MONITORING YEAR 5 ANNUAL REPORT
Final

LYLE CREEK MITIGATION SITE
Catawba County, NC
DEQ Contract 003241
DMS Project Number 94643

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EXECUTIVE SUMMARY

Wildlands Engineering (Wildlands) implemented a full delivery project for the North Carolina Department of Environmental Quality North Carolina Division of Mitigation Services (DMS) to restore and enhance 6,795 linear feet (LF) of perennial and intermittent stream channel and to restore and create 9.5 acres (ac) of riparian wetlands on a full delivery site in Catawba County, NC. The project originally proposed the generation of 5,965 stream mitigation units (SMU's) and 7.6 wetland mitigation units (WMU's). The project stream reaches consist of UT1, UT1A, UT1B (stream restoration) and UT1C and UT1D (stream enhancement level II). The project wetland areas consist of RW1 and RW2 (wetland restoration and creation).

The Lyle Creek Mitigation Site, hereafter referred to as the site, is located west of NC Highway 10 / North Main Street in the Town of Catawba, NC, on an active tree farm surrounded by woods and residential land use (Figure 1). The site is located in the Catawba River Basin Hydrologic Unit Code (HUC) 03050101140010, and North Carolina Division of Water Resources (NCDWR) Subbasin 03-08-32, which is within a DMS Targeted Local Watershed. This HUC qualifies as a service area for an adjacent HUC; as a result, the site was submitted for mitigation credit in the Catawba River Basin HUC 03050103. The site is located on one parcel owned by the Garmon Family.

Prior to construction activities, the project streams were regularly modified and maintained and therefore lacked bedform diversity, habitat, and riparian buffer. The lack of bedform diversity combined with continued anthropogenic disturbance resulted in degraded aquatic habitat, altered hydrology, and water quality concerns such as lowered dissolved oxygen levels. The primary goals of the project were to provide ecological and water quality enhancements to the Catawba River Basin while creating a functional riparian corridor at the site level, providing wetland habitat and ecological function, and restoring a Piedmont Bottomland Forest as described by Schafale and Weakley (1990). These goals were achieved by restoring 5,411 LF of perennial and intermittent stream channel and 6.6 ac of wetland area, enhancing 1,384 LF of intermittent stream channel and creating 2.9 ac of wetland area. Approximately 179 LF of stream associated with the site crossings (farm roads and power line easements) was excluded from the total project credit calculations. Figure 2 and Table 1 present the restoration design for the site.

The following project goals were established in the mitigation plan to address the effects listed above from project site stressors:

- Wetland areas will be disked to increase surface roughness and better capture rainfall which will improve connection with the water table for groundwater recharge. Adjacent streams will be stabilized and established with a floodplain connection to promote hydrologic transfer between wetland and stream;
- A channel with riffle-pool sequences and some rock and wood structures will be created in the steeper project reaches and a channel with run-pool sequences and woody debris structures will be created in the low sloped project reaches for macroinvertebrate and fish habitat. Introduction of wood including root wads and woody 'riffles' along with native stream bank vegetation will substantially increase habitat value. Gravel areas will be added as appropriate to further diversify available habitats;
- Adjacent buffer areas will be restored by removing invasive vegetation and planting native vegetation. These areas will be allowed to receive more regular and inundating flows. Riparian wetland areas will be restored and enhanced to provide wetland habitat; and
- Sediment input from eroding stream banks will be reduced by installing bioengineering and in-stream structures while creating a stable channel form using geomorphic design principles.

Construction and planting activities were completed by River Works in April 2012. A Conservation Easement held by the State of North Carolina has been recorded with the Catawba County Register of Deeds on the 26.62-acre project area within the Garmon parcel. The conservation easement protects the project area in perpetuity.

Monitoring Year 5 (MY5) monitoring and site visits were completed between February and November 2016 to assess the conditions of the project. A majority of groundwater gages (GWG) at the site have met the required hydrologic success criteria for MY5, exceptions include GWG 6 and 9. These two gages are the only ones that have not met hydrologic success criteria during a majority (at least 3 out of 5 years) of post-construction monitoring. All project streams have met the required success criteria of exhibiting two overbank events in separate monitoring years. All streams within the site are stable and meeting the MY5 success criteria with the exception of the upper reach (approximately 394 LF) of UT1A. UT1A has aggraded due to a large influx of sediment from upstream of the project. The site's overall average stem density of 419 stems/acre is greater than the final vegetative success criteria of 260 stems/acre for MY5.

Based on the performance of project components through MY5, credit is not proposed for 394 LF of stream restoration (394 SMU's) along UT1A that has aggraded due to offsite sediment sources. Credit is not proposed for 0.6 acres of wetland creation (0.2 WMU's) in RW1 where groundwater gages (GWG 6 and 9) within the right floodplain of UT1 Reach 1 have not met hydrologic success criteria during the majority of monitoring years. Based on these modifications to proposed credits the project is anticipated to generate 5,571 SMU's and 7.1 WMU's.

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Monitoring Year 5 Annual Report

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APPENDICES

Section 1: PROJECT OVERVIEW

The Lyle Creek Mitigation Site is a full delivery stream and wetland restoration project for the DMS in Catawba County, NC. The site is located in the Catawba River Basin HUC 03050101140010, and NCDWR Subbasin 03-08-32, which is within a DMS Targeted Local Watershed. This HUC qualifies as a service area for an adjacent HUC; as a result, the Lyle Creek Mitigation Site was submitted for mitigation credit in the Catawba River Basin HUC 03050103. The site is located west of NC Highway 10/ North Main Street in the Town of Catawba, NC, on an active tree farm surrounded by woods and residential land use. The Site is bounded by Lyle Creek to the north, NC Highway 10/ North Main Street to the east and an elevated railroad right-of-way to the south.

The project stream reaches consist of UT1, UT1A, UT1B (stream restoration) and UT1C and UT1D (stream enhancement level II). The project wetland areas consist of RW1 and RW2 (wetland restoration and creation). Mitigation work within the site included restoring and enhancing 6,795 LF of perennial and intermittent stream channel and restoring and creating 9.5 ac of riparian wetland and proposes the generation of 5,571 SMU's and 7.1 WMU's. The stream and wetland areas were planted with native vegetation to improve habitat and protect water quality. Construction and planting activities were completed by River Works in April 2012. The site is located on one parcel owned by the Garmon Family. A Conservation Easement held by the State of North Carolina has been recorded with the Catawba County Register of Deeds on the 26.62-acre Lyle Creek project area within the Garmon parcel. The conservation easement protects the project area in perpetuity.

Directions and a map of the site are provided in Figure 1 and project components are illustrated for the site in Figure 2.

1.1 Project Goals and Objectives

Prior to construction activities, the project streams were regularly modified and maintained and therefore lacked bedform diversity, habitat, and riparian buffer. The primary impacts to the project streams were the result of mowing, ditching, vegetation maintenance, and dredging associated with tree farming activities. As a result of the aforementioned land activities, the onsite streams were incised and overly wide with shallow flow. The streams were unable to maintain their channel form and subsequently filled in with sediment, organic matter, and vegetation. In-stream bedform diversity was extremely poor and the longitudinal profile was dominated by shallow runs. The lack of bedform diversity combined with continued anthropogenic disturbance resulted in degraded aquatic habitat, altered hydrology (related to loss of floodplain connection and lowered water table), and water quality concerns such as lower dissolved oxygen levels (due to shallow flow with few re-aeration points). Table 4 in Appendix 1 and Tables 10a, 10b, and 10c in Appendix 4 present the pre-restoration conditions in detail.

The primary goals of the project were to provide ecological and water quality enhancements to the Catawba River Basin while creating a functional riparian corridor at the site level, providing wetland habitat and ecological function, and restoring a Piedmont Bottomland Forest as described by Schafale and Weakley (1990). These goals were achieved by restoring 5,411 LF of perennial and intermittent stream channel and 6.4 ac of wetland area, enhancing 1,384 LF of intermittent stream channel and creating 2.2 ac of wetland area. Approximately 179 LF of stream crossings (farm roads and power line easements) were excluded from the total project credit calculations. The site's riparian areas were also planted to stabilize streambanks and wetland areas, improve habitat, and protect water quality. The ecological uplift can be summarized as starting from tree farming-impacted streams and wetlands and moving to stable channels and wetlands in a protected riparian corridor. Restoration of dimension,

pattern, and profile was implemented for UT1, UT1A, and UT1B; enhancement of profile and dimension was implemented for UT1C and UT1D. Wetland restoration and creation included RW1 and RW2. UT1A and UT1B discharge into an anastomosed wetland complex upstream of their confluence with UT1 as depicted in Figure 2. This anastomosed wetland complex was not proposed for stream mitigation credit. Figure 2 and Table 1 present the implemented design for the site.

Monitored enhancements to water quality and ecological processes established in the mitigation plan (approved 8/2011) are outlined below, followed by expected project benefits which are associated with restoration, but will not be monitored as part of this project:

Monitored Project Goals

- Wetland areas will be disked to increase surface roughness and better capture rainfall which will improve connection with the water table for groundwater recharge. Adjacent streams will be stabilized and established with a floodplain elevation to promote hydrologic transfer between wetland and stream;
- A channel with riffle-pool sequences and some rock and wood structures will be created in the steeper project reaches and a channel with run-pool sequences and woody debris structures will be created in the low sloped project reaches for macroinvertebrate and fish habitat. Introduction of wood including root wads and woody 'riffles' along with native stream bank vegetation will substantially increase habitat value. Gravel areas will be added as appropriate to further diversify available habitats;
- Adjacent buffer areas will be restored by removing invasive vegetation and planting native vegetation. These areas will be allowed to receive more regular and inundating flows. Riparian wetland areas will be restored and enhanced to provide wetland habitat; and
- Sediment input from eroding stream banks will be reduced by installing bioengineering and in-stream structures while creating a stable channel form using geomorphic design principles.

Expected Project Benefits

- Chemical fertilizer and pesticide levels will be decreased by filtering runoff from adjacent tree farm operations through restored native buffer zones and wetlands. Offsite nutrient input will be absorbed onsite by filtering flood flows through restored floodplain areas and wetlands, where flood flows can disperse through native vegetation and be captured in vernal pools. Increased surface water residency time will provide contact treatment time and groundwater recharge potential;
- Sediment from offsite sources will be captured during bankfull or greater flows by deposition on restored floodplain areas where native vegetation will slow overland flow velocities;
- Restored riffle/step-pool sequences on the upper reach of UT1A, where distinct points of re-aeration can occur, will allow for oxygen levels to be maintained in the perennial reaches. Small log steps on the upstream portion of UT1B and UT1 Reach 1 Upper will also provide re-aeration points; and
- Creation of deep pool zones will lower temperature, helping to maintain dissolved oxygen concentrations. Pools will form below drops on the steeper project reaches and around areas of woody debris on the low-sloped project reaches. Establishment and maintenance of riparian buffers will create long-term shading of the channel flow to minimize thermal heating.

The design streams and wetlands were restored to the appropriate type based on the surrounding landscape, climate, and natural vegetation communities but also with strong consideration to existing watershed conditions and trajectory.

The stream restoration success criteria for the site follows the approved performance criteria presented in the DMS Mitigation Plan Template (Version 1.0, 11/20/2009) and the Stream Mitigation Guidelines issued in April 2003 by the U.S. Army Corps of Engineers (USACE) and DWR. Annual monitoring and quarterly site visits will be conducted to assess the condition of the finished project for five years, or until success criteria are met. The stream restoration reaches (UT1, UT1A, and UT1B) of the project were assigned specific performance criteria components for stream morphology, hydrology, and vegetation. The enhancement reaches (UT1C and UT1D) were documented through photographs and visual assessments to verify that no significant degradational changes are occurring in the stream channel or riparian corridor. Monitoring for wetland vegetation will extend five years beyond completion of construction. The wetland restoration and creation sections have been assigned specific performance criteria for hydrology and vegetation. The final mitigation plan was submitted and accepted by the DMS in August 2011. Construction activities were completed by River Works, Inc. in April 2012. Baseline monitoring (MY0) and as-built survey was conducted between April and May 2012. Annual monitoring has been conducted for five years including stream, vegetation, and wetland assessment. The final monitoring activities were conducted in 2016 with the close-out anticipated to commence in 2017 given the success criteria are met. Appendix 1 provides more detailed project activity, history, contact information, and watershed/site background information for this project.

1.2 Monitoring Year 5 Data Assessment

Annual monitoring and quarterly site visits were conducted between February and November 2016 to assess the condition of the project.

1.2.1 Vegetative Assessment

Planted woody vegetation is being monitored in accordance with the guidelines and procedures developed by the Carolina Vegetation Survey-NCEEP Level 2 Protocol (Lee et al., 2008). A total of 35 vegetation monitoring plots were established during the baseline monitoring within the project easement areas using a standard 10 by 10-meter plot. The final vegetative success criteria will be the survival of 260 planted stems per acre at the end of year five of the monitoring period.

The site was re-planted in late winter 2012 in response to the dead bare roots observed during the MY1 vegetative survey. Most likely, the mortality of planted stems during MY1 was a result of dry soil conditions, low precipitation, and/or from grass suffocation or crowding of planted stems. Replanting was conducted across the site with focus in and around areas not meeting success criteria after MY1 (such as plots 4, 5, 7, 10, 12, 19, 21, 29, & 30) and included approximately 1,200 additional stems. The MY2 vegetation survey resulted in an 11% increase in stem density due to supplemental planting and the re-sprout of existing bare roots. After the MY2 vegetation survey an additional supplemental planting was conducted within the vicinity of plots 4, 6, and 19. During the spring of 2014, approximately 200 1-gallon containerized trees were planted in and around these plots. During MY4 additional stems were observed in several plots whose composition, stem height, and location correlate to the supplemental plantings in 2012 and 2014. These additional stems were assumed to be planted stems missed in previous monitoring years.

The MY5 annual vegetation monitoring was completed in June 2016 and resulted in an average planted stem density of 419 stems per acre for the site, which is greater than the final success criteria requirement. All 35 vegetation plots individually meet the year 5 final criteria of 260 stems/acre. Planted stem densities ranged from 283 – 607 stems per acre. A strong presence of volunteers was observed in several plots. When volunteers are included the total stem densities ranged from 283 – 1,619 stems per acre with an overall average of 667 stems per acre. Between four and ten native woody species were documented in the vegetation plots with 26 species present site wide.

1.2.2 Vegetative Areas of Concern

The MY5 vegetation monitoring and visual assessment revealed few vegetation areas of concern. Invasive species including Chinese privet (*Ligustrum sinense*), Chinese lespedeza (*Lespedeza cuneate*), Johnsongrass (*Sorghum halepense)*, kudzu (*Pueraria lobata*), and multiflora rose (*Rosa multiflora*) were identified at a few isolated areas during MY5. The presence of these species does not currently appear to be affecting the survivability of planted stems. Minor encroachment of the conservation easement was observed as a result of adjacent field mowing performed by the surrounding tree farm. Refer to Appendix 3 for vegetation summary tables and raw data tables and to Appendix 2 for vegetation plot photographs, the vegetation condition assessment table and Figures 3.0-3.3 for the Integrated Current Condition Plan View which outlines these areas of concern.

Maintenance Plan

Currently the invasive species identified on the site do not appear to be negatively affecting planted stems but will be treated during Spring 2017. Additional conservation easement markers will be installed along areas of encroachment.

1.2.3 Stream Assessment

Morphological surveys for MY5 were conducted between May and September 2016. The majority of the streams within the site have met the success criteria for MY5. Aggradation was documented on the upper portions of UT1, UT1A, and UT1B as a result of their contributing upstream watersheds. The aggradation at the top of UT1 (Stations 100+17 and 100+95) is contained within the active channel and resulted in a slight rise in channel bed elevation through this section. The minor amount of sediment was first observed in MY4 and currently is not impacting the channel's overall stability and function. Aggradation in UT1A was initially documented during MY3 between Stations 301+75 to 304+34 and continued through MY4 when sediment filled the channel between Stations 300+36 to 304+34. During MY5 sediment filled UT1A from Station 300+36 to 304+30. This portion of UT1A has served as a reservoir for off-site sediment which has completely filled in this portion of channel. UT1B experienced minor aggradation between Stations 201+52 and 204+30 to a lesser degree than UT1A. This aggradation in not impacting the overall stability of UT1B as the channel has remained a single thread system with some decrease in pool length and depth. Over time UT1 and UT1B should naturally transport this sediment. Refer to Appendix 2 for the visual assessment table, Integrated Current Condition Plan View (CCPV), photographs, and Appendix 4 for morphological data and plots.

Surveyed riffle cross-sections fell within the parameters defined for channels of the appropriate Rosgen stream type with the exception of cross-sections 9 and 13 along UT1A due to aggradation from the contributing upstream watershed. Two additional cross-sections were installed in MY4 at Stations 308+41 and 310+26 of UT1A to characterize this downstream portion of the reach (refer to Figure 2 and 3). All cross-sections were monitored within the guidelines presented in the mitigation plan. In general cross-sections along UT1 and UT1B show little to no change in the bankfull area, maximum depth ratio, or width-to-depth ratio.

The surveyed longitudinal profile data for the stream restoration reaches illustrate that the bedform features are maintaining lateral and vertical stability throughout UT1, and the lower sections of UT1A and UT1B. In UT1, the downstream section of UT1A, and the majority of UT1B, the riffles and runs are remaining steeper and shallower than the pools, while the pools are remaining deeper than the riffles and maintaining flat water surface slopes. The longitudinal profiles show that the bank height ratios remain very near to 1.0. In the aggraded section of UT1A, the sediment load remains extended above the top of bank. Pools within the aggraded section of UT1B are less distinguishable and resemble shallow runs (Appendix 4, Longitudinal Profile Plots).

Due to the sand/silt nature of the substrate throughout the project, fluctuations in bed elevations were observed and expected as described in the mitigation plan. These fluctuations within UT1 are temporary and seem to typically correspond to storm events.

In-stream structures, such as brush mattresses and sod mats used to enhance channel habitat and stability on the outside bank of meander bends continue to provide stability and habitat as designed. No changes were observed during MY5 that indicate a change in the radius of curvature or channel belt width. Therefore, no pattern data were collected during MY5.

1.2.4 Hydrology Assessment

As of MY5, two or more bankfull events have occurred in separate years within all the restoration reaches (UT1, UT1A and UT1B). During MY5, one bankfull events was recorded on UT1 using a crest gage. Due to high sedimentation rates on UT1A, the crest gage located at cross section 9 was relocated to station 305+16 on UT1A downstream of the aggraded section of the stream. Refer to Table 13 in Appendix 5 for hydrologic data.

1.2.5 Wetland Assessment

Eight groundwater monitoring gages (GWG 1 – 8) were established during the baseline monitoring throughout the wetland restoration and creation areas. The gages were installed at appropriate locations so that the data collected will provide an indication of groundwater levels throughout the wetland project area. Three additional gages (GWG 9 – 11) were also installed during subsequent monitoring years. GWG 10 was added within the wetland restoration portion of RW1. GWG 9 and 11 were added to creation areas in RW2. A barotroll logger and a rain gage were also installed onsite. Historical growing season data is not available for Catawba County therefore the growing season used for success criteria in previous monitoring years was applied from nearby Iredell County whose growing season runs from April 8th to October 27th (202 days). Additional growing season data are being collected by two soil temperature loggers that were installed, one within each wetland. Based on discussions with the United States Army Corps of Engineers (USACE) the on-site soil temperature data may be used to determine the beginning of the growing season and Natural Resources Conservation Service (NRCS) WETS data to determine the end of the growing season. During MY5 the two on-site soil temperatures reached and/or stayed above 41 degrees Fahrenheit at 12 inches below the ground surface starting on February 21st and 22nd which are 48 and 47 days, respectively, earlier than the Iredell County growing season defined by the WETS data that starts on April 8th. Based on general experience the Interagency Review Team (IRT) typically does not accept growing season start dates before March 9th in the Piedmont. Therefore, the growing season was only extended by 30 days from March 9th to October 27th (232 days).

All groundwater monitoring gages were downloaded on a quarterly basis and were maintained on an as needed basis. The success criteria for wetland hydrology at this site is to have a free groundwater surface within 12 inches of the ground surface for seven percent of the growing season, which is measured on consecutive days under typical precipitation conditions. The majority of groundwater gages (9 out of 11 gages) met the annual wetland hydrology success criteria for MY5. Exceptions include GWG 6 and 9 located on the western side of the site. Monthly on-site rainfall was below average for the majority of the growing season. Refer to Appendix 2 for the groundwater gage locations and Appendix 5 for groundwater hydrology data and plots.

1.2.6 Benthic Macroinvertebrate Assessment

Prior to site construction, three macroinvertebrate assessment locations were established at the site (UT1 Upper Reach, UT1 Lower Reach and UT1B) as shown on Figure 3. These sites were sampled before

construction (December 2011), MY-2 (January 2014), MY3 (January 2015), and MY4 (January 2016). Sampling was conducted using an abbreviation of the standard qualitative method (Qual 4) in compliance with the North Carolina Rapid Bioassessment *Standard Operating Procedures for Benthic Macroinvertebrates* set by North Carolina Department of Environmental Quality (NCDEQ, 2012). Samples were assessed and identified at the species level by Pennington & Associates, Inc. Overall taxa richness decreased from pre-construction to MY4 at the three sampling locations. Ephemeroptera + Plecoptera + Trichoptera (EPT) taxa richness increased from pre-construction to MY4 on UT1 Lower while EPT taxa richness decreased on UT1 Upper and UT1B. MY4 NC biotic indices at each sampling location were lower than pre-construction values indicating pollutant intolerant bugs are establishing across the site.

1.3 Monitoring Year 5 Summary

Streams within the site are stable and functioning as designed. Aggradation documented in UT1A persists. Wildlands has removed this 394 LF from the credit request. Lesser amounts of aggradation where observed on the upper portion of UT1 and UT1B however these channels are stable and functioning as single thread channels. It is anticipated that aggraded sediment in UT1 and UT1B will be evacuated from the system. The average stem density for the site has met the MY5 success criteria. There have been more than two bankfull events recorded in separate monitoring years along each restored project reach since construction commenced; therefore, the site has met the MY5 stream hydrology attainment requirement. A majority of groundwater gages (9 out of 11 gages) met the wetland hydrology success criteria for MY5. Wildlands has removed 0.6 acres of wetland creation located on the west side of UT1 in the area represented by GWG 6 and 9 from our credit request.

Summary information and data related to the performance of various project and monitoring elements can be found in the tables and figures in the report appendices. Narrative background and supporting information formerly found in these reports can be found in the Mitigation Plan documents available on DMS's website. All raw data supporting the tables and figures in the appendices are available from DMS upon request.

Section 2: METHODOLOGY

Geomorphic data was collected following 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. All Integrated Current Condition Plan View mapping was recorded using a Trimble handheld GPS with sub-meter accuracy and processed using was Pathfinder and ArcView. Crest gages were installed in surveyed riffle cross-sections and 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 Tables and Figures

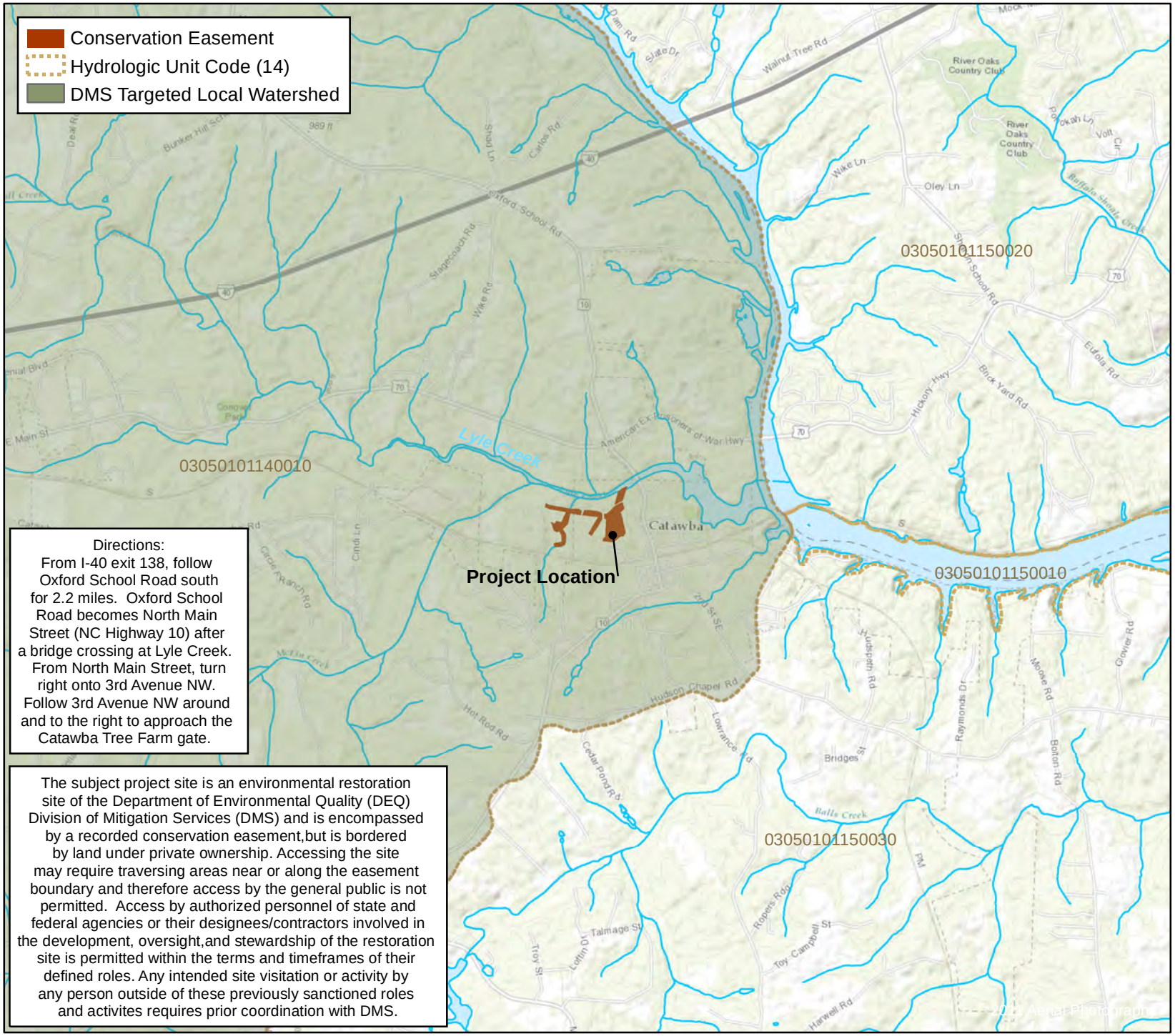


Figure 1. Project Vicinity Map
Lyle Creek Mitigation Site
DMS Project Number 94643
Monitoring Year 5

Catawba County, NC

N

0 2,000 4,000 ft

WILDLANDS ENGINEERING

Figure 2. Project Component/ Asset Map
Lyle Creek Mitigation Site
DMS Project Number 94643
Monitoring Year 5

Catawba County, NC

Table 1. Project Components and Mitigation Credits

Lyle Creek Mitigation Site

DMS Project No.94643

Monitoring Year 5 - 2016

Mitigation Credits									
	Stream		Riparian Wetland		Non-Riparian Wetland		Buffer	Nitrogen Nutrient Offet	Phosphorous Nutrient Offset
Type	R	RE	R	RE	R	RE			
Totals	5,571	N/A	7.1	N/A	N/A	N/A	N/A	N/A	N/A

Project Components							
Reach ID	As-Built Stationing/ Location	Existing Footage (LF)	Approach	Restoration or Restoration Equivalent	As-Built Mitigation Length/Area (LF/acres)	Mitigation Ratio	Credits (SMU)
UT1	100+00-141+30	4,071	Priority 1/2	Restoration	3,951 LF[1]	1:1	3,951
UT1a	300+00-306+15	1,141	Priority 1	Restoration	221 LF[2,5]	1:1	221
UT1b	201+52-209+97	890	Priority 1/2	Restoration	845 LF[3]	1:1	845
UT1c	400+00-406+77	695	in-stream structures, grading, planting	Enhancement II	677 LF[4]	2.5:1	271
UT1d	500+00-507+07	760	in-stream structures, grading, planting	Enhancement II	707 LF	2.5:1	283
RW1	N/A	N/A	grading, planting	Restoration	5.6 AC[7]	1:1	5.6
RW1	N/A	N/A	grading, planting	Creation	1.0 AC[7]	3:1	0.3
RW2	N/A	N/A	grading, planting	Restoration	0.8 AC[7]	1:1	0.8
RW2	N/A	N/A	grading, planting	Creation	1.2 AC[6&7]	3:1	0.4

Component Summation						
Restoration Level	Stream (linear feet)	Riparian Wetland (acres)		Non-Riparian Wetland (acres)	Buffer (square feet)	Upland (acres)
		Riverine	Non-Riverine			
Restoration	5,017	6.4	-	-	-	-
Enhancement		-	-	-	-	-
Enhancement I						
Enhancement II	1,384					
Creation		2.2	-	-		
Preservation	-	-	-	-		-
High Quality	-	-	-	-		-

[1] Excludes 179 LF in crossings (farm road and power line easements). Includes length from station 125+42 to 125+60 where left bank buffer width ranges from 48.5' to 50'. The right bank buffer width in this area exceeds 100'.

[2] Excludes downstream 419 LF of UT1a that is in the anastomosed wetland complex

[3] Excludes downstream 243 LF of UT1b that is in the anastomosed wetland complex

[4] Includes length from station 4+48 to 6+11 where left bank buffer width ranges from 28.7' to 50'. The right bank buffer width in this area ranges from 65.5' to 102.6'.

[5] Excludes length from station 300+36 to 304+30 which has filled as a result of heavy sedimentation from off-site sources.

[6] Excludes 0.6 AC of wetland creation in RW2 where groundwater gages 6 and 9 haven't met success criteria in a majority of monitoring years.

7 Excludes stream footprint within wetland area.

Table 2. Project Activity and Reporting History

Lyle Creek Mitigation Site
DMS Project No.94643
Monitoring Year 5 - 2016

Activity or Report	Date Collection Complete	Completion or Scheduled Delivery
Mitigation Plan	May 2011	August 2011
Final Design - Construction Plans	October 2011	December 2011
Construction	Jan-Apr 2012	April 2012
Temporary S&E mix applied to entire project area*	April 2012	April 2012
Permanent seed mix applied to reach/segments	April 2012	April 2012
Bare root and live stake plantings for reach/segments	April 2012	April 2012
Baseline Monitoring Document (Year 0 Monitoring - baseline)	April 2012	July 2012
Year 1 Monitoring	October 2012	December 2012
Supplemental Planting	N/A	December 2012
Year 2 Monitoring	October 2013	November 2013
Supplemental Planting	N/A	April 2014
Year 3 Monitoring	June 2014	December 2014
Beaver dam removal on UT1 Reach 2	N/A	February 2015
Year 4 Monitoring	June 2015	March 2016
Beaver dam removal on UT1 Reach 1 Lower	N/A	October & November 2015
Beaver dam removal on UT1 Reach 2	N/A	February & July 2016
Year 5 Monitoring	Feb-Nov 2016	December 2016

*Seed and mulch is added as each section of construction is completed.

Table 3. Project Contact Table

Lyle Creek Mitigation Site (DMS Project No.94643)
DMS Project No.94643
Monitoring Year 5 - 2016

Designer Emily Reinicker, PE	**Wildlands Engineering, Inc.** 1430 S. Mint St, Suite 104 Charlotte, NC 28203 704.332.7754
Construction Contractor Bill Wright	**River Works, Inc.** 6105 Chapel Hill Rd Raleigh, NC 27607 336.279.1002
Planting Contractor George Morris	**River Works, Inc.** 6105 Chapel Hill Rd Raleigh, NC 27607 336.279.1002
Seeding Contractor **George Morris**	**River Works, Inc.** 6105 Chapel Hill Rd Raleigh, NC 27607 336.279.1002
Seed Mix Sources	**Green Resource**
Nursery Stock Suppliers	**ArborGlen** **Superior Tree** **Mellow Marsh Farm**
Monitoring Performers Stream, Vegetation, and Wetland Monitoring POC	**Wildlands Engineering, Inc.** Kirsten Y. Gimbert 704.332.7754, ext. 110

Table 4. Project Information and Attributes

Lyle Creek Mitigation Site
DMS Project No.94643
Monitoring Year 5 - 2016

Project Information							
Project Name	Lyle Creek Mitigation Site						
County	Catawba County, NC						
Project Area (acres)	26.62						
Project Coordinates (latitude and longitude)	35° 42' 39.218" N, 81° 4' 54.628" W						
Project Watershed Summary Information							
Physiographic Province	Piedmont						
River Basin	Catawba						
USGS Hydrologic Unit 8-digit	03050101						
USGS Hydrologic Unit 14-digit	03050101140010						
DWQ Sub-basin	Catawba River Subbasin 03-08-32						
Project Drainage Area (acres)	315						
Project Drainage Area Percentage of Impervious Area	5%						
CGIA Land Use Classification	50% Forested, 20% Developed, 17% Agricultural, 8% Shrubland, 5% Herbaceous Upland						
Reach Summary Information							
Parameters	**UT1**	**UT1A**	**UT1B**	**UT1C**	**UT1D**	**RW1**	**RW2**
Length of reach (linear feet) - Post-Restoration	3,951 [1]	615 [2]	845 [3]	677	707	N/A	N/A
Drainage area (acres)	315	56	78	26	9	96	134
NCDWQ stream identification	Lyle Creek - 11-76-(4.5)						
NCDWQ Water Quality Classification	Lyle Creek - WS-IV;CA						
Morphological Desription (stream type) of Pre-Existing	F5 [4], F6 [4], G6 [4]	F6 [4]	F6 [4]	F6 [4]	F6 [4]	N/A	N/A
Morphological Desription (stream type) of Design	B5c, C6	B6c, C6	C6	C6	C6	N/A	N/A
Evolutionary trend (Simon's Model) - Pre- Restoration	Stage II - Channelized						
Underlying mapped soils	Chewacla loam	Chewacla loam	Wehadkee fine sandy loam	Chewacla loam	Congaree complex	Chewacla loam and Wehadkee fine sand	Chewacla loam
Drainage class	somewhat poorly drained	somewhat poorly drained	frequently flooded	somewhat poorly drained	moderately well drained	somewhat poorly drained and frequently flooded	somewhat poorly drained
Soil Hydric status	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Slope	0-2%	0-2%	0-2%	0-2%	0-2%	0-2%	0-2%
FEMA classification	AE[5]						
Native vegetation community	Palustrine Emergent System						
Percent composition of 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. 3689
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	Lyle Creek Mitigation Plan: two federally listed species, the bald eagle (*Haliaeetus leucocephalus*) and dwarf-flowered hearleaf (*Hexastylis naniflora*), are currently listed in Catawba County. Studies found "no individual species, critical habitat, or suitable habitat was found to exist on the site" (letter to USFWS; no response was received within the 30-day time frame from USFWS)
Historic Preservation Act	X	X	No historic resources were found to be impacted (letter from SHPO and THPO)
Coastal Zone Management Act (CZMA)/Coastal Area	N/A	N/A	N/A
FEMA Floodplain Compliance	X	X	No-rise certification and floodplain development permit approved by Catawba County floodplain administrator.
Essential Fisheries Habitat	X	X	Project area has warm water fisheries; found no reason to object to the restoration project (letter from NCWRC).

[1] Excludes 179 LF of crossings

[2] Excludes 419 LF of UT1a in the anastomosed wetlands complex

[3] Excludes 243 LF of UT1b in the anastomosed wetlands complex

[4] The Rosgen classification system is for natural streams. These channels have been heavily manipulated by man and therefore the Rosgen classification system is not applicable. These classifications are provided for illustrative purposes only.

[5] The project area does not have an associate regulated floodplain; however, the project reaches and wetland areas area located within the floodway and flood fringe of Lyle Creek.

APPENDIX 2. Visual Assessment Data

Conservation Easement
Power Lines
Railroad
Stream Restoration
Stream Enhancement
Braided Reach (No credit)
Wetland Restoration
Wetland Creation
Wetland Creation (No Credit)
Designed Bankfull
Photo Points (PP)
Structures
Macroinvertebrate Sampling Sites
Groundwater Gage (GWG) - MY5
Criteria Met
Criteria Not Met
Vegetation Plot - MY5
Criteria Met
Invasives
Easement Encroachment
Stream Problem Areas - MY5
Severe Aggradation (Credit no longer proposed)

Sheet 1
Sheet 2
Sheet 3
NC Highway 10
UT1
UT1A
UT1B
UT1C
UT1D
RW1
RW2
PP 1
PP 2
PP 3
PP 4
PP 5
PP 6
PP 7
PP 8
PP 9
PP 10
PP 11
PP 12
PP 13
PP 14
PP 15
PP 16
PP 17
PP 18
PP 19
PP 20
PP 21
PP 22
PP 23
PP 24
PP 25
PP 26
PP 27
PP 28
PP 29
PP 30
PP 31
PP 32
PP 33
PP 34
PP 35
PP 36
PP 37
2014 Aerial Photography

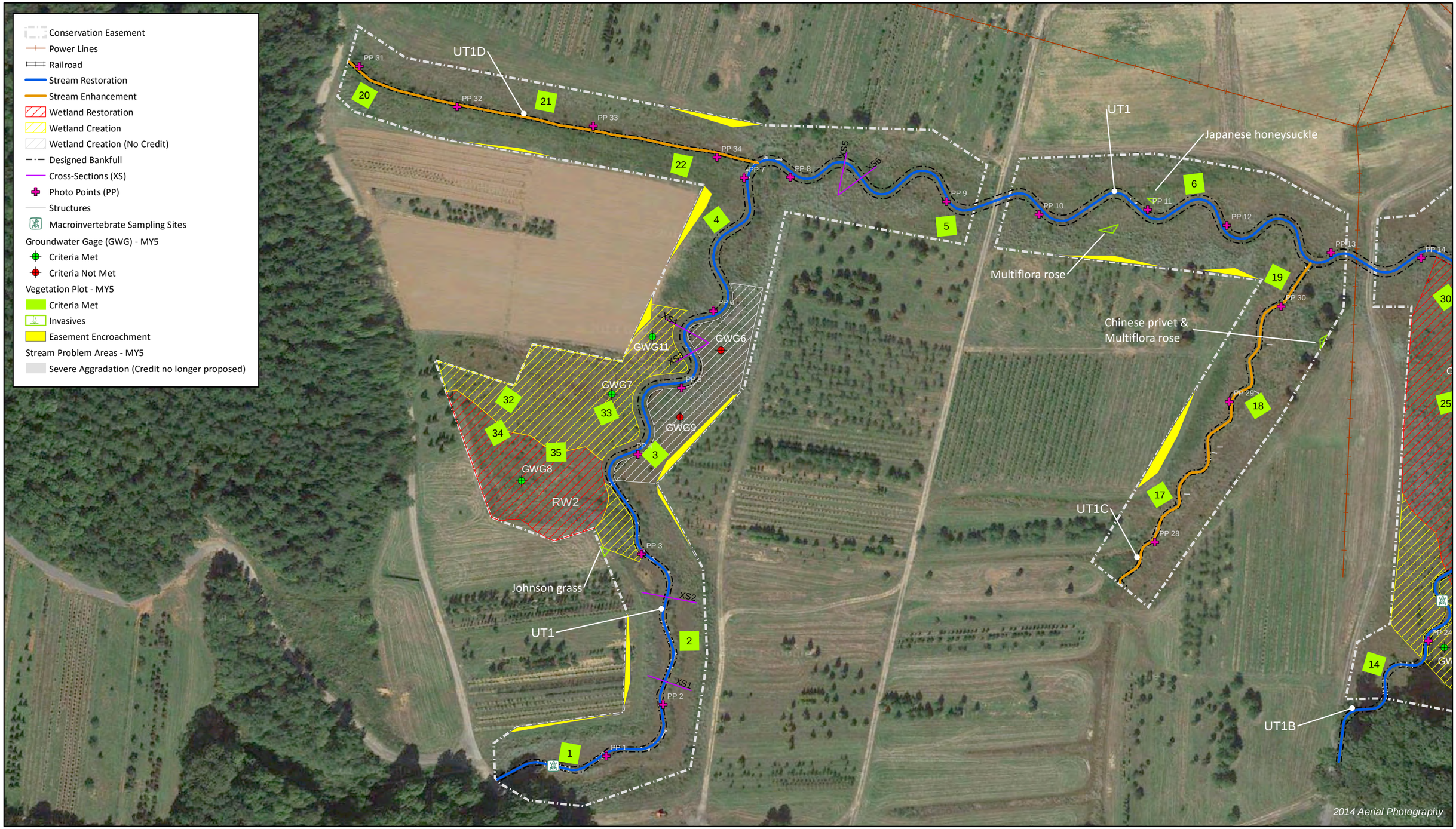
WILDLANDS ENGINEERING

0 100 200 300 400 500 ft

N

Figure 3.0 Integrated Current Condition Plan View (key)
Lyle Creek Mitigation Site
DMS Project Number 94643
Monitoring Year 5

Catawba County, NC

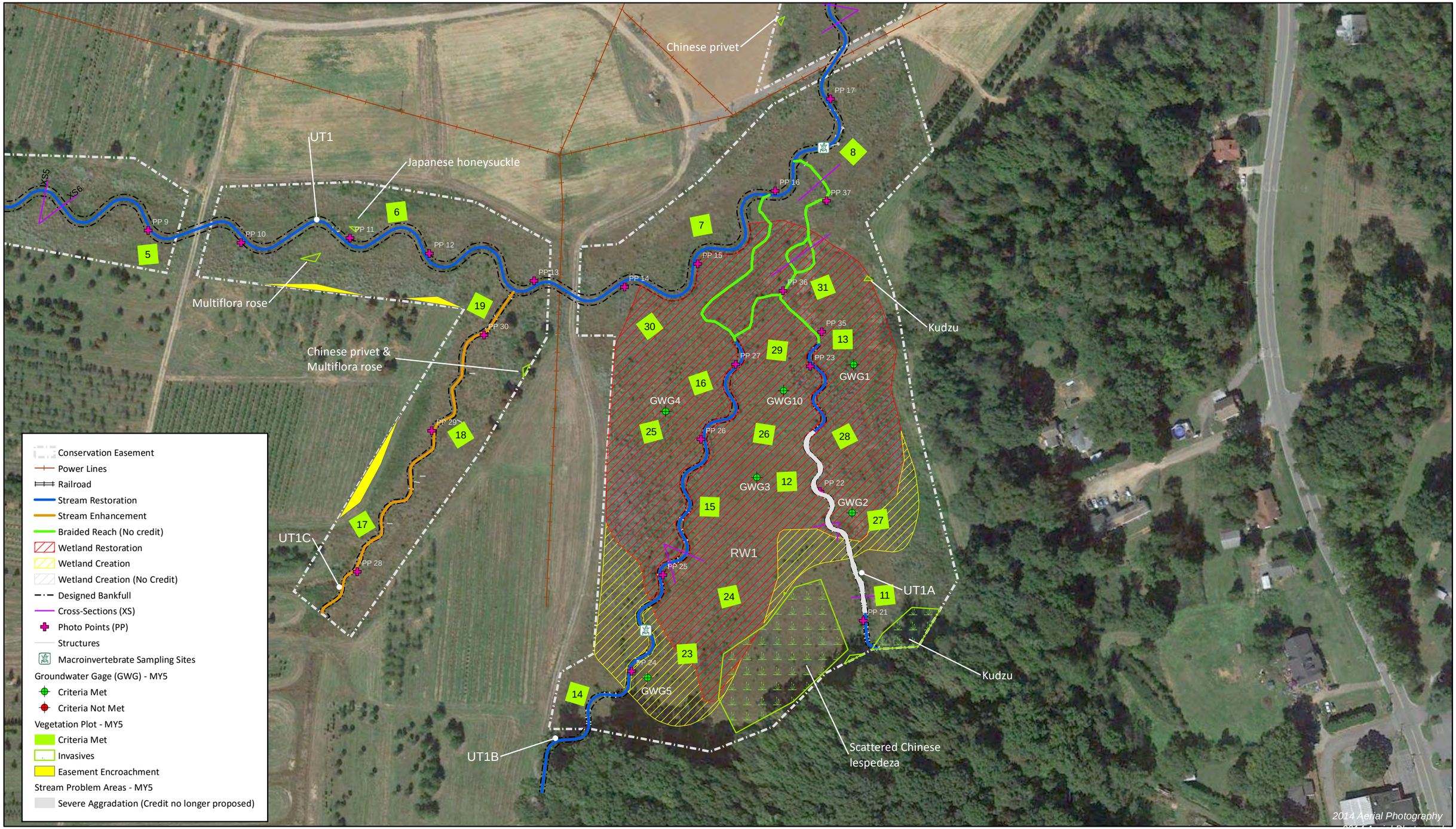


WILDLANDS ENGINEERING

0 100 200 ft

Figure 3.1 Integrated Current Condition Plan View (Sheet 1 of 3)
Lyle Creek Mitigation Site
DMS Project Number 94643
Monitoring Year 5

Catawba County, NC



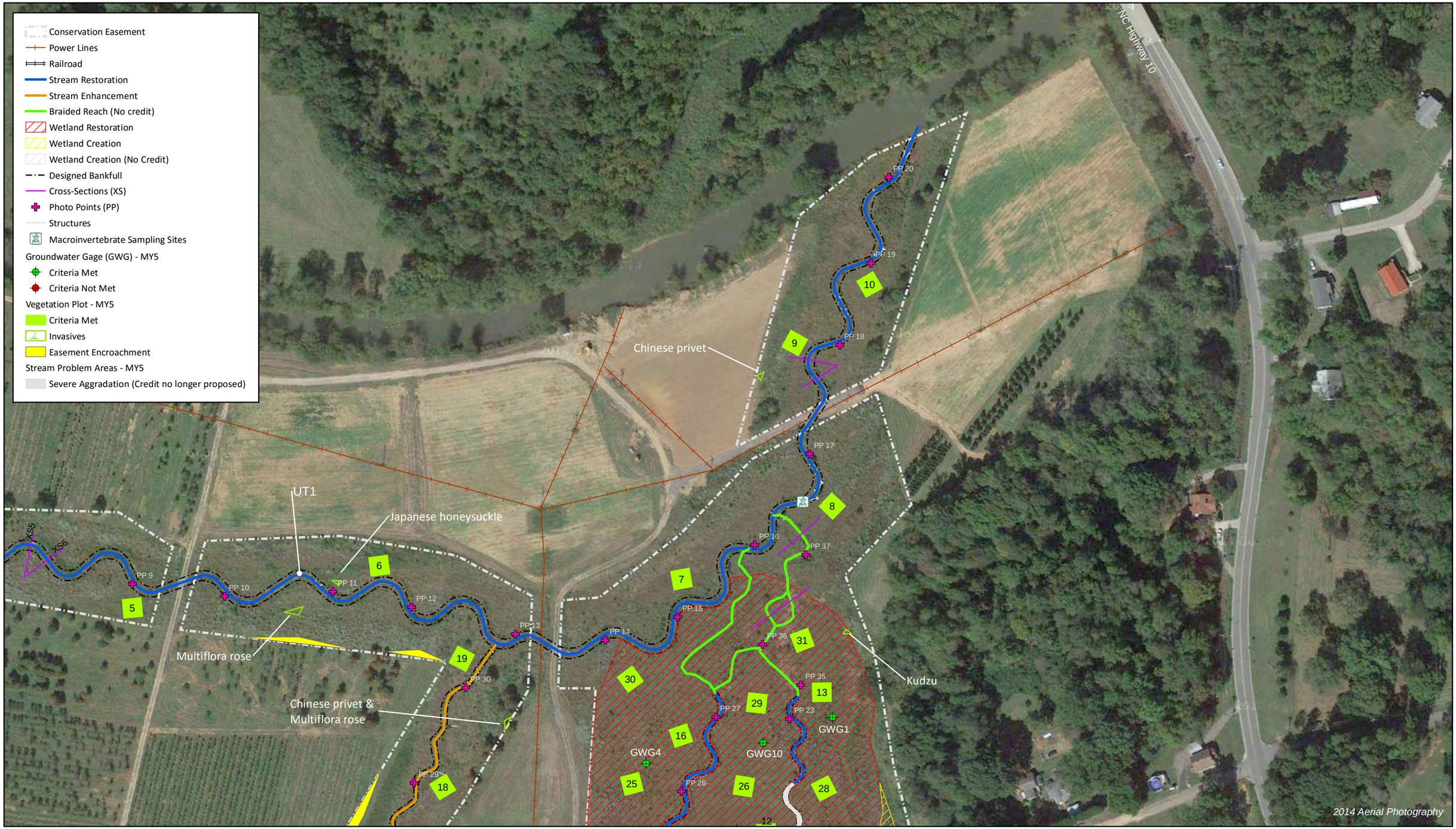
WILDLANDS ENGINEERING

0 100 200 ft

N

Figure 3.2 Integrated Current Condition Plan View (Sheet 2 of 3)
Lyle Creek Mitigation Site
DMS Project Number 94643
Monitoring Year 5

Catawba County, NC



WILDLANDS ENGINEERING

0 100 200 ft

N

Figure 3.3 Integrated Current Condition Plan View (Sheet 3 of 3)
Lyle Creek Mitigation Site
DMS Project Number 94643
Monitoring Year 5

Catawba County, NC

Table 5a. Visual Stream Morphology Stability Assessment Table
Lyle Creek Mitigation Site
DMS Project No. 94643
Monitoring Year 5 - 2016

UT1 Reach 1 Upper (700 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			1	77	89%			
		Degradation			0	0	100%			
	2. Riffle Condition	Texture/Substrate	15	15			100%			
	3. Meander Pool Condition	Depth Sufficient	8	9			89%			
		Length Appropriate	9	9			100%			
	4. Thalweg Position	Thalweg centering at upstream of meander bend (Run)	9	9			100%			
		Thalweg centering at downstream of meander bend (Glide)	9	9			100%			
2. Bank	1. Scoured/ Eroded	Bank lacking vegetative cover resulting simply from poor growth and/or scour and erosion			0	0	100%	0	0	100%
	2. Undercut	Banks undercut/overhanging to the extent that mass wasting appears likely. Does NOT include undercuts that are modest, appear sustainable and are providing habitat			0	0	100%	0	0	100%
	3. Mass Wasting	Bank slumping, calving, or collapse			0	0	100%	0	0	100%
				Totals	0	0	100%	0	0	100%
3. Engineered Structures	1. Overall Integrity	Structures physically intact with no dislodged boulders or logs.	40	40			100%			
	2. Grade Control	Grade control structures exhibiting maintenance of grade across the sill	39	39			100%			
	2a. Piping	Structures lacking any substantial flow underneath sills or arms.	24	24			100%			
	3. Bank Protection	Bank erosion within the structures extent of influence does not exceed 15%.	40	40			100%			
	4. Habitat	Pool forming structures maintaining ~Max Pool Depth : Bankfull Depth ≥ 1.6 Rootwads/logs providing some cover at baseflow.	6	6			100%			

Table 5b. Visual Stream Morphology Stability Assessment Table
Lyle Creek Mitigation Site
DMS Project No. 94643
Monitoring Year 5 - 2016

UT1 Reach 1 Lower (2,558 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	29	29			100%			
		Length Appropriate	29	29			100%			
	4. Thalweg Position	Thalweg centering at upstream of meander bend (Run)	29	29			100%			
		Thalweg centering at downstream of meander bend (Glide)	29	29			100%			
2. Bank	1. Scoured/Eroded	Bank lacking vegetative cover resulting simply from poor growth and/or scour and erosion			0	0	100%	0	0	100%
	2. Undercut	Banks undercut/overhanging to the extent that mass wasting appears likely. Does NOT include undercuts that are modest, appear sustainable and are providing habitat			0	0	100%	0	0	100%
	3. Mass Wasting	Bank slumping, calving, or collapse			0	0	100%	0	0	100%
				Totals	0	0	100%	0	0	100%
3. Engineered Structures	1. Overall Integrity	Structures physically intact with no dislodged boulders or logs.	34	34			100%			
	2. Grade Control	Grade control structures exhibiting maintenance of grade across the sill	30	30			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%.	34	34			100%			
	4. Habitat	Pool forming structures maintaining ~Max Pool Depth : Bankfull Depth ≥ 1.6 Rootwads/logs providing some cover at baseflow.	4	4			100%			

Table 5c. Visual Stream Morphology Stability Assessment Table
Lyle Creek Mitigation Site
DMS Project No. 94643
Monitoring Year 5 - 2016

UT1 Reach 2 (883 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	12	12			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)	10	10			100%			
		Thalweg centering at downstream of meander bend (Glide)	10	10			100%			
2. Bank	1. Scoured/Eroded	Bank lacking vegetative cover resulting simply from poor growth and/or scour and erosion			0	0	100%	0	0	100%
	2. Undercut	Banks undercut/overhanging to the extent that mass wasting appears likely. Does NOT include undercuts that are modest, appear sustainable and are providing habitat			0	0	100%	0	0	100%
	3. Mass Wasting	Bank slumping, calving, or collapse			0	0	100%	0	0	100%
				Totals	0	0	100%	0	0	100%
3. Engineered Structures	1. Overall Integrity	Structures physically intact with no dislodged boulders or logs.	16	16			100%			
	2. Grade Control	Grade control structures exhibiting maintenance of grade across the sill	13	13			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%.	16	16			100%			
	4. Habitat	Pool forming structures maintaining ~Max Pool Depth : Bankfull Depth ≥ 1.6 Rootwads/logs providing some cover at baseflow.	4	4			100%			

Table 5d. Visual Stream Morphology Stability Assessment Table
Lyle Creek Mitigation Site
DMS Project No. 94643
Monitoring Year 5 - 2016

UT1A (615 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			1	394	36%			
		Degradation			0	0	100%			
	2. Riffle Condition	Texture/Substrate	8	8			100%			
	3. Meander Pool Condition	Depth Sufficient	3	11			27%			
		Length Appropriate	3	11			27%			
	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%	0	0	100%
	2. Undercut	Banks undercut/overhanging to the extent that mass wasting appears likely. Does NOT include undercuts that are modest, appear sustainable and are providing habitat			0	0	100%	0	0	100%
	3. Mass Wasting	Bank slumping, calving, or collapse			0	0	100%	0	0	100%
				Totals	0	0	100%	0	0	100%
3. Engineered Structures[2]	1. Overall Integrity	Structures physically intact with no dislodged boulders or logs.	43	43			100%			
	2. Grade Control	Grade control structures exhibiting maintenance of grade across the sill	43	43			100%			
	2a. Piping	Structures lacking any substantial flow underneath sills or arms.	35	35			100%			
	3. Bank Protection	Bank erosion within the structures extent of influence does not exceed 15%.	43	43			100%			
	4. Habitat	Pool forming structures maintaining ~Max Pool Depth : Bankfull Depth ≥ 1.6 Rootwads/logs providing some cover at baseflow.[1]	0	10			0%			

[1] Pools are expected to fill in slightly and re-scour over time due to the fine-grained substrate in the system.
[2] Unable to assess structues between Stations 300+36 and 304+30 due to heavy aggradation.

Table 5e. Visual Stream Morphology Stability Assessment Table
Lyle Creek Mitigation Site
DMS Project No. 94643
Monitoring Year 5 - 2016

UT1B (845 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			1	278	67%			
		Degradation			0	0	100%			
	2. Riffle Condition	Texture/Substrate	11	11			100%			
	3. Meander Pool Condition	Depth Sufficient	10	19			53%			
		Length Appropriate	10	19			53%			
	4. Thalweg Position	Thalweg centering at upstream of meander bend (Run)	19	19			100%			
		Thalweg centering at downstream of meander bend (Glide)	19	19			100%			
2. Bank	1. Scoured/Eroded	Bank lacking vegetative cover resulting simply from poor growth and/or scour and erosion			0	0	100%	0	0	100%
	2. Undercut	Banks undercut/overhanging to the extent that mass wasting appears likely. Does NOT include undercuts that are modest, appear sustainable and are providing habitat			0	0	100%	0	0	100%
	3. Mass Wasting	Bank slumping, calving, or collapse			0	0	100%	0	0	100%
				Totals	0	0	100%	0	0	100%
3. Engineered Structures[1]	1. Overall Integrity	Structures physically intact with no dislodged boulders or logs.	31	31			100%			
	2. Grade Control	Grade control structures exhibiting maintenance of grade across the sill	31	31			100%			
	2a. Piping	Structures lacking any substantial flow underneath sills or arms.	21	21			100%			
	3. Bank Protection	Bank erosion within the structures extent of influence does not exceed 15%.	31	31			100%			
	4. Habitat	Pool forming structures maintaining ~Max Pool Depth : Bankfull Depth ≥ 1.6 Rootwads/logs providing some cover at baseflow.[1]	0	0			100%			

[1] Pools are expected to fill in slightly and re-scour over time due to the fine-grained substrate in the system.
[2]Unable to assess structues between Stations 201+52 and 204+30 due to aggradation.

Table 6. Vegetation Condition Assessment Table

Lyle Creek Mitigation Site

DMS Project No. 94643

Monitoring Year 5 - 2016

Planted Acreage **26.2**

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

Easement Acreage **26.6**

Vegetation Category	Definitions	Mapping Threshold (SF)	Number of Polygons	Combined Acreage	% of Planted Acreage
Invasive Areas of Concern	Areas of points (if too small to render as polygons at map scale).	1000	9	0.8	3.0%
Easement Encroachment Areas	Areas of points (if too small to render as polygons at map scale).	none	11	0.3	1.0%

^Acreage calculated from vegetation plots monitored for site.

Stream Photographs

	
Photo Point 1 – view upstream *(07/13/16)*	**Photo Point 1** – view downstream *(07/13/16)*
	
Photo Point 2 – view upstream *(07/13/16)*	**Photo Point 2** – view downstream *(07/13/16)*
	
Photo Point 3 – view upstream *(07/13/16)*	**Photo Point 3** – view downstream *(07/13/16)*

	
Photo Point 4 – view upstream *(07/13/16)*	**Photo Point 4** – view downstream *(07/23/15)*
	
Photo Point 5 – view upstream *(07/13/16)*	**Photo Point 5** – view downstream *(07/13/16)*
	
Photo Point 6 – view upstream *(07/13/16)*	**Photo Point 6** – view downstream *(07/13/16)*

	
Photo Point 7 – view upstream *(07/13/16)*	**Photo Point 7** – view downstream *(07/13/16)*
	
Photo Point 8 – view upstream *(07/13/16)*	**Photo Point 8** – view downstream *(07/13/16)*
	
Photo Point 9 – view upstream *(07/13/16)*	**Photo Point 9** – view downstream *(07/13/16)*

	
Photo Point 10 – view upstream *(07/13/16)*	**Photo Point 10** – view downstream *(07/13/16)*
	
Photo Point 11 – view upstream *(07/13/16)*	**Photo Point 11** – view downstream *(07/13/16)*
	
Photo Point 12 – view upstream *(07/13/16)*	**Photo Point 12** – view downstream *(07/13/16)*

	
Photo Point 13 – view upstream *(07/13/16)*	**Photo Point 13** – view downstream *(07/13/16)*
	
Photo Point 14 – view upstream *(07/13/16)*	**Photo Point 14** – view downstream *(07/13/16)*
	
Photo Point 15 – view upstream *(07/13/16)*	**Photo Point 15** – view downstream *(07/13/16)*

	
Photo Point 16 – view upstream *(07/13/16)*	**Photo Point 16** – view downstream *(07/13/16)*
	
Photo Point 17 – view upstream *(07/13/16)*	**Photo Point 17** – view downstream *(07/13/16)*
	
Photo Point 18 – view upstream *(07/13/16)*	**Photo Point 18** – view downstream *(07/13/16)*

	
Photo Point 19 – view upstream *(07/13/16)*	**Photo Point 19** – view downstream *(07/13/16)*
	
Photo Point 20 – view upstream *(07/13/16)*	**Photo Point 20** – view downstream *(07/13/16)*
	
Photo Point 21 – view upstream *(09/28/16)*	**Photo Point 21** – view downstream *(09/28/16)*

	
Photo Point 22 – view upstream *(09/28/16)*	**Photo Point 22** – view downstream *(09/28/16)*
	
Photo Point 23 – view upstream *(09/28/16)*	**Photo Point 23** – view downstream *(09/28/16)*
	
Photo Point 24 – view upstream *(07/13/16)*	**Photo Point 24** – view downstream *(07/13/16)*

	
Photo Point 25 – view upstream *(07/13/16)*	**Photo Point 25** – view downstream *(07/13/16)*
	
Photo Point 26 – view upstream *(07/13/16)*	**Photo Point 26** – view downstream *(07/13/16)*
	
Photo Point 27 – view upstream *(07/13/16)*	**Photo Point 27** – view downstream *(07/13/16)*

	
Photo Point 28 – view upstream *(09/28/16)*	**Photo Point 28** – view downstream *(09/28/16)*
	
Photo Point 29 – view upstream *(09/28/16)*	**Photo Point 29** – view downstream *(09/28/16)*
	
Photo Point 30 – view upstream *(09/28/16)*	**Photo Point 30** – view downstream *(09/28/16)*

	
Photo Point 31 – view upstream *(09/28/16)*	**Photo Point 31** – view downstream *(09/28/16)*
	
Photo Point 32 – view upstream *(09/28/16)*	**Photo Point 32** – view downstream *(09/28/16)*
	
Photo Point 33 – view upstream *(09/28/16)*	**Photo Point 33** – view downstream *(09/28/16)*

Photo Point 34 – view upstream *(09/28/16)*

Photo Point 34 – view downstream *(09/28/16)*

Photo Point 35 – view upstream *(09/28/16)*

Photo Point 35 – view downstream *(09/28/16)*

Photo Point 36 – view upstream *(09/28/16)*

Photo Point 36 – view downstream *(09/28/16)*

	
Photo Point 37 – view upstream *(09/28/16)*	**Photo Point 37** – view downstream *(09/28/16)*

Vegetation Plot Photographs

Vegetation Plot 1 *(06/3/2016)*

Vegetation Plot 2 *(06/3/2016)*

Vegetation Plot 3 *(06/3/2016)*

Vegetation Plot 4 *(06/3/2016)*

Vegetation Plot 5 *(06/3/2016)*

Vegetation Plot 6 *(06/3/2016)*

	
Vegetation Plot 7 *(06/3/2016)*	**Vegetation Plot 8** *(06/2/2016)*
	
Vegetation Plot 9 *(06/3/2016)*	**Vegetation Plot 10** *(06/2/2016)*
	
Vegetation Plot 11 *(06/2/2016)*	**Vegetation Plot 12** *(06/2/2016)*

Vegetation Plot 13 *(06/2/2016)*

Vegetation Plot 14 *(06/2/2016)*

Vegetation Plot 15 *(06/2/2016)*

Vegetation Plot 16 *(06/2/2016)*

Vegetation Plot 17 *(06/3/2016)*

Vegetation Plot 18 *(10/14/2016)*

Vegetation Plot 19 *(06/3/2016)*

Vegetation Plot 20 *(06/3/2016)*

Vegetation Plot 21 *(06/3/2016)*

Vegetation Plot 22 *(06/3/2016)*

Vegetation Plot 23 *(06/2/2016)*

Vegetation Plot 24 *(06/2/2016)*

Vegetation Plot 25 *(06/2/2016)*

Vegetation Plot 26 *(06/2/2016)*

Vegetation Plot 27 *(06/2/2016)*

Vegetation Plot 28 *(06/2/2016)*

Vegetation Plot 29 *(06/2/2016)*

Vegetation Plot 30 *(06/2/2016)*

Vegetation Plot 31 *(06/2/2016)*

Vegetation Plot 32 *(06/3/2016)*

Vegetation Plot 33 *(06/3/2016)*

Vegetation Plot 34 *(06/3/2016)*

Vegetation Plot 35 *(06/3/2016)*

APPENDIX 3. Vegetation Plot Data

Table 7. Vegetation Plot Criteria Attainment
Lyle Creek Mitigation Site
DMS Project No. 94643
Monitoring Year 5 - 2016

Plot	MY5 Success Criteria Met (Y/N)	Tract Mean
1	Y	
2	Y	
3	Y	
4	Y	
5	Y	
6	Y	
7	Y	
8	Y	
9	Y	
10	Y	
11	Y	
12	Y	
13	Y	
14	Y	
15	Y	
16	Y	
17	Y	
18	Y	100%
19	Y	
20	Y	
21	Y	
22	Y	
23	Y	
24	Y	
25	Y	
26	Y	
27	Y	
28	Y	
29	Y	
30	Y	
31	Y	
32	Y	
33	Y	
34	Y	
35	Y	

Table 8. CVS Vegetation Plot Metadata
Lyle Creek Mitigation Site
DMS Project No. 94643
Monitoring Year 5 - 2016

Report Prepared By	Alea Tuttle
Date Prepared	9/21/2016 16:44
Database Name	Lyle MY5 cvs-eep-entrytool-v2.3.1.mdb
Database Location	Q:\ActiveProjects\005-02123 Lyle Creek Mitigation FDP\Monitoring\Monitoring Year 5\Vegetation Assessment
DESCRIPTION OF WORKSHEETS IN THIS DOCUMENT----------	
Metadata	Description of database file, the report worksheets, and a summary of project(s) and project data.
Project Planted	Each project is listed with its PLANTED stems per acre, for each year. This excludes live stakes.
Project 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	94643
project Name	Lyle Creek Mitigation Site
Description	Stream and Wetland Mitigation
Required Plots (calculated)	35
Sampled Plots	35

Table 9. Planted and Total Stem Counts
Lyle Creek Mitigation Site
DMS Project No. 94643
Monitoring Year 5 - 2016

			Current Plot Data (MY5 - 2016)																																				
			94643-WEI-0001			94643-WEI-0002			94643-WEI-0003			94643-WEI-0004			94643-WEI-0005			94643-WEI-0006			94643-WEI-0007			94643-WEI-0008			94643-WEI-0009			94643-WEI-0010			94643-WEI-0011			94643-WEI-0012			94643-WEI-0013		
Scientific Name	**Common Name**	**Species Type**	**PnoLS**	**P-all**	**T**	**PnoLS**	**P-all**	**T**	**PnoLS**	**P-all**	**T**	**PnoLS**	**P-all**	**T**	**PnoLS**	**P-all**	**T**	**PnoLS**	**P-all**	**T**	**PnoLS**	**P-all**	**T**	**PnoLS**	**P-all**	**T**	**PnoLS**	**P-all**	**T**	**PnoLS**	**P-all**	**T**	**PnoLS**	**P-all**	**T**	**PnoLS**	**P-all**	**T**	**PnoLS**	**P-all**	**T**
Acer floridanum	southern sugar maple	Tree																																					
Acer negundo	boxelder	Tree										1	1	1							1	1	1				2	2	2											
Acer rubrum	red maple	Tree			1																		2													2				
Alnus serrulata	hazel alder	Shrub	1	1	1	1	1	1				3	3	3	2	2	2	1	1	1	2	2	2	2	2	2														
Betula nigra	river birch	Tree																									2	2	2			1	1	1	1	1	1	3	3	3
Callicarpa americana	American beautyberry	Shrub																																					
Carpinus caroliniana	American hornbeam	Tree										1	1	1																									
Celtis laevigata	sugarberry	Tree				3	3	3																2	2	2													
Cephalanthus occidentalis	common buttonbush	Shrub																										1								1			1
Cercis canadensis	eastern redbud	Tree																																					
Cornus amomum	silky dogwood	Shrub																																					
Cornus florida	flowering dogwood	Tree																																					
Diospyros virginiana	common persimmon	Tree							1	1	1			1	3	3	3			1	1	1	1							1	1	1							
Fraxinus pennsylvanica	green ash	Tree				1	1	1	1	1	1				2	2	2	2	2	3	1	1	1	4	4	8	1	1	3	1	1	1	4	4	4	2	2	2	6	6	6
Hibiscus	rosemallow	Shrub																																					
Juglans nigra	black walnut	Tree																																					
Liquidambar styraciflua	sweetgum	Tree																																2					
Liriodendron tulipifera	tuliptree	Tree				1	1	1				1	1	2	1	1	1	3	3	3	1	1	1	2	2	2										1	1	1			
Nyssa sylvatica	blackgum	Tree	4	4	4				2	2	2																									2	2	2	4	4	4
Pinus rigida	pitch pine	Tree																																					
Pinus taeda	loblolly pine	Tree			1						1			1																										
Platanus occidentalis	American sycamore	Tree	4	4	4	1	1	1	3	3	3							1	1	1	4	4	4							6	6	22	4	4	4	2	2	2	1	1	1
Populus deltoides	eastern cottonwood	Tree																					1									7								
Prunus serotina	black cherry	Tree																																					
Quercus michauxii	swamp chestnut oak	Tree							4	4	4	1	1	1																								1	1	1
Quercus phellos	willow oak	Tree										1	1	1	2	2	2	1	1	1							2	2	2											
Quercus rubra	northern red oak	Tree										1	1	1	1	1	1	1	1	1																				
Rosa palustris	swamp rose	Shrub																																					
Salix bebbiana	Bebb willow	Tree																																				1		
Salix nigra	black willow	Tree			1																		7									8								
Salix sericea	silky willow	Shrub									4															1														
Sambucus canadensis	common elderberry	Shrub																																					
Ulmus alata	winged elm	Tree																																					
Ulmus americana	American elm	Tree																																					
Ulmus rubra	slippery elm	Tree																																					
		Stem count	9	9	12	7	7	7	11	11	16	9	9	12	11	11	11	9	9	11	10	10	20	10	10	15	7	7	10	8	8	40	9	9	11	8	8	12	15	15	16
		size (ares)	1			1			1			1			1			1			1			1			1			1			1			1			1	
		size (ACRES)	0.02			0.02			0.02			0.02			0.02			0.02			0.02			0.02			0.02			0.02			0.02			0.02			0.02	
		Species count	3	3	6	5	5	5	5	5	7	7	7	9	6	6	6	6	6	7	6	6	9	4	4	5	4	4	5	3	3	6	3	3	4	5	5	8	5	5	6
		Stems per ACRE	364.2	364.2	485.6	283.3	283.3	283.3	445.2	445.2	647.5	364.2	364.2	485.6	445.2	445.2	445.2	364.2	364.2	445.2	404.7	404.7	809.4	404.7	404.7	607	283.3	283.3	404.7	323.7	323.7	1619	364.2	364.2	445.2	323.7	323.7	485.6	607	607	647.5

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: Number of Planted stems excluding live stakes
P-all: Number of planted stems including live stakes
T: Total Stems

Table 9. Planted and Total Stem Counts
Lyle Creek Mitigation Site
DMS Project No. 94643
Monitoring Year 5 - 2016

			Current Plot Data (MY5 2016)																																				
			94643-WEI-0014			94643-WEI-0015			94643-WEI-0016			94643-WEI-0017			94643-WEI-0018			94643-WEI-0019			94643-WEI-0020			94643-WEI-0021			94643-WEI-0022			94643-WEI-0023			94643-WEI-0024			94643-WEI-0025			94643-WEI-0026		
Scientific Name	**Common Name**	**Species Type**	**PnoLS**	**P-all**	**T**	**PnoLS**	**P-all**	**T**	**PnoLS**	**P-all**	**T**	**PnoLS**	**P-all**	**T**	**PnoLS**	**P-all**	**T**	**PnoLS**	**P-all**	**T**	**PnoLS**	**P-all**	**T**	**PnoLS**	**P-all**	**T**	**PnoLS**	**P-all**	**T**	**PnoLS**	**P-all**	**T**	**PnoLS**	**P-all**	**T**	**PnoLS**	**P-all**	**T**	**PnoLS**	**P-all**	**T**
Acer floridanum	southern sugar maple	Tree										4	4	4	1	1	1						1	1	1	2														
Acer negundo	boxelder	Tree									3			1												1								2							
Acer rubrum	red maple	Tree													2	2	2	1	1	1				1	1	1				2	2	2				1	1	1			
Alnus serrulata	hazel alder	Shrub	1	1	1																1	1	1				3	3	3	1	1	1	4	4	4	3	3	3			
Betula nigra	river birch	Tree				5	5	5	2	2	2	4	4	4							1	1	1																	
Callicarpa americana	American beautyberry	Shrub																																						
Carpinus caroliniana	American hornbeam	Tree																														2	2	2						
Celtis laevigata	sugarberry	Tree	1	1	1																											2	2	2						
Cephalanthus occidentalis	common buttonbush	Shrub									1									1			2									1			2			1
Cercis canadensis	eastern redbud	Tree																																						
Cornus amomum	silky dogwood	Shrub																																						
Cornus florida	flowering dogwood	Tree																																						
Diospyros virginiana	common persimmon	Tree										1	1	1																										
Fraxinus pennsylvanica	green ash	Tree	10	10	10	3	3	3	7	7	7				1	1	1	3	3	3	2	2	3	1	1	5	3	3	4	3	3	3	2	2	3	4	4	4	1	1	1
Hibiscus	rosemallow	Shrub																																						
Juglans nigra	black walnut	Tree																																						
Liquidambar styraciflua	sweetgum	Tree																																						
Liriodendron tulipifera	tuliptree	Tree				4	4	4																			1	1	1						1						
Nyssa sylvatica	blackgum	Tree							5	5	5																			3	3	3	4	4	4				6	6	6
Pinus rigida	pitch pine	Tree																																						
Pinus taeda	loblolly pine	Tree																								3														
Platanus occidentalis	American sycamore	Tree													1	1	1	4	4	4	8	8	11	6	6	14	2	2	2							3	3	3	4	4	4
Populus deltoides	eastern cottonwood	Tree			1																											1								
Prunus serotina	black cherry	Tree																								1														
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	1	1	1	1	1	1	2	2	2												
Quercus rubra	northern red oak	Tree																																						
Rosa palustris	swamp rose	Shrub																																						
Salix bebbiana	Bebb willow	Tree																																						
Salix nigra	black willow	Tree																		1																				
Salix sericea	silky willow	Shrub			20																													1			9			
Sambucus canadensis	common elderberry	Shrub																																						
Ulmus alata	winged elm	Tree						1																																
Ulmus americana	American elm	Tree																																						
Ulmus rubra	slippery elm	Tree																					4																	
	Stem count		12	12	33	12	12	13	14	14	18	9	9	10	7	7	7	9	9	11	13	13	24	10	10	28	11	11	12	9	9	10	15	15	21	11	11	22	11	11	12
	size (ares)		1			1			1			1			1			1			1			1			1			1			1			1			1		
	size (ACRES)		0.02			0.02			0.02			0.02			0.02			0.02			0.02			0.02			0.02			0.02			0.02			0.02			0.02		
	Species count		3	3	5	3	3	4	3	3	5	3	3	4	6	6	6	4	4	6	5	5	8	5	5	8	5	5	5	4	4	5	6	6	10	4	4	6	3	3	4
	Stems per ACRE		485.6	485.6	1335	485.6	485.6	526.1	566.6	566.6	728.4	364.2	364.2	404.7	283.3	283.3	283.3	364.2	364.2	445.2	526.1	526.1	971.2	404.7	404.7	1133	445.2	445.2	485.6	364.2	364.2	404.7	607	607	849.8	445.2	445.2	890.3	445.2	445.2	485.6

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: Number of Planted stems excluding live stakes
P-all: Number of planted stems including live stakes
T: Total Stems

Table 9. Planted and Total Stem Counts
Lyle Creek Mitigation Site
DMS Project No. 94643
Monitoring Year 5 - 2016

			Current Plot Data (MY5 2016)																										Annual Summary																	
			94643-WEI-0027			94643-WEI-0028			94643-WEI-0029			94643-WEI-0030			94643-WEI-0031			94643-WEI-0032			94643-WEI-0033			94643-WEI-0034			94643-WEI-0035			MY5 (2016)			MY4 (2015)			MY3 (2014)			MY2 (2013)			MY1 (2012)			MY0 (2012)		
Scientific Name	**Common Name**	**Species Type**	**PnoLS**	**P-all**	**T**	**PnoLS**	**P-all**	**T**	**PnoLS**	**P-all**	**T**	**PnoLS**	**P-all**	**T**	**PnoLS**	**P-all**	**T**	**PnoLS**	**P-all**	**T**	**PnoLS**	**P-all**	**T**	**PnoLS**	**P-all**	**T**	**PnoLS**	**P-all**	**T**	**PnoLS**	**P-all**	**T**	**PnoLS**	**P-all**	**T**	**PnoLS**	**P-all**	**T**	**PnoLS**	**P-all**	**T**	**PnoLS**	**P-all**	**T**	**PnoLS**	**P-all**	**T**
Acer floridanum	southern sugar maple	Tree																																2												
Acer negundo	boxelder	Tree																											10	10	12	11	11	13	10	10	11	11	11	12	14	14	14	24	24	24
Acer rubrum	red maple	Tree																													12			4												
Alnus serrulata	hazel alder	Shrub	1	1	1							4	4	4				3	3	3	2	2	2	4	4	4				34	34	34	34	34	34	33	33	33	33	33	33	13	13	13	25	25	25
Betula nigra	river birch	Tree				7	7	7	4	4	4							2	2	2	5	5	5				5	5	5	53	53	54	52	52	53	51	51	55	52	52	55	52	52	52	71	71	71
Callicarpa americana	American beautyberry	Shrub																																						15					
Carpinus caroliniana	American hornbeam	Tree																											3	3	3	3	3	3	4	4	4	4	4	4	2	2	2	17	17	17
Celtis laevigata	sugarberry	Tree																1	1	1										9	9	9	14	14	14	11	11	11	13	13	13	13	13	13	15	15	15
Cephalanthus occidentalis	common buttonbush	Shrub			4			5			2			3			3						1						4			34			50			35			22					
Cercis canadensis	eastern redbud	Tree																																1						1					
Cornus amomum	silky dogwood	Shrub												1	1	1	2			2				2	2	7			1	3	3	13	3	3	11											
Cornus florida	flowering dogwood	Tree																																	1	1	2									
Diospyros virginiana	common persimmon	Tree										1	1	3	1	1	1													9	9	13	9	9	9	8	8	8	8	8	9	8	8	8	10	10	10
Fraxinus pennsylvanica	green ash	Tree	1	1	2	3	3	3				4	4	4	3	3	3				1	1	2	2	2	3	1	1	1	80	80	97	82	82	95	74	74	84	77	77	88	63	63	63	69	69	69
Hibiscus	rosemallow	Shrub																																			1								
Juglans nigra	black walnut	Tree																																						1					
Liquidambar styraciflua	sweetgum	Tree																													2			10			2			3					
Liriodendron tulipifera	tuliptree	Tree																											15	15	17	16	16	19	17	17	19	20	20	21	20	20	20	52	52	52
Nyssa sylvatica	blackgum	Tree																2	2	2	2	2	4				5	5	5	39	39	41	40	40	40	38	38	38	40	40	40	38	38	38	48	48	48
Pinus rigida	pitch pine	Tree																																2											
Pinus taeda	loblolly pine	Tree																													6														
Platanus occidentalis	American sycamore	Tree	5	5	5	1	1	1	3	3	3				3	3	3													66	66	93	65	65	113	66	66	97	68	68	97	66	66	66	88	88	88
Populus deltoides	eastern cottonwood	Tree						1			1						1												1			14			29			10			7					
Prunus serotina	black cherry	Tree																													1									3					
Quercus michauxii	swamp chestnut oak	Tree													2	2	2										2	2	2	13	13	13	13	13	13	14	14	14	12	12	12	12	12	12	14	14	14
Quercus phellos	willow oak	Tree	6	6	6	1	1	1																4	4	6				23	23	25	23	23	24	23	23	24	22	22	22	21	21	21	27	27	27
Quercus rubra	northern red oak	Tree	1	1	1																									4	4	4	4	4	4	1	1	1									
Rosa palustris	swamp rose	Shrub																																36			12			32					
Salix bebbiana	Bebb willow	Tree							1	1	1																			1	1	2	1	1	1											
Salix nigra	black willow	Tree																													17			72						1					
Salix sericea	silky willow	Shrub						1			2						2						4						11			55			40			13			36					
Sambucus canadensis	common elderberry	Shrub															1															1			1											
Ulmus alata	winged elm	Tree																													1						5								
Ulmus americana	American elm	Tree																																5											
Ulmus rubra	slippery elm	Tree																													4														
Stem count			14	14	19	12	12	19	8	8	13	9	9	15	10	10	18	8	8	10	10	10	18	12	12	21	13	13	30	362	362	577	370	370	698	351	351	479	360	360	527	322	322	322	460	460	460
size (ares)			1			1			1			1			1			1			1			1			1			35			35			35			35			35					
size (ACRES)			0.02			0.02			0.02			0.02			0.02			0.02			0.02			0.02			0.02			0.86			0.86			0.86			0.86			0.86					
Species count			5	5	6	4	4	7	3	3	6	3	3	5	5	5	9	4	4	5	4	4	6	4	4	5	4	4	8	15	15	26	15	15	27	14	14	21	12	12	22	12	12	12	12	12	12
Stems per ACRE			566.6	566.6	768.9	485.6	485.6	768.9	323.7	323.7	526.1	364.2	364.2	607	404.7	404.7	728.4	323.7	323.7	404.7	404.7	404.7	728.4	485.6	485.6	849.8	526.1	526.1	1214	418.6	418.6	667.2	427.8	427.8	807.1	405.8	405.8	553.8	416.2	416.2	609.3	372.3	372.3	372.3	531.9	531.9	531.9

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: Number of Planted stems excluding live stakes
P-all: Number of planted stems including live stakes
T: Total Stems

APPENDIX 4. Morphological Summary Data and Plots

Table 10a. Baseline Stream Data Summary
Lyle Creek Mitigation Site
DMS Project No. 94643
Monitoring Year 5 - 2016

UT1 Reaches 1 and 2

Parameter	Gauge	Regional Curve									Pre-Restoration Condition[1]						Reference Reach Data								Design						As-Built/Baseline					
		UT1 Reach 1			UT1 Reach 2			UT1 Reach 3			Reach 1		Reach 2		Reach 3		UT to Lyle Creek		UT to Catawba River		UT to Lake Wheeler		Westbrook Lowlands		UT1 Reach 1 Upper		UT1 Reach 1 Lower		UT1 Reach 2		UT1 Reach 1 Upper		UT1 Reach 1 Lower		UT1 Reach 2	
		LL	UL	Eq.	LL	UL	Eq.	LL	UL	Eq.	Min	Max	Min	Max	Min	Max	Min	Max	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)	n/a										23.1	31.5	19.4		10.0		15.2		13.8		10.6		9.7		8.0		15.2		12.4		4.6		11.9		19.1	11.8
Floodprone Width (ft)											43.0	48.0	62.0		34.0		38+		80+		N/A[5]		100+		17.6+		33.4+		27.3+		66.7		62.6		79.6	69.7
Bankfull Mean Depth											0.65		0.93		1.05		0.5		1.5		1.3		0.8		0.6		0.8		0.9		0.6		0.6		0.7	1.0
Bankfull Max Depth											1.1		1.5		1.7		1.4		2.0		2.2		1.1		1.0		1.2		1.4		0.9		1.4		1.6	1.8
Bankfull Cross-sectional Area (ft^2)											14.9	19.2	18.1		10.5		7.3		20.8		17.4		8.0		4.6		12.4		11.5		2.7		8.8		13.1	11.7
Width/Depth Ratio											35.8	48.8	20.8		9.5		31.7		9.1		6.5		12.0		13.9		18.6		13.4		7.7		20.8		27.7	11.8
Entrenchment Ratio											1.5	1.8	3.2		3.4		2.5+		5.8+		15.7		2.2+		2.2+		2.2+		2.2+		2.2+		2.2+		2.2+	2.2+
Bank Height Ratio											1.6	3.0	1.4	2.3	1.7	2.4	1.0		1.0		N/A[5]		1.0		1.0		1.0		1.0		1.0		1.0		1.0	1.0
D50 (mm)											Very Fine Sand		Silt		$Silt^2$		Fine Sand		V.Coarse Sand		V. Fine Gravel		Coarse Sand													
Profile																																			
Riffle Length (ft)	n/a										-		-		-		-		-		-		-		-	-	-	-	-	-	7	23	10	75	27	47
Riffle Slope (ft/ft)											0.0030	0.0260	0.0033	0.0060	0.0030	0.0110	0.0055	0.0597	0.0110	0.0300	0.0430		N/A[6]		0.0167	0.0283	0.0025	0.0032	0.0000	0.0005	0.0025	0.0598	0.0000	0.0289	0.0020	0.0180
Pool Length (ft)											-		-		-		-		-		-		-		6	32	12	76	19	53	10	39	6	81	15	62
Pool Max Depth (ft)											1.9	2.3	2.5	5.9	4.1	5.6	1.7		2.9		1.4		1.5		1.2	1.8	1.6	2.4	1.8	2.7	1.2	2.9	1.4	3.6	2.1	3.4
Pool Spacing (ft)*											2	3	3	6	4	6	15	28	31	60	42		16	59	14	41	56	114	62	96	23	49	51	131	48	99
Pool Volume (ft^3)																																			
Pattern																																			
Channel Beltwidth (ft)	n/a										N/A[2]	N/A[2]	N/A[2]	N/A[2]	N/A[2]	N/A[2]	21		55		26	64	14	20	N/A	N/A	36	78	41	65	N/A	N/A	36	78	41	65
Radius of Curvature (ft)											N/A[2]	N/A[2]	N/A[2]	N/A[2]	N/A[2]	N/A[2]	19	32	31	56	8	34	15	27	N/A	N/A	27	48	27	34	N/A	N/A	27	48	27	34
Rc:Bankfull Width (ft/ft)											N/A[2]	N/A[2]	N/A[2]	N/A[2]	N/A[2]	N/A[2]	1.3	2.1	2.2	4.1	0.8	3.2	1.5	2.8	N/A	N/A	2	3	2	3	N/A	N/A	2	3	2	3
Meander Wave Length (ft)											N/A[2]	N/A[2]	N/A[2]	N/A[2]	N/A[2]	N/A[2]	39	44	65	107	40	191	50		N/A	N/A	100	166	113	161	N/A	N/A	100	166	113	161
Meander Width Ratio											N/A[2]	N/A[2]	N/A[2]	N/A[2]	N/A[2]	N/A[2]	1.3		4		6	11	1.4	2.1	N/A	N/A	2	5	3	5	N/A	N/A	2	5	3	5
Substrate, Bed and Transport Parameters																																			
Ri%/Ru%/P%/G%/S%	n/a																																		
SC%/Sa%/G%/C%/B%/Be%																																			
d16/d35/d50/d84/d95/d100											0.013/0.08/0.12/ 0.3/1.2/4.8		0.0016/0.008/ 0.019/0.13/0.26/0.9		-		n/a/0.1/0.2/0.5/4.0/8.0		0.3/0.4/1.8/12.8/25.2/90.0		N/A		N/A								-		-	-
Reach Shear Stress (Competency) lb/ft^2											Reach 1 Upper: 0.48, Reach 1 Lower: 0.06, Reach 2: 0.24														0.49		0.07		0.26		-		-	-
Max part size (mm) mobilized at bankfull											Reach 1 Upper: 30, Reach 1 Lower: 4, Reach 2: 15														30		5		16		-		-	-
Stream Power (Capacity) W/m^2																																			
Additional Reach Parameters																																			
Drainage Area (SM)	n/a										0.10	0.16	0.16	0.35	0.35	0.49	0.25		1.60		0.4		0.9													
Impervious Cover Estimate (%)											5%						-		-		-		-													
Rosgen Classification											$F5^2$		$F6^2$		$G6^2$		C5		E5		E4		E/C5		B5c		C6		C6		Bc		C		C	
Bankfull Velocity (fps)											0.7	0.9	0.8		2.7										3.0		1.2		2.4		-		-		-	
Bankfull Discharge (cfs)		17	24	-	24	42	-	42	52	-	14		15		28		33		119		N/A[7]		N/A[6]		14		15		28							
Q-NFF regression											37		65		79																					
Q-USGS extrapolation											8	15	15	31	31	49																				
Q-Mannings											-		-		-		-																			
Valley Length (ft)											-		-		-		-		-		-		-		651		2012		692							
Channel Thalweg Length (ft)											4017						-		-		-		-		761		2369		520		700		2558		883	
Sinuosity (ft)											1.2		1.0		1.1		1.7		1.3		1.6		1.2		1.1		1.3		1.3		1.1		1.3		1.3	
Water Surface Slope (ft/ft)											0.012		0.0011		0.0036^4		0.0048		0.0046		0.006		0.0022		0.0142		0.0013		0.0047		0.0140		0.0015		0.0047	
Bankfull Slope (ft/ft)											0.012		0.0011		0.0036^4		-		-		-		-		0.0142		0.0013		0.0047		0.0140		0.0015		0.0049	

(-): Data was not provided
N/A: Not Applicable

[1]Pre-Restoration Reaches differ from the as-built/baseline reaches.

[2]Channel was straightened, moved, and/or maintained to prevent pattern formation prior to restoration.

[3]The Rosgen classification system is for natural streams. These channels have been heavily manipulated by man and therefore theRosgen classification system is not applicable. These classifications are provided for illustrative purposes only.

[4]UT1 Reach 3 drops down to meet the Lyle Creek water surface elevation, which accounts for a channel slope steeper than the valley slope.

[5]Data not provided in reference reach report (Lowther, 2008).

[6]Data not provided in Neu-Con Umbrella Wetland and Stream Mitigation Bank Westbrook Lowgrounds Site Specific MitigationPlan (Environmental Bank and Exchange, 2002).

[7]Lowther reported a range of possible discharges from 46.8 to 108.9 cfs based on different Manning's 'n' estimation techniques(Lowther, 2008).

Table 10b. Baseline Stream Data Summary
Lyle Creek Mitigation Site
DMS Project No. 94643
Monitoring Year 5 - 2016

UT1A and UT1B

Parameter	Gauge	Regional Curve						Pre-Restoration Condition[1]				Reference Reach Data		Design								As-Built/Baseline									
		UT1A			UT1B			UT1A		UT1B				UT1A Upper		UT1A Lower		UT1B 200+00 to 203+20		UT1B 203+21 to 207+18		UT1B 207+18 to 209+97		UT1A		UT1A Upper		UT1A Lower		UT1B 200+00 to 203+20		UT1B 203+21 to 207+18		UT1B 207+18 to 209+97	
		LL		Eq.		UL		Min		Min		Min	Max	Min		Min		Min	Max	Min	Max	Min	Max	Min		Max		Min		Max		Min		Max	
Dimension and Substrate - Riffle																																			
Bankfull Width (ft)	n/a							8.7		16.3		refer to table 10a		6.5				8.0						4.6				4.5							
Floodprone Width (ft)								21.0		42.0				14.3+				11.0+						30.5				67.3							
Bankfull Mean Depth								0.53		0.48				0.5				0.6						0.4				0.5							
Bankfull Max Depth								0.8		1.0				0.8				1.0						0.8				1.0							
Bankfull Cross-sectional Area (ft^2)								4.6		7.9				3.2				5.0						2.1				2.3							
Width/Depth Ratio								16.5		33.6				13.3				12.8						10.4				8.7							
Entrenchment Ratio								2.4		2.6				2.2+				2.2+						2.2+				2.2+							
Bank Height Ratio								0.8		1.0				1.0				1.0						1.0				1.0							
D50 (mm)								Silt[2]		Silt[2]																									
Profile																																			
Riffle Length (ft)	n/a							-	-	-	-	refer to table 10a		-	-	-	-	-	-	-	-	-	-	8	19	10	23	19	31	15	22	10	20		
Riffle Slope (ft/ft)								0.0035	0.0320	0.0056	0.0160			0.0350	0.0571	0.0156	0.0192	0.0263	0.0309	0.0145	0.0218	0.0045	0.0079	0.0353	0.0477	0.0086	0.0290	0.0224	0.0593	0.0072	0.0323	0.0032	0.0217		
Pool Length (ft)								-	-	-	-			4	14	10	25	18	64	15	22	16	20	5	12	12	34	23	40	17	41	28	42		
Pool Max Depth (ft)								1.1		1.6				1.25	1.45	1.05	1.45	1.6	1.8	1.2	1.8	1.4	1.7	1.0	1.9	1.2	1.9	1.2	2.1	1.3	2.4	1.9	2.2		
Pool Spacing (ft)								35	68	28	87			13	30	31	52	49	63	37	58	49	57	4	33	29	90	43	71	34	61	46	66		
Pool Volume (ft^3)																																			
Pattern																																			
Channel Beltwidth (ft)	n/a							N/A[2]	N/A[2]	N/A[2]	N/A[2]	refer to table 10a		N/A	N/A	25	35	35	39	23	39	29	41	N/A	N/A	25	35	35	39	23	39	29	41		
Radius of Curvature (ft)								N/A[2]	N/A[2]	N/A[2]	N/A[2]			N/A	N/A	14	20	19	27	16	26	19	26	N/A	N/A	14	20	19	27	16	26	19	26		
Rc:Bankfull Width (ft/ft)								N/A[2]	N/A[2]	N/A[2]	N/A[2]			N/A	N/A	2	3	2	3	2	3	2	3	N/A	N/A	2	3	2	3	2	3	2	3		
Meander Wave Length (ft)								N/A[2]	N/A[2]	N/A[2]	N/A[2]			N/A	N/A	53	82	83	106	78	86	79	90	N/A	N/A	53	82	83	106	78	86	79	90		
Meander Width Ratio								N/A[2]	N/A[2]	N/A[2]	N/A[2]			N/A	N/A	4	5	4	5	3	5	4	5	N/A	N/A	4	5	4	5	3	5	4	5		
Substrate, Bed and Transport Parameters																																			
Ri%/Ru%/P%/G%/S%	n/a											refer to table 10a																							
SC%/Sa%/G%/C%/B%/Be%																																			
d16/d35/d50/d84/d95/d100								-		-														N/A											
Reach Shear Stress (Competency) lb/ft^2								0.35		0.06				0.84		0.28		0.6		0.32		0.12		-											
Max part size (mm) mobilized at bankfull								20		4				60		17		38		20		7		-											
Stream Power (Capacity) W/m^2																																			
Additional Reach Parameters																																			
Drainage Area (SM)	n/a							0.05		0.13		refer to table 10a																							
Impervious Cover Estimate (%)																																			
Rosgen Classification								F6[3]		F6[3]				B6		C6		C6						C				E							
Bankfull Velocity (fps)								2.0		1.6				2.8				2.6						-				-							
Bankfull Discharge (cfs)								8		13				9				13																	
Q-NFF regression								-		-																									
Q-USGS extrapolation								4	9	10	18																								
Q-Mannings								-		-																									
Valley Length (ft)								-		-				190		352		279		326		227													
Channel Thalweg Length (ft)								1141		890				201		414		320		398		279		201		414		320		398		279			
Sinuosity (ft)								1.0		1.0				1.1		1.2		1.1		1.2		1.2		1.1		1.2		1.1		1.2		1.2			
Water Surface Slope (ft/ft)								0.0106		0.0085				0.0284		0.0095		0.0131		0.0086		0.0032		0.0296		0.0089		0.0187		0.0080		0.0039			
Bankfull Slope (ft/ft)								0.0106		0.0085				0.0284		0.0095		0.0161		0.0086		0.0032		0.0294		0.0091		0.0190		0.0079		0.0039			

(-): Data was not provided
N/A: Not Applicable

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[3]The Rosgen classification system is for natural streams. These channels have been heavily manipulated by man and therefore theRosgen classification system is not applicable. These classifications are provided for illustrative purposes only.

[4]UT1 Reach 3 drops down to meet the Lyle Creek water surface elevation, which accounts for a channel slope steeper than the valley slope.

[5]Data not provided in reference reach report (Lowther, 2008).

[6]Data not provided in Neu-Con Umbrella Wetland and Stream Mitigation Bank Westbrook Lowgrounds Site Specific MitigationPlan (Environmental Bank and Exchange, 2002).

[7]Lowther reported a range of possible discharges from 46.8 to 108.9 cfs based on different Manning's 'n' estimation techniques(Lowther, 2008).

Table 11. Morphology and Hydraulic Monitoring Summary (Dimensional Parameters - Cross-Section)
Lyle Creek Mitigation Site
DMS Project No. 94643
Monitoring Year 5 - 2016

UT1 Reaches 1 and 2, UT1A and UT1B

	UT1 Reach 1 Upper												UT1 Reach 1 Lower											
	Cross-Section 1 (Riffle)						Cross-Section 2 (Pool)						Cross-Section 3 (Riffle)						Cross-Section 4 (Pool)					
Dimension and Substrate	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**
based on fixed bankfull elevation																								
Bankfull Width (ft)	4.6	5.8	6.1	5.1	9.7	6.5	13.6	10.8	10.3	10.6	8.9	9.9	19.1	13.7	18.2	15.5	15.6	13.4	21.6	15.3	17.4	16.4	17.3	16.2
Floodprone Width (ft)	66.7	65.4	65.4	65.4	66.8	67.0	---	---	---	---	---	---	62.6	63.4	55.7	55.7	63.4	63.4	---	---	---	---	---	---
Bankfull Mean Depth (ft)	0.6	0.5	0.4	0.3	0.2	0.3	1.0	0.9	0.8	0.5	0.6	0.5	0.7	0.7	0.6	0.5	0.6	0.7	1.0	1.0	1.0	1.0	1.0	1.1
Bankfull Max Depth (ft)	0.9	0.8	0.8	0.9	0.8	0.9	2.4	1.9	1.8	1.1	1.4	1.3	1.6	1.3	1.5	1.5	1.6	1.5	2.4	2.2	2.2	2.2	2.3	2.3
Bankfull Cross-Sectional Area (ft^2)	2.7	2.7	2.3	1.7	2.1	2.1	14.2	9.8	8.1	5.1	5.0	4.9	13.1	9.0	10.8	8.1	9.5	8.9	22.0	16.1	17.9	17.0	17.3	17.8
Bankfull Width/Depth Ratio	7.7	12.8	16.0	15.2	43.8	20.1	13.0	12.0	13.0	22.2	15.9	19.7	27.7	20.9	30.7	29.6	25.6	20.1	21.1	14.6	16.9	15.8	17.5	14.8
Bankfull Entrenchment Ratio	2.2+	2.2+	2.2+	2.2+	2.2+	2.2+	N/A	N/A	N/A	N/A	N/A	N/A	2.2+	2.2+	2.2+	2.2+	2.2+	2.2+	N/A	N/A	N/A	N/A	N/A	N/A
Bankfull Bank Height Ratio	1.0	1.0	1.0	1.0	1.0	1.0	N/A	N/A	N/A	N/A	N/A	N/A	1.0	1.0	1.1	1.0	1.0	1.0	N/A	N/A	N/A	N/A	N/A	N/A

	UT1 Reach 1 Lower												UT1 Reach 2											
	Cross-Section 5 (Pool)						Cross-Section 6 (Riffle)						Cross-Section 7 (Riffle)						Cross-Section 8 (Pool)					
Dimension and Substrate	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**
based on fixed bankfull elevation																								
Bankfull Width (ft)	15.6	14.4	18.0	15.9	14.4	15.1	11.9	12.4	13.5	13.4	12.6	12.8	11.8	8.7	14.7	12.1	13.1	11.0	23.6	16.9	22.7	21.0	20.5	22.5
Floodprone Width (ft)	---	---	---	---	---	---	79.6	80.3	76.9	76.9	79.7	79.7	69.7	70.8	65.9	65.9	71.8	71.7	---	---	---	---	---	---
Bankfull Mean Depth (ft)	1.0	1.0	0.8	0.9	0.8	0.9	0.7	0.7	0.7	0.6	0.6	0.7	1.0	1.1	0.8	0.9	0.9	0.9	1.2	1.3	1.1	1.0	1.0	0.8
Bankfull Max Depth (ft)	2.1	1.9	1.9	1.9	1.8	1.7	1.4	1.2	1.4	1.4	1.2	1.3	1.8	1.7	1.8	1.7	1.8	1.6	3.0	2.1	2.7	2.9	2.3	2.2
Bankfull Cross-Sectional Area (ft^2)	16.4	13.7	14.8	13.8	11.8	12.9	8.1	8.5	8.8	7.6	7.4	8.3	11.7	9.4	11.8	10.9	11.4	9.3	27.4	21.3	24.4	20.9	19.6	18.6
Bankfull Width/Depth Ratio	14.9	15.1	21.9	18.3	17.6	17.7	17.3	18.0	20.8	23.6	21.7	19.7	11.8	8.0	18.3	13.5	15.1	12.9	20.3	13.4	21.0	21.1	21.4	27.2
Bankfull Entrenchment Ratio	N/A	N/A	N/A	N/A	N/A	N/A	2.2+	2.2+	2.2+	2.2+	2.2+	2.2+	2.2+	2.2+	2.2+	2.2+	2.2+	2.2+	N/A	N/A	N/A	N/A	N/A	N/A
Bankfull Bank Height Ratio	N/A	N/A	N/A	N/A	N/A	N/A	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	N/A	N/A	N/A	N/A	N/A	N/A

	UT1A												UT1B											
	Cross-Section 9 (Riffle)						Cross-Section 10 (Pool)						Cross-Section 11 (Riffle)						Cross-Section 12 (Pool)					
Dimension and Substrate	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**
based on fixed bankfull elevation																								
Bankfull Width (ft)	4.6	1.9	2.1	0.0	0.0	0.0	5.9	---	2.7	0.0	0.0	0.0	4.5	3.1	4.8	2.8	4.0	3.6	6.0	6.4	8.5	4.7	6.7	4.9
Floodprone Width (ft)	30.5	31.4	27.0	0.0	0.0	0.0	---	---	---	---	---	---	67.3	66.5	64.2	53.8	45.4	67.8	---	---	---	---	---	---
Bankfull Mean Depth (ft)	0.4	0.3	0.4	0.0	0.0	0.0	0.6	---	0.3	0.0	0.0	0.0	0.5	0.3	0.5	0.4	0.3	0.3	0.8	0.6	0.4	0.3	0.2	0.3
Bankfull Max Depth (ft)	0.8	0.4	0.6	0.0	0.0	0.0	1.0	---	0.5	0.0	0.0	0.0	1.0	1.1	1.0	0.7	0.6	0.7	1.2	1.0	0.7	0.5	0.4	0.4
Bankfull Cross-Sectional Area (ft^2)	2.1	0.6	0.8	0.0	0.0	0.0	3.3	---	0.9	0.0	0.0	0.0	2.3	1.0	2.3	1.2	1.3	1.2	4.5	3.9	3.1	1.3	1.5	1.3
Bankfull Width/Depth Ratio	10.4	6.2	5.2	0.0	0.0	0.0	10.7	---	8.0	0.0	0.0	0.0	8.7	9.8	10.0	6.4	12.6	10.7	8.0	10.6	23.4	17.9	29.7	18.5
Bankfull Entrenchment Ratio	2.2+	2.2+	2.2+	N/A	N/A	N/A	N/A	---	N/A	N/A	N/A	N/A	2.2+	2.2+	2.2+	2.2+	2.2+	2.2+	N/A	N/A	N/A	N/A	N/A	N/A
Bankfull Bank Height Ratio	1.0	1.0	1.0	N/A	N/A	N/A	N/A	---	N/A	N/A	N/A	N/A	1.0	1.0	1.0	1.0	1.0	1.0	N/A	N/A	N/A	N/A	N/A	N/A

	UT1A						UT1A						UT1A					
	Cross-Section 13 (Riffle)						Cross-Section 14 (Run)						Cross-Section 15 (Run)					
Dimension and Substrate	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**
based on fixed bankfull elevation																		
Bankfull Width (ft)	---	---	---	5.7	0.0	0.0	---	---	---	---	8.9	7.0	---	---	---	---	6.3	7.4
Floodprone Width (ft)	---	---	---	54.9	---	---	---	---	---	---	200+	200+	---	---	---	---	200+	200+
Bankfull Mean Depth (ft)	---	---	---	0.4	0.0	0.0	---	---	---	---	0.5	0.6	---	---	---	---	0.4	0.4
Bankfull Max Depth (ft)	---	---	---	1.0	0.0	0.0	---	---	---	---	1.1	1.1	---	---	---	---	0.8	0.8
Bankfull Cross-Sectional Area (ft^2)	---	---	---	2.0	0.0	0.0	---	---	---	---	4.3	4.5	---	---	---	---	2.2	2.9
Bankfull Width/Depth Ratio	---	---	---	16.3	0.0	0.0	---	---	---	---	18.6	11.0	---	---	---	---	17.7	19.2
Bankfull Entrenchment Ratio	---	---	---	2.2+	N/A	N/A	---	---	---	---	2.2+	2.2+	---	---	---	---	2.2+	2.2+
Bankfull Bank Height Ratio	---	---	---	1.0	N/A	N/A	---	---	---	---	1.0	1.0	---	---	---	---	1.0	1.0

Table 12a. Monitoring Data - Stream Reach Data Summary
Lyle Creek Mitigation Site
DMS Project No. 94643
Monitoring Year 5 - 2016

UT1 Reach 1 Upper

Parameter	As-Built/Baseline		MY-1			MY-2			MY-3			MY-4			MY-5		
	Min	Max	Min	Med	Max	Min	Med	Max	Min	Med	Max	Min	Med	Max	Min	Med	Max
Dimension and Substrate - Riffle																	
Bankfull Width (ft)	4.6		5.8			6.1			5.1			9.7			6.5		
Floodprone Width (ft)	66.7		65.4			65.4			65.4			66.8			67.0		
Bankfull Mean Depth	0.6		0.5			0.4			0.3			0.2			0.3		
Bankfull Max Depth	0.9		0.8			0.8			0.9			0.8			0.9		
Bankfull Cross-sectional Area (ft^2)	2.7		2.7			2.3			1.7			2.1			2.1		
Width/Depth Ratio	7.7		12.8			16.0			15.2			43.8			20.1		
Entrenchment Ratio	2.2+		2.2+			2.2+			2.2+			2.2+			2.2+		
Bank Height Ratio	1.0		1.0			1.0			1.0			1.0			1.0		
D50 (mm)																	
Profile																	
Riffle Length (ft)	7	23	3	12	26	4	10	23	2	13	34	2	5	41	2	8	21
Riffle Slope (ft/ft)	0.0025	0.0598	0.0043	0.0230	0.0518	0.0100	0.0260	0.0505	0.0096	0.0307	0.0879	0.0075	0.0348	0.1106	0.0056	0.0520	0.1319
Pool Length (ft)	10	39	10	16	26	8	20	28	4	13	50	9	16	33	6	14	31
Pool Max Depth (ft)	1	3	0.3	0.7	2.4	0.3	0.8	1.1	0.5	1.3	2.5	0.6	1.2	1.9	0.2	1.2	1.9
Pool Spacing (ft)	23	49	17	29	61	12	39	61	8	27	68	16	30	83	17	36	75
Pool Volume (ft^3)																	
Pattern																	
Channel Beltwidth (ft)	N/A																
Radius of Curvature (ft)	N/A																
Rc:Bankfull Width (ft/ft)	N/A																
Meander Wave Length (ft)	N/A																
Meander Width Ratio	N/A																
Additional Reach Parameters																	
Rosgen Classification	Bc		Bc			Bc			Bc			Bc			Bc		
Channel Thalweg Length (ft)	700		700			700			700			700			700		
Sinuosity (ft)	1.1		1.1			1.1			1.1			1.1			1.1		
Water Surface Slope (ft/ft)	0.0140		0.0147			0.0147			0.0150			0.0155			0.0146		
Bankfull Slope (ft/ft)	0.0140		0.0146			0.0150			0.0150			0.0153			0.0156		
Ri%/Ru%/P%/G%/S%																	
SC%/Sa%/G%/C%/B%/Be%																	
d16/d35/d50/d84/d95/d100	N/A		N/A			N/A			N/A			N /A			N /A		
% of Reach with Eroding Banks			0%			0%			0%			0%			0%		

N/A: Not Applicable

Table 12b. Monitoring Data - Stream Reach Data Summary
Lyle Creek Mitigation Site
DMS Project No. 94643
Monitoring Year 5 - 2016

UT1 Reach 1 Lower

Parameter	As-Built/Baseline		MY-1			MY-2			MY-3			MY-4			MY-5		
	Min	Max	Min	Med	Max	Min	Med	Max	Min	Med	Max	Min	Med	Max	Min	Med	Max
Dimension and Substrate - Riffle																	
Bankfull Width (ft)	12.3	22.4	13.3	15.2	17.1	13.5	17.0	20.5	13.4	15.7	16.4	12.6	14.1	15.6	12.8	13.1	13.4
Floodprone Width (ft)	62.6	79.6	63.4	71.9	80.3	55.7	66.3	76.9	55.7	66.3	76.9	63.4	71.6	79.7	63.4	74.1	79.7
Bankfull Mean Depth	0.5	0.7	0.6	0.7	0.7	0.6	0.6	0.7	0.5	0.7	1.0	0.6	0.6	0.6	0.7	0.7	0.7
Bankfull Max Depth	1.5	1.7	1.3	1.3	1.3	1.5	1.5	1.5	1.4	1.7	2.2	1.2	1.4	1.6	1.3	1.4	1.5
Bankfull Cross-sectional Area (ft^2)	10.1	14.3	9.5	9.6	9.7	8.8	10.1	11.5	7.6	10.9	17.0	7.4	8.5	9.5	8.3	8.6	8.9
Width/Depth Ratio	36.8	35.0	18.5	24.3	30.1	20.8	28.8	36.8	15.8	21.0	29.6	21.7	23.6	25.6	19.7	19.9	20.1
Entrenchment Ratio	2.2+	2.2+	2.2+	2.2+	2.2+	2.2+	2.2+	2.2+	2.2+	2.2+	2.2+	2.2+	2.2+	2.2+	2.2+	2.2+	2.2+
Bank Height Ratio	1.0	1.0	1.0	1.0	1.0	1.0	1.1	1.1	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
D50 (mm)																	
Profile																	
Riffle Length (ft)	10	75	8	28	70	12	31	81	15	35	80	8	27	73	6	25	67
Riffle Slope (ft/ft)	0.000	0.029	0.000	0.005	0.025	0.001	0.005	0.026	0.001	0.005	0.028	0.000	0.002	0.012	0.000	0.002	0.026
Pool Length (ft)	6	81	12	56	95	5	54	81	5	46	79	37	59	81	38	52	74
Pool Max Depth (ft)	1.4	3.6	0.7	1.2	2.0	0.4	1.2	1.9	1.9	2.3	4.0	2.0	2.5	3.7	2.1	2.5	3.7
Pool Spacing (ft)	51	131	29	82	118	35	80	117	39	86	124	59	88	115	57	86	126
Pool Volume (ft^3)																	
Pattern																	
Channel Beltwidth (ft)	36	78															
Radius of Curvature (ft)	27	48															
Rc:Bankfull Width (ft/ft)	2	3															
Meander Wave Length (ft)	100	166															
Meander Width Ratio	2	5															
Additional Reach Parameters																	
Rosgen Classification	C		C			C			C			C			C		
Channel Thalweg Length (ft)	2558		2558			2558			2558			2558			2558		
Sinuosity (ft)	1.3		1.3			1.3			1.3			1.3			1.3		
Water Surface Slope (ft/ft)	0.0015		0.0024			0.0025			0.0024			0.0022			0.0025		
Bankfull Slope (ft/ft)	0.0015		0.0024			0.0023			0.0024			0.0023			0.0022		
Ri%/Ru%/P%/G%/S%																	
SC%/Sa%/G%/C%/B%/Be%																	
d16/d35/d50/d84/d95/d100	N/A		N/A			N/A			N/A			N/A			N/A		
% of Reach with Eroding Banks			0%			0%			0%			0%			0%		

N/A: Not Applicable

Table 12c. Monitoring Data - Stream Reach Data Summary
Lyle Creek Mitigation Site
DMS Project No. 94643
Monitoring Year 5 - 2016

UT1 Reach 2

Parameter	As-Built/Baseline		MY-1			MY-2			MY-3			MY-4			MY-5		
	Min	Max	Min	Med	Max	Min	Med	Max	Min	Med	Max	Min	Med	Max	Min	Med	Max
Dimension and Substrate - Riffle																	
Bankfull Width (ft)	11.8		8.7			14.7			12.1			13.1			11.0		
Floodprone Width (ft)	69.7		70.8			65.9			65.9			71.8			71.7		
Bankfull Mean Depth	1.0		1.1			0.8			0.9			0.9			0.9		
Bankfull Max Depth	1.8		1.7			1.8			1.7			1.8			1.6		
Bankfull Cross-sectional Area (ft^2)	11.7		9.4			11.8			10.9			11.4			9.3		
Width/Depth Ratio	11.8		8.0			18.3			13.5			15.1			12.9		
Entrenchment Ratio	2.2+		2.2+			2.2+			2.2+			2.2+			2.2+		
Bank Height Ratio	1.0		1.0			1.0			1.0			1.0			1.0		
D50 (mm)																	
Profile																	
Riffle Length (ft)	27	47	11	24	48	27	34	48	20	37	64	20	28	40	17	30	42
Riffle Slope (ft/ft)	0.002	0.018	0.002	0.013	0.021	0.000	0.008	0.016	0.0003	0.0071	0.0231	0.0000	0.0081	0.0204	0.0000	0.0059	0.0250
Pool Length (ft)	15	62	20	46	68	28	44	58	20	44	63	37	53	61	17	49	79
Pool Max Depth (ft)	2	3	0.9	1.3	1.8	1.0	1.5	2.5	0.8	1.8	4.0	1.5	2.7	3.5	1.8	3.1	3.3
Pool Spacing (ft)	48	99	37	78	96	26	78	108	54	79	105	27	73	110	55	79	110
Pool Volume (ft^3)																	
Pattern																	
Channel Beltwidth (ft)	41	65															
Radius of Curvature (ft)	27	34															
Rc:Bankfull Width (ft/ft)	2	3															
Meander Wave Length (ft)	113	161															
Meander Width Ratio	3	5															
Additional Reach Parameters																	
Rosgen Classification	C		C			C			C			C			C		
Channel Thalweg Length (ft)	883		883			883			883			883			883		
Sinuosity (ft)	1.3		1.3			1.3			1.3			1.3			1.3		
Water Surface Slope (ft/ft)	0.0047		0.0049			0.0049			0.0039			0.0036			0.0044		
Bankfull Slope (ft/ft)	0.0049		0.0049			0.0046			0.0035			0.0032			0.0034		
Ri%/Ru%/P%/G%/S%																	
SC%/Sa%/G%/C%/B%/Be%																	
d16/d35/d50/d84/d95/d100	N/A		N/A			N/A			N/A			N/A			N/A		
% of Reach with Eroding Banks			0%			0%			0%			0%			0%		

(-): Data was not provided
N/A: Not Applicable

Table 12d. Monitoring Data - Stream Reach Data Summary
Lyle Creek Mitigation Site
DMS Project No. 94643
Monitoring Year 5 - 2016

UT1A

Parameter	As-Built/Baseline				MY-1		MY-2		MY-3		MY-4		MY-5	
	UT1A Upper		UT1A Lower											
	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
Dimension and Substrate - Riffle														
Bankfull Width (ft)	4.6				1.9		2.1		0.0		6.3	8.9	7.0	7.4
Floodprone Width (ft)	30.5				31.4		27.0		0.0		200+		200+	
Bankfull Mean Depth	0.4				0.3		0.4		0.0		0.4	0.5	0.4	0.6
Bankfull Max Depth	0.8				0.4		0.6		0.0.		0.8	1.1	0.8	1.1
Bankfull Cross-sectional Area (ft^2)	2.1				0.6		0.8		0.0		2.2	4.3	2.9	4.5
Width/Depth Ratio	10.4				6.2		5.2		0.0		17.7	18.6	11.0	19.2
Entrenchment Ratio	2.2+				2.2+		2.2+		N/A		2.2+		2.2+	
Bank Height Ratio	1.0				1.0		1.0		N/A		1.0		1.0	
D50 (mm)														
Profile														
Riffle Length (ft)	8	19	10	23	4	27	9	31	8	46	4	10	8	14
Riffle Slope (ft/ft)	0.035	0.048	0.009	0.029	0.000	0.056	0.007	0.046	0.0032	0.0442	0.0152	0.0280	0.0090	0.0348
Pool Length (ft)	5	12	12	34	4	31	4	30	7	22	12	39	11	22
Pool Max Depth (ft)	1.0	1.9	1.2	1.9	0.2	1.1	0.2	1.0	1.3	3.2	1.0	2.2	1.2	2.0
Pool Spacing (ft)	4	33	29	90	12	55	5	88	7	185	38	101	31	99
Pool Volume (ft^3)														
Pattern														
Channel Beltwidth (ft)	N/A	N/A	25	35										
Radius of Curvature (ft)	N/A	N/A	14	20										
Rc:Bankfull Width (ft/ft)	N/A	N/A	2	3										
Meander Wave Length (ft)	N/A	N/A	53	82										
Meander Width Ratio	N/A	N/A	4	5										
Additional Reach Parameters														
Rosgen Classification	C		E		C/E		C/E		C/E		C		C	
Channel Thalweg Length (ft)	201		414		615		615		615		615		615	
Sinuosity (ft)	1.1		1.2		1.2		1.2		1.2		1.2		1.2	
Water Surface Slope (ft/ft)	0.0296		0.0089		0.0162		0.0159		0.0154		0.0153		*	
Bankfull Slope (ft/ft)	0.0294		0.0091		0.0160		0.0159		0.0168		0.0165		0.0164	
Ri%/Ru%/P%/G%/S%														
SC%/Sa%/G%/C%/B%/Be%														
d16/d35/d50/d84/d95/d100	N/A		N/A		N/A		N/A		N/A		N/A		N/A	
% of Reach with Eroding Banks					0%		0%		0%		0%		0%	

MY4 & MY5 Dimension data taken from recently established cross-sections (XS14 & 15) within the braided section of UT1A.
N/A: Not Applicable
* Not calculated because the majority of UT1A was dry during MY5 survey

Table 12e. Monitoring Data - Stream Reach Data Summary
Lyle Creek Mitigation Site
DMS Project No. 94643
Monitoring Year 5 - 2016

UT1B

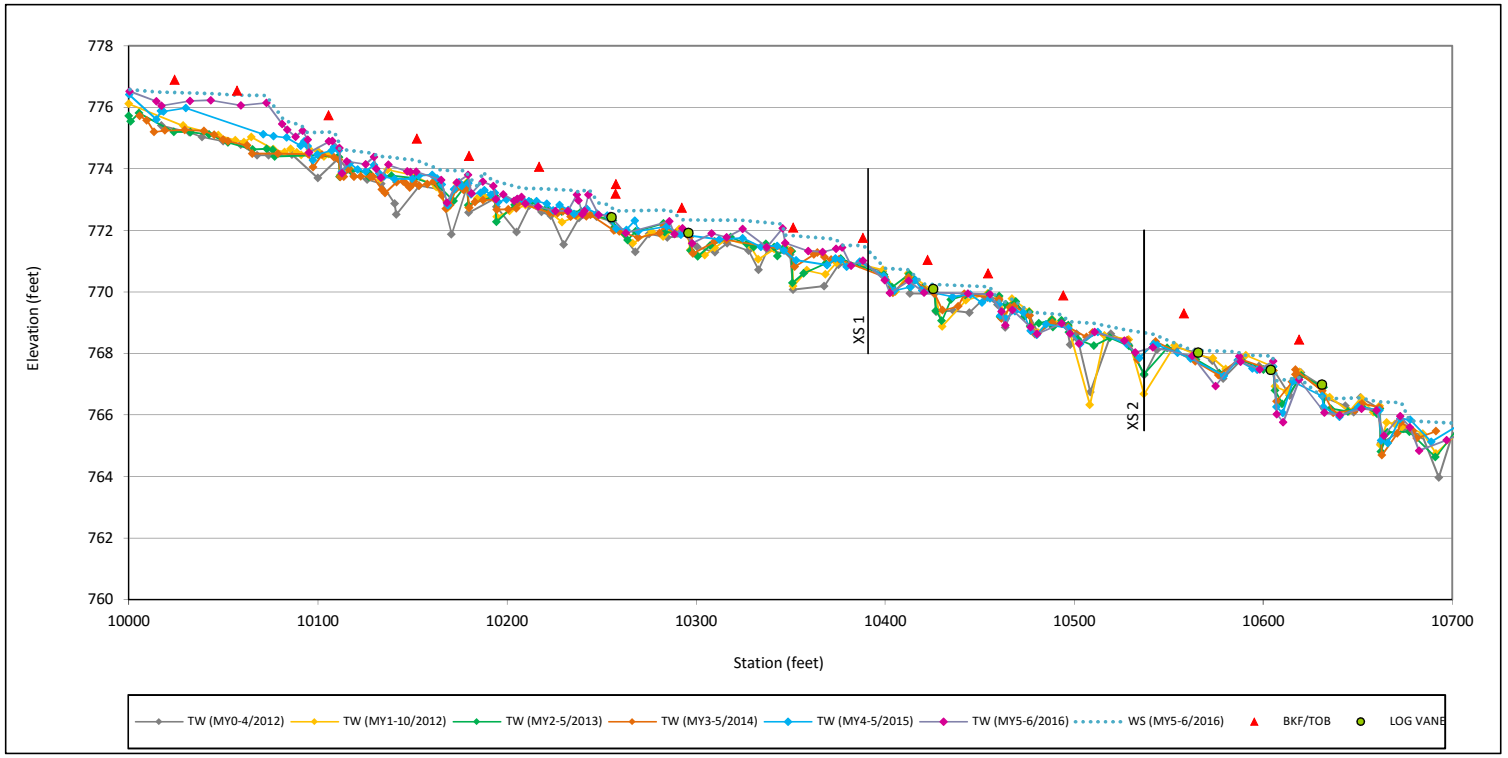
Parameter	As-Built/Baseline						MY-1		MY-2		MY-3		MY-4		MY-5	
	UT1B 200+00 to 203+20		UT1B 203+21 to 207+18		UT1B 207+18 to 209+97											
	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
Dimension and Substrate - Riffle																
Bankfull Width (ft)	4.5						3.1		4.8		2.8		4.0		3.6	
Floodprone Width (ft)	67.3						66.5		64.2		53.8		45.4		67.8	
Bankfull Mean Depth	0.5						0.3		0.5		0.4		0.3		0.3	
Bankfull Max Depth	1.0						1.1		1.0		0.7		0.6		0.7	
Bankfull Cross-sectional Area (ft^2)	2.3						1.0		2.3		1.2		1.3		1.2	
Width/Depth Ratio	8.7						9.8		10.0		6.4		12.6		10.7	
Entrenchment Ratio	2.2+						2.2+		2.2+		2.2+		2.2+		2.2+	
Bank Height Ratio	1.0						1.0		1.0		1.0		1.0		1.0	
D50 (mm)																
Profile																
Riffle Length (ft)	19	31	15	22	10	20	15	35	9	40	15	112	3	39	7	25
Riffle Slope (ft/ft)	0.0224	0.0593	0.0072	0.0323	0.0032	0.0217	0.0048	0.0589	0.0020	0.0340	0.0046	0.0164	0.0033	0.0950	0.0000	0.0397
Pool Length (ft)	23	40	17	41	28	42	11	44	14	55	6	52	7	42	9	52
Pool Max Depth (ft)	1.2	2.1	1.3	2.4	1.9	2.2	0.4	1.5	0.1	1.5	1.7	3.1	1.2	3.3	1.6	3.0
Pool Spacing (ft)	43	71	34	61	46	66	28	77	32	79	51	140	23	176	29	185
Pool Volume (ft^3)																
Pattern																
Channel Beltwidth (ft)	35	39	23	39	29	41										
Radius of Curvature (ft)	19	27	16	26	19	26										
Rc:Bankfull Width (ft/ft)	2	3	2	3	2	3										
Meander Wave Length (ft)	83	106	78	86	79	90										
Meander Width Ratio	4	5	3	5	4	5										
Additional Reach Parameters																
Rosgen Classification	E						C/E		C/E		C/E		C/E		C/E	
Channel Thalweg Length (ft)	320		398		279		997		997		997		997		997	
Sinuosity (ft)	1.1		1.2		1.2		1.2		1.2		1.2		1.2		1.2	
Water Surface Slope (ft/ft)	0.0187		0.0080		0.0039		0.0085		0.0086		0.0085		0.0088		0.0098	
Bankfull Slope (ft/ft)	0.0190		0.0079		0.0039		0.0081		0.0083		0.0085		0.0092		0.0091	
Ri%/Ru%/P%/G%/S%																
SC%/Sa%/G%/C%/B%/Be%																
d16/d35/d50/d84/d95/d100	N/A						N/A		N/A		N/A		N/A		N/A	
% of Reach with Eroding Banks							0%		0%		0%		0%		0%	

N/A: Not Applicable

Longitudinal Profile Plots

Lyle Creek Mitigation Site
DMS Project No. 94643
Monitoring Year 5 - 2016

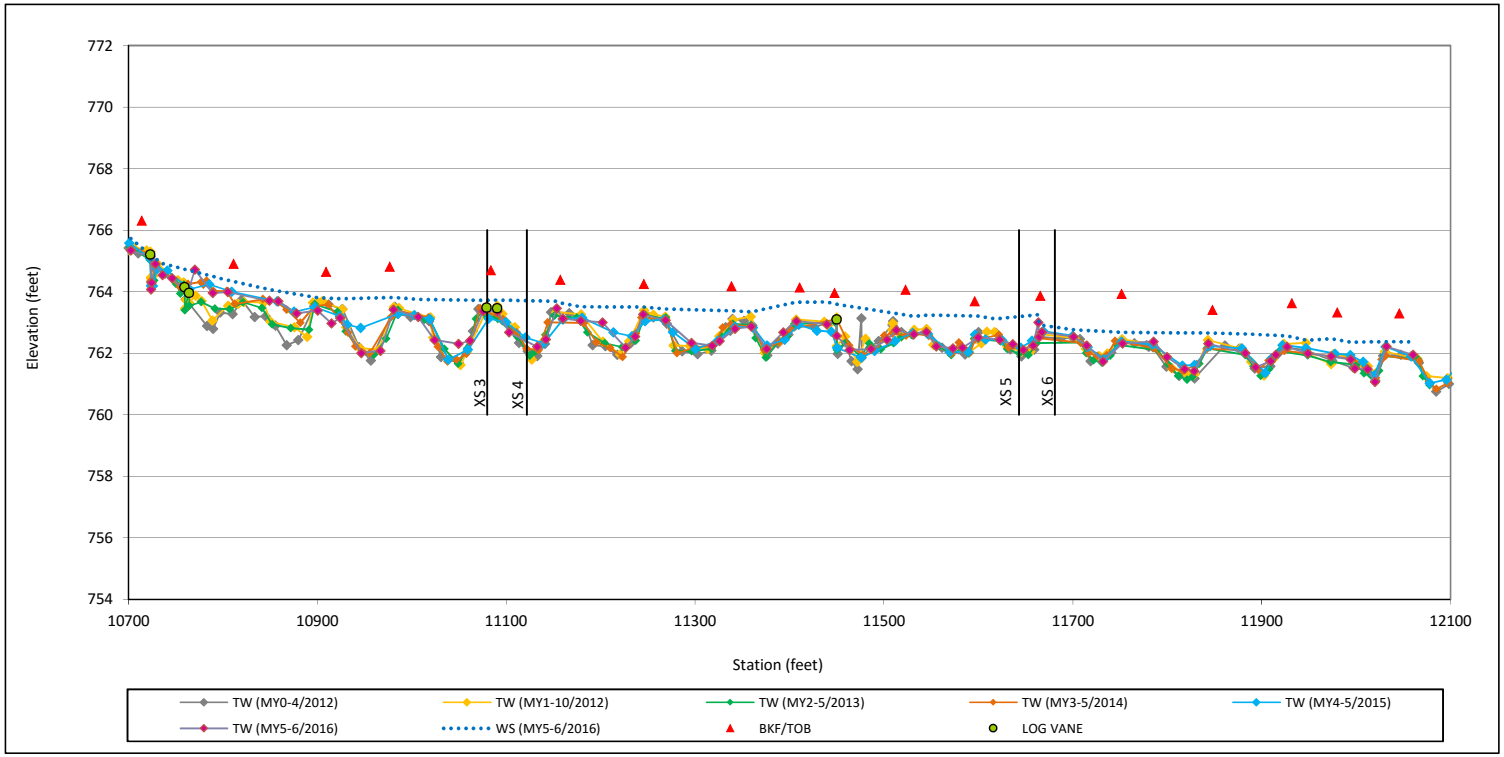
UT1 Reach 1 Upper



Longitudinal Profile Plots

Lyle Creek Mitigation Site
DMS Project No. 94643
Monitoring Year 5 - 2016

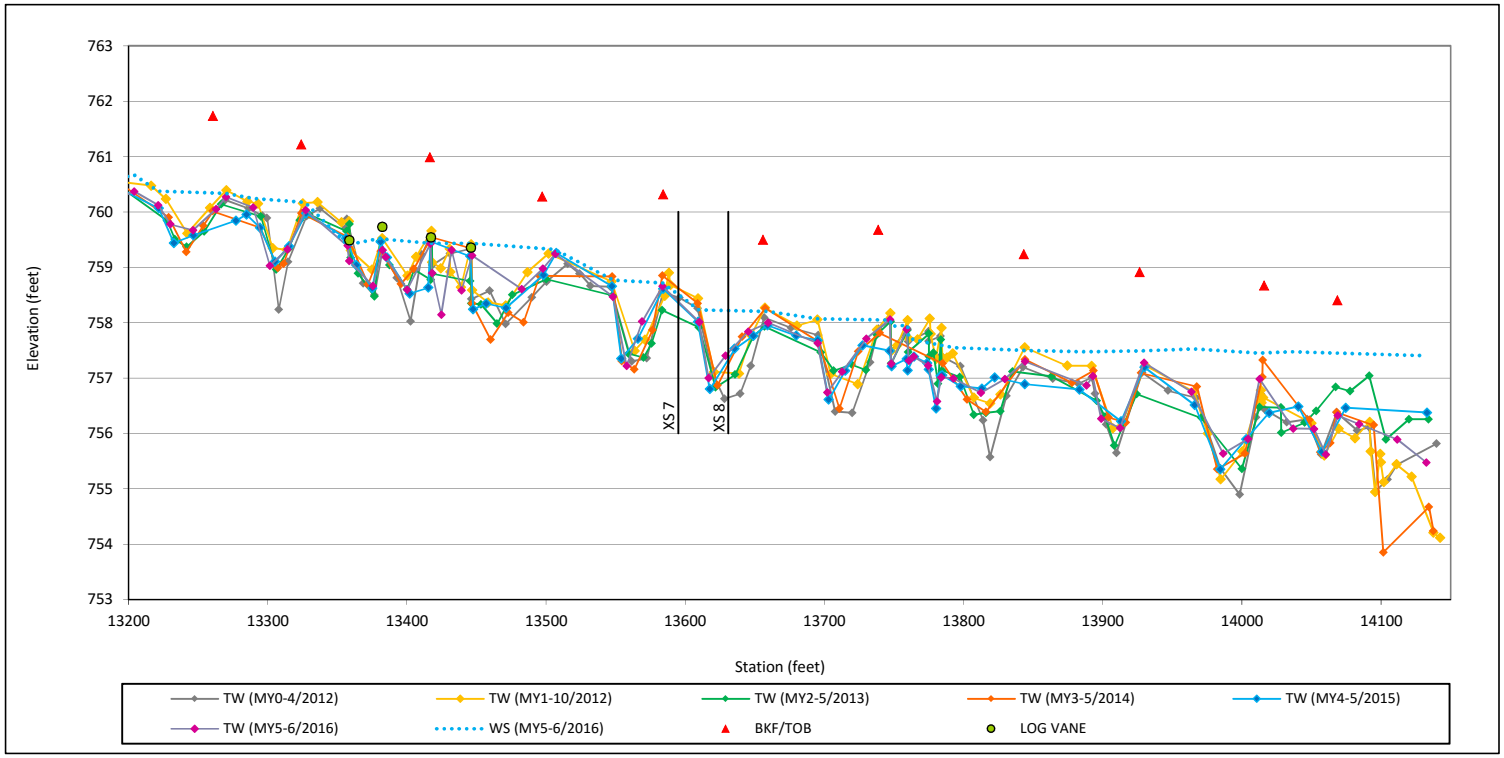
UT1 Reach 1 Lower



Longitudinal Profile Plots

Lyle Creek Mitigation Site
DMS Project No. 94643
Monitoring Year 5 - 2016

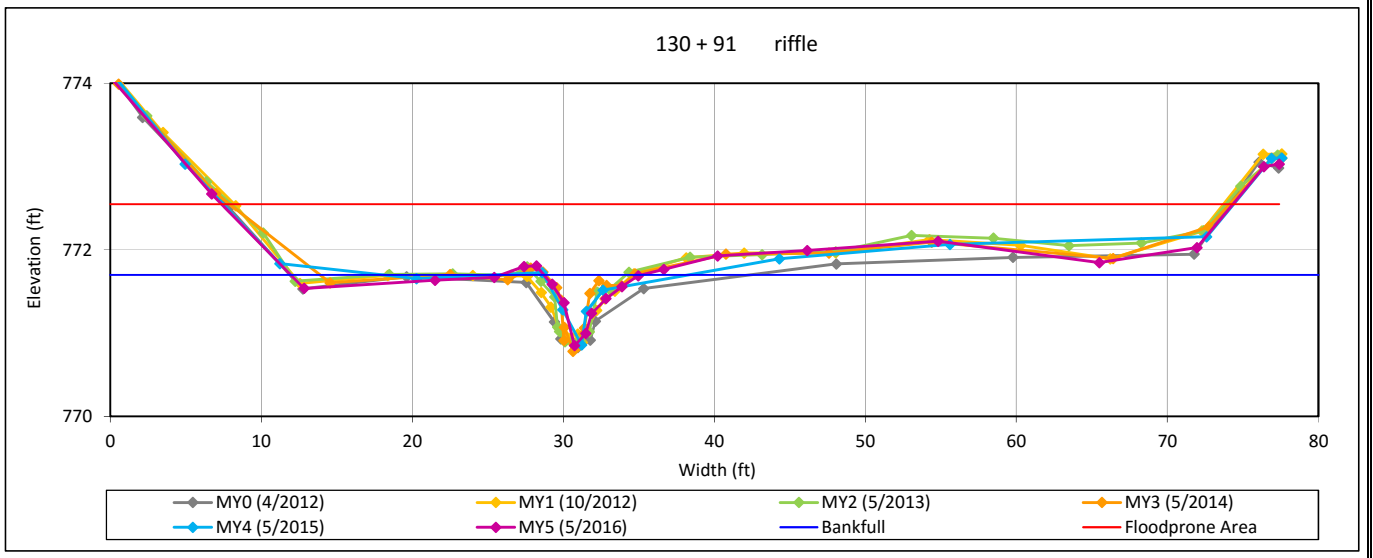
UT1 Reach 2



Cross-Section Plots

Lyle Creek Mitigation Site
DMS Project No. 94643
Monitoring Year 5 -2016

Cross Section 1 - UT1 Reach 1 Upper



Bankfull Dimensions	
2.1	x-section area (ft.sq.)
6.5	width (ft)
0.3	mean depth (ft)
0.9	max depth (ft)
6.8	wetted parimeter (ft)
0.3	hyd radi (ft)
20.1	width-depth ratio

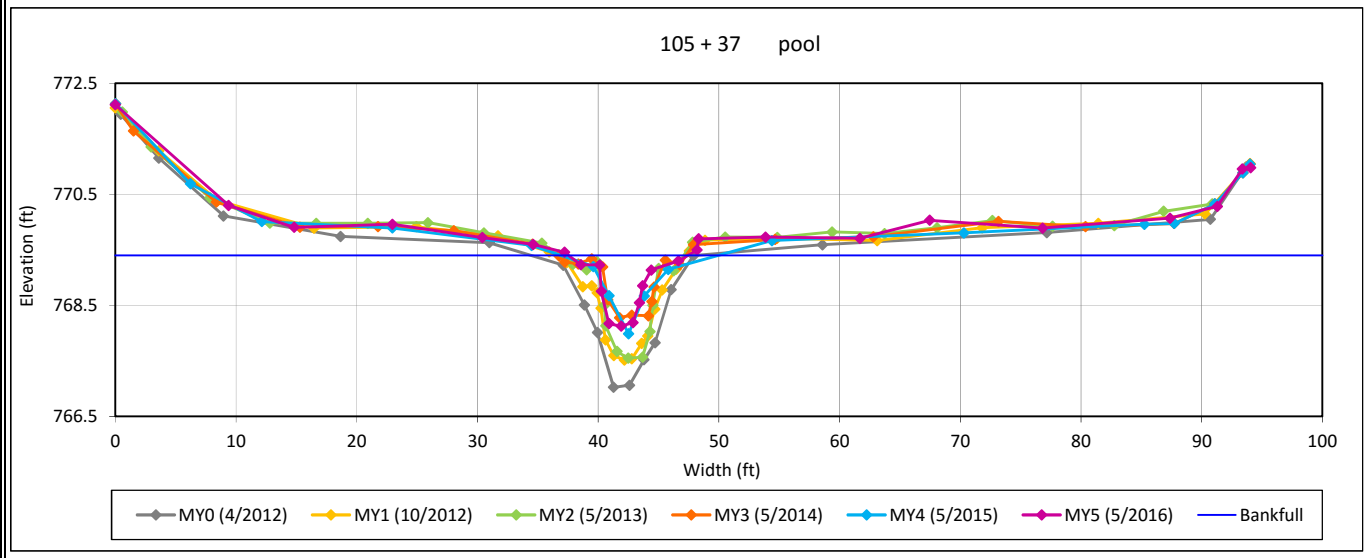
Survey Date: May-16
Field Crew: RD/AT

View Downstream (5/2016)

Cross-Section Plots

Lyle Creek Mitigation Site
DMS Project No. 94643
Monitoring Year 5 -2016

Cross Section 2 - UT1 Reach 1 Upper



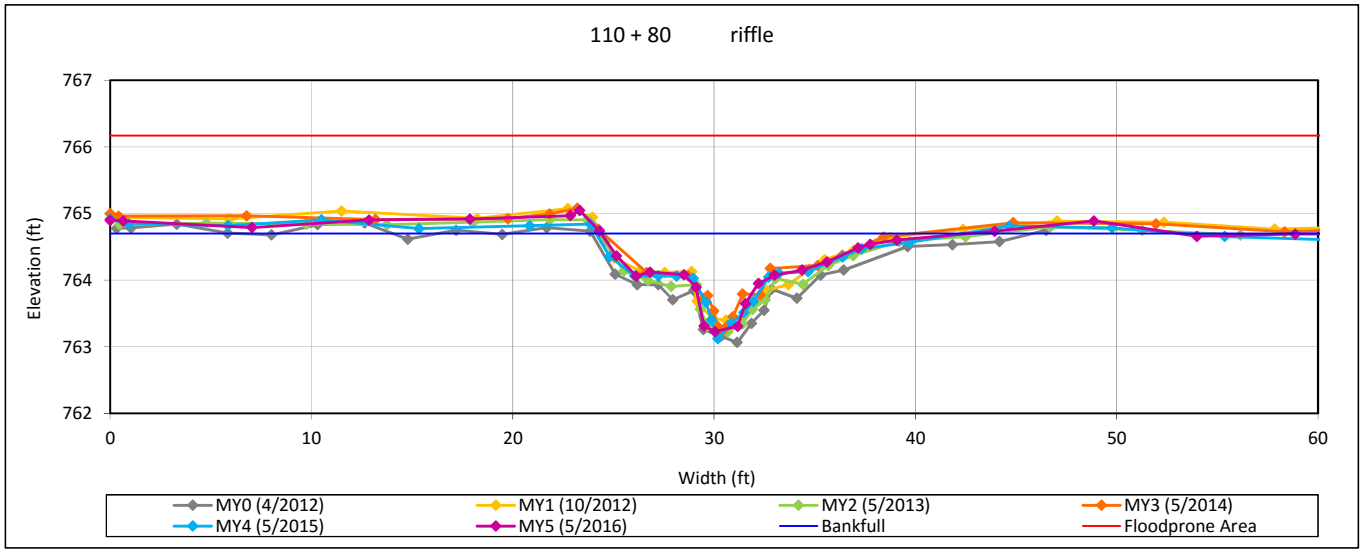
Bankfull Dimensions	
4.9	x-section area (ft.sq.)
9.9	width (ft)
0.5	mean depth (ft)
1.3	max depth (ft)
10.8	wetted parimeter (ft)
0.5	hyd radi (ft)
19.7	width-depth ratio

Survey Date: May-16
Field Crew: RD/AT

View Downstream (5/2016)

Cross-Section Plots
Lyle Creek Mitigation Site
DMS Project No. 94643
Monitoring Year 5 -2016

Cross Section 3 - UT1 Reach 1 Lower



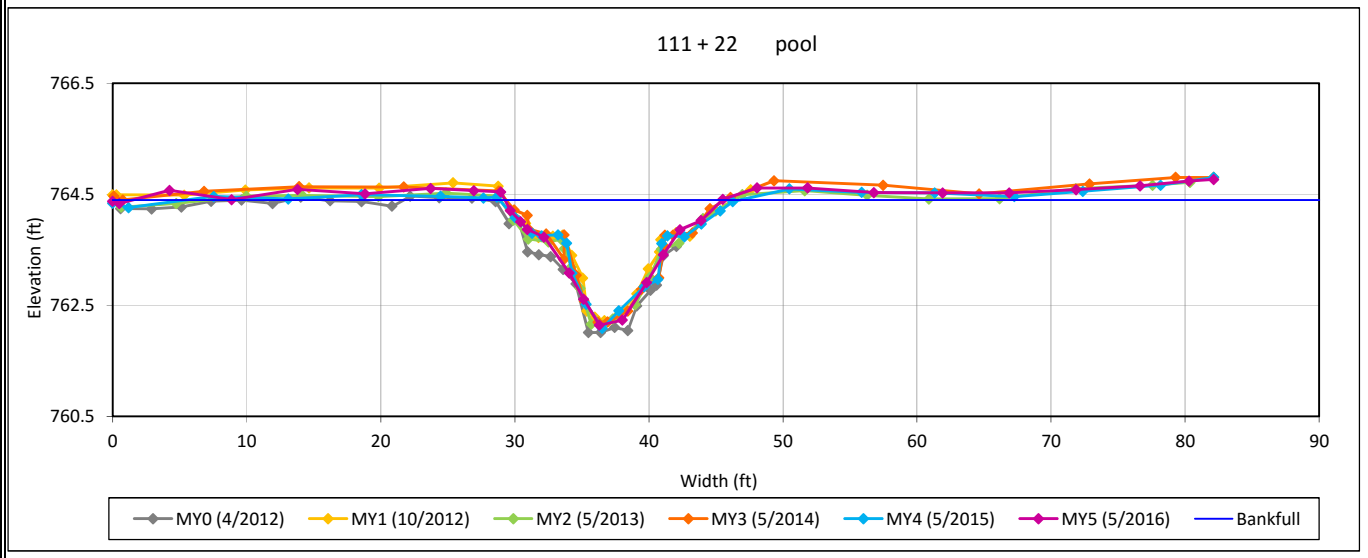
Bankfull Dimensions	
8.9	x-section area (ft.sq.)
13.4	width (ft)
0.7	mean depth (ft)
1.5	max depth (ft)
14.0	wetted parimeter (ft)
0.6	hyd radi (ft)
20.1	width-depth ratio

Survey Date: May-16
Field Crew: IE/RD

View Downstream (5/2016)

Cross-Section Plots
Lyle Creek Mitigation Site
DMS Project No. 94643
Monitoring Year 5 -2016

Cross Section 4 - UT1 Reach 1 Lower



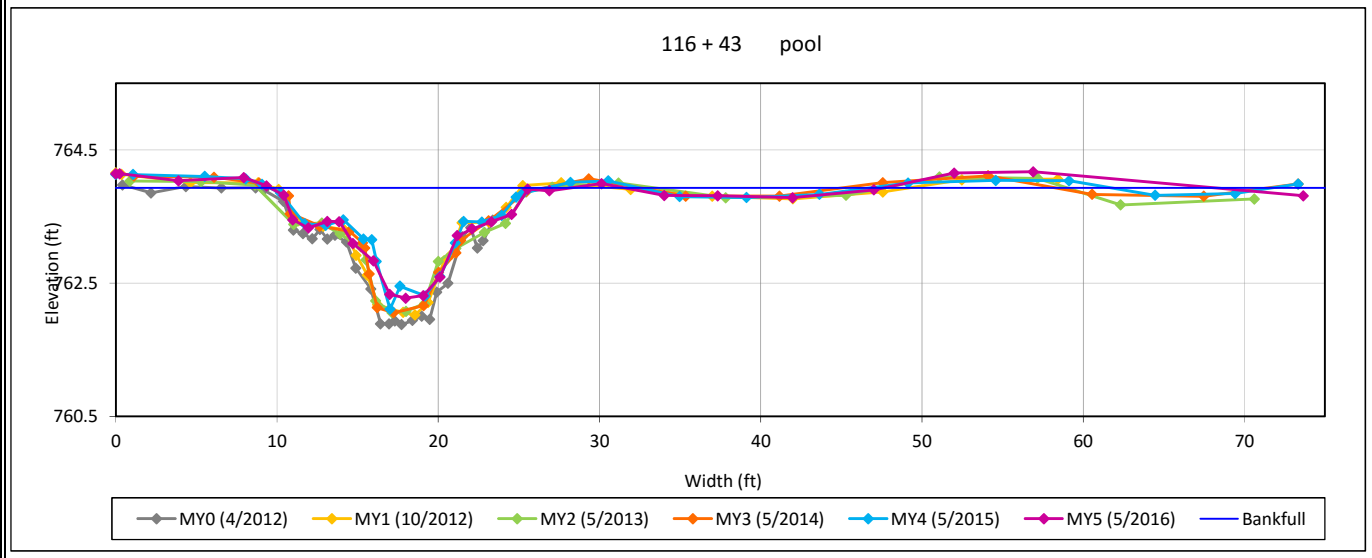
Bankfull Dimensions	
17.8	x-section area (ft.sq.)
16.2	width (ft)
1.1	mean depth (ft)
2.3	max depth (ft)
17.0	wetted parimeter (ft)
1.0	hyd radi (ft)
14.8	width-depth ratio

Survey Date: May-16
Field Crew: IE/RD

View Downstream (5/2016)

Cross-Section Plots
Lyle Creek Mitigation Site
DMS Project No. 94643
Monitoring Year 5 -2016

Cross Section 5 - UT1 Reach 1 Lower



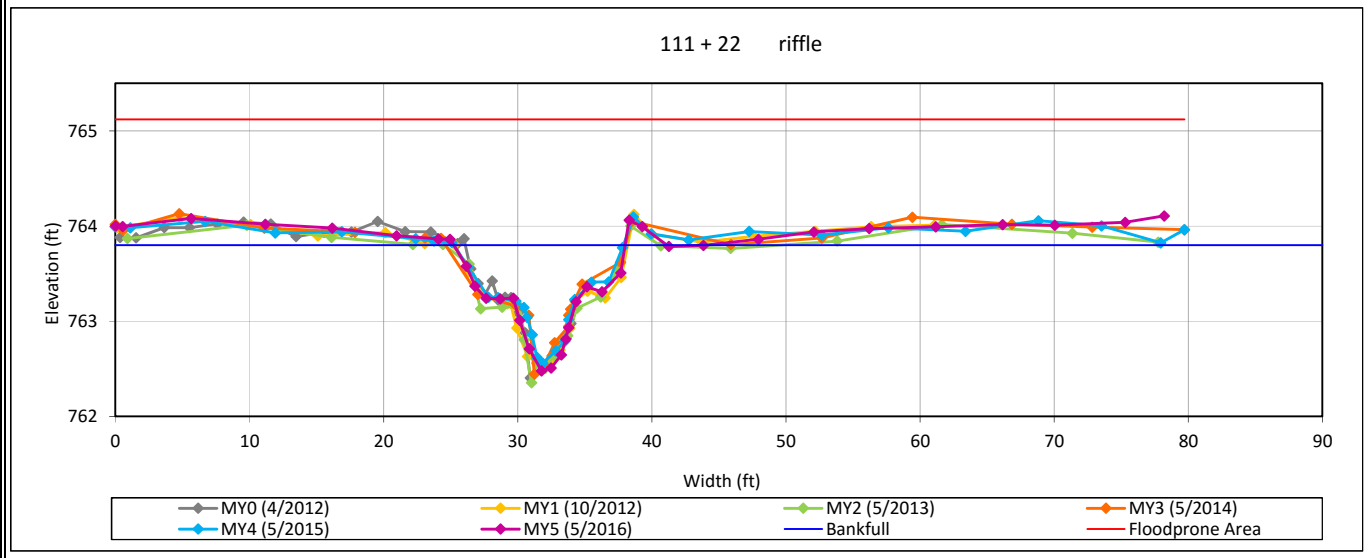
Bankfull Dimensions	
12.9	x-section area (ft.sq.)
15.1	width (ft)
0.9	mean depth (ft)
1.7	max depth (ft)
15.8	wetted parimeter (ft)
0.8	hyd radi (ft)
17.7	width-depth ratio

Survey Date: May-16
Field Crew: IE/RD

View Downstream (5/2016)

Cross-Section Plots
Lyle Creek Mitigation Site
DMS Project No. 94643
Monitoring Year 5 -2016

Cross Section 6 - UT1 Reach 1 Lower



Bankfull Dimensions	
8.3	x-section area (ft.sq.)
12.8	width (ft)
0.7	mean depth (ft)
1.3	max depth (ft)
13.3	wetted parimeter (ft)
0.6	hyd radi (ft)
19.7	width-depth ratio

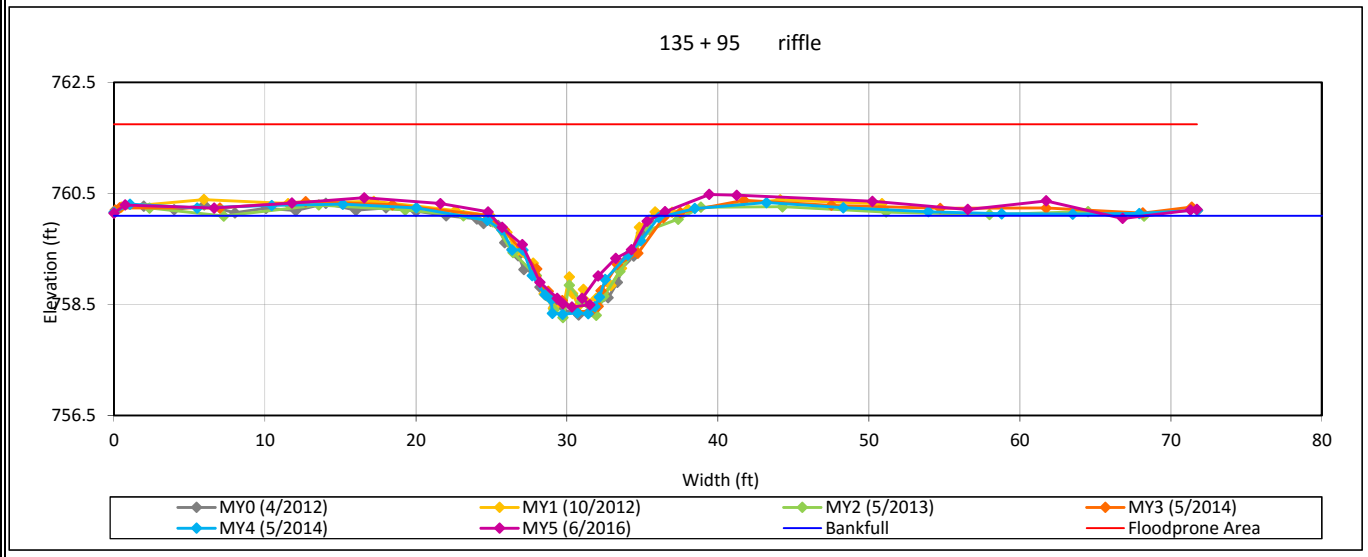
Survey Date: May-16
Field Crew: IE/RD

View Downstream (5/2016)

Cross-Section Plots

Lyle Creek Mitigation Site
DMS Project No. 94643
Monitoring Year 5 -2016

Cross Section 7 - UT1 Reach 2



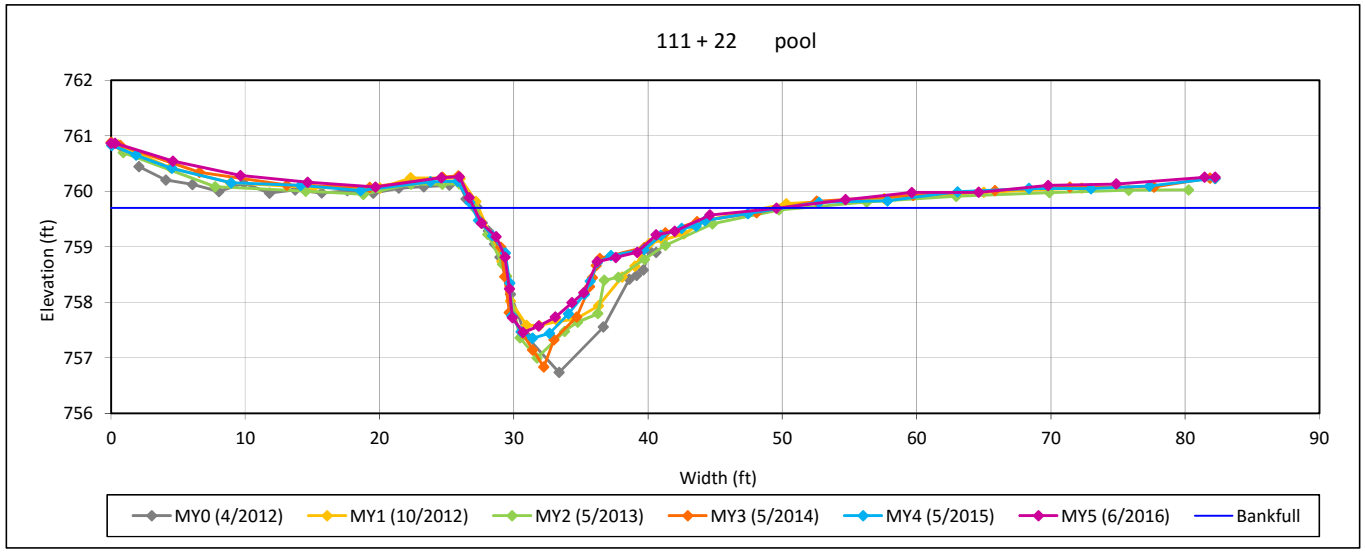
Bankfull Dimensions	
9.3	x-section area (ft.sq.)
11.0	width (ft)
0.9	mean depth (ft)
1.6	max depth (ft)
12.6	wetted parimeter (ft)
0.7	hyd radi (ft)
12.9	width-depth ratio

Survey Date: Jun-16
Field Crew: IE/RD

View Downstream (6/2016)

Cross-Section Plots
Lyle Creek Mitigation Site
DMS Project No. 94643
Monitoring Year 5 -2016

Cross Section 8 - UT1 Reach 2



Bankfull Dimensions	
18.6	x-section area (ft.sq.)
22.5	width (ft)
0.8	mean depth (ft)
2.2	max depth (ft)
23.7	wetted parimeter (ft)
0.8	hyd radi (ft)
27.2	width-depth ratio

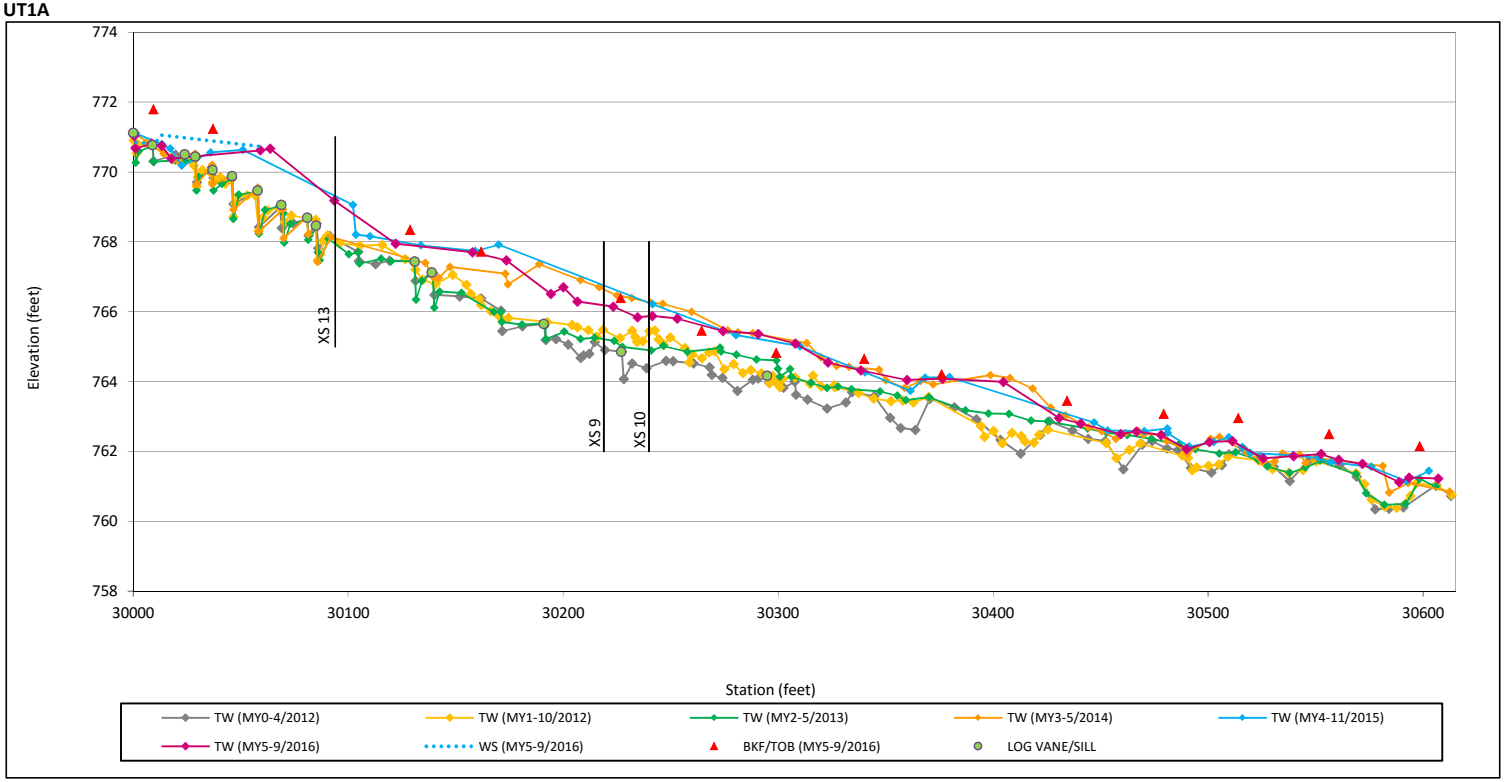
Survey Date: Jun-16
Field Crew: IE/RD

View Downstream (6/2016)

Longitudinal Profile Plots

Lyle Creek Mitigation Site
DMS Project No. 94643
Monitoring Year 5 - 2016

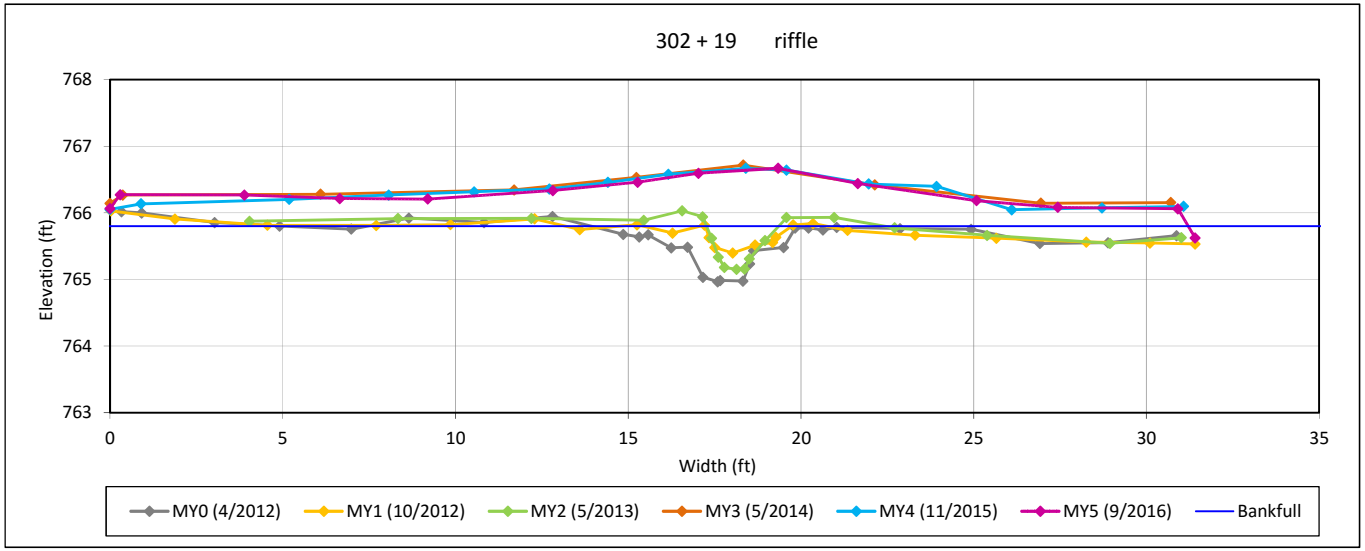
UT1A



Cross-Section Plots

Lyle Creek Mitigation Site
DMS Project No. 94643
Monitoring Year 5 - 2016

Cross Section 9 - UT1A



Bankfull Dimensions	
0.0	x-section area (ft.sq.)
0.0	width (ft)
0.0	mean depth (ft)
0.0	max depth (ft)
0.0	wetted parimeter (ft)
0.0	hyd radi (ft)
0.0	width-depth ratio

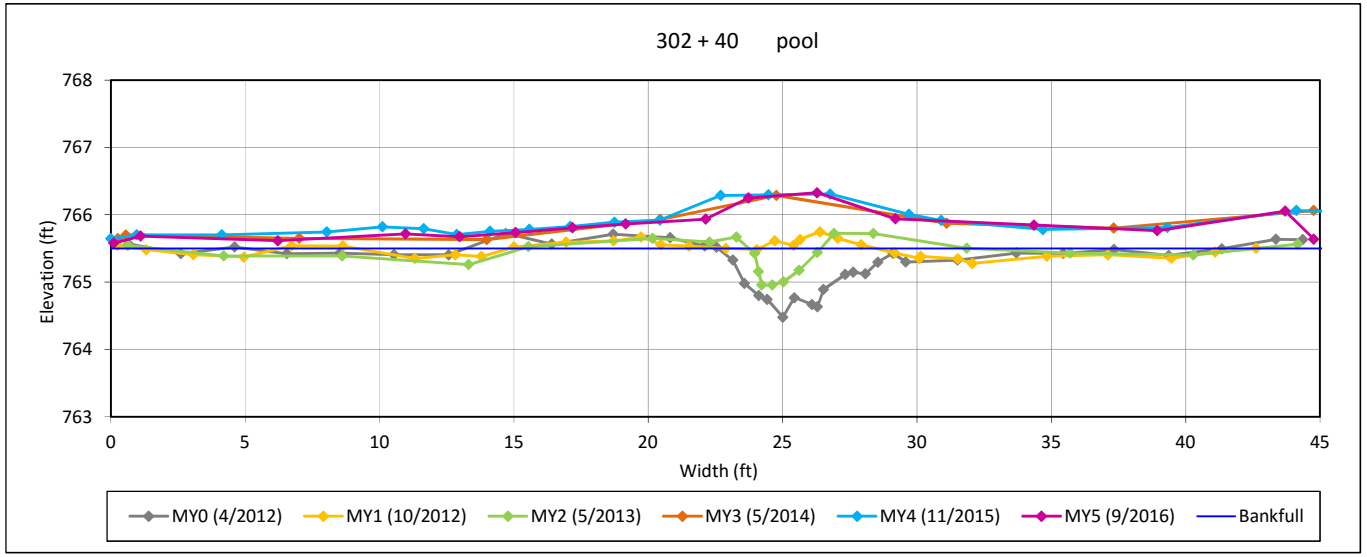
Survey Date: Sep-16
Field Crew: IE/JM

View Downstream (9/2016)

Cross-Section Plots

Lyle Creek Mitigation Site
DMS Project No. 94643
Monitoring Year 5 - 2016

Cross Section 10 - UT1A



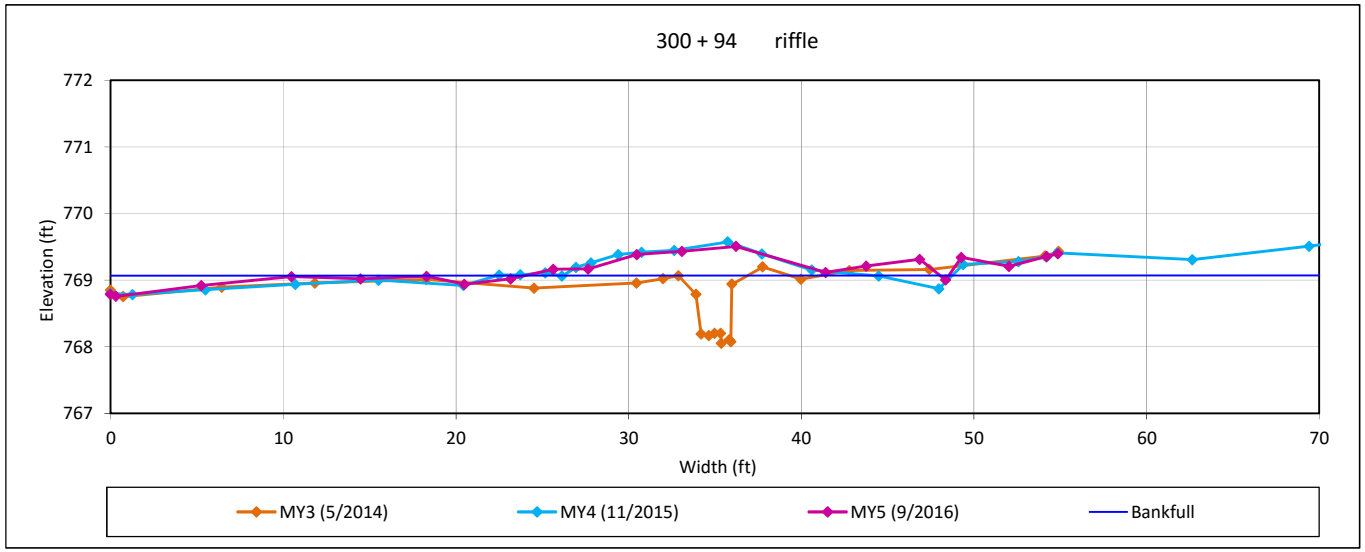
Bankfull Dimensions	
0.0	x-section area (ft.sq.)
0.0	width (ft)
0.0	mean depth (ft)
0.0	max depth (ft)
0.0	wetted parimeter (ft)
0.0	hyd radi (ft)
0.0	width-depth ratio

Survey Date: Sep-16
Field Crew: IE/JM

View Downstream (9/2016)

Cross-Section Plots
Lyle Creek Mitigation Site
DMS Project No. 94643
Monitoring Year 5 - 2016

Cross Section 13 - UT1A



Bankfull Dimensions	
0.0	x-section area (ft.sq.)
0.0	width (ft)
0.0	mean depth (ft)
0.0	max depth (ft)
0.0	wetted parimeter (ft)
0.0	hyd radi (ft)
0.0	width-depth ratio

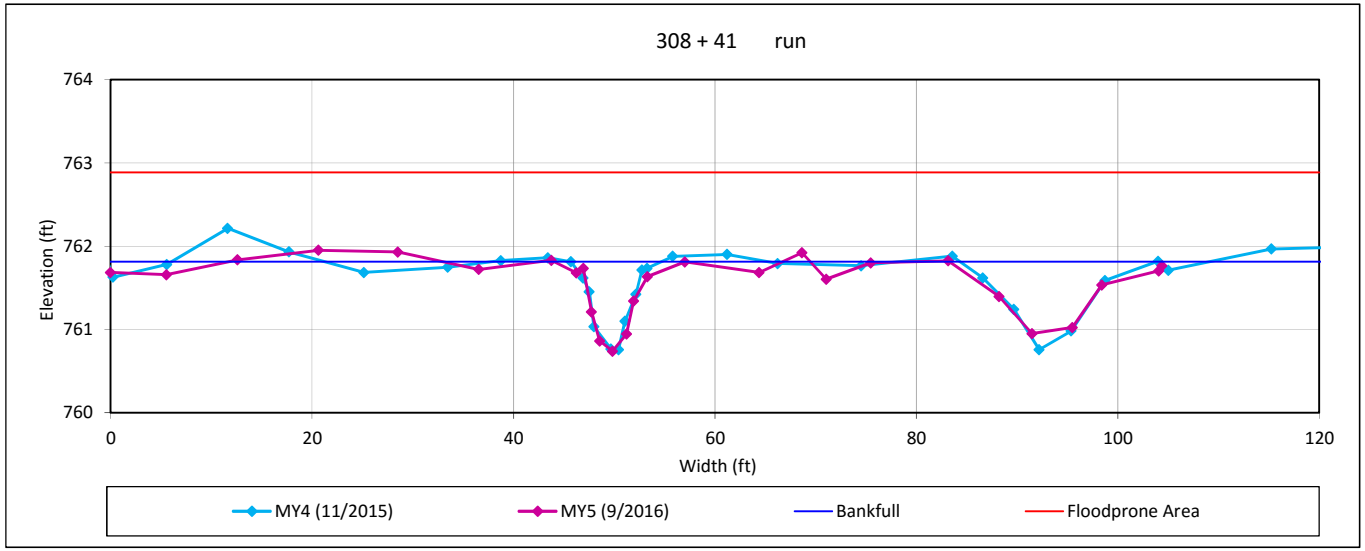
Survey Date: Sep-16
Field Crew: IE/JM

View Downstream (9/2016)

Cross-Section Plots

Lyle Creek Mitigation Site
DMS Project No. 94643
Monitoring Year 5 - 2016

Cross Section 14 - UT1A



Bankfull Dimensions	
4.5	x-section area (ft.sq.)
7.0	width (ft)
0.6	mean depth (ft)
1.1	max depth (ft)
7.4	wetted parimeter (ft)
0.6	hyd radi (ft)
11.0	width-depth ratio

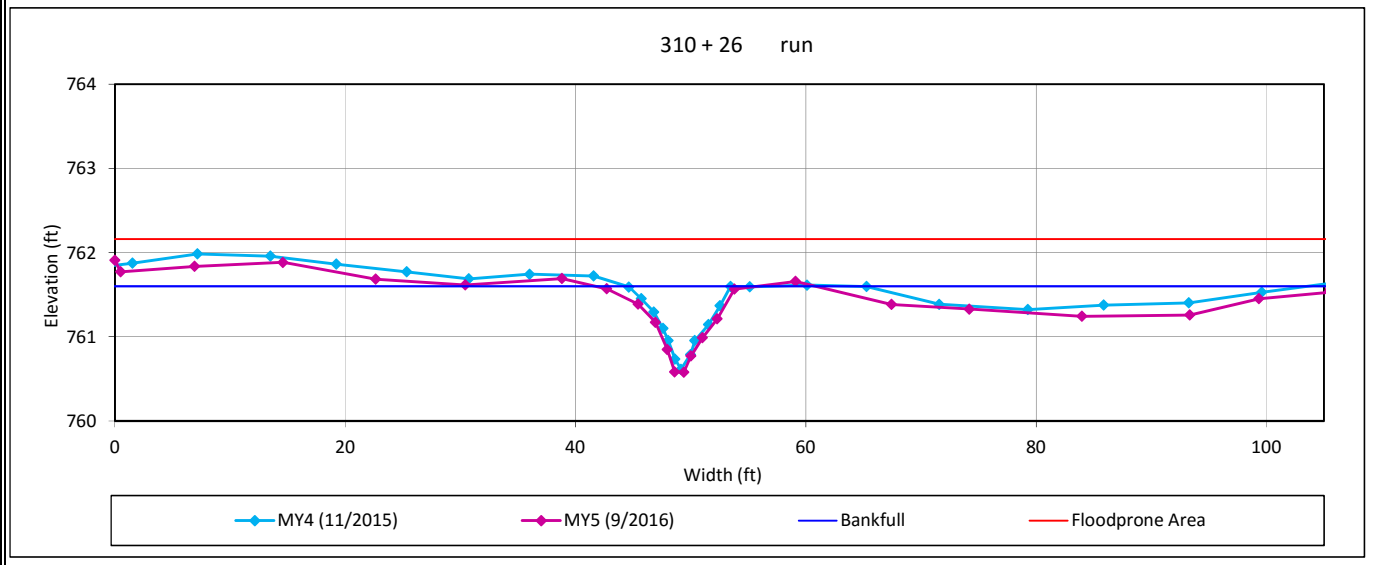
Survey Date: Sep-16
Field Crew: IE/JM

View Downstream (9/2016)

Cross-Section Plots

Lyle Creek Mitigation Site
DMS Project No. 94643
Monitoring Year 5 - 2016

Cross Section 15 - UT1A



Bankfull Dimensions	
2.9	x-section area (ft.sq.)
7.4	width (ft)
0.4	mean depth (ft)
0.8	max depth (ft)
7.6	wetted parimeter (ft)
0.4	hyd radi (ft)
19.2	width-depth ratio

Survey Date: Sep-16
Field Crew: IE/JM

View Downstream (9/2016)

Longitudinal Profile Plots

Lyle Creek Mitigation Site

DMS Project No. 94643

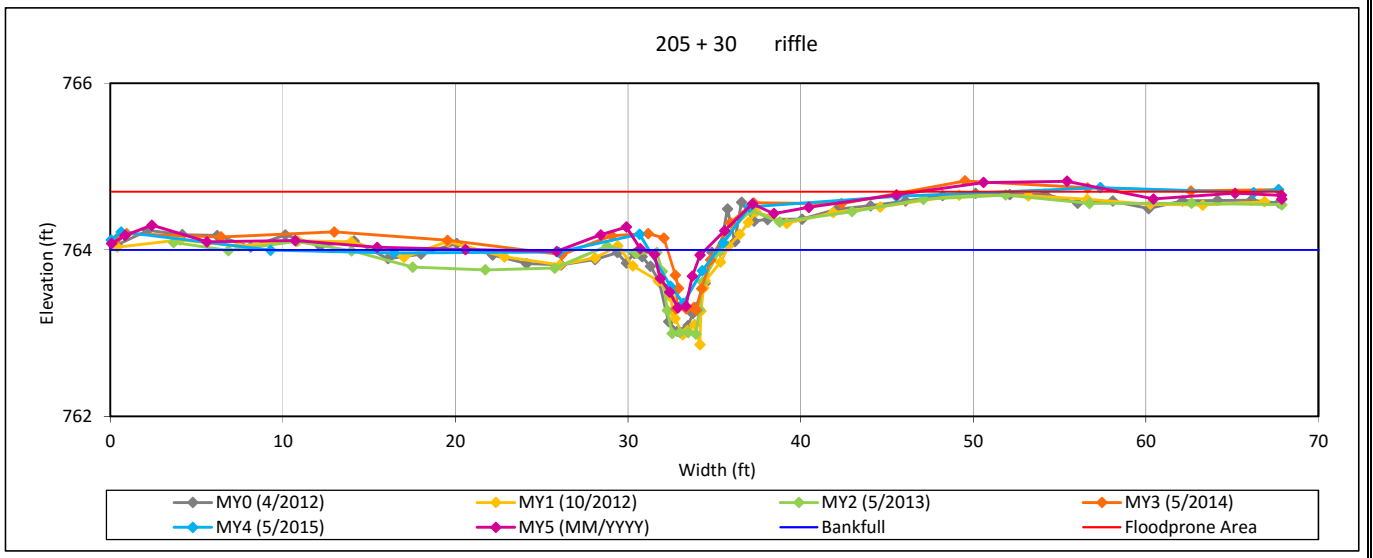
Monitoring Year 5 - 2016

UT1B

Cross-Section Plots

Lyle Creek Mitigation Site
DMS Project No. 94643
Monitoring Year 5 - 2016

Cross Section 11 - UT1B



Bankfull Dimensions	
1.2	x-section area (ft.sq.)
3.6	width (ft)
0.3	mean depth (ft)
0.7	max depth (ft)
4.0	wetted parimeter (ft)
0.3	hyd radi (ft)
10.7	width-depth ratio

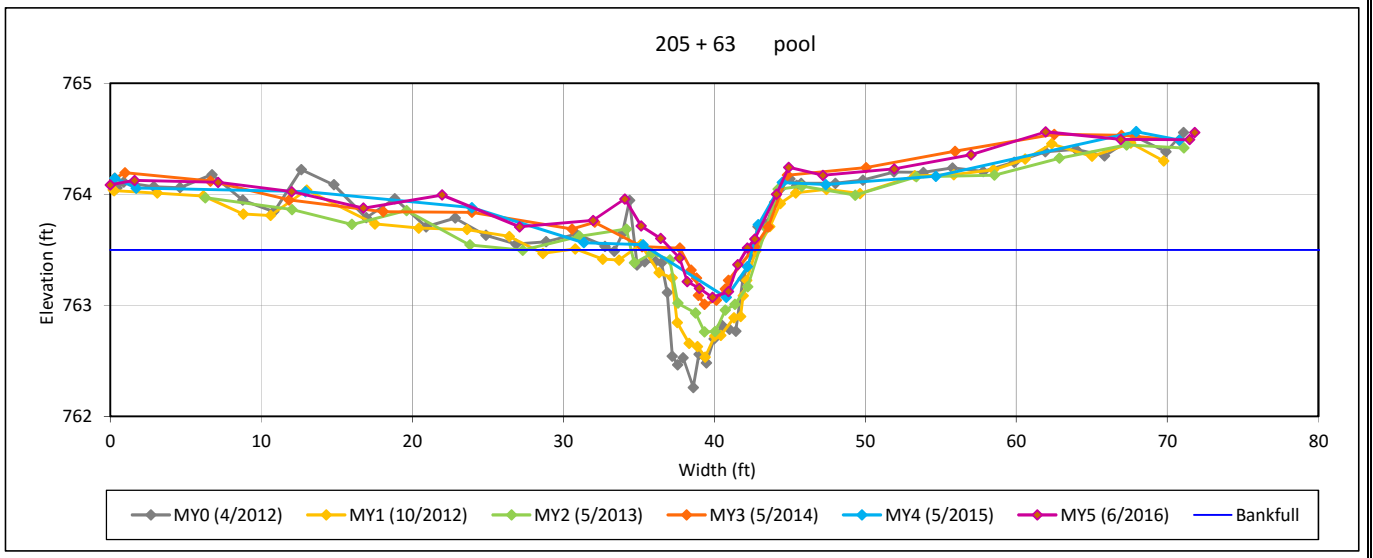
Survey Date: Jun-16
Field Crew: IE/TM

View Downstream (6/2016)

Cross-Section Plots

Lyle Creek Mitigation Site DMS
Project No. 94643
Monitoring Year 5 - 2016

Cross Section 12 - UT1B



Bankfull Dimensions	
1.3	x-section area (ft.sq.)
4.9	width (ft)
0.3	mean depth (ft)
0.4	max depth (ft)
5.1	wetted parimeter (ft)
0.3	hyd radi (ft)
18.5	width-depth ratio

Survey Date: Jun-16
Field Crew: IE/TM

View Downstream (6/2016)

APPENDIX 5. Hydrology Summary Data and Plots

Table 13. Verification of Bankfull Events

Lyle Creek Mitigation Site
DMS Project No. 94643
Monitoring Year 5 - 2016

UT1, UT1A, and UT1B

Reach	Date of Data Collection	Date of Occurrence	MY of Occurrence	Method
UT1	5/11/2012	U	1	Crest Gage
	10/31/2013	U	2	Crest Gage
	6/17/2016	U	5	Crest Gage
UT1A	7/10/2012	U	1	Crest Gage
	3/7/2013	U	2	Crest Gage
	6/30/2014	5/15/2014	3	Crest Gage
UT1B	7/10/2012	U	1	Crest Gage
	3/7/2013	U	2	Crest Gage
	6/30/2014	5/15/2014	3	Crest Gage
	11/4/2015	U	4	Crest Gage

Table 14. Wetland Gage Attainment Summary

Lyle Creek Mitigation Site
DMS Project No. 94643
Monitoring Year 5 - 2016

Wetlands RW1 and RW2

Summary of Groundwater Gage Results for Years 1 through 5					
Gage	Success Criteria Achieved/Max Consecutive Days During Growing Season (%)				
	Year 1 (2012)	Year 2 (2013)	Year 3 (2014)	Year 4 (2015)	Year 5 (2016)
1	No/5 Days (2.5%)	Yes/49 Days (24.0%)	Yes/47 Days (23.0%)	Yes/59 Days (25.4%)	Yes/42 Days (18.1%)
2	No/0 Days (0.0%)	Yes/93 Days (46.0%)	Yes/113.5 Days (56.0%)	Yes/99.5 Days (42.9%)	Yes/108 Days (46.6%)
3	Yes/29 Days (14.0%)	Yes/49 Days (24.0%)	Yes/52.5 Days 26.0%)	Yes/101.5 Days (43.8%)	Yes/84 Days (36.2%)
4	Yes/27 Days (13.0%)	Yes/54.5 Days (27.0%)	Yes/47 Days (23.0%)	Yes/65.5 Days (28.2%)	Yes/48 Days (20.7%)
5	No/11 Days (5.0%)	Yes/41.5 Days (20.3%)	Yes/52.5 Days (26.0%)	Yes/75.5 Days (32.5%)	Yes/233 Days (100.0%)
6	No/5 Days (2.5%)	Yes/16 Days (7.8%)	No/10 Days (5.0%)	Yes/35.5 Days (15.3%)	No/9 Days (3.9%)
7	Yes/22 Days (11.0%)	Yes/179 Days (88.0%)	Yes/49.5 Days (25.0%)	Yes/79.5 Days (34.3%)	Yes/43 Days (18.5%)
8	No/12 Days (6.0%)	Yes/53 Days (26.0%)	Yes/44.5 Days (22.0%)	Yes/63 Days (27.2%)	Yes/42 Days (18.1%)
9	N/A	N/A	N/A	Yes/17 Days (7.3%)	No/9 Days (3.9%)
10	N/A	Yes/180 Days (88.0%)	Yes/45.5 Days (23.0%)	Yes/85 Days (36.6%)	Yes/45 Days (19.4%)
11	N/A	Yes/80 Days (39.0%)	Yes/50.5 Days (25.0%)	Yes/73.5 Days (31.7%)	Yes/84 Days (36.2%)

N/A: Gages 10 and 11 were installed during MY2. Gage 9 was installed during MY4.

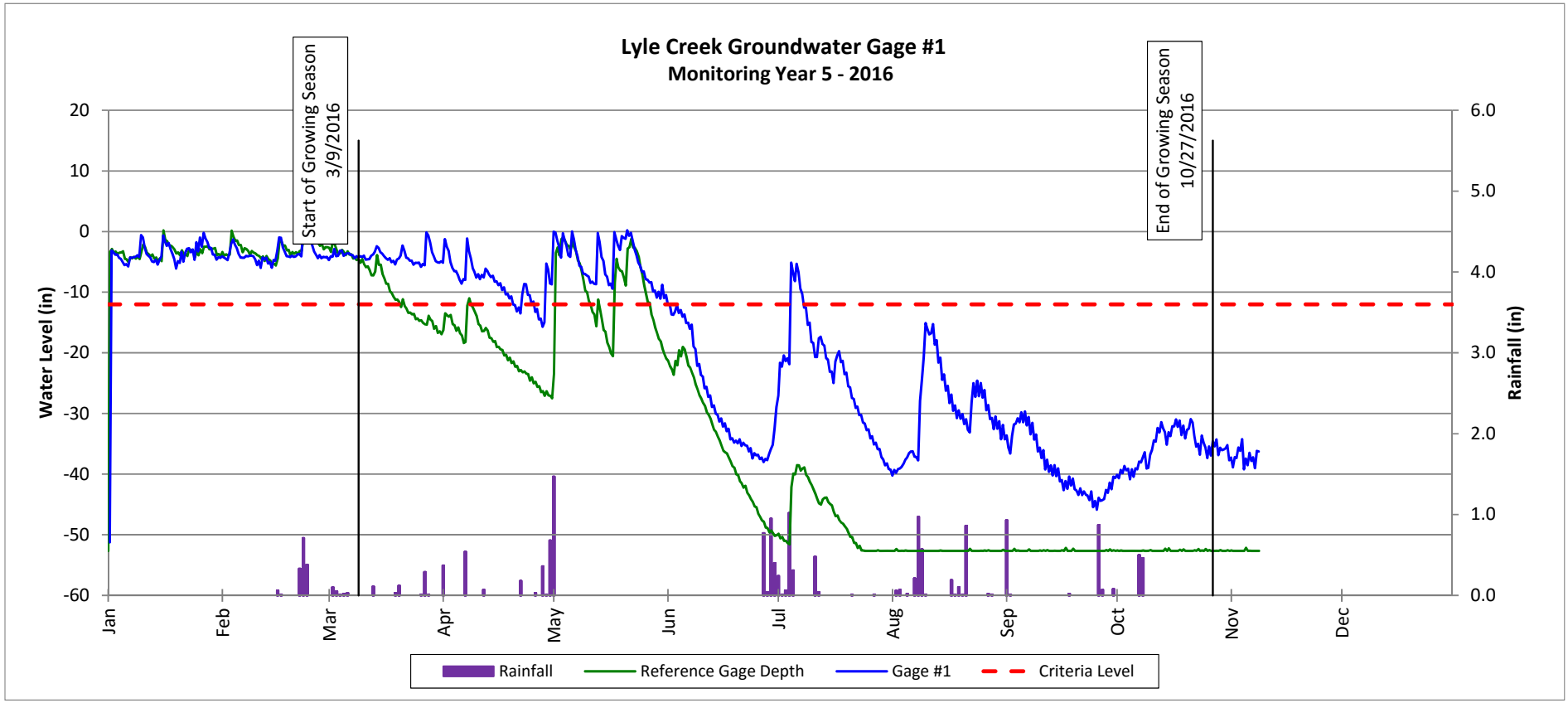
Groundwater Gage Plots

Lyle Creek Mitigation Site

DMS Project No. 94643

Monitoring Year 5 - 2016

Wetland RW1



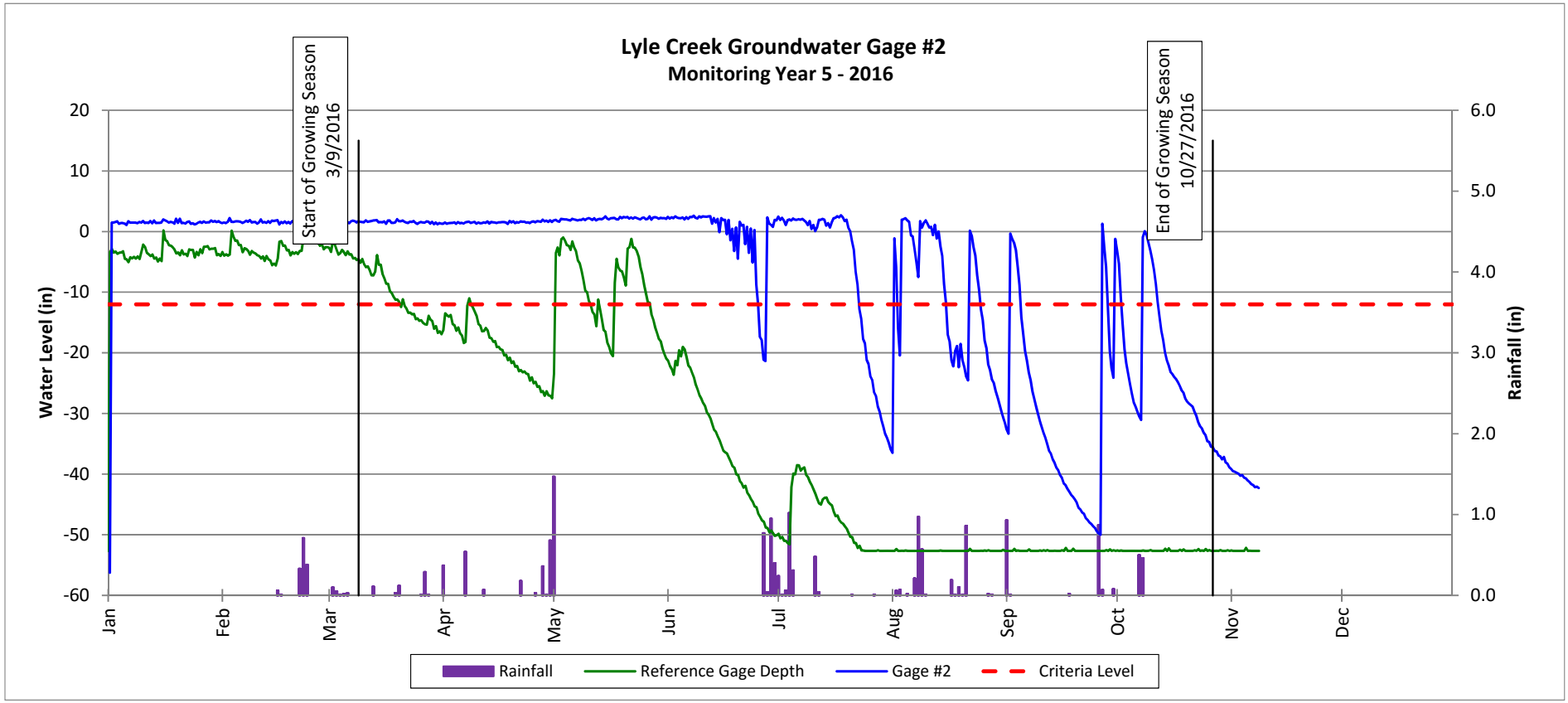
Groundwater Gage Plots

Lyle Creek Mitigation Site

DMS Project No. 94643

Monitoring Year 5 - 2016

Wetland RW1



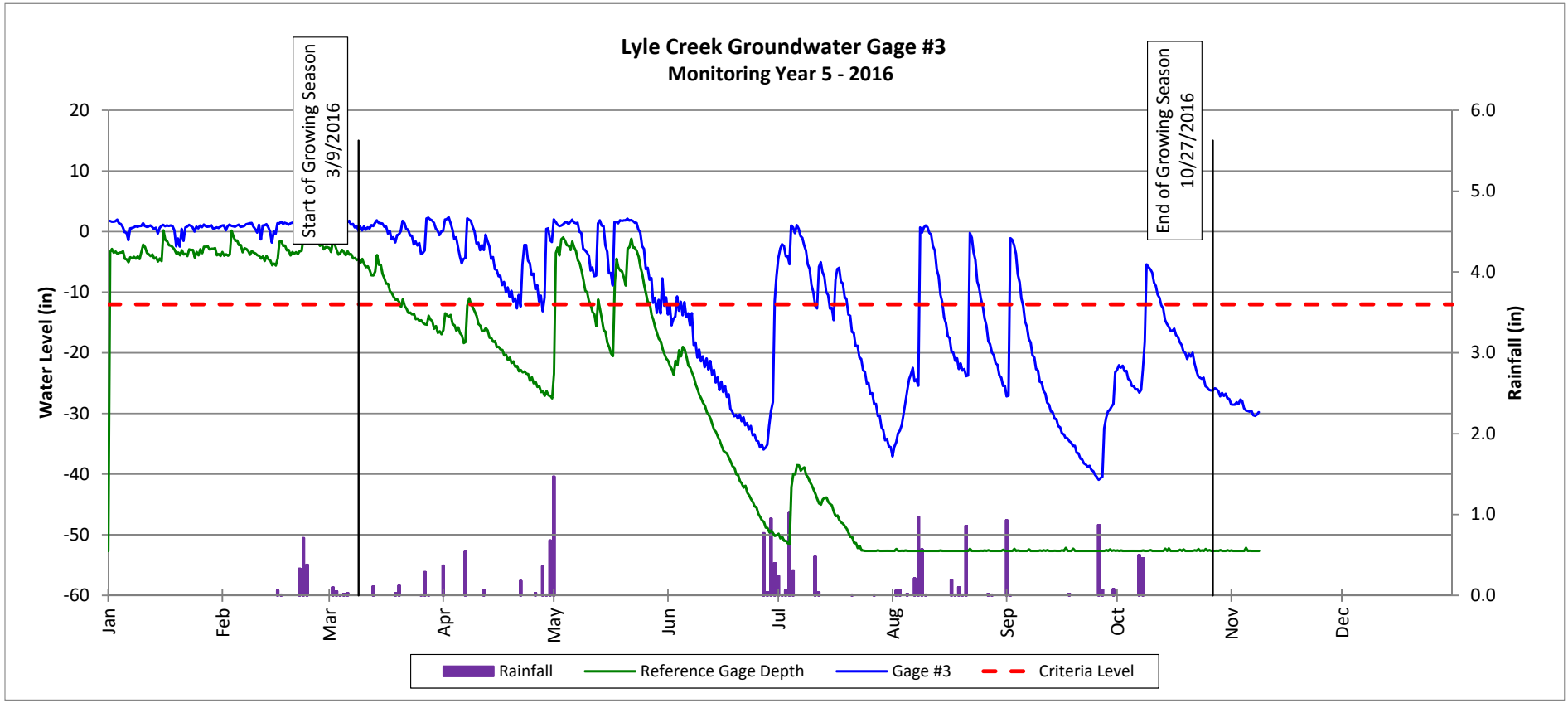
Groundwater Gage Plots

Lyle Creek Mitigation Site

DMS Project No. 94643

Monitoring Year 5 - 2016

Wetland RW1



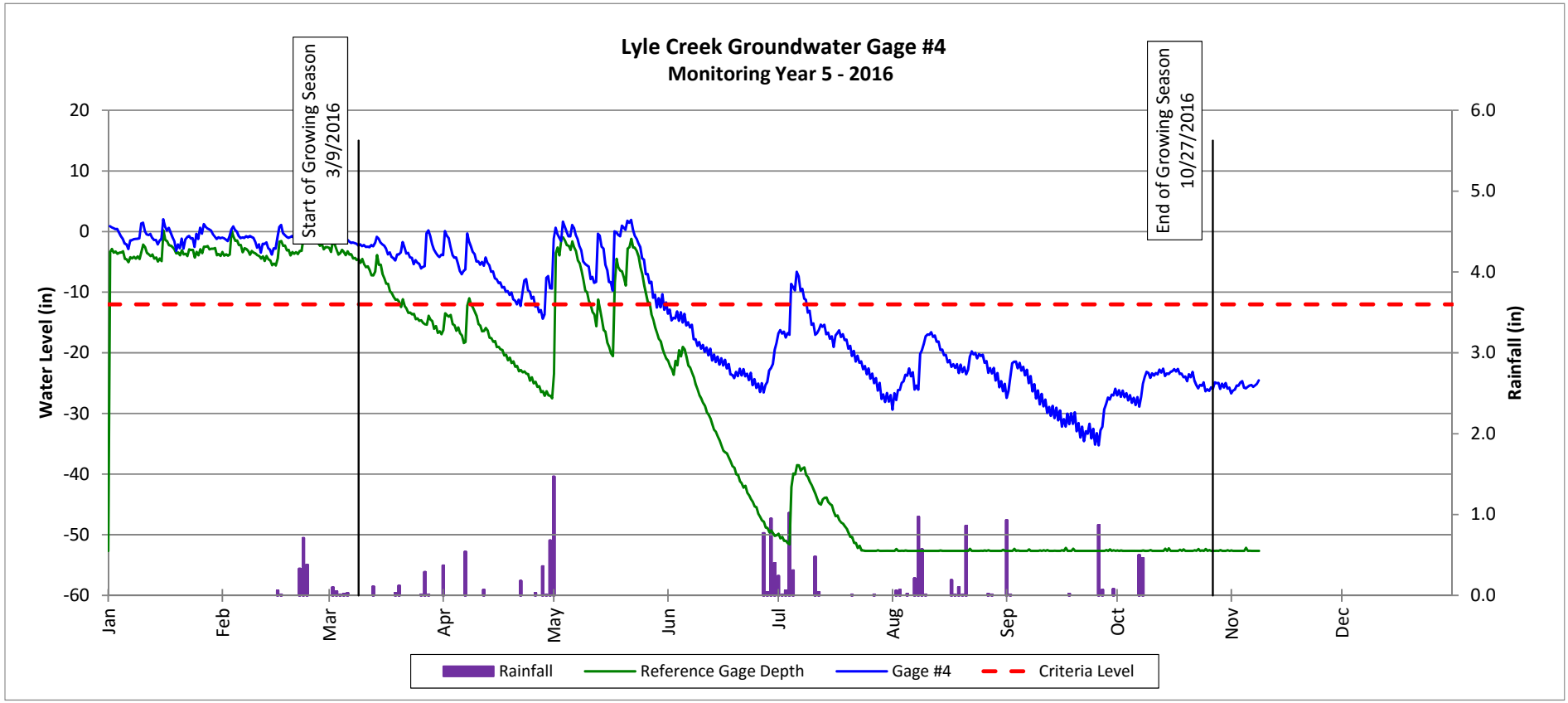
Groundwater Gage Plots

Lyle Creek Mitigation Site

DMS Project No. 94643

Monitoring Year 5 - 2016

Wetland RW1



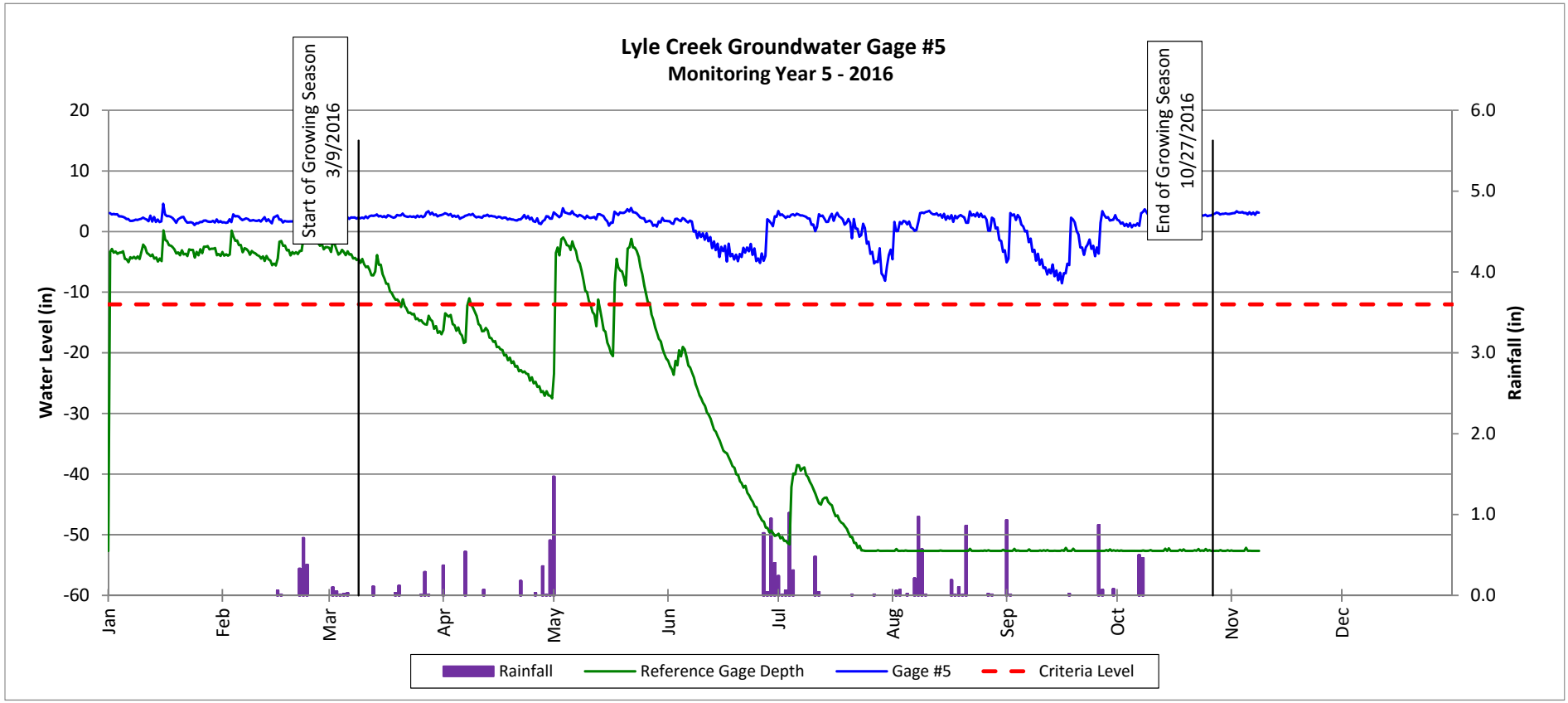
Groundwater Gage Plots

Lyle Creek Mitigation Site

DMS Project No. 94643

Monitoring Year 5 - 2016

Wetland RW1



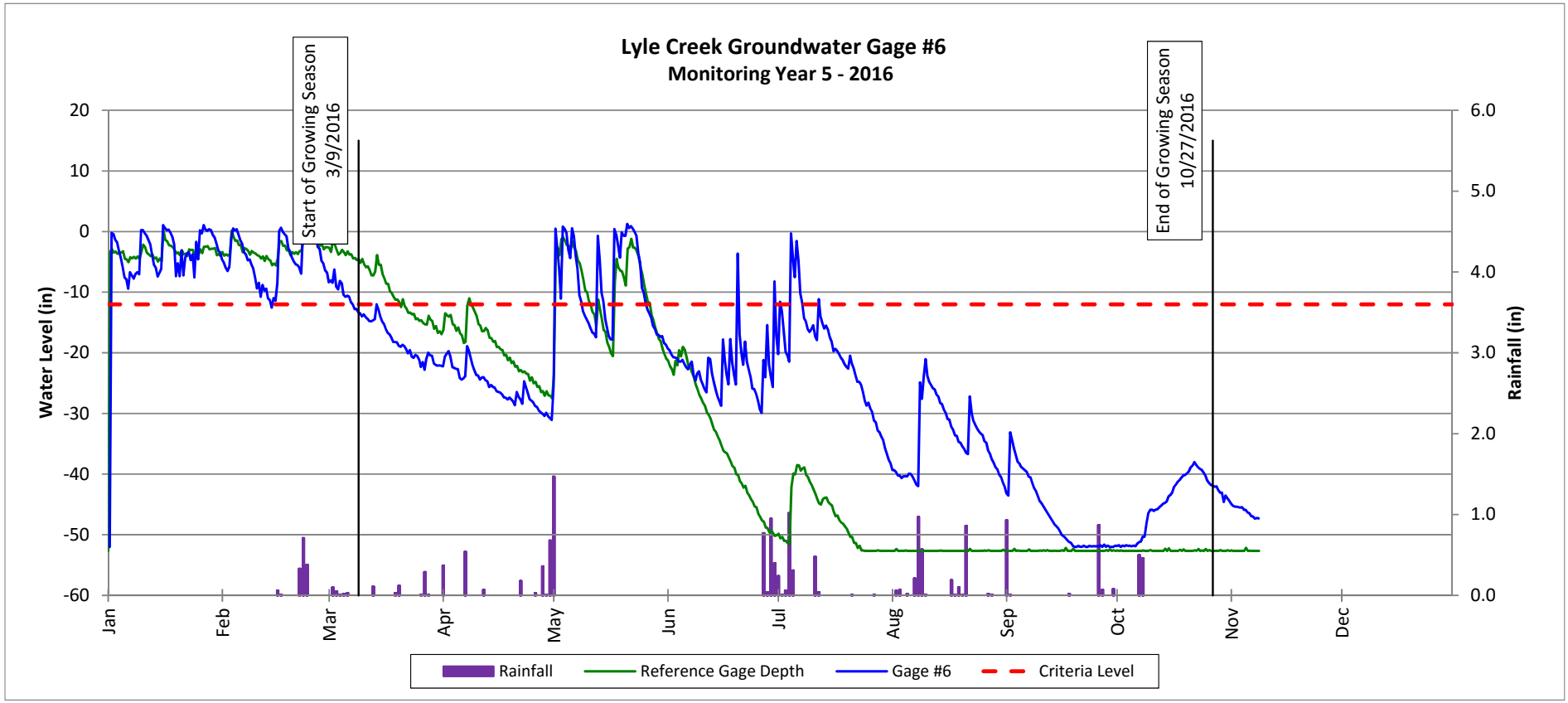
Groundwater Gage Plots

Lyle Creek Mitigation Site

DMS Project No. 94643

Monitoring Year 5 - 2016

Wetland RW2



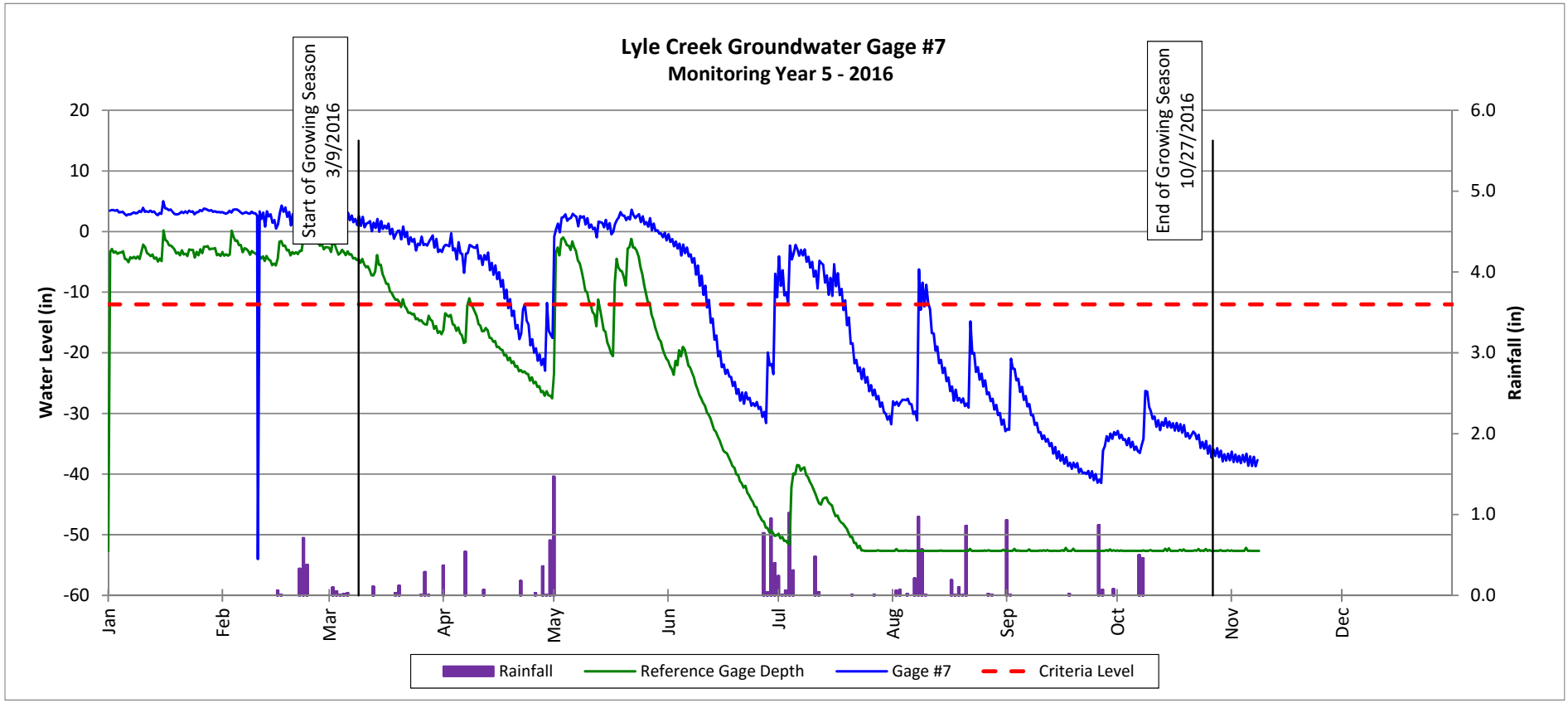
Groundwater Gage Plots

Lyle Creek Mitigation Site

DMS Project No. 94643

Monitoring Year 5 - 2016

Wetland RW2



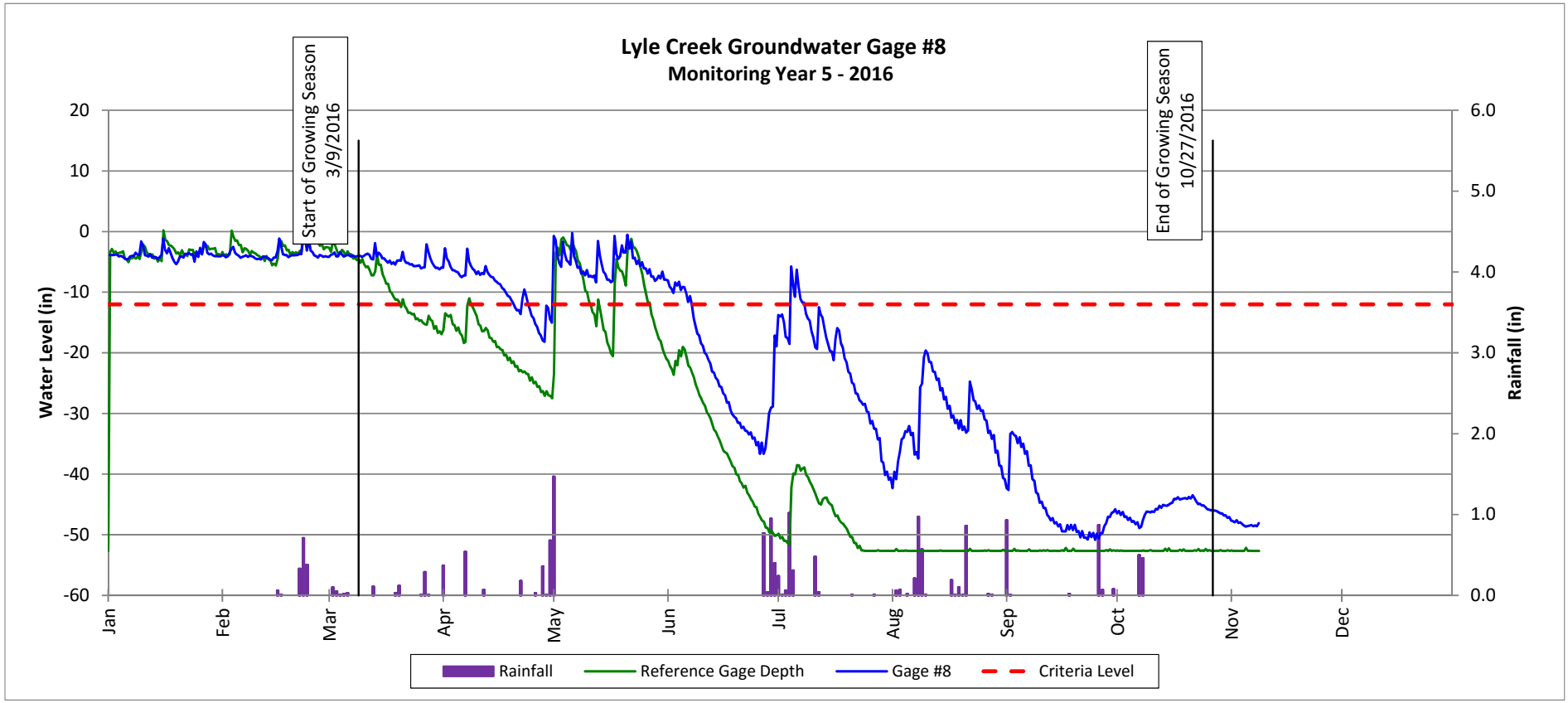
Groundwater Gage Plots

Lyle Creek Mitigation Site

DMS Project No. 94643

Monitoring Year 5 - 2016

Wetland RW2



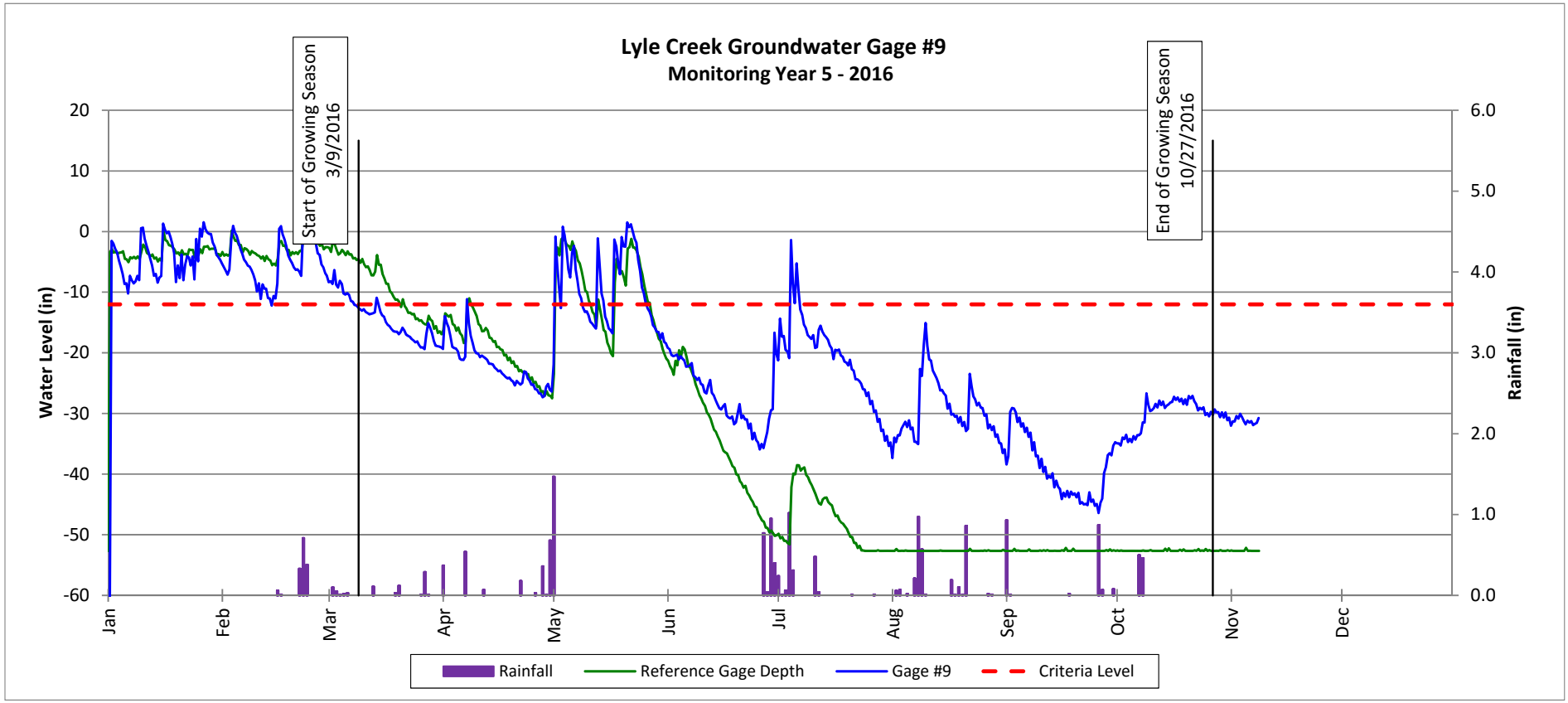
Groundwater Gage Plots

Lyle Creek Mitigation Site

DMS Project No. 94643

Monitoring Year 5 - 2016

Wetland RW1



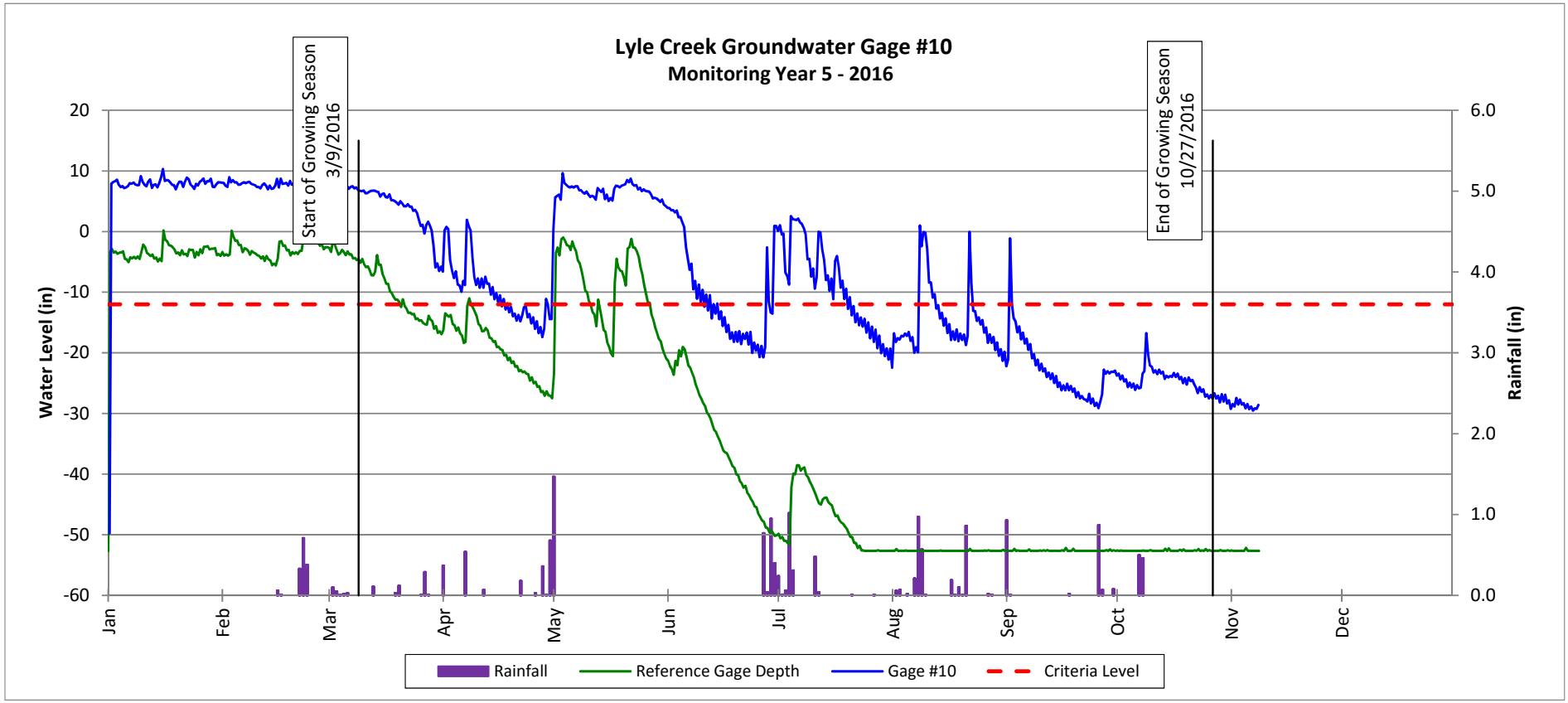
Groundwater Gage Plots

Lyle Creek Mitigation Site

DMS Project No. 94643

Monitoring Year 5 - 2016

Wetland RW2



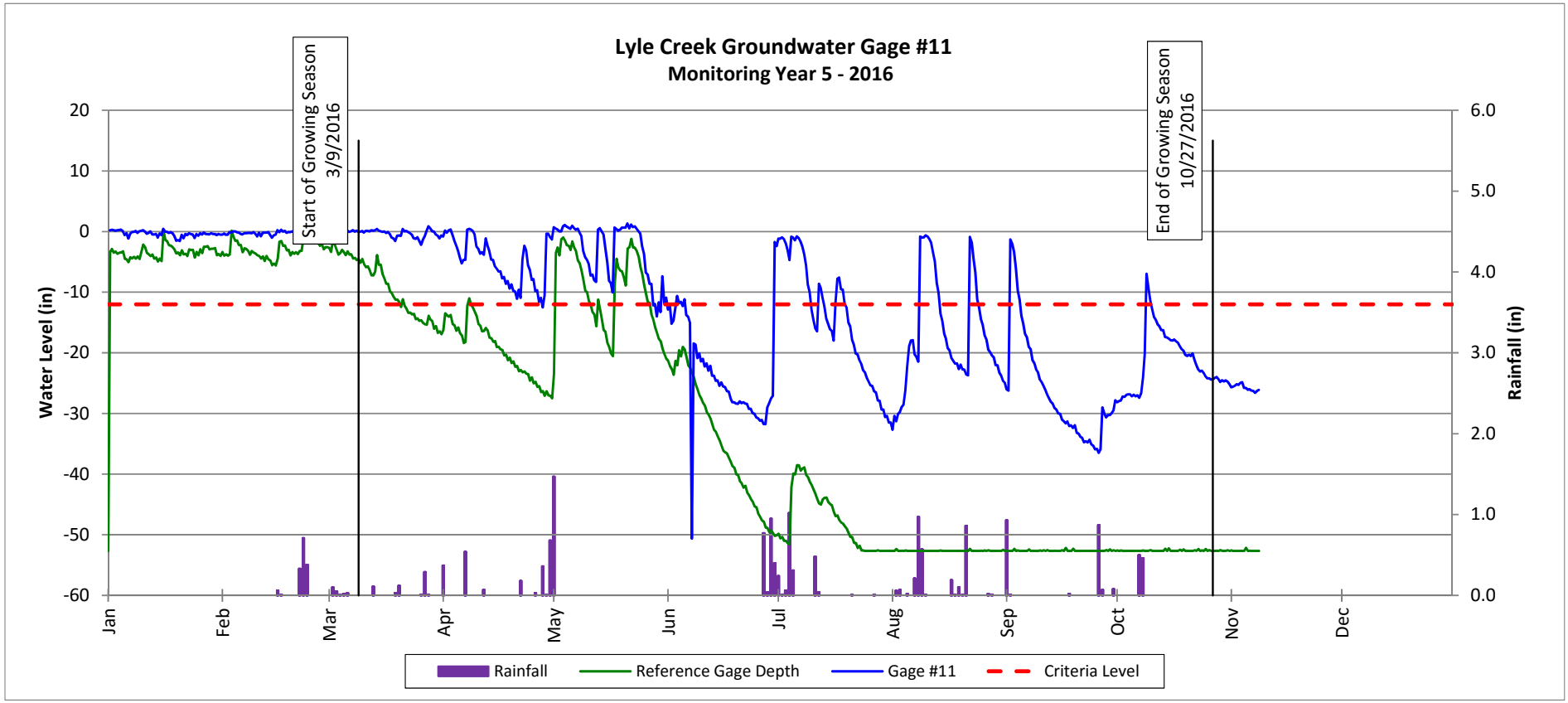
Groundwater Gage Plots

Lyle Creek Mitigation Site

DMS Project No. 94643

Monitoring Year 5 - 2016

Wetland RW1

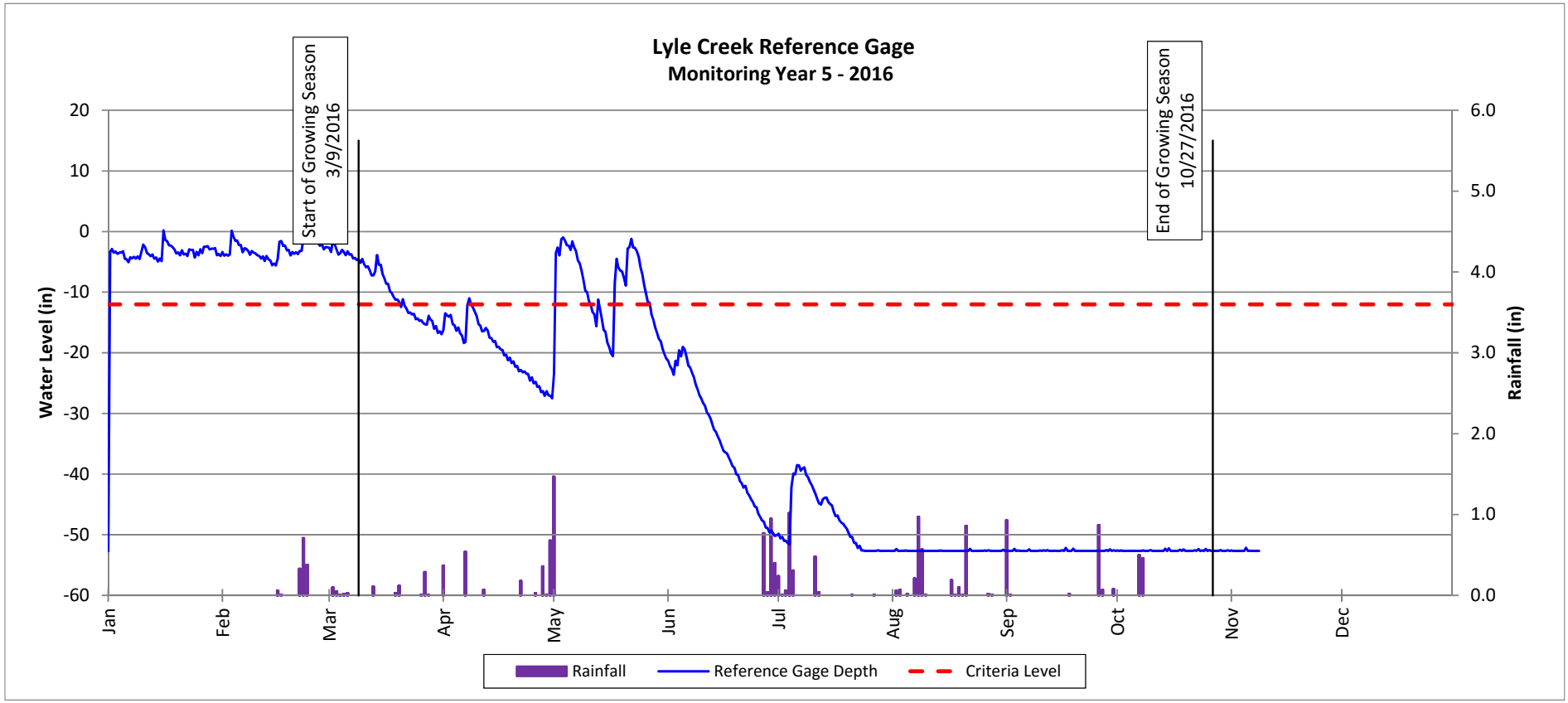


Groundwater Gage Plots

Lyle Creek Mitigation Site

DMS Project No. 94643

Monitoring Year 5 - 2016

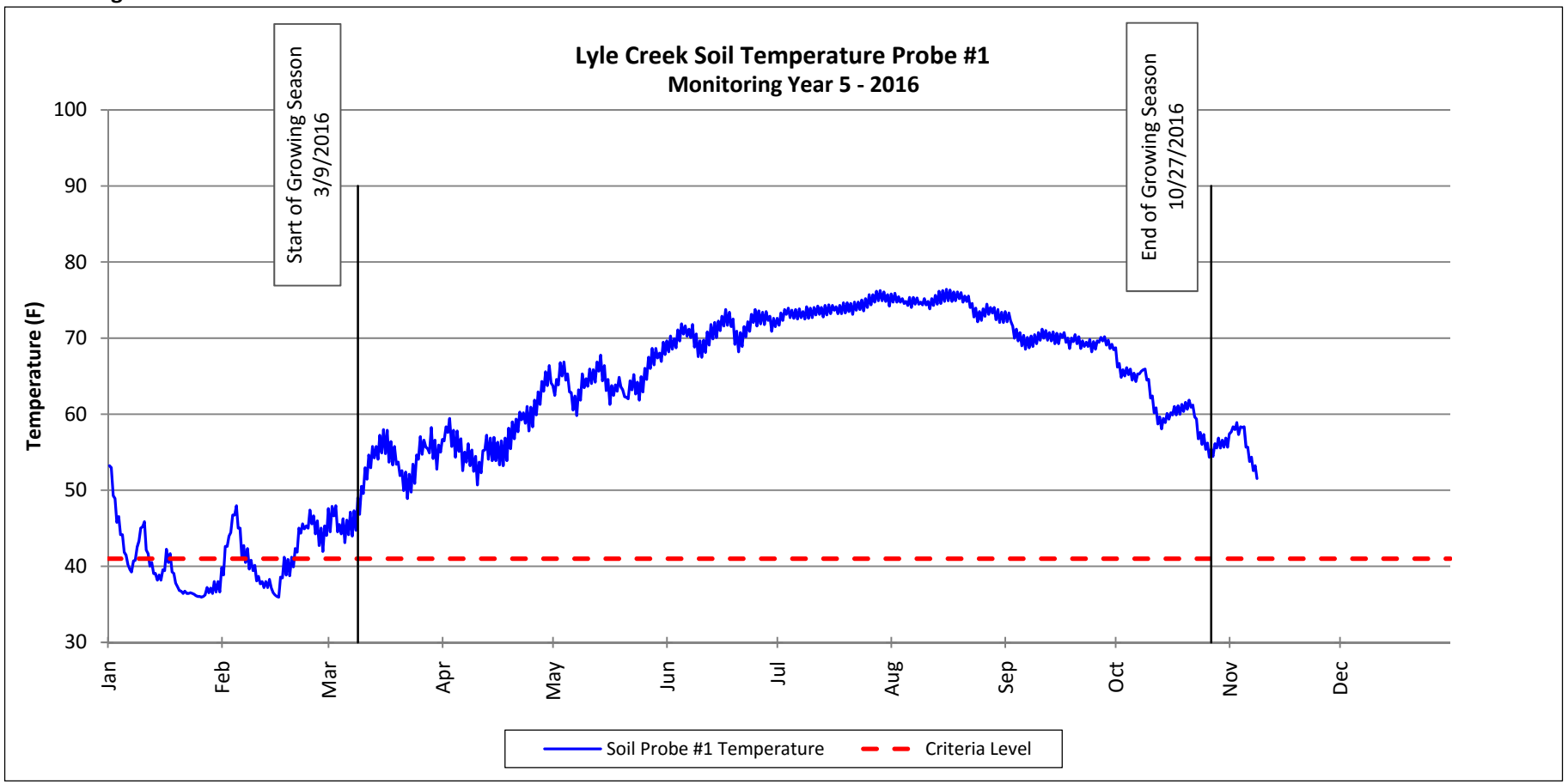


Soil Temperature Probe Plots

Lyle Creek Mitigation Site

DMS Project No. 94643

Monitoring Year 5 - 2016

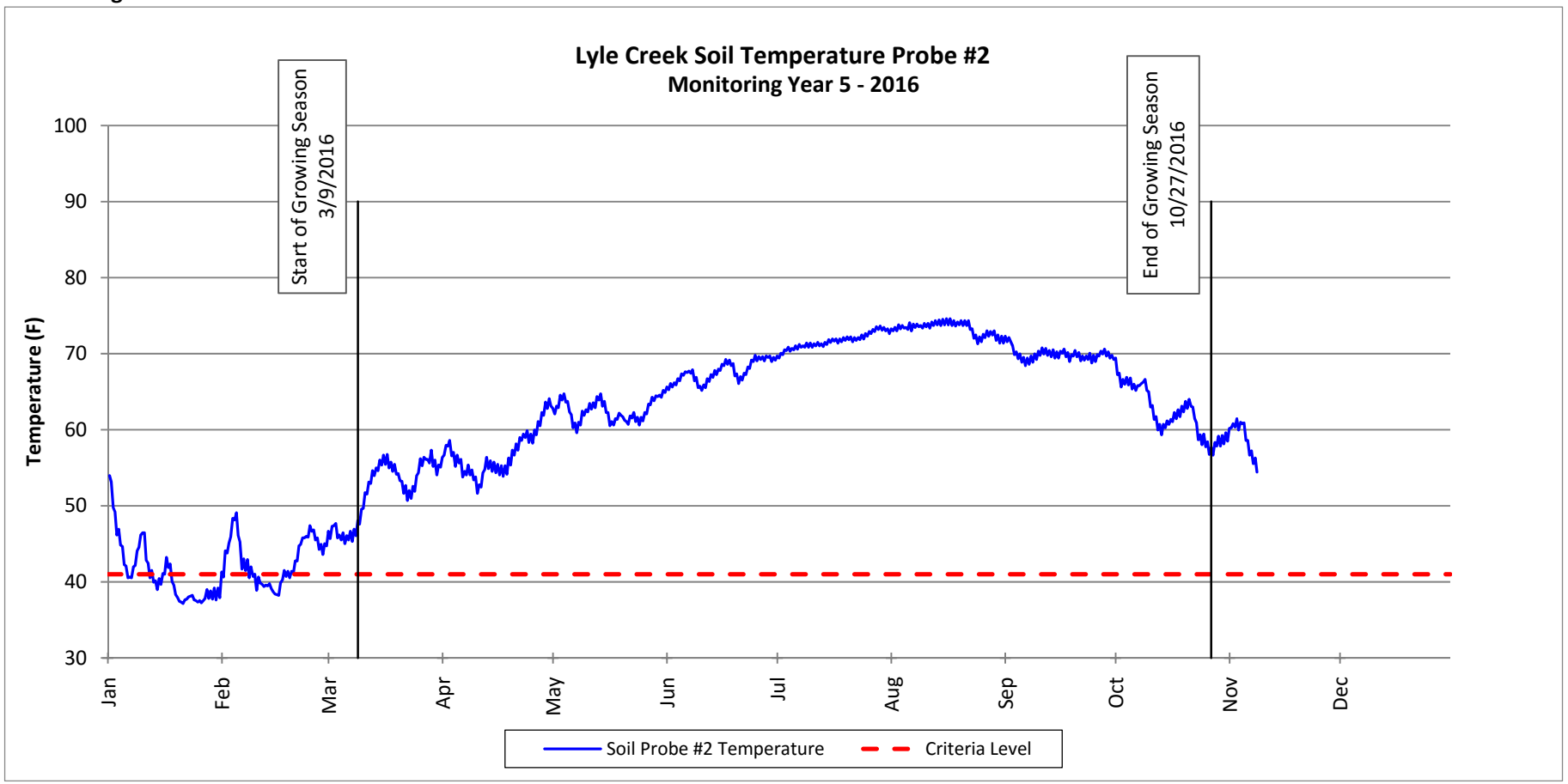


Soil Temperature Probe Plots

Lyle Creek Mitigation Site

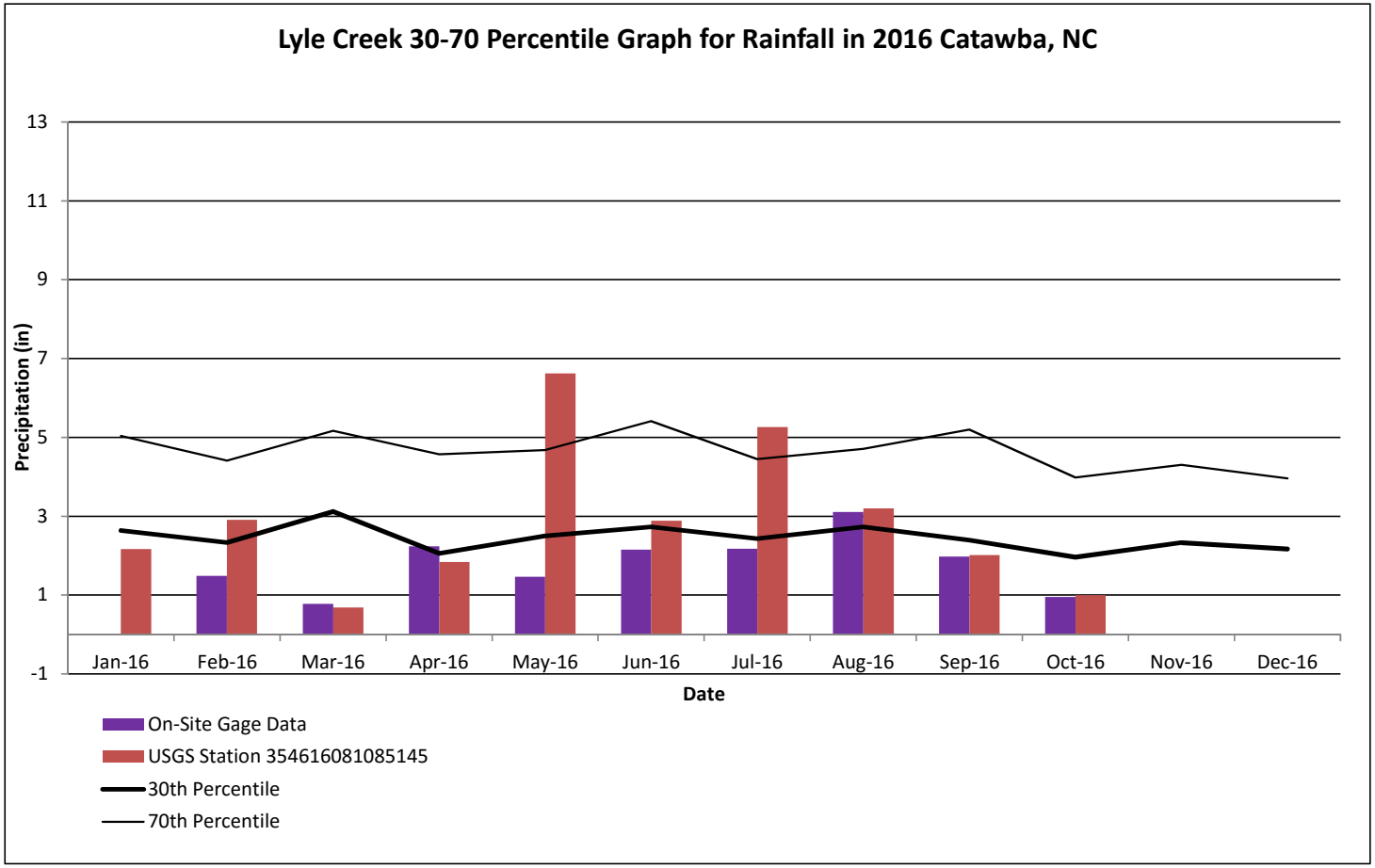
DMS Project No. 94643

Monitoring Year 5 - 2016



Monthly Rainfall Data

Lyle Creek Mitigation Site
DMS Project No. 94643
Monitoring Year 5 - 2016



[1] 2016 rainfall collected by onsite rainfall gage and USGS station 354616081085145

[2] 30th and 70th percentile rainfall data collected from weather station Catawba 3 NNW, NC1579 (USDA, 2002)

[3] Onsite rainfall gage malfunctioned in January, 2016