

Heath Dairy Road Stream Restoration Site Randolph County, North Carolina

DMS Project #170

USACE Action Item # SAW 2008 02860



MY – 04 Fall Monitoring Report

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Prepared for:

North Carolina Department of Environmental Quality

Division of Mitigation Services

217 West Jones St. Suite 3000A

Raleigh, NC 27603

Prepared by:

Mogensen Mitigation, Inc.

P.O. Box 690429

Charlotte, NC, 28227



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1.0 Project Summary

1.1 Goals & Objectives

The Heath Dairy Road Stream Restoration Site (Heath Dairy Site, DMS # 170) lies along Back Creek and unnamed tributaries in Randolph County NC. The site lies within the Yadkin-Pee Dee watershed (HUC #03040103-050050). This project includes restoration, enhancement and preservation of approximately 7,708 linear feet of degraded channels, and wetland enhancement and preservation including soil restoration (scarification of compacted soil) and planting of wetland vegetation. Specific **goals** for the Heath Dairy project include:

- Improve local water quality within the restored channel reaches as well as the downstream watercourses through:
 - Reduction of current channel and off-site sediment loads by restoring appropriately sized channels with stable beds and banks.
 - Reduction of nutrient loads from adjacent agricultural fields by restoring the riparian buffer.
 - Reduction of water temperatures provided through shading of the channel by canopy species along with the resultant increase in oxygen content.
- Improve local aquatic and terrestrial habitat and diversity within the restored channels and their vicinity through:
 - Restoration of appropriate bed form to provide habitat for fish, amphibian, and benthic species.
 - Enhancement of riparian wetlands along the stream corridor to provide additional landscape and habitat diversity.
 - Restoration of a suitable riparian buffer corridor in order to provide both vertical and horizontal structure and connectivity with adjacent upland areas.
 - Restoration of understory and canopy species in order to provide forage, cover, and nesting for a variety of mammals, reptiles, and avian species.

To meet these goals, the following **objectives** have been established for the Heath Dairy project:

- Restore natural stable channel morphology and proper sediment transport capacity;
- Create and/or improve bed form diversity and improve aquatic and benthic macroinvertebrate habitat;
- Construct a floodplain (or local bankfull bench) that is accessible at the proposed bankfull channel elevation;
- Improve channel and stream bank stabilization by integrating in-stream structures and native bank vegetation;
- Restore 7,781 linear feet of stream through Priority I and II restoration from the existing 6,748 linear feet of stream;
- Enhance 960 linear feet of stream from the existing 960 linear feet of stream;
- Preserve 636 linear feet of stream;
- Enhance 0.6 acres of wetlands from the existing 0.6 acres of wetlands (all are riparian non-riverine wetlands);

- Preserve 1.18 acres of wetlands (all are riparian non-riverine wetlands, except Wetland J which is a riparian riverine wetland consisting of 0.090 acres of preservation); and,
- Restore approximately 30 acres of riparian buffer by establishing a native forested and herbaceous riparian buffer plant community.

1.2 Project Success Criteria

1.2.1 Streams

Post-restoration monitoring of channel stability will include dimension (cross-sections), pattern and profile (longitudinal profile), and photo documentation of the project. Success criteria for the stream restoration also include substrate analysis (Wolmann Pebble Counts) and the frequency of bankfull events. The success criteria are described below for each parameter.

- ***Dimension***

Due to watershed dynamics, riffle cross-sections on the restoration reaches should remain relatively stable; however, due to the sand/silt nature of the substrate throughout the project reaches, fluctuations of the riffle bed elevation over time are expected. These fluctuations should be temporary and will likely correspond to storm events. Riffle cross-sectional ratios (width-to-depth, depth ratio, and bank height ratio) should fall within the parameters defined for channels of the appropriate Natural Channel Design stream type. If persistent changes are observed, these changes will be evaluated to assess whether the stream channel is showing signs of long term instability. Indicators of instability include, but are not limited to, a vertically incising thalweg or eroding channel banks. Changes in the channel that indicate a movement toward stability or enhanced habitat include a decrease in the width-to-depth ratio in meandering channels or an increase in pool depth. Remedial action should not be taken if channel changes indicate a movement toward stability.

- ***Pattern and Profile***

Longitudinal profile data for the stream restoration reaches should show that the bedform features are remaining stable. The riffles should be steeper and shallower than the pools, while the pools should be deep with flat water surface slopes. The relative percentage of riffles and pools should not change significantly from the design parameters. Adjustments in length and slope of run and glide features are expected and will not be considered a sign of instability. The longitudinal profile should show that the bank height ratio remains very near to 1.0 for the majority of the restoration reaches.

- ***Photo Documentation***

Photographs illustrate the site's vegetation and morphological stability on an annual basis. Cross-section photos should demonstrate no excessive erosion or degradation of the banks. Longitudinal photos should indicate the absence of persistent bars within the channel or vertical incision. Grade control structures should remain stable. Deposition of sediment on the bank side of vane arms is preferable. Maintenance of scour pools on the channel side of vane arms is expected. Reference photos will also be taken for each of the vegetation plots.

- ***Substrate***

Substrate materials in the restoration reaches should indicate a progression towards or the presence of coarser materials in the riffle features and smaller particles in the pool features.

- ***Bankfull Events***

Two bankfull flow events in separate years must be documented on the project within the five- year monitoring period. Bankfull events will be documented using a crest gage, photographs, and visual assessments such as debris lines.

1.2.2 Vegetation

Success will be determined by survival of target species within the sample plots. A minimum of 260 stems/acre must survive for at least five years after initial planting. If the vegetative success criteria are not met, the cause of failure will be determined and an appropriate corrective action will be taken. The criteria for vegetative success will be as follows:

- A minimum survival rate of 320 trees per acre in the riparian buffer at the end of 3 years.
- A minimum survival rate of 260 trees per acre in the conservation easement at the end of 5 years.

These values include both planted and native volunteer species as per the mitigation plan.

1.2.3 Hydrologic Success

As per the mitigation plan, wetland hydrology success criteria will be satisfied in restored wetlands when saturated soil conditions occur within 12 inches of the ground's surface for a minimum of 12.5% of the growing season during average climatic conditions, OR if the restored area is within 20% of the reference wetland's hydroperiod during drought conditions.

1.3 Project Setting & Pre-Restoration Conditions

The Heath Dairy Site is located in Randolph County, North Carolina, northwest of Asheboro and southwest of the Town of Randleman (Figure 1).

The site is located in the Back Creek watershed of the Yadkin-Pee Dee River Basin, United States Geological Survey (USGS) Hydrologic Unit Code 03040103050050, within the North Carolina Division of Water Resources (NCDWR) sub-basin 03-07-09. Back Creek drains into the Back Creek (Lucas) Lake and then into the Uwharrie River approximately eleven miles downstream of the site. This HUC is identified as a Targeted Local Watershed (TLW) in EEP's 2003 and 2009 Yadkin River Basin Restoration Priority (RBRP) Plan. Prior to restoration, the site was utilized for agricultural purposes,

including grazing pasture. The surrounding land uses consist of pastureland, woodland, and residential lots.

1.4 Project Components and Mitigation Assets

The project components are summarized in Table 1 of Appendix A and depicted on Figure 2.9.

1.5 Project Design Approach

The Heath Dairy Site restored and/or enhanced approximately 7,708 linear feet of degraded channels. Table 1 and Figure 2 in the Appendix present the project assets.

With the exception of the lower portion of Back Creek, the channel was designed as a Type B4c stream. This channel configuration provided the most stable form in moderately sloping colluvial valleys. Not only does it effectively convey bankfull discharge and sediment load but also conforms to the natural conveyance of flood flows. Along the lower reach of Back Creek where the topography opens into a broad flat alluvial floodplain the channel was designed as a Type E4 stream. The proposed channel dimensions, patterns, and profiles were based on hydraulic relationships and morphological dimensionless ratios of reference reaches.

Restoration consisted of Priority I and II activities which involved reconstruction of the channels along new and existing alignments. Bed material from the existing channel was mined and used in the riffles of the channels. Bed material was augmented with additional stone where necessary.

At the request of the DMS the upper portion of Back Creek was redesigned as an enhancement reach to facilitate a paired watershed study to be conducted by North Carolina State University (NCSU). Enhancement efforts entailed raising the profile in place to reconnect the stream to the relic floodplain, construction of in-stream structures, and stabilization of the banks.

Nine separate wetland areas totaling 1.78 acres were identified on the Heath Dairy Site, including 1.18 acres of preserved Non-Riverine Riparian Wetland and 0.6 acres of enhanced Non-Riverine Riparian Wetland (Table 1a). Enhancement activities included removal of grazing activity and planting of native wetland vegetation.

1.6. Current Conditions and Performance Summary

Based on our field observations and data collected during the spring and fall site visits of 2017, the Heath Dairy Site appears to be in generally good condition and is continuing to trend towards a successful restoration project. Several minor stream issues that were noted in the spring (i.e. center bars, loose geotech fabric, etc.) were difficult to reassess in the fall due to higher water in the tributaries. We have removed these locations from the current CCPV and will reassess any issues in the spring. No signs of cattle within the easement were observed and the fence line integrity was intact. As an interesting side-note regarding habitat quality, we observed Monarch butterflies and their larvae in many areas of

the site as well as large migratory flocks of Ruby-throated hummingbirds nectaring on the abundant wetland flowers.

The only new, larger issue we observed during the fall site visit is the evidence of beaver activity in several places along Back Creek. During a routine visit to check gages in July, we discovered one dam and reported it to the DMS project manager – while that particular dam appears to have been successfully removed, several more have become established within the past two months. One large dam occurs at approximately Sta. 44+00 near VP 17 and is backing up water to at least XS's 10 and 11, where fresh beaver chew is evident. A second set of dams occurs further downstream near approximately Sta. 52+00. The larger of these two dams occurs at 50' downstream of XS 15 is creating a backwater effect up to XS 14. The smaller of these dams is located directly at XS 14. The locations of all active and remnant dams are denoted on the CCPV. Due to ongoing beaver activity on the site, first noted in the year 4 spring assessment, the site has been added to the APHIS contract and quarterly site visits will be mandatory. Traps have been set for current residents and dam removal will follow.

In general, native woody stem densities visually appear adequate across the site, although some areas were difficult to assess due to thick, waist-high herbaceous cover. Volunteers appear to be becoming more abundant, especially in areas with wooded borders along West Branch, North Branch, and the upstream reaches of Back creek. Successful treatment for multiflora rose noted by previous reports was evident. However, scattered occurrences of multiflora rose and privet are becoming more prevalent across the site and may require continued management, as sources of these species are abundant just outside of the easement boundary in several places.

1.6.1. Stream Assessment

During our fall assessment, water was found through along the entire extent of Back Creek and North Branch with levels sufficient to cover all riffles to a depth of a few inches. West Branch and East Branch did not have base flow but still retained water in the deepest pools. The beaver activity influenced small changes to a few cross sections, such as a shallowing of XS11, and a change in the bank profile at XS 14. A large center bar is notably bifurcating the channel at XS12.

As noted in previous reports, water is piping under riffles in several places along the most downstream reaches of Back Creek just above the confluence with North Branch. Several of the more perched riffle sections along North Branch are starting to become increasingly vegetated. None of these issues seemed significant enough to warrant inclusion on the CCPV but we will continue to monitor them and include them in subsequent years in they persist or become more significant. Other than these minor issues, our field observations suggest that stream characteristics appear to be generally stable across all reaches and functioning as intended. Pebble counts also show that all reaches appear relatively stable and an acceptable level of gravel transport seems to be occurring.

1.6.2. Wetlands

Standing water and obviously saturated soils were observed in many of enhanced and preserved wetlands on site (i.e. Wetlands "A" through "L"; Figure 2.9) during the Spring MY4 site visit while all but the wettest of these areas were visibly dry during the fall MY4 site visit. Consistent with previous

years' findings, the growing season groundwater data from monitoring gages in the restored wetland (Wetland 'M') suggest that the southern end of this area is drier and may not be meeting criteria for jurisdictional hydrology (Table 13). As-built wetlands area combination of preservation, for which there are no performance standards required and wetland enhancement areas. Which are subject to vegetation performance standards. At this time, all wetland areas appear to meeting vegetation criteria – none are located in mapped low-stem-density areas and VP 26 (located in Wetland 'C') is meeting criteria.

1.6.3. Vegetation Assessment

MMI staff monitored the 26 permanent CVS vegetation plots (.0247 acre / plot) and evaluated the surrounding planted area (32 acres) within the conservation easement. Planted stem counts in the CVS plots ranged from 1 to 13 per plot (average = 7 stems per plot, or 265 stems per acre), and total native hardwood stems (planted plus volunteers) ranged from 2 to 23 (average = 10 stems per plot, or 391 stems per acre). Eighteen plots (69%) exceed the 260 stems/acre success criteria based on planted and volunteer stems combined (at MY4). Four areas of low woody stem density in the planted area are mapped in the CCPV figures, totaling 1.14 acres. Portions of the remaining 25 acre easement area beyond the planted area also have low woody stem density. These untreated and unplanted former pasture areas are dominated by fescue, blackberry, other old-field weeds, and low-density scattered seedlings of rapidly colonizing hardwoods, especially sweetgum, winged elm, red maple, and persimmon. Small patches of Chinese privet and multiflora rose persist at scattered sites throughout the planted area, but large, obvious outcroppings are less extensive than in previous years due to effective herbicide treatments. Fifteen invasive patches totaling 0.51 acres are mapped in the planted area in the current CCPV figures. Areas of low woody stem density and invasive species beyond the planted areas are not mapped in the CCPV figures, but Chinese privet, multiflora rose, and porcelainberry are common along woodland edges and fences along much of the easement boundary. Cattail (*Typha spp.*) is becoming more prevalent in some areas along East branch, including a large portion of VP 26 that overlaps an as-built wetland. A single occurrence of tree-of-heaven (*Ailanthus spp.*) was observed several feet outside the SE corner of VP 9 on West Branch, which we manually removed and photographed (*efiles: Photos/Vegetation/Problem Areas*). This occurrence was not included with the plot data, however, as it was outside of the plot boundary.

1.6.4. Hydrology Assessment

During the spring assessment, standing water was noted in many of the mapped wetland areas on site. Conditions were somewhat drier this year (compared to previous monitoring years) despite the relatively high amount of late-summer rainfall, and all mapped wetland areas were relatively dry with no standing water present or visible evidence of saturation. All four (4) RDS Gages were most recently downloaded in September 2017 and recorded complete data for 2017 to date. Groundwater Gages # 3 and 4 did meet hydrological success criteria (Gage 3 = 20% of growing season, Gage 4 = 41% of growing season) with the latter being located in a reference wetland (Table 12; Appendix E). Gages #'s 1 & 2, which are located in the southern end of the restored wetland "M" did not meet criteria as they both recorded jurisdictional hydrology for only 2% of the growing season. We will return to the site after the end of the growing season to complete the dataset, however it is unlikely that these results will change as typically the site conditions are relatively dry in the late summer / fall.

We estimate that several flood events accessed the bank during 2017 (Table 12). The peak stage reading for the cork crest gage on Back Creek (~60 feet upstream of the confluence with West Branch) was >2 feet above the bankfull elevation at that location. HOBO gage observations show numerous episodes of stream level increase greater than 0.2 feet, which likely resulted in at least 5 episodes of overbank flooding compared to design bankfull elevations near the in-stream HOBO gage on North Branch. One particularly large rainfall event in on June 20th resulted in a stream level rise to >10 feet above the HOBO in-stream gauge height.

2.0. Monitoring Methods

2.1. Vegetation Methodologies

Twenty six (26) permanent vegetation plots were monitored for native woody species according to the CVS Level 2 Vegetation Monitoring Protocol Version 4.2 (Lee *et al.* 2008). Beginning in MY4, non-native woody volunteers have been listed with the plot data but they are not included towards the total stem density calculation and success criteria evaluation.

2.2. Wetland Methodologies

All four (4) RDS groundwater monitoring gauges and two (2) HOBO gauges were downloaded most recently in September 2017 and will continue to be downloaded at regular intervals to ensure that the gauges are functioning properly. Both Crest Stage Gauges on Back creek were visually inspected and cork replaced.

2.3. Stream Methodologies

Longitudinal Profiles were conducted using a Trimble RDK survey-grade GPS unit along the entire length of West Branch, East Branch North Branch, and three 1,000-foot reaches on Back Creek (Stations: 14+15 to 24+15, 26+80 to 40+28, and 51+42 to 62+22. All twenty eight (28) of the permanent stream cross sections established on the site were surveyed using a rod and level. Wolman pebble counts were conducted at 20 of the 28 permanent cross-sections and used to calculate the sediment distributions.

3.0. References

Lee, Michael T., Peet, Robert K., Roberts, Steven D., Wentworth, Thomas R. (2008). *CVS-EEP Protocol for Recording Vegetation version 4.2, October 2008*. Retrieved September 2011, from: <http://cvs.bio.unc.edu/methods.htm>

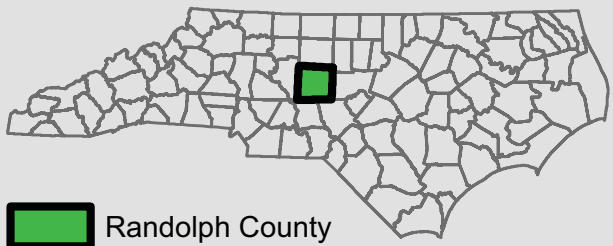
AECOM March 2015. Monitoring Report Year #1

Rosgen, D. L. 1996 *Applied River Morphology*. Wildlands Hydrology Books, Pagosa Springs, CO.

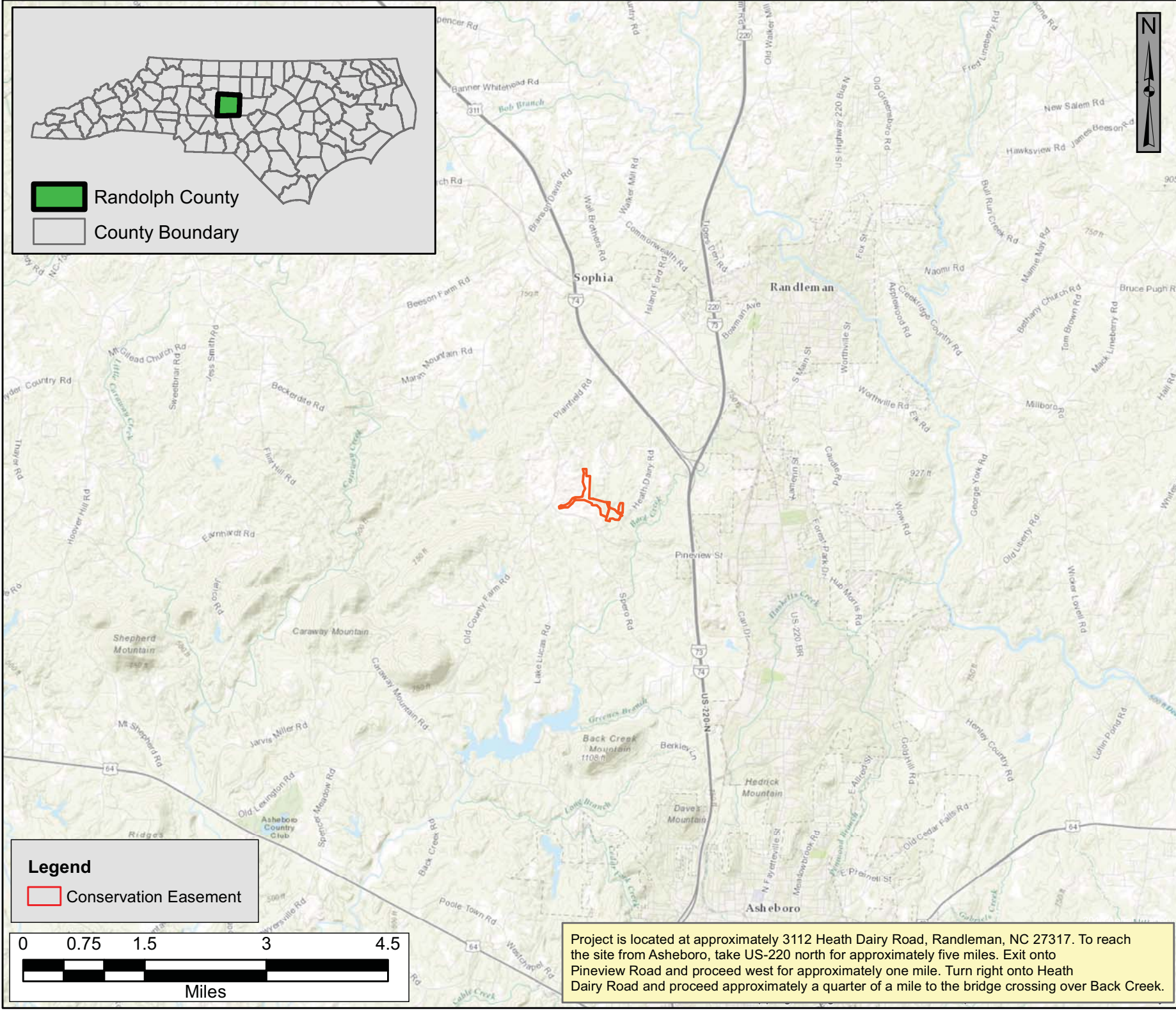
Weakley, A.S. (2011) *Flora of the Carolinas, Virginia, Georgia and the Surrounding Areas* University of North Carolina at Chapel Hill

Wolman, M. G. 1954. *A Method of Sampling Coarse River-Bed Material*, Transactions of American Geophysical Union 35:951-956

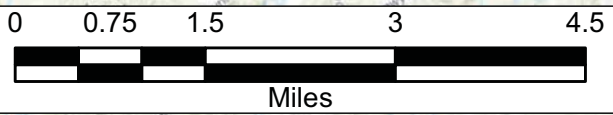
Appendix A: Project Background Data



Legend
 Randolph County
 County Boundary



Legend
 Conservation Easement



Project is located at approximately 3112 Heath Dairy Road, Randleman, NC 27317. To reach the site from Asheboro, take US-220 north for approximately five miles. Exit onto Pineview Road and proceed west for approximately one mile. Turn right onto Heath Dairy Road and proceed approximately a quarter of a mile to the bridge crossing over Back Creek.

Mogensen Mitigation, Inc.
 P.O. Box 690429
 Charlotte, NC 28227
 (704) 576-1111



2017

HEATH DAIRY MONITORING YEAR 4
 VICINITY MAP
 DMS #170

Randolph County, North Carolina



FIGURE 1

Table 1. Project Components & Mitigation Credits

Table 1. Project Components and Mitigation Credits Heath Dairy Road Stream Restoration/ DMS No. 170									
Mitigation Credits									
	Stream		Riparian Wetland		Non-riparian Wetland		Buffer	Nitrogen Offset	Phosphorous Offset
Type	R	RE	R	RE	R	RE			
Totals	8431	127		0.54					
Project Components									
Project Component	Stationing/Location		Existing Footage or Acreage		Approach	Restoration or Restoration Equivalent	Restoration Footage or	Mitigation Ratio	
Back Creek 1	10+00 – 11+55		149 LF		Restoration	Restoration	155 LF	1:1	
Back Creek 2	11+55 – 16+25		470 LF		Enhancement I	Restoration	470 LF	1.5:1	
Back Creek 3	16+25 – 17+00		75 LF		Restoration	Restoration	75 LF	1:1	
Back Creek 4	17+00 – 20+90		390 LF		Enhancement I	Restoration	390 LF	1.5:1	
Back Creek 5	20+90 – 24+60		374 LF		Restoration	Restoration	370 LF	1:1	
Back Creek 6	24+60 – 25+60		100 LF		Enhancement I	Restoration	100 LF	1.5:1	
Back Creek 7	25+60 – 63+45		3450 LF		Restoration	Restoration	3785 LF	1:1	
West Preserve	14+58 - 18+75		417 LF		Preservation	Restoration Equivalent	417 LF	5:1	
West Branch 1	10+00 – 26+12		1523 LF		Restoration	Restoration	1590 LF*	1:1	
North Branch 1	10+30 – 21+97		495 LF		Restoration	Restoration	1167 LF	1:1	
East Preserve	5+01 - 7+20		219 LF		Preservation	Restoration Equivalent	219 LF	5:1	
East Branch 1	9+96 – 15+93		580 LF		Restoration	Restoration	547 LF*	1:1	
UT to West Br.	10+36 – 11+38		102 LF		Restoration	Restoration	102 LF	1:1	
Wetland A1	NA		1.075 AC		Preservation	Restoration Equivalent	1.075 AC	5:1	
Wetland A2	NA		0.136AC		Enhancement	Restoration Equivalent	0.136 AC	2:1	
Wetland B	NA		0.307 AC		Enhancement	Restoration Equivalent	0.307 AC	2:1	
Wetland C	NA		0.104 AC		Enhancement	Restoration Equivalent	0.104 AC	2:1	
Wetland E	NA		0.010 AC		Enhancement	Restoration Equivalent	0.010 AC	2:1	
Wetland F	NA		0.036 AC		Enhancement	Restoration Equivalent	0.036 AC	2:1	
Wetland I	NA		0.007 AC		Preservation	Restoration Equivalent	0.007 AC	5:1	
Wetland J	NA		0.090 AC		Preservation	Restoration Equivalent	0.090 AC	5:1	
Wetland K	NA		0.010 AC		Enhancement	Restoration Equivalent	0.010 AC	2:1	
Wetland L	NA		0.007 AC		Preservation	Restoration Equivalent	0.007 AC	5:1	
Wetland M	NA		1.4 AC		Restoration	Restoration	1.4 AC	1:01	
Component Summation									
Restoration Level	Stream	Riparian Wetland			Non-Riparian Wetland	Buffer	Upland		
	(linear feet)	(acres)		(acres)	(square feet)	(acres)			
		Riverine	Non-Riverine						
Restoration	7791								30
Enhancement			0.6						
Enhancement I	960								
Enhancement II									
Creation									
Preservation	636		1.18						
High Quality Preservation									

Table 2. Project Activity & Reporting History

Table 2. Project Activity and Reporting History Heath Dairy Road Stream Restoration/ DMS No. 170		
Activity or Report	Data Collection Complete	Completion or Delivery
Restoration Plan	Apr-09	May-09
CLOMR	Jun-10	Mar-11
LOMR	Apr-14	Oct-15
Final Design – Construction Plans	NA	Jun-11
Construction	NA	Aug-13
Permanent seed applied to entire site	NA	Aug-13
Plantings for entire site	NA	Feb-14
Mitigation Plan (Year 0 Monitoring – baseline)	Apr-14	May-14
Year 1 Fall Monitoring	Nov-14	Mar-15
Year 2 Fall Monitoring	Sep-15	Jan-16
Supplemental Planting	NA	Apr-16
Year 3 Spring Monitoring	Mar-16	Apr-16
Invasive Species Management		
Year 3 Fall Monitoring	Sep/Oct-16	Nov-16
Beaver Management	Observed Summer 2017	Treated Summer 2017
Year 4 Spring Monitoring	Apr-17	Apr-217
Year 4 Fall Monitoring	Sep/Oct-17	Oct-17

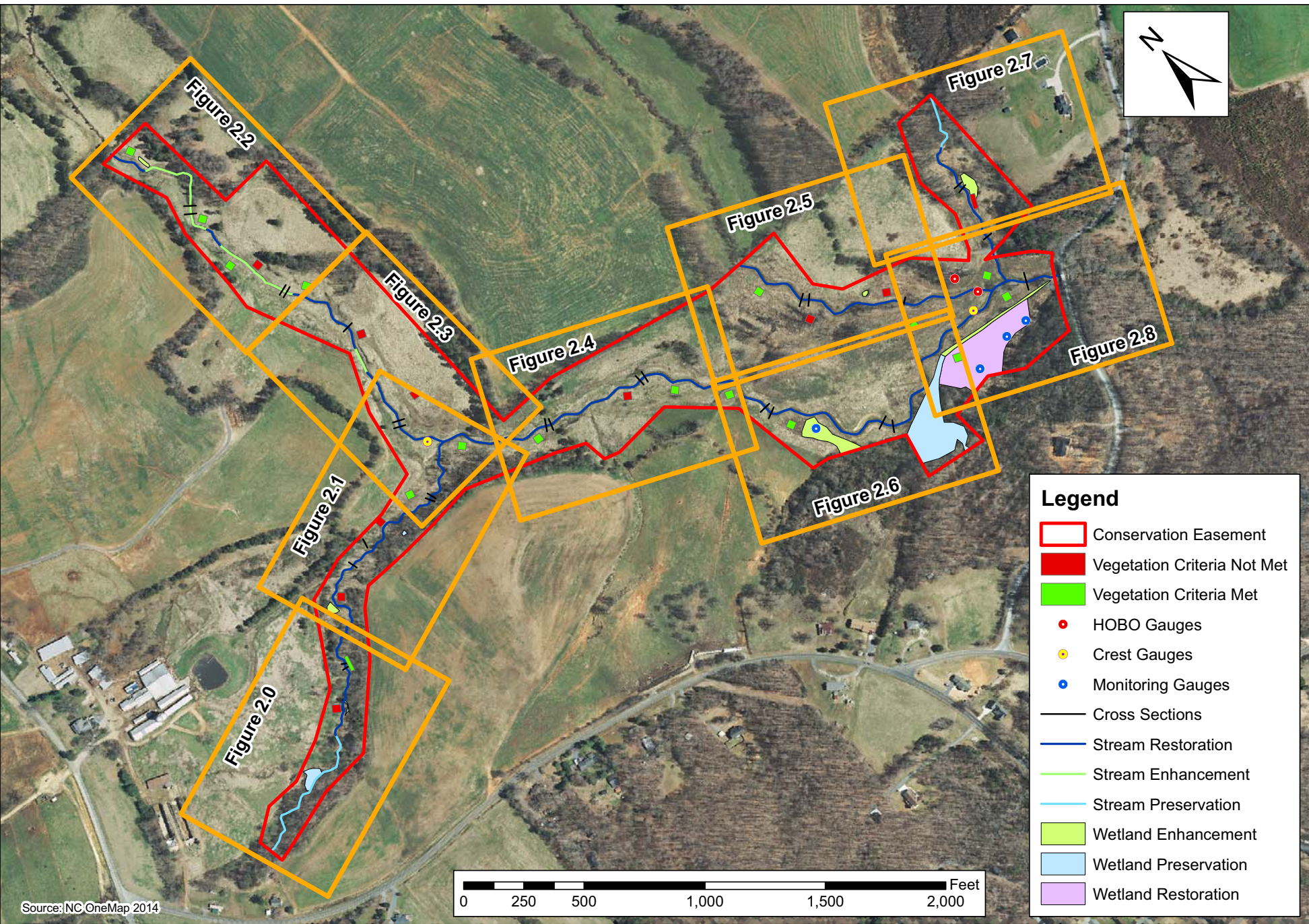
Table 3. Project Contacts

Table 3. Project Contact Table Heath Dairy Road Stream Restoration/ DMS No. 170	
Owner NCDENR Division of Mitigation Services	Melonie Allen 217 W. Jones Street Suite 300A Raleigh, NC 27603 919-368-9352
Designer Wolf Creek Engineering, PLLC	Grant Ginn 7 Florida Avenue Weaverville, NC, 28787 828-658-3649
Landowner Mr. Phillip Ridge Dr. Edward Shackelford	3562 Plainfield Road Sophia, NC 27350 336-861-4555 203 Shannon Road Asheboro, NC 27203 336-625-6222
Construction Contractor	Backwater Environmental 515 S. Kennedy Avenue Eden, NC 27288
Planting Contractor	Carolina Silvics, Inc. 908 Indian Trail Road Edenton, NC 27932
Seeding Contractor	Backwater Environmental 515 S. Kennedy Avenue Eden, NC 27288
Monitoring Performer Mogensen Mitigation, Inc.	Richard K. Mogensen P.O. Box 690429 Charlotte, NC, 28227 704-576-1111

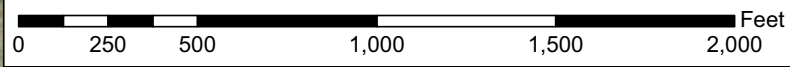
Table 4. Project Attributes

Table 4. Project Baseline Information and Attributes Heath Dairy Road Stream Restoration / DMS Project #170					
Project Information					
Project Name	Heath Dairy Farm Road Stream Restoration				
Project County	Randolph				
Project Area (acres)	56.8				
Project Coordinates (lat/long)	35°46'47.85"N / 79°50'51.50"W				
Project Watershed Summary					
Physiographic Province	Piedmont				
Project River Basin	Yadkin				
USGS HUC for Project	3.0401E+12				
NCDWQ Sub-basin for Project	3/7/2009				
Project Drainage Area (acres)	1722				
Project Drainage Area Percentage of Impervious Area	< 2%				
CGIA Land Use Classification	Agricultural Land – Cropland and Pasture				
Reach Summary Information (Pre-restoration)					
Parameters	Back Creek	West Branch	North Branch	East Branch	UT to West Branch
Length of Reach (feet)	5008	1940	495	799	102
Valley Classification	VIII	II	II	II	II
Drainage area (acres)	1722	90	730	160	32
NCDWQ Stream ID Score	NA	NA	NA	NA	NA
NCDWQ Water Quality Classification	WS-II, HQW	WS-II, HQW	WS-II, HQW	WS-II, HQW	WS-II, HQW
Morphological Description	G4, E4	G4	E4	G4	G4
Evolutionary Trend	NA	NA	NA	NA	NA
Underlying Mapped Soils	(DoB) Dogue and (BtC2) Badin-Tarrus Complex				
Drainage Class	Well Drained to Moderately Well Drained				
Soil Hydric Status	Non-hydric	Non-hydric	Non-hydric	Non-hydric	Non-hydric
Slope					
FEMA Classification	Detail Study	None	Detail Study	None	None
Native Vegetation	Mesic Mixed Hardwood Forest (Piedmont Subtype)				
Percent Composition of Exotic Invasive Vegetation	20%	20%	20%	20%	20%
Wetland Summary Information					
Parameters	Wetland A	Wetland B	Wetland C	Wetland D - L	
Size of Wetland (acres)	1.21	0.31	0.1	0.26	
Wetland Type	Riparian	Riparian	Riparian	Riparian	
Mapped Soil Series	(BtC2) Badin-Tarrus Complex				
Drainage Class	Moderately Well Drained				
Soil Hydric Series	Soil series not hydric but soils exhibited low-chroma colors and mottling				
Source of Hydrology	Surface drainage	Surface drainage	Toe of Slope Seepage	Toe of Slope Seepage	
Hydrologic Impairment	No	No	No	No	
Native Vegetation	Piedmont Bottomland Forest / Piedmont Alluvial Forest				
Percent Composition of Exotic Invasive Vegetation	20%	20%	20%	20%	
Regulatory Considerations					
Regulation	Applicable	Resolved	Supporting Documentation		
Waters of the US – Section 404	Yes	Yes			
Waters of the US – Section 401	Yes	Yes			
Endangered Species Act	Yes	Yes			
Historic Preservation Act	Yes	Yes	2/1/2007 SHPO Concurrence Letter		
CZMA/CAMA	No	NA			
FEMA Floodplain Compliance	Yes	Yes			
Essential Fisheries Habitat	No	NA			

Appendix B: Visual Assessment Data



Source: NC OneMap 2014



Legend

- Conservation Easement
- Vegetation Criteria Not Met
- Vegetation Criteria Met
- HOBO Gauges
- Crest Gauges
- Monitoring Gauges
- Cross Sections
- Stream Restoration
- Stream Enhancement
- Stream Preservation
- Wetland Enhancement
- Wetland Preservation
- Wetland Restoration

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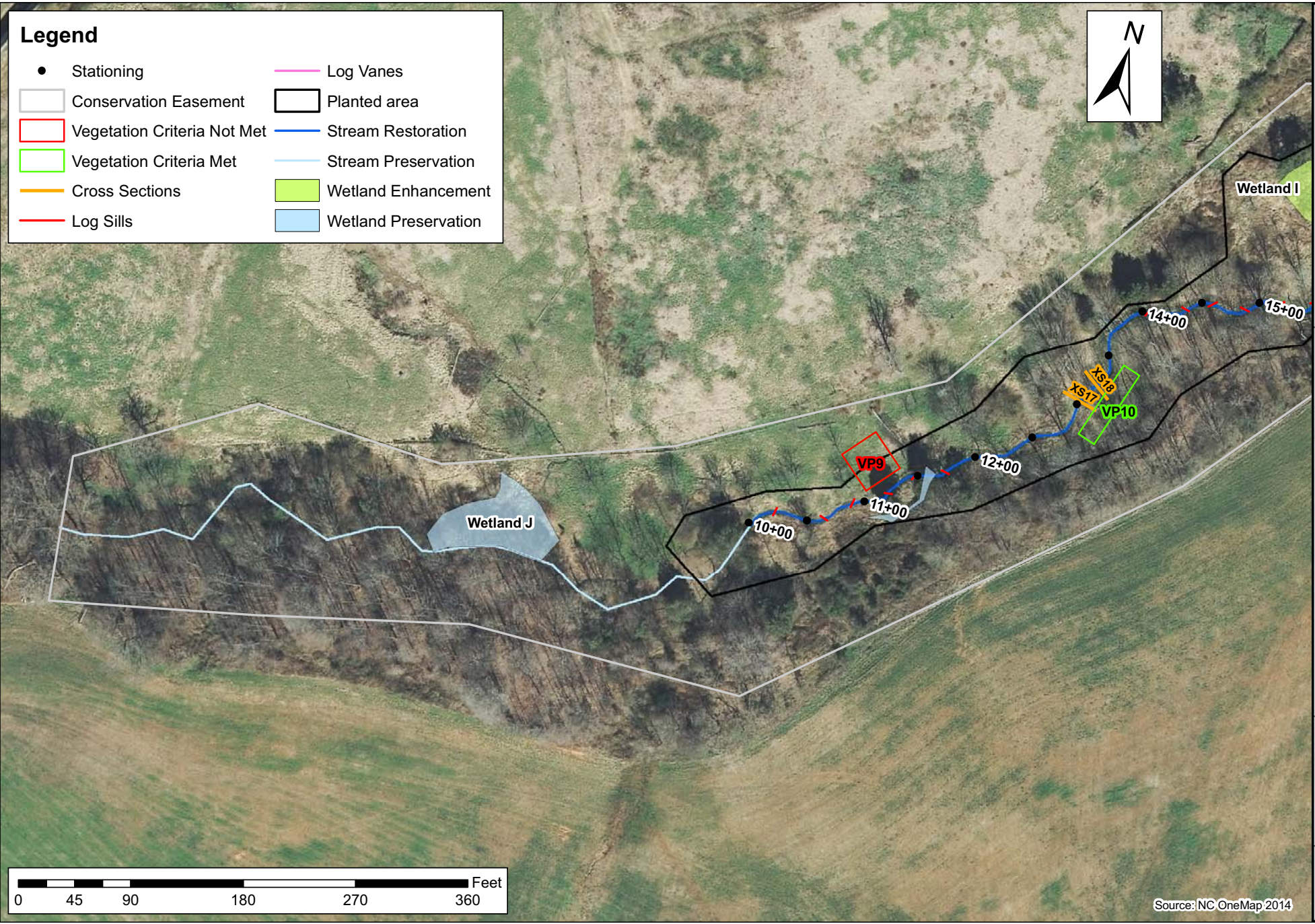
HEATH DAIRY MONITORING YEAR 4 (2017)
 CURRENT CONDITIONS PLAN VIEW OVERVIEW
 DMS #170

RANDOLPH COUNTY
 NORTH CAROLINA

Figure 2

Legend

- Stationing
- Conservation Easement
- Vegetation Criteria Not Met
- Vegetation Criteria Met
- Cross Sections
- Log Sills
- Log Vanes
- Planted area
- Stream Restoration
- Stream Preservation
- Wetland Enhancement
- Wetland Preservation



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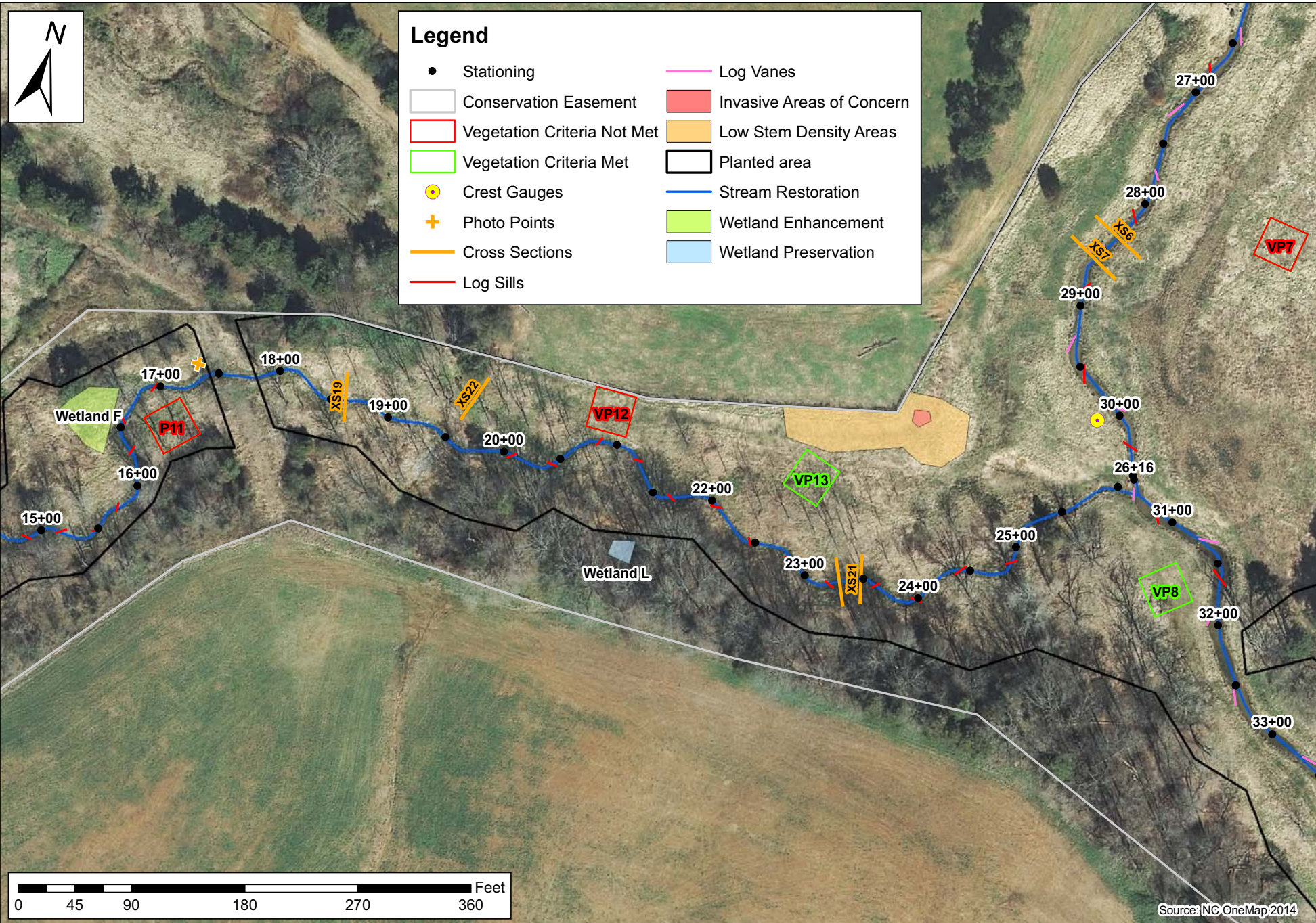


HEATH DAIRY MONITORING YEAR 4 (2017)
 CURRENT CONDITIONS PLAN VIEW OVERVIEW
 DMS #170 - WEST BRANCH
 RANDOLPH COUNTY
 NORTH CAROLINA



Figure 2.0

Source: NC OneMap 2014



Legend

●	Stationing	—	Log Vanes
□	Conservation Easement	■	Invasive Areas of Concern
□	Vegetation Criteria Not Met	■	Low Stem Density Areas
□	Vegetation Criteria Met	□	Planted area
⊙	Crest Gauges	—	Stream Restoration
+	Photo Points	■	Wetland Enhancement
—	Cross Sections	■	Wetland Preservation
—	Log Sills		

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HEATH DAIRY MONITORING YEAR 4 (2017)
 CURRENT CONDITIONS PLAN VIEW OVERVIEW
 DMS #170 - WEST BRANCH

RANDOLPH COUNTY
 NORTH CAROLINA

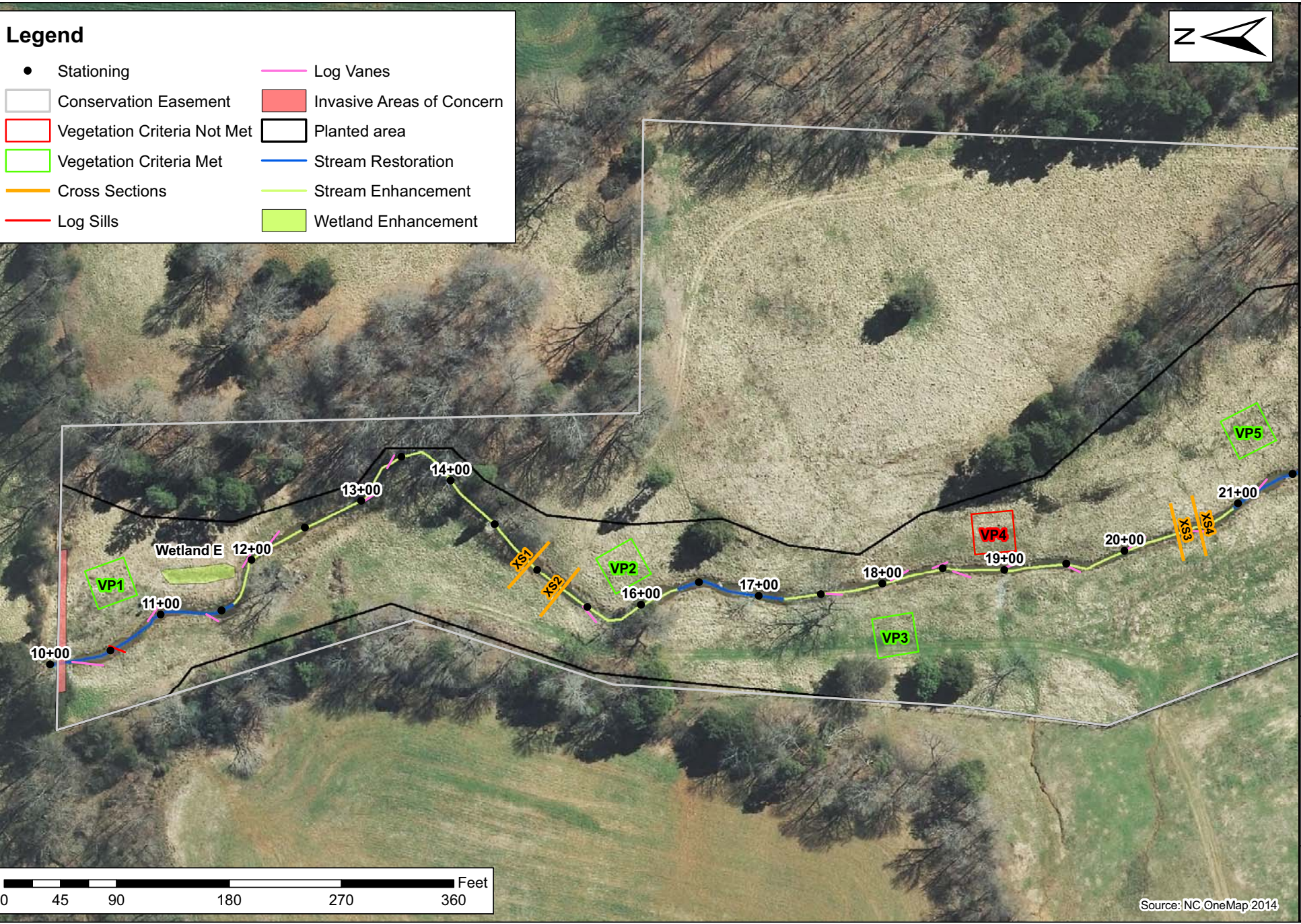
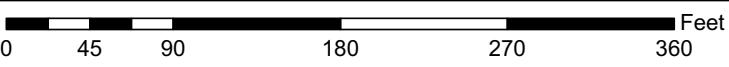


Figure 2.1

Source: NC OneMap 2014

Legend

- Stationing
- Conservation Easement
- Vegetation Criteria Not Met
- Vegetation Criteria Met
- Cross Sections
- Log Sills
- Log Vanes
- Invasive Areas of Concern
- Planted area
- Stream Restoration
- Stream Enhancement
- Wetland Enhancement



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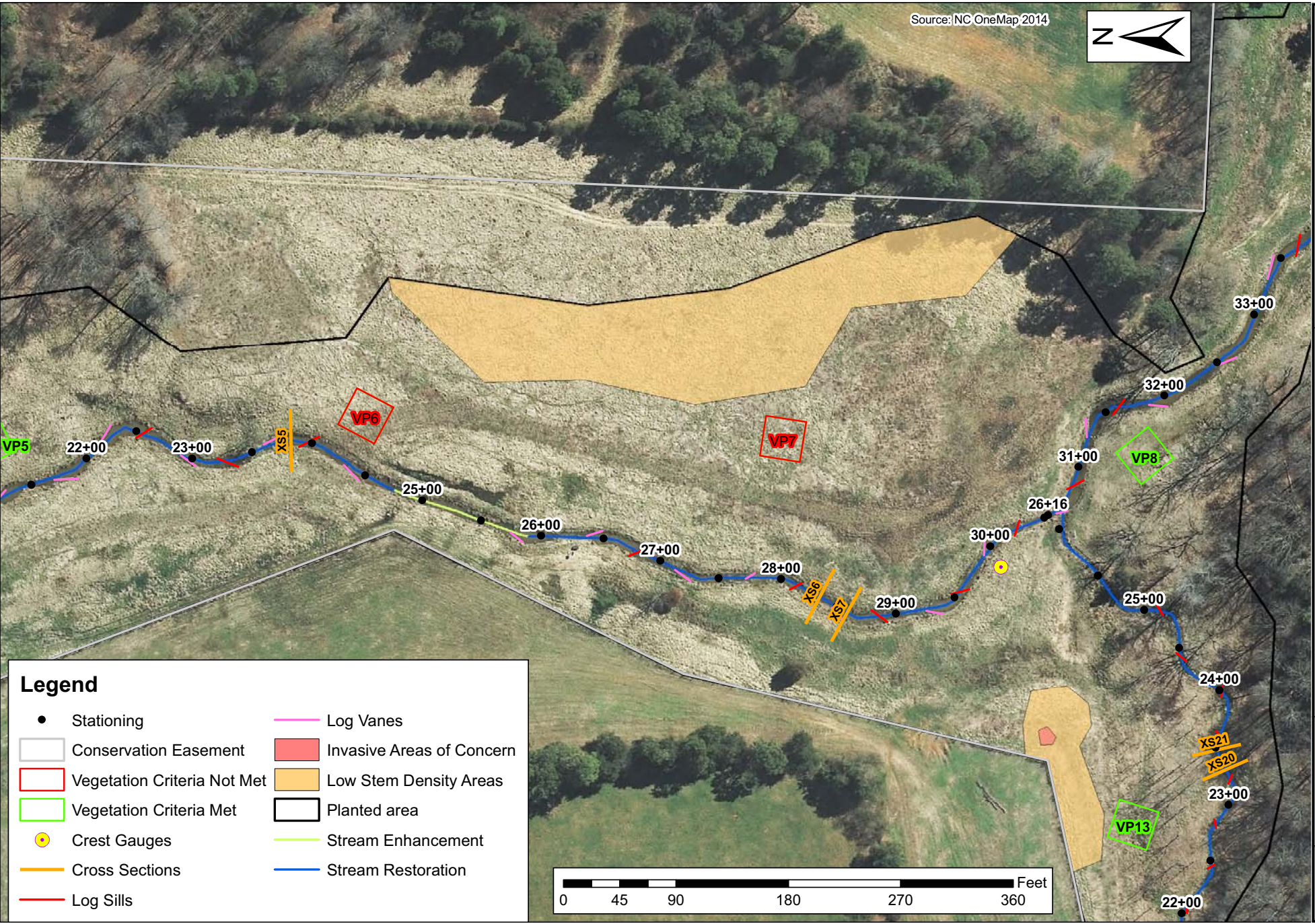
HEATH DAIRY MONITORING YEAR 4 (2017)
 CURRENT CONDITIONS PLAN VIEW OVERVIEW
 DMS #170 - BACK CREEK
 RANDOLPH COUNTY
 NORTH CAROLINA



Figure 2.2

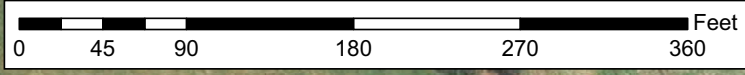
Source: NC OneMap 2014

Source: NC OneMap 2014



Legend

● Stationing	— Log Vanes
□ Conservation Easement	■ Invasive Areas of Concern
□ Vegetation Criteria Not Met	■ Low Stem Density Areas
□ Vegetation Criteria Met	□ Planted area
● Crest Gauges	— Stream Enhancement
— Cross Sections	— Stream Restoration
— Log Sills	



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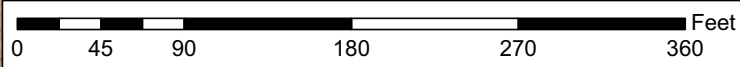
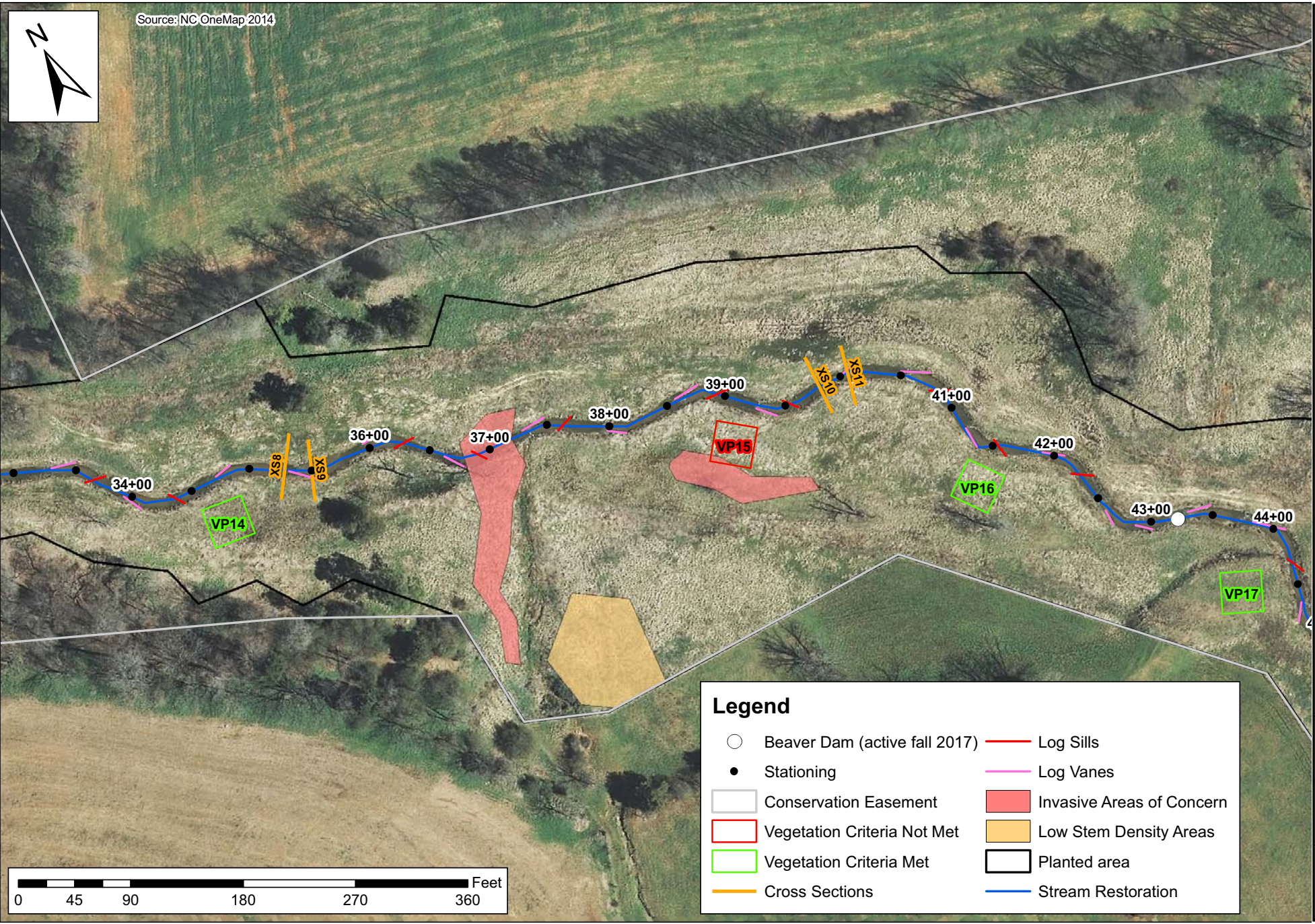


HEATH DAIRY MONITORING YEAR 4 (2017)
CURRENT CONDITIONS PLAN VIEW OVERVIEW
DMS #170 - BACK CREEK
RANDOLPH COUNTY
NORTH CAROLINA



Figure 2.3

Source: NC OneMap 2014



Legend

○ Beaver Dam (active fall 2017)	— Log Sills
● Stationing	— Log Vanes
▭ Conservation Easement	■ Invasive Areas of Concern
▭ Vegetation Criteria Not Met	■ Low Stem Density Areas
▭ Vegetation Criteria Met	▭ Planted area
— Cross Sections	— Stream Restoration

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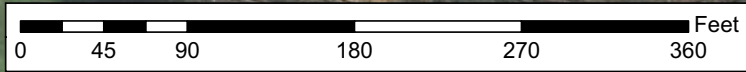


HEATH DAIRY MONITORING YEAR 4 (2017)
 CURRENT CONDITIONS PLAN VIEW OVERVIEW
 DMS #170 - BACK CREEK
 RANDOLPH COUNTY
 NORTH CAROLINA



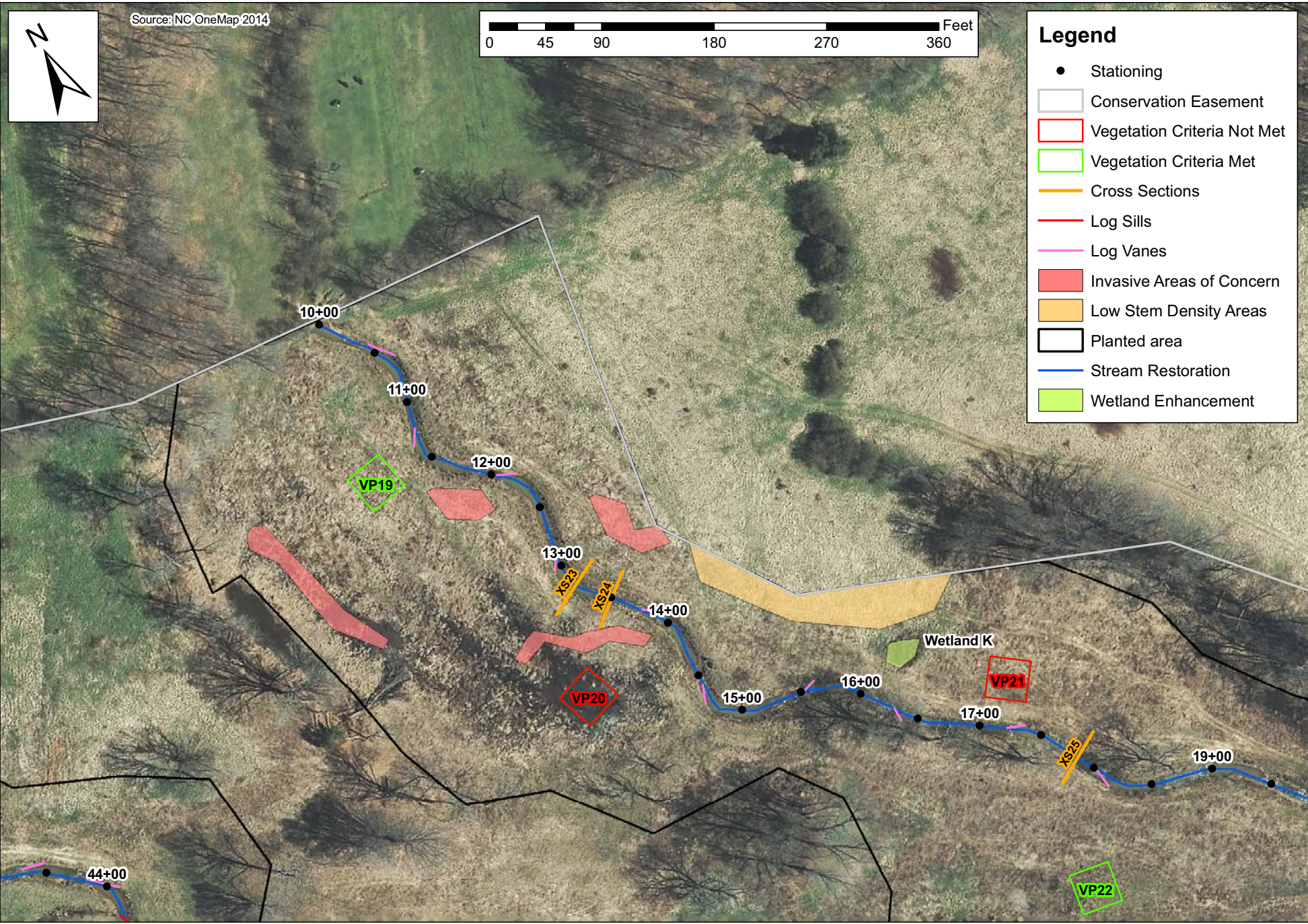
Figure 2.4

Source: NC OneMap 2014



Legend

- Stationing
- Conservation Easement
- Vegetation Criteria Not Met
- Vegetation Criteria Met
- Cross Sections
- Log Sills
- Log Vanes
- Invasive Areas of Concern
- Low Stem Density Areas
- Planted area
- Stream Restoration
- Wetland Enhancement



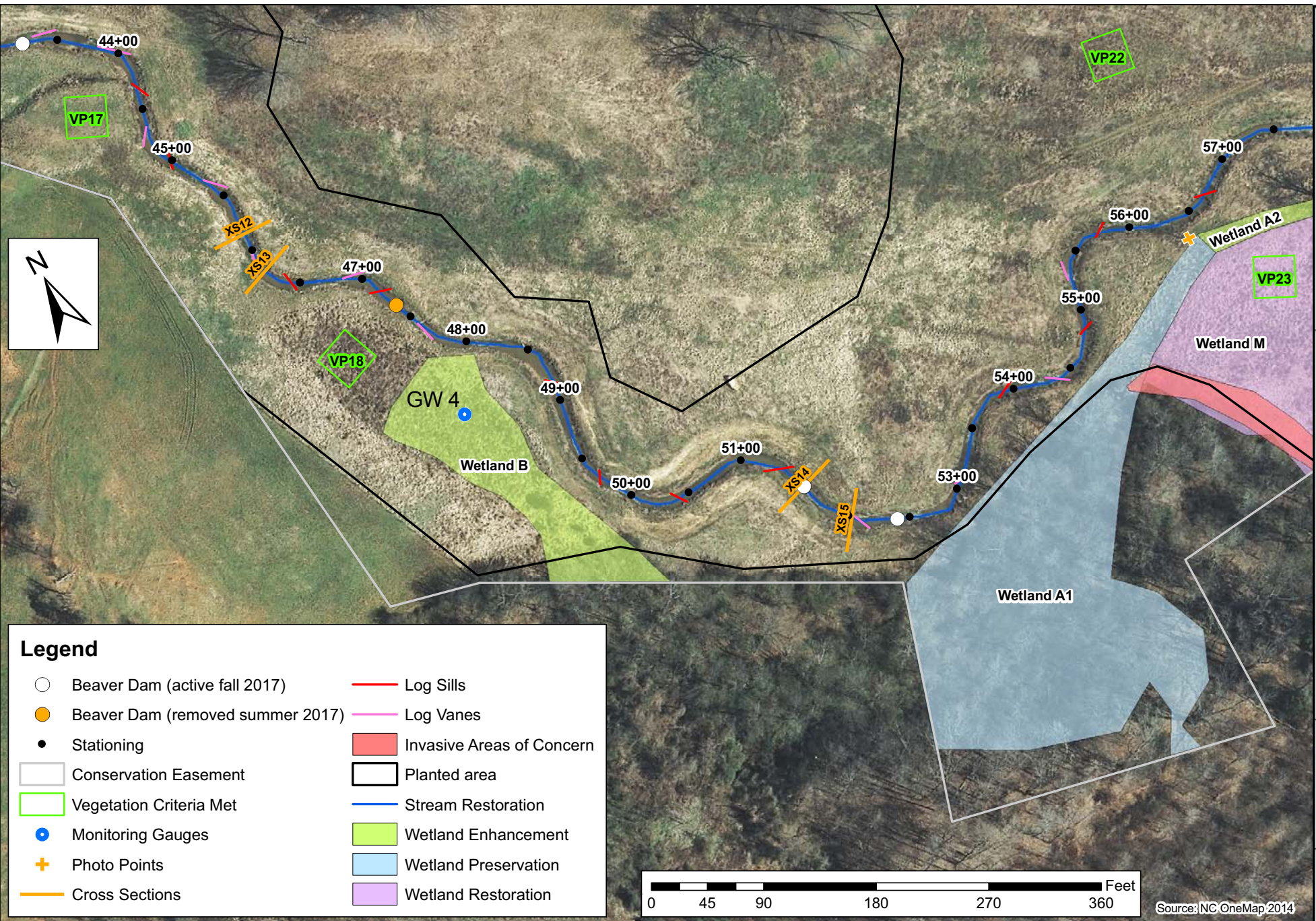
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HEATH DAIRY MONITORING YEAR 4 (2017)
 CURRENT CONDITIONS PLAN VIEW OVERVIEW
 DMS #170 - NORTH BRANCH
 RANDOLPH COUNTY
 NORTH CAROLINA

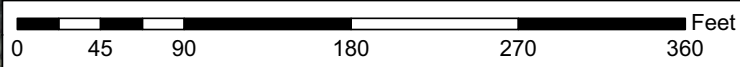


Figure 2.5



Legend

○ Beaver Dam (active fall 2017)	— Log Sills
● Beaver Dam (removed summer 2017)	— Log Vanes
● Stationing	■ Invasive Areas of Concern
□ Conservation Easement	□ Planted area
□ Vegetation Criteria Met	— Stream Restoration
● Monitoring Gauges	■ Wetland Enhancement
✚ Photo Points	■ Wetland Preservation
— Cross Sections	■ Wetland Restoration



Source: NC OneMap 2014

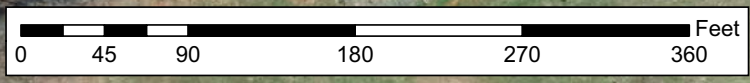
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HEATH DAIRY MONITORING YEAR 4 (2017)
 CURRENT CONDITIONS PLAN VIEW OVERVIEW
 DMS #170 - BACK CREEK
 RANDOLPH COUNTY
 NORTH CAROLINA



Figure 2.6



Legend

- Stationing
- Conservation Easement
- Vegetation Criteria Not Met
- Cross Sections
- Log Sills
- Log Vanes
- Invasive Areas of Concern
- Planted area
- Stream Restoration
- Stream Preservation
- Wetland Enhancement



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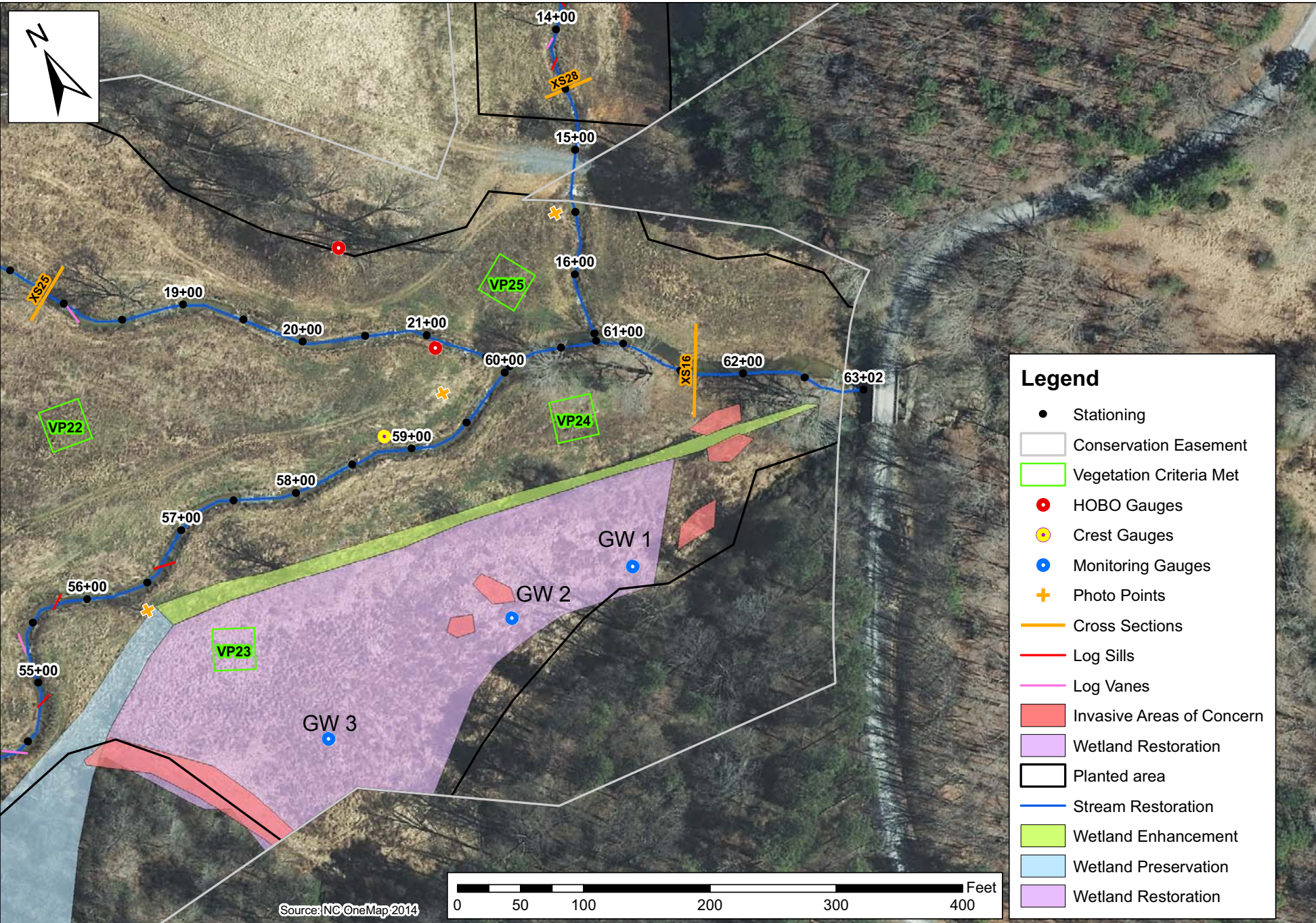


HEATH DAIRY MONITORING YEAR 4 (2017)
 CURRENT CONDITIONS PLAN VIEW OVERVIEW
 DMS #170 - EAST BRANCH
 RANDOLPH COUNTY
 NORTH CAROLINA



Figure 2.7

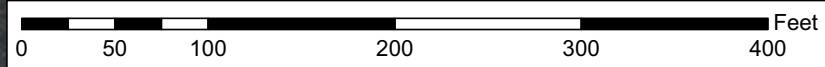
Source: NC OneMap 2014



Legend

- Stationing
- Conservation Easement
- Vegetation Criteria Met
- HOB0 Gauges
- Crest Gauges
- Monitoring Gauges
- ✚ Photo Points
- Cross Sections
- Log Sills
- Log Vanes
- Invasive Areas of Concern
- Wetland Restoration
- Planted area
- Stream Restoration
- Wetland Enhancement
- Wetland Preservation
- Wetland Restoration

Source: NC OneMap 2014



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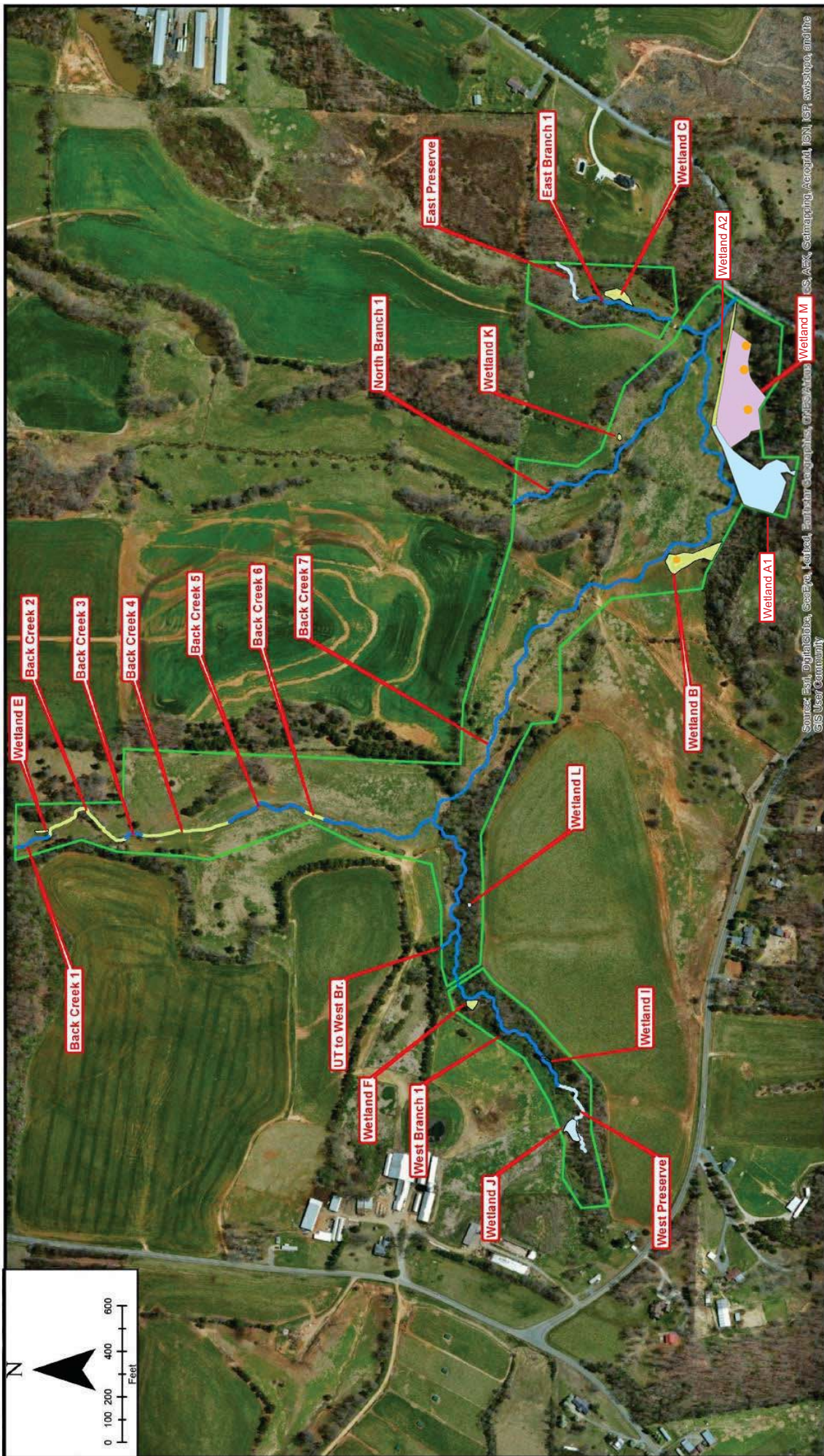


HEATH DAIRY MONITORING YEAR 4 (2017)
 CURRENT CONDITIONS PLAN VIEW OVERVIEW
 DMS #170 - BACK CREEK

RANDOLPH COUNTY
 NORTH CAROLINA

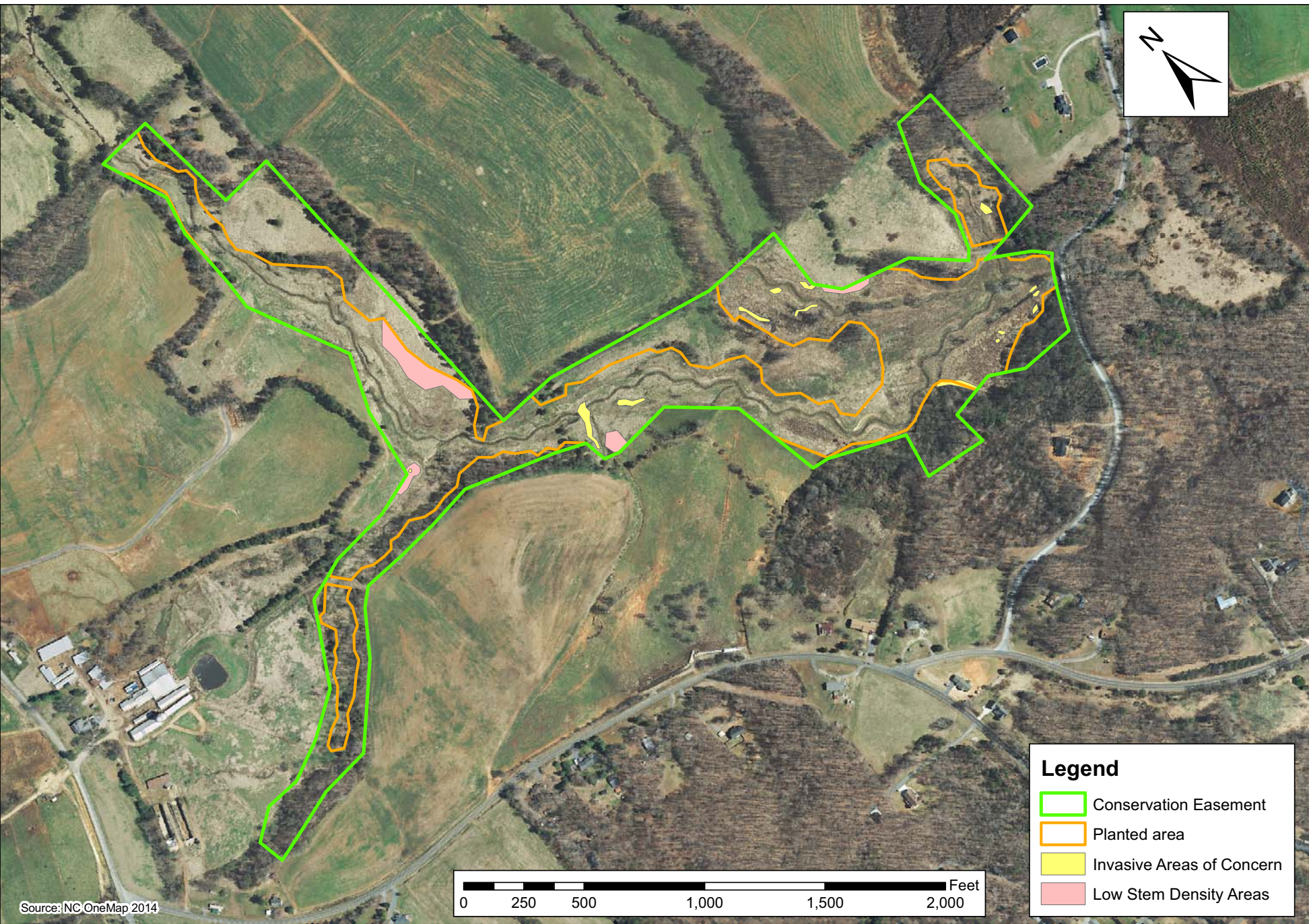


Figure 2.8



Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNR/Airphoto, IGN, USA, Aero, GeoEye, AeroGRID, IGN, Esri, Swisstopo, and the GIS User Community

<p>Legend</p> <ul style="list-style-type: none"> Stream Restoration Stream Enhancement I Stream Preservation Easement Boundary GW Gauges <p>Wetland Type</p> <ul style="list-style-type: none"> Wetland Enhancement Wetland Preservation Wetland Restoration 	
<p>Reproduced from the HDR As-built report; Figure 2, July 2014</p>	
<p>2017</p>	
<p>Mogensen Mitigation, Inc. P. O. Box 690429 Charlotte, NC 28227 (704) 576-1111</p>	
<p>COMPONENT ASSESSMENT MAP HEATH DAIRY ROAD STREAM RESTORATION SITE RANDOLPH COUNTY, NORTH CAROLINA MONITORING YEAR 4 DMS # 170</p>	
<p>Figure 2.9</p>	



Source: NC OneMap 2014

Legend

- Conservation Easement
- Planted area
- Invasive Areas of Concern
- Low Stem Density Areas

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HEATH DAIRY MONITORING YEAR 4 (2017)
 VEGETATION PROBLEM AREAS
 DMS #170 - WEST BRANCH

RANDOLPH COUNTY
 NORTH CAROLINA

Figure 2.10

Table 5.1. Visual Stream Assessment

Visual Stream Assessment - Back Creek								
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. <u>Aggradation</u> - Bar formation/growth sufficient to significantly deflect flow laterally (not to include point bars)			0	0	100%	
		2. <u>Degradation</u> - Evidence of downcutting			0	0	100%	
	2. Riffle Condition	1. <u>Texture/Substrate</u> - Riffle maintains coarser substrate	76	76			100%	
		3. Meander Pool Condition	1. <u>Depth</u> Sufficient (Max Pool Depth : Mean Bankfull Depth \geq 1.6)	76	76			100%
	4. Thalweg Position	1. Thalweg centering at upstream of meander bend (Run)	2. <u>Length</u> appropriate (>30% of centerline distance between tail of upstream riffle and head of downstream riffle)	76	76			100%
			1. Thalweg centering at upstream of meander bend (Run)	76	76			100%
		2. Thalweg centering at downstream of meander (Glide)	1. Thalweg centering at upstream of meander bend (Run)	76	76			100%
			2. Thalweg centering at downstream of meander (Glide)	76	76			100%
2. Bank	1. Scoured/Eroding	Bank lacking vegetative cover resulting simply from poor growth and/or scour and erosion			0	0	100%	
	2. Undercut	Banks undercut/overhanging to the extent that mass wasting appears likely. Does NOT include undercuts that are modest, appear sustainable and are providing habitat.			0	0	100%	
	3. Mass Wasting	Bank slumping, calving, or collapse			0	0	100%	
3. Engineered Structures	1. Overall Integrity	Structures physically intact with no dislodged boulders or logs.	104	104			100%	
	2. Grade Control	Grade control structures exhibiting maintenance of grade across the sill.	43	43			100%	
	2a. Piping	Structures lacking any substantial flow underneath sills or arms.	42	43			98%	
	3. Bank Protection	Bank erosion within the structures extent of influence does <u>not</u> exceed 15%. (See guidance for this table in EEP monitoring guidance document)	43	43			100%	
	4. Habitat	Pool forming structures maintaining ~ Max Pool Depth : Mean Bankfull Depth ratio \geq 1.6 Rootwads/logs providing some cover at base-flow.	104	104			100%	

Table 5.2. Visual Stream Assessment

Visual Stream Assessment - West Branch to Back Creek

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. <u>Aggradation</u> - Bar formation/growth sufficient to significantly deflect flow laterally (not to include point bars)			0	0	100%		
		2. <u>Degradation</u> - Evidence of downcutting					0	0	100%
	2. Riffle Condition	1. <u>Texture/Substrate</u> - Riffle maintains coarser substrate	52	52			100%		
	3. Meander Pool Condition	1. <u>Depth</u> Sufficient (Max Pool Depth : Mean Bankfull Depth \geq 1.6)	52	52			100%		
		2. <u>Length</u> appropriate (>30% of centerline distance between tail of upstream riffle and head of downstream riffle)	52	52			100%		
	4. Thalweg Position	1. Thalweg centering at upstream of meander bend (Run)	52	52			100%		
		2. Thalweg centering at downstream of meander (Glide)	52	52			100%		
2. Bank	1. Scoured/Eroding	Bank lacking vegetative cover resulting simply from poor growth and/or scour and erosion					0	0	100%
	2. Undercut	Banks undercut/overhanging to the extent that mass wasting appears likely. Does <u>NOT</u> 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%
3. Engineered Structures	1. Overall Integrity	Structures physically intact with no dislodged boulders or logs.	84	84			100%		
	2. Grade Control	Grade control structures exhibiting maintenance of grade across the sill.	84	84			100%		
	2a. Piping	Structures lacking any substantial flow underneath sills or arms.	84	84			100%		
	3. Bank Protection	Bank erosion within the structures extent of influence does <u>not</u> exceed 15%. (See guidance for this table in EEP monitoring guidance document)	84	84			100%		
	4. Habitat	Pool forming structures maintaining ~ Max Pool Depth : Mean Bankfull Depth ratio \geq 1.6 Rootwads/logs providing some cover at base-flow.	84	84			100%		

Table 5.3. Visual Stream Assessment

Visual Stream Assessment - North Branch to Back Creek							
Major Channel Category	Channel Sub-Category	Metric	Number Stable, Performing	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. <u>Aggradation</u> - Bar formation/growth sufficient to significantly deflect flow laterally (not to include point bars)			0	0	100%
		2. <u>Degradation</u> - Evidence of downcutting			0	0	100%
	2. Riffle Condition	1. <u>Texture/Substrate</u> - Riffle maintains coarser substrate	14	14			100%
		3. Meander Pool Condition	1. <u>Depth</u> Sufficient (Max Pool Depth : Mean Bankfull Depth \geq 1.6)	14			14
	2. <u>Length</u> appropriate (>30% of centerline distance between tail of upstream riffle and head of downstream riffle)		14	14			100%
	4. Thalweg Position	1. Thalweg centering at upstream of meander bend (Run)	14	14			100%
2. Thalweg centering at downstream of meander (Glide)		14	14	100%			
2. Bank	1. Scoured/Eroding	Bank lacking vegetative cover resulting simply from poor growth and/or scour and erosion					0
	2. Undercut	Banks undercut/overhanging to the extent that mass wasting appears likely. Does <u>NOT</u> 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%
3. Engineered Structures	1. Overall Integrity	Structures physically intact with no dislodged boulders or logs.	15	15			100%
	2. Grade Control	Grade control structures exhibiting maintenance of grade across the sill.	15	15			100%
	2a. Piping	Structures lacking any substantial flow underneath sills or arms.	15	15			100%
	3. Bank Protection	Bank erosion within the structures extent of influence does <u>not</u> exceed 15%. (See guidance for this table in EEP monitoring guidance document)	15	15			100%
	4. Habitat	Pool forming structures maintaining ~ Max Pool Depth : Mean Bankfull Depth ratio \geq 1.6 Rootwads/logs providing some cover at base-flow.	15	15			100%

Table 5.4. Visual Stream Assessment

Visual Stream Assessment - East Branch to Back Creek							
Major Channel Category	Channel Sub-Category	Metric	Number Stable, Performing	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. <u>Aggradation</u> - Bar formation/growth sufficient to significantly deflect flow laterally (not to include point bars)			0	0	100%
		2. <u>Degradation</u> - Evidence of downcutting			0	0	100%
	2. Riffle Condition	1. <u>Texture/Substrate</u> - Riffle maintains coarser substrate	14	14			100%
	3. Meander Pool Condition	1. <u>Depth</u> Sufficient (Max Pool Depth : Mean Bankfull Depth \geq 1.6)	14	14			100%
		2. <u>Length</u> appropriate (>30% of centerline distance between tail of upstream riffle and head of downstream riffle)	14	14			100%
	4. Thalweg Position	1. Thalweg centering at upstream of meander bend (Run)	14	14			100%
		2. Thalweg centering at downstream of meander (Glide)	14	14			100%
2. Bank	1. Scoured/Eroding	Bank lacking vegetative cover resulting simply from poor growth and/or scour and erosion			0	0	100%
	2. Undercut	Banks undercut/overhanging to the extent that mass wasting appears likely. Does <u>NOT</u> 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%
3. Engineered Structures	1. Overall Integrity	Structures physically intact with no dislodged boulders or logs.	17	17			100%
	2. Grade Control	Grade control structures exhibiting maintenance of grade across the sill.	17	17			100%
	2a. Piping	Structures lacking any substantial flow underneath sills or arms.	17	17			100%
	3. Bank Protection	Bank erosion within the structures extent of influence does <u>not</u> exceed 15%. (See guidance for this table in EEP monitoring guidance document)	17	17			100%
	4. Habitat	Pool forming structures maintaining ~ Max Pool Depth : Mean Bankfull Depth ratio \geq 1.6 Rootwads/logs providing some cover at base-flow.	17	17			100%

Table 6. Vegetation Condition Assessment

Planted Acreage		32				
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	N/A	0	0.00	0.0%
2. Low Stem Density Areas	Woody stem densities clearly below target levels based on MY4 criteria.	0.1 acres	blue polygon	4	1.14	3.6%
Total				0	1.14	3.6%
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	N/A	0	0.00	0.0%
Cumulative Total				4	1.14	3.6%

Easement Acreage		56.8				
Vegetation Category	Definitions	Mapping Threshold (SF)	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).	0	pink polygon	15	0.51	0.9%
5. Easement Encroachment Areas	Areas or points (if too small to render as polygons at map scale).	0	N/A	0	0.00	0.0%

Heath Dairy Stream Restoration/DMS Project No. 170 Photo Points - MY4 (2017)



Heath Dairy Stream Restoration Photo Point 1 Spring 2017



Heath Dairy Stream Restoration Photo Point 1 Fall 2017



Heath Dairy Stream Restoration Photo Point 2 Spring 2017



Heath Dairy Stream Restoration Photo Point 2 Fall 2017

Heath Dairy Stream Restoration/DMS Project No. 170 Photo Points - MY4 (2017)



Heath Dairy Stream Restoration Photo Point 3 Spring 2017



Heath Dairy Stream Restoration Photo Point 3 Fall 2017



Heath Dairy Stream Restoration Photo Point 4 Spring 2017



Heath Dairy Stream Restoration Photo Point 4 Fall 2017

Heath Dairy Stream Restoration/DMS Project No. 170 Vegetation Plot Photos - MY4 (2017)



Heath Dairy Stream Restoration Veg Plot 1 Fall 2014



Heath Dairy Stream Restoration Veg Plot 1 Fall 2017



Heath Dairy Stream Restoration Veg Plot 2 Fall 2014



Heath Dairy Stream Restoration Veg Plot 2 Fall 2017

Heath Dairy Stream Restoration/DMS Project No. 170 Vegetation Plot Photos - MY4 (2017)



Heath Dairy Stream Restoration Veg Plot 3 Fall 2014



Heath Dairy Stream Restoration Veg Plot 3 Fall 2017



Heath Dairy Stream Restoration Veg Plot 4 Fall 2014



Heath Dairy Stream Restoration Veg Plot 4 Fall 2017

Heath Dairy Stream Restoration/DMS Project No. 170 Vegetation Plot Photos - MY4 (2017)



Heath Dairy Stream Restoration Veg Plot 5 Fall 2014



Heath Dairy Stream Restoration Veg Plot 5 Fall 2017



Heath Dairy Stream Restoration Veg Plot 6 Fall 2014



Heath Dairy Stream Restoration Veg Plot 6 Fall 2017

Heath Dairy Stream Restoration/DMS Project No. 170 Vegetation Plot Photos - MY4 (2017)



Heath Dairy Stream Restoration Veg Plot 7 Fall 2014



Heath Dairy Stream Restoration Veg Plot 7 Fall 2017



Heath Dairy Stream Restoration Veg Plot 8 Fall 2014



Heath Dairy Stream Restoration Veg Plot 8 Fall 2017

Heath Dairy Stream Restoration/DMS Project No. 170 Vegetation Plot Photos - MY4 (2017)



Heath Dairy Stream Restoration Veg Plot 9 Fall 2014



Heath Dairy Stream Restoration Veg Plot 9 Fall 2017



Heath Dairy Stream Restoration Veg Plot 10 Fall 2014



Heath Dairy Stream Restoration Veg Plot 10 Fall 2017

Heath Dairy Stream Restoration/DMS Project No. 170 Vegetation Plot Photos - MY4 (2017)



Heath Dairy Stream Restoration Veg Plot 11 Fall 2014



Heath Dairy Stream Restoration Veg Plot 11 Fall 2017



Heath Dairy Stream Restoration Veg Plot 12 Fall 2014



Heath Dairy Stream Restoration Veg Plot 12 Fall 2017

Heath Dairy Stream Restoration/DMS Project No. 170 Vegetation Plot Photos - MY4 (2017)



Heath Dairy Stream Restoration Veg Plot 13 Fall 2014



Heath Dairy Stream Restoration Veg Plot 13 Fall 2017



Heath Dairy Stream Restoration Veg Plot 14 Fall 2014



Heath Dairy Stream Restoration Veg Plot 14 Fall 2017

Heath Dairy Stream Restoration/DMS Project No. 170 Vegetation Plot Photos - MY4 (2017)



Heath Dairy Stream Restoration Veg Plot 15 Fall 2014



Heath Dairy Stream Restoration Veg Plot 15 Fall 2017



Heath Dairy Stream Restoration Veg Plot 16 Fall 2014



Heath Dairy Stream Restoration Veg Plot 16 Fall 2017

Heath Dairy Stream Restoration/DMS Project No. 170 Vegetation Plot Photos - MY4 (2017)



Heath Dairy Stream Restoration Veg Plot 17 Fall 2014



Heath Dairy Stream Restoration Veg Plot 17 Fall 2017



Heath Dairy Stream Restoration Veg Plot 18 Fall 2014



Heath Dairy Stream Restoration Veg Plot 18 Fall 2017

Heath Dairy Stream Restoration/DMS Project No. 170 Vegetation Plot Photos - MY4 (2017)



Heath Dairy Stream Restoration Veg Plot 19 Fall 2014



Heath Dairy Stream Restoration Veg Plot 19 Fall 2017



Heath Dairy Stream Restoration Veg Plot 20 Fall 2014



Heath Dairy Stream Restoration Veg Plot 20 Fall 2017

Heath Dairy Stream Restoration/DMS Project No. 170 Vegetation Plot Photos - MY4 (2017)



Heath Dairy Stream Restoration Veg Plot 21 Fall 2014



Heath Dairy Stream Restoration Veg Plot 21 Fall 2017



Heath Dairy Stream Restoration Veg Plot 22 Fall 2014



Heath Dairy Stream Restoration Veg Plot 22 Fall 2017

Heath Dairy Stream Restoration/DMS Project No. 170 Vegetation Plot Photos - MY4 (2017)



Heath Dairy Stream Restoration Veg Plot 23 Fall 2014



Heath Dairy Stream Restoration Veg Plot 23 Fall 2017



Heath Dairy Stream Restoration Veg Plot 24 Fall 2014



Heath Dairy Stream Restoration Veg Plot 24 Fall 2017

Heath Dairy Stream Restoration/DMS Project No. 170 Vegetation Plot Photos - MY4 (2017)



Heath Dairy Stream Restoration Veg Plot 25 Fall 2014



Heath Dairy Stream Restoration Veg Plot 25 Fall 2017



Heath Dairy Stream Restoration Veg Plot 26 Fall 2014



Heath Dairy Stream Restoration Veg Plot 26 Fall 2017

Appendix C: Vegetation Plot Data

Table 7. Vegetation Plot Success Criteria Attainment Summary

Plot #	Stream/ Wetland Stems ²	Volunteers ³	Total ⁴	Success Criteria Met?
1	405	121	526	Yes
2	364	324	688	Yes
3	526	283	809	Yes
4	202	40	243	No
5	324	0	324	Yes
6	243	0	243	No
7	81	0	81	No
8	324	243	567	Yes
9	40	426	526	Yes
10	324	40	364	Yes
11	243	0	243	No
12	121	0	121	No
13	202	162	364	Yes
14	283	162	445	Yes
15	81	40	121	No
16	324	81	405	Yes
17	486	162	647	Yes
18	445	0	445	Yes
19	486	445	931	Yes
20	121	40	162	No
21	40	162	202	No
22	243	162	405	Yes
23	486	81	567	Yes
24	243	162	405	Yes
25	81	202	283	Yes
26	202	364	567	Yes
Project Avg	265	126	391	Yes

Stem Class	Characteristics
¹ Buffer Stems	Native planted hardwood trees. Does NOT include shrubs. No pines. No vines.
² Stream/ Wetland Stems	Native planted woody stems. Includes shrubs, does NOT include live stakes. No vines
³ Volunteers	Native woody stems. Not planted. No vines.
⁴ Total	Planted + volunteer native woody stems. Includes live stakes. Excl. exotics. Excl. vines.

Table 8.1. Vegetation Plot Summary

Scientific Name	Common Name	Species Type	Veg Plot 01			Veg Plot 02			Veg Plot 03			Veg Plot 04			Veg Plot 05			
			PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	
Acer negundo	boxelder	Tree																
Baccharis	baccharis	Shrub																
Betula nigra	river birch	Tree	1	1	1			1	2	2	2				2	2	2	
Carpinus	hornbeam	Tree																
Carya	hickory	Tree																
Carya glabra	pignut hickory	Tree							1	1	1							
Celtis	hackberry	Tree																
Celtis laevigata	sugarberry	Tree																
Celtis occidentalis	common hackberry	Tree																
Diospyros virginiana	common persimmon	Tree	6	6	6	1	1	1	1	1	1							
Fraxinus pennsylvanica	green ash	Tree			1			1	3	3	3							
Juglans nigra	black walnut	Tree			1			3			4							
Liquidambar styraciflua	sweetgum	Tree			1			1										
Liriodendron tulipifera	tuliptree	Tree	2	2	2	1	1	2	1	1	1							
Nyssa sylvatica	blackgum	Tree				2	2	2										
Platanus occidentalis	American sycamore	Tree						1				3	3	4	2	2	2	
Quercus	oak	Tree																
Quercus falcata	southern red oak	Tree																
Quercus michauxii	swamp chestnut oak	Tree																
Quercus nigra	water oak	Tree																
Quercus palustris	pin oak	Tree																
Quercus phellos	willow oak	Tree				4	4	4							2	2	2	
Quercus rubra	northern red oak	Tree	1	1	1				5	5	5	2	2	2	1	1	1	
Quercus velutina	black oak	Tree				1	1	1							1	1	1	
Salix nigra	black willow	Tree																
Sambucus nigra	European black elderberry	Shrub																
Ulmus alata	winged elm	Tree																
Ulmus americana	American elm	Tree									3							
Ligustrum sinense	Chinese privet	Shrub																
Rosa multiflora	multiflora rose	Shrub																
			Stem count	10	10	13	9	9	17	13	13	20	5	5	6	8	8	8
			Stem count size (ares)	1			1			1			1			1		
			Stem count size (ACRES)	0.02			0.02			0.02			0.02			0.02		
			Species count	4	4	7	5	5	10	6	6	8	2	2	2	5	5	5
			Stems per ACRE	404.7	404.7	526	364.2	364.2	688	526.1	526.1	809	202.3	202.3	243	323.7	323.7	324
			Color Codes for Total Stem 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%															

Table 8.2. Vegetation Plot Summary

Scientific Name	Common Name	Species Type	Veg Plot 06			Veg Plot 07			Veg Plot 08			Veg Plot 09			Veg Plot 10		
			PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T
Acer negundo	boxelder	Tree															
Baccharis	baccharis	Shrub															
Betula nigra	river birch	Tree	1	1	1										1	1	1
Carpinus	hornbeam	Tree													1	1	1
Carya	hickory	Tree															
Carya glabra	pignut hickory	Tree															
Celtis	hackberry	Tree															
Celtis laevigata	sugarberry	Tree															
Celtis occidentalis	common hackberry	Tree															
Diospyros virginiana	common persimmon	Tree	1	1	1										2	2	2
Fraxinus pennsylvanica	green ash	Tree	2	2	2	1	1	1	2	2	2						
Juglans nigra	black walnut	Tree											12				1
Liquidambar styraciflua	sweetgum	Tree									1						
Liriodendron tulipifera	tuliptree	Tree							3	3	4				1	1	1
Nyssa sylvatica	blackgum	Tree															
Platanus occidentalis	American sycamore	Tree	1	1	1				1	1	1						
Quercus	oak	Tree															
Quercus falcata	southern red oak	Tree													1	1	1
Quercus michauxii	swamp chestnut oak	Tree															
Quercus nigra	water oak	Tree							1	1	1						
Quercus palustris	pin oak	Tree															
Quercus phellos	willow oak	Tree	1	1	1				1	1	1	1	1	1	1	1	1
Quercus rubra	northern red oak	Tree				1	1	1							1	1	1
Quercus velutina	black oak	Tree															
Salix nigra	black willow	Tree															
Sambucus nigra	European black elderberry	Shrub															
Ulmus alata	winged elm	Tree															
Ulmus americana	American elm	Tree									4						
Ligustrum sinense	Chinese privet	Shrub						3									2
Rosa multiflora	multiflora rose	Shrub															
Color Codes for Total Stem Density		Stem count size (ares) size (ACRES) Species count Stems per ACRE	6	6	6	2	2	2	8	8	14	1	1	13	8	8	9
Exceeds requirements by 10%			1			1			1			1			1		
Exceeds requirements, but by less than 10%			0.02			0.02			0.02			0.02			0.02		
Fails to meet requirements, by less than 10%			5	5	5	2	2	2	5	5	7	1	1	2	7	7	8
Fails to meet requirements by more than 10%			242.8	242.8	243	80.94	80.94	80	323.7	323.7	567	40.5	40.5	526	323.7	323.7	364

Table 8.3. Vegetation Plot Summary

Scientific Name	Common Name	Species Type	Veg Plot 11			Veg Plot 12			Veg Plot 13			Veg Plot 14			Veg Plot 15								
			PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T						
Acer negundo	boxelder	Tree																					
Baccharis	baccharis	Shrub																					
Betula nigra	river birch	Tree																					
Carpinus	hornbeam	Tree																					
Carya	hickory	Tree																					
Carya glabra	pignut hickory	Tree	2	2	2																		
Celtis	hackberry	Tree	1	1	1																		
Celtis laevigata	sugarberry	Tree																					
Celtis occidentalis	common hackberry	Tree																					
Diospyros virginiana	common persimmon	Tree									1	1	1	1	1	1							
Fraxinus pennsylvanica	green ash	Tree				3	3	3	1	1	1												
Juglans nigra	black walnut	Tree								1													
Liquidambar styraciflua	sweetgum	Tree										1				1							
Liriodendron tulipifera	tuliptree	Tree	2	2	2				2	2	2	1	1	1									
Nyssa sylvatica	blackgum	Tree										1	1	1									
Platanus occidentalis	American sycamore	Tree								1													
Quercus	oak	Tree										2	2	2									
Quercus falcata	southern red oak	Tree																					
Quercus michauxii	swamp chestnut oak	Tree																					
Quercus nigra	water oak	Tree																					
Quercus palustris	pin oak	Tree																					
Quercus phellos	willow oak	Tree										1	1	1									
Quercus rubra	northern red oak	Tree	1	1	1				1	1	1				1	1							
Quercus velutina	black oak	Tree																					
Salix nigra	black willow	Tree								1			3										
Sambucus nigra	European black elderberry	Shrub							1	1	2												
Ulmus alata	winged elm	Tree																					
Ulmus americana	American elm	Tree										1	1	1									
Ligustrum sinense	Chinese privet	Shrub														18							
Rosa multiflora	multiflora rose	Shrub																					
<table border="1"> <tr><td>Color Codes for Total Stem Density</td></tr> <tr><td>Exceeds requirements by 10%</td></tr> <tr><td>Exceeds requirements, but by less than 10%</td></tr> <tr><td>Fails to meet requirements, by less than 10%</td></tr> <tr><td>Fails to meet requirements by more than 10%</td></tr> </table>			Color Codes for Total Stem 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%	Stem count	6	6	6	3	3	3	5	5	9	7	7	11	2	2	3
			Color Codes for Total Stem 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%																							
size (ares)	1			1			1			1			1										
size (ACRES)	0.02			0.02			0.02			0.02			0.02										
Species count	4	4	4	1	1	1	4	4	7	6	6	8	2	2	3								
Stems per ACRE	242.8	242.8	243	121.4	121.4	121	202.3	202.3	364	283.3	283.3	445	80.94	80.94	121								

Table 8.4. Vegetation Plot Summary

Scientific Name	Common Name	Species Type	Veg Plot 16			Veg Plot 17			Veg Plot 18			Veg Plot 19			Veg Plot 20		
			PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T
Acer negundo	boxelder	Tree															
Baccharis	baccharis	Shrub															
Betula nigra	river birch	Tree						1	1	1			7	1	1	1	
Carpinus	hombeam	Tree															
Carya	hickory	Tree															
Carya glabra	pignut hickory	Tree															
Celtis	hackberry	Tree															
Celtis laevigata	sugarberry	Tree															
Celtis occidentalis	common hackberry	Tree			1												
Diospyros virginiana	common persimmon	Tree	2	2	3	5	5	6									
Fraxinus pennsylvanica	green ash	Tree	2	2	2				9	9	9	1	1	1	1	1	2
Juglans nigra	black walnut	Tree												1			
Liquidambar styraciflua	sweetgum	Tree															
Liriodendron tulipifera	tuliptree	Tree				2	2	3				1	1	1			
Nyssa sylvatica	blackgum	Tree										1	1	1			
Platanus occidentalis	American sycamore	Tree						1							1	1	1
Quercus	oak	Tree															
Quercus falcata	southern red oak	Tree										3	3	3			
Quercus michauxii	swamp chestnut oak	Tree	1	1	1	1	1	1									
Quercus nigra	water oak	Tree															
Quercus palustris	pin oak	Tree															
Quercus phellos	willow oak	Tree	1	1	1	2	2	2				2	2	2			
Quercus rubra	northern red oak	Tree	1	1	1	2	2	2	1	1	1	3	3	6			
Quercus velutina	black oak	Tree	1	1	1												
Salix nigra	black willow	Tree						1									
Sambucus nigra	European black elderberry	Shrub															
Ulmus alata	winged elm	Tree															
Ulmus americana	American elm	Tree										1	1	1			
Ligustrum sinense	Chinese privet	Shrub			4												
Rosa multiflora	multiflora rose	Shrub												4		1	
			8	8	10	12	12	16	11	11	11	12	12	23	3	3	4
Color Codes for Total Stem Density			1			1			1			1			1		
Exceeds requirements by 10%			0.02			0.02			0.02			0.02			0.02		
Exceeds requirements, but by less than 10%			6			7			5			7			9		
Fails to meet requirements, by less than 10%			6			7			5			7			9		
Fails to meet requirements by more than 10%			6			7			5			7			9		
Stem count size (ares)			6			7			5			7			9		
Species count			6			7			5			7			9		
Stems per ACRE			323.7			405			485.6			445			931		

Table 8.5. Vegetation Plot Summary

Scientific Name	Common Name	Species Type	Veg Plot 21			Veg Plot 22			Veg Plot 23			Veg Plot 24			Veg Plot 25		
			PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T
Acer negundo	boxelder	Tree															
Baccharis	baccharis	Shrub															
Betula nigra	river birch	Tree				1	1	2	1	1	1						
Carpinus	hombbeam	Tree															
Carya	hickory	Tree															
Carya glabra	pignut hickory	Tree															
Celtis	hackberry	Tree															
Celtis laevigata	sugarberry	Tree															
Celtis occidentalis	common hackberry	Tree															
Diospyros virginiana	common persimmon	Tree				1	1	1	3	3	4						
Fraxinus pennsylvanica	green ash	Tree	1	1	4	2	2	4	1	1	1	1	1	3	1	1	1
Juglans nigra	black walnut	Tree			1									2			
Liquidambar styraciflua	sweetgum	Tree															
Liriodendron tulipifera	tuliptree	Tree															
Nyssa sylvatica	blackgum	Tree							2	2	3	1	1	1			
Platanus occidentalis	American sycamore	Tree						1	1	1	1						5
Quercus	oak	Tree															
Quercus falcata	southern red oak	Tree													1	1	1
Quercus michauxii	swamp chestnut oak	Tree				1	1	1	1	1	1						
Quercus nigra	water oak	Tree				1	1	1				2	2	2			
Quercus palustris	pin oak	Tree															
Quercus phellos	willow oak	Tree							1	1	1	2	2	2			
Quercus rubra	northern red oak	Tree							1	1	1						
Quercus velutina	black oak	Tree							1	1	1						
Salix nigra	black willow	Tree															
Sambucus nigra	European black elderberry	Shrub															
Ulmus alata	winged elm	Tree															
Ulmus americana	American elm	Tree															
Ligustrum sinense	Chinese privet	Shrub															
Rosa multiflora	multiflora rose	Shrub	3														
Stem count			1	1	5	6	6	10	12	12	14	6	6	10	2	2	7
Color Codes for Total Stem Density																	
Exceeds requirements by 10%			1			1			1			1			1		
Exceeds requirements, but by less than 10%			0.02			0.02			0.02			0.02			0.02		
Fails to meet requirements, by less than 10%			1	1	2	5	5	6	9	9	9	4	4	5	2	2	3
Fails to meet requirements by more than 10%			40.47	40.47	202	242.8	242.8	405	485.6	485.6	567	242.8	242.8	405	80.94	80.94	283
Species count			1	1	2	5	5	6	9	9	9	4	4	5	2	2	3
Stems per ACRE			40.47	40.47	202	242.8	242.8	405	485.6	485.6	567	242.8	242.8	405	80.94	80.94	283

Table 8.6. Vegetation Plot Summary

Scientific Name	Common Name	Species Type	Veg Plot 26		
			PnoLS	P-all	T
Acer negundo	boxelder	Tree			
Baccharis	baccharis	Shrub			
Betula nigra	river birch	Tree			
Carpinus	hornbeam	Tree			
Carya	hickory	Tree			
Carya glabra	pignut hickory	Tree			
Celtis	hackberry	Tree			
Celtis laevigata	sugarberry	Tree			
Celtis occidentalis	common hackberry	Tree			
Diospyros virginiana	common persimmon	Tree			
Fraxinus pennsylvanica	green ash	Tree	3	3	4
Juglans nigra	black walnut	Tree			
Liquidambar styraciflua	sweetgum	Tree			
Liriodendron tulipifera	tuliptree	Tree			
Nyssa sylvatica	blackgum	Tree			
Platanus occidentalis	American sycamore	Tree			1
Quercus	oak	Tree			
Quercus falcata	southern red oak	Tree	1	1	1
Quercus michauxii	swamp chestnut oak	Tree	1	1	1
Quercus nigra	water oak	Tree			
Quercus palustris	pin oak	Tree			
Quercus phellos	willow oak	Tree			
Quercus rubra	northern red oak	Tree			
Quercus velutina	black oak	Tree			
Salix nigra	black willow	Tree			7
Sambucus nigra	European black elderberry	Shrub			
Ulmus alata	winged elm	Tree			
Ulmus americana	American elm	Tree			
Ligustrum sinense	Chinese privet	Shrub			
Rosa multiflora	multiflora rose	Shrub			3
Stem count			5	5	14
size (ares)			1		
size (ACRES)			0.02		
Species count			3	3	5
Stems per ACRE			202.3	202.3	567
Color Codes for Total Stem 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%					

Table 8.7. Vegetation Plot Summary

Scientific Name	Common Name	Species Type	MY5 (2018)			MY4 (2017)			MY3 (2016)			MY2 (2015)			MY1 (2014)		
			PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T
Acer negundo	boxelder	Tree	-	-	-						2						
Baccharis	baccharis	Shrub	-	-	-						9						
Betula nigra	river birch	Tree	-	-	-	11	11	20	11	11	12	3	3	3	2	2	2
Carpinus	hornbeam	Tree	-	-	-	1	1	1	1	1	1						
Carya	hickory	Tree	-	-	-						1						
Carya glabra	pignut hickory	Tree	-	-	-	3	3	3	3	3	3	4	4	4	6	6	6
Celtis	hackberry	Tree	-	-	-	1	1	1	1	1	1						
Celtis laevigata	sugarberry	Tree	-	-	-									1			
Celtis occidentalis	common hackberry	Tree	-	-	-			1									
Diospyros virginiana	common persimmon	Tree	-	-	-	24	24	27	24	24	24	18	18	20	12	12	12
Fraxinus pennsylvanica	green ash	Tree	-	-	-	34	34	45	35	35	42	28	28	34	19	19	19
Juglans nigra	black walnut	Tree	-	-	-			26			34			25			
Liquidambar styraciflua	sweetgum	Tree	-	-	-			5			13	1	1	6			
Liriodendron tulipifera	tuliptree	Tree	-	-	-	16	16	19	16	16	24	17	17	23	7	7	7
Nyssa sylvatica	blackgum	Tree	-	-	-	7	7	8	7	7	8	3	3	4			
Platanus occidentalis	American sycamore	Tree	-	-	-	9	9	20	10	10	12	10	10	10	3	3	3
Quercus	oak	Tree	-	-	-	2	2	2	2	2	2	7	7	7	18	18	18
Quercus falcata	southern red oak	Tree	-	-	-	6	6	6	5	5	5	9	9	9	3	3	3
Quercus michauxii	swamp chestnut oak	Tree	-	-	-	5	5	5	2	2	2				1	1	1
Quercus nigra	water oak	Tree	-	-	-	4	4	4	3	3	3	4	4	4	3	3	3
Quercus palustris	pin oak	Tree	-	-	-				1	1	1						
Quercus phellos	willow oak	Tree	-	-	-	18	18	19	20	20	20	12	12	12	15	15	15
Quercus rubra	northern red oak	Tree	-	-	-	22	22	25	26	26	26	16	16	16	1	1	1
Quercus velutina	black oak	Tree	-	-	-	4	4	4	4	4	5						
Salix nigra	black willow	Tree	-	-	-			12			11			9			
Sambucus nigra	European black elderberry	Shrub	-	-	-	1	1	2	1	1	1						
Ulmus alata	winged elm	Tree	-	-	-						1			3			
Ulmus americana	American elm	Tree	-	-	-	2	2	9	2	2	7			3			
Ligustrum sinense	Chinese privet	Shrub	-	-	-			24									
Rosa multiflora	multiflora rose	Shrub	-	-	-			11									
Stem count			-	-	-	171	171	264	174	174	270	132	132	193	90	90	90
Color Codes for Total Stem Density																	
Exceeds requirements by 10%						26			26			26			26		
Exceeds requirements, but by less than 10%						0.64			0.64			0.64			0.64		
Fails to meet requirements, by less than 10%						18			19			13			12		
Fails to meet requirements by more than 10%						266.2			270.8			205.5			140		
Species count			-	-	-	18	18	22	19	19	26	13	13	18	12	12	12
Stems per ACRE			-	-	-	266.2	266.2	410	270.8	270.8	420	205.5	205.5	300	140	140	140

Appendix D: Stream Survey Data

3.2 Cross Section Data

Project Name	Heath Dairy
DMS Project Number	170
Cross-Section ID	XS-2, Riffle
Survey Date	9/2017
SUMMARY DATA	
Bankfull Elevation (ft)	613.66
Bankfull Cross-Sectional Area (ft ²)	14.70
Bankfull Width (ft)	16.98
Flood Prone Area Elevation (ft)	615.07
Flood Prone Width (ft)	26.00
Bankfull Mean Depth (ft)	0.87
Bankfull Max Depth (ft)	1.41
W/D Ratio	19.62
Entrenchment Ratio	1.53
Bank Height Ratio	1.10



XS-2: Upstream



XS-2: Downstream

Station	Elevation	Notes
0.0	615.07	TLP
2.5	615.08	
6.1	614.78	
8.4	614.66	
11.0	614.35	
12.9	614.02	
14.9	613.81	TLB
16.7	613.28	
18.1	612.74	
19.8	612.46	
22.5	612.25	THW
24.1	612.35	REW
25.4	612.61	
27.1	612.54	
29.0	613.11	
30.8	613.25	
31.9	613.75	TRB
34.0	614.44	
36.6	614.86	
39.8	615.00	
43.1	615.38	
46.2	615.74	
48.3	616.39	
50.1	616.68	TRP

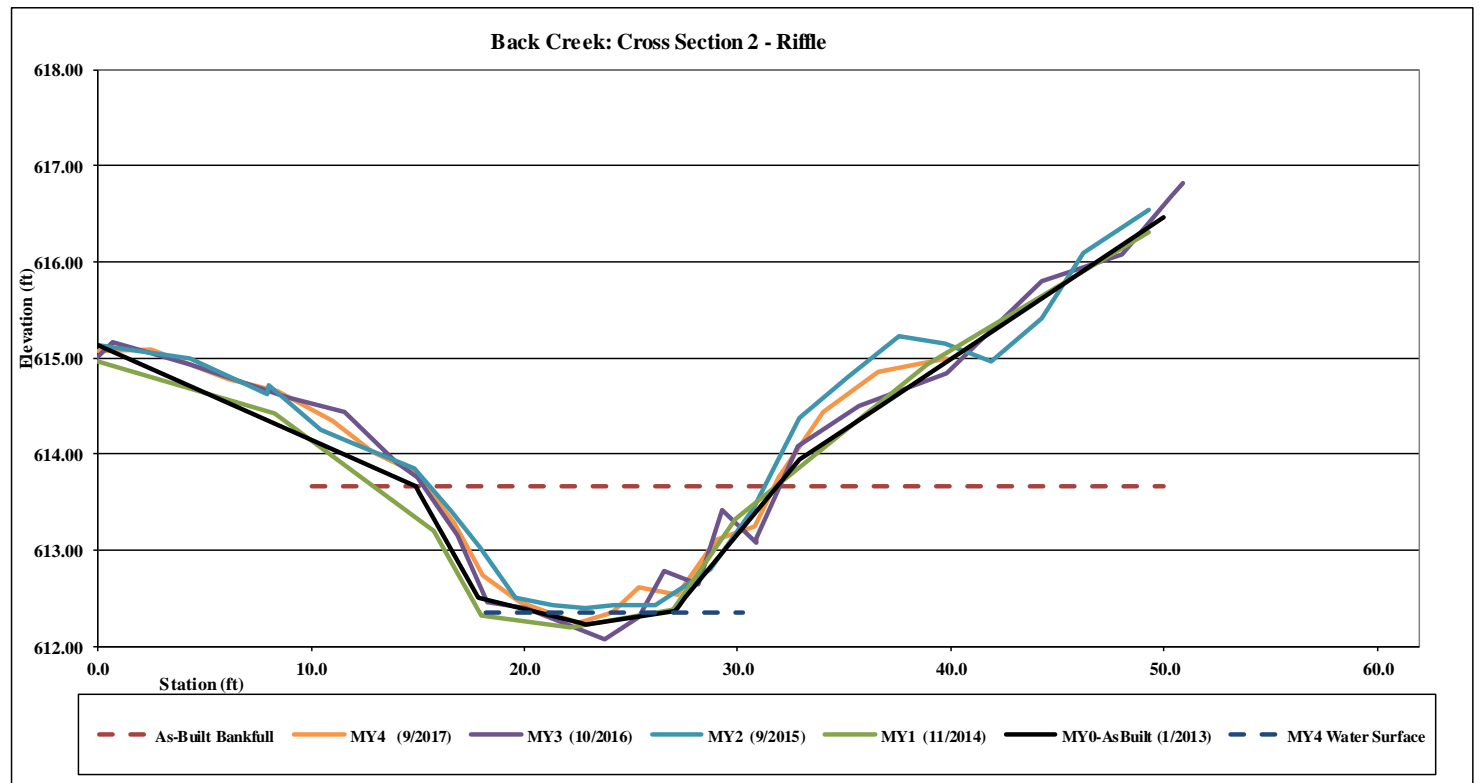


Figure 3.3 Cross Section Data

Project Name	Heath Dairy
DMS Project Number	170
Cross-Section ID	XS-3, Riffle
Survey Date	9/2017
SUMMARY DATA	
Bankfull Elevation (ft)	611.43
Bankfull Cross-Sectional Area (ft²)	31.20
Bankfull Width (ft)	15.30
Flood Prone Area Elevation (ft)	614.52
Flood Prone Width (ft)	100.00
Bankfull Mean Depth (ft)	2.04
Bankfull Max Depth (ft)	3.09
W/D Ratio	7.50
Entrenchment Ratio	6.54
Bank Height Ratio	0.99



XS-3: Upstream



XS-3: Downstream

Station	Elevation	Notes
0.0	611.43	TLP
0.0	611.03	BLP
5.2	611.20	
12.2	611.48	
17.2	611.38	
19.7	611.40	TLB
20.6	611.04	
21.8	610.29	
22.3	609.13	LEW
23.2	608.36	
25.7	608.34	THW
27.7	608.45	
29.2	608.64	
30.3	608.73	
30.3	609.13	REW
30.7	610.09	
31.7	610.60	
35.0	611.38	TRB
36.9	611.43	
43.2	612.47	
48.7	612.73	BRP
48.7	613.16	TRP

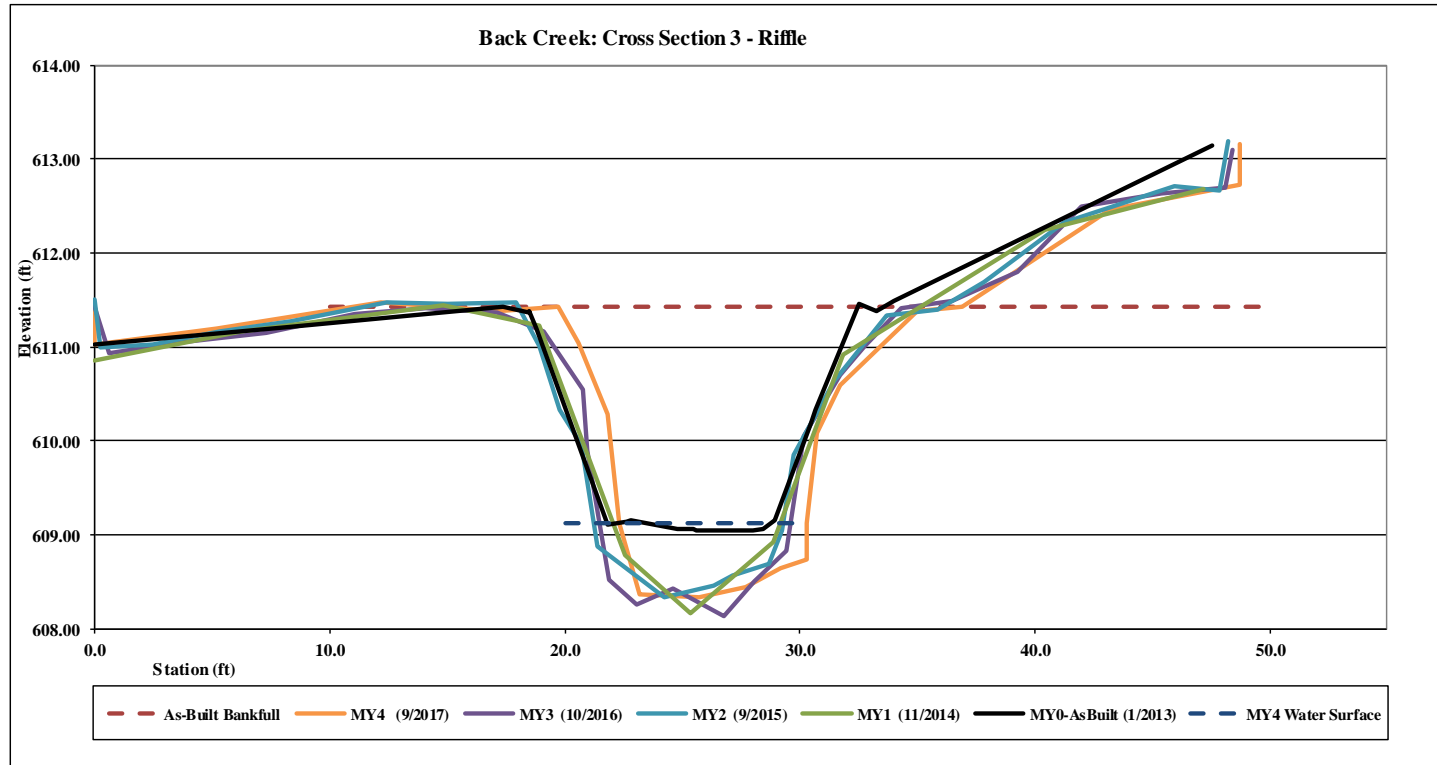


Figure 3.7 Cross Section Data

Project Name	Heath Dairy
DMS Project Number	170
Cross-Section ID	XS-7, Pool
Survey Date	9/2017
SUMMARY DATA	
Bankfull Elevation (ft)	606.22
Bankfull Cross-Sectional Area (ft²)	36.90
Bankfull Width (ft)	15.90
Flood Prone Area Elevation (ft)	609.64
Flood Prone Width (ft)	100.00
Bankfull Mean Depth (ft)	2.32
Bankfull Max Depth (ft)	3.42
W/D Ratio	6.85
Entrenchment Ratio	6.29
Bank Height Ratio	0.85



XS-7: Upstream



XS-7: Downstream

Station	Elevation	Notes
0.0	608.27	TLP
0.0	607.89	BLP
4.0	607.83	
8.0	606.94	
13.0	606.46	
15.7	605.69	TLB
18.1	605.47	
18.8	605.03	
18.9	604.80	LEW
18.9	603.86	BLB
19.7	603.26	
22.5	602.80	THW
25.0	602.82	
27.5	603.49	
29.8	604.34	BRB
29.8	604.80	REW
30.6	605.72	
31.6	606.17	TRB
36.0	606.10	
41.0	606.91	
46.0	607.28	
49.7	607.36	BRP
49.7	607.72	TRP

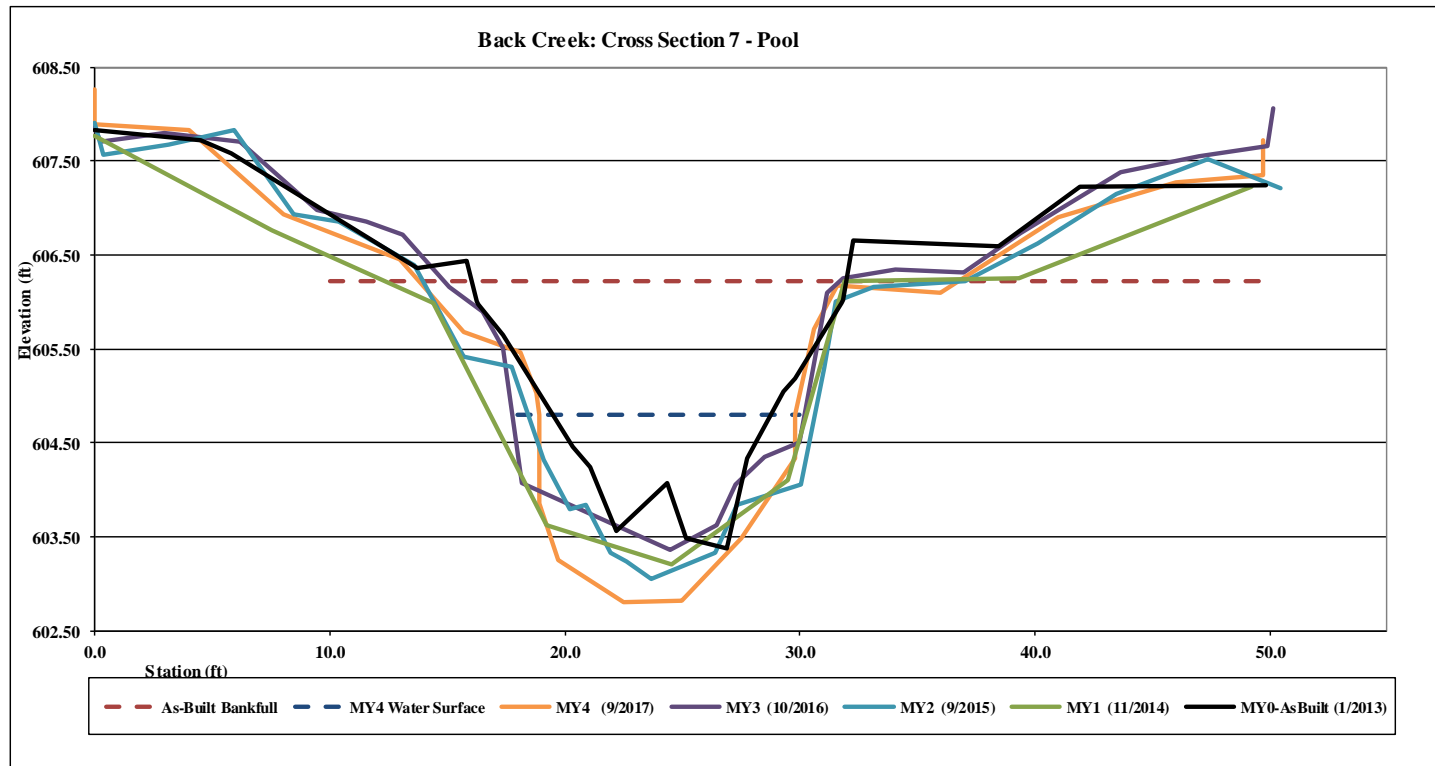


Figure 3.8 Cross Section Data

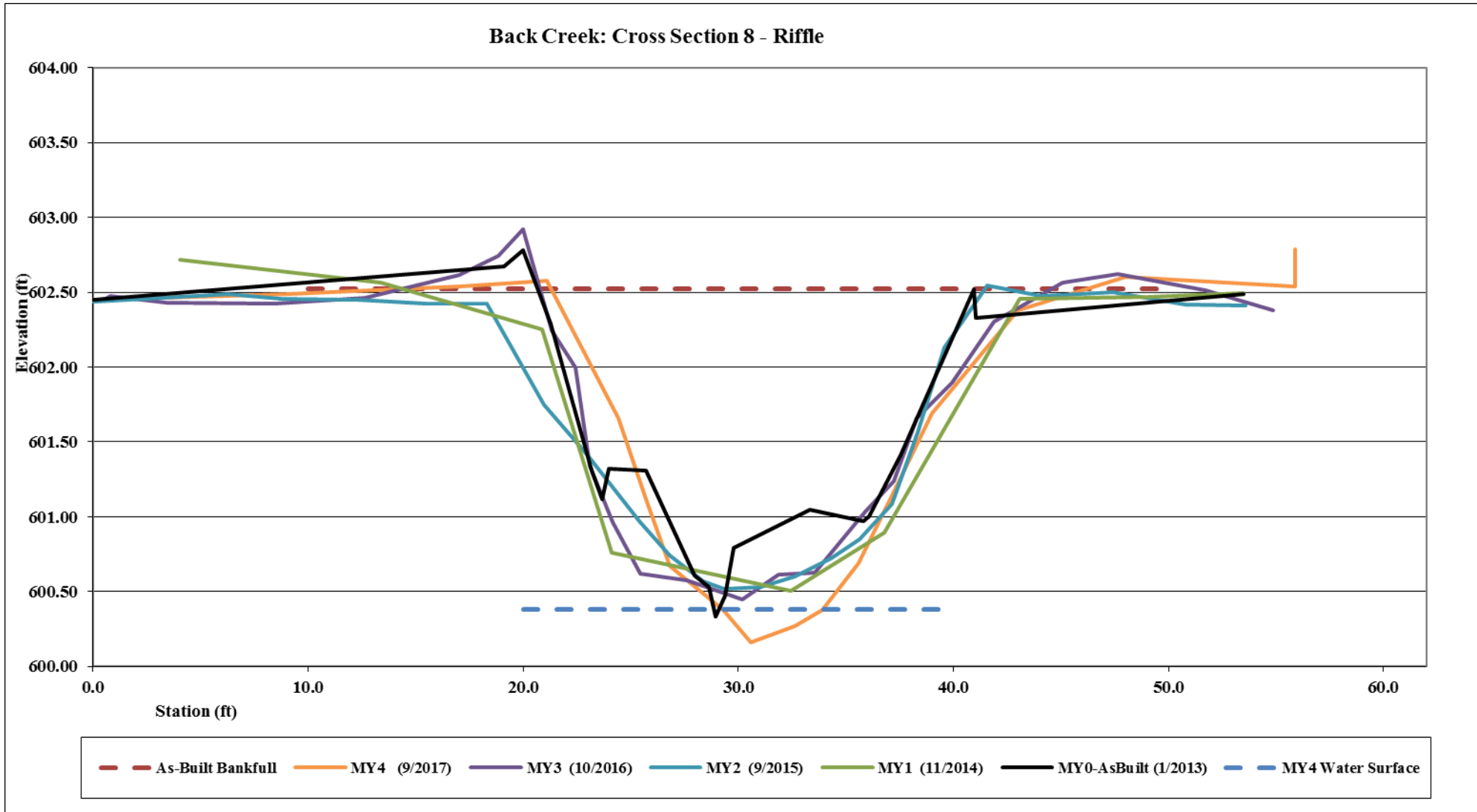


Figure 3.9 Cross Section Data

Project Name	Heath Dairy
DMS Project Number	170
Cross-Section ID	XS-9, Pool
Survey Date	9/2017
SUMMARY DATA	
Bankfull Elevation (ft)	602.50
Bankfull Cross-Sectional Area (ft²)	42.80
Bankfull Width (ft)	21.30
Flood Prone Area Elevation (ft)	605.75
Flood Prone Width (ft)	100.00
Bankfull Mean Depth (ft)	2.01
Bankfull Max Depth (ft)	3.25
W/D Ratio	10.60
Entrenchment Ratio	4.69
Bank Height Ratio	0.97



XS-9: Upstream



XS-9: Downstream

Station	Elevation	Notes
0.0	603.25	TLP
0.0	602.94	BLP
7.2	602.95	
11.7	602.79	
13.9	602.40	TLB
15.8	601.80	
16.4	601.54	
16.9	600.87	LEW
16.9	600.57	BLB
18.2	600.25	
19.2	599.55	
21.0	599.25	THW
27.7	599.43	
29.7	599.90	BRB
30.4	600.87	REW
30.9	601.76	
32.7	602.20	
35.2	602.91	TRB
42.2	602.94	
50.0	602.74	BRP
50.0	603.11	TRP

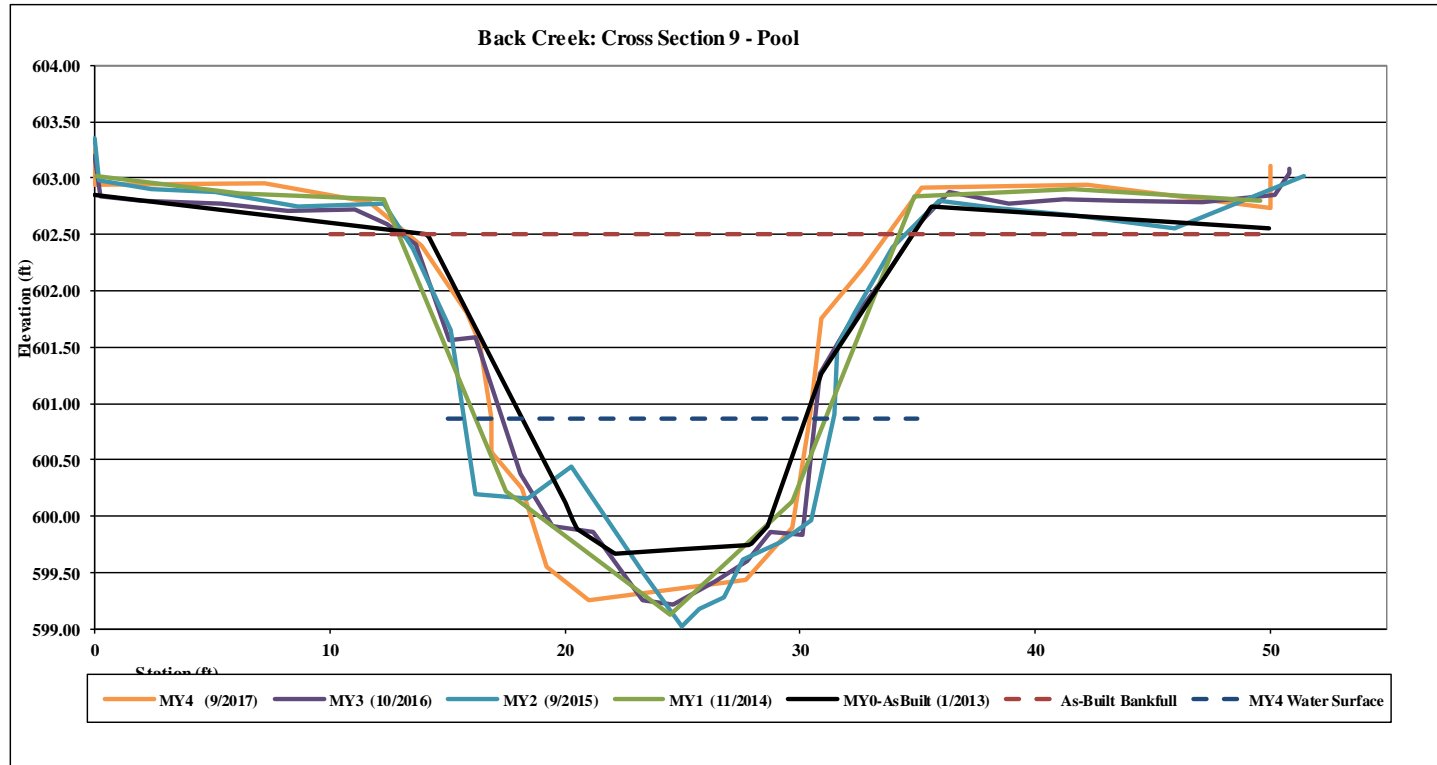


Figure 3.10 Cross Section Data

Project Name	Heath Dairy
DMS Project Number	170
Cross-Section ID	XS-10, Riffle
Survey Date	9/2017
SUMMARY DATA	
Bankfull Elevation (ft)	600.10
Bankfull Cross-Sectional Area (ft²)	23.90
Bankfull Width (ft)	22.52
Flood Prone Area Elevation (ft)	602.04
Flood Prone Width (ft)	100.00
Bankfull Mean Depth (ft)	1.06
Bankfull Max Depth (ft)	1.94
W/D Ratio	21.21
Entrenchment Ratio	4.44
Bank Height Ratio	1.00



XS-10: Upstream



XS-10: Downstream

Station	Elevation	Notes
0.0	600.12	TLP
0.5	599.81	
4.5	600.00	
8.3	600.05	
12.1	600.16	
15.2	600.22	TLB
17.2	600.17	
18.5	599.81	LEW
19.7	599.42	
20.6	599.07	
22.0	598.38	
23.5	598.29	
24.9	598.16	THW
26.2	598.23	
28.1	598.51	
29.8	598.57	
31.4	598.54	
33.0	599.23	
34.3	599.73	
35.6	600.02	
37.7	600.11	TRB
41.4	600.26	
45.6	600.28	TRP

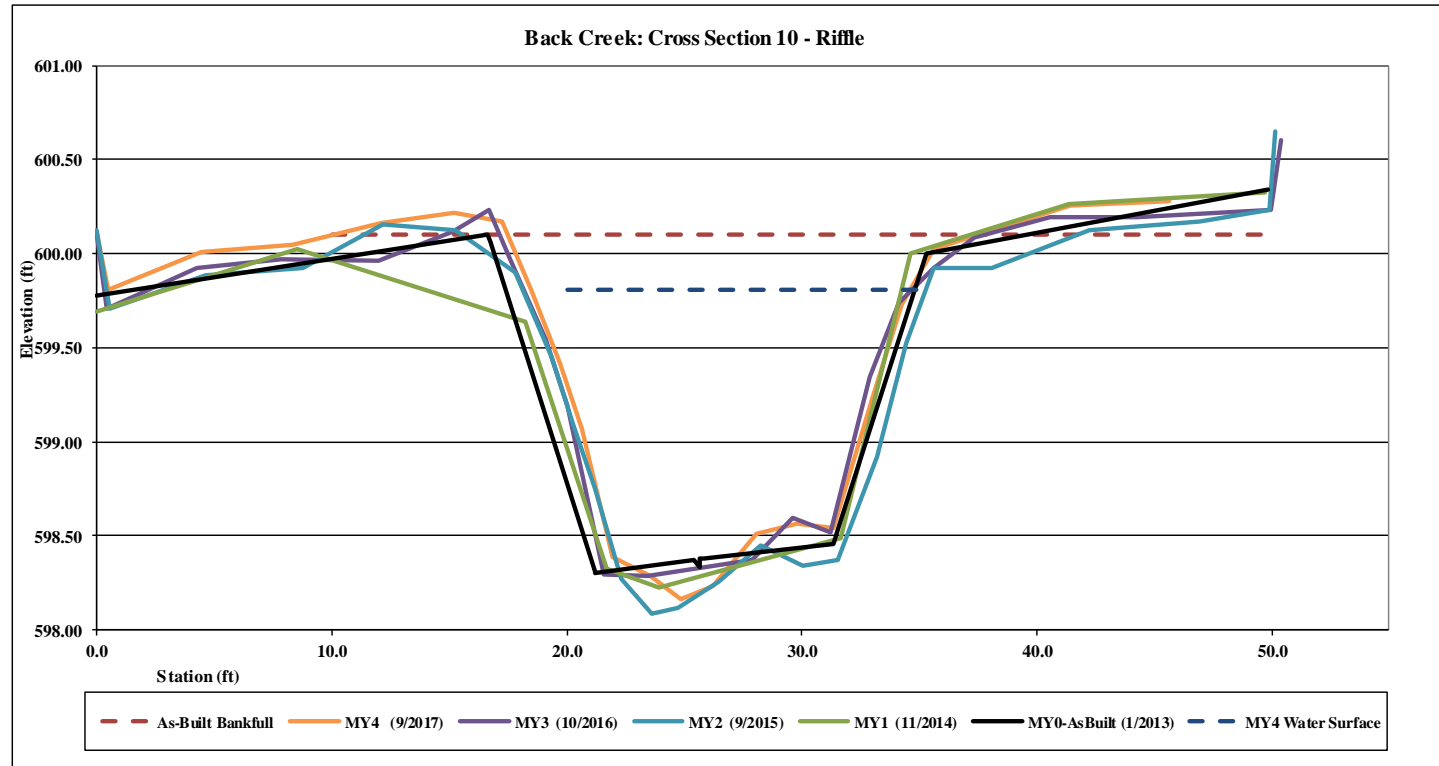


Figure 3.11 Cross Section Data

Project Name	Heath Dairy
DMS Project Number	170
Cross-Section ID	XS-11, Pool
Survey Date	9/2017
SUMMARY DATA	
Bankfull Elevation (ft)	599.62
Bankfull Cross-Sectional Area (ft²)	25.1
Bankfull Width (ft)	16.90
Flood Prone Area Elevation (ft)	601.71
Flood Prone Width (ft)	100.00
Bankfull Mean Depth (ft)	1.49
Bankfull Max Depth (ft)	2.09
W/D Ratio	11.38
Entrenchment Ratio	5.92
Bank Height Ratio	0.86



XS-11: Upstream



XS-11: Downstream

Station	Elevation	Notes
0.0	600.00	TLP
0.0	599.72	BLP
4.0	599.91	
9.0	599.97	
12.0	600.04	
15.1	599.34	TLB
18.1	598.46	LEW
19.8	597.53	THW
22.9	597.58	
25.3	597.64	
28.0	598.21	
29.2	598.40	
30.8	598.46	REW
32.0	599.79	RTB
40.0	600.17	
45.0	600.14	
49.4	600.36	BRP
49.4	601.20	TRP

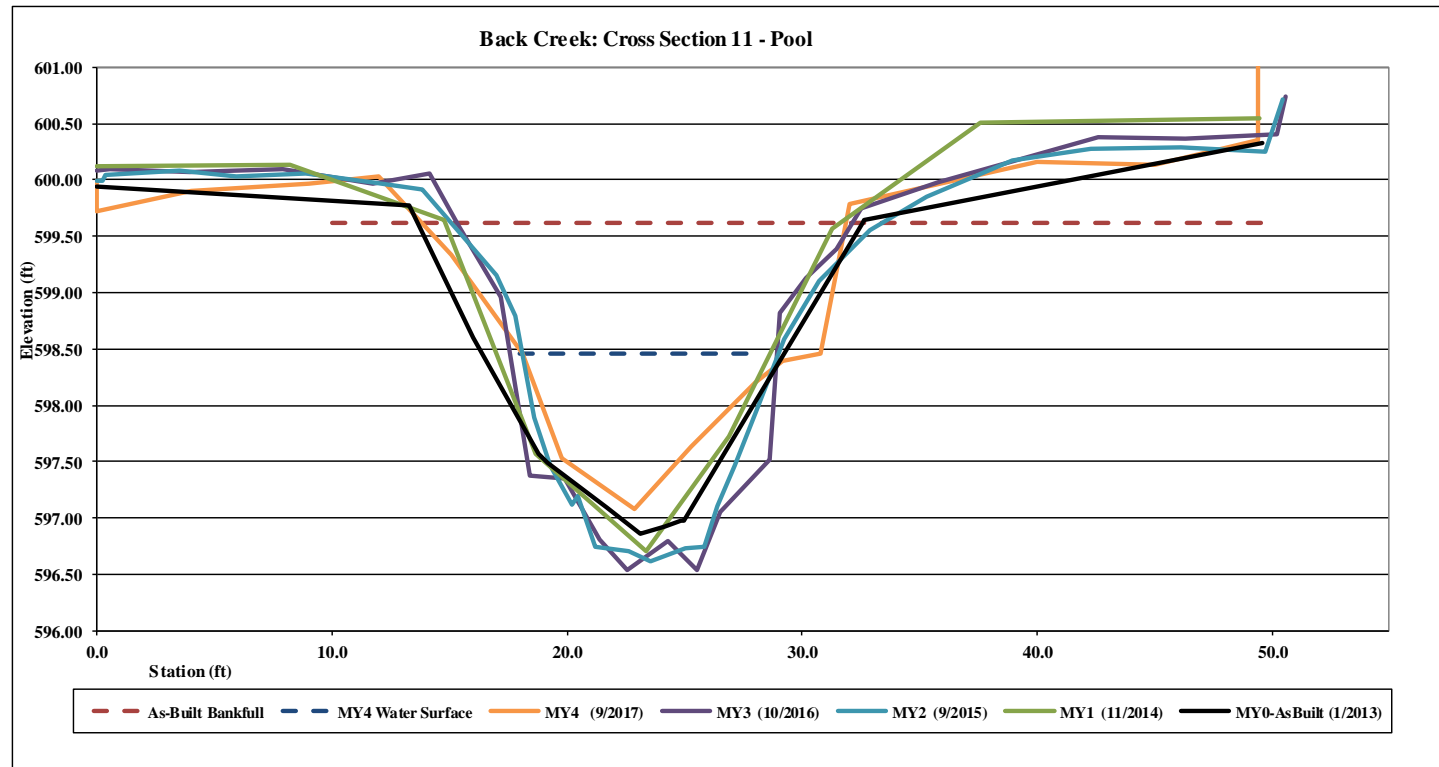


Figure 3.12 Cross Section Data

Project Name	Heath Dairy
DMS Project Number	170
Cross-Section ID	XS-12, Riffle
Survey Date	9/2017
SUMMARY DATA	
Bankfull Elevation (ft)	596.12
Bankfull Cross-Sectional Area (ft²)	21.0
Bankfull Width (ft)	17.50
Flood Prone Area Elevation (ft)	597.97
Flood Prone Width (ft)	100.00
Bankfull Mean Depth (ft)	1.20
Bankfull Max Depth (ft)	1.85
W/D Ratio	14.61
Entrenchment Ratio	5.71
Bank Height Ratio	1.02



XS-12: Upstream



XS-12: Downstream

Station	Elevation	Notes
0.0	596.62	TLP
0.0	596.62	BLP
3.5	596.67	
9.5	596.53	
16.0	596.16	TLB
17.0	595.47	
18.0	595.05	
19.1	594.43	LEW
19.7	594.27	THW
21.2	594.78	
23.0	594.83	
25.4	594.69	
26.5	594.35	
27.3	594.43	REW
28.8	594.50	
31.5	595.48	
33.5	596.28	TRB
37.5	596.64	
43.5	597.00	
50.0	597.45	BRP
50.0	597.85	TRP

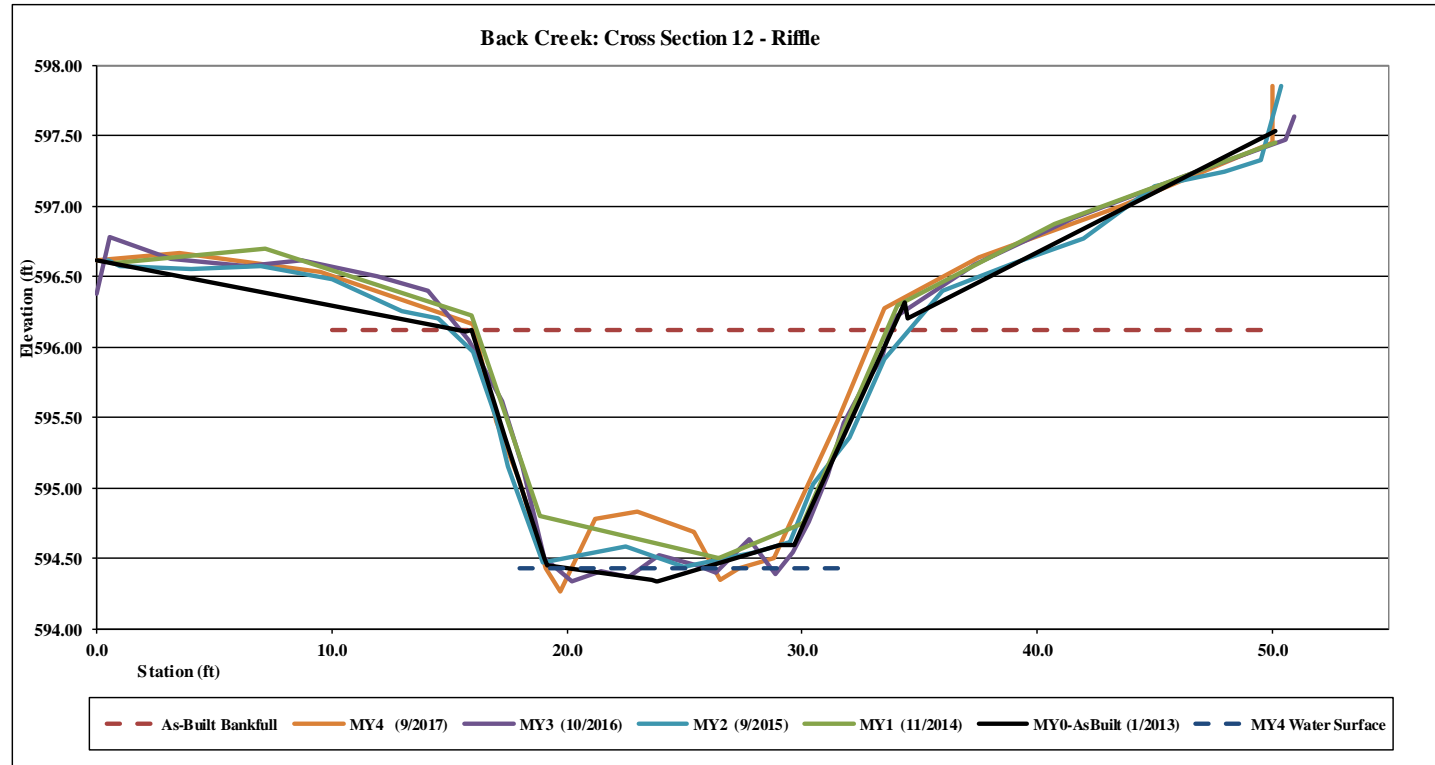


Figure 3.13 Cross Section Data

Project Name	Heath Dairy
DMS Project Number	170
Cross-Section ID	XS-13, Pool
Survey Date	9/2017
SUMMARY DATA	
Bankfull Elevation (ft)	595.94
Bankfull Cross-Sectional Area (ft²)	32.2
Bankfull Width (ft)	14.80
Flood Prone Area Elevation (ft)	599.03
Flood Prone Width (ft)	100.00
Bankfull Mean Depth (ft)	2.17
Bankfull Max Depth (ft)	3.09
W/D Ratio	6.81
Entrenchment Ratio	6.76
Bank Height Ratio	0.81



XS-13: Upstream



XS-13: Downstream

Station	Elevation	Notes
0.0	596.97	TLP
0.0	596.76	BLP
4.0	596.56	
12.0	596.67	
16.5	596.50	
19.5	596.25	
20.7	595.65	
21.7	595.36	TLB
22.6	594.44	LEW
23.1	593.35	BLB
25.5	592.94	
27.0	592.85	THW
28.8	593.18	
31.0	592.93	
32.6	593.91	BRB
32.9	594.44	REW
34.3	595.30	
36.5	595.91	TRB
38.0	596.59	
41.0	596.63	
46.0	596.90	
50.8	597.32	BRP
50.8	597.59	TRP

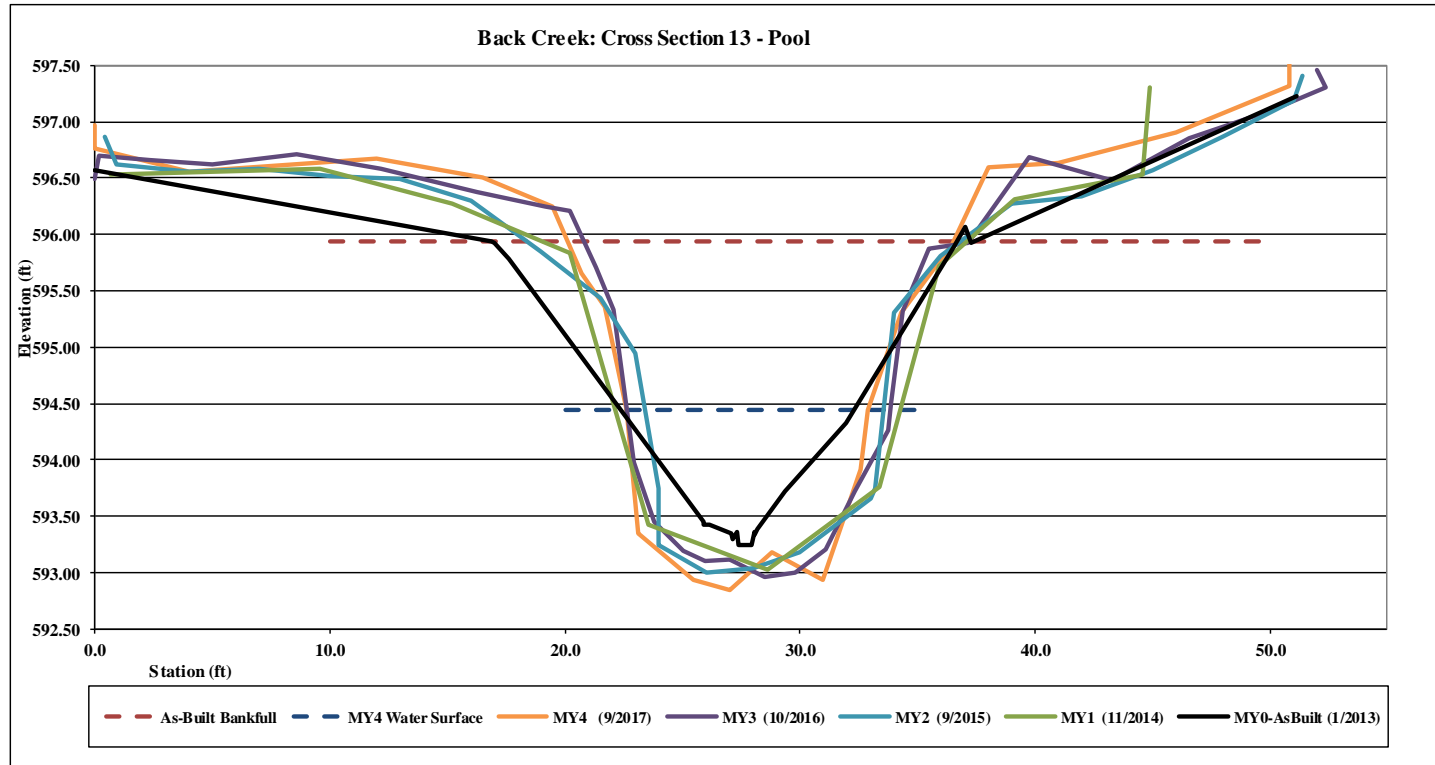


Figure 3.14 Cross Section Data

Project Name	Heath Dairy
DMS Project Number	170
Cross-Section ID	XS-14, Riffle
Survey Date	9/2017
SUMMARY DATA	
Bankfull Elevation (ft)	594.56
Bankfull Cross-Sectional Area (ft²)	19.83
Bankfull Width (ft)	17.00
Flood Prone Area Elevation (ft)	596.50
Flood Prone Width (ft)	70.00
Bankfull Mean Depth (ft)	1.17
Bankfull Max Depth (ft)	1.94
W/D Ratio	14.57
Entrenchment Ratio	4.12
Bank Height Ratio	0.85



XS-14: Upstream



XS-14: Downstream

Station	Elevation	Notes
0.0	596.09	TLP
0.0	595.84	BLP
3.5	594.90	
6.5	594.62	
9.5	594.65	
12.5	594.60	
15.5	594.64	
18.5	594.74	
21.5	594.61	TLB
24.8	593.82	
28.3	593.41	
29.4	593.46	
30.0	592.67	
31.0	592.62	LEW
32.5	592.37	THW
34.3	592.62	REW
35.2	592.76	BRB
35.9	593.66	
38.5	594.26	TRB
40.5	594.65	
47.5	594.51	
54.5	594.75	
58.1	595.49	BRP
58.1	595.81	TRP

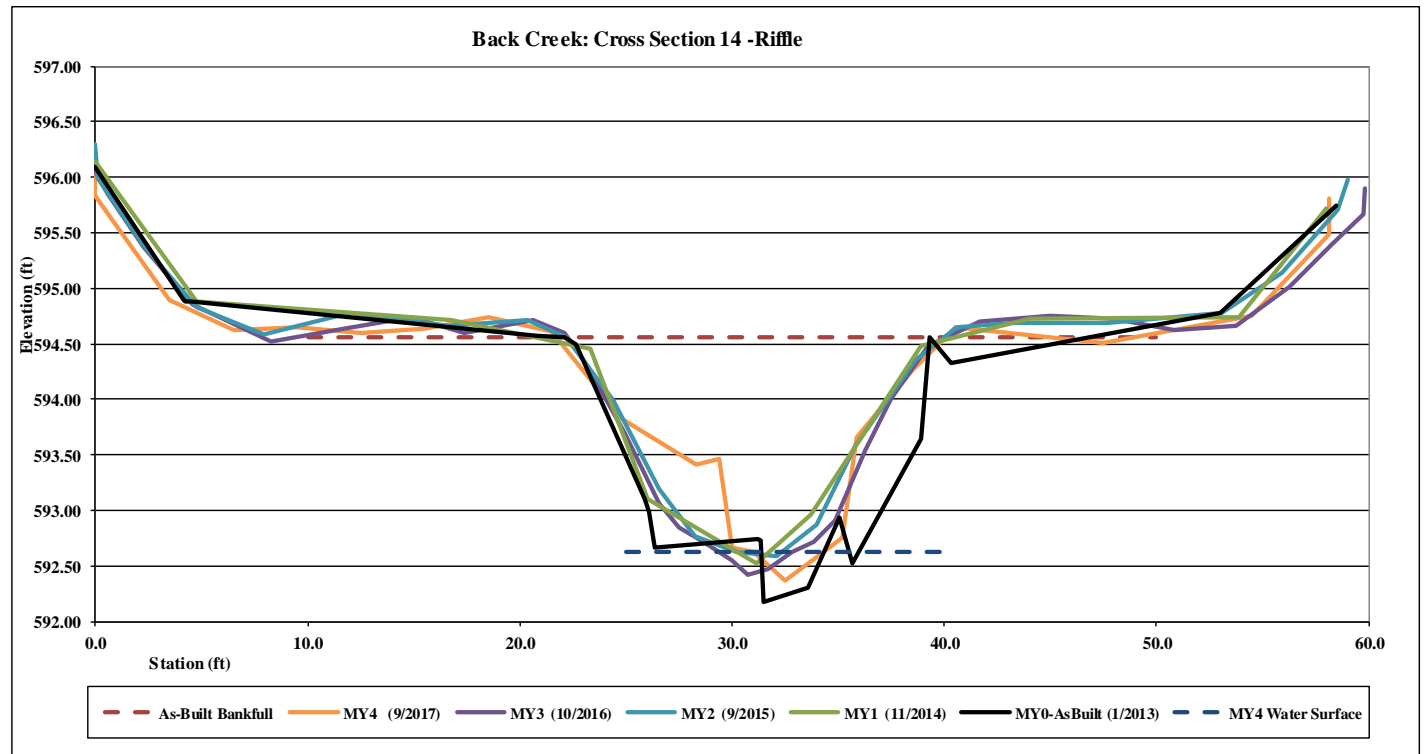


Figure 3.15 Cross Section Data

Project Name	Heath Dairy
DMS Project Number	170
Cross-Section ID	XS-15, Pool
Survey Date	9/2017
SUMMARY DATA	
Bankfull Elevation (ft)	593.70
Bankfull Cross-Sectional Area (ft²)	28.97
Bankfull Width (ft)	14.10
Flood Prone Area Elevation (ft)	596.87
Flood Prone Width (ft)	100.00
Bankfull Mean Depth (ft)	2.05
Bankfull Max Depth (ft)	3.17
W/D Ratio	6.86
Entrenchment Ratio	7.09
Bank Height Ratio	1.14



XS-15: Upstream



XS-15: Downstream

Station	Elevation	Notes
0.0	595.30	TLP
0.0	595.10	BLP
5.0	594.60	
9.0	594.29	
14.5	594.55	
20.1	594.15	TLB
20.5	593.87	
21.4	593.43	
22.0	592.71	LEW
22.5	592.20	BLB
24.5	591.24	
26.7	590.53	THW
30.0	590.59	
31.9	591.24	
32.7	592.71	REW
33.4	593.12	
34.2	593.99	TRB
37.0	594.50	
44.0	594.25	
46.5	594.42	
52.0	594.95	BRP
52.0	595.20	TRP

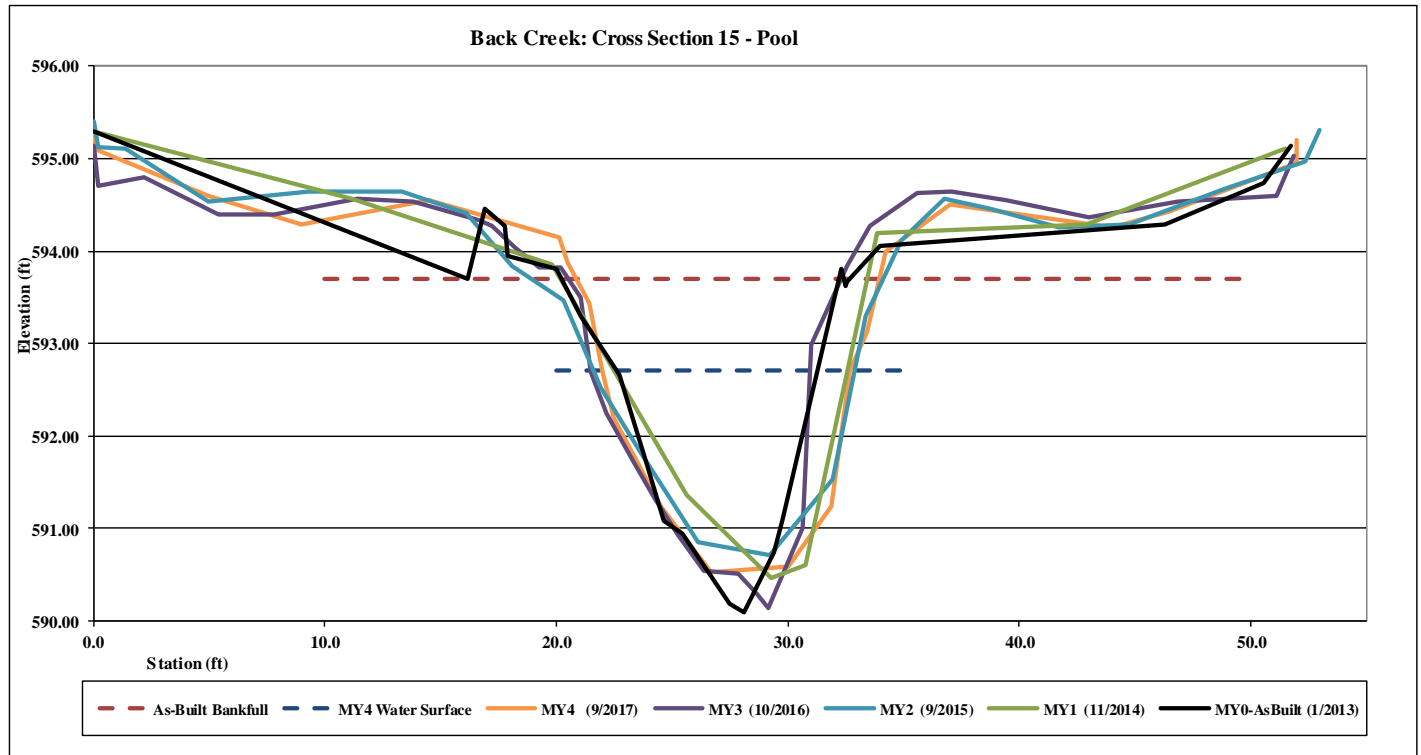


Figure 3.18 Cross Section Data

Project Name	Heath Dairy
DMS Project Number	170
Cross-Section ID	XS-18, Riffle
Survey Date	9/2017
SUMMARY DATA	
Bankfull Elevation (ft)	626.62
Bankfull Cross-Sectional Area (ft ²)	4.11
Bankfull Width (ft)	8.50
Flood Prone Area Elevation (ft)	627.43
Flood Prone Width (ft)	30.00
Bankfull Mean Depth (ft)	0.48
Bankfull Max Depth (ft)	0.81
W/D Ratio	17.58
Entrenchment Ratio	3.53
Bank Height Ratio	0.81



XS-18: Upstream



XS-18: Downstream

Station	Elevation	Notes
0.0	628.43	TLP
0.0	628.11	BLP
3.0	627.61	
6.0	627.10	
9.0	626.67	
11.5	626.47	TLB
12.2	625.91	BLB
13.4	625.81	THW
16.3	625.95	BRB
17.6	626.50	
20.0	626.67	TRB
23.0	626.95	
26.0	626.97	
29.3	627.14	BRP
29.3	627.42	TRP

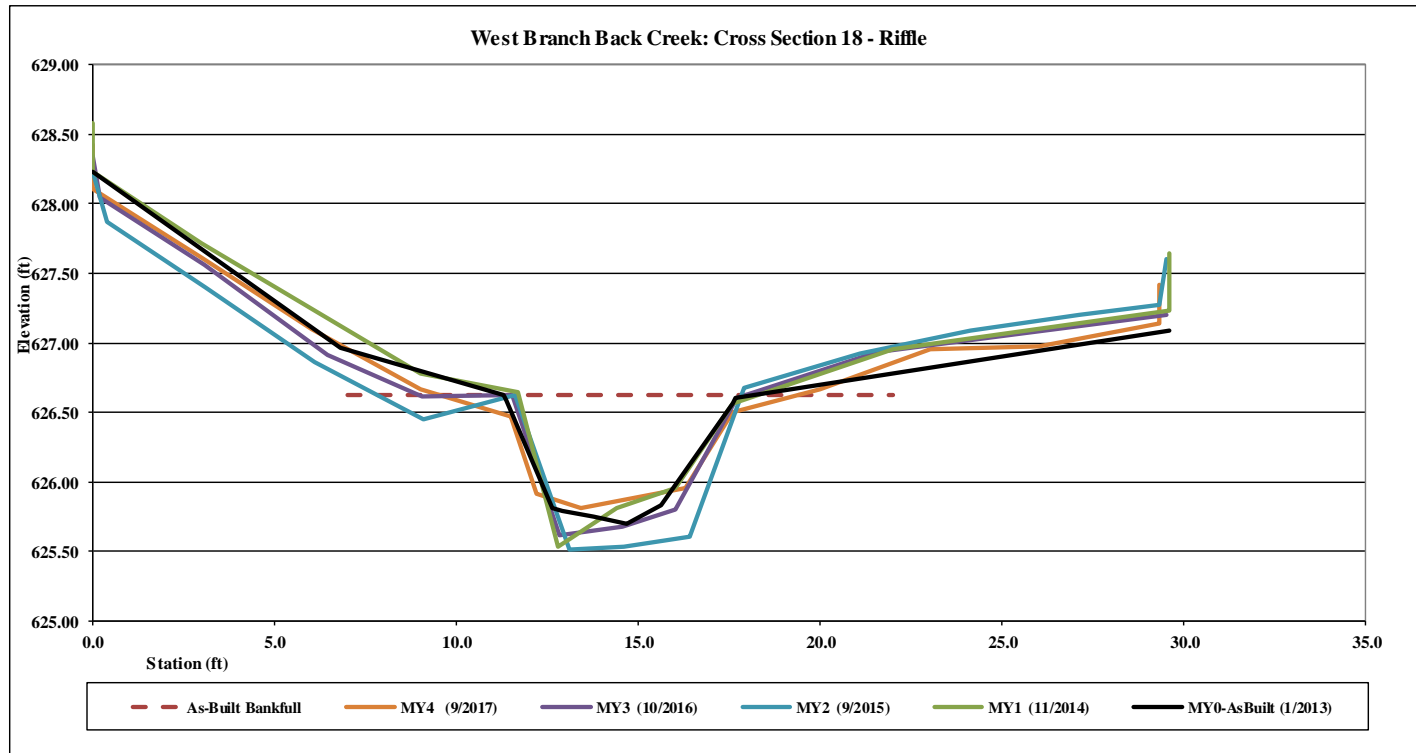


Figure 3.19 Cross Section Data

Project Name	Heath Dairy
DMS Project Number	170
Cross-Section ID	XS-19, Riffle
Survey Date	9/2017
SUMMARY DATA	
Bankfull Elevation (ft)	616.15
Bankfull Cross-Sectional Area (ft ²)	4.98
Bankfull Width (ft)	6.90
Flood Prone Area Elevation (ft)	616.93
Flood Prone Width (ft)	30.00
Bankfull Mean Depth (ft)	0.72
Bankfull Max Depth (ft)	0.78
W/D Ratio	9.56
Entrenchment Ratio	4.35
Bank Height Ratio	1.15



XS-19: Upstream



XS-19: Downstream

Station	Elevation	Notes
0.0	617.25	TLP
0.0	616.76	BLP
3.0	616.89	
8.0	616.94	
11.0	616.89	
14.0	616.71	
17.0	616.23	
18.8	616.27	TLB
20.0	615.41	BLB
22.2	615.37	THW
24.7	615.46	BRB
25.7	616.28	TRB
29.0	615.99	
32.0	616.23	
35.0	616.25	
40.0	616.72	BRP
40.0	617.13	TRP

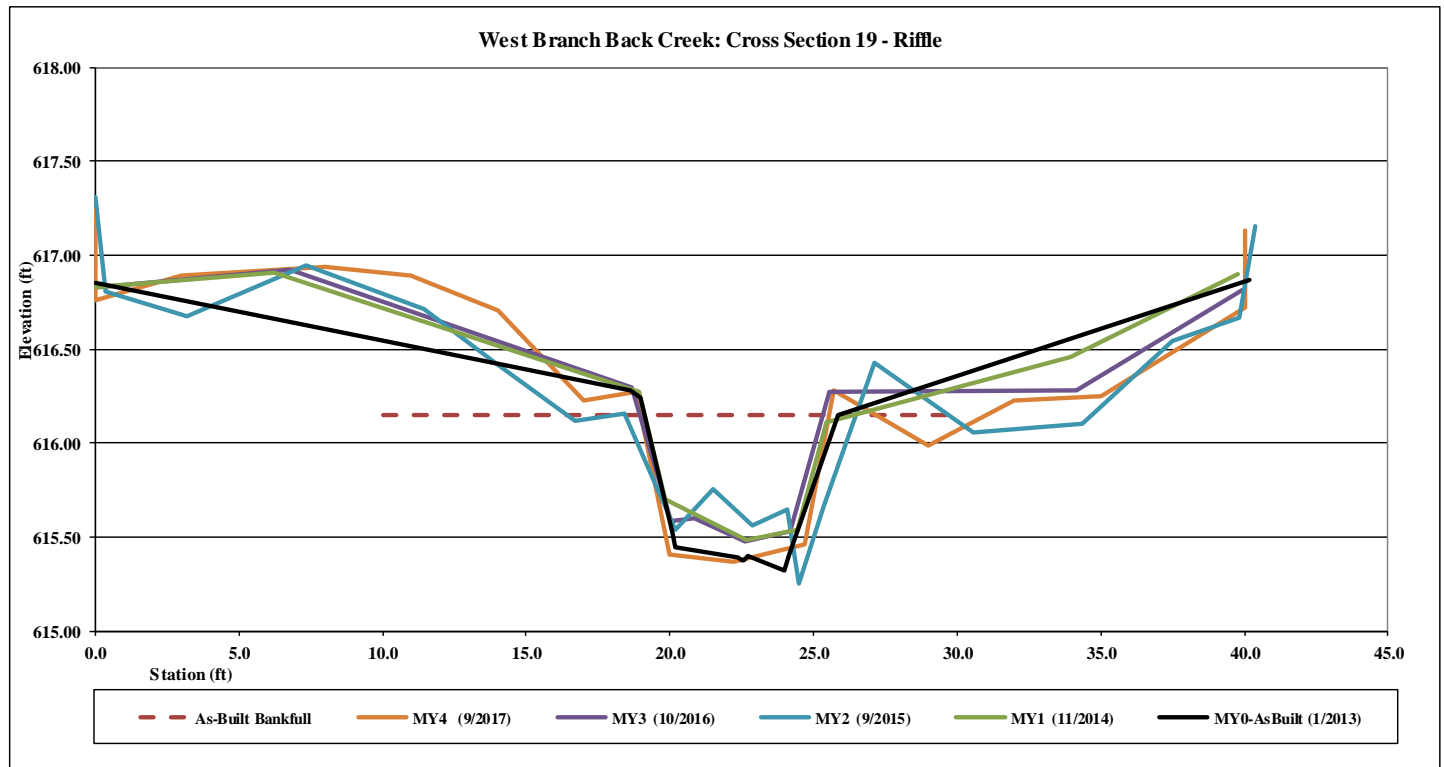


Figure 3.20 Cross Section Data

Project Name	Heath Dairy
DMS Project Number	170
Cross-Section ID	XS-20, Riffle
Survey Date	9/2017
SUMMARY DATA	
Bankfull Elevation (ft)	608.97
Bankfull Cross-Sectional Area (ft²)	6.66
Bankfull Width (ft)	9.50
Flood Prone Area Elevation (ft)	610.15
Flood Prone Width (ft)	30.00
Bankfull Mean Depth (ft)	0.70
Bankfull Max Depth (ft)	1.18
W/D Ratio	13.55
Entrenchment Ratio	3.16
Bank Height Ratio	1.06



XS-20: Upstream



XS-20: Downstream

Station	Elevation	Notes
0.0	609.86	BLP
3.5	609.71	
6.0	609.76	
9.0	609.46	
12.0	609.13	
14.0	609.19	TLB
15.6	608.90	
16.4	608.14	
18.9	607.97	LEW
20.7	607.79	THW
21.7	607.97	
23.5	609.04	TRB
26.0	609.11	
29.0	608.89	
32.0	609.05	
35.0	608.96	
39.4	609.63	BRP

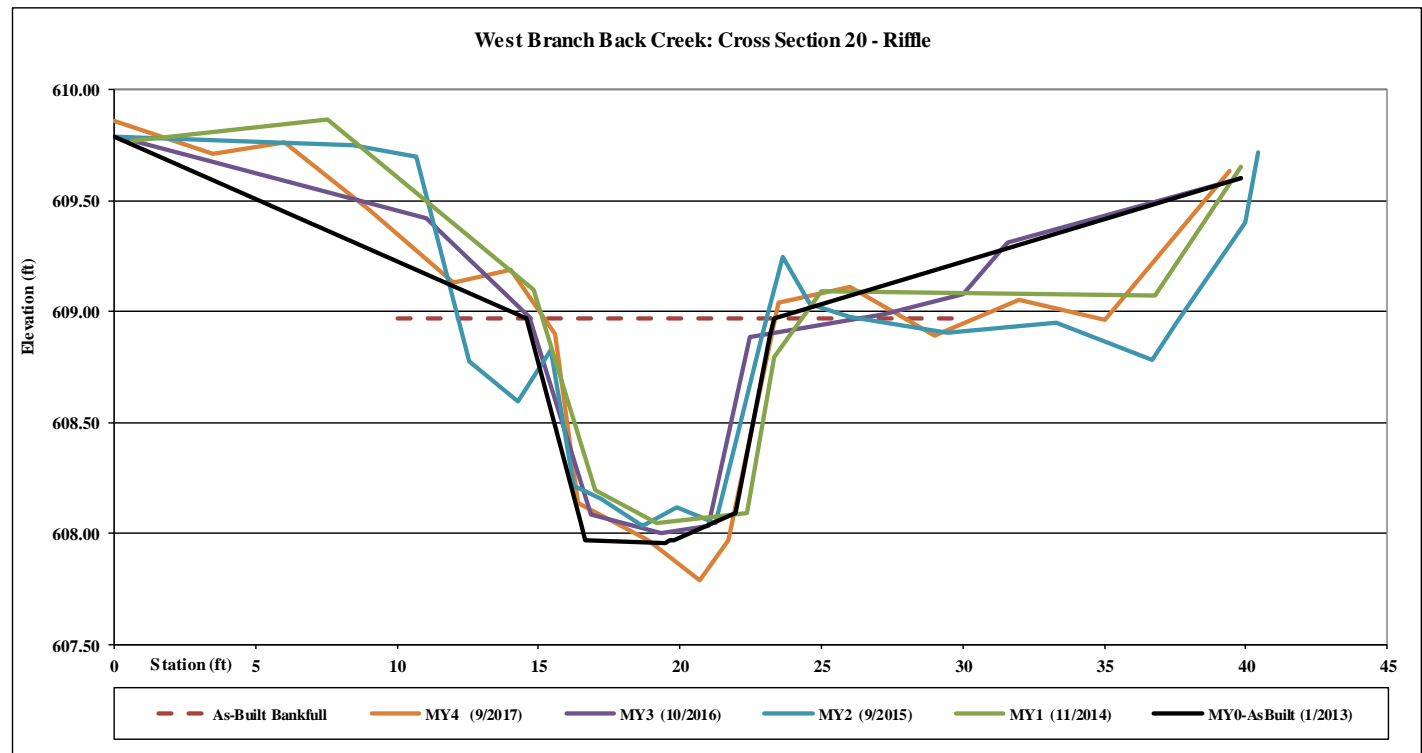


Figure 3.21 Cross Section Data

Project Name	Heath Dairy
DMS Project Number	170
Cross-Section ID	XS-21, Pool
Survey Date	9/2017
SUMMARY DATA	
Bankfull Elevation (ft)	608.51
Bankfull Cross-Sectional Area (ft ²)	13.20
Bankfull Width (ft)	10.20
Flood Prone Area Elevation (ft)	610.63
Flood Prone Width (ft)	40.00
Bankfull Mean Depth (ft)	1.29
Bankfull Max Depth (ft)	2.12
W/D Ratio	7.88
Entrenchment Ratio	3.92
Bank Height Ratio	0.89



XS-21: Upstream



XS-21: Downstream

Station	Elevation	Notes
0.0	609.37	TLP
0.0	609.11	BLP
3.0	609.05	
6.0	609.00	
9.0	609.14	
13.0	608.67	
15.8	608.38	TLB
16.5	607.01	BLB
18.0	606.55	
19.5	606.39	THW
20.5	606.53	
21.5	606.94	BRB
21.9	607.45	REW
22.3	607.88	
23.5	608.11	
26.0	608.27	TRB
29.0	608.49	
32.0	608.39	
35.0	608.49	
38.0	608.78	
40.0	608.99	BRP

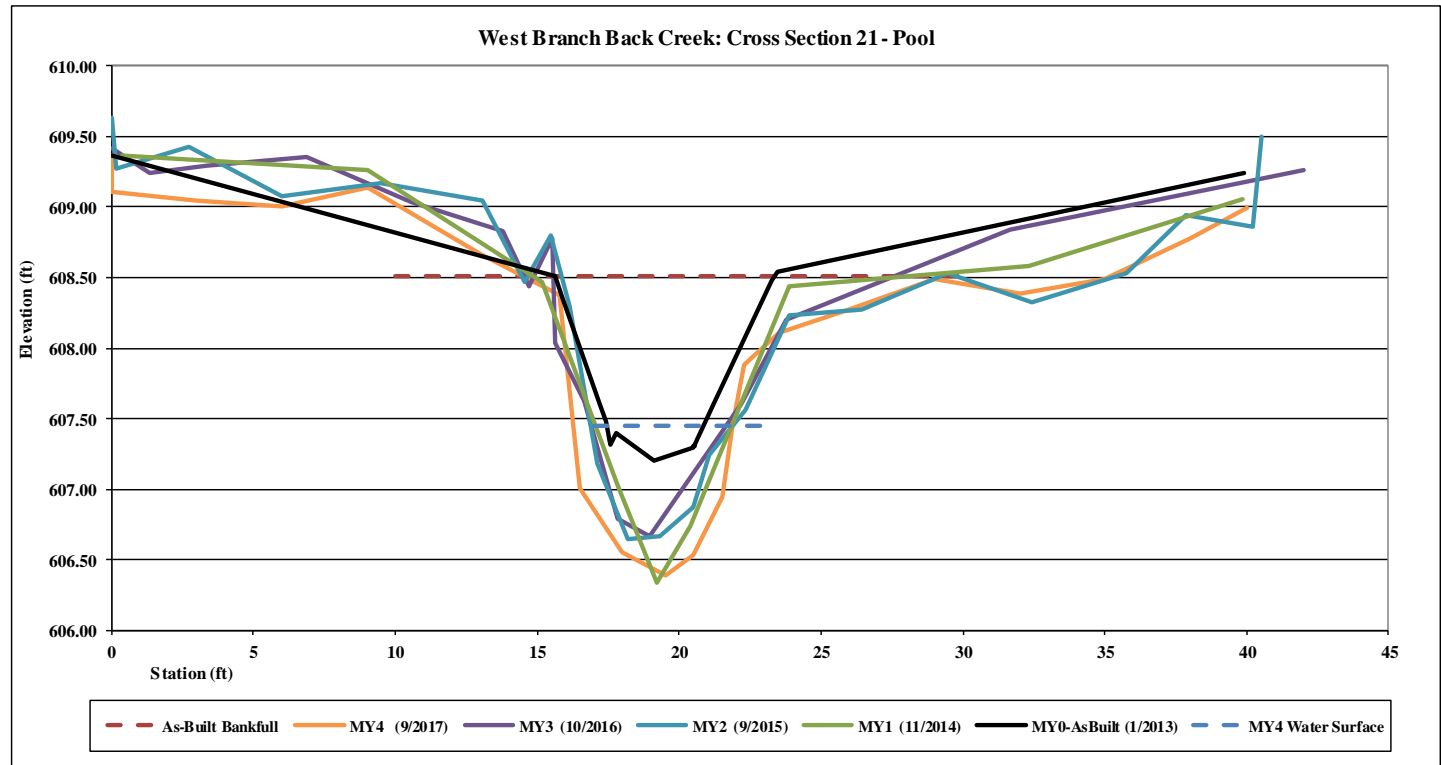


Figure 3.22 Cross Section Data

Project Name	Heath Dairy
DMS Project Number	170
Cross-Section ID	XS-22, Riffle
Survey Date	9/2017
SUMMARY DATA	
Bankfull Elevation (ft)	613.85
Bankfull Cross-Sectional Area (ft²)	8.75
Bankfull Width (ft)	14.00
Flood Prone Area Elevation (ft)	614.74
Flood Prone Width (ft)	75.00
Bankfull Mean Depth (ft)	0.63
Bankfull Max Depth (ft)	0.89
W/D Ratio	22.40
Entrenchment Ratio	5.36
Bank Height Ratio	0.99



XS-22: Upstream



XS-22: Downstream

Station	Elevation	Notes
0.0	614.35	TLP
0.0	614.35	BLP
3.0	614.19	
6.0	614.14	
9.0	614.11	
12.0	614.05	TLB
15.0	613.53	
17.4	613.51	
18.5	613.01	LEW
19.8	612.96	THW
21.8	613.11	
23.3	613.40	
26.0	613.84	TRB
29.0	613.73	
32.0	613.59	
35.0	613.46	
38.0	613.57	BRP
38.0	613.57	TRP

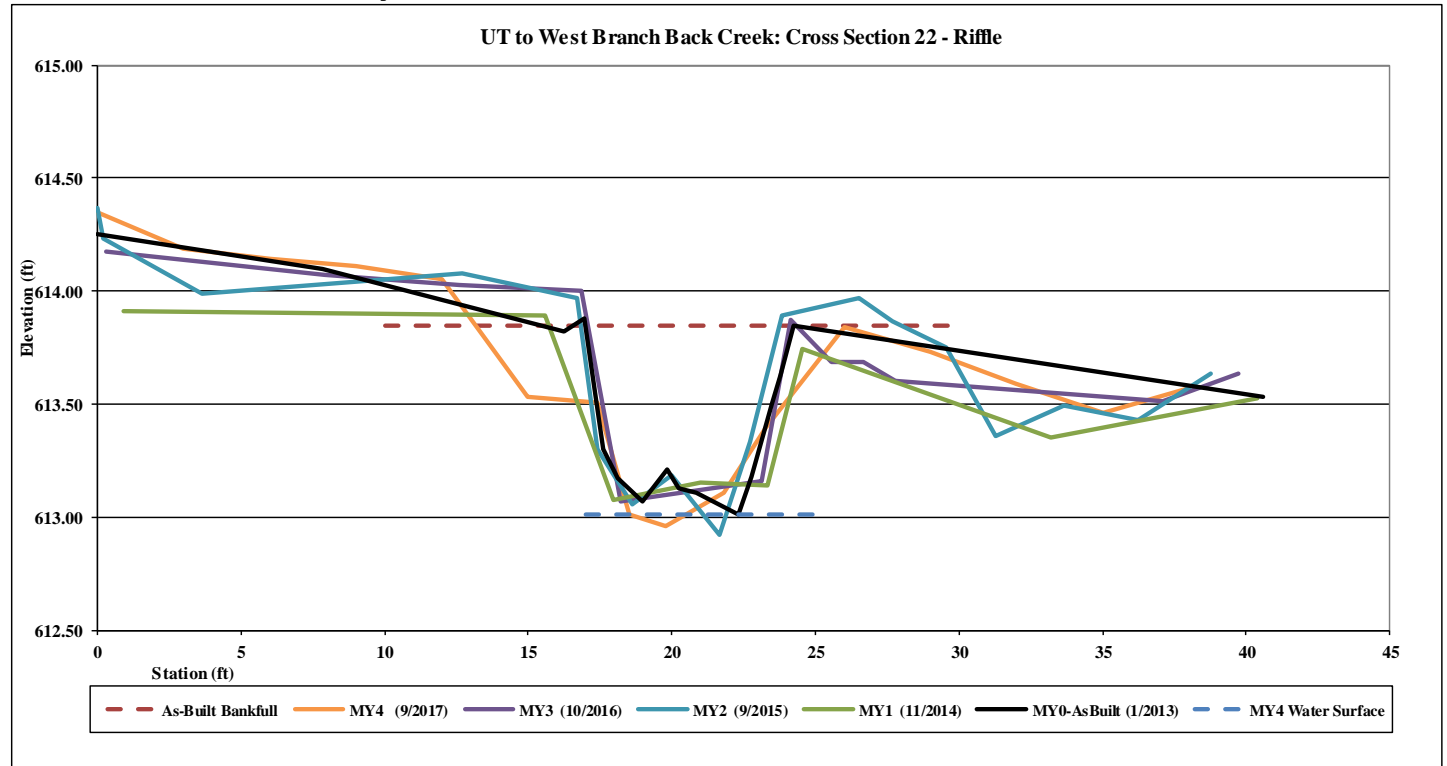


Figure 3.23 Cross Section Data

Project Name	Heath Dairy
DMS Project Number	170
Cross-Section ID	XS-23, Pool
Survey Date	9/2017
SUMMARY DATA	
Bankfull Elevation (ft)	594.88
Bankfull Cross-Sectional Area (ft²)	51.90
Bankfull Width (ft)	20.31
Flood Prone Area Elevation (ft)	600.06
Flood Prone Width (ft)	200.00
Bankfull Mean Depth (ft)	2.56
Bankfull Max Depth (ft)	5.18
W/D Ratio	7.95
Entrenchment Ratio	9.85
Bank Height Ratio	1.02



XS-23: Upstream



XS-23: Downstream

Station	Elevation	Notes
0.0	596.02	BLP
0.4	595.77	
3.6	595.75	
8.0	595.46	
11.2	595.22	
14.7	594.99	TLB
16.8	594.83	
19.0	594.49	
20.2	593.74	
22.1	591.85	
23.2	591.29	
23.8	590.81	
25.4	590.52	
26.7	589.70	THW
27.6	589.79	
28.4	589.61	
30.8	591.06	
31.9	592.34	REW
33.2	593.14	
34.0	593.83	
35.0	595.00	TRB
36.4	595.25	
39.5	595.42	
42.6	595.60	
46.3	595.76	
49.8	595.79	
53.7	595.55	
55.6	595.72	BRP

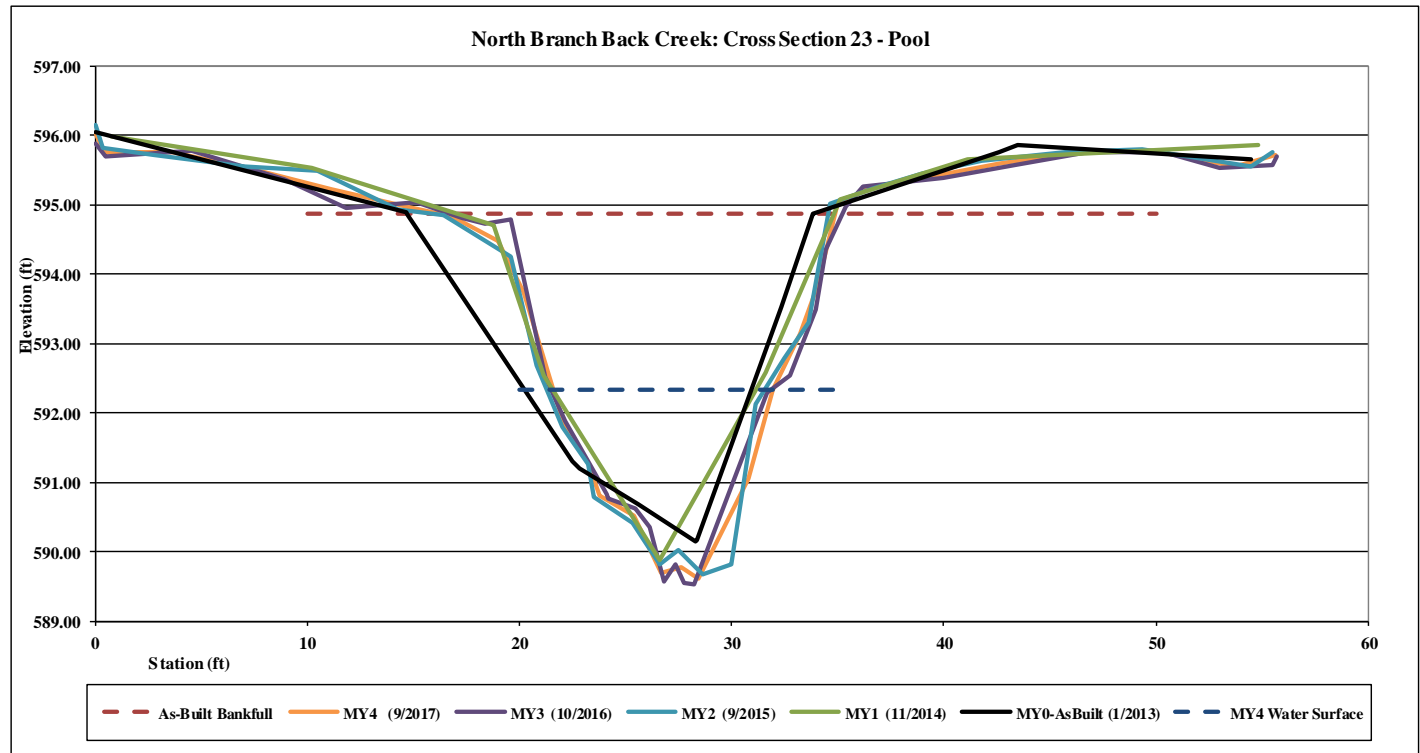


Figure 3.24 Cross Section Data

Project Name	Heath Dairy
DMS Project Number	170
Cross-Section ID	XS-24, Riffle
Survey Date	11/2017
SUMMARY DATA	
Bankfull Elevation (ft)	594.81
Bankfull Cross-Sectional Area (ft²)	22.20
Bankfull Width (ft)	18.50
Flood Prone Area Elevation (ft)	597.03
Flood Prone Width (ft)	200.00
Bankfull Mean Depth (ft)	1.20
Bankfull Max Depth (ft)	2.22
W/D Ratio	15.42
Entrenchment Ratio	10.81
Bank Height Ratio	1.00



XS-24: Upstream



XS-24: Downstream

Station	Elevation	Notes
0.0	596.00	TLP
0.0	595.83	BLP
4.6	595.60	
8.6	595.21	
12.6	595.02	
14.6	594.81	TLB
16.8	594.36	
17.8	593.74	
18.6	593.35	
19.7	593.31	
20.2	593.46	
20.9	593.46	
21.4	593.32	
23.3	593.32	
23.6	593.22	
24.3	593.19	
24.8	592.88	LEW
25.4	592.76	
26.0	592.68	
26.6	592.63	
27.2	592.67	
28.1	592.65	
28.4	592.59	THW
28.6	592.65	REW
28.9	593.66	
29.4	593.77	
29.9	593.92	
30.3	594.21	
31	594.38	
31.5	594.54	
32.3	594.68	
33.1	594.85	TRB
36.3	595.23	
39.3	595.32	
41.9	595.48	
42.3	595.57	
44.6	595.77	
47.6	595.86	
49.2	596.03	BRP
49.3	596.28	TRP

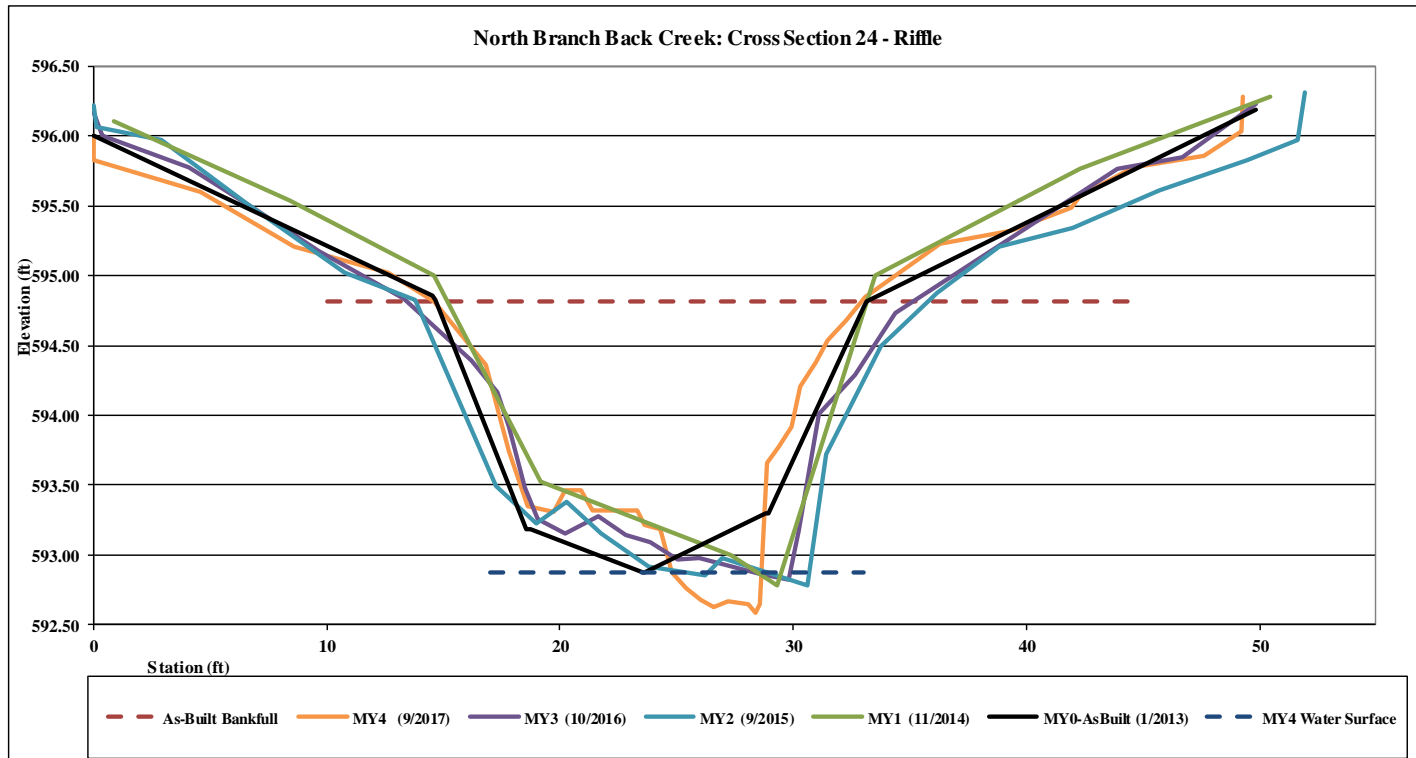


Figure 3.25 Cross Section Data

Project Name	Heath Dairy
DMS Project Number	170
Cross-Section ID	XS-25, Riffle
Survey Date	9/2017
SUMMARY DATA	
Bankfull Elevation (ft)	593.18
Bankfull Cross-Sectional Area (ft ²)	24.70
Bankfull Width (ft)	18.00
Flood Prone Area Elevation (ft)	595.16
Flood Prone Width (ft)	100.00
Bankfull Mean Depth (ft)	1.37
Bankfull Max Depth (ft)	1.98
W/D Ratio	13.12
Entrenchment Ratio	5.56
Bank Height Ratio	0.95



XS-25: Upstream



XS-25: Downstream

Station	Elevation	Notes
0.0	594.70	TLP
0.0	594.70	BLP
3.0	594.58	
6.0	594.24	
9.0	593.93	
12.0	593.77	
16.0	593.09	TLB
17.9	592.36	
19.2	591.39	LEW
22.0	591.34	
25.0	591.21	
28.0	591.20	THW
29.3	591.39	REW
29.9	591.46	BRB
31.5	592.86	
34.0	593.29	TRB
37.0	593.59	
40.0	593.73	
43.0	594.00	
46.0	593.99	
49.8	594.23	BRP
49.8	594.49	TRP

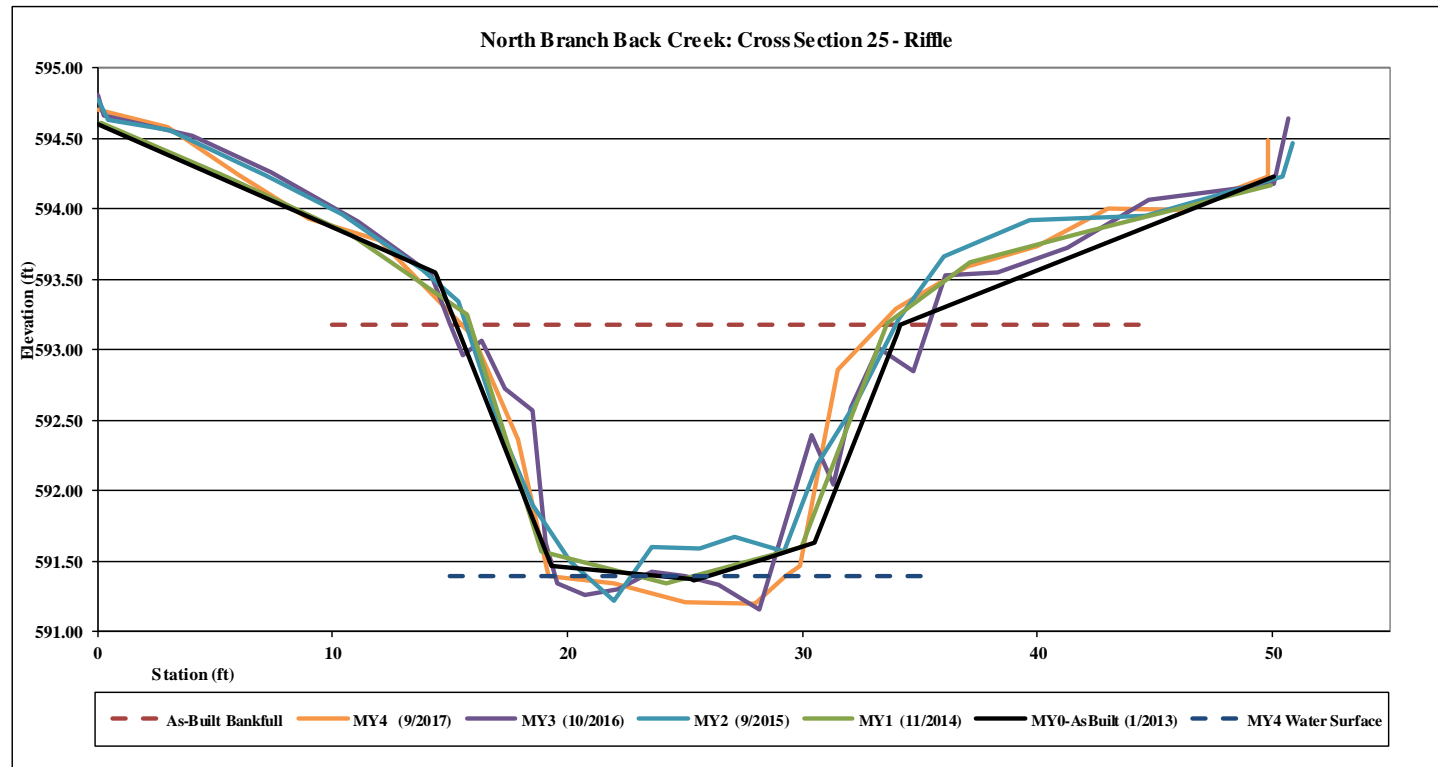


Figure 3.26 Cross Section Data

Project Name	Heath Dairy
DMS Project Number	170
Cross-Section ID	XS-26, Pool
Survey Date	9/2017
SUMMARY DATA	
Bankfull Elevation (ft)	596.36
Bankfull Cross-Sectional Area (ft ²)	8.32
Bankfull Width (ft)	11.40
Flood Prone Area Elevation (ft)	597.97
Flood Prone Width (ft)	50.00
Bankfull Mean Depth (ft)	0.73
Bankfull Max Depth (ft)	1.61
W/D Ratio	15.62
Entrenchment Ratio	4.39
Bank Height Ratio	0.97



XS-26: Upstream



XS-26: Downstream

Station	Elevation	Notes
0.0	596.45	TLP
0.0	596.29	BLP
3.0	596.32	
6.0	596.50	
9.0	596.58	
12.0	596.43	TLB
15.0	595.88	
16.7	595.65	
17.3	595.31	
18.2	594.95	BLB
18.7	594.88	LEW
19.3	594.75	THW
20.0	594.88	REW
20.4	594.99	BRB
21.3	595.78	
23.4	596.31	TRB
24.8	596.38	
28.0	596.86	
32.0	597.26	
36.0	597.55	
39.4	597.72	BRP
39.4	598.07	TRP

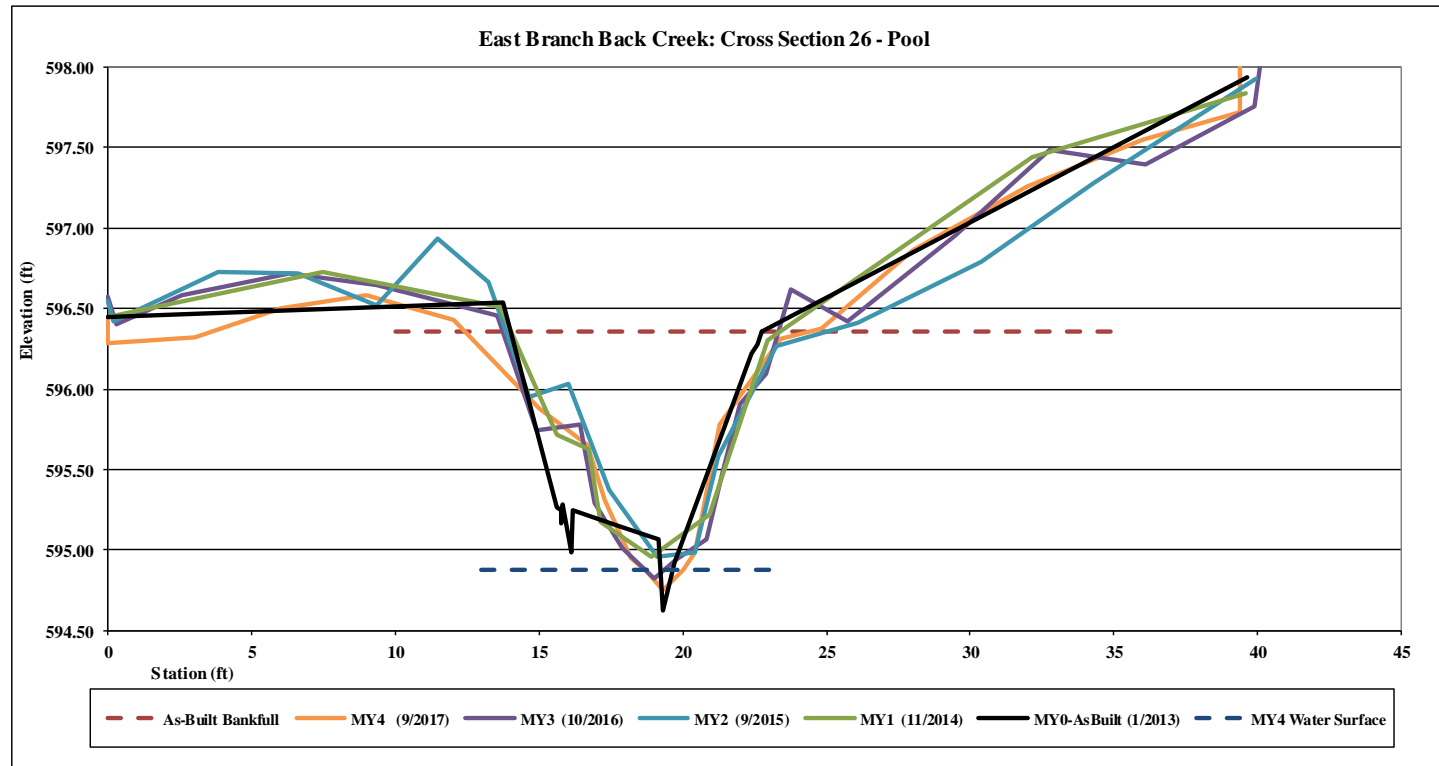
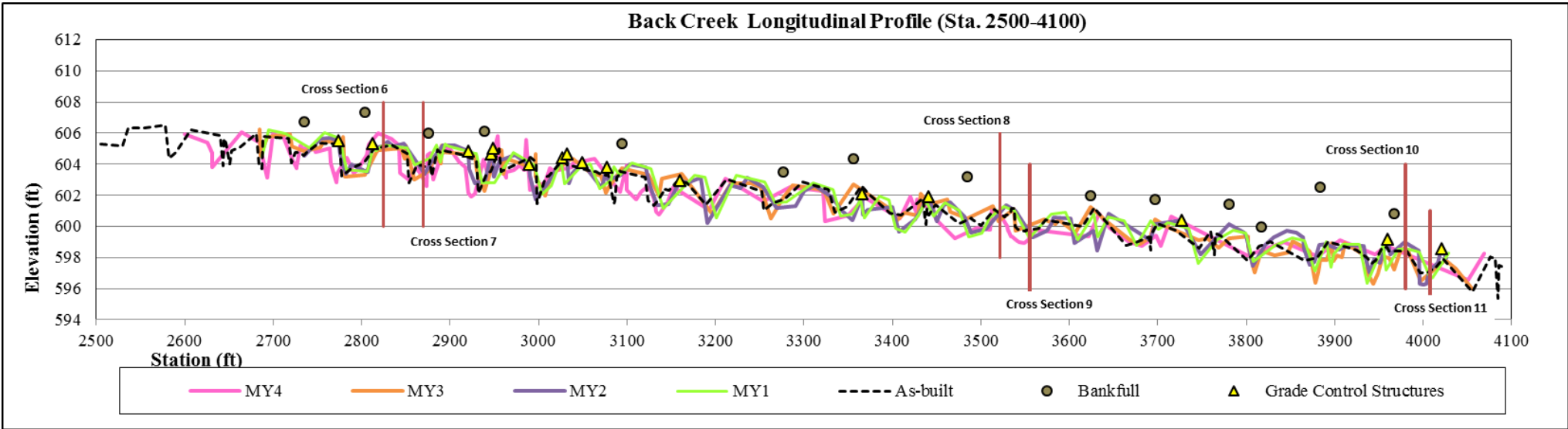
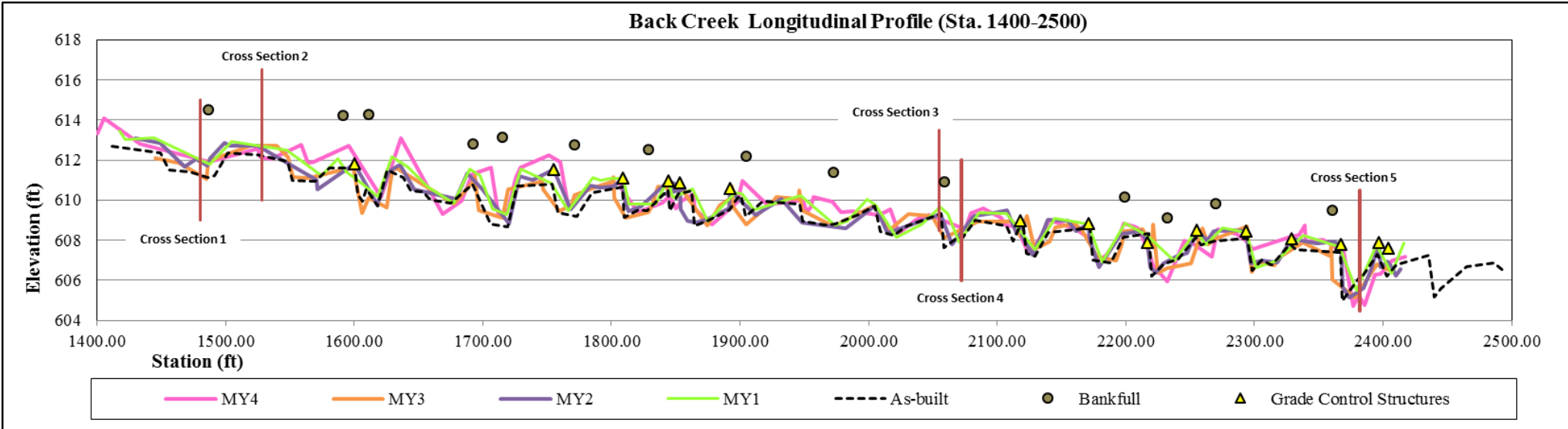


Figure 4.1. Longitudinal Profile – Back Creek



Back Creek Longitudinal Profile (Sta. 5000-6200)

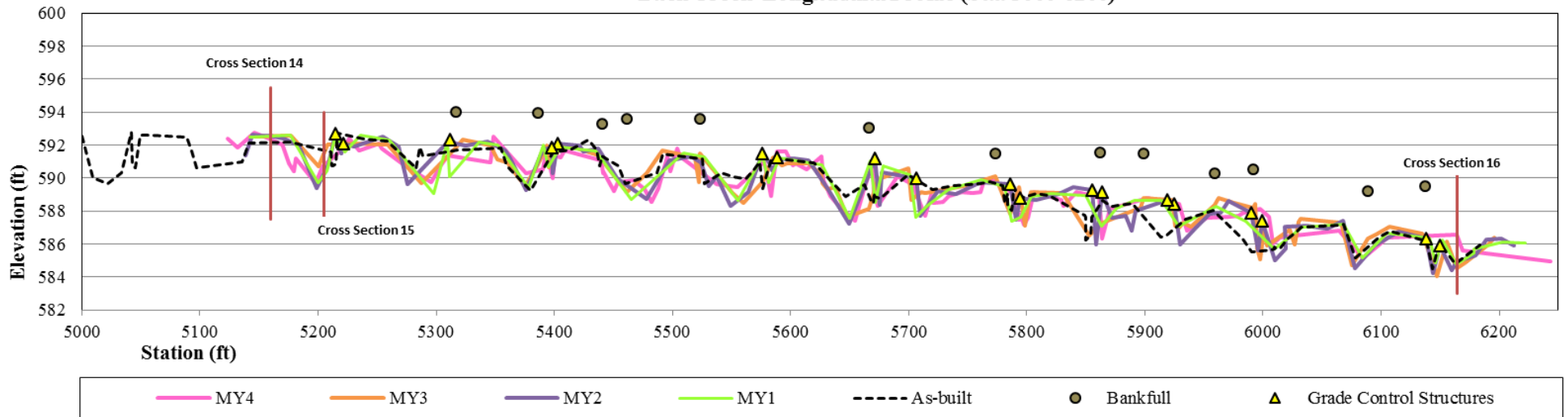


Figure 4.2. Longitudinal Profile – West Branch

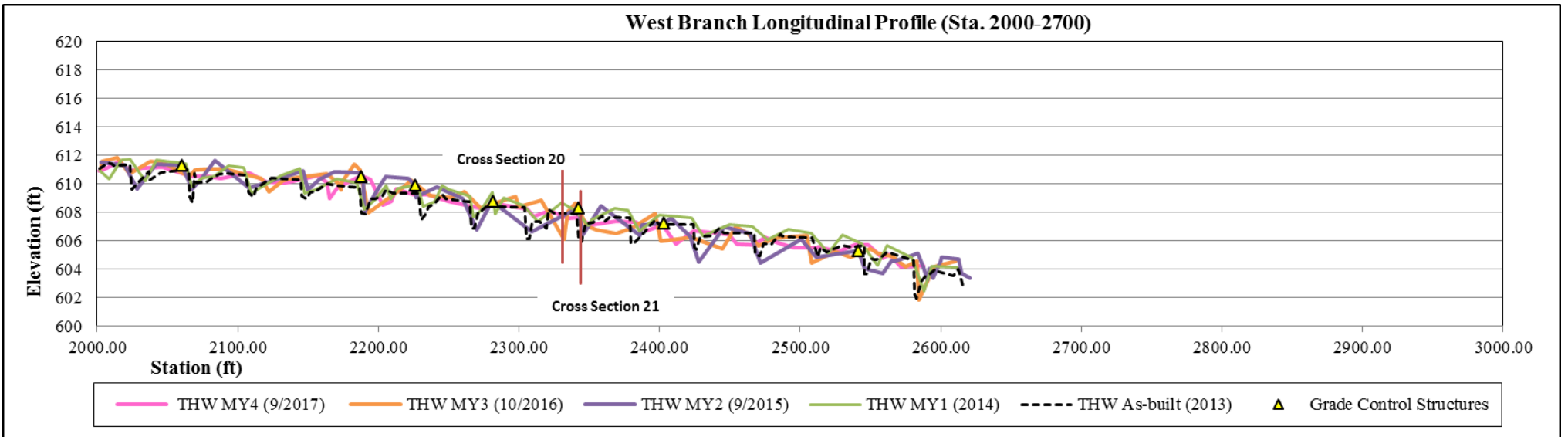
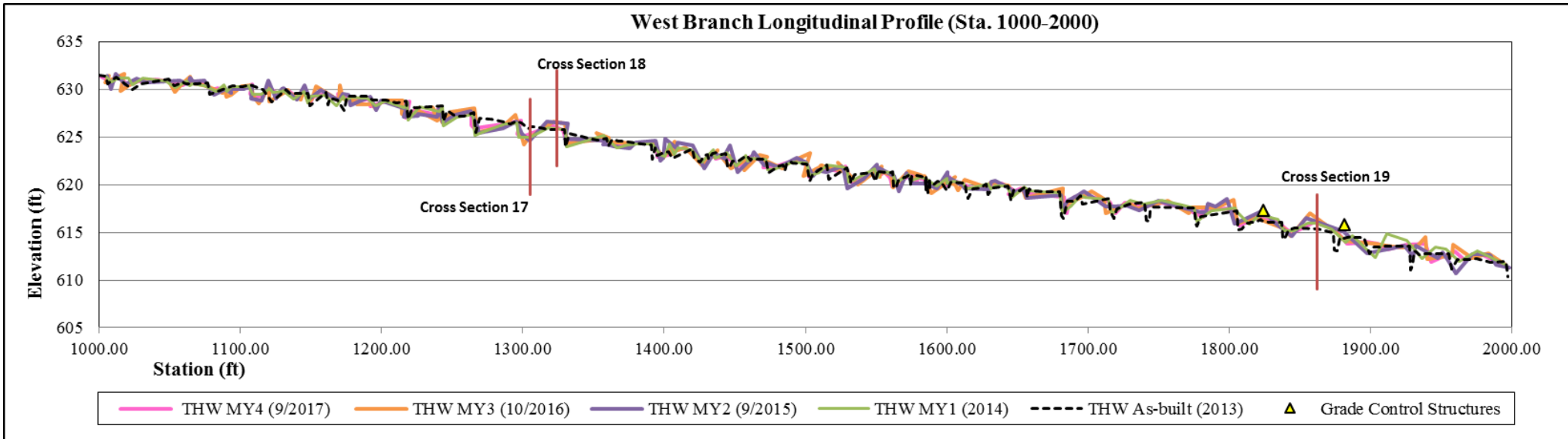


Figure 4.3. Longitudinal Profile – East Branch

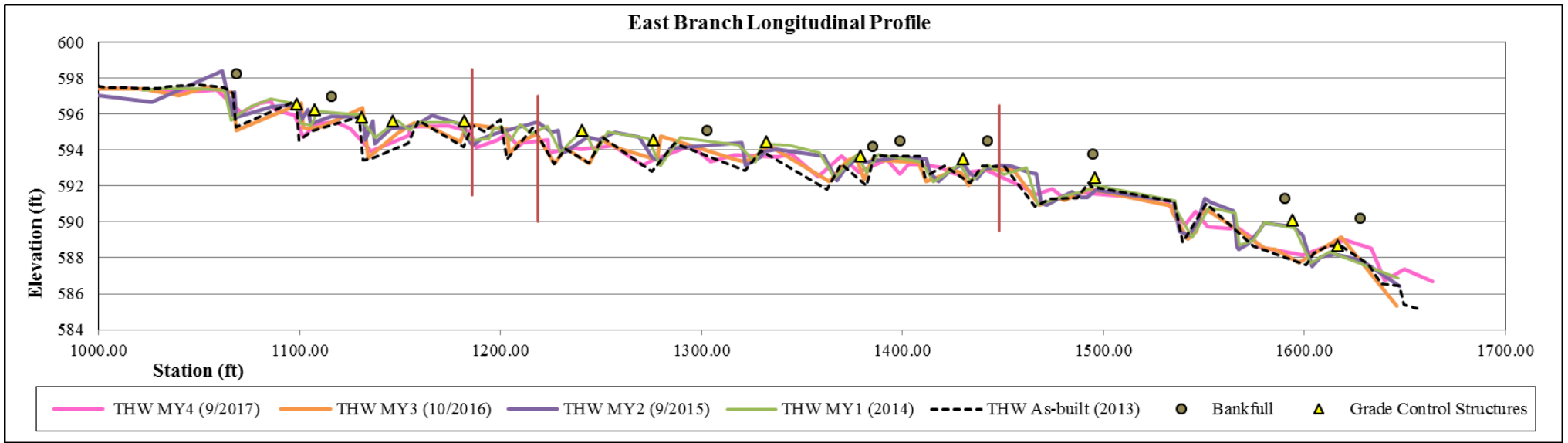
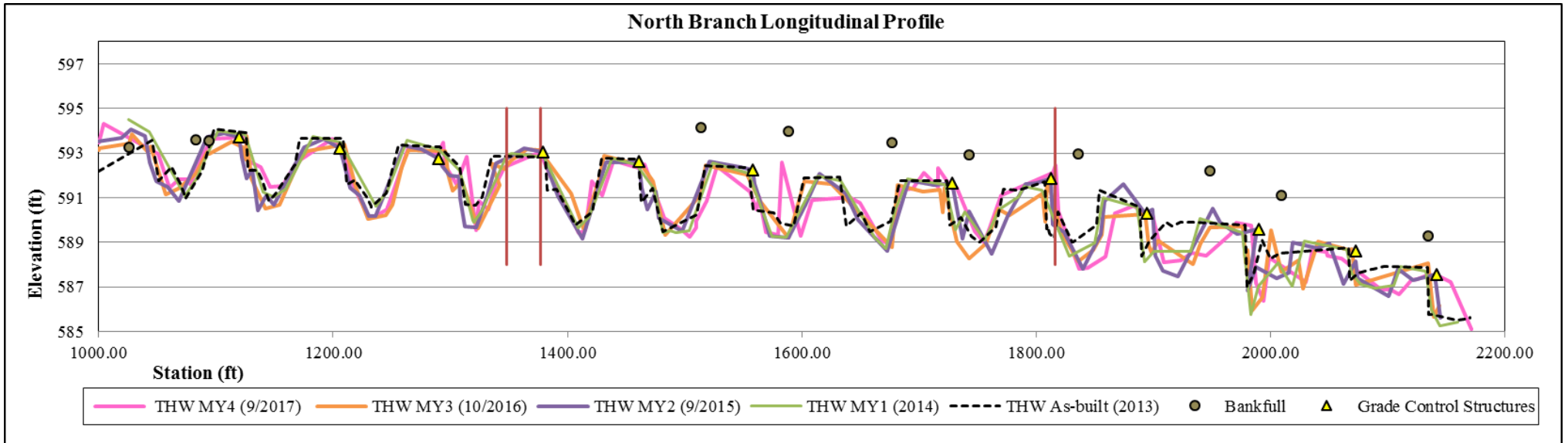


Figure 4.4. Longitudinal Profile – North Branch

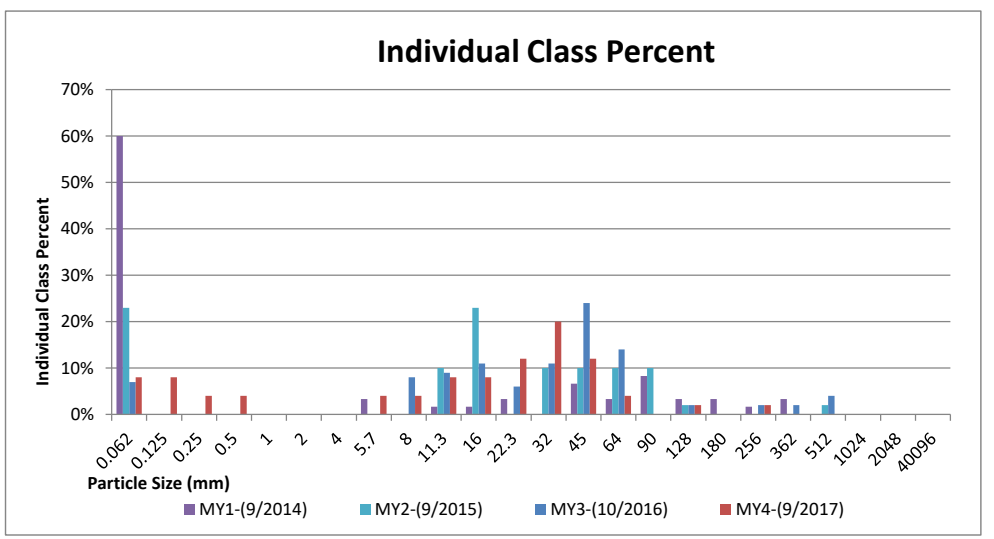
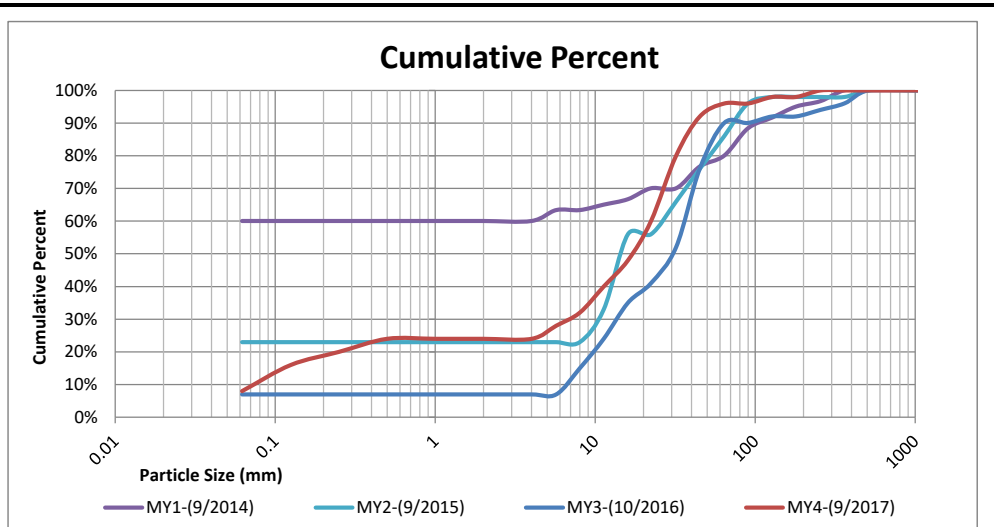


Appendix D: Stream Survey Data

Figure 5.1 Pebble Count Plots with Annual Overlays
Heath Dairy Stream Restoration/DMS Project No. 170
Monitoring Year 4

Project Name: Heath Dairy					
Reach: Back Creek					
Feature: Pool (XS 1)					
MY4-(9/2017)					
Description	Material	Size (mm)	Total #	Item %	Cum %
Silt/Clay	silt/clay	0.062	8	8%	8%
Sand	very fine sand	0.125	8	8%	16%
	fine sand	0.250	4	4%	20%
	medium sand	0.50	4	4%	24%
	coarse sand	1.00	0	0%	24%
Gravel	very coarse sand	2.0	0	0%	24%
	very fine gravel	4.0	0	0%	24%
	fine gravel	5.7	4	4%	28%
	fine gravel	8.0	4	4%	32%
	medium gravel	11.3	8	8%	40%
	medium gravel	16.0	8	8%	48%
	course gravel	22.3	12	12%	60%
	course gravel	32.0	20	20%	80%
Cobble	very coarse gravel	45	12	12%	92%
	very coarse gravel	64	4	4%	96%
	small cobble	90	0	0%	96%
	medium cobble	128	2	2%	98%
Boulder	large cobble	180	0	0%	98%
	very large cobble	256	2	2%	100%
	small boulder	362	0	0%	100%
	small boulder	512	0	0%	100%
Bedrock	medium boulder	1024	0	0%	100%
	large boulder	2048	0	0%	100%
	bedrock	40096	0	0%	100%
TOTAL % of whole count			-	100	100%

Summary Data	
D50	17.1
D84	36.3
D95	59.3

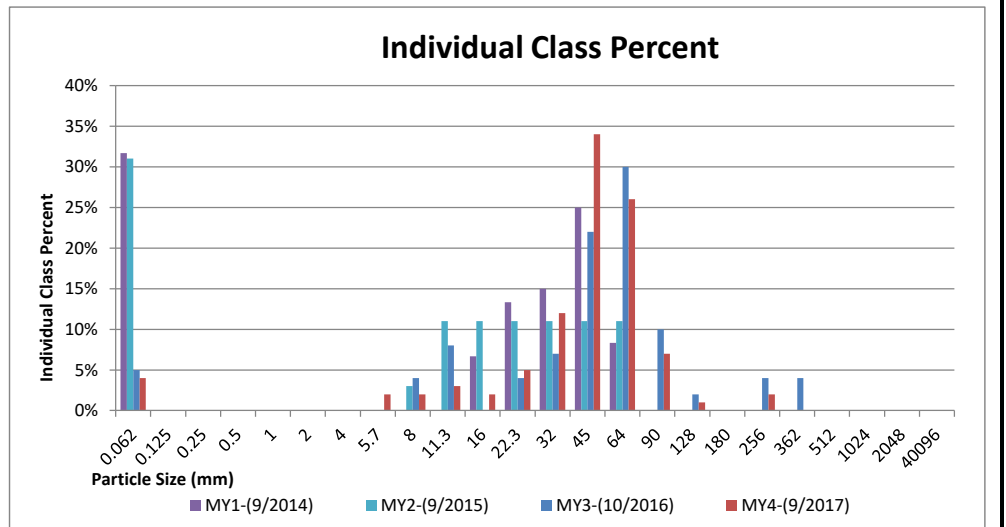
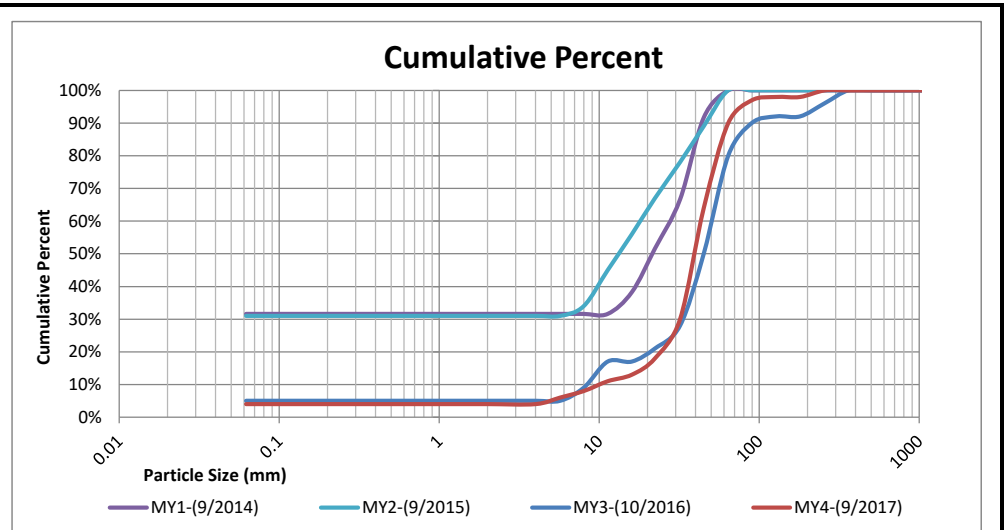


Appendix D: Stream Survey Data

Figure 5.2 Pebble Count Plots with Annual Overlays
Heath Dairy Stream Restoration/DMS Project No. 170
Monitoring Year 4

Project Name: Heath Dairy					
Reach: Back Creek					
Feature: Riffle (XS 2)					
MY4-(9/2017)					
Description	Material	Size (mm)	Total #	Item %	Cum %
Silt/Clay	silt/clay	0.062	4	4%	4%
Sand	very fine sand	0.125	0	0%	4%
	fine sand	0.250	0	0%	4%
	medium sand	0.50	0	0%	4%
	coarse sand	1.00	0	0%	4%
	very coarse sand	2.0	0	0%	4%
Gravel	very fine gravel	4.0	0	0%	4%
	fine gravel	5.7	2	2%	6%
	fine gravel	8.0	2	2%	8%
	medium gravel	11.3	3	3%	11%
	medium gravel	16.0	2	2%	13%
	course gravel	22.3	5	5%	18%
	course gravel	32.0	12	12%	30%
	very coarse gravel	45	34	34%	64%
	very coarse gravel	64	26	26%	90%
Cobble	small cobble	90	7	7%	97%
	medium cobble	128	1	1%	98%
	large cobble	180	0	0%	98%
	very large cobble	256	2	2%	100%
Boulder	small boulder	362	0	0%	100%
	small boulder	512	0	0%	100%
	medium boulder	1024	0	0%	100%
	large boulder	2048	0	0%	100%
Bedrock	bedrock	40096	0	0%	100%
TOTAL % of whole count			-	100	100%

Summary Data	
D50	39.6
D84	59.6
D95	82.6

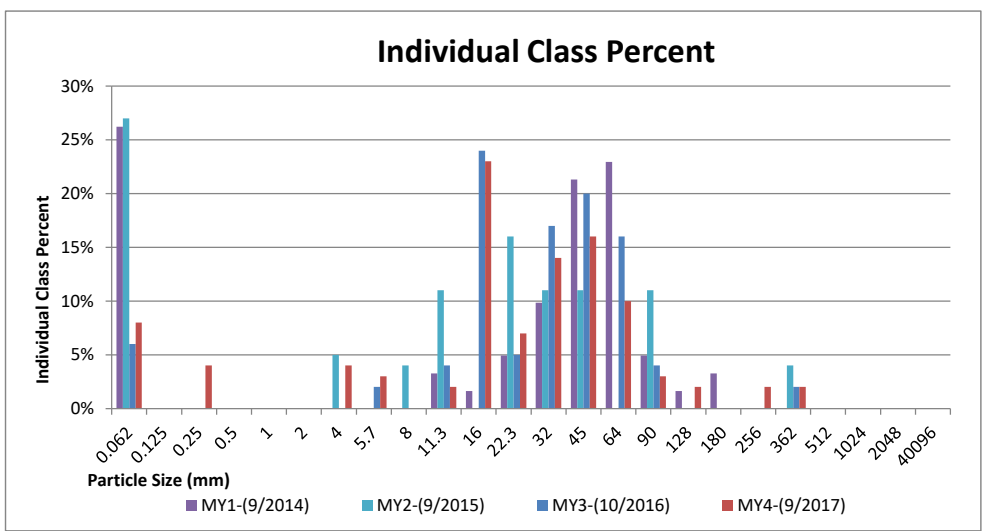
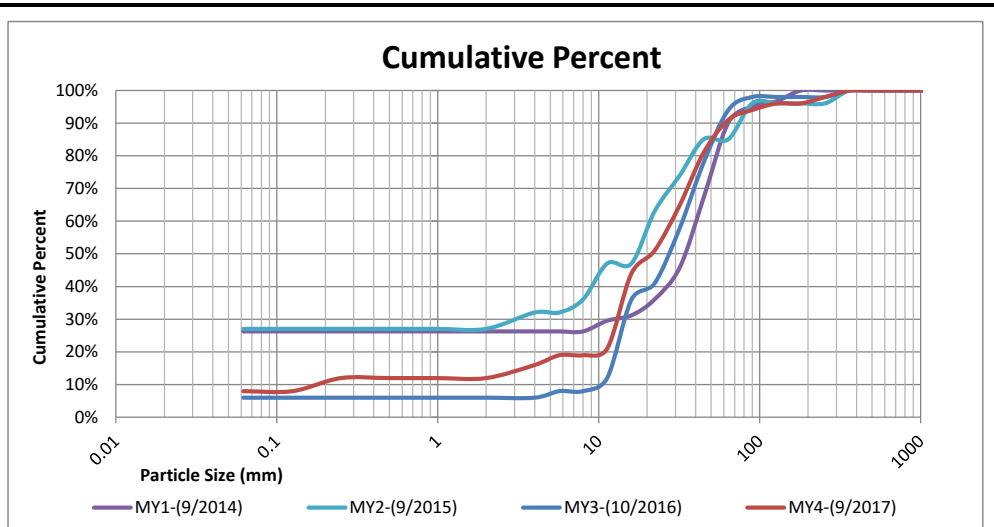


Appendix D: Stream Survey Data

Figure 5.3 Pebble Count Plots with Annual Overlays
Heath Dairy Stream Restoration/DMS Project No. 170
Monitoring Year 4

Project Name: Heath Dairy					
Reach: Back Creek					
Feature: Riffle (XS 3)					
MY4-(9/2017)					
Description	Material	Size (mm)	Total #	Item %	Cum %
Silt/Clay	silt/clay	0.062	8	8%	8%
Sand	very fine sand	0.125	0	0%	8%
	fine sand	0.250	4	4%	12%
	medium sand	0.50	0	0%	12%
	coarse sand	1.00	0	0%	12%
	very coarse sand	2.0	0	0%	12%
Gravel	very fine gravel	4.0	4	4%	16%
	fine gravel	5.7	3	3%	19%
	fine gravel	8.0	0	0%	19%
	medium gravel	11.3	2	2%	21%
	medium gravel	16.0	23	23%	44%
	course gravel	22.3	7	7%	51%
	course gravel	32.0	14	14%	65%
	very coarse gravel	45	16	16%	81%
	very coarse gravel	64	10	10%	91%
Cobble	small cobble	90	3	3%	94%
	medium cobble	128	2	2%	96%
	large cobble	180	0	0%	96%
	very large cobble	256	2	2%	98%
Boulder	small boulder	362	2	2%	100%
	small boulder	512	0	0%	100%
	medium boulder	1024	0	0%	100%
	large boulder	2048	0	0%	100%
Bedrock	bedrock	40096	0	0%	100%
TOTAL % of whole count			-	100	100%

Summary Data	
D50	21.4
D84	50.7
D95	109.0

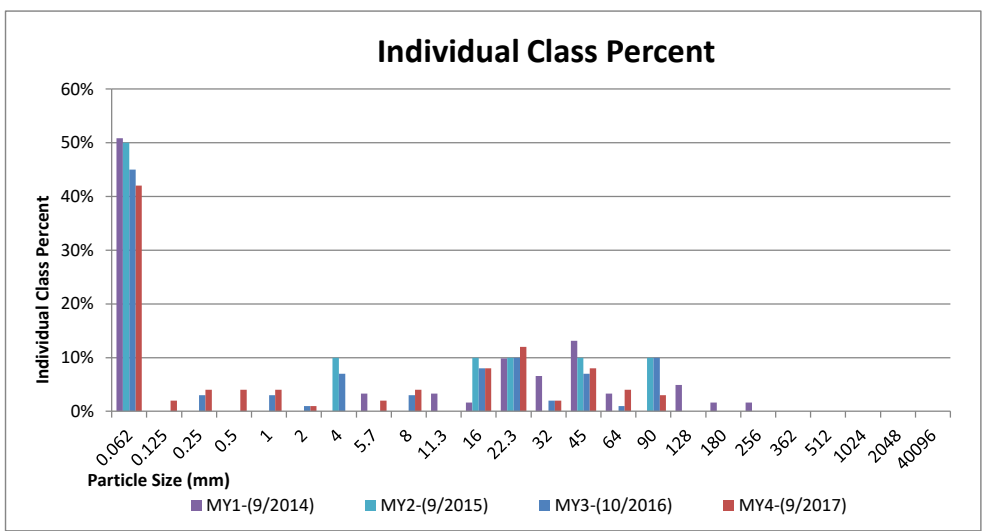
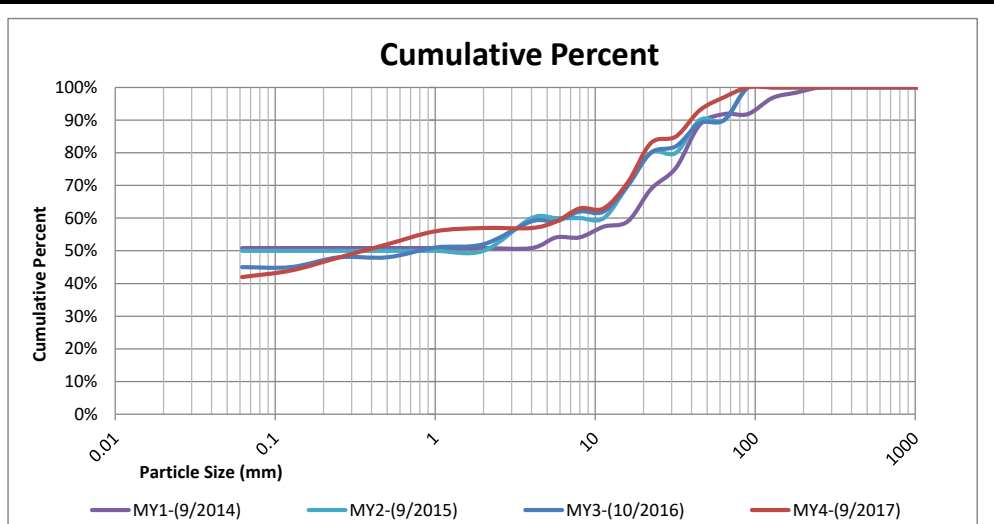


Appendix D: Stream Survey Data

Figure 5.4 Pebble Count Plots with Annual Overlays
Heath Dairy Stream Restoration/DMS Project No. 170
Monitoring Year 4

Project Name: Heath Dairy					
Reach: Back Creek					
Feature: Pool (XS 4)					
MY4-(9/2017)					
Description	Material	Size (mm)	Total #	Item %	Cum %
Silt/Clay	silt/clay	0.062	42	42%	42%
Sand	very fine sand	0.125	2	2%	44%
	fine sand	0.250	4	4%	48%
	medium sand	0.50	4	4%	52%
	coarse sand	1.00	4	4%	56%
	very coarse sand	2.0	1	1%	57%
Gravel	very fine gravel	4.0	0	0%	57%
	fine gravel	5.7	2	2%	59%
	fine gravel	8.0	4	4%	63%
	medium gravel	11.3	0	0%	63%
	medium gravel	16.0	8	8%	71%
	course gravel	22.3	12	12%	83%
	course gravel	32.0	2	2%	85%
	very coarse gravel	45	8	8%	93%
	very coarse gravel	64	4	4%	97%
Cobble	small cobble	90	3	3%	100%
	medium cobble	128	0	0%	100%
	large cobble	180	0	0%	100%
	very large cobble	256	0	0%	100%
Boulder	small boulder	362	0	0%	100%
	small boulder	512	0	0%	100%
	medium boulder	1024	0	0%	100%
	large boulder	2048	0	0%	100%
Bedrock	bedrock	40096	0	0%	100%
TOTAL % of whole count			-	100	100%

Summary Data	
D50	0.4
D84	27.2
D95	54.5

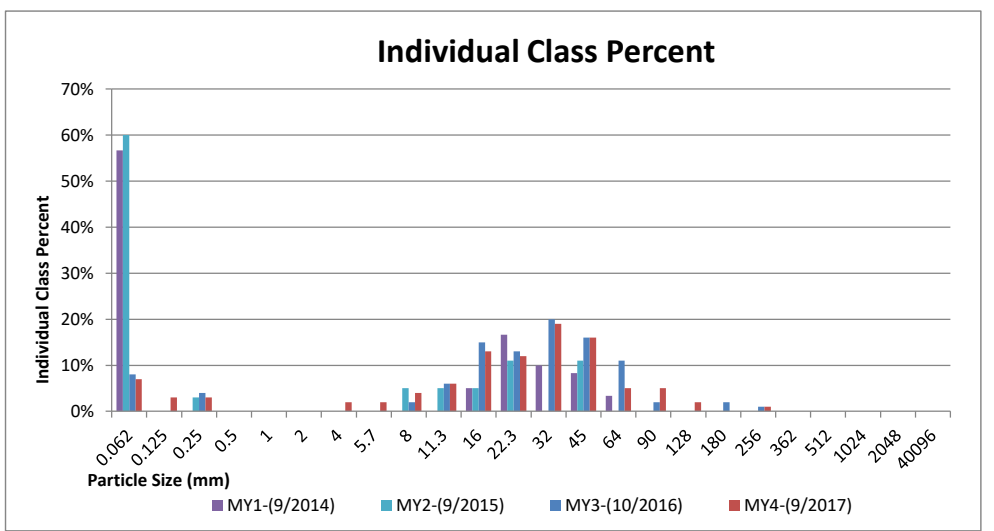
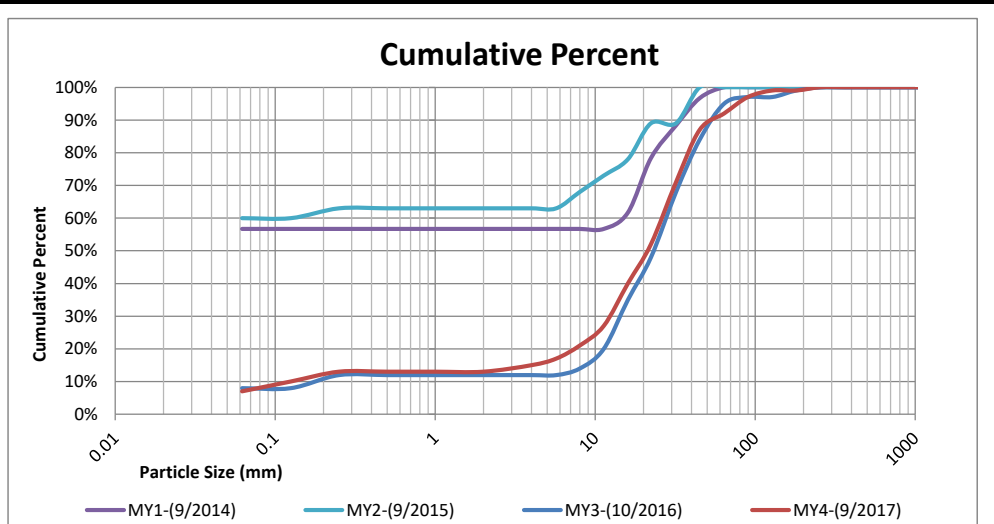


Appendix D: Stream Survey Data

Figure 5.5 Pebble Count Plots with Annual Overlays
Heath Dairy Stream Restoration/DMS Project No. 170
Monitoring Year 4

Project Name: Heath Dairy					
Reach: Back Creek					
Feature: Riffle (XS 6)					
MY4-(9/2017)					
Description	Material	Size (mm)	Total #	Item %	Cum %
Silt/Clay	silt/clay	0.062	7	7%	7%
Sand	very fine sand	0.125	3	3%	10%
	fine sand	0.250	3	3%	13%
	medium sand	0.50	0	0%	13%
	coarse sand	1.00	0	0%	13%
	very coarse sand	2.0	0	0%	13%
Gravel	very fine gravel	4.0	2	2%	15%
	fine gravel	5.7	2	2%	17%
	fine gravel	8.0	4	4%	21%
	medium gravel	11.3	6	6%	27%
	medium gravel	16.0	13	13%	40%
	course gravel	22.3	12	12%	52%
	course gravel	32.0	19	19%	71%
	very coarse gravel	45	16	16%	87%
	very coarse gravel	64	5	5%	92%
Cobble	small cobble	90	5	5%	97%
	medium cobble	128	2	2%	99%
	large cobble	180	0	0%	99%
	very large cobble	256	1	1%	100%
Boulder	small boulder	362	0	0%	100%
	small boulder	512	0	0%	100%
	medium boulder	1024	0	0%	100%
	large boulder	2048	0	0%	100%
Bedrock	bedrock	40096	0	0%	100%
TOTAL % of whole count			-	100	100%

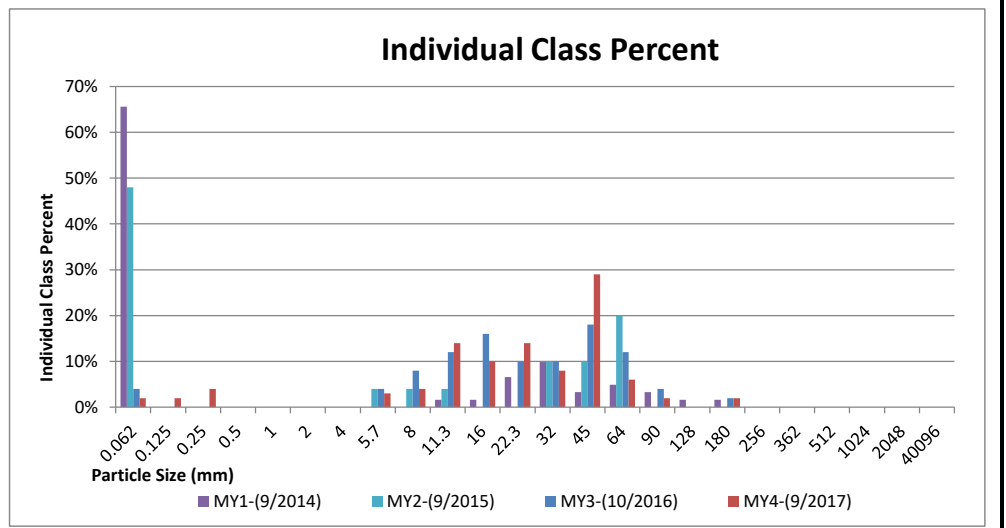
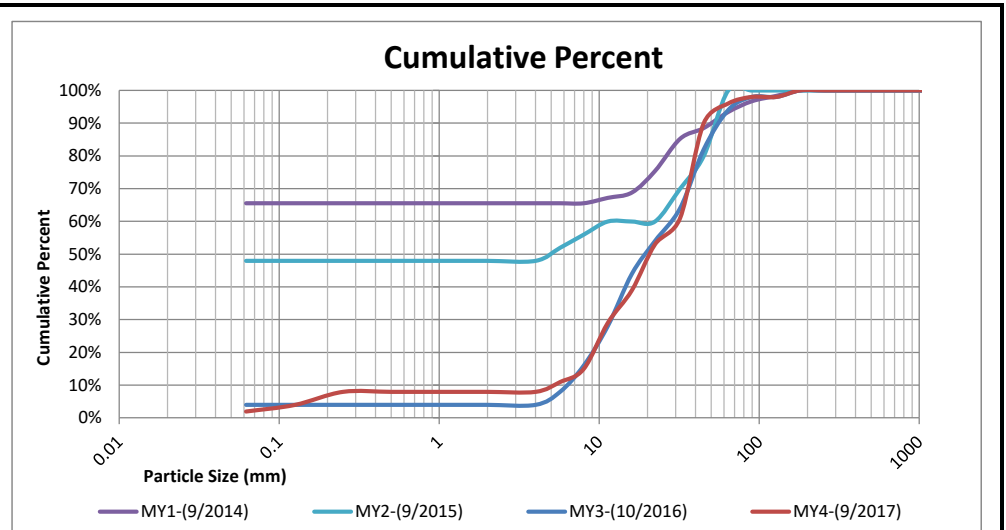
Summary Data	
D50	21.3
D84	42.6
D95	79.6



Appendix D: Stream Survey Data

Figure 5.6 Pebble Count Plots with Annual Overlays
Heath Dairy Stream Restoration/DMS Project No. 170
Monitoring Year 4

Project Name: Heath Dairy					
Reach: Back Creek					
Feature: Riffle (XS 8)					
MY4-(9/2017)					
Description	Material	Size (mm)	Total #	Item %	Cum %
Silt/Clay	silt/clay	0.062	2	2%	2%
Sand	very fine sand	0.125	2	2%	4%
	fine sand	0.250	4	4%	8%
	medium sand	0.50	0	0%	8%
	coarse sand	1.00	0	0%	8%
	very coarse sand	2.0	0	0%	8%
Gravel	very fine gravel	4.0	0	0%	8%
	fine gravel	5.7	3	3%	11%
	fine gravel	8.0	4	4%	15%
	medium gravel	11.3	14	14%	29%
	medium gravel	16.0	10	10%	39%
	course gravel	22.3	14	14%	53%
	course gravel	32.0	8	8%	61%
	very coarse gravel	45	29	29%	90%
Cobble	very coarse gravel	64	6	6%	96%
	small cobble	90	2	2%	98%
	medium cobble	128	0	0%	98%
	large cobble	180	2	2%	100%
Boulder	very large cobble	256	0	0%	100%
	small boulder	362	0	0%	100%
	small boulder	512	0	0%	100%
	medium boulder	1024	0	0%	100%
Boulder	large boulder	2048	0	0%	100%
Bedrock	bedrock	40096	0	0%	100%
TOTAL % of whole count			-	100	100%
Summary Data					
D50	21.0				
D84	42.3				
D95	60.8				

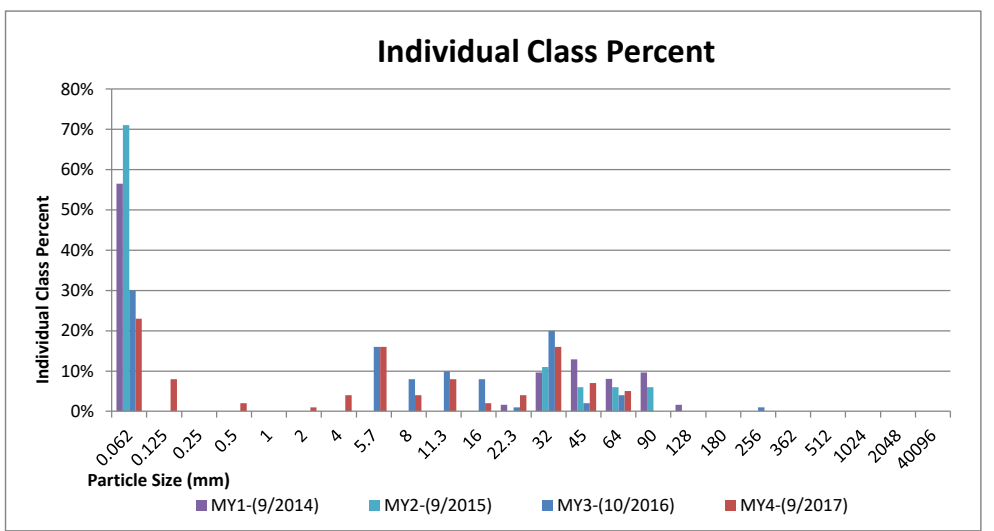
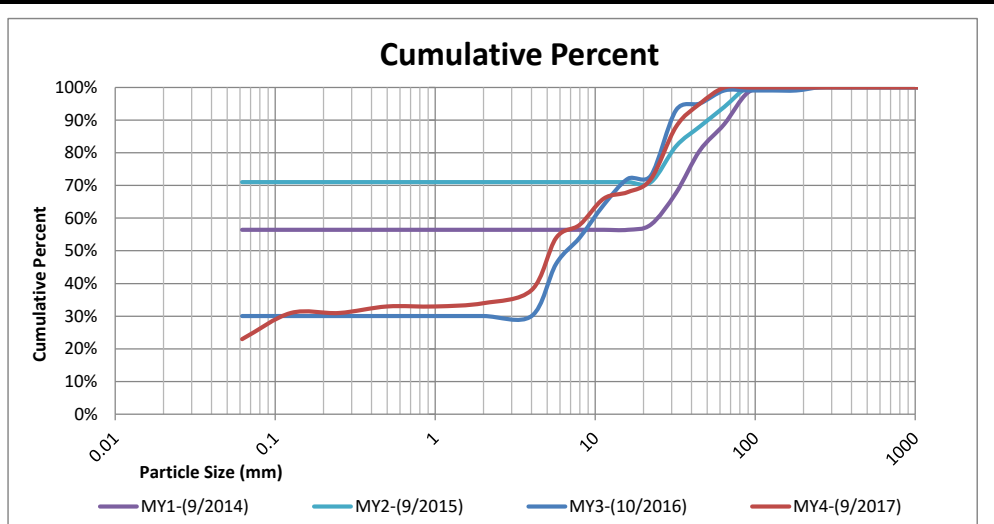


Appendix D: Stream Survey Data

Figure 5.7 Pebble Count Plots with Annual Overlays
Heath Dairy Stream Restoration/DMS Project No. 170
Monitoring Year 4

Project Name: Heath Dairy					
Reach: Back Creek					
Feature: Pool (XS 9)					
MY4-(9/2017)					
Description	Material	Size (mm)	Total #	Item %	Cum %
Silt/Clay	silt/clay	0.062	23	23%	23%
Sand	very fine sand	0.125	8	8%	31%
	fine sand	0.250	0	0%	31%
	medium sand	0.50	2	2%	33%
	coarse sand	1.00	0	0%	33%
	very coarse sand	2.0	1	1%	34%
Gravel	very fine gravel	4.0	4	4%	38%
	fine gravel	5.7	16	16%	54%
	fine gravel	8.0	4	4%	58%
	medium gravel	11.3	8	8%	66%
	medium gravel	16.0	2	2%	68%
	course gravel	22.3	4	4%	72%
	course gravel	32.0	16	16%	88%
	very coarse gravel	45	7	7%	95%
	very coarse gravel	64	5	5%	100%
Cobble	small cobble	90	0	0%	100%
	medium cobble	128	0	0%	100%
	large cobble	180	0	0%	100%
	very large cobble	256	0	0%	100%
Boulder	small boulder	362	0	0%	100%
	small boulder	512	0	0%	100%
	medium boulder	1024	0	0%	100%
	large boulder	2048	0	0%	100%
Bedrock	bedrock	40096	0	0%	100%
TOTAL % of whole count			-	100	100%

Summary Data	
D50	5.3
D84	29.6
D95	45.0

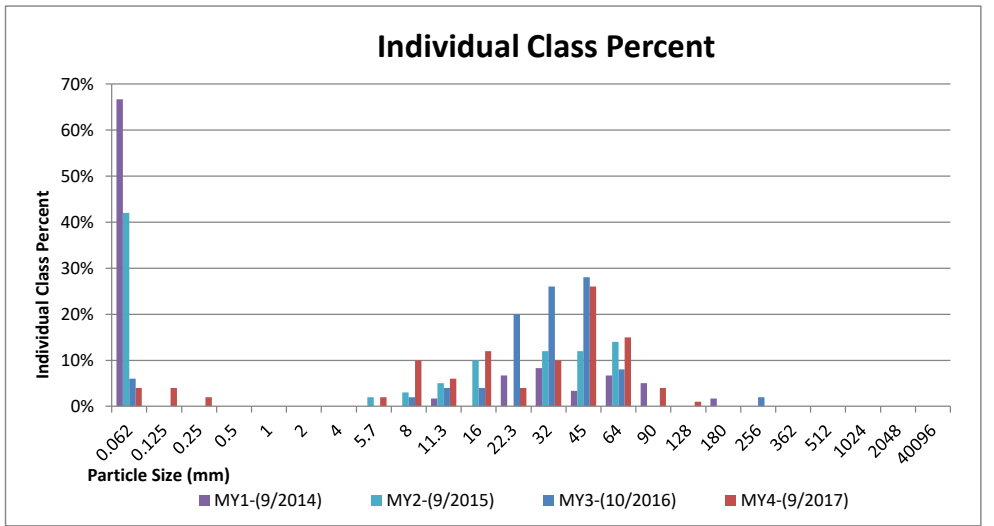
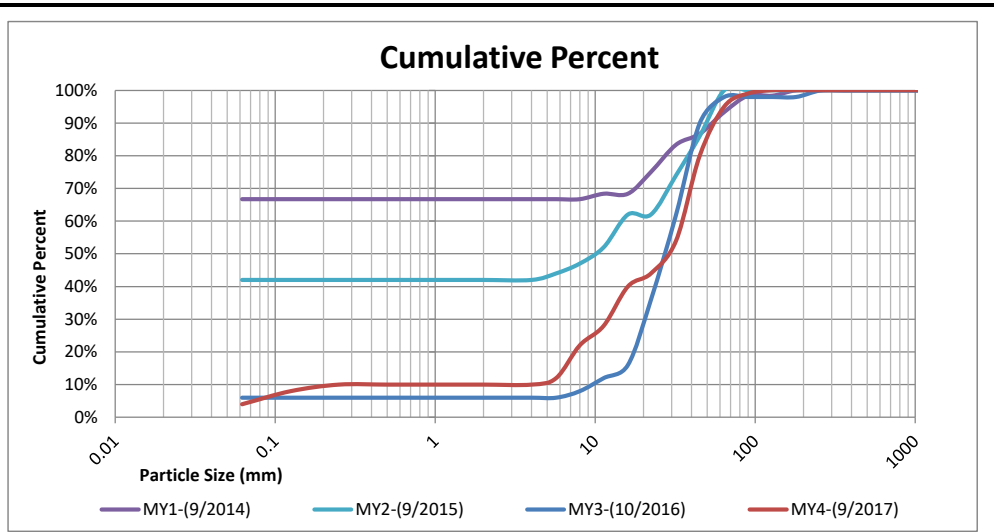


Appendix D: Stream Survey Data

Figure 5.8 Pebble Count Plots with Annual Overlays
Heath Dairy Stream Restoration/DMS Project No. 170
Monitoring Year 4

Project Name: Heath Dairy					
Reach: Back Creek					
Feature: Riffle (XS 10)					
MY4-(9/2017)					
Description	Material	Size (mm)	Total #	Item %	Cum %
Silt/Clay	silt/clay	0.062	4	4%	4%
Sand	very fine sand	0.125	4	4%	8%
	fine sand	0.250	2	2%	10%
	medium sand	0.50	0	0%	10%
	coarse sand	1.00	0	0%	10%
	very coarse sand	2.0	0	0%	10%
Gravel	very fine gravel	4.0	0	0%	10%
	fine gravel	5.7	2	2%	12%
	fine gravel	8.0	10	10%	22%
	medium gravel	11.3	6	6%	28%
	medium gravel	16.0	12	12%	40%
	course gravel	22.3	4	4%	44%
	course gravel	32.0	10	10%	54%
	very coarse gravel	45	26	26%	80%
	very coarse gravel	64	15	15%	95%
Cobble	small cobble	90	4	4%	99%
	medium cobble	128	1	1%	100%
	large cobble	180	0	0%	100%
	very large cobble	256	0	0%	100%
Boulder	small boulder	362	0	0%	100%
	small boulder	512	0	0%	100%
	medium boulder	1024	0	0%	100%
	large boulder	2048	0	0%	100%
Bedrock	bedrock	40096	0	0%	100%
TOTAL % of whole count			-	100	100%

Summary Data	
D50	28.1
D84	50.1
D95	64.0

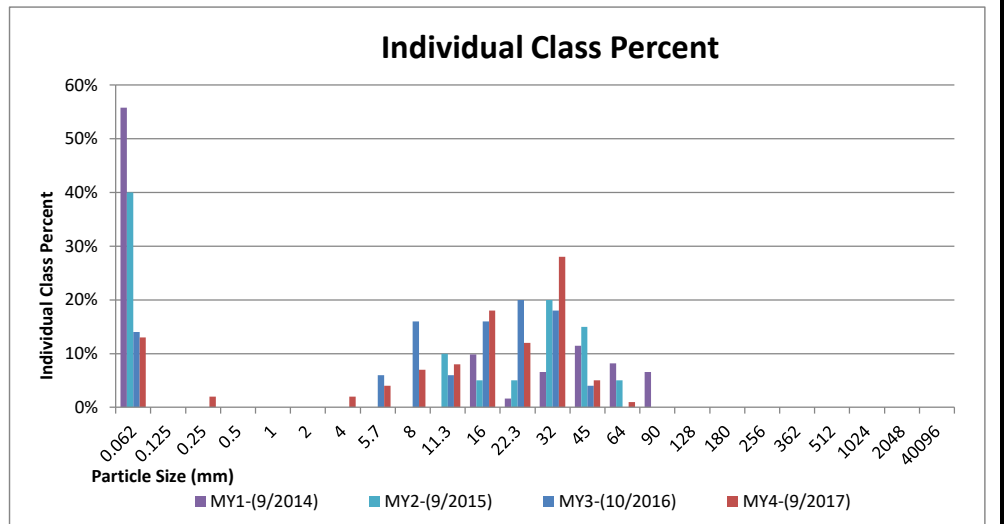
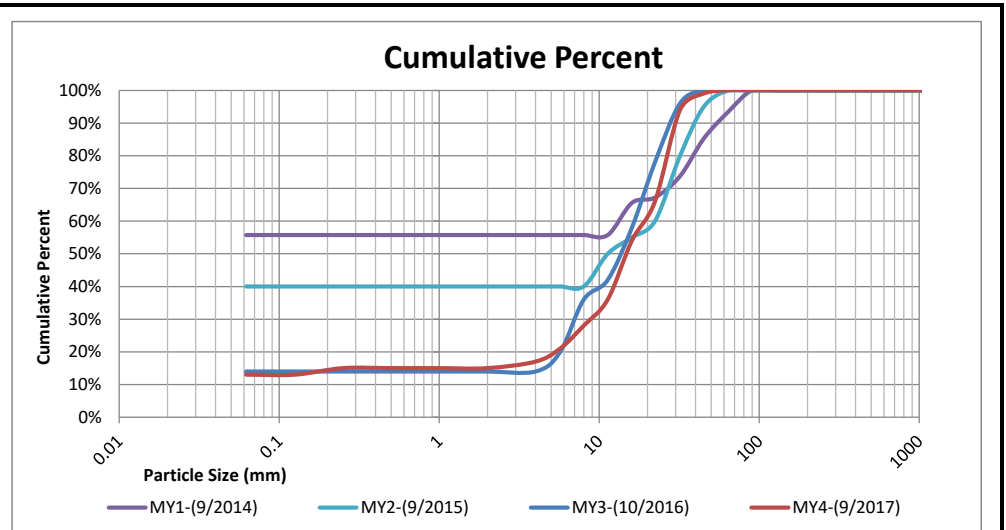


Appendix D: Stream Survey Data

Figure 5.9 Pebble Count Plots with Annual Overlays
Heath Dairy Stream Restoration/DMS Project No. 170
Monitoring Year 4

Project Name: Heath Dairy					
Reach: Back Creek					
Feature: Riffle (XS 12)					
MY4-(9/2017)					
Description	Material	Size (mm)	Total #	Item %	Cum %
Silt/Clay	silt/clay	0.062	13	13%	13%
Sand	very fine sand	0.125	0	0%	13%
	fine sand	0.250	2	2%	15%
	medium sand	0.50	0	0%	15%
	coarse sand	1.00	0	0%	15%
	very coarse sand	2.0	0	0%	15%
Gravel	very fine gravel	4.0	2	2%	17%
	fine gravel	5.7	4	4%	21%
	fine gravel	8.0	7	7%	28%
	medium gravel	11.3	8	8%	36%
	medium gravel	16.0	18	18%	54%
	course gravel	22.3	12	12%	66%
	course gravel	32.0	28	28%	94%
	very coarse gravel	45	5	5%	99%
	very coarse gravel	64	1	1%	100%
Cobble	small cobble	90	0	0%	100%
	medium cobble	128	0	0%	100%
	large cobble	180	0	0%	100%
	very large cobble	256	0	0%	100%
Boulder	small boulder	362	0	0%	100%
	small boulder	512	0	0%	100%
	medium boulder	1024	0	0%	100%
	large boulder	2048	0	0%	100%
Bedrock	bedrock	40096	0	0%	100%
TOTAL % of whole count			-	100	100%

Summary Data	
D50	15.0
D84	28.5
D95	34.6

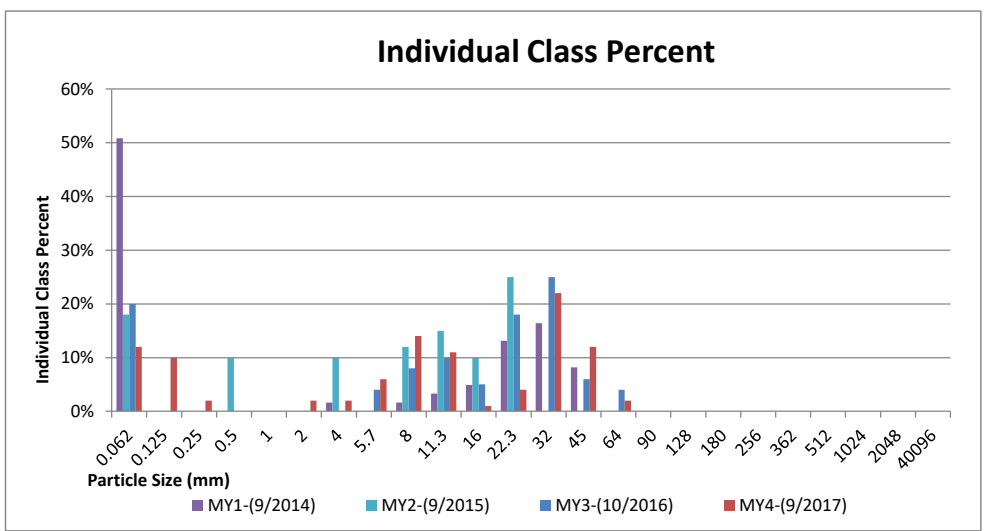
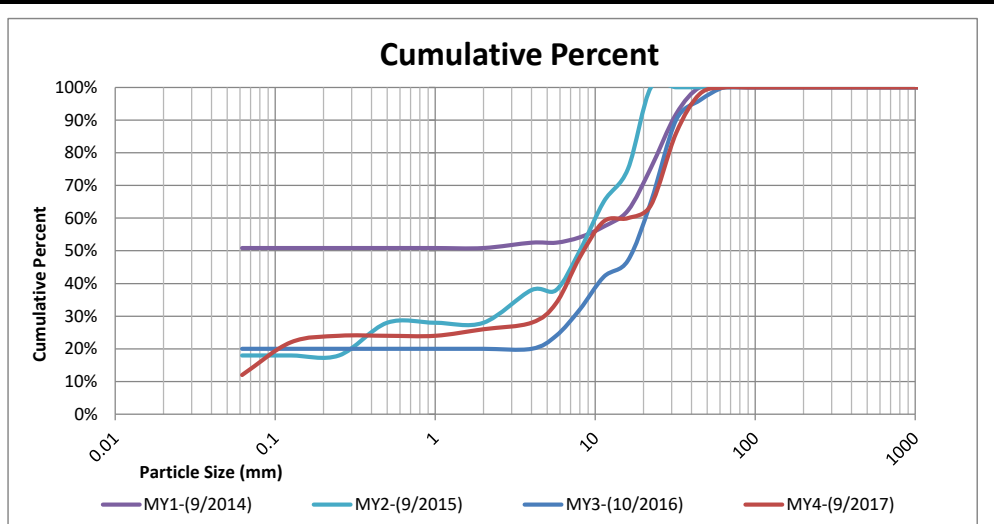


Appendix D: Stream Survey Data

Figure 5.10 Pebble Count Plots with Annual Overlays
Heath Dairy Stream Restoration/DMS Project No. 170
Monitoring Year 4

Project Name: Heath Dairy					
Reach: Back Creek					
Feature: Riffle (XS 14)					
MY4-(9/2017)					
Description	Material	Size (mm)	Total #	Item %	Cum %
Silt/Clay	silt/clay	0.062	12	12%	12%
Sand	very fine sand	0.125	10	10%	22%
	fine sand	0.250	2	2%	24%
	medium sand	0.50	0	0%	24%
	coarse sand	1.00	0	0%	24%
	very coarse sand	2.0	2	2%	26%
Gravel	very fine gravel	4.0	2	2%	28%
	fine gravel	5.7	6	6%	34%
	fine gravel	8.0	14	14%	48%
	medium gravel	11.3	11	11%	59%
	medium gravel	16.0	1	1%	60%
	course gravel	22.3	4	4%	64%
	course gravel	32.0	22	22%	86%
	very coarse gravel	45	12	12%	98%
	very coarse gravel	64	2	2%	100%
Cobble	small cobble	90	0	0%	100%
	medium cobble	128	0	0%	100%
	large cobble	180	0	0%	100%
	very large cobble	256	0	0%	100%
Boulder	small boulder	362	0	0%	100%
	small boulder	512	0	0%	100%
	medium boulder	1024	0	0%	100%
	large boulder	2048	0	0%	100%
Bedrock	bedrock	40096	0	0%	100%
TOTAL % of whole count			-	100	100%

Summary Data	
D50	8.6
D84	31.1
D95	41.8

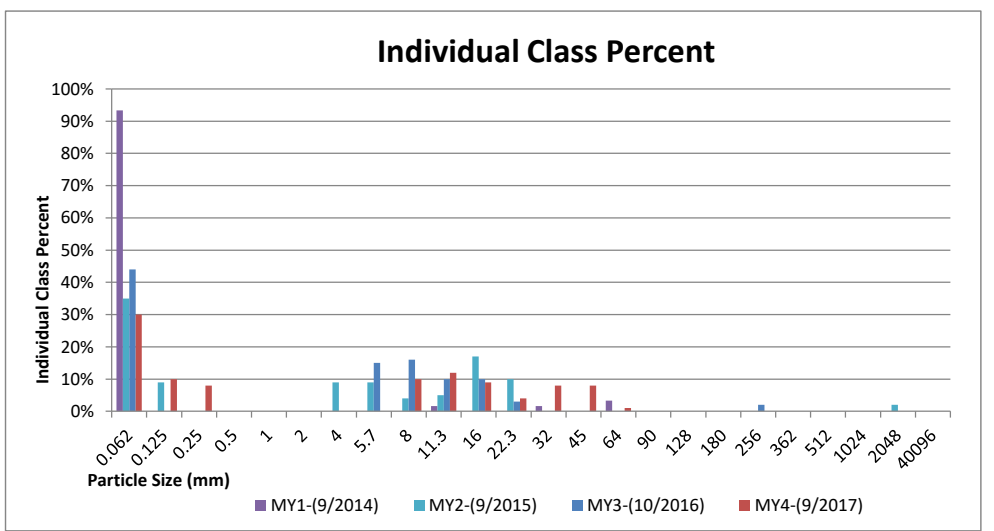
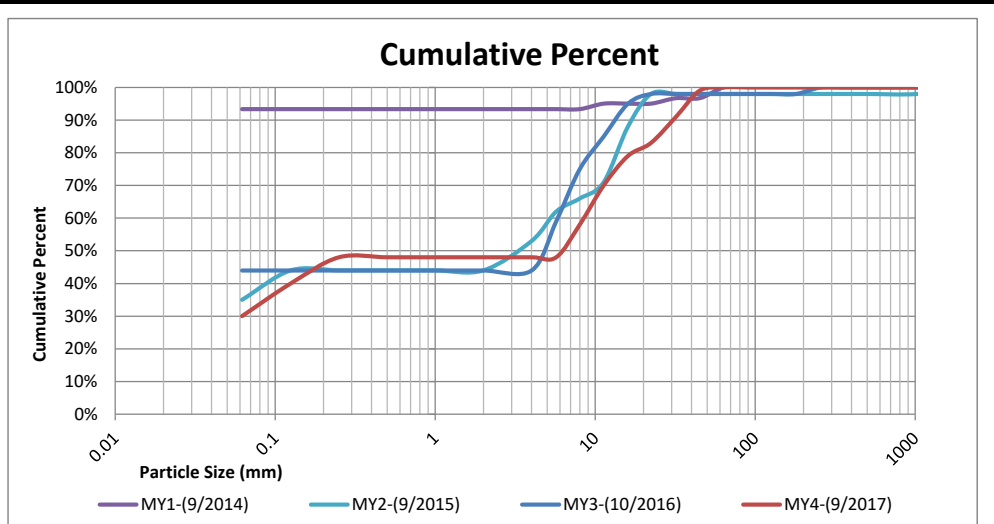


Appendix D: Stream Survey Data

Figure 5.11 Pebble Count Plots with Annual Overlays
Heath Dairy Stream Restoration/DMS Project No. 170
Monitoring Year 4

Project Name: Heath Dairy					
Reach: Back Creek					
Feature: Riffle (XS 16)					
MY4-(9/2017)					
Description	Material	Size (mm)	Total #	Item %	Cum %
Silt/Clay	silt/clay	0.062	30	30%	30%
Sand	very fine sand	0.125	10	10%	40%
	fine sand	0.250	8	8%	48%
	medium sand	0.50	0	0%	48%
	coarse sand	1.00	0	0%	48%
	very coarse sand	2.0	0	0%	48%
Gravel	very fine gravel	4.0	0	0%	48%
	fine gravel	5.7	0	0%	48%
	fine gravel	8.0	10	10%	58%
	medium gravel	11.3	12	12%	70%
	medium gravel	16.0	9	9%	79%
	course gravel	22.3	4	4%	83%
	course gravel	32.0	8	8%	91%
	very coarse gravel	45	8	8%	99%
	very coarse gravel	64	1	1%	100%
Cobble	small cobble	90	0	0%	100%
	medium cobble	128	0	0%	100%
	large cobble	180	0	0%	100%
	very large cobble	256	0	0%	100%
Boulder	small boulder	362	0	0%	100%
	small boulder	512	0	0%	100%
	medium boulder	1024	0	0%	100%
	large boulder	2048	0	0%	100%
Bedrock	bedrock	40096	0	0%	100%
TOTAL % of whole count			-	100	100%

Summary Data	
D50	1.8
D84	23.5
D95	38.5

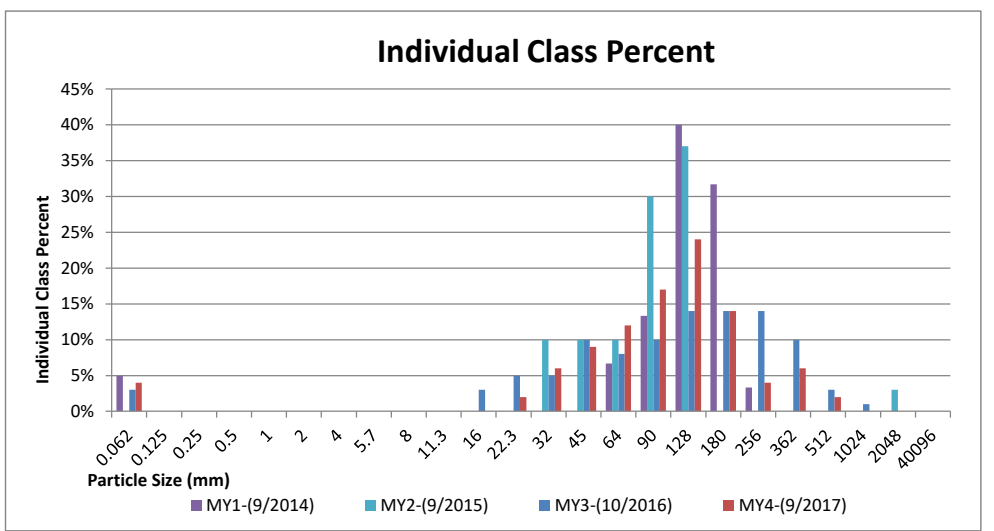
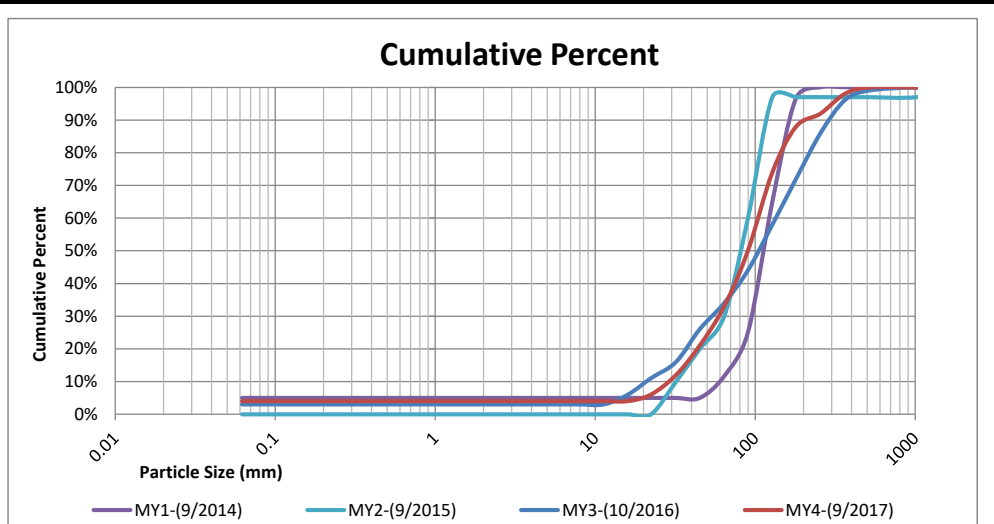


Appendix D: Stream Survey Data

Figure 5.12 Pebble Count Plots with Annual Overlays
Heath Dairy Stream Restoration/DMS Project No. 170
Monitoring Year 4

Project Name: Heath Dairy					
Reach: West Branch to Back Creek					
Feature: Riffle (XS 19)					
MY4-(9/2017)					
Description	Material	Size (mm)	Total #	Item %	Cum %
Silt/Clay	silt/clay	0.062	4	4%	4%
Sand	very fine sand	0.125	0	0%	4%
	fine sand	0.250	0	0%	4%
	medium sand	0.50	0	0%	4%
	coarse sand	1.00	0	0%	4%
Gravel	very coarse sand	2.0	0	0%	4%
	very fine gravel	4.0	0	0%	4%
	fine gravel	5.7	0	0%	4%
	fine gravel	8.0	0	0%	4%
	medium gravel	11.3	0	0%	4%
	medium gravel	16.0	0	0%	4%
	course gravel	22.3	2	2%	6%
	course gravel	32.0	6	6%	12%
Cobble	very coarse gravel	45	9	9%	21%
	very coarse gravel	64	12	12%	33%
	small cobble	90	17	17%	50%
	medium cobble	128	24	24%	74%
Boulder	large cobble	180	14	14%	88%
	very large cobble	256	4	4%	92%
	small boulder	362	6	6%	98%
	small boulder	512	2	2%	100%
Bedrock	medium boulder	1024	0	0%	100%
	large boulder	2048	0	0%	100%
Bedrock	bedrock	40096	0	0%	100%
TOTAL % of whole count			-	100	100%

Summary Data	
D50	90.0
D84	165.1
D95	309.0

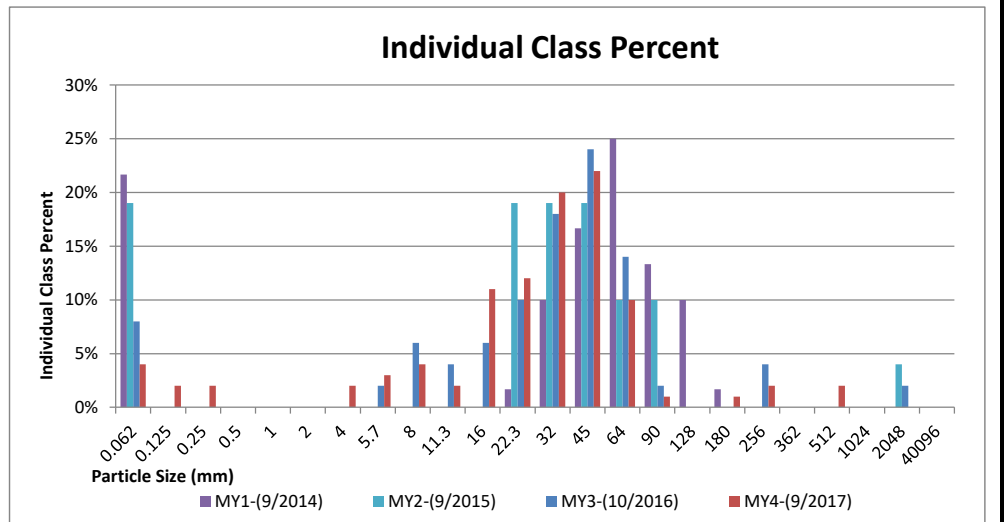
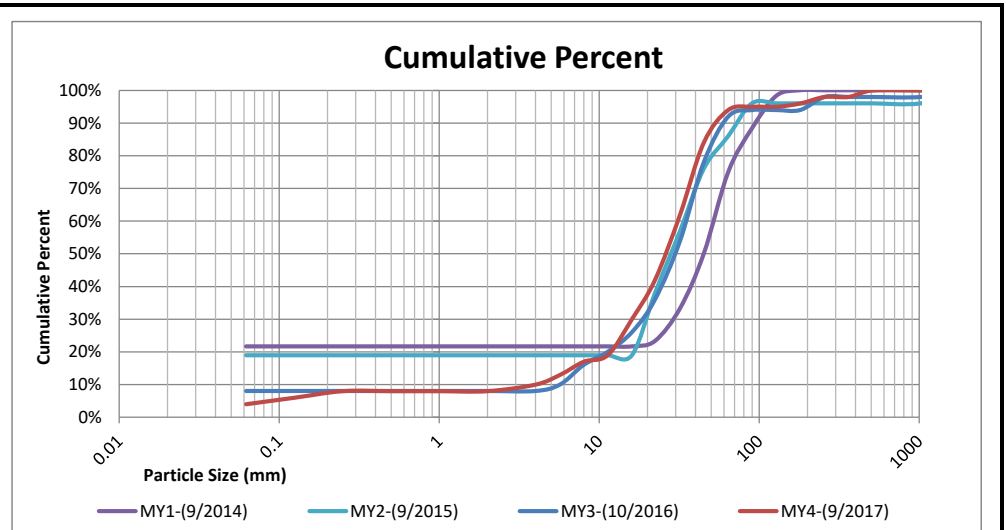


Appendix D: Stream Survey Data

Figure 5.13 Pebble Count Plots with Annual Overlays
Heath Dairy Stream Restoration/DMS Project No. 170
Monitoring Year 4

Project Name: Heath Dairy					
Reach: West Branch to Back Creek					
Feature: Riffle (XS 20)					
MY4-(9/2017)					
Description	Material	Size (mm)	Total #	Item %	Cum %
Silt/Clay	silt/clay	0.062	4	4%	4%
Sand	very fine sand	0.125	2	2%	6%
	fine sand	0.250	2	2%	8%
	medium sand	0.50	0	0%	8%
	coarse sand	1.00	0	0%	8%
Gravel	very coarse sand	2.0	0	0%	8%
	very fine gravel	4.0	2	2%	10%
	fine gravel	5.7	3	3%	13%
	fine gravel	8.0	4	4%	17%
	medium gravel	11.3	2	2%	19%
	medium gravel	16.0	11	11%	30%
	course gravel	22.3	12	12%	42%
	course gravel	32.0	20	20%	62%
Cobble	very coarse gravel	45	22	22%	84%
	very coarse gravel	64	10	10%	94%
	small cobble	90	1	1%	95%
	medium cobble	128	0	0%	95%
Boulder	large cobble	180	1	1%	96%
	very large cobble	256	2	2%	98%
	small boulder	362	0	0%	98%
	small boulder	512	2	2%	100%
Bedrock	medium boulder	1024	0	0%	100%
	large boulder	2048	0	0%	100%
Bedrock	bedrock	40096	0	0%	100%
TOTAL % of whole count			-	100	100%

Summary Data	
D50	26.2
D84	45.0
D95	90.0

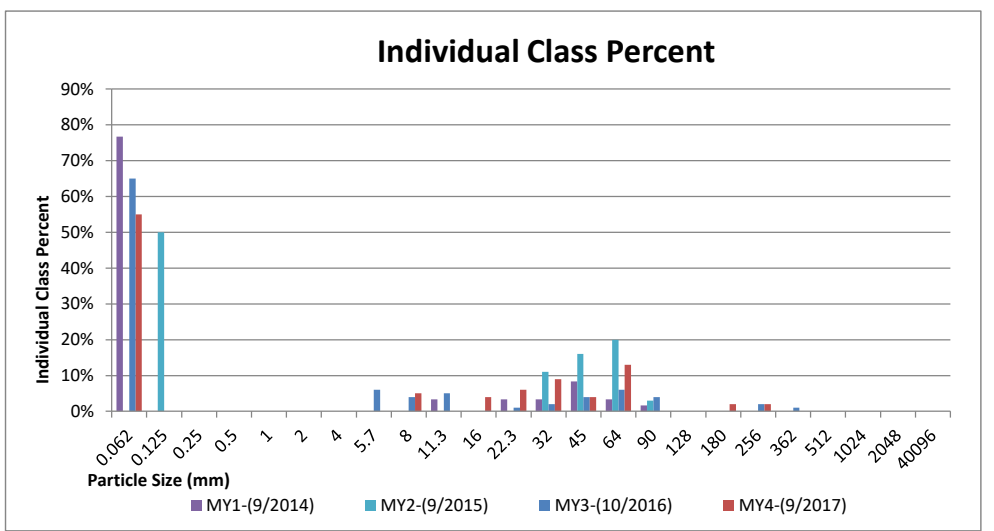
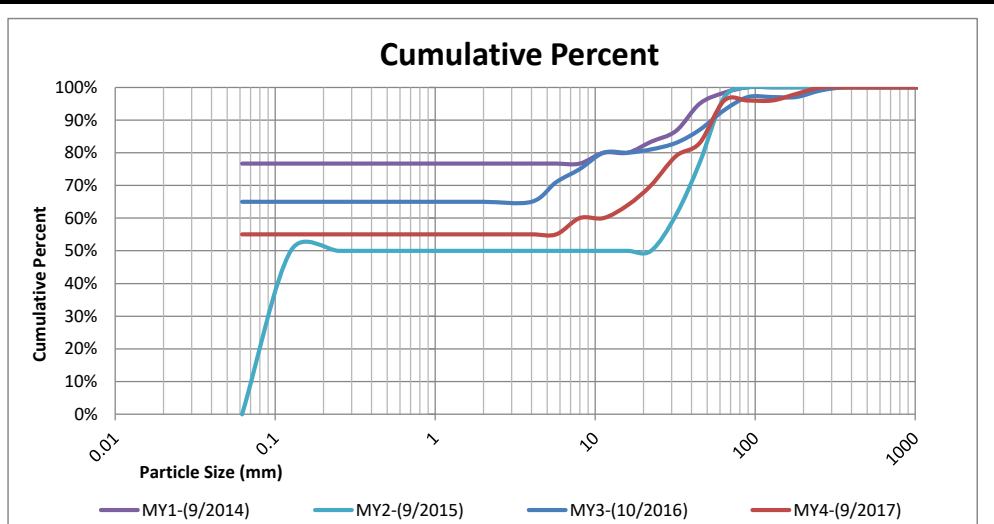


Appendix D: Stream Survey Data

Figure 5.14 Pebble Count Plots with Annual Overlays
Heath Dairy Stream Restoration/DMS Project No. 170
Monitoring Year 4

Project Name: Heath Dairy					
Reach: West Branch to Back Creek					
Feature: Pool (XS 21)					
MY4-(9/2017)					
Description	Material	Size (mm)	Total #	Item %	Cum %
Silt/Clay	silt/clay	0.062	55	55%	55%
Sand	very fine sand	0.125	0	0%	55%
	fine sand	0.250	0	0%	55%
	medium sand	0.50	0	0%	55%
	coarse sand	1.00	0	0%	55%
Gravel	very coarse sand	2.0	0	0%	55%
	very fine gravel	4.0	0	0%	55%
	fine gravel	5.7	0	0%	55%
	fine gravel	8.0	5	5%	60%
	medium gravel	11.3	0	0%	60%
	medium gravel	16.0	4	4%	64%
	course gravel	22.3	6	6%	70%
	course gravel	32.0	9	9%	79%
Cobble	very coarse gravel	45	4	4%	83%
	very coarse gravel	64	13	13%	96%
	small cobble	90	0	0%	96%
	medium cobble	128	0	0%	96%
Boulder	large cobble	180	2	2%	98%
	very large cobble	256	2	2%	100%
	small boulder	362	0	0%	100%
	small boulder	512	0	0%	100%
Boulder	medium boulder	1024	0	0%	100%
	large boulder	2048	0	0%	100%
	large boulder	2048	0	0%	100%
Bedrock	bedrock	40096	0	0%	100%
TOTAL % of whole count			-	100	100%

Summary Data	
D50	<.062
D84	46.5
D95	62.5

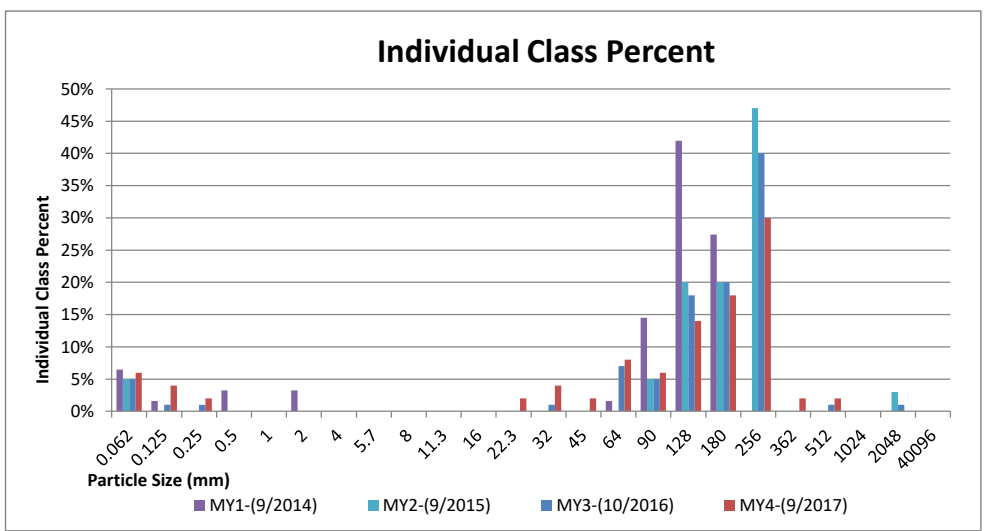
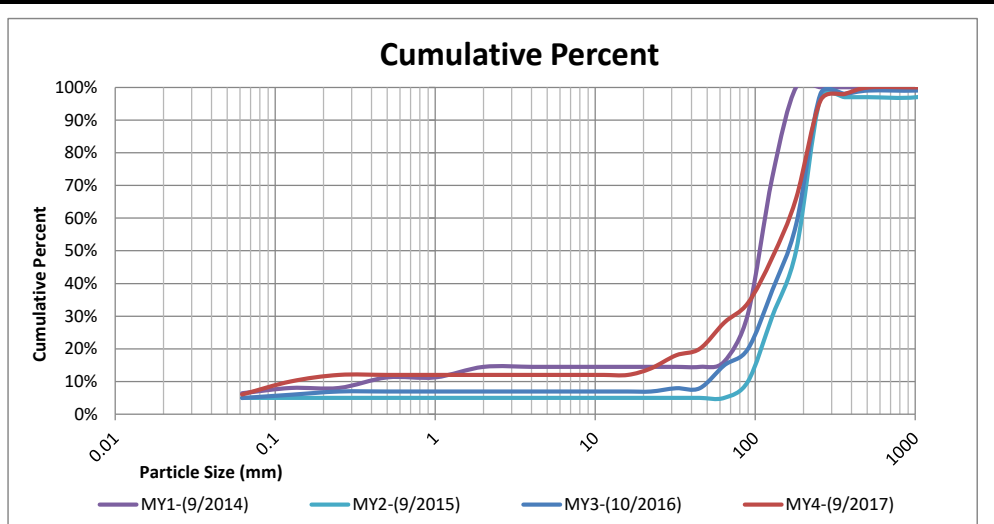


Appendix D: Stream Survey Data

Figure 5.15 Pebble Count Plots with Annual Overlays
Heath Dairy Stream Restoration/DMS Project No. 170
Monitoring Year 4

Project Name: Heath Dairy					
Reach: West Branch to Back Creek					
Feature: Riffle (XS 22)					
MY4-(9/2017)					
Description	Material	Size (mm)	Total #	Item %	Cum %
Silt/Clay	silt/clay	0.062	6	6%	6%
Sand	very fine sand	0.125	4	4%	10%
	fine sand	0.250	2	2%	12%
	medium sand	0.50	0	0%	12%
	coarse sand	1.00	0	0%	12%
	very coarse sand	2.0	0	0%	12%
Gravel	very fine gravel	4.0	0	0%	12%
	fine gravel	5.7	0	0%	12%
	fine gravel	8.0	0	0%	12%
	medium gravel	11.3	0	0%	12%
	medium gravel	16.0	0	0%	12%
	course gravel	22.3	2	2%	14%
	course gravel	32.0	4	4%	18%
	very coarse gravel	45	2	2%	20%
	very coarse gravel	64	8	8%	28%
Cobble	small cobble	90	6	6%	34%
	medium cobble	128	14	14%	48%
	large cobble	180	18	18%	66%
	very large cobble	256	30	30%	96%
Boulder	small boulder	362	2	2%	98%
	small boulder	512	2	2%	100%
	medium boulder	1024	0	0%	100%
	large boulder	2048	0	0%	100%
Bedrock	bedrock	40096	0	0%	100%
TOTAL % of whole count			-	100	100%

Summary Data	
D50	133.8
D84	225.6
D95	253.5

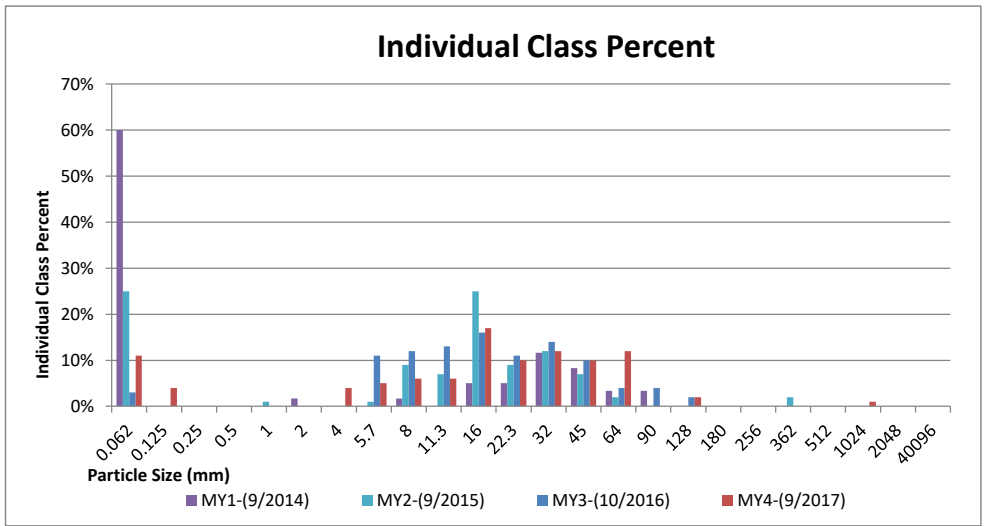
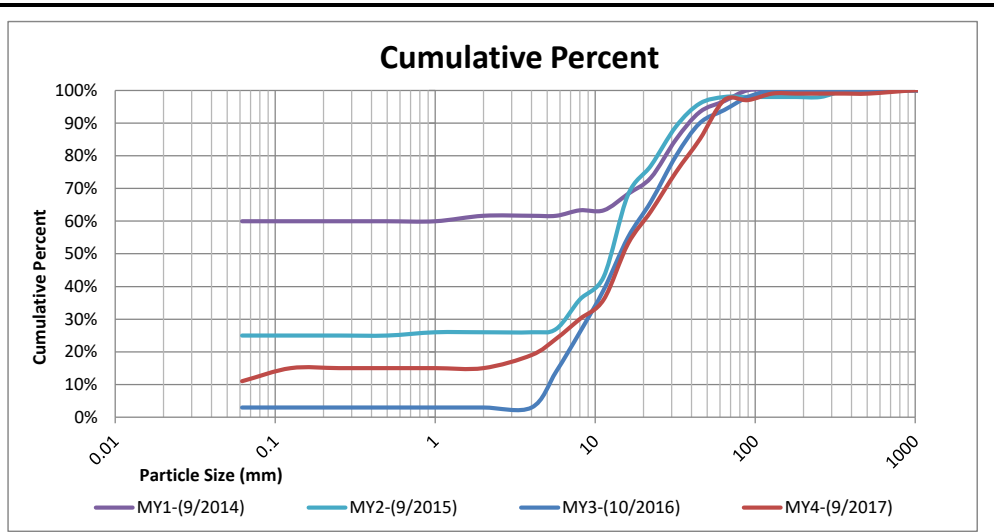


Appendix D: Stream Survey Data

Figure 5.16 Pebble Count Plots with Annual Overlays
Heath Dairy Stream Restoration/DMS Project No. 170
Monitoring Year 4

Project Name: Heath Dairy					
Reach: North Branch to Back Creek					
Feature: Riffle (XS 24)					
MY4-(9/2017)					
Description	Material	Size (mm)	Total #	Item %	Cum %
Silt/Clay	silt/clay	0.062	11	11%	11%
Sand	very fine sand	0.125	4	4%	15%
	fine sand	0.250	0	0%	15%
	medium sand	0.50	0	0%	15%
	coarse sand	1.00	0	0%	15%
	very coarse sand	2.0	0	0%	15%
Gravel	very fine gravel	4.0	4	4%	19%
	fine gravel	5.7	5	5%	24%
	fine gravel	8.0	6	6%	30%
	medium gravel	11.3	6	6%	36%
	medium gravel	16.0	17	17%	53%
	course gravel	22.3	10	10%	63%
	course gravel	32.0	12	12%	75%
	very coarse gravel	45	10	10%	85%
	very coarse gravel	64	12	12%	97%
Cobble	small cobble	90	0	0%	97%
	medium cobble	128	2	2%	99%
	large cobble	180	0	0%	99%
	very large cobble	256	0	0%	99%
Boulder	small boulder	362	0	0%	99%
	small boulder	512	0	0%	99%
	medium boulder	1024	1	1%	100%
	large boulder	2048	0	0%	100%
Bedrock	bedrock	40096	0	0%	100%
TOTAL % of whole count			-	100	100%

Summary Data	
D50	15.2
D84	43.7
D95	60.8

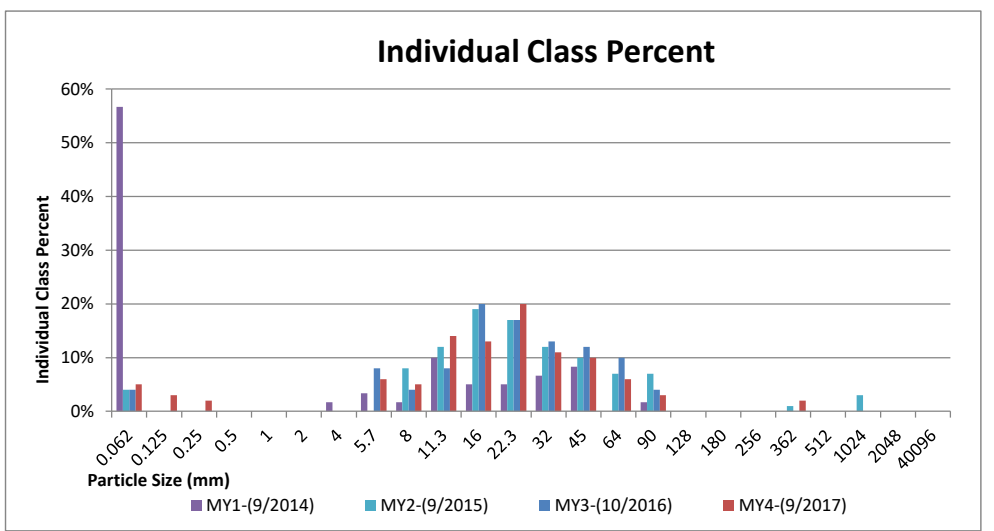
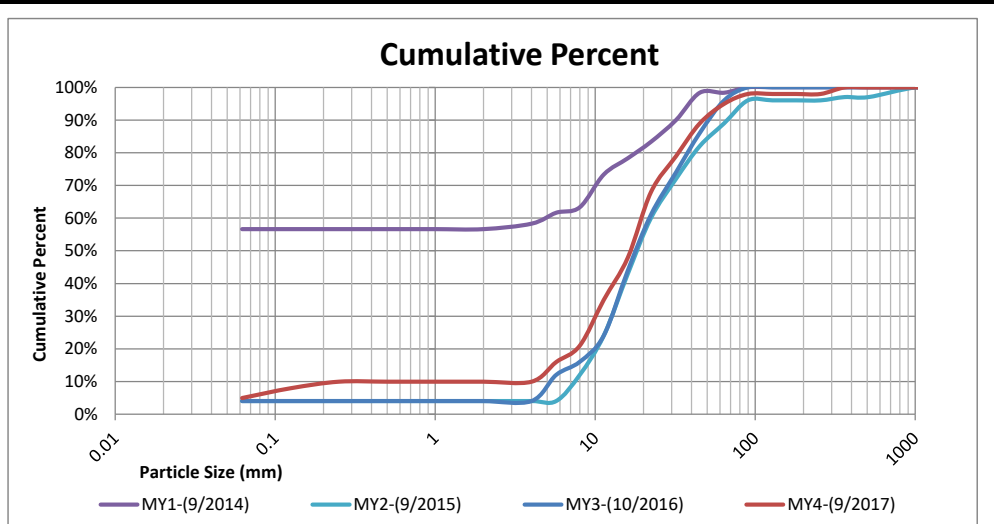


Appendix D: Stream Survey Data

Figure 5.17 Pebble Count Plots with Annual Overlays
Heath Dairy Stream Restoration/DMS Project No. 170
Monitoring Year 4

Project Name: Heath Dairy					
Reach: North Branch to Back Creek					
Feature: Riffle (XS 25)					
MY4-(9/2017)					
Description	Material	Size (mm)	Total #	Item %	Cum %
Silt/Clay	silt/clay	0.062	5	5%	5%
Sand	very fine sand	0.125	3	3%	8%
	fine sand	0.250	2	2%	10%
	medium sand	0.50	0	0%	10%
	coarse sand	1.00	0	0%	10%
Gravel	very coarse sand	2.0	0	0%	10%
	very fine gravel	4.0	0	0%	10%
	fine gravel	5.7	6	6%	16%
	fine gravel	8.0	5	5%	21%
	medium gravel	11.3	14	14%	35%
	medium gravel	16.0	13	13%	48%
	course gravel	22.3	20	20%	68%
	course gravel	32.0	11	11%	79%
Cobble	very coarse gravel	45	10	10%	89%
	very coarse gravel	64	6	6%	95%
	small cobble	90	3	3%	98%
	medium cobble	128	0	0%	98%
Boulder	large cobble	180	0	0%	98%
	very large cobble	256	0	0%	98%
	small boulder	362	2	2%	100%
	small boulder	512	0	0%	100%
Boulder	medium boulder	1024	0	0%	100%
	large boulder	2048	0	0%	100%
	large boulder	2048	0	0%	100%
Bedrock	bedrock	40096	0	0%	100%
TOTAL % of whole count			-	100	100%

Summary Data	
D50	16.6
D84	38.5
D95	64.0

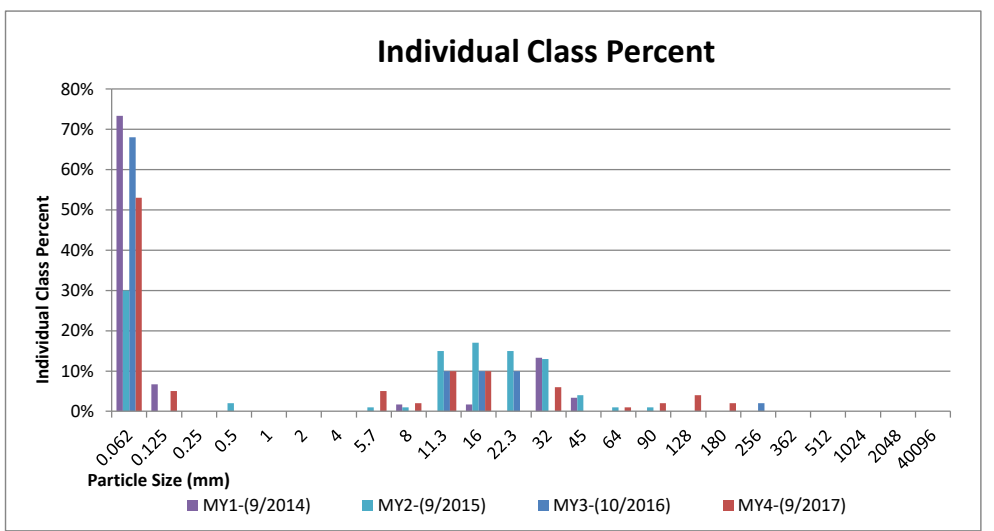
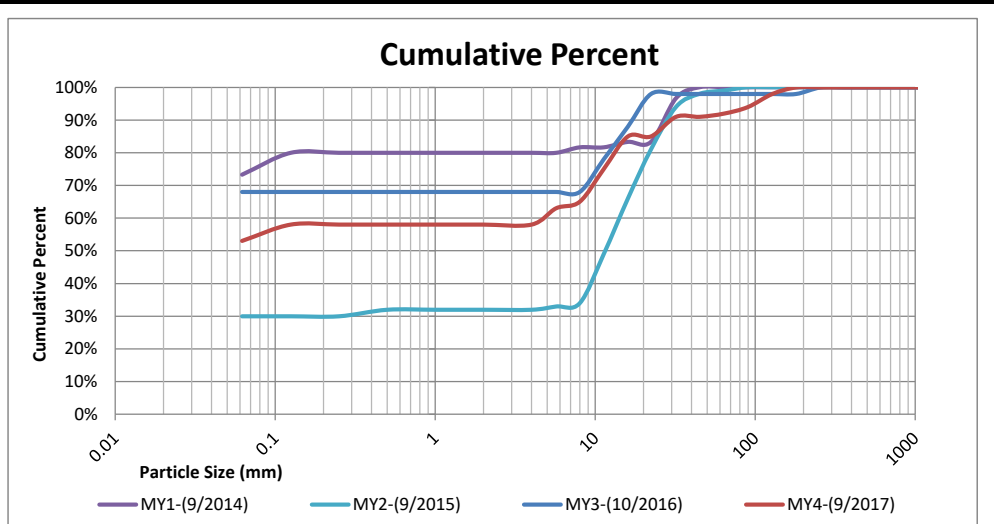


Appendix D: Stream Survey Data

Figure 5.18 Pebble Count Plots with Annual Overlays
Heath Dairy Stream Restoration/DMS Project No. 170
Monitoring Year 4

Project Name: Heath Dairy					
Reach: East Branch to Back Creek					
Feature: Pool (XS 26)					
MY4-(9/2017)					
Description	Material	Size (mm)	Total #	Item %	Cum %
Silt/Clay	silt/clay	0.062	53	53%	53%
Sand	very fine sand	0.125	5	5%	58%
	fine sand	0.250	0	0%	58%
	medium sand	0.50	0	0%	58%
	coarse sand	1.00	0	0%	58%
	very coarse sand	2.0	0	0%	58%
Gravel	very fine gravel	4.0	0	0%	58%
	fine gravel	5.7	5	5%	63%
	fine gravel	8.0	2	2%	65%
	medium gravel	11.3	10	10%	75%
	medium gravel	16.0	10	10%	85%
	course gravel	22.3	0	0%	85%
	course gravel	32.0	6	6%	91%
	very coarse gravel	45	0	0%	91%
Cobble	very coarse gravel	64	1	1%	92%
	small cobble	90	2	2%	94%
	medium cobble	128	4	4%	98%
	large cobble	180	2	2%	100%
Boulder	very large cobble	256	0	0%	100%
	small boulder	362	0	0%	100%
	small boulder	512	0	0%	100%
	medium boulder	1024	0	0%	100%
Bedrock	large boulder	2048	0	0%	100%
	bedrock	40096	0	0%	100%
TOTAL % of whole count			-	100	100%

Summary Data	
D50	<.062
D84	15.5
D95	99.5

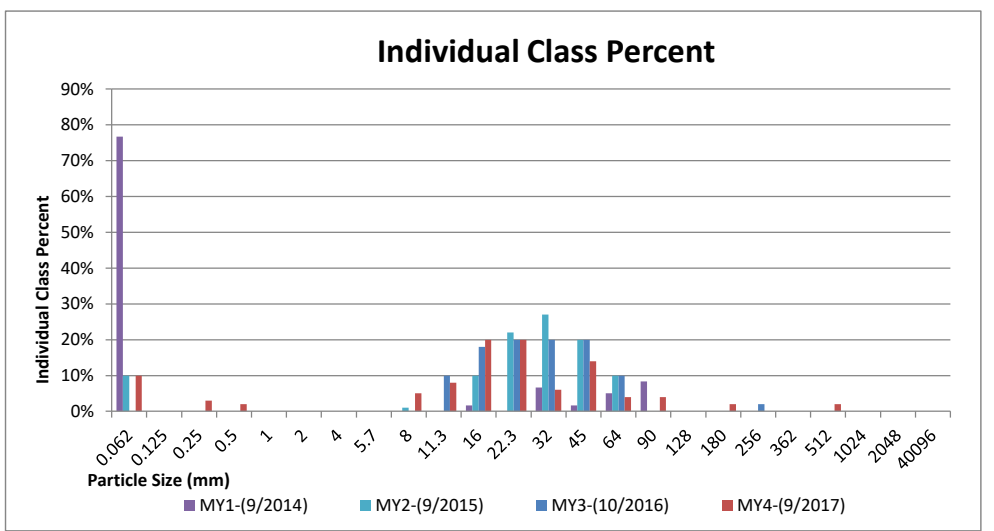
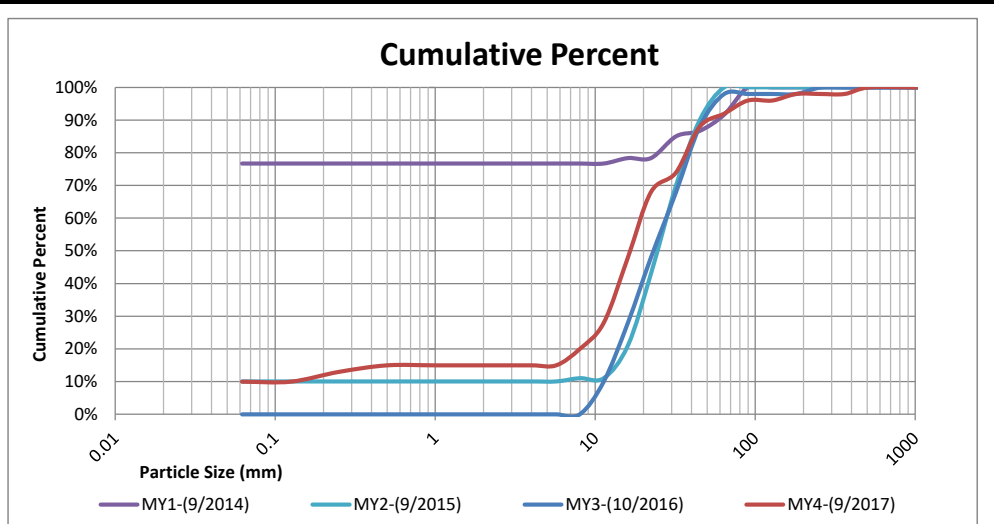


Appendix D: Stream Survey Data

Figure 5.19 Pebble Count Plots with Annual Overlays
Heath Dairy Stream Restoration/DMS Project No. 170
Monitoring Year 4

Project Name: Heath Dairy					
Reach: East Branch to Back Creek					
Feature: Riffle (XS 27)					
MY4-(9/2017)					
Description	Material	Size (mm)	Total #	Item %	Cum %
Silt/Clay	silt/clay	0.062	10	10%	10%
Sand	very fine sand	0.125	0	0%	10%
	fine sand	0.250	3	3%	13%
	medium sand	0.50	2	2%	15%
	coarse sand	1.00	0	0%	15%
	very coarse sand	2.0	0	0%	15%
Gravel	very fine gravel	4.0	0	0%	15%
	fine gravel	5.7	0	0%	15%
	fine gravel	8.0	5	5%	20%
	medium gravel	11.3	8	8%	28%
	medium gravel	16.0	20	20%	48%
	course gravel	22.3	20	20%	68%
	course gravel	32.0	6	6%	74%
	very coarse gravel	45	14	14%	88%
	very coarse gravel	64	4	4%	92%
Cobble	small cobble	90	4	4%	96%
	medium cobble	128	0	0%	96%
	large cobble	180	2	2%	98%
	very large cobble	256	0	0%	98%
Boulder	small boulder	362	0	0%	98%
	small boulder	512	2	2%	100%
	medium boulder	1024	0	0%	100%
	large boulder	2048	0	0%	100%
Bedrock	bedrock	40096	0	0%	100%
TOTAL % of whole count			-	100	100%

Summary Data	
D50	16.6
D84	41.3
D95	83.5



Appendix D: Stream Survey Data

Figure 5.20 Pebble Count Plots with Annual Overlays
Heath Dairy Stream Restoration/DMS Project No. 170
Monitoring Year 4

Project Name: Heath Dairy					
Reach: East Branch to Back Creek					
Feature: Riffle (XS 28)					
MY4-(9/2017)					
Description	Material	Size (mm)	Total #	Item %	Cum %
Silt/Clay	silt/clay	0.062	4	4%	4%
Sand	very fine sand	0.125	4	4%	8%
	fine sand	0.250	0	0%	8%
	medium sand	0.50	4	4%	12%
	coarse sand	1.00	0	0%	12%
Gravel	very coarse sand	2.0	0	0%	12%
	very fine gravel	4.0	0	0%	12%
	fine gravel	5.7	5	5%	17%
	fine gravel	8.0	10	10%	27%
	medium gravel	11.3	10	10%	37%
	medium gravel	16.0	15	15%	52%
	course gravel	22.3	18	18%	70%
	course gravel	32.0	10	10%	80%
Cobble	very coarse gravel	45	10	10%	90%
	very coarse gravel	64	4	4%	94%
	small cobble	90	4	4%	98%
	medium cobble	128	1	1%	99%
Boulder	large cobble	180	0	0%	99%
	very large cobble	256	1	1%	100%
	small boulder	362	0	0%	100%
	small boulder	512	0	0%	100%
Bedrock	medium boulder	1024	0	0%	100%
	large boulder	2048	0	0%	100%
	bedrock	40096	0	0%	100%
TOTAL % of whole count			-	100	100%

Summary Data	
D50	15.4
D84	37.2
D95	70.5

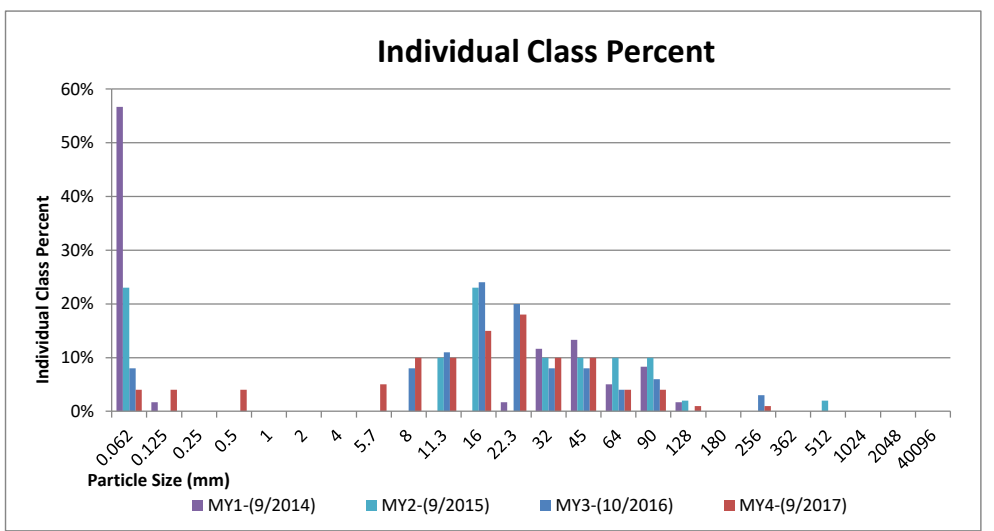
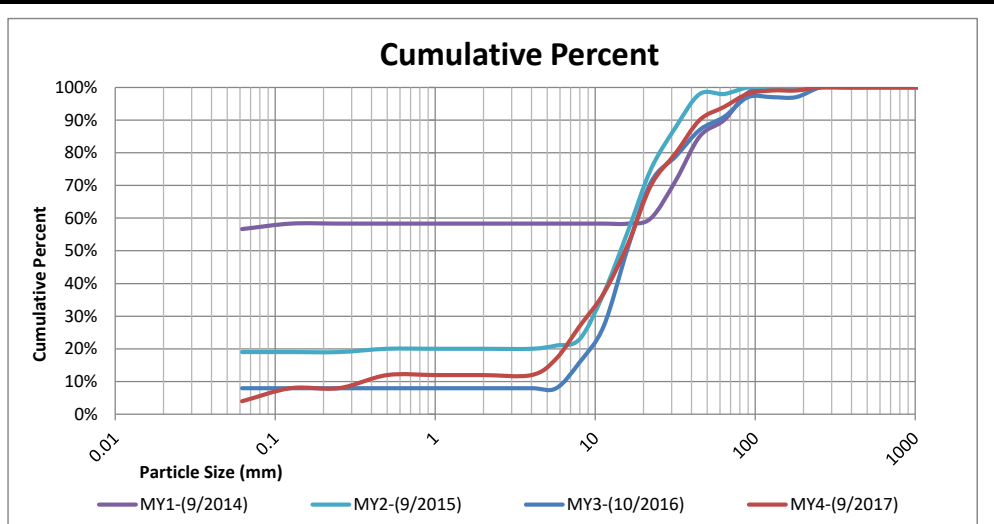


Table 9.1 Baseline Stream Data Summary

Stream Reach	Existing Conditions	Reference Reach	Design			Existing Conditions	Reference Reach	Design	Reference Reach	Design	
	Back Creek Upper	Fork Creek	Back Cr. Reach 1*	Back Cr. Reach 2*	Back Cr. Reach 3*	Back Creek Lower	UT to Polecat Cr.	Back Creek Reach 4*	Fork Creek	Back Cr. Reach 4b*	Back Cr. Reach 5*
Stream Type	G4	B4c	B4c	B4c	B4c	E4	E4	E4	B4c	B4c	B4c
Drainage Area (mi ²)	0.94	2.2	1.04	1.08	1.22	2.5	0.4	1.3	2.2	1.34	2.69
Bankfull Width (ft)	10.1	20.1	16.5	16.6	17.5	13.8	9.4	16.5	20.1	17.5	22.5
Mean Depth (ft)	1.68	1.73	1.2	1.2	1.3	3.07	1.13	1.4	1.73	1.2	1.6
Bankfull X _{AREA} (ft ²)	17	34.8	19	19	22	42.3	10.6	23	34.8	22	36
Bankfull Discharge (cfs)	75	163	86	88	101	167	37.4	101	163	101	174
Bkf Mean Velocity (ft/s)	4.4	4.7	4.5	4.5	4.5	3.9	3.5	3	4.7	3	4.5
Width/Depth Ratio	6	12	14	14	14	4.5	8.3	12	12	14	14
Max. Riffle Depth (ft)	2.4	2	1.6	1.6	1.7	4.1	1.6	2	2	1.7	2.2
Riffle Depth Ratio	1.4	1.2	1.3	1.3	1.3	1.3	1.4	1.45	1.2	1.4	1.4
Max. Pool Depth (ft)	2.8	2.6	2.4	2.5	2.6	5	1.6	3.5	2.6	2.6	3.3
Pool Depth Ratio	1.7	1.5	2	2	2	1.6	1.8	2.2	1.5	2.1	2.1
Flood Prone Width (ft)	29	63	30 – 45	28 – 77	34 – 120	200	50	200	63	35	45
Entrenchment Ratio	1.4 – 4.5	2.7 – 3.1	1.9 – 2.9	1.7 – 4.8	2.0 – 7.0	14.5	5.3	12.5	2.7 – 3.1	2	2
Bank Height Ratio	1.4 – 2.3	1.2	1	1	1	1.5	1.2	1	1.2	1	1
Meander Length (ft)	190	37 – 172	110 – 120	125 – 145	130 – 145	160	56 – 85	135 – 155	37 – 172	115	145
Meander Length Ratio	19	1.8 – 8.6	7.1 – 7.7	7.8 – 9.1	7.6 – 8.5	12	6 – 9	8.4 – 9.7	1.8 – 8.6	6.6	6.6
Radius of Curvature (ft)	18	47 – 318	31 – 46	32 – 48	34 – 51	15	19 – 50	32 – 48	47 – 318	35 – 52	44 – 66
Rc Ratio	1.8	2.3 – 16	2 – 3	2 – 3	2 – 3	1.1	2.0 – 5.3	2 – 3	2.3 – 16	2 – 3	2 – 3
Belt Width (ft)	25	33 – 40	30 – 35	40 – 50	45 – 60	23	28 – 50	90	33 – 40	40	60
Meander Width Ratio	2.5	1.6 – 2.0	1.9 – 2.2	2.5 – 3.1	2.6 – 3.5	1.7	3.0 – 5.3	5.6	1.6 – 2.0	2.3	2.7
Sinuosity	1	1.05	1.1	1.1	1.1	1	1.4	1.3	1.05	1.1	1.1
Channel Slope (ft/ft)	0.0087	0.0079	0.006	0.0062	0.0062	0.0045	0.012	0.0023	0.0079	0.0095	0.0095
Valley Slope (ft/ft)	0.0087	0.0083	0.0066	0.0068	0.0068	0.0045	0.017	0.003	0.0083	0.0105	0.0105
Riffle Slope (ft/ft)	0.023	0.013	0.006	0.0062	0.0062	0.0037	0.027	0.0023	0.013	0.0095	0.0095
Riffle Slope Ratio	2.6	0.1	1	1	1	0.8	2.3	1	0.1	1	1
Pool Slope (ft/ft)	0	0.001	0	0	0	0	0.017	0	0.001	0	0
Pool Slope Ratio	0	0.1	0	0	0	0	1.4	0	0.1	0	0
Pool Width (ft)	7.8	19.9	18.1	18.3	19.2	13.4	7.1	18.1	19.9	19.2	24.7
Pool Width Ratio	0.8	1	1.1	1.1	1.1	1	0.8	1.1	1	1.1	1.1
Pool Spacing (ft)	57.6	71 – 134	66 – 99	66 – 99	70 – 105	43	34 – 52	66 – 99	71 – 134	70 – 105	90 – 135
Pool Spacing Ratio	5.7	3.5 – 6.7	6-Apr	4 – 6	4 – 6	3.1	3.6 – 5.5	4 – 6	3.5 – 6.7	4 – 6	4 – 6
D ₅₀ (mm)	25	28	25	25	25	25	15	25	28	25	25
D ₈₄ (mm)	63	81	63	63	63	81	91	81	81	81	81

*See Restoration Plan dated 2009 for reach designations

Table 9.2 Baseline Stream Data Summary

Stream Reach	Existing Conditions	Reference Reach	Design	Existing Conditions	Reference Reach	Design	Existing Conditions	Reference Reach	Design		
	North Branch	Fork Creek	North Branch	East Branch	Fork Creek	East Branch	West Branch	Fork Creek	West Branch Reach 1*	West Branch Reach 2*	West Branch Reach 3*
Stream Type	E4	B4c	B4c	G4	B4c	B4c	G4	B4c	B4c	B4c	B4c
Drainage Area (mi ²)	2.5	2.2	1.14	0.05	2.2	0.25	0.05	2.2	0.05	0.06	0.14
Bankfull Width (ft)	13.8	20.1	16.5	5	20.1	10	5	20.1	5.8	6.2	8.2
Mean Depth (ft)	3.07	1.73	1.2	0.62	1.73	0.7	0.62	1.73	0.4	0.44	0.6
Bankfull XS _{AREA} (ft ²)	42.3	34.8	20	3.1	34.8	7	3.1	34.8	2.4	2.7	4.7
Bankfull Discharge (cfs)	167	163	92	8.5	163	30	8.5	163	9	10	19
Bkf Mean Velocity (ft/s)	3.9	4.7	4.5	2.7	4.7	4.5	2.7	4.7	4.5	4.5	4.5
Width/Depth Ratio	4.5	12	13	8	12	14	8	12	14	14	14
Max. Riffle Depth (ft)	4.1	2	1.7	0.8	2	1	0.8	2	0.55	0.6	0.8
Riffle Depth Ratio	1.3	1.2	1.4	1.3	1.2	1.4	1.3	1.2	1.38	1.36	1.36
Max. Pool Depth (ft)	5	2.6	2.6	1.4	2.6	1.5	1.4	2.6	0.8	0.9	1
Pool Depth Ratio	1.6	1.5	2.1	2.3	1.5	2.1	2.3	1.5	2	2	2
Flood Prone Width (ft)	200	63	40 – 57	5.8	63	26 – 42	5.8	63	12 – 22	12 – 30	16
Entrenchment Ratio	14.5	2.7 – 3.1	2.4 – 3.4	1.2	2.7 – 3.1	2.7 – 4.4	1.2	2.7 – 3.1	2.0 – 3.8	2.0 – 4.8	2
Bank Height Ratio	1.5	1.2	1	2.6	1.2	1	2.6	1.2	1	1	1
Meander Length (ft)	55	37 – 172	150 – 160	80	37 – 172	90	60 – 120	37 – 172	50 – 55	50 – 60	60 – 70
Meander Length Ratio	4	1.8 – 8.6	9.1 – 9.7	16	1.8 – 8.6	9.5	12 – 24	1.8 – 8.6	8.6 – 9.5	8.1 – 9.7	7.3 – 8.5
Radius of Curvature (ft)	13	47 – 318	33 – 49	9 – 43	47 – 318	21 – 31	9 – 43	47 – 318	12 – 17	12 – 19	16 – 25
Rc Ratio	1	2.3 – 16	2 – 3	1.8 – 8.6	2.3 – 16	2 – 3	1.8 – 8.6	2.3 – 16	2 – 3	2 – 3	2 – 3
Belt Width (ft)	35	33 – 40	40 – 50	16	33 – 40	25	20	33 – 40	15 – 20	15 – 20	25 – 30
Meander Width Ratio	2.5	1.6 – 2.0	2.4 – 3.0	3.2	1.6 – 2.0	2.6	4	1.6 – 2.0	2.6 – 3.4	2.4 – 3.2	3.1 – 3.7
Sinuosity	1	1.05	1.1	1.05	1.05	1.1	1.07	1.05	1.1	1.2	1.1
Channel Slope (ft/ft)	0.0045	0.0079	0.0036	0.011	0.0079	0.008	0.011	0.0079	0.0128	0.0174	0.00108
Valley Slope (ft/ft)	0.0045	0.0083	0.004	0.012	0.0083	0.0088	0.019	0.0083	0.0141	0.0209	0.00119
Riffle Slope (ft/ft)	0.0037	0.013	0.0036	0.31	0.013	0.008	0.31	0.013	0.0128	0.0174	0.0108
Riffle Slope Ratio	0.8	0.1	1	28	0.1	1	28	0.1	1	1	1
Pool Slope (ft/ft)	0	0.001	0	0	0.001	0	0	0.001	0	0	0
Pool Slope Ratio	0	0.1	0	0	0.1	0	0	0.1	0	0	0
Pool Width (ft)	13.4	19.9	16.5	4.4	19.9	11	4.4	19.9	6.4	6.8	9
Pool Width Ratio	1	1	1	0.9	1	1.1	0.9	1	1.1	1.1	1.1
Pool Spacing (ft)	43	71 – 134	66 – 99	9 – 45	71 – 134	40 – 60	9 – 45	71 – 134	23 – 35	25 – 37	32 – 49
Pool Spacing Ratio	3.1	3.5 – 6.7	4 – 6	2 – 9	3.5 – 6.7	4 – 6	2 – 9	3.5 – 6.7	4 – 6	4 – 6	4 – 6
D ₅₀ (mm)	25	28	25	9	28	25	9	28	9	9	9
D ₈₄ (mm)	81	81	81	19	81	81	19	81	19	19	19

*See Restoration Plan dated 2009 for reach designations

Table 10.1 Monitoring – Cross Section Morphology

Morphology and Hydraulic Monitoring Summary (Dimensional Parameters – Cross Sections)																																			
Heath Dairy Road Stream Restoration/DMS # 170 Segment/Reach: Back Creek XS1 - 10																																			
Based on fixed baseline bankfull elevation	Cross Section 1 (Pool)							Cross Section 2 (Riffle)							Cross Section 3 (Riffle)							Cross Section 4 (Pool)							Cross Section 5 (Pool)						
	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+
Bankfull Width (ft)	21.8	14.3	17.7	20.3	20.8			16.9	13.8	15.6	16.7	17.0			15.3	13.6	29.6	34.8	15.3			15.0	20.2	17.8	19.0	15.0			18.3	16.2	14.5	14.9	14.4		
Floodprone Width (ft)	32.0	32.0	32.0	32.0	32.0			26.0	25.3	26.0	26.0	26.0			100.0	100.0	100.0	100.0	100.0			100.0	100.0	100.0	100.0	100.0			50.0	50.0	50.0	50.0	50.0		
Bankfull Mean Depth (ft)	1.5	1.1	1.3	1.3	1.4			1.0	0.8	0.9	1.0	0.9			1.6	1.6	1.1	1.0	2.0			1.7	1.9	1.7	1.5	1.6			1.6	2.2	2.0	2.1	2.3		
Bankfull Max Depth (ft)	2.4	1.5	1.6	2.0	2.5			1.4	1.0	1.3	1.6	1.4			2.4	2.8	3.0	3.3	3.1			2.7	2.9	2.9	2.7	2.6			2.8	3.3	3.3	3.3	3.3		
Bankfull Cross Sectional Area (ft ²)	32.0	16.1	22.1	26.9	29.8			17.0	10.4	14.1	16.0	14.7			24.6	21.4	32.8	34.1	31.2			25.3	37.7	30.3	27.8	24.6			29.3	34.9	29.8	31.1	33.8		
Bankfull Width/Depth Ratio	14.8	12.7	14.2	15.3	14.5			16.7	18.1	17.4	17.5	19.6			9.5	8.6	26.6	35.6	7.5			8.9	10.8	10.4	12.9	9.1			11.4	7.5	7.1	7.2	6.1		
Bankfull Entrenchment Ratio	2.2	2.3	1.8	1.6	1.5			2.4	1.8	1.7	1.6	1.5			6.6	7.3	3.4	2.9	6.5			6.7	5.0	5.6	5.3	6.7			2.7	8.2	3.4	3.4	3.5		
Bankfull Bank Height Ratio			0.7	1.2	1.0					0.8	0.8	1.1					1.0	0.8	1.0					1.0	1.0	1.0					1.0	0.9	1.0		
d50 (mm)		0.05	16	30	17.1					30.8	16	45	39.6			34.5	22	38	21.4				0.06	0.06	1	0.4			NA	NA	NA	NA			
Based on fixed baseline bankfull elevation	Cross Section 6 (Riffle)							Cross Section 7 (Pool)							Cross Section 8 (Riffle)							Cross Section 9 (Pool)							Cross Section 10 (Riffle)						
	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+
Bankfull Width (ft)	14.3	14.8	15.1	13.8	14.2			18.8	19.5	23.1	16.8	15.9			26.3	21.3	22.6	21.5	21.9			20.7	22.5	21.3	21.8	21.3			22.9	15.7	37.5	35.5	22.5		
Floodprone Width (ft)	75.0	75.0	75.0	75.0	75.0			100.0	100.0	100.0	100.0	100.0			100.0	100.0	100.0	100.0	100.0			100.0	100.0	100.0	100.0	100.0			100.0	100.0	100.0	100.0	100.0		
Bankfull Mean Depth (ft)	0.9	1.0	0.9	0.8	0.8			1.6	1.9	1.5	1.9	2.3			1.0	1.2	0.6	0.8	1.4			1.8	2.3	2.1	2.0	2.0			1.1	1.1	0.8	0.7	1.1		
Bankfull Max Depth (ft)	1.3	1.7	1.4	1.5	1.5			3.1	3.0	3.2	2.6	3.4			2.2	1.7	2.0	1.9	2.4			2.8	3.7	3.5	3.3	3.2			1.8	1.4	2.0	1.8	1.9		
Bankfull Cross Sectional Area (ft ²)	12.4	14.9	13.7	11.5	10.9			29.9	37.2	35.4	31.3	36.9			25.6	26.2	32.2	31.2	30.5			37.4	52.2	44.7	42.8	42.8			25.1	16.6	28.4	25.5	23.9		
Bankfull Width/Depth Ratio	16.4	14.6	16.6	16.5	18.5			11.8	10.3	15.1	9.0	6.9			27.3	17.3	85.8	55.1	15.7			11.4	9.7	10.2	11.1	10.6			20.8	14.8	49.7	49.4	21.2		
Bankfull Entrenchment Ratio	5.3	5.0	5.0	5.4	5.3			5.3	5.1	4.3	6.0	6.3			3.8	4.7	1.9	2.4	4.6			4.8	4.4	4.7	4.6	4.7			4.4	6.4	2.7	2.8	4.4		
Bankfull Bank Height Ratio			1.0	0.9	1.1					0.7	1.1	0.8					1.0	1.0	0.9					1.0	1.0	1.0					0.9	1.0	1.0		
d50 (mm)		0.05	0.1	21	21.3				NA	NA	NA	NA				0.05	5	18	21				0.06	0.6	7	5.3			0.05	9	26	28.1			

Table 10.2 Monitoring – Cross Section Morphology

Morphology and Hydraulic Monitoring Summary (Dimensional Parameters – Cross Sections)																																			
Heath Dairy Road Stream Restoration/DMS # 170 Segment/Reach: Back Creek XS11-16; West Branch XS17-20																																			
Based on fixed baseline bankfull elevation	Cross Section 11 (Pool)							Cross Section 12 (Riffle)							Cross Section 13 (Pool)							Cross Section 14 (Riffle)							Cross Section 15 (Pool)						
	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+
Bankfull Width (ft)	22.55	16.96	18.41	16.81	16.9			18.44	17.94	19.55	18.25	17.5			20.02	16.42	18.45	16.42	14.8			17.3	15.48	17.89	19.3	17			16.12	13.76	15.21	11.79	14.1		
Floodprone Width (ft)	100	100	100	100	100			100	100	100	100	100			100	100	100	100	100			70	70	70	70	70			100	100	100	100	100		
Bankfull Mean Depth (ft)	1.51	1.69	1.633	1.864	1.485			1.28	1.26	1.185	1.268	1.198			1.43	1.93	1.657	1.897	2.173			1.54	1.19	1.146	1.148	1.167			1.81	1.99	1.827	2.196	2.054		
Bankfull Max Depth (ft)	2.91	2.94	2.918	3.079	2.094			1.78	1.73	1.68	1.724	1.85			2.69	2.81	2.94	2.827	3.09			2.39	1.92	1.969	2.092	1.94			3.96	3.38	2.984	3.19	3.17		
Bankfull Cross Sectional Area (ft ²)	34.05	28.68	30.07	31.34	25.1			23.57	22.69	23.16	23.14	20.96			28.58	31.75	30.56	31.15	32.16			26.6	18.37	20.5	22.16	19.83			29.14	27.4	27.79	25.9	28.97		
Bankfull Width/Depth Ratio	14.93	10.04	11.27	9.021	11.38			14.41	14.24	16.5	14.39	14.61			14	8.51	11.14	8.658	6.81			11.23	13.01	15.61	16.81	14.57			8.91	6.91	8.321	5.368	6.864		
Bankfull Entrenchment Ratio	4.43	5.9	5.431	5.95	5.917			5.42	5.6	5.115	5.48	5.714			4.99	6	5.421	6.09	6.757			4.00	4.5	3.914	3.63	4.118			6.20	7.3	6.576	8.48	7.092		
Bankfull Bank Height Ratio			0.976	0.99	0.864					0.875	0.959	1.022					0.663	0.995	0.812					0.998	1.065	0.845					1.047	1.178	1.142		
d50 (mm)		NA	NA	NA	NA				0.06	11	15	15				NA	NA	NA	NA				0.06	8	18	8.6				NA	NA	NA	NA		
Based on fixed baseline bankfull elevation	Cross Section 16 (Pool)							Cross Section 17 (Riffle)							Cross Section 18 (Pool)							Cross Section 19 (Riffle)							Cross Section 20 (Riffle)						
	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+
Bankfull Width (ft)	18.22	16.95	17.59	17.93	18			6.65	4.96	7.67	8.511	6.5			6.86	5.82	9.961	7.492	8.5			6.7	6.23	14.57	6.351	6.9			8.79	7.74	12.23	11.66	9.5		
Floodprone Width (ft)	57	57	60	60	60			20	20	20	20	20			26	26	30	30	30				27.7	30	30	30				29	30	30.00	30		
Bankfull Mean Depth (ft)	2.34	2.53	2.31	2.499	2.505			0.62	0.97	0.966	0.951	1.232			0.58	0.6	0.544	0.576	0.484			0.59	0.47	0.274	0.503	0.722			0.78	0.58	0.317	0.49	0.701		
Bankfull Max Depth (ft)	3.12	3.22	2.964	3.075	3.82			0.99	1.22	1.69	1.53	1.8			0.92	1.03	1.09	1.003	0.81			0.83	0.62	0.588	0.67	0.78			1.01	0.75	0.852	0.97	1.18		
Bankfull Cross Sectional Area (ft ²)	42.73	42.85	40.64	44.8	45.09			4.11	4.82	7.407	8.094	8.01			3.97	3.51	5.422	4.317	4.11			3.98	2.91	3.998	3.192	4.98			6.83	4.53	7.047	5.76	6.66		
Bankfull Width/Depth Ratio	7.79	6.7	7.615	7.176	7.186			10.73	5.1	7.943	8.948	5.275			11.83	9.7	18.3	13	17.58			11.36	13.26	53.08	12.64	9.56			11.27	13.34	70.14	23.57	13.55		
Bankfull Entrenchment Ratio	3.13	3.4	3.411	3.35	3.333			3.69	4.22	2.608	2.35	3.077			3.78	4.43	3.012	4.004	3.529			6.00	4.45	2.059	4.723	4.348			4.53	3.71	1.349	2.57	3.158		
Bankfull Bank Height Ratio			1.082	0.997	1.031					0.817	0.614	0.939					1	0.98	0.815					1.019	1.188	1.154				0.771	1.00	1.059			
d50 (mm)		0.03	3	5	1.8				NA	NA	NA	NA				NA	NA	NA	NA				113	80	100	90				45	30	30	26.2		

Appendix E: Hydrologic Data

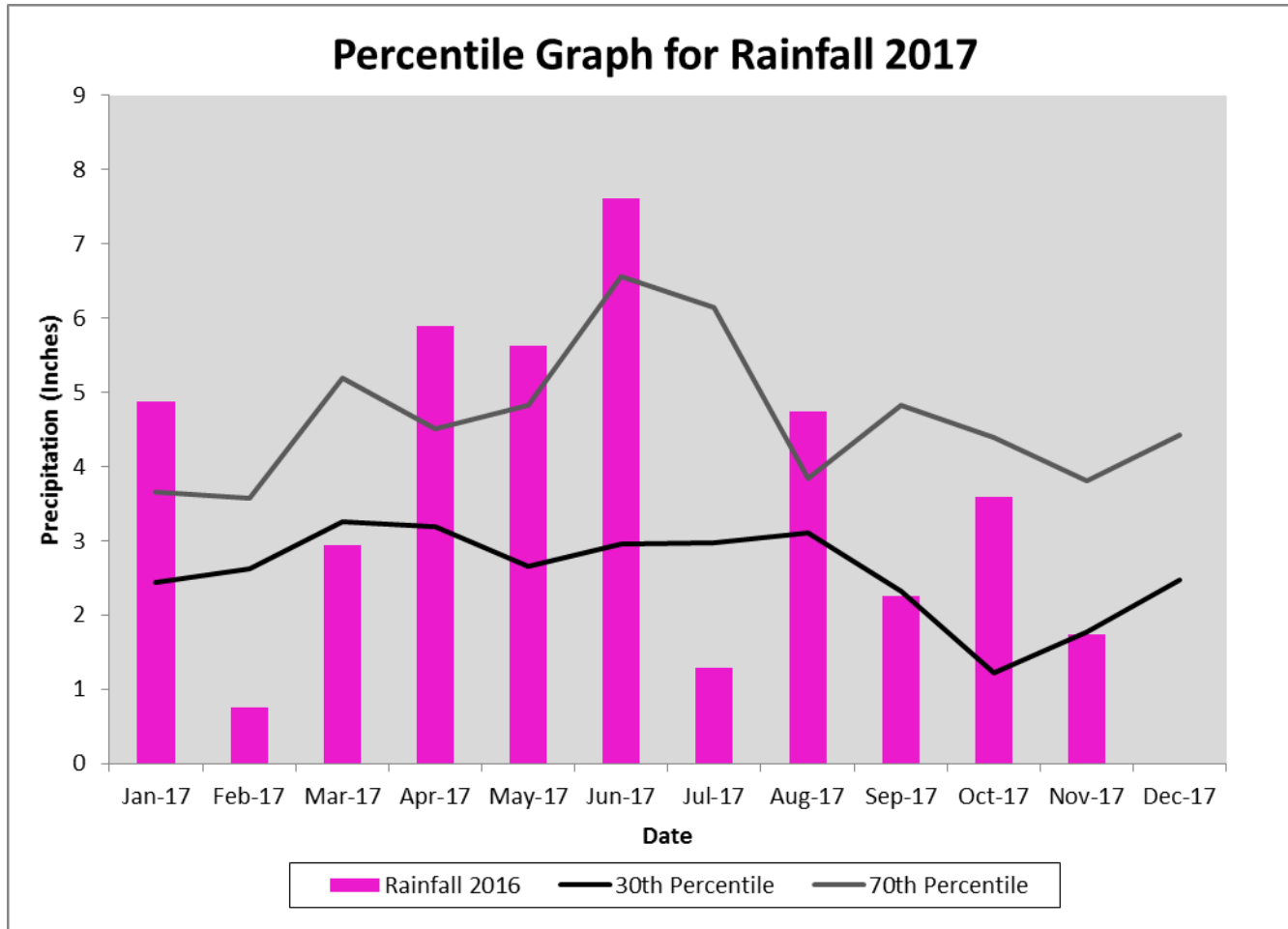
Table 12. Verification of Bankfull Events

Date of Collection	Date of occurrence	Method and Location	Photo (If Available)	Feet Above Bankfull
Sep-15	May-Sept/2015	CSG on Main Trib	NA	0.4
Nov-15	11/9/2015	HOBO on North Trib	NA	0.7
Dec-15	12/22/2015	HOBO on North Trib	NA	6.8
Dec-15	12/30/2015	HOBO on North Trib	NA	6.5
Feb-16	2/16/2016	HOBO on North Trib	NA	0.4
Feb-16	2/24/2016	HOBO on North Trib	NA	2
Aug-16	8/8/2016	HOBO on North Trib	NA	1.4
Oct-16	Summer-Fall 2016	CSG on Main Trib	NA	1.4
Sep-17	Summer-Fall 2017	CSG on Main Trib	Below	2.5
Sep-17	4/25/2017; 6/20/2017	HOBO on North Trib	NA	>2

Downstream Crest Stage Gauge, September 2017

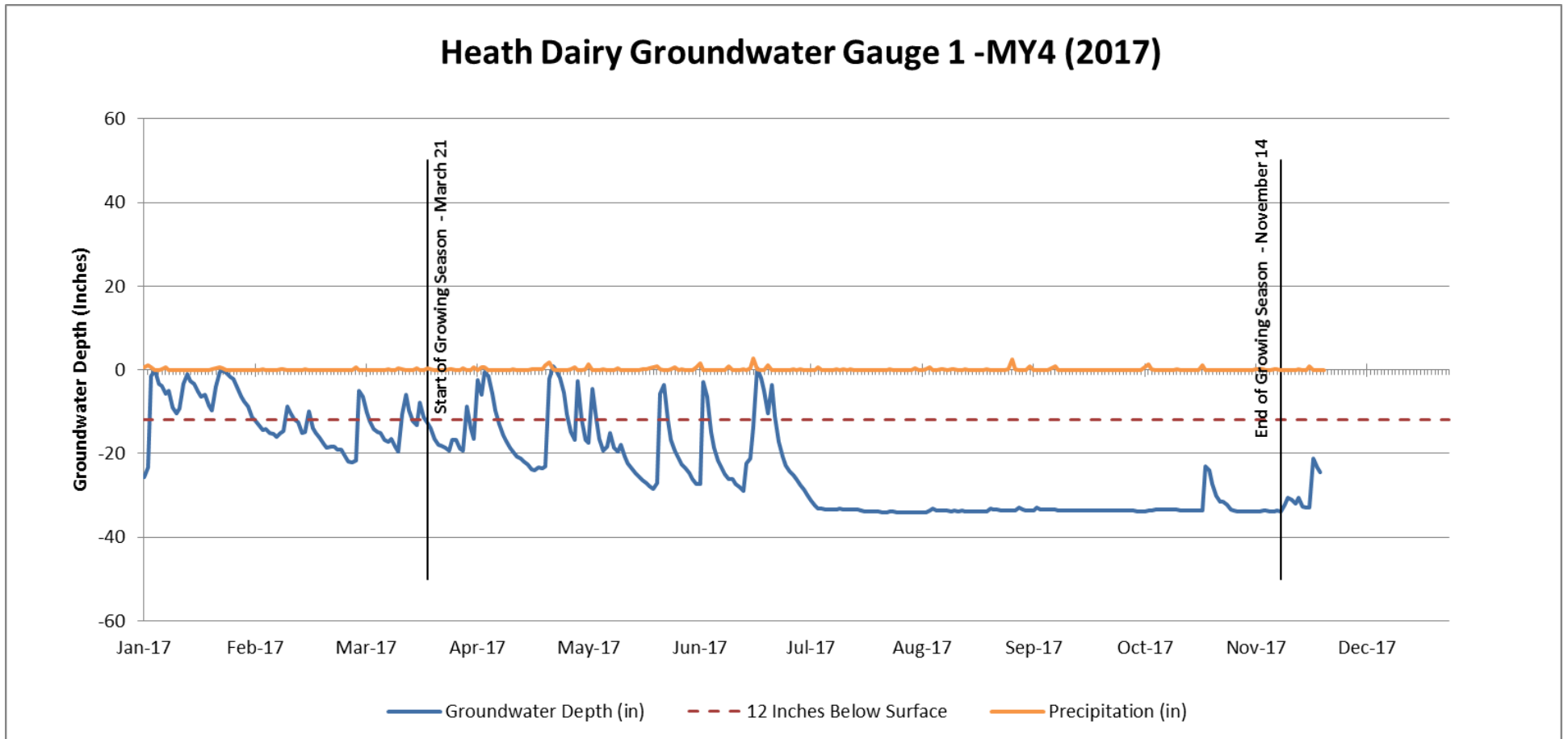


Figure 6. Rainfall Percentile



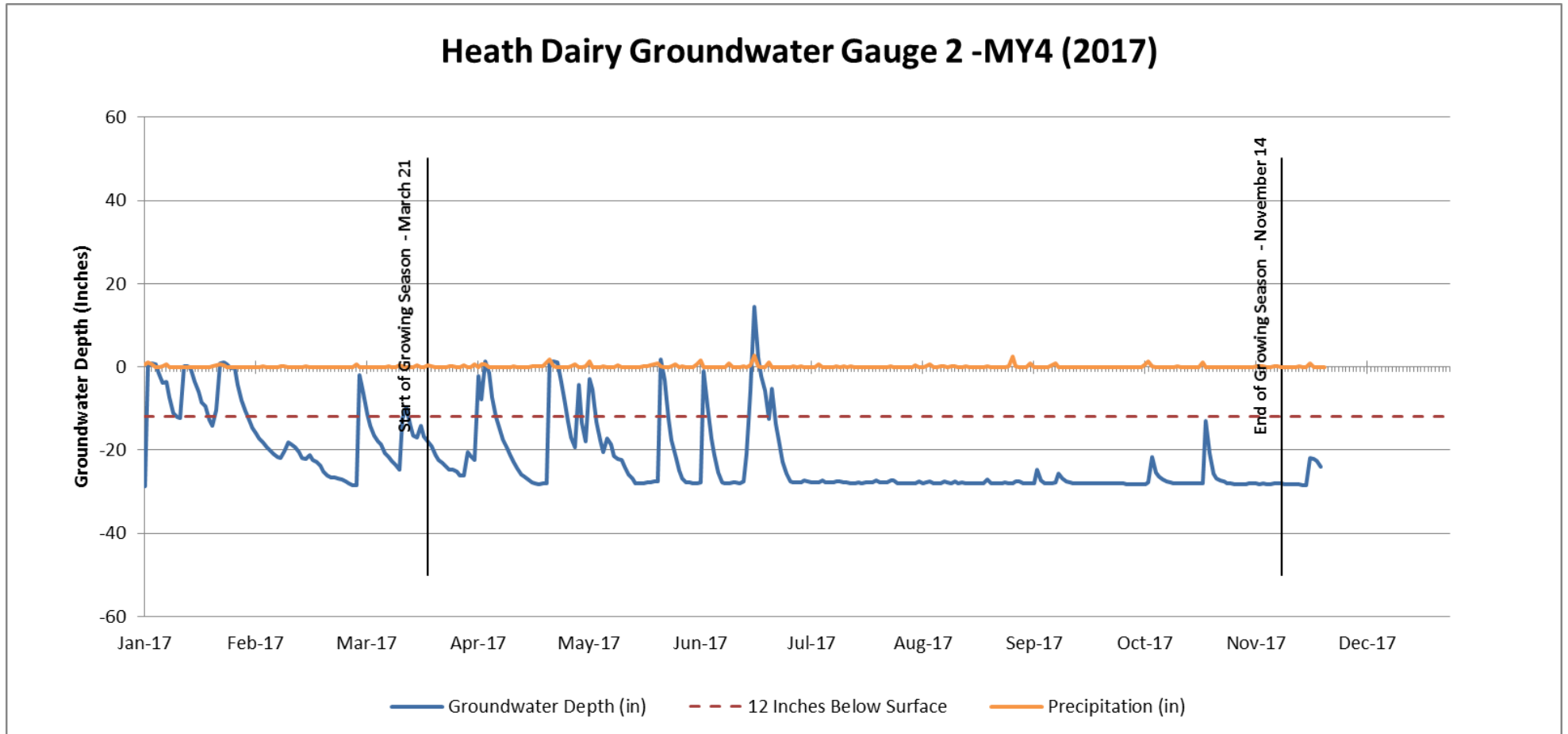
- Monthly rainfall data from CRONOS Station ID: 310286, Asheboro, NC

Figure 7.1. Groundwater Data



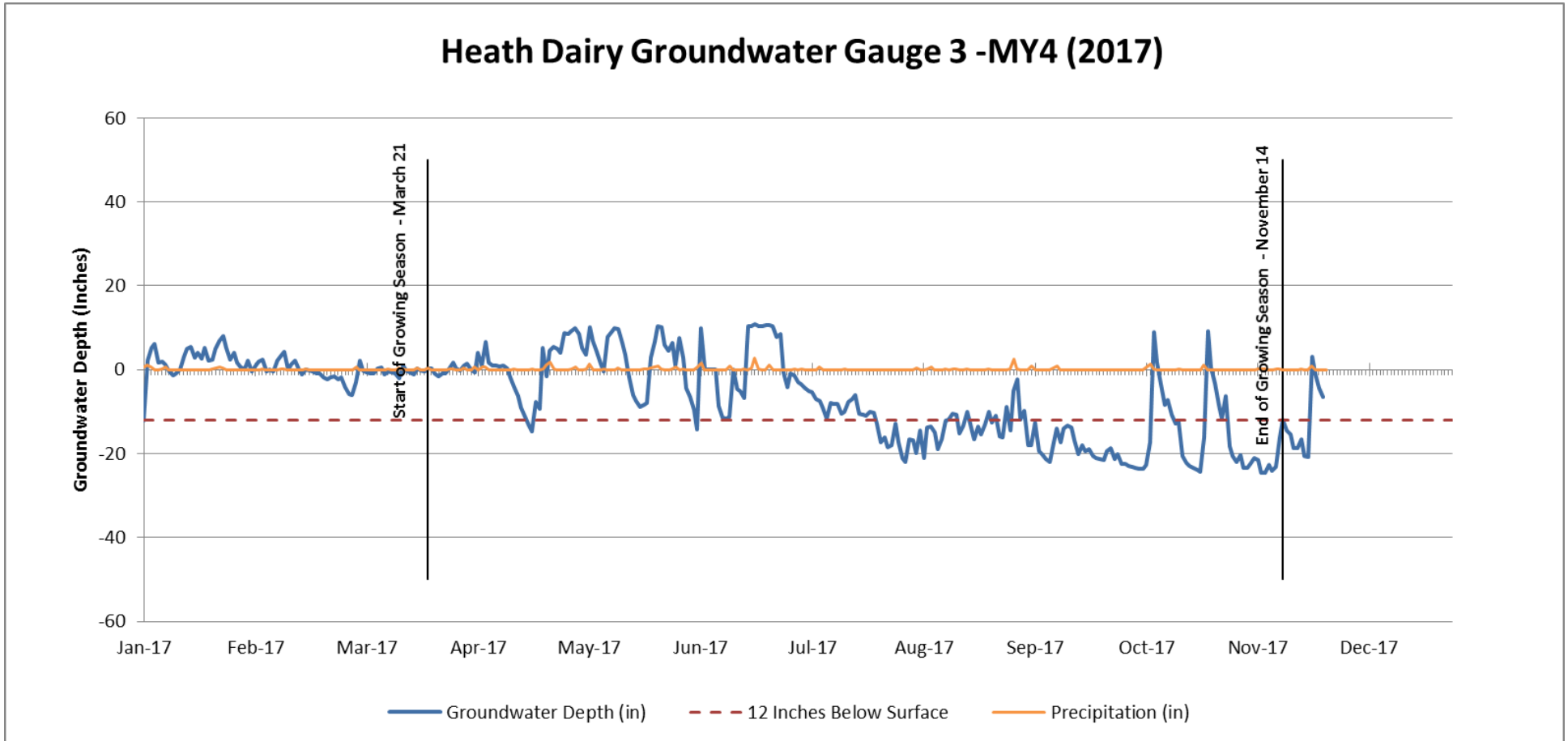
- Daily rainfall data from CRONOS Station ID: 310286, Asheboro, NC

Figure 7.2. Groundwater Data



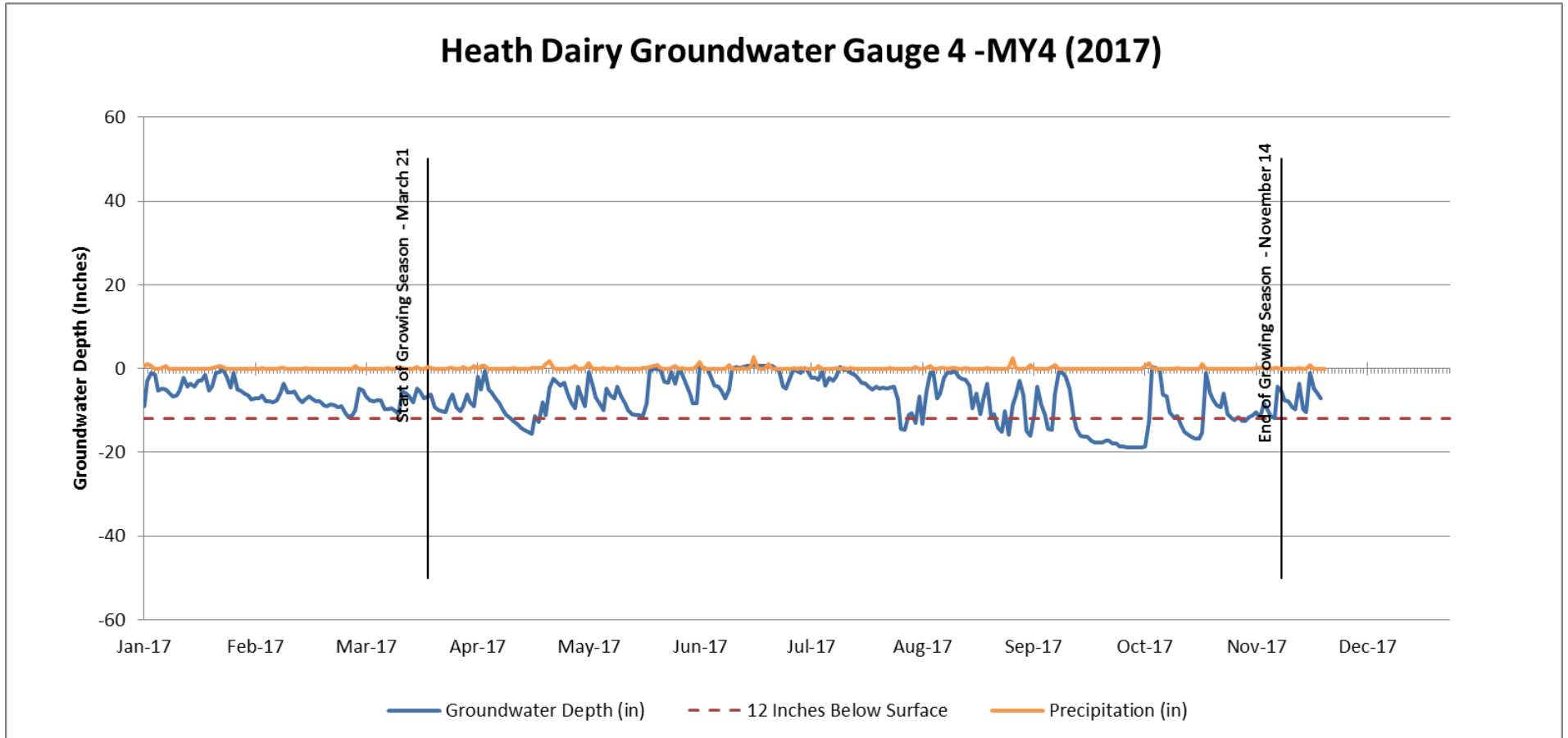
- Daily rainfall data from CRONOS Station ID: 310286, Asheboro, NC

Figure 7.3. Groundwater Data



- Daily rainfall data from CRONOS Station ID: 310286, Asheboro, NC

Figure 7.4. Groundwater Data



- Daily rainfall data from CRONOS Station ID: 310286, Asheboro, NC

Table 13. Wetland Gauge Attainment

MY4 2017				
Gage #	% of Growing Season Monitored	Max # Consec. Days	% of Growing Season	Success Criteria Attained?
1	100%	6	3	<i>No</i>
2	100%	6	3	<i>No</i>
3	100%	49	21	<i>Yes</i>
4	100%	100	42	<i>Yes</i>

Gage # 4 is located in a reference wetland.

12.5% of growing season needed to meet success criteria.

Growing season dates are based on the WETS table for Ashboro 2W, NC
 Date Range: 1981-2010, 50% Probability at 28 F or higher.
http://efotg.sc.egov.usda.gov/efotg_locator.aspx