YEAR 4 of 7 (2015)
ANNUAL MONITORING REPORT
HERMAN DAIRY STREAM AND WETLAND RESTORATION SITE
Alexander County, North Carolina
DMS Project No. 94642
Full Delivery Contract No. 003271

Catawba River Basin
Cataloging Unit and Targeted Local Watershed
03050101120030

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

January 2016

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Cataloging Unit and Targeted Local Watershed
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Prepared By:
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Submitted to:
NC Department of Environmental Quality
Division of Mitigation Services
Raleigh, North Carolina

January 2016

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1.0 EXECUTIVE SUMMARY

Restoration Systems, LLC has established the Herman Dairy Stream and Wetland Mitigation Site (Site) located approximately 1.5 miles northwest of Taylorsville, in central Alexander County within 14-digit Cataloging Unit and Targeted Local Watershed 03050101120030 of the Catawba River Basin. The Site encompasses approximately 31.12 acres of land previously used for agricultural row crop production and the spray application of sludge from a lagoon associated with a dairy cattle operation. The Site was identified to assist the Department of Mitigation Services (DMS) in meeting its stream and wetland restoration goals. This report (compiled based on DMS *Guidance and Content Requirements for DMS Monitoring Reports* Version 1.2.1 dated 12/1/09) serves as the Year 4 (2015) annual monitoring report.

The primary goals and objectives of this stream and wetland restoration project focused on improving water quality, enhancing flood attenuation, and restoring wildlife habitat and will be accomplished by the following.

1. Removing nonpoint sources of pollution associated with agricultural production including a) cessation of broadcasting sludge, fertilizer, pesticides, and other agricultural materials into and adjacent to Site streams/wetlands and b) restoration of a forested riparian buffer adjacent to streams and wetlands to treat surface runoff.
2. Reducing sedimentation within onsite and downstream receiving waters through a) reduction of bank erosion, vegetation maintenance, and plowing to Site streams and wetlands and b) restoration of a forested riparian buffer adjacent to Site streams and wetlands.
3. Reestablishing stream stability and the capacity to transport watershed flows and sediment loads by restoring stable dimension, pattern, and profile supported by natural in-stream habitat and grade/bank stabilization structures.
4. Promoting floodwater attenuation by a) reconnecting bankfull stream flows to the abandoned floodplain, b) restoring secondary, entrenched tributaries thereby reducing floodwater velocities within smaller catchment basins, c) restoring depressional floodplain wetlands to increase the floodwater storage capacity within the Site, and d) revegetating Site floodplains to increase frictional resistance on floodwaters crossing Site floodplains.
5. Improving aquatic habitat by enhancing stream bed variability and the use of in-stream structures.
6. Providing a terrestrial wildlife corridor and refuge in an area extensively developed for agricultural production.
7. Restoring and reestablishing natural community structure, habitat diversity, and functional continuity.
8. Enhancing and protecting the Site's full potential of stream and wetland functions and values in perpetuity.

Vegetation Success Criteria: An average density of 320 stems per acre of Characteristic Tree Species must be surviving in the first three monitoring years. Subsequently, 290 Characteristic Tree Species per acre must be surviving in year 4, 260 Characteristic Tree Species per acre in year 5, and 210 Characteristic Tree Species per acre in year 7. No single volunteer species (most notably red maple, loblolly pine, and sweet gum) will comprise more than 20 percent of the total composition at years 3, 5, or 7. If this occurs, remedial procedures/protocols outlined in the contingency plan will be implemented. During years 3, 5, and 7, no single volunteer species, comprising over 20 percent of the total composition, may be more than twice the height of the planted trees. If this occurs, remedial procedures outlined in the contingency plan will be implemented. If, within the first 3 years, any species exhibits greater than 50 percent mortality, the species will either be replanted or an acceptable replacement species will be planted in its place as specified in the contingency plan.

Vegetation Results: Vegetation sampling across the Site was above the required average density with 445 planted stems per acre surviving. In addition, 9 out of 10 individual plots exceeded success criteria, with plot 4 being two stems shy of the required stem density. However, when including natural recruits of American elm (*Ulmus americana*), plot four exceeds the required stem density. The number of native tree and shrub species observed in plots ranged from three (Plot 3) to seven (Plot 5), with 17 total native species observed. Treatment for invasive species, primarily Chinese privet (*Ligustrum sinense*) was initiated prior to construction and will continue as necessary, primarily within areas denoted on Figures 2 and 2A-2B (Appendix A).

Replanting occurred during the winter of 2013/2014 in the southeastern portion of the Site between UT2 and UT3 with 3-gallon containerized trees as follows. Overall, newly planted stems appear vigorous, and stem counts have risen well-above success criteria in this area.

175 Tulip poplar (*Liriodendron tulipifera*)
150 Ironwood (*Carpinus caroliniana*)
175 American elm (*Ulmus americana*)
500 TOTAL

Stream Success Criteria: Success criteria for stream restoration will include 1) successful classification of the reach as a functioning stream system (Rosgen 1996) and 2) channel variables indicative of a stable stream system. The channel profile will be measured on 3000 linear feet of stream and 20 cross-sections on an annual basis in order to track changes in channel geometry, profile, or substrate. These data will be utilized to determine the success in restoring stream channel stability. Specifically, the width-to-depth ratio and bank-height ratios should be indicative of stability with minimal changes in cross-sectional area, channel width, and/or bank erosion along the monitoring reach. In addition, channel abandonment and/or shoot cutoffs must not occur and sinuosity values must remain relatively constant. Visual assessment of in-stream structures will be conducted to determine if failure has occurred. Failure of a structure may be indicated by collapse of the structure, undermining of the structure, abandonment of the channel around the structure, and/or stream flow beneath the structure.

Stream Results: As a whole, monitoring measurements indicate there have been minimal changes in both the longitudinal profile and cross-sections as compared to as-built data. The as-built channel geometry compares favorably with the emulated, stable E/C type stream reach as set forth in the detailed mitigation plan and construction plans. Current monitoring has demonstrated dimension, pattern, and profile were stable over the course of the monitoring period. Pebble counts were performed at six cross sections (3 on UT1, 2 on UT2, and 1 on UT3). These pebble counts provide a representative sample of the site substrate.

Beaver activity surrounding the Site is prevalent, and a beaver dam was observed just upstream of Cross-section 1 on UT1 during Year 4 (2015) monitoring. The dam was present for less than a few weeks and was easily removed; no additional evidence of onsite beaver activity has been observed. Site streams and particularly this stream reach are walked and checked monthly (during all monitoring activities including vegetation surveys, stream surveys, and groundwater gauge downloads) for beaver activity and areas of concern. Beaver dams have been removed, as necessary, and will continue to be removed throughout the monitoring period. No adverse effects have resulted from beaver activity, subsequently beaver dam locations have not been added to the Current Conditions Plan View (Figures 2, 2A-2B) since no remedial action plan is expressly needed and no stream stability or sedimentation issues have arisen as the result of beaver activity.

Fine sediments move through the Site during high flow storm events; however, UT1 receives a significant amount of sediment deposition as the result of upstream land uses, which include livestock pastures, dairy operations, and cleared riparian buffers. No additional stream problem areas were noted during Year 4 (2015) monitoring.

Hydrology Success Criteria: According to the *Soil Survey of Alexander County*, the growing season for Alexander County as recorded in Hickory, North Carolina during the period from 1951-1984 is from March 20-November 9 (235 days) (USDA 1995). Year 1 (2012) groundwater gauge installation occurred between March 30 and April 4, 2012; therefore, given the date of groundwater gauge installation and the initiation of monitoring, Year 1 groundwater monitoring utilized the published growing season dates from the county soil survey for success criteria. However, in future monitoring years, if soil temperatures and/or vegetative growth (bud burst) is documented, project gauge hydrologic success will be determined using those dates to more accurately represent the period of biological activity (see following "Summary of Hydrology Success Criteria by Year" table.

Target hydrological characteristics include saturation or inundation for 8 percent of the monitored period, during average climatic conditions. During years with atypical climatic conditions, groundwater gauges in reference wetlands may dictate threshold hydrology success criteria (75 percent of reference). These areas are expected to support hydrophytic vegetation. If wetland parameters are marginal as indicated by vegetation and/or hydrology monitoring, a jurisdictional determination will be performed.

Summary of Hydrology Success Criteria by Year

Year	Soil Temperatures/Date Bud Burst Documented	Monitoring Period Used for Determining Success	8 Percent of Monitoring Period
2012 (Year 1)	--	March 20-November 9 (235 days)	19 days
2013 (Year 2)	No bud burst during February 13-14, 2013 Site visit	March 20-November 9 (235 days)	19 days
2014 (Year 3)	No bud burst during February site visit	March 20-November 9 (235 days)	19 Days
2015 (Year 4)	No bud burst during February site visit	March 20-November 9 (235 days)	19 days
2016 (Year 5)			

Hydrology Results: All ten Site groundwater monitoring gauges and the reference gauge exhibited inundation/saturation within 12 inches of the surface for greater than 8 percent of the growing season. All gauges were well-above success criteria for monitoring Year 4 (2015).

Benthics: Habitat Assessment Field Data Sheet scores for UT 1 increased from a total score of 45 prior to restoration to 79 after four annual monitoring years. Similarly, UT 2 improved from a score of 36 to 84 and UT3 improved from a score of 21 to 88 after four annual monitoring years. North Carolina Biotic Index (NCBI) assigned value for UT1 (6.10) was lower in Year 4 (2015) than in previous monitoring years, indicating an improvement from the range of values for *Poor* biotic indices to *Fair* (NCDWQ, 2011). NCBI assigned value for UT2 (5.21) was significantly lower in Year 4 (2015) than in previous monitoring years, indicating a substantial improvement from *Very Poor* to *Good*. Both Year 3 (2014) NCBI values indicate an improvement from the preconstruction values. The habitat assessment scores have gradually improved since construction, and therefore, the NCBI assigned values are expected to continue to improve. No benthic samples were obtained from UT3 because the stream was dry at the time of the site visit. Benthic results and Habitat Assessment Field Data Sheets are included in Appendix F.

In summary: Site vegetation, streams, and wetland hydrology met success criteria for Year 4 (2015) monitoring. Based on achievement of success criteria in Years 1-4 (2012-2015), it is anticipated the project will be present for IRT close-out after completion of Year 5 (2016) monitoring. Summary information and data related to the occurrence of items such as beaver or encroachment and statistics related to performance

of various project and monitoring elements can be found in tables and figures within this report's appendices. Narrative background and supporting information formerly found in these reports can be found in the Baseline Monitoring Document (formerly Mitigation Plan) and in the Mitigation Plan (formerly called the Restoration Plan) documents available on the DMS website. All raw data supporting the tables and figures in the appendices is available from DMS upon request.

2.0 METHODOLOGY

Monitoring of the Site's restoration efforts will be performed until agreed upon success criteria are fulfilled. Monitoring is proposed for the stream channel, riparian vegetation, and hydrology (Figure 2, Appendix A). Stream morphology is proposed to be monitored for a period of five years. Riparian vegetation is proposed to be monitored for a period of seven years. Wetland hydrology is proposed to be monitored for a period of five years; at which time a request will be made to the IRT to discontinue groundwater hydrology monitoring. The IRT reserves the right to request additional groundwater monitoring if it deems necessary. Monitoring reports of the data collected will be submitted to the IRT no later than December of each monitoring year.

2.1 Vegetation Assessment

After planting was completed, an initial evaluation was performed to verify planting methods were successful and to determine initial species composition and density. Ten sample vegetation plots (10-meter by 10-meter) were installed and measured within the Site as per guidelines established in *CVS-DMS Protocol for Recording Vegetation, Version 4.2* (Lee et al. 2008). Plots were measured in July 2015 for Year 4 monitoring. Vegetation plots are permanently monumented with 4-foot metal garden posts at each corner. In each sample plot, vegetation parameters to be monitored include species composition and species density. Visual observations of the percent cover of shrub and herbaceous species will also be documented by photograph. Vegetation plot information can be found in Appendix C.

2.2 Stream Assessment

Restored stream reaches are proposed to be monitored for geometric activity for five years. Annual fall monitoring will include development of 20 channel cross-sections on riffles and pools and a water surface profile of the channel. The data will be presented in graphic and tabular format. Data to be presented will include 1) cross-sectional area, 2) bankfull width, 3) average depth, 4) maximum depth, 5) width-to-depth ratio, 6) water surface slope, and 7) sinuosity. The stream will subsequently be classified according to stream geometry and substrate (Rosgen 1996). Significant changes in channel morphology will be tracked and reported by comparing data in each successive monitoring year. Stream data can be found in Appendix D.

2.3 Wetland Assessment

Ten groundwater monitoring gauges were installed within Site wetland restoration areas and one additional gauge was installed in a reference wetland to monitor groundwater hydrology (Figure 2, Appendix A). Hydrological sampling will continue for five years throughout the growing season at intervals necessary to satisfy the hydrology success criteria within each design unit (USEPA 1990). In addition, an onsite rain gauge will document rainfall data for comparison of groundwater conditions with extended drought conditions. Finally, groundwater gauges located within riverine wetlands adjacent to restored stream reaches will supplement crest gauge measurements to confirm overbank flooding events. Graphs of groundwater hydrology and precipitation from a nearby rain station are included in Appendix E.

2.4 Biotic Community Changes

Changes in the biotic community are anticipated from a shift in habitat opportunities as tributaries are restored. In-stream, biological monitoring is proposed to track changes during the monitoring period. The benthic macroinvertebrate community will be sampled using North Carolina Division of Water Resources (NCDWR) protocols found in the Standard Operating Procedures for Benthic Macroinvertebrates

(NCDWR 2006) and Benthic Macroinvertebrate Protocols for Compensatory Stream Restoration Projects (NCDWR 2001). Biological sampling of benthic macroinvertebrates will be used to compare preconstruction baseline data with post-construction restored conditions.

Benthic macroinvertebrate monitoring locations were established within Site restoration reaches. Post-construction collections occurred in approximately the same locations as pre-construction sampling; however, sampling was not possible in UT 3 in Year 4 (2015) due to lack of stream flow. Benthic macroinvertebrate samples were collected using the Qual-4 collection method. Sampling techniques of the Qual-4 collection method consist of kick nets, sweep nets, leaf packs, and visual searches. Post-construction biological sampling occurred on June 23, 2015 for Year 4 monitoring; post-construction monitoring will occur in June of each monitoring year. Identification of collected organisms was performed by Pennington and Associates, a NCDWR certified laboratory. Results and Habitat Assessment Field Data Sheets are enclosed in Appendix F.

3.0 REFERENCES

Lee, M.T., R.K. Peet, S.D. Roberts, and T.R. Wentworth. 2008. CVS-DMS Protocol for Recording Vegetation. Version 4.2. Department of Environmental Quality. Division of Mitigation Services. Raleigh, North Carolina.

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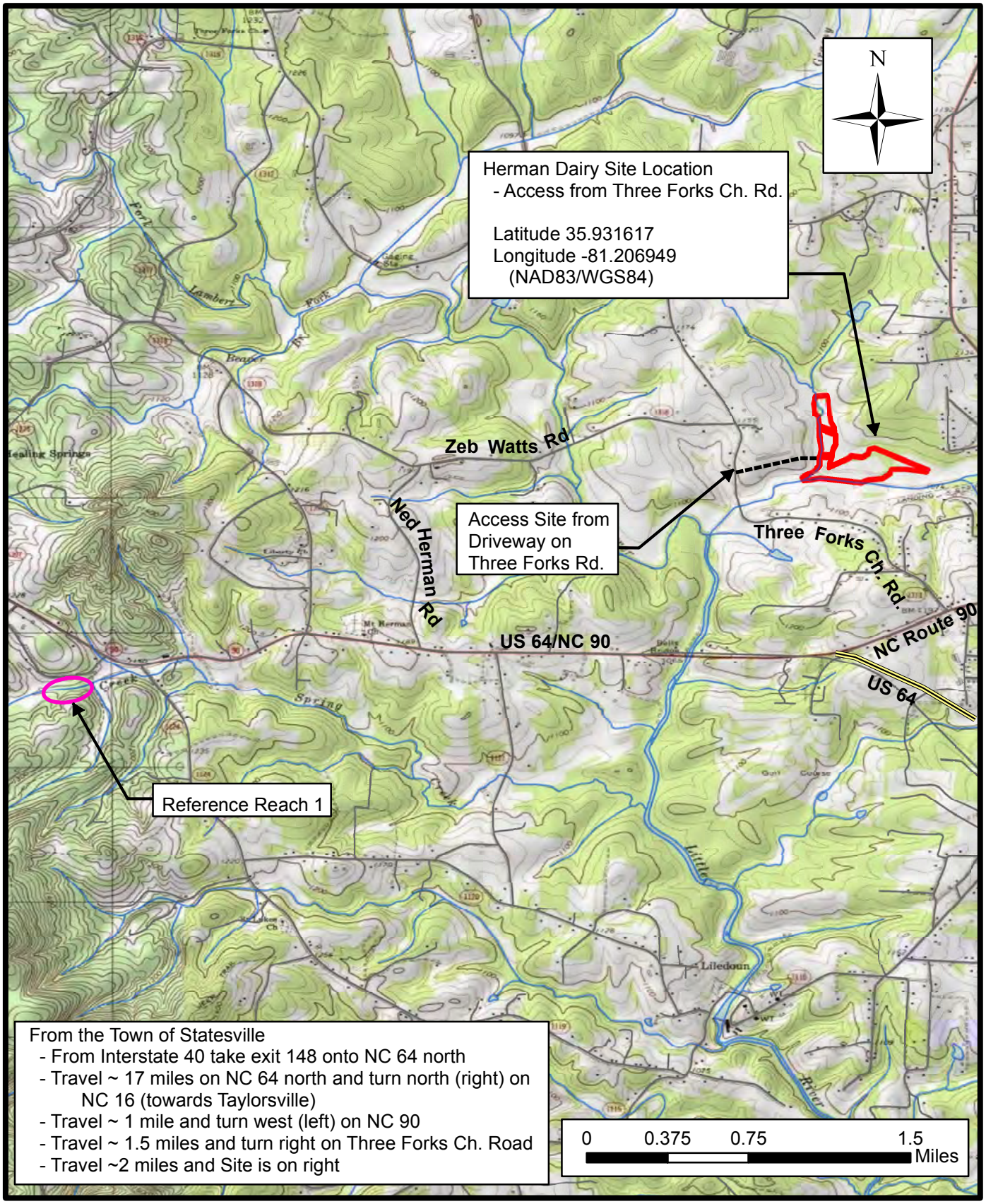
Appendix A.
Figures

Figure 1. The Site Location
Figures 2, 2A-2B. Consolidated Current Conditions Plan View



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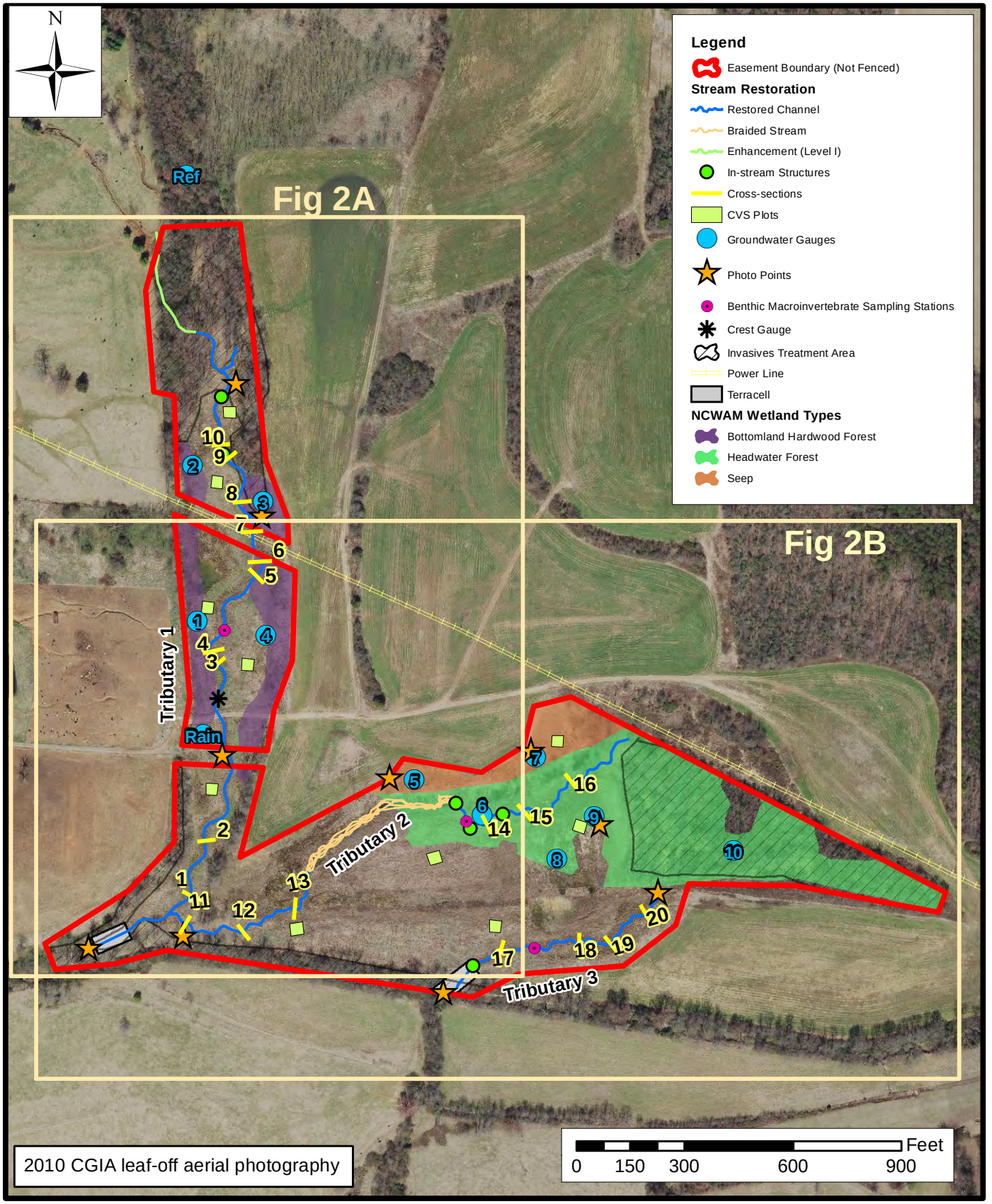
HERMAN DAIRY
STREAM AND WETLAND MITIGATION SITE
THE SITE LOCATION
Alexander County, North Carolina

Dwn. By: WGL/CLF	FIGURE
Date: May 2012	1
Project: 10-016	



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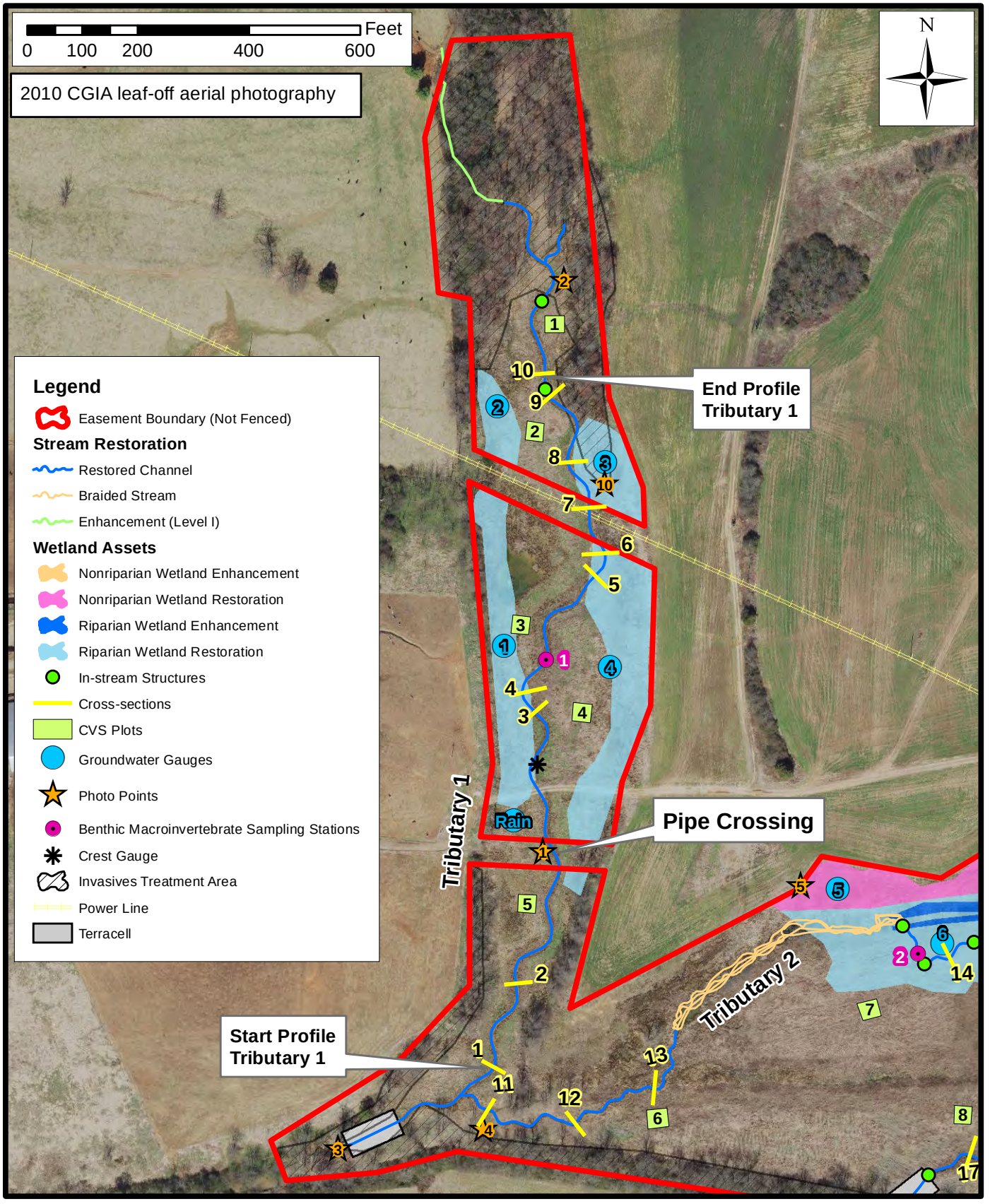
HERMAN DAIRY
STREAM AND WETLAND MITIGATION SITE
CONSOLIDATED CURRENT CONDITION PLAN VIEW
Alexander County, North Carolina

Dwn. By:	KRJ
Date:	Dec. 2015
Project:	10-001

FIGURE 2



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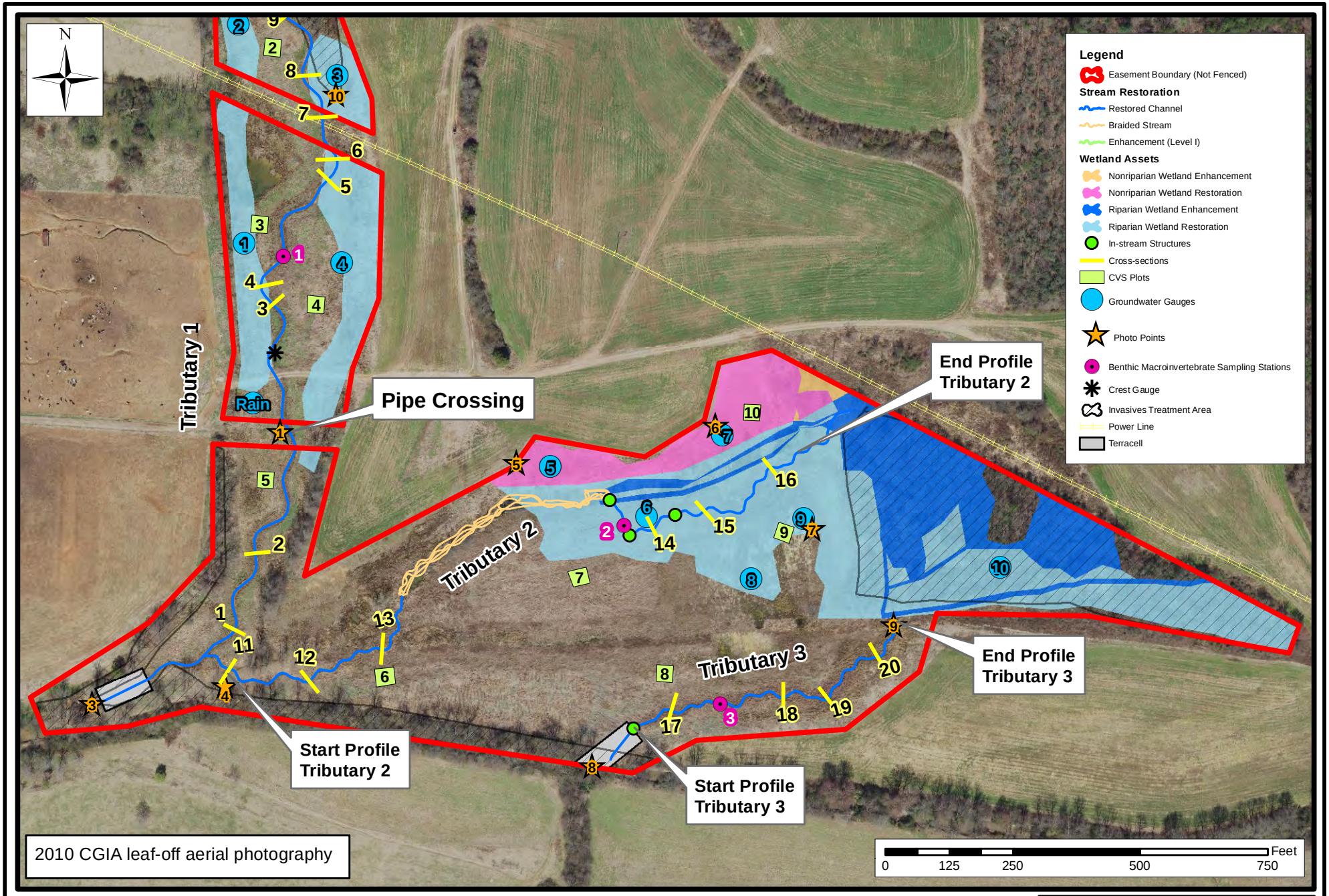
HERMAN DAIRY
STREAM AND WETLAND MITIGATION SITE
CONSOLIDATED CURRENT CONDITION PLAN VIEW
Alexander County, North Carolina

Dwn. By: KRJ/CLF	FIGURE
Date: Dec. 2015	2A
Project: 10-001	



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CONSOLIDATED CURRENT CONDITION PLAN VIEW
Alexander County, North Carolina

Dwn. By:	KRJ/CLF
Date:	Dec. 2015
Project:	10-001

FIGURE
2B

Appendix B.
General Project Tables

Table 1. Project Restoration Components
Table 2. Project Activity and Reporting History
Table 3. Project Contacts Table
Table 4. Project Attribute Table

Table 1. Project Restoration Components
Herman Dairy Restoration Site

Mitigation Credits					
Stream		**Riparian Wetland**		**Nonriparian Wetland**	
Restoration	**Restoration Equivalent**	**Restoration**	**Restoration Equivalent**	**Restoration**	**Restoration Equivalent**
4780	**0**	**7.2**	**1.1**	**1.2**	**0.05**

Projects Components						
Station Range	**Existing Linear Footage/ Acreage**	**Priority Approach**	**Restoration/ Restoration Equivalent**	**Restoration Linear Footage/ Acreage**	**Mitigation Ratio**	**Comment**
UT1 10+00-31+67.8* UT1A 10+00-10+85.71 UT2 10+00-16+69.04, 21+50.67-27+10.09 UT3 10+00-17+28.39	4540	I	Restoration	3997	1:1	Priority I stream restoration through construction of stable channel at the historic floodplain elevation.
UT2 16+69.04-21+50.67 UT3 upper 81.10 linear feet		--	Restoration	563	1:1	Braided stream restoration by redirecting diffuse flow across riparian wetlands. Linear footage of stream is based on a straight line valley distance.
UT1 upper 330.00 linear feet	330	Level I	Enhancement	330	1.5:1	Level I stream enhancement by altering profile and dimension, cessation of current land use practices, removing invasive species, and planting with native forest vegetation.
Riparian Wetlands	0	--	Restoration	7.2	1:1	Restoration of riparian wetlands within the floodplain as the result of stream restoration activities, filling abandoned channels and ditches, removing spoil castings, and planting with native forest vegetation.
Riparian Wetlands	2.2	--	Enhancement	2.2	2:1	Enhancement of existing riparian wetlands characterized by disturbed pasture by planting with native forest vegetation.
Nonriparian Wetlands	0	--	Restoration	1.2	1:1	Restoration of nonriparian wetlands by removing spoil castings, filling abandoned ditches to rehydrate hydric soils along the slope, eliminating land use practices, and planting with native forest vegetation.
Nonriparian Wetlands	0.1	--	Enhancement	0.1	2:1	Enhancement of existing nonriparian wetlands characterized by disturbed pasture by planting with native forest vegetation.

Component Summation			
Restoration Level	**Stream (linear footage)**	**Riparian Wetland (acreage)**	**Nonriparian Wetland (acreage)**
Restoration	4560	7.2	1.2
Enhancement (Level 1)	330	--	--
Enhancement	--	2.2	0.05
Totals	**4890**	**9.4**	**1.25**
Mitigation Units	**4780 SMUs**	**8.3 Riparian WMUs**	**1.25 Nonriparian WMUs**

*Restoration linear footage excludes 145.76 linear feet of stream located within the utility easement and 67.79 linear feet of stream located within a culverted crossing, which are both excluded from the easement.

Table 2. Project Activity and Reporting History
Herman Dairy Restoration Site

Activity or Deliverable	Data Collection Complete	Completion or Delivery
Technical Proposal (RFP No. 16-002830)	--	March 2010
DMS Contract No. 003271	--	July 23, 2010
Restoration Plan	--	January 2011
Construction Plans	--	August 2011
Construction Earthwork		March 2012
Invasive Species Treatment		Ongoing
As-Built Documentation		June 2012
Year 1 (2012) Annual Monitoring	September 2012	October 2012
Year 2 (2013) Annual Monitoring	October 2013	November 2013
Replanting	--	Late 2013/Early 2014
Year 3 (2014) Annual Monitoring	November 2014	January 2015
Year 4 (2015) Annual Monitoring	November 2015	December 2015

Table 3. Project Contacts Table
Herman Dairy Restoration Site

Full Delivery Provider	Restoration Systems 1101 Haynes Street, Suite 211 Raleigh, North Carolina 27604 George Howard and John Preyer 919-755-9490
Designer	Axiom Environmental, Inc. 218 Snow Avenue Raleigh, NC 27603 Grant Lewis 919-215-1693
Construction Plans and Sediment and Erosion Control Plans	Sungate Design Group, PA 915 Jones Franklin Road Raleigh, NC 27606 W. Henry Wells, Jr, PE 919-859-2243
Construction and Planting Contractor	Land Mechanic Designs 780 Landmark Road Willow Spring, NC 27592 Lloyd Glover 919-639-6132
As-built Surveyor	K2 Design Group 5688 US Highway 70 East Goldsboro, NC 27534 John Rudolph 919-751-0075
Baseline Data Collection and Annual Monitoring	Axiom Environmental, Inc. 218 Snow Avenue Raleigh, NC 27603 Grant Lewis 919-215-1693

Table 4. Project Attribute Table
Herman Dairy Restoration Site

Project County	Alexander County, North Carolina		
Physiographic Region	Northern Inner Piedmont		
Ecoregion	Carolina Slate Belt		
Project River Basin	Catawba		
USGS HUC for Project (14 digit)	03050101120030		
NCDWQ Sub-basin for Project	03-08-32		
Identify planning area (LWP, RBRP, other)?	Yes – Upper Catawba River Basin Restoration Priorities 2009		
WRC Class (Warm, Cool, Cold)	Warm		
% of project easement fenced or demarcated	100		
Beaver activity observed during design phase?	Yes		
	Unnamed Tributaries to Muddy Fork		
	UT 1	**UT 2**	**UT 3**
Drainage Area	1.0	0.06	0.04
Stream Order (USGS topo)	2nd	1st	1st
Restored Length (feet)	2156	1684	760
Perennial (P) or Intermittent (I)	P	P	I
Watershed Type	Rural	Rural	Rural
Watershed impervious cover	<5%	<5%	<5%
NCDWQ AU/Index number	11-69-4	11-69-4	11-69-4
NCDWQ Classification	C	C	C
303d listed?	No	No	No
Upstream of a 303d listed	Yes	Yes	Yes
Reasons for 303d listed segment	aquatic life/sediment	aquatic life/sediment	aquatic life/sediment
Total acreage of easement	31.12	31.12	31.12
Total existing vegetated acreage of easement	8	8	8
Total planted restoration acreage	31.5	31.5	31.5
Rosgen Classification of preexisting	Cd5	Fc5/6	Fc5/6
Rosgen Classification of As-built	E/C 4/5	E/C 4/5	E/C 4/5
Valley type	VIII	VIII	VIII
Valley slope	0.0066	0.0052	0.0013
Cowardin classification of proposed	R3UB1/2	R3UB1/2	R4SB3/4
Trout waters designation	NA	NA	NA
Species of concern, endangered etc.	NA	NA	NA
Dominant Soil Series	Codorus/Hatboro	Codorus/Hatboro	Codorus/Hatboro

Appendix C.
Vegetation Assessment Data

Table 5. Vegetation Plot Mitigation Success Summary Table
Table 6. CVS Vegetation Metadata Table
Table 7. CVS Stem Count Total and Planted by Plot and Species
Vegetation Plot Photographs

Table 5. Vegetation Plot Mitigation Success Summary Table

Vegetation Plot ID	Vegetation Survival Threshold Met?	Tract Mean
1	Yes	90%
2	Yes	
3	Yes	
4	No*	
5	Yes	
6	Yes	
7	Yes	
8	Yes	
9	Yes	
10	Yes	

*Plot 4 did not meet success criteria based on planted stems alone; however, when including natural recruits of American elm (*Ulmus americana*), plot 4 exceeds the required stem density.

Table 6. CVS Vegetation Metadata Table

Report Prepared By	Corri Faquin
Date Prepared	7/8/2015 15:34
database name	RS-HermanDiary-2015-A-v2.3.1.mdb
database location	S:\CVS database\2015
computer name	PHILLIP-PC
file size	61227008
DESCRIPTION OF WORKSHEETS IN THIS DOCUMENT----------	
Metadata	Description of database file, the report worksheets, and a summary of project(s) and project data.
Proj, planted	Each project is listed with its PLANTED stems per acre, for each year. This excludes live stakes.
Proj, total stems	Each project is listed with its TOTAL stems per acre, for each year. This includes live stakes, all planted stems, and all natural/volunteer stems.
Plots	List of plots surveyed with location and summary data (live stems, dead stems, missing, etc.).
Vigor	Frequency distribution of vigor classes for stems for all plots.
Vigor by Spp	Frequency distribution of vigor classes listed by species.
Damage	List of most frequent damage classes with number of occurrences and percent of total stems impacted by each.
Damage by Spp	Damage values tallied by type for each species.
Damage by Plot	Damage values tallied by type for each plot.
Planted Stems by Plot and Spp	A matrix of the count of PLANTED living stems of each species for each plot; dead and missing stems are excluded.
ALL Stems by Plot and spp	A matrix of the count of total living stems of each species (planted and natural volunteers combined) for each plot; dead and missing stems are excluded.
PROJECT SUMMARY----------	
Project Code	Herman
project Name	Herman Dairy
Description	Stream and wetland restoration Alexander County NC
River Basin	Catawba
Sampled Plots	10

Table 7. Total and Planted Stems by Plot and Species
DMS Project Code Herman. Project Name: Herman Dairy

			Current Plot Data (MY4 2015)																												
			Herman-P-0001			Herman-P-0002			Herman-P-0003			Herman-P-0004			Herman-P-0005			Herman-P-0006			Herman-P-0007			Herman-P-0008			Herman-P-0009			Herman-P-0010		
Scientific Name	Common Name	Species Type	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T
Acer negundo	boxelder	Tree																		19												
Acer rubrum	red maple	Tree						18																					14			1
Betula nigra	river birch	Tree	3	3	3	4	4	4	1	1	1	1	1	1				1	1	1				2	2	2	2	2	2	2	2	2
Carpinus caroliniana	American hornbeam	Tree	1	1	1										2	2	2															
Carya	hickory	Tree													1	1	1															
Cephalanthus occidentalis	common buttonbush	Shrub																			1	1	1	1	1	1						
Cornus amomum	silky dogwood	Shrub	2	2	2																			1	1	1						
Diospyros virginiana	common persimmon	Tree			1																											
Fraxinus pennsylvanica	green ash	Tree	1	1	1	1	1	1	4	4	5	3	3	3	1	1	1	3	3	3	5	5	5	6	6	6	9	9	9	2	2	2
Liriodendron tulipifera	tuliptree	Tree	1	1	1	1	1	4										5	5	5	2	2	2				3	3	3	1	1	1
Nyssa	tupelo	Tree							4	4	4				5	5	5													3	3	3
Platanus occidentalis	American sycamore	Tree						1										1	1	1							1	1	22			
Quercus	oak	Tree																														
Quercus nigra	water oak	Tree													2	2	2															
Quercus pagoda	cherrybark oak	Tree	2	2	2	2	2	2				2	2	2	2	2	2	3	3	3	2	2	2	3	3	3	1	1	1	3	3	3
Quercus phellos	willow oak	Tree													1	1	1															
Sambucus canadensis	Common Elderberry	Shrub																					1									
Ulmus americana	American elm	Tree												2																		
Unknown		Shrub or Tree																														
		Stem count	10	10	11	8	8	30	9	9	10	6	6	8	14	14	14	13	13	32	10	10	11	13	13	13	16	16	51	11	11	12
		size (ares)	1			1			1			1			1			1			1			1			1			1		
		size (ACRES)	0.02			0.02			0.02			0.02			0.02			0.02			0.02			0.02			0.02			0.02		
		Species count	6	6	7	4	4	6	3	3	3	3	3	4	7	7	7	5	5	6	4	4	5	5	5	5	5	5	6	5	5	6
		Stems per ACRE	404.7	404.7	445.2	323.7	323.7	1214	364.2	364.2	404.7	242.8	242.8	323.7	566.6	566.6	566.6	526.1	526.1	1295	404.7	404.7	445.2	526.1	526.1	526.1	647.5	647.5	2064	445.2	445.2	485.6

Color for Density

Exceeds requirements by 10%
Exceeds requirements, but by less than 10%
Fails to meet requirements, by less than 10%
Fails to meet requirements by more than 10%

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

Table 7. Total and Planted Stems by Plot and Species (continued)
DMS Project Code Herman. Project Name: Herman Dairy

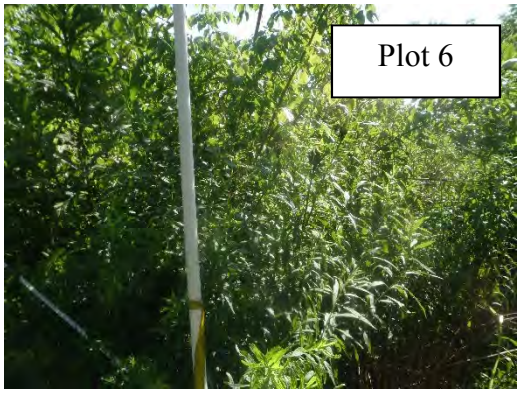
			Annual Means													
			MY4 (2015)			MY3 (2014)			MY2 (2013)			MY1 (2012)			MY0 (2012)		
Scientific Name	Common Name	Species Type	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T
Acer negundo	boxelder	Tree			19			39			9			15			
Acer rubrum	red maple	Tree			33			20			21			7			
Betula nigra	river birch	Tree	16	16	16	16	16	16	18	18	18	19	19	19	41	41	41
Carpinus caroliniana	American hornbeam	Tree	3	3	3	3	3	3	2	2	2	2	2	2	3	3	3
Carya	hickory	Tree	1	1	1	2	2	2	2	2	2	4	4	4			
Cephalanthus occidentalis	common buttonbush	Shrub	2	2	2	2	2	3	2	2	2						
Cornus amomum	silky dogwood	Shrub	3	3	3	3	3	3	3	3	3	2	2	2	2	2	2
Diospyros virginiana	common persimmon	Tree			1												
Fraxinus pennsylvanica	green ash	Tree	35	35	36	34	34	34	34	34	34	33	33	33	32	32	32
Liriodendron tulipifera	tuliptree	Tree	13	13	16	14	14	20	15	15	19	17	17	18	25	25	25
Nyssa	tupelo	Tree	12	12	12	15	15	15	16	16	16	14	14	14			
Platanus occidentalis	American sycamore	Tree	2	2	24	2	2	31	2	2	36			46	1	1	1
Quercus	oak	Tree										1	1	1	6	6	6
Quercus nigra	water oak	Tree	2	2	2	2	2	2	2	2	2	2	2	2			
Quercus pagoda	cherrybark oak	Tree	20	20	20	21	21	21	22	22	22	22	22	22	23	23	23
Quercus phellos	willow oak	Tree	1	1	1	1	1	1	1	1	1	1	1	1			
Sambucus canadensis	Common Elderberry	Shrub			1												
Ulmus americana	American elm	Tree			2										2	2	2
Unknown		Shrub or Tree							1	1	1	1	1	1	10	10	10
		Stem count	110	110	192	115	115	210	120	120	188	118	118	187	145	145	145
		size (ares)	10			10			10			10			10		
		size (ACRES)	0.25			0.25			0.25			0.25			0.25		
		Species count	12	12	17	12	12	14	13	13	15	12	12	15	10	10	10
		Stems per ACRE	445.2	445.2	777	465.4	465.4	849.8	485.6	485.6	760.8	477.5	477.5	756.8	586.8	586.8	586.8

Color for Density

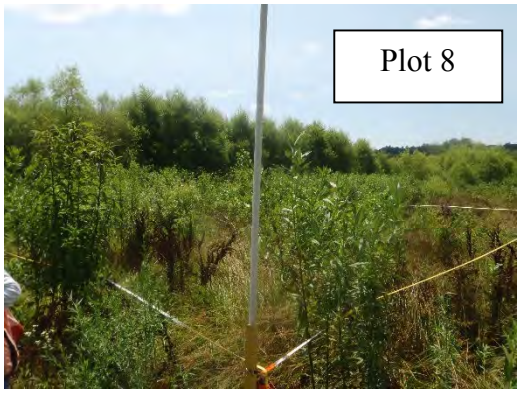
Exceeds requirements by 10%
Exceeds requirements, but by less than 10%
Fails to meet requirements, by less than 10%
Fails to meet requirements by more than 10%

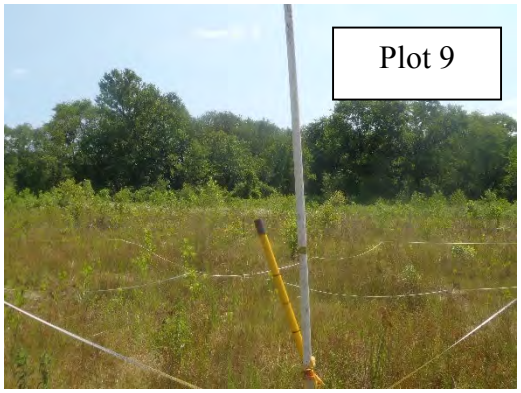
PnoLS = Planted excluding livestakes
P-all = Planting including livestakes
T = All planted and natural recruits including livestakes
T includes natural recruits

Herman Dairy
2015 (Year 4) Vegetation Monitoring Photographs
Taken July 2015



Herman Dairy
2015 (Year 4) Vegetation Monitoring Photographs
Taken July 2015
(continued)





Appendix D.
Stream Assessment Data

Stream Station Photos
Table 8a-8c. Visual Assessment Tables
Table 9. Verification of Bankfull Events
Tables 10a-10c. Baseline Stream Data Summary
Tables 11a-11e. Monitoring Data-Dimensional Data Summary
Longitudinal Profile Plots
Cross-section Plots
Substrate Plots

Herman Dairy
Fixed Station Photographs
Taken July 1, 2015

Photo Point 1

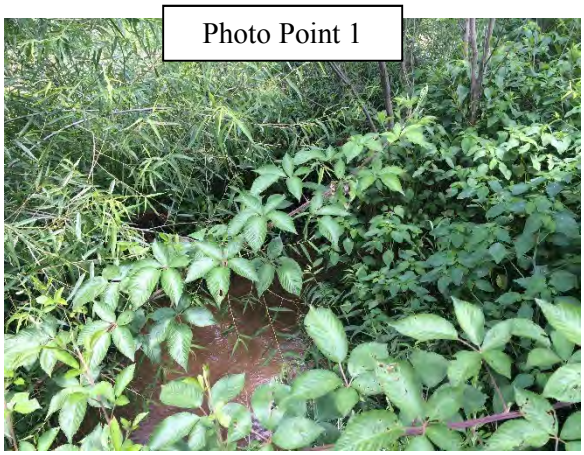


Photo Point 2

Photo Point 3

Photo Point 4

Photo Point 5

Photo Point 6

Herman Dairy
Fixed Station Photographs (continued)
Taken July 1, 2015

Photo Point 7

Photo Point 8

Photo Point 9

Photo Point 10

Table 8A **Visual Stream Morphology Stability Assessment**
Reach ID **Tributary 1**
Assessed Length **1374**

Major Channel Category	Channel Sub-Category	Metric	Number Stable, Performing as Intended	Total Number in As-built	Number of Unstable Segments	Amount of Unstable Footage	% Stable, Performing as Intended	Number with Stabilizing Woody Vegetation	Footage with Stabilizing Woody Vegetation	Adjusted % for Stabilizing Woody Vegetation
1. Bed	1. **Vertical Stability** (Riffle and Run units)	1. Aggradation - Bar formation/growth sufficient to significantly deflect flow laterally (not to include point bars)			0	0	100%			
		2. Degradation - Evidence of downcutting			0	0	100%			
	2. Riffle Condition	1. Texture/Substrate - Riffle maintains coarser substrate	19	19			100%			
	3. Meander Pool Condition	1. Depth Sufficient (Max Pool Depth : Mean Bankfull Depth ≥ 1.6)	20	20			100%			
		2. Length appropriate (>30% of centerline distance between tail of upstream riffle and head of downstrem riffle)	100	100			100%			
	4.**Thalweg Position**	1. Thalweg centering at upstream of meander bend (Run)	100	100			100%			
		2. Thalweg centering at downstream of meander (Glide)	100	100			100%			
2. Bank	**1. Scoured/Eroding**	Bank lacking vegetative cover resulting simply from poor growth and/or scour and erosion			0	0	100%			100%
	2. Undercut	Banks undercut/overhanging to the extent that mass wasting appears likely. Does NOT include undercuts that are modest, appear sustainable and are providing habitat.			0	0	100%			100%
	3. Mass Wasting	Bank slumping, calving, or collapse			0	0	100%			100%
				Totals	0	0	100%	0	0	100%
3. Engineered Structures	**1. Overall Integrity**	Structures physically intact with no dislodged boulders or logs.	2	2			100%			
	2. Grade Control	Grade control structures exhibiting maintenance of grade across the sill.	2	2			100%			
	2a. Piping	Structures lacking any substantial flow underneath sills or arms.	2	2			100%			
	3. Bank Protection	Bank erosion within the structures extent of influence does not exceed 15%. (See guidance for this table in EEP monitoring guidance document)	2	2			100%			
	4. Habitat	Pool forming structures maintaining ~ Max Pool Depth : Mean Bankfull Depth ratio ≥ 1.6 Rootwads/logs providing some cover at base-flow.	2	2			100%			

Table 8B **Visual Stream Morphology Stability Assessment**
Reach ID **Tributary 2**
Assessed Length **1522**

Major Channel Category	Channel Sub-Category	Metric	Number Stable, Performing as Intended	Total Number in As-built	Number of Unstable Segments	Amount of Unstable Footage	% Stable, Performing as Intended	Number with Stabilizing Woody Vegetation	Footage with Stabilizing Woody Vegetation	Adjusted % for Stabilizing Woody Vegetation
1. Bed	1. **Vertical Stability** (Riffle and Run units)	1. Aggradation - Bar formation/growth sufficient to significantly deflect flow laterally (not to include point bars)			0	0	100%			
		2. Degradation - Evidence of downcutting			0	0	100%			
	2. Riffle Condition	1. Texture/Substrate - Riffle maintains coarser substrate	39	39			100%			
	3. Meander Pool Condition	1. Depth Sufficient (Max Pool Depth : Mean Bankfull Depth ≥ 1.6)	37	37			100%			
		2. Length appropriate (>30% of centerline distance between tail of upstream riffle and head of downstrem riffle)	100	100			100%			
	4.**Thalweg Position**	1. Thalweg centering at upstream of meander bend (Run)	100	100			100%			
		2. Thalweg centering at downstream of meander (Glide)	100	100			100%			
2. Bank	**1. Scoured/Eroding**	Bank lacking vegetative cover resulting simply from poor growth and/or scour and erosion			0	0	100%			100%
	2. Undercut	Banks undercut/overhanging to the extent that mass wasting appears likely. Does NOT include undercuts that are modest, appear sustainable and are providing habitat.			0	0	100%			100%
	3. Mass Wasting	Bank slumping, calving, or collapse			0	0	100%			100%
				Totals	0	0	100%	0	0	100%
3. Engineered Structures	**1. Overall Integrity**	Structures physically intact with no dislodged boulders or logs.	3	3			100%			
	2. Grade Control	Grade control structures exhibiting maintenance of grade across the sill.	3	3			100%			
	2a. Piping	Structures lacking any substantial flow underneath sills or arms.	3	3			100%			
	3. Bank Protection	Bank erosion within the structures extent of influence does not exceed 15%. (See guidance for this table in EEP monitoring guidance document)	3	3			100%			
	4. Habitat	Pool forming structures maintaining ~ Max Pool Depth : Mean Bankfull Depth ratio ≥ 1.6 Rootwads/logs providing some cover at base-flow.	3	3			100%			

Table 8C **Visual Stream Morphology Stability Assessment**
Reach ID **Tributary 3**
Assessed Length **644**

Major Channel Category	Channel Sub-Category	Metric	Number Stable, Performing as Intended	Total Number in As-built	Number of Unstable Segments	Amount of Unstable Footage	% Stable, Performing as Intended	Number with Stabilizing Woody Vegetation	Footage with Stabilizing Woody Vegetation	Adjusted % for Stabilizing Woody Vegetation
1. Bed	1. **Vertical Stability** (Riffle and Run units)	1. Aggradation - Bar formation/growth sufficient to significantly deflect flow laterally (not to include point bars)			0	0	100%			
		2. Degradation - Evidence of downcutting			0	0	100%			
	2. Riffle Condition	1. Texture/Substrate - Riffle maintains coarser substrate	27	27			100%			
	3. Meander Pool Condition	1. Depth Sufficient (Max Pool Depth : Mean Bankfull Depth ≥ 1.6)	27	27			100%			
		2. Length appropriate (>30% of centerline distance between tail of upstream riffle and head of downstrem riffle)	100	100			100%			
	4.**Thalweg Position**	1. Thalweg centering at upstream of meander bend (Run)	100	100			100%			
		2. Thalweg centering at downstream of meander (Glide)	100	100			100%			
2. Bank	**1. Scoured/Eroding**	Bank lacking vegetative cover resulting simply from poor growth and/or scour and erosion			0	0	100%			100%
	2. Undercut	Banks undercut/overhanging to the extent that mass wasting appears likely. Does NOT include undercuts that are modest, appear sustainable and are providing habitat.			0	0	100%			100%
	3. Mass Wasting	Bank slumping, calving, or collapse			0	0	100%			100%
				Totals	0	0	100%	0	0	100%
3. Engineered Structures	**1. Overall Integrity**	Structures physically intact with no dislodged boulders or logs.	8	8			100%			
	2. Grade Control	Grade control structures exhibiting maintenance of grade across the sill.	8	8			100%			
	2a. Piping	Structures lacking any substantial flow underneath sills or arms.	8	8			100%			
	3. Bank Protection	Bank erosion within the structures extent of influence does not exceed 15%. (See guidance for this table in EEP monitoring guidance document)	8	8			100%			
	4. Habitat	Pool forming structures maintaining ~ Max Pool Depth : Mean Bankfull Depth ratio ≥ 1.6 Rootwads/logs providing some cover at base-flow.	8	8			100%			

Table 9. Verification of Bankfull Events

Date of Data Collection	Date of Occurrence	Method	Photo (if available)
May 11, 2013	May 6, 2013	Bankfull event documented when sediment deposits were observed on top of banks after 3.00 inches of rain was documented* over a two-day period.	--
July 18, 2013	June 6, 2013	Bankfull event documented after wrack was observed on top of bank and throughout floodplain after 4.27 inches of rain was documented* over a two-day period.	1-2
November 19, 2014	August 11, 2014	Bankfull event likely occurred after 3.61 inches of rain over a two-day period that was preceeded by 0.56 inches and followed by an additional 0.78 inches as documented by an onsite rain gauge.	--
July 31, 2015	April 19, 2015	Bankfull Event likely occurred after 2.2 inches of rain was documented over a one day period by an onsite rain gauge.	--
November 23, 2015	November 21, 2015	Bankfull event documented after sediment deposits were observed in floodplain of the main tributary and 1.96 inches of rain was documented over a three day period by an onsite rain gauge.	3

*Weather Underground (2013)

Table 10A. Baseline Morphology and Hydraulic Summary
Herman Dairy UT 1

Parameter	USGS Gage Data			Pre-Existing Condition			Project Reference Stream UT Catawba*			Project Reference Reach 1			Design			As-built		
Dimension	**Min**	**Max**	**Med**	**Min**	**Max**	**Med**	**Min**	**Max**	**Med**	**Min**	**Max**	**Med**	**Min**	**Max**	**Med**	**Min**	**Max**	**Med**
BF Width (ft)	USGS gage data is unavailable for this project			16	19	18	9	12	10	9	10	10	16	18	17	15.5	16.4	16.1
Floodprone Width (ft)				26	150	150	25	150	50	22	25	24			150			250
BF Cross Sectional Area (ft2)						20.2			10.9			11.8	36	53	20.2	14	18.2	16.4
BF Mean Depth (ft)				1.1	1.3	1.2	1.1	1.3	1.1	1.2	1.3	1.3	1.1	1.3	1.2	0.9	1.1	1
BF Max Depth (ft)				1.9	2.3	2	1.5	1.8	1.7	1.5	1.6	1.6	1.4	1.8	1.6	1.2	1.6	1.4
Width/Depth Ratio				12	17	16	8	13	10	7.2	8	7.6	12	16	14	14	17	16
Entrenchment Ratio				1.6	9.6	7.9	2.7	14.6	4.9	2.3	2.7	2.5	8	10	9	15	16	16
Bank Height Ratio				1.8	3.1	1.9			1			1	1	1.3	1.1			1
Wetted Perimeter(ft)						===			===			===			===	15.9	16.8	16.7
Hydraulic radius (ft)						===			===			===			===	0.9	1.1	1
Pattern																		
Channel Beltwidth (ft)				No pattern of riffles and pools due to straightening activties			30	40	35	35	58	45	50	101	67	50	101	67
Radius of Curvature (ft)							12.5	25	18	10	32	16	34	168	50	34	168	50
Meander Wavelength (ft)							25	70	45	65	128	81	101	202	143	101	202	143
Meander Width ratio							2.9	3.9	3.4	3.7	6.1	4.7	3	6	4	3	6	4
Profile																		
Riffle length (ft)				No pattern of riffles and pools due to straightening activties					===			===			===	23	65	36
Riffle slope (ft/ft)							0.30%	0.36%	0.34%	0.34%	4.31%	2.48%	1.10%	1.65%	1.38%	0.00%	1.50%	0.64%
Pool length (ft)									===			===			===	10	54	32
Pool spacing (ft)							22	62	39	29	103	60	50	134	67	50	134	67
Substrate																		
d50 (mm)						===			===			===			===			===
d84 (mm)						===			===			===			===			===
Additional Reach Parameters																		
Valley Length (ft)						===			===			===			===			.
Channel Length (ft)						===			===			===			===			2108
Sinuosity						1.1			1.4			1.4			1.2			1.2
Water Surface Slope (ft/ft)						0.62%			0.28%			1.27%			0.55%			0.53%
BF slope (ft/ft)						===			===			===			===			===
Rosgen Classification						Cd 5			E 4/5			E 4/5			Ec4/5			E/C 4/5

*UT to Catawba River Reference Site includes measurements from a stream measured in 2008.

Table 10B. Baseline Morphology and Hydraulic Summary
Herman Dairy UT 2

Parameter	USGS Gage Data			Pre-Existing Condition			Project Reference Stream UT Catawba*			Project Reference Reach 1			Design			As-built^		
Dimension	**Min**	**Max**	**Med**	**Min**	**Max**	**Med**	**Min**	**Max**	**Med**	**Min**	**Max**	**Med**	**Min**	**Max**	**Med**	**Min**	**Max**	**Med**
BF Width (ft)	USGS gage data is unavailable for this project			6	15	9	9	12	10	9	10	10	5.3	6.1	5.7	6.8	7.9	6.9
Floodprone Width (ft)				14	19	15	25	150	50	22	25	24			150			150
BF Cross Sectional Area (ft2)						2.3			10.9			11.8			2.3	2.2	2.4	2.3
BF Mean Depth (ft)				0.2	0.4	0.3	1.1	1.3	1.1	1.2	1.3	1.3	0.3	0.5	0.4	0.3	0.3	0.3
BF Max Depth (ft)				0.4	0.8	0.5	1.5	1.8	1.7	1.5	1.6	1.6	0.4	0.6	0.5	0.5	0.5	0.5
Width/Depth Ratio				16	76	30	8	13	10	7.2	8	7.6	12	16	14	20	27	21
Entrenchment Ratio				1.3	2.2	1.6	2.7	14.6	4.9	2.3	2.7	2.5	14	38	26	19	22	22
Bank Height Ratio				5	12	7			1			1	1	1.3	1.1			1
Wetted Perimeter(ft)						===			===			===			===	7	8	7.1
Hydraulic radius (ft)						===			===			===			===	0.3	0.3	0.3
Pattern																		
Channel Beltwidth (ft)				No pattern of riffles and pools due to straightening activties			30	40	35	35	58	45	17	34	23	17	34	23
Radius of Curvature (ft)							12.5	25	18	10	32	16	11	57	17	11	57	17
Meander Wavelength (ft)							25	70	45	65	128	81	34	68	49	34	68	49
Meander Width ratio							2.9	3.9	3.4	3.7	6.1	4.7	3	8	4	3	8	4
Profile																		
Riffle length (ft)				No pattern of riffles and pools due to straightening activties					===			===			===	6	44	14
Riffle slope (ft/ft)							0.30%	0.36%	0.34%	0.34%	4.31%	2.48%	0.86%	1.29%	1.08%	0.00%	1.25%	0.39%
Pool length (ft)									===			===			===	6	32	13
Pool spacing (ft)							22	62	39	29	103	60	17	46	23	17	46	23
Substrate																		
d50 (mm)						===			===			===			===			===
d84 (mm)						===			===			===			===			===
Additional Reach Parameters																		
Valley Length (ft)						===			===			===			===			.
Channel Length (ft)						===			===			===			===			1696
Sinuosity						1.04			1.4			1.4			1.2			1.2
Water Surface Slope (ft/ft)						0.85%			0.28%			1.27%			0.43%			0.40%
BF slope (ft/ft)						===			===			===			===			===
Rosgen Classification						Fc 5/6			E 4/5			E 4/5			Ec4/5			C 4/5

^Measured as-built numbers do not include D-type reach.
*UT to Catawba River Reference Site includes measurements from a stream measured in 2008.

Table 10C. Baseline Morphology and Hydraulic Summary
Herman Dairy UT 3

Parameter	USGS Gage Data			Pre-Existing Condition			Project Reference Stream UT Catawba*			Project Reference Reach 1			Design			As-built		
Dimension	**Min**	**Max**	**Med**	**Min**	**Max**	**Med**	**Min**	**Max**	**Med**	**Min**	**Max**	**Med**	**Min**	**Max**	**Med**	**Min**	**Max**	**Med**
BF Width (ft)	USGS gage data is unavailable for this project			6	9	7	9	12	10	9	10	10	6	7	6.5	6.8	8.5	7.7
Floodprone Width (ft)				12	13	12	25	150	50	22	25	24			150			150
BF Cross Sectional Area (ft2)						3			10.9			11.8			3	2.2	3.1	2.7
BF Mean Depth (ft)				0.3	0.5	0.4	1.1	1.3	1.1	1.2	1.3	1.3	0.4	0.6	0.5	0.3	0.4	0.4
BF Max Depth (ft)				0.6	0.9	0.7	1.5	1.8	1.7	1.5	1.6	1.6	0.6	0.8	0.7	0.5	0.5	0.5
Width/Depth Ratio				13	31	17	8	13	10	7.2	8	7.6	12	16	14	21	23	22
Entrenchment Ratio				1.4	1.9	1.7	2.7	14.6	4.9	2.3	2.7	2.5	22	25	23	17	22	19.5
Bank Height Ratio				4	7	6			1			1	1	1.3	1.1			1
Wetted Perimeter(ft)						===			===			===			===	7	8.7	7.9
Hydraulic radius (ft)						===			===			===			===	0.3	0.4	0.4
Pattern																		
Channel Beltwidth (ft)				No pattern of riffles and pools due to straightening activties			30	40	35	35	58	45	20	39	26	20	39	26
Radius of Curvature (ft)							12.5	25	18	10	32	16	13	65	20	13	65	20
Meander Wavelength (ft)							25	70	45	65	128	81	39	78	55	39	78	55
Meander Width ratio							2.9	3.9	3.4	3.7	6.1	4.7	3	8	4	3	8	4
Profile																		
Riffle length (ft)				No pattern of riffles and pools due to straightening activties					===			===			===	5	26	11
Riffle slope (ft/ft)							0.30%	0.36%	0.34%	0.34%	4.31%	2.48%	0.22%	0.33%	0.28%	0.00%	1.59%	0.22%
Pool length (ft)									===			===			===	7	21	13
Pool spacing (ft)							22	62	39	29	103	60	20	52	26	20	52	26
Substrate																		
d50 (mm)						===			===			===			===			===
d84 (mm)						===			===			===			===			===
Additional Reach Parameters																		
Valley Length (ft)						===			===			===			===			.
Channel Length (ft)						===			===			===			===			743
Sinuosity						1.01			1.4			1.4			1.2			1.2
Water Surface Slope (ft/ft)						0.40%			0.28%			1.27%			0.11%			0.12%
BF slope (ft/ft)						===			===			===			===			===
Rosgen Classification						Fc 5/6			E 4/5			E 4/5			Ec4/5			C 4/5

*UT to Catawba River Reference Site includes measurements from a stream measured in 2008.

Table 11A. Morphology and Hydraulic Monitoring Summary
Herman Dairy - Stream and Wetland Restoration Site

Parameter	Cross Section 1 Pool (UT 1)						Cross Section 2 Riffle (UT 1)						Cross Section 3 Riffle (UT 1)						Cross Section 4 Pool (UT 1)					
Dimension	**MY 0**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**MY 0**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**MY 0**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**MY 0**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**
BF Width (ft)	20.9	19.6	18.1	24.8	20.9		16.9	17.1	17.4	18.2	17.2		16.4	17	18.9	14	13		16.8	18.2	20.2	10.2	14	
Floodprone Width (ft)	----	----	----	----	----		250	250	250	250	250		250	250	250	250	250		----	----	----	----	----	
BF Cross Sectional Area (ft2)	19.9	18.9	17.4	17.4	14.8		16.3	16	14.9	14	11		16.7	17	17.5	10	7.9		14.4	14.5	13.8	10.5	10.6	
BF Mean Depth (ft)	1.0	1.0	1.0	0.7	0.7		1.0	0.9	0.9	0.8	0.6		1.0	1.0	0.9	0.7	0.6		0.9	0.8	0.7	1.0	0.8	
BF Max Depth (ft)	2.3	2.2	2.1	1.7	1.8		1.4	1.5	1.4	1.5	1.3		1.4	1.4	1.4	1.4	1.4		2.1	2.1	2.3	1.5	1.7	
Width/Depth Ratio	----	----	----	----	----		17.5	18.3	20.3	23.7	26.9		16.1	17.0	20.4	19.6	21.4		----	----	----	----	----	
Entrenchment Ratio	----	----	----	----	----		14.8	14.6	14.4	13.7	14.5		15.2	14.7	13.2	17.9	19.2		----	----	----	----	----	
Bank Height Ratio	----	----	----	----	----		1.0	1.0	1.0	1.0	1.0		1.0	1.0	1.0	1.0	1.0		----	----	----	----	----	
Wetted Perimeter (ft)	21.7	20.4	18.8	25.6	21.6		17.2	17.4	17.8	18.6	17.5		16.8	17.6	19.5	14.6	13.7		17.6	19.1	21.2	10.9	14.8	
Hydraulic Radius (ft)	0.9	0.9	0.9	0.6	0.7		0.9	0.9	0.8	0.8	0.6		1	1	0.9	0.7	0.6		0.8	0.8	0.6	1	0.7	
Substrate																								
d50 (mm)	----	----	----	----	----		----	----	0.4	0.4	NA		----	----	0.2	0.2	0.2		----	----	----	----	----	
d84 (mm)	----	----	----	----	----		----	----	15	14	1		----	----	10	4	1		----	----	----	----	----	

Parameter	MY-00 (2012)			MY-01 (2012)			MY-02 (2013)			MY-03 (2014)			MY-04 (2015)			MY-05 (2016)		
	Min	**Max**	**Med**	**Min**	**Max**	**Med**	**Min**	**Max**	**Med**	**Min**	**Max**	**Med**	**Min**	**Max**	**Med**	**Min**	**Max**	**Med**
Pattern																		
Channel Beltwidth (ft)	50	101	67	50	101	67	50	101	67	50	101	67	50	101	67			
Radius of Curvature (ft)	34	168	50	34	168	50	34	168	50	34	168	50	34	168	50			
Meander Wavelength (ft)	50	101	67	50	101	67	50	101	67	50	101	67	50	101	67			
Meander Width Ratio	3	6	4	3	6	4	3	6	4	3	6	4	3	6	4			
Profile																		
Riffle Length (ft)	23	65	36	16	49	28	5	82	33	5	117	36	8	135	49			
Riffle Slope (ft/ft)	0.00%	1.50%	0.64%	0.05%	1.05%	0.57%	0.14%	1.92%	0.65%	0.11%	1.13%	0.37%	0.01%	1.27%	0.41%			
Pool Length (ft)	10	54	32	18	62	35	12	63	31	7	49	30	11	56	30			
Pool Spacing (ft)	50	134	67	50	134	67	50	134	67	50	134	67	50	134	67			
Additonal Reach Parameters																		
Valley Length (ft)	1757			1373			1525			1513			1508					
Channel Length (ft)	2,108			1,648			1830			1816			1809					
Sinuosity	1.2			1.2			1.2			1.2			1.2					
Water Surface Slope (ft/ft)	0.0053			0.0045			0.0054			0.0051			0.005					
BF Slope (ft/ft)	------			------			------			------			------					
Rosgen Classification	C/E 4/5			C-4/5			C 4/5			C 4/5			C4/5					

Table 11B. Morphology and Hydraulic Monitoring Summary
Herman Dairy - Stream and Wetland Restoration Site

Parameter	Cross Section 5 Riffle (UT 1)						Cross Section 6 Pool (UT 1)						Cross Section 7 Riffle (UT 1)						Cross Section 8 Pool (UT 1)					
Dimension	**MY 0**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**MY 0**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**MY 0**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**MY 0**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**
BF Width (ft)	16.1	16.3	16.7	9.5	11		20	17.2	19.5	8.3	14.8		15.5	14.6	16.8	10.4	9.7		16.1	18.4	18.7	9.6	9.1	
Floodprone Width (ft)	250	250	250	250	250		----	----	----	----	----		250	250	250	250	250		----	----	----	----	----	
BF Cross Sectional Area (ft2)	18.2	16.6	15.2	7.5	8.9		20.3	17.7	15	7.8	8		14	14	14.5	9.3	8		15.5	16	16	11.7	10.3	
BF Mean Depth (ft)	1.1	1.0	0.9	0.8	0.8		1.0	1.0	0.8	0.9	0.9398		0.9	1.0	0.9	0.9	0.8		1.0	0.9	0.9	1.2	1.1	
BF Max Depth (ft)	1.6	1.4	1.5	1.1	1.4		2.3	2.2	2.2	1.5	1.5		1.2	1.4	1.5	1.5	1.4		1.9	2.1	2.3	2.1	1.8	
Width/Depth Ratio	14.2	16.0	18.3	12.0	13.6		----	----	----	----	----		17.161	15.226	19.465	11.6	11.8		----	----	----	----	----	
Entrenchment Ratio	15.5	15.3	15.0	26.3	22.7		----	----	----	----	----		16.129	17.123	14.881	24	25.8		----	----	----	----	----	
Bank Height Ratio	1	1	1	1	1		----	----	----	----	----		1	1	1	1	1		----	----	----	----	----	
Wetted Perimeter (ft)	16.8	16.9	17.2	10	11.8		21	18.3	20.5	9.1	15.5		15.9	15.1	17.3	11.2	10.4		16.8	19.1	19.6	10.8	10.1	
Hydraulic Radius (ft)	1.1	1	0.9	0.8	0.8		1	1	0.7	0.9	0.5		0.9	0.9	0.8	0.8	0.8		0.9	0.8	0.8	1.1	1	
Substrate																								
d50 (mm)	----	----	----	----	----		----	----	----	----	----		----	----	----	----	----		----	----	----	----	----	
d84 (mm)	----	----	----	----	----		----	----	----	----	----		----	----	----	----	----		----	----	----	----	----	

Parameter	**MY-00 (2012)**			**MY-01 (2012)**			**MY-02 (2013)**			**MY-03 (2014)**			**MY-04 (2015)**			**MY-05 (2016)**		
	Min	**Max**	**Med**	**Min**	**Max**	**Med**	**Min**	**Max**	**Med**	**Min**	**Max**	**Med**	**Min**	**Max**	**Med**	**Min**	**Max**	**Med**
Pattern																		
Channel Beltwidth (ft)	50	101	67	50	101	67	50	101	67	50	101	67	50	101	67			
Radius of Curvature (ft)	34	168	50	34	168	50	34	168	50	34	168	50	34	168	50			
Meander Wavelength (ft)	50	101	67	50	101	67	50	101	67	50	101	67	50	101	67			
Meander Width Ratio	3	6	4	3	6	4	3	6	4	3	6	4	3	6	4			
Profile																		
Riffle Length (ft)	23	65	36	16	49	28	5	82	33	5	117	36	8	135	49			
Riffle Slope (ft/ft)	0.00%	1.50%	0.64%	0.05%	1.05%	0.57%	0.14%	1.92%	0.65%	0.11%	1.13%	0.37%	0.01%	1.27%	0.41%			
Pool Length (ft)	10	54	32	18	62	35	12	63	31	7	49	30	11	56	30			
Pool Spacing (ft)	50	134	67	50	134	67	50	134	67	50	134	67	50	134	67			
Additonal Reach Parameters																		
Valley Length (ft)	1757			1373			1525			1513			1508					
Channel Length (ft)	2,108			1,648			1830			1816			1809					
Sinuosity	1.2			1.2			1.2			1.2			1.2					
Water Surface Slope (ft/ft)	0.0053			0.0045			0.0054			0.0051			0.005					
BF Slope (ft/ft)	------			------			------			------			------					
Rosgen Classification	C/E 4/5			C-4/5			C 4/5			C 4/5			C4/5					

Table 11C. Morphology and Hydraulic Monitoring Summary
Herman Dairy - Stream and Wetland Restoration Site

Parameter	Cross Section 9 Pool (UT 1)						Cross Section 10 Riffle (UT 1)						Cross Section 11 Riffle (UT2)						Cross Section 12 Pool (UT2)					
Dimension	**MY 0**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**MY 0**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**MY 0**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**MY 0**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**
BF Width (ft)	18.7	16.2	16.6	17.8	17.5		16	17	15.5	8.4	8.4		7.9	5.2	5.8	6.1	6		5.5	5.8	5.3	5.2	5.4	
Floodprone Width (ft)	----	----	----	----	----		250	250	250	250	250		150	150	150	150	150		----	----	----	----	----	
BF Cross Sectional Area (ft2)	15.7	15.4	16	12.8	13		16	15.6	13.2	8.5	8.3		2.3	1.3	1.4	1.3	1.3		2.3	2.1	2	2	2	
BF Mean Depth (ft)	0.8	1.0	1.0	0.7	0.7		1.0	0.9	0.9	1.0	1.0		0.3	0.3	0.2	0.2	0.2		0.4	0.4	0.4	0.4	0.4	
BF Max Depth (ft)	2	2.3	2.4	2	2.1		1.3	1.4	1.3	1.5	1.5		0.5	0.4	0.4	0.3	0.4		0.8	0.7	0.7	0.7	0.6	
Width/Depth Ratio	----	----	----	----	----		16.0	18.5	18.2	8.3	8.5		27.1	20.8	24.0	28.6	27.7		----	----	----	----	----	
Entrenchment Ratio	----	----	----	----	----		15.6	14.7	16.1	29.8	29.8		19.0	28.8	25.9	24.6	25.0		----	----	----	----	----	
Bank Height Ratio	----	----	----	----	----		1	1	1	1	1		1	1	1	1	1		----	----	----	----	----	
Wetted Perimeter (ft)	19.5	17	17.8	19	18.8		16.5	17.6	15.9	9.1	9.1		8	5.3	5.9	6.2	6.1		5.8	6	5.5	5.4	5.6	
Hydraulic Radius (ft)	0.8	0.9	0.9	0.7	0.7		1	0.9	0.8	0.9	0.9		0.3	0.2	0.2	0.2	0.2		0.4	0.3	0.4	0.4	0.4	
Substrate																								
d50 (mm)	----	----	----	----	----		----	----	9.8	8	0.8		----	----	----	----	----		----	----	----	----	----	
d84 (mm)	----	----	----	----	----		----	----	21	17	13		----	----	----	----	----		----	----	----	----	----	

Parameter	MY-00 (2012)			MY-01 (2012)			MY-02 (2013)			MY-03 (2014)			MY-04 (2015)			MY-05 (2016)		
	Min	**Max**	**Med**	**Min**	**Max**	**Med**	**Min**	**Max**	**Med**	**Min**	**Max**	**Med**	**Min**	**Max**	**Med**	**Min**	**Max**	**Med**
Pattern																		
Channel Beltwidth (ft)	50	101	67	50	101	67	50	101	67	50	101	67	50	101	67			
Radius of Curvature (ft)	34	168	50	34	168	50	34	168	50	34	168	50	34	168	50			
Meander Wavelength (ft)	50	101	67	50	101	67	50	101	67	50	101	67	50	101	67			
Meander Width Ratio	3	6	4	3	6	4	3	6	4	3	6	4	3	6	4			
Profile																		
Riffle Length (ft)	17	111	51	16	49	28	5	82	33	5	117	36	8	135	49			
Riffle Slope (ft/ft)	0.43%	4.80%	1.54%	0.05%	1.05%	0.57%	0.14%	1.92%	0.65%	0.11%	1.13%	0.37%	0.01%	1.27%	0.41%			
Pool Length (ft)	26	78	46	18	62	35	12	63	31	7	49	30	11	56	30			
Pool Spacing (ft)	76	176	126	50	134	67	50	134	67	50	134	67	50	134	67			
Additonal Reach Parameters																		
Valley Length (ft)	1757			1373			1525			1513			1508					
Channel Length (ft)	2,108			1,648			1830			1816			1809					
Sinuosity	1.2			1.2			1.2			1.2			1.2					
Water Surface Slope (ft/ft)	0.0053			0.0045			0.0054			0.0051			0.005					
BF Slope (ft/ft)	------			------			------			------			------					
Rosgen Classification	C/E 4/5			C-4/5			C 4/5			C 4/5			C4/5					

Table 11D. Morphology and Hydraulic Monitoring Summary
Herman Dairy - Stream and Wetland Restoration Site

Parameter	Cross Section 13 Riffle (UT 2)						Cross Section 14 Pool (UT 2)						Cross Section 15 Riffle (UT2)						Cross Section 16 Pool (UT2)					
Dimension	**MY 0**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**MY 0**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**MY 0**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**MY 0**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**
BF Width (ft)	6.9	7	6.3	6.5	6.6		6.6	6.8	6	5.8	6		6.8	6.9	6.9	7.1	6.8		5.7	7.1	5.6	3.6	5.8	
Floodprone Width (ft)	150	150	150	150	150		----	----	----	----	----		150	150	150	150	150		----	----	----	----	----	
BF Cross Sectional Area (ft2)	2.4	1.5	1.7	1.7	1.6		2.4	2.6	2.5	2.4	2.5		2.2	2.2	2.2	1.2	1.6		2.3	2.4	2.1	1.4	1.6	
BF Mean Depth (ft)	0.3	0.2	0.3	0.3	0.2		0.4	0.4	0.4	0.4	0.4		0.3	0.3	0.3	0.2	0.2		0.4	0.3	0.4	0.4	0.3	
BF Max Depth (ft)	0.5	0.5	0.5	0.6	0.3		0.7	0.7	0.8	0.8	0.8		0.5	0.5	0.5	0.3	0.4		0.8	0.8	0.9	0.8	0.8	
Width/Depth Ratio	19.8	32.7	23.3	24.9	27.2		----	----	----	----	----		21.0	21.6	21.6	42.0	28.9		----	----	----	----	----	
Entrenchment Ratio	21.7	21.4	23.8	23.1	22.7		----	----	----	----	----		22.1	21.7	21.7	21.1	22.1		----	----	----	----	----	
Bank Height Ratio	1	1	1	1	1		----	----	----	----	----		1	1	1	1	1		----	----	----	----	----	
Wetted Perimeter (ft)	7.1	7.2	6.5	6.7	6.8		6.8	7	6.3	6.1	6.2		7	7.1	7.1	7.2	7		6	7.3	6	4.1	6.3	
Hydraulic Radius (ft)	0.3	0.2	0.3	0.3	0.2		0.3	0.4	0.4	0.4	0.4		0.3	0.3	0.3	0.2	0.2		0.4	0.3	0.3	0.3	0.3	
Substrate																								
d50 (mm)	----	----	24.6	26.5	24.6		----	----	----	----	----		----	----	24.2	23.9	22		----	----	----	----	----	
d84 (mm)	----	----	40	48	43		----	----	----	----	----		----	----	45	49	45		----	----	----	----	----	

Parameter	**MY-00 (2012)**			**MY-01 (2012)**			**MY-02 (2013)**			**MY-03 (2014)**			**MY-04 (2015)**			**MY-05 (2016)**		
	Min	**Max**	**Med**	**Min**	**Max**	**Med**	**Min**	**Max**	**Med**	**Min**	**Max**	**Med**	**Min**	**Max**	**Med**	**Min**	**Max**	**Med**
Pattern																		
Channel Beltwidth (ft)	17	34	23	17	34	23	17	34	23	17	34	23	17	34	23			
Radius of Curvature (ft)	11	57	17	11	57	17	11	57	17	11	57	17	11	57	17			
Meander Wavelength (ft)	34	68	49	34	68	49	34	68	49	34	68	49	34	68	49			
Meander Width Ratio	3	6	4	3	6	4	3	6	4	3	6	4	3	6	4			
Profile																		
Riffle Length (ft)	6	44	14	6	41	11	6	28	12	6	34	12	3	24	12			
Riffle Slope (ft/ft)	0.00%	1.25%	0.39%	0	3.39	0.42	0.00%	3.33%	0.42%	0.00%	2.76%	0.39%	0.00%	2.94%	0.51%			
Pool Length (ft)	6	32	13	7	21	11	6	21	11	4	20	10	5	37	13			
Pool Spacing (ft)	17	46	23	17	46	23	17	46	23	17	46	23	17	46	23			
Additonal Reach Parameters																		
Valley Length (ft)	1413			1522			1298			1316			1314					
Channel Length (ft)	1,696			1,827			1557			1579			1577					
Sinuosity	1.2			1.2			1.2			1.2			1.2					
Water Surface Slope (ft/ft)	0.004			0.0041			0.0042			0.0043			0.0044					
BF Slope (ft/ft)	------			------			------			------			------					
Rosgen Classification	C/E 4/5			C 4/5			C 4/5			C 4/5			C4/5					

Table 11E. Morphology and Hydraulic Monitoring Summary
Herman Dairy - Stream and Wetland Restoration Site

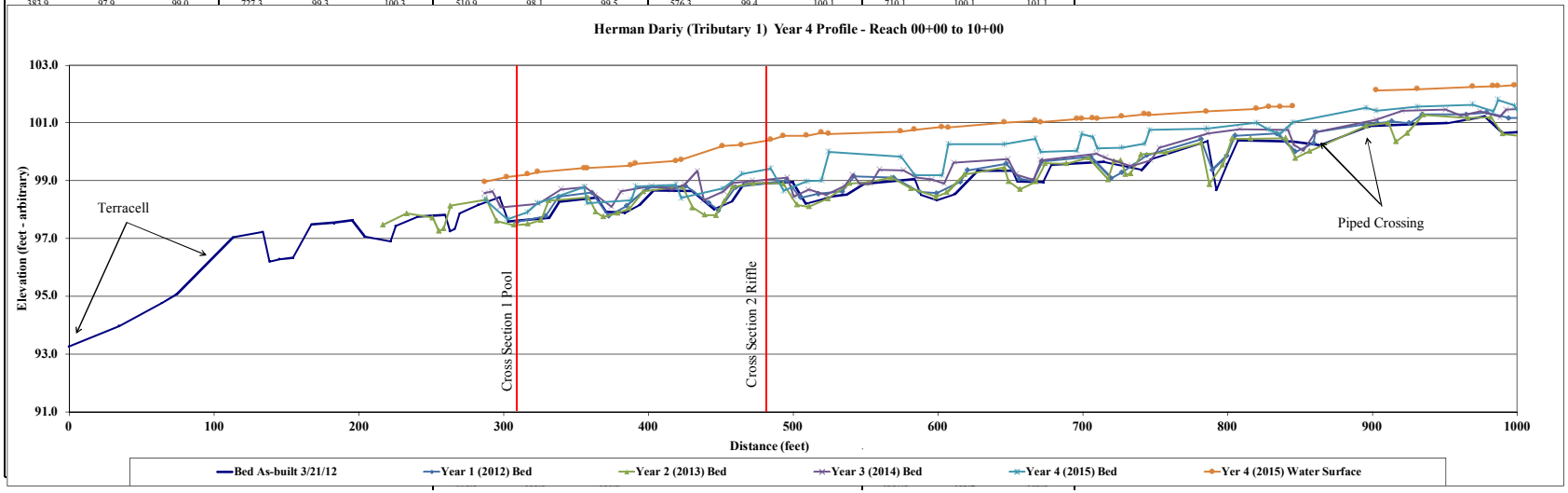
Parameter	Cross Section 17 Riffle (UT 3)						Cross Section 18 Pool (UT 3)						Cross Section 19 Pool (UT3)						Cross Section 20 Riffle (UT3)					
Dimension	**MY 0**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**MY 0**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**MY 0**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**MY 0**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**
BF Width (ft)	8.5	7.7	7.7	8.5	8		6.2	6.2	6.5	6.5	6.4		6.8	6.5	6.4	6.2	9		9.5	7.8	7.5	7.2	7.5	
Floodprone Width (ft)	150	150	150	150	150		----	----	----	----	----		----	----	----	----	----		150	150	150	150	150	
BF Cross Sectional Area (ft2)	3.1	2.6	2.7	2.9	2.7		3.8	3.7	3.6	3.6	3.5		3	3	2.9	2.7	2.9		3.2	2.3	2.6	2.4	2.8	
BF Mean Depth (ft)	0.4	0.3	0.4	0.3	0.3		0.6	0.6	0.6	0.6	0.5		0.4	0.5	0.5	0.4	0.3		0.3	0.3	0.3	0.3	0.4	
BF Max Depth (ft)	0.5	0.5	0.5	0.5	0.5		1	1.1	1	1	1		0.9	1	0.9	0.9	0.9		0.6	0.4	0.5	0.5	0.5	
Width/Depth Ratio	23.3	22.8	22.0	24.9	23.7		----	----	----	----	----		----	----	----	----	----		28.2	26.5	21.6	21.6	20.1	
Entrenchment Ratio	17.6	19.5	19.5	17.6	18.8		----	----	----	----	----		----	----	----	----	----		15.8	19.2	20.0	20.8	20.0	
Bank Height Ratio	1	1	1	1	1		----	----	----	----	----		----	----	----	----	----		1	1	1	1	1	
Wetted Perimeter (ft)	8.7	7.8	7.8	8.7	8.2		6.7	6.6	6.9	7	6.8		7.2	6.9	6.7	6.5	9.2		9.7	7.9	7.7	7.3	7.7	
Hydraulic Radius (ft)	0.4	0.3	0.3	0.3	0.3		0.6	0.6	0.5	0.5	0.5		0.4	0.4	0.4	0.4	0.3		0.3	0.3	0.3	0.3	0.4	
Substrate																								
d50 (mm)	----	----	28.2	27.7	24		----	----	----	----	----		----	----	----	----	----		----	----	----	----	----	
d84 (mm)	----		43	45	48		----	----	----	----	----		----	----	----	----	----		----	----	----	----	----	

Parameter	MY-00 (2012)			MY-01 (2012)			MY-02 (2013)			MY-03 (2014)			MY-04 (2015)			MY-05 (2016)		
	Min	**Max**	**Med**	**Min**	**Max**	**Med**	**Min**	**Max**	**Med**	**Min**	**Max**	**Med**	**Min**	**Max**	**Med**	**Min**	**Max**	**Med**
Pattern																		
Channel Beltwidth (ft)	20	39	26	20	39	26	20	39	26	20	39	26	20	39	26			
Radius of Curvature (ft)	13	65	20	13	65	20	13	65	20	13	65	20	13	65	20			
Meander Wavelength (ft)	39	78	55	39	78	55	39	78	55	39	78	55	39	78	55			
Meander Width Ratio	3	6	4	3	6	4	3	6	4	3	6	4	3	6	4			
Profile																		
Riffle Length (ft)	5	26	11	5	27	9	4	27	10	5	27	11	5	19	11			
Riffle Slope (ft/ft)	0.00%	1.59%	0.22%	----	----	----	0.00%	1.43%	0.28%	0.00%	1.66%	0.26%	0.00%	2.32%	0.54%			
Pool Length (ft)	8	21	13	7	24	13	7	21	13	6	21	14	7	22	13			
Pool Spacing (ft)	20	52	26	20	52	26	20	52	26	20	52	26	20	52	26			
Additonal Reach Parameters																		
Valley Length (ft)	619			645			616			609			601					
Channel Length (ft)	743			774			739			731			721					
Sinuosity	1.2			1.2			1.2			1.2			1.2					
Water Surface Slope (ft/ft)	0.0012			----			0.0015			0.0015			0.0013					
BF Slope (ft/ft)	------			----			----			----			----					
Rosgen Classification	C/E 4/5			C 4/5			C 4/5			C 4/5			C4/5					

Project Name	Herman Dairy - Year 4 (2015) Profile
Reach	Tributary 1
Feature	Profile
Date	4/6/15
Crew	Perkinson, Jernigan

2012 As-built Survey			2012 Year 1 Monitoring \Survey			2013 Year 2 Monitoring \Survey			2014 Year 3 Monitoring \Survey			2015 Year 4 Monitoring \Survey		
Station	**Bed Elevation**	**Water Elevation**	**Station**	**Bed Elevation**	**Water Elevation**	**Station**	**Bed Elevation**	**Water Elevation**	**Station**	**Bed Elevation**	**Water Elevation**	**Station**	**Bed Elevation**	**Water Elevation**
0.0	93.3	93.9	309.6	97.6	98.9	216.9	97.5	98.2	287.0	98.6	98.8	287.0	98.4	99.0
34.6	94.0	94.3	328.9	97.8	98.9	233.1	97.9	98.2	292.2	98.6	98.9	302.5	97.7	99.1
64.3	94.8	95.2	338.1	98.4	99.0	251.0	97.7	98.3	298.1	98.1	98.9	316.7	97.9	99.2
74.2	95.1	95.4	361.2	98.6	99.1	255.4	97.3	98.2	323.8	98.2	99.1	323.6	98.2	99.3
113.3	97.0	97.5	372.6	97.8	99.2	258.6	97.3	98.3	339.8	98.7	99.1	355.9	98.8	99.4
133.7	97.2	97.9	384.9	98.1	99.2	263.3	98.1	98.4	356.5	98.8	99.2	357.8	98.2	99.4
138.4	96.2	98.0	399.8	98.8	99.2	288.3	98.3	98.7	363.3	98.5	99.2	388.1	98.3	99.5
145.3	96.3	97.9	425.9	98.8	99.2	295.3	97.6	98.7	374.5	98.1	99.3	391.4	98.8	99.6
154.5	96.3	98.0	442.1	98.2	99.2	307.2	97.5	98.7	381.1	98.6	99.3	419.2	98.9	99.7
167.2	97.5	98.0	448.7	98.0	99.3	316.9	97.5	98.7	402.4	98.8	99.4	422.9	98.4	99.7
182.9	97.5	98.1	460.2	98.8	99.3	326.0	97.6	98.7	408.9	98.8	99.4	451.4	98.7	100.2
195.8	97.6	98.1	495.5	99.0	99.5	331.1	98.3	98.8	416.2	98.7	99.4	464.7	99.2	100.2
204.1	97.1	98.1	505.1	98.4	99.5	358.4	98.4	99.0	425.2	98.9	99.4	484.6	99.4	100.4
221.9	96.9	98.1	517.5	98.5	99.5	363.8	97.9	99.1	433.9	99.3	99.5	493.4	98.7	100.5
225.5	97.4	98.1	534.0	98.6	99.4	368.9	97.7	99.1	438.3	98.3	99.5	509.5	99.0	100.6
240.5	97.8	98.2	542.1	99.2	99.5	378.8	97.9	99.1	452.1	98.6	99.5	519.5	99.0	100.7
259.8	97.8	98.3	569.5	99.1	99.6	386.9	98.0		458.1	98.9	99.6	524.7	100.0	100.6
263.0	97.3	98.3	587.1	98.6	99.6	396.6	98.6	99.1	471.9	99.0	99.6	574.5	99.8	100.7
266.2	97.3	98.3	599.2	98.6	99.6	423.5	98.8	99.1	496.2	99.1	99.7	584.0	99.2	100.8
269.8	97.9	98.4	615.4	99.0	99.6	430.5	98.1	99.2	500.7	98.5	99.7	602.9	99.2	100.9
282.4	98.2	98.5	620.7	99.4	99.7	438.9	97.8	99.2	510.7	98.7	99.7	607.3	100.3	100.8
297.4	98.4	98.7	647.1	99.6	99.9	446.6	97.8	99.2	522.8	98.5	99.8	645.9	100.3	101.0
303.3	97.6	98.7	656.5	99.1	100.0	452.6	98.3	99.1	535.7	98.8	99.8	667.3	100.5	101.1
331.6	97.7	98.7	665.6	99.0	100.0	458.2	98.8	99.3	541.2	99.2	99.8	671.0	100.0	101.0
338.2	98.3	98.8	672.0	99.7	100.0	472.7	98.9	99.3	546.1	98.9	99.9	696.2	100.0	101.1
364.5	98.4	98.9	705.7	99.8	100.2	493.2	98.9	99.5	553.4	98.9	99.9	699.4	100.6	101.2
370.8	97.9	99.0	719.8	99.1	100.2	502.7	98.2	99.5	559.6	99.4	99.9	707.0	100.5	101.2
383.9	97.9	99.0	727.3	99.3	100.3	510.9	98.1	99.5	576.3	99.4	100.1	710.1	100.1	101.1

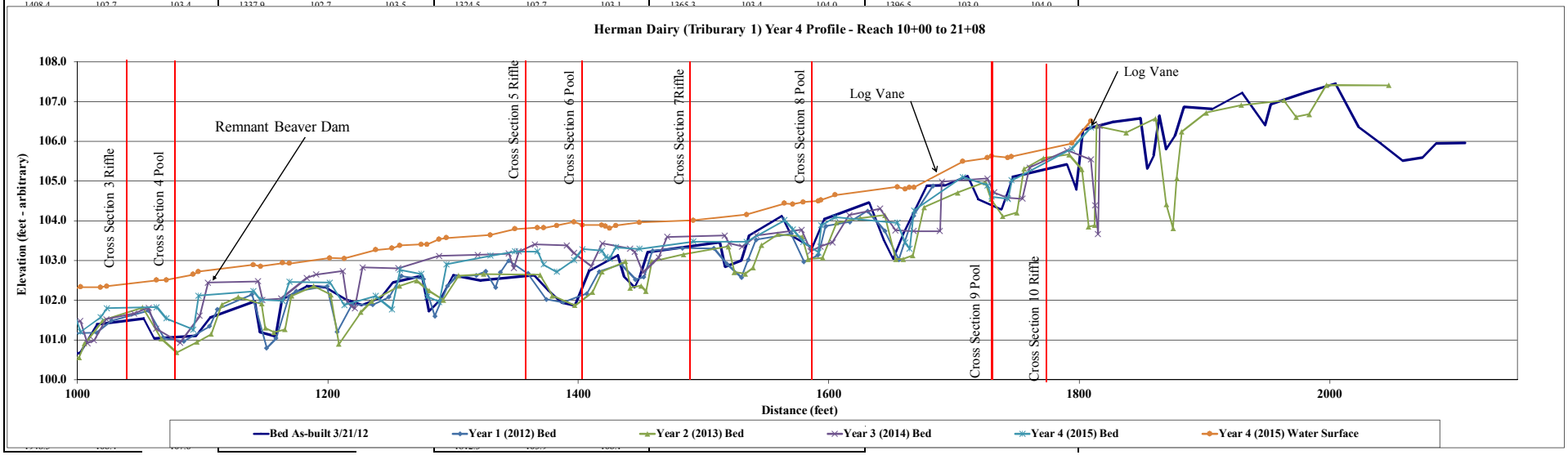
	As-built	2012	2013	2014	2015
Avg. Water Surface Slope	0.0053	0.0045	0.0054	0.0051	0.0050
Riffle Length	36	28	36	38	49
Avg. Riffle Slope	0.0064	0.0057	0.0075	0.0049	0.0041
Pool Length	32	35	32	30	30



Project Name	Herman Dairy - Year 4 (2015) Profile
Reach	Tributary 1
Feature	Profile
Date	4/6/15
Crew	Perkinson, Jernigan

2012 As-built Survey			2012 Year 1 Monitoring \Survey			2013 Year 2 Monitoring \Survey			2014 Year 3 Monitoring \Survey			2015 Year 4 Monitoring \Survey		
Station	**Bed Elevation**	**Water Elevation**	**Station**	**Bed Elevation**	**Water Elevation**	**Station**	**Bed Elevation**	**Water Elevation**	**Station**	**Bed Elevation**	**Water Elevation**	**Station**	**Bed Elevation**	**Water Elevation**
990.2	100.6	101.7	994.2	101.2	102.0	990.0	100.6	101.8	992.7	101.5	102.2	998.1	101.6	102.3
1001.8	100.7	101.7	1015.4	101.2	102.1	1001.2	100.6	101.8	1002.4	101.5	102.2	1002.5	101.2	102.3
1015.7	101.4	101.7	1027.3	101.5	102.1	1005.6	100.9	101.8	1008.0	100.9	102.2	1018.4	101.6	102.3
1053.0	101.5	101.9	1056.7	101.7	102.3	1020.3	101.5	101.9	1013.1	101.0	102.3	1023.6	101.8	102.4
1061.5	101.0	101.9	1069.3	101.0	102.3	1052.0	101.8	102.3	1022.9	101.5	102.3	1063.3	101.8	102.5
1094.8	101.1	102.0	1085.1	101.0	102.3	1066.9	101.0	102.3	1045.3	101.7	102.3	1071.0	101.5	102.5
1106.1	101.6	102.2	1105.4	101.3	102.4	1079.1	100.7	102.3	1056.9	101.8	102.3	1092.6	101.3	102.6
1141.7	102.0	102.4	1111.8	101.8	102.4	1095.5	100.9	102.3	1062.7	101.3	102.4	1096.7	102.1	102.7
1145.7	101.2	102.3	1139.4	102.2	102.7	1106.7	101.1	102.3	1081.8	100.9	102.4	1140.7	102.2	102.9
1158.5	101.1	102.3	1151.1	100.8	102.7	1115.3	101.9	102.3	1097.5	101.6	102.7	1146.3	102.0	102.9
1163.3	102.0	102.4	1158.5	101.0	102.7	1128.3	102.1	102.5	1104.2	102.4	103.0	1164.0	102.0	102.9
1183.3	102.4	102.7	1168.8	102.1	102.7	1147.1	101.9	102.6	1144.4	102.5	103.2	1169.2	102.5	102.9
1197.8	102.3	102.8	1174.7	102.2	102.7	1149.9	101.3	102.6	1147.7	102.0	103.2	1201.7	102.4	103.1
1214.6	102.0	102.8	1199.3	102.4	102.9	1157.0	101.2	102.6	1162.6	102.0	103.2	1213.2	101.9	103.0
1226.9	101.9	102.8	1207.4	101.2	103.0	1165.6	101.3	102.6	1183.3	102.6	103.3	1238.1	102.1	103.3
1242.5	102.1	102.8	1219.3	101.9	103.0	1170.8	102.1	102.6	1190.6	102.6	103.3	1251.2	101.8	103.3
1251.9	102.4	102.8	1235.6	101.9	103.0	1188.6	102.4	102.8	1211.9	102.7	103.4	1257.6	102.8	103.4
1275.5	102.6	102.8	1248.9	102.1	103.1	1202.2	102.1	102.8	1215.7	101.9	103.4	1274.8	102.7	103.4
1280.7	101.7	102.9	1258.6	102.6	103.2	1208.7	100.9	102.9	1221.5	101.8	103.4	1279.4	102.1	103.4
1289.3	102.0	102.9	1276.2	102.5	103.3	1226.2	101.7	102.9	1227.7	102.8	103.5	1289.0	102.0	103.5
1300.0	102.6	102.8	1285.3	101.6	103.3	1234.8	102.0	102.9	1256.2	102.8	103.6	1294.9	102.9	103.6
1321.8	102.5	102.9	1295.7	102.4	103.3	1257.0	102.4	102.9	1288.7	103.1	103.8	1329.8	103.1	103.6
1364.7	102.6		1302.3	102.6	103.4	1270.7	102.5	103.0	1319.8	103.1	103.9	1349.3	103.2	103.8
1376.2	102.2	103.0	1318.4	102.6	103.5	1280.9	102.2	103.0	1344.6	103.2	103.9	1367.6	103.2	103.8
1386.5	102.0	103.1	1326.0	102.7	103.5	1292.0	102.0	103.0	1348.5	102.8	104.0	1372.2	102.9	103.8
1397.1	101.9	103.1	1333.8	102.3	103.5	1304.3	102.6	103.0	1352.5	103.2	104.0	1382.7	102.7	103.9
1408.4	102.7	103.4	1337.9	102.7	103.5	1324.5	102.7	103.1	1365.3	103.4	104.0	1396.5	103.0	104.0

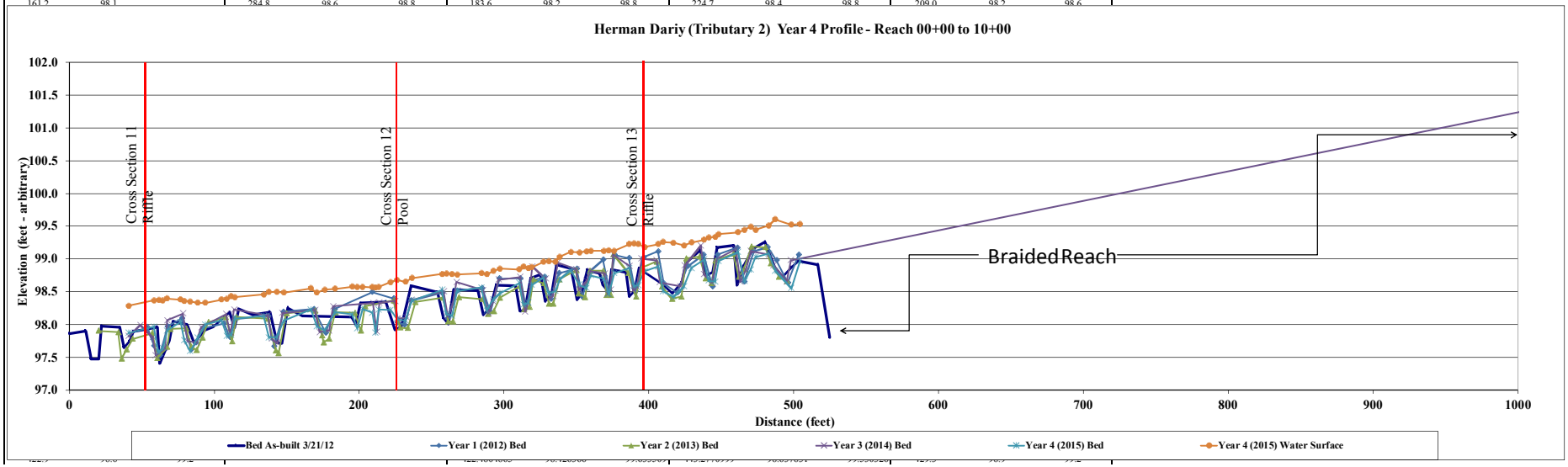
	As-built	2012	2013	2014	2015
Avg. Water Surface Slope	0.0053	0.0045	0.0054	0.0051	0.0050
Riffle Length	36	28	36	38	49
Avg. Riffle Slope	0.0064	0.0057	0.0075	0.0049	0.0041
Pool Length	32	35	32	30	30



Project Name	Herman Dairy - Year 4 (2015) Profile
Reach	Tributary 2
Feature	Profile
Date	4/6/15
Crew	Perkinson, Jernigan

2012 As-built Survey			2012 Year 1 Monitoring \Survey			2013 Year 2 Monitoring \Survey			2014 Year 3 Monitoring \Survey			2015 Year 4 Monitoring \Survey		
Station	**Bed Elevation**	**Water Elevation**	**Station**	**Bed Elevation**	**Water Elevation**	**Station**	**Bed Elevation**	**Water Elevation**	**Station**	**Bed Elevation**	**Water Elevation**	**Station**	**Bed Elevation**	**Water Elevation**
0.0	97.9	98.2	53.5	98.0	98.4	20.0	97.9	98.5	40.8	97.8	98.4	40.8	97.9	98.3
11.2	97.9	98.2	58.4	97.7	98.4	33.8	97.9	98.5	48.9	98.0	98.4	58.1	98.0	98.4
14.9	97.5	98.2	62.3	97.5	98.3	36.0	97.5	98.6	57.4	97.8	98.4	61.7	97.6	98.4
20.1	97.5	98.2	67.7	98.0	98.3	39.4	97.6	98.6	59.6	97.5	98.4	64.3	97.6	98.4
22.2	98.0	98.0	77.5	98.1	98.4	43.6	97.8		66.0	97.6	98.4	67.4	97.9	98.4
34.9	98.0		84.1	97.6	98.4	57.3	97.9	98.6	67.6	98.1	98.4	76.7	98.0	98.4
37.6	97.6	98.1	87.5	97.7	98.4	60.4	97.5	98.6	78.2	98.2	98.5	79.3	97.8	98.4
41.7	97.7	98.1	92.2	97.9	98.4	67.4	97.7	98.6	81.4	97.7	98.5	83.3	97.6	98.3
44.1	97.9		106.8	98.0	98.4	69.4	97.9	98.6	87.5	97.7	98.5	88.5	97.8	98.3
60.6	98.0		110.6	97.8	98.3	80.5	97.9	98.6	90.9	98.0	98.5	93.8	98.0	98.3
62.3	97.4	98.1	114.0	98.1	98.2	84.1	97.7	98.7	108.0	98.2	98.6	104.9	98.1	98.4
69.1	97.8	98.1	137.1	98.1	98.4	87.7	97.6	98.7	110.9	97.9	98.5	108.6	97.8	98.4
71.7	98.0		141.4	97.7	98.4	91.8	97.8	98.6	111.5	97.9	98.5	111.7	97.8	98.4
81.1	98.0		147.7	98.2	98.3	95.9	98.0	98.7	113.6	98.2	98.6	114.1	98.1	98.4
85.9	97.7	98.3	168.6	98.2	98.5	107.8	98.1	98.7	137.1	98.1	98.6	134.0	98.1	98.5
93.8	97.9	98.3	176.9	97.9	98.5	112.1	97.7	98.7	139.6	97.8	98.6	137.6	97.8	98.5
99.3	98.0	98.3	182.9	98.2	98.4	115.2	98.1	98.7	143.6	97.7	98.6	143.2	97.8	98.5
110.8	98.2		209.1	98.5	98.5	136.8	98.1	98.8	146.9	98.2	98.6	147.8	98.1	98.5
113.8	97.9	98.4	223.9	98.4	98.6	142.5	97.6	98.8	169.5	98.2	98.7	166.7	98.2	98.6
116.9	98.2		226.4	98.0	98.6	144.2	97.6	98.8	172.8	97.9	98.7	170.7	98.0	98.5
126.7	98.1	98.4	231.4	98.0	98.6	149.8	98.2	98.8	179.2	97.9	98.7	176.0	97.9	98.5
138.4	98.2		235.9	98.4	98.7	169.3	98.2	98.8	182.2	98.3	98.8	183.4	98.2	98.5
143.4	97.7	98.4	257.1	98.5	98.8	174.4	97.8	98.8	209.6	98.3	98.8	195.1	98.2	98.6
146.8	97.7	98.5	261.1	98.1	98.8	175.4	97.7	98.8	212.1	97.9	98.8	198.5	97.9	98.6
150.8	98.3		267.6	98.5	98.8	179.1	97.8	98.8	213.9	98.3	98.8	202.3	98.2	98.6
161.2	98.1		284.8	98.6	98.8	183.6	98.2	98.8	224.7	98.4	98.8	209.0	98.2	98.6

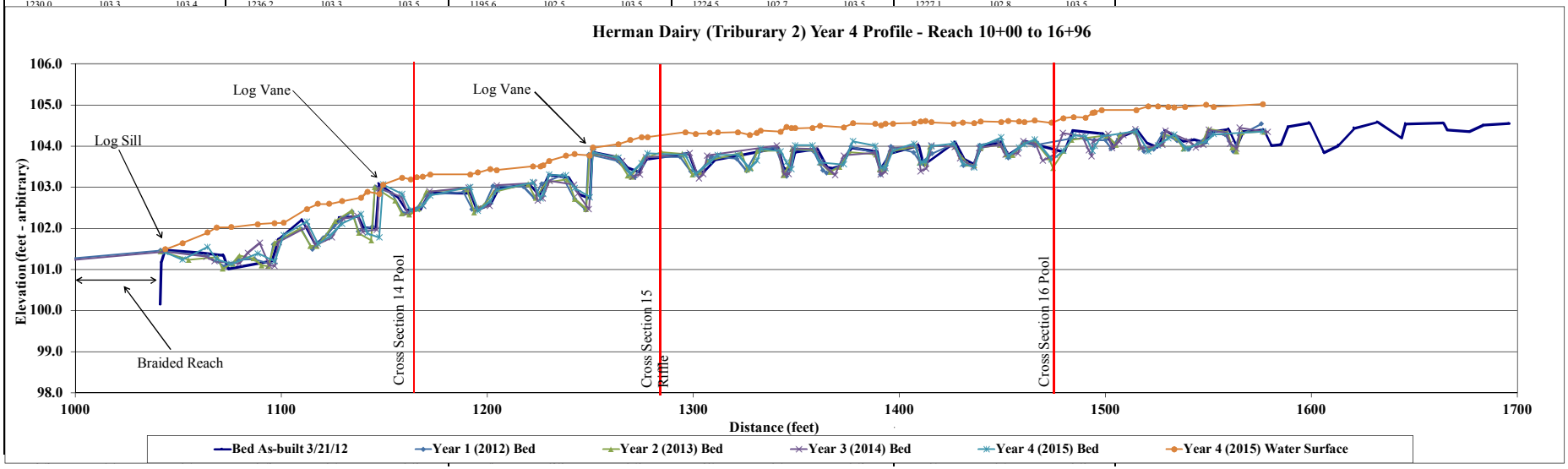
	As-built	2012	2013	2014	2015
Avg. Water Surface Slope	0.0040	0.0041	0.0042	0.0043	0.0044
Riffle Length	14	13	13	14	12
Avg. Riffle Slope	0.0039	0.0042	0.0061	0.0057	0.0051
Pool Length	13	12	11	11	13



Project Name Herman Dairy - Year 4 (2015) Profile
Reach Tributary 2
Feature Profile
Date 4/6/15
Crew Perkinson, Jernigan

2012 As-built Survey			2012 Year 1 Monitoring \Survey			2013 Year 2 Monitoring \Survey			2014 Year 3 Monitoring \Survey			2015 Year 4 Monitoring \Survey		
Station	Bed Elevation	Water Elevation	Station	Bed Elevation	Water Elevation	Station	Bed Elevation	Water Elevation	Station	Bed Elevation	Water Elevation	Station	Bed Elevation	Water Elevation
524.8		99.4	503.3	99.1	99.6	495.4	98.7		498.0	99.0	99.7	1043.6	101.4	101.5
1041.2	100.2	100.8	1041.2	101.5	101.5	1041.2	101.4		1043.6	101.4	101.5	1052.0	101.2	101.6
1041.8	101.2	101.2	1064.1	101.3	101.6	1055.1	101.2	101.8	1063.5	101.3	101.9	1064.2	101.6	101.9
1043.5	101.5	101.5	1072.4	101.1	101.7	1068.9	101.3	102.0	1067.5	101.2	102.0	1068.5	101.3	102.0
1060.7	101.4	101.7	1078.9	101.2	101.7	1071.4	101.0	102.0	1079.6	101.1	102.0	1075.7	101.1	102.0
1071.8	101.3	101.7	1087.0	101.3	101.7	1076.4	101.1	102.0	1083.8	101.4	102.0	1088.6	101.4	102.1
1074.4	101.0	101.6	1094.2	101.1	101.7	1079.6	101.3	102.0	1089.6	101.6	102.1	1096.7	101.2	102.1
1095.6	101.2	101.7	1096.1	101.6	101.9	1086.6	101.3	102.0	1094.1	101.1	102.1	1101.1	101.8	102.1
1098.7	101.7		1109.7	102.0	102.4	1090.3	101.1	102.0	1096.7	101.1	102.1	1112.4	102.2	102.5
1110.0	102.2		1115.0	101.5	102.4	1093.7	101.1	102.0	1098.7	101.7	102.1	1117.8	101.6	102.6
1116.6	101.6	102.3	1120.4	101.8	102.4	1096.8	101.7	102.2	1112.5	102.0	102.5	1123.2	101.8	102.6
1122.1	101.8	102.3	1125.5	102.1	102.4	1109.1	102.0	102.6	1116.7	101.6	102.5	1129.5	102.1	102.7
1128.3	102.3		1134.2	102.4	102.8	1114.1	101.6	102.6	1124.5	101.8	102.5	1138.7	102.3	102.7
1137.3	102.3		1137.5	101.9		1117.1	101.6	102.6	1130.2	102.2	102.6	1141.8	101.9	102.9
1139.8	102.0	102.6	1144.2	102.0	102.8	1120.4	101.7	102.6	1136.9	102.3	102.8	1147.6	101.8	102.8
1146.0	102.0	102.6	1145.5	103.0		1126.1	102.2	102.7	1139.6	101.9	102.8	1149.3	103.1	103.1
1147.4	103.1		1153.5	102.9	103.1	1134.2	102.4	103.0	1146.4	102.0	102.8	1158.6	102.8	103.2
1156.8	102.8	103.1	1159.3	102.4	103.1	1137.5	101.9	103.0	1147.4	103.0	103.2	1162.8	102.4	103.2
1160.6	102.4	103.1	1165.4	102.5	103.1	1143.7	101.7	103.0	1158.3	102.8	103.3	1165.7	102.5	103.2
1167.7	102.5	103.1	1170.1	102.8	103.1	1145.3	103.0	103.3	1161.3	102.4	103.3	1168.7	102.6	103.3
1172.0	102.9	103.1	1188.5	102.9	103.2	1155.2	102.7	103.4	1168.8	102.6	103.2	1172.4	102.8	103.3
1191.8	102.9	103.2	1192.5	102.5	103.2	1158.5	102.4	103.4	1172.1	102.9	103.3	1191.6	103.0	103.3
1195.0	102.4	103.2	1198.5	102.6	103.3	1162.1	102.3	103.4	1190.9	103.0	103.4	1195.5	102.4	103.4
1201.3	102.6	103.2	1202.8	103.0	103.3	1166.4	102.5	103.4	1195.5	102.5	103.3	1201.5	102.7	103.4
1205.2	103.0	103.2	1217.5	103.0	103.4	1170.4	102.9	103.4	1201.1	102.6	103.3	1204.5	102.9	103.4
1220.4	103.1	103.3	1222.8	102.7	103.4	1190.0	103.0	103.5	1204.7	103.0	103.4	1222.2	103.1	103.5
1225.1	102.8	103.3	1226.2	103.1	103.5	1193.6	102.4	103.5	1222.7	103.1	103.5	1225.8	102.7	103.5
1230.0	103.3	103.4	1236.2	103.3	103.5	1195.6	102.5	103.5	1224.5	102.7	103.5	1227.1	102.8	103.5

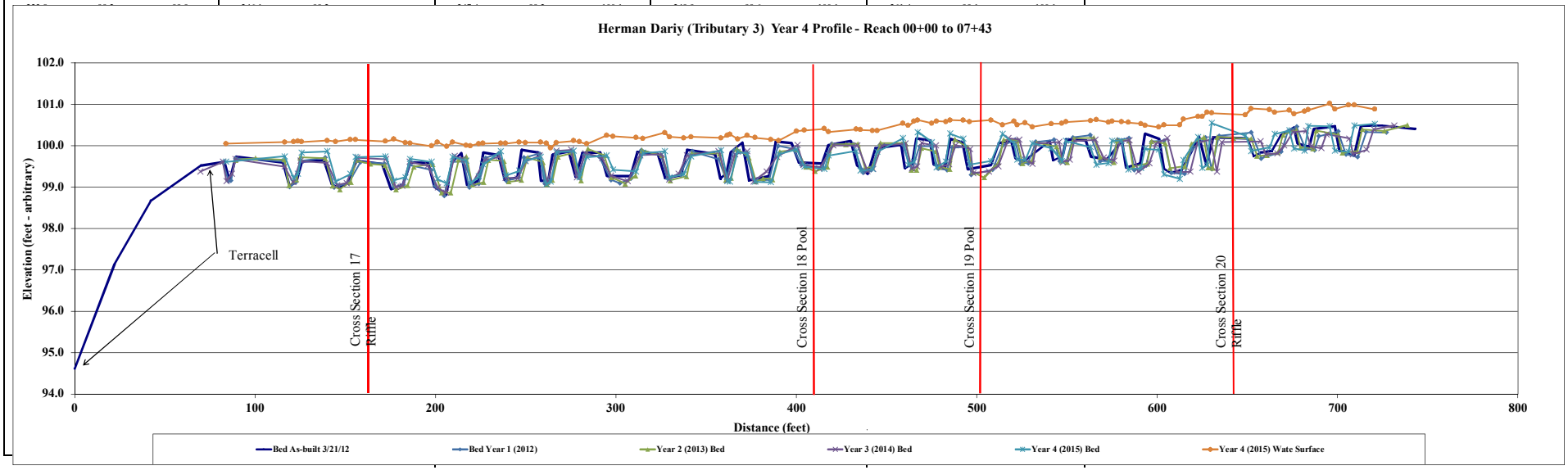
	As-built	2012	2013	2014	2015
Avg. Water Surface Slope	0.0040	0.0041	0.0042	0.0043	0.0044
Riffle Length	14	13	13	14	12
Avg. Riffle Slope	0.0039	0.0042	0.0061	0.0057	0.0051
Pool Length	13	12	11	11	13



Project Name Herman Dairy - Year 4 (2015) Profile
Reach Tributary 3
Feature Profile
Date 4/6/15
Crew Perkinson, Jernigan

2012 As-built Survey			2012 Year 1 Monitoring \Survey			2013 Year 2 Monitoring \Survey			2014 Year 3 Monitoring \Survey			2015 Year 4 Monitoring \Survey		
Station	Bed Elevation	Water Elevation	Station	Bed Elevation	Water Elevation	Station	Bed Elevation	Water Elevation	Station	Bed Elevation	Water Elevation	Station	Bed Elevation	Water Elevation
0.0	94.6		82.0	99.6		89.0	99.7	99.9	69.8	99.4	99.7	83.8	99.6	100.0
22.2	97.1		85.1	99.1		100.1	99.7	99.9	82.0	99.6	99.9	116.3	99.7	100.1
42.1	98.7		86.6	99.2		116.2	99.7	100.0	84.0	99.1	99.9	121.3	99.2	100.1
69.9	99.5		89.0	99.7		118.7	99.0	100.0	87.2	99.3	99.9	123.6	99.3	100.1
82.7	99.6		116.0	99.6		122.8	99.2	100.0	89.0	99.7	99.9	125.8	99.8	100.1
85.8	99.2	99.9	118.9	99.0		124.9	99.7	99.9	116.3	99.5	100.0	140.0	99.9	100.1
89.2	99.7	99.9	122.4	99.1		138.9	99.7	100.0	121.0	99.1	100.1	144.6	99.1	100.1
115.5	99.6	99.9	125.1	99.6		142.8	99.0	100.0	125.1	99.6	100.0	152.8	99.3	100.2
119.0	99.0	99.9	138.8	99.7		146.9	98.9	100.0	139.9	99.6	100.1	155.8	99.7	100.1
122.7	99.1	99.9	143.8	99.0		153.0	99.1	100.0	145.4	99.0	100.1	172.3	99.7	100.1
125.8	99.6	99.9	151.9	99.1		155.7	99.6	100.0	150.6	99.1	100.1	177.0	99.2	100.2
138.2	99.6	99.9	158.4	99.6		163.8	99.6	100.0	156.5	99.7	100.1	183.1	99.2	100.1
142.3	99.1	99.9	171.8	99.6		171.9	99.5	100.0	172.5	99.7	100.1	185.9	99.7	100.1
146.4	99.0	99.9	176.8	99.0		178.1	98.9	100.0	177.9	99.0	100.1	197.7	99.6	100.0
151.0	99.1	99.9	182.1	99.1		184.5	99.0	100.0	181.6	99.0	100.1	201.1	99.2	100.1
156.1	99.6	99.9	185.4	99.5		187.8	99.5	100.0	185.6	99.6	100.1	206.1	99.1	100.0
170.2	99.6	99.9	197.4	99.4		198.4	99.6	100.0	195.7	99.5	100.2	209.5	99.7	100.1
175.3	99.0	99.9	199.7	99.0		203.3	98.9	100.0	201.2	99.0	100.1	216.9	99.6	100.0
182.1	99.1	99.9	204.8	98.8		208.4	98.9	100.0	205.5	98.9	100.1	219.4	99.1	100.0
185.9	99.6	99.9	209.1	99.6		212.7	99.7	100.0	210.5	99.7	100.1	223.9	99.3	100.0
196.0	99.6	99.9	215.3	99.6		217.1	99.7	100.0	215.1	99.7	100.1	226.4	99.5	100.1
199.5	99.0	99.9	218.7	99.0		220.5	99.1	100.0	220.4	99.1	100.1	236.1	99.9	100.1
205.7	98.8	99.9	223.9	99.1		226.5	99.1	100.0	227.2	99.6	100.2	238.8	99.3	100.1
208.9	99.6		227.8	99.7		229.2	99.7	100.0	235.4	99.7	100.1	246.4	99.4	100.1
214.2	99.8	100.0	234.9	99.8		237.8	99.6	100.1	238.8	99.2	100.1	249.9	99.6	100.1
217.5	99.0	100.0	239.4	99.1		240.6	99.1	100.1	245.3	99.2	100.1	258.2	99.7	100.1

	As-built	2012	2013	2014	2015
Avg. Water Surface Slope	0.0012	NA	0.0015	0.0015	0.0013
Riffle Length	11	10	11	11	11
Avg. Riffle Slope	0.0022	NA	0.0042	0.0040	0.0054
Pool Length	13	13	13	13	13

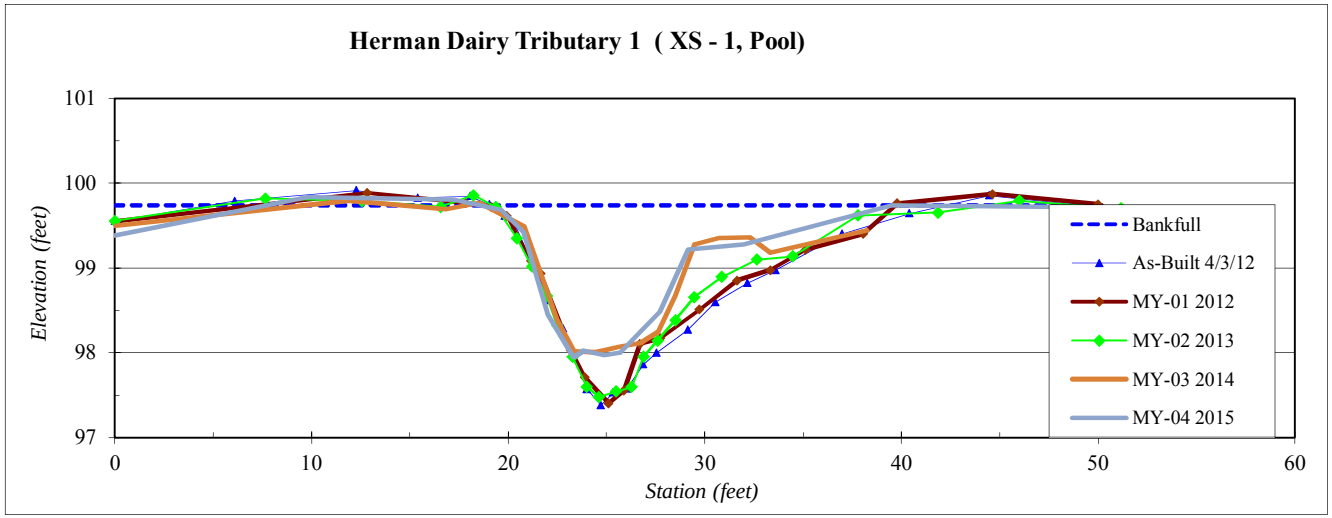


Site Name:	Herman Dairy
Watershed:	30501001120030
XS ID	Tributary 1 (XS - 1, Pool)
Drainage Area (sq mi):	1.01
Date:	4/6/2015
Field Crew:	Perkinson, Jernigan

Station	Elevation
0.00	99.39
9.82	99.84
17.19	99.81
19.64	99.69
20.78	99.42
22.03	98.45
23.32	97.95
23.85	98.02
24.88	97.97
25.69	98.00
26.54	98.21
27.72	98.49
29.16	99.22
31.99	99.28
39.50	99.74
50.17	99.72

SUMMARY DATA	
Bankfull Elevation:	99.7
Bankfull Cross-Sectional Area:	14.8
Bankfull Width:	20.9
Flood Prone Area Elevation:	-
Flood Prone Width:	-
Max Depth at Bankfull:	1.8
Mean Depth at Bankfull:	0.7
W / D Ratio:	-
Entrenchment Ratio:	-
Bank Height Ratio:	-

Stream Type	E

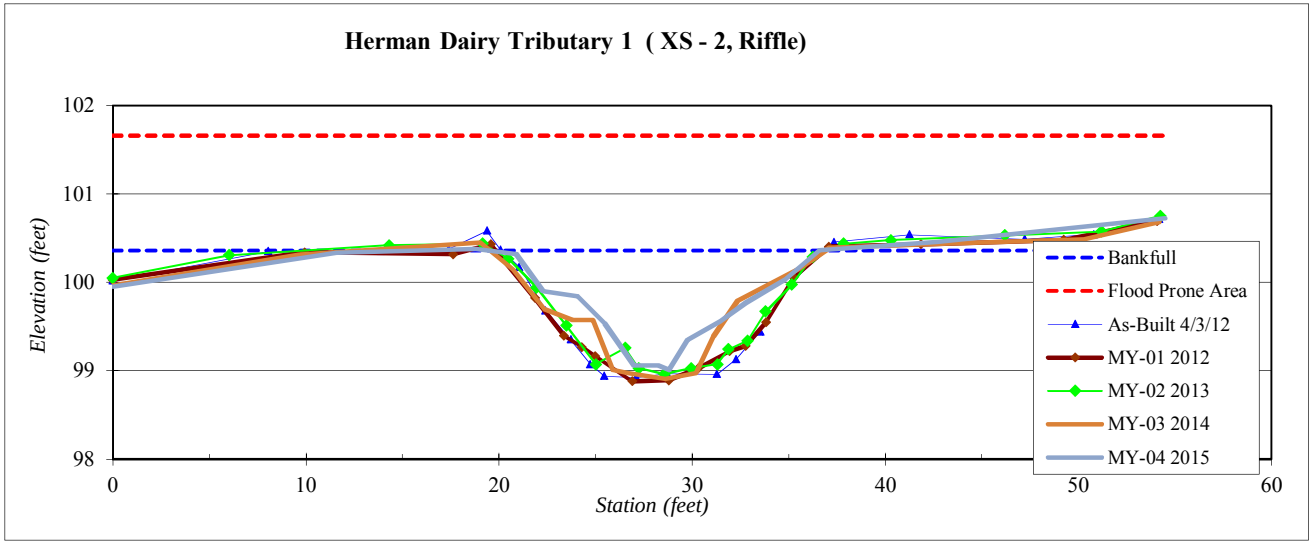


Site Name:	Herman Dairy
Watershed:	30501001120030
XS ID	Tributary 1 (XS - 2, Pool)
Drainage Area (sq mi):	1.01
Date:	4/6/2015
Field Crew:	Perkinson, Jernigan

Station	Elevation
0.00	99.95
11.58	100.33
18.80	100.38
20.87	100.32
22.28	99.90
24.08	99.85
25.48	99.54
27.00	99.06
28.23	99.06
28.82	99.01
29.76	99.35
31.47	99.56
32.80	99.77
34.81	100.03
36.6	100.36
42.7	100.46
54.5	100.73

SUMMARY DATA	
Bankfull Elevation:	100.4
Bankfull Cross-Sectional Area:	11.0
Bankfull Width:	17.2
Flood Prone Area Elevation:	101.7
Flood Prone Width:	>80
Max Depth at Bankfull:	1.3
Mean Depth at Bankfull:	0.6
W / D Ratio:	26.9
Entrenchment Ratio:	>5
Bank Height Ratio:	1.0

Stream Type	E

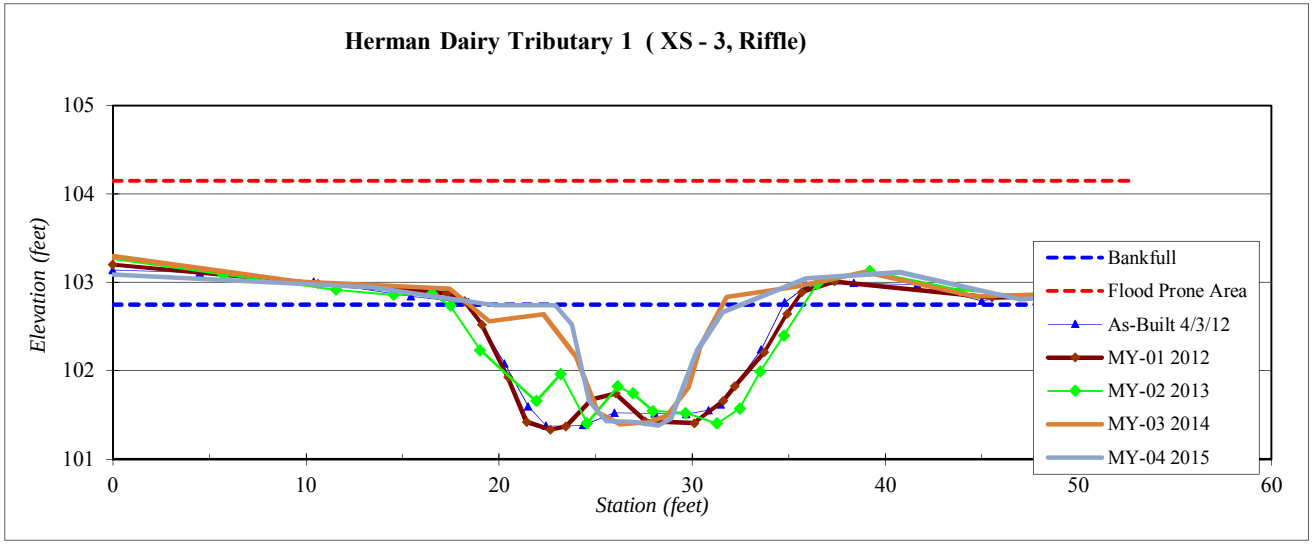


Site Name:	Herman Dairy
Watershed:	30501001120030
XS ID	Tributary 1 (XS - 3, Riffle)
Drainage Area (sq mi):	1.01
Date:	4/6/2015
Field Crew:	Perkinson, Jernigan

Station	Elevation
0.00	103.09
13.44	102.94
19.79	102.74
22.91	102.75
23.77	102.53
24.66	101.66
25.56	101.43
26.86	101.42
28.26	101.38
28.89	101.46
30.23	102.22
31.56	102.66
35.90	103.04
40.78	103.12
47.0	102.81
52.9	102.92

SUMMARY DATA	
Bankfull Elevation:	102.8
Bankfull Cross-Sectional Area:	7.9
Bankfull Width:	13.0
Flood Prone Area Elevation:	104.2
Flood Prone Width:	>80
Max Depth at Bankfull:	1.4
Mean Depth at Bankfull:	0.6
W / D Ratio:	21.4
Entrenchment Ratio:	>5
Bank Height Ratio:	1.0

Stream Type	E/C

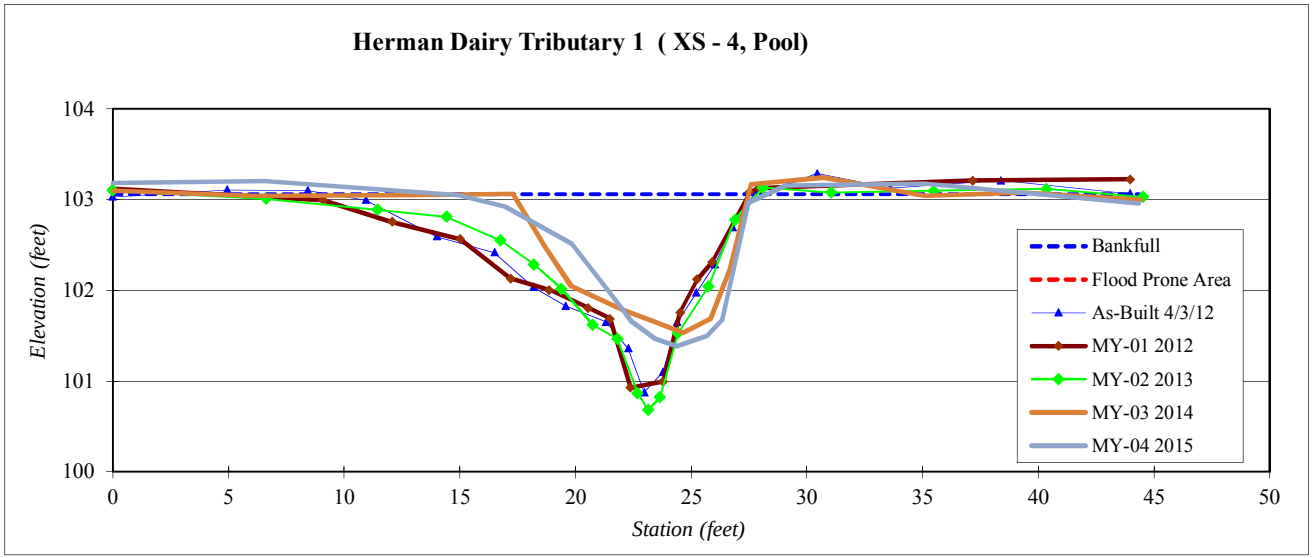


Site Name:	Herman Dairy
Watershed:	30501001120030
XS ID	Tributary 1 (XS - 4, Pool)
Drainage Area (sq mi):	1.01
Date:	4/6/2015
Field Crew:	Perkinson, Jernigan

Station	Elevation
0.0	103.2
6.6	103.2
14.9	103.0
17.0	102.9
19.8	102.5
21.6	101.9
22.5	101.6
23.4	101.5
24.4	101.4
25.7	101.5
26.3	101.7
27.5	103.0
29.1	103.2
35.1	103.2
44.4	102.96

SUMMARY DATA	
Bankfull Elevation:	103.1
Bankfull Cross-Sectional Area:	10.6
Bankfull Width:	14.0
Flood Prone Area Elevation:	-
Flood Prone Width:	-
Max Depth at Bankfull:	1.7
Mean Depth at Bankfull:	0.8
W / D Ratio:	-
Entrenchment Ratio:	-
Bank Height Ratio:	-

Stream Type	E

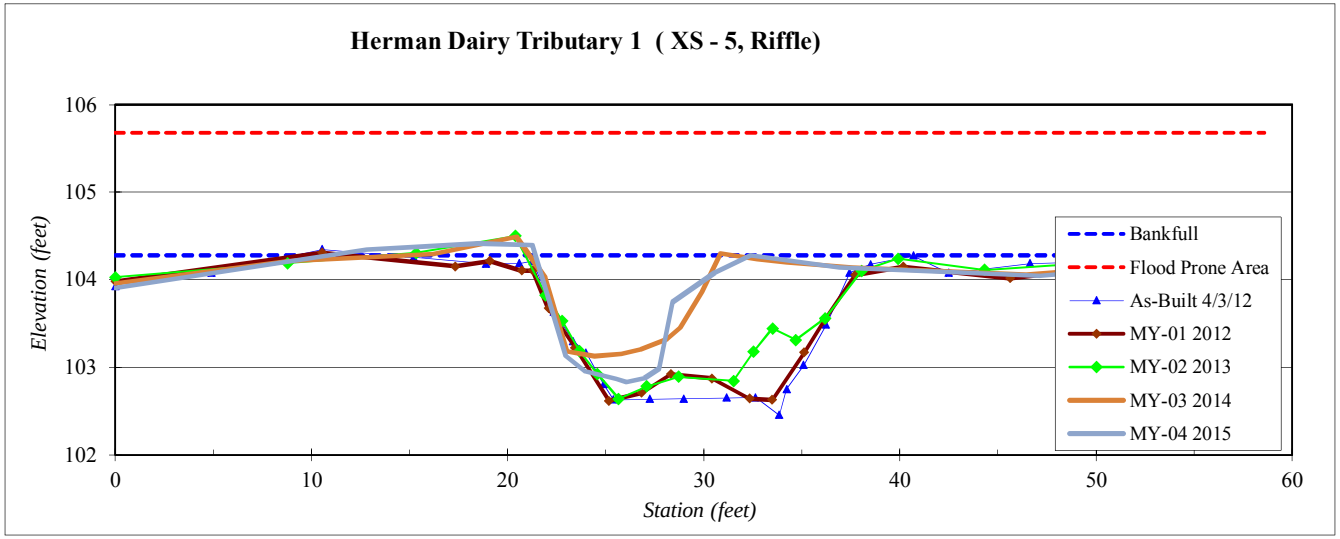


Site Name:	Herman Dairy
Watershed:	30501001120030
XS ID	Tributary 1 (XS - 5, Riffle)
Drainage Area (sq mi):	1.01
Date:	4/6/2015
Field Crew:	Perkinson, Jernigan

Station	Elevation
0.0	103.9
12.8	104.3
18.6	104.4
21.3	104.4
23.0	103.1
24.0	103.0
25.5	102.9
26.1	102.8
27.0	102.9
27.7	103.0
28.4	103.7
30.6	104.1
32.4	104.3
36.9	104.14
47.1	104.04
58.6	104.26

SUMMARY DATA	
Bankfull Elevation:	104.3
Bankfull Cross-Sectional Area:	8.9
Bankfull Width:	11.0
Flood Prone Area Elevation:	105.7
Flood Prone Width:	>80
Max Depth at Bankfull:	1.4
Mean Depth at Bankfull:	0.8
W / D Ratio:	13.6
Entrenchment Ratio:	>5
Bank Height Ratio:	1.0

Stream Type	E/C

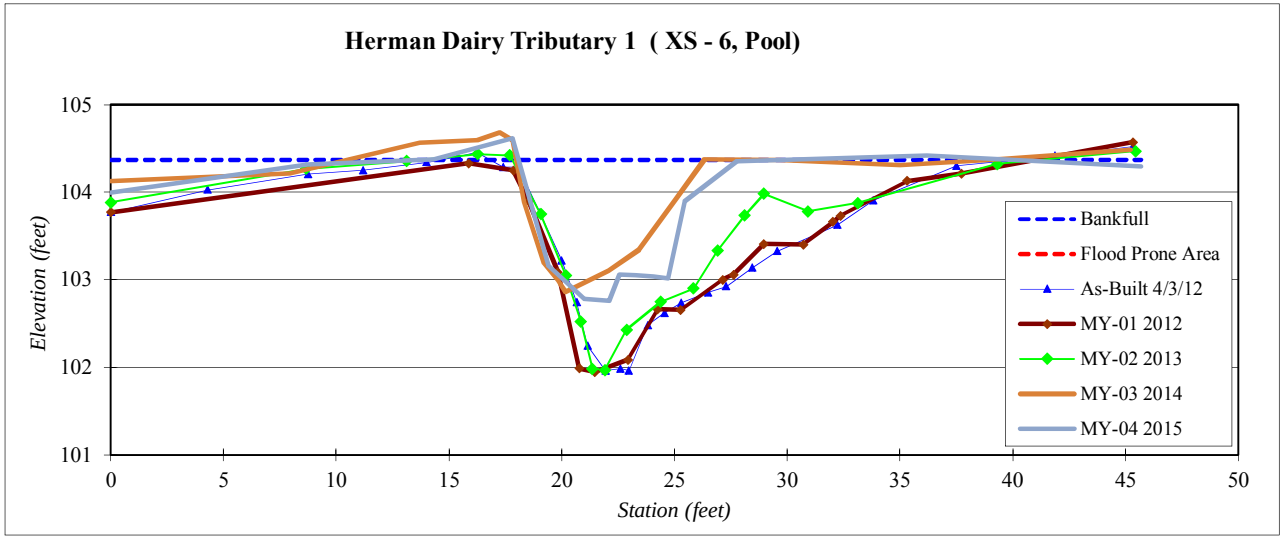


Site Name:	Herman Dairy
Watershed:	30501001120030
XS ID	Tributary 1 (XS - 6, Pool)
Drainage Area (sq mi):	1.01
Date:	4/6/2015
Field Crew:	Perkinson, Jernigan

Station	Elevation
0.0	104.0
8.7	104.3
14.3	104.4
17.8	104.6
19.4	103.2
21.0	102.8
22.1	102.8
22.6	103.1
23.3	103.1
24.1	103.0
24.7	103.0
25.5	103.9
27.8	104.4
36.2	104.4
45.7	104.3

SUMMARY DATA	
Bankfull Elevation:	104.4
Bankfull Cross-Sectional Area:	8.0
Bankfull Width:	14.8
Flood Prone Area Elevation:	-
Flood Prone Width:	-
Max Depth at Bankfull:	1.5
Mean Depth at Bankfull:	0.5
W / D Ratio:	-
Entrenchment Ratio:	-
Bank Height Ratio:	-

Stream Type	E/C

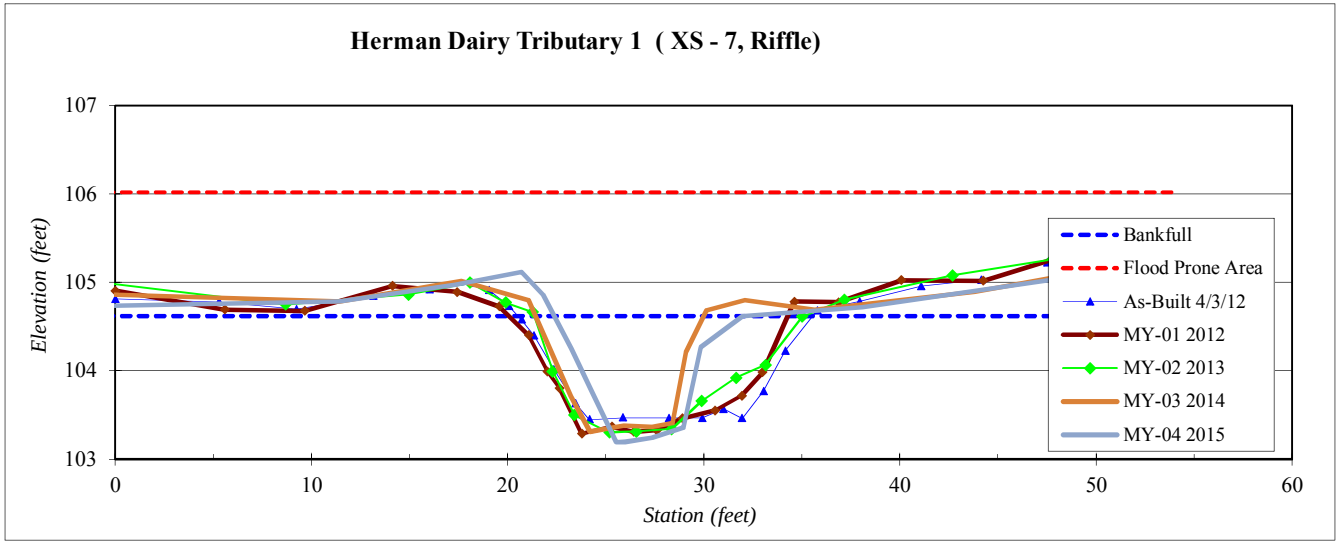


Site Name:	Herman Dairy
Watershed:	30501001120030
XS ID	Tributary 1 (XS - 7, Riffle)
Drainage Area (sq mi):	1.01
Date:	4/6/2015
Field Crew:	Perkinson, Jernigan

Station	Elevation
-0.5	104.7
11.4	104.8
17.3	105.0
20.7	105.1
21.8	104.9
23.2	104.2
24.3	103.8
25.5	103.2
26.0	103.2
27.4	103.2
29.0	103.4
29.9	104.3
32.0	104.6
38.1	104.72
53.9	105.23

SUMMARY DATA	
Bankfull Elevation:	104.6
Bankfull Cross-Sectional Area:	8.0
Bankfull Width:	9.7
Flood Prone Area Elevation:	106.0
Flood Prone Width:	>80
Max Depth at Bankfull:	1.4
Mean Depth at Bankfull:	0.8
W / D Ratio:	11.8
Entrenchment Ratio:	>5
Bank Height Ratio:	1.0

Stream Type	E/C

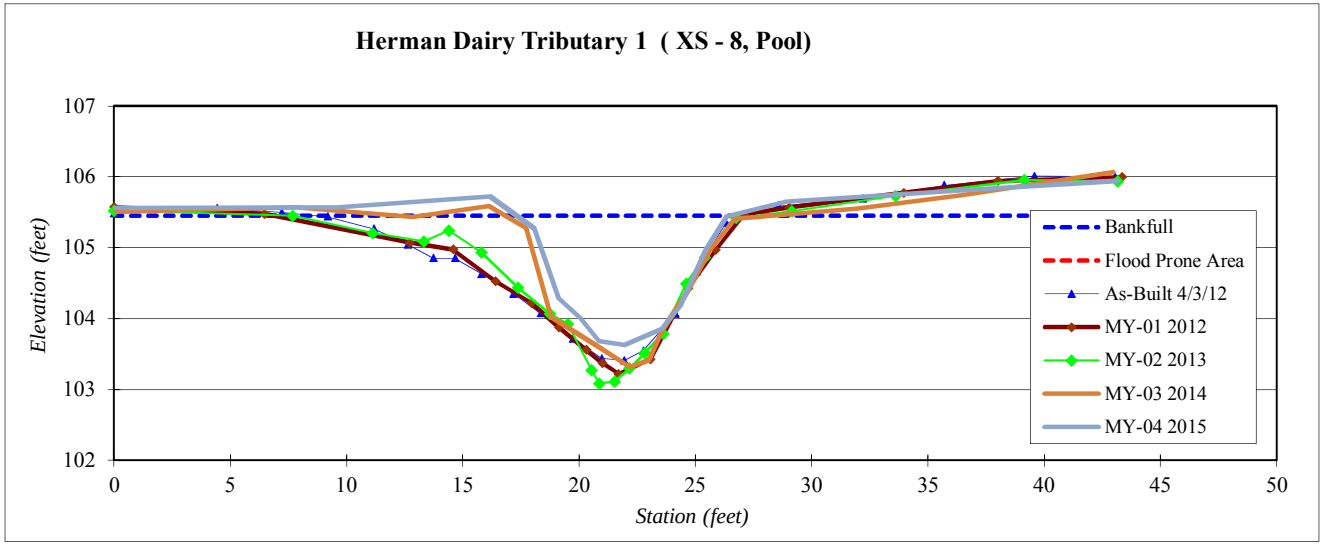


Site Name:	Herman Dairy
Watershed:	30501001120030
XS ID	Tributary 1 (XS - 8, Pool)
Drainage Area (sq mi):	1.01
Date:	4/6/2015
Field Crew:	Perkinson, Jernigan

Station	Elevation
0.0	105.6
9.6	105.6
16.2	105.7
18.1	105.3
19.1	104.3
20.1	104.0
20.9	103.7
21.9	103.6
23.6	103.9
24.3	104.2
25.4	105.0
26.4	105.4
28.9	105.6
36.2	105.81
43.2	105.95

SUMMARY DATA	
Bankfull Elevation:	105.5
Bankfull Cross-Sectional Area:	10.3
Bankfull Width:	9.1
Flood Prone Area Elevation:	-
Flood Prone Width:	-
Max Depth at Bankfull:	1.8
Mean Depth at Bankfull:	1.1
W / D Ratio:	-
Entrenchment Ratio:	-
Bank Height Ratio:	-

Stream Type	E/C

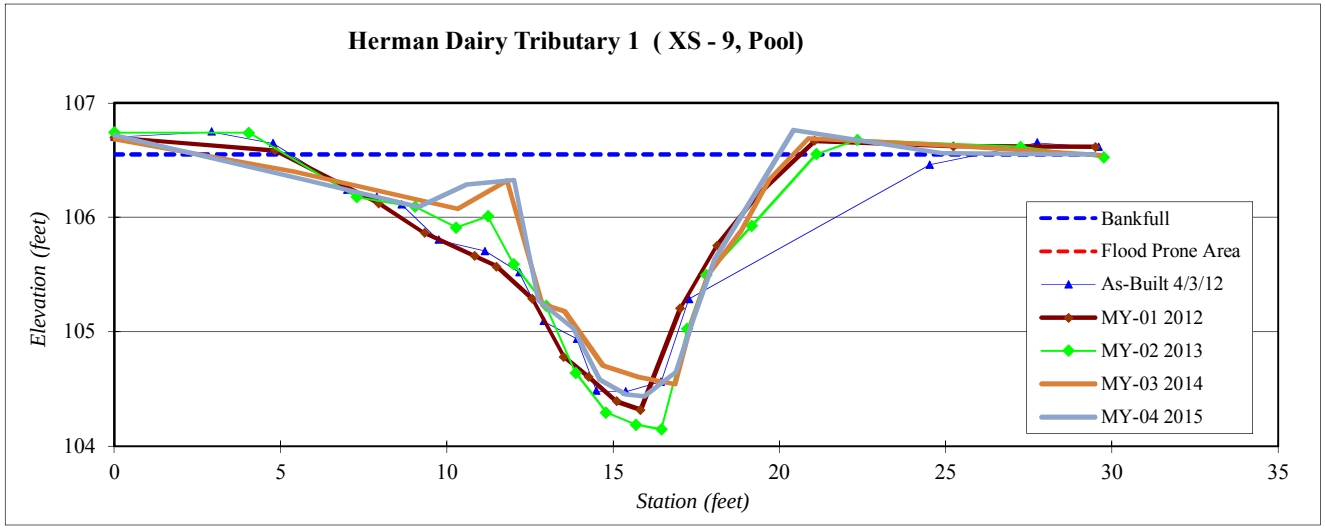


Site Name:	Herman Dairy
Watershed:	30501001120030
XS ID	Tributary 1 (XS - 9, Pool)
Drainage Area (sq mi):	1.01
Date:	4/6/2015
Field Crew:	Perkinson, Jernigan

Station	Elevation
0.0	106.7
5.8	106.3
9.2	106.1
10.6	106.3
12.0	106.3
12.8	105.3
13.8	105.0
14.6	104.6
15.4	104.5
16.0	104.4
16.9	104.7
17.4	105.1
18.0	105.6
19.3	106.22
20.4	106.76
24.9	106.56
29.5	106.55

SUMMARY DATA	
Bankfull Elevation:	106.6
Bankfull Cross-Sectional Area:	13.0
Bankfull Width:	17.5
Flood Prone Area Elevation:	-
Flood Prone Width:	-
Max Depth at Bankfull:	2.1
Mean Depth at Bankfull:	0.7
W / D Ratio:	-
Entrenchment Ratio:	-
Bank Height Ratio:	-

Stream Type	E/C

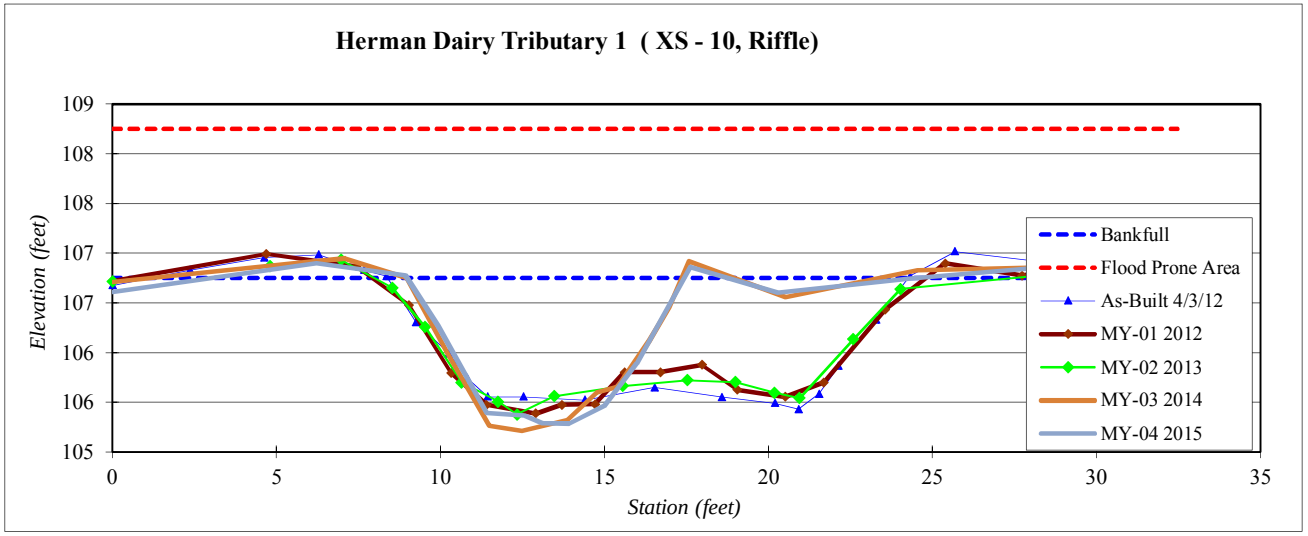


Site Name:	Herman Dairy
Watershed:	30501001120030
XS ID	Tributary 1 (XS - 10, Riffle)
Drainage Area (sq mi):	1.01
Date:	4/6/2015
Field Crew:	Perkinson, Jernigan

Station	Elevation
0.0	106.6
6.2	106.9
8.9	106.8
9.9	106.3
11.4	105.4
12.6	105.4
13.1	105.3
13.9	105.3
15.0	105.5
16.0	105.9
17.6	106.9
20.3	106.6
24.3	106.7
30.6	106.92
32.5	106.94

SUMMARY DATA	
Bankfull Elevation:	106.8
Bankfull Cross-Sectional Area:	8.3
Bankfull Width:	8.4
Flood Prone Area Elevation:	108.3
Flood Prone Width:	>80
Max Depth at Bankfull:	1.5
Mean Depth at Bankfull:	1.0
W / D Ratio:	8.5
Entrenchment Ratio:	>5
Bank Height Ratio:	1.0

Stream Type	E/C

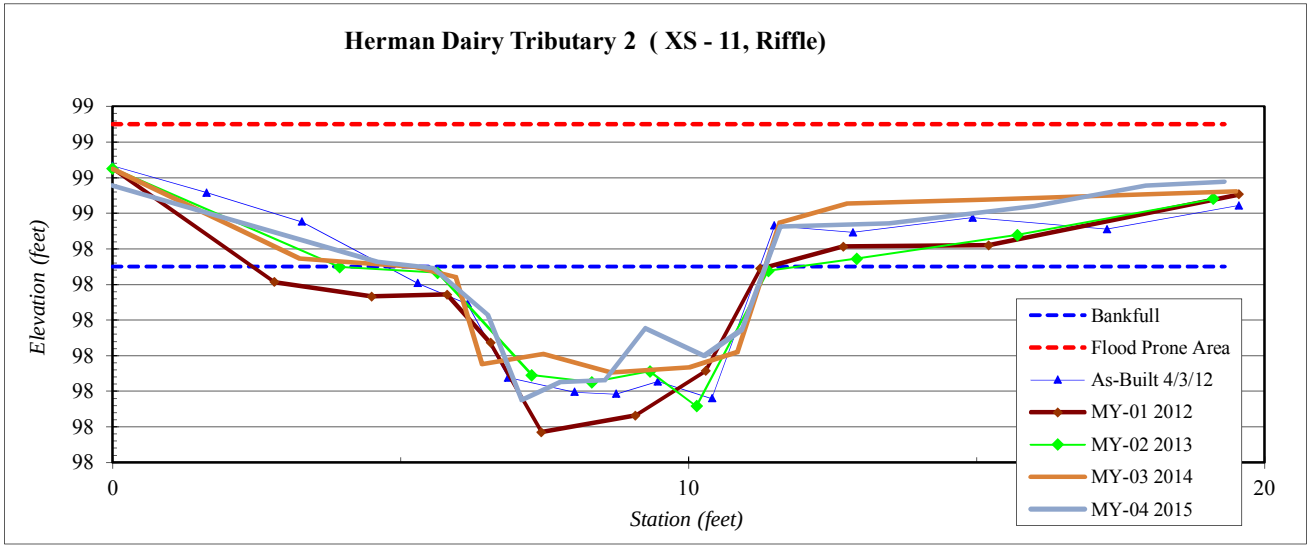


Site Name:	Herman Dairy
Watershed:	30501001120030
XS ID	Tributary 2 (XS - 11, Riffle)
Drainage Area (sq mi):	1.01
Date:	4/6/2015
Field Crew:	Perkinson, Jernigan

Station	Elevation
0.0	98.6
4.6	98.4
5.6	98.3
6.5	98.2
7.1	98.0
7.8	98.0
8.6	98.0
9.3	98.2
10.3	98.1
10.9	98.2
11.6	98.5
13.5	98.5
16.0	98.5
17.9	98.58
19.3	98.59

SUMMARY DATA	
Bankfull Elevation:	98.4
Bankfull Cross-Sectional Area:	1.3
Bankfull Width:	6.0
Flood Prone Area Elevation:	98.8
Flood Prone Width:	>80
Max Depth at Bankfull:	0.4
Mean Depth at Bankfull:	0.2
W / D Ratio:	27.7
Entrenchment Ratio:	>5
Bank Height Ratio:	1.0

Stream Type	E/C

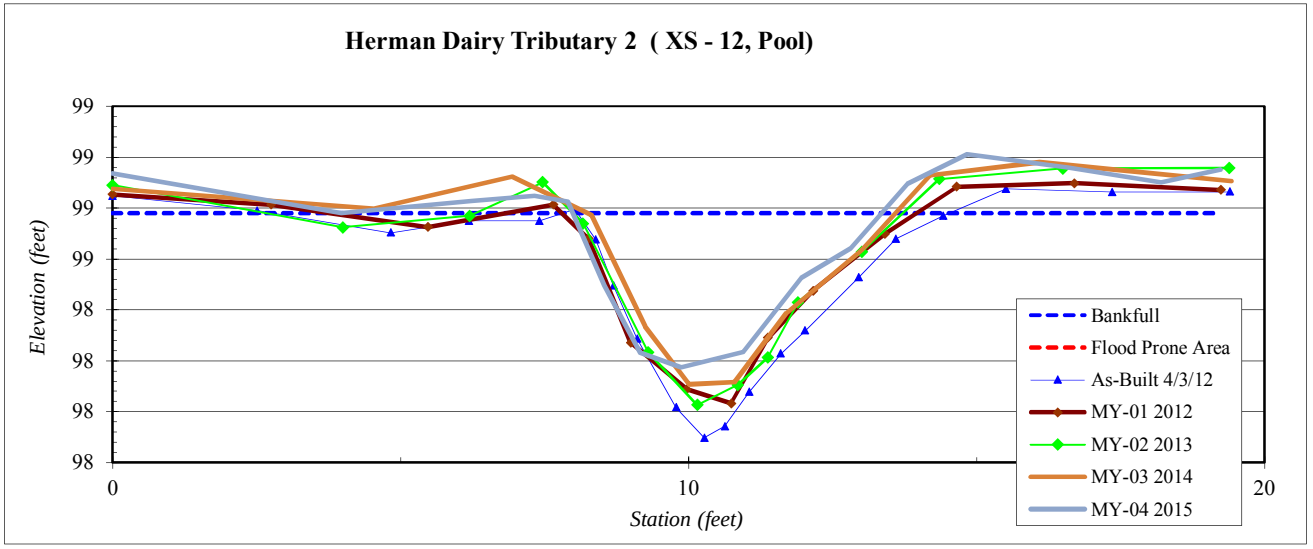


Site Name:	Herman Dairy
Watershed:	30501001120030
XS ID	Tributary 2 (XS - 12, Pool)
Drainage Area (sq mi):	1.01
Date:	4/6/2015
Field Crew:	Perkinson, Jernigan

Station	Elevation
0.0	98.9
4.0	98.8
6.2	98.8
7.3	98.8
7.9	98.8
8.5	98.5
9.2	98.2
9.9	98.2
11.0	98.2
12.0	98.5
12.8	98.6
13.8	98.9
14.8	99.0
16.6	98.96
18.2	98.90
19.2	98.95

SUMMARY DATA	
Bankfull Elevation:	98.8
Bankfull Cross-Sectional Area:	2.0
Bankfull Width:	5.4
Flood Prone Area Elevation:	-
Flood Prone Width:	-
Max Depth at Bankfull:	0.6
Mean Depth at Bankfull:	0.4
W / D Ratio:	-
Entrenchment Ratio:	-
Bank Height Ratio:	-

Stream Type	E/C

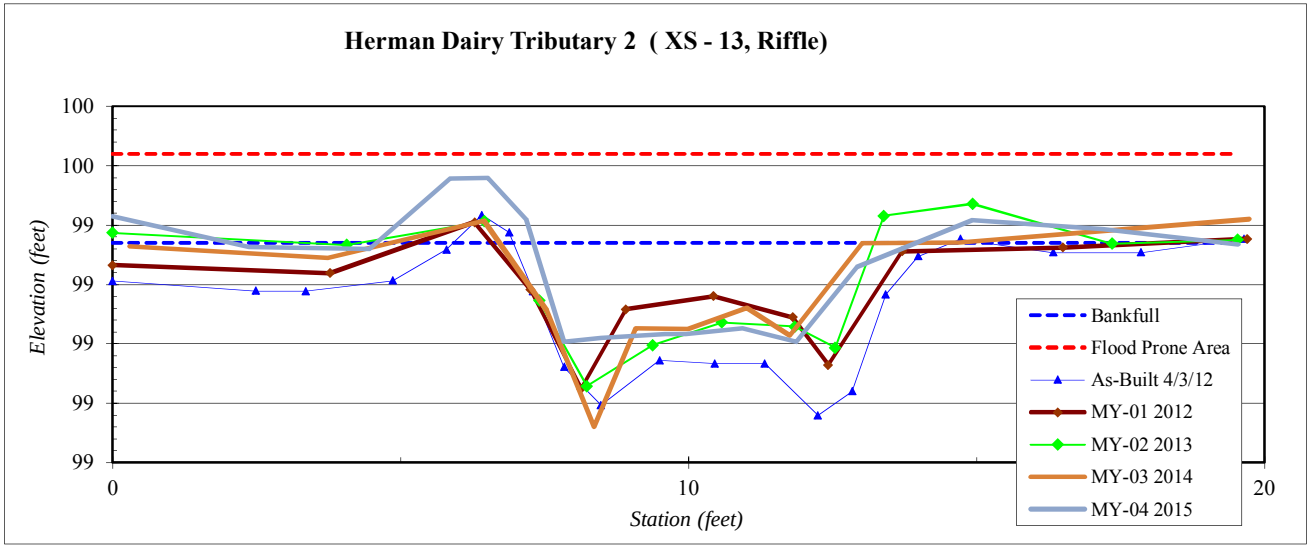


Site Name:	Herman Dairy
Watershed:	30501001120030
XS ID	Tributary 2 (XS - 13, Riffle)
Drainage Area (sq mi):	1.01
Date:	4/6/2015
Field Crew:	Perkinson, Jernigan

Station	Elevation
0.0	99.4
2.4	99.3
4.5	99.3
5.9	99.6
6.5	99.6
7.2	99.4
7.8	99.0
8.5	99.0
9.6	99.0
10.0	99.0
10.9	99.1
11.9	99.0
12.9	99.3
14.9	99.42
17.2	99.39
19.5	99.33

SUMMARY DATA	
Bankfull Elevation:	99.3
Bankfull Cross-Sectional Area:	1.6
Bankfull Width:	6.6
Flood Prone Area Elevation:	99.6
Flood Prone Width:	>80
Max Depth at Bankfull:	0.3
Mean Depth at Bankfull:	0.2
W / D Ratio:	27.2
Entrenchment Ratio:	>5
Bank Height Ratio:	1.0

Stream Type	E/C

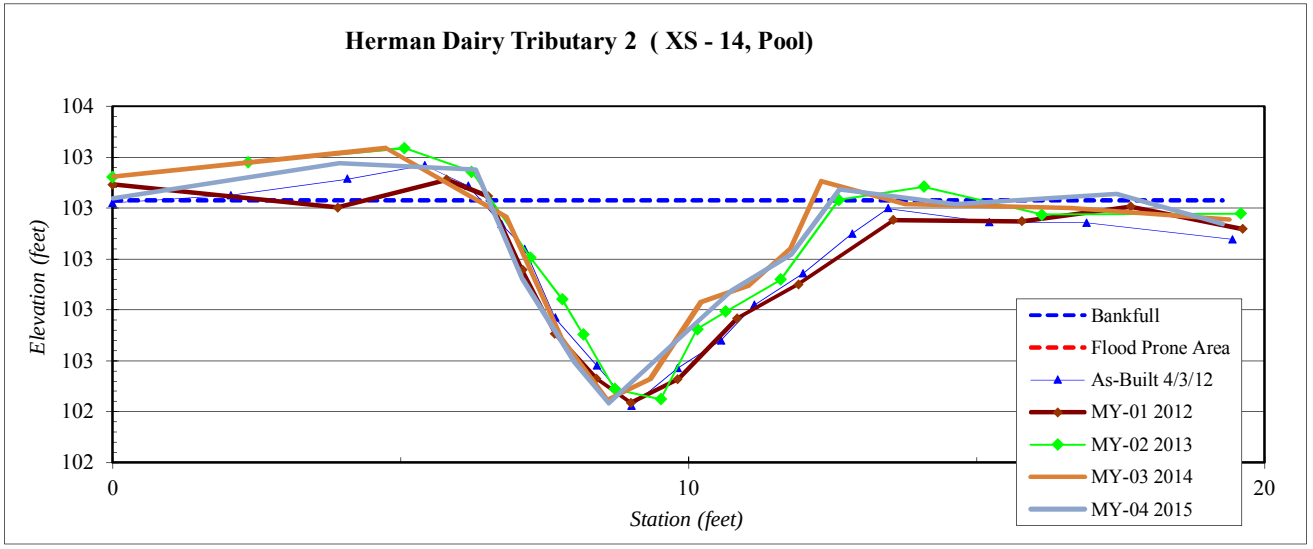


Site Name:	Herman Dairy
Watershed:	30501001120030
XS ID	Tributary 2 (XS - 14, Pool)
Drainage Area (sq mi):	1.01
Date:	4/6/2015
Field Crew:	Perkinson, Jernigan

Station	Elevation
0.0	103.2
3.9	103.4
6.3	103.4
7.1	102.9
8.0	102.6
8.6	102.4
9.6	102.6
10.8	102.9
11.8	103.0
12.6	103.3
14.6	103.2
17.4	103.3
19.3	103.1

SUMMARY DATA	
Bankfull Elevation:	103.2
Bankfull Cross-Sectional Area:	2.5
Bankfull Width:	6.0
Flood Prone Area Elevation:	-
Flood Prone Width:	-
Max Depth at Bankfull:	0.8
Mean Depth at Bankfull:	0.4
W / D Ratio:	-
Entrenchment Ratio:	-
Bank Height Ratio:	-

Stream Type	E/C

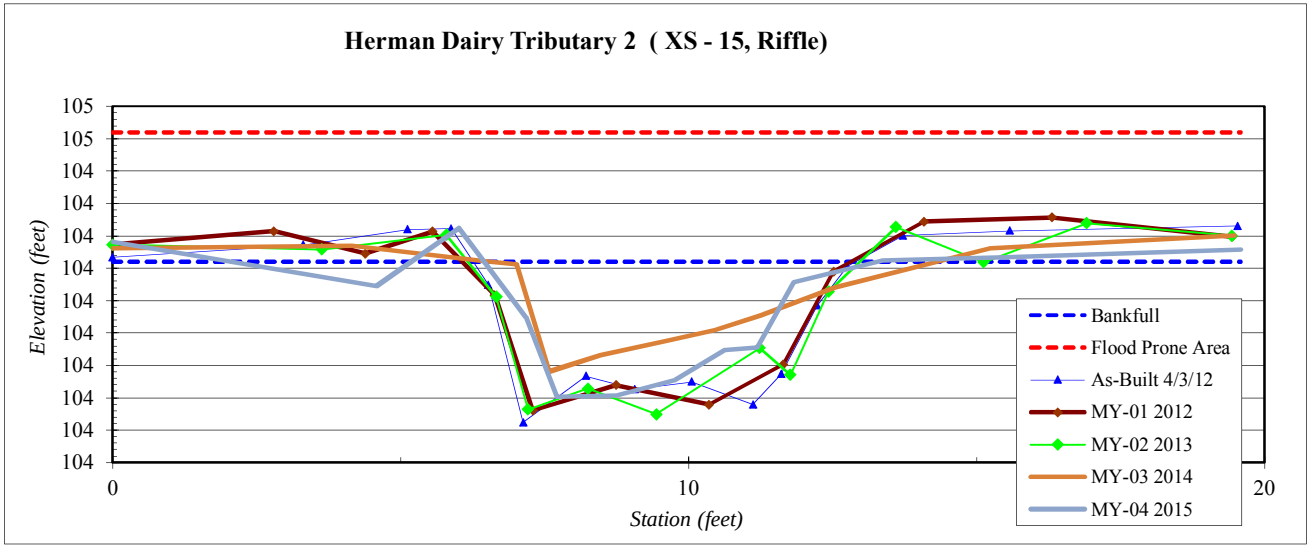


Site Name:	Herman Dairy
Watershed:	30501001120030
XS ID	Tributary 2 (XS - 15, Riffle)
Drainage Area (sq mi):	1.01
Date:	4/6/2015
Field Crew:	Perkinson, Jernigan

Station	Elevation
0.0	104.2
4.6	104.0
6.0	104.2
7.2	103.9
7.7	103.7
8.7	103.7
9.8	103.8
10.6	103.8
11.2	103.9
11.8	104.1
13.4	104.1
15.5	104.1
19.6	104.2

SUMMARY DATA	
Bankfull Elevation:	104.1
Bankfull Cross-Sectional Area:	1.6
Bankfull Width:	6.8
Flood Prone Area Elevation:	104.5
Flood Prone Width:	>80
Max Depth at Bankfull:	0.4
Mean Depth at Bankfull:	0.2
W / D Ratio:	28.9
Entrenchment Ratio:	>5
Bank Height Ratio:	1.0

Stream Type	E/C

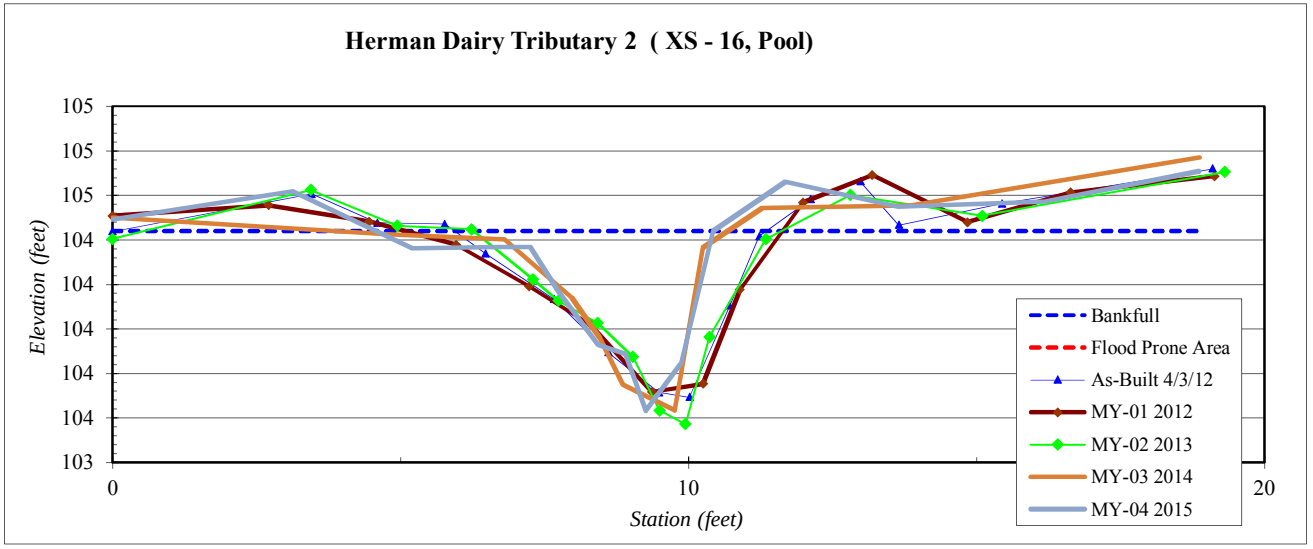


Site Name:	Herman Dairy
Watershed:	30501001120030
XS ID	Tributary 2 (XS - 16, Pool)
Drainage Area (sq mi):	1.01
Date:	4/6/2015
Field Crew:	Perkinson, Jernigan

Station	Elevation
-0.3	104.5
3.1	104.6
5.2	104.4
6.7	104.4
7.3	104.4
7.8	104.2
8.4	103.9
8.9	103.9
9.3	103.6
9.9	103.8
10.4	104.4
11.7	104.7
13.6	104.5
16.2	104.57
18.9	104.71

SUMMARY DATA	
Bankfull Elevation:	104.4
Bankfull Cross-Sectional Area:	1.6
Bankfull Width:	5.8
Flood Prone Area Elevation:	-
Flood Prone Width:	-
Max Depth at Bankfull:	0.8
Mean Depth at Bankfull:	0.3
W / D Ratio:	-
Entrenchment Ratio:	-
Bank Height Ratio:	-

Stream Type	E/C

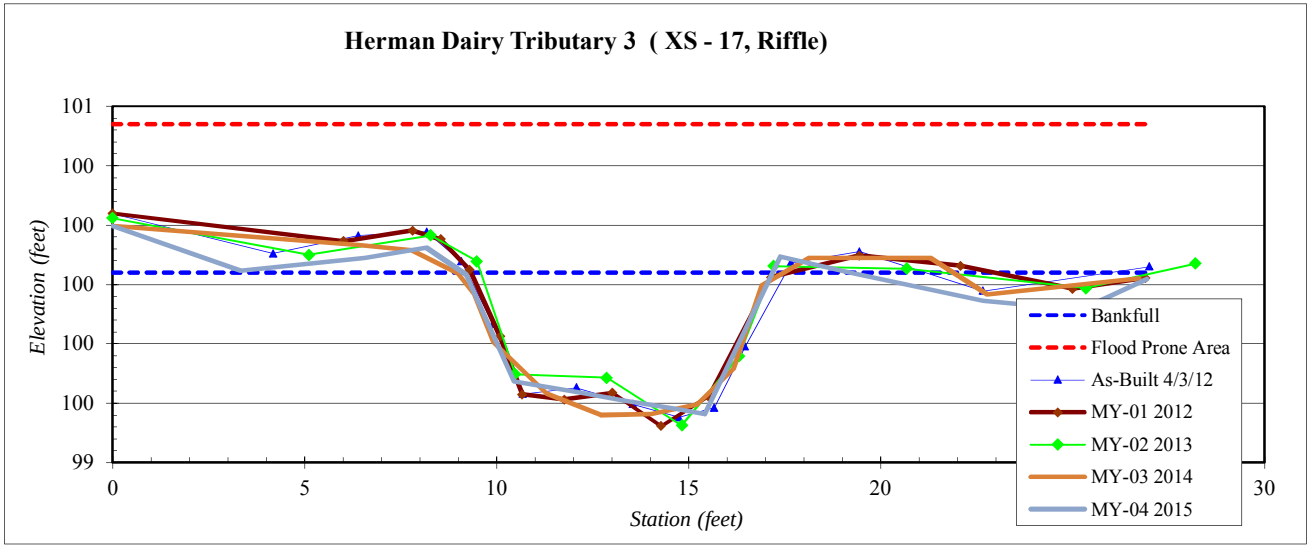


Site Name:	Herman Dairy
Watershed:	30501001120030
XS ID	Tributary 3 (XS - 17, Riffle)
Drainage Area (sq mi):	0.06
Date:	4/6/2015
Field Crew:	Perkinson, Jernigan

Station	Elevation
0.0	100.2
3.3	100.0
6.6	100.1
8.2	100.1
9.2	100.0
10.5	99.7
12.1	99.6
13.3	99.6
14.7	99.6
15.4	99.6
16.6	99.9
17.4	100.1
19.2	100.0
22.7	99.95
25.2	99.91
26.9	100.02

SUMMARY DATA	
Bankfull Elevation:	100.0
Bankfull Cross-Sectional Area:	2.7
Bankfull Width:	8.0
Flood Prone Area Elevation:	100.5
Flood Prone Width:	>80
Max Depth at Bankfull:	0.5
Mean Depth at Bankfull:	0.3
W / D Ratio:	23.7
Entrenchment Ratio:	>5
Bank Height Ratio:	1.0

Stream Type	E/C

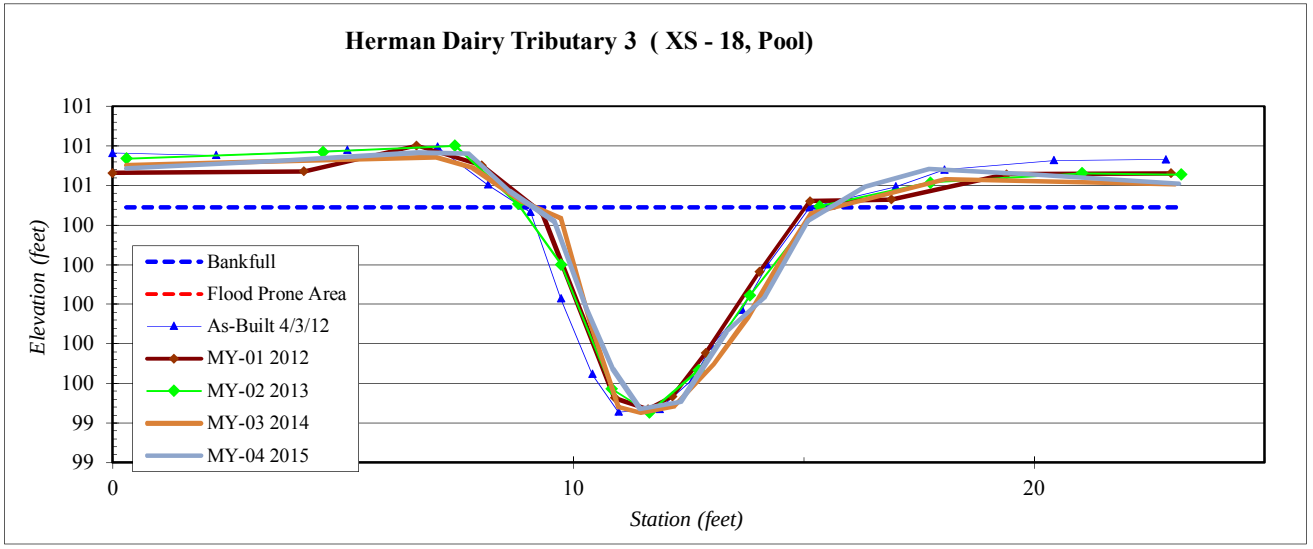


Site Name:	Herman Dairy
Watershed:	30501001120030
XS ID	Tributary 3 (XS - 18, Pool)
Drainage Area (sq mi):	0.06
Date:	4/6/2015
Field Crew:	Perkinson, Jernigan

Station	Elevation
0.3	100.7
3.7	100.7
6.6	100.8
7.7	100.8
8.6	100.6
9.6	100.4
10.3	100.0
10.9	99.7
11.4	99.5
12.3	99.5
13.3	99.9
14.1	100.0
15.1	100.4
16.3	100.59
17.7	100.68
20.1	100.66
23.1	100.61

SUMMARY DATA	
Bankfull Elevation:	100.5
Bankfull Cross-Sectional Area:	3.5
Bankfull Width:	6.4
Flood Prone Area Elevation:	-
Flood Prone Width:	-
Max Depth at Bankfull:	1.0
Mean Depth at Bankfull:	0.5
W / D Ratio:	-
Entrenchment Ratio:	-
Bank Height Ratio:	-

Stream Type	E/C

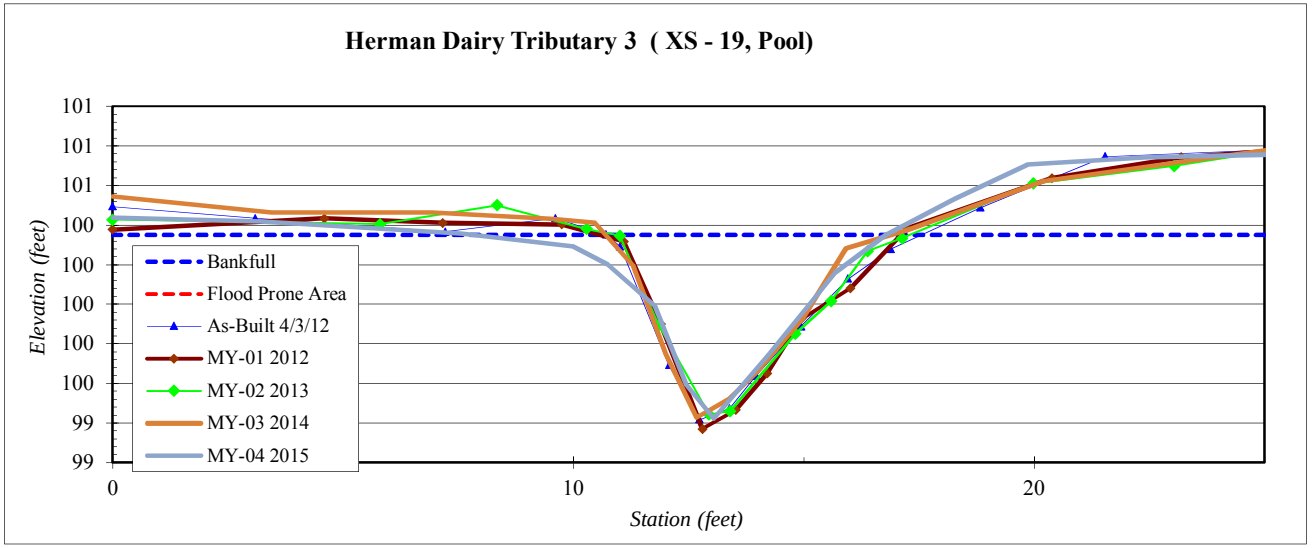


Site Name:	Herman Dairy
Watershed:	30501001120030
XS ID	Tributary 3 (XS - 19, Pool)
Drainage Area (sq mi):	0.06
Date:	4/6/2015
Field Crew:	Perkinson, Jernigan

Station	Elevation
0.0	100.4
3.2	100.4
7.6	100.4
10.0	100.3
10.7	100.2
11.8	100.0
12.5	99.6
13.0	99.4
14.2	99.7
15.7	100.2
16.8	100.4
18.3	100.5
19.9	100.7
22.4	100.74
25.7	100.76

SUMMARY DATA	
Bankfull Elevation:	100.4
Bankfull Cross-Sectional Area:	2.9
Bankfull Width:	9.0
Flood Prone Area Elevation:	-
Flood Prone Width:	-
Max Depth at Bankfull:	0.9
Mean Depth at Bankfull:	0.3
W / D Ratio:	-
Entrenchment Ratio:	-
Bank Height Ratio:	-

Stream Type	E/C

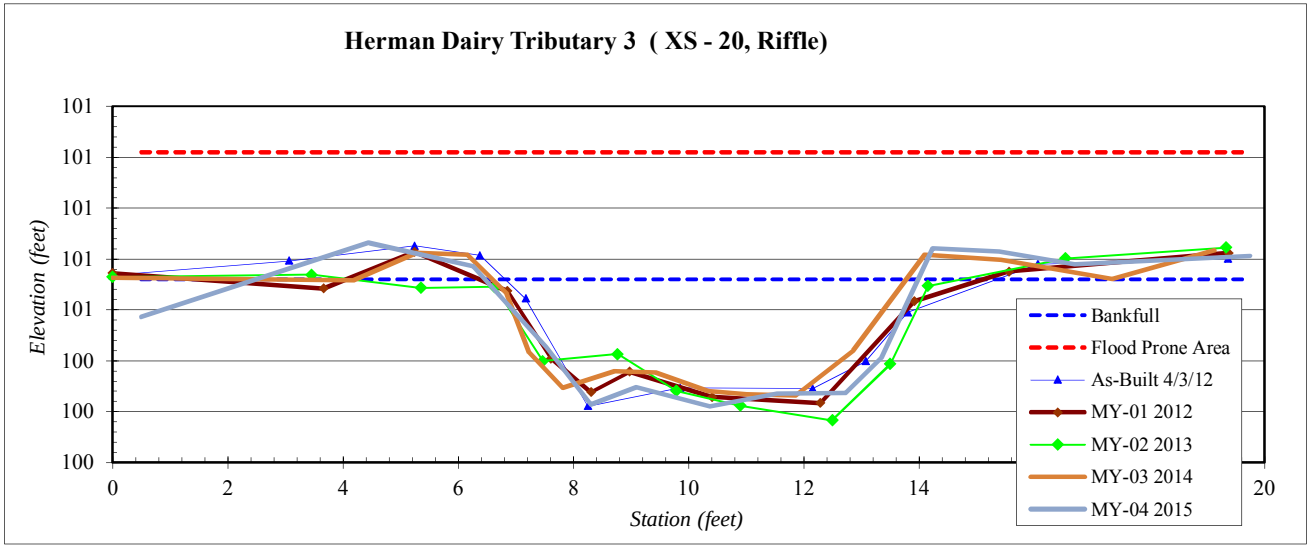


Site Name:	Herman Dairy
Watershed:	30501001120030
XS ID	Tributary 3 (XS - 20, Riffle)
Drainage Area (sq mi):	0.06
Date:	4/6/2015
Field Crew:	Perkinson, Jernigan

Station	Elevation
0.5	100.6
4.5	100.9
6.3	100.8
7.5	100.5
8.3	100.2
9.1	100.3
10.4	100.2
11.5	100.3
12.7	100.3
13.4	100.4
14.2	100.8
15.4	100.8
16.7	100.8
19.7	100.81

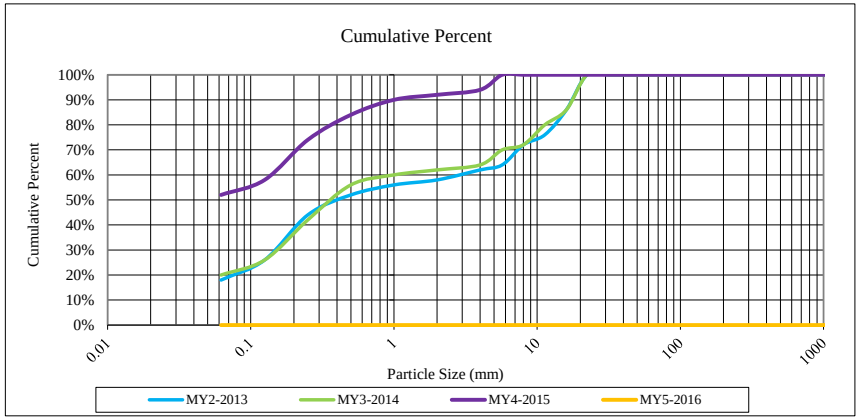
SUMMARY DATA	
Bankfull Elevation:	100.7
Bankfull Cross-Sectional Area:	2.8
Bankfull Width:	7.5
Flood Prone Area Elevation:	101.2
Flood Prone Width:	>80
Max Depth at Bankfull:	0.5
Mean Depth at Bankfull:	0.4
W / D Ratio:	20.1
Entrenchment Ratio:	>5
Bank Height Ratio:	1.0

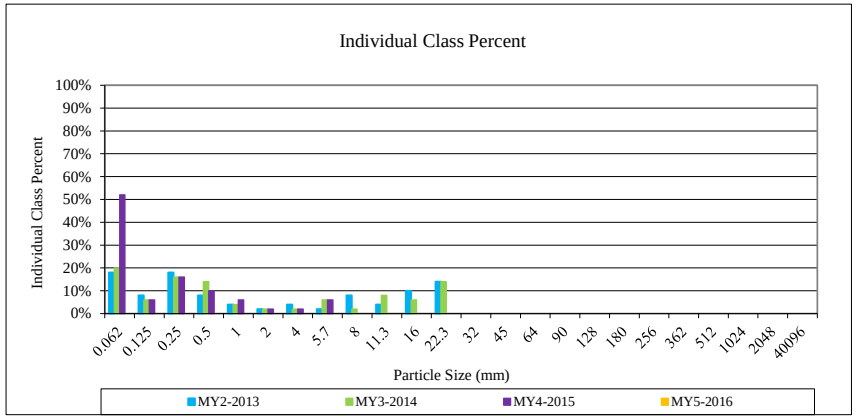
Stream Type	E/C



Project Name: Herman Dairy UT1					
Cross-Section: 2					
Feature: Riffle					
			2015		
Description	Material	Size (mm)	Total #	Item %	Cum %
Silt/Clay	silt/clay	0.062	26	52%	36%
Sand	very fine sand	0.125	3	6%	44%
	fine sand	0.250	8	16%	48%
	medium sand	0.50	5	10%	48%
	coarse sand	1.00	3	6%	56%
	very coarse sand	2.0	1	2%	60%
Gravel	very fine gravel	4.0	1	2%	68%
	fine gravel	5.7	3	6%	72%
	fine gravel	8.0	0	0%	84%
	medium gravel	11.3	0	0%	92%
	medium gravel	16.0	0	0%	92%
	course gravel	22.3	0	0%	96%
	course gravel	32.0	0	0%	96%
	very coarse gravel	45	0	0%	96%
	very coarse gravel	64	0	0%	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			50	100%	100%

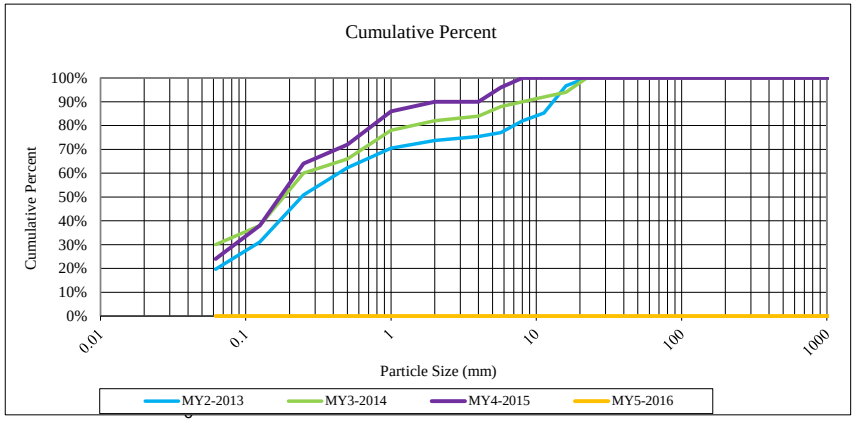
Summary Data	
D50	NA
D84	1
D95	4



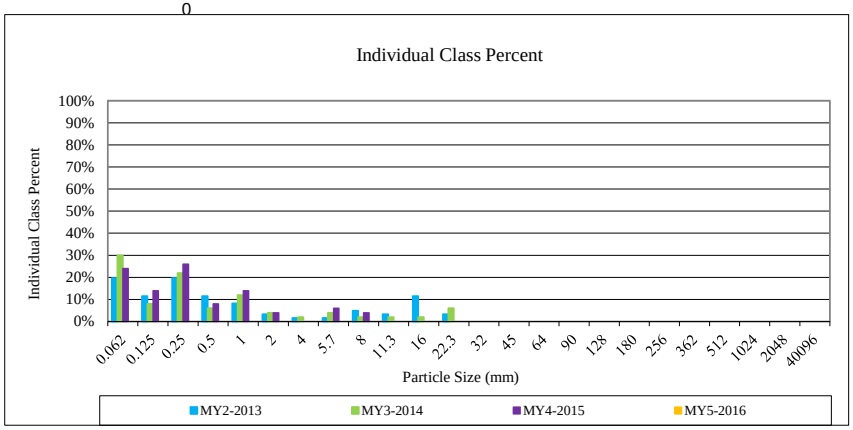


Project Name: Herman Dairy UT1					
Cross-Section: 3					
Feature: Riffle					
			2015		
Description	**Material**	**Size (mm)**	**Total #**	**Item %**	**Cum %**
Silt/Clay	silt/clay	0.062	12	24%	33%
Sand	very fine sand	0.125	7	14%	43%
	fine sand	0.250	13	26%	48%
	medium sand	0.50	4	8%	52%
	coarse sand	1.00	7	14%	62%
	very coarse sand	2.0	2	4%	67%
Gravel	very fine gravel	4.0	0	0%	67%
	fine gravel	5.7	3	6%	67%
	fine gravel	8.0	2	4%	71%
	medium gravel	11.3	0	0%	76%
	medium gravel	16.0	0	0%	86%
	course gravel	22.3	0	0%	90%
	course gravel	32.0	0	0%	95%
	very coarse gravel	45	0	0%	95%
	very coarse gravel	64	0	0%	95%
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			50	100%	100%

Summary Data	
D50	0.2
D84	1
D95	6

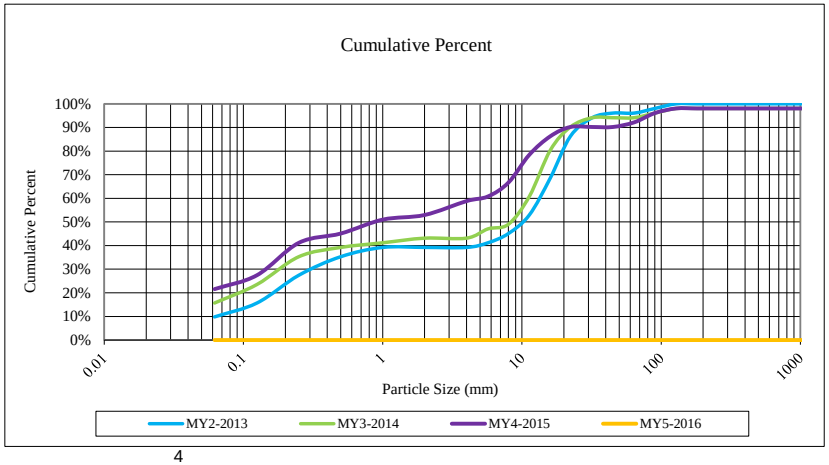


0

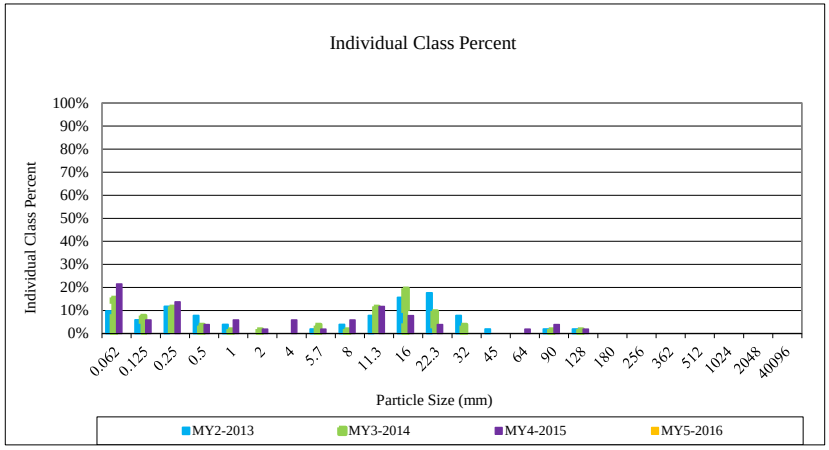


Project Name: Herman Dairy UT1					
Cross-Section: 10					
Feature: Riffle					
			2015		
Description	Material	Size (mm)	Total #	Item %	Cum %
Silt/Clay	silt/clay	0.062	11	22%	24%
Sand	very fine sand	0.125	3	6%	32%
	fine sand	0.250	7	14%	44%
	medium sand	0.50	2	4%	48%
	coarse sand	1.00	3	6%	56%
	very coarse sand	2.0	1	2%	60%
Gravel	very fine gravel	4.0	3	6%	68%
	fine gravel	5.7	1	2%	72%
	fine gravel	8.0	3	6%	80%
	medium gravel	11.3	6	12%	80%
	medium gravel	16.0	4	8%	84%
	course gravel	22.3	2	4%	96%
	course gravel	32.0	0	0%	96%
	very coarse gravel	45	0	0%	96%
	very coarse gravel	64	1	2%	100%
Cobble	small cobble	90	2	4%	100%
	medium cobble	128	1	2%	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			50	100%	100%

Summary Data	
D50	0.8
D84	13
D95	70

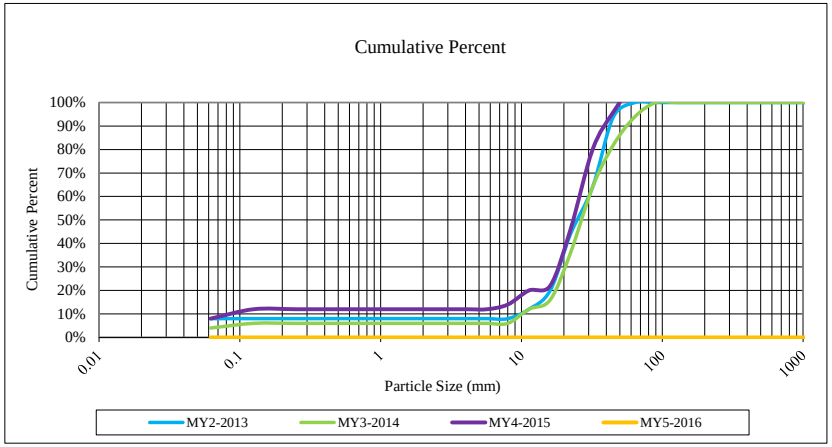


4



Project Name: Herman Dairy UT2					
Cross-Section: 13					
Feature: Riffle					
			2015		
Description	Material	Size (mm)	Total #	Item %	Cum %
Silt/Clay	silt/clay	0.062	4	7%	68%
Sand	very fine sand	0.125	2	4%	72%
	fine sand	0.250	0	0%	84%
	medium sand	0.50	0	0%	84%
	coarse sand	1.00	0	0%	88%
	very coarse sand	2.0	0	0%	92%
Gravel	very fine gravel	4.0	0	0%	100%
	fine gravel	5.7	0	0%	100%
	fine gravel	8.0	1	2%	100%
	medium gravel	11.3	3	5%	100%
	medium gravel	16.0	1	2%	100%
	course gravel	22.3	12	21%	100%
	course gravel	32.0	17	30%	100%
	very coarse gravel	45	8	14%	100%
	very coarse gravel	64	6	11%	100%
Cobble	small cobble	90	2	4%	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			56	100%	100%

Summary Data	
D50	24.6
D84	43
D95	61



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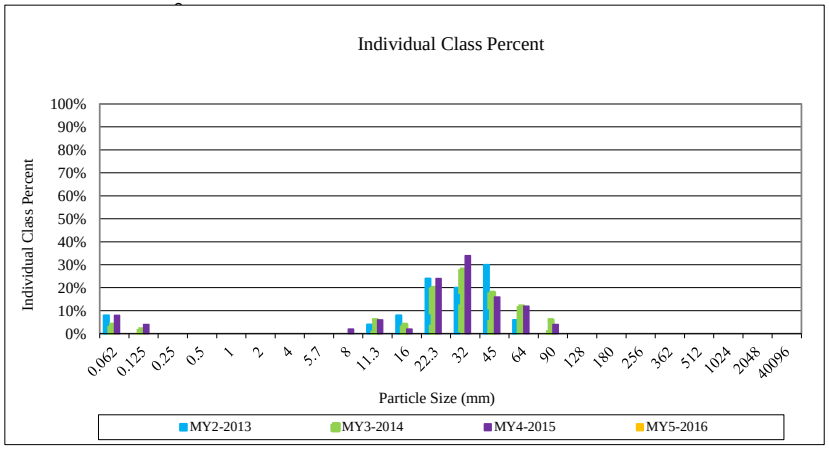
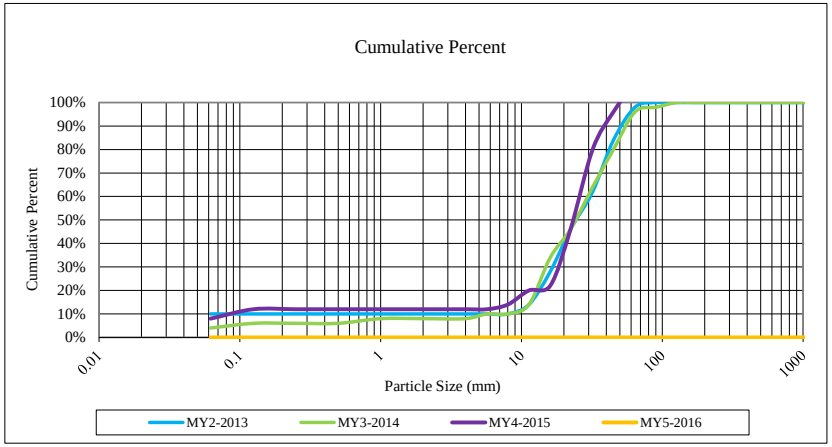


Project Name: Herman Dairy UT2					
Cross-Section: 15					
Feature: Riffle					
			2015		
Description	**Material**	**Size (mm)**	**Total #**	**Item %**	**Cum %**
Silt/Clay	silt/clay	0.062	4	8%	68%
Sand	very fine sand	0.125	1	2%	72%
	fine sand	0.250	0	0%	84%
	medium sand	0.50	2	4%	84%
	coarse sand	1.00	1	2%	88%
	very coarse sand	2.0	0	0%	92%
Gravel	very fine gravel	4.0	1	2%	100%
	fine gravel	5.7	0	0%	100%
	fine gravel	8.0	1	2%	100%
	medium gravel	11.3	3	6%	100%
	medium gravel	16.0	4	8%	100%
	course gravel	22.3	9	17%	100%
	course gravel	32.0	7	13%	100%
	very coarse gravel	45	11	21%	100%
	very coarse gravel	64	5	10%	100%
Cobble	small cobble	90	1	2%	100%
	medium cobble	128	2	4%	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			52	100%	100%

Summary Data	
D50	22
D84	45
D95	73



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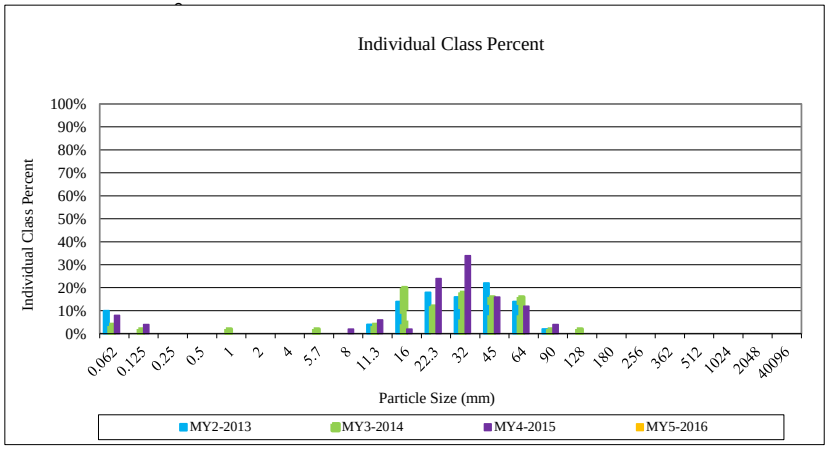
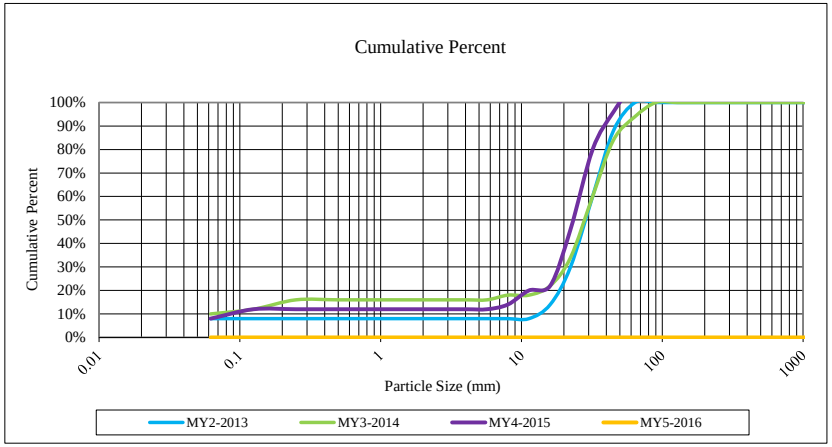


Project Name: Herman Dairy UT3					
Cross-Section: 17					
Feature: Riffle					
			2015		
Description	**Material**	**Size (mm)**	**Total #**	**Item %**	**Cum %**
Silt/Clay	silt/clay	0.062	7	12%	68%
Sand	very fine sand	0.125	2	4%	72%
	fine sand	0.250	3	5%	84%
	medium sand	0.50	1	2%	84%
	coarse sand	1.00	2	4%	88%
	very coarse sand	2.0	0	0%	92%
Gravel	very fine gravel	4.0	0	0%	100%
	fine gravel	5.7	2	4%	100%
	fine gravel	8.0	1	2%	100%
	medium gravel	11.3	0	0%	100%
	medium gravel	16.0	3	5%	100%
	course gravel	22.3	4	7%	100%
	course gravel	32.0	16	28%	100%
	very coarse gravel	45	5	9%	100%
	very coarse gravel	64	11	19%	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			57	100%	100%

Summary Data	
D50	24
D84	48
D95	58



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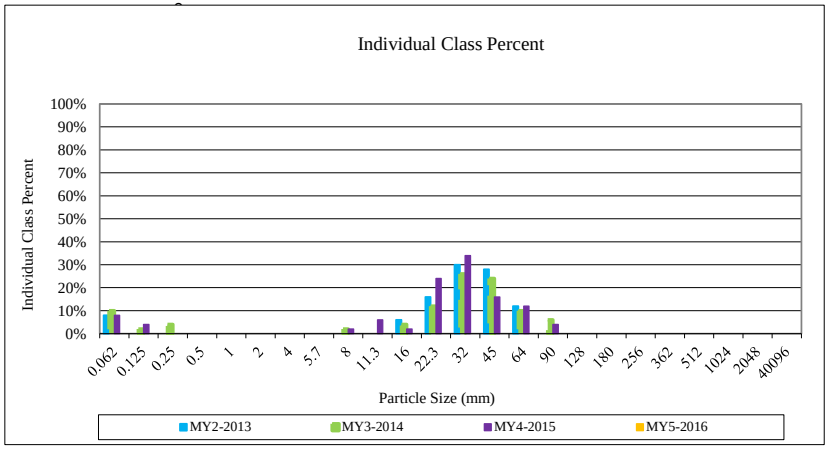
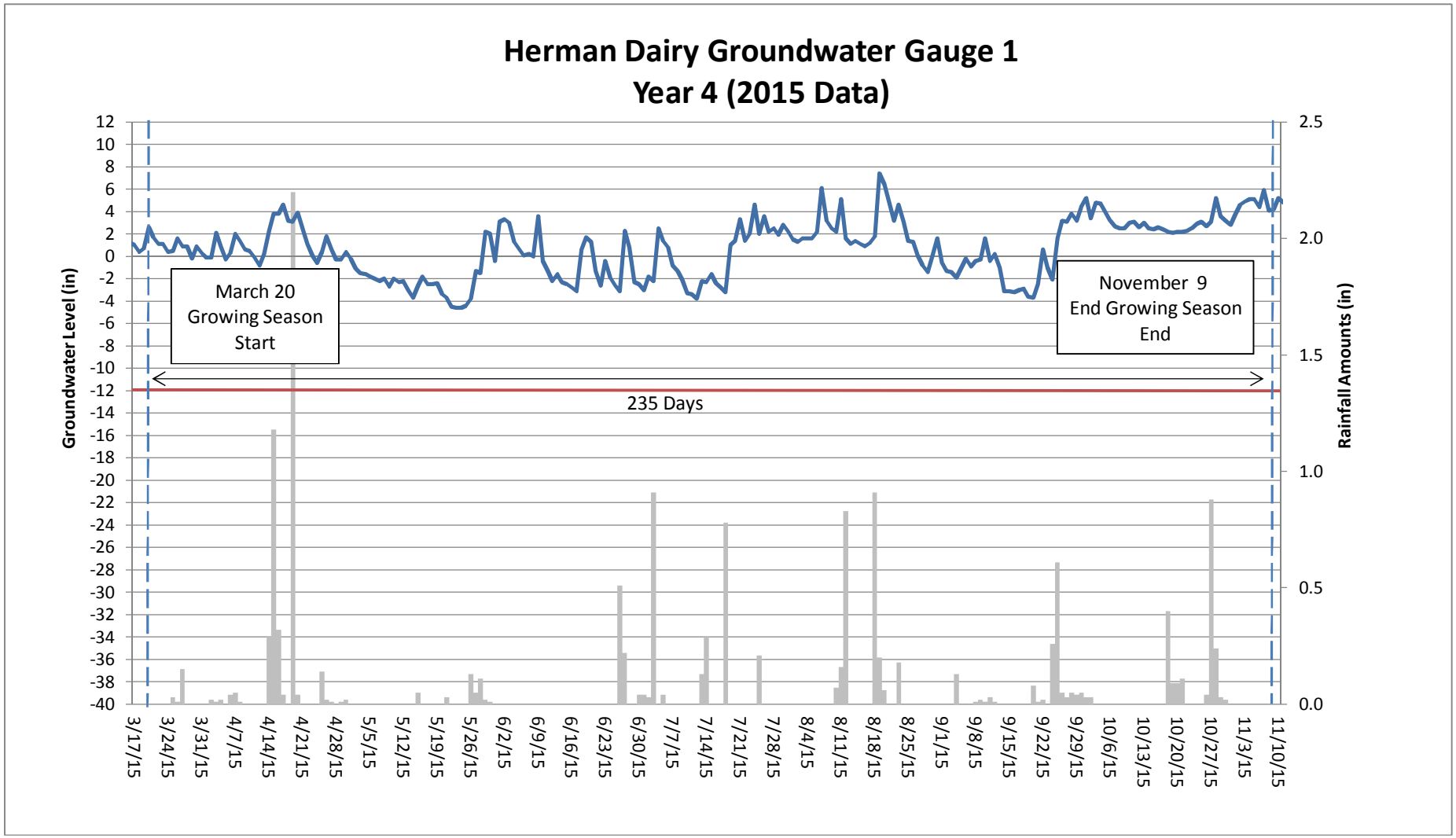


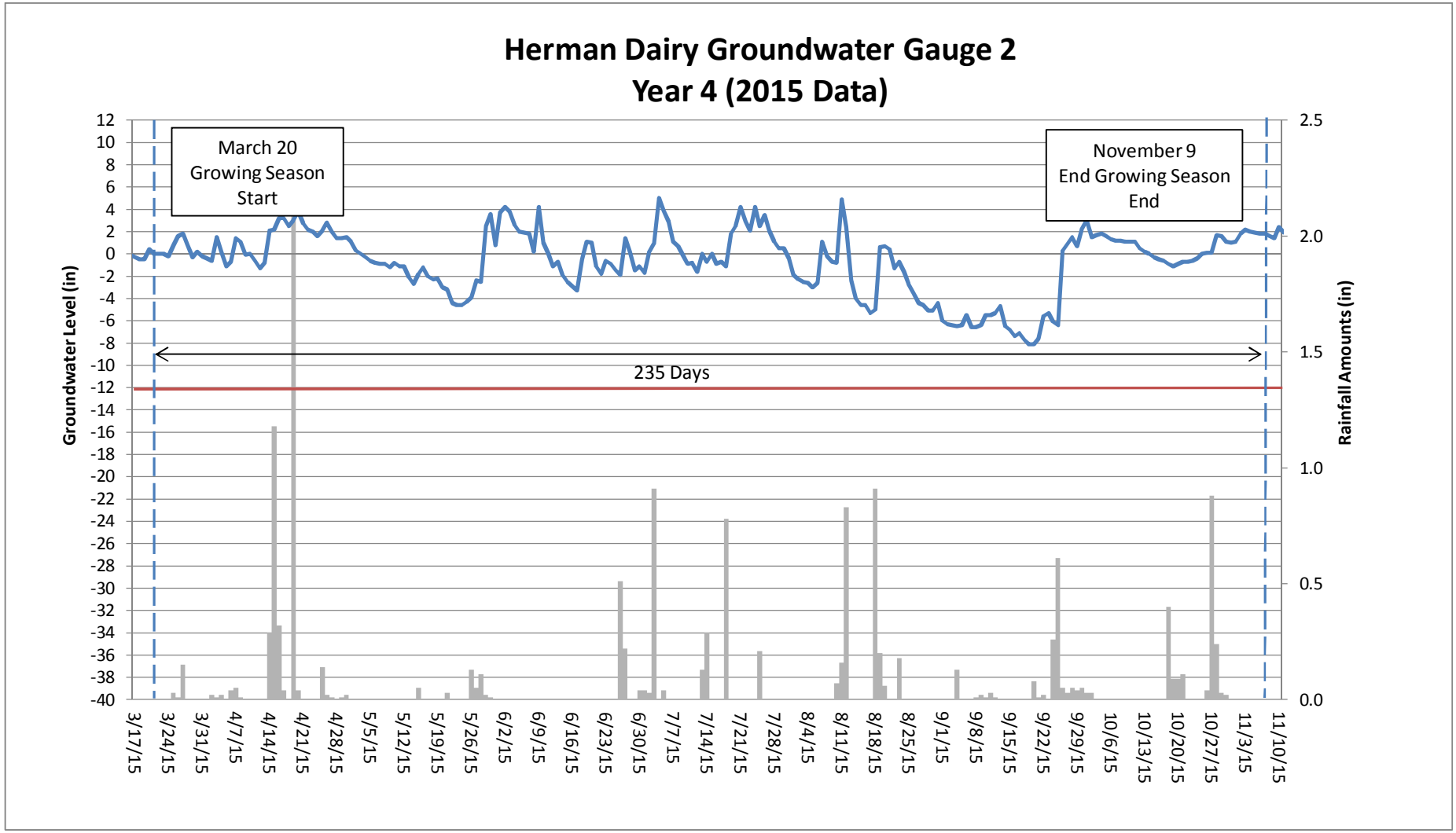
Appendix E.
Hydrology Data

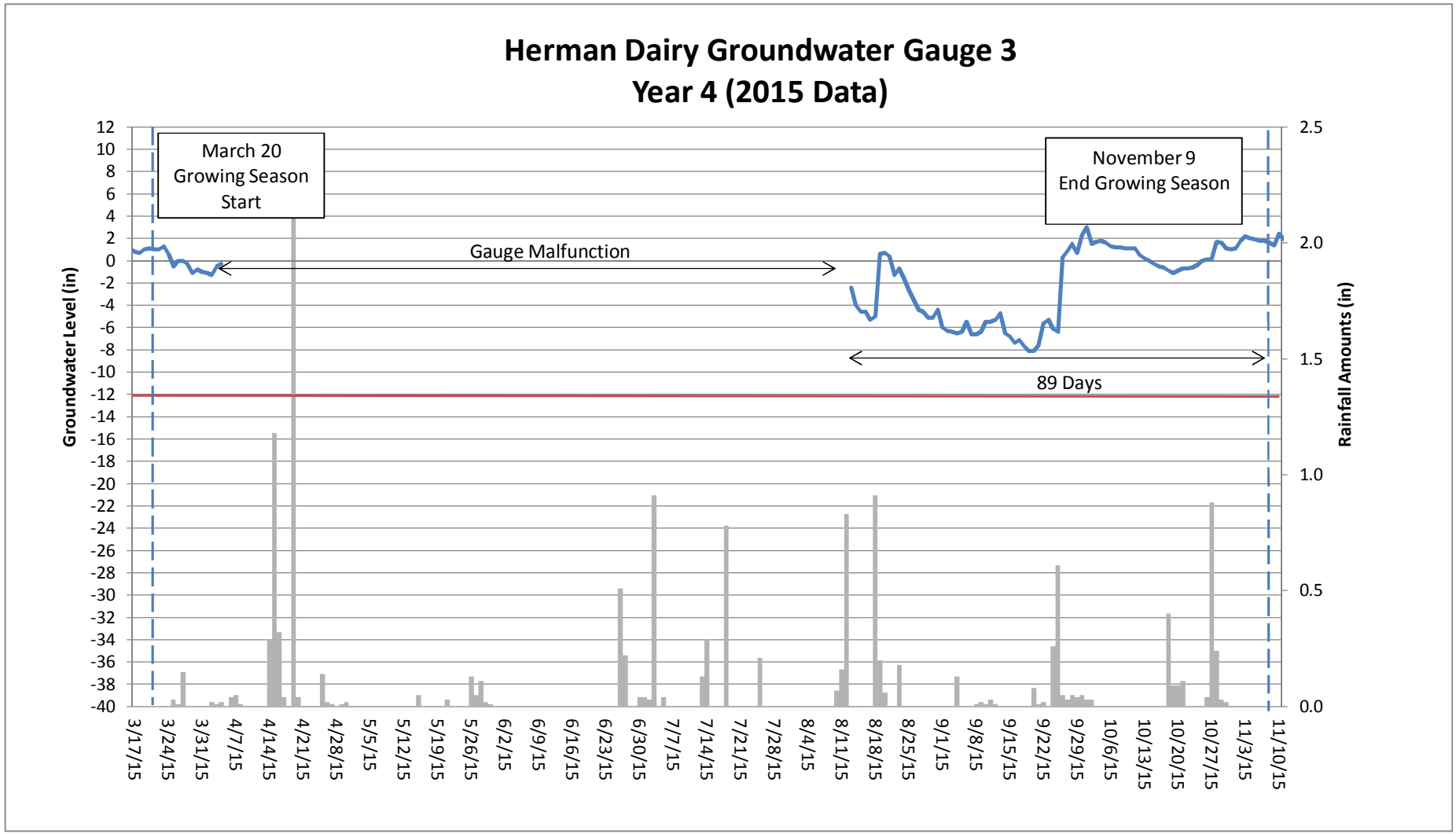
Table 12. Wetland Hydrology Criteria Attainment
2015 Groundwater Gauge Graphs
Figure E1. Annual Climatic Data vs. 30-year Historic Data

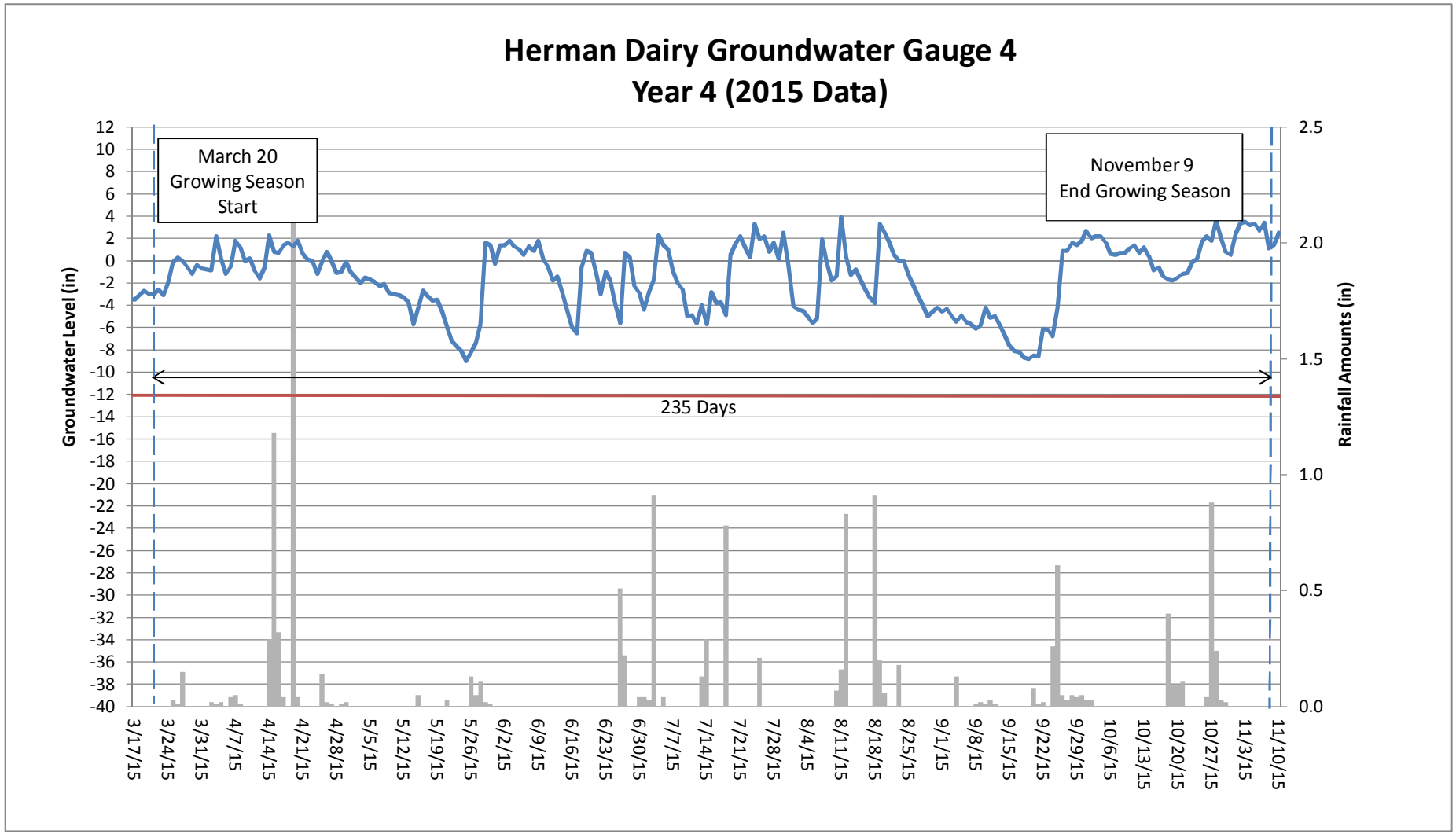
Table 12. Wetland Hydrology Criteria Attainment

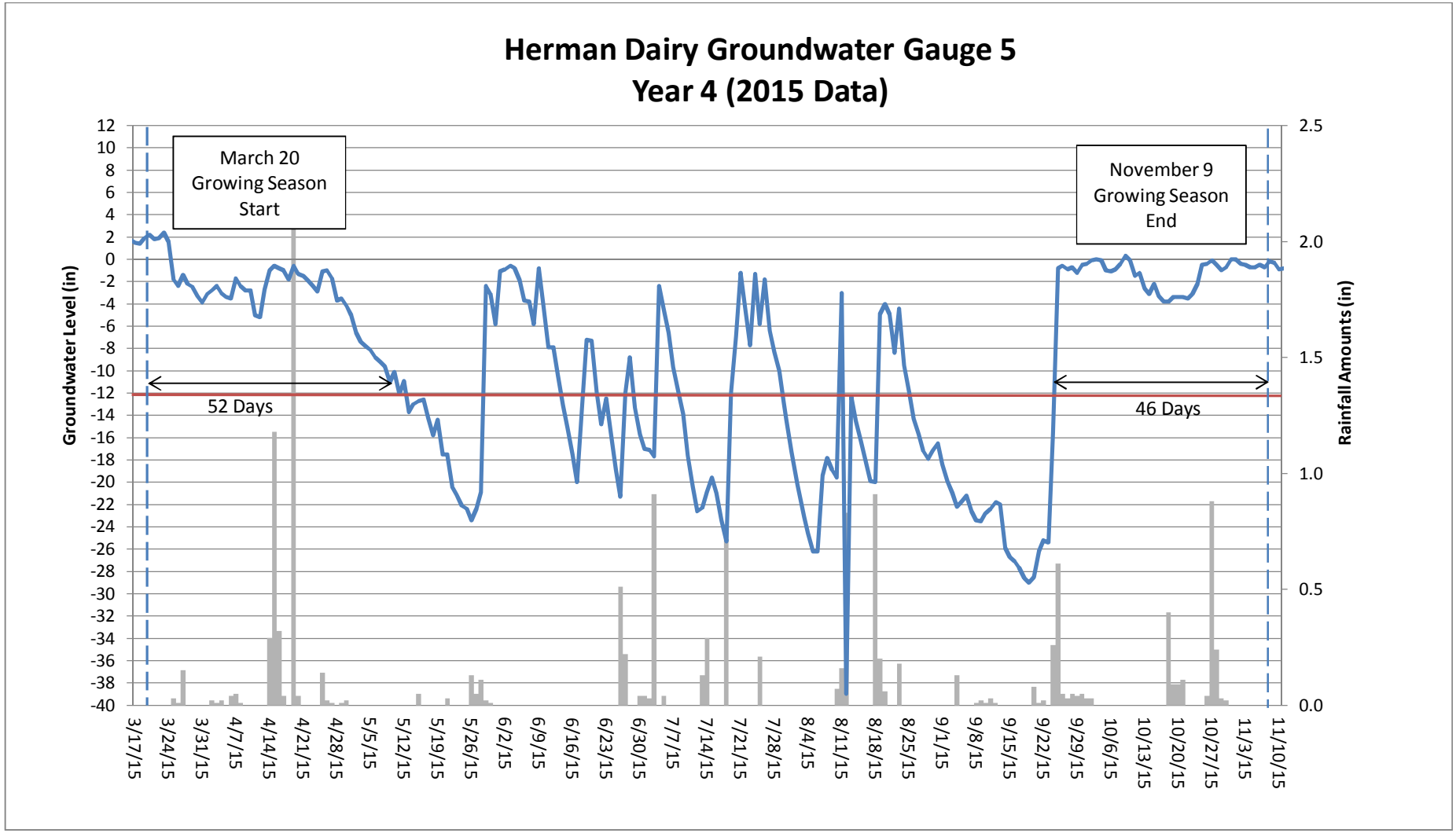
Gauge	Success Criteria Achieved/Max Consecutive Days During Growing Season (Percentage)				
	Year 1 (2012)	Year 2 (2013)	Year 3 (2014)	Year 4 (2015)	Year 5 (2016)
1	Yes/38 days (16.2 percent)	Yes/235 days (100 percent)	Yes/235 days (100 percent)	Yes/235 days (100 percent)	
2	Yes/101days (43 percent)	Yes/235 days (100 percent)	Yes/39 days (16.6 percent)	Yes/235 days (100 percent)	
3	Yes/226 days (96.2 percent)	Yes/235 days (100 percent)	Yes/130 days (55.3 percent)	Yes/89 days (37.8 percent)	
4	Yes/226 days (96.2 percent)	Yes/46 days (19.6 percent)	Yes/235 days (100 percent)	Yes/235 days (100 percent)	
5	Yes/87 days (37.0 percent)	Yes/179 days (76.2 percent)	Yes/108 days (46 percent)	Yes/52 days (22 percent)	
6	Yes/100 days (42.5 percent)	Yes/235 days (100 percent)	Yes/79 days (33.6 percent)	Yes/49 days (20.8 percent)	
7	Yes/235 days (100 percent)	Yes/235days (100 percent)	Yes/117 days (49.8 percent)	Yes/115 days (48.9 percent)	
8	Yes/178 days (75.7 percent)	Yes/193 days (82.1 percent)	Yes/119 days (50.6 percent)	Yes/81 days (34.4 percent)	
9	Yes/29 days (12.3 percent)	Yes/104 days (44.2 percent)	Yes/100 days (42.6 percent)	Yes/49 days (20.8 percent)	
10	Yes/102 days (43.4 percent)	Yes/235 days (100 percent)	Yes/235 days (100 percent)	Yes/167 days (71 percent)	
Ref	Yes/148 days (62.9 percent)	Yes/235 days (100 percent)	Yes/235 days (100 percent)	Yes/235 days (100 percent)	

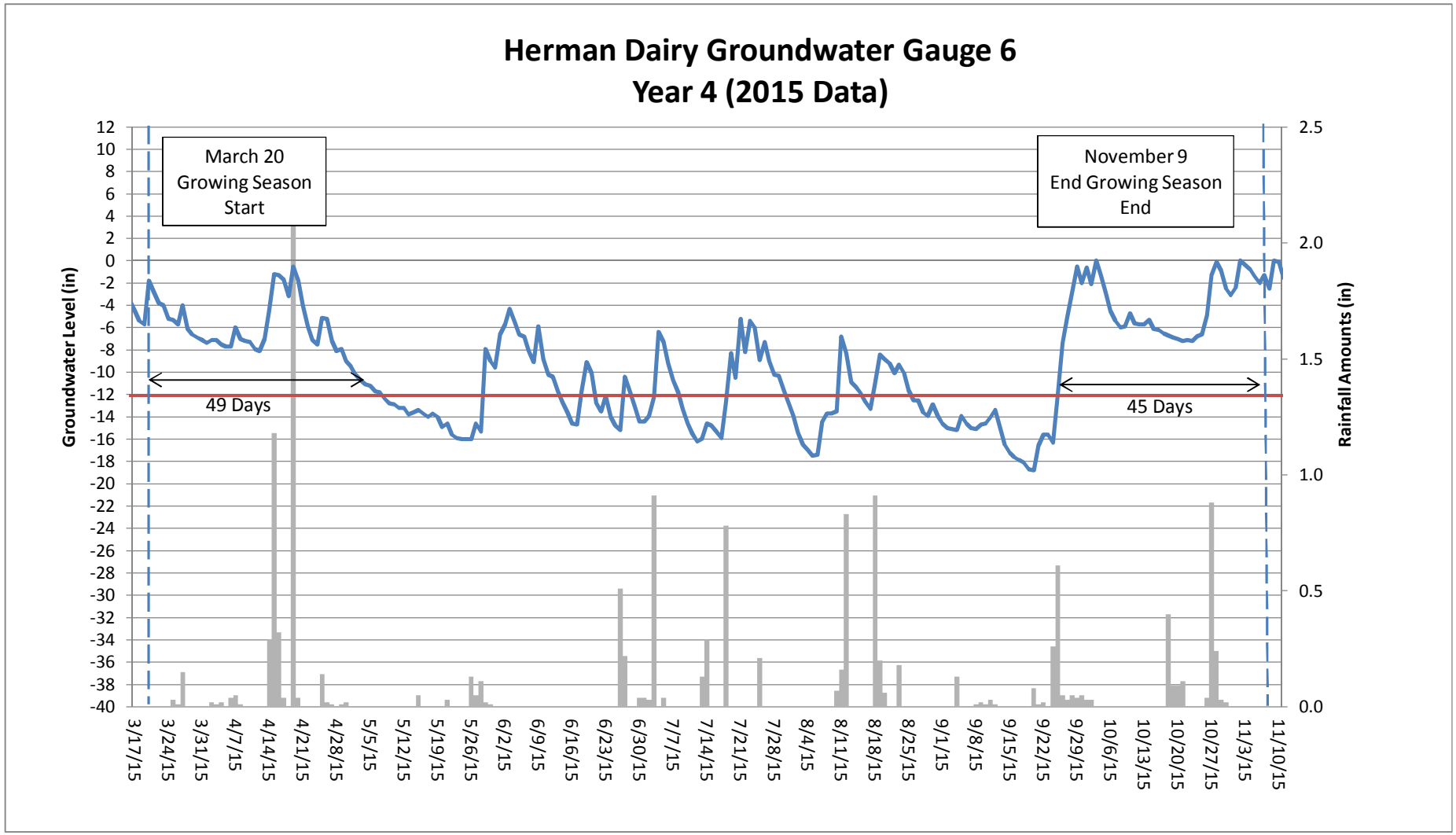

Herman Dairy Groundwater Gauge 1
Year 4 (2015 Data)
Groundwater Level (in)
Rainfall Amounts (in)
March 20
Growing Season
Start
November 9
End Growing Season
End
235 Days
12
10
8
6
4
2
0
-2
-4
-6
-8
-10
-12
-14
-16
-18
-20
-22
-24
-26
-28
-30
-32
-34
-36
-38
-40
2.5
2.0
1.5
1.0
0.5
0.0
3/17/15
3/24/15
3/31/15
4/7/15
4/14/15
4/21/15
4/28/15
5/5/15
5/12/15
5/19/15
5/26/15
6/2/15
6/9/15
6/16/15
6/23/15
6/30/15
7/7/15
7/14/15
7/21/15
7/28/15
8/4/15
8/11/15
8/18/15
8/25/15
9/1/15
9/8/15
9/15/15
9/22/15
9/29/15
10/6/15
10/13/15
10/20/15
10/27/15
11/3/15
11/10/15

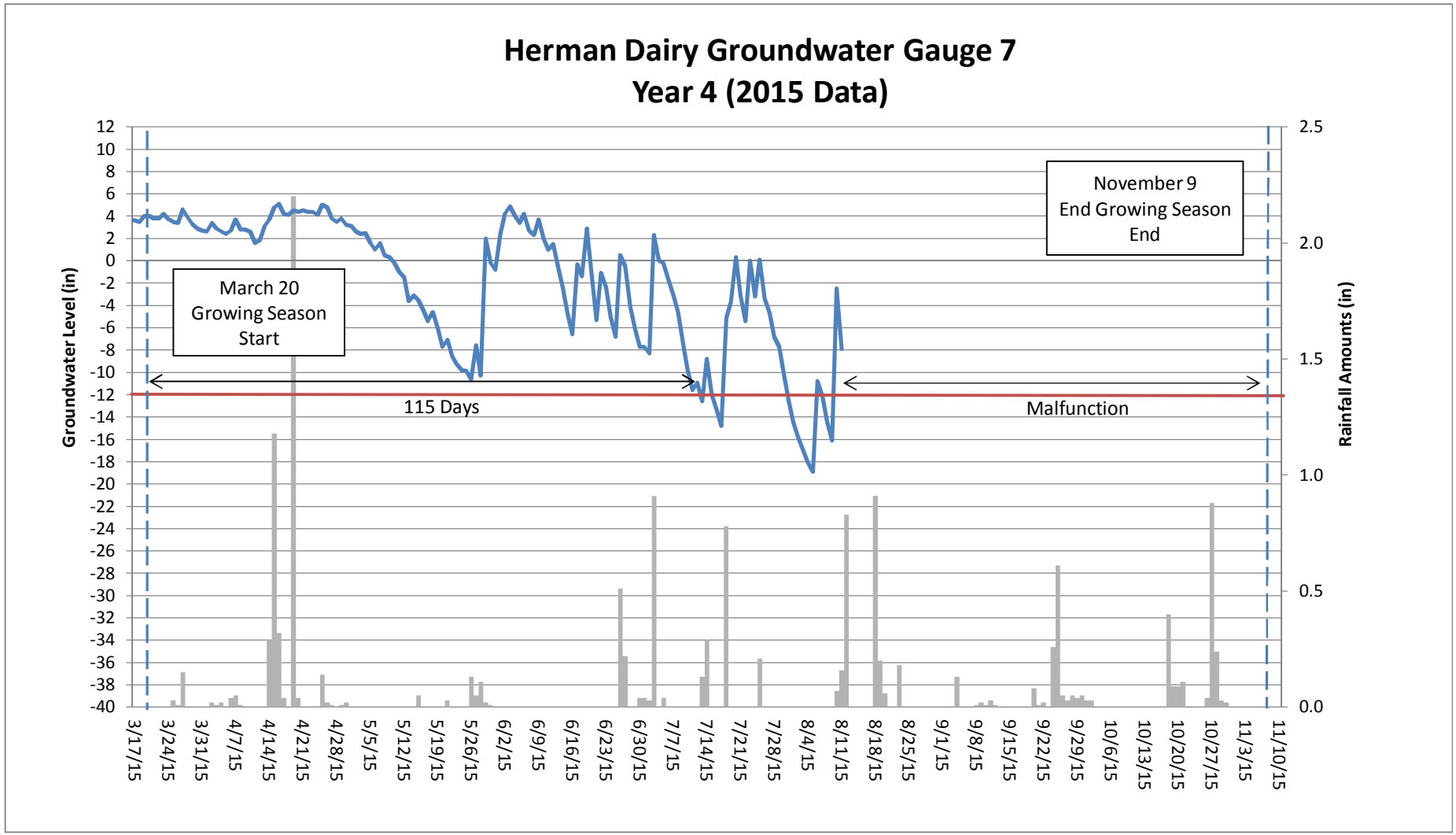

Herman Dairy Groundwater Gauge 2
Year 4 (2015 Data)
March 20
Growing Season
Start
November 9
End Growing Season
End
235 Days
Groundwater Level (in)
Rainfall Amounts (in)
12
10
8
6
4
2
0
-2
-4
-6
-8
-10
-12
-14
-16
-18
-20
-22
-24
-26
-28
-30
-32
-34
-36
-38
-40
2.5
2.0
1.5
1.0
0.5
0.0
3/17/15
3/24/15
3/31/15
4/7/15
4/14/15
4/21/15
4/28/15
5/5/15
5/12/15
5/19/15
5/26/15
6/2/15
6/9/15
6/16/15
6/23/15
6/30/15
7/7/15
7/14/15
7/21/15
7/28/15
8/4/15
8/11/15
8/18/15
8/25/15
9/1/15
9/8/15
9/15/15
9/22/15
9/29/15
10/6/15
10/13/15
10/20/15
10/27/15
11/3/15
11/10/15

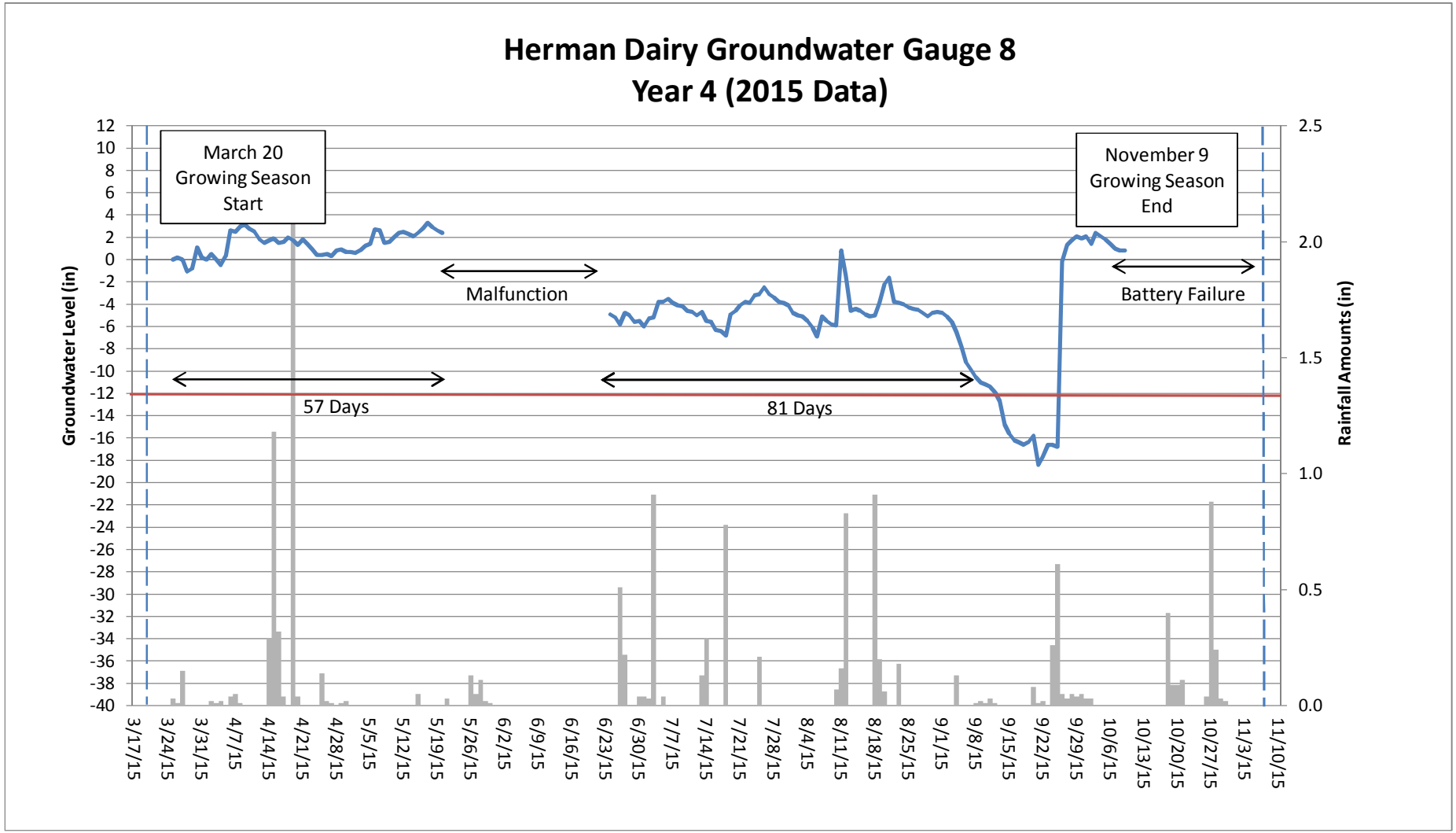

Herman Dairy Groundwater Gauge 3
Year 4 (2015 Data)
March 20
Growing Season
Start
November 9
End Growing Season
Gauge Malfunction
89 Days
Groundwater Level (in)
Rainfall Amounts (in)
12
10
8
6
4
2
0
-2
-4
-6
-8
-10
-12
-14
-16
-18
-20
-22
-24
-26
-28
-30
-32
-34
-36
-38
-40
2.5
2.0
1.5
1.0
0.5
0.0
3/17/15
3/24/15
3/31/15
4/7/15
4/14/15
4/21/15
4/28/15
5/5/15
5/12/15
5/19/15
5/26/15
6/2/15
6/9/15
6/16/15
6/23/15
6/30/15
7/7/15
7/14/15
7/21/15
7/28/15
8/4/15
8/11/15
8/18/15
8/25/15
9/1/15
9/8/15
9/15/15
9/22/15
9/29/15
10/6/15
10/13/15
10/20/15
10/27/15
11/3/15
11/10/15


Herman Dairy Groundwater Gauge 4
Year 4 (2015 Data)
March 20
Growing Season
Start
November 9
End Growing Season
235 Days
Groundwater Level (in)
Rainfall Amounts (in)
12
10
8
6
4
2
0
-2
-4
-6
-8
-10
-12
-14
-16
-18
-20
-22
-24
-26
-28
-30
-32
-34
-36
-38
-40
2.5
2.0
1.5
1.0
0.5
0.0
3/17/15
3/24/15
3/31/15
4/7/15
4/14/15
4/21/15
4/28/15
5/5/15
5/12/15
5/19/15
5/26/15
6/2/15
6/9/15
6/16/15
6/23/15
6/30/15
7/7/15
7/14/15
7/21/15
7/28/15
8/4/15
8/11/15
8/18/15
8/25/15
9/1/15
9/8/15
9/15/15
9/22/15
9/29/15
10/6/15
10/13/15
10/20/15
10/27/15
11/3/15
11/10/15


Herman Dairy Groundwater Gauge 5
Year 4 (2015 Data)
March 20
Growing Season
Start
November 9
Growing Season
End
52 Days
46 Days
Groundwater Level (in)
Rainfall Amounts (in)
12
10
8
6
4
2
0
-2
-4
-6
-8
-10
-12
-14
-16
-18
-20
-22
-24
-26
-28
-30
-32
-34
-36
-38
-40
2.5
2.0
1.5
1.0
0.5
0.0
3/17/15
3/24/15
3/31/15
4/7/15
4/14/15
4/21/15
4/28/15
5/5/15
5/12/15
5/19/15
5/26/15
6/2/15
6/9/15
6/16/15
6/23/15
6/30/15
7/7/15
7/14/15
7/21/15
7/28/15
8/4/15
8/11/15
8/18/15
8/25/15
9/1/15
9/8/15
9/15/15
9/22/15
9/29/15
10/6/15
10/13/15
10/20/15
10/27/15
11/3/15
11/10/15


Herman Dairy Groundwater Gauge 6
Year 4 (2015 Data)
March 20
Growing Season
Start
November 9
End Growing Season
End
49 Days
45 Days
Groundwater Level (in)
Rainfall Amounts (in)
12
10
8
6
4
2
0
-2
-4
-6
-8
-10
-12
-14
-16
-18
-20
-22
-24
-26
-28
-30
-32
-34
-36
-38
-40
2.5
2.0
1.5
1.0
0.5
0.0
3/17/15
3/24/15
3/31/15
4/7/15
4/14/15
4/21/15
4/28/15
5/5/15
5/12/15
5/19/15
5/26/15
6/2/15
6/9/15
6/16/15
6/23/15
6/30/15
7/7/15
7/14/15
7/21/15
7/28/15
8/4/15
8/11/15
8/18/15
8/25/15
9/1/15
9/8/15
9/15/15
9/22/15
9/29/15
10/6/15
10/13/15
10/20/15
10/27/15
11/3/15
11/10/15


Herman Dairy Groundwater Gauge 7
Year 4 (2015 Data)
Groundwater Level (in)
Rainfall Amounts (in)
March 20
Growing Season
Start
November 9
End Growing Season
End
115 Days
Malfunction
12
10
8
6
4
2
0
-2
-4
-6
-8
-10
-12
-14
-16
-18
-20
-22
-24
-26
-28
-30
-32
-34
-36
-38
-40
2.5
2.0
1.5
1.0
0.5
0.0
3/17/15
3/24/15
3/31/15
4/7/15
4/14/15
4/21/15
4/28/15
5/5/15
5/12/15
5/19/15
5/26/15
6/2/15
6/9/15
6/16/15
6/23/15
6/30/15
7/7/15
7/14/15
7/21/15
7/28/15
8/4/15
8/11/15
8/18/15
8/25/15
9/1/15
9/8/15
9/15/15
9/22/15
9/29/15
10/6/15
10/13/15
10/20/15
10/27/15
11/3/15
11/10/15


Herman Dairy Groundwater Gauge 8
Year 4 (2015 Data)
March 20
Growing Season
Start
November 9
Growing Season
End
Malfunction
Battery Failure
57 Days
81 Days
Groundwater Level (in)
Rainfall Amounts (in)
12
10
8
6
4
2
0
-2
-4
-6
-8
-10
-12
-14
-16
-18
-20
-22
-24
-26
-28
-30
-32
-34
-36
-38
-40
2.5
2.0
1.5
1.0
0.5
0.0
3/17/15
3/24/15
3/31/15
4/7/15
4/14/15
4/21/15
4/28/15
5/5/15
5/12/15
5/19/15
5/26/15
6/2/15
6/9/15
6/16/15
6/23/15
6/30/15
7/7/15
7/14/15
7/21/15
7/28/15
8/4/15
8/11/15
8/18/15
8/25/15
9/1/15
9/8/15
9/15/15
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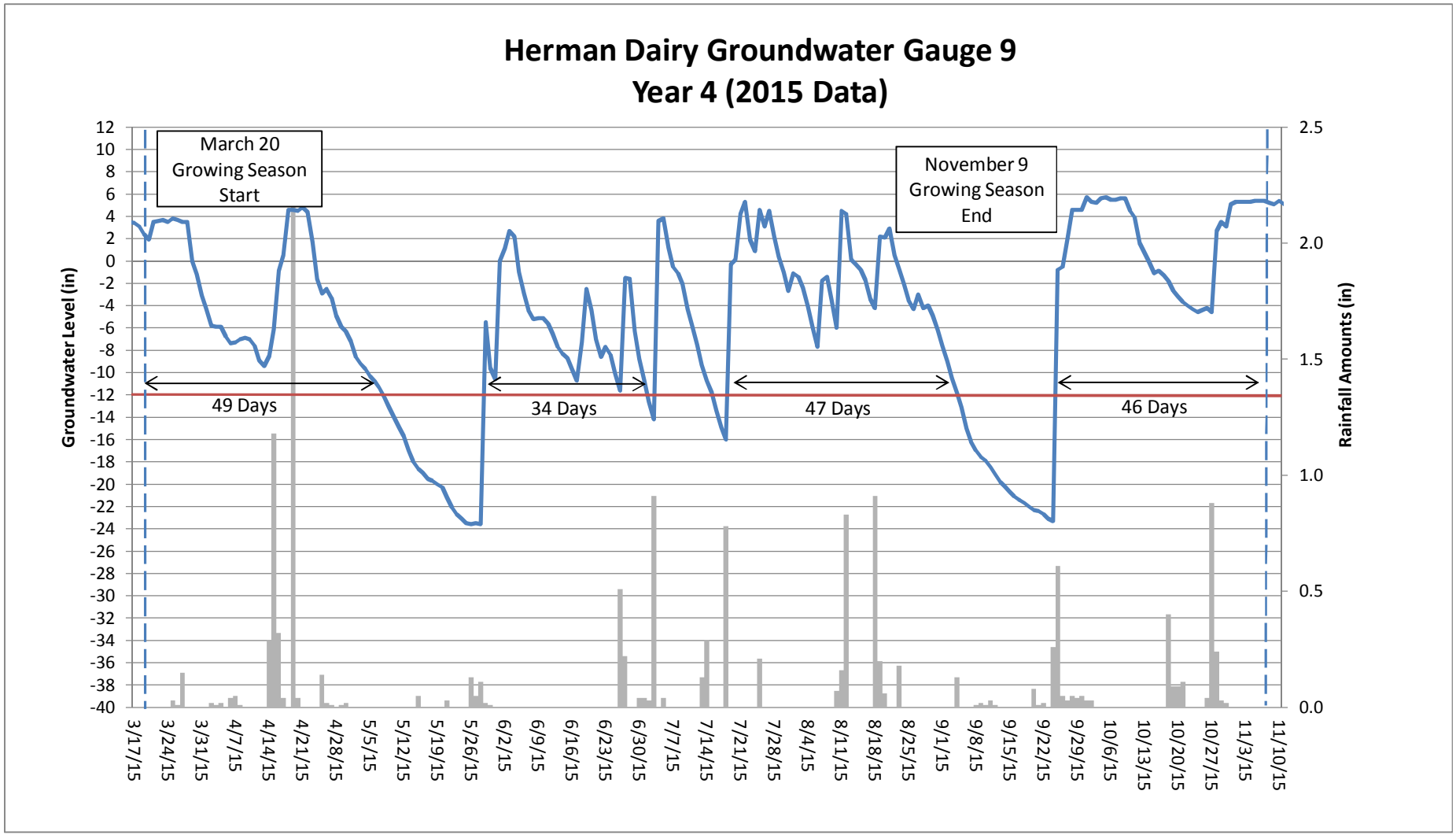
10/20/15
10/27/15
11/3/15
11/10/15


Herman Dairy Groundwater Gauge 9
Year 4 (2015 Data)
March 20
Growing Season
Start
November 9
Growing Season
End
49 Days
34 Days
47 Days
46 Days
Groundwater Level (in)
Rainfall Amounts (in)
12
10
8
6
4
2
0
-2
-4
-6
-8
-10
-12
-14
-16
-18
-20
-22
-24
-26
-28
-30
-32
-34
-36
-38
-40
2.5
2.0
1.5
1.0
0.5
0.0
3/17/15
3/24/15
3/31/15
4/7/15
4/14/15
4/21/15
4/28/15
5/5/15
5/12/15
5/19/15
5/26/15
6/2/15
6/9/15
6/16/15
6/23/15
6/30/15
7/7/15
7/14/15
7/21/15
7/28/15
8/4/15
8/11/15
8/18/15
8/25/15
9/1/15
9/8/15
9/15/15
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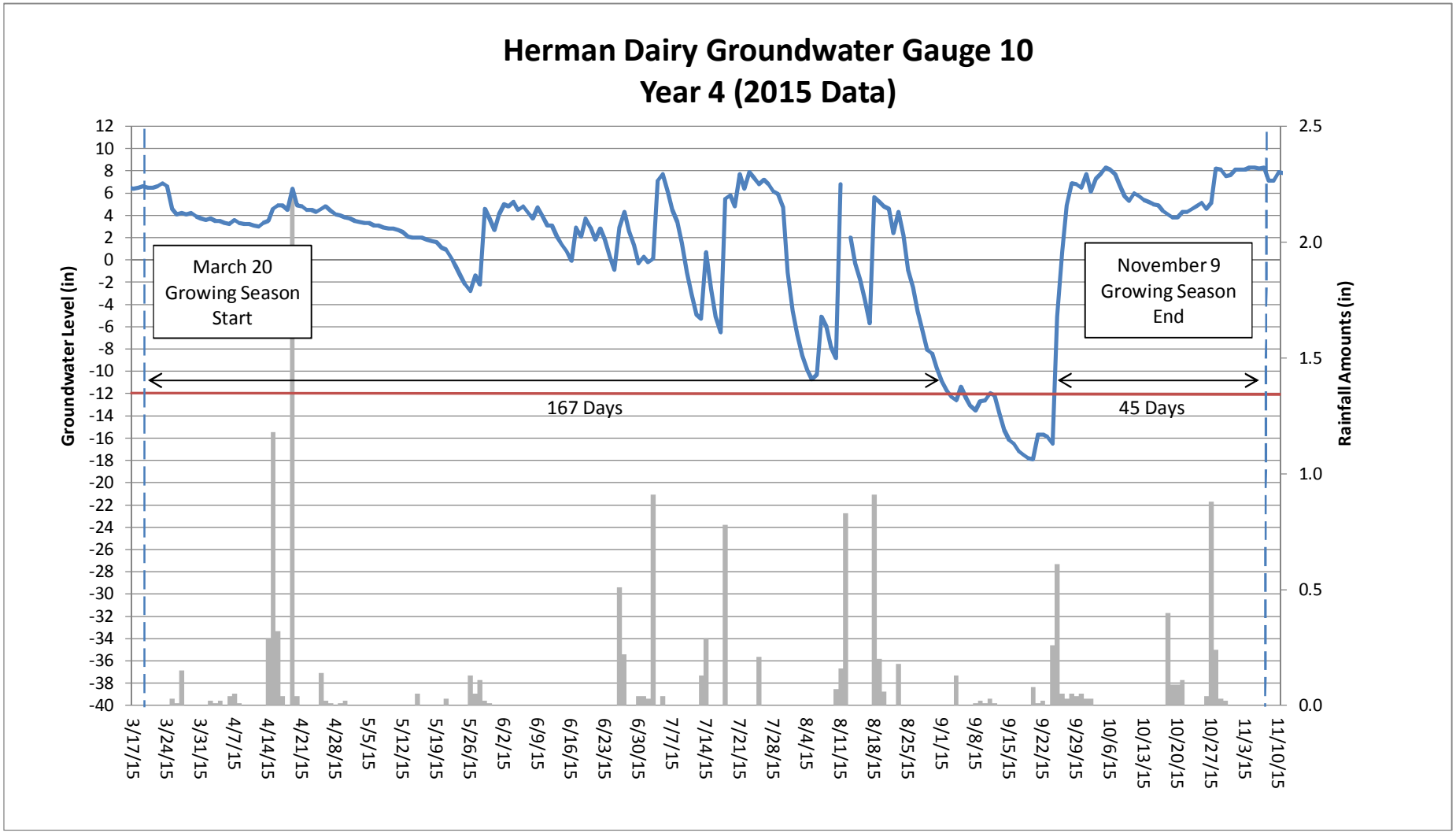
10/20/15
10/27/15
11/3/15
11/10/15


Herman Dairy Groundwater Gauge 10
Year 4 (2015 Data)
Groundwater Level (in)
Rainfall Amounts (in)
March 20
Growing Season
Start
November 9
Growing Season
End
167 Days
45 Days
12
10
8
6
4
2
0
-2
-4
-6
-8
-10
-12
-14
-16
-18
-20
-22
-24
-26
-28
-30
-32
-34
-36
-38
-40
2.5
2.0
1.5
1.0
0.5
0.0
3/17/15
3/24/15
3/31/15
4/7/15
4/14/15
4/21/15
4/28/15
5/5/15
5/12/15
5/19/15
5/26/15
6/2/15
6/9/15
6/16/15
6/23/15
6/30/15
7/7/15
7/14/15
7/21/15
7/28/15
8/4/15
8/11/15
8/18/15
8/25/15
9/1/15
9/8/15
9/15/15
9/22/15
9/29/15
10/6/15
10/13/15
10/20/15
10/27/15
11/3/15
11/10/15

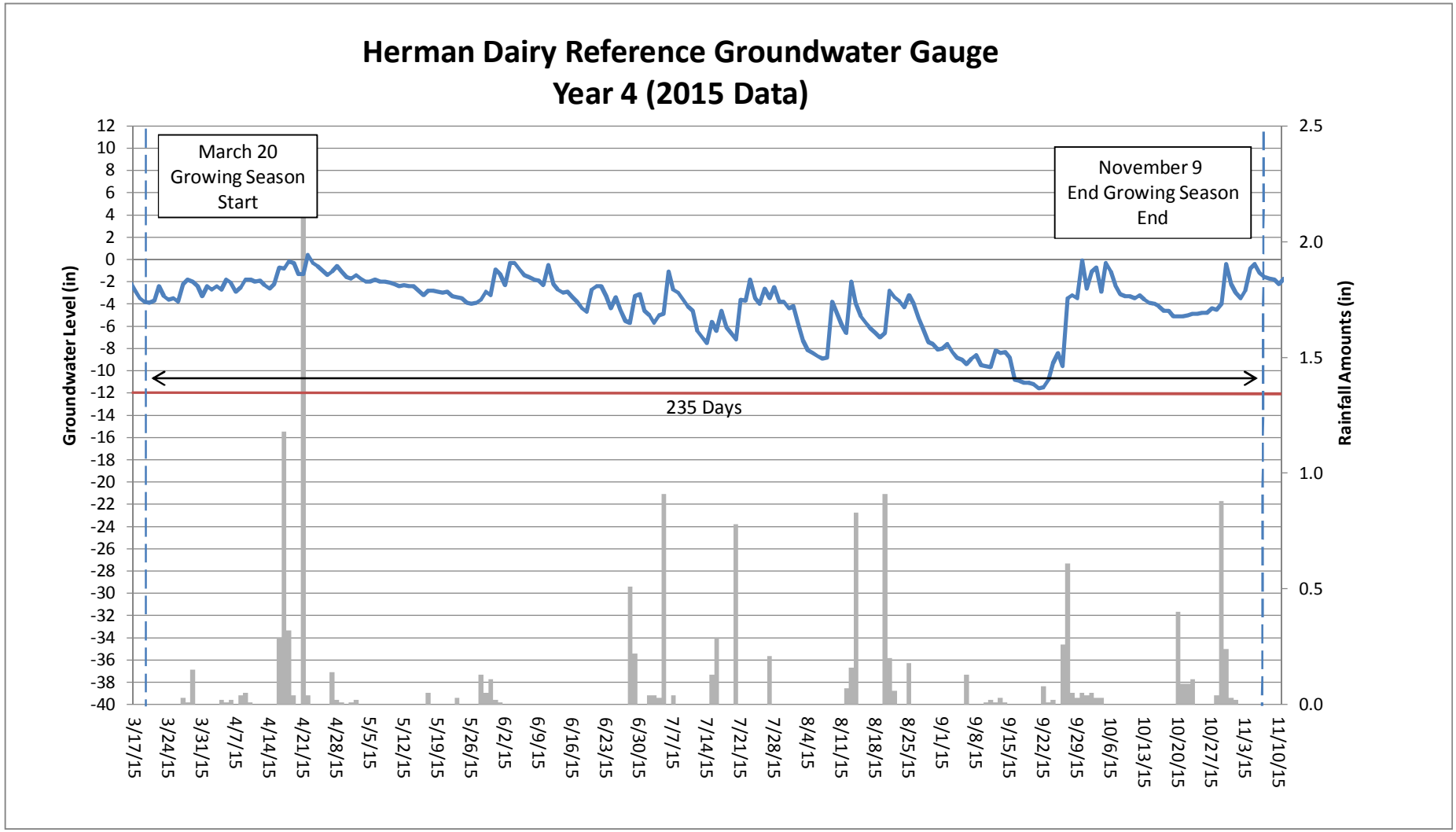
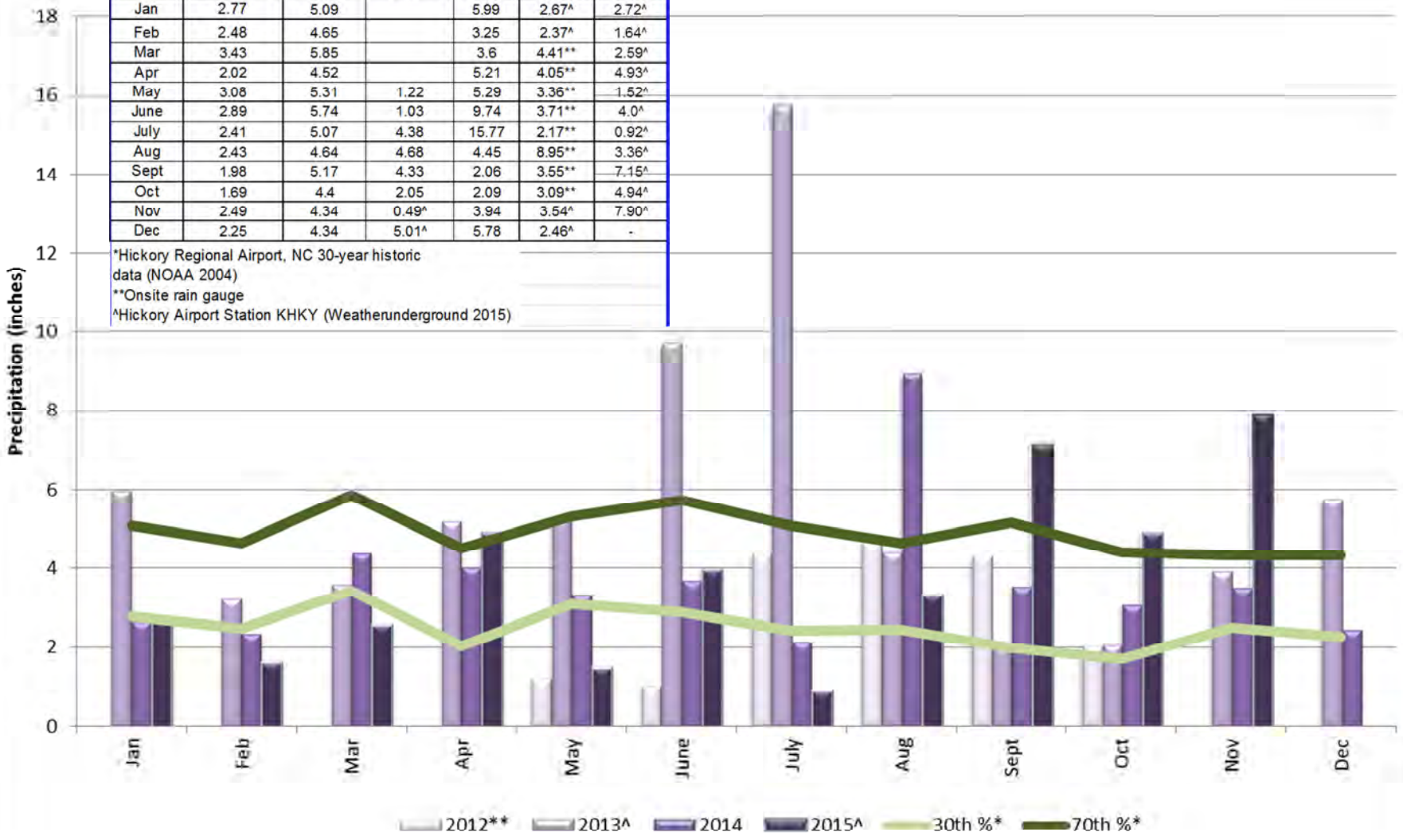

Herman Dairy Reference Groundwater Gauge
Year 4 (2015 Data)
March 20
Growing Season
Start
November 9
End Growing Season
End
235 Days
Groundwater Level (in)
Rainfall Amounts (in)
12
10
8
6
4
2
0
-2
-4
-6
-8
-10
-12
-14
-16
-18
-20
-22
-24
-26
-28
-30
-32
-34
-36
-38
-40
2.5
2.0
1.5
1.0
0.5
0.0
3/17/15
3/24/15
3/31/15
4/7/15
4/14/15
4/21/15
4/28/15
5/5/15
5/12/15
5/19/15
5/26/15
6/2/15
6/9/15
6/16/15
6/23/15
6/30/15
7/7/15
7/14/15
7/21/15
7/28/15
8/4/15
8/11/15
8/18/15
8/25/15
9/1/15
9/8/15
9/15/15
9/22/15
9/29/15
10/6/15
10/13/15
10/20/15
10/27/15
11/3/15
11/10/15

Figure E1. Annual Climatic Data vs. 30-year Historic Data

Month	30th %*	70th %*	2012**	2013^	2014	2015^
Jan	2.77	5.09		5.99	2.67^	2.72^
Feb	2.48	4.65		3.25	2.37^	1.64^
Mar	3.43	5.85		3.6	4.41**	2.59^
Apr	2.02	4.52		5.21	4.05**	4.93^
May	3.08	5.31	1.22	5.29	3.36**	1.52^
June	2.89	5.74	1.03	9.74	3.71**	4.0^
July	2.41	5.07	4.38	15.77	2.17**	0.92^
Aug	2.43	4.64	4.68	4.45	8.95**	3.36^
Sept	1.98	5.17	4.33	2.06	3.55**	7.15^
Oct	1.69	4.4	2.05	2.09	3.09**	4.94^
Nov	2.49	4.34	0.49^	3.94	3.54^	7.90^
Dec	2.25	4.34	5.01^	5.78	2.46^	-

*Hickory Regional Airport, NC 30-year historic data (NOAA 2004)
**Onsite rain gauge
^Hickory Airport Station KHKY (Weatherunderground 2015)



Appendix F.
Benthic Data

2015 Benthic Data Lab Results
2015 Habitat Assessment Field Datasheets

SPECIES	T.V.	F.F.G.	PA47258	PA47259
			UT-1	UT-2
MOLLUSCA				
Gastropoda				
Basommatophora				
Ancylidae		**SC**		
Ferrissia SP.	**6.6**	**SC**		1
Physidae				
Physella sp.	**8.7**	**CG**	3	
ANNELIDA				
Clitellata				
Oligochaeta		**CG**		
Tubificida				
Naididae				
Tubificinae w.o.h.c.		**CG**	1	
ARTHROPODA				
Insecta				
Collembola				
Isotomidae		**CG**	2	3
Hemiptera				
Belostomatidae				
Belostoma sp.	**9.5**	**P**		1
Megaloptera				
Corydalidae		**P**		
Chauliodes pectinicornis				7
Sialidae		**P**		
Sialis sp.	**7**	**P**	1	3
Coleoptera				
Dytiscidae		**P**		
Ilybius biguttulus				1
Prodaticus biomarginatus	**9.8**	**P**		1
Hydrophilidae		**P**		
Enochrus ochraceus	**8.5**	**CG**		8
Cymbiodyta sp.		**CG**	2	1
Helochares maculicollis		**P**	1	
Scirtidae		**SC**		
Scirtes sp.			1	32
Diptera				
Chironomidae				
Ablabesmyia mallochi	**7.4**	**P**	1	
Alotanypus sp.	**4**	**FC**		4
Conchapelopia sp.	**8.4**	**P**	2	
Heterotrissocladius sp.		**CG**	1	
Micropsectra sp.	**2.4**	**CG**	2	
Natarsia sp.	**9.6**	**P**	1	1
Prodiamesa olivacea	**8.8**		1	

SPECIES	T.V.	F.F.G.	PA47258	PA47259
			UT-1	UT-2
Stictochironomus devinctus	5.4	CG	10	1
Zavrelimyia sp.	8.6	P		1
Culicidae		FC		
Culex sp.		FC		2
Ptychopteridae				
Bittacomorpha sp.			3	14
Ptychoptera sp.				5
Simuliidae		FC		
Simulium vittatum	9.1		1	
Stratiomyidae		CG		
Allognosta sp.			7	1
Tabanidae		PI		
Chrysops sp.	6.7	PI		1
Tipulidae		SH		
Tipula sp.	7.5	SH	1	
TOTAL NO. OF ORGANISMS			**41**	**88**
TOTAL NO. OF TAXA			**18**	**19**
EPT TAXA			**0**	**0**
BIOTIC INDEX Assigned Values			**6.10**	**5.21**

3/06 Revision 6

Habitat Assessment Field Data Sheet UT-1
Mountain/ Piedmont Streams

Biological Assessment Unit, DWQ **TOTAL SCORE** 79

Directions for use: The observer is to survey a **minimum of 100 meters with 200 meters preferred** of stream, preferably in an **upstream** direction starting above the bridge pool and the road right-of-way. The segment which is assessed should represent average stream conditions. To perform a proper habitat evaluation the observer needs to get into the stream. To complete the form, select the description which best fits the observed habitats and then circle the score. If the observed habitat falls in between two descriptions, select an intermediate score. A final habitat score is determined by adding the results from the different metrics.

Stream UT- Muddy Fork Location/road: Three Forks Church Rd. (Road Name) County Alexander

Date 6/23/15 **CC#** 03050101120030 Basin catawba Subbasin 03-08-02

Observer(s) Kerrigan/Krim Type of Study: ☐ Fish ☑ Benthos ☐ Basinwide ☐ Special Study (Describe) _____

Latitude 35.9316 Longitude -81.2069 Ecoregion: ☐ MT ☑ P ☐ Slate Belt ☐ Triassic Basin

Water Quality: Temperature _____ °C DO _____ mg/l Conductivity (corr.) _____ µS/cm pH _____

Physical Characterization: Visible land use refers to immediate area that you can see from sampling location - include what you estimate driving thru the watershed in watershed land use.

Visible Land Use: _____%Forest _____%Residential 40 %Active Pasture 40 % Active Crops
_____%Fallow Fields _____% Commercial _____%Industrial 20 %Other - Describe: Riparian Restoration

Watershed land use : ☐Forest ☐Agriculture ☐Urban ☐ Animal operations upstream

Width: (meters) Stream 1.5 Channel (at top of bank) 2.0 **Stream Depth**: (m) Avg 0.4 Max 1.0
☐ Width variable ☐ Large river >25m wide
Bank Height (from deepest part of riffle to top of bank-first flat surface you stand on): (m) 0.5

Bank Angle: 60 ° or ☐ NA (Vertical is 90°, horizontal is 0°. Angles > 90° indicate slope is towards mid-channel, < 90° indicate slope is away from channel. NA if bank is too low for bank angle to matter.)
☐ Channelized Ditch
☐Deeply incised-steep, straight banks ☐Both banks undercut at bend ☐Channel filled in with sediment
☐ Recent overbank deposits ☐Bar development ☐Buried structures ☐Exposed bedrock
☐ Excessive periphyton growth ☐ Heavy filamentous algae growth ☐Green tinge ☐ Sewage smell
Manmade Stabilization: ☐N ☒Y: ☐Rip-rap, cement, gabions ☒ Sediment/grade-control structure ☐Berm/levee
Flow conditions : ☐High ☒Normal ☐Low
Turbidity: ☐Clear ☐ Slightly Turbid ☒Turbid ☐Tannic ☐Milky ☐Colored (from dyes)
Good potential for Wetlands Restoration Project?? ☒ **YES** ☐**NO Details**_____
Channel Flow Status
Useful especially under abnormal or low flow conditions.

A. Water reaches base of both lower banks, minimal channel substrate exposed	☒
B. Water fills >75% of available channel, or <25% of channel substrate is exposed	☐
C. Water fills 25-75% of available channel, many logs/snags exposed	☐
D. Root mats out of water	☐
E. Very little water in channel, mostly present as standing pools	☐

Weather Conditions:_____ **Photos:** ☐N ☒Y ☒ Digital ☐35mm P-1+2

Remarks:_____

I. Channel Modification

	Score
A. channel natural, frequent bends	(5)
B. channel natural, infrequent bends (channelization could be old)	4
C. some channelization present	3
D. more extensive channelization, >40% of stream disrupted	2
E. no bends, completely channelized or rip rapped or gabioned, etc	0

☐ Evidence of dredging ☐Evidence of desnagging=no large woody debris in stream ☐Banks of uniform shape/height

Remarks_____ Subtotal 5

II. Instream Habitat: Consider the percentage of the reach that is favorable for benthos colonization or fish cover. If >70% of the reach is rocks, 1 type is present, circle the score of 17. Definition: leafpacks consist of older leaves that are packed together and have begun to decay (not piles of leaves in pool areas). Mark as **R**are, **C**ommon, or **A**bundant.

C **Rocks** ___ **Macrophytes** R **Sticks and leafpacks** C **Snags and logs** A **Undercut banks or root mats**

AMOUNT OF REACH FAVORABLE FOR COLONIZATION OR COVER

	>70% Score	40-70% Score	20-40% Score	<20% Score
4 or 5 types present	20	16	12	(8)
3 types present	19	15	11	7
2 types present	18	14	10	6
1 type present	17	13	9	5
No types present	0			

☐ No woody vegetation in riparian zone Remarks_____ Subtotal 8

III. Bottom Substrate (silt, sand, detritus, gravel, cobble, boulder) Look at entire reach for substrate scoring, but only look at riffle for embeddedness, and use rocks from all parts of riffle-look for "mud line" or difficulty extracting rocks.

	Score
A. substrate with good mix of gravel, cobble and boulders	
1. embeddedness <20% (very little sand, usually only behind large boulders)	15
2. embeddedness 20-40%	12
3. embeddedness 40-80%	8
4. embeddedness >80%	3
B. substrate gravel and cobble	
1. embeddedness <20%	14
2. embeddedness 20-40%	11
3. embeddedness 40-80%	(6)
4. embeddedness >80%	2
C. substrate mostly gravel	
1. embeddedness <50%	8
2. embeddedness >50%	4
D. substrate homogeneous	
1. substrate nearly all bedrock	3
2. substrate nearly all sand	3
3. substrate nearly all detritus	2
4. substrate nearly all silt/ clay	1

Remarks_____ Subtotal 6

IV. Pool Variety Pools are areas of deeper than average maximum depths with little or no surface turbulence. Water velocities associated with pools are always slow. Pools may take the form of "pocket water", small pools behind boulders or obstructions, in large high gradient streams, or side eddies.

	Score
A. Pools present	
1. Pools Frequent (>30% of 200m area surveyed)	
a. variety of pool sizes	(10)
b. pools about the same size (indicates pools filling in)	8
2. Pools Infrequent (<30% of the 200m area surveyed)	
a. variety of pool sizes	6
b. pools about the same size	4
B. Pools absent	0

Subtotal 10

☐ Pool bottom boulder-cobble=hard ☒ Bottom sandy-sink as you walk ☐ Silt bottom ☐ Some pools over wader depth

Remarks_____

Page Total 29

V. Riffle Habitats

Definition: Riffle is area of reaeration-can be debris dam, or narrow channel area.

	Riffles **Frequent** Score	Riffles **Infrequent** Score
A. well defined riffle and run, riffle as wide as stream and extends 2X width of stream....	16	12
B. riffle as wide as stream but riffle length is not 2X stream width	14	7
C. riffle not as wide as stream and riffle length is not 2X stream width	10	3
D. riffles absent.....	0	

Channel Slope: ☑Typical for area ☐Steep=fast flow ☐Low=like a coastal stream Subtotal 16

VI. Bank Stability and Vegetation

FACE UPSTREAM	Left Bank Score	Rt. Bank Score
A. Banks stable		
1. little evidence of erosion or bank failure(except outside of bends), little potential for erosion..	7	7
B. Erosion areas present		
1. diverse **trees**, shrubs, grass; plants healthy with good root systems.....	6	6
2. few trees or small trees and **shrubs**; vegetation appears generally healthy.....	5	5
3. sparse **mixed** vegetation; plant types and conditions suggest poorer soil binding.....	3	3
4. mostly **grasses**, few if any trees and shrubs, high erosion and failure potential at high flow..	2	2
5. little or no bank vegetation, mass erosion and bank failure evident.....	0	0

Total 14

Remarks_____

VII. Light Penetration Canopy is defined as tree or vegetative cover directly above the stream's surface. Canopy would block out sunlight when the sun is directly overhead. Note shading from mountains, but not use to score this metric.

	Score
A. Stream with **good** canopy with some breaks for light penetration	10
B. Stream with **full canopy** - breaks for light penetration absent.....	8
C. Stream with **partial** canopy - sunlight and shading are essentially equal.....	7
D. Stream with **minimal** canopy - full sun in all but a few areas.....	2
E. **No canopy** and no shading.....	0

Remarks_____ Subtotal 10

VIII. Riparian Vegetative Zone Width

Definition: Riparian zone for this form is area of natural vegetation adjacent to stream (can go beyond floodplain). Definition: A break in the riparian zone is any place on the stream banks which allows sediment or pollutants to directly enter the stream, such as paths down to stream, storm drains, uprooted trees, otter slides, etc.

FACE UPSTREAM Dominant vegetation: ☐ Trees ☐ Shrubs ☐ Grasses ☐ Weeds/old field ☐Exotics (kudzu, etc)	Lft. Bank Score	Rt. Bank Score
A. Riparian zone **intact** (no breaks)		
1. width > 18 meters.....	5	5
2. width 12-18 meters.....	4	4
3. width 6-12 meters.....	3	3
4. width < 6 meters.....	2	2
B. Riparian zone **not intact** (breaks)		
1. breaks rare		
a. width > 18 meters.....	4	4
b. width 12-18 meters.....	3	3
c. width 6-12 meters.....	2	2
d. width < 6 meters.....	1	1
2. breaks common		
a. width > 18 meters.....	3	3
b. width 12-18 meters.....	2	2
c. width 6-12 meters.....	1	1
d. width < 6 meters.....	0	0

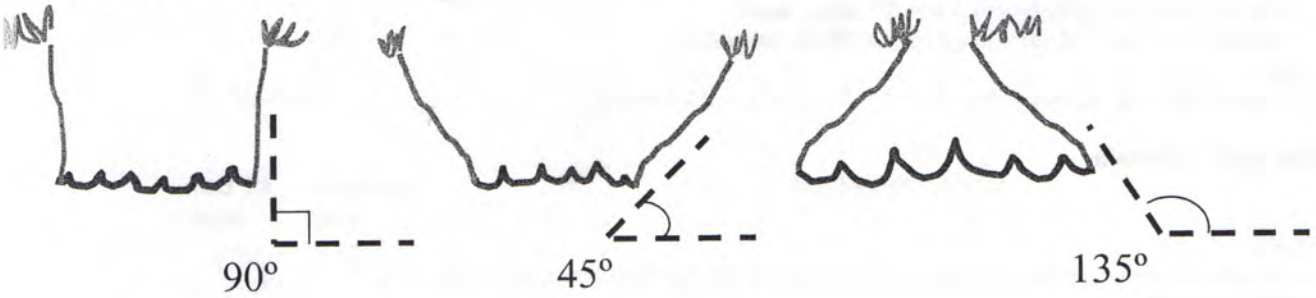
Remarks_____ Total 10

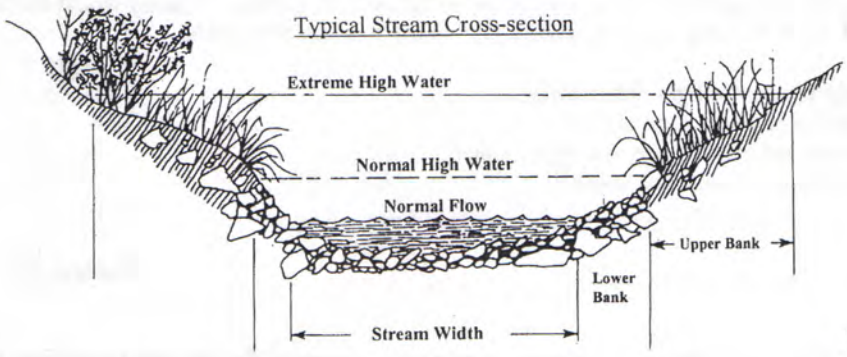
Page Total 50

☐ Disclaimer-form filled out, but score doesn't match subjective opinion-atypical stream. **TOTAL SCORE** 79

Supplement for Habitat Assessment Field Data Sheet

Diagram to determine bank angle:





This side is 45° bank angle.

Site Sketch:

Other comments: _____

_____

_____

_____

_____

3/06 Revision 6

Habitat Assessment Field Data Sheet
Mountain/ Piedmont Streams

UT-2

Biological Assessment Unit, DWQ **TOTAL SCORE** 84

Directions for use: The observer is to survey a **minimum of 100 meters with 200 meters preferred** of stream, preferably in an **upstream** direction starting above the bridge pool and the road right-of-way. The segment which is assessed should represent average stream conditions. To perform a proper habitat evaluation the observer needs to get into the stream. To complete the form, select the description which best fits the observed habitats and then circle the score. If the observed habitat falls in between two descriptions, select an intermediate score. A final habitat score is determined by adding the results from the different metrics.

Stream UT Muddy Fork Location/road: Threeforks Church Rd (Road Name) County Alexander

Date 6/23/15 **CC#** 03050101120030 Basin Catawba Subbasin 03-08-32

Observer(s) Jernigan/Keith Type of Study: ☐ Fish ☒ Benthos ☐ Basinwide ☐ Special Study (Describe)

Latitude 35.9316 Longitude 81.2069 Ecoregion: ☐ MT ☒ P ☐ Slate Belt ☐ Triassic Basin

Water Quality: Temperature °C DO mg/l Conductivity (corr.) µS/cm pH

Physical Characterization: Visible land use refers to immediate area that you can see from sampling location - include what you estimate driving thru the watershed in watershed land use.

Visible Land Use: 15 %Forest %Residential %Active Pasture 60 % Active Crops
%Fallow Fields % Commercial %Industrial 25 %Other - Describe: Riparian Buffer Restoration

Watershed land use : ☐Forest ☐Agriculture ☐Urban ☐ Animal operations upstream

Width: (meters) Stream 1.0 Channel (at top of bank) 1.2 **Stream Depth**: (m) Avg 0.2 Max 0.5
☐ Width variable ☐ Large river >25m wide
Bank Height (from deepest part of riffle to top of bank-first flat surface you stand on): (m) 0.5

Bank Angle: 45 ° or ☐ NA (Vertical is 90°, horizontal is 0°. Angles > 90° indicate slope is towards mid-channel, < 90° indicate slope is away from channel. NA if bank is too low for bank angle to matter.)

☐ Channelized Ditch
☐Deeply incised-steep, straight banks ☐Both banks undercut at bend ☐Channel filled in with sediment
☐ Recent overbank deposits ☐Bar development ☐Buried structures ☐Exposed bedrock
☐ Excessive periphyton growth ☐ Heavy filamentous algae growth ☐Green tinge ☐ Sewage smell
Manmade Stabilization: ☐N ☒Y: ☐Rip-rap, cement, gabions ☒ Sediment/grade-control structure ☐Berm/levee
Flow conditions : ☐High ☒Normal ☐Low
Turbidity: ☐Clear ☒ Slightly Turbid ☐Turbid ☐Tannic ☐Milky ☐Colored (from dyes)
Good potential for Wetlands Restoration Project?? ☐ YES ☐NO Details

Channel Flow Status

Useful especially under abnormal or low flow conditions.

A. Water reaches base of both lower banks, minimal channel substrate exposed	☒
B. Water fills >75% of available channel, or <25% of channel substrate is exposed	☐
C. Water fills 25-75% of available channel, many logs/snags exposed	☐
D. Root mats out of water	☐
E. Very little water in channel, mostly present as standing pools	☐

Weather Conditions: **Photos:** ☐N ☒Y ☐ Digital ☐35mm P-3-4

Remarks:

I. Channel Modification

	Score
A. channel natural, frequent bends	(5)
B. channel natural, infrequent bends (channelization could be old)	4
C. some channelization present	3
D. more extensive channelization, >40% of stream disrupted	2
E. no bends, completely channelized or rip rapped or gabioned, etc	0

☐ Evidence of dredging ☐Evidence of desnagging=no large woody debris in stream ☐Banks of uniform shape/height

Remarks_____ Subtotal 5

II. Instream Habitat: Consider the percentage of the reach that is favorable for benthos colonization or fish cover. If >70% of the reach is rocks, 1 type is present, circle the score of 17. Definition: leafpacks consist of older leaves that are packed together and have begun to decay (not piles of leaves in pool areas). Mark as **R**are, **C**ommon, or **A**bundant.

__C__ **Rocks** __A__ **Macrophytes** __C__ **Sticks and leafpacks** __C__ **Snags and logs** __R__ **Undercut banks or root mats**

AMOUNT OF REACH FAVORABLE FOR COLONIZATION OR COVER

	>70% Score	40-70% Score	20-40% Score	<20% Score
4 or 5 types present	20	(16)	12	8
3 types present	19	15	11	7
2 types present	18	14	10	6
1 type present	17	13	9	5
No types present	0			

☐ No woody vegetation in riparian zone Remarks_____ Subtotal 16

III. Bottom Substrate (silt, sand, detritus, gravel, cobble, boulder) Look at entire reach for substrate scoring, but only look at riffle for embeddedness, and use rocks from all parts of riffle-look for "mud line" or difficulty extracting rocks.

	Score
A. substrate with good mix of gravel, cobble and boulders	
1. embeddedness <20% (very little sand, usually only behind large boulders)	15
2. embeddedness 20-40%	12
3. embeddedness 40-80%	8
4. embeddedness >80%	3
B. substrate gravel and cobble	
1. embeddedness <20%	14
2. embeddedness 20-40%	11
3. embeddedness 40-80%	(6)
4. embeddedness >80%	2
C. substrate mostly gravel	
1. embeddedness <50%	8
2. embeddedness >50%	4
D. substrate homogeneous	
1. substrate nearly all bedrock	3
2. substrate nearly all sand	3
3. substrate nearly all detritus	2
4. substrate nearly all silt/ clay	1

Remarks_____ Subtotal 6

IV. Pool Variety Pools are areas of deeper than average maximum depths with little or no surface turbulence. Water velocities associated with pools are always slow. Pools may take the form of "pocket water", small pools behind boulders or obstructions, in large high gradient streams, or side eddies.

	Score
A. Pools present	
1. Pools Frequent (>30% of 200m area surveyed)	
a. variety of pool sizes	(10)
b. pools about the same size (indicates pools filling in)	8
2. Pools Infrequent (<30% of the 200m area surveyed)	
a. variety of pool sizes	6
b. pools about the same size	4
B. Pools absent	0

Subtotal 10

☐ Pool bottom boulder-cobble=hard ☒ Bottom sandy-sink as you walk ☐ Silt bottom ☐ Some pools over wader depth

Remarks_____

Page Total 37

VI 2

V. Riffle Habitats

Definition: Riffle is area of reaeration-can be debris dam, or narrow channel area.

	Riffles **Frequent** Score	Riffles **Infrequent** Score
A. well defined riffle and run, riffle as wide as stream and extends 2X width of stream....	16	12
B. riffle as wide as stream but riffle length is not 2X stream width	14	7
C. riffle not as wide as stream and riffle length is not 2X stream width	10	3
D. riffles absent.....	0	

Channel Slope: ☐Typical for area ☐Steep=fast flow ☐Low=like a coastal stream Subtotal 16

VI. Bank Stability and Vegetation

FACE UPSTREAM	Left Bank Score	Rt. Bank Score
A. Banks stable		
1. little evidence of erosion or bank failure(except outside of bends), little potential for erosion..	7	7
B. Erosion areas present		
1. diverse **trees**, shrubs, grass; plants healthy with good root systems.....	6	6
2. few trees or small trees and **shrubs**; vegetation appears generally healthy.....	5	5
3. sparse **mixed** vegetation; plant types and conditions suggest poorer soil binding.....	3	3
4. mostly **grasses**, few if any trees and shrubs, high erosion and failure potential at high flow..	2	2
5. little or no bank vegetation, mass erosion and bank failure evident.....	0	0

Total 14

Remarks_____

VII. Light Penetration Canopy is defined as tree or vegetative cover directly above the stream's surface. Canopy would block out sunlight when the sun is directly overhead. Note shading from mountains, but not use to score this metric.

	Score
A. Stream with **good** canopy with some breaks for light penetration	10
B. Stream with **full canopy** - breaks for light penetration absent.....	8
C. Stream with **partial** canopy - sunlight and shading are essentially equal.....	~~7~~
D. Stream with **minimal** canopy - full sun in all but a few areas.....	2
E. **No canopy** and no shading.....	0

Remarks_____ Subtotal 7

VIII. Riparian Vegetative Zone Width

Definition: Riparian zone for this form is area of natural vegetation adjacent to stream (can go beyond floodplain). Definition: A break in the riparian zone is any place on the stream banks which allows sediment or pollutants to directly enter the stream, such as paths down to stream, storm drains, uprooted trees, otter slides, etc.

FACE UPSTREAM Dominant vegetation: ☐ Trees ☐ Shrubs ☐ Grasses ☐ Weeds/old field ☐Exotics (kudzu, etc)	Lft. Bank Score	Rt. Bank Score
A. Riparian zone **intact** (no breaks)		
1. width > 18 meters.....	5	5
2. width 12-18 meters.....	4	4
3. width 6-12 meters.....	3	3
4. width < 6 meters.....	2	2
B. Riparian zone **not intact** (breaks)		
1. breaks rare		
a. width > 18 meters.....	4	4
b. width 12-18 meters.....	3	3
c. width 6-12 meters.....	2	2
d. width < 6 meters.....	1	1
2. breaks common		
a. width > 18 meters.....	3	3
b. width 12-18 meters.....	2	2
c. width 6-12 meters.....	1	1
d. width < 6 meters.....	0	0

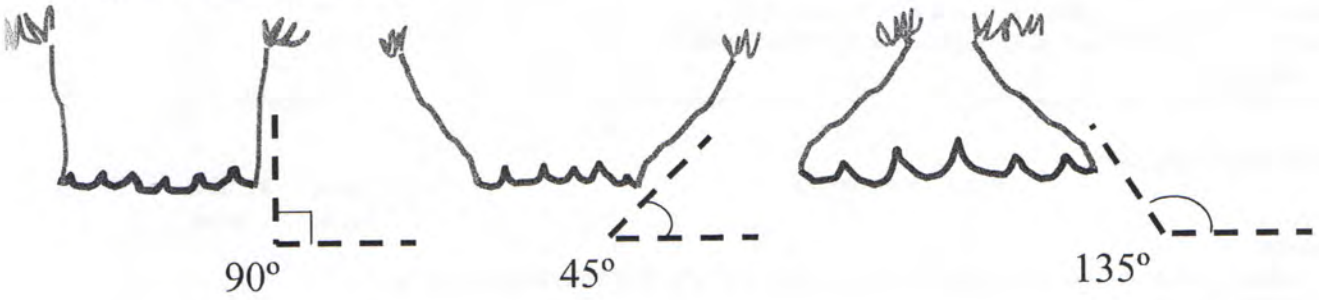
Remarks_____ Total 10

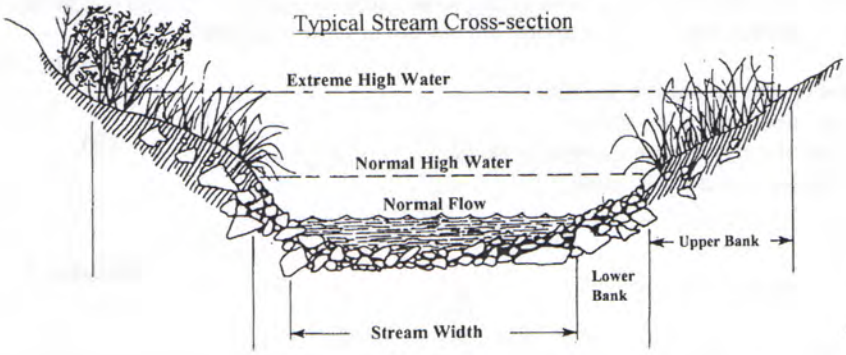
Page Total 47

☐ Disclaimer-form filled out, but score doesn't match subjective opinion-atypical stream. **TOTAL SCORE** 84

Supplement for Habitat Assessment Field Data Sheet

Diagram to determine bank angle:





This side is 45° bank angle.

Site Sketch:

Other comments: _____

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3/06 Revision 6

Habitat Assessment Field Data Sheet
Mountain/ Piedmont Streams

UT-3

Biological Assessment Unit, DWQ **TOTAL SCORE** 88

Directions for use: The observer is to survey a **minimum of 100 meters with 200 meters preferred** of stream, preferably in an **upstream** direction starting above the bridge pool and the road right-of-way. The segment which is assessed should represent average stream conditions. To perform a proper habitat evaluation the observer needs to get into the stream. To complete the form, select the description which best fits the observed habitats and then circle the score. If the observed habitat falls in between two descriptions, select an intermediate score. A final habitat score is determined by adding the results from the different metrics.

Stream UT-Muddy Fork Location/road: Three forks Church Rd (Road Name) County Alexander

Date 6/23/15 **CC#** 03050101120030 Basin Catawba Subbasin 03-08-32

Observer(s) Jernigan/Keith Type of Study: ☐ Fish ☑ Benthos ☐ Basinwide ☐ Special Study (Describe) _____

Latitude 35.9316 Longitude -81.2069 Ecoregion: ☐ MT ☑ P ☐ Slate Belt ☐ Triassic Basin

Water Quality: Temperature _____ °C DO _____ mg/l Conductivity (corr.) _____ µS/cm pH _____

Physical Characterization: Visible land use refers to immediate area that you can see from sampling location - include what you estimate driving thru the watershed in watershed land use.

Visible Land Use: _____%Forest _____%Residential 40 %Active Pasture 40 % Active Crops
_____%Fallow Fields _____% Commercial _____%Industrial 20 %Other - Describe: Riparian Buffer Restoration

Watershed land use : ☑ Forest ☑ Agriculture ☐ Urban ☑ Animal operations upstream

Width: (meters) Stream 1.0 Channel (at top of bank) 1.3 **Stream Depth**: (m) Avg 0.5 Max 0.7
☐ Width variable ☐ Large river >25m wide

Bank Height (from deepest part of riffle to top of bank-first flat surface you stand on): (m) 0.5

Bank Angle: 45 ° or ☐ NA (Vertical is 90°, horizontal is 0°. Angles > 90° indicate slope is towards mid-channel, < 90° indicate slope is away from channel. NA if bank is too low for bank angle to matter.)

☐ Channelized Ditch
☐ Deeply incised-steep, straight banks ☐ Both banks undercut at bend ☐ Channel filled in with sediment
☐ Recent overbank deposits ☐ Bar development ☐ Buried structures ☐ Exposed bedrock
☐ Excessive periphyton growth ☐ Heavy filamentous algae growth ☐ Green tinge ☐ Sewage smell
Manmade Stabilization: ☐ N ☑ Y: ☐ Rip-rap, cement, gabions ☑ Sediment/grade-control structure ☐ Berm/levee
Flow conditions : ☐ High ☐ Normal ☑ Low
Turbidity: ☐ Clear ☐ Slightly Turbid ☐ Turbid ☐ Tannic ☐ Milky ☐ Colored (from dyes)
Good potential for Wetlands Restoration Project?? ☑ **YES** ☐ **NO Details** _____

Channel Flow Status
Useful especially under abnormal or low flow conditions.

A. Water reaches base of both lower banks, minimal channel substrate exposed	☐
B. Water fills >75% of available channel, or <25% of channel substrate is exposed	☐
C. Water fills 25-75% of available channel, many logs/snags exposed	☐
D. Root mats out of water	☐
E. Very little water in channel, mostly present as standing pools	☐

Weather Conditions: Hot, Sunny, Dry **Photos:** ☐ N ☑ Y ☑ Digital ☐ 35mm P-5+6

Remarks: No water present during site visit; therefore no benthic sample was obtained

I. Channel Modification

	Score
A. channel natural, frequent bends	(5)
B. channel natural, infrequent bends (channelization could be old)	4
C. some channelization present	3
D. more extensive channelization, >40% of stream disrupted	2
E. no bends, completely channelized or rip rapped or gabioned, etc	0

☐ Evidence of dredging ☐Evidence of desnagging=no large woody debris in stream ☐Banks of uniform shape/height

Remarks_____ Subtotal 5

II. Instream Habitat: Consider the percentage of the reach that is favorable for benthos colonization or fish cover. If >70% of the reach is rocks, 1 type is present, circle the score of 17. Definition: leafpacks consist of older leaves that are packed together and have begun to decay (not piles of leaves in pool areas). Mark as **R**are, **C**ommon, or **A**bundant.

A **Rocks** C **Macrophytes** R **Sticks and leafpacks** R **Snags and logs** C **Undercut banks or root mats**

AMOUNT OF REACH FAVORABLE FOR COLONIZATION OR COVER

	>70% Score	40-70% Score	20-40% Score	<20% Score
4 or 5 types present	20	16	12	8
3 types present	19	(15)	11	7
2 types present	18	14	10	6
1 type present	17	13	9	5
No types present	0			

☐ No woody vegetation in riparian zone Remarks_____ Subtotal 15

III. Bottom Substrate (silt, sand, detritus, gravel, cobble, boulder) Look at entire reach for substrate scoring, but only look at riffle for embeddedness, and use rocks from all parts of riffle-look for "mud line" or difficulty extracting rocks.

A. substrate with good mix of gravel, cobble and boulders	**Score**
1. embeddedness <20% (very little sand, usually only behind large boulders)	15
2. embeddedness 20-40%	12
3. embeddedness 40-80%	8
4. embeddedness >80%	3
B. substrate gravel and cobble	
1. embeddedness <20%	14
2. embeddedness 20-40%	(11)
3. embeddedness 40-80%	6
4. embeddedness >80%	2
C. substrate mostly gravel	
1. embeddedness <50%	8
2. embeddedness >50%	4
D. substrate homogeneous	
1. substrate nearly all bedrock	3
2. substrate nearly all sand	3
3. substrate nearly all detritus	2
4. substrate nearly all silt/ clay	1

Remarks_____ Subtotal 11

IV. Pool Variety Pools are areas of deeper than average maximum depths with little or no surface turbulence. Water velocities associated with pools are always slow. Pools may take the form of "pocket water", small pools behind boulders or obstructions, in large high gradient streams, or side eddies.

A. Pools present	Score
1. Pools Frequent (>30% of 200m area surveyed)	
a. variety of pool sizes	(10)
b. pools about the same size (indicates pools filling in)	8
2. Pools Infrequent (<30% of the 200m area surveyed)	
a. variety of pool sizes	6
b. pools about the same size	4
B. Pools absent	0

Subtotal 10

☐ Pool bottom boulder-cobble=hard ☒ Bottom sandy-sink as you walk ☐ Silt bottom ☐ Some pools over wader depth

Remarks_____

Page Total 41

UT 3

V. Riffle Habitats

Definition: Riffle is area of reaeration-can be debris dam, or narrow channel area.

	Riffles **Frequent** Score	Riffles **Infrequent** Score
A. well defined riffle and run, riffle as wide as stream and extends 2X width of stream....	16	12
B. riffle as wide as stream but riffle length is not 2X stream width	14	7
C. riffle not as wide as stream and riffle length is not 2X stream width	10	3
D. riffles absent.....	0	

Channel Slope: ☐Typical for area ☐Steep=fast flow ☐Low=like a coastal stream Subtotal 16

VI. Bank Stability and Vegetation

FACE UPSTREAM	Left Bank Score	Rt. Bank Score
A. Banks stable		
1. little evidence of erosion or bank failure(except outside of bends), little potential for erosion.	7	7
B. Erosion areas present		
1. diverse **trees**, shrubs, grass; plants healthy with good root systems.....	6	6
2. few trees or small trees and **shrubs**; vegetation appears generally healthy.....	5	5
3. sparse **mixed** vegetation; plant types and conditions suggest poorer soil binding.....	3	3
4. mostly **grasses**, few if any trees and shrubs, high erosion and failure potential at high flow..	2	2
5. little or no bank vegetation, mass erosion and bank failure evident.....	0	0
		Total 14

Remarks_____

VII. Light Penetration Canopy is defined as tree or vegetative cover directly above the stream's surface. Canopy would block out sunlight when the sun is directly overhead. Note shading from mountains, but not use to score this metric.

	Score
A. Stream with **good** canopy with some breaks for light penetration	10
B. Stream with **full canopy** - breaks for light penetration absent.....	8
C. Stream with **partial** canopy - sunlight and shading are essentially equal.....	7
D. Stream with **minimal** canopy - full sun in all but a few areas.....	2
E. **No canopy** and no shading.....	0

Remarks_____ Subtotal 7

VIII. Riparian Vegetative Zone Width

Definition: Riparian zone for this form is area of natural vegetation adjacent to stream (can go beyond floodplain). Definition: A break in the riparian zone is any place on the stream banks which allows sediment or pollutants to directly enter the stream, such as paths down to stream, storm drains, uprooted trees, otter slides, etc.

FACE UPSTREAM Dominant vegetation: ☐ Trees ☐ Shrubs ☐ Grasses ☐ Weeds/old field ☐Exotics (kudzu, etc)	Lft. Bank Score	Rt. Bank Score
A. Riparian zone **intact** (no breaks)		
1. width > 18 meters.....	5	5
2. width 12-18 meters.....	4	4
3. width 6-12 meters.....	3	3
4. width < 6 meters.....	2	2
B. Riparian zone **not intact** (breaks)		
1. breaks rare		
a. width > 18 meters.....	4	4
b. width 12-18 meters.....	3	3
c. width 6-12 meters.....	2	2
d. width < 6 meters.....	1	1
2. breaks common		
a. width > 18 meters.....	3	3
b. width 12-18 meters.....	2	2
c. width 6-12 meters.....	1	1
d. width < 6 meters.....	0	0

Remarks_____ Total 10

Page Total 47

☐ Disclaimer-form filled out, but score doesn't match subjective opinion-atypical stream. **TOTAL SCORE** 88

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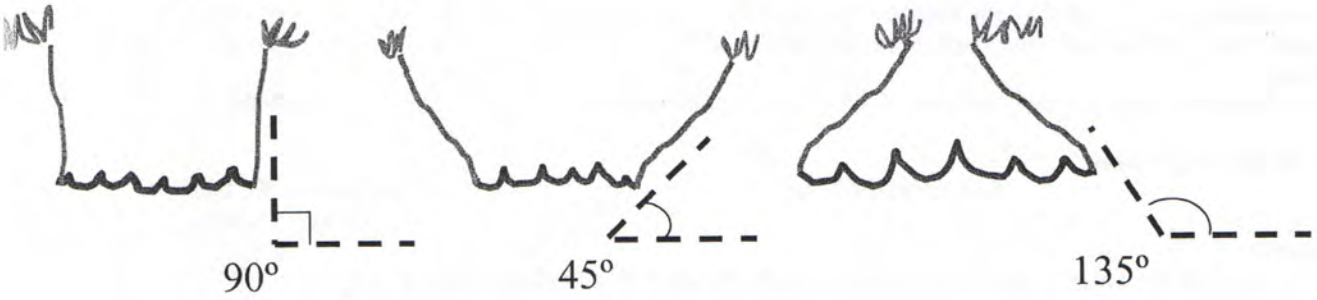
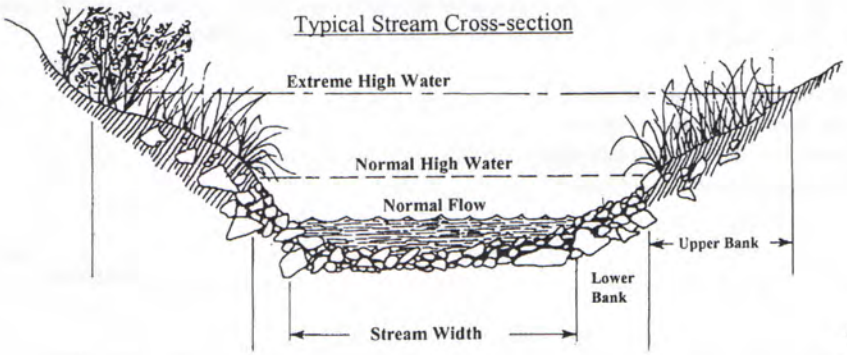
Diagram to determine bank angle:





This side is 45° bank angle.

Site Sketch:

Other comments: _____

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