**YEAR 3 of 7 (2014)**
**ANNUAL MONITORING REPORT**
**HERMAN DAIRY STREAM AND WETLAND RESTORATION SITE**
Alexander County, North Carolina
EEP Project No. 94642
Full Delivery Contract No. 003271

Catawba River Basin
Cataloging Unit and Targeted Local Watershed
03050101120030

Submitted to:
NCDENR Ecosystem Enhancement Program
Raleigh, North Carolina

JANUARY 2015

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**Prepared By:**
Restoration Systems, LLC
1101 Haynes Street, Suite 211
Raleigh, North Carolina 27604

and

Axiom Environmental, Inc.
218 Snow Avenue
Raleigh, North Carolina 27603

**Submitted to:**
NCDENR Ecosystem Enhancement Program
Raleigh, North Carolina

JANUARY 2015

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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 3 (2014) 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 465 planted stems per acre surviving. In addition, 9 out of 10 individual plots exceeded success criteria, with plot 4 being only one stem shy of the required stem density. The number of native tree and shrub species observed in plots ranged from three (Plot 4) to seven (Plot 5), with 16 total native species observed. Treatment for invasive species, primarily Chinese privet (*Ligustrum sinense*) was initiated prior to construction and will continue as necessary, primarily within areas denoted on Figures 2 and 2A-2B (Appendix A).

Replanting occurred during the winter of 2013/2014 in the southeastern portion of the Site between UT2 and UT3 with 3-gallon containerized trees as follows. Newly planted stems are generally viable and vigorous in year 3 (2014).

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

Stream Success Criteria: Success criteria for stream restoration will include 1) successful classification of the reach as a functioning stream system (Rosgen 1996) and 2) channel variables indicative of a stable stream system. The channel 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. Pebble counts were performed at six cross sections; 3 on UT1, 2 on UT2, and 1 on UT3. These pebble counts provide a representative sample of the site substrate. A small remnant beaver dam was observed on UT1 allowing some finer particles (sand, silt/clay) to settle and cause slight aggradation on this reach. No evidence of long-term inundation was observed, and it is expected that these fine particles will be moved through the site and should not pose any future problems. No stream problem areas were noted during Year 3 (2014) monitoring.

Hydrology Success Criteria: According to the *Soil Survey of Alexander County*, the growing season for Alexander County as recorded in Hickory, North Carolina during the period from 1951-1984 is from March 20-November 9 (235 days) (USDA 1995). Year 1 (2012) groundwater gauge installation occurred between March 30 and April 4, 2012; therefore, given the date of groundwater gauge installation and the initiation of

monitoring, Year 1 groundwater monitoring utilized the published growing season dates from the county soil survey for success criteria. However, in future monitoring years, if soil temperatures and/or vegetative growth (bud burst) is documented, project gauge hydrologic success will be determined using dates from February 1-November 9 (282 days) to more accurately represent the period of biological activity (see following "Summary of Hydrology Success Criteria by Year" table.

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

**Summary of Hydrology Success Criteria by Year**

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

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. All gauges were well above success criteria for monitoring Year 3 (2014).

Benthics: Habitat Assessment Field Data Sheet scores for UT 1 increased from a total score of 45 prior to restoration to 76 after three annual monitoring years. Similarly, UT 2 improved from a score of 36 to 78 and UT3 improved from a score of 21 to 81 after three annual monitoring years. North Carolina Biotic Index (NCBI) assigned value for UT1 (7.76) was lower in Year 3 (2014) than in previous monitoring years, indicating a slight improvement; however, the score remains in the range of values for *Poor* biotic indices (NCDWQ, 2011). This *Poor* classification can be attributed to the increase in fine substrate between Year 2 (2013) and Year 3 (2014) due to a remnant beaver dam observed in early 2014. It is expected that these particles will be moved through the site and should not pose further problems for benthic macroinvertebrate communities. NCBI assigned value for UT2 (9.45) was higher in Year 3 (2014) than in previous monitoring years, indicating a decline. This decline can be attributed to slightly below average precipitation during the winter and spring of 2014 (Figure E1, Appendix E). Both Year 3 (2014) NCBI values indicate a decline from the preconstruction values. This is expected just three years after channel construction. The habitat assessment scores have gradually improved since construction, and therefore, the NCBI assigned values are expected to improve in the future. No benthic samples were obtained from UT3 because the stream was dry at the time of the site visit. Benthic results and Habitat Assessment Field Data Sheets are included in Appendix F.

In summary: Site vegetation, streams, and wetland hydrology met success criteria for Year 3 (2014) 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 4.2* (Lee et al. 2008). Plots were measured in July 2014 for Year 3 monitoring. Vegetation plots are permanently monumented with 4-foot metal garden posts at each corner. In each sample plot, vegetation parameters to be monitored include species composition and species density. Visual observations of the percent cover of shrub and herbaceous species will also be documented by photograph. Vegetation plot information can be found in Appendix C.

### 2.2 Stream Assessment

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

### 2.3 Wetland Assessment

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

### 2.4 Biotic Community Changes

Changes in the biotic community are anticipated from a shift in habitat opportunities as tributaries are restored. In-stream, biological monitoring is proposed to track changes during the monitoring period. The benthic macroinvertebrate community will be sampled using North Carolina Division of Water 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 post-construction restored conditions.

Benthic macroinvertebrate monitoring locations were established within Site restoration reaches. Post-construction collections occurred in approximately the same locations as pre-construction sampling; however, sampling was not possible in UT 3 in Year 3 (2014) due to lack of stream flow. Benthic macroinvertebrate samples were collected using the Qual-4 collection method. Sampling techniques of the Qual-4 collection method consist of kick nets, sweep nets, leaf packs, and visual searches. Post-construction biological sampling occurred on June 27, 2014 for Year 3 monitoring; post-construction monitoring will occur in June of each monitoring year. Identification of collected organisms was performed by Pennington and Associates, a NCDWQ certified laboratory. Results and Habitat Assessment Field Data Sheets are enclosed in Appendix F.

## 3.0 REFERENCES


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North Carolina Division of Water Quality (NCDWQ). 2001. Benthic Macroinvertebrate Monitoring Protocols for Compensatory Mitigation. 401/Wetlands Unit, Department of Environment and Natural Resources. Raleigh, North Carolina.

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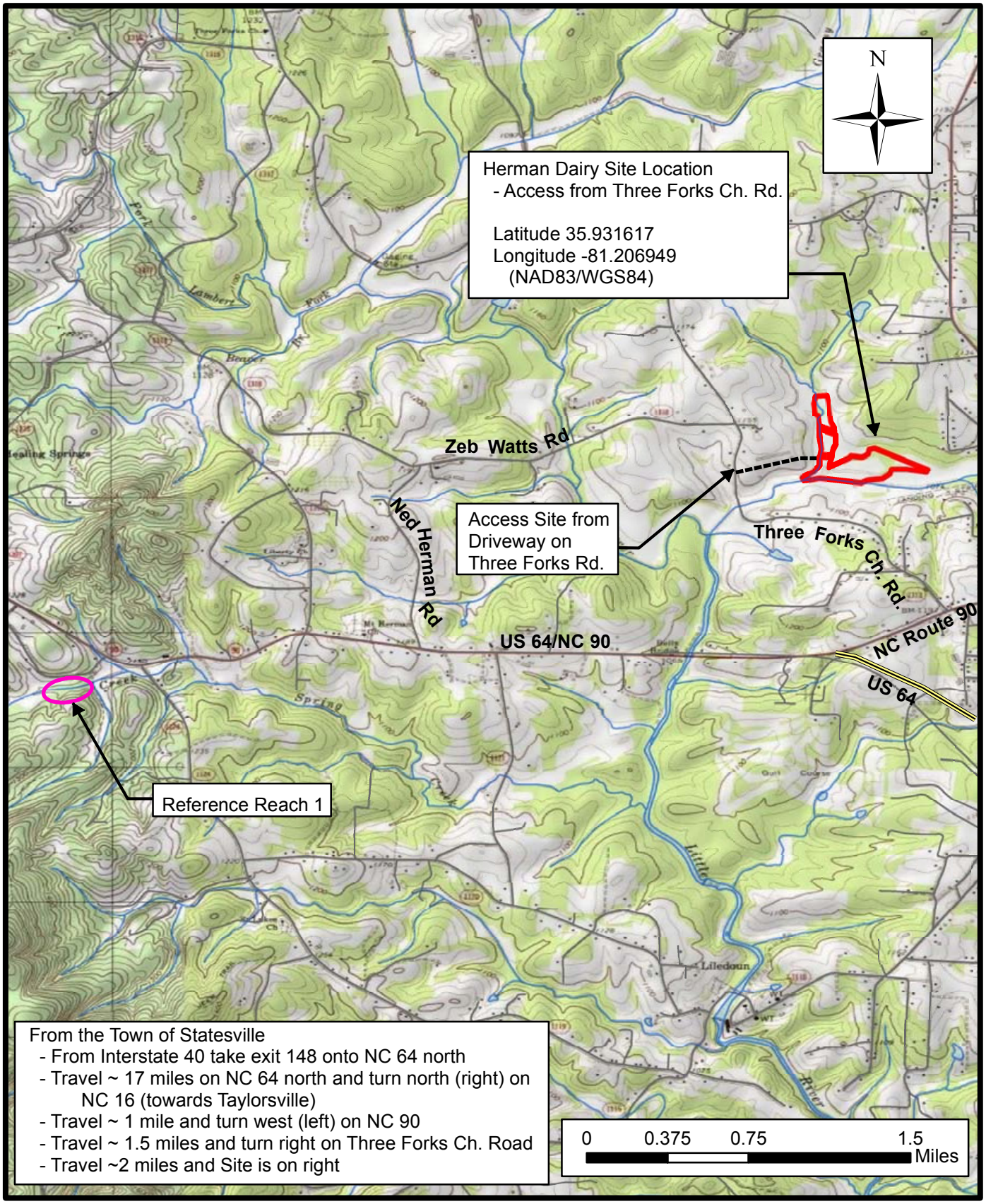
**Appendix A.**
**Figures**

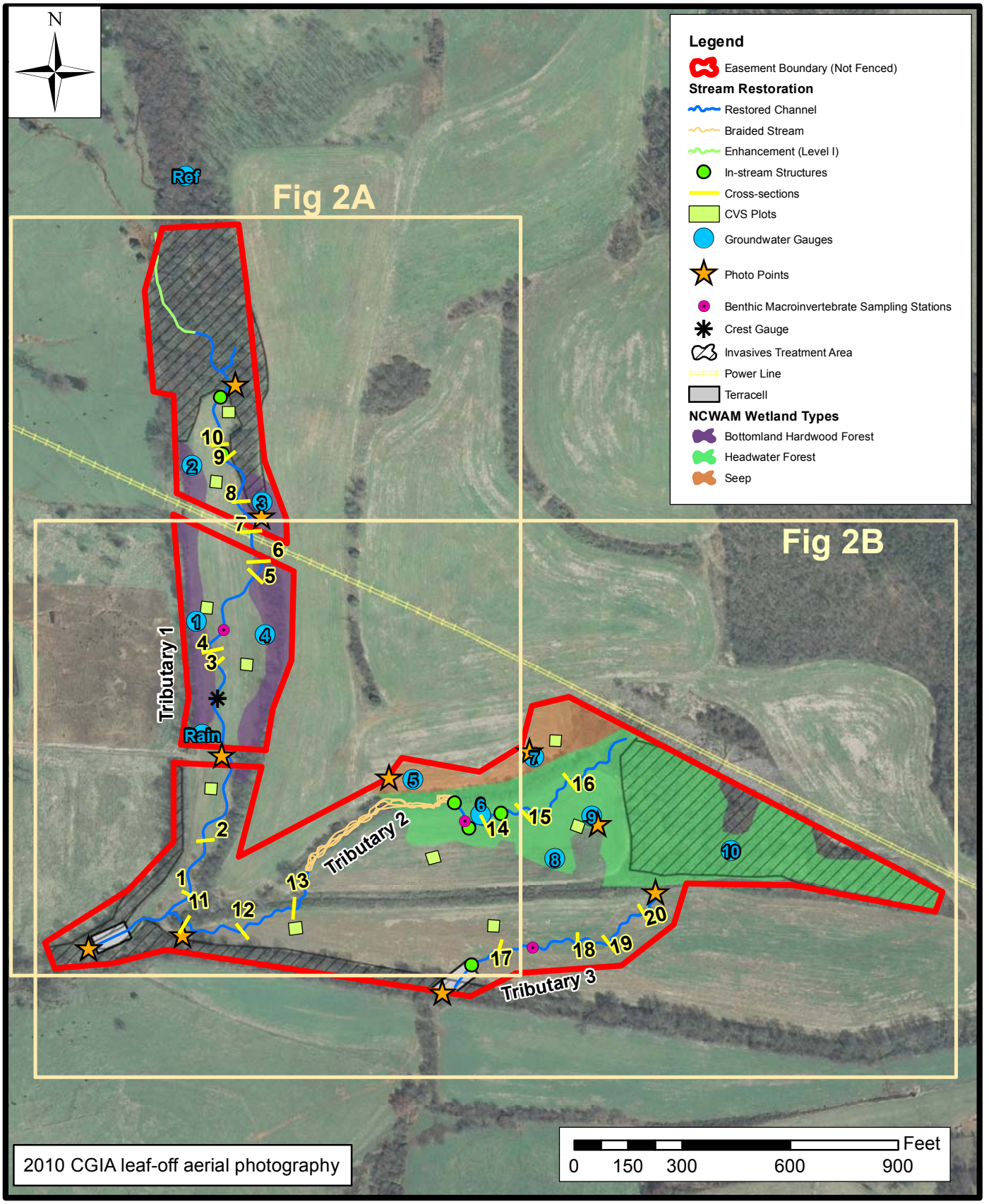
Figure 1. The Site Location
Figures 2, 2A-2B. Consolidated Current Conditions Plan View




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

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

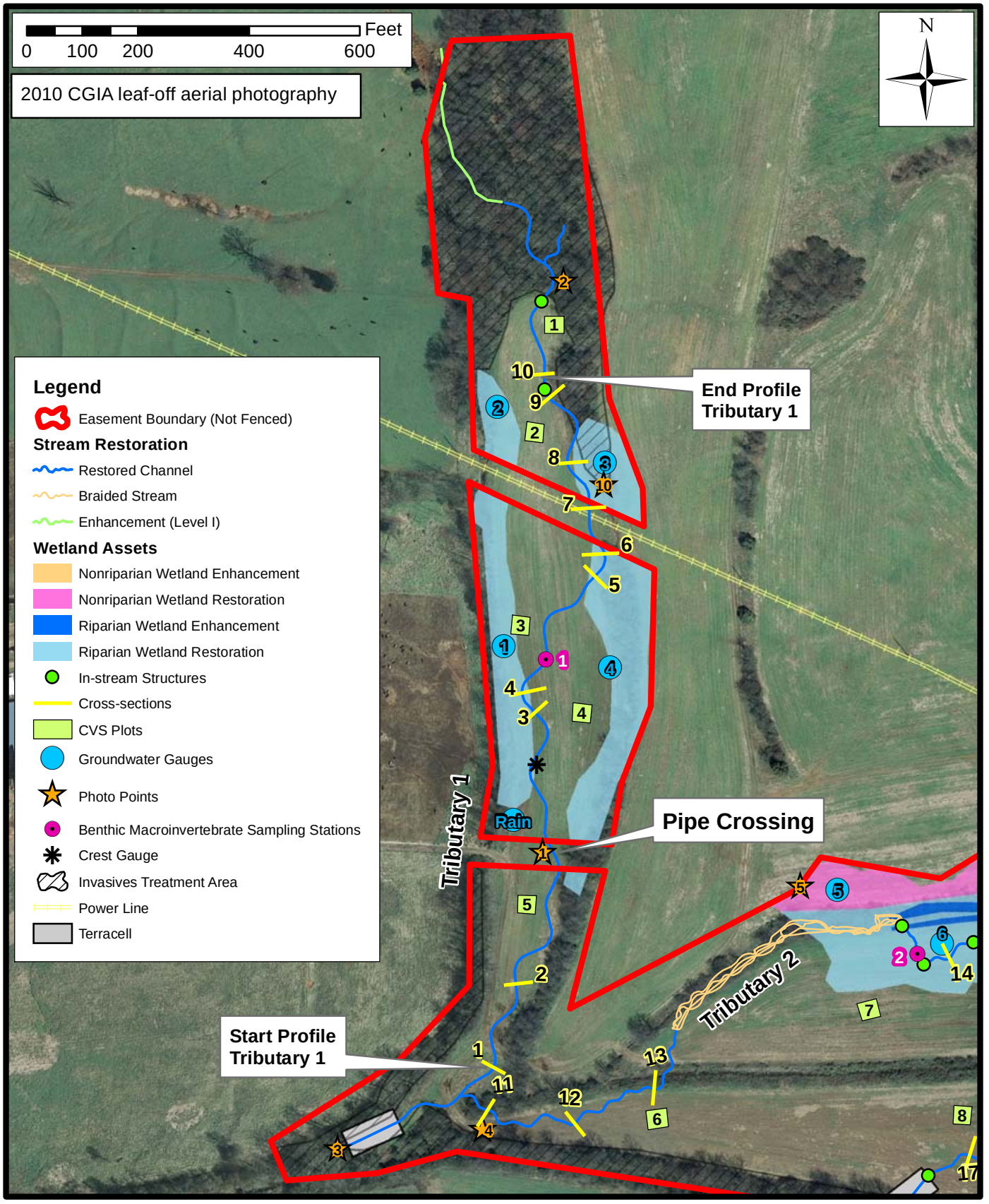
| | |
|---|---|
| Dwn. By: WGL/CLF | FIGURE |
| Date: May 2012 | 1 |
| Project: 10-016 | |




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

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

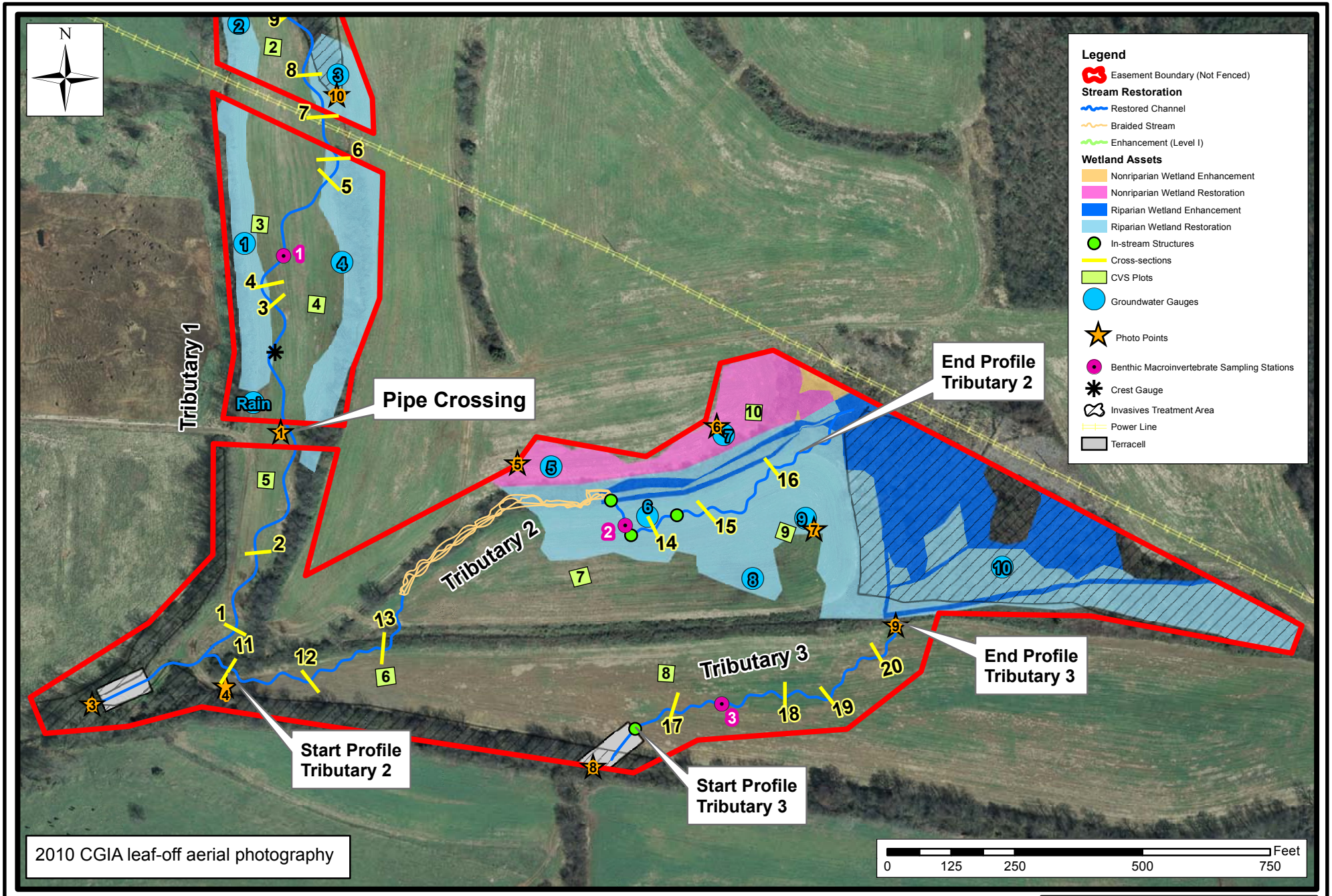
| | |
|---|---|
| Dwn. By: KRJ | FIGURE |
| Date: July 2013 | 2 |
| Project: 10-001 | |




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

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

| | |
|---|---|
| Dwn. By: | KRJ/CLF |
| Date: | Nov 2014 |
| Project: | 10-001 |
| FIGURE | 2A |




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

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

| | |
|---|---|
| Dwn. By: KRJ/CLF | FIGURE |
| Date: Nov 2014 | 2B |
| Project: 10-001 | |

## Appendix B.
## General Project Tables

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

## Table 1. Project Restoration Components
## Herman Dairy Restoration Site

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

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

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

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

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

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

**Table 3. Project Contacts Table**
**Herman Dairy Restoration Site**

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

**Table 4. Project Attribute Table**
**Herman Dairy Restoration Site**

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

**Appendix C.**
**Vegetation Assessment Data**

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

**Table 5. Vegetation Plot Mitigation Success Summary Table**

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

**Table 6. CVS Vegetation Metadata Table**

| | |
|---|---|
| **Report Prepared By** | Corri Faquin |
| **Date Prepared** | 7/7/2014 14:25 |
| | |
| **database name** | RS-HermanDiary-2014-A-v2.3.1.mdb |
| **database location** | \\AE-SBS\RedirectedFolders\KJernigan\Desktop |
| **computer name** | KEENAN-PC |
| **file size** | 51687424 |
| | |
| **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**
**Project Name: Herman Dairy**

| | | | Current Plot Data (MY3 2014) | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Herman-P-0001 | | | Herman-P-0002 | | | Herman-P-0003 | | | Herman-P-0004 | | | Herman-P-0005 | | | Herman-P-0006 | | | Herman-P-0007 | | | Herman-P-0008 | | | Herman-P-0009 | | | Herman-P-0010 | | |
| Scientific Name | Common Name | Species Type | PnoLS | P-all | T | PnoLS | P-all | T | PnoLS | P-all | T | PnoLS | P-all | T | PnoLS | P-all | T | PnoLS | P-all | T | PnoLS | P-all | T | PnoLS | P-all | T | PnoLS | P-all | T | PnoLS | P-all | T |
| Acer negundo | boxelder | Tree | | | | | | | | | | | | | | | | | | 38 | | | | | | 1 | | | | | |
| Acer rubrum | red maple | Tree | | | | | | 14 | | | | | | | | | | | | | | | 2 | | | | | | 4 | | | |
| Betula nigra | river birch | Tree | 3 | 3 | 3 | 4 | 4 | 4 | 1 | 1 | 1 | 1 | 1 | 1 | | | | 1 | 1 | 1 | | | | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| Carpinus caroliniana | American hornbeam | Tree | 1 | 1 | 1 | | | | | | | | | | 2 | 2 | 2 | | | | | | | | | | | | | | | |
| Carya | hickory | Tree | | | | | | | | | | | | | 2 | 2 | 2 | | | | | | | | | | | | | | | |
| Cephalanthus occidentalis | common buttonbush | Shrub | | | | | | | | | | | | | | | | | | | 1 | 1 | 1 | 1 | 1 | 1 | | | | | | 1 |
| Cornus amomum | silky dogwood | Shrub | 2 | 2 | 2 | | | | | | | | | | | | | | | | | | | 1 | 1 | 1 | | | | | | |
| Fraxinus pennsylvanica | green ash | Tree | 1 | 1 | 1 | 1 | 1 | 1 | 4 | 4 | 4 | 3 | 3 | 3 | 1 | 1 | 1 | 3 | 3 | 3 | 4 | 4 | 4 | 6 | 6 | 6 | 9 | 9 | 9 | 2 | 2 | 2 |
| Liriodendron tulipifera | tuliptree | Tree | 1 | 1 | 1 | 1 | 1 | 7 | | | | | | | | | | 6 | 6 | 6 | 2 | 2 | 2 | | | | 3 | 3 | 3 | 1 | 1 | 1 |
| Nyssa | tupelo | Tree | | | | | | | 6 | 6 | 6 | | | | 6 | 6 | 6 | | | | | | | | | | | | | 3 | 3 | 3 |
| Platanus occidentalis | American sycamore | Tree | | | | | | | | | | | | | | | | 1 | 1 | 1 | | | | | | | 1 | 1 | 30 | | | |
| Quercus | oak | Tree | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 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 | 2 | 2 | 2 | 3 | 3 | 3 | 2 | 2 | 2 | 3 | 3 | 3 | 1 | 1 | 1 | 2 | 2 | 2 |
| Quercus phellos | willow oak | Tree | | | | | | | | | | | | | 1 | 1 | 1 | | | | | | | | | | | | | | | |
| Ulmus americana | American elm | Tree | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Unknown | | Shrub or Tree | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | **Stem count** | 10 | 10 | 10 | 8 | 8 | 28 | 12 | 12 | 12 | 7 | 7 | 7 | 16 | 16 | 16 | 14 | 14 | 52 | 9 | 9 | 11 | 13 | 13 | 14 | 16 | 16 | 49 | 10 | 10 | 11 |
| | | **size (ares)** | 1 | | | 1 | | | 1 | | | 1 | | | 1 | | | 1 | | | 1 | | | 1 | | | 1 | | | 1 | | |
| | | **size (ACRES)** | 0.02 | | | 0.02 | | | 0.02 | | | 0.02 | | | 0.02 | | | 0.02 | | | 0.02 | | | 0.02 | | | 0.02 | | | 0.02 | | |
| | | **Species count** | 6 | 6 | 6 | 4 | 4 | 5 | 4 | 4 | 4 | 3 | 3 | 3 | 7 | 7 | 7 | 5 | 5 | 6 | 4 | 4 | 5 | 5 | 5 | 6 | 5 | 5 | 6 | 5 | 5 | 6 |
| | | **Stems per ACRE** | 404.7 | 404.7 | 404.7 | 323.7 | 323.7 | 1133 | 485.6 | 485.6 | 485.6 | 283.3 | 283.3 | 283.3 | 647.5 | 647.5 | 647.5 | 566.6 | 566.6 | 2104 | 364.2 | 364.2 | 445.2 | 526.1 | 526.1 | 566.6 | 647.5 | 647.5 | 1983 | 404.7 | 404.7 | 445.2 |

**Color for Density**

| | |
|---|---|
| Exceeds requirements by 10% | PnoLS = Planted excluding livestakes |
| Exceeds requirements, but by less than 10% | P-all = Planting including livestakes |
| Fails to meet requirements, by less than 10% | T = All planted and natural recruits including livestakes |
| Fails to meet requirements by more than 10% | T includes natural recruits |

**Table 7. CVS Stem Count Total and Planted by Plot and Species (continued)**
**Project Name: Herman Dairy**

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

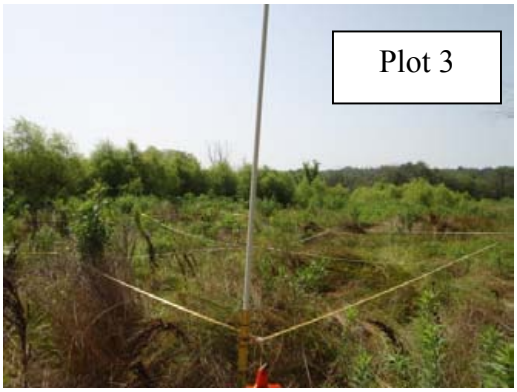
**Color for Density**

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

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

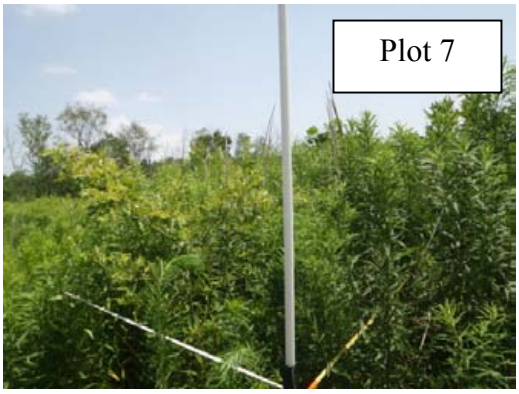
**Herman Dairy**
**2014 (Year 3) Vegetation Monitoring Photographs**
**Taken July 2014**



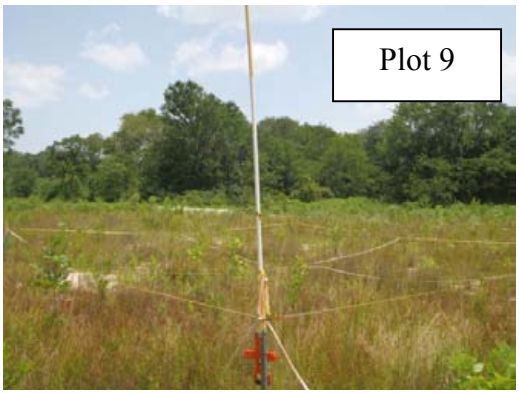


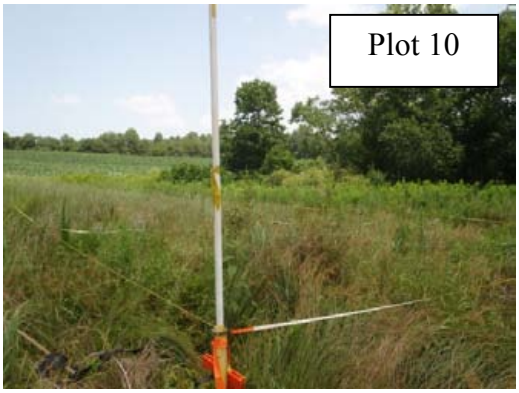



**Herman Dairy**
**2014 (Year 3) Vegetation Monitoring Photographs**
**Taken July 2014**
**(continued)**







**Appendix D.**
**Stream Assessment Data**

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

**Herman Dairy**
**Fixed Station Photographs**
**Taken October 8, 2014**

Photo Point 1

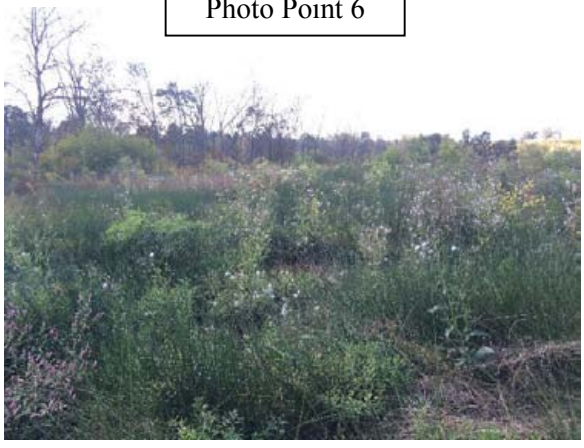
Photo Point 2

Photo Point 3

Photo Point 4

Photo Point 5

Photo Point 6



**Herman Dairy**
**Fixed Station Photographs (continued)**
**Taken October 8, 2014**

Photo Point 7

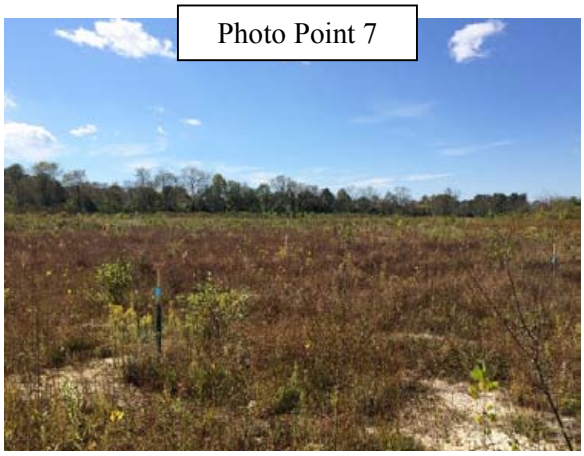


Photo Point 8

Photo Point 9

Photo Point 10

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

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

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

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

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

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

**Table 9. Verification of Bankfull Events**

| Date of Data Collection | Date of Occurrence | Method | Photo (if available) |
|---|---|---|---|
| May 11, 3013 | May 6, 2013 | Bankfull event documented when sediment deposits were observed on top of banks after 3.00 inches of rain was documented* over a two-day period. | -- |
| July 18, 2013 | June 6, 2013 | Bankfull event documented after wrack was observed on top of bank and throughout floodplain after 4.27 inches of rain was documented* over a two-day period. | 1-2 |
| November 19, 2014 | August 11, 2014 | Bankfull event likely occurred after 3.61 inches of rain over a two-day period that was preceeded by 0.56 inches and followed by an additional 0.78 inches as documented by an onsite rain gauge. | -- |

*Weather Underground (2013)

Bankfull Photo 1

Bankfull Photo 2

**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 | 18.1 | 24.8 | | | 16.9 | 17.1 | 17.4 | 18.2 | | | 16.4 | 17 | 18.9 | 14 | | | 16.8 | 18.2 | 20.2 | 10.2 | | |
| Floodprone Width (ft) | ---- | ---- | ---- | ---- | | | ---- | ---- | ---- | ---- | | | 250 | 250 | 250 | 250 | | | ---- | ---- | ---- | ---- | | |
| BF Cross Sectional Area (ft2) | 19.9 | 18.9 | 17.4 | 17.4 | | | 16.3 | 16 | 14.9 | 14 | | | 16.7 | 17 | 17.5 | 10 | | | 14.4 | 14.5 | 13.8 | 10.5 | | |
| BF Mean Depth (ft) | 1.0 | 1.0 | 1.0 | 0.7 | | | 1.0 | 0.9 | 0.9 | 0.8 | | | 1.0 | 1.0 | 0.9 | 0.7 | | | 0.9 | 0.8 | 0.7 | 1.0 | | |
| BF Max Depth (ft) | 2.3 | 2.2 | 2.1 | 1.7 | | | 1.4 | 1.5 | 1.4 | 1.5 | | | 1.4 | 1.4 | 1.4 | 1.4 | | | 2.1 | 2.1 | 2.3 | 1.5 | | |
| Width/Depth Ratio | ---- | ---- | ---- | ---- | | | ---- | ---- | ---- | ---- | | | 16.11 | 17 | 20.41 | 19.6 | | | ---- | ---- | ---- | ---- | | |
| Entrenchment Ratio | ---- | ---- | ---- | ---- | | | ---- | ---- | ---- | ---- | | | 15.2 | 14.7 | 13.2 | 17.9 | | | ---- | ---- | ---- | ---- | | |
| Bank Height Ratio | ---- | ---- | ---- | ---- | | | ---- | ---- | ---- | ---- | | | 1 | 1 | 1 | 1 | | | ---- | ---- | ---- | ---- | | |
| Wetted Perimeter (ft) | 21.7 | 20.4 | 18.8 | 25.6 | | | 17.2 | 17.4 | 17.8 | 18.6 | | | 16.8 | 17.6 | 19.5 | 14.6 | | | 17.6 | 19.1 | 21.2 | 10.9 | | |
| Hydraulic Radius (ft) | 0.9 | 0.9 | 0.9 | 0.6 | | | 0.9 | 0.9 | 0.8 | 0.8 | | | 1 | 1 | 0.9 | 0.7 | | | 0.8 | 0.8 | 0.6 | 1 | | |
| **Substrate** | | | | | | | | | | | | | | | | | | | | | | | | |
| d50 (mm) | ---- | ---- | ---- | ---- | | | ---- | ---- | 0.4 | 0.4 | | | ---- | ---- | 0.2 | 0.2 | | | ---- | ---- | ---- | ---- | | |
| d84 (mm) | ---- | ---- | ---- | ---- | | | ---- | ---- | 15 | 14 | | | ---- | ---- | 10 | 4 | | | ---- | ---- | ---- | ---- | | |

| Parameter | MY-00 (2012) | | | MY-01 (2012) | | | MY-02 (2013) | | | MY-03 (2014) | | | MY-04 (2015) | | | MY-05 (2016) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **Min** | **Max** | **Med** | **Min** | **Max** | **Med** | **Min** | **Max** | **Med** | **Min** | **Max** | **Med** | **Min** | **Max** | **Med** | **Min** | **Max** | **Med** |
| **Pattern** | | | | | | | | | | | | | | | | | | |
| Channel Beltwidth (ft) | 50 | 101 | 67 | 50 | 101 | 67 | 50 | 101 | 67 | 50 | 101 | 67 | | | | | | |
| Radius of Curvature (ft) | 34 | 168 | 50 | 34 | 168 | 50 | 34 | 168 | 50 | 34 | 168 | 50 | | | | | | |
| Meander Wavelength (ft) | 50 | 101 | 67 | 50 | 101 | 67 | 50 | 101 | 67 | 50 | 101 | 67 | | | | | | |
| Meander Width Ratio | 3 | 6 | 4 | 3 | 6 | 4 | 3 | 6 | 4 | 3 | 6 | 4 | | | | | | |
| **Profile** | | | | | | | | | | | | | | | | | | |
| Riffle Length (ft) | 23 | 65 | 36 | 16 | 49 | 28 | 5 | 82 | 33 | 5 | 117 | 36 | | | | | | |
| Riffle Slope (ft/ft) | 0.00% | 1.50% | 0.64% | 0.05% | 1.05% | 0.57% | 0.14% | 1.92% | 0.65% | 0.11% | 1.13% | 0.37% | | | | | | |
| Pool Length (ft) | 10 | 54 | 32 | 18 | 62 | 35 | 12 | 63 | 31 | 7 | 49 | 30 | | | | | | |
| Pool Spacing (ft) | 50 | 134 | 67 | 50 | 134 | 67 | 50 | 134 | 67 | 50 | 134 | 67 | | | | | | |
| **Additonal Reach Parameters** | | | | | | | | | | | | | | | | | | |
| Valley Length (ft) | 1757 | | | 1373 | | | 1525 | | | 1513 | | | | | | | | |
| Channel Length (ft) | 2,108 | | | 1,648 | | | 1830 | | | 1816 | | | | | | | | |
| Sinuosity | 1.2 | | | 1.2 | | | 1.2 | | | 1.2 | | | | | | | | |
| Water Surface Slope (ft/ft) | 0.0053 | | | 0.0045 | | | 0.0054 | | | 0.0051 | | | | | | | | |
| BF Slope (ft/ft) | ------ | | | ------ | | | ------ | | | ------ | | | | | | | | |
| Rosgen Classificatior | C/E 4/5 | | | C-4/5 | | | C 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 | 16.7 | 9.5 | | | 20 | 17.2 | 19.5 | 8.3 | | | 15.5 | 14.6 | 16.8 | 10.4 | | | 16.1 | 18.4 | 18.7 | 9.6 | | |
| Floodprone Width (ft) | 250 | 250 | 250 | 250 | | | ---- | ---- | ---- | ---- | | | 250 | 250 | 250 | 250 | | | ---- | ---- | ---- | ---- | | |
| BF Cross Sectional Area (ft2) | 18.2 | 16.6 | 15.2 | 7.5 | | | 20.3 | 17.7 | 15 | 7.8 | | | 14 | 14 | 14.5 | 9.3 | | | 15.5 | 16 | 16 | 11.7 | | |
| BF Mean Depth (ft) | 1.1 | 1.0 | 0.9 | 0.8 | | | 1.0 | 1.0 | 0.8 | 0.9 | | | 0.9 | 1.0 | 0.9 | 0.9 | | | 1.0 | 0.9 | 0.9 | 1.2 | | |
| BF Max Depth (ft) | 1.6 | 1.4 | 1.5 | 1.1 | | | 2.3 | 2.2 | 2.2 | 1.5 | | | 1.2 | 1.4 | 1.5 | 1.5 | | | 1.9 | 2.1 | 2.3 | 2.1 | | |
| Width/Depth Ratio | 14.2 | 16.0 | 18.3 | 12.0 | | | ---- | ---- | ---- | ---- | | | 17.16 | 15.23 | 19.46 | 11.63 | | | ---- | ---- | ---- | ---- | | |
| Entrenchment Ratio | 15.5 | 15.3 | 15.0 | 26.3 | | | ---- | ---- | ---- | ---- | | | 16.13 | 17.12 | 14.88 | 24.04 | | | ---- | ---- | ---- | ---- | | |
| Bank Height Ratio | 1 | 1 | 1 | 1 | | | ---- | ---- | ---- | ---- | | | 1 | 1 | 1 | 1 | | | ---- | ---- | ---- | ---- | | |
| Wetted Perimeter (ft) | 16.8 | 16.9 | 17.2 | 10 | | | 21 | 18.3 | 20.5 | 9.1 | | | 15.9 | 15.1 | 17.3 | 11.2 | | | 16.8 | 19.1 | 19.6 | 10.8 | | |
| Hydraulic Radius (ft) | 1.1 | 1 | 0.9 | 0.8 | | | 1 | 1 | 0.7 | 0.9 | | | 0.9 | 0.9 | 0.8 | 0.8 | | | 0.9 | 0.8 | 0.8 | 1.1 | | |
| **Substrate** | | | | | | | | | | | | | | | | | | | | | | | | |
| d50 (mm) | ---- | ---- | ---- | ---- | | | ---- | ---- | ---- | ---- | | | ---- | ---- | ---- | ---- | | | ---- | ---- | ---- | ---- | | |
| d84 (mm) | ---- | ---- | ---- | ---- | | | ---- | ---- | ---- | ---- | | | ---- | ---- | ---- | ---- | | | ---- | ---- | ---- | ---- | | |

| Parameter | MY-00 (2012) | | | MY-01 (2012) | | | MY-02 (2013) | | | MY-03 (2014) | | | MY-04 (2015) | | | MY-05 (2016) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **Min** | **Max** | **Med** | **Min** | **Max** | **Med** | **Min** | **Max** | **Med** | **Min** | **Max** | **Med** | **Min** | **Max** | **Med** | **Min** | **Max** | **Med** |
| **Pattern** | | | | | | | | | | | | | | | | | | |
| Channel Beltwidth (ft) | 50 | 101 | 67 | 50 | 101 | 67 | 50 | 101 | 67 | 50 | 101 | 67 | | | | | | |
| Radius of Curvature (ft) | 34 | 168 | 50 | 34 | 168 | 50 | 34 | 168 | 50 | 34 | 168 | 50 | | | | | | |
| Meander Wavelength (ft) | 50 | 101 | 67 | 50 | 101 | 67 | 50 | 101 | 67 | 50 | 101 | 67 | | | | | | |
| Meander Width Ratio | 3 | 6 | 4 | 3 | 6 | 4 | 3 | 6 | 4 | 3 | 6 | 4 | | | | | | |
| **Profile** | | | | | | | | | | | | | | | | | | |
| Riffle Length (ft) | 23 | 65 | 36 | 16 | 49 | 28 | 5 | 82 | 33 | 5 | 117 | 36 | | | | | | |
| Riffle Slope (ft/ft) | 0.00% | 1.50% | 0.64% | 0.05% | 1.05% | 0.57% | 0.14% | 1.92% | 0.65% | 0.11% | 1.13% | 0.37% | | | | | | |
| Pool Length (ft) | 10 | 54 | 32 | 18 | 62 | 35 | 12 | 63 | 31 | 7 | 49 | 30 | | | | | | |
| Pool Spacing (ft) | 50 | 134 | 67 | 50 | 134 | 67 | 50 | 134 | 67 | 50 | 134 | 67 | | | | | | |
| **Additonal Reach Parameters** | | | | | | | | | | | | | | | | | | |
| Valley Length (ft) | 1757 | | | 1373 | | | 1525 | | | 1513 | | | | | | | | |
| Channel Length (ft) | 2,108 | | | 1,648 | | | 1830 | | | 1816 | | | | | | | | |
| Sinuosity | 1.2 | | | 1.2 | | | 1.2 | | | 1.2 | | | | | | | | |
| Water Surface Slope (ft/ft) | 0.0053 | | | 0.0045 | | | 0.0054 | | | 0.0051 | | | | | | | | |
| BF Slope (ft/ft) | ------ | | | ------ | | | ------ | | | ------ | | | | | | | | |
| Rosgen Classificatior | C/E 4/5 | | | C-4/5 | | | C 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 | 16.6 | 17.8 | | | 16 | 17 | 15.5 | 8.4 | | | 7.9 | 5.2 | 5.8 | 6.1 | | | 5.5 | 5.8 | 5.3 | 5.2 | | |
| Floodprone Width (ft) | ---- | ---- | ---- | ---- | | | 250 | 250 | 250 | 250 | | | 150 | 150 | 150 | 150 | | | ---- | ---- | ---- | ---- | | |
| BF Cross Sectional Area (ft2) | 15.7 | 15.4 | 16 | 12.8 | | | 16 | 15.6 | 13.2 | 8.5 | | | 2.3 | 1.3 | 1.4 | 1.3 | | | 2.3 | 2.1 | 2 | 2 | | |
| BF Mean Depth (ft) | 0.8 | 1.0 | 1.0 | 0.7 | | | 1.0 | 0.9 | 0.9 | 1.0 | | | 0.3 | 0.3 | 0.2 | 0.2 | | | 0.4 | 0.4 | 0.4 | 0.4 | | |
| BF Max Depth (ft) | 2 | 2.3 | 2.4 | 2 | | | 1.3 | 1.4 | 1.3 | 1.5 | | | 0.5 | 0.4 | 0.4 | 0.3 | | | 0.8 | 0.7 | 0.7 | 0.7 | | |
| Width/Depth Ratio | ---- | ---- | ---- | ---- | | | 16.0 | 18.5 | 18.2 | 8.3 | | | 27.1 | 20.8 | 24.0 | 28.6 | | | ---- | ---- | ---- | ---- | | |
| Entrenchment Ratio | ---- | ---- | ---- | ---- | | | 15.6 | 14.7 | 16.1 | 29.8 | | | 19.0 | 28.8 | 25.9 | 24.6 | | | ---- | ---- | ---- | ---- | | |
| Bank Height Ratio | ---- | ---- | ---- | ---- | | | 1 | 1 | 1 | 1 | | | 1 | 1 | 1 | 1 | | | ---- | ---- | ---- | ---- | | |
| Wetted Perimeter (ft) | 19.5 | 17 | 17.8 | 19 | | | 16.5 | 17.6 | 15.9 | 9.1 | | | 8 | 5.3 | 5.9 | 6.2 | | | 5.8 | 6 | 5.5 | 5.4 | | |
| Hydraulic Radius (ft) | 0.8 | 0.9 | 0.9 | 0.7 | | | 1 | 0.9 | 0.8 | 0.9 | | | 0.3 | 0.2 | 0.2 | 0.2 | | | 0.4 | 0.3 | 0.4 | 0.4 | | |
| **Substrate** | | | | | | | | | | | | | | | | | | | | | | | | |
| d50 (mm) | ---- | ---- | ---- | ---- | | | ---- | ---- | 9.8 | 8 | | | ---- | ---- | ---- | ---- | | | ---- | ---- | ---- | ---- | | |
| d84 (mm) | ---- | ---- | ---- | ---- | | | ---- | ---- | 21 | 17 | | | ---- | ---- | ---- | ---- | | | ---- | ---- | ---- | ---- | | |

| Parameter | MY-00 (2012) | | | MY-01 (2012) | | | MY-02 (2013) | | | MY-03 (2014) | | | MY-04 (2015) | | | MY-05 (2016) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **Min** | **Max** | **Med** | **Min** | **Max** | **Med** | **Min** | **Max** | **Med** | **Min** | **Max** | **Med** | **Min** | **Max** | **Med** | **Min** | **Max** | **Med** |
| **Pattern** | | | | | | | | | | | | | | | | | | |
| Channel Beltwidth (ft) | 50 | 101 | 67 | 50 | 101 | 67 | 50 | 101 | 67 | 50 | 101 | 67 | | | | | | |
| Radius of Curvature (ft) | 34 | 168 | 50 | 34 | 168 | 50 | 34 | 168 | 50 | 34 | 168 | 50 | | | | | | |
| Meander Wavelength (ft) | 50 | 101 | 67 | 50 | 101 | 67 | 50 | 101 | 67 | 50 | 101 | 67 | | | | | | |
| Meander Width Ratio | 3 | 6 | 4 | 3 | 6 | 4 | 3 | 6 | 4 | 3 | 6 | 4 | | | | | | |
| **Profile** | | | | | | | | | | | | | | | | | | |
| Riffle Length (ft) | 17 | 111 | 51 | 16 | 49 | 28 | 5 | 82 | 33 | 5 | 117 | 36 | | | | | | |
| Riffle Slope (ft/ft) | 0.43% | 4.80% | 1.54% | 0.05% | 1.05% | 0.57% | 0.14% | 1.92% | 0.65% | 0.11% | 1.13% | 0.37% | | | | | | |
| Pool Length (ft) | 26 | 78 | 46 | 18 | 62 | 35 | 12 | 63 | 31 | 7 | 49 | 30 | | | | | | |
| Pool Spacing (ft) | 76 | 176 | 126 | 50 | 134 | 67 | 50 | 134 | 67 | 50 | 134 | 67 | | | | | | |
| **Additonal Reach Parameters** | | | | | | | | | | | | | | | | | | |
| Valley Length (ft) | 1757 | | | 1373 | | | 1525 | | | 1513 | | | | | | | | |
| Channel Length (ft) | 2,108 | | | 1,648 | | | 1830 | | | 1816 | | | | | | | | |
| Sinuosity | 1.2 | | | 1.2 | | | 1.2 | | | 1.2 | | | | | | | | |
| Water Surface Slope (ft/ft) | 0.0053 | | | 0.0045 | | | 0.0054 | | | 0.0051 | | | | | | | | |
| BF Slope (ft/ft) | ------ | | | ------ | | | ------ | | | ------ | | | | | | | | |
| Rosgen Classificatior | C/E 4/5 | | | C-4/5 | | | C 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 | 6.3 | 6.5 | | | 6.6 | 6.8 | 6 | 5.8 | | | 6.8 | 6.9 | 6.9 | 7.1 | | | 5.7 | 7.1 | 5.6 | 3.6 | | |
| Floodprone Width (ft) | 150 | 150 | 150 | 150 | | | ---- | ---- | ---- | ---- | | | 150 | 150 | 150 | 150 | | | ---- | ---- | ---- | ---- | | |
| BF Cross Sectional Area (ft2) | 2.4 | 1.5 | 1.7 | 1.7 | | | 2.4 | 2.6 | 2.5 | 2.4 | | | 2.2 | 2.2 | 2.2 | 1.2 | | | 2.3 | 2.4 | 2.1 | 1.4 | | |
| BF Mean Depth (ft) | 0.3 | 0.2 | 0.3 | 0.3 | | | 0.4 | 0.4 | 0.4 | 0.4 | | | 0.3 | 0.3 | 0.3 | 0.2 | | | 0.4 | 0.3 | 0.4 | 0.4 | | |
| BF Max Depth (ft) | 0.5 | 0.5 | 0.5 | 0.6 | | | 0.7 | 0.7 | 0.8 | 0.8 | | | 0.5 | 0.5 | 0.5 | 0.3 | | | 0.8 | 0.8 | 0.9 | 0.8 | | |
| Width/Depth Ratio | 19.8 | 32.7 | 23.3 | 24.9 | | | ---- | ---- | ---- | ---- | | | 21.0 | 21.6 | 21.6 | 42.0 | | | ---- | ---- | ---- | ---- | | |
| Entrenchment Ratio | 21.7 | 21.4 | 23.8 | 23.1 | | | ---- | ---- | ---- | ---- | | | 22.1 | 21.7 | 21.7 | 21.1 | | | ---- | ---- | ---- | ---- | | |
| Bank Height Ratio | 1 | 1 | 1 | 1 | | | ---- | ---- | ---- | ---- | | | 1 | 1 | 1 | 1 | | | ---- | ---- | ---- | ---- | | |
| Wetted Perimeter (ft) | 7.1 | 7.2 | 6.5 | 6.7 | | | 6.8 | 7 | 6.3 | 6.1 | | | 7 | 7.1 | 7.1 | 7.2 | | | 6 | 7.3 | 6 | 4.1 | | |
| Hydraulic Radius (ft) | 0.3 | 0.2 | 0.3 | 0.3 | | | 0.3 | 0.4 | 0.4 | 0.4 | | | 0.3 | 0.3 | 0.3 | 0.2 | | | 0.4 | 0.3 | 0.3 | 0.3 | | |
| **Substrate** | | | | | | | | | | | | | | | | | | | | | | | | |
| d50 (mm) | ---- | ---- | 24.6 | 26.5 | | | ---- | ---- | ---- | ---- | | | ---- | ---- | 24.2 | 23.9 | | | ---- | ---- | ---- | ---- | | |
| d84 (mm) | ---- | ---- | 40 | 48 | | | ---- | ---- | ---- | ---- | | | ---- | ---- | 45 | 49 | | | ---- | ---- | ---- | ---- | | |

| Parameter | MY-00 (2012) | | | MY-01 (2012) | | | MY-02 (2013) | | | MY-03 (2014) | | | MY-04 (2015) | | | MY-05 (2016) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **Min** | **Max** | **Med** | **Min** | **Max** | **Med** | **Min** | **Max** | **Med** | **Min** | **Max** | **Med** | **Min** | **Max** | **Med** | **Min** | **Max** | **Med** |
| **Pattern** | | | | | | | | | | | | | | | | | | |
| Channel Beltwidth (ft) | 17 | 34 | 23 | 17 | 34 | 23 | 17 | 34 | 23 | 17 | 34 | 23 | | | | | | |
| Radius of Curvature (ft) | 11 | 57 | 17 | 11 | 57 | 17 | 11 | 57 | 17 | 11 | 57 | 17 | | | | | | |
| Meander Wavelength (ft) | 34 | 68 | 49 | 34 | 68 | 49 | 34 | 68 | 49 | 34 | 68 | 49 | | | | | | |
| Meander Width Ratio | 3 | 6 | 4 | 3 | 6 | 4 | 3 | 6 | 4 | 3 | 6 | 4 | | | | | | |
| **Profile** | | | | | | | | | | | | | | | | | | |
| Riffle Length (ft) | 6 | 44 | 14 | 6 | 41 | 11 | 6 | 28 | 12 | 6 | 34 | 12 | | | | | | |
| Riffle Slope (ft/ft) | 0.00% | 1.25% | 0.39% | 0 | 3.39 | 0.42 | 0.00% | 3.33% | 0.42% | 0.00% | 2.76% | 0.39% | | | | | | |
| Pool Length (ft) | 6 | 32 | 13 | 7 | 21 | 11 | 6 | 21 | 11 | 4 | 20 | 10 | | | | | | |
| Pool Spacing (ft) | 17 | 46 | 23 | 17 | 46 | 23 | 17 | 46 | 23 | 50 | 134 | 67 | | | | | | |
| **Additonal Reach Parameters** | | | | | | | | | | | | | | | | | | |
| Valley Length (ft) | 1413 | | | 1522 | | | 1298 | | | 1316 | | | | | | | | |
| Channel Length (ft) | 1,696 | | | 1,827 | | | 1557 | | | 1579 | | | | | | | | |
| Sinuosity | 1.2 | | | 1.2 | | | 1.2 | | | 1.2 | | | | | | | | |
| Water Surface Slope (ft/ft) | 0.004 | | | 0.0041 | | | 0.0042 | | | 0.0043 | | | | | | | | |
| BF Slope (ft/ft) | ------ | | | ------ | | | ------ | | | ------ | | | | | | | | |
| Rosgen Classificatior | C/E 4/5 | | | C 4/5 | | | C 4/5 | | | C 4/5 | | | | | | | | |

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

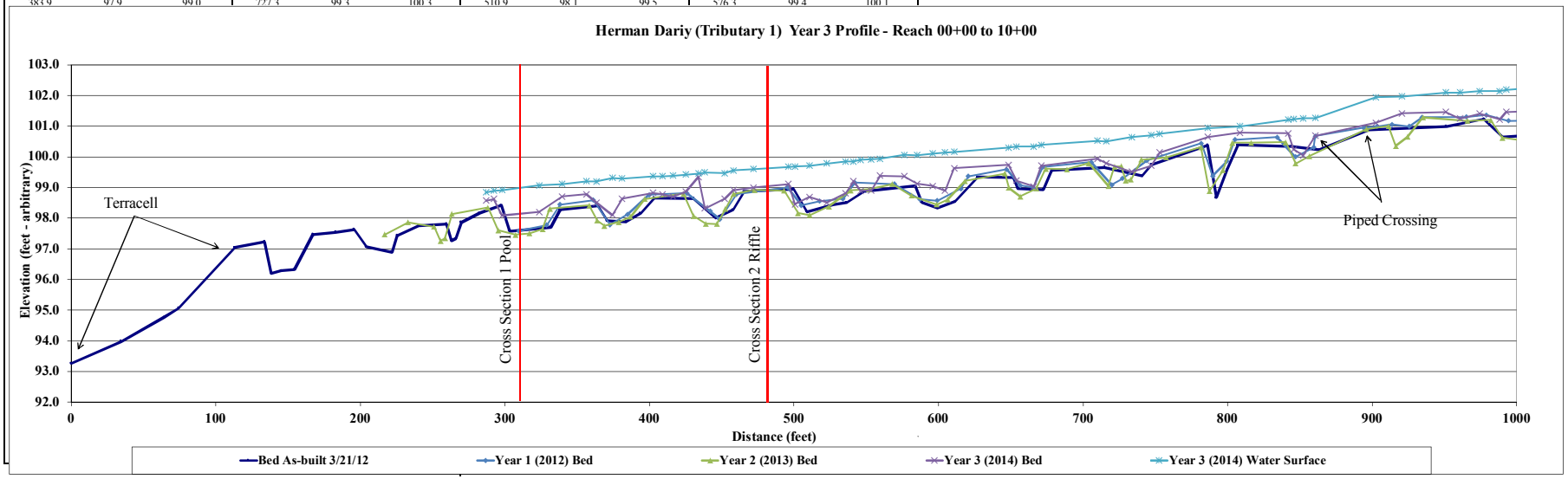
| Parameter | Cross Section 17 Riffle (UT 3) | | | | | | Cross Section 18 Pool (UT 3) | | | | | | Cross Section 19 Pool (UT3) | | | | | | Cross Section 20 Riffle (UT3) | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Dimension** | **MY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

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

| | |
|---|---|
| **Project Name** | Herman Dairy - Year 3 (2014) Profile |
| **Reach** | Tributary 1 |
| **Feature** | Profile |
| **Date** | 3/13/14 |
| **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 | 93.3 | 93.9 | 309.6 | 97.6 | 98.9 | 216.9 | 97.5 | 98.2 | 287.0 | 98.6 | 98.8 |
| 34.6 | 94.0 | 94.3 | 328.9 | 97.8 | 98.9 | 233.1 | 97.9 | 98.2 | 292.2 | 98.6 | 98.9 |
| 64.3 | 94.8 | 95.2 | 338.1 | 98.4 | 99.0 | 251.0 | 97.7 | 98.3 | 298.1 | 98.1 | 98.9 |
| 74.2 | 95.1 | 95.4 | 361.2 | 98.6 | 99.1 | 255.4 | 97.3 | 98.2 | 323.8 | 98.2 | 99.1 |
| 113.3 | 97.0 | 97.5 | 372.6 | 97.8 | 99.2 | 258.6 | 97.3 | 98.3 | 339.8 | 98.7 | 99.1 |
| 133.7 | 97.2 | 97.9 | 384.9 | 98.1 | 99.2 | 263.3 | 98.1 | 98.4 | 356.5 | 98.8 | 99.2 |
| 138.4 | 96.2 | 98.0 | 399.8 | 98.8 | 99.2 | 288.3 | 98.3 | 98.7 | 363.3 | 98.5 | 99.2 |
| 145.3 | 96.3 | 97.9 | 425.9 | 98.8 | 99.2 | 295.3 | 97.6 | 98.7 | 374.5 | 98.1 | 99.3 |
| 154.5 | 96.3 | 98.0 | 442.1 | 98.2 | 99.2 | 307.2 | 97.5 | 98.7 | 381.1 | 98.6 | 99.3 |
| 167.2 | 97.5 | 98.0 | 448.7 | 98.0 | 99.3 | 316.9 | 97.5 | 98.7 | 402.4 | 98.8 | 99.4 |
| 182.9 | 97.5 | 98.1 | 460.2 | 98.8 | 99.3 | 326.0 | 97.6 | 98.7 | 408.9 | 98.8 | 99.4 |
| 195.8 | 97.6 | 98.1 | 495.5 | 99.0 | 99.5 | 331.1 | 98.3 | 98.8 | 416.2 | 98.7 | 99.4 |
| 204.1 | 97.1 | 98.1 | 505.1 | 98.4 | 99.5 | 358.4 | 98.4 | 99.0 | 425.2 | 98.9 | 99.4 |
| 221.9 | 96.9 | 98.1 | 517.5 | 98.5 | 99.5 | 363.8 | 97.9 | 99.1 | 433.9 | 99.3 | 99.5 |
| 225.5 | 97.4 | 98.1 | 534.0 | 98.6 | 99.4 | 368.9 | 97.7 | 99.1 | 438.3 | 98.3 | 99.5 |
| 240.5 | 97.8 | 98.2 | 542.1 | 99.2 | 99.5 | 378.8 | 97.9 | 99.1 | 452.1 | 98.6 | 99.5 |
| 259.8 | 97.8 | 98.3 | 569.5 | 99.1 | 99.6 | 386.9 | 98.0 | | 458.1 | 98.9 | 99.6 |
| 263.0 | 97.3 | 98.3 | 587.1 | 98.6 | 99.6 | 396.6 | 98.6 | 99.1 | 471.9 | 99.0 | 99.6 |
| 266.2 | 97.3 | 98.3 | 599.2 | 98.6 | 99.6 | 423.5 | 98.8 | 99.1 | 496.2 | 99.1 | 99.7 |
| 269.8 | 97.9 | 98.4 | 615.4 | 99.0 | 99.6 | 430.5 | 98.1 | 99.2 | 500.7 | 98.5 | 99.7 |
| 282.4 | 98.2 | 98.5 | 620.7 | 99.4 | 99.7 | 438.9 | 97.8 | 99.2 | 510.7 | 98.7 | 99.7 |
| 297.4 | 98.4 | 98.7 | 647.1 | 99.6 | 99.9 | 446.6 | 97.8 | 99.2 | 522.8 | 98.5 | 99.8 |
| 303.3 | 97.6 | 98.7 | 656.5 | 99.1 | 100.0 | 452.6 | 98.3 | 99.1 | 535.7 | 98.8 | 99.8 |
| 331.6 | 97.7 | 98.7 | 665.6 | 99.0 | 100.0 | 458.2 | 98.8 | 99.3 | 541.2 | 99.2 | 99.8 |
| 338.2 | 98.3 | 98.8 | 672.0 | 99.7 | 100.0 | 472.7 | 98.9 | 99.3 | 546.1 | 98.9 | 99.9 |
| 364.5 | 98.4 | 98.9 | 705.7 | 99.8 | 100.2 | 493.2 | 98.9 | 99.5 | 553.4 | 98.9 | 99.9 |
| 370.8 | 97.9 | 99.0 | 719.8 | 99.1 | 100.2 | 502.7 | 98.2 | 99.5 | 559.6 | 99.4 | 99.9 |
| 383.9 | 97.9 | 99.0 | 727.3 | 99.3 | 100.3 | 510.9 | 98.1 | 99.5 | 576.3 | 99.4 | 100.1 |

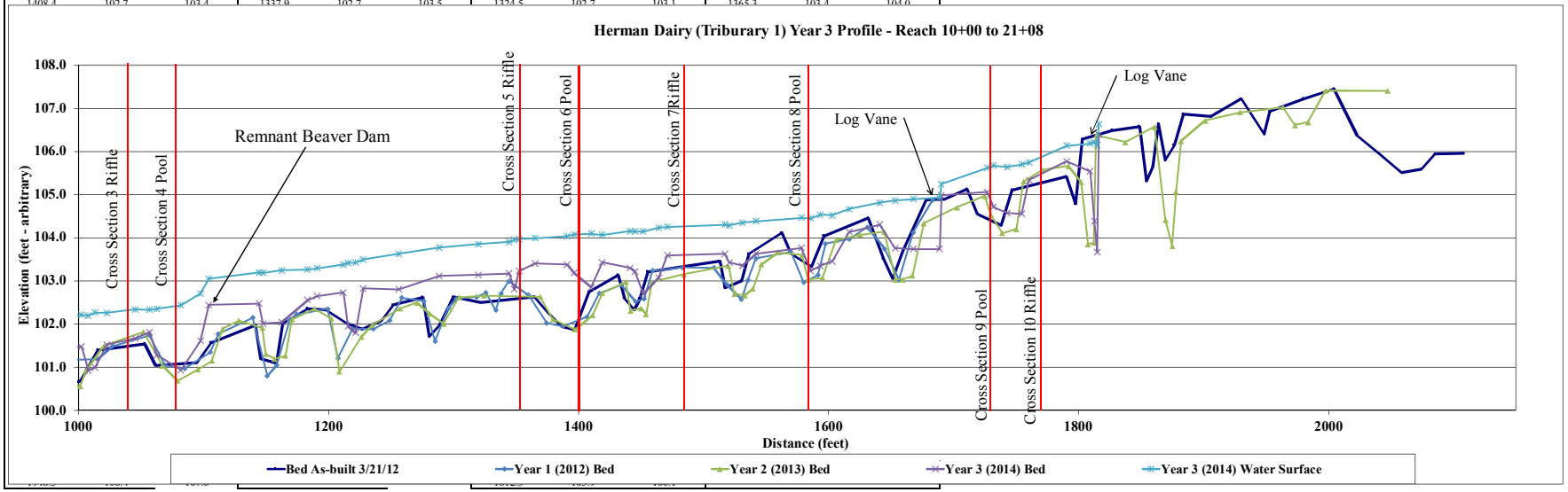
| | As-built | 2012 | 2013 | 2014 |
|---|---|---|---|---|
| **Avg. Water Surface Slope** | 0.0053 | 0.0045 | 0.0054 | 0.0051 |
| **Riffle Length** | 36 | 28 | 36 | 38 |
| **Avg. Riffle Slope** | 0.0064 | 0.0057 | 0.0075 | 0.0049 |
| **Pool Length** | 32 | 35 | 32 | 30 |



| | |
|---|---|
| **Project Name** | Herman Dairy - Year 3 (2014) Profile |
| **Reach** | Tributary 1 |
| **Feature** | Profile |
| **Date** | 3/13/14 |
| **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 |
| 990.2 | 100.6 | 101.7 | 994.2 | 101.2 | 102.0 | 990.0 | 100.6 | 101.8 | 992.7 | 101.5 | 102.2 |
| 1001.8 | 100.7 | 101.7 | 1015.4 | 101.2 | 102.1 | 1001.2 | 100.6 | 101.8 | 1002.4 | 101.5 | 102.2 |
| 1015.7 | 101.4 | 101.7 | 1027.3 | 101.5 | 102.1 | 1005.6 | 100.9 | 101.8 | 1008.0 | 100.9 | 102.2 |
| 1053.0 | 101.5 | 101.9 | 1056.7 | 101.7 | 102.3 | 1020.3 | 101.5 | 101.9 | 1013.1 | 101.0 | 102.3 |
| 1061.5 | 101.0 | 101.9 | 1069.3 | 101.0 | 102.3 | 1052.0 | 101.8 | 102.3 | 1022.9 | 101.5 | 102.3 |
| 1094.8 | 101.1 | 102.0 | 1085.1 | 101.0 | 102.3 | 1066.9 | 101.0 | 102.3 | 1045.3 | 101.7 | 102.3 |
| 1106.1 | 101.6 | 102.2 | 1105.4 | 101.3 | 102.4 | 1079.1 | 100.7 | 102.3 | 1056.9 | 101.8 | 102.3 |
| 1141.7 | 102.0 | 102.4 | 1111.8 | 101.8 | 102.4 | 1095.5 | 100.9 | 102.3 | 1062.7 | 101.3 | 102.4 |
| 1145.7 | 101.2 | 102.3 | 1139.4 | 102.2 | 102.7 | 1106.7 | 101.1 | 102.3 | 1081.8 | 100.9 | 102.4 |
| 1158.5 | 101.1 | 102.3 | 1151.1 | 100.8 | 102.7 | 1115.3 | 101.9 | 102.3 | 1097.5 | 101.6 | 102.7 |
| 1163.3 | 102.0 | 102.4 | 1158.5 | 101.0 | 102.7 | 1128.3 | 102.1 | 102.5 | 1104.2 | 102.4 | 103.0 |
| 1183.3 | 102.4 | 102.7 | 1168.8 | 102.1 | 102.7 | 1147.1 | 101.9 | 102.6 | 1144.4 | 102.5 | 103.2 |
| 1197.8 | 102.3 | 102.8 | 1174.7 | 102.2 | 102.7 | 1149.9 | 101.3 | 102.6 | 1147.7 | 102.0 | 103.2 |
| 1214.6 | 102.0 | 102.8 | 1199.3 | 102.4 | 102.9 | 1157.0 | 101.2 | 102.6 | 1162.6 | 102.0 | 103.2 |
| 1226.9 | 101.9 | 102.8 | 1207.4 | 101.2 | 103.0 | 1165.6 | 101.3 | 102.6 | 1183.3 | 102.6 | 103.3 |
| 1242.5 | 102.1 | 102.8 | 1219.3 | 101.9 | 103.0 | 1170.8 | 102.1 | 102.6 | 1190.6 | 102.6 | 103.3 |
| 1251.9 | 102.4 | 102.8 | 1235.6 | 101.9 | 103.0 | 1188.6 | 102.4 | 102.8 | 1211.9 | 102.7 | 103.4 |
| 1275.5 | 102.6 | 102.8 | 1248.9 | 102.1 | 103.1 | 1202.2 | 102.1 | 102.8 | 1215.7 | 101.9 | 103.4 |
| 1280.7 | 101.7 | 102.9 | 1258.6 | 102.6 | 103.2 | 1208.7 | 100.9 | 102.9 | 1221.5 | 101.8 | 103.4 |
| 1289.3 | 102.0 | 102.9 | 1276.2 | 102.5 | 103.3 | 1226.2 | 101.7 | 102.9 | 1227.7 | 102.8 | 103.5 |
| 1300.0 | 102.6 | 102.8 | 1285.3 | 101.6 | 103.3 | 1234.8 | 102.0 | 102.9 | 1256.2 | 102.8 | 103.6 |
| 1321.8 | 102.5 | 102.9 | 1295.7 | 102.4 | 103.3 | 1257.0 | 102.4 | 102.9 | 1288.7 | 103.1 | 103.8 |
| 1364.7 | 102.6 | | 1302.3 | 102.6 | 103.4 | 1270.7 | 102.5 | 103.0 | 1319.8 | 103.1 | 103.9 |
| 1376.2 | 102.2 | 103.0 | 1318.4 | 102.6 | 103.5 | 1280.9 | 102.2 | 103.0 | 1344.6 | 103.2 | 103.9 |
| 1386.5 | 102.0 | 103.1 | 1326.0 | 102.7 | 103.5 | 1292.0 | 102.0 | 103.0 | 1348.5 | 102.8 | 104.0 |
| 1397.1 | 101.9 | 103.1 | 1333.8 | 102.3 | 103.5 | 1304.3 | 102.6 | 103.0 | 1352.5 | 103.2 | 104.0 |
| 1408.4 | 102.7 | 103.4 | 1337.9 | 102.7 | 103.5 | 1324.5 | 102.7 | 103.1 | 1365.3 | 103.4 | 104.0 |

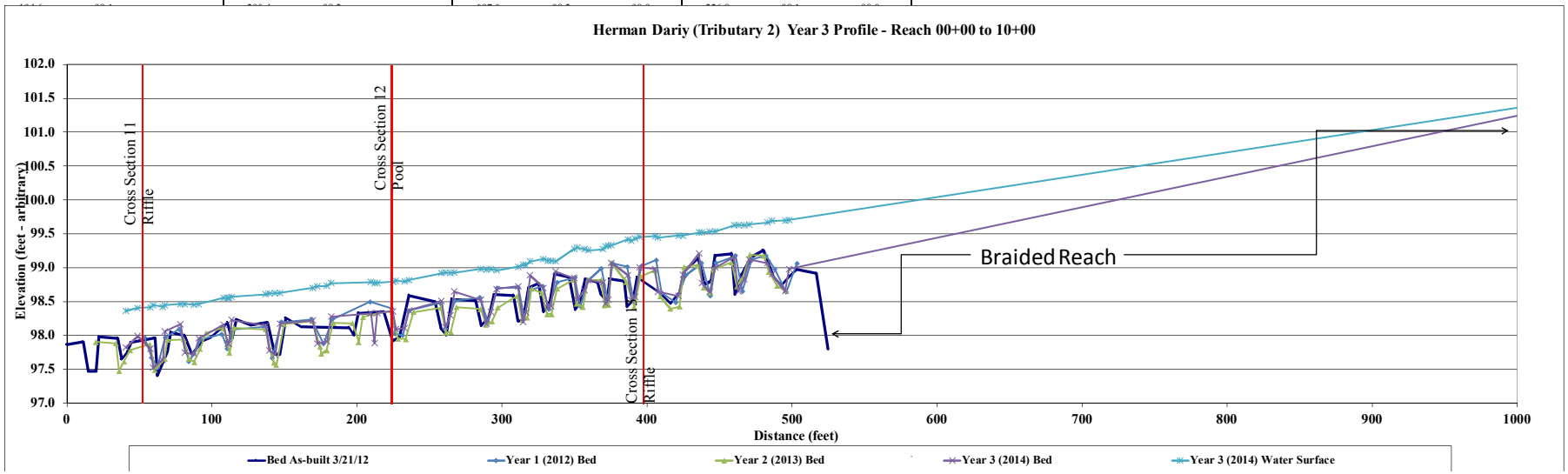
| | As-built | 2012 | 2013 | 2014 |
|---|---|---|---|---|
| **Avg. Water Surface Slope** | 0.0053 | 0.0045 | 0.0054 | 0.0051 |
| **Riffle Length** | 36 | 28 | 36 | 38 |
| **Avg. Riffle Slope** | 0.0064 | 0.0057 | 0.0075 | 0.0049 |
| **Pool Length** | 32 | 35 | 32 | 30 |



| | |
|---|---|
| **Project Name** | Herman Dairy - Year 3 (2014) Profile |
| **Reach** | Tributary 2 |
| **Feature** | Profile |
| **Date** | 3/13/14 |
| **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 | 20.0 | 97.9 | 98.5 | 40.8 | 97.8 | 98.4 |
| 11.2 | 97.9 | 98.2 | 58.4 | 97.7 | 98.4 | 33.8 | 97.9 | 98.5 | 48.9 | 98.0 | 98.4 |
| 14.9 | 97.5 | 98.2 | 62.3 | 97.5 | 98.3 | 36.0 | 97.5 | 98.6 | 57.4 | 97.8 | 98.4 |
| 20.1 | 97.5 | 98.2 | 67.7 | 98.0 | 98.3 | 39.4 | 97.6 | 98.6 | 59.6 | 97.5 | 98.4 |
| 22.2 | 98.0 | 98.0 | 77.5 | 98.1 | 98.4 | 43.6 | 97.8 | | 66.0 | 97.6 | 98.4 |
| 34.9 | 98.0 | | 84.1 | 97.6 | 98.4 | 57.3 | 97.9 | 98.6 | 67.6 | 98.1 | 98.4 |
| 37.6 | 97.6 | 98.1 | 87.5 | 97.7 | 98.4 | 60.4 | 97.5 | 98.6 | 78.2 | 98.2 | 98.5 |
| 41.7 | 97.7 | 98.1 | 92.2 | 97.9 | 98.4 | 67.4 | 97.7 | 98.6 | 81.4 | 97.7 | 98.5 |
| 44.1 | 97.9 | | 106.8 | 98.0 | 98.4 | 69.4 | 97.9 | 98.6 | 87.5 | 97.7 | 98.5 |
| 60.6 | 98.0 | | 110.6 | 97.8 | 98.3 | 80.5 | 97.9 | 98.6 | 90.9 | 98.0 | 98.5 |
| 62.3 | 97.4 | 98.1 | 114.0 | 98.1 | 98.2 | 84.1 | 97.7 | 98.7 | 108.0 | 98.2 | 98.6 |
| 69.1 | 97.8 | 98.1 | 137.1 | 98.1 | 98.4 | 87.7 | 97.6 | 98.7 | 110.9 | 97.9 | 98.5 |
| 71.7 | 98.0 | | 141.4 | 97.7 | 98.4 | 91.8 | 97.8 | 98.6 | 111.5 | 97.9 | 98.5 |
| 81.1 | 98.0 | | 147.7 | 98.2 | 98.3 | 95.9 | 98.0 | 98.7 | 113.6 | 98.2 | 98.6 |
| 85.9 | 97.7 | 98.3 | 168.6 | 98.2 | 98.5 | 107.8 | 98.1 | 98.7 | 137.1 | 98.1 | 98.6 |
| 93.8 | 97.9 | 98.3 | 176.9 | 97.9 | 98.5 | 112.1 | 97.7 | 98.7 | 139.6 | 97.8 | 98.6 |
| 99.3 | 98.0 | 98.3 | 182.9 | 98.2 | 98.4 | 115.2 | 98.1 | 98.7 | 143.6 | 97.7 | 98.6 |
| 110.8 | 98.2 | | 209.1 | 98.5 | 98.5 | 136.8 | 98.1 | 98.8 | 146.9 | 98.2 | 98.6 |
| 113.8 | 97.9 | 98.4 | 223.9 | 98.4 | 98.6 | 142.5 | 97.6 | 98.8 | 169.5 | 98.2 | 98.7 |
| 116.9 | 98.2 | | 226.4 | 98.0 | 98.6 | 144.2 | 97.6 | 98.8 | 172.8 | 97.9 | 98.7 |
| 126.7 | 98.1 | 98.4 | 231.4 | 98.0 | 98.6 | 149.8 | 98.2 | 98.8 | 179.2 | 97.9 | 98.7 |
| 138.4 | 98.2 | | 235.9 | 98.4 | 98.7 | 169.3 | 98.2 | 98.8 | 182.2 | 98.3 | 98.8 |
| 143.4 | 97.7 | 98.4 | 257.1 | 98.5 | 98.8 | 174.4 | 97.8 | 98.8 | 209.6 | 98.3 | 98.8 |
| 146.8 | 97.7 | 98.5 | 261.1 | 98.1 | 98.8 | 175.4 | 97.7 | 98.8 | 212.1 | 97.9 | 98.8 |
| 150.8 | 98.3 | | 267.6 | 98.5 | 98.8 | 179.1 | 97.8 | 98.8 | 213.9 | 98.3 | 98.8 |
| 161.2 | 98.1 | | 284.8 | 98.6 | 98.8 | 183.6 | 98.2 | 98.8 | 224.7 | 98.4 | 98.8 |

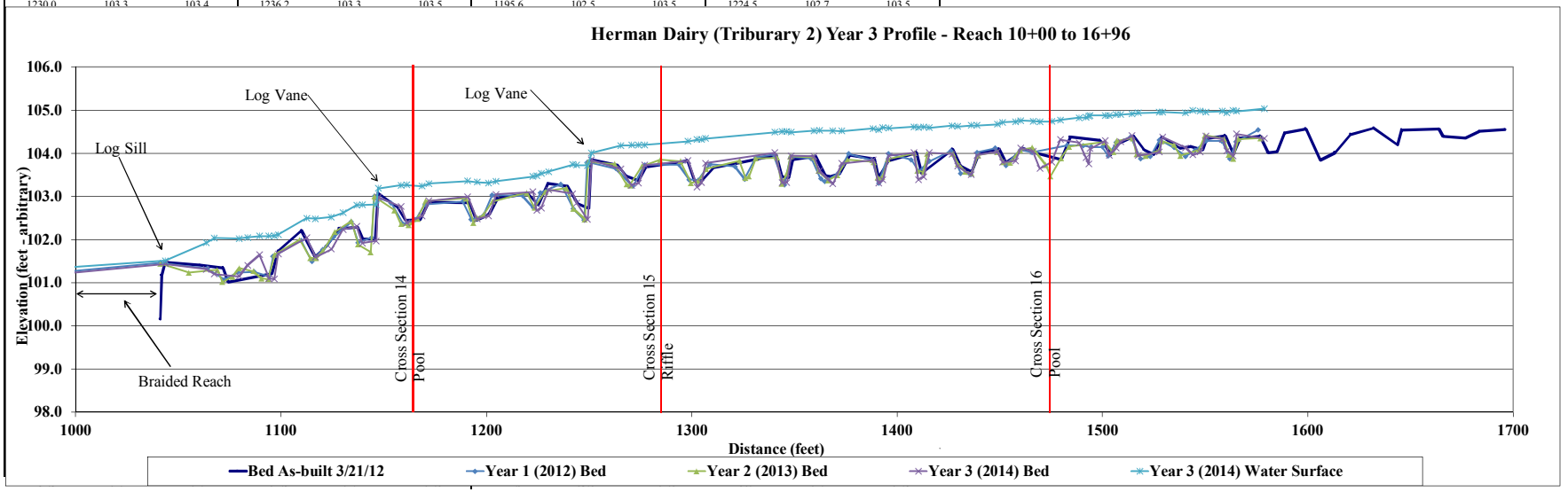
| | As-built | 2012 | 2013 | 2014 |
|---|---|---|---|---|
| **Avg. Water Surface Slope** | 0.0040 | 0.0041 | 0.0042 | 0.0043 |
| **Riffle Length** | 14 | 13 | 13 | 14 |
| **Avg. Riffle Slope** | 0.0039 | 0.0042 | 0.0061 | 0.0057 |
| **Pool Length** | 13 | 12 | 11 | 11 |



| | |
|---|---|
| **Project Name** | Herman Dairy - Year 3 (2014) Profile |
| **Reach** | Tributary 2 |
| **Feature** | Profile |
| **Date** | 3/13/14 |
| **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 | 495.4 | 98.7 | | 498.0 | 99.0 | 99.7 |
| 1041.2 | 100.2 | 100.8 | 1041.2 | 101.5 | 101.5 | 1041.2 | 101.4 | | 1043.6 | 101.4 | 101.5 |
| 1041.8 | 101.2 | 101.2 | 1064.1 | 101.3 | 101.6 | 1055.1 | 101.2 | 101.8 | 1063.5 | 101.3 | 101.9 |
| 1043.5 | 101.5 | 101.5 | 1072.4 | 101.1 | 101.7 | 1068.9 | 101.3 | 102.0 | 1067.5 | 101.2 | 102.0 |
| 1060.7 | 101.4 | 101.7 | 1078.9 | 101.2 | 101.7 | 1071.4 | 101.0 | 102.0 | 1079.6 | 101.1 | 102.0 |
| 1071.8 | 101.3 | 101.7 | 1087.0 | 101.3 | 101.7 | 1076.4 | 101.1 | 102.0 | 1083.8 | 101.4 | 102.0 |
| 1074.4 | 101.0 | 101.6 | 1094.2 | 101.1 | 101.7 | 1079.6 | 101.3 | 102.0 | 1089.6 | 101.6 | 102.1 |
| 1095.6 | 101.2 | 101.7 | 1096.1 | 101.6 | 101.9 | 1086.6 | 101.3 | 102.0 | 1094.1 | 101.1 | 102.1 |
| 1098.7 | 101.7 | | 1109.7 | 102.0 | 102.4 | 1090.3 | 101.1 | 102.0 | 1096.7 | 101.1 | 102.1 |
| 1110.0 | 102.2 | | 1115.0 | 101.5 | 102.4 | 1093.7 | 101.1 | 102.0 | 1098.7 | 101.7 | 102.1 |
| 1116.6 | 101.6 | 102.3 | 1120.4 | 101.8 | 102.4 | 1096.8 | 101.7 | 102.2 | 1112.5 | 102.0 | 102.5 |
| 1122.1 | 101.8 | 102.3 | 1125.5 | 102.1 | 102.4 | 1109.1 | 102.0 | 102.6 | 1116.7 | 101.6 | 102.5 |
| 1128.3 | 102.3 | | 1134.2 | 102.4 | 102.8 | 1114.1 | 101.6 | 102.6 | 1124.5 | 101.8 | 102.5 |
| 1137.3 | 102.3 | | 1137.5 | 101.9 | | 1117.1 | 101.6 | 102.6 | 1130.2 | 102.2 | 102.6 |
| 1139.8 | 102.0 | 102.6 | 1144.2 | 102.0 | 102.8 | 1120.4 | 101.7 | 102.6 | 1136.9 | 102.3 | 102.8 |
| 1146.0 | 102.0 | 102.6 | 1145.5 | 103.0 | | 1126.1 | 102.2 | 102.7 | 1139.6 | 101.9 | 102.8 |
| 1147.4 | 103.1 | | 1153.5 | 102.9 | 103.1 | 1134.2 | 102.4 | 103.0 | 1146.4 | 102.0 | 102.8 |
| 1156.8 | 102.8 | 103.1 | 1159.3 | 102.4 | 103.1 | 1137.5 | 101.9 | 103.0 | 1147.4 | 103.0 | 103.2 |
| 1160.6 | 102.4 | 103.1 | 1165.4 | 102.5 | 103.1 | 1143.7 | 101.7 | 103.0 | 1158.3 | 102.8 | 103.3 |
| 1167.7 | 102.5 | 103.1 | 1170.1 | 102.8 | 103.1 | 1145.3 | 103.0 | 103.3 | 1161.3 | 102.4 | 103.3 |
| 1172.0 | 102.9 | 103.1 | 1188.5 | 102.9 | 103.2 | 1155.2 | 102.7 | 103.4 | 1168.8 | 102.6 | 103.2 |
| 1191.8 | 102.9 | 103.2 | 1192.5 | 102.5 | 103.2 | 1158.5 | 102.4 | 103.4 | 1172.1 | 102.9 | 103.3 |
| 1195.0 | 102.4 | 103.2 | 1198.5 | 102.6 | 103.3 | 1162.1 | 102.3 | 103.4 | 1190.9 | 103.0 | 103.4 |
| 1201.3 | 102.6 | 103.2 | 1202.8 | 103.0 | 103.3 | 1166.4 | 102.5 | 103.4 | 1195.5 | 102.5 | 103.3 |
| 1205.2 | 103.0 | 103.2 | 1217.5 | 103.0 | 103.4 | 1170.4 | 102.9 | 103.4 | 1201.1 | 102.6 | 103.3 |
| 1220.4 | 103.1 | 103.3 | 1222.8 | 102.7 | 103.4 | 1190.0 | 103.0 | 103.5 | 1204.7 | 103.0 | 103.4 |
| 1225.1 | 102.8 | 103.3 | 1226.2 | 103.1 | 103.5 | 1193.6 | 102.4 | 103.5 | 1222.7 | 103.1 | 103.5 |
| 1230.0 | 103.3 | 103.4 | 1236.2 | 103.3 | 103.5 | 1195.6 | 102.5 | 103.5 | 1224.5 | 102.7 | 103.5 |

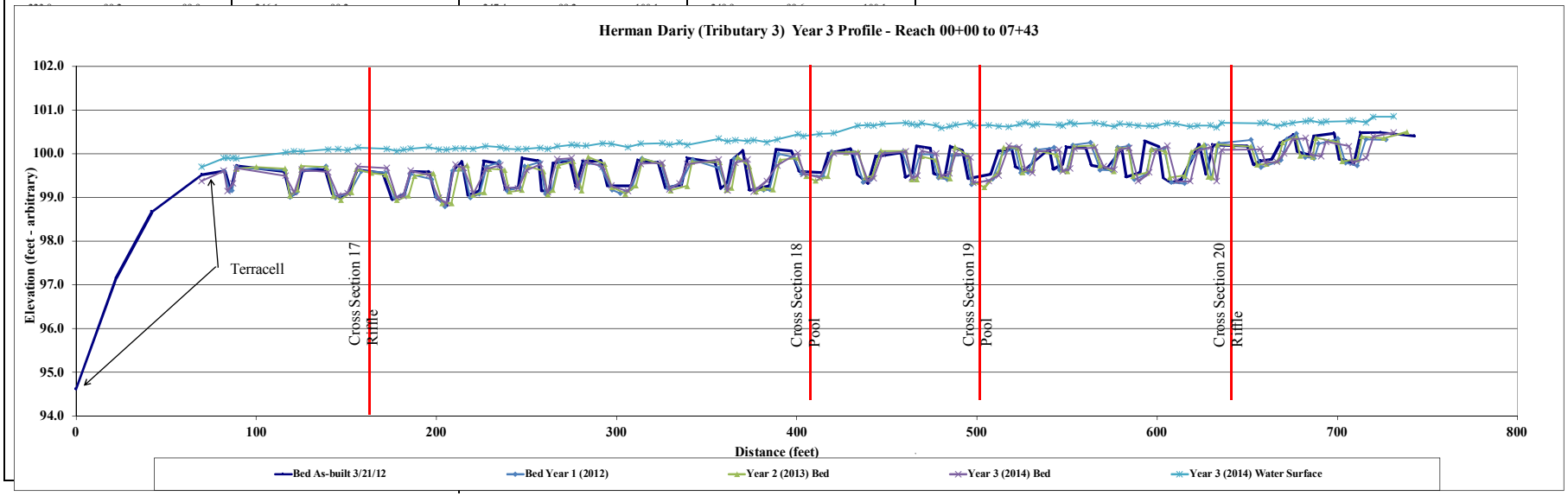
| | As-built | 2012 | 2013 | 2014 |
|---|---|---|---|---|
| **Avg. Water Surface Slope** | 0.0040 | 0.0041 | 0.0042 | 0.0043 |
| **Riffle Length** | 14 | 13 | 13 | 14 |
| **Avg. Riffle Slope** | 0.0039 | 0.0042 | 0.0061 | 0.0057 |
| **Pool Length** | 13 | 12 | 11 | 11 |



| | |
|---|---|
| **Project Name** | Herman Dairy - Year 3 (2014) Profile |
| **Reach** | Tributary 3 |
| **Feature** | Profile |
| **Date** | 3/13/14 |
| **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 | | 89.0 | 99.7 | 99.9 | 69.8 | 99.4 | 99.7 |
| 22.2 | 97.1 | | 85.1 | 99.1 | | 100.1 | 99.7 | 99.9 | 82.0 | 99.6 | 99.9 |
| 42.1 | 98.7 | | 86.6 | 99.2 | | 116.2 | 99.7 | 100.0 | 84.0 | 99.1 | 99.9 |
| 69.9 | 99.5 | | 89.0 | 99.7 | | 118.7 | 99.0 | 100.0 | 87.2 | 99.3 | 99.9 |
| 82.7 | 99.6 | | 116.0 | 99.6 | | 122.8 | 99.2 | 100.0 | 89.0 | 99.7 | 99.9 |
| 85.8 | 99.2 | 99.9 | 118.9 | 99.0 | | 124.9 | 99.7 | 99.9 | 116.3 | 99.5 | 100.0 |
| 89.2 | 99.7 | 99.9 | 122.4 | 99.1 | | 138.9 | 99.7 | 100.0 | 121.0 | 99.1 | 100.1 |
| 115.5 | 99.6 | 99.9 | 125.1 | 99.6 | | 142.8 | 99.0 | 100.0 | 125.1 | 99.6 | 100.0 |
| 119.0 | 99.0 | 99.9 | 138.8 | 99.7 | | 146.9 | 98.9 | 100.0 | 139.9 | 99.6 | 100.1 |
| 122.7 | 99.1 | 99.9 | 143.8 | 99.0 | | 153.0 | 99.1 | 100.0 | 145.4 | 99.0 | 100.1 |
| 125.8 | 99.6 | 99.9 | 151.9 | 99.1 | | 155.7 | 99.6 | 100.0 | 150.6 | 99.1 | 100.1 |
| 138.2 | 99.6 | 99.9 | 158.4 | 99.6 | | 163.8 | 99.6 | 100.0 | 156.5 | 99.7 | 100.1 |
| 142.3 | 99.1 | 99.9 | 171.8 | 99.6 | | 171.9 | 99.5 | 100.0 | 172.5 | 99.7 | 100.1 |
| 146.4 | 99.0 | 99.9 | 176.8 | 99.0 | | 178.1 | 98.9 | 100.0 | 177.9 | 99.0 | 100.1 |
| 151.0 | 99.1 | 99.9 | 182.1 | 99.1 | | 184.5 | 99.0 | 100.0 | 181.6 | 99.0 | 100.1 |
| 156.1 | 99.6 | 99.9 | 185.4 | 99.5 | | 187.8 | 99.5 | 100.0 | 185.6 | 99.6 | 100.1 |
| 170.2 | 99.6 | 99.9 | 197.4 | 99.4 | | 198.4 | 99.6 | 100.0 | 195.7 | 99.5 | 100.2 |
| 175.3 | 99.0 | 99.9 | 199.7 | 99.0 | | 203.3 | 98.9 | 100.0 | 201.2 | 99.0 | 100.1 |
| 182.1 | 99.1 | 99.9 | 204.8 | 98.8 | | 208.4 | 98.9 | 100.0 | 205.5 | 98.9 | 100.1 |
| 185.9 | 99.6 | 99.9 | 209.1 | 99.6 | | 212.7 | 99.7 | 100.0 | 210.5 | 99.7 | 100.1 |
| 196.0 | 99.6 | 99.9 | 215.3 | 99.6 | | 217.1 | 99.7 | 100.0 | 215.1 | 99.7 | 100.1 |
| 199.5 | 99.0 | 99.9 | 218.7 | 99.0 | | 220.5 | 99.1 | 100.0 | 220.4 | 99.1 | 100.1 |
| 205.7 | 98.8 | 99.9 | 223.9 | 99.1 | | 226.5 | 99.1 | 100.0 | 227.2 | 99.6 | 100.2 |
| 208.9 | 99.6 | | 227.8 | 99.7 | | 229.2 | 99.7 | 100.0 | 235.4 | 99.7 | 100.1 |
| 214.2 | 99.8 | 100.0 | 234.9 | 99.8 | | 237.8 | 99.6 | 100.1 | 238.8 | 99.2 | 100.1 |
| 217.5 | 99.0 | 100.0 | 239.4 | 99.1 | | 240.6 | 99.1 | 100.1 | 245.3 | 99.2 | 100.1 |

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



| | |
|---|---|
| **Site Name:** | Herman Dairy |
| **Watershed:** | 30501001120030 |
| **XS ID** | Tributary 1 ( XS - 1, Pool) |
| **Drainage Area (sq mi):** | 1.01 |
| **Date:** | 3/13/2014 |
| **Field Crew:** | Perkinson, Jernigan |

| Station | Elevation |
|---|---|
| 0.00 | 99.50 |
| 11.90 | 99.80 |
| 16.81 | 99.70 |
| 18.55 | 99.77 |
| 20.83 | 99.49 |
| 22.49 | 98.40 |
| 23.34 | 98.02 |
| 24.46 | 98.01 |
| 25.63 | 98.07 |
| 26.75 | 98.12 |
| 27.63 | 98.24 |
| 28.49 | 98.67 |
| 29.49 | 99.28 |
| 30.72 | 99.35 |
| 32.28 | 99.36 |
| 33.33 | 99.18 |
| 38.3 | 99.44 |
| 45.09 | 99.76 |
| 50.25 | 99.70 |
| | |
| | |
| | |
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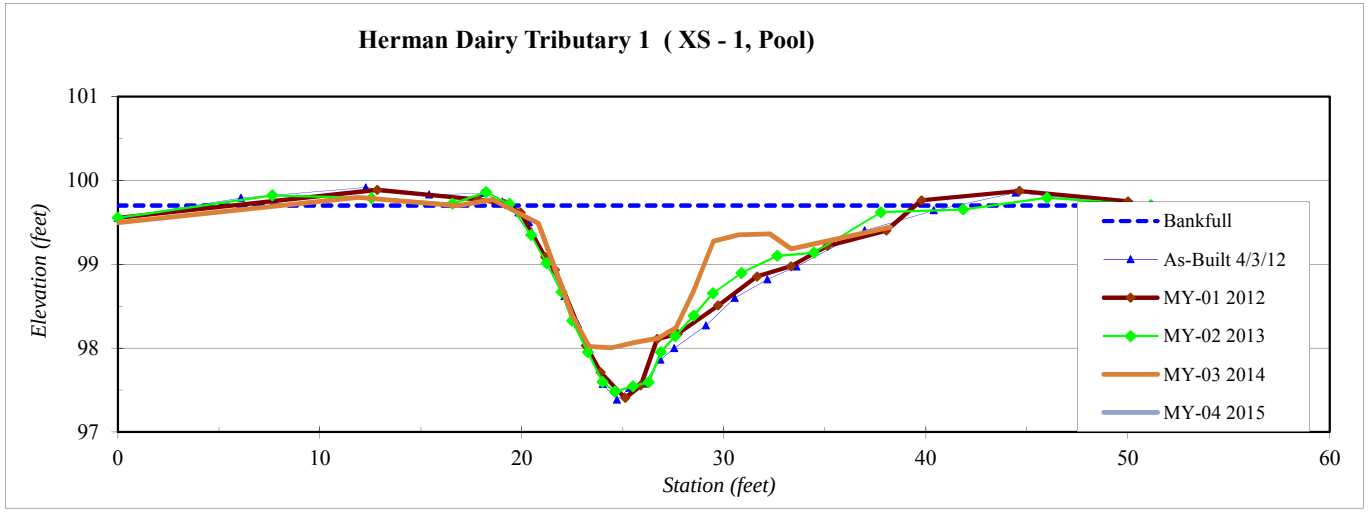
| | |

| SUMMARY DATA | |
|---|---|
| **Bankfull Elevation:** | 99.7 |
| **Bankfull Cross-Sectional Area:** | 15.6 |
| **Bankfull Width:** | 24.8 |
| **Flood Prone Area Elevation:** | - |
| **Flood Prone Width:** | - |
| **Max Depth at Bankfull:** | 1.7 |
| **Mean Depth at Bankfull:** | 0.6 |
| **W / D Ratio:** | - |
| **Entrenchment Ratio:** | - |
| **Bank Height Ratio:** | - |

| | |
|---|---|
| **Stream Type** | E |

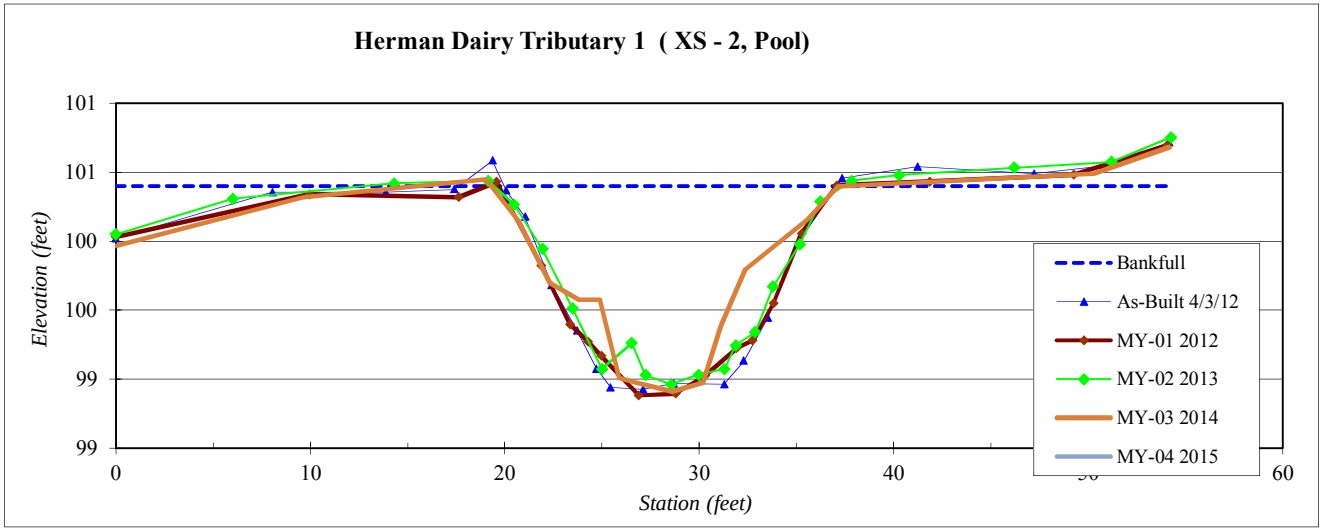


| | |
|---|---|
| **Site Name:** | Herman Dairy |
| **Watershed:** | 30501001120030 |
| **XS ID** | Tributary 1 ( XS - 2, Pool) |
| **Drainage Area (sq mi):** | 1.01 |
| **Date:** | 3/13/2014 |
| **Field Crew:** | Perkinson, Jernigan |

| Station | Elevation |
|---|---|
| 0.00 | 99.97 |
| 9.61 | 100.32 |
| 19.04 | 100.45 |
| 20.72 | 100.15 |
| 22.33 | 99.70 |
| 23.81 | 99.57 |
| 24.87 | 99.58 |
| 25.88 | 99.01 |
| 26.69 | 98.98 |
| 28.61 | 98.91 |
| 30.19 | 98.97 |
| 31.11 | 99.39 |
| 32.35 | 99.79 |
| 35.54 | 100.16 |
| 37.13 | 100.40 |
| 43.8 | 100.45 |
| 50.3 | 100.49 |
| 54.2 | 100.68 |
| | |
| | |
| | |
| | |
| | |
| | |
| | |

| SUMMARY DATA | |
|---|---|
| **Bankfull Elevation:** | 100.4 |
| **Bankfull Cross-Sectional Area:** | 14.0 |
| **Bankfull Width:** | 18.2 |
| **Flood Prone Area Elevation:** | - |
| **Flood Prone Width:** | - |
| **Max Depth at Bankfull:** | 1.5 |
| **Mean Depth at Bankfull:** | 0.8 |
| **W / D Ratio:** | - |
| **Entrenchment Ratio:** | - |
| **Bank Height Ratio:** | - |

| | |
|---|---|
| **Stream Type** | E |

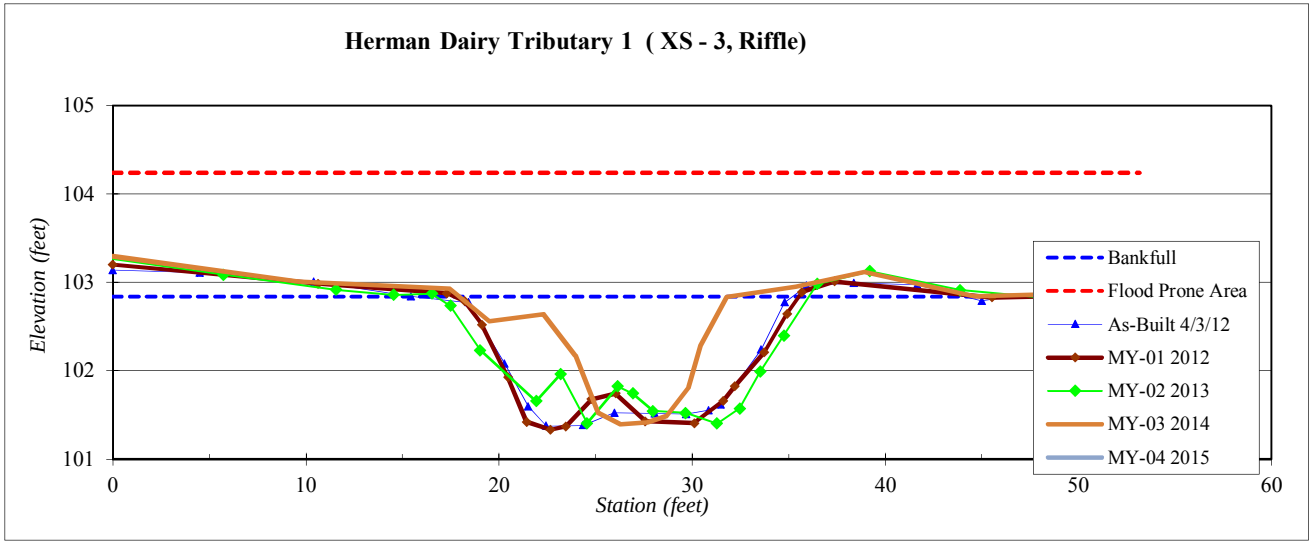


| | |
|---|---|
| **Site Name:** | Herman Dairy |
| **Watershed:** | 30501001120030 |
| **XS ID** | Tributary 1 ( XS - 3, Riffle) |
| **Drainage Area (sq mi):** | 1.01 |
| **Date:** | 3/13/2014 |
| **Field Crew:** | Perkinson, Jernigan |

| Station | Elevation |
|---|---|
| 0.00 | 103.30 |
| 9.62 | 103.01 |
| 17.42 | 102.93 |
| 19.49 | 102.56 |
| 22.31 | 102.64 |
| 23.98 | 102.17 |
| 25.12 | 101.52 |
| 26.29 | 101.39 |
| 27.68 | 101.42 |
| 28.68 | 101.49 |
| 29.80 | 101.81 |
| 30.43 | 102.29 |
| 31.80 | 102.83 |
| 35.36 | 102.95 |
| 38.9 | 103.12 |
| 44.6 | 102.84 |
| 53.2 | 102.89 |

| SUMMARY DATA | |
|---|---|
| **Bankfull Elevation:** | 102.8 |
| **Bankfull Cross-Sectional Area:** | 10.0 |
| **Bankfull Width:** | 14.0 |
| **Flood Prone Area Elevation:** | 104.2 |
| **Flood Prone Width:** | >80 |
| **Max Depth at Bankfull:** | 1.4 |
| **Mean Depth at Bankfull:** | 0.7 |
| **W / D Ratio:** | 19.6 |
| **Entrenchment Ratio:** | >5 |
| **Bank Height Ratio:** | 1.0 |

| | |
|---|---|
| **Stream Type** | E/C |

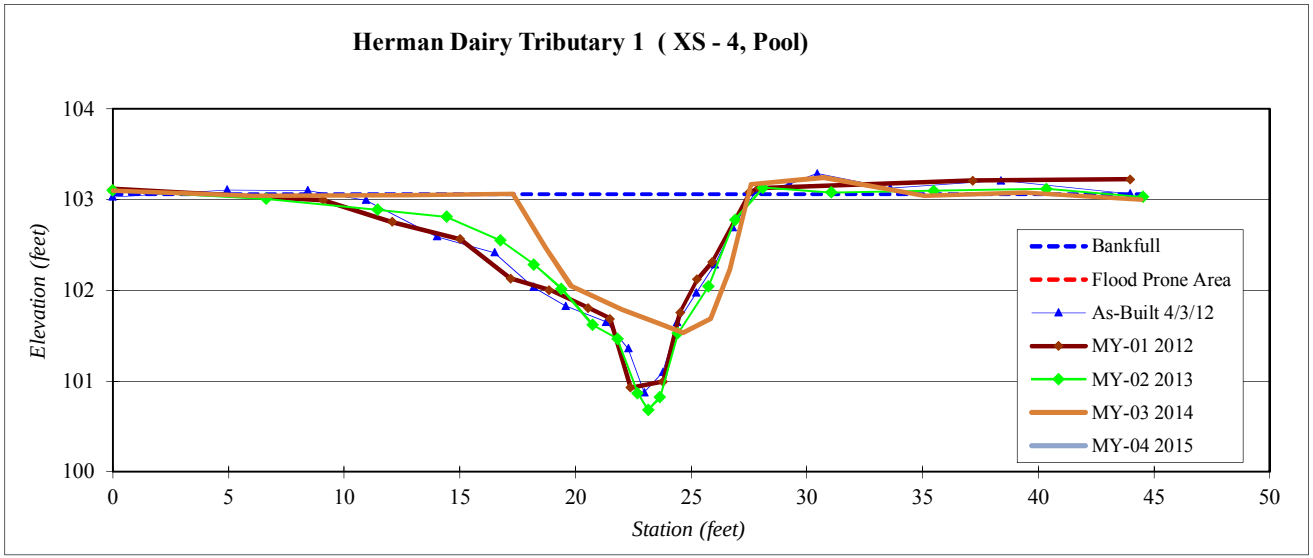


| | |
|---|---|
| **Site Name:** | Herman Dairy |
| **Watershed:** | 30501001120030 |
| **XS ID** | Tributary 1 ( XS - 4, Pool) |
| **Drainage Area (sq mi):** | 1.01 |
| **Date:** | 3/13/2014 |
| **Field Crew:** | Perkinson, Jernigan |

| Station | Elevation |
|---|---|
| 0.0 | 103.1 |
| 6.0 | 103.0 |
| 12.8 | 103.0 |
| 17.3 | 103.1 |
| 18.7 | 102.5 |
| 19.8 | 102.1 |
| 22.0 | 101.8 |
| 23.6 | 101.6 |
| 24.7 | 101.5 |
| 25.8 | 101.7 |
| 26.7 | 102.2 |
| 27.6 | 103.2 |
| 30.7 | 103.2 |
| 35.1 | 103.0 |
| 39.4 | 103.08 |
| 44.4 | 103.00 |

| SUMMARY DATA | |
|---|---|
| **Bankfull Elevation:** | 103.1 |
| **Bankfull Cross-Sectional Area:** | 10.5 |
| **Bankfull Width:** | 10.2 |
| **Flood Prone Area Elevation:** | - |
| **Flood Prone Width:** | - |
| **Max Depth at Bankfull:** | 1.5 |
| **Mean Depth at Bankfull:** | 1.0 |
| **W / D Ratio:** | - |
| **Entrenchment Ratio:** | - |
| **Bank Height Ratio:** | - |

| | |
|---|---|
| **Stream Type** | E |

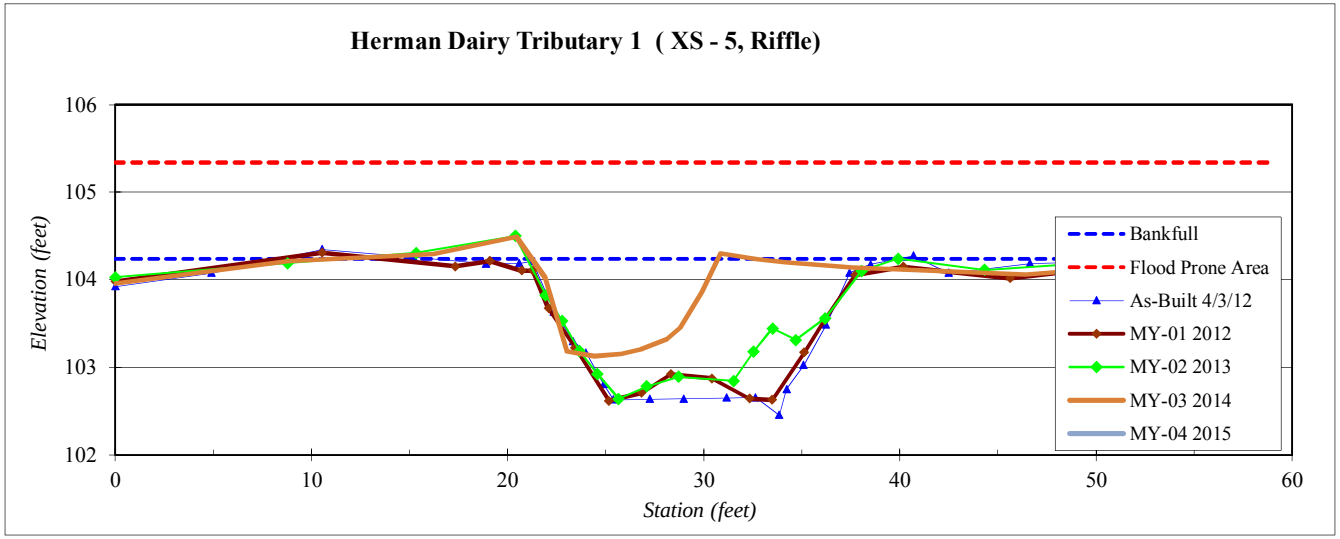


| | |
|---|---|
| **Site Name:** | Herman Dairy |
| **Watershed:** | 30501001120030 |
| **XS ID** | Tributary 1 ( XS - 5, Riffle) |
| **Drainage Area (sq mi):** | 1.01 |
| **Date:** | 3/13/2014 |
| **Field Crew:** | Perkinson, Jernigan |

| Station | Elevation |
|---|---|
| 0.0 | 104.0 |
| 8.8 | 104.2 |
| 16.2 | 104.3 |
| 20.5 | 104.5 |
| 21.9 | 104.0 |
| 23.0 | 103.2 |
| 24.4 | 103.1 |
| 25.8 | 103.2 |
| 26.8 | 103.2 |
| 28.1 | 103.3 |
| 28.8 | 103.5 |
| 29.9 | 103.9 |
| 30.9 | 104.3 |
| 32.7 | 104.24 |
| 34.2 | 104.20 |
| 37.6 | 104.14 |
| 46.4 | 104.06 |
| 52.8 | 104.17 |
| 58.8 | 104.32 |

| SUMMARY DATA | |
|---|---|
| **Bankfull Elevation:** | 104.2 |
| **Bankfull Cross-Sectional Area:** | 7.5 |
| **Bankfull Width:** | 9.5 |
| **Flood Prone Area Elevation:** | 105.3 |
| **Flood Prone Width:** | >80 |
| **Max Depth at Bankfull:** | 1.1 |
| **Mean Depth at Bankfull:** | 0.8 |
| **W / D Ratio:** | 12.0 |
| **Entrenchment Ratio:** | >5 |
| **Bank Height Ratio:** | 1.0 |

| | |
|---|---|
| **Stream Type** | E/C |

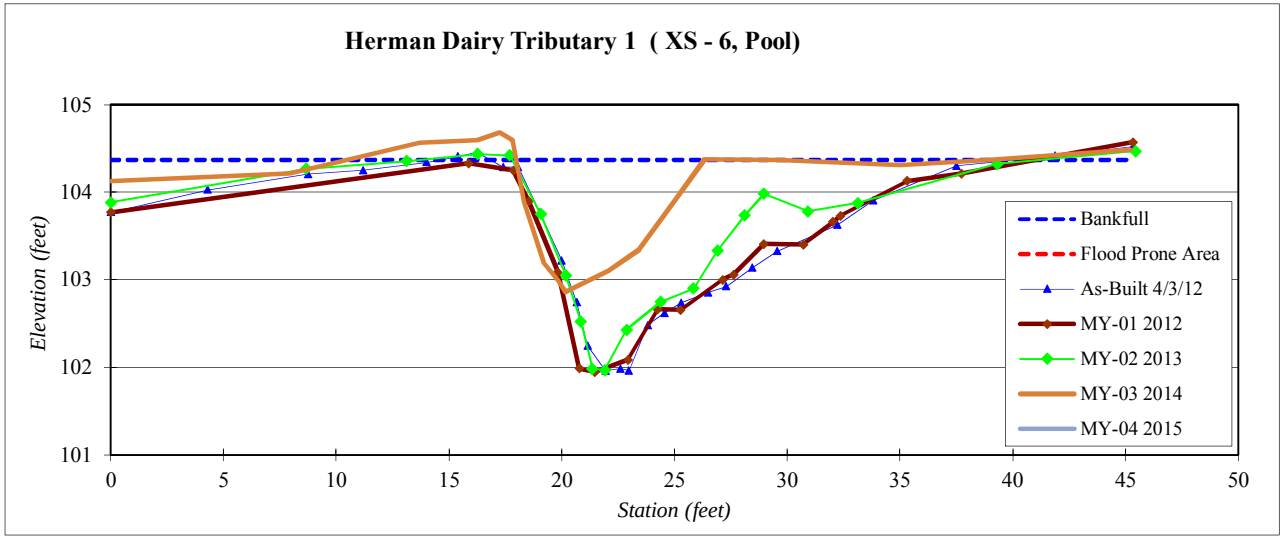


| | |
|---|---|
| **Site Name:** | Herman Dairy |
| **Watershed:** | 30501001120030 |
| **XS ID** | Tributary 1 ( XS - 6, Pool) |
| **Drainage Area (sq mi):** | 1.01 |
| **Date:** | 3/13/2014 |
| **Field Crew:** | Perkinson, Jernigan |

| Station | Elevation |
|---|---|
| 0.0 | 104.1 |
| 8.0 | 104.2 |
| 13.7 | 104.6 |
| 16.3 | 104.6 |
| 17.2 | 104.7 |
| 17.8 | 104.6 |
| 18.3 | 103.9 |
| 19.2 | 103.2 |
| 19.8 | 103.0 |
| 20.2 | 102.9 |
| 22.1 | 103.1 |
| 23.4 | 103.3 |
| 25.0 | 103.9 |
| 26.3 | 104.4 |
| 29.7 | 104.4 |
| 35.0 | 104.3 |
| 38.9 | 104.4 |
| 45.2 | 104.5 |

| SUMMARY DATA | |
|---|---|
| **Bankfull Elevation:** | 104.4 |
| **Bankfull Cross-Sectional Area:** | 7.8 |
| **Bankfull Width:** | 8.3 |
| **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/C |

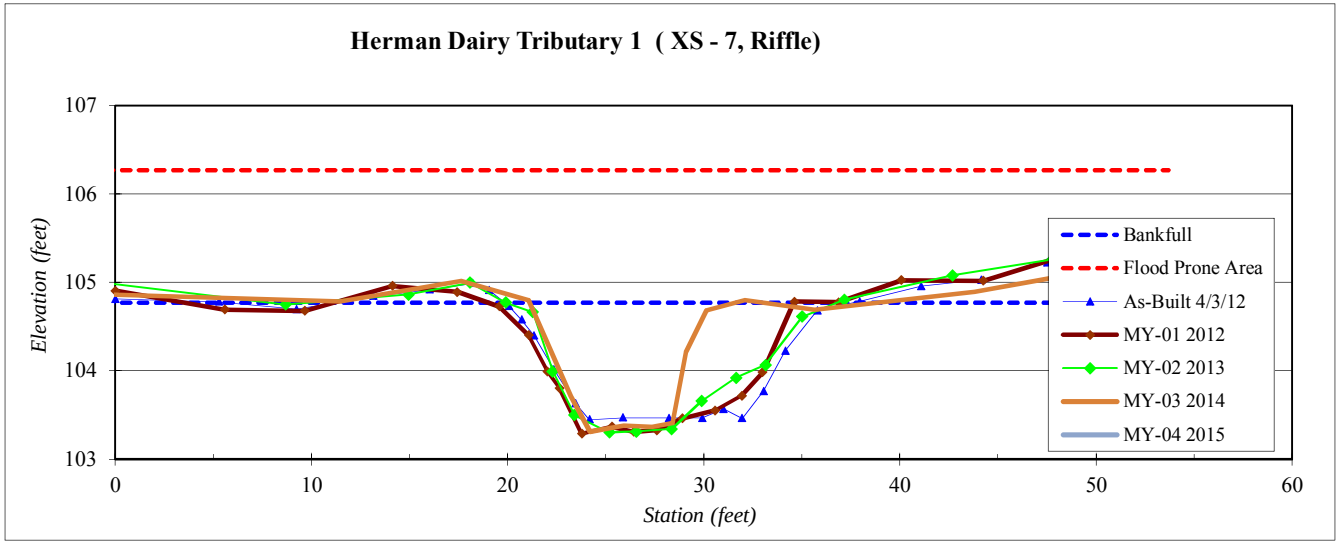


| | |
|---|---|
| **Site Name:** | Herman Dairy |
| **Watershed:** | 30501001120030 |
| **XS ID** | Tributary 1 ( XS - 7, Riffle) |
| **Drainage Area (sq mi):** | 1.01 |
| **Date:** | 3/13/2014 |
| **Field Crew:** | Perkinson, Jernigan |

| Station | Elevation |
|---|---|
| -0.5 | 104.9 |
| 11.5 | 104.8 |
| 17.6 | 105.0 |
| 21.1 | 104.8 |
| 23.2 | 103.7 |
| 24.2 | 103.3 |
| 25.9 | 103.4 |
| 27.4 | 103.4 |
| 28.4 | 103.4 |
| 29.1 | 104.2 |
| 30.1 | 104.7 |
| 32.1 | 104.8 |
| 35.7 | 104.7 |
| 43.8 | 104.90 |
| 53.7 | 105.29 |

| SUMMARY DATA | |
|---|---|
| **Bankfull Elevation:** | 104.8 |
| **Bankfull Cross-Sectional Area:** | 9.3 |
| **Bankfull Width:** | 10.4 |
| **Flood Prone Area Elevation:** | 106.3 |
| **Flood Prone Width:** | >80 |
| **Max Depth at Bankfull:** | 1.5 |
| **Mean Depth at Bankfull:** | 0.9 |
| **W / D Ratio:** | 11.6 |
| **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:** | 3/13/2014 |
| **Field Crew:** | Perkinson, Jernigan |

| Station | Elevation |
|---|---|
| 0.0 | 105.5 |
| 7.8 | 105.6 |
| 12.9 | 105.4 |
| 16.1 | 105.6 |
| 17.7 | 105.3 |
| 18.8 | 104.0 |
| 20.6 | 103.6 |
| 22.2 | 103.3 |
| 23.0 | 103.4 |
| 23.6 | 103.8 |
| 24.6 | 104.3 |
| 25.6 | 105.0 |
| 26.7 | 105.4 |
| 31.9 | 105.55 |
| 36.5 | 105.74 |
| 43.0 | 106.07 |
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| SUMMARY DATA | |
|---|---|
| **Bankfull Elevation:** | 105.4 |
| **Bankfull Cross-Sectional Area:** | 11.7 |
| **Bankfull Width:** | 9.6 |
| **Flood Prone Area Elevation:** | - |
| **Flood Prone Width:** | - |
| **Max Depth at Bankfull:** | 2.1 |
| **Mean Depth at Bankfull:** | 1.2 |
| **W / D Ratio:** | - |
| **Entrenchment Ratio:** | - |
| **Bank Height Ratio:** | - |

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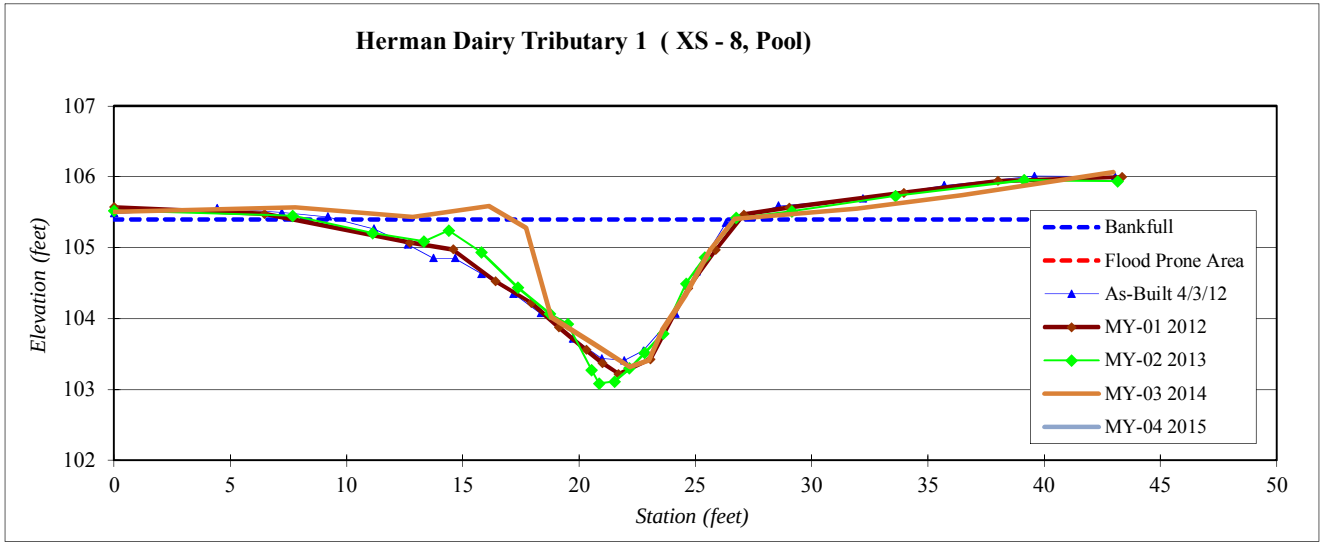
|---|---|
| **Stream Type** | E/C |

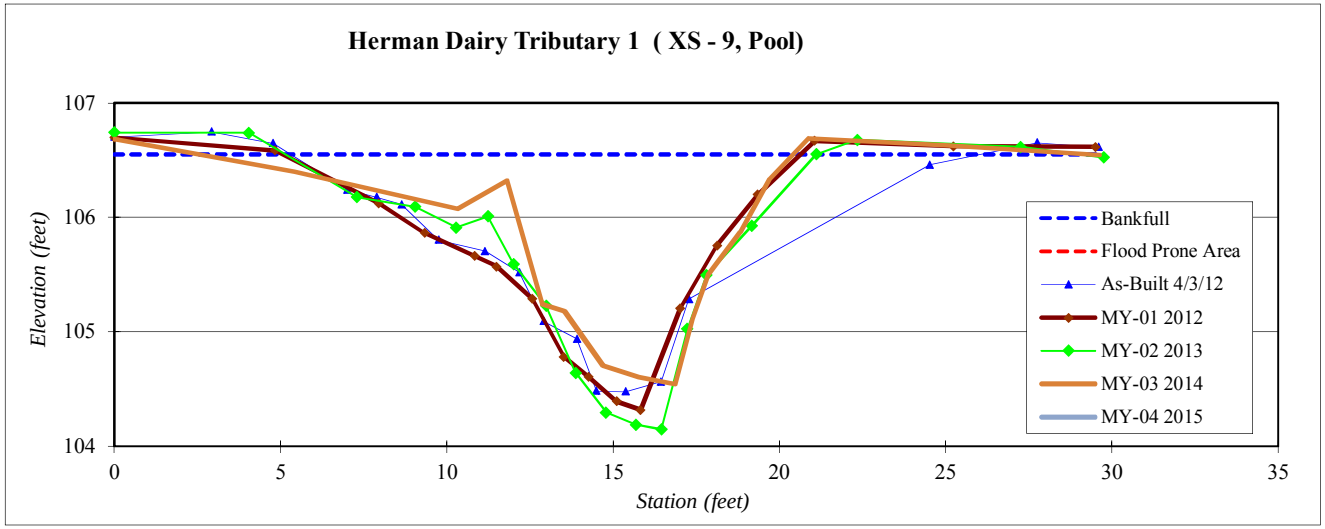


| | |
|---|---|
| **Site Name:** | Herman Dairy |
| **Watershed:** | 30501001120030 |
| **XS ID** | Tributary 1 ( XS - 9, Pool) |
| **Drainage Area (sq mi):** | 1.01 |
| **Date:** | 3/13/2014 |
| **Field Crew:** | Perkinson, Jernigan |

| Station | Elevation |
|---|---|
| 0.0 | 106.7 |
| 5.4 | 106.4 |
| 10.3 | 106.1 |
| 11.8 | 106.3 |
| 12.9 | 105.2 |
| 13.5 | 105.2 |
| 14.7 | 104.7 |
| 15.8 | 104.6 |
| 16.9 | 104.5 |
| 17.4 | 105.1 |
| 17.9 | 105.5 |
| 18.8 | 105.9 |
| 19.7 | 106.3 |
| 20.9 | 106.69 |
| 25.1 | 106.63 |
| 29.6 | 106.55 |

| SUMMARY DATA | |
|---|---|
| **Bankfull Elevation:** | 106.6 |
| **Bankfull Cross-Sectional Area:** | 12.8 |
| **Bankfull Width:** | 17.8 |
| **Flood Prone Area Elevation:** | - |
| **Flood Prone Width:** | - |
| **Max Depth at Bankfull:** | 2.0 |
| **Mean Depth at Bankfull:** | 0.7 |
| **W / D Ratio:** | - |
| **Entrenchment Ratio:** | - |
| **Bank Height Ratio:** | - |

| | |
|---|---|
| **Stream Type** | E/C |



| | |
|---|---|
| **Site Name:** | Herman Dairy |
| **Watershed:** | 30501001120030 |
| **XS ID** | Tributary 1 ( XS - 10, Riffle) |
| **Drainage Area (sq mi):** | 1.01 |
| **Date:** | 3/13/2014 |
| **Field Crew:** | Perkinson, Jernigan |

| Station | Elevation |
|---|---|
| -0.5 | 106.7 |
| 5.5 | 106.9 |
| 7.1 | 106.9 |
| 9.0 | 106.8 |
| 10.2 | 106.0 |
| 11.0 | 105.5 |
| 11.5 | 105.3 |
| 12.5 | 105.2 |
| 13.9 | 105.3 |
| 14.8 | 105.6 |
| 15.4 | 105.7 |
| 16.4 | 106.1 |
| 17.0 | 106.5 |
| 17.6 | 106.92 |
| 20.5 | 106.56 |
| 24.5 | 106.83 |
| 32.2 | 106.88 |
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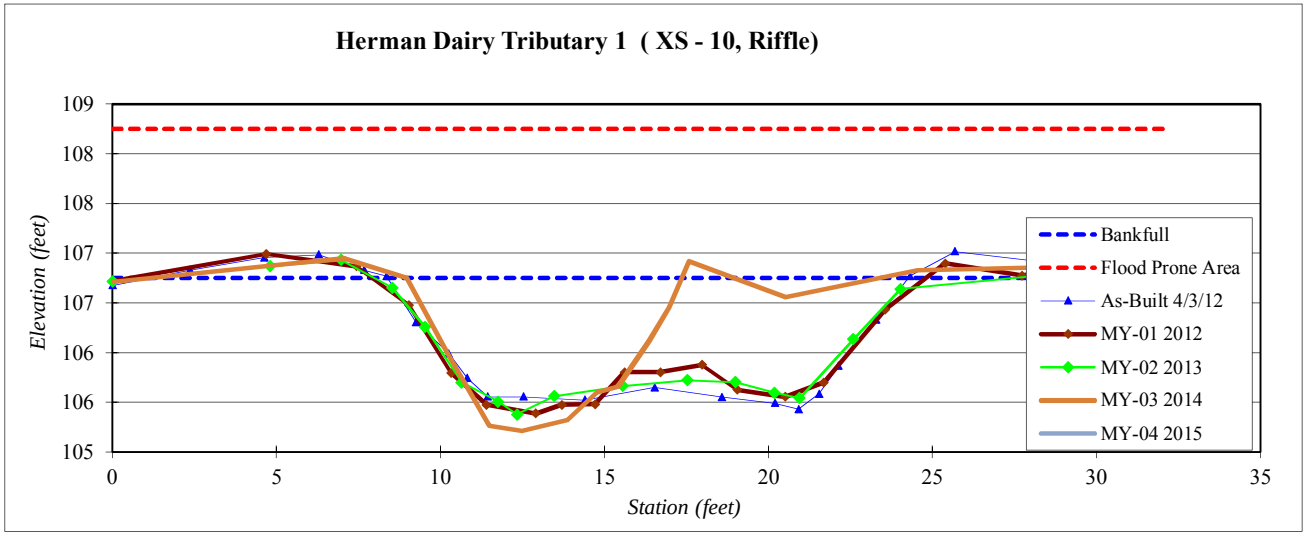
| SUMMARY DATA | |
|---|---|
| **Bankfull Elevation:** | 106.8 |
| **Bankfull Cross-Sectional Area:** | 8.5 |
| **Bankfull Width:** | 8.4 |
| **Flood Prone Area Elevation:** | 108.3 |
| **Flood Prone Width:** | >80 |
| **Max Depth at Bankfull:** | 1.5 |
| **Mean Depth at Bankfull:** | 1.0 |
| **W / D Ratio:** | 8.3 |
| **Entrenchment Ratio:** | >5 |
| **Bank Height Ratio:** | 1.0 |

| | |
|---|---|
| **Stream Type** | E/C |

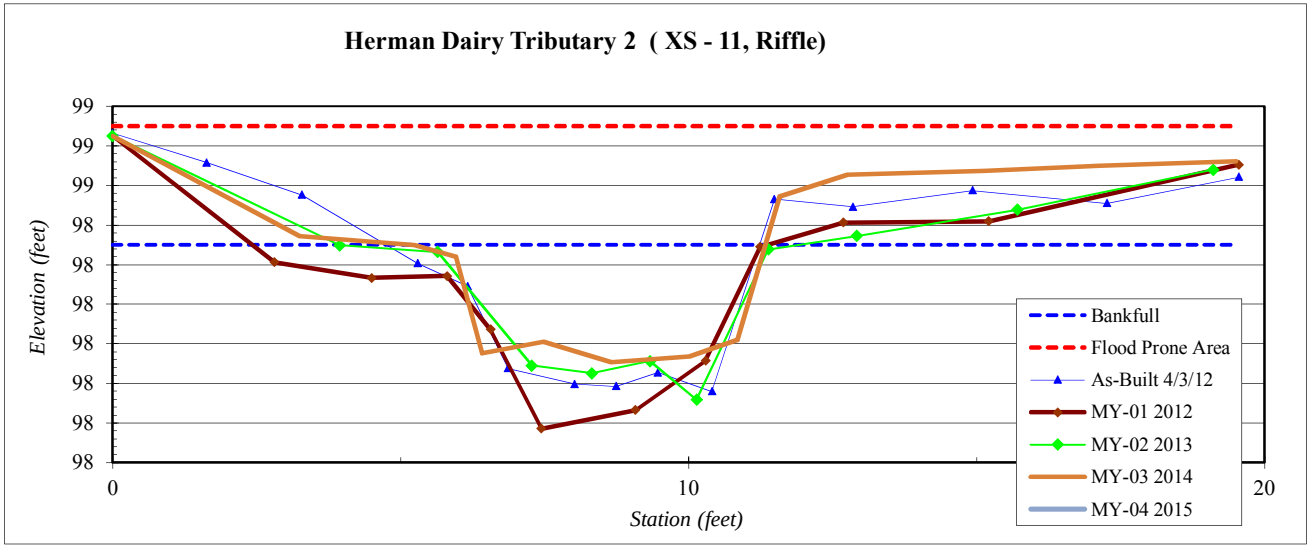


| | |
|---|---|
| **Site Name:** | Herman Dairy |
| **Watershed:** | 30501001120030 |
| **XS ID** | Tributary 2 ( XS - 11, Riffle) |
| **Drainage Area (sq mi):** | 1.01 |
| **Date:** | 3/13/2014 |
| **Field Crew:** | Perkinson, Jernigan |

| Station | Elevation |
|---|---|
| 0.0 | 98.6 |
| 3.2 | 98.4 |
| 5.3 | 98.3 |
| 6.0 | 98.3 |
| 6.4 | 98.1 |
| 7.5 | 98.1 |
| 8.7 | 98.1 |
| 10.0 | 98.1 |
| 10.8 | 98.1 |
| 11.6 | 98.5 |
| 12.8 | 98.5 |
| 15.1 | 98.5 |
| 17.1 | 98.5 |
| 19.5 | 98.56 |

| SUMMARY DATA | |
|---|---|
| **Bankfull Elevation:** | 98.4 |
| **Bankfull Cross-Sectional Area:** | 1.3 |
| **Bankfull Width:** | 6.1 |
| **Flood Prone Area Elevation:** | 98.7 |
| **Flood Prone Width:** | >80 |
| **Max Depth at Bankfull:** | 0.3 |
| **Mean Depth at Bankfull:** | 0.2 |
| **W / D Ratio:** | 28.6 |
| **Entrenchment Ratio:** | >5 |
| **Bank Height Ratio:** | 1.0 |

| | |
|---|---|
| **Stream Type** | E/C |

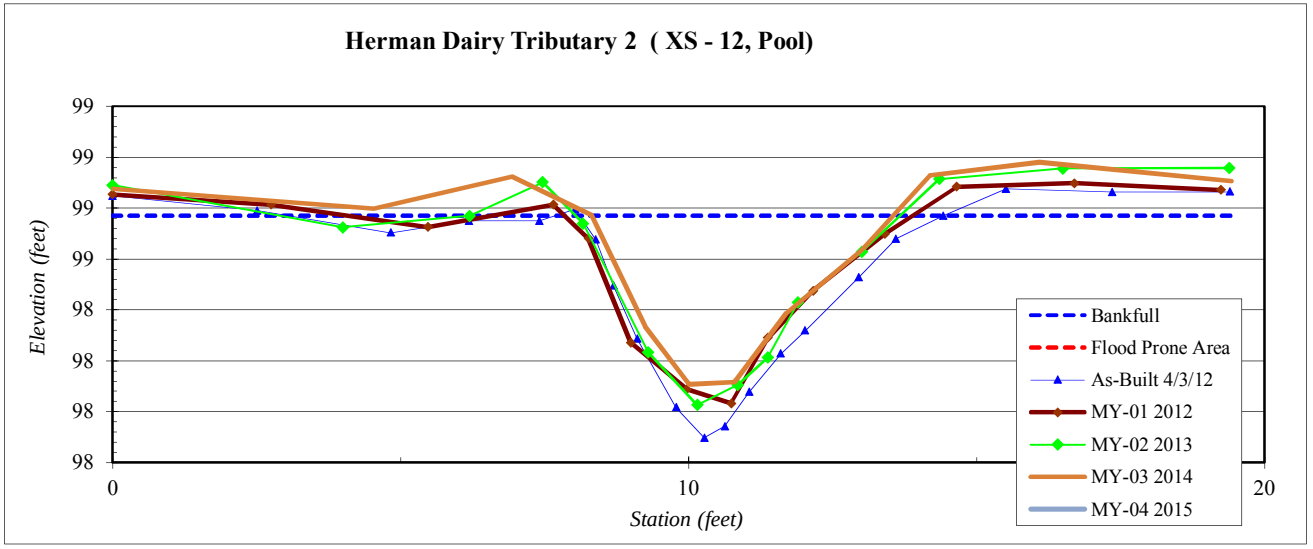


| | |
|---|---|
| **Site Name:** | Herman Dairy |
| **Watershed:** | 30501001120030 |
| **XS ID** | Tributary 2 ( XS - 12, Pool) |
| **Drainage Area (sq mi):** | 1.01 |
| **Date:** | 3/13/2014 |
| **Field Crew:** | Perkinson, Jernigan |

| Station | Elevation |
|---|---|
| 0.0 | 98.9 |
| 4.5 | 98.8 |
| 6.9 | 98.9 |
| 8.3 | 98.8 |
| 9.2 | 98.3 |
| 10.0 | 98.1 |
| 10.8 | 98.1 |
| 11.7 | 98.4 |
| 13.0 | 98.6 |
| 14.2 | 98.9 |
| 16.1 | 99.0 |
| 19.4 | 98.9 |

| SUMMARY DATA | |
|---|---|
| **Bankfull Elevation:** | 98.8 |
| **Bankfull Cross-Sectional Area:** | 2.0 |
| **Bankfull Width:** | 5.2 |
| **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 |

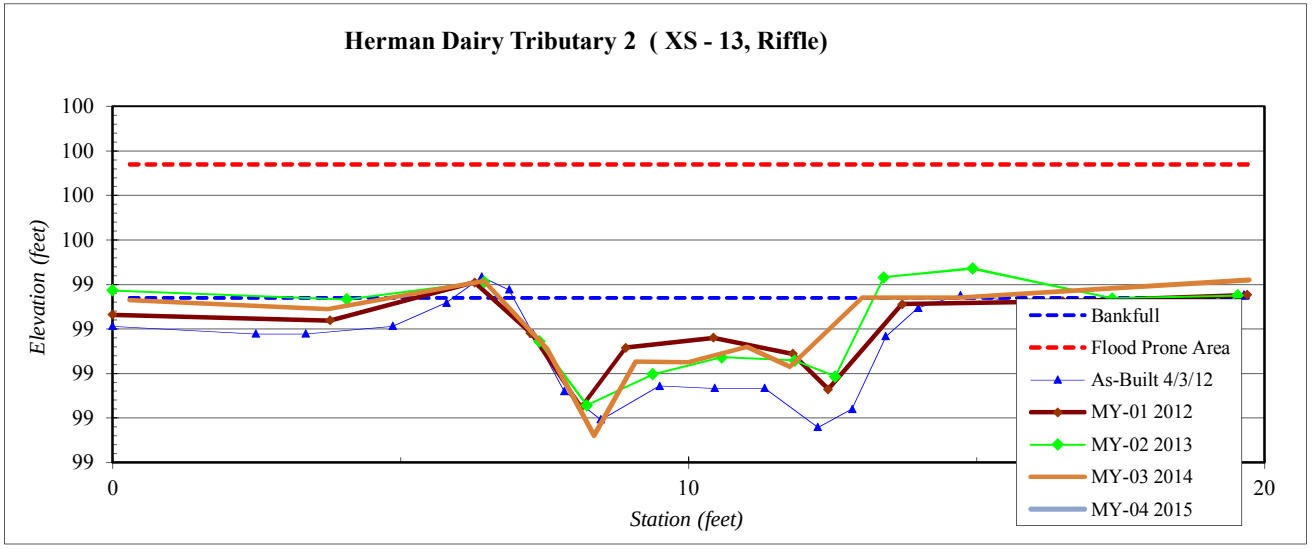


| | |
|---|---|
| **Site Name:** | Herman Dairy |
| **Watershed:** | 30501001120030 |
| **XS ID** | Tributary 2 ( XS - 13, Riffle) |
| **Drainage Area (sq mi):** | 1.01 |
| **Date:** | 3/13/2014 |
| **Field Crew:** | Perkinson, Jernigan |

| Station | Elevation |
|---|---|
| 0.3 | 99.3 |
| 3.7 | 99.3 |
| 6.4 | 99.4 |
| 7.5 | 99.1 |
| 8.4 | 98.7 |
| 9.1 | 99.1 |
| 10.0 | 99.0 |
| 11.0 | 99.1 |
| 11.8 | 99.0 |
| 13.0 | 99.3 |
| 14.7 | 99.3 |
| 19.7 | 99.4 |

| SUMMARY DATA | |
|---|---|
| **Bankfull Elevation:** | 99.3 |
| **Bankfull Cross-Sectional Area:** | 1.7 |
| **Bankfull Width:** | 6.5 |
| **Flood Prone Area Elevation:** | 99.9 |
| **Flood Prone Width:** | >80 |
| **Max Depth at Bankfull:** | 0.6 |
| **Mean Depth at Bankfull:** | 0.3 |
| **W / D Ratio:** | 24.9 |
| **Entrenchment Ratio:** | >5 |
| **Bank Height Ratio:** | 1.0 |

| | |
|---|---|
| **Stream Type** | E/C |

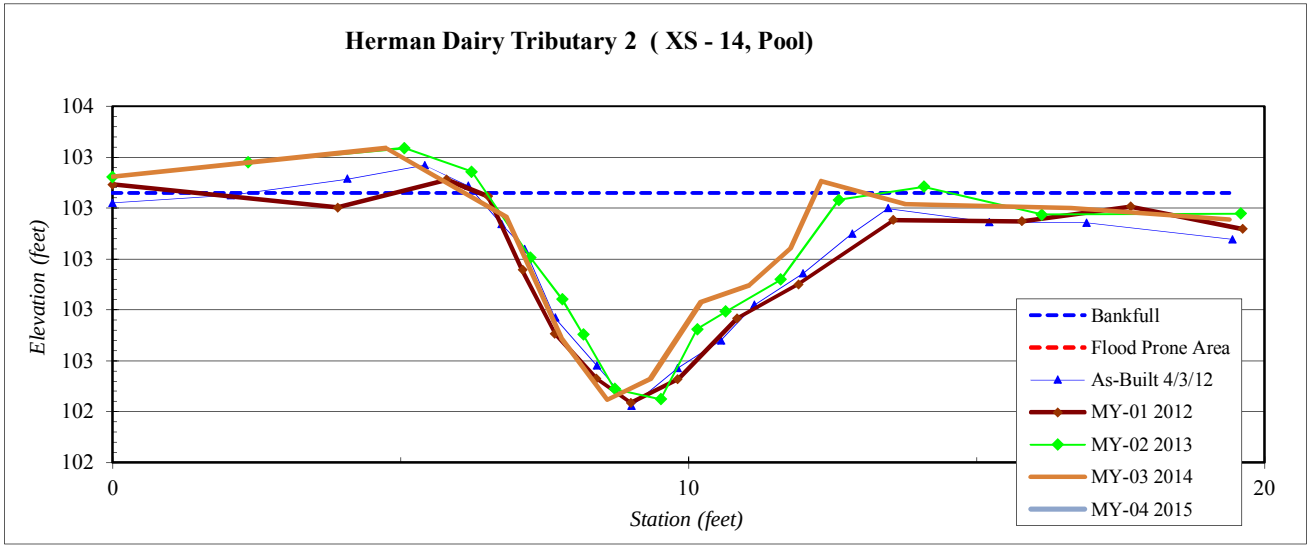


| | |
|---|---|
| **Site Name:** | Herman Dairy |
| **Watershed:** | 30501001120030 |
| **XS ID** | Tributary 2 ( XS - 14, Pool) |
| **Drainage Area (sq mi):** | 1.01 |
| **Date:** | 3/13/2014 |
| **Field Crew:** | Perkinson, Jernigan |

| Station | Elevation |
|---|---|
| 0.0 | 103.3 |
| 4.7 | 103.4 |
| 6.8 | 103.2 |
| 7.8 | 102.7 |
| 8.6 | 102.4 |
| 9.3 | 102.5 |
| 10.2 | 102.8 |
| 11.0 | 102.9 |
| 11.8 | 103.0 |
| 12.3 | 103.3 |
| 13.8 | 103.2 |
| 16.6 | 103.2 |
| 19.4 | 103.2 |

| SUMMARY DATA | |
|---|---|
| **Bankfull Elevation:** | 103.3 |
| **Bankfull Cross-Sectional Area:** | 2.4 |
| **Bankfull Width:** | 5.8 |
| **Flood Prone Area Elevation:** | - |
| **Flood Prone Width:** | - |
| **Max Depth at Bankfull:** | 0.8 |
| **Mean Depth at Bankfull:** | 0.4 |
| **W / D Ratio:** | - |
| **Entrenchment Ratio:** | - |
| **Bank Height Ratio:** | - |

| | |
|---|---|
| **Stream Type** | E/C |

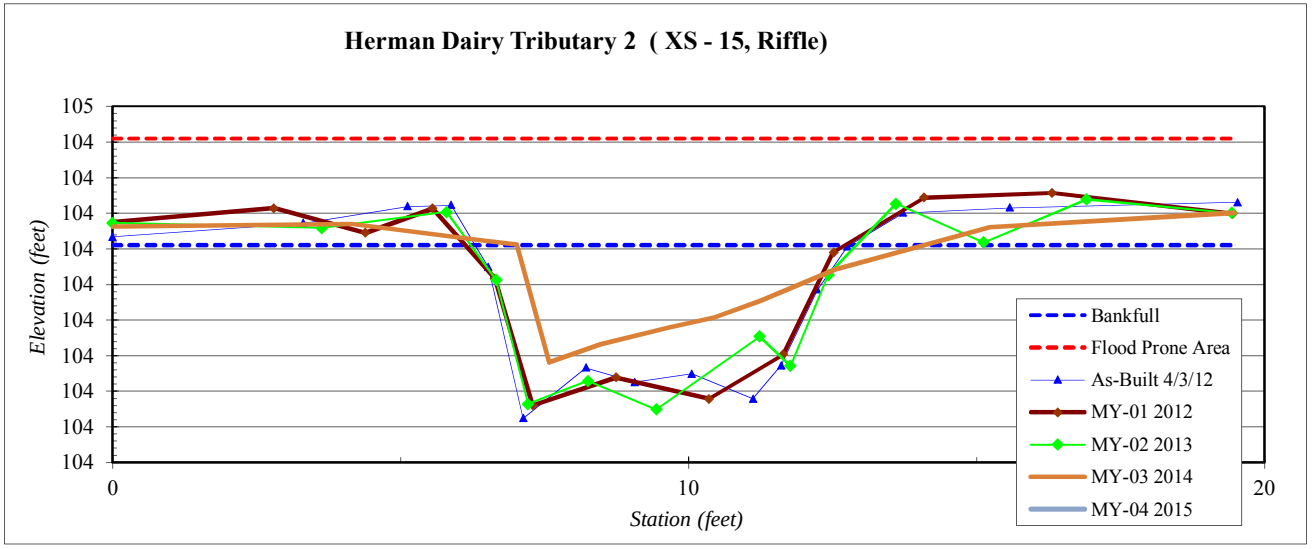


| | |
|---|---|
| **Site Name:** | Herman Dairy |
| **Watershed:** | 30501001120030 |
| **XS ID** | Tributary 2 ( XS - 15, Riffle) |
| **Drainage Area (sq mi):** | 1.01 |
| **Date:** | 3/13/2014 |
| **Field Crew:** | Perkinson, Jernigan |

| Station | Elevation |
|---|---|
| 0.0 | 104.2 |
| 4.2 | 104.2 |
| 6.4 | 104.1 |
| 7.0 | 104.1 |
| 7.6 | 103.8 |
| 8.5 | 103.8 |
| 9.6 | 103.9 |
| 10.5 | 103.9 |
| 11.2 | 104.0 |
| 12.6 | 104.0 |
| 15.2 | 104.2 |
| 19.5 | 104.2 |

| SUMMARY DATA | |
|---|---|
| **Bankfull Elevation:** | 104.1 |
| **Bankfull Cross-Sectional Area:** | 1.2 |
| **Bankfull Width:** | 7.1 |
| **Flood Prone Area Elevation:** | 104.4 |
| **Flood Prone Width:** | >80 |
| **Max Depth at Bankfull:** | 0.3 |
| **Mean Depth at Bankfull:** | 0.2 |
| **W / D Ratio:** | 42.0 |
| **Entrenchment Ratio:** | >5 |
| **Bank Height Ratio:** | 1.0 |

| | |
|---|---|
| **Stream Type** | E/C |

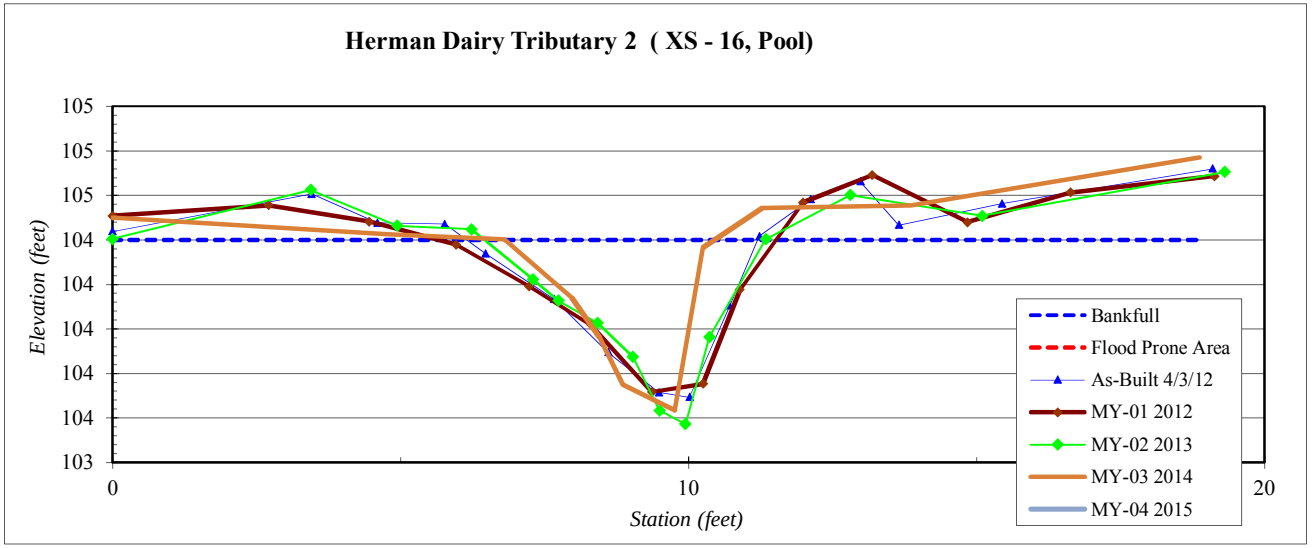


| | |
|---|---|
| **Site Name:** | Herman Dairy |
| **Watershed:** | 30501001120030 |
| **XS ID** | Tributary 2 ( XS - 16, Pool) |
| **Drainage Area (sq mi):** | 1.01 |
| **Date:** | 3/13/2014 |
| **Field Crew:** | Perkinson, Jernigan |

| Station | Elevation |
|---|---|
| 0.0 | 104.5 |
| 4.8 | 104.4 |
| 6.8 | 104.4 |
| 8.0 | 104.1 |
| 8.5 | 104.0 |
| 8.9 | 103.7 |
| 9.8 | 103.6 |
| 10.3 | 104.4 |
| 11.3 | 104.5 |
| 13.9 | 104.6 |
| 18.9 | 104.8 |

| SUMMARY DATA | |
|---|---|
| **Bankfull Elevation:** | 104.4 |
| **Bankfull Cross-Sectional Area:** | 1.4 |
| **Bankfull Width:** | 3.6 |
| **Flood Prone Area Elevation:** | - |
| **Flood Prone Width:** | - |
| **Max Depth at Bankfull:** | 0.8 |
| **Mean Depth at Bankfull:** | 0.4 |
| **W / D Ratio:** | - |
| **Entrenchment Ratio:** | - |
| **Bank Height Ratio:** | - |

| | |
|---|---|
| **Stream Type** | E/C |



| | |
|---|---|
| **Site Name:** | Herman Dairy |
| **Watershed:** | 30501001120030 |
| **XS ID** | Tributary 3 ( XS - 17, Riffle) |
| **Drainage Area (sq mi):** | 0.06 |
| **Date:** | 3/13/2014 |
| **Field Crew:** | Perkinson, Jernigan |

| Station | Elevation |
|---|---|
| 0.0 | 100.2 |
| 6.4 | 100.1 |
| 7.8 | 100.1 |
| 9.0 | 100.0 |
| 9.4 | 100.0 |
| 9.9 | 99.8 |
| 11.3 | 99.6 |
| 12.7 | 99.6 |
| 14.0 | 99.6 |
| 15.2 | 99.6 |
| 16.2 | 99.7 |
| 16.9 | 100.0 |
| 18.1 | 100.1 |
| 21.3 | 100.09 |
| 22.8 | 99.97 |
| 26.7 | 100.02 |
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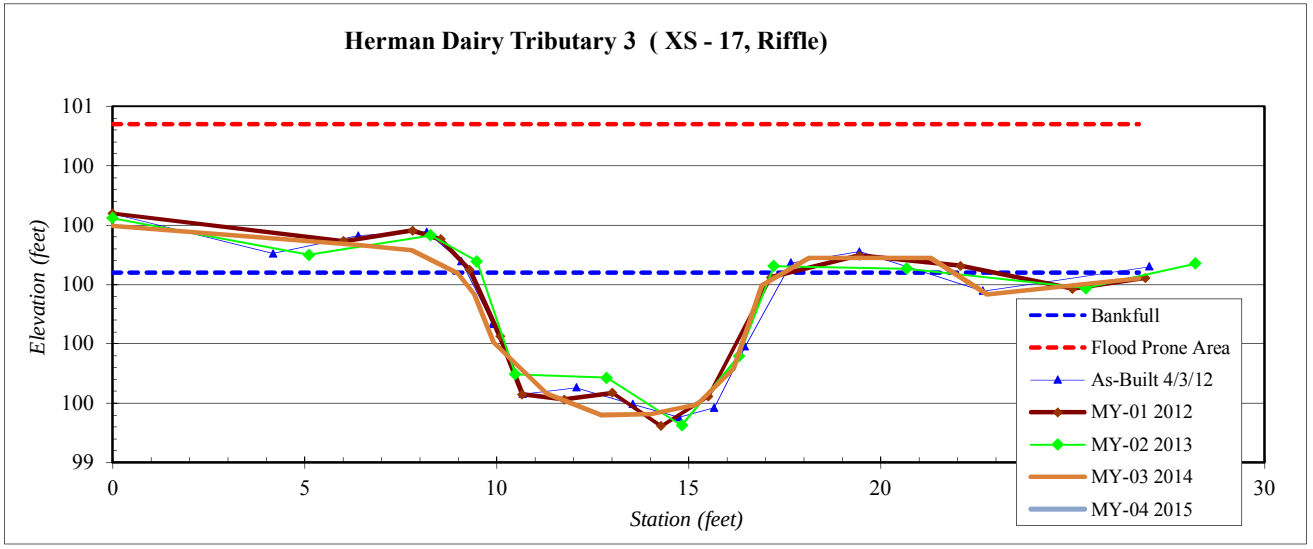
| **SUMMARY DATA** | |
|---|---|
| **Bankfull Elevation:** | 100.0 |
| **Bankfull Cross-Sectional Area:** | 2.9 |
| **Bankfull Width:** | 8.5 |
| **Flood Prone Area Elevation:** | 100.5 |
| **Flood Prone Width:** | >80 |
| **Max Depth at Bankfull:** | 0.5 |
| **Mean Depth at Bankfull:** | 0.3 |
| **W / D Ratio:** | 24.9 |
| **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:** | 3/13/2014 |
| **Field Crew:** | Perkinson, Jernigan |

| Station | Elevation |
|---|---|
| 0.3 | 100.7 |
| 7.0 | 100.7 |
| 7.8 | 100.7 |
| 8.9 | 100.5 |
| 9.7 | 100.4 |
| 10.4 | 99.9 |
| 11.0 | 99.5 |
| 11.5 | 99.5 |
| 12.2 | 99.5 |
| 13.0 | 99.7 |
| 13.8 | 99.9 |
| 14.5 | 100.2 |
| 15.2 | 100.5 |
| 18.1 | 100.63 |
| 23.1 | 100.61 |
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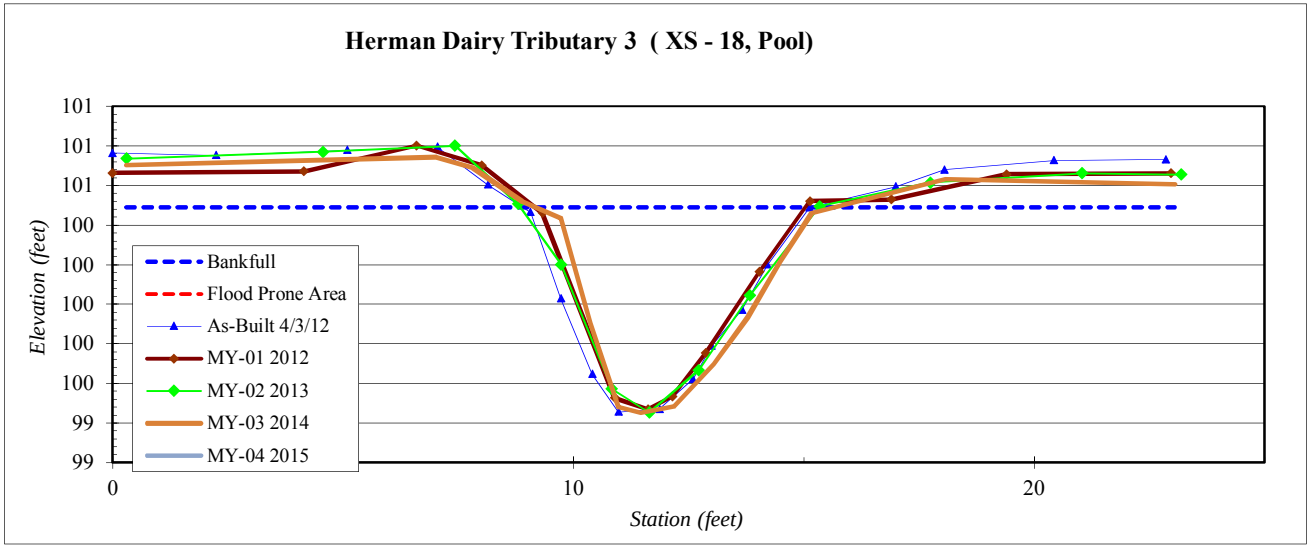
| SUMMARY DATA | |
|---|---|
| **Bankfull Elevation:** | 100.5 |
| **Bankfull Cross-Sectional Area:** | 3.6 |
| **Bankfull Width:** | 6.5 |
| **Flood Prone Area Elevation:** | - |
| **Flood Prone Width:** | - |
| **Max Depth at Bankfull:** | 1.0 |
| **Mean Depth at Bankfull:** | 0.6 |
| **W / D Ratio:** | - |
| **Entrenchment Ratio:** | - |
| **Bank Height Ratio:** | - |

| | |
|---|---|
| **Stream Type** | E/C |

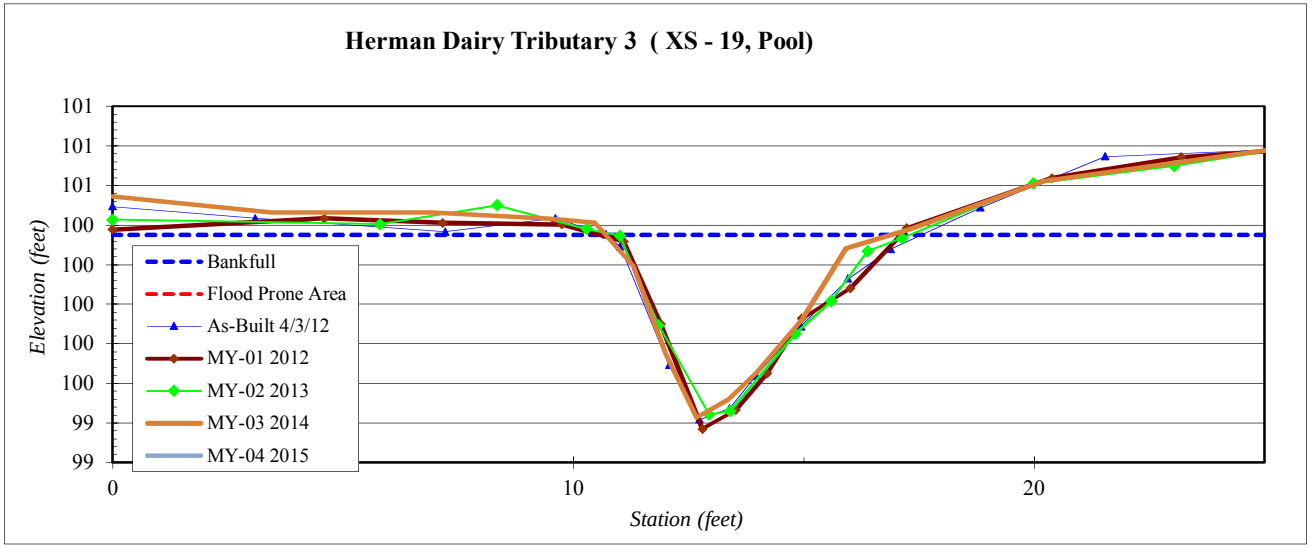


| | |
|---|---|
| **Site Name:** | Herman Dairy |
| **Watershed:** | 30501001120030 |
| **XS ID** | Tributary 3 ( XS - 19, Pool) |
| **Drainage Area (sq mi):** | 0.06 |
| **Date:** | 3/13/2014 |
| **Field Crew:** | Perkinson, Jernigan |

| Station | Elevation |
|---|---|
| 0.0 | 100.5 |
| 3.4 | 100.5 |
| 6.9 | 100.5 |
| 9.5 | 100.4 |
| 10.5 | 100.4 |
| 11.3 | 100.2 |
| 12.0 | 99.7 |
| 12.7 | 99.4 |
| 13.4 | 99.5 |
| 14.0 | 99.7 |
| 15.0 | 99.9 |
| 15.9 | 100.3 |
| 17.3 | 100.4 |
| 20.2 | 100.62 |
| 25.6 | 100.80 |

| **SUMMARY DATA** | |
|---|---|
| **Bankfull Elevation:** | 100.4 |
| **Bankfull Cross-Sectional Area:** | 2.7 |
| **Bankfull Width:** | 6.2 |
| **Flood Prone Area Elevation:** | - |
| **Flood Prone Width:** | - |
| **Max Depth at Bankfull:** | 0.9 |
| **Mean Depth at Bankfull:** | 0.4 |
| **W / D Ratio:** | - |
| **Entrenchment Ratio:** | - |
| **Bank Height Ratio:** | - |

| | |
|---|---|
| **Stream Type** | E/C |

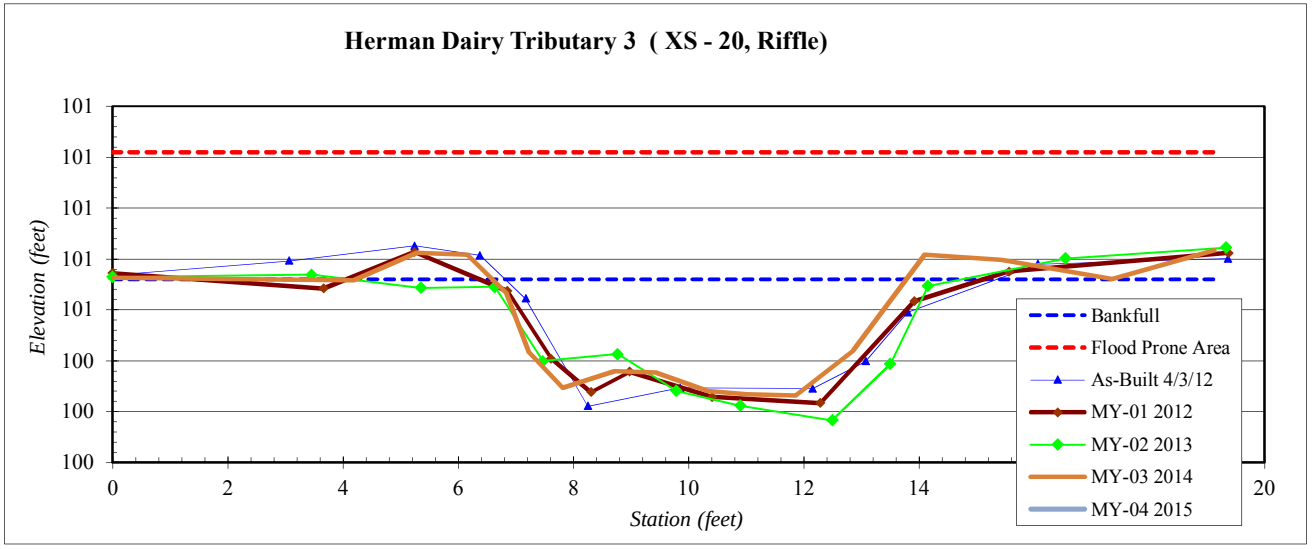


| | |
|---|---|
| **Site Name:** | Herman Dairy |
| **Watershed:** | 30501001120030 |
| **XS ID** | Tributary 3 ( XS - 20, Riffle) |
| **Drainage Area (sq mi):** | 0.06 |
| **Date:** | 3/13/2014 |
| **Field Crew:** | Perkinson, Jernigan |

| Station | Elevation |
|---|---|
| 0.0 | 100.7 |
| 4.2 | 100.7 |
| 5.3 | 100.8 |
| 6.2 | 100.8 |
| 6.8 | 100.7 |
| 7.2 | 100.4 |
| 7.8 | 100.3 |
| 8.7 | 100.4 |
| 9.4 | 100.4 |
| 10.3 | 100.3 |
| 11.0 | 100.3 |
| 11.9 | 100.3 |
| 12.9 | 100.4 |
| 14.1 | 100.82 |
| 15.4 | 100.80 |
| 17.4 | 100.72 |
| 19.1 | 100.83 |
| | |
| | |
| | |
| | |
| | |
| | |
| | |
| | |

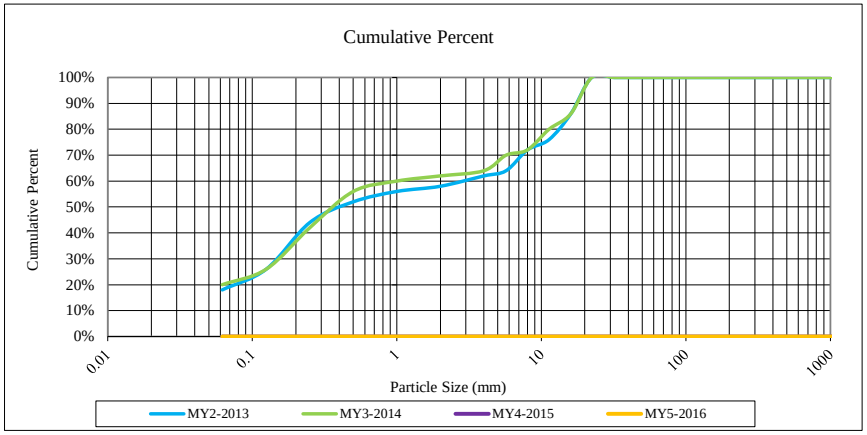
| SUMMARY DATA | |
|---|---|
| **Bankfull Elevation:** | 100.7 |
| **Bankfull Cross-Sectional Area:** | 2.4 |
| **Bankfull Width:** | 7.2 |
| **Flood Prone Area Elevation:** | 101.2 |
| **Flood Prone Width:** | >80 |
| **Max Depth at Bankfull:** | 0.5 |
| **Mean Depth at Bankfull:** | 0.3 |
| **W / D Ratio:** | 21.6 |
| **Entrenchment Ratio:** | >5 |
| **Bank Height Ratio:** | 1.0 |

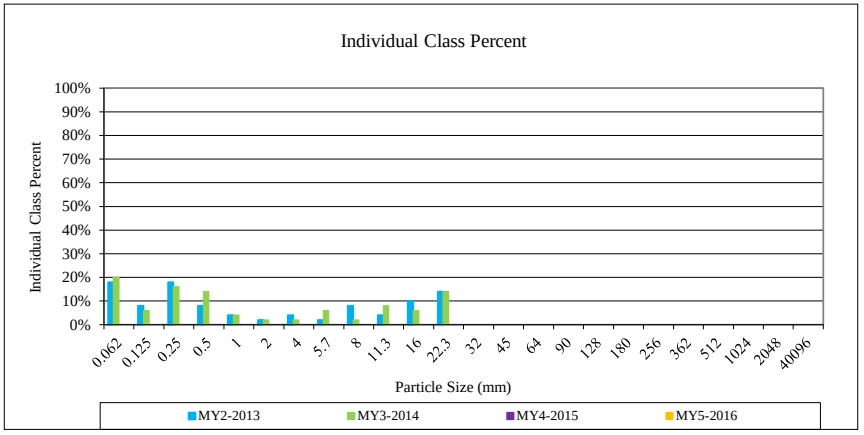
| | |
|---|---|
| **Stream Type** | E/C |



| Project Name: Herman Dairy UT1 | | | | | |
|---|---|---|---|---|---|
| Cross-Section: 2 | | | | | |
| Feature: Riffle | | | | | |
| | | | 2014 | | |
| **Description** | **Material** | **Size (mm)** | **Total #** | **Item %** | **Cum %** |
| **Silt/Clay** | silt/clay | 0.062 | 10 | 20% | 36% |
| **Sand** | very fine sand | 0.125 | 3 | 6% | 44% |
| | fine sand | 0.250 | 8 | 16% | 48% |
| | medium sand | 0.50 | 7 | 14% | 48% |
| | coarse sand | 1.00 | 2 | 4% | 56% |
| | very coarse sand | 2.0 | 1 | 2% | 60% |
| **Gravel** | very fine gravel | 4.0 | 1 | 2% | 68% |
| | fine gravel | 5.7 | 3 | 6% | 72% |
| | fine gravel | 8.0 | 1 | 2% | 84% |
| | medium gravel | 11.3 | 4 | 8% | 92% |
| | medium gravel | 16.0 | 3 | 6% | 92% |
| | course gravel | 22.3 | 7 | 14% | 96% |
| | course gravel | 32.0 | 0 | 0% | 96% |
| | very coarse gravel | 45 | 0 | 0% | 96% |
| | very coarse gravel | 64 | 0 | 0% | 100% |
| **Cobble** | small cobble | 90 | 0 | 0% | 100% |
| | medium cobble | 128 | 0 | 0% | 100% |
| | large cobble | 180 | 0 | 0% | 100% |
| | very large cobble | 256 | 0 | 0% | 100% |
| **Boulder** | small boulder | 362 | 0 | 0% | 100% |
| | small boulder | 512 | 0 | 0% | 100% |
| | medium boulder | 1024 | 0 | 0% | 100% |
| | large boulder | 2048 | 0 | 0% | 100% |
| **Bedrock** | bedrock | 40096 | 0 | 0% | 100% |
| **TOTAL % of whole count** | | | 50 | 100% | 100% |

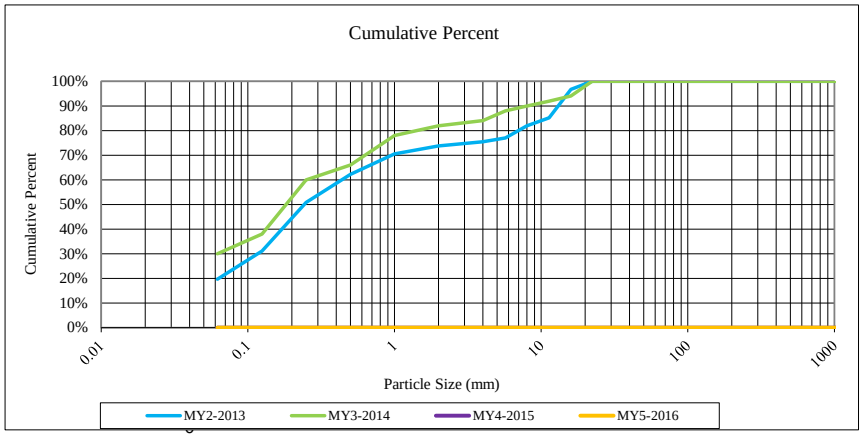
| Summary Data | |
|---|---|
| D50 | 0.2 |
| D84 | 14 |
| D95 | 20 |



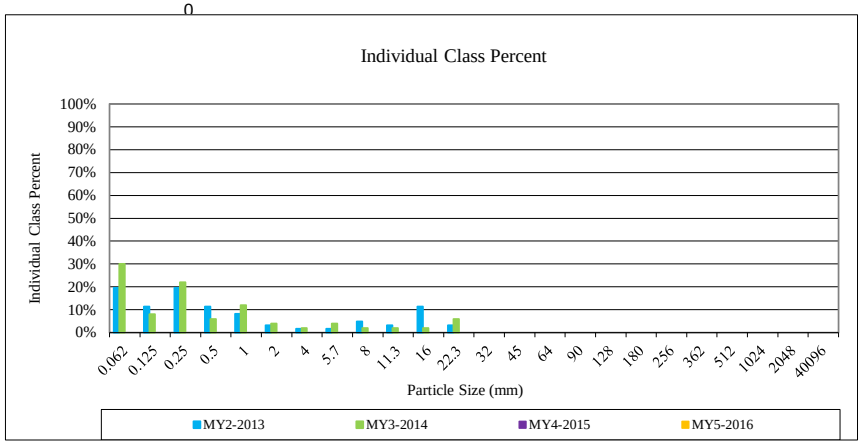



| Project Name: Herman Dairy UT1 | | | | | |
|---|---|---|---|---|---|
| Cross-Section: 3 | | | | | |
| Feature: Riffle | | | | | |
| | | | 2014 | | |
| **Description** | **Material** | **Size (mm)** | **Total #** | **Item %** | **Cum %** |
| **Silt/Clay** | silt/clay | 0.062 | 15 | 30% | 33% |
| **Sand** | very fine sand | 0.125 | 4 | 8% | 43% |
| | fine sand | 0.250 | 11 | 22% | 48% |
| | medium sand | 0.50 | 3 | 6% | 52% |
| | coarse sand | 1.00 | 6 | 12% | 62% |
| | very coarse sand | 2.0 | 2 | 4% | 67% |
| **Gravel** | very fine gravel | 4.0 | 1 | 2% | 67% |
| | fine gravel | 5.7 | 2 | 4% | 67% |
| | fine gravel | 8.0 | 1 | 2% | 71% |
| | medium gravel | 11.3 | 1 | 2% | 76% |
| | medium gravel | 16.0 | 1 | 2% | 86% |
| | course gravel | 22.3 | 3 | 6% | 90% |
| | course gravel | 32.0 | 0 | 0% | 95% |
| | very coarse gravel | 45 | 0 | 0% | 95% |
| | very coarse gravel | 64 | 0 | 0% | 95% |
| **Cobble** | small cobble | 90 | 0 | 0% | 100% |
| | medium cobble | 128 | 0 | 0% | 100% |
| | large cobble | 180 | 0 | 0% | 100% |
| | very large cobble | 256 | 0 | 0% | 100% |
| **Boulder** | small boulder | 362 | 0 | 0% | 100% |
| | small boulder | 512 | 0 | 0% | 100% |
| | medium boulder | 1024 | 0 | 0% | 100% |
| | large boulder | 2048 | 0 | 0% | 100% |
| **Bedrock** | bedrock | 40096 | 0 | 0% | 100% |
| **TOTAL % of whole count** | | | 50 | 100% | 100% |

| Summary Data | |
|---|---|
| D50 | 0.2 |
| D84 | 4 |
| D95 | 17 |

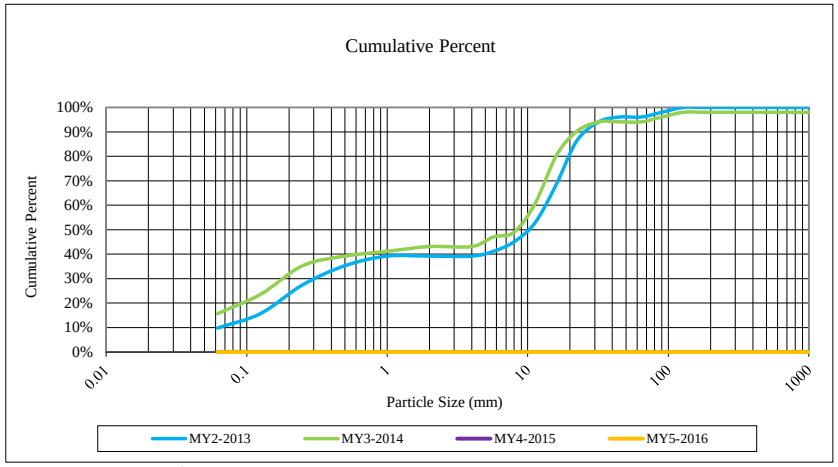



0

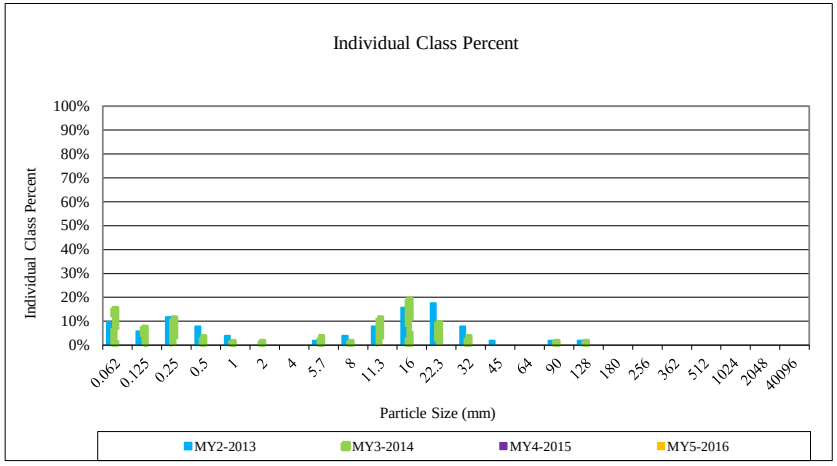


| Project Name: Herman Dairy UT1 | | | | | |
|---|---|---|---|---|---|
| Cross-Section: 10 | | | | | |
| Feature: Riffle | | | | | |
| | | | 2014 | | |
| **Description** | **Material** | **Size (mm)** | **Total #** | **Item %** | **Cum %** |
| **Silt/Clay** | silt/clay | 0.062 | 8 | 16% | 24% |
| **Sand** | very fine sand | 0.125 | 4 | 8% | 32% |
| | fine sand | 0.250 | 6 | 12% | 44% |
| | medium sand | 0.50 | 2 | 4% | 48% |
| | coarse sand | 1.00 | 1 | 2% | 56% |
| | very coarse sand | 2.0 | 1 | 2% | 60% |
| **Gravel** | very fine gravel | 4.0 | 0 | 0% | 68% |
| | fine gravel | 5.7 | 2 | 4% | 72% |
| | fine gravel | 8.0 | 1 | 2% | 80% |
| | medium gravel | 11.3 | 6 | 12% | 80% |
| | medium gravel | 16.0 | 10 | 20% | 84% |
| | course gravel | 22.3 | 5 | 10% | 96% |
| | course gravel | 32.0 | 2 | 4% | 96% |
| | very coarse gravel | 45 | 0 | 0% | 96% |
| | very coarse gravel | 64 | 0 | 0% | 100% |
| **Cobble** | small cobble | 90 | 1 | 2% | 100% |
| | medium cobble | 128 | 1 | 2% | 100% |
| | large cobble | 180 | 0 | 0% | 100% |
| | very large cobble | 256 | 0 | 0% | 100% |
| **Boulder** | small boulder | 362 | 0 | 0% | 100% |
| | small boulder | 512 | 0 | 0% | 100% |
| | medium boulder | 1024 | 0 | 0% | 100% |
| | large boulder | 2048 | 0 | 0% | 100% |
| **Bedrock** | bedrock | 40096 | 0 | 0% | 100% |
| **TOTAL % of whole count** | | | 50 | 100% | 100% |

| Summary Data | |
|---|---|
| D50 | 8 |
| D84 | 17 |
| D95 | 29 |

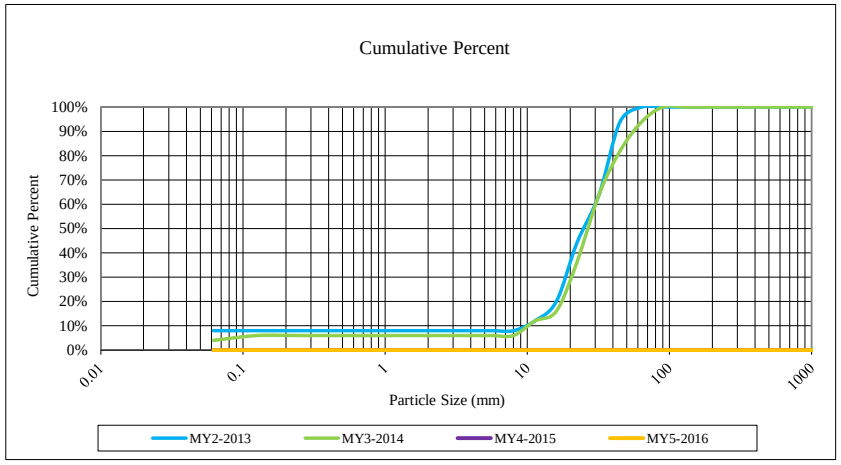




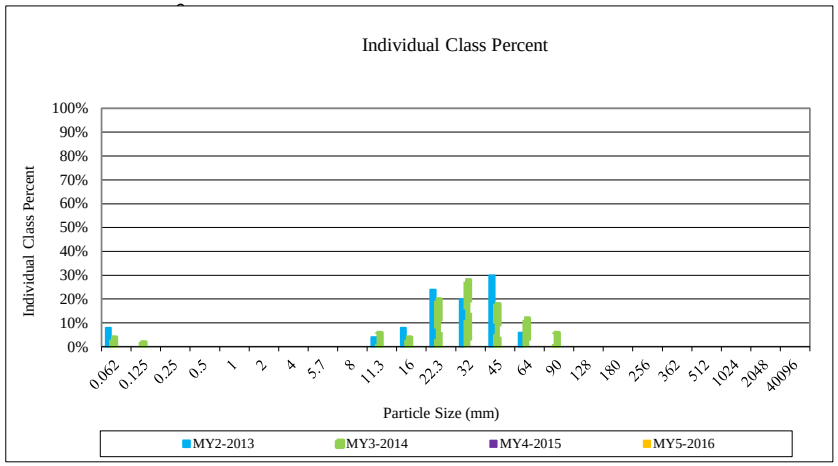



| Project Name: Herman Dairy UT2 | | | | | |
|---|---|---|---|---|---|
| Cross-Section: 13 | | | | | |
| Feature: Riffle | | | | | |
| | | | 2014 | | |
| **Description** | **Material** | **Size (mm)** | **Total #** | **Item %** | **Cum %** |
| **Silt/Clay** | silt/clay | 0.062 | 2 | 4% | 68% |
| **Sand** | very fine sand | 0.125 | 1 | 2% | 72% |
| | fine sand | 0.250 | | 0% | 84% |
| | medium sand | 0.50 | | 0% | 84% |
| | coarse sand | 1.00 | | 0% | 88% |
| | very coarse sand | 2.0 | | 0% | 92% |
| **Gravel** | very fine gravel | 4.0 | | 0% | 100% |
| | fine gravel | 5.7 | | 0% | 100% |
| | fine gravel | 8.0 | | 0% | 100% |
| | medium gravel | 11.3 | 3 | 6% | 100% |
| | medium gravel | 16.0 | 2 | 4% | 100% |
| | course gravel | 22.3 | 10 | 20% | 100% |
| | course gravel | 32.0 | 14 | 28% | 100% |
| | very coarse gravel | 45 | 9 | 18% | 100% |
| | very coarse gravel | 64 | 6 | 12% | 100% |
| **Cobble** | small cobble | 90 | 3 | 6% | 100% |
| | medium cobble | 128 | | 0% | 100% |
| | large cobble | 180 | 0 | 0% | 100% |
| | very large cobble | 256 | 0 | 0% | 100% |
| **Boulder** | small boulder | 362 | 0 | 0% | 100% |
| | small boulder | 512 | 0 | 0% | 100% |
| | medium boulder | 1024 | 0 | 0% | 100% |
| | large boulder | 2048 | 0 | 0% | 100% |
| **Bedrock** | bedrock | 40096 | 0 | 0% | 100% |
| **TOTAL % of whole count** | | | 50 | 100% | 100% |

| Summary Data | |
|---|---|
| D50 | 26.5 |
| D84 | 48 |
| D95 | 68 |

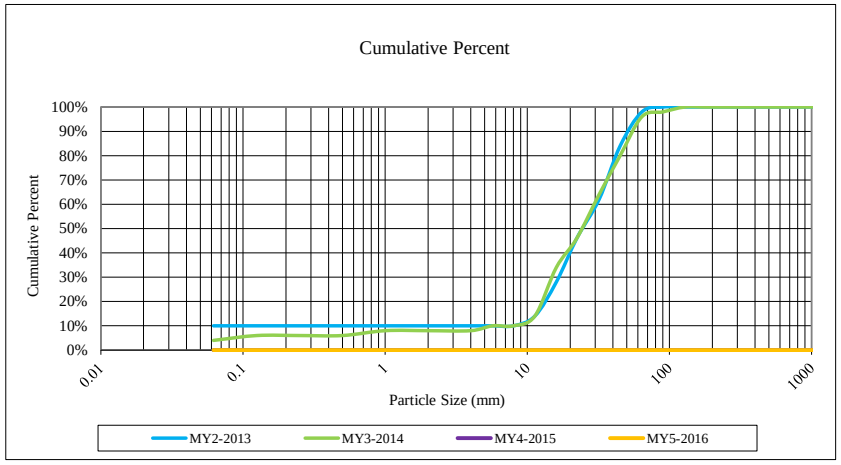



4

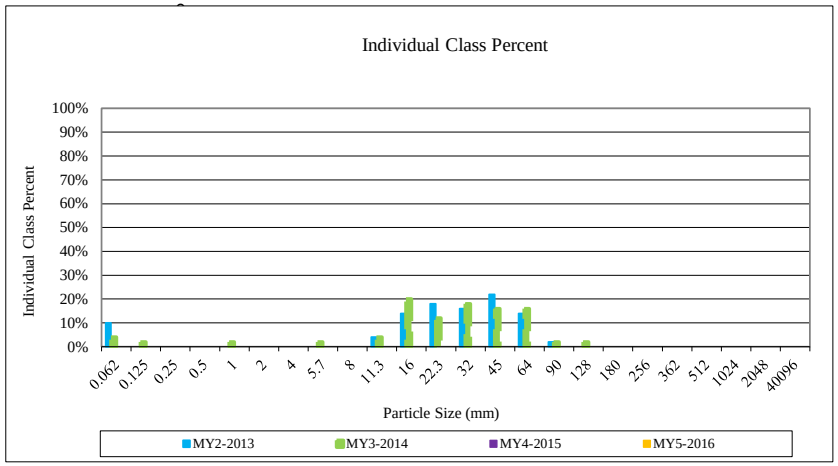


| Project Name: Herman Dairy UT2 | | | | | |
|---|---|---|---|---|---|
| Cross-Section: 15 | | | | | |
| Feature: Riffle | | | | | |
| | | | 2014 | | |
| **Description** | **Material** | **Size (mm)** | **Total #** | **Item %** | **Cum %** |
| **Silt/Clay** | silt/clay | 0.062 | 2 | 4% | 68% |
| **Sand** | very fine sand | 0.125 | 1 | 2% | 72% |
| | fine sand | 0.250 | | 0% | 84% |
| | medium sand | 0.50 | | 0% | 84% |
| | coarse sand | 1.00 | 1 | 2% | 88% |
| | very coarse sand | 2.0 | | 0% | 92% |
| **Gravel** | very fine gravel | 4.0 | | 0% | 100% |
| | fine gravel | 5.7 | 1 | 2% | 100% |
| | fine gravel | 8.0 | | 0% | 100% |
| | medium gravel | 11.3 | 2 | 4% | 100% |
| | medium gravel | 16.0 | 10 | 20% | 100% |
| | course gravel | 22.3 | 6 | 12% | 100% |
| | course gravel | 32.0 | 9 | 18% | 100% |
| | very coarse gravel | 45 | 8 | 16% | 100% |
| | very coarse gravel | 64 | 8 | 16% | 100% |
| **Cobble** | small cobble | 90 | 1 | 2% | 100% |
| | medium cobble | 128 | 1 | 2% | 100% |
| | large cobble | 180 | | 0% | 100% |
| | very large cobble | 256 | 0 | 0% | 100% |
| **Boulder** | small boulder | 362 | 0 | 0% | 100% |
| | small boulder | 512 | 0 | 0% | 100% |
| | medium boulder | 1024 | 0 | 0% | 100% |
| | large boulder | 2048 | 0 | 0% | 100% |
| **Bedrock** | bedrock | 40096 | 0 | 0% | 100% |
| **TOTAL % of whole count** | | | 50 | 100% | 100% |

| Summary Data | |
|---|---|
| D50 | 23.9 |
| D84 | 49 |
| D95 | 63 |

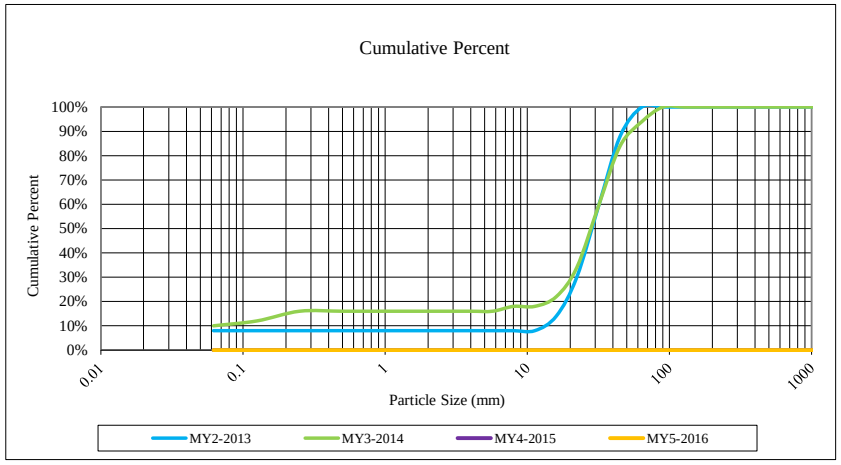



4

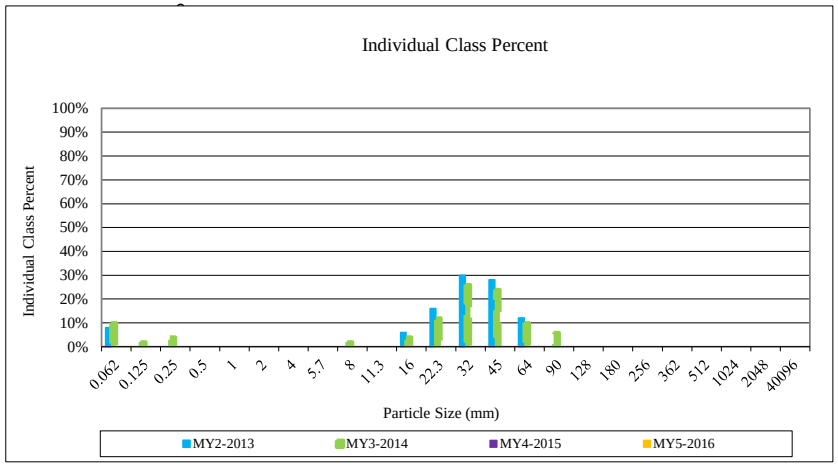


| Project Name: Herman Dairy UT3 | | | | | |
|---|---|---|---|---|---|
| Cross-Section: 17 | | | | | |
| Feature: Riffle | | | | | |
| | | | 2014 | | |
| **Description** | **Material** | **Size (mm)** | **Total #** | **Item %** | **Cum %** |
| **Silt/Clay** | silt/clay | 0.062 | 5 | 10% | 68% |
| **Sand** | very fine sand | 0.125 | 1 | 2% | 72% |
| | fine sand | 0.250 | 2 | 4% | 84% |
| | medium sand | 0.50 | | 0% | 84% |
| | coarse sand | 1.00 | | 0% | 88% |
| | very coarse sand | 2.0 | | 0% | 92% |
| **Gravel** | very fine gravel | 4.0 | | 0% | 100% |
| | fine gravel | 5.7 | | 0% | 100% |
| | fine gravel | 8.0 | 1 | 2% | 100% |
| | medium gravel | 11.3 | | 0% | 100% |
| | medium gravel | 16.0 | 2 | 4% | 100% |
| | course gravel | 22.3 | 6 | 12% | 100% |
| | course gravel | 32.0 | 13 | 26% | 100% |
| | very coarse gravel | 45 | 12 | 24% | 100% |
| | very coarse gravel | 64 | 5 | 10% | 100% |
| **Cobble** | small cobble | 90 | 3 | 6% | 100% |
| | medium cobble | 128 | | 0% | 100% |
| | large cobble | 180 | 0 | 0% | 100% |
| | very large cobble | 256 | 0 | 0% | 100% |
| **Boulder** | small boulder | 362 | 0 | 0% | 100% |
| | small boulder | 512 | 0 | 0% | 100% |
| | medium boulder | 1024 | 0 | 0% | 100% |
| | large boulder | 2048 | 0 | 0% | 100% |
| **Bedrock** | bedrock | 40096 | 0 | 0% | 100% |
| **TOTAL % of whole count** | | | 50 | 100% | 100% |

| Summary Data | |
|---|---|
| D50 | 27.7 |
| D84 | 45 |
| D95 | 68 |




4

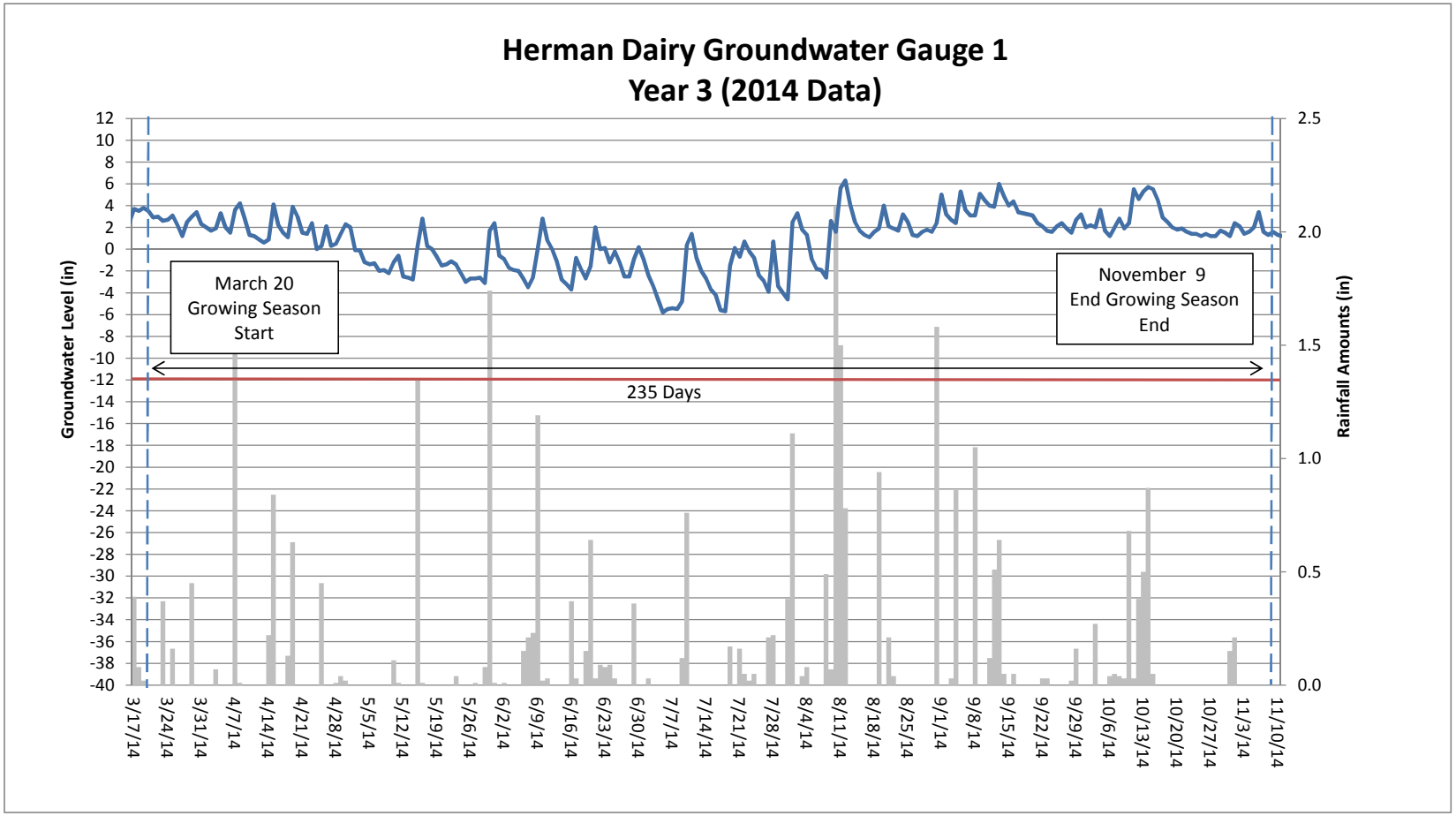


**Appendix E.**
**Hydrology Data**

Table 12. Wetland Hydrology Criteria Attainment
2014 Groundwater Gauge Graphs
Figure E1. Annual Climatic Data vs. 30-year Historic Data

**Table 12. Wetland Hydrology Criteria Attainment**

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


Herman Dairy Groundwater Gauge 1
Year 3 (2014 Data)
Groundwater Level (in)
Rainfall Amounts (in)
March 20
Growing Season
Start
November 9
End Growing Season
End
235 Days
12
10
8
6
4
2
0
-2
-4
-6
-8
-10
-12
-14
-16
-18
-20
-22
-24
-26
-28
-30
-32
-34
-36
-38
-40
2.5
2.0
1.5
1.0
0.5
0.0
3/17/14
3/24/14
3/31/14
4/7/14
4/14/14
4/21/14
4/28/14
5/5/14
5/12/14
5/19/14
5/26/14
6/2/14
6/9/14
6/16/14
6/23/14
6/30/14
7/7/14
7/14/14
7/21/14
7/28/14
8/4/14
8/11/14
8/18/14
8/25/14
9/1/14
9/8/14
9/15/14
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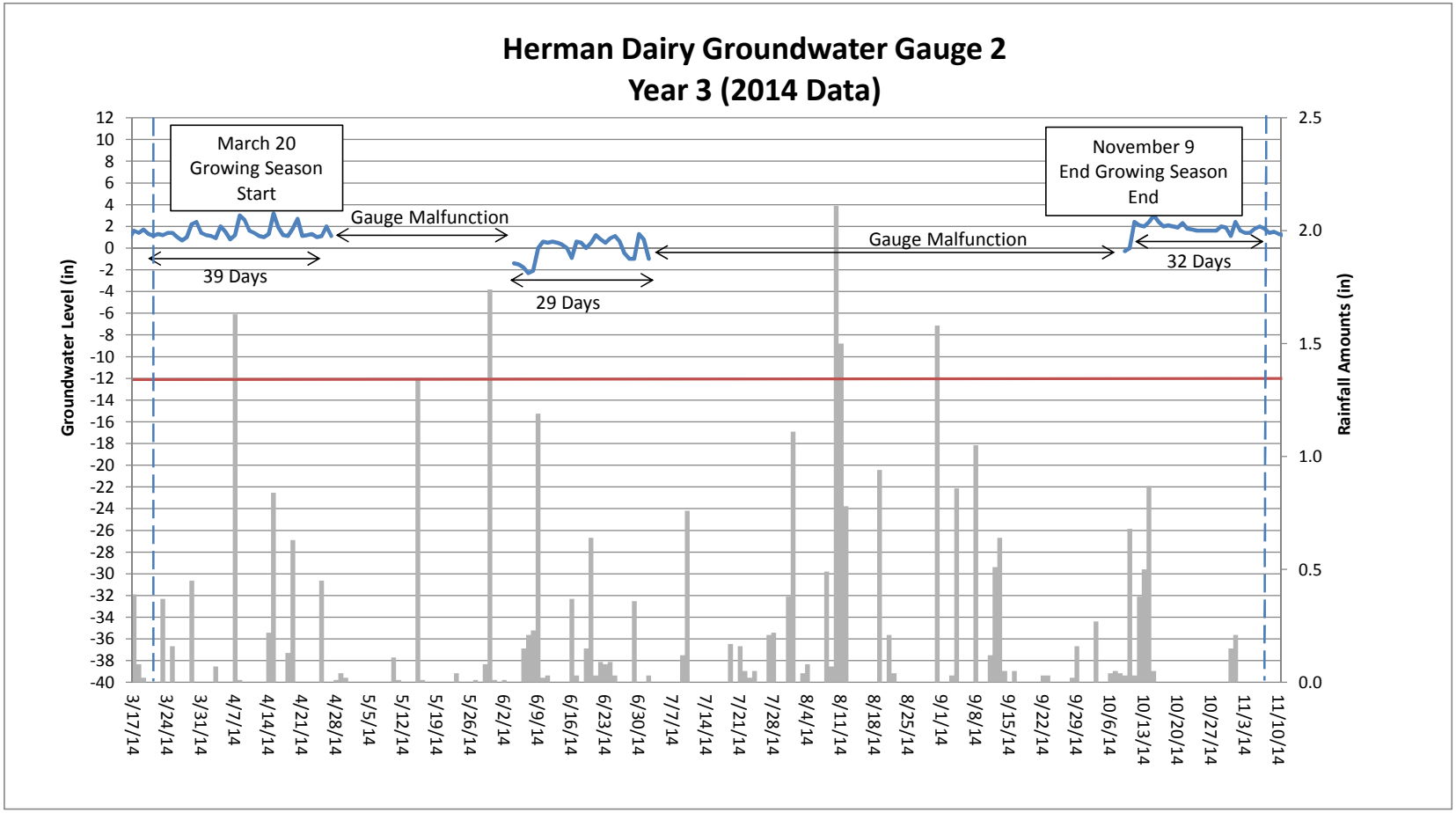
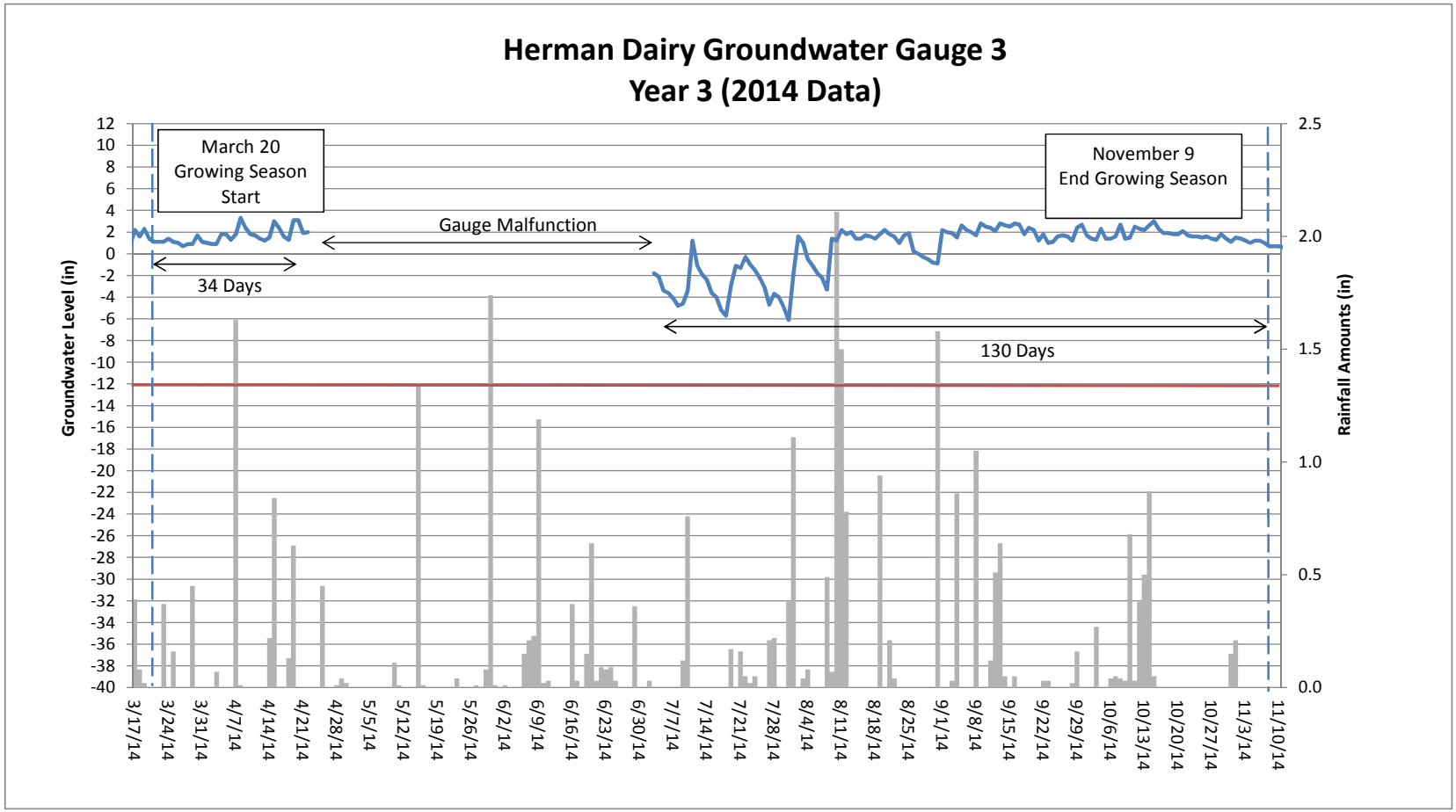
10/20/14
10/27/14
11/3/14
11/10/14


Herman Dairy Groundwater Gauge 2
Year 3 (2014 Data)
Groundwater Level (in)
Rainfall Amounts (in)
March 20
Growing Season
Start
November 9
End Growing Season
End
Gauge Malfunction
Gauge Malfunction
39 Days
29 Days
32 Days
12
10
8
6
4
2
0
-2
-4
-6
-8
-10
-12
-14
-16
-18
-20
-22
-24
-26
-28
-30
-32
-34
-36
-38
-40
2.5
2.0
1.5
1.0
0.5
0.0
3/17/14
3/24/14
3/31/14
4/7/14
4/14/14
4/21/14
4/28/14
5/5/14
5/12/14
5/19/14
5/26/14
6/2/14
6/9/14
6/16/14
6/23/14
6/30/14
7/7/14
7/14/14
7/21/14
7/28/14
8/4/14
8/11/14
8/18/14
8/25/14
9/1/14
9/8/14
9/15/14
9/22/14
9/29/14
10/6/14
10/13/14
10/20/14
10/27/14
11/3/14
11/10/14


Herman Dairy Groundwater Gauge 3
Year 3 (2014 Data)
March 20
Growing Season
Start
November 9
End Growing Season
Gauge Malfunction
34 Days
130 Days
Groundwater Level (in)
Rainfall Amounts (in)
12
10
8
6
4
2
0
-2
-4
-6
-8
-10
-12
-14
-16
-18
-20
-22
-24
-26
-28
-30
-32
-34
-36
-38
-40
2.5
2.0
1.5
1.0
0.5
0.0
3/17/14
3/24/14
3/31/14
4/7/14
4/14/14
4/21/14
4/28/14
5/5/14
5/12/14
5/19/14
5/26/14
6/2/14
6/9/14
6/16/14
6/23/14
6/30/14
7/7/14
7/14/14
7/21/14
7/28/14
8/4/14
8/11/14
8/18/14
8/25/14
9/1/14
9/8/14
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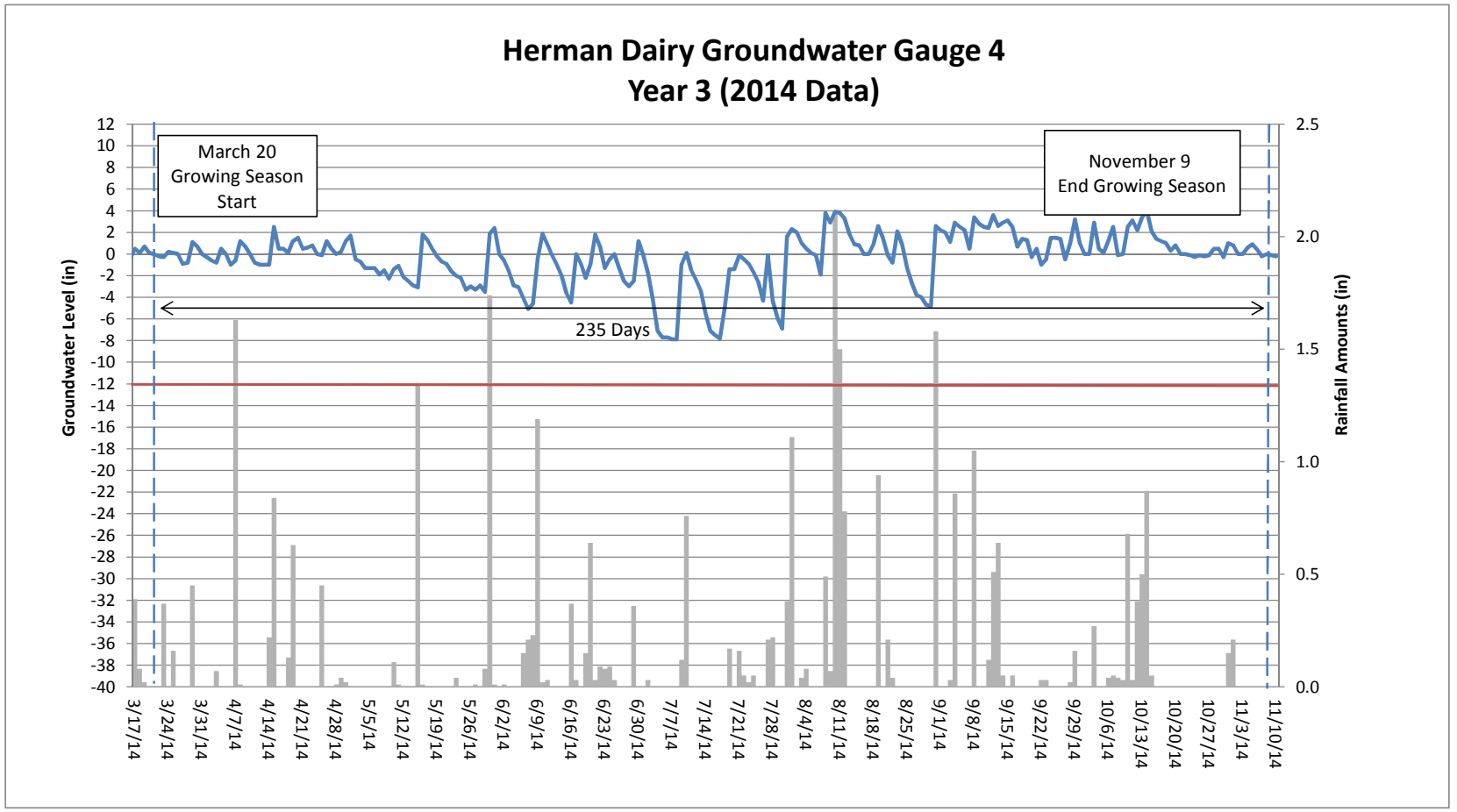
10/20/14
10/27/14
11/3/14
11/10/14


Herman Dairy Groundwater Gauge 4
Year 3 (2014 Data)
March 20
Growing Season
Start
November 9
End Growing Season
235 Days
Groundwater Level (in)
Rainfall Amounts (in)
12
10
8
6
4
2
0
-2
-4
-6
-8
-10
-12
-14
-16
-18
-20
-22
-24
-26
-28
-30
-32
-34
-36
-38
-40
2.5
2.0
1.5
1.0
0.5
0.0
3/17/14
3/24/14
3/31/14
4/7/14
4/14/14
4/21/14
4/28/14
5/5/14
5/12/14
5/19/14
5/26/14
6/2/14
6/9/14
6/16/14
6/23/14
6/30/14
7/7/14
7/14/14
7/21/14
7/28/14
8/4/14
8/11/14
8/18/14
8/25/14
9/1/14
9/8/14
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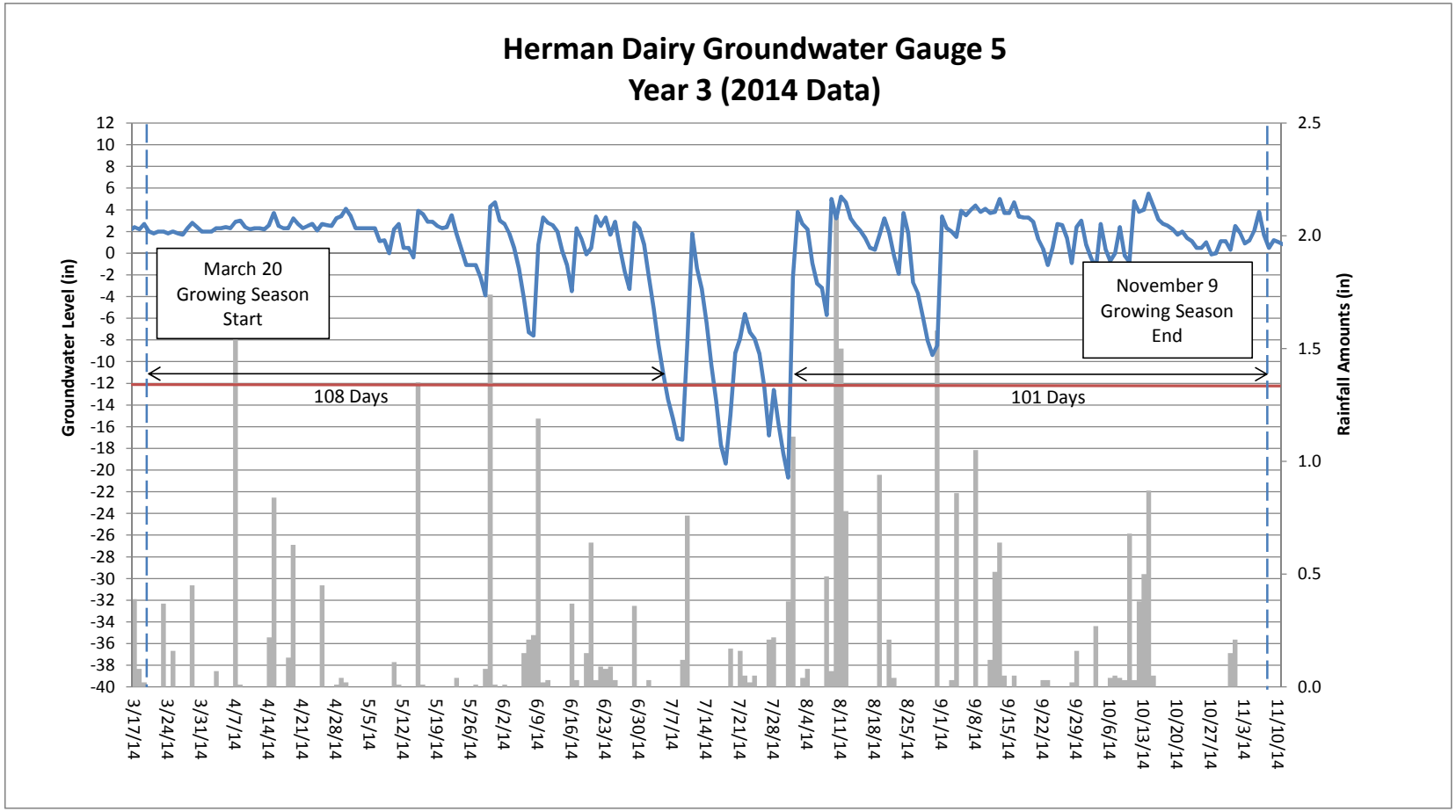
10/20/14
10/27/14
11/3/14
11/10/14


Herman Dairy Groundwater Gauge 5
Year 3 (2014 Data)
Groundwater Level (in)
Rainfall Amounts (in)
March 20
Growing Season
Start
November 9
Growing Season
End
108 Days
101 Days
12
10
8
6
4
2
0
-2
-4
-6
-8
-10
-12
-14
-16
-18
-20
-22
-24
-26
-28
-30
-32
-34
-36
-38
-40
2.5
2.0
1.5
1.0
0.5
0.0
3/17/14
3/24/14
3/31/14
4/7/14
4/14/14
4/21/14
4/28/14
5/5/14
5/12/14
5/19/14
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6/9/14
6/16/14
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7/14/14
7/21/14
7/28/14
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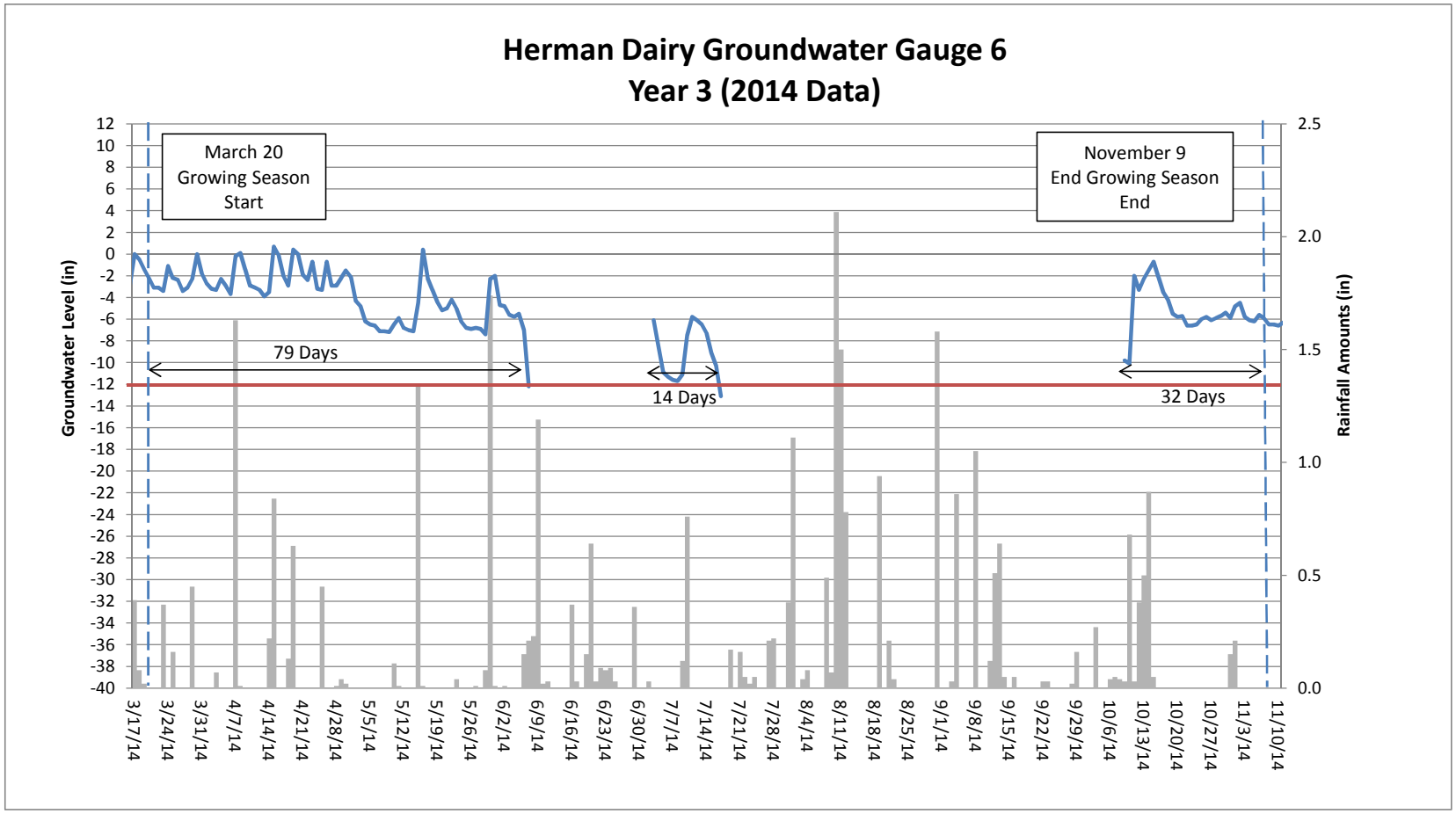
10/20/14
10/27/14
11/3/14
11/10/14


Herman Dairy Groundwater Gauge 6
Year 3 (2014 Data)
March 20
Growing Season
Start
November 9
End Growing Season
End
79 Days
14 Days
32 Days
Groundwater Level (in)
Rainfall Amounts (in)
12
10
8
6
4
2
0
-2
-4
-6
-8
-10
-12
-14
-16
-18
-20
-22
-24
-26
-28
-30
-32
-34
-36
-38
-40
2.5
2.0
1.5
1.0
0.5
0.0
3/17/14
3/24/14
3/31/14
4/7/14
4/14/14
4/21/14
4/28/14
5/5/14
5/12/14
5/19/14
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6/2/14
6/9/14
6/16/14
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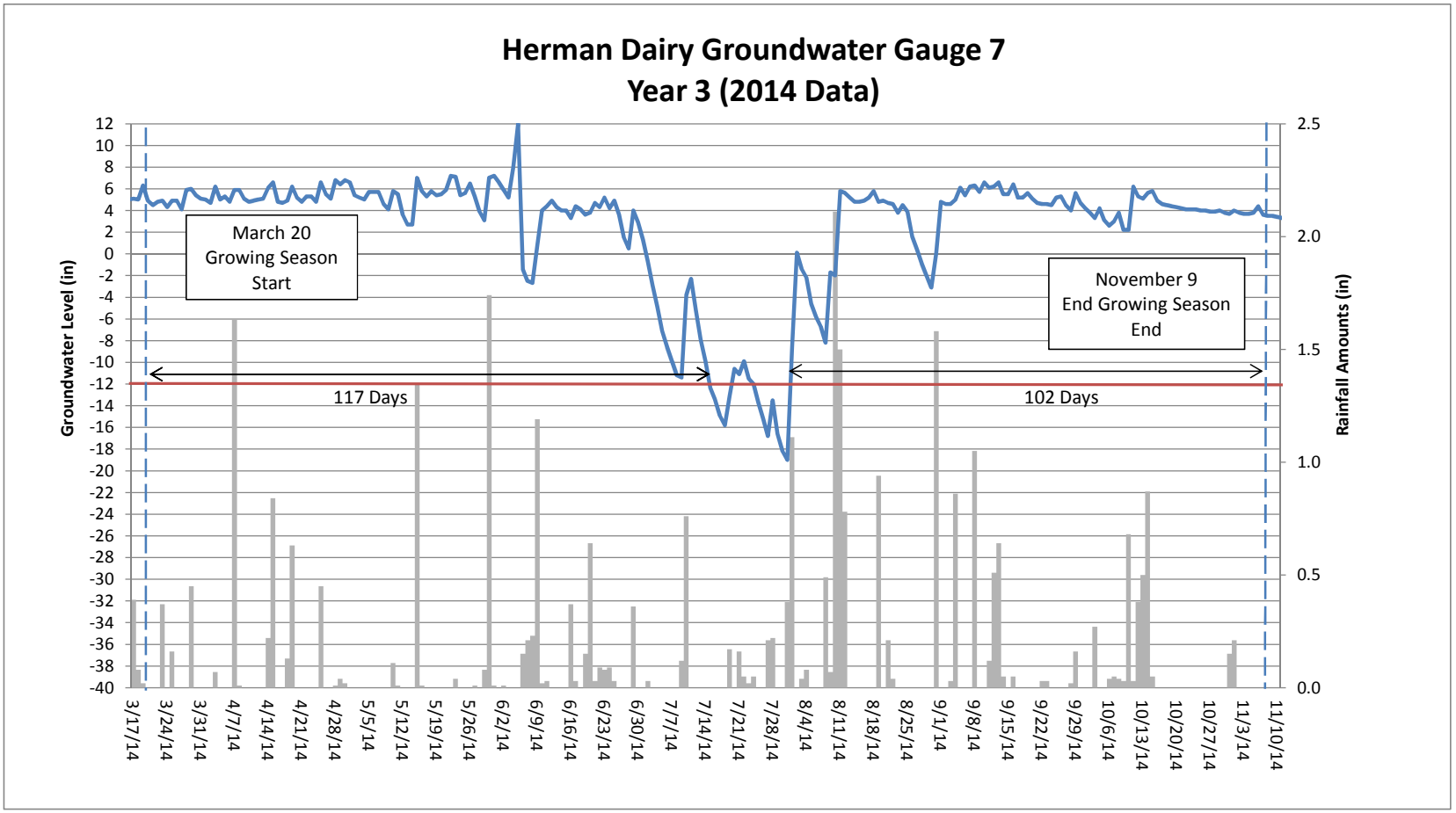
10/20/14
10/27/14
11/3/14
11/10/14


Herman Dairy Groundwater Gauge 7
Year 3 (2014 Data)
Groundwater Level (in)
Rainfall Amounts (in)
March 20
Growing Season
Start
November 9
End Growing Season
End
117 Days
102 Days
12
10
8
6
4
2
0
-2
-4
-6
-8
-10
-12
-14
-16
-18
-20
-22
-24
-26
-28
-30
-32
-34
-36
-38
-40
2.5
2.0
1.5
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0.5
0.0
3/17/14
3/24/14
3/31/14
4/7/14
4/14/14
4/21/14
4/28/14
5/5/14
5/12/14
5/19/14
5/26/14
6/2/14
6/9/14
6/16/14
6/23/14
6/30/14
7/7/14
7/14/14
7/21/14
7/28/14
8/4/14
8/11/14
8/18/14
8/25/14
9/1/14
9/8/14
9/15/14
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10/20/14
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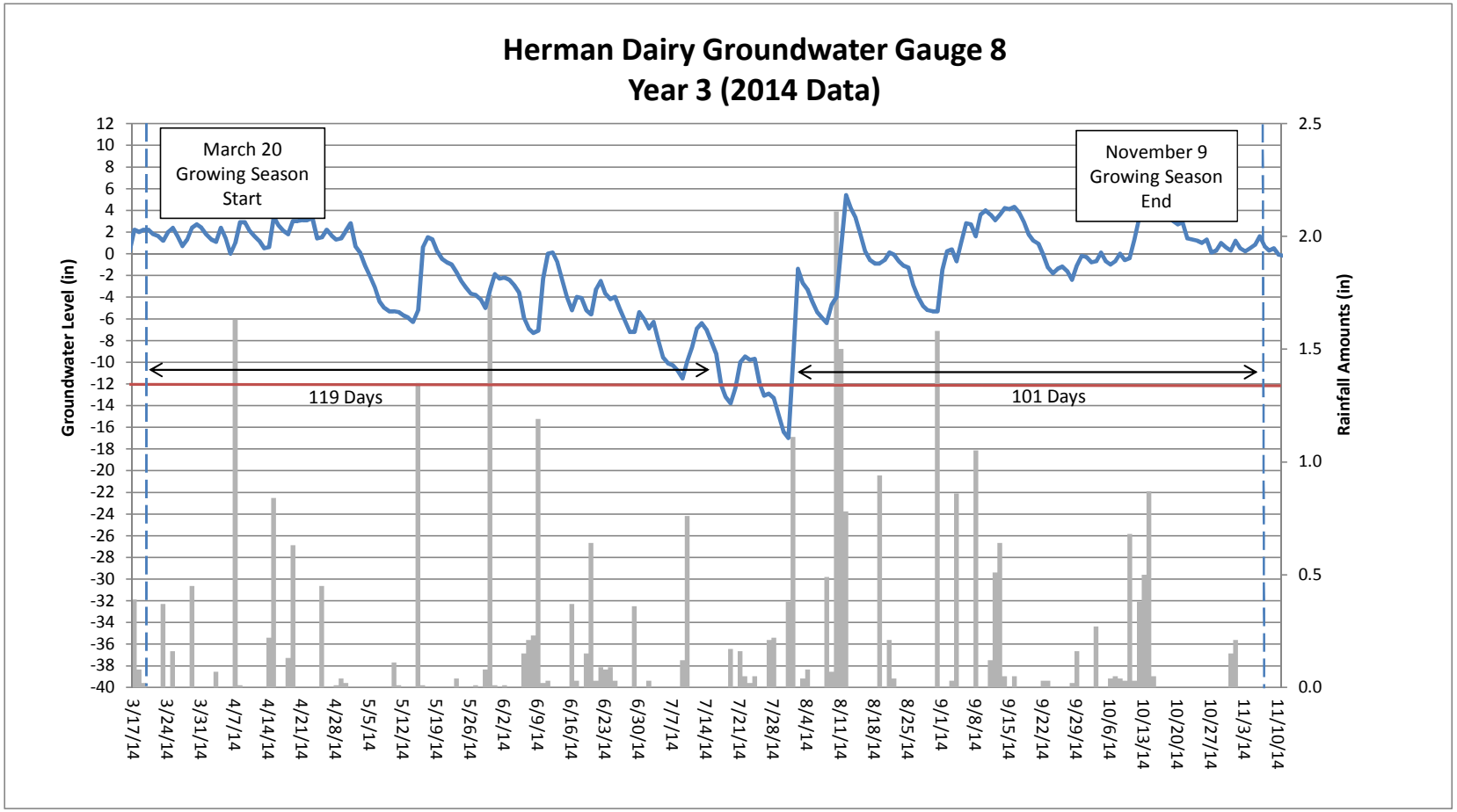
11/3/14
11/10/14


Herman Dairy Groundwater Gauge 8
Year 3 (2014 Data)
Groundwater Level (in)
Rainfall Amounts (in)
March 20
Growing Season
Start
November 9
Growing Season
End
119 Days
101 Days
12
10
8
6
4
2
0
-2
-4
-6
-8
-10
-12
-14
-16
-18
-20
-22
-24
-26
-28
-30
-32
-34
-36
-38
-40
2.5
2.0
1.5
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3/17/14
3/24/14
3/31/14
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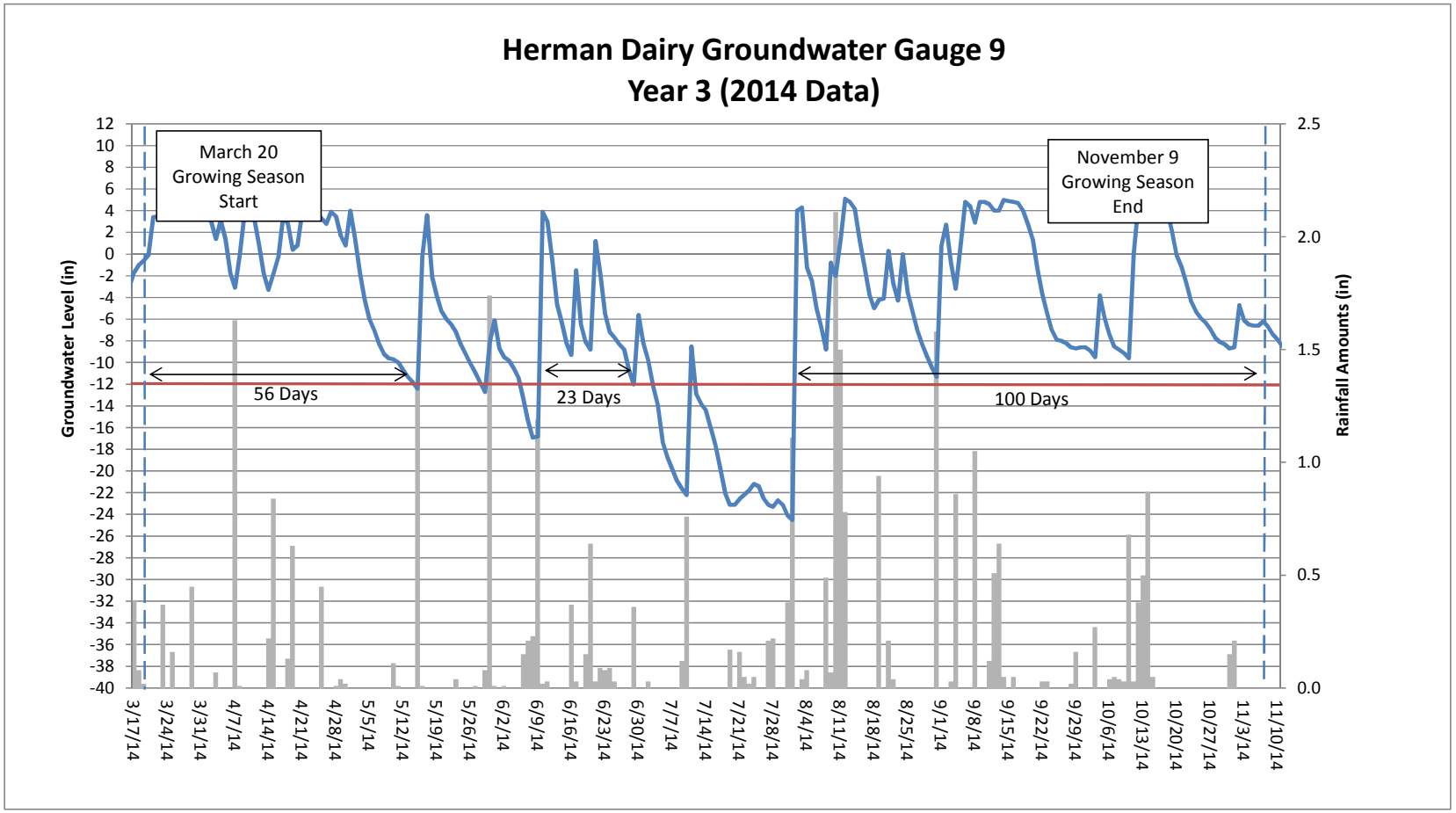
4/28/14
5/5/14
5/12/14
5/19/14
5/26/14
6/2/14
6/9/14
6/16/14
6/23/14
6/30/14
7/7/14
7/14/14
7/21/14
7/28/14
8/4/14
8/11/14
8/18/14
8/25/14
9/1/14
9/8/14
9/15/14
9/22/14
9/29/14
10/6/14
10/13/14
10/20/14
10/27/14
11/3/14
11/10/14


Herman Dairy Groundwater Gauge 9
Year 3 (2014 Data)
March 20
Growing Season
Start
November 9
Growing Season
End
56 Days
23 Days
100 Days
Groundwater Level (in)
Rainfall Amounts (in)
12
10
8
6
4
2
0
-2
-4
-6
-8
-10
-12
-14
-16
-18
-20
-22
-24
-26
-28
-30
-32
-34
-36
-38
-40
2.5
2.0
1.5
1.0
0.5
0.0
3/17/14
3/24/14
3/31/14
4/7/14
4/14/14
4/21/14
4/28/14
5/5/14
5/12/14
5/19/14
5/26/14
6/2/14
6/9/14
6/16/14
6/23/14
6/30/14
7/7/14
7/14/14
7/21/14
7/28/14
8/4/14
8/11/14
8/18/14
8/25/14
9/1/14
9/8/14
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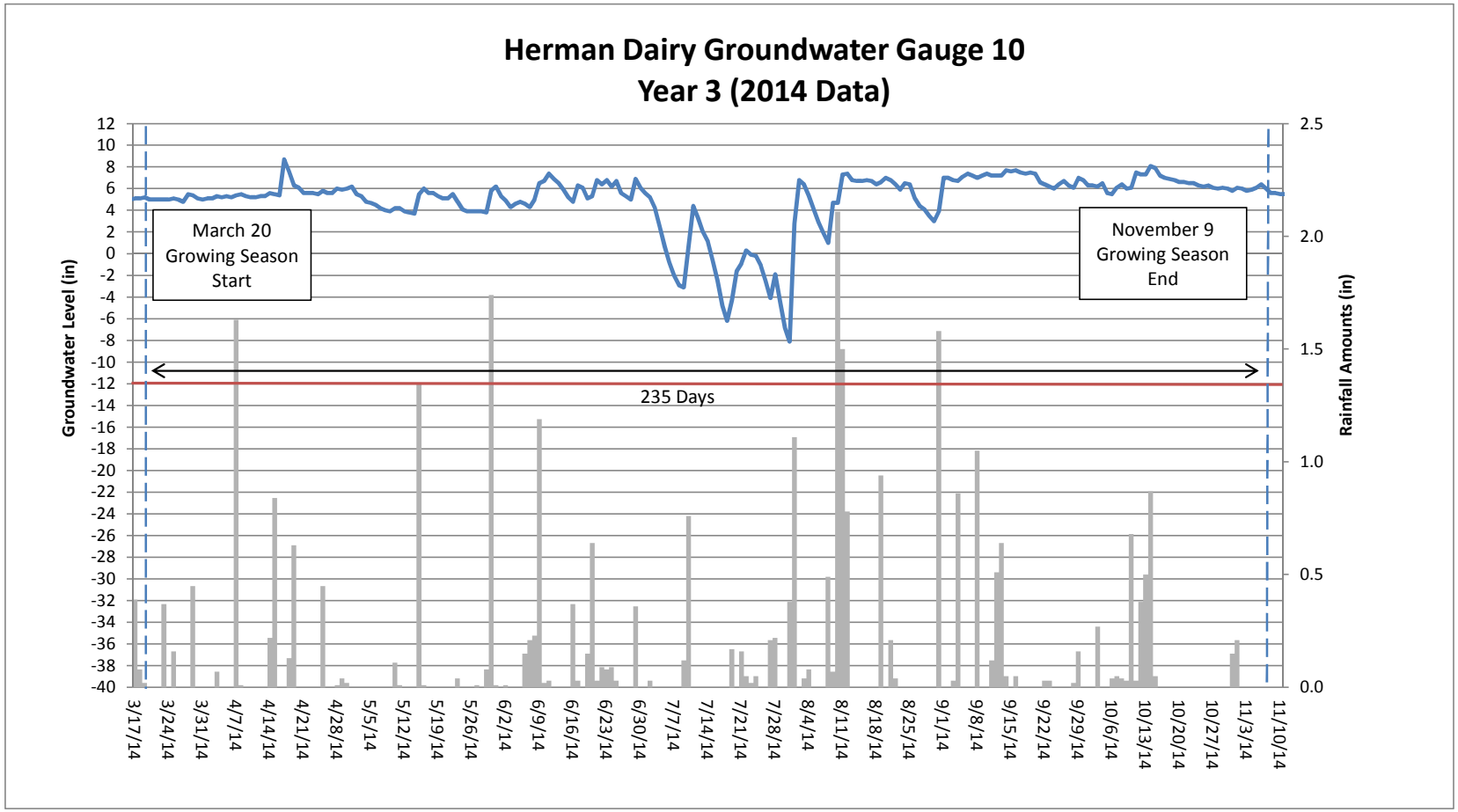
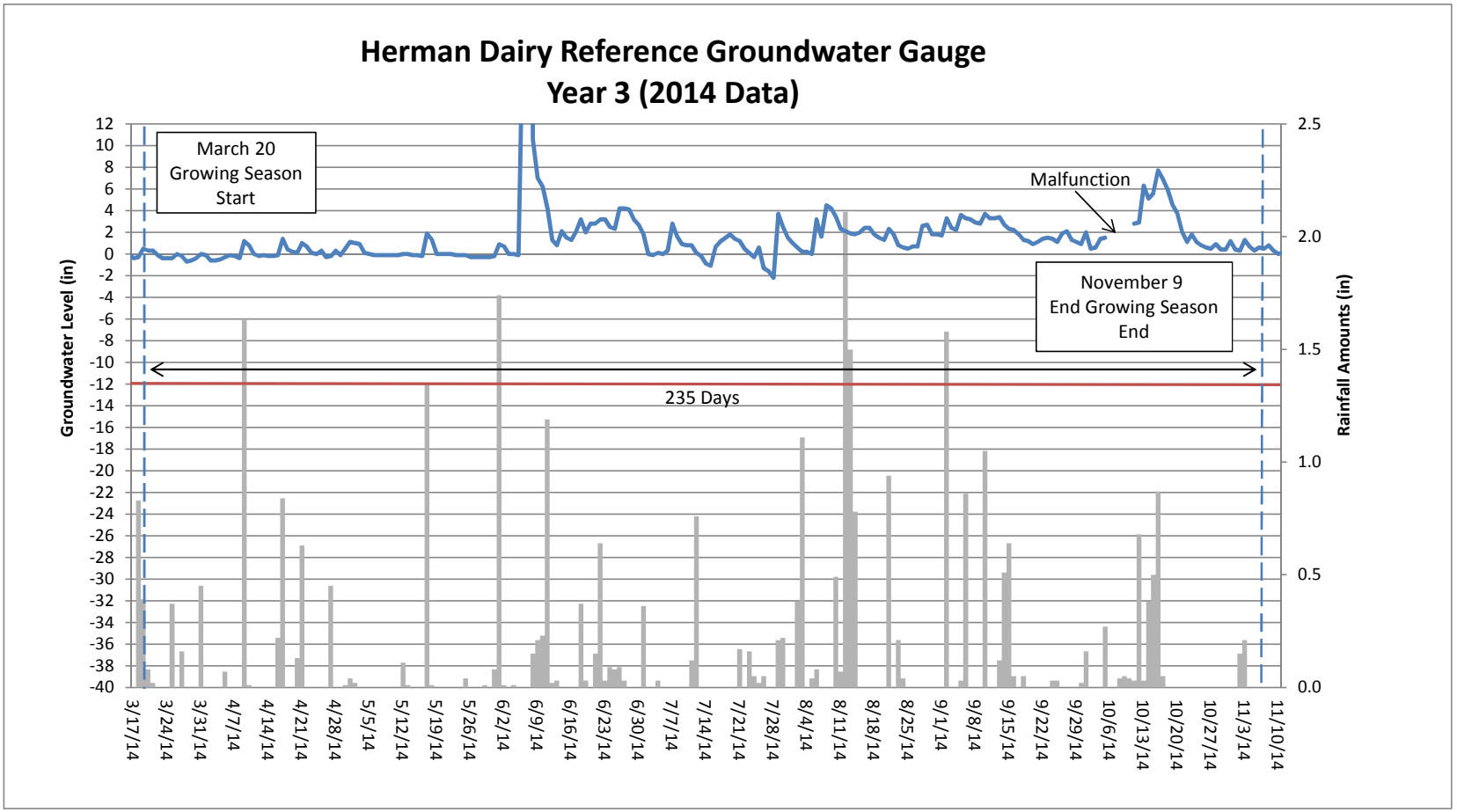
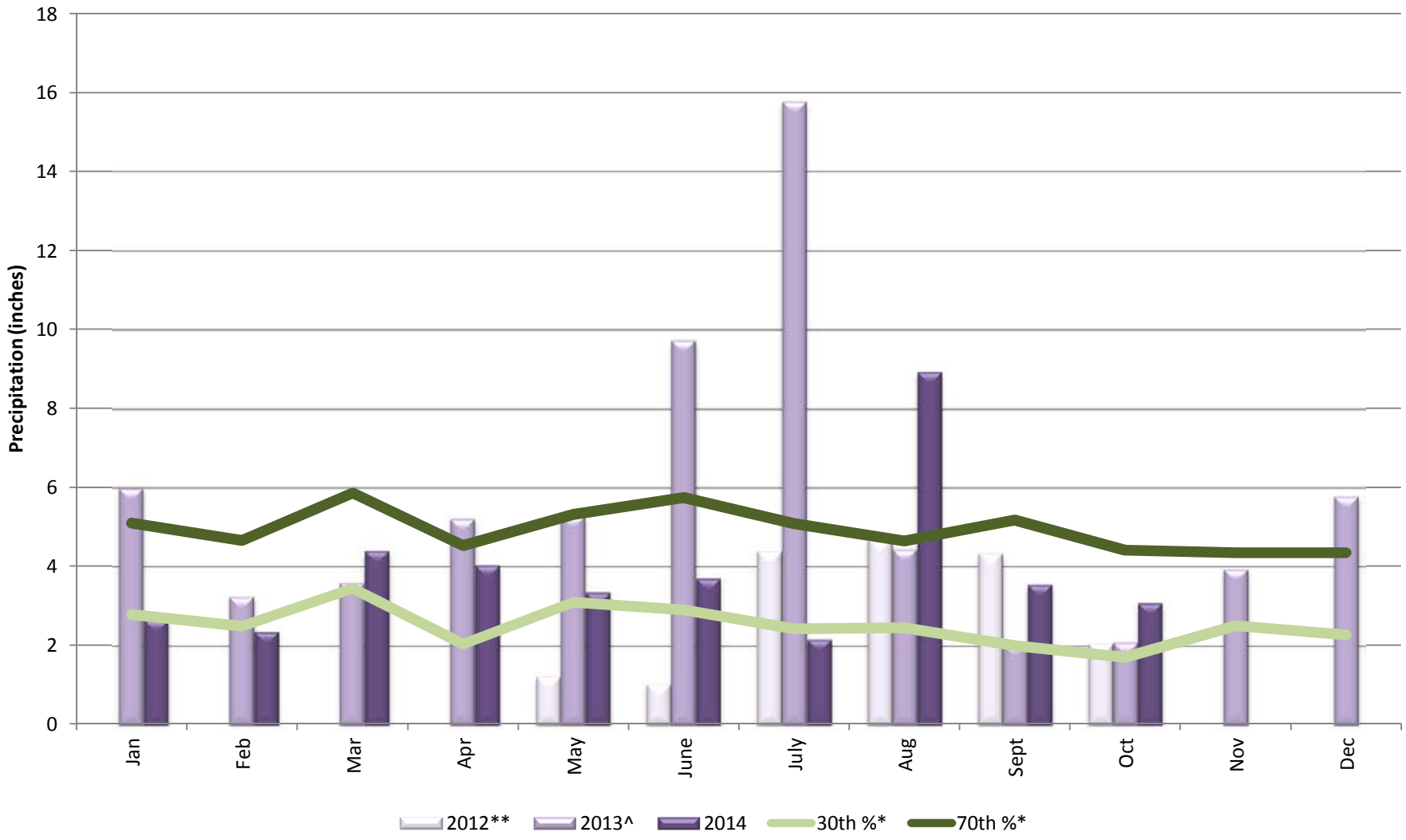
10/20/14
10/27/14
11/3/14
11/10/14


Herman Dairy Groundwater Gauge 10
Year 3 (2014 Data)
Groundwater Level (in)
Rainfall Amounts (in)
March 20
Growing Season
Start
November 9
Growing Season
End
235 Days
12
10
8
6
4
2
0
-2
-4
-6
-8
-10
-12
-14
-16
-18
-20
-22
-24
-26
-28
-30
-32
-34
-36
-38
-40
2.5
2.0
1.5
1.0
0.5
0.0
3/17/14
3/24/14
3/31/14
4/7/14
4/14/14
4/21/14
4/28/14
5/5/14
5/12/14
5/19/14
5/26/14
6/2/14
6/9/14
6/16/14
6/23/14
6/30/14
7/7/14
7/14/14
7/21/14
7/28/14
8/4/14
8/11/14
8/18/14
8/25/14
9/1/14
9/8/14
9/15/14
9/22/14
9/29/14
10/6/14
10/13/14
10/20/14
10/27/14
11/3/14
11/10/14


Herman Dairy Reference Groundwater Gauge
Year 3 (2014 Data)
Groundwater Level (in)
Rainfall Amounts (in)
March 20
Growing Season
Start
Malfunction
November 9
End Growing Season
End
235 Days
12
10
8
6
4
2
0
-2
-4
-6
-8
-10
-12
-14
-16
-18
-20
-22
-24
-26
-28
-30
-32
-34
-36
-38
-40
2.5
2.0
1.5
1.0
0.5
0.0
3/17/14
3/24/14
3/31/14
4/7/14
4/14/14
4/21/14
4/28/14
5/5/14
5/12/14
5/19/14
5/26/14
6/2/14
6/9/14
6/16/14
6/23/14
6/30/14
7/7/14
7/14/14
7/21/14
7/28/14
8/4/14
8/11/14
8/18/14
8/25/14
9/1/14
9/8/14
9/15/14
9/22/14
9/29/14
10/6/14
10/13/14
10/20/14
10/27/14
11/3/14
11/10/14

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



**Appendix F.**
**Benthic Data**

2014 Benthic Data Lab Results
2014 Habitat Assessment Field Datasheets

| SPECIES | Tolerance Values | Functional Feeding Groups | UT1 | UT 2 |
|---|---|---|---|---|
| | | | | |
| **ARTHROPODA** | | | | |
| **Crustacea** | | | | |
| **Isopoda** | | | | |
| Asellidae | | **SH** | | |
| *Caecidotea sp.* | **8.4** | **CG** | | 1 |
| **Collembola** | | | | |
| Isotomidae | | | 1 | |
| **Insecta** | | | | |
| **Ephemeroptera** | | | | |
| Baetidae | | | | |
| *Baetis pluto* | **3.4** | | 2 | |
| **Odonata** | | | | |
| Libellulidae | | **P** | | |
| *Plathemis lydia* | **9.8** | | | 3 |
| **Trichoptera** | | | | |
| Hydropsychidae | | | | |
| *Hydropsyche depravata gp.* | **7.9** | **FC** | 9 | |
| **Coleoptera** | | | | |
| Dytiscidae | | **P** | | 1 |
| Scirtidae | | **SC** | | |
| *Scirtes sp.* | | | | 5 |
| **Diptera** | | | | |
| Chironomidae | | | | |
| *Chironomus sp.* | **9.3** | **CG** | 5 | |
| *Conchapelopia sp.* | **8.4** | **P** | 1 | |
| *Polypedilum illinoense gp.* | **8.7** | **SH** | 1 | |
| *Psectrotanypus dyari* | **10** | **P** | 1 | |
| *Stictochironomus devinctus* | **5.4** | **CG** | 9 | |
| *Tanytarsus sp.* | **6.6** | **FC** | 2 | |
| Simuliidae | | **FC** | | |
| *Simulium vittatum* | **9.1** | | 7 | |
| Ptychopteridae | | | | |
| *Bittacomorpha sp.* | | | | 9 |
| Tipulidae | | **SH** | | |
| *Tipula sp.* | **7.5** | **SH** | 2 | |
| | | | | |
| **TOTAL NO. OF ORGANISMS** | | | **40** | **19** |
| **TOTAL NO. OF TAXA** | | | **11** | **5** |
| **EPT** | | | **2** | **0** |
| **Biotic Index-Assigned Values** | | | **7.76** | **9.45** |

3/06 Revision 6

Herman Dairy
UT1

**Habitat Assessment Field Data Sheet**
**Mountain/ Piedmont Streams**

**Biological Assessment Unit, DWQ** **TOTAL SCORE** 76

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** 6/27/14 **CC#** 03050101120030 **Basin** Catawba **Subbasin** 03-08-02

Observer(s) KRJ, PHP 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: riparian buffer restoration 5% animal operations

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

**Width**: (~~meters~~ feet) Stream 4 Channel (at top of bank) 5 **Stream Depth**: (~~m~~ ft.) Avg 0.5 Max 1
☐ 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:** cloudy **Photos:** ☐ N ☑ Y ☑ Digital ☐ 35mm

**Remarks:** very turbid, highted load P-10

VT1

**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.

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

Remarks_____ Subtotal 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.

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

Subtotal 10

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

Remarks_____

Page Total 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_____ Subtotal 7

**VIII. Riparian Vegetative Zone Width**

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

| FACE UPSTREAM | 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 |

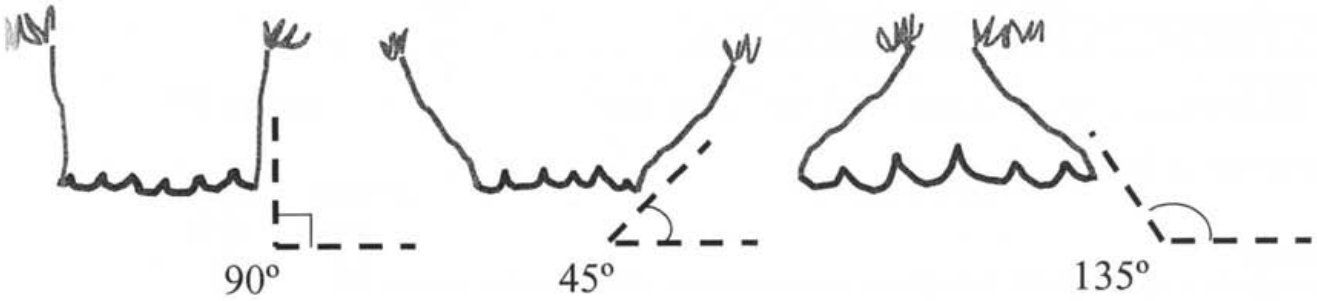
Remarks_____ Total 10

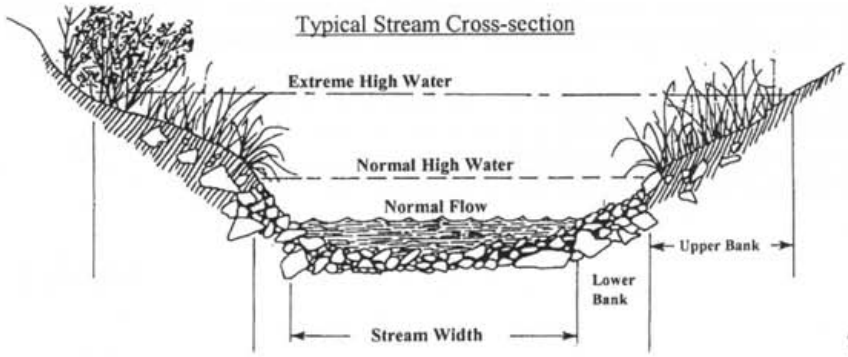
Page Total 47

☐ Disclaimer-form filled out, but score doesn't match subjective opinion-atypical stream. **TOTAL SCORE** 76

**Supplement for Habitat Assessment Field Data Sheet**

Diagram to determine bank angle:




This side is 45° bank angle.

Site Sketch:

Other comments:_____

_____

_____

_____

_____

3/06 Revision 6

**Habitat Assessment Field Data Sheet**
**Mountain/ Piedmont Streams**

UT 2

**Biological Assessment Unit, DWQ** **TOTAL SCORE** 78

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** 4/27/14 **CC#** 03050101120038 **Basin** Catawba **Subbasin** 03-08-32

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

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

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

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

Visible Land Use: 15 %Forest _____ %Residential _____ %Active Pasture 75 % Active Crops
_____ %Fallow Fields _____ % Commercial _____ %Industrial 10 %Other - Describe: riparian buffer restoration

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:** cloudy **Photos:** ☐ N ☑ Y ☑ Digital ☐ 35mm

**Remarks:** _____

VT2

**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** A **Macrophytes** C **Sticks and leafpacks** R **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.

**A. substrate with good mix of gravel, cobble and boulders** **Score**

1. embeddedness <20% (very little sand, usually only behind large boulders)..... 15
2. embeddedness 20-40%..... 12
3. embeddedness 40-80%..... 8
4. embeddedness >80%..... 3

**B. substrate gravel and cobble**

1. embeddedness <20%..... 14
2. embeddedness 20-40%..... 11
3. embeddedness 40-80%..... (6)
4. embeddedness >80%..... 2

**C. substrate mostly gravel**

1. embeddedness <50%..... 8
2. embeddedness >50%..... 4

**D. substrate homogeneous**

1. substrate nearly all bedrock..... 3
2. substrate nearly all sand..... 3
3. substrate nearly all detritus..... 2
4. substrate nearly all silt/ clay..... 1

Remarks_____ Subtotal 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.

**A. Pools present** Score

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

**B. Pools absent**..... 0

Subtotal 10

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

Page Total 36

UT 2

**V. Riffle Habitats**

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

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

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

**VI. Bank Stability and Vegetation**

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

Remarks_____

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

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

Remarks_____ Subtotal 2

**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 |

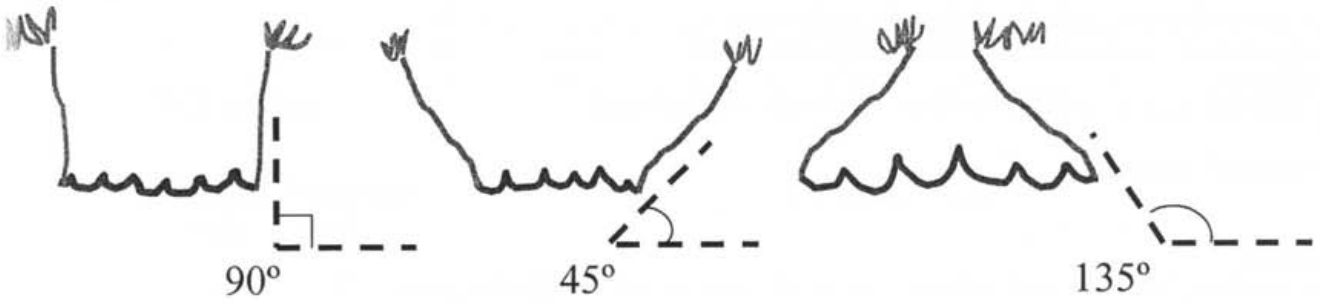
Remarks_____ Total 10

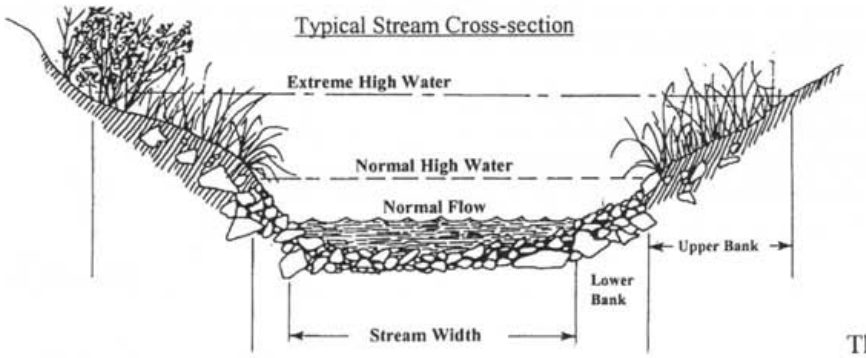
Page Total 42

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

**Supplement for Habitat Assessment Field Data Sheet**

Diagram to determine bank angle:




This side is 45° bank angle.

Site Sketch:

Other comments:_____

_____

_____

_____

_____

**Habitat Assessment Field Data Sheet**
**Mountain/ Piedmont Streams**

UT3

**Biological Assessment Unit, DWQ** **TOTAL SCORE** 81

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** 6/27/14 **CC#** 03050101120090 Basin catawba Subbasin 03-08-32

Observer(s) KRJ/PHP 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: riparian buffer restoration
5% animal operation

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 0.5 Max 1
☐ 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:** cloudy **Photos:** ☐N ☑Y ☑Digital ☐35mm

**Remarks:** No water present during visit; therefore, no benthic samples were obtained.

UT3

**I. Channel Modification**

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

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

Remarks _____ Subtotal 5

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

A **Rocks** C **Macrophytes** R **Sticks and leafpacks** R **Snags and logs** 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.

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

Remarks _____ Subtotal 11

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

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

Subtotal 10

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

Remarks _____

Page Total 41

UT 3

**V. Riffle Habitats**

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

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

Channel Slope: ☐Typical for area ☐Steep=fast flow ☐Low=like a coastal stream Subtotal 14

**VI. Bank Stability and Vegetation**

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

Total 14

Remarks_____

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

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

Remarks_____ Subtotal 2

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

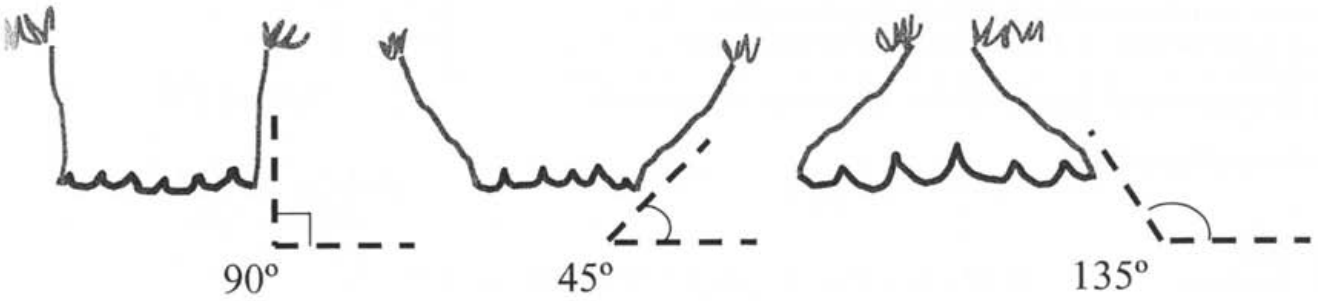
Remarks_____ Total 10

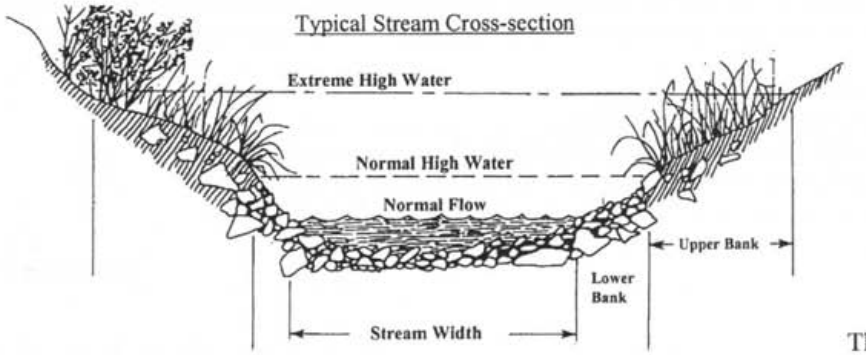
Page Total 40

☐ Disclaimer-form filled out, but score doesn't match subjective opinion-atypical stream. **TOTAL SCORE** 91

**Supplement for Habitat Assessment Field Data Sheet**

Diagram to determine bank angle:




This side is 45° bank angle.

Site Sketch:

Other comments:_____

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