YEAR 1 (2008)
ANNUAL MONITORING REPORT
JARMANS OAK RESTORATION SITE
ONSLOW COUNTY, NORTH CAROLINA

(CONTRACT D06069-A)
FULL DELIVERY PROJECT
WHITE OAK RIVER BASIN
CATALOGING UNIT 03030001

Prepared for:

NORTH CAROLINA DEPARTMENT OF ENVIRONMENT AND NATURAL RESOURCES
RALEIGH, NORTH CAROLINA

Prepared by:

Restoration Systems, LLC
1101 Haynes Street, Suite 211
Raleigh, North Carolina 27604

And

Axiom Environmental, Inc.
2126 Rowland Pond Drive
Willow Springs, North Carolina 27592

November 2008

EXECUTIVE SUMMARY

Restoration Systems, L.L.C. has completed restoration of stream and riverine wetlands at the Jarmans Oak Stream and Wetland Restoration Site to assist the North Carolina Ecosystem Enhancement Program in fulfilling stream and wetland mitigation goals in the region. The Site is located less than 2 miles east of the Onslow/Duplin County line and approximately 3 miles west of the Town of Richlands in Onslow County. The Site is located in United States Geological Survey (USGS) Catologing Unit (CU) and Targeted Local Watershed 03030001010010 (North Carolina Division of Water Quality Subbasin 03-05-02) of the White Oak River Basin and will service the USGS 8-digit CU 03030001. This report serves as the Year 1 (2008) annual monitoring report.

Primary activities at the Site included 1) stream restoration, 2) wetland restoration, 3) soil scarification, and 4) plant community restoration. Project restoration efforts will provide a minimum of 6640 Stream Mitigation Units and 12 riverine Wetland Mitigation Units.

Fourteen vegetation plots (13-10 meters by 10 meters and 1-20 meters by 5 meters in size) were established and permanently monumented. These plots were surveyed in September 2008 for the Year 1 (2008) monitoring season. Based on the number of stems present, the average density of all plots was 471 planted stems per acre surviving in Year 1 (2008). The dominant species identified at the Site were planted stems of blackgum (*Nyssa biflora*), green ash (*Fraxinus pennsylvanica*), and river birch (*Betula nigra*), and natural recruits of red maple (*Acer rubrum*) and sweetgum (*Liquidambar styraciflua*).

Vegetation sampling across the Site was above the required average density with 471 planted stems per acre. Two of the fourteen plots had low densities (plots 1 and 9) with 283 and 202 planted stems per acres, respectively; however, this is not considered to be a problem at this time. These areas should be watched over the monitoring period; the establishment of natural recruits is expected over the next few years. No vegetation problem areas were noted during the Year 1 (2008) monitoring season.

Twenty cross-sections and longitudinal profiles within five 600-foot reaches were measured during Year 1 (2008) monitoring. As a whole, monitoring measurements indicate that 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.

Two potential stream problem areas were documented within the Site during the Year 1 (2008) monitoring year. Each is an area of reduced bed and bank integrity, located on the Main Tributary near Station 32+50 and on the Southern Tributary (West) near Station 16+50, that should be watched throughout the monitoring period. No additional stream problem areas were noted within the Site during the Year 1 (2008) monitoring year.

Four restoration Site and one reference groundwater gauges were operated for the Year 1 (2008) monitoring season. All monitored gauges within restoration areas were inundated/saturated within 12 inches of the surface for greater than 8 percent (ranging from 28 to 38 percent) of the growing season. No wetland problem areas were noted during Year 1 (2008) monitoring.

In summary, the restoration site achieved success criteria for vegetation, stream, and hydrology attributes in the First Monitoring Year (2008).

TABLE OF CONTENTS

FIGURES

TABLES

APPENDICES

1.0 PROJECT BACKGROUND

1.1 Location and Setting

Restoration Systems, L.L.C. (Restoration Systems) has completed restoration of stream and riverine wetlands at the Jarmans Oak Stream and Wetland Restoration Site (hereafter referred to as the "Site") to assist the North Carolina Ecosystem Enhancement Program (EEP) in fulfilling stream and wetland mitigation goals in the region. The Site, located less than 2 miles east of the Onslow/Duplin County line and approximately 3 miles west of the Town of Richlands in Onslow County, will provide a minimum of 6640 stream mitigation units and 12 riverine wetland mitigation units (Figure 1). The Site is located in United States Geological Survey (USGS) Catologing Unit (CU) and Targeted Local Watershed 03030001010010 (North Carolina Division of Water Quality [NCDWQ] Subbasin 03-05-02) of the White Oak River Basin and will service the USGS 8-digit CU 03030001.

Directions to the Site from Richlands, North Carolina, are as follows:

- Travel west on Highway 24 for approximately 3 miles
- The Site is on the right immediately before Haw Branch Road

1.2 Project Objectives

The primary components of the restoration project included 1) construction of a stable, riffle-pool stream channel; 2) enhancement of water quality functions within, upstream, and downstream of the Site 3) creation of a natural vegetated buffer along restored stream channels; 4) restoration of jurisdictional riverine wetlands in the Site; 5) improvement of aquatic habitat and species diversity by enhancing stream bed variability; and 6) restoration of wildlife functions associated with a riparian corridor/stable stream.

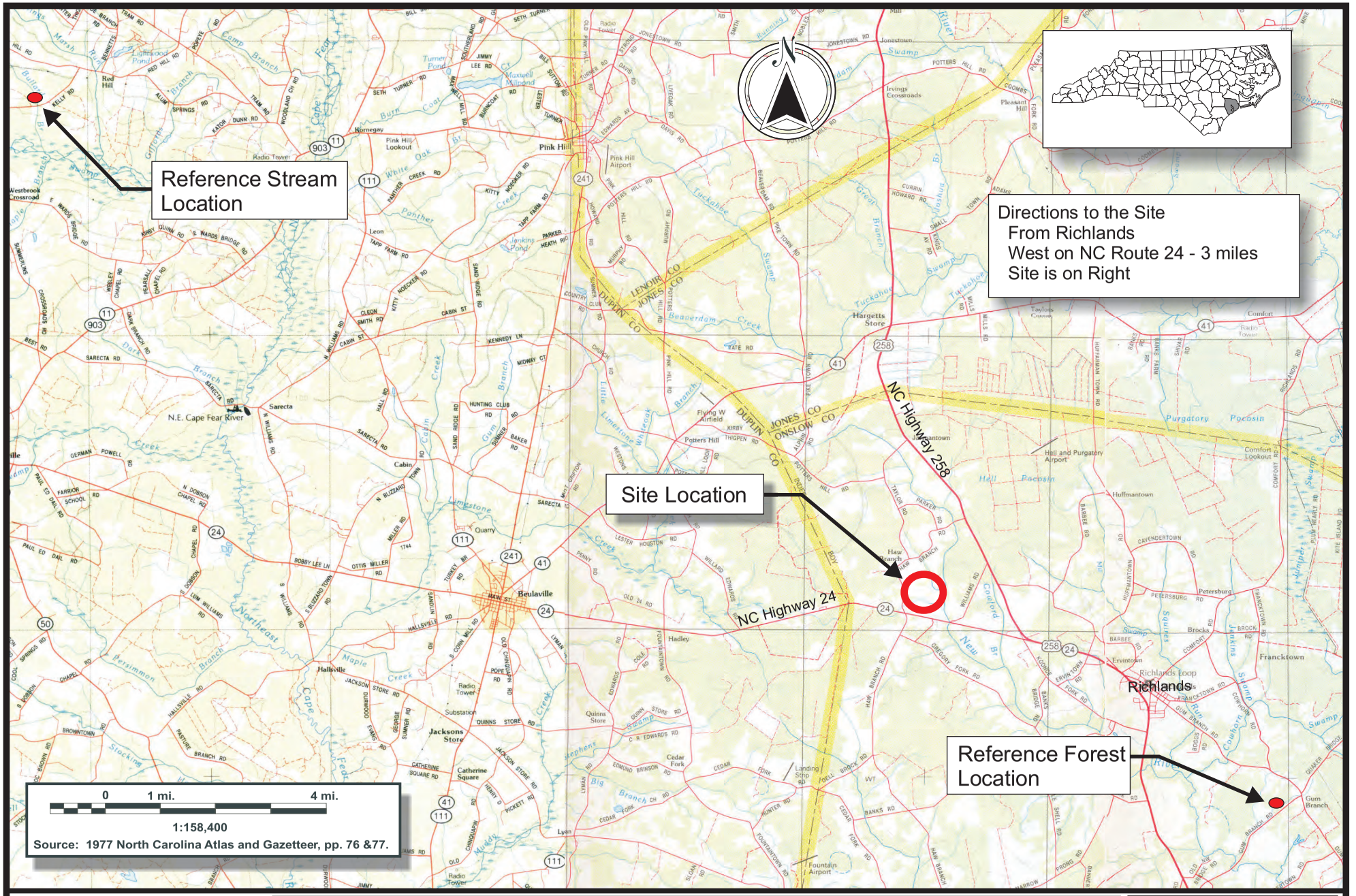
1.3 Project Structure, Restoration Type, and Approach

A conservation easement has been placed on the Site to incorporate all restoration activities. The Site contains 17.1 acres of hydric soils, three UTs to the New River (main tributary, southern tributary [west] and southern tributary [east]), associated floodplains, and upland slopes. The purpose of this project was to restore stable pattern, dimension, and profile to the UTs; restore hydrology to drained riverine wetlands; and revegetate streams, floodplains, and wetlands within the Site. The Site drainage area encompasses approximately 0.59 square mile of land at the downstream Site outfall that is characterized by forest, agricultural land, and sparse industrial/residential development.

Prior to construction, the entire Site was utilized for row crop production. In order to maximize useable field acreage streams were channelized and riparian vegetation was removed. Site streams were subject to contamination from the broadcast application of agricultural chemicals. Site agricultural practices contributed to degraded water quality, unstable channel characteristics (stream entrenchment, erosion, and bank collapse), and decreased wetland function.

The primary goals of this stream and wetland restoration project focus on improving water quality, enhancing flood attenuation, and restoring aquatic and riparian habitat and will be accomplished by:

- Removing nonpoint and point sources of pollution associated with agriculture including a) cessation of broadcasting fertilizer, pesticides, and other agricultural chemicals into and adjacent to Site streams and b) restoration of a forested riparian buffer adjacent to streams to treat surface runoff.



Axiom Environmental
2126 Rowland Pond Dr
Willow Spring, NC 27592
(919) 215-1693
(919) 341-3839 fax

SITE LOCATION
JARMANS OAK RESTORATION SITE
Onslow County, North Carolina

Dwn. by:	WGL
Ckd by:	WGL
Date:	Nov 2006
Project:	06-018

FIGURE
1

- Reducing sedimentation within onsite and downstream receiving waters by a) reducing bank erosion associated with vegetation maintenance and agricultural plowing to Site streams and b) planting a forested riparian buffer adjacent to Site streams.
- 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.
- Promoting floodwater attenuation by a) reconnecting bankfull stream flows to the abandoned floodplain terrace; b) restoring secondary, dredged, straightened, and entrenched tributaries, thereby reducing floodwater velocities within smaller catchment basins; c) increasing storage capacity for floodwaters within the Site; and d) revegetating Site floodplains to increase frictional resistance on floodwaters.
- Restoring onsite wetlands, thereby promoting flood storage, nutrient cycling, and aquatic wildlife habitat.
- Improving aquatic habitat with bed variability and the use of in-stream structures.
- Providing a terrestrial wildlife corridor and refuge in an area developed for agricultural production.

Primary activities at the Site included 1) stream restoration, 2) wetland restoration, 3) soil scarification, and 4) plant community restoration.

Table 1 describes the Site restoration structures and objectives, which have provided the minimum of 6640 Stream Mitigation Units and 12 riverine Wetland Mitigation Units.

- Restore 6418 linear feet of stream within three UTs to the New River by constructing meandering, E-type and braided, D-type channels.
- Enhance (level II) 1205 linear feet of stream within three UTs to the New River
- Restore 11 acres of jurisdictional riverine wetland by reestablishing historic water table elevations.
- Enhance an additional 6.1 acres of jurisdictional riverine wetland.
- Reforest the entire floodplain with native forest species.

Table 1. Site Restoration Structures and Objectives

Restoration Segment/ Reach ID	Station Range	Restoration Type/Approach*	Designed Linear Footage/Acreage	SMU/WMUs
Main Tributary	10+00 – 57+09	Restoration/PI	4709	4709
Southern UT (east)	--	Restoration/PI	1013	1013
Southern UT (west)	10+00 – 17+96	Restoration/PI	696	696
--	--	Enhancement II	1205	482
Riverine Wetlands	--	Restoration	11.0	11.0
Riverine Wetlands	--	Enhancement	6.1	3.05
Mitigation Unit Summations				
Stream	**Riverine Wetland**			
6900 SMU's	14.05 WMU's			

*PI=Priority 1

1.4 Project History and Background

Completed project activities, reporting history, completion dates, project contacts, and background information are summarized in Tables 2-4.

Table 2. Project Activity and Reporting History

Activity or Report	Data Collection Completion	Actual Completion or Delivery
Restoration Plan	December 2006	December 2006
Construction Completion	NA	September 2007
Site Planting	NA	January 2008
Mitigation Plan/As-builts	November 2007	February 2008
Year 1 Monitoring (2008)	November 2008	November 2008

Table 3. Project Contacts Table

Full Delivery Provider	Restoration Systems 1101 Haynes Street, Suite 211 Raleigh, North Carolina 27604 George Howard and John Preyer (919) 755-9490
Construction Contractor	Backwater Environmental PO Box 1654 Pittsboro, North Carolina 27312 Wes Newell (919) 523-4375
Planting Contractor	Carolina Silvics 908 Indian Trail Road Edenton, North Carolina 27932 Dwight McKinney (919) 523-4375
Designer and Monitoring Performer	Axiom Environmental, Inc. 2126 Rowland Pond Dr. Willow Spring, NC 27592 Grant Lewis (919) 215-1693

Table 4. Project Background Table

Project County	Onslow County, North Carolina
Drainage Area	0.59 square mile
Drainage impervious cover estimate (%)	< 1
Stream Order	First and Second
Physiographic Region	Coastal Plain
Ecoregion	Carolina Flatwoods
Rosgen Classification of As-built	E-/C-type
Dominant Soil Types	Muckalee, Autryville
Reference Site ID	Bullard Branch
USGS HUC	03030001
NCDWQ Subbasin	03-05-02
NCDWQ Classification	C NSW (Stream Index # 19-(1))
Any portion of any project segment 303d listed?	No
Any portion of project upstream of a 303d listed segment?	No
Reasons for 303d listing or stressor	Not Applicable
% of project easement fenced	0%

1.5 Monitoring Plan View

Monitoring activities for the Site, including relevant structures and utilities, project features, specific project structures, and monitoring features are detailed in the monitoring plan view in Appendix D. Site features including vegetation, stream dimension (cross-sections), stream profile and pattern, wetland hydrology, and photographic documentation were monitored in Year 1 (2008).

2.0 PROJECT CONDITION AND MONITORING RESULTS

2.1 Vegetation Assessment

Following Site construction, fourteen plots (13-10 meters by 10 meters and 1-20 meters by 5 meters in size) were established and monumented with metal fence posts at all plot corners and PVC at each plot origin. Sampling was conducted as outlined in the *CVS-EEP Protocol for Recording Vegetation, Version 4.0* (Lee et al. 2006) (http://cvs.bio.unc.edu/methods.htm); results are included in Appendix A. The taxonomic standard for vegetation used for this document was *Flora of the Carolinas, Virginia, Georgia, and Surrounding Areas* (Weakley 2007). The locations of vegetation monitoring plots were placed to accurately represent the entire Site and are depicted on the monitoring plan view in Appendix D.

2.1.1 Vegetation Success Criteria

Success criteria have been established to verify that vegetation components support community elements necessary for forest development. Success criteria are dependent upon the density and growth of characteristic forest species. Additional success criteria are dependent upon density and growth of "Character Tree Species." Character Tree Species include planted species, species identified through visual inventory of an approved reference (relatively undisturbed) forest community used to orient the Site design, and appropriate community descriptions from *Classification of the Natural Communities of North Carolina* (Schafale and Weakley 1990) including Coastal Plain Small Stream Swamp and Nonriverine Wet Hardwood Forest. All canopy tree species planted and identified in the reference forest will be utilized to define "Character Tree Species" as termed in the success criteria. Table 5 below outlines planted and reference forest species.

Table 5. Planted Species and Reference Forest Ecosystem

Planted Species	Reference Species
River birch (*Betula nigra*)	Red maple (*Acer rubrum*)
Sugarberry (*Celtis laevigata*)	Ironwood (*Carpinus carolinia*)
Buttonbush (*Cephalanthus occidentalis*)	Pignut hickory (*Carya glabra*)
Green ash (*Fraxinus pennsylvanica*)	Dogwood (*Cornus* sp.)
Swamp black gum (*Nyssa biflora*)	Ash (*Fraxinus* sp.)
Sycamore (*Platanus occidentalis*)	American holly (*Ilex opaca*)
Cherrybark oak (*Quercus pagodaefolia*)	Sweetgum (*Liquidambar styraciflua*)
Water oak (*Quercus nigra*)	Yellow poplar (*Liriodendron tulipifera*)
Willow oak (*Quercus phellos*)	White oak (*Quercus alba*)
Elderberry (*Sambucus canadensis*)	Water oak (*Quercus nigra*)
	Laurel oak (*Quercus laurifolia*)
	Swamp chestnut oak (*Quercus michauxii*)
	Cherrybark oak (*Quercus pagoda*)

Success criteria dictate that an average density of 320 stems per acre of Character Tree Species must be surviving in the first three monitoring years. Subsequently, 290 Character Tree Species per acre must be surviving in year 4 and 260 Character Tree Species per acre in year 5.

2.1.2 Vegetative Problem Areas

Vegetation sampling across the Site was above the required average density with an overall average of 471 planted stems per acre. Two of the fourteen plots had low densities (plots 1 and 9) with 283 and 202 planted stems per acre, respectively; however, this is not considered to be a problem at this time. These areas should be watched over the monitoring period; the establishment of natural recruits is expected over the next few years. No vegetation problem areas were noted during the Year 1 (2008) monitoring season.

2.2 Stream Assessment

Twenty permanent cross-sections within five 600-foot reaches were established after construction was completed. Measurements of each cross-section include points at all breaks in slope including top of bank, bankfull, and thalweg. Riffle cross-sections are classified using the Rosgen stream classification system. Longitudinal profile measurements of five 600-foot reaches include thalweg, water surface, and bankfull; with each measurement taken at the head of facets (i.e. riffle, run, pool, and glide) in addition to the maximum pool depth.

2.2.1 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 an annual basis in order to track changes in channel geometry and profile. These data will be utilized to determine the success in restoring stream channel stability. Specifically, the width-to-depth ratio should characterize an E-type or borderline E-/C-type channel, bank-height ratios indicative of a stable or moderately unstable channel, and 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. The field indicator of bankfull will be described in each monitoring year and indicated on a representative channel cross-section figure. If the stream channel is down-cutting or the channel width is enlarging due to bank erosion, additional bank or slope stabilization methods will be employed.

Stream substrate is not expected to coarsen over time; therefore, pebble counts are not proposed as part of the stream success criteria.

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.

2.2.2 Bankfull Events

No bankfull events were documented during the Year 1 (2008) monitoring period.

Table 6. Verification of Bankfull Events

Date of Data Collection	Date of Occurrence	Method	Photo (if available)
No bankfull events were documented during the Year 1 (2008) monitoring period.			

2.2.3 Stream Problem Areas

Two potential stream problem areas were documented within the Site during the Year 1 (2008) monitoring period. Each is an area of reduced bed and bank integrity, located on the Main Tributary near Station 32+50 and on the Southern Tributary (West) near Station 16+50, that should be watched throughout the monitoring period. No additional stream problem areas were noted within the Site during the Year 1 (2008) monitoring year.

2.2.4 Categorical Stream Feature Visual Stability Assessment

Each stream reach was visually inspected during the Year 1 (2008) monitoring period using eight feature categories and various metrics within each category. Assessment features included riffles, pools, thalweg, meanders, channel bed, structures, and root wads/boulders. Tables for semi-quantitative assessements of each reach are included in Appendix B (Tables B1-B5). The mean percentage of performance for features within each reach are summarized in the tables below.

Table 7A. Categorical Stream Feature Visual Stability Assessment

Jarmans Oaks (Reach 1)

Feature	Year 1 (2008)	Year 2 (2009)	Year 3 (2010)	Year 4 (2011)	Year 5 (2012)
A. Riffles	100%				
B. Pools	100%				
C. Thalweg	100%				
D. Meanders	100%				
E. Bed General	100%				
F. Banks	100%				
G. Vanes / J. Hooks, Etc.	NA				
H. Wads and Boulders	NA				

Table 7B. Categorical Stream Feature Visual Stability Assessment

Jarmans Oaks (Reach 2)

Feature	Year 1 (2008)	Year 2 (2009)	Year 3 (2010)	Year 4 (2011)	Year 5 (2012)
A. Riffles	100%				
B. Pools	100%				
C. Thalweg	100%				
D. Meanders	100%				
E. Bed General	99%				
F. Banks	99%				
G. Vanes / J. Hooks, Etc.	NA				
H. Wads and Boulders	NA				

Table 7C. Categorical Stream Feature Visual Stability Assessment

Jarmans Oaks (Reach 3)

Feature	Year 1 (2008)	Year 2 (2009)	Year 3 (2010)	Year 4 (2011)	Year 5 (2012)
A. Riffles	100%				
B. Pools	100%				
C. Thalweg	100%				
D. Meanders	100%				
E. Bed General	99%				
F. Banks	99%				
G. Vanes / J. Hooks, Etc.	NA				
H. Wads and Boulders	NA				

Table 7D. Categorical Stream Feature Visual Stability Assessment

Jarmans Oaks (Reach 4)

Feature	Year 1 (2008)	Year 2 (2009)	Year 3 (2010)	Year 4 (2011)	Year 5 (2012)
A. Riffles	96%				
B. Pools	100%				
C. Thalweg	100%				
D. Meanders	100%				
E. Bed General	100%				
F. Banks	100%				
G. Vanes / J. Hooks, Etc.	NA				
H. Wads and Boulders	NA				

Table 7E. Categorical Stream Feature Visual Stability Assessment

Jarmans Oaks (Reach 5)

Feature	Year 1 (2008)	Year 2 (2009)	Year 3 (2010)	Year 4 (2011)	Year 5 (2012)
A. Riffles	100%				
B. Pools	100%				
C. Thalweg	100%				
D. Meanders	100%				
E. Bed General	100%				
F. Banks	100%				
G. Vanes / J. Hooks, Etc.	NA				
H. Wads and Boulders	NA				

2.2.5 Quantitative Stream Measurements

During the Year 1 (2008) monitoring period 20 cross-sections and longitudinal profiles within five 600-foot reaches were measured. Permanent cross-sections and longitudinal profiles are included in Appendix B;

each is graphically depicted for as-built through Year 1 (2008) for analysis. As a whole, monitoring measurements indicate minimal changes in both the longitudinal profile and cross-sections as compared to as-built data. The channel geometry compares favorably with the emulated, stable E/C type stream reach as set forth in the detailed mitigation plan and as constructed. Current monitoring has demonstrated dimension, pattern, and profile were stable over the course of the monitoring period. Tables for quantitative assessements are included below; these tables include data from previous years.

2.3 Wetland Assessment

Four groundwater monitoring gauges and one reference groundwater gauge were maintained and monitored throughout the Year 1 (2008) growing season. Graphs of groundwater hydrology and precipitation from a nearby rain station in Kenansville (Weather Underground 2008) are included in Appendix C.

2.3.1 Wetland Success Criteria

Target hydrological characteristics include saturation or inundation for at least 8 percent of the growing season, within Muckalee soils (riverine wetlands), during average climatic conditions. The growing season extends from April 8 to November 5 (212 days). The target hydrological value is based on DRAINMOD simulations for 42 years of rainfall data in an old field stage. In addition, these areas are expected to support hydrophytic vegetation; if wetland parameters are marginal, a jurisdictional determination will be performed for vegetation and soils in these areas (Environmental Laboratory 1987).

2.3.2 Wetland Problem Areas

No wetland problem areas were identified within the Site during Year 1 (2008) monitoring.

2.3.3 Wetland Criteria Attainment

All monitored gauges within restoration areas were inundated/saturated within 12 inches of the surface for greater than 8 percent (ranging from 28 to 38 percent) of the growing season (Table 10). Hydrographs containing groundwater and precipitation data for each gauge can be found in Appendix C.

Table 8. Baseline Morphology and Hydraulic Summary
Jarmans Oak

Parameter	USGS Gage Data			Pre-Existing Condition			Project Reference Stream			Design			As-built		
Dimension	**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					5.6			9.3	6	8	7	5	9.1	7.5
Floodprone Width (ft)						8			225	150	250	225			150
BF Cross Sectional Area (ft2)						5			11.6	3.8	6.5		3	5.9	4.9
BF Mean Depth (ft)						0.9			1.2	0.6	0.8	0.7	0.5	0.8	0.6
BF Max Depth (ft)						1.3			2.3	1	1.3	1.1	0.9	1.2	1.1
Width/Depth Ratio						7			7.4			14	8	16	12
Entrenchment Ratio						1.4			24	11	31	28			===
Bank Height Ratio						4			1			1			1
Wetted Perimeter(ft)						===			===			===			===
Hydraulic radius (ft)						===			===			===			===
Pattern															
Channel Beltwidth (ft)				No pattern of riffles and pools due to straightening activties					34	15	77	31	15	77	31
Radius of Curvature (ft)									16	15	44	21	15	44	21
Meander Wavelength (ft)									71	46	154	75	46	154	75
Meander Width ratio									3.7	2	7	4	2	7	4
Profile															
Riffle length (ft)				No pattern of riffles and pools due to straightening activties					===			===			===
Riffle slope (ft/ft)									1.29%	0.17%	0.97%	0.57%	0.17%	0.97%	0.57%
Pool length (ft)									===			===			===
Pool spacing (ft)									43	31	77	47	31	77	47
Substrate															
d50 (mm)						===			===			===			===
d84 (mm)						===			===			===			===
Additional Reach Parameters															
Valley Length (ft)						===			===			===			===
Channel Length (ft)						===			===			===			===
Sinuosity						1.1			1.37			1.35			1.3
Water Surface Slope (ft/ft)						0.49%			0.40%			0.44%			0.27%
BF slope (ft/ft)						===			===			===			===
Rosgen Classification						G6			E6			C/E6			C/E6

Table 9A. Morphology and Hydraulic Monitoring Summary
Jarmans Oak
Reach 1

Parameter	Cross Section 1						Cross Section 2						Cross Section 3						Cross Section 4					
	Riffle						Pool						Pool						Riffle					
Dimension	MY1	MY2	MY3	MY4	MY5	MY+	MY1	MY2	MY3	MY4	MY5	MY+	MY1	MY2	MY3	MY4	MY5	MY+	MY1	MY2	MY3	MY4	MY5	MY+
BF Width (ft)	9.0						12.8						12.1						7.5					
Floodprone Width (ft) (approx)	150.0						150.0						100.0						100.0					
BF Cross Sectional Area (ft^2)	6.4						11.4						10.0						5.6					
BF Mean Depth (ft)	0.7						0.9						0.8						0.7					
BF Max Depth (ft)	1.1						1.8						1.7						1.1					
Width/Depth Ratio	12.7						NA						NA						10.2					
Entrenchment Ratio	16.7						NA						NA						13.3					
Bank Height Ratio	1.0						NA						NA						1.0					
Wetted Perimeter(ft)	9.4						13.5						12.9						8.0					
Hydraulic radius (ft)	0.7						0.8						0.8						0.7					
Substrate	MY1	MY2	MY3	MY4	MY5	MY+	MY1	MY2	MY3	MY4	MY5	MY+	MY1	MY2	MY3	MY4	MY5	MY+	MY1	MY2	MY3	MY4	MY5	MY+
d50 (mm)																								
d84 (mm)																								

Parameter	MY-01 (2008)			MY-02 (2009)			MY-03 (2010)			MY-04 (2011)			MY-05 (2012)			MY+		
Pattern	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med
Channel Beltwidth (ft)	32	15	77															
Radius of Curvature (ft)	18	13	44															
Meander Wavelength (ft)	73	46	154															
Meander Width ratio	3.8	2.0	7.0															
Profile	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med
Riffle length (ft)	18	14	24															
Riffle slope (ft/ft)	NA*	NA*	NA*															
Pool length (ft)	30	25	45															
Pool spacing (ft)	45	32	77															

Additional Reach Parameters	MY-01 (2008)	MY-02 (2009)	MY-03 (2010)	MY-04 (2011)	MY-05 (2012)	MY+
Valley Length (ft)	569					
Channel Length (ft)	740					
Sinuosity	1.3					
Water Surface Slope (ft/ft)	NA*					
BF slope (ft/ft)	– – –					
Rosgen Classification	C/E type					

Table 9B. Morphology and Hydraulic Monitoring Summary
Jarmans Oak
Reach 2

Parameter	Cross Section 1 (Pool)						Cross Section 2 (Riffle)						Cross Section 3 (Pool)						Cross Section 4 (Riffle)					
Dimension	MY1	MY2	MY3	MY4	MY5	MY+	MY1	MY2	MY3	MY4	MY5	MY+	MY1	MY2	MY3	MY4	MY5	MY+	MY1	MY2	MY3	MY4	MY5	MY+
BF Width (ft)	13.6						6.6						8.8						8.3					
Floodprone Width (ft) (approx)	150.0						150.0						150.0						150.0					
BF Cross Sectional Area (ft^2)	11.3						4.6						8.3						3.7					
BF Mean Depth (ft)	0.8						0.7						1.0						0.5					
BF Max Depth (ft)	1.9						1.1						1.8						1.0					
Width/Depth Ratio	NA						9.3						NA						18.3					
Entrenchment Ratio	NA						22.8						NA						18.1					
Bank Height Ratio	NA						1.0						NA						1.0					
Wetted Perimeter(ft)	14.4						7.1						9.7						8.8					
Hydraulic radius (ft)	0.8						0.7						0.9						0.4					
Substrate	MY1	MY2	MY3	MY4	MY5	MY+	MY1	MY2	MY3	MY4	MY5	MY+	MY1	MY2	MY3	MY4	MY5	MY+	MY1	MY2	MY3	MY4	MY5	MY+
d50 (mm)																								
d84 (mm)																								

Parameter	MY-01 (2008)			MY-02 (2009)			MY-03 (2010)			MY-04 (2011)			MY-05 (2012)			MY+		
Pattern	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med
Channel Beltwidth (ft)	32	15	77															
Radius of Curvature (ft)	18	13	44															
Meander Wavelength (ft)	73	46	154															
Meander Width ratio	3.8	2.0	7.0															
Profile	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med
Riffle length (ft)	29	24	34															
Riffle slope (ft/ft)	NA*	NA*	NA*															
Pool length (ft)	33	24	59															
Pool spacing (ft)	45	32	77															

Additional Reach Parameters	MY-01 (2008)	MY-02 (2009)	MY-03 (2010)	MY-04 (2011)	MY-05 (2012)	MY+
Valley Length (ft)	507					
Channel Length (ft)	659					
Sinuosity	1.3					
Water Surface Slope (ft/ft)	NA*					
BF slope (ft/ft)	– – –					
Rosgen Classification	C/E type					

Table 9C. Morphology and Hydraulic Monitoring Summary
Jarmans Oak
Reach 3

Parameter	Cross Section 1						Cross Section 2						Cross Section 3						Cross Section 4					
	Pool						Riffle						Riffle						Pool					
Dimension	MY1	MY2	MY3	MY4	MY5	MY+	MY1	MY2	MY3	MY4	MY5	MY+	MY1	MY2	MY3	MY4	MY5	MY+	MY1	MY2	MY3	MY4	MY5	MY+
BF Width (ft)	6.2						6.1						5.2						5.6					
Floodprone Width (ft) (approx)	150.0						150.0						150.0						150.0					
BF Cross Sectional Area (ft^2)	3.3						2.7						2.2						2.5					
BF Mean Depth (ft)	0.5						0.4						0.4						0.4					
BF Max Depth (ft)	1.0						0.9						0.8						0.7					
Width/Depth Ratio	NA						13.8						12.3						NA					
Entrenchment Ratio	NA						24.7						28.7						NA					
Bank Height Ratio	NA						1.0						1.0						NA					
Wetted Perimeter(ft)	6.7						6.5						5.5						5.9					
Hydraulic radius (ft)	0.5						0.4						0.4						0.4					
Substrate	MY1	MY2	MY3	MY4	MY5	MY+	MY1	MY2	MY3	MY4	MY5	MY+	MY1	MY2	MY3	MY4	MY5	MY+	MY1	MY2	MY3	MY4	MY5	MY+
d50 (mm)																								
d84 (mm)																								

Parameter	MY-01 (2008)			MY-02 (2009)			MY-03 (2010)			MY-04 (2011)			MY-05 (2012)			MY+		
Pattern	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med
Channel Beltwidth (ft)	32	15	77															
Radius of Curvature (ft)	18	13	44															
Meander Wavelength (ft)	73	46	154															
Meander Width ratio	3.8	2.0	7.0															
Profile	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med
Riffle length (ft)	19	15	27															
Riffle slope (ft/ft)	NA*	NA*	NA*															
Pool length (ft)	21	13	26															
Pool spacing (ft)	45	32	77															

Additional Reach Parameters	MY-01 (2008)	MY-02 (2009)	MY-03 (2010)	MY-04 (2011)	MY-05 (2012)	MY+
Valley Length (ft)	555					
Channel Length (ft)	721					
Sinuosity	1.3					
Water Surface Slope (ft/ft)	NA*					
BF slope (ft/ft)	– – –					
Rosgen Classification	C/E type					

Table 9D. Morphology and Hydraulic Monitoring Summary
Jarmans Oak
Reach 4

Parameter	Cross Section 1						Cross Section 2						Cross Section 3						Cross Section 4					
	Riffle						Pool						Pool						Riffle					
Dimension	MY1	MY2	MY3	MY4	MY5	MY+	MY1	MY2	MY3	MY4	MY5	MY+	MY1	MY2	MY3	MY4	MY5	MY+	MY1	MY2	MY3	MY4	MY5	MY+
BF Width (ft)	6.5						10.3						9.5						5.6					
Floodprone Width (ft) (approx)	150.0						150.0						150.0						150.0					
BF Cross Sectional Area (ft^2)	5.0						4.8						5.3						3.1					
BF Mean Depth (ft)	0.8						0.5						0.6						0.6					
BF Max Depth (ft)	1.2						0.9						1.3						0.9					
Width/Depth Ratio	8.6						NA						NA						10.0					
Entrenchment Ratio	22.9						NA						NA						26.9					
Bank Height Ratio	1.0						NA						NA						1.0					
Wetted Perimeter(ft)	7.2						10.5						10.0						6.0					
Hydraulic radius (ft)	0.7						0.5						0.5						0.5					
Substrate	MY1	MY2	MY3	MY4	MY5	MY+	MY1	MY2	MY3	MY4	MY5	MY+	MY1	MY2	MY3	MY4	MY5	MY+	MY1	MY2	MY3	MY4	MY5	MY+
d50 (mm)																								
d84 (mm)																								

Parameter	MY-01 (2008)			MY-02 (2009)			MY-03 (2010)			MY-04 (2011)			MY-05 (2012)			MY+		
Pattern	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med
Channel Beltwidth (ft)	32	15	77															
Radius of Curvature (ft)	18	13	44															
Meander Wavelength (ft)	73	46	154															
Meander Width ratio	3.8	2.0	7.0															
Profile	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med
Riffle length (ft)	21	5	61															
Riffle slope (ft/ft)	0.9%	0.0%	4.2%															
Pool length (ft)	21	7	44															
Pool spacing (ft)	45	32	77															
Additional Reach Parameters	MY-01 (2008)			MY-02 (2009)			MY-03 (2010)			MY-04 (2011)			MY-05 (2012)			MY+		
Valley Length (ft)	505																	
Channel Length (ft)	657																	
Sinuosity	1.3																	
Water Surface Slope (ft/ft)	0.56%																	
BF slope (ft/ft)	– – –																	
Rosgen Classification	C/E type																	

Table 9E. Morphology and Hydraulic Monitoring Summary
Jarmans Oak
Reach 5

Parameter	Cross Section 1						Cross Section 2						Cross Section 3						Cross Section 4					
	Pool						Riffle						Pool						Riffle					
Dimension	MY1	MY2	MY3	MY4	MY5	MY+	MY1	MY2	MY3	MY4	MY5	MY+	MY1	MY2	MY3	MY4	MY5	MY+	MY1	MY2	MY3	MY4	MY5	MY+
BF Width (ft)	7.5						8.9						11.8						5.8					
Floodprone Width (ft) (approx)	150.0						150.0						150.0						150.0					
BF Cross Sectional Area (ft^2)	5.9						7.4						10.6						3.6					
BF Mean Depth (ft)	0.8						0.8						0.9						0.6					
BF Max Depth (ft)	1.3						1.8						1.8						0.9					
Width/Depth Ratio	NA						10.7						NA						9.2					
Entrenchment Ratio	NA						16.9						NA						26.1					
Bank Height Ratio	NA						1.0						NA						1.0					
Wetted Perimeter(ft)	8.0						9.7						12.4						6.2					
Hydraulic radius (ft)	0.7						0.8						0.9						0.6					
Substrate	MY1	MY2	MY3	MY4	MY5	MY+	MY1	MY2	MY3	MY4	MY5	MY+	MY1	MY2	MY3	MY4	MY5	MY+	MY1	MY2	MY3	MY4	MY5	MY+
d50 (mm)																								
d84 (mm)																								

Parameter	MY-01 (2008)			MY-02 (2009)			MY-03 (2010)			MY-04 (2011)			MY-05 (2012)			MY+		
Pattern	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med
Channel Beltwidth (ft)	32	15	77															
Radius of Curvature (ft)	18	13	44															
Meander Wavelength (ft)	73	46	154															
Meander Width ratio	3.8	2.0	7.0															
Profile	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med
Riffle length (ft)	32	4	109															
Riffle slope (ft/ft)	0.1%	0.0%	0.3%															
Pool length (ft)	25	11	52															
Pool spacing (ft)	45	32	77															

Additional Reach Parameters	MY-01 (2008)	MY-02 (2009)	MY-03 (2010)	MY-04 (2011)	MY-05 (2012)	MY+
Valley Length (ft)	442					
Channel Length (ft)	574					
Sinuosity	1.3					
Water Surface Slope (ft/ft)	0.06%					
BF slope (ft/ft)	– – –					
Rosgen Classification	C/E type					

Table 10. Wetland Criteria Attainment for Year 1 (2008)

Gauge ID	Hydrology Threshold Met?	Hydrophytic Vegetation Criteria Met?	Site Mean	Vegetation Plot ID	Vegetation Survival Threshold Met?	Site Mean
1	Yes	Yes	100 %	1	No	86 %
2	Yes	Yes		2	Yes	
3	Yes	Yes		3	Yes	
4	Yes	Yes		4	Yes	
				5	Yes	
				6	Yes	
				7	Yes	
				8	Yes	
				9	No	
				10	Yes	
				11	Yes	
				12	Yes	
				13	Yes	
				14	Yes	

3.0 CONCLUSIONS

The Site achieved the defined (or targeted) success criteria, with saturation (free water) within one foot of the soil surface for a minimum of 8 percent (ranging from 28 to 38 percent) of the growing season, for all Site groundwater gauges in the First Monitoring Year (Year 2008). A summary of groundwater gauge data for the Year 1 (2008) is included in Table 11. Also, most vegetation plots across the Site were above the required 320 stems per acre with an average of 471 tree stems per acre in the First Monitoring Year (Year 2008) (Table 12).

Table 11. Summary of Groundwater Gauge Results

Gauge	Success Criteria Achieved/Max Consecutive Days During Growing Season (Percentage)				
	Year 1 (2008)*	Year 2 (2009)	Year 3 (2010)	Year 4 (2011)	Year 5 (2012)
1	Yes/81 days (38 percent)				
2	Yes/67 days (32 percent)				
3	Yes/63 days (30 percent)				
4	Yes/65 days (31 percent)				
Ref 1	Yes/60 days (28 percent)				

Table 12. Summary of Planted Vegetation Plot Results

Plot	Planted Stems/Acre Counting Towards Success Criteria				
	Year 1 (2008)	Year 2 (2009)	Year 3 (2010)	Year 4 (2011)	Year 5 (2012)
1	283				
2	526				
3	324				
4	405				
5	647				
6	405				
7	324				
8	324				
9	202				
10	809				
11	890				
12	324				
13	445				
14	688				
Average of All Plots (1-17)	**471**				

4.0 REFERENCES

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APPENDIX A
VEGETATION DATA

1. **Vegetation Survey Data Tables**
2. **Vegetation Monitoring Plot Photos**

Report Prepared By	Corri Faquin
Date Prepared	10/22/2008 9:59
database name	RestorationSystems-2008-Al-v2.2.5.mdb
database location	C:\Business\CVS database
computer name	AXIOM-0A9116A70

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.
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	Jarmons
project Name	Jarmons Oaks Restoration Site
Description	Stream and Wetland Restoration Site in Onslow County
River Basin	
length(ft)	
stream-to-edge width (ft)	
area (sq m)	
Required Plots (calculated)	
Sampled Plots	

Living planted stems, excluding live stakes, per acre: Negative (red) numbers indicate the project failed to reach requirements in a particular year.

Project Code	Project Name	River Basin	Year 1
Jarmons	Jarmons Oaks Restoration Site		471

Total stems, including planted stems of all kinds (including live stakes) and natural/volunteer stems:

Project Code	Project Name	River Basin	Year 1
Jarmons	Jarmons Oaks Restoration Site		471

plot	Plot Level	Year	Latitude/Northing	Longitude/Easting	Zone	Datum	Date Sampled	Planted Living Stems	Dead/ Missing Stems	Planted Living Stems per ACRE	# species
Jarmons-AXE-0001	2	1	429957.0794	2413835.1602	17N	NAD83/WGS84	9/18/2008	7	0	283	3
Jarmons-AXE-0002	2	1	430123.9211	2413822.5320	17N	NAD83/WGS84	9/18/2008	13	0	526	5
Jarmons-AXE-0003	2	1	430300.3929	2413722.0653	17N	NAD83/WGS84	9/18/2008	8	0	324	4
Jarmons-AXE-0004	2	1	430063.8761	2413654.7930	17N	NAD83/WGS84	9/23/2008	10	0	405	4
Jarmons-AXE-0005	2	1	430192.6763	2413603.3470	17N	NAD83/WGS84	9/23/2008	16	0	647	5
Jarmons-AXE-0006	2	1	430194.5689	2413048.6970	17N	NAD83/WGS84	9/23/2008	10	0	405	4
Jarmons-AXE-0007	2	1	430146.6218	2412737.6983	17N	NAD83/WGS84	9/23/2008	8	0	324	2
Jarmons-AXE-0008	2	1	430319.8816	2412210.3114	17N	NAD83/WGS84	9/22/2008	8	0	324	4
Jarmons-AXE-0009	2	1	429978.3189	2411929.6730	17N	NAD83/WGS84	9/22/2008	5	0	202	2
Jarmons-AXE-0010	2	1	430284.2654	2412049.8633	17N	NAD83/WGS84	9/22/2008	20	0	809	6
Jarmons-AXE-0011	2	1	430627.3287	2411729.0074	17N	NAD83/WGS84	9/22/2008	22	0	890	5
Jarmons-AXE-0012	2	1	430431.7267	2411159.6299	17N	NAD83/WGS84	9/22/2008	8	0	324	3
Jarmons-AXE-0013	2	1	430328.6356	2410943.9349	17N	NAD83/WGS84	9/22/2008	11	0	445	4
Jarmons-AXE-0014	2	1	430054.2795	2410657.9532	17N	NAD83/WGS84	9/22/2008	17	0	688	3

Vigor

vigor	Count	Percent
2	43	26.4
3	86	52.8
4	34	20.9

Damage

Damage	Count	Percent Of Stems
(no damage)	108	66.3
(other damage)	24	14.7
Deer	17	10.4
Insects	11	6.7
Unknown	2	1.2
Human Trampled	1	0.6

Vigor by Species

	Species	4	3	2	1	0	Missing	Unknown
	Betula nigra	9	17	3				
	Celtis laevigata		3	2				
	Cephalanthus occidentalis		2	1				
	Fraxinus pennsylvanica	10	19	3				
	Nyssa biflora		13	20				
	Quercus nigra	2		1				
	Quercus pagoda	3	15	5				
	Quercus phellos	1	6	2				
	Quercus			3				
	Platanus occidentalis	9	11	3				
TOT:	**10**	**34**	**86**	**43**				

Damage by Species

	Species	All Damage Categories	(no damage)	Deer	Human Trampled	Insects	Unknown	(other damage)
	Betula nigra	29	24	1	1	2		1
	Celtis laevigata	5	4				1	
	Cephalanthus occidentalis	3		1		2		
	Fraxinus pennsylvanica	32	29	1		1		1
	Nyssa biflora	33	10	10				13
	Platanus occidentalis	23	21			1		1
	Quercus	3				1		2
	Quercus nigra	3	2				1	
	Quercus pagoda	23	13	4		2		4
	Quercus phellos	9	5			2		2
TOT:	**10**	**163**	**108**	**17**	**1**	**11**	**2**	**24**

Damage by Plot

	plot	All Damage Categories	(no damage)	Deer	Human Trampled	Insects	Unknown	(other damage)
	Jarmons-AXE-0001-year:1	7	3			1		3
	Jarmons-AXE-0002-year:1	13	7	3		2		1
	Jarmons-AXE-0003-year:1	8	2	3		2	1	
	Jarmons-AXE-0004-year:1	10	4			1		5
	Jarmons-AXE-0005-year:1	16	13			1		2
	Jarmons-AXE-0006-year:1	10	8					2
	Jarmons-AXE-0007-year:1	8	5			2		1
	Jarmons-AXE-0008-year:1	8	5			2		1
	Jarmons-AXE-0009-year:1	5	4					1
	Jarmons-AXE-0010-year:1	20	15	2			1	2
	Jarmons-AXE-0011-year:1	22	17	3				2
	Jarmons-AXE-0012-year:1	8	6	2				
	Jarmons-AXE-0013-year:1	11	3	4	1			3
	Jarmons-AXE-0014-year:1	17	16					1
TOT:	**14**	**163**	**108**	**17**	**1**	**11**	**2**	**24**

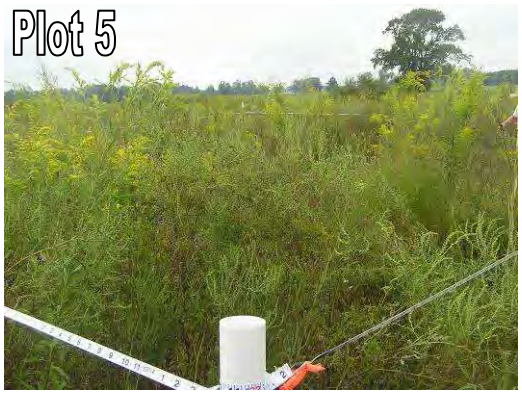
Planted Stems by Plot and Species

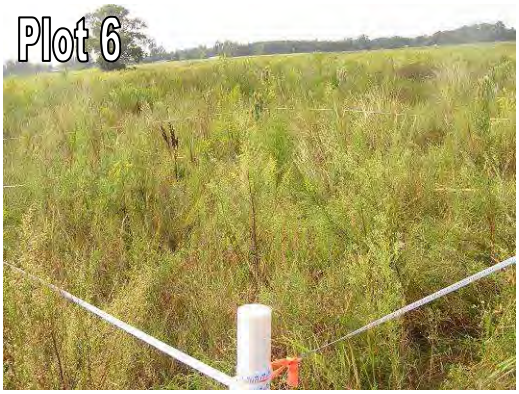
	Species	Total Planted Stems	# plots	avg# stems	plot Jarmons-AXE-0001-	plot Jarmons-AXE-0002-	plot Jarmons-AXE-0003-	plot Jarmons-AXE-0004-	plot Jarmons-AXE-0005-	plot Jarmons-AXE-0006-	plot Jarmons-AXE-0007-	plot Jarmons-AXE-0008-	plot Jarmons-AXE-0009-	plot Jarmons-AXE-0010-	plot Jarmons-AXE-0011-	plot Jarmons-AXE-0012-	plot Jarmons-AXE-0013-	plot Jarmons-AXE-0014- year:1
	Betula nigra	29	8	3.62		8				2	6			6	1	3	2	1
	Celtis laevigata	5	4	1.25			1		1	1						2		
	Cephalanthus occidentalis	3	2	1.5		2			1									
	Fraxinus pennsylvanica	32	6	5.33		1	1		8			3			11			8
	Nyssa biflora	33	10	3.3	3	1		4	2	3	2			7	3	3	5	
	Platanus occidentalis	23	7	3.29			1	1		4		2		3	4			8
	Quercus	3	3	1		1		1									1	
	Quercus nigra	3	2	1.5	2									1				
	Quercus pagoda	23	7	3.29			5		4			2	4	2	3		3	
	Quercus phellos	9	5	1.8	2			4				1	1	1				
TOT:	**10**	**163**	**10**		**7**	**13**	**8**	**10**	**16**	**10**	**8**	**8**	**5**	**20**	**22**	**8**	**11**	**17**

All Stems by Plot and Species

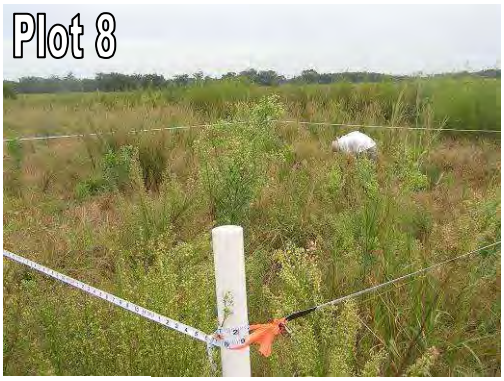
	Species	Total Planted Stems	# plots	avg# stems	plot Jarmons-AXE-0001-	plot Jarmons-AXE-0002-	plot Jarmons-AXE-0003-	plot Jarmons-AXE-0004-	plot Jarmons-AXE-0005-	plot Jarmons-AXE-0006-	plot Jarmons-AXE-0007-	plot Jarmons-AXE-0008-	plot Jarmons-AXE-0009-	plot Jarmons-AXE-0010-	plot Jarmons-AXE-0011-	plot Jarmons-AXE-0012-	plot Jarmons-AXE-0013-	plot Jarmons-AXE-0014- year:1
	Baccharis halimifolia	22	8	2.75	4		6	2	1	2	5				1	1		
	Betula nigra	29	8	3.62		8				2	6			6	1	3	2	1
	Celtis laevigata	5	4	1.25			1		1	1						2		
	Cephalanthus occidentalis	3	2	1.5		2			1									
	Diospyros virginiana	1	1	1	1													
	Fraxinus pennsylvanica	32	6	5.33		1	1		8			3			11			8
	Liquidambar styraciflua	62	4	15.5		1	59	1	1									
	Nyssa biflora	33	10	3.3	3	1		4	2	3	2			7	3	3	5	
	Quercus nigra	3	2	1.5	2									1				
	Quercus pagoda	23	7	3.29			5		4			2	4	2	3		3	
	Quercus phellos	9	5	1.8	2			4				1	1	1				
	Quercus	3	3	1		1		1									1	
	Platanus occidentalis	23	7	3.29			1	1		4		2		3	4			8
	Acer rubrum	14	4	3.5	3	9		1							1			
	Unknown	1	1	1										1				
TOT:	**15**	**263**	**15**		**15**	**23**	**73**	**14**	**18**	**12**	**13**	**8**	**5**	**21**	**24**	**9**	**11**	**17**

Jarmans Oaks Stream and Wetland Restoration Site
Year 1 (2008) Annual Monitoring
Vegetation Plot Photos
Taken September 2008





Jarmans Oaks Stream and Wetland Restoration Site
Year 1 (2008) Annual Monitoring
Vegetation Plot Photos
Taken September 2008
(continued)



APPENDIX B
GEOMORPHOLOGIC DATA

1. **Tables B1-B5. Qualitative Visual Stability Assessment**
2. **Cross-section Plots and Tables**
3. **Longitudinal Profile Plots**

Table B1. Visual Morphological Stability Assessment
Jarmans Oak Reach 1

Feature Category	Metric (per As-built and reference baselines)	(# Stable) Number Performing as Intended	Total number	Number / feet in unstable state	% Perform in Stable Condition	Feature Perform. Mean or Total
	1. Present	10	10	NA	100%	
	2. Armor stable (e.g. no displacement)?	10	10	NA	100%	
	3. Facet grade appears stable?	10	10	NA	100%	
	4. Minimal evidence of embedding / fining?	10	10	NA	100%	
A. Riffles	5. Length appropriate?	9	10	NA	90%	
	1. Present? (e.g. not subject to severe aggrad. Or migrat.?)	12	12	NA	100%	
	2. Sufficiently deep (Max Pool D:Mean Bkf>1.6?)	12	12	NA	100%	
B. Pools	3. Length appropriate?	12	12	NA	100%	100%
	1. Upstream of meander bend (run/inflection) centering?	12	12	NA	100%	
C. Thalweg	2. Downstream of meander (glide/inflection) centering?	12	12	NA	100%	100%
	1. Outer bend in state of limited/controlled erosion?	12	12	NA	100%	
	2. Of those eroding, # w/concomitant point bar formation?	NA	NA	0	100%	
	3. Apparent Rc within spec?	12	12	NA	100%	
D. Meanders	4. Sufficient floodplain access and relief?	12	12	NA	100%	100%
	1. General channel bed aggradation areas (bar formation)	NA	NA	0	100%	
E. Bed General	2. Channel bed degradation – areas of increasing down-cutting or head cutting?	NA	NA	0	100%	100%
F. Bank	1. Actively eroding, wasting, or slumping bank	NA	NA	0	100%	100%
	1. Free of back or arm scour?	NA	NA	NA	NA	
	2. Height appropriate?	NA	NA	NA	NA	
	3. Angle and geometry appear appropriate?	NA	NA	NA	NA	
G. Vanes	4. Free of piping or other structural failures?	NA	NA	NA	NA	NA
	1. Free of scour?	NA	NA	NA	NA	
H. Wads / Boulders	2. Footing stable?	NA	NA	NA	NA	NA

Table B2. Visual Morphological Stability Assessment
Jarmans Oak Reach 2

Feature Category	Metric (per As-built and reference baselines)	(# Stable) Number Performing as Intended	Total number	Number / feet in unstable state	% Perform in Stable Condition	Feature Perform. Mean or Total
	1. Present	10	10	NA	100%	
	2. Armor stable (e.g. no displacement)?	10	10	NA	100%	
	3. Facet grade appears stable?	10	10	NA	100%	
	4. Minimal evidence of embedding / fining?	10	10	NA	100%	
A. Riffles	5. Length appropriate?	10	10	NA	100%	100%
	1. Present? (e.g. not subject to severe aggrad. Or migrat.?)	11	11	NA	100%	
	2. Sufficiently deep (Max Pool D:Mean Bkf>1.6?)	11	11	NA	100%	
B. Pools	3. Length appropriate?	11	11	NA	100%	100%
	1. Upstream of meander bend (run/inflection) centering?	11	11	NA	100%	
C. Thalweg	2. Downstream of meander (glide/inflection) centering?	11	11	NA	100%	100%
	1. Outer bend in state of limited/controlled erosion?	11	11	NA	100%	
	2. Of those eroding, # w/concomitant point bar formation?	NA	NA	0	100%	
	3. Apparent Rc within spec?	11	11	NA	100%	
D. Meanders	4. Sufficient floodplain access and relief?	11	11	NA	100%	100%
	1. General channel bed aggradation areas (bar formation)	NA	NA	0	100%	
E. Bed General	2. Channel bed degradation – areas of increasing down-cutting or head cutting?	NA	NA	0	100%	100%
F. Bank	1. Actively eroding, wasting, or slumping bank	NA	NA	0	100%	100%
	1. Free of back or arm scour?	NA	NA	NA	NA	
	2. Height appropriate?	NA	NA	NA	NA	
	3. Angle and geometry appear appropriate?	NA	NA	NA	NA	
G. Vanes	4. Free of piping or other structural failures?	NA	NA	NA	NA	NA
	1. Free of scour?	NA	NA	NA	NA	
H. Wads / Boulders	2. Footing stable?	NA	NA	NA	NA	NA

Table B3. Visual Morphological Stability Assessment
Jarmans Oak Reach 3

Feature Category	Metric (per As-built and reference baselines)	(# Stable) Number Performing as Intended	Total number	Number / feet in unstable state	% Perform in Stable Condition	Feature Perform. Mean or Total
	1. Present	14	14	NA	100%	
	2. Armor stable (e.g. no displacement)?	14	14	NA	100%	
	3. Facet grade appears stable?	14	14	NA	100%	
	4. Minimal evidence of embedding / fining?	14	14	NA	100%	
A. Riffles	5. Length appropriate?	14	14	NA	100%	100%
	1. Present? (e.g. not subject to severe aggrad. Or migrat.?)	16	16	NA	100%	
	2. Sufficiently deep (Max Pool D:Mean Bkf>1.6?)	16	16	NA	100%	
B. Pools	3. Length appropriate?	16	16	NA	100%	100%
	1. Upstream of meander bend (run/inflection) centering?	16	16	NA	100%	
C. Thalweg	2. Downstream of meander (glide/inflection) centering?	16	16	NA	100%	100%
	1. Outer bend in state of limited/controlled erosion?	16	16	NA	100%	
	2. Of those eroding, # w/concomitant point bar formation?	NA	NA	0	100%	
	3. Apparent Rc within spec?	16	16	NA	100%	
D. Meanders	4. Sufficient floodplain access and relief?	16	16	NA	100%	100%
	1. General channel bed aggradation areas (bar formation)	NA	NA	0	100%	
E. Bed General	2. Channel bed degradation – areas of increasing down-cutting or head cutting?	NA	NA	10	99%	99%
F. Bank	1. Actively eroding, wasting, or slumping bank	NA	NA	10	99%	99%
	1. Free of back or arm scour?	NA	NA	NA	NA	
	2. Height appropriate?	NA	NA	NA	NA	
	3. Angle and geometry appear appropriate?	NA	NA	NA	NA	
G. Vanes	4. Free of piping or other structural failures?	NA	NA	NA	NA	NA
	1. Free of scour?	NA	NA	NA	NA	
H. Wads / Boulders	2. Footing stable?	NA	NA	NA	NA	NA

Table B4. Visual Morphological Stability Assessment
Jarmans Oak Reach 4

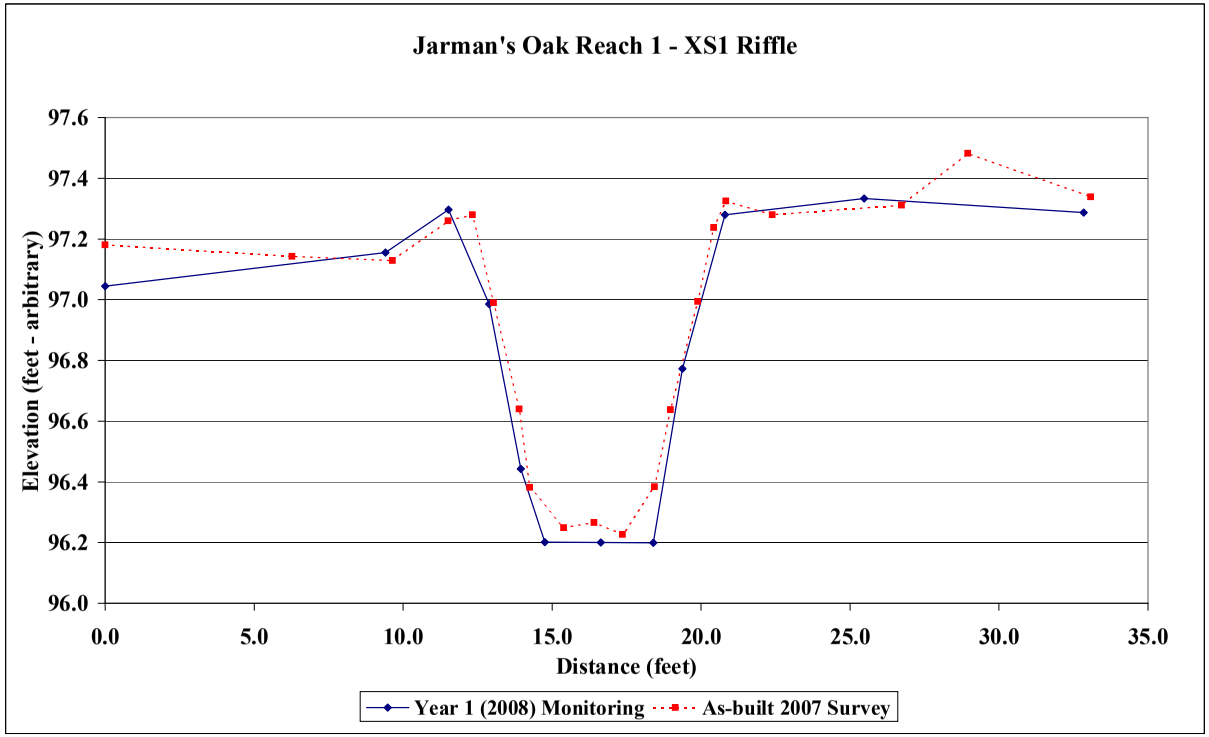
Feature Category	Metric (per As-built and reference baselines)	(# Stable) Number Performing as Intended	Total number	Number / feet in unstable state	% Perform in Stable Condition	Feature Perform. Mean or Total
	1. Present	9	9	NA	100%	
	2. Armor stable (e.g. no displacement)?	9	9	NA	100%	
	3. Facet grade appears stable?	9	9	NA	100%	
	4. Minimal evidence of embedding / fining?	9	9	NA	100%	
A. Riffles	5. Length appropriate?	7	9	NA	78%	96%
	1. Present? (e.g. not subject to severe aggrad. Or migrat.?)	11	11	NA	100%	
	2. Sufficiently deep (Max Pool D:Mean Bkf>1.6?)	11	11	NA	100%	
B. Pools	3. Length appropriate?	11	11	NA	100%	100%
	1. Upstream of meander bend (run/inflection) centering?	11	11	NA	100%	
C. Thalweg	2. Downstream of meander (glide/inflection) centering?	11	11	NA	100%	100%
	1. Outer bend in state of limited/controlled erosion?	11	11	NA	100%	
	2. Of those eroding, # w/concomitant point bar formation?	NA	NA	0	100%	
	3. Apparent Rc within spec?	11	11	NA	100%	
D. Meanders	4. Sufficient floodplain access and relief?	11	11	NA	100%	100%
	1. General channel bed aggradation areas (bar formation)	NA	NA	0	100%	
E. Bed General	2. Channel bed degradation – areas of increasing down-cutting or head cutting?	NA	NA	0	100%	100%
F. Bank	1. Actively eroding, wasting, or slumping bank	NA	NA	0	100%	100%
	1. Free of back or arm scour?	NA	NA	NA	NA	
	2. Height appropriate?	NA	NA	NA	NA	
	3. Angle and geometry appear appropriate?	NA	NA	NA	NA	
G. Vanes	4. Free of piping or other structural failures?	NA	NA	NA	NA	NA
	1. Free of scour?	NA	NA	NA	NA	
H. Wads / Boulders	2. Footing stable?	NA	NA	NA	NA	NA

Table B5. Visual Morphological Stability Assessment
Jarmans Oak Reach 5

Feature Category	Metric (per As-built and reference baselines)	(# Stable) Number Performing as Intended	Total number	Number / feet in unstable state	% Perform in Stable Condition	Feature Perform. Mean or Total
	1. Present	11	11	NA	100%	
	2. Armor stable (e.g. no displacement)?	11	11	NA	100%	
	3. Facet grade appears stable?	11	11	NA	100%	
	4. Minimal evidence of embedding / fining?	11	11	NA	100%	
A. Riffles	5. Length appropriate?	11	11	NA	100%	100%
	1. Present? (e.g. not subject to severe aggrad. Or migrat.?)	10	10	NA	100%	
	2. Sufficiently deep (Max Pool D:Mean Bkf>1.6?)	10	10	NA	100%	
B. Pools	3. Length appropriate?	10	10	NA	100%	100%
	1. Upstream of meander bend (run/inflection) centering?	10	10	NA	100%	
C. Thalweg	2. Downstream of meander (glide/inflection) centering?	10	10	NA	100%	100%
	1. Outer bend in state of limited/controlled erosion?	10	10	NA	100%	
	2. Of those eroding, # w/concomitant point bar formation?	NA	NA	0	100%	
	3. Apparent Rc within spec?	10	10	NA	100%	
D. Meanders	4. Sufficient floodplain access and relief?	10	10	NA	100%	100%
	1. General channel bed aggradation areas (bar formation)	NA	NA	0	100%	
E. Bed General	2. Channel bed degradation – areas of increasing down-cutting or head cutting?	NA	NA	0	100%	100%
F. Bank	1. Actively eroding, wasting, or slumping bank	NA	NA	0	100%	100%
	1. Free of back or arm scour?	NA	NA	NA	NA	
	2. Height appropriate?	NA	NA	NA	NA	
	3. Angle and geometry appear appropriate?	NA	NA	NA	NA	
G. Vanes	4. Free of piping or other structural failures?	NA	NA	NA	NA	NA
	1. Free of scour?	NA	NA	NA	NA	
H. Wads / Boulders	2. Footing stable?	NA	NA	NA	NA	NA

Project Name	Jarman's Oak
Cross Section	R1-XS1
Feature	Riffle
Date	6/20/08
Crew	Adasme, Jeffers

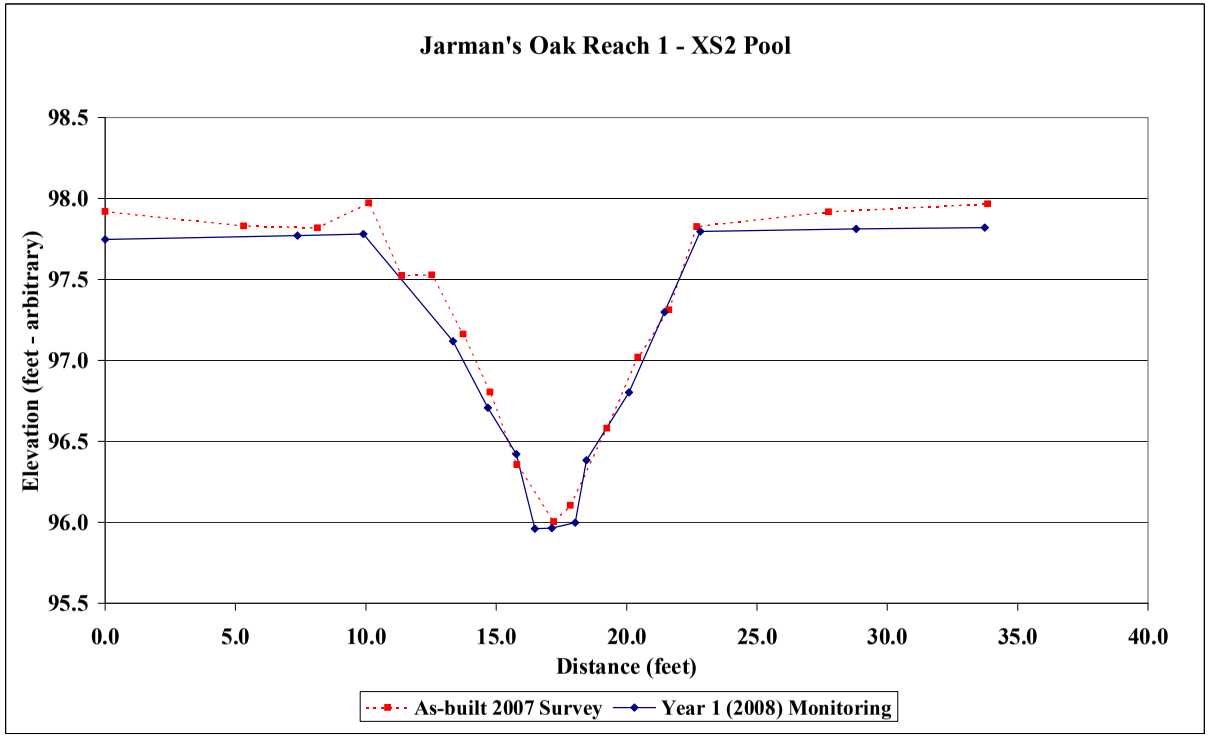
As-built 2007 Survey		2008 2008 Survey		2009 2009 Survey		2010 2010 Survey	
Station	**Elevation**	**Station**	**Elevation**	**Station**	**Elevation**	**Station**	**Elevation**
0.0	97.2	0.0	97.0				
6.3	97.1	9.4	97.2				
9.6	97.1	11.5	97.3				
11.5	97.3	12.9	97.0				
12.3	97.3	13.9	96.4				
13.0	97.0	14.8	96.2				
13.9	96.6	16.6	96.2				
14.3	96.4	18.4	96.2				
15.4	96.2	19.4	96.8				
16.4	96.3	20.8	97.3				
17.4	96.2	25.5	97.3				
18.4	96.4	32.8	97.3				
19.0	96.6						
19.9	97.0						
20.4	97.2						
20.8	97.3						
22.4	97.3						
26.7	97.3						
29.0	97.5						
33.1	97.3						



	As-built	2008	2009	2010
Area	5.9	6.4		
Width	9.1	9.0		
Mean Depth	0.6	0.7		
Max Depth	1.1	1.1		
W/D Ratio	14.1	12.7		

Project Name	Jarman's Oak
Cross Section	R1-XS2
Feature	Pool
Date	6/20/08
Crew	Adasme, Jeffers

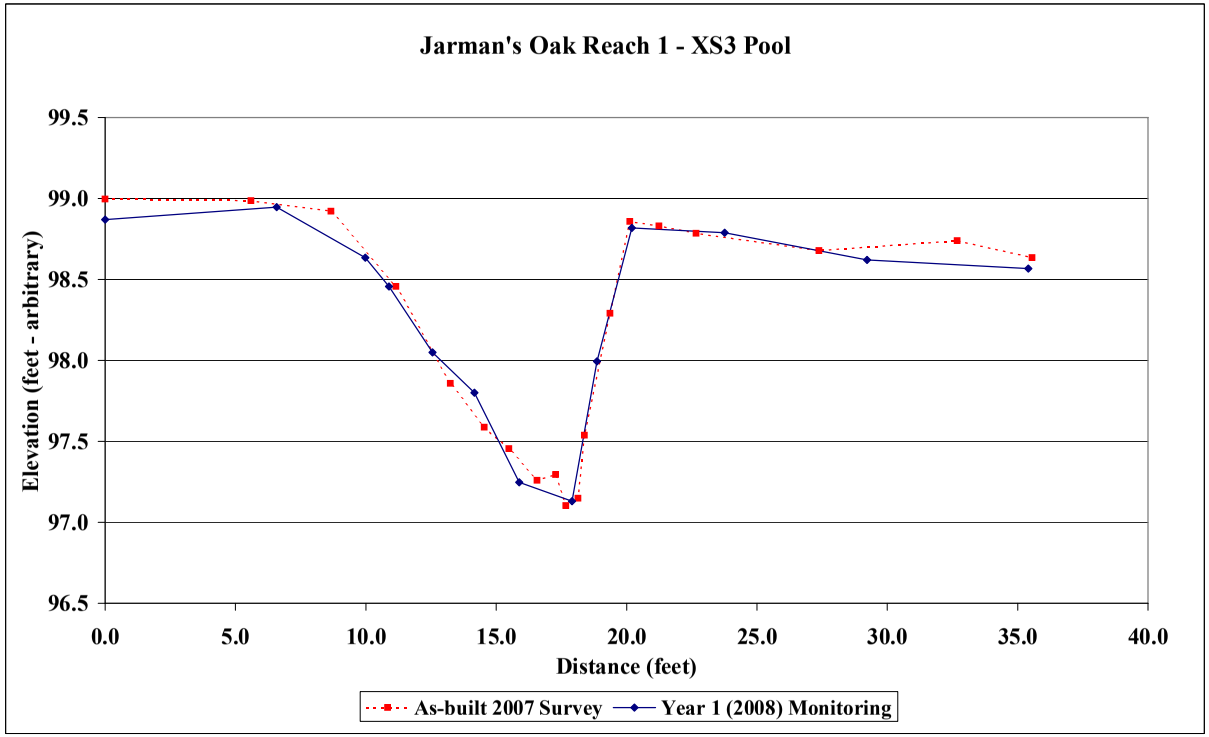
As-built 2007 Survey		2008 2008 Survey		2009 2009 Survey		2010 2010 Survey	
Station	**Elevation**	**Station**	**Elevation**	**Station**	**Elevation**	**Station**	**Elevation**
0.0	97.9	0.0	97.7				
5.3	97.8	7.4	97.8				
8.1	97.8	9.9	97.8				
10.1	98.0	13.3	97.1				
11.4	97.5	14.7	96.7				
12.5	97.5	15.8	96.4				
13.7	97.2	16.5	96.0				
14.8	96.8	17.1	96.0				
15.8	96.4	18.0	96.0				
17.2	96.0	18.5	96.4				
17.8	96.1	20.1	96.8				
19.2	96.6	21.4	97.3				
20.4	97.0	22.8	97.8				
21.6	97.3	28.8	97.8				
22.7	97.8	33.7	97.8				
27.8	97.9						
33.9	98.0						



	As-built	2008	2009	2010
Area	7.6	11.4		
Width	9.5	12.8		
Mean Depth	0.8	0.9		
Max Depth	1.5	1.8		
W/D Ratio	N/A	N/A		

Project Name	Jarman's Oak
Cross Section	R1-XS3
Feature	Pool
Date	6/20/08
Crew	Adasme, Jeffers

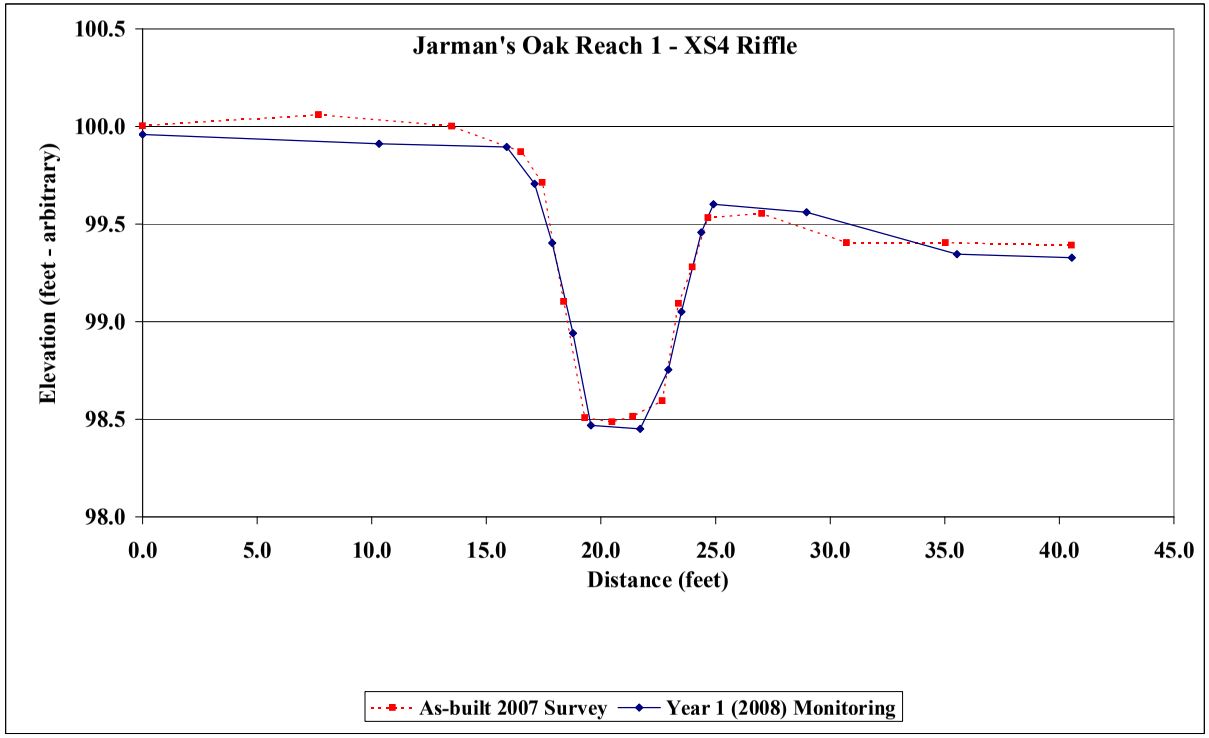
As-built 2007 Survey		2008 2008 Survey		2009 2009 Survey		2010 2010 Survey	
Station	**Elevation**	**Station**	**Elevation**	**Station**	**Elevation**	**Station**	**Elevation**
0.0	99.0	0.0	98.9				
5.6	99.0	6.6	98.9				
8.7	98.9	10.0	98.6				
11.2	98.5	10.9	98.5				
13.2	97.9	12.6	98.0				
14.5	97.6	14.2	97.8				
15.5	97.5	15.9	97.2				
16.6	97.3	17.9	97.1				
17.3	97.3	18.9	98.0				
17.7	97.1	20.2	98.8				
18.1	97.1	23.8	98.8				
18.4	97.5	29.2	98.6				
19.4	98.3	35.4	98.6				
20.1	98.9						
21.3	98.8						
22.7	98.8						
27.4	98.7						
32.7	98.7						
35.6	98.6						



	As-built	2008	2009	2010
Area	10.4	10.0		
Width	12.3	12.1		
Mean Depth	0.8	0.8		
Max Depth	1.8	1.7		
W/D Ratio	N/A	N/A		

Project Name	Jarman's Oak
Cross Section	R1-XS4
Feature	Riffle
Date	6/20/08
Crew	Adasme, Jeffers

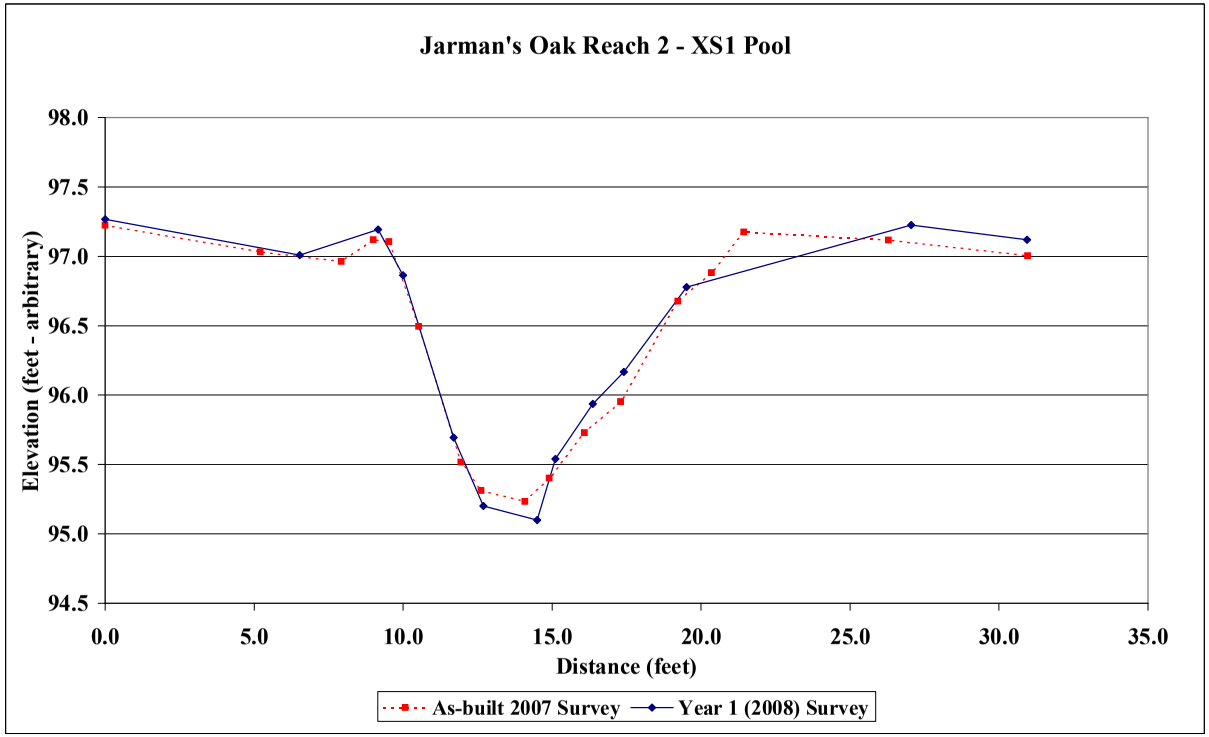
As-built 2007 Survey		2008 2008 Survey		2009 2009 Survey		2010 2010 Survey	
Station	**Elevation**	**Station**	**Elevation**	**Station**	**Elevation**	**Station**	**Elevation**
0.0	100.0	0.0	100.0				
7.7	100.1	10.3	99.9				
13.5	100.0	15.9	99.9				
16.5	99.9	17.1	99.7				
17.4	99.7	17.9	99.4				
18.4	99.1	18.8	98.9				
19.3	98.5	19.6	98.5				
20.5	98.5	21.7	98.5				
21.4	98.5	22.9	98.8				
22.7	98.6	23.5	99.1				
23.4	99.1	24.4	99.5				
24.0	99.3	24.9	99.6				
24.7	99.5	29.0	99.6				
27.0	99.6	35.5	99.3				
30.7	99.4	40.5	99.3				
35.0	99.4						
40.5	99.4						



	As-built	2008	2009	2010
Area	5.0	5.6		
Width	6.9	7.5		
Mean Depth	0.7	0.7		
Max Depth	1.0	1.1		
W/D Ratio	9.6	10.2		

Project Name	Jarman's Oak
Cross Section	R2-XS1
Feature	Pool
Date	6/23/08
Crew	Adasme, Jeffers

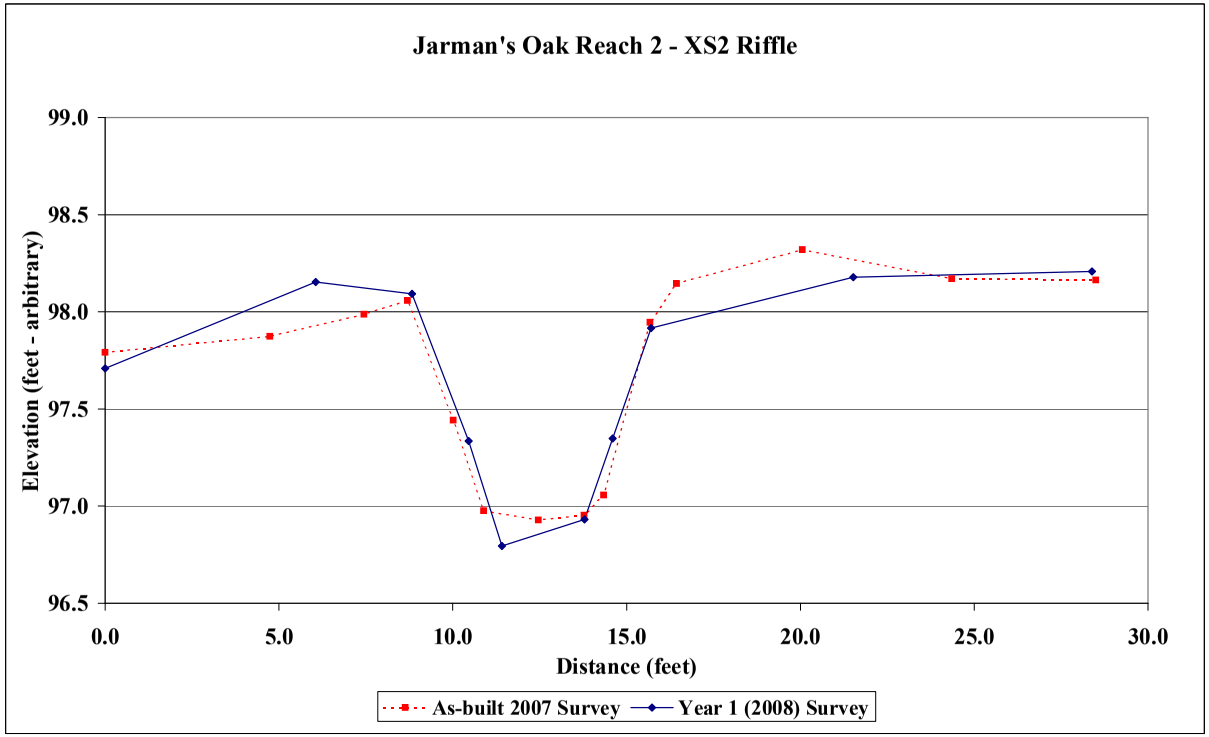
As-built 2007 Survey		2008 2008 Survey		2009 2009 Survey		2010 2010 Survey	
Station	**Elevation**	**Station**	**Elevation**	**Station**	**Elevation**	**Station**	**Elevation**
0.0	97.2	0.0	97.3				
5.2	97.0	6.5	97.0				
7.9	97.0	9.2	97.2				
9.0	97.1	10.0	96.9				
9.5	97.1	11.7	95.7				
10.5	96.5	12.7	95.2				
11.9	95.5	14.5	95.1				
12.6	95.3	15.1	95.5				
14.1	95.2	16.4	95.9				
14.9	95.4	17.4	96.2				
16.1	95.7	19.5	96.8				
17.3	96.0	27.1	97.2				
19.2	96.7	30.9	97.1				
20.4	96.9						
21.4	97.2						
26.3	97.1						
31.0	97.0						



	As-built	2008	2009	2010
Area	12.7	11.3		
Width	11.7	13.6		
Mean Depth	1.1	0.8		
Max Depth	1.9	1.9		
W/D Ratio	N/A	N/A		

Project Name	Jarman's Oak
Cross Section	R2-XS2
Feature	Riffle
Date	6/23/08
Crew	Adasme, Jeffers

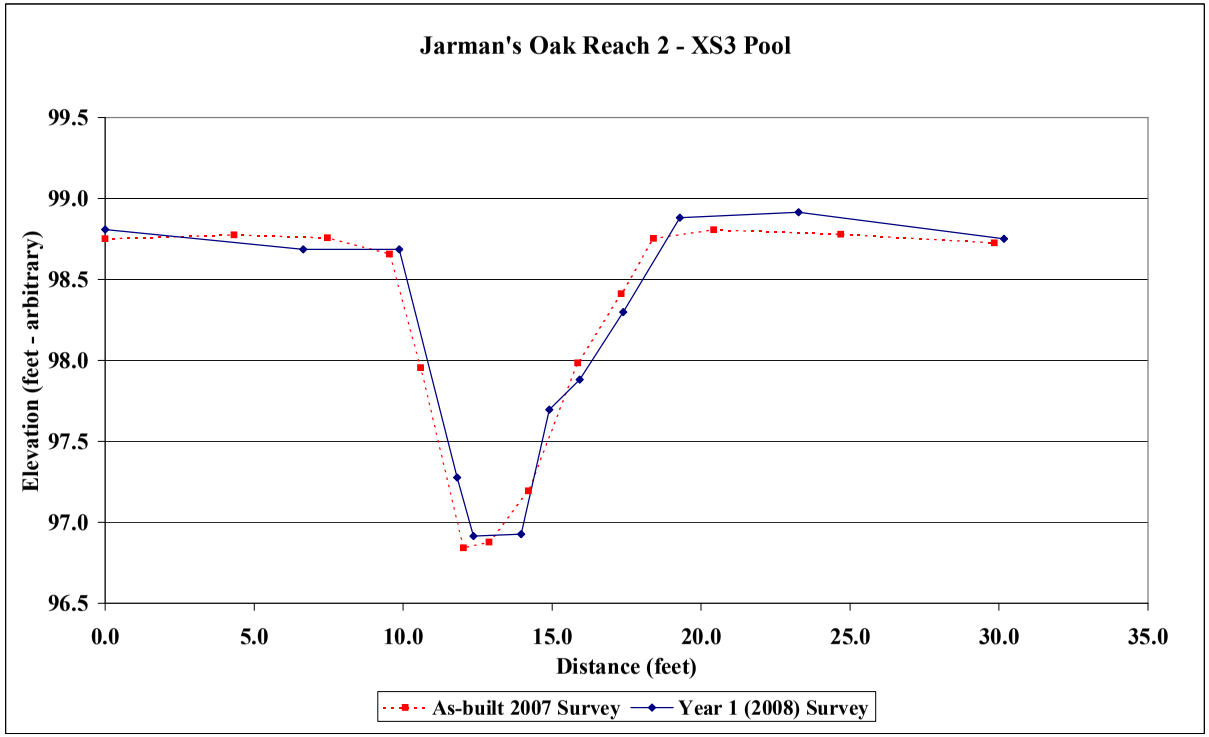
As-built 2007 Survey		2008 2008 Survey		2009 2009 Survey		2010 2010 Survey	
Station	**Elevation**	**Station**	**Elevation**	**Station**	**Elevation**	**Station**	**Elevation**
0.0	97.8	0.0	97.7				
4.7	97.9	6.1	98.2				
7.4	98.0	8.8	98.1				
8.7	98.1	10.5	97.3				
10.0	97.4	11.4	96.8				
10.9	97.0	13.8	96.9				
12.5	96.9	14.6	97.3				
13.8	97.0	15.7	97.9				
14.3	97.1	21.5	98.2				
15.7	97.9	28.4	98.2				
16.4	98.1						
20.1	98.3						
24.4	98.2						
28.5	98.2						



	As-built	2008	2009	2010
Area	5.7	4.6		
Width	7.4	6.6		
Mean Depth	0.8	0.7		
Max Depth	1.1	1.1		
W/D Ratio	9.6	9.3		

Project Name	Jarman's Oak
Cross Section	R2-XS3
Feature	Pool
Date	6/23/08
Crew	Adasme, Jeffers

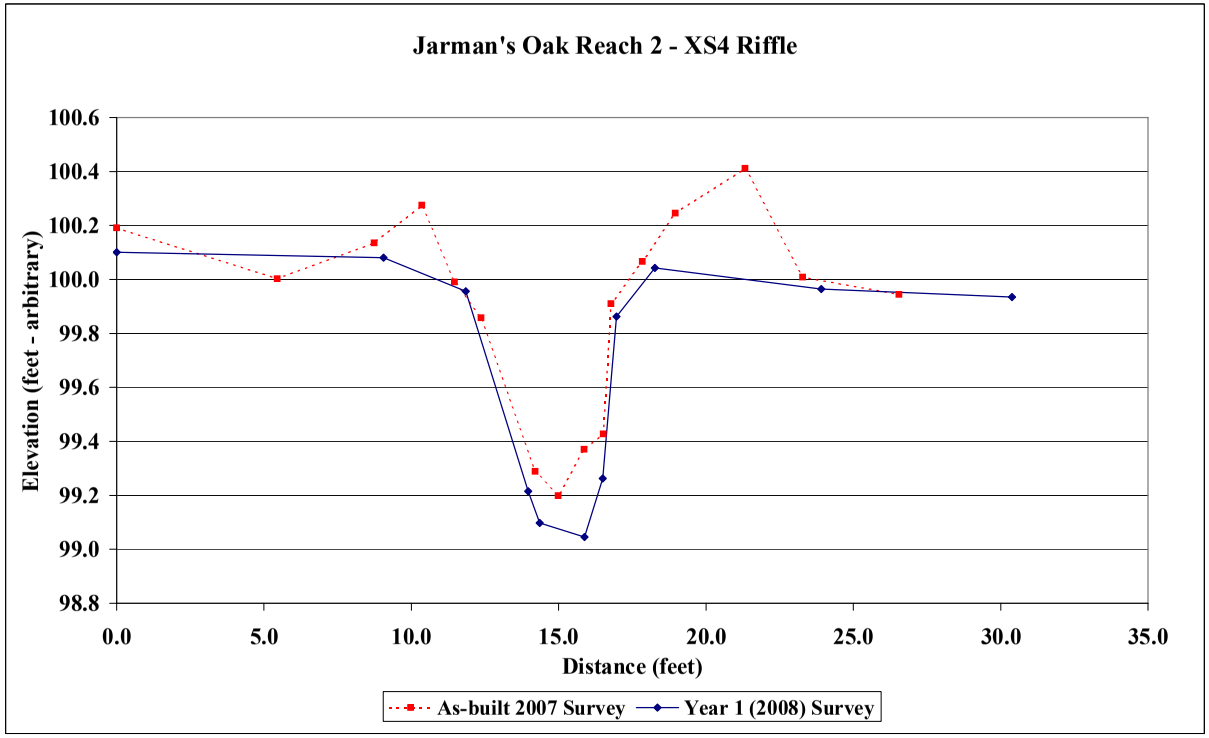
As-built 2007 Survey		2008 2008 Survey		2009 2009 Survey		2010 2010 Survey	
Station	**Elevation**	**Station**	**Elevation**	**Station**	**Elevation**	**Station**	**Elevation**
0.0	98.8	0.0	98.8				
4.3	98.8	6.6	98.7				
7.5	98.8	9.9	98.7				
9.5	98.7	11.8	97.3				
10.6	98.0	12.4	96.9				
12.0	96.8	14.0	96.9				
12.9	96.9	14.9	97.7				
14.2	97.2	15.9	97.9				
15.9	98.0	17.4	98.3				
17.3	98.4	19.3	98.9				
18.4	98.8	23.3	98.9				
20.4	98.8	30.2	98.8				
24.7	98.8						
29.8	98.7						



	As-built	2008	2009	2010
Area	8.4	8.3		
Width	8.7	8.8		
Mean Depth	1.0	1.0		
Max Depth	1.8	1.8		
W/D Ratio	N/A	N/A		

Project Name	Jarman's Oak
Cross Section	R2-XS4
Feature	Riffle
Date	6/23/08
Crew	Adasme, Jeffers

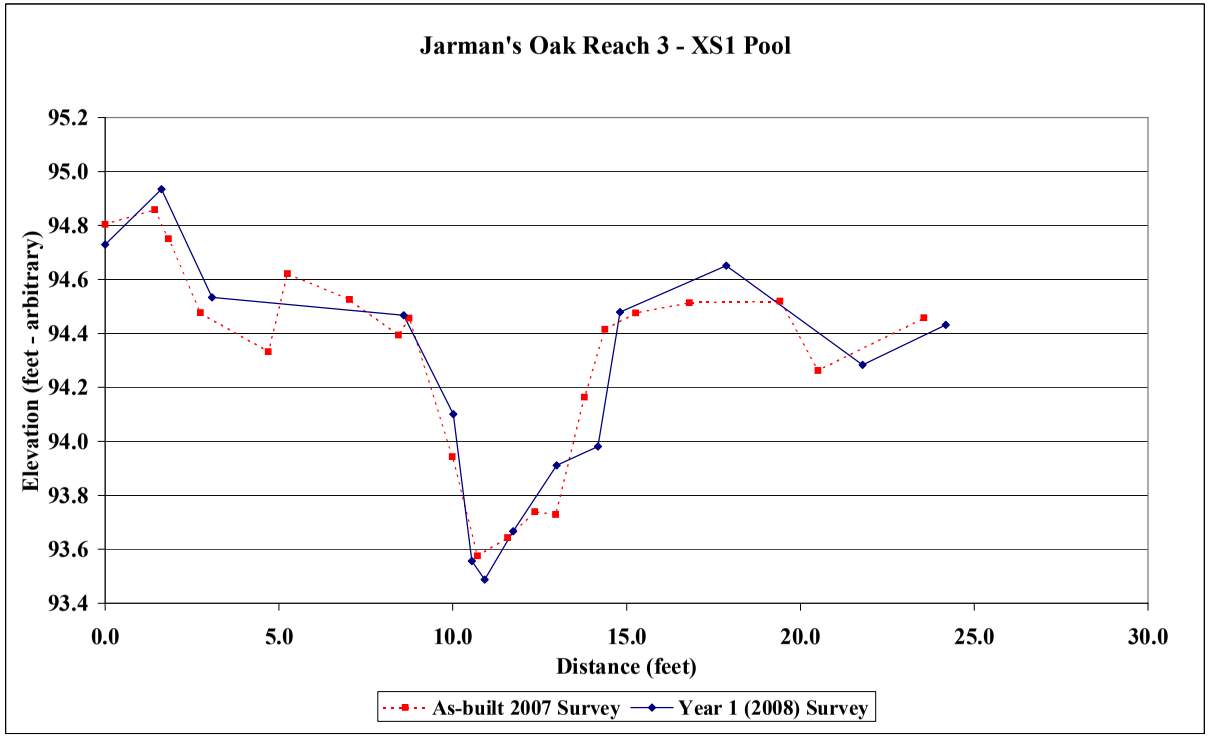
As-built 2007 Survey		2008 2008 Survey		2009 2009 Survey		2010 2010 Survey	
Station	**Elevation**	**Station**	**Elevation**	**Station**	**Elevation**	**Station**	**Elevation**
0.0	100.2	0.0	100.1				
5.5	100.0	9.1	100.1				
8.7	100.1	11.8	100.0				
10.4	100.3	14.0	99.2				
11.5	100.0	14.4	99.1				
12.4	99.9	15.9	99.0				
14.2	99.3	16.5	99.3				
15.0	99.2	17.0	99.9				
15.9	99.4	18.3	100.0				
16.5	99.4	23.9	100.0				
16.8	99.9	30.4	99.9				
17.8	100.1						
19.0	100.2						
21.3	100.4						
23.3	100.0						
26.6	99.9						



	As-built	2008	2009	2010
Area	4.7	3.7		
Width	8.6	8.3		
Mean Depth	0.5	0.5		
Max Depth	1.1	1.0		
W/D Ratio	15.9	18.3		

Project Name	Jarman's Oak
Cross Section	R3-XS1
Feature	Pool
Date	6/23/08
Crew	Adasme, Jeffers

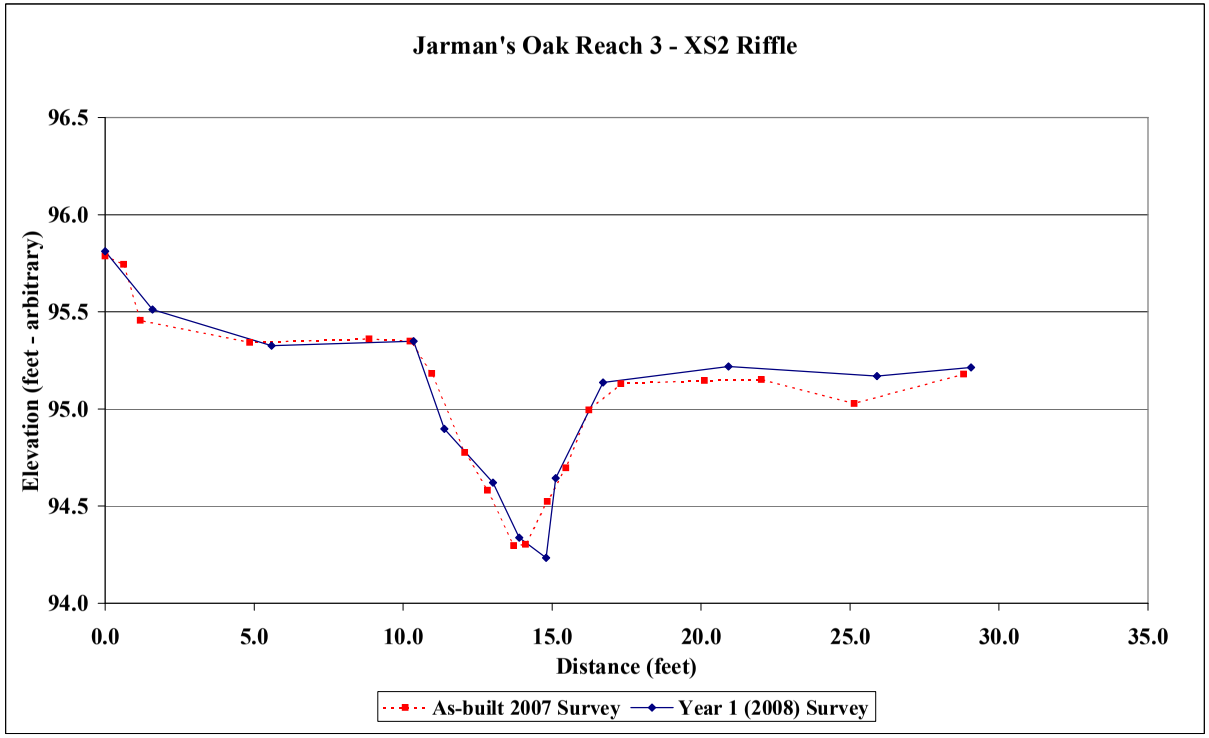
As-built 2007 Survey		2008 2008 Survey		2009 2009 Survey		2010 2010 Survey	
Station	**Elevation**	**Station**	**Elevation**	**Station**	**Elevation**	**Station**	**Elevation**
0.0	94.8	0.0	94.7				
1.4	94.9	1.6	94.9				
1.8	94.8	3.1	94.5				
2.7	94.5	8.6	94.5				
4.7	94.3	10.0	94.1				
5.2	94.6	10.5	93.6				
7.0	94.5	10.9	93.5				
8.4	94.4	11.7	93.7				
8.7	94.5	13.0	93.9				
10.0	93.9	14.2	94.0				
10.7	93.6	14.8	94.5				
11.6	93.6	17.9	94.7				
12.4	93.7	21.8	94.3				
13.0	93.7	24.2	94.4				
13.8	94.2						
14.4	94.4						
15.3	94.5						
16.8	94.5						
19.4	94.5						
20.5	94.3						
23.6	94.5						



	As-built	2008	2009	2010
Area	2.9	3.3		
Width	5.6	6.2		
Mean Depth	0.5	0.5		
Max Depth	0.8	1.0		
W/D Ratio	N/A	N/A		

Project Name	Jarman's Oak
Cross Section	R3-XS2
Feature	Riffle
Date	6/23/08
Crew	Adasme, Jeffers

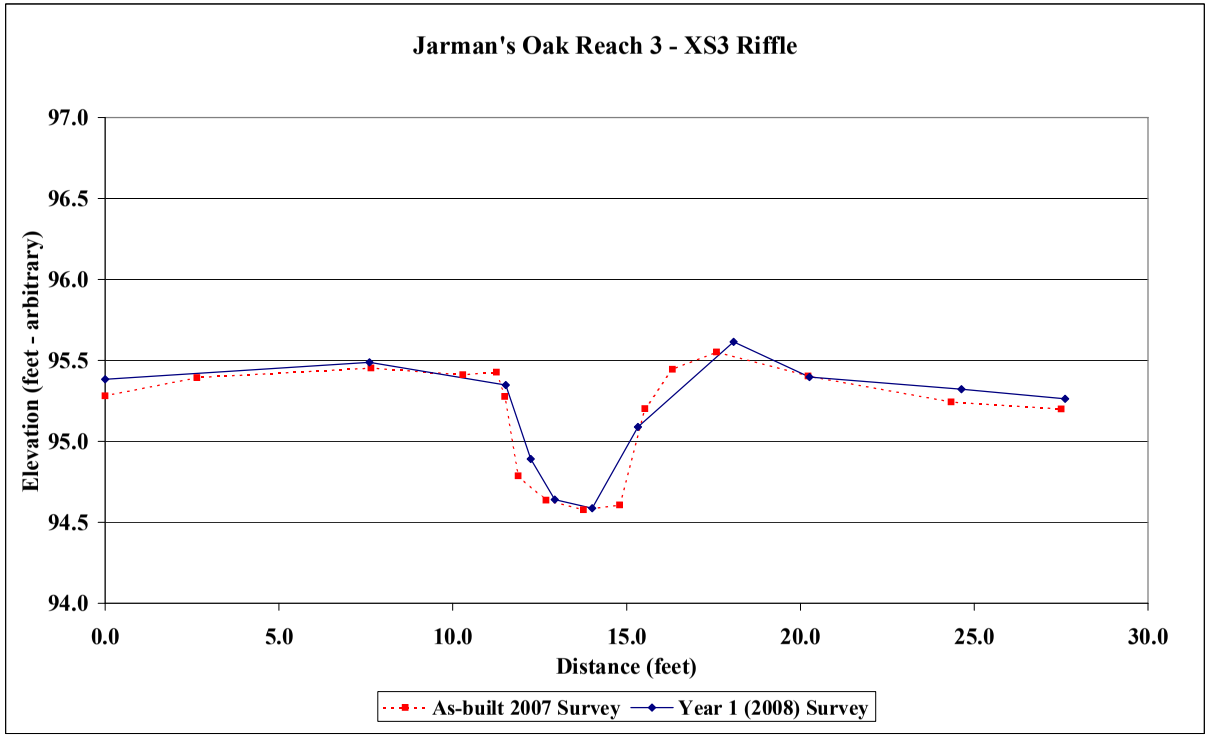
As-built 2007 Survey		2008 2008 Survey		2009 2009 Survey		2010 2010 Survey	
Station	**Elevation**	**Station**	**Elevation**	**Station**	**Elevation**	**Station**	**Elevation**
0.0	95.8	0.0	95.8				
0.6	95.7	1.6	95.5				
1.2	95.5	5.6	95.3				
4.9	95.3	10.4	95.3				
8.9	95.4	11.4	94.9				
10.2	95.3	13.0	94.6				
11.0	95.2	13.9	94.3				
12.1	94.8	14.8	94.2				
12.8	94.6	15.1	94.6				
13.7	94.3	16.7	95.1				
14.1	94.3	20.9	95.2				
14.8	94.5	25.9	95.2				
15.5	94.7	29.1	95.2				
16.2	95.0						
17.3	95.1						
20.1	95.1						
22.0	95.2						
25.1	95.0						
28.8	95.2						



	As-built	2008	2009	2010
Area	2.6	2.7		
Width	6.2	6.1		
Mean Depth	0.4	0.4		
Max Depth	0.8	0.9		
W/D Ratio	14.9	13.8		

Project Name	Jarman's Oak
Cross Section	R3-XS3
Feature	Riffle
Date	6/23/08
Crew	Adasme, Jeffers

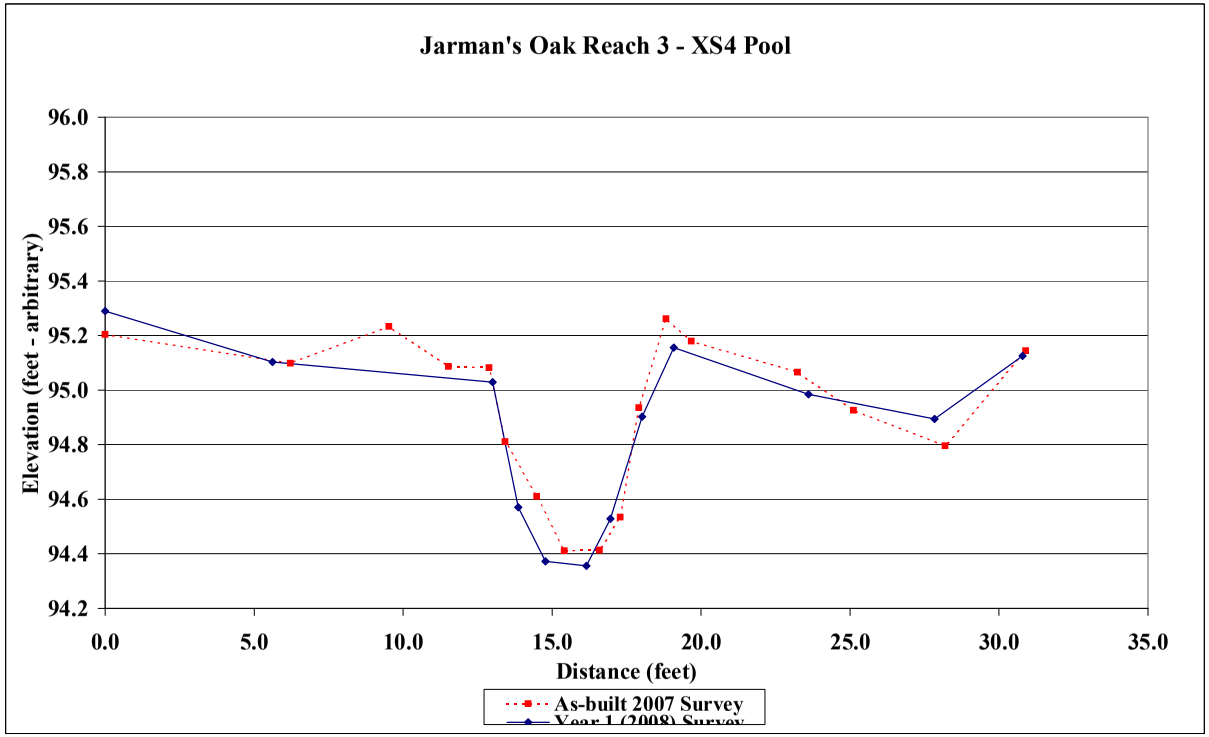
As-built 2007 Survey		2008 2008 Survey		2009 2009 Survey		2010 2010 Survey	
Station	**Elevation**	**Station**	**Elevation**	**Station**	**Elevation**	**Station**	**Elevation**
0.0	95.3	0.0	95.4				
2.6	95.4	7.6	95.5				
7.6	95.5	11.5	95.3				
10.3	95.4	12.2	94.9				
11.3	95.4	12.9	94.6				
11.5	95.3	14.0	94.6				
11.9	94.8	15.3	95.1				
12.7	94.6	18.1	95.6				
13.8	94.6	20.3	95.4				
14.8	94.6	24.6	95.3				
15.5	95.2	27.6	95.3				
16.3	95.4						
17.6	95.6						
20.2	95.4						
24.3	95.2						
27.5	95.2						



	As-built	2008	2009	2010
Area	3.0	2.2		
Width	5.0	5.2		
Mean Depth	0.6	0.4		
Max Depth	0.9	0.8		
W/D Ratio	8.5	12.3		

Project Name	Jarman's Oak
Cross Section	R3-XS4
Feature	Pool
Date	6/23/08
Crew	Adasme, Jeffers

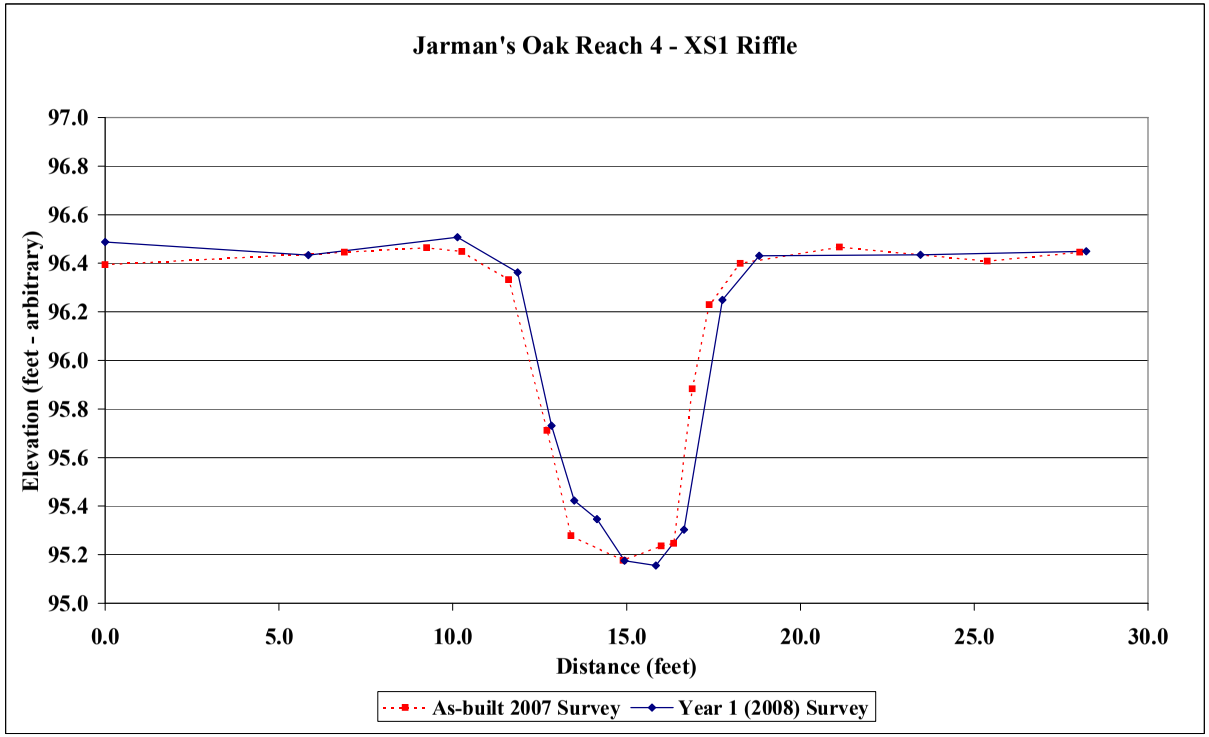
As-built 2007 Survey		2008 2008 Survey		2009 2009 Survey		2010 2010 Survey	
Station	**Elevation**	**Station**	**Elevation**	**Station**	**Elevation**	**Station**	**Elevation**
0.0	95.2	0.0	95.3				
6.2	95.1	5.6	95.1				
9.5	95.2	13.0	95.0				
11.5	95.1	13.9	94.6				
12.9	95.1	14.8	94.4				
13.4	94.8	16.1	94.4				
14.5	94.6	17.0	94.5				
15.4	94.4	18.0	94.9				
16.6	94.4	19.1	95.2				
17.3	94.5	23.6	95.0				
17.9	94.9	27.8	94.9				
18.8	95.3	30.8	95.1				
19.7	95.2						
23.2	95.1						
25.1	94.9						
28.2	94.8						
30.9	95.1						



	As-built	2008	2009	2010
Area	2.4	2.5		
Width	5.4	5.6		
Mean Depth	0.5	0.4		
Max Depth	0.7	0.7		
W/D Ratio	N/A	N/A		

Project Name	Jarman's Oak
Cross Section	R4-XS1
Feature	Riffle
Date	6/24/08
Crew	Adasme, Jeffers

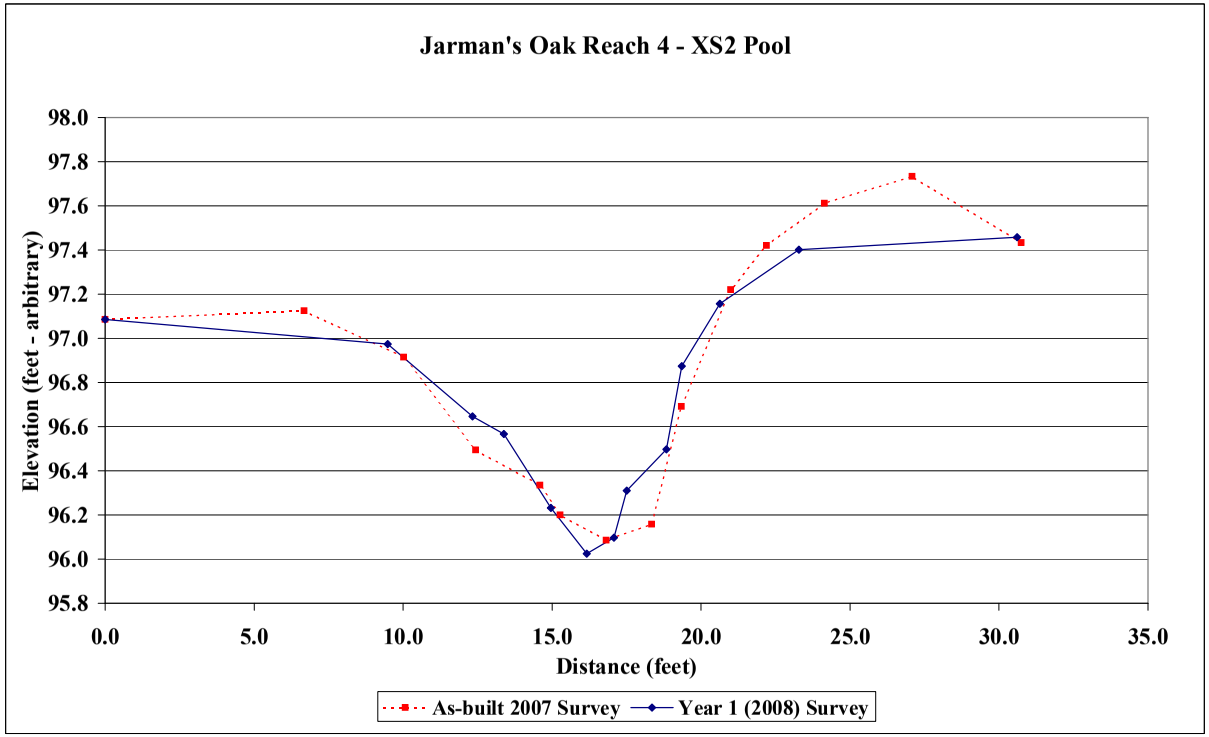
As-built 2007 Survey		2008 2008 Survey		2009 2009 Survey		2010 2010 Survey	
Station	**Elevation**	**Station**	**Elevation**	**Station**	**Elevation**	**Station**	**Elevation**
0.0	96.4	0.0	96.5				
6.9	96.4	5.8	96.4				
9.3	96.5	10.1	96.5				
10.3	96.4	11.9	96.4				
11.6	96.3	12.8	95.7				
12.7	95.7	13.5	95.4				
13.4	95.3	14.2	95.3				
14.9	95.2	14.9	95.2				
16.0	95.2	15.8	95.2				
16.4	95.2	16.7	95.3				
16.9	95.9	17.8	96.2				
17.4	96.2	18.8	96.4				
18.3	96.4	23.5	96.4				
21.1	96.5	28.2	96.4				
25.4	96.4						
28.0	96.4						



	As-built	2008	2009	2010
Area	5.2	5.0		
Width	7.5	6.5		
Mean Depth	0.7	0.8		
Max Depth	1.2	1.2		
W/D Ratio	10.6	8.6		

Project Name	Jarman's Oak
Cross Section	R4-XS2
Feature	Pool
Date	6/24/08
Crew	Adasme, Jeffers

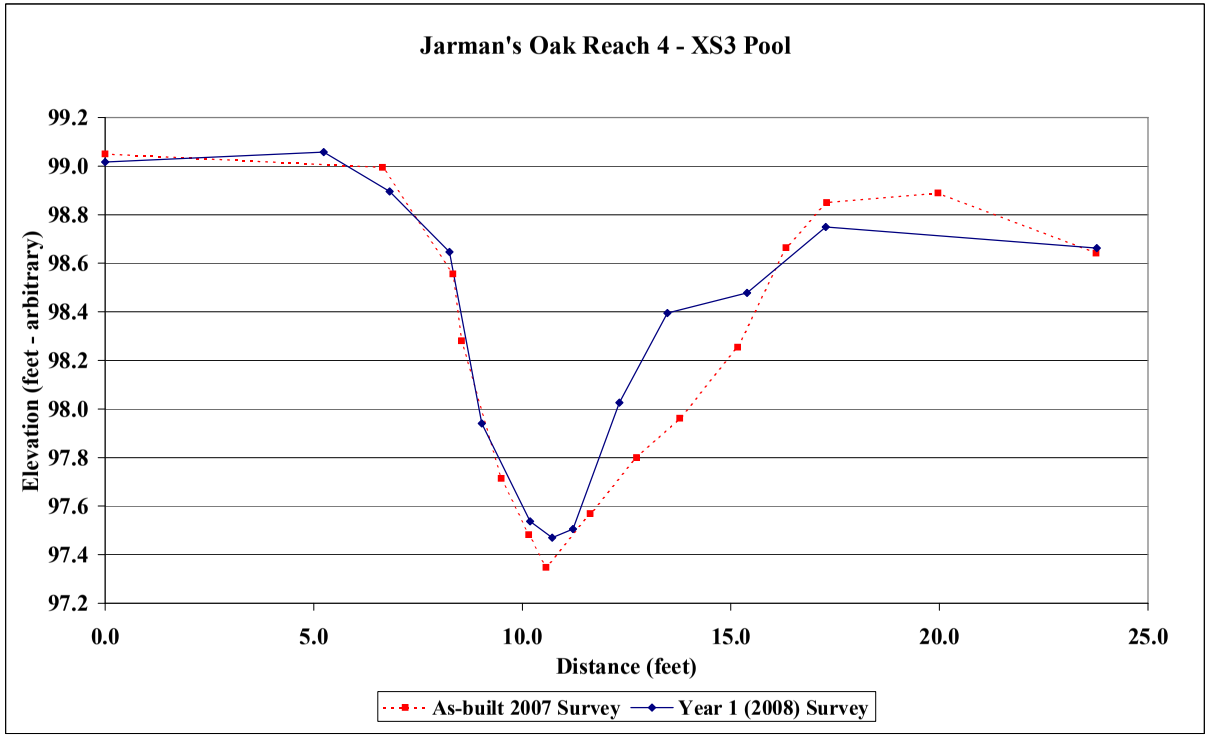
As-built 2007 Survey		2008 2008 Survey		2009 2009 Survey		2010 2010 Survey	
Station	**Elevation**	**Station**	**Elevation**	**Station**	**Elevation**	**Station**	**Elevation**
0.0	97.1	0.0	97.1				
6.7	97.1	9.5	97.0				
10.0	96.9	12.3	96.6				
12.4	96.5	13.4	96.6				
14.6	96.3	15.0	96.2				
15.3	96.2	16.2	96.0				
16.8	96.1	17.1	96.1				
18.3	96.2	17.5	96.3				
19.3	96.7	18.8	96.5				
21.0	97.2	19.3	96.9				
22.2	97.4	20.6	97.2				
24.1	97.6	23.3	97.4				
27.1	97.7	30.6	97.5				
30.7	97.4						



	As-built	2008	2009	2010
Area	7.5	4.8		
Width	13.9	10.3		
Mean Depth	0.5	0.5		
Max Depth	1.0	0.9		
W/D Ratio	N/A	N/A		

Project Name	Jarman's Oak
Cross Section	R4-XS3
Feature	Pool
Date	6/24/08
Crew	Adasme, Jeffers

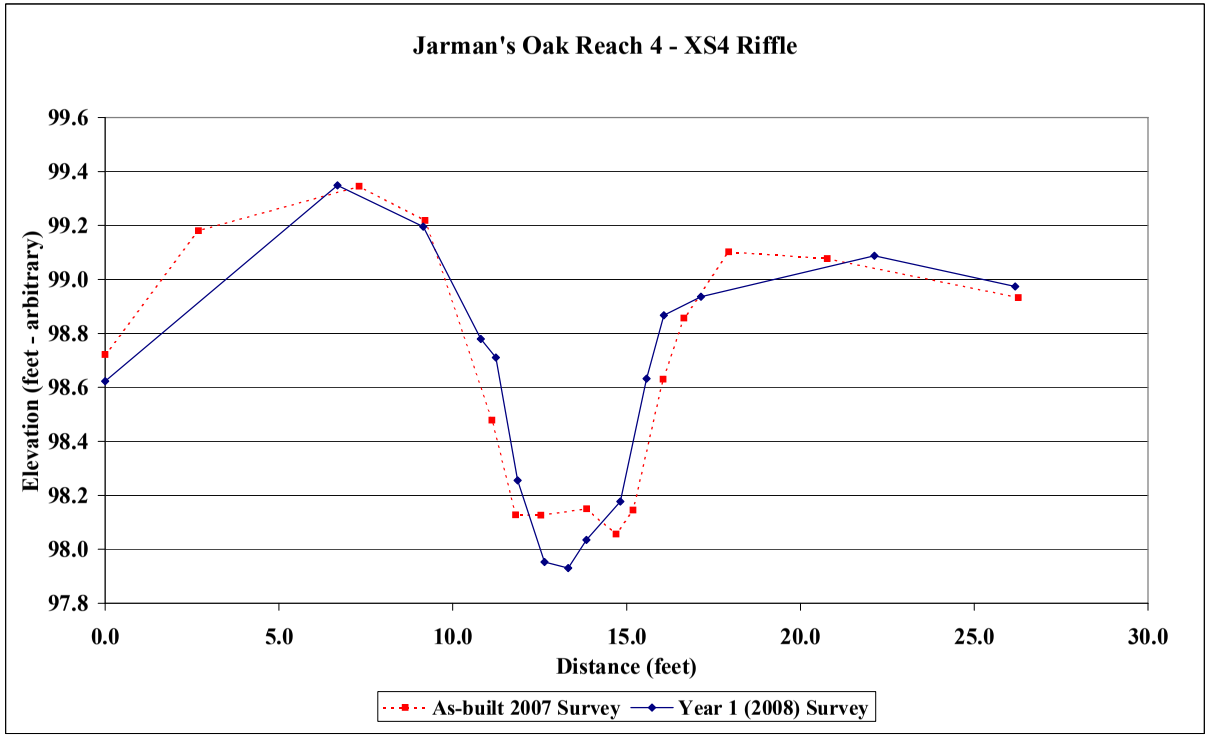
As-built 2007 Survey		2008 2008 Survey		2009 2009 Survey		2010 2010 Survey	
Station	**Elevation**	**Station**	**Elevation**	**Station**	**Elevation**	**Station**	**Elevation**
0.0	99.0	0.0	99.0				
6.7	99.0	5.2	99.1				
8.3	98.6	6.8	98.9				
8.5	98.3	8.3	98.6				
9.5	97.7	9.0	97.9				
10.2	97.5	10.2	97.5				
10.6	97.3	10.7	97.5				
11.6	97.6	11.2	97.5				
12.7	97.8	12.3	98.0				
13.8	98.0	13.5	98.4				
15.2	98.3	15.4	98.5				
16.3	98.7	17.3	98.7				
17.3	98.8	23.8	98.7				
20.0	98.9						
23.8	98.6						



	As-built	2008	2009	2010
Area	7.8	5.3		
Width	10.1	9.5		
Mean Depth	0.8	0.6		
Max Depth	1.5	1.3		
W/D Ratio	N/A	N/A		

Project Name	Jarman's Oak
Cross Section	R4-XS4
Feature	Riffle
Date	6/24/08
Crew	Adasme, Jeffers

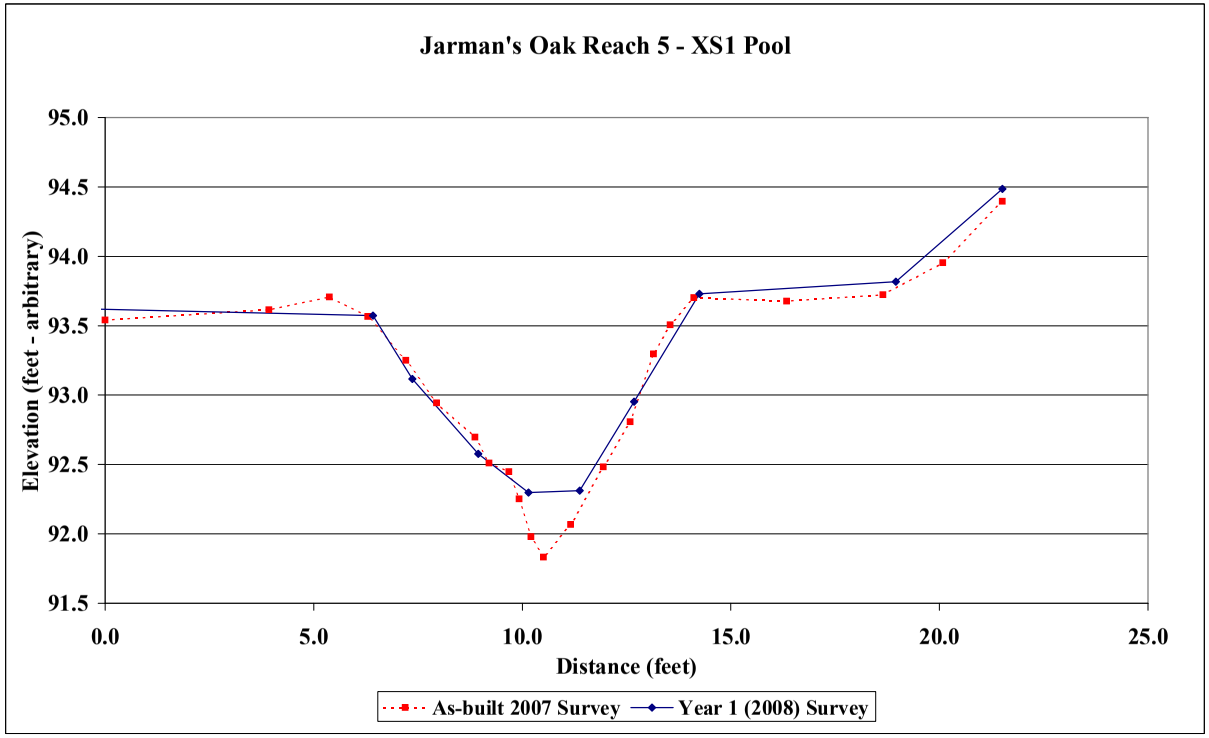
As-built 2007 Survey		2008 2008 Survey		2009 2009 Survey		2010 2010 Survey	
Station	**Elevation**	**Station**	**Elevation**	**Station**	**Elevation**	**Station**	**Elevation**
0.0	98.7	0.0	98.6				
2.7	99.2	6.7	99.3				
7.3	99.3	9.2	99.2				
9.2	99.2	10.8	98.8				
11.1	98.5	11.2	98.7				
11.8	98.1	11.9	98.3				
12.5	98.1	12.6	98.0				
13.8	98.2	13.3	97.9				
14.7	98.1	13.8	98.0				
15.2	98.1	14.8	98.2				
16.1	98.6	15.6	98.6				
16.6	98.9	16.1	98.9				
17.9	99.1	17.1	98.9				
20.8	99.1	22.1	99.1				
26.3	98.9	26.2	99.0				



	As-built	2008	2009	2010
Area	5.3	3.1		
Width	8.4	5.6		
Mean Depth	0.6	0.6		
Max Depth	1.0	0.9		
W/D Ratio	13.3	10.0		

Project Name	Jarman's Oak
Cross Section	R5-XS1
Feature	Pool
Date	7/7/08
Crew	Adasme, Jeffers

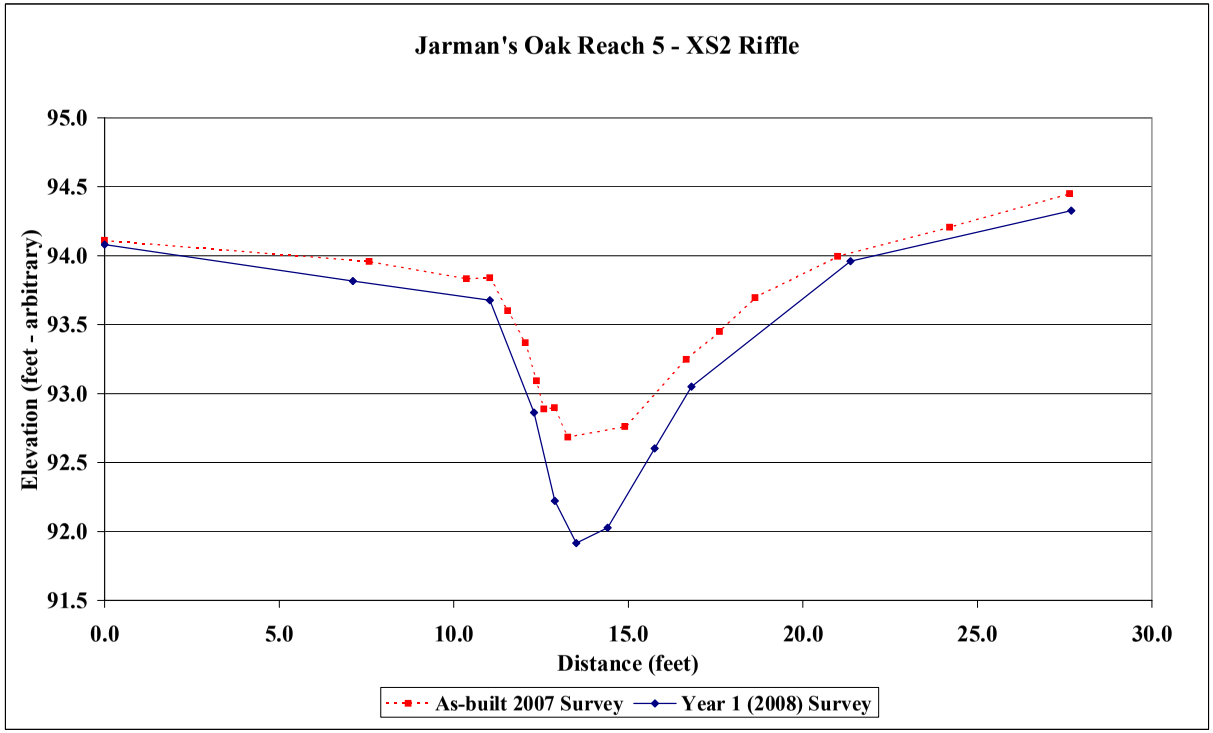
As-built 2007 Survey		2008 2008 Survey		2009 2009 Survey		2010 2010 Survey	
Station	**Elevation**	**Station**	**Elevation**	**Station**	**Elevation**	**Station**	**Elevation**
0.0	93.5	-5.3	93.7				
3.9	93.6	6.4	93.6				
5.4	93.7	7.4	93.1				
6.3	93.6	8.9	92.6				
7.2	93.2	10.1	92.3				
7.9	92.9	11.4	92.3				
8.9	92.7	12.7	93.0				
9.2	92.5	14.2	93.7				
9.7	92.4	19.0	93.8				
9.9	92.3	21.5	94.5				
10.2	92.0						
10.5	91.8						
11.2	92.1						
11.9	92.5						
12.6	92.8						
13.2	93.3						
13.5	93.5						
14.1	93.7						
16.3	93.7						
18.6	93.7						
20.1	94.0						
21.5	94.4						



	As-built	2008	2009	2010
Area	7.3	5.9		
Width	8.7	7.5		
Mean Depth	0.8	0.8		
Max Depth	1.9	1.3		
W/D Ratio	N/A	N/A		

Project Name	Jarman's Oak
Cross Section	R5-XS2
Feature	Riffle
Date	77/2008
Crew	Adasme, Jeffers

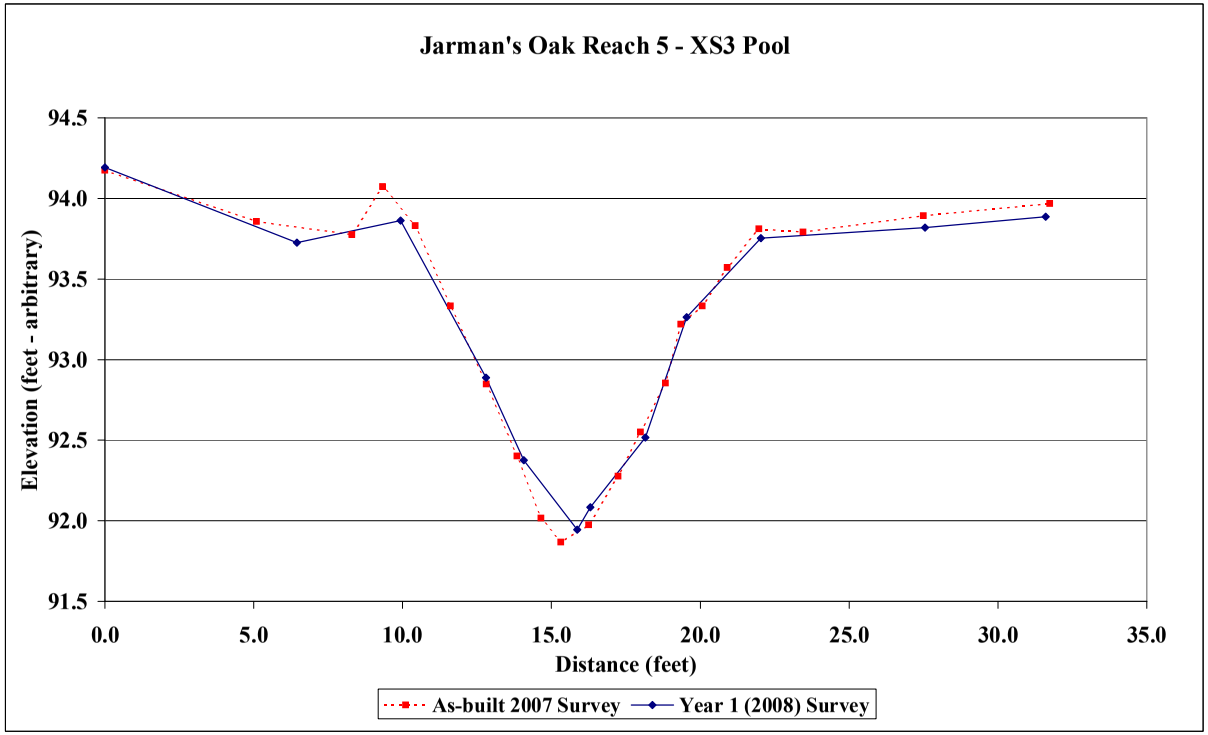
As-built 2007 Survey		2008 2008 Survey		2009 2009 Survey		2010 2010 Survey	
Station	**Elevation**	**Station**	**Elevation**	**Station**	**Elevation**	**Station**	**Elevation**
0.0	94.1	0.0	94.1				
7.6	94.0	7.1	93.8				
10.4	93.8	11.0	93.7				
11.0	93.8	12.3	92.9				
11.5	93.6	12.9	92.2				
12.1	93.4	13.5	91.9				
12.4	93.1	14.4	92.0				
12.6	92.9	15.8	92.6				
12.9	92.9	16.8	93.1				
13.3	92.7	21.4	94.0				
14.9	92.8	27.7	94.3				
16.7	93.2						
17.6	93.4						
18.6	93.7						
21.0	94.0						
24.2	94.2						
27.6	94.4						



	As-built	2008	2009	2010
Area	5.4	7.4		
Width	8.7	8.9		
Mean Depth	0.6	0.8		
Max Depth	1.2	1.8		
W/D Ratio	14.1	10.7		

Project Name	Jarman's Oak
Cross Section	R5-XS3
Feature	Pool
Date	7/7/08
Crew	Adasme, Jeffers

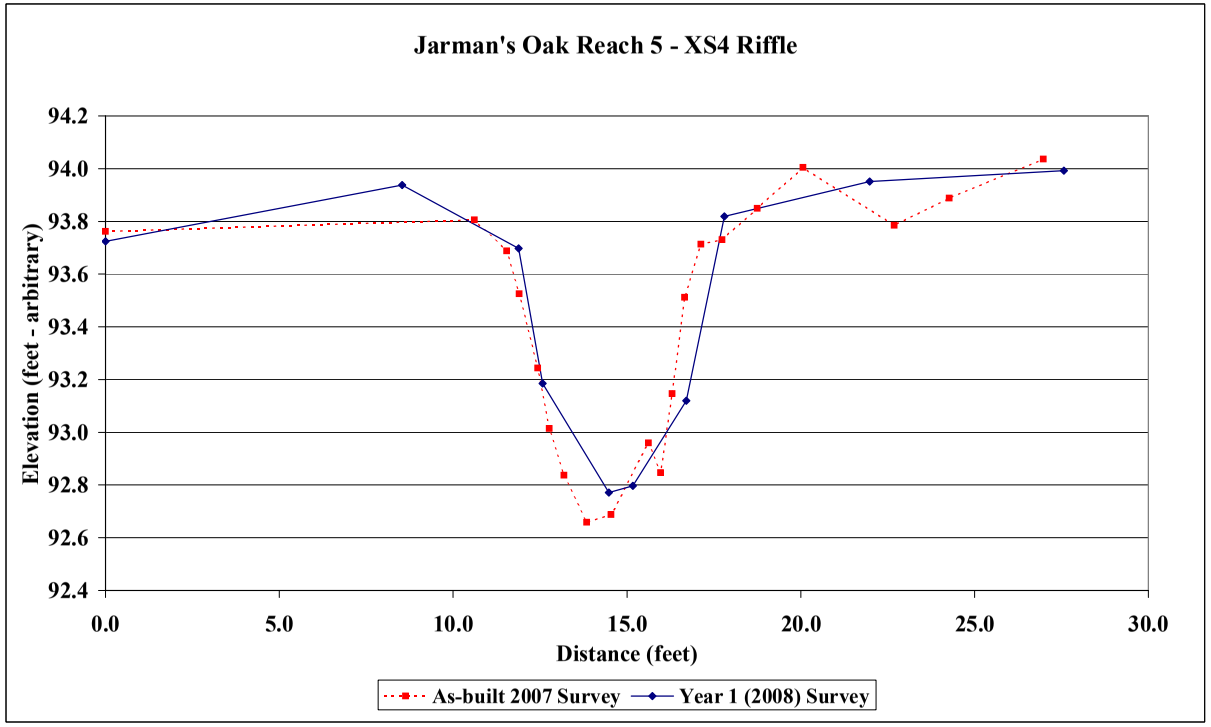
As-built 2007 Survey		2008 2008 Survey		2009 2009 Survey		2010 2010 Survey	
Station	**Elevation**	**Station**	**Elevation**	**Station**	**Elevation**	**Station**	**Elevation**
0.0	94.2	0.0	94.2				
5.1	93.9	6.4	93.7				
8.3	93.8	9.9	93.9				
9.3	94.1	12.8	92.9				
10.4	93.8	14.1	92.4				
11.6	93.3	15.9	91.9				
12.8	92.8	16.3	92.1				
13.8	92.4	18.2	92.5				
14.7	92.0	19.5	93.3				
15.3	91.9	22.0	93.8				
16.3	92.0	27.5	93.8				
17.2	92.3	31.6	93.9				
18.0	92.6						
18.8	92.9						
19.3	93.2						
20.1	93.3						
20.9	93.6						
22.0	93.8						
23.5	93.8						
27.5	93.9						
31.7	94.0						



	As-built	2008	2009	2010
Area	11.5	10.6		
Width	11.5	11.8		
Mean Depth	1.0	0.9		
Max Depth	1.9	1.8		
W/D Ratio	N/A	N/A		

Project Name	Jarman's Oak
Cross Section	R5-XS4
Feature	Riffle
Date	7/7/08
Crew	Adasme, Jeffers

As-built 2007 Survey		2008 2008 Survey		2009 2009 Survey		2010 2010 Survey	
Station	**Elevation**	**Station**	**Elevation**	**Station**	**Elevation**	**Station**	**Elevation**
0.0	93.8	0.0	93.7				
10.6	93.8	8.5	93.9				
11.5	93.7	11.9	93.7				
11.9	93.5	12.6	93.2				
12.4	93.2	14.5	92.8				
12.8	93.0	15.2	92.8				
13.2	92.8	16.7	93.1				
13.8	92.7	17.8	93.8				
14.5	92.7	22.0	94.0				
15.6	93.0	27.6	94.0				
16.0	92.8						
16.3	93.1						
16.7	93.5						
17.1	93.7						
17.7	93.7						
18.8	93.8						
20.1	94.0						
22.7	93.8						
24.3	93.9						
27.0	94.0						



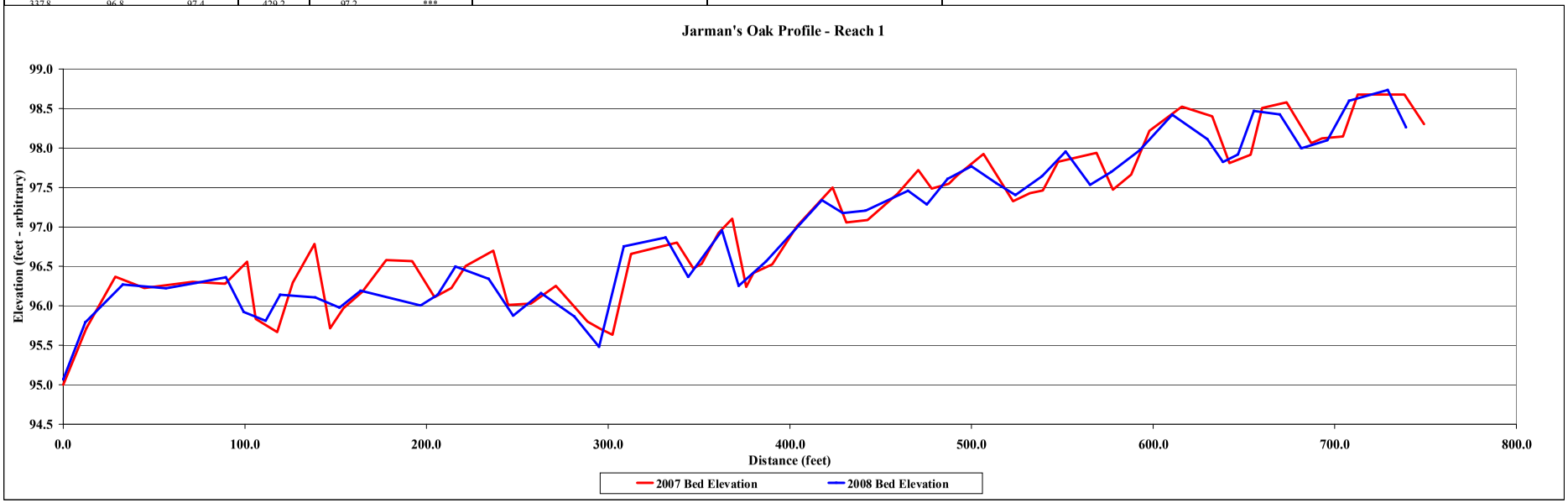
	As-built	2008	2009	2010
Area	3.7	3.6		
Width	5.6	5.8		
Mean Depth	0.7	0.6		
Max Depth	1.1	0.9		
W/D Ratio	8.3	9.2		

Project Name	Jarman's Oak
Reach	1
Feature	Profile
Date	6/23/08
Crew	Adasme, Jeffers

As-built 2007 Survey			2008 2008 Survey			2009 2009 Survey			2010 2010 Survey		
Station	**Bed Elevation**	**Water Elevation**	**Station**	**Bed Elevation**	**Water Elevation**	**Station**	**Bed Elevation**	**Water Elevation**	**Station**	**Bed Elevation**	**Water Elevation**
0.0	95.0	96.8	0.0	95.1	***						
12.7	95.7	96.8	12.1	95.8	***						
28.6	96.4	96.8	32.8	96.3	***						
44.7	96.2	96.8	56.6	96.2	***						
71.3	96.3	96.8	73.2	96.3	***						
89.2	96.3	96.8	89.5	96.4	***						
101.2	96.6	96.8	99.3	95.9	***						
105.9	95.8	96.9	111.4	95.8	***						
117.7	95.7	96.9	119.5	96.1	***						
126.4	96.3	96.9	138.8	96.1	***						
138.3	96.8	97.0	152.2	96.0	***						
146.9	95.7	97.0	163.8	96.2	***						
154.2	96.0	97.0	196.6	96.0	***						
164.6	96.2	97.0	206.2	96.1	***						
177.7	96.6	97.0	215.9	96.5	***						
192.1	96.6	97.1	234.3	96.3	***						
204.3	96.1	97.1	247.8	95.9	***						
213.8	96.2	97.1	263.1	96.2	***						
221.6	96.5	97.1	281.4	95.9	***						
236.8	96.7	97.2	295.1	95.5	***						
244.9	96.0	97.2	308.6	96.8	***						
257.5	96.0	97.2	331.7	96.9	***						
271.2	96.3	97.2	344.1	96.4	***						
288.6	95.8	97.2	362.7	97.0	***						
295.5	95.7	97.2	371.9	96.3	***						
302.4	95.6	97.2	386.9	96.6	***						
312.6	96.7	97.2	417.7	97.3	***						
337.8	96.8	97.4	429.2	97.2	***						

	As-built	2008	2009	2010
Avg. Water Surface Slope	0.0031	NA		
Avg. Riffle Slope	0.0093	NA		
Avg. Pool Slope	0.0006	NA		
Avg. Run Slope	0.0021	NA		
Avg. Glide Slope	0.0013	NA		

*** Insufficent water in stream to determine

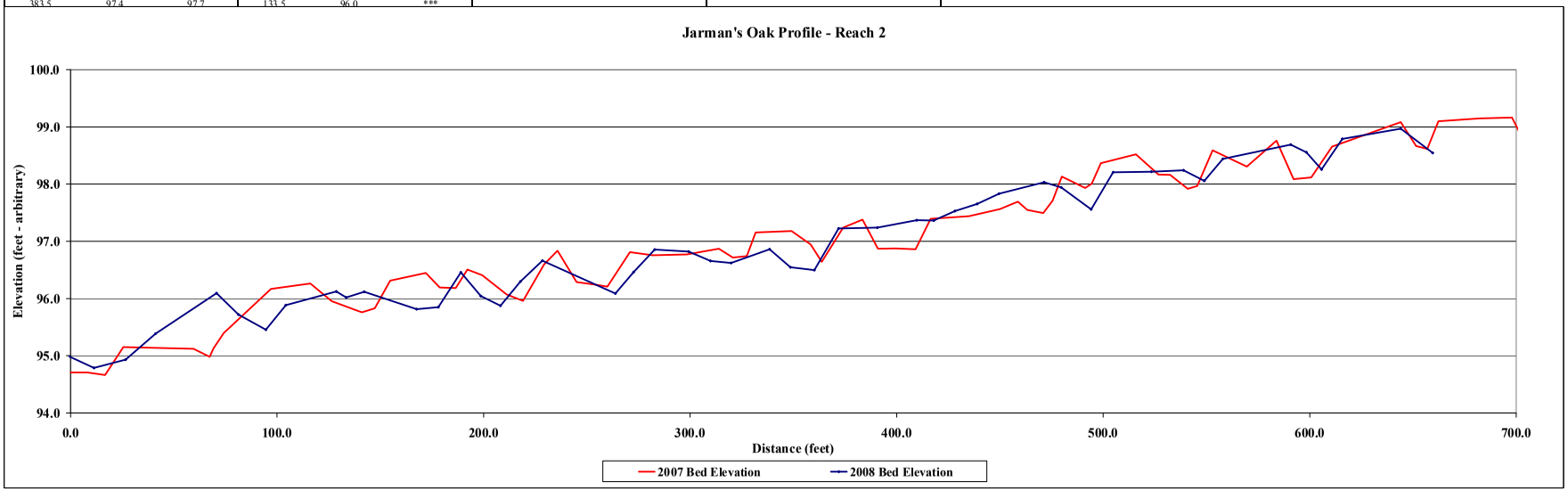


Project Name	Jarman's Oak
Reach	2
Feature	Profile
Date	6/23/08
Crew	Adasme, Jeffers

Station	As-built 2007 Survey Bed Elevation	Water Elevation	Station	2008 2008 Survey Bed Elevation	Water Elevation	Station	2009 2009 Survey Bed Elevation	Water Elevation	Station	2010 2010 Survey Bed Elevation	Water Elevation
0.0	94.7	95.5	659.5	98.5	***						
8.1	94.7	95.4	644.1	99.0	***						
16.7	94.7	95.5	615.8	98.8	***						
25.6	95.1	95.5	605.8	98.3	***						
59.5	95.1	95.8	598.4	98.6	***						
67.3	95.0	95.7	590.8	98.7	***						
69.1	95.1	95.8	558.0	98.4	***						
74.2	95.4	95.8	549.0	98.1	***						
97.1	96.2	96.4	539.0	98.2	***						
116.1	96.3	96.6	523.3	98.2	***						
126.5	96.0	96.6	504.8	98.2	***						
138.8	95.8	96.7	494.1	97.6	***						
141.1	95.8	96.7	479.7	97.9	***						
147.4	95.8	96.7	471.4	98.0	***						
154.7	96.3	96.7	449.6	97.8	***						
172.0	96.4	96.8	439.0	97.7	***						
178.7	96.2	96.8	428.1	97.5	***						
186.4	96.2	96.8	418.0	97.4	***						
192.1	96.5	96.8	409.7	97.4	***						
199.4	96.4	96.9	390.6	97.2	***						
211.1	96.1	96.9	371.9	97.2	***						
219.1	96.0	96.9	360.1	96.5	***						
229.3	96.6	96.9	348.6	96.5	***						
235.8	96.8	97.2	338.5	96.9	***						
245.1	96.3	97.2	319.8	96.6	***						
255.0	96.2	97.2	309.9	96.7	***						
259.9	96.2	97.2	299.2	96.8	***						
270.8	96.8	97.2	282.8	96.9	***						
281.9	96.8	97.3	272.6	96.5	***						
298.5	96.8	97.4	263.8	96.1	***						
313.8	96.9	97.4	228.5	96.7	***						
320.7	96.7	97.4	217.9	96.3	***						
327.4	96.7	97.4	208.2	95.9	***						
331.7	97.2	97.4	198.6	96.0	***						
349.1	97.2	97.5	189.0	96.5	***						
358.4	96.9	97.6	178.0	95.8	***						
363.8	96.6	97.6	167.5	95.8	***						
374.1	97.2	97.6	142.2	96.1	***						
383.5	97.4	97.7	133.5	96.0	***						

	As-built	2008	2009	2010
Avg. Water Surface Slope	0.0057	***		
Avg. Riffle Slope	0.0143	***		
Avg. Pool Slope	0.0020	***		
Avg. Run Slope	0.0047	***		
Avg. Glide Slope	0.0023	***		

*** Insufficent water in stream to determine

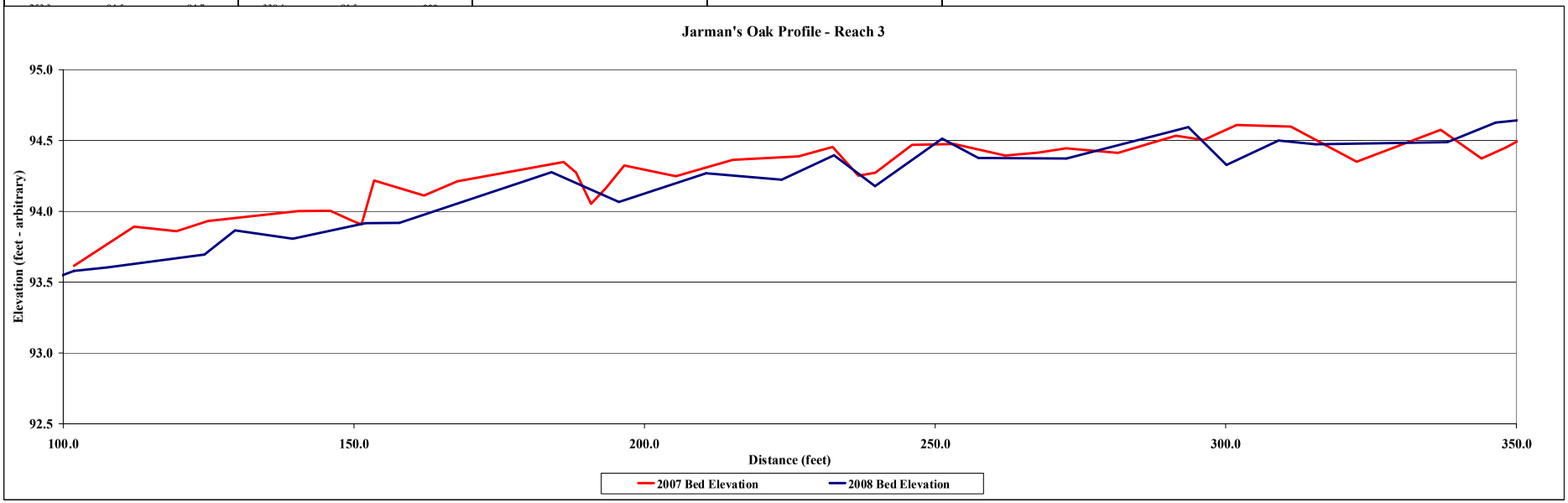


Project Name	Jarman's Oak
Reach	3
Feature	Profile
Date	6/24/08
Crew	Adasme, Jeffers

As-built 2007 Survey			2008 2008 Survey			2009 2009 Survey			2010 2010 Survey		
Station	**Bed Elevation**	**Water Elevation**	**Station**	**Bed Elevation**	**Water Elevation**	**Station**	**Bed Elevation**	**Water Elevation**	**Station**	**Bed Elevation**	**Water Elevation**
101.9	93.6	94.5	720.9	94.8	***						
112.2	93.9	94.5	717.3	94.5	***						
119.5	93.9	94.5	693.3	93.4	***						
124.9	93.9	94.5	680.1	93.1	***						
140.5	94.0	94.5	664.1	93.6	***						
146.0	94.0	94.5	657.9	93.9	***						
149.4	93.9	94.5	610.9	94.4	***						
151.3	93.9	94.5	591.5	94.3	***						
153.5	94.2	94.5	587.8	94.5	***						
162.1	94.1	94.5	554.1	94.3	***						
167.8	94.2	94.5	533.0	94.3	***						
186.1	94.3	94.6	524.2	94.3	***						
188.2	94.3	94.6	510.4	94.5	***						
190.8	94.1	94.6	499.6	94.4	***						
193.4	94.2	94.6	469.9	94.4	***						
196.5	94.3	94.6	460.3	94.3	***						
205.4	94.2	94.6	428.2	94.3	***						
215.2	94.4	94.6	419.0	94.4	***						
226.5	94.4	94.7	389.6	94.3	***						
232.4	94.5	94.7	379.6	94.3	***						
236.8	94.3	94.7	369.2	94.4	***						
239.7	94.3	94.7	359.2	94.7	***						
246.0	94.5	94.7	346.4	94.6	***						

	As-built	2008	2009	2010
Avg. Water Surface Slope	0.0015	***		
Avg. Riffle Slope	0.0023	***		
Avg. Pool Slope	0.0000	***		
Avg. Run Slope	0.0045	***		
Avg. Glide Slope	0.0037	***		

*** Insufficent water in stream to determine

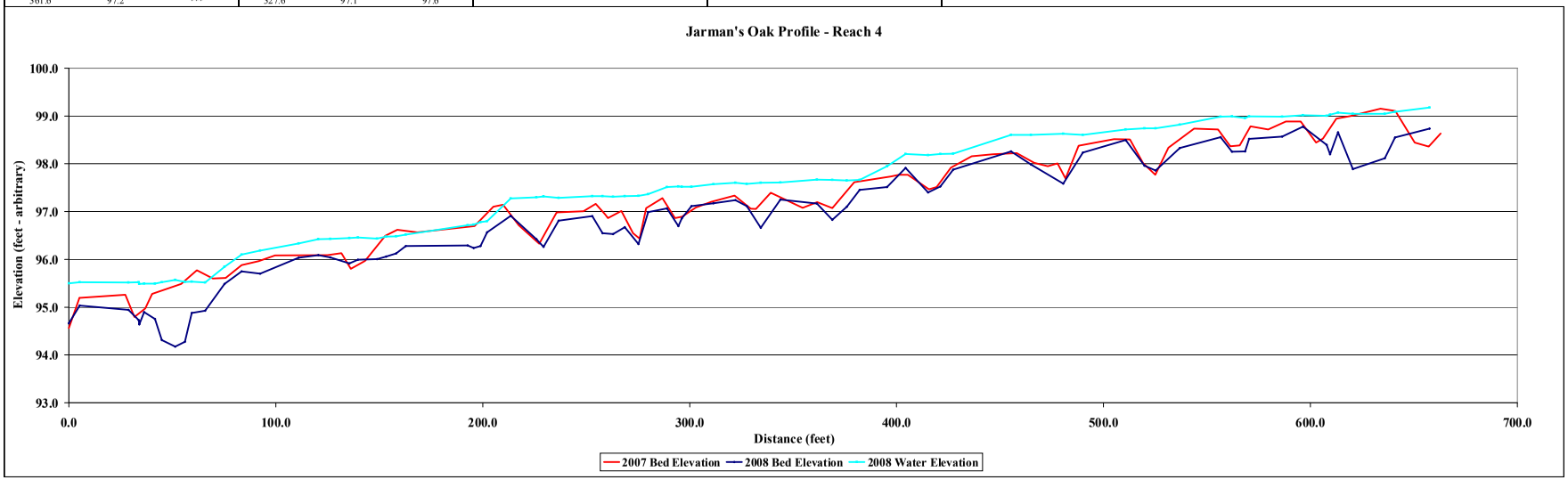


Project Name	Jarman's Oak
Reach	4
Feature	Profile
Date	6/24/08
Crew	Adasme, Jeffers

As-built 2007 Survey			2008 2008 Survey			2009 2009 Survey			2010 2010 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	***	0.0	94.7	95.5						
5.1	95.2	***	5.3	95.0	95.5						
27.3	95.3	***	28.7	94.9	95.5						
31.7	94.8	***	33.8	94.7	95.5						
37.0	95.0	***	34.1	94.6	95.5						
40.2	95.3	***	36.4	94.9	95.5						
54.2	95.5	***	41.6	94.8	95.5						
61.9	95.8	***	44.9	94.3	95.5						
69.6	95.6	***	51.4	94.2	95.6						
75.8	95.6	***	56.0	94.3	95.5						
83.5	95.9	***	59.4	94.9	95.5						
91.8	96.0	***	65.8	94.9	95.5						
99.6	96.1	***	75.2	95.5	95.8						
125.0	96.1	***	83.5	95.7	96.1						
131.7	96.1	***	92.4	95.7	96.2						
136.3	95.8	***	111.1	96.0	96.3						
143.2	96.0	***	120.5	96.1	96.4						
153.0	96.5	***	126.4	96.0	96.4						
158.8	96.6	***	135.6	95.9	96.4						
168.3	96.6	***	139.8	96.0	96.5						
196.0	96.7	***	148.9	96.0	96.4						
205.1	97.1	***	153.4	96.1	96.5						
209.9	97.1	***	158.2	96.1	96.5						
217.3	96.7	***	162.9	96.3	96.5						
227.4	96.3	***	192.8	96.3	96.7						
235.7	97.0	***	195.6	96.2	96.7						
248.6	97.0	***	198.9	96.3	96.8						
254.6	97.2	***	202.2	96.6	96.8						
259.1	96.9	***	213.6	96.9	97.3						
260.6	96.9	***	225.9	96.4	97.3						
267.0	97.0	***	229.3	96.3	97.3						
272.7	96.5	***	236.7	96.8	97.3						
275.8	96.4	***	253.0	96.9	97.3						
279.0	97.1	***	257.9	96.5	97.3						
286.8	97.3	***	263.0	96.5	97.3						
292.9	96.9	***	268.7	96.7	97.3						
296.3	96.9	***	275.3	96.3	97.3						
302.9	97.1	***	279.9	97.0	97.4						
310.5	97.2	***	289.1	97.1	97.5						
321.7	97.3	***	294.5	96.7	97.5						
329.6	97.1	***	296.3	96.9	97.5						
332.0	97.1	***	300.9	97.1	97.5						
339.2	97.4	***	311.5	97.2	97.6						
354.6	97.1	***	322.1	97.2	97.6						
361.6	97.2	***	327.6	97.1	97.6						

	As-built	2008	2009	2010
Avg. Water Surface Slope	***	0.0056		
Avg. Riffle Slope	***	0.0094		
Avg. Pool Slope	***	0.0028		
Avg. Run Slope	***	0.0050		
Avg. Glide Slope	***	0.0021		

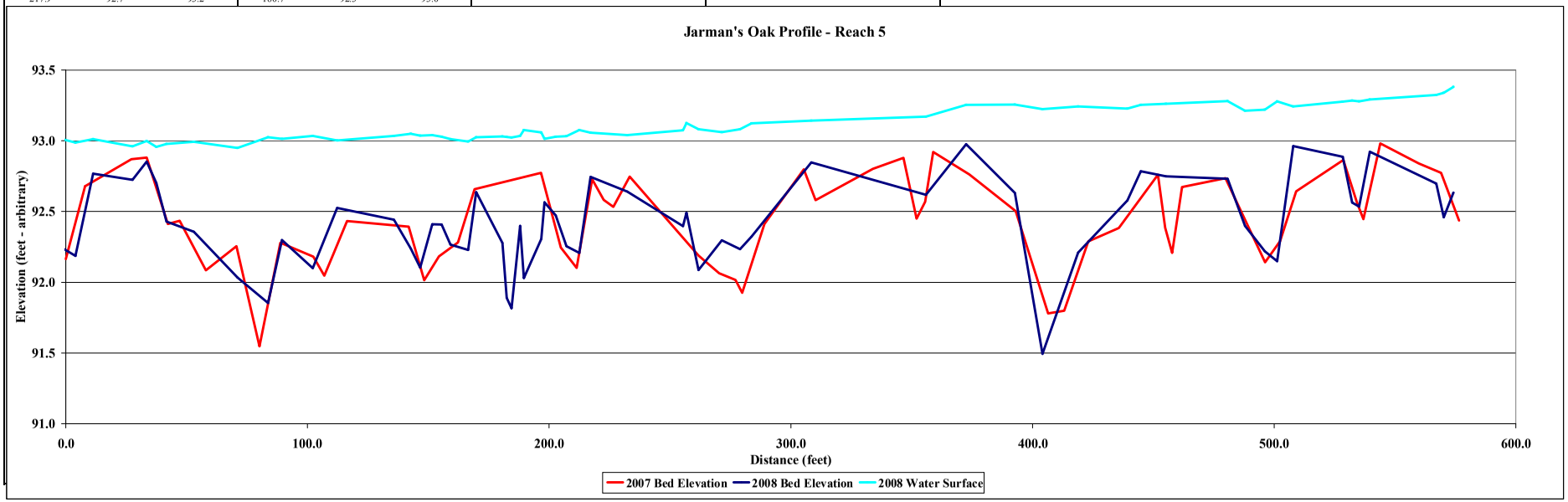
*** Insufficent water in stream to determine



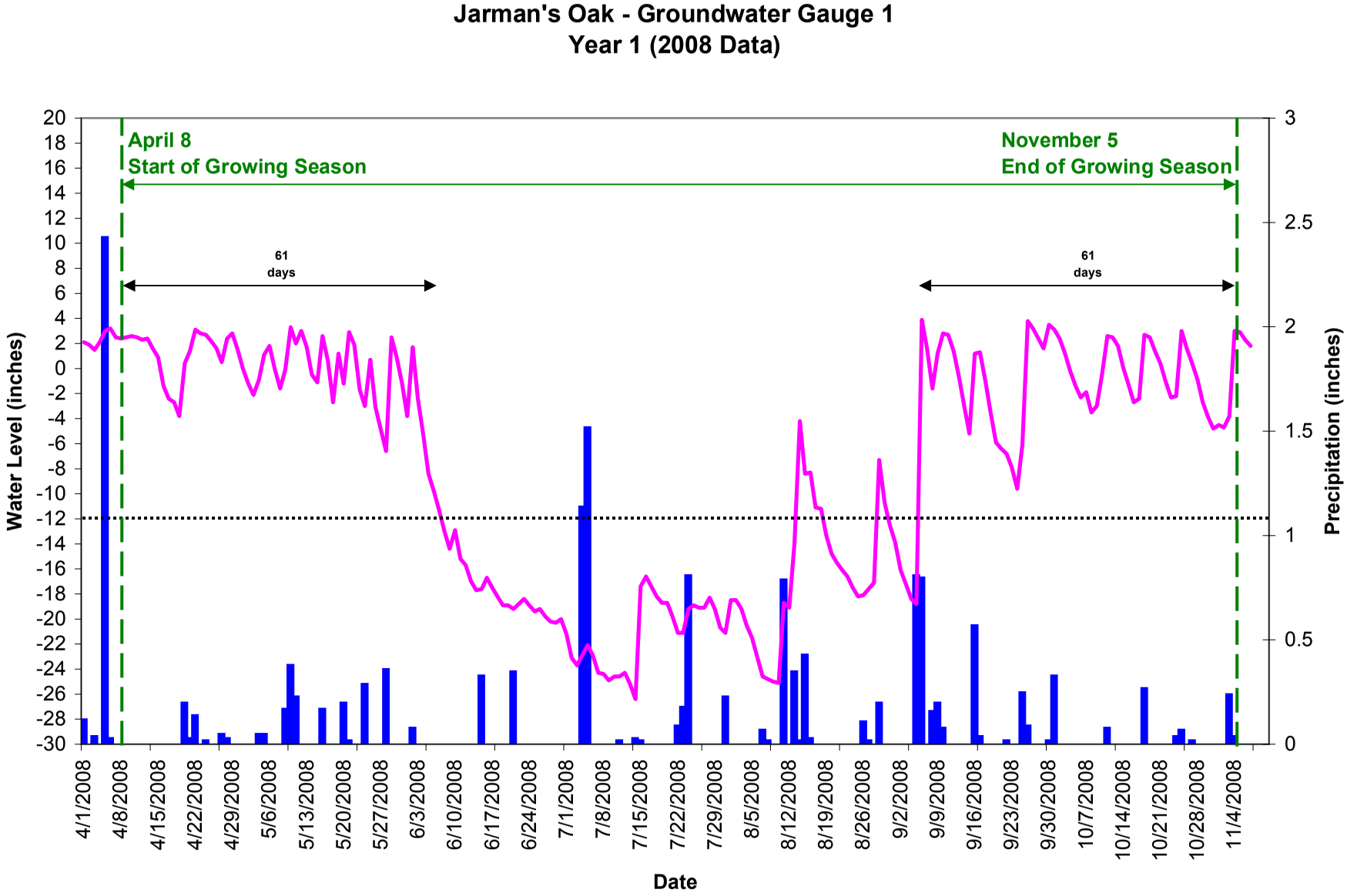
Project Name	Jarman's Oak
Reach	5
Feature	Profile
Date	6/24/08
Crew	Adasme, Jeffers

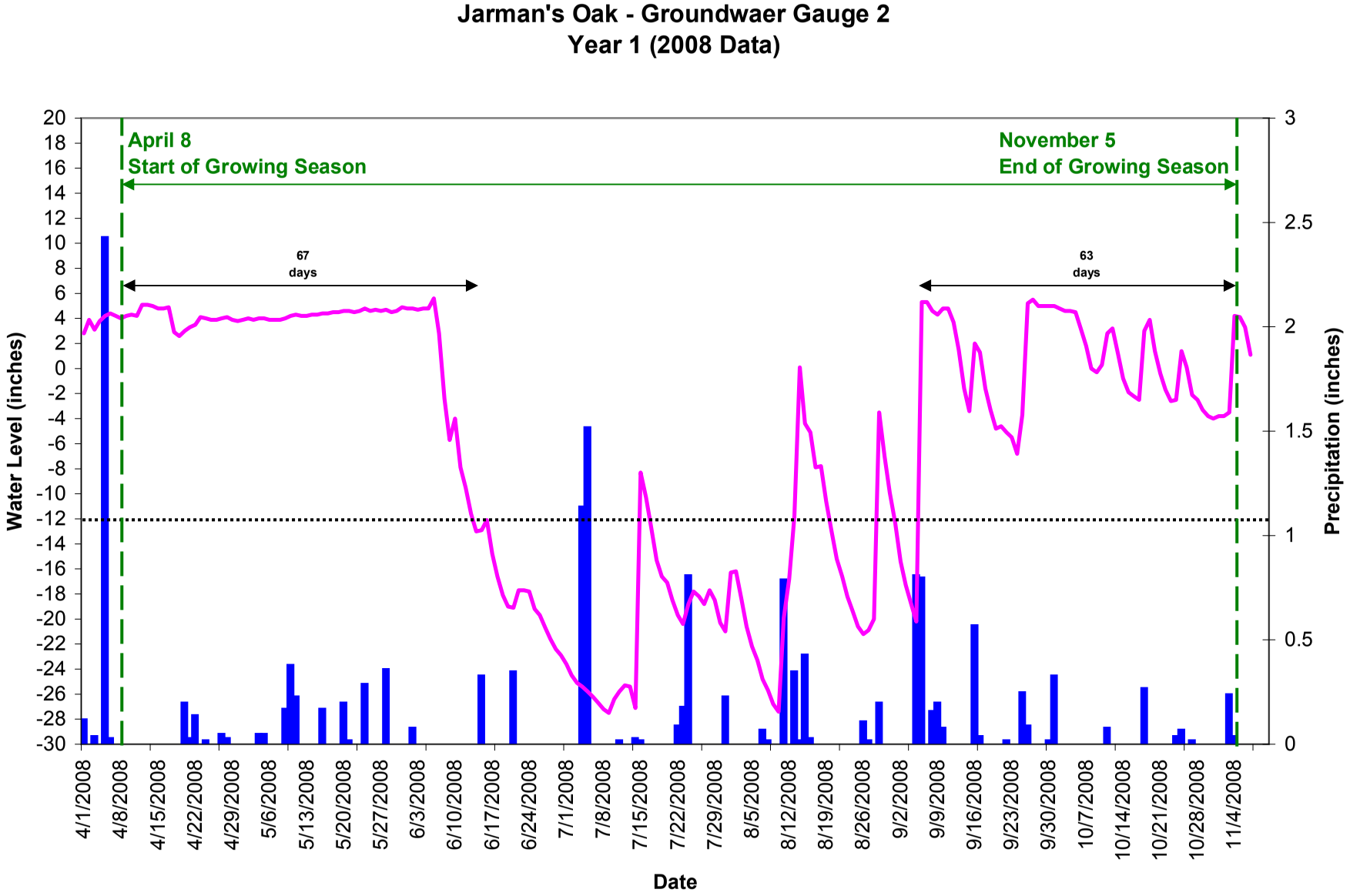
As-built 2007 Survey			2008 2008 Survey			2009 2009 Survey			2010 2010 Survey		
Station	**Bed Elevation**	**Water Elevation**	**Station**	**Bed Elevation**	**Water Elevation**	**Station**	**Bed Elevation**	**Water Elevation**	**Station**	**Bed Elevation**	**Water Elevation**
0.0	92.2	93.1	-9.2	92.4	93.0						
7.9	92.7	93.1	-4.5	92.3	93.0						
27.2	92.9	93.1	3.9	92.2	93.0						
33.5	92.9	93.2	11.3	92.8	93.0						
42.3	92.4	93.2	27.6	92.7	93.0						
47.1	92.4	93.2	33.5	92.9	93.0						
57.9	92.1	93.2	37.5	92.7	93.0						
70.7	92.3	93.2	41.7	92.4	93.0						
80.1	91.5	93.2	53.0	92.4	93.0						
88.7	92.3	93.2	71.1	92.0	92.9						
102.4	92.2	93.2	83.7	91.9	93.0						
107.0	92.0	93.2	89.4	92.3	93.0						
110.8	92.2	93.2	102.2	92.1	93.0						
116.4	92.4	93.2	112.3	92.5	93.0						
141.8	92.4	93.2	135.8	92.4	93.0						
148.3	92.0	93.2	142.7	92.2	93.1						
154.4	92.2	93.2	146.7	92.1	93.0						
162.3	92.3	93.2	151.6	92.4	93.0						
169.2	92.7	93.2	155.5	92.4	93.0						
196.7	92.8	93.2	159.1	92.3	93.0						
204.9	92.2	93.2	166.5	92.2	93.0						
211.4	92.1	93.2	169.8	92.6	93.0						
217.9	92.7	93.2	180.7	92.3	93.0						

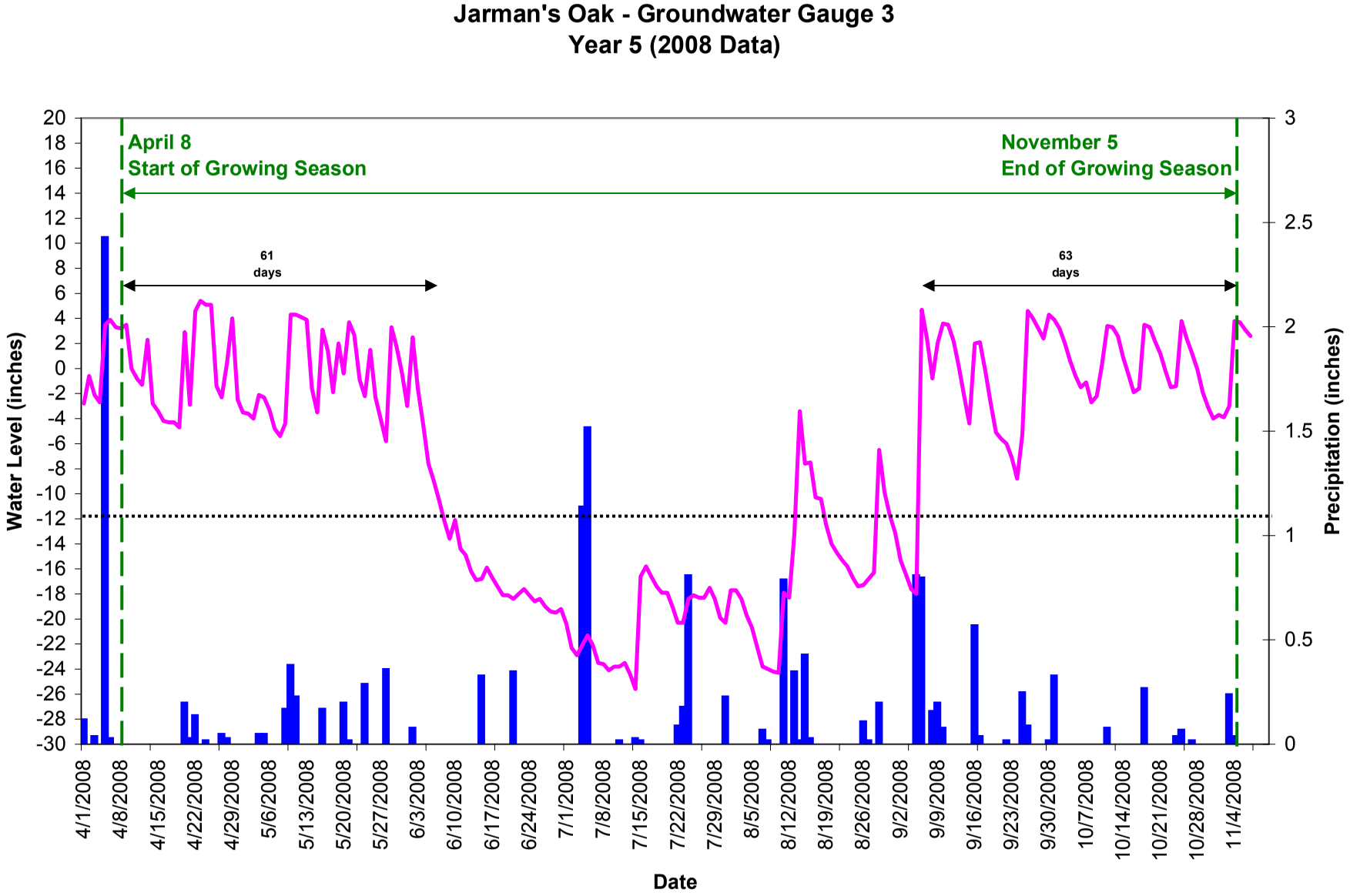
	As-built	2008	2009	2010
Avg. Water Surface Slope	0.0004	0.0006		
Avg. Riffle Slope	0.0013	0.0011		
Avg. Pool Slope	0.0014	0.0013		
Avg. Run Slope	0.0013	0.0030		
Avg. Glide Slope	0.0004	0.0039		



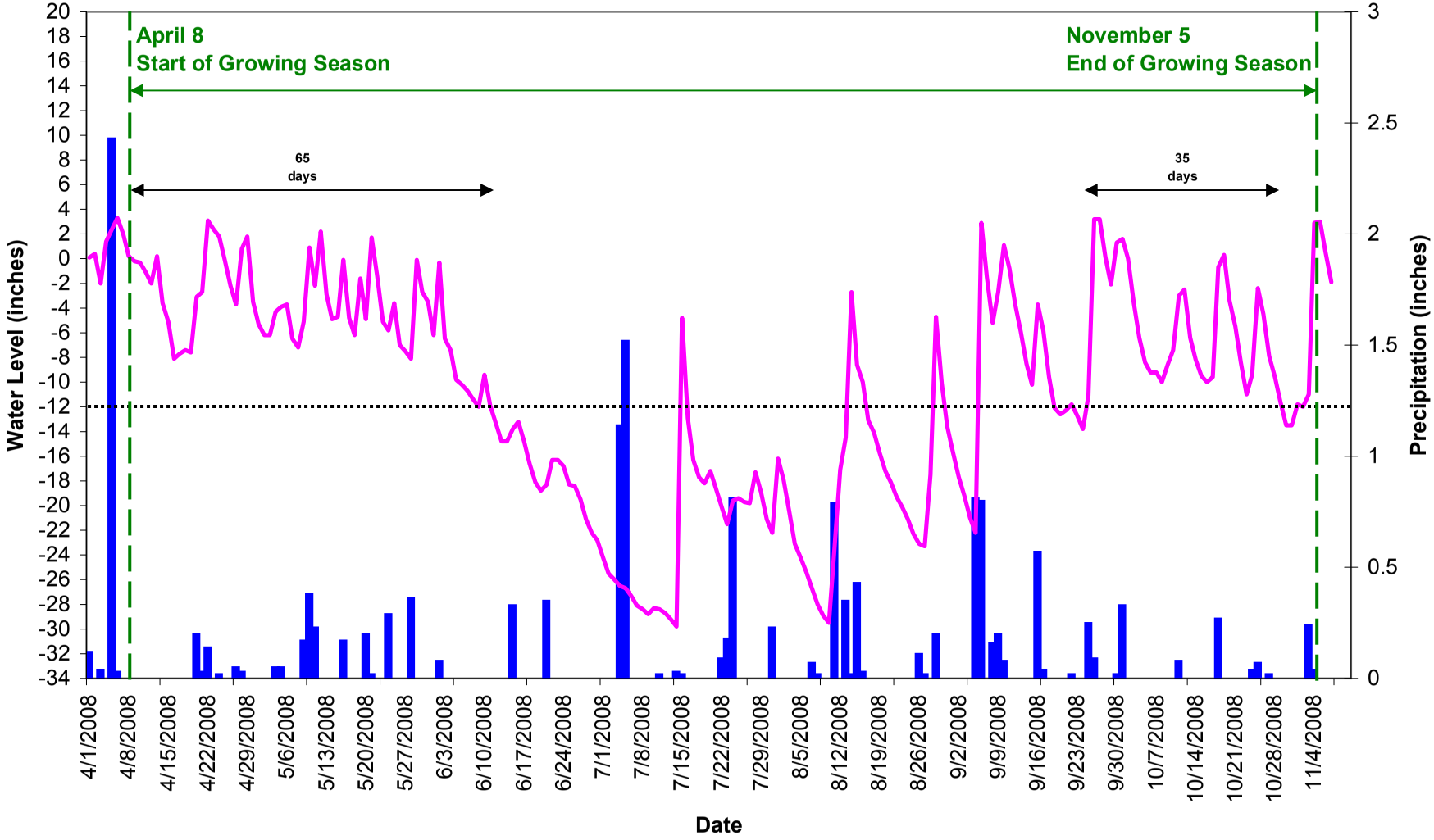
APPENDIX C
HYDROLOGY DATA
2008 Groundwater Gauge Graphs


Jarman's Oak - Groundwater Gauge 1
Year 1 (2008 Data)
April 8
Start of Growing Season
November 5
End of Growing Season
61
days
61
days
Water Level (inches)
Precipitation (inches)
Date
20
18
16
14
12
10
8
6
4
2
0
-2
-4
-6
-8
-10
-12
-14
-16
-18
-20
-22
-24
-26
-28
-30
3
2.5
2
1.5
1
0.5
0
4/1/2008
4/8/2008
4/15/2008
4/22/2008
4/29/2008
5/6/2008
5/13/2008
5/20/2008
5/27/2008
6/3/2008
6/10/2008
6/17/2008
6/24/2008
7/1/2008
7/8/2008
7/15/2008
7/22/2008
7/29/2008
8/5/2008
8/12/2008
8/19/2008
8/26/2008
9/2/2008
9/9/2008
9/16/2008
9/23/2008
9/30/2008
10/7/2008
10/14/2008
10/21/2008
10/28/2008
11/4/2008

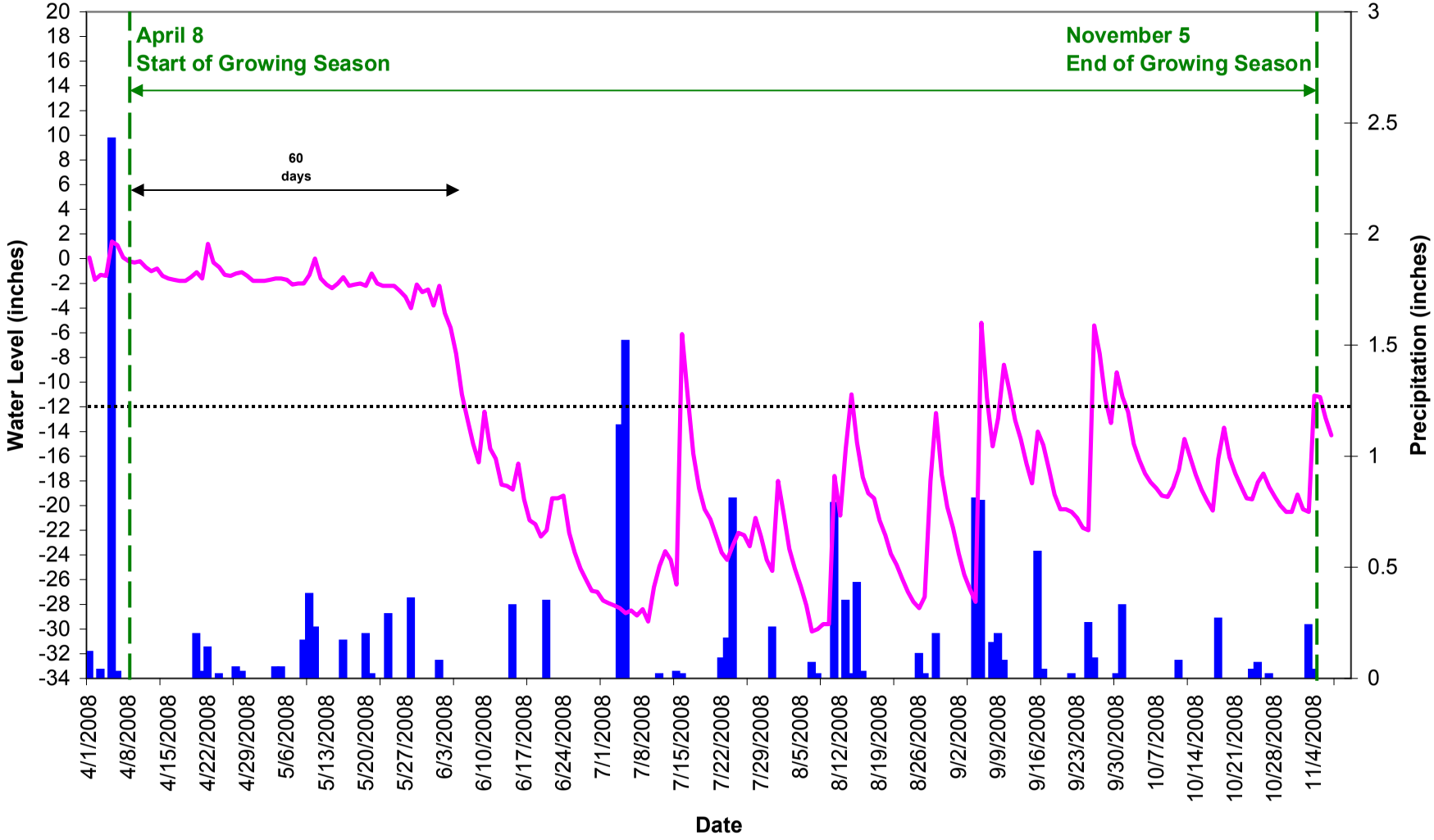

Jarman's Oak - Groundwaer Gauge 2
Year 1 (2008 Data)
April 8
Start of Growing Season
November 5
End of Growing Season
67
days
63
days
Water Level (inches)
Precipitation (inches)
Date
20
18
16
14
12
10
8
6
4
2
0
-2
-4
-6
-8
-10
-12
-14
-16
-18
-20
-22
-24
-26
-28
-30
3
2.5
2
1.5
1
0.5
0
4/1/2008
4/8/2008
4/15/2008
4/22/2008
4/29/2008
5/6/2008
5/13/2008
5/20/2008
5/27/2008
6/3/2008
6/10/2008
6/17/2008
6/24/2008
7/1/2008
7/8/2008
7/15/2008
7/22/2008
7/29/2008
8/5/2008
8/12/2008
8/19/2008
8/26/2008
9/2/2008
9/9/2008
9/16/2008
9/23/2008
9/30/2008
10/7/2008
10/14/2008
10/21/2008
10/28/2008
11/4/2008


Jarman's Oak - Groundwater Gauge 3
Year 5 (2008 Data)
April 8
Start of Growing Season
November 5
End of Growing Season
61
days
63
days
Water Level (inches)
Precipitation (inches)
Date
20
18
16
14
12
10
8
6
4
2
0
-2
-4
-6
-8
-10
-12
-14
-16
-18
-20
-22
-24
-26
-28
-30
3
2.5
2
1.5
1
0.5
0
4/1/2008
4/8/2008
4/15/2008
4/22/2008
4/29/2008
5/6/2008
5/13/2008
5/20/2008
5/27/2008
6/3/2008
6/10/2008
6/17/2008
6/24/2008
7/1/2008
7/8/2008
7/15/2008
7/22/2008
7/29/2008
8/5/2008
8/12/2008
8/19/2008
8/26/2008
9/2/2008
9/9/2008
9/16/2008
9/23/2008
9/30/2008
10/7/2008
10/14/2008
10/21/2008
10/28/2008
11/4/2008

Jarman's Oak - Groundwater Gauge 4
Year 1 (2008 Data)



Jarman's Oak - Groundwater Reference Gauge
Year 1 (2008 Data)

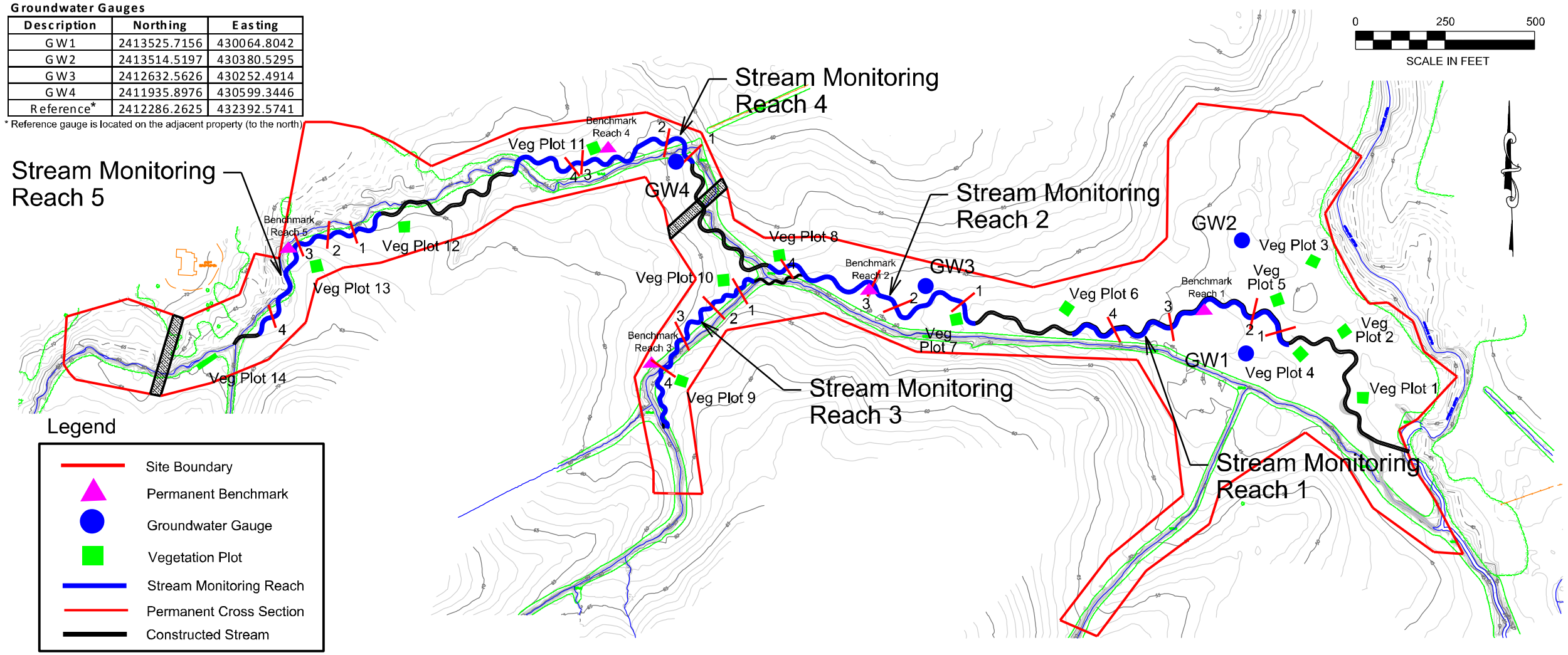


APPENDIX D
MONITORING PLAN VIEW

Groundwater Gauges

Description	Northing	Easting
GW1	2413525.7156	430064.8042
GW2	2413514.5197	430380.5295
GW3	2412632.5626	430252.4914
GW4	2411935.8976	430599.3446
Reference*	2412286.2625	432392.5741

* Reference gauge is located on the adjacent property (to the north)



Legend

- Site Boundary
- Permanent Benchmark
- Groundwater Gauge
- Vegetation Plot
- Stream Monitoring Reach
- Permanent Cross Section
- Constructed Stream

Stream Reaches/Cross-sections

Description	Northing	Easting
start reach 1	430093.7267	2413647.7787
R1-XS1R	430126.2162	2413607.3028
R1-XS1R	430135.3266	2413638.9224
R1-XS2P	430157.4338	2413541.9976
R1-XS2P	430190.2373	2413549.2122
R1-XS3P	430124.2744	2413319.9627
R1-XS3P	430158.4163	2413313.5504
R1-XS4R	430113.2513	2413164.1445
R1-XS4R	430148.2992	2413146.4336
end reach 1	430127.1266	2413044.5401
start reach 2	430152.2962	2412770.9984
R2-XS1P	430197.3952	2412722.0428
R2-XS1P	430217.2678	2412746.0071
R2-XS2R	430202.7034	2412565.4195
R2-XS2R	430191.2646	2412539.0389
R2-XS3P	430245.7953	2412478.9592
R2-XS3P	430273.7678	2412491.2251
R2-XS4R	430289.6992	2412252.3333
R2-XS4R	430313.8240	2412237.4801
end reach 2	430308.7049	2412193.9601
R3-XS1P	430234.4825	2412117.1620
R3-XS1P	430254.0574	2412104.9363
R3-XS2R	430185.7018	2412046.7879
R3-XS2R	430206.6997	2412027.2225
R3-XS3R	430111.1233	2411951.3344
R3-XS3R	430087.5783	2411965.1523
R3-XS4P	430013.9301	2411913.5511
R3-XS4P	430031.4856	2411889.6842
end reach 3	429859.3747	2411909.3746

Stream Reaches/Cross-sections

Description	Northing	Easting
start reach 4	430599.7354	2411988.3921
R4-XS1R	430602.2209	2411964.5521
R4-XS1R	430621.3637	2411984.1885
R4-XS2P	430634.8438	2411904.4977
R4-XS2P	430668.4012	2411911.3323
R4-XS3P	430609.6915	2411671.1280
R4-XS3P	430585.8661	2411670.3979
R4-XS4R	430577.2425	2411653.0998
R4-XS4R	430597.4064	2411636.6176
end reach 4	430566.2762	2411479.8096
start reach 5	430450.8228	2411114.0086
R5-XS1R	430387.2783	2411038.3312
R5-XS1R	430413.2441	2411031.3049
R5-XS2P	430407.2693	2410964.3448
R5-XS2P	430378.9043	2410963.6319
R5-XS3P	430356.0676	2410887.7939
R5-XS3P	430379.9865	2410877.0846
R5-XS4R	430177.9257	2410803.4790
R5-XS4R	430154.0829	2410812.0633
end reach 5	430115.9333	2410774.5277

Vegetation Plots

Description	Northing	Easting
veg plot 1	429957.0794	2413835.1602
veg plot 1	429925.4763	2413836.7323
veg plot 1	429956.9765	2413869.9535
veg plot 1	429922.9545	2413866.6703
veg plot 2	430123.9211	2413822.5320
veg plot 2	430103.6517	2413793.8502
veg plot 2	430129.1503	2413779.4344
veg plot 2	430149.1822	2413803.8525
veg plot 3	430300.3929	2413722.0653
veg plot 3	430341.7098	2413707.7886
veg plot 3	430328.8858	2413735.3831
veg plot 3	430315.0431	2413691.2075
veg plot 4	430063.8761	2413654.7930
veg plot 4	430086.7946	2413678.7938
veg plot 4	430062.5237	2413701.6484
veg plot 4	430038.8176	2413677.6039
veg plot 5	430192.6736	2413603.3470
veg plot 5	430223.2083	2413592.5482
veg plot 5	430236.0562	2413623.1145
veg plot 5	430203.4437	2413634.5804
veg plot 6	430194.5689	2413048.6970
veg plot 6	430213.1956	2413022.4641
veg plot 6	430185.0407	2413002.9632
veg plot 6	430166.5270	2413029.6368
veg plot 7	430146.6218	2412737.6983
veg plot 7	430179.5155	2412730.0134
veg plot 7	430171.6394	2412698.9100
veg plot 7	430140.5384	2412705.3911

Vegetation Plots

Description	Northing	Easting
veg plot 8	430319.8816	2412210.3114
veg plot 8	430324.4388	2412242.5557
veg plot 8	430351.0120	2412205.8185
veg plot 8	430356.6507	2412236.9981
veg plot 9	429978.3189	2411929.6730
veg plot 9	430007.6750	2411940.8159
veg plot 9	429995.5651	2411971.5294
veg plot 9	429967.5953	2411962.7811
veg plot 10	430284.2654	2412049.8633
veg plot 10	430287.1348	2412083.7488
veg plot 10	430253.8616	2412085.4613
veg plot 10	430250.6449	2412053.6031
veg plot 11	430627.3287	2411729.0074
veg plot 11	430658.0475	2411714.6956
veg plot 11	430646.6545	2411685.1754
veg plot 11	430616.1621	2411697.3212
veg plot 12	430431.7267	2411159.6299
veg plot 12	430401.3307	2411163.3512
veg plot 12	430402.6181	2411193.1361
veg plot 12	430434.6749	2411193.7574
veg plot 13	430328.6356	2410943.9349
veg plot 13	430294.8668	2410953.1250
veg plot 13	430288.7899	2410920.2712
veg plot 13	430321.5799	2410913.0535
veg plot 14	430054.2795	2410657.9532
veg plot 14	430066.5505	2410650.3076
veg plot 14	430031.5062	2410595.6140
veg plot 14	430017.4452	2410604.7982

RESTORATION SYSTEMS, LLC

NOTES/REVISIONS

Project:

Jarmans Oak Restoration Site

Onslow County North Carolina

Title:

MONITORING PLAN

Scale: 1 IN = 335 FT

Date: NOV 2008

Project No.: 06-018

FIGURE NO.

D-1