FINAL

ANNUAL MONITORING REPORT
YEAR 5 (2016)
TATE FARM (RIPSHIN BRANCH)
STREAM/WETLAND RESTORATION SITE
ASHE COUNTY, NORTH CAROLINA
(DMS Project No. 372, Contract No. 004802)
Construction Completed December 2011

Submitted to:
North Carolina Department of Environmental Quality
Division of Mitigation Services
Raleigh, North Carolina

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Prepared by:
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Raleigh, North Carolina 27603

Axiom Environmental, Inc.

December 2016

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1.0 EXECUTIVE SUMMARY

The Tate Farm (Ripshin Branch) Stream and Wetland Restoration Site (hereafter referred to as the Site) is situated within US Geological Survey (USGS) hydrologic unit 05050001 of the Upper New River Basin and is in a portion of NC Division of Water Resources (NCDWR) Priority Sub-basin 05-07-02. The project is located in the northwest corner of Ashe County, about 1 mile south of the Virginia state line and 3 miles east of the Tennessee state line (Figure 1, Appendix A). The Site is encompassed within a 61.92-acre easement located in a tract owned by Michael and Virginia Tate. The Site includes an unnamed tributary to Ripshin Branch (UT), Ripshin Branch proper, associated floodplain wetlands, and additional tributaries found on the property (Figure 2, Appendix B). This report (compiled based on DMS's *Procedural Guidance and Content Requirements for EEP Monitoring Reports,* Version 1.4, dated 11/7/11) summarizes data for Year 5 (2016) monitoring.

The project goals are as follows.

- Improve stream water quality and ecological function by excluding livestock, restoring pool and riffle sequences, and restoring tree canopy and instream large woody debris.
- Enhance aquatic and terrestrial habitat in the stream corridor and adjacent wetlands.
- Enhance and/or restore the ecological function of riparian wetlands.
- Restore the riparian corridor (forested buffer) for watershed and wildlife benefits.
- Enhance habitat for native brook trout (*Salvelinus fontinalis*) and improve fishery potential.
- Increase biodiversity of the stream ecology, riparian buffers, and wetlands.

These goals will be accomplished through the implementation of the following objectives.

- Improve channel geomorphology toward reference conditions by providing watershed scaled and Rosgen-typed channel dimension, adding floodplain benches where floodplain access is not feasible, restoring sinuous pattern to straightened reaches where possible, and adjusting profile as needed to restore or maintain sediment transport equilibrium.
- Restore stream-side floodprone area where appropriate (increase floodwater access to the floodplain).
- Reduce sediment and nutrient loading by reshaping and stabilizing banks, reducing bank scour, excluding livestock, and restoring riparian buffers.
- Enhance or restore wetland hydrology and vegetation in former pastures and filled wetlands.

After construction, five vegetation plots were established and sampled. During Year 2 (2013) monitoring, thirteen additional vegetation plots were established and sampled. Vegetation Success Criteria (from the approved *Ripshin Branch Stream & Wetland Restoration Plan* [NCDMS 2007]) include the following.

- Survival of planted vegetation should exceed 80 percent after 5 years following planting (minimum 260 stems/acre).
- Planted vegetation stabilizing at 20 years with distinct canopy, subcanopy, and shrub layers.
- Establishment of herbaceous cover over 75 percent of the soil surface in restored wetlands and riparian areas.
- Plant biodiversity dominated by native species, with minimal ecological impact from invasive species.

Overall, vegetation was below success criteria with an average of 258 planted stems/acre (excluding livestakes) across the Site. Six of the eighteen vegetation monitoring plots met, or exceeded success criteria. Plots 1-5 and 14 are located along the Ripshin Branch and unnamed tributary stream and wetland restoration areas. The vegetation within these areas is meeting success criteria with an average of 432 planted stems/acre. Additionally, four of the six plots in this area met or exceeded success criteria. Potential causes of the low stem counts at Plots 2 and 4 include excessive hydrology associated with wetland restoration and over competition by sedges and soft rush (*Carex* spp. and *Juncus effusus*, respectively). Plots 6-13 and 15-18 are located in the Enhancement (level II) areas throughout the remainder of the Site. Average stem density throughout this area is 391 stems/acre. Additionally, only two of the twelve plots in these areas met or exceeded success criteria based on planted stem densities. Plots 15 and 18 have had zero planted stems since they were initially installed and measured during year 2 (2016). Plot placement according to the CVS methodology is random, and these plots were randomly placed in areas with no surviving planted stems. With just over two years between the planting of these reaches (May 2011) and initial CVS measurements (August 2013), it is difficult to pinpoint the cause of this planted stem mortality. Harsh, high elevation climate and nutrient-poor, rocky soils are likely factors attributing to the high rate of planted stem mortality in these areas.

In addition to low stem densities, one vegetation area of concern was noted at the beginning of 2013. An overbank event scoured the floodplain and deposited gravel and silt along both banks at the downstream end of Ripshin Branch near Vegetation Plot 5, and a number of planted stems were buried by debris and sediment. This area appears to have stabilized, with woody stems and herbaceous vegetation reestablishing. However, this area continues to scour during high stream flows and is characterized by poorly developed rocky soils.

A visual assessment and geomorphic survey were completed for the Site. The visual assessment indicated that project reaches were performing within established success criteria ranges as shown below. During a 2013 heavy, summer rain event, a boulder was dislodged in a right bank structure in the lower portion of Ripshin Branch. The boulder has since been stabilized by dense herbaceous vegetation and is no longer dislodged; it has remained stable during year 5 (2016).

Over the course of the project, cross-section 8 on the Unnamed Tributary exhibited some thalweg movement. This was documented in the annual cross-section data as well as photographs. Prior to year 1 (2012) a gravel bar formed in the riffle at cross-section 8. Several high energy flow events during years 2 (2013) and 3 (2014) pushed much of this gravel downstream. This resulted in the thalweg migrating to the left bank of the stream and becoming slightly scoured at cross-section 8. The sediment was transported downstream and deposited in pools, which is captured in the cross-section 7 data. Though slight changes were observed in the cross-sectional area and thalweg position of these cross-sections, the channel movement is natural and does not indicate instability.

Stream Success Criteria (from the approved *Ripshin Branch Stream & Wetland Restoration Plan* [NCDMS 2007]) is as follows.

- Channel morphology retains the design stream type over the majority of the reach.
- Coarsening of riffle bed material in newly constructed reaches.

- Pool/riffle spacing should remain fairly constant.
- Maintenance of bankfull width at riffles within 10 percent of the design.
- Maintenance of bank height ratios at 1:1.
- Bank stability over 90 percent of altered channel reaches.
- Dimension and profile stability over 90 percent of altered channel reaches.
- No significant channel aggradation or degradation.
- Minimal development of instream bars.
- Biological populations (invertebrate and fish) remain constant or increase and species composition indicates a positive trend.

Success criteria for stream restoration will be based on stream stability assessed using measurements of stream dimension, pattern, and profile; Site photographs; visual assessments; and vegetation sampling. Streams appear to be functioning properly, emulate design conditions, and are trending towards success.

Wetland hydrology success criteria (from the approved *Ripshin Branch Stream & Wetland Restoration Plan* [NCDMS 2007]) is as follows.

- Hydrologic monitoring indicates groundwater within 12 inches of the ground surface for 10 percent of the growing season
- Increasing wetland vegetation
- Development of hydric soils
- Fulfill US Army Corps of Engineers (USACE) criteria for jurisdictional wetlands

Six groundwater gauges were installed at the Site in mid-October 2012; therefore, no groundwater gauge data is available for year 1 (2012) monitoring. All six groundwater gauges were saturated/inundated for well over 10 percent of the year 5 (2016) growing season.

Summary information/data related to the occurrence of items such as beaver or encroachment and statistics related to performance of various project and monitoring elements can be found in tables and figures within this report's appendices. Narrative background and supporting information formerly found in these reports can be found in the Baseline Monitoring Report (formerly Mitigation Plan) and in the Mitigation Plan (formerly the Restoration Plan) documents available on the NC Division of Mitigation Services' (NCDMS) website. All raw data supporting the tables and figures in the appendices are available from NCDMS upon request.

2.0 METHODOLOGY

2.1 Vegetation Assessment

Five vegetation plots (Plots 1-5) were established and marked during the Year 1 (2012) monitoring period, and 13 additional plots (Plots 6-18) were established and marked during the Year 2 (2013) monitoring period, yielding a total of 18 vegetation plots on the site. Plots were established by installing 4-foot, metal U-bar post at the corners and a 10-foot, 0.75 inch PVC at the origin. The plots are 10 meters square or 20 meters by 5 meters and are located randomly within the Site. These plots were surveyed in August 2016 for the Year 5 (2016) monitoring season *CVS-EEP Protocol for Recording Vegetation, Levels 1-2 Plot Sampling Only Version 4.2* (Lee et al. 2008) (http://cvs.bio.unc.edu/methods.htm); results are included in Appendix C. The

taxonomic standard for vegetation used for this document was *Flora of the Southern and Mid-Atlantic States* (Weakley 2012).

2.2 Stream Assessment

Annual stream monitoring was conducted in July 2016. Measurements were taken using a Topcon GTS 303 total station and Recon data collector. The raw total station file was processed using Carlson Survey Software into a Computer Aided Design (CAD) file. Coordinates were exported as a text/ASCII file to Microsoft Excel for processing and presentation of data. Pebble counts were completed using the modified Wolman method (Rosgen 1993).

Eight permanent cross-sections, six riffle and two pool, were established and will be used to evaluate stream dimension; locations are depicted on Figures 2A and 2B (Appendix B). Cross-sections are permanently monumented with 4-foot metal U-bar posts at each end point. Cross-sections will be surveyed to provide a detailed measurement of the stream and banks, including points on the adjacent floodplain, top of bank, bankfull, breaks in slope, edge of water, and thalweg. Data will be used to calculate width-depth ratios, entrenchment ratios, and bank height ratios for each cross-section. In addition, pebble counts were completed at cross-sections 4 and 8, and photographs will be taken at each permanent cross-section annually.

Two monitoring reaches were established (Unnamed Tributary and Ripshin Branch) and will be used to evaluate stream pattern and longitudinal profile; locations are depicted on Figures 2A and 2B (Appendix B). Longitudinal profile measurements include average water surface slopes, facet slopes, and pool-to-pool spacing. Seventeen permanent photo points were established throughout the restoration reach; locations are depicted on Figures 2A and 2B (Appendix B). In addition, visual stream morphology and stability assessments were completed in each of the two monitoring reaches to assess the channel bed, banks, and in-stream structures.

2.3 Wetland Hydrology Assessment

Six RDS Ecotone WM groundwater monitoring gauges were installed within Site wetland restoration areas to monitor groundwater hydrology (Figures 2A-2B, Appendix A). Hydrological sampling will continue for five years with gauges recording daily and downloaded at a minimum of quarterly throughout the growing season (May 1-October 7). In addition, an on-site rain gauge was installed to document rainfall data for comparison of groundwater conditions with extended drought conditions. Onsite rain data will also be used to pinpoint the occurrence of bankfull events.

3.0 REFERENCES

.Lee, M.T., R.K. Peet, S.D. Roberts, and T.R. Wentworth. 2008. CVS-EEP Protocol for Recording Vegetation, Levels 1-2 Plot Sampling Only, Version 4.2. Available online at http://cvs.bio.unc.edu/methods.htm.

N.C. Division of Mitigation Services (DMS, formerly Ecosystem Enhancement Program). Unpublished. Procedural Guidance and Content Requirements for EEP Monitoring Projects, Version 1.4, dated 11/07/11. NC Department of Environment and Natural Resources. Available online at http://portal.ncdenr.org/c/document_library/get_file?p_l_id=1169848&folderId=2288101&name=DLFE-39268.pdf

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Rosgen. 1993. Applied Fluvial Geomorphology, Training Manual. River Short Course, Wildland Hydrology, Pagosa Springs, CO.

Weakley, Alan S. 2012. Flora of the Southern and Mid-Atlantic States. Available online at: http://www.herbarium.unc.edu/WeakleysFlora.pdf [September 28, 2012]. University of North Carolina Herbarium, North Carolina Botanical Garden, University of North Carolina, Chapel Hill, North Carolina.

Weather Underground. 2014. Station at Jefferson, North Carolina. (online). Available: http://www.wunderground.com/history/airport/KGEV/2014/1/1/CustomHistory.html?dayend=7&monthend=6&yearend=2013&req_city=NA&req_state=NA&req_statename=NA [June 7, 2014]. Weather Underground.

APPENDIX A

PROJECT VICINITY MAP AND BACKGROUND TABLES

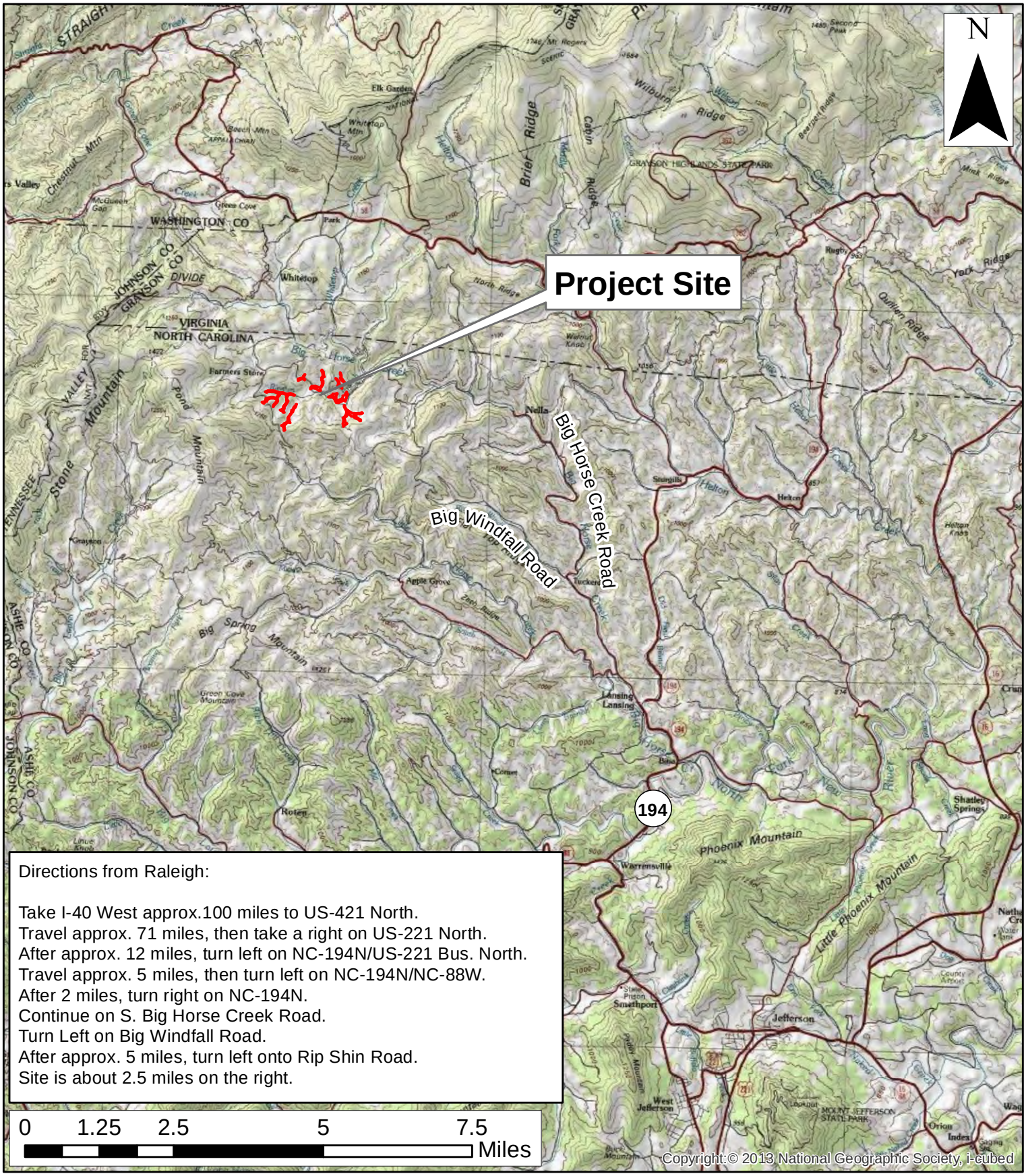
Figure 1. Vicinity Map

Table 1. Project Components and Mitigation Credits

Table 2. Project Activity and Reporting History

Table 3. Project Contacts Table

Table 4. Project Baseline Information and Attributes



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VICINITY MAP
TATE FARM (RIPSHIN BRANCH)
DMS PROJECT NUMBER 372
Ashe County, North Carolina

Dwn. by. KRJ	FIGURE
Date: November 2015	1
Project: 12-004.13	

Table 1. Project Components and Mitigation Credits

Tate Farm (Ripshin Branch) Stream and Wetland Restoration Site (DMS Project Number 372)

Mitigation Credits							
	Stream		Riparian Wetland		Buffer		
Type	Restoration	Restoration Equivalent	Restoration	Restoration Equivalent			
Totals	7293	2696	3.69	1.95			
Projects Components							
Project Component/ Reach ID	**Station Range**	**Existing Linear Footage/ Acreage**	**Priority Approach**	**Restoration/ Restoration Equivalent**	**Restoration Linear Footage/ Acreage**	**Mitigation Ratio**	**Comment**
Reach 1A (Ripshin Br. – Area 2)	00+00–08+00	800	Enhancement	E II	800	1:2.5	237 feet are within a powerline right-of-way and will receive 50% credit.
Reach 1B (Ripshin Br. – Area 2)	08+00-12+00	350	Priority II	R	400	1:1	
Reach 1C (Ripshin Br. – Area 2)	12+00-14+85	285	Enhancement	E II	285	1:2.5	
Reach 2A (Ripshin Br. – Area 2)	14+85-23+00	785	Priority II	R	815	1:1	
Ripshin Branch – Area 2	--	518	Preservation	P	518	1:5	
Reach 3A (UT – Area 1)	00+00-01+24	132	Enhancement	E I	124	1:1.5	69 feet are within a powerline right-of-way and will receive 50% credit.
Reach 3B (UT – Area 1)	01+24-09+12	688	Priority I	R	788	1:1	30 feet are within a powerline right-of-way and will receive 50% credit.
Area 1 Tributaries		2419	Enhancement	E II	2419	1:2.5	
Area 1 Tributaries		889	Preservation	P	889	1:5	
Area 2 Tributaries		2166	Enhancement	E II	2166	1:2.5	38 feet are within a powerline right-of-way and will receive 50% credit.
Area 2 Tributaries		1158	Preservation	P	1158	1:5	
Area 3 Tributaries		4020	Enhancement	E II	4020	1:2.5	
Area 3 Tributaries		2208	Preservation	P	2208	1:5	
Area 4 Tributaries		3367	Enhancement	E II	3367	1:2.5	
Area 4 Tributaries		9096	Preservation	P	9096	1:5	
Wetland UT		0		R	1.5	1:1	0.11 acres are within a powerline right-of-way and will receive 50% credit.
Wetland UT		1.24		E	1.24	1:2	0.11 acres are within a powerline right-of-way and will receive 50% credit.
Wetland Ripshin Branch		0		R	2.30	1:1	
Wetland Ripshin Branch		2.74		E	2.74	1:2	0.04 acres are within a powerline right-of-way and will receive 50% credit.

Table 1. Project Components and Mitigation Credits (continued)

Tate Farm (Ripshin Branch) Stream and Wetland Restoration Site (DMS Project Number 372)

Component Summation			
Restoration Level	**Stream (linear footage)**	**Riparian Wetland (acres)**	**Buffer (square footage)**
Restoration	2003	3.8	
Enhancement (Level I)	124		
Enhancement (Level II)	13057		
Preservation	13869		
Wetland Enhancement		3.98	
Creation			
Totals	**29053**	**7.78**	
Mitigation Units	**9989 SMUs**	**5.64 WMUs**	

Table 2. Project Activity and Reporting History

Tate Farm (Ripshin Branch) Stream and Wetland Restoration Site (DMS Project Number 372)

Elapsed Time Since Grading Complete: 5 years 4 months
Elapsed Time Since Planting Complete: 5 years
Number of Reporting Years: 5

Activity or Deliverable	Data Collection Complete	Completion or Delivery
USACE Wetland Verification		February 2007
Restoration Plan		March 2007
Final Design – Construction Plans		September 2009
Supplemental planting on enhancement (level II) reaches		May 2011
Construction		August 2011
Temporary S&E mix applied to entire project area		August 2011
Permanent seed mix applied to entire project area		August 2011
Containerized and B&B plantings for entire reach		December 2011
As-built Construction Plans		December 2011
Year 1 Monitoring (2012)	October 2012	December 2012
Year 2 Monitoring (2013)	November 2013	January 2014
Year 3 Monitoring (2014)	October 2014	November 2014
Year 4 Monitoring (2015)	October 2015	December 2015
Year 5 Monitoring (2016)	October 2016	December 2016

Table 3. Project Contacts Table

Tate Farm (Ripshin Branch) Stream and Wetland Restoration Site (DMS Project Number 372)

Designer	Ecologic Associates, P.C. Greensboro, NC 27404 Mark Taylor 336-382-9362
Construction Contractor	Land Mechanics Designs, Inc Willow Spring, NC 27529 Lloyd Glover 919-422-3392
Planting and Seeding Contractor	Habitat Assessment Restoration Program Charlotte, NC 28262
Surveyor	Stewart Proctor Raleigh, NC 27603 Herb Proctor 919-779-1855
Seed Mix Source	Green Resource Colfax, NC 27235 336-855-6363
Years 1-5 Monitoring Performers	Axiom Environmental, Inc. 218 Snow Avenue Raleigh, NC 27603 Grant Lewis 919-215-1693

Table 4. Project Baseline Information and Attributes

Tate Farm (Ripshin Branch) Stream and Wetland Restoration Site (DMS Project Number 372)

Project Information						
Project Name	Tate Farm (Ripshin Branch)					
Project County	Ashe					
Project Area (Acres)	61.92					
Project Coordinates (NAD83 2007)	1,037,279.65, 1,234,847,66					
Project Watershed Summary Information						
Physiographic Region	Blue Ridge					
Ecoregion	Southern Crystalline Ridges and Mountains					
Project River Basin	Upper New					
USGS 8-digit HUC	05050001					
USGS 14-digit HUC	05050001010050					
NCDWQ Subbasin	05-07-02					
Project Drainage Area (Sq. Mi.)	2.0					
Project Drainage Area Impervious Surface	<5%					
Watershed Type	Rural					
Reach Summary Information						
Parameters	**Reach 1 (Ripshin Branch)**	**Reach 2 (UT)**	**Area 1 Tributaries**	**Area 2 Tributaries**	**Area 3 Tributaries**	**Area 4 Tributaries**
Restored/Enhanced Length (Linear Feet)	2300	912	2419	2166	4020	3367
Drainage Area (Square Miles)	2.0	0.56	NA	NA	NA	NA
NCDWQ Index Number	05-07					
NCDWQ Classification	C, NSW, Tr					
Valley Type/Morphological Description	II/BC4					
Dominant Soil Series	Colvard and Toxaway					
Drainage Class	Well and Poorly Drained					
Soil Hydric Status	Nonhydric and Hydric					
Slope	0.02	0.02				
FEMA Classification	NA					
Native Vegetation Community	Montane Alluvial Forest and Swamp Forest-Bog Complex					
Percent Composition of Exotic Invasives	<5%	<5%				
Regulatory Considerations						
Regulation	**Applicable**					
Waters of the U.S. –Sections 404 and 401	Yes-Received Appropriate Permits					
Endangered Species Act	No Effect					
Historic Preservation Act	No					
CZMA/CAMA	NA					
FEMA Floodplain Compliance	NA					
Essential Fisheries Habitat	Trout					

APPENDIX B

VISUAL ASSESSMENT DATA

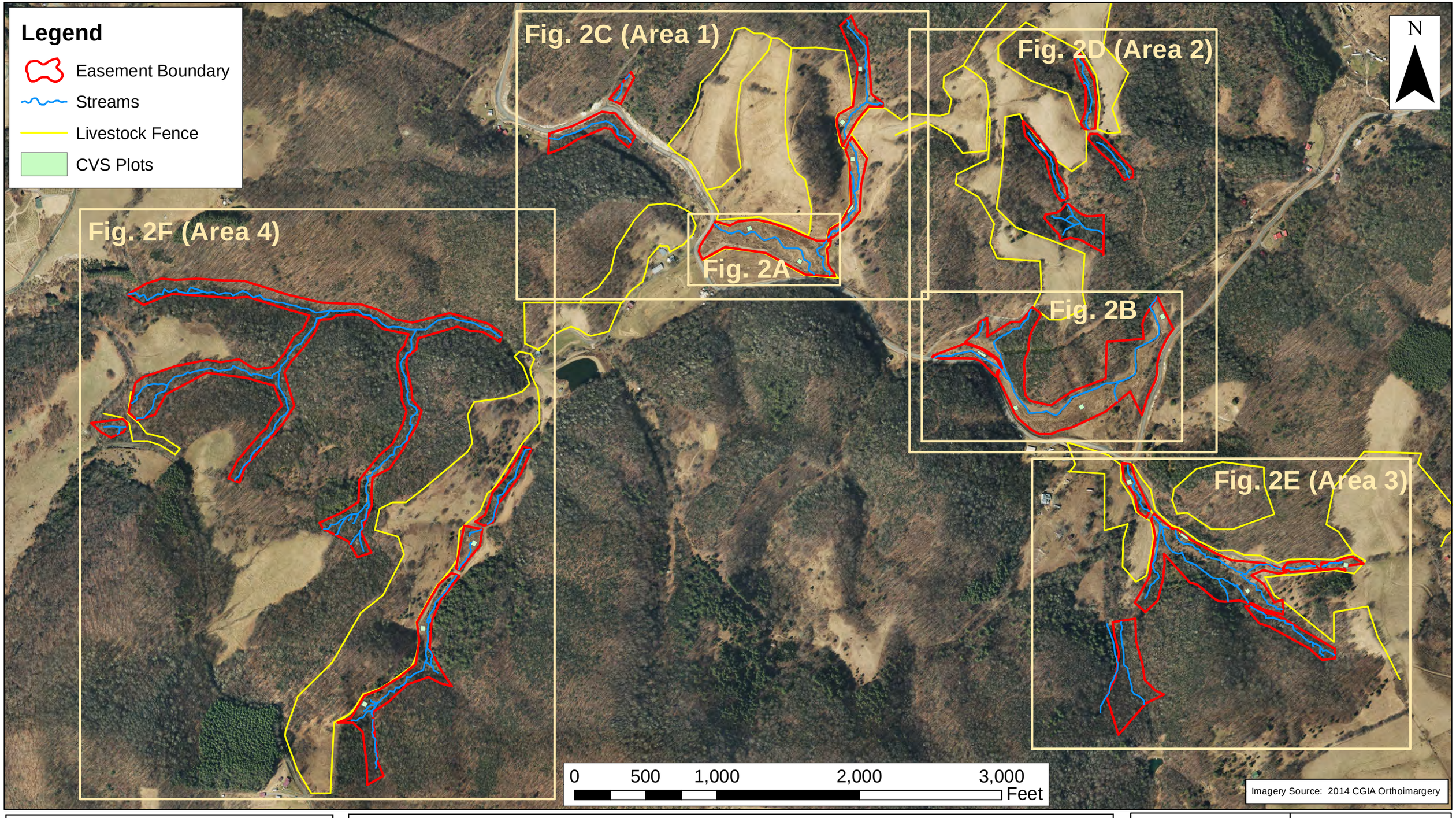
Figures 2 and 2A-2F. Current Conditions Plan View

Tables 5A-5B. Visual Stream Morphology Stability Assessment

Table 6. Vegetation Condition Assessment

Stream Fixed-Station Photographs

Vegetation Monitoring Photographs



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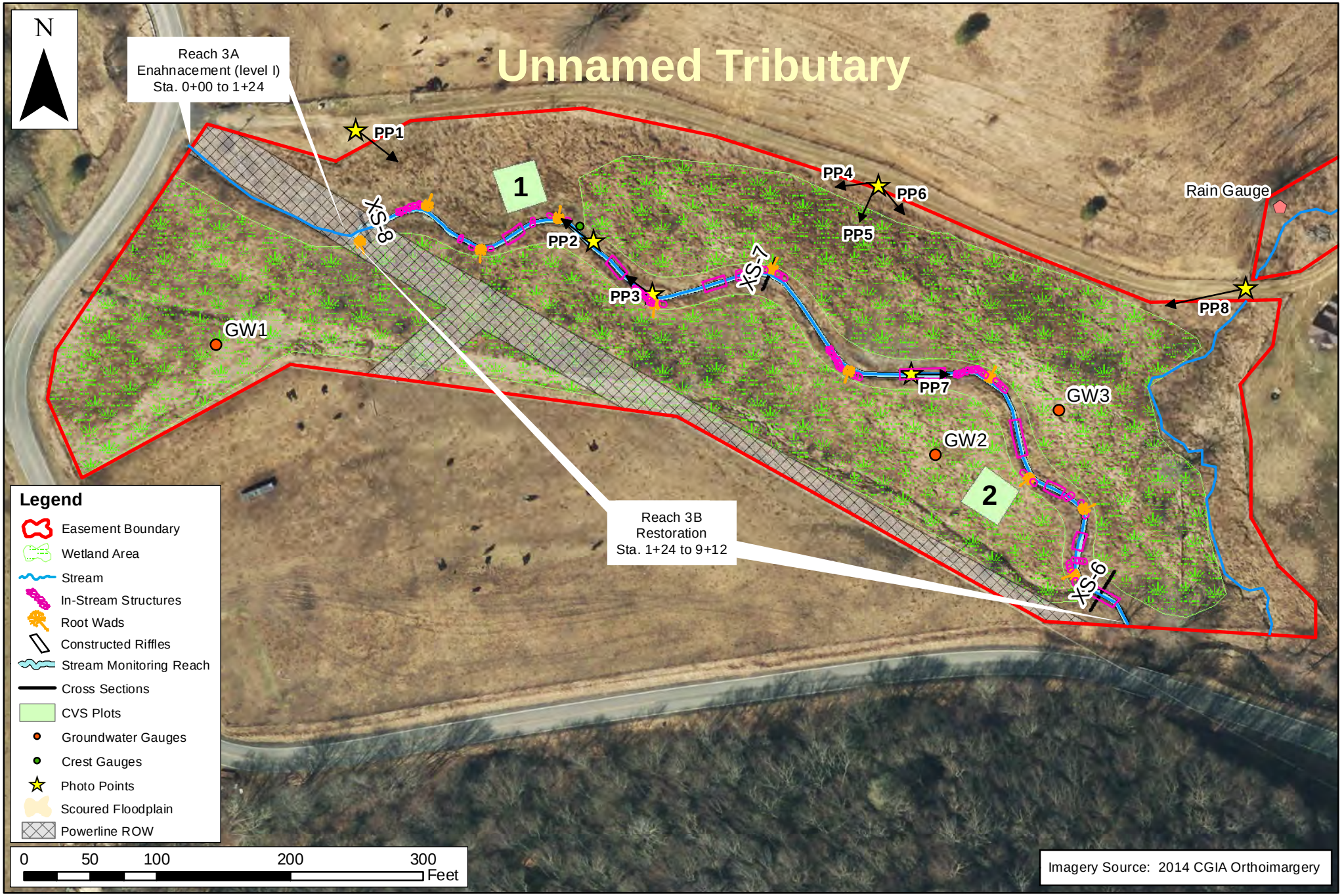
CURRENT CONDITIONS PLAN VIEW
TATE FARM
DMS PROJECT NUMBER 372
Ashe County, North Carolina

Dwn. by. KRJ	FIGURE
Date: Dec. 2016	2
Project: 12-004.13	



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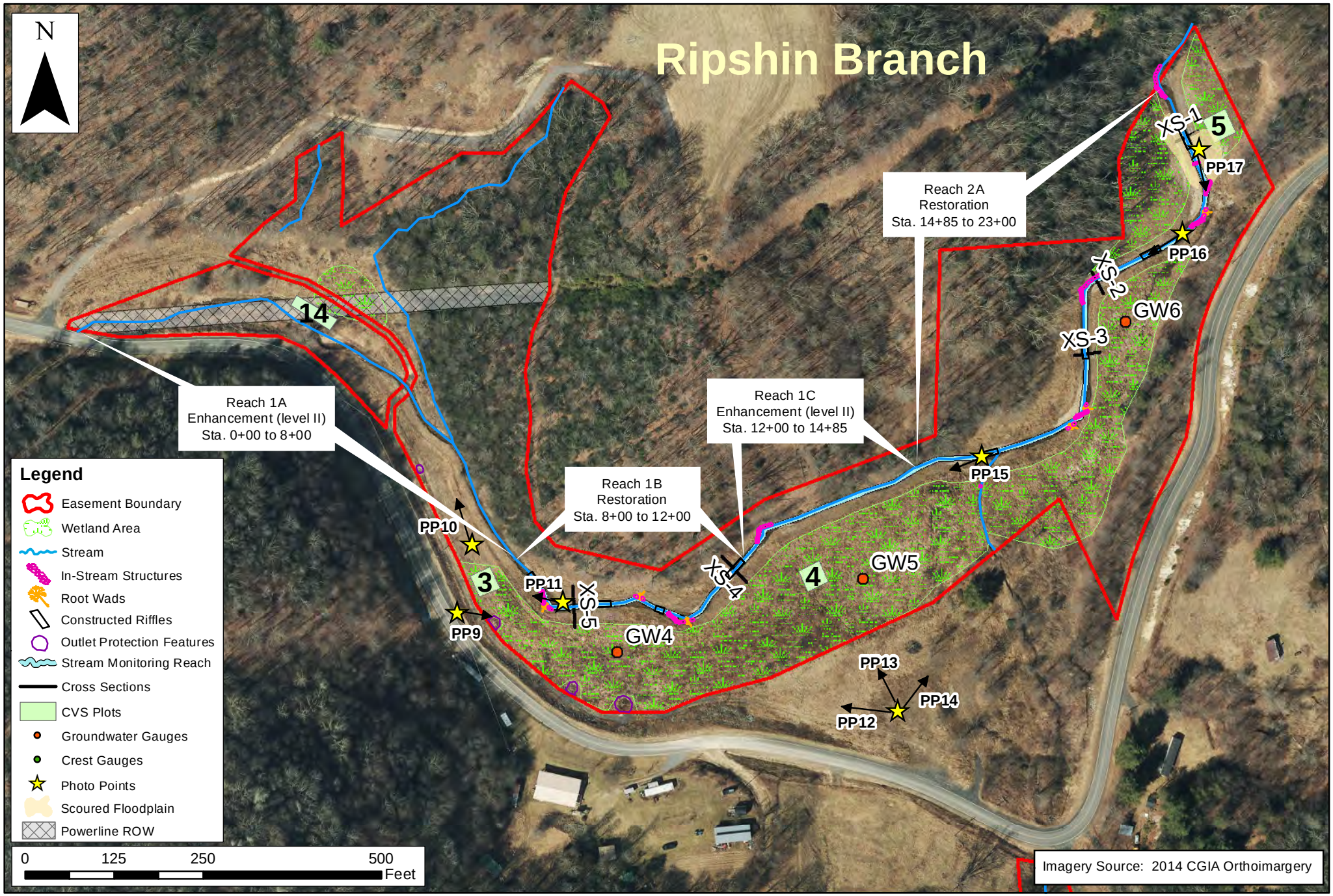
CURRENT CONDITIONS PLAN VIEW
TATE FARM (UT)
DMS PROJECT NUMBER 372
Ashe County, North Carolina

Dwn. by.	KRJ
Date:	Dec. 2016
Project:	12-004.13

FIGURE
2A



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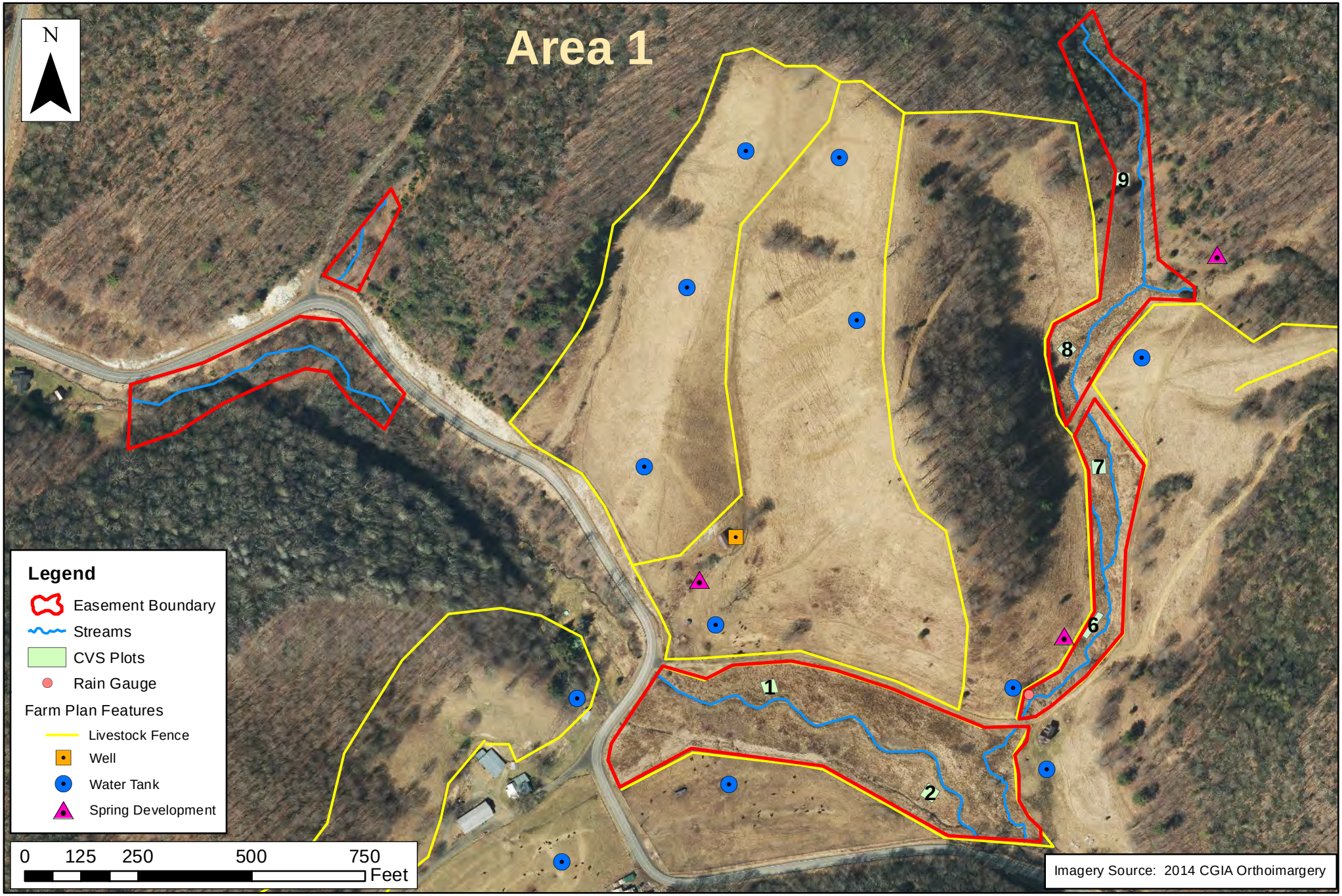
CURRENT CONDITIONS PLAN VIEW
TATE FARM (RIPSHIN BRANCH)
DMS PROJECT NUMBER 372
Ashe County, North Carolina

Dwn. by. KRJ	FIGURE
Date: Dec. 2016	2B
Project: 12-004.13	



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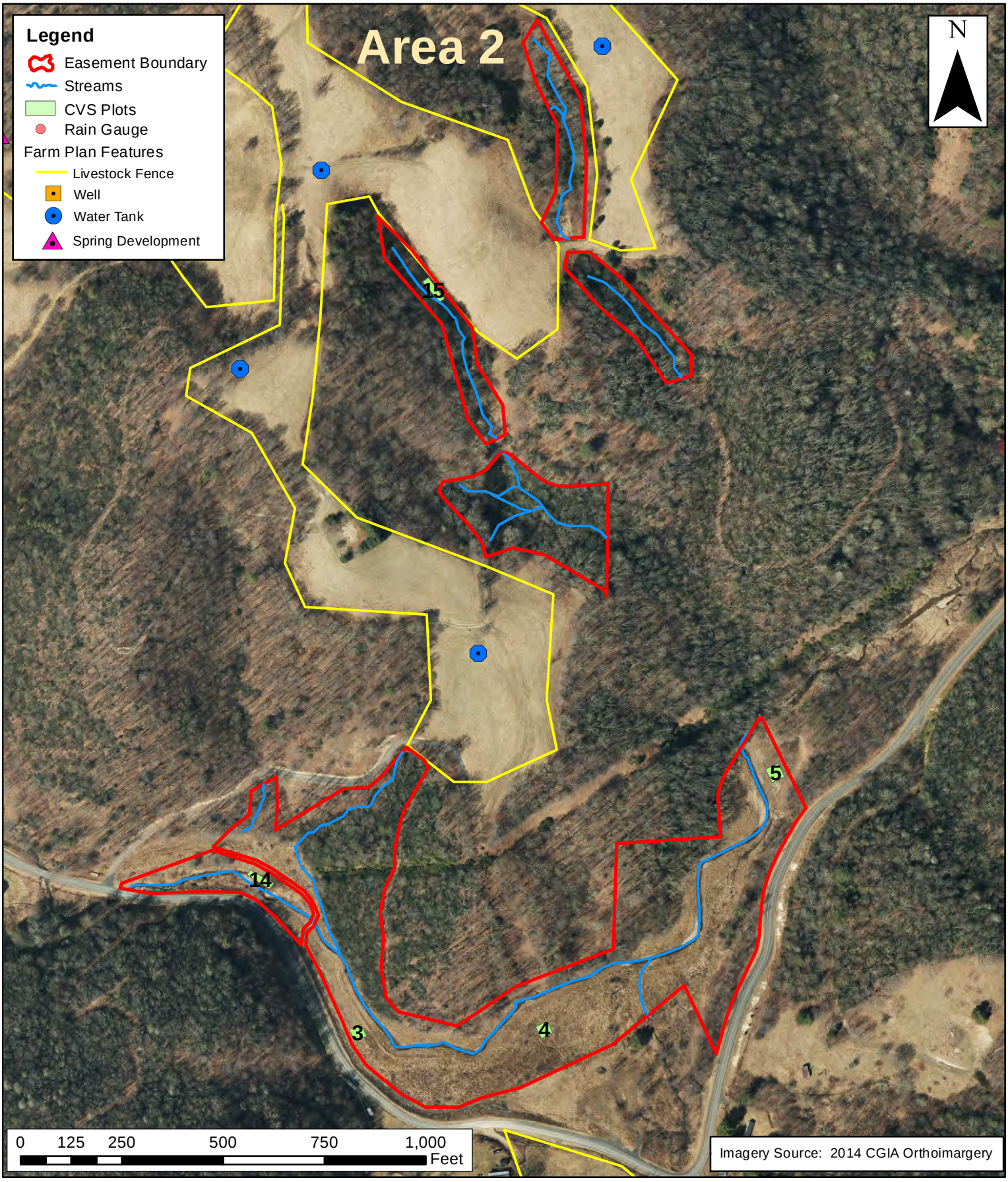
CURRENT CONDITIONS PLAN VIEW
TATE FARM (AREA 1)
DMS PROJECT NUMBER 372
Ashe County, North Carolina

Dwn. by.	KRJ
Date:	Dec. 2016
Project:	12-004.13

FIGURE
2C



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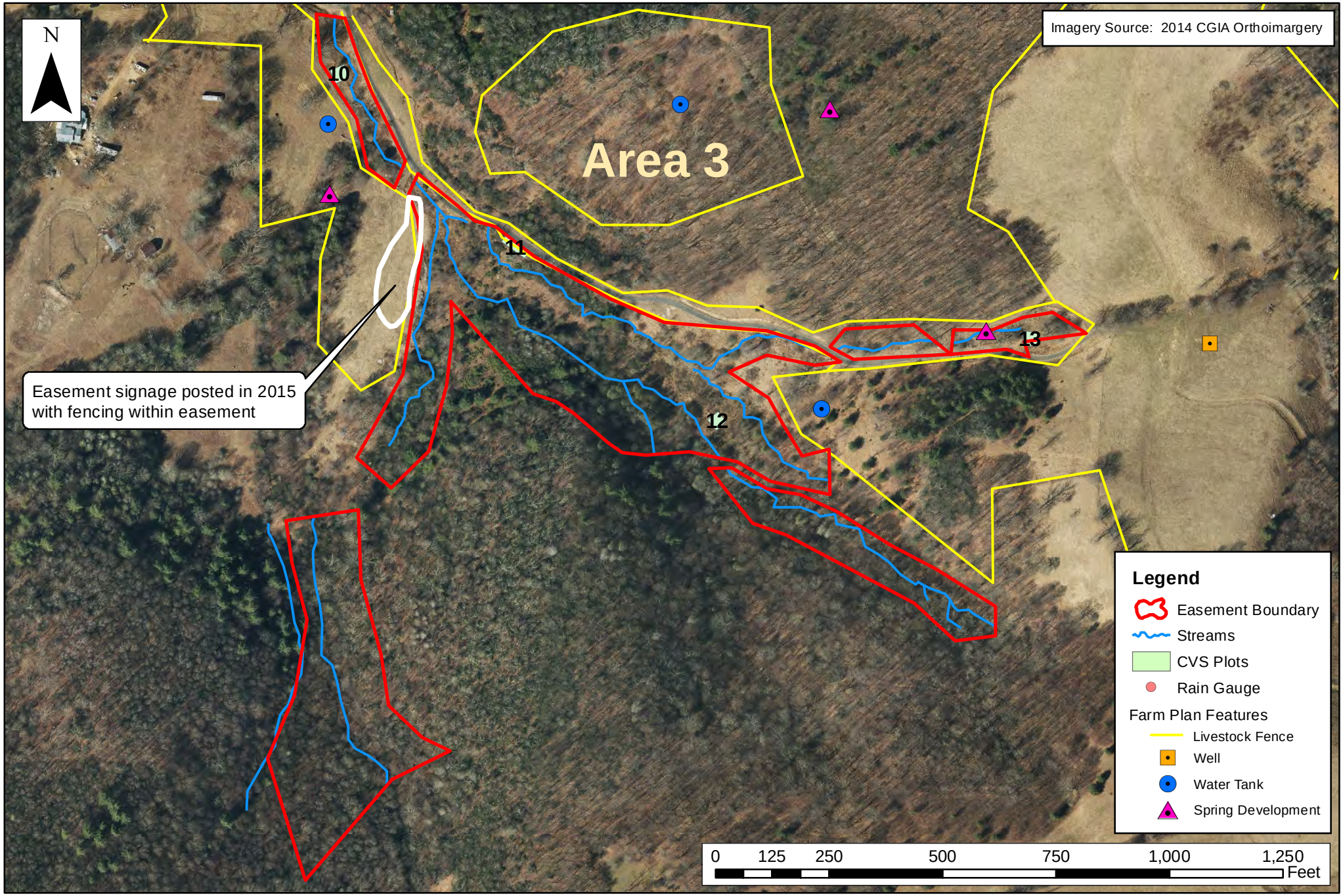
CURRENT CONDITIONS PLAN VIEW
TATE FARM (AREA 2)
DMS PROJECT NUMBER 372
Ashe County, North Carolina

Dwn. by. KRJ	FIGURE
Date: Dec. 2016	2D
Project: 12-004.13	



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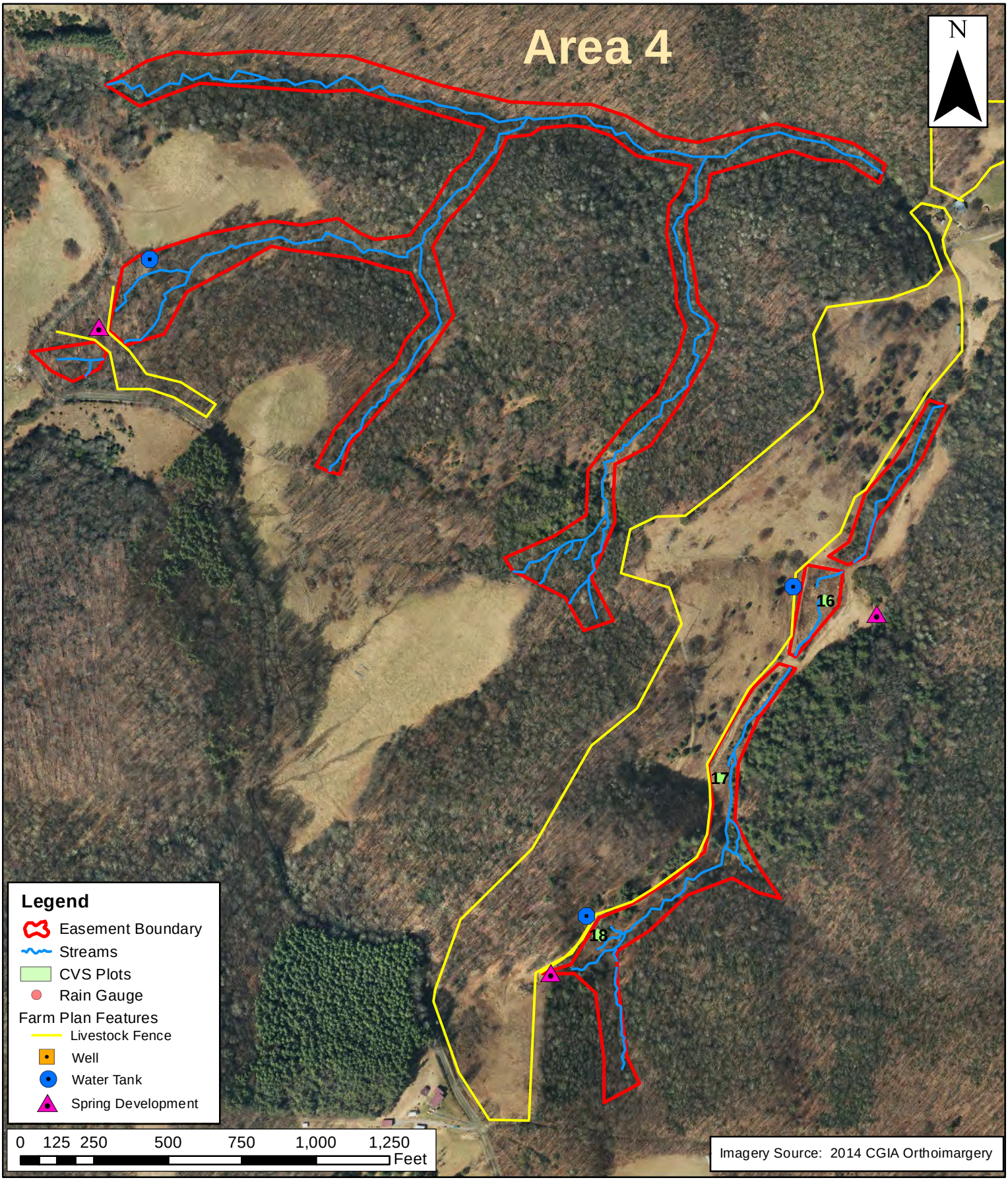
CURRENT CONDITIONS PLAN VIEW
TATE FARM (AREA 3)
DMS PROJECT NUMBER 372
Ashe County, North Carolina

Dwn. by.	KRJ
Date:	Dec. 2016
Project:	12-004.13

FIGURE
2E



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CURRENT CONDITIONS PLAN VIEW
TATE FARM (AREA 4)
DMS PROJECT NUMBER 372
Ashe County, North Carolina

Dwn. by. KRJ	FIGURE
Date: Dec. 2016	2F
Project: 12-004.13	

Table 5A **Visual Stream Morphology Stability Assessment**

Reach ID **Unnamed Tributary**
Assessed Length **800**

Major Channel Category	Channel Sub-Category	Metric	Number Stable, Performing as Intended	Total Number in As-built	Number of Unstable Segments	Amount of Unstable Footage	% Stable, Performing as Intended	Number with Stabilizing Woody Vegetation	Footage with Stabilizing Woody Vegetation	Adjusted % for Stabilizing Woody Vegetation
1. Bed	1. **Vertical Stability** (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	12	12			100%			
	3. Meander Pool Condition	1. Depth Sufficient (Max Pool Depth : Mean Bankfull Depth ≥ 1.6)	10	10			100%			
		2. Length appropriate (>30% of centerline distance between tail of upstream riffle and head of downstrem riffle)	10	10			100%			
	4.**Thalweg Position**	1. Thalweg centering at upstream of meander bend (Run)	10	10			100%			
		2. Thalweg centering at downstream of meander (Glide)	10	10			100%			
2. Bank	**1. Scoured/Eroding**	Bank lacking vegetative cover resulting simply from poor growth and/or scour and erosion			0	0	100%			100%
	2. Undercut	Banks undercut/overhanging to the extent that mass wasting appears likely. Does NOT include undercuts that are modest, appear sustainable and are providing habitat.			0	0	100%			100%
	3. Mass Wasting	Bank slumping, calving, or collapse			0	0	100%			100%
				Totals	0	0	100%	0	0	100%
3. Engineered Structures	**1. Overall Integrity**	Structures physically intact with no dislodged boulders or logs.	4	4			100%			
	2. Grade Control	Grade control structures exhibiting maintenance of grade across the sill.	8	8			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%. (See guidance for this table in EEP monitoring guidance document)	4	4			100%			
	4. Habitat	Pool forming structures maintaining ~ Max Pool Depth : Mean Bankfull Depth ratio ≥ 1.6 Rootwads/logs providing some cover at base-flow.	4	4			100%			

Table 5B **Visual Stream Morphology Stability Assessment**

Reach ID **Ripshin Branch**

Assessed Length **1444**

Major Channel Category	Channel Sub-Category	Metric	Number Stable, Performing as Intended	Total Number in As-built	Number of Unstable Segments	Amount of Unstable Footage	% Stable, Performing as Intended	Number with Stabilizing Woody Vegetation	Footage with Stabilizing Woody Vegetation	Adjusted % for Stabilizing Woody Vegetation
1. Bed	1. **Vertical Stability** (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	21	21			100%			
	3. Meander Pool Condition	1. Depth Sufficient (Max Pool Depth : Mean Bankfull Depth ≥ 1.6)	25	25			100%			
		2. Length appropriate (>30% of centerline distance between tail of upstream riffle and head of downstrem riffle)	25	25			100%			
	4.**Thalweg Position**	1. Thalweg centering at upstream of meander bend (Run)	25	25			100%			
		2. Thalweg centering at downstream of meander (Glide)	25	25			100%			
2. Bank	**1. Scoured/Eroding**	Bank lacking vegetative cover resulting simply from poor growth and/or scour and erosion			0	0	100%			100%
	2. Undercut	Banks undercut/overhanging to the extent that mass wasting appears likely. Does NOT include undercuts that are modest, appear sustainable and are providing habitat.			0	0	100%			100%
	3. Mass Wasting	Bank slumping, calving, or collapse			0	0	100%			100%
				Totals	0	0	100%	0	0	100%
3. Engineered Structures	**1. Overall Integrity**	Structures physically intact with no dislodged boulders or logs.	8	8			100%			
	2. Grade Control	Grade control structures exhibiting maintenance of grade across the sill.	0	0			NA			
	2a. Piping	Structures lacking any substantial flow underneath sills or arms.	8	8			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)	8	8			100%			
	4. Habitat	Pool forming structures maintaining ~ Max Pool Depth : Mean Bankfull Depth ratio ≥ 1.6 Rootwads/logs providing some cover at base-flow.	8	8			100%			

Table 6 Vegetation Condition Assessment

Planted Acreage[1] **17.48**

Vegetation Category	Definitions	Mapping Threshold	CCPV Depiction	Number of Polygons	Combined Acreage	% of Planted Acreage
1. Bare Areas	Very limited cover of both woody and herbaceous material.	0.1 acres	Tan	2	0.22	1.3%
2. Low Stem Density Areas	Woody stem densities clearly below target levels.	0.1 acres	NA	11	7.41	42.4%
			Total	13	7.63	43.6%
3. Areas of Poor Growth Rates or Vigor	Areas with woody stems of a size class that are obviously small given the monitoring year.	0.25 acres	NA	0	0.00	0.0%
			Cumulative Total	13	7.63	43.6%

Easement Acreage[2] **61.9**

Vegetation Category	Definitions	Mapping Threshold	CCPV Depiction	Number of Polygons	Combined Acreage	% of Easement Acreage
4. Invasive Areas of Concern[4]	Areas or points (if too small to render as polygons at map scale).	100 SF	NA	0	0.00	0.0%
5. Easement Encroachment Areas[3]	Areas or points (if too small to render as polygons at map scale).	none	NA	0	0.00	0.0%

1 = Enter the planted acreage within the easement. This number is calculated as the easement acreage minus any existing mature tree stands that were not subject to supplemental planting of the understory, the channel acreage, crossings or any other elements not directly planted as part of the project effort.

2 = The acreage within the easement boundaries.

3 = Encroachment may occur within or outside of planted areas and will therefore be calculated against the overall easement acreage. In the event a polygon is cataloged into items 1, 2 or 3 in the table and is the result of encroachment, the associated acreage should be tallied in the relevant item (i.e., item 1,2 or 3) as well as a parallel tally in item 5.

4 = Invasives may occur in or out of planted areas, but still within the easement and will therefore be calculated against the overall easement acreage. Invasives of concern/interest are listed below. The list of high concern spcies are those with the potential to directly outcompete native, young, woody stems in the short-term (e.g. monitoring period or shortly thereafter) or affect the community structure for existing, more established tree/shrub stands over timeframes that are slightly longer (e.g. 1-2 decades). The low/moderate concern group are those species that generally do not have this capacity over the timeframes discussed and therefore are not expected to be mapped with regularity, but can be mapped, if in the judgement of the observer their coverage, density or distribution is suppressing the viability, density, or growth of planted woody stems. Decisions as to whether remediation will be needed are based on the integration of risk factors by DMS such as species present, their coverage, distribution relative to native biomass, and the practicality of treatment. For example, even modest amounts of Kudzu or Japanese Knotweed early in the projects history will warrant control, but potentially large coverages of Microstegium in the herb layer will not likley trigger control because of the limited capacities to impact tree/shrub layers within the timeframes discussed and the potential impacts of treating extensive amounts of ground cover. Those species with the "watch list" designator in gray shade are of interest as well, but have yet to be observed across the state with any frequency. Those in *red italics* are of particular interest given their extreme risk/threat level for mapping as points where isolated specimens are found, particularly early in a projects monitoring history. However, areas of discreet, dense patches will of course be mapped as polygons. The symbology scheme below was one that was found to be helpful for symbolzing invasives polygons, particulalry for situations where the conditon for an area is somewhere between isolated specimens and dense, discreet patches. In any case, the point or polygon/area feature can be symbolized to describe things like high or low concern and species can be listed as a map inset, in legend items if the number of species are limited or in the narrative section of the executive summary.

Tate Farm (Ripshin Branch)
Stream Fixed-Station Photographs
Taken August 2016

Photo Point 1

Photo Point 2

Photo Point 3

Photo Point 4

Photo Point 5

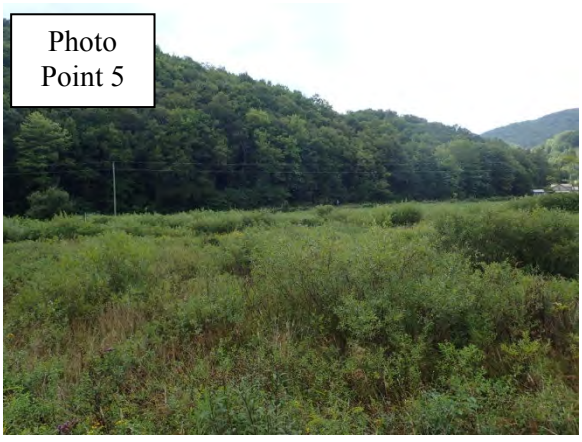
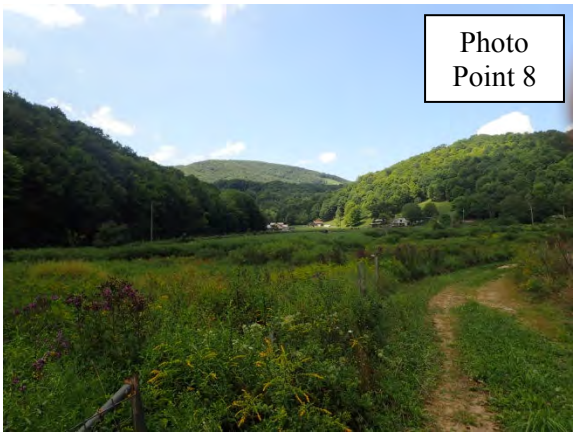
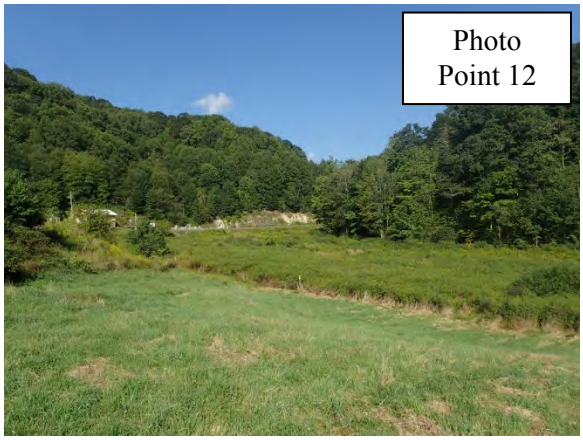


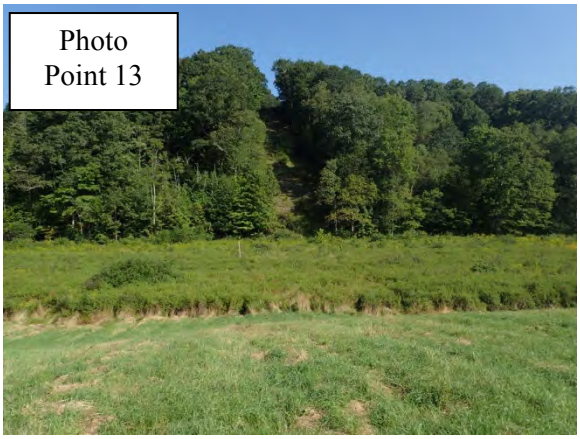
Photo Point 6

Tate Farm (Ripshin Branch)
Stream Fixed-Station Photographs
Taken August 2016
(continued)

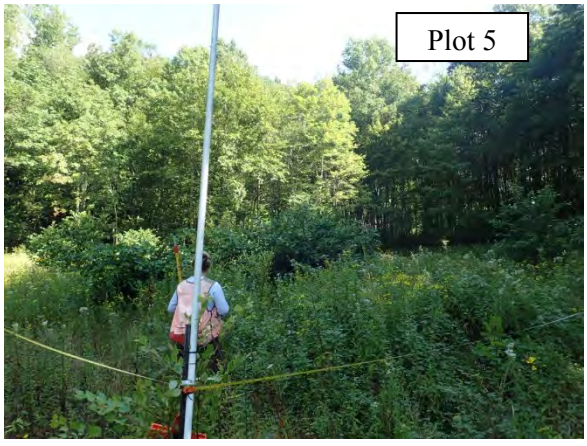




Tate Farm (Ripshin Branch)
Stream Fixed-Station Photographs
Taken August 2016
(continued)



Tate Farm (Ripshin Branch)
Vegetation Monitoring Photographs
Taken August 2016



Tate Farm (Ripshin Branch)
Vegetation Monitoring Photographs
Taken August 2016
(Continued)

Tate Farm (Ripshin Branch)
Vegetation Monitoring Photographs
Taken August 2016
(Continued)

APPENDIX C

VEGETATION PLOT DATA

Table 7. Vegetation Plot Criteria Attainment

Table 8. CVS Vegetation Plot Metadata

Table 9. Total and Planted Stems by Plot and Species

Table 7. Vegetation Plot Criteria Attainment Based on Planted Stems

Tate Farm (Ripshin Branch) Stream and Wetland Restoration Site (DMS Project Number 372)

Vegetation Plot ID	Vegetation Survival Threshold Met?	Tract Mean
1	Yes	33%
2	No	
3	Yes	
4	No	
5	Yes	
6	No	
7	No	
8	No	
9	Yes	
10	No	
11	Yes	
12	No*	
13	No	
14	Yes	
15	No	
16	No	
17	No	
18	No*	

*When including natural recruits such as red maple (*Acer rubrum*), mountain laurel (*Kalmia latifolia*), eastern hemlock (*Tsuga canadensis*), and silky willow (*Salix sericea*) in plot 12 and striped maple (*Acer pensylvanicum*), yellow buckeye (*Aesculus flava*), yellow birch (*Betula alleghaniensis*), and tulip tree (*Liriodendron tulipifera*) in plot 18, these plots exceed success criteria.

Table 8. CVS Vegetation Plot Metadata

Tate Farm (Ripshin Branch) Stream and Wetland Restoration Site (DMS Project Number 372)

Report Prepared By	Corri Faquin
Date Prepared	11/21/2016 17:07
database name	Axiom-Tate-2016-A-v2.3.1.mdb
database location	S:\Business\Projects\12\12-004 EEP Monitoring\12-004.13 Tate Farm\2016\CVS
computer name	KEENAN-PC
file size	49373184
DESCRIPTION OF WORKSHEETS IN THIS DOCUMENT----------	
Metadata	Description of database file, the report worksheets, and a summary of project(s) and project data.
Proj, planted	Each project is listed with its PLANTED stems per acre, for each year. This excludes live stakes.
Proj, total stems	Each project is listed with its TOTAL stems per acre, for each year. This includes live stakes, all planted stems, and all natural/volunteer stems.
Plots	List of plots surveyed with location and summary data (live stems, dead stems, missing, etc.).
Vigor	Frequency distribution of vigor classes for stems for all plots.
Vigor by Spp	Frequency distribution of vigor classes listed by species.
Damage	List of most frequent damage classes with number of occurrences and percent of total stems impacted by each.
Damage by Spp	Damage values tallied by type for each species.
Damage by Plot	Damage values tallied by type for each plot.
Planted Stems by Plot and Spp	A matrix of the count of PLANTED living stems of each species for each plot; dead and missing stems are excluded.
ALL Stems by Plot and spp	A matrix of the count of total living stems of each species (planted and natural volunteers combined) for each plot; dead and missing stems are excluded.
PROJECT SUMMARY----------	
Project Code	372
project Name	Tate Farm
Description	Stream and Wetland Restoration
River Basin	New
length(ft)	
stream-to-edge width (ft)	
area (sq m)	
Required Plots (calculated)	
Sampled Plots	18

Table 9. Total and Planted Stems by Plot and Species
DMS Project Code 372. Project Name: Tate Farm

			Current Plot Data (MY5 2016)																														
			372-01-0001			372-01-0002			372-01-0003			372-01-0004			372-01-0005			372-01-0006			372-01-0007			372-01-0008			372-01-0009			372-01-0010			372-01-0011		
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**
Acer pensylvanicum	striped maple	Shrub Tree																																
Acer rubrum	red maple	Tree																																
Acer saccharinum	silver maple	Tree																																
Aesculus flava	yellow buckeye	Tree																																
Alnus	alder	Shrub																																
Alnus serrulata	hazel alder	Shrub													4	4	4																	
Aronia arbutifolia	Red Chokeberry	Shrub													3	3	3																	
Betula alleghaniensis	yellow birch	Tree																																
Betula lenta	sweet birch	Tree																																10
Betula nigra	river birch	Tree	3	3	3				1	1	1				2	2	3				1	1	1	1	1	1								
Carpinus caroliniana	American hornbeam	Tree																																
Carya	hickory	Tree																																
Cornus amomum	silky dogwood	Shrub	1	1	1	1	1	1				2	2	2																				
Corylus americana	American hazelnut	Shrub																1	1	1							1	1	1					
Crataegus	hawthorn	Tree																																
Crataegus phaenopyrum	Washington hawthorn	Shrub Tree																														2	2	2
Fagus grandifolia	American beech	Tree																																
Fraxinus pennsylvanica	green ash	Tree	5	5	5	2	2	2	4	4	4	1	1	1	2	2	2				1	1	1											
Ilex opaca	American holly	Tree				2	2	2																										
Kalmia	laurel																																	
Kalmia latifolia	mountain laurel	Shrub Tree																																
Liriodendron tulipifera	tuliptree	Tree																									3	3	3					8
Malus	apple	Tree																												1	1	1		
Pinus strobus	eastern white pine	Tree																																
Platanus occidentalis	American sycamore	Tree							6	6	6				2	2	2													3	3	3		
Prunus serotina	black cherry	Tree							1	1	1																							
Quercus alba	white oak	Tree																																
Quercus rubra	northern red oak	Tree																									1	1	1				1	1
Rhododendron	rhododendron																																	
Rhododendron maximum	great laurel	Shrub																									1	1	1				3	3
Rhus	sumac	shrub																																
Salix	willow	Shrub or Tree																																
Salix nigra	black willow	Tree																																
Salix sericea	silky willow	Shrub																																
Sambucus canadensis	Common Elderberry	Shrub																																
Tsuga canadensis	eastern hemlock	Tree																									3	3	3					
Vaccinium corymbosum	highbush blueberry	Shrub																1	1	1							1	1	1				13	13
Viburnum dentatum	southern arrowwood	Shrub	3	3	3																													
		Stem count	12	12	12	5	5	5	12	12	12	3	3	3	13	13	14	2	2	2	2	2	2	1	1	1	10	10	10	4	4	4	19	19
		size (ares)	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	
		Species count	4	4	4	3	3	3	4	4	4	2	2	2	5	5	5	2	2	2	2	2	2	1	1	1	6	6	6	2	2	2	4	4
		Stems per ACRE	485.6	485.6	485.6	202.3	202.3	202.3	485.6	485.6	485.6	121.4	121.4	121.4	526.1	526.1	566.6	80.94	80.94	80.94	80.94	80.94	80.94	40.47	40.47	40.47	404.7	404.7	404.7	161.9	161.9	161.9	768.9	768.9

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%

PnoLS = Planted excluding livestakes
P-all = Planting including livestakes
T = All planted and natural recruits including livestakes
T includes natural recruits

Table 9. Total and Planted Stems by Plot and Species (continued)
DMS Project Code 372. Project Name: Tate Farm

			Current Plot Data (MY5 2016)																			Annual Means														
			372-01-0012			372-01-0013			372-01-0014			372-01-0015			372-01-0016			372-01-0017			372-01-0018			MY5 (2016)			MY4 (2015)			MY3 (2014)			MY2 (2013)			MY1 (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
Acer pensylvanicum	striped maple	Shrub Tree																					2			2			3			1						3
Acer rubrum	red maple	Tree			2																					2			4			10			17			12
Acer saccharinum	silver maple	Tree																											2									
Aesculus flava	yellow buckeye	Tree																					7			7						7						3
Alnus	alder	Shrub																									1	1	1	1	1	1				1	1	1
Alnus serrulata	hazel alder	Shrub																						4	4	4	4	4	4	4	4	4	4	4	4	5	5	5
Aronia arbutifolia	Red Chokeberry	Shrub									1													3	3	4	4	4	4	5	5	5	5	5	5	5	5	5
Betula alleghaniensis	yellow birch	Tree																					1			1												
Betula lenta	sweet birch	Tree																								10			18									3
Betula nigra	river birch	Tree	1	1	1				1	1	1													10	10	11	11	11	11	13	13	13	14	14	14	12	12	12
Carpinus caroliniana	American hornbeam	Tree							1	1	1													1	1	1	1	1	1	1	1	30	1	1	1	1	1	33
Carya	hickory	Tree																											5			6						
Cornus amomum	silky dogwood	Shrub													1	1	1							5	5	5	6	6	6	6	6	6	5	5	5	5	5	5
Corylus americana	American hazelnut	Shrub							4	4	4													6	6	6	6	6	7	6	6	6	6	6	30	6	6	6
Crataegus	hawthorn	Tree																															1	1	3			
Crataegus phaenopyrum	Washington hawthorn	Shrub Tree			3				1	1	1				2	2	2						1	5	5	9	4	4	4	4	4	5	2	2	2	2	2	2
Fagus grandifolia	American beech	Tree																														9			2			
Fraxinus pennsylvanica	green ash	Tree	1	1	1																			16	16	16	15	15	16	16	16	16	15	15	15	10	10	14
Ilex opaca	American holly	Tree							1	1	1													3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Kalmia	laurel																																	15			
Kalmia latifolia	mountain laurel	Shrub Tree			2																					2						3						2
Liriodendron tulipifera	tuliptree	Tree																					1	3	3	12	3	3	14	3	3	11	3	3	4	3	3	16
Malus	apple	Tree																						1	1	1	1	1	2	1	1	1	1	1	1	1	1	1
Pinus strobus	eastern white pine	Tree																											1			1			2			1
Platanus occidentalis	American sycamore	Tree				2	2	2										1	1	1				14	14	14	14	14	14	15	15	15	14	14	14	14	14	14
Prunus serotina	black cherry	Tree							1	1	1				1	1	1							3	3	3	3	3	3	4	4	4	3	3	3	3	3	3
Quercus alba	white oak	Tree							1	1	1													1	1	1	1	1	3	1	1	1	1	1	1	1	1	1
Quercus rubra	northern red oak	Tree																						2	2	2	2	2	2	2	2	2	1	1	1	2	2	2
Rhododendron	rhododendron																										2	2	2	2	2	2	2	2	9	1	1	4
Rhododendron maximum	great laurel	Shrub	2	2	5	1	1	1										1	1	1				8	8	22	7	7	10	7	7	9	7	7	7	7	7	7
Rhus	sumac	shrub																																				1
Salix	willow	Shrub or Tree																											6									5
Salix nigra	black willow	Tree			12											1	1								1	13		1	1		1	1		2	2		1	1
Salix sericea	silky willow	Shrub																														3			7			
Sambucus canadensis	Common Elderberry	Shrub							3	3	3													3	3	3	4	4	5	4	4	4	4	4	4	4	4	4
Tsuga canadensis	eastern hemlock	Tree			1						1													3	3	5	3	3	5	3	3	5	3	3	4			1
Vaccinium corymbosum	highbush blueberry	Shrub																						15	15	15	16	16	16	16	16	16	15	15	19	13	13	13
Viburnum dentatum	southern arrowwood	Shrub							6	6	6													9	9	9	10	10	10	10	10	10	9	9	9	9	9	9
		Stem count	4	4	27	3	3	3	19	19	21	0	0	0	4	5	5	2	2	2	0	0	12	115	116	183	121	122	183	127	128	210	119	121	203	108	109	192
		size (ares)	1			1			1			1			1			1			1			18			18			18			18			18		
		size (ACRES)	0.02			0.02			0.02			0.02			0.02			0.02			0.02			0.44			0.44			0.44			0.44			0.44		
		Species count	3	3	8	2	2	2	9	9	11	0	0	0	3	4	4	2	2	2	0	0	5	20	21	27	22	23	30	22	23	31	22	23	28	21	22	31
		Stems per ACRE	161.9	161.9	1093	121.4	121.4	121.4	768.9	768.9	849.8	0	0	0	161.9	202.3	202.3	80.94	80.94	80.94	0	0	485.6	258.5	260.8	411.4	272	274.3	411.4	285.5	287.8	472.1	267.5	272	456.4	242.8	245.1	431.7

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%

PnoLS = Planted excluding livestakes
P-all = Planting including livestakes
T = All planted and natural recruits including livestakes
T includes natural recruits

APPENDIX D

STREAM SURVEY DATA

Cross-section Plots

Longitudinal Profile Plots

Substrate Plots

Tables 10a-d. Baseline Stream Data Summary

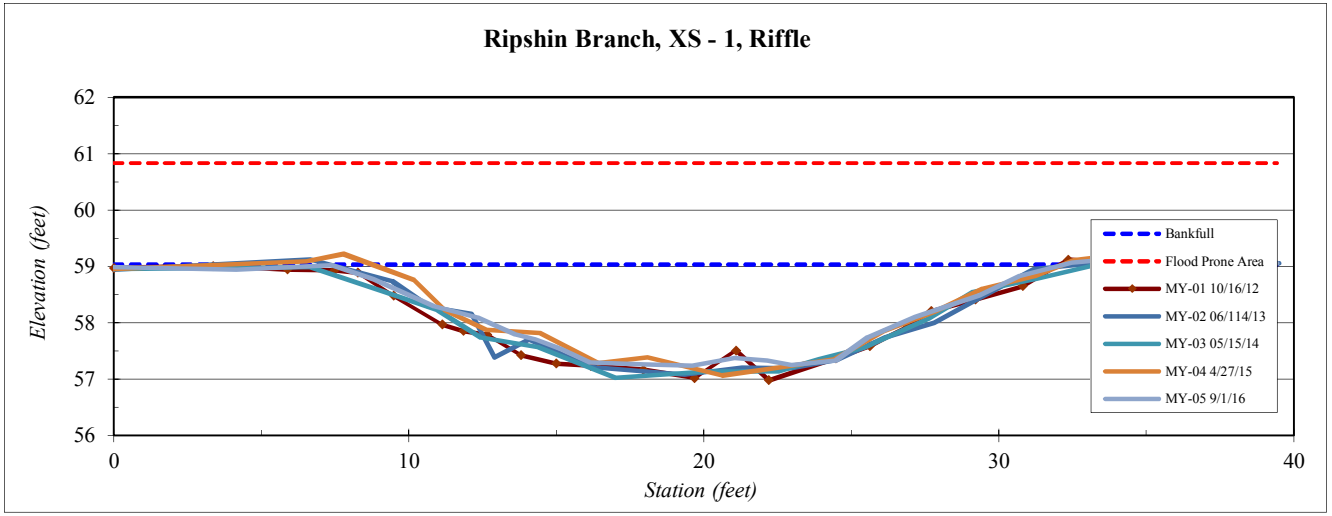
Tables 11a-d. Monitoring Data

River Basin:	Upper New
Watershed:	Tate Farm
XS ID	XS - 1, Riffle
Drainage Area (sq mi):	1.6
Date:	9/1/2016
Field Crew:	Perkinson, Keith

Station	Elevation
0.00	58.99
4.15	58.94
7.38	59.03
8.81	58.77
10.84	58.29
12.33	58.09
13.59	57.79
14.28	57.70
15.15	57.53
16.13	57.29
17.96	57.26
19.61	57.24
21.04	57.37
22.14	57.32
22.96	57.25
24.48	57.33
25.54	57.73
27.15	58.10
29.34	58.49
30.70	58.82
32.47	59.07
35.96	59.22
39.43	59.05

SUMMARY DATA	
Bankfull Elevation:	59.0
Bankfull Cross-Sectional Area:	27.7
Bankfull Width:	24.8
Flood Prone Area Elevation:	60.8
Flood Prone Width:	80.0
Max Depth at Bankfull:	1.8
Mean Depth at Bankfull:	1.1
W / D Ratio:	22.2
Entrenchment Ratio:	3.2
Bank Height Ratio:	1.0

Stream Type	B/C

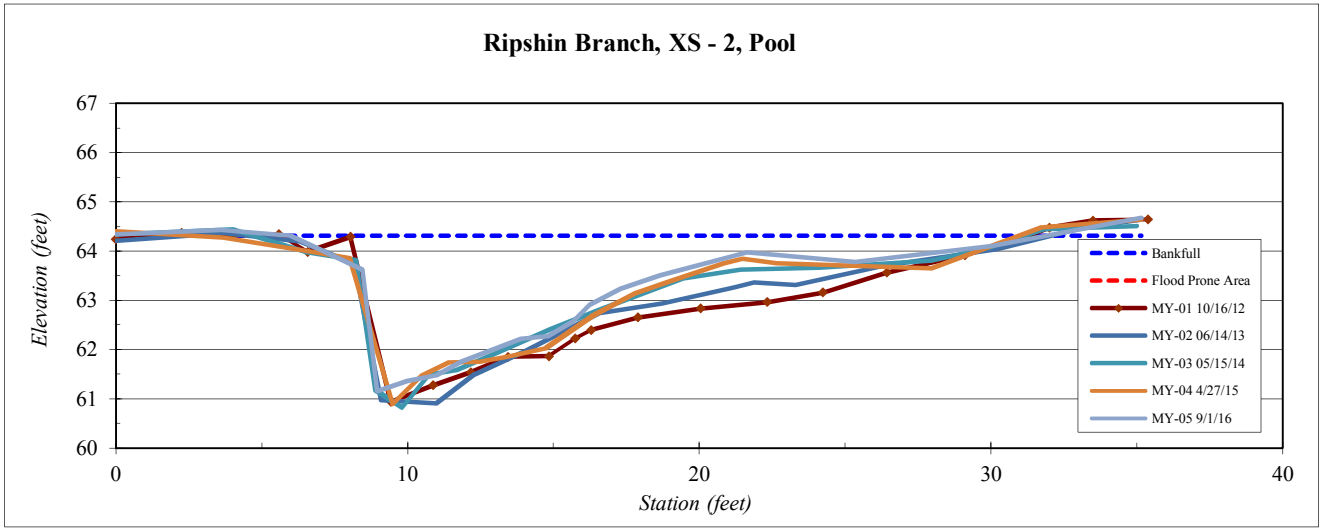


River Basin:	Upper New
Watershed:	Tate Farm
XS ID	XS - 2, Pool
Drainage Area (sq mi):	1.6
Date:	9/1/2016
Field Crew:	Perkinson, Keith

Station	Elevation
0.00	64.34
3.61	64.43
5.99	64.31
8.45	63.62
8.95	61.15
9.99	61.37
11.00	61.47
11.83	61.75
13.90	62.21
14.81	62.27
15.67	62.57
16.25	62.91
17.29	63.23
18.66	63.50
21.63	63.98
25.3	63.78
30.1	64.11
35.2	64.67

SUMMARY DATA	
Bankfull Elevation:	64.3
Bankfull Cross-Sectional Area:	27.2
Bankfull Width:	25.9
Flood Prone Area Elevation:	-
Flood Prone Width:	-
Max Depth at Bankfull:	3.2
Mean Depth at Bankfull:	1.1
W / D Ratio:	-
Entrenchment Ratio:	-
Bank Height Ratio:	-

Stream Type	B/C

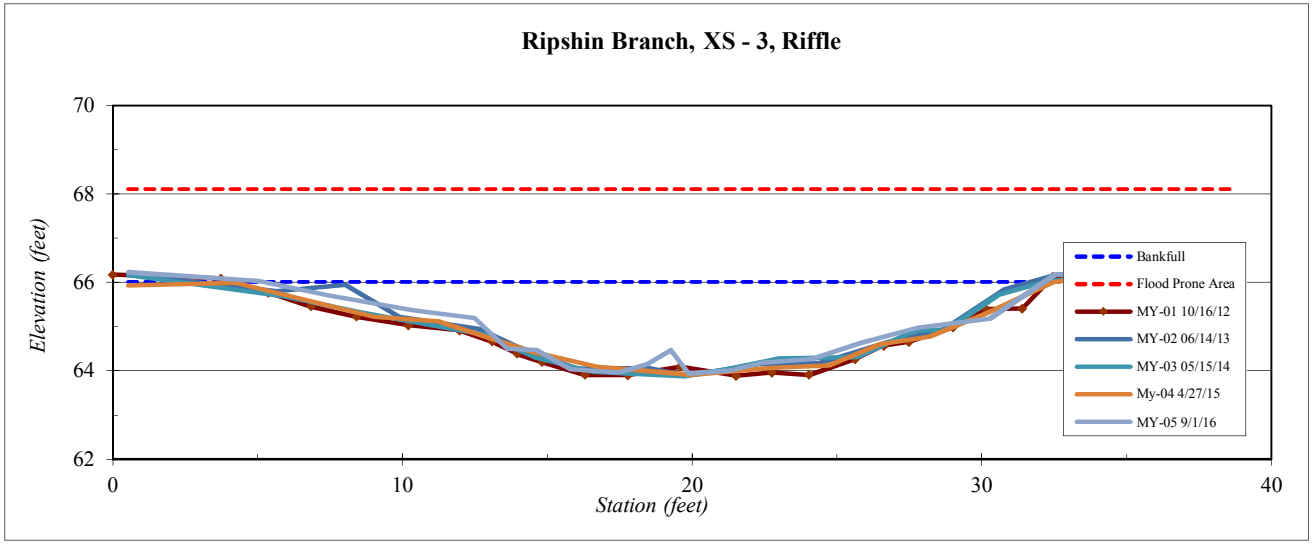


River Basin:	Upper New
Watershed:	Tate Farm
XS ID	XS - 3, Riffle
Drainage Area (sq mi):	1.6
Date:	9/1/2016
Field Crew:	Perkinson, Keith

Station	Elevation
0.54	66.23
5.02	66.04
7.49	65.70
10.39	65.37
12.49	65.20
13.61	64.50
14.62	64.47
15.81	64.04
17.47	63.97
18.46	64.15
19.27	64.48
19.90	63.94
21.31	64.00
22.40	64.19
24.1	64.26
25.8	64.62
27.8	64.98
30.3	65.19
32.5	66.18
36.2	66.21
38.6	66.20

SUMMARY DATA	
Bankfull Elevation:	66.0
Bankfull Cross-Sectional Area:	32.1
Bankfull Width:	26.9
Flood Prone Area Elevation:	68.1
Flood Prone Width:	>80
Max Depth at Bankfull:	2.1
Mean Depth at Bankfull:	1.2
W / D Ratio:	22.5
Entrenchment Ratio:	3.0
Bank Height Ratio:	1.0

Stream Type	B/C

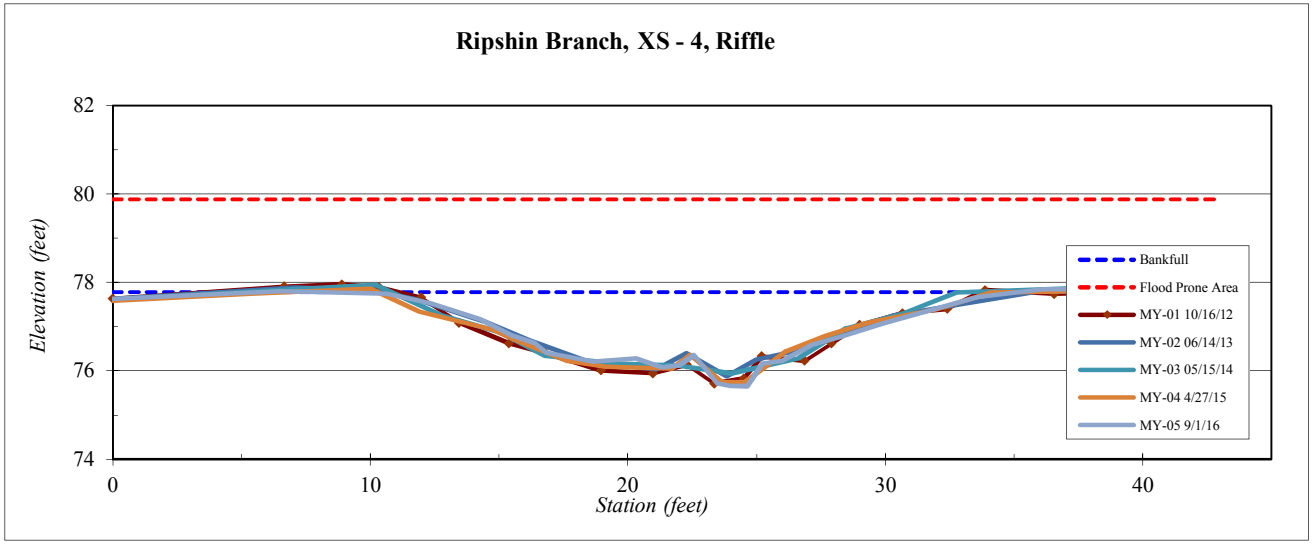


River Basin:	Upper New
Watershed:	Tate Farm
XS ID	XS - 4, Riffle
Drainage Area (sq mi):	1.6
Date:	9/1/2016
Field Crew:	Perkinson, Keith

Station	Elevation
0.00	77.63
6.54	77.80
10.64	77.75
12.35	77.52
14.27	77.16
15.50	76.80
16.38	76.64
16.84	76.41
18.65	76.20
20.31	76.28
21.32	76.08
21.98	76.12
22.58	76.35
23.47	75.72
24.0	75.66
24.6	75.65
25.2	76.17
26.0	76.23
27.2	76.59
28.2	76.76
29.9	77.06
33.6	77.68
36.1	77.85
39.3	77.84
42.9	77.67

SUMMARY DATA	
Bankfull Elevation:	77.8
Bankfull Cross-Sectional Area:	24.6
Bankfull Width:	24.5
Flood Prone Area Elevation:	79.9
Flood Prone Width:	>80
Max Depth at Bankfull:	2.1
Mean Depth at Bankfull:	1.1
W / D Ratio:	22.3
Entrenchment Ratio:	3.3
Bank Height Ratio:	1.0

Stream Type	B/C

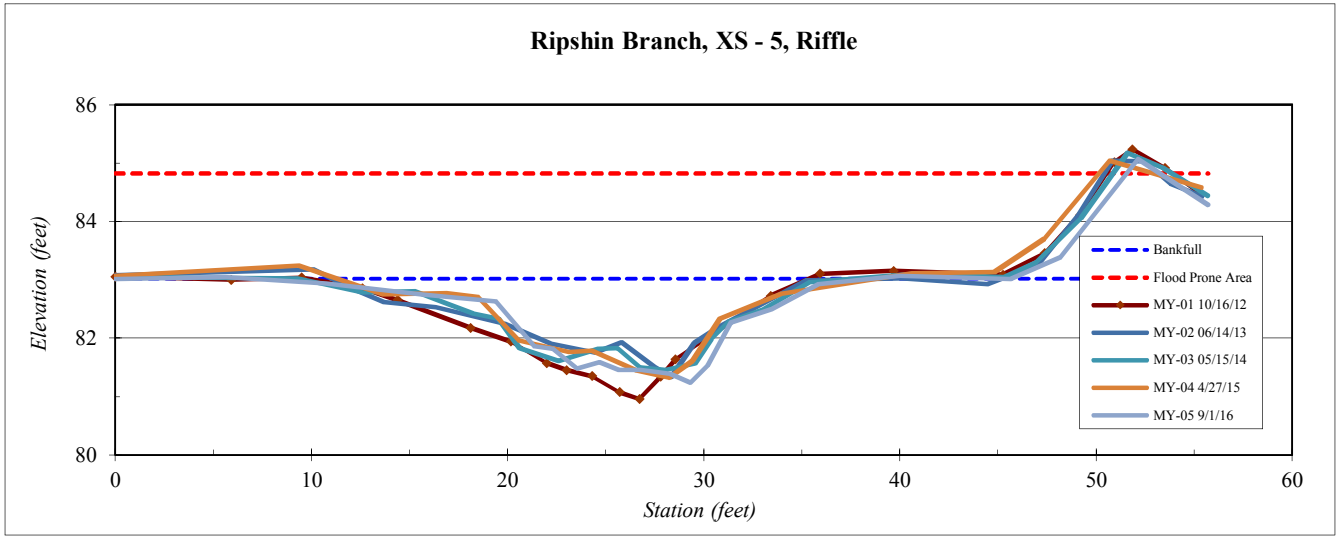


River Basin:	Upper New
Watershed:	Tate Farm
XS ID	XS - 5, Riffle
Drainage Area (sq mi):	1.6
Date:	9/1/2016
Field Crew:	Perkinson, Keith

Station	Elevation
0.0	83.0
5.6	83.0
10.8	82.9
15.6	82.7
19.4	82.6
21.4	81.9
22.3	81.8
23.6	81.5
24.7	81.6
25.7	81.5
26.8	81.5
28.3	81.4
29.3	81.2
30.2	81.53
31.4	82.27
33.5	82.49
35.8	82.93
40.0	83.07
45.6	83.02
48.2	83.39
52.1	85.07
55.7	84.29

SUMMARY DATA	
Bankfull Elevation:	83.0
Bankfull Cross-Sectional Area:	20.6
Bankfull Width:	31.9
Flood Prone Area Elevation:	84.8
Flood Prone Width:	>80
Max Depth at Bankfull:	1.8
Mean Depth at Bankfull:	0.6
W / D Ratio:	49.4
Entrenchment Ratio:	2.5
Bank Height Ratio:	1.0

Stream Type	B/C

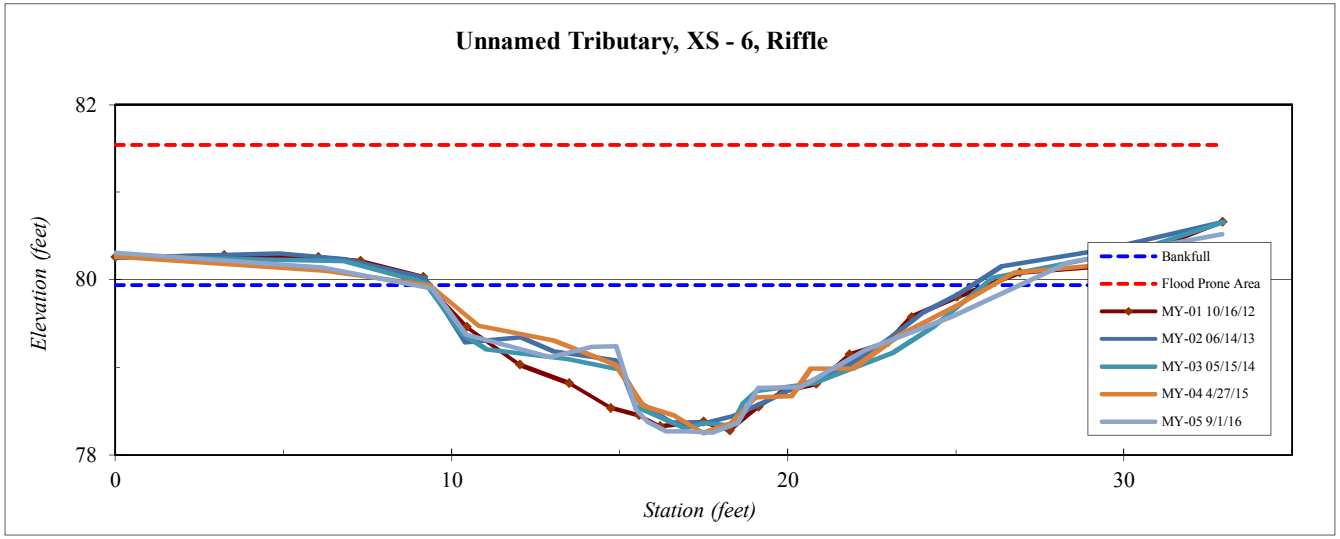


River Basin:	Upper New
Watershed:	Tate Farm
XS ID	XS - 6, Riffle
Drainage Area (sq mi):	0.6
Date:	9/1/2016
Field Crew:	Perkinson, Keith

Station	Elevation
0.0	80.3
6.2	80.1
9.4	79.9
10.4	79.4
12.9	79.1
14.2	79.2
14.9	79.2
15.5	78.5
15.8	78.4
16.4	78.3
17.0	78.3
17.8	78.3
18.5	78.4
19.1	78.77
20.4	78.77
22.3	79.20
24.9	79.58
28.3	80.20
32.9	80.52

SUMMARY DATA	
Bankfull Elevation:	79.9
Bankfull Cross-Sectional Area:	14.3
Bankfull Width:	17.2
Flood Prone Area Elevation:	81.5
Flood Prone Width:	>80
Max Depth at Bankfull:	1.6
Mean Depth at Bankfull:	0.8
W / D Ratio:	20.7
Entrenchment Ratio:	4.7
Bank Height Ratio:	1.0

Stream Type	B/C

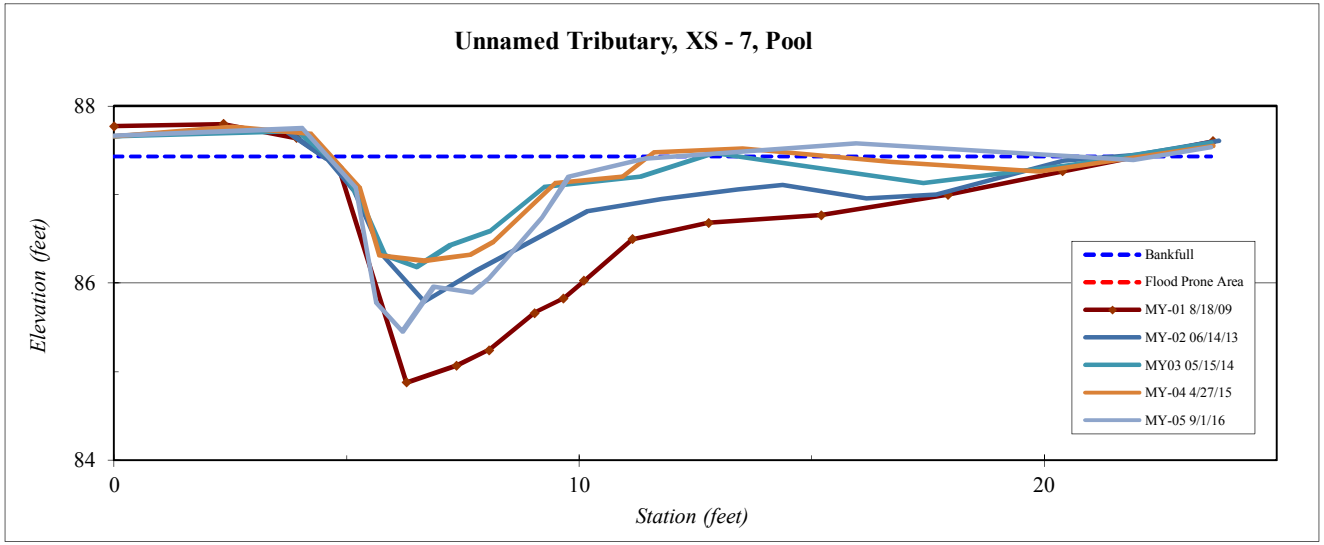


River Basin:	Upper New
Watershed:	Tate Farm
XS ID	XS - 7, Pool
Drainage Area (sq mi):	0.6
Date:	9/1/2016
Field Crew:	Perkinson, Keith

Station	Elevation
0.0	87.7
4.1	87.7
5.2	87.1
5.6	85.8
6.2	85.5
6.9	86.0
7.7	85.9
8.1	86.1
8.5	86.3
9.2	86.7
9.8	87.2
11.4	87.4
16.0	87.6
21.9	87.39
23.6	87.53

SUMMARY DATA	
Bankfull Elevation:	87.4
Bankfull Cross-Sectional Area:	6.2
Bankfull Width:	9.3
Flood Prone Area Elevation:	-
Flood Prone Width:	-
Max Depth at Bankfull:	2.0
Mean Depth at Bankfull:	0.7
W / D Ratio:	-
Entrenchment Ratio:	-
Bank Height Ratio:	-

Stream Type	B/C

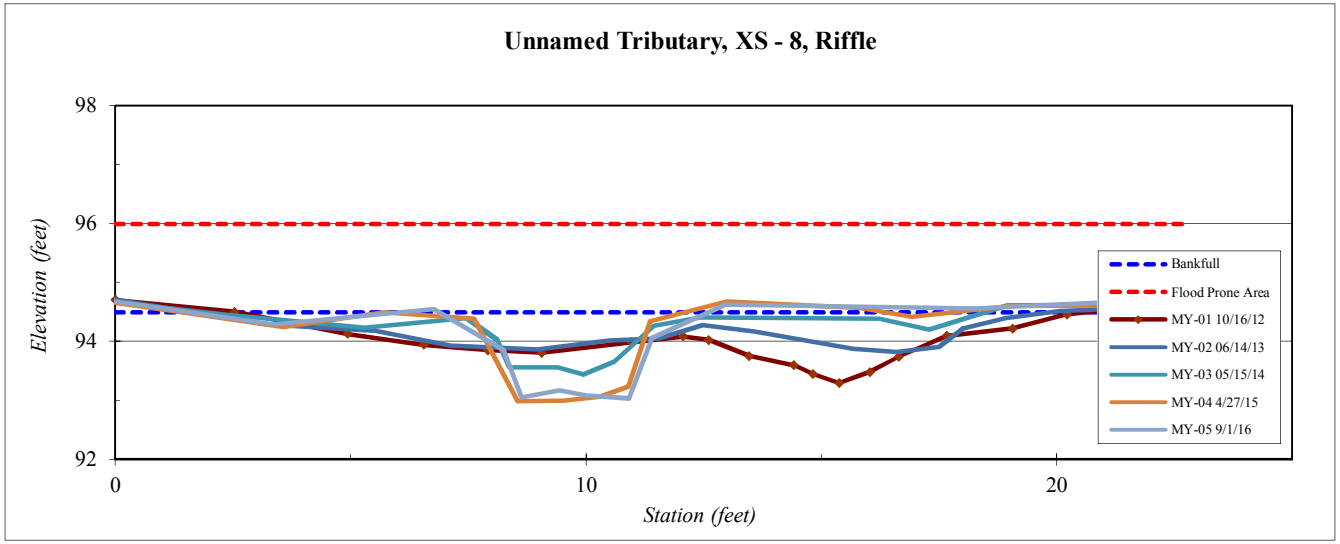


River Basin:	Upper New
Watershed:	Tate Farm
XS ID	XS - 8, Riffle
Drainage Area (sq mi):	0.6
Date:	9/1/2016
Field Crew:	Perkinson, Keith

Station	Elevation
0.0	94.7
3.4	94.3
6.8	94.5
8.2	93.9
8.6	93.1
9.4	93.2
10.0	93.1
10.9	93.0
11.4	94.1
13.0	94.6
18.3	94.6
21.1	94.7
22.7	94.7

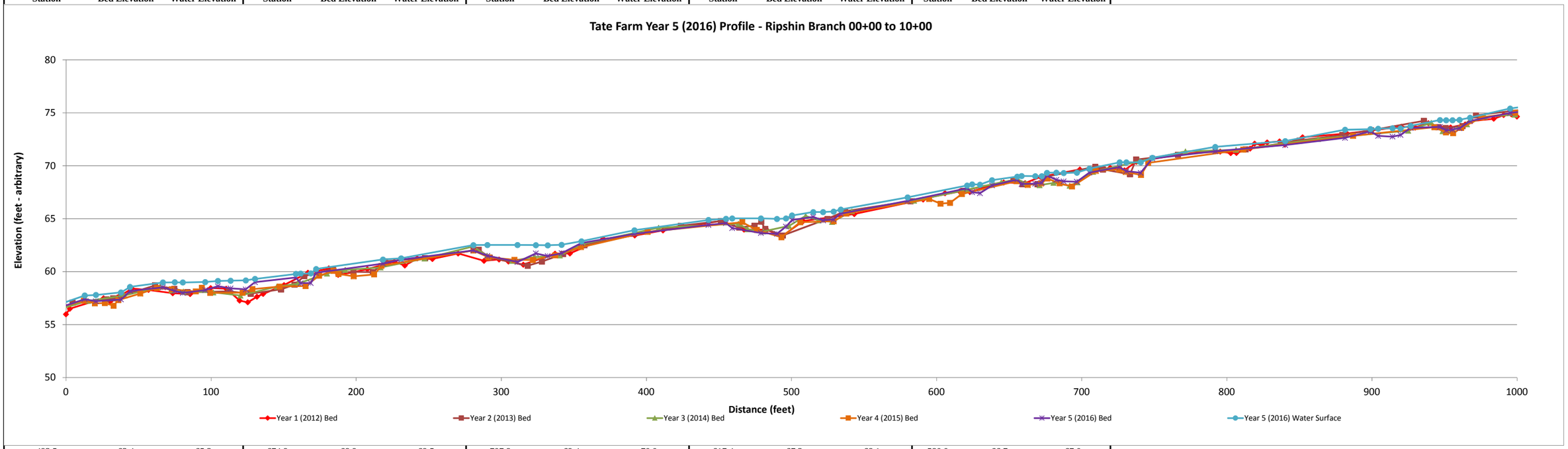
SUMMARY DATA	
Bankfull Elevation:	94.5
Bankfull Cross-Sectional Area:	4.7
Bankfull Width:	5.7
Flood Prone Area Elevation:	96.0
Flood Prone Width:	>80
Max Depth at Bankfull:	1.5
Mean Depth at Bankfull:	0.8
W / D Ratio:	6.9
Entrenchment Ratio:	14.0
Bank Height Ratio:	1.0

Stream Type	B/C



Project Name	Tate Farm - Profile
Reach	Ripshin Branch Station 00+00 - 10+00
Feature	Profile
Date	9/1/16
Crew	Perkinson, Gibbons

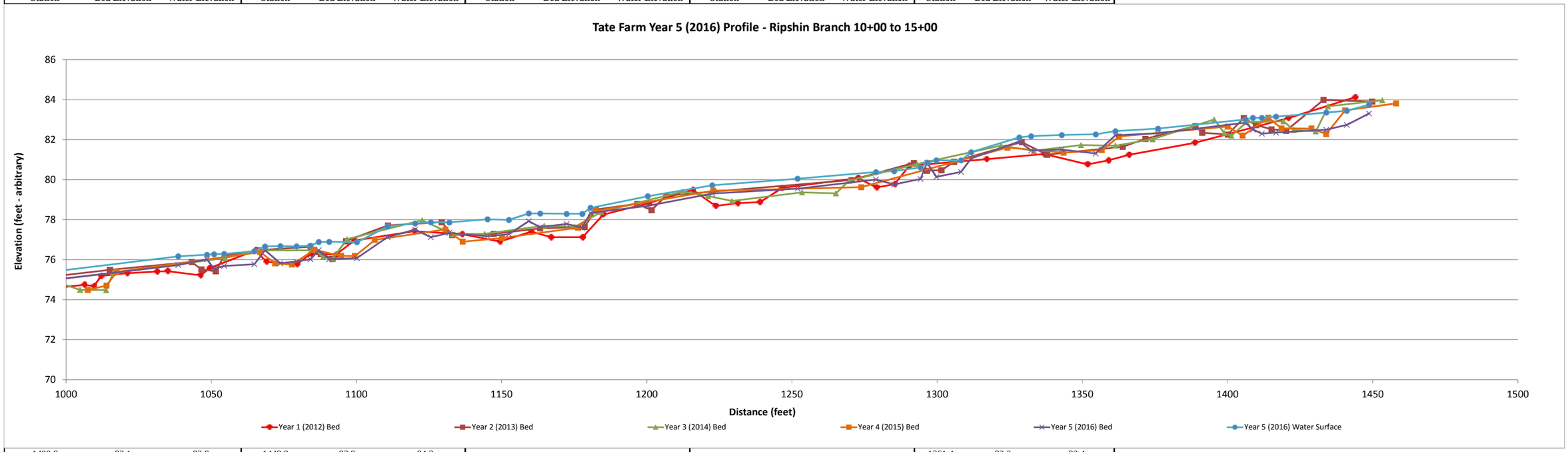
	2012	2013	2014	2015	2016
Avg. Water Surface Slope	0.0182	0.0189	0.0191	0.0190	0.0186
Riffle Length	35	33	53	61	53
Avg. Riffle Slope	0.0247	0.0228	0.0224	0.0215	0.0237
Pool Length	28	28	43	35	28
Pool to Pool Spacing	55	66	88	87	66



2012 Year 1 Monitoring \Survey			2013 Year 2 Monitoring \Survey			2014 Year 3 Monitoring \Survey			2015 Year 4 Monitoring \Survey			2016 Year 5 Monitoring \Survey		
Station	Bed Elevation	Water Elevation	Station	Bed Elevation	Water Elevation	Station	Bed Elevation	Water Elevation	Station	Bed Elevation	Water Elevation	Station	Bed Elevation	Water Elevation
493.5	63.4	65.3	674.9	68.9	69.5	707.8	69.4	70.0	617.4	67.3	68.1	580.0	66.7	67.0
508.0	64.8	65.3	709.3	69.9	70.3	739.9	70.4	70.9	654.9	68.5	69.2	621.0	67.9	68.1
543.2	65.4	66.1	714.6	69.7	70.4	771.4	71.4	71.8	662.8	68.2	69.2	624.5	67.5	68.2
590.7	66.8	67.4	733.3	69.2	70.4	806.4	71.5	72.1	672.0	68.3	69.2	629.8	67.4	68.2
605.8	67.4	67.9	737.5	70.6	70.9	862.9	72.5	73.2	676.4	68.8	69.5	638.1	68.1	68.6
615.8	67.6	68.1	766.3	71.0	71.7	924.9	73.3	73.9	684.8	68.3	69.6	655.5	68.7	69.0
622.9	67.5	68.1	812.9	71.6	72.4	940.8	74.0	74.4	693.2	68.0	69.5	658.5	68.3	69.0
632.7	67.9	68.4	850.3	72.4	73.0	948.7	73.3	74.4	709.7	69.5	70.1	668.0	68.3	69.0
646.2	68.4	69.0	879.4	72.9	73.6	952.9	73.3	74.4	725.8	69.6	70.5	672.4	68.4	69.0
660.9	68.4	69.1	899.2	73.3	73.9	965.5	73.9	74.7	730.2	69.4	70.5	676.0	69.1	69.3
671.5	69.0	69.5	935.8	74.2	74.5	977.7	74.6	75.1	740.9	69.1	70.5	682.4	68.7	69.4
698.6	69.6	70.2	945.7	73.7	74.7	998.2	74.8	75.3	745.8	70.3	70.9	687.5	68.5	69.3
709.9	69.6	70.5	950.7	73.6	74.7	1004.8	74.5	75.3	811.3	71.5	72.2	696.7	68.5	69.3
719.6	69.8	70.6	962.3	73.8	74.8				886.9	72.8	73.6	705.3	69.4	69.7
729.5	69.6	70.6	971.6	74.8	75.2				943.0	73.6	74.5	726.1	69.9	70.3
737.6	70.4	70.9	1015.1	75.5	76.0				950.9	73.2	74.5	730.6	69.5	70.3
767.0	71.1	71.6							955.9	73.1	74.5	740.6	69.3	70.3
792.0	71.4	72.0							961.5	73.6	74.9	748.6	70.7	70.8
795.4	71.3	72.0							975.3	74.6	75.0	792.0	71.4	71.8
802.6	71.2	72.0							998.8	75.0	75.5	840.2	72.0	72.3
806.6	71.2	72.0										881.4	72.6	73.4
816.0	71.6	72.5										898.9	73.2	73.5
819.1	72.1	72.5										904.2	72.8	73.5
824.0	71.9	72.5										914.1	72.7	73.6
827.8	72.2	72.8										919.6	72.9	73.5
836.3	72.3	72.8										926.614416	73.583025	73.765014
840.0	72.0	72.8										946.8	73.7	74.3
852.2	72.7	73.1										951.1	73.3	74.3

Project Name	Tate Farm - Profile
Reach	Ripshin Branch Station 10+00 - 15+00
Feature	Profile
Date	9/1/16
Crew	Perkinson, Gibbons

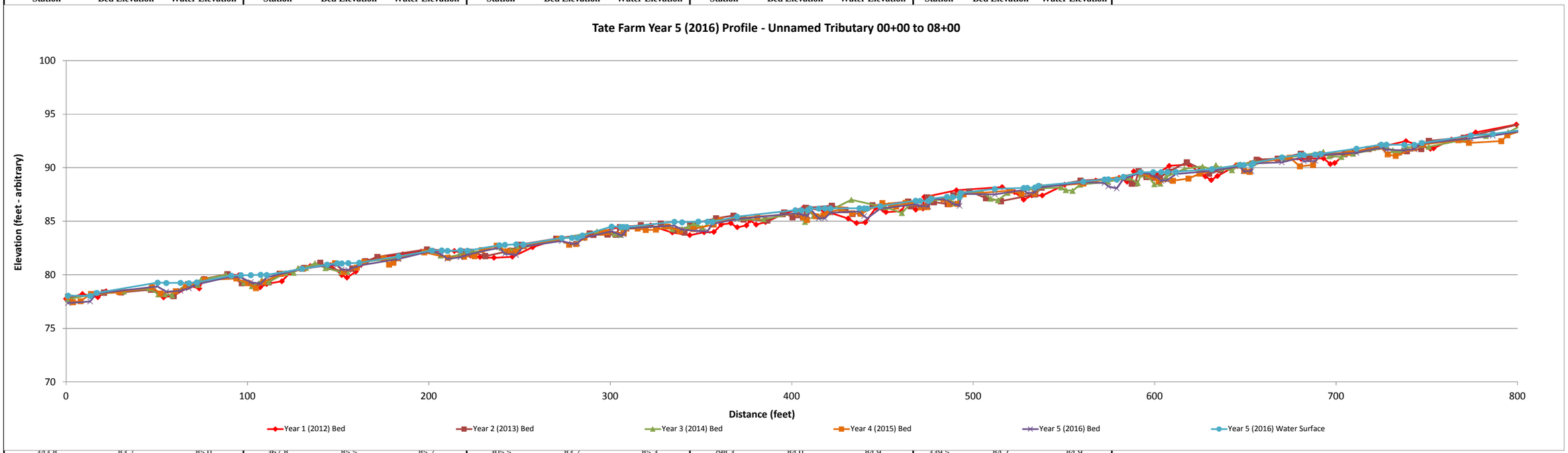
	2012	2013	2014	2015	2016
Avg. Water Surface Slope	0.0182	0.0189	0.0191	0.0190	0.0186
Riffle Length	35	33	53	61	53
Avg. Riffle Slope	0.0247	0.0228	0.0224	0.0215	0.0237
Pool Length	28	28	43	35	28
Pool to Pool Spacing	55	66	88	87	66



2012 Year 1 Monitoring \Survey			2013 Year 2 Monitoring \Survey			2014 Year 3 Monitoring \Survey			2015 Year 4 Monitoring \Survey			2016 Year 5 Monitoring \Survey		
Station	**Bed Elevation**	**Water Elevation**	**Station**	**Bed Elevation**	**Water Elevation**	**Station**	**Bed Elevation**	**Water Elevation**	**Station**	**Bed Elevation**	**Water Elevation**	**Station**	**Bed Elevation**	**Water Elevation**
1420.9	83.1	83.9	1449.8	83.9	84.3							1361.4	82.2	82.4
1443.9	84.1	84.2										1376.1	82.3	82.6
												1406.2	82.8	83.0
												1408.8	82.5	83.1
												1411.8	82.3	83.1
												1416.7	82.3	83.2
												1434.0	82.5	83.4
												1441.1	82.7	83.4
												1448.7	83.3	83.7

Project Name	Tate Farm - Profile
Reach	Unnamed Tributary Station 00+00 - 08+00
Feature	Profile
Date	9/1/16
Crew	Perkinson, Gibbons

	2012	2013	2014	2015	2016
Avg. Water Surface Slope	0.0201	0.0205	0.0196	0.0195	0.0200
Riffle Length	30	22	26	20	29
Avg. Riffle Slope	0.0235	0.0294	0.0251	0.0289	0.0242
Pool Length	21	24	13	17	12
Pool to Pool Spacing	44	48	37	37	40



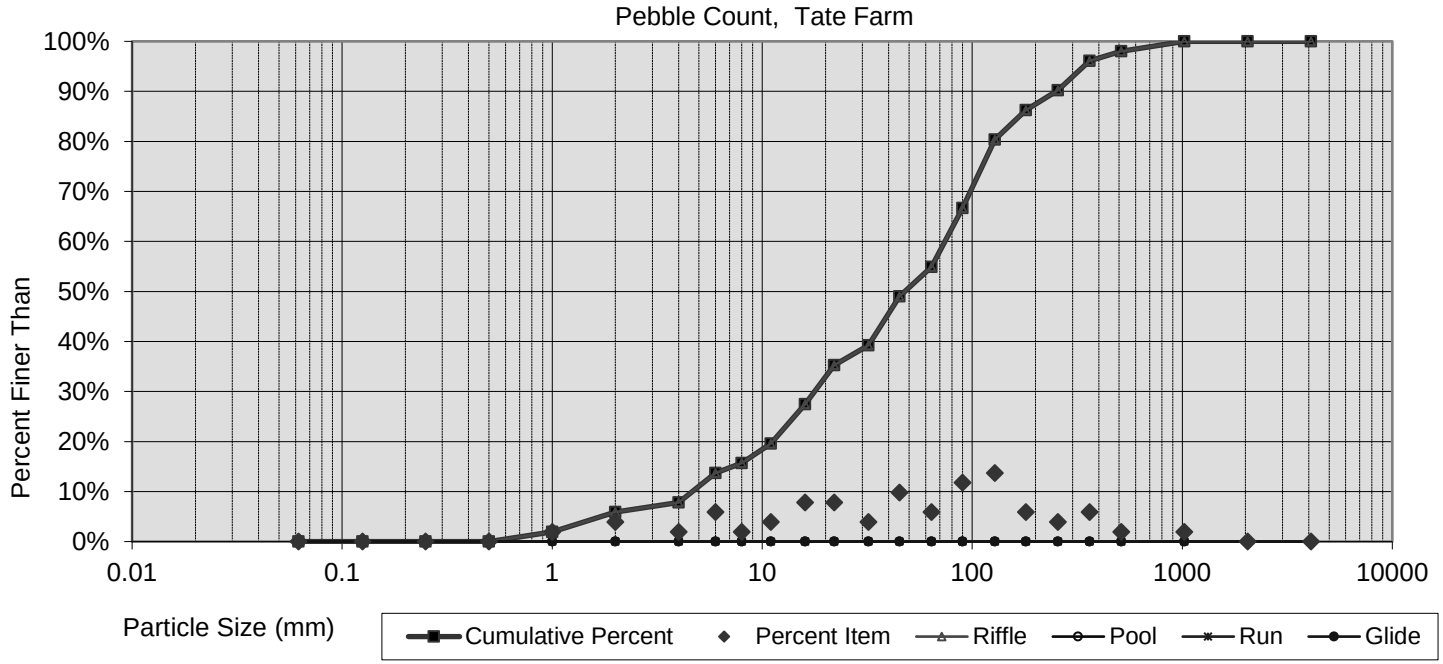
2012 Year 1 Monitoring \Survey			2013 Year 2 Monitoring \Survey			2014 Year 3 Monitoring \Survey			2015 Year 4 Monitoring \Survey			2016 Year 5 Monitoring \Survey		
Station	Bed Elevation	Water Elevation	Station	Bed Elevation	Water Elevation	Station	Bed Elevation	Water Elevation	Station	Bed Elevation	Water Elevation	Station	Bed Elevation	Water Elevation
343.8	83.7	85.0	367.8	85.5	85.7	305.5	83.7	85.3	298.3	84.0	84.9	339.5	84.2	84.9
351.6	84.0	85.0	373.3	85.2	85.7	306.8	84.4	85.5	307.4	83.9	84.9	348.4	84.1	85.0
357.0	84.0	85.0	386.5	85.1	85.7	330.1	84.5	85.9	308.9	84.3	85.0	353.5	84.1	85.0
361.1	84.7		394.9	85.7	86.1	334.0	84.3	85.8	315.1	84.3	85.2	356.2	84.7	84.9
366.4	84.8	85.1	395.9	85.8	86.0	339.5	84.3	85.8	319.5	84.2	85.2	369.7	85.2	85.4
369.9	84.4	85.2	400.3	85.4	86.1	343.0	84.5	85.9	325.2	84.2	85.2	402.0	85.7	86.0
375.0	84.6	85.2	406.2	85.4	86.1	345.9	84.7	86.0	331.7	84.5	85.4	405.2	85.6	86.0
376.9	85.1	85.2	407.8	86.2	86.4	347.9	84.6	86.1	338.2	84.1	85.3	408.7	85.5	86.0
380.3	84.7	85.2	422.1	86.4	86.8	350.8	84.4	86.1	345.7	84.3	85.4	410.2	86.2	86.2
385.6	84.9	85.5	429.6	86.1	86.8	356.6	85.1	86.3	356.9	84.7	85.5	414.9	85.3	86.2
395.5	85.7	86.1	433.5	85.7	86.8	384.4	85.2	86.6	360.8	85.1	86.0	418.2	85.3	86.2
406.6	86.3	86.3	437.8	85.8	86.8	403.2	85.8	87.0	381.0	85.4	86.2	421.2	85.8	86.2
417.5	86.0	86.4	444.5	86.5	86.9	407.3	84.9	87.0	403.6	85.7	86.5	437.2	85.9	86.2
431.0	85.2	86.5	464.2	86.8	87.0	408.6	86.1	87.2	406.5	85.4	86.5	439.9	85.5	86.2
435.7	84.8	86.5	465.5	86.4	87.0	412.0	85.5	87.3	408.5	85.1	86.4	441.5	85.3	86.2
440.5	84.9	86.4	473.4	86.4	87.0	415.2	85.4	87.3	409.6	86.1	86.8	448.7	86.2	86.4
446.3	86.3	86.4	474.7	87.2	87.3	419.7	85.9	87.4	413.2	85.5	86.8	468.2	86.6	86.9
450.3	86.1	86.5	478.2	86.8	87.4	432.8	87.0	87.5	417.4	85.6	86.8	470.6	86.4	86.9
451.9	85.9	86.5	485.8	86.6	87.4	449.1	86.4	87.8	420.2	85.8	86.8	475.3	86.4	86.9
460.5	85.9	86.6	489.0	87.4	87.9	451.8	86.3	87.9	427.0	86.1	87.0	476.8	87.1	87.1
463.0	86.8	86.9	497.8	87.8	88.1	460.7	85.8	87.8	433.2	85.7	87.0	485.5	87.0	87.3
468.4	86.1	87.0	507.1	87.2	88.2	465.4	86.7	87.9	438.1	85.7	87.1	488.7	86.7	87.3
472.3	86.2	86.9	515.3	86.9	88.1	476.4	87.0	88.1	450.0	86.7	87.6	492.4	86.4	87.3
473.0	87.3	87.4	534.0	87.5	88.3	487.4	87.0	88.3	454.7	86.5	87.6	493.2	87.6	87.6
490.8	87.9	88.1	537.7	88.1	88.5	489.0	86.7	88.4	457.6	86.4	87.6	511.8	87.5	88.0
515.9	88.2	88.6	559.1	88.8	89.2	491.5	86.7	88.4	462.6729028	86.717596	87.598112	527.8	87.9	88.1
522.8	87.7	88.6	583.8	89.1	89.3	492.3	87.7	88.8	466.7	86.7	87.6	529.7	87.6	88.1
527.8	87.0	88.6	587.3	88.5	89.4	505.1	87.7	89.1	471.0	86.3	87.6	534.0	87.7	88.2

Pebble Count,

Tate Farm

New River

Note: **Cross Section 4 - Ripshin Branch**

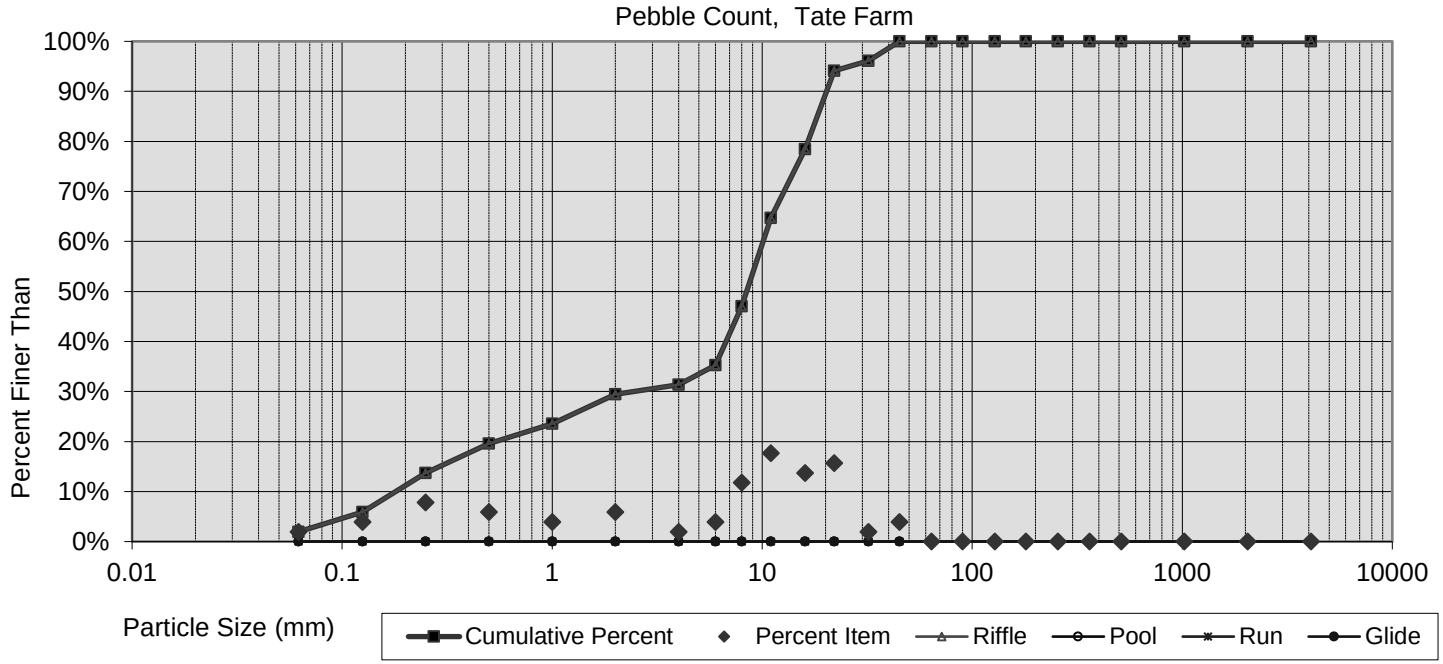


Size percent less than (mm)					Percent by substrate type					
D16	D35	D50	D84	D95	silt/clay	sand	gravel	cobble	boulder	bedrock
8.206	21.74	47.7	158	340	0%	6%	49%	35%	10%	0%

Pebble Count,

	Tate Farm
	New River

Note:	**Cross Section 8 - Unnamed Tributary**



Size percent less than (mm)					Percent by substrate type					
D16	D35	D50	D84	D95	silt/clay	sand	gravel	cobble	boulder	bedrock
0.327	5.82	8.4	18	26	2%	27%	71%	0%	0%	0%

Table 10a. Baseline Stream Data Summary (Ripshin Branch)
Tate Farm (Ripshin Branch) - DMS Project Number 372

Parameter	Gauge	Regional Curve			Pre-Existing Condition					Reference Reach(es) Data					Design			Monitoring Baseline				
Dimension and Substrate - Riffle Only		**LL**	**UL**	**Eq.**	**Min**	**Mean**	**Med**	**Max**	**SD**	**Min**	**Mean**	**Med**	**Max**	**SD**	**Min**	**Max**	**Med**	**Min**	**Mean**	**Med**	**Max**	**SD**
BF Width (ft)					21.0			24.0		14.4			17.1		23.0	25.0						
Floodprone Width (ft)					35			60		27			95		25	80						
BF Mean Depth (ft)					1.2			1.3		1.2			1.3		1.3	1.4						
BF Max Depth (ft)							1.9			1.7			1.9		2.7	2.9						
BF Cross Sectional Area (ft^2)					26.0			29.0		17.6			20.7		30.0	35.0						
Width/Depth Ratio					18.5			21.0		11.8			13.2		17.0	18.0						
Entrenchment Ratio					1.9			2.6		1.6			6.6		1.5	2.0						
Bank Height Ratio							1.8					1.2			1.0	1.2						
Profile																						
Riffle length (ft)																						
Riffle slope (ft/ft)							0.0040			0.0170			0.0420				0.0400					
Pool length (ft)					9.0			43.0		11.0			18.7		20.0	70.0						
Pool Max depth (ft)							3.6			0.9			2.6		3.5	3.6						
Pool spacing (ft)					33.0			253.0		25.7			69.3		80.0	130.0						
Pattern																						
Channel Beltwidth (ft)					7			80		20			41.7		29	150						
Radius of Curvature (ft)					10			160		25.3			185		55	135						
Rc:Bankfull width (ft/ft)					0.4			1		1.8			5.9		3	4.2						
Meander Wavelength (ft)					30			240		97.5			140		85	365						
Meander Width ratio					0.8			2.1		6.8			8		4.4	6.6						
Transport parameters																						
Reach Shear Stress (competency) lbs/ft^2																						
Max part size (mm) mobilized at bankfull																						
Stream Power (transport capacity) W/m^2																						
Additional Reach Parameters																						
Rosgen Classification					B4/F4/C4					B4/C4					B4/C4							
Bankfull Velocity (fps)					5.5										4.8 - 5							
Bankfull Discharge (cfs)					158																	
Valley Length (ft)					----					----												
Channel Thalweg Length (ft)					----					----					2300							
Sinuosity					1.2					1.1 - 1.2					1.1 - 1.3							
Water Surface Slope (ft/ft)					0.018-0.024					0.012 - 0.019					0.02							
BF slope (ft/ft)					----					----					----							
Bankfull Floodplain Area (acres)					----					----					----							
% of Reach with Eroding Banks					----					----												
Channel Stability or Habitat Metric					----					----												
Biological or Other					----					----												

Table 10b. Baseline Stream Data Summary (Substrate, Bed, Bank, and Hydrologic Containment Parameter Distributions)
Tate Farm (Ripshin Branch) - DMS Project Number 372 - Ripshin Branch

Parameter	Pre-Existing Condition							Reference Reach(es) Data							Design							Monitoring Baseline						
Ri%/RU%P%G%/S%																											
SC%/SA%/G%/C%/B%BE%																											
d16/d35/d50/d84/d95			0.2-0.3	4.0-12.0						0.5	3.0-5.0																
Entrainment Class <1.5/1.5-1.99/2.0-4.9/5.0-																											
Incision Class <1.2/1.2-1.49/1.5-1.99/>2.0																											

Table 10c. Baseline Stream Data Summary (Unnamed Tributary)
Tate Farm (Ripshin Branch) - DMS Project Number 372

Parameter	Gauge	Regional Curve			Pre-Existing Condition					Reference Reach(es) Data					Design			Monitoring Baseline				
Dimension and Substrate - Riffle Only		**LL**	**UL**	**Eq.**	**Min**	**Mean**	**Med**	**Max**	**SD**	**Min**	**Mean**	**Med**	**Max**	**SD**	**Min**	**Max**	**Med**	**Min**	**Mean**	**Med**	**Max**	**SD**
BF Width (ft)							18.0					14.4					16.0					
Floodprone Width (ft)							28					95			16	80	50					
BF Mean Depth (ft)							0.9					1.2					0.9					
BF Max Depth (ft)							1.4					1.7			1.3	1.4						
BF Cross Sectional Area (ft^2)							16.3					17.6					14.0					
Width/Depth Ratio							21.8					11.8					18.0					
Entrenchment Ratio							1.6					6.6			1.0	2.5						
Bank Height Ratio							2.3					1.2					1.0					
Profile																						
Riffle length (ft)																						
Riffle slope (ft/ft)							0.0400					0.0170					0.0400					
Pool length (ft)					3.6			19.9				18.7					25.0					
Pool Max depth (ft)							1.4					2.6					1.9					
Pool spacing (ft)					11.0		80.0					69.0			50.0	90.0	60.0					
Pattern																						
Channel Beltwidth (ft)					12			33				41.7			35	100						
Radius of Curvature (ft)					2.5			25				25.3			40	200						
Rc:Bankfull width (ft/ft)							0.8					1.8			3.4	14						
Meander Wavelength (ft)					50			170				97.5			120	160						
Meander Width ratio							4.9					2.9			8.3	8.8						
Transport parameters																						
Reach Shear Stress (competency) lbs/ft^2																						
Max part size (mm) mobilized at bankfull																						
Stream Power (transport capacity) W/m^2																						
Additional Reach Parameters																						
Rosgen Classification							B4/F4					C4					B4/C4					
Bankfull Velocity (fps)							5.1										4.5					
Bankfull Discharge (cfs)							83.07															
Valley Length (ft)							----					----										
Channel Thalweg Length (ft)							----					----					912					
Sinuosity							1.2					1.2					1.0-1.2					
Water Surface Slope (ft/ft)							0.02					0.012					0.02					
BF slope (ft/ft)							----					----					----					
Bankfull Floodplain Area (acres)							----					----					----					
% of Reach with Eroding Banks							----					----										
Channel Stability or Habitat Metric							----					----										
Biological or Other							----					----										

Table 10d. Baseline Stream Data Summary (Substrate, Bed, Bank, and Hydrologic Containment Parameter Distributions)
Tate Farm (Ripshin Branch) - DMS Project Number 372 - Unnamed Tributary

Parameter	Pre-Existing Condition							Reference Reach(es) Data							Design							Monitoring Baseline						
Ri%/RU%P%G%/S%																											
SC%/SA%/G%/C%/B%BE%																											
d16/d35/d50/d84/d95	0.2	4.8	12.8	44.2	78.5			8.0	11.8	18.4	73.0	100.0															
Entrainment Class <1.5/1.5-1.99/2.0-4.9/5.0-																											
Incision Class <1.2/1.2-1.49/1.5-1.99/>2.0																											

Table 11a. Monitoring Data - Dimensional Morphology Summary (Dimensional Parameters - Cross Sections)
Tate Farm (Ripshin Branch) - DMS Project Number 372 - Ripshin Branch

Parameter	Cross Section 1 Riffle							Cross Section 2 Pool							Cross Section 3 Riffle							Cross Section 4 Riffle							Cross Section 5 Riffle						
Dimension	MY0	MY1	MY2	MY3	MY4	MY5	MY5+	MY0	MY1	MY2	MY3	MY4	MY5	MY5+	MY0	MY1	MY2	MY3	MY4	MY5	MY5+	MY0	MY1	MY2	MY3	MY4	MY5	MY5+	MY0	MY1	MY2	MY3	MY4	MY5	MY5+
BF Width (ft)		23.4	23.3	25.8	24.3	24.8			23.2	25.0	25.3	26.0	27.2			28.1	23.3	28.7	28.2	26.9			21.4	23.3	22.0	23.8	24.6			21.7	24.0	25.3	31.0	31.9	
Floodprone Width (ft) (approx)		80.0	80.0	80.0	80.0	80.0			NA	NA	NA	NA	NA			80.0	80.0	80.0	80.0	80.0			80.0	80.0	80.0	80.0	80.0			80.0	80.0	80.0	80.0	80.0	
BF Mean Depth (ft)		1.2	1.2	1.1	1.2	1.1			1.6	1.3	1.1	1.1	1.0			1.3	1.3	1.2	1.3	1.2			1.1	0.9	1.1	1.1	1.0			0.9	0.8	0.7	0.7	0.6	
BF Max Depth (ft)		1.9	1.9	1.9	2.0	1.8			3.4	3.3	3.4	3.3	3.2			2.1	2.0	2.1	2.1	2.1			2.0	1.8	1.8	2.0	2.1			1.9	1.7	1.5	1.8	1.8	
BF Cross Sectional Area (ft^2)		27.6	27.9	28.8	29.0	27.7			36.1	32.2	28.1	27.7	27.2			37.4	30.7	33.2	35.5	32.1			23.5	21.0	24.4	25.3	24.6			19.2	18.0	18.3	21.7	20.6	
Width/Depth Ratio		19.8	19.5	23.1	20.4	22.2			NA	NA	NA	NA	NA			21.1	17.7	24.8	22.4	22.5			19.5	25.9	19.8	21.6	24.6			24.5	32.0	35.0	44.3	49.4	
Entrenchment Ratio		3.4	3.4	3.1	3.3	3.2			NA	NA	NA	NA	NA			2.8	3.4	2.8	2.8	3.0			3.7	3.4	3.6	3.4	3.3			3.7	3.3	3.2	2.6	2.5	
Bank Height Ratio		1.0	1.0	1.0	1.0	1.0			1.0	1.0	1.0	1.0	1.0			1.0	1.0	1.0	1.0	1.0			1.0	1.0	1.0	1.0	1.0			1.0	1.0	1.0	1.0	1.0	
d50 (mm)		----	----	----	----	----			----	----	----	----	----			----	----	----	----	----			79.2	81.6	80.3	56.9	47.7			----	----	----	----	----	

Table 11b. Monitoring Data - Stream Reach Data Summary
Tate Farm (Ripshin Branch) - DMS Project Number 372 - Ripshin Branch

Parameter	Baseline					MY-1					MY-2					MY-3					MY-4					MY-5				
Dimension and Substrate - Riffle Only	Min	Mean	Med	Max	SD	Min	Mean	Med	Max	SD	Min	Mean	Med	Max	SD	Min	Mean	Med	Max	SD	Min	Mean	Med	Max	SD	Min	Mean	Med	Max	SD
BF Width (ft)						21.4	23.7	22.6	28.1	3.1	23.3	23.5	23.3	24	0.4	22.0	25.5	25.6	28.7	2.7	23.8	26.8	26.3	31	3.4	24.5	27.0	25.9	31.9	3.4
Floodprone Width (ft)								80					80					80				80						80			
BF Mean Depth (ft)						0.9	1.1	1.2	1.3	0.2	0.8	1.1	1.1	1.3	0.2	0.7	1.0	1.1	1.2	0.2	0.7	1.1	1.2	1.3	0.3	0.6	1.0	1.1	1.2	0.3
BF Max Depth (ft)						1.9	2.0	2.0	2.1	0.1	1.7	1.9	1.9	2.0	0.1	1.5	1.8	1.9	2.1	0.3	1.8	2.0	2.0	2.1	0.1	1.8	2.0	2.0	2.1	0.2
BF Cross Sectional Area (ft^2)						19.2	26.9	25.6	37.4	7.8	18.0	24.4	24.5	30.7	5.9	18.3	26.2	26.6	33.2	6.4	21.7	27.9	27.2	35.5	5.9	20.6	26.3	26.2	32.1	4.9
Width/Depth Ratio						19.5	21.2	20.6	24.1	2.2	17.9	23.3	22.7	30.0	5.6	20.0	25.9	23.7	36.1	7.1	20.3	27.0	21.7	44.3	11.6	22.4	30.7	23.5	53.2	15.0
Entrenchment Ratio						2.8	3.4	3.6	3.7	0.4	3.3	3.4	3.4	3.4	0.1	2.8	3.2	3.1	3.6	0.4	2.6	3.0	3.1	3.4	0.4	2.5	3.0	3.1	3.3	0.3
Bank Height Ratio								1.0					1.0					1.0					1.0					1.0		
Profile -Downstream																														
Riffle length (ft)						5.3	35.1	26.3	107.8	28.6	14.2	56.5	33	198.3	50.7	13	71	52	233	63	10	61	38	197	56	9.5	52.7	26.2	150.3	44.1
Riffle slope (ft/ft)						0.0059	0.0247	0.0260	0.0445	0.0105	0.0145	0.0238	0.0228	0.0355	0.0065	0.0014	0.0224	0.0239	0.0363	0.01	0.0056	0.0215	0.0212	0.0398	0.0096	0.0130	0.0237	0.0209	0.0479	0.0098
Pool length (ft)						8.6	27.7	24.7	77.0	16.2	10.1	34.1	27.8	102.9	25.5	11	43	46	95	26	14.0	34.7	28.7	80.8	21.9	13.9	28.0	23.1	74.5	13.8
Pool Max depth (ft)								3.4					3.3					3.4					3.3					3.2		
Pool spacing (ft)						8.6	55.4	43.8	160.7	37.0	24.3	84.0	65.9	234.1	54.6	28	113	88	270	77	20.9	87.2	76.0	229.5	61.4	15.1	66.4	46.0	182.8	50.7
Pattern																														
Channel Beltwidth (ft)																														
Radius of Curvature (ft)																														
Rc:Bankfull width (ft/ft)																														
Meander Wavelength (ft)																														
Meander Width ratio																														
Additional Reach Parameters																														
Rosgen Classification						B/C-type					B/C-type					B/C-type					B/C-type					B/C-type				
Channel Thalweg Length (ft)						1444					1449					453					1499					1600				
Sinuosity						1.2					1.2					1.2					1.2					1.2				
Water Surface Slope (Channel) (ft/ft)						0.0182					0.0189					0.0191					0.019					0.0186				
BF slope (ft/ft)						----					----					----					----					----				
Ri%/RU%P%G%/S%																														
SC%/SA%/G%/C%/B%BE%																														
d16/d35/d50/d84/d95																														
% of Reach with Eroding Banks						0					0					0					0					0				
Channel Stability or Habitat Metric						----					----					----					----					----				
Biological or Other						----					----					----					----					----				

Table 11c. Monitoring Data - Dimensional Morphology Summary (Dimensional Parameters - Cross Sections)
Tate Farm (Ripshin Branch) - DMS Project Number 372 - Unnamed Tributary

Parameter	Cross Section 6 Riffle							Cross Section 7 Pool							Cross Section 8 Riffle						
Dimension	MY0	MY1	MY2	MY3	MY4	MY5	MY5+	MY0	MY1	MY2	MY3	MY4	MY5	MY5+	MY0	MY1	MY2	MY3	MY4	MY5	MY5+
BF Width (ft)		17.4	16.8	17.5	16.8	17.2			16.0	15.8	14.7	13.5	9.3			17.4	18.7	5.0	5.6	57.0	
Floodprone Width (ft) (approx)		80.0	80.0	80.0	80.0	80.0			NA	NA	NA	NA	NA			80.0	80.0	80.0	80.0	80.0	
BF Mean Depth (ft)		1.0	0.9	1.0	0.9	0.8			0.9	0.6	0.3	0.4	0.7			0.5	0.4	0.5	0.0	0.1	
BF Max Depth (ft)		1.7	1.7	1.7	1.7	1.6			2.4	1.6	1.2	1.2	2.0			1.2	0.7	1.0	1.5	1.5	
BF Cross Sectional Area (ft^2)		17.4	15.8	16.9	14.4	14.3			14.5	8.9	4.9	5.1	6.2			8.9	7.6	2.6	4.6	4.7	
Width/Depth Ratio		17.4	17.9	18.1	19.6	20.7			NA	NA	NA	NA	NA			34.0	46.0	9.6	3.7	691.3	
Entrenchment Ratio		4.6	4.8	4.6	4.8	4.7			NA	NA	NA	NA	NA			4.6	4.3	16.0	14.3	1.4	
Bank Height Ratio		1.0	1.0	1.0	1.0	1.0			1.0	1.0	1.0	1.0	1.0			1.0	1.0	1.0	1.0	1.0	
d50 (mm)		----	----	----	----	----			----	----	----	----	----			1.0	7.3	8.4	8.4	8.4	

Table 11d. Monitoring Data - Stream Reach Data Summary
Tate Farm (Ripshin Branch) - DMS Project Number 372 - Unnamed Tributary

Parameter	Baseline					MY-1					MY-2					MY-3					MY-4					MY-5				
Dimension and Substrate - Riffle Only	**Min**	**Mean**	**Med**	**Max**	**SD**	**Min**	**Mean**	**Med**	**Max**	**SD**	**Min**	**Mean**	**Med**	**Max**	**SD**	**Min**	**Mean**	**Med**	**Max**	**SD**	**Min**	**Mean**	**Med**	**Max**	**SD**	**Min**	**Mean**	**Med**	**Max**	**SD**
BF Width (ft)								17.4			16.8	17.8	17.8	18.7	1.3	5.0	11.3	11.3	17.5	8.8	5.6	11.2	11.2	16.8	6.7	5.7	11.5	11.5	17.2	8.1
Floodprone Width (ft)								80					80					80					80					80		
BF Mean Depth (ft)						0.5	0.8	0.8	1.0	0.4	0.4	0.7	0.7	0.9	0.4	0.5	0.8	0.8	1.0	0.4	0.8	0.8	0.8	0.8	0.0	0.8	0.8	0.8	0.8	0.0
BF Max Depth (ft)						1.2	1.5	1.5	1.7	0.4	0.7	1.2	1.2	1.7	0.7	1.0	1.4	1.4	1.7	0.5	1.5	1.6	1.6	1.7	0.1	1.5	1.6	1.6	1.6	0.1
BF Cross Sectional Area (ft^2)						8.9	13.2	13.2	17.4	6.0	7.6	11.7	11.7	15.8	5.8	2.6	9.8	9.8	16.9	10.1	4.6	9.4	9.4	14.1	6.7	4.7	9.5	9.5	14.3	6.8
Width/Depth Ratio						17.4	26.1	26.1	34.8	12.3	18.7	32.7	32.7	46.8	19.9	10.0	13.8	13.8	17.5	8.1	7.0	14.0	14.0	21.0	9.9	7.1	14.3	14.3	21.5	10.2
Entrenchment Ratio								4.6			4.3	4.5	4.5	4.8	0.3	4.6	10.3	10.3	16.0	8.1	4.8	9.5	9.5	14.3	6.7	4.7	9.3	9.3	14.0	6.6
Bank Height Ratio								1.0					1.0					1.0					1.0					1.0		
Profile - Upstream																														
Riffle length (ft)						3.9	29.7	27.3	65	17.9	8.79	26.5	22.4	53	14.8	3	26	23	66	17	4.03	20.36	19.45	55.8	14.3	8.7	29.2	26.3	59.9	15.1
Riffle slope (ft/ft)						0.0064	0.0235	0.0233	0.0436	0.0108	0.0038	0.0305	0.0294	0.0639	0.0154	0.0000	0.0251	0.0230	0.0627	0.02	0.0048	0.0289	0.0299	0.0632	0.0165	0.0003	0.0242	0.0257	0.0518	0.0118
Pool length (ft)						7.1	20.8	19.0	43.2	10.8	7.4	22.7	23.7	39.9	9.8	3.0	13.0	11.0	33.0	7.0	6.0	17.0	15.3	33.0	8.9	7.0	12.1	11.4	22.3	5.7
Pool Max depth (ft)								2.4					1.6					1.2					1.2					2.0		
Pool spacing (ft)						7.1	43.6	39.3	103.9	28.7	12.9	42.7	47.9	85.2	18.3	8.0	37.0	35.0	78.0	20.0	10.6	37.2	37.9	88.5	20.3	11.0	40.0	40.5	66.8	18.3
Pattern																														
Channel Beltwidth (ft)																														
Radius of Curvature (ft)																														
Rc:Bankfull width (ft/ft)																														
Meander Wavelength (ft)																														
Meander Width ratio																														
Additional Reach Parameters																														
Rosgen Classification						B/C-type					B/C-type					B/C-type					B/C-type					B/C-type				
Channel Thalweg Length (ft)						799					803					816					814					813				
Sinuosity						1.2					1.2					1.2					1.2					1.2				
Water Surface Slope (Channel) (ft/ft)						0.0201					0.0205					0.0196					0.0195					0.02				
BF slope (ft/ft)						----					----					----					----					----				
Ri%/RU%P%G%/S%																														
SC%/SA%/G%/C%/B%BE%																														
d16/d35/d50/d84/d95																														
% of Reach with Eroding Banks						19					0					0					0					0				
Channel Stability or Habitat Metric						----					----					----					----					----				
Biological or Other						----					----					----					----					----				

APPENDIX E

HYDROLOGY DATA

Table 12. Verification of Bankfull Events

Table 13. Wetland Hydrology Criteria Attainment Summary

Groundwater Gauge Graphs

Table 12. Verification of Bankfull Events

Tate Farm (Ripshin Branch) Stream and Wetland Restoration Site (DMS Project Number 372)

Date of Data Collection	Date of Occurrence	Method	Photo (if available)
June 7, 2013	January 17, 2013	Approximately 3.9 inches of rain documented* at a nearby rain station over a four day period from January 14-17, 2013.	---
April 28, 2013	January 30, 2013	Wrack and sediment observe on top of banks after approximately 4.2 inches of rain was documented* at a nearby rain station on January 30, 2013.	1-3
June 12, 2013	May 7, 2013	Approximately 4.34 inches of rain documented over three days at the onsite rain gauge.	---
June 12, 2013	May 24, 2013	Wrack observed in the floodplain after approximately 5.92 inches of rain was documented over eight days at the onsite rain gauge.	4
August 13, 2013	July 4, 2013	Approximately 4.13 inches of rain documented over two days at the onsite rain gauge.	---
August 13, 2013	August 10, 2013	Wrack and laid back vegetation observed in the flood plain after approximately 3.52 inches of rain was documented at the onsite rain gauge.	5
October 7, 2014	September 2-8, 2014	Wrack observed in floodplain after rainfall totaling 4.37 inches documented at the onsite rain gauge.	6
April 26, 2015	April 19, 2015	Wrack and laid-back vegetation observed on the floodplain after approximately 2.32 inches of rain documented at an onsite rain guage on 4/19/15 with an additional 3.21 inches documented the preceding 2 weeks.	7-8
November 5, 2015	July 14, 2015	Approximately 4.21 inches of rain documented over two days at the onsite rain gauge.	---
November 5, 2015	October 3, 2015	Approximately 6.38 inches of rain documented over a ten day period at the onsite rain gauge.	---
August 31, 2016	August 8, 2016	Approximately 2.57 inches of rain documented in one day after 3.59 inches of rain was documented over the previous five days at the onsite rain gauge.	---

*Jefferson Weather Station (Weatherunderground 2014)

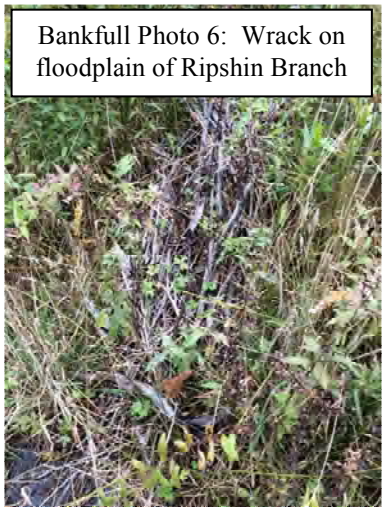
Bankfull Photo 1: Unnamed Tributary

Bankfull Photo 2: Unnamed Tributary

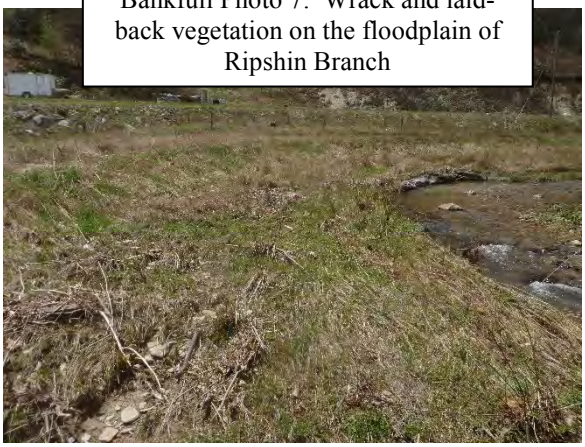
Bankfull Photo 3: Ripshin Branch

Bankfull Photo 4: Ripshin Branch

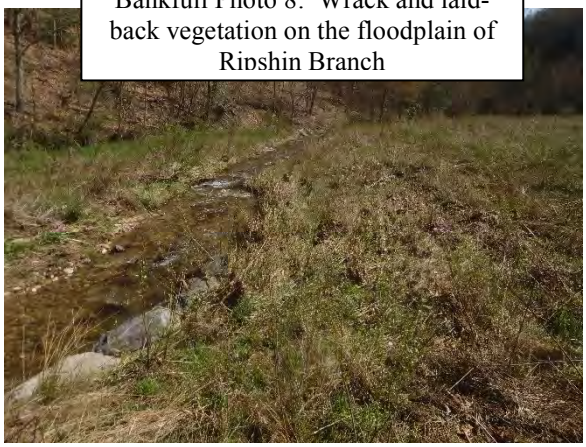
Bankfull Photo 5: Ripshin Branch



Bankfull Photo 6: Wrack on floodplain of Ripshin Branch



Bankfull Photo 7: Wrack and laid-back vegetation on the floodplain of Ripshin Branch



Bankfull Photo 8: Wrack and laid-back vegetation on the floodplain of Ripshin Branch

Table 13. Wetland Hydrology Criteria Attainment Summary

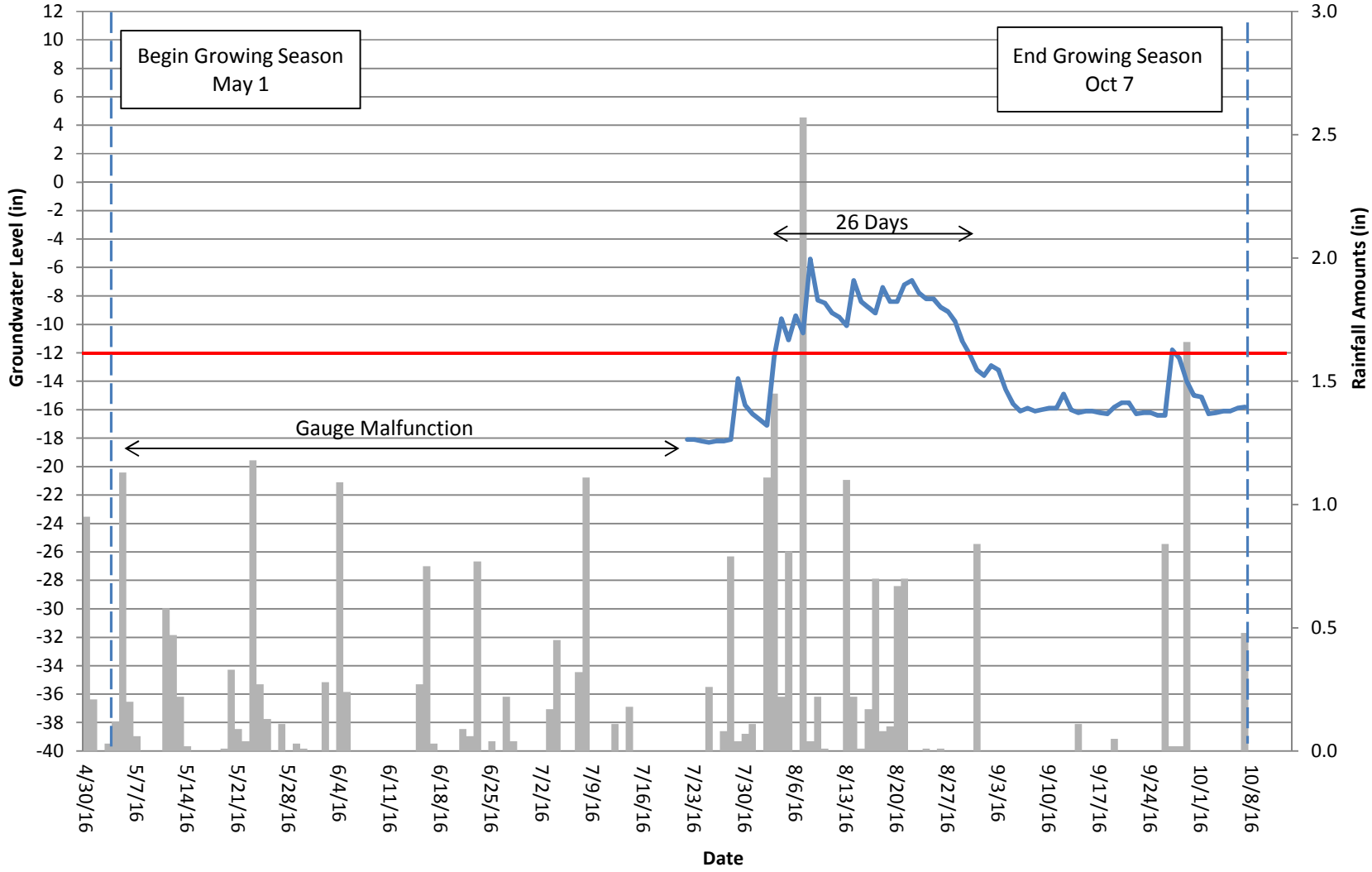
Tate Farm (Ripshin Branch) Stream and Wetland Restoration Site (DMS Project Number 372)

Gauge	Success Criteria Achieved/Max Consecutive Days During Growing Season (Percentage)				
	Year 1 (2012)*	**Year 2 (2013)**	**Year 3 (2014)**	**Year 4 (2015)**	**Year 5 (2016)**
1	--	Yes/130 Days (81%)	Yes/34 Days (21%)	Yes/22 Days (14%)	Yes/26 Days (16%)
2	--	Yes/160 Days (100%)	Yes/160 Days (100%)	Yes/160 Days (100%)	Yes/160 Days (100%)
3	--	Yes/160 Days (100%)	Yes/160 Days (100%)	Yes/160 Days (100%)	Yes/160 Days (100%)
4	--	Yes/152 Days (95%)	No/14 Days** (8%)	Yes/46 Days (29%)	Yes/61 Days (38%)
5	--	Yes/160 Days (100%)	Yes/47 Days (29%)	Yes/43 Days (27%)	Yes/60 Days (38%)
6	--	Yes/160 Days (100%)	Yes/46 Days (29%)	Yes/114 Days (71%)	Yes/80 Days (50%)

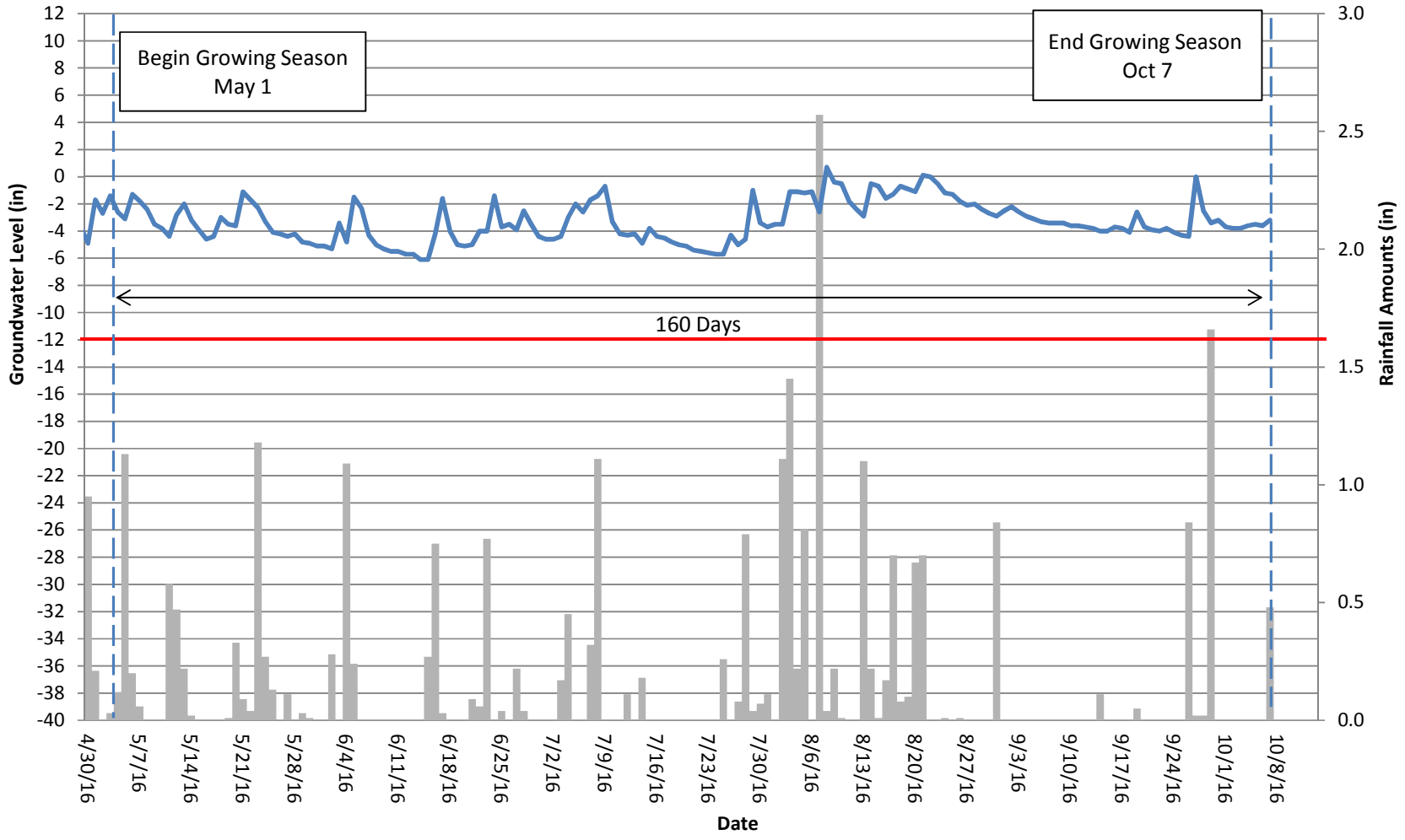
* Groundwater Gauges were installed in October 2012; therefore, groundwater monitoring was initiated during the Year 2 (2013) monitoring year.

**Gauge 4 malfunctioned at beginning of 2014 growing season resulting in loss of data. A battery failure at the beginning of the growing season resulted in a loss of data. The gauge was replaced and is currently functioning properly, but during a subsequent visit additional data was lost due to a failed Meazura PDA. Based on hydrology of the additional gauges, in addition to abundant precipitation, it is likely that Gauge 4 would have met success for year 3 (2014).

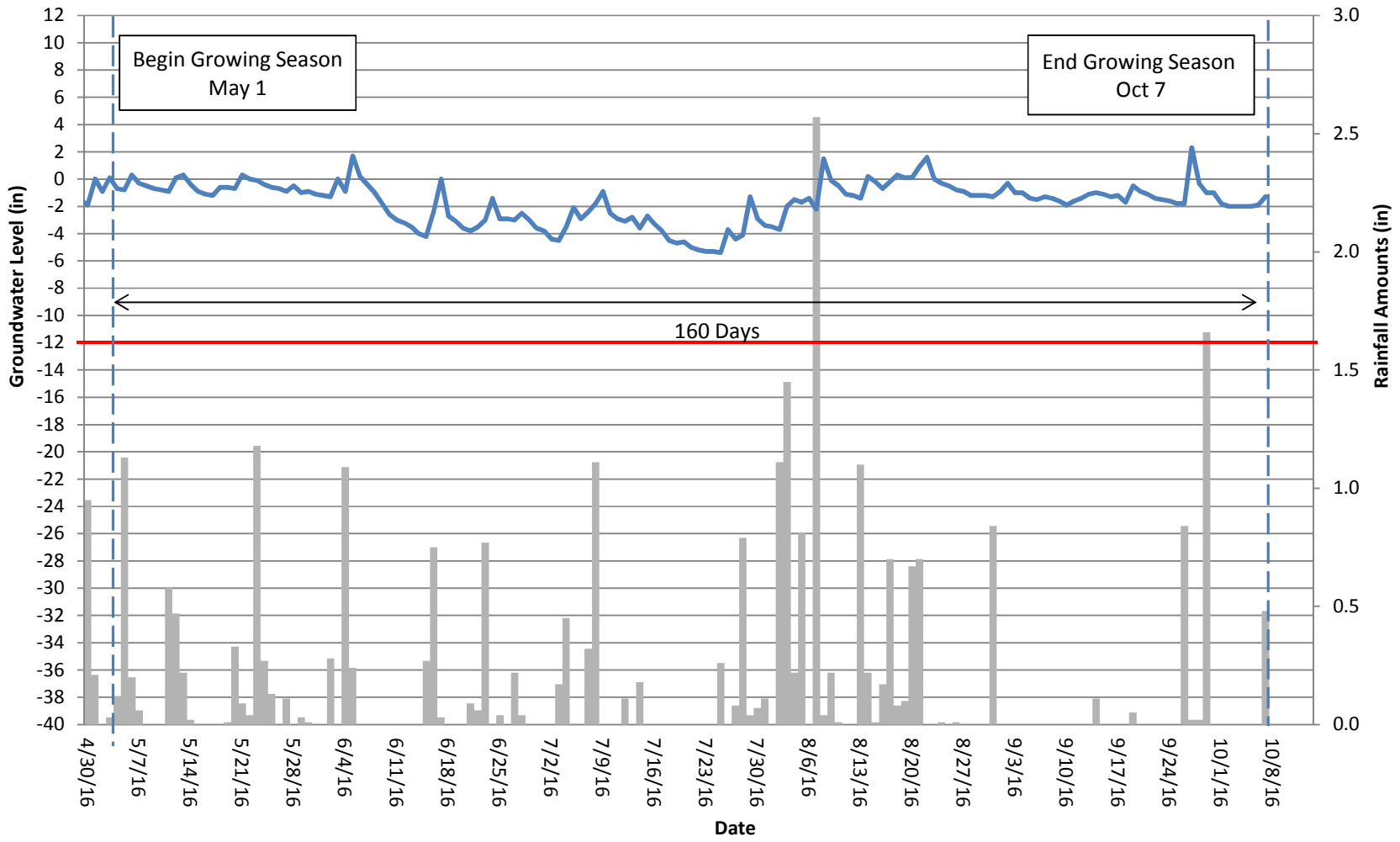
Tate Farm Groundwater Gauge 1
Year 5 (2016 Data)



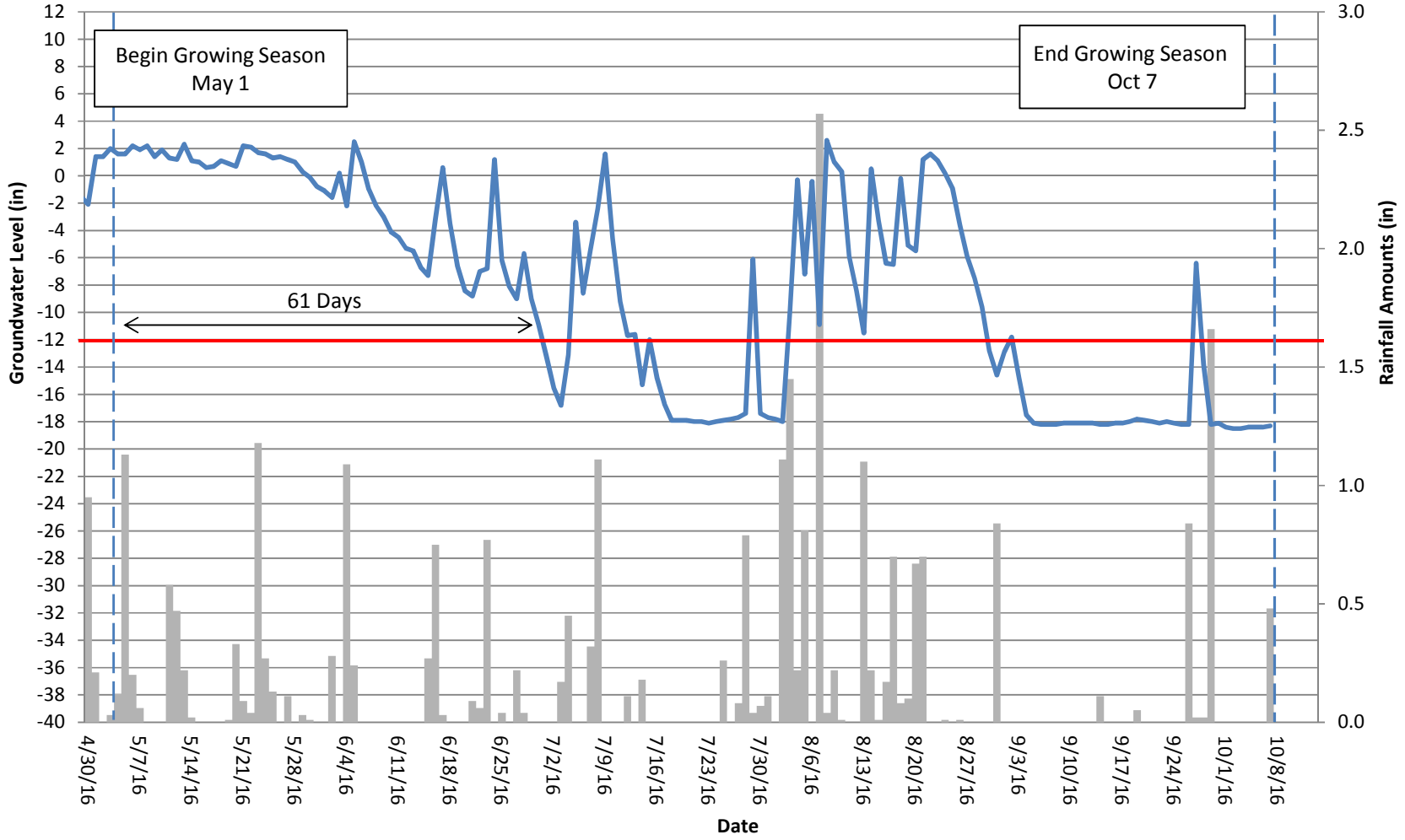
Tate Farm Groundwater Gauge 2
Year 5 (2016 Data)



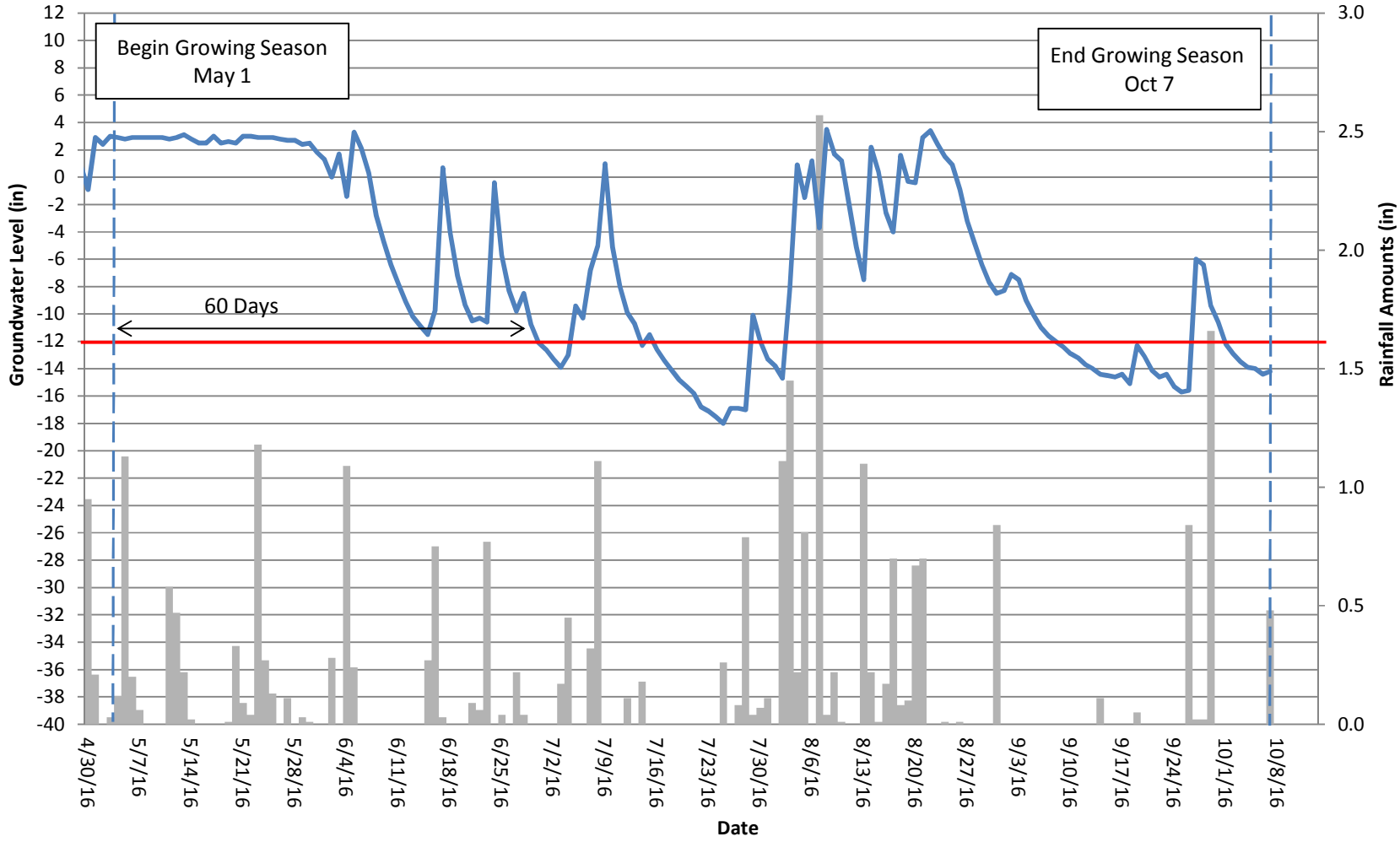
Tate Farm Groundwater Gauge 3
Year 5 (2016 Data)



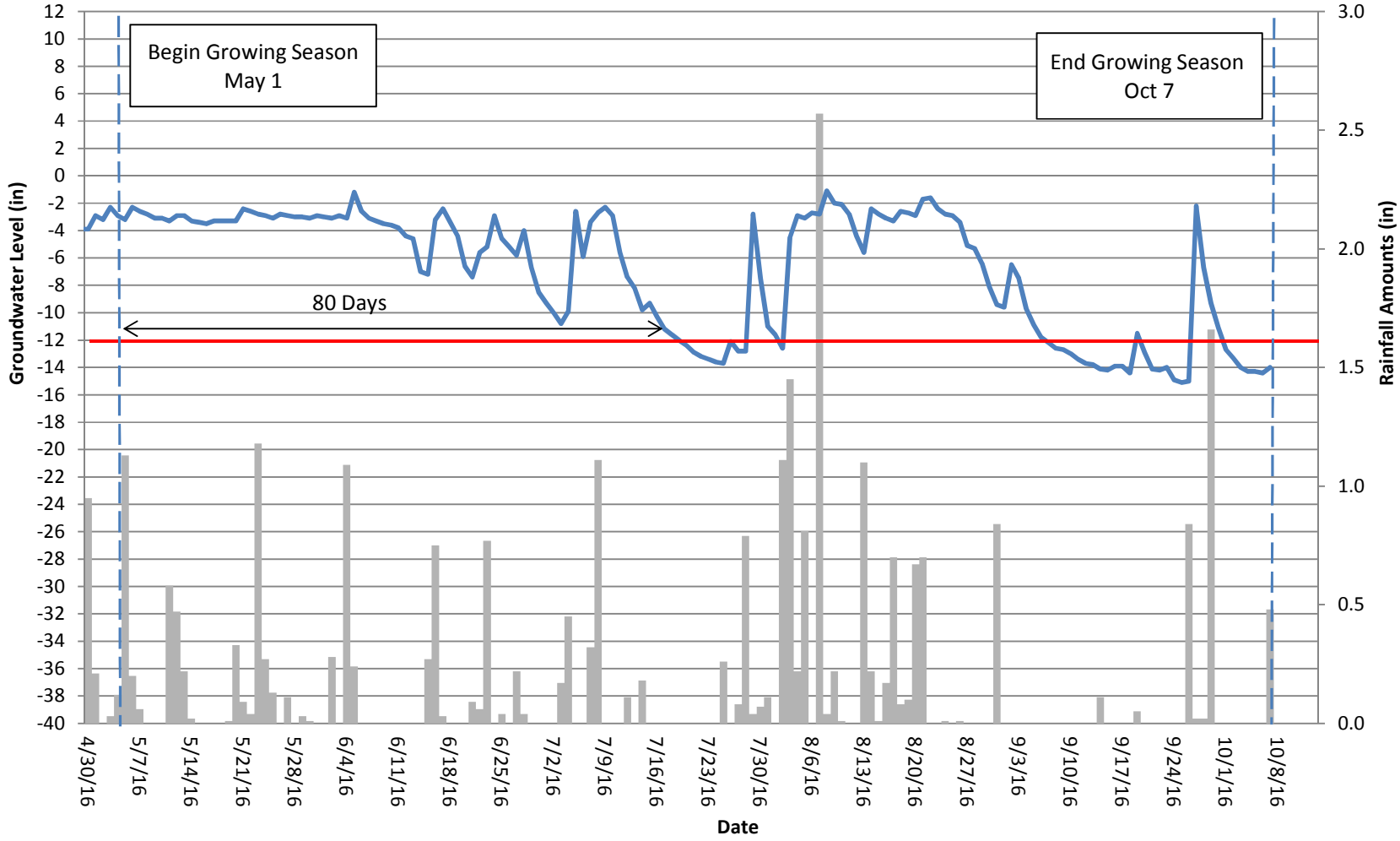
Tate Farm Groundwater Gauge 4
Year 5 (2016 Data)



Tate Farm Groundwater Gauge 5
Year 5 (2016 Data)



Tate Farm Groundwater Gauge 6
Year 5 (2016 Data)



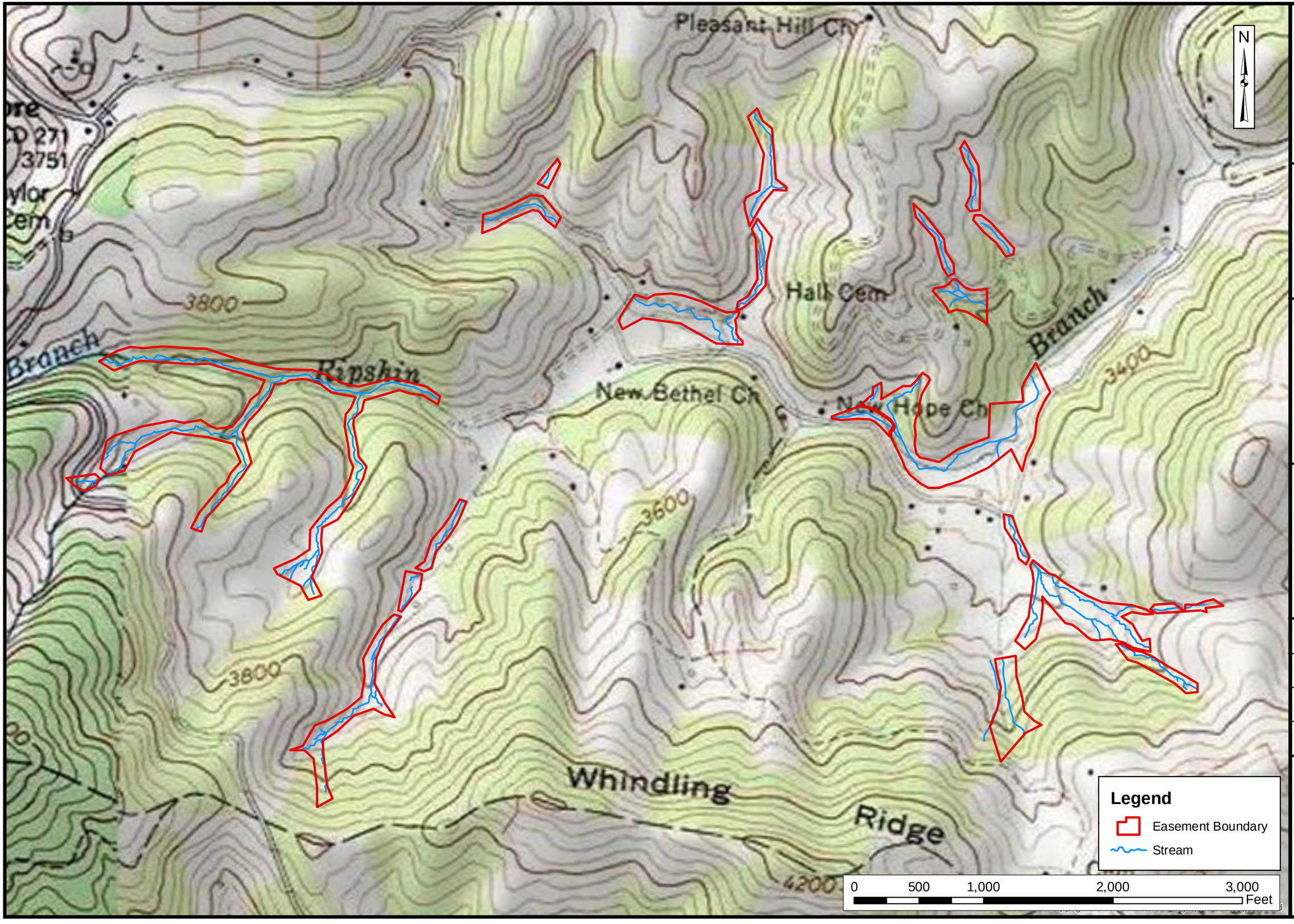
APPENDIX F

ADDITIONAL SITE DATA

Figure 3. USGS Topographic Map

Figure 4. NRCS Soils Map

Preconstruction Photographs



Axiom Environmental, Inc.

Prepared for:

North Carolina Department of Environmental Quality

Division of Mitigation Services

Project:

TATE FARM (RIPSHIN BRANCH) STREAM AND WETLAND RESTORATION SITE

DMS Project Number 372
Ashe County, NC

Title:

USGS TOPOGRAPHIC MAP

Park and Grayson 7.5 Minute Quads

Drawn by: KRJ

Date: Nov. 2016

Scale: 1 in = 670 ft

Project No.: 12-004.13

FIGURE

3

Map Symbol	Soil Description
Co	Colvard fine sandy loam
EdE	Edneyville loam 15-25% slopes
EdF	Edneyville loam 25-45% slopes

N

Legend

- Easement Boundary
- Stream
- NRCS Soil Boundaries

0 500 1,000 2,000 3,000 Feet

Axiom Environmental, Inc.

Prepared for:

North Carolina Department of Environmental Quality

Division of Mitigation Services

Project:

TATE FARM (RIPSHIN BRANCH) STREAM AND WETLAND RESTORATION SITE

DMS Project Number 372
Ashe County, NC

Title:

NRCS SOILS MAP

Drawn by: KRJ

Date: Nov. 2016

Scale: 1 in = 670 ft

Project No.: 12-004.13

FIGURE

4

Preconstruction Photographs

Extracted from Restoration Plan (dated March 9, 2007)

Preconstruction Photographs (continued)

Extracted from Restoration Plan (dated March 9, 2007)