WELLS CREEK
FINAL MONITORING REPORT
YEAR 3 OF 5
2007

EEP Project # 414
Alamance County, North Carolina

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Submitted to:

Ecosystem Enhancement Program

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Executive Summary

The North Carolina Ecosystem Enhancement Program (EEP) restored two reaches along Wells Creek and an unnamed tributary in 2004. This project is located in Alamance County, NC. The three different reaches flow through pasture areas and wooded sections. Prior to restoration, cattle and horses had unlimited access to the stream channels which created areas of severe bank erosion and loss of vegetation. Since the restoration has been complete, the livestock have been fenced out of the stream with the exception of a few crossings that are used throughout the year to move the cattle from one field to another.

There were several goals for this stream and buffer restoration project. Goals of the stream project included: reducing the bank erosion; reducing nutrient runoff on the site; stabilizing stream channel banks by planting vegetation; and helping the stream reach its equilibrium through the proper design ratios for dimension, pattern, and profile.

This report documents the data collected for Year 3 monitoring. Current monitoring for the site consists of evaluating both stream morphology and riparian vegetation. The stream monitoring included a longitudinal survey, cross section surveys, pebble counts, problem area identification, and photo documentation. A plan view featuring bankfull, edge of water, and thalweg lines as well as problem area locations was developed from the longitudinal survey. The vegetation assessment included a tally of planted vegetation in permanent vegetation plots, vegetation-specific problem area identification (i.e. bare areas and invasive species), and photo documentation. A vegetation problem area plan view was developed from the problem area identification. All morphological data, vegetation plot and pebble counts, cross section surveys, the longitudinal profile, and the plan view features were compared between monitoring years to assess project performance.

All reaches are considered to have remained geomorphically stable between Monitoring Years 2 and 3, with the exception of several areas of aggradation occurring in riffle sections of all three reaches. However, it has been concluded so far that the riffles are probably just adjusting to a more stable state, post-construction. There were several areas of bank erosion in all three reaches. All three reaches had problems with structures being positioned wrong or placed at the wrong angle and therefore allowing excess stress and erosion on the bank. Only Reach 1 had structures where the structural integrity appeared to be compromised, a cross-vane located at Station 12+75 and a j-hook located at station 14+03. These two structures had water piping under or around stones, were the most severe problem structures, and should be assessed to determine the need for future maintenance.

Overall, there appears to be good vegetation along the stream channel and floodplain of all three reaches. There are extensive stands of Japanese grass (*Microstegium vimenium*) in all of the monitored reaches. The largest areas of the grass are noted on the plan view sheets in Appendix C.Bare root trees in all Reach 1 plots, and Plot 4 in Reach 2, are not meeting the stems/acre for 260 stems at Year 5. Overall, the survivability from Monitoring Year 2 and 3 was good despite the area being in a drought.

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APPENDICES

1.0 PROJECT BACKGROUND

1.1 Project Objectives

The goal of this stream restoration project is to improve the water quality in the Cape Fear River Basin. Wells Creek and its unnamed tributary (UT) at this project site are typical of streams within this and surrounding watersheds. Prior to restoration, the channels exhibited instability and degradation in response to the current and historical land use practices. Nutrient input should decrease with the establishment of a riparian buffer and fencing the cattle out of the streams. In time, the buffer will provide wildlife cover and shade to the stream which will encourage wildlife diversity, both aquatic and terrestrial.

1.2 Project Structure, Restoration Type, and Approach

Reach 1 (the northern-most section) is the longest section covering approximately 1,246 linear feet. Reach 2 includes 1,140 linear feet of Wells Creek and is located south of Reach 1. The Unnamed Tributary (UT) reach is approximately 1,014 linear feet and lies west of Reach 2. Figure 2 shows the relative location of the three reaches.

Priority Level I, II and III restoration were implemented to restore the streams to a more stable condition. Boulder structures were constructed and installed at strategic locations to provide stream bed and bank stability. Root wads were installed to provide bank protection and increase habitat diversity. Table I details the specific restoration components employed on each reach.

Table I. Project Mitigation Structure and Objectives Table
Wells Creek/EEP Project Number 414

Project Segment or Reach ID	Mitigation Type	Approach*	Linear Footage or Acreage Stationing#	Comment#
Reach 1	R	P I	756	New channel constructed
	E (I)	P II & P III	2,250	Modified profile and dimension
Reach 2	R	P I	840	New channel constructed
	E (I)	P II & P III	404	Modified profile and dimension
Unnamed Tributary	R	P I	1,161	New channel constructed
	E (I)	P II & P III	332	Modified profile and dimension

Note: "R" and "E (I)" in the Mitigation Type column refer to Restoration and Enhancement Level I.
"P" in the Approach column refers to Priority Level.
"*" – The Monitoring Year 1 report does not designate the Priority Level for each project reach. The noted approach is inferred based on comments in Table 2 of Monitoring Year 1 for the project.
"#" – information taken from Table 2 of Monitoring Year 1 for the project.

1.3 Project Location and Setting

This project is near Snow Camp, North Carolina in south-central Alamance County. To reach the site from Raleigh, go west on US 64 to Siler City. From Siler City, go north on Martin Luther King Boulevard. The North Carolina Atlas and Gazetteer (DeLorme 1997) labels Martin Luther King Boulevard as Snow Camp Road. Continue north toward the community of Snow Camp (approximately 12 miles). Just before Snow Camp, take a left on SR 2360 (Sylvan School Road). Continue on Sylvan School Road for approximately 2 miles then take a right on Bass Mountain Road. Continue on Bass Mountain Road for approximately ½ mile and take a left on Beale Road. Continue on Beale Road for approximately 1 mile, then turn right on Longest Acre Road (Wright Road in the NC Gazetteer). Reach 1 is at the end of Longest Acre Road. All three reaches are located in the triangle created by Bass Mountain

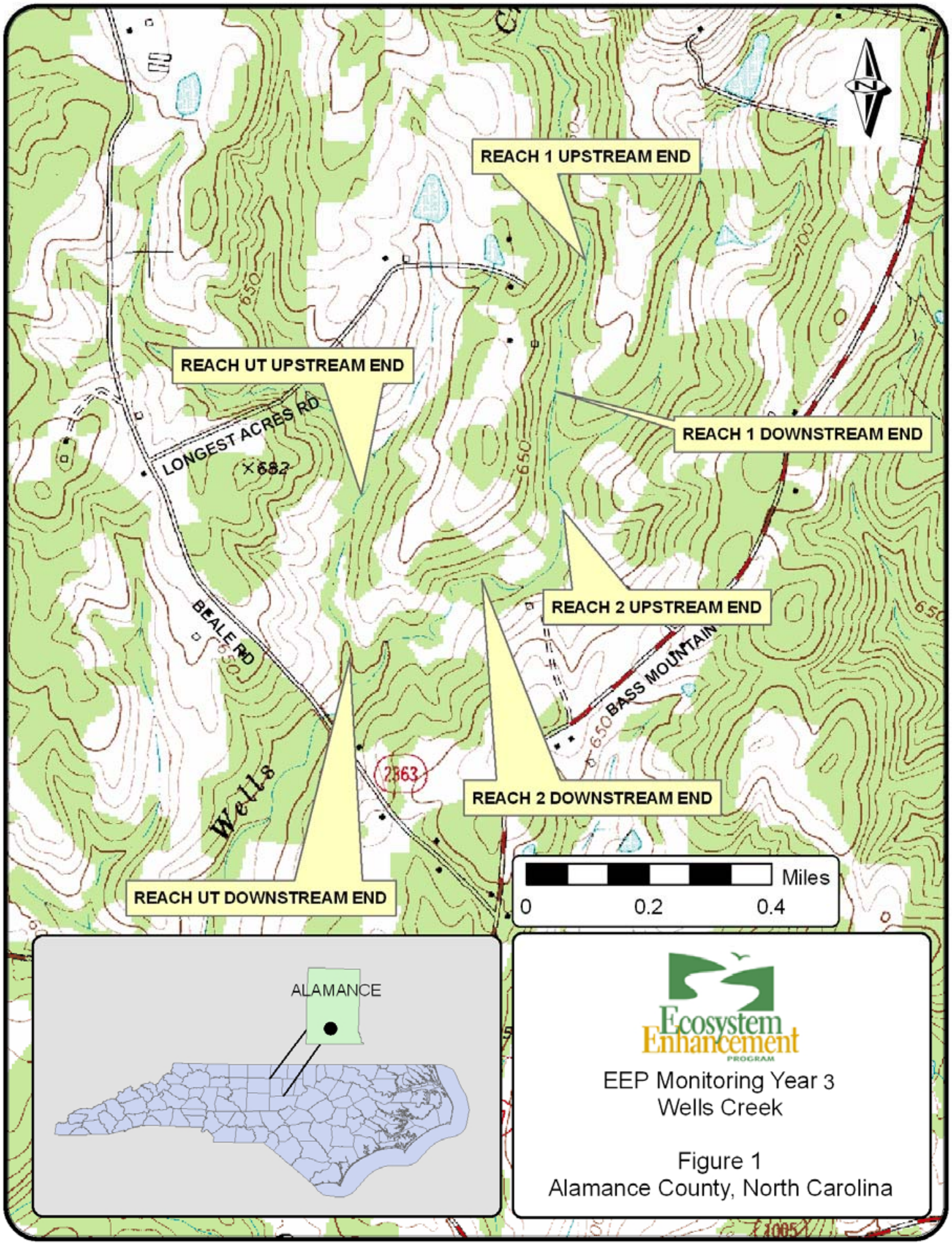
Road, Beale Road, and Thompson Road. Figure 1 shows the location of the three reaches. The site is located in a rural portion of Alamance County on a working livestock farm. The stream reaches flow through pasture and wooded areas. Prior to restoration, livestock had unlimited access to several portions of the channel. Since the completion of restoration, the stream has been fenced off from the livestock. The surrounding topography has gently sloping hills.

1.4 History and Background

Wells Creek and its tributary were in an active cattle pasture prior to restoration. The current land owner cleared the land for pasture in the 1970's. Prior to the 1970's the land was forested. According to the owner, there was a mill on site. An old rock dam is located upstream of Reach 2, and an old breached rock dam is at the downstream end of Reach 1. Prior to restoration the streams lacked sinuosity and they were likely altered for agriculture. Tables II-IV provide background information for the project.

Table II. Project Activity and Reporting History
Wells Creek/EEP Project Number 414

Activity or Report	Scheduled Completion	Data Collection Complete	Actual Completion or Delivery
Restoration Plan			August 1, 2002
Final Design - 90%			unknown
Construction			August 2003-April 2004
Temporary S&E mix applies to entire project area			August 2003-April 2004
Permanent seed mix applies to reach/segments 1&2			August 2003-April 2005
Containerized and B&B plantings for reach/segments 1&2			August 2003-April 2006
Mitigation Plan/ As-built (Year 0 Monitoring - baseline)		Dec-04	December 2004/July 2004
Year 1 monitoring			Sep-05
Year 2 monitoring		Apr-06	Nov-06
Year 3 monitoring		Oct-07	Dec-07
Year 4 monitoring	Apr-08		
Year 5 monitoring	Apr-09		
Year 5+ monitoring			


REACH 1 UPSTREAM END
REACH UT UPSTREAM END
REACH 1 DOWNSTREAM END
LONGEST ACRES RD
×682
REACH 2 UPSTREAM END
BEALE RD
BASS MOUNTAIN
2363
REACH 2 DOWNSTREAM END
Wells
REACH UT DOWNSTREAM END
Miles
0
0.2
0.4
ALAMANCE
Ecosystem Enhancement PROGRAM
EEP Monitoring Year 3
Wells Creek
Figure 1
Alamance County, North Carolina

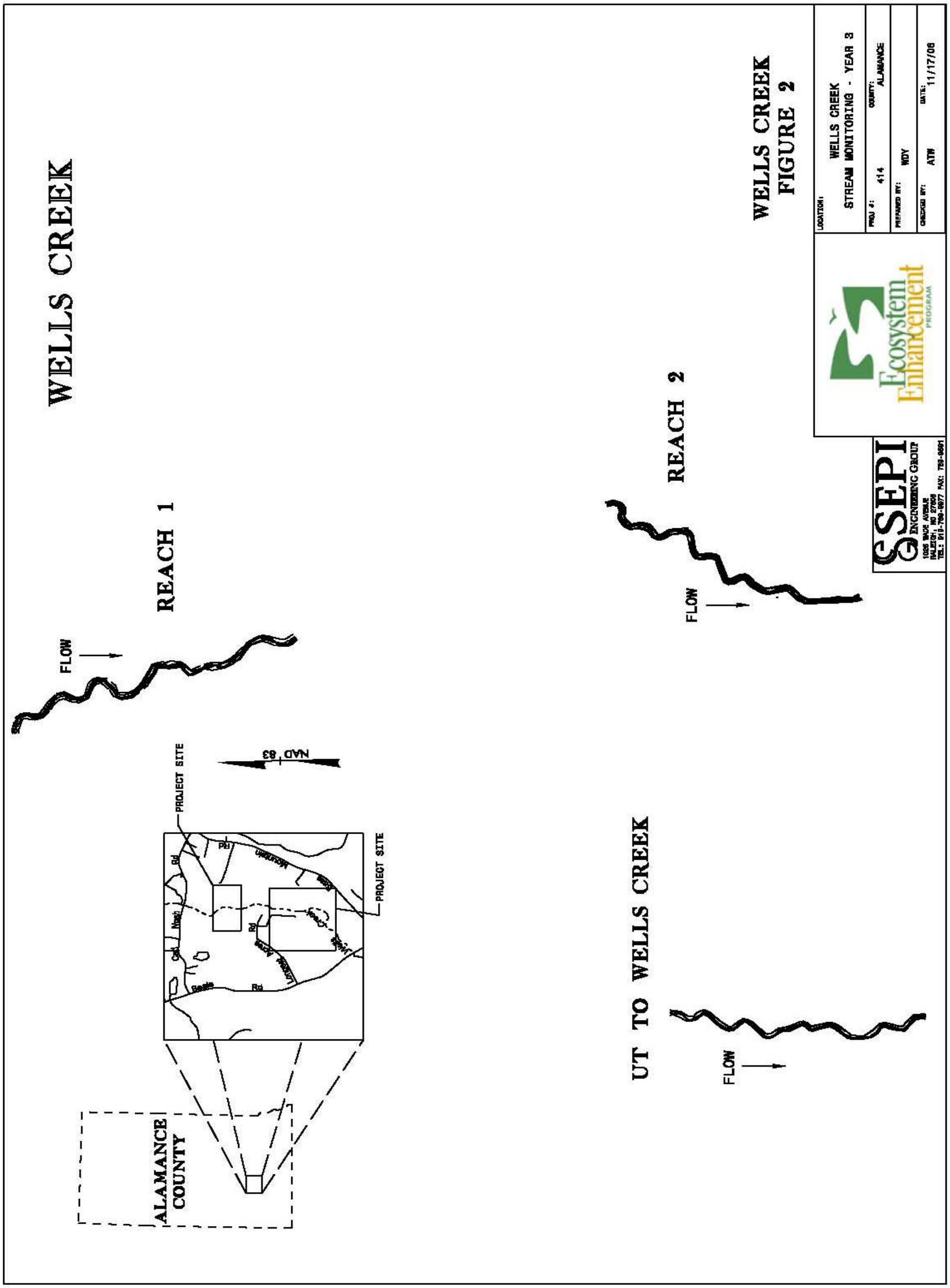

WELLS CREEK
REACH 1
FLOW
REACH 2
FLOW
UT TO WELLS CREEK
FLOW
ALAMANCE COUNTY
PROJECT SITE
PROJECT SITE
NAD 83
WELLS CREEK
FIGURE 2
LOCATION: WELLS CREEK STREAM MONITORING - YEAR 3
PROJ #: 414
COUNTY: ALAMANCE
PREPARED BY: WDY
CHECKED BY: ATW
SEPI ENGINEERING GROUP
Ecosystem Enhancement PROGRAM

Table III. Project Contract Table	
Wells Creek/EEP Project Number 414	
Designer	ARCADIS G&M of North Carolina 801 Corporate Center Drive, Suite 300 Raleigh, NC 27607
Construction Contractor	A&D Environmental and Industrial Services, Inc. Gerald Walker 2718 Uwharrie Road Archdale, NC 27263 336-434-7750
Planting Contractor	Seal Brothers Contracting Eddie Tobler PO BOX 86 Dobson, NC 27017 336-786-8863
Seeding Contractor	A&D Environmental and Industrial Services, Inc. Gerald Walker 2718 Uwharrie Road Archdale, NC 27263 336-434-7750
2005 Monitoring Performers	ARCADIS G&M of North Carolina 801 Corporate Center Drive, Suite 300 Raleigh, NC 27607
2006 & 2007 Monitoring Performers	SEPI Engineering Group 1025 Wade Avenue Raleigh, NC 27605 Phillip Todd (919) 789-9977
Stream Monitoring POC	Ira Poplar-Jeffers (919) 573-9914
Vegetation Monitoring POC	Phil Beach (919) 573-9936
Wetland Monitoring POC	N/A

Table IV. Project Background Table	
Wells Creek/EEP Project Number 414	
Project County	Alamance
Drainage Area	Reach 1: 1.63 sq mi Reach 2: 2.23 sq mi and UT: 0.71 sq. mi
Drainage impervious cover estimate (%) For example	Wells Creek Reach 1 & 2 ~3%; Unnamed Tributary <1%
Stream Order	Wells Creek Reach 1: 2nd Order
	Wells Creek Reach 2: 3rd Order
	Unnamed Tributary: 1st Order
Physiographic Region	Piedmont
Ecoregion	Southern Outer Piedmont Carolina Slate Belt
Rosgen Classification of As-built	C 4/1
Cowardin Classification	Disturbed Cattle Pasture
Dominant soil types	Colfax, Lignum, Georgeville, Tarrus, Herndon, Local Alluvial Land, and Vance
Reference site ID	UT to Wells Creek, Cane Creek Mountains, Alamance County and 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	Project and reference are Class C, NSW
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)	NA

2.0 PROJECT MONITORING METHODOLOGY

2.1 Vegetation Methodology

The following methodology was used for the stem count. The configuration of the vegetation plots was marked out with tape to measure 10 meters by 10 meters (or equivalent to 100 square meters) depending on buffer width. The planted material, in the plot was marked with flagging. The targeted vegetation was then identified by species and a tally of each species was kept and recorded in a field book.

2.2 Stream Methodology

The project monitoring for the stream channel included a longitudinal survey, cross-sectional surveys, pebble counts and photo documentation. These measurements were taken at each reach. The stationing was based on thalweg. The methodology for each portion of the stream monitoring is described in detail below.

2.2.1 Longitudinal Profile and Plan View

A longitudinal profile was surveyed for each reach 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, thalweg, water surface, edge of water, left and right bankfull, and left and right top of bank were surveyed. All profile measurements were calculated from this survey, including channel and valley length and length of each feature, water surface slope for each reach and feature, bankfull slope for the reach, and pool-to-pool spacing. This survey also was used to draw plan view figures with Microstation v8 (Bentley Systems, Inc., Exton, PA) for each reach, 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.

2.2.2 Permanent Cross Sections

Four permanent cross sections (two riffles and two pools) were surveyed at each reach. The beginning and end of each permanent cross section were originally marked with a wooden stake. Cross sections were established perpendicular to the stream flow with station 0+00 feet located on the left bank. The survey noted all changes in slopes, tops of both banks, left and right bankfull, edges of water, thalweg and water surface. Before each cross section was surveyed, bankfull level was identified, and a quick bankfull area was calculated by measuring a bankfull depth at 1-foot intervals between bankfulls and adding the area of each block across the channel. This rough area was then compared to the North Carolina Rural Piedmont Regional Curve-calculated bankfull area to ensure that bankfull was accurately located prior to the survey. The cross sections were plotted, and Year 3 monitoring data was overlain on Monitoring Year 2 and Monitoring Year 1 (where available) 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 calculated from these plots and compared to Monitoring Year 1 and Monitoring Year 2 data.

2.2.3 Pebble Counts

A modified Wolman pebble count (Rosgen 1994), consisting of 50 samples, was taken at each permanent cross section. The cumulative percentages were graphed, and the D50 and D84 particle sizes were calculated and compared to Monitoring Year 1 (where available) and 2 data.

2.3 Photo Documentation

Permanent photo points were established during Year 1 monitoring. 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 Year 2 photograph. 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.

3.0 PROJECT CONDITION AND MONITORING RESULTS

3.1 Vegetation Assessment

3.1.1 Soils Data

Table V. Preliminary Soil Data

Series	Max Depth (in.)	% Clay on Surface	K	T	OM %
Colfax (Ce)	67	5.0 - 20.0	0.45	*	1.0 - 3.0
Colfax (Cf)	67	7.0 - 25.0	0.36	*	1.0 - 3.0
Efland (EaC)	86	<<<<<<< Information unavailable >>>>>>>			
Efland (EaC2)	86	<<<<<<< Information unavailable >>>>>>>			
Efland (EbC3)	86	<<<<<<< Information unavailable >>>>>>>			
Georgeville (GaC2)	63	5.0 - 20.0	0.48	*	0.5 - 2.0
Georgeville (GaD2)	63	5.0 - 20.0	0.48	*	0.5 - 2.0
Local alluvial (Ld)		<<<<<<< High variability of data >>>>>>>			
Starr (Sb)	70	10.0 - 25.0	0.34	*	0.5 - 2.0
Vance (VcC2)	72	8.0 - 20.0	0.55	*	0.5 - 2.0

* The soils information was not available from the Natural Resources Conservation Service (NRCS)

3.1.2 Vegetative Problem Area Plan View

Overall, there appears to be good vegetation along the stream channel. There are some bank erosion areas as noted in the stream problem area section of the report (See Section 3.2.4).

All three monitoring reaches have good herbaceous vegetative cover. Bare root trees are not as prevalent in Reach 1 when compared the numbers in Reach 2 and the UT.

There are extensive stands of Japanese stilt grass (*Microstegium vimineum*) in all of the monitored reaches. The largest areas of the grass are noted on the plan view sheets in Appendix C.

3.1.3 Stem Counts

The stem densities on Reaches 2 and the UT are well above the Monitoring Year 5 stem density goal (260 stems/acre). Stem densities on Reach 1 were below the Monitoring Year 5 goal (260 stems/acre).

The overall survival rate among all vegetation plots (VP) was 73% between Monitoring Years 1 and 3 and 85% between Monitoring Years 2 and 3. The survival rate is good considering the 2007 drought in addition to the 2005 drought. Vegetation plot photos are located in Appendix A2, and vegetation data tables are located in Appendix A3.

It should be noted that there were several species for which one-to-many additional stems were counted within a given plot relative to the Monitoring Year 2 count. These additional stems were assumed to be volunteers and were not included in the survival calculations. The species were *Betula nigra* (VP #8), *Carpinus caroliniana* (VP #6), *Fraxinus pennsylvanica* (VP #9), *Platanus occidentalis* (VP #1, 2, 6, 8, and 9), and *Quercus michauxii* (VP #3, 7, and 9). In addition, the following species were found in plots but were assumed to be volunteers because they were apparently not found during Monitoring Year 2: *Acer rubra* (VP #1), *Acer saccharinum* (VP #8), *Alnus serrulata* (VP #2 and 4), *Cephalanthus occidentalis* (VP #5), *Cornus ammomum* (VP #1), *Cornus florida* (VP #5), *Diospyros virginiana* (VP #1, 4, and 9), *Fraxinus pennsylvanica* (VP #8), *Juglans nigra* (VP #8), *Liquidambar styraciflua* (VP #4, 5, 6, 8, and 9), *Liriodendron tulipifera* (VP #4, 5, and 6), *Platanus occidentalis* (VP #5), *Quercus michauxii* (VP #1 and 8), *Quercus alba* (VP #1 and 3), and *Ulmus rubra* (VP #8).

3.2 Stream Assessment

Considering the 5 year timeframe of standard mitigation monitoring, restored streams should demonstrate morphologic stability in order to be considered successful. Stability does not equate to an absence of change, but rather to sustainable rates of change or stable patterns of variation. Restored streams often demonstrate some level of initial adjustment in the several months that follow construction and some change/variation subsequent to that is to also be expected. However, the observed change should not indicate a high rate or be unidirectional over time such that a robust trend is evident. If some trend is evident, it should be very modest or indicate migration to another stable form. Examples of the latter include depositional processes resulting in the development of constructive features on the banks and floodplain, such as an inner berm, slight channel narrowing, modest natural levees, and general floodplain deposition. Annual variation is to be expected, but over time this should demonstrate maintenance around some acceptable central tendency while also demonstrating consistency or a reduction in the amplitude of variation. Lastly, all of this must be evaluated in the context of hydrologic events to which the system is exposed over the monitoring period.

For channel dimension, cross-sectional overlays and key parameters such as cross-sectional area and the channel's width to depth ratio should demonstrate modest overall change and patterns of variation that are in keeping with above. For the channels' profile, the reach under assessment should not demonstrate any consistent trends in thalweg aggradation or degradation over any significant continuous portion of its length. Over the monitoring period, the profile should also demonstrate the maintenance or development of bedform (facets) more in keeping with reference level diversity and distributions for the stream type in question. It should also provide a meaningful contrast in terms of bedform diversity against the pre-existing condition. Bedform distributions, riffle/pool lengths and slopes will vary, but should do so with maintenance around design/As-built distributions. This requires that the majority of pools are maintained at greater depths with lower water surface slopes and riffles are shallow with greater water surface slopes. Substrate measurements should indicate the progression towards, or the maintenance of, the known distributions from the design phase.

In addition to these geomorphic criteria, a minimum of two bankfull events must be documented during separate monitoring years within the five year monitoring period for the monitoring to be considered complete. Table VIII documents all bankfull events recorded since the start of Monitoring Year 1.

Table VIII. Verification of Bankfull Events - Wells Creek			
Date of Data Collection	**Date of Occurrence**	**Method**	**Photo # (if available)**
7/19/2006	Unknown	Bankfull event recorded: evident by crest stage gauge (0.6" wet on the measuring stick).	no photo
1/19/2007	Unknown	Bankfull event recorded: evident by crest stage gauge (7.0" wet on the measuring stick).	no photo
4/5/2007	Unknown	Crest gauge reading of 4.75" over bankfull (located at 0.00" on gauge).	no photo
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 assumed, but not confirmed, that this event resulted in a bankfull flow.	No Photo.

3.2.1 Longitudinal Profile and Plan View

The overall water surface slopes of the three reaches appear stable between Monitoring Years 1 through 3. In addition, all pattern parameters (including sinuosity) and the plan view overlay remain consistent between Monitoring Years 1 through 3.

All other profile parameters in all reaches appear consistent since Monitoring Year 1 except for riffle length and pool spacing. In Reach 1 both of these parameters appear to have decreased slightly between Monitoring Years 1 and 2 and then stabilized between Monitoring Years 2 and 3. Although this result may be explained by probable differences in survey calls in the field, it is also indicative of a possible settling period after construction during which the streambed adjusted to a stable state prior to Monitoring Year 2. In Reaches 2 and UT, a fairly consistent annual decline in riffle length and pool spacing is apparent between Monitoring Years 1 and 3. As with Reach 1, it is most likely the case that differences in survey calls account for most of this apparent change, based on the consistency of the longitudinal overlays. It may also be possible that the post-construction streambed adjustment is taking longer in these two reaches compared to Reach 1 and may reach a stable state in the next monitoring year.

3.2.2 Permanent Cross Sections

All Reach 1 cross sections appear stable between monitoring years, except for cross section #3, which appears to have filled in slightly on the right side of the channel since Monitoring Year 2. . This result is indicative of deposition occurring on this riffle which is consistent with the fact that cross section #3 crosses a bed aggradation and mid-channel bar area. To further support this result, there was a notable decrease in the cross-sectional area of cross section #3 since Monitoring Year 2.

In Reach UT, cross sections #5 and #6 appear stable between Monitoring Years 2 and 3. It appears that the Monitoring Year 2 survey stationing was off somehow for both cross sections #7 and #8 compared to the Monitoring Year 3 survey. However, it was still possible to compare the shape of these two cross sections. It appears that cross section 7 has filled in notably since Monitoring Year 2, which is consistent with the aggradation associated with this section of Reach UT. Unfortunately, cross sectional areas cannot be compared between the two years because if the survey stationing was off in Monitoring Year 2, then the cross-sectional area would have been impacted. Cross section #8 has a bank erosion area on the right side, and although it is difficult to make a comparison because there are apparent differences in survey stationing between Monitoring Years 2 and 3. It does appear through the comparison of the overall shape of the surveys that the right side of cross section #8 has widened slightly.

In Reach 2, cross sections #10 and #11 remain stable between monitoring Years 2 and 3 and have no problem areas associated with their location. Cross section #9 crosses a section of aggradation, which is consistent with a slight filling in of the right side of the stream bed. The aggradation is noted on the cross sectional overlay, and there is a slight overall decrease in the cross-sectional area of cross section #9 since Monitoring Year 1. Also it is apparent, through observation of the cross sectional overlay, that cross section #12 experienced a significant down-cutting of the channel bed between Monitoring Years 1 and 2. The channel then stabilized after the scour event, and the overlay between Monitoring Years 2 and 3 remains stable. This observation is consistent with a notable increase in both cross sectional area and bankfull mean depth between Monitoring Years 1 and 2, and subsequent consistency in these variables between Monitoring Years 2 and 3.

3.2.3 Pebble Counts

Based on the pebble data overlays, it appears that the upper end of Reach 1 has experienced a notable amount of fine sediment deposition. This result is evident in the fact that the cross section #1 pebble distribution plot (Appendix B6) shows a rather dramatic increase in fine sediments since Monitoring Year 2, and the cross section #2 plot (Appendix B6) shows progressively higher percentages of fine sediments each year since Monitoring Year 1. The sediments are presumably entrained from an upstream source, because of on-going agricultural and other sediment-producing land-uses upstream and there are only two small sections of erosional bank (only one upstream of cross section #1) located in the upstream half of the reach that could have contributed fine sediments to the channel. In addition, it appears that most of the entrained fine particles were deposited before reaching cross section #3, because both cross section #3 and #4 pebble counts show that the bed material in these locations has at least remained consistent since Year 1 and possibly has coarsened slightly. This result is somewhat surprising considering cross section #3 is associated with an aggradation and central bar formation problem area, but it does appear from the pebble count overlay that the bed material of this cross section experienced an influx of fine sediments in Year 2 and then a re-coarsening in Year 3. Even though the cross section survey overlay does not show a bed elevation fluctuation to support this result, the sediment trend does indicate the occurrence of an aggradational event at some point after Year 1 monitoring and a recoarsening of the bed material post-aggradation.

Reach UT pebble count overlays show that Reach UT has experienced a progressive coarsening of riffle bed materials every monitoring year since Monitoring Year 1 (see cross sections #6 and #7 pebble counts Appendix B6). The pool pebble counts have remained consistent with some possible slight fine sediment deposition (normal for a pool) since Monitoring Year 2 (see cross sections #8 count Appendix B6) or have coarsened notably (see cross section #5 count Appendix B6).

The Reach 2 pebble count overlays show that Reach 2 riffles have experienced a progressive coarsening of bed materials since Monitoring Year 1 (see cross sections #9 and #11 pebble counts Appendix B6). Reach 2 pool bed materials have at least remained consistent or have even coarsened slightly since Monitoring Year 2 (see cross section #10 and #12 pebble counts Appendix B6).

3.2.4 Stream Problem Areas

Aggradation in riffle sections remains fairly prominent in all three restoration reaches. In many cases, this aggradation may not be a problem as the stream appears to be narrowing to a stable dimension where the riffle sections were built too wide. However, in some cases, the aggradation is a result of grass or cattails growing in the channel substrate and retaining excess fine sediments. There is some bank erosion in all reaches, but more commonly in Reaches 2 and UT. There is no severe erosion to note in Reach 1. There are several severe cases of bank erosion in Reaches 2 and UT (see plan views) with the most common causes being either lack of vegetation, soil instability, or incorrect angle or placement location of protective structures associated with the location of the erosional area. In fact, the majority of the problems found with in-stream structures were based on placement angle or position. However, there were two structures where there was significant piping observed underneath stones or between the stream bank and stones lodged in the bank. These structures were a cross-vane located at Station 12+75 along Reach 1 and a j-hook located at Station 14+03 along Reach 1. The plan view sheets (Appendix C) show the location of the problem areas. Table X in Appendix B3 provides a list of problem areas for each reach along with the feature issue, station number, and suspected cause.

Table XI a. Categorical Stream Feature Visual Stability Assessment

Wells Creek

Segment/Reach: 1

Feature	Initial	MY-01	MY-02	MY-03	MY-04	MY-05
A. Riffles	Unknown	Unknown	95%	79%		
B. Pools			95%	92%		
C. Thalweg			92%	93%		
D. Meanders			74%	76%		
E. Bed General			96%	92%		
F. Bank Condition			95%	98%		
G. Vanes / J Hooks etc.			94%	99%		
H. Wads and Boulders			88%	97%		

Table XI b. Categorical Stream Feature Visual Stability Assessment

Wells Creek

Segment/Reach: 2

Feature	Initial	MY-01	MY-02	MY-03	MY-04	MY-05
A. Riffles	Unknown	Unknown	80%	84%		
B. Pools			85%	95%		
C. Thalweg			83%	93%		
D. Meanders			53%	77%		
E. Bed General			90%	92%		
F. Bank Condition			70%	79%		
G. Vanes / J Hooks etc.			86%	89%		
H. Wads and Boulders			71%	86%		

Table XI c. Categorical Stream Feature Visual Stability Assessment						
Wells Creek						
Segment/Reach: UT						
Feature	**Initial**	**MY-01**	**MY-02**	**MY-03**	**MY-04**	**MY-05**
A. Riffles	Unknown	Unknown	83%	96%		
B. Pools			88%	96%		
C. Thalweg			87%	93%		
D. Meanders			81%	76%		
E. Bed General			84%	85%		
F. Bank Condition			83%	94%		
G. Vanes / J Hooks etc.			85%	94%		
H. Wads and Boulders			69%	88%		

3.3 Photo Documentation

Photos taken of the vegetation problem areas and photos of the vegetation plots are in Appendix A. Stream problem area photographs are provided in Appendix B1. The photographs taken at the marked photo point locations and at the cross-sections are provided in Appendix B2.

4.0 RECOMMENDATIONS AND CONCLUSIONS

All reaches are considered to have remained geomorphically stable between Monitoring Years 2 and 3, with the exception of several areas of aggradation occurring in riffle sections of all three reaches. These areas do correspond to several riffle sections on the longitudinal profile overlay plots where it appears that bed elevations have risen slightly since Monitoring Year 2 (e.g. at Station 15+95 along Reach UT and at Station 17+24 along Reach 2). However, it has been concluded so far that the riffles are probably just adjusting to a more stable state, post-construction. There was a trend in all three reaches toward shorter riffles and reduced pool spacing. It has been concluded at this point probably to have been caused by differences in survey field calls between monitoring years and that this trend was probably not caused by actual geomorphic change. These parameters and trends will be reviewed again in Monitoring Year 4. All other plan, profile, and pattern factors appear stable between monitoring years. There were several areas of bank erosion in all three reaches. The only severe bank erosion areas to review closely again in Monitoring Year 4 were identified in Reaches 2 and UT. The most common causes of bank erosion were likely either lack of vegetation, soil instability, or incorrect angle or placement location of protective structures associated with the location of the erosional area. All three reaches had problems with structures being positioned wrong or placed at the wrong angle and therefore allowing excess stress and erosion on the bank. Only Reach 1 had structures where the structural integrity appeared to be compromised, a cross-vane located at Station 12+75 and a j-hook located at station 14+03. These two structures had water piping under or around stones, were the most severe problem structures, and should be assessed to determine the need for future maintenance.

The conclusion regarding vegetation at the end of Monitoring Year 3 is that bare root trees in the plots for Reach 1, and Plot 4 in Reach 2, are not meeting the stems/acre for 260 stems at Year 5. Overall, the survivability from Monitoring Year 2 and 3 was good despite the area being in a drought.

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Appendix A1

Photolog - Vegetation Problem Areas

APPENDIX A1
PHOTOLOG – WELLS CREEK (REACH 1)

PROBLEM AREAS (Vegetation)


Photo 1: Bank Erosion (Station 10+85 along plan view).


Photo 2: Bank erosion (Station 22+20 along plan view).

APPENDIX A1
PHOTOLOG – WELLS CREEK (REACH 2)

PROBLEM AREAS (Vegetation)

Photo 1: Bank Erosion (Station 10+20 along plan view).

Photo 3. Past Bank Erosion Stabilizing.

Photo 2: Bank erosion

APPENDIX A1
PHOTOLOG – WELLS CREEK (UT)

PROBLEM AREAS (Vegetation)

Photo 1: Bank Erosion April 11 DSCN 5750
(Station along plan view).

Appendix A2

Photolog - Vegetation Plots

APPENDIX A2
PHOTOLOG - WELLS CREEK

VEGETATION PLOTS


Photo 1: Vegetation Plot 1


Photo 2: Vegetation Plot 2


Photo 3: Vegetation Plot 3


Photo 4: Vegetation Plot 4


Photo 5: Vegetation Plot 5


Photo 6: Vegetation Plot 6


Photo 7: Vegetation Plot 7


Photo 8: Vegetation Plot 8


Photo 9: Vegetation Plot 9

Appendix A3

Vegetation Data Tables

Table VIA. Vegetative Problem Areas			
Feature/Issue	**Station # / Range**	**Probable Cause**	**Photo #**
Bare Bank	Reach 1 - 13+00 (LEFT)	Lack of vegetation; flow direction from upslope cross vane	
	Reach 1 - 13+18 (LEFT)	& back water effect of downstream j-hook	
	Reach 1 10+83 (LEFT)	Location of rootwads upstream creating backeddies downstream	SPA - #2
	Reach 1 - 10+95 (LEFT)	contributing directly bank erosion	
	Reach 1 - 11+15 (LEFT)		
	Reach 1 - 12+98 (LEFT)	Lack of vegetation; Also flow direction coming from upstream cross-vane and backwater affect of downstream J-Hook	
	Reach 1 - 13+17 (LEFT)		
	Reach 1 - 22+19 (RIGHT)	Direction of flow, unstable soils, lack of vegetation	
	Reach 1 - 22+35 (RIGHT)	Direction of flow, unstable soils, lack of vegetation	
	Reach 2 - 10+22 (LEFT)	Possibly due to rootwad/j-hook placement upstream, soil stability,	
	Reach 2 - 10+46 (LEFT)	lack of vegetation, and/or radius of curvature	
	Reach 2 - 10+76 (LEFT)	Soil instability and/or lack of protective vegetation.	
	Reach 2 - 10+72 (LEFT)	Soil instability and/or lack of protective vegetation.	
	Reach 2 - 10+81 (RIGHT)	Soil instability and/or lack of protective vegetation.	
	Reach 2 - 11+00 (RIGHT)	Soil instability and/or lack of protective vegetation.	
	Reach 2 - 11+80 (RIGHT)	Angle/placement of rootwad directly downstream. Also soil instability and/or lack of protective vegetation.	
	Reach 2 - 11+90 (RIGHT)		
	Reach 2 - 11+94 (LEFT)	Angle/placement of rootwad directly upstream. Also soil instability and/or lack of protective vegetation.	SPA - 3
	Reach 2 - 12+11 (LEFT)		
	Reach 2 - 12+56 (RIGHT)	Soil instability and/or lack of protective vegetation. Possible that adjacent j-hook was placed slightly too far downstream.	
	Reach 2 - 12+59 (RIGHT)		
	Reach 2 - 12+82 (RIGHT)	Placement angle/size is major cause of severe erosion directly downstream.	
	Reach 2 - 12+92 (RIGHT)		
	Reach 2 - 13+37 (LEFT)	Soil instability and/or lack of protective vegetation. Adjacent j-hook possibly placed too far downstream and/or angle is directing flow into bank.	
	Reach 2 - 13+42 (LEFT)		
	Reach 2 - 13+63 (LEFT)	Soil instability and/or lack of protective vegetation on outside of meander.	
	Reach 2 - 13+87 (LEFT)		
	Reach 2 - 14+67 (LEFT)	Soil instability and/or lack of protective vegetation.	
	Reach 2 - 14+75 (LEFT)		
	Reach 2 - 14+69 (RIGHT)	Soil instability and/or lack of protective vegetation.	
	Reach 2 - 14+93 (RIGHT)		
	Reach 2 - 15+03 (LEFT)	Placement/angle possible cause of downstream adjacent erosion;	SPA - 2
	Reach 2 - 15+12 (RIGHT)	also soil instability and/or lack of protective vegetation.	
	Reach 2 - 15+98 (RIGHT)		
	Reach 2 - 15+24 (LEFT)	Placement/angle of j-hook directly upstream. Also soil instability and/or lack of protective vegetation.	
	Reach 2 - 15+86 (LEFT)		
	Reach 2 - 16+21 (RIGHT)	Placement/angle of j-hook probable cause of downstream adjacent erosion. Flow being directed into bank.	
	Reach 2 - 16+25 (RIGHT)		
	Reach 2 - 16+94 (RIGHT)	Possibly caused by back eddy from adjacent crossvane.	
	Reach 2 - 17+05 (RIGHT)		
	Reach 2 - 17+00 (LEFT)	Soil instability and/or lack of protective vegetation. Crossvane directly upstream not adequtely dissipating flow energy during high flow events.	
	Reach 2 - 17+37 (LEFT)		
	Reach 2 - 17+50 (RIGHT)	Soil instability and/or lack of protective vegetation. Possible that adjacent j-hook was placed slightly too far downstream.	
	Reach 2 - 17+61 (RIGHT)		
	Reach 2 - 18+94 (LEFT)	Healing, but small amount of active erosion still left caused by angle/placement of the j-hook located just upstream.	
	Reach 2 - 18+96 (LEFT)		
	Reach 2 - 19+34 (RIGHT	Soil instability and/or lack of protective vegetation. Adjacent j-hook possibly placed too far downstream and/or angle is directing flow into bank.	
	Reach 2 - 19+53 (RIGHT)		
	UT - 10+10 (LEFT)	Possibly caused by improper placement of J-hook directly upstream	SPA - 1
	UT - 10+22 (LEFT)		
	UT - 11+40 (LEFT)	Possibly caused by angle of j-hook upstream.	
	UT - 11+55 (LEFT)		
	UT - 16+50 (LEFT)	Possibly due to the flow being directed toward the bank from J-hook upstream	
	UT - 16+54 (LEFT)		
	UT - 17+28 (LEFT)	Probably caused by J-hook placement too far downstream. At high flows water is to be redirected toward left bank, causing erosion.	
	UT 17+50 (LEFT)		
	UT - 17+80 (RIGHT)	Possibly caused by improper angle or location of upstream rock vane	
	UT - 17+92 (RIGHT)		
	UT - 19+45 (RIGHT)	Lack of vegetation/bank protection, channel narrowing adjacent to riffle.	
	UT - 19+56 (RIGHT)		

Table VIB. Vegetative Problem Areas			
Feature/Issue	**Station # / Range**	**Probable Cause**	**Photo #**
Bare Bank	UT - 19+66 (LEFT)	Lack of vegetation/bank protection	
	UT - 19+93 (LEFT)		
Bare Bench			
Bare Flood Plain	Reach 1 - 11+25 to 11+50 (LEFT)		
	Reach 1 - 11+90 to 12+00 (LEFT)		
Invasive/Exotic Populations	Reach 1 - 17+50 to 17+75 (LEFT)	Japanese stilt grass	
	Reach 1 - 18+25 to 18+50 (LEFT)	Japanese stilt grass	
	Reach 1 - 19+50 to 19+75 (LEFT)	Japanese stilt grass	
	Reach 1 - 20+25 to 21+00 (LEFT)	Japanese stilt grass	
	Reach 1 - 22+15 to 22+40 (RIGHT)	Japanese stilt grass	
	Reach 2 - 12+00 to 12+25 (LEFT)	Japanese stilt grass	
	Reach 2 - 15+25 to 15+50 (LEFT)	Japanese stilt grass	
	UT - 13+50 to 13+75 (RIGHT)	Japanese stilt grass	
	UT - 16+20 to 16+50 (RIGHT)	Japanese stilt grass	
	UT - 19+10 to 19+30 (RIGHT)	Japanese stilt grass	

Note: SPA refers to Stream Problem Area photolog.

Table VII. Stem counts for each species arranged by plot (Wells Creek)													
Species	**Plots**									**Year 1 Totals**	**Year 2 Totals**	**Year 3 Totals**	**Survival %**
	1	2	3	4	5	6	7	8	9				
Shrubs													
Cornus ammomum			2	1	(7 LS)	(2 LS)	(1 LS)		(1 LS)	11 (12 LS)	4 (13 LS)	3 (11 LS)	75.0%
Trees													
Betula nigra					3	2		2	2	10	9	9	100.0%
Carpinus caroliniana					3	3		2		11	10	8	80.0%
Diospyros virginiana										0	2	0	0.0%
Fraxinus pennsylvanica							1		2	2	6	3	50.0%
Juglans nigra		2	1	1	1	2	1		2	12	13	10	76.9%
Nyssa sylvatica										1	0	0	0.0%
Platanus occidentalis	1	1		1		3	1	5	4	22	16	16	100.0%
Salix nigra							17			13	17	17	100.0%
Sambucus canandensis										1	0	0	0.0%
Quercus michauxii			1			1	3		1	16	9	6	66.7%
Quercus rubra										2	2	0	0.0%
Quercus alba		1		1	2					5	4	4	100.0%
Quercus marilandica										1	1	0	0.0%
Total including live stake	1	4	4	4	16	13	24	9	12	119	102	87	73
Stems per acre	48	190	190	182	800	592	1142	450	571				
Total exluding live stake	1	4	4	4	9	11	23	9	11	107	89	76	71
Stems per acre	48	190	190	182	450	501	1095	450	524				

Note: Survival was calculated between Monitoring Year 1 and Monitoring Year 3 totals.

Appendix B1

Photolog – Stream Problem Areas

APPENDIX B1
PHOTOLOG – WELLS CREEK (REACH 1)

PROBLEM AREAS (Stream)


Photo 1: Representative grass aggradation problem area (19+06.73 along plan view).


Photo 2: Representative cattail aggradation problem area (18+63.51 along plan view).


Photo 3: Representative problem root wad and bank erosion (10+82.28 along plan view). Root wads located in bank along left side of picture.


Photo 4: Representative problem cross vane (12+75.47 along plan view).

APPENDIX B1
PHOTOLOG – WELLS CREEK (REACH 2)

PROBLEM AREAS (Stream)


Photo 1: Representative grass aggradation/lateral bar problem area (Station 18+15 along plan view).


Photo 2: Representative problem j-hook and bank erosion (Station 15+03 along plan view).


Photo 3: Representative problem root wad and bank erosion (Station 11+94along plan view).

APPENDIX B1
PHOTOLOG REACH 1 – WELLS CREEK (UT)

PROBLEM AREAS (Stream)

Photo 1: Representative grass aggradation problem area (12+55.96 along plan view).

Photo2: Representative problem j-hook and bank erosion (10+10.93 along plan view).

Appendix B2

Photolog – Cross-Sections & Photo Points

APPENDIX B2
PHOTOLOG – WELLS CREEK (REACH 1)

CROSS-SECTIONS & PHOTOPOINTS


Cross-Section 1: Looking Downstream


Cross-Section 1: Looking Upstream


Cross-Section 2: Looking Downstream


Cross-Section 2: Looking Upstream


Cross-Section 3: Looking Downstream


Cross-Section 3: Looking Upstream


Cross-Section 4: Looking Downstream


Cross-Section 4: Looking Upstream


Photo point 1: Looking Upstream


Photo point 2: Looking Upstream


Photo point 1: Looking Downstream


Photo point 2: Looking Downstream


Photo point 1: Looking at Channel


Photo point 2: Looking at Channel


Photo point 3: Looking Upstream


Photo point 4: Looking Upstream


Photo point 3: Looking Downstream


Photo point 4: Looking Downstream


Photo point 3: Looking at Channel


Photo point 4: Looking at Channel

APPENDIX B2
PHOTOLOG WELLS CREEK (REACH 2)

CROSS-SECTIONS & PHOTOPOINTS


Cross-Section 9: Looking Downstream


Cross-Section 9: Looking Upstream


Cross-Section 10: Looking Downstream


Cross-Section 10: Looking Upstream


Cross-Section 11: Looking Downstream


Cross-Section 11: Looking Upstream


Cross-Section 12: looking Downstream


Photo point 5: Looking Upstream


Cross-Section 12: looking upstream


Photo point 5: Looking at Channel


Photo point 5: Looking Downstream


Photo point 6: Looking Downstream


Photo point 6: Looking Upstream


Photo point 7: Looking Upstream


Photo point 6: Looking at Channel


Photo point 7: Looking at Channel


Photo point 7: Looking Downstream


Photo point 8: Looking Downstream

Photo point 8: Looking Upstream

Photo point 9: Looking Upstream

Photo point 8: Looking at Channel

Photo point 9: Looking at Channel

Photo point 9: Looking Downstream

APPENDIX B2
PHOTOLOG WELLS CREEK (UT)


Cross-Section 5: Looking Downstream


Cross-Section 5: Looking Upstream


Cross-Section 6: Looking Downstream


Cross-Section 6: Looking Upstream


Cross-Section 7: Looking Downstream


Cross-Section 7: Looking Upstream


Cross-Section 8: Looking Downstream


Cross-Section 8: Looking Upstream


Photo point 10: Looking Downstream


Photo point 11: Looking Downstream


Photo point 10: Looking Upstream


Photo point 11: Looking Upstream


Photo point 10: Looking at Channel


Photo point 12: Looking Downstream


Photo point 12: Looking Upstream

Appendix B3

Stream Data Tables

Table X. Stream Problem Areas

Wells Creek Reach 1

Feature Issue	Station numbers	Suspected Cause	Photo number
Aggradation (grass)	10+18.30 10+47.44	Channel built too wide for riffle; narrowing to a stable dimension	
Rootwad	10+82.16	Location of rootwads upstream creating backeddys around downstream rootwads and contributing to bank erosion problem directly downstream	Photo 3
Rootwad	10+87.90		
Rootwad	10+92.28		
Cross-Vane	12+75.47	Piping around right side of structure.	Photo 4
Aggradation (grass)	15+57.26 16+12.68	Channel built too wide; narrowing to a stable dimension	
Aggradation (grass)	17+51.49 17+70.64	Downstream J-hook elevation higher which created deposition upstream; eventually built up so grasses growing in channel	
Aggradation (grass)	17+91.04 18+03.11	Channel built too wide; narrowing to a stable dimension	
Bar Formation	18+03.11 18+25.08	Downstream rootwads and cross-vane causing deposition upstream and creation of a central bar with grasses.	
Aggradation (cattails)	18+63.51 18+68.58	Channel too wide; narrowing to a stable dimension	Photo 2
Aggradation (grass)	19+06.73 19+20.77	Channel built too wide; narrowing to a stable dimension	Photo 1
Aggradation (grass)	19+69.79 19+82.28	Channel built too wide; narrowing to a stable dimension	
Aggradation (grass)	19+96.65 20+05.09	Channel built too wide; narrowing to a stable dimension	
Aggradation (grass)	21+55.88 21+65.65	Channel built too wide; narrowing to a stable dimension	
Central Bar	21+65.65 21+76.54	Deposition from upstream sediment sources.	

Table X. Stream Problem Areas			
Wells Creek Reach 2			
Feature Issue	**Station numbers**	**Suspected Cause**	**Photo number**
Rootwad	11+91.52	Angle/placement possibly cause of bank erosion directly up- and downstream.	Photo 3
Aggradation (grass lateral bar)	12+16.28 12+53.87	Channel built too wide. Stream naturally narrowing at a stable dimension.	
Rootwad	12+79.46	Placement angle/size is major cause of severe erosion directly downstream.	
Aggradation (grass)	13+12.45 13.41.21	Channel built too wide. Stream naturally narrowing at a stable dimension.	
J-hook	13+41.87	See above comment.	
J-hook	14+03.21	Significant piping around right side of structure, minor piping around left side.	
J-hook	15+07.75	Placement/angle possible cause of downstream adjacent erosion.	Photo 2
J-hook (severe)	15+98.98	Placement/angle probable cause of downstream adjacent erosion. Flow being directed into bank.	
Aggradation (grass)	16+30.11 16+62.22	Channel built too wide. Stream naturally narrowing at a stable dimension. Appears to be remnants of previous erosion now healed over leaving a side-bar in the channel.	
Aggradation (grass)	17+07.91 17+37.24	Channel built too wide. Stream naturally narrowing at a stable dimension.	
Aggradation (grass)	18+13.61 18+52.92	Channel built too wide. Stream naturally narrowing at a stable dimension.	Photo 1
J-hook	18+69.61	Placement/angle possible cause of downstream erosion.	
J-hook	19+48.02	See above comment.	
Aggradation (grass)	20+40.41 20+52.64	Gravel sand deposit at tail of pool, possibly made too deep.	

Table X. Stream Problem Areas			
Wells Creek Reach UT			
Feature Issue	**Station numbers**	**Suspected Cause**	**Photo number**
J-hook	10+00.00	Improper angle and placement of J-hook may be cause of adjacent bank erosion	Photo 2
Aggradation (grass)	10+37.57 10+40.00	Channel narrowing to stable state	
Aggradation (grass)	10+93.71 11+10.53	Channel narrowing to stable state	
Aggradation (cattail)	11+55.36 11+77.17	Channel narrowing to stable state	
Aggradation (grass)	11+77.17 12+12.44	Channel narrowing to stable state	
Aggradation (grass)	12+58.40 12+70.34	Channel narrowing to stable state	Photo 1
Aggradation (grass)/Lateral Bar Formation	13+35.05 13+83.44	Channel narrowing to stable state as evidenced by lateral bar formation.	
Aggradation (grass)	14+21.44 14+46.88	Channel narrowing to stable state	
Aggradation (grass)	14+86.35 15+25.19	Channel narrowing to stable state	
Aggradation (grass)	15+87.53 16+30.15	Channel narrowing to stable state	
J-hook	16+35.89	Angle and/or placement of J-hook causing bank erosion downstream	
Aggradation (grass)	16+61.37 16+84.71	Channel narrowing to stable state	
Rock Vane	17+76.47	Angle and/or placement of rock vane may be causing bank erosion directly downstream	
Rootwad (severe)	18+07.10	Bank failure/undermining around structure and placement too high	
Rootwad	18+11.88	Placed too high.	
Rootwad	18+18.21	Placed too high.	
Bank Erosion (right bank)	18+41.74 18+60.92	Lack of protective vegetation and/or soil instability.	
Aggradation (grass)	18+85.20 19+06.50	Channel narrowing to stable state	
Rootwad	19+27.97	Some minimal bank failure/undermining around structure.	
Aggradation (grass)	19+43.93 19+58.06	Channel narrowing to stable state	

Table B2. Visual Morphological Stability Assessment						
Wells Creek						
Segment/Reach: 1 (1241 feet)						
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	13	16	NA	81%	
	2. Armor stable	13	16	NA	81%	
	3. Facet grade appears stable	12	16	NA	75%	
	4. Minimal evidence of embedding/fining	13	16	NA	81%	
	5. Length appropriate	12	16	NA	75%	**79%**
B. Pools	1. Present	19	20	NA	95%	
	2. Sufficiently deep	19	20	NA	95%	
	3. Length appropriate	17	20	NA	85%	**92%**
C. Thalweg	1. Upstream of meander bend (run/inflection) centering	6	6	NA	100%	
	2. Downstream of meander (glide/inflection) centering	6	7	NA	86%	**93%**
D. Meanders	1. Outer bend in state of limited/controlled erosion	8	13	NA	62%	
	2. Of those eroding, # w/concomitant point bar formation	3	5	NA	60%	
	3. Apparent Rc within specifications	9	11	NA	82%	
	4. Sufficient floodplain access and relief	13	13	NA	100%	**76%**
E. Bed General	1. General channel bed aggradation areas (bar formation)	NA	NA	10/187.6	85%	
	2. Channel bed degradation - areas of increasing down cutting or head cutting	NA	NA	0/0	100%	**92%**
F. Bank Condition	1. Actively eroding, wasting, or slumping bank	NA	NA	3/56.3	98%	**98%**
G. Vanes / J Hooks etc.	1. Free of back or arm scour	18	18	NA	100%	
	2. Height appropriate	18	18	NA	100%	
	3. Angle and geometry appear appropriate	18	18	NA	100%	
	4. Free of piping or other structural failures	17	18	NA	94%	**99%**
H. Wads and Boulders	1. Free of scour	15	16	NA	94%	
	2. Footing stable	16	16	NA	100%	**97%**

Table B2. Visual Morphological Stability Assessment						
Wells Creek						
Segment/Reach: 2 (1153 feet)						
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	9	10	NA	90%	
	2. Armor stable	9	10	NA	90%	
	3. Facet grade appears stable	7	10	NA	70%	
	4. Minimal evidence of embedding/fining	9	10	NA	90%	
	5. Length appropriate	8	10	NA	80%	**84%**
B. Pools	1. Present	13	13	NA	100%	
	2. Sufficiently deep	13	13	NA	100%	
	3. Length appropriate	11	13	NA	85%	**95%**
C. Thalweg	1. Upstream of meander bend (run/inflection) centering	6	6	NA	100%	
	2. Downstream of meander (glide/inflection) centering	6	7	NA	86%	**93%**
D. Meanders	1. Outer bend in state of limited/controlled erosion	6	12	NA	50%	
	2. Of those eroding, # w/concomitant point bar formation	4	6	NA	67%	
	3. Apparent Rc within specifications	12	12	NA	100%	
	4. Sufficient floodplain access and relief	12	13	NA	92%	**77%**
E. Bed General	1. General channel bed aggradation areas (bar formation)	NA	NA	6/179.3	84%	
	2. Channel bed degradation - areas of increasing down cutting or head cutting	NA	NA	0/0	100%	**92%**
F. Bank Condition	1. Actively eroding, wasting, or slumping bank	NA	NA	19/477.64	79%	**79%**
G. Vanes / J Hooks etc.	1. Free of back or arm scour	14	14	NA	100%	
	2. Height appropriate	14	14	NA	100%	
	3. Angle and geometry appear appropriate	9	14	NA	64%	
	4. Free of piping or other structural failures	13	14	NA	93%	**89%**
H. Wads and Boulders	1. Free of scour	5	7	NA	71%	
	2. Footing stable	7	7	NA	100%	**86%**

Table B2. Visual Morphological Stability Assessment						
Wells Creek						
Segment/Reach: UT (1013 feet)						
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	15	15	NA	100%	
	2. Armor stable	15	15	NA	100%	
	3. Facet grade appears stable	13	15	NA	87%	
	4. Minimal evidence of embedding/fining	15	15	NA	100%	
	5. Length appropriate	14	15	NA	93%	**96%**
B. Pools	1. Present	17	17	NA	100%	
	2. Sufficiently deep	15	17	NA	88%	
	3. Length appropriate	17	17	NA	100%	**96%**
C. Thalweg	1. Upstream of meander bend (run/inflection) centering	6	6	NA	100%	
	2. Downstream of meander (glide/inflection) centering	6	7	NA	86%	**93%**
D. Meanders	1. Outer bend in state of limited/controlled erosion	8	13	NA	62%	
	2. Of those eroding, # w/concomitant point bar formation	3	5	NA	60%	
	3. Apparent Rc within specifications	9	11	NA	82%	
	4. Sufficient floodplain access and relief	13	13	NA	100%	**76%**
E. Bed General	1. General channel bed aggradation areas (bar formation)	NA	NA	12/302.3	70%	
	2. Channel bed degradation - areas of increasing down cutting or head cutting	NA	NA	0/0	100%	**85%**
F. Bank Condition	1. Actively eroding, wasting, or slumping bank	NA	NA	8/122.26	94%	**94%**
G. Vanes / J Hooks etc.	1. Free of back or arm scour	13	13	NA	100%	
	2. Height appropriate	13	13	NA	100%	
	3. Angle and geometry appear appropriate	10	13	NA	77%	
	4. Free of piping or other structural failures	13	13	NA	100%	**94%**
H. Wads and Boulders	1. Free of scour	14	16	NA	88%	
	2. Footing stable	14	16	NA	88%	**88%**

Table XII Baseline Morphology and Hydraulic Summary
Wells Creek/EEP Number 414

Parameter	USGS Gage Data			Regional Curve Interval			Pre-Existing Condition			Project Reference Stream			Design (SR#1)			As-built (SR#1)			Design (SR#2)			As-built (SR#2)			Design (UT)			As-built (UT)		
	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med
Dimension																														
BF Width (ft)	28	30	29			14.77	15.4	28.9	22.75	6.5	10	8			25	20.1	27.4	23.7			20	19.3	31.6	25.4			15	13.5	16	14.9
Floodporne Width (ft)	40	100	70				24.5	50	40.7	16	22	18.8			>55	48	66	57			>50			100			>33	50	77	63.5
BFCross Sectional Area (ft)	58.6	58.9	58			29.9	22.2	34.8	31	3.9	6.3	5.3			33	25.2	42.8	34	32.2	36	34.1	44.2	47.1	45.6			17	13.5	16	14.7
BF Mean Depth (ft)	2	2.1	2			1.75	0.8	1.9	1.4	0.4	1	0.7			1.3	1.3	1.6	1.4			1.8	1.5	2.3	1.9			1.1			1
Max Depth (ft)	2.7	3	2.9				1.3	3.1	2.1	0.9	1.4	1.1	1.7	2.6	2.1	1.6	3.1	2.3	2.3	3.6	2.9	2.5	3.5	3	1.4	2.2	1.8	1.4	2.1	1.6
Width/Depth Ratio	13	15	14				8	38	18.3	7	26	13.5			19	16.1	17.6	16.8			11	8.4	21.2	14.8			12.5	14.8	15.3	15
Entrenchment Ratio	1.3	3.6	2.4				1	3.2	1.9	2	3.4	2.4			>2.2			2.4			>2.2	3.2	5.2	4.2			>2.2	3.5	4.9	4.2
Wetted Perimeter (ft)	33.6	33.7	33.65				16.8	29.2	24.1	7.2	11.7	9			27.6	21.5	28.2	24.9			23.6	21	33.1	27			17.2	14.7	16.2	15.5
Hydraulic radious (ft)	1.7	1.7	1.7				1	1.8	1.4	0.3	0.9	0.7			1.2	1.2	1.5	1.35			1.4	1.4	2.1	1.8			1	0.9	1	0.95
Pattern																														
Channel Beltwidth (ft)							6	271	69.4	10	35	20.9	33	110	65	29.5	105.6	55.9	26	88	52	32.5	81.8	57.2	19.5	66	39	17.8	71.7	45.4
Radius of Curvature (ft)							2.5	641	81.9	2.3	31.8	13.5	8	100	40	10	80	44.6	6	80	32	40	130	69.2	4.5	60	24	20	150	70.7
Meander Wavelenght (ft)							56	360	182.2	35	70	50	110	220	157	49.3	232.4	137.5	88	176	126	113.1	151.3	129.5	66	132	94.5	55	184.3	116.5
Meander Width Ratio							3.2	9.1	5.3	1.3	4.4	2.6	1.3	4.4	2.6	1.2	4.4	2.3	1.3	4.4	2.6	1.3	3.2	2.2	1.3	4.4	2.6	1.2	4.8	3
Profile																														
Riffle length (ft)							3.4	108.5	40.2	2	25	13.9	6.3	77.5	42.5	20.1	110.8	41.1	5	62	34	14.3	128.3	38.2	3.8	46.5	25.5	5.6	89.5	26.7
Riffle slope (ft/ft)							0.0006	0.041	0.0208	0.0173	0.078	0.039	0.0042	0.019	0.011	0.002	0.019	0.007	0.006	0.0276	0.017	0.002	0.0228	0.0107	0.0058	0.0256	0.0154	0.0027	0.0483	0.02
Pool length (ft)							3.5	218.6	43.8	7	27	14.5	22.5	85	45	7.4	93.9	27.2	18	68	36	4.6	84.8	43.6	13.5	51	27	8	61.1	36.8
Pool spacing (ft)							10.2	258.1	90.4	17	63	36.5	30	197.5	115	31	176.5	66.2	42	158	92	22.4	170.6	79.9	31.5	118.5	69	29.8	139.6	59.9
Substrate																														
d50 (mm)									0.9			4.5						0.1						0.5						0.6
d84 (mm)									68			53						9						17						13
Additional Reach Parameters																														
Valley Length (ft)							2850			337			945			960			1010			1010			1415			859		
Channel Length (ft)							3714			447			1127			1193			1244			1127			1696			1083		
Sinuosity							1.3			1.3			1.2			1.2			1.3			1.1			1.2			1.3		
Water Surface Slope (ft/ft)	0.0016						0.0084			0.0197			0.0047			0.0049			0.0069			0.0062			0.0064			0.0053		
BF slope (ft/ft)							0.79			0.0199			0.0047			0.0049			0.0069			0.0062			0.0064			0.0053		
Rosgen Classification	B/C						E5, B5, F5, and G5			C4/1			C4/1			C5/1			C4/1			C/E4/1			C4/1			C5/1		
*Habitat Index							N/A																							
*Macrobenthos							N/A																							

Table XIII. Morphology and Hydraulic Monitoring Summary
Wells Creek
Segment/Reach: 1

Parameter	Cross Section 1 Pool						Cross Section 2 Riffle					
Dimension	MY1	MY2	MY3	MY4	MY5	MY+	MY1	MY2	MY3	MY4	MY5	MY+
BF Width (ft)	36.9	26.4	26.4				19.6	20.4	20.1			
Floodprone Width (ft)	100+	NA	NA				100+	85+	84+			
BFCross Sectional Area (ft)	66.9	46.9	42.0				32.9	38.7	38.3			
BF Mean Depth (ft)	1.8	1.8	1.6				1.7	1.9	1.9			
Width/Depth Ratio	20.5	NA	NA				11.5	10.7	10.6			
Entrenchment Ratio	2.7	NA	NA				5.1+	3.3+	4.2+			
Bank Height Ratio	NA	NA	NA				1	1	1			
Wetted Perimeter (ft)	39.2	44.7	29.0				21.7	23.4	22.9			
Hydraulic radius (ft)	1.7	1.6	1.4				1.5	1.7	1.7			
Substrate												
d50 (mm)	NA	0.25	<0.062				8.3	0.25	<0.062			
d84 (mm)	NA	11.3	<0.062				41	18	0.1			

Parameter	Cross Section 3 Riffle						Cross Section 4 Pool					
Dimension	MY1	MY2	MY3	MY4	MY5	MY+	MY1	MY2	MY3	MY4	MY5	MY+
BF Width (ft)	33	28.8	27.6				30.4	26.1	24.6			
Floodprone Width (ft)	70+	43	49.5				100+	NA	NA			
BFCross Sectional Area (ft)	41.7	40.7	33.7				36.3	40.3	38.7			
BF Mean Depth (ft)	1.3	1.4	1.2				1.2	1.5	1.6			
Width/Depth Ratio	25.4	20.5	22.6				25.3	NA	NA			
Entrenchment Ratio	>2.1	1.5	1.8				3.3	NA	NA			
Bank Height Ratio	1	1	1				NA	NA	NA			
Wetted Perimeter (ft)	33.5	49.7	28.3				31.6	30.9	27.3			
Hydraulic radius (ft)	1.2	2	1.2				1.1	1.3	1.4			
Substrate												
d50 (mm)	8	0.125	4.9				NA	0.25	1.1			
d84 (mm)	19	11.3	15.5				NA	11.3	70			

Parameter	MY-01 (2005)			MY-02 (2006)			MY-03 (2007)			MY-04 (2008)			MY-05 (2009)			MY+ (2010)		
Pattern	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med
Channel Beltwidth (ft)	29	101.7	63.4	37.45	107.3	67.26	37.81	106.4	64.7									
Radius of Curvature (ft)	20	100	52.7	15	120	40	15	120	46.63									
Meander Wavelenght (ft)	123	465.1	246	136.45	324.8	198.45	119.0	357.2	195.1									
Meander Width Ratio	0.8	2.8	1.7	1.30	3.72	2.34	1.59	4.46	2.71									
Profile																		
Riffle length (ft)	6.8	46.7	24.6	1.5	38.8	8.1*	8.2	37.4	18.1									
Riffle slope (ft/ft)	0.000	0.032	0.012	0.000	0.473	0.015*	0.000	0.038	0.010									
Pool length (ft)	5.9	128.9	36.5	6.2	108.0	23.5*	12.2	134.0	33.9									
Pool spacing (ft)	20.5	169.5	66.2	25.1	239.4	46.5*	22.6	220.2	49.5									
Additional Reach Parameters																		
Valley Length (ft)	952			995			995											
Channel Length (ft)	1213			1244			1241											
Sinuosity	1.3			1.2			1.2											
Water Surface Slope (ft/ft)	0.005			0.0052			0.0051											
BF slope (ft/ft)	0.0055			0.0042			0.0045											
Rosgen Classification	C4/1			C4			C4											
*Habitat Index	NA			NA			NA											
*Macrobenthos	NA			NA			NA											

"*" -- Values reported in Monitoring Year 2 were averages instead of medians. These values have been changed to median values in the Monitoring Year 3 report

Table XIII. Morphology and Hydraulic Monitoring Summary
Wells Creek
Segment/Reach: 2

Parameter	Cross Section 9 Riffle						Cross Section 10 Pool						Cross Section 11 Riffle						Cross Section 12 Pool					
Dimension	MY1	MY2	MY3	MY4	MY5	MY+	MY1	MY2	MY3	MY4	MY5	MY+	MY1	MY2	MY3	MY4	MY5	MY+	MY1	MY2	MY3	MY4	MY5	MY+
BF Width (ft)	23.1	19.5	20.6				27	20.8	20.8				20.9	18.8	19.6				22.1	22.1	21.4			
Floodprone Width (ft)	100+	45+	42+				100+	NA	NA				100+	38	45+				100+	NA	NA			
BFCross Sectional Area (ft)	44	41.6	42.6				54.8	51.4	48.4				40.9	47	44.0				35.5	52	46			
BF Mean Depth (ft)	1.9	2.1	2.1				2	2.4	2.3				2	2.5	2.2				1.6	2.3	2.2			
Width/Depth Ratio	12.1	10.8	10.0				13.5	NA	NA				10.5	7.5	8.7				13.8	NA	NA			
Entrenchment Ratio	4.3	2.3+	2.0+				3.7+	NA	NA				4.8+	2.0	2.3+				4.5+	NA	NA			
Bank Height Ratio	1	1	1				NA	NA	NA				1	1	1				NA	NA	NA			
Wetted Perimeter (ft)	24.9	22.4	22.4				28.6	23.7	23.2				22.5	22.9	22.6				23.4	31.9	26.3			
Hydraulic radius (ft)	1.8	1.9	1.9				1.9	2.2	2.1				1.8	2.1	1.9				1.5	1.7	1.7			
Substrate																								
d50 (mm)	12.5	8	39				NA	0.45	0.63				13.5	0.45	8.5				NA	0.25	0.59			
d84 (mm)	43	44	81				NA	32	1.7				23	32	58				NA	1	0.9			

Parameter	MY-01 (2005)			MY-02 (2006)			MY-03 (2007)			MY-04 (2008)			MY-05 (2009)			MY+ (2010)		
Pattern	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med
Channel Beltwidth (ft)	13.1	85.4	55	38.52	85.07	54.16	35.72	89.2	52.59									
Radius of Curvature (ft)	15	120	39.4	22	70	31.5	22	61	32.6									
Meander Wavelenght (ft)	105	180	134.8	115.79	149.8	127	94.3	156.5	126.0									
Meander Width Ratio	0.6	3.9	2.5	2.02	4.45	2.84	1.65	4.13	2.43									
Profile																		
Riffle length (ft)	3.8	53.9	26	13.0	53.0	26.0*	12.0	42.8	22									
Riffle slope (ft/ft)	0.0018	0.039	0.014	0.000	0.041	0.011*	0.0015	0.051	0.018									
Pool length (ft)	17	128.4	42.9	5.8	208.8	39.7*	7.2	78.4	34.0									
Pool spacing (ft)	46.4	184.3	87	23.6	117.8	76.8*	22.2	102.2	69.0									
Additional Reach Parameters																		
Valley Length (ft)	906			902.9			908.3											
Channel Length (ft)	1127			1140			1153											
Sinuosity	1.24			1.26			1.27											
Water Surface Slope (ft/ft)	0.0053			0.005			0.0055											
BF slope (ft/ft)	0.0058			0.005			0.0058											
Rosgen Classification	C4/1			E4			C4											
*Habitat Index	NA			NA			NA											
*Macrobenthos	NA			NA			NA											

"*" -- Values reported in Monitoring Year 2 were averages instead of medians. These values have been changed to median values in the Monitoring Year 3 repor

Table XIII. Morphology and Hydraulic Monitoring Summary
Wells Creek
Segment/Reach: UT

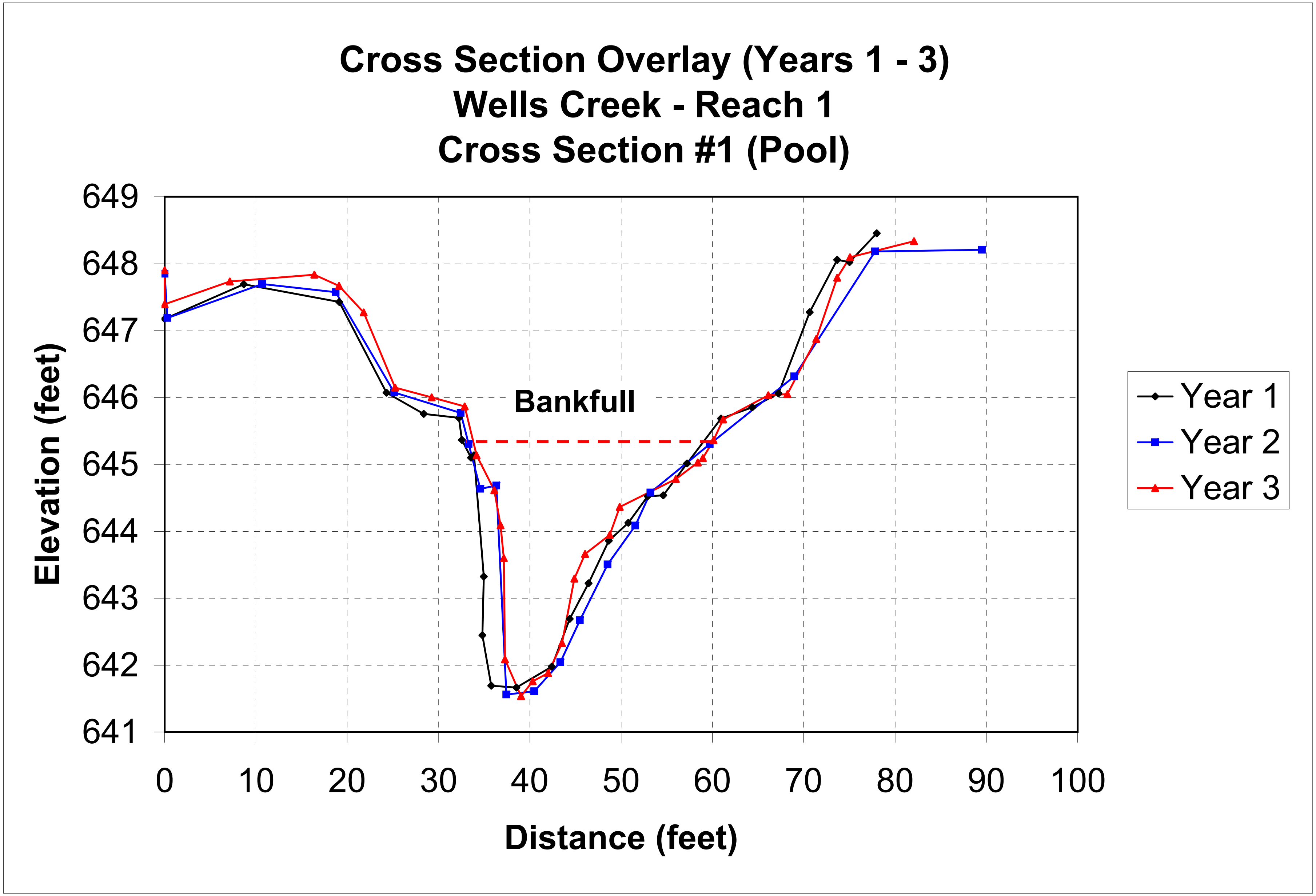
Parameter	Cross Section 5- Pool						Cross Section 6 -Riffle						Cross Section 7 - Riffle						Cross Section 8 - Pool					
Dimension	MY1	MY2	MY3	MY4	MY5	MY+	MY1	MY2	MY3	MY4	MY5	MY+	MY1	MY2	MY3	MY4	MY5	MY+	MY1	MY2	MY3	MY4	MY5	MY+
BF Width (ft)	17	14.4	14.7				18.2	20.4	14.7				17.8	9.2	14.6				15.8	18.9	17.4			
Floodprone Width (ft)	67	NA	NA				72	67	73				50	67	59				50	NA	NA			
BFCross Sectional Area (ft)	18.3	21.9	22.8				12.8	14.4	15.8				13.1	13.6	16.8				22.3	23	26.2			
BF Mean Depth (ft)	1.1	1.5	1.6				0.7	0.7	0.9				0.7	1.5	1.2				1.4	1.2	1.5			
Width/Depth Ratio	15.5	NA	NA				26	26.9	17.1				25.4	6.2	12.7				11.3	NA	NA			
Entrenchment Ratio	3.9	NA	NA				4	3.4	4.6				2.8	7.2	4				3.2	NA	NA			
Bank Height Ratio	NA	NA	NA				1	1	1				1	1	1				NA	NA	NA			
Wetted Perimeter (ft)	18.1	19.9	17.4				18.5	21.6	16.6				18.2	39.6	15.4				17.2	26.2	20			
Hydraulic radius (ft)	1	1.1	1.3				1	0.7	0.9				0.7	0.8	1.1				1.3	1.1	1.3			
Substrate																								
d50 (mm)	NA	0.5	7.2				0.2	1	10				0.1	0.5	2				NA	0.5	1.7			
d84 (mm)	NA	23	42				22	32	25				35	18	30				NA	18	18			

Parameter	MY-01 (2005)			MY-02 (2006)			MY-03 (2007)			MY-04 (2008)			MY-05 (2009)			MY+ (2010)		
Pattern	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med
Channel Beltwidth (ft)	9.4	67.7	42.4	27.33	72.73	56.87	30.93	72.93	58.77									
Radius of Curvature (ft)	8	110	40.1	18.63	79.72	28.26	18.11	87.52	26.88									
Meander Wavelenght (ft)	71	176	116.7	91.3	191.72	136.74	88.71	189.8	144									
Meander Width Ratio	0.5	3.8	2.4	1.39	3.71	2.90	1.82	4.29	3.46									
Profile																		
Riffle length (ft)	8.2	49.8	21.8	3.3	69.3	19.1*	6.2	42.7	15.2									
Riffle slope (ft/ft)	0.000	0.045	0.016	0.000	0.038	0.012*	0.000	0.050	0.013									
Pool length (ft)	7.6	57.2	27	4.8	39.2	25.2*	7.7	54.7	31.2									
Pool spacing (ft)	22	125.4	64	35.3	100.6	60.7*	16.8	89.3	52.3									
Additional Reach Parameters																		
Valley Length (ft)	841.4			853.46			852.39											
Channel Length (ft)	1014.2			1012.3			1013.5											
Sinuosity	1.2			1.2			1.2											
Water Surface Slope (ft/ft)	0.006			0.006			0.006											
BF slope (ft/ft)	0.006			0.006			0.006											
Rosgen Classification	C4/1			C4			C4											
*Habitat Index	NA			NA			NA											
*Macrobenthos	NA			NA			NA											

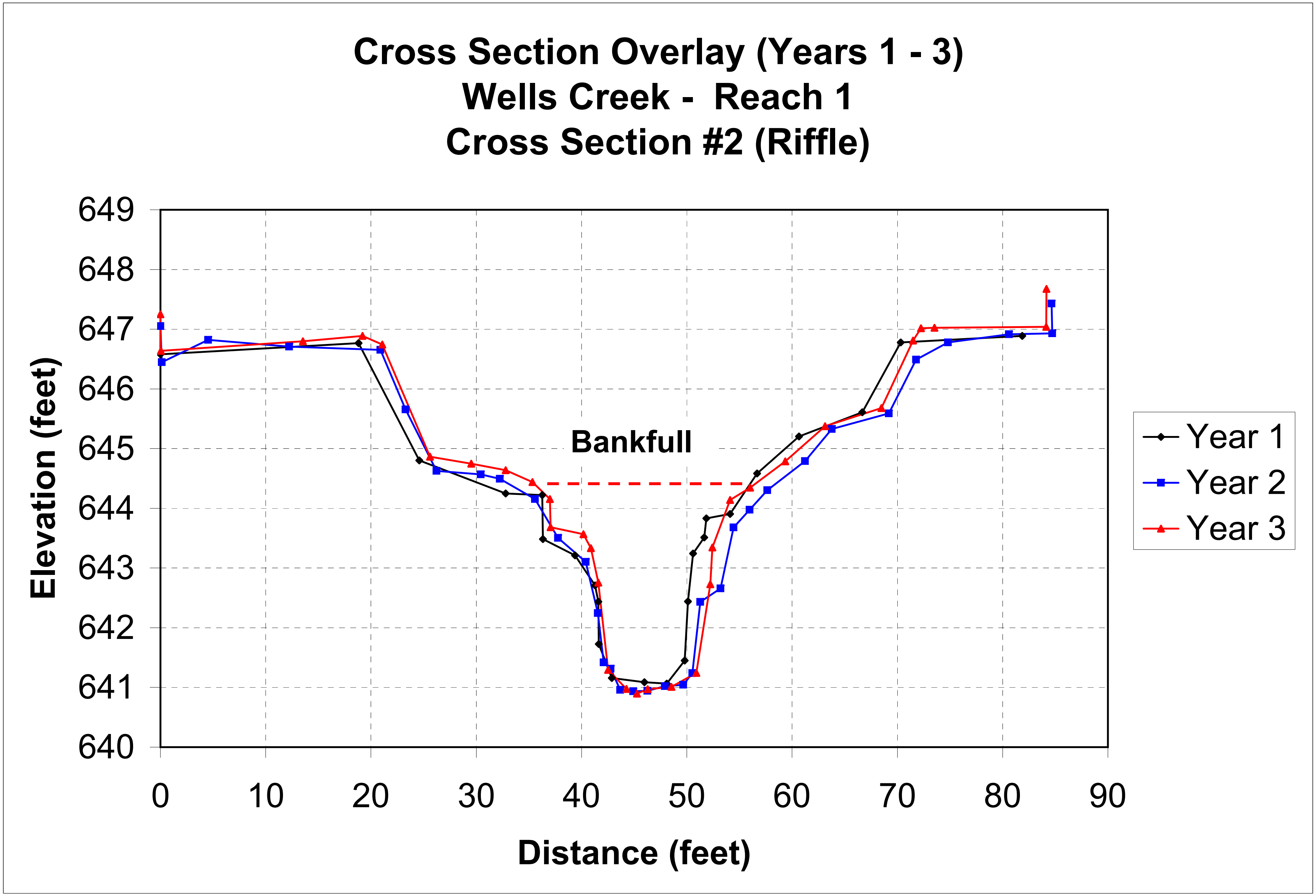
"*" -- Values reported in Monitoring Year 2 were averages instead of medians. These values have been changed to median values in the Monitoring Year 3 report.

Appendix B4

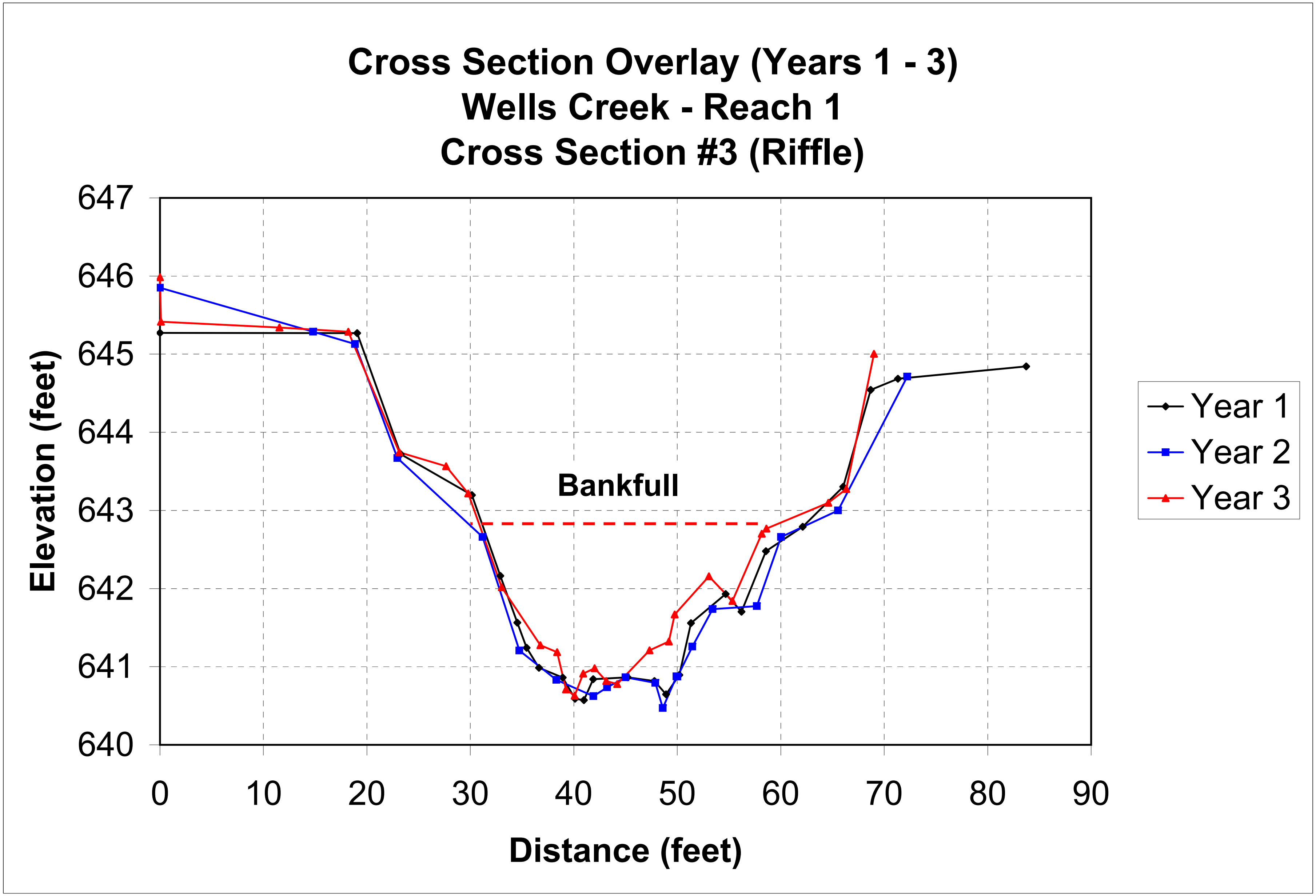
Stream Cross-Sections

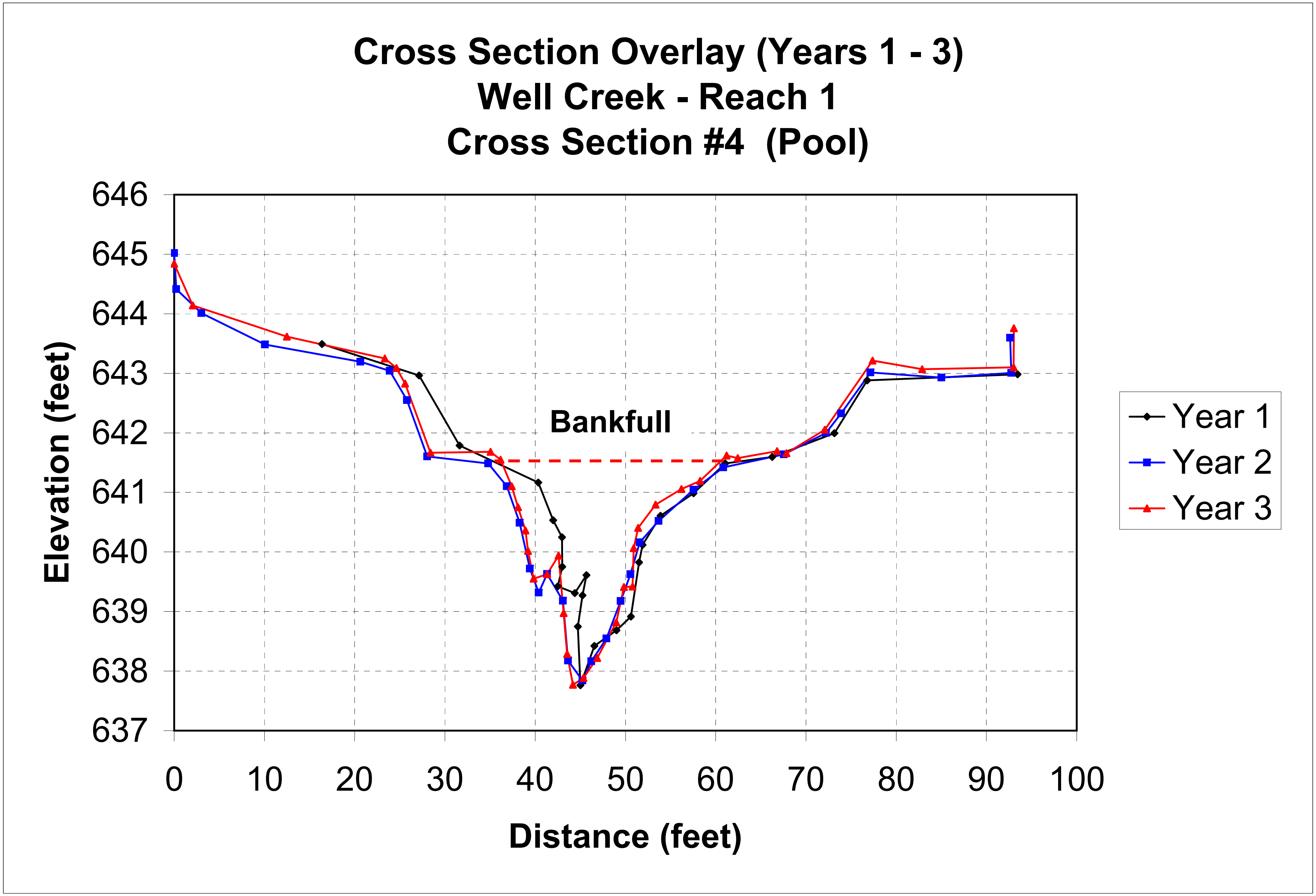


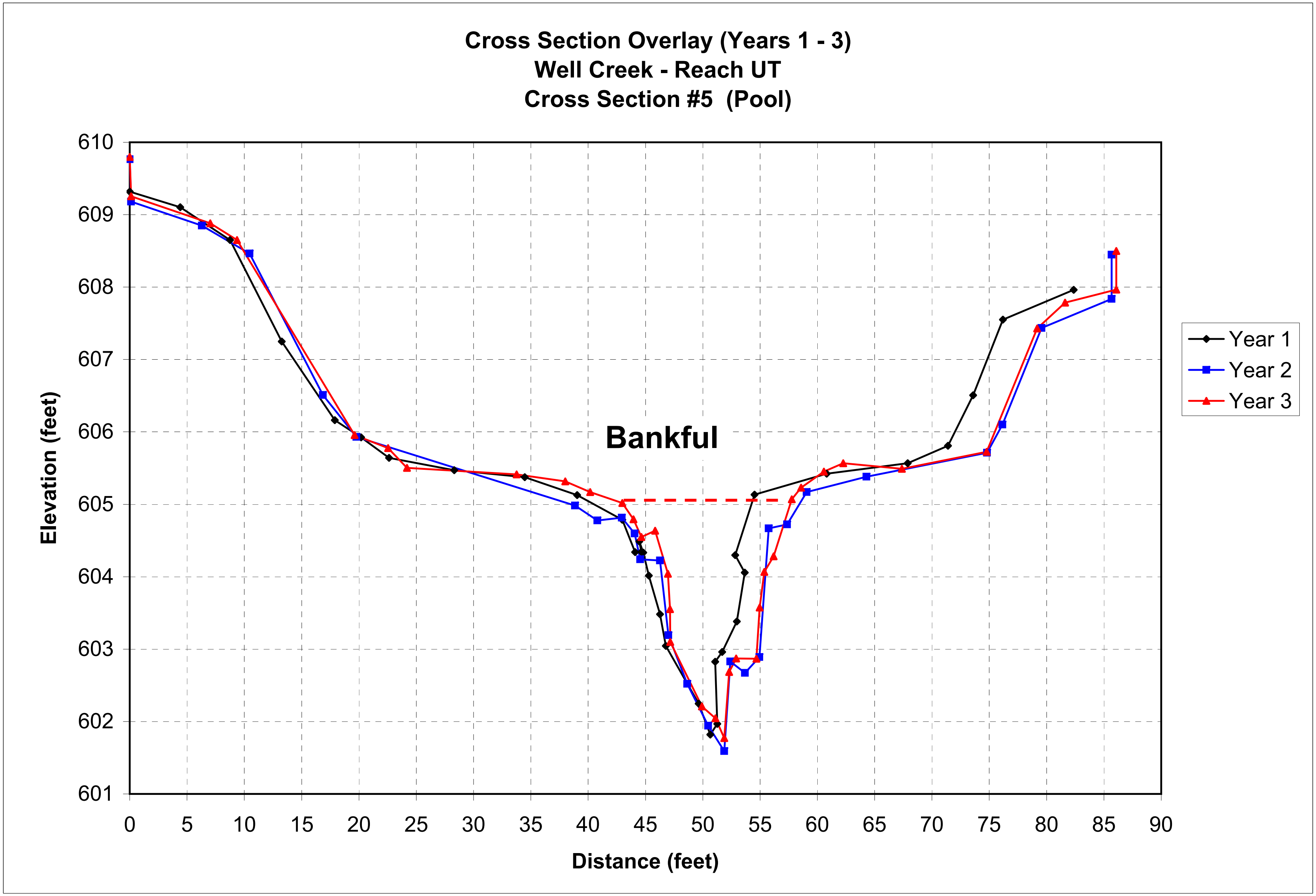
Cross Section Overlay (Years 1 - 3)
Wells Creek - Reach 1
Cross Section #1 (Pool)
Bankfull
Elevation (feet)
649
648
647
646
645
644
643
642
641
0
10
20
30
40
50
60
70
80
90
100
Distance (feet)
Year 1
Year 2
Year 3



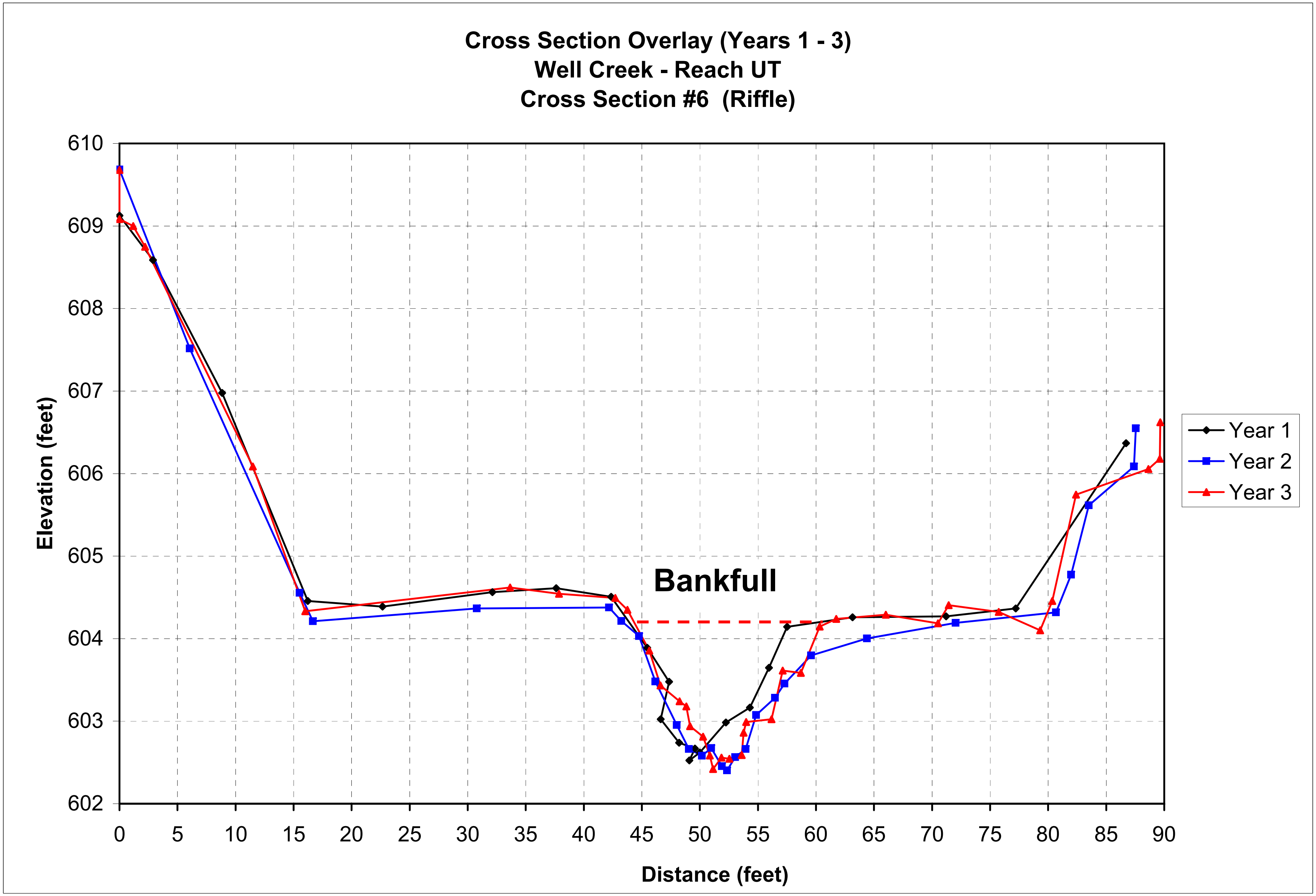
Cross Section Overlay (Years 1 - 3)
Wells Creek - Reach 1
Cross Section #2 (Riffle)
Elevation (feet)
Distance (feet)
Bankfull
Year 1
Year 2
Year 3
649
648
647
646
645
644
643
642
641
640
0
10
20
30
40
50
60
70
80
90


Cross Section Overlay (Years 1 - 3)
Wells Creek - Reach 1
Cross Section #3 (Riffle)
647
646
645
644
643
642
641
640
Elevation (feet)
Bankfull
0
10
20
30
40
50
60
70
80
90
Distance (feet)
Year 1
Year 2
Year 3

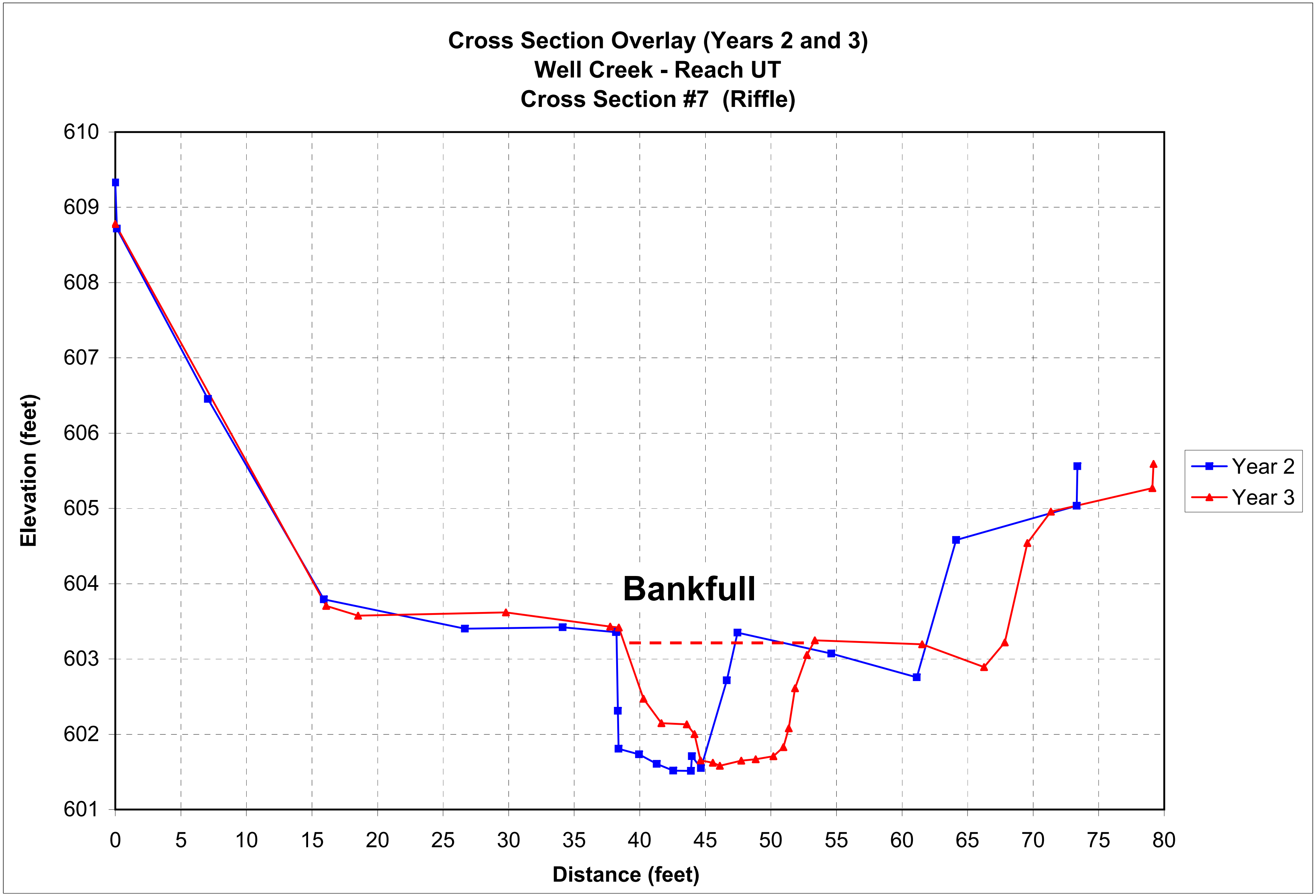

Cross Section Overlay (Years 1 - 3)
Well Creek - Reach 1
Cross Section #4 (Pool)
Elevation (feet)
646
645
644
643
642
641
640
639
638
637
Bankfull
0
10
20
30
40
50
60
70
80
90
100
Distance (feet)
Year 1
Year 2
Year 3

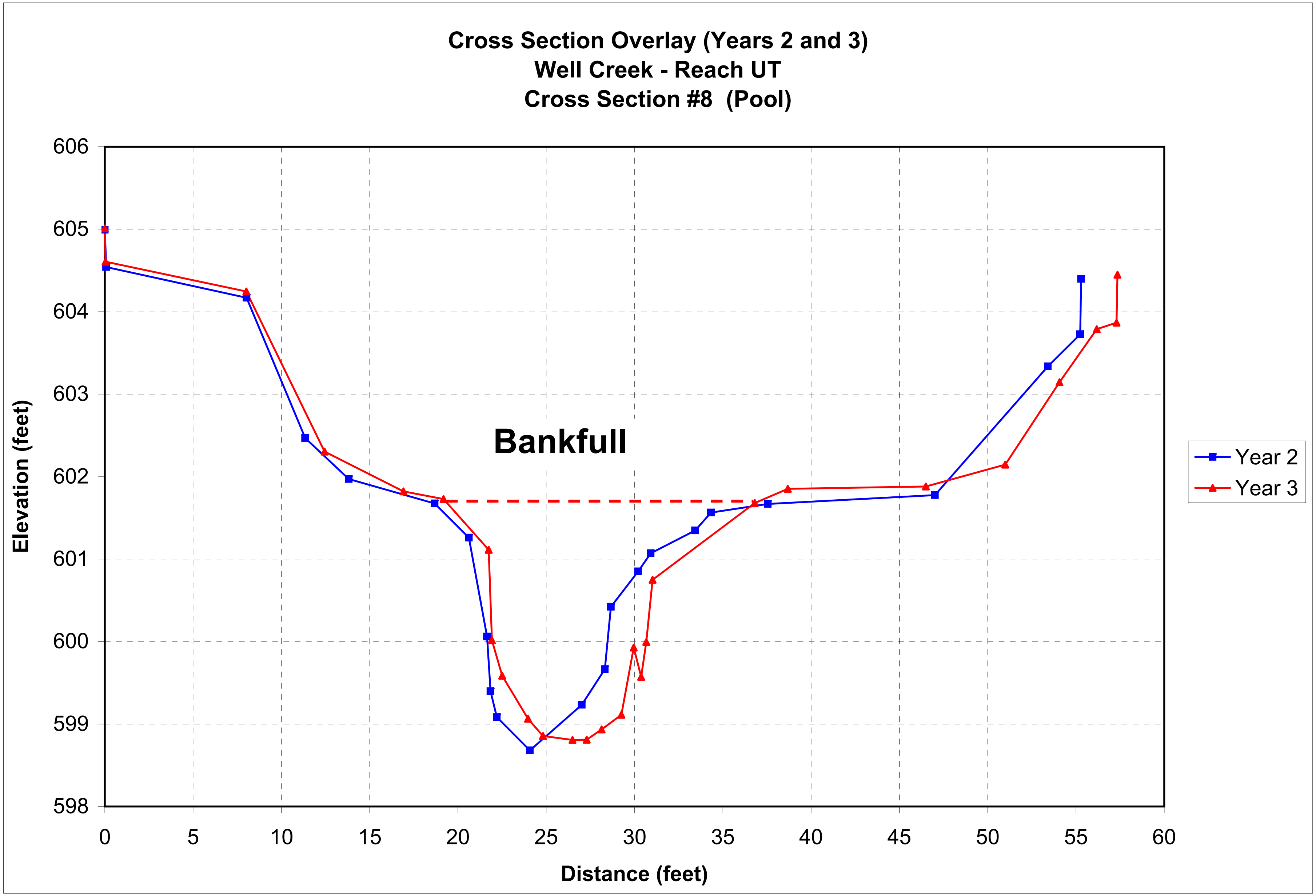


Cross Section Overlay (Years 1 - 3)
Well Creek - Reach UT
Cross Section #5 (Pool)
Bankful
Elevation (feet)
Distance (feet)
610
609
608
607
606
605
604
603
602
601
0
5
10
15
20
25
30
35
40
45
50
55
60
65
70
75
80
85
90
Year 1
Year 2
Year 3

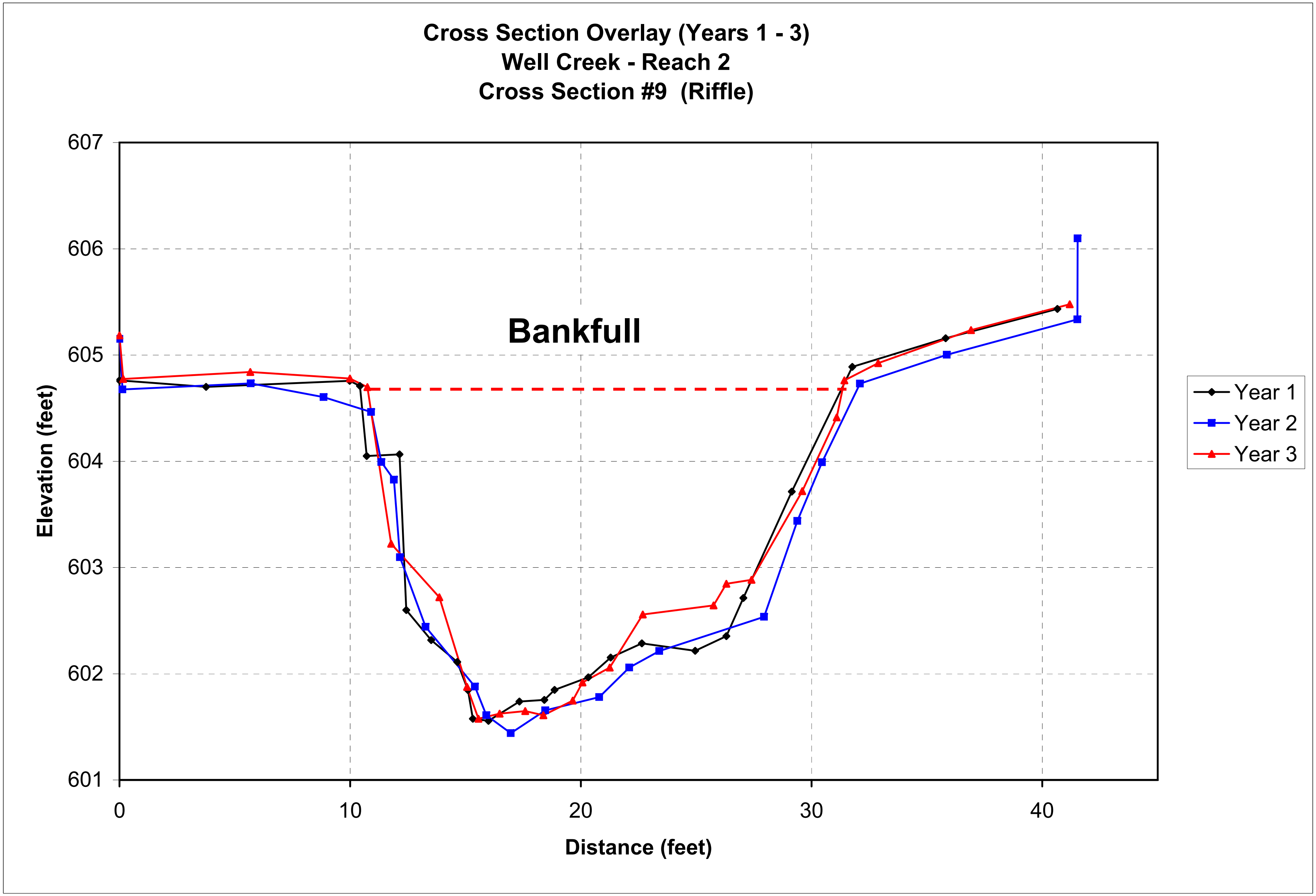


Cross Section Overlay (Years 1 - 3)
Well Creek - Reach UT
Cross Section #6 (Riffle)
Elevation (feet)
Distance (feet)
Bankfull
Year 1
Year 2
Year 3
610
609
608
607
606
605
604
603
602
0
5
10
15
20
25
30
35
40
45
50
55
60
65
70
75
80
85
90

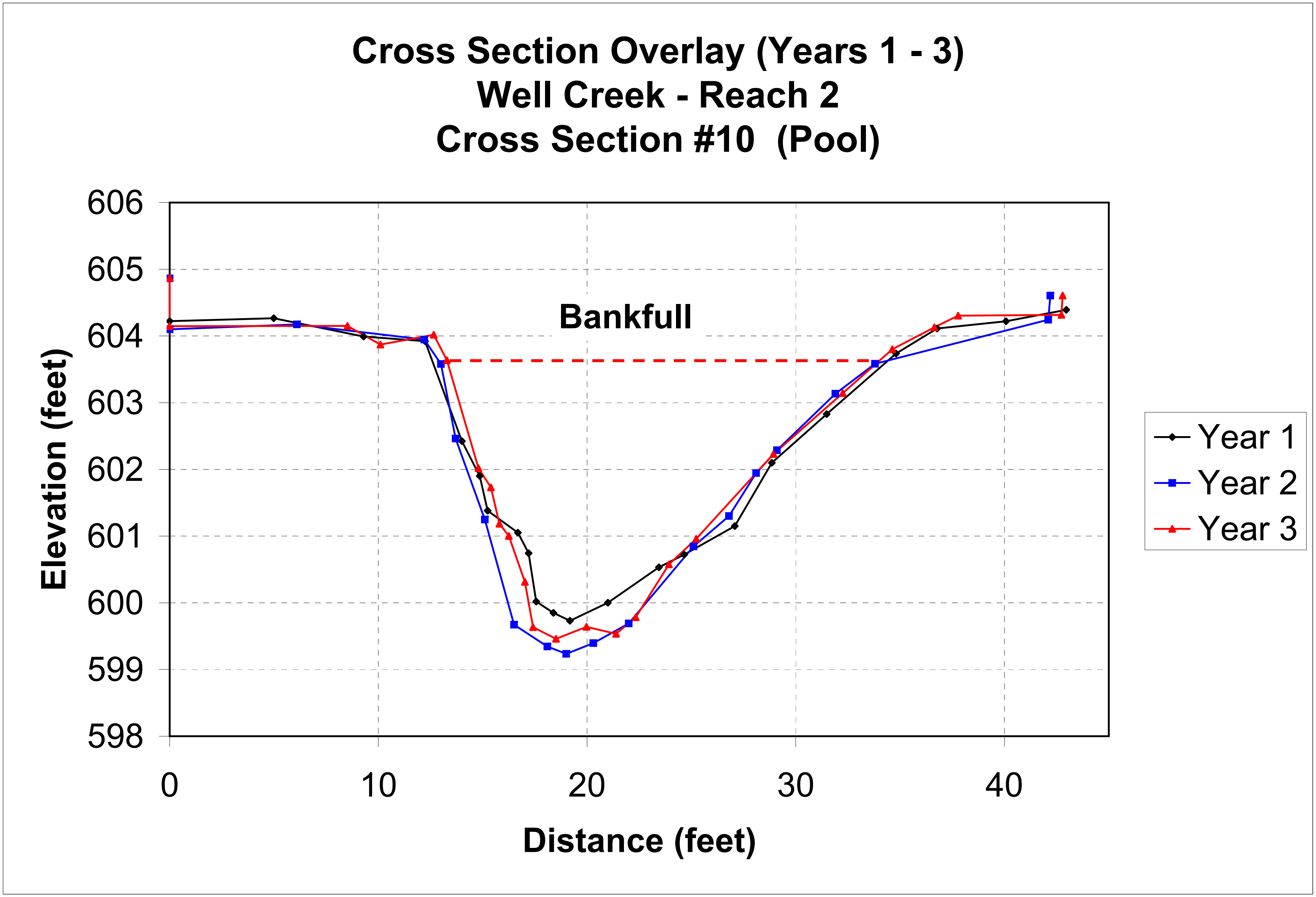

Cross Section Overlay (Years 2 and 3)
Well Creek - Reach UT
Cross Section #7 (Riffle)
Elevation (feet)
610
609
608
607
606
605
604
603
602
601
0
5
10
15
20
25
30
35
40
45
50
55
60
65
70
75
80
Distance (feet)
Bankfull
Year 2
Year 3



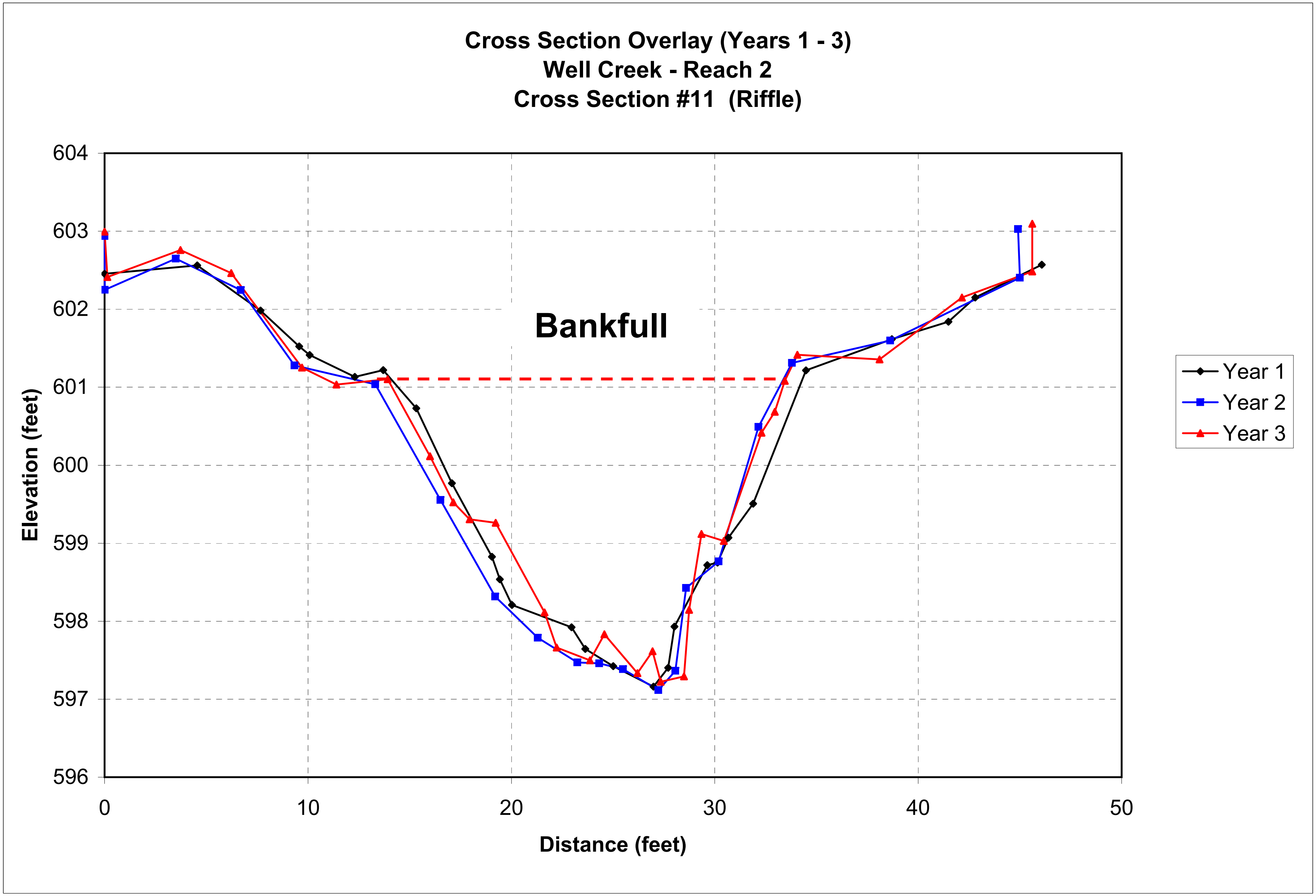
Cross Section Overlay (Years 2 and 3)
Well Creek - Reach UT
Cross Section #8 (Pool)
Bankfull
Elevation (feet)
Distance (feet)
Year 2
Year 3
606
605
604
603
602
601
600
599
598
0
5
10
15
20
25
30
35
40
45
50
55
60



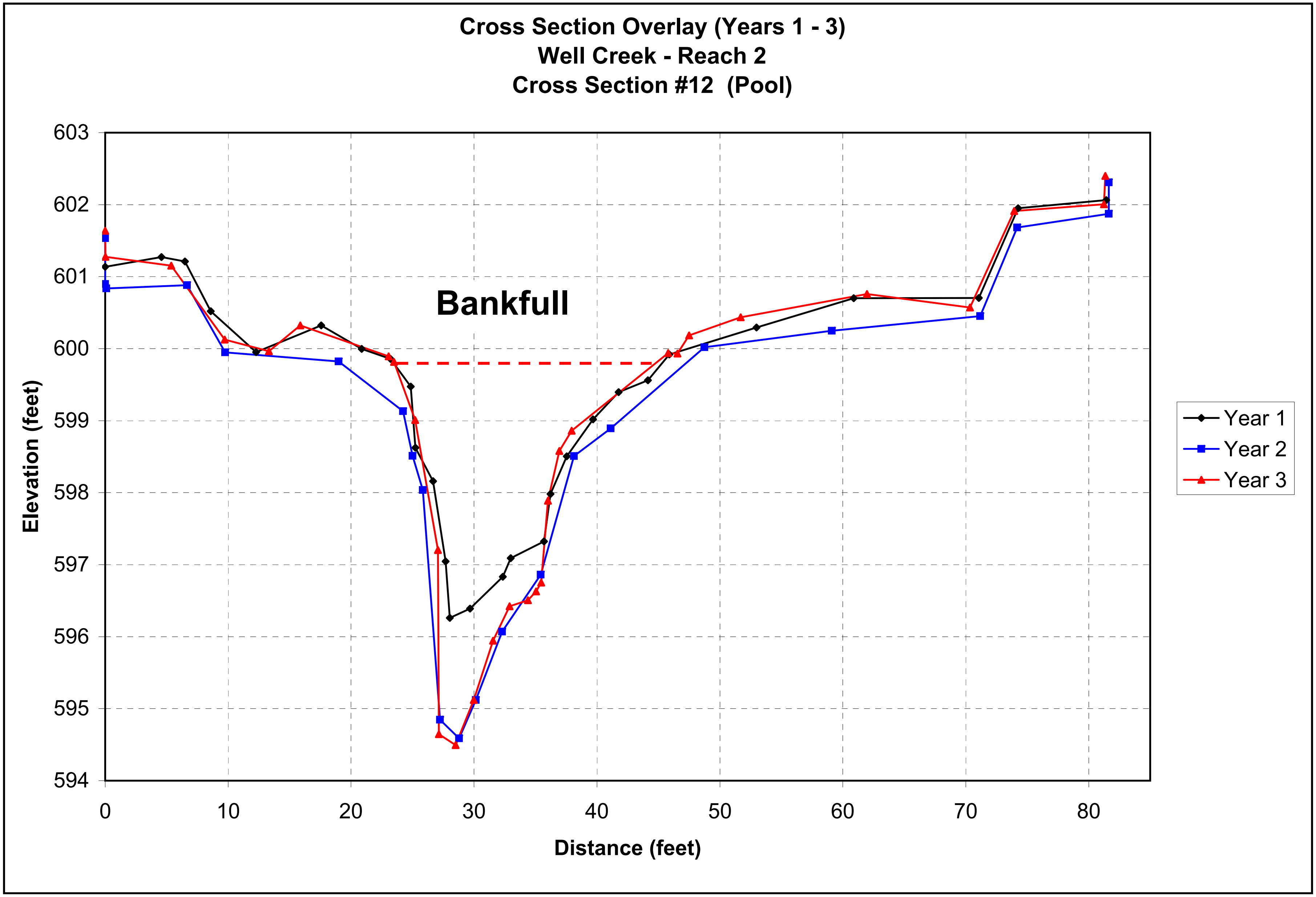
Cross Section Overlay (Years 1 - 3)
Well Creek - Reach 2
Cross Section #9 (Riffle)
Bankfull
Elevation (feet)
Distance (feet)
607
606
605
604
603
602
601
0
10
20
30
40
Year 1
Year 2
Year 3



Cross Section Overlay (Years 1 - 3)
Well Creek - Reach 2
Cross Section #10 (Pool)
Bankfull
Elevation (feet)
606
605
604
603
602
601
600
599
598
0
10
20
30
40
Distance (feet)
Year 1
Year 2
Year 3



Cross Section Overlay (Years 1 - 3)
Well Creek - Reach 2
Cross Section #11 (Riffle)
Bankfull
Elevation (feet)
604
603
602
601
600
599
598
597
596
0
10
20
30
40
50
Distance (feet)
Year 1
Year 2
Year 3



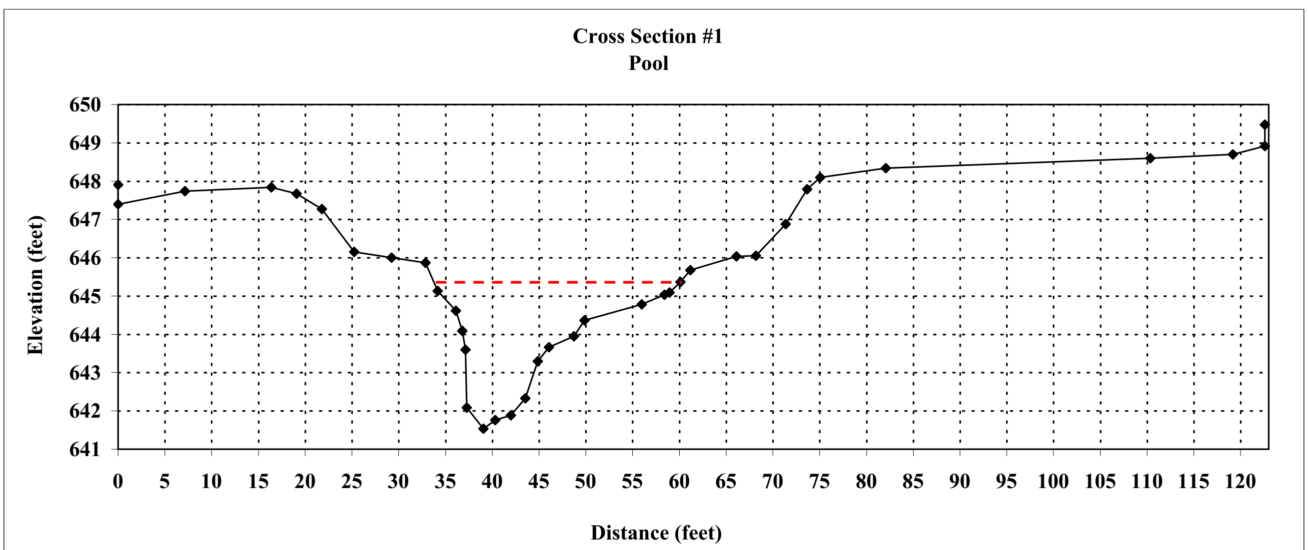
Cross Section Overlay (Years 1 - 3)
Well Creek - Reach 2
Cross Section #12 (Pool)
Bankfull
Elevation (feet)
Distance (feet)
603
602
601
600
599
598
597
596
595
594
0
10
20
30
40
50
60
70
80
Year 1
Year 2
Year 3

Field Crew:	IPJ and PDB
Stream Reach:	1
Project:	Wells Creek
Drainage Area:	1.63
Date:	Jan-07
Monitoring Year	2

STATION (Feet)	ELEVATION (Feet)	NOTES
0.00	647.90	
0.00	647.39	
7.14	647.74	
16.40	647.83	
19.10	647.67	
21.79	647.27	
25.24	646.15	
29.24	646.00	
32.87	645.87	TOB
34.16	645.14	
36.10	644.62	
36.78	644.09	
37.15	643.60	LEW
37.29	642.08	
39.04	641.53	TW
40.31	641.76	
42.01	641.88	
43.53	642.33	
44.88	643.29	
46.06	643.66	REW
48.74	643.95	
49.84	644.36	
55.99	644.78	
58.39	645.03	
58.96	645.09	
60.12	645.36	BKF
61.18	645.67	TOB
66.11	646.03	
68.20	646.05	
71.37	646.87	
73.66	647.79	
75.06	648.09	
82.07	648.34	
110.36	648.60	
119.17	648.69	
122.59	648.91	
122.59	649.48	

Bankfull/Top of Bank Hydraulic Geometry		
Width (Feet)	**Depth (Feet)**	**Area (Sq. Ft.)**
0.0	0.0	0.0
0.4	0.2	0.0
1.9	0.7	0.9
0.7	1.3	0.7
0.4	1.8	0.6
0.1	3.3	0.4
1.8	3.8	6.2
1.3	3.6	4.7
1.7	3.5	6.0
1.5	3.0	5.0
1.4	2.1	3.4
1.2	1.7	2.2
2.7	1.4	4.2
1.1	1.0	1.3
6.2	0.6	4.9
2.4	0.3	1.1
0.6	0.3	0.2
1.2	0.0	0.2
TOTALS 26.4		42.0

SUMMARY DATA	
A(BKF)	42.0
W(BKF)	26.4
Max d	3.8
Mean d	1.6



Field Crew:	IPJ and PDB
Stream Reach:	1
Project:	Wells Creek
Drainage Area:	1.63
Date:	Jan-07
Monitoring Year	2

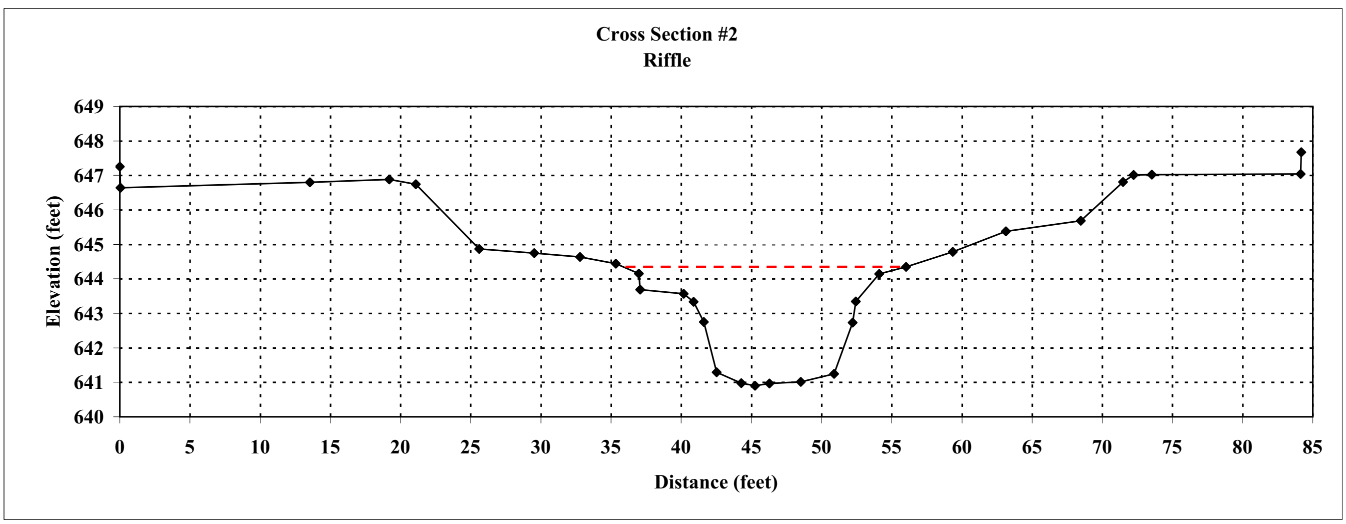
STATION (Feet)	ELEVATION (Feet)	NOTES
0.00	647.25	
0.05	646.64	
13.53	646.80	
19.19	646.89	
21.08	646.74	
25.60	644.87	
29.52	644.75	
32.80	644.64	
35.33	644.44	TOB
36.99	644.15	
37.06	643.69	
40.18	643.57	
40.88	643.33	
41.60	642.75	LEW
42.51	641.29	
44.27	640.97	
45.26	640.90	
46.28	640.97	
48.53	641.01	TW
50.90	641.24	
52.22	642.73	REW
52.44	643.34	
54.11	644.14	
56.01	644.34	BKF
59.35	644.78	
63.13	645.38	
68.48	645.68	
71.48	646.81	
72.24	647.01	
73.53	647.02	
84.14	647.04	
84.17	647.67	

Bankfull/Top of Bank Hydraulic Geometry

	Width (Feet)	Depth (Feet)	Area (Sq. Ft.)
	0.0	0.0	0.0
	1.0	0.2	0.1
	0.1	0.7	0.0
	3.1	0.8	2.2
	0.7	1.0	0.6
	0.7	1.6	0.9
	0.9	3.1	2.1
	1.8	3.4	5.6
	1.0	3.4	3.4
	1.0	3.4	3.5
	2.2	3.3	7.5
	2.4	3.1	7.6
	1.3	1.6	3.1
	0.2	1.0	0.3
	1.7	0.2	1.0
	1.9	0.0	0.2
TOTALS	20.1		38.3

SUMMARY DATA (BANKFULL)

A(BKF)	38.3	W(FPA)	84+
W(BKF)	20.1	Slope	0.005
Max d	3.4		
Mean d	1.9	Area= A	
W/D	10.5	Width= W	
Entrenchment	4.2+	Depth= D	
Stream Type	C	Bankfull= BKF	
Area from Rural Regional Curve			30.5



Appendix B4

Field Crew:	IPJ and PDB
Stream Reach:	1
Project:	Wells Creek
Drainage Area:	1.63
Date:	Jan-07
Monitoring Year	2

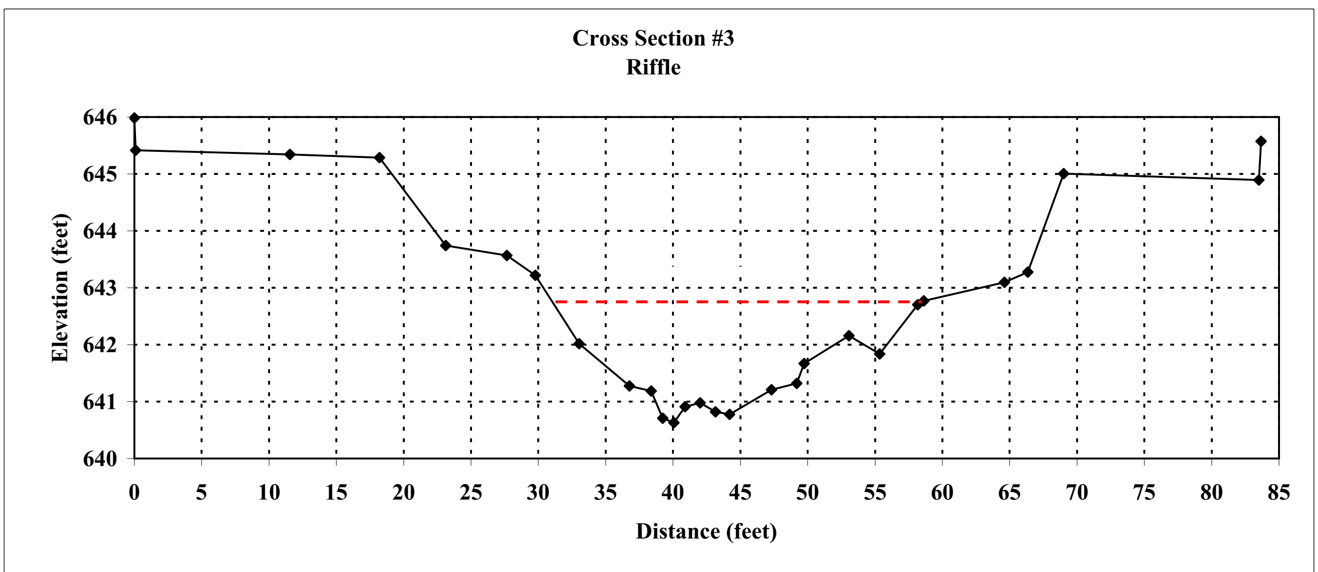
STATION (Feet)	HI (Feet)	NOTES
0.00	645.99	
0.10	645.41	
11.54	645.34	
18.20	645.29	
23.12	643.74	
27.65	643.56	
29.78	643.22	
33.02	642.02	
36.76	641.28	
38.38	641.19	LEW
39.23	640.71	
40.07	640.63	TW
40.90	640.91	
42.01	640.98	
43.14	640.82	
44.20	640.78	
47.31	641.21	REW
49.19	641.32	
49.74	641.67	
53.05	642.16	
55.34	641.84	
58.17	642.70	
58.62	642.77	BKF
64.60	643.10	
66.34	643.27	
69.02	645.00	
83.51	644.89	
83.66	645.57	

Bankfull Hydraulic Geometry

	Width (Feet)	Depth (Feet)	Area (Sq. Ft.)
	0.0	0.0	0.0
	2.0	0.8	0.8
	3.7	1.5	4.2
	1.6	1.6	2.5
	0.8	2.1	1.5
	0.8	2.1	1.8
	0.8	1.9	1.7
	1.1	1.8	2.0
	1.1	2.0	2.1
	1.1	2.0	2.1
	3.1	1.6	5.5
	1.9	1.4	2.8
	0.6	1.1	0.7
	3.3	0.6	2.8
	2.3	0.9	1.8
	2.8	0.1	1.4
	0.4	0.0	0.0
TOTALS	27.6		33.7

SUMMARY DATA (BANKFULL)

A(BKF)	33.7	W(FPA)	49.5
W(BKF)	27.6	Slope	0.005
Max d	2.1		
Mean d	1.2	Area=	A
W/D	22.6	Width=	W
Entrenchment	1.8	Depth=	D
Stream Type	C	Bankfull=	BKF
Area from Rural Regional Curve			30.5



Appendix B4

Field Crew:	IPJ and PDB
Stream Reach:	1
Project:	Wells Creek
Drainage Area:	1.63
Date:	Jan-07
Monitoring Year	2

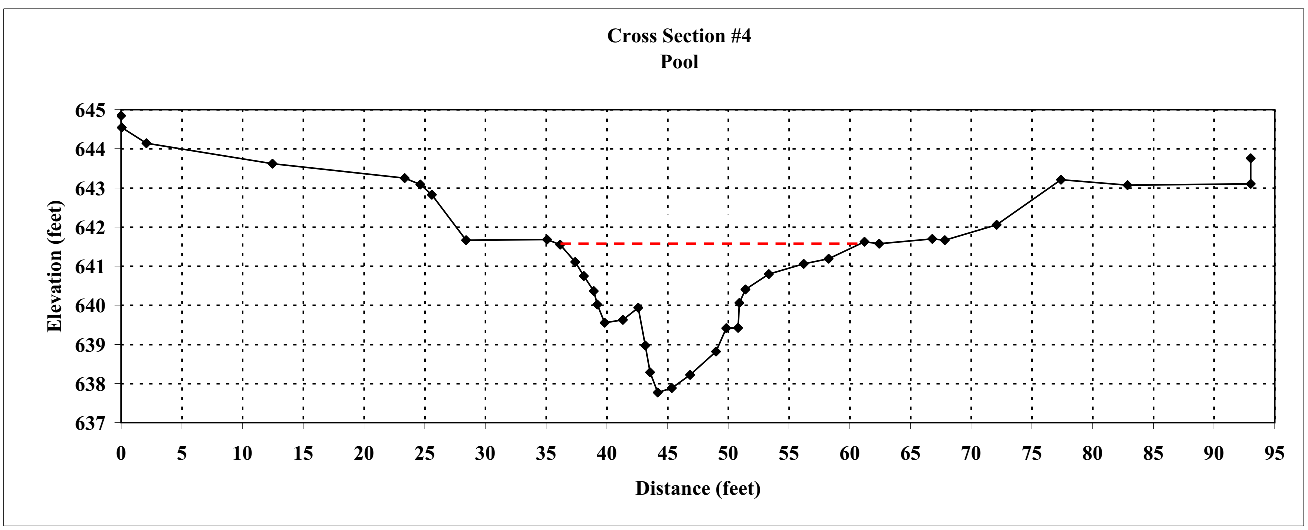
STATION (Feet)	ELEVATION (Feet)	NOTES
0.00	644.84	
0.05	644.54	
2.07	644.14	
12.47	643.62	
23.35	643.25	
24.63	643.09	
25.59	642.83	
28.40	641.67	
35.07	641.68	
36.15	641.55	BKF
37.39	641.11	
38.10	640.75	
38.92	640.36	
39.22	640.02	LEW
39.83	639.55	
41.32	639.63	
42.60	639.94	
43.16	638.97	
43.55	638.28	
44.19	637.77	TW
45.34	637.88	
46.87	638.22	
48.98	638.82	
49.84	639.41	
50.80	639.42	
50.91	640.06	REW
51.41	640.41	
53.34	640.79	
56.21	641.06	
58.26	641.19	
61.22	641.62	TOB
62.44	641.58	
66.80	641.70	
67.83	641.66	
72.09	642.05	
77.39	643.21	
82.88	643.07	
93.02	643.10	
93.03	643.76	

Bankfull/Top of Bank Hydraulic Geometry

	Width (Feet)	Depth (Feet)	Area (Sq. Ft.)
	0.0	0.0	0.0
	1.2	0.4	0.3
	0.7	0.8	0.4
	0.8	1.2	0.8
	0.3	1.5	0.4
	0.6	2.0	1.1
	1.5	1.9	2.9
	1.3	1.6	2.3
	0.6	2.6	1.2
	0.4	3.3	1.1
	0.6	3.8	2.3
	1.1	3.7	4.3
	1.5	3.3	5.3
	2.1	2.7	6.4
	0.9	2.1	2.1
	1.0	2.1	2.0
	0.1	1.5	0.2
	0.5	1.1	0.7
	1.9	0.8	1.8
	2.9	0.5	1.8
	2.0	0.4	0.9
	2.5		0.4
TOTALS	24.6		38.7

SUMMARY DATA

A(BKF)	38.7
W(BKF)	24.6
Max d	3.8
Mean d	1.6



Field Crew:	IPJ and PDB
Stream Reach:	UT
Project:	Wells Creek
Drainage Area:	0.71
Date:	Apr-07
Monitoring Year	2

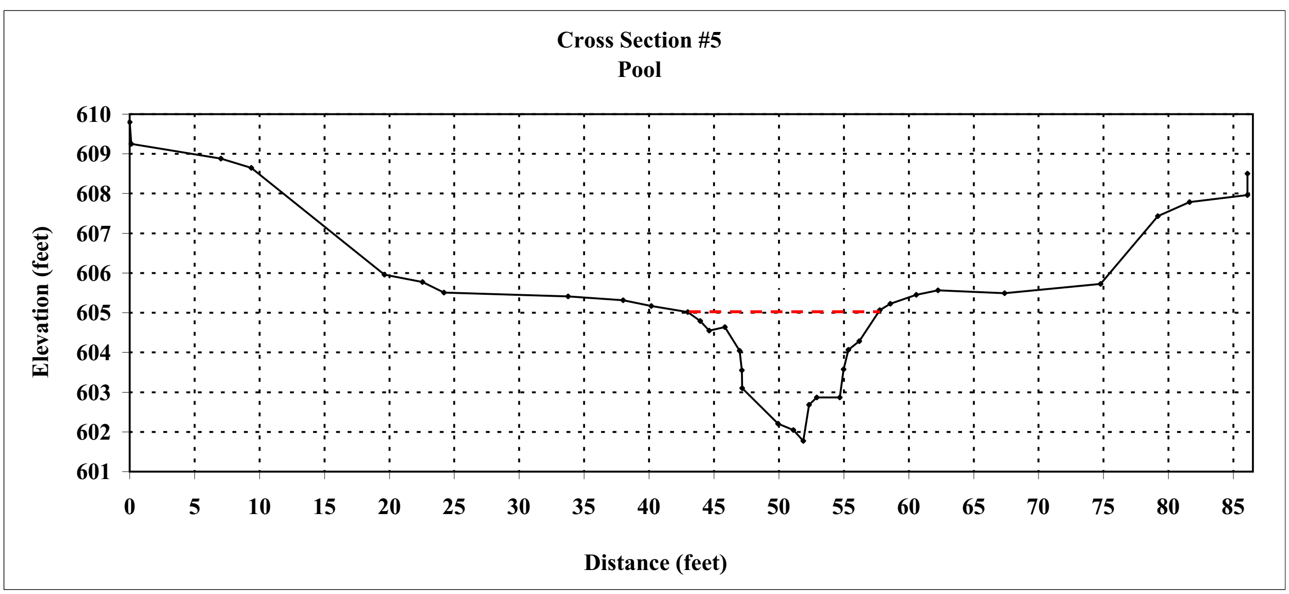
STATION (Feet)	ELEVATION (Feet)	NOTES
0.00	609.80	
0.12	609.25	
7.03	608.88	
9.37	608.65	
19.62	605.96	
22.55	605.77	
24.19	605.50	
33.76	605.41	
38.00	605.32	
40.18	605.17	
42.98	605.02	BKF
43.95	604.79	
44.64	604.55	
45.84	604.64	
46.96	604.04	
47.14	603.55	LEW
47.17	603.10	
49.92	602.21	
51.10	602.05	
51.87	601.77	TW
52.31	602.69	
52.90	602.87	
54.67	602.87	
54.97	603.57	REW
55.36	604.07	
56.19	604.28	
57.76	605.07	
58.58	605.23	TOB
60.57	605.45	
62.26	605.57	
67.38	605.49	
74.76	605.72	
79.17	607.43	
81.62	607.79	
86.08	607.97	
86.08	608.50	

Bankfull/Top of Bank Hydraulic Geometry

	Width (Feet)	Depth (Feet)	Area (Sq. Ft.)
	0.0	0.0	0.0
	1.0	0.2	0.1
	0.7	0.5	0.2
	1.2	0.4	0.5
	1.1	1.0	0.8
	0.2	1.5	0.2
	0.0	1.9	0.0
	2.8	2.8	6.5
	1.2	3.0	3.4
	0.8	3.2	2.4
	0.4	2.3	1.2
	0.6	2.1	1.3
	1.8	2.2	3.8
	0.3	1.4	0.5
	0.4	1.0	0.5
	0.8	0.7	0.7
	1.4	0.0	0.5
TOTALS	14.7		22.8

SUMMARY DATA

A(BKF)	22.8
W(BKF)	14.7
Max d	3.2
Mean d	1.6

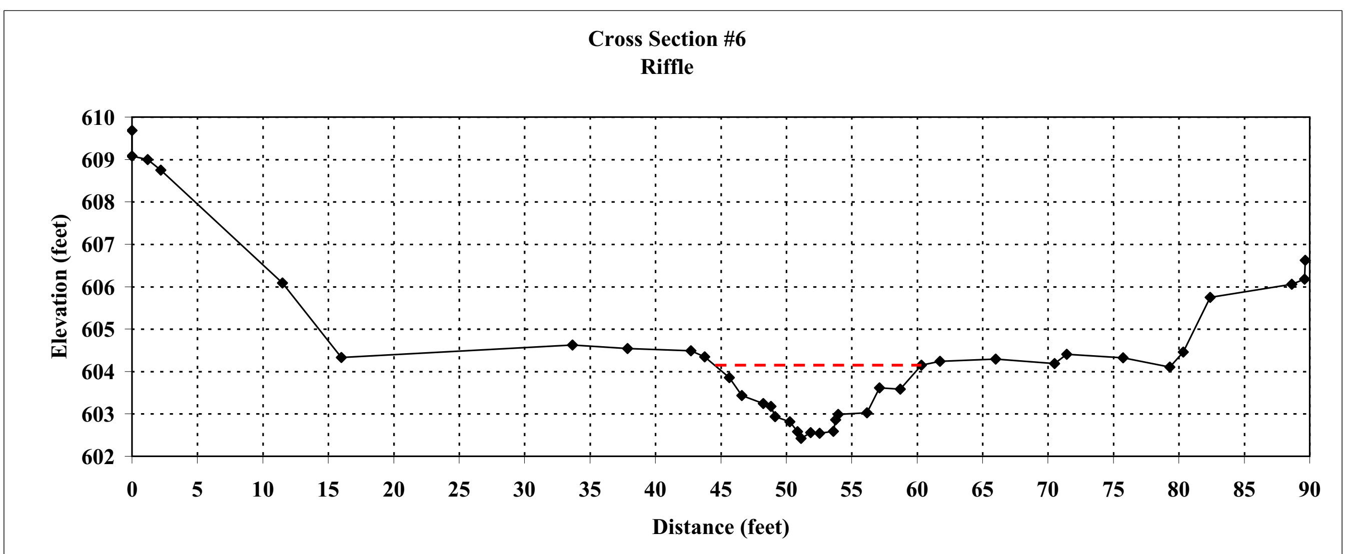


Field Crew:	IPJ and PDB
Stream Reach:	UT
Project:	Wells Creek
Drainage Area:	0.71
Date:	Apr-07
Monitoring Year	2

STATION (Feet)	ELEVATION (Feet)	NOTES
0.00	609.68	
0.01	609.08	
1.19	609.00	
2.20	608.75	
11.50	606.09	
16.00	604.33	
33.65	604.62	
37.87	604.54	
42.72	604.49	TOB
43.75	604.35	
45.64	603.86	
46.60	603.43	
48.25	603.24	
48.84	603.18	
49.15	602.94	
50.28	602.81	LEW
50.85	602.58	
51.13	602.42	
51.85	602.56	TW
52.55	602.54	
53.60	602.59	
53.77	602.86	REW
53.97	602.99	
56.17	603.02	
57.13	603.61	
58.70	603.58	
60.32	604.15	BKF
61.74	604.24	
66.01	604.29	
70.50	604.19	
71.43	604.40	
75.74	604.32	
79.32	604.10	
80.35	604.46	
82.40	605.74	
88.64	606.05	
89.62	606.18	
89.66	606.62	

	Bankfull/Top of Bank Hydraulic Geometry		
	Width (Feet)	Depth (Feet)	Area (Sq. Ft.)
	0.0	0.0	0.0
	1.1	0.3	0.2
	1.0	0.7	0.5
	1.6	0.9	1.3
	0.6	1.0	0.6
	0.3	1.2	0.3
	1.1	1.3	1.4
	0.6	1.6	0.8
	0.3	1.7	0.5
	0.7	1.6	1.2
	0.7	1.6	1.1
	1.1	1.6	1.7
	0.2	1.3	0.2
	0.2	1.2	0.3
	2.2	1.1	2.5
	1.0	0.5	0.8
	1.6	0.6	0.9
	1.6	0.0	0.5
TOTALS	15.8		14.7

SUMMARY DATA (BANKFULL)			
A(BKF)	14.7	W(FPA)	73
W(BKF)	15.8	Slope	0.006
Max d	1.7		
Mean d	0.9	Area=	A
W/D	17.1	Width=	W
Entrenchment	4.6	Depth=	D
Stream Type	C	Bankfull=	BKF
Area from Rural Regional Curve			17.5



Field Crew:	IPJ and PDB
Stream Reach:	UT
Project:	Wells Creek
Drainage Area:	0.71
Date:	Apr-07
Monitoring Year	2

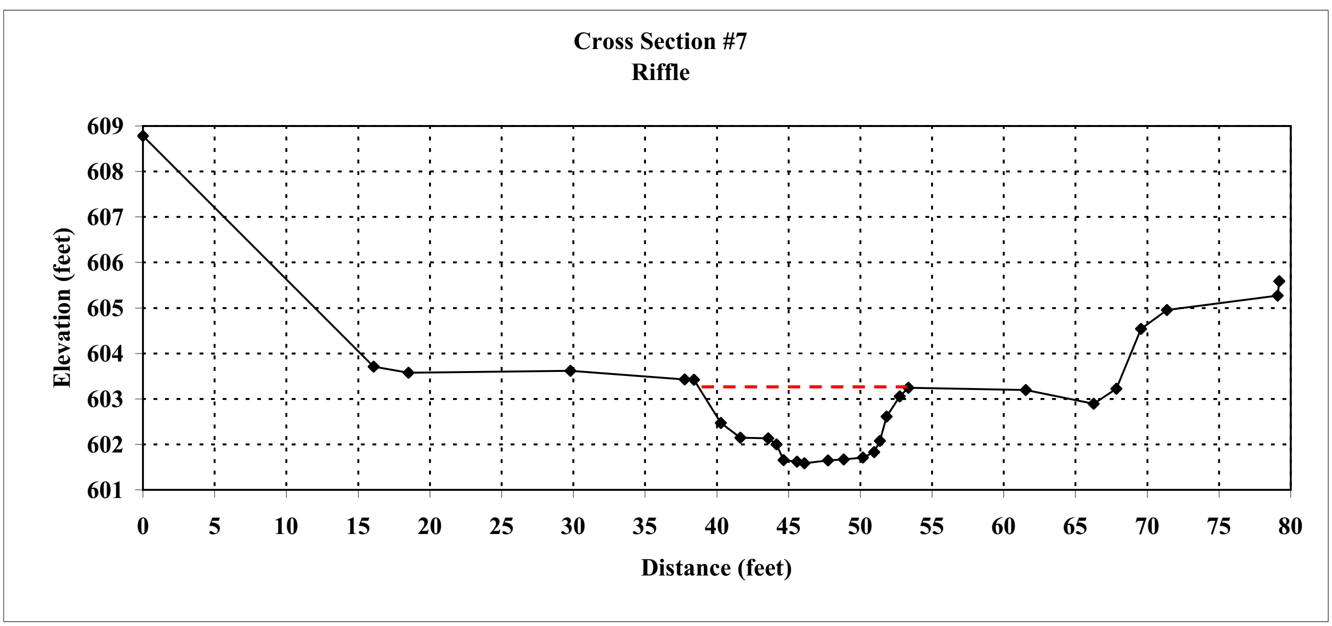
STATION (Feet)	HI (Feet)	NOTES
0.00	608.78	
16.08	603.71	
18.52	603.58	
29.79	603.62	
37.75	603.43	
38.41	603.42	TOB
40.28	602.47	
41.65	602.15	
43.58	602.13	
44.17	602.00	LEW
44.64	601.65	
45.58	601.62	
46.11	601.58	TW
47.74	601.65	
48.85	601.67	
50.19	601.71	
50.96	601.83	REW
51.37	602.08	
51.84	602.61	
52.75	603.05	
53.35	603.25	BKF
61.54	603.19	
66.26	602.89	
67.84	603.22	
69.56	604.54	
71.36	604.96	
79.09	605.27	
79.19	605.59	

Bankfull Hydraulic Geometry

	Width (Feet)	Depth (Feet)	Area (Sq. Ft.)
	0.0	0.0	0.0
	1.5	0.8	0.6
	1.4	1.1	1.3
	1.9	1.1	2.1
	0.6	1.2	0.7
	0.5	1.6	0.7
	0.9	1.6	1.5
	0.5	1.7	0.9
	1.6	1.6	2.7
	1.1	1.6	1.8
	1.3	1.5	2.1
	0.8	1.4	1.1
	0.4	1.2	0.5
	0.5	0.6	0.4
	0.9	0.2	0.4
	0.6	0.0	0.1
TOTALS	14.6		16.8

SUMMARY DATA (BANKFULL)

A(BKF)	16.8	W(FPA)	59.1
W(BKF)	14.6	Slope	0.006
Max d	1.7		
Mean d	1.2	Area=	A
W/D	12.7	Width=	W
Entrenchment	4.0	Depth=	D
Stream Type	C	Bankfull=	BKF
Area from Rural Regional Curve			17.5



Appendix B4

Field Crew:	IPJ and PDB
Stream Reach:	UT
Project:	Wells Creek
Drainage Area:	0.71
Date:	Apr-07
Monitoring Year	2

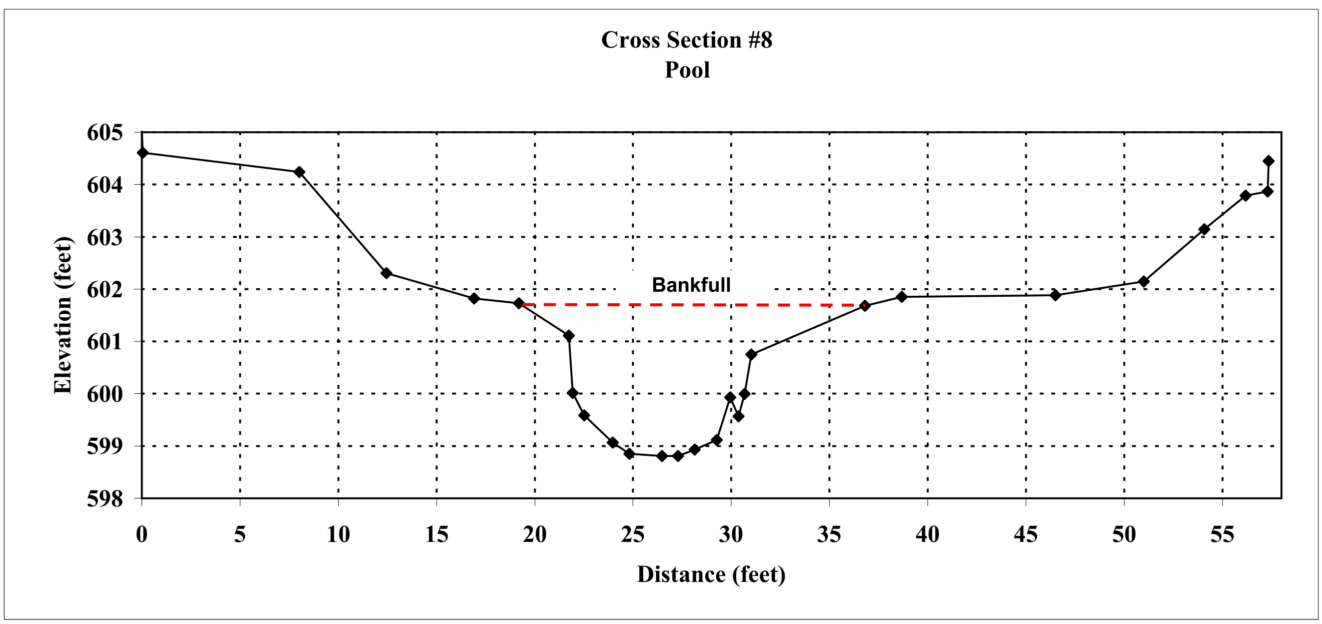
STATION (Feet)	ELEVATION (Feet)	NOTES
0.00	605.01	
0.04	604.61	
8.02	604.24	
12.45	602.30	
16.91	601.82	
19.19	601.73	TOB
21.74	601.11	
21.93	600.01	LEW
22.51	599.59	
23.97	599.07	
24.81	598.85	TW
26.48	598.81	
27.29	598.81	
28.13	598.93	
29.26	599.11	
29.95	599.93	
30.37	599.57	
30.67	600.00	REW
31.02	600.75	
36.81	601.68	BKF
38.68	601.85	TOB
46.50	601.88	
51.00	602.14	
54.07	603.14	
56.18	603.79	
57.30	603.87	
57.35	604.45	

Bankfull/Top of Bank Hydraulic Geometry

	Width (Feet)	Depth (Feet)	Area (Sq. Ft.)
	0.0	0.0	0.0
	2.4	0.6	0.7
	0.2	1.7	0.2
	0.6	2.1	1.1
	1.5	2.6	3.4
	0.8	2.8	2.3
	1.7	2.9	4.8
	0.8	2.9	2.3
	0.8	2.7	2.4
	1.1	2.6	3.0
	0.7	1.8	1.5
	0.4	2.1	0.8
	0.3	1.7	0.6
	0.3	0.9	0.5
	5.8	0.0	2.7
TOTALS	17.4		26.2

SUMMARY DATA

A(BKF)	26.2
W(BKF)	17.4
Max d	2.9
Mean d	1.5



Field Crew:	IPJ and PDB
Stream Reach:	2
Project:	Wells Creek
Drainage Area:	2.23
Date:	May-07
Monitoring Year:	2

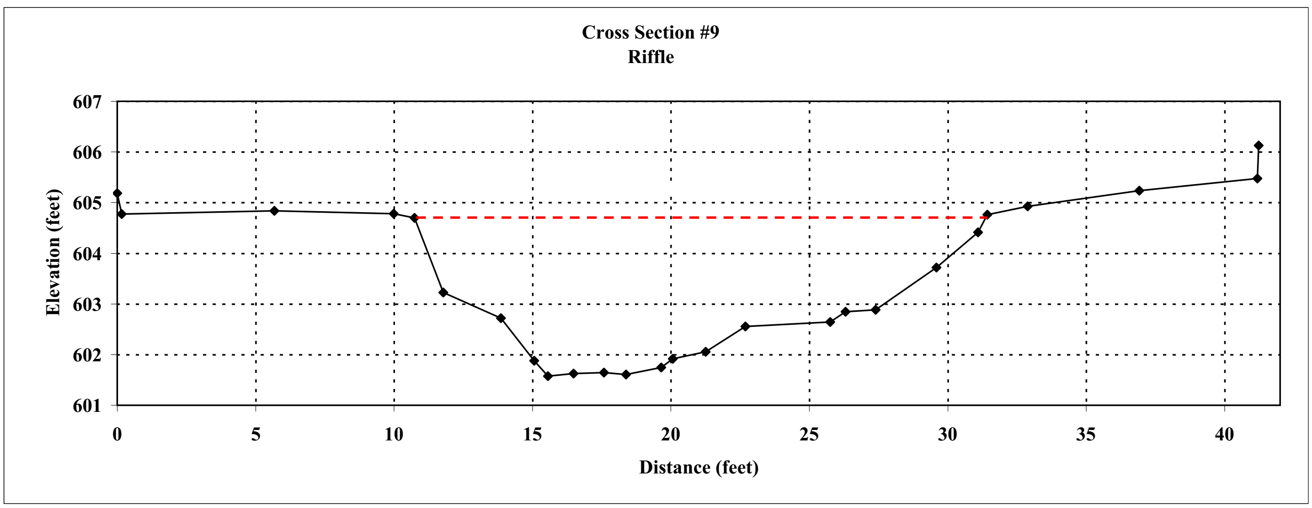
STATION (Feet)	ELEVATION (Feet)	NOTES
0.00	605.18	
0.16	604.77	
5.67	604.84	
9.99	604.78	
10.74	604.70	BKF
11.78	603.22	
13.86	602.72	
15.06	601.88	LEW
15.55	601.58	
16.48	601.62	
17.58	601.65	TW
18.38	601.61	
19.64	601.75	
20.06	601.92	REW
21.25	602.06	
22.69	602.56	
25.75	602.64	
26.30	602.85	
27.40	602.88	
29.59	603.72	
31.09	604.41	
31.42	604.76	
32.89	604.92	TOB
36.91	605.24	
41.18	605.48	
41.22	606.13	

Bankfull/Top of Bank Hydraulic Geometry

	Width (Feet)	Depth (Feet)	Area (Sq. Ft.)
	0.0	0.0	0.0
	1.0	1.5	0.8
	2.1	2.0	3.6
	1.2	2.8	2.9
	0.5	3.1	1.5
	0.9	3.1	2.9
	1.1	3.0	3.4
	0.8	3.1	2.4
	1.3	3.0	3.8
	0.4	2.8	1.2
	1.2	2.6	3.2
	1.4	2.1	3.4
	3.1	2.1	6.4
	0.6	1.9	1.1
	1.1	1.8	2.0
	2.2	1.0	3.1
	1.5	0.3	0.9
	0.3		0.0
TOTALS	20.6		42.6

SUMMARY DATA (BANKFULL)

A(BKF)	42.6	W(FPA)	42+
W(BKF)	20.6	Slope	0.006
Max d	3.1		
Mean d	2.1	Area= A	
W/D	10.0	Width= W	
Entrenchment	2.0+	Depth= D	
Stream Type	C	Bankfull= BKF	
Area from Rural Regional Curve			37.6



Field Crew:	IPJ and PDB
Stream Reach:	2
Project:	Wells Creek
Drainage Area:	2.23
Date:	May-07
Monitoring Year:	2

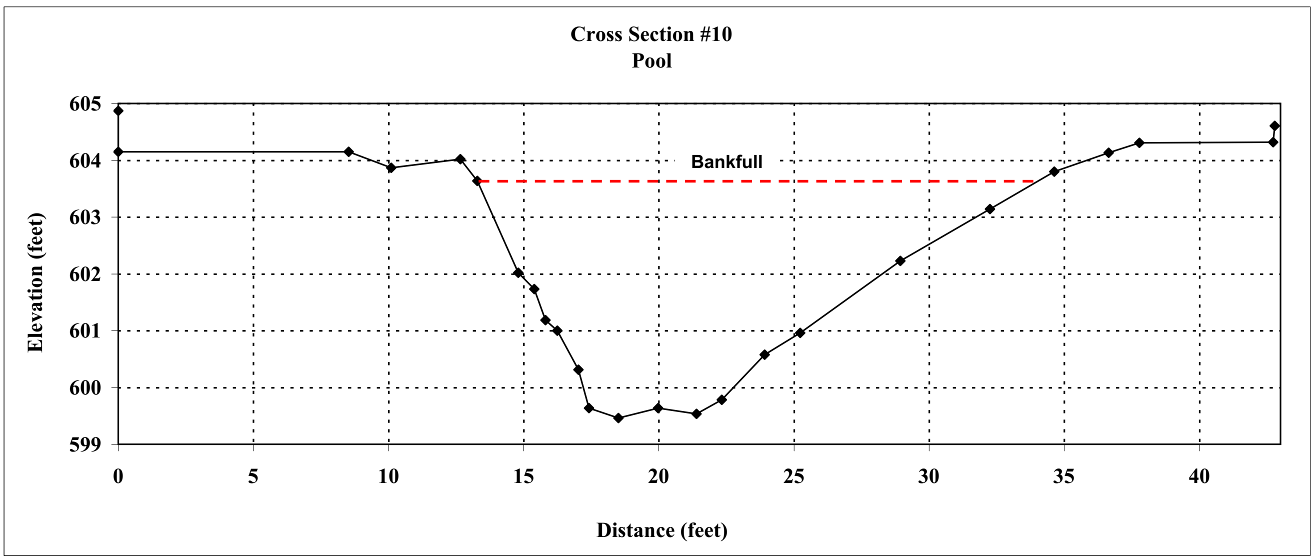
STATION (Feet)	ELEVATION (Feet)	NOTES
0.00	604.87	
0.00	604.15	
8.52	604.15	
10.10	603.87	
12.65	604.02	
13.28	603.64	BKF
14.80	602.02	
15.39	601.73	
15.80	601.19	
16.25	601.00	LEW
17.02	600.31	
17.41	599.63	
18.51	599.46	TW
19.97	599.64	
21.39	599.53	
22.33	599.78	
23.92	600.58	
25.23	600.96	REW
28.93	602.23	
32.25	603.14	
34.63	603.80	
36.64	604.13	TOB
37.78	604.30	
42.73	604.32	
42.79	604.61	

Bankfull/Top of Bank Hydraulic Geometry

	Width (Feet)	Depth (Feet)	Area (Sq. Ft.)
	0.0	0.0	0.0
	1.5	1.6	1.2
	0.6	1.9	1.1
	0.4	2.5	0.9
	0.4	2.6	1.1
	0.8	3.3	2.3
	0.4	4.0	1.4
	1.1	4.2	4.5
	1.5	4.0	6.0
	1.4	4.1	5.8
	0.9	3.9	3.7
	1.6	3.1	5.5
	1.3	2.7	3.8
	3.7	1.4	7.6
	3.3	0.5	3.2
	1.8		0.4
TOTALS	20.8		48.4

SUMMARY DATA

A(BKF)	48.4
W(BKF)	20.8
Max d	4.2
Mean d	2.3



Field Crew:	IPJ and PDB
Stream Reach:	2
Project:	Wells Creek
Drainage Area:	2.23
Date:	May-07
Monitoring Year:	2

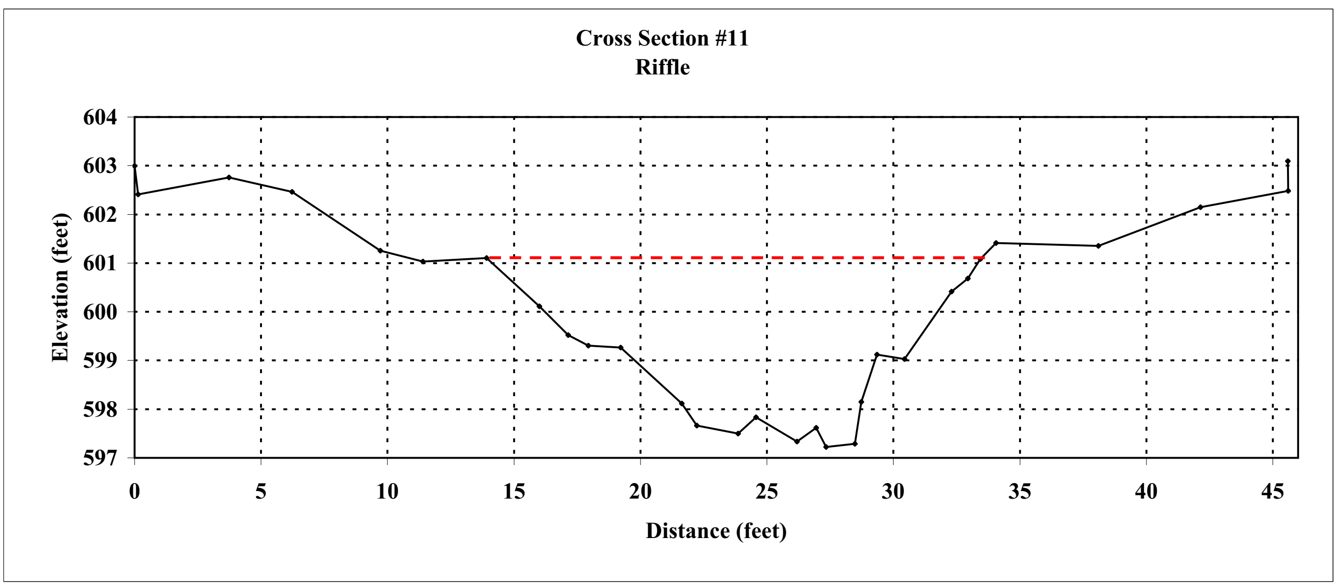
STATION (Feet)	HI (Feet)	NOTES
0.00	602.99	
0.14	602.41	
3.73	602.76	
6.22	602.46	
9.71	601.25	
11.40	601.03	
13.92	601.10	BKF
16.00	600.11	
17.14	599.52	
17.94	599.31	
19.22	599.26	
21.63	598.11	LEW
22.23	597.66	
23.86	597.50	
24.57	597.83	
26.19	597.33	
26.94	597.62	
27.34	597.22	TW
28.48	597.29	
28.73	598.15	REW
29.35	599.12	
30.44	599.03	
32.30	600.42	
32.94	600.68	
33.44	601.08	
34.06	601.42	TOB
38.10	601.36	
42.15	602.15	
45.60	602.48	
45.60	603.10	

Bankfull Hydraulic Geometry

	Width (Feet)	Depth (Feet)	Area (Sq. Ft.)
	0.0	0.0	0.0
	2.1	1.0	1.0
	1.1	1.6	1.5
	0.8	1.8	1.4
	1.3	1.8	2.3
	2.4	3.0	5.8
	0.6	3.4	1.9
	1.6	3.6	5.7
	0.7	3.3	2.5
	1.6	3.8	5.7
	0.7	3.5	2.7
	0.4	3.9	1.5
	1.1	3.8	4.4
	0.2	3.0	0.8
	0.6	2.0	1.5
	1.1	2.1	2.2
	1.9	0.7	2.6
	0.6	0.4	0.4
	0.5	0.0	0.1
	0.0		0.0
TOTALS	19.6		44.0

SUMMARY DATA (BANKFULL)

A(BKF)	44.0	W(FPA)	45+
W(BKF)	19.6	Slope	0.006
Max d	3.9		
Mean d	2.2	Area=	A
W/D	8.7	Width=	W
Entrenchment	2.3+	Depth=	D
Stream Type	C	Bankfull=	BKF
Area from Rural Regional Curve			37.6



Field Crew:	IPJ and PDB
Stream Reach:	2
Project:	Wells Creek
Drainage Area:	2.23
Date:	May-07
Monitoring Year:	2

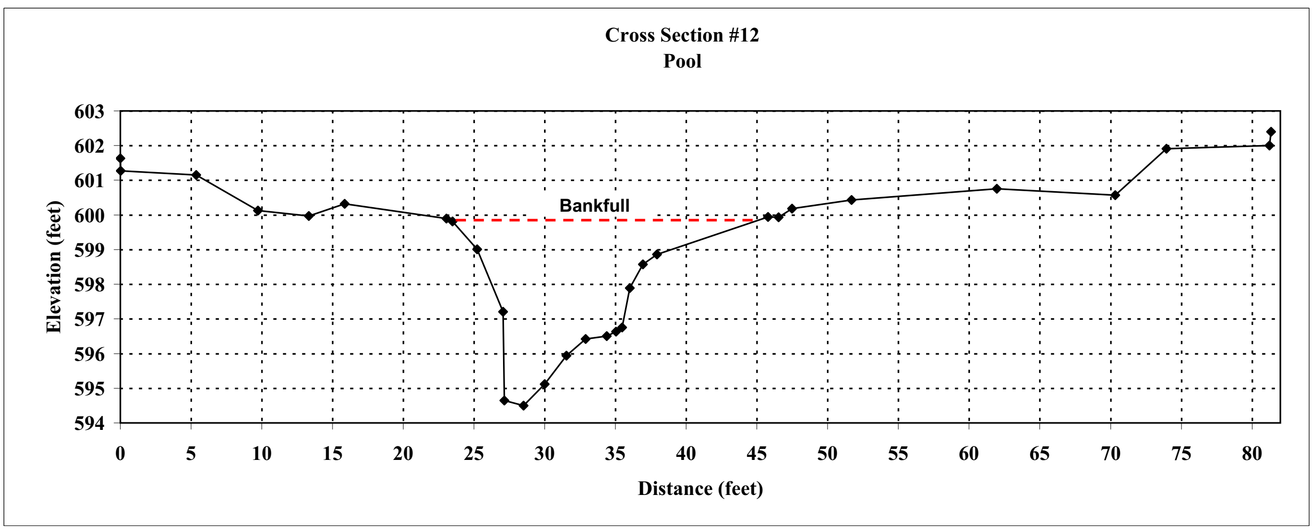
STATION (Feet)	ELEVATION (Feet)	NOTES
0.00	601.64	
0.01	601.28	
5.37	601.15	
9.73	600.12	
13.32	599.97	
15.87	600.32	
23.06	599.89	
23.49	599.82	BKF
25.22	599.01	
27.06	597.20	LEW
27.14	594.65	
28.51	594.49	TW
29.99	595.12	
31.54	595.94	
32.90	596.42	
34.39	596.51	
35.05	596.63	
35.47	596.75	REW
36.00	597.89	
36.94	598.58	
37.95	598.86	
45.79	599.94	
46.54	599.93	
47.49	600.18	TOB
51.69	600.44	
61.96	600.76	
70.34	600.57	
73.94	601.91	
81.24	602.01	
81.34	602.40	

Bankfull/Top of Bank Hydraulic Geometry

	Width (Feet)	Depth (Feet)	Area (Sq. Ft.)
	0.0	0.0	0.0
	1.7	0.8	0.7
	1.8	2.6	3.1
	0.1	5.2	0.3
	1.4	5.3	7.1
	1.5	4.7	7.4
	1.6	3.9	6.7
	1.4	3.4	4.9
	1.5	3.3	5.0
	0.7	3.2	2.1
	0.4	3.1	1.3
	0.5	1.9	1.3
	0.9	1.2	1.5
	1.0	1.0	1.1
	6.9		3.3
TOTALS	21.4		46.0

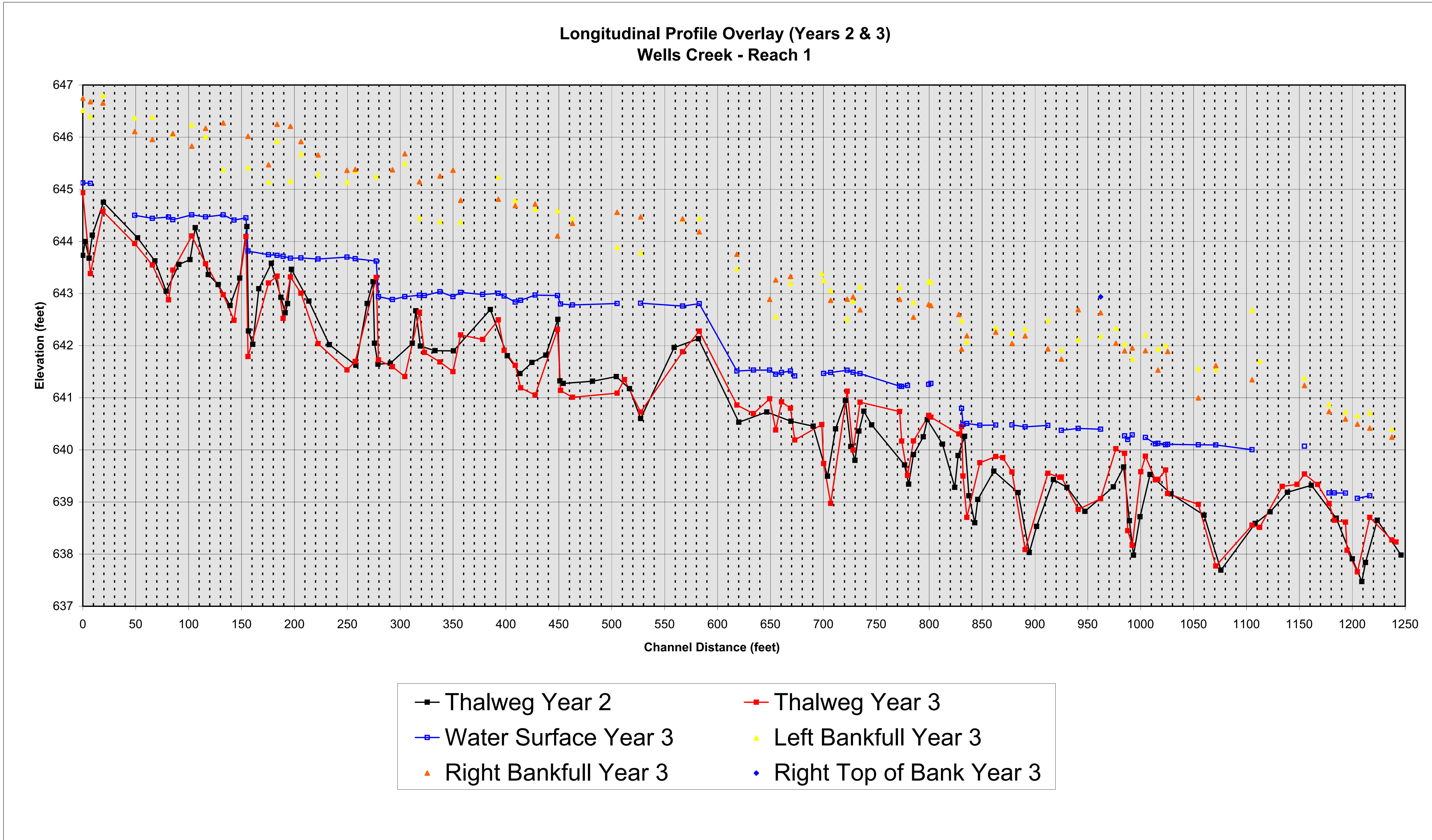
SUMMARY DATA

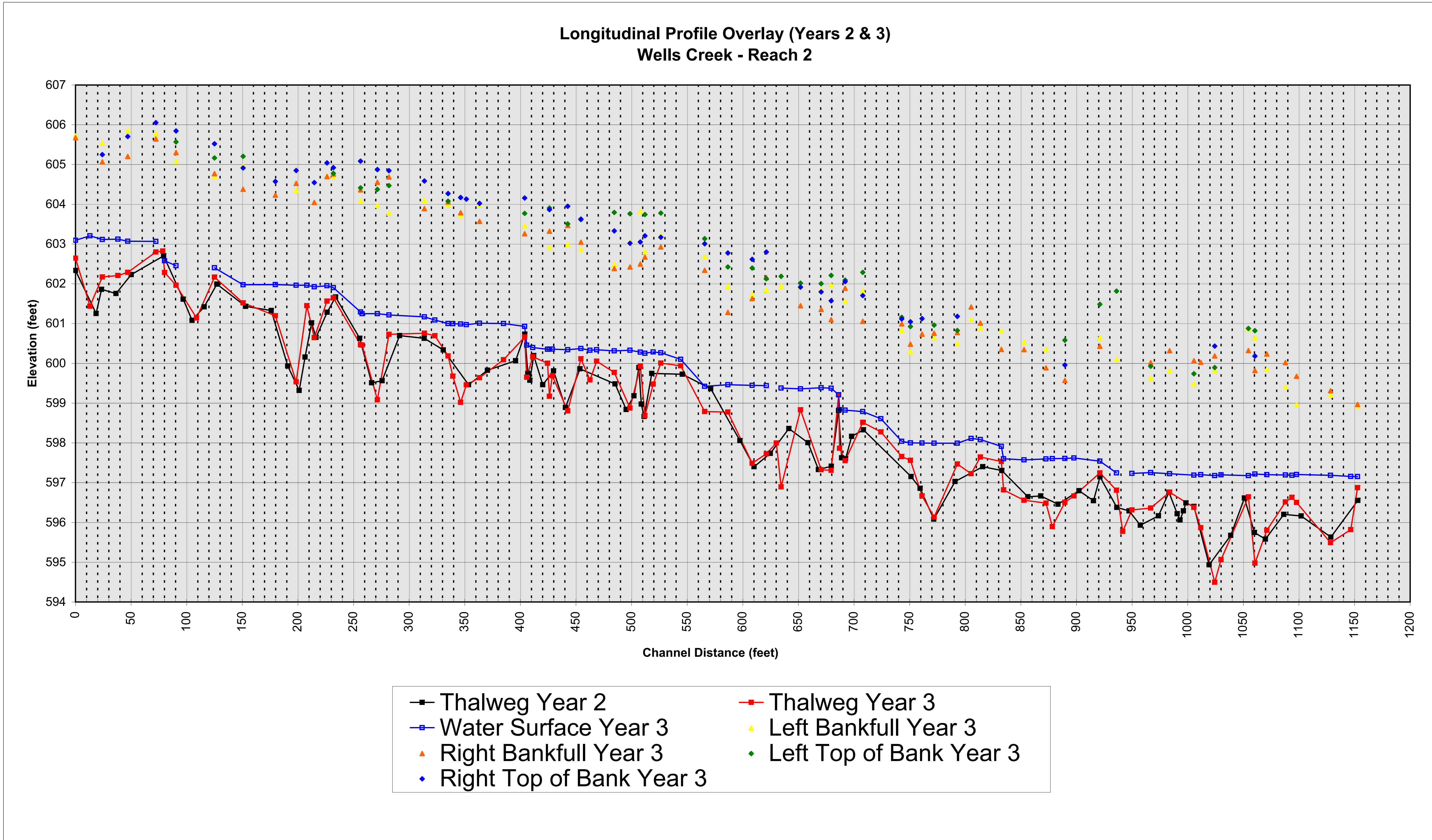
A(BKF)	46.0
W(BKF)	21.4
Max d	5.3
Mean d	2.2

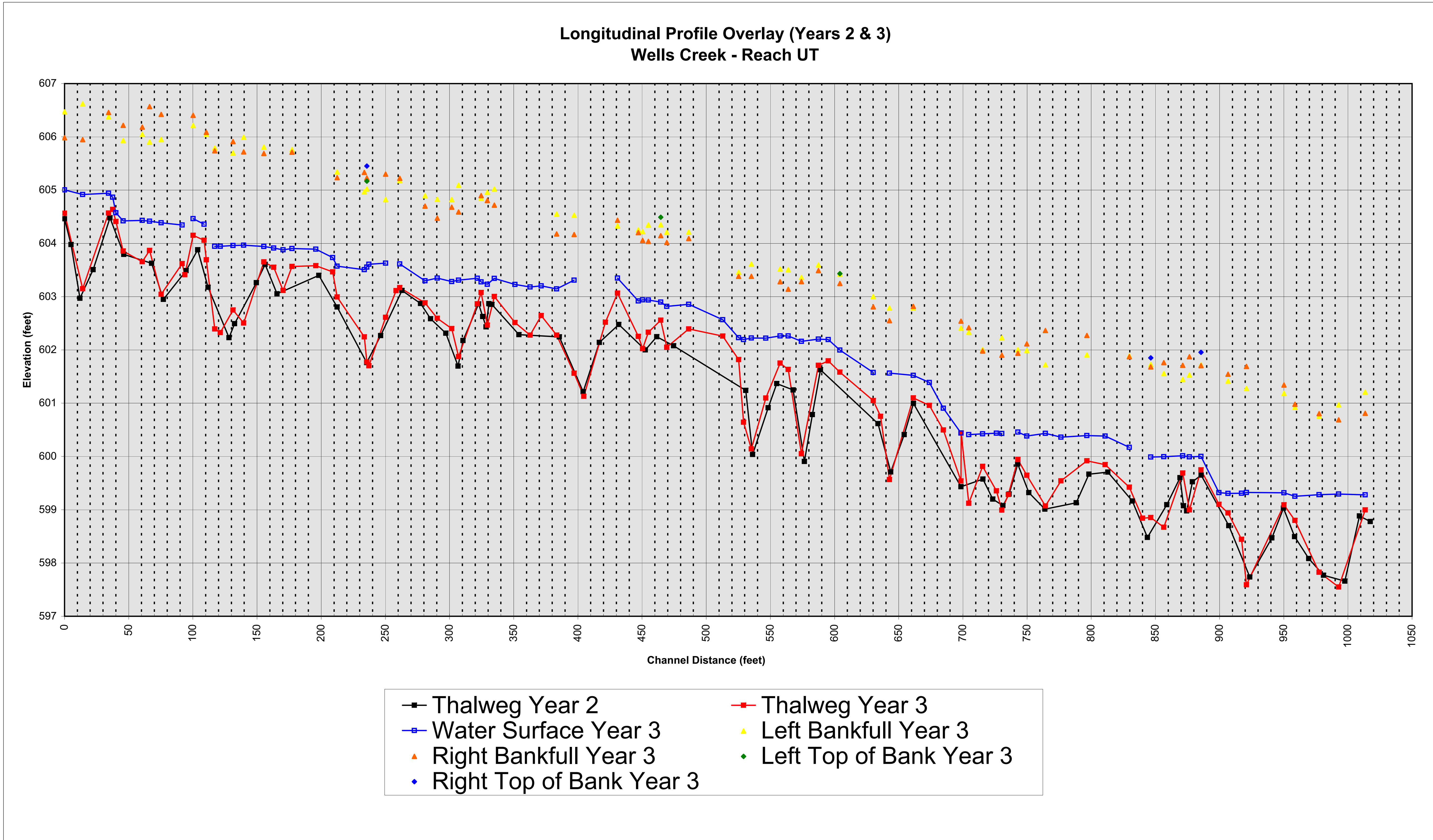


Appendix B5

Stream Longitudinal Profile


Longitudinal Profile Overlay (Years 2 & 3)
Wells Creek - Reach 1
Elevation (feet)
Channel Distance (feet)
647
646
645
644
643
642
641
640
639
638
637
0
50
100
150
200
250
300
350
400
450
500
550
600
650
700
750
800
850
900
950
1000
1050
1100
1150
1200
1250
Thalweg Year 2
Thalweg Year 3
Water Surface Year 3
Left Bankfull Year 3
Right Bankfull Year 3
Right Top of Bank Year 3


Longitudinal Profile Overlay (Years 2 & 3)
Wells Creek - Reach 2
Elevation (feet)
Channel Distance (feet)
607
606
605
604
603
602
601
600
599
598
597
596
595
594
0
50
100
150
200
250
300
350
400
450
500
550
600
650
700
750
800
850
900
950
1000
1050
1100
1150
1200
Thalweg Year 2
Thalweg Year 3
Water Surface Year 3
Left Bankfull Year 3
Right Bankfull Year 3
Left Top of Bank Year 3
Right Top of Bank Year 3



Longitudinal Profile Overlay (Years 2 & 3)
Wells Creek - Reach UT
Elevation (feet)
607
606
605
604
603
602
601
600
599
598
597
0
50
100
150
200
250
300
350
400
450
500
550
600
650
700
750
800
850
900
950
1000
1050
Channel Distance (feet)
Thalweg Year 2
Thalweg Year 3
Water Surface Year 3
Left Bankfull Year 3
Right Bankfull Year 3
Left Top of Bank Year 3
Right Top of Bank Year 3

Appendix B6

Stream Pebble Counts

PEBBLE COUNT

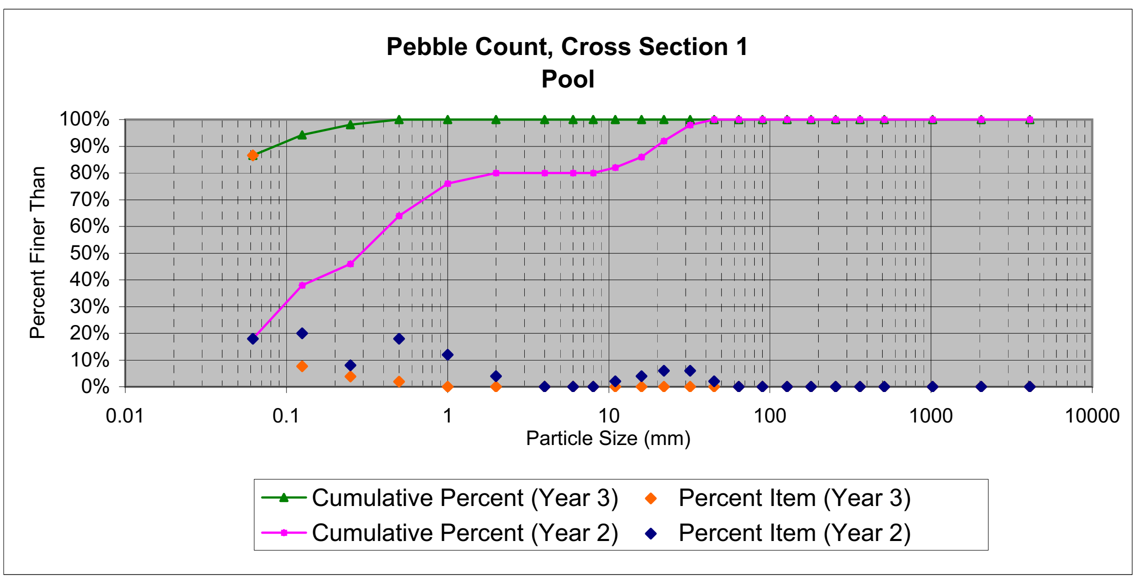
Site: Wells Creek

Party: IPJ & PDB

Date: 10/16/07

PARTICLE COUNT

Inches	Particle	Millimeters		CS 1	TOT#	ITEM %	% CUM
	Silt/Clay	< 0.062	**S/C**	45	45	87%	87%
	Very Fine	.062-.125	SAND	4	4	8%	94%
	Fine	.125-.25		2	2	4%	98%
	Medium	.25-.50		1	1	2%	100%
	Coarse	.50-1.0			0	0%	100%
.04-.08	Very Coarse	1.0-2			0	0%	100%
.08-.16	Very Fine	2.0-4.0	GRAVEL		0	0%	100%
.16-.22	Fine	4-5.7			0	0%	100%
.22-.31	Fine	5.7-8			0	0%	100%
.31-.44	Medium	8-11.3			0	0%	100%
.44-.63	Medium	11.3-16			0	0%	100%
.63-.89	Coarse	16-22.6			0	0%	100%
.89-1.26	Coarse	22.6-32			0	0%	100%
1.26-1.77	Very Coarse	32-45			0	0%	100%
1.77-2.5	Very Coarse	45-64			0	0%	100%
2.5-3.5	Small	64-90	COBBLE		0	0%	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%
				TOTALS →	52	**100%**	**100%**



PEBBLE COUNT

Site: Wells Creek

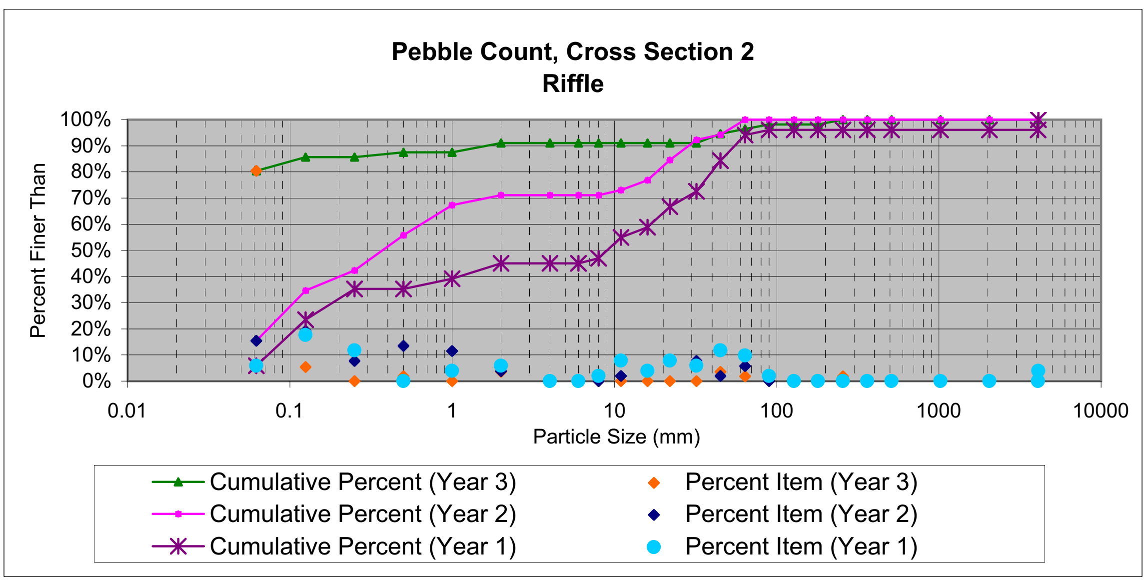
Party: IPJ & PDB

Date: 10/16/07

SEPI ENGINEERING GROUP

PARTICLE COUNT

Inches	Particle	Millimeters		CS 2	TOT#	ITEM %	% CUM
	Silt/Clay	< 0.062	**S/C**	45	45	80%	80%
	Very Fine	.062-.125	SAND	3	3	5%	86%
	Fine	.125-.25			0	0%	86%
	Medium	.25-.50		1	1	2%	88%
	Coarse	.50-1.0			0	0%	88%
.04-.08	Very Coarse	1.0-2		2	2	4%	91%
.08-.16	Very Fine	2.0-4.0	GRAVEL		0	0%	91%
.16-.22	Fine	4-5.7			0	0%	91%
.22-.31	Fine	5.7-8			0	0%	91%
.31-.44	Medium	8-11.3			0	0%	91%
.44-.63	Medium	11.3-16			0	0%	91%
.63-.89	Coarse	16-22.6			0	0%	91%
.89-1.26	Coarse	22.6-32			0	0%	91%
1.26-1.77	Very Coarse	32-45		2	2	4%	95%
1.77-2.5	Very Coarse	45-64		1	1	2%	96%
2.5-3.5	Small	64-90	COBBLE	1	1	2%	98%
3.5-5.0	Small	90-128			0	0%	98%
5.0-7.1	Large	128-180			0	0%	98%
7.1-10.1	Large	180-256		1	1	2%	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%
				TOTALS →	56	**100%**	**100%**



PEBBLE COUNT

Site: Wells Creek

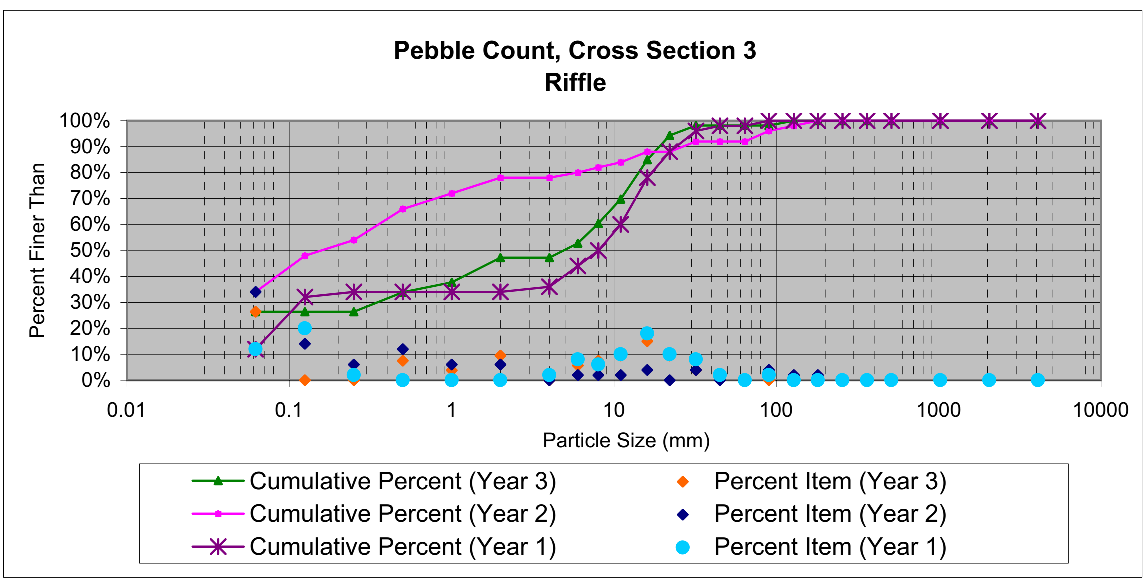
Party: IPJ & PDB

Date: 10/16/07

SEPI ENGINEERING GROUP

PARTICLE COUNT

Inches	Particle	Millimeters		CS 3	TOT#	ITEM %	% CUM
	Silt/Clay	< 0.062	**S/C**	14	14	26%	26%
	Very Fine	.062-.125	SAND		0	0%	26%
	Fine	.125-.25			0	0%	26%
	Medium	.25-.50		4	4	8%	34%
	Coarse	.50-1.0		2	2	4%	38%
.04-.08	Very Coarse	1.0-2		5	5	9%	47%
.08-.16	Very Fine	2.0-4.0	GRAVEL		0	0%	47%
.16-.22	Fine	4-5.7		3	3	6%	53%
.22-.31	Fine	5.7-8		4	4	8%	60%
.31-.44	Medium	8-11.3		5	5	9%	70%
.44-.63	Medium	11.3-16		8	8	15%	85%
.63-.89	Coarse	16-22.6		5	5	9%	94%
.89-1.26	Coarse	22.6-32		2	2	4%	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		0	0%	98%
3.5-5.0	Small	90-128		1	1	2%	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%
				TOTALS →	53	**100%**	**100%**



PEBBLE COUNT

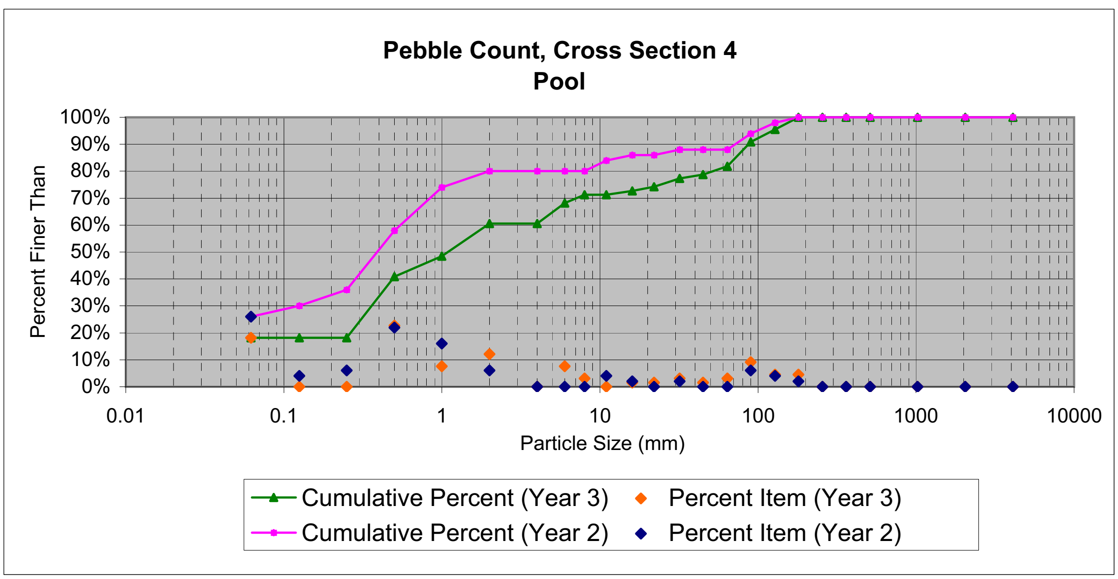
Site: Wells Creek

Party: IPJ & PDB

Date: 10/16/07

PARTICLE COUNT

Inches	Particle	Millimeters		CS 4	TOT#	ITEM %	% CUM
	Silt/Clay	< 0.062	**S/C**	12	12	18%	18%
	Very Fine	.062-.125	SAND		0	0%	18%
	Fine	.125-.25	SAND		0	0%	18%
	Medium	.25-.50	SAND	15	15	23%	41%
	Coarse	.50-1.0	SAND	5	5	8%	48%
.04-.08	Very Coarse	1.0-2	SAND	8	8	12%	61%
.08-.16	Very Fine	2.0-4.0	GRAVEL		0	0%	61%
.16-.22	Fine	4-5.7	GRAVEL	5	5	8%	68%
.22-.31	Fine	5.7-8	GRAVEL	2	2	3%	71%
.31-.44	Medium	8-11.3	GRAVEL		0	0%	71%
.44-.63	Medium	11.3-16	GRAVEL	1	1	2%	73%
.63-.89	Coarse	16-22.6	GRAVEL	1	1	2%	74%
.89-1.26	Coarse	22.6-32	GRAVEL	2	2	3%	77%
1.26-1.77	Very Coarse	32-45	GRAVEL	1	1	2%	79%
1.77-2.5	Very Coarse	45-64	GRAVEL	2	2	3%	82%
2.5-3.5	Small	64-90	COBBLE	6	6	9%	91%
3.5-5.0	Small	90-128	COBBLE	3	3	5%	95%
5.0-7.1	Large	128-180	COBBLE	3	3	5%	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%
				TOTALS →	66	**100%**	**100%**



PEBBLE COUNT

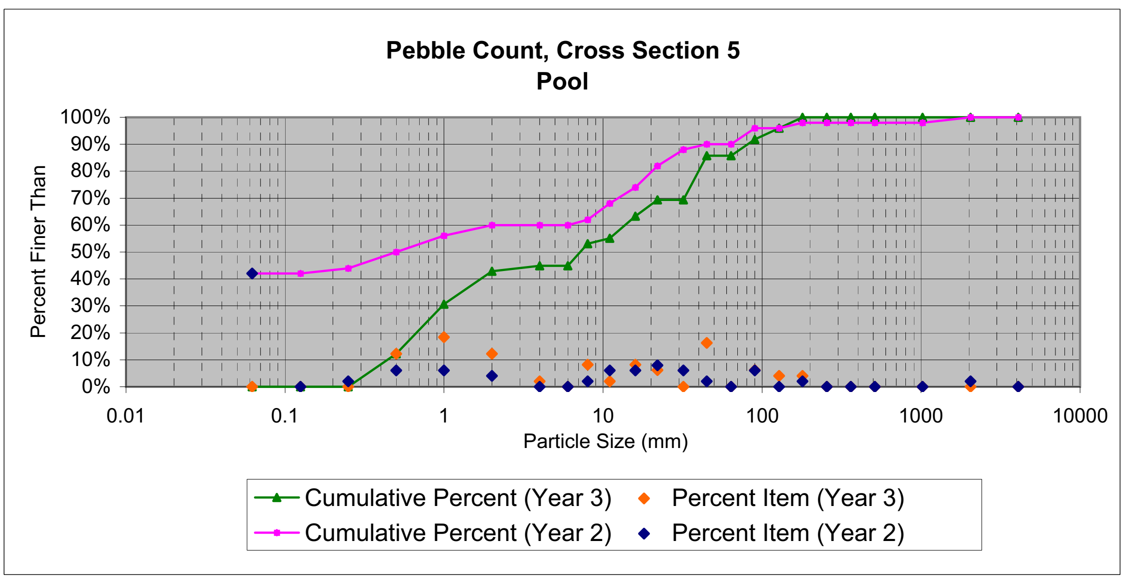
Site: Wells Creek

Party: IPJ & PDB

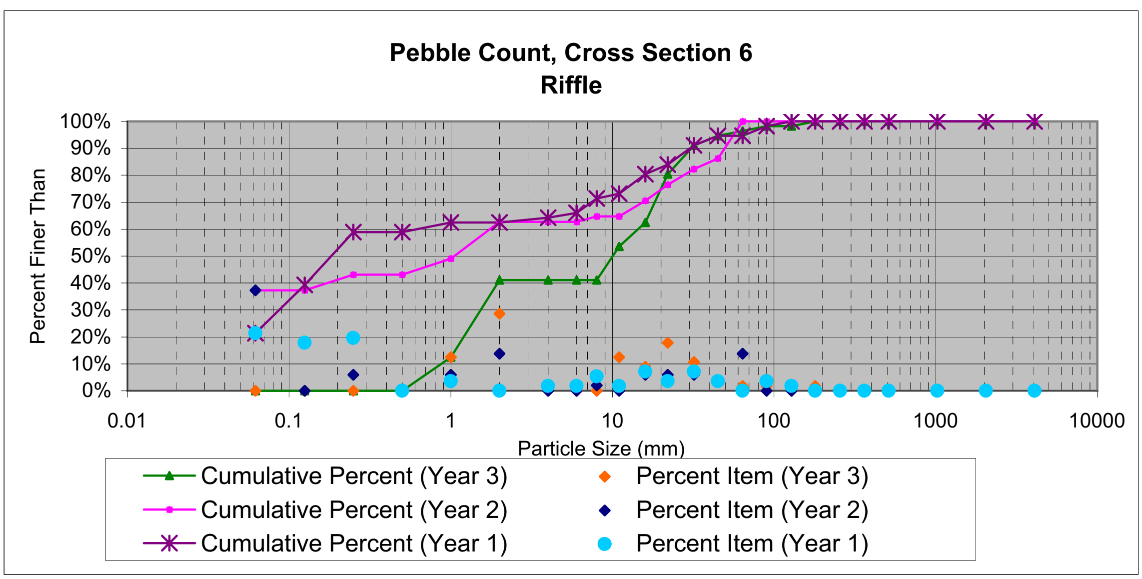
Date: 10/17/07

PARTICLE COUNT

Inches	Particle	Millimeters		CS 5	TOT#	ITEM %	% CUM
	Silt/Clay	< 0.062	**S/C**		0	0%	0%
	Very Fine	.062-.125	SAND		0	0%	0%
	Fine	.125-.25			0	0%	0%
	Medium	.25-.50		6	6	12%	12%
	Coarse	.50-1.0		9	9	18%	31%
.04-.08	Very Coarse	1.0-2		6	6	12%	43%
.08-.16	Very Fine	2.0-4.0	GRAVEL	1	1	2%	45%
.16-.22	Fine	4-5.7			0	0%	45%
.22-.31	Fine	5.7-8		4	4	8%	53%
.31-.44	Medium	8-11.3		1	1	2%	55%
.44-.63	Medium	11.3-16		4	4	8%	63%
.63-.89	Coarse	16-22.6		3	3	6%	69%
.89-1.26	Coarse	22.6-32			0	0%	69%
1.26-1.77	Very Coarse	32-45		8	8	16%	86%
1.77-2.5	Very Coarse	45-64			0	0%	86%
2.5-3.5	Small	64-90	COBBLE	3	3	6%	92%
3.5-5.0	Small	90-128		2	2	4%	96%
5.0-7.1	Large	128-180		2	2	4%	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%
				TOTALS ⟶	49	**100%**	**100%**



PEBBLE COUNT							
Site: Wells Creek							
Party: IPJ & PDB							
Date: 10/17/07				**PARTICLE COUNT**			
				CS 6			
Inches	**Particle**	**Millimeters**			TOT#	ITEM %	% CUM
	Silt/Clay	< 0.062	**S/C**		0	0%	0%
	Very Fine	.062-.125	SAND		0	0%	0%
	Fine	.125-.25			0	0%	0%
	Medium	.25-.50			0	0%	0%
	Coarse	.50-1.0		7	7	13%	13%
.04-.08	Very Coarse	1.0-2		16	16	29%	41%
.08-.16	Very Fine	2.0-4.0	GRAVEL		0	0%	41%
.16-.22	Fine	4-5.7			0	0%	41%
.22-.31	Fine	5.7-8			0	0%	41%
.31-.44	Medium	8-11.3		7	7	13%	54%
.44-.63	Medium	11.3-16		5	5	9%	63%
.63-.89	Coarse	16-22.6		10	10	18%	80%
.89-1.26	Coarse	22.6-32		6	6	11%	91%
1.26-1.77	Very Coarse	32-45		2	2	4%	95%
1.77-2.5	Very Coarse	45-64		1	1	2%	96%
2.5-3.5	Small	64-90	COBBLE	1	1	2%	98%
3.5-5.0	Small	90-128			0	0%	98%
5.0-7.1	Large	128-180		1	1	2%	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%
				TOTALS ⟶	56	**100%**	**100%**



PEBBLE COUNT

Site: Wells Creek

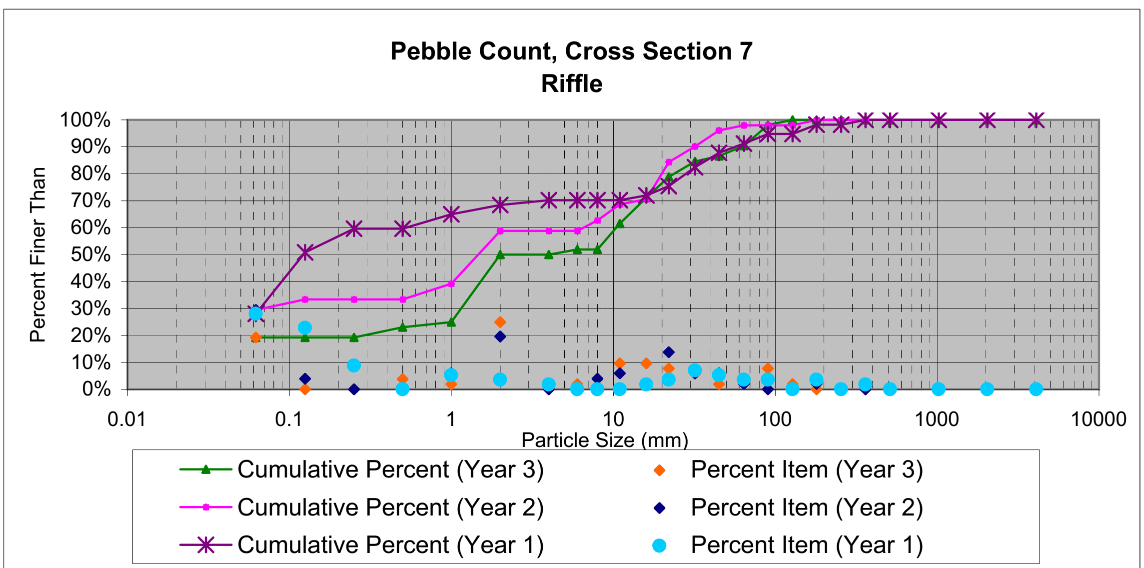
Party: IPJ & PDB

Date: 10/17/07

SEPI ENGINEERING GROUP

PARTICLE COUNT

Inches	Particle	Millimeters		CS 7	TOT#	ITEM %	% CUM
	Silt/Clay	< 0.062	**S/C**	10	10	19%	19%
	Very Fine	.062-.125	SAND		0	0%	19%
	Fine	.125-.25			0	0%	19%
	Medium	.25-.50		2	2	4%	23%
	Coarse	.50-1.0		1	1	2%	25%
.04-.08	Very Coarse	1.0-2		13	13	25%	50%
.08-.16	Very Fine	2.0-4.0	GRAVEL		0	0%	50%
.16-.22	Fine	4-5.7		1	1	2%	52%
.22-.31	Fine	5.7-8			0	0%	52%
.31-.44	Medium	8-11.3		5	5	10%	62%
.44-.63	Medium	11.3-16		5	5	10%	71%
.63-.89	Coarse	16-22.6		4	4	8%	79%
.89-1.26	Coarse	22.6-32		3	3	6%	85%
1.26-1.77	Very Coarse	32-45		1	1	2%	87%
1.77-2.5	Very Coarse	45-64		2	2	4%	90%
2.5-3.5	Small	64-90	COBBLE	4	4	8%	98%
3.5-5.0	Small	90-128		1	1	2%	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%
				TOTALS →	52	**100%**	**100%**



PEBBLE COUNT

Site: Wells Creek

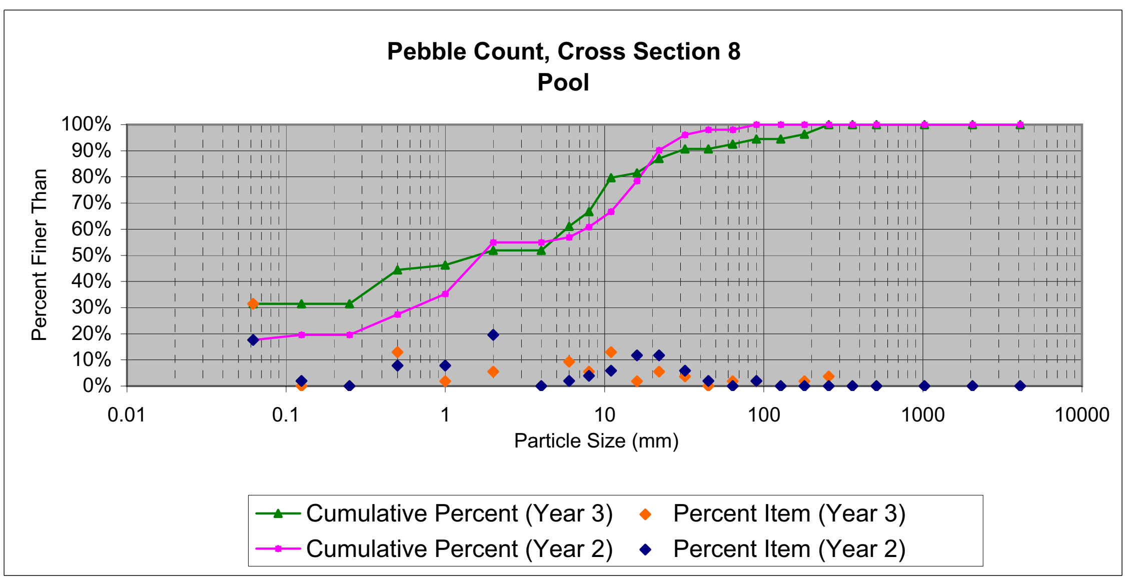
Party: IPJ & PDB

Date: 10/17/07

SEPI ENGINEERING GROUP

PARTICLE COUNT

Inches	Particle	Millimeters		CS 8	TOT#	ITEM %	% CUM
	Silt/Clay	< 0.062	**S/C**	17	17	31%	31%
	Very Fine	.062-.125	SAND		0	0%	31%
	Fine	.125-.25			0	0%	31%
	Medium	.25-.50		7	7	13%	44%
	Coarse	.50-1.0		1	1	2%	46%
.04-.08	Very Coarse	1.0-2		3	3	6%	52%
.08-.16	Very Fine	2.0-4.0	GRAVEL		0	0%	52%
.16-.22	Fine	4-5.7		5	5	9%	61%
.22-.31	Fine	5.7-8		3	3	6%	67%
.31-.44	Medium	8-11.3		7	7	13%	80%
.44-.63	Medium	11.3-16		1	1	2%	81%
.63-.89	Coarse	16-22.6		3	3	6%	87%
.89-1.26	Coarse	22.6-32		2	2	4%	91%
1.26-1.77	Very Coarse	32-45			0	0%	91%
1.77-2.5	Very Coarse	45-64		1	1	2%	93%
2.5-3.5	Small	64-90	COBBLE	1	1	2%	94%
3.5-5.0	Small	90-128			0	0%	94%
5.0-7.1	Large	128-180		1	1	2%	96%
7.1-10.1	Large	180-256		2	2	4%	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%
				TOTALS →	54	**100%**	**100%**



PEBBLE COUNT

Site: Wells Creek

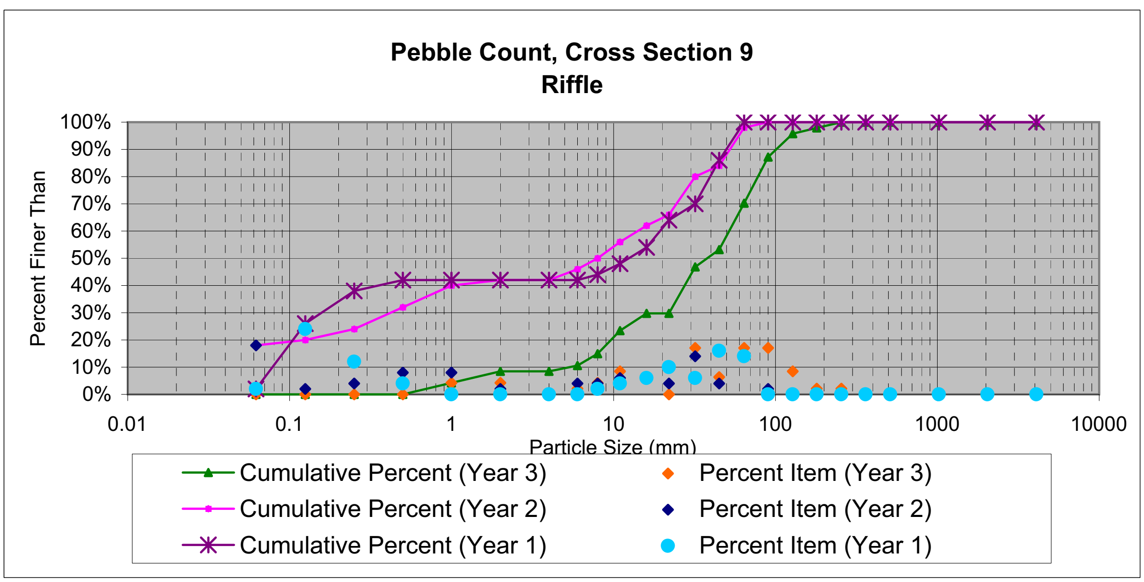
Party: IPJ & PDB

Date: 10/17/07

SEPI ENGINEERING GROUP

PARTICLE COUNT

Inches	Particle	Millimeters		CS 9	TOT#	ITEM %	% CUM
	Silt/Clay	< 0.062	**S/C**		0	0%	0%
	Very Fine	.062-.125	SAND		0	0%	0%
	Fine	.125-.25			0	0%	0%
	Medium	.25-.50			0	0%	0%
	Coarse	.50-1.0		2	2	4%	4%
.04-.08	Very Coarse	1.0-2		2	2	4%	9%
.08-.16	Very Fine	2.0-4.0	GRAVEL		0	0%	9%
.16-.22	Fine	4-5.7		1	1	2%	11%
.22-.31	Fine	5.7-8		2	2	4%	15%
.31-.44	Medium	8-11.3		4	4	9%	23%
.44-.63	Medium	11.3-16		3	3	6%	30%
.63-.89	Coarse	16-22.6			0	0%	30%
.89-1.26	Coarse	22.6-32		8	8	17%	47%
1.26-1.77	Very Coarse	32-45		3	3	6%	53%
1.77-2.5	Very Coarse	45-64		8	8	17%	70%
2.5-3.5	Small	64-90	COBBLE	8	8	17%	87%
3.5-5.0	Small	90-128		4	4	9%	96%
5.0-7.1	Large	128-180		1	1	2%	98%
7.1-10.1	Large	180-256		1	1	2%	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%
				TOTALS ⟶	47	**100%**	**100%**



PEBBLE COUNT

Site: Wells Creek

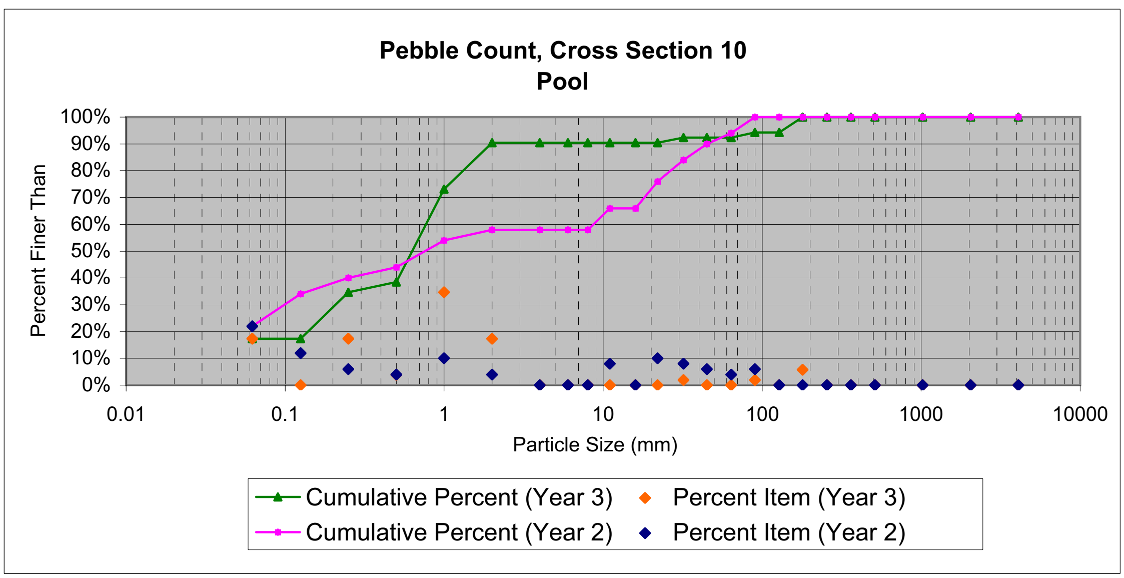
Party: IPJ & PDB

Date: 10/17/07

SEPI ENGINEERING GROUP

PARTICLE COUNT

Inches	Particle	Millimeters		CS 10	TOT#	ITEM %	% CUM
	Silt/Clay	< 0.062	**S/C**	9	9	17%	17%
	Very Fine	.062-.125	SAND		0	0%	17%
	Fine	.125-.25		9	9	17%	35%
	Medium	.25-.50		2	2	4%	38%
	Coarse	.50-1.0		18	18	35%	73%
.04-.08	Very Coarse	1.0-2		9	9	17%	90%
.08-.16	Very Fine	2.0-4.0	GRAVEL		0	0%	90%
.16-.22	Fine	4-5.7			0	0%	90%
.22-.31	Fine	5.7-8			0	0%	90%
.31-.44	Medium	8-11.3			0	0%	90%
.44-.63	Medium	11.3-16			0	0%	90%
.63-.89	Coarse	16-22.6			0	0%	90%
.89-1.26	Coarse	22.6-32		1	1	2%	92%
1.26-1.77	Very Coarse	32-45			0	0%	92%
1.77-2.5	Very Coarse	45-64			0	0%	92%
2.5-3.5	Small	64-90	COBBLE	1	1	2%	94%
3.5-5.0	Small	90-128			0	0%	94%
5.0-7.1	Large	128-180		3	3	6%	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%
				TOTALS →	52	**100%**	**100%**



PEBBLE COUNT

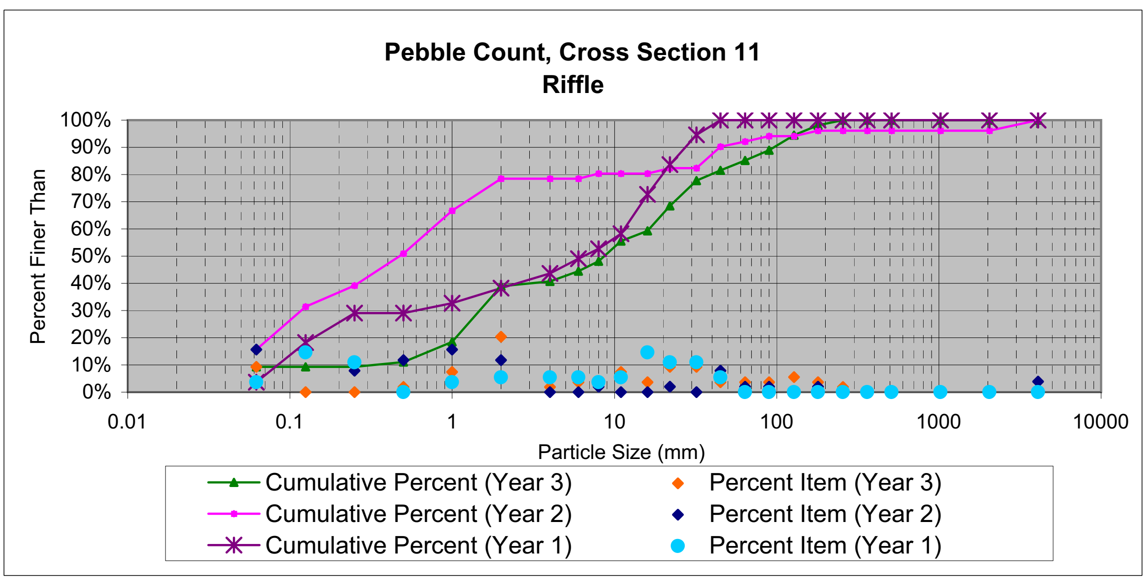
Site: Wells Creek

Party: IPJ & PDB

Date: 10/17/07

PARTICLE COUNT

Inches	Particle	Millimeters		CS 11	TOT#	ITEM %	% CUM
	Silt/Clay	< 0.062	**S/C**	5	5	9%	9%
	Very Fine	.062-.125	SAND		0	0%	9%
	Fine	.125-.25			0	0%	9%
	Medium	.25-.50		1	1	2%	11%
	Coarse	.50-1.0		4	4	7%	19%
.04-.08	Very Coarse	1.0-2		11	11	20%	39%
.08-.16	Very Fine	2.0-4.0	GRAVEL	1	1	2%	41%
.16-.22	Fine	4-5.7		2	2	4%	44%
.22-.31	Fine	5.7-8		2	2	4%	48%
.31-.44	Medium	8-11.3		4	4	7%	56%
.44-.63	Medium	11.3-16		2	2	4%	59%
.63-.89	Coarse	16-22.6		5	5	9%	69%
.89-1.26	Coarse	22.6-32		5	5	9%	78%
1.26-1.77	Very Coarse	32-45		2	2	4%	81%
1.77-2.5	Very Coarse	45-64		2	2	4%	85%
2.5-3.5	Small	64-90	COBBLE	2	2	4%	89%
3.5-5.0	Small	90-128		3	3	6%	94%
5.0-7.1	Large	128-180		2	2	4%	98%
7.1-10.1	Large	180-256		1	1	2%	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%
				TOTALS →	54	**100%**	**100%**



PEBBLE COUNT

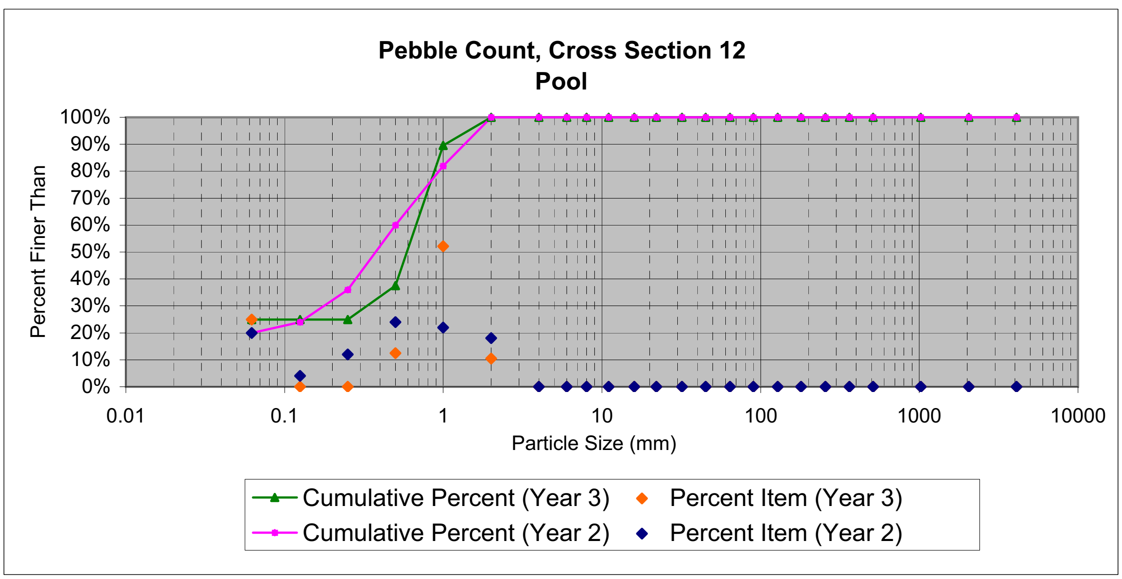
Site: Wells Creek

Party: IPJ & PDB

Date: 10/17/07

PARTICLE COUNT

Inches	Particle	Millimeters		CS 12	TOT#	ITEM %	% CUM
	Silt/Clay	< 0.062	**S/C**	12	12	25%	25%
	Very Fine	.062-.125	SAND		0	0%	25%
	Fine	.125-.25			0	0%	25%
	Medium	.25-.50		6	6	13%	38%
	Coarse	.50-1.0		25	25	52%	90%
.04-.08	Very Coarse	1.0-2		5	5	10%	100%
.08-.16	Very Fine	2.0-4.0	GRAVEL		0	0%	100%
.16-.22	Fine	4-5.7			0	0%	100%
.22-.31	Fine	5.7-8			0	0%	100%
.31-.44	Medium	8-11.3			0	0%	100%
.44-.63	Medium	11.3-16			0	0%	100%
.63-.89	Coarse	16-22.6			0	0%	100%
.89-1.26	Coarse	22.6-32			0	0%	100%
1.26-1.77	Very Coarse	32-45			0	0%	100%
1.77-2.5	Very Coarse	45-64			0	0%	100%
2.5-3.5	Small	64-90	COBBLE		0	0%	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%
				TOTALS →	48	**100%**	**100%**



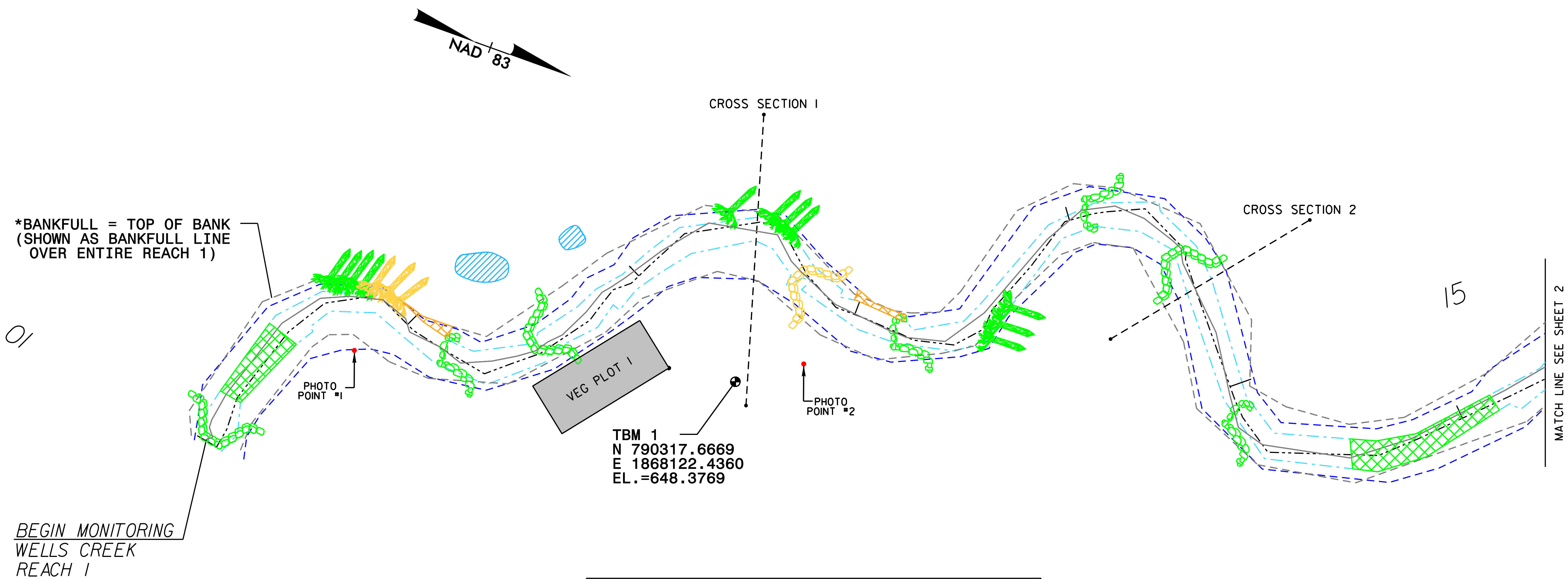
Appendix C

Plan View Sheets

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

PROJECT REFERENCE NO.	SHEET NO.
414	1
PROJECT ENGINEER	

10 0 20
SCALE



CROSS SECTION STAKING			
	NORTHING	EASTING	ELEVATION
XSC 1 LEFT	790305.5148	1868218.0170	647.6658
XSC 1 RIGHT	790314.0373	1868113.8230	649.1659
XSC 2 LEFT	790110.5344	1868176.2530	647.0516
XSC 2 RIGHT	790182.8344	1868135.0260	647.4296

LEGEND

THALWEG 2006
BANKFULL 2006
THALWEG 2007
EDGE OF WATER 2007
BANKFULL 2007
TOP OF BANK 2007
CROSS-SECTIONS

BANK EROSION
SEVERE BANK EROSION
AGGRADATION (GRASSES)
AGGRADATON (CATTAILS)

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

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

WELLS CREEK - REACH 1

Ecosystem Enhancement PROGRAM

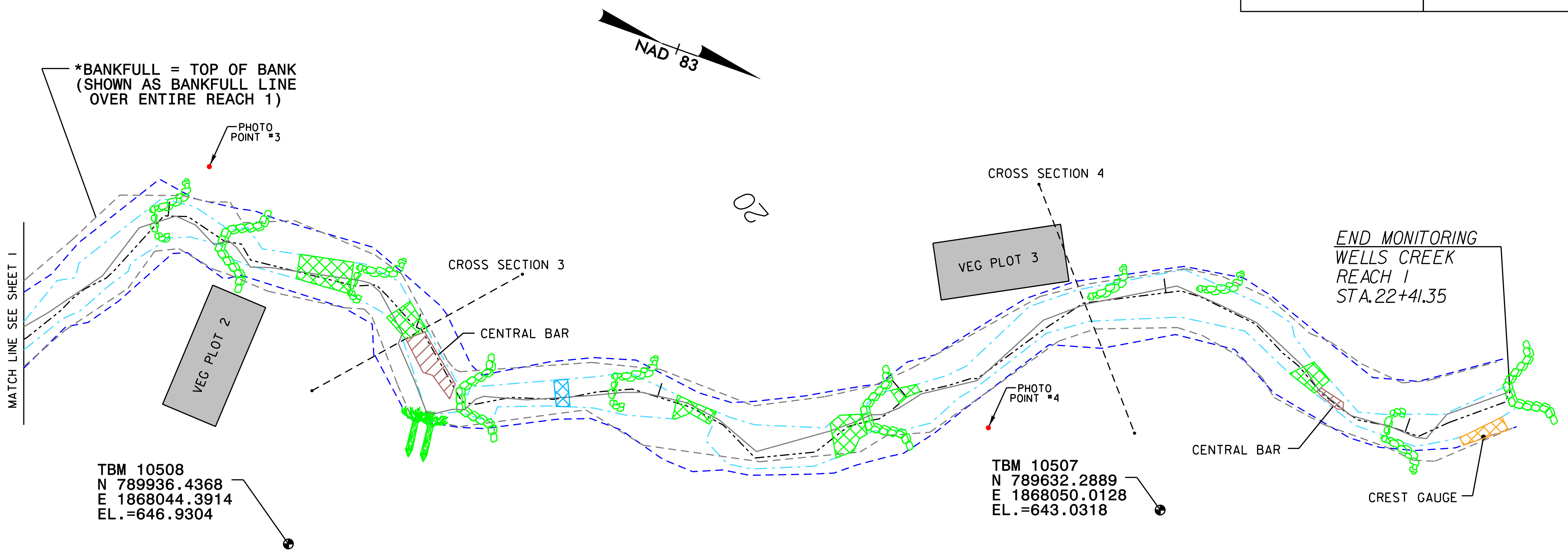
LOCATION:
WELLS CREEK
STREAM MONITORING - YEAR 3

PROJ #: 414
COUNTY: ALAMANCE
PREPARED BY: IPJ
CHECKED BY: PDB
DATE: 5/14/07

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

PROJECT REFERENCE NO.	SHEET NO.
414	2
PROJECT ENGINEER	

10 0 20
SCALE



CROSS SECTION STAKING

	NORTHING	EASTING	ELEVATION
XSC 3 LEFT	789852.9624	1868136.6510	645.8511
XSC 3 RIGHT	789927.1424	1868097.5820	645.5129
XSC 4 LEFT	789672.2703	1868164.3220	645.0177
XSC 4 RIGHT	789640.7034	1868076.9910	643.5958

LEGEND

THALWEG 2006
BANKFULL 2006
THALWEG 2007
EDGE OF WATER 2007
BANKFULL 2007
TOP OF BANK 2007
CROSS-SECTIONS

BANK EROSION
SEVERE BANK EROSION
AGGRADATION (GRASSES)
AGGRADATON (CATTAILS)

STRUCTURE TYPES

ROCK CROSS VANE
J-HOOK VANE
ROOTWAD
ROCK VANE

COLOR CODE FOR STRUCTURES

GOOD STRUCTURE
STRUCTURE WITH POTENTIAL PROBLEM
FAILING STRUCTURE

WELLS CREEK - REACH 1

Ecosystem Enhancement PROGRAM

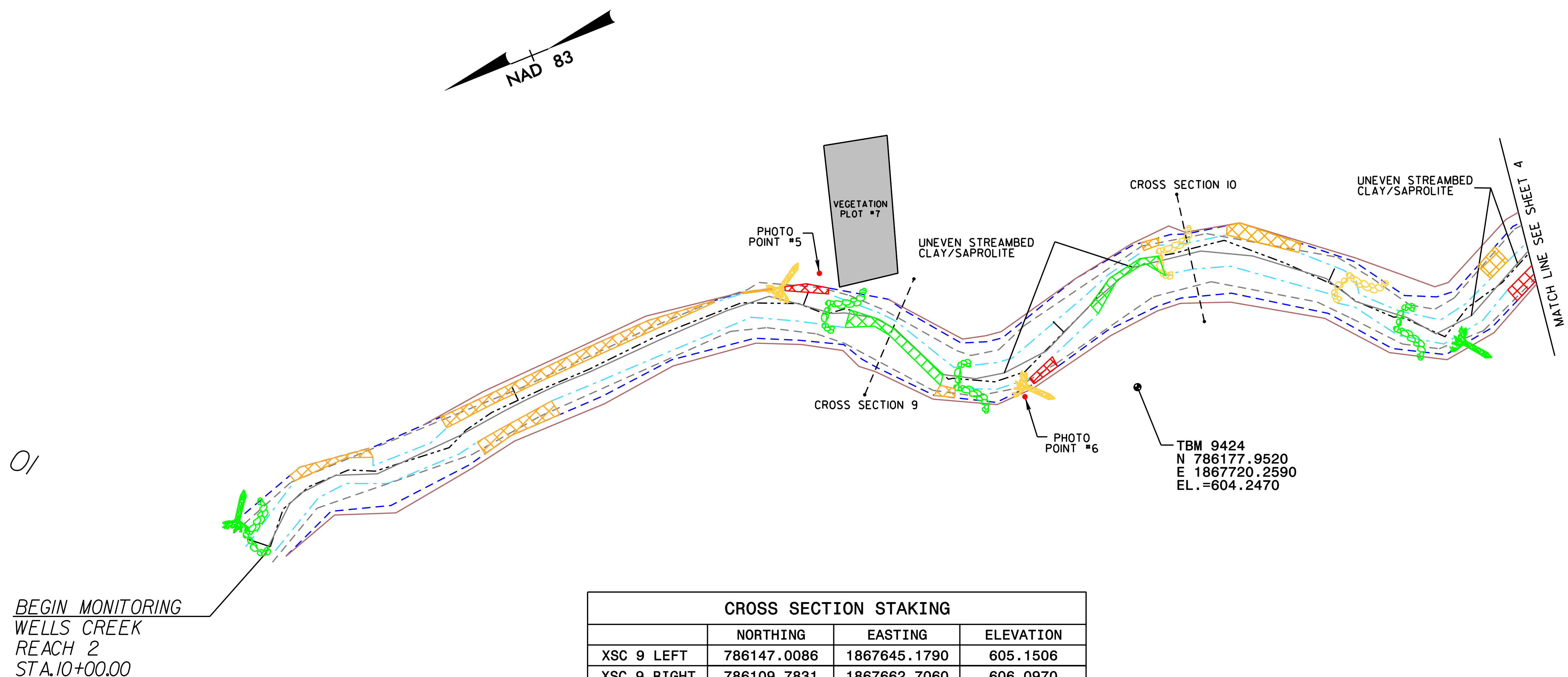
LOCATION:
WELLS CREEK
STREAM MONITORING - YEAR 3

PROJ #: 414 COUNTY: ALAMANCE
PREPARED BY: IPJ
CHECKED BY: PDB DATE: 5/14/07

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

PROJECT REFERENCE NO.	SHEET NO.
414	3
PROJECT ENGINEER	

10 0 20
SCALE



CROSS SECTION STAKING			
	NORTHING	EASTING	ELEVATION
XSC 9 LEFT	786147.0086	1867645.1790	605.1506
XSC 9 RIGHT	786109.7831	1867662.7060	606.0970
XSC 10 LEFT	786229.4962	1867681.8020	604.8637
XSC 10 RIGHT	786208.5385	1867718.8310	604.6050

LEGEND

- THALWEG 2006
- BANKFULL 2006
- THALWEG 2007
- EDGE OF WATER 2007
- BANKFULL 2007
- TOP OF BANK 2007
- CROSS-SECTIONS

- BANK EROSION
- SEVERE BANK EROSION
- AGGRADATION (GRASSES)
- AGGRADATON (CATTAILS)

STRUCTURE TYPES

- ROCK CROSS VANE
- J-HOOK VANE
- ROOTWAD
- ROCK VANE

COLOR CODE FOR STRUCTURES

- GOOD STRUCTURE
- STRUCTURE WITH POTENTIAL PROBLEM
- FAILING STRUCTURE

WELLS CREEK - REACH 2

Ecosystem Enhancement PROGRAM

LOCATION: WELLS CREEK STREAM MONITORING - YEAR 3

PROJ #: 414 COUNTY: ALAMANCE

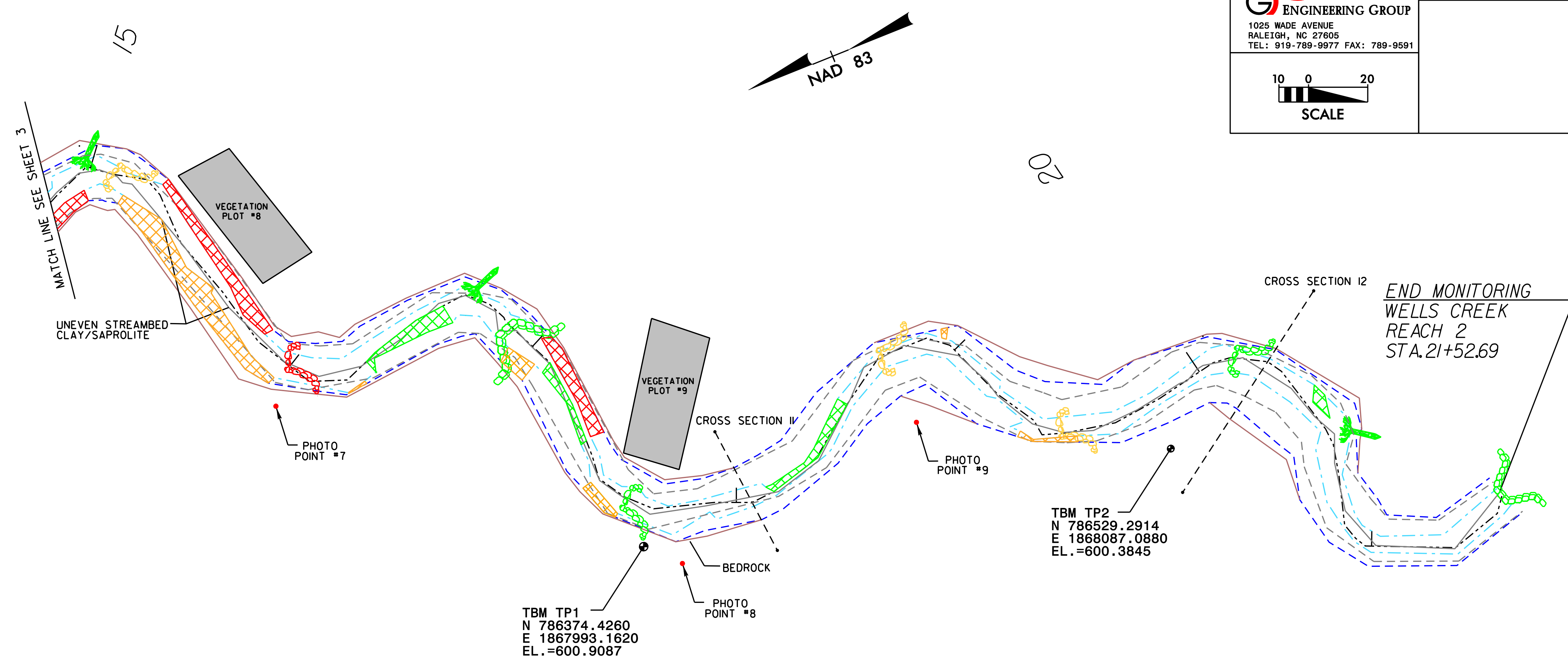
PREPARED BY: IPJ

CHECKED BY: PDB DATE: 5/14/07

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

PROJECT REFERENCE NO.	SHEET NO.
414	4
PROJECT ENGINEER	

10 0 20
SCALE



CROSS SECTION STAKING			
	NORTHING	EASTING	ELEVATION
XSC 11 LEFT	786418.2249	1867980.2450	602.9365
XSC 11 RIGHT	786407.2489	1868024.1950	603.0278
XSC 12 LEFT	786600.8247	1868079.4820	601.5332
XSC 12 RIGHT	786522.4359	1868100.7920	602.3083

LEGEND

- THALWEG 2006
- BANKFULL 2006
- THALWEG 2007
- EDGE OF WATER 2007
- BANKFULL 2007
- TOP OF BANK 2007
- CROSS-SECTIONS

- BANK EROSION
- SEVERE BANK EROSION
- AGGRADATION (GRASSES)
- AGGRADATON (CATTAILS)

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

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

WELLS CREEK - REACH 2

Ecosystem Enhancement PROGRAM

LOCATION:
WELLS CREEK
STREAM MONITORING - YEAR 3

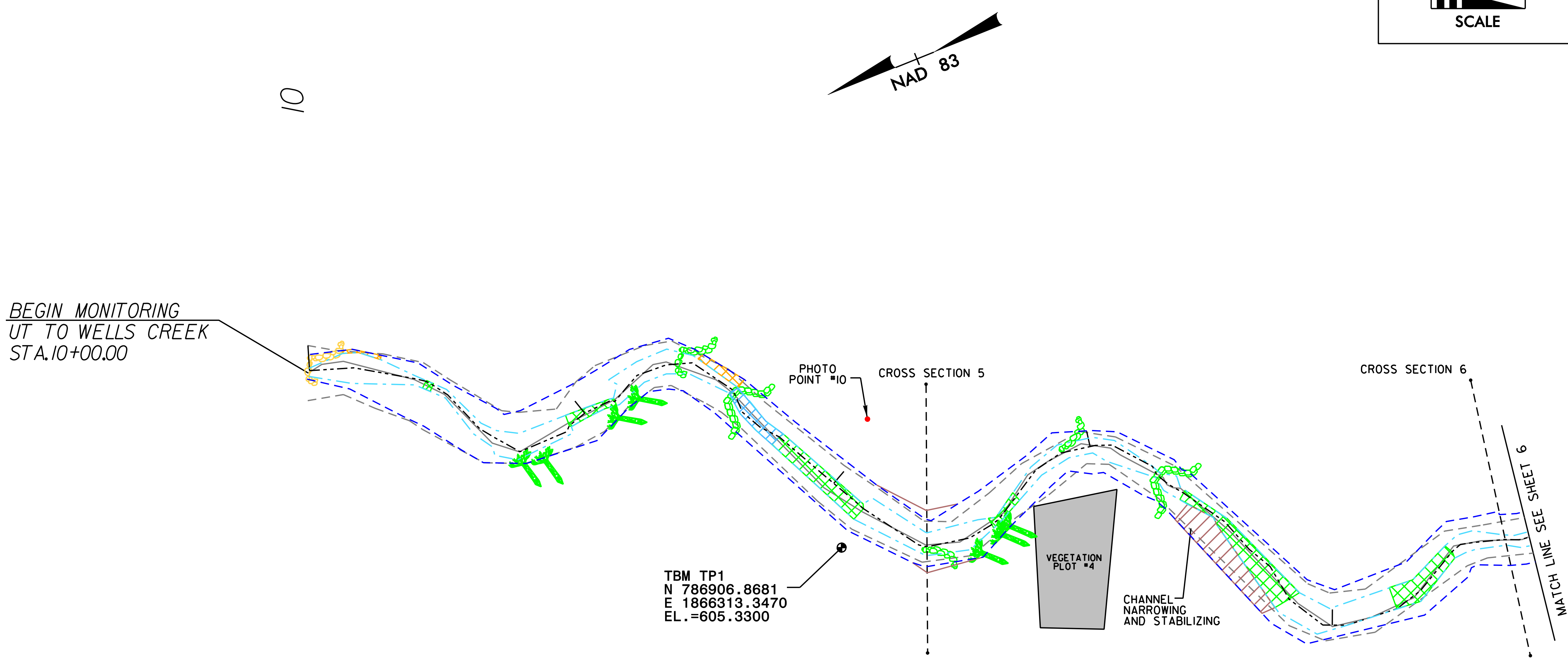
PROJ #: 414	COUNTY: ALAMANCE
PREPARED BY: IPJ	
CHECKED BY: PDB	DATE: 5/14/07

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

PROJECT REFERENCE NO.	SHEET NO.
414	5

PROJECT ENGINEER

10 0 20
SCALE



CROSS SECTION STAKING			
	NORTHING	EASTING	ELEVATION
XSC 5 LEFT	786862.4549	1866351.6519	609.7649
XSC 5 RIGHT	786893.9555	1866271.9524	608.4476
XSC 6 LEFT	786700.8207	1866288.0700	609.6833
XSC 6 RIGHT	786715.8993	1866199.4730	606.5492

LEGEND

THALWEG 2006
BANKFULL 2006
THALWEG 2007
EDGE OF WATER 2007
BANKFULL 2007
TOP OF BANK 2007
CROSS-SECTIONS

BANK EROSION
SEVERE BANK EROSION
AGGRADATION (GRASSES)
AGGRADATON (CATTAILS)

STRUCTURE TYPES

ROCK CROSS VANE
J-HOOK VANE
ROOTWAD
ROCK VANE

COLOR CODE FOR STRUCTURES

GOOD STRUCTURE
STRUCTURE WITH POTENTIAL PROBLEM
FAILING STRUCTURE

UT TO WELLS CREEK

Ecosystem Enhancement PROGRAM

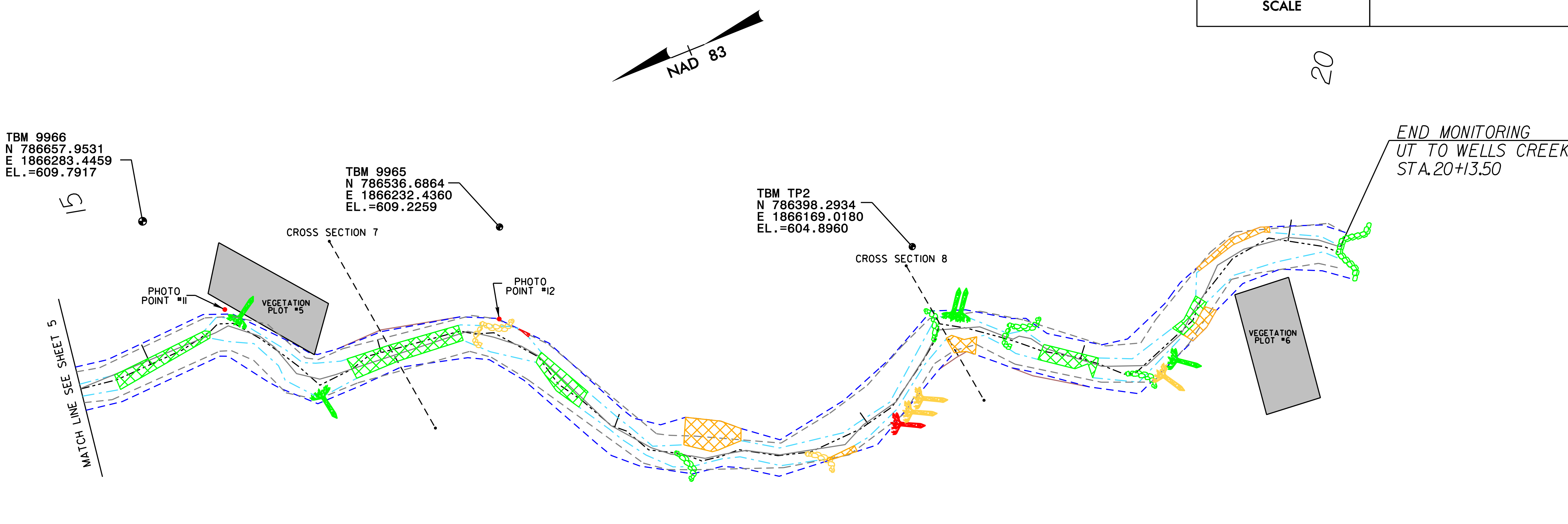
LOCATION:
WELLS CREEK
STREAM MONITORING - YEAR 3

PROJ #: 414
COUNTY: ALAMANCE
PREPARED BY: IPJ
CHECKED BY: PDB
DATE: 5/14/07

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

PROJECT REFERENCE NO.	SHEET NO.
414	6
PROJECT ENGINEER	

10 0 20
SCALE



CROSS SECTION STAKING			
	NORTHING	EASTING	ELEVATION
XSC 7 LEFT	786596.8813	1866250.9420	609.3301
XSC 7 RIGHT	786586.2595	1866172.4990	605.5594
XSC 8 LEFT	786403.0018	1866163.2910	604.9927
XSC 8 RIGHT	786394.8939	1866106.6040	604.3983

LEGEND

THALWEG 2006
BANKFULL 2006
THALWEG 2007
EDGE OF WATER 2007
BANKFULL 2007
TOP OF BANK 2007
CROSS-SECTIONS

BANK EROSION
SEVERE BANK EROSION
AGGRADATION (GRASSES)
AGGRADATON (CATTAILS)

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

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

UT TO WELLS CREEK

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STREAM MONITORING - YEAR 3

PROJ #: 414 COUNTY: ALAMANCE
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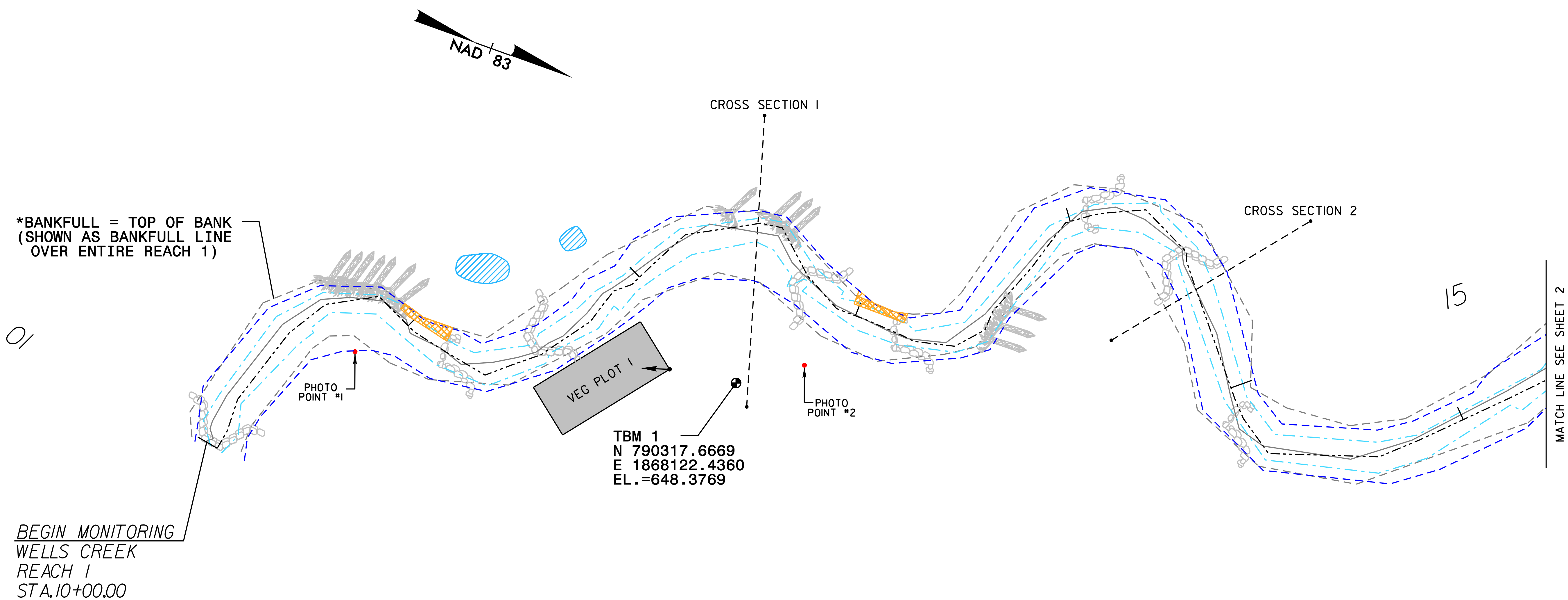
PROJECT REFERENCE NO.	SHEET NO.
414	1
PROJECT ENGINEER	

SCALE 10 0 20



LEGEND

- THALWEG 2006
- BANKFULL 2006
- THALWEG 2007
- EDGE OF WATER 2007
- BANKFULL 2007
- CROSS-SECTIONS
- PHOTO POINT

STRUCTURE TYPES

- ROCK CROSS VANE
- J-HOOK VANE
- ROOTWAD
- ROCK VANE

- BARE BANK - MODERATE
- BARE BANK - SEVERE
- BARE BENCH
- BARE FLOODPLAIN
- INVASIVE/EXOTIC (MICROSTEGIUM)

WELLS CREEK - REACH 1

Ecosystem Enhancement PROGRAM

LOCATION:
WELLS CREEK
VEGETATION ASSESSMENT - YEAR 3

PROJ #: 414
COUNTY: ALAMANCE
MONITORED BY: IPJ
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DATE: 5/14/07

SEPI ENGINEERING GROUP
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PROJECT REFERENCE NO.	SHEET NO.
414	2
PROJECT ENGINEER	

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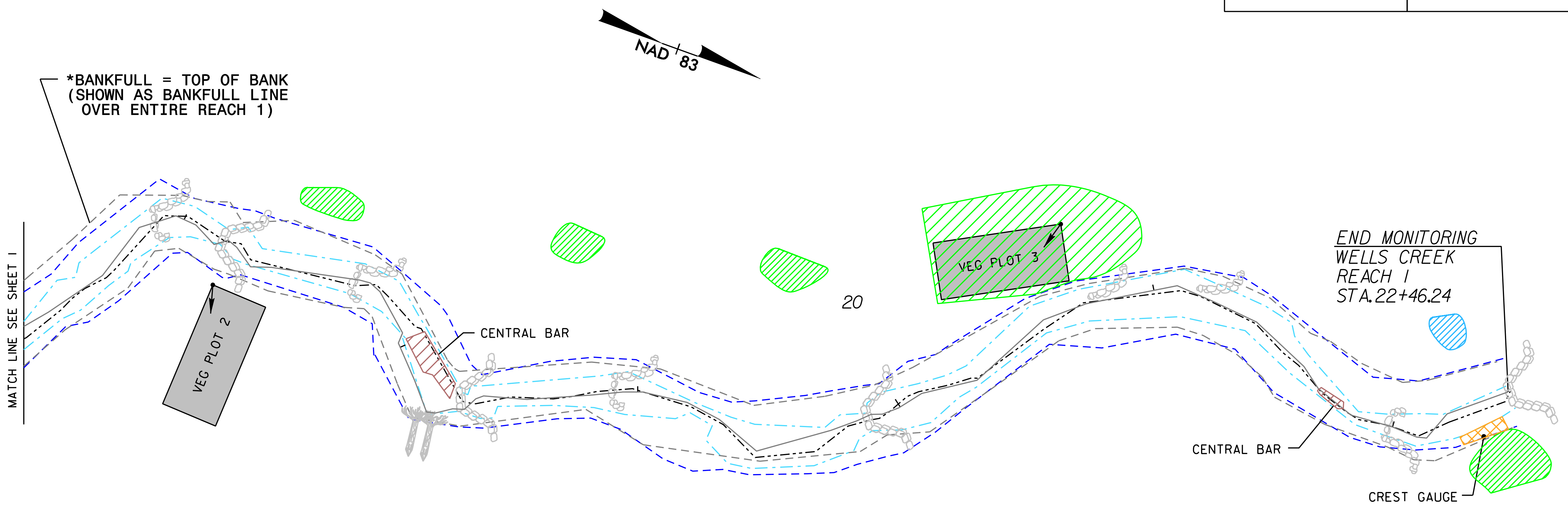
SCALE



LEGEND

THALWEG 2006
BANKFULL 2006
THALWEG 2007
EDGE OF WATER 2007
BANKFULL 2007
CROSS-SECTIONS
PHOTO POINT

STRUCTURE TYPES

ROCK CROSS VANE
J-HOOK VANE
ROOTWAD
ROCK VANE

BARE BANK - MODERATE
BARE BANK - SEVERE
BARE BENCH
BARE FLOODPLAIN
INVASIVE/EXOTIC (MICROSTEGIUM)

WELLS CREEK - REACH 1

Ecosystem Enhancement PROGRAM

LOCATION:
WELLS CREEK
VEGETATION ASSESSMENT - YEAR 3

PROJ #: 414	COUNTY: ALAMANCE
MONITORED BY: IPJ	
CHECKED BY: PDB	DATE: 5/14/07

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PROJECT REFERENCE NO.	SHEET NO.
414	5
PROJECT ENGINEER	

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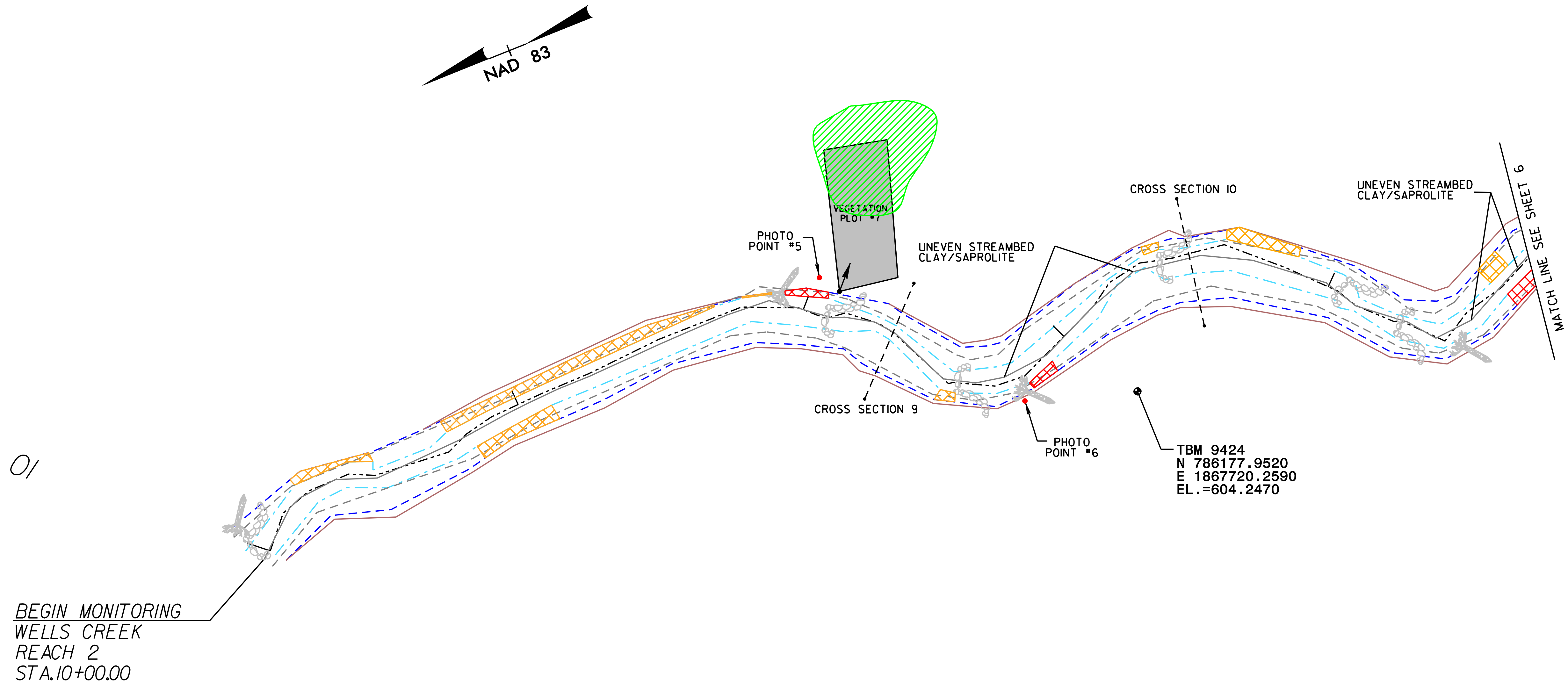
SCALE



WELLS CREEK - REACH 2

LEGEND

THALWEG 2006
BANKFULL 2006
THALWEG 2007
EDGE OF WATER 2007
BANKFULL 2007
TOP OF BANK 2007
CROSS-SECTIONS
PHOTO POINT

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

BARE BANK - MODERATE
BARE BANK - SEVERE
BARE BENCH
BARE FLOODPLAIN
INVASIVE/EXOTIC (MICROSTEGIUM)

Ecosystem Enhancement PROGRAM

LOCATION:
WELLS CREEK
VEGETATION ASSESSMENT - YEAR 3

PROJ #: 414	COUNTY: ALAMANCE
MONITORED BY: IPJ	
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SEPI ENGINEERING GROUP
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PROJECT REFERENCE NO.	SHEET NO.
414	6
PROJECT ENGINEER	

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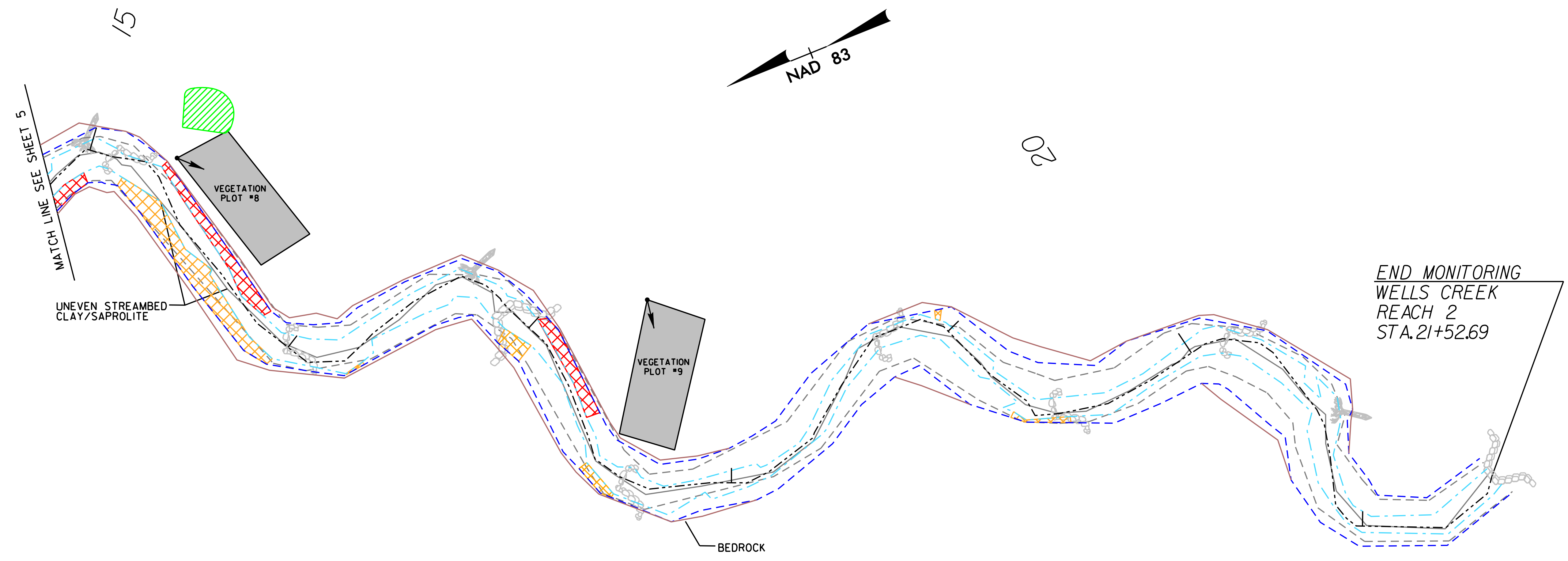
SCALE



WELLS CREEK - REACH 2

LEGEND

THALWEG 2006	STRUCTURE TYPES		BARE BANK - MODERATE
BANKFULL 2006	ROCK CROSS VANE	J-HOOK VANE	BARE BANK - SEVERE
THALWEG 2007			BARE BENCH
EDGE OF WATER 2007			BARE FLOODPLAIN
BANKFULL 2007	ROOTWAD	ROCK VANE	INVASIVE/EXOTIC (MICROSTEGIUM)
TOP OF BANK 2007			
CROSS-SECTIONS			
PHOTO POINT			

Ecosystem Enhancement PROGRAM

LOCATION: WELLS CREEK VEGETATION ASSESSMENT - YEAR 3	
PROJ #: 414	COUNTY: ALAMANCE
MONITORED BY: IPJ	
CHECKED BY: PDB	DATE: 5/14/07

SEPI ENGINEERING GROUP
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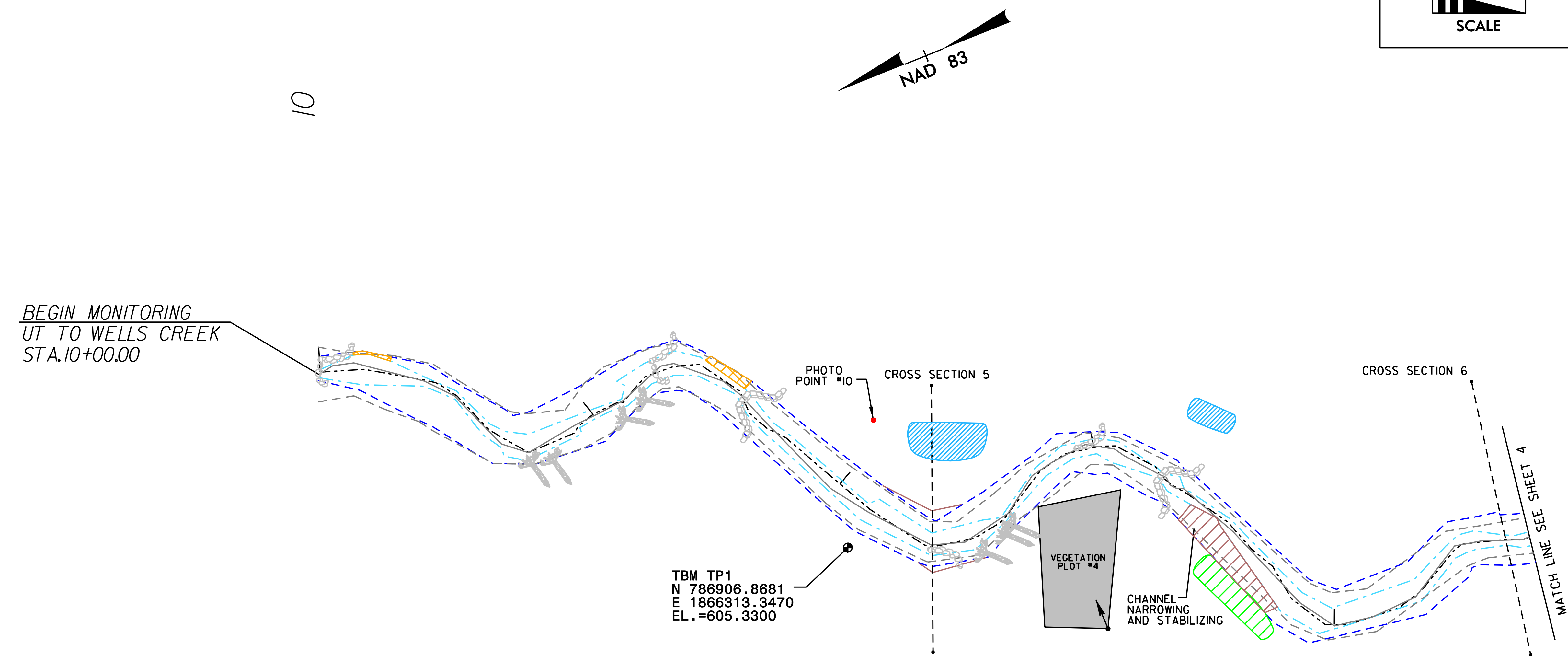
PROJECT REFERENCE NO.	SHEET NO.
414	3
PROJECT ENGINEER	

10 0 20
SCALE



UT TO WELLS CREEK

LEGEND

THALWEG 2006
BANKFULL 2006
THALWEG 2007
EDGE OF WATER 2007
BANKFULL 2007
TOP OF BANK 2007
CROSS-SECTIONS
PHOTO POINT

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

BARE BANK - MODERATE
BARE BANK - SEVERE
BARE BENCH
BARE FLOODPLAIN
INVASIVE/EXOTIC (MICROSTEGIUM)

Ecosystem Enhancement PROGRAM

LOCATION: WELLS CREEK VEGETATION ASSESSMENT - YEAR 3	
PROJ #: 414	COUNTY: ALAMANCE
MONITORED BY: IPJ	
CHECKED BY: PDB	DATE: 5/14/07

SEPI ENGINEERING GROUP

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RALEIGH, NC 27605
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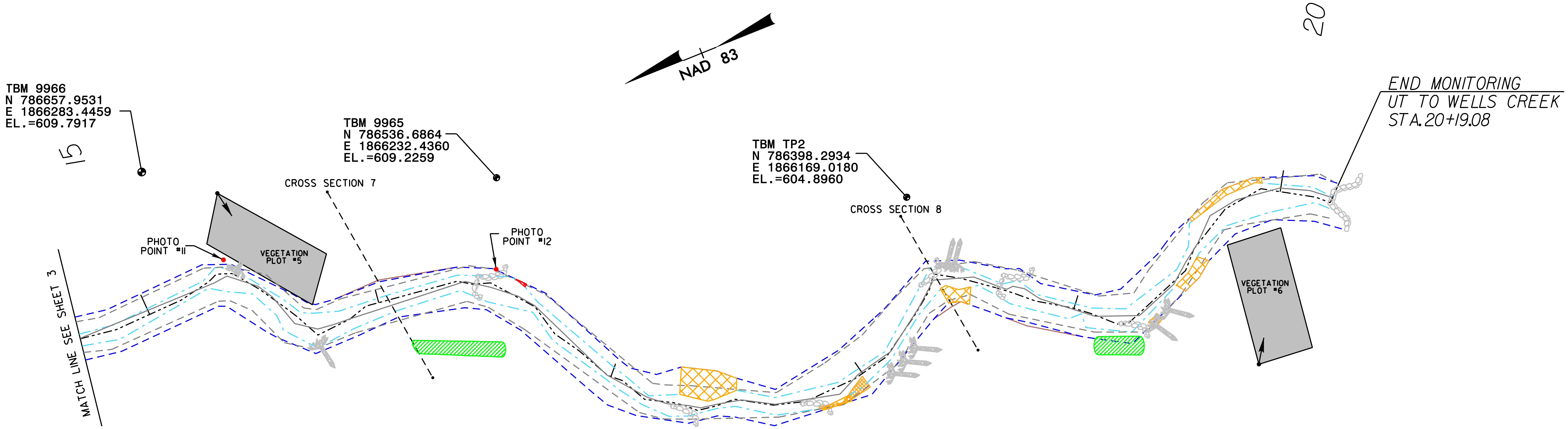
PROJECT REFERENCE NO.	SHEET NO.
414	4
PROJECT ENGINEER	

10 0 20
SCALE



LEGEND

		STRUCTURE TYPES		
THALWEG 2006		ROCK CROSS VANE		BARE BANK - MODERATE
BANKFULL 2006		J-HOOK VANE		BARE BANK - SEVERE
THALWEG 2007		ROOTWAD		BARE BENCH
EDGE OF WATER 2007		ROCK VANE		BARE FLOODPLAIN
BANKFULL 2007				INVASIVE/EXOTIC (MICROSTEGIUM)
TOP OF BANK 2007				
CROSS-SECTIONS				
PHOTO POINT				

UT TO WELLS CREEK

Ecosystem Enhancement PROGRAM

LOCATION:
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