YEAR 1 MONITORING REPORT

ROSES CREEK STREAM MITIGATION SITE
Burke County, North Carolina
NC DMS Project # 96309

Prepared for:

NCDEQ Division of Mitigation Services (DMS)
217 West Jones St., Suite 3000A
Raleigh, North Carolina 27603

Construction Completed: May 2016
Morphology Data Collected: November 22, 2016
Vegetation Data Collected: October 5, 2016
Submitted: December 2016

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1.0 PROJECT SUMMARY

The following report summarizes the vegetation establishment and stream stability for Year 1 monitoring for the Roses Creek Site (hereafter referred to as the "Site") in Burke County, North Carolina.

1.1 Goals and Objectives

Primary goals for the Site, as detailed in the Roses Creek Stream Mitigation Site Mitigation Plan (ICA Engineering 2015) include:

1. Reducing water quality stressors and providing/enhancing flood attenuation.
2. Restoring and enhancing aquatic, semi-aquatic and riparian habitat.
3. Restoring and enhancing habitat connectivity with adjacent natural habitats.

The following objectives accomplish the goals listed above:

1. Reducing water quality stressors and providing/enhancing flood attenuation through:
    a. Restoring the existing degraded, straightened and incised/entrenched streams as primarily a Priority 1 restoration where bankfull and larger flows can access the floodplain allowing nutrients, sedimentation, trash and debris from upstream runoff to settle from floodwaters to the extent practical. Restoring a stable dimension, pattern, and profile will ensure the channel will transport and attenuate watershed flows and sediment loads without aggrading or degrading.
    b. Restore channel banks by relocating the channel, excavating bankfull benches, placing in-stream structures to reduce shearing forces on outside meander bends, and planting native vegetative species to provide soil stability, thus reducing stream bank stressors.
    c. Reducing point source (i.e. cattle and equipment crossings) and non-point source (i.e. stormwater runoff through pastures) pollution associated with on-site agricultural operations (hay production and cattle) by exclusionary fencing from the stream and riparian buffer and by eliminating all stream crossings from the easement.
    d. Plant a vegetative buffer on stream banks and adjacent floodplains to treat nutrient enriched surface runoff from adjacent pastureland associated with on-site agricultural operations.
    e. Restoring riparian buffers adjacent to the streams that are currently maintained for hay production that will attenuate floodwaters, in turn reducing stressors from upstream impacts.
2. Restoring and enhancing aquatic, semi-aquatic and riparian habitat through:
    a. Restoration of a sinuous gravel bed channel that promotes a stable bed form, and accommodates benthic macroinvertebrate and fish propagation. Additionally, woody materials such as log structures, overhanging planted vegetation and toe wood/brush toe in submerged water will provide a diversity of shading, bed form and foraging opportunities for aquatic organisms.
    b. Restoring native vegetation to the stream channel banks and the adjacent riparian corridor, that is currently grass dominated, will diversify flora and create a protected habitat corridor, which will provide an abundance of available foraging and cover habitat for a multitude of amphibians, reptiles, mammals and birds.
3. Restoring and enhancing habitat connectivity with adjacent natural habitats through:
    a. Planting the riparian buffer with native vegetation.

b. Protection of the restored community will ensure a protected wildlife corridor between the Site and the upstream and downstream mature riparian buffers and upland habitats.
c. Converting approximately 15 acres from existing agricultural land to riparian buffer protected by permanent conservation easement.

1.2 Success Criteria

Monitoring of restoration efforts will be performed until success criteria are fulfilled. Monitoring includes stream channel/hydraulics and vegetation. In general, the restoration success criteria, and required remediation actions, are based on the Stream Mitigation Guidelines (USACE et al. 2003) and the Ecosystem Enhancement Program Monitoring Requirements and Performance Standards for stream and/or Wetland Mitigation (NCEEP 2011). Project success criteria are further detailed in the Baseline Monitoring Document & As-Built Baseline Report (HDR|ICA 2016).

1.3 Background Summary

The North Carolina Department of Environmental Quality Division of Mitigation Services (DMS) contracted HDR|ICA to restore 4,746 linear feet of Roses Creek and three of its unnamed tributaries within the Site to assist in fulfilling stream mitigation needs in the watershed. The Site is located approximately 12 miles northwest of downtown Morganton in Burke County, NC. The Site contains Roses Creek and three unnamed headwater tributaries of Roses Creek (UT 1, UT 2 and UT 3). The Site is located within the 03050101060030 14-digit Hydrologic Unit, which is also a DMS Targeted Hydrologic Unit for Cataloging Unit 03050101 of the Catawba River Basin. Roses Creek is classified as a Water Supply Watershed (WS-III), as it is part of the headwaters that feed Lake Rhodhiss. The Site is comprised of one property owned by Robert B. Sisk and Martha M. Sisk (PIN # 1767479652) (known as the Sisk Farm). Additional information concerning project history is presented in Table 2.

1.4 Vegetation

Bare root plantings within vegetation plots are surviving well across the site. Vegetation plots are averaging 703.5 planted stems per acre, exceeding Year 3 monitoring success criteria of 320 stems per acre or greater. While vegetation plots are also exceeding success criteria individually, with average planted stem counts per plot ranging from 550 to 950 stems per acre, the stems do not appear to be healthy, and the majority of plots average a vigor of two or less.

Due to the low vigor and visual assessment of vegetation throughout the site, HDR|ICA surveyed ten, 30 foot radius warranty plots throughout the Site to determine the survivability of stems outside of vegetation plots. Warranty plots exhibited low survivability rates and the Site is scheduled to receive supplemental planting in the winter of 2017. Warranty plot locations are shown in Appendix F.

1.5 Stream Stability

Roses Creek and its tributaries appear to be in stable and functioning condition. Cross Section dimensions remain consistent with baseline surveys. Cross Sections 7 and 8 have decreased slightly in depth and area. Both cross sections are located on UT 1, which currently has vegetation in the channel. It is likely that in-channel vegetation has trapped sediment,

contributing to reduced channel area. It is expected that when flows increase over the winter, the sediment will flush out.

Two small holes were noted on-site where backfill from construction has settled. HDR|ICA will monitor these areas to ensure that they do not increase in size.

Woody vegetation is not well established along the stream banks; however, there are currently no signs of stream bank erosion. The live stakes along the stream banks are scheduled to be supplemented in the winter of 2017.

Bank pins were examined during morphological surveys and were not exposed.

A pebble count was conducted on site indicating that particle size has increased since baseline from and average of 46.44 to 61.39 mm.

The site has not experienced an overbank flow during the monitoring period. It is required that the site experiences at least two bankfull flows during the course of the seven year monitoring period. Crest gauge records can be found in Appendix E.

It should be noted that the site has been in drought or near-drought conditions since construction was completed. An overview of the site's drought status according to the NC Drought Management Advisory Council can be found in Appendix E.

2.0 METHODOLOGY

Year 1 monitoring surveys were completed using a Total Station. Each cross section was marked with a rebar monument at their beginning and ending points. The rebar has been located vertically and horizontally in NAD 83-State Plane. Surveying these monuments throughout the Site ensured proper orientation. The survey data was imported into MicroStation for verification. RIVERMorph and the Ohio Department of Natural Resources' "The Reference Reach Spreadsheet Version 4.3L" were used to analyze cross section data. Tables and figures were created using Microsoft Excel. A pebble count was conducted and analyzed in RIVERMorph.

Vegetation monitoring was completed using CVS level II methods, for 17, 100 square meter vegetation plots (Lee et al. 2006). The taxonomic standard for vegetation used for this document was Flora of the Southern and Mid-Atlantic States (Weakley 2011).

3.0 REFERENCES

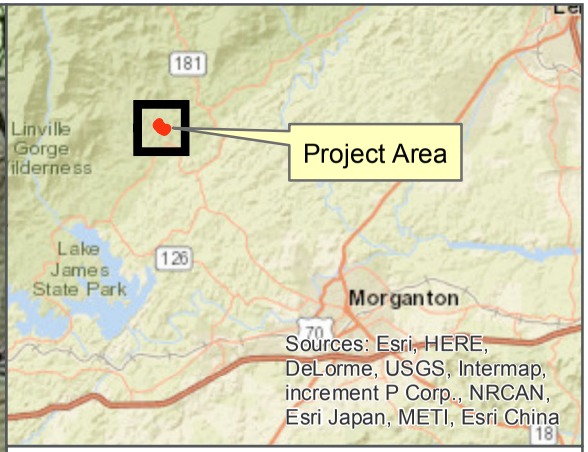
Lee, Michael T., R. K. Peet, S. D. Roberts, and T. R. Wentworth. 2006. CVS-EEP Protocol for Recording Vegetation, Version 4.0 (http://cvs.bio.unc.edu/methods.htm).

Mecklenburg, Dan. 2006. The Reference Reach Spreadsheet Version 4.3L. 2006. Ohio Department of Natural Resources. Division of Soil and Water. (http://www.dnr.state.oh.us/tabid/9188/default.aspx)

Weakley, Alan S. 2011. Flora of the Southern and Mid-Atlantic States (online). Available: http://www.herbarium.unc.edu/FloraArchives/WeakleyFlora_2011-May-nav.pdf [May 15, 2011]. University of North Carolina Herbarium, North Carolina Botanical Garden, University of North Carolina, Chapel Hill, North Carolina.

APPENDICES

Appendix A. Project Vicinity Map and Background Tables



Legend

Project Easement

The subject project site is an environmental restoration site of the NCDEQ Divison of Mitigation Services (DMS) and is encompassed by a recorded conservation easement, but is bordered by land under private ownership. Therefore access by the general public is not permitted. Access by authorized personnel of state and federal agencies or their designees/contractors involved in the development, monitoring, and stewardship of the restoration site is permitted within the terms and timeframes of their defined, pre-approved roles. Any intended site visitation or activity by any person outside of these previously sanctioned activities/roles requires prior coordination with DMS.

ROSES CREEK STREAM MITIGATION SITE

VICINITY MAP
BURKE COUNTY, NC

N

0 1,000 2,000 4,000 Feet

HDR | ICA

FIGURE 1

PATH: S:\ROSES_CREEK\5.0_PROJECT_DEVELOPMENT\5.2_WORK_IN_PROGRESS\DOCS\MONITORING\YEAR 1\APPENDIX A_VICINITY MAP AND BACKGROUND TABLES\VICINITY MAP.MXD - USER: WWOLLMAN - DATE: 12/2/2016

Map Produced 12/2/2016

Table 1. Project Components and Mitigation Credits

Roses Creek, Burke County DMS Project No. 96309									
Credit Summary									
	Stream SMU		Riparian Wetland WMU		Non-riparian Wetland		Buffer	Nitrogen Nutrient Offset	Phosphorous Nutrient Offset
Type	R	RE	R	RE	R	RE			
Totals	5,009								
Project Components									
Project Component or Reach ID	Stationing/ Location		Existing Footage/ Acreage	Approach (PI, PII, etc.)	Restoration or Restoration Equivalent	Restoration Footage or Acreage	Mitigation Ratio	SMU	
Roses Creek	10+00-41+81		3,643	PI	Restoration	3,181	1:1	3,121*	
Roses Creek	41+81-42+19		38	-	EII	38	2.5:1	15	
UT 1	10+00-12+54; 16+11-16+46		267	PI	Restoration	289	1:1	289	
UT 1	12+54-16+11; 16+46-19+30		641	-	EII	641	2.5:1	256	
UT 2	10+00-17+07		610	PI	Restoration	707	1:1	707	
UT 3	10+00-16+21		558	PI	Restoration	621	1:1	621	
Total	NA		5,757	PI	Restoration/ EII	5,477	1-2.5:1	5,009	

* Stream Mitigation Units decreased by 60 to account for break in easement at the stream crossing on Sisk Farm Road

Component Summation						
Restoration Level	Stream (linear feet)	Riparian Wetland (acres)		Non-Riparian Wetland (acres)	Buffer (square feet)	Upland (acres)
		Riverine	Non-Riverine			
Restoration	4,798					
Enhancement II	679					

Table 2. Project Activity and Reporting History

Activity or Report	Data Collection Complete	Completion or Delivery
Mitigation Plan	September 2015	September 2015
Final Design – Construction Plans	September 2015	March 2016
Construction	February 25, 2016	May 18, 2016
Temporary S&E Mix Applied to Entire Project Area	---	May 18, 2016
Permanent Seed Mix Applied to Entire Project Area	---	May 18, 2016
Bare Root, Containerized, and B&B plantings for Entire Project Area	---	May 27, 2016
Mitigation Plan/As-built (Year 0 Monitoring-Baseline)	May 2016	July 2016
Year 1 Monitoring	November 2016	December 2016
Year 2 Monitoring		
Year 3 Monitoring		
Year 4 Monitoring		
Year 5 Monitoring		
Year 6 Monitoring		
Year 7 Monitoring		

Table 3. Project Contacts Table

Designer Primary project design POC	ICA Engineering 5121 Kingdom Way, Suite 100 Raleigh, North Carolina 27607 Chris Smith (919) 851-6066
Construction Contractor Construction Contractor POC	Land Mechanic Designs, Inc. 126 Circle G Lane Willow Spring, NC 27592 Lloyd Glover (919) 639-6132
Planting Contractor Planting Contractor POC	Land Mechanic Designs, Inc. 126 Circle G Lane Willow Spring, NC 27592 Lloyd Glover (919) 639-6132
Seeding Contractor Seeding Contractor POC	Land Mechanic Designs, Inc. 126 Circle G Lane Willow Spring, NC 27592 Lloyd Glover (919) 639-6132
Seed Mix Sources	Green Resources – Triangle Office
Nursery Stock Suppliers	1) Dykes and Son Nursery, McMinnville, TN 2) Foggy Mountain Nursery (live stakes)
Monitoring Performers	HDR|ICA Engineering Inc. 5121 Kingdom Way, Suite 100 Raleigh, North Carolina 27607 Ben Furr (919) 851-6066
Stream Monitoring POC	HDR|ICA Engineering Inc. 5121 Kingdom Way, Suite 100 Raleigh, North Carolina 27607 Ben Furr (919) 851-6066
Vegetation Monitoring POC	HDR|ICA Engineering Inc. 5121 Kingdom Way, Suite 100 Raleigh, North Carolina 27607 Ben Furr (919) 851-6066

Table 4. Project Information

Project Information				
Project Name		Roses Creek Stream Mitigation Site		
County		Burke		
Project Area (acres)		17.3		
Project Coordinates (latitude and longitude)		35.850953,-81.819541		
Project Watershed Summary Information				
Physiographic Province		Piedmont / Mountain		
River Basin		Catawba		
USGS Hydrologic Unit 8-digit	03050101	USGS Hydrologic Unit 14-digit	03050101060030	
NCDWQ Sub-basin		03-08-31		
Project Drainage Area (acres)		Roses: 3,309, UT 1: 35, UT 2: 47, UT 3: 10		
Project Drainage Area Percentage of Impervious Area		<1%		
CGIA Land Use Classification		Agricultural/Pasture		
Ecoregion		Northern Inner Piedmont		
Geological Unit		Zabg: Alligator Back Formation; Gneiss		
Reach Summary Information				
Parameters	**Roses Creek**	**UT 1**	**UT 2**	**UT 3**
Length of reach (linear feet)	3,681 existing	900 existing	610 existing	558 existing
Valley Classification	VIII	VIII	VIII	VIII
Drainage Area (acres)	3,309	35	47	13
NCDWQ Stream Identification Score	56	30	33.5	34
NCDWQ Water Quality Classification	WS-III; Tr	WS-III; Tr	WS-III; Tr	WS-III; Tr
Morphological Description (stream type)	E4, B4, and F4	B5, F5	B5	B5, G5
Evolutionary Trend	Simon's Stages: Premodified » Constructed » Degradation and Widening	Could maintain a B type channel in majority of reach Or F » B	G » B/E	G » B

Regulatory Considerations (cont.)			
Coastal Zone Management (CZMA)/ Coastal Area Management Act (CAMA)	No	N/A	N/A
FEMA Floodplain Compliance	Yes	Yes*	CLOMR/LOMR
Essential Fisheries Habitat	No	N/A	N/A

*The CLOMR was approved before construction. The LOMR has been supported by the local floodplain administrator and is currently being reviewed by FEMA.

Appendix B. Visual Assessment Data

STATE		SHEET NO.
N.C.	ROSES CREEK	1

CURRENT CONDITIONS PLAN VIEW (CCPV)
ROSES CREEK

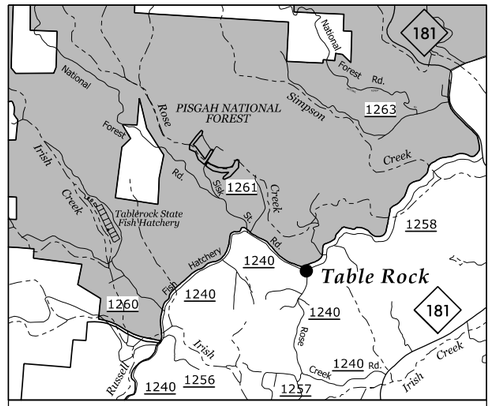
DMS PROJECT #: 96309

CONTRACT: ROSES CREEK

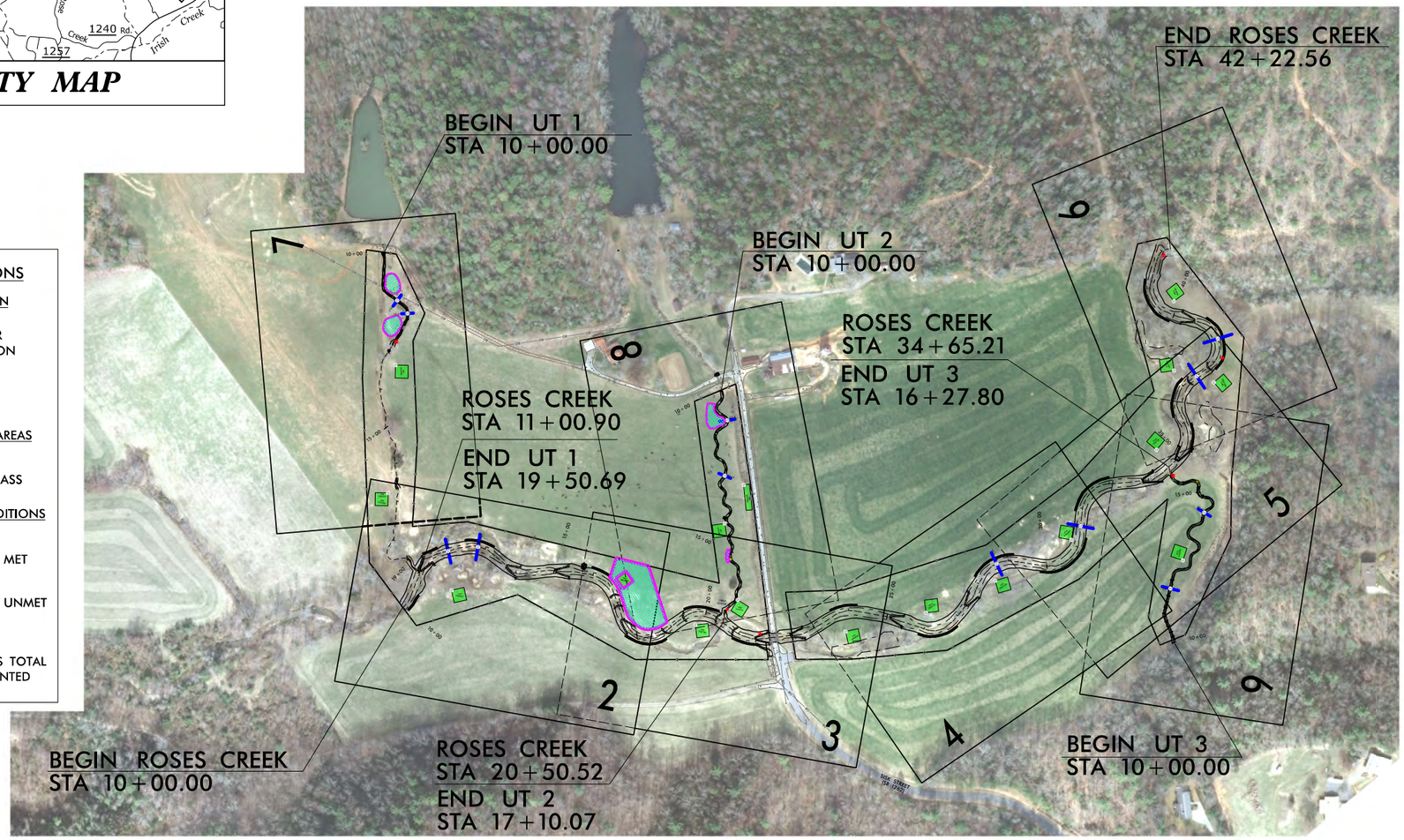
LOCATION: BURKE COUNTY, NORTH CAROLINA

LAT: 35°51' 01" N *LONG: –81°49' 11" W*

TYPE OF WORK: CCPV PLANS – YEAR 1



VICINITY MAP



YEAR 1 CONDITIONS

BANK/BED CONDITION

- MINOR EROSION
- HOLE

VEGETATION PROBLEM AREAS

- THIN GRASS

VEGETATION PLOT CONDITIONS

- CRITERIA MET
- CRITERIA UNMET

NOTE:
650/650 – REPRESENTS TOTAL STEMS PER ACRE /PLANTED STEMS PER ACRE

LEGEND

- ASBUILT ALIGNMENTS & STATIONING (15+00)
- THALWEG
- BANKFULL
- EPHEMERAL POOL
- CONSERVATION EASEMENT
- FENCE
- CROSS–SECTION LOCATION (XS-1)
- FLOW METER (FM)
- CREST GAUGE
- PHOTO POINT & DIRECTION
- EXISTING WETLANDS (WLB)
- 10 x 10 VEG PLOT
- 5 x 20 VEG PLOT
- BRUSH TOE
- ROCK L–VANE
- ROCK CROSS VANE
- ROCK STEP STRUCTURE w/ BOULDERS
- ROCK STEP STRUCTURE w/ CLASS B RIP RAP
- ROCK /LOG CROSS VANE
- FLOODPLAIN INTERCEPTOR

GRAPHIC SCALES

50 25 0 50 100
PLANS

10 5 0 10 20
PROFILE (HORIZONTAL)

20 10 0 20 40
PROFILE (VERTICAL)

DESIGN DATA

ROSES CREEK			UT 1			UT 2			UT 3		
DESIGN STREAM TYPE	=	C4	DESIGN STREAM TYPE	=	C5	DESIGN STREAM TYPE	=	C5	DESIGN STREAM TYPE	=	C5
BANKFULL AREA (FT^2) CROSS–SECTIONED	=	66.4	BANKFULL AREA (FT^2) CROSS–SECTIONED	=	2.1	BANKFULL AREA (FT^2) CROSS–SECTIONED	=	2.1	BANKFULL AREA (FT^2)	=	2.6
BANKFULL WIDTH (FT)	=	30.5	BANKFULL WIDTH (FT)	=	5.0	BANKFULL WIDTH (FT)	=	5.0	BANKFULL WIDTH (FT)	=	5.5
MAX DEPTH (FT)	=	2.72	MAX DEPTH (FT)	=	0.58	MAX DEPTH (FT)	=	0.58	MAX DEPTH (FT)	=	0.63
WIDTH /DEPTH RATIO	=	14.0	WIDTH /DEPTH RATIO	=	13.0	WIDTH /DEPTH RATIO	=	13.0	WIDTH /DEPTH RATIO	=	13.1
DRAINAGE AREA (MI^2)	=	5.17	DRAINAGE AREA (MI^2)	=	0.06	DRAINAGE AREA (MI^2)	=	0.07	DRAINAGE AREA (MI^2)	=	0.02
BANKFULL SLOPE(FT/FT)	=	0.0062	BANKFULL SLOPE(FT/FT)	=	0.0021	BANKFULL SLOPE(FT/FT)	=	0.0021	BANKFULL SLOPE(FT/FT)	=	0.0021

PROJECT LENGTH

		PROPOSED DESIGN STREAM LENGTH		ASBUILT STREAM LENGTH	
ROSES CREEK	=	3,219.20	FT	3,222.56	FT
UT 1	=	930.38	FT	950.69	FT
UT 2	=	707.59	FT	710.07	FT
UT 3	=	621.03	FT	627.80	FT

CHRISTOPHER L. SMITH
PROJECT MANAGER

Prepared in the Office of:

HDR | ICA

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Raleigh, NC 27607
NC License No: F-0258

12/8/2016
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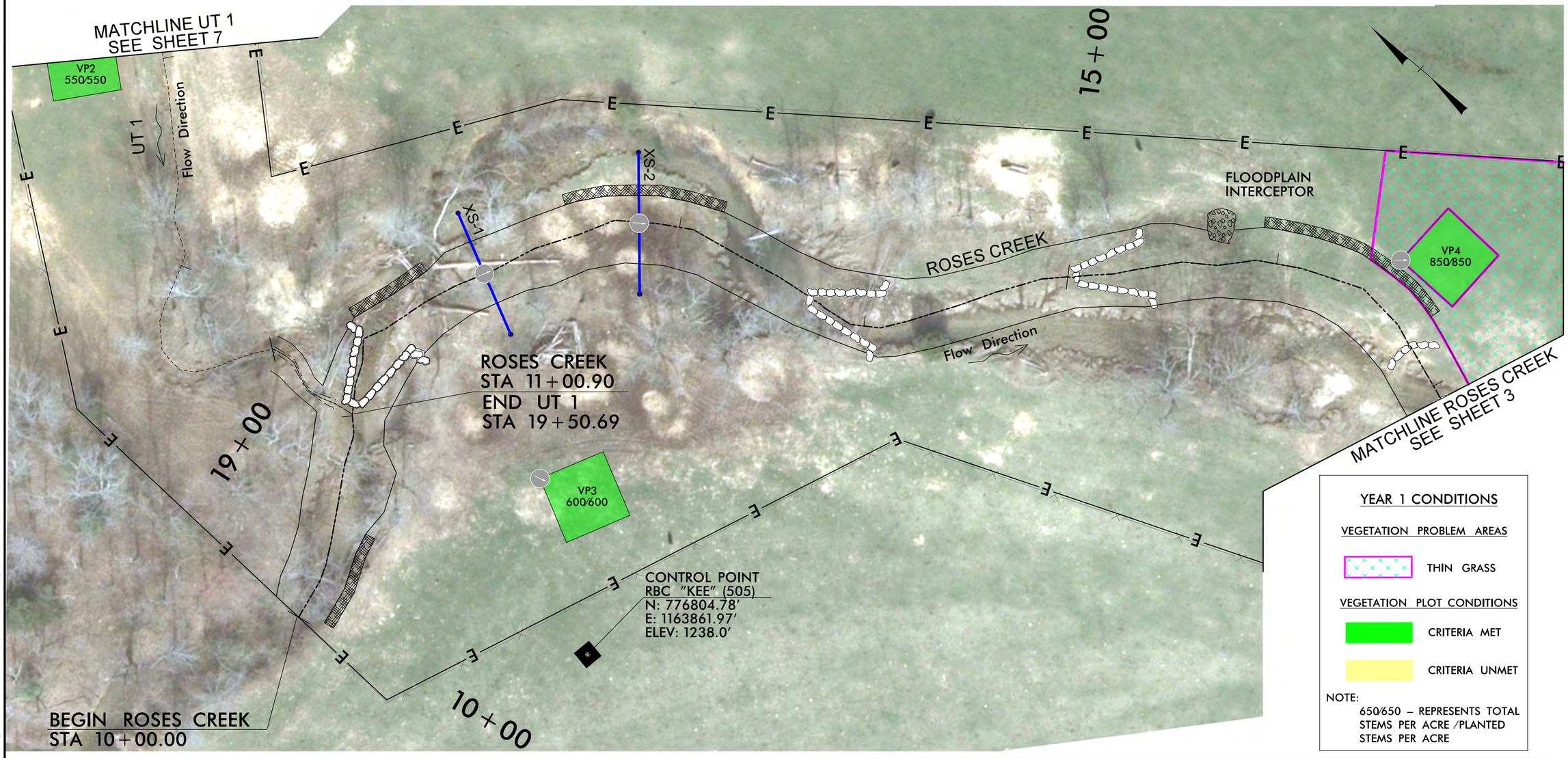
ICA Engineering

CURRENT CONDITIONS PLAN VIEW (CCPV)
YEAR 1



YEAR 1 CONDITIONS

VEGETATION PROBLEM AREAS

THIN GRASS

VEGETATION PLOT CONDITIONS

CRITERIA MET

CRITERIA UNMET

NOTE:
650/650 – REPRESENTS TOTAL STEMS PER ACRE /PLANTED STEMS PER ACRE

LEGEND

- 15+00 — ASBUILT ALIGNMENTS & STATIONING
- THALWEG
- BANKFULL
- EPHEMERAL POOL
- E — CONSERVATION EASEMENT
- FENCE
- PHOTO POINT & DIRECTION
- XS-1 — CROSS–SECTION LOCATION
- 10 x 10 VEG PLOT
- 5 x 20 VEG PLOT
- BRUSH TOE
- CREST GAUGE
- ROCK L–VANE
- ROCK CROSS VANE
- ROCK STEP STRUCTURE w/ BOULDERS
- ROCK STEP STRUCTURE w/ CLASS B RIP RAP
- FLOODPLAIN INTERCEPTOR

GRAPHIC SCALE
50 25 0 25
PLANS

5121 Kingdom Way, Suite 100
Raleigh, NC 27607
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ROSES CREEK RESTORATION PROJECT
STREAM BURKE COUNTY, NORTH CAROLINA

DATE: 11–30–16

CCPV YEAR 1

SHEET 2

EEP# 96309

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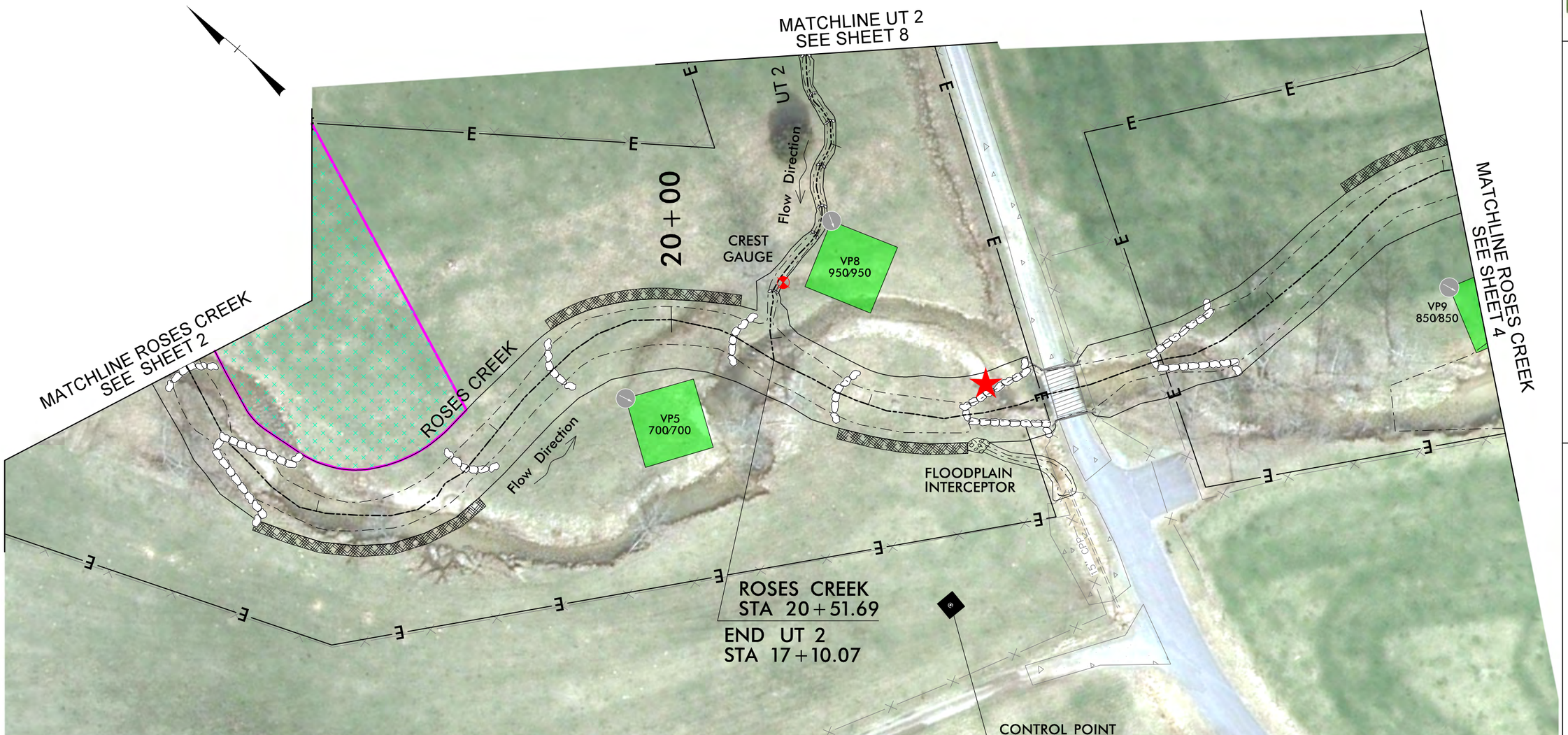
CURRENT CONDITIONS PLAN VIEW (CCPV)
YEAR 1



LEGEND

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YEAR 1 CONDITIONS

BANK/BED CONDITION
- HOLE

VEGETATION PROBLEM AREAS
- THIN GRASS

VEGETATION PLOT CONDITIONS
- CRITERIA MET
- CRITERIA UNMET

NOTE:
650/650 – REPRESENTS TOTAL STEMS PER ACRE /PLANTED STEMS PER ACRE

5121 Kingdom Way,
Suite 100
Raleigh, NC 27607
NC License No: F-0258

ROSES CREEK RESTORATION PROJECT
STREAM
BURKE COUNTY, NORTH CAROLINA

GRAPHIC SCALE
50 25 0 25
PLANS

DATE: 11-30-16

CCPV
YEAR 1

SHEET
3

EEP# 96309

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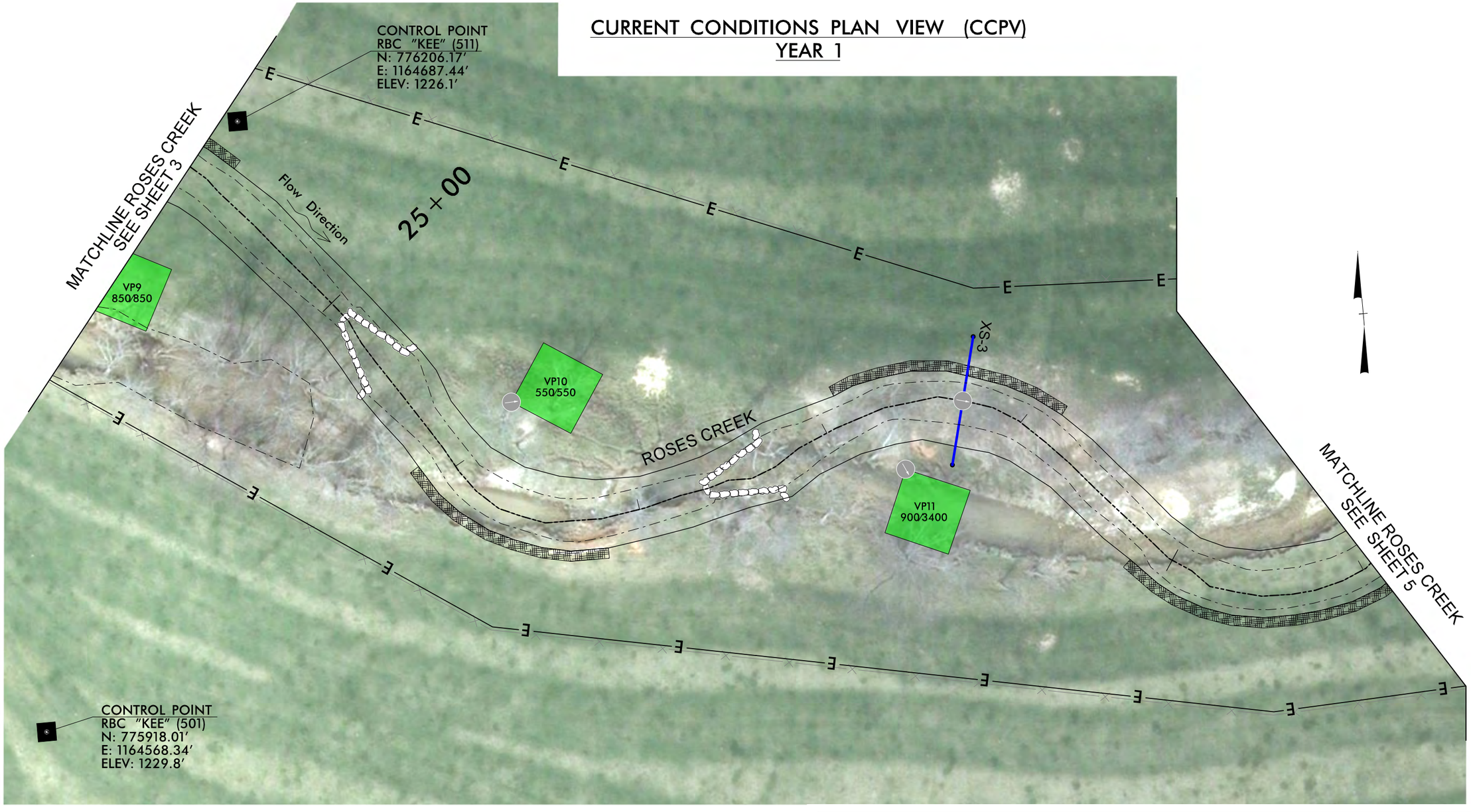
K. Eggleston

CURRENT CONDITIONS PLAN VIEW (CCPV)
YEAR 1



YEAR 1 CONDITIONS

VEGETATION PLOT CONDITIONS

- CRITERIA MET
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NOTE:
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LEGEND

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NC License No: F-0258

ROSES CREEK STREAM RESTORATION PROJECT
BURKE COUNTY, NORTH CAROLINA

GRAPHIC SCALE
50 25 0 25
PLANS

DATE: 11–30–16

CCPV YEAR 1

SHEET 4

EEP# 96309

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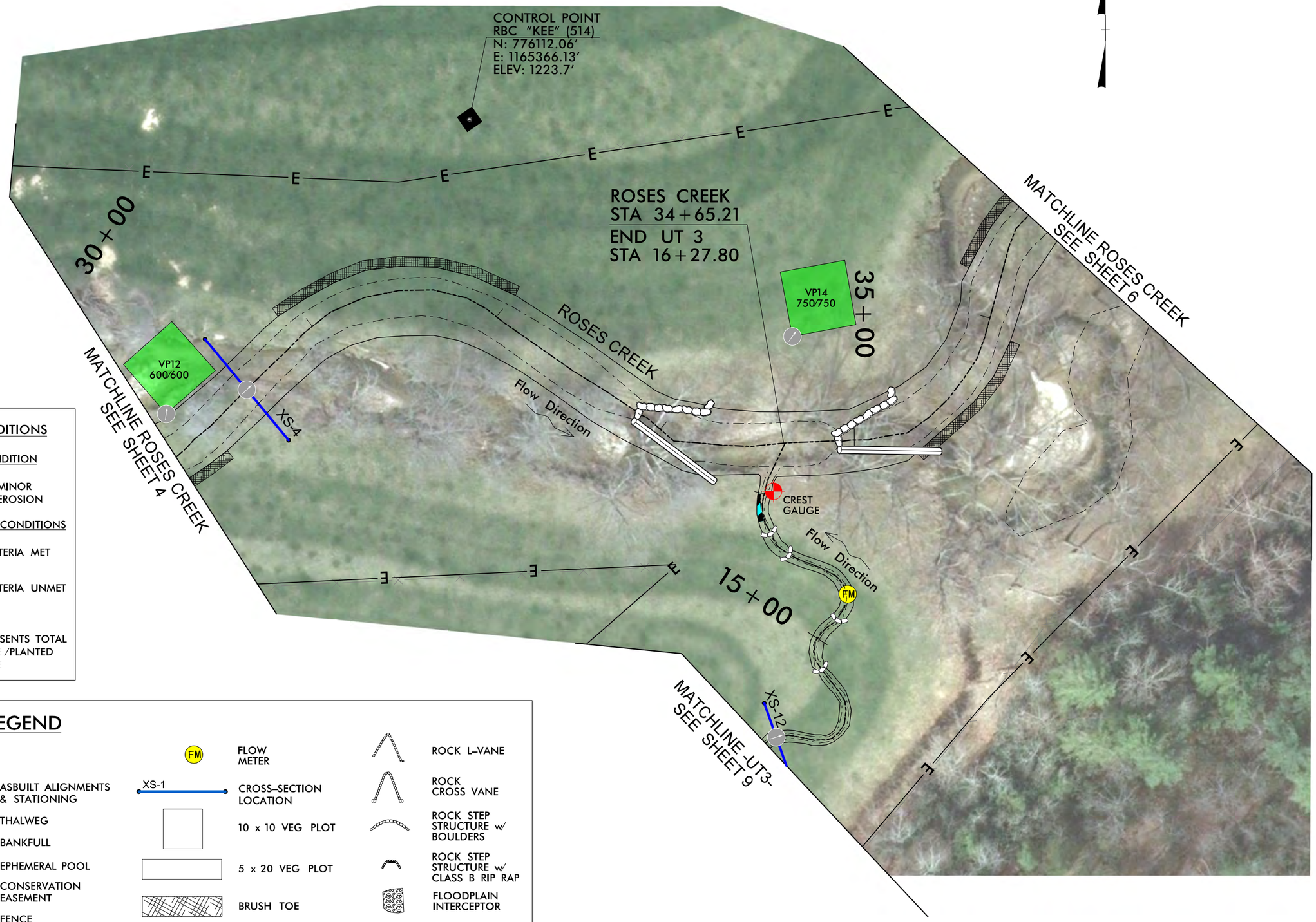
CURRENT CONDITIONS PLAN VIEW (CCPV)
YEAR 1



YEAR 1 CONDITIONS

BANK/BED CONDITION

MINOR EROSION

VEGETATION PLOT CONDITIONS

CRITERIA MET

CRITERIA UNMET

NOTE:
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5121 Kingdom Way,
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ROSES CREEK PROJECT
RESTORATION
STREAM
BURKE COUNTY, NORTH CAROLINA

GRAPHIC SCALE
50 25 0 25
PLANS

DATE: 11-30-16

CCPV
YEAR 1

SHEET
5

EEP# 96309

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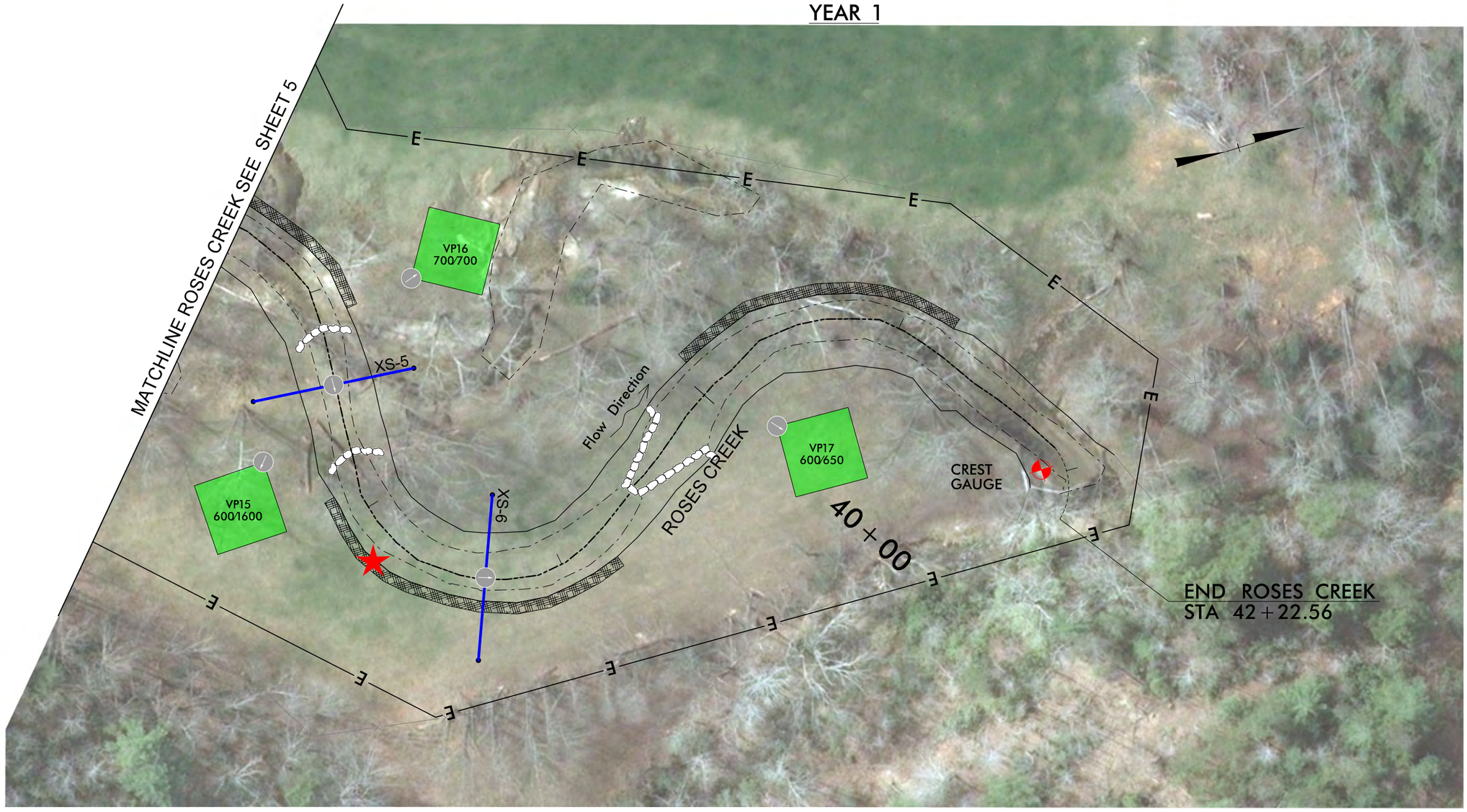
ICA Engineering

CURRENT CONDITIONS PLAN VIEW (CCPV)
YEAR 1



YEAR 1 CONDITIONS

BANK/BED CONDITION

HOLE

VEGETATION PLOT CONDITIONS

CRITERIA MET

CRITERIA UNMET

NOTE:
650/650 – REPRESENTS TOTAL STEMS PER ACRE /PLANTED STEMS PER ACRE

LEGEND

15+00 — ASBUILT ALIGNMENTS & STATIONING

THALWEG

BANKFULL

EPHEMERAL POOL

E — CONSERVATION EASEMENT

FENCE

XS-1 — CROSS–SECTION LOCATION

10 x 10 VEG PLOT

5 x 20 VEG PLOT

BRUSH TOE

PHOTO POINT & DIRECTION

CREST GAUGE

ROCK L–VANE

ROCK CROSS VANE

ROCK STEP STRUCTURE w/ BOULDERS

ROCK STEP STRUCTURE w/ CLASS B RIP RAP

FLOODPLAIN INTERCEPTOR

5121 Kingdom Way, Suite 100
Raleigh, NC 27607
NC License No: P-0258

ROSES CREEK
STREAM RESTORATION PROJECT
BURKE COUNTY, NORTH CAROLINA

GRAPHIC SCALE
50 25 0 25
PLANS

DATE: 11–30–16

CCPV
YEAR 1

SHEET
6

EEP# 96309

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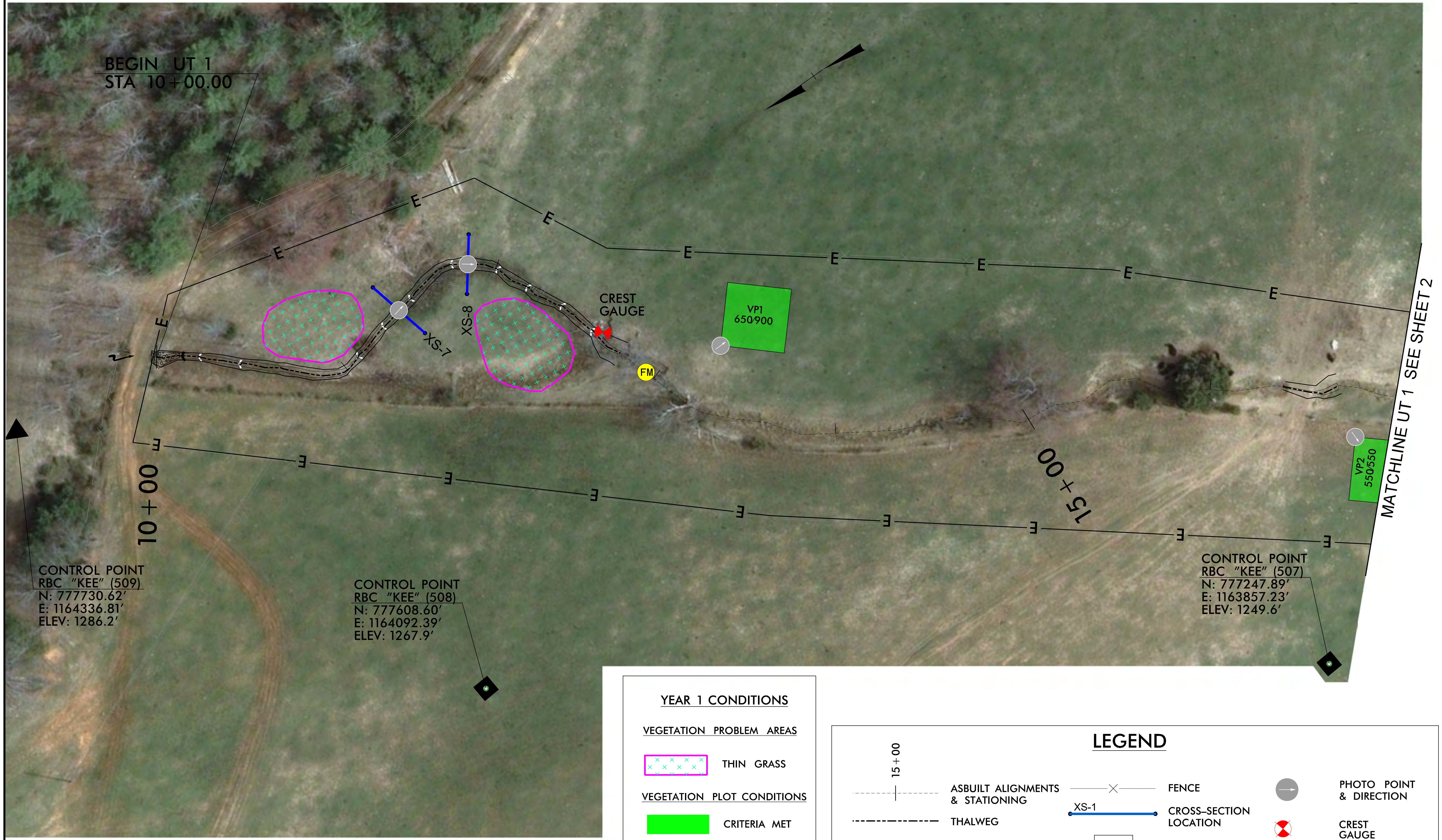
CURRENT CONDITIONS PLAN VIEW (CCPV)
YEAR 1



YEAR 1 CONDITIONS

VEGETATION PROBLEM AREAS

▨ THIN GRASS

VEGETATION PLOT CONDITIONS

🟩 CRITERIA MET

🟨 CRITERIA UNMET

NOTE:
650/650 – REPRESENTS TOTAL STEMS PER ACRE /PLANTED STEMS PER ACRE

LEGEND

- 15+00 ASBUILT ALIGNMENTS & STATIONING
- THALWEG
- BANKFULL
- EPHEMERAL POOL
- E CONSERVATION EASEMENT
- FENCE
- XS-1 CROSS-SECTION LOCATION
- □ 10 x 10 VEG PLOT
- FM FLOW METER
- PHOTO POINT & DIRECTION
- CREST GAUGE
- ROCK STEP STRUCTURE w/ CLASS B RIP RAP
- FLOODPLAIN INTERCEPTOR

5121 Kingdom Way,
Suite 100
Raleigh, NC 27607
NC License No: F-0258

HDR | ICA

STREAM RESTORATION PROJECT
ROSES CREEK
BURKE COUNTY, NORTH CAROLINA

GRAPHIC SCALE
25 0 25 50
PLANS

DATE: 11-30-16

CCPV
YEAR 1

SHEET
7

EEP# 96309

12/8/2016
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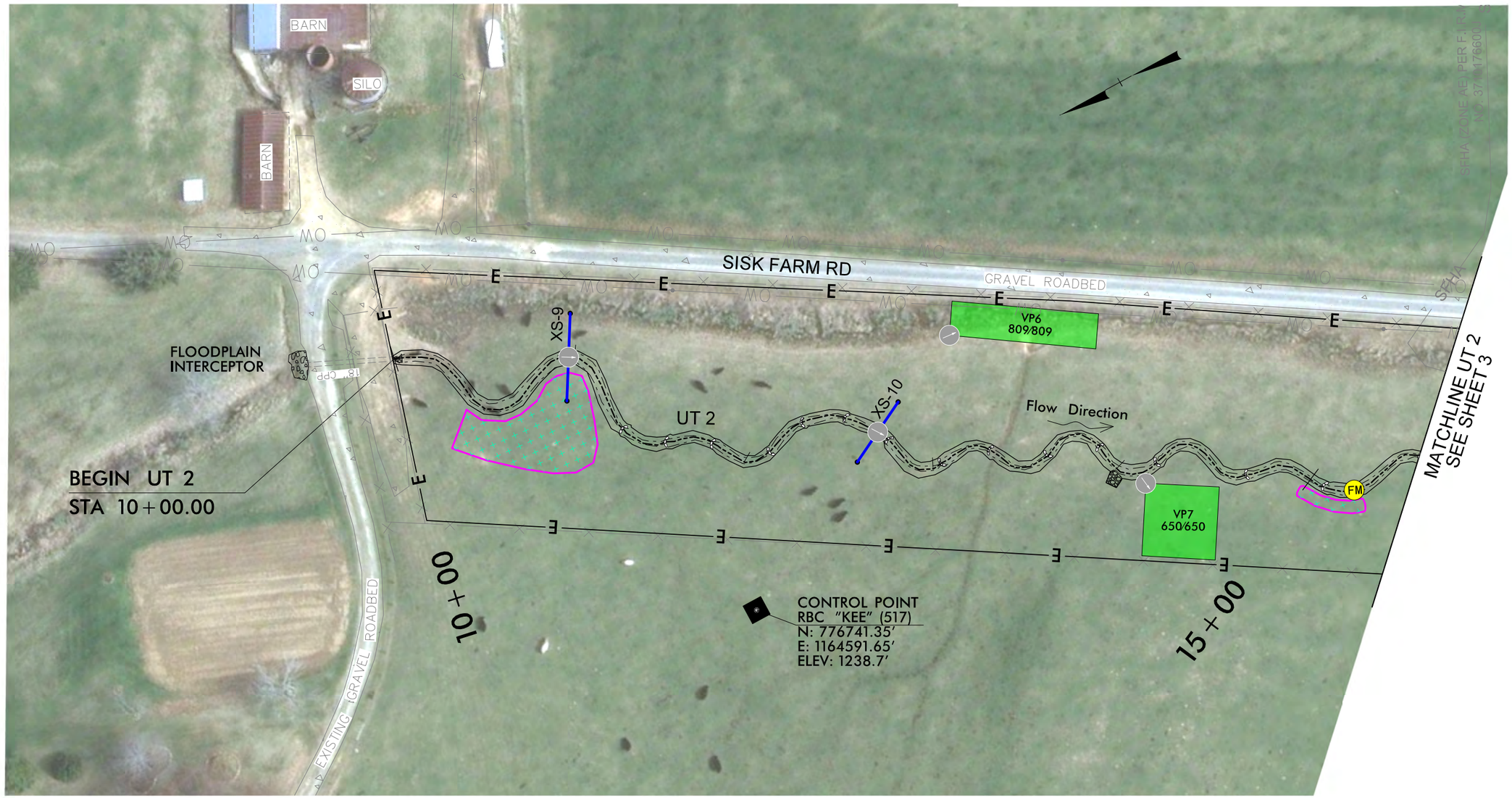
ICA Engineering

CURRENT CONDITIONS PLAN VIEW (CCPV)
YEAR 1



YEAR 1 CONDITIONS

VEGETATION PROBLEM AREAS

THIN GRASS

VEGETATION PLOT CONDITIONS

CRITERIA MET

CRITERIA UNMET

NOTE:
650/650 – REPRESENTS TOTAL STEMS PER ACRE /PLANTED STEMS PER ACRE

LEGEND

15+00

ASBUILT ALIGNMENTS & STATIONING

THALWEG

BANKFULL

EPHEMERAL POOL

E — CONSERVATION EASEMENT

FENCE

XS-1 — CROSS-SECTION LOCATION

10 x 10 VEG PLOT

5 x 20 VEG PLOT

FM — FLOW METER

PHOTO POINT & DIRECTION

CREST GAUGE

BRUSH TOE

ROCK STEP STRUCTURE w/ CLASS B RIP RAP

FLOODPLAIN INTERCEPTOR

5121 Kingdom Way, Suite 100
Raleigh, NC 27607
NC License No: P-0258

ROSES CREEK STREAM RESTORATION PROJECT
BURKE COUNTY, NORTH CAROLINA

GRAPHIC SCALE
50 25 0 25
PLANS

DATE: 11-30-16

CCPV YEAR 1

SHEET 8

EEP# 96309

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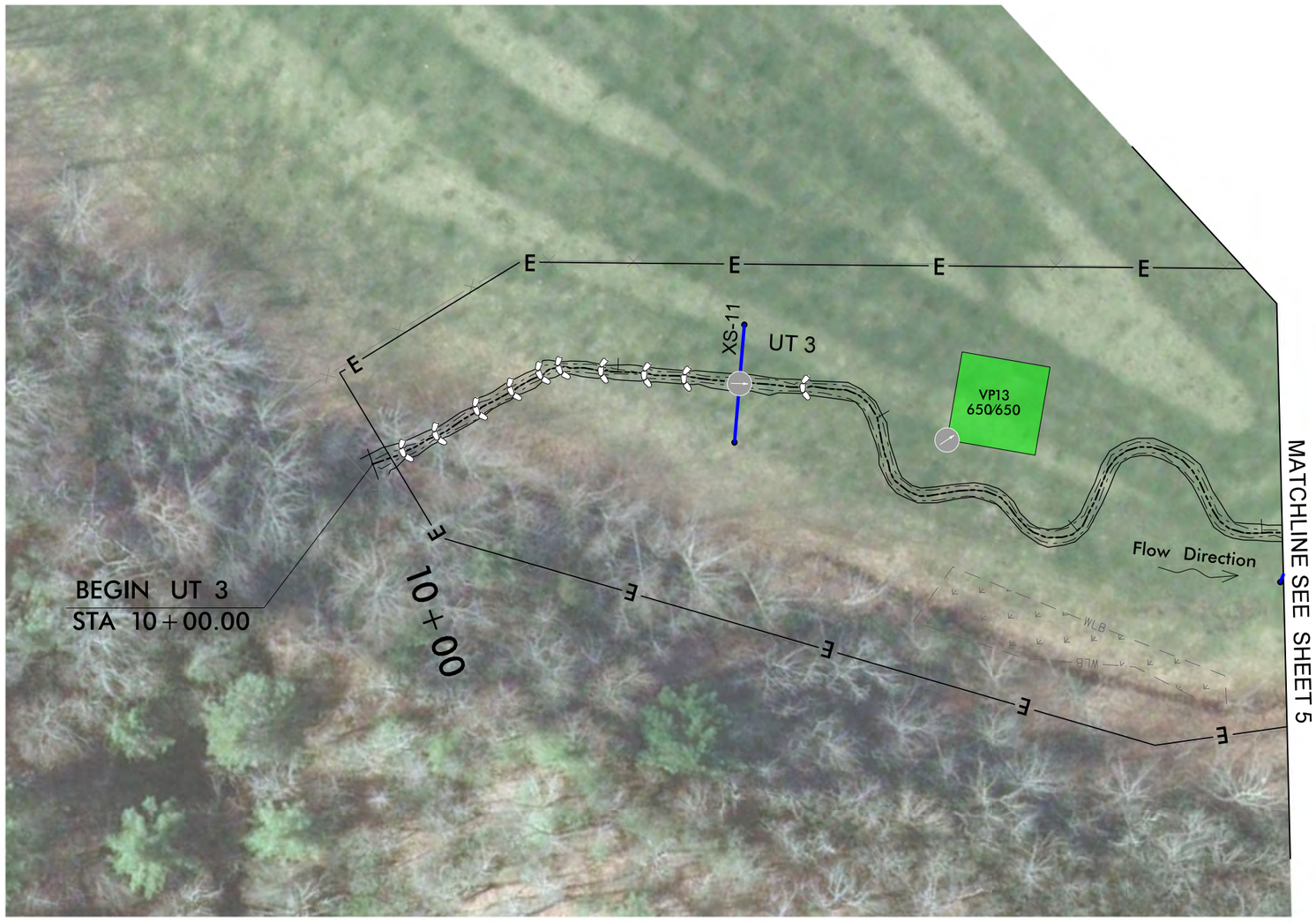
CURRENT CONDITIONS PLAN VIEW (CCPV)
YEAR 1



YEAR 1 CONDITIONS

VEGETATION PLOT CONDITIONS

- CRITERIA MET
- CRITERIA UNMET

NOTE:
650/650 – REPRESENTS TOTAL STEMS PER ACRE /PLANTED STEMS PER ACRE

LEGEND

- 15+00 — ASBUILT ALIGNMENTS & STATIONING
- THALWEG
- BANKFULL
- EPHEMERAL POOL
- E — CONSERVATION EASEMENT
- FENCE
- PHOTO POINT & DIRECTION
- XS-1 — CROSS–SECTION LOCATION
- 10 x 10 VEG PLOT
- WLB — EXISTING WETLANDS
- ROCK STEP STRUCTURE w/ CLASS B RIP RAP
- FLOODPLAIN INTERCEPTOR

5121 Kingdom Way,
Suite 100
Raleigh, NC 27607
NC License No: P-0258

ROSES CREEK RESTORATION PROJECT
STREAM
BURKE COUNTY, NORTH CAROLINA

GRAPHIC SCALE
50 25 0 25
PLANS

DATE: 11-30-16

CCPV YEAR 1

SHEET 9

EEP# 96309

12/8/2016
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HDR Engineering

Table 4: Visual Stream Morphology Stability Assessment
Reach ID: Roses Creek
Assessed Length: 3,121 FT

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
1. Bed	1. **Vertical Stability** (Riffle and Run units)	1. Aggradation - Bar formation/growth sufficient to significantly deflect flow laterally (not to include point bars)			0	0	100%
		2. Degradation - Evidence of downcutting			0	0	100%
	2. Riffle Condition	1. Texture/Substrate - Riffle maintains coarser substrate	17	17			100%
	3. Meander Pool Condition	1. Depth Sufficient (Max Pool Depth : Mean Bankfull Depth ≥ 1.6)	18	18			100%
		2. Length appropriate (>30% of centerline distance between tail of upstream riffle and head of downstrem riffle)	18	18			100%
	4.**Thalweg Position**	1. Thalweg centering at upstream of meander bend (Run)	17	17			100%
		2. Thalweg centering at downstream of meander (Glide)	17	17			100%
2. Bank	**1. Scoured/Eroding**	Bank lacking vegetative cover resulting simply from poor growth and/or scour and erosion			0	0	100.0%
	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%
	3. Mass Wasting	Bank slumping, calving, or collapse			0	0	100%
				Totals	0	0	100.0%
3. Engineered Structures	**1. Overall Integrity**	Structures physically intact with no dislodged boulders or logs.	19	19			100%
	2. Grade Control	Grade control structures exhibiting maintenance of grade across the sill.	19	19			100%
	2a. Piping	Structures lacking any substantial flow underneath sills or arms.	19	19			100%
	3. Bank Protection	Bank erosion within the structures extent of influence does not exceed 15%. (See guidance for this table in EEP monitoring guidance document)	19	19			100%
	4. Habitat	Pool forming structures maintaining ~ Max Pool Depth : Mean Bankfull Depth ratio ≥ 1.6 Rootwads/logs providing some cover at base-flow.	19	19			100%

Table 4a: Visual Stream Morphology Stability Assessment
Reach ID: UT1
Assessed Length: 234 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
1. Bed	1. **Vertical Stability** (Riffle and Run units)	1. Aggradation - Bar formation/growth sufficient to significantly deflect flow laterally (not to include point bars)			0	0	100%
		2. Degradation - Evidence of downcutting			0	0	100%
	2. Riffle Condition	1. Texture/Substrate - Riffle maintains coarser substrate	N/A	N/A			100%
	3. Meander Pool Condition	1. Depth Sufficient (Max Pool Depth : Mean Bankfull Depth ≥ 1.6)	2	2			100%
		2. Length appropriate (>30% of centerline distance between tail of upstream riffle and head of downstrem riffle)	2	2			100%
	4.**Thalweg Position**	1. Thalweg centering at upstream of meander bend (Run)	3	3			100%
		2. Thalweg centering at downstream of meander (Glide)	3	3			100%
2. Bank	**1. Scoured/Eroding**	Bank lacking vegetative cover resulting simply from poor growth and/or scour and erosion			0	0	100.0%
	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%
	3. Mass Wasting	Bank slumping, calving, or collapse			0	0	100%
				Totals	0	0	100.0%
3. Engineered Structures	**1. Overall Integrity**	Structures physically intact with no dislodged boulders or logs.	12	12			100%
	2. Grade Control	Grade control structures exhibiting maintenance of grade across the sill.	12	12			100%
	2a. Piping	Structures lacking any substantial flow underneath sills or arms.	12	12			100%
	3. Bank Protection	Bank erosion within the structures extent of influence does not exceed 15%. (See guidance for this table in EEP monitoring guidance document)	12	12			100%
	4. Habitat	Pool forming structures maintaining ~ Max Pool Depth : Mean Bankfull Depth ratio ≥ 1.6 Rootwads/logs providing some cover at base-flow.	12	12			100%

Table 4b: Visual Stream Morphology Stability Assessment
Reach ID: UT2
Assessed Length: 707 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
1. Bed	1. **Vertical Stability** (Riffle and Run units)	1. Aggradation - Bar formation/growth sufficient to significantly deflect flow laterally (not to include point bars)			0	0	100%
		2. Degradation - Evidence of downcutting			0	0	100%
	2. Riffle Condition	1. Texture/Substrate - Riffle maintains coarser substrate	22	22			100%
	3. Meander Pool Condition	1. Depth Sufficient (Max Pool Depth : Mean Bankfull Depth ≥ 1.6)	21	21			100%
		2. Length appropriate (>30% of centerline distance between tail of upstream riffle and head of downstrem riffle)	21	21			100%
	4.**Thalweg Position**	1. Thalweg centering at upstream of meander bend (Run)	22	22			100%
		2. Thalweg centering at downstream of meander (Glide)	22	22			100%
2. Bank	**1. Scoured/Eroding**	Bank lacking vegetative cover resulting simply from poor growth and/or scour and erosion			0	0	100.0%
	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%
	3. Mass Wasting	Bank slumping, calving, or collapse			0	0	100%
				Totals	0	0	100.0%
3. Engineered Structures	**1. Overall Integrity**	Structures physically intact with no dislodged boulders or logs.	21	21			100%
	2. Grade Control	Grade control structures exhibiting maintenance of grade across the sill.	21	21			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%. (See guidance for this table in EEP monitoring guidance document)	21	21			100%
	4. Habitat	Pool forming structures maintaining ~ Max Pool Depth : Mean Bankfull Depth ratio ≥ 1.6 Rootwads/logs providing some cover at base-flow.	21	21			100%

Table 4c: Visual Stream Morphology Stability Assessment Reach ID: UT3 Assessed Length: 620 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**
1. Bed	1. **Vertical Stability** (Riffle and Run units)	1. Aggradation - Bar formation/growth sufficient to significantly deflect flow laterally (not to include point bars)			0	0	100%
		2. Degradation - Evidence of downcutting			0	0	100%
	2. Riffle Condition	1. Texture/Substrate - Riffle maintains coarser substrate	13	13			100%
	3. Meander Pool Condition	1. Depth Sufficient (Max Pool Depth : Mean Bankfull Depth ≥ 1.6)	12	12			100%
		2. Length appropriate (>30% of centerline distance between tail of upstream riffle and head of downstrem riffle)	12	12			100%
	4.**Thalweg Position**	1. Thalweg centering at upstream of meander bend (Run)	13	13			100%
		2. Thalweg centering at downstream of meander (Glide)	13	13			100%
2. Bank	**1. Scoured/Eroding**	Bank lacking vegetative cover resulting simply from poor growth and/or scour and erosion			0	0	100.0%
	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%
	3. Mass Wasting	Bank slumping, calving, or collapse			0	0	100%
				Totals	0	0	100.0%
3. Engineered Structures	**1. Overall Integrity**	Structures physically intact with no dislodged boulders or logs.	14	14			100%
	2. Grade Control	Grade control structures exhibiting maintenance of grade across the sill.	14	14			100%
	2a. Piping	Structures lacking any substantial flow underneath sills or arms.	14	14			100%
	3. Bank Protection	Bank erosion within the structures extent of influence does not exceed 15%. (See guidance for this table in EEP monitoring guidance document)	14	14			100%
	4. Habitat	Pool forming structures maintaining ~ Max Pool Depth : Mean Bankfull Depth ratio ≥ 1.6 Rootwads/logs providing some cover at base-flow.	14	14			100%

Table 5 **Vegetation Condition Assessment**

Planted Acreage **15.81**

Vegetation Category	Definitions	Mapping Threshold	CCPV Depiction	Number of Polygons	Combined Acreage	% of Planted Acreage
1. Bare Areas	Very limited cover of both woody and herbaceous material.	0.44 Acres	Pink polygons filled with green x's	5	0.44	2.8%
2. Low Stem Density Areas	Woody stem densities clearly below target levels based on MY3, 4, or 5 stem count criteria.	None	N/A	N/A	N/A	N/A
			Total			
3. Areas of Poor Growth Rates or Vigor	Areas with woody stems of a size class that are obviously small given the monitoring year.	The entire site is experiencing low stem vigor.	The entire site is experiencing low stem vigor.	1	15.81	100%
			Cumulative Total			

Easement Acreage **17.33**

Vegetation Category	Definitions	Mapping Threshold	CCPV Depiction	Number of Polygons	Combined Acreage	% of Easement Acreage
4. Invasive Areas of Concern	Areas or points (if too small to render as polygons at map scale).	None	N/A	N/A	N/A	N/A
5. Easement Encroachment Areas	Areas or points (if too small to render as polygons at map scale).	None	N/A	N/A	N/A	N/A

Figures 3.1 - 3.17. Vegetation Plot Photos

3.1 Vegetation Plot 1

3.2 Vegetation Plot 2

3.3 Vegetation Plot 3

3.4 Vegetation Plot 4

3.5 Vegetation Plot 5

3.6 Vegetation Plot 6

3.7 Vegetation Plot 7

3.8 Vegetation Plot 8

3.9 Vegetation Plot 9

3.10 Vegetation Plot 10

3.11 Vegetation Plot 11

3.12 Vegetation Plot 12

3.13 Vegetation Plot 13

3.14 Vegetation Plot 14

3.15 Vegetation Plot 15

3.16 Vegetation Plot 16

3.17 Vegetation Plot 17

Table 6.
EEP Project Code 96309. Project Name: Roses Creek

			Current Plot Data (MY1 2016)																																																		Annual Means					
			96309-WFW-0001			96309-WFW-0002			96309-WFW-0003			96309-WFW-0004			96309-WFW-0005			96309-WFW-0006			96309-WFW-0007			96309-WFW-0008			96309-WFW-0009			96309-WFW-0010			96309-WFW-0011			96309-WFW-0012			96309-WFW-0013			96309-WFW-0014			96309-WFW-0015			96309-WFW-0016			96309-WFW-0017			MY1 (2016)			MY0 (2016)		
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	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T
Betula nigra	river birch	Tree	1	1	1	1	1	1	2	2	2	1	1	1	2	2	2	2	2	2	1	1	1	1	1	1	1	1	1				1	1	51	1	1	1									20	1	1	1	1	1	1	1.25	1.25	6.54	2.36	2.36	2.36
Cephalanthus occidentalis	common buttonbush	Shrub																												1	1	1	1	1	1																			1.00	1.00	1.00	1.67	1.67	1.67
Cornus alternifolia	alternateleaf dogwood	Tree																			1	1	1																															1.00	1.00	1.00	1	1	1
Cornus amomum	silky dogwood	Shrub				2	2	2	2	2	2	2	2	2	1	1	1	7	7	7	3	3	3	5	5	5	4	4	4	1	1	1	2	2	2	1	1	1	2	2	2	2	2	2	3	3	3	3	3	3	3	3	3	2.67	2.67	2.67	3.38	3.38	3.38
Cornus florida	flowering dogwood	Tree																																														1	1	1				1.00	1.00	1.00			
Fraxinus nigra	black ash	Tree													2	2	2	1	1	1																			1	1	1	1	1	1				1	1	1				1.20	1.20	1.20	1.5	1.5	1.5
Fraxinus pennsylvanica	green ash	Tree	2	2	2	3	3	3	3	3	3	3	3	3	4	4	4	9	9	9	3	3	3	2	2	2	5	5	5	5	5	5	7	7	7	3	3	3	3	3	3	2	2	2	5	5	5				1	1	1	3.93	3.93	3.93	4.63	4.63	4.63
Liriodendron tulipifera	tuliptree	Tree	1	1	1																			1	1	1	1	1	1							2	2	2	1	1	1	1	1	1	1	1	1				2	2	2	1.14	1.14	1.14	1.71	1.71	1.71
Nyssa biflora	swamp tupelo	Tree																																														1	1	1	1	1	1	1.00	1.00	1.00			
Platanus occidentalis	American sycamore	Tree	3	3	3	5	5	5	2	2	2	9	9	9	3	3	3				3	3	3	8	8	8	4	4	4	2	2	2	3	3	3	2	2	2	6	6	6	8	8	8	1	1	1	2	2	2	3	3	3	4.07	4.07	4.07	3.93	3.93	3.93
Populus heterophylla	swamp cottonwood	Tree																																														2	2	2				2.00	2.00	2.00			
Prunus serotina	black cherry	Tree																																											1	1	1						1	1.00	1.00	1.00			
Quercus michauxii	swamp chestnut oak	Tree																															2	2	2																			2.00	2.00	2.00	2	2	2
Quercus nigra	water oak	Tree																												1	1	1																						1.00	1.00	1.00	1	1	1
Quercus phellos	willow oak	Tree	4	4	4				2	2	2	1	1	1	1	1	1	1	1	1	2	2	2	2	2	2	2	2	2	1	1	1	1	1	1	3	3	3				1	1	1	1	1	1	2	2	2	1	1	1	1.71	1.71	1.71	4	4	4
Salix nigra	black willow	Tree	1	1	1																																											1	1	1				1.00	1.00	1.00	3.5	3.5	3.5
Ulmus americana	American elm	Tree	1	1	1				1	1	1	1	1	1	1	1	1																																					1.00	1.00	1.00	1.4	1.4	1.4
Unknown		Shrub or Tree																															1	1	1																			1.00	1.00	1.00			
		Stem count	13	13	13	11	11	11	12	12	12	17	17	17	14	14	14	20	20	20	13	13	13	19	19	19	17	17	17	11	11	11	18	18	68	12	12	12	13	13	13	15	15	15	12	12	32	14	14	14	12	12	13	12.00	12.00	13.00	19.4	19.4	19.4
		size (ares)	1			1			1			1			1			1			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			0.02			0.02			0.02			0.02			0.02			0.02		
		Species count	7	7	7	4	4	4	6	6	6	6	6	6	7	7	7	5	5	5	6	6	6	6	6	6	6	6	6	6	6	6	8	8	8	6	6	6	5	5	5	6	6	6	6	6	7	9	9	9	7	7	8	18	18	18	13	13	13
		Stems per ACRE	650	650	650	550	550	550	600	600	600	850	850	850	700	700	700	809	809	809	650	650	650	950	950	950	850	850	850	550	550	550	900	900	3400	600	600	600	650	650	650	750	750	750	600	600	1600	700	700	700	600	600	650	703.49	703.49	912.32	945	945	945

Color for Density

Exceeds requirements by 10%

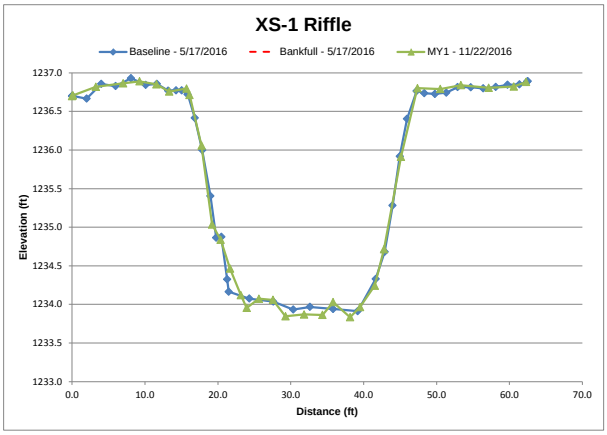
Exceeds requirements, but by less than 10%

Fails to meet requirements, by less than 10%

Fails to meet requirements by more than 10%

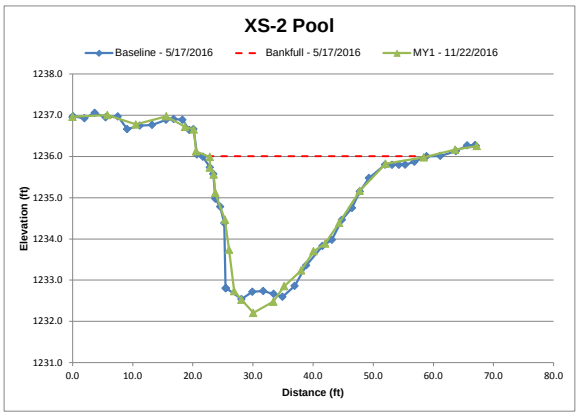
Appendix D. Stream Survey Data

River Basin	Catawba
Watershed	03050101060030
XS ID	XS 1
Drainage Area (Acres)	3,309
Date	11/22/2016
Field Crew	Bill Wollman, Alex DeGironimo



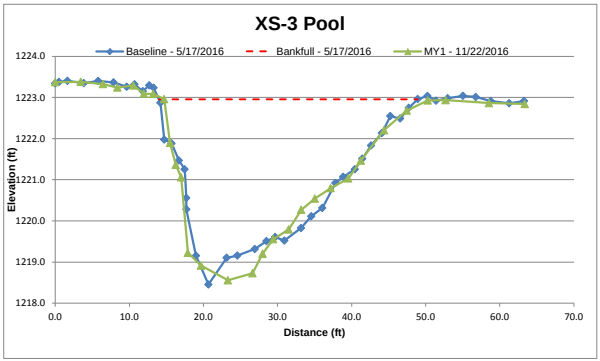
	Cross Section 1 (Riffle)							
Dimension and substrate	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**MY6**	**MY7**
Based on fixed baseline bankfull elevation								
Bankfull Width (ft)	33.80	31.20						
Floodprone Width (ft)	508.32	508.32						
Bankfull Mean Depth (ft)	2.00	2.18						
Bankfull Max Depth (ft)	2.81	2.88						
Bankfull Cross Sectional Area (ft^2)	67.70	67.97						
Bankfull Width/Depth Ratio	16.90	14.31						
Bankfull Entrenchment Ratio	15.04	16.29						
Bankfull Bank Height Ratio	1.00	1.00						

River Basin	Catawba
Watershed	03050101060030
XS ID	XS 2
Drainage Area (Acres)	3,309
Date	11/22/2016
Field Crew	Bill Wollman, Alex DeGironimo



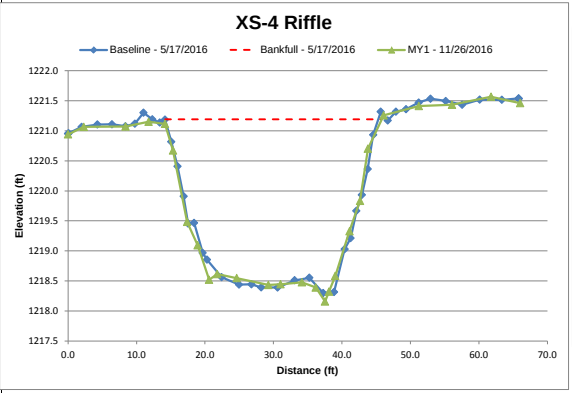
	Cross Section 2 (Pool)							
Dimension and substrate	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**MY6**	**MY7**
Based on fixed baseline bankfull elevation								
Bankfull Width (ft)	38.53	35.95						
Floodprone Width (ft)								
Bankfull Mean Depth (ft)	1.73	1.79						
Bankfull Max Depth (ft)	3.47	3.78						
Bankfull Cross Sectional Area (ft^2)	66.48	64.24						
Bankfull Width/Depth Ratio								
Bankfull Entrenchment Ratio								
Bankfull Bank Height Ratio								

River Basin	Catawba
Watershed	03050101060030
XS ID	XS 3
Drainage Area (Acres)	3,309
Date	11/22/2016
Field Crew	Bill Wollman, Alex DeGironimo



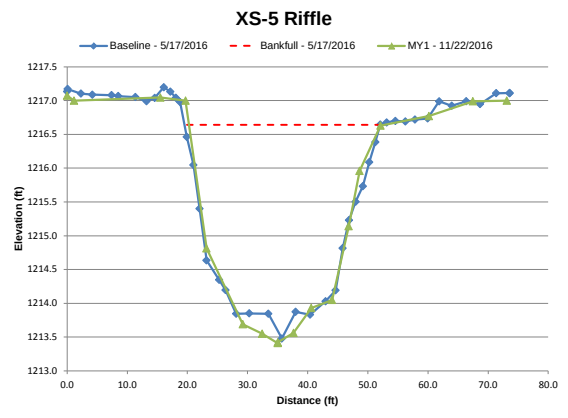
	Cross Section 3 (Pool)							
Dimension and substrate	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**MY6**	**MY7**
Based on fixed baseline bankfull elevation								
Bankfull Width (ft)	32.44	35.57						
Floodprone Width (ft)								
Bankfull Mean Depth (ft)	2.19	2.45						
Bankfull Max Depth (ft)	4.10	4.40						
Bankfull Cross Sectional Area (ft^2)	71.10	87.13						
Bankfull Width/Depth Ratio								
Bankfull Entrenchment Ratio								
Bankfull Bank Height Ratio								

River Basin	Catawba
Watershed	03050101060030
XS ID	XS 4
Drainage Area (Acres)	3,309
Date	11/22/2016
Field Crew	Bill Wollman, Alex DeGironimo



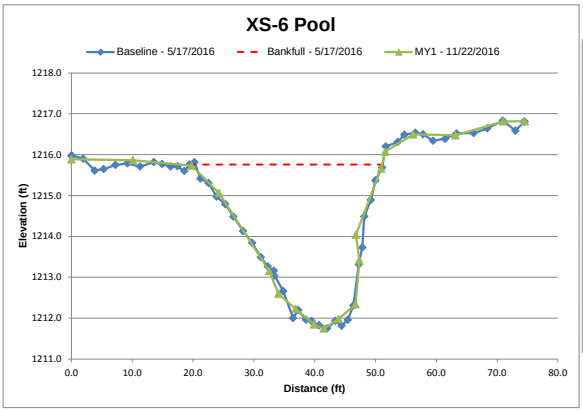
	Cross Section 4 (Riffle)							
Dimension and substrate	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**MY6**	**MY7**
Based on fixed baseline bankfull elevation								
Bankfull Width (ft)	31.11	31.42						
Floodprone Width (ft)	696.00	696.00						
Bankfull Mean Depth (ft)	2.19	2.11						
Bankfull Max Depth (ft)	2.89	2.96						
Bankfull Cross Sectional Area (ft^2)	68.21	66.2						
Bankfull Width/Depth Ratio	14.21	14.89						
Bankfull Entrenchment Ratio	22.37	22.15						
Bankfull Bank Height Ratio	1.00	1.00						

River Basin	Catawba
Watershed	03050101060030
XS ID	XS 5
Drainage Area (Acres)	3,309
Date	11/22/2016
Field Crew	Bill Wollman, Alex DeGironimo



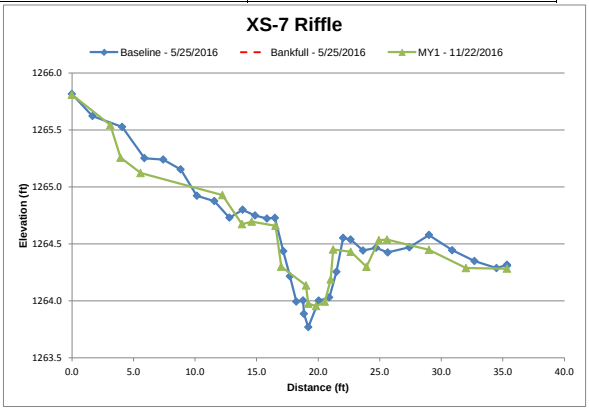
	Cross Section 5 (Riffle)							
Dimension and substrate	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**MY6**	**MY7**
Based on fixed baseline bankfull elevation								
Bankfull Width (ft)	32.56	33.03						
Floodprone Width (ft)	563.60	563.60						
Bankfull Mean Depth (ft)	2.13	2.23						
Bankfull Max Depth (ft)	3.16	3.22						
Bankfull Cross Sectional Area (ft^2)	69.41	73.79						
Bankfull Width/Depth Ratio	15.29	14.81						
Bankfull Entrenchment Ratio	17.31	17.06						
Bankfull Bank Height Ratio	1.00	1.00						

River Basin	Catawba
Watershed	03050101060030
XS ID	XS 6
Drainage Area (Acres)	3,309
Date	11/22/2016
Field Crew	Bill Wollman, Alex DeGironimo



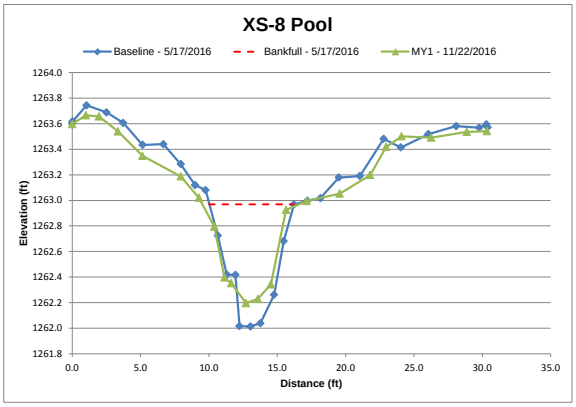
	Cross Section 6 (Pool)							
Dimension and substrate	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**MY6**	**MY7**
Based on fixed baseline bankfull elevation								
Bankfull Width (ft)	31.02	31.30						
Floodprone Width (ft)								
Bankfull Mean Depth (ft)	2.37	2.23						
Bankfull Max Depth (ft)	4.07	3.98						
Bankfull Cross Sectional Area (ft^2)	73.63	69.77						
Bankfull Width/Depth Ratio								
Bankfull Entrenchment Ratio								
Bankfull Bank Height Ratio								

River Basin	Catawba
Watershed	03050101060030
XS ID	XS 7
Drainage Area (Acres)	38.40
Date	11/22/2016
Field Crew	Bill Wollman, Alex DeGironimo



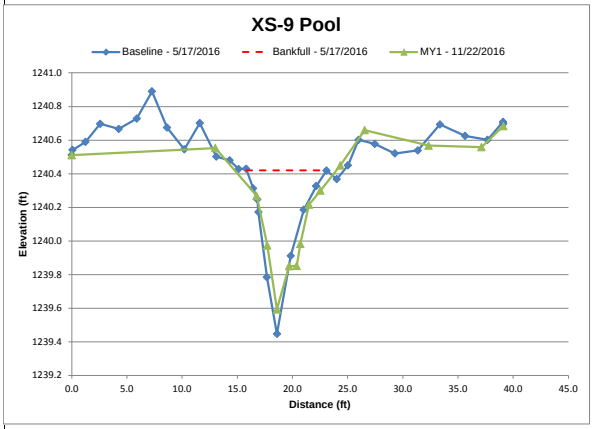
	Cross Section 7 (Riffle)							
Dimension and substrate	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**MY6**	**MY7**
Based on fixed baseline bankfull elevation								
Bankfull Width (ft)	5.12	4.46						
Floodprone Width (ft)	91.80	91.80						
Bankfull Mean Depth (ft)	0.45	0.41						
Bankfull Max Depth (ft)	0.78	0.59						
Bankfull Cross Sectional Area (ft^2)	2.30	1.82						
Bankfull Width/Depth Ratio	11.38	10.88						
Bankfull Entrenchment Ratio	17.93	20.58						
Bankfull Bank Height Ratio	1.00	1.00						

River Basin	Catawba
Watershed	03050101060030
XS ID	XS 8
Drainage Area (Acres)	38.40
Date	11/22/2016
Field Crew	Bill Wollman, Alex DeGironimo



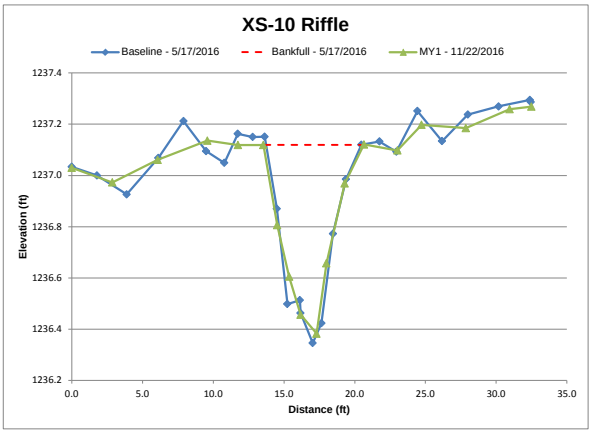
	Cross Section 8 (Pool)							
Dimension and substrate	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**MY6**	**MY7**
Based on fixed baseline bankfull elevation								
Bankfull Width (ft)	6.24	6.00						
Floodprone Width (ft)								
Bankfull Mean Depth (ft)	0.58	0.47						
Bankfull Max Depth (ft)	0.96	0.73						
Bankfull Cross Sectional Area (ft^2)	3.64	2.83						
Bankfull Width/Depth Ratio								
Bankfull Entrenchment Ratio								
Bankfull Bank Height Ratio								

River Basin	Catawba
Watershed	03050101060030
XS ID	XS 9
Drainage Area (Acres)	44.80
Date	11/22/2016
Field Crew	Bill Wollman, Alex DeGironimo



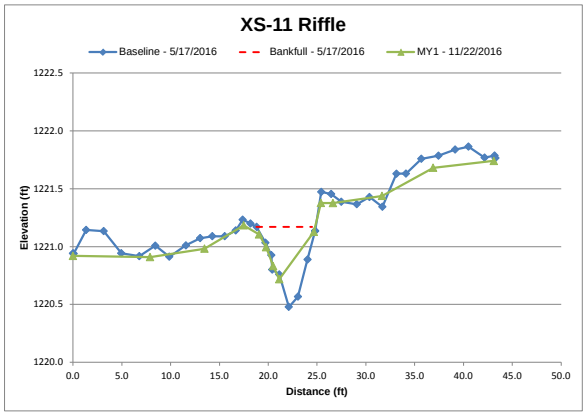
	Cross Section 9 (Pool)							
Dimension and substrate	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**MY6**	**MY7**
Based on fixed baseline bankfull elevation								
Bankfull Width (ft)	5.56	5.70						
Floodprone Width (ft)								
Bankfull Mean Depth (ft)	0.37	0.48						
Bankfull Max Depth (ft)	0.86	0.86						
Bankfull Cross Sectional Area (ft^2)	2.07	2.72						
Bankfull Width/Depth Ratio								
Bankfull Entrenchment Ratio								
Bankfull Bank Height Ratio	1.00	1.00						

River Basin	Catawba
Watershed	03050101060030
XS ID	XS 10
Drainage Area (Acres)	44.80
Date	11/22/2016
Field Crew	Bill Wollman, Alex DeGironimo



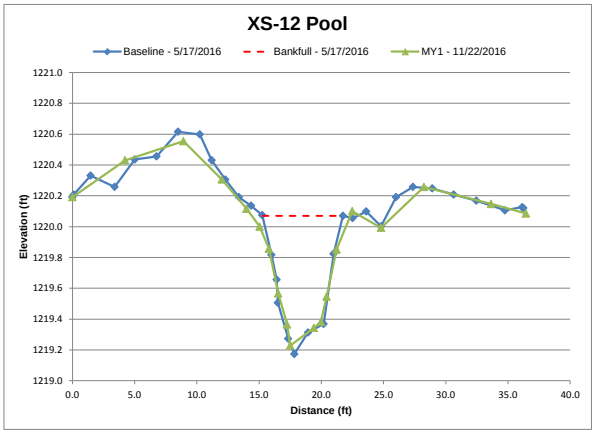
	Cross Section 10 (Riffle)							
Dimension and substrate	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**MY6**	**MY7**
Based on fixed baseline bankfull elevation								
Bankfull Width (ft)	6.7	7.1						
Floodprone Width (ft)	93.36	93.36						
Bankfull Mean Depth (ft)	0.4	0.38						
Bankfull Max Depth (ft)	0.77	0.74						
Bankfull Cross Sectional Area (ft^2)	2.79	2.69						
Bankfull Width/Depth Ratio	16.75	18.68						
Bankfull Entrenchment Ratio	13.93	13.14						
Bankfull Bank Height Ratio	1.00	1.00						

River Basin	Catawba
Watershed	03050101060030
XS ID	XS 11
Drainage Area (Acres)	12.80
Date	11/22/2016
Field Crew	Bill Wollman, Alex DeGironimo



	Cross Section 11 (Riffle)							
Dimension and substrate	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**MY6**	**MY7**
Based on fixed baseline bankfull elevation								
Bankfull Width (ft)	6.00	7.28						
Floodprone Width (ft)	175.41	175.41						
Bankfull Mean Depth (ft)	0.36	0.21						
Bankfull Max Depth (ft)	0.69	0.46						
Bankfull Cross Sectional Area (ft^2)	2.19	1.51						
Bankfull Width/Depth Ratio	16.67	34.67						
Bankfull Entrenchment Ratio	29.24	24.09						
Bankfull Bank Height Ratio	1.00	1.00						

River Basin	Catawba
Watershed	03050101060030
XS ID	XS 12
Drainage Area (Acres)	12.80
Date	11/22/2016
Field Crew	Bill Wollman, Alex DeGironimo



	Cross Section 12 (Pool)							
Dimension and substrate	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**MY6**	**MY7**
Based on fixed baseline bankfull elevation								
Bankfull Width (ft)	8.85	8.34						
Floodprone Width (ft)								
Bankfull Mean Depth (ft)	0.4	0.46						
Bankfull Max Depth (ft)	0.9	0.87						
Bankfull Cross Sectional Area (ft^2)	3.61	3.85						
Bankfull Width/Depth Ratio								
Bankfull Entrenchment Ratio								
Bankfull Bank Height Ratio								

Table 7. Baseline Stream Data Summary
Roses Creek Mitigation Site
Roses Creek: 3,200 LF.

Parameter	Regional Curve		Pre-Existing Condition	Reference - Roses Creek Upstream	Design	As-built/Baseline					
Dimension and Substrate - Riffle	Eq. Mountains	Eq. Piedmont	Mean	Mean	Mean	Min	Mean	Med	Max	SD	n
Bankfull Width (ft)	35.00	26.20	41.10	30.50	30.50	31.02	31.98	31.11	33.80	1.58	3.00
Floodprone Width (ft)			78.90	250.00	480.00	394.24	524.76	508.32	671.72	139.47	3.00
Bankfull Mean Depth (ft)	1.80	2.60	1.67	1.88	2.18	2.00	2.19	2.19	2.37	0.19	3.00
Bankfull Max Depth (ft)			2.92	2.71	2.72	2.81	3.26	2.89	4.07	0.71	3.00
Bankfull Cross Sectional Area (ft^2)	66.00	66.10	68.83	57.40	66.40	67.70	69.85	68.21	73.63	3.29	3.00
Width/Depth Ratio			24.60	16.20	14.00	13.09	14.73	14.21	16.90	1.96	3.00
Entrenchment Ratio			1.92	8.20	15.70	12.67	16.45	15.04	21.65	4.65	3.00
Bank Height Ratio			1.80	1.00	1.00	1.00	1.00	1.00	1.00	0.00	3.00
d50 (mm)			61.30	61.30	61.30						
Profile											
Riffle Length (ft)						37.17	64.41	58.40	106.19	18.18	23.00
Riffle Slope (ft/ft)			0.01	0.02	0.03	0.01	0.02	0.02	0.05	0.01	23.00
Pool Length (ft)						17.36	53.01	54.24	93.29	20.18	26.00
Pool Max depth (ft)			4.13	4.70	4.36	3.31	4.50	4.43	6.20	0.80	26.00
Pool Spacing (ft)			37.00 - 171.00	76.9 - 227.9	2.0 - 7.5	86.78	130.47	130.18	210.45	35.20	25.00
Pool Cross Sectional Area (ft^2)											
Pattern											
Channel Beltwidth (ft)			73.00 - 152.00	30.0 - 195.0	61.0 - 195.2						
Radius of Curvature (ft)			28 - 168	30.0 - 178.0	61.0 - 91.5						
Rc: Bankfull Width (ft/ft)			0.7 - 4.1	1.0 - 5.8	2.0 - 3.0						
Meander Wavelength (ft)			200 - 375	60 - 344	61.0 - 344.0						
Meander Width Ratio			1.78 - 3.70	1.0 - 6.4	2.0 - 6.4						
Substrate, bed and transport parameters											
Ri% / P%						35% / 65%					
SC% / Sa% / G% / C% / B% / Be%											
d16 / d35 / d50 / d84 / d95/ di^3 / di^{50} (mm)											
Reach Shear Stress (competency) lb/ft^2											
Max part size (mm) mobilized at bankfull											
Unit Stream Power (transport capacity) lbs/ft.s			3.83		3.83	3.83					
Additional Reach Parameters											
Drainage Area (SM)			5.17	4.66	5.17						
Impervious cover estimate (%)											
Rosgen Classification			B4	C4	C4	C4					
Bankfull Velocity (fps)				5.10	4.80						
Bankfull Discharge (cfs)			300.00	295.00	300.00						
Valley length (ft)			2894.00		2894.00	2894.00					
Channel Thalweg length (ft)			3425.00		3219.00	3219.00					
Sinuosity (ft)			1.18	1.11	1.11	1.11					
Water Surface Slope (Channel) (ft/ft)			0.0099	0.0192	0.0062	0.0059					
BF slope (ft/ft)					0.0062	0.0059					
Bankfull Floodplain Area (acres)											
Proportion over wide (%)											
Entrenchment Class (ER Range)											
Incision Class (BHR Range)											
BEHI VL% / L% / M% / H% / VH% / E%											
Channel Stability or Habitat Metric											
Biological or Other											

Table 7a. Baseline Stream Data Summary
Roses Creek Mitigation Site
UT 1 to Roses Creek: 234 LF

Parameter	Regional Curve		Pre-Existing Condition	Reference - UT West Branch Rocky River	Design	As-built/Baseline					
Dimension and Substrate - Riffle	Eq. Mountains	Eq. Piedmont	Mean	Mean	Mean	Min	Mean	Med	Max	SD	n
Bankfull Width (ft)	6.70	5.30	6.00	4.40	5.00	5.12	5.12	5.12	5.12	0.00	1.00
Floodprone Width (ft)			8.40	27.50	60.00	91.80	91.80	91.80	91.80	0.00	1.00
Bankfull Mean Depth (ft)	0.50	0.70	0.23	0.51	0.38	0.45	0.45	0.45	0.45	0.00	1.00
Bankfull Max Depth (ft)			0.36	1.00	0.58	0.78	0.78	0.78	0.78	0.00	1.00
Bankfull Cross Sectional Area (ft^2)	3.20	3.30	1.39	2.30	2.10	2.30	2.30	2.30	2.30	0.00	1.00
Width/Depth Ratio			26.20	12.80	13.00	11.38	11.38	11.38	11.38	0.00	1.00
Entrenchment Ratio			1.40	6.28	12.00	17.93	17.93	17.93	17.93	0.00	1.00
Bank Height Ratio			6.11	1.00	1.00	1.00	1.00	1.00	1.00	0.00	1.00
d50 (mm)											
Profile											
Riffle Length (ft)						7.20	10.60	9.60	17.00	2.91	12.00
Riffle Slope (ft/ft)			0.0260	0.0033 - 0.0284	0.0021 - 0.0029	0.0201	0.0265	0.0213	0.0799	0.0210	12.00
Pool Length (ft)						3.60	11.89	9.80	37.39	9.23	11.00
Pool Max depth (ft)			Channelized	1.98	0.77	0.49	0.73	0.77	0.96	0.19	11.00
Pool Spacing (ft)			Channelized	10.10 - 41.0	10.0 - 30.0	18.40	24.04	20.90	45.59	8.03	10.00
Pool Cross Sectional Area (ft^2)											
Pattern											
Channel Beltwidth (ft)			Channelized	12.00 - 18.00	10.00 - 30.00						
Radius of Curvature (ft)			Channelized	10.00 - 14.00	12.00 - 15.00						
Rc: Bankfull Width (ft/ft)			Channelized	2.30 - 3.20	2.40 - 3.00						
Meander Wavelength (ft)			Channelized	45.00 - 66.00	20.0 - 55.0						
Meander Width Ratio			Channelized	2.74 - 4.11	2.00 - 6.00						
Substrate, bed and transport parameters											
Ri% / P%						49% / 51%					
SC% / Sa% / G% / C% / B% / Be%											
d16 / d35 / d50 / d84 / d95/ di^p / di^{sp} (mm)											
Reach Shear Stress (competency) lb/ft^2											
Max part size (mm) mobilized at bankfull											
Unit Stream Power (transport capacity) lbs/ft.s			0.07		0.07	0.07					
Additional Reach Parameters											
Drainage Area (SM)			0.06	0.07	0.06						
Impervious cover estimate (%)											
Rosgen Classification			F5	C5	C5	C5					
Bankfull Velocity (fps)				1.30	1.10						
Bankfull Discharge (cfs)			2.4	3.00	2.40						
Valley length (ft)			199.00		199.00	199.00					
Channel Thalweg length (ft)			199.00		234.00	234.00					
Sinuosity (ft)			1.00	1.16	1.18	1.18					
Water Surface Slope (Channel) (ft/ft)			0.0260	0.0033 - 0.0284	0.0021	0.0027					
BF slope (ft/ft)					0.0021	0.0027					
Bankfull Floodplain Area (acres)											
Proportion over wide (%)											
Entrenchment Class (ER Range)											
Incision Class (BHR Range)											
BEHI VL% / L% / M% / H% / VH% / E%											
Channel Stability or Habitat Metric											
Biological or Other											

Table 7b. Baseline Stream Data Summary
Roses Creek Mitigation Site
UT 2 to Roses Creek: 707 LF

Parameter	Regional Curve		Pre-Existing Condition	Reference - UT West Branch Rocky River	Design	As-built/Baseline					
Dimension and Substrate - Riffle	Mountains Eq.	Piedmont Eq.	Mean	Mean	Mean	Min	Mean	Med	Max	SD	n
Bankfull Width (ft)	7.10	5.60	4.40	4.40	5.00	6.70	6.70	6.70	6.70	0.00	1.00
Floodprone Width (ft)			8.10	27.50	60.00	32.45	32.45	32.45	32.45	0.00	1.00
Bankfull Mean Depth (ft)	0.50	0.80	0.95	0.51	0.38	0.42	0.42	0.42	0.42	0.00	1.00
Bankfull Max Depth (ft)			1.39	1.00	0.58	0.77	0.77	0.77	0.77	0.00	1.00
Bankfull Cross Sectional Area (ft^2)	3.50	3.70	4.16	2.30	2.10	2.79	2.79	2.79	2.79	0.00	1.00
Width/Depth Ratio			4.60	12.80	13.00	15.95	15.95	15.95	15.95	0.00	1.00
Entrenchment Ratio			1.84	6.28	12.00	4.84	4.84	4.84	4.84	0.00	1.00
Bank Height Ratio			1.70	1.00	1.00	1.00	1.00	1.00	1.00	0.00	1.00
d50 (mm)											
Profile											
Riffle Length (ft)						4.27	13.94	13.33	31.46	6.12	23.00
Riffle Slope (ft/ft)			0.0260	0.0033 - 0.0284	0.0021 - 0.0030	0.0020	0.0025	0.0025	0.0038	0.0006	23.00
Pool Length (ft)						3.73	10.18	8.00	27.19	5.71	24.00
Pool Max depth (ft)			Channelized	1.98	0.77	0.53	0.96	0.92	1.59	0.24	24.00
Pool Spacing (ft)			Channelized	10.10 - 41.00	10.0 - 30.00	7.46	25.57	22.39	57.59	11.77	23.00
Pool Cross Sectional Area (ft^2)											
Pattern											
Channel Beltwidth (ft)			Channelized	12.00 - 18.00	13.70 - 30.00						
Radius of Curvature (ft)			Channelized	10.00 - 14.00	12.00 - 16.00						
Rc: Bankfull Width (ft/ft)			Channelized	2.30 - 3.20	2.40 - 3.20						
Meander Wavelength (ft)			Channelized	45.00 - 66.00	20.00 - 75.50						
Meander Width Ratio			Channelized	2.74 - 4.11	2.70 - 6.00						
Substrate, bed and transport parameters											
Ri% / P%						58% / 42%					
SC% / Sa% / G% / C% / B% / Be%											
d16 / d35 / d50 / d84 / d95/ di^p / di^{sp} (mm)											
Reach Shear Stress (competency) lb/ft^2											
Max part size (mm) mobilized at bankfull											
Unit Stream Power (transport capacity) lbs/ft.s			0.89		0.06	0.06					
Additional Reach Parameters											
Drainage Area (SM)			0.07	0.07	0.07						
Impervious cover estimate (%)											
Rosgen Classification			G5	C5	C5	C5					
Bankfull Velocity (fps)				1.30	1.10						
Bankfull Discharge (cfs)			2.40	3.00	2.40						
Valley length (ft)			575.00		575.00	575.00					
Channel Thalweg length (ft)			575.00		707.00	707.00					
Sinuosity (ft)			1.00	1.16	1.99	1.23					
Water Surface Slope (Channel) (ft/ft)			0.0260	0.0033 - 0.0284	0.0021	0.0023					
BF slope (ft/ft)					0.0021	0.0023					
Bankfull Floodplain Area (acres)											
Proportion over wide (%)											
Entrenchment Class (ER Range)											
Incision Class (BHR Range)											
BEHI VL% / L% / M% / H% / VH% / E%											
Channel Stability or Habitat Metric											
Biological or Other											

Table 7c. Baseline Stream Data Summary
Roses Creek Mitigation Site
UT 3 to Roses Creek: 620 LF

Parameter	Regional Curve		Pre-Existing Condition	Reference - UT West Branch Rocky River	Design	As-built/Baseline					
Dimension and Substrate - Riffle	Mountains Eq.	Piedmont Eq.	Mean	Mean	Mean	Min	Mean	Med	Max	SD	n
Bankfull Width (ft)	4.50	3.50	5.00	4.40	5.50	6.00	6.00	6.00	6.00	0.00	1
Floodprone Width (ft)			44.13	27.50	70.00	175.41	175.41	175.41	175.41	0.00	1
Bankfull Mean Depth (ft)	0.30	0.30	0.26	0.51	0.42	0.36	0.36	0.36	0.36	0.00	1
Bankfull Max Depth (ft)			1.70	1.00	0.63	0.69	0.69	0.69	0.69	0.00	1
Bankfull Cross Sectional Area (ft^2)	1.50	1.60	2.40	2.30	2.60	2.19	2.19	2.19	2.19	0.00	1
Width/Depth Ratio			12.23	12.80	13.10	16.67	16.67	16.67	16.67	0.00	1
Entrenchment Ratio			9.52	6.28	12.70	29.24	29.24	29.24	29.24	0.00	1
Bank Height Ratio			3.33	1.00	1.00	1.00	1.00	1.00	1.00	0.00	1
d50 (mm)											
Profile											
Riffle Length (ft)						4.0	13.7	11.1	46.1	9.2	20
Riffle Slope (ft/ft)			0.0295	0.0033 - 0.0284	0.0029 - 0.0045	0.0025	0.0030	0.0030	0.0035	0.0004	20
Pool Length (ft)						3.2	12.1	8.1	34.6	9.0	20
Pool Max depth (ft)			Channelized	1.98	0.84	0.76	1.49	1.29	2.61	0.61	20
Pool Spacing (ft)			Channelized	10.10 - 41.00	12.7 - 51.70	10.3	25.0	25.8	45.3	9.4	19
Pool Cross Sectional Area (ft^2)											
Pattern											
Channel Beltwidth (ft)			Channelized	12.00 - 18.00	15.10 - 49.50						
Radius of Curvature (ft)			Channelized	10.00 - 14.00	12.70 - 17.60						
Rc: Bankfull Width (ft/ft)			Channelized	2.30 - 3.20	2.30 - 3.20						
Meander Wavelength (ft)			Channelized	45.00 - 66.00	15.10 - 83.10						
Meander Width Ratio			Channelized	2.74 - 4.11	2.70 - 9.00						
Substrate, bed and transport parameters											
Ri% / P%						53% / 47%					
SC% / Sa% / G% / C% / B% / Be%											
d16 / d35 / d50 / d84 / d95/ di^p / di^{sp} (mm)											
Reach Shear Stress (competency) lb/ft^2											
Max part size (mm) mobilized at bankfull											
Unit Stream Power (transport capacity) lbs/ft.s			0.09		0.08	0.08					
Additional Reach Parameters											
Drainage Area (SM)			0.02	0.07	0.02						
Impervious cover estimate (%)											
Rosgen Classification			B5	C5	C5	C5					
Bankfull Velocity (fps)				1.30	1.00						
Bankfull Discharge (cfs)			2.6	3.0	2.6						
Valley length (ft)			422		422	422					
Channel Thalweg length (ft)			422		620	620					
Sinuosity (ft)			1.00	1.16	1.47	1.47					
Water Surface Slope (Channel) (ft/ft)			0.0268	0.0033 - 0.0284	0.0021	0.0037					
BF slope (ft/ft)					0.0021	0.0037					
Bankfull Floodplain Area (acres)											
Proportion over wide (%)											
Entrenchment Class (ER Range)											
Incision Class (BHR Range)											
BEHI VL% / L% / M% / H% / VH% / E%											
Channel Stability or Habitat Metric											
Biological or Other											

Table 8. Morphology and Hydraulic Monitoring Summary (Dimensional Parameters - Cross Section) Roses Creek Mitigation Site

Roses Creek: 3,200 LF

	Cross Section 1 (Riffle)							Cross Section 2 (Pool)						
Dimension	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+
Based on fixed baseline bankfull elevation														
Bankfull Width (ft)	33.80	31.20						38.53	35.95					
Floodprone Width (ft)	508.32	508.32												
Bankfull Mean Depth (ft)	2.00	2.18						1.73	1.79					
Bankfull Max Depth (ft)	2.81	2.88						3.47	3.78					
Bankfull Cross Sectional Area (ft^2)	67.70	67.97						66.48	64.24					
Bankfull Width/Depth Ratio	16.90	14.31												
Bankfull Entrenchment Ratio	15.04	16.29												
Bankfull Bank Height Ratio	1.00	1.00						1.00	1.00					
	Cross Section 3 (Pool)							**Cross Section 4 (Riffle)**						
Dimension	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+
Based on fixed baseline bankfull elevation														
Bankfull Width (ft)	32.44	35.57						31.11	31.42					
Floodprone Width (ft)								696.00	696.00					
Bankfull Mean Depth (ft)	2.19	2.45						2.19	2.11					
Bankfull Max Depth (ft)	4.10	4.40						2.89	2.96					
Bankfull Cross Sectional Area (ft^2)	71.10	87.13						68.21	66.20					
Bankfull Width/Depth Ratio								14.21	14.89					
Bankfull Entrenchment Ratio								22.37	22.15					
Bankfull Bank Height Ratio	1.00	1.00						1.00	1.00					
	Cross Section 5 (Riffle)							**Cross Section 6 (Pool)**						
Dimension	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+
Based on fixed baseline bankfull elevation[1]														
Bankfull Width (ft)	32.56	33.03						31.02	31.30					
Floodprone Width (ft)	563.60	563.60												
Bankfull Mean Depth (ft)	2.13	2.23						2.37	2.23					
Bankfull Max Depth (ft)	3.16	3.22						4.07	3.98					
Bankfull Cross Sectional Area (ft^2)	69.41	73.79						73.63	69.77					
Bankfull Width/Depth Ratio	15.29	14.81												
Bankfull Entrenchment Ratio	17.31	17.06												
Bankfull Bank Height Ratio	1.00	1.00						1.00	1.00					

Table 8a. Morphology and Hydraulic Monitoring Summary (Dimensional Parameters - Cross Section) Roses Creek Mitigation Site UT 1 Roses Creek: 234 LF														
	Cross Section 7 (Riffle)							Cross Section 8 (Pool)						
Dimension	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+
Based on fixed baseline bankfull elevation														
Bankfull Width (ft)	5.12	4.46						6.24	6					
Floodprone Width (ft)	91.80	91.80												
Bankfull Mean Depth (ft)	0.45	0.41						0.58	0.47					
Bankfull Max Depth (ft)	0.78	0.59						0.96	0.73					
Bankfull Cross Sectional Area (ft^2)	2.30	1.82						3.64	2.83					
Bankfull Width/Depth Ratio	11.38	10.88												
Bankfull Entrenchment Ratio	17.93	20.58												
Bankfull Bank Height Ratio	1.00	1.00						1.00	1					

Table 8b. Morphology and Hydraulic Monitoring Summary (Dimensional Parameters - Cross Section) Roses Creek Mitigation Site UT2 Roses Creek: 707 LF																
	Cross Section 9 (Riffle)								Cross Section 10 (Pool)							
Dimension	Base	MY1	MY2	MY3	MY4	MY5	MY6	MY7	Base	MY1	MY2	MY3	MY4	MY5	MY6	MY7
Based on fixed baseline bankfull elevation																
Bankfull Width (ft)	5.56	4.76							6.70	7.1						
Floodprone Width (ft)	418.38	418.38														
Bankfull Mean Depth (ft)	0.37	0.52							0.42	0.38						
Bankfull Max Depth (ft)	0.86	0.84							0.77	0.74						
Bankfull Cross Sectional Area (ft^2)	2.07	2.48							2.79	2.69						
Bankfull Width/Depth Ratio	15.03	9.15														
Bankfull Entrenchment Ratio	75.25	87.89														
Bankfull Bank Height Ratio	1.00	1.00							1.00	1.00						

Table 8c. Morphology and Hydraulic Monitoring Summary (Dimensional Parameters - Cross Section) Roses Creek Mitigation Site UT3 Roses Creek: 620 LF																
	Cross Section 11 (Riffle)								Cross Section 12 (Pool)							
Dimension	Base	MY1	MY2	MY3	MY4	MY5	MY6	MY7	Base	MY1	MY2	MY3	MY4	MY5	MY6	MY7
Based on fixed baseline bankfull elevation																
Bankfull Width (ft)	6.00	7.28							8.85	8.34						
Floodprone Width (ft)	175.41	175.41														
Bankfull Mean Depth (ft)	0.36	0.21							0.41	0.46						
Bankfull Max Depth (ft)	0.69	0.46							0.90	0.87						
Bankfull Cross Sectional Area (ft^2)	2.19	1.51							3.61	3.85						
Bankfull Width/Depth Ratio	16.67	34.67														
Bankfull Entrenchment Ratio	29.24	24.09														
Bankfull Bank Height Ratio	1.00	1.00							1.00	1.00						

Appendix E. Hydrologic Data

Table 9. Verification of Bankfull Events

Date	Crest Gauge Info		Gauge Reading (ft)	Gauge Elevation (ft)	Crest Elevation (ft)	Bankfull Elevation (ft)	Height above Bankfull (ft)	Photo
	Site	Sta.						
10/5/2016	1	Roses Creek Lower	0.00	1212.11	N/A	1213.93	N/A	5.1
10/5/2016	2	UT 1	0.00	1267.45	N/A	1267.95	N/A	5.2
10/5/2016	3	UT 2	0.35	1227.81	1228.16	1228.19	N/A	5.3
10/5/2016	4	UT 3	0.25	1216.94	1217.19	1217.36	N/A	5.4
11/22/2016	1	Roses Creek Lower	0.00	1212.11	N/A	1213.93	N/A	5.5
11/22/2016	2	UT 1	0.00	1267.45	N/A	1267.95	N/A	5.6
11/22/2016	3	UT 2	0.00	1227.81	N/A	1228.19	N/A	5.7
11/22/2016	4	UT 3	0.35	1216.94	1217.29	1217.36	N/A	5.8

Figures 5.1 - 5.4 Crest Gauge Photos

5.1 Crest Gauge Roses Creek Lower (10/5/2016)

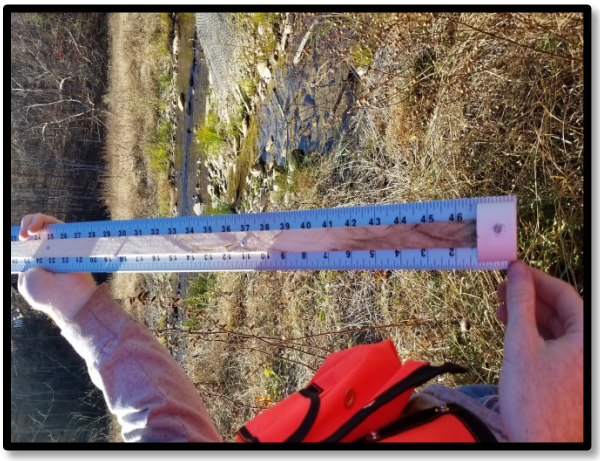
5.2 Crest Gauge UT 1 (10/5/2016)

5.3 Crest Gauge UT 2 (10/5/2016)

5.4 Crest Gauge UT 3 (10/5/2016)

5.5 Crest Gauge Roses Creek (11/22/2016)

5.6 Crest Gauge UT 1 (11/22/2016)



5.7 Crest Gauge UT 2 (11/22/2016)

5.8 Crest Gauge UT 3 (11/22/2016)

Table 10. Burke County Drought Status

Month	Drought Status
June	Abnormally Dry
July	Abnormally Dry
August	Abnormally Dry
September	Moderate Drought
October	Moderate Drought
November	Severe Drought

Source: NC Drought Management Advisory Council

Figure 6.1 UT 1 Water Level

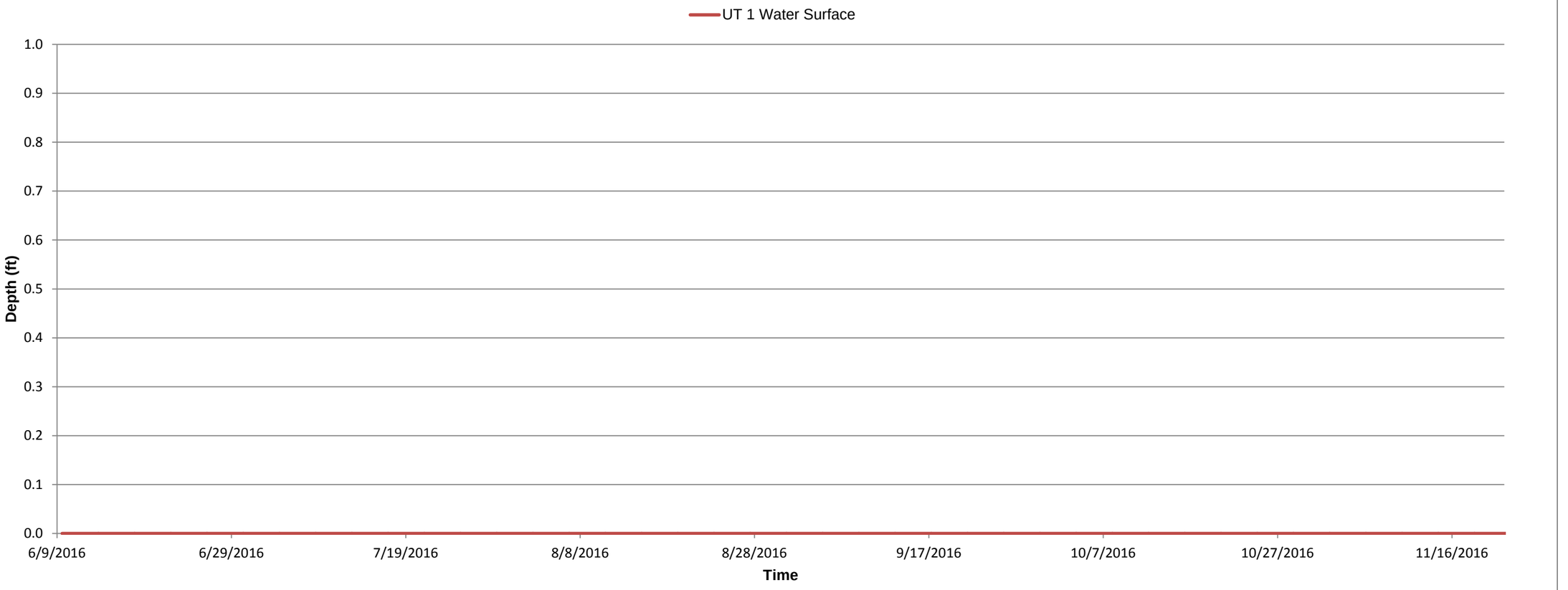


Figure 6.2 UT 2 Water Level

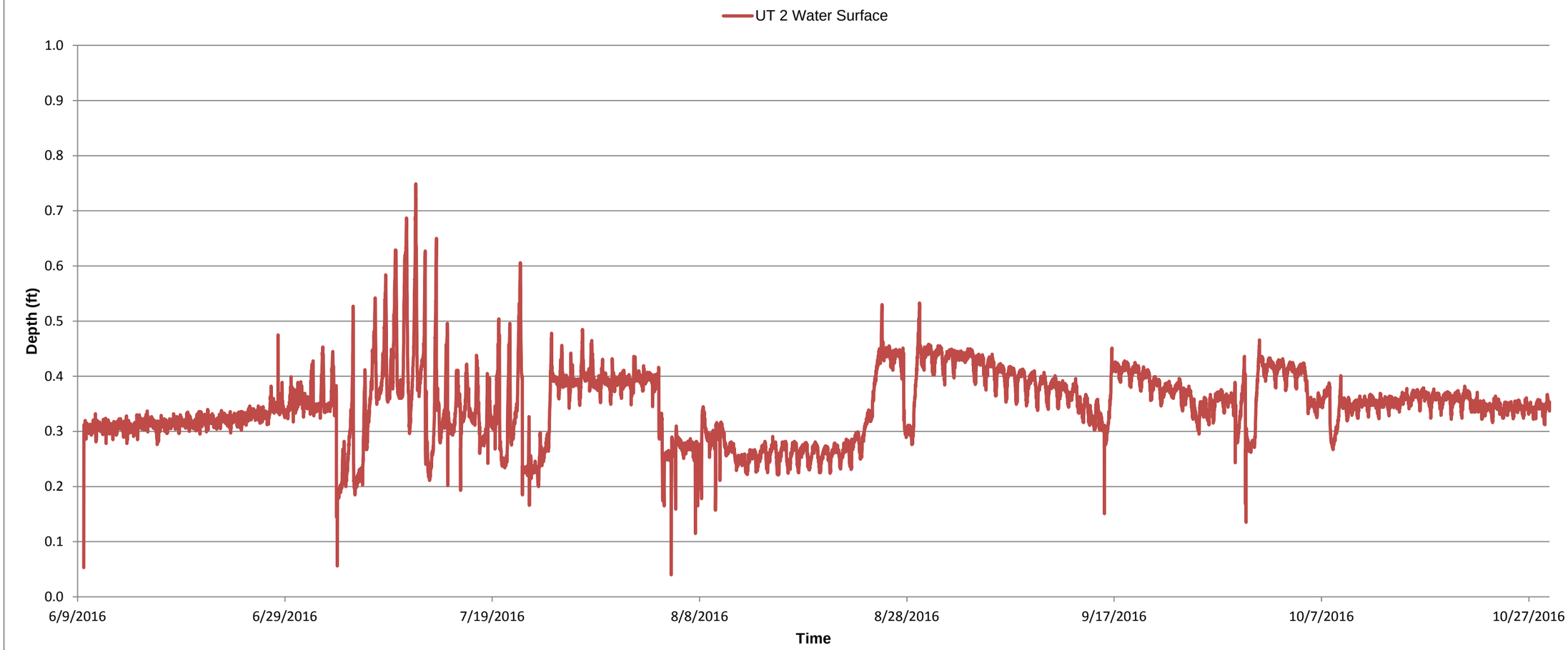
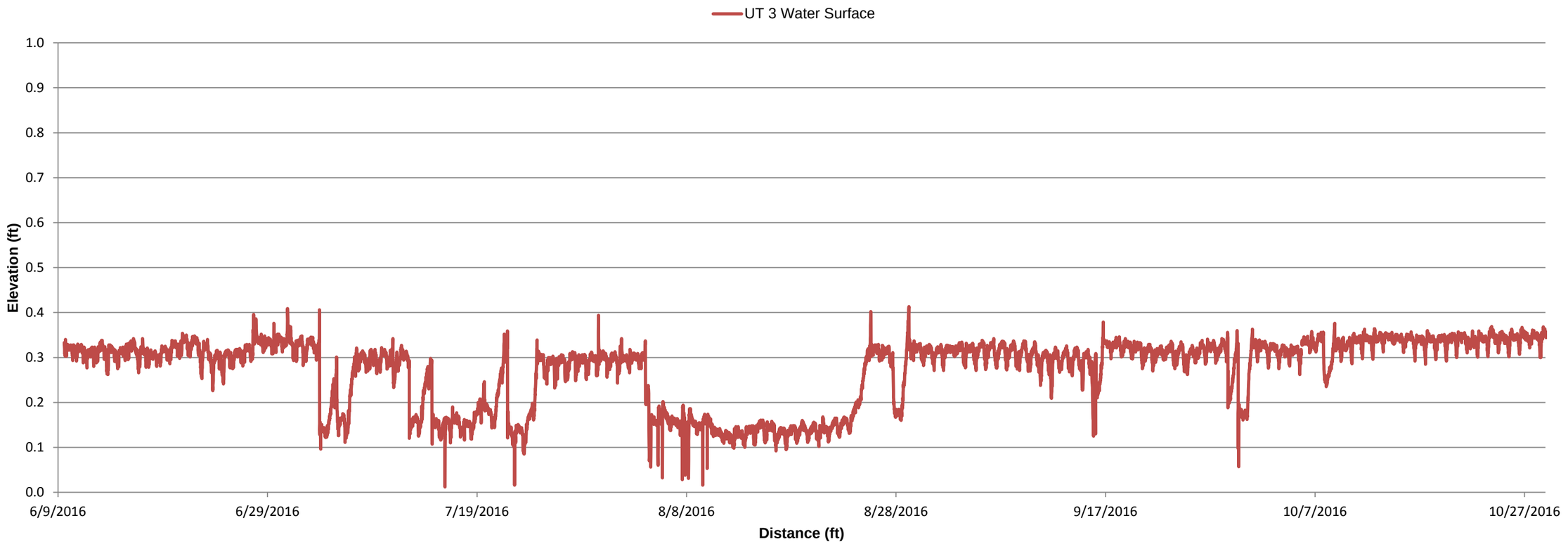
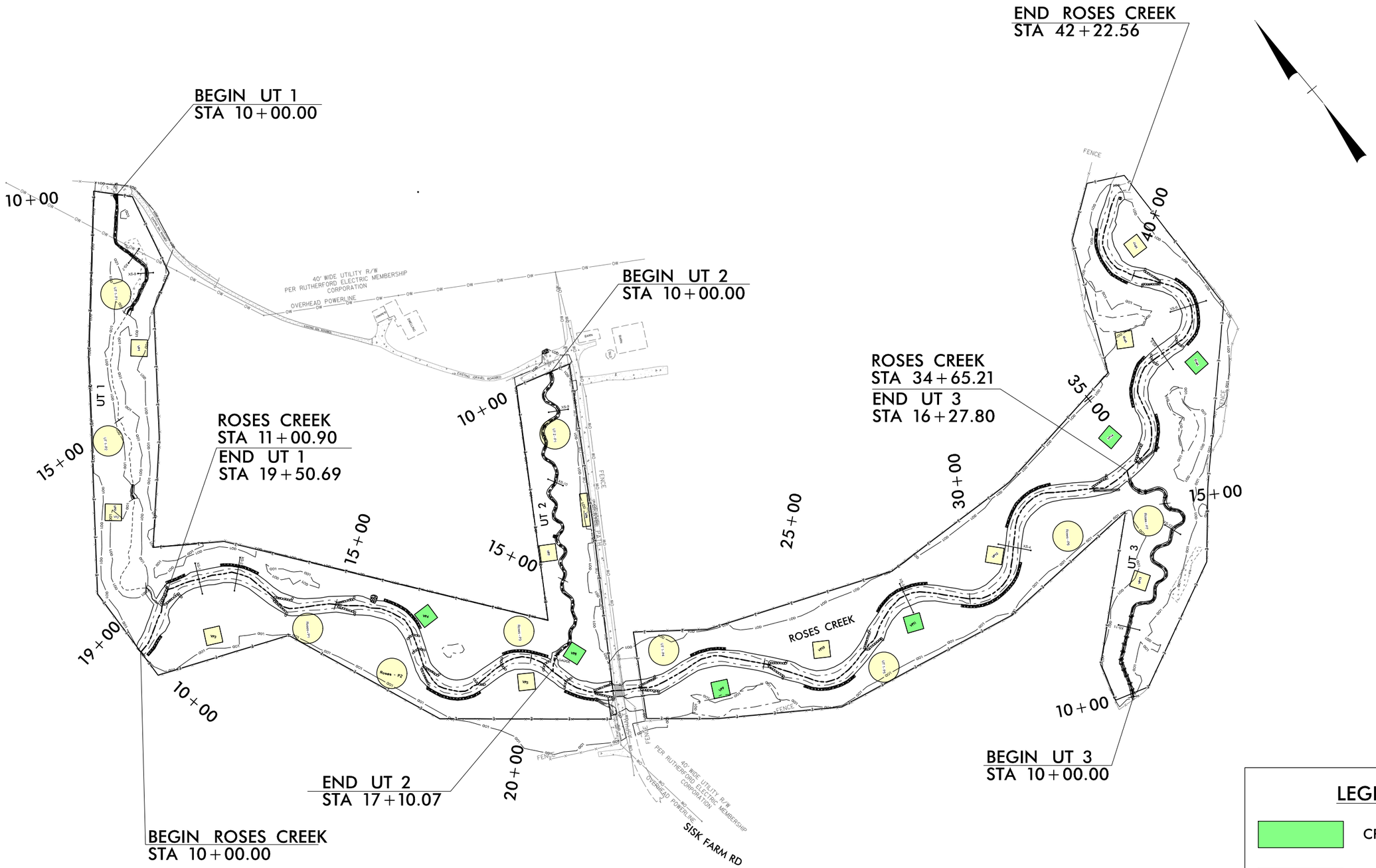


Figure 6.3 UT 3 Water Level



Appendix F. Warranty Plots

VEGETATION MORTALITY MAP



LEGEND

CRITERIA MET

CRITERIA UNMET

VEGETATION MORTALITY CRITERIA
85% SURVIVAL (578 STEMS/AC)

5121 Kingdom Way,
Suite 100
Raleigh, NC 27607
NC License No: P-0258

ICA Engineering

ROSES CREEK
STREAM RESTORATION PROJECT
BURKE COUNTY, NORTH CAROLINA

GRAPHIC SCALE
200 100 0 100 200
PLANS

DATE: 11-14-16

VEGETATION MORTALITY MAP

SHEET
2

EEP# 963090

11/14/2016
11:15:28 AM
H:\Projects\Project_Development\5.2_Work_In_Progress\Docs\Monitoring\2016.10.13_Vegetation_Mortality_Following_Year_1_Growing_Season.dgn