REEDY BRANCH
FINAL MONTORING REPORT
MONITORING YEAR 5 OF 5
2009

EEP Project # 301
Alamance County, North Carolina

Submitted to:

NCDENR-EEP
1652 Mail Service Center
Raleigh, NC 27699

Monitoring Firm:

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MONITORING SUMMARY

Reedy Branch is a typical stream within this and surrounding watersheds, exhibiting instability and degradation in response to current and historical land use practices. Reedy Branch is a tributary of Cane Creek in the Cape Fear River Basin. The project site is located off of Quakenbush Road near Snow Camp, NC. Cattle pasture and chicken production make up the farming practices on the farm surrounding the restoration site. The restored stream is enclosed in a moderately dense wooded area and contains large bedrock outcrops as well other sporadic occurrences of bedrock throughout the reach. The site is located in the Carolina Slate Belt, known for shallow soils and high run-off during storm events resulting in very "flashy" flows and streams that tend to dry out during the summer. This summer drying trend has been confirmed during Monitoring Years 3 through 5. The goals and objectives of this project are as follows:

- Improve water quality by reducing the sediment load generated by eroding banks and by restoring a riparian buffer
- Reestablish stable channel dimension, pattern, and profile
- Restore a functioning floodplain
- Enhance aquatic and terrestrial habitat in the stream corridor
- Provide at least one stable cattle crossing across the main channel.

'Planted stem' survival has been limited to a level below the final Monitoring Year 5 goal of 260 stems per acre in VP 6, 7, 8, 10, and 11. The overall 'planted' seedling density across all plots is 436 stems per acre, meeting the Monitoring Year 5 stem density goal. It should be noted that volunteers of the following species were documented in vegetation plots during Monitoring Year 5: *Acer rubrum* (VP 2,3,5,12), *Baccharis halimifolia* (VP 1, 5-9), *Betula nigra* (VP 1-3), *Cornus amomum* (VP 1-3,6,9), Carpinus caroliniana (VP 1-5,7-9,11,12), Juglans nigra (VP 10, 12), *Juniperus virginiana* (VP 2,3,5,10), Liriodendron tulipifera (VP 7,10), Salix nigra (VP 3,6,7), *Liquidambar styraciflua* (VP 1-12), *Platanus occidentalis* (VP 3,11), *Quercus sp.* (VP 1,6,9,10), *Quercus alba* (VP 3,9,10), *Quercus phellos* (VP 2,3,8), *Rhus copallina* (VP 7), *Sambucus canandensis* (VP 1,2,6), *Pinus taeda* (VP 2-4,6-10), and *Ulmus alata* (VP 1-4,6,8,12). With the inclusion of these volunteers in density calculations, all plots pass the Monitoring Year 5 stem density goal of 260 stems per acre. At the end of Monitoring Year 5, the 'planted seedling' tree survival may be described as minorly inhibited. The cause of decreased survival may be attributed to high densities of *Microstegium virmineum*. All vegetation plots were observed to have at least some *Microstegium virmineum* and the grass is pervasive throughout the easement. Where observed, *Microstegium virimineum* appeared to limit the survival of planted stems. *Microstegium virmineum* is known to limit native understory plants in sunny to shady and wet to dry areas. In addition, the invasion of this *Microstegium virmineum* may be facilitated by heavy browsing in areas with dense deer populations (USFS 2005).

The overall pattern, dimension, and profile have remained stable through Monitoring Year 5. Several of the pebbles counts show a silt fining effect between monitoring years. This effect is most likely a result of the stream channel being dry most of the year. The silt probably deposits in the channel bottom as flow recedes because it is last to be entrained in the water column. A very small amount of bank erosion was observed at three locations (see plan view). There were four cross vanes that had evidence of water piping around/under stones (Station 10+87, 18+76, 30+00, and 33+20). The most severe problem to note on the reach is the 2 failing cattle crossings (Station 15+80 and 23+85). Both have damaged fencing, dislodged fence posts, and scour of the gravel path. Both of these crossings warrant a review to determine if repair work is necessary.

Summary information/data related to the occurrence of items such as beaver or encroachment and statistics related to performance of various project and monitoring elements can be found in the tables and figures in the report appendices. Narrative background and supporting information formerly found in these reports can be found in the mitigation and restoration plan documents available on EEPs website. All raw data supporting the tables and figures in the appendices is available from EEP upon request.

METHODOLOGY

Vegetation Methodology

For this monitoring project, a total of twelve (12) plots were studied. Plot sizes measure 10 meters by 10 meters (or equivalent to 100 square meters), depending on buffer width. The vegetation monitoring was not the Carolina Vegetation Survey (CVS) protocol. Instead, it was based on the number of stems for the targeted species that were planted for the stream restoration project. The planted material in the plot (previously marked with flagging) was identified by species and a tally of each species was kept and recorded in a field book. Any stems for a given species in a given plot that were not flagged and were counted over and above the baseline total were considered volunteers.

It should be noted that Monitoring Year 1 vegetation plot stem count totals are unknown (i.e., never reported to SEPI). The planted stems were not originally marked after vegetation installation. Therefore, all stem density and survivability calculations from vegetation plots stem counts are based upon using Monitoring Year 2 'planted' stem counts as a baseline. SEPI project scientists had to use their best judgement to determine which stems were 'planted' versus which were 'volunteers.' The determination of which species were likely 'planted' stems was based on the species listed in the planting plan.

Stream Methodology

The project monitoring for the stream channel included a longitudinal survey, cross-sectional surveys, pebble counts, problem area identification, and photo documentation. These activities were performed for the entire monitored reach. The stationing was based on thalweg. The methodology for each portion of the stream monitoring is described in detail below.

Longitudinal Profile and Plan View

A longitudinal profile was surveyed with a Nikon DTM-520 Total Station, prism, and a TDS Recon Pocket PC. The heads of features (i.e., riffles, runs, pools, and glides) were surveyed, as well as the point of maximum depth of each pool, boundaries of problem areas, and any other significant slope-breaks or points of interest. At the head of each feature and at the maximum pool depth, the thalweg, water surface, edge of water, left and right bankfull, and left and right top of bank (if different than bankfull) were surveyed. All profile measurements were calculated from this survey, including channel and valley length and length of each feature, water surface slope for the reach and each pool and riffle, bankfull slope, and pool spacing. This survey also was used to draw plan view figures with Microstation v8 (Bentley Systems, Inc., Exton, PA), and all pattern measurements (i.e. meander length, radius of curvature, belt width, meander width ratio, and sinuosity) were measured from the plan view. Stationing was calculated along the thalweg.

Permanent Cross Sections

Six permanent cross sections (four riffles and two pools) were surveyed. The beginning and end of each permanent cross section were originally marked with a wooden stake and metal conduit. Cross sections were installed perpendicular to the stream flow. Each survey noted all changes in slope, tops of both banks, left and right bankfull, edges of water, thalweg, and water surface. The cross sections were then plotted, and Monitoring Year 5 data was overlain on data from each of the three previous monitoring years for comparison. All dimension measurements (i.e. bankfull width, floodprone width, bankfull mean depth, cross sectional area, width-to-depth ratio, entrenchment ratio, bank height ratio, wetted perimeter, and hydraulic radius) were extracted from these plots and compared all previous monitoring data.

Pebble Counts

A modified Wolman pebble count (Rosgen 1994), consisting of 50 samples, was conducted at each permanent cross section. The cumulative percentages were plotted, and the D50 and D84 particle sizes were calculated and compared to data from all previous monitoring years.

Photo Documentation

Permanent photo points were established during Monitoring Year 1. A set of three photographs (facing upstream, facing downstream, and facing the channel) were taken at each photo point with a digital camera. Two photographs were taken at each cross-section (facing upstream and downstream). A representative photograph of each vegetation plot was taken at the designated corner of the vegetation plot and in the same direction as the Monitoring Years 2-4 photographs. An arrow was placed on the designated corner of each vegetation plot on the plan view sheets to document the corner and direction of each photograph. Photos were also taken of all significant stream and vegetation problem areas.

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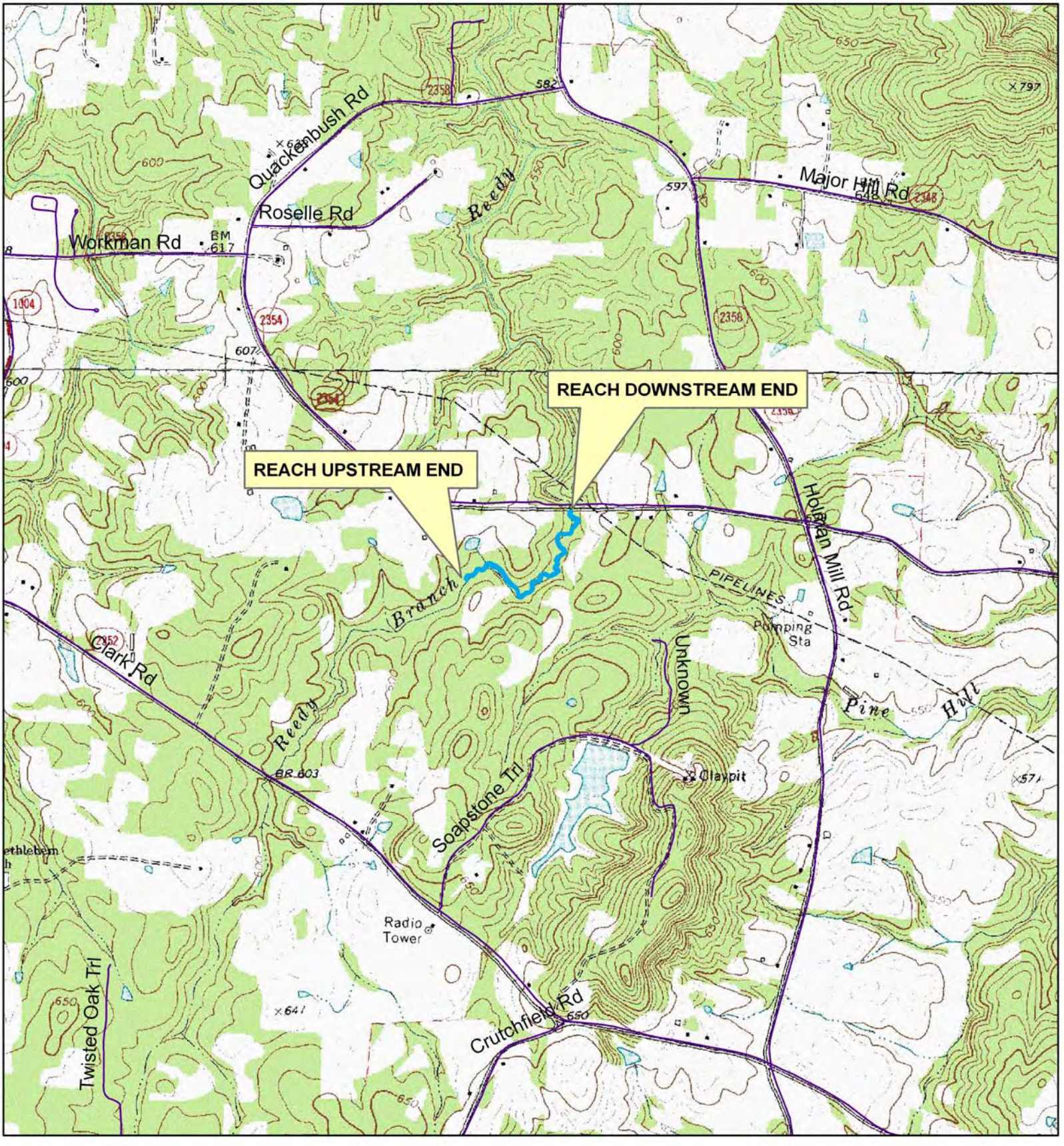
APPENDIX A

GENERAL FIGURES AND PLAN VIEWS



REEDY BRANCH SITE VICINITY MAP

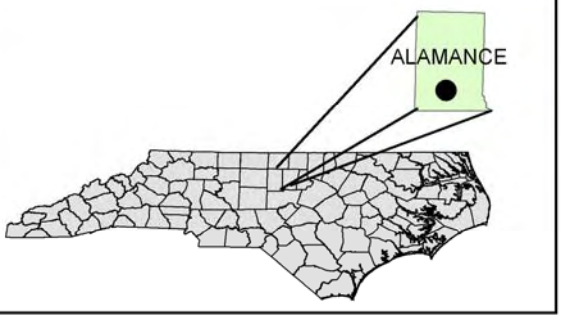
Ecosystem Enhancement Program

FIGURE 1
ALAMANCE COUNTY NC

N W E S

Surveyed Stream Centerline (2008 Survey)

1,000 500 0 1,000 Feet



SEPI ENGINEERING GROUP
1025 WADE AVENUE
RALEIGH, NC 27605
TEL: 919-789-9977 FAX: 789-9591

PROJECT REFERENCE NO.	SHEET NO.
301	1
PROJECT ENGINEER	

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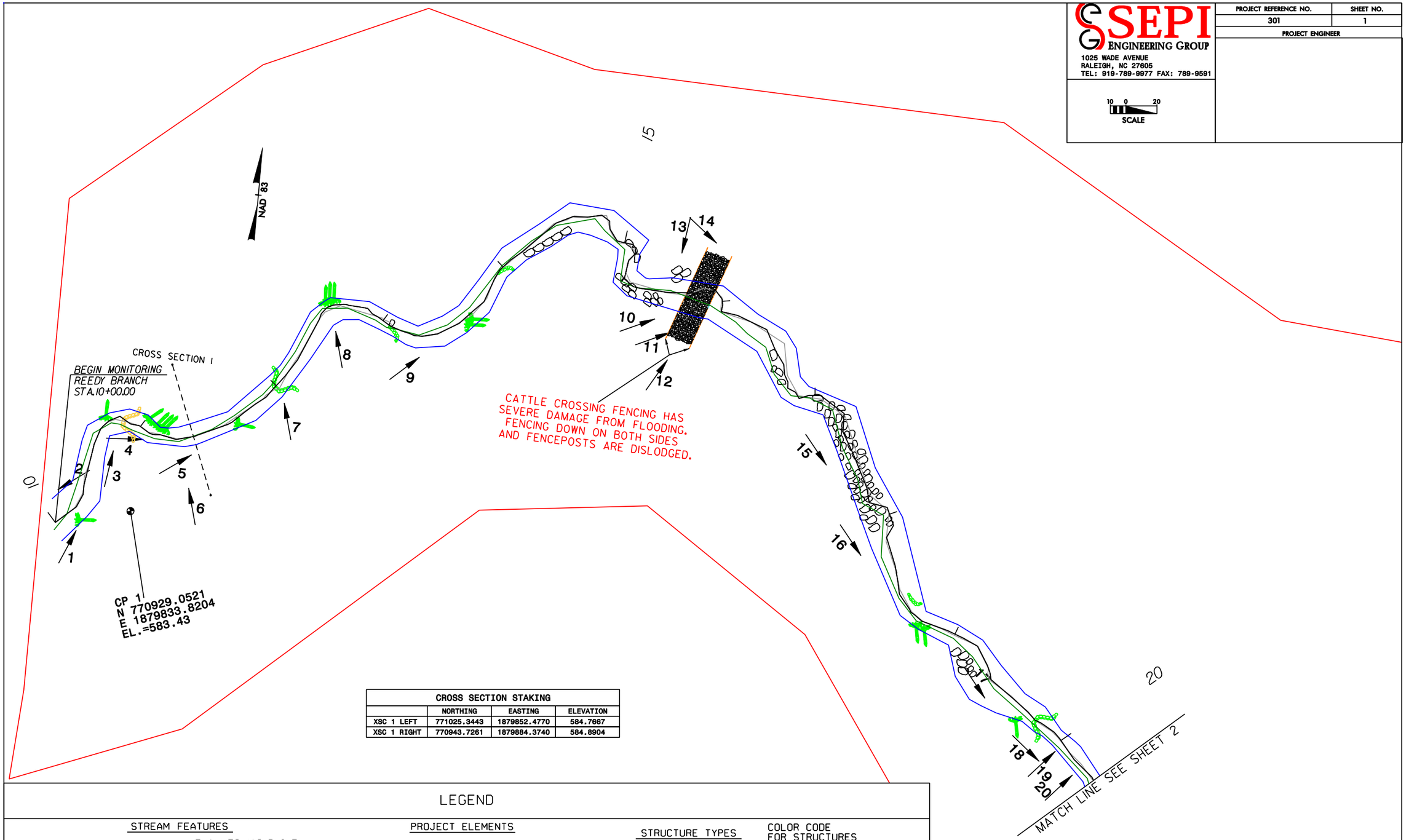

CROSS SECTION STAKING			
	NORTHING	EASTING	ELEVATION
XSC 1 LEFT	771025.3443	1879852.4770	584.7667
XSC 1 RIGHT	770943.7261	1879884.3740	584.8904

LEGEND

STREAM FEATURES
- THALWEG (AS-BUILT)
- THALWEG 2008
- THALWEG 2009
- BANKFULL 2009
- BANK EROSION
- SEVERE BANK EROSION
- AGGRADATION (GRASSES)
- UNDERCUT BANKS

PROJECT ELEMENTS
- CROSS-SECTIONS
- PHOTO POINT
- FENCED CATTLE CROSSING (FORD)
- CONTROL POINT (CP)
- CONSERVATION EASEMENT

•SEPI was unable to locate quality aerial photographs for this figure. The old photographs were omitted due to poor quality.

STRUCTURE TYPES
ROCK CROSS VANE, J-HOOK VANE, ROCK VANE
ROOTWAD BEDROCK

COLOR CODE FOR STRUCTURES
- GOOD STRUCTURE
- STRUCTURE WITH POTENTIAL PROBLEM
- FAILING STRUCTURE

Ecosystem Enhancement PROGRAM

LOCATION:	REEDY BRANCH CURRENT CONDITIONS PLAN VIEW INITIAL STREAM - YEAR 5
PROJ #: 301	COUNTY: ALAMANCE
PREPARED BY:	IPJ
CHECKED BY: PDB	DATE: 1/13/2010

SEPI ENGINEERING GROUP
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PROJECT REFERENCE NO.	SHEET NO.
301	2
PROJECT ENGINEER	

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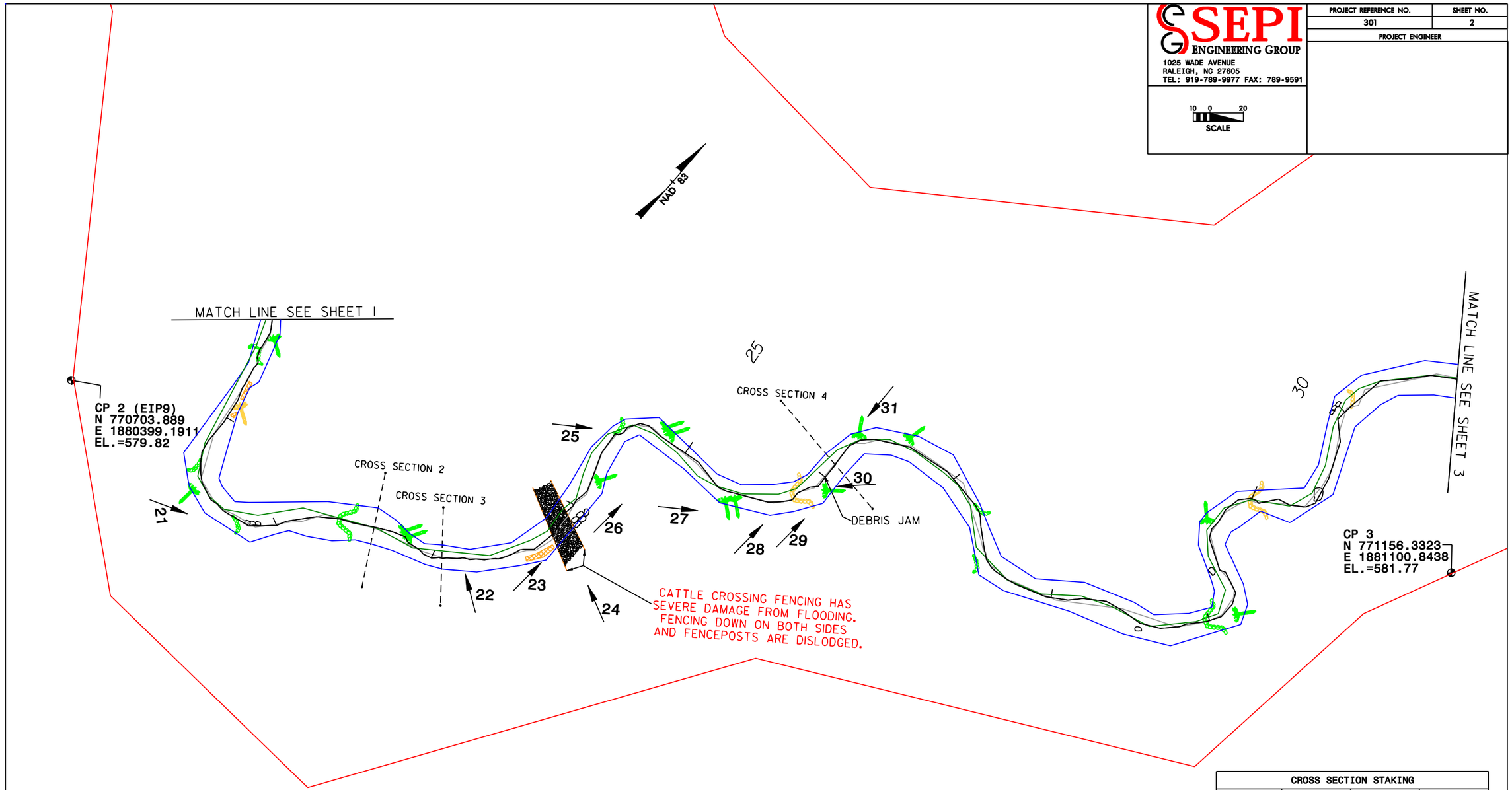
SCALE



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XSC 2 RIGHT	770721.2748	1880608.5008	579.8611
XSC 3 LEFT	770788.7579	1880614.5106	579.1104
XSC 3 RIGHT	770743.0304	1880651.6428	578.9910
XSC 4 LEFT	770968.3605	1880727.1468	575.6349
XSC 4 RIGHT	770955.0930	1880810.9364	575.2575

LEGEND

STREAM FEATURES
- THALWEG (AS-BUILT)
- THALWEG 2008
- THALWEG 2009
- BANKFULL 2009
- BANK EROSION
- SEVERE BANK EROSION
- AGGRADATION (GRASSES)
- UNDERCUT BANKS

PROJECT ELEMENTS
- CROSS-SECTIONS
- PHOTO POINT
- FENCED CATTLE CROSSING (FORD)
- CONTROL POINT (CP)
- CONSERVATION EASEMENT

•SEPI was unable to locate quality aerial photographs for this figure. The old photographs were omitted due to poor quality.

STRUCTURE TYPES
ROCK CROSS VANE, J-HOOK VANE, ROCK VANE, ROOTWAD, BEDROCK

COLOR CODE FOR STRUCTURES
- GOOD STRUCTURE
- STRUCTURE WITH POTENTIAL PROBLEM
- FAILING STRUCTURE

Ecosystem Enhancement PROGRAM

LOCATION: REEDY BRANCH
CURRENT CONDITIONS PLAN VIEW
INITIAL STREAM - YEAR 5

PROJ #:	COUNTY:
301	ALAMANCE
PREPARED BY: IPJ	
CHECKED BY: PDB	DATE: 1/13/2010

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PROJECT REFERENCE NO.	SHEET NO.
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PROJECT ENGINEER	

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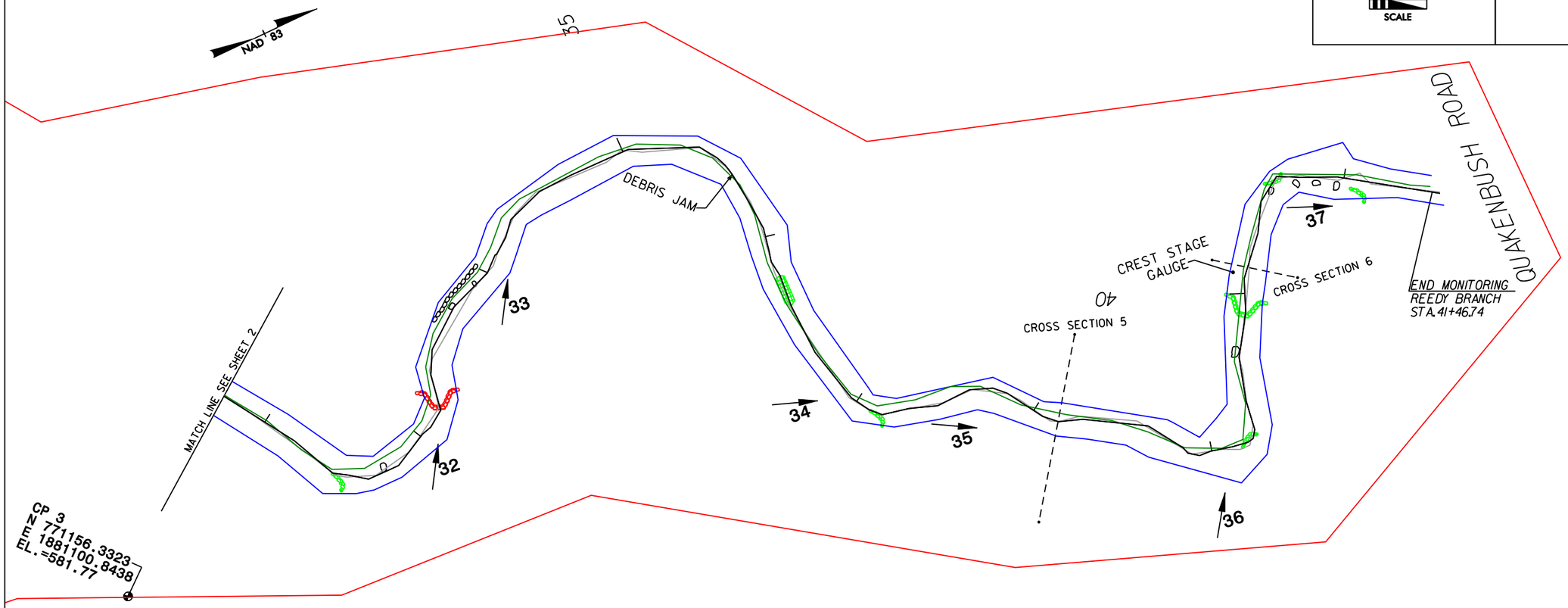

CROSS SECTION STAKING			
	NORTHING	EASTING	ELEVATION
XSC 5 LEFT	771655.7440	1881190.6814	572.4095
XSC 5 RIGHT	771596.7893	1881270.3239	572.6393
XSC 6 LEFT	771737.2562	1881187.0696	570.5211
XSC 6 RIGHT	771773.7453	1881214.5737	571.7398

LEGEND

STREAM FEATURES

- THALWEG (AS-BUILT)
- THALWEG 2008
- THALWEG 2009
- BANKFULL 2009
- BANK EROSION
- SEVERE BANK EROSION
- AGGRADATION (GRASSES)
- UNDERCUT BANKS

PROJECT ELEMENTS

- CROSS-SECTIONS
- PHOTO POINT
- FENCED CATTLE CROSSING (FORD)
- CONTROL POINT (CP)
- CONSERVATION EASEMENT

•SEPI was unable to locate quality aerial photographs for this figure. The old photographs were omitted due to poor quality.

STRUCTURE TYPES

ROCK CROSS VANE, J-HOOK VANE, ROCK VANE, ROOTWAD, BEDROCK

COLOR CODE FOR STRUCTURES

- GOOD STRUCTURE
- STRUCTURE WITH POTENTIAL PROBLEM
- FAILING STRUCTURE

Ecosystem Enhancement PROGRAM

LOCATION: REEDY BRANCH
CURRENT CONDITIONS PLAN VIEW
INITIAL STREAM - YEAR 5

PROJ #:	COUNTY:
301	ALAMANCE
PREPARED BY: IPJ	
CHECKED BY: PDB	DATE: 1/13/2010

SEPI ENGINEERING GROUP
1025 WADE AVENUE
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PROJECT REFERENCE NO.	SHEET NO.
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PROJECT ENGINEER	

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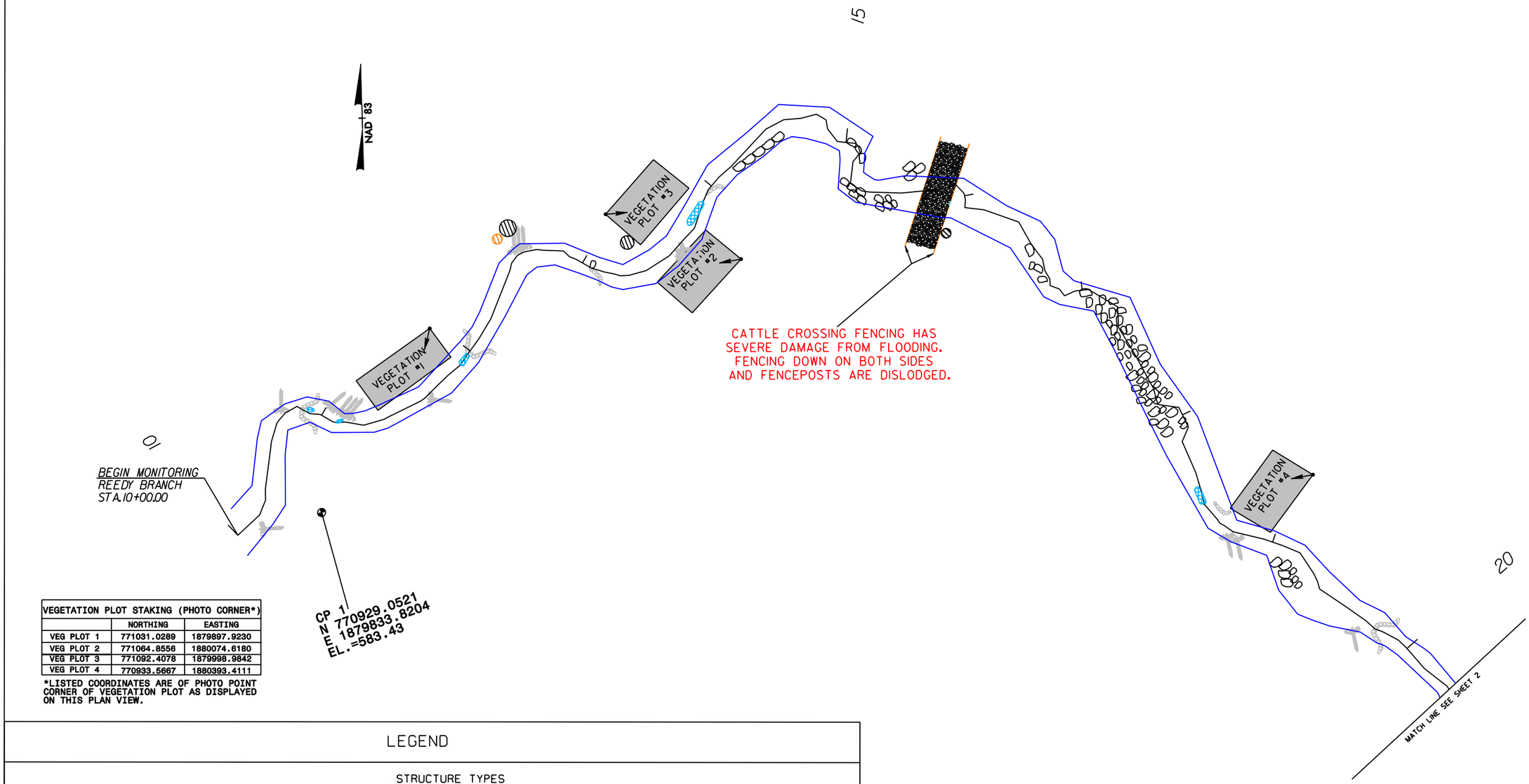

VEGETATION PLOT STAKING (PHOTO CORNER*)		
	NORTHING	EASTING
VEG PLOT 1	771031.0289	1879897.9230
VEG PLOT 2	771064.8556	1880074.6180
VEG PLOT 3	771092.4078	1879998.9842
VEG PLOT 4	770933.5667	1880393.4111

*LISTED COORDINATES ARE OF PHOTO POINT CORNER OF VEGETATION PLOT AS DISPLAYED ON THIS PLAN VIEW.

LEGEND

THALWEG 2009

BANKFULL 2009

CROSS-SECTIONS

VEGETATION PLOT WITH PHOTO CORNER

VEGETATION PLOT NOT MEETING SUCCESS REQUIREMENTS

STRUCTURE TYPES

ROCK CROSS VANE

J-HOOK VANE

ROCK VANE

ROOTWAD

BEDROCK

PONTEDERIA CORDATA GROWTH

ROSA MULTIFLORA PRESENT

AILANTHUS ALTISSIMA PRESENT

LIGUSTRUM SINENSE PRESENT

Ecosystem Enhancement PROGRAM

LOCATION:
REEDY BRANCH
CURRENT CONDITIONS PLAN VIEW
INITIAL VEGETATION - YEAR 5

PROJ #:	COUNTY:
301	ALAMANCE
MONITORED BY: IPJ	
CHECKED BY: PDB	DATE: 11/13/2009

SEPI ENGINEERING GROUP
1025 WADE AVENUE
RALEIGH, NC 27605
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PROJECT REFERENCE NO.	SHEET NO.
301	2
PROJECT ENGINEER	

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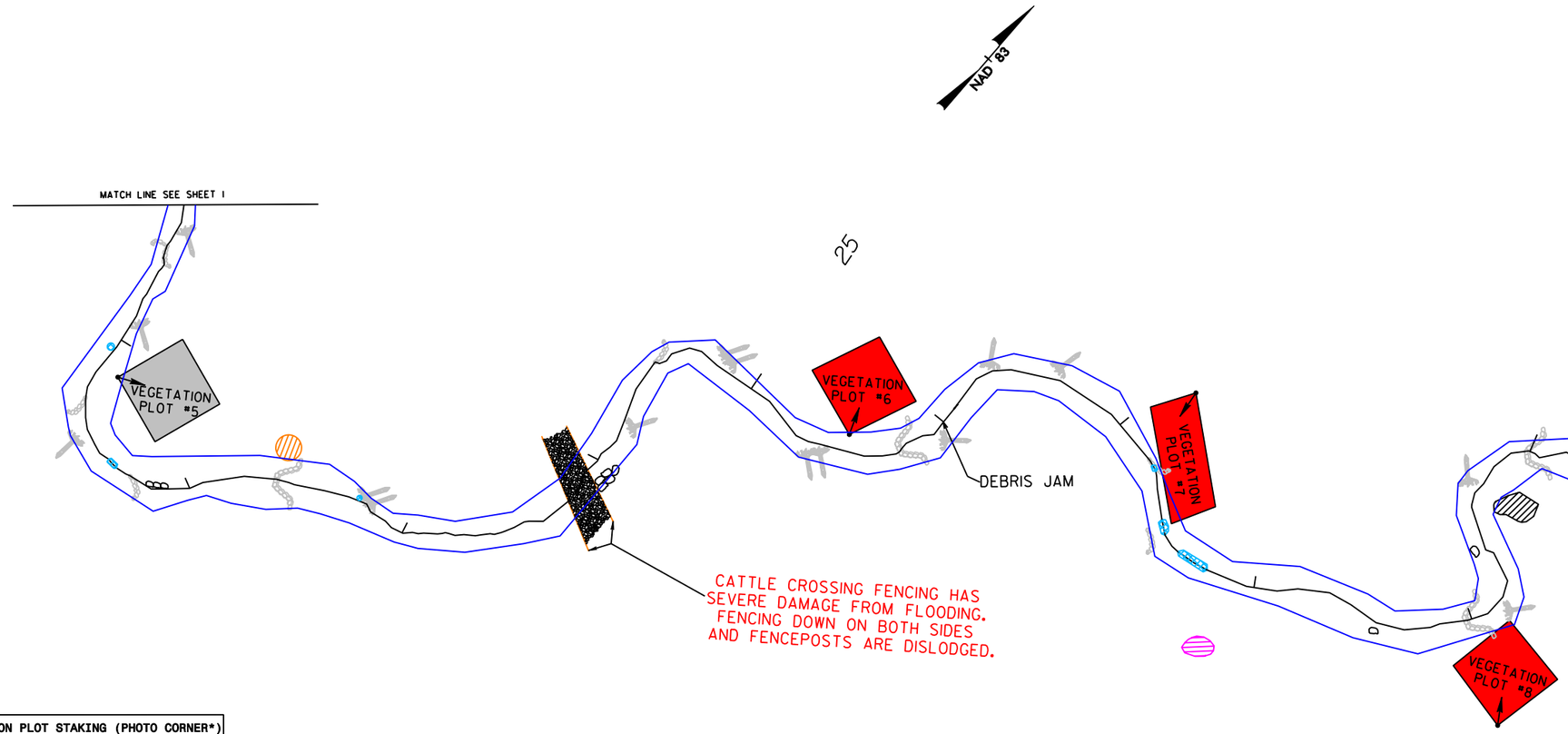

VEGETATION PLOT STAKING (PHOTO CORNER*)		
	NORTHING	EASTING
VEG PLOT 5	770734.5241	1880493.7336
VEG PLOT 6	770923.8296	1880751.6924
VEG PLOT 7	771036.2431	1880854.3849
VEG PLOT 8	771012.3764	1881048.6540

*LISTED COORDINATES ARE OF PHOTO POINT CORNER OF VEGETATION PLOT AS DISPLAYED ON THIS PLAN VIEW.

LEGEND

THALWEG 2009

BANKFULL 2009

CROSS-SECTIONS

VEGETATION PLOT WITH PHOTO CORNER

VEGETATION PLOT NOT MEETING SUCCESS REQUIREMENTS

STRUCTURE TYPES

ROCK CROSS VANE

J-HOOK VANE

ROCK VANE

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BEDROCK

PONTEDERIA CORDATA GROWTH

ROSA MULTIFLORA PRESENT

AILANTHUS ALTISSIMA PRESENT

LIGUSTRUM SINENSE PRESENT

Ecosystem Enhancement PROGRAM

LOCATION:
REEDY BRANCH
CURRENT CONDITIONS PLAN VIEW
INITIAL VEGETATION - YEAR 5

PROJ #:	COUNTY:
301	ALAMANCE
MONITORED BY: IPJ	
CHECKED BY: PDB	DATE: 11/13/2009

SEPI ENGINEERING GROUP
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TEL: 919-789-9977 FAX: 789-9591

PROJECT REFERENCE NO.	SHEET NO.
301	3
PROJECT ENGINEER	

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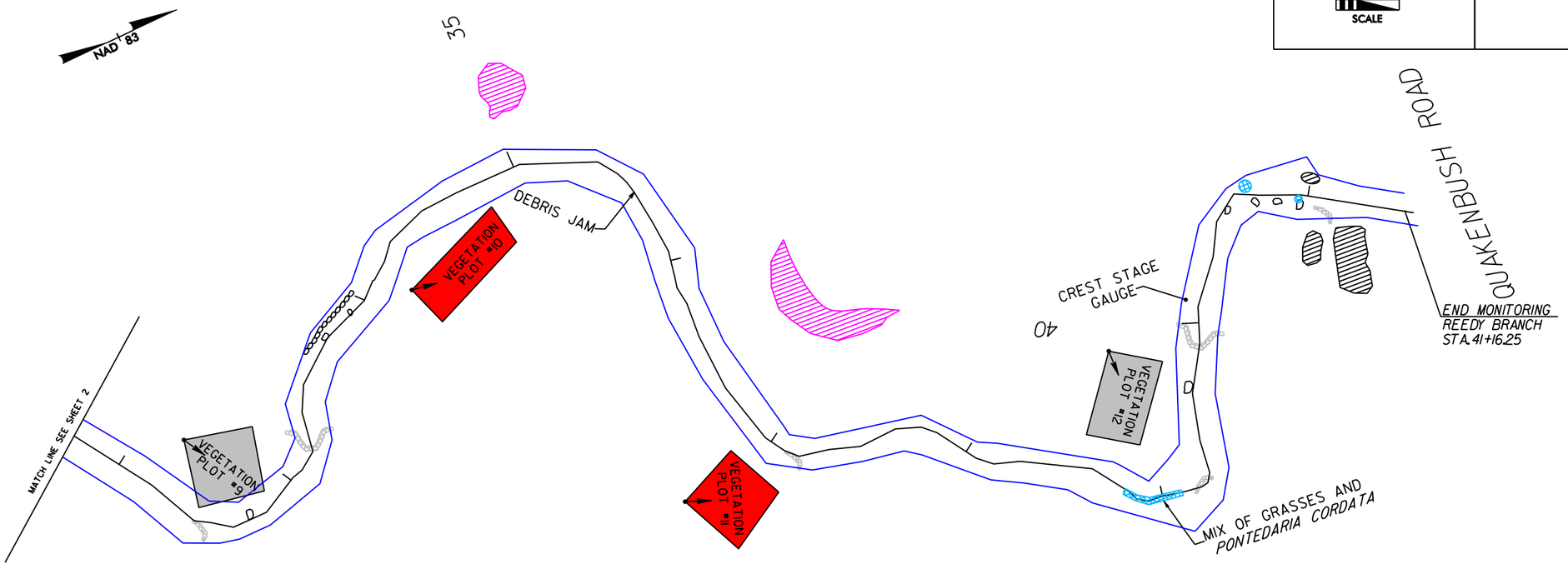
SCALE



VEG PLOT STAKING (PHOTO CORNER*)		
	NORTHING	EASTING
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VEG PLOT 10	771421.1759	1881033.7591
VEG PLOT 11	771495.3763	1881180.2835
VEG PLOT 12	771707.8736	1881201.8622

*LISTED COORDINATES ARE OF PHOTO POINT CORNER OF VEGETATION PLOT AS DISPLAYED ON THIS PLAN VIEW.

LEGEND

THALWEG 2009

BANKFULL 2009

CROSS-SECTIONS

VEGETATION PLOT WITH PHOTO CORNER

VEGETATION PLOT NOT MEETING SUCCESS REQUIREMENTS

STRUCTURE TYPES

ROCK CROSS VANE

J-HOOK VANE

ROCK VANE

ROOTWAD

BEDROCK

PONTEDERIA CORDATA GROWTH

ROSA MULTIFLORA PRESENT

AILANTHUS ALTISSIMA PRESENT

LIGUSTRUM SINENSE PRESENT

Ecosystem Enhancement PROGRAM

LOCATION:	REEDY BRANCH CURRENT CONDITIONS PLAN VIEW INITIAL VEGETATION - YEAR 5
PROJ #: 301	COUNTY: ALAMANCE
MONITORED BY: IPJ	
CHECKED BY: PDB	DATE: 11/13/2009

APPENDIX B

GENERAL PROJECT TABLES

Table 1. Project Restoration Components Reedy Branch/EEP Project Number 301							
Project Segment or Reach ID	**Pre-Existing Footage**	**Type**	**Approach**	**As-Built Footage**	**As-Built Stationing**	**Monitoring Year 4 Stationing**	**Comments**
Reedy Branch	3,100	Restoration	PII	3,155	0+00 - 31+55	10+00 – 41+16	New channel construction

"P" in the Approach column refers to Priority Level.

Table 2. Project Activity and Reporting History Reedy Branch/EEP Project Number 301			
Activity or Report	**Scheduled Completion**	**Data Collection Complete**	**Actual Completion or Delivery**
Restoration Plan			September 17, 2002
Final Design - 90%			September 17, 2002
Construction			November 1, 2003
Temporary S&E mix applied to entire project area			November 1, 2003
Permanent seed mix applied to entire project area			December 1, 2003
Vegetative Planting			January 1, 2003
Mitigation Plan/ As-built (Year 0 Monitoring - baseline)		February 2005	August 1, 2005
Repair Work			Fall 2004
Repair Work			May 1, 2005
Year 1 monitoring		May 2005	August 2005
Year 2 monitoring	December 2007	June 2006	December 2006
Year 3 monitoring	December 2007	November 2007	December 2007
Year 4 monitoring	December 2008	November 2008	November 15, 2008
Year 5 monitoring	December 2009	October 2009	November 15, 2008

Table 3. Project Contacts Table	
Reedy Branch/EEP Project Number 301	
Designer Mark Taylor	EcoLogic 218-4 Swing Road Greensboro, NC 27409 336-335-1108
Construction Contractor	Phillips and Jordan, Inc. 8245 Chapel Hill Road Cary, NC 27513 919-388-4222
Planting Contractor	Ecologic
Seeding Contractor	Ecologic
2005 Monitoring Performers	EcoLogic Associates, P.C. 4321-A South Elm-Eugene Street, Greensboro, NC 27406 336-335-1108
2006-2009 Monitoring Performers	SEPI Engineering Group 1025 Wade Avenue Raleigh, NC 27605 919-789-9977
Stream Monitoring POC	Ira Poplar-Jeffers
Vegetation Monitoring POC	Phil Beach
Wetland Monitoring POC	NA

Table 4. Project Background Table	
Reedy Branch/EEP Project Number 301	
Project County	Alamance
Drainage Area	1.6 square miles
Drainage impervious cover estimate (%)	10%
Stream Order	Second
Physiographic Region	Piedmont
Ecoregion	Carolina Slate Belt
Rosgen Classification of As-built	C5
Cowardin Classification	N/A
Dominant soil types	Herndon
Reference site ID	UT to Varnals Creek
USGS HUC for Project and Reference	03030002 Haw River
NCDWQ Sub-basin for Project and Reference	03-06-04
NCDWQ classification for Project and Reference	16-28-3
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	100%
% of project easement demarcated with bollards (if fencing absent)	N/A

APPENDIX C

VEGETATION ASSESSMENT DATA

Table 5. Vegetation Plot Mitigation Success Summary Table			
Tract	**Vegetation Plot ID**	**Vegetation Survival Threshold Met?**	**Tract Mean (Stems per Acre)**
Reedy Branch	1	Yes	436
	2	Yes	
	3	Yes	
	4	Yes	
	5	Yes	
	6	No	
	7	No	
	8	No	
	9	Yes	
	10	No	
	11	No	
	12	Yes	

APPENDIX C
PHOTOLOG REEDY BRANCH

VEGETATION PLOTS


Photo 1: Vegetation Plot 1 (10-20-2009).


Photo 2: Vegetation Plot 2 (10-20-2009).


Photo 3: Vegetation Plot 3 (10-20-2009).


Photo 4: Vegetation Plot 4 (10-20-2009).


Photo 5: Vegetation Plot 5 (10-20-2009).


Photo 6: Vegetation Plot 6 (10-20-2009).

Photo 7: Vegetation Plot 7 (10-20-2009).

Photo 8: Vegetation Plot 8 (10-20-2009).

Photo 9: Vegetation Plot 9 (10-20-2009).

Photo 10: Vegetation Plot 10 (10-20-2009).

Photo 11: Vegetation Plot 11 (10-20-2009).

Photo unavailable.

Photo 12: Vegetation Plot 12.

Table A1. Stem counts for each species arranged by plot for Reedy Branch

Species	Plots												Year 2 Totals	Year 3 Totals	Year 4 Totals	Year 5 Totals	Survival %
	1	2	3	4	5	6	7	8	9	10	11	12					
Shrubs																	
Cornus ammomum	1 (LS)												1 (LS 1)	1 (LS 1)	1 (LS 1)	1 (LS 1)	100%
Trees																	
Betula nigra													2	0	0	0	0%
Carpinus caroliniana	30	5	18	6	3	1	1	3	1	0	1	3	84	80	74	72	86%
Carya tomentosa		0											5	2	2	0	0%
Diospyros virginiana													4	1	0	0	0%
Juglans nigra					2				1				7	3	3	3	43%
Platanus occidentalis	1		2	1	2	3	2	1	7	5	3	2	46	41	34	29	63%
Salix nigra			2										21 (LS 2)	4	2	2	10%
Sambucus canandensis													1	0	0	0	0%
Quercus alba		4	2										9	8	7	6	67%
Quercus michauxii							1					2	10	8	5	3	30%
Quercus phellos			10	1									13	12	11	11	85%
Quercus sp.													1	1	0	0	0%
Rhus copallina													1	0	0	0	0%
Ulmus alata													1	1	0	0	0%
Total including live stake	32	9	34	8	7	4	4	4	9	5	4	7	278	162	139	127	46%
Stems per acre	1340	372	1378	325	287	166	168	165	376	199	166	287	927	540	463	436	
Total excluding live stake	31	9	34	8	7	4	4	4	9	5	4	7	275	161	138	126	46%
Stems per acre	1298	372	1378	325	287	166	168	165	376	199	166	287	917	537	460	432	

Note: Survival was calculated between Monitoring Year 2 and Monitoring Year 5 totals.

**Volunteers of the following species, not initially recorded as planted, were counted: Acer rubrum (VP 2,3,5,12), Baccharis halimifolia (VP 1, 5-9), Betula nigra (VP 1-3), Cornus amomum (VP 1-3,6,9), Carpinus caroliniana (VP 1-5,7-9,11,12), Juglans nigra (VP 10, 12), Juniperus virginiana (VP 2,3,5,10), Liriodendron tulipifera (VP 7,10), Salix nigra (VP 3,6,7), Liquidambar styraciflua (VP 1-12), Platanus occidentalis (VP 3,11), Quercus sp. (VP 1,6,9,10), Quercus alba (VP 3,9,10), Quercus phellos (VP 2,3,8), Rhus copallina (VP 7), Sambucus canandensis (VP 1,2,6), Pinus taeda (VP 2-4,6-10), and Ulmus alata (VP 1-4,6,8,12).*

**Liquidambar styraciflua volunteers were too numerous to count in VP 2-5, 7-10, and 12.*

APPENDIX D

STREAM ASSESSMENT DATA

APPENDIX D
PHOTOLOG – REEDY BRANCH

CROSS-SECTIONS & PHOTOPOINTS

Cross-Section 1: View Downstream (7-23-2009)

Cross-Section 1: View Upstream (7-23-2009)

Cross-Section 2: View Downstream (8-3-2009)

Cross-Section 2: View Upstream (8-3-2009)

Cross-Section 3: View Downstream (8-3-2009)

Cross-Section 3: View Upstream (8-3-2009)

Cross-Section 4: View Downstream (8-4-2009)

Cross-Section 4: View Upstream (8-4-2009)

Cross-Section 5: View Downstream (8-18-2009)

Cross-Section 5: View Upstream (108-18-2009)

Cross-Section 6: View Downstream (8-18-2009)

Cross-Section 6: View Upstream (8-18-2009)


Photo point 1 (8-3-2009).


Photo point 2 (8-3-2009).


Photo point 3 (8-3-2009).


Photo point 4 (8-3-2009).


Photo point 5 (8-3-2009).


Photo point 6 (8-3-2009).


Photo point 7 (8-3-2009).


Photo point 8 (8-3-2009).


Photo point 9 (8-3-2009).


Photo point 10 (8-3-2009).


Photo point 11 (8-3-2009).


Photo point 12 (8-3-2009).


Photo point 13 (8-3-2009).


Photo point 14 (8-3-2009).


Photo point 15 (8-3-2009).


Photo point 16 (8-3-2009).


Photo point 17 8-3-2009).


Photo point 18 (8-3-2009).


Photo point 19 (8-3-2009).


Photo point 20 (8-3-2009).


Photo point 21 (8-3-2009).


Photo point 22 (8-4-2009).


Photo point 23 (8-4-2009).


Photo point 24 (8-4-2009).


Photo point 25 (8-4-2009).


Photo point 26 (8-4-2009).


Photo point 27 (8-4-2009).


Photo point 28 (8-4-2009).


Photo point 29 (8-4-2009).


Photo point 30 (8-18-2009).


Photo point 31 (8-18-2009).


Photo point 32 (8-18-2009).


Photo point 33 (8-18-2009).


Photo point 34 (8-18-2009).


Photo point 35 (8-18-2009).

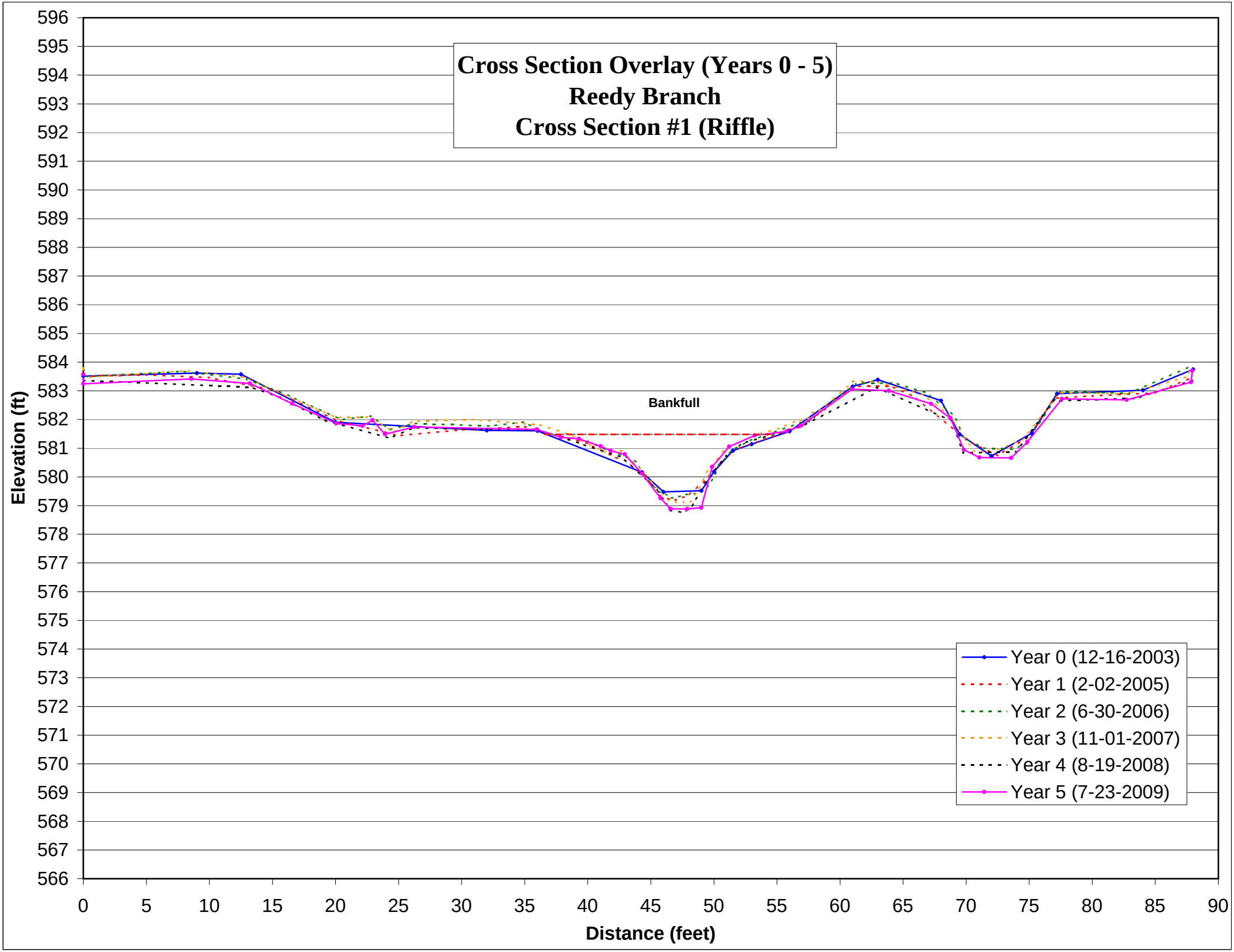

Photo point 36 (8-18-2009).

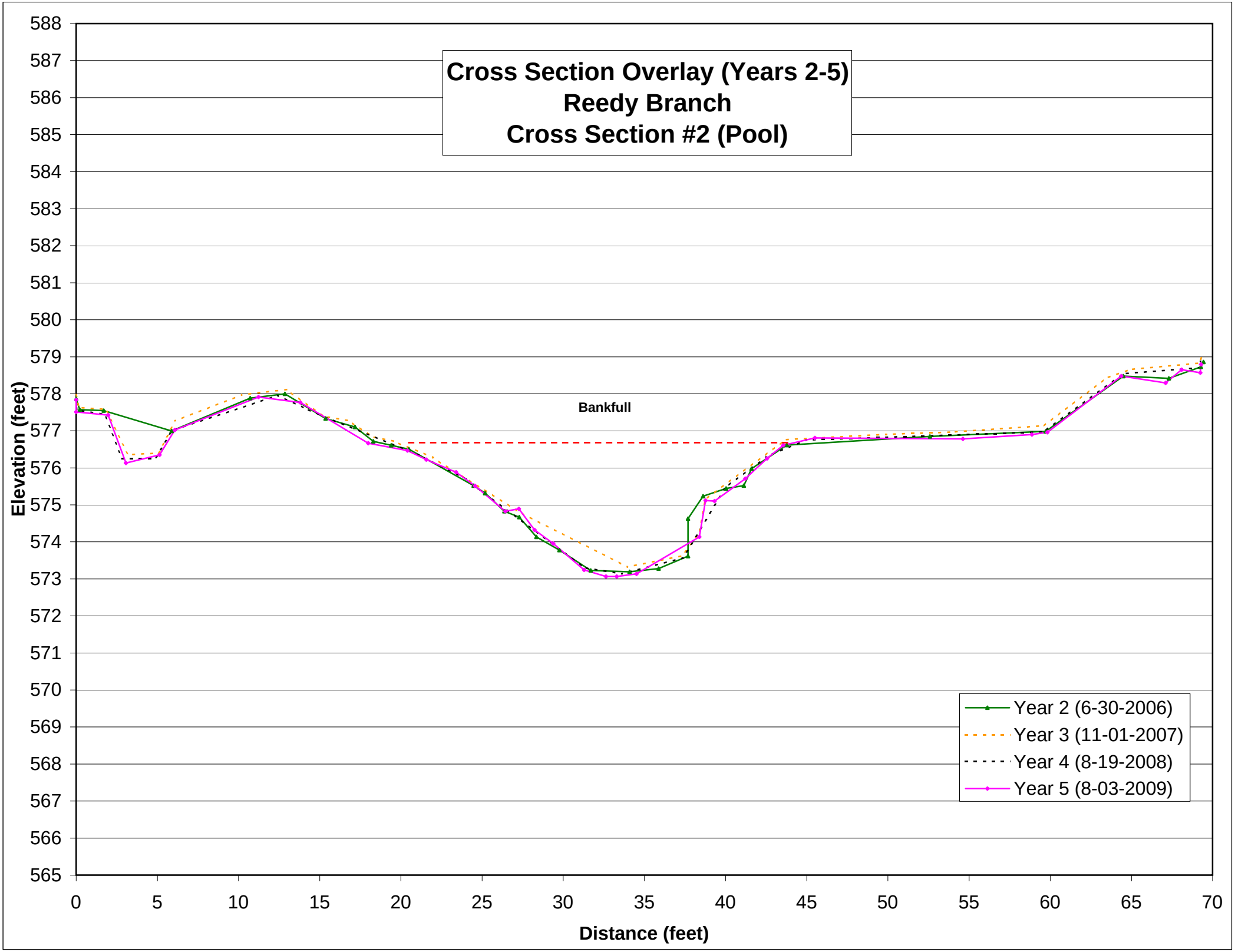
Photo point 37 (8-18-2009).

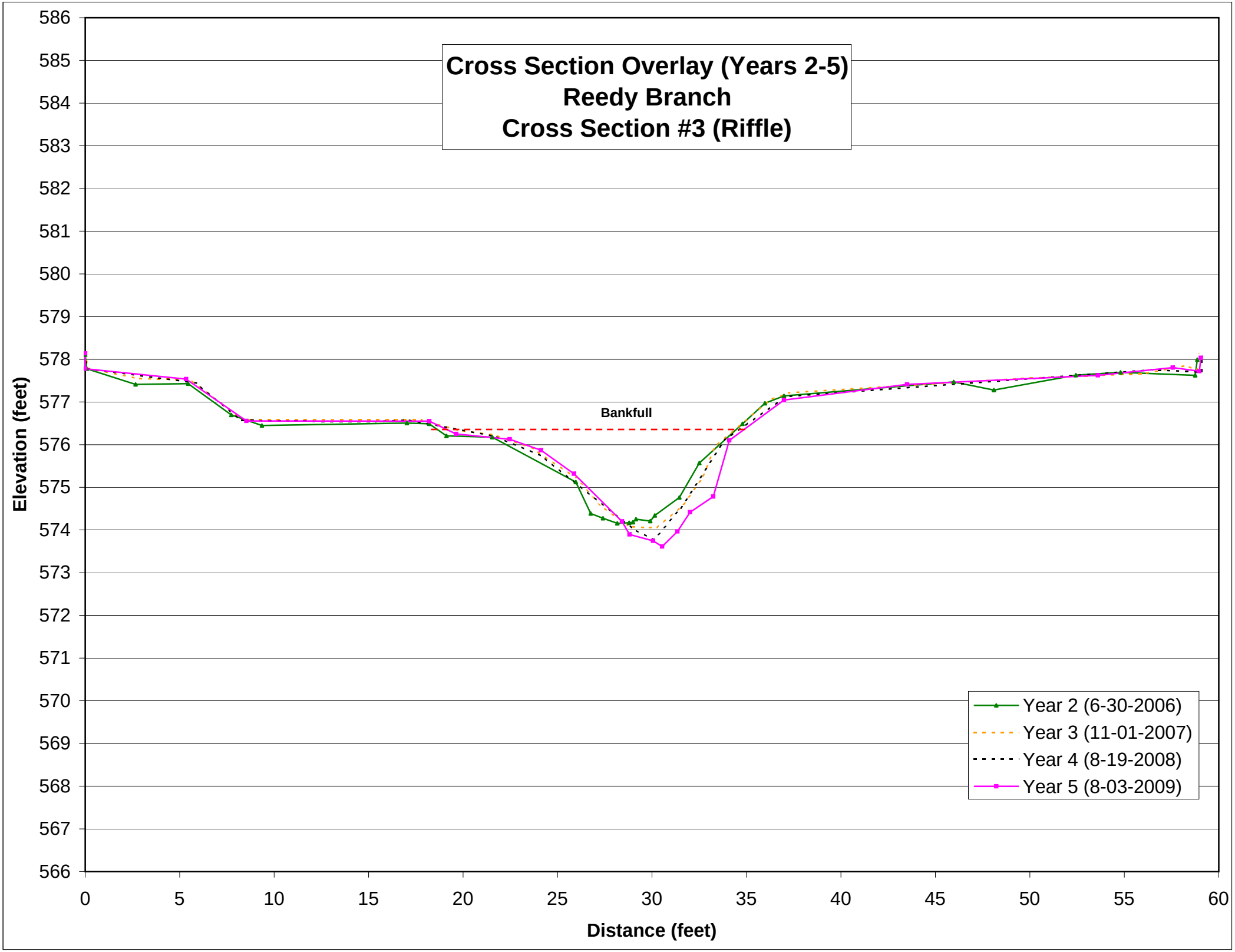
Table B2. Visual Morphological Stability Assessment Reedy Branch						
Feature Category	**Metric (per As-built and reference baselines)**	**(#Stable) Number Performing as Intended**	**Total Number per As-built**	**Total Number / feet in unstable state**	**% Performing in Stable Condition**	**Feature Performance Mean or Total**
A. Riffles	1. Present	21	21	NA	100%	
	2. Armor stable	17	21	NA	81%	
	3. Facet grade appears stable	18	21	NA	86%	
	4. Minimal evidence of embedding/fining	19	21	NA	90%	
	5. Length appropriate	19	21	NA	90%	**90%**
B. Pools	1. Present	24	24	NA	100%	
	2. Sufficiently deep	24	24	NA	100%	
	3. Length appropriate	16	24	NA	67%	**89%**
C. Thalweg	1. Upstream of meander bend (run/inflection) centering	14	14	NA	100%	
	2. Downstream of meander (glide/inflection) centering	13	14	NA	93%	**96%**
D. Meanders	1. Outer bend in state of limited/controlled erosion	28	29	NA	97%	
	2. Of those eroding, # w/concomitant point bar formation	0	1	NA	0%	
	3. Apparent Rc within specifications*	26	29	NA	90%	
	4. Sufficient floodplain access and relief	29	29	NA	100%	**72%**
E. Bed General	1. General channel bed aggradation areas (bar formation)	NA	NA	1/17	99%	
	2. Channel bed degradation - areas of increasing down cutting or head cutting	NA	NA	0/0	100%	**100%**
F. Bank Condition	1. Actively eroding, wasting, or slumping bank	NA	NA	3/32	99%	**99%**
G. Vanes / J Hooks	1. Free of back or arm scour	22	23	NA	96%	
	2. Height appropriate	23	23	NA	100%	
	3. Angle and geometry appear appropriate	23	23	NA	100%	
	4. Free of piping or other structural failures	19	23	NA	83%	**95%**
H. Wads and Boulders	1. Free of scour	29	30	NA	97%	
	2. Footing stable	30	30	NA	100%	**98%**

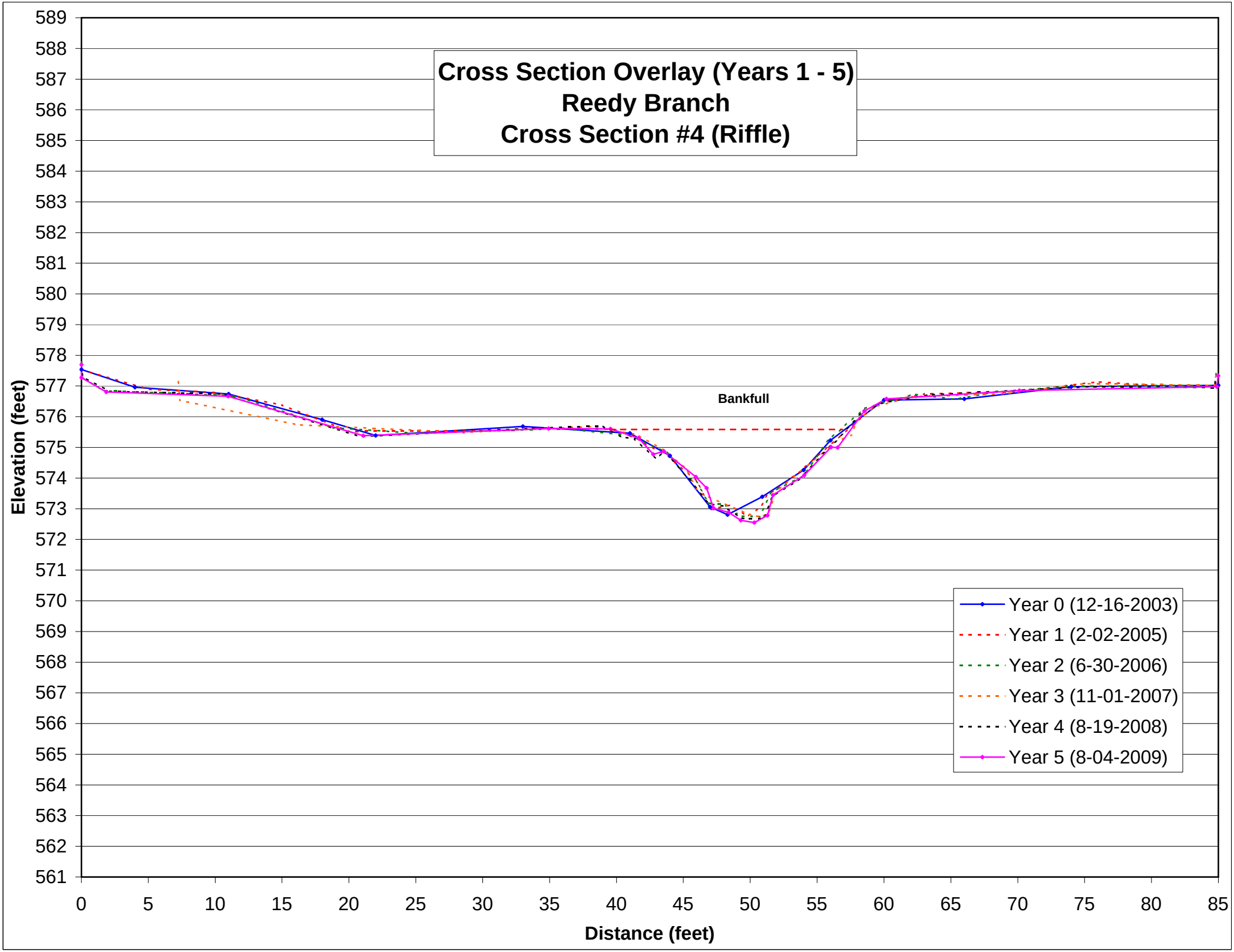
*The range of Rc values from the as-built appeared to be incorrect for this project. So the range from Monitoring Year 2 was used for comparison.

Table V. Verification of Bankfull Events			
Date of Data Collection	**Date of Occurrence**	**Method**	**Photo # (if available)**
Monitoring Year 1	Unknown	Several bankfull events resulting from hurricanes noted in Monitoring Year 1 report.	
8/8/2006	Unknown	Crest Stage Gauge measurement of approximately 2" on stick (bottom of stick at bkf)	
1/11/2007	Unknown	Crest Stage Gauge measurement of approximately 6" on stick (bottom of stick at bkf)	
6/4/2007	6/3/2007 – 6/4/2007	According to NOAA National Weather Service daily climate data, approximately 1.45” of precipitation fell over the listed two day period. 1” of this fell on 6/3. An additional 0.4” fell on 6/5/2007. It was inferred that this event resulted in a bankfull flow.	
9/15/2008	6/23/2008 - 6/24/2008	2.84" of rain fell over this two day period according to NOAA NCDC Graham 2 ENE, NC substattion (ID 313555). It was inferred that this event resulted in a bankfull flow.	
9/15/2008	6/30/2008	1.95" of rain fell over this day according to NOAA NCDC Graham 2 ENE, NC substattion (ID 313555). It was inferred that this event resulted in a bankfull flow.	
10/13/2008	8/27/2008 - 8/28/2008	6.58" of rain fell over this two day period according to NOAA NCDC Graham 2 ENE, NC substattion (ID 313555); Prominent wrack lines observed with large amounts of debris caught in fencing well above bankfull elevation.	Photo 4 in 2008 SPA Photolog; note large amount of debris caught in fencing.
10/13/2008	9/6/2008 - 9/7/2008	2.35" of rain fell over this two day period according to NOAA NCDC Graham 2 ENE, NC substattion (ID 313555); Prominent wrack lines observed with large amounts of debris caught in fencing well above bankfull elevation.	Photo 4 in 2008 SPA Photolog; note large amount of debris caught in fencing.
1/15/2009	unknown	Crest gauge reading of 40" on gauge stick, well above bankfull elevetion.	Photo 7 in 2009 SPA photolog for photo.


Cross Section Overlay (Years 0 - 5)
Reedy Branch
Cross Section #1 (Riffle)
Bankfull
Elevation (ft)
Distance (feet)
596
595
594
593
592
591
590
589
588
587
586
585
584
583
582
581
580
579
578
577
576
575
574
573
572
571
570
569
568
567
566
0
5
10
15
20
25
30
35
40
45
50
55
60
65
70
75
80
85
90
Year 0 (12-16-2003)
Year 1 (2-02-2005)
Year 2 (6-30-2006)
Year 3 (11-01-2007)
Year 4 (8-19-2008)
Year 5 (7-23-2009)


Cross Section Overlay (Years 2-5)
Reedy Branch
Cross Section #2 (Pool)
Bankfull
Elevation (feet)
Distance (feet)
588
587
586
585
584
583
582
581
580
579
578
577
576
575
574
573
572
571
570
569
568
567
566
565
0
5
10
15
20
25
30
35
40
45
50
55
60
65
70
Year 2 (6-30-2006)
Year 3 (11-01-2007)
Year 4 (8-19-2008)
Year 5 (8-03-2009)


Cross Section Overlay (Years 2-5)
Reedy Branch
Cross Section #3 (Riffle)
Bankfull
Elevation (feet)
Distance (feet)
586
585
584
583
582
581
580
579
578
577
576
575
574
573
572
571
570
569
568
567
566
0
5
10
15
20
25
30
35
40
45
50
55
60
Year 2 (6-30-2006)
Year 3 (11-01-2007)
Year 4 (8-19-2008)
Year 5 (8-03-2009)


Cross Section Overlay (Years 1 - 5)
Reedy Branch
Cross Section #4 (Riffle)
Bankfull
Elevation (feet)
Distance (feet)
589
588
587
586
585
584
583
582
581
580
579
578
577
576
575
574
573
572
571
570
569
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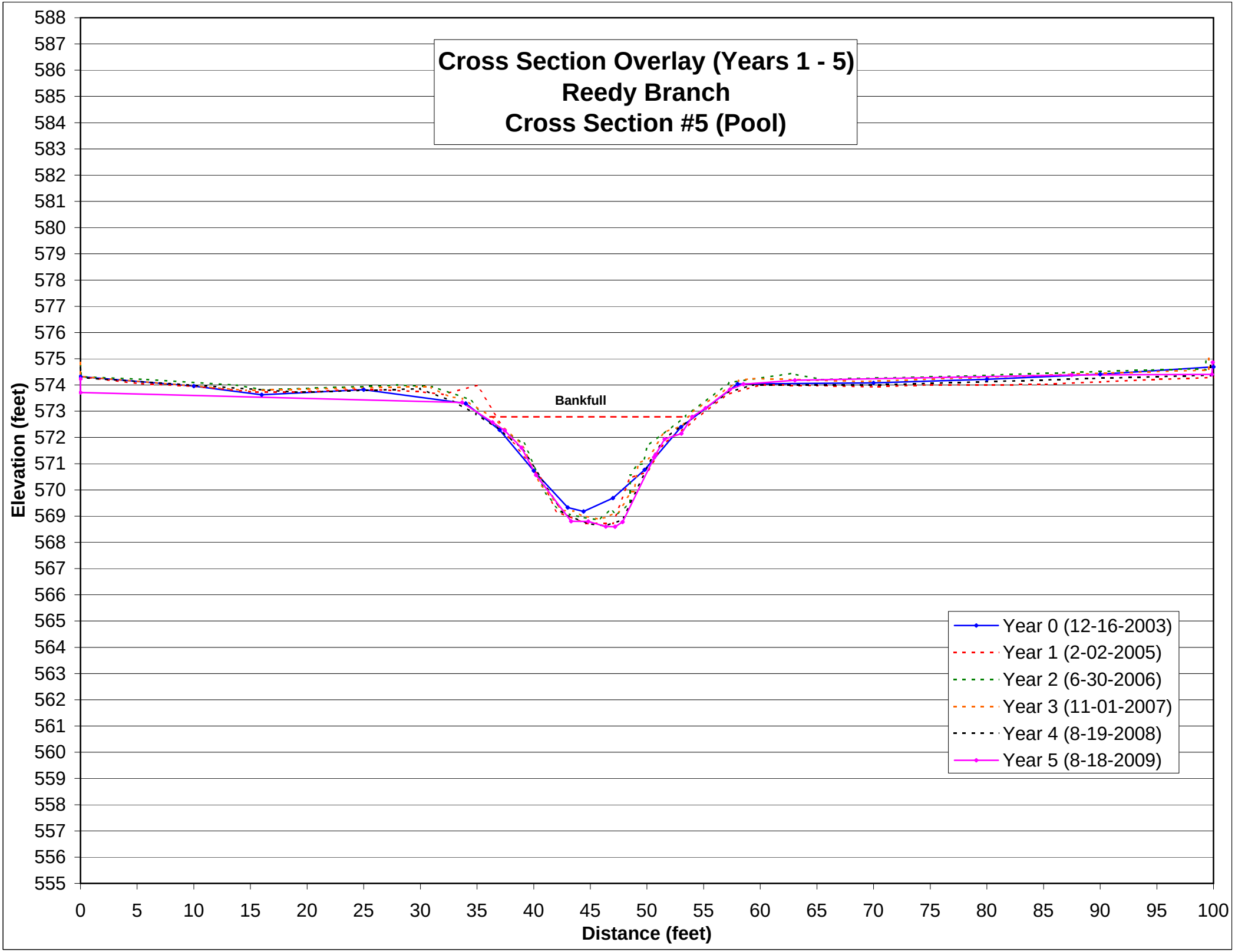
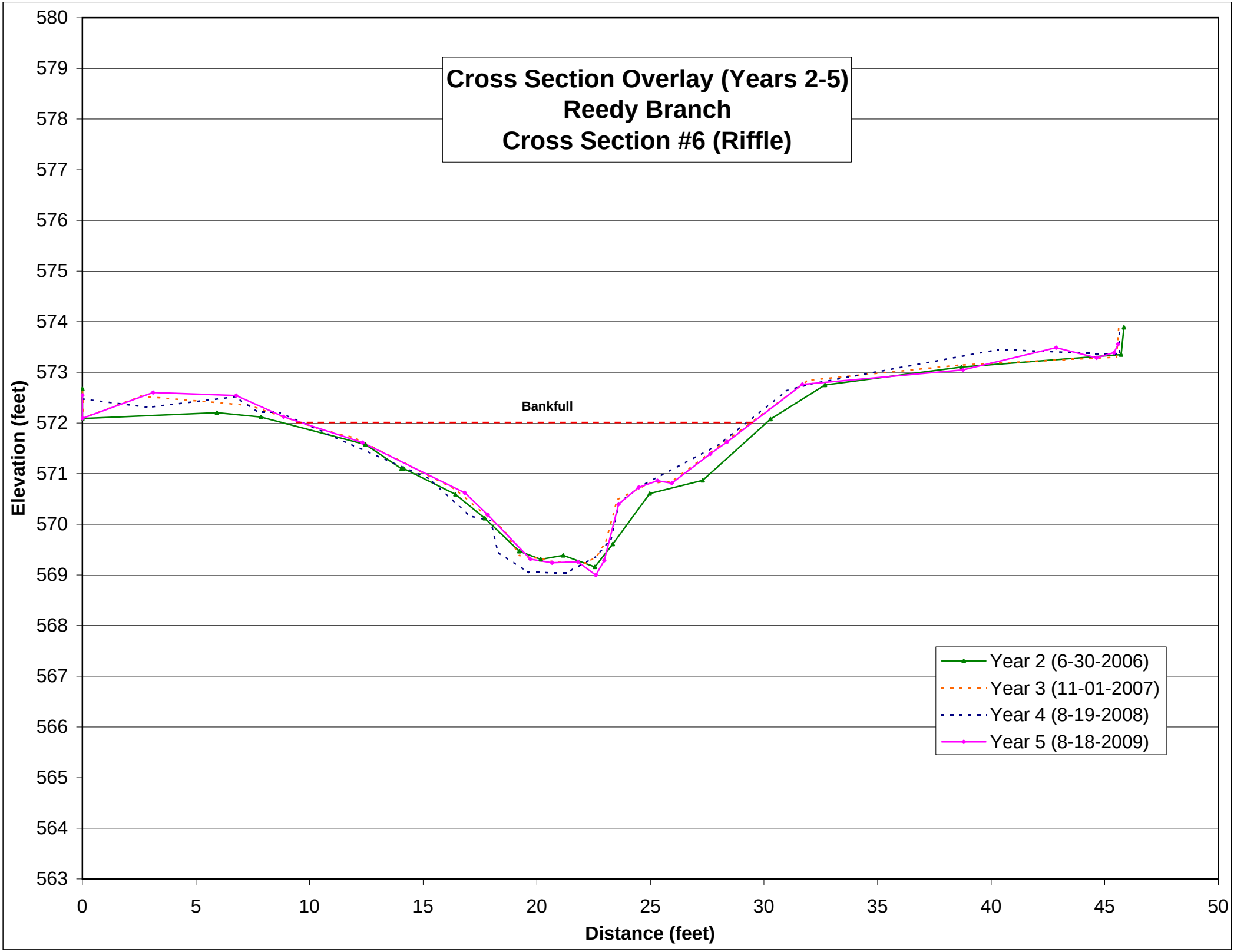
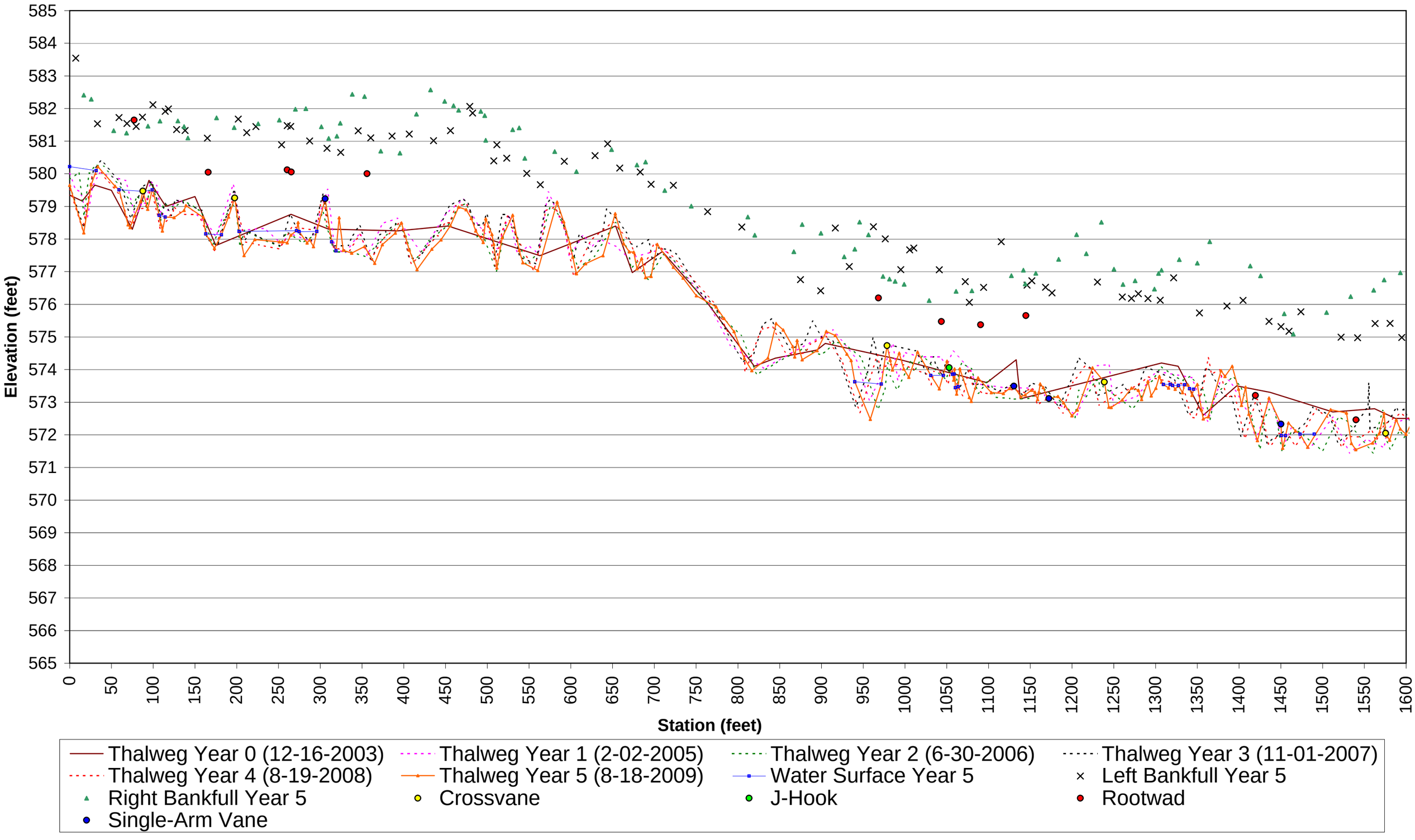
567
566
565
564
563
562
561
0
5
10
15
20
25
30
35
40
45
50
55
60
65
70
75
80
85
Year 0 (12-16-2003)
Year 1 (2-02-2005)
Year 2 (6-30-2006)
Year 3 (11-01-2007)
Year 4 (8-19-2008)
Year 5 (8-04-2009)

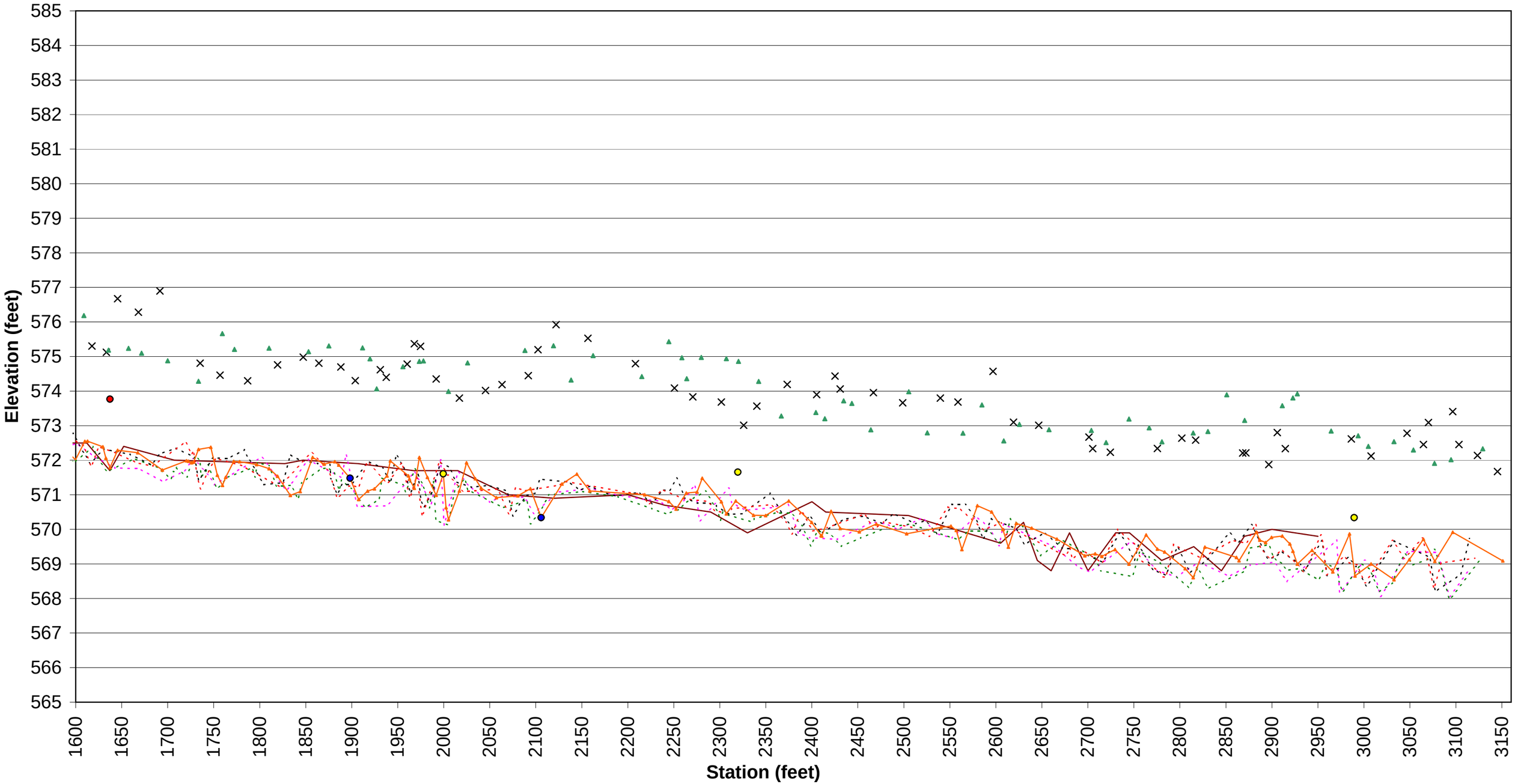

Cross Section Overlay (Years 1 - 5)
Reedy Branch
Cross Section #5 (Pool)
Bankfull
Elevation (feet)
Distance (feet)
588
587
586
585
584
583
582
581
580
579
578
577
576
575
574
573
572
571
570
569
568
567
566
565
564
563
562
561
560
559
558
557
556
555
0
5
10
15
20
25
30
35
40
45
50
55
60
65
70
75
80
85
90
95
100
Year 0 (12-16-2003)
Year 1 (2-02-2005)
Year 2 (6-30-2006)
Year 3 (11-01-2007)
Year 4 (8-19-2008)
Year 5 (8-18-2009)


Cross Section Overlay (Years 2-5)
Reedy Branch
Cross Section #6 (Riffle)
Bankfull
Elevation (feet)
Distance (feet)
580
579
578
577
576
575
574
573
572
571
570
569
568
567
566
565
564
563
0
5
10
15
20
25
30
35
40
45
50
Year 2 (6-30-2006)
Year 3 (11-01-2007)
Year 4 (8-19-2008)
Year 5 (8-18-2009)

Longitudinal Profile Overlay Page 1 of 2
Reedy Branch



Longitudinal Profile Overlay Page 2 of 2
Reedy Branch



PEBBLE COUNT

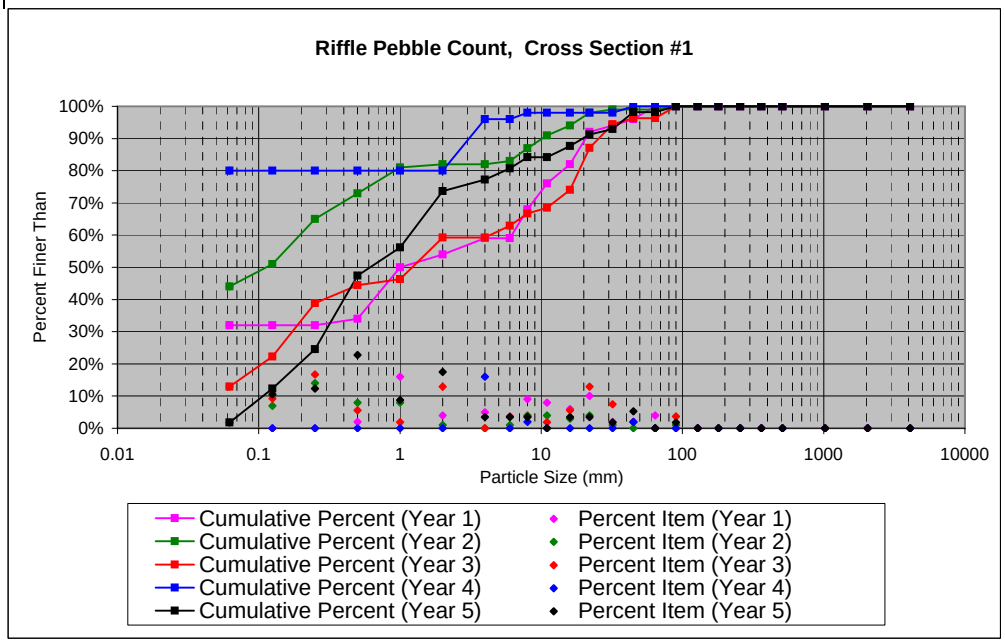
Site: Reedy Branch

Party: IPJ

Date: 10/19/2009

SEPI ENGINEERING GROUP

Inches	Particle	Millimeters		Cross-Section 1 (Riffle)	TOT#	ITEM %	% CUM
	Silt/Clay	< 0.062	**S/C**	1	1	2%	2%
	Very Fine	.062-.125	SAND	6	6	11%	12%
	Fine	.125-.25		7	7	12%	25%
	Medium	.25-.50		13	13	23%	47%
	Coarse	.50-1.0		5	5	9%	56%
.04-.08	Very Coarse	1.0-2		10	10	18%	74%
.08-.16	Very Fine	2.0-4.0	GRAVEL	2	2	4%	77%
.16-.22	Fine	4-5.7		2	2	4%	81%
.22-.31	Fine	5.7-8		2	2	4%	84%
.31-.44	Medium	8-11.3			0	0%	84%
.44-.63	Medium	11.3-16		2	2	4%	88%
.63-.89	Coarse	16-22.6		2	2	4%	91%
.89-1.26	Coarse	22.6-32		1	1	2%	93%
1.26-1.77	Very Coarse	32-45		3	3	5%	98%
1.77-2.5	Very Coarse	45-64			0	0%	98%
2.5-3.5	Small	64-90	COBBLE	1	1	2%	100%
3.5-5.0	Small	90-128			0	0%	100%
5.0-7.1	Large	128-180			0	0%	100%
7.1-10.1	Large	180-256			0	0%	100%
10.1-14.3	Small	256-362	BOULDER		0	0%	100%
14.3-20	Small	362-512			0	0%	100%
20-40	Medium	512-1024			0	0%	100%
40-80	Large	1024-2048			0	0%	100%
	Bedrock		**BDRK**		0	0%	100%
					57	**100%**	**100%**



PEBBLE COUNT

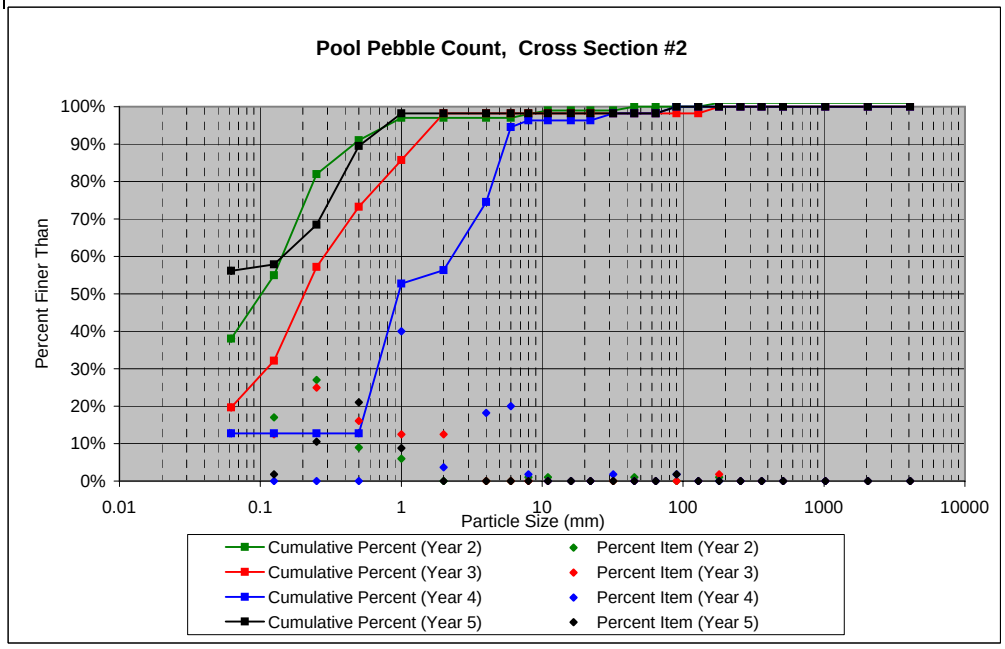
Site: Reedy Branch

Party: IPJ

Date: 10/19/2009

SEPI ENGINEERING GROUP

Inches	Particle	Millimeters		Cross-Section 2 (Pool)	TOT#	ITEM %	% CUM
	Silt/Clay	< 0.062	**S/C**	32	32	56%	56%
	Very Fine	.062-.125	SAND	1	1	2%	58%
	Fine	.125-.25		6	6	11%	68%
	Medium	.25-.50		12	12	21%	89%
	Coarse	.50-1.0		5	5	9%	98%
.04-.08	Very Coarse	1.0-2			0	0%	98%
.08-.16	Very Fine	2.0-4.0	GRAVEL		0	0%	98%
.16-.22	Fine	4-5.7			0	0%	98%
.22-.31	Fine	5.7-8			0	0%	98%
.31-.44	Medium	8-11.3			0	0%	98%
.44-.63	Medium	11.3-16			0	0%	98%
.63-.89	Coarse	16-22.6			0	0%	98%
.89-1.26	Coarse	22.6-32			0	0%	98%
1.26-1.77	Very Coarse	32-45			0	0%	98%
1.77-2.5	Very Coarse	45-64			0	0%	98%
2.5-3.5	Small	64-90	COBBLE	1	1	2%	100%
3.5-5.0	Small	90-128			0	0%	100%
5.0-7.1	Large	128-180			0	0%	100%
7.1-10.1	Large	180-256			0	0%	100%
10.1-14.3	Small	256-362	BOULDER		0	0%	100%
14.3-20	Small	362-512			0	0%	100%
20-40	Medium	512-1024			0	0%	100%
40-80	Large	1024-2048			0	0%	100%
	Bedrock		**BDRK**		0	0%	100%
					57	**100%**	**100%**



PEBBLE COUNT

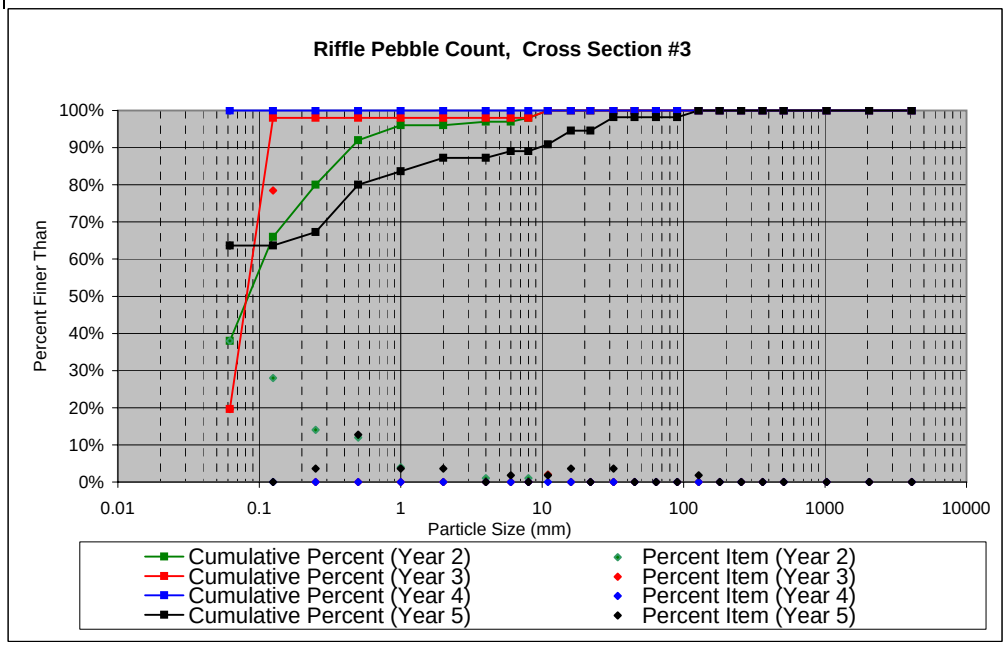
Site: Reedy Branch

Party: IPJ

Date: 10/19/2009

SEPI ENGINEERING GROUP

Inches	Particle	Millimeters		Cross-Section 3 (Riffle)	TOT#	ITEM %	% CUM
	Silt/Clay	< 0.062	**S/C**	35	35	64%	64%
	Very Fine	.062-.125	SAND		0	0%	64%
	Fine	.125-.25	SAND	2	2	4%	67%
	Medium	.25-.50	SAND	7	7	13%	80%
	Coarse	.50-1.0	SAND	2	2	4%	84%
.04-.08	Very Coarse	1.0-2	SAND	2	2	4%	87%
.08-.16	Very Fine	2.0-4.0	GRAVEL		0	0%	87%
.16-.22	Fine	4-5.7	GRAVEL	1	1	2%	89%
.22-.31	Fine	5.7-8	GRAVEL		0	0%	89%
.31-.44	Medium	8-11.3	GRAVEL	1	1	2%	91%
.44-.63	Medium	11.3-16	GRAVEL	2	2	4%	95%
.63-.89	Coarse	16-22.6	GRAVEL		0	0%	95%
.89-1.26	Coarse	22.6-32	GRAVEL	2	2	4%	98%
1.26-1.77	Very Coarse	32-45	GRAVEL		0	0%	98%
1.77-2.5	Very Coarse	45-64	GRAVEL		0	0%	98%
2.5-3.5	Small	64-90	COBBLE		0	0%	98%
3.5-5.0	Small	90-128	COBBLE	1	1	2%	100%
5.0-7.1	Large	128-180	COBBLE		0	0%	100%
7.1-10.1	Large	180-256	COBBLE		0	0%	100%
10.1-14.3	Small	256-362	BOULDER		0	0%	100%
14.3-20	Small	362-512	BOULDER		0	0%	100%
20-40	Medium	512-1024	BOULDER		0	0%	100%
40-80	Large	1024-2048	BOULDER		0	0%	100%
	Bedrock		**BDRK**		0	0%	100%
					55	**100%**	**100%**



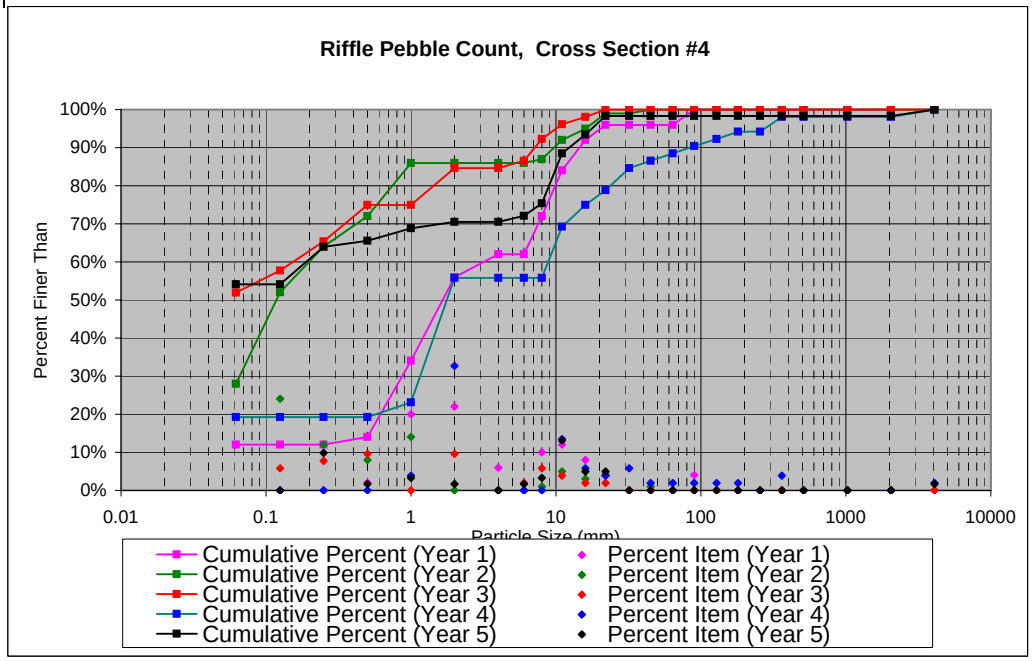
PEBBLE COUNT

Site: Reedy Branch

Party: IPJ

Date: 10/19/2009

Inches	Particle	Millimeters		Cross-Section 4 (Riffle)	TOT#	ITEM %	% CUM
	Silt/Clay	< 0.062	**S/C**	33	33	54%	54%
	Very Fine	.062-.125	SAND		0	0%	54%
	Fine	.125-.25	SAND	6	6	10%	64%
	Medium	.25-.50	SAND	1	1	2%	66%
	Coarse	.50-1.0	SAND	2	2	3%	69%
.04-.08	Very Coarse	1.0-2	SAND	1	1	2%	70%
.08-.16	Very Fine	2.0-4.0	GRAVEL		0	0%	70%
.16-.22	Fine	4-5.7	GRAVEL	1	1	2%	72%
.22-.31	Fine	5.7-8	GRAVEL	2	2	3%	75%
.31-.44	Medium	8-11.3	GRAVEL	8	8	13%	89%
.44-.63	Medium	11.3-16	GRAVEL	3	3	5%	93%
.63-.89	Coarse	16-22.6	GRAVEL	3	3	5%	98%
.89-1.26	Coarse	22.6-32	GRAVEL		0	0%	98%
1.26-1.77	Very Coarse	32-45	GRAVEL		0	0%	98%
1.77-2.5	Very Coarse	45-64	GRAVEL		0	0%	98%
2.5-3.5	Small	64-90	COBBLE		0	0%	98%
3.5-5.0	Small	90-128	COBBLE		0	0%	98%
5.0-7.1	Large	128-180	COBBLE		0	0%	98%
7.1-10.1	Large	180-256	COBBLE		0	0%	98%
10.1-14.3	Small	256-362	BOULDER		0	0%	98%
14.3-20	Small	362-512	BOULDER		0	0%	98%
20-40	Medium	512-1024	BOULDER		0	0%	98%
40-80	Large	1024-2048	BOULDER		0	0%	98%
	Bedrock		**BDRK**	1	1	2%	100%
					61	**100%**	**100%**



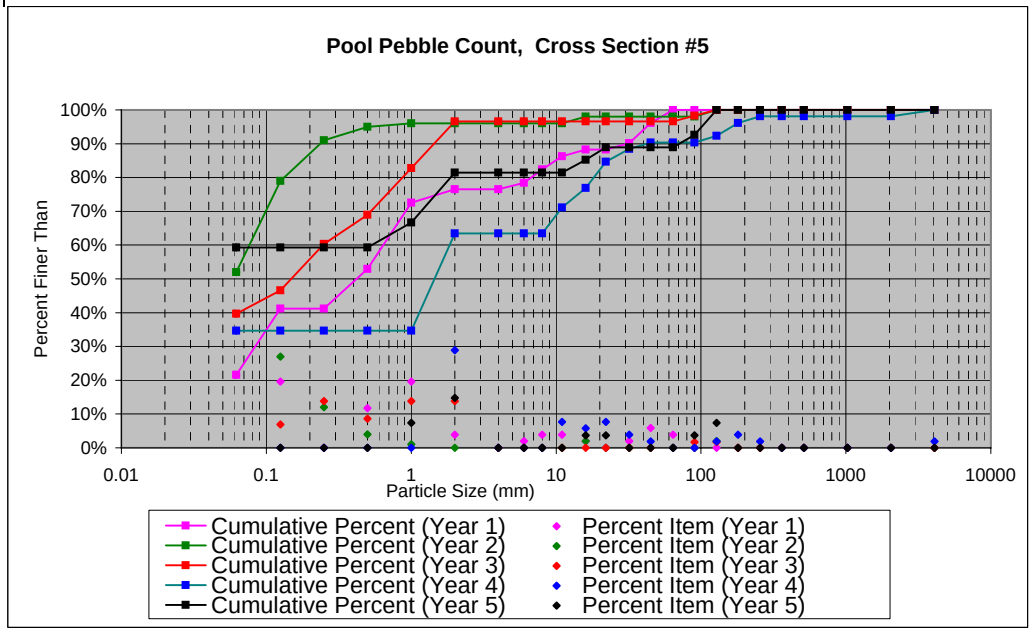
PEBBLE COUNT

Site: Reedy Branch

Party: IPJ

Date: 10/19/2009

Inches	Particle	Millimeters		Cross-Section 5 (Pool)	TOT#	ITEM %	% CUM
	Silt/Clay	< 0.062	**S/C**	16	16	59%	59%
	Very Fine	.062-.125	SAND		0	0%	59%
	Fine	.125-.25			0	0%	59%
	Medium	.25-.50			0	0%	59%
	Coarse	.50-1.0		2	2	7%	67%
.04-.08	Very Coarse	1.0-2		4	4	15%	81%
.08-.16	Very Fine	2.0-4.0	GRAVEL		0	0%	81%
.16-.22	Fine	4-5.7			0	0%	81%
.22-.31	Fine	5.7-8			0	0%	81%
.31-.44	Medium	8-11.3			0	0%	81%
.44-.63	Medium	11.3-16		1	1	4%	85%
.63-.89	Coarse	16-22.6		1	1	4%	89%
.89-1.26	Coarse	22.6-32			0	0%	89%
1.26-1.77	Very Coarse	32-45			0	0%	89%
1.77-2.5	Very Coarse	45-64			0	0%	89%
2.5-3.5	Small	64-90	COBBLE	1	1	4%	93%
3.5-5.0	Small	90-128		2	2	7%	100%
5.0-7.1	Large	128-180			0	0%	100%
7.1-10.1	Large	180-256			0	0%	100%
10.1-14.3	Small	256-362	BOULDER		0	0%	100%
14.3-20	Small	362-512			0	0%	100%
20-40	Medium	512-1024			0	0%	100%
40-80	Large	1024-2048			0	0%	100%
	Bedrock		**BDRK**		0	0%	100%
					27	**100%**	**100%**



PEBBLE COUNT

Site: Reedy Branch

Party: IPJ

Date: 10/19/2009

SEPI ENGINEERING GROUP

Inches	Particle	Millimeters		Cross-Section 6 (Riffle)	TOT#	ITEM %	% CUM
	Silt/Clay	< 0.062	**S/C**	19	19	36%	36%
	Very Fine	.062-.125	SAND		0	0%	36%
	Fine	.125-.25			0	0%	36%
	Medium	.25-.50			0	0%	36%
	Coarse	.50-1.0		3	3	6%	42%
.04-.08	Very Coarse	1.0-2		5	5	9%	51%
.08-.16	Very Fine	2.0-4.0	GRAVEL	1	1	2%	53%
.16-.22	Fine	4-5.7			0	0%	53%
.22-.31	Fine	5.7-8			0	0%	53%
.31-.44	Medium	8-11.3			0	0%	53%
.44-.63	Medium	11.3-16		1	1	2%	55%
.63-.89	Coarse	16-22.6		4	4	8%	62%
.89-1.26	Coarse	22.6-32		3	3	6%	68%
1.26-1.77	Very Coarse	32-45		6	6	11%	79%
1.77-2.5	Very Coarse	45-64		10	10	19%	98%
2.5-3.5	Small	64-90	COBBLE	1	1	2%	100%
3.5-5.0	Small	90-128			0	0%	100%
5.0-7.1	Large	128-180			0	0%	100%
7.1-10.1	Large	180-256			0	0%	100%
10.1-14.3	Small	256-362	BOULDER		0	0%	100%
14.3-20	Small	362-512			0	0%	100%
20-40	Medium	512-1024			0	0%	100%
40-80	Large	1024-2048			0	0%	100%
	Bedrock		**BDRK**		0	0%	100%
					53	**100%**	**100%**