Reach Wide (RW) / Riffle (RF) 100 Pebble Count	RW-1, RF-3	RW-1, RF-2	RW-1, RF-1	RW-1, RF-1	RW-1, RF-2	RW-1, RF-1	RW-1, RF-1	N/A	N/A	Annual
Stream Hydrology	Crest Gage	1		1	1				N/A	N/A	Quarterly
Wetland Hydrology	Groundwater Gages	N/A									N/A
Vegetation[1]	CVS Level 2	26									Annual
Visual Assessment	All Streams	Y	Y	Y	Y	Y	Y	Y	Y	Y	Annual
Exotic and nuisance vegetation											
Project Boundary											
Reference Photos[2]	Photographs	51									Annual

[1]A deviation from the vegetation plot quantity indicated in the Mitigation Plan is due to a smaller than expected planted area.
[2]Additional reference photo locations were added for site documentation to exceed quantity indicated in the Mitigation Plan.

APPENDIX 2. Visual Assessment Data



WILDLANDS ENGINEERING

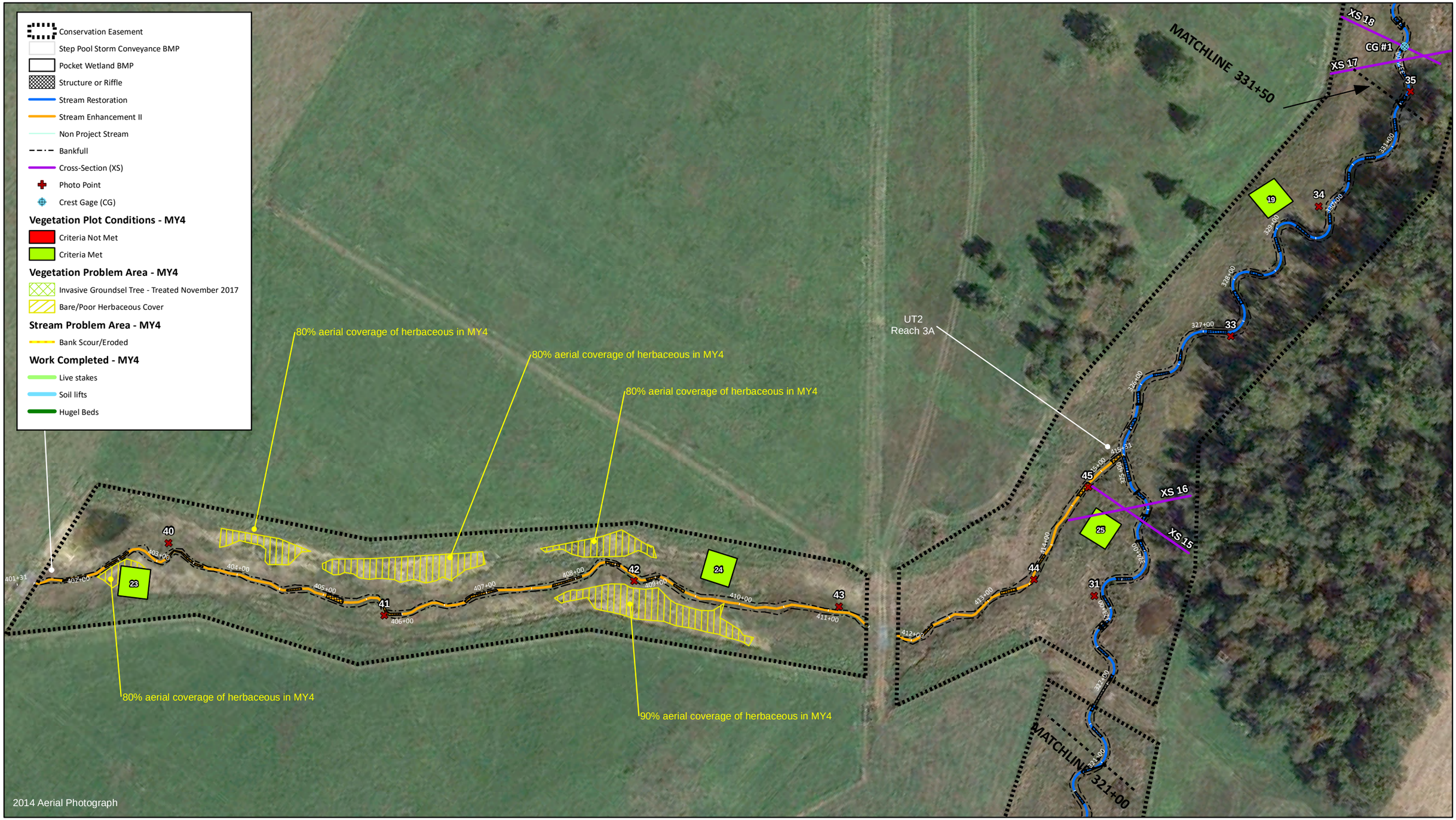
0 500 1,000 Feet

N

Figure 3.0 Integrated Current Condition Plan View (Key)
Norkett Branch Stream Mitigation Site
DMS Project No. 95360
Monitoring Year 4 - 2017
Union County, NC

0 100 200 Feet

Figure 3.1 Integrated Current Condition Plan View (Sheet 1 of 6)
Norkett Branch Stream Mitigation Site
DMS Project No. 95360
Monitoring Year 4 - 2017
Union County, NC

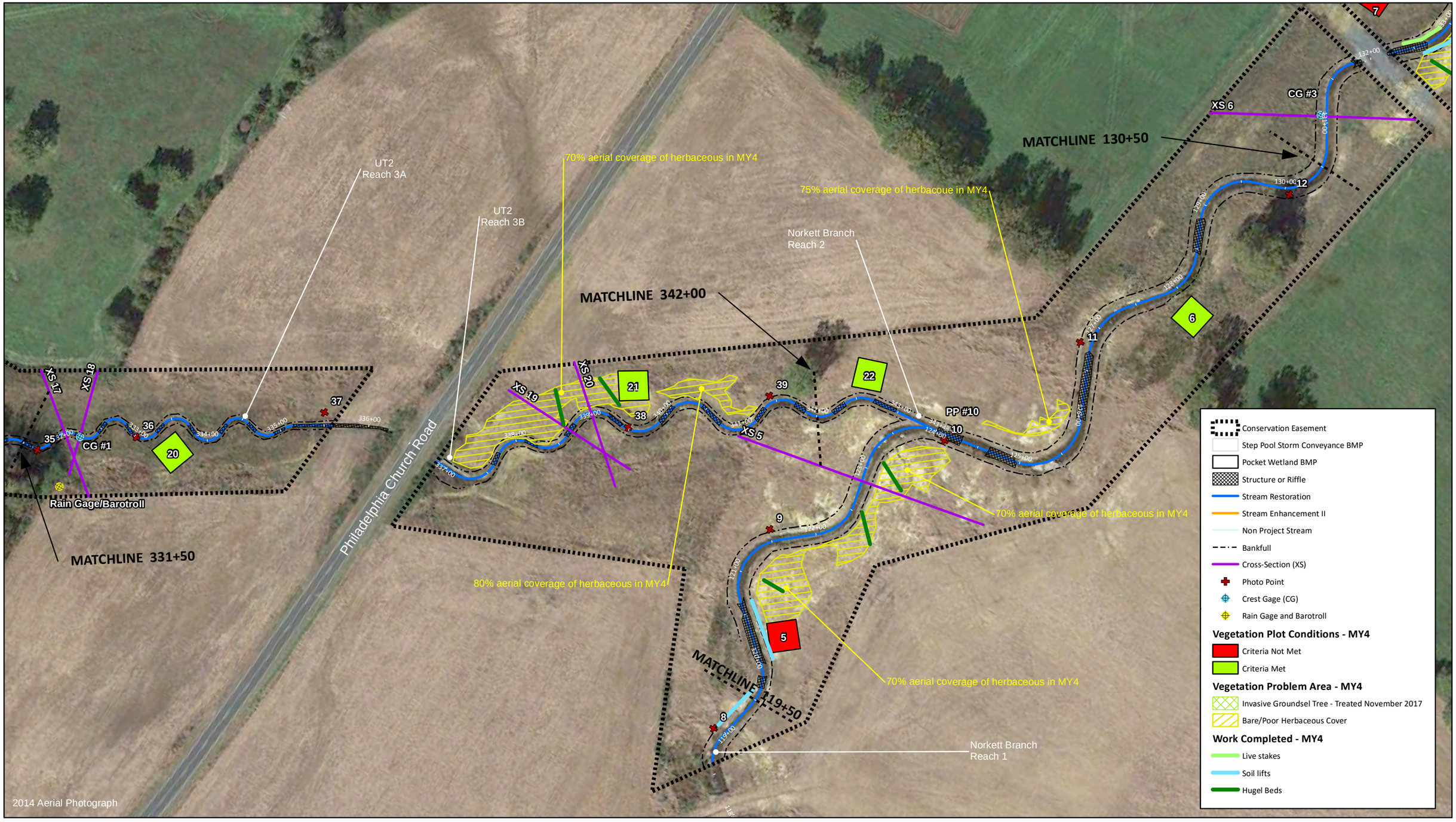


WILDLANDS ENGINEERING

0 100 200 Feet

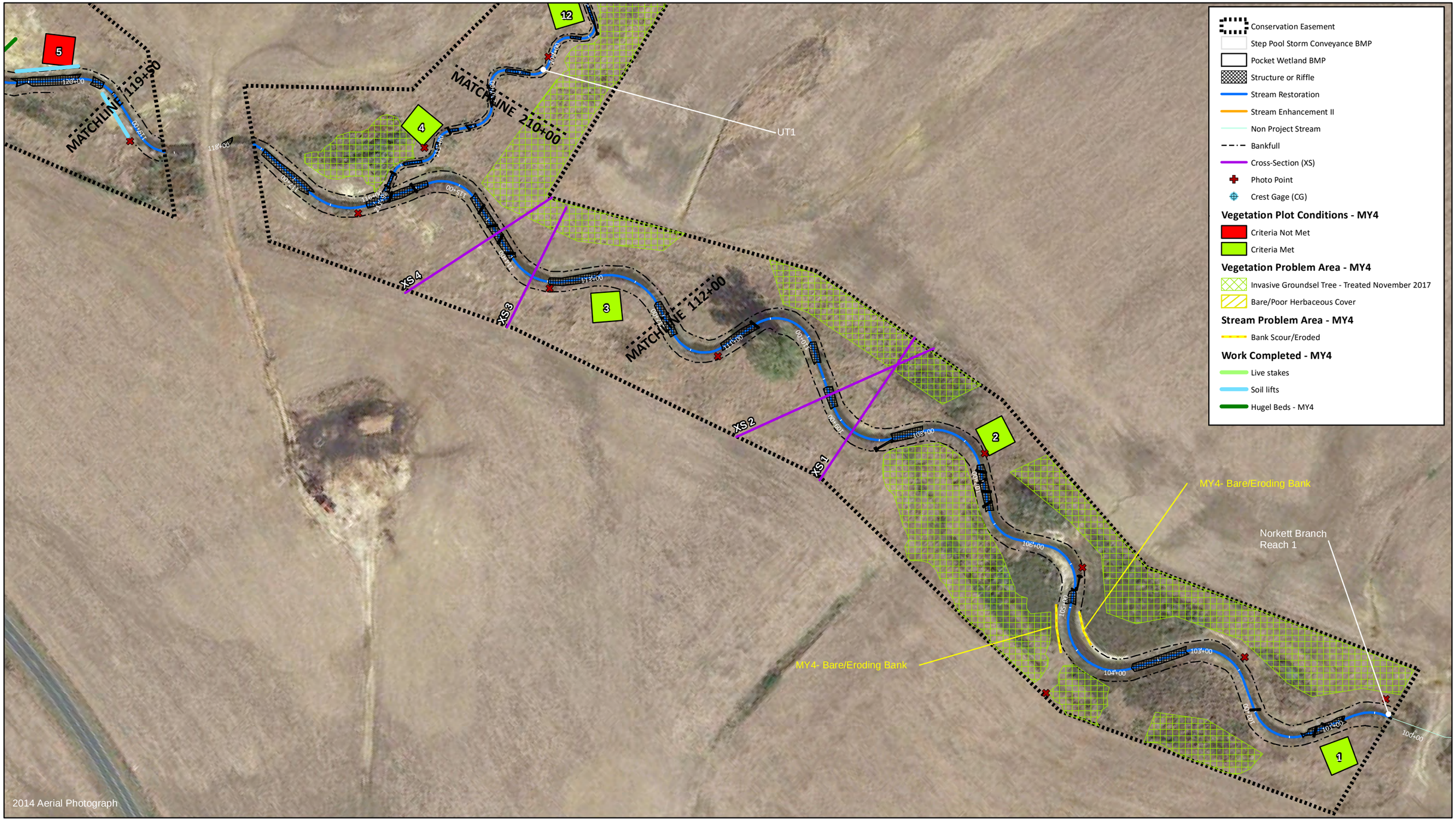
Figure 3.2 Integrated Current Condition Plan View (Sheet 2 of 6)
Norkett Branch Stream Mitigation Site
DMS Project No. 95360
Monitoring Year 4 - 2017

Union County, NC



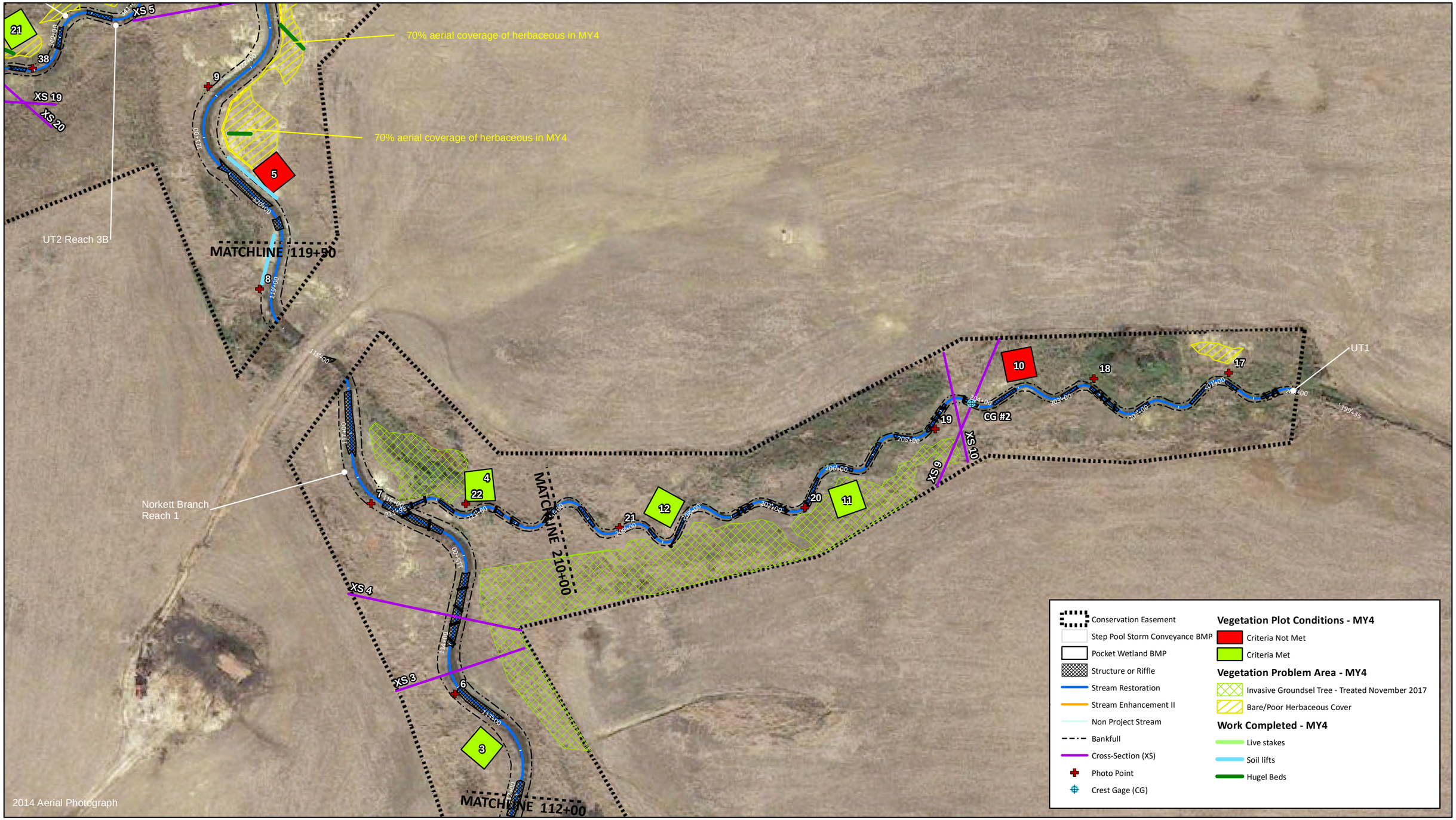
0 100 200 Feet

Figure 3.3 Integrated Current Condition Plan View (Sheet 3 of 6)
Norkett Branch Stream Mitigation Site
DMS Project No. 95360
Monitoring Year 4 - 2017
Union County, NC



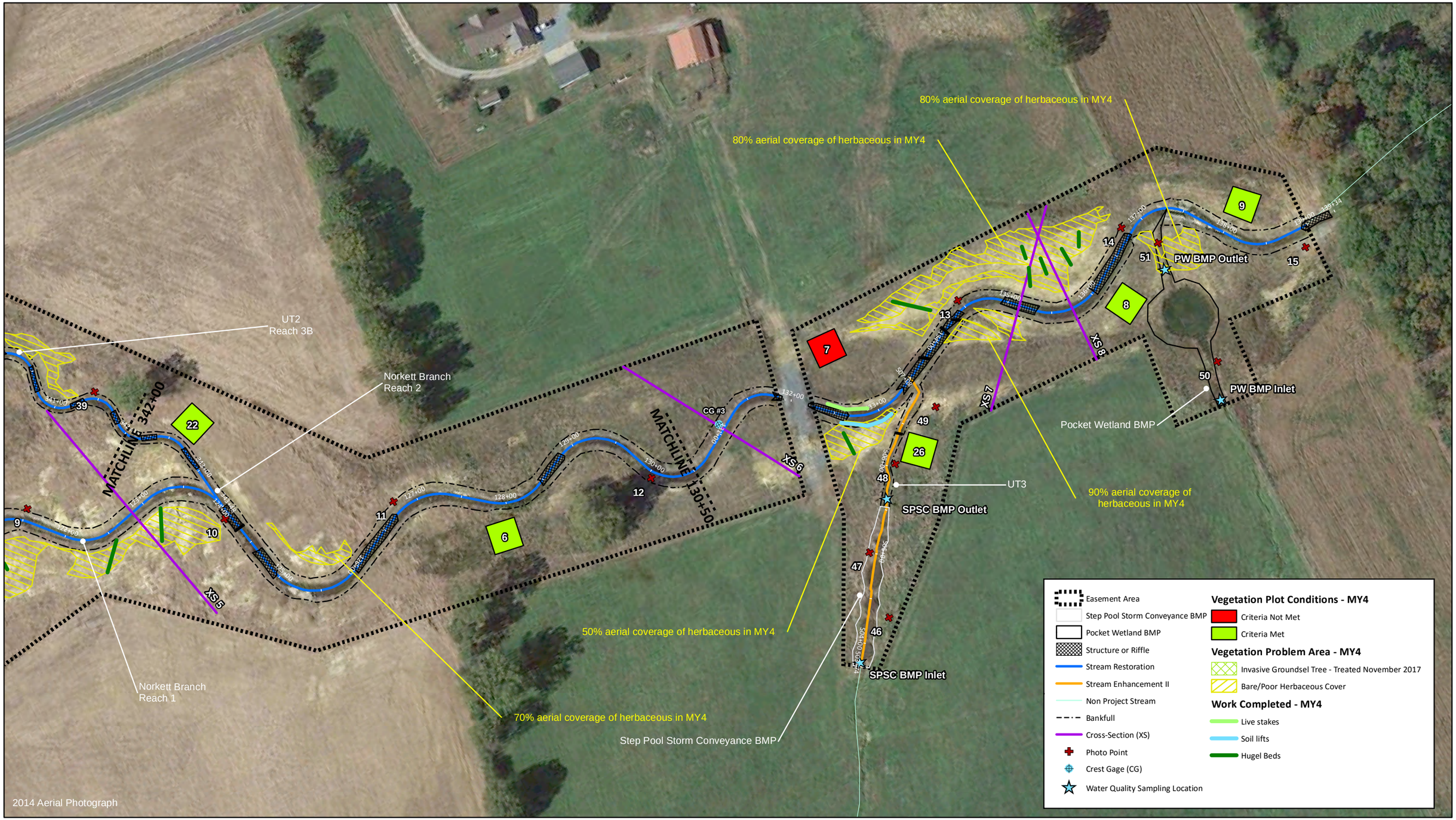
0 100 200 Feet

Figure 3.4 Integrated Current Condition Plan View (Sheet 4 of 6)
Norkett Branch Stream Mitigation Site
DMS Project No. 95360
Monitoring Year 4 - 2017
Union County, NC



0 100 200 Feet

Figure 3.5 Integrated Current Condition Plan View (Sheet 5 of 6)
Norkett Branch Stream Mitigation Site
DMS Project No. 95360
Monitoring Year 4 - 2017
Union County, NC



WILDLANDS ENGINEERING

0 100 200 Feet

Figure 3.6 Integrated Current Condition Plan View (Sheet 6 of 6)
Norkett Branch Stream Mitigation Site
DMS Project No. 95360
Monitoring Year 4 - 2017
Union County, NC

Table 6a. Visual Stream Morphology Stability Assessment Table
Norkett Branch Stream Mitigation Site
DMS Project No. 95360
Monitoring Year 4 - 2017

Norkett Branch Reach 1 - 2,313 LF

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	Adjust % for Stabilizing Woody Vegetation
1. Bed	1. Vertical Stability (Riffle and Run units)	Aggradation			0	0	100%			
		Degradation			0	0	100%			
	2. Riffle Condition	Texture/Substrate	17	17			100%			
	3. Meander Pool Condition	Depth Sufficient	16	16			100%			
		Length Appropriate	16	16			100%			
	4. Thalweg Position	Thalweg centering at upstream of meander bend (Run)	17	17			100%			
		Thalweg centering at downstream of meander bend (Glide)	17	17			100%			
2. Bank	1. Scoured/Eroded	Bank lacking vegetative cover resulting simply from poor growth and/or scour and erosion			2	140	97%	100%	100%	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%	100%	100%	100%
	3. Mass Wasting	Bank slumping, calving, or collapse			0	0	100%	100%	100%	100%
				Totals	2	140	97%	100%	100%	100%
3. Engineered Structures[1]	1. Overall Integrity	Structures physically intact with no dislodged boulders or logs.	2	2			100%			
	2. Grade Control	Grade control structures exhibiting maintenance of grade across the sill	2	2			100%			
	2a. Piping	Structures lacking any substantial flow underneath sills or arms.	2	2			100%			
	3. Bank Protection	Bank erosion within the structures extent of influence does not exceed 15%.	2	2			100%			
	4. Habitat	Pool forming structures maintaining ~Max Pool Depth : Bankfull Depth ≥ 1.6 Rootwads/logs providing some cover at baseflow.	2	2			100%			

[1]Excludes constructed riffles since they are evaluated in section 1.

Table 6b. Visual Stream Morphology Stability Assessment Table
Norkett Branch Stream Mitigation Site
DMS Project No. 95360
Monitoring Year 4 - 2017

Norkett Branch Reach 2 - 1,513 LF

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	Adjust % for Stabilizing Woody Vegetation
1. Bed	1. Vertical Stability (Riffle and Run units)	Aggradation			0	0	100%			
		Degradation			0	0	100%			
	2. Riffle Condition	Texture/Substrate	10	10			100%			
	3. Meander Pool Condition	Depth Sufficient	11	11			100%			
		Length Appropriate	11	11			100%			
	4. Thalweg Position	Thalweg centering at upstream of meander bend (Run)	12	12			100%			
		Thalweg centering at downstream of meander bend (Glide)	12	12			100%			
2. Bank	1. Scoured/Eroded	Bank lacking vegetative cover resulting simply from poor growth and/or scour and erosion			0	0	100%	100%	100%	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%	100%	100%	100%
	3. Mass Wasting	Bank slumping, calving, or collapse			0	0	100%	100%	100%	100%
				Totals	0	0	100%	100%	100%	100%
3. Engineered Structures[1]	1. Overall Integrity	Structures physically intact with no dislodged boulders or logs.	1	1			100%			
	2. Grade Control	Grade control structures exhibiting maintenance of grade across the sill	1	1			100%			
	2a. Piping	Structures lacking any substantial flow underneath sills or arms.	1	1			100%			
	3. Bank Protection	Bank erosion within the structures extent of influence does not exceed 15%.	1	1			100%			
	4. Habitat	Pool forming structures maintaining ~Max Pool Depth : Bankfull Depth ≥ 1.6 Rootwads/logs providing some cover at baseflow.	1	1			100%			

[1]Excludes constructed riffles since they are evaluated in section 1.

Table 6c. Visual Stream Morphology Stability Assessment Table

Norkett Branch Stream Mitigation Site

DMS Project No. 95360

Monitoring Year 4 - 2017

UT1 - 1,212 LF

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	Adjust % for Stabilizing Woody Vegetation
1. Bed	1. Vertical Stability (Riffle and Run units)	Aggradation			0	0	100%			
		Degradation			0	0	100%			
	2. Riffle Condition	Texture/Substrate	27	27			100%			
	3. Meander Pool Condition	Depth Sufficient	26	26			100%			
		Length Appropriate	27	27			100%			
	4. Thalweg Position	Thalweg centering at upstream of meander bend (Run)	27	27			100%			
		Thalweg centering at downstream of meander bend (Glide)	27	27			100%			
2. Bank	1. Scoured/Eroded	Bank lacking vegetative cover resulting simply from poor growth and/or scour and erosion			0	0	100%	100%	100%	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%	100%	100%	100%
	3. Mass Wasting	Bank slumping, calving, or collapse			0	0	100%	100%	100%	100%
				Totals	0	0	100%	100%	100%	100%
3. Engineered Structures[1]	1. Overall Integrity	Structures physically intact with no dislodged boulders or logs.	1	1			100%			
	2. Grade Control	Grade control structures exhibiting maintenance of grade across the sill	1	1			100%			
	2a. Piping	Structures lacking any substantial flow underneath sills or arms.	1	1			100%			
	3. Bank Protection	Bank erosion within the structures extent of influence does not exceed 15%.	1	1			100%			
	4. Habitat	Pool forming structures maintaining ~Max Pool Depth : Bankfull Depth ≥ 1.6 Rootwads/logs providing some cover at baseflow.	1	1			100%			

[1]Excludes constructed riffles since they are evaluated in section 1.

Table 6d. Visual Stream Morphology Stability Assessment Table
Norkett Branch Stream Mitigation Site
DMS Project No. 95360
Monitoring Year 4 - 2017

UT2 Reach 1 - 1,033 LF

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	Adjust % for Stabilizing Woody Vegetation
1. Bed	1. Vertical Stability (Riffle and Run units)	Aggradation			0	0	100%			
		Degradation			0	0	100%			
	2. Riffle Condition	Texture/Substrate	24	24			100%			
	3. Meander Pool Condition	Depth Sufficient	24	24			100%			
		Length Appropriate	24	24			100%			
	4. Thalweg Position	Thalweg centering at upstream of meander bend (Run)	25	25			100%			
		Thalweg centering at downstream of meander bend (Glide)	25	25			100%			
2. Bank	1. Scoured/Eroded	Bank lacking vegetative cover resulting simply from poor growth and/or scour and erosion			0	0	100%	100%	100%	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%	100%	100%	100%
	3. Mass Wasting	Bank slumping, calving, or collapse			0	0	100%	100%	100%	100%
				Totals	0	0	100%	100%	100%	100%
3. Engineered Structures[1]	1. Overall Integrity	Structures physically intact with no dislodged boulders or logs.	2	2			100%			
	2. Grade Control	Grade control structures exhibiting maintenance of grade across the sill	2	2			100%			
	2a. Piping	Structures lacking any substantial flow underneath sills or arms.	2	2			100%			
	3. Bank Protection	Bank erosion within the structures extent of influence does not exceed 15%.	2	2			100%			
	4. Habitat	Pool forming structures maintaining ~Max Pool Depth : Bankfull Depth ≥ 1.6 Rootwads/logs providing some cover at baseflow.	2	2			100%			

[1]Excludes constructed riffles since they are evaluated in section 1.

Table 6e. Visual Stream Morphology Stability Assessment Table
Norkett Branch Stream Mitigation Site
DMS Project No. 95360
Monitoring Year 4 - 2017

UT2 Reach 2 - 1,416 LF

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	Adjust % for Stabilizing Woody Vegetation
1. Bed	1. Vertical Stability (Riffle and Run units)	Aggradation			0	0	100%			
		Degradation			0	0	100%			
	2. Riffle Condition	Texture/Substrate	31	31			100%			
	3. Meander Pool Condition	Depth Sufficient	31	31			100%			
		Length Appropriate	33	33			100%			
	4. Thalweg Position	Thalweg centering at upstream of meander bend (Run)	34	34			100%			
		Thalweg centering at downstream of meander bend (Glide)	34	34			100%			
2. Bank	1. Scoured/Eroded	Bank lacking vegetative cover resulting simply from poor growth and/or scour and erosion			0	0	100%	100%	100%	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%	100%	100%	100%
	3. Mass Wasting	Bank slumping, calving, or collapse			0	0	100%	100%	100%	100%
				Totals	0	0	100%	100%	100%	100%
3. Engineered Structures[1]	1. Overall Integrity	Structures physically intact with no dislodged boulders or logs.	4	4			100%			
	2. Grade Control	Grade control structures exhibiting maintenance of grade across the sill	4	4			100%			
	2a. Piping	Structures lacking any substantial flow underneath sills or arms.	4	4			100%			
	3. Bank Protection	Bank erosion within the structures extent of influence does not exceed 15%.	4	4			100%			
	4. Habitat	Pool forming structures maintaining ~Max Pool Depth : Bankfull Depth ≥ 1.6 Rootwads/logs providing some cover at baseflow.	4	4			100%			

[1]Excludes constructed riffles since they are evaluated in section 1.

Table 6f. Visual Stream Morphology Stability Assessment Table
Norkett Branch Stream Mitigation Site
DMS Project No. 95360
Monitoring Year 4 - 2017

UT2 Reach 3A - 1,041 LF

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	Adjust % for Stabilizing Woody Vegetation
1. Bed	1. Vertical Stability (Riffle and Run units)	Aggradation			0	0	100%			
		Degradation			0	0	100%			
	2. Riffle Condition	Texture/Substrate	25	25			100%			
	3. Meander Pool Condition	Depth Sufficient	24	24			100%			
		Length Appropriate	24	24			100%			
	4. Thalweg Position	Thalweg centering at upstream of meander bend (Run)	25	25			100%			
		Thalweg centering at downstream of meander bend (Glide)	25	25			100%			
2. Bank	1. Scoured/Eroded	Bank lacking vegetative cover resulting simply from poor growth and/or scour and erosion			0	0	100%	100%	100%	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%	100%	100%	100%
	3. Mass Wasting	Bank slumping, calving, or collapse			0	0	100%	100%	100%	100%
				Totals	0	0	100%	100%	100%	100%
3. Engineered Structures[1]	1. Overall Integrity	Structures physically intact with no dislodged boulders or logs.	1	1			100%			
	2. Grade Control	Grade control structures exhibiting maintenance of grade across the sill	1	1			100%			
	2a. Piping	Structures lacking any substantial flow underneath sills or arms.	1	1			100%			
	3. Bank Protection	Bank erosion within the structures extent of influence does not exceed 15%.	1	1			100%			
	4. Habitat	Pool forming structures maintaining ~Max Pool Depth : Bankfull Depth ≥ 1.6 Rootwads/logs providing some cover at baseflow.	1	1			100%			

[1]Excludes constructed riffles since they are evaluated in section 1.

Table 6g. Visual Stream Morphology Stability Assessment Table
Norkett Branch Stream Mitigation Site
DMS Project No. 95360
Monitoring Year 4 - 2017

UT2 Reach 3B - 668 LF

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	Adjust % for Stabilizing Woody Vegetation
1. Bed	1. Vertical Stability (Riffle and Run units)	Aggradation			0	0	100%			
		Degradation			0	0	100%			
	2. Riffle Condition	Texture/Substrate	10	10			100%			
	3. Meander Pool Condition	Depth Sufficient	10	10			100%			
		Length Appropriate	10	10			100%			
	4. Thalweg Position	Thalweg centering at upstream of meander bend (Run)	11	11			100%			
		Thalweg centering at downstream of meander bend (Glide)	11	11			100%			
2. Bank	1. Scoured/Eroded	Bank lacking vegetative cover resulting simply from poor growth and/or scour and erosion			0	0	100%	100%	100%	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%	100%	100%	100%
	3. Mass Wasting	Bank slumping, calving, or collapse			0	0	100%	100%	100%	100%
				Totals	0	0	100%	100%	100%	100%
3. Engineered Structures[1]	1. Overall Integrity	Structures physically intact with no dislodged boulders or logs.	2	2			100%			
	2. Grade Control	Grade control structures exhibiting maintenance of grade across the sill	2	2			100%			
	2a. Piping	Structures lacking any substantial flow underneath sills or arms.	2	2			100%			
	3. Bank Protection	Bank erosion within the structures extent of influence does not exceed 15%.	2	2			100%			
	4. Habitat	Pool forming structures maintaining ~Max Pool Depth : Bankfull Depth ≥ 1.6 Rootwads/logs providing some cover at baseflow.	2	2			100%			

[1]Excludes constructed riffles since they are evaluated in section 1.

Table 7. Vegetation Condition Assessment Table

Norkett Branch Stream Mitigation Site

DMS Project No. 95360

Monitoring Year 4 - 2017

Planted Acreage **29.9**

Vegetation Category	Definitions	Mapping Threshold (acres)	Number of Polygons	Combined Acreage	% of Planted Acreage
Bare Areas	Very limited cover of both woody and herbaceous material	0.1	15	0.4	1%
Low Stem Density Areas[1]	Woody stem densities clearly below target levels based on MY3, 4, 5, or 7 stem count criteria.	0.1	3	0.1	0%
		Total	**18**	**0.5**	**2%**
Areas of Poor Growth Rates or Vigor	Areas with woody stems of a size class that are obviously small given the monitoring year.	0	0	0.0	0%
		Cumulative Total	**18**	**0.5**	**2%**

Easement Acreage **31.6**

Vegetation Category	Definitions	Mapping Threshold (SF)	Number of Polygons	Combined Acreage	% of Planted Acreage
Invasive Areas of Concern	Areas or points (if too small to render as polygons at map scale).	1000	8	2.3	8%
Easement Encroachment Areas	Areas or points (if too small to render as polygons at map scale).	none	0	0	0%

[1]Acreage calculated from vegetation plots monitored for site.

Stream Photographs

	
Photo Point 1 – looking upstream *(08/22/2017)*	**Photo Point 1** – looking downstream *(08/22/2017)*
	
Photo Point 2 – looking upstream *(08/22/2017)*	**Photo Point 2** – looking downstream *(08/22/2017)*
	
Photo Point 3 – looking upstream *(08/22/2017)*	**Photo Point 3** – looking downstream *(08/22/2017)*

	
Photo Point 4 – looking upstream *(08/22/2017)*	**Photo Point 4** – looking downstream *(08/22/2017)*
	
Photo Point 5 – looking upstream *(08/22/2017)*	**Photo Point 5** – looking downstream *(08/22/2017)*
	
Photo Point 6 – looking upstream *(08/22/2017)*	**Photo Point 6** – looking downstream *(08/22/2017)*

	
Photo Point 7 – looking upstream *(08/22/2017)*	**Photo Point 7** – looking downstream *(08/22/2017)*
	
Photo Point 8 – looking upstream *(08/15/2017)*	**Photo Point 8** – looking downstream *(08/15/2017)*
	
Photo Point 9 – looking upstream *(08/15/2017)*	**Photo Point 9** – looking downstream *(08/15/2017)*

	
Photo Point 10 – looking upstream *(08/15/2017)*	**Photo Point 10** – looking downstream *(08/15/2017)*
	
Photo Point 11 – looking upstream *(08/15/2017)*	**Photo Point 11** – looking downstream *(08/15/2017)*
	
Photo Point 12 – looking upstream *(08/15/2017)*	**Photo Point 12** – looking downstream *(08/15/2017)*

	
Photo Point 13 – looking upstream *(08/15/2017)*	**Photo Point 13** – looking downstream *(08/15/2017)*
	
Photo Point 14 – looking upstream *(08/15/2017)*	**Photo Point 14** – looking downstream *(08/15/2017)*
	
Photo Point 15 – looking upstream *(08/15/2017)*	**Photo Point 15** – looking downstream *(08/15/2017)*

	
Photo Point 16 – looking upstream *(08/22/2017)*	**Photo Point 16** – looking downstream *(08/22/2017)*
	
Photo Point 17 – looking upstream *(08/22/2017)*	**Photo Point 17** – looking downstream *(08/22/2017)*
	
Photo Point 18 – looking upstream *(08/22/2017)*	**Photo Point 18** – looking downstream *(08/22/2017)*

	
Photo Point 19 – looking upstream *(08/22/2017)*	**Photo Point 19** – looking downstream *(08/22/2017)*
	
Photo Point 20 – looking upstream *(08/22/2017)*	**Photo Point 20** – looking downstream *(08/22/2017)*
	
Photo Point 21 – looking upstream *(08/22/2017)*	**Photo Point 21** – looking downstream *(08/22/2017)*

	
Photo Point 22 – looking upstream *(08/22/2017)*	**Photo Point 22** – looking downstream *(08/22/2017)*
	
Photo Point 23 – looking upstream *(08/15/2017)*	**Photo Point 23** – looking downstream *(08/15/2017)*
	
Photo Point 24 – looking upstream *(08/15/2017)*	**Photo Point 24** – looking downstream *(08/15/2017)*

	
Photo Point 25 – looking upstream *(08/15/2017)*	**Photo Point 25** – looking downstream *(08/15/2017)*
	
Photo Point 26 – looking upstream *(08/15/2017)*	**Photo Point 26** – looking downstream *(08/15/2017)*
	
Photo Point 27 – looking upstream *(08/15/2017)*	**Photo Point 27** – looking downstream *(08/15/2017)*

	
Photo Point 28 – looking upstream *(08/15/2017)*	**Photo Point 28** – looking downstream *(08/15/2017)*
	
Photo Point 29 – looking upstream *(08/15/2017)*	**Photo Point 29** – looking downstream *(08/15/2017)*
	
Photo Point 30 – looking upstream *(08/15/2017)*	**Photo Point 30** – looking downstream *(08/15/2017)*

	
Photo Point 31 – looking upstream *(08/15/2017)*	**Photo Point 31** – looking downstream *(08/15/2017)*
	
Photo Point 32 – looking upstream *(08/15/2017)*	**Photo Point 32** – looking downstream *(08/15/2017)*
	
Photo Point 33 – looking upstream *(08/15/2017)*	**Photo Point 33** – looking downstream *(08/15/2017)*

	
Photo Point 34 – looking upstream *(08/15/2017)*	**Photo Point 34** – looking downstream *(08/15/2017)*
	
Photo Point 35 – looking upstream *(08/15/2017)*	**Photo Point 35** – looking downstream *(08/15/2017)*
	
Photo Point 36 – looking upstream *(08/15/2017)*	**Photo Point 36** – looking downstream *(08/15/2017)*

	
Photo Point 37 – looking upstream *(08/15/2017)*	**Photo Point 37** – looking downstream *(08/15/2017)*
	
Photo Point 38 – looking upstream *(08/15/2017)*	**Photo Point 38** – looking downstream *(08/15/2017)*
	
Photo Point 39 – looking upstream *(08/15/2017)*	**Photo Point 39** – looking downstream *(08/15/2017)*

	
Photo Point 40 – looking upstream *(08/15/2017)*	**Photo Point 40** – looking downstream *(08/15/2017)*
	
Photo Point 41 – looking upstream *(08/15/2017)*	**Photo Point 41** – looking downstream *(08/15/2017)*
	
Photo Point 42 – looking upstream *(08/15/2017)*	**Photo Point 42** – looking downstream *(08/15/2017)*

	
Photo Point 43 – looking upstream *(08/15/2017)*	**Photo Point 43** – looking downstream *(08/15/2017)*
	
Photo Point 44 – looking upstream *(08/15/2017)*	**Photo Point 44** – looking downstream *(08/15/2017)*
	
Photo Point 45 – looking upstream *(08/15/2017)*	**Photo Point 45** – looking downstream *(08/15/2017)*

	
Photo Point 46 – looking upstream *(08/15/2017)*	**Photo Point 46** – looking downstream *(08/15/2017)*
	
Photo Point 47 – looking upstream *(08/15/2017)*	**Photo Point 47** – looking downstream *(08/15/2017)*
	
Photo Point 48 – looking upstream *(08/15/2017)*	**Photo Point 48** – looking downstream *(08/15/2017)*

	
Photo Point 49 – looking upstream *(08/15/2017)*	**Photo Point 49** – looking downstream *(08/15/2017)*
	
Photo Point 50 – looking downstream *(08/15/2017)*	**Photo Point 51** – looking upstream *(08/15/2017)*

Vegetation Photographs

	
Vegetation Plot 1 – (08/16/2017)	Vegetation Plot 2 – (08/16/2017)
	
Vegetation Plot 3 – (08/16/2017)	Vegetation Plot 4 – (08/14/2017)
	
Vegetation Plot 5 – (08/14/2017)	Vegetation Plot 6 – (08/14/2017)

	
Vegetation Plot 7 – (08/14/2017)	Vegetation Plot 8 – (08/14/2017)
	
Vegetation Plot 9 – (08/14/2017)	Vegetation Plot 10 – (08/16/2017)
	
Vegetation Plot 11 – (08/16/2017)	Vegetation Plot 12 – (08/14/2017)

	
Vegetation Plot 13 – (08/16/2017)	Vegetation Plot 14 – (08/16/2017)
	
Vegetation Plot 15 – (08/16/2017)	Vegetation Plot 16 – (08/16/2017)
	
Vegetation Plot 17 – (08/16/2017)	Vegetation Plot 18 – (08/16/2017)

	
Vegetation Plot 19 – (08/18/2017)	Vegetation Plot 20 – (08/16/2017)
	
Vegetation Plot 21 – (08/14/2017)	Vegetation Plot 22 – (08/14/2017)
	
Vegetation Plot 23 – (08/18/2017)	Vegetation Plot 24 – (08/14/2017)

	
Vegetation Plot 25 – (08/18/2017)	Vegetation Plot 26 – (08/14/2017)

Areas of Concern

Invasive Plant Population (Groundsel Tree) – 10/17/2017

Invasive Plant Population (Parrotfeather) – 10/17/2017

Bare / Poor Herbaceous Cover – 10/17/2017

Bare / Poor Herbaceous Cover – 10/17/2017

Bare Banks: Norkett Branch Station 104+00 – 10/17/2017

APPENDIX 3. Vegetation Plot Data

Table 8. Vegetation Plot Criteria Attainment

Norkett Branch Stream Mitigation Site
DMS Project No. 95360
Monitoring Year 4 - 2017

Plot	MY4 Success Criteria Met (Y/N)	Tract Mean
1	Y	88%
2	Y	
3	Y	
4	Y	
5	N	
6	Y	
7	N	
8	Y	
9	Y	
10	N	
11	Y	
12	Y	
13	Y	
14	Y	
15	Y	
16	Y	
17	Y	
18	Y	
19	Y	
20	Y	
21	Y	
22	Y	
23	Y	
24	Y	
25	Y	
26	Y	

Table 9. CVS Vegetation Plot Metadata
Norkett Branch Stream Mitigation Site
DMS Project No. 95360
Monitoring Year 4 - 2017

Report Prepared By	Ian Eckardt
Date Prepared	10/13/2017 14:59
database name	cvs-eep-entrytool-v2.3.1 MY4.mdb
database location	Q:\ActiveProjects\005-02134 Norkett Branch FDP\Monitoring\Monitoring Year 4\Vegetation Assessment
computer name	IAN-PC
file size	48234496
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	95360
project Name	Norkett Branch Stream Mitigation Site
Description	
River Basin	
length(ft)	10706
stream-to-edge width (ft)	50
area (sq m)	127880.66
Required Plots (calculated)	22
Sampled Plots	26

Table 10. Planted and Total Stem Counts (Species by Plot with Annual Means)
Norkett Branch Stream Mitigation Site
DMS Project No. 95360
Monitoring Year 4 - 2017

Scientific Name	Common Name	Species Type	Current Plot Data (MY4 2017)																				
			95360-WEI-0001			95360-WEI-0002			95360-WEI-0003			95360-WEI-0004			95360-WEI-0005			95360-WEI-0006			95360-WEI-0007		
			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 rubrum	red maple	Tree				1	1	1	1	1	1	2	2	2									
Betula nigra	river birch	Tree	3	3	3	1	1	1	1	1	1				2	2	2	2	2	2	1	1	1
Carya sp.	hickory	Tree																					
Celtis laevigata	sugarberry	Tree																					
Cephalanthus occidentalis	common buttonbush	Shrub			2																		
Cercis canadensis	eastern redbud	Tree													1	1	1						
Cornus florida	flowering dogwood	Tree																					
Diospyros virginiana	common persimmon	Tree						3															
Fraxinus pennsylvanica	green ash	Tree	2	2	2	5	5	5							1	1	1	4	4	4	3	3	3
Hamamelis virginiana	American witchhazel	Tree																					
Liquidambar styraciflua	sweetgum	Tree																					
Liriodendron tulipifera	tuliptree	Tree																					
Pinus rigida	pitch pine	Tree									1												
Pinus strobus	eastern white pine	Tree																					
Platanus occidentalis	American sycamore	Tree	5	5	5	6	6	6	7	7	7	8	8	8	2	2	2	3	3	3	1	1	1
Populus deltoides	eastern cottonwood	Tree									1												
Quercus michauxii	swamp chestnut oak	Tree																					
Quercus phellos	willow oak	Tree																1	1	1			
Quercus rubra	northern red oak	Tree	1	1	1				3	3	3	1	1	1									
Salix	Unknown willow	Shrub or Tree																					
Salix nigra	black willow	Tree																					
Sambucus canadensis	Common Elderberry	Shrub										1	1	1									
Taxodium distichum	bald cypress	Tree																					
Ulmus alata	winged elm	Tree																					
Unknown		Shrub or Tree																					
Stem count			11	11	13	13	13	16	12	12	14	12	12	12	6	6	6	10	10	10	5	5	5
size (ares)			1			1			1			1			1			1			1		
size (ACRES)			0.02			0.02			0.02			0.02			0.02			0.02			0.02		
Species count			4	4	5	4	4	5	4	4	6	4	4	4	4	4	4	4	4	4	3	3	3
Stems per ACRE			445	445	526	526	526	647	486	486	567	486	486	486	243	243	243	405	405	405	202	202	202

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%
Volunteer species included in total

PnoLS: Planted Stems excluding live stakes
P-all: All planted stems
T: Total stems including volunteers
* Supplemental planting was performed in MY2 (February 2015) included 6,000 stems or approximately 37% of MY1 stem total.

Table 10. Planted and Total Stem Counts (Species by Plot with Annual Means)
Norkett Branch Stream Mitigation Site
DMS Project No. 95360
Monitoring Year 4 - 2017

Scientific Name	Common Name	Species Type	Current Plot Data (MY4 2017)																					
			95360-WEI-0008			95360-WEI-0009			95360-WEI-0010			95360-WEI-0011			95360-WEI-0012			95360-WEI-0013			95360-WEI-0014		
			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 rubrum	red maple	Tree			1																			
Betula nigra	river birch	Tree	3	3	3				2	2	2	1	1	1	1	1	1	1	1	1	1	1	1	1
Carya sp.	hickory	Tree																						
Celtis laevigata	sugarberry	Tree																		5				
Cephalanthus occidentalis	common buttonbush	Shrub																						
Cercis canadensis	eastern redbud	Tree							1	1	1										1	1	1	
Cornus florida	flowering dogwood	Tree																						
Diospyros virginiana	common persimmon	Tree																						
Fraxinus pennsylvanica	green ash	Tree	5	5	5	2	2	7	2	2	2	6	6	6	1	1	1	2	2	2	3	3	3	
Hamamelis virginiana	American witchhazel	Tree																						
Liquidambar styraciflua	sweetgum	Tree																		1				
Liriodendron tulipifera	tuliptree	Tree	1	1	1																			
Pinus rigida	pitch pine	Tree			1																			
Pinus strobus	eastern white pine	Tree						1																
Platanus occidentalis	American sycamore	Tree	4	4	4	6	6	6	1	1	1	4	4	4	7	7	7	4	4	4	2	2	2	
Populus deltoides	eastern cottonwood	Tree																						
Quercus michauxii	swamp chestnut oak	Tree	1	1	1																			
Quercus phellos	willow oak	Tree				2	2	2										1	1	1				
Quercus rubra	northern red oak	Tree	1	1	1										1	1	1	1	1	1	1	1	1	
Salix	Unknown willow	Shrub or Tree												4						1				
Salix nigra	black willow	Tree																						
Sambucus canadensis	Common Elderberry	Shrub																						
Taxodium distichum	bald cypress	Tree																						
Ulmus alata	winged elm	Tree						6																
Unknown		Shrub or Tree																						
Stem count			15	15	17	10	10	22	6	6	6	11	11	15	10	10	10	9	9	16	8	8	8	
size (ares)			1			1			1			1			1			1			1			
size (ACRES)			0.02			0.02			0.02			0.02			0.02			0.02			0.02			
Species count			6	6	8	3	3	5	4	4	4	3	3	4	4	4	4	5	5	8	5	5	5	
Stems per ACRE			607	607	688	405	405	890	243	243	243	445	445	607	405	405	405	364	364	647	324	324	324	

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%
Volunteer species included in total

PnoLS: Planted Stems excluding live stakes
P-all: All planted stems
T: Total stems including volunteers
* Supplemental planting was performed in MY2 (February 2015) included 6,000 stems or approximately 37% of MY1 stem total.

Table 10. Planted and Total Stem Counts (Species by Plot with Annual Means)
Norkett Branch Stream Mitigation Site
DMS Project No. 95360
Monitoring Year 4 - 2017

Scientific Name	Common Name	Species Type	Current Plot Data (MY4 2017)																				
			95360-WEI-0015			95360-WEI-0016			95360-WEI-0017			95360-WEI-0018			95360-WEI-0019			95360-WEI-0020			95360-WEI-0021		
			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 rubrum	red maple	Tree																					2
Betula nigra	river birch	Tree	1	1	1				1	1	1				1	1	1	1	1	1			
Carya sp.	hickory	Tree																					
Celtis laevigata	sugarberry	Tree									1												
Cephalanthus occidentalis	common buttonbush	Shrub																					
Cercis canadensis	eastern redbud	Tree				1	1	1													4	4	4
Cornus florida	flowering dogwood	Tree																					
Diospyros virginiana	common persimmon	Tree																					
Fraxinus pennsylvanica	green ash	Tree	4	4	4	3	3	3	3	3	5	3	3	3	3	3	3	3	3	3			1
Hamamelis virginiana	American witchhazel	Tree																			2	2	2
Liquidambar styraciflua	sweetgum	Tree									6						2						
Liriodendron tulipifera	tuliptree	Tree													1	1	1				1	1	1
Pinus rigida	pitch pine	Tree																					
Pinus strobus	eastern white pine	Tree																					
Platanus occidentalis	American sycamore	Tree	3	3	3	1	1	1	4	4	4	4	4	4	4	4	4	4	4	4	6	6	6
Populus deltoides	eastern cottonwood	Tree																					
Quercus michauxii	swamp chestnut oak	Tree										1	1	1	1	1	1	1	1	1			
Quercus phellos	willow oak	Tree	1	1	1	1	1	1	2	2	2	1	1	1	1	1	1	1	1	1	1	1	1
Quercus rubra	northern red oak	Tree	1	1	1	1	1	1	2	2	2				1	1	1				1	1	1
Salix	Unknown willow	Shrub or Tree																					
Salix nigra	black willow	Tree																					
Sambucus canadensis	Common Elderberry	Shrub																					
Taxodium distichum	bald cypress	Tree																					
Ulmus alata	winged elm	Tree						3			3			1			1						
Unknown		Shrub or Tree															1						
Stem count			10	10	10	7	7	10	12	12	24	9	9	10	12	12	16	10	10	10	15	15	18
size (ares)			1			1			1			1			1			1			1		
size (ACRES)			0.02			0.02			0.02			0.02			0.02			0.02			0.02		
Species count			5	5	5	5	5	6	5	5	8	4	4	5	7	7	10	5	5	5	6	6	8
Stems per ACRE			405	405	405	283	283	405	486	486	971	364	364	405	486	486	647	405	405	405	607	607	728

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%
Volunteer species included in total

PnoLS: Planted Stems excluding live stakes
P-all: All planted stems
T: Total stems including volunteers
* Supplemental planting was performed in MY2 (February 2015) included 6,000 stems or approximately 37% of MY1 stem total.

Table 10. Planted and Total Stem Counts (Species by Plot with Annual Means)

Norkett Branch Stream Mitigation Site

DMS Project No. 95360

Monitoring Year 4 - 2017

Scientific Name	Common Name	Species Type	Current Plot Data (MY4 2017)														
			95360-WEI-0022			95360-WEI-0023			95360-WEI-0024			95360-WEI-0025			95360-WEI-0026		
			PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T
Acer rubrum	red maple	Tree															
Betula nigra	river birch	Tree	1	1	1	1	1	1	1	1	1	1	1	1			
Carya sp.	hickory	Tree															
Celtis laevigata	sugarberry	Tree															
Cephalanthus occidentalis	common buttonbush	Shrub															
Cercis canadensis	eastern redbud	Tree				1	1	1				1	1	1			
Cornus florida	flowering dogwood	Tree															
Diospyros virginiana	common persimmon	Tree															
Fraxinus pennsylvanica	green ash	Tree	6	6	6	3	3	3	3	3	3	3	3	3	5	5	5
Hamamelis virginiana	American witchhazel	Tree													1	1	1
Liquidambar styraciflua	sweetgum	Tree															
Liriodendron tulipifera	tuliptree	Tree				1	1	1				1	1	1	1	1	1
Pinus rigida	pitch pine	Tree															
Pinus strobus	eastern white pine	Tree															
Platanus occidentalis	American sycamore	Tree	5	5	5	3	3	3	4	4	4	2	2	2	2	2	2
Populus deltoides	eastern cottonwood	Tree															
Quercus michauxii	swamp chestnut oak	Tree				1	1	1	1	1	1	1	1	1			
Quercus phellos	willow oak	Tree	2	2	2	2	2	2	1	1	1						
Quercus rubra	northern red oak	Tree				1	1	1				1	1	1	2	2	2
Salix	Unknown willow	Shrub or Tree															
Salix nigra	black willow	Tree															
Sambucus canadensis	Common Elderberry	Shrub															
Taxodium distichum	bald cypress	Tree															
Ulmus alata	winged elm	Tree															1
Unknown		Shrub or Tree															
Stem count			14	14	14	13	13	13	10	10	10	10	10	10	11	11	12
size (ares)			1			1			1			1			1		
size (ACRES)			0.02			0.02			0.02			0.02			0.02		
Species count			4	4	4	8	8	8	5	5	5	7	7	7	5	5	6
Stems per ACRE			567	567	567	526	526	526	405	405	405	405	405	405	445	445	486

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%

Volunteer species included in total

PnoLS: Planted Stems excluding live stakes

P-all: All planted stems

T: Total stems including volunteers

* Supplemental planting was performed in MY2 (February 2015) included 6,000 stems or approximately 37% of MY1 stem total.

Table 10. Planted and Total Stem Counts (Species by Plot with Annual Means)

Norkett Branch Stream Mitigation Site

DMS Project No. 95360

Monitoring Year 4 - 2017

Scientific Name	Common Name	Species Type	Annual Sumarry														
			MY4 (2017)			MY3 (2016)			MY2 (2015)			MY1 (2014)			MY0 (2014)		
			PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T
Acer rubrum	red maple	Tree	4	4	7	4	4	6	4	4	4						
Betula nigra	river birch	Tree	27	27	27	27	27	27	27	27	27	25	25	25	32	32	32
Carya sp.	hickory	Tree						6									
Celtis laevigata	sugarberry	Tree			6							1	1	1	7	7	7
Cephalanthus occidentalis	common buttonbush	Shrub			2	1	1	1	1	1	2						
Cercis canadensis	eastern redbud	Tree	10	10	10	12	12	12	14	14	14	25	25	25	42	42	42
Cornus florida	flowering dogwood	Tree				8	8	8	10	10	10	48	48	48	75	75	75
Diospyros virginiana	common persimmon	Tree			3			2			3						
Fraxinus pennsylvanica	green ash	Tree	75	75	83	76	76	82	73	73	75	63	63	63	67	67	67
Hamamelis virginiana	American witchhazel	Tree	3	3	3	3	3	3	3	3	3	7	7	7	8	8	8
Liquidambar styraciflua	sweetgum	Tree			9						5						
Liriodendron tulipifera	tuliptree	Tree	6	6	6	9	9	16	11	11	11	24	24	24	59	59	59
Pinus rigida	pitch pine	Tree			2												
Pinus strobus	eastern white pine	Tree			1												
Platanus occidentalis	American sycamore	Tree	100	100	100	105	105	106	106	106	106	67	67	67	57	57	57
Populus deltoides	eastern cottonwood	Tree			1			1			1						
Quercus michauxii	swamp chestnut oak	Tree	7	7	7	7	7	7	7	7	7	18	18	18	36	36	36
Quercus phellos	willow oak	Tree	17	17	17	19	19	19	20	20	20	34	34	34	27	27	27
Quercus rubra	northern red oak	Tree	19	19	19	20	20	20	23	23	23	24	24	24	24	24	24
Salix	Unknown willow	Shrub or Tree			5												
Salix nigra	black willow	Tree						7			1						
Sambucus canadensis	Common Elderberry	Shrub	1	1	1	2	2	3	2	2	2	10	10	11	13	13	13
Taxodium distichum	bald cypress	Tree							1	1	1						
Ulmus alata	winged elm	Tree			15			17			6						
Unknown		Shrub or Tree			1												
		Stem count	269	269	325	293	293	343	302	302	321	346	346	347	447	447	447
		size (ares)	26			26			26			26			26		
		size (ACRES)	0.64			0.64			0.64			0.64			0.64		
		Species count	11	11	21	13	13	18	14	14	19	12	12	12	12	12	12
		Stems per ACRE	419	419	506	456	456	534	470	470	500	539	539	540	696	696	696

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%

Volunteer species included in total

PnoLS: Planted Stems excluding live stakes

P-all: All planted stems

T: Total stems including volunteers

* Supplemental planting was performed in MY2 (February 2015) included 6,000 stems or approximately 37% of MY1 stem total.

APPENDIX 4. Morphological Summary Data and Plots

Table 11a. Baseline Stream Data Summary

Norkett Branch Stream Mitigation Site

DMS Project No. 95360

Monitoring Year 4 - 2017

Norkett Branch Reaches 1 and 2

		PRE-RESTORATION CONDITION				REFERENCE REACHES						DESIGN				AS-BUILT/BASELINE			
Parameter	**Gage**	**Norkett Branch Reach 1**		**Norkett Branch Reach 2**		**Spencer Creek**		**UT to Spencer Creek**		**UT Richland Creek Reach 2**		**Norkett Branch Reach 1**		**Norkett Branch Reach 2**		**Norkett Branch Reach 1**		**Norkett Branch Reach 2**	
		Min	**Max**	**Min**	**Max**	**Min**	**Max**	**Min**	**Max**	**Min**	**Max**	**Min**	**Max**	**Min**	**Max**	**Min**	**Max**	**Min**	**Max**
Dimension and Substrate - Riffle																			
Bankfull Width (ft)		12.8	21.5	22.0	29.5	10.7	11.2	7.0		13.3	15.2	22.0		23.0		22.5	26.6	25.6	25.7
Floodprone Width (ft)		35	58	72	85	60	114+	>81		>50		48	>110	61	>115	>200	>200	>200	>200
Bankfull Mean Depth		1.7	1.8	1.4	2.4	1.6	1.8	2.0		1.1	1.3	1.8		1.9		1.6	1.8	1.8	2.0
Bankfull Max Depth		3.1	3.2	2.3	2.9	2.1	2.6	1.1		1.8	2.1	2.8		2.8		2.6	3.3	3.0	3.3
Bankfull Cross-sectional Area (ft^2)	n/a	28.1	35.6	40.6	52.8	17.8	19.7	7.7		16.5	17.5	40.6		43.2		38.8	44.6	46.7	50.8
Width/Depth Ratio		5.9	13.0	9.2	21.4	5.8	7.1	6.4		10.1	13.9	11.9		12.2		13.1	16.7	13.0	14.1
Entrenchment Ratio		2.1	4.5	2.9	3.3	5.5	10.2	>11.6		>2.5		2.2	>5.0	2.2	>5.0	>2.2		>2.2	
Bank Height Ratio		1.0	1.4	1.3	1.6	1.0		1.0		1.0		1.0		1.0		1.0		1.0	
D50 (mm)		8.6		0.4								---		---		18.4	59.6	7.3	9.9
Profile																			
Riffle Length (ft)						---		---		---		---		---		14	84	19	111
Riffle Slope (ft/ft)		0.0036	0.0039	0.0032	0.0120	0.0130		0.0140		0.0183	0.0355	0.0018	0.0120	0.0023	0.0180	0.0000	0.0152	0.0009	0.0163
Pool Length (ft)	n/a					---		---		---		---		---		12	88	51	102
Pool Max Depth (ft)		4.0	4.0	2.9	4.0	3.3		2.5		1.8		2.8	7.8	2.8	7.9	3.3	5.1	3.5	4.8
Pool Spacing (ft)^		62	300	60	300	71.0		19	42	33.0	93.0	29	163	30	170	67	183	98	172
Pool Volume (ft^3)																			
Pattern																			
Channel Beltwidth (ft)		N/A		N/A		38	41	11	27	N/A		35	161	37	168	38	147	38	155
Radius of Curvature (ft)		N/A		N/A		11	15	6	16	N/A		40	66	41	69	38	65	40	64
Rc:Bankfull Width (ft/ft)	n/a	N/A		N/A		1.0	1.3	0.8	2.3	N/A		1.8	3.0	1.8	3.0	1.7	2.4	1.6	2.5
Meander Length (ft)		N/A		N/A		46	48	37.7	43	N/A		66	264	69	276	167	263	181	277
Meander Width Ratio		N/A		N/A		3.6	3.7	1.6	3.8	N/A		1.6	7.3	1.6	7.3	1.7	5.5	1.5	6.0
Substrate, Bed and Transport Parameters																			
Ri%/Ru%/P%/G%/S%																			
SC%/Sa%/G%/C%/B%/Be%																			
d16/d35/d50/d84/d95/d100	n/a	SC/4.6/8.7/28.5/64/2048		SC/SC/0.4/21.1/>2048/>2048		---		---		---						0.4/3.6/7.4/52.3/139.4/362		2.6/6.7/13.0/62.6/210.9/>2048	
Reach Shear Stress (Competency) lb/ft^2		0.41	0.44	0.17	0.38							0.28		0.40		0.27	0.29	0.30	0.32
Max part size (mm) mobilized at bankfull												15-25		20-35		15-25		20-35	
Stream Power (Capacity) W/m^2																			
Additional Reach Parameters																			
Drainage Area (SM)		2.3		3.2		0.96		0.01		0.28		2.3		3.2		2.3		3.2	
Watershed Impervious Cover Estimate (%)		<1% [1]		<1% [1]		---		---		---		<1% [1]		<1% [1]		<1% [1]		<1% [1]	
Rosgen Classification		E4		C/E5		E4		E5		C4/E4		C4		C5		C4		C4/E4	
Bankfull Velocity (fps)		3.5	4.0	2.5	3.5	4.9	5.4	3.2		3.5	4.1	2.8		3.3		2.6	2.8	2.8	2.9
Bankfull Discharge (cfs)		110		140		97		25		29	32	110		140		105	124	130	148
Q-NFF regression																			
Q-USGS extrapolation	n/a																		
Q-Mannings																			
Valley Length (ft)		---		---		---		---		---		1,910		1,249		1,910		1,249	
Channel Thalweg Length (ft^2)		1,980		1,505		---		---		---		2,369		1,499		2,369		1,499	
Sinuosity (ft^3)		1.10		1.10		2.30		2.50		1.00		1.24		1.20		1.24		1.20	
Water Surface Slope (ft/ft^2)		0.0039		0.0013	0.0046	---		---		---		0.0025		0.0036		0.0031		0.0033	
Bankfull Slope (ft/ft)		---		---		---		---		---		---		---		0.0029		0.0034	

[1] No impervious land use is present within the project watershed per the CGIA Land Use Classification data set.

[2] Channel Length represented does not include easement breaks.

(---): Data was not provided

N/A: Not Applicable

SC: Silt/Clay

Table 11b. Baseline Stream Data Summary
Norkett Branch Stream Mitigation Site
DMS Project No. 95360
Monitoring Year 4 - 2017

UT1 and UT2 Reaches 1 and 2

		PRE-RESTORATION CONDITION						REFERENCE REACHES	DESIGN						AS BUILT/ BASELINE					
Parameter	**Gage**	**UT1**		**UT2 Reach 1**		**UT2 Reach 2**		**See Table 11a**	**UT1**		**UT2 Reach 1**		**UT2 Reach 2**		**UT1**		**UT2 Reach 1**		**UT2 Reach 2**	
		Min	**Max**	**Min**	**Max**	**Min**	**Max**	**Min**	**Min**	**Max**	**Min**	**Max**	**Min**	**Max**	**Min**	**Max**	**Min**	**Max**	**Min**	**Max**
Dimension and Substrate - Riffle																				
Bankfull Width (ft)	n/a	2.9	8.2	13.6		7.1		See Table 11a	7.5		8.0		8.0		10.5		9.4		9.0	9.6
Floodprone Width (ft)		6	40	29		53			16.5	>38	>40		>40		136		144		>200	>200
Bankfull Mean Depth		0.9	1	0.6		0.7			0.6		0.6		0.7		0.4		0.5		0.5	0.6
Bankfull Max Depth		1.2	2	1		1.5			0.9		0.9		1.0		0.8		1.2		1.1	1.2
Bankfull Cross-sectional Area (ft^2)		2.6	8.6	7.9		5.1			4.6		4.6		5.3		4.5		4.5		5.2	5.3
Width/Depth Ratio		2.6	8.6	23.4		9.8			12.2		13.9		12.1		24.5		19.8		15.3	17.6
Entrenchment Ratio		2.2	4.9	>7		>8			2.2	>5	>5		>5		>2.2		>2.2		>2.2	
Bank Height Ratio		1.5	2.4	1		1	1.7		1.0		1.0		1.0		1.0		1.0		1.0	
D50 (mm)		SC		7.3		7.3									20.9		19.5		20.1	27.4
Profile																				
Riffle Length (ft)	n/a							See Table 11a	---		---		---		7	39	7	34	6	27
Riffle Slope (ft/ft)		0.017	0.054	0.009	0.032	0.006			0.013	0.045	0.01	0.032	0.013	0.028	0.007	0.044	0.006	0.037	0.009	0.039
Pool Length (ft)									---		---		---		12	69	11	35	11	45
Pool Max Depth (ft)		1.4	1.7	1.3		2.5			0.9	2.6	0.9	2.4	1.0	2.8	1.2	2.5	1.5	2.6	1.5	2.5
Pool Spacing (ft)^		61	295	190		51	130		10	56	10	56	10	56	30	58	21	64	22	71
Pool Volume (ft^3)																				
Pattern																				
Channel Beltwidth (ft)	n/a	N/A		N/A	N/A	26.9	49.5	See Table 11a	12	55	13	44	13	44	13	49	10	42	12	52
Radius of Curvature (ft)		N/A		N/A	N/A	6.92	33.39		12	23	13.0	24.0	13	24	14	23	15	21	14	22
Rc:Bankfull Width (ft/ft)		N/A		N/A	N/A	0.98	4.73		1.6	3	1.6	3.0	1.6	3	1.3	2.2	1.6	2.2	1.6	2.3
Meander Length (ft)		N/A		N/A	N/A	83.5	141.4		23	90	24.0	96.0	24	96	61	88	45	92	44	83
Meander Width Ratio		N/A		N/A	N/A	3.8	7.01		1.6	7.3	1.6	5.5	1.6	5.5	1.2	4.7	1.0	4.4	1.3	5.4
Substrate, Bed and Transport Parameters																				
Ri%/Ru%/P%/G%/S%	n/a																			
SC%/Sa%/G%/C%/B%/Be%																				
d16/d35/d50/d84/d95/d100		SC/SC/SC/SC/0.77/9.38/>2048		SC/SC/7.3/47.7/85.7/>2048		SC/SC/7.3/47.7/85.7/>2048		See Table 11a							SC/1.0/12.7/55.3/90/256		SC/7.1/12.2/28.5/42.9/90		2.4/11.6/20.7/56.1/86.7/180	
Reach Shear Stress (Competency) lb/ft^2		0.57	0.82	0.14		0.42			0.38		0.18		0.27		0.27		0.16		0.21	0.23
Max part size (mm) mobilized at bankfull									20-35		10-20		15-25		15-25		10-20		15-25	
Stream Power (Capacity) W/m^2																				
Additional Reach Parameters																				
Drainage Area (SM)	n/a	0.08		0.40		0.48		See Table 5a	0.08		0.15		0.22		0.08		0.15		0.22	
Watershed Impervious Cover Estimate (%)		<1% [1]		<1% [1]		<1% [1]			<1% [1]		<1% [1]		<1% [1]		<1% [1]		<1% [1]		<1% [1]	
Rosgen Classification		E6		C/E4		E4			C/E6		C/E4		C/E4		C4		C4		C4	
Bankfull Velocity (fps)		3.3	4.2	1.4		3.4			2.6		2.4		3.2		2.1		1.6		1.9	2.0
Bankfull Discharge (cfs)		12		11		17			12		11		17		10		7		10	11
Q-NFF regression																				
Q-USGS extrapolation																				
Q-Mannings																				
Valley Length (ft)		840		820		1156		See Table 5a	998		866		1108		998		866		1108	
Channel Thalweg Length (ft)[2]		840		820		1,272			1,198		1,039		1,440		1,198		1,039		1,440	
Sinuosity (ft)[3]		1.0		1.0		1.1			1.20		1.20		1.30		1.20		1.20		1.30	
Water Surface Slope (ft/ft)[2]		0.15		0.004		0.012			0.010		0.005		0.007		0.011		0.006		0.007	
Bankfull Slope (ft/ft)									---		---		---		0.011		0.006		0.007	

[1] No impervious land use is present within the project watershed per the CGIA Land Use Classification data set.

[2] Channel Length represented does not include easement breaks.

(---): Data was not provided

N/A: Not Applicable

SC: Silt/Clay

Table 11c. Baseline Stream Data Summary
Norkett Branch Stream Mitigation Site
DMS Project No. 95360
Monitoring Year 4 - 2017

UT2 Reaches 3A and 3B

		RE-RESTORATION CONDITION		REFERENCE REACHES		DESIGN				AS BUILT/BASELINE			
Parameter	**Gage**	**UT2 Reach 3**		**See Table 11a**		**UT2 Reach 3A**		**UT2 Reach 3B**		**UT2 Reach 3A**		**UT2 Reach 3B**	
		Min	**Max**	**Min**	**Max**	**Min**	**Max**	**Min**	**Max**	**Min**	**Max**	**Min**	**Max**
Dimension and Substrate - Riffle													
Bankfull Width (ft)		7.5				9.0		11.0		10.5		13.9	
Floodprone Width (ft)		24				45+		55+		>200		130	
Bankfull Mean Depth		1.1				0.8		1.0		0.7		0.8	
Bankfull Max Depth		1.6		See Table 11a		1.2		1.5		1.2		1.6	
Bankfull Cross-sectional Area (ft^2)	n/a	8.3				6.9		10.8		7.2		11.8	
Width/Depth Ratio		6.7				11.7		11.2		15.3		16.5	
Entrenchment Ratio		3.2				5.0+		5.0+		>2.2		>2.2	
Bank Height Ratio		1.3	1.8			1.0		1.0		1.0		1.0	
D50 (mm)		7.32								32.0		33.4	
Profile													
Riffle Length (ft)						---		---		8	25	13	28
Riffle Slope (ft/ft)		0.014	0.025			0.011	0.032	0.008	0.017	0.010	0.046	0.001	0.024
Pool Length (ft)	n/a			See Table 11a		---		---		10	42	32	45
Pool Max Depth (ft)		2				1.20	3.20	1.50	4.10	1.77	2.98	2.45	3.32
Pool Spacing (ft)^		26	53			12	63	14	77	26	66	38	72
Pool Volume (ft^3)													
Pattern													
Channel Beltwidth (ft)		N/A	N/A			14	50	18	61	8	37	20	61
Radius of Curvature (ft)		15	63.4			14	27	20	33	14	27	24	31
Rc:Bankfull Width (ft/ft)	n/a	2	8.45	See Table 11a		1.6	3.0	1.8	3.0	1.3	2.6	1.7	2.2
Meander Length (ft)		N/A	N/A			27	108	33	132	58	88	87	105
Meander Width Ratio		N/A	N/A			1.6	5.5	1.6	5.5	0.8	3.5	1.4	4.4
Substrate, Bed and Transport Parameters													
Ri%/Ru%/P%/G%/S%													
SC%/Sa%/G%/C%/B%/Be%													
d16/d35/d50/d84/d95/d100	n/a	SC/SC/7.3/47.7/85.7/>2048		See Table 11a						22.6/27.4/32/53.7/69.7/128		SC/4.9/13.3/67.2/89.9/128	
Reach Shear Stress (Competency) lb/ft^2						0.29		0.23		0.23		0.14	
Max part size (mm) mobilized at bankfull						15	25	12	20	17		10	
Stream Power (Capacity) W/m^2													
Additional Reach Parameters													
Drainage Area (SM)		0.71				0.46		0.46		0.46		0.46	
Watershed Impervious Cover Estimate (%)		<1% [1]				<1% [1]		<1% [1]		<1% [1]		<1% [1]	
Rosgen Classification		E4		See Table 5a		C/E4		C/E4		E4		C4	
Bankfull Velocity (fps)		3.7				3.7		3.0		2.1		1.7	
Bankfull Discharge (cfs)		26	33			26		33		15		20	
Q-NFF regression													
Q-USGS extrapolation	n/a												
Q-Mannings													
Valley Length (ft)		1184				830		548		830		548	
Channel Thalweg Length (ft)[2]		1,303				1,038		658		1,038		658	
Sinuosity (ft)[3]		1.1		See Table 5a		1.25		1.20		1.25		1.20	
Water Surface Slope (ft/ft)[2]		0.009				0.006		0.004		0.006		0.003	
Bankfull Slope (ft/ft)						---		---		0.007		0.002	

[1] No impervious land use is present within the project watershed per the CGIA Land Use Classification data set.
[2] Channel Length represented does not include easement breaks.
(---): Data was not provided
N/A: Not Applicable
SC: Silt/Clay

Table 12a. Morphology and Hydraulic Summary (Dimensional Parameters - Cross-Section)
Norkett Branch Stream Mitigation Site
DMS Project No. 95360
Monitoring Year 4 - 2017

Norkett Branch Reach 1 and 2

	Cross-Section 1, Norkett Branch Reach 1 (Pool)								Cross-Section 2, Norkett Branch Reach 1, (Riffle)								Cross-Section 3, Norkett Branch Reach 1, (Pool)								Cross-Section 4, Norkett Branch Reach 1, (Riffle)							
Dimension	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**MY6**	**MY7**	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**MY6**	**MY7**	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**MY6**	**MY7**	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**MY6**	**MY7**
based on fixed bankfull elevation																																
Bankfull Width (ft)	33.2	34.1	34.3	29.1	31.3				26.6	23.2	23.4	22.8	21.8				26.7	29.2	25.8	24.3	24.8				25.1	23.1	26.2	22.4	23.4			
Floodprone Width (ft)	---	---	---	---	---				>200	>200	>200	>200	>200				---	---	---	---	---				>200	>200	>200	>200	>200			
Bankfull Mean Depth (ft)	1.8	2.0	2.0	2.2	2.0				1.6	2.0	2.0	1.9	2.0				2.3	2.3	2.4	2.7	3.0				1.8	2.1	1.9	2.0	1.9			
Bankfull Max Depth (ft)	3.6	3.7	3.8	3.7	3.6				2.9	3.0	3.0	2.9	2.9				3.9	4.4	4.6	5.0	5.6				3.3	3.4	3.4	3.3	3.3			
Bankfull Cross-Sectional Area (ft^2)	58.4	68.3	68.7	64.3	61.7				42.6	45.5	48.0	44.1	42.6				60.3	67.5	62.9	64.9	74.4				44.6	47.7	48.8	44.0	45.2			
Bankfull Width/Depth Ratio	18.9	17.1	17.1	13.2	15.9				16.7	11.9	11.4	11.8	11.1				11.8	12.7	10.6	9.1	8.2				14.1	11.1	14.1	11.4	12.1			
Bankfull Entrenchment Ratio	---	---	---	---	---				>7.5	>12	>8.5	>8.8	>11.6				---	---	---	---	---				>8	>9	>7.6	>8.9	>8.5			
Bankfull Bank Height Ratio	---	---	---	---	---				1.0	1.0	1.0	1.0	1.0				---	---	---	---	---				1.0	1.0	1.0	1.0	1.0			
	Cross-Section 5, Norkett Branch Reach 1 (Riffle)								**Cross-Section 6, Norkett Branch Reach 2, (Riffle)**								**Cross-Section 7, Norkett Branch Reach 2, (Riffle)**								**Cross-Section 8, Norkett Branch Reach 2, (Pool)**							
Dimension	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**MY6**	**MY7**	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**MY6**	**MY7**	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**MY6**	**MY7**	**Base**	**MY1**	**MY2**	**MY3[1]**	**MY4**	**MY5**	**MY6**	**MY7**
based on fixed bankfull elevation																																
Bankfull Width (ft)	22.5	23.5	23.3	22.3	24.1				25.7	26.0	25.6	25.0	24.3				25.6	24.9	25.6	23.2	23.0				30.1	26.8	29.1	28.7	30.1			
Floodprone Width (ft)	>200	>200	>200	>200	>200				>200	>200	>200	>200	>200				>200	>200	>200	>200	>200				---	---	---	---	---			
Bankfull Mean Depth (ft)	1.7	1.8	1.7	1.7	1.6				2.0	2.0	2.1	2.0	2.0				1.8	2.0	1.9	1.9	1.9				2.4	2.7	2.5	2.5	2.4			
Bankfull Max Depth (ft)	2.6	3.0	2.9	2.7	2.9				3.3	3.3	3.6	3.2	3.1				3.0	3.2	3.1	3.1	3.1				4.5	4.4	4.5	4.6	4.7			
Bankfull Cross-Sectional Area (ft^2)	38.8	42.3	40.5	37.4	39.5				50.8	52.0	53.4	49.6	48.5				46.7	48.7	48.5	44.6	43.3				72.5	71.0	73.2	71.5	71.9			
Bankfull Width/Depth Ratio	13.1	13.1	13.3	13.2	14.7				13.0	13.0	12.3	12.6	12.2				14.1	12.7	13.6	12.1	12.3				12.5	10.1	11.6	11.5	12.6			
Bankfull Entrenchment Ratio	>9	>9	>8.6	>9.0	>8.3				>8	>8	>7.8	>8.0	>8.6				>8	>8	>7.8	>8.6	>8.7				---	---	---	---	---			
Bankfull Bank Height Ratio	1.0	1.0	1.0	1.0	1.0				1.0	1.0	1.0	1.0	1.0				1.0	1.0	1.0	1.0	1.0				---	---	---	---	---			

--- : Not Applicable
[1] MY3 calculations were adjusted on Cross-section 8 because they were found to omit a portion of the bankfull area.

Table 12b. Morphology and Hydraulic Summary (Dimensional Parameters - Cross-Section)
Norkett Branch Stream Mitigation Site
DMS Project No. 95360
Monitoring Year 4 - 2017

UT1 and UT2 Reaches 1 and 2

	Cross-Section 9, UT1, (Riffle)								Cross-Section 10, UT1, (Pool)								Cross-Section 11, UT2 Reach 1, (Pool)								Cross-Section 12, UT2 Reach 1, (Riffle)							
Dimension	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**MY6**	**MY7**	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**MY6**	**MY7**	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**MY6**	**MY7**	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**MY6**	**MY7**
based on fixed bankfull elevation																																
Bankfull Width (ft)	10.5	11.6	11.1	10.2	10.2				18.1	15.9	17.3	13.5	11.7				10.6	11.1	11.3	12.1	9.1				9.4	11.1	9.5	10.8	9.9			
Floodprone Width (ft)	136	136	138	131	107.3				---	---	---	---	---				---	---	---	---	---				144	151	155	146.5	152.9			
Bankfull Mean Depth (ft)	0.4	0.5	0.6	0.4	0.4				0.5	0.9	0.9	0.8	1.0				0.7	0.8	0.8	0.6	1.0				0.5	0.5	0.6	0.4	0.6			
Bankfull Max Depth (ft)	0.8	1.1	0.9	0.6	0.9				1.8	2.0	2.1	1.9	2.1				1.9	2.0	0.8	1.7	1.9				1.2	1.1	1.2	1.0	1.1			
Bankfull Cross-Sectional Area (ft^2)	4.5	6.2	6.7	4.0	4.4				9.8	14.0	12.7	10.3	12.2				7.5	9.4	8.8	6.7	9.1				4.5	5.6	5.5	3.9	5.8			
Bankfull Width/Depth Ratio	24.5	21.7	18.5	25.7	23.6				33.3	18.0	23.5	17.7	11.2				15.2	13.2	14.6	21.9	9.0				19.8	22.0	16.4	29.6	17.1			
Bankfull Entrenchment Ratio	13.0	11.7	12.4	12.9	10.6				---	---	---	---	---				---	---	---	---	---				15.2	13.6	16.3	13.6	15.4			
Bankfull Bank Height Ratio	1.0	1.0	1.0	1.0	1.0				---	---	---	---	---				---	---	---	---	---				1.0	1.0	1.0	1.0	1.0			
	Cross-Section 13, UT2 Reach 2, (Riffle)								**Cross-Section 14, UT2 Reach 2, (Pool)**								**Cross-Section 15, UT2 Reach 2, (Riffle)**								**Cross-Section 16, UT2 Reach 2, (Pool)**							
Dimension	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**MY6**	**MY7**	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**MY6**	**MY7**	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**MY6**	**MY7**	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**MY6**	**MY7**
based on fixed bankfull elevation																																
Bankfull Width (ft)	9.0	9.5	9.1	8.9	8.2				13.9	13.7	14.8	12.9	15.3				9.6	10.5	11.5	11.9	11.2				9.6	9.4	7.9	9.6	8.6			
Floodprone Width (ft)	>200	>200	>200	>200	>200				---	---	---	---	---				>200	>200	>200	>200	>200				---	---	---	---	---			
Bankfull Mean Depth (ft)	0.6	0.7	0.7	0.6	0.7				0.8	1.0	0.8	0.9	0.8				0.5	0.7	0.8	0.7	0.8				0.7	0.9	1.0	1.0	1.0			
Bankfull Max Depth (ft)	1.2	1.2	1.2	1.1	1.0				2.1	2.2	2.0	2.0	1.9				1.1	1.4	1.3	1.6	1.5				1.8	1.9	1.9	2.0	1.9			
Bankfull Cross-Sectional Area (ft^2)	5.3	7.1	6.4	5.6	5.5				11.7	14.1	12.0	11.3	11.6				5.2	7.6	8.7	8.8	8.7				7.0	8.1	8.1	9.2	8.8			
Bankfull Width/Depth Ratio	15.3	12.8	13.0	14.1	12.4				16.4	13.2	18.2	14.7	20.1				17.6	14.5	15.4	15.9	14.5				13.3	10.9	7.7	10.1	8.4			
Bankfull Entrenchment Ratio	>22	>21	>22	>22.5	>24.4				---	---	---	---	---				>15	>19	>17.3	>16.9	>17.9				---	---	---	---	---			
Bankfull Bank Height Ratio	1.0	1.0	1.0	1.0	1.0				---	---	---	---	---				1.0	1.0	1.0	1.0	1.0				---	---	---	---	---			

---: Not Applicable

Table 12c. Morphology and Hydraulic Summary (Dimensional Parameters - Cross-Section)
Norkett Branch Stream Mitigation Site
DMS Project No. 95360
Monitoring Year 4 - 2017

UT2 Reaches 3A and 3B

	Cross-Section 17, UT2 Reach 3A, (Pool)								Cross-Section 18, UT2 Reach 3A, (Riffle)								Cross-Section 19, UT2 Reach 3B, (Riffle)								Cross-Section 20, UT2 Reach 3B, (Pool)							
Dimension	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**MY6**	**MY7**	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**MY6**	**MY7**	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**MY6**	**MY7**	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**MY6**	**MY7**
based on fixed bankfull elevation																																
Bankfull Width (ft)	10.5	10.9	11.3	10.1	10.2				10.5	11.1	10.1	10.5	10.2				13.9	12.6	14.3	13.6	13.2				14.7	15.0	15.5	14.5	14.5			
Floodprone Width (ft)	---	---	---	---	---				>200	>200	>200	>200	>200				130	130	146	131.9	135.3				---	---	---	---	---			
Bankfull Mean Depth (ft)	1.0	1.2	1.1	1.3	1.3				0.7	0.7	0.7	0.9	0.9				0.8	1.2	1.0	0.9	1.0				1.4	1.5	1.5	1.5	1.5			
Bankfull Max Depth (ft)	2.0	2.0	2.2	2.1	2.3				1.2	1.3	1.4	1.5	1.5				1.6	1.8	1.8	1.7	1.6				2.6	2.7	2.7	2.8	2.6			
Bankfull Cross-Sectional Area (ft^2)	10.7	12.9	12.1	13.0	13.7				7.2	7.6	7.6	9.3	9.5				11.8	14.9	14.3	12.6	12.6				21.2	22.7	23.0	21.3	21.5			
Bankfull Width/Depth Ratio	10.2	9.2	10.5	7.8	7.6				15.3	16.2	13.6	11.9	11.1				16.5	10.6	14.4	14.7	13.7				10.2	9.9	10.4	9.8	9.8			
Bankfull Entrenchment Ratio	---	---	---	---	---				>19	>18	>9.3	>19.0	>15.6				9.3	10.3	10.2	9.7	10.3				---	---	---	---	---			
Bankfull Bank Height Ratio	---	---	---	---	---				1.0	1.0	1.0	1.0	1.0				1.0	1.0	1.0	1.0	1.0				---	---	---	---	---			

---: Not Applicable

Table 13a. Monitoring Data - Stream Reach Data Summary
Norkett Branch Stream Mitigation Site
DMS Project No. 95360
Monitoring Year 4 - 2017

Norkett Branch Reach 1

Parameter	As-Built/Baseline		MY1		MY2		MY3		MY4		MY5		MY6		MY7	
	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
Dimension and Substrate - Riffle																
Bankfull Width (ft)	22.5	26.6	23.1	23.5	23.3	26.2	22.3	22.8	21.8	24.1						
Floodprone Width (ft)	>200		>200		>200		>200		>200							
Bankfull Mean Depth	1.6	1.8	1.8	2.1	1.7	2.0	1.7	2.0	1.6	2.0						
Bankfull Max Depth	2.6	3.3	3.0	3.4	2.9	3.4	2.7	3.3	2.9	3.3						
Bankfull Cross-sectional Area (ft^2)	38.8	44.6	42.3	47.7	40.5	48.8	37.4	44.1	39.5	45.2						
Width/Depth Ratio	13.1	16.7	11.1	13.1	11.4	14.1	11.4	13.2	11.1	14.7						
Entrenchment Ratio	>2.2		>2.2		>2.2		>2.2		>2.2							
Bank Height Ratio	1.0		1.0		1.0		1.0		1.0							
D50 (mm)	18.4	59.6	13.3	26.9	24.7	90.0	20.9	51.8	4.0	34.3						
Profile																
Riffle Length (ft)	14	84														
Riffle Slope (ft/ft)	0.0000	0.0152														
Pool Length (ft)	12	88														
Pool Max Depth (ft)	3.3	5.1														
Pool Spacing (ft)	67	183														
Pool Volume (ft^3)																
Pattern																
Channel Beltwidth (ft)	38	147														
Radius of Curvature (ft)	38	65														
Rc:Bankfull Width (ft/ft)	1.7	2.4														
Meander Wave Length (ft)	167	263														
Meander Width Ratio	1.7	5.5														
Additional Reach Parameters																
Rosgen Classification	C4		C4		C4		C4		C4							
Channel Thalweg Length (ft)	2,369															
Sinuosity (ft)	1.24															
Water Surface Slope (ft/ft)	0.003															
Bankfull Slope (ft/ft)	0.003															
Ri%/Ru%/P%/G%/S%																
SC%/Sa%/G%/C%/B%/Be%																
d16/d35/d50/d84/d95/d100	0.4/3.6/7.4/52.3/139.4/362		1.0/8.0/16.7/50.6/90/1024		0.3/11.0/29.3/121.7/180/1024		SC/0.79/18.4/132.0/214.7/>2048		SC/6.40/11.8/39.8/89.6/180							
% of Reach with Eroding Banks			6%		0%		6%		3%							

Table 13b. Monitoring Data - Stream Reach Data Summary
Norkett Branch Stream Mitigation Site
DMS Project No. 95360
Monitoring Year 4 - 2017

Norkett Branch Reach 2

Parameter	As-Built/Baseline		MY1		MY2		MY3		MY4		MY5		MY6		MY7	
	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
Dimension and Substrate - Riffle																
Bankfull Width (ft)	25.6	25.7	24.9	26.0	25.6	25.6	23.2	25.0	23.0	24.3						
Floodprone Width (ft)	>200		>200		>200		>200		>200							
Bankfull Mean Depth	1.8	2.0	2.0	2.0	1.9	2.1	1.9	2.0	1.9	2.0						
Bankfull Max Depth	3.0	3.3	3.2	3.3	3.1	3.6	3.1	3.2	3.1	3.1						
Bankfull Cross-sectional Area (ft^2)	46.7	50.8	48.7	52.0	48.5	53.4	44.6	49.6	43.3	48.5						
Width/Depth Ratio	13.0	14.1	12.7	13.0	12.3	13.6	12.1	12.6	12.2	12.3						
Entrenchment Ratio	>2.2		>2.2		>2.2		>2.2		>2.2							
Bank Height Ratio	1.0		1.0		1.0		1.0		1.0							
D50 (mm)	7.3	9.9	3.6	12.1	1.0	27.8	4.4	11.0	1.7	5.6						
Profile																
Riffle Length (ft)	19	111														
Riffle Slope (ft/ft)	0.0009	0.0163														
Pool Length (ft)	51	102														
Pool Max Depth (ft)	3.5	4.8														
Pool Spacing (ft)	98	172														
Pool Volume (ft^3)																
Pattern																
Channel Beltwidth (ft)	38	155														
Radius of Curvature (ft)	40	64														
Rc:Bankfull Width (ft/ft)	1.6	2.5														
Meander Wave Length (ft)	181	277														
Meander Width Ratio	1.5	6.0														
Additional Reach Parameters																
Rosgen Classification	C4/E4		C4/E4		C4/E4		C4/E4		C4/E4							
Channel Thalweg Length (ft)	1,499															
Sinuosity (ft)	1.20															
Water Surface Slope (ft/ft)	0.003															
Bankfull Slope (ft/ft)	0.003															
Ri%/Ru%/P%/G%/S%																
SC%/Sa%/G%/C%/B%/Be%																
d16/d35/d50/d84/d95/d100	2.6/6.7/13.0/62.6/210.9/>2048		0.3/10.4/15.3/49.1/90/362		4.2/16/24.9/83.4/151.8/362		SC/6.7/17.6/52.6/101.2/256.0		SC/2.95/11.9/56.9/90.8/180							
% of Reach with Eroding Banks			7%		5%		12%		2%							

Table 13c. Monitoring Data - Stream Reach Data Summary
Norkett Branch Stream Mitigation Site
DMS Project No. 95360
Monitoring Year 4 - 2017

UT1

Parameter	As-Built/Baseline		MY1		MY2		MY3		MY4		MY5		MY6		MY7	
	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
Dimension and Substrate - Riffle																
Bankfull Width (ft)	10.5		11.6		11.1		10.2		10.2							
Floodprone Width (ft)	136		136		138		131		107.3							
Bankfull Mean Depth	0.4		0.5		0.6		0.4		0.4							
Bankfull Max Depth	0.8		1.1		0.9		0.6		0.9							
Bankfull Cross-sectional Area (ft^2)	4.5		6.2		6.7		4.0		4.4							
Width/Depth Ratio	24.5		21.7		18.5		20.8		23.6							
Entrenchment Ratio	13.0		11.7		12.4		14.4		10.6							
Bank Height Ratio	1.0		1.0		1.0		1.0		1							
D50 (mm)	20.9		48.3		21.9		68.2		8.3							
Profile																
Riffle Length (ft)	7	39														
Riffle Slope (ft/ft)	0.007	0.044														
Pool Length (ft)	12	69														
Pool Max Depth (ft)	1.2	2.5														
Pool Spacing (ft)	30	58														
Pool Volume (ft^3)																
Pattern																
Channel Beltwidth (ft)	13	49														
Radius of Curvature (ft)	14	23														
Rc:Bankfull Width (ft/ft)	1.3	2.2														
Meander Wave Length (ft)	61	88														
Meander Width Ratio	1.2	4.7														
Additional Reach Parameters																
Rosgen Classification	C4		C4		C4		C4		C4							
Channel Thalweg Length (ft)	1,198															
Sinuosity (ft)	1.20															
Water Surface Slope (ft/ft)	0.011															
Bankfull Slope (ft/ft)	0.011															
Ri%/Ru%/P%/G%/S%																
SC%/Sa%/G%/C%/B%/Be%																
d16/d35/d50/d84/d95/d100	SC/1.0/12.7/55.3/90/256		SC/2.4/9.4/61.2/139.4/256.0		SC/0.1/8.6/82.6/139.4/256		SC/SC/5.6/49.8/107.3/>2048		SC/1.04/8.3/69.2/143/256							
% of Reach with Eroding Banks			0%		0%		0%		0%							

Table 13d. Monitoring Data - Stream Reach Data Summary
Norkett Branch Stream Mitigation Site
DMS Project No. 95360
Monitoring Year 4 - 2017

UT2 Reach 1

Parameter	As-Built/Baseline		MY1		MY2		MY3		MY4		MY5		MY6		MY7	
	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
Dimension and Substrate - Riffle																
Bankfull Width (ft)	9.4		11.1		9.5		10.8		9.9							
Floodprone Width (ft)	144		151		155		147		152.9							
Bankfull Mean Depth	0.5		0.5		0.6		0.4		0.6							
Bankfull Max Depth	1.2		1.1		1.2		1.0		1.1							
Bankfull Cross-sectional Area (ft^2)	4.5		5.6		5.5		3.9		5.8							
Width/Depth Ratio	19.8		22.0		16.4		29.6		17.1							
Entrenchment Ratio	15.2		13.6		16.3		13.6		15.4							
Bank Height Ratio	1.0		1.0		1.0		1.0		1							
D50 (mm)	19.5		32.0		37.9		49.8		53.7							
Profile																
Riffle Length (ft)	7	34														
Riffle Slope (ft/ft)	0.006	0.037														
Pool Length (ft)	11	35														
Pool Max Depth (ft)	1.5	2.6														
Pool Spacing (ft)	21	64														
Pool Volume (ft^3)																
Pattern																
Channel Beltwidth (ft)	10	42														
Radius of Curvature (ft)	15	21														
Rc:Bankfull Width (ft/ft)	1.6	2.2														
Meander Wave Length (ft)	45	92														
Meander Width Ratio	1.0	4.4														
Additional Reach Parameters																
Rosgen Classification	C4		C4		C4		C4		C4							
Channel Thalweg Length (ft)	1,039															
Sinuosity (ft)	1.20															
Water Surface Slope (ft/ft)	0.006															
Bankfull Slope (ft/ft)	0.006															
Ri%/Ru%/P%/G%/S%																
SC%/Sa%/G%/C%/B%/Be%																
d16/d35/d50/d84/d95/d100	SC/7.1/12.2/28.5/42.9/90		SC/12/20.6/58.1/111.2/256		SC/5.6/16.7/57.4/107.3/362		SC/0.25/12.9/69.7/120.7/362.0		SC/SC/SC/52.8/96.6/180							
% of Reach with Eroding Banks			0%		0%		0%		0%							

Table 13e. Monitoring Data - Stream Reach Data Summary
Norkett Branch Stream Mitigation Site
DMS Project No. 95360
Monitoring Year 4 - 2017

UT2 Reach 2

Parameter	As-Built/Baseline		MY1		MY2		MY3		MY4		MY5		MY6		MY7	
	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
Dimension and Substrate - Riffle																
Bankfull Width (ft)	9.0	9.6	9.5	10.5	9.1	11.5	8.9	11.9	8.2	11.2						
Floodprone Width (ft)	>200		>200		>200		>200		>200							
Bankfull Mean Depth	0.5	0.6	0.7	0.7	0.7	0.8	0.6	0.7	0.7	0.8						
Bankfull Max Depth	1.1	1.2	1.2	1.4	1.2	1.3	1.1	1.6	1.0	1.5						
Bankfull Cross-sectional Area (ft^2)	5.2	5.3	7.1	7.6	6.4	8.7	5.6	8.8	5.5	8.7						
Width/Depth Ratio	15.3	17.6	12.8	14.5	13.0	15.4	14.1	15.9	12.4	14.5						
Entrenchment Ratio	>2.2		>2.2		>2.2		>2.2		>2.2							
Bank Height Ratio	1.0		1.0		1.0		1.0		1.0							
D50 (mm)	20.1	27.4	41.3	50.6	39.0	39.3	35.4	51.4	53.7	68.5						
Profile																
Riffle Length (ft)	6	27														
Riffle Slope (ft/ft)	0.009	0.039														
Pool Length (ft)	11	45														
Pool Max Depth (ft)	1.5	2.5														
Pool Spacing (ft)	22	71														
Pool Volume (ft^3)																
Pattern																
Channel Beltwidth (ft)	12	52														
Radius of Curvature (ft)	14	22														
Rc:Bankfull Width (ft/ft)	1.6	2.3														
Meander Wave Length (ft)	44	83														
Meander Width Ratio	1.3	5.4														
Additional Reach Parameters																
Rosgen Classification	C4		C4		C4		C4		C4							
Channel Thalweg Length (ft)	1,440															
Sinuosity (ft)	1.30															
Water Surface Slope (ft/ft)	0.007															
Bankfull Slope (ft/ft)	0.007															
Ri%/Ru%/P%/G%/S%																
SC%/Sa%/G%/C%/B%/Be%																
d16/d35/d50/d84/d95/d100	2.4/11.6/20.7/56.1/86.7/180		8.5/20.1/32/90/160.7/512		0.3/18.4/45/119.3/196.6/1024		SC/SC/SC/73.4/118.9/180.0		SC/SC/12.5/71.7/112.2/180							
% of Reach with Eroding Banks			0%		0%		0%		0%							

Table 13f. Monitoring Data - Stream Reach Data Summary
Norkett Branch Stream Mitigation Site
DMS Project No. 95360
Monitoring Year 4 - 2017

UT2 Reach 3A

Parameter	As-Built/Baseline		MY1		MY2		MY3		MY4		MY5		MY6		MY7	
	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
Dimension and Substrate - Riffle																
Bankfull Width (ft)	10.5		11.1		10.1		10.5		10.2							
Floodprone Width (ft)	>200		>200		>200		>200		>200							
Bankfull Mean Depth	0.7		0.7		0.7		0.9		0.9							
Bankfull Max Depth	1.2		1.3		1.4		1.5		1.5							
Bankfull Cross-sectional Area (ft^2)	7.2		7.6		7.6		9.3		9.5							
Width/Depth Ratio	15.3		16.2		13.6		11.9		11.1							
Entrenchment Ratio	>2.2		>2.2		>2.2		>2.2		>2.2							
Bank Height Ratio	1.0		1.0		1.0		1.0		1.0							
D50 (mm)	32.0		45.0		25.7		40.8		53.7							
Profile																
Riffle Length (ft)	8	25														
Riffle Slope (ft/ft)	0.010	0.046														
Pool Length (ft)	10	42														
Pool Max Depth (ft)	1.77	2.98														
Pool Spacing (ft)	26	66														
Pool Volume (ft^3)																
Pattern																
Channel Beltwidth (ft)	8	37														
Radius of Curvature (ft)	14	27														
Rc:Bankfull Width (ft/ft)	1.3	2.6														
Meander Wave Length (ft)	58	88														
Meander Width Ratio	0.8	3.5														
Additional Reach Parameters																
Rosgen Classification	C4		C4		C4		C4		C4							
Channel Thalweg Length (ft)	658															
Sinuosity (ft)	1.20															
Water Surface Slope (ft/ft)	0.003															
Bankfull Slope (ft/ft)	0.002															
Ri%/Ru%/P%/G%/S%																
SC%/Sa%/G%/C%/B%/Be%																
d16/d35/d50/d84/d95/d100	22.6/27.4/32/53.7/69.7/128		16.0/30.3/41.5/87.0/202.4/362.0		6.7/24.8/40.6/116.3/173.3/1024		12.8/27.8/41.3/85.7/128.0/180.0		SC/11/42.5/112.6/>2048/>2048							
% of Reach with Eroding Banks			0%		0%		0%		0%							

Table 13g. Monitoring Data - Stream Reach Data Summary
Norkett Branch Stream Mitigation Site
DMS Project No. 95360
Monitoring Year 4 - 2017

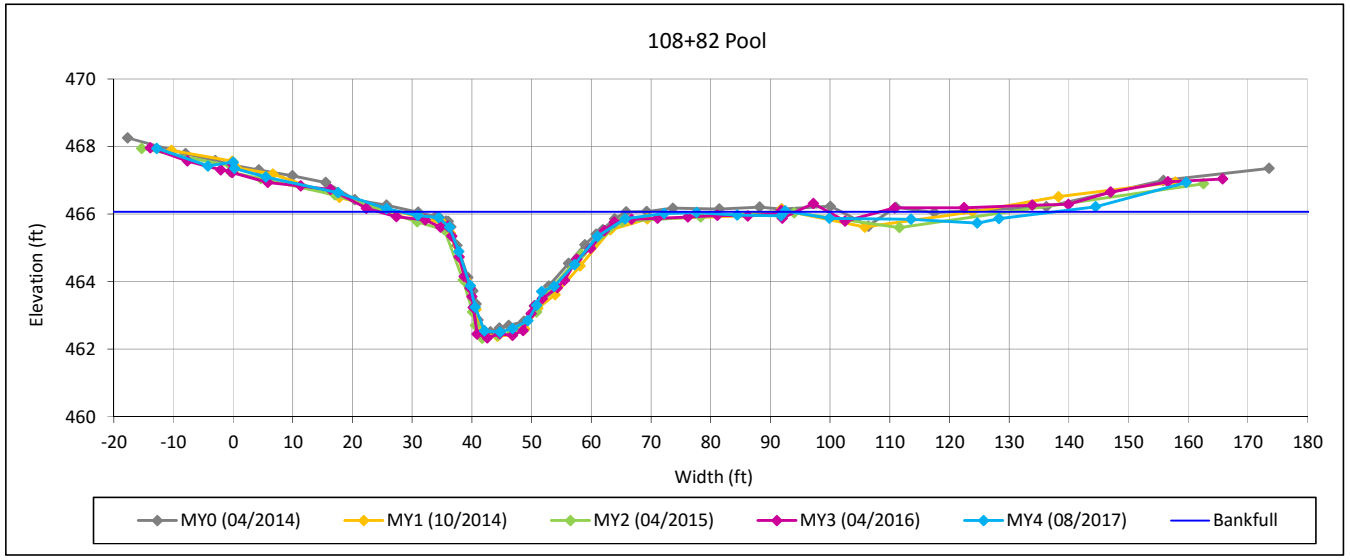
UT2 Reach 3B

Parameter	As-Built/Baseline		MY1		MY2		MY3		MY4		MY5		MY6		MY7	
	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
Dimension and Substrate - Riffle																
Bankfull Width (ft)	13.9		12.6		14.3		13.6		13.2							
Floodprone Width (ft)	130		130		146		132		135.3							
Bankfull Mean Depth	0.8		1.2		1.0		0.9		1							
Bankfull Max Depth	1.6		1.8		1.8		1.7		1.6							
Bankfull Cross-sectional Area (ft^2)	11.8		14.9		14.3		12.6		13.2							
Width/Depth Ratio	16.5		10.6		14.4		14.7		13.7							
Entrenchment Ratio	9.3		10.3		10.2		9.7		10.3							
Bank Height Ratio	1.0		1.0		1.0		1.0		1							
D50 (mm)	33.4		30.6		68.5		48.3		45							
Profile																
Riffle Length (ft)	13	28														
Riffle Slope (ft/ft)	0.001	0.024														
Pool Length (ft)	32	45														
Pool Max Depth (ft)	2.45	3.32														
Pool Spacing (ft)	38	72														
Pool Volume (ft^3)																
Pattern																
Channel Beltwidth (ft)	20	61														
Radius of Curvature (ft)	24	31														
Rc:Bankfull Width (ft/ft)	1.7	2.2														
Meander Wave Length (ft)	87	105														
Meander Width Ratio	1.4	4.4														
Additional Reach Parameters																
Rosgen Classification	C4		C4		C4		C4		C4							
Channel Thalweg Length (ft)	658															
Sinuosity (ft)	1.20															
Water Surface Slope (ft/ft)	0.003															
Bankfull Slope (ft/ft)	0.002															
Ri%/Ru%/P%/G%/S%																
SC%/Sa%/G%/C%/B%/Be%																
d16/d35/d50/d84/d95/d100	SC/4.9/13.3/67.2/89.9/128		SC/4.5/14.8/60.0/98.3/180.0		SC/0.7/12.7/71.7/128/362		SC/SC/SC/60.4/107.3/180.0		SC/6.12/19/82.6/151.8/>2048							
% of Reach with Eroding Banks			3%		0%		0%		0%							

Cross Section Plots

Norkett Branch Mitigation Site
DMS Project No. 95360
Monitoring Year 4 - 2017

Cross-Section 1-Norkett Branch Reach 1



Bankfull Dimensions

61.7	x-section area (ft.sq.)
31.3	width (ft)
2.0	mean depth (ft)
3.6	max depth (ft)
32.4	wetted parimeter (ft)
1.9	hyd radi (ft)
15.9	width-depth ratio

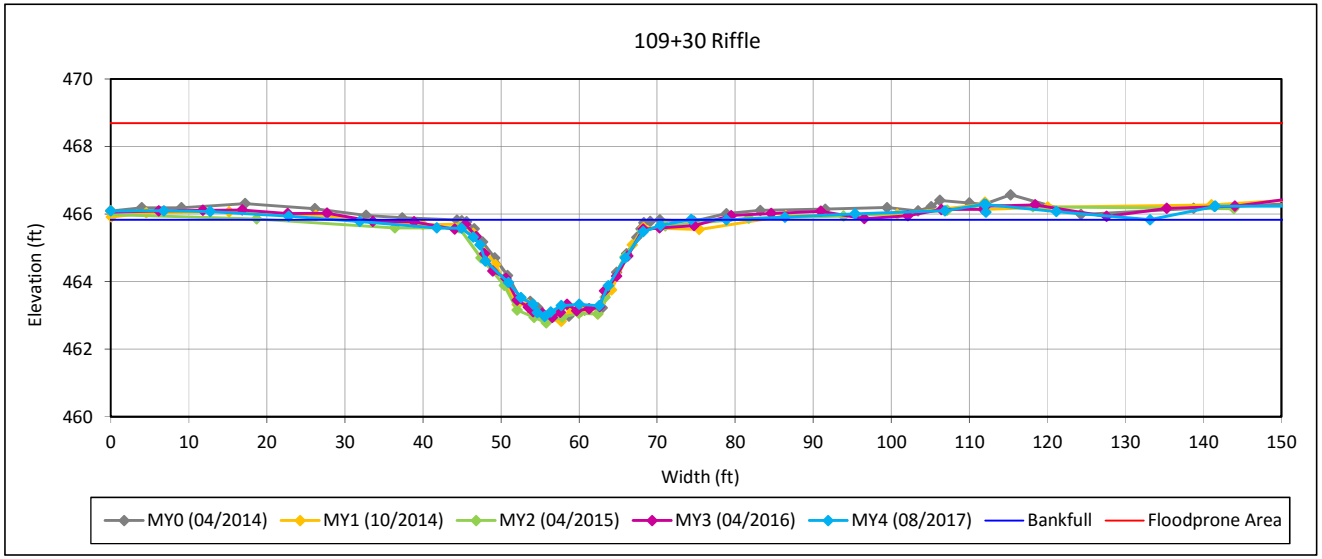
Survey Date: 08/2017
Field Crew: Wildlands Engineering

View Downstream

Cross-Section Plots

Norkett Branch Mitigation Site
DMS Project No. 95360
Monitoring Year 4 - 2017

Cross-Section 2-Norkett Branch Reach 1



Bankfull Dimensions

42.6	x-section area (ft.sq.)
21.8	width (ft)
2.0	mean depth (ft)
2.9	max depth (ft)
22.6	wetted parimeter (ft)
1.9	hyd radi (ft)
11.1	width-depth ratio
>200	W flood prone area (ft)
>11.6	entrenchment ratio
1.0	low bank height ratio

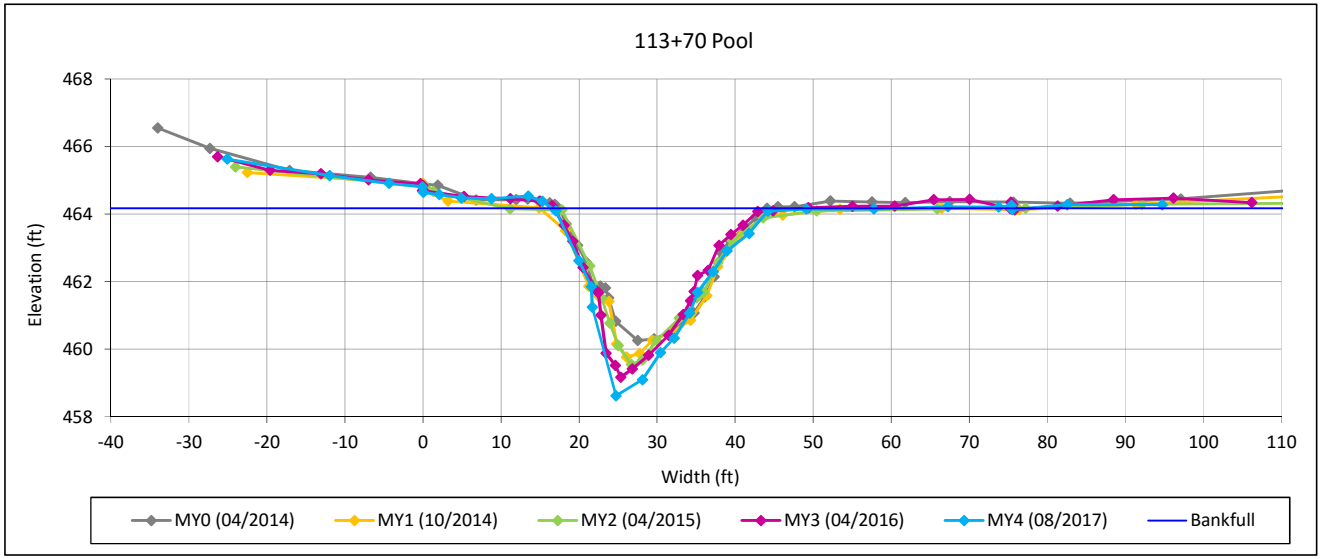
Survey Date: 08/2017
Field Crew: Wildlands Engineering

View Downstream

Cross-Section Plots

Norkett Branch Mitigation Site
DMS Project No. 95360
Monitoring Year 4 - 2017

Cross-Section 3-Norkett Branch Reach 1



Bankfull Dimensions

74.4	x-section area (ft.sq.)
24.8	width (ft)
3.0	mean depth (ft)
5.6	max depth (ft)
27.5	wetted parimeter (ft)
2.7	hyd radi (ft)
8.2	width-depth ratio

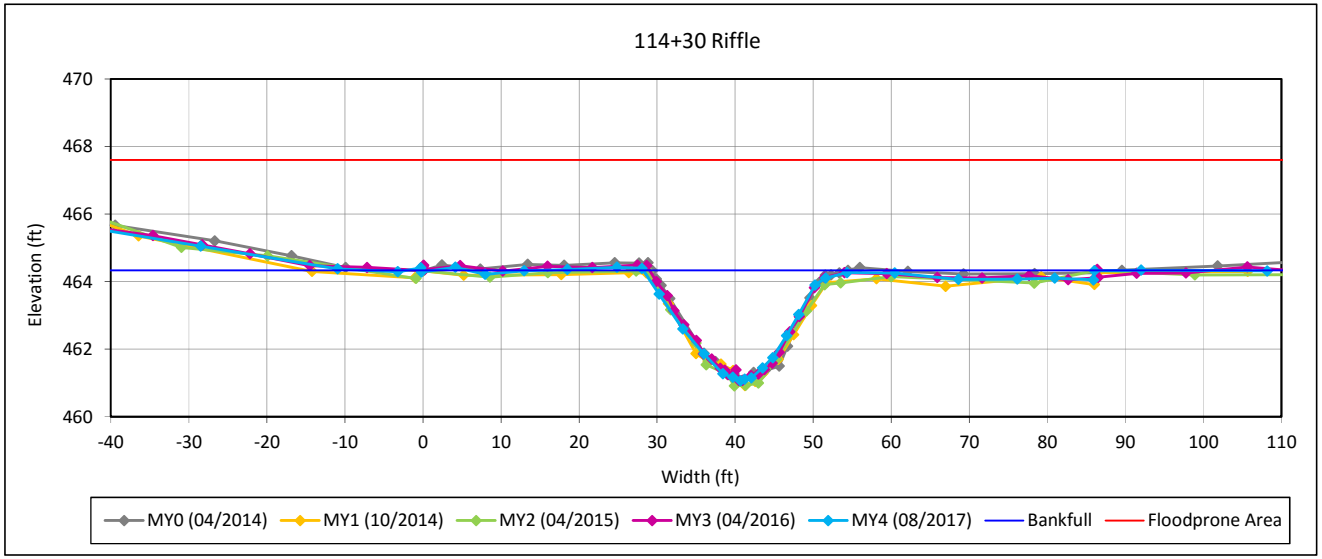
Survey Date: 08/2017
Field Crew: Wildlands Engineering

View Downstream

Cross-Section Plots

Norkett Branch Mitigation Site
DMS Project No. 95360
Monitoring Year 4 - 2018

Cross-Section 4-Norkett Branch Reach 1



Bankfull Dimensions

45.2	x-section area (ft.sq.)
23.4	width (ft)
1.9	mean depth (ft)
3.3	max depth (ft)
24.3	wetted parimeter (ft)
1.9	hyd radi (ft)
12.1	width-depth ratio
>200	W flood prone area (ft)
>8.5	entrenchment ratio
1.0	low bank height ratio

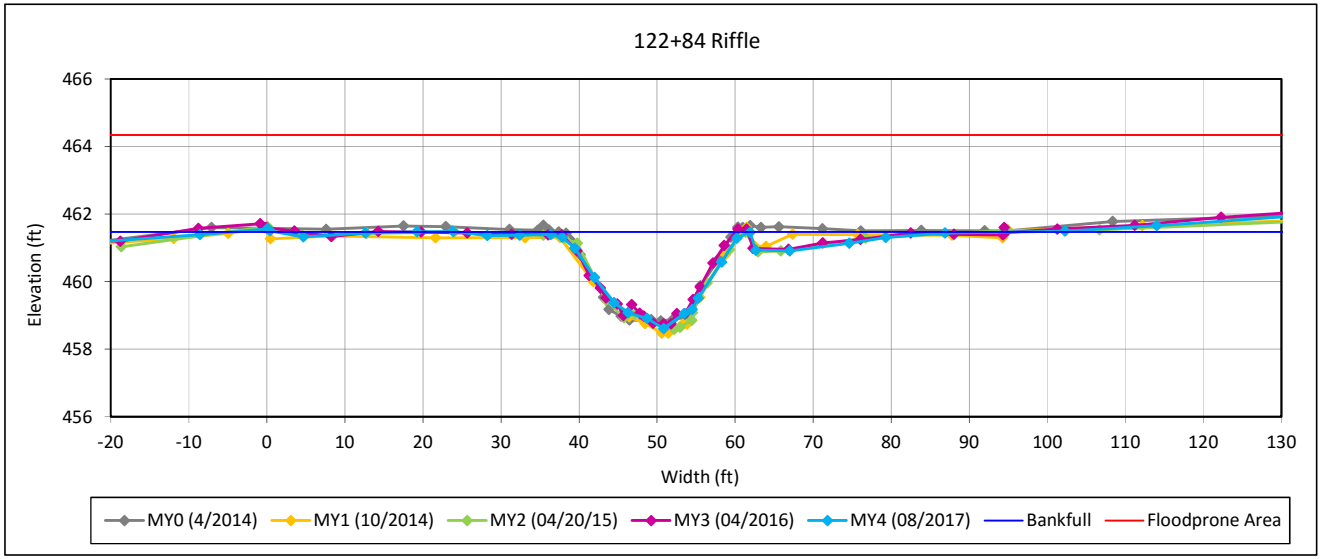
Survey Date: 08/2017
Field Crew: Wildlands Engineering

View Downstream

Cross-Section Plots

Norkett Branch Mitigation Site
DMS Project No. 95360
Monitoring Year 4 - 2018

Cross-Section 5-Norkett Branch Reach 1



Bankfull Dimensions

39.5	x-section area (ft.sq.)
24.1	width (ft)
1.6	mean depth (ft)
2.9	max depth (ft)
24.9	wetted parimeter (ft)
1.6	hyd radi (ft)
14.7	width-depth ratio
>200	W flood prone area (ft)
>8.3	entrenchment ratio
1.0	low bank height ratio

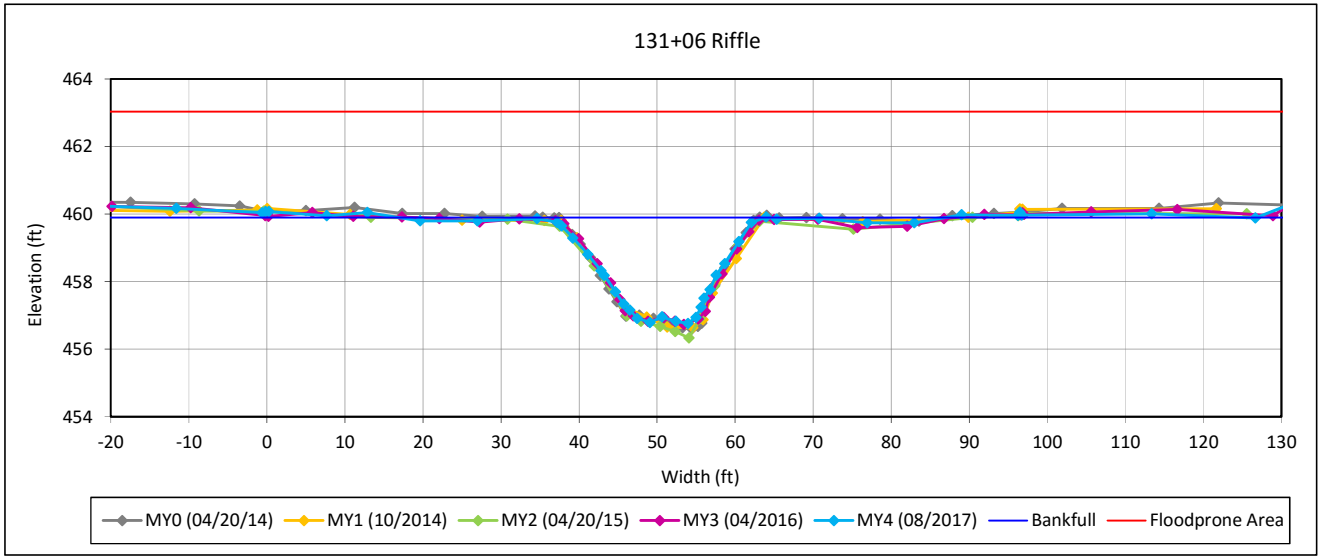
Survey Date: 08/2017
Field Crew: Wildlands Engineering

View Downstream

Cross-Section Plots

Norkett Branch Mitigation Site
DMS Project No. 95360
Monitoring Year 4 - 2018

Cross-Section 6-Norkett Branch Reach 2



Bankfull Dimensions

48.5	x-section area (ft.sq.)
24.3	width (ft)
2.0	mean depth (ft)
3.1	max depth (ft)
25.3	wetted parimeter (ft)
1.9	hyd radi (ft)
12.2	width-depth ratio
>200	W flood prone area (ft)
>8.6	entrenchment ratio
1.0	low bank height ratio

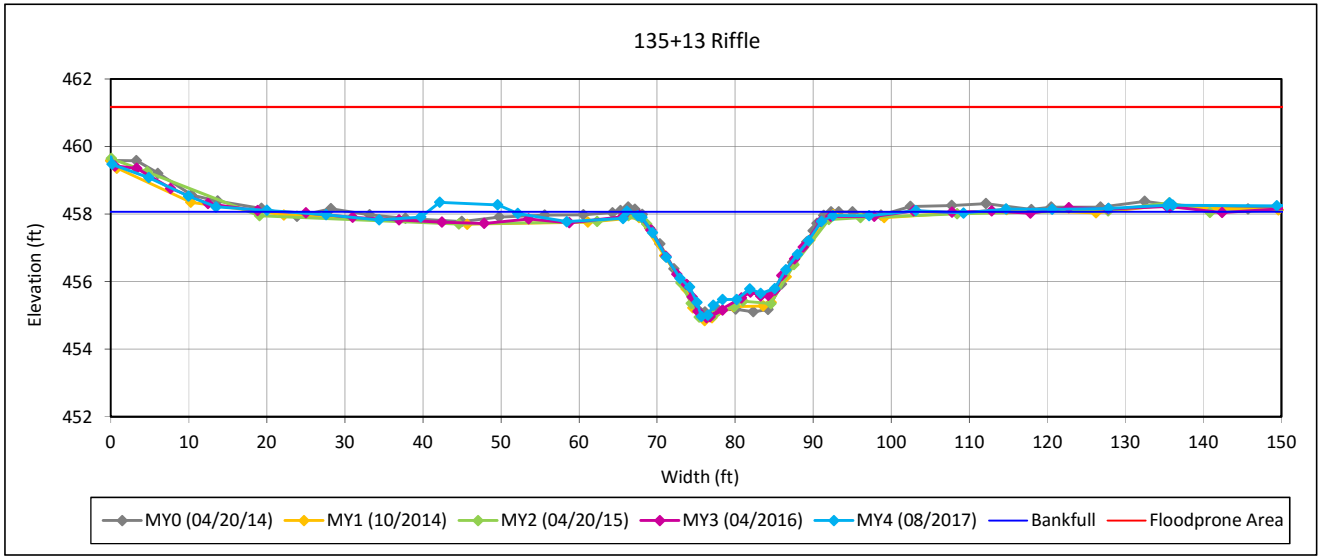
Survey Date: 08/2017
Field Crew: Wildlands Engineering

View Downstream

Cross-Section Plots

Norkett Branch Mitigation Site
DMS Project No. 95360
Monitoring Year 4 - 2018

Cross-Section 7-Norkett Branch Reach 2



Bankfull Dimensions

43.3	x-section area (ft.sq.)
23.0	width (ft)
1.9	mean depth (ft)
3.1	max depth (ft)
24.1	wetted parimeter (ft)
1.8	hyd radi (ft)
12.3	width-depth ratio
>200	W flood prone area (ft)
>6.8	entrenchment ratio
1.0	low bank height ratio

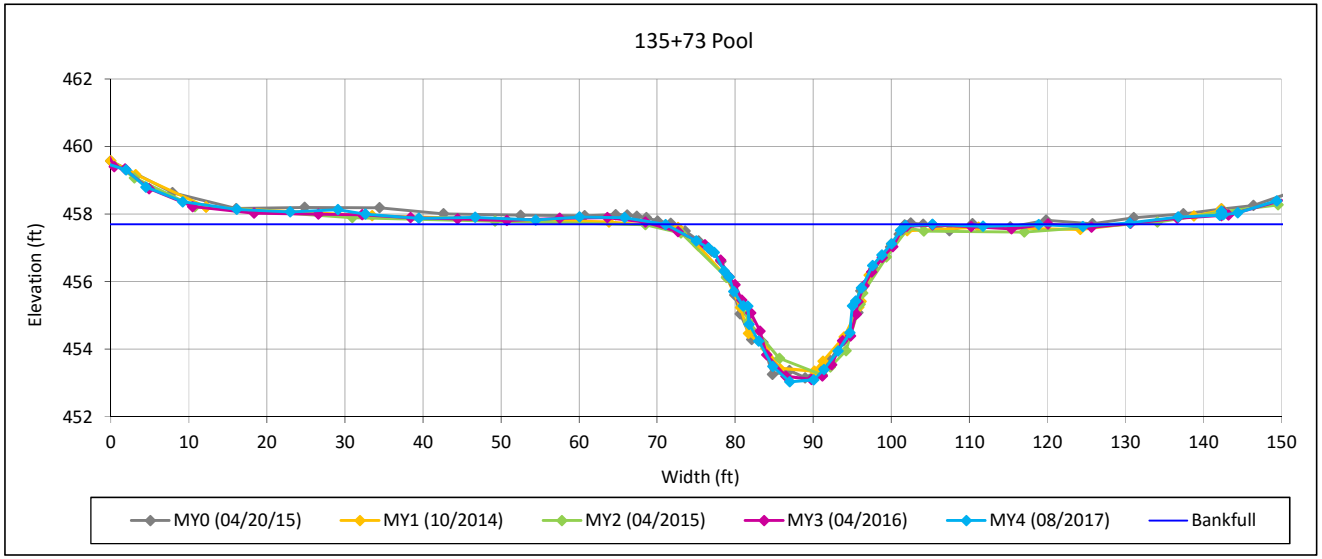
Survey Date: 08/2017
Field Crew: Wildlands Engineering

View Downstream

Cross-Section Plots

Norkett Branch Mitigation Site
DMS Project No. 95360
Monitoring Year 4 - 2017

Cross-Section 8-Norkett Branch Reach 2



Bankfull Dimensions

71.9	x-section area (ft.sq.)
30.1	width (ft)
2.4	mean depth (ft)
4.7	max depth (ft)
32.3	wetted parimeter (ft)
2.2	hyd radi (ft)
12.6	width-depth ratio

Survey Date: 08/2017
Field Crew: Wildlands Engineering

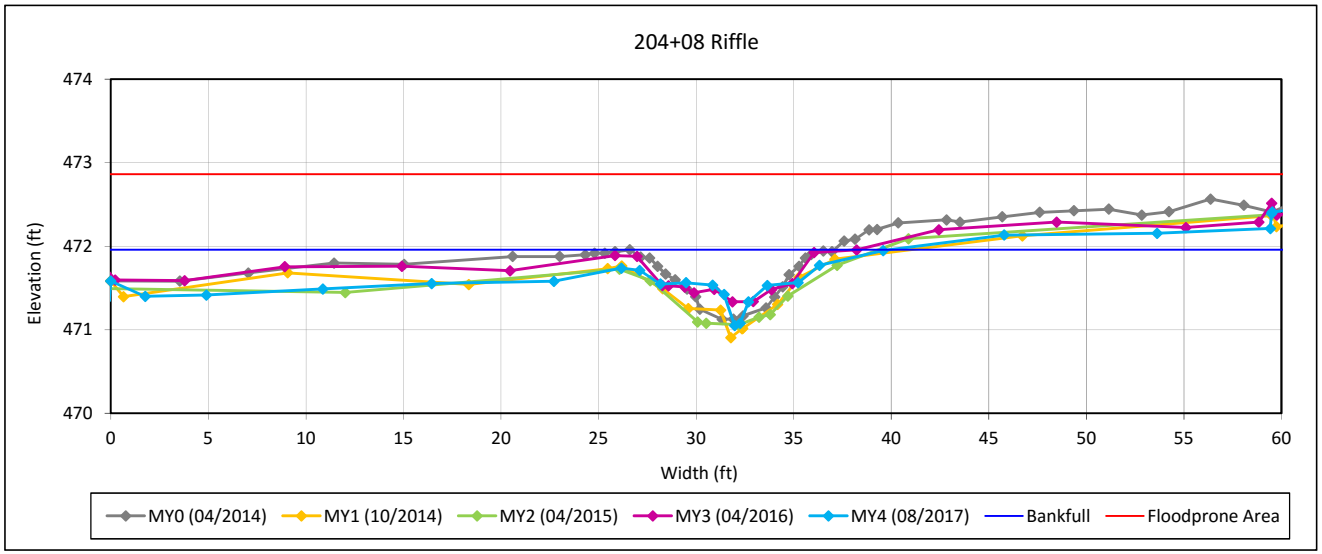
View Downstream

Cross-Section Plots

Norkett Branch Mitigation Site
DMS Project No. 95360

Monitoring Year 4 - 2017

Cross-Section 9-UT1



Bankfull Dimensions

4.4	x-section area (ft.sq.)
10.2	width (ft)
0.4	mean depth (ft)
0.9	max depth (ft)
10.4	wetted parimeter (ft)
0.4	hyd radi (ft)
23.6	width-depth ratio
107.3	W flood prone area (ft)
10.6	entrenchment ratio
1.0	low bank height ratio

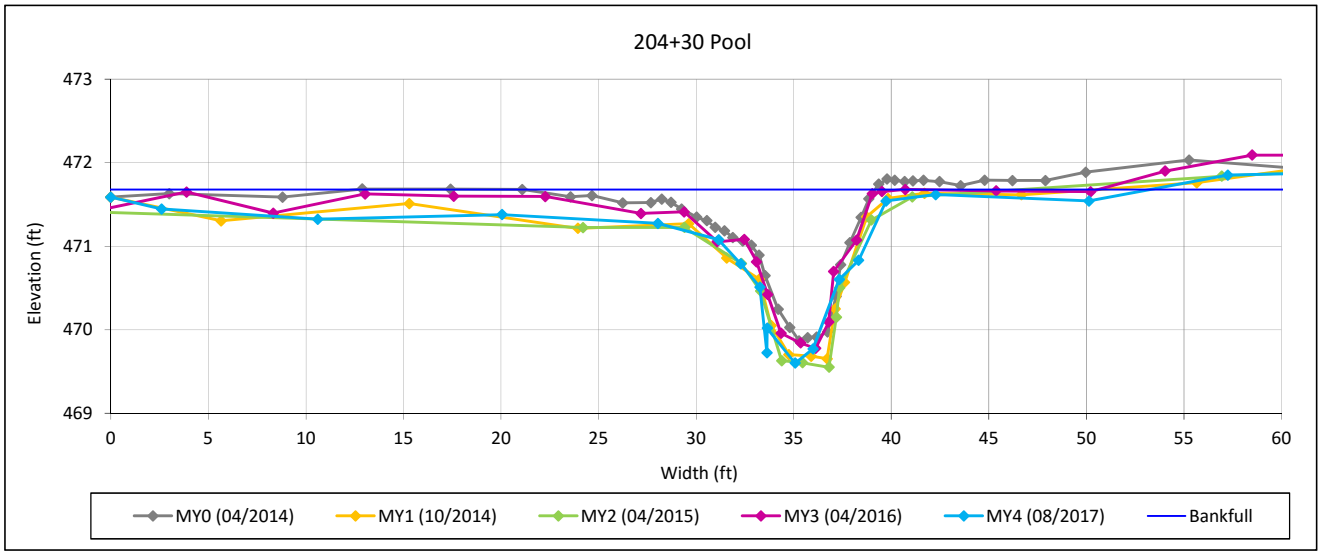
Survey Date: 08/2017
Field Crew: Wildlands Engineering

View Downstream

Cross-Section Plots

Norkett Branch Mitigation Site
DMS Project No. 95360
Monitoring Year 4 - 2017

Cross-Section 10-UT1



Bankfull Dimensions

12.2	x-section area (ft.sq.)
11.7	width (ft)
1.0	mean depth (ft)
2.1	max depth (ft)
13.1	wetted parimeter (ft)
0.9	hyd radi (ft)
11.2	width-depth ratio

Survey Date: 08/2017
Field Crew: Wildlands Engineering

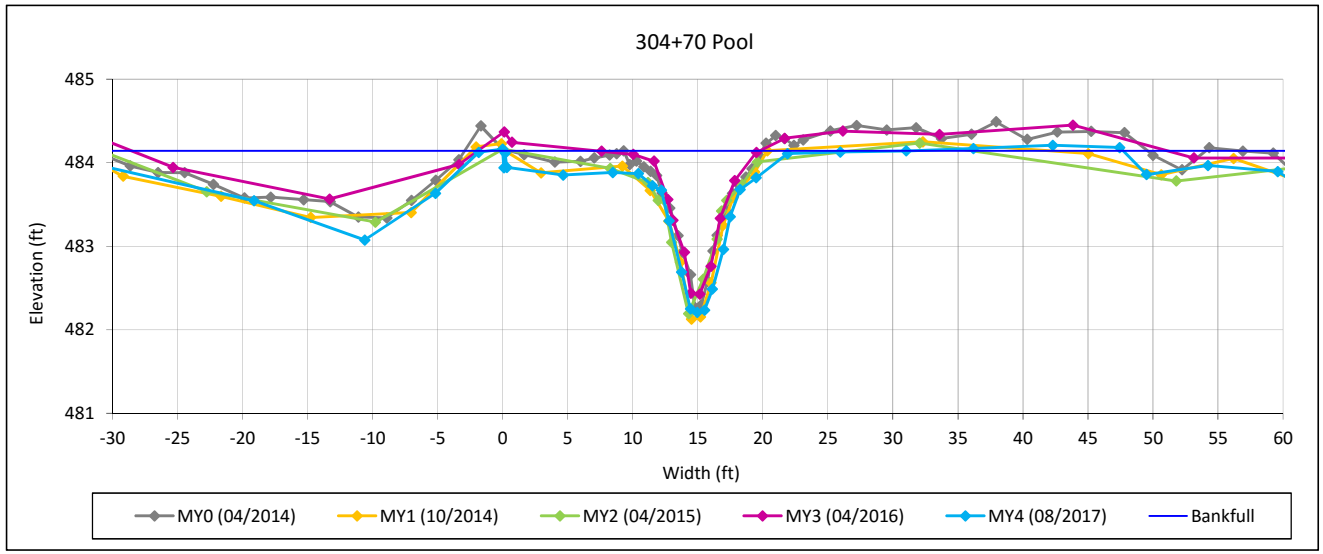
View Downstream

Cross-Section Plots

Norkett Branch Mitigation Site
DMS Project No. 95360

Monitoring Year 4 - 2017

Cross-Section 11-UT2 Reach 1



Bankfull Dimensions

9.1	x-section area (ft.sq.)
9.1	width (ft)
1.0	mean depth (ft)
1.9	max depth (ft)
9.9	wetted parimeter (ft)
0.9	hyd radi (ft)
9.0	width-depth ratio

Survey Date: 08/2017
Field Crew: Wildlands Engineering

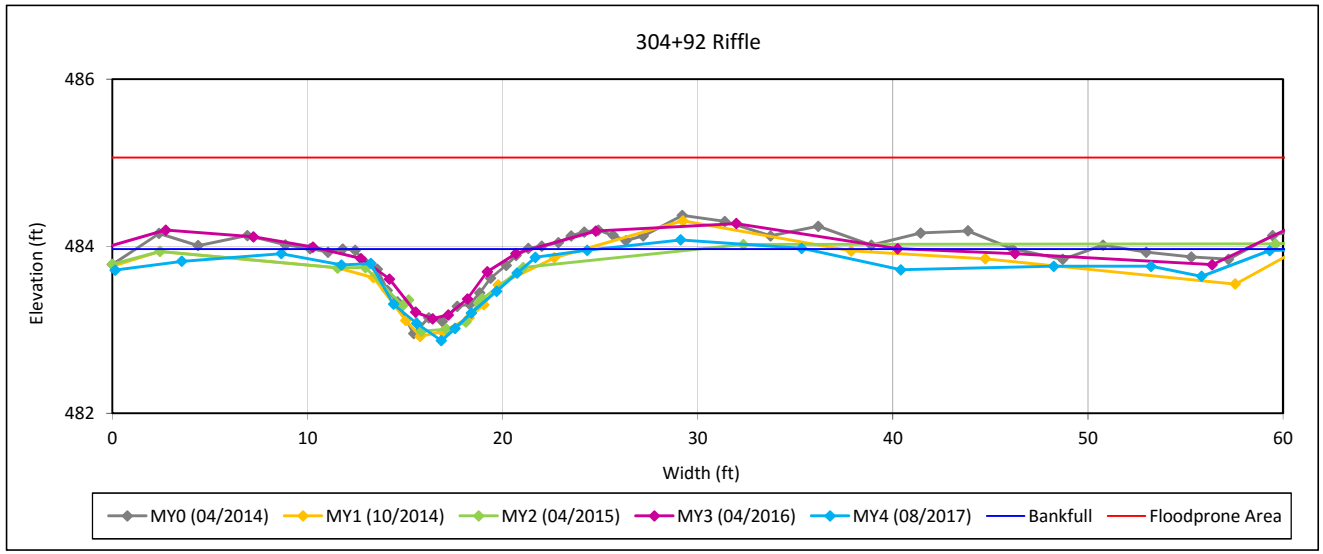
View Downstream

Cross-Section Plots

Norkett Branch Mitigation Site
DMS Project No. 95360

Monitoring Year 4 - 2017

Cross-Section 12-UT2 Reach 1



Bankfull Dimensions

5.8	x-section area (ft.sq.)
9.9	width (ft)
0.6	mean depth (ft)
1.1	max depth (ft)
10.2	wetted parimeter (ft)
0.6	hyd radi (ft)
17.1	width-depth ratio
152.9	W flood prone area (ft)
15.4	entrenchment ratio
1.0	low bank height ratio

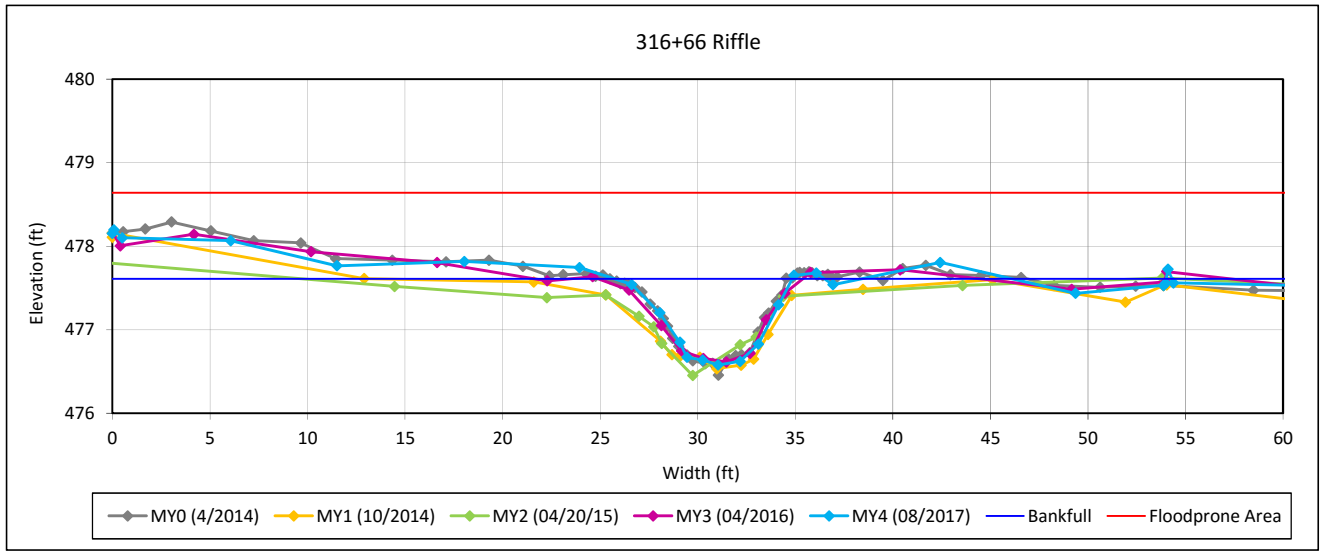
Survey Date: 08/2017
Field Crew: Wildlands Engineering

View Downstream

Cross-Section Plots

Norkett Branch Mitigation Site
DMS Project No. 95360
Monitoring Year 4 - 2017

Cross-Section 13-UT2 Reach 2



Bankfull Dimensions

5.5	x-section area (ft.sq.)
8.2	width (ft)
0.7	mean depth (ft)
1.0	max depth (ft)
8.6	wetted parimeter (ft)
0.6	hyd radi (ft)
12.4	width-depth ratio
>200	W flood prone area (ft)
>24.4	entrenchment ratio
1.0	low bank height ratio

Survey Date: 08/2017
Field Crew: Wildlands Engineering

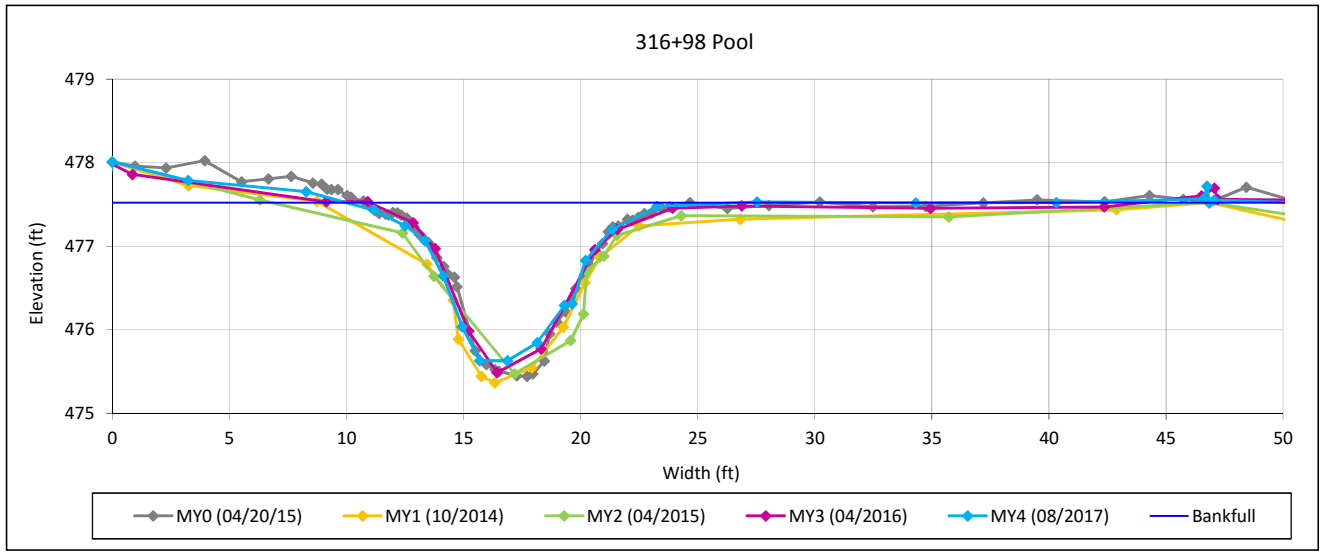
View Downstream

Cross-Section Plots

Norkett Branch Mitigation Site
DMS Project No. 95360

Monitoring Year 4 - 2017

Cross-Section 14-UT2 Reach 2



Bankfull Dimensions

11.6	x-section area (ft.sq.)
15.3	width (ft)
0.8	mean depth (ft)
1.9	max depth (ft)
16.1	wetted parimeter (ft)
0.7	hyd radi (ft)
20.1	width-depth ratio

Survey Date: 08/2017
Field Crew: Wildlands Engineering

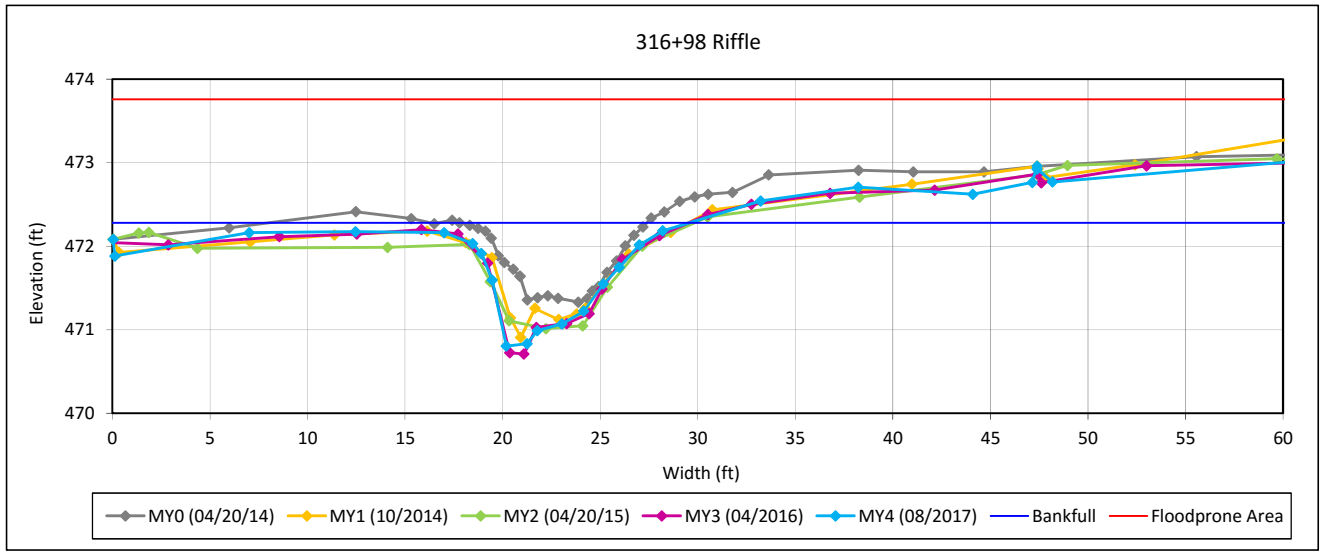
View Downstream

Cross-Section Plots

Norkett Branch Mitigation Site
DMS Project No. 95360

Monitoring Year 4 - 2017

Cross-Section 15-UT2 Reach 2



Bankfull Dimensions

8.7	x-section area (ft.sq.)
11.2	width (ft)
0.8	mean depth (ft)
1.5	max depth (ft)
11.8	wetted parimeter (ft)
0.7	hyd radi (ft)
14.5	width-depth ratio
>200	W flood prone area (ft)
>17.9	entrenchment ratio
1.0	low bank height ratio

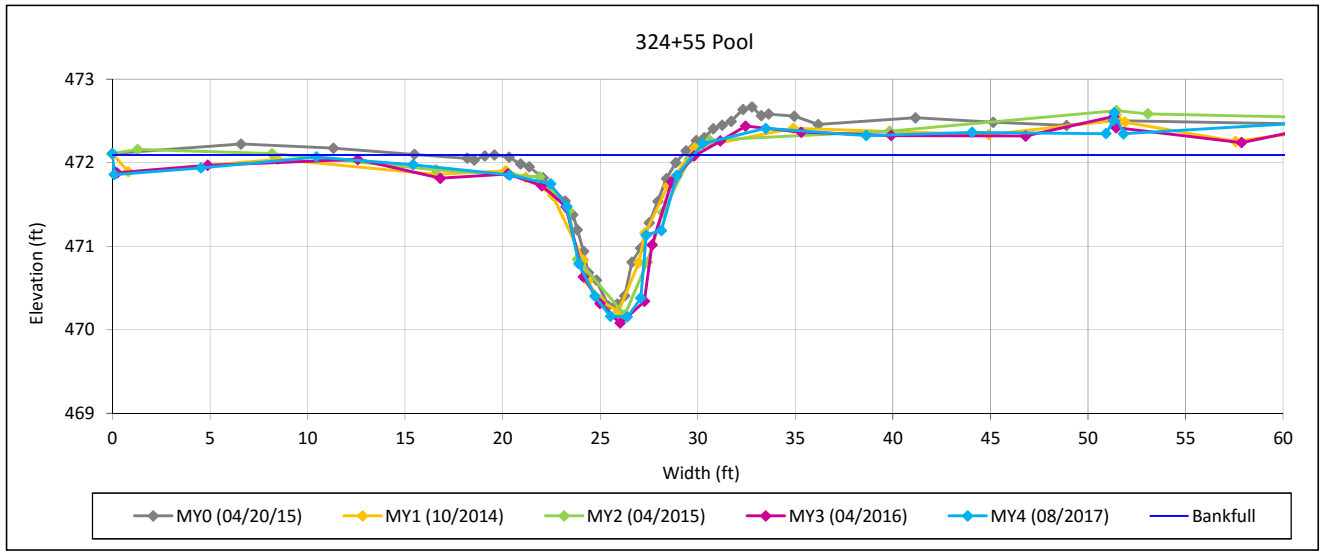
Survey Date: 08/2017
Field Crew: Wildlands Engineering

View Downstream

Cross-Section Plots

Norkett Branch Mitigation Site
DMS Project No. 95360
Monitoring Year 4 - 2017

Cross-Section 16-UT2 Reach 2



Bankfull Dimensions

8.8	x-section area (ft.sq.)
8.6	width (ft)
1.0	mean depth (ft)
1.9	max depth (ft)
9.8	wetted parimeter (ft)
0.9	hyd radi (ft)
8.4	width-depth ratio

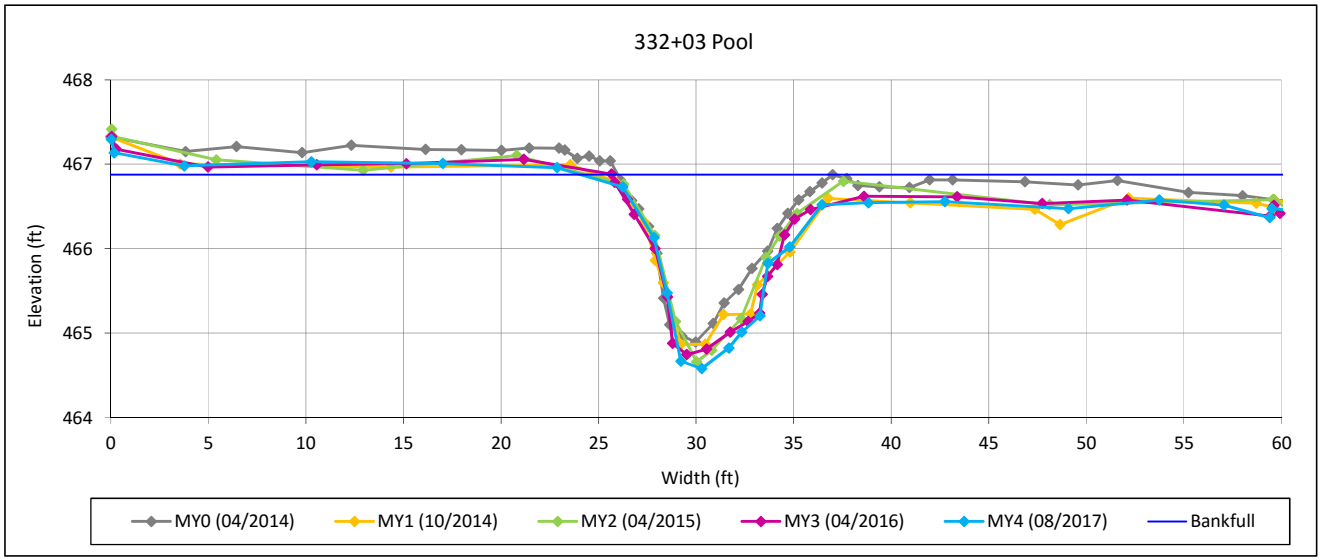
Survey Date: 08/2017
Field Crew: Wildlands Engineering

View Downstream

Cross-Section Plots

Norkett Branch Mitigation Site
DMS Project No. 95360
Monitoring Year 4 - 2017

Cross-Section 17-UT2 Reach 3A



Bankfull Dimensions

13.7	x-section area (ft.sq.)
10.2	width (ft)
1.3	mean depth (ft)
2.3	max depth (ft)
11.5	wetted parimeter (ft)
1.2	hyd radi (ft)
7.6	width-depth ratio

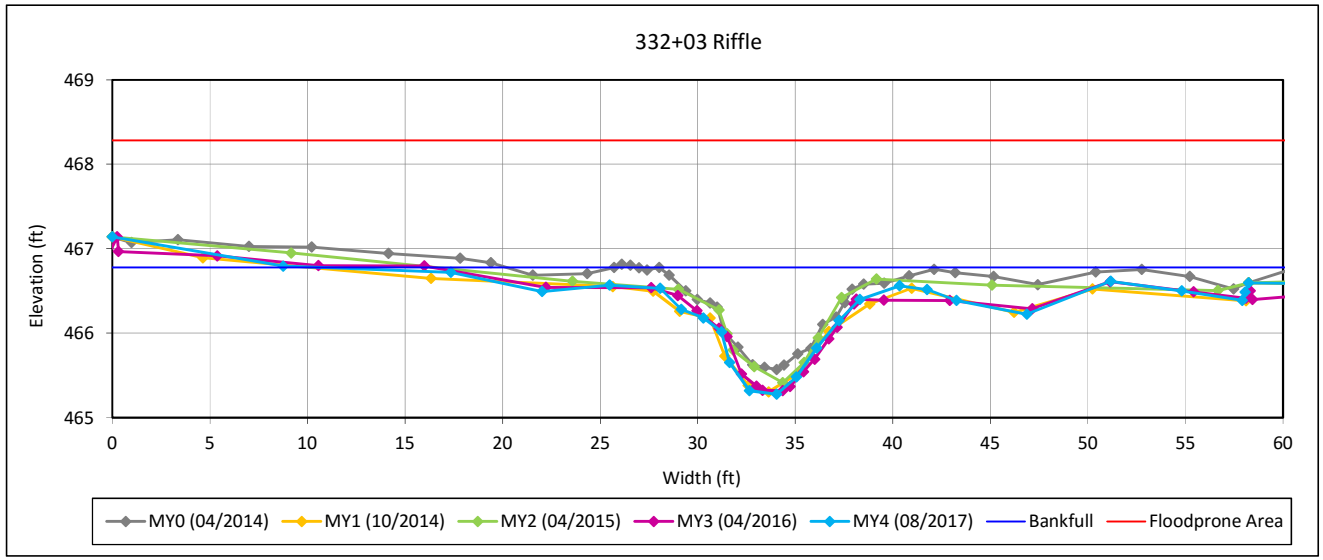
Survey Date: 08/2017
Field Crew: Wildlands Engineering

View Downstream

Cross-Section Plots

Norkett Branch Mitigation Site
DMS Project No. 95360
Monitoring Year 4 - 2017

Cross-Section 18-UT2 Reach 3A



Bankfull Dimensions

9.5	x-section area (ft.sq.)
10.2	width (ft)
0.9	mean depth (ft)
1.5	max depth (ft)
10.6	wetted parimeter (ft)
0.9	hyd radi (ft)
11.1	width-depth ratio
>200	W flood prone area (ft)
>15.6	entrenchment ratio
1.0	low bank height ratio

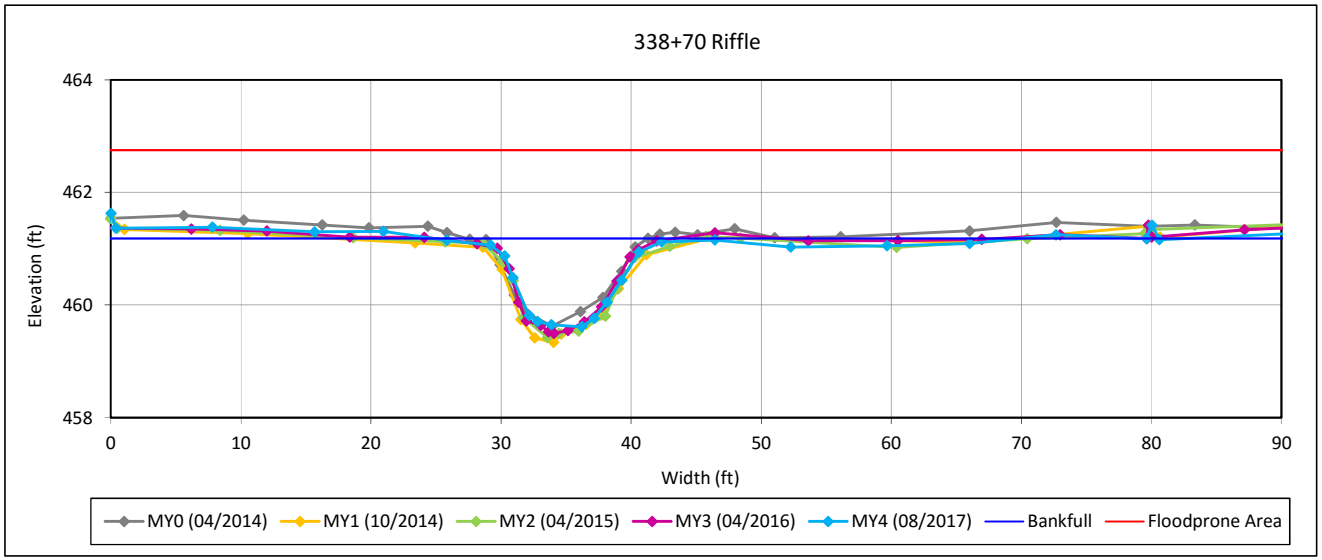
Survey Date: 08/2017
Field Crew: Wildlands Engineering

View Downstream

Cross-Section Plots

Norkett Branch Mitigation Site
DMS Project No. 95360
Monitoring Year 4 - 2017

Cross-Section 19-UT2 Reach 3B



Bankfull Dimensions

12.6	x-section area (ft.sq.)
13.2	width (ft)
1.0	mean depth (ft)
1.6	max depth (ft)
13.7	wetted parimeter (ft)
0.9	hyd radi (ft)
13.7	width-depth ratio
135.3	W flood prone area (ft)
10.3	entrenchment ratio
1.0	low bank height ratio

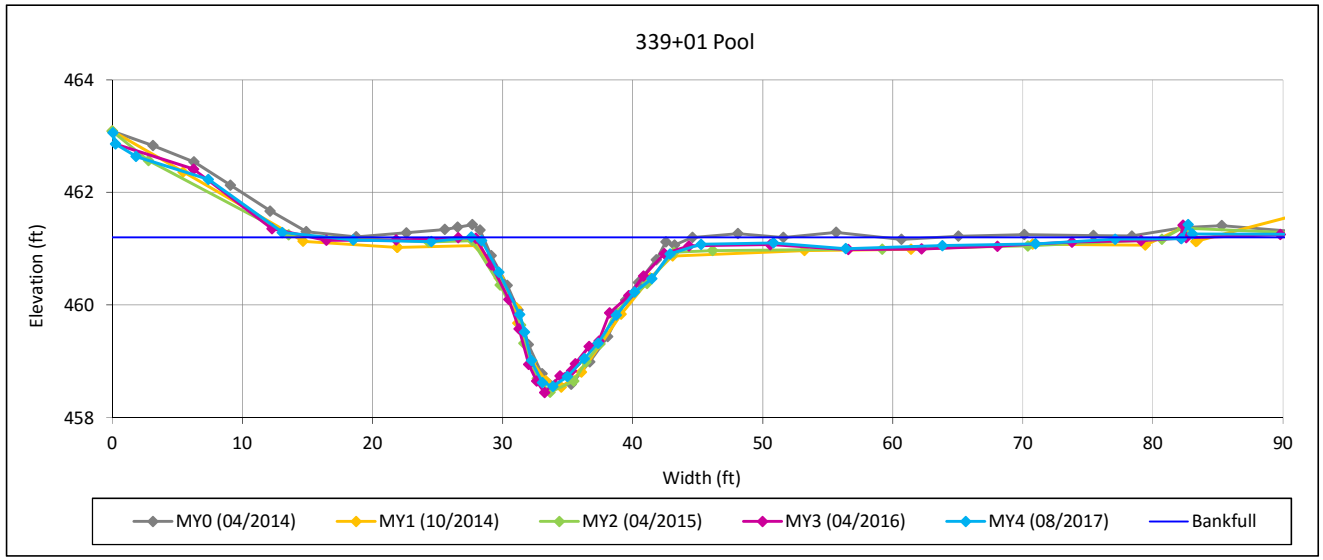
Survey Date: 08/2017
Field Crew: Wildlands Engineering

View Downstream

Cross-Section Plots

Norkett Branch Mitigation Site
DMS Project No. 95360
Monitoring Year 4 - 2017

Cross-Section 20-UT2 Reach 3B



Bankfull Dimensions

21.5	x-section area (ft.sq.)
14.5	width (ft)
1.5	mean depth (ft)
2.6	max depth (ft)
15.5	wetted parimeter (ft)
1.4	hyd radi (ft)
9.8	width-depth ratio

Survey Date: 08/2017
Field Crew: Wildlands Engineering

View Downstream

Reachwide and Cross-Section Pebble Count Plots

Norkett Branch Stream Mitigation Site

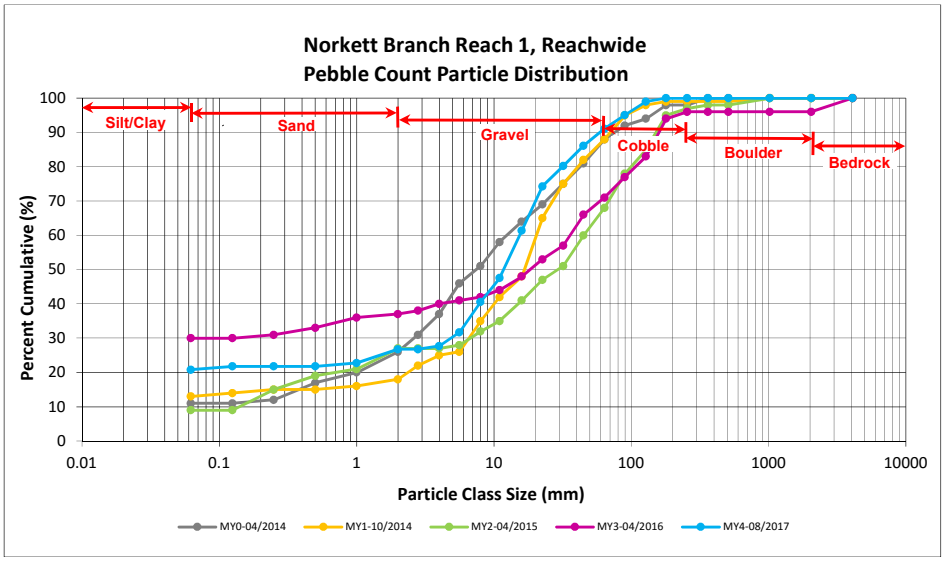
DMS Project No. 95360

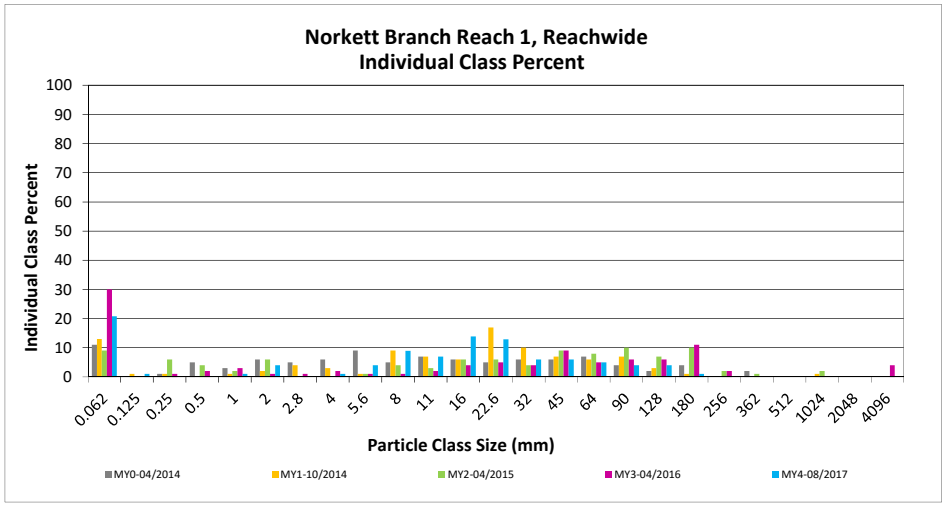
Monitoring Year 4 - 2017

Norkett Branch Reach 1, Reachwide

Particle Class		Diameter (mm)		Particle Count			Reach Summary	
		min	max	Riffle	Pool	Total	Class Percentage	Percent Cumulative
SILT/CLAY	Silt/Clay	0.000	0.062	7	14	21	21	21
SAND	Very fine	0.062	0.125		1	1	1	22
	Fine	0.125	0.250					22
	Medium	0.25	0.50					22
	Coarse	0.5	1.0		1	1	1	23
	Very Coarse	1.0	2.0	2	2	4	4	27
GRAVEL	Very Fine	2.0	2.8					27
	Very Fine	2.8	4.0	1		1	1	28
	Fine	4.0	5.6	2	2	4	4	32
	Fine	5.6	8.0	3	6	9	9	41
	Medium	8.0	11.0	1	6	7	7	48
	Medium	11.0	16.0	11	3	14	14	61
	Coarse	16.0	22.6	7	6	13	13	74
	Coarse	22.6	32	4	2	6	6	80
	Very Coarse	32	45	4	2	6	6	86
	Very Coarse	45	64	3	2	5	5	91
COBBLE	Small	64	90	2	2	4	4	95
	Small	90	128	3	1	4	4	99
	Large	128	180		1	1	1	100
	Large	180	256					100
BOULDER	Small	256	362					100
	Small	362	512					100
	Medium	512	1024					100
	Large/Very Large	1024	2048					100
BEDROCK	Bedrock	2048	>2048					100
			Total	**50**	**51**	**101**	**100**	**100**

Reachwide	
Channel materials (mm)	
D_{16} =	Silt/Clay
D_{35} =	6.40
D_{50} =	11.8
D_{84} =	39.8
D_{95} =	89.6
D_{100} =	180.0





Reachwide and Cross-Section Pebble Count Plots

Norkett Branch Stream Mitigation Site

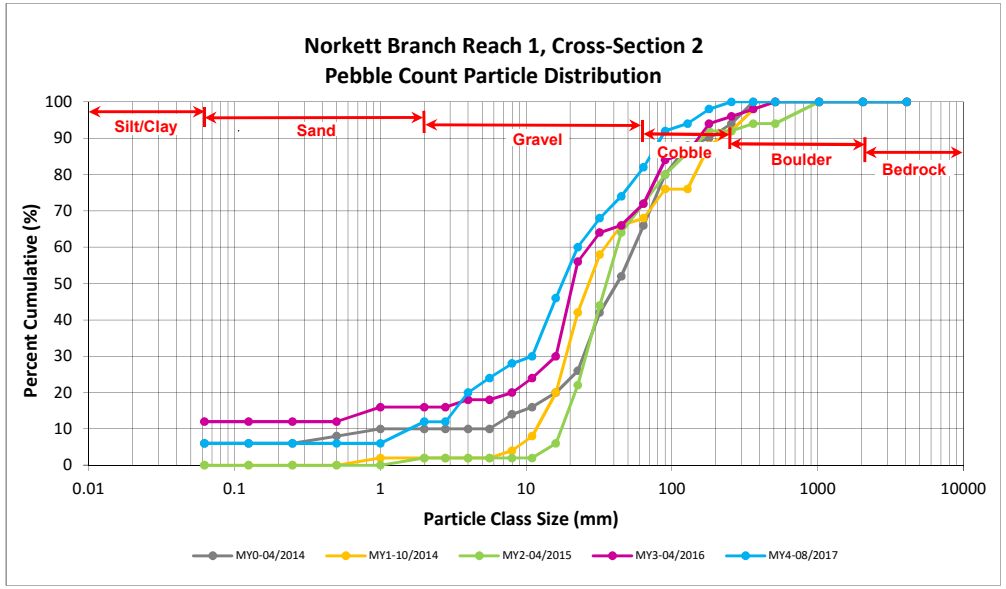
DMS Project No. 95360

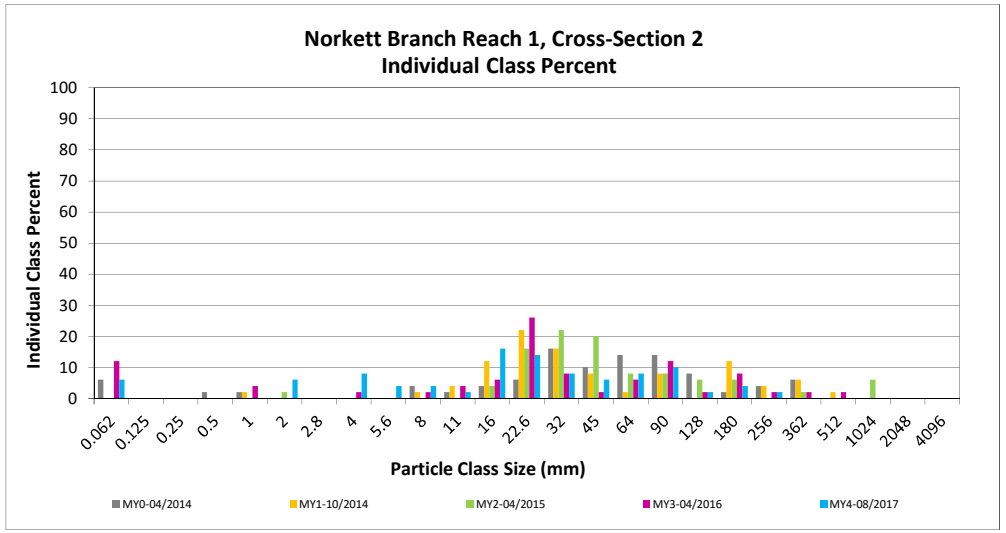
Monitoring Year 4 - 2017

Norkett Branch Reach 1, Cross-Section 2

Particle Class		Diameter (mm)		Riffle 100-Count	Summary	
		min	max		Class Percentage	Percent Cumulative
SILT/CLAY	Silt/Clay	0.000	0.062	6	6	6
SAND	Very fine	0.062	0.125			6
	Fine	0.125	0.250			6
	Medium	0.25	0.50			6
	Coarse	0.5	1.0			6
	Very Coarse	1.0	2.0	6	6	12
GRAVEL	Very Fine	2.0	2.8			12
	Very Fine	2.8	4.0	8	8	20
	Fine	4.0	5.6	4	4	24
	Fine	5.6	8.0	4	4	28
	Medium	8.0	11.0	2	2	30
	Medium	11.0	16.0	16	16	46
	Coarse	16.0	22.6	14	14	60
	Coarse	22.6	32	8	8	68
	Very Coarse	32	45	6	6	74
	Very Coarse	45	64	8	8	82
COBBLE	Small	64	90	10	10	92
	Small	90	128	2	2	94
	Large	128	180	4	4	98
	Large	180	256	2	2	100
BOULDER	Small	256	362			100
	Small	362	512			100
	Medium	512	1024			100
	Large/Very Large	1024	2048			100
BEDROCK	Bedrock	2048	>2048			100
			Total	**100**	**100**	**100**

Cross Section 2	
Channel materials (mm)	
D_{16} =	3.35
D_{35} =	12.37
D_{50} =	17.7
D_{84} =	68.5
D_{95} =	139.4
D_{100} =	256.0





Reachwide and Cross-Section Pebble Count Plots

Norkett Branch Stream Mitigation Site

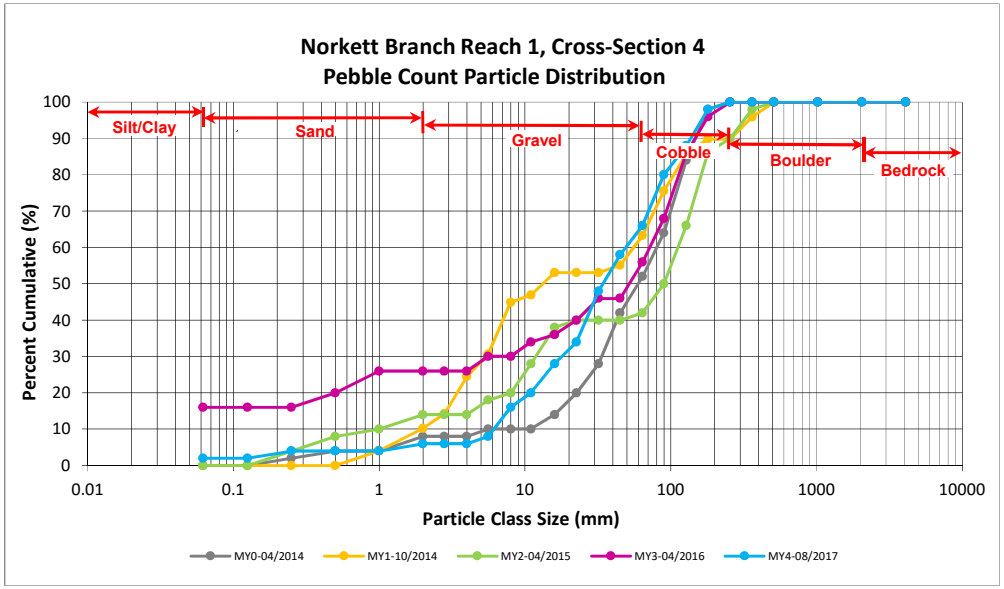
DMS Project No. 95360

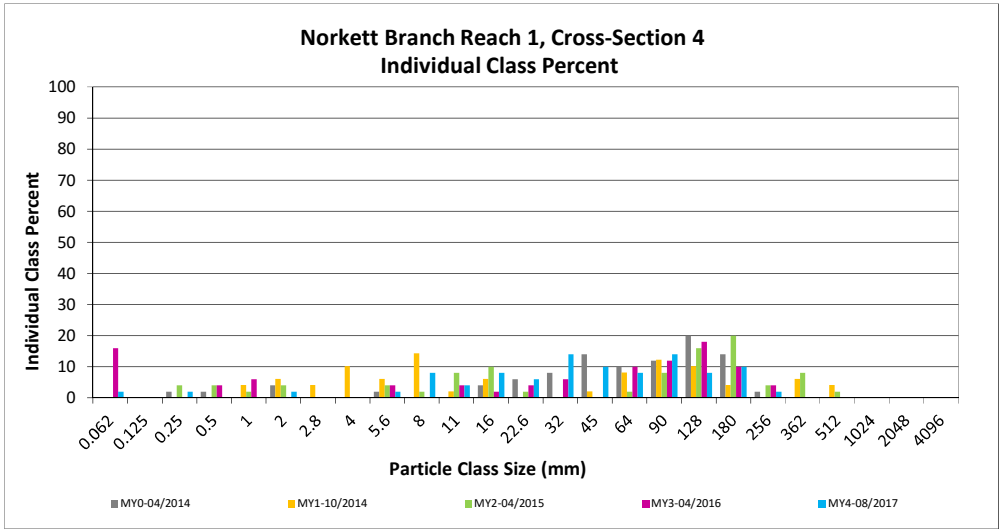
Monitoring Year 4 - 2017

Norkett Branch Reach 1, Cross-Section 4

Particle Class		Diameter (mm)		Riffle 100-Count	Summary	
		min	max		Class Percentage	Percent Cumulative
SILT/CLAY	Silt/Clay	0.000	0.062	2	2	2
SAND	Very fine	0.062	0.125			2
	Fine	0.125	0.250	2	2	4
	Medium	0.25	0.50			4
	Coarse	0.5	1.0			4
	Very Coarse	1.0	2.0	2	2	6
GRAVEL	Very Fine	2.0	2.8			6
	Very Fine	2.8	4.0			6
	Fine	4.0	5.6	2	2	8
	Fine	5.6	8.0	8	8	16
	Medium	8.0	11.0	4	4	20
	Medium	11.0	16.0	8	8	28
	Coarse	16.0	22.6	6	6	34
	Coarse	22.6	32	14	14	48
	Very Coarse	32	45	10	10	58
	Very Coarse	45	64	8	8	66
COBBLE	Small	64	90	14	14	80
	Small	90	128	8	8	88
	Large	128	180	10	10	98
	Large	180	256	2	2	100
BOULDER	Small	256	362			100
	Small	362	512			100
	Medium	512	1024			100
	Large/Very Large	1024	2048			100
BEDROCK	Bedrock	2048	>2048			100
			Total	**100**	**100**	**100**

Cross Section 4	
Channel materials (mm)	
D_{16} =	8.00
D_{35} =	23.17
D_{50} =	34.3
D_{84} =	107.3
D_{95} =	162.5
D_{100} =	256.0





Reachwide and Cross-Section Pebble Count Plots

Norkett Branch Stream Mitigation Site

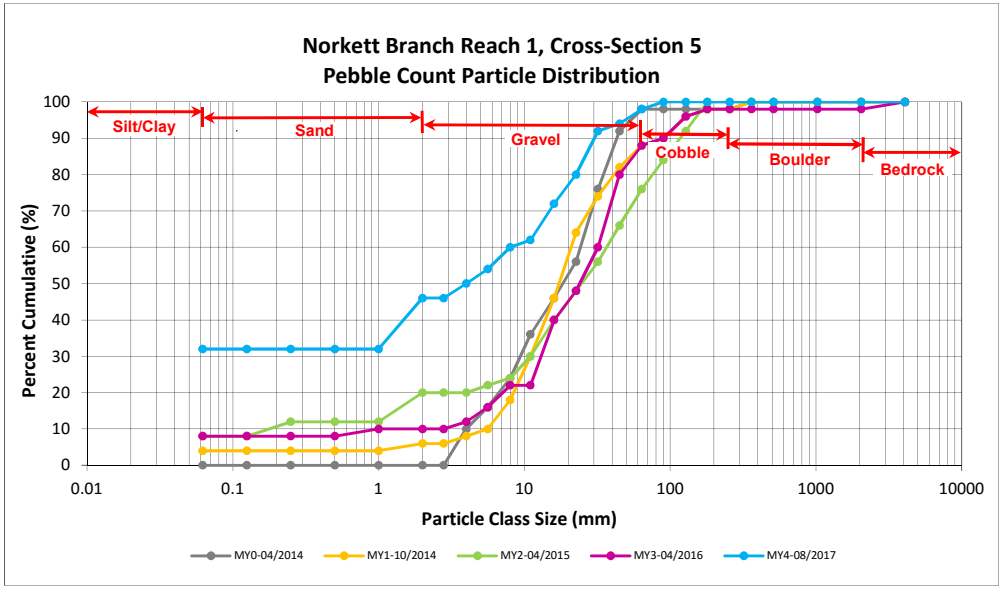
DMS Project No. 95360

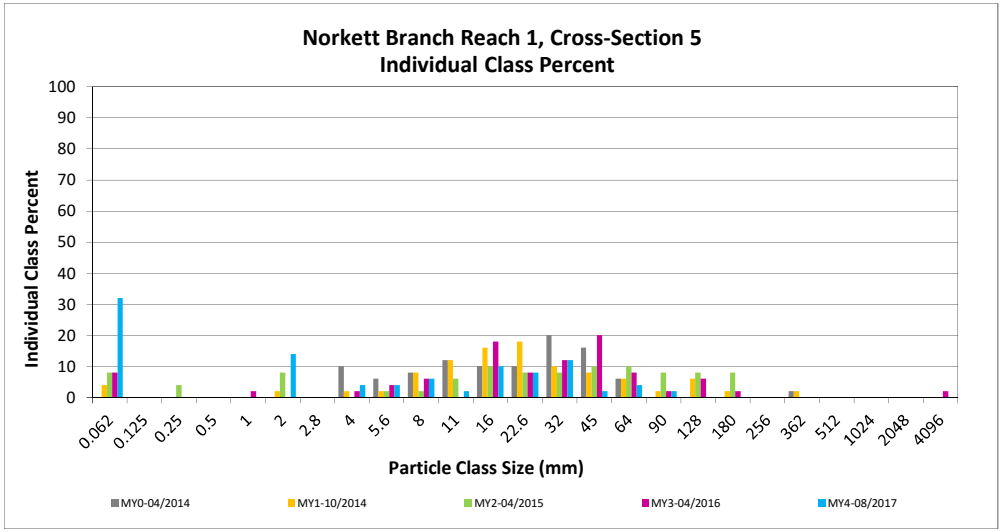
Monitoring Year 4 - 2017

Norkett Branch Reach 1, Cross-Section 5

Particle Class		Diameter (mm)		Riffle 100-Count	Summary	
		min	max		Class Percentage	Percent Cumulative
SILT/CLAY	Silt/Clay	0.000	0.062	32	32	32
SAND	Very fine	0.062	0.125			32
	Fine	0.125	0.250			32
	Medium	0.25	0.50			32
	Coarse	0.5	1.0			32
	Very Coarse	1.0	2.0	14	14	46
GRAVEL	Very Fine	2.0	2.8			46
	Very Fine	2.8	4.0	4	4	50
	Fine	4.0	5.6	4	4	54
	Fine	5.6	8.0	6	6	60
	Medium	8.0	11.0	2	2	62
	Medium	11.0	16.0	10	10	72
	Coarse	16.0	22.6	8	8	80
	Coarse	22.6	32	12	12	92
	Very Coarse	32	45	2	2	94
	Very Coarse	45	64	4	4	98
COBBLE	Small	64	90	2	2	100
	Small	90	128			100
	Large	128	180			100
	Large	180	256			100
BOULDER	Small	256	362			100
	Small	362	512			100
	Medium	512	1024			100
	Large/Very Large	1024	2048			100
BEDROCK	Bedrock	2048	>2048			100
			Total	**100**	**100**	**100**

Cross Section 5	
Channel materials (mm)	
D_{16} =	Silt/Clay
D_{35} =	1.16
D_{50} =	4.0
D_{84} =	25.4
D_{95} =	49.1
D_{100} =	90.0





Reachwide and Cross-Section Pebble Count Plots

Norkett Branch Stream Mitigation Site

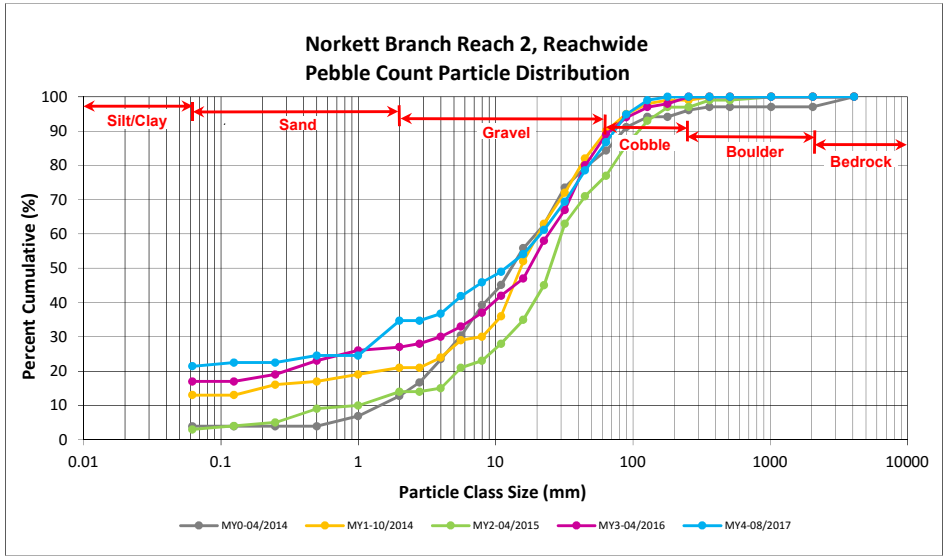
DMS Project No. 95360

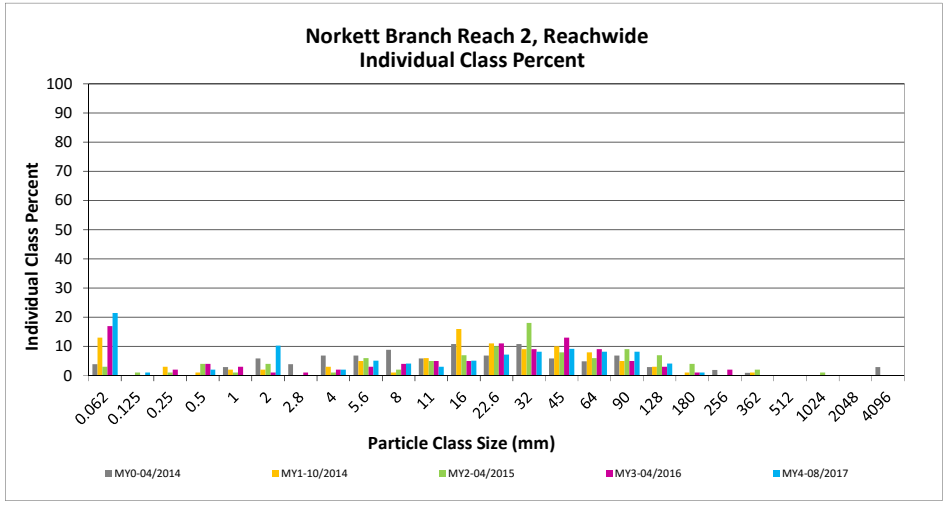
Monitoring Year 4 - 2017

Norkett Branch Reach 2, Reachwide

Particle Class		Diameter (mm)		Particle Count			Reach Summary	
		min	max	Riffle	Pool	Total	Class Percentage	Percent Cumulative
SILT/CLAY	Silt/Clay	0.000	0.062	11	10	21	21	21
SAND	Very fine	0.062	0.125	1		1	1	22
	Fine	0.125	0.250					22
	Medium	0.25	0.50		2	2	2	24
	Coarse	0.5	1.0					24
	Very Coarse	1.0	2.0	6	4	10	10	35
GRAVEL	Very Fine	2.0	2.8					35
	Very Fine	2.8	4.0		2	2	2	37
	Fine	4.0	5.6	3	2	5	5	42
	Fine	5.6	8.0	1	3	4	4	46
	Medium	8.0	11.0	2	1	3	3	49
	Medium	11.0	16.0	2	3	5	5	54
	Coarse	16.0	22.6	2	5	7	7	61
	Coarse	22.6	32	6	2	8	8	69
	Very Coarse	32	45	5	4	9	9	79
	Very Coarse	45	64	3	5	8	8	87
COBBLE	Small	64	90	6	2	8	8	95
	Small	90	128	1	3	4	4	99
	Large	128	180		1	1	1	100
	Large	180	256					100
BOULDER	Small	256	362					100
	Small	362	512					100
	Medium	512	1024					100
	Large/Very Large	1024	2048					100
BEDROCK	Bedrock	2048	>2048					100
			Total	**49**	**49**	**98**	**100**	**100**

Reachwide	
Channel materials (mm)	
D_{16} =	Silt/Clay
D_{35} =	2.95
D_{50} =	11.9
D_{84} =	56.9
D_{95} =	90.8
D_{100} =	180.0





Reachwide and Cross-Section Pebble Count Plots

Norkett Branch Stream Mitigation Site

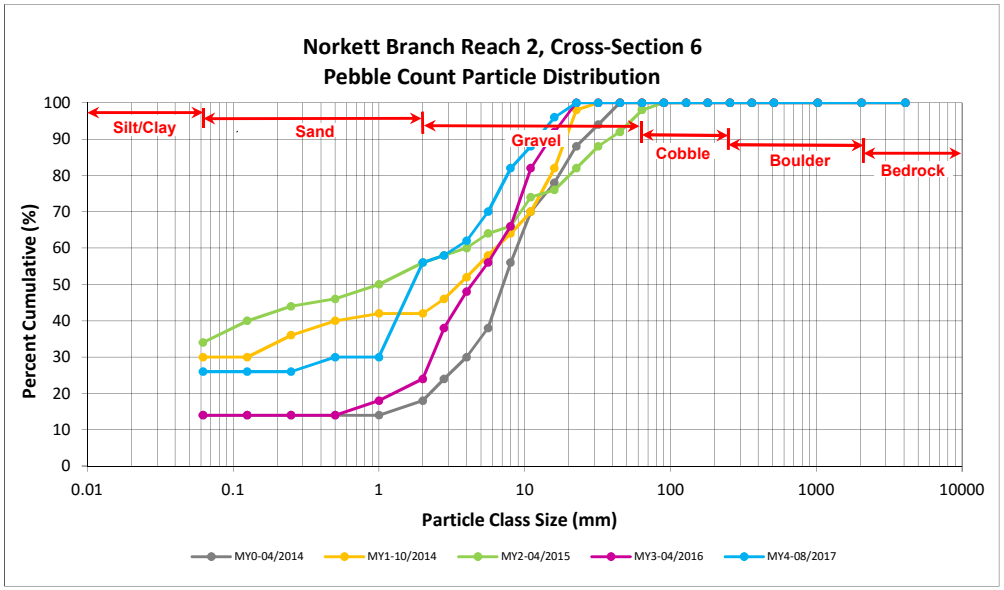
DMS Project No. 95360

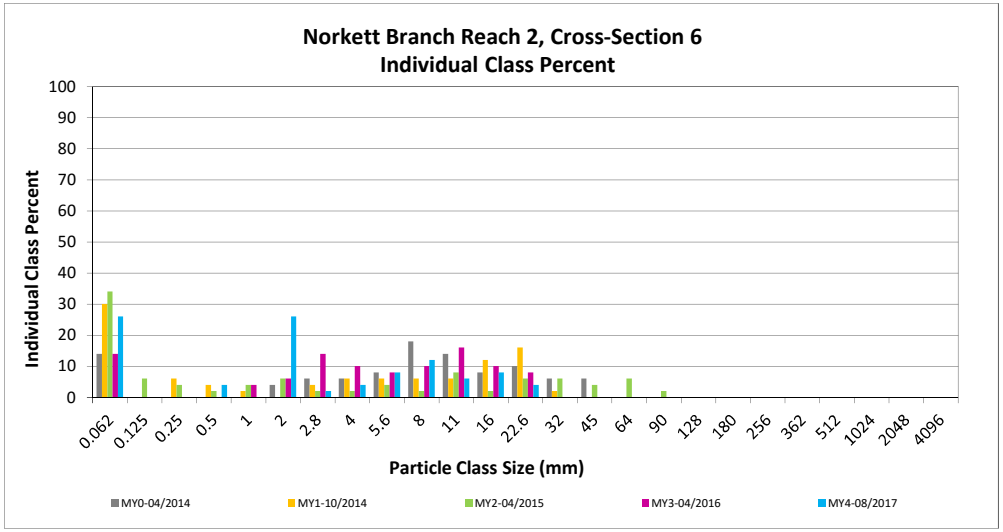
Monitoring Year 4 - 2017

Norkett Branch Reach 2, Cross-Section 6

Particle Class		Diameter (mm)		Riffle 100-Count	Summary	
		min	max		Class Percentage	Percent Cumulative
SILT/CLAY	Silt/Clay	0.000	0.062	26	26	26
SAND	Very fine	0.062	0.125			26
	Fine	0.125	0.250			26
	Medium	0.25	0.50	4	4	30
	Coarse	0.5	1.0			30
	Very Coarse	1.0	2.0	26	26	56
GRAVEL	Very Fine	2.0	2.8	2	2	58
	Very Fine	2.8	4.0	4	4	62
	Fine	4.0	5.6	8	8	70
	Fine	5.6	8.0	12	12	82
	Medium	8.0	11.0	6	6	88
	Medium	11.0	16.0	8	8	96
	Coarse	16.0	22.6	4	4	100
	Coarse	22.6	32			100
	Very Coarse	32	45			100
	Very Coarse	45	64			100
COBBLE	Small	64	90			100
	Small	90	128			100
	Large	128	180			100
	Large	180	256			100
BOULDER	Small	256	362			100
	Small	362	512			100
	Medium	512	1024			100
	Large/Very Large	1024	2048			100
BEDROCK	Bedrock	2048	>2048			100
			Total	**100**	**100**	**100**

Cross Section 6	
Channel materials (mm)	
D_{16} =	Silt/Clay
D_{35} =	1.14
D_{50} =	1.7
D_{84} =	8.9
D_{95} =	15.3
D_{100} =	22.6





Reachwide and Cross-Section Pebble Count Plots

Norkett Branch Stream Mitigation Site

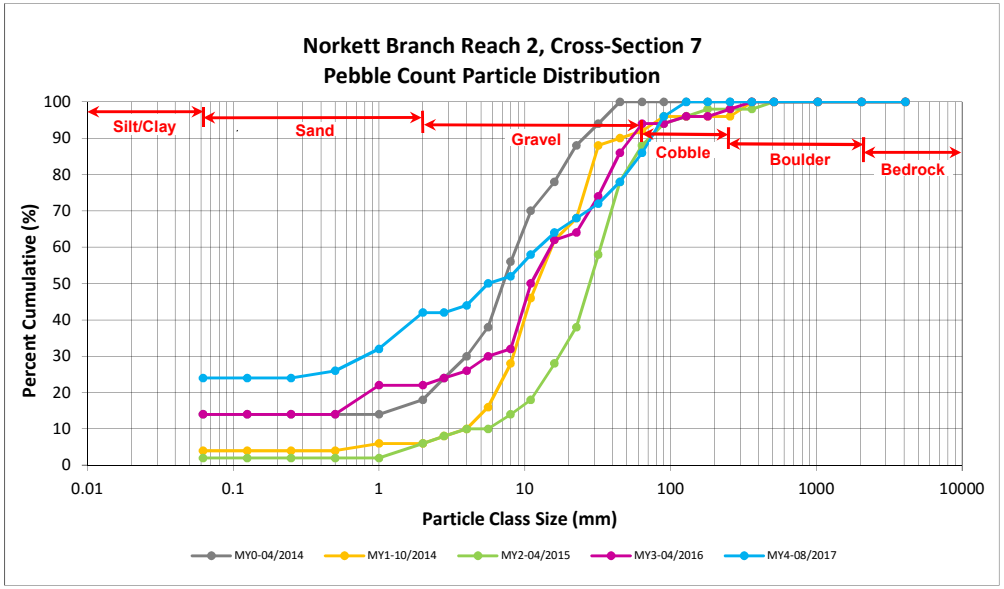
DMS Project No. 95360

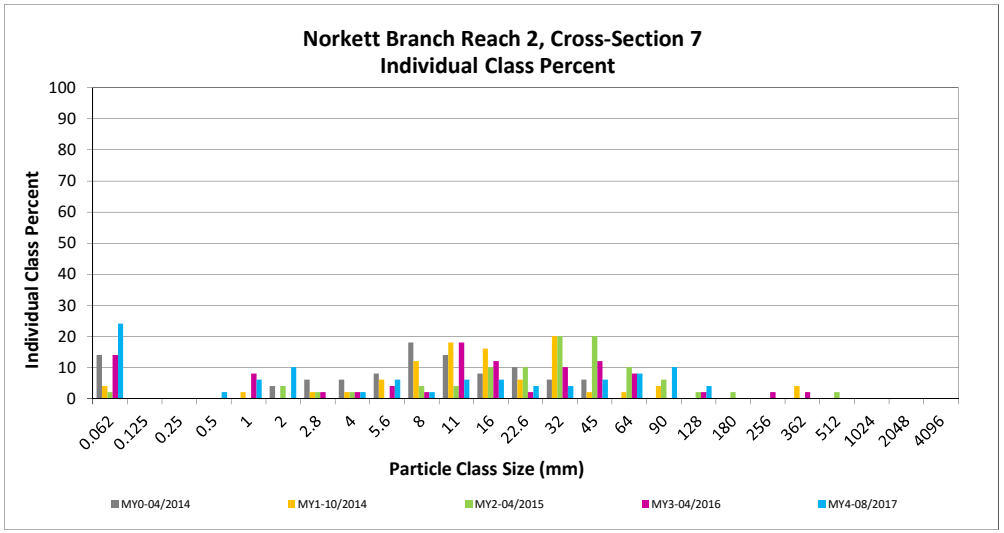
Monitoring Year 4 - 2017

Norkett Branch Reach 2, Cross-Section 7

Particle Class		Diameter (mm) min	Diameter (mm) max	Riffle 100-Count	Summary Class Percentage	Summary Percent Cumulative
SILT/CLAY	Silt/Clay	0.000	0.062	24	24	24
SAND	Very fine	0.062	0.125			24
	Fine	0.125	0.250			24
	Medium	0.25	0.50	2	2	26
	Coarse	0.5	1.0	6	6	32
	Very Coarse	1.0	2.0	10	10	42
GRAVEL	Very Fine	2.0	2.8			42
	Very Fine	2.8	4.0	2	2	44
	Fine	4.0	5.6	6	6	50
	Fine	5.6	8.0	2	2	52
	Medium	8.0	11.0	6	6	58
	Medium	11.0	16.0	6	6	64
	Coarse	16.0	22.6	4	4	68
	Coarse	22.6	32	4	4	72
	Very Coarse	32	45	6	6	78
	Very Coarse	45	64	8	8	86
COBBLE	Small	64	90	10	10	96
	Small	90	128	4	4	100
	Large	128	180			100
	Large	180	256			100
BOULDER	Small	256	362			100
	Small	362	512			100
	Medium	512	1024			100
	Large/Very Large	1024	2048			100
BEDROCK	Bedrock	2048	>2048			100
			Total	**100**	**100**	**100**

Cross Section 7	
Channel materials (mm)	
D_{16} =	Silt/Clay
D_{35} =	1.23
D_{50} =	5.6
D_{84} =	58.6
D_{95} =	87.0
D_{100} =	128.0





Reachwide and Cross-Section Pebble Count Plots

Norkett Branch Stream Mitigation Site

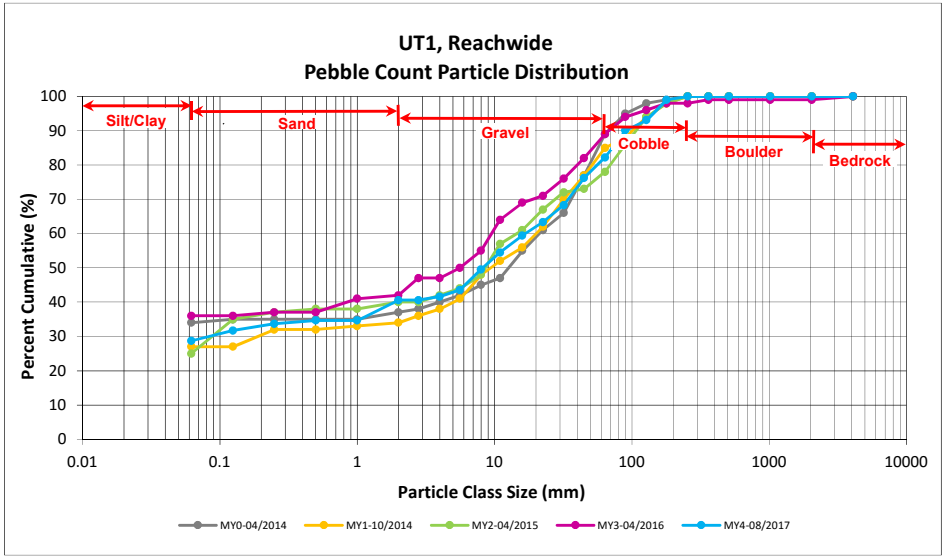
DMS Project No. 95360

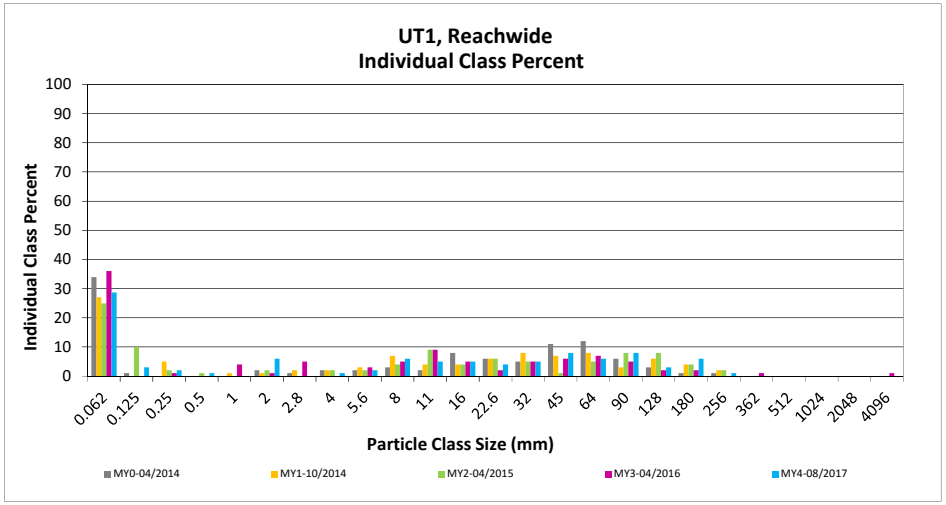
Monitoring Year 4 - 2017

UT1, Reachwide

Particle Class		Diameter (mm)		Particle Count			Reach Summary	
		min	max	Riffle	Pool	Total	Class Percentage	Percent Cumulative
SILT/CLAY	Silt/Clay	0.000	0.062	2	27	29	29	29
SAND	Very fine	0.062	0.125		3	3	3	32
	Fine	0.125	0.250		2	2	2	34
	Medium	0.25	0.50		1	1	1	35
	Coarse	0.5	1.0					35
	Very Coarse	1.0	2.0	4	2	6	6	41
GRAVEL	Very Fine	2.0	2.8					41
	Very Fine	2.8	4.0		1	1	1	42
	Fine	4.0	5.6		2	2	2	44
	Fine	5.6	8.0	3	3	6	6	50
	Medium	8.0	11.0	4	1	5	5	54
	Medium	11.0	16.0	5		5	5	59
	Coarse	16.0	22.6	4		4	4	63
	Coarse	22.6	32	3	2	5	5	68
	Very Coarse	32	45	6	2	8	8	76
	Very Coarse	45	64	6		6	6	82
COBBLE	Small	64	90	6	2	8	8	90
	Small	90	128	1	2	3	3	93
	Large	128	180	6		6	6	99
	Large	180	256	1		1	1	100
BOULDER	Small	256	362					100
	Small	362	512					100
	Medium	512	1024					100
	Large/Very Large	1024	2048					100
BEDROCK	Bedrock	2048	>2048					100
			Total	**51**	**50**	**101**	**100**	**100**

Reachwide	
Channel materials (mm)	
D_{16} =	Silt/Clay
D_{35} =	1.04
D_{50} =	8.3
D_{84} =	69.2
D_{95} =	143.0
D_{100} =	256.0





Reachwide and Cross-Section Pebble Count Plots

Norkett Branch Stream Mitigation Site

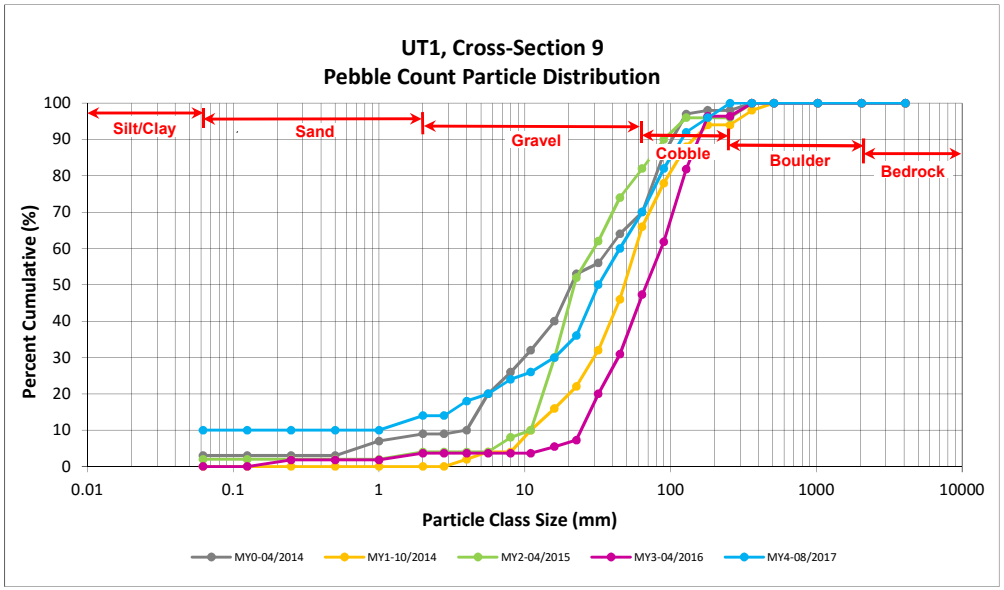
DMS Project No. 95360

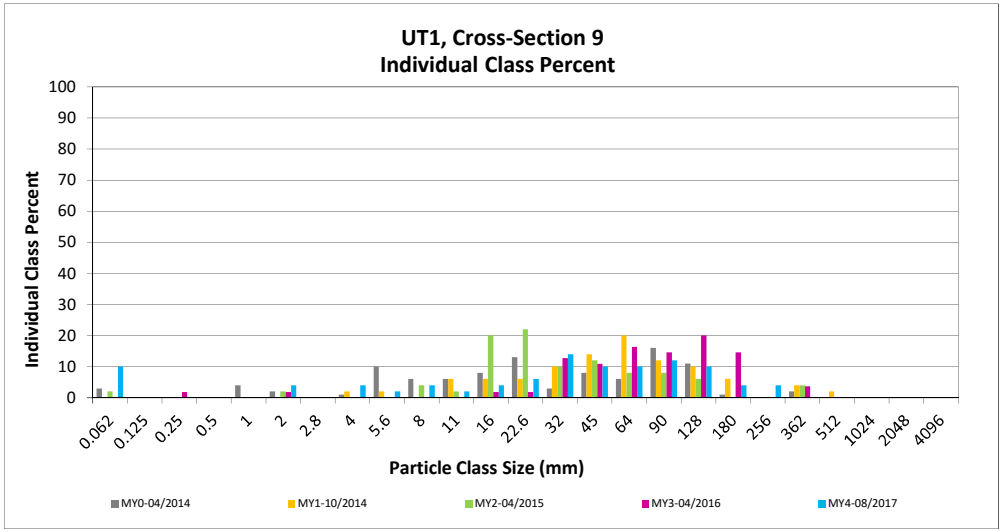
Monitoring Year 4 - 2017

UT1, Cross-Section 9

Particle Class		Diameter (mm)		Riffle 100-Count	Summary	
		min	max		Class Percentage	Percent Cumulative
SILT/CLAY	Silt/Clay	0.000	0.062	10	10	10
SAND	Very fine	0.062	0.125			10
	Fine	0.125	0.250			10
	Medium	0.25	0.50			10
	Coarse	0.5	1.0			10
	Very Coarse	1.0	2.0	4	4	14
GRAVEL	Very Fine	2.0	2.8			14
	Very Fine	2.8	4.0	4	4	18
	Fine	4.0	5.6	2	2	20
	Fine	5.6	8.0	4	4	24
	Medium	8.0	11.0	2	2	26
	Medium	11.0	16.0	4	4	30
	Coarse	16.0	22.6	6	6	36
	Coarse	22.6	32	14	14	50
	Very Coarse	32	45	10	10	60
	Very Coarse	45	64	10	10	70
COBBLE	Small	64	90	12	12	82
	Small	90	128	10	10	92
	Large	128	180	4	4	96
	Large	180	256	4	4	100
BOULDER	Small	256	362			100
	Small	362	512			100
	Medium	512	1024			100
	Large/Very Large	1024	2048			100
BEDROCK	Bedrock	2048	>2048			100
			Total	**100**	**100**	**100**

Cross Section 9	
Channel materials (mm)	
D_{16} =	3.35
D_{35} =	21.34
D_{50} =	32.0
D_{84} =	96.6
D_{95} =	165.3
D_{100} =	256.0





Reachwide and Cross-Section Pebble Count Plots

Norkett Branch Stream Mitigation Site

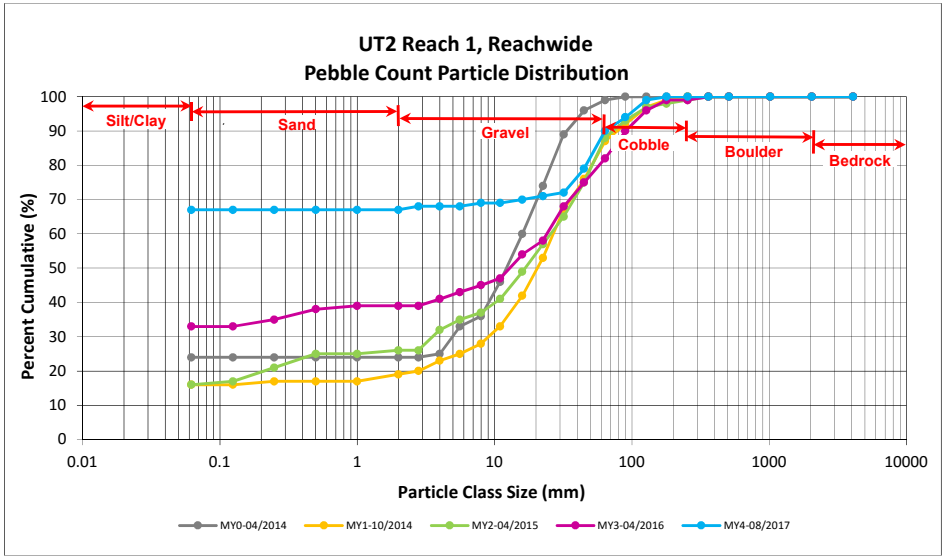
DMS Project No. 95360

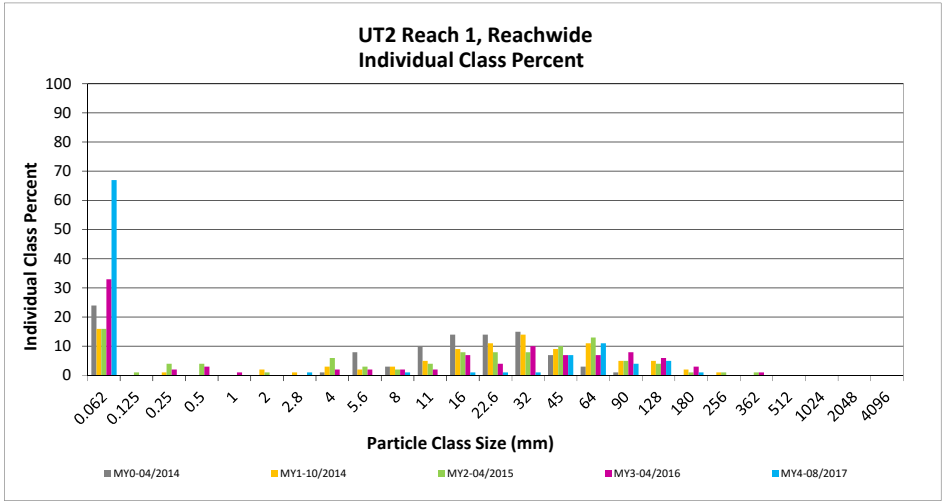
Monitoring Year 4 - 2017

UT2 Reach 1, Reachwide

Particle Class		Diameter (mm)		Particle Count			Reach Summary	
		min	max	Riffle	Pool	Total	Class Percentage	Percent Cumulative
SILT/CLAY	Silt/Clay	0.000	0.062	20	47	67	67	67
SAND	Very fine	0.062	0.125					67
	Fine	0.125	0.250					67
	Medium	0.25	0.50					67
	Coarse	0.5	1.0					67
	Very Coarse	1.0	2.0					67
GRAVEL	Very Fine	2.0	2.8		1	1	1	68
	Very Fine	2.8	4.0					68
	Fine	4.0	5.6					68
	Fine	5.6	8.0		1	1	1	69
	Medium	8.0	11.0					69
	Medium	11.0	16.0		1	1	1	70
	Coarse	16.0	22.6	1		1	1	71
	Coarse	22.6	32	1		1	1	72
	Very Coarse	32	45	7		7	7	79
	Very Coarse	45	64	11		11	11	90
COBBLE	Small	64	90	4		4	4	94
	Small	90	128	5		5	5	99
	Large	128	180	1		1	1	100
	Large	180	256					100
BOULDER	Small	256	362					100
	Small	362	512					100
	Medium	512	1024					100
	Large/Very Large	1024	2048					100
BEDROCK	Bedrock	2048	>2048					100
			Total	**50**	**50**	**100**	**100**	**100**

Reachwide	
Channel materials (mm)	
D_{16} =	Silt/Clay
D_{35} =	Silt/Clay
D_{50} =	Silt/Clay
D_{84} =	52.8
D_{95} =	96.6
D_{100} =	180.0





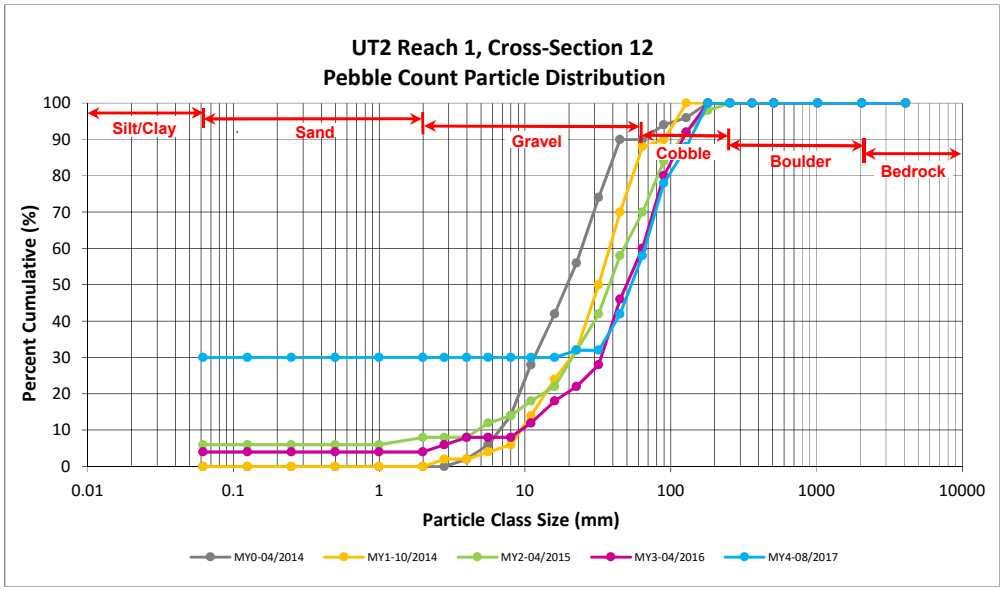
Reachwide and Cross-Section Pebble Count Plots

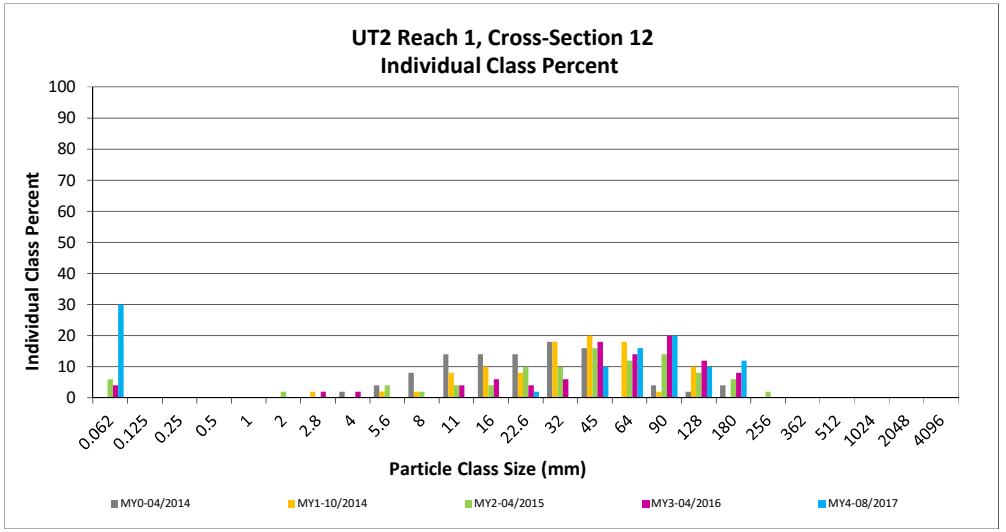
Norkett Branch Stream Mitigation Site
DMS Project No. 95360
Monitoring Year 4 - 2017

UT2 Reach 1, Cross-Section 12

Particle Class		Diameter (mm)		Riffle 100-Count	Summary	
		min	max		Class Percentage	Percent Cumulative
SILT/CLAY	Silt/Clay	0.000	0.062	30	30	30
SAND	Very fine	0.062	0.125			30
	Fine	0.125	0.250			30
	Medium	0.25	0.50			30
	Coarse	0.5	1.0			30
	Very Coarse	1.0	2.0			30
GRAVEL	Very Fine	2.0	2.8			30
	Very Fine	2.8	4.0			30
	Fine	4.0	5.6			30
	Fine	5.6	8.0			30
	Medium	8.0	11.0			30
	Medium	11.0	16.0			30
	Coarse	16.0	22.6	2	2	32
	Coarse	22.6	32			32
	Very Coarse	32	45	10	10	42
	Very Coarse	45	64	16	16	58
COBBLE	Small	64	90	20	20	78
	Small	90	128	10	10	88
	Large	128	180	12	12	100
	Large	180	256			100
BOULDER	Small	256	362			100
	Small	362	512			100
	Medium	512	1024			100
	Large/Very Large	1024	2048			100
BEDROCK	Bedrock	2048	>2048			100
			Total	**100**	**100**	**100**

Cross Section 12	
Channel materials (mm)	
D_{16} =	Silt/Clay
D_{35} =	35.45
D_{50} =	53.7
D_{84} =	111.2
D_{95} =	156.2
D_{100} =	180.0





Reachwide and Cross-Section Pebble Count Plots

Norkett Branch Stream Mitigation Site

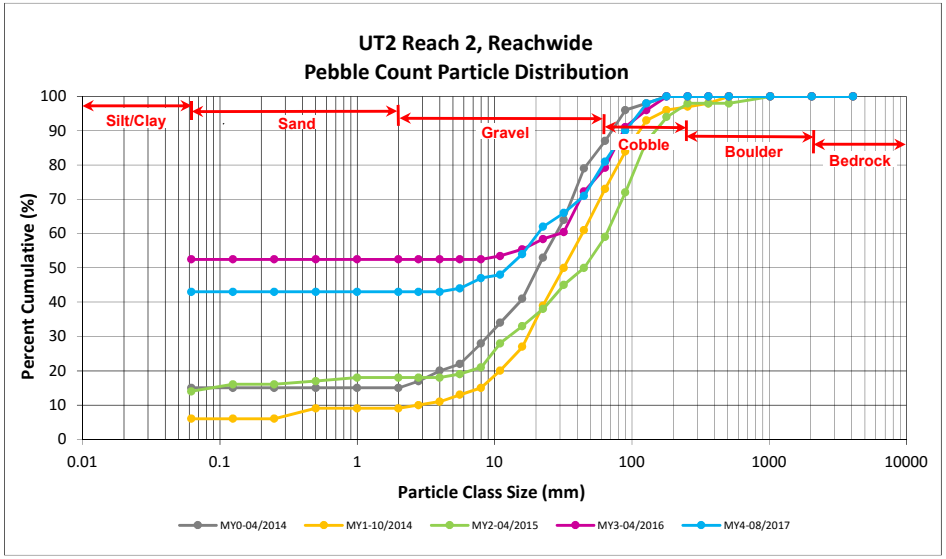
DMS Project No. 95360

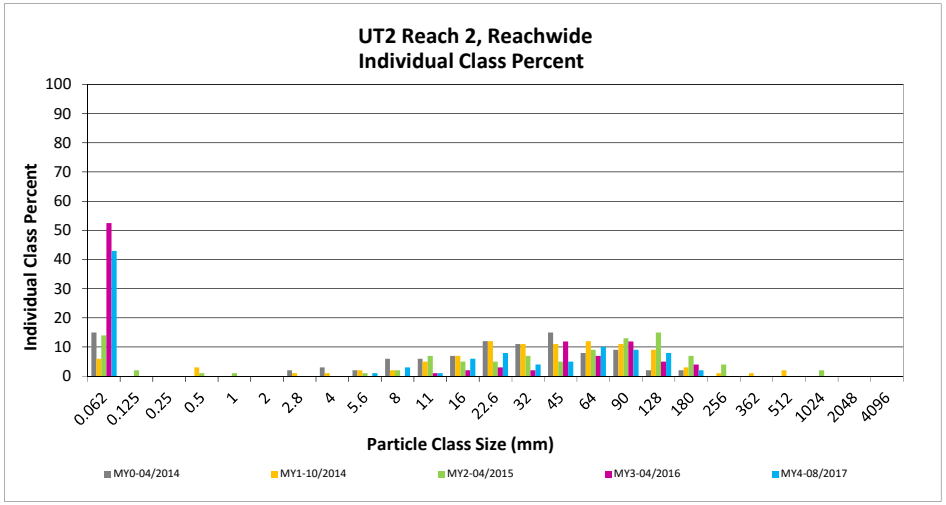
Monitoring Year 4 - 2017

UT2 Reach 2, Reachwide

Particle Class		Diameter (mm)		Particle Count			Reach Summary	
		min	max	Riffle	Pool	Total	Class Percentage	Percent Cumulative
SILT/CLAY	Silt/Clay	0.000	0.062	4	39	43	43	43
SAND	Very fine	0.062	0.125					43
	Fine	0.125	0.250					43
	Medium	0.25	0.50					43
	Coarse	0.5	1.0					43
	Very Coarse	1.0	2.0					43
GRAVEL	Very Fine	2.0	2.8					43
	Very Fine	2.8	4.0					43
	Fine	4.0	5.6	1		1	1	44
	Fine	5.6	8.0	1	2	3	3	47
	Medium	8.0	11.0		1	1	1	48
	Medium	11.0	16.0	2	4	6	6	54
	Coarse	16.0	22.6	6	2	8	8	62
	Coarse	22.6	32	4		4	4	66
	Very Coarse	32	45	5		5	5	71
	Very Coarse	45	64	9	1	10	10	81
COBBLE	Small	64	90	8	1	9	9	90
	Small	90	128	8		8	8	98
	Large	128	180	2		2	2	100
	Large	180	256					100
BOULDER	Small	256	362					100
	Small	362	512					100
	Medium	512	1024					100
	Large/Very Large	1024	2048					100
BEDROCK	Bedrock	2048	>2048					100
			Total	**50**	**50**	**100**	**100**	**100**

Reachwide	
Channel materials (mm)	
D_{16} =	Silt/Clay
D_{35} =	Silt/Clay
D_{50} =	12.5
D_{84} =	71.7
D_{95} =	112.2
D_{100} =	180.0





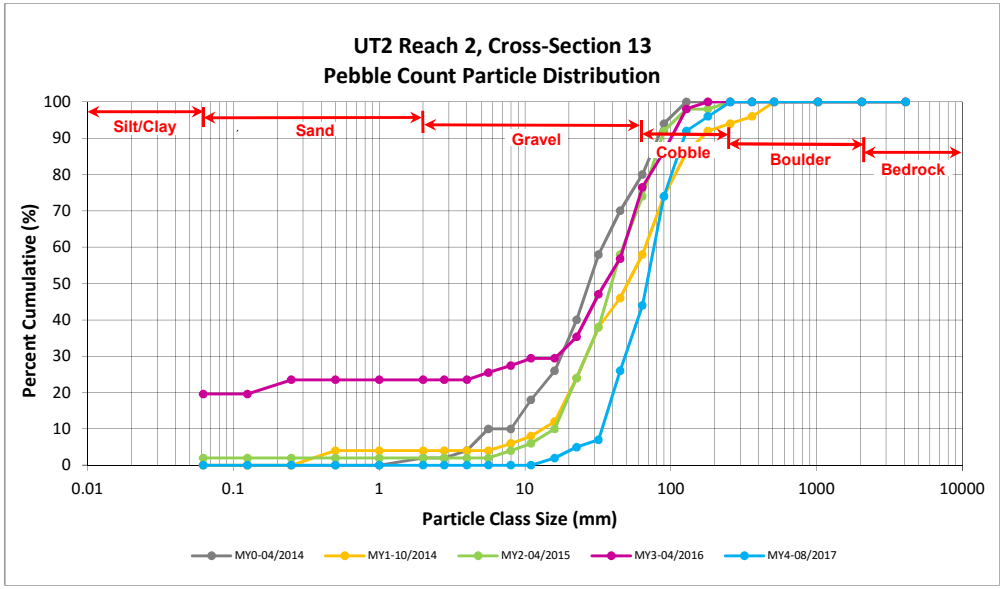
Reachwide and Cross-Section Pebble Count Plots

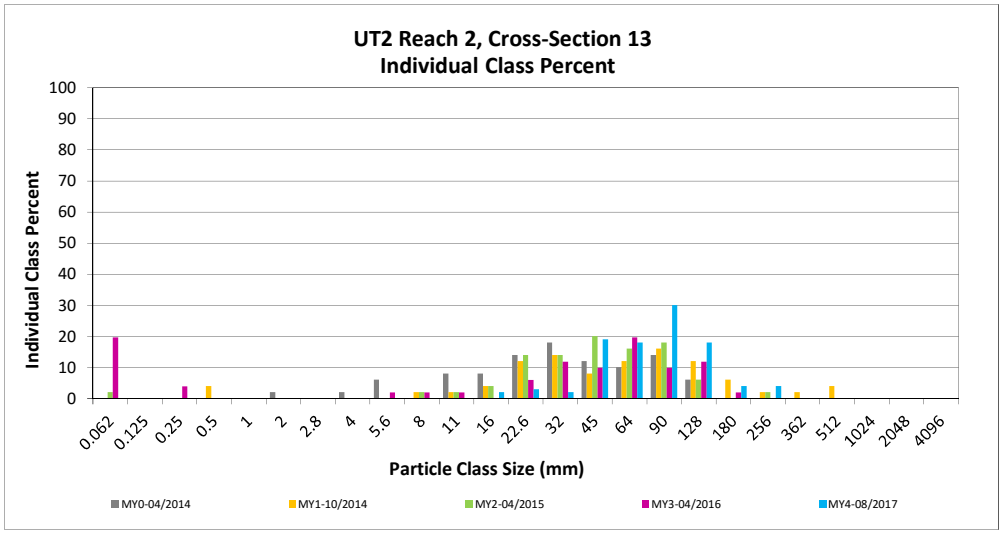
Norkett Branch Stream Mitigation Site
DMS Project No. 95360
Monitoring Year 4 - 2017

UT2 Reach 2, Cross-Section 13

Particle Class		Diameter (mm)		Riffle 100-Count	Summary	
		min	max		Class Percentage	Percent Cumulative
SILT/CLAY	Silt/Clay	0.000	0.062			0
SAND	Very fine	0.062	0.125			0
	Fine	0.125	0.250			0
	Medium	0.25	0.50			0
	Coarse	0.5	1.0			0
	Very Coarse	1.0	2.0			0
GRAVEL	Very Fine	2.0	2.8			0
	Very Fine	2.8	4.0			0
	Fine	4.0	5.6			0
	Fine	5.6	8.0			0
	Medium	8.0	11.0			0
	Medium	11.0	16.0	2	2	2
	Coarse	16.0	22.6	3	3	5
	Coarse	22.6	32	2	2	7
	Very Coarse	32	45	19	19	26
	Very Coarse	45	64	18	18	44
COBBLE	Small	64	90	30	30	74
	Small	90	128	18	18	92
	Large	128	180	4	4	96
	Large	180	256	4	4	100
BOULDER	Small	256	362			100
	Small	362	512			100
	Medium	512	1024			100
	Large/Very Large	1024	2048			100
BEDROCK	Bedrock	2048	>2048			100
			Total	**100**	**100**	**100**

Cross Section 13	
Channel materials (mm)	
D_{16} =	37.61
D_{35} =	53.67
D_{50} =	68.5
D_{84} =	109.5
D_{95} =	165.3
D_{100} =	256.0





Reachwide and Cross-Section Pebble Count Plots

Norkett Branch Stream Mitigation Site

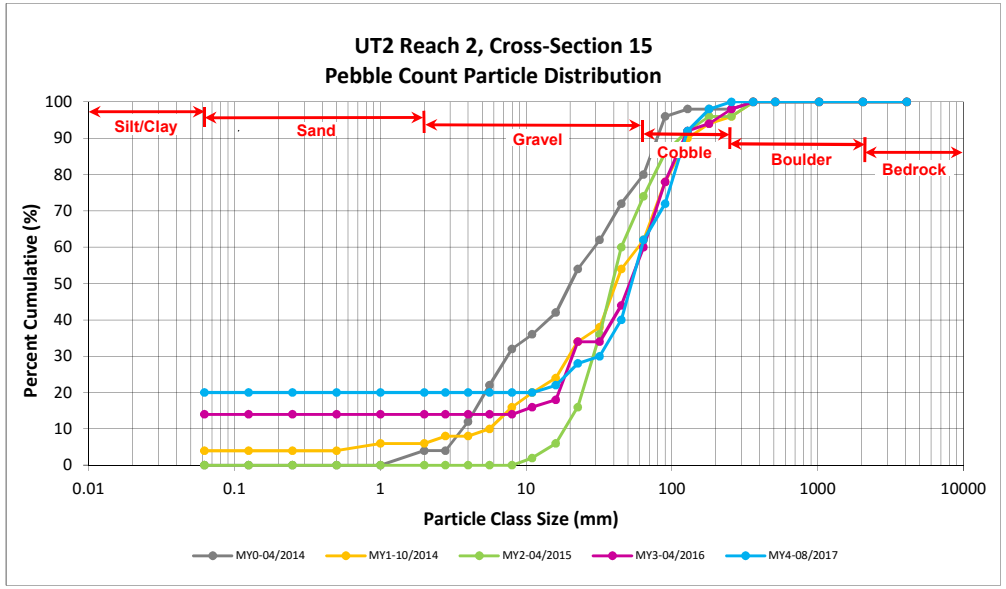
DMS Project No. 95360

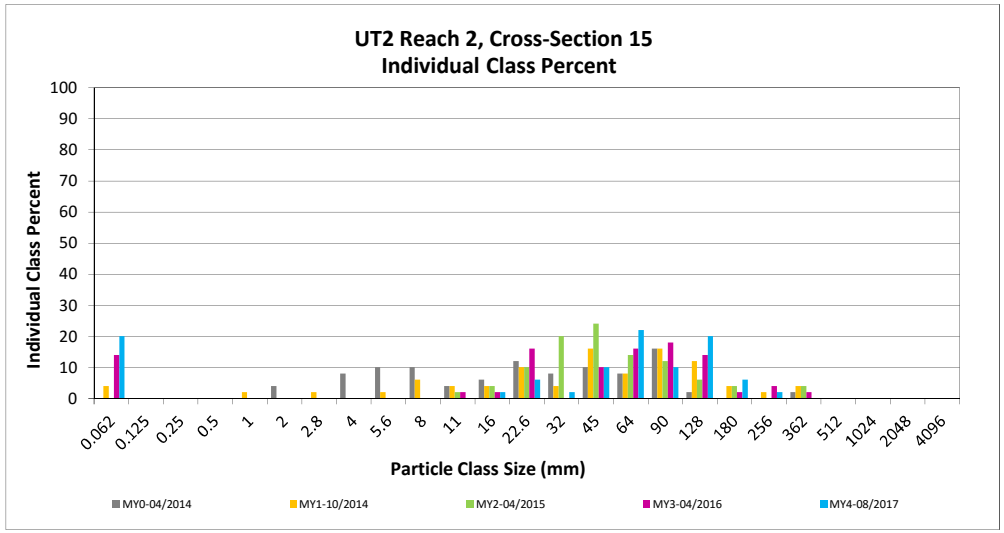
Monitoring Year 4 - 2017

UT2 Reach 2, Cross-Section 15

Particle Class		Diameter (mm)		Riffle 100-Count	Summary	
		min	max		Class Percentage	Percent Cumulative
SILT/CLAY	Silt/Clay	0.000	0.062	6	6	6
SAND	Very fine	0.062	0.125			6
	Fine	0.125	0.250			6
	Medium	0.25	0.50			6
	Coarse	0.5	1.0			6
	Very Coarse	1.0	2.0			6
GRAVEL	Very Fine	2.0	2.8			6
	Very Fine	2.8	4.0			6
	Fine	4.0	5.6			6
	Fine	5.6	8.0			6
	Medium	8.0	11.0	2	2	8
	Medium	11.0	16.0	2	2	10
	Coarse	16.0	22.6	8	8	18
	Coarse	22.6	32	10	10	28
	Very Coarse	32	45	12	12	40
	Very Coarse	45	64	20	20	60
COBBLE	Small	64	90	16	16	76
	Small	90	128	14	14	90
	Large	128	180	6	6	96
	Large	180	256	2	2	98
BOULDER	Small	256	362	2	2	100
	Small	362	512			100
	Medium	512	1024			100
	Large/Very Large	1024	2048			100
BEDROCK	Bedrock	2048	>2048			100
			Total	**100**	**100**	**100**

Cross Section 15	
Channel materials (mm)	
D_{16} =	20.73
D_{35} =	39.04
D_{50} =	53.7
D_{84} =	110.1
D_{95} =	170.1
D_{100} =	362.0





Reachwide and Cross-Section Pebble Count Plots

Norkett Branch Stream Mitigation Site

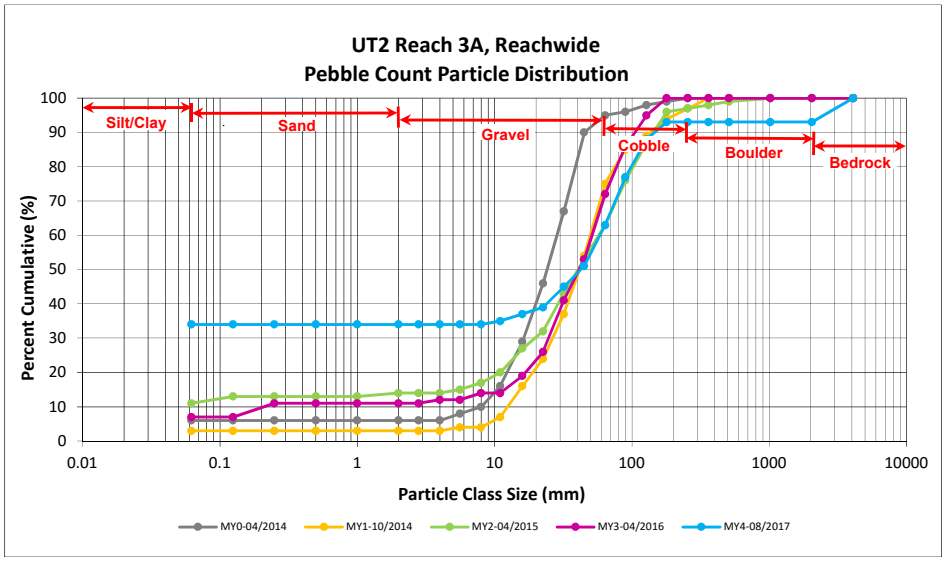
DMS Project No. 95360

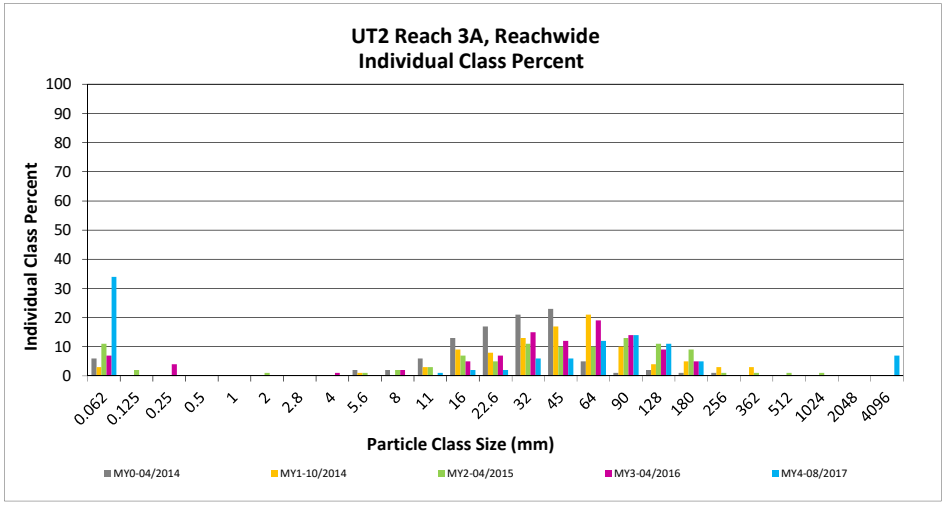
Monitoring Year 4 - 2017

UT2 Reach 3A, Reachwide

Particle Class		Diameter (mm)		Particle Count			Reach Summary	
		min	max	Riffle	Pool	Total	Class Percentage	Percent Cumulative
SILT/CLAY	Silt/Clay	0.000	0.062	6	28	34	34	34
SAND	Very fine	0.062	0.125					34
	Fine	0.125	0.250					34
	Medium	0.25	0.50					34
	Coarse	0.5	1.0					34
	Very Coarse	1.0	2.0					34
GRAVEL	Very Fine	2.0	2.8					34
	Very Fine	2.8	4.0					34
	Fine	4.0	5.6					34
	Fine	5.6	8.0					34
	Medium	8.0	11.0		1	1	1	35
	Medium	11.0	16.0	1	1	2	2	37
	Coarse	16.0	22.6	1	1	2	2	39
	Coarse	22.6	32	3	3	6	6	45
	Very Coarse	32	45	3	3	6	6	51
	Very Coarse	45	64	10	2	12	12	63
COBBLE	Small	64	90	11	3	14	14	77
	Small	90	128	8	3	11	11	88
	Large	128	180	5		5	5	93
	Large	180	256					93
BOULDER	Small	256	362					93
	Small	362	512					93
	Medium	512	1024					93
	Large/Very Large	1024	2048					93
BEDROCK	Bedrock	2048	>2048	2	5	7	7	100
			Total	**50**	**50**	**100**	**100**	**100**

Reachwide	
Channel materials (mm)	
D_{16} =	Silt/Clay
D_{35} =	11.00
D_{50} =	42.5
D_{84} =	112.6
D_{95} =	>2048
D_{100} =	>2048





Reachwide and Cross-Section Pebble Count Plots

Norkett Branch Stream Mitigation Site

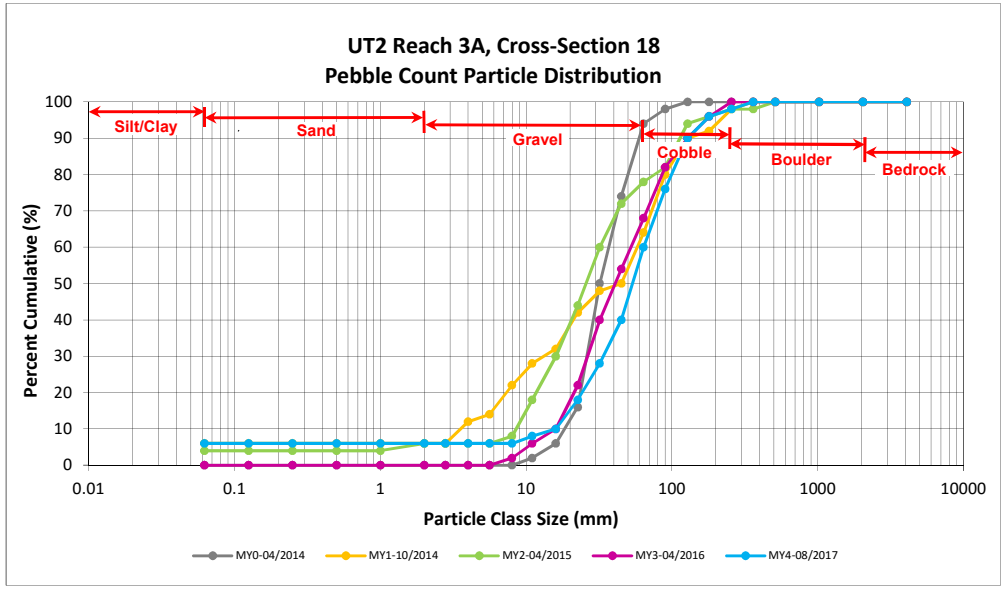
DMS Project No. 95360

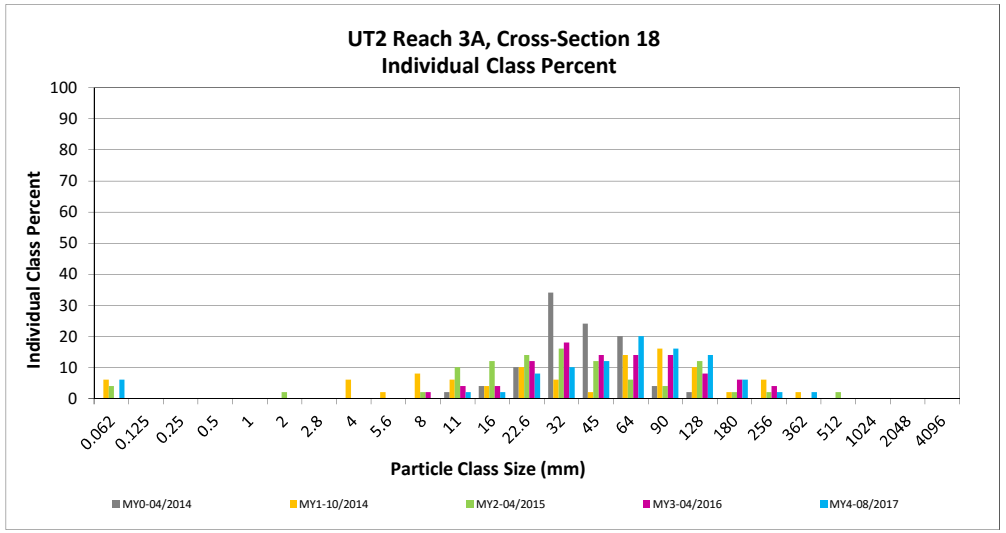
Monitoring Year 4 - 2017

UT2 Reach 3A, Cross-Section 18

Particle Class		Diameter (mm)		Riffle 100-Count	Summary	
		min	max		Class Percentage	Percent Cumulative
SILT/CLAY	Silt/Clay	0.000	0.062	6	6	6
SAND	Very fine	0.062	0.125			6
	Fine	0.125	0.250			6
	Medium	0.25	0.50			6
	Coarse	0.5	1.0			6
	Very Coarse	1.0	2.0			6
GRAVEL	Very Fine	2.0	2.8			6
	Very Fine	2.8	4.0			6
	Fine	4.0	5.6			6
	Fine	5.6	8.0			6
	Medium	8.0	11.0	2	2	8
	Medium	11.0	16.0	2	2	10
	Coarse	16.0	22.6	8	8	18
	Coarse	22.6	32	10	10	28
	Very Coarse	32	45	12	12	40
	Very Coarse	45	64	20	20	60
COBBLE	Small	64	90	16	16	76
	Small	90	128	14	14	90
	Large	128	180	6	6	96
	Large	180	256	2	2	98
BOULDER	Small	256	362	2	2	100
	Small	362	512			100
	Medium	512	1024			100
	Large/Very Large	1024	2048			100
BEDROCK	Bedrock	2048	>2048			100
			Total	**100**	**100**	**100**

Cross Section 18	
Channel materials (mm)	
D_{16} =	20.73
D_{35} =	39.04
D_{50} =	53.7
D_{84} =	110.1
D_{95} =	170.1
D_{100} =	362.0





Reachwide and Cross-Section Pebble Count Plots

Norkett Branch Stream Mitigation Site

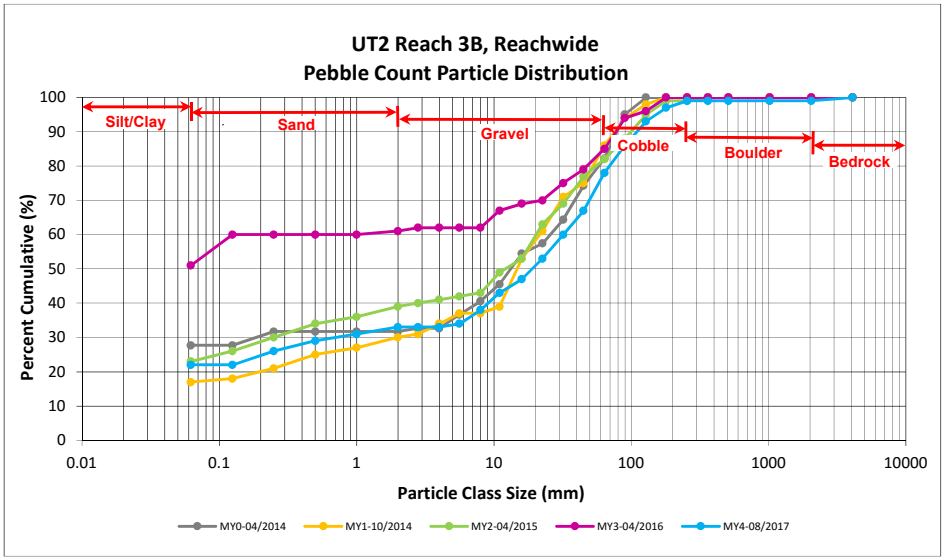
DMS Project No. 95360

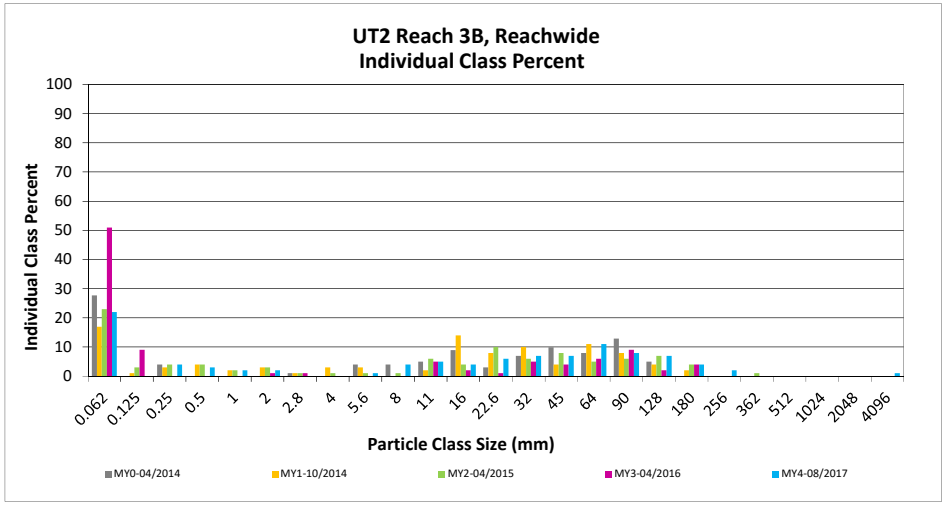
Monitoring Year 4 - 2017

UT2 Reach 3B, Reachwide

Particle Class		Diameter (mm)		Particle Count			Reach Summary	
		min	max	Riffle	Pool	Total	Class Percentage	Percent Cumulative
SILT/CLAY	Silt/Clay	0.000	0.062	6	16	22	22	22
SAND	Very fine	0.062	0.125					22
	Fine	0.125	0.250	1	3	4	4	26
	Medium	0.25	0.50		3	3	3	29
	Coarse	0.5	1.0		2	2	2	31
	Very Coarse	1.0	2.0		2	2	2	33
GRAVEL	Very Fine	2.0	2.8					33
	Very Fine	2.8	4.0					33
	Fine	4.0	5.6		1	1	1	34
	Fine	5.6	8.0	1	3	4	4	38
	Medium	8.0	11.0	2	3	5	5	43
	Medium	11.0	16.0	1	3	4	4	47
	Coarse	16.0	22.6	3	3	6	6	53
	Coarse	22.6	32	5	2	7	7	60
	Very Coarse	32	45	5	2	7	7	67
	Very Coarse	45	64	8	3	11	11	78
COBBLE	Small	64	90	7	1	8	8	86
	Small	90	128	6	1	7	7	93
	Large	128	180	3	1	4	4	97
	Large	180	256	2		2	2	99
BOULDER	Small	256	362					99
	Small	362	512					99
	Medium	512	1024					99
	Large/Very Large	1024	2048					99
BEDROCK	Bedrock	2048	>2048		1	1	1	100
			Total	**50**	**50**	**100**	**100**	**100**

Reachwide	
Channel materials (mm)	
D_{16} =	Silt/Clay
D_{35} =	6.12
D_{50} =	19.0
D_{84} =	82.6
D_{95} =	151.8
D_{100} =	>2048





Reachwide and Cross-Section Pebble Count Plots

Norkett Branch Stream Mitigation Site

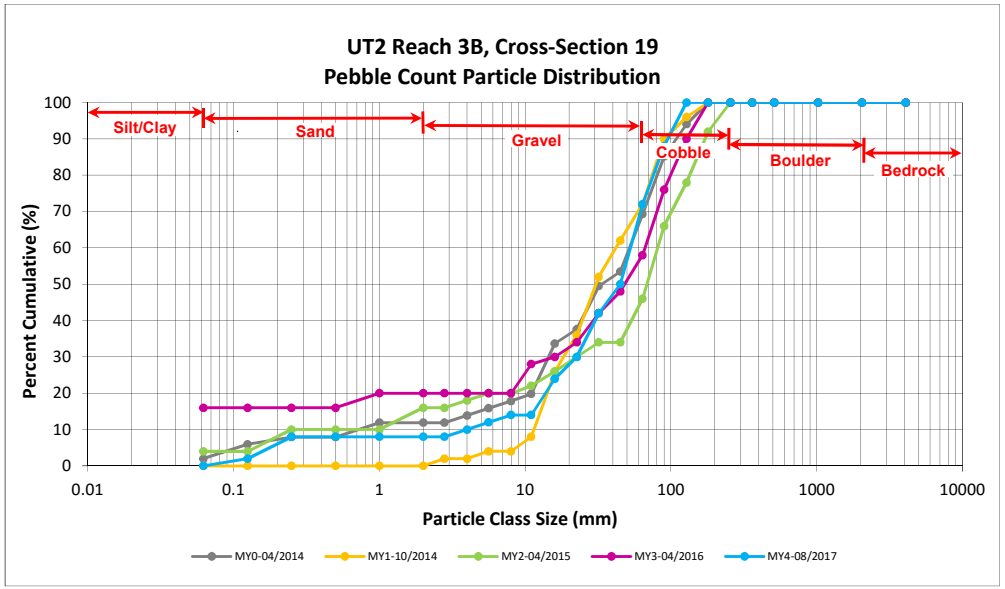
DMS Project No. 95360

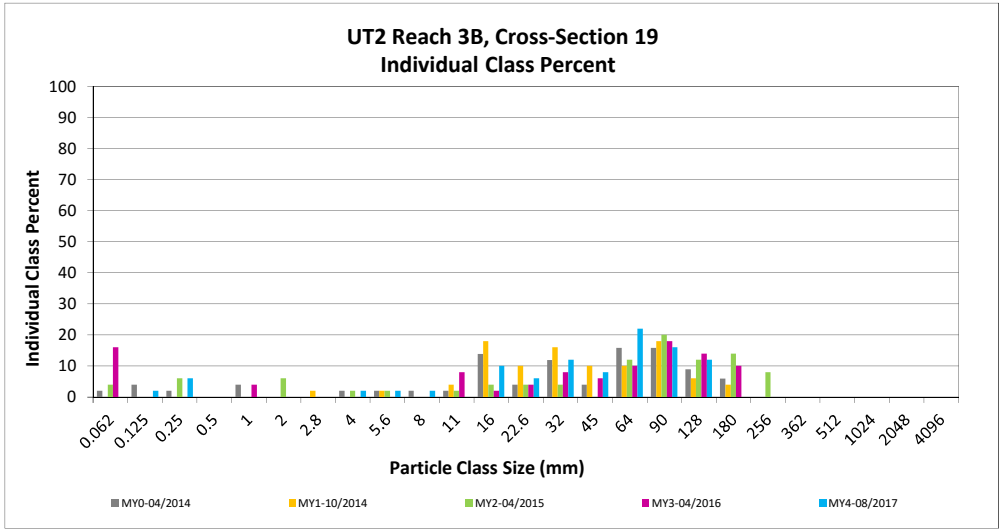
Monitoring Year 4 - 2017

UT2 Reach 3B, Cross-Section 19

Particle Class		Diameter (mm)		Riffle 100-Count	Summary	
		min	max		Class Percentage	Percent Cumulative
SILT/CLAY	Silt/Clay	0.000	0.062			0
SAND	Very fine	0.062	0.125	2	2	2
	Fine	0.125	0.250	6	6	8
	Medium	0.25	0.50			8
	Coarse	0.5	1.0			8
	Very Coarse	1.0	2.0			8
GRAVEL	Very Fine	2.0	2.8			8
	Very Fine	2.8	4.0	2	2	10
	Fine	4.0	5.6	2	2	12
	Fine	5.6	8.0	2	2	14
	Medium	8.0	11.0			14
	Medium	11.0	16.0	10	10	24
	Coarse	16.0	22.6	6	6	30
	Coarse	22.6	32	12	12	42
	Very Coarse	32	45	8	8	50
	Very Coarse	45	64	22	22	72
COBBLE	Small	64	90	16	16	88
	Small	90	128	12	12	100
	Large	128	180			100
	Large	180	256			100
BOULDER	Small	256	362			100
	Small	362	512			100
	Medium	512	1024			100
	Large/Very Large	1024	2048			100
BEDROCK	Bedrock	2048	>2048			100
			Total	**100**	**100**	**100**

Cross Section 19	
Channel materials (mm)	
D_{16} =	11.86
D_{35} =	26.12
D_{50} =	45.0
D_{84} =	82.6
D_{95} =	110.5
D_{100} =	128.0





APPENDIX 5. Hydrology Data

Table 14. Verification of Bankfull Events
Norkett Branch Stream Mitigation Site
DMS Project No. 95360
Monitoring Year 4 - 2017

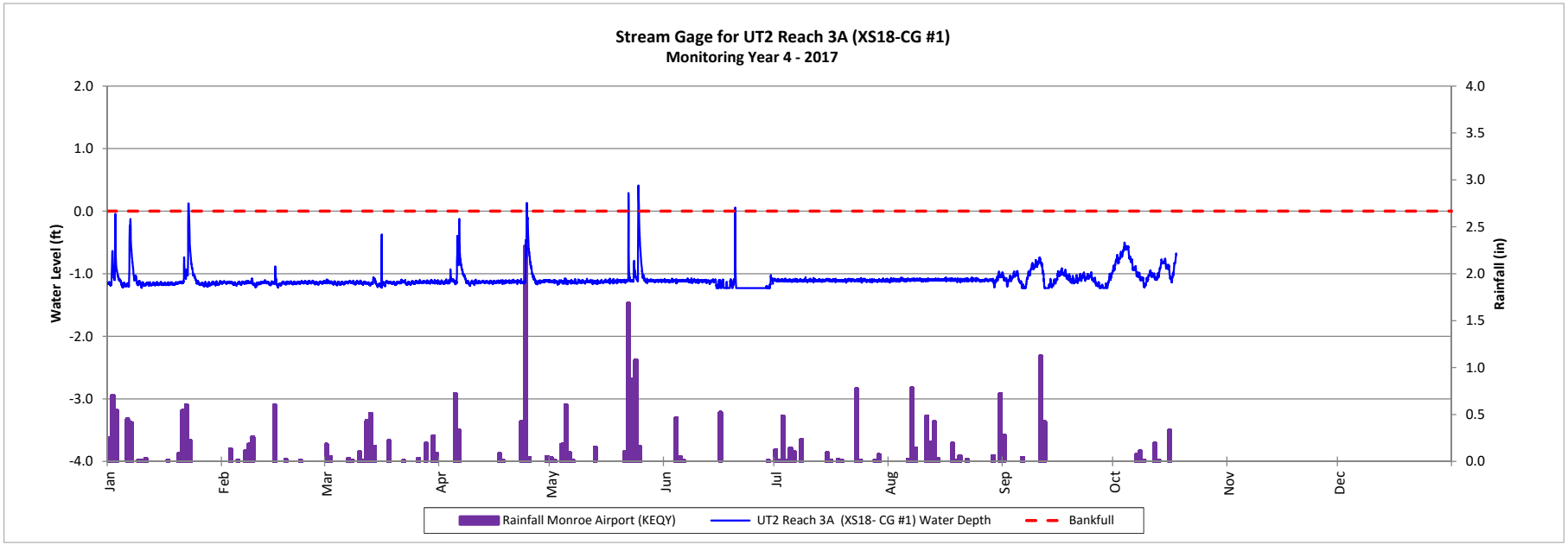
Monitoring Year	Reach	Date of Data Collection	Date of Occurrence	Method
MY1	UT2 Reach 3A (CG #1 XS18)	6/3/2014	5/30/2014	Stream Gage
		9/4/2014	7/21/2014	Stream Gage
		10/17/2014	9/16/2014	Wrack Line
	UT1 (CG #2 XS9)	6/3/2014	5/30/2014	Stream Gage
		9/4/2014	7/21/2014	Stream Gage
	Norkett Branch Reach 2 (CG #3 XS6)	6/3/2014	5/30/2014	Stream Gage
		9/4/2014	7/21/2014	Stream Gage
		10/17/2014	9/16/2014	Stream Gage
MY2	UT2 Reach 3A (CG #1 XS18)	1/4/2015	1/4/2015	Stream Gage
		1/12/2015	1/12/2015	Stream Gage
		2/26/2015	2/26/2015	Stream Gage
		3/5/2015	3/5/2015	Stream Gage
		4/19/2015	4/19/2015	Stream Gage
		10/3/2015	10/3/2015	Stream Gage, Crest Gage
	Norkett Branch Reach 2 (CG #3 XS6)	1/4/2015	1/4/2015	Stream Gage
		1/12/2015	1/12/2015	Stream Gage
		2/26/2015	2/26/2015	Stream Gage
		3/5/2015	3/5/2015	Stream Gage, Crest Gage
		4/19/2015	4/19/2015	Stream Gage, Crest Gage
		10/3/2015	10/3/2015	Stream Gage, Crest Gage
MY3	UT2 Reach 3A (CG #1 XS18)	2/3/2016	2/3/2016	Stream Gage
		2/16/2016	2/16/2016	Stream Gage
		2/24/2016	2/24/2016	Stream Gage
		3/28/2016	3/28/2016	Stream Gage, Crest Gage
		10/8/2016	10/8/2016	Stream Gage
	UT1 (CG #2 XS9)	4/22/2016	Spring 2016	Crest Gage
		10/8/2016	10/8/2016	Stream Gage
	Norkett Branch Reach 2 (CG #3 XS6)	2/3/2016	2/3/2016	Stream Gage
		2/16/2016	2/16/2016	Stream Gage
		2/24/2016	2/24/2016	Stream Gage
		3/28/2016	3/28/2016	Stream Gage, Crest Gage
		10/8/2016	10/8/2016	Stream Gage
MY4	UT2 Reach 3A (CG #1 XS18)	1/22/2017	1/22/2017	Stream Gage
		4/24/2017	4/24/2017	Stream Gage
		5/22/2017	5/22/2017	Stream Gage
		5/24/2017	5/24/2017	Stream Gage
		6/20/2017	6/20/2017	Stream Gage
		6/29/2017	N/A	Crest Gage
	Norkett Branch Reach 2 (CG #3 XS6)	1/23/2017	1/23/2017	Stream Gage
		5/24/2017	5/24/2017	Stream Gage

Stream Flow Gage Plots

Norkett Branch Mitigation Project

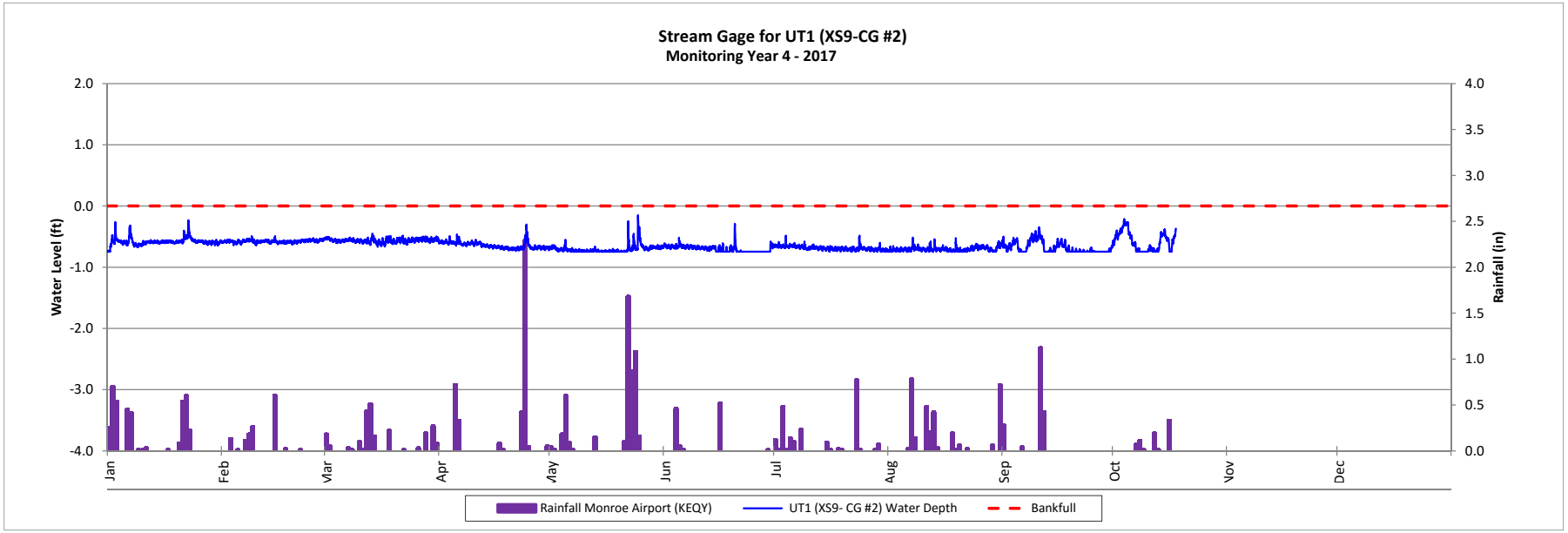
DMS Project No. 95360

Monitoring Year 4 - 2017



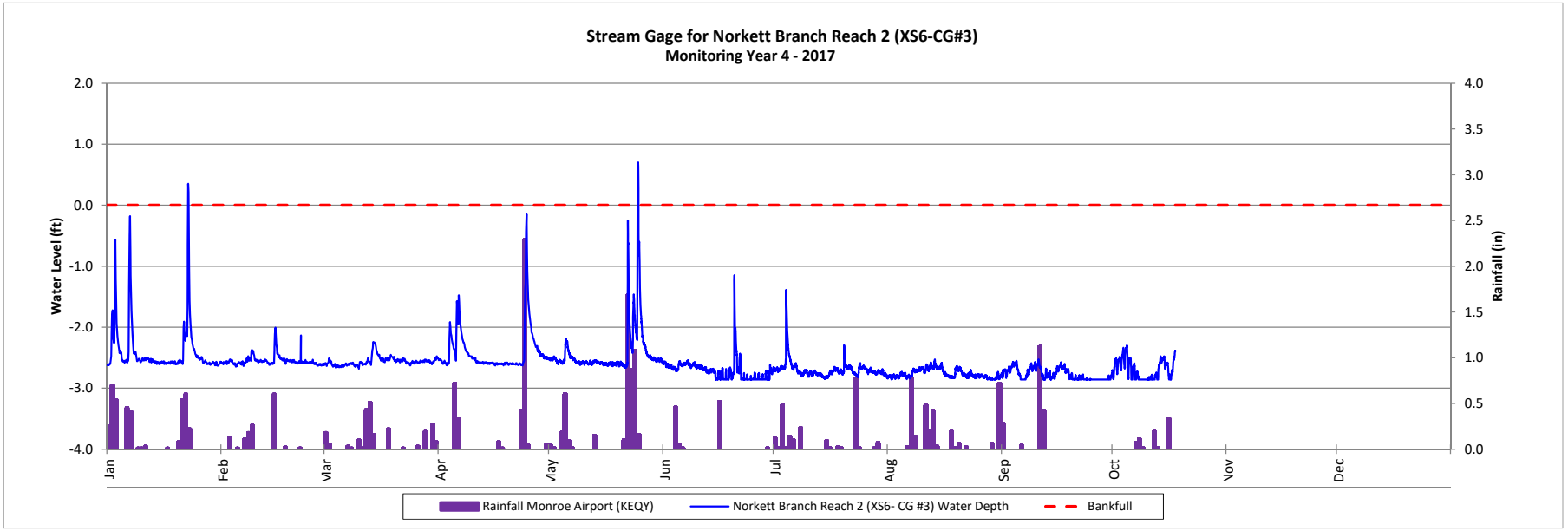
Stream Flow Gage Plots

Norkett Branch Mitigation Project
DMS Project No. 95360
Monitoring Year 4 - 2017



Stream Flow Gage Plots

Norkett Branch Mitigation Project
DMS Project No. 95360
Monitoring Year 4 - 2017



APPENDIX 6. Water Quality BMPs

Table 15. Water Quality Sampling Results
Norkett Branch Stream Mitigation Site
DMS Project No. 95360
Monitoring Year 4 - 2017

Monitoring Year	Location	Sample Collection Date	TN (mg/L)	NO_x (mg/L)	TKN (mg/L)	TP (mg/L)	TSS (mg/L)	FC (CFU/100mL)	Conductivity (µS/cm)	Temp °C	pH
MY1	SPSC BMP Inlet	4/22/2014 (Baseflow)	1.1	0.2	0.9	0.4	16.0	31	151.0	21.4	7.0
	SPSC BMP Outlet		0.9	DL	0.9	0.5	25.0	11	127.6	23.5	7.3
	PW BMP Inlet		DL	DL	0.5	0.2	11.0	68	65.0	25.3	7.4
	PW BMP Outlet		DL	0.1	DL	0.3	39.0	110	69.8	26.2	7.0
	SPSC BMP Inlet	5/15/2014	100.0	50.0	50.0	19.0	970.0	20000	1230.0	21.0	6.8
	SPSC BMP Outlet		47.0	18.0	29.0	7.0	410.0	20000	1185.0	21.0	6.9
	PW BMP Inlet		2.5	0.2	2.3	0.6	15.0	5600	95.5	22.9	6.9
	PW BMP Outlet		1.8	0.2	1.6	0.5	150.0	2100	11.3	23.8	6.9
	SPSC BMP Inlet	10/15/2014	5.5	1.3	4.2	5.4	27.0	490	437.0	19.8	7.1
	SPSC BMP Outlet		1.8	0.2	1.7	0.7	1.7	2300	333.0	21.0	7.1
	PW BMP Inlet		NF								
	PW BMP Outlet										
	SPSC BMP Inlet	11/26/2014	7.2	2.2	5.0	5.0	30.0	HT	201.1	10.1	7.2
	SPSC BMP Outlet		6.5	2.0	4.6	4.9	32.0		196.2	10.0	7.2
	PW BMP Inlet		2.8	1.1	1.7	0.6	6.6		57.8	11.2	6.7
	PW BMP Outlet		2.6	1.0	1.7	1.0	6.3		82.0	11.1	6.8
MY2	SPSC BMP Inlet	3/30/2015	1.2	0.16	1.0	0.3	6.2	120	277.8	10.0	7.1
	SPSC BMP Outlet		1.5	0.12	1.3	0.3	DL	DL	329.9	10.5	7.2
	PW BMP Inlet		DL	0.12	DL	0.3	16.0	120	180.0	9.5	7.3
	PW BMP Outlet		1.2	0.12	1.1	0.2	9.0	64	184.0	11.8	8.1
	SPSC BMP Inlet	10/28/2015	3.8	1.3	2.5	1.2	16.0	150.0	141.9	17.5	6.6
	SPSC BMP Outlet		4.5	2.4	2.1	1.0	20.0	140.0	154.8	17.0	6.4
	PW BMP Inlet		2.9	1.1	1.8	0.8	48.0	DL	97.7	17.1	4.2
	PW BMP Outlet		1.7	DL	1.7	0.3	7.6	DL	92.7	18.7	7.2
MY3	SPSC BMP Inlet	9/3/2016	13.0	1.6	11.0	5.2	140.0	HT	---	---	---
	SPSC BMP Outlet		8.5	5.2	3.2	2.5	DL		---	---	---
	PW BMP Inlet		2.3	1.0	1.3	0.9	6.7		---	---	---
	PW BMP Outlet		NF								
MY4	SPSC BMP Inlet	4/4/2017	5.9	0.7	5.2	0.2	480.0	---	---	---	---
	SPSC BMP Outlet		3.2	1.2	2.1	---	---	---	---	---	---
	PW BMP Inlet		6.1	1.4	4.7	0.3	840.0	---	---	---	---
	PW BMP Outlet		5.3	0.3	5.0	DL	150.0	---	---	---	---
	SPSC BMP Inlet	5/23/2017	5.2	1.3	4.0	2.1	25.0	---	170.0	---	6.7
	SPSC BMP Outlet		3.5	0.6	2.9	1.5	30.0	---	---	---	6.6
	PW BMP Inlet		2.6	0.4	2.2	0.2	21.0	---	42.0	---	5.8
	PW BMP Outlet		1.3	DL	1.3	0.3	3.5	---	51.0	---	6.4

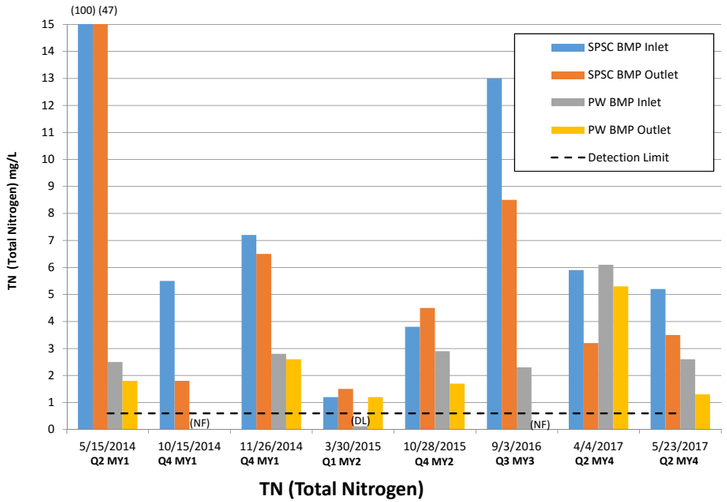
DL: Parameter was below the detection limit
NF: No flow was available for sample collection/insufficient sample volume
HT: Laboratory analysis was not available due to the short holding time for this parameter
--- : Data was not provided

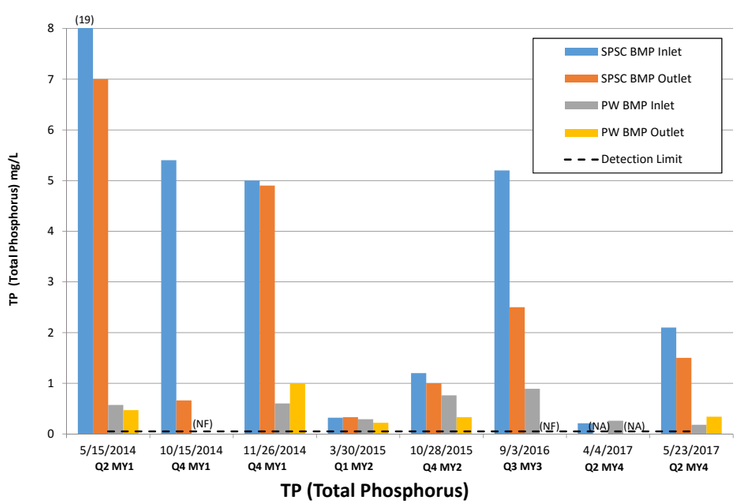
Table 16. Pollutant Removal Rates
Norkett Branch Stream Mitigation Site
DMS Project No. 95360
Monitoring Year 4 - 2017

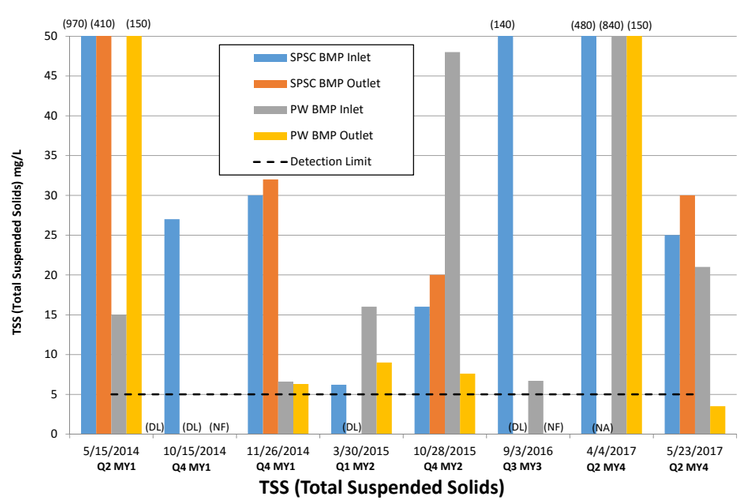
Monitoring Year	Location	Sample Collection Date	Percent Reduction[1]					
			TN	NO_x	TKN	TP	TSS	FC
MY1	SPSC BMP	4/22/2014 (Baseflow)	18%	57%	1%	-29%	-56%	65%
	PW BMP		N/A	N/A	0%	-74%	-255%	-62%
	SPSC BMP	5/15/2014	53%	64%	42%	63%	58%	0%
	PW BMP		28%	27%	30%	18%	-900%	63%
	SPSC BMP	10/15/2014	67%	88%	60%	88%	94%	-369%
	PW BMP		N/A					
	SPSC BMP	11/26/2014	10%	9%	8%	2%	-7%	N/A
	PW BMP		7%	14%	0%	-67%	5%	
MY2	SPSC BMP	3/30/2015	-25%	25%	-30%	-3%	N/A	N/A
	PW BMP		N/A	0%	N/A	24%	44%	47%
	SPSC BMP	10/28/2015	-18%	-85%	16%	17%	-25%	7%
	PW BMP		41%	N/A	6%	57%	84%	N/A
MY3	SPSC BMP	9/3/2016	35%	-225%	71%	52%	N/A	N/A
	PW BMP		N/A	N/A	N/A	N/A	N/A	N/A
MY4	SPSC BMP	4/4/2017	46%	-67%	60%	N/A	N/A	N/A
	PW BMP		13%	78%	-6%	N/A	82%	N/A
	SPSC BMP	5/23/2017	33%	55%	28%	29%	-20%	N/A
	PW BMP		50%	N/A	41%	-89%	83%	N/A

[1]Positive values indicate a reduction in pollutant concentration from inlet to outlet samples, negative values indicate an increase in concentration
N/A: Metric cannot be calculated

Water Quality Data
Norkett Branch Stream Mitigation Site
DMS Project No. 95360
Monitoring Year 4 -2017





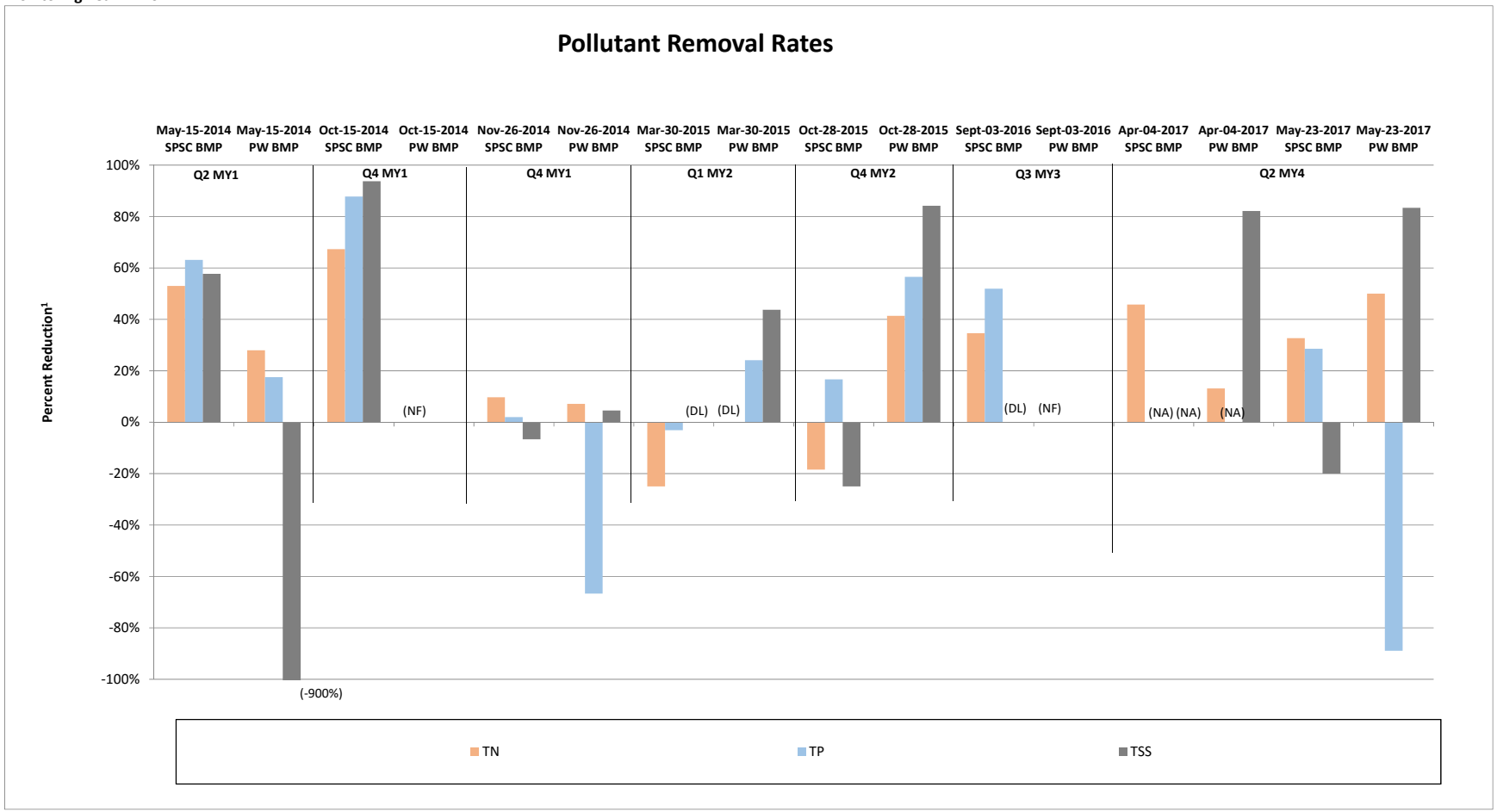


Pollutant Removal Plot

Norkett Branch Stream Mitigation Site

DMS Project No. 95360

Monitoring Year 4 -2017



DL: Parameter was below the detection limit

NF: No flow was available for sample collection/insufficient sample volume

NA: No data available at inlet and/or outlet sample for comparison

[1]Positive values indicate a reduction in pollutant concentration from inlet to outlet samples, negative values indicate an increase in concentration