YEAR 1 of 7 (2012)
ANNUAL MONITORING REPORT
HERMAN DAIRY STREAM AND WETLAND RESTORATION SITE
Alexander County, North Carolina
Full Delivery Contract No. 003271

Catawba River Basin
Cataloging Unit and Targeted Local Watershed
03050101120030

Submitted to:
NCDENR Ecosystem Enhancement Program
Raleigh, North Carolina

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Prepared By:
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Submitted to:
NCDENR Ecosystem Enhancement Program
Raleigh, North Carolina

FEBRUARY 2013

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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 North Carolina Ecosystem Enhancement Program (NCEEP) in meeting its stream and wetland restoration goals. This report (compiled based on EEP's *Guidance and Content Requirements for EEP Monitoring Reports* Version 1.2.1 dated 12/1/09) serves as the Year 1 (2012) 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 478 planted stems per acre surviving. In addition, each individual plot exceeded success criteria and no vegetation problem areas were identified during Year 1 (2012) Monitoring.

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 configuration 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 a stable or moderately unstable channel 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. No stream problem areas were noted during Year 1 (2012) 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 (USDA 1995). Year 1 (2012) groundwater gauge installation occurred between March 30 and April 4, 2012. Given the date of groundwater gauge installation and the initiation of monitoring, Year 1 groundwater monitoring will utilize the published growing season dates from the county soil survey for success criteria. However, for future monitoring years, if soil temperatures and vegetative growth (bud burst) is documented, project gauge hydrologic success will be determined using dates from February 1-November 9 to more accurately represent the period of biological activity.

Target hydrological characteristics include saturation or inundation for 8 percent of the monitored period (March 20 1-November 9), 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.

Hydrology Results: All ten Site groundwater monitoring gauges and the reference gauge exhibited inundated/saturated within 12 inches of the surface for greater than 8 percent of the growing season. The

majority of the gauges were well above success criteria, despite being installed after the initiation of the growing season. The only gauge close to not meeting success criteria was gauge 9, which is close to an upland/wetland boundary. This gauge had two consecutive 19 day periods of wetland hydrology separated by only a few days.

Benthics: Although data from the certified laboratory concerning number of organisms and taxa is not available at this time, field habitat assessment forms indicate that Site restoration reaches are improving for benthic macroinvertebrates. The Habitat Assessment Field Data Sheet for UT 1 increased from a total score of 45 prior to restoration to 69 in the first annual monitoring year. Similarly, UT 2 improved from a score of 36 to 72 after the first year. Detailed data from the laboratory will be kept on file and included in future annual monitoring reports.

In summary, Site vegetation, streams, and wetland hydrology met success criteria for Year 1 (2012) 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 EEPs website. All raw data supporting the tables and figures in the appendices is available from EEP 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-EEP Protocol for Recording Vegetation, Version 4.0* (Lee et al. 2006). Plots were measured in September 2012 for Year 1 monitioring. 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 off-site 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 staff 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 the changes during the monitoring period. The benthic macroinvertebrate community will be sampled using North Carolina Division of Water Quality (NCDWQ) protocols found in the Standard Operating Procedures for Benthic Macroinvertebrates (NCDWQ 2006) and Benthic Macroinvertebrate Protocols for Compensatory Stream Restoration Projects (NCDWQ 2001). Biological sampling of benthic macroinvertebrates will be used to compare preconstruction baseline data with postconstruction restored conditions.

Benthic macroinvertebrate monitoring locations were established within Site restoration reaches. Postrestoration collections occured in approximately the same locations as prerestoration sampling; however, sampling was not possible in UT 3 due to lack of stream flow. Benthic macroinvertebrate samples were collected from UT 1 and UT 2 reaches 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. Postproject biological sampling occurred on June 28, 2012 (data sheets are included in Appendix F); postproject monitoring will occur in June of each monitoring year.

Identification of collected organisms will be performed by personnel with NCDWQ or by a NCDWQ certified laboratory. Other data collected will include D50 values/NCDWQ habitat assessment forms. A detailed list of collected benthic macroinvertebrates is not available at this time due to delays at the certified laboratory; however, Habitat Assessment Field Data Sheets used in benthic macroinvertebrate monitoring are enclosed in Appendix F.

3.0 REFERENCES

Lee, M.T., R.K. Peet, S.D. Roberts, and T.R. Wentworth. 2006. CVS-EEP Protocol for Recording Vegetation. Version 4.0. North Carolina Department of Environment and Natural Resources, Ecosystem Enhancement Program. Raleigh, North Carolina.

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Schafale, M.P. and A.S. Weakley. 1990. Classification of the Natural Communities of North Carolina: Third Approximation. North Carolina Natural Heritage Program, Division of Parks and Recreation, North Carolina Department of Environment, Health, and Natural Resources. Raleigh, North Carolina.

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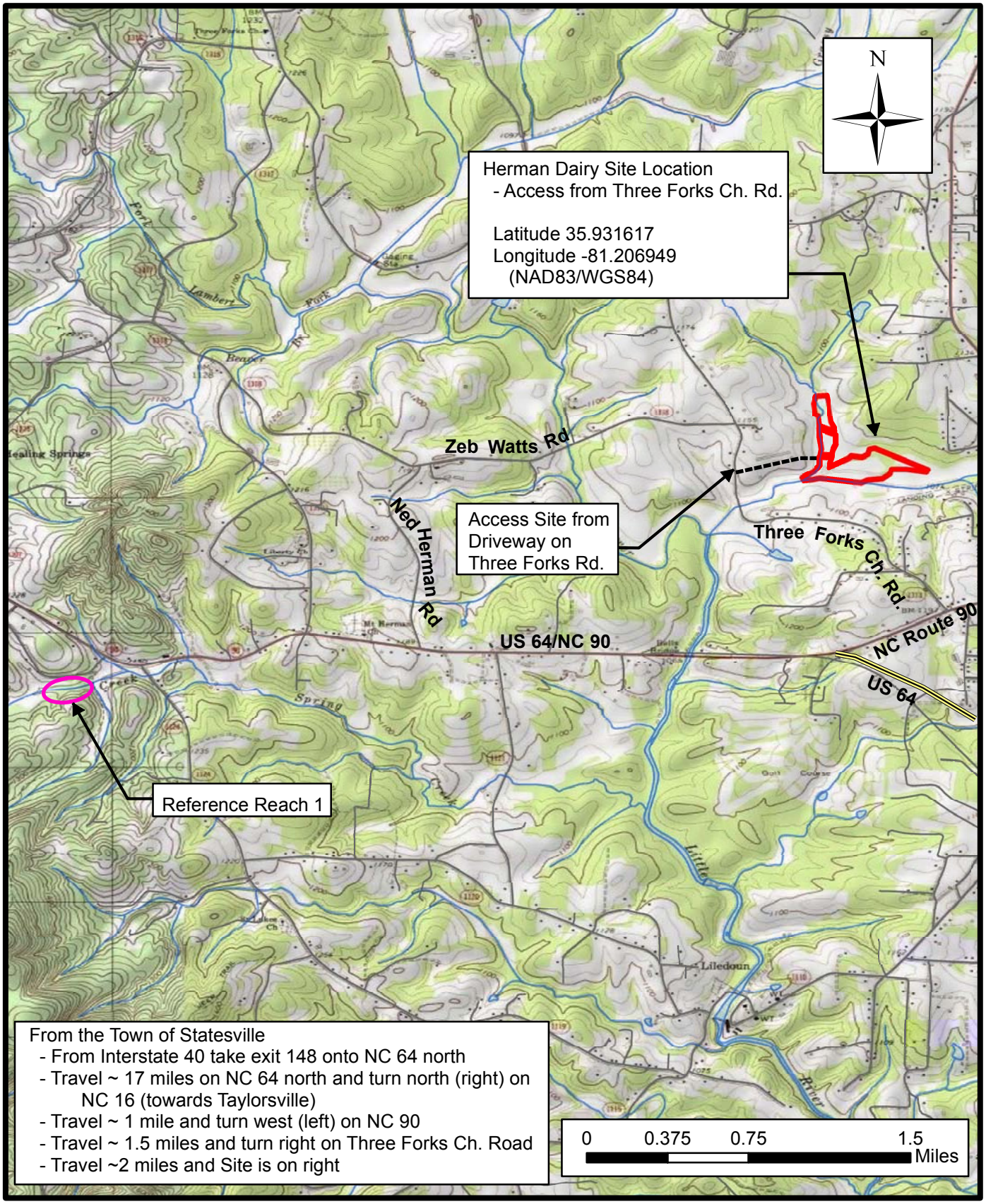
Appendix A.
Figures

Figure 1. The Site Location
Figure 2. Consolidated Current Conditions Plan View



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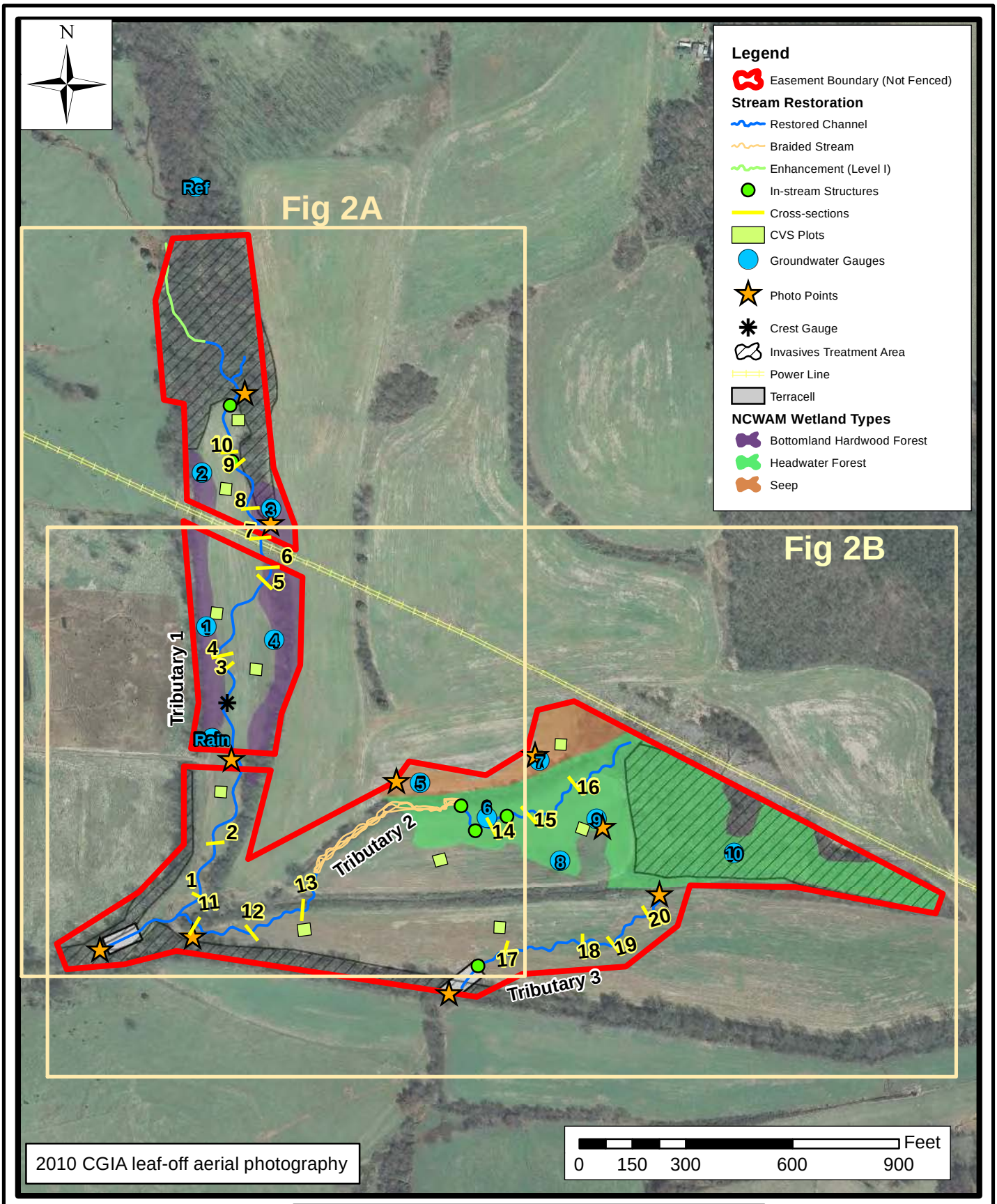
HERMAN DAIRY
STREAM AND WETLAND MITIGATION SITE
THE SITE LOCATION
Alexander County, North Carolina

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



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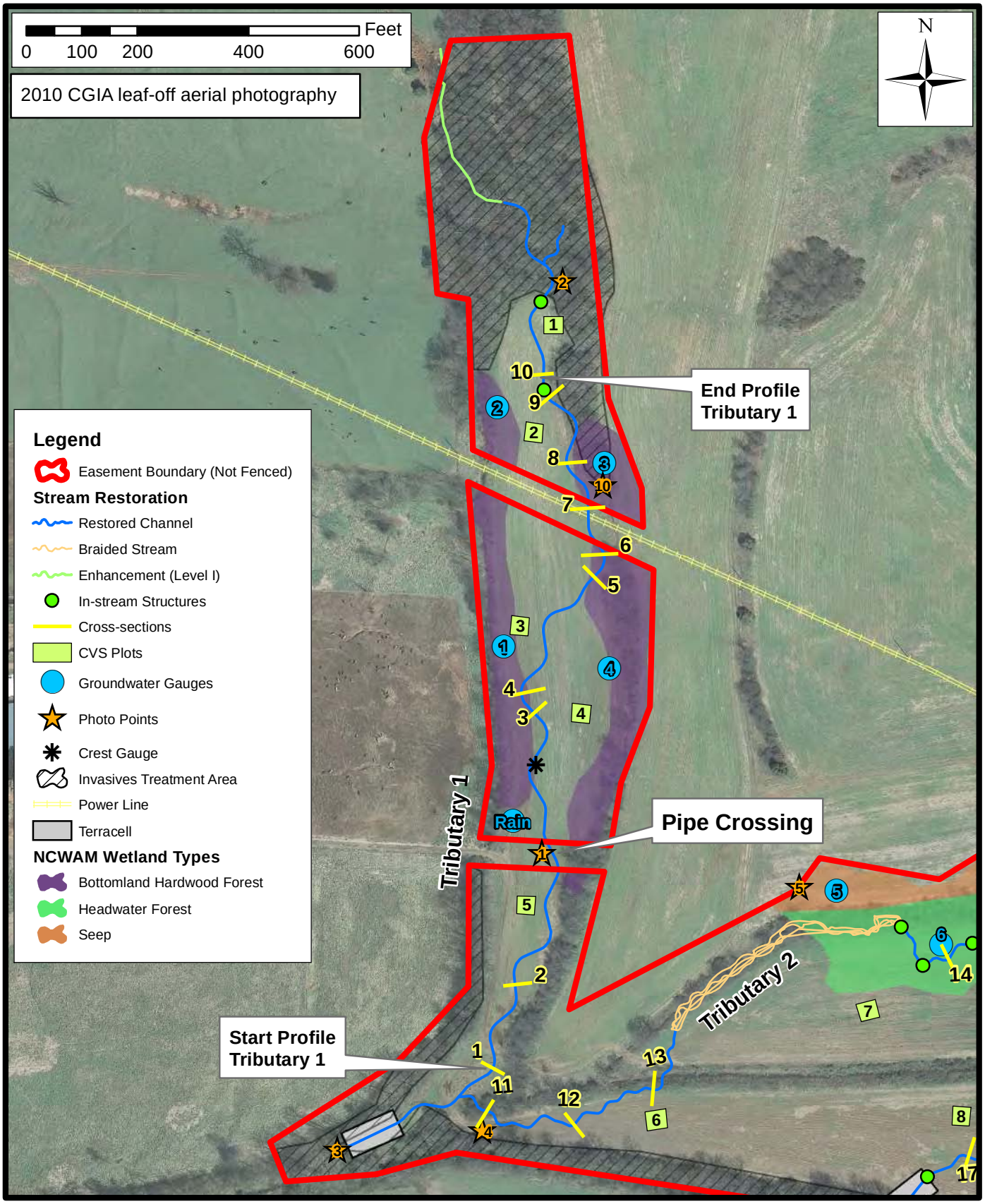
HERMAN DAIRY
STREAM AND WETLAND MITIGATION SITE
CONSOLIDATED CURRENT CONDITION PLAN VIEW
Alexander County, North Carolina

Dwn. By: KRJ	FIGURE 2
Date: Jan 2013	
Project: 10-016	



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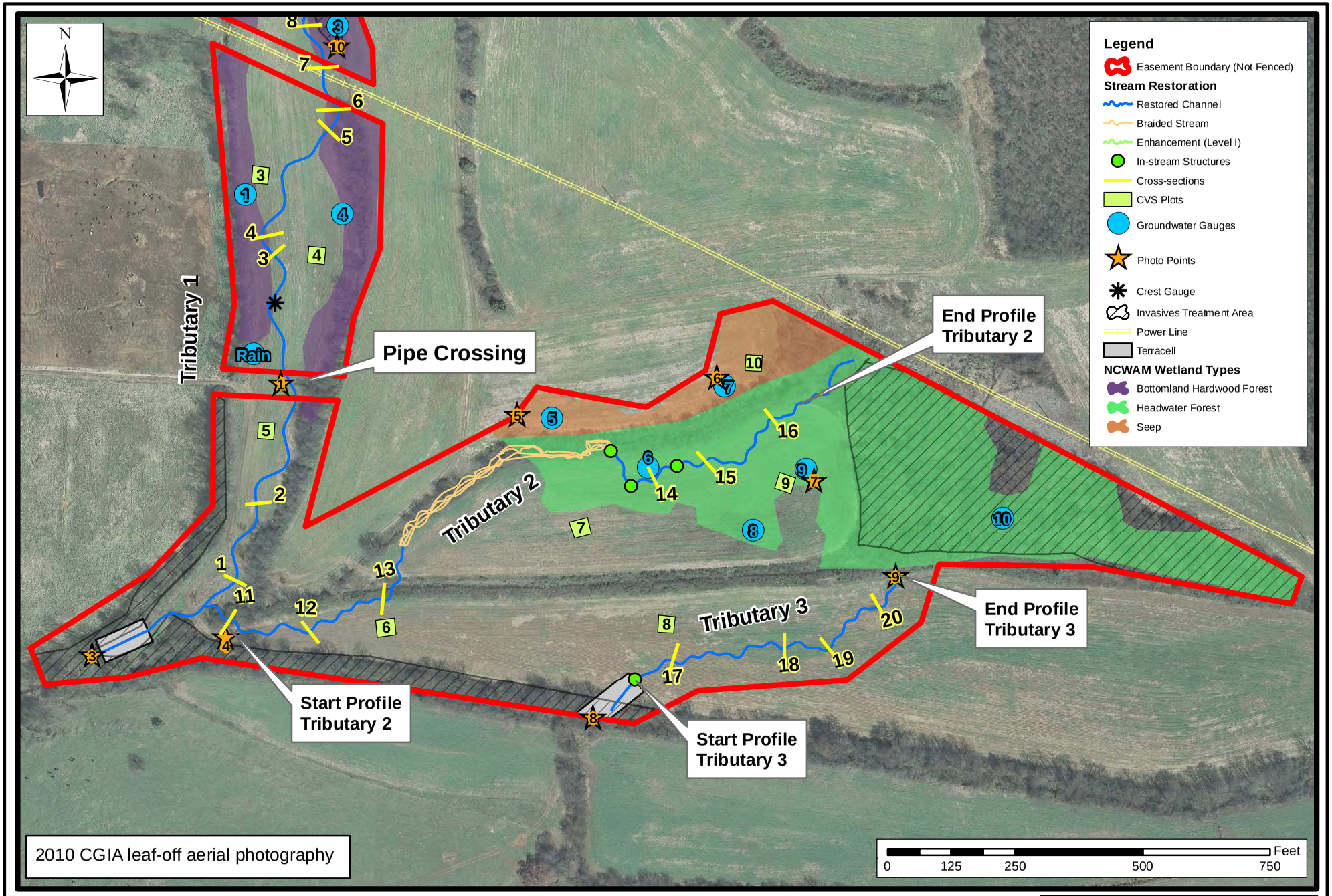
CONSOLIDATED CURRENT CONDITION PLAN VIEW
Alexander County, North Carolina

Dwn. By: KRJ	FIGURE
Date: Jan 2013	2A
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	FIGURE
Date: Jan 2013	2B
Project: 10-016	

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**
4560	**220**	**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 through cessation of current land use practices, removing invasive species, and planting with native forest vegetation.
--	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.
--	2.2	--	Enhancement	2.2	2:1	Enhancement of existing riparian wetlands characterized by disturbed pasture by planting with native forest vegetation.
--	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.
--	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
EEP Contract No. 003271	--	July 23, 2010
Restoration Plan	--	January 2011
Construction Plans	--	August 2011
Construction Earthwork		March 2012
As-Built Documentation		June 2012
Year 1 (2012) Annual Monitoring	September 2012	October 2012

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	100%
2	Yes	
3	Yes	
4	Yes	
5	Yes	
6	Yes	
7	Yes	
8	Yes	
9	Yes	
10	Yes	

Table 6. CVS Vegetation Metadata Table

Report Prepared By	Corri Faquin
Date Prepared	9/21/2012 8:17
database name	RestorationSystems-2012-A.mdb
database location	C:\Documents and Settings\pperkinson\Desktop
computer name	PHILLIP-LT
file size	81784832
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. CVS Stem Count Total and Planted by Plot and Species

Herman Dairy Stream and Wetland Restoration Site

			Current Plot Data (MY1 2012)																	
			Herman-P-0001			Herman-P-0002			Herman-P-0003			Herman-P-0004			Herman-P-0005			Herman-P-0006		
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
Acer negundo	boxelder	Tree																		15
Acer rubrum	red maple	Tree						1												
Betula nigra	river birch	Tree	4	4	4	4	4	4	1	1	1	1	1	1	1	1	1	1	1	1
Carpinus caroliniana	American hornbeam	Tree													2	2	2			
Carya	hickory	Tree							1	1	1				1	1	1			
Cornus amomum	silky dogwood	Shrub	1	1	1															
Fraxinus pennsylvanica	green ash	Tree	1	1	1	1	1	1	2	2	2	4	4	4	1	1	1	3	3	3
Liriodendron tulipifera	tuliptree	Tree	1	1	1	1	1	2				1	1	1				6	6	6
Nyssa	tupelo	Tree							6	6	6				5	5	5			
Platanus occidentalis	American sycamore	Tree																		14
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	3	3	3	2	2	2	3	3	3
Quercus phellos	willow oak	Tree													1	1	1			
Ulmus americana	American elm	Tree																		
Unknown		Shrub or Tree													1	1	1			
		Stem count	9	9	9	8	8	10	12	12	12	9	9	9	16	16	16	13	13	42
		size (ares)	1			1			1			1			1			1		
		size (ACRES)	0.02			0.02			0.02			0.02			0.02			0.02		
		Species count	5	5	5	4	4	5	5	5	5	4	4	4	9	9	9	4	4	6
		Stems per ACRE	364.2	364.2	364.2	323.7	323.7	404.7	485.6	485.6	485.6	364.2	364.2	364.2	647.5	647.5	647.5	526.1	526.1	1700

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%

Table 7. CVS Stem Count Total and Planted by Plot and Species (continued)

Herman Dairy Stream and Wetland Restoration Site

			Current Plot Data (MY1 2012)												Annual Means					
			Herman-P-0007			Herman-P-0008			Herman-P-0009			Herman-P-0010			MY1 (2012)			MY0 (2012)		
Scientific Name	Common Name	Species Type	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T
Acer negundo	boxelder	Tree															15			
Acer rubrum	red maple	Tree									6						7			
Betula nigra	river birch	Tree				3	3	3	2	2	2	2	2	2	19	19	19	41	41	41
Carpinus caroliniana	American hornbeam	Tree													2	2	2	3	3	3
Carya	hickory	Tree										2	2	2	4	4	4			
Cornus amomum	silky dogwood	Shrub				1	1	1							2	2	2	2	2	2
Fraxinus pennsylvanica	green ash	Tree	4	4	4	6	6	6	9	9	9	2	2	2	33	33	33	32	32	32
Liriodendron tulipifera	tuliptree	Tree	3	3	3				4	4	4	1	1	1	17	17	18	25	25	25
Nyssa	tupelo	Tree										3	3	3	14	14	14			
Platanus occidentalis	American sycamore	Tree									32						46	1	1	1
Quercus	oak	Tree										1	1	1	1	1	1	6	6	6
Quercus nigra	water oak	Tree													2	2	2			
Quercus pagoda	cherrybark oak	Tree	2	2	2	2	2	2	1	1	1	3	3	3	22	22	22	23	23	23
Quercus phellos	willow oak	Tree													1	1	1			
Ulmus americana	American elm	Tree																2	2	2
Unknown		Shrub or Tree													1	1	1	10	10	10
		Stem count	9	9	9	12	12	12	16	16	54	14	14	14	118	118	187	145	145	145
		size (ares)	1			1			1			1			10			10		
		size (ACRES)	0.02			0.02			0.02			0.02			0.25			0.25		
		Species count	3	3	3	4	4	4	4	4	6	7	7	7	12	12	15	10	10	10
		Stems per ACRE	364.2	364.2	364.2	485.6	485.6	485.6	647.5	647.5	2185	566.6	566.6	566.6	477.5	477.5	756.8	586.8	586.8	586.8

Color for Density

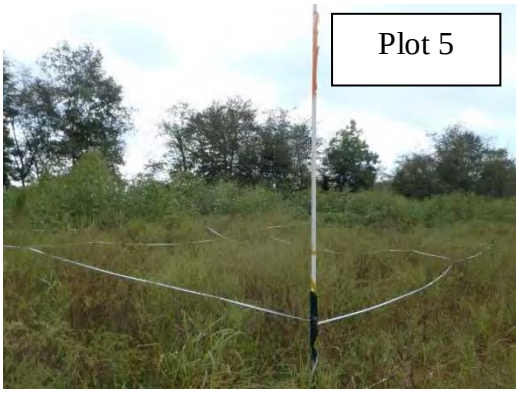
Exceeds requirements by 10%

Exceeds requirements, but by less than 10%

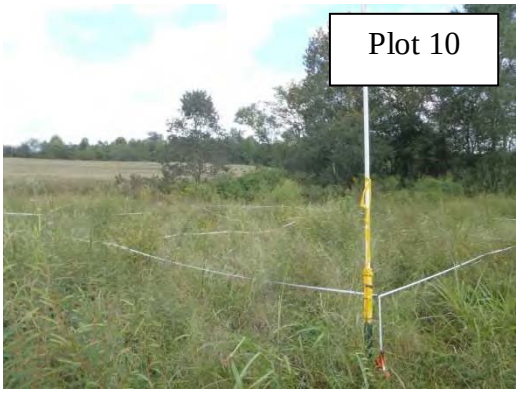
Fails to meet requirements, by less than 10%

Fails to meet requirements by more than 10%

Herman Dairy
2012 (Year 1) Vegetation Monitoring Photographs
Taken September 2012



Herman Dairy
2012 (Year 1) Vegetation Monitoring Photographs
Taken September 2012
(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

Herman Dairy
Fixed Station Photographs (continued)
Taken September 20, 2012

Photo Point 1

Photo Point 2

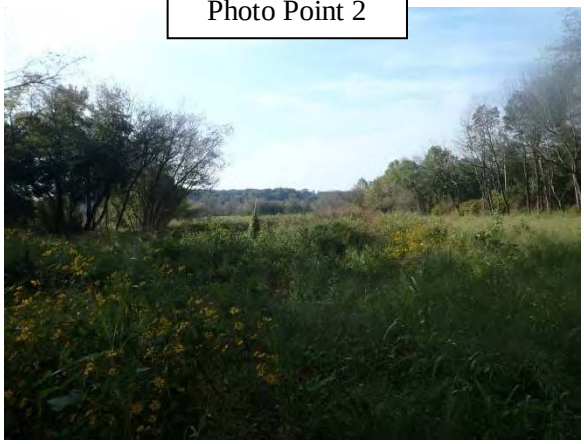


Photo Point 3

Photo Point 4

Photo Point 5

No photo available

Photo Point 6

Herman Dairy
Fixed Station Photographs (continued)
Taken September 20, 2012

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%			

Table8B **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)
		No Bankfull Events Recorded to Date	

*Weather Underground 2012

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 Pool (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					16.9	17.1					16.4	17					16.8	18.2				
Floodprone Width (ft)	----	----					----	----					250	250					----	----				
BF Cross Sectional Area (ft2)	19.9	18.9					16.3	16					16.7	17					14.4	14.5				
BF Mean Depth (ft)	1.0	1.0					1.0	0.9					1.0	1.0					0.9	0.8				
BF Max Depth (ft)	2.3	2.2					1.4	1.5					1.4	1.4					2.1	2.1				
Width/Depth Ratio	----	----					----	----					16.1	17					----	----				
Entrenchment Ratio	----	----					----	----					15.2	14.7					----	----				
Bank Height Ratio	----	----					----	----					1	1					----	----				
Wetted Perimeter (ft)	21.7	20.4					17.2	17.4					16.8	17.6					17.6	19.1				
Hydraulic Radius (ft)	0.9	0.9					0.9	0.9					1	1					0.8	0.8				
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												
Radius of Curvature (ft)	34	168	50	34	168	50												
Meander Wavelength (ft)	50	101	67	50	101	67												
Meander Width Ratio	3	6	4	3	6	4												
Profile																		
Riffle Length (ft)	23	65	36	16	49	28												
Riffle Slope (ft/ft)	0.00%	1.50%	0.64%	0.05%	1.05%	0.57%												
Pool Length (ft)	10	54	32	18	62	35												
Pool Spacing (ft)	50	134	67	50	134	67												
Additonal Reach Parameters																		
Valley Length (ft)	1757			1373														
Channel Length (ft)	2,108			1,648														
Sinuosity	1.2			1.2														
Water Surface Slope (ft/ft)	0.0053			0.0045														
BF Slope (ft/ft)	------			------														
Rosgen Classification	C/E 4/5			C-4/5														

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					20	17.2					15.5	14.6					16.1	18.4				
Floodprone Width (ft)	250	250					----	----					250	250					----	----				
BF Cross Sectional Area (ft2)	18.2	16.6					20.3	17.7					14	14					15.5	16				
BF Mean Depth (ft)	1.1	1.0					1.0	1.0					0.9	1.0					1.0	0.9				
BF Max Depth (ft)	1.6	1.4					2.3	2.2					1.2	1.4					1.9	2.1				
Width/Depth Ratio	14.2	16.0					----	----					17.2	15.2					----	----				
Entrenchment Ratio	15.5	15.3					----	----					16.1	17.1					----	----				
Bank Height Ratio	1	1					----	----					1	1					----	----				
Wetted Perimeter (ft)	16.8	16.9					21	18.3					15.9	15.1					16.8	19.1				
Hydraulic Radius (ft)	1.1	1					1	1					0.9	0.9					0.9	0.8				
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												
Radius of Curvature (ft)	34	168	50	34	168	50												
Meander Wavelength (ft)	50	101	67	50	101	67												
Meander Width Ratio	3	6	4	3	6	4												
Profile																		
Riffle Length (ft)	23	65	36	16	49	28												
Riffle Slope (ft/ft)	0.00%	1.50%	0.64%	0.05%	1.05%	0.57%												
Pool Length (ft)	10	54	32	18	62	35												
Pool Spacing (ft)	50	134	67	50	134	67												
Additonal Reach Parameters																		
Valley Length (ft)	1757			1373														
Channel Length (ft)	2,108			1,648														
Sinuosity	1.2			1.2														
Water Surface Slope (ft/ft)	0.0053			0.0045														
BF Slope (ft/ft)	------			------														
Rosgen Classification	C/E 4/5			C-4/5														

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	17					7.9	5.2					5.5	5.8				
Floodprone Width (ft)	----	----					250	250					150	150					----	----				
BF Cross Sectional Area (ft2)	15.7	15.4					16	15.6					2.3	1.3					2.3	2.1				
BF Mean Depth (ft)	0.8	1.0					1.0	0.9					0.3	0.3					0.4	0.4				
BF Max Depth (ft)	2	2.3					1.3	1.4					0.5	0.4					0.8	0.7				
Width/Depth Ratio	----	----					16.0	18.5					27.1	20.8					----	----				
Entrenchment Ratio	----	----					15.6	14.7					19.0	28.8					----	----				
Bank Height Ratio	----	----					1	1					1	1					----	----				
Wetted Perimeter (ft)	19.5	17					16.5	17.6					8	5.3					5.8	6				
Hydraulic Radius (ft)	0.8	0.9					1	0.9					0.3	0.2					0.4	0.3				
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												
Radius of Curvature (ft)	34	168	50	34	168	50												
Meander Wavelength (ft)	50	101	67	50	101	67												
Meander Width Ratio	3	6	4	3	6	4												
Profile																		
Riffle Length (ft)	17	111	51	16	49	28												
Riffle Slope (ft/ft)	0.43%	4.80%	1.54%	0.05%	1.05%	0.57%												
Pool Length (ft)	26	78	46	18	62	35												
Pool Spacing (ft)	76	176	126	50	134	67												
Additonal Reach Parameters																		
Valley Length (ft)	1757			1373														
Channel Length (ft)	2,108			1,648														
Sinuosity	1.2			1.2														
Water Surface Slope (ft/ft)	0.0053			0.0045														
BF Slope (ft/ft)	------			------														
Rosgen Classification	C/E 4/5			C-4/5														

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					6.6	6.8					6.8	6.9					5.7	7.1				
Floodprone Width (ft)	150	150					----	----					150	150					----	----				
BF Cross Sectional Area (ft2)	2.4	1.5					2.4	2.6					2.2	2.2					2.3	2.4				
BF Mean Depth (ft)	0.3	0.2					0.4	0.4					0.3	0.3					0.4	0.3				
BF Max Depth (ft)	0.5	0.5					0.7	0.7					0.5	0.5					0.8	0.8				
Width/Depth Ratio	19.8	32.7					----	----					21.0	21.6					----	----				
Entrenchment Ratio	21.7	21.4					----	----					22.1	21.7					----	----				
Bank Height Ratio	1	1					----	----					1	1					----	----				
Wetted Perimeter (ft)	7.1	7.2					6.8	7					7	7.1					6	7.3				
Hydraulic Radius (ft)	0.3	0.2					0.3	0.4					0.3	0.3					0.4	0.3				
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)	17	34	23	17	34	23												
Radius of Curvature (ft)	11	57	17	11	57	17												
Meander Wavelength (ft)	34	68	49	34	68	49												
Meander Width Ratio	3	6	4	3	6	4												
Profile																		
Riffle Length (ft)	6	44	14	6	41	11												
Riffle Slope (ft/ft)	0.00%	1.25%	0.39%	0	3.39	0.42												
Pool Length (ft)	6	32	13	7	21	11												
Pool Spacing (ft)	17	46	23	17	46	23												
Additonal Reach Parameters																		
Valley Length (ft)	1413			1522														
Channel Length (ft)	1,696			1,827														
Sinuosity	1.2			1.2														
Water Surface Slope (ft/ft)	0.004			0.0041														
BF Slope (ft/ft)	------			------														
Rosgen Classification	C/E 4/5			C 4/5														

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

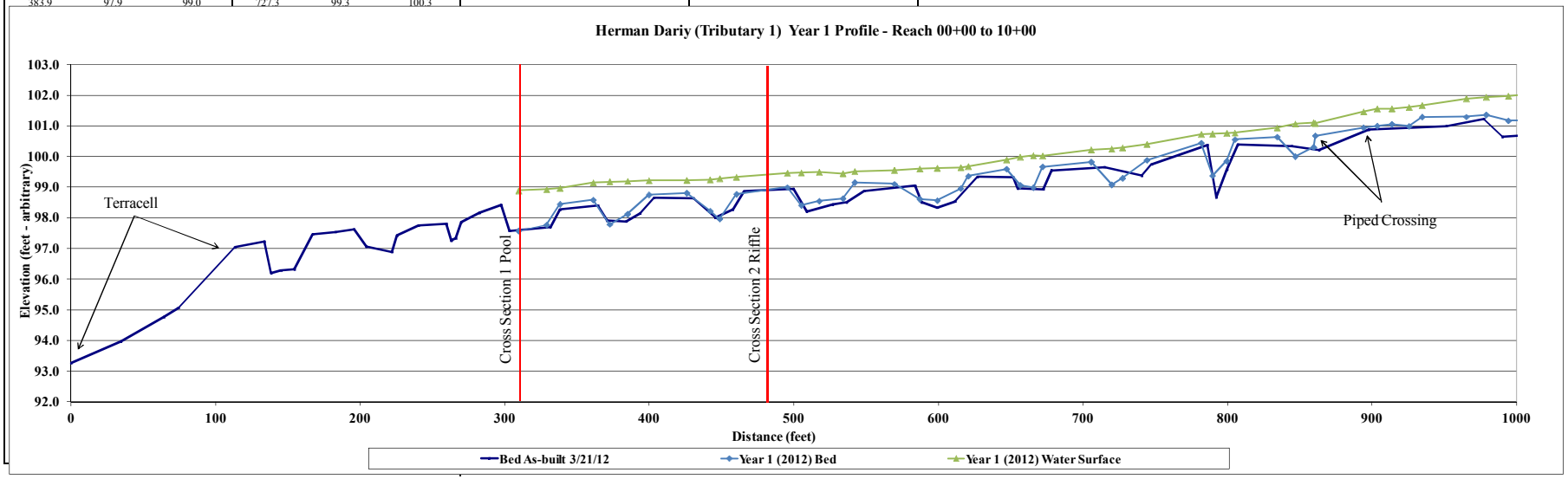
Parameter	Cross Section 17 Riffle (UT 3)						Cross Section 18 Pool (UT 3)						Cross Section 19 Pool (UT3)						Cross Section 20 Riffle (UT3)					
Dimension	**MY 0**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**MY 0**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**MY 0**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**MY 0**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**
BF Width (ft)	8.5	7.7					6.2	6.2					6.8	6.5					9.5	7.8				
Floodprone Width (ft)	150	150					----	----					----	----					150	150				
BF Cross Sectional Area (ft2)	3.1	2.6					3.8	3.7					3	3					3.2	2.3				
BF Mean Depth (ft)	0.4	0.3					0.6	0.6					0.4	0.5					0.3	0.3				
BF Max Depth (ft)	0.5	0.5					1	1.1					0.9	1					0.6	0.4				
Width/Depth Ratio	23.3	22.8					----	----					----	----					28.2	26.5				
Entrenchment Ratio	17.6	19.5					----	----					----	----					15.8	19.2				
Bank Height Ratio	1	1					----	----					----	----					1	1				
Wetted Perimeter (ft)	8.7	7.8					6.7	6.6					7.2	6.9					9.7	7.9				
Hydraulic Radius (ft)	0.4	0.3					0.6	0.6					0.4	0.4					0.3	0.3				
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)	20	39	26	20	39	26												
Radius of Curvature (ft)	13	65	20	13	65	20												
Meander Wavelength (ft)	39	78	55	39	78	55												
Meander Width Ratio	3	6	4	3	6	4												
Profile																		
Riffle Length (ft)	5	26	11	5	27	9												
Riffle Slope (ft/ft)	0.00%	1.59%	0.22%	----	----	----												
Pool Length (ft)	8	21	13	7	24	13												
Pool Spacing (ft)	20	52	26	20	52	26												
Additonal Reach Parameters																		
Valley Length (ft)	619			645														
Channel Length (ft)	743			774														
Sinuosity	1.2			1.2														
Water Surface Slope (ft/ft)	0.0012			----														
BF Slope (ft/ft)	------			----														
Rosgen Classification	C/E 4/5			C 4/5														

Project Name	Herman Dairy - Year 1 (2012) Profile
Reach	Tributary 1
Feature	Profile
Date	8/29/12
Crew	Perkinson, Lewis

2012 As-built Survey			2012 Year 1 Monitoring \Survey			2013 Year 2 Monitoring \Survey			2014 Year 3 Monitoring \Survey		
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						
34.6	94.0	94.3	328.9	97.8	98.9						
64.3	94.8	95.2	338.1	98.4	99.0						
74.2	95.1	95.4	361.2	98.6	99.1						
113.3	97.0	97.5	372.6	97.8	99.2						
133.7	97.2	97.9	384.9	98.1	99.2						
138.4	96.2	98.0	399.8	98.8	99.2						
145.3	96.3	97.9	425.9	98.8	99.2						
154.5	96.3	98.0	442.1	98.2	99.2						
167.2	97.5	98.0	448.7	98.0	99.3						
182.9	97.5	98.1	460.2	98.8	99.3						
195.8	97.6	98.1	495.5	99.0	99.5						
204.1	97.1	98.1	505.1	98.4	99.5						
221.9	96.9	98.1	517.5	98.5	99.5						
225.5	97.4	98.1	534.0	98.6	99.4						
240.5	97.8	98.2	542.1	99.2	99.5						
259.8	97.8	98.3	569.5	99.1	99.6						
263.0	97.3	98.3	587.1	98.6	99.6						
266.2	97.3	98.3	599.2	98.6	99.6						
269.8	97.9	98.4	615.4	99.0	99.6						
282.4	98.2	98.5	620.7	99.4	99.7						
297.4	98.4	98.7	647.1	99.6	99.9						
303.3	97.6	98.7	656.5	99.1	100.0						
331.6	97.7	98.7	665.6	99.0	100.0						
338.2	98.3	98.8	672.0	99.7	100.0						
364.5	98.4	98.9	705.7	99.8	100.2						
370.8	97.9	99.0	719.8	99.1	100.2						
383.9	97.9	99.0	727.3	99.3	100.3						

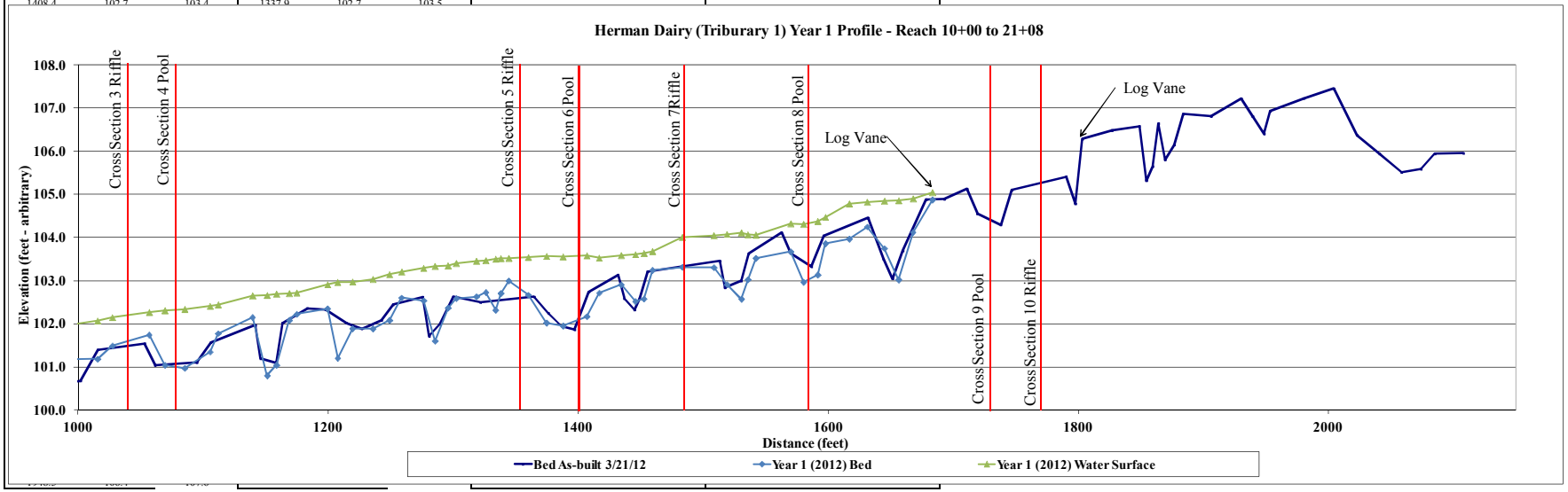
	As-built	2012	2013	2014
Avg. Water Surface Slope	0.0053	0.0045		
Riffle Length	36	28		
Avg. Riffle Slope	0.0064	0.0057		
Pool Length	32	35		



Project Name	Herman Dairy - Year 1 (2012) Profile
Reach	Tributary 1
Feature	Profile
Date	8/29/12
Crew	Perkinson, Lewis

2012 As-built Survey			2012 Year 1 Monitoring \Survey			2013 Year 2 Monitoring \Survey			2014 Year 3 Monitoring \Survey		
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						
1001.8	100.7	101.7	1015.4	101.2	102.1						
1015.7	101.4	101.7	1027.3	101.5	102.1						
1053.0	101.5	101.9	1056.7	101.7	102.3						
1061.5	101.0	101.9	1069.3	101.0	102.3						
1094.8	101.1	102.0	1085.1	101.0	102.3						
1106.1	101.6	102.2	1105.4	101.3	102.4						
1141.7	102.0	102.4	1111.8	101.8	102.4						
1145.7	101.2	102.3	1139.4	102.2	102.7						
1158.5	101.1	102.3	1151.1	100.8	102.7						
1163.3	102.0	102.4	1158.5	101.0	102.7						
1183.3	102.4	102.7	1168.8	102.1	102.7						
1197.8	102.3	102.8	1174.7	102.2	102.7						
1214.6	102.0	102.8	1199.3	102.4	102.9						
1226.9	101.9	102.8	1207.4	101.2	103.0						
1242.5	102.1	102.8	1219.3	101.9	103.0						
1251.9	102.4	102.8	1235.6	101.9	103.0						
1275.5	102.6	102.8	1248.9	102.1	103.1						
1280.7	101.7	102.9	1258.6	102.6	103.2						
1289.3	102.0	102.9	1276.2	102.5	103.3						
1300.0	102.6	102.8	1285.3	101.6	103.3						
1321.8	102.5	102.9	1295.7	102.4	103.3						
1364.7	102.6		1302.3	102.6	103.4						
1376.2	102.2	103.0	1318.4	102.6	103.5						
1386.5	102.0	103.1	1326.0	102.7	103.5						
1397.1	101.9	103.1	1333.8	102.3	103.5						
1408.4	102.7	103.4	1337.9	102.7	103.5						

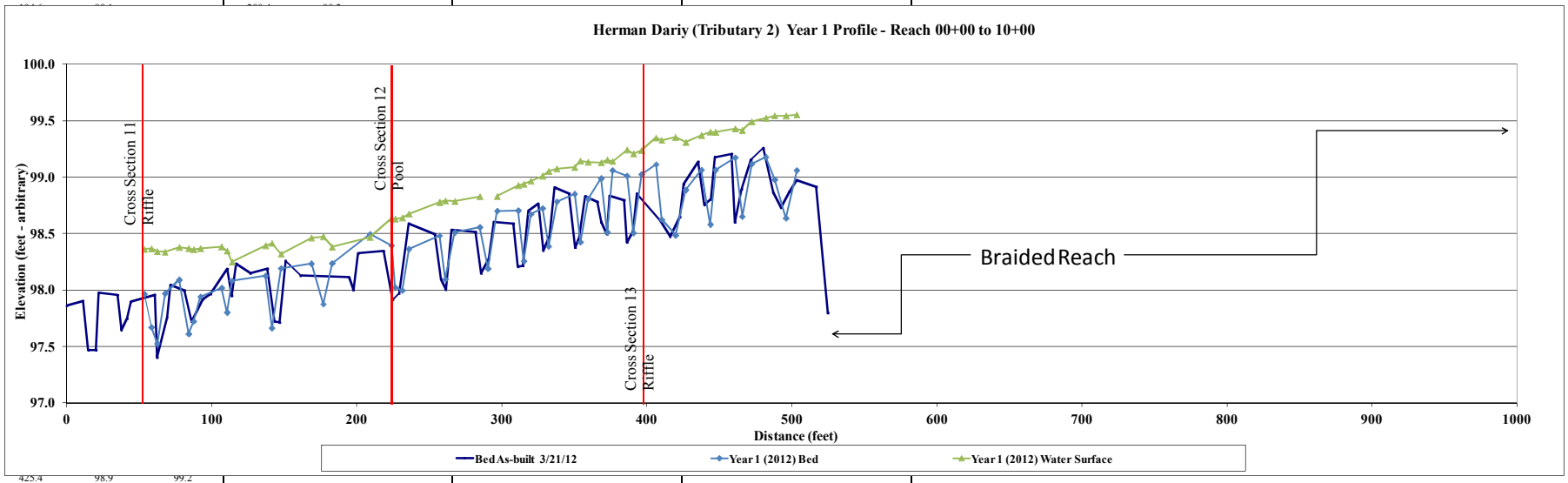
	As-built	2012	2013	2014
Avg. Water Surface Slope	0.0053	0.0045		
Riffle Length	36	28		
Avg. Riffle Slope	0.0064	0.0057		
Pool Length	32	35		



Project Name	Herman Dairy - Year 1 (2012) Profile
Reach	Tributary 2
Feature	Profile
Date	9/19/12
Crew	Perkinson, Jernigan

2012 As-built Survey			2012 Year 1 Monitoring \Survey			2013 Year 2 Monitoring \Survey			2014 Year 3 Monitoring \Survey		
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						
11.2	97.9	98.2	58.4	97.7	98.4						
14.9	97.5	98.2	62.3	97.5	98.3						
20.1	97.5	98.2	67.7	98.0	98.3						
22.2	98.0	98.0	77.5	98.1	98.4						
34.9	98.0		84.1	97.6	98.4						
37.6	97.6	98.1	87.5	97.7	98.4						
41.7	97.7	98.1	92.2	97.9	98.4						
44.1	97.9		106.8	98.0	98.4						
60.6	98.0		110.6	97.8	98.3						
62.3	97.4	98.1	114.0	98.1	98.2						
69.1	97.8	98.1	137.1	98.1	98.4						
71.7	98.0		141.4	97.7	98.4						
81.1	98.0		147.7	98.2	98.3						
85.9	97.7	98.3	168.6	98.2	98.5						
93.8	97.9	98.3	176.9	97.9	98.5						
99.3	98.0	98.3	182.9	98.2	98.4						
110.8	98.2		209.1	98.5	98.5						
113.8	97.9	98.4	223.9	98.4	98.6						
116.9	98.2		226.4	98.0	98.6						
126.7	98.1	98.4	231.4	98.0	98.6						
138.4	98.2		235.9	98.4	98.7						
143.4	97.7	98.4	257.1	98.5	98.8						
146.8	97.7	98.5	261.1	98.1	98.8						
150.8	98.3		267.6	98.5	98.8						
161.2	98.1		284.8	98.6	98.8						
425.4	98.9	99.2									
435.5	99.1	99.3									

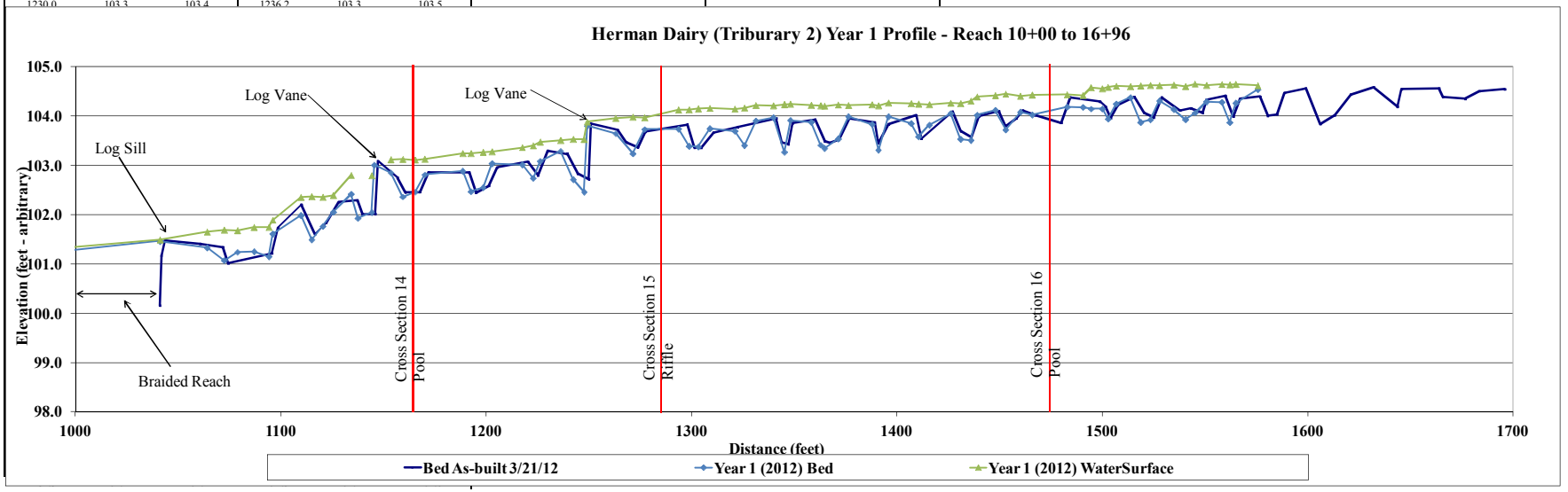
	As-built	2012	2013	2014
Avg. Water Surface Slope	0.0040	0.0041		
Riffle Length	14	13		
Avg. Riffle Slope	0.0039	0.0042		
Pool Length	13	12		



Project Name	Herman Dairy - Year 1 (2012) Profile
Reach	Tributary 2
Feature	Profile
Date	9/19/12
Crew	Perkinson, Jernigan

2012 As-built Survey			2012 Year 1 Monitoring \Survey			2013 Year 2 Monitoring \Survey			2014 Year 3 Monitoring \Survey		
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						
1041.2	100.2	100.8	1041.2	101.5	101.5						
1041.8	101.2	101.2	1064.1	101.3	101.6						
1043.5	101.5	101.5	1072.4	101.1	101.7						
1060.7	101.4	101.7	1078.9	101.2	101.7						
1071.8	101.3	101.7	1087.0	101.3	101.7						
1074.4	101.0	101.6	1094.2	101.1	101.7						
1095.6	101.2	101.7	1096.1	101.6	101.9						
1098.7	101.7		1109.7	102.0	102.4						
1110.0	102.2		1115.0	101.5	102.4						
1116.6	101.6	102.3	1120.4	101.8	102.4						
1122.1	101.8	102.3	1125.5	102.1	102.4						
1128.3	102.3		1134.2	102.4	102.8						
1137.3	102.3		1137.5	101.9							
1139.8	102.0	102.6	1144.2	102.0	102.8						
1146.0	102.0	102.6	1145.5	103.0							
1147.4	103.1		1153.5	102.9	103.1						
1156.8	102.8	103.1	1159.3	102.4	103.1						
1160.6	102.4	103.1	1165.4	102.5	103.1						
1167.7	102.5	103.1	1170.1	102.8	103.1						
1172.0	102.9	103.1	1188.5	102.9	103.2						
1191.8	102.9	103.2	1192.5	102.5	103.2						
1195.0	102.4	103.2	1198.5	102.6	103.3						
1201.3	102.6	103.2	1202.8	103.0	103.3						
1205.2	103.0	103.2	1217.5	103.0	103.4						
1220.4	103.1	103.3	1222.8	102.7	103.4						
1225.1	102.8	103.3	1226.2	103.1	103.5						
1230.0	103.3	103.4	1236.2	103.3	103.5						

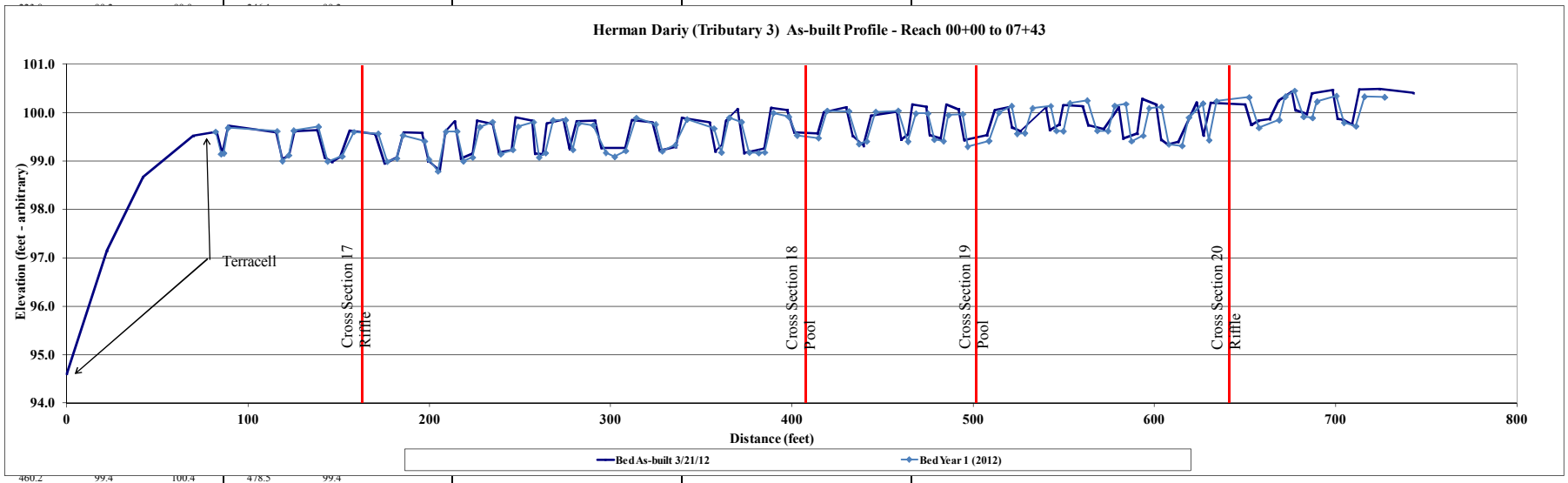
	As-built	2012	2013	2014
Avg. Water Surface Slope	0.0040	0.0041		
Riffle Length	14	13		
Avg. Riffle Slope	0.0039	0.0042		
Pool Length	13	12		



Project Name Herman Dairy - Year 1 (2012) Profile
Reach Tributary 3
Feature Profile
Date 9/27/12
Crew Perkinson, Jernigan

2012 As-built Survey			2012 Year 1 Monitoring \Survey			2013 Year 2 Monitoring \Survey			2014 Year 3 Monitoring \Survey		
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							
22.2	97.1		85.1	99.1							
42.1	98.7		86.6	99.2							
69.9	99.5		89.0	99.7							
82.7	99.6		116.0	99.6							
85.8	99.2	99.9	118.9	99.0							
89.2	99.7	99.9	122.4	99.1							
115.5	99.6	99.9	125.1	99.6							
119.0	99.0	99.9	138.8	99.7							
122.7	99.1	99.9	143.8	99.0							
125.8	99.6	99.9	151.9	99.1							
138.2	99.6	99.9	158.4	99.6							
142.3	99.1	99.9	171.8	99.6							
146.4	99.0	99.9	176.8	99.0							
151.0	99.1	99.9	182.1	99.1							
156.1	99.6	99.9	185.4	99.5							
170.2	99.6	99.9	197.4	99.4							
175.3	99.0	99.9	199.7	99.0							
182.1	99.1	99.9	204.8	98.8							
185.9	99.6	99.9	209.1	99.6							
196.0	99.6	99.9	215.3	99.6							
199.5	99.0	99.9	218.7	99.0							
205.7	98.8	99.9	223.9	99.1							
208.9	99.6		227.8	99.7							
214.2	99.8	100.0	234.9	99.8							
217.5	99.0	100.0	239.4	99.1							
460.2	99.4	100.4	478.5	99.4							
464.1	99.6	100.4	483.6	99.4							

	As-built	2012	2013	2014
Avg. Water Surface Slope	0.0012	NA		
Riffle Length	11	10		
Avg. Riffle Slope	0.0022	NA		
Pool Length	13	13		

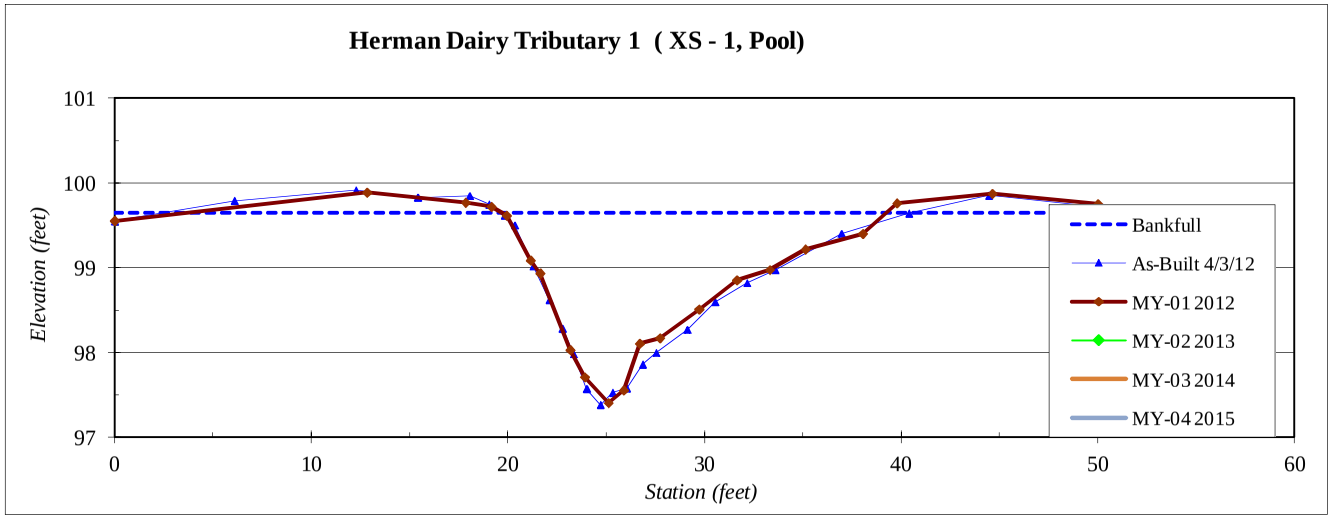


Site Name:	Herman Dairy
Watershed:	30501001120030
XS ID	Tributary 1 (XS - 1, Pool)
Drainage Area (sq mi):	1.01
Date:	4/3/2012
Field Crew:	Perkinson, Thomas

Station	Elevation
0.00	99.55
12.84	99.89
17.85	99.77
19.16	99.72
19.93	99.62
21.15	99.09
21.64	98.93
23.18	98.03
23.91	97.71
25.11	97.41
25.88	97.55
26.70	98.11
27.73	98.17
29.72	98.51
31.64	98.85
33.32	98.98
35.1	99.22
38.05	99.40
39.79	99.76
44.63	99.87
50.01	99.75

SUMMARY DATA	
Bankfull Elevation:	99.7
Bankfull Cross-Sectional Area:	19.6
Bankfull Width:	19.6
Flood Prone Area Elevation:	-
Flood Prone Width:	-
Max Depth at Bankfull:	2.2
Mean Depth at Bankfull:	1.0
W / D Ratio:	-
Entrenchment Ratio:	-
Bank Height Ratio:	-

Stream Type	E

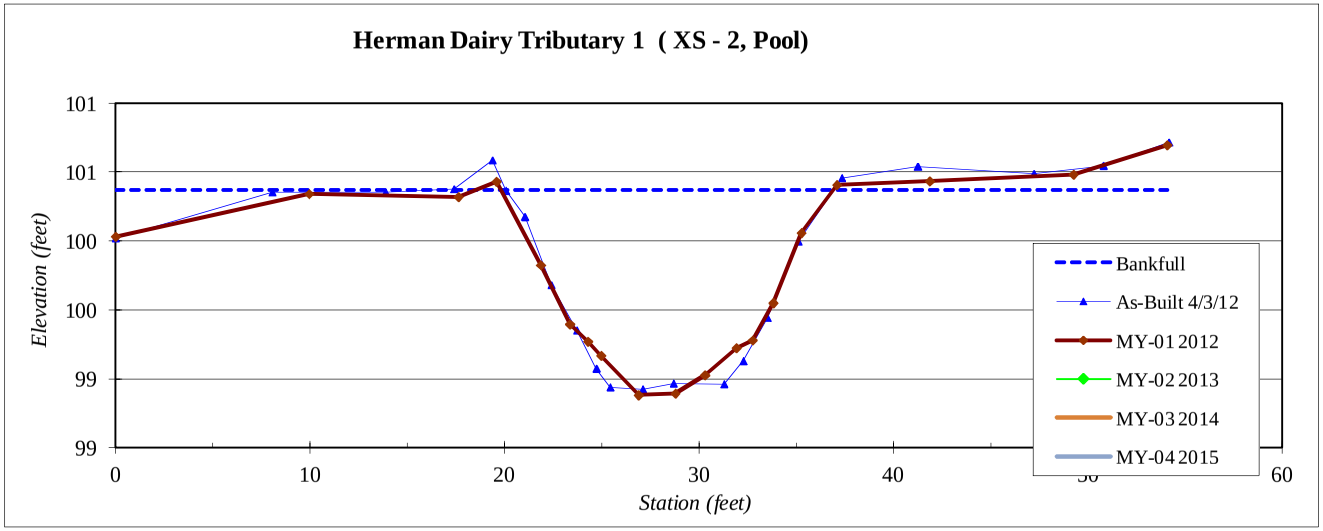


Site Name:	Herman Dairy
Watershed:	30501001120030
XS ID	Tributary 1 (XS - 2, Pool)
Drainage Area (sq mi):	1.01
Date:	4/3/2012
Field Crew:	Perkinson, Thomas

Station	Elevation
0.00	100.03
9.95	100.34
17.63	100.32
19.58	100.43
21.86	99.82
23.36	99.40
24.28	99.27
24.96	99.17
26.89	98.88
28.78	98.89
30.30	99.03
31.93	99.22
32.75	99.28
33.82	99.55
35.26	100.06
37.1	100.41
41.9	100.43
49.3	100.48
54.07	100.70

SUMMARY DATA	
Bankfull Elevation:	100.4
Bankfull Cross-Sectional Area:	16.0
Bankfull Width:	17.1
Flood Prone Area Elevation:	-
Flood Prone Width:	-
Max Depth at Bankfull:	1.5
Mean Depth at Bankfull:	0.9
W / D Ratio:	-
Entrenchment Ratio:	-
Bank Height Ratio:	-

Stream Type	E

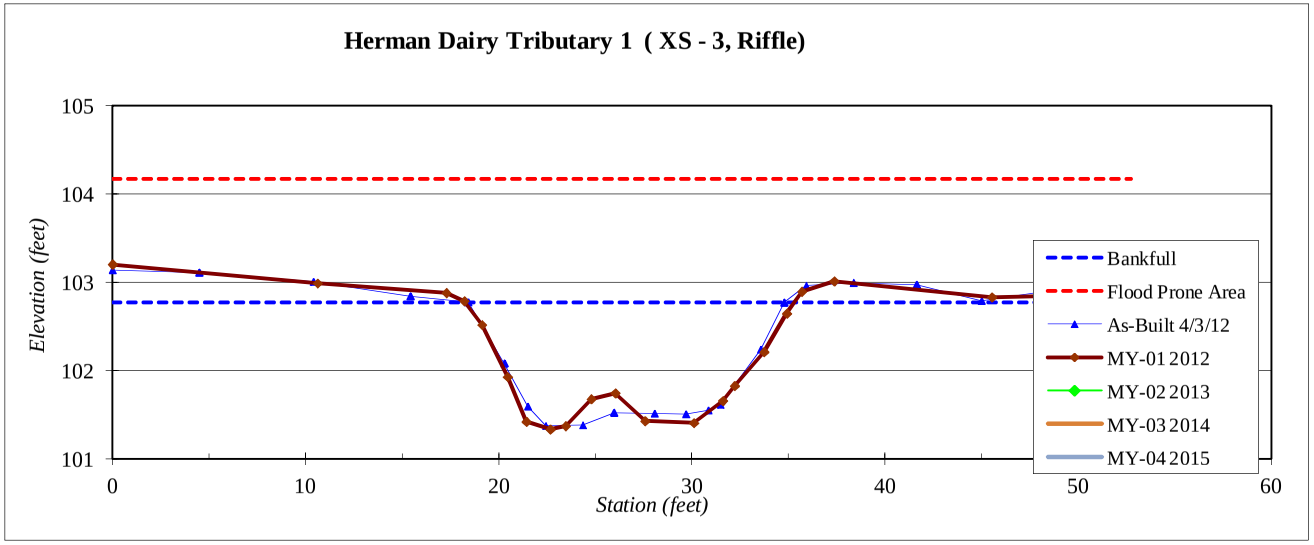


Site Name:	Herman Dairy
Watershed:	30501001120030
XS ID	Tributary 1 (XS - 3, Riffle)
Drainage Area (sq mi):	1.01
Date:	4/3/2012
Field Crew:	Perkinson, Thomas

Station	Elevation
0.00	103.20
10.61	102.99
17.28	102.88
18.21	102.79
19.13	102.52
20.46	101.93
21.43	101.42
22.66	101.33
23.46	101.37
24.79	101.68
26.03	101.75
27.57	101.43
30.10	101.41
31.61	101.66
32.2	101.83
33.7	102.21
34.9	102.65
35.7	102.89
37.4	103.01
45.5	102.83
52.7	102.86

SUMMARY DATA	
Bankfull Elevation:	102.8
Bankfull Cross-Sectional Area:	17.0
Bankfull Width:	17.0
Flood Prone Area Elevation:	104.2
Flood Prone Width:	>80
Max Depth at Bankfull:	1.4
Mean Depth at Bankfull:	1.0
W / D Ratio:	17.0
Entrenchment Ratio:	>5
Bank Height Ratio:	1.0

Stream Type	E/C

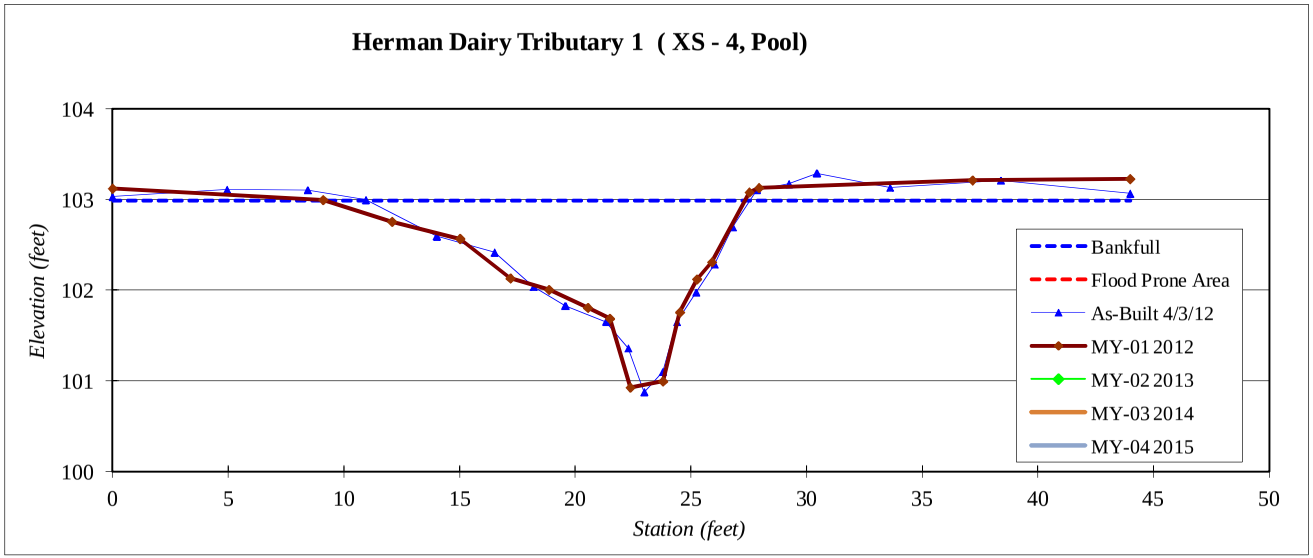


Site Name:	Herman Dairy
Watershed:	30501001120030
XS ID	Tributary 1 (XS - 4, Pool)
Drainage Area (sq mi):	1.01
Date:	4/3/2012
Field Crew:	Perkinson, Thomas

Station	Elevation
0.0	103.1
9.1	103.0
12.1	102.8
15.0	102.6
17.2	102.1
18.9	102.0
20.5	101.8
21.5	101.7
22.4	100.9
23.8	101.0
24.5	101.8
25.3	102.1
25.9	102.3
27.5	103.1
27.9	103.13
37.2	103.21
44.0	103.23

SUMMARY DATA	
Bankfull Elevation:	103.0
Bankfull Cross-Sectional Area:	14.5
Bankfull Width:	18.2
Flood Prone Area Elevation:	-
Flood Prone Width:	-
Max Depth at Bankfull:	2.1
Mean Depth at Bankfull:	0.8
W / D Ratio:	-
Entrenchment Ratio:	-
Bank Height Ratio:	-

Stream Type	E

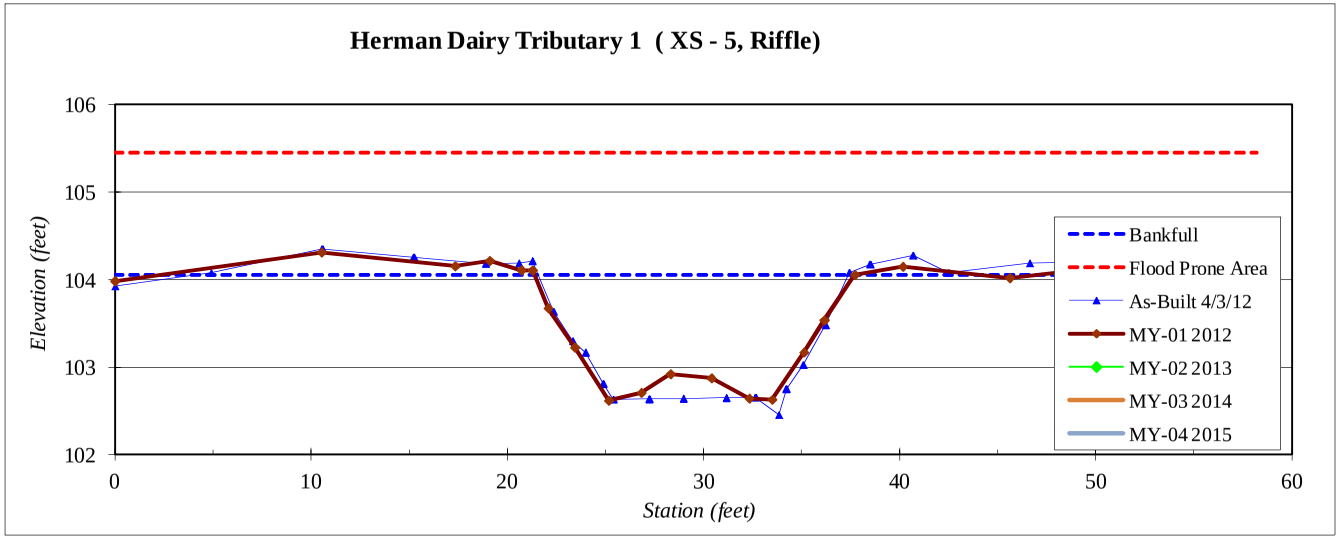


Site Name:	Herman Dairy
Watershed:	30501001120030
XS ID	Tributary 1 (XS - 5, Riffle)
Drainage Area (sq mi):	1.01
Date:	4/3/2012
Field Crew:	Perkinson, Thomas

Station	Elevation
0.0	104.0
10.5	104.3
17.3	104.2
19.1	104.2
20.7	104.1
21.3	104.1
22.1	103.7
23.4	103.2
25.2	102.6
26.8	102.7
28.3	102.9
30.4	102.9
32.3	102.6
33.5	102.63
35.1	103.17
36.2	103.54
37.7	104.05
40.2	104.15
45.6	104.02
53.5	104.22
58.2	104.32

SUMMARY DATA	
Bankfull Elevation:	104.1
Bankfull Cross-Sectional Area:	16.6
Bankfull Width:	16.3
Flood Prone Area Elevation:	105.5
Flood Prone Width:	>80
Max Depth at Bankfull:	1.4
Mean Depth at Bankfull:	1.0
W / D Ratio:	16.0
Entrenchment Ratio:	>5
Bank Height Ratio:	1.0

Stream Type	E/C

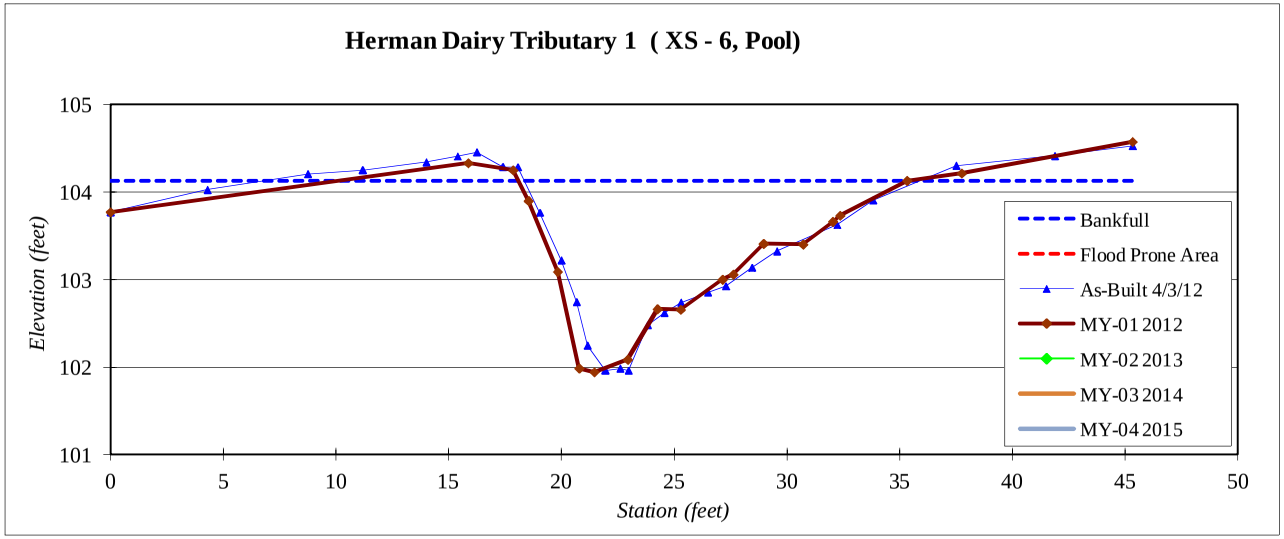


Site Name:	Herman Dairy
Watershed:	30501001120030
XS ID	Tributary 1 (XS - 6, Pool)
Drainage Area (sq mi):	1.01
Date:	4/3/2012
Field Crew:	Perkinson, Thomas

Station	Elevation
45.3	104.6
37.7	104.2
35.3	104.1
32.4	103.7
32.0	103.7
30.7	103.4
29.0	103.4
27.6	103.1
27.1	103.0
25.3	102.7
24.3	102.7
22.9	102.1
21.5	101.9
20.8	102.0
19.8	103.1
18.5	103.9
17.9	104.2
15.9	104.3
0.0	103.8

SUMMARY DATA	
Bankfull Elevation:	104.1
Bankfull Cross-Sectional Area:	17.7
Bankfull Width:	17.2
Flood Prone Area Elevation:	-
Flood Prone Width:	-
Max Depth at Bankfull:	2.2
Mean Depth at Bankfull:	1.0
W / D Ratio:	-
Entrenchment Ratio:	-
Bank Height Ratio:	-

Stream Type	E/C

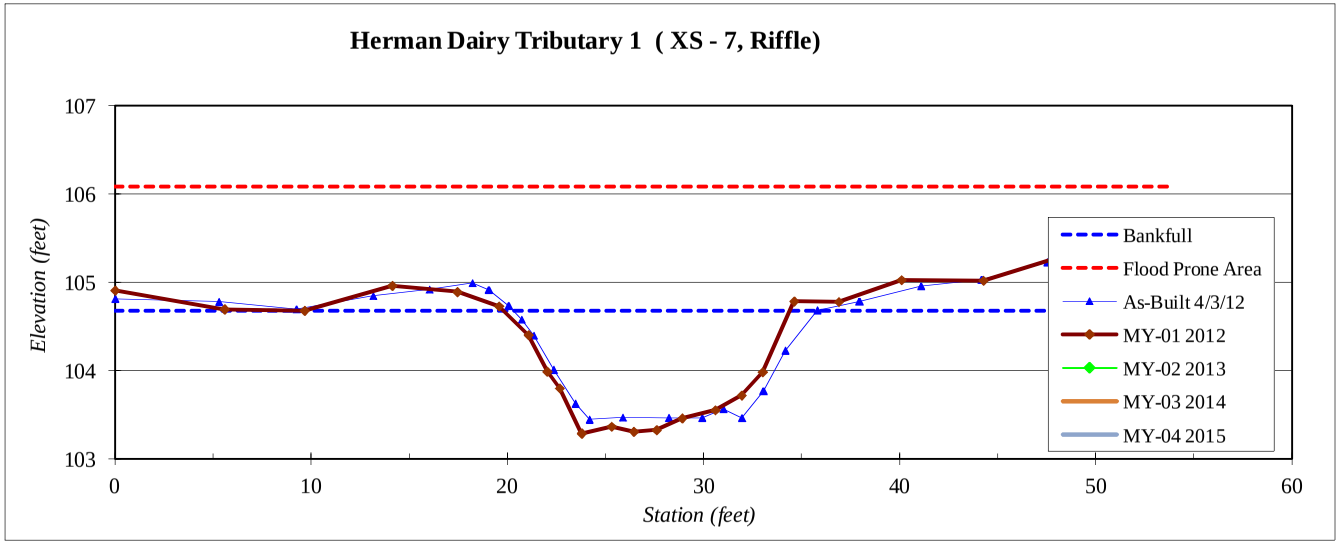


Site Name:	Herman Dairy
Watershed:	30501001120030
XS ID	Tributary 1 (XS - 7, Riffle)
Drainage Area (sq mi):	1.01
Date:	4/3/2012
Field Crew:	Perkinson, Thomas

Station	Elevation
0.0	104.9
5.6	104.7
9.7	104.7
14.1	105.0
17.4	104.9
19.6	104.7
21.1	104.4
22.0	104.0
22.7	103.8
23.8	103.3
25.3	103.4
26.4	103.3
27.6	103.3
28.9	103.46
30.6	103.55
31.9	103.72
33.0	103.98
34.6	104.78
36.9	104.78
40.1	105.03
44.3	105.02
47.9	105.27
54.0	105.27

SUMMARY DATA	
Bankfull Elevation:	104.7
Bankfull Cross-Sectional Area:	14.0
Bankfull Width:	14.6
Flood Prone Area Elevation:	106.1
Flood Prone Width:	>80
Max Depth at Bankfull:	1.4
Mean Depth at Bankfull:	1.0
W / D Ratio:	15.2
Entrenchment Ratio:	>5
Bank Height Ratio:	1.0

Stream Type	E/C

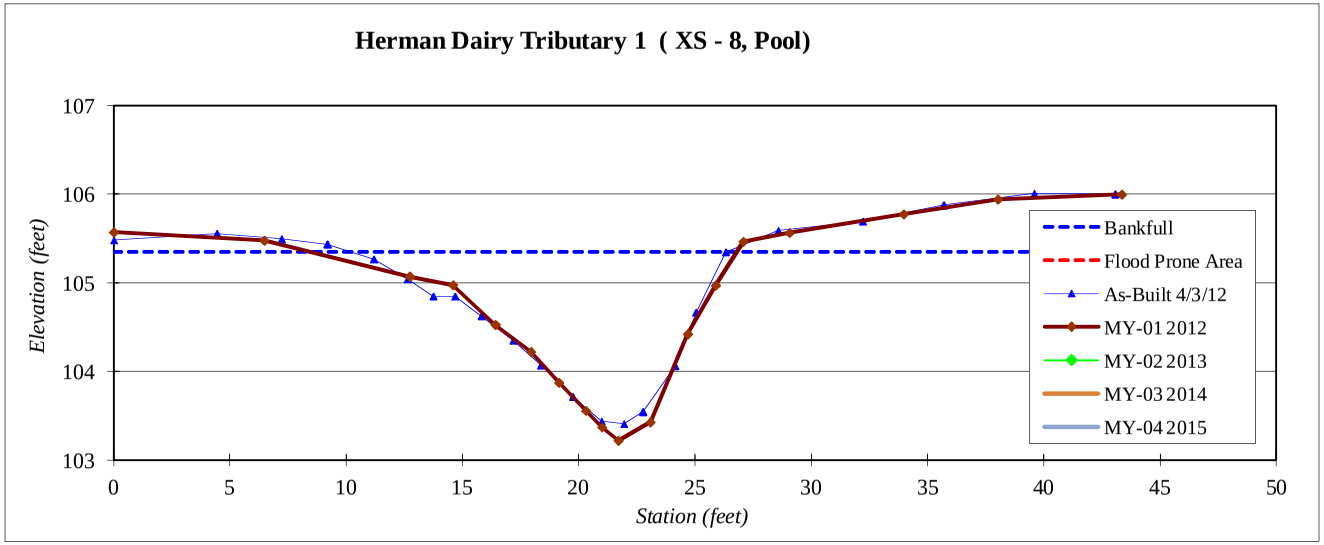


Site Name:	Herman Dairy
Watershed:	30501001120030
XS ID	Tributary 1 (XS - 8, Pool)
Drainage Area (sq mi):	1.01
Date:	4/3/2012
Field Crew:	Perkinson, Thomas

Station	Elevation
0.0	105.6
6.5	105.5
12.7	105.1
14.6	105.0
16.4	104.5
18.0	104.2
19.1	103.9
20.3	103.6
21.0	103.4
21.7	103.2
23.1	103.4
24.7	104.4
25.9	105.0
27.1	105.47
29.1	105.56
34.0	105.78
38.0	105.94
43.3	106.00

SUMMARY DATA	
Bankfull Elevation:	105.4
Bankfull Cross-Sectional Area:	16.0
Bankfull Width:	18.4
Flood Prone Area Elevation:	-
Flood Prone Width:	-
Max Depth at Bankfull:	2.1
Mean Depth at Bankfull:	0.9
W / D Ratio:	-
Entrenchment Ratio:	-
Bank Height Ratio:	-

Stream Type	E/C

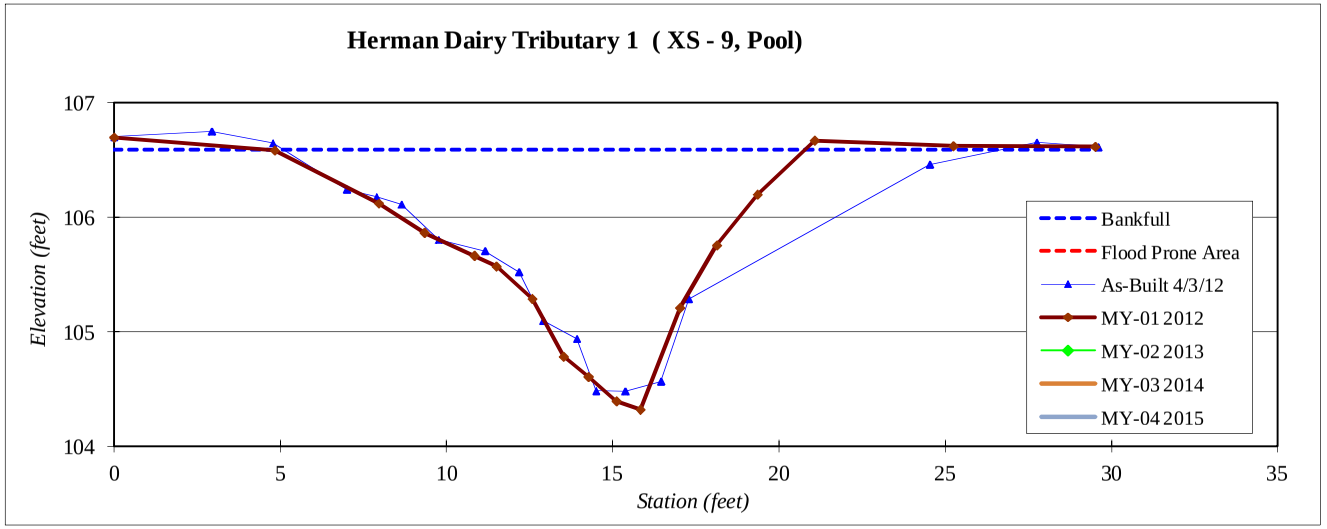


Site Name:	Herman Dairy
Watershed:	30501001120030
XS ID	Tributary 1 (XS - 9, Pool)
Drainage Area (sq mi):	1.01
Date:	4/3/2012
Field Crew:	Perkinson, Thomas

Station	Elevation
0.0	106.7
4.8	106.6
8.0	106.1
9.3	105.9
10.8	105.7
11.5	105.6
12.6	105.3
13.5	104.8
14.3	104.6
15.1	104.4
15.8	104.3
17.0	105.2
18.1	105.8
19.3	106.20
21.1	106.67
25.2	106.62
29.5	106.62

SUMMARY DATA	
Bankfull Elevation:	106.6
Bankfull Cross-Sectional Area:	15.4
Bankfull Width:	16.2
Flood Prone Area Elevation:	-
Flood Prone Width:	-
Max Depth at Bankfull:	2.3
Mean Depth at Bankfull:	1.0
W / D Ratio:	-
Entrenchment Ratio:	-
Bank Height Ratio:	-

Stream Type	E/C

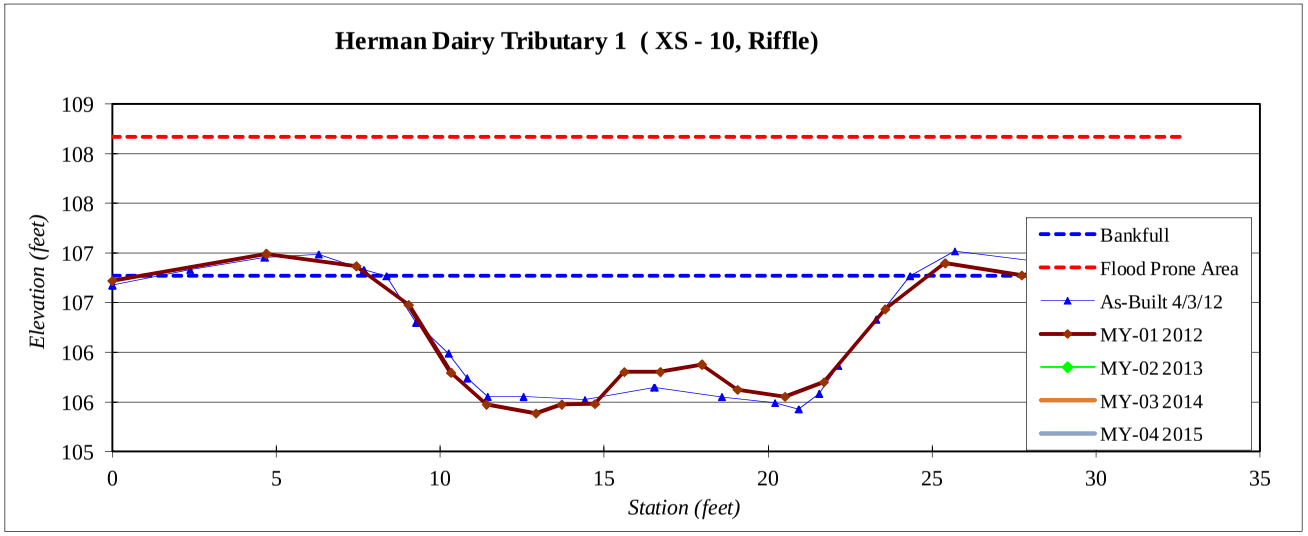


Site Name:	Herman Dairy
Watershed:	30501001120030
XS ID	Tributary 1 (XS - 10, Riffle)
Drainage Area (sq mi):	1.01
Date:	4/3/2012
Field Crew:	Perkinson, Thomas

Station	Elevation
0.0	106.7
4.7	107.0
7.4	106.9
9.0	106.5
10.3	105.8
11.4	105.5
12.9	105.4
13.7	105.5
14.7	105.5
15.6	105.8
16.7	105.8
18.0	105.9
19.1	105.6
20.5	105.55
21.7	105.70
23.6	106.43
25.4	106.90
27.7	106.77
32.6	106.99

SUMMARY DATA	
Bankfull Elevation:	106.8
Bankfull Cross-Sectional Area:	15.6
Bankfull Width:	17.0
Flood Prone Area Elevation:	108.2
Flood Prone Width:	>80
Max Depth at Bankfull:	1.4
Mean Depth at Bankfull:	0.9
W / D Ratio:	18.5
Entrenchment Ratio:	>5
Bank Height Ratio:	1.0

Stream Type	E/C

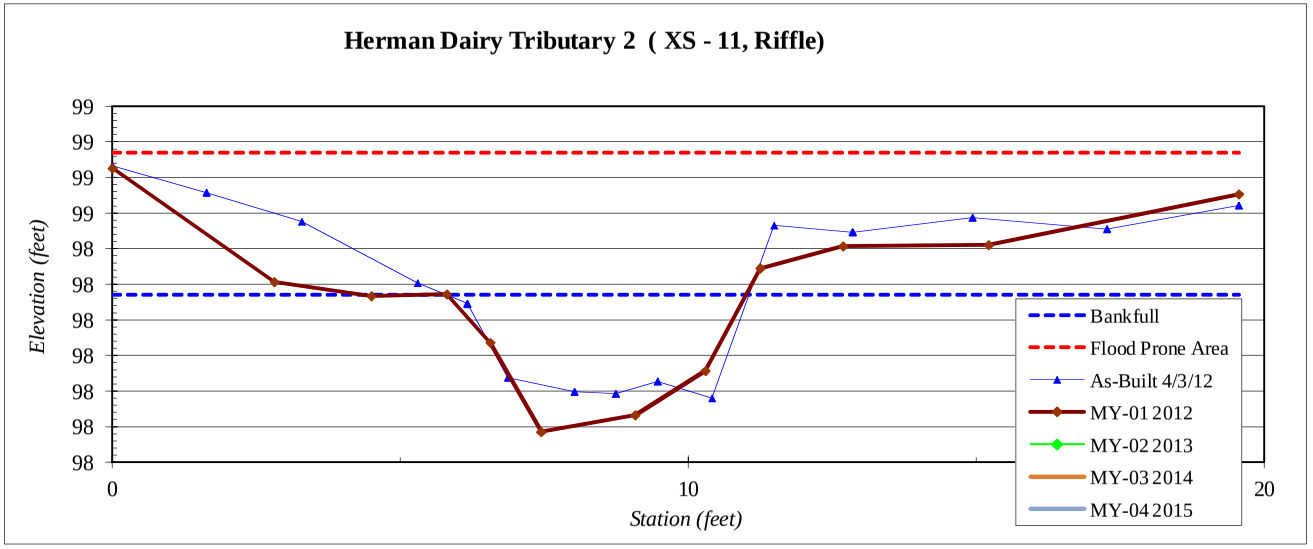


Site Name:	Herman Dairy
Watershed:	30501001120030
XS ID	Tributary 2 (XS - 11, Riffle)
Drainage Area (sq mi):	1.01
Date:	4/3/2012
Field Crew:	Perkinson, Thomas

Station	Elevation
0.0	98.6
2.8	98.3
4.5	98.3
5.8	98.3
6.6	98.1
7.4	97.9
9.1	97.9
10.3	98.1
11.2	98.3
12.7	98.4
15.2	98.4
19.6	98.6
14.9	98.5
17.3	98.46
19.6	98.52

SUMMARY DATA	
Bankfull Elevation:	98.3
Bankfull Cross-Sectional Area:	1.3
Bankfull Width:	5.2
Flood Prone Area Elevation:	98.7
Flood Prone Width:	>80
Max Depth at Bankfull:	0.4
Mean Depth at Bankfull:	0.3
W / D Ratio:	20.8
Entrenchment Ratio:	>5
Bank Height Ratio:	1.0

Stream Type	E/C

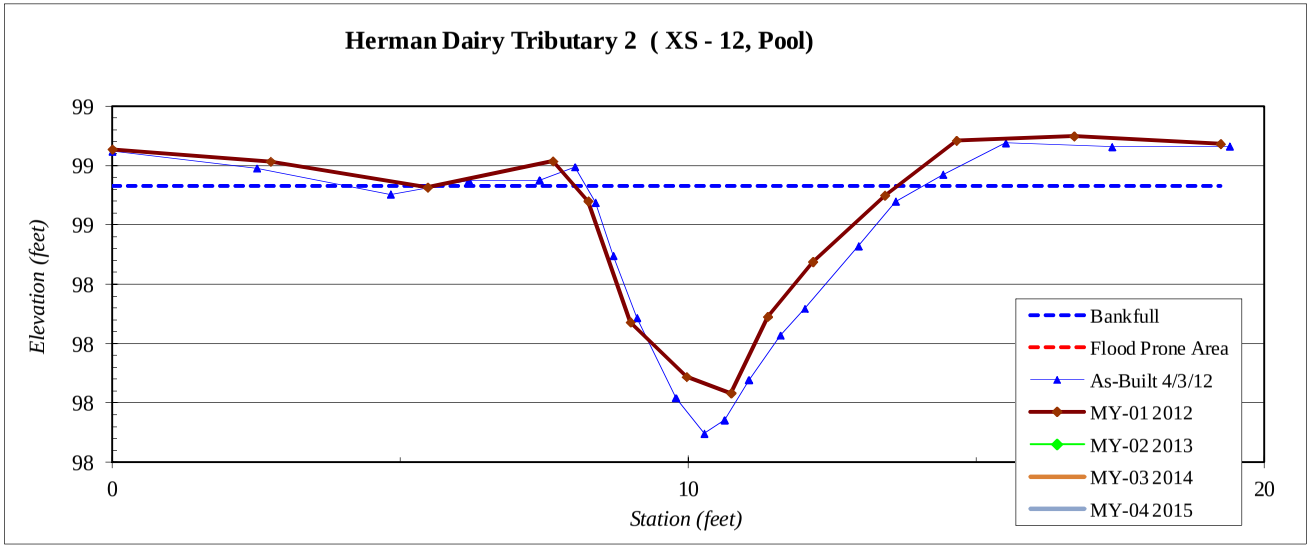


Site Name:	Herman Dairy
Watershed:	30501001120030
XS ID	Tributary 2 (XS - 12, Pool)
Drainage Area (sq mi):	1.01
Date:	4/3/2012
Field Crew:	Perkinson, Thomas

Station	Elevation
0.0	98.9
2.7	98.8
5.5	98.7
7.7	98.8
8.3	98.7
9.0	98.3
10.0	98.1
10.7	98.0
11.4	98.3
12.2	98.5
13.4	98.7
14.7	98.9
16.7	98.9
19.2	98.87

SUMMARY DATA	
Bankfull Elevation:	98.7
Bankfull Cross-Sectional Area:	2.1
Bankfull Width:	5.8
Flood Prone Area Elevation:	-
Flood Prone Width:	-
Max Depth at Bankfull:	0.7
Mean Depth at Bankfull:	0.4
W / D Ratio:	-
Entrenchment Ratio:	-
Bank Height Ratio:	-

Stream Type	E/C

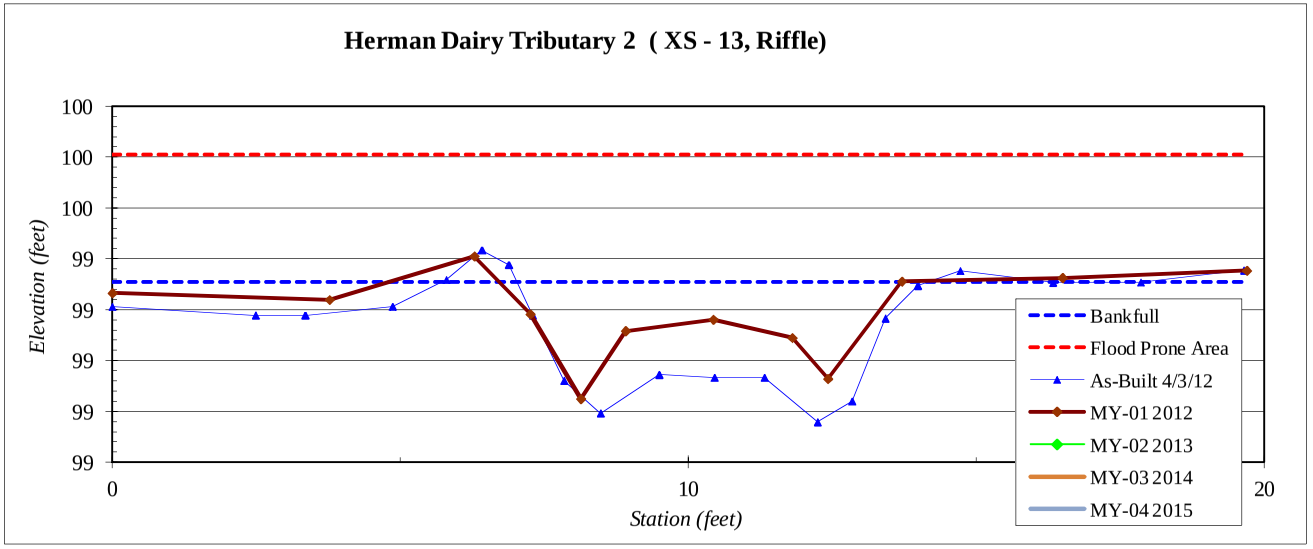


Site Name:	Herman Dairy
Watershed:	30501001120030
XS ID	Tributary 2 (XS - 13, Riffle)
Drainage Area (sq mi):	1.01
Date:	4/3/2012
Field Crew:	Perkinson, Thomas

Station	Elevation
0.0	99.3
3.8	99.2
6.3	99.4
7.3	99.2
8.1	98.8
8.9	99.1
10.4	99.2
11.8	99.1
12.4	98.9
13.7	99.3
16.5	99.3
19.7	99.4

SUMMARY DATA	
Bankfull Elevation:	99.3
Bankfull Cross-Sectional Area:	1.5
Bankfull Width:	7.0
Flood Prone Area Elevation:	99.8
Flood Prone Width:	>80
Max Depth at Bankfull:	0.5
Mean Depth at Bankfull:	0.2
W / D Ratio:	32.7
Entrenchment Ratio:	>5
Bank Height Ratio:	1.0

Stream Type	E/C

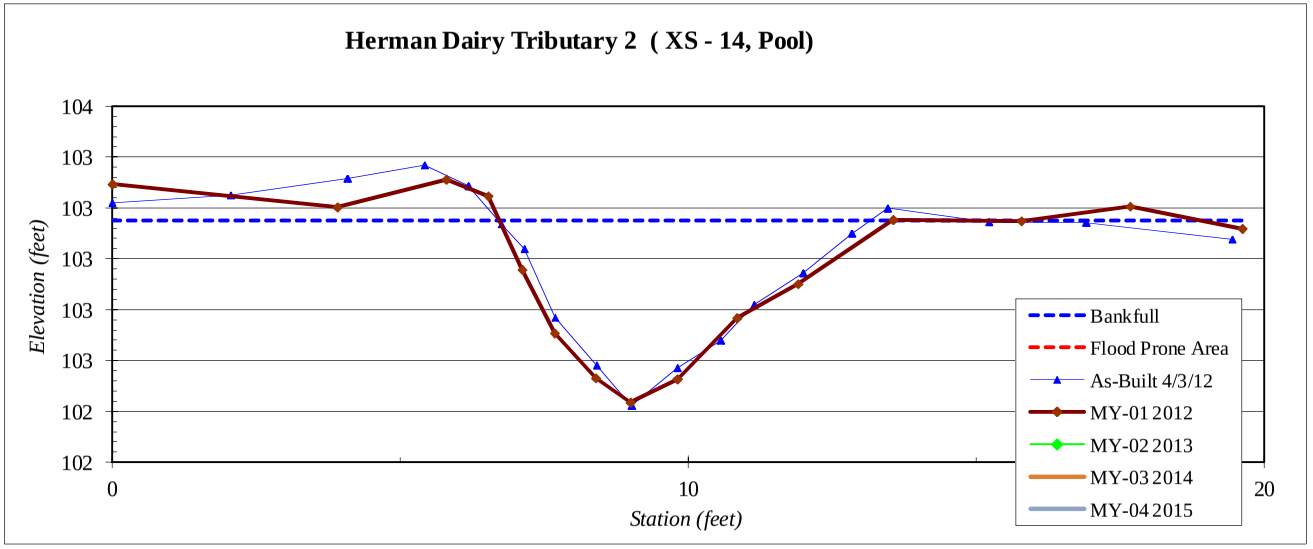


Site Name:	Herman Dairy
Watershed:	30501001120030
XS ID	Tributary 2 (XS - 14, Pool)
Drainage Area (sq mi):	1.01
Date:	4/3/2012
Field Crew:	Perkinson, Thomas

Station	Elevation
0.0	103.3
3.9	103.2
5.8	103.3
6.5	103.2
7.1	103.0
7.7	102.7
8.4	102.5
9.0	102.4
9.8	102.5
10.8	102.8
11.9	102.9
13.6	103.2
15.8	103.1
17.7	103.21
19.6	103.12

SUMMARY DATA	
Bankfull Elevation:	103.2
Bankfull Cross-Sectional Area:	2.6
Bankfull Width:	6.8
Flood Prone Area Elevation:	-
Flood Prone Width:	-
Max Depth at Bankfull:	0.7
Mean Depth at Bankfull:	0.4
W / D Ratio:	-
Entrenchment Ratio:	-
Bank Height Ratio:	-

Stream Type	E/C

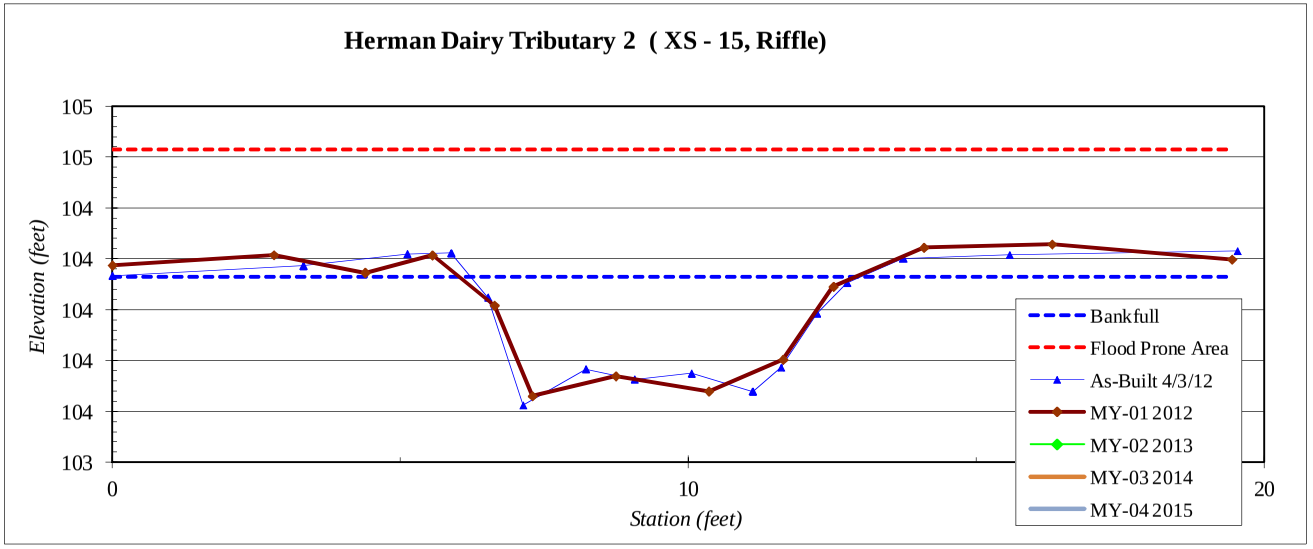


Site Name:	Herman Dairy
Watershed:	30501001120030
XS ID	Tributary 2 (XS - 15, Riffle)
Drainage Area (sq mi):	1.01
Date:	4/3/2012
Field Crew:	Perkinson, Thomas

Station	Elevation
0.0	104.2
2.8	104.2
4.4	104.1
5.6	104.2
6.6	104.0
7.3	103.7
8.7	103.7
10.4	103.7
11.6	103.8
12.5	104.1
14.1	104.2
16.3	104.3
19.4	104.2

SUMMARY DATA	
Bankfull Elevation:	104.1
Bankfull Cross-Sectional Area:	2.2
Bankfull Width:	6.9
Flood Prone Area Elevation:	104.6
Flood Prone Width:	>80
Max Depth at Bankfull:	0.5
Mean Depth at Bankfull:	0.3
W / D Ratio:	21.6
Entrenchment Ratio:	>5
Bank Height Ratio:	1.0

Stream Type	E/C

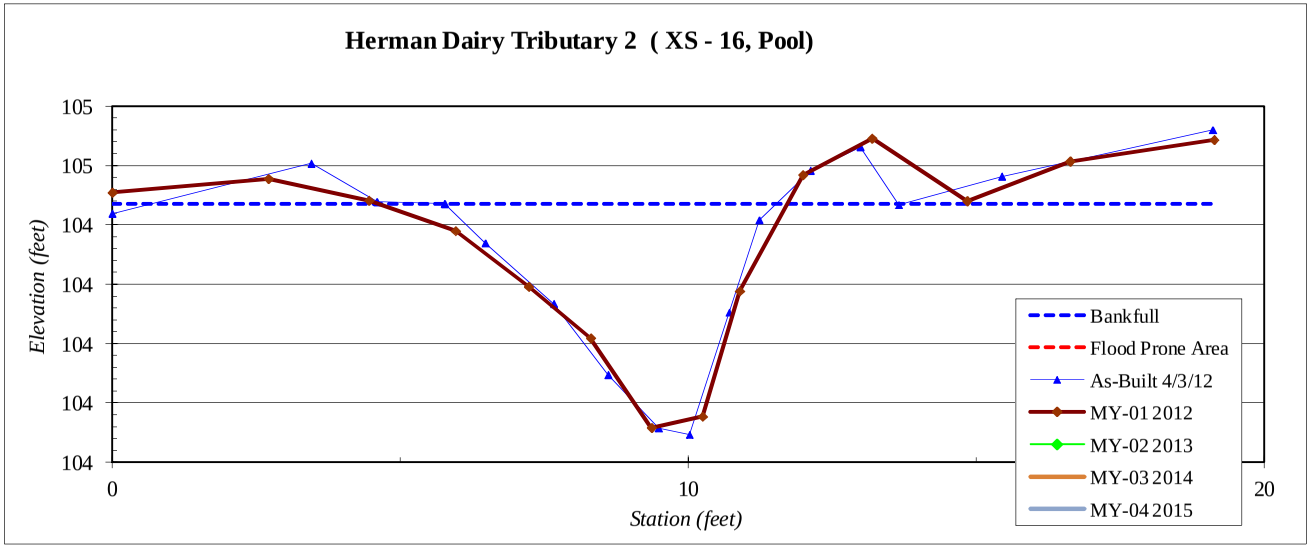


Site Name:	Herman Dairy
Watershed:	30501001120030
XS ID	Tributary 2 (XS - 16, Pool)
Drainage Area (sq mi):	1.01
Date:	4/3/2012
Field Crew:	Perkinson, Thomas

Station	Elevation
0.0	104.5
2.7	104.6
4.5	104.5
6.0	104.4
7.2	104.2
8.3	104.0
9.4	103.7
10.2	103.8
10.9	104.2
12.0	104.6
13.2	104.7
14.8	104.5
16.6	104.6
19.1	104.69

SUMMARY DATA	
Bankfull Elevation:	104.5
Bankfull Cross-Sectional Area:	2.4
Bankfull Width:	7.1
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

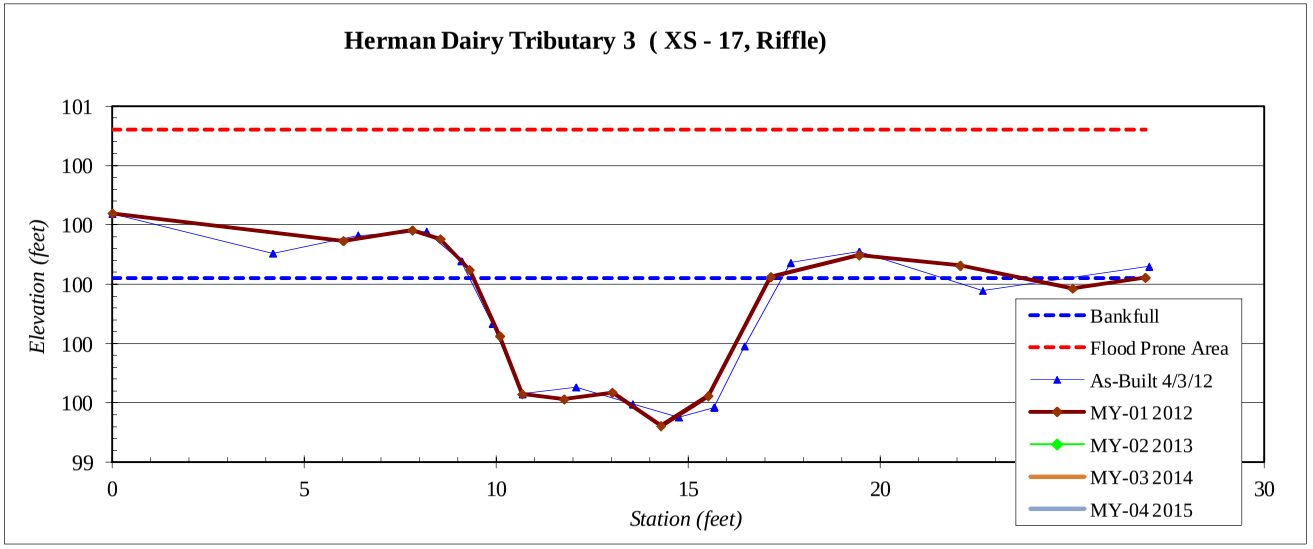


Site Name:	Herman Dairy
Watershed:	30501001120030
XS ID	Tributary 3 (XS - 17, Riffle)
Drainage Area (sq mi):	0.06
Date:	4/3/2012
Field Crew:	Perkinson, Thomas

Station	Elevation
0.0	100.2
6.0	100.1
7.8	100.2
8.5	100.2
9.3	100.0
10.1	99.8
10.7	99.6
11.8	99.6
13.0	99.6
14.3	99.5
15.5	99.6
17.1	100.0
19.4	100.1
22.1	100.06
25.0	99.99
26.9	100.02

SUMMARY DATA	
Bankfull Elevation:	100.0
Bankfull Cross-Sectional Area:	2.6
Bankfull Width:	7.7
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:	22.8
Entrenchment Ratio:	>5
Bank Height Ratio:	1.0

Stream Type	E/C

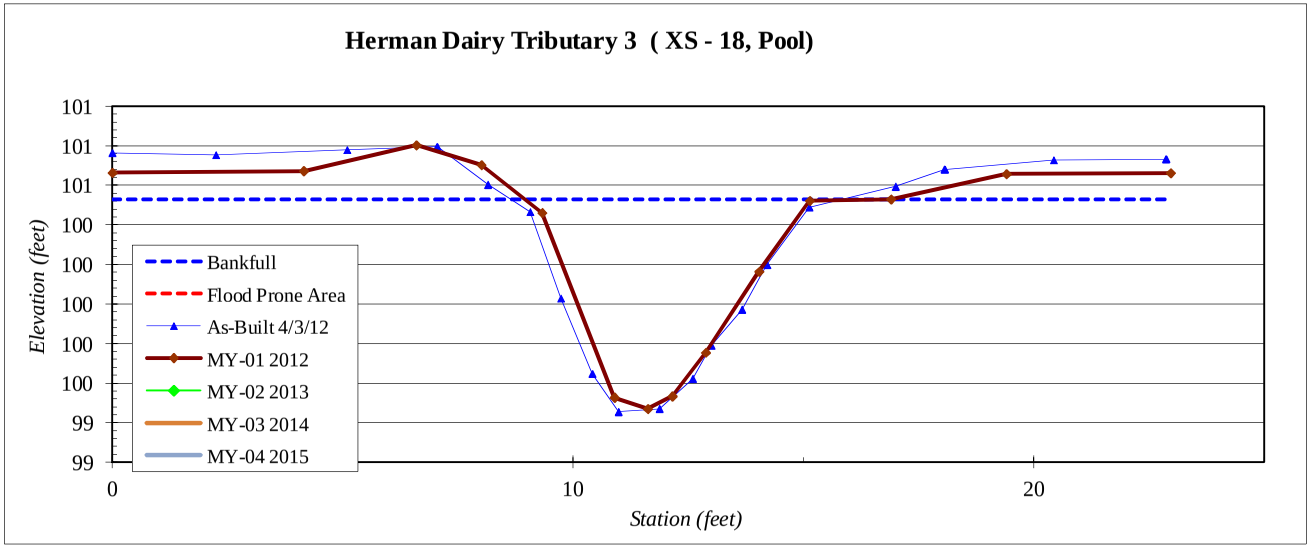


Site Name:	Herman Dairy
Watershed:	30501001120030
XS ID	Tributary 3 (XS - 18, Pool)
Drainage Area (sq mi):	0.06
Date:	4/3/2012
Field Crew:	Perkinson, Thomas

Station	Elevation
0.0	100.7
4.2	100.7
6.6	100.8
8.0	100.7
9.3	100.5
10.9	99.5
11.6	99.5
12.2	99.5
12.9	99.8
14.0	100.2
15.1	100.5
16.9	100.5
19.4	100.7
23.0	100.66

SUMMARY DATA	
Bankfull Elevation:	100.5
Bankfull Cross-Sectional Area:	3.7
Bankfull Width:	6.2
Flood Prone Area Elevation:	-
Flood Prone Width:	-
Max Depth at Bankfull:	1.1
Mean Depth at Bankfull:	0.6
W / D Ratio:	-
Entrenchment Ratio:	-
Bank Height Ratio:	-

Stream Type	E/C

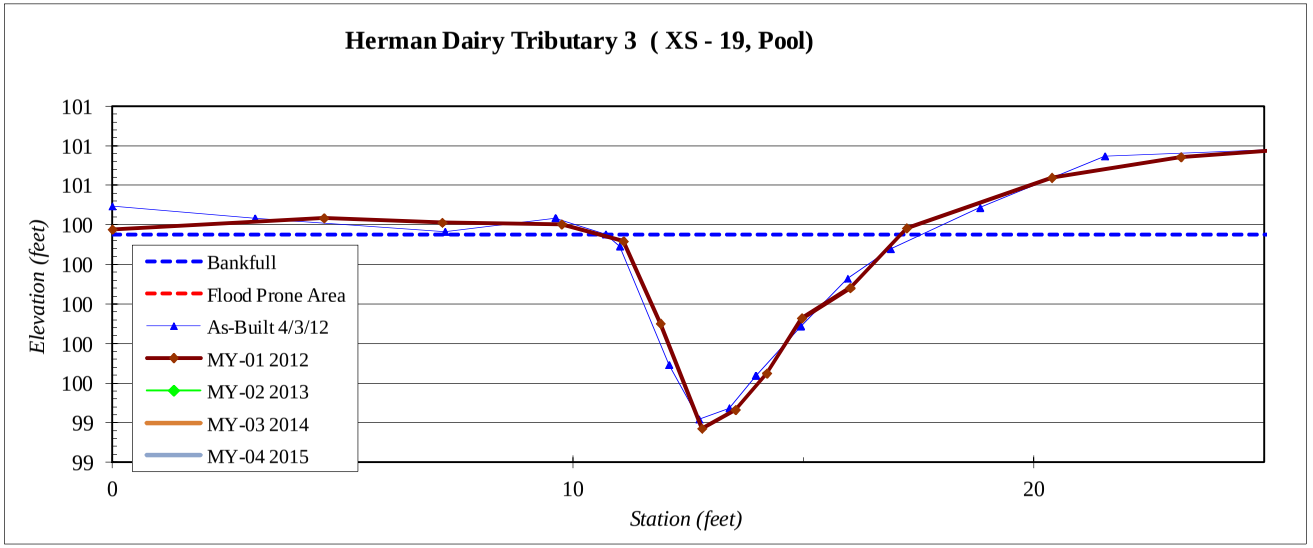


Site Name:	Herman Dairy
Watershed:	30501001120030
XS ID	Tributary 3 (XS - 19, Pool)
Drainage Area (sq mi):	0.06
Date:	4/3/2012
Field Crew:	Perkinson, Thomas

Station	Elevation
0.0	100.4
4.6	100.4
7.2	100.4
9.8	100.4
11.1	100.3
11.9	99.9
12.8	99.4
13.5	99.5
14.2	99.6
15.0	99.9
16.0	100.1
17.2	100.4
20.4	100.6
23.2	100.74
25.9	100.79

SUMMARY DATA	
Bankfull Elevation:	100.4
Bankfull Cross-Sectional Area:	3.0
Bankfull Width:	6.5
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

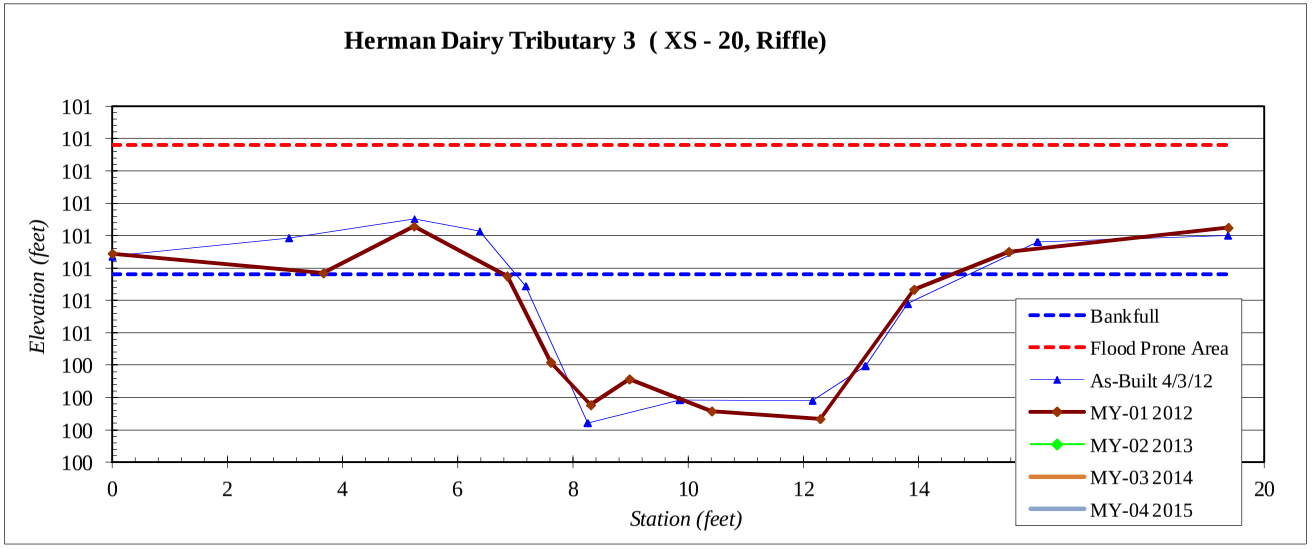


Site Name:	Herman Dairy
Watershed:	30501001120030
XS ID	Tributary 3 (XS - 20, Riffle)
Drainage Area (sq mi):	0.06
Date:	4/3/2012
Field Crew:	Perkinson, Thomas

Station	Elevation
0.0	100.7
3.7	100.7
5.2	100.8
6.9	100.7
7.6	100.4
8.3	100.3
9.0	100.4
10.4	100.3
12.3	100.2
13.9	100.6
15.6	100.8
19.4	100.8

SUMMARY DATA	
Bankfull Elevation:	100.7
Bankfull Cross-Sectional Area:	2.3
Bankfull Width:	7.8
Flood Prone Area Elevation:	101.1
Flood Prone Width:	>80
Max Depth at Bankfull:	0.4
Mean Depth at Bankfull:	0.3
W / D Ratio:	26.5
Entrenchment Ratio:	>5
Bank Height Ratio:	1.0

Stream Type	E/C



Appendix E.
Hydrology Data

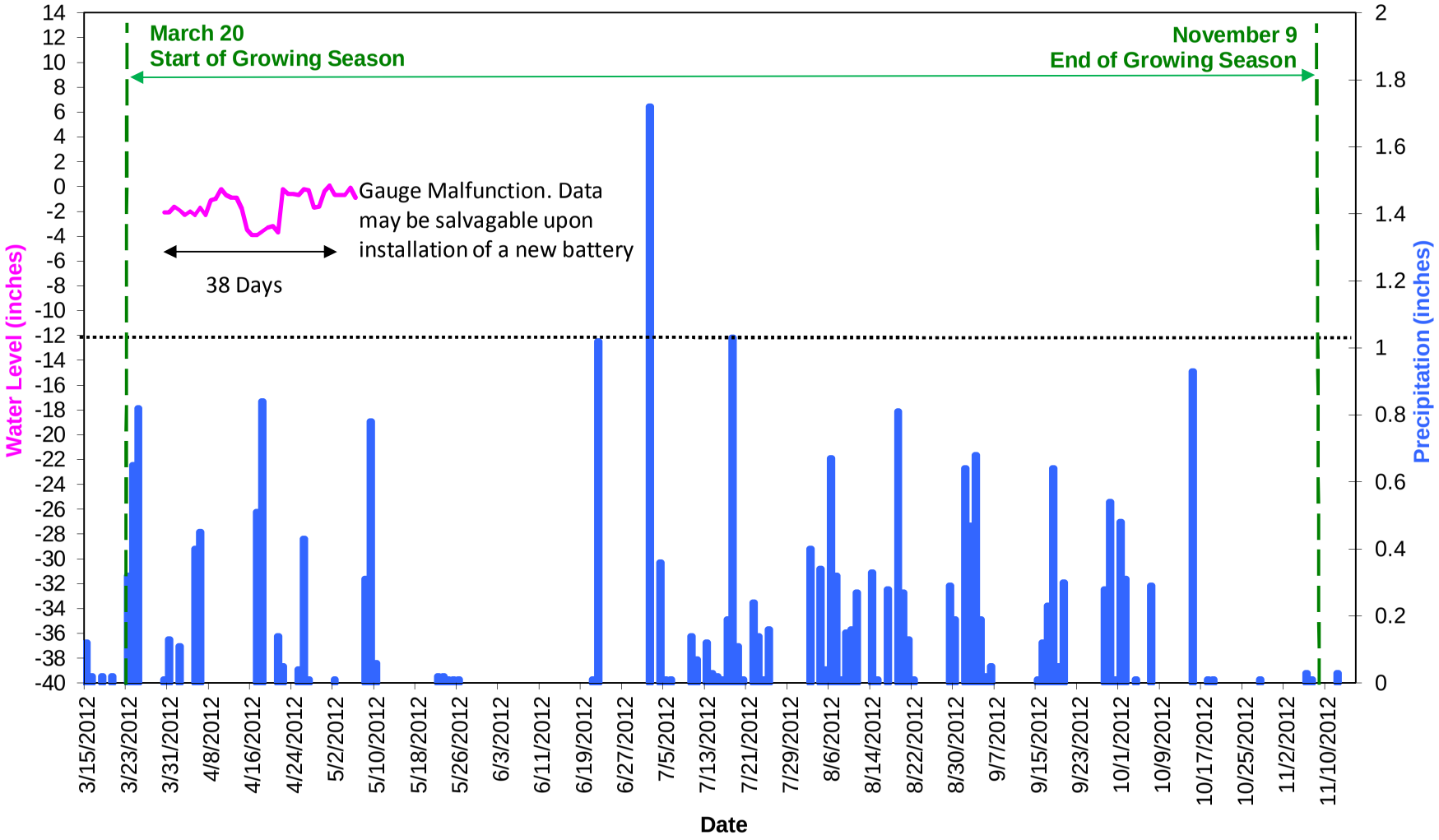
Table 12. Wetland Hydrology Criteria Attainment
2012 Groundwater Gauge Graphs
Figure E1. Annual Climatic Data vs. 30-year Historic Data

Table 12. Wetland Hydrology Criteria Attainment

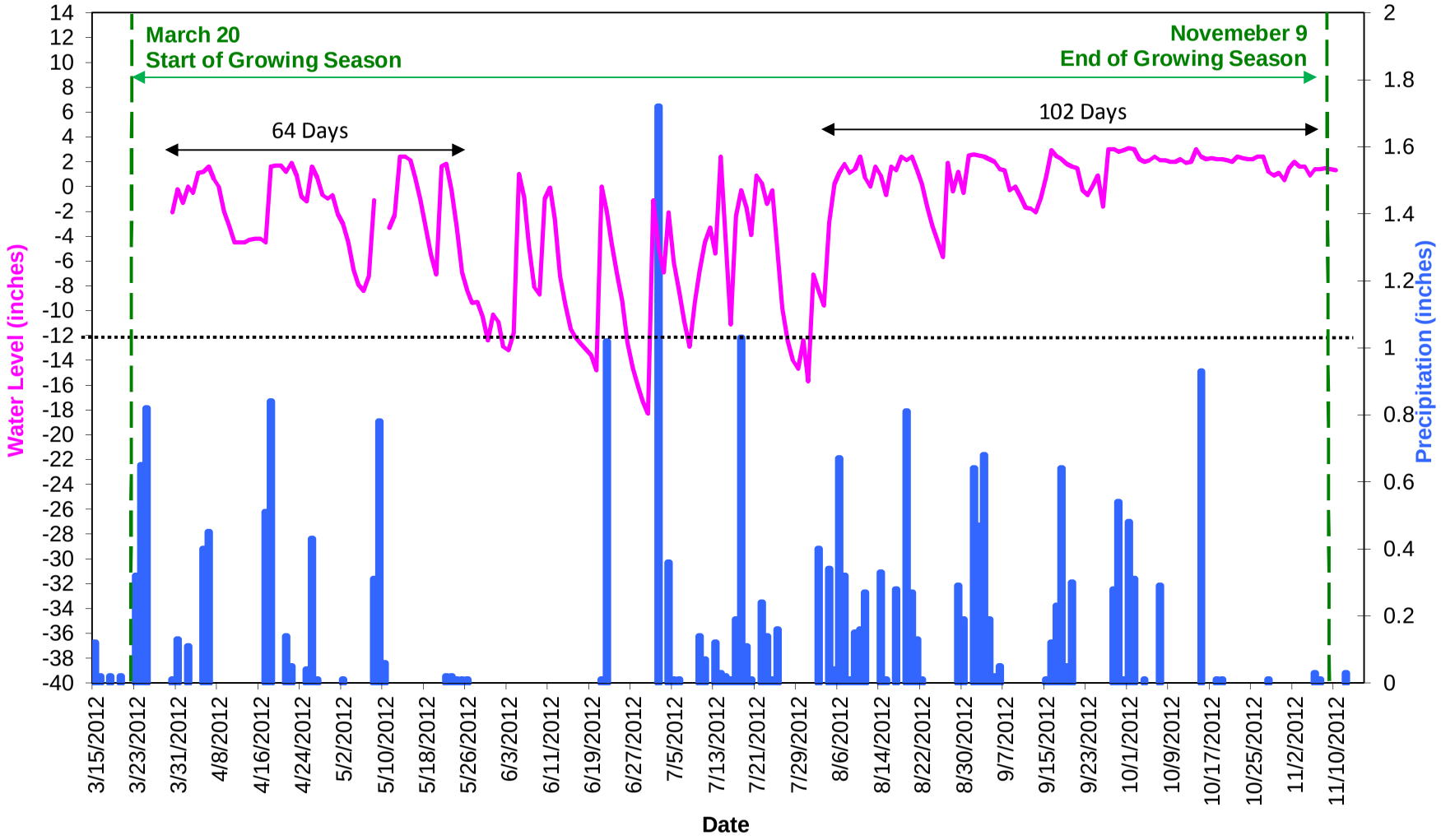
Gauge	Success Criteria Achieved/Max Consecutive Days During Growing Season (Percentage)				
	Year 1 (2012)*	**Year 2 (2013)**	**Year 3 (2014)**	**Year 4 (2015)**	**Year 5 (2016)**
1	Yes/38 days (16.2 percent)				
2	Yes/64 days (27.2 percent)				
3	Yes/182 days (77.4 percent)				
4	Yes/183 days (77.9 percent)				
5	Yes/87 days (37.0 percent)				
6	Yes/86 days (36.6 percent)				
7	Yes/192 days (81.7 percent)				
8	Yes/178 days (75.7 percent)				
9	Yes/19 days (8.1 percent)				
10	Yes/102 days (43.4 percent)				
Ref	Yes/148 days (62.9 percent)				

*Data has been collected through October 15, 2012 for the Year 1 (2012) monitoring season; data will continue to be collected throughout the remainder of the growing season and will be available upon request.

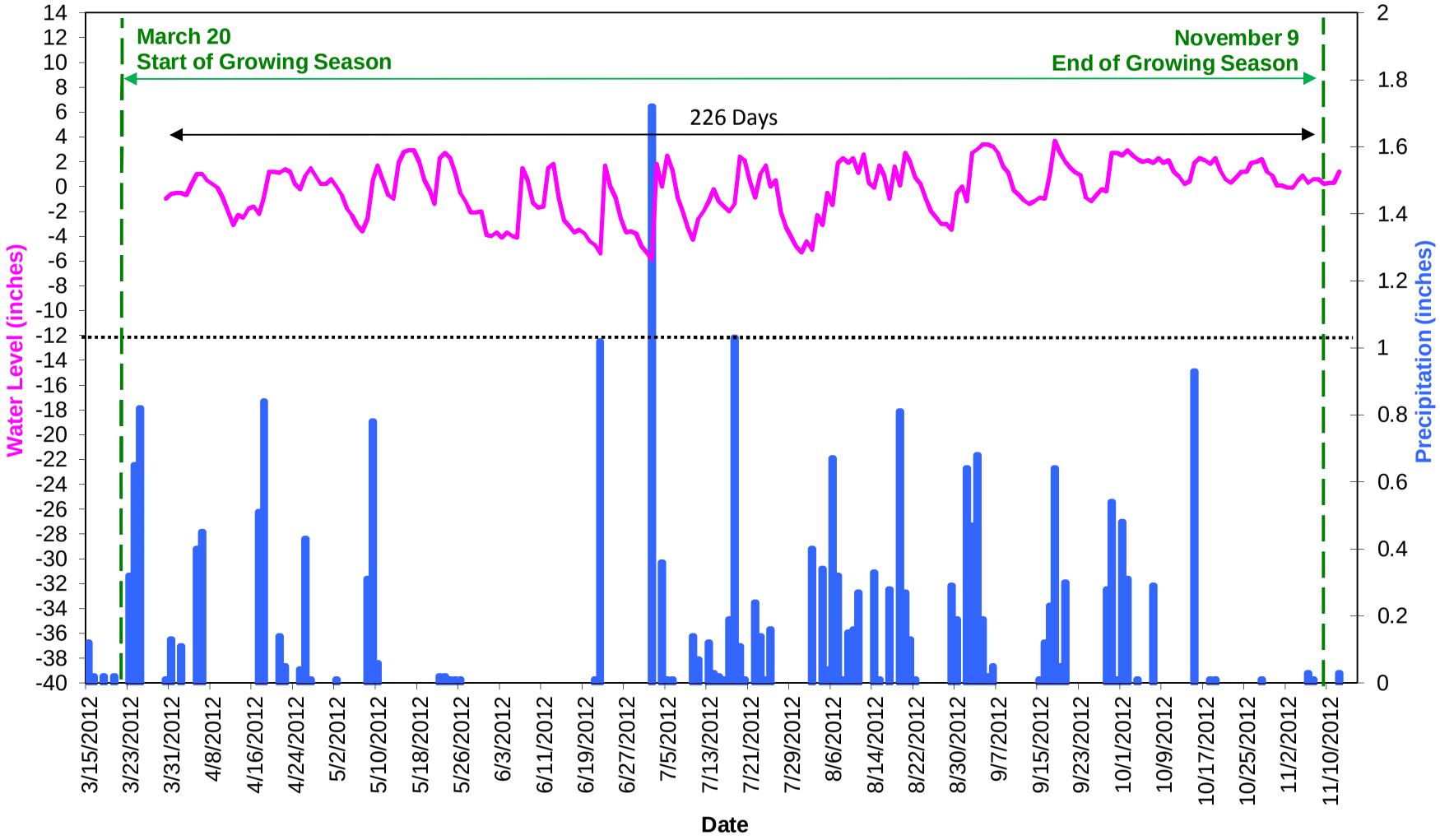
Herman Dairy Groundwater Gauge 1
Year 1 (2012 Gauge Data)



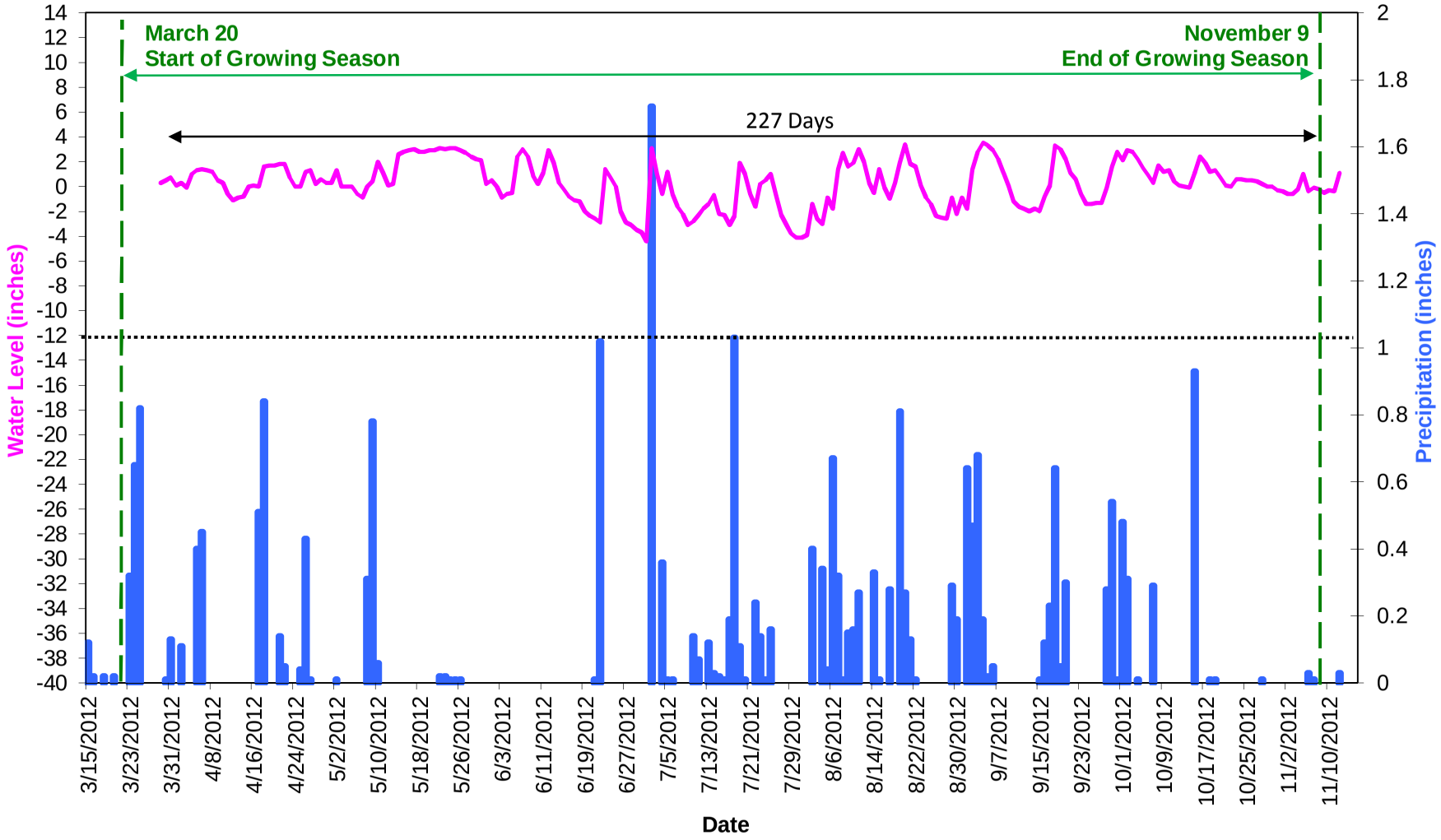
Herman Dairy Groundwater Gauge 2
Year 1 (2012 Gauge Data)



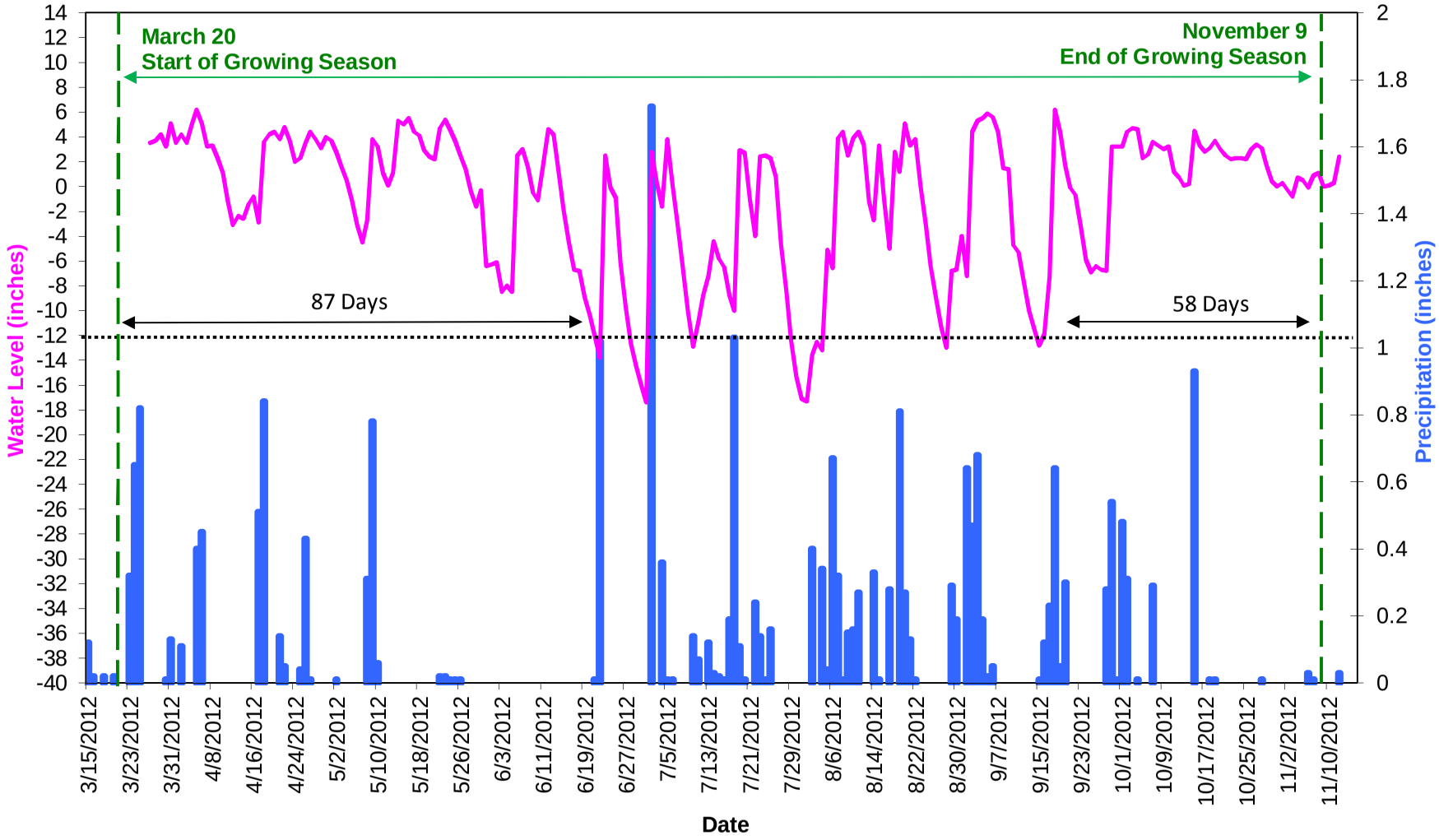
Herman Dairy Groundwater Gauge 3
Year 1 (2012 Gauge Data)



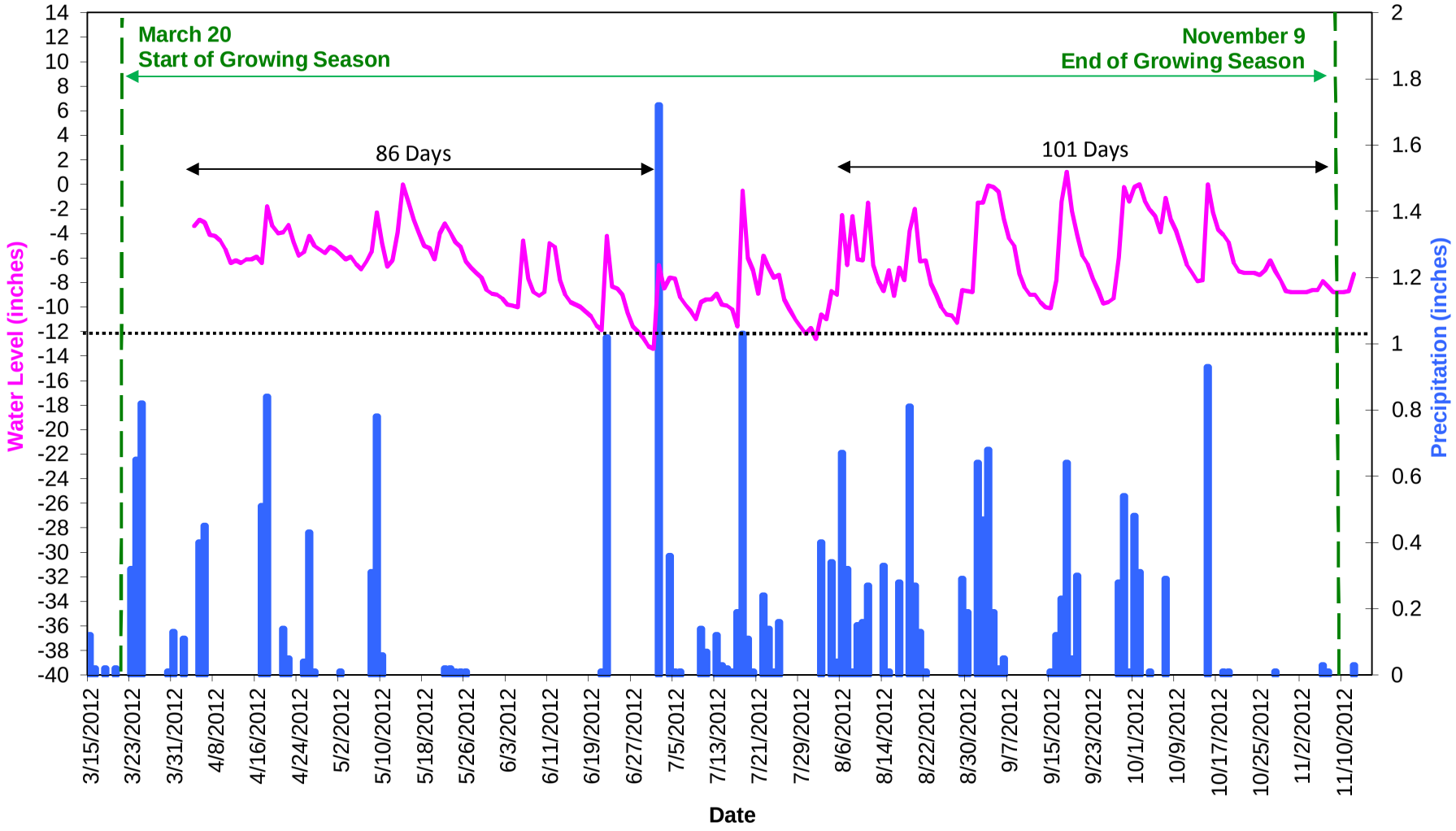
Herman Dairy Groundwater Gauge 4
Year 1 (2012 Gauge Data)



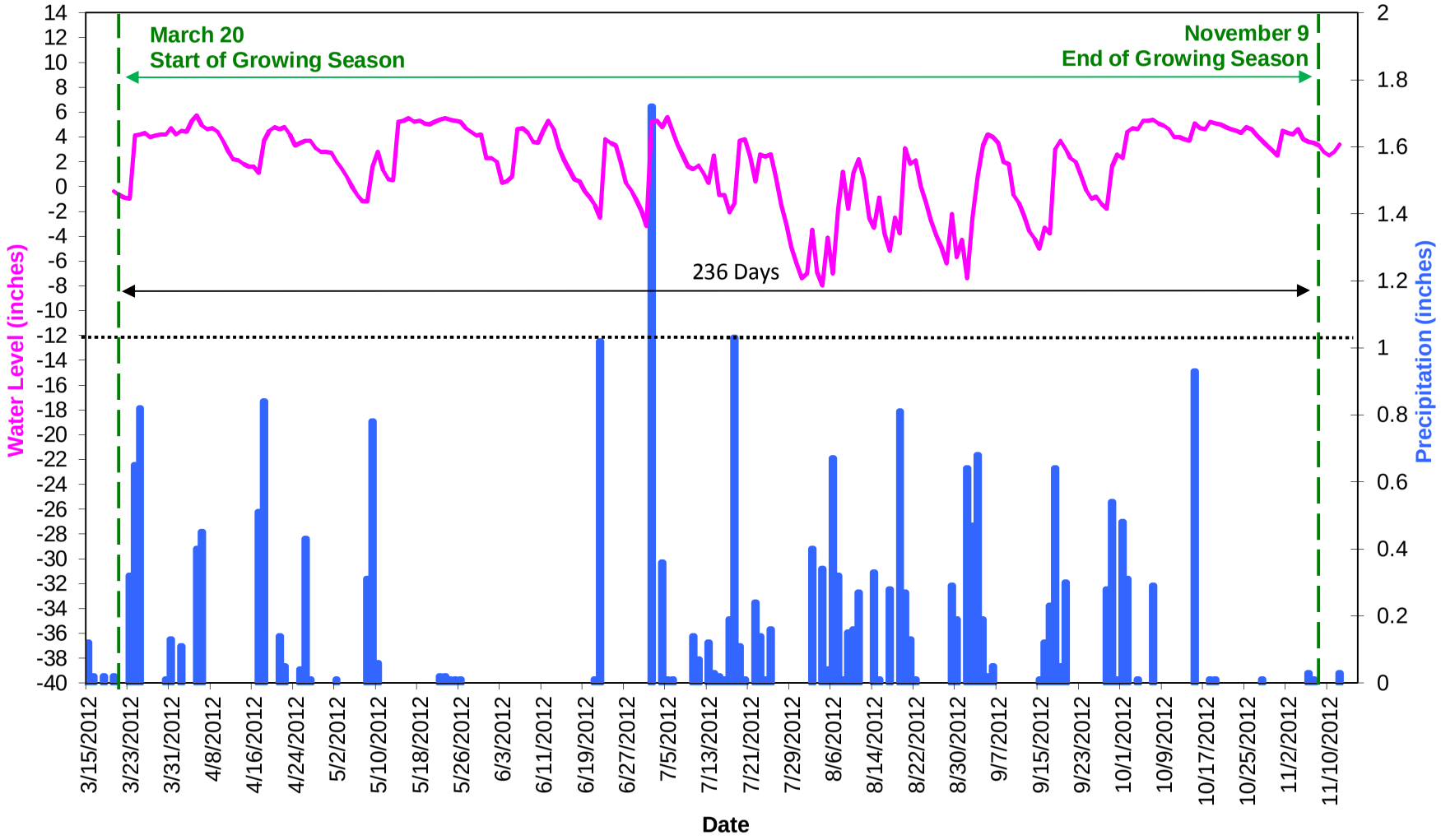
Herman Dairy Groundwater Gauge 5
Year 1 (2012 Gauge Data)



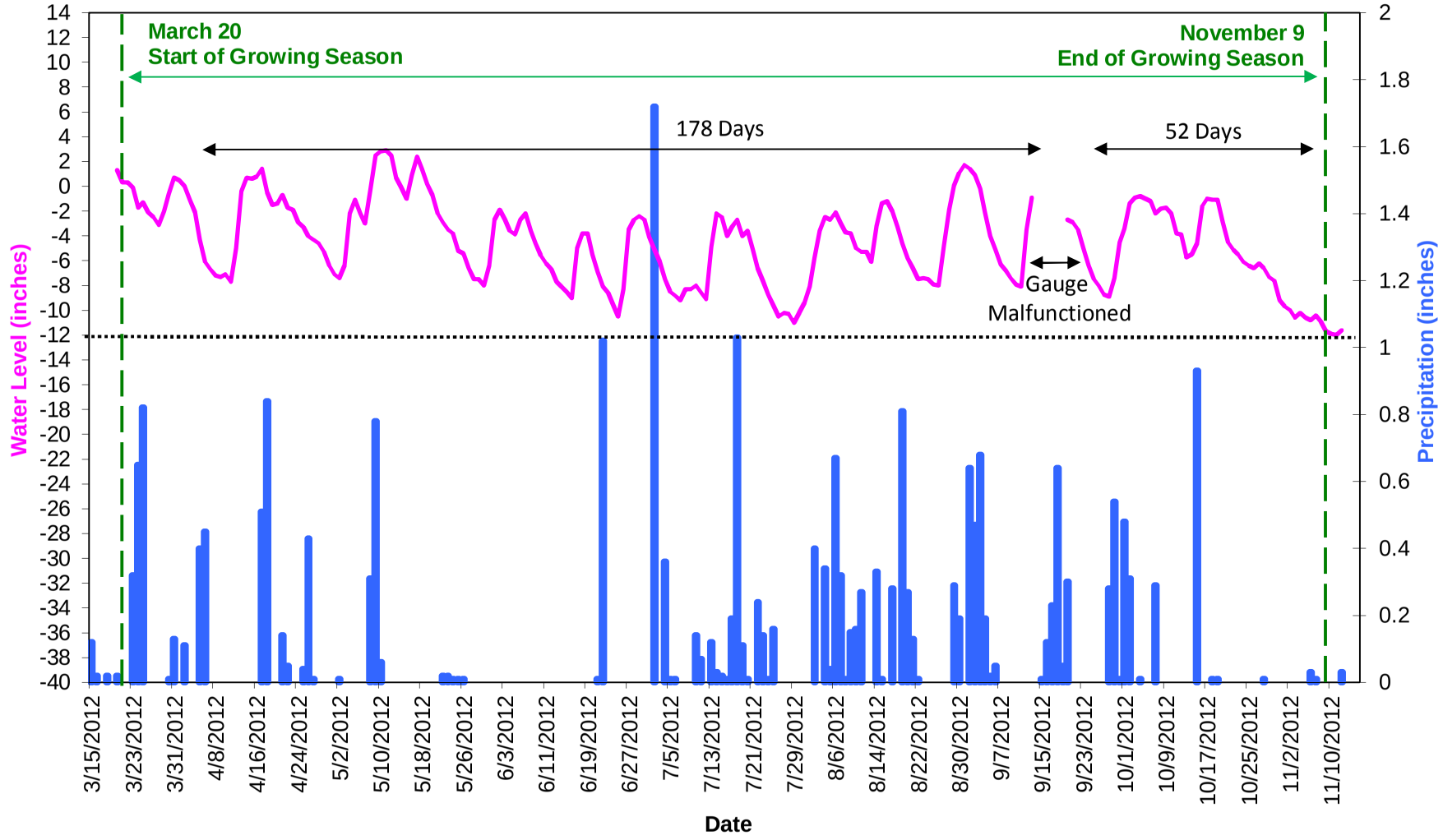
Herman Dairy Groundwater Gauge 6
Year 1 (2012 Gauge Data)



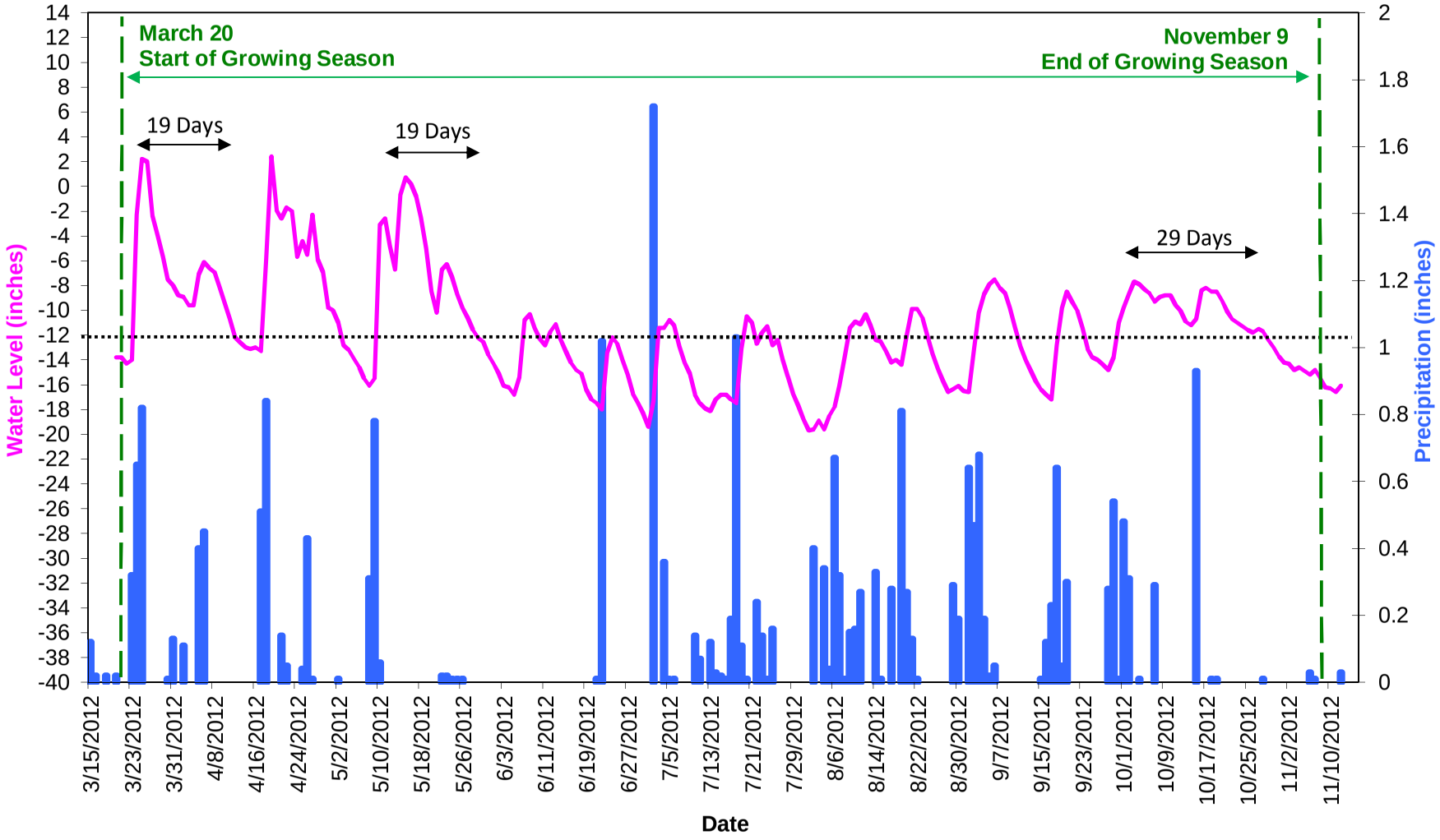
Herman Dairy Groundwater Gauge 7
Year 1 (2012 Gauge Data)



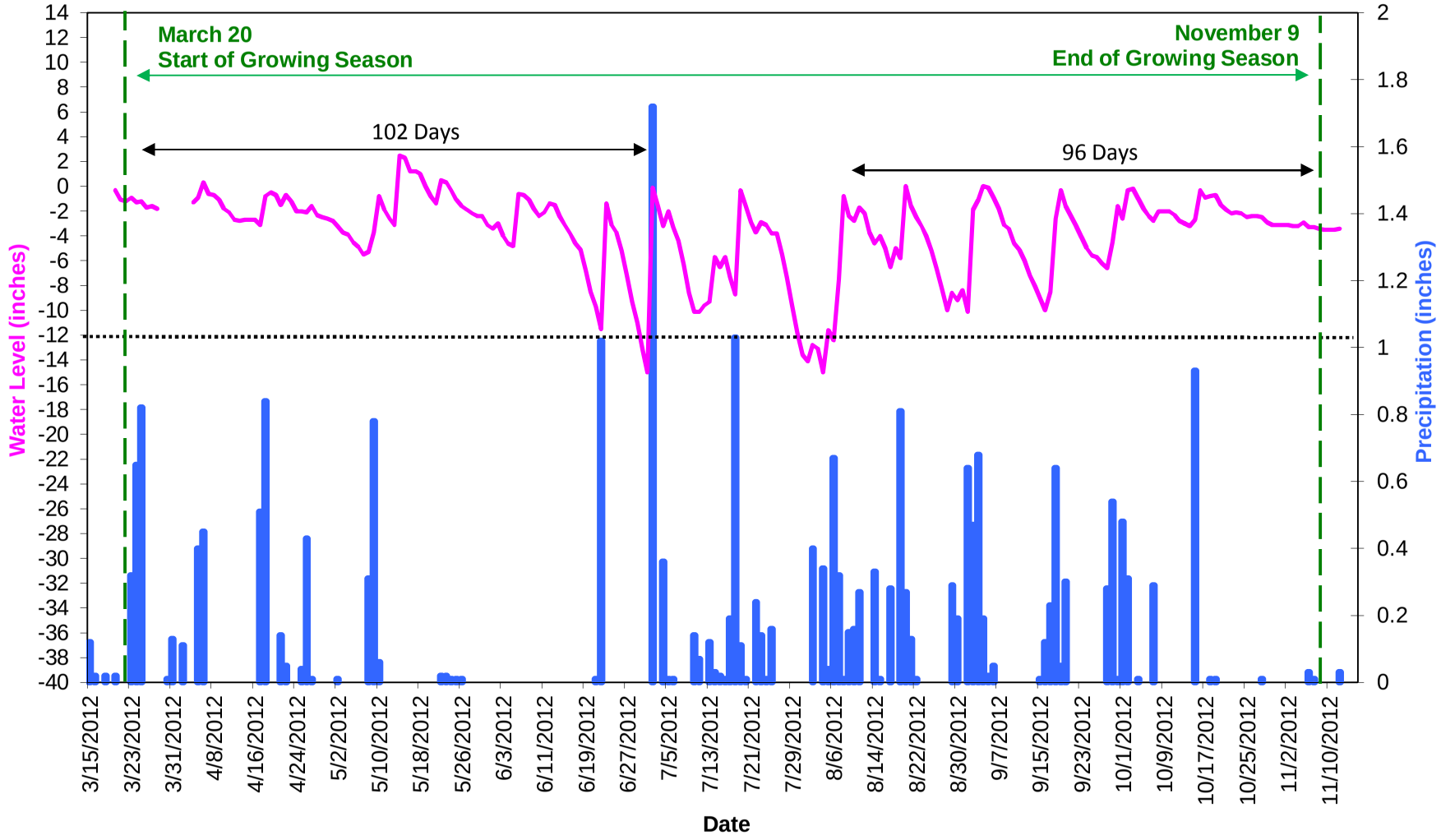
Herman Dairy Groundwater Gauge 8
Year 1 (2012 Gauge Data)



Herman Dairy Groundwater Gauge 9
Year 1 (2012 Gauge Data)



Herman Dairy Groundwater Gauge 10
Year 1 (2012 Gauge Data)



Herman Dairy Groundwater Reference Gauge
Year 1 (2012 Gauge Data)

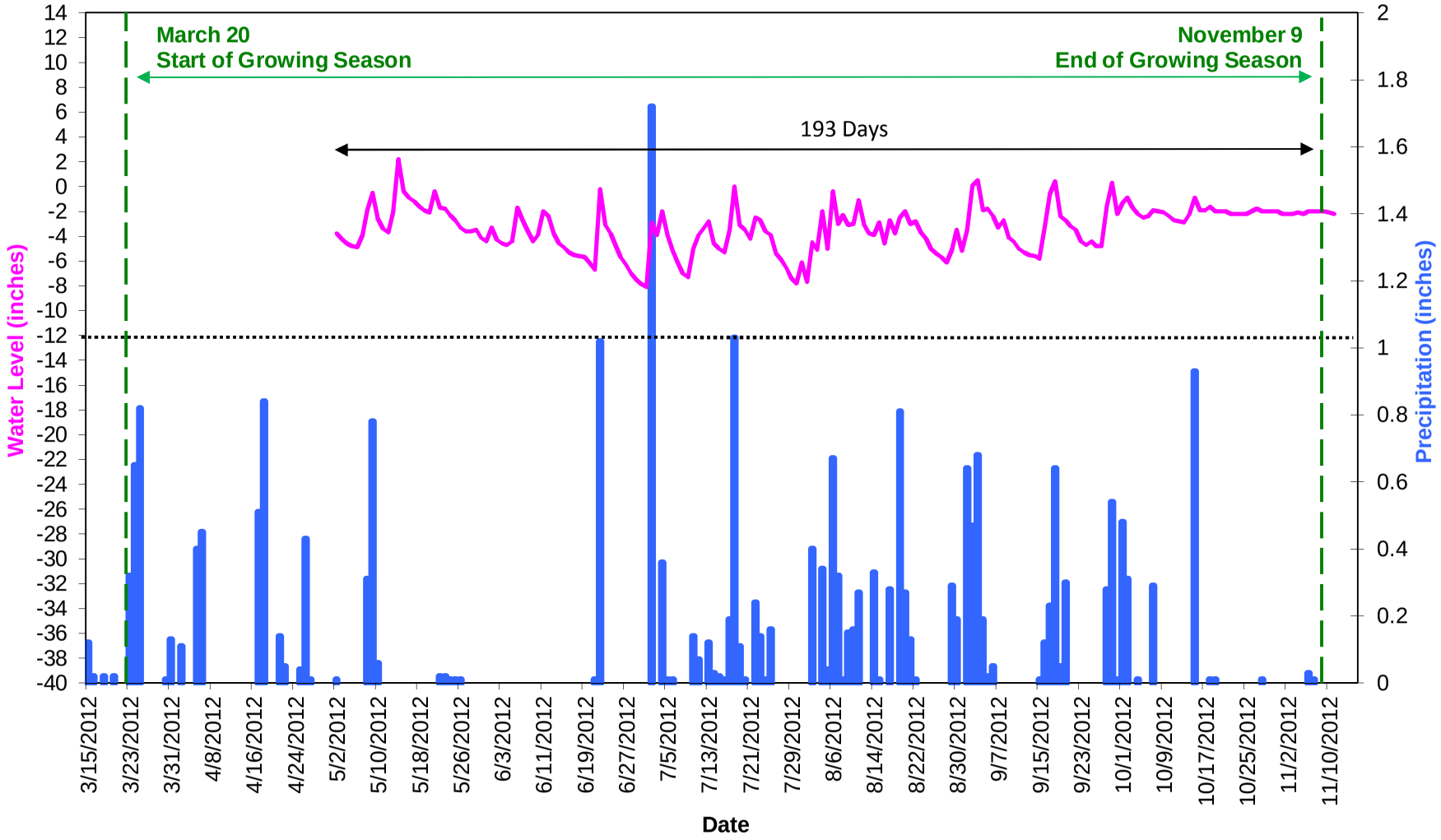
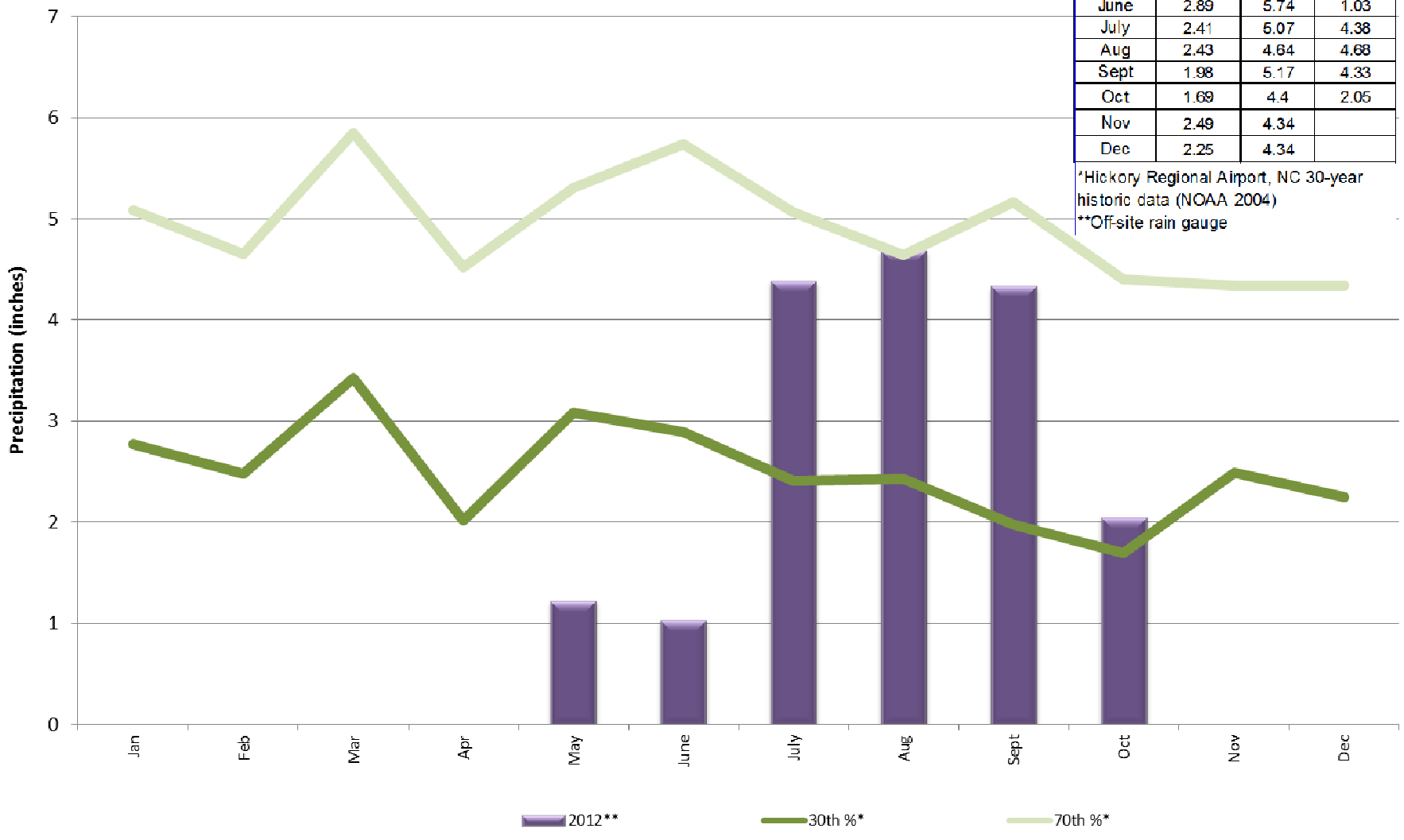


Figure E1. Annual Climatic Data vs. 30-year Historic Data

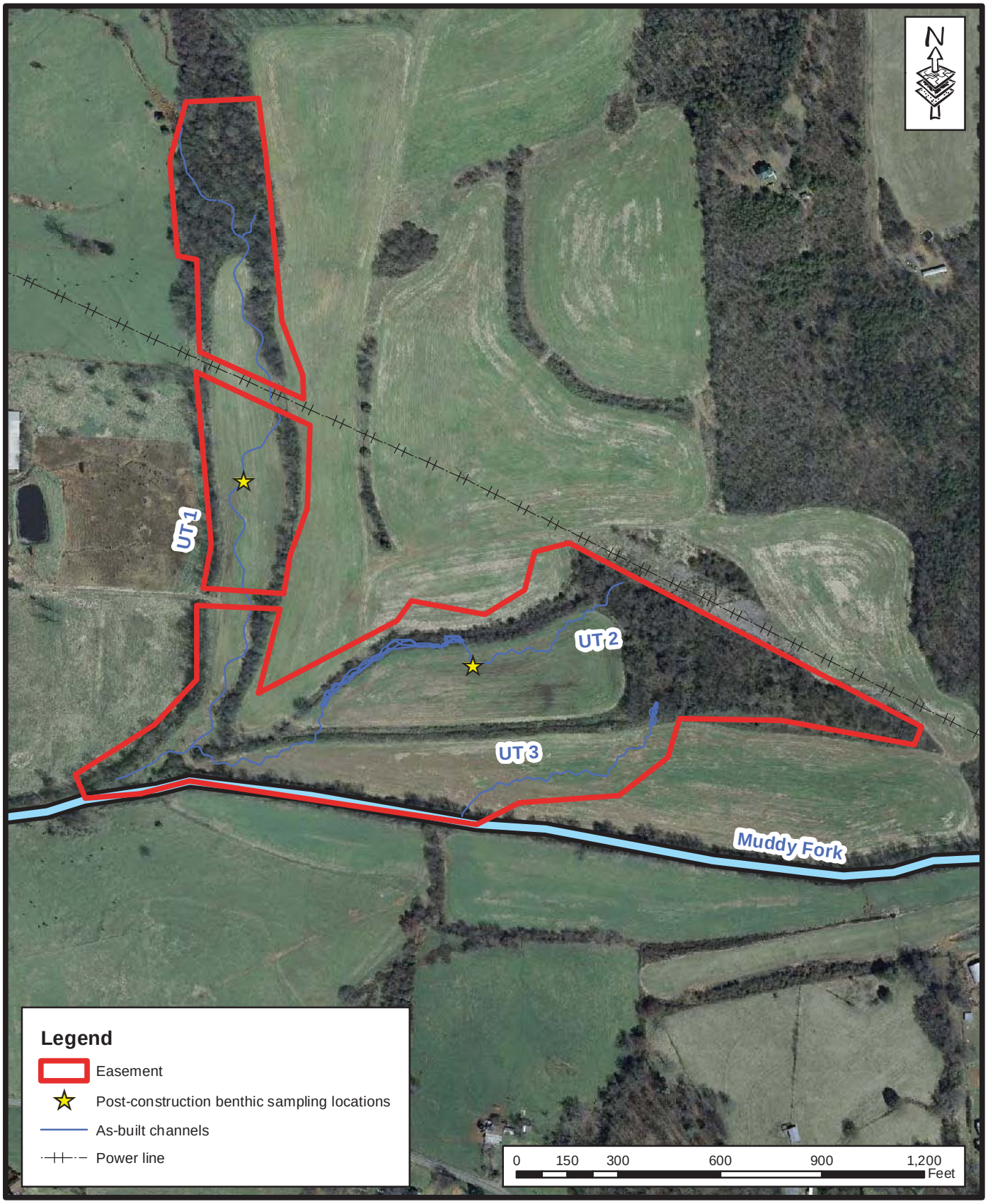
Month	30th %*	70th %*	2012**
Jan	2.77	5.09	
Feb	2.48	4.65	
Mar	3.43	5.85	
Apr	2.02	4.52	
May	3.08	5.31	1.22
June	2.89	5.74	1.03
July	2.41	5.07	4.38
Aug	2.43	4.64	4.68
Sept	1.98	5.17	4.33
Oct	1.69	4.4	2.05
Nov	2.49	4.34	
Dec	2.25	4.34	

*Hickory Regional Airport, NC 30-year historic data (NOAA 2004)
**Off-site rain gauge



Appendix F.
Benthic Data

Figure F1. Post construction Benthic Station Locations
Habitat Assessment Field Datasheets



Axiom Environmental
218 Snow Avenue
Raleigh, NC 27603
(919) 215-1693
Axiom Environmental, Inc.

HERMAN DAIRY
STREAM AND WETLAND MITIGATION SITE
POST-CONSTRUCTION BENTHIC LOCATIONS
Alexander County, North Carolina

Dwn. By:	SGD
Date:	Oct 2012
Project:	10-016

FIGURE
F1

Habitat Assessment Field Data Sheet
Mountain/ Piedmont Streams

UT 1

Biological Assessment Unit, DWQ **TOTAL SCORE** 69

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 6/28/12 **CC#** 03050101120030 **Basin** Catawba **Subbasin** 03-08-32

Observer(s) Davis/ Perkinson **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 42 %Active Pasture 43 % Active Crops
____%Fallow Fields ____% Commercial ____%Industrial 10 %Other - Describe: recently planted riparian buffer

Watershed land use : ☒Forest ☒Agriculture ☐Urban ☒ Animal operations upstream 5% Animal operations.

Width: (~~meters~~ feet) Stream 4 Channel (at top of bank) 5 **Stream Depth**: (~~m~~ ft) Avg 0.5-1 ~~0.5-1~~ 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~~ ft) 0.75-1

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, dry, 90's **Photos:** ☐N ☐Y ☐ Digital ☐35mm

Remarks: Site is in 1st year of post-construction monitoring.

UT1

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 Rare, Common, or Abundant.

C **Rocks** ___ **Macrophytes** R **Sticks and leafpacks** A **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 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

UT 1

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 Just planted this winter; young seedlings. Subtotal 0

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	Lft. Bank Score	Rt. Bank Score
Dominant vegetation: ☐ Trees ☒ Shrubs ☐ Grasses ☒ Weeds/old field ☐Exotics (kudzu, etc)		
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
		Total 10

Remarks _____

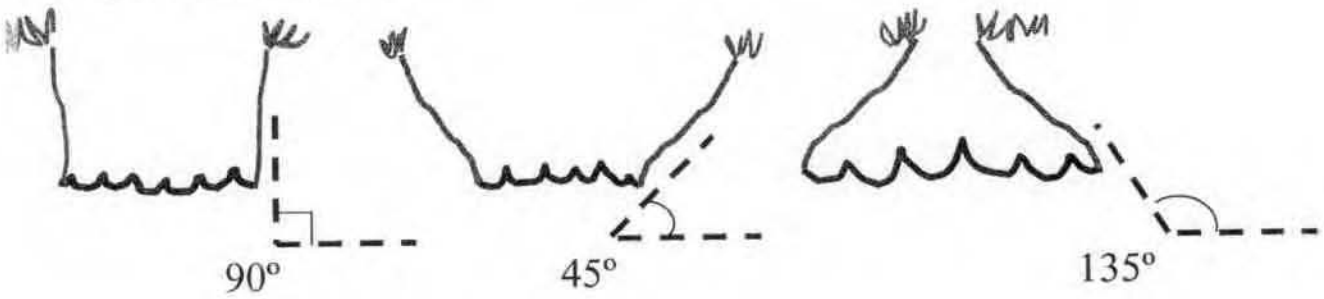
Page Total 40

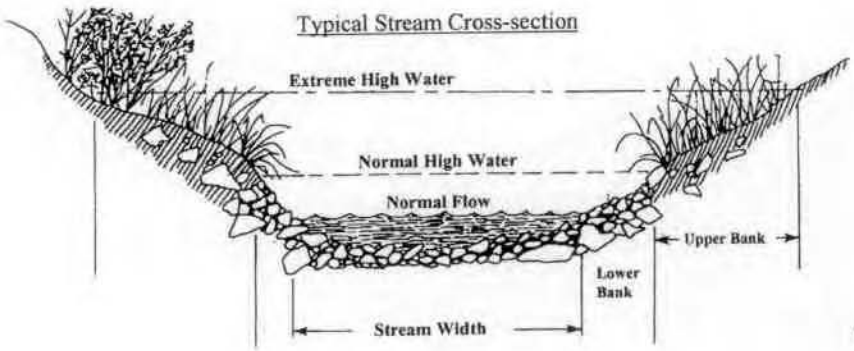
☐ Disclaimer-form filled out, but score doesn't match subjective opinion-atypical stream. **TOTAL SCORE** 69

UT 1

Supplement for Habitat Assessment Field Data Sheet

Diagram to determine bank angle:





This side is 45° bank angle.

Site Sketch:

Other comments:

multiple frogs, salamanders, tadpoles.

Habitat Assessment Field Data Sheet
Mountain/ Piedmont Streams

UT 2

Biological Assessment Unit, DWQ

TOTAL SCORE 72

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 6/28/12 **CC#** 03050101120030 Basin catawba Subbasin 03-08-32

Observer(s) Davis/Perkinson Type of Study: ☐ Fish ☒ Benthos ☐ Basinwide ☐ Special Study (Describe) _____

Latitude 35.9314 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 75 % Active Crops
___ %Fallow Fields ___ % Commercial ___ %Industrial 10 %Other - Describe: recently planted riparian buffer

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

Width: (~~meters~~ feet) Stream 2 Channel (at top of bank) 3 **Stream Depth:** (~~m~~ ft) Avg 0.1-0.2 Max 0.2
☐ Width variable ☐ Large river >25m wide

Bank Height (from deepest part of riffle to top of bank-first flat surface you stand on): (~~m~~ ft) 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, dry, 90's **Photos:** ☐N ☐Y ☐ Digital ☐35mm

Remarks: Site is in 1st year of post-restoration monitoring.

UT2

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** R **Sticks and leafpacks** A **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 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.

	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 36

UT2

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 12

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 recently planted with young seedlings. Subtotal 0

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)
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a. width > 18 meters.....	3	3
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d. width < 6 meters.....	0	0

Total 10

Remarks _____

Page Total 36

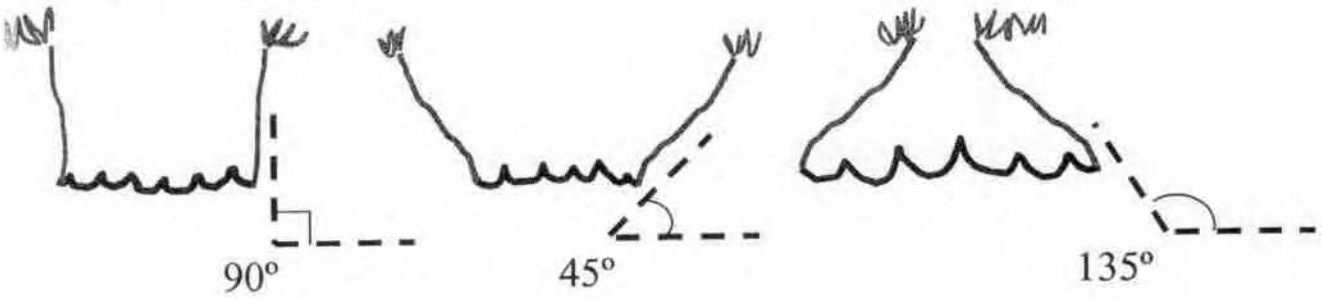
☐ Disclaimer-form filled out, but score doesn't match subjective opinion-atypical stream.

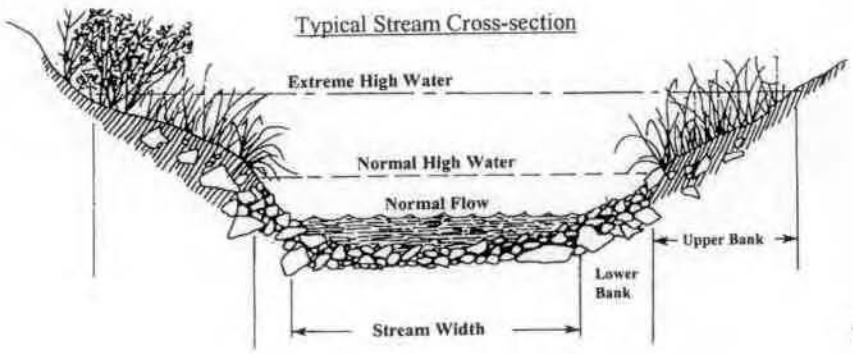
TOTAL SCORE 72

UT2

Supplement for Habitat Assessment Field Data Sheet

Diagram to determine bank angle:





This side is 45° bank angle.

Site Sketch:

Other comments:

Multiple frogs & tadpoles.

Herman Dairy
Year 1 Profile (2012)

Tributary 3
Average Water Surface Slope
NA

Point	Description	Station	Bed Elevation	Water Elevation	Riffle Length	Pool Length	Riffle Slope
3	tr structure	82	99.60643				
4	gl	85.09	99.14768				
5	r	86.58	99.16396				
6	br	88.96	99.68868		27.1	7.0	
7	tr	116.03	99.61981				
8	gl	118.90	99.00211				
9	r	122.39	99.12086				
10	br	125.14	99.63055		13.7	9.1	
11	tr	138.80	99.71201				
12	gl	143.81	98.99396				
13	r	151.86	99.09967				
14	br	158.40	99.60502		13.3	19.6	
31	tr	171.75	99.56886				
32	gl	176.81	98.98937				
33	r	182.12	99.05873				
34	br	185.44	99.53456		12.0	13.7	
35	tr	197.40	99.41204				
36	gl	199.75	99.03574				
37	r	204.76	98.78868				
38	br	209.12	99.61027		6.1	11.7	
39	tr	215.25	99.61475				
40	gl	218.73	98.9984				
41	r	223.88	99.07643				
42	br	227.83	99.70605		7.0	12.6	
43	tr	234.86	99.81036				
44	gl	239.39	99.14756				
45	r	246.10	99.23519				
46	br	248.99	99.71146		8.6	14.1	
47	tr	257.54	99.80705				
48	gl	260.52	99.0788				
49	r	264.09	99.16883				
50	br	268.24	99.8462		6.9	10.7	
51	tr	275.14	99.84858				
52	p	279.19	99.23515				
53	br	282.44	99.77872		8.0	7.3	
54	tr	290.47	99.74185				
55	gl	297.33	99.17284				
56	p	302.20	99.08933				
57	r	308.26	99.21192				
58	br	314.11	99.89287		10.7	23.6	
59	tr	324.83	99.75984				
60	gl	328.48	99.20494				
61	r	335.65	99.33486				
62	br	342.14	99.86091		14.8	17.3	
63	tr	356.97	99.67441				
64	p	361.08	99.18057				
65	br	365.37	99.89562		6.7	8.4	
66	tr	372.12	99.80793				
67	gl	376.50	99.17751				
68	p	381.63	99.16793				
69	r	384.96	99.18051				
70	br	389.86	99.99439		8.3	17.7	

71	tr	398.21	99.9194				
72	gl	402.83	99.53157				
87	r	414.61	99.47699				
88	br	419.40	100.0406			12.0	21.2
89	tr	431.38	100.0305				
90	gl	436.99	99.35207				
91	r	441.27	99.4084				
92	br	446.19	100.0191			12.4	14.8
93	tr	458.60	100.0423				
94	p	464.02	99.40542				
95	br	468.38	99.98652			6.6	9.8
96	tr	475.03	99.98543				
97	gl	478.48	99.44599				
98	r	483.61	99.41471				
99	br	486.33	99.95104			7.9	11.3
100	tr	494.21	99.97183				
101	gl	496.93	99.30021				
117	r	508.66	99.41739				
118	br	514.18	100.0006			7.1	20.0
119	tr	521.27	100.1405				
120	gl	524.22	99.5669				
121	r	528.50	99.57733				
122	br	532.69	100.0928			10.1	11.4
123	tr	542.82	100.1392				
124	gl	545.85	99.6234				
125	r	549.75	99.61901				
126	br	553.27	100.1971			9.6	10.5
127	tr	562.90	100.2529				
128	gl	568.38	99.62612				
129	r	574.37	99.62264				
130	br	578.06	100.1408			6.2	15.2
131	tr	584.24	100.1812				
132	gl	587.31	99.40846				
133	r	593.79	99.5259				
134	br	596.98	100.0943			6.8	12.7
135	tr	603.79	100.1211				
136	gl	607.90	99.34593	99.81509			
138	r	615.22	99.31616	99.82848			
140	br	618.92	99.89949			7.8	15.1
141	tr	626.74	100.1916				
142	p	630.13	99.43265	99.81272			
144	br	634.25	100.2394			17.9	7.5
157	tr	652.18	100.319				
158	gl	657.64	99.68881				
159	r	668.71	99.85003				
160	br	672.17	100.3335			5.1	20.0
161	tr	677.30	100.455				
162	gl	682.24	99.91877				
163	r	687.18	99.89439				
164	br	689.69	100.2286			10.6	12.4
165	tr	700.33	100.3461				
166	gl	704.52	99.79428				
167	r	711.11	99.7219				
168	br	715.80	100.3339			11.1	15.5
169	tr	726.95	100.3206				
					ave	**10.2**	**13.7**
					med	**8.6**	**12.7**
					min	**5.1**	**7.0**
					max	**27.1**	**23.6**
					count	**27**	**27**
					sd	**4.6**	**4.5**