Dog Bite Stream Restoration Site
As-Built / Baseline Monitoring Report
Contract # D06056-A

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April 2010

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EXECUTIVE SUMMARY

The Dog Bite Site (DBS) is located in the Blue Ridge physiographic province in central Mitchell County, North Carolina. The project will provide mitigation for stream impacts within the 8-digit hydrologic cataloging unit 06010108 in the French Broad River Basin by restoring and enhancing 3,707 linear feet on the DBS, generating 3,335 stream mitigation units (SMU's.) The goals of the project include restoring the stream's riparian buffer and creating a stable stream system. In order to reach these goals, the project objectives included planting a functional Montane Alluvial Forest community along with Montane Oak-Hickory Forest to create an effective riparian buffer, removing livestock from the riparian areas with fencing, stopping bank erosion by developing the appropriate channel dimension, arresting bed elevation lowering, creating in-stream habitat by restoring a profile with defined pools and adding woody debris habitat structures, and removing a livestock waste pond previously adjacent to the stream.

The project generally flows from east to west and has a contributing drainage area of approximately 0.54 square mile. The project is made up of the headwaters of White Oak Creek, including the main stem of White Oak Creek (WOC) and two tributaries (UT1 and UT2). The project watershed is rural and faces low development pressure from the surrounding area. The stream design and the restoration plan were completed in July 2008, construction began in August 2009, and the riparian buffer was planted in December 2009.

The stream restoration included eight separate reaches, which have each been enhanced or restored based on a combination of Priority 2 and 3 approaches. Log cross vanes, log step pools, and log j-hooks were used to control grade and create feature diversity throughout the profile. The streams were restored to a B/C3, stream type. The as-built survey and baseline monitoring found that there were minimal deviations from the designed cross-sections and profile. During construction, small sections of the stream planform and profile were altered from the design and structures were moved, added, or not installed as necessary. These changes were made in an effort to save existing trees or to create more habitat and structure diversity in the restored stream. These deviations from the design have been recorded on the as-built site plan.

The site was planted with bare root trees and shrubs and live stakes in December 2009. A total of 19 different species were planted at the site. The site was planted according to the planting plan except for the approved substitution of additional river birch (*Betula nigra*) for yellow birch (*Betula alleghaniensis*). Since construction and the as-built survey, high tensile electrified fence has been erected along the entire easement boundary. All of the livestock on the property have been excluded from the conservation easement.

The site will be monitored for at least five years beginning in 2010 through 2014 or until the success criteria are achieved. Reports will be submitted to the EEP each year. The planted riparian buffer must meet the success criteria of 260 planted stems/acre at the end of the monitoring period. The baseline monitoring counted an average of 659 stems/acre in the seven vegetation monitoring plots. Stream success will be assessed utilizing measurements of stream dimension, pattern, and profile as well as through site photographs. Two bankfull events also must occur on the restored stream over the monitoring period in separate monitoring years.

1.0 PROJECT BACKGROUND

1.1 Location and Setting

The Dog Bite Site (DBS) is located at the end of Wilson Dairy Road in central Mitchell County, North Carolina (Figure 1). The project is centered at approximately 35.9956 degrees north and –82.1302 degrees west (WGS84). To reach the site from Raleigh, begin by proceeding west on I-40 for approximately 200 miles. Then take Exit 86 for NC-226 toward Shelby/Marion. Take a right onto NC-226, traveling north. Follow NC-226 through Marion and Spruce Pine. Just before reaching Bakersville, make a right onto White Oak Road. Follow White Oak Road for approximately 1.5 miles and then make a left onto Wilson Dairy Road. The road will dead end at the Wilson property and the DBS is on the left. Due to the close proximity of the landowner's residence to the property, the landowner has asked to be contacted before any site visits are made.

1.2 Project Goals and Objectives

The project goals are to:

- Restore the stream's riparian buffer.
- Create a stable network of headwater streams.

In order to meet these goals, the following objectives were accomplished:

- Plant a functional Montane Alluvial Forest community along with a Montane Oak-Hickory Forest to create an effective riparian buffer.
- Arrest bed elevation lowering and stream widening.
- Create in-stream habitat by restoring a profile with defined pools and adding woody debris habitat structures.
- Stop bank erosion by developing the appropriate channel dimension and by stabilizing with vegetation.
- Remove the livestock waste pond adjacent to the stream.
- Exclude livestock from the riparian areas with fencing.

1.3 Project Structure, Restoration Type and Approach

The project streams had become degraded primarily through poor grazing management, vegetation removal, and channelization. Historically, the site was cleared and converted into pasture except for isolated, narrow strips of riparian vegetation along the streams. White Oak Creek (WOC) was also channelized around two ponds. Prior to restoration, many of the project streams were experiencing severe bank erosion and bed degradation. Restoration and enhancement of 3,707 linear feet of channel was accomplished utilizing a combination of Priority 2 and 3 approaches (Table 1).

All of WOC was built as a B3 channel, but in areas where a larger floodplain was excavated, the stream classifies as a C3b. WOC has been divided into five different reaches to reflect changes in drainage area and mitigation type. WOC-1 runs from Station 10+00 to 12+54, stopping at a 15' easement exception and ford crossing. This reach was enhanced by grading back the existing eroding banks, narrowing over-widened portions of the channel, building a bankfull bench, and developing distinct riffle and pools with step pool structures. Many of the existing trees on the left bank of this reach were left intact, which helps shade the channel and keep the water temperature lower.

WOC-2 was restored from Station 12+70, the end of the ford crossing, to Station 19+50. The restoration of this reach established stable riffle and pool features with in-stream structures and created a new stable planform, moving the stream away from the constructed pond berm. There is a 15' easement exception and ford crossing in this reach.

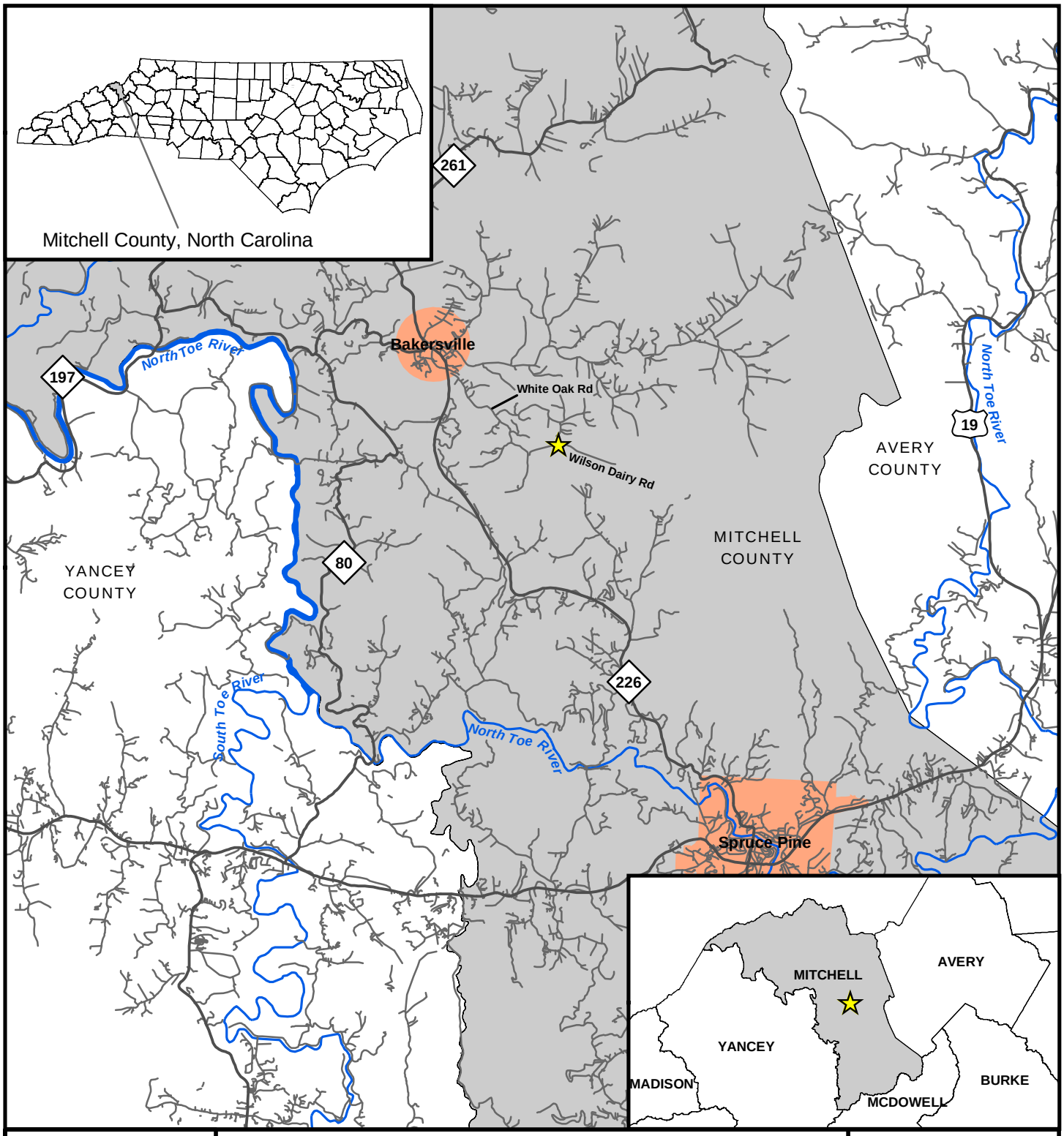

Figure 1. Vicinity Map

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- Project Site Location
- Major Roads
- Other Roads
- Major Rivers
- Cities and Towns

1:126,720
1 inch = 2 miles

2 1 0 2 Miles

Ecosystem Enhancement PROGRAM

WOC-3 was enhanced from Station 19+50 to 22+69, with the reach ending at a 15' easement exception and ford crossing. This reach was enhanced by grading back the existing eroding banks, narrowing over-widened portions of the channel, building a bankfull bench, and developing distinct riffle and pools with step pool structures. Many of the existing trees in the middle portion of this reach were able to be left intact. As was the case with the other enhancement reaches, many of the designed in-stream structures were moved, changed, or eliminated to best fit the field conditions encountered during construction.

The restoration of WOC-4 begins at the end of a rock ford crossing at Station 22+85 and ends at Station 36+35. The restoration of this reach established stable riffle and pool features with in-stream structures and created a new stable planform. This reach was also moved away from a constructed pond berm on the left bank of the top portion of this reach. The dairy holding pond was closed in May 2009. The reach receives drainage from barns that support a small number of horses and cattle. A water detention structure was built to receive this drainage and hold it before it flows into WOC. This reach has a 15' easement exception and ford crossing at Station 27+20.

WOC-5 was enhanced from Station 36+35 to 40+82, and this is the last reach on WOC. This reach was improved by grading back the existing eroding banks, narrowing over-widened portions of the channel, building a bankfull bench, and developing distinct riffle and pools with step pool and log vane structures. Throughout most of this reach, one of the two stream banks was left intact where there were mature trees.

The two tributaries to WOC on the project property were also restored or enhanced. UT1 is divided into two reaches. Reach UT1-1 was enhanced from Station 50+00 to 50+97 by grading back the existing eroding banks, building a bankfull bench, and developing distinct riffle and pools with a step pool for grade control. Mature trees surround this reach until the beginning of UT1-2 at Station 50+97. This reach of UT1 was restored through Station 54+45. Historically, this reach was channelized to open up additional land for cattle grazing. The restoration of UT1-2 returned the stream to its natural position in the valley and established stable riffle and pool features with in-stream structures and created a new stable planform. A 15' easement exception and ford crossing cross the reach at Station 53+95.

The last project reach is the second tributary, UT2. This is an intermittent stream that had been straightened. From Station 60+00 to 62+45, this reach was restored by developing stable riffle and pool features with step pool structures and creating a new stable planform.

Table 1 provides the linear footage for existing and as-built stream length as well as the total stream mitigation units by reach.

Table 1. Project Components
Dog Bite Stream Restoration Site

Project Component or Reach ID	Existing Feet	Restoration Level	Approach	Restored / Enhanced Footage	Stationing	Mitigation Ratio	Mitigation Units	BMP Elements	Comment
WOC-1	254	EI	-	253	10+00 - 12+53	1.5 : 1	169	-	Regraded eroding banks and created bankfull benches, created distinct riffles and pools, installed in-stream grade control and habitat structures
WOC-2	633	R	P2/3	663	12+70 - 19+50	1 : 1	663	-	Adjusted planform, created stable cross-section with bankfull bench and a profile with distinct riffles and pools, installed in-stream structures, a 15' easement exception in the middle of the reach has been excluded from the project length
WOC-3	349	EI	-	317	19+51 - 22+68	1.5 : 1	211	-	Regraded eroding banks and created bankfull benches, created distinct riffles and pools, installed in-stream grade control and habitat structures
WOC-4	1,374	R	P2/3	1,332	22+85 - 36+34	1 : 1	1,332	Water Quality Detention Structure	Adjusted planform, created stable cross-section with bankfull bench and a profile with distinct riffles and pools, installed in-stream structures, a 15' easement exception in the middle of the reach has been excluded from the project length
WOC-5	458	EI	-	447	36+35 - 40+82	1.5 : 1	298	-	Regraded eroding banks and created bankfull benches, created distinct riffles and pools, installed in-stream grade control and habitat structures
T1-1	95	EI	-	96	50+00 - 50+96	1.5 : 1	64	-	Regraded eroding banks and created bankfull benches, created distinct riffles and pools, installed in-stream grade control and habitat structures
T1-2	336	R	P2/3	331	50+97 - 54+45	1 : 1	331	-	Adjusted planform, created stable cross-section with bankfull bench and a profile with distinct riffles and pools, installed in-stream structures, a 15' easement exception in the middle of the reach has been excluded from the project length
T2	219	R	P2/3	245	60+00 - 62+45	1 : 1	245	-	Adjusted planform, created stable cross-section with bankfull bench and a profile with distinct riffles and pools and installed in-stream structures
Totals	3,718			3,684			3,313		The discrepancy between the existing and project footage is due to a detailed existing conditions survey of an unstable thalweg.

EI = Enhancement I P2/3 = Combination of Priority 2 and 3

R = Restoration

Note: 15'-wide easement exceptions on WOC-2, WOC-4, and T2 have been excluded from the restored/enhanced footage and mitigation unit calculations.

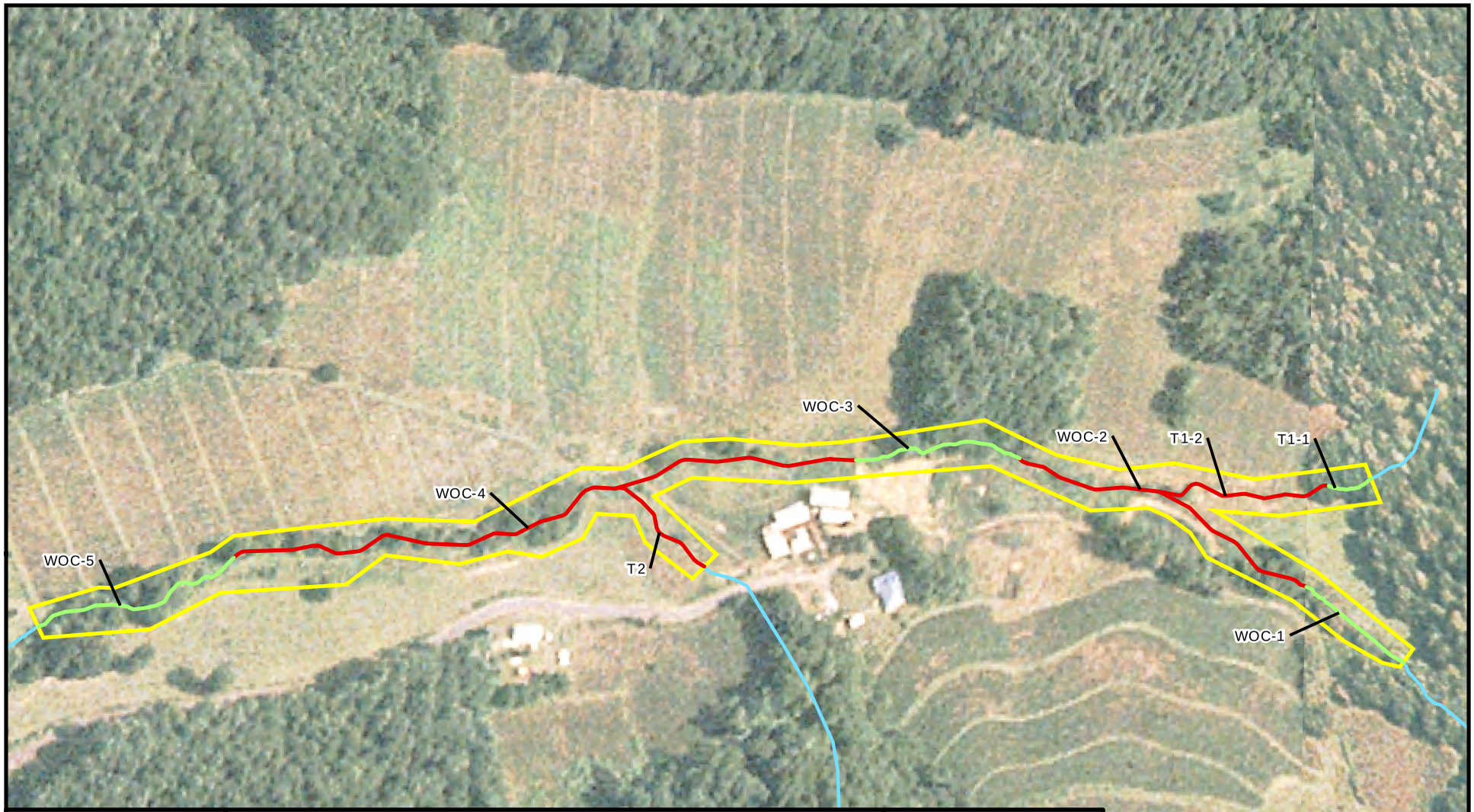

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Figure 2. Site Map

Project Easement Boundary

Enhancement I Reach

Restoration Reach

Other Streams

N
W E
S

1:3,600

1 inch = 300 feet

300 150 0 300 Feet

Source: USDA, NAIP, 2006

Ecosystem Enhancement PROGRAM

1.4 Project History, Contacts and Data

Table 2. Project Activity and Reporting History Dog Bite Stream Restoration Site		
Activity or Report	**Data Collection Complete**	**Completion or Delivery**
Restoration Plan	2007/2008	Jul 08
Final Design	-	Feb 09
Construction	-	Sep 09
Planting - Stream	-	Dec 09
As-Built / Baseline Monitoring (Year 0)	Oct 09 / Mar 10	Apr 10

Table 3. Project Contact Table Dog Bite Stream Restoration Site	
Design Firm	KCI Associates of NC, PA Landmark Center II, Suite 220 4601 Six Forks Rd. Raleigh, NC 27609 Contact: Mr. Adam Spiller Phone: (919) 783-9214 Fax: (919) 783-9266
Construction Contractors	Land Mechanics, Inc. 126 Circle G Lane Willow Springs, NC 27592 Contact: Mr. Lloyd Glover Phone: (919) 639-6132 Fax: (919) 639-7079
Planting Contractor	Bruton Nurseries & Landscapes 150 Black Creek Rd. Fremont, NC 27830 Contact: Charles Bruton Phone: (919) 242-6555
Monitoring Performers	
MY-00 - MY-05	KCI Associates of NC, PA Landmark Center II, Suite 220 4601 Six Forks Rd. Raleigh, NC 27609 Contact: Mr. Adam Spiller Phone: (919) 278-2514 Fax: (919) 783-9266

Table 4. Project Background Table Dog Bite Stream Restoration Site	
Project County	Mitchell County
Physiographic Region	Mountains
Ecoregion	Southern Crystalline Ridges and Mountains
Project River Basin	French Broad
USGS HUC for Project and Reference	06010108040010 (WOC)
	03040101090010 (UT Fisher River - reference)
NCDWQ Sub-basin for Project and Reference	04-03-06 (WOC)
	03-07-02 (UT Fisher River - reference)
Drainage Area	0.54 sq. mi.
Stream Order	First Order
Watershed Type (Rural, Urban, Developing, etc.)	Rural
Watershed LULC Distribution Urban	<1%
Ag-Row Crop	2%
Ag-Livestock	17%
Forested	80%
Water/Wetlands	<1%
Watershed impervious cover (%)	<1%
Rosgen Classification of As-built (Stream)	C3b (WOC, T1, T2)
NCDWQ Classification for Project	Class C (WOC)
Within EEP Watershed Plan?	No
Any portion of the project segment upstream of a 303d listed segment?	No
Reasons for 303d Listing or Stressor	N/A
Total project acreage of easement	7.0 Acres
Total planted acreage	5.8 Acres
WRC Class (Warm, Cool, Cold)	Cool, Trout Waters
Species of concern, endangered etc.	None
Pre-construction Beaver activity?	No
Dominant Soil Types	Banadana, Dellwood-Reddies, and Thunder-Saunook
% of Project Easement Fenced	100%

2.0 PROJECT MONITORING / AS-BUILT CONDITIONS

2.1 Monitoring Features

Permanent monuments marking monitoring feature locations were established on-site. The beginning and end of each permanent cross-section was marked with rebar monuments. Vegetation plots were installed with flagged metal conduit at each corner and a flagged PVC pipe was installed at the photo corner. Two automatic recording gauges were installed, one on WOC-2 and one on WOC-4, to record water levels indicating when bankfull events occur. The locations of these monitoring features and the permanent photo points are shown in the As-Built Plan (Appendix A).

2.2 Monitoring Guidelines

Stream data will be calculated from the monitored longitudinal profiles and cross-sections (Tables 5 and 6). Nine permanent cross-sections were established and will be used to evaluate stream dimension: two riffles and one pool cross-section on WOC-2, three riffles and one pool cross-section on WOC-4, and one riffle and one pool cross-section on T1-2. Annual pebble counts will be performed at each cross-section

(Appendix B). Cross-sections will be surveyed each year using a total station and morphological data will be calculated. A total of 3,170 lf of longitudinal profile will be surveyed on WOC (Station 10+00 to 38+50) and T1 (Station 51+00 to 54+20). The profiles will be surveyed with a total station and will record elevations of bed features, water surface levels, and bankfull elevations (Appendix C). Various morphological parameters will be calculated from this information, including bankfull slopes, pool-to-pool spacing, and feature lengths. Stem counts of planted trees and shrubs will be conducted in seven 10 by 10 meter vegetation monitoring plots (Appendix D). The vegetation monitoring will be conducted following the CVS-EEP vegetation monitoring guidelines. The two stream gauges on-site will be checked and/or downloaded every other month and the data will be analyzed to ascertain whether bankfull events have occurred. Visual monitoring of the stream and riparian buffer will be conducted with annual site walks and site photos will be taken from 12 permanent photo points located throughout the site (Appendix E).

2.3 As-Built Conditions

2.3.1 Stream

Baseline stream monitoring data were collected in October 2009. Any changes made to the design during construction are shown on the As-Built Site Plan in Appendix A. The majority of the restoration reaches were implemented as designed. Design changes were also made during construction to the enhancement reaches to make sure that the stream fit well into the existing landscape and that existing trees were preserved wherever possible. These adjustments resulted in certain structures being moved, changed, or eliminated altogether.

Table 5 below compares the designed morphological values and ratios to the as-built values and ratios of the restored streams. Overall, the site was built as designed. The differences between the designed and as-built channels are minor. However, on small channels like at the DBS, small changes can cause large differences in morphological values. One of these differences is that a larger bankfull bench than was designed was built throughout the project. This means that most of the channels classify as “C” channels instead of “B” channels. Also, with small variances in the depth and width of the channels, the as-built width to depth ratios classifies most of the reaches as “E” channel types. However, because these differences are small and the character of the channel is more like a “C” channel, they have been classified as “C” channels. Additionally, because coarser native bed material was used more than the finer gravels and silt that were on the surface of the existing channel, the as-built channel classifies as a cobble bed stream. None of these differences from the design parameters are expected to cause instability in the as-built channel.

Due to the range of variability in the morphological parameters of the project’s enhancement reaches, they are not included in Table 5 below. These reaches have a wider range of widths and depths because in some instances only one bank was adjusted in order to preserve existing vegetation or the profile was adjusted to match existing stable bed features. These adjustments did not change the overall nature of channel work.

Table 5a. WOC-2 Baseline Stream Summary
Dog Bite Stream Restoration Site

Parameter	Pre-Existing Condition					Reference Reach(es) Data					Design		As-built			
Dimension - Riffle	Min	Mean	Med	Max	n	Min	Mean	Med	Max	n	Min	Max	Min	Mean	Max	n
Bankfull Width (ft)	5.0	6.9	7.3	8.3	3	9.0	9.5		10.0	2	8.6		6.8	7.1	7.4	2
Floodprone Width (ft)	9	10	10	11	3	13	17		20	2	19		21	24	26	2
Bankfull Mean Depth (ft)	0.6	0.8	0.9	0.9	3	1.1	1.2		1.2	2	0.7		0.7	0.7	0.7	2
Bankfull Max Depth (ft)	0.8	1.2	1.3	1.4	3	1.3	1.4		1.5	2	0.9		1.0	1.1	1.2	2
Bankfull Cross-Sectional Area (ft^2)	4.6	5.4	5.0	6.7	3	10.4	10.6		10.7	2	6.3		4.8	5.2	5.5	2
Width/Depth Ratio	5.4	9.1	8.0	13.8	3	8.0	9.0		10.0	2	12.3		9.6	9.8	10.0	2
Entrenchment Ratio	1.2	1.5	1.3	2.1	3	1.3	1.8		2.3	2	2.2		2.8	3.3	3.8	2
Bank Height Ratio	1.6	2.1	2.0	2.6	3			1.0		2	1.0		1.0	1.0	1.0	2
Pattern																
Channel Beltwidth (ft)		21						45			80	140	80		140	
Radius of Curvature (ft)	8			15		13			42		15	30	15	25	30	11
Rc:Bankfull width (ft/ft)	1			3		1.3			4.4		1.7	3.5	2.1	3.5	4.2	
Meander Wavelength (ft)	32			45		93			136		80	140	80	125	140	7
Meander Width Ratio	2.5			4.2		4.5			5.0		9.3	16.3	11.3		19.7	
Profile																
Riffle Length (ft)													19	37	58	13
Riffle Slope (ft/ft)	0.0301			0.0898		0.013			0.028		0.043	0.074	0.041	0.063	0.098	13
Pool Length (ft)						3			25		5	8	5	11	20	12
Pool Spacing (ft)						30			59		25	78	33	53	77	12
Substrate and Transport Parameters																
SC% / Sa% / G% / C% / B% / Be%	4% / 26% / 56% / 13% / 1% / 0%					0% / 15% / 78% / 7% / 0% / 0%							0% / 3% / 46% / 50% / 1% / 0%			
d16 / d35 / d50 / d84 / d95 (mm)	0.6 / 6.2 / 12 / 60 / 150					2.0 / 4.2 / 6.9 / 30 / 70							32 / 44 / 65 / 130 / 170			
Additional Reach Parameters																
Channel length (ft)	633					297					639		663			
Drainage Area (SM)	0.36					0.38					0.36		0.36			
Rosgen Classification	E/B4a					B4c					B4a		C3b			
Sinuosity	1.00					1.20					1.00		1.00			
Water Surface Slope (ft/ft)	0.0617					0.0130					0.0593		0.0631			

Table 5b. WOC-4 Baseline Stream Summary
Dog Bite Stream Restoration Site

Parameter	Pre-Existing Condition					Reference Reach(es) Data					Design		As-built			
Dimension - Riffle	Min	Mean	Med	Max	n	Min	Mean	Med	Max	n	Min	Max	Min	Mean	Max	n
Bankfull Width (ft)	9.2	10.0	10.2	10.6	4	9.0	9.5		10.0	2	9.8		8.6	8.9	9.1	3
Floodprone Width (ft)	12	16	15	21	4	13	17		20	1	20		26	27	28	3
Bankfull Mean Depth (ft)	0.6	0.7	0.7	0.9	4	1.1	1.2		1.2	2	0.8		0.7	0.8	0.9	3
Bankfull Max Depth (ft)	0.9	1.2	1.2	1.3	4	1.3	1.4		1.5	2	1.0		1.2	1.3	1.3	3
Bankfull Cross-Sectional Area (ft^2)	6.4	6.9	6.7	7.9	4	10.4	10.6		10.7	2	7.7		6.2	7.3	8.1	3
Width/Depth Ratio	10.7	14.8	15.7	17.2	4	8.0	9.0		10.0	2	12.5		9.7	11.0	13.4	3
Entrenchment Ratio	1.1	1.6	1.6	2.0	4	1.3	1.8		2.3	1	2.0		2.8	3.0	3.3	3
Bank Height Ratio	1.8	2.8	2.8	3.7	4			1.0		2	1.0		1.0	1.0	1.0	3
Pattern																
Channel Beltwidth (ft)	31			80				45			15	40	15		40	
Radius of Curvature (ft)	14			52		13			42		20	40	20	29	40	20
Rc:Bankfull width (ft/ft)	1.3			5.7		1.3			4.4		2.0	4.1	2.2	3.3	4.5	
Meander Wavelength (ft)	81			244		93			136		95	160	94	128	153	18
Meander Width Ratio	2.9			8.7		4.5			5.0		1.5	4.1	1.7		4.5	
Profile																
Riffle Length (ft)													18	44	89	22
Riffle Slope (ft/ft)	0.041			0.077		0.013			0.028		0.032	0.064	0.027	0.047	0.098	22
Pool Length (ft)	7			14		3			25		5	16	5	9	30	23
Pool Spacing (ft)		231				30			59		30	83	33	61	100	23
Substrate and Transport Parameters																
SC% / Sa% / G% / C% / B% / Be%	14% / 11% / 39% / 29% / 7% / 0%					0% / 15% / 78% / 7% / 0% / 0%							0% / 1% / 21% / 76% / 2% / 0%			
d16 / d35 / d50 / d84 / d95 (mm)	0.10 / 5.2 / 11 / 120 / 360					2.0 / 4.2 / 6.9 / 30 / 70							55/ 77 / 94 / 150 / 210			
Additional Reach Parameters																
Channel length (ft)	1,374					297					1,325		1,332			
Drainage Area (SM)	0.50					0.38					0.50		0.50			
Rosgen Classification	G/F4b					B4c					B4a		C3b			
Sinuosity	1.10					1.20					1.10		1.10			
Water Surface Slope (ft/ft)	0.0399					0.0130					0.0405		0.0404			

Table 5c. T1-2 Baseline Stream Summary
Dog Bite Stream Restoration Site

Parameter	Pre-Existing Condition*					Reference Reach(es) Data					Design		As-built			
Dimension - Riffle	Min	Mean	Med	Max	n	Min	Mean	Med	Max	n	Min	Max	Min	Mean	Max	n
Bankfull Width (ft)	19.5				1	9.0	9.5		10.0	2	6.6		5.5			1
Floodprone Width (ft)	38				1	13	17		20	1	14		21			1
Bankfull Mean Depth (ft)	0.3				1	1.1	1.2		1.2	2	0.5		0.5			1
Bankfull Max Depth (ft)	0.8				1	1.3	1.4		1.5	2	0.6		0.7			1
Bankfull Cross-Sectional Area (ft^2)	6.5				1	10.4	10.6		10.7	2	3.2		3.0			1
Width/Depth Ratio	58.5				1	8.0	9.0		10.0	2	13.6		10.1			1
Entrenchment Ratio	1.9				1	1.3	1.8		2.3	1	2.1		3.8			1
Bank Height Ratio	1.0				1			1.0		2	1.0		1.0			1
Pattern																
Channel Beltwidth (ft)								45			15	30	15		30	
Radius of Curvature (ft)						13			42		10	25	10	18	25	8
Rc:Bankfull width (ft/ft)						1.3			4.4		1.5	3.8	1.8	3.3	4.5	
Meander Wavelength (ft)						93			136		70	105	70	83	105	8
Meander Width Ratio						4.5			5.0		2.3	4.5	2.7		5.5	
Profile																
Riffle Length (ft)													18	26	32	7
Riffle Slope (ft/ft)						0.013			0.028		0.050	0.058	0.051	0.062	0.075	7
Pool Length (ft)						3			25		5	17	2	9	13	7
Pool Spacing (ft)						30			59		35	45	28	40	45	7
Substrate and Transport Parameters																
SC% / Sa% / G% / C% / B% / Be%	71% / 29% / 0% / 0% / 0% / 0%					0% / 15% / 78% / 7% / 0% / 0%							3% / 3% / 27% / 61% / 7% / 0%			
d16 / d35 / d50 / d84 / d95 (mm)	0.06 / 0.06 / 0.06 / 0.09 / 0.11					2.0 / 4.2 / 6.9 / 30 / 70							26 / 68 / 90 / 170 / 2400			
Additional Reach Parameters																
Channel length (ft)	336					297					336		331			
Drainage Area (SM)	0.08					0.38					0.08		0.08			
Rosgen Classification	B5a					B4c					B4a		C3b			
Sinuosity	1.00					1.20					1.10		1.10			
Water Surface Slope (ft/ft)	0.0601					0.0130					0.0590		0.0613			

* T1-2 was historically filled and only a shallow swale with no discernible bed features or pattern present during the existing conditions survey.

Table 6. Morphology and Hydraulic Monitoring Summary Dog Bite Stream Restoration Site					
Parameter	X-Section 1 Riffle	X-Section 2 Pool	X-Section 3 Riffle	X-Section 4 Riffle	X-Section 5 Pool
Reach	WOC-2	WOC-2	WOC-2	WOC-4	WOC-4
Dimension					
Bankfull Width (ft)	6.8	9.1	7.4	9.1	11.6
Floodprone Width (ft)	26	-	21	26	-
Bankfull Mean Depth (ft)	0.7	1.4	0.7	0.7	1.5
Bankfull Max Depth (ft)	1.0	2.3	1.2	1.2	2.6
Bankfull Cross-Sectional Area (ft^2)	4.8	12.7	5.5	6.2	16.9
Width/Depth Ratio	9.6	-	10.0	13.4	-
Entrenchment Ratio	3.8	-	2.8	2.8	-
Bank Height Ratio	1.0	-	1.0	1.0	-
Substrate					
d50 (mm)	51	9.6	65	94	0.062
d84 (mm)	100	47	130	150	0.11

Parameter	X-Section 6 Riffle	X-Section 7 Riffle	X-Section 8 Riffle	X-Section 9 Pool
Reach	WOC-4	WOC-4	T1-2	T1-2
Dimension				
Bankfull Width (ft)	8.6	9.0	5.5	6.9
Floodprone Width (ft)	28	26	21	-
Bankfull Mean Depth (ft)	0.9	0.9	0.5	1.0
Bankfull Max Depth (ft)	1.3	1.3	0.7	1.6
Bankfull Cross-Sectional Area (ft^2)	7.6	8.1	3.0	6.8
Width/Depth Ratio	9.7	10.0	10.1	-
Entrenchment Ratio	3.3	2.9	3.8	-
Bank Height Ratio	1.0	1.0	1.0	-
Substrate				
d50 (mm)	100	90	90	0.062
d84 (mm)	150	130	170	0.1

2.3.2 Vegetation

The site was planted with bare root trees and shrubs and live stakes in December 2009. A total of 19 different species were planted at the site. The site was planted according to the planting plan except for the approved substitution of additional river birch (*Betula nigra*) for yellow birch (*Betula alleghaniensis*).

Baseline vegetation monitoring data from the seven vegetation plots were collected in March 2010. The vegetation monitoring follows the CVS/EEP vegetation monitoring protocol. Plot photos from all the vegetation plots can be found in Appendix D.

The results of the baseline monitoring show an average of 659 stems per acre in the riparian area (Table 7). An attempt to identify all trees was made, but since monitoring was conducted while the trees were dormant, many were unidentifiable. All trees will be positively identified during the first year of monitoring.

Table 7. Stem Count by Plot and Species Dog Bite Stream Restoration Site											
	Species	Total Planted Stems	# plots	avg # stems	plot Dog Bite-A-0001	plot Dog Bite-A-0002	plot Dog Bite-A-0003	plot Dog Bite-A-0004	plot Dog Bite-A-0005	plot Dog Bite-A-0006	plot Dog Bite-A-0007
	Betula nigra	7	3	2	2	1			4		
	Calycanthus floridus	4	3	1	1			1		2	
	Platanus occidentalis	6	1	6	6						
	Quercus	15	4	4		8	4		2		1
	Quercus alba	6	4	2	1		2	1			2
	Quercus michauxii	1	1	1	1						
	Quercus montana	5	3	2			1	1	3		
	Unknown	70	7	10	9	8	9	11	6	16	11
TOT:	**8**	**44**	**19**		**11**	**9**	**7**	**3**	**9**	**2**	**3**
Plot Stem Density (stems/acre)					**809**	**688**	**647**	**567**	**607**	**728**	**567**

3.0 SUCCESS CRITERIA

3.1 Stream Stability

Cross-section measurements should show little or no change from the as-built cross-sections. Annual measurements of the longitudinal profile should indicate a stable bedform with little change from the as-built survey. Sediment transport should remain relatively unchanged with respect to aggradation and deposition of sediments. Any observed variation in the annual monitoring of the cross-sections and longitudinal profiles will be evaluated to determine whether they are minor adjustments associated with normal sediment transport and increasing stability or whether they indicate movement toward an unstable condition. If any changes occur, they will be discussed within the yearly monitoring reports.

3.2 Vegetation

Riparian vegetation must meet a minimum site average density of 320 stems/acre after three years, 288 stems/acre after four years, and 260 stems/acre after five years. If monitoring indicates that the specified survival rate is not being met, appropriate corrective actions will be developed, which could include invasive species control, the removal of dead/dying plants, and replanting.

3.3 Hydrology

Within the five-year monitoring period, a minimum of two bankfull events must occur in separate monitoring years on the restored stream. If stream gauge data reveal that this criterion is not met, probable causes for this will be determined.

4.0 MAINTENANCE AND CONTINGENCY PLAN

The site will be monitored for any problem areas that could arise and any such issues will be dealt with according to severity. Site maintenance may include reinstallation of coir matting, removal of debris from the channel, stabilization of bank erosion with protective structures, or adjustments to in-stream structures. Any maintenance activities will be documented in the yearly monitoring reports.

Appendix A

As-Built Plans

CONTRACT #: D06056-A

KCI JOB# : 12065439

STATE	CONTRACT NUMBER	SHEET NO.	TOTAL SHEETS
N.C.	D06056-A	1	9

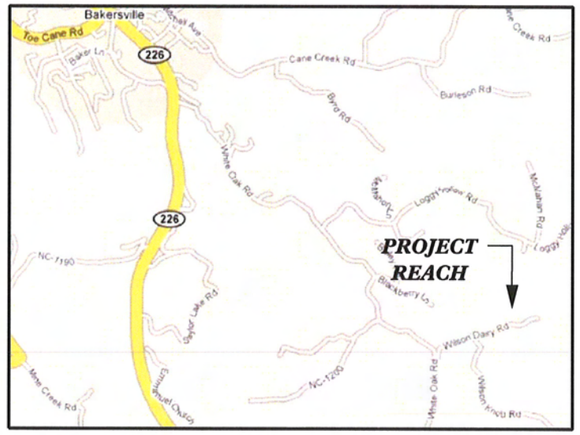
SYM.	DESCRIPTION	DATE	APPROVED
	REVISIONS		

STATE OF NORTH CAROLINA
ECOSYSTEM ENHANCEMENT PROGRAM

MITCHELL COUNTY

LOCATION: DOG BITE SITE
WHITE OAK CREEK
BAKERSVILLE, NORTH CAROLINA

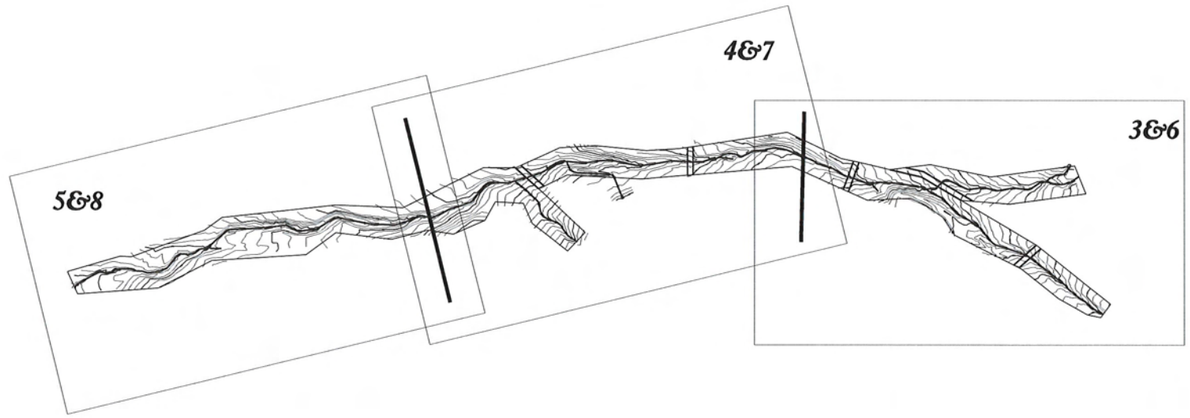
TYPE OF WORK: STREAM RESTORATION AND ENHANCEMENT



VICINITY MAP
NOT TO SCALE

DIRECTIONS TO SITE

TO REACH THE SITE FROM RALEIGH, BEGIN BY PROCEEDING WEST ON I-40 FOR APPROXIMATELY 200 MILES. THEN TAKE EXIT 86 FOR NC-226 TOWARD SHELBY/MARION. TAKE A RIGHT ONTO NC-226. TRAVELING NORTH, FOLLOW NC-226 THROUGH MARION AND SPRUCE PINE. JUST BEFORE REACHING BAKERSVILLE, MAKE A RIGHT ONTO WHITE OAK ROAD. FOLLOW WHITE OAK ROAD FOR APPROXIMATELY 1.5 MILES AND THEN MAKE A LEFT ONTO WILSON DAIRY ROAD. THE ROAD WILL DEAD END AT THE WILSON PROPERTY AND THE DOG BITE SITE IS ON THE LEFT.



INDEX OF SHEETS

NC GRID NAD 83

AS-BUILT PLANS

GRAPHIC SCALES

–40 –20 0 40 80
PLANS

PROJECT DATA

STREAM RESTORATION LENGTH = 2,571 FEET

STREAM ENHANCEMENT I LENGTH = 1,113 FEET

Prepared In the Office of:

KCI ASSOCIATES OF NC
ENGINEERS•PLANNERS•ECOLOGISTS
SUITE 220 LANDMARK CENTER II
4601 SIX FORKS RD., RALEIGH, NC

GARY M. MRYNCZA, PE
PROJECT ENGINEER

ADAM SPILLER
NATURAL CHANNEL DESIGN

PROJECT ENGINEER

NORTH CAROLINA PROFESSIONAL SEAL 32733 ENGINEER GARY MICHAEL MRYNCZA

04.01.10

SIGNATURE: *P.E.*

Prepared for:

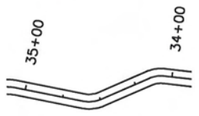
Ecosystem Enhancement PROGRAM

GUY PEARCE
CONTRACT ADMINISTRATOR

PROJECT LEGEND

STREAM RESTORATION

Stationed Thalweg w/Approximate Bankfull Limits



Log Cross Vane

Log Sill Grade Control

J–Hook /Log Vane

Log Step Pools

Rock Ford Crossing

TOPOGRAPHY

Minor Contour Line

Major Contour Line

MONITORING

Cross–Section

Photo Point

Vegetation Plot

Stream Gauge

AS–BUILT NOTE:

THE AS–BUILT SITE PLAN (SHEETS 3–5) DEPICTS THE AS–BUILT CONDITIONS. ANY DEVIATIONS FROM THE DESIGN PLANS ARE SPECIFICALLY CALLED OUT WITH NOTES. IF THERE ARE NOT NOTES ASSOCIATED WITH A SPECIFIC SECTION, THEN THAT SECTION WAS BUILT AS DESIGNED.

PROJECT ENGINEER

NORTH CAROLINA PROFESSIONAL SEAL 32733 ENGINEER GARY MICHAEL MRYNCZA

04.01.10

NO.	DESCRIPTION	DATE	APPROVED
	REVISIONS		

Ecosystem Enhancement Program

KCI ASSOCIATES OF NC
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4601 SIX FORKS ROAD
RALEIGH, NORTH CAROLINA 27609

DOG BITE
STREAM RESTORATION PROJECT
BAKERSVILLE, MITCHELL COUNTY, NORTH CAROLINA

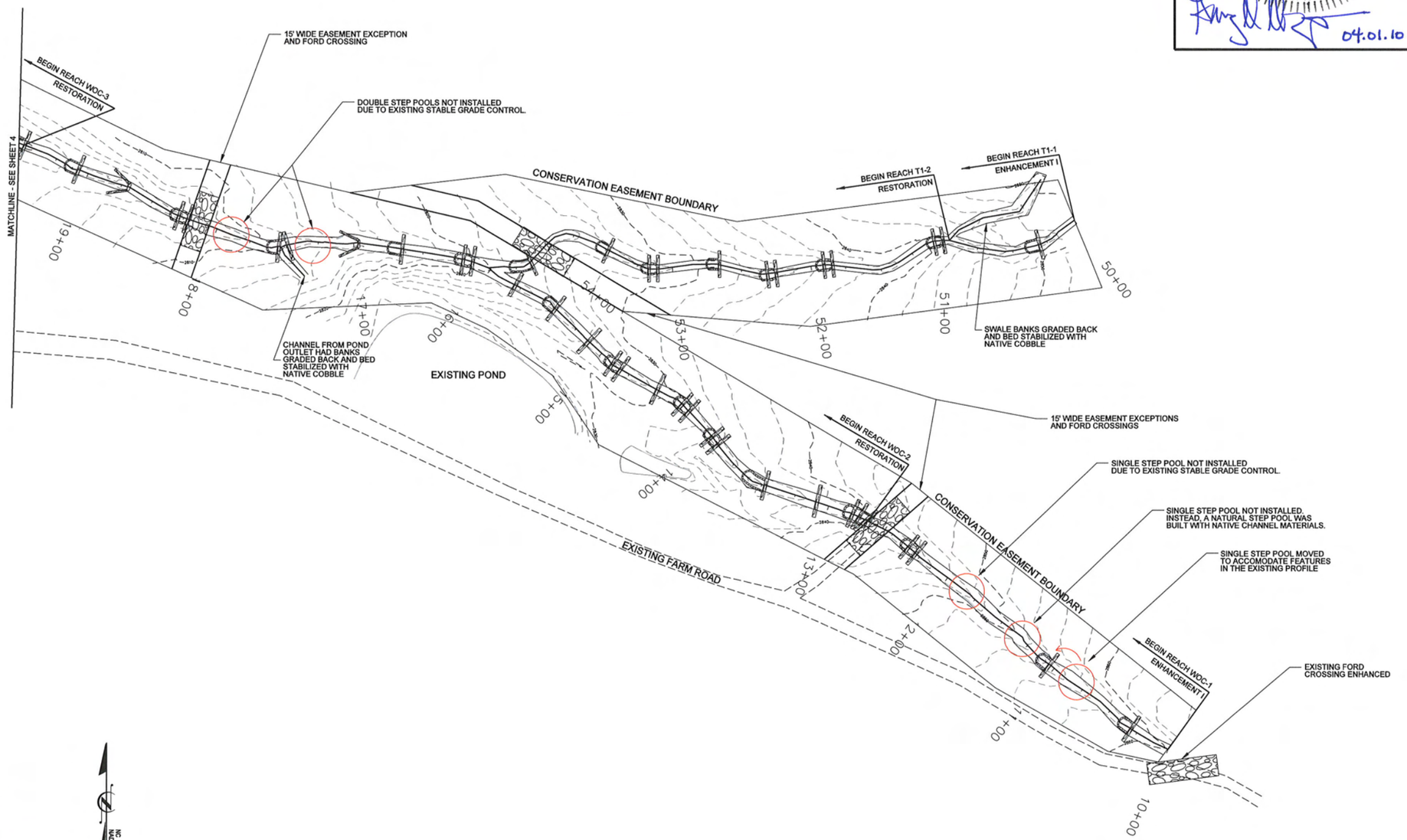
DATE: APRIL 2010
SCALE: N.T.S.

PROJECT LEGEND

PROJECT ENGINEER

NORTH CAROLINA PROFESSIONAL SEAL 32733 ENGINEER GARY MICHAEL MRYNCZA

04.01.10



NOTE:
ALL RIFFLES WERE ENHANCED WITH NATIVE COBBLE. DESIGNED RIFFLE GRADE CONTROLS WERE NOT INSTALLED.

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	REVISIONS		

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DOG BITE STREAM RESTORATION PROJECT

BAKERSVILLE, MITCHELL COUNTY, NORTH CAROLINA

WOC-1, WOC-2, WOC-3: STATION 10+00 TO STATION 19+55
T1-1 AND T1-2: STATION 50+00 TO STATION 54+45

DATE: APRIL 2010

SCALE: 1" = 80'

PLAN AND PROFILE

SHEET 3 OF 12

PROJECT ENGINEER

NORTH CAROLINA PROFESSIONAL SEAL 32733 ENGINEER GARY MICHAEL MRYNCZA

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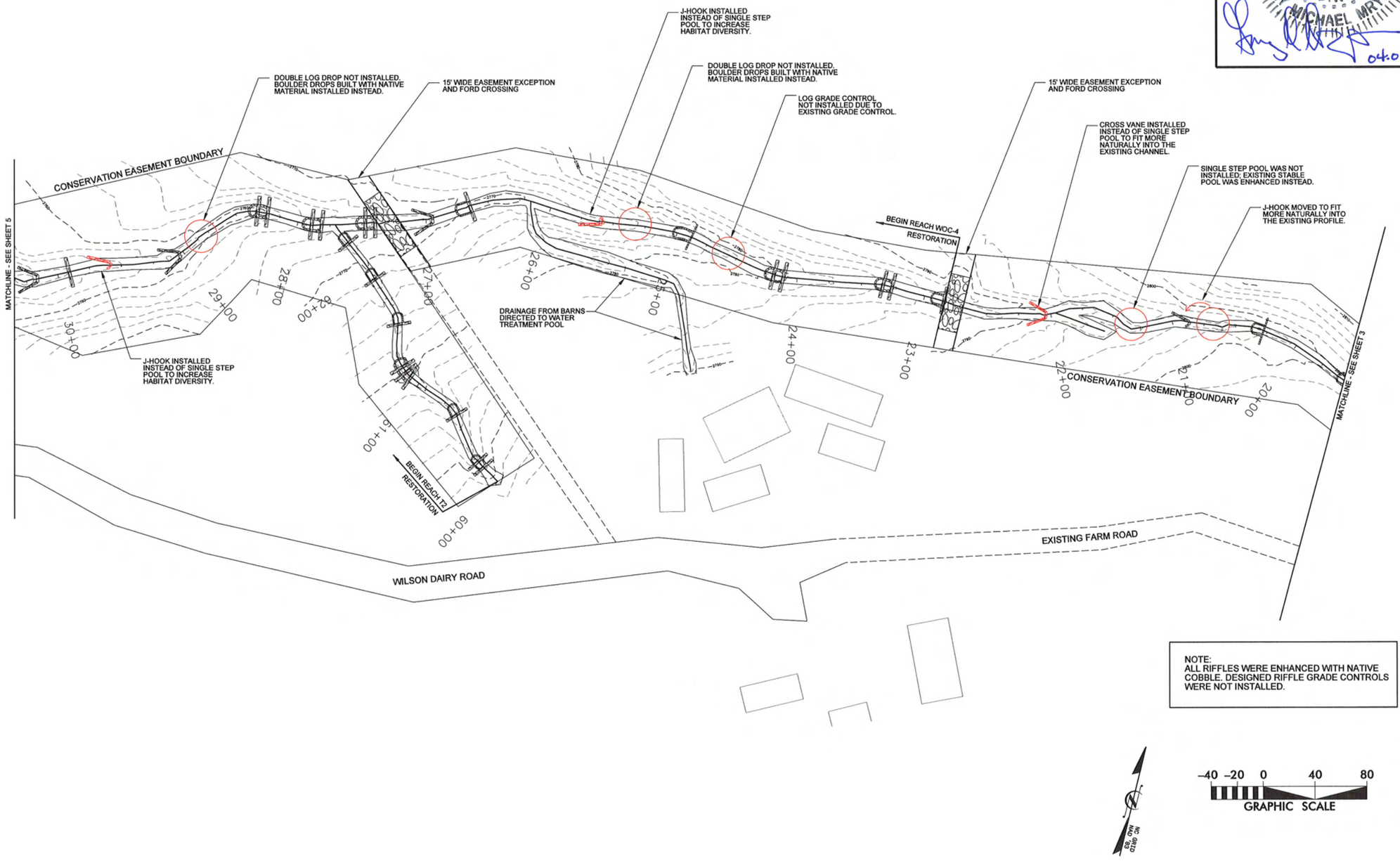
STAL			

REVISIONS



NOTE:
ALL RIFFLES WERE ENHANCED WITH NATIVE COBBLE. DESIGNED RIFFLE GRADE CONTROLS WERE NOT INSTALLED.

-40 -20 0 40 80
GRAPHIC SCALE

BE SURE YOU DIG!

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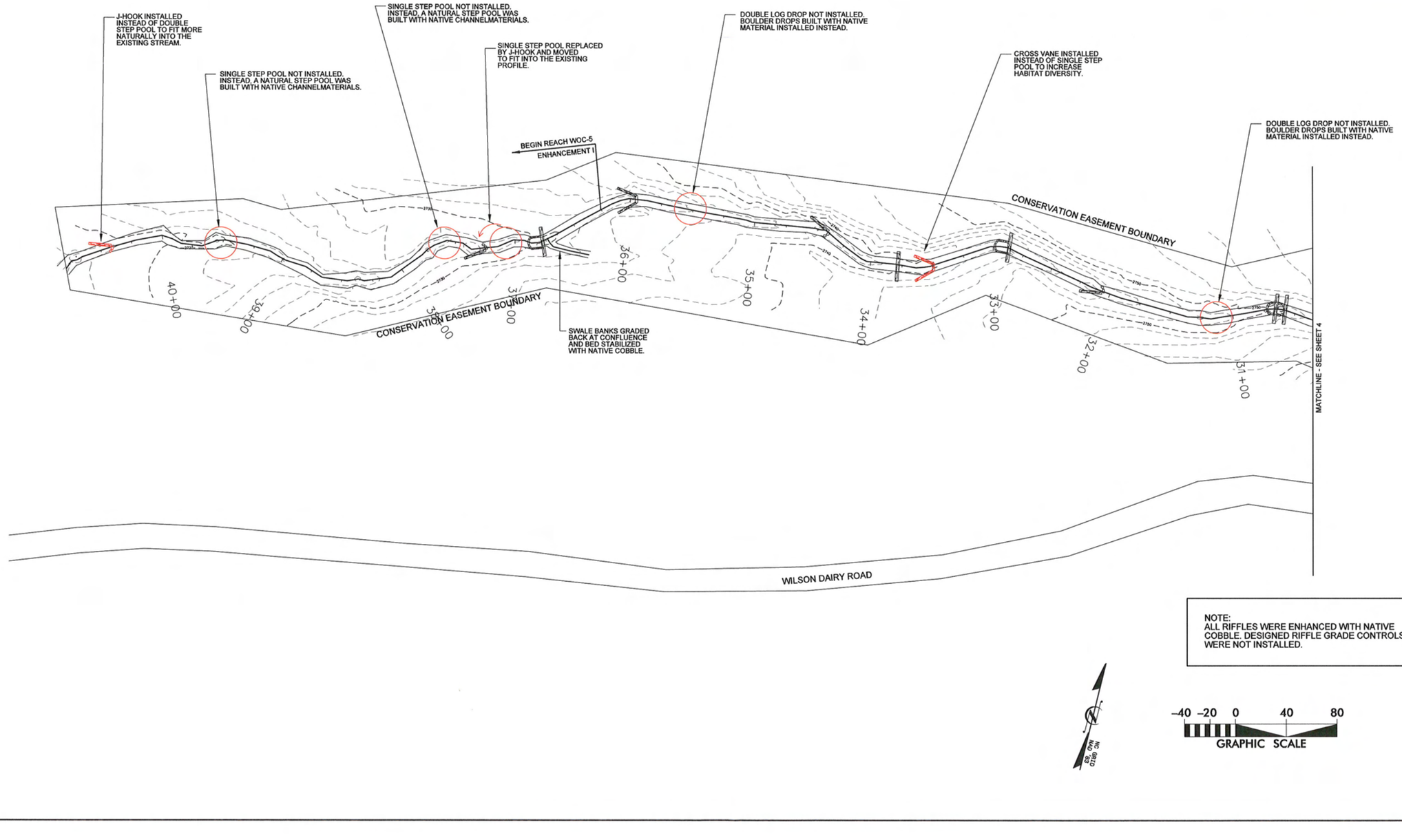
Ecosystem Enhancement Program

DOG BITE
STREAM RESTORATION PROJECT
BAKERSVILLE, MITCHELL COUNTY, NORTH CAROLINA
WOC-3, WOC-4: STATION 19+55 TO STATION 30+35
T2: STATION 60+00 TO STATION 62+45

DATE: APRIL 2009
SCALE: 1" = 80'

AS-BUILT
SITE PLAN

SHEET 4 OF 12



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DOG BITE STREAM RESTORATION PROJECT

BAKERSVILLE, MITCHELL COUNTY, NORTH CAROLINA

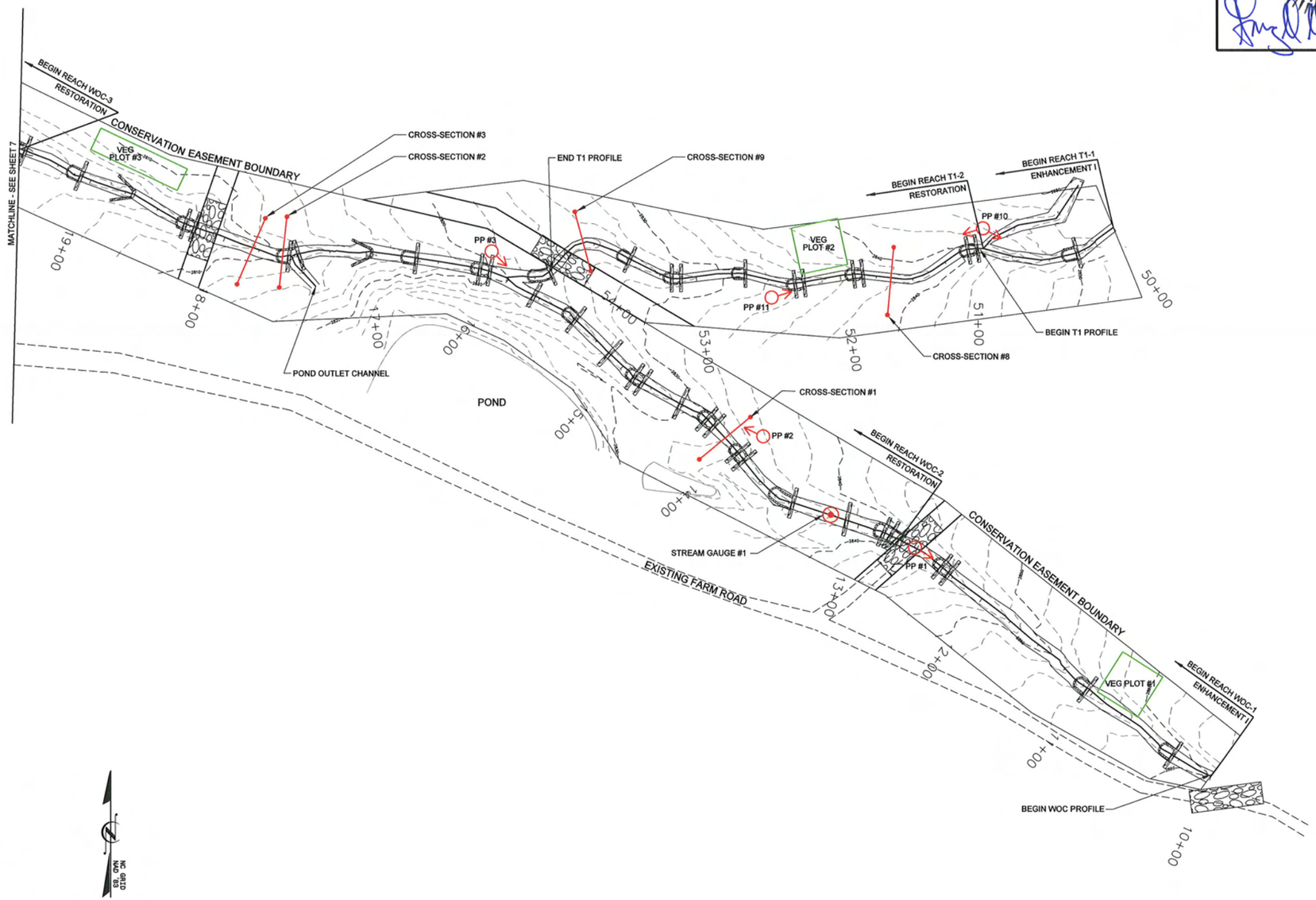
WOC-4, WOC-5: STATION 30+35 TO STATION 40+82

DATE: APRIL 2010

SCALE: 1" = 80'

AS-BUILT SITE PLAN

SHEET 5 OF 12



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RALEIGH, NORTH CAROLINA 27609

DOG BITE STREAM RESTORATION PROJECT

BAKERSVILLE, MITCHELL COUNTY, NORTH CAROLINA

WOC-1, WOC-2, WOC-3: STATION 10+00 TO STATION 19+55
T1-1 AND T1-2: STATION 50+00 TO STATION 54+45

DATE: APRIL 2010
SCALE: 1" = 80'

MONITORING PLAN VIEW

SHEET 6 OF 12

PROJECT ENGINEER

NORTH CAROLINA PROFESSIONAL SEAL 32733 ENGINEER GARY MICHAEL MRYNCZA

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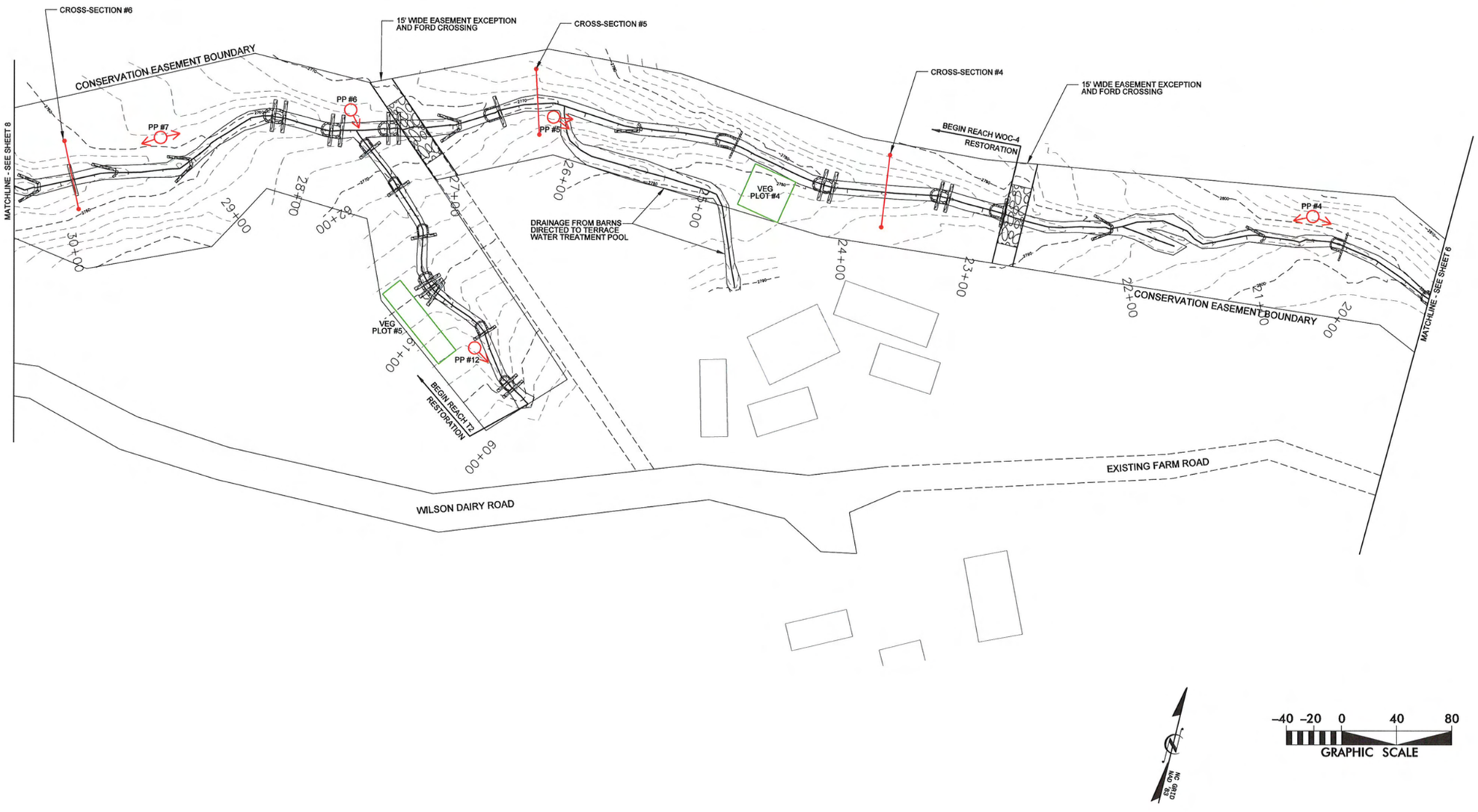
	REVISIONS		



Ecosystem Enhancement

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4601 SIX FORKS ROAD
RALEIGH, NORTH CAROLINA 27609

DOG BITE STREAM RESTORATION PROJECT

BAKERSVILLE, MITCHELL COUNTY, NORTH CAROLINA

WOC-3, WOC-4: STATION 19+55 TO STATION 30+35
T2: STATION 60+00 TO STATION 62+45

DATE: APRIL 2009

SCALE: 1" = 80'

MONITORING PLAN VIEW

SHEET 7 OF 12

PROJECT ENGINEER

NORTH CAROLINA PROFESSIONAL SEAL 32733 ENGINEER GARY MICHAEL MRYNCZA

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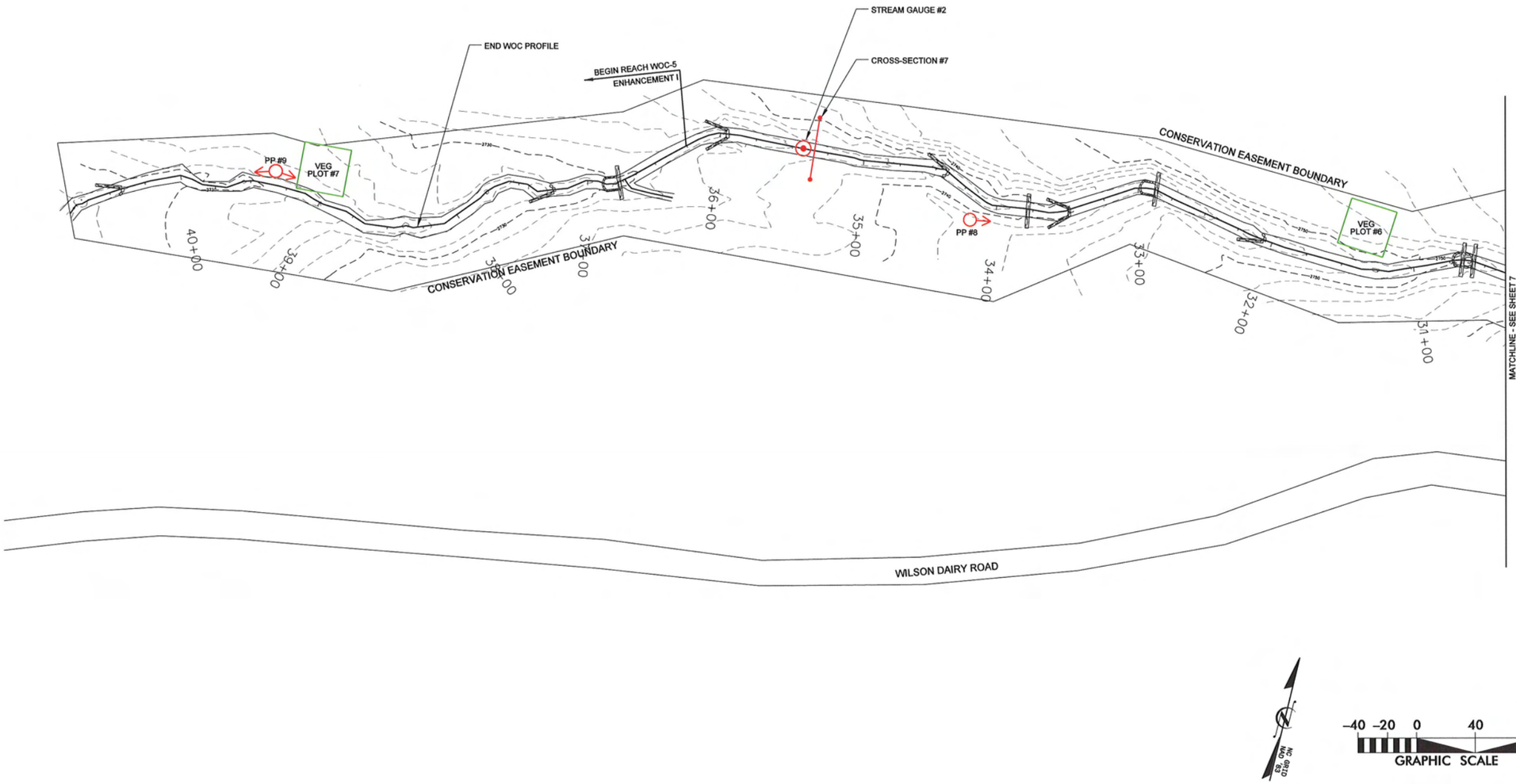

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STAL	DESCRIPTION	DATE	APPROVED

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RALEIGH, NORTH CAROLINA 27609

DOG BITE
STREAM RESTORATION PROJECT

BAKERSVILLE, MITCHELL COUNTY, NORTH CAROLINA

WOC-4, WOC-5: STATION 30+35 TO STATION 40+82

DATE: APRIL 2010

SCALE: 1" = 80'

MONITORING PLAN VIEW

SHEET 8 OF 12

AS-BUILT PLANTING PLAN AND SPECIES COMPOSITION

THERE ARE TWO DISTINCT PLANTING ZONES ON THE RESTORATION SITE. THE FIRST IS THE STREAM ZONE, WHICH OCCURS FROM THE BOTTOM OF THE BANK TO THE TOP OF THE BANK WITHIN THE LIMITS OF THE BANKFULL CHANNEL. THE SECOND PLANTING ZONE IS THE RIPARIAN BUFFER, WHICH STARTS AT THE TOP OF THE BANK AND CONTINUES TO THE CONSERVATION EASEMENT BOUNDARY. THIS ZONE CONSISTS OF A GRADATION FROM A MONTANE ALLUVIAL FOREST COMMUNITY TYPE CLOSE TO THE STREAM TO A MONTANE OAK-HICKORY FOREST COMMUNITY TYPE AS THE ELEVATION INCREASES WITHIN THE CONSERVATION EASEMENT. THE LIVE STAKES WERE INSTALLED ON THREE FOOT CENTERS AND THE RIPARIAN BUFFER WAS PLANTED AT A DENSITY OF 680 STEMS PER ACRE. THE SPECIES PLANTED IN EACH ZONE ARE DESCRIBED BELOW, WITH THE RIPARIAN BUFFER SPECIES DIVIDED BY COMMUNITY TYPE IN WHICH THEY WOULD COMMONLY OCCUR. AREAS OFTHE SITE THAT WERE NOT CLEARED WERE NOT PLANTED.

STREAM ZONE

LIVE STAKES: 1.5' TO 2' LENGTHS, 1/2" TO 2" DIAMETER
3' CENTER SPACING, RANDOM SPECIES PLACEMENT

COMMON NAME	SCIENTIFIC NAME
BLACK WILLOW	SALIX NIGRA
SILKY WILLOW	SALIX SERICEA
SILKY DOGWOOD	CORNUS AMOMUM
ELDERBERRY	SAMBUCUS CANADENSIS

NOTE: NO SINGLE LIVE STAKING SPECIES COMPOSES MORE THAN 40% OF THE TOTAL NUMBER OF LIVE STAKES INSTALLED

RIPARIAN BUFFER PLANTING ZONE = 6.0 ACRES

12" - 18" BARE ROOT MATERIAL
680 STEMS/ACRE (8' X 8' SPACING), RANDOM SPECIES PLACEMENT

MONTANE ALLUVIAL FOREST COMMUNITY

COMMON NAME	SCIENTIFIC NAME
WINTERBERRY	ILEX VERTICILLATA
SPICEBUSH	LINDERA BENZOIN
TAG ALDER	ALNUS SERRULATA
WITCH HAZEL	HAMAMELIS VIRGINIANA
SYCAMORE	PLATANUS OCCIDENTALIS
RIVER BIRCH	BETULA NIGRA
TULIP POPLAR	LIRIODENDRON TULIPIFERA
WHITE OAK	QUERCUS ALBA

MONTANE OAK-HICKORY FOREST COMMUNITY

COMMON NAME	SCIENTIFIC NAME
SWEETSHRUB	CALYCANTHUS FLORIDA
SPICEBUSH	LINDERA BENZOIN
SERVICEBERRY	AMELANCHIER ARBOREA
WITCH HAZEL	HAMAMELIS VIRGINIANA
BLACK WALNUT	JUGLANS NIGRA
MOCKERNUT HICKORY	CARYA ALBA
TULIP POPLAR	LIRIODENDRON TULIPIFERA
BLACK GUM	NYSSA SYLVATICA
WHITE OAK	QUERCUS ALBA
CHESTNUT OAK	QUERCUS PRINUS

PROJECT ENGINEER

NORTH CAROLINA PROFESSIONAL SEAL 32733 ENGINEER GARY MICHAEL MRYNCZA

04.01.10

REVISIONS

SYM.	DESCRIPTION	DATE	APPROVED

Ecosystem Enhancement Program

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4601 SIX FORKS ROAD
RALEIGH, NORTH CAROLINA 27609

DOG BITE
STREAM RESTORATION PROJECT
BAKERSVILLE, MITCHELL COUNTY, NORTH CAROLINA

DATE: APRIL 2010
SCALE: N.T.S.

AS-BUILT PLANTING PLAN

Appendix B

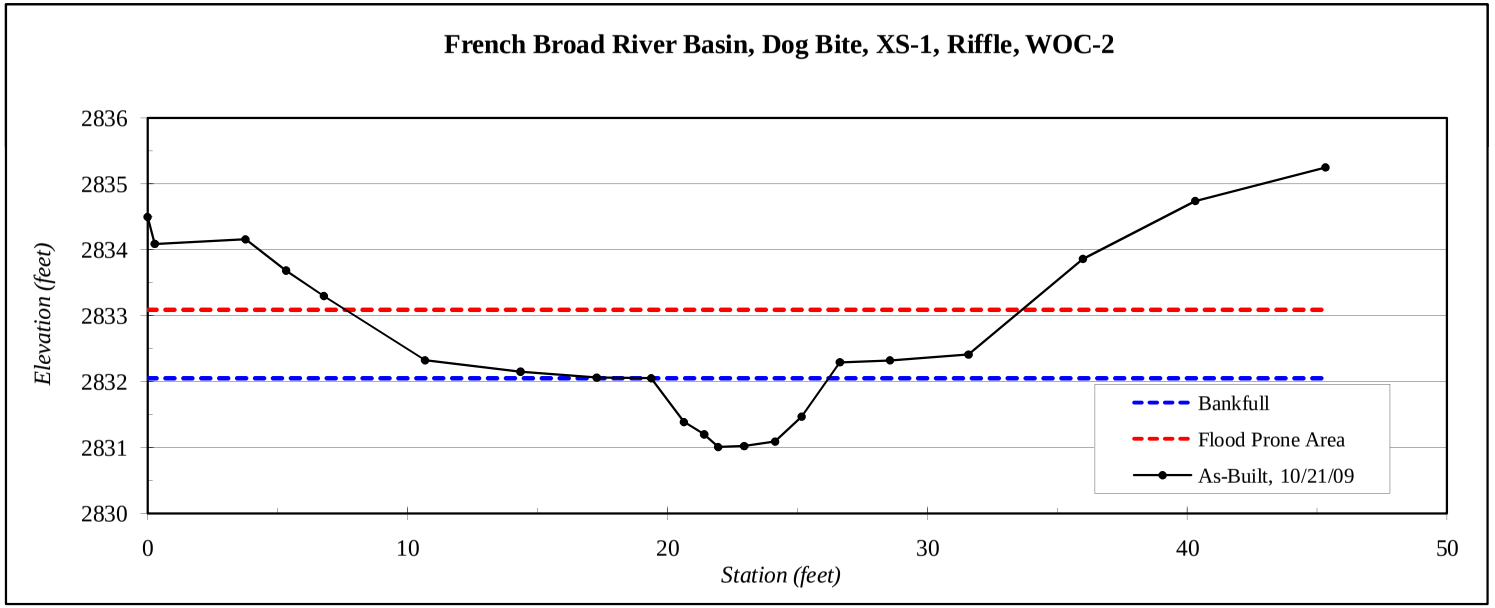
Cross-Section Plots and Pebble Counts

River Basin:	French Broad
Watershed:	Dog Bite
XS ID	XS-1, Riffle, WOC-2
Drainage Area (sq mi):	0.36
Date:	10/21/2009
Field Crew:	A. Spiller, K. Knight-Meng

Station	Elevation
0.0	2834.50
0.3	2834.09
3.8	2834.16
5.3	2833.69
6.8	2833.30
10.7	2832.32
14.3	2832.15
17.3	2832.06
19.4	2832.05
20.6	2831.39
21.4	2831.20
22.0	2831.01
23.0	2831.02
24.1	2831.09
25.2	2831.47
26.6	2832.29
28.6	2832.32
31.6	2832.41
36.0	2833.86
40.3	2834.74
45.3	2835.25

SUMMARY DATA	
Bankfull Elevation:	2832.1
Bankfull Cross-Sectional Area:	4.8
Bankfull Width:	6.8
Flood Prone Area Elevation:	2833.1
Flood Prone Width:	26
Max Depth at Bankfull:	1.0
Mean Depth at Bankfull:	0.7
W / D Ratio:	9.6
Entrenchment Ratio:	3.8
Bank Height Ratio:	1.0

Stream Type	C3b

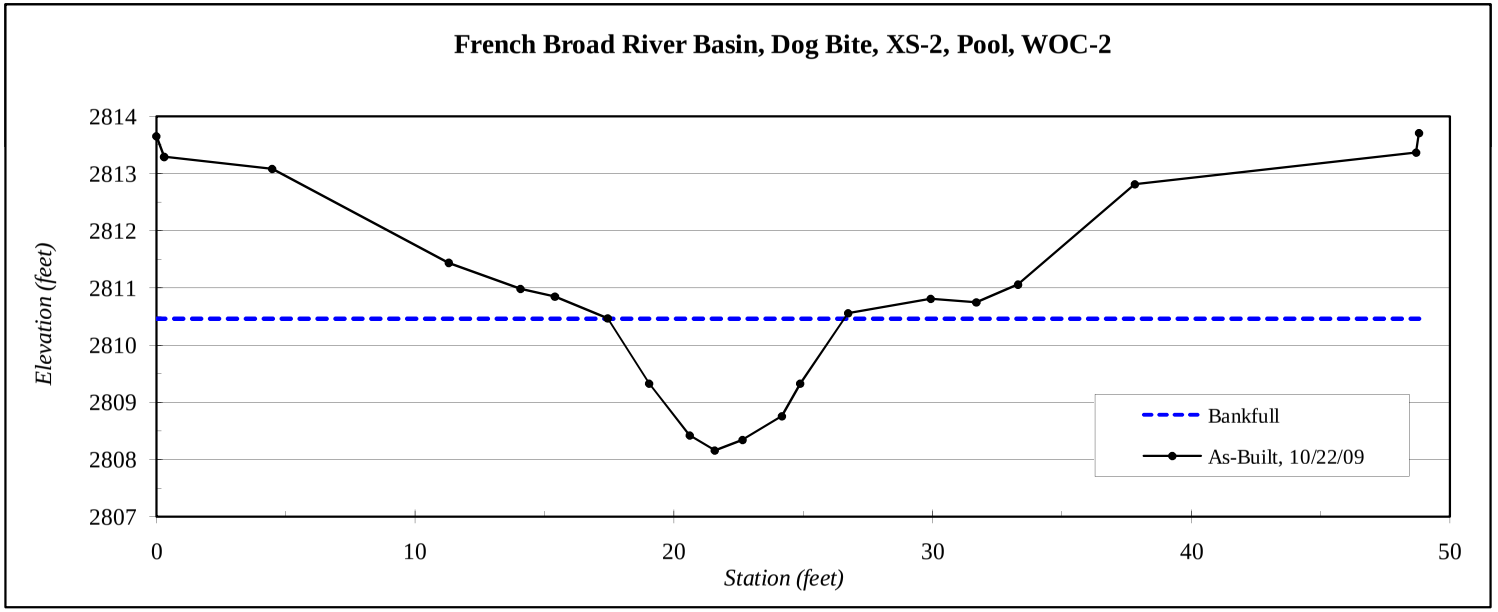


River Basin:	French Broad
Watershed:	Dog Bite
XS ID	XS-2, Pool, WOC-2
Drainage Area (sq mi):	0.36
Date:	10/22/2009
Field Crew:	A. Spiller, K. Knight-Meng

Station	Elevation
0.0	2813.65
0.3	2813.29
4.5	2813.08
11.3	2811.44
14.1	2810.99
15.4	2810.85
17.4	2810.47
19.0	2809.33
20.6	2808.42
21.6	2808.16
22.7	2808.34
24.2	2808.75
24.9	2809.33
26.7	2810.56
29.9	2810.81
31.7	2810.75
33.3	2811.06
37.8	2812.81
48.7	2813.37
48.8	2813.71

SUMMARY DATA	
Bankfull Elevation:	2810.5
Bankfull Cross-Sectional Area:	12.7
Bankfull Width:	9.1
Flood Prone Area Elevation:	-
Flood Prone Width:	-
Max Depth at Bankfull:	2.3
Mean Depth at Bankfull:	1.4
W / D Ratio:	-
Entrenchment Ratio:	-
Bank Height Ratio:	-

Stream Type	C3b

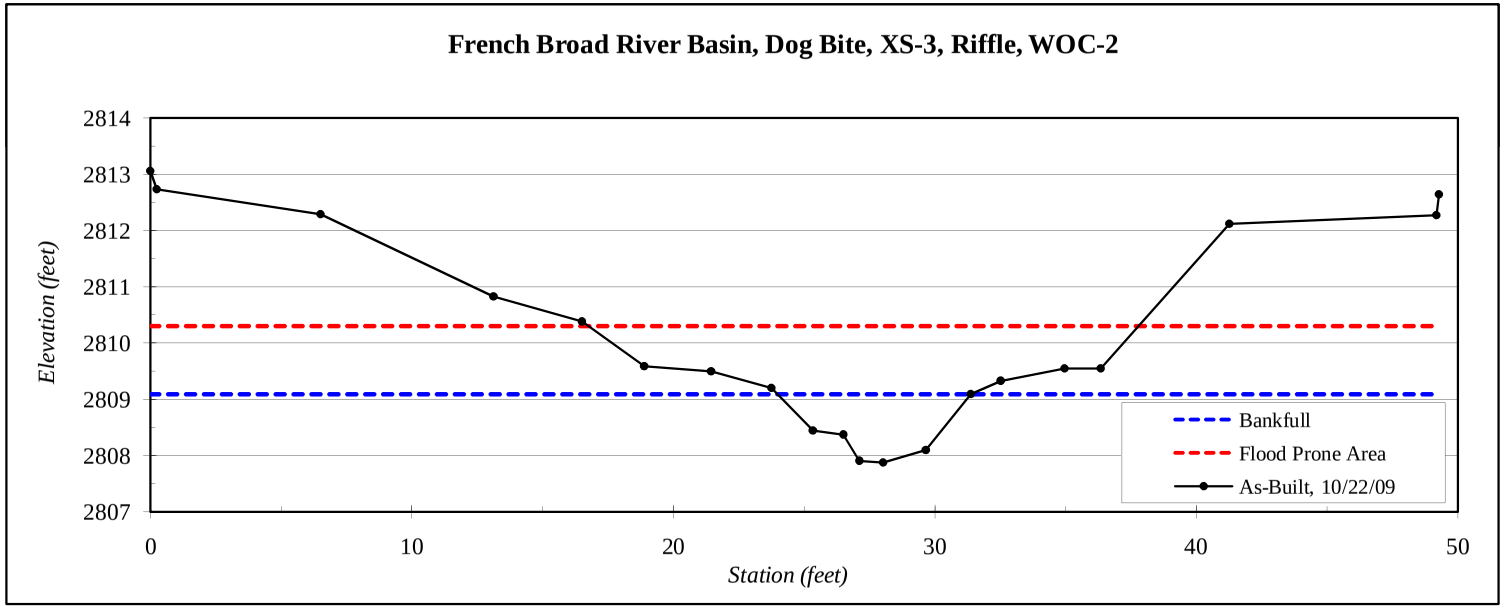


River Basin:	French Broad
Watershed:	Dog Bite
XS ID	XS-3, Riffle, WOC-2
Drainage Area (sq mi):	0.36
Date:	10/22/2009
Field Crew:	A. Spiller, K. Knight-Meng

Station	Elevation
0.0	2813.06
0.2	2812.74
6.5	2812.29
13.1	2810.83
16.5	2810.38
18.9	2809.59
21.4	2809.50
23.7	2809.20
25.3	2808.45
26.5	2808.37
27.1	2807.91
28.0	2807.88
29.7	2808.10
31.4	2809.10
32.5	2809.33
35.0	2809.55
36.3	2809.55
41.3	2812.12
49.2	2812.28
49.3	2812.65

SUMMARY DATA	
Bankfull Elevation:	2809.1
Bankfull Cross-Sectional Area:	5.5
Bankfull Width:	7.4
Flood Prone Area Elevation:	2810.3
Flood Prone Width:	21
Max Depth at Bankfull:	1.2
Mean Depth at Bankfull:	0.7
W / D Ratio:	10.0
Entrenchment Ratio:	2.8
Bank Height Ratio:	1.0

Stream Type	C3b

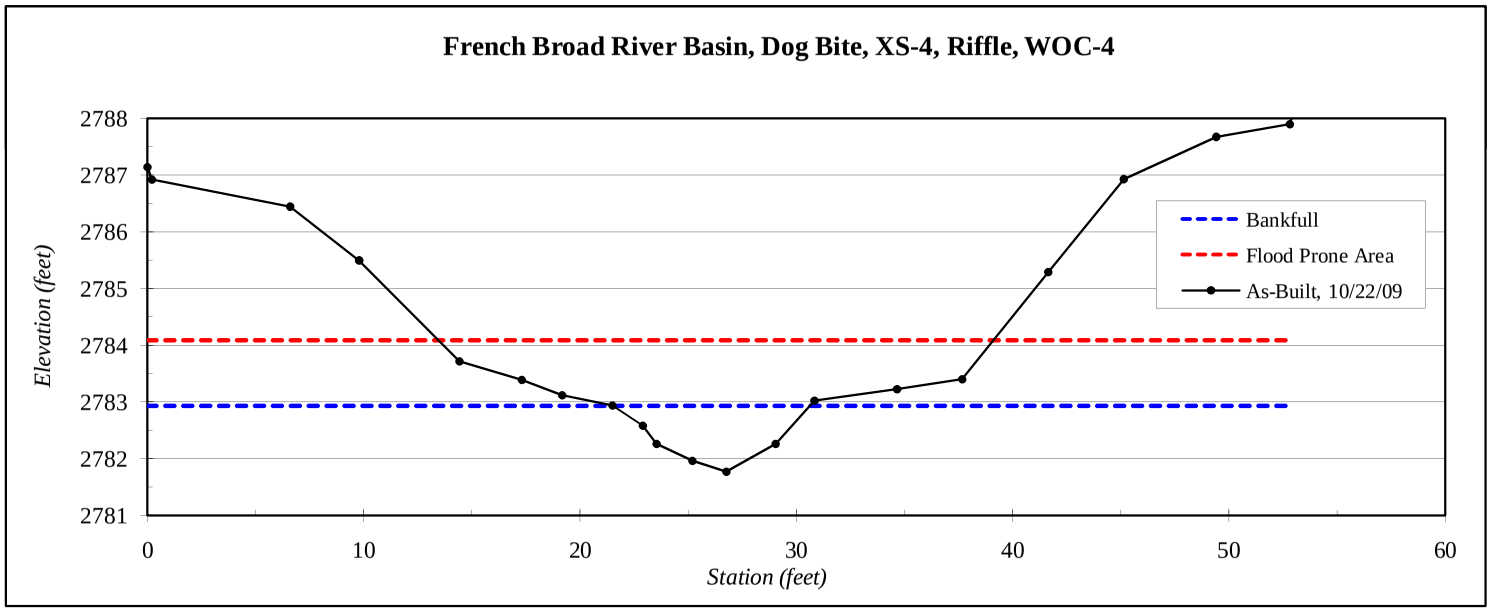


River Basin:	French Broad
Watershed:	Dog Bite
XS ID	XS-4, Riffle, WOC-4
Drainage Area (sq mi):	0.54
Date:	10/22/2009
Field Crew:	A. Spiller, K. Knight-Meng

Station	Elevation
0.0	2787.15
0.2	2786.92
6.6	2786.45
9.8	2785.50
14.4	2783.72
17.3	2783.39
19.2	2783.12
21.5	2782.94
22.9	2782.58
23.5	2782.26
25.2	2781.96
26.8	2781.77
29.1	2782.26
30.8	2783.02
34.7	2783.23
37.7	2783.40
41.7	2785.29
45.2	2786.93
49.4	2787.68
52.8	2787.90
53.0	2788.13

SUMMARY DATA	
Bankfull Elevation:	2782.9
Bankfull Cross-Sectional Area:	6.2
Bankfull Width:	9.1
Flood Prone Area Elevation:	2784.1
Flood Prone Width:	26
Max Depth at Bankfull:	1.2
Mean Depth at Bankfull:	0.7
W / D Ratio:	13.4
Entrenchment Ratio:	2.8
Bank Height Ratio:	1.0

Stream Type	C3b

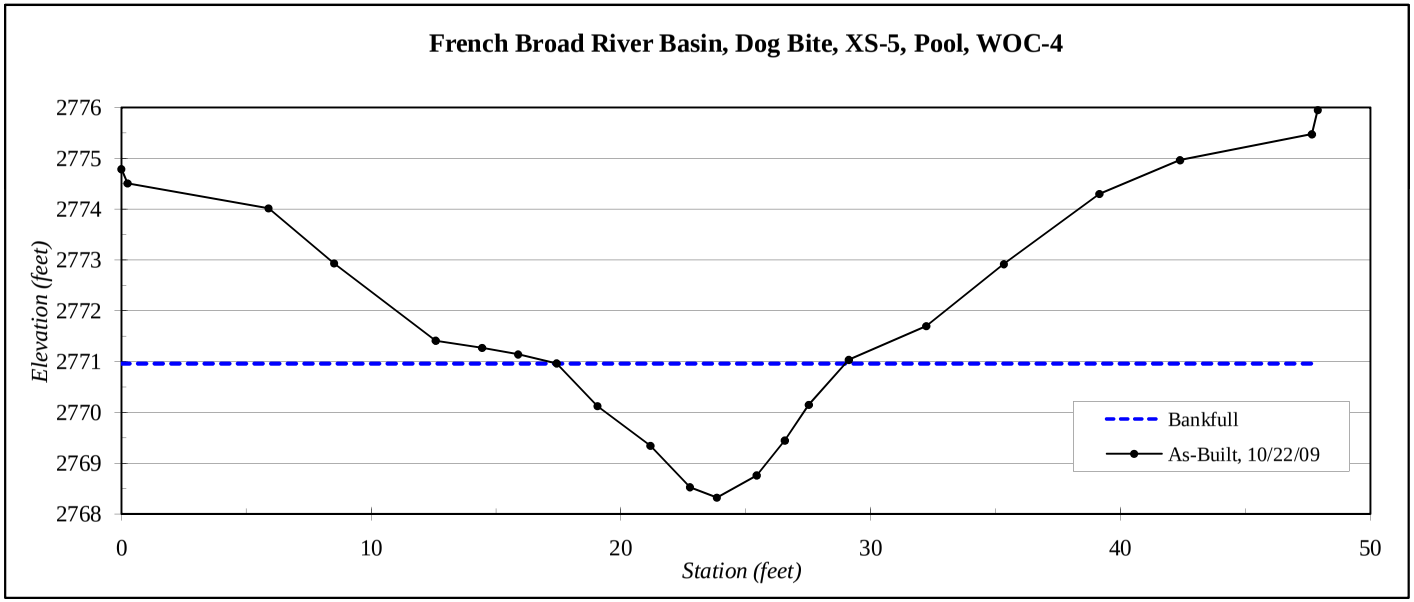


River Basin:	French Broad
Watershed:	Dog Bite
XS ID	XS-5, Pool, WOC-4
Drainage Area (sq mi):	0.54
Date:	10/22/2009
Field Crew:	A. Spiller, K. Knight-Meng

Station	Elevation
0.0	2774.79
0.2	2774.51
5.9	2774.02
8.5	2772.93
12.6	2771.41
14.4	2771.27
15.9	2771.14
17.4	2770.96
19.1	2770.12
21.2	2769.34
22.8	2768.52
23.8	2768.32
25.4	2768.76
26.6	2769.45
27.5	2770.15
29.1	2771.03
32.2	2771.70
35.3	2772.92
39.2	2774.30
42.4	2774.96
47.7	2775.47
47.9	2775.95

SUMMARY DATA	
Bankfull Elevation:	2771.0
Bankfull Cross-Sectional Area:	16.9
Bankfull Width:	11.6
Flood Prone Area Elevation:	-
Flood Prone Width:	-
Max Depth at Bankfull:	2.6
Mean Depth at Bankfull:	1.5
W / D Ratio:	-
Entrenchment Ratio:	-
Bank Height Ratio:	-

Stream Type	C3b

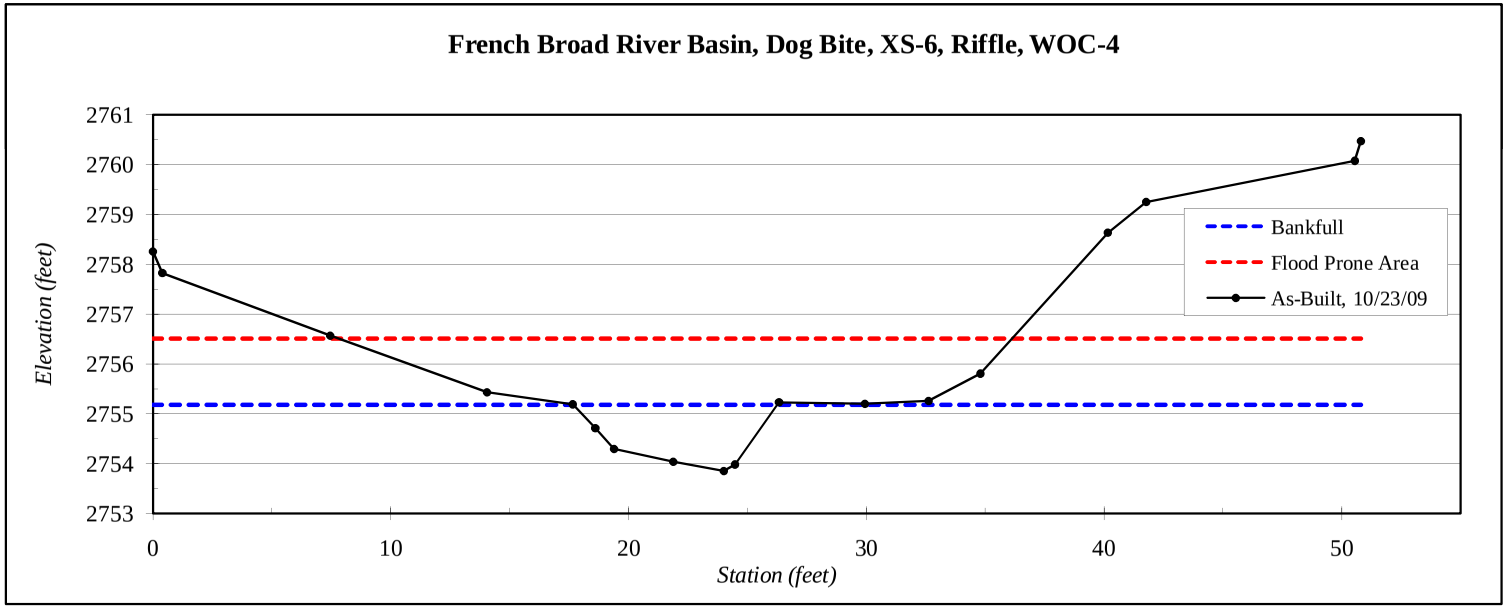


River Basin:	French Broad
Watershed:	Dog Bite
XS ID	XS-6, Riffle, WOC-4
Drainage Area (sq mi):	0.54
Date:	10/23/2009
Field Crew:	A. Spiller, K. Knight-Meng

Station	Elevation
0.0	2758.25
0.4	2757.82
7.5	2756.57
14.1	2755.43
17.7	2755.19
18.6	2754.71
19.4	2754.29
21.9	2754.04
24.0	2753.85
24.5	2753.98
26.3	2755.23
29.9	2755.20
32.6	2755.25
34.8	2755.80
40.2	2758.63
41.8	2759.25
50.5	2760.07
50.8	2760.47

SUMMARY DATA	
Bankfull Elevation:	2755.2
Bankfull Cross-Sectional Area:	7.6
Bankfull Width:	8.6
Flood Prone Area Elevation:	2756.5
Flood Prone Width:	28
Max Depth at Bankfull:	1.3
Mean Depth at Bankfull:	0.9
W / D Ratio:	9.7
Entrenchment Ratio:	3.3
Bank Height Ratio:	1.0

Stream Type	C3b

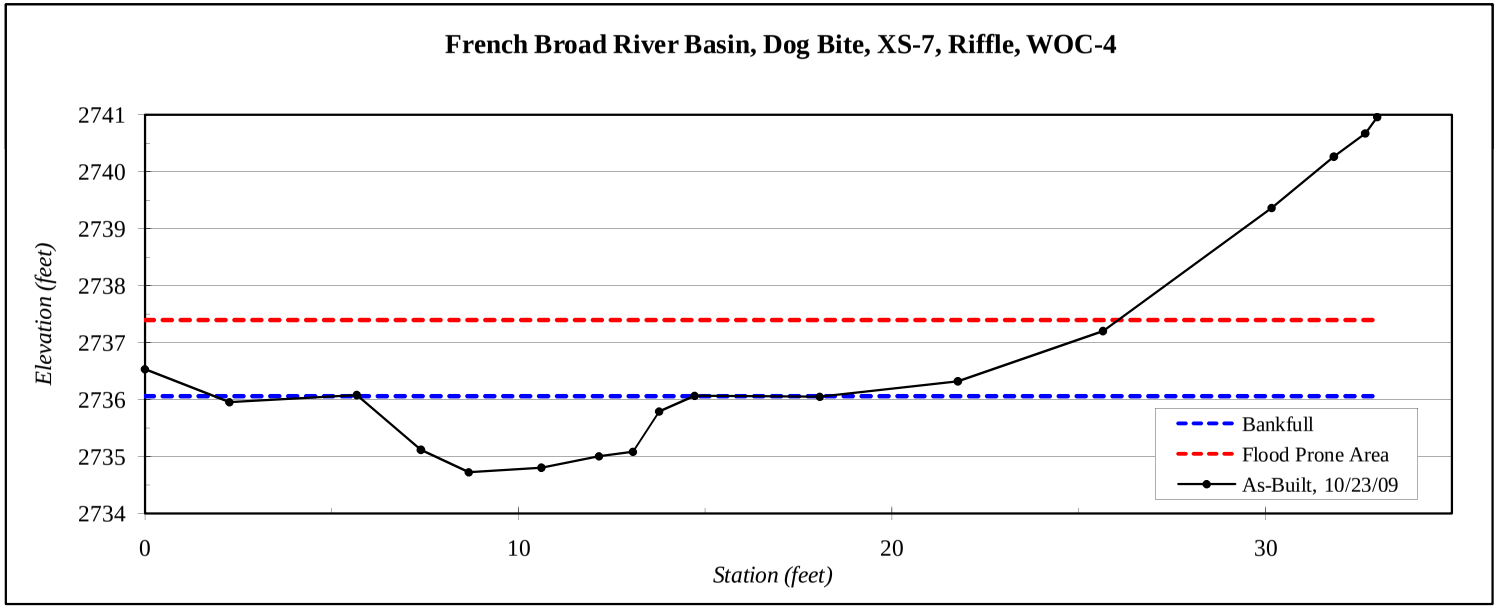


River Basin:	French Broad
Watershed:	Dog Bite
XS ID	XS-7, Riffle, WOC-4
Drainage Area (sq mi):	0.54
Date:	10/23/2009
Field Crew:	A. Spiller, K. Knight-Meng

Station	Elevation
0.0	2736.53
2.3	2735.95
5.7	2736.08
7.4	2735.12
8.7	2734.72
10.6	2734.80
12.2	2735.00
13.1	2735.08
13.8	2735.79
14.7	2736.07
18.1	2736.05
21.8	2736.32
25.7	2737.20
30.2	2739.36
31.8	2740.27
32.7	2740.67
33.0	2740.96

SUMMARY DATA	
Bankfull Elevation:	2736.1
Bankfull Cross-Sectional Area:	8.1
Bankfull Width:	9.0
Flood Prone Area Elevation:	2737.4
Flood Prone Width:	26
Max Depth at Bankfull:	1.3
Mean Depth at Bankfull:	0.9
W / D Ratio:	10.0
Entrenchment Ratio:	2.9
Bank Height Ratio:	1.0

Stream Type	C3b

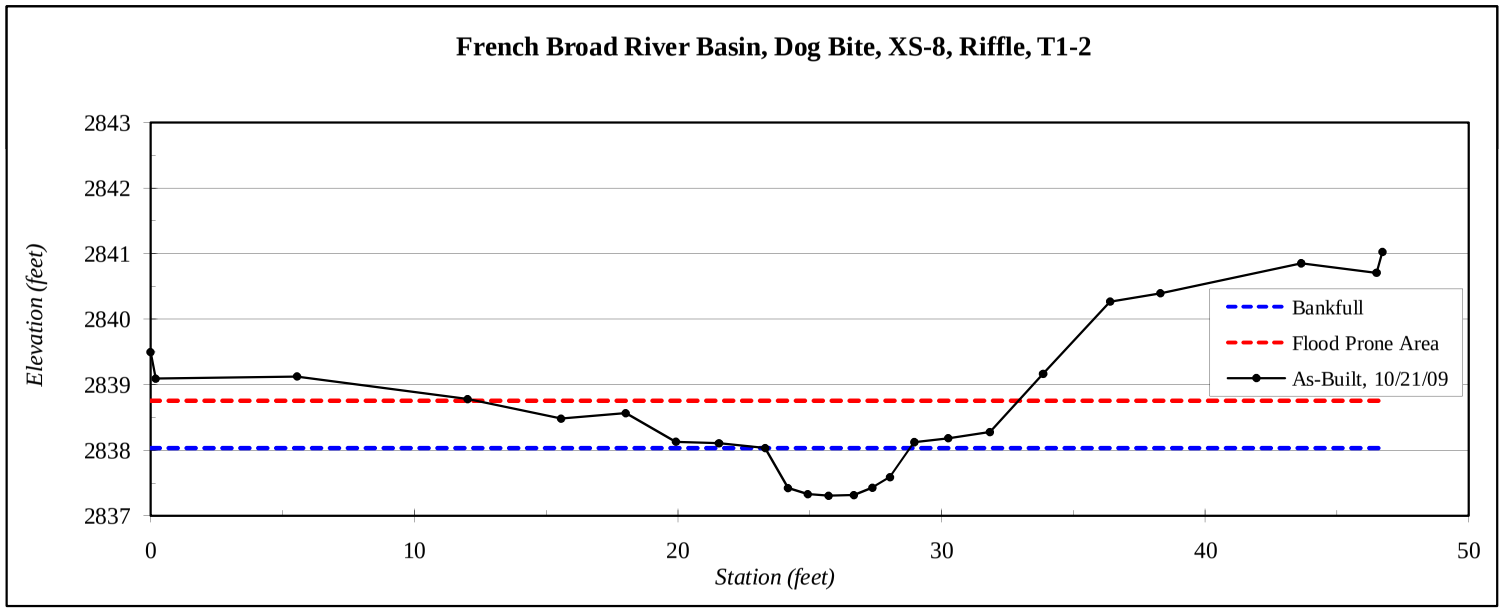


River Basin:	French Broad
Watershed:	Dog Bite
XS ID	XS-8, Riffle, T1-2
Drainage Area (sq mi):	0.08
Date:	10/21/2009
Field Crew:	A. Spiller, K. Knight-Meng

Station	Elevation
0.0	2839.50
0.2	2839.09
5.6	2839.13
12.0	2838.78
15.6	2838.48
18.0	2838.57
19.9	2838.13
21.6	2838.11
23.3	2838.03
24.2	2837.42
24.9	2837.33
25.7	2837.31
26.7	2837.32
27.4	2837.43
28.0	2837.59
29.0	2838.12
30.3	2838.18
31.8	2838.28
33.9	2839.17
36.4	2840.27
38.3	2840.40
43.6	2840.85
46.5	2840.71
46.7	2841.03

SUMMARY DATA	
Bankfull Elevation:	2838.0
Bankfull Cross-Sectional Area:	3.0
Bankfull Width:	5.5
Flood Prone Area Elevation:	2838.8
Flood Prone Width:	21
Max Depth at Bankfull:	0.7
Mean Depth at Bankfull:	0.5
W / D Ratio:	10.1
Entrenchment Ratio:	3.8
Bank Height Ratio:	1.0

Stream Type	C3b

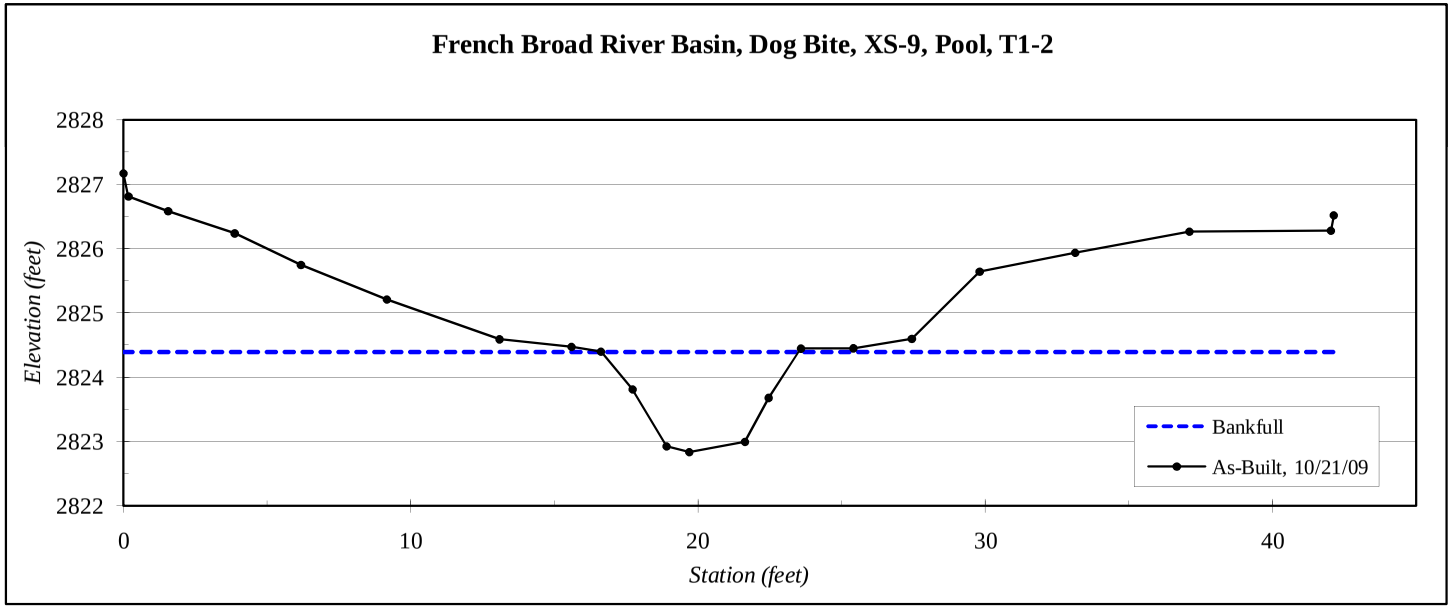


River Basin:	French Broad
Watershed:	Dog Bite
XS ID	XS-9, Pool, T1-2
Drainage Area (sq mi):	0.08
Date:	5/8/2009
Field Crew:	A. Spiller, K. Knight-Meng

Station	Elevation
0.0	2827.17
0.2	2826.81
1.6	2826.58
3.9	2826.23
6.2	2825.74
9.2	2825.21
13.1	2824.59
15.6	2824.47
16.6	2824.39
17.7	2823.81
18.9	2822.93
19.7	2822.83
21.6	2822.99
22.5	2823.68
23.6	2824.44
25.4	2824.45
27.4	2824.60
29.8	2825.64
33.1	2825.94
37.1	2826.26
42.0	2826.28
42.1	2826.52

SUMMARY DATA	
Bankfull Elevation:	2824.4
Bankfull Cross-Sectional Area:	6.8
Bankfull Width:	6.9
Flood Prone Area Elevation:	-
Flood Prone Width:	-
Max Depth at Bankfull:	1.6
Mean Depth at Bankfull:	1.0
W / D Ratio:	-
Entrenchment Ratio:	-
Bank Height Ratio:	-

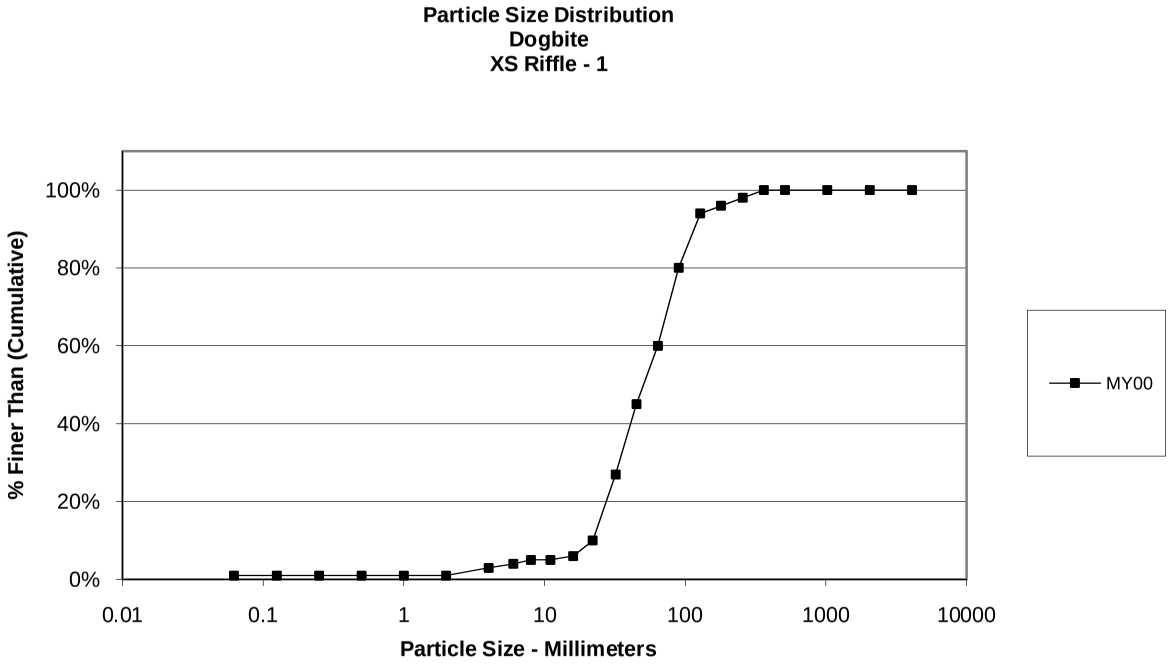
Stream Type	C3b



Pebble Count Plots

Cross-Section Riffle 1 - MY00			
Particle	Millimeter		Count
Silt/Clay	< 0.062	S/C	1
Very Fine	.062 - .125	S	
Fine	.125 - .25	A	
Medium	.25 - .50	N	
Coarse	.50 - 1	D	
Very Coarse	1 - 2	S	
Very Fine	2 - 4		2
Fine	4 - 5.7	G	1
Fine	5.7 - 8	R	1
Medium	8 - 11.3	A	
Medium	11.3 - 16	V	1
Coarse	16 - 22.6	E	4
Coarse	22.6 - 32	L	17
Very Coarse	32 - 45	S	18
Very Coarse	45 - 64		15
Small	64 - 90	C	20
Small	90 - 128	O	14
Large	128 - 180	B	2
Large	180 - 256	L	2
Small	256 - 362	B	2
Small	362 - 512	L	
Medium	512 - 1024	D	
Lrg- Very Lrg	1024 - 2048	R	
Bedrock	>2048	BDRK	
		Total	100

Note:



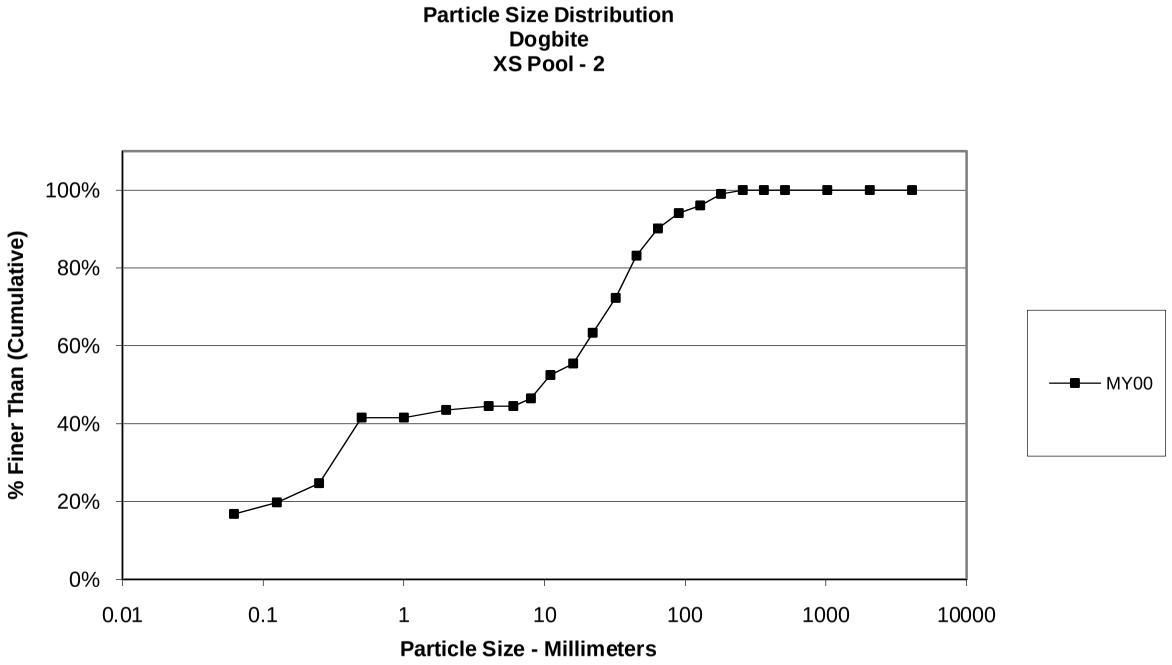
Size (mm)	
D16	25
D35	37
D50	51
D65	70
D84	100
D95	150

Size Distribution	
mean	50.0
dispersion	2.0
skewness	-0.01

Type	
silt/clay	1%
sand	0%
gravel	59%
cobble	38%
boulder	2%
bedrock	0%
hardpan	0%
wood/det	0%
artificial	0%

Cross-Section Pool 2 - MY00			
Particle	Millimeter		Count
Silt/Clay	< 0.062	S/C	17
Very Fine	.062 - .125	S	3
Fine	.125 - .25	A	5
Medium	.25 - .50	N	17
Coarse	.50 - 1	D	
Very Coarse	1 - 2	S	2
Very Fine	2 - 4		1
Fine	4 - 5.7	G	
Fine	5.7 - 8	R	2
Medium	8 - 11.3	A	6
Medium	11.3 - 16	V	3
Coarse	16 - 22.6	E	8
Coarse	22.6 - 32	L	9
Very Coarse	32 - 45	S	11
Very Coarse	45 - 64		7
Small	64 - 90	C	4
Small	90 - 128	O	2
Large	128 - 180	B	3
Large	180 - 256	L	1
Small	256 - 362	B	
Small	362 - 512	L	
Medium	512 - 1024	D	
Lrg- Very Lrg	1024 - 2048	R	
Bedrock	>2048	BDRK	
		Total	101

Note:



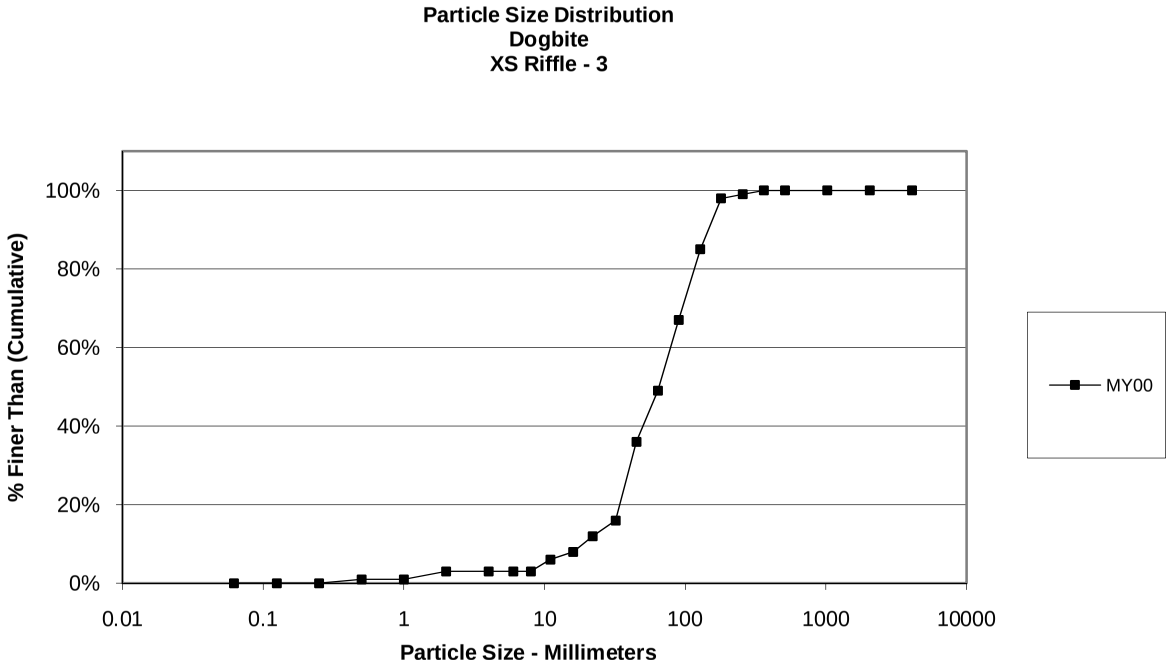
Size (mm)	
D16	0.062
D35	0.38
D50	9.6
D65	24
D84	47
D95	110

Size Distribution	
mean	1.7
dispersion	79.9
skewness	-0.44

Type	
silt/clay	17%
sand	27%
gravel	47%
cobble	10%
boulder	0%
bedrock	0%
hardpan	0%
wood/det	0%
artificial	0%

Cross-Section Riffle 3 - MY00			
Particle	Millimeter		Count
Silt/Clay	< 0.062	S/C	
Very Fine	.062 - .125	S	
Fine	.125 - .25	A	
Medium	.25 - .50	N	1
Coarse	.50 - 1	D	
Very Coarse	1 - 2	S	2
Very Fine	2 - 4		
Fine	4 - 5.7	G	
Fine	5.7 - 8	R	
Medium	8 - 11.3	A	3
Medium	11.3 - 16	V	2
Coarse	16 - 22.6	E	4
Coarse	22.6 - 32	L	4
Very Coarse	32 - 45	S	20
Very Coarse	45 - 64		13
Small	64 - 90	C	18
Small	90 - 128	O	18
Large	128 - 180	B	13
Large	180 - 256	L	1
Small	256 - 362	B	1
Small	362 - 512	L	
Medium	512 - 1024	D	
Lrg- Very Lrg	1024 - 2048	R	
Bedrock	>2048	BDRK	
		Total	100

Note:



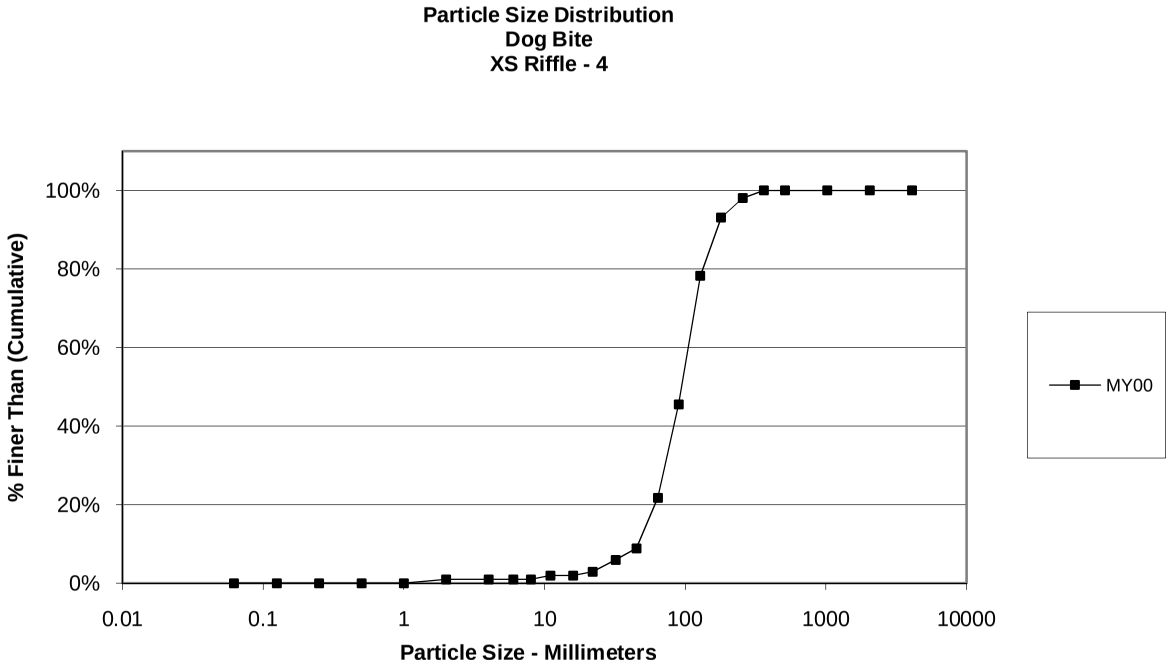
Size (mm)	
D16	32
D35	44
D50	65
D65	87
D84	130
D95	170

Size Distribution	
mean	64.5
dispersion	2.0
skewness	0.00

Type	
silt/clay	0%
sand	3%
gravel	46%
cobble	50%
boulder	1%
bedrock	0%
hardpan	0%
wood/det	0%
artificial	0%

Cross-Section Riffle 4 - MY00			
Particle	Millimeter		Count
Silt/Clay	< 0.062	S/C	
Very Fine	.062 - .125	S	
Fine	.125 - .25	A	
Medium	.25 - .50	N	
Coarse	.50 - 1	D	
Very Coarse	1 - 2	S	1
Very Fine	2 - 4		
Fine	4 - 5.7	G	
Fine	5.7 - 8	R	
Medium	8 - 11.3	A	1
Medium	11.3 - 16	V	
Coarse	16 - 22.6	E	1
Coarse	22.6 - 32	L	3
Very Coarse	32 - 45	S	3
Very Coarse	45 - 64		13
Small	64 - 90	C	24
Small	90 - 128	O	33
Large	128 - 180	B	15
Large	180 - 256	L	5
Small	256 - 362	B	2
Small	362 - 512	L	
Medium	512 - 1024	D	
Lrg- Very Lrg	1024 - 2048	R	
Bedrock	>2048	BDRK	
		Total	101

Note:



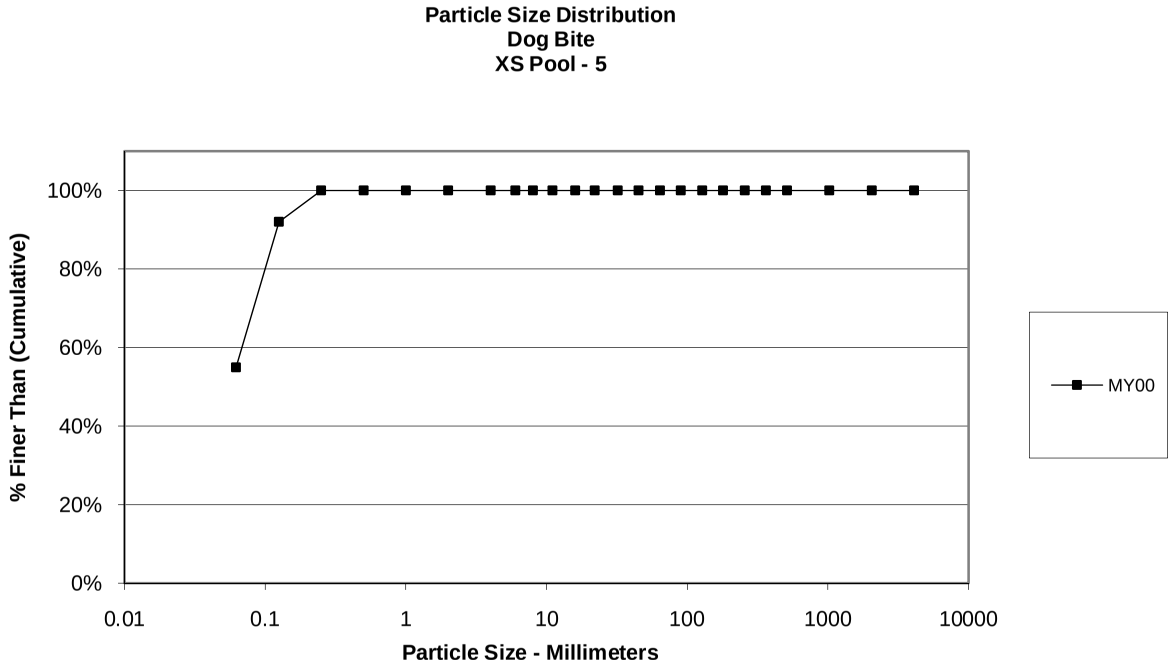
Size (mm)	
D16	55
D35	77
D50	94
D65	110
D84	150
D95	210

Size Distribution	
mean	90.8
dispersion	1.7
skewness	-0.02

Type	
silt/clay	0%
sand	1%
gravel	21%
cobble	76%
boulder	2%
bedrock	0%
hardpan	0%
wood/det	0%
artificial	0%

Cross-Section Pool 5 - MY00			
Particle	Millimeter		Count
Silt/Clay	< 0.062	S/C	55
Very Fine	.062 - .125	S	37
Fine	.125 - .25	A	8
Medium	.25 - .50	N	
Coarse	.50 - 1	D	
Very Coarse	1 - 2	S	
Very Fine	2 - 4		
Fine	4 - 5.7	G	
Fine	5.7 - 8	R	
Medium	8 - 11.3	A	
Medium	11.3 - 16	V	
Coarse	16 - 22.6	E	
Coarse	22.6 - 32	L	
Very Coarse	32 - 45	S	
Very Coarse	45 - 64		
Small	64 - 90	C	
Small	90 - 128	O	
Large	128 - 180	B	
Large	180 - 256	L	
Small	256 - 362	B	
Small	362 - 512	L	
Medium	512 - 1024	D	
Lrg- Very Lrg	1024 - 2048	R	
Bedrock	>2048	BDRK	
		Total	100

Note:



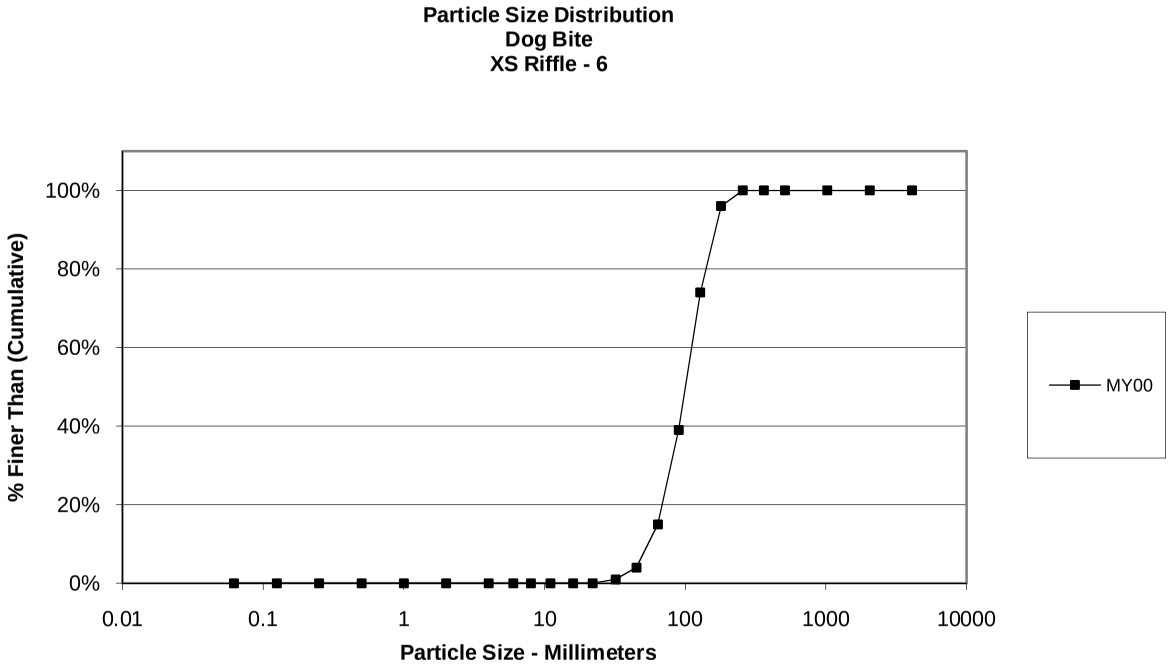
Size (mm)	
D16	0.062
D35	0.062
D50	0.062
D65	0.075
D84	0.11
D95	0.16

Size Distribution	
mean	0.1
dispersion	1.4
skewness	0.25

Type	
silt/clay	55%
sand	45%
gravel	0%
cobble	0%
boulder	0%
bedrock	0%
hardpan	0%
wood/det	0%
artificial	0%

Cross-Section Riffle 6 - MY00			
Particle	Millimeter		Count
Silt/Clay	< 0.062	S/C	
Very Fine	.062 - .125	S	
Fine	.125 - .25	A	
Medium	.25 - .50	N	
Coarse	.50 - 1	D	
Very Coarse	1 - 2	S	
Very Fine	2 - 4		
Fine	4 - 5.7	G	
Fine	5.7 - 8	R	
Medium	8 - 11.3	A	
Medium	11.3 - 16	V	
Coarse	16 - 22.6	E	
Coarse	22.6 - 32	L	1
Very Coarse	32 - 45	S	3
Very Coarse	45 - 64		11
Small	64 - 90	C	24
Small	90 - 128	O	35
Large	128 - 180	B	22
Large	180 - 256	L	4
Small	256 - 362	B	
Small	362 - 512	L	
Medium	512 - 1024	D	
Lrg- Very Lrg	1024 - 2048	R	
Bedrock	>2048	BDRK	
		Total	100

Note:



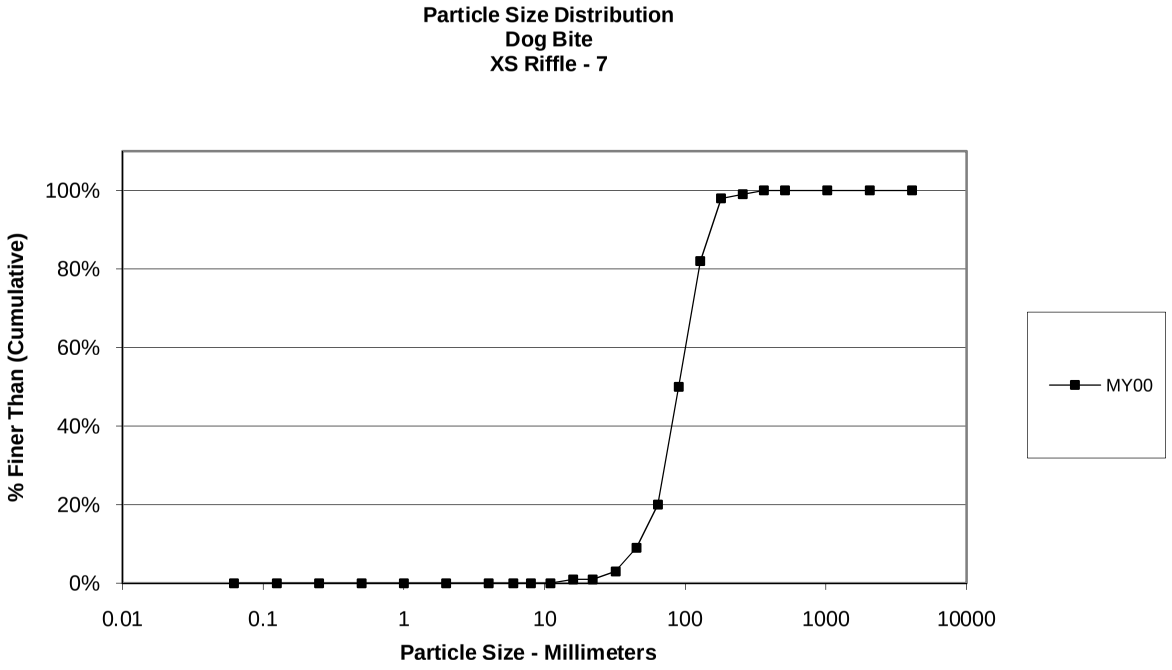
Size (mm)	
D16	65
D35	85
D50	100
D65	120
D84	150
D95	180

Size Distribution	
mean	98.7
dispersion	1.5
skewness	-0.01

Type	
silt/clay	0%
sand	0%
gravel	15%
cobble	85%
boulder	0%
bedrock	0%
hardpan	0%
wood/det	0%
artificial	0%

Cross-Section Riffle 7 - MY00			
Particle	Millimeter		Count
Silt/Clay	< 0.062	S/C	
Very Fine	.062 - .125	S	
Fine	.125 - .25	A	
Medium	.25 - .50	N	
Coarse	.50 - 1	D	
Very Coarse	1 - 2	S	
Very Fine	2 - 4		
Fine	4 - 5.7	G	
Fine	5.7 - 8	R	
Medium	8 - 11.3	A	
Medium	11.3 - 16	V	1
Coarse	16 - 22.6	E	
Coarse	22.6 - 32	L	2
Very Coarse	32 - 45	S	6
Very Coarse	45 - 64		11
Small	64 - 90	C	30
Small	90 - 128	O	32
Large	128 - 180	B	16
Large	180 - 256	L	1
Small	256 - 362	B	1
Small	362 - 512	L	
Medium	512 - 1024	D	
Lrg- Very Lrg	1024 - 2048	R	
Bedrock	>2048	BDRK	
		Total	100

Note:



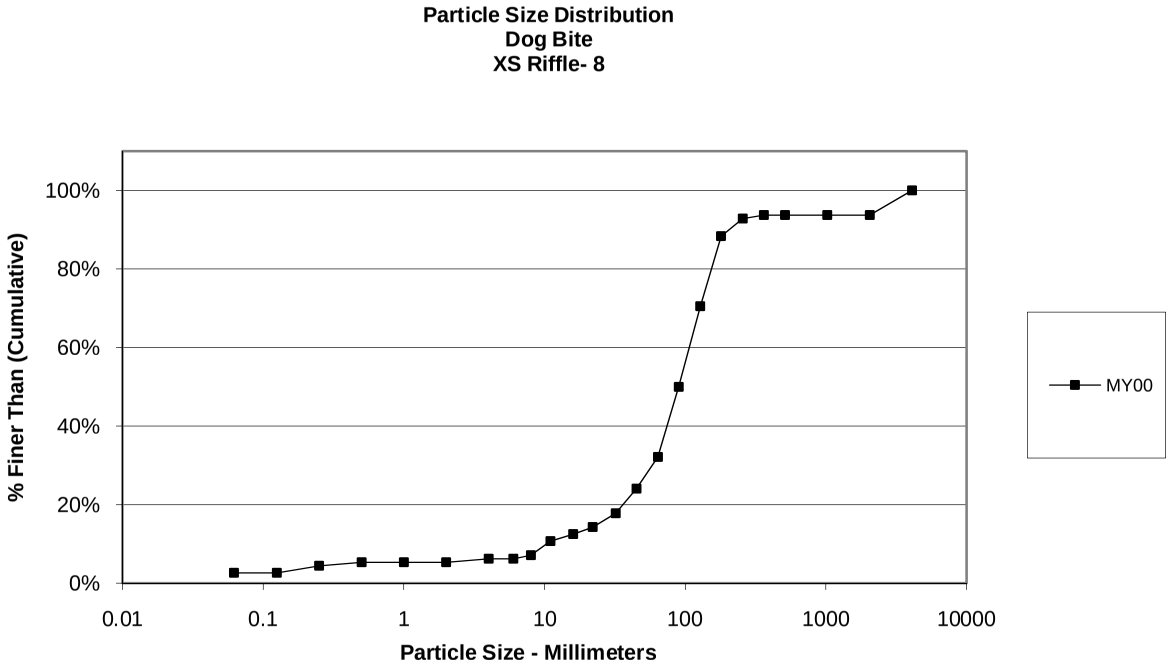
Size (mm)	
D16	56
D35	76
D50	90
D65	110
D84	130
D95	170

Size Distribution	
mean	85.3
dispersion	1.5
skewness	-0.04

Type	
silt/clay	0%
sand	0%
gravel	20%
cobble	79%
boulder	1%
bedrock	0%
hardpan	0%
wood/det	0%
artificial	0%

Cross-Section Riffle 8 - MY00			
Particle	Millimeter		Count
Silt/Clay	< 0.062	S/C	3
Very Fine	.062 - .125	S	
Fine	.125 - .25	A	2
Medium	.25 - .50	N	1
Coarse	.50 - 1	D	
Very Coarse	1 - 2	S	
Very Fine	2 - 4		1
Fine	4 - 5.7	G	
Fine	5.7 - 8	R	1
Medium	8 - 11.3	A	4
Medium	11.3 - 16	V	2
Coarse	16 - 22.6	E	2
Coarse	22.6 - 32	L	4
Very Coarse	32 - 45	S	7
Very Coarse	45 - 64		9
Small	64 - 90	C	20
Small	90 - 128	O	23
Large	128 - 180	B	20
Large	180 - 256	L	5
Small	256 - 362	B	1
Small	362 - 512	L	
Medium	512 - 1024	D	
Lrg- Very Lrg	1024 - 2048	R	
Bedrock	>2048	BDRK	7
		Total	112

Note:



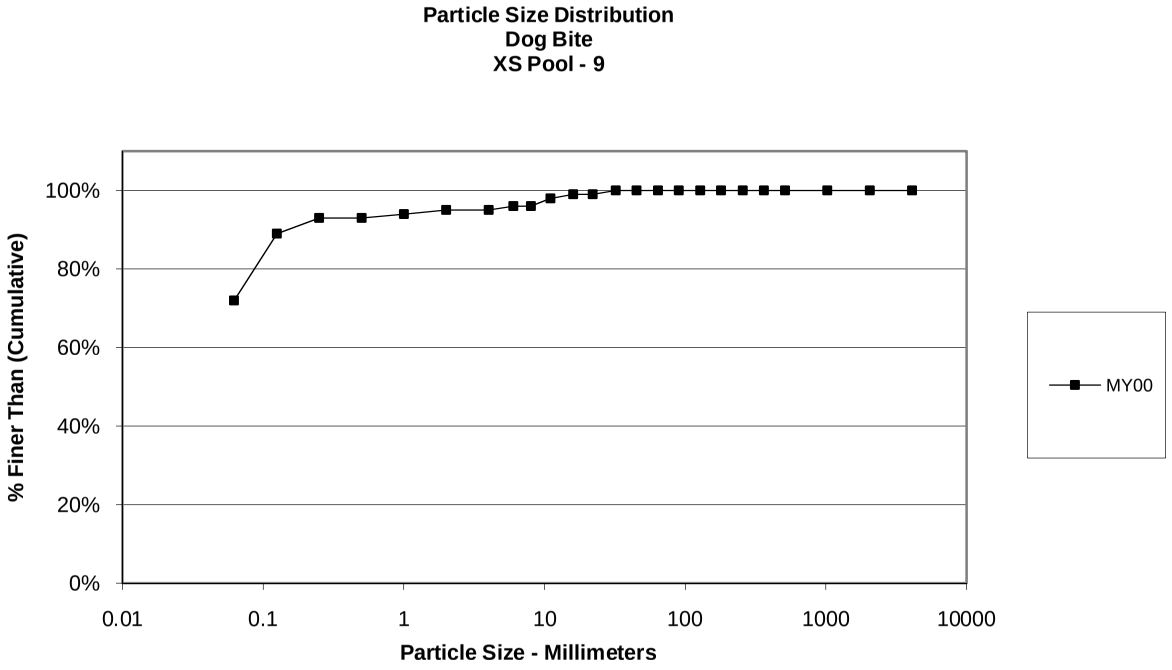
Size (mm)	
D16	26
D35	68
D50	90
D65	120
D84	170
D95	2400

Size Distribution	
mean	66.5
dispersion	2.7
skewness	-0.15

Type	
silt/clay	3%
sand	3%
gravel	27%
cobble	61%
boulder	7%
bedrock	0%
hardpan	0%
wood/det	0%
artificial	0%

Cross-Section Pool 9 - MY00			
Particle	Millimeter		Count
Silt/Clay	< 0.062	S/C	72
Very Fine	.062 - .125	S	17
Fine	.125 - .25	A	4
Medium	.25 - .50	N	
Coarse	.50 - 1	D	1
Very Coarse	1 - 2	S	1
Very Fine	2 - 4		
Fine	4 - 5.7	G	1
Fine	5.7 - 8	R	
Medium	8 - 11.3	A	2
Medium	11.3 - 16	V	1
Coarse	16 - 22.6	E	
Coarse	22.6 - 32	L	1
Very Coarse	32 - 45	S	
Very Coarse	45 - 64		
Small	64 - 90	C	
Small	90 - 128	O	
Large	128 - 180	B	
Large	180 - 256	L	
Small	256 - 362	B	
Small	362 - 512	L	
Medium	512 - 1024	D	
Lrg- Very Lrg	1024 - 2048	R	
Bedrock	>2048	BDRK	
		Total	100

Note:



Size (mm)	
D16	0.062
D35	0.062
D50	0.062
D65	0.062
D84	0.1
D95	#N/A

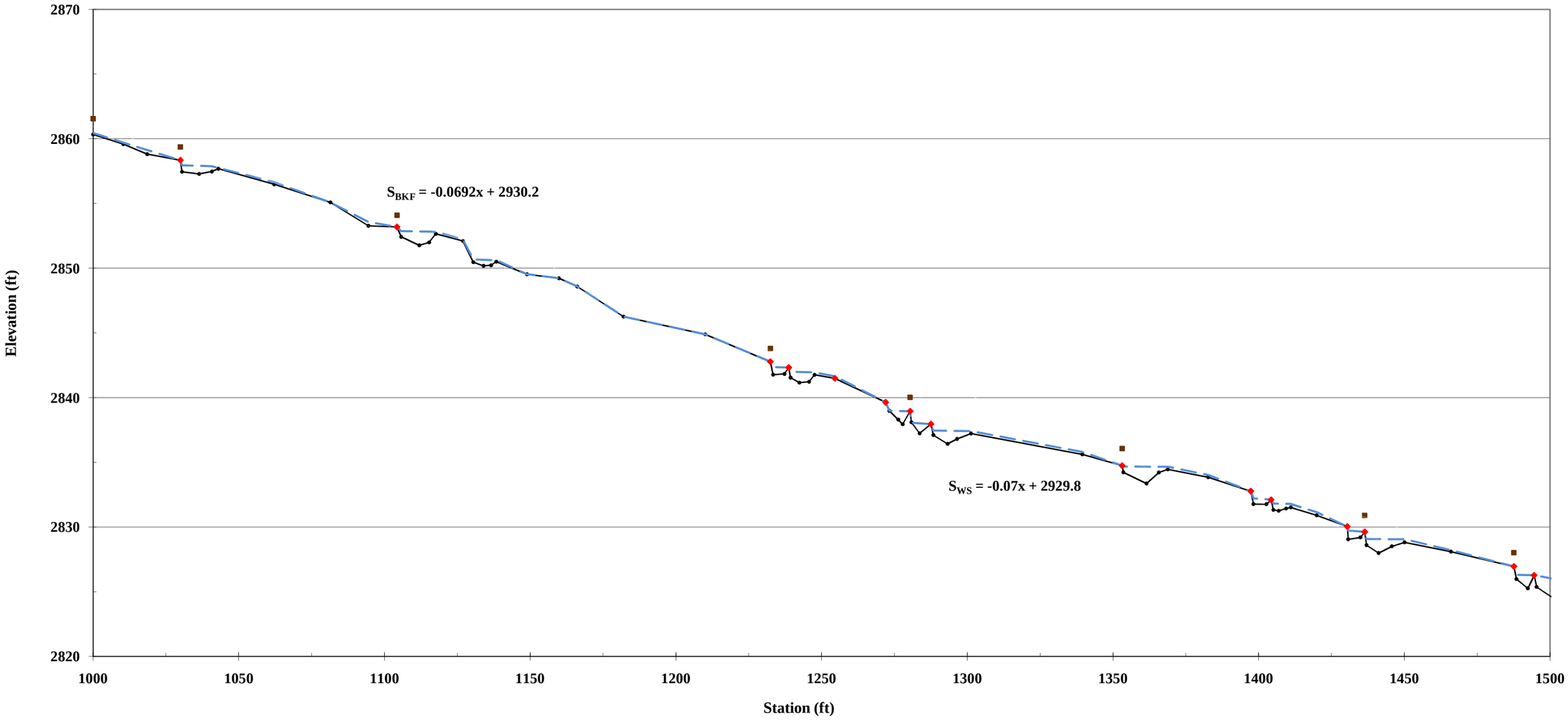
Size Distribution	
mean	0.1
dispersion	1.3
skewness	0.23

Type	
silt/clay	72%
sand	23%
gravel	5%
cobble	0%
boulder	0%
bedrock	0%
hardpan	0%
wood/det	0%
artificial	0%

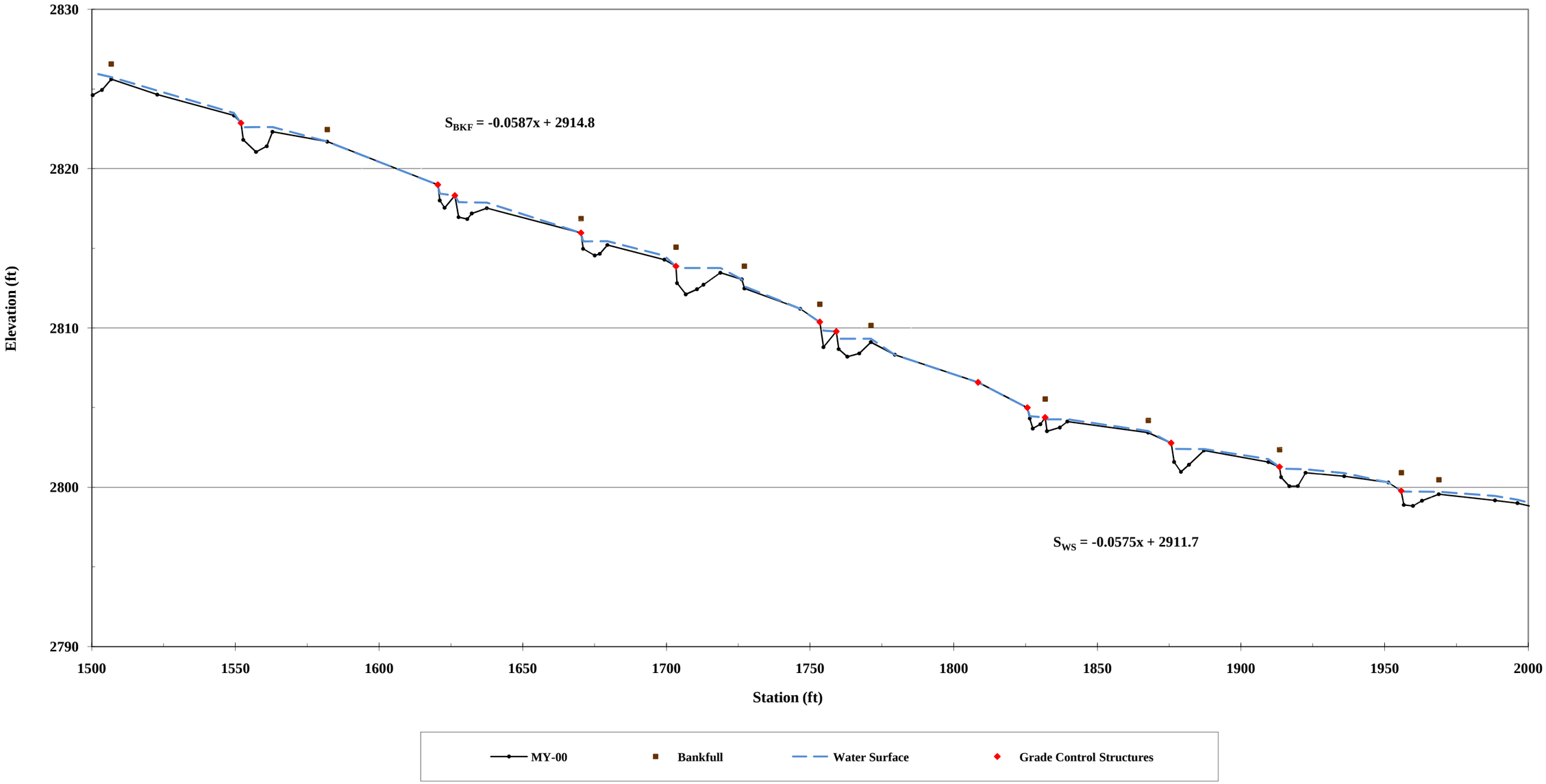
Appendix C

Longitudinal Profiles

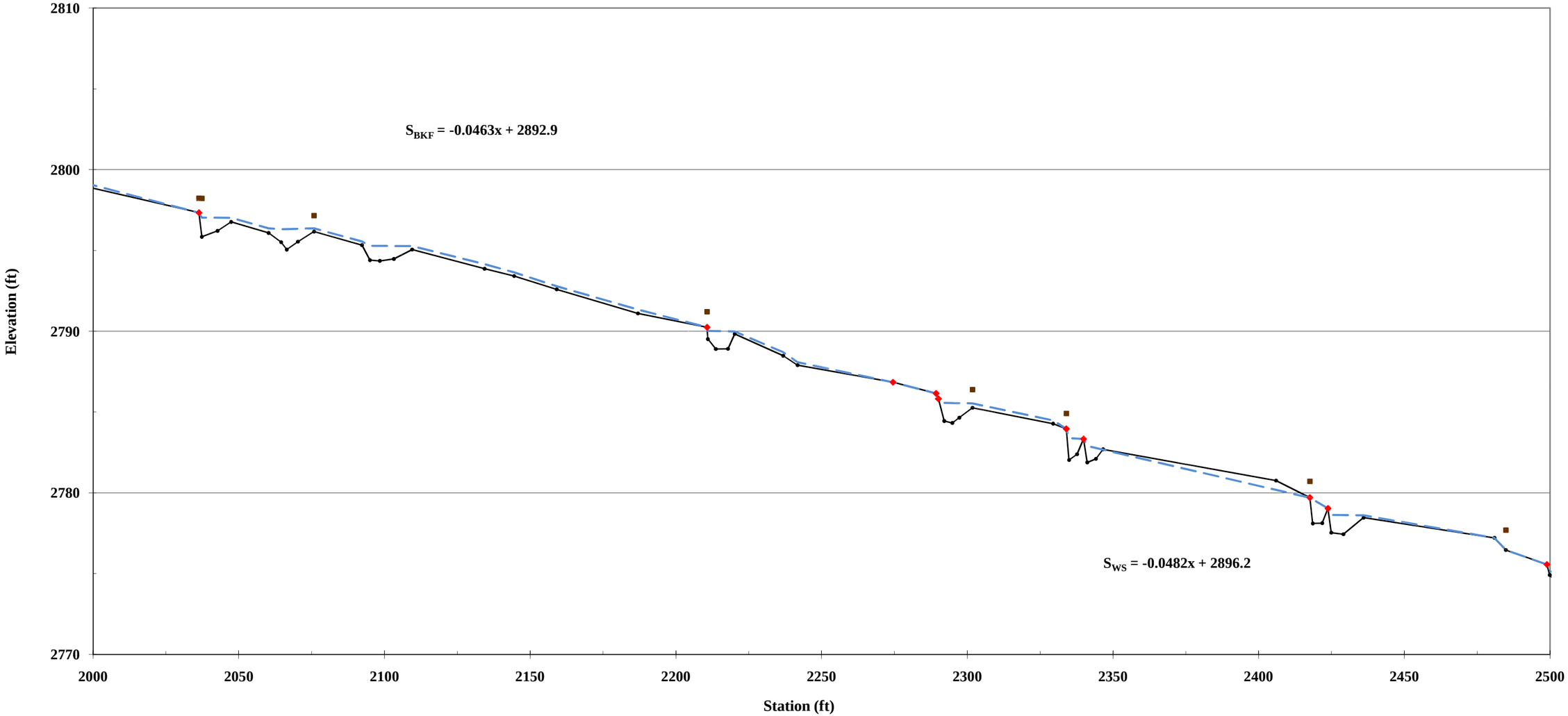
Dog Bite Site
Longitudinal Profile
White Oak Creek, MY-00
Stations 10+00 - 15+00



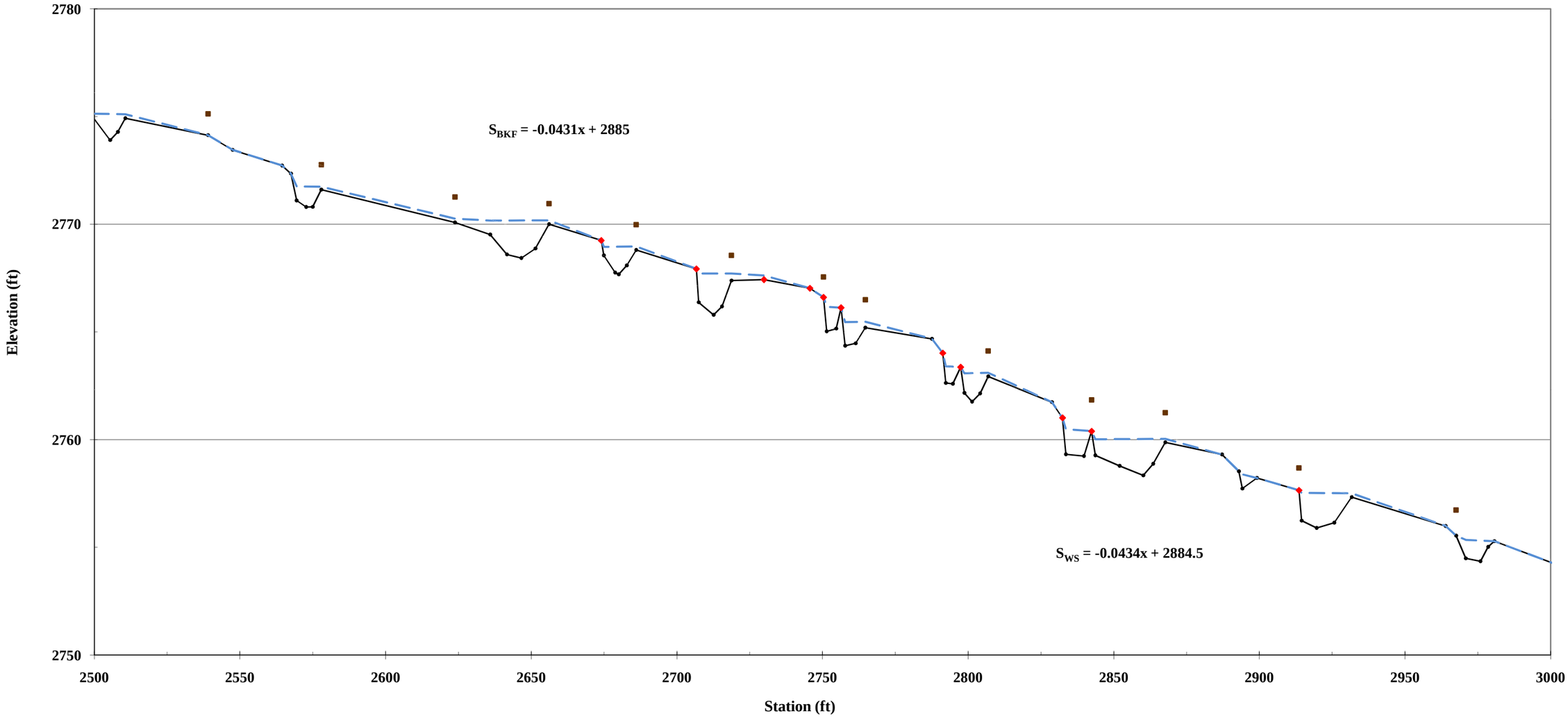
Dog Bite Site
Longitudinal Profile
White Oak Creek, MY-00
Stations 15+00 - 20+00



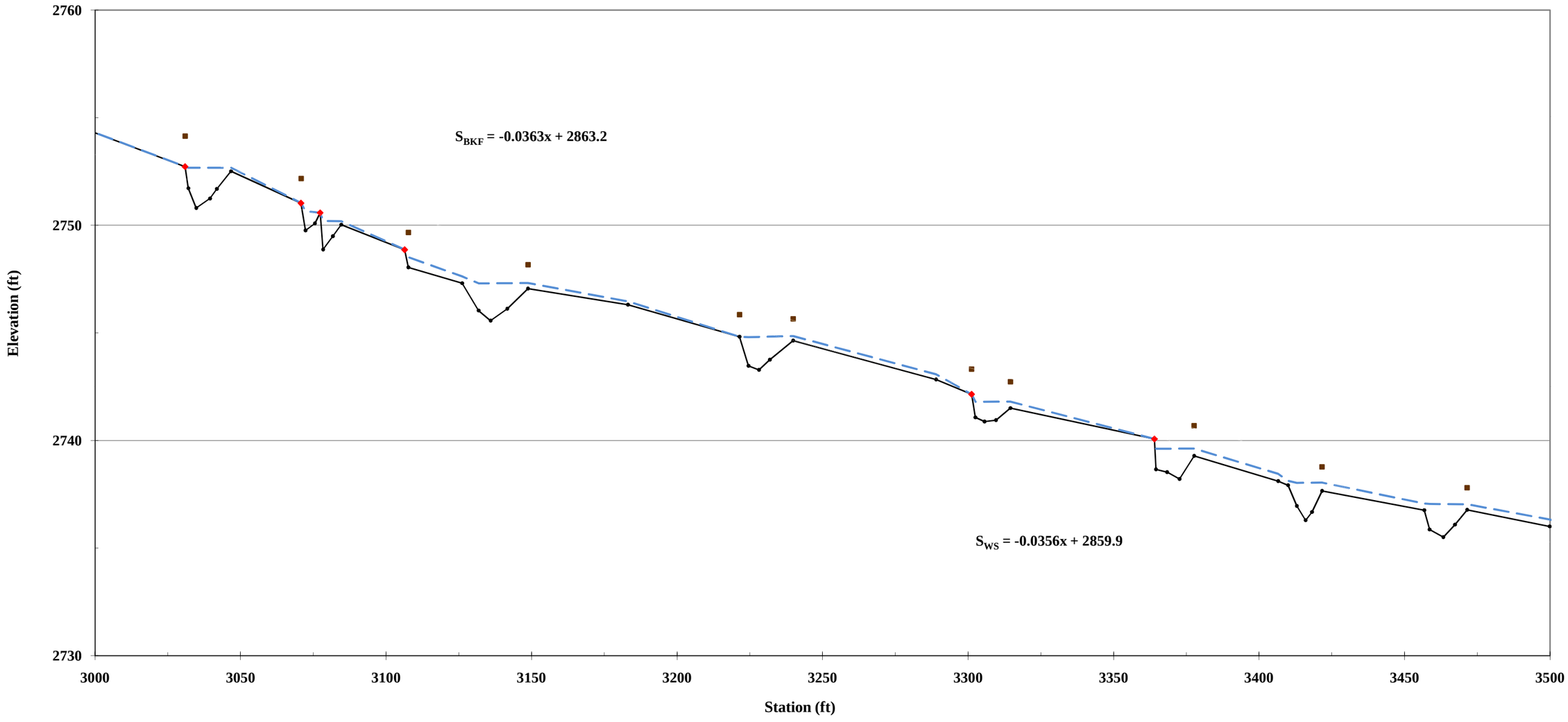
Dog Bite Site
Longitudinal Profile
White Oak Creek, MY-00
Stations 20+00 - 25+00



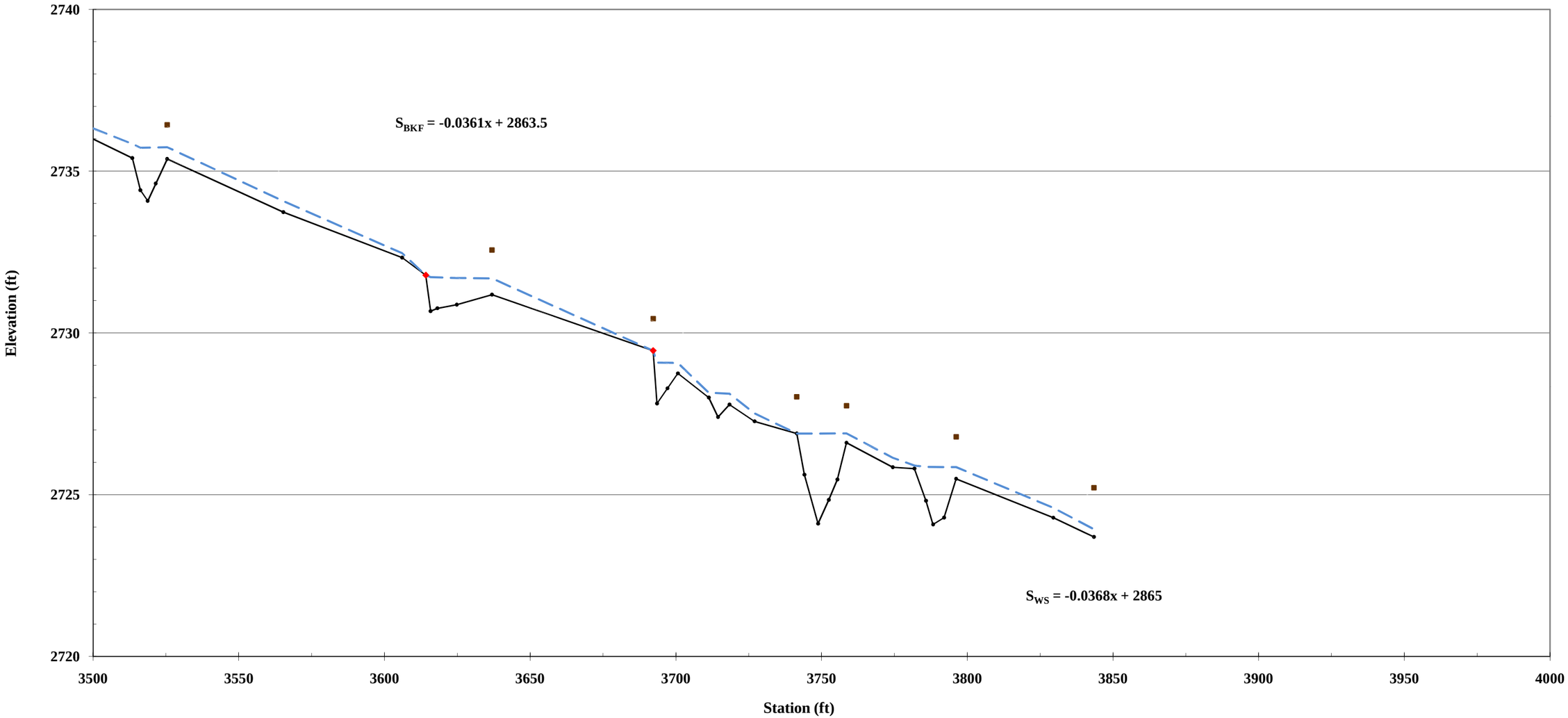
Dog Bite Site
Longitudinal Profile
White Oak Creek, MY-00
Stations 25+00 - 30+00



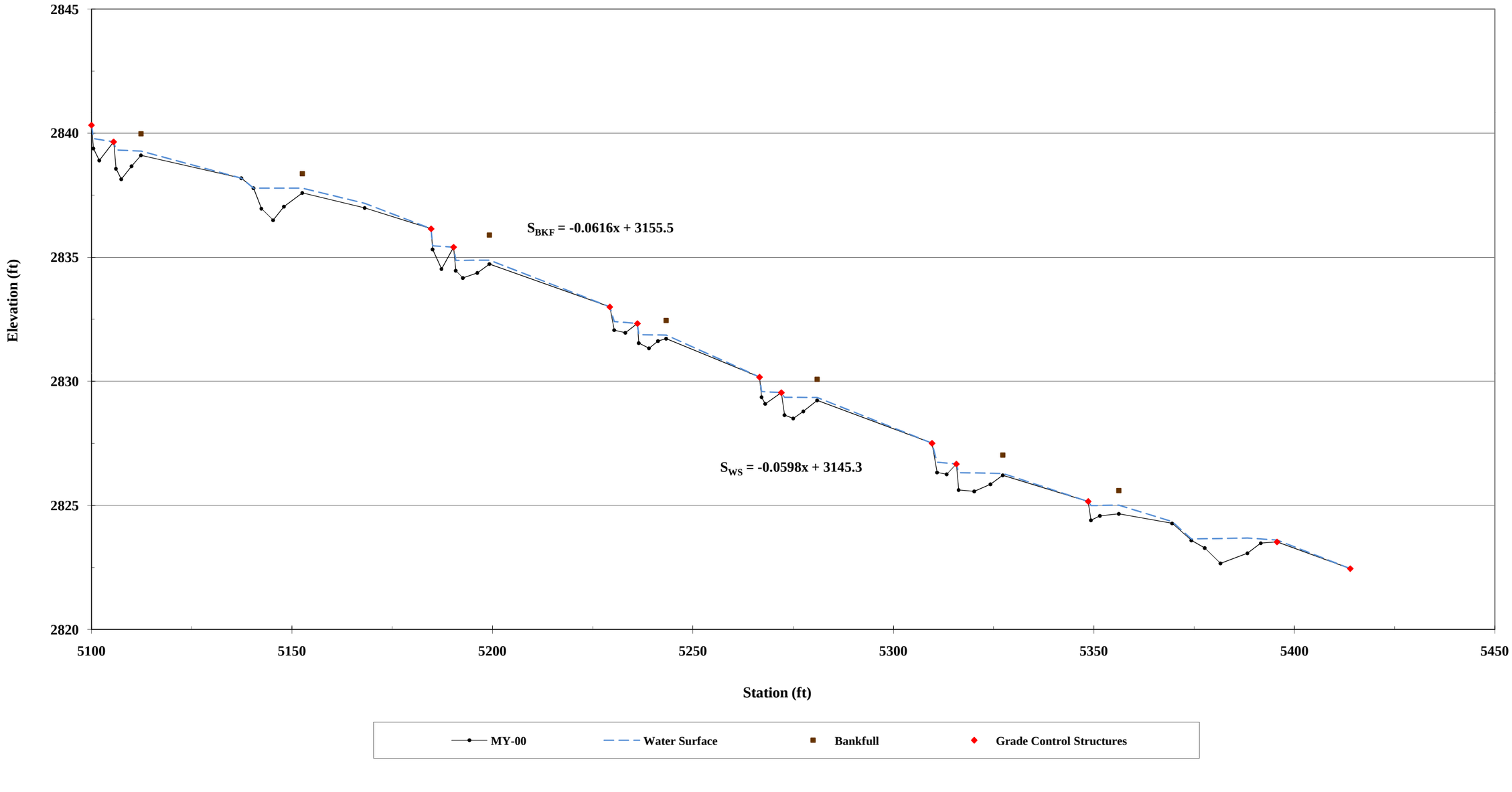
Dog Bite Site
Longitudinal Profile
White Oak Creek, MY-00
Stations 30+00 - 35+00



Dog Bite Site
Longitudinal Profile
White Oak Creek, MY-00
Stations 35+00 - 40+00

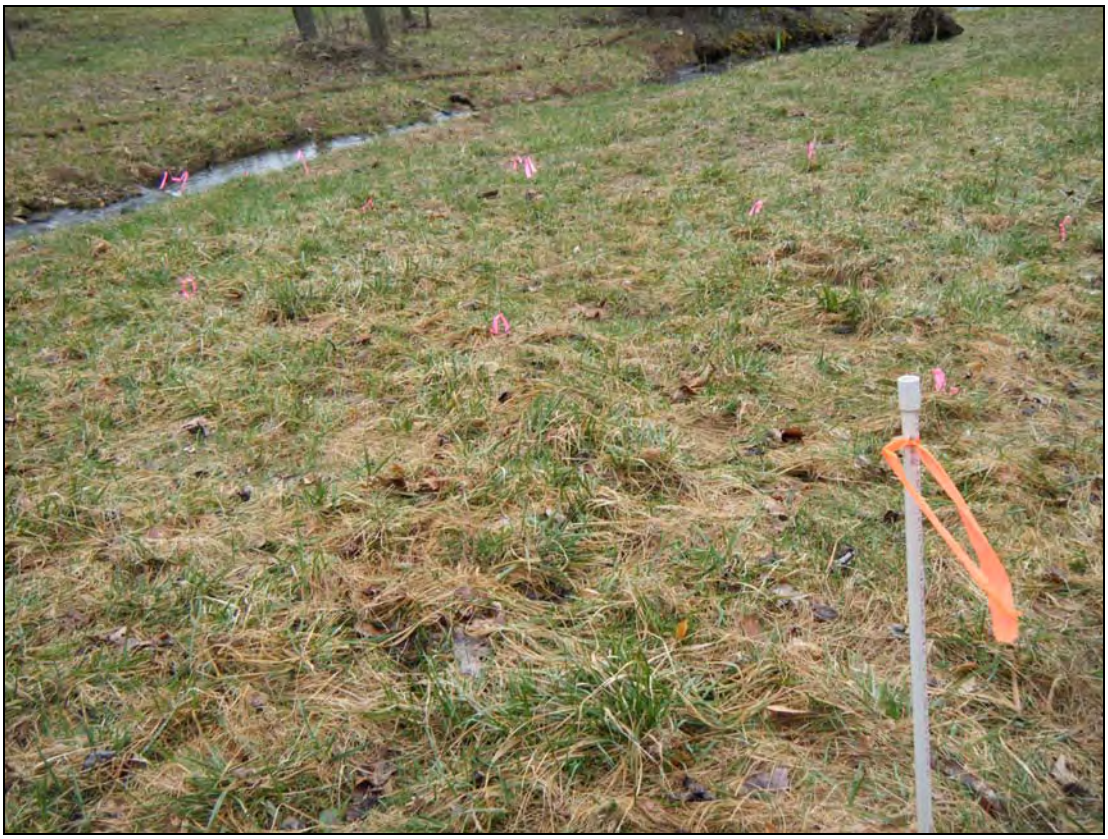


Dog Bite Site
Longitudinal Profile
T1, MY-00
Stations 51+00 - 54+13



Appendix D

Vegetation Plot Photos



Vegetation Plot 1: 3/23/10 – Baseline

Vegetation Plot 2: 3/23/10 – Baseline

Vegetation Plot 3: 3/23/10 – Baseline

Vegetation Plot 4: 3/23/10 – Baseline

Vegetation Plot 5: 3/23/10 – Baseline

Vegetation Plot 6: 3/23/10 – Baseline

Vegetation Plot 7: 3/23/10 – Baseline

Appendix E

Stream Photos

Photo Point 1: View looking upstream, from ford crossing near Station 12+50. 3/23/10 – Baseline

Photo Point 2: View looking downstream, near Station 14+00. 3/23/10 – Baseline

Photo Point 3: View looking upstream at the confluence of WOC and T1. 3/23/10 – Baseline

Photo Point 4: View looking upstream taken near Station 20+50. 3/23/10 – Baseline

Photo Point 4: View looking downstream near Station 20+50. 3/23/10 – Baseline

Photo Point 5: View looking upstream at WOC, near Station 26+25. 3/23/10 – Baseline

Photo Point 5: View looking at water treatment pool, near Station 26+25. 3/23/10 – Baseline

Photo Point 6: View looking upstream at T2, near Station 27+75. 3/23/10 – Baseline

Photo Point 7: View looking upstream near Station 29+25. 3/23/10 – Baseline

Photo Point 7: View looking downstream near Station 29+25. 3/23/10 – Baseline

Photo Point 8: View looking upstream near Station 34+00. 3/23/10 – Baseline

Photo Point 9: View looking upstream near Station 39+25. 3/23/10 – Baseline

Photo Point 9: View looking downstream near Station 34+00. 3/23/10 – Baseline

Photo Point 10: View looking upstream on T1 near Station 51+00. 3/23/10 – Baseline

Photo Point 10: View looking downstream on T1 near Station 51+00. 3/23/10 – Baseline

Photo Point 11: View looking upstream on T1 near Station 52+50. 3/23/10 – Baseline

Photo Point 12: View looking upstream on T2 near Station 60+50. 3/23/10 – Baseline