Gray Farm Stream Restoration Monitoring Report – Year Five

Contract # D05016-2
EEP Project # 92219

Iredell County, North Carolina

December 2010

Cataloging Unit – Catawba Basin 03050101

Prepared For:

Ecosystem Enhancement PROGRAM

1652 Mail Service Center
Raleigh, NC 27699-1652

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I. Executive Summary / Project Abstract

The Gray Farm Stream Restoration project consists of two separate stream reaches (Reach 1 and Reach 2) along unnamed tributaries of Buffalo Shoals Creek, a tributary of the Catawba River (Cataloging Unit 03050101). The site is located approximately 10 miles due west of the City of Statesville in western Iredell County, NC. This restoration was contracted by Restoration Systems LLC (Contract # D05016-2) as a full-delivery project for the North Carolina Ecosystem Enhancement Program (NCEEP). This report summarizes the monitoring efforts for Year Five (2010) of the Gray Farm Stream Restoration Project.

Restoration construction of Reach 2 began in early March 2006 and was completed in mid-April 2006. Restoration construction of Reach 1 began in mid-April 2006 and was completed in early July 2006. Demobilization and minor contractor punch list items were completed shortly thereafter. Installation of monitoring devices and As-built surveys for both reaches were performed as construction progressed.

Year Five monitoring of the vegetated buffer was performed by Soil & Environmental Consultants, PA (S&EC) in the fall of 2010. Stem counts were performed within the established vegetation monitoring plots, resulting in an average live stem density of approximately 398 stems per acre.

Physical monitoring of the restored channels for Year Five was also performed by S&EC and consisted of the collection of cross-section and representative longitudinal profile data, in conjunction with visual stability assessment of the stream. This work was performed in the fall of 2010. Collected data was then compared with As-built, Year One, Year Two, Year Three, and Year Four Monitoring data.

Based on Year Five Monitoring results, the overall site has met the prescribed success criteria. Detailed analysis of the success of localized areas is discussed within.

The completion of Year Five monitoring marks the end of the prescribed monitoring period duration.

II. Project Background

The Gray Farm Stream Restoration project is located in the Catawba River Basin within Hydrologic Cataloging Unit 03050101. The site consists of two separate reaches (Reach 1 and Reach 2) along unnamed tributaries of Buffalo Shoals Creek, a tributary of the Catawba River. The site is located approximately 10 miles due west of the City of Statesville in western Iredell County, NC.

The restoration project objective was to restore the impaired streams to appropriately sized stream channels that were stable and self-maintaining, and would not aggrade or degrade over time. Restoration was accomplished with Rosgen-based natural channel design procedures and techniques. Reach 1 restoration was a combination of a Priority I (reconnection of the channel with its historic floodplain) restoration and a Priority II (construction of a new floodplain at a lower elevation) restoration. Reach 2 was a Priority I restoration. Restoring an appropriate sinuosity lengthened both channels, thereby lowering their bankfull slopes.

Restoration construction of Reach 2 began in early March 2006 and was completed in mid-April 2006. Restoration construction of Reach 1 began in mid-April 2006 and was completed in early July 2006. The buffers of both reaches of the restored stream channel were planted with native tree and shrub species and seeded with a native grass seed mix. During construction, site topography and grading allowed for the creation of vernal pools, oxbows, or pocket wetlands within the riparian zone along the restored stream reaches. Planting operations were performed in April 2006. Supplemental planting was performed in December of 2006.

Demobilization and minor contractor punch list items were completed shortly after the completion of construction. Installation of monitoring devices and As-built surveys for both reaches were performed as construction progressed.

1. Project Goals and Objectives

The goals of the Gray Farm Stream Restoration project are:

1) Improve local water quality within the restored channel reaches as well as the downstream watercourses through;

    a. The reduction of current channel and off site sediment loads by restoring appropriately sized channels with stable beds and banks.

    b. The reduction of nutrient loads (both soil enhancement practices and cattle) from adjacent agricultural fields with a restored riparian buffer.

    c. The reduction of water temperatures provided by shading of the channel from canopy species along with the resultant increase in oxygen content.

2) Improve local aquatic and terrestrial habitat and diversity within the restored channels and their vicinity through;

    a. The formation of varying bed form within the channels to provide for fish, amphibian, and benthic species.

b. The restoration of a suitable riparian buffer corridor which will provide both vertical and horizontal structure and connectivity with adjacent upland areas.

c. The restoration of understory and canopy species which will provide forage, cover, and nesting for a variety of mammals, reptiles, and birds.

3) Improve local watershed conditions through the restoration of two low order streams (one first order, one second order) and the placement of permanent conservation easements.

Through the restoration process the following objectives were accomplished:

1) Restore approximately 8,004 linear feet of appropriately sized stream channel that is stable and self-maintaining, and will not aggrade or degrade over time. Restoration was accomplished with Rosgen-based natural channel design procedures and techniques.

2) Develop restored channels with the appropriate morphological characteristics (cross-sectional dimension, pattern, and longitudinal profile) utilizing collected reference reach data as a guide. Allow for no net loss of overall channel length in the process.

3) Create and/or improve bed form diversity (riffles, runs, pools, and glides) and improve aquatic and benthic macroinvertebrate habitat.

4) Construct a floodplain (or local bankfull bench) that is accessible at the proposed bankfull channel elevation.

5) Ensure channel and stream bank stabilization by integrating in-stream structures and native bank vegetation.

6) Establish a native forested and herbaceous riverine buffer plant community within a minimum width of 50 feet from the edge of the restored channel. This new community will be established in conjunction with the eradication of any existing exotic and/or undesirable plant species.

7) Improve water quality within the subject channels and the downstream receiving waters.
8) Supplement the education and conservation efforts for natural resources in Iredell County as indicated in program goals for the local Soil & Water Conservation District and the NC Cooperative Extension Service.

2. Project Structure, Restoration Type, and Approach

The restoration project was intended to restore the impaired streams to appropriately sized stream channels that are stable and self-maintaining, and will not aggrade or degrade over time. Restoration was accomplished with Rosgen-based natural channel

design procedures and techniques. Restoring an appropriate sinuosity lengthened both channels, thereby lowering their bankfull slope. A total of 8,004 linear feet of stream channel was restored onsite (8,004 SMU's).

Reach 1

Reach 1 restoration was a combination of a Priority I restoration (reconnection of the channel with its historic floodplain) and a Priority II restoration (construction of a new floodplain at a lower elevation). Reach 1 consists of 5,813 linear feet (5,813 SMU's) of restored Type C4 channel. Approximately 800 linear feet of this length was previously inundated by an existing farm pond that was removed during the channel restoration. The pre-restoration length of this channel segment was approximately 4,340 linear feet.

One additional piped farm road crossing previously existed approximately 700 feet downstream of an existing dam and farm pond near the upper end of Reach 1. This piped crossing was removed and replaced with an at-grade in-stream crossing. Immediately downstream of the dam for a distance of approximately 1,000 feet, severe bank erosion, channel incision, and an over-widening of the stream channel had occurred. This degradation appeared in large part due to previous uncontrolled releases from the existing dam spillway.

The lower two thirds of the reach were characterized by overly steep and undercut banks. Significant localized erosion had occurred along this lower portion. Trees of large diameter lined the banks, many of which were undercut, suspended, or had collapsed into the stream. The channel had down cut and over widened in many locations along the reach allowing no access to its floodplain. The last 200 feet (approximately) of the pre-existing channel was not down cut due to a change in surrounding topography.

Reach 2

Reach 2 was a Priority I restoration. Reach 2 consists of 2,191 linear feet (2,191 SMU's) of restored Type B4 channel. A small impoundment previously existed near the lower end of the reach; however, it was drained and removed a number of years prior to the channel restoration. A piped farm road crossing existed at roughly the same location (the old dam embankment). This was (and remains) the only existing crossing along the reach. The pre-restoration length of this channel segment was approximately 1,600 linear feet.

Throughout Reach 2, severe bank erosion, channel incision, and an over-widening of the stream channel had occurred. This impairment appeared in large part due to previous uncontrolled grazing operations. The reach was characterized by overly steep, sloughing, and undercut banks.

Significant localized erosion had occurred along the entire reach. Trees of large diameter lined the banks, many of which were undercut, suspended, or collapsed into the stream. The channel had down cut and over widened in many places along the reach allowing no access to its floodplain.

3. Location and Setting

The Gray Farm Stream Restoration project is located in the Catawba River Basin, Cataloguing Unit 03050101. The site consists of two separate reaches (Reach 1 and Reach 2) along unnamed tributaries of Buffalo Shoals Creek, a tributary of the Catawba River. The site is located approximately 10 miles due west of the City of Statesville in western Iredell County, NC.

Reach 1 is located immediately north of Bolick Road (SR 1532). Reach 2 is located immediately west of the intersection of New Sterling Road (SR 1525) and Gray House Road. The watershed areas for Reaches 1 and 2 are estimated at approximately 0.91 square miles (582 acres) and 0.085 square miles (54 acres) respectively. See attached Figure 1.

4. Project History and Background

The following tables summarize the project history and background:

Exhibit Table I. Project Restoration Components
Gray Farm Stream Restoration Site/EEP Project # 92219

Project Segment or Reach ID	Existing Feet/Acres	Type	Approach	Footage or Acreage	Mitigation Ratio	Mitigation Units	Stationing	Comment
Reach I	3,000	R	PI	4,119	1:1	4,119	0+00 to 41+19	
Reach I	1,340	R	PII	1,694	1:1	1,694	41+19 to 58+13	
Reach II	1,600	R	PI	2,191	1:1	2,191	0+00 to 21+91	

Mitigation Unit Summations

Stream (lf)	Riparian Wetland (Ac)	Nonriparian Wetland (Ac)	Total Wetland (Ac)	Buffer (Ac)	Comment
8,004	N/A	N/A	N/A	18.38	

Exhibit Table II. Project Activity and Reporting History
Gray Farm Stream Restoration Site/EEP Project # 92219

Activity or Report	Data Collection Complete	Actual Completion or Delivery
Restoration Plan	Aug-05	Nov-05
Construction	Reach 1	Jul-06
	Reach 2	Apr-06
Temporary S&E mix applied to entire project area	Apr-06	Apr-06
Permanent seed mix applied to reach/segments 1 & 2	Apr-06	Apr-06
Plantings for reach/segments 1 & 2	Apr-06	Apr-06
Mitigation Plan / As-built (Year 0 Monitoring - baseline)	May-06	Jun-06
Year 1 Monitoring	Dec-06	Dec-06
Supplemental Planting	Dec-06	
Year 2 Monitoring	Nov-07	Dec-07
Year 3 Monitoring	Nov-08	Dec-08
Year 4 Monitoring	Nov-09	Dec-09
Year 5 Monitoring	Nov-10	Dec-10

Exhibit Table III. Project Contact Table Gray Farm Stream Restoration Site/EEP Project # 92219	
Designer Primary Project Design POC	Soil & Environmental Consultants, PA 11010 Raven Ridge Rd Raleigh, NC 27614 Patrick K. Smith, P.E. (919) 846-5900
Construction Contractor Construction Contractor POC	North State Environmental 2889 Lowery St. Winston-Salem, NC 27101 Darrell Westmoreland (336) 725-2010
Planting Contractor Planting Contractor POC	North State Environmental 2889 Lowery St. Winston-Salem, NC 27101 Darrell Westmoreland (336) 725-2010
Seeding Contractor Seeding Contractor POC	North State Environmental 2889 Lowery St. Winston-Salem, NC 27101 Darrell Westmoreland (336) 725-2010
Monitoring Performers	Soil & Environmental Consultants, PA 11010 Raven Ridge Rd. Raleigh, NC 2761
Stream Monitoring POC	David Gainey (919) 846-5900
Vegetation Monitoring POC	David Gainey (919) 846-5900

Exhibit Table IV. Project Background Table Gray Farm Stream Restoration Site/EEP Project # 92219	
Project County	Iredell
Drainage area	Reach 1 - 0.91 square miles (582 acres)
	Reach 2 - 0.085 square miles (54 acres)
Drainage impervious cover estimate (%)	< 20%
Stream Order	Reach 1 - 2nd order
	Reach 2 - 1st order
Physiographic Region	Piedmont
Ecoregion	Northern Inner Piedmont
Rosgen Classification of As-built	Reach 1 - C4
	Reach 2 - B4
Cowardin Classification	N/A
Dominant soil types	Reach 1 - Cw, CxB
	Reach 2 - CsE2
Reference site ID	Reach 1 - Tributary of Turkey Creek
	Reach 2 - Basin Creek
USGS HUC for Project and Reference	3050101
NCDWQ Sub-basin for Project and Reference	Reach 1 - 03-08-32 / 03-04-02
	Reach 2 - 03-08-32 / 03-07-01
NCDWQ classification for Project and Reference	Reach 1 - WS-IV; CA / C;NSW
	Reach 2 - WS-IV; CA / C; Tr; ORW
Any portion of any project segment 303d listed?	No
Any portion of any project segment upstream of a 303d listed segment?	No
Reasons for 303d listing or stressor	N/A
% of project easement fenced	Reach 1 – No Fence, Reach 2 - 100%

5. Monitoring Plan View

Six (6) tree and shrub buffer vegetation plots (four (4) on Reach 1 and two (2) on Reach 2) and four (4) bank vegetation plots (two (2) on Reach 1 and two (2) on Reach 2) were established. All vegetation monitoring occurs within these plots throughout the monitoring period for as long as they continue to be representative of the community.

For all buffer monitoring plots, Level 1 of the Carolina Vegetation Survey-Ecosystem Enhancement Program (CVS-EEP) Protocol for Recording Vegetation was utilized for vegetation sampling in Years 1 and 2. Beginning in Year 3, Level 2 of the CVS-EEP protocol was utilized in order to record and report woody plant volunteers within vegetation monitoring plots along with planted stems. A corner of each vegetation monitoring plot will be used as a permanent photo point for vegetation monitoring photos. Locations of these photo points are shown on the attached Monitoring Plan View.

Benthic macroinvertebrate sampling was performed at a total of five (5) previously established sampling stations. Reach 1, Station 1 is located immediately upstream of the restored Reach 1. Reach 1, Station 2 is located within the restored Reach 1. Reach 1, Station 3 is located immediately downstream of the restored Reach 1. Reach 2, Station 1 is located within the restored Reach 2. Reach 2, station 2 is located immediately downstream of the restored Reach 2. Locations of these benthic macroinvertebrate sampling points for Year 3 are shown in Appendix D.1. Benthic macroinvertebrate sampling was performed during Monitoring Years 1 through 3.

A total of seven (7) nested riffle and pool cross-section pairs was established along Reach 1, and two (2) nested riffle and pool cross-section pairs were established along Reach 2. Each cross-section also serves as a designated photo point that is photographed annually.

The locations of all monitoring devices are shown in Appendix C.1 (Monitoring Plan View, Reaches 1 and 2).

III. Project Condition and Monitoring Results

A. Vegetation Assessment

The success of the adjacent riparian buffer will be based on the combined survival of tree and shrub species for the five-year monitoring period.

In order to be considered successful, survival of woody (tree and shrub) species planted within the restored buffers will be at least 320 stems/acre through year three, 290 stems/acre at year four, and 260 stems/acre at year five. The stem count will be based on an average of the stem counts of the evaluated tree and shrub buffer vegetation plots.

The success of the bank vegetation plots along the restored channels will be based on the survival of live stake (or other) bank plantings for the five-year monitoring period. Survival of bank plantings will be based on a linear average of approximately 50 percent of the planted stems within the restoration reaches.

The approximately 18.4 acre restoration area was planted with various hardwood tree and shrub species native to the area. Reaches 1 and 2 were planted in April 2006. Supplemental planting was performed in December of 2006.

The following tree species were planted in the Riparian Buffer Area:

- *Alnus serrulata* (Tag Alder)
- *Betula nigra* (River Birch)
- *Carpinus caroliniana* (Ironwood)
- *Fraxinus pennsylvanica* (Green Ash)
- *Ilex opaca* (American Holly)
- *Lindera benzoin* (Spicebush)
- *Liriodendron tulipifera* (Tulip Poplar)
- *Platanus occidentalis* (Sycamore)
- *Quercus michauxii* (Swamp Chestnut Oak)
- *Quercus nigra* (Water Oak)
- *Quercus phellos* (Willow Oak)
- *Viburnum nudum* (Possumhaw)

Stream banks were planted with live stakes in two offset rows. The following shrub species were planted as live stakes:

- *Cornus amomum* (Silky Dogwood)
- *Salix sericea* (Silky Willow)
- *Sambucus canadensis* (Elderberry)

As previously described, a total of six (6) buffer vegetation monitoring plots was established on-site in 2006. The success criteria for the site require a minimum of 260 live stems per acre at the end of the five (5) years of monitoring. Year Five vegetation monitoring shows 398 live stems per acre. Vegetation monitoring data for

buffer plots was collected using Level 2 of the CVS-EEP monitoring protocol and is presented in Appendix A.

NOTE: Level 2 of the CVS-EEP monitoring protocol includes both planted and natural (volunteer) woody stems. For this reason, volunteer specimens are included in the total number of species, as reflected in Tables V-2 through V-4. Table V- 5 (Stem Count by Plot and Species) does not include volunteer/natural woody stem data, only planted stems.

A summary of planted vegetation survival is presented in the following table:

REACH 1					
Plot	**Planted Stems/Acre**				
	Year 1 (2006)	**Year 2 (2007)**	**Year 3 (2008)**	**Year 4 (2009)**	**Year 5 (2010)**
1	688	486	445	324	324
2	607	486	405	364	283
3	607	607	567	567	567
4	445	445	445	445	445
REACH 2					
Plot	**Planted Stems/Acre**				
	Year 1 (2006)	**Year 2 (2007)**	**Year 3 (2008)**	**Year 4 (2009)**	**Year 5 (2010)**
1	931	486	567*	567	526
2	607	202	243*	243	243
Average of All Plots	**647**	**452**	**445**	**418**	**398**

* Denotes resprouts following a drought year

Four (4) bank vegetation plots were also established (two on each reach) to monitor survival of live stake plantings along stream banks. Live stake survival is based on baseline data collected during Year 1 Monitoring in 2006. Live stake survival from Monitoring Year One to Monitoring Year Five for the site overall is approximately 81.2%.

Live stake counts by species and by plot are presented in the following tables:

2006 - REACH 1					
Common Name	**Species**	**REACH 1**		**Species Total**	**% of Total**
		BANK 1	**BANK 2**		
Silky Dogwood	*Cornus amomum*	12	17	29	39%
Silky Willow	*Salix sericea*	30	16	46	61%
	TOTAL	42	33	75	100%
2007 - REACH 1					
Common Name	**Species**	**REACH 1**		**Species Total**	**% of Total**
		BANK 1	**BANK 2**		
Silky Dogwood	*Cornus amomum*	4	9	13	27%
Silky Willow	*Salix sericea*	27	9	36	73%
	TOTAL	31	18	49	100%
	Live Stake Survival =	73.8%	54.5%	65.3%	

2008 - REACH 1					
Common Name	**Species**	**REACH 1**		**Species Total**	**% of Total**
		BANK 1	**BANK 2**		
Silky Dogwood	*Cornus amomum*	10	9	19	36%
Silky Willow	*Salix sericea*	30	4	34	64%
	TOTAL	40	13	53	100%
	Live Stake Survival =	95.2%	39.4%	70.7%	
2009 - REACH 1					
Common Name	**Species**	**REACH 1**		**Species Total**	**% of Total**
		BANK 1	**BANK 2**		
Silky Dogwood	*Cornus amomum*	10	9	19	32%
Silky Willow	*Salix sericea*	30	10	40	68%
	TOTAL	40	19	59	100%
	Live Stake Survival =	95.2%	57.6%	78.7%	
2010 - REACH 1					
Common Name	**Species**	**REACH 1**		**Species Total**	**% of Total**
		BANK 1	**BANK 2**		
Silky Dogwood	*Cornus amomum*	10	6	16	32%
Silky Willow	*Salix sericea*	26	8	34	68%
	TOTAL	36	14	50	100%
	Live Stake Survival =	85.7%	42.4%	66.7%	

2006 - REACH 2					
Common Name	**Species**	**REACH 2**		**Species Total**	**% of Total**
		BANK 1	**BANK 2**		
Silky Willow	*Salix sericea*	7	4	11	23%
Silky Dogwood	*Cornus amomum*	9	25	34	72%
Elderberry	*Sambucus canadensis*	0	2	2	4%
	TOTAL	16	31	47	100%
2007 - REACH 2					
Common Name	**Species**	**REACH 2**		**Species Total**	**% of Total**
		BANK 1	**BANK 2**		
Silky Willow	*Salix sericea*	6	4	10	29%
Silky Dogwood	*Cornus amomum*	5	20	25	71%
Elderberry	*Sambucus canadensis*	0	0	0	0%
	TOTAL	11	24	35	100%
	Live Stake Survival =	68.8%	77.4%	74.5%	
2008 - REACH 2					
Common Name	**Species**	**REACH 2**		**Species Total**	**% of Total**
		BANK 1	**BANK 2**		
Silky Willow	*Salix sericea*	7	4	11	24%
Silky Dogwood	*Cornus amomum*	8	25	33	73%
Elderberry	*Sambucus canadensis*	0	1	1	2%
	TOTAL	15	30	45	100%
	Live Stake Survival =	93.8%	96.8%	95.7%	

2009 - REACH 2					
Common Name	**Species**	**REACH 2**		**Species Total**	**% of Total**
		BANK 1	**BANK 2**		
Silky Willow	*Salix sericea*	7	4	11	24%
Silky Dogwood	*Cornus amomum*	8	25	33	73%
Elderberry	*Sambucus canadensis*	0	1	1	2%
	TOTAL	15	30	45	100%
	Live Stake Survival =	93.8%	96.8%	95.7%	
2010 - REACH 2					
Common Name	**Species**	**REACH 2**		**Species Total**	**% of Total**
		BANK 1	**BANK 2**		
Silky Willow	*Salix sericea*	7	4	11	24%
Silky Dogwood	*Cornus amomum*	8	25	33	73%
Elderberry	*Sambucus canadensis*	0	1	1	2%
	TOTAL	15	30	45	100%
	Live Stake Survival =	93.8%	96.8%	95.7%	

Most surviving live stakes appear healthy and are growing vigorously.

Herbaceous vegetation varies widely throughout the restoration site. The native herbaceous species have become densely established and are dominant throughout the site. Herbaceous species observed along stream banks and in the buffer and wetlands onsite include:

- Jewelweed – *Impatiens capensis*
- Soft Rush – *Juncus effusus*
- Cutgrass – *Leersia oryzoides*
- Monkeyflower – *Mimulus ringens*
- Sedges – *Carex spp.*
- Switchgrass – *Panicum virgatum*
- Duck Potato – *Sagittaria latifolia*
- Goldenrod – *Solidago sp.*
- Dog-fennel – *Eupatorium capillifolium*
- Boneset – *Eupatorium perfoliatum*

1. Problem Areas Plan View (Vegetation)

During field inspections on October 25th-28th and November 10th, 2010, a total of one (1) localized area of bare floodplain was observed on Reach 1. This area appears to be due primarily to surface flows. Continued revegetation of previously bare areas within both reaches was observed during Monitoring Year Five. Vegetation Problem Areas are shown on Sheets 6 through 9 (Reach 1). Photos are included in Appendix A.

During Monitoring Year Two, small amounts of the non-natives Johnsongrass (*Sorghum halepense*) and tall fescue (*Lolium arundinaceum*) were observed at the edges of the buffer restoration areas that border the agricultural fields on both

reaches. These populations have not become dominant, nor have they excluded native vegetation.

An area of Kudzu (*Pueraria lobata*) was noted at the site in early June 2007, on the west side of Reach 1 between stations 16+00 to 19+00. Although the majority of the Kudzu was along and in the edge of the woods immediately outside the easement area, some had encroached into the easement area. The area (approximately 0.5 acre) was treated with the herbicide Transline (clopyralid) at a rate of one pint per acre in 2007. A small portion of this area was again treated in 2008. During 2008, a small area (approximately 0.009 acre) of Kudzu was observed immediately east of station 13+00, within the easement area. During 2009, two very small areas of kudzu (totaling approximately 350 sq. feet) were treated with Transline (clopyralid) in the upper part of Reach 1. During 2010, kudzu was observed within a localized area east of station 18+00, including a portion of buffer Vegetation Monitoring Plot 1.

Based on vegetative success criteria the overall site currently exhibits strong vegetative success.

2. Vegetative Problem Areas Table Summary

Vegetative problem areas observed are described in Table A1 in Appendix A.

3. Vegetative Problem Areas Plan View

Vegetative problem areas are shown on Sheets 6 through 9 for Reach 1 (Problem Area Plan View). During 2009, it was noted that Vegetation Plot 2 on Reach 2 did not meet the required planted stem survival rate of 260 stems per acre for Year Five monitoring. North State Environmental performed supplemental planting of Reach 2 in the spring of 2010. Additionally, natural stems within Vegetation Plot 2 on Reach 2 include large, healthy specimens of Box Elder, Red Maple, and Sycamore. If natural stems are taken into account, this vegetation plot meets and exceeds the required success criteria.

B. Stream Assessment

A review of available on-line U.S. Geological Survey (USGS) gauge sites was performed to determine if a suitable surrogate gauges was present in the area. No nearby gauge was identified. The closest USGS gauge to the site was on the Lower Little River (near Healing Springs, NC, Gauge Identification Number 02142000) which is approximately 15 miles from the project site. Based on this large distance, significant disparity in watershed sizes, and topographic variation, it is unlikely that a conclusive determination regarding the number of bankfull events experienced on the restoration site could be made.

Based upon recommendations provided by NCEEP a crest gauge was installed on site (at Cross-section 3 on Reach 1). The gauge was installed in June of 2008 and checked during subsequent site visits for evidence of bankfull events. In addition, site observations during visits performed this monitoring year including wrack lines, staining of vegetation, displaced/flattened vegetation, and observable sediment

deposition indicate that multiple overbank events have occurred. Photographs documenting overbank conditions during Monitoring Year Five are provided in Appendix B. The dates of site visits where evidence of bankfull events were observed are listed in the table below.

Exhibit Table V. Verification of Bankfull Events
Gray Farm Stream Restoration Site/EEP Project # 92219

Date of Data Collection	Date of Occurrence	Method	Photo #
4/24/2006	Unknown	Onsite observations (wrack lines, staining of vegetation, displaced/flattened vegetation, and observable sediment deposition and select crest gauge readings)	N/A
6/22/2006	Unknown		N/A
10/19/2006	Unknown		N/A
11/27/2006	Unknown		N/A
12/18/2006	Unknown		N/A
03/01/2007	Unknown		N/A
03/22/2007	Unknown		N/A
04/05/2007	Unknown		N/A
08/22/2007	Unknown		N/A
11/27/2007	Unknown		N/A
5/19/2008	Unknown		N/A
6/25/2008	Unknown		N/A
8/26/2008	Unknown		N/A
9/17/2008	Unknown		Year 3 Report, Photos 1,2,4
11/19/2008	Unknown		Year 3 Report, Photo 3
10/27/2009	Unknown		Year 4 Report, Photo 1
11/11/2009	11/11/2009	Observation of bankfull event – Reach 1	Year 4 Report, Photo 2
11/11/2009	11/11/2009	Observation of bankfull event – Reach 2	Year 4 Report, Photo 3
10/27/2010 (am)	Unknown	Onsite observations (wrack lines, staining of vegetation, displaced/flattened vegetation, and observable sediment deposition and crest gauge reading)	1
10/27/2010 (pm)	10/27/2010	Observation of bankfull event – Reach 1	2
11/10/2010	10/27/2010	Onsite observations (wrack lines, staining of vegetation, displaced/flattened vegetation, and observable sediment deposition)	3

1. Problem Areas Plan View (Stream)

An assessment of channel stability was performed on November 10th, 2010. Areas of concern that were observed and documented included some minor localized bank scour, buried structures, and stressed structures. Detail of scour is evident in cross-section 6 (pool). These problem areas are shown on Sheets 6 through 9 for Reach 1 and Sheets 14 through 16 for Reach 2 (Problem Area Plan View). The minimal extent of scour and erosion around structures does not warrant repair at this time.

The previously noted stressed log J-hook structure at station 41+50 on Reach 1 was investigated by North State Environmental on April 7, 2010 and was observed to be stable. Bank erosion immediately downstream of the structure was repaired by hand grading the banks and installation of a brush mattress to further protect the bank from erosion.

Although a beaver dam was previously noted on October 27, 2009 at station 56+40 within Reach 1, no beaver dams were observed within the restored stream reaches during the 2010 stream monitoring.

The upper portion of Reach 1 has demonstrated pool development since the as-built survey. Significant sediment entered the pools at the upper end of Reach 1 shortly after construction. This sediment came from upstream sources to the north of the restoration site including areas of cattle pasture and areas previously inundated due to the old pond. This sediment was flushed from the system during the first year, causing these pools to deepen to their previously excavated depth. During Monitoring Year Three, sediment from the upstream cattle pasture again entered the upper portion of Reach 1. Based on the Year Four assessment, this sedimentation continued and increased. Year Four monitoring showed that the area between station 0+00 and station 5+20 contained significant sediment, pools had filled, and structures had been buried. From station 5+20 to station 9+50, sediment was present, but less severe, and the riffle-pool sequence was more easily observed. Observations of this area during Year Five show that sedimentation from the upstream cattle pasture has continued to increase. Continuous, heavy sediment now exists between station 0+00 and station 7+50. From station 7+50 to station 17+75, sediment depth is variable, with some pools containing deep sediment. It is important to note that the cattle pasture north of the restoration site is not under the ownership of the Grays.

2. Problem Areas Table Summary

Stream problem areas observed are shown in Table B1 in Appendix B.

3. Numbered Issues Photo Section

Representative photos of each category of stream problem area are shown in Appendix B.

4. Fixed Photo Station Photos

Photos from established photo stations (at each cross-section) were collected during the stream survey (October 25-28 and November 10, 2010). These photos are included in Appendix B.

5. Stability Assessment

A visual qualitative assessment was performed to inspect channel facets, meanders, bed, banks, and installed structures. This visual assessment was confirmed and enhanced with a quantitative assessment of the physical stream survey. The goal of this assessment is to provide a percentage of the features listed in Table VII that are in

a state of stability. Table VII was compiled from the data in Table B2 in Appendix B of this report.

Table VIIa: Categorical Stream Feature Visual Stability Assessment Gray Farm Stream and Wetland Restoration Site/EEP Project # 92219 Reach 1					
Feature	**MY-1 2006**	**MY-2 2007**	**MY-3 2008**	**MY-4 2009**	**MY-5 2010**
A. Riffles	100%	100%	98%	100%	95%
B. Pools	100%	100%	100%	99%	88%
C. Thalweg	99%	99%	99%	99%	98%
D. Meanders	100%	100%	100%	99%	99%
E. Bed General	96%	99%	99%	99%	99%
F. Bank Condition	100%	99%	99%	99%	99%
G. Vanes/ J Hooks, etc.	99%	98%	98%	98%	95%
H. Wads and Boulders	N/A	N/A	N/A	N/A	N/A

Table VIIb: Categorical Stream Feature Visual Stability Assessment Gray Farm Stream and Wetland Restoration Site/EEP Project # 92219 Reach 2					
Feature	**MY-1 2006**	**MY-2 2007**	**MY-3 2008**	**MY-4 2009**	**MY-5 2010**
A. Riffles	100%	100%	100%	100%	100%
B. Pools	100%	100%	100%	100%	100%
C. Thalweg	100%	100%	100%	100%	100%
D. Meanders	99%	98%	98%	97%	97%
E. Bed General	100%	100%	100%	99%	99%
F. Bank Condition	100%	100%	99%	100%	100%
G. Vanes/ J Hooks, etc.	99%	96%	95%	96%	96%
H. Wads and Boulders	N/A	N/A	N/A	N/A	N/A

6. Quantitative Measures Summary Tables

The following tables (Table VIII and Table IX) summarize the quantitative data collected from the cross-sectional and representative longitudinal stream survey. These data were analyzed and summarized, and then compared with baseline data available for this project.

The Quantitative Morphology Tables illustrate the degree of departure, if any, of the current channel from the baseline data. Tables VIII and IX were compiled from the cross-section and profile raw data and plots located in Appendix B of this report.

Table VIII. Baseline Morphology and Hydraulic Summary
GRAY FARM STREAM RESTORATION SITE (EEP Project #92219)
REACH 1

Parameter	Pre-Existing Condition			Project Reference Stream			Design			As-built		
Dimension	Min	Max	Avg.	Min	Max	Avg.	Min	Max	Avg.	Min	Max	Avg.
BF Width (ft)	15.77	15.77	15.77	32.08	32.08	32.08	15.2	15.2	15.2	13.62	19.48	16.02
Floodprone Width (ft)	19.41	52.54	20.39	100			47	90.34	47	37.49	89.67	61.53
BF Cross Sectional Area (ft^2)	17.87	17.87	17.87	79.79	79.79	79.79	17.84	17.84	17.84	11.01	17.92	13.79
BF Mean Depth (ft)	1.13	1.13	1.13	2.49	2.49	2.49	1.17	1.17	1.17	0.7	0.94	0.86
BF Max Depth (ft)	1.49	1.49	1.49	3.61	3.61	3.61	1.71	1.71	1.71	1.36	2.04	1.61
Width/Depth Ratio	13.96	13.96	13.96	12.43	12.43	12.43	12.67	12.67	12.67	18.63	20.07	19.46
Entrenchment Ratio	1.29	1.29	1.29	3.47	3.47	3.47	3.09	3.09	3.09	2.75	4.6	3.84
Wetted Perimeter(ft)	16.52	16.52	16.52	34.8	34.8	34.8	16.01	16.01	16.01	13.26	16.41	15.67
Hydraulic radius (ft)	1.08			2.29			1.11			0.69	0.92	0.83
Pattern												
Channel Beltwidth (ft)	67.62	137.29	98.27	70.8	91.93	84.35	26.1	61.8	40.75	59.32	93.89	72.85
Radius of Curvature (ft)	64.8	121.04	81.58	13.36	36.57	26.56	19.97	37.85	28.23	16.64	40.88	25.73
Meander Wavelength (ft)	716.91	716.91	716.91	148.13	291.09	221.56	77.08	117.13	95.07	77.08	117.13	94.8
Meander Width ratio	4.29	8.71	6.23	2.21	2.87	2.63	1.72	4.07	2.68	3.7	5.86	4.55
Profile												
Riffle length (ft)	N/A	N/A	N/A	32.94	48.35	40.29	19.31	54.86	30.86	25.87	54.2	37.85
Riffle slope (ft/ft)	0.00632	0.00657	0.00647	0.00809	0.01395	0.01074	0.0057			0.00092	0.0187	0.0062
Pool length (ft)	93.8	159.47	119.6	8.96	41.09	26.43	22.9	33.17	29.66	7.41	244.47	23.01
Pool Slope (ft/ft)	N/A	N/A	N/A	N/A	N/A	N/A	0.0009	0.0029	0.0013	0.0007	0.0064	0.0016
Pool spacing (ft)	347.07	525.3	444	44.08	130.73	67.98	51.66	82.92	67.79	12.35	142	70.94
Substrate												
d50 (mm)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
d84 (mm)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Additional Reach Parameters												
Valley Length (ft)	4258.3			648.35			4258.3			4258.3		
Channel Length (ft)	4939.628			758.58			5622			5813.3		
Sinuosity	1.16			1.17			1.29			1.36		
Water Surface Slope (ft/ft)	0.00647			0.01074			0.0057			0.00544		
BF slope (ft/ft)	0.00647			0.01074			0.0057			0.00544		
Rosgen Classification	F4			C4			C4			C4		
*Habitat Index	N/A			N/A			N/A			N/A		
*Macrobenthos	N/A			N/A			N/A			N/A		

Table VIII. Baseline Morphology and Hydraulic Summary
GRAY FARM STREAM RESTORATION SITE (EEP Project #92219)
REACH 2

Parameter	Pre-Existing Condition			Project Reference Stream			Design			As-built		
Dimension	Min	Max	Avg.	Min	Max	Avg.	Min	Max	Avg.	Min	Max	Avg.
BF Width (ft)	5.34	5.34	5.34	4.86	4.86	4.86	6.9	6.9	6.9	7.38	8.21	7.8
Floodprone Width (ft)	7.04	7.04	7.04	8.73	8.73	8.73	12.4	12.4	12.4	13.96	39.05	26.53
BF Cross Sectional Area (ft^2)	3.88	3.88	3.88	1.94	1.94	1.94	3.96	3.96	3.96	4.14	6.77	5.46
BF Mean Depth (ft)	0.73	0.73	0.73	0.4	0.4	0.4	0.57	0.57	0.57	0.56	0.82	0.69
BF Max Depth (ft)	1.13	1.13	1.13	0.61	0.61	0.61	0.87	0.87	0.87	0.86	1.3	1.08
Width/Depth Ratio	7.32	7.32	7.32	12.15	12.15	12.15	12.11	12.11	12.11	1.01	13.18	11.3
Entrenchment Ratio	1.32	1.32	1.32	1.8	1.8	1.8	1.8	1.8	1.8	1.9	4.7	3.4
Wetted Perimeter(ft)	6.03	6.03	6.03	5.28	5.28	5.28	7.36	7.36	7.36	7.68	8.77	8.23
Hydraulic radius (ft)	0.64			0.37			0.94737	0.94737	0.94737	0.78261	1.11594	0.95652
Pattern												
Channel Beltwidth (ft)	43.58	68.11	54.22	6.97	22.7	13.32	9.49	16.5	12.65	11.83	22.05	16.96
Radius of Curvature (ft)	32.54	52.64	41.25	4.1	8.88	5.93	6.71	9.9	8.05	4.63	9.1	6.43
Meander Wavelength (ft)	209.46	394.66	334.46	22.47	68.78	46.57	31.6	37.12	34.08	27.51	34.72	31.75
Meander Width ratio	8.16	12.75	10.15	1.43	4.67	2.74	1.38	2.39	1.83	1.52	2.83	2.17
Profile												
Riffle length (ft)	N/A	N/A	N/A	5.52	7.6	6.39	4.93	7.24	5.88	3.36	11.6	5.6
Riffle slope (ft/ft)	0.0179	0.03688	0.02444	0.03022	0.05058	0.04025	0.0258			0.0053	0.0555	0.0279
Pool length (ft)	26.27	54.41	40.34	7.56	10.65	8.78	6.25	10.46	8.45	5.2	10.08	7.59
Pool Slope (ft/ft)	N/A	N/A	N/A	N/A	N/A	N/A	0.0017	0.0087	0.003	0.001	0.0092	0.0022
Pool spacing (ft)	125.7	474.65	265.15	20.17	70.04	46.72	15.73	23.84	19.22	9.43	28.94	19.51
Substrate												
d50 (mm)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
d84 (mm)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Additional Reach Parameters												
Valley Length (ft)	1872			216.55			1872			1872		
Channel Length (ft)	1965.6			266.36			2114			2191		
Sinuosity	1.05			1.23			1.16			1.2		
Water Surface Slope (ft/ft)	0.0286			0.039			0.0258			0.025		
BF slope (ft/ft)	0.0286			0.039			0.0258			0.025		
Rosgen Classification	G4			B4			B4			B4		
*Habitat Index	N/A			N/A			N/A			N/A		
*Macrobenthos	N/A			N/A			N/A			N/A		

Exhibit Table IX. Morphology and Hydraulic Monitoring Summary
GRAY FARM STREAM RESTORATION SITE (EEP Project #92219)

Parameter	REACH 1																							
	RIFFLE 1						POOL 1						RIFFLE 2						POOL 2					
Dimension	AS BUILT	MY1	MY2	MY3	MY4	MY5	AS BUILT	MY1	MY2	MY3	MY4	MY5	AS BUILT	MY1	MY2	MY3	MY4	MY5	AS BUILT	MY1	MY2	MY3	MY4	MY5
	2006	2006	2007	2008	2009	2010	2006	2006	2007	2008	2009	2010	2006	2006	2007	2008	2009	2010	2006	2006	2007	2008	2009	2010
BF Width (ft)	15.34	11.25	11.58	10.89	8.76	8.9	22.32	20.84	24.21	20.82	21.89	14.43	13.62	11.33	13.59	14.78	12.48	14.6	20.84	20.41	21.64	19.85	20.02	21.74
Floodprone Width (ft)	54.53	50	50	50	50.86	50	61.28	62.34	62.25	62.65	63.15	63.42	59.9	60.26	60.01	59.8	59.91	60.23	57.43	58.07	54.82	57.47	57.93	57.81
BF Cross Sectional Area (ft^2)	11.97	5.96	6.46	5.98	4.19	5.15	39.71	41.33	35.99	36.03	42.12	37.69	11.01	9.18	9.27	9.23	8.5	11.93	29.04	26.98	28.27	27.23	27.51	28.76
BF Mean Depth (ft)	0.78	0.53	0.56	0.55	0.48	0.58	1.78	1.98	1.56	1.73	1.92	2.61	0.81	0.68	0.68	0.62	0.68	0.82	1.39	1.32	1.31	1.37	1.37	1.32
BF Max Depth (ft)	1.39	0.87	1	1.26	1.18	1.17	3.29	3.47	3.5	3.58	3.68	3.68	1.53	1.25	1.46	1.6	1.79	1.98	2.89	2.74	3.5	3.04	3.33	3.11
Width/Depth Ratio	19.67	21.23	20.68	19.8	18.25	15.34	12.54	10.53	14.79	12.03	11.4	5.53	16.81	19.94	19.99	23.84	18.35	17.8	14.99	15.46	16.52	14.49	14.61	16.47
Entrenchment Ratio	3.56	4.44	4.32	4.59	5.81	5.62	2.75	2.99	2.7	3.01	2.88	4.4	4.4	4.45	4.41	4.05	4.8	4.13	2.76	2.85	2.67	2.89	2.89	2.66
Wetted Perimeter(ft)	15.67	11.41	11.77	11.21	9.67	9.67	23.83	22.42	24.22	22.41	25.69	17.46	13.97	13.82	14.04	15.21	13.52	15.91	21.83	21.52	23.58	22.24	23.11	24.77
Hydraulic radius (ft)	0.76	0.52	0.55	0.53	0.43	0.53	1.67	1.84	1.49	1.61	1.64	2.16	0.79	0.66	0.66	0.61	0.63	0.75	1.33	1.25	1.2	1.22	0.76	1.16
Substrate																								
d50 (mm)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
d84 (mm)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Parameter	REACH 1																							
	RIFFLE 3						POOL 3						RIFFLE 4						POOL 4					
Dimension	AS BUILT	MY1	MY2	MY3	MY4	MY5	AS BUILT	MY1	MY2	MY3	MY4	MY5	AS BUILT	MY1	MY2	MY3	MY4	MY5	AS BUILT	MY1	MY2	MY3	MY4	MY5
	2006	2006	2007	2008	2009	2010	2006	2006	2007	2008	2009	2010	2006	2006	2007	2008	2009	2010	2006	2006	2007	2008	2009	2010
BF Width (ft)	12.94	12.1	13.55	12.89	13.37	14.33	20.75	21.49	22.08	21.98	21.66	22.61	15.7	19	17.9	18.01	18.49	18.18	20.28	21.29	20.2	19.85	20.19	18.67
Floodprone Width (ft)	89.67	89.64	89.86	89.54	89.77	89.71	61.38	61.32	61.04	61.15	61.39	61.34	66.39	66.2	66.27	66.51	66.39	66.54	65.77	65.75	66	65.83	65.92	65.95
BF Cross Sectional Area (ft^2)	9.49	9.25	10.46	9.82	10.62	12.1	34.09	33.59	32.19	31.82	33.75	32.38	11.02	13.49	11.8	11.58	13.39	13.28	32.64	38.77	32.03	33.03	33.19	33.78
BF Mean Depth (ft)	0.73	0.76	0.77	0.76	0.79	0.84	1.64	1.56	1.46	1.45	1.56	1.43	0.7	0.71	0.66	0.64	0.72	0.73	1.61	1.82	1.59	1.66	1.64	1.81
BF Max Depth (ft)	1.41	1.36	1.47	1.44	1.61	1.67	3.03	2.83	2.94	2.78	2.99	2.77	1.36	1.41	1.3	1.37	1.41	1.61	2.79	3.2	2.83	2.83	3.07	3.03
Width/Depth Ratio	17.73	15.92	17.6	16.96	16.92	17.06	12.65	13.78	15.12	15.16	13.88	15.81	22.43	26.76	27.12	28.14	25.68	24.9	12.6	11.79	12.7	11.96	12.31	10.31
Entrenchment Ratio	6.93	7.41	6.63	6.94	6.71	6.26	2.96	2.85	2.76	2.78	2.83	2.71	4.23	3.48	3.7	3.69	3.59	3.66	3.24	3.09	3.27	3.32	3.27	3.53
Wetted Perimeter(ft)	13.26	12.46	13.92	13.27	13.97	15	21.78	22.45	23.01	22.94	22.79	23.84	16.01	19.29	18.22	18.39	19.13	18.83	21.59	22.97	21.45	21.21	22.74	21.3
Hydraulic radius (ft)	0.72	0.74	0.75	0.74	0.76	0.81	1.57	1.5	1.4	1.39	1.48	1.36	0.69	0.7	0.65	0.63	0.7	0.71	1.51	1.69	1.49	1.56	1.46	1.59
Substrate																								
d50 (mm)	0.65	17	1.6	20	19	33	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
d84 (mm)	4	33	50	60	43	82	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Parameter	REACH 1																							
	RIFFLE 5						POOL 5						RIFFLE 6						POOL 6					
Dimension	AS BUILT	MY1	MY2	MY3	MY4	MY5	AS BUILT	MY1	MY2	MY3	MY4	MY5	AS BUILT	MY1	MY2	MY3	MY4	MY5	AS BUILT	MY1	MY2	MY3	MY4	MY5
	2006	2006	2007	2008	2009	2010	2006	2006	2007	2008	2009	2010	2006	2006	2007	2008	2009	2010	2006	2006	2007	2008	2009	2010
BF Width (ft)	15.63	14.32	16.03	13.84	15.92	16.56	26.27	23.03	26.67	24.07	24.14	24.69	17.01	14.54	20.16	19.03	16.48	36.01	18.59	21.11	19.69	22.85	19.25	19.96
Floodprone Width (ft)	72.27	64.56	73.17	72.59	72.68	72.76	68.23	68.53	68.67	68.48	68.73	68.93	50.57	60	60	49.29	48.65	51.62	60.15	62.76	63	66.56	67.18	67.04
BF Cross Sectional Area (ft^2)	14.76	14.03	15.16	13.33	14.29	15.28	37.47	33.39	37.64	35.95	35.15	36.5	16	14.61	16.36	12.89	11.82	19.76	26.72	27.06	51.7	53	53.19	59.74
BF Mean Depth (ft)	0.94	0.98	0.95	0.96	0.9	0.92	1.43	1.45	1.41	1.49	1.46	1.48	0.94	1.01	0.81	0.68	0.72	0.55	1.44	1.28	2.63	2.32	2.76	2.99
BF Max Depth (ft)	1.67	2.27	1.92	1.99	1.93	2.27	2.75	3.08	3.35	3.23	3.27	3.23	1.56	1.49	1.43	1.31	1.24	1.36	2.83	3.14	4.82	4.71	4.98	5.63
Width/Depth Ratio	16.63	14.61	16.87	14.42	17.69	18	18.37	15.88	18.91	16.15	16.53	16.68	18.1	14.4	24.89	27.99	22.89	65.47	12.91	16.49	7.49	9.85	6.97	6.68
Entrenchment Ratio	4.62	4.51	4.56	5.24	4.56	4.39	2.6	2.98	2.57	2.85	2.85	2.79	2.97	4.13	2.98	2.59	2.95	1.43	3.24	2.97	3.2	2.91	3.49	3.36
Wetted Perimeter(ft)	16.14	15.28	17.15	14.88	17.12	18.22	27.26	24.24	28	25.72	26.13	26.68	17.42	15	20.56	19.32	17.4	37.05	20.27	22.27	23.49	27.89	25.01	26.63
Hydraulic radius (ft)	0.91	0.92	0.88	0.9	0.84	0.84	1.37	1.38	1.34	1.4	1.35	1.37	0.92	0.97	0.8	0.67	0.68	0.53	1.32	1.21	2.2	1.9	2.13	2.24
Substrate																								
d50 (mm)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
d84 (mm)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Parameter	REACH 1											
	RIFFLE 7						POOL 7					
Dimension	AS BUILT	MY1	MY2	MY3	MY4	MY5	AS BUILT	MY1	MY2	MY3	MY4	MY5
	2006	2006	2007	2008	2009	2010	2006	2006	2007	2008	2009	2010
BF Width (ft)	19.48	16.96	22.43	19.14	17.33	23.11	22.66	22.31	23.12	22.38	23.96	25.68
Floodprone Width (ft)	50	50	50	50	38.06	39.27	51.23	55	55	51	47.21	51.08
BF Cross Sectional Area (ft^2)	17.92	15.49	16.94	15.82	17.03	20.04	42.08	38.22	36.39	35.4	35.15	47.69
BF Mean Depth (ft)	0.92	0.91	0.76	0.83	0.98	0.87	1.86	1.71	1.57	1.58	1.47	1.86
BF Max Depth (ft)	2.04	1.61	1.68	1.76	1.93	2.14	3.47	3.06	3.03	2.91	2.76	3.17
Width/Depth Ratio	21.17	18.64	29.51	23.06	17.68	26.56	12.18	13.03	14.73	14.16	16.3	13.81
Entrenchment Ratio	2.57	2.95	2.23	2.61	2.2	1.7	2.26	2.46	2.38	2.28	1.97	1.99
Wetted Perimeter(ft)	20.08	17.38	22.83	19.59	18.27	23.73	23.91	24.11	24.31	23.66	25.89	27.62
Hydraulic radius (ft)	0.89	0.89	0.74	0.81	0.93	0.84	1.76	1.59	1.5	1.5	1.36	1.73
Substrate												
d50 (mm)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
d84 (mm)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

REACH 1

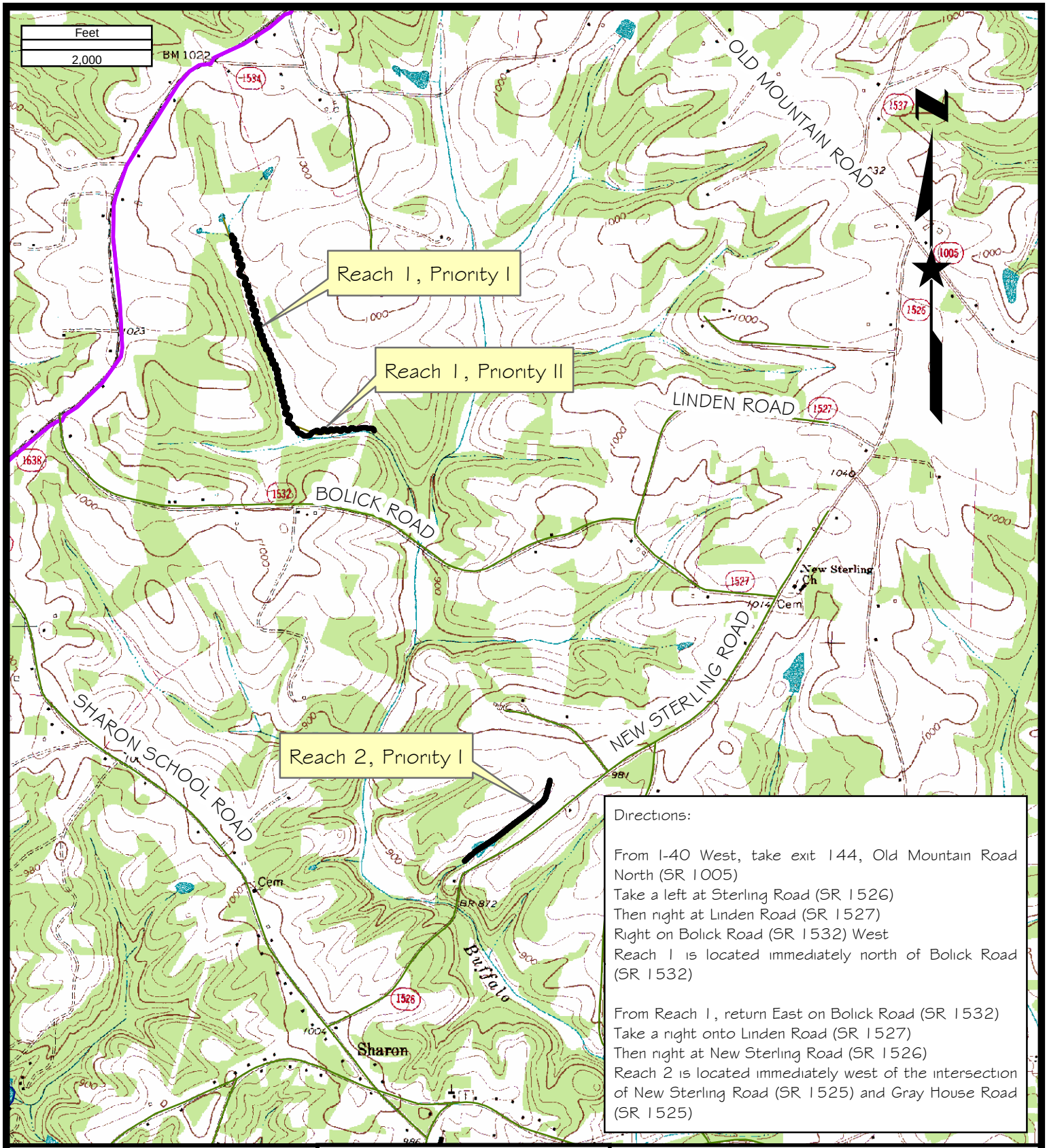
Parameter	As-built (2006)			MY-1 (2006)			MY-2 (2007)			MY-3 (2008)			MY-4 (2009)			MY-5 (2010)		
Pattern	Min	Max	Avg	Min	Max	Avg	Min	Max	Avg	Min	Max	Avg	Min	Max	Avg	Min	Max	Avg
Channel Beltwidth (ft)	59.32	93.89	72.85	58.48	96.38	71.67	58.96	97.33	72.54	35.42	103.28	67.02	52.64	75.36	62.48	50.07	75.86	59.56
Radius of Curvature (ft)	16.64	40.88	25.73	16.84	39.51	24.43	16.72	40.02	25.69	18.06	41.31	29.62	14.21	38.24	22.46	13.31	35.85	26.11
Meander Wavelength (ft)	77.08	117.13	94.8	76.54	118.26	91.85	75.94	120.96	92.17	81.64	125.68	102.42	86.25	127.4	107.22	85.53	120.36	105.1
Meander Width ratio	3.7	5.86	4.55	3.56	5.72	4.65	3.24	6.23	4.98	4.08	6.28	5.12	4.31	6.37	5.36	4.28	6.02	5.26
Profile																		
Riffle length (ft)	25.87	54.2	37.85	19.31	54.86	30.86	22.15	58.62	34.61	17.03	56.21	34.53	20.37	73.65	37.06	18.79	75.62	30.9
Riffle slope (ft/ft)	0.00092	0.0187	0.0062	0.00125	0.01763	0.00883	0.0017	0.025	0.009	0.00115	0.033	0.01196	0.00223	0.03447	0.01102	0.00066	0.02599	0.01217
Pool length (ft)	7.41	38.61	23.01	14.19	31.92	24.11	15.64	34.81	26.84	23.86	56.25	38.65	25.59	52.88	42.19	20.77	59.12	38.23
Pool Slope (ft/ft)	0.0007	0.0064	0.0016	0.0007	0.0029	0.0012	0.0007	0.004	0.0017	0.0007	0.0033	0.0013	0	0.00212	0.00042	0	0.00329	0.00099
Pool spacing (ft)	12.35	142	70.94	52.58	159	88.05	45.21	148	85.94	44.7	172.7	92.69	10.82	125.17	69.28	11.75	121.44	60.79
Additional Reach Parameters																		
Valley Length (ft)	4258.3			4258.3			4258.3			4258.3			4258.3			4258.3		
Channel Length (ft)	5813.3			5813.3			5813.3			5813.3			5813.3			5813.3		
Sinuosity	1.36			1.36			1.36			1.36			1.36			1.36		
Water Surface Slope (ft/ft)	0.00544			0.00544			0.00544			0.00544			0.00544			0.00544		
BF slope (ft/ft)	0.00544			0.00544			0.00544			0.00544			0.00544			0.00544		
Rosgen Classification	C4			C4			C4			C4			C4			C4		
Habitat Index*	N/A			N/A			N/A			N/A			N/A			N/A		
Macrobenthos*	N/A			N/A			N/A			N/A			N/A			N/A		

Parameter	REACH 2																							
	RIFFLE 1						POOL 1						RIFFLE 2						POOL 2					
Dimension	AS BUILT	MY1	MY2	MY3	MY4	MY5	AS BUILT	MY1	MY2	MY3	MY4	MY5	AS BUILT	MY1	MY2	MY3	MY4	MY5	AS BUILT	MY1	MY2	MY3	MY4	MY5
	2006	2006	2007	2008	2009	2010	2006	2006	2007	2008	2009	2010	2006	2006	2007	2008	2009	2010	2006	2006	2007	2008	2009	2010
BF Width (ft)	7.38	7.61	10.66	8.67	11.12	9.62	18.44	17.46	22.47	20.95	21.52	26.27	8.21	7.6	9.16	8.98	8.85	8.57	5.98	6.17	5.56	3.56	5.03	4.72
Floodprone Width (ft)	23.08	26.25	29.56	25.54	30.39	32.77	46.7	46.7	46.7	46.78	46.62	46.7	39.05	26.17	26	40.5	41.9	42.63	15.65	10.59	10.84	10.93	13.37	15.48
BF Cross Sectional Area (ft^2)	4.14	4.65	5.33	4.74	6.02	5.91	19.78	18.94	23.35	21.96	21.12	22.25	6.77	4.86	7.71	6.71	6.42	6.81	6.89	4.93	5.82	3.92	5.79	5.71
BF Mean Depth (ft)	0.56	0.61	0.5	0.55	0.54	0.61	1.07	1.09	1.04	1.05	0.98	0.85	0.82	0.64	0.84	0.75	0.73	0.79	1.15	0.8	1.05	1.1	1.15	1.21
BF Max Depth (ft)	0.86	0.98	1	0.94	1.11	1.17	2.6	2.64	2.63	2.58	2.47	2.52	1.3	1.19	1.47	1.23	1.3	1.4	1.81	1.49	1.54	1.63	1.66	1.74
Width/Depth Ratio	13.18	12.48	13.5	15.76	20.59	15.77	17.23	16.02	21.61	19.95	21.96	30.91	10.01	11.88	10.9	11.97	12.12	10.85	5.2	7.71	5.3	3.24	4.37	3.9
Entrenchment Ratio	3.13	1.84	2.77	2.95	2.73	3.4	2.53	2.67	2.08	2.23	2.17	1.78	4.76	3.44	2.84	4.51	4.73	4.97	2.61	8.86	9.8	15.37	2.66	3.28
Wetted Perimeter(ft)	7.68	7.92	10.91	8.94	11.44	10.09	20.58	19.14	24.19	22.77	23.23	27.92	8.77	8.01	9.68	9.36	9.27	9.21	7.38	6.99	6.8	5.41	6.54	6.33
Hydraulic radius (ft)	0.54	0.59	0.58	0.53	0.53	0.59	0.96	0.99	0.97	0.96	0.91	0.8	0.77	0.61	0.8	0.72	0.69	0.74	0.93	0.71	0.86	0.72	0.89	0.9
Substrate																								
d50 (mm)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	4.8	7	0.12	4	20.5	6	N/A	N/A	N/A	N/A	N/A	N/A
d84 (mm)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	28	42	0.6	66	79	36	N/A	N/A	N/A	N/A	N/A	N/A

REACH 2																		
Parameter	As-built (2006)			MY-1 (2006)			MY-2 (2007)			MY-3 (2008)			MY-4 (2009)			MY-5 (2010)		
Pattern	Min	Max	Avg	Min	Max	Avg	Min	Max	Avg	Min	Max	Avg	Min	Max	Avg	Min	Max	Avg
Channel Beltwidth (ft)	11.83	22.05	16.96	11.56	23.13	17.05	11.45	24.13	17.55	10.41	25.86	15.91	11.96	21.21	15.94	8.93	20.86	15.88
Radius of Curvature (ft)	4.63	9.1	6.43	4.776	9.84	6.32	4.7	9.7	6.1	3.85	11.5	7.38	4.22	11.02	7.29	3.56	11.87	6.86
Meander Wavelength (ft)	27.51	34.72	31.75	28.61	35.43	32.47	28.42	35.03	31.73	21.56	40.37	30.58	28.77	35.91	31.36	26.41	38.55	31.32
Meander Width ratio	1.52	2.83	2.17	1.43	2.94	2.33	1.48	2.95	2.41	2.70	5.05	3.82	3.60	4.49	3.92	3.30	4.82	3.92
Profile																		
Riffle length (ft)	3.36	11.6	5.6	4.93	7.24	5.88	4.95	7.64	6.01	4.2	15.24	8.73	5.7	11.39	8.19	5.27	11.05	6.29
Riffle slope (ft/ft)	0.0053	0.0555	0.0279	0.0045	0.1073	0.0393	0.0049	0.0534	0.0325	0.00231	0.10249	0.037	0.01052	0.05894	0.036	0.023	0.085	0.05211
Pool length (ft)	5.2	10.08	7.59	5.17	14.37	8.67	5	15.25	10.125	4.07	12.31	9.59	6.47	16.42	10.3	6.85	15.49	10.93
Pool Slope (ft/ft)	0.001	0.0092	0.0022	0.00087	0.00754	0.00253	0.00084	0.00253	0.00738	0.0009	0.01199	0.00236	0	0.00746	0.00257	0	0.0073	0.00251
Pool spacing (ft)	9.43	28.94	19.51	14.65	35.31	21.98	14.65	36.12	26.95	8.83	33.24	19.04	11.19	31.62	18.34	10.35	34.98	17.83
Additional Reach Parameters																		
Valley Length (ft)	1872.37			1872.37			1872.37			1872.37			1872.37			1872.37		
Channel Length (ft)	2190.67			2190.67			2190.67			2190.67			2190.67			2190.67		
Sinuosity	1.2			1.2			1.2			1.2			1.2			1.2		
Water Surface Slope (ft/ft)	0.025			0.025			0.025			0.025			0.025			0.025		
BF slope (ft/ft)	0.025			0.025			0.025			0.025			0.025			0.025		
Rosgen Classification	B4			B4			B4			B4			B4			B4		
Habitat Index*	N/A			N/A			N/A			N/A			N/A			N/A		
Macrobenthos*	N/A			N/A			N/A			N/A			N/A			N/A		

IV. Methodology Section

With the exception of the aforementioned use of Level 2 (Planted and Natural Woody Stems) of the CVS-EEP Vegetation Monitoring Protocol, no deviations from initially prescribed methodologies were implemented as a part of Monitoring Year Five (2010) activities.



Directions:

From I-40 West, take exit 144, Old Mountain Road North (SR 1005)
Take a left at Sterling Road (SR 1526)
Then right at Linden Road (SR 1527)
Right on Bolick Road (SR 1532) West
Reach 1 is located immediately north of Bolick Road (SR 1532)

From Reach 1, return East on Bolick Road (SR 1532)
Take a right onto Linden Road (SR 1527)
Then right at New Sterling Road (SR 1526)
Reach 2 is located immediately west of the intersection of New Sterling Road (SR 1525) and Gray House Road (SR 1525)

Project Number: 9385.D11	Map Title: Figure 1 - Project Location
Project Manager: DG	Gray Farm Stream Restoration Site EEP Job # 92219 Iredell County, NC
Scale: 1" = 2,000'	
Date: DECEMBER 2010	Source: Stony Point Quadrangle

S&EC Soil & Environmental Consultants, PA
11010 Raven Ridge Rd • Raleigh, NC 27614
(919) 848-5002 • (919) 848-5467
Web Page: www.SandEC.com

Ecosystem Enhancement Program

APPENDIX A

VEGETATION RAW DATA

APPENDIX A.1 –

Vegetation Survey Data Tables

Table V-1 – Vegetation Metadata

Report Prepared By David Cooper
Date Prepared 11/16/2010 9:53

database name DRAFT_2008-Gray Farm-level2.mdb
database location \\Sec2\jobs7-9k\9385.D7-D11\YEAR 5 - D11\Monitoring_Data

DESCRIPTION OF WORKSHEETS IN THIS DOCUMENT----------

Metadata	This worksheet, which is a summary of the project and the project data.
Plots	List of plots surveyed.
Vigor	Frequency distribution of vigor classes.
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.
Stem Count by Plot and Spp	Count of living stems of each species for each plot; dead and missing stems are excluded.

PROJECT SUMMARY----------

Project Code	project Name	Description	length(ft)	stream-to-edge width (ft)	area (sq m)	Required Plots (calculated)	Sampled Plots
GF1	Gray Farm Reach 1	Gray Farm stream restoration - Reach 1					4
GF2	Gray Farm Reach 2	Gray Farm stream restoration - Reach 2					2

Table V-2 – Vegetation Vigor by Species

	Species	4	3	2	1	0	Missing
	Alnus serrulata	2	2			1	
	Betula nigra	2				1	
	Cornus amomum	1	1	1			
	Diospyros virginiana						
	Fraxinus pennsylvanica	1	1	1			
	Liquidambar styraciflua						
	Pinus taeda						
	Pinus virginiana						
	Quercus michauxii					1	
	Quercus phellos	3	4	7		4	
	Salix nigra						
	Sambucus canadensis						
	Viburnum nudum			1			
	Viburnum					1	
	Viburnum dentatum			1			
	Ilex opaca		1	1			
	Betula lenta						
	Carpinus caroliniana		1				
	Juniperus virginiana						
	Quercus rubra	2				1	
	Lindera benzoin					1	
	Liriodendron tulipifera	2		1			
	Platanus occidentalis	12	7	4		1	
	Prunus serotina						
	Acer negundo						
	Acer rubrum						
TOT:	**26**	**25**	**17**	**17**		**11**	

Table V-3 – Vegetation Damage by Species

	Species	All Damage Categories	(no damage)	Flood	Insects	Site Too Wet	Vine Strangulation
	Acer negundo	2	2				
	Acer rubrum	6	6				
	Alnus serrulata	5	3		2		
	Betula lenta	1	1				
	Betula nigra	3	2				1
	Carpinus caroliniana	2	2				
	Cornus amomum	3	3				
	Diospyros virginiana	3	3				
	Fraxinus pennsylvanica	4	4				
	Ilex opaca	2	2				
	Juniperus virginiana	1	1				
	Lindera benzoin	1	1				
	Liquidambar styraciflua	2	2				
	Liriodendron tulipifera	4	3			1	
	Pinus taeda	1	1				
	Pinus virginiana	1	1				
	Platanus occidentalis	28	26				2
	Prunus serotina	2	2				
	Quercus michauxii	1	1				
	Quercus phellos	18	16		1		1
	Quercus rubra	4	4				
	Salix nigra	1	1				
	Sambucus canadensis	1	1				
	Viburnum	1	1				
	Viburnum dentatum	1					1
	Viburnum nudum	1		1			
TOT:	**26**	**99**	**89**	**1**	**3**	**1**	**5**

Table V-4 – Vegetation Damage by Plot

	plot	All Damage Categories	(no damage)	Flood	Insects	Site Too Wet	Vine Strangulation
	GFR1-01-buffer1-year:4	13	11		1		1
	GFR1-01-buffer2-year:4	17	15	1		1	
	GFR1-01-buffer3-year:4	21	18		1		2
	GFR1-01-buffer4-year:4	18	17		1		
	GFR2-01-Buffer1-year:4	20	20				
	GFR2-01-Buffer2-year:4	10	8				2
TOT:	**6**	**99**	**89**	**1**	**3**	**1**	**5**

Table V-5 – Stem Count by Plot and Species

	Species	Total Stems	# plots	avg# stems	Gray Farm Reach 1, Buffer Plot 1, Year 5	Gray Farm Reach 1, Buffer Plot 2, Year 5	Gray Farm Reach 1, Buffer Plot 3, Year 5	Gray Farm Reach 1, Buffer Plot 4, Year 5	Gray Farm Reach 2, Buffer Plot 1, Year 5	Gray Farm Reach 2, Buffer Plot 2, Year 5
	Alnus serrulata	4	3	1.33	2		1	1		
	Betula nigra	2	2	1			1	1		
	Carpinus caroliniana	1	1	1					1	
	Cornus amomum	3	2	1.5			1	2		
	Fraxinus pennsylvanica	3	3	1	1	1	1			
	Ilex opaca	2	2	1			1		1	
	Liriodendron tulipifera	3	2	1.5		1				2
	Platanus occidentalis	23	6	3.83	2	2	9	7	2	1
	Quercus phellos	14	4	3.5	2	2			9	1
	Quercus rubra	2	2	1	1					1
	Viburnum dentatum	1	1	1						1
	Viburnum nudum	1	1	1		1				
TOT:	**12**	**59**	**12**		**8**	**7**	**14**	**11**	**13**	**6**
	Total Plot Density (Stems Per Acre)				**324**	**283**	**567**	**445**	**526**	**243**
	Average Plot Density (Stems Per Acre)				**398**					

APPENDIX A.2 –

Vegetation Problem Area Tables

Exhibit Table A1 - Vegetative Problem Areas
Gray Farm Stream Restoration Site/EEP Project #92219

Reach 1

Feature/Issue	Station # / Range	Probable Cause	Photo #
Bare Floodplain	42+75 - 43+30	Surface flow / Poor soil quality	1
Vegetative Problem Areas Improved from Last Year	All other previous problem areas	Revegetation of previously bare areas	2

Reach 2

Feature/Issue	Station # / Range	Probable Cause	Photo #
No Vegetative Problem Areas Observed	N/A	Revegetation of previously bare areas	N/A

APPENDIX A.3 –

Vegetation Problem Area Photos

Photo 1 – Bare Bench/Floodplain – Reach 1 – Year 5 (2010)

Photo 2 – Typical Vegetated Bank, Improved from Year 4 – Reach 1 – Year 5 (2010)

APPENDIX A.4 –

Vegetation Monitoring Plot Photos

Vegetation Monitoring Plot—Reach 1— Buffer 1—Year 5 (2010)

Vegetation Monitoring Plot—Reach 1— Buffer 1—Year 4 (2009)

Vegetation Monitoring Plot—Reach 1— Buffer 1—Year 3 (2008)

Vegetation Monitoring Plot—Reach 1—Buffer 1—Year 2 (2007)

Vegetation Monitoring Plot—Reach 1—Buffer 1—Year 1 (2006)

Appendix A Vegetation Monitoring Plot Photos

Vegetation Monitoring Plot—Reach 1— Buffer 2—Year 5 (2010)

Vegetation Monitoring Plot—Reach 1— Buffer 2—Year 4 (2009)

Vegetation Monitoring Plot—Reach 1— Buffer 2—Year 3 (2008)

Vegetation Monitoring Plot—Reach 1— Buffer 2—Year 2 (2007)

Vegetation Monitoring Plot—Reach 1— Buffer 2—Year 1 (2006)

Vegetation Monitoring Plot—Reach 1— Buffer 3—Year 5 (2010)

Vegetation Monitoring Plot—Reach 1— Buffer 3—Year 4 (2009)

Vegetation Monitoring Plot—Reach 1— Buffer 3—Year 3 (2008)

Vegetation Monitoring Plot—Reach 1— Buffer 3—Year 2 (2007)

Vegetation Monitoring Plot—Reach 1— Buffer 3—Year 1 (2006)

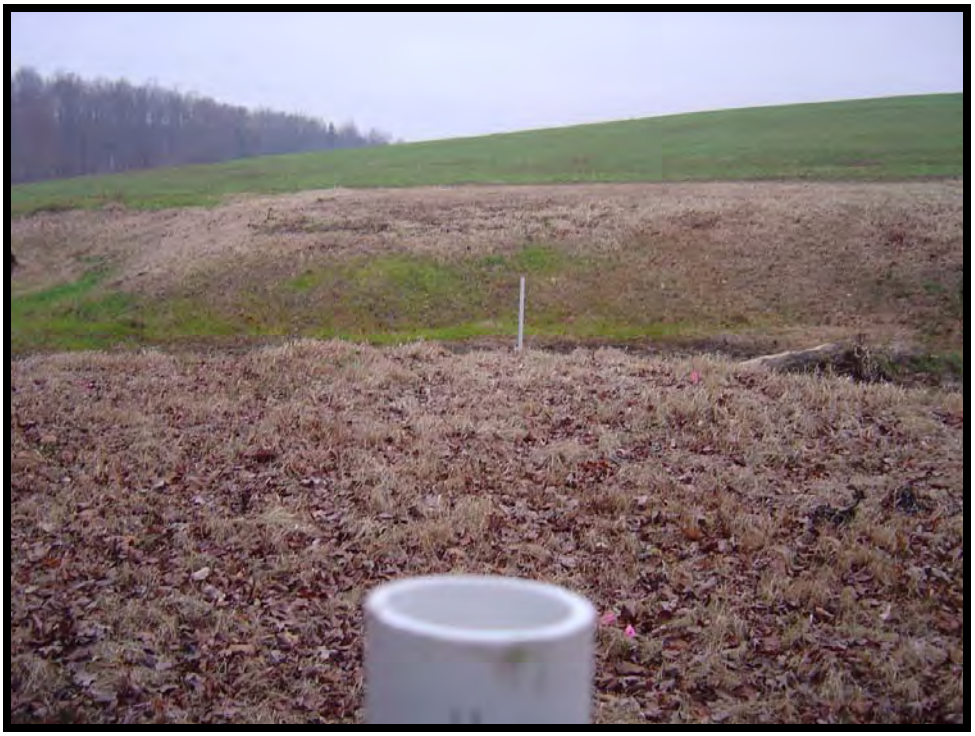
Vegetation Monitoring Plot—Reach 1— Buffer 4—Year 5 (2010)

Vegetation Monitoring Plot—Reach 1— Buffer 4—Year 4 (2009)

Vegetation Monitoring Plot—Reach 1— Buffer 4—Year 3 (2008)

Vegetation Monitoring Plot—Reach 1— Buffer 4—Year 2 (2007)

Appendix A Vegetation Monitoring Plot Photos



Vegetation Monitoring Plot—Reach 1— Buffer 4—Year 1 (2006)

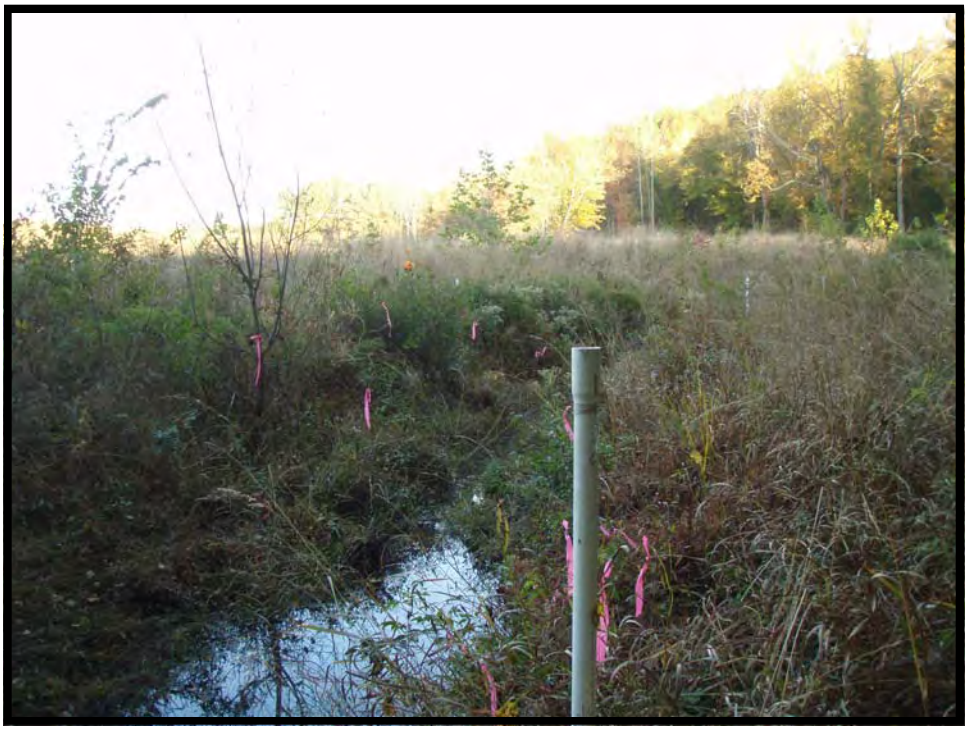
Vegetation Monitoring Plot—Reach 1— Bank 1—Year 5 (2010)

Vegetation Monitoring Plot—Reach 1— Bank 1—Year 4 (2009)

Vegetation Monitoring Plot—Reach 1— Bank 1—Year 3 (2008)

Vegetation Monitoring Plot—Reach 1— Bank 1—Year 2 (2007)

Vegetation Monitoring Plot—Reach 1— Bank 1—Year 1 (2006)



Vegetation Monitoring Plot—Reach 1— Bank 2—Year 5 (2010)

Vegetation Monitoring Plot—Reach 1— Bank 2—Year 4 (2009)

Vegetation Monitoring Plot—Reach 1— Bank 2—Year 3 (2008)

Vegetation Monitoring Plot—Reach 1— Bank 2—Year 2 (2007)

Vegetation Monitoring Plot—Reach 1— Bank 2—Year 1 (2006)

Vegetation Monitoring Plot—Reach 2— Buffer 1—Year 5 (2010)

Vegetation Monitoring Plot—Reach 2— Buffer 1—Year 4 (2009)

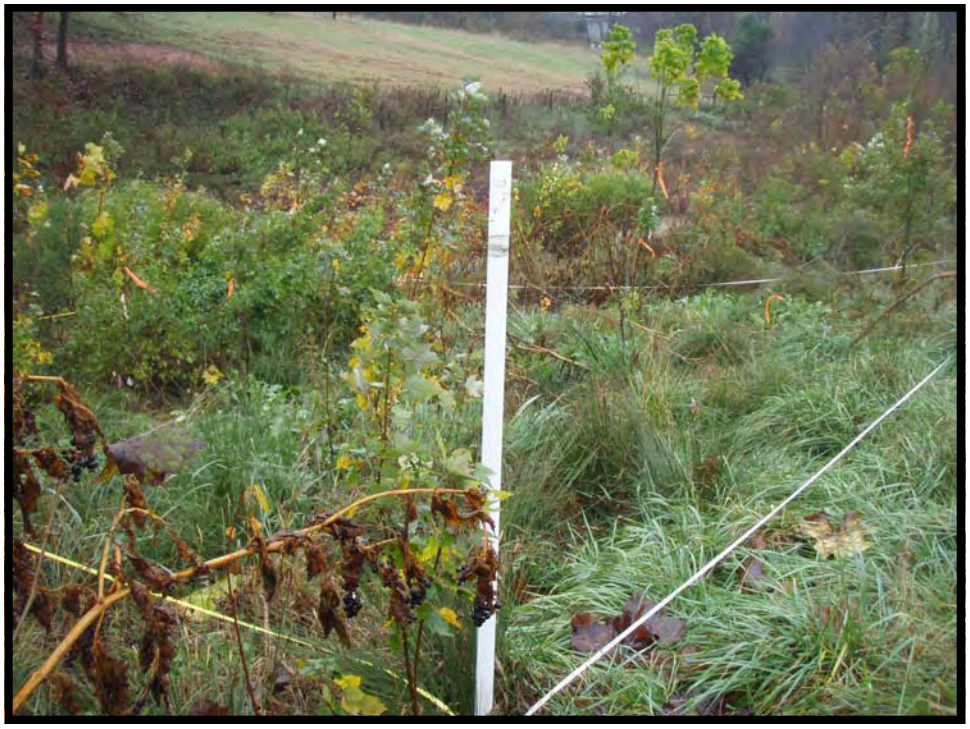
Vegetation Monitoring Plot—Reach 2— Buffer 1—Year 3 (2008)

Vegetation Monitoring Plot—Reach 2— Buffer 1—Year 2 (2007)

Appendix A Vegetation Monitoring Plot Photos

Vegetation Monitoring Plot—Reach 2— Buffer 1—Year 1 (2006)

Vegetation Monitoring Plot—Reach 2— Buffer 2—Year 5 (2010)



Vegetation Monitoring Plot—Reach 2— Buffer 2—Year 4 (2009)

Vegetation Monitoring Plot—Reach 2— Buffer 2—Year 3 (2008)

Vegetation Monitoring Plot—Reach 2— Buffer 2—Year 2 (2007)

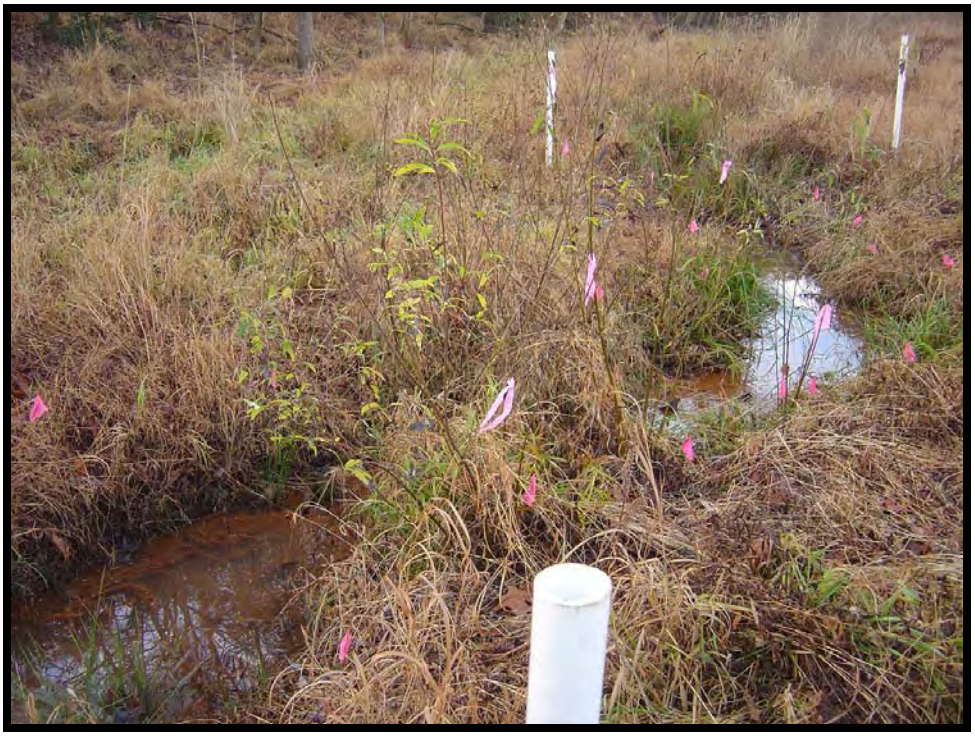
Vegetation Monitoring Plot—Reach 2— Buffer 2—Year 1 (2006)

Vegetation Monitoring Plot—Reach 2— Bank 1—Year 5 (2010)

Vegetation Monitoring Plot—Reach 2— Bank 1—Year 4 (2009)

Vegetation Monitoring Plot—Reach 2— Bank 1—Year 3 (2008)

Vegetation Monitoring Plot—Reach 2— Bank 1—Year 2 (2007)



Vegetation Monitoring Plot—Reach 2— Bank 1—Year 1 (2006)

Vegetation Monitoring Plot—Reach 2— Bank 2—Year 5 (2010)

Vegetation Monitoring Plot—Reach 2— Bank 2—Year 4 (2009)

Vegetation Monitoring Plot—Reach 2— Bank 2—Year 3 (2008)

Vegetation Monitoring Plot—Reach 2— Bank 2—Year 2 (2007)

Vegetation Monitoring Plot—Reach 2— Bank 2—Year 1 (2006)

APPENDIX B

GEOMORPHOLOGIC RAW DATA

APPENDIX B.1 –

Bankfull Events

Photo 1 – Reach 1 – Flattened vegetation near Cross-section 6

Photo 2 – Reach 1 – Overbank Event 10/27/2010

Photo 3 – Reach 2 – Wrack pile above channel

APPENDIX B.2 –

Stream Problem Area Table (Table B1)

Exhibit Table B1- Stream Problem Areas
Gray Farm Stream Restoration Site/EEP Project #92219

Reach 1			
Feature Issue	**Station numbers**	**Suspected Cause**	**Photo number**
Bank Scour	24+75	Surface flow	1-2
	30+00	Surface flow	
	41+60	Surface flow	
	43+05	Surface flow - Settling fill	
Undercut Bank	47+00 - 47+50	Increased water velocity from nearby tributary	3
Structures	0+30	Buried Structure - Upstream Sediment	4
	1+50	Buried Structure - Upstream Sediment	
	11+75	Stressed structure - Bank Scour	1-2
	24+75	Stressed structure - Bank Scour	
	31+60	Stressed structure - Bank Scour	
	41+60	Stressed structure - Bank Scour	
	43+05	Stressed structure - Bank Scour	

Reach 2			
Feature Issue	**Station numbers**	**Suspected Cause**	**Photo number**
Bank Scour	2+50	Surface Flow	5
	4+80	Surface flow	
	6+00	Surface flow	
	16+60	Surface flow	
	12+70 - 12+80	Surface flow	
Channel Scour	16+10	High Stormwater Flow	N/A
Structures	2+50	Stressed Structure - Bank Scour	5
	4+80	Stressed structure - Bank Scour	
	6+00	Stressed structure - Bank Scour	
	16+60	Stressed structure - Bank Scour	
	12+70 - 12+80	Stressed structures - Bank Scour	

APPENDIX B.3 –

Stream Problem Area Photos

Photo 1 – Typical Stressed Structure/Bank Scour – Reach 1 – Year 5 (2010)

Photo 2 – Typical Stressed Structure/Bank Scour – Reach 1 – Year 5 (2010)

Photo 3 – Typical Undercut Bank – Reach 1 – Year 5 (2010)

Photo 4 – Sediment from Off-site – Reach 1 near Beginning of Restoration – Year 5 (2010)

Photo 5 – Typical Stressed Structure/Bank Scour – Reach 2 – Year 5 (2010)

APPENDIX B.4 –

Stream Photo-Station Photos

Cross-Section 1— Reach 1—Riffle 1—Year 5 (2010)

Cross-Section 1— Reach 1—Riffle 1—Year 4 (2009)

Cross-Section 1— Reach 1—Riffle 1—Year 3 (2008)

Cross-Section 1— Reach 1—Riffle 1—Year 2 (2007)

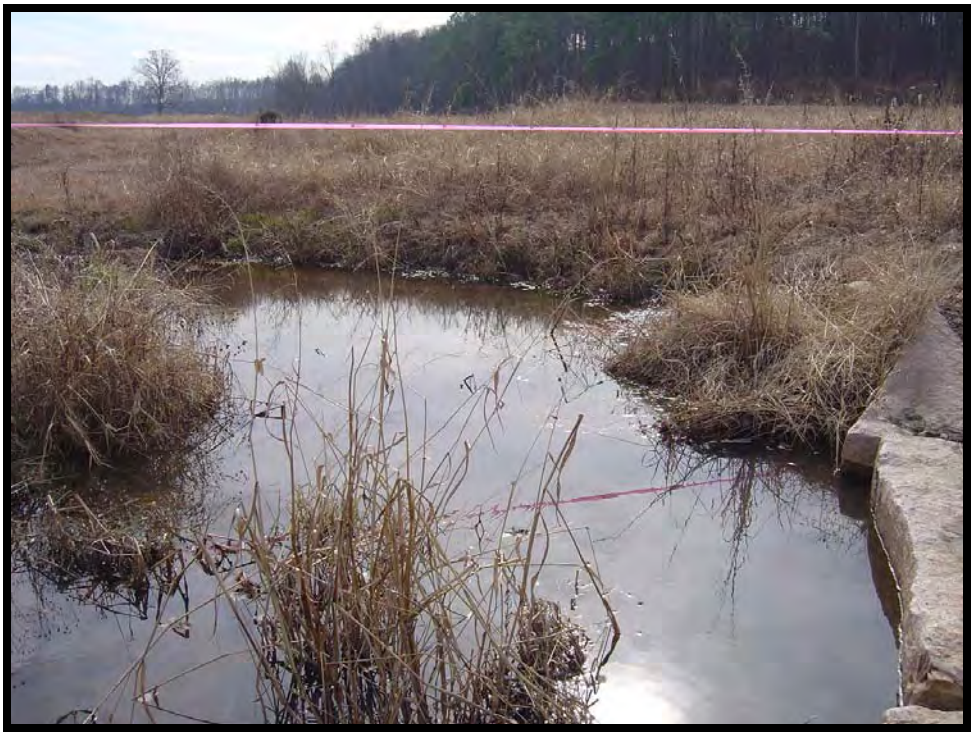
Cross-Section 1— Reach 1—Riffle 1—Year 1 (2006)

Cross-Section 1— Reach 1—Pool 1—Year 5 (2010)

Cross-Section 1— Reach 1—Pool 1—Year 4 (2009)

Cross-Section 1— Reach 1—Pool 1—Year 3 (2008)

Cross-Section 1— Reach 1—Pool 1—Year 2 (2007)



Cross-Section 1— Reach 1—Pool 1—Year 1 (2006)

Cross-Section 1— Reach 1—Riffle 2—Year 5 (2010)

Cross-Section 2—Reach 1—Riffle 2—Year 4 (2009)

Cross-Section 2—Reach 1—Riffle 2—Year 3 (2008)

Cross-Section 2—Reach 1—Riffle 2—Year 2 (2007)

Cross-Section 2—Reach 1—Riffle 2—Year 1 (2006)

Cross-Section 1— Reach 1—Pool 2—Year 5 (2010)

Cross-Section 2—Reach 1 - Pool 2—Year 4 (2009)

Cross-Section 2—Reach 1 - Pool 2—Year 3 (2008)

Cross-Section 2—Reach 1 - Pool 2—Year 2 (2007)

Cross-Section 2—Reach 1 - Pool 2—Year 1 (2006)

Cross-Section 1— Reach 1—Riffle 3—Year 5 (2010)

Cross-Section 3—Reach 1—Riffle 3—Year 4 (2009)

Cross-Section 3—Reach 1—Riffle 3—Year 3 (2008)

Cross-Section 3—Reach 1—Riffle 3—Year 2 (2007)

Cross-Section 3—Reach 1—Riffle 3—Year 1 (2006)

Cross-Section 1— Reach 1—Pool 3—Year 5 (2010)

Cross-Section 3—Reach 1 - Pool 3—Year 4 (2009)

Cross-Section 3—Reach 1 - Pool 3—Year 3 (2008)

Cross-Section 3—Reach 1 - Pool 3—Year 2 (2007)

Cross-Section 3—Reach 1 - Pool 3—Year 1 (2006)

Cross-Section 1— Reach 1—Riffle 4—Year 5 (2010)

Cross-Section 4—Reach 1—Riffle 4—Year 4 (2009)

Cross-Section 4—Reach 1—Riffle 4—Year 3 (2008)

Cross-Section 4—Reach 1—Riffle 4—Year 2 (2007)

Cross-Section 4—Reach 1—Riffle 4—Year 1 (2006)

Cross-Section 1— Reach 1—Pool 4—Year 5 (2010)

Cross-Section 4—Reach 1—Pool 4—Year 4 (2009)

Cross-Section 4—Reach 1—Pool 4—Year 3 (2008)

Cross-Section 4—Reach 1—Pool 4—Year 2 (2007)

Cross-Section 4—Reach 1—Pool 4—Year 1 (2006)

Cross-Section 1— Reach 1—Riffle 5—Year 5 (2010)

Cross-Section 5—Reach 1—Riffle 5—Year 4 (2009)

Cross-Section 5—Reach 1—Riffle 5—Year 3 (2008)

Cross-Section 5—Reach 1—Riffle 5—Year 2 (2007)

Cross-Section 5—Reach 1—Riffle 5—Year 1 (2006)

Cross-Section 1— Reach 1—Pool 5—Year 5 (2010)

Cross-Section 5—Reach 1—Pool 5—Year 4 (2009)

Cross-Section 5—Reach 1—Pool 5—Year 3 (2008)

Cross-Section 5—Reach 1—Pool 5—Year 2 (2007)

Cross-Section 5—Reach 1—Pool 5—Year 1 (2006)

Cross-Section 1— Reach 1—Riffle 6—Year 5 (2010)

Cross-Section 6—Reach 1—Riffle 6—Year 4 (2009)

Cross-Section 6—Reach 1—Riffle 6—Year 3 (2008)

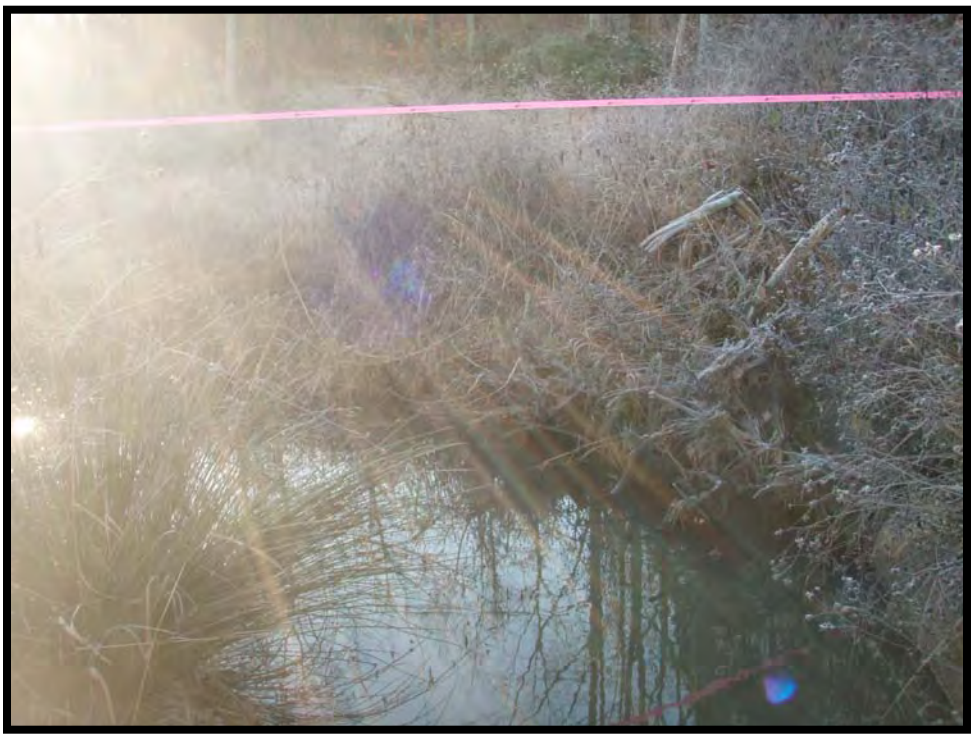
Cross-Section 6—Reach 1—Riffle 6—Year 2 (2007)

Cross-Section 6—Reach 1—Riffle 6—Year 1 (2006)

Cross-Section 1— Reach 1—Pool 6—Year 5 (2010)

Cross-Section 6—Reach 1—Pool 6—Year 4 (2009)

Cross-Section 6—Reach 1—Pool 6—Year 3 (2008)



Cross-Section 6—Reach 1—Pool 6—Year 2 (2007)

Cross-Section 6—Reach 1—Pool 6—Year 1 (2006)

Cross-Section 1— Reach 1—Riffle 7—Year 5 (2010)

Cross-Section 7—Reach 1—Riffle 7—Year 4 (2009)

Cross-Section 7—Reach 1—Riffle 7—Year 3 (2008)

Cross-Section 7—Reach 1—Riffle 7—Year 2 (2007)

Cross-Section 7—Reach 1—Riffle 7—Year 1 (2006)

Cross-Section 1— Reach 1—Pool 7—Year 5 (2010)

Cross-Section 7—Reach 1—Pool 7—Year 4 (2009)

Cross-Section 7—Reach 1—Pool 7—Year 3 (2008)

Cross-Section 7—Reach 1—Pool 7—Year 2 (2007)

Cross-Section 7—Reach 1—Pool 7—Year 1 (2006)

Cross-Section 1— Reach 2—Riffle 1—Year 5 (2010)

Cross-Section 1—Reach 2—Riffle 1—Year 4 (2009)

Cross-Section 1—Reach 2—Riffle 1—Year 3 (2008)

Cross-Section 1—Reach 2—Riffle 1—Year 2 (2007)

Cross-Section 1—Reach 2—Riffle 1—Year 1 (2006)

Cross-Section 1— Reach 2—Pool 1—Year 5 (2010)

Cross-Section 1—Reach 2—Pool 1—Year 4 (2009)

Cross-Section 1—Reach 2—Pool 1—Year 3 (2008)

Cross-Section 1—Reach 2—Pool 1—Year 2 (2007)

Cross-Section 1—Reach 2—Pool 1—Year 1 (2006)

Cross-Section 1— Reach 2—Riffle 2—Year 5 (2010)

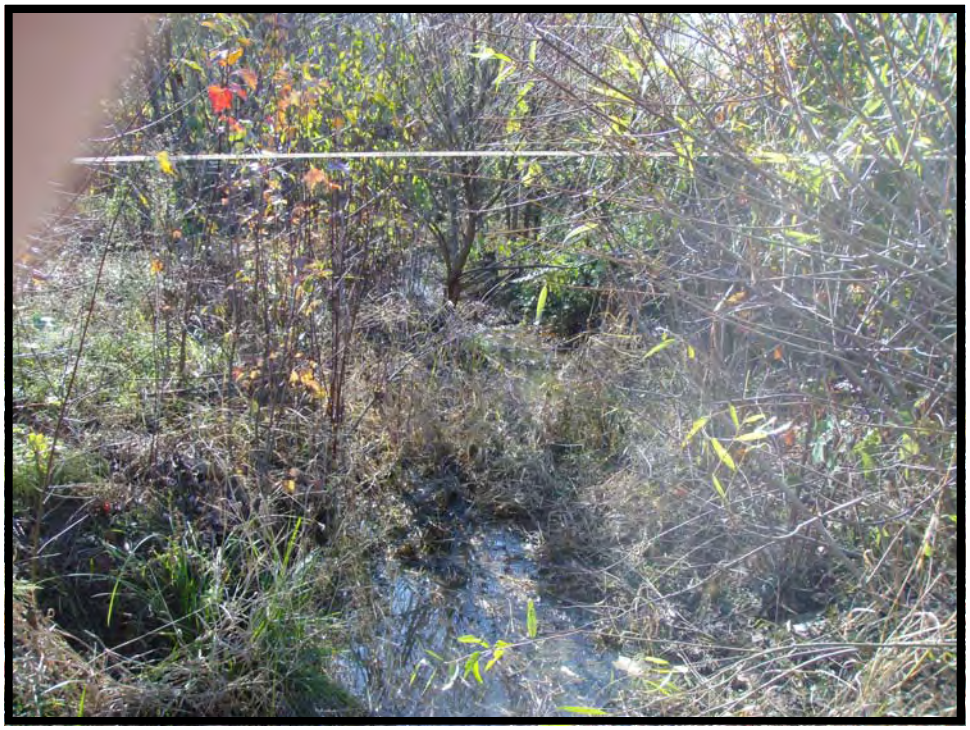
Cross-Section 2—Reach 2—Riffle 2—Year 4 (2009)

Cross-Section 2—Reach 2—Riffle 2—Year 3 (2008)

Cross-Section 2—Reach 2—Riffle 2—Year 2 (2007)

Cross-Section 2—Reach 2—Riffle 2—Year 1 (2006)

Cross-Section 1— Reach 2—Pool 2—Year 5 (2010)



Cross-Section 2—Reach 2—Pool 2—Year 4 (2009)

Cross-Section 2—Reach 2—Pool 2—Year 3 (2008)

Cross-Section 2—Reach 2—Pool 2—Year 2 (2007)

Cross-Section 2—Reach 2—Pool 2—Year 1 (2006)

APPENDIX B.5 –

Exhibit Table B2 - Qualitative Visual Stability Assessment

Table B2 - Qualitative Visual Stability Assessment
Date: NOVEMBER 2010 Project # 9385.D11
GRAY FARM STREAM RESTORATION - REACH 1

Feature Category	Metric (per As-built and reference baselines	(# stable) Number performing as intended	Total number per As-built	Total Number / feet in unstable state	% perfor. in stable condition	Feature Perform. Mean or Total
A. Riffles	1. Present?	34	34	NA	100%	
	2. Armor stable (e.g. no displacement)?	34	34	NA	100%	
	3. Facet grade appears stable?	33	34	NA	97%	
	4. Stable interval grade?	34	34	NA	100%	
	5. Feature spacing appropriate?	34	34	NA	100%	
	6. Minimal evidence of embedding/fining?	22	34	NA	65%	
	7. Depth appears appropriate for current discharge?	34	34	NA	100%	
	8. Length appropriate?	34	34	NA	100%	**95%**
B. Pools	1. Present? (e.g. not subject to severe aggradation?)	35	49	NA	71%	
	2. Sufficiently deep (Max Pool D:Mean Bkf>1.6)	48	49	NA	98%	
	3. Thalweg located outer bend?	49	49	NA	100%	
	4. Spacing appropriate?	49	49	NA	100%	
	5. Non-aggrading (not filling)?	35	49	NA	71%	
	6. Length appropriate?	49	49	NA	100%	**88%**
C. Thalweg	1. Upstream of meander bend (run/inflection) centering?	34	34	NA	100%	
	2. Downstream of meander (glide/inflection) centering?	33	34	NA	95%	**98%**
D. Meanders	1. Outer bend in state of limited/controlled erosion?	48	49	NA	98%	
	2. Of those eroding, # w/ concomitant point bar formation?	N/A	49	NA	N/A	
	3. Apparent Rc within spec?	49	49	NA	100%	
	4. Sufficient floodplain access and relief?	49	49	NA	100%	**99%**
E. Bed General	1. General channel bed aggradation areas (bar formation)	NA	NA	25	99%	
	2. Channel bed degradation - areas of increasing dow cutting or head cutting?	NA	NA	75	98%	**99%**
G. Banks	1. Apparent scour points from channel processes	NA	NA	35	99%	
	2. Apparent cut points from overland flow	NA	NA	150	96%	
	3. Apparent cut or scour from flood water re-entry to channel (e.g. inadequate floodplain access?)	NA	NA	0	100%	
	4. Tension cracks	NA	NA	0	100%	
	5. Bank gradient in excess of 40%?	NA	NA	0	100%	
	6. Collapse/slumping	NA	NA	25	99%	
	7. Ratio of bank height: bankfull height elevated	NA	NA	0	100%	**99%**
H. Vanes	1. Free of back or arm scour?	26	28	N/A	93%	
	2. Height appropriate?	28	28	N/A	100%	
	3. Angle and geometry appear appropriate?	26	28	N/A	93%	
	4. Free of piping or other structural failures?	26	28	N/A	93%	**95%**
I. Wads/Boulders	1. Free of scour?	0	0	N/A	N/A	
	2. Footing stable?	0	0	N/A	N/A	**N/A**

Notes:

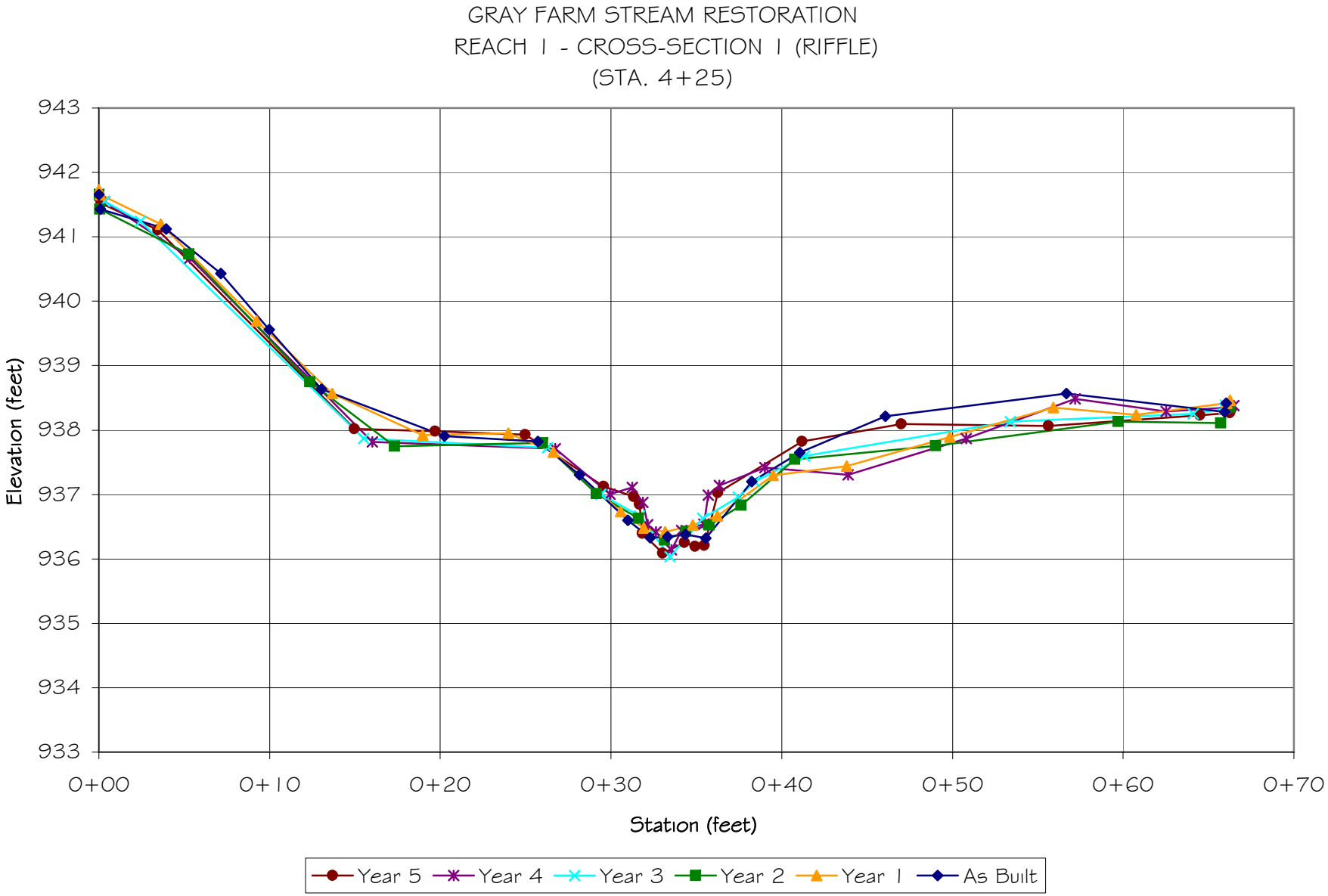
Table B2 - Qualitative Visual Stability Assessment
Date: NOVEMBER 2010 Project # 9385.D11
GRAY FARM STREAM RESTORATION - REACH 2

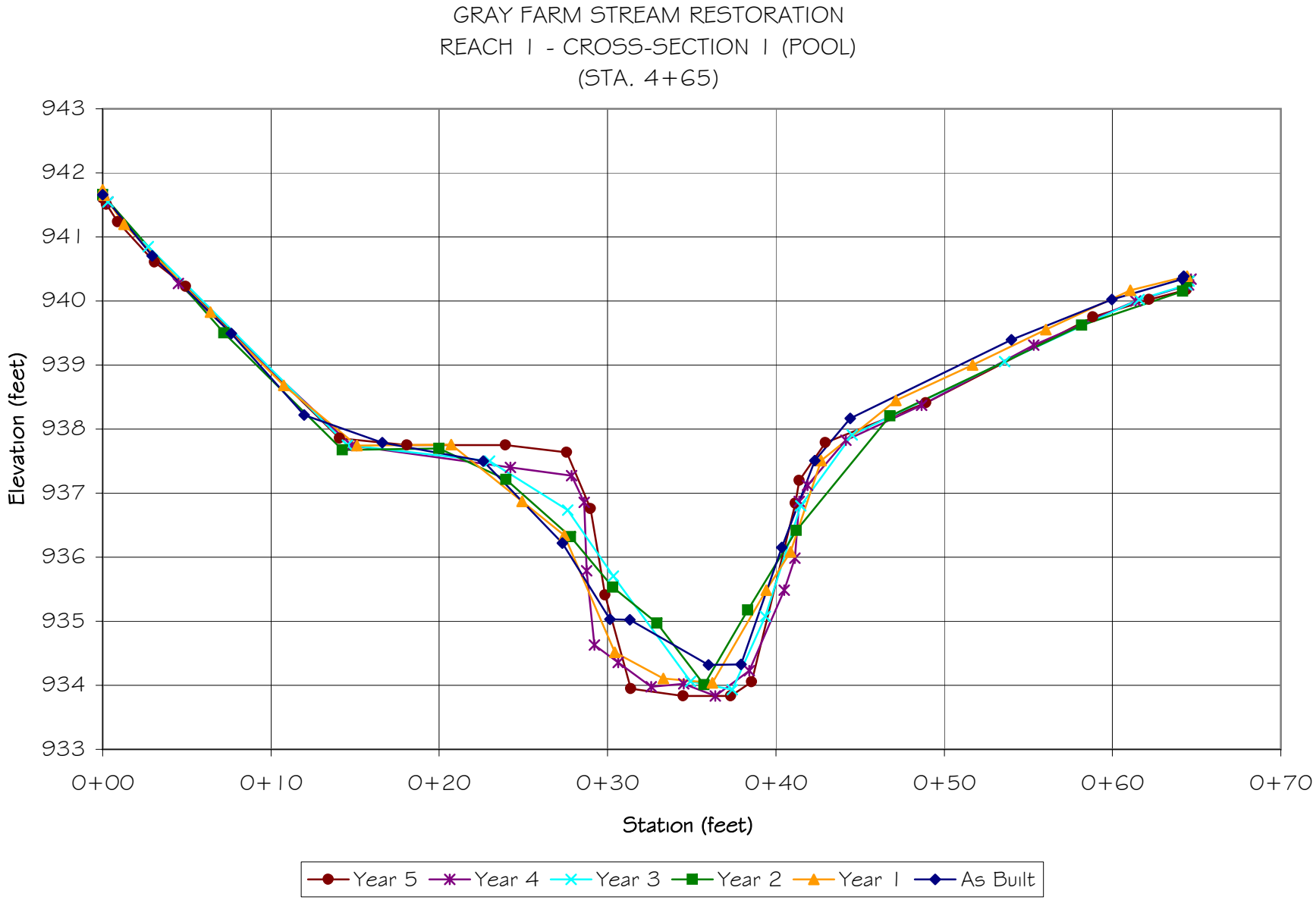
Feature Category	Metric (per As-built and reference baselines	(# stable) Number performing as intended	Total number per As-built	Total Number / feet in unstable state	% perfor. in stable condition	Feature Perform. Mean or Total
A. Riffles	1. Present?	51	51	NA	100%	
	2. Armor stable (e.g. no displacement)?	51	51	NA	100%	
	3. Facet grade appears stable?	51	51	NA	100%	
	4. Stable interval grade?	51	51	NA	100%	
	5. Feature spacing appropriate?	51	51	NA	100%	
	6. Minimal evidence of embedding/fining?	51	51	NA	100%	
	7. Depth appears appropriate for current discharge?	51	51	NA	100%	
	8. Length appropriate?	51	51	NA	100%	**100%**
B. Pools	1. Present? (e.g. not subject to severe aggradation?)	52	52	NA	100%	
	2. Sufficiently deep (Max Pool D:Mean Bkf>1.6)	52	52	NA	100%	
	3. Thalweg located outer bend?	52	52	NA	100%	
	4. Spacing appropriate?	52	52	NA	N/A	
	5. Non-aggrading (not filling)?	52	52	NA	100%	
	6. Length appropriate?	52	52	NA	N/A	**100%**
C. Thalweg	1. Upstream of meander bend (run/inflection) centering?	51	51	NA	100%	
	2. Downstream of meander (glide/inflection) centering?	51	51	NA	100%	**100%**
D. Meanders	1. Outer bend in state of limited/controlled erosion?	49	52	NA	94%	
	2. Of those eroding, # w/ concomitant point bar formation?	N/A	N/A	NA	N/A	
	3. Apparent Rc within spec?	52	52	NA	100%	
	4. Sufficient floodplain access and relief?	52	52	NA	100%	**97%**
E. Bed General	1. General channel bed aggradation areas (bar formation)	NA	NA	0	100%	
	2. Channel bed degradation - areas of increasing dow cutting or head cutting?	NA	NA	25	98%	**99%**
G. Banks	1. Apparent scour points from channel processes	NA	NA	25	98%	
	2. Apparent cut points from overland flow	NA	NA	0	100%	
	3. Apparent cut or scour from flood water re-entry to channel (e.g. inadequate floodplain access?)	NA	NA	0	100%	
	4. Tension cracks	NA	NA	0	100%	
	5. Bank gradient in excess of 40%?	NA	NA	0	100%	
	6. Collapse/slumping	NA	NA	0	100%	
	7. Ratio of bank height: bankfull height elevated	NA	NA	0	100%	**100%**
H. Vanes	1. Free of back or arm scour?	50	53	NA	94%	
	2. Height appropriate?	53	53	NA	100%	
	3. Angle and geometry appear appropriate?	51	53	NA	96%	
	4. Free of piping or other structural failures?	50	53	NA	94%	**96%**
I. Wads/Boulders	1. Free of scour?	0	0	NA	N/A	
	2. Footing stable?	0	0	NA	N/A	**N/A**

Notes:

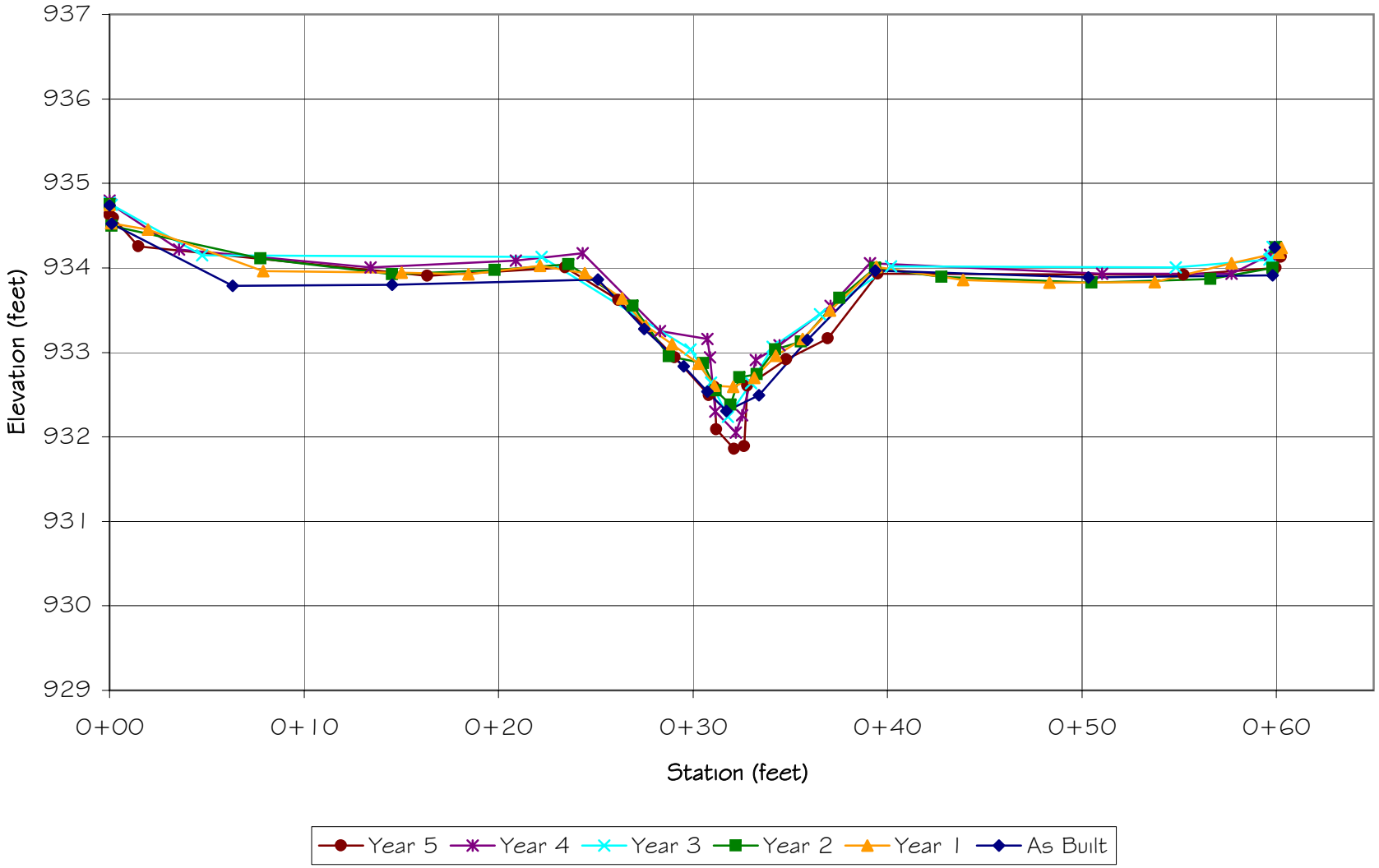
APPENDIX B.6 –

Annual Overlays of Cross Section Plots

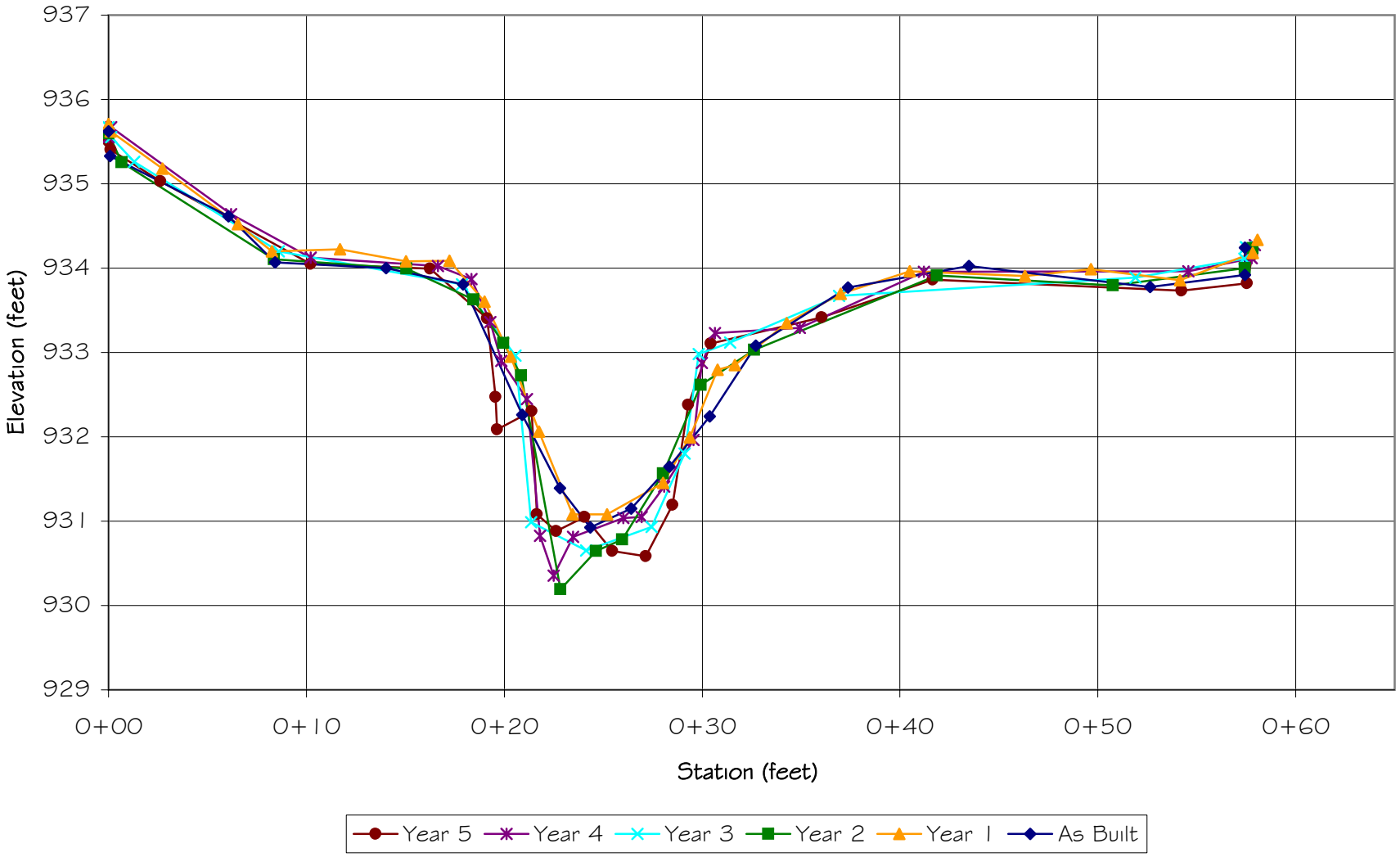

GRAY FARM STREAM RESTORATION
REACH 1 - CROSS-SECTION 1 (RIFFLE)
(STA. 4+25)
Elevation (feet)
943
942
941
940
939
938
937
936
935
934
933
0+00
0+10
0+20
0+30
0+40
0+50
0+60
0+70
Station (feet)
Year 5
Year 4
Year 3
Year 2
Year 1
As Built


GRAY FARM STREAM RESTORATION
REACH 1 - CROSS-SECTION 1 (POOL)
(STA. 4+65)
Elevation (feet)
943
942
941
940
939
938
937
936
935
934
933
0+00
0+10
0+20
0+30
0+40
0+50
0+60
0+70
Station (feet)
Year 5
Year 4
Year 3
Year 2
Year 1
As Built

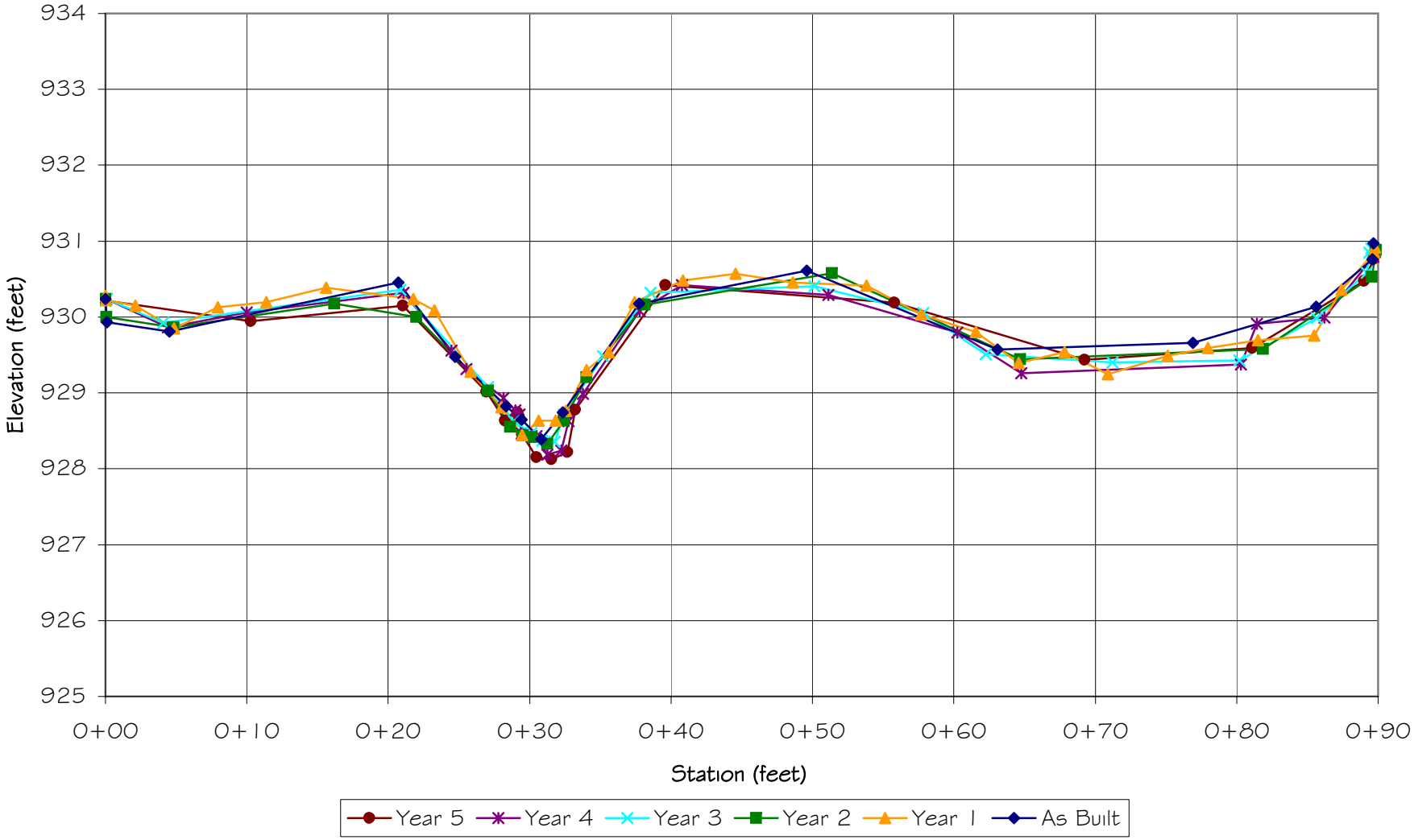
GRAY FARM STREAM RESTORATION
REACH 1 - CROSS-SECTION 2 (RIFFLE)
(STA. 13+55)



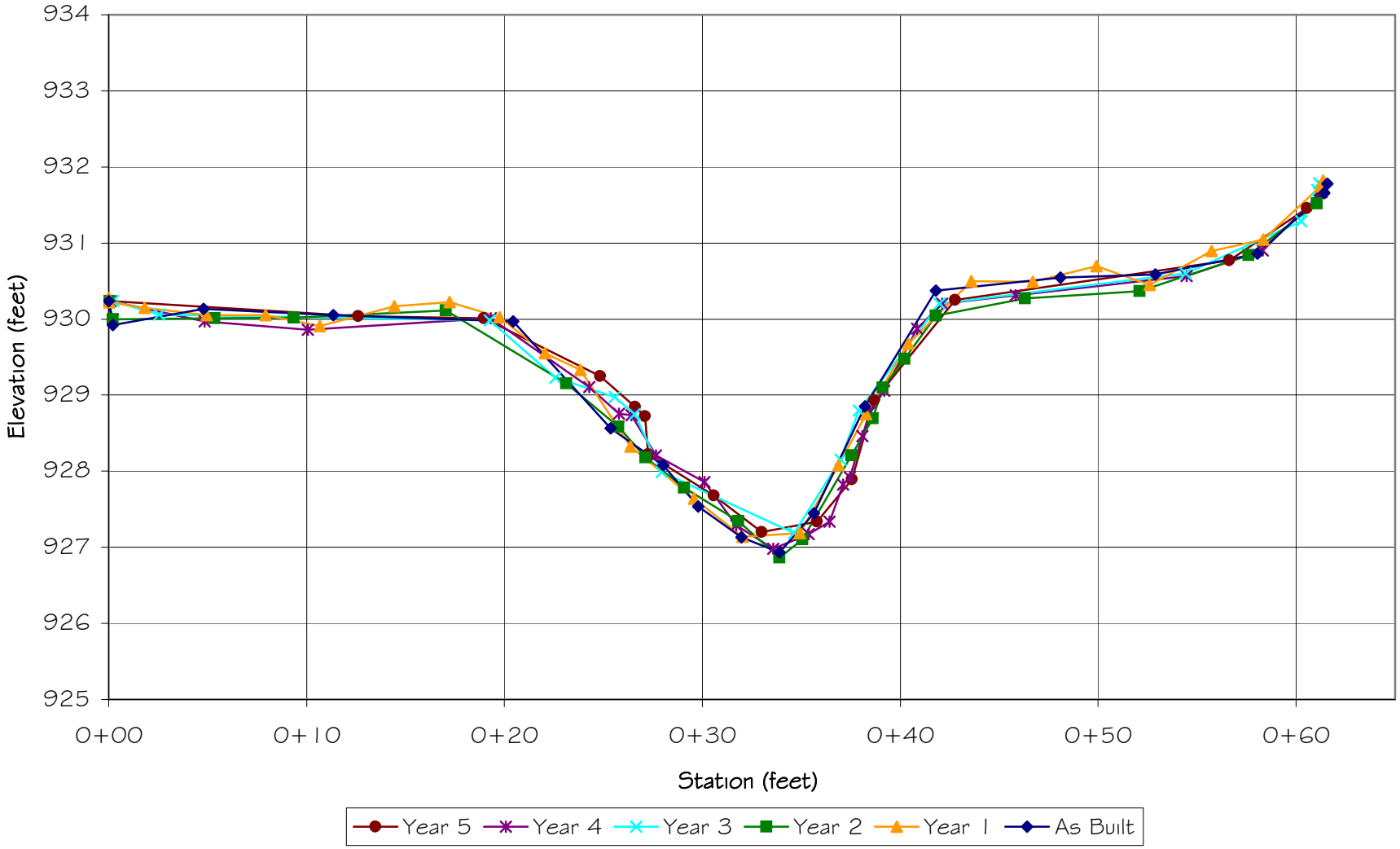
GRAY FARM STREAM RESTORATION
REACH 1 - CROSS-SECTION 2 (POOL)
(STA. 13+90)



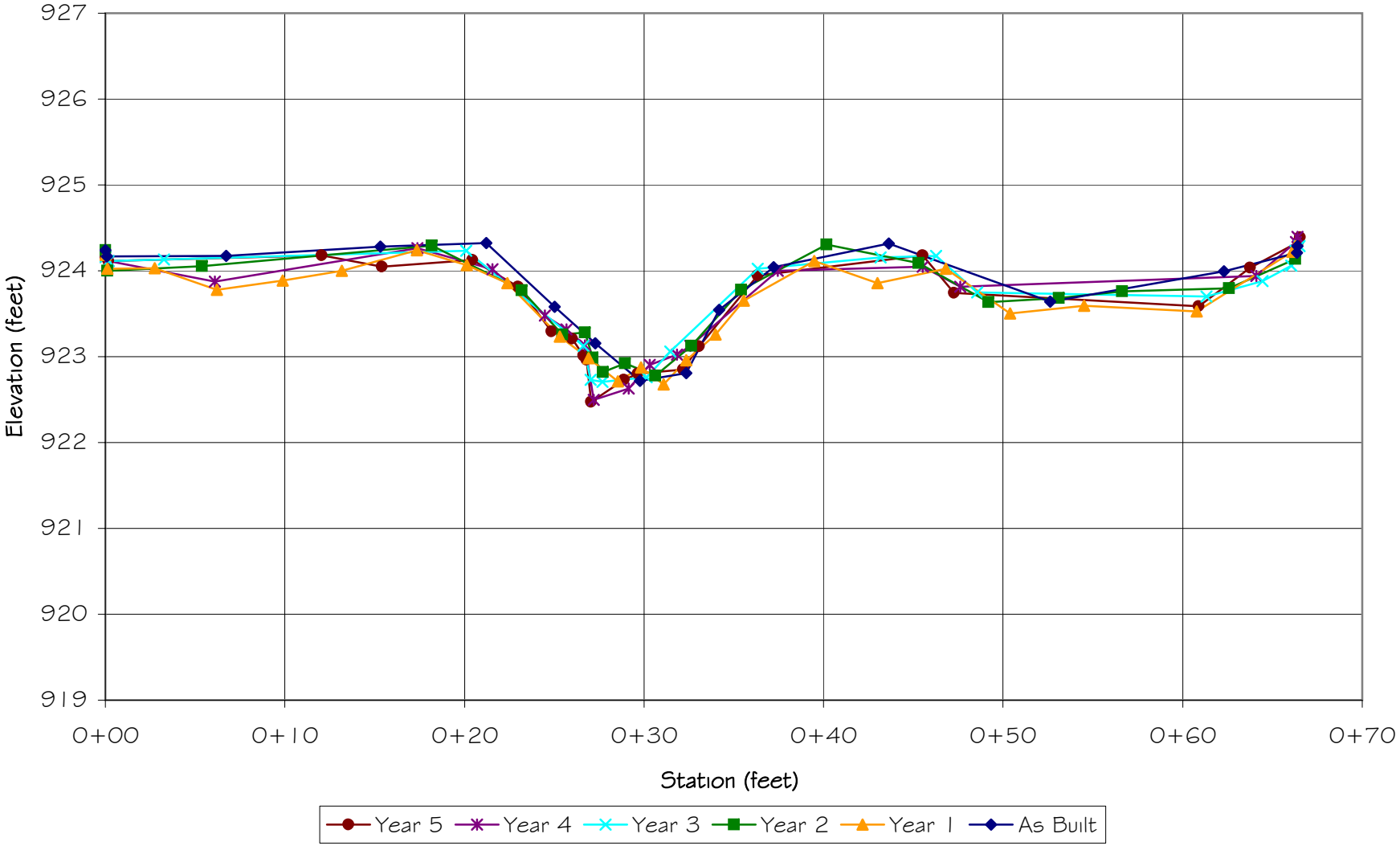
GRAY FARM STREAM RESTORATION
REACH 1 - CROSS-SECTION 3 (RIFFLE)
(STA. 23+40)



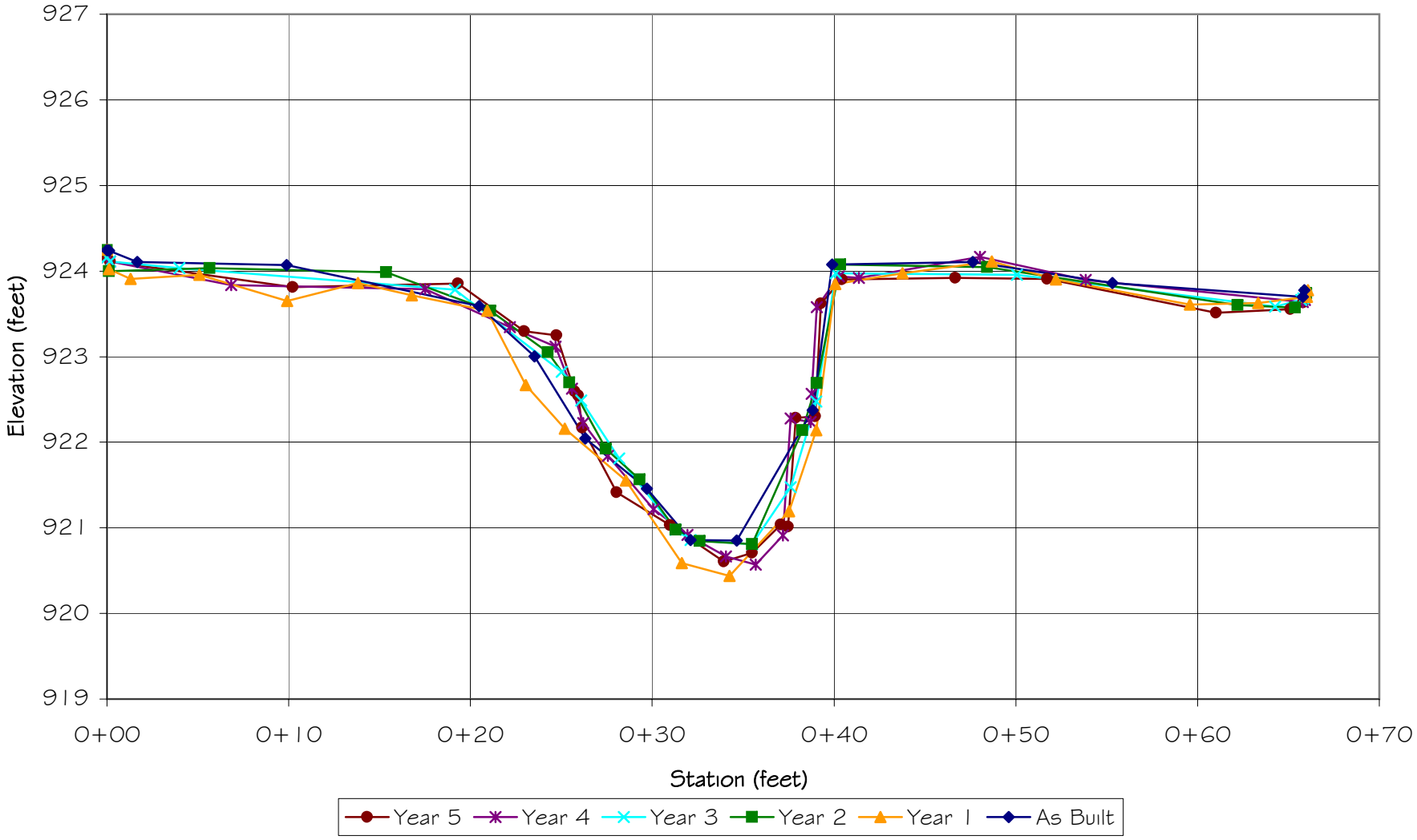
GRAY FARM STREAM RESTORATION
REACH 1 - CROSS-SECTION 3 (POOL)
(STA. 23+20)



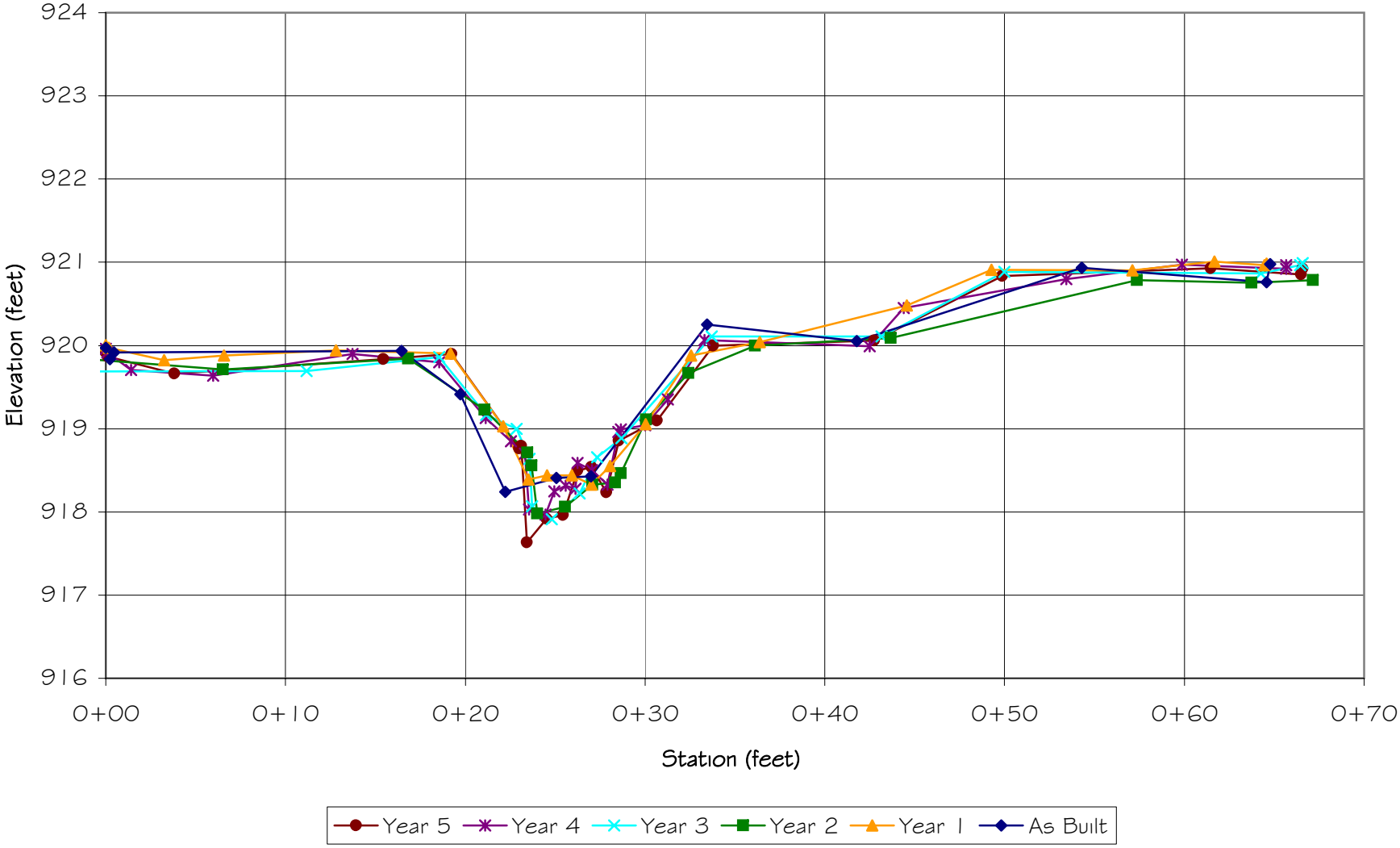
GRAY FARM STREAM RESTORATION
REACH 1 - CROSS-SECTION 4 (RIFFLE)
(STA. 32+95)

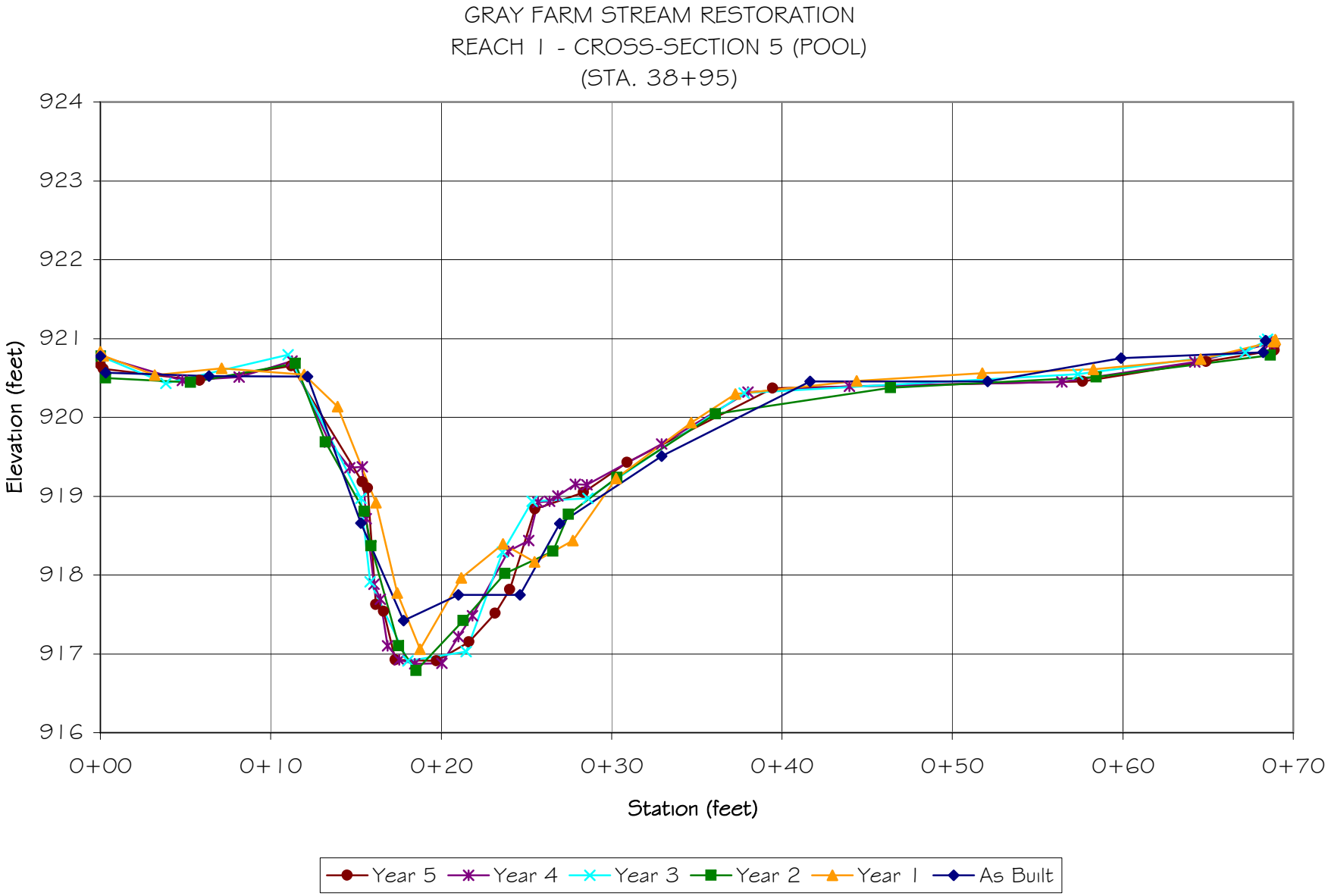


GRAY FARM STREAM RESTORATION
REACH 1 - CROSS-SECTION 4 (POOL)
(STA. 33+30)

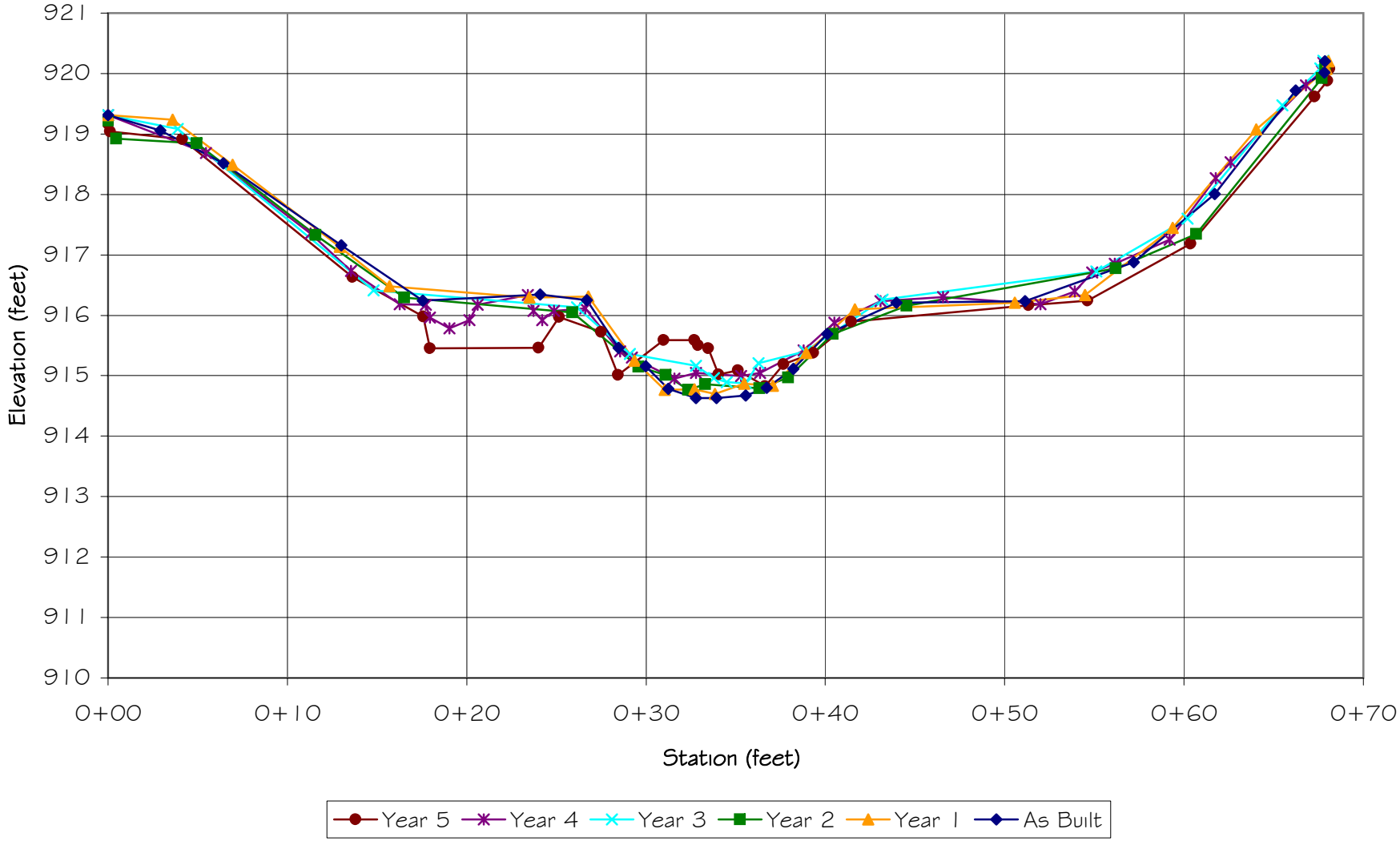


GRAY FARM STREAM RESTORATION
REACH 1 - CROSS-SECTION 5 (RIFFLE)
(STA. 39+30)

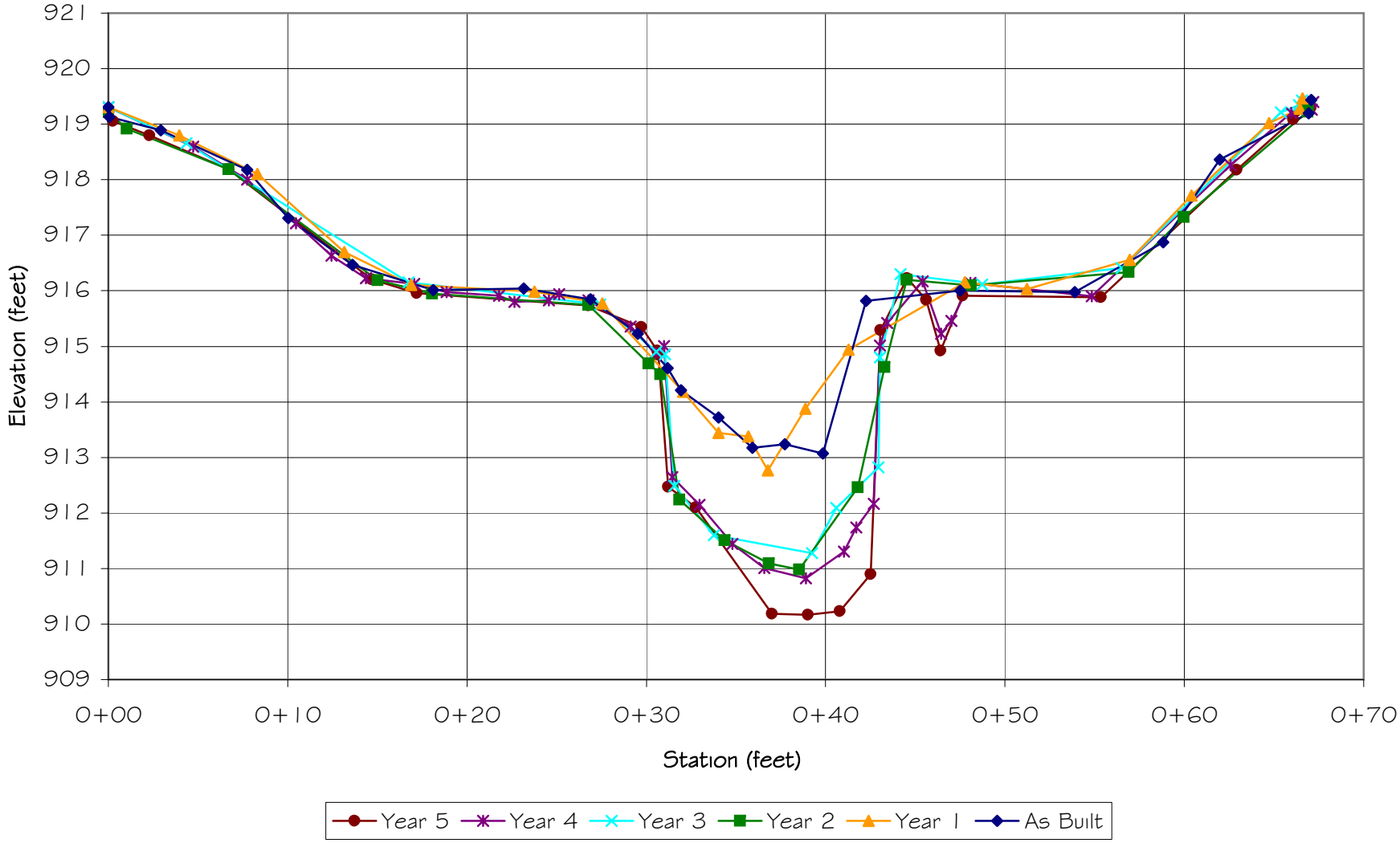



GRAY FARM STREAM RESTORATION
REACH 1 - CROSS-SECTION 5 (POOL)
(STA. 38+95)
924
923
922
921
920
919
918
917
916
Elevation (feet)
0+00
0+10
0+20
0+30
0+40
0+50
0+60
0+70
Station (feet)
Year 5
Year 4
Year 3
Year 2
Year 1
As Built

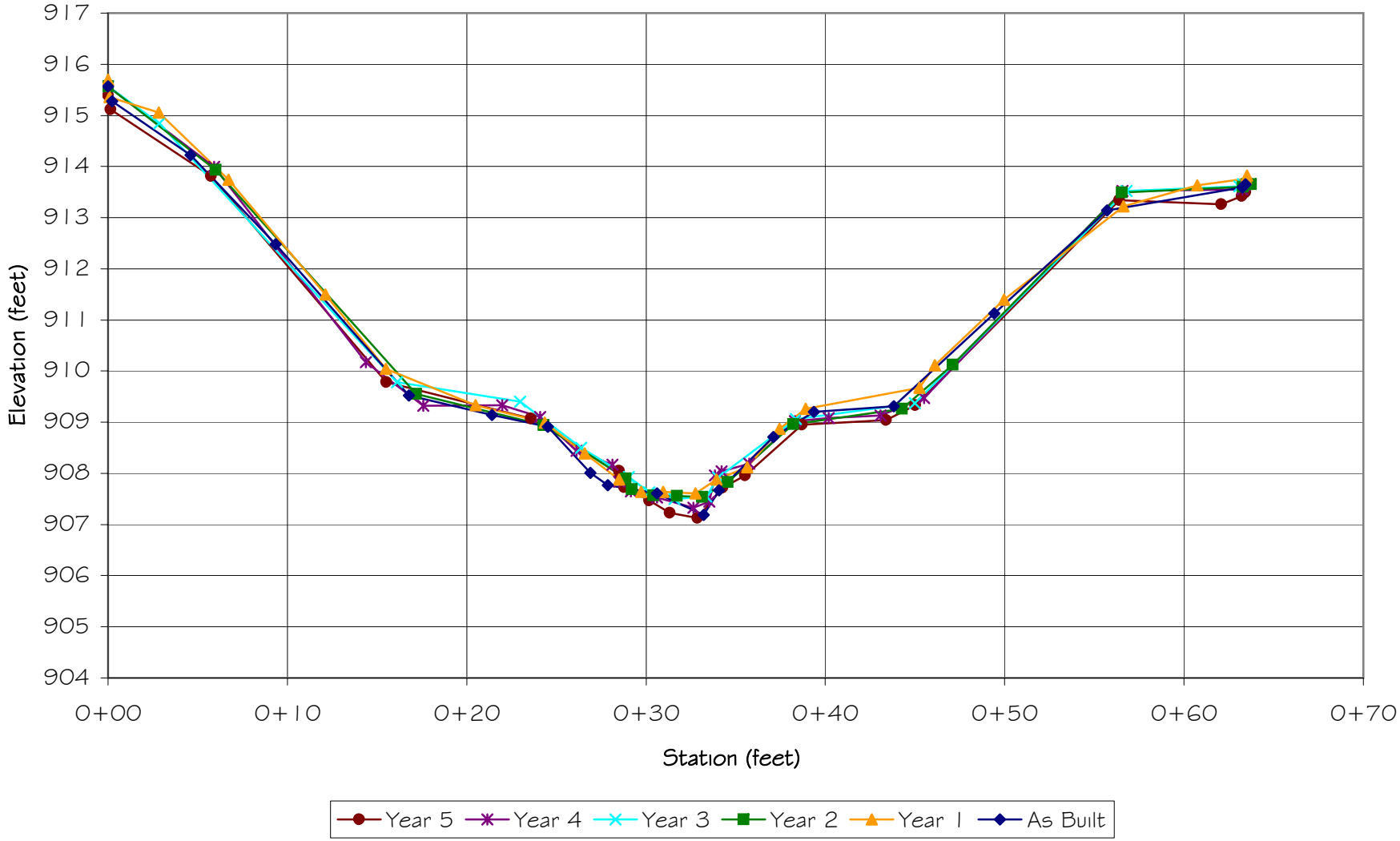
GRAY FARM STREAM RESTORATION
REACH 1 - CROSS-SECTION 6 (RIFFLE)
(STA. 42+80)



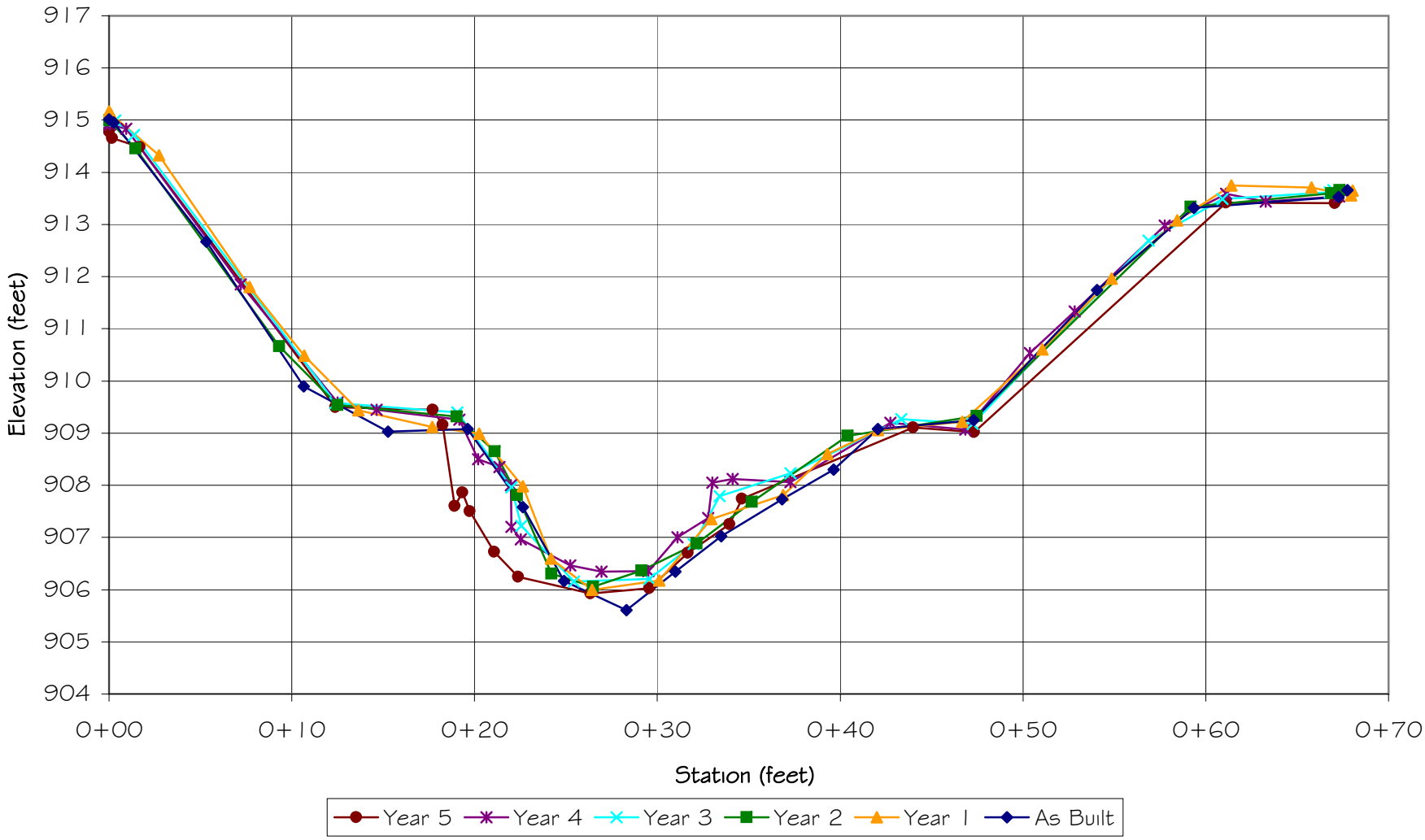
GRAY FARM STREAM RESTORATION
REACH 1 - CROSS-SECTION 6 (POOL)
(STA. 43+10)

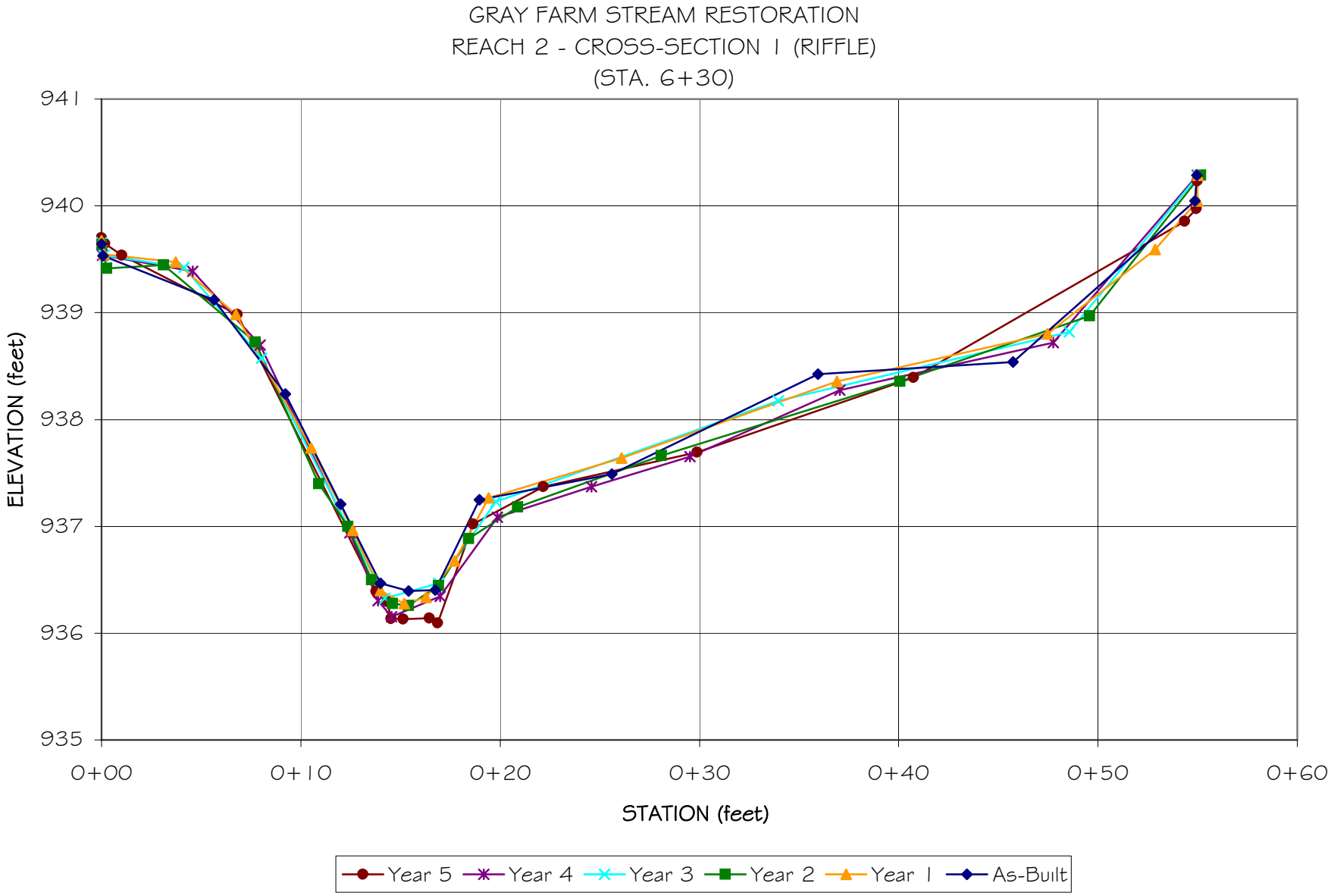


GRAY FARM STREAM RESTORATION
REACH 1 - CROSS-SECTION 7 (RIFFLE)
(STA. 54+05)

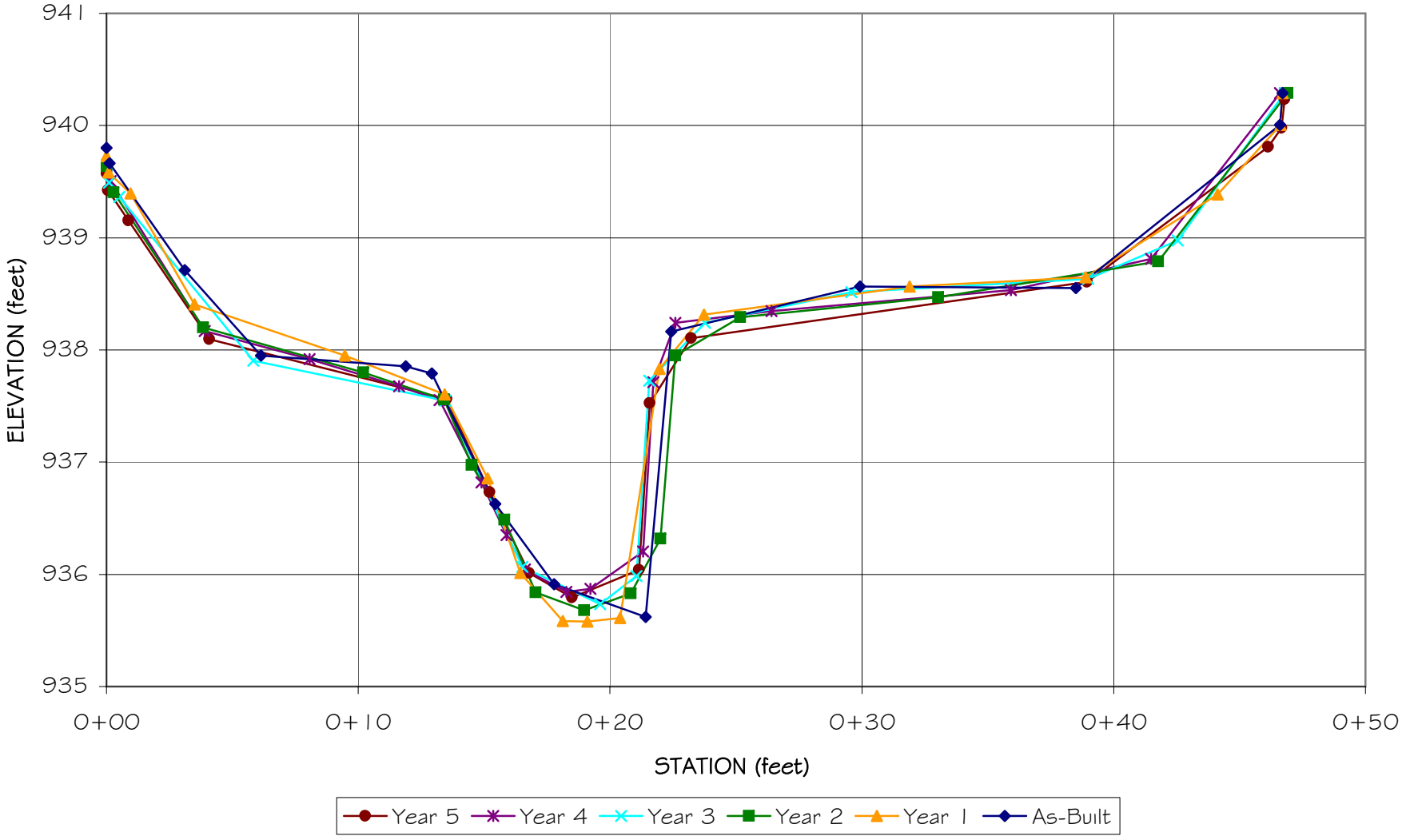


GRAY FARM STREAM RESTORATION
REACH 1 - CROSS-SECTION 7 (POOL)
(STA. 54+45)

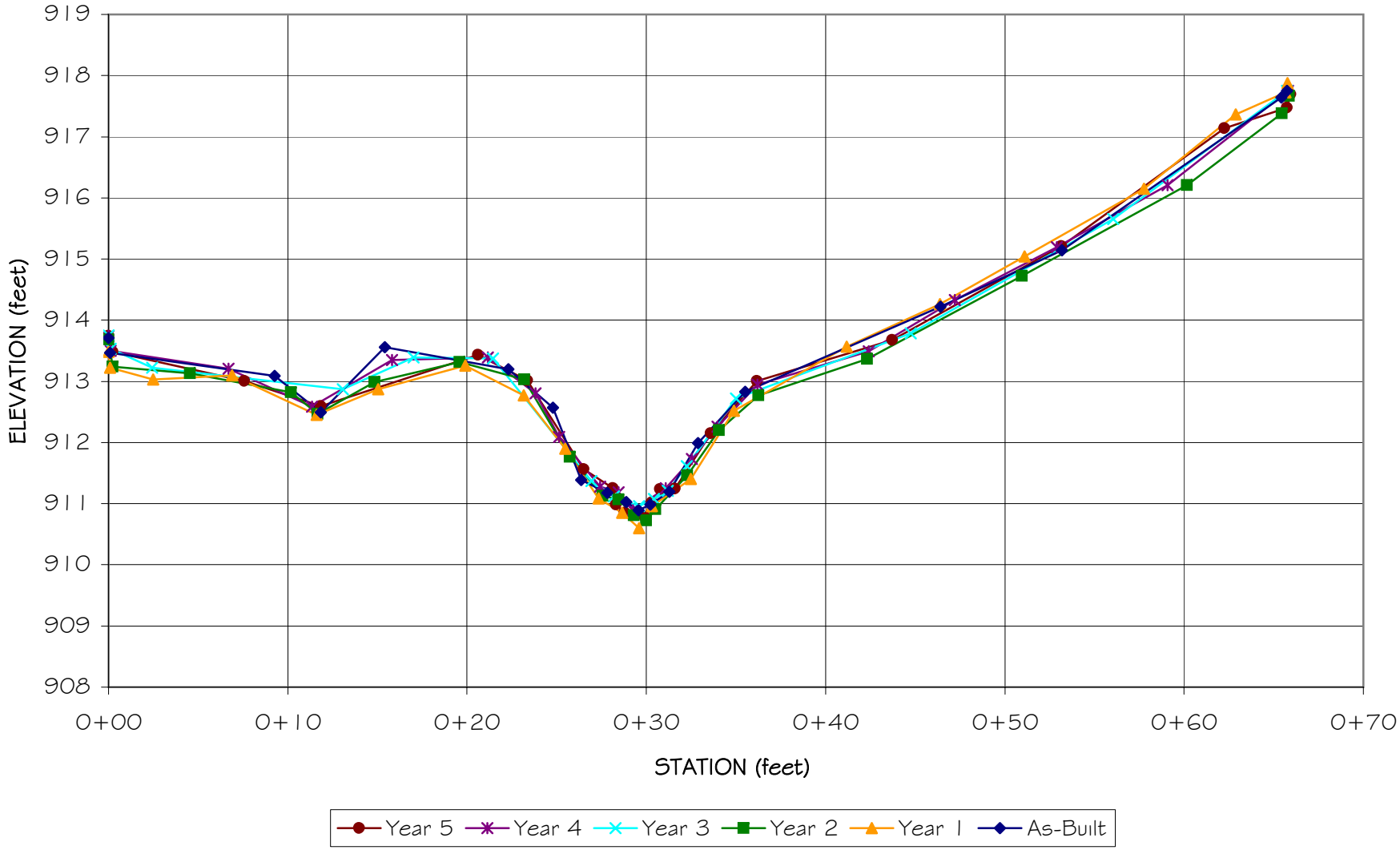



GRAY FARM STREAM RESTORATION
REACH 2 - CROSS-SECTION 1 (RIFFLE)
(STA. 6+30)
941
940
939
938
937
936
935
ELEVATION (feet)
0+00
0+10
0+20
0+30
0+40
0+50
0+60
STATION (feet)
Year 5
Year 4
Year 3
Year 2
Year 1
As-Built

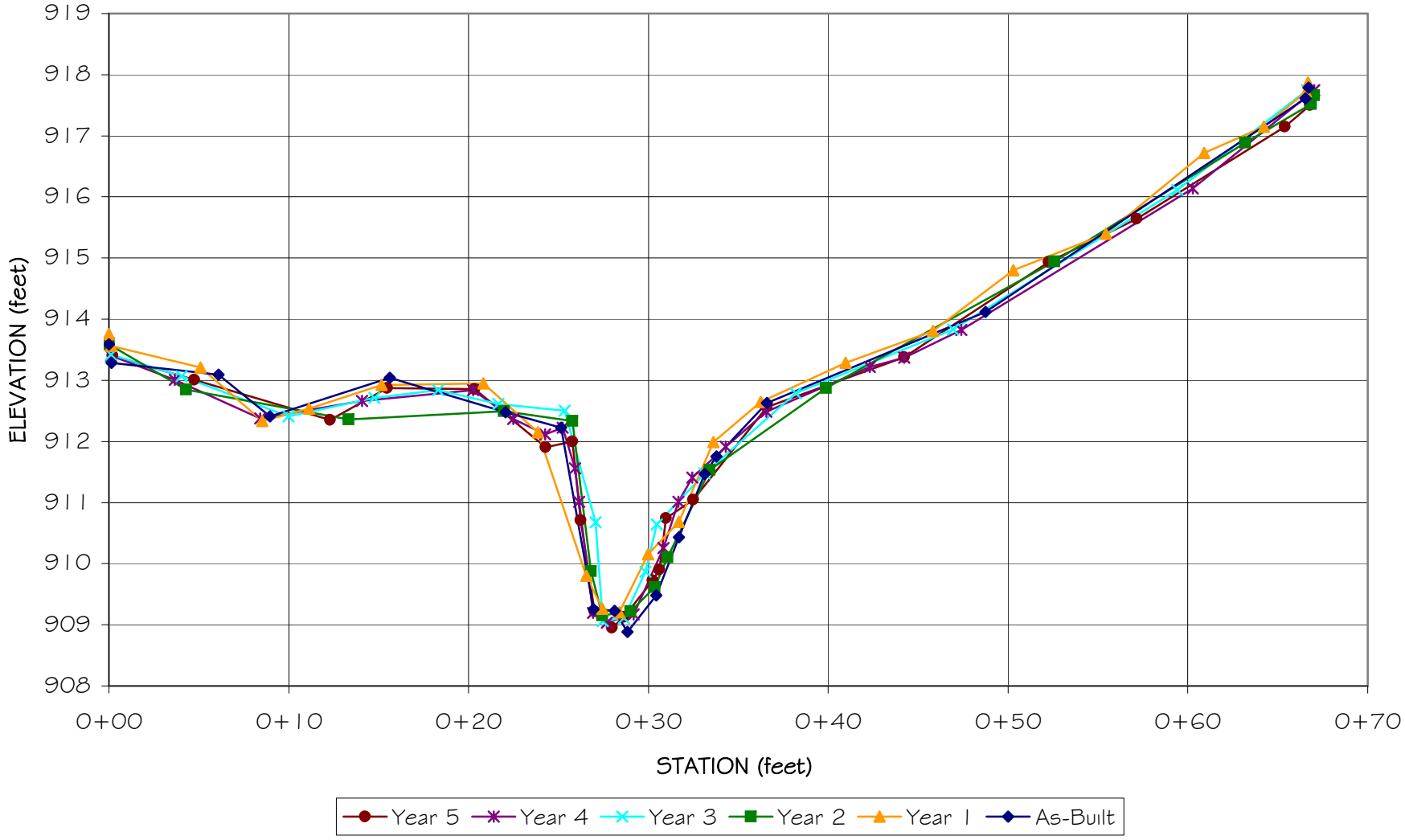
GRAY FARM STREAM RESTORATION
REACH 2 - CROSS-SECTION 1 (POOL)
(STA. 6+00)



GRAY FARM STREAM RESTORATION
REACH 2 - CROSS-SECTION 2 (RIFFLE)
(STA. 19+30)



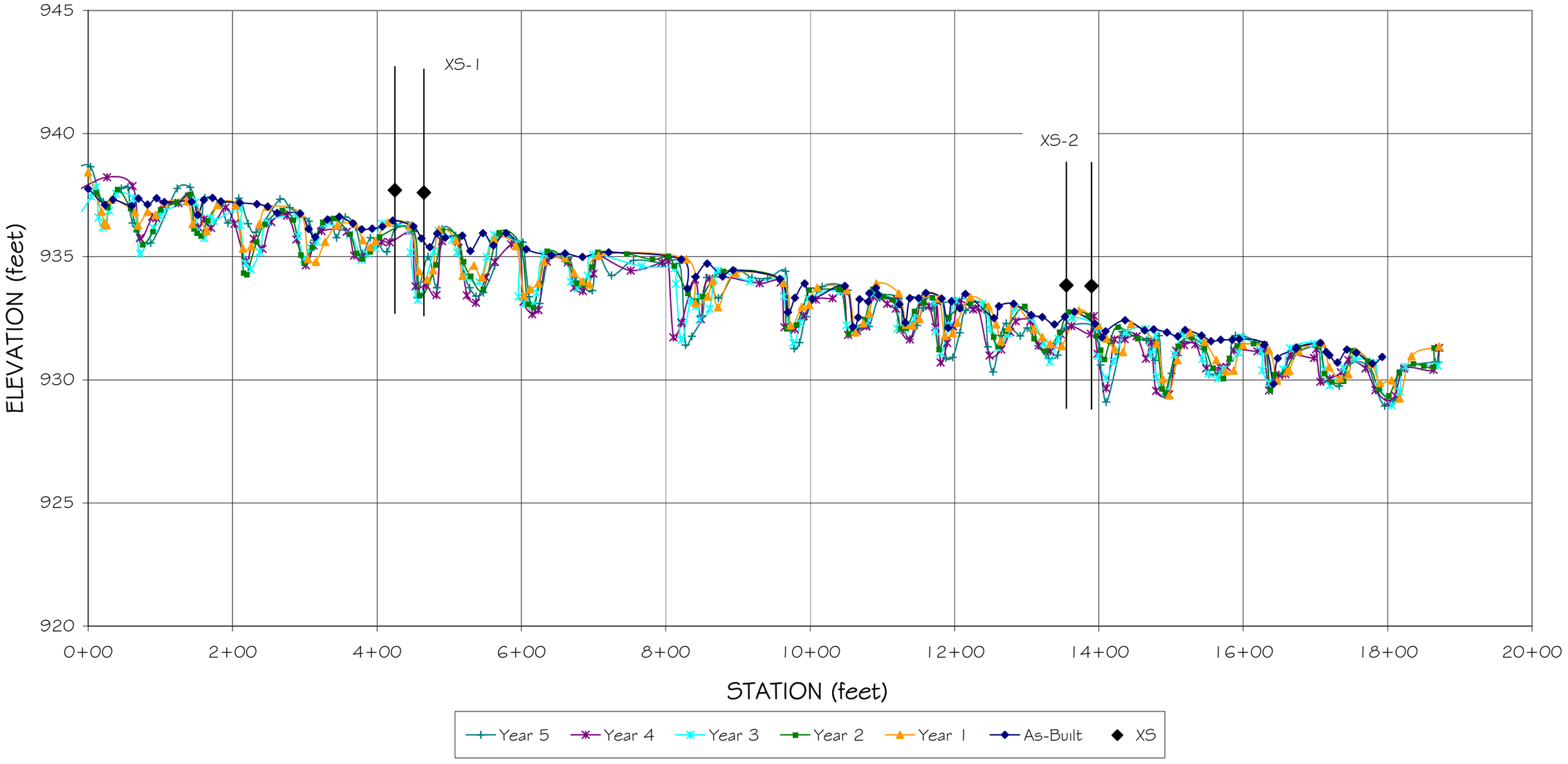
GRAY FARM STREAM RESTORATION
REACH 2 - CROSS-SECTION 2 (POOL)
(STA. 19+45)



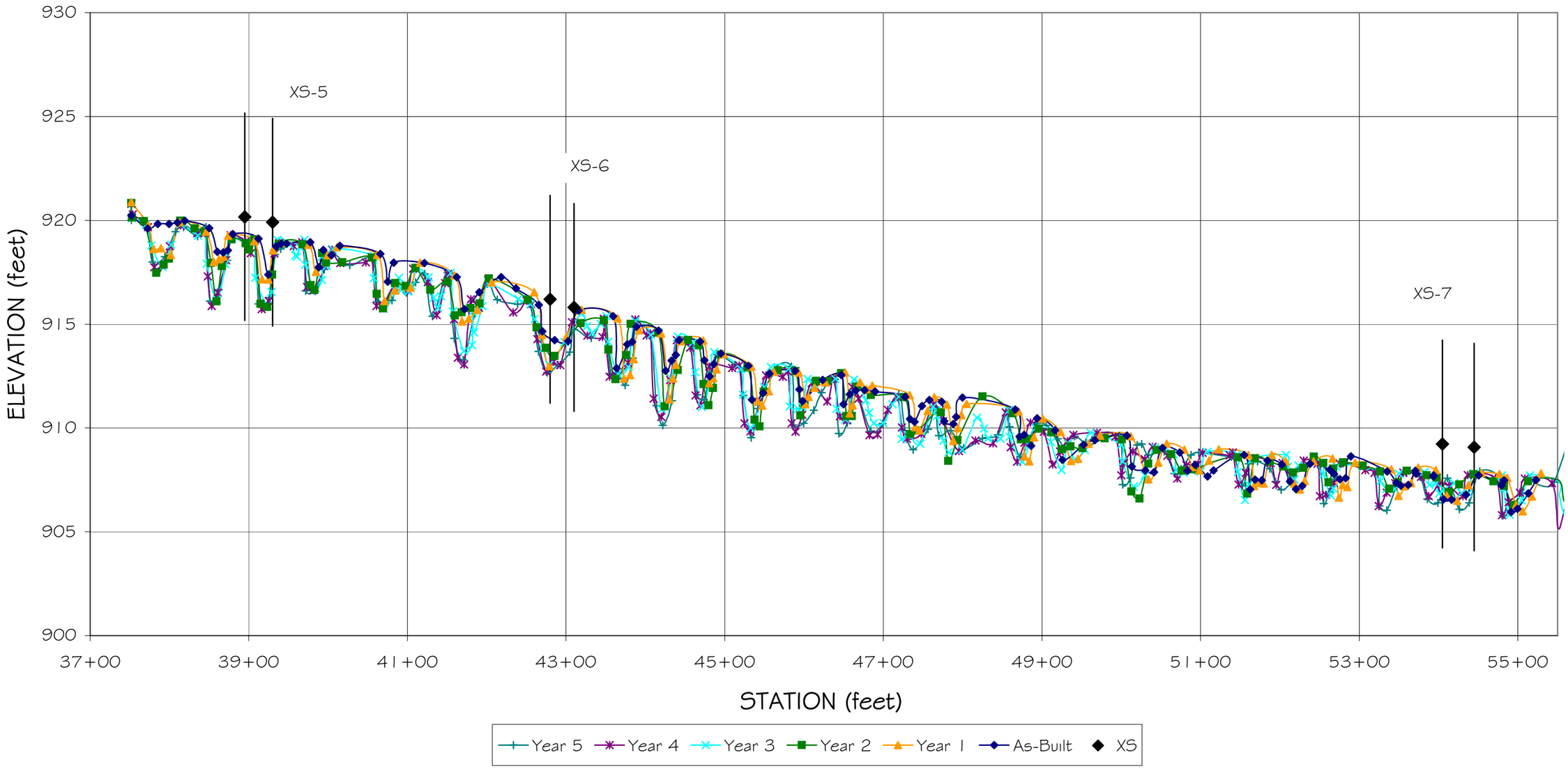
APPENDIX B.7 –

Annual Overlays of Longitudinal Plots

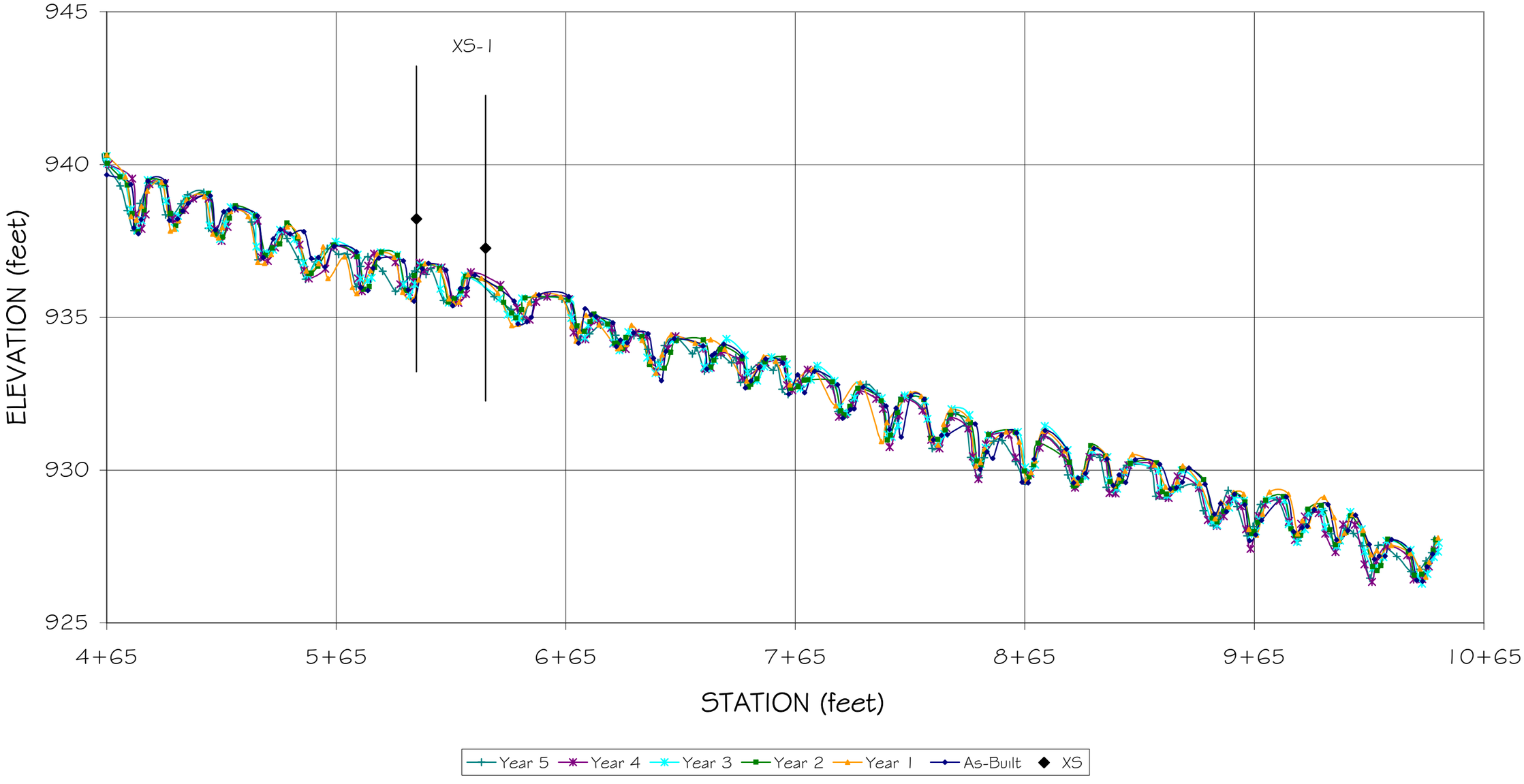
GRAY FARM STREAM RESTORATION
REACH 1 - LONGITUDINAL PROFILE
(STA. 0+00 TO 18+70)



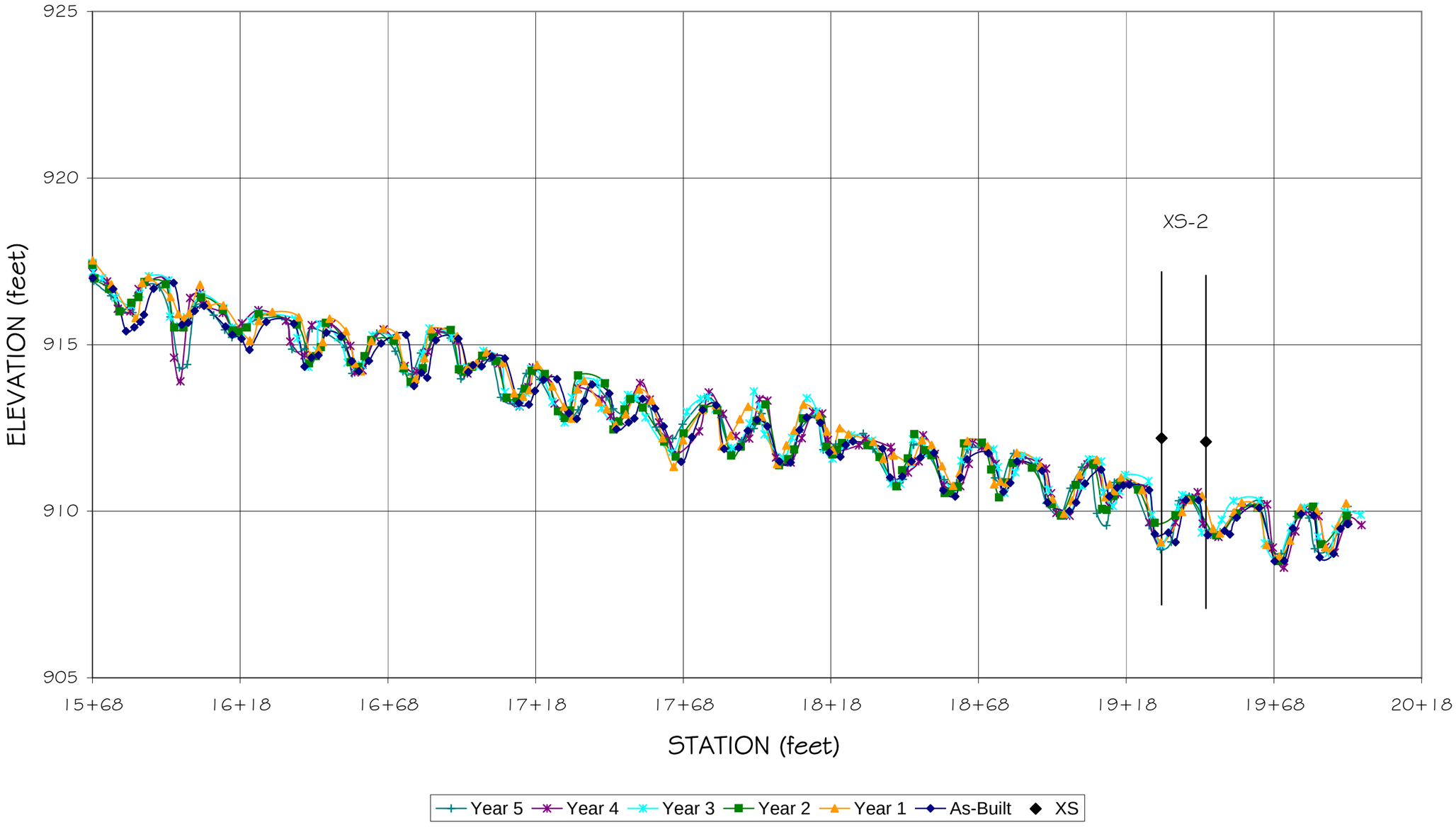
GRAY FARM STREAM RESTORATION
REACH 1 - LONGITUDINAL PROFILE
(STA. 37+50 TO 55+50)



GRAY FARM STREAM RESTORATION
REACH 2 - LONGITUDINAL PROFILE
(STA. 4+65 TO 10+65)

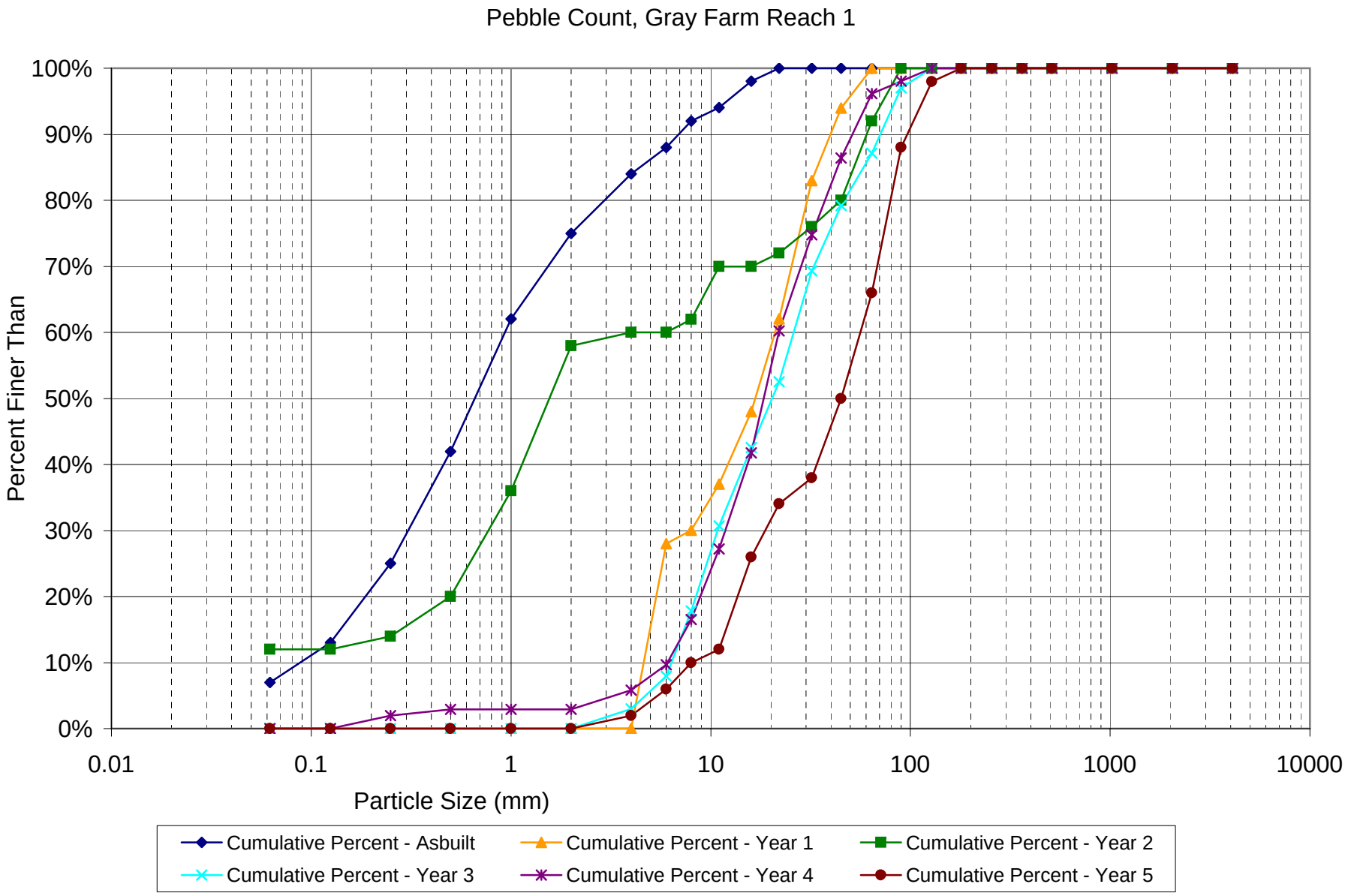


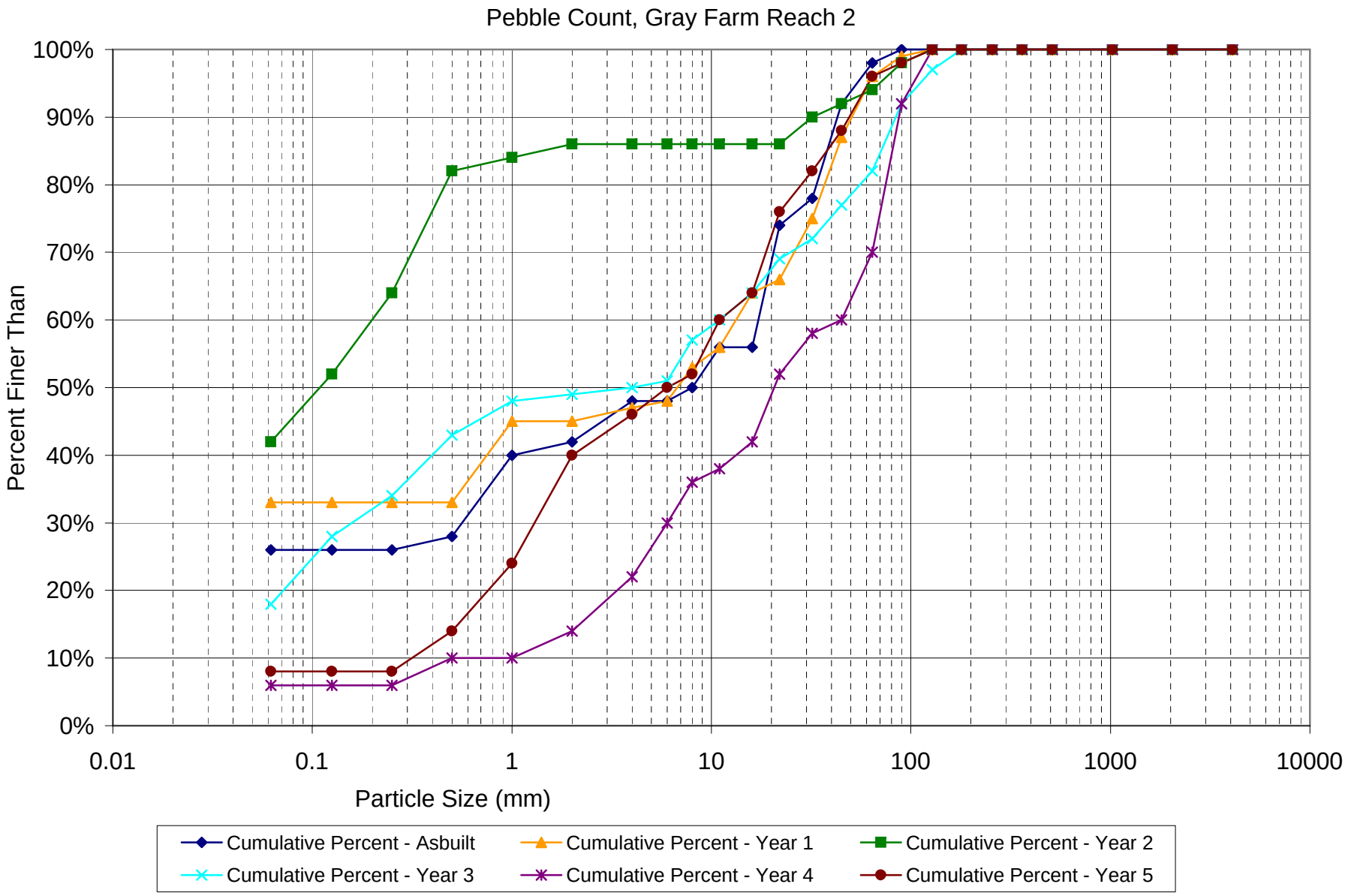
GRAY FARM STREAM RESTORATION
REACH 2 - LONGITUDINAL PROFILE
(STA. 15+68 TO 20+18)



APPENDIX B.8 –

Annual Overlays of Pebble Count Frequency Distribution Plots


Pebble Count, Gray Farm Reach 1
Percent Finer Than
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
0.01
0.1
1
10
100
1000
10000
Particle Size (mm)
Cumulative Percent - Asbuilt
Cumulative Percent - Year 1
Cumulative Percent - Year 2
Cumulative Percent - Year 3
Cumulative Percent - Year 4
Cumulative Percent - Year 5


Pebble Count, Gray Farm Reach 2
Percent Finer Than
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
0.01
0.1
1
10
100
1000
10000
Particle Size (mm)
Cumulative Percent - Asbuilt
Cumulative Percent - Year 1
Cumulative Percent - Year 2
Cumulative Percent - Year 3
Cumulative Percent - Year 4
Cumulative Percent - Year 5

APPENDIX C

INTEGRATED PROBLEM AREA PLAN VIEW

APPENDIX C.1 –

Monitoring and Problem Area Plan View, Reach 1

DRAWINGS PRINTED AT HALF- SCALE

REACH 1 - RESTORATION SITE LAYOUT & KEYSHEET

RESTORED STREAM CHANNEL

EXISTING CONTOURS

EXISTING NCDENR STREAMS

EXISTING DOT ROADS

NOTES:

1. SITE DATA AS DETERMINED BY LIMITED ENGINEERING SURVEY PERFORMED BY S&EC. (NCDENR STREAMS, LIDAR CONTOURS, AND NCDOT ROADS TAKEN FROM REFERENCE GIS LAYERS)
2. ALL LOCATIONS, ELEVATIONS, AND DIMENSIONS ARE APPROXIMATE.
3. ELEVATIONS ARE APPROXIMATE AND BASED ON AN ASSUMED ELEVATION OF 100' ADJUSTED TO MATCH 2 FOOT CONTOURS.

VEGETATION PLOT COORDINATES - REACH 1		
	NORTHING	EASTING
BUFFER 1	1385846.18	754364.36
BUFFER 2	1386151.38	753549.82
BUFFER 3	1386517.37	752569.75
BUFFER 4	1386971.65	752535.59
BANK 1	1385719.13	754523.63
BANK 2	1386297.12	752693.45

CROSS SECTION COORDINATES		
	NORTHING	EASTING
CROSS SECTION 1	1385544.83	755250.67
RIFFLE 1	1385494.08	755292.77
POOL 1	1385487.56	755221.71
CROSS SECTION 2	1385714.11	754599.75
RIFFLE 2	1385729.62	754657.41
POOL 2	1385770.59	754609.35
CROSS SECTION 3	1385927.02	753997.26
RIFFLE 3	1385893.90	753914.02
POOL 3	1385874.14	753966.36
CROSS SECTION 4	1386175.52	753301.89
RIFFLE 4	1386120.46	753338.88
POOL 4	1386121.44	753264.47
CROSS SECTION 5	1386236.38	752913.75
RIFFLE 5	1386293.26	752869.42
POOL 5	1386303.28	752926.82
CROSS SECTION 6	1386408.7	752648.11
RIFFLE 6	1386341.17	752644.43
POOL 6	1386369.35	752594.7
CROSS SECTION 7	1387272.28	752583.14
RIFFLE 7	1387227.69	752627.95
POOL 7	1387286.91	752648.36

BENTHIC SAMPLING POINT

BEGIN UPPER LONG PROFILE

EXISTING TREELINE

END UPPER LONG PROFILE

BANKFULL GAUGE LOCATION

PEBBLE COUNT LOCATION

PERMANENT ACCESS EASEMENT

PERMANENT CONSERVATION EASEMENT

BEGIN LOWER LONG PROFILE

END LOWER LONG PROFILE

BENTHIC SAMPLING POINT

BENTHIC SAMPLING POINT

KEY SHEET INDEX

A

B

C

D

NORTH

SCALE 1" = 200'

200 100 0 200

CONTOUR INTERVAL = 2'

BOLICK ROAD (SR 1532)

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Project: GRAY FARM STREAM RESTORATION YEAR FIVE MONITORING

Project No.: 9385.D11

Proj. Mgr.: DG

Drawn: DGC

Location: IREDELL CO., NC

Client: NC ECOSYSTEM ENHANCEMENT PROGRAM

Scale: 1" = 200'

Sheet Title: REACH 1 RESTORATION SITE LAYOUT & KEYSHEET

Sheet No.: 1 OF 16

\\Sec2\jobs7-9k\9385.D7-D11\YEAR 5 - D11\Drawings\REACH 1- Gray Farm Mont.and PAPV - Year 5.dwg

NOTES:

1. SITE DATA AS DETERMINED BY LIMITED ENGINEERING SURVEY PERFORMED BY S&EC. (NCDENR STREAMS, LIDAR CONTOURS, AND NCDOT ROADS TAKEN FROM REFERENCE GIS LAYERS)
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3. ELEVATIONS ARE APPROXIMATE AND BASED ON AN ASSUMED ELEVATION OF 100' ADJUSTED TO MATCH 2 FOOT CONTOURS.

NORTH

SCALE 1" = 50'

50 25 0 50

CONTOUR INTERVAL = 2'

DRAWINGS PRINTED AT HALF- SCALE

PERMANENT ACCESS EASEMENT

UPPER LIMITS OF RESTORATION

BENTHIC SAMPLING POINT

BEGIN UPPER LONG PROFILE

0+00 1+00 2+00 3+00 4+00 5+00 6+00 7+00 8+00 9+00 10+00 11+00 12+00 13+00 14+00 15+00

XS 1

XS 2

BANK 1

EXISTING TREELINE

PERMANENT CONSERVATION EASEMENT BOUNDARY

LEGEND FOR ASBUILT FEATURES

- RESTORED STREAM CHANNEL
- LOG J-HOOK (LJH)
- ROCK J-HOOK (RJH)
- CROSS ROCK VANE (CRV)
- CREATED/RESTORED WETLANDS
- EXISTING STREAMS

LEGEND FOR MONITORING FEATURES

- BUFFER VEGETATION PLOT
- BANK VEGETATION PLOT
- PERMANENT PHOTO POINT
- CROSS-SECTION LOCATION (XS1)
- BENTHIC SAMPLING POINT

REACH 1 - MONITORING PLAN VIEW - A

A

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REV.	DESCRIPTION	DATE	APP.

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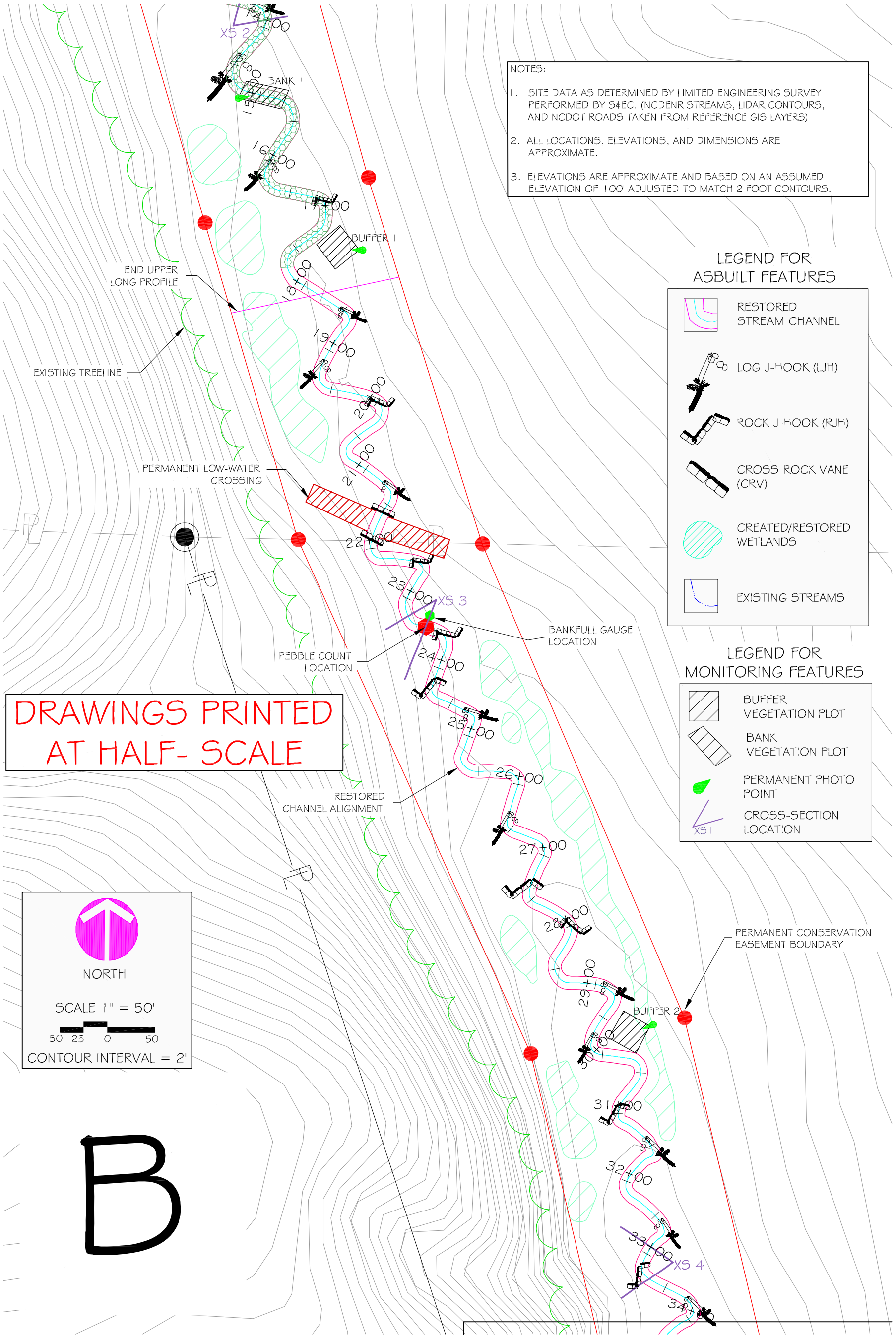
		Proj. Mgr.: DG	Drawn: DGC
Location: IREDELL CO., NC	Client: NC ECOSYSTEM ENHANCEMENT PROGRAM	Scale: 1" = 50'	
Sheet Title: REACH 1 - MONITORING PLAN VIEW - A		Sheet No.: 2 OF 16	

REACH 1 - MONITORING PLAN VIEW - B



NOTES:

1. SITE DATA AS DETERMINED BY LIMITED ENGINEERING SURVEY PERFORMED BY S&EC. (NCDENR STREAMS, LIDAR CONTOURS, AND NCDOT ROADS TAKEN FROM REFERENCE GIS LAYERS)
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3. ELEVATIONS ARE APPROXIMATE AND BASED ON AN ASSUMED ELEVATION OF 100' ADJUSTED TO MATCH 2 FOOT CONTOURS.

LEGEND FOR ASBUILT FEATURES

- RESTORED STREAM CHANNEL
- LOG J-HOOK (LJH)
- ROCK J-HOOK (RJH)
- CROSS ROCK VANE (CRV)
- CREATED/RESTORED WETLANDS
- EXISTING STREAMS

LEGEND FOR MONITORING FEATURES

- BUFFER VEGETATION PLOT
- BANK VEGETATION PLOT
- PERMANENT PHOTO POINT
- CROSS-SECTION LOCATION (XS1)

DRAWINGS PRINTED AT HALF- SCALE

NORTH

SCALE 1" = 50'

50 25 0 50

CONTOUR INTERVAL = 2'

B

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REV.	DESCRIPTION	DATE	APP.

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		Proj. Mgr.: DG / Drawn: DGC
Location: IREDELL CO., NC	Client: NC ECOSYSTEM ENHANCEMENT PROGRAM	Scale: 1" = 50'
Sheet Title: REACH 1 - MONITORING PLAN VIEW - B		Sheet No.: 3 OF 16

DRAWINGS PRINTED AT HALF- SCALE

NOTES:

1. SITE DATA AS DETERMINED BY LIMITED ENGINEERING SURVEY PERFORMED BY S&EC. (NCDENR STREAMS, LIDAR CONTOURS, AND NCDOT ROADS TAKEN FROM REFERENCE GIS LAYERS)
2. ALL LOCATIONS, ELEVATIONS, AND DIMENSIONS ARE APPROXIMATE.
3. ELEVATIONS ARE APPROXIMATE AND BASED ON AN ASSUMED ELEVATION OF 100' ADJUSTED TO MATCH 2 FOOT CONTOURS.

BEGIN LOWER LONG PROFILE

PERMANENT CONSERVATION EASEMENT BOUNDARY

BANK 2

XS 5

XS 6

BENTHIC SAMPLING POINT

BUFFER 3

EXISTING TREELINE

NORTH

SCALE 1" = 50'

50 25 0 50

CONTOUR INTERVAL = 2'

LEGEND FOR MONITORING FEATURES

- BUFFER VEGETATION PLOT
- BANK VEGETATION PLOT
- PERMANENT PHOTO POINT
- CROSS-SECTION LOCATION (XS 1)
- BENTHIC SAMPLING POINT

LEGEND FOR ASBUILT FEATURES

- RESTORED STREAM CHANNEL
- LOG J-HOOK (LJH)
- ROCK J-HOOK (RJH)
- CROSS ROCK VANE (CRV)
- CREATED/RESTORED WETLANDS
- EXISTING STREAMS

REACH 1 - MONITORING PLAN VIEW - C

C

REVISIONS			
REV.	DESCRIPTION	DATE	APPR.

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Location: IREDELL CO., NC	Client: NC ECOSYSTEM ENHANCEMENT PROGRAM	Proj. Mgr.: DG	Drawn: DGC
Sheet Title: REACH 1 - MONITORING PLAN VIEW - C		Scale: 1" = 50'	
		Sheet No.: 4 OF 16	

NOTES:

1. SITE DATA AS DETERMINED BY LIMITED ENGINEERING SURVEY PERFORMED BY S&EC. (NCDENR STREAMS, LIDAR CONTOURS, AND NCDOT ROADS TAKEN FROM REFERENCE GIS LAYERS)
2. ALL LOCATIONS, ELEVATIONS, AND DIMENSIONS ARE APPROXIMATE.
3. ELEVATIONS ARE APPROXIMATE AND BASED ON AN ASSUMED ELEVATION OF 100' ADJUSTED TO MATCH 2 FOOT CONTOURS.

NORTH

SCALE 1" = 50'

50 25 0 50

CONTOUR INTERVAL = 2'

DRAWINGS PRINTED AT HALF- SCALE

LEGEND FOR ASBUILT FEATURES

- RESTORED STREAM CHANNEL
- LOG J-HOOK (LJH)
- ROCK J-HOOK (RJH)
- CROSS ROCK VANE (CRV)
- CREATED/RESTORED WETLANDS
- EXISTING STREAMS

LEGEND FOR MONITORING FEATURES

- BUFFER VEGETATION PLOT
- BANK VEGETATION PLOT
- PERMANENT PHOTO POINT
- CROSS-SECTION LOCATION (XS1)
- BENTHIC SAMPLING POINT

REACH 1 - MONITORING PLAN VIEW - D

PERMANENT CONSERVATION EASEMENT BOUNDARY

50+00 51+00 52+00 53+00 54+00 55+00 56+00 57+00 58+00 58+13

XS 7

BUFFER 4

DOWNSTREAM LIMIT OF RESTORATION

END LOWER LONG PROFILE

EXISTING TREELINE

BENTHIC SAMPLING POINT

D

REVISIONS			
REV.	DESCRIPTION	DATE	APPR.

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		Proj. Mgr.: DG / Drawn: DGC
Location: IREDELL CO., NC	Client: NC ECOSYSTEM ENHANCEMENT PROGRAM	Scale: 1" = 50'
Sheet Title: REACH 1 - MONITORING PLAN VIEW - D		Sheet No.: 5 OF 16

NOTES:

1. SITE DATA AS DETERMINED BY LIMITED ENGINEERING SURVEY PERFORMED BY S&EC. (NCDENR STREAMS, LIDAR CONTOURS, AND NCDOT ROADS TAKEN FROM REFERENCE GIS LAYERS)
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3. ELEVATIONS ARE APPROXIMATE AND BASED ON AN ASSUMED ELEVATION OF 100' ADJUSTED TO MATCH 2 FOOT CONTOURS.

NORTH

SCALE 1" = 50'

50 25 0 50

CONTOUR INTERVAL = 2'

DRAWINGS PRINTED AT HALF- SCALE

PERMANENT ACCESS EASEMENT

UPPER LIMITS OF RESTORATION

BEGIN UPPER LONG PROFILE

BURIED STRUCTURES

DEBRIS PILE IN STREAM

EXISTING TREELINE

PERMANENT CONSERVATION EASEMENT BOUNDARY

STRESSED STRUCTURE # 1

0+00 1+00 2+00 3+00 4+00 5+00 6+00 7+00 8+00 9+00 10+00 11+00 12+00 13+00 14+00

PL

LEGEND FOR ASBUILT FEATURES

- RESTORED STREAM CHANNEL
- LOG J-HOOK (LJH)
- ROCK J-HOOK (RJH)
- CROSS ROCK VANE (CRV)
- CREATED/RESTORED WETLANDS
- EXISTING STREAMS

PAPV LEGEND

- STREAM PROBLEM AREAS-STRESSED
- VEGETATION PROBLEM AREAS-MODERATE
- SEDIMENT FROM UPSTREAM, HEAVY DEPOSITION
- SEDIMENT FROM UPSTREAM, VARIABLE DEPOSITION

REACH 1 - PROBLEM AREA PLAN VIEW - A

A

REVISIONS			
REV.	DESCRIPTION	DATE	APP.

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Location: IREDELL CO., NC	Client: NC ECOSYSTEM ENHANCEMENT PROGRAM	Proj. Mgr.: DG	Drawn: DGC
Sheet Title: REACH 1-PROBLEM AREA PLAN VIEW - A		Scale: 1" = 50'	Sheet No.: 6 OF 16

REACH 1 - PROBLEM AREA PLAN VIEW - B

NOTES:

1. SITE DATA AS DETERMINED BY LIMITED ENGINEERING SURVEY PERFORMED BY S&EC. (NCDENR STREAMS, LIDAR CONTOURS, AND NCDOT ROADS TAKEN FROM REFERENCE GIS LAYERS)
2. ALL LOCATIONS, ELEVATIONS, AND DIMENSIONS ARE APPROXIMATE.
3. ELEVATIONS ARE APPROXIMATE AND BASED ON AN ASSUMED ELEVATION OF 100' ADJUSTED TO MATCH 2 FOOT CONTOURS.

PAPV LEGEND

- STREAM PROBLEM AREAS-STRESSED
- VEGETATION PROBLEM AREAS-MODERATE
- SEDIMENT FROM UPSTREAM, HEAVY DEPOSITION
- SEDIMENT FROM UPSTREAM, VARIABLE DEPOSITION

LEGEND FOR ASBUILT FEATURES

- RESTORED STREAM CHANNEL
- LOG J-HOOK (LJH)
- ROCK J-HOOK (RJH)
- CROSS ROCK VANE (CRV)
- CREATED/RESTORED WETLANDS
- EXISTING STREAMS

END UPPER LONG PROFILE

EXISTING TREELINE

PERMANENT LOW-WATER CROSSING

STRESSED STRUCTURE # 2 / BANK SCOUR # 1

STRESSED STRUCTURE #3

BANK SCOUR #2

PERMANENT CONSERVATION EASEMENT BOUNDARY

DRAWINGS PRINTED AT HALF- SCALE

NORTH

SCALE 1" = 50'

50 25 0 50

CONTOUR INTERVAL = 2'

B

REVISIONS			
REV.	DESCRIPTION	DATE	APP.

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		Proj. Mgr.: DG	Drawn: DGC
Location: IREDELL CO., NC	Client: NC ECOSYSTEM ENHANCEMENT PROGRAM	Scale: 1" = 50'	
Sheet Title: REACH 1-PROBLEM AREA PLAN VIEW - B		Sheet No.: 7 OF 16	

\\Sec2\jobs7-9k\9385.D7-D11\YEAR 5 - D11\Drawings\REACH 1 - Gray Farm Mont.and PAPV - Year 5.dwg

DRAWINGS PRINTED AT HALF- SCALE

NOTES:

1. SITE DATA AS DETERMINED BY LIMITED ENGINEERING SURVEY PERFORMED BY S&EC. (NCDENR STREAMS, LIDAR CONTOURS, AND NCDOT ROADS TAKEN FROM REFERENCE GIS LAYERS)
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3. ELEVATIONS ARE APPROXIMATE AND BASED ON AN ASSUMED ELEVATION OF 100' ADJUSTED TO MATCH 2 FOOT CONTOURS.

BEGIN LOWER LONG PROFILE

PERMANENT CONSERVATION EASEMENT BOUNDARY

STRESSED STRUCTURE #4
BANK SCOUR #3

STRESSED STRUCTURE #5
BANK SCOUR #4

BANK 2

BARE FLOODPLAIN #1

UNDERCUT BANK
CHANNEL SCOUR

BUFFER 3

EXISTING TREELINE

NORTH

SCALE 1" = 50'

50 25 0 50

CONTOUR INTERVAL = 2'

LEGEND FOR ASBUILT FEATURES

- RESTORED STREAM CHANNEL
- LOG J-HOOK (LJH)
- ROCK J-HOOK (RJH)
- CROSS ROCK VANE (CRV)
- CREATED/RESTORED WETLANDS
- EXISTING STREAMS

PAPV LEGEND

- STREAM PROBLEM AREAS-STRESSED
- VEGETATION PROBLEM AREAS-MODERATE

REACH 1 - PROBLEM AREA PLAN VIEW - C

C

REVISIONS			
REV.	DESCRIPTION	DATE	APPR.

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Location: IREDELL CO., NC	Client: NC ECOSYSTEM ENHANCEMENT PROGRAM	Proj. Mgr.: DG	Drawn: DGC
Sheet Title: REACH 1-PROBLEM AREA PLAN VIEW - C		Scale: 1" = 50'	Sheet No.: 8 OF 16

\\Sec2\jobs7-9k\9385.D7-D11\YEAR 5 - D11\Drawings\REACH 1- Gray Farm Mont.and PAPV - Year 5.dwg

NOTES:

1. SITE DATA AS DETERMINED BY LIMITED ENGINEERING SURVEY PERFORMED BY S&EC. (NCDENR STREAMS, LIDAR CONTOURS, AND NCDOT ROADS TAKEN FROM REFERENCE GIS LAYERS)
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NORTH

SCALE 1" = 50'

50 25 0 50

CONTOUR INTERVAL = 2'

DRAWINGS PRINTED AT HALF- SCALE

LEGEND FOR ASBUILT FEATURES

- RESTORED STREAM CHANNEL
- LOG J-HOOK (LJH)
- ROCK J-HOOK (RJH)
- CROSS ROCK VANE (CRV)
- CREATED/RESTORED WETLANDS
- EXISTING STREAMS

PERMANENT CONSERVATION EASEMENT BOUNDARY

XS 7

DOWNSTREAM LIMIT OF RESTORATION

END LOWER LONG PROFILE

EXISTING TREELINE

REACH 1 - PROBLEM AREA PLAN VIEW - D

D

PAPV LEGEND

- STREAM PROBLEM AREAS-STRESSED
- VEGETATION PROBLEM AREAS-MODERATE

REVISIONS			
REV.	DESCRIPTION	DATE	APP.

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Project: GRAY FARM STREAM RESTORATION YEAR FIVE MONITORING		Project No.: 9385.D11	
		Proj. Mgr.: DG	Drawn: DGC
Location: IREDELL CO., NC	Client: NC ECOSYSTEM ENHANCEMENT PROGRAM	Scale: 1" = 50'	
Sheet Title: REACH 1-PROBLEM AREA PLAN VIEW - D		Sheet No.: 9 OF 16	

APPENDIX C.2 –

Monitoring and Problem Area Plan View, Reach 2

\\Sec2\jobs7-9k\9385.D7-D11\YEAR 5 - D11\Drawings\REACH2-GrayFarmMontandPAPV_Year5.dwg

NOTES:

1. SITE DATA AS DETERMINED BY LIMITED ENGINEERING SURVEY PERFORMED BY S&EC. (NCDENR STREAMS, LIDAR CONTOURS, AND NCDOT ROADS TAKEN FROM REFERENCE GIS LAYERS)
2. ALL LOCATIONS, ELEVATIONS, AND DIMENSIONS ARE APPROXIMATE.
3. ELEVATIONS ARE APPROXIMATE AND BASED ON AN ASSUMED ELEVATION OF 100' ADJUSTED TO MATCH 2 FOOT CONTOURS.

MONITORING FEATURES COORDINATES - REACH 2		
	NORTHING	EASTING
CROSS SECTION 1	1390081.29	746853.93
RIFFLE 1	1390079.60	746799.51
POOL 1	1390109.67	746817.05
CROSS SECTION 2	1389209.56	746215.22
RIFFLE 2	1389254.69	746167.91
POOL 2	1389238.99	746155.98
BUFFER 1	1389961.86	746771.34
BUFFER 2	1389300.47	746281.07
BANK 1	1389733.94	746553.76
BANK 2	1389408.61	746305.49

DRAWINGS PRINTED AT HALF- SCALE

RESTORED STREAM CHANNEL

EXISTING CONTOURS

EXISTING NCDENR STREAMS

EXISTING DOT ROADS

REACH 2 - RESTORATION SITE LAYOUT & KEYSHEET

BEGIN UPPER LONG PROFILE

END UPPER LONG PROFILE

BEGIN LOWER LONG PROFILE

END LOWER LONG PROFILE

EXISTING TREELINE

PERMANENT ACCESS EASEMENT

BENTHIC SAMPLING POINT

PERMANENT CONSERVATION EASEMENT & FENCELINE

PEBBLE COUNT LOCATION

BENTHIC SAMPLING POINT

KEY SHEET INDEX

NEW STERLING ROAD (SR 1526)

E

F

G

NORTH

SCALE 1" = 100'

100 50 0 100

CONTOUR INTERVAL = 2'

REVISIONS			
REV.	DESCRIPTION	DATE	APPR.

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Location: IREDELL CO., NC	Client: NC ECOSYSTEM ENHANCEMENT PROGRAM	Proj. Mgr.: DG	Drawn: DGC
Sheet Title: REACH 2 - RESTORATION SITE LAYOUT & KEYSHEET		Scale: 1" = 100'	
		Sheet No.: 10 OF 16	

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NOTES:

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DRAWINGS PRINTED AT HALF- SCALE

NORTH

SCALE 1" = 30'

30 15 0 30

CONTOUR INTERVAL = 2'

LEGEND FOR ASBUILT FEATURES

- RESTORED STREAM CHANNEL
- LOG J-HOOK (LJH)
- ROCK J-HOOK (RJH)
- CROSS ROCK VANE (CRV)
- CREATED/RESTORED WETLANDS
- EXISTING STREAMS

LEGEND FOR MONITORING FEATURES

- BUFFER VEGETATION PLOT
- BANK VEGETATION PLOT
- PERMANENT PHOTO POINT
- CROSS-SECTION LOCATION (XS1)

UPSTREAM LIMIT OF RESTORATION
0+00
1+00
2+00
3+00
4+00
5+00
6+00
7+00
8+00
9+00
XS 1
BUFFER 1
EXISTING TREELINE
BEGIN UPPER LONG PROFILE
PERMANENT CONSERVATION EASEMENT & FENCELINE
PL

REACH 2 - MONITORING PLAN VIEW - E

E

REVISIONS			
REV.	DESCRIPTION	DATE	APP.

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		Proj. Mgr.: DG / Drawn: DGC
Location: IREDELL CO., NC	Client: NC ECOSYSTEM ENHANCEMENT PROGRAM	Scale: 1" = 30'
Sheet Title: REACH 2 - MONITORING PLAN VIEW - E		Sheet No.: 11 OF 16

\\Sec2\jobs7-9k\9385.D7-D11\YEAR 5 - D11\Drawings\REACH2-GrayFarmMontandPAPV_Year5.dwg

NOTES:

1. SITE DATA AS DETERMINED BY LIMITED ENGINEERING SURVEY PERFORMED BY S&EC. (NCDENR STREAMS, LIDAR CONTOURS, AND NCDOT ROADS TAKEN FROM REFERENCE GIS LAYERS)
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DRAWINGS PRINTED AT HALF- SCALE

NORTH

SCALE 1" = 30'

30 15 0 30

CONTOUR INTERVAL = 2'

LEGEND FOR ASBUILT FEATURES

- RESTORED STREAM CHANNEL
- LOG J-HOOK (LJH)
- ROCK J-HOOK (RJH)
- CROSS ROCK VANE (CRV)
- CREATED/RESTORED WETLANDS
- EXISTING STREAMS

LEGEND FOR MONITORING FEATURES

- BUFFER VEGETATION PLOT
- BANK VEGETATION PLOT
- PERMANENT PHOTO POINT
- CROSS-SECTION LOCATION (XS1)

END UPPER LONG PROFILE

10+00

11+00

BANK 1

12+00

13+00

14+00

15+00

EXISTING TREELINE

PERMANENT CONSERVATION EASEMENT & FENCELINE

16+00

BEGIN LOWER LONG PROFILE

BANK 2

17+00

REACH 2 - MONITORING PLAN VIEW - F

F

REVISIONS			
REV.	DESCRIPTION	DATE	APP.

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		Proj. Mgr.: DG / Drawn: DGC
Location: IREDELL CO., NC	Client: NC ECOSYSTEM ENHANCEMENT PROGRAM	Scale: 1" = 30'
Sheet Title: REACH 2 - MONITORING PLAN VIEW - F		Sheet No.: 12 OF 16

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NOTES:

1. SITE DATA AS DETERMINED BY LIMITED ENGINEERING SURVEY PERFORMED BY S&EC. (NCDENR STREAMS, LIDAR CONTOURS, AND NCDOT ROADS TAKEN FROM REFERENCE GIS LAYERS)
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DRAWINGS PRINTED AT HALF- SCALE

NORTH

SCALE 1" = 30'

30 15 0 30

CONTOUR INTERVAL = 2'

LEGEND FOR ASBUILT FEATURES

- RESTORED STREAM CHANNEL
- LOG J-HOOK (LJH)
- ROCK J-HOOK (RJH)
- CROSS ROCK VANE (CRV)
- CREATED/RESTORED WETLANDS
- EXISTING STREAMS

LEGEND FOR MONITORING FEATURES

- BUFFER VEGETATION PLOT
- BANK VEGETATION PLOT
- PERMANENT PHOTO POINT
- CROSS-SECTION LOCATION (XS1)

BENTHIC SAMPLING POINT

BUFFER 2

18+00

XS 2

19+00

PEBBLE COUNT LOCATION

END LOWER LONG PROFILE

20+34.14

20+00

PERMANENT ACCESS EASEMENT

20+34.14

EXISTING CULVERT TO REMAIN

21+00

EXISTING TREELINE

21+90.67

CC

DOWNSTREAM LIMIT OF RESTORATION

IPF

PERMANENT CONSERVATION EASEMENT & FENCELINE

IPS

BENTHIC SAMPLING POINT

BL

BL

CC

REACH 2 - MONITORING PLAN VIEW - G

G

REVISIONS			
REV.	DESCRIPTION	DATE	APPR.

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Location: IREDELL CO., NC	Client: NC ECOSYSTEM ENHANCEMENT PROGRAM
Proj. Mgr.: DG	Drawn: DGC
Scale: 1" = 30'	
Sheet Title: REACH 2 - MONITORING PLAN VIEW - G	Sheet No.: 13 OF 16

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NOTES:

1. SITE DATA AS DETERMINED BY LIMITED ENGINEERING SURVEY PERFORMED BY S&EC. (NCDENR STREAMS, LIDAR CONTOURS, AND NCDOT ROADS TAKEN FROM REFERENCE GIS LAYERS)
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DRAWINGS PRINTED AT HALF- SCALE

NORTH

SCALE 1" = 30'

30 15 0 30

CONTOUR INTERVAL = 2'

LEGEND FOR ASBUILT FEATURES

- RESTORED STREAM CHANNEL
- LOG J-HOOK (LJH)
- ROCK J-HOOK (RJH)
- CROSS ROCK VANE (CRV)
- CREATED/RESTORED WETLANDS
- EXISTING STREAMS

PAPV LEGEND

- STREAM PROBLEM AREAS-STRESSED
- VEGETATION PROBLEM AREAS-MODERATE

UPSTREAM LIMIT OF RESTORATION

0+00

1+00

2+00

3+00

4+00

5+00

6+00

7+00

8+00

9+00

STRESSED STRUCTURE #1
BANK SCOUR #1

STRESSED STRUCTURE #2
BANK SCOUR #2

STRESSED STRUCTURE #3
BANK SCOUR #3

XS 1

EXISTING TREELINE

BEGIN UPPER LONG PROFILE

PERMANENT CONSERVATION EASEMENT & FENCELINE

BUFFER 1

PL

REACH 2 - PROBLEM AREA PLAN VIEW - E

E

REVISIONS			
REV.	DESCRIPTION	DATE	APPR.

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		Proj. Mgr.: DG / Drawn: DGC
Location: IREDELL CO., NC	Client: NC ECOSYSTEM ENHANCEMENT PROGRAM	Scale: 1" = 30'
Sheet Title: REACH 2-PROBLEM AREA PLAN VIEW - E		Sheet No.: 14 OF 16

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NOTES:

1. SITE DATA AS DETERMINED BY LIMITED ENGINEERING SURVEY PERFORMED BY S&EC. (NCDENR STREAMS, LIDAR CONTOURS, AND NCDOT ROADS TAKEN FROM REFERENCE GIS LAYERS)
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DRAWINGS PRINTED AT HALF- SCALE

NORTH

SCALE 1" = 30'

30 15 0 30

CONTOUR INTERVAL = 2'

LEGEND FOR ASBUILT FEATURES

- RESTORED STREAM CHANNEL
- LOG J-HOOK (LJH)
- ROCK J-HOOK (RJH)
- CROSS ROCK VANE (CRV)
- CREATED/RESTORED WETLANDS
- EXISTING STREAMS

PAPV LEGEND

- STREAM PROBLEM AREAS-STRESSED
- VEGETATION PROBLEM AREAS-MODERATE

END UPPER LONG PROFILE

10+00

11+00

12+00

13+00

14+00

15+00

16+00

17+00

STRESSED STRUCTURES #4 and #5, DOWNCUT RIFFLE

EXISTING TREELINE

BED SCOUR

PERMANENT CONSERVATION EASEMENT & FENCELINE

BEGIN LOWER LONG PROFILE

STRESSED STRUCTURE #6 BANK SCOUR #4

REACH 2 - PROBLEM AREA PLAN VIEW - F

F

REVISIONS			
REV.	DESCRIPTION	DATE	APP.

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Project: GRAY FARM STREAM RESTORATION YEAR FIVE MONITORING		Project No.: 9385.D11	
		Proj. Mgr.: DG	Drawn: DGC
Location: IREDELL CO., NC	Client: NC ECOSYSTEM ENHANCEMENT PROGRAM	Scale: 1" = 30'	
Sheet Title: REACH 2-PROBLEM AREA PLAN VIEW - F		Sheet No.: 15 OF 16	

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NOTES:

1. SITE DATA AS DETERMINED BY LIMITED ENGINEERING SURVEY PERFORMED BY S&EC. (NCDENR STREAMS, LIDAR CONTOURS, AND NCDOT ROADS TAKEN FROM REFERENCE GIS LAYERS)
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DRAWINGS PRINTED AT HALF- SCALE

NORTH

SCALE 1" = 30'

30 15 0 30

CONTOUR INTERVAL = 2'

LEGEND FOR ASBUILT FEATURES

- RESTORED STREAM CHANNEL
- LOG J-HOOK (LJH)
- ROCK J-HOOK (RJH)
- CROSS ROCK VANE (CRV)
- CREATED/RESTORED WETLANDS
- EXISTING STREAMS

PAPV LEGEND

- STREAM PROBLEM AREAS-STRESSED
- VEGETATION PROBLEM AREAS-MODERATE

END LOWER LONG PROFILE

18+00

19+00

20+00

20+34.14

20+34.14

21+00

21+90.67

CC

IPF

IPS

DOWNSTREAM LIMIT OF RESTORATION

PERMANENT ACCESS EASEMENT

EXISTING TREELINE

PERMANENT CONSERVATION EASEMENT & FENCELINE

RL

CC

RL

REACH 2 - PROBLEM AREA PLAN VIEW - G

G

REVISIONS			
REV.	DESCRIPTION	DATE	APPR.

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Location: IREDELL CO., NC	Client: NC ECOSYSTEM ENHANCEMENT PROGRAM	Scale: 1" = 30'
Sheet Title: REACH 2-PROBLEM AREA PLAN VIEW - G		Sheet No.: 16 OF 16