Dog Bite Stream Restoration Site
Monitoring Report – MY04
Mitchell County, NC
Basin 06010108
EEP Project ID # 92533
Contract # D06056-A

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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 3,684 linear feet on the DBS, generating 3,313 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. This report describes the results from the fourth year of monitoring that took place in 2013.

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 and construction began in August 2009 and ended in September 2009.

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. Seven vegetation monitoring plots were established during the as-built survey. The riparian vegetation must meet a minimum survival success rate of 260 stems/acre after five years. The plots were monitored following the CVS-EEP monitoring protocol and the fourth-year monitoring counted an average of 382 planted stems/ acre. Isolated invasive species, most notably multiflora rose (*Rosa multiflora*) and white poplar (*Populus alba*), were noted in the restored stream buffer and will be controlled over the course of the monitoring period. The fourth-year monitoring found the vegetation component of the project to be on track to meeting the success criterion.

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 fourth year of monitoring found the project streams to be functioning as designed.

During a November site visit, two photos depicting wrack lines were taken to document bankfull events. See Section 2.2.1 Bankfull Events.

1.0 PROJECT BACKGROUND

1.1 Project Location

The Dog Bite Site 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 site 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

Restoration Goals:

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

Restoration Objectives:

- 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 to go 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). WOC-1 (Station 10+00 to 12+54) was enhanced by grading back the existing eroding banks, narrowing over-widened portions of the channel, building a bankfull bench, and developing distinct riffles and pools with step pool structures. Many of the existing trees on the left bank of this reach were left intact. The restoration of WOC-2 (Station 12+70 to 19+50) 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. WOC-3 (Station 19+50 to 22+69) 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 left intact. The restoration of WOC-4 (Station 22+85 to 36+35) 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 (a dairy holding pond closed as a part of this project in May 2009) on the left bank of the top portion of this reach. The reach receives drainage from barns

that support a small number of livestock. A water detention structure was built to receive this drainage and hold it before it flows into WOC. WOC-5 (Station 36+35 to 40+82) is the last reach of WOC and was enhanced by grading back the existing eroding banks, narrowing over-widened portions of the channel, building a bankfull bench, and developing distinct riffles 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 were also restored or enhanced. UT1 is divided into two reaches. Reach UT1-1 (Station 50+00 to 50+97) was enhanced by grading back the existing eroding banks, building a bankfull bench, and developing distinct riffles and pools with a step pool for grade control. Mature trees surround this reach until the beginning of UT1-2 (Station 50+97 to 54+45). The restoration of UT1-2 returned the stream to its natural valley position and established stable riffle and pool features with in-stream structures and created a new stable planform. The last project reach is the second tributary, UT2 (Station 60+00 to 62+45), an intermittent stream that had been historically straightened. This reach was restored by developing stable riffle and pool features with step pool structures and creating a new stable planform.

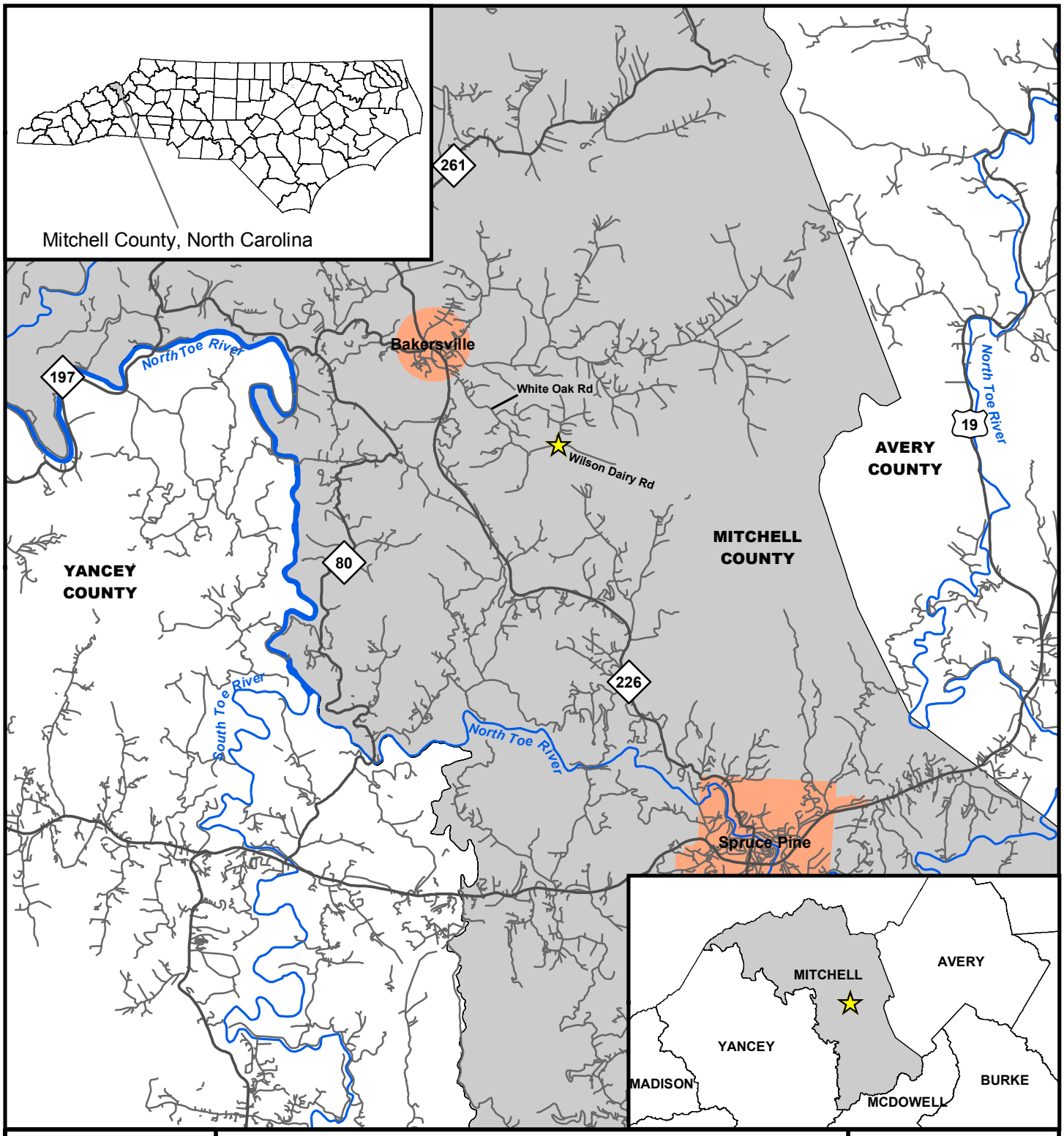

Figure 1. Vicinity Map

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

1:126,720
1 inch = 2 miles

2 1 0 2 Miles

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Ecosystem Enhancement PROGRAM

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, and 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, and 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, and 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, and 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, and 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, and 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, and 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		Note: The discrepancy between the existing and project footage is due to a highly 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.

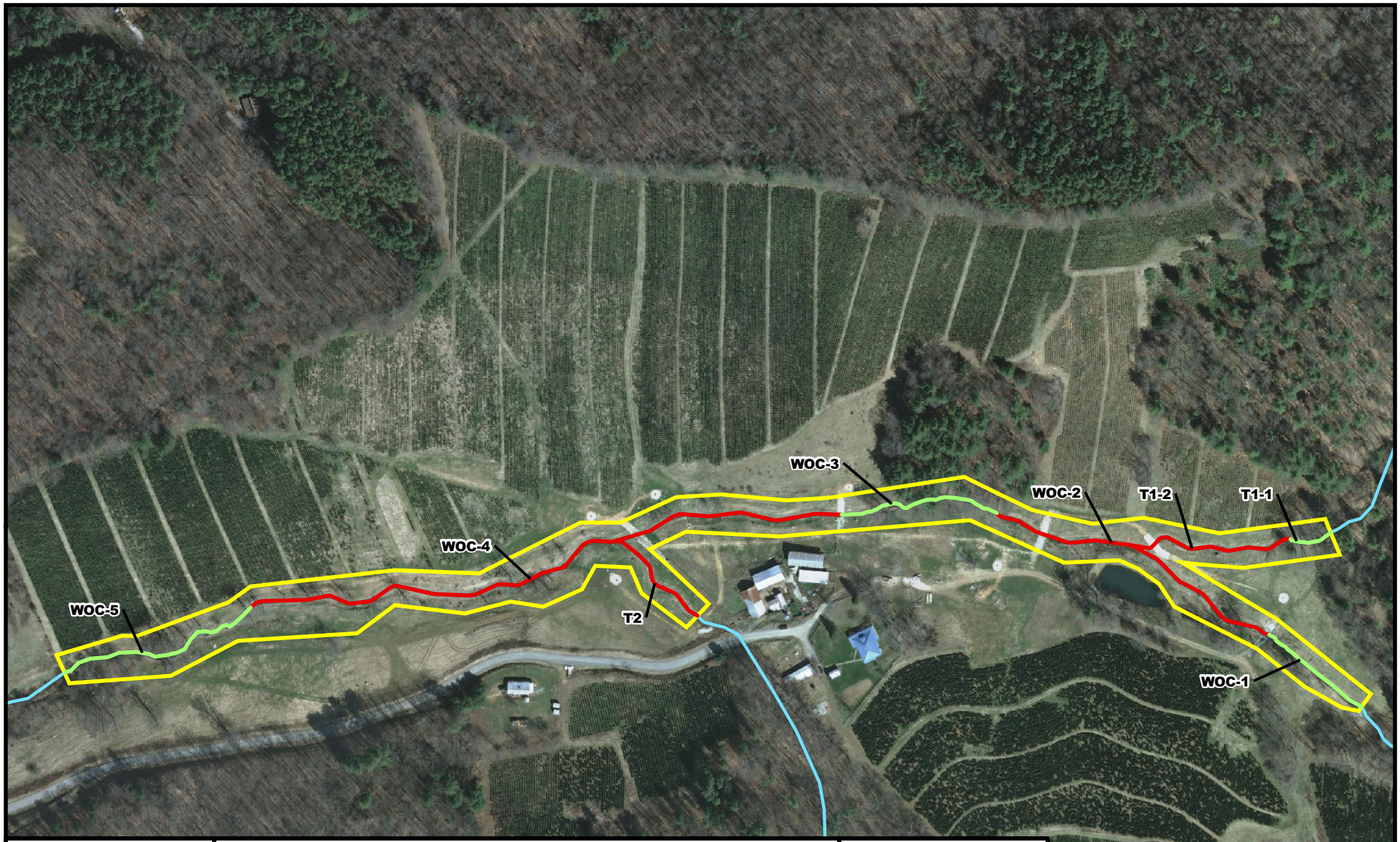

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Figure 2. Site Map

Project Easement Boundary
Enhancement I Reach
Restoration Reach
Other Streams

Source: NC Statewide Orthoimagery, 2010.

N
W E
S

1:3,600
1 inch = 300 feet

300 150 0 300 Feet

Ecosystem Enhancement PROGRAM

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	-	Dec 09
As-Built / Baseline Monitoring (Year 0)	Oct 09 / Mar 10	Apr 10
First Year Monitoring	Oct 10	Dec 10
Second Year Monitoring	Oct 11	Dec 11
Third Year Monitoring	Aug-Sept 12	Dec 12
Fourth Year Monitoring	Oct 13	Dec 13

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)	Cold, 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 CONDITIONS AND MONITORING RESULTS

2.1 Vegetation Assessment

The survivability of the original planted vegetation has been variable across the site. Overall the site is well vegetated, with some areas of low planted stem density. These areas received supplemental planting in early 2011.

Some scattered populations of invasive species have been identified in the floodplain and surrounding areas. Multiflora rose (*Rosa multiflora*) is the most prominent of these. In addition to the multiflora rose, invasive management will also focus on the non-native white poplar (*Populus alba*) and burdock (*Articum minus)*, which have been found growing in the easement. Management of these invasive species will continue over the course of the monitoring period.

The seven monitored vegetation plots were monitored using the Level 2 CVS-EEP vegetation monitoring protocol, which revealed an average planted stem density of 382 stems/acre. There are three monitoring plots (Plots 4, 6, and 7) that have a calculated planted stem density less than 260 stems/acre. Sometime during 2012 and 2013, a portion of Plots 6 and 7 were mowed by adjacent property renters. These parts of the site may receive supplemental planting again during the dormant season. Any additional supplemental planting will be reported in next year's monitoring report. Given the mature trees that still exist on the site, there is a high potential for desirable volunteers to become established across the site. Like natural vegetative communities, some areas will have slightly higher densities than others, but the data from the vegetation monitoring plots reveal that the site has an adequate average stem density. The vegetation assessment found the site to be on track to meeting the vegetative success criteria. The vegetative monitoring results are displayed in Appendix A.

2.2 Stream Assessment

During the 2013 growing season the site experienced several large storm events. The largest of these was a 3.04" event on July 4, 2013 (See Figure 3). This event resulted in full mobilization of the cobble/gravel bed, which resulted in some changes throughout the restored channel dimension and profile. These changes mimic the response that a natural headwater step pool stream would have to a similar event. The changes in the channel are evident in the cross-section and profile data in this report. These data show that some of the features have changed position, but the grade control structures are still functioning and the stream is not showing any signs of instability. One headcut developed as a result of this storm event, located near the top of T1. This headcut was identified as being a risk to the stability of the project and was repaired in December 2013.

Specifically Tables 7a, 7b, and 7c contain the cross-section data. These data show that there have been minor changes from the previous monitoring years' data when viewing the cross-section graphs in Appendix B2. The most significant change that occurred was in Cross-Section 6. This cross-section riffle has transformed into a pool feature. The profile also shows some migration of the pool and riffle features.

Additional stream assessment data can be found in Appendix B and the Current Condition Plan View in Appendix C.

2.2.1 Bankfull Events

As a part of the stream success criterion, the stream must experience at least two bankfull events, each in separate monitoring years. The site has experienced at least two documented bankfull events in 2013.

Table 5. Verification of Bankfull Events
Dog Bite Stream Restoration Site

Date of Data Collection	Date of Occurrence	Method	Photo Number
None in 2010 or 2011			
August 9, 2012	Unknown	Photographed on site	#1, see below
November 11, 2013	Unknown	Photographed on site	#2, see below
November 11, 2013	Unknown	Photographed on site	#3, see below

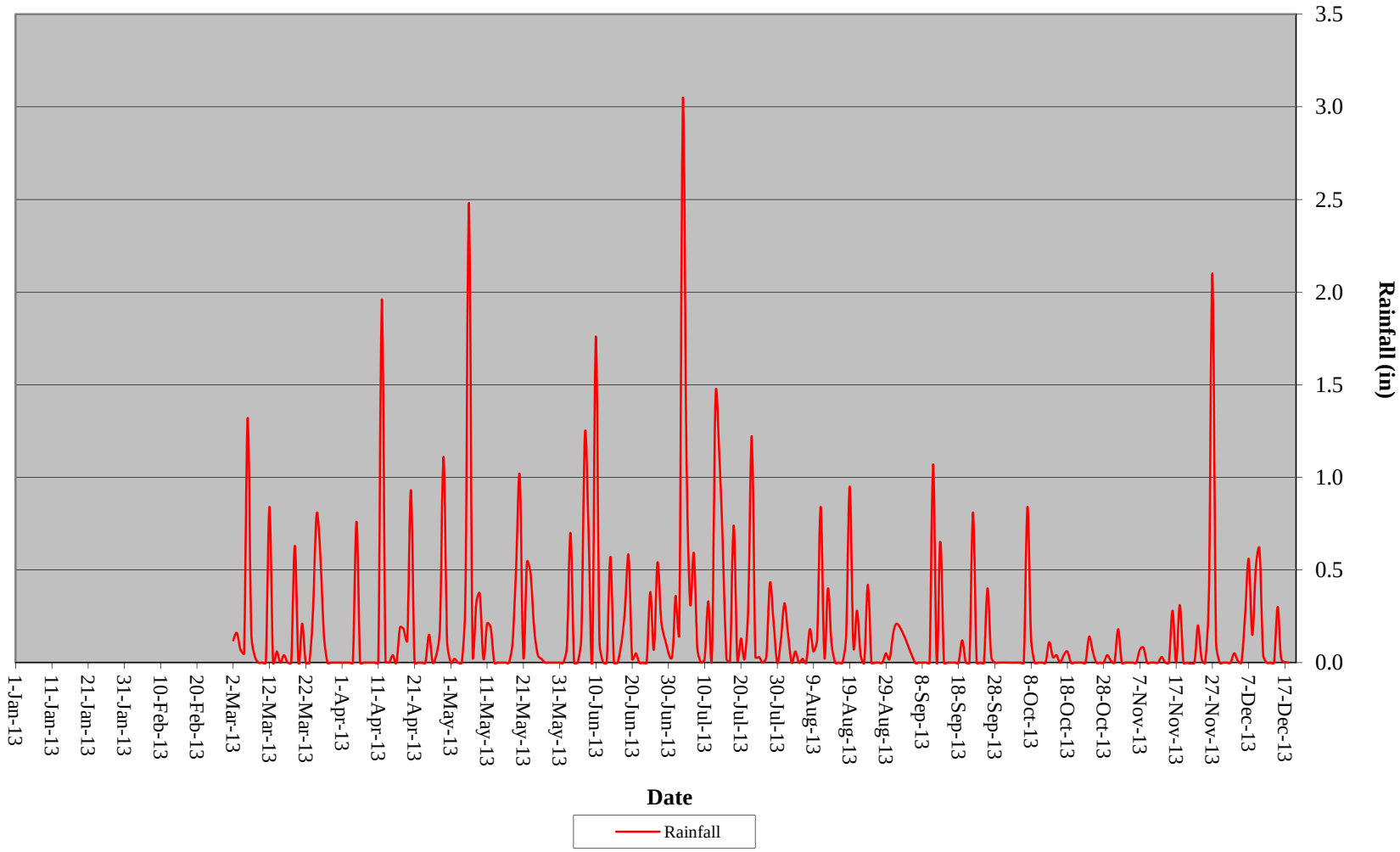
Photo #1 – Bankfull Evidence (wrack lines), 8/9/2012

Photo #2 – Bankfull Evidence on (wrack lines), 11/11/2013

Photo #3 – Bankfull Evidence on (wrack lines), 11/11/2013

Figure 3. 2013 Daily Rainfall

Dog Bite Stream Restoration Site
Station name: Bakersville 5.4, NC



2.2.2 Quantitative Measures Summary Tables

Table 6a. 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 6b. 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 6c. 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 / 240			
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 7a. Morphology and Hydraulic Monitoring Summary
Dog Bite Stream Restoration Site

Parameter	Cross-Section 1 Riffle						Cross-Section 2 Pool						Cross-Section 3 Riffle					
Reach	WOC-2						WOC-2						WOC-2					
Dimension	MY0	MY1	MY2	MY3	MY4	MY5	MY0	MY1	MY2	MY3	MY4	MY5	MY0	MY1	MY2	MY3	MY4	MY5
Bankfull Width (ft)	6.8	6.4	7.3	7.5	7.0		9.1	9.6	10.1	11.3	11.6		7.4	7.4	7.9	8.3	8.1	
Floodprone Width (ft)	26	29	30	32	39		-	-	-	-	-		21	22	21	26	29	
Bankfull Cross-Sectional Area (ft^2)	4.8	7.1	7.7	6.9	10.8		12.7	11.9	12.0	9.0	8.9		5.5	5.4	5.2	6.6	9.0	
Bankfull Mean Depth (ft)	0.7	1.1	1.1	0.9	1.5		1.4	1.2	1.2	0.8	0.8		0.7	0.7	0.7	0.8	1.1	
Bankfull Max Depth (ft)	1.0	1.6	1.7	1.8	2.4		2.3	2.0	1.9	1.3	1.5		1.2	1.2	1.2	1.7	1.9	
Width/Depth Ratio	9.6	5.8	6.9	8.2	4.5		-	-	-	-	-		10.0	10.1	12.0	10.4	7.3	
Entrenchment Ratio	3.8	4.5	4.1	4.3	5.6		-	-	-	-	-		2.8	3.0	2.7	2.9	3.6	
Bank Height Ratio	1.0	1.0	1.0	1.0	1.0		-	-	-	-	-		1.0	1.0	1.0	1.0	1.0	
Substrate																		
d50 (mm)	51	44	18	32	7		9.6	2.7	22	66	18		65	15	60	26	9	
d84 (mm)	100	87	60	64	55		47	50	41	120	63		130	120	130	86	64	

Table 7b. Morphology and Hydraulic Monitoring Summary continued
Dog Bite Stream Restoration Site

Parameter	Cross-Section 4 Riffle						Cross-Section 5 Pool						Cross-Section 6 Riffle					
Reach	WOC-4						WOC-4						WOC-4					
Dimension	MY0	MY1	MY2	MY3	MY4	MY5	MY0	MY1	MY2	MY3	MY4	MY5	MY0	MY1	MY2	MY3	MY4	MY5
Bankfull Width (ft)	9.1	10.7	10.6	11.6	8.7		11.6	12.3	12.7	12.9	13.2		8.6	8.5	9.2	8.9	10.0	
Floodprone Width (ft)	26	27	26	26	26		-	-	-	-	-		28	29	30	26	40	
Bankfull Cross-Sectional Area (ft^2)	6.2	7.2	6.0	5.6	3.8		16.9	16.7	15.6	17.5	16.2		7.6	7.7	7.9	7.0	23.2	
Bankfull Mean Depth (ft)	0.7	0.7	0.6	0.5	0.4		1.5	1.4	1.2	1.4	1.2		0.9	0.9	0.9	0.8	2.3	
Bankfull Max Depth (ft)	1.2	1.2	1.0	1.0	0.8		2.6	2.6	2.4	2.7	2.8		1.3	1.4	1.5	1.4	3.9	
Width/Depth Ratio	13.4	15.9	18.7	24	19.9		-	-	-	-	-		9.7	9.4	10.7	11.3	4.3	
Entrenchment Ratio	2.8	2.5	2.5	2.2	2.9		-	-	-	-	-		3.3	3.4	3.3	2.9	4.0	
Bank Height Ratio	1.0	1.0	1.0	1.0	1.0		-	-	-	-	-		1.0	1.0	1.0	1.0	1.0	
Substrate																		
d50 (mm)	94	82	38	85	29		0.062	0.062	0.062	0.220	0.170		100	90	71	83	10	
d84 (mm)	150	160	110	140	59		0.11	0.15	0.17	23.00	0.22		150	130	120	150	55	

Table 7c. Morphology and Hydraulic Monitoring Summary continued
Dog Bite Stream Restoration Site

Parameter	Cross-Section 7 Riffle						Cross-Section 8 Riffle						Cross-Section 9 Pool					
Reach	WOC-4						T1-2						T1-2					
Dimension	MY0	MY1	MY2	MY3	MY4	MY5	MY0	MY1	MY2	MY3	MY4	MY5	MY0	MY1	MY2	MY3	MY4	MY5
Bankfull Width (ft)	9.0	8.5	8.2	8.0	8.3		5.5	5.8	6.7	9.4	5.0		6.9	7.1	7.4	8.9	6.2	
Floodprone Width (ft)	26	26	25	25	25		21	27	21	25	20		-	-	-	-	-	
Bankfull Cross-Sectional Area (ft^2)	8.1	7.0	6.1	7.7	10.1		3.0	3.3	2.9	3.1	2.0		6.8	6.2	4.5	4.8	3.3	
Bankfull Mean Depth (ft)	0.9	0.8	0.7	1.0	1.2		0.5	0.6	0.4	0.3	0.4		1.0	0.9	0.6	0.5	0.5	
Bankfull Max Depth (ft)	1.3	1.1	1.1	1.4	2.2		0.7	0.9	0.7	0.8	0.6		1.3	1.6	1.1	1.0	1.1	
Width/Depth Ratio	10.0	10.3	11.0	8.3	6.8		10.1	10.2	15.5	28.5	12.5		-	-	-	-	-	
Entrenchment Ratio	2.9	3.1	3.0	3.1	3.0		3.8	4.6	3.1	2.9	4.0		-	-	-	-	-	
Bank Height Ratio	1.0	1.0	1.0	1.0	1.0		1.0	1.0	1.0	1.0	1.0		-	-	-	-	-	
Substrate																		
d50 (mm)	90	68	98	52	15		90	97	74	68	5		0.062	0.062	0.062	0.062	0.440	
d84 (mm)	130	120	170	110	60		170	150	240	150	49		0.10	0.062	0.062	0.062	29.0	

Table 7d. Morphology and Hydraulic Monitoring Summary continued
Dog Bite Stream Restoration Site

Reach WOC-2															
Parameter	MY - 01 (2010)			MY - 02 (2011)			MY - 03 (2012)			MY - 04 (2013)			MY - 05 (2014)		
Profile	Min	Avg.	Max	Min	Avg.	Max	Min	Avg.	Max	Min	Avg.	Max	Min	Avg.	Max
Riffle Length (ft)	21	42	80	13	32	59	7	25	54	8	18	40			
Riffle Slope (ft/ft)	0.0353	0.0579	0.0984	0.0261	0.0672	0.1076	0.0156	0.0582	0.0974	0.025	0.062	0.083			
Pool Length (ft)	2	7	13	2	6	9	4	8	12	5	8	19			
Pool Spacing (ft)	31	57	122	32	70	159	6	54	132	8	50	105			
Additional Reach Parameters															
Water Surface Slope (ft/ft)	0.0560			0.0533			0.0543			0.0554					
Rosgen Classification	C3			C3			C3			C3					

Table 7e. Morphology and Hydraulic Monitoring Summary continued
Dog Bite Stream Restoration Site

Reach WOC-4															
Parameter	MY - 01 (2010)			MY - 02 (2011)			MY - 03 (2012)			MY - 04 (2013)			MY - 05 (2014)		
Profile	Min	Avg.	Max	Min	Avg.	Max	Min	Avg.	Max	Min	Avg.	Max	Min	Avg.	Max
Riffle Length (ft)	10	45	102	6	31	72	4	28	90	7	17	58			
Riffle Slope (ft/ft)	0.0090	0.0480	0.0902	0.0372	0.0590	0.1091	0.0117	0.0420	0.0912	0.025	0.052	0.087			
Pool Length (ft)	2	8	20	1	7	19	3	8	17	1	10	22			
Pool Spacing (ft)	6	54	100	7	52	145	6	60	142	10	75	141			
Additional Reach Parameters															
Water Surface Slope (ft/ft)	0.0407			0.0403			0.0406			0.0385					
Rosgen Classification	C3			C3			C3			C3					

* Pattern measurements will only be taken after MY-00 if it is visually apparent that the pattern has changed.

Table 7f. Morphology and Hydraulic Monitoring Summary continued
Dog Bite Stream Restoration Site

Reach T1-2															
Parameter	MY - 01 (2010)			MY - 02 (2011)			MY - 03 (2012)			MY - 04 (2013)			MY - 05 (2014)		
Profile	Min	Avg.	Max	Min	Avg.	Max	Min	Avg.	Max	Min	Avg.	Max	Min	Avg.	Max
Riffle Length (ft)	15	27	31	8	22	28	6	18	30	8	25	41			
Riffle Slope (ft/ft)	0.0461	0.0599	0.0744	0.0271	0.0597	0.0962	0.0582	0.0767	0.1199	0.0377	0.0558	0.0753			
Pool Length (ft)	3	9	14	4	10	24	3	6	10	4	7	11			
Pool Spacing (ft)	26	39	44	24	39	51	38	41	45	6	25	49			
Additional Reach Parameters															
Water Surface Slope (ft/ft)	0.0578			0.0571			0.0550			0.0578					
Rosgen Classification	C3			C3			C3			C3					

* Pattern measurements will only be taken after MY-00 if it is visually apparent that the pattern has changed.

Appendix A
Vegetation Data

Appendix A1: Vegetation Data

Table A1. Vegetation Metadata
Dog Bite Stream Restoration Site

Report Prepared By	Tommy Seelinger
Date Prepared	11/4/2013 8:59
Database Name	KCI-2013-D.mdb
Database Location	M:\2006\12065439 - Dog Bite\Veg_Database

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

Project Code	Project Name	Description	Length (ft)	Stream-to-Edge Width (ft)	Area (sq m)	Required Plots (calculated)	Sampled Plots
Dog Bite	Dog Bite	This is a Full-Delivery Stream Restoration in Mitchell County, North Carolina	3,707	35	24,116	7	7

Table A1b. Vegetation History (stems/acre)
Dog Bite Stream Restoration Site

Plot Number	MY-00	MY-01	MY-02		MY-03		MY-04		MY-05	
			planted	total	planted	total	planted	total	planted	total
1	809	647	567	647	526	728	526	728		
2	688	647	850	850	850	890	809	849		
3	647	567	567	567	567	1,416	567	1,497		
4	567	242	202	202	162	202	162	445		
5	607	324	445	445	445	445	405	607		
6	728	202	40	40	40	40	0	0		
7	567	283	283	324	283	607	202	324		
Buffer Average			422	439	410	619	382	636		

Table A2. CVS Stem Count Total and Planted by Plot and Species

Dog Bite Stream Restoration Site

Scientific Name	Common Name	Species Type	Dog Bite-A-0001			Dog Bite-A-0002			Dog Bite-A-0003			Dog Bite-A-0004			Dog Bite-A-0005			Dog Bite-A-0006			Dog Bite-A-0007		
			PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T
Alnus serrulata	hazel alder	Tree				2	2	2															
Amelanchier arborea	common serviceberry	Tree	1	1	1																		
Betula nigra	river birch	Tree				1	1	1						1	2	2	4						
Calycanthus floridus	eastern sweetshrub	Tree	1	1	1																		
Carya sp.	hickory	Tree									2												
Carya alba	mockernut hickory	Tree							1	1	1												
Fagus grandifolia	American beech	Tree									1												
Fraxinus pennsylvanica	green ash	Tree			3						1			1			3						
Hamamelis virginiana	American witchhazel	Tree				2	2	2							1	1	1						
Ilex verticillata	common winterberry	Tree				1	1	1															
Juglans nigra	black walnut	Tree							3	3	4				3	3	3				1	1	1
Liriodendron tulipifera	tuliptree	Tree	2	2	4	5	5	6	1	1	1	1	1	2	1	1	1				1	1	4
Nyssa sylvatica	blackgum	Tree	2	2	2				1	1	1										1	1	1
Pinus strobus	eastern white pine	Tree									9												
Platanus occidentalis	American sycamore	Tree	6	6	6						1			4									
Quercus alba	white oak	Tree	1	1	1				7	7	9	3	3	3	1	1	1				2	2	2
Quercus montana	chestnut oak	Tree							1	1	2				2	2	2						
Quercus phellos	willow oak	Tree				9	9	10															
Rhus sp.	sumac	Tree									4												
Robinia pseudoacacia	black locust	Tree									1												
		Stem count	13	13	18	20	20	22	14	14	37	4	4	11	10	10	15	0	0	0	5	5	8
		size (ares)	1			1			1			1			1			1			1		
		size (ACRES)	0.02			0.02			0.02			0.02			0.02			0.02			0.02		
		Species count	6	6	7	6	6	6	6	6	13	2	2	5	6	6	7	0	0	0	4	4	4
		Stems per ACRE	526	526	728	809	809	890	567	567	1497	162	162	445	405	405	607	0	0	0	202	202	324

Table A2. CVS Stem Count Total and Planted by Plot and Species Cont.
Dog Bite Stream Restoration Site

Scientific Name	Common Name	Species Type	MY4 (2013)			MY3 (2012)			MY2 (2011)			MY1 (2010)			MY0 (2010)		
			PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T
Aesculus flava	yellow buckeye	Tree						7									
Alnus serrulata	hazel alder	Shrub	2	2	2	2	2	2	3	3	3	3	3	3			
Amelanchier arborea	common serviceberry	Tree	1	1	1	1	1	1	1	1	1	1	1	1			
Betula nigra	river birch	Tree	3	3	6	3	3	4	3	3	3	6	6	6	7	7	7
Calycanthus floridus	eastern sweetshrub	Shrub	1	1	1	1	1	1	1	1	1	1	1	1	4	4	4
Carpinus caroliniana var. virginiana		Tree												1			
Carya sp.	hickory	Tree			2												
Carya alba	mockernut hickory	Tree	1	1	1	1	1	3	1	1	1	1	1	1			
Fagus grandifolia	American beech	Tree			1			5									
Fraxinus pennsylvanica	green ash	Tree			8			1			1						
Hamamelis virginiana	American witchhazel	Tree	3	3	3	3	3	3	3	3	3	3	3	3			
Ilex verticillata	common winterberry	Shrub	1	1	1	1	1	1	1	1	1	1	1	1			
Juglans nigra	black walnut	Tree	7	7	8	7	7	8	7	7	7	4	4	4			
Liriodendron tulipifera	tuliptree	Tree	11	11	18	11	11	15	12	12	14	8	8	8			
Nyssa sylvatica	blackgum	Tree	4	4	4	5	5	7	5	5	5	6	6	6			
Pinus strobus	eastern white pine	Tree			9			6									
Platanus occidentalis	American sycamore	Tree	6	6	11	6	6	7	6	6	6	6	6	6	6	6	6
Quercus	oak	Tree							2	2	2	3	3	3	15	15	15
Quercus alba	white oak	Tree	14	14	16	17	17	17	16	16	16	16	16	16	6	6	6
Quercus michauxii	swamp chestnut oak	Tree													1	1	1
Quercus montana		Tree	3	3	4	3	3	5	4	4	4	3	3	3	5	5	5
Quercus phellos	willow oak	Tree	9	9	10	10	10	10	8	8	8	8	8	8			
Rhus sp.	sumac	shrub			4			3									
Robinia pseudoacacia	black locust	Tree			1			1									
Unknown		Shrub or Tree										2	2	2	70	70	70
		Stem count	66	66	111	71	71	107	73	73	76	72	72	73	114	114	114
		size (ares)	7			7			7			7			7		
		size (ACRES)	0.17			0.17			0.17			0.17			0.17		
		Species count	14	14	20	14	14	20	15	15	16	16	16	17	8	8	8
		Stems per ACRE	388	388	653	410	410	619	422	422	439	416	416	422	659	659	659

Appendix A2: Vegetation Monitoring Plot Photos

Plot 1 Photo – 10/7/13 - MY 04

Plot 2 Photo – 10/7/13 - MY 04

Plot 3 Photo – 10/7/13 - MY 04

Plot 4 Photo – 10/7/13 - MY 04

Plot 5 Photo – 10/7/13 - MY 04

Plot 6 Photo – Photo unavailable - MY 04

Plot 7 Photo – 10/7/13 - MY 04

Appendix B
Geomorphologic Data

Appendix B1: Stream Photos

Photo Point 1: View looking upstream, from ford crossing near Station 12+50. 10/7/13 - MY 04

Photo Point 2: View looking downstream, near Station 14+00. 10/7/13 - MY 04

Photo Point 3: View looking upstream at the confluence of WOC and T1. 10/7/13 - MY 04

Photo Point 4: View looking upstream taken near Station 20+50. 10/7/13 - MY 04

Photo Point 4: View looking downstream near Station 20+50. 10/7/13 - MY 04

Photo Point 5: View looking upstream at WOC, near Station 26+25. 10/7/13 - MY 04

Photo Point 5: View looking at water treatment pool, near Station 26+25. 10/7/13 - MY 04

Photo Point 6: View looking upstream at T2, near Station 27+75. 10/7/13 - MY 04

Photo Point 7: View looking upstream near Station 29+25. 10/7/13 - MY 04

Photo Point 7: View looking downstream near Station 29+25. 10/7/13 - MY 04

Photo Point 8: View looking upstream near Station 34+00. 10/7/13 - MY 04

Photo Point 9: View looking upstream near Station 39+25. 10/7/13 - MY 04

Photo Point 9: View looking downstream near Station 34+00. 10/7/13 - MY 04

Photo Point 10: View looking upstream on T1 near Station 51+00. 10/7/13 - MY 04

Photo Point 10: View looking downstream on T1 near Station 51+00. 10/7/13 - MY 04

Photo Point 11: View looking upstream on T1 near Station 52+50. 10/7/13 - MY 04

Photo Point 12: View looking upstream on T2 near Station 60+50. 10/7/13 - MY 04

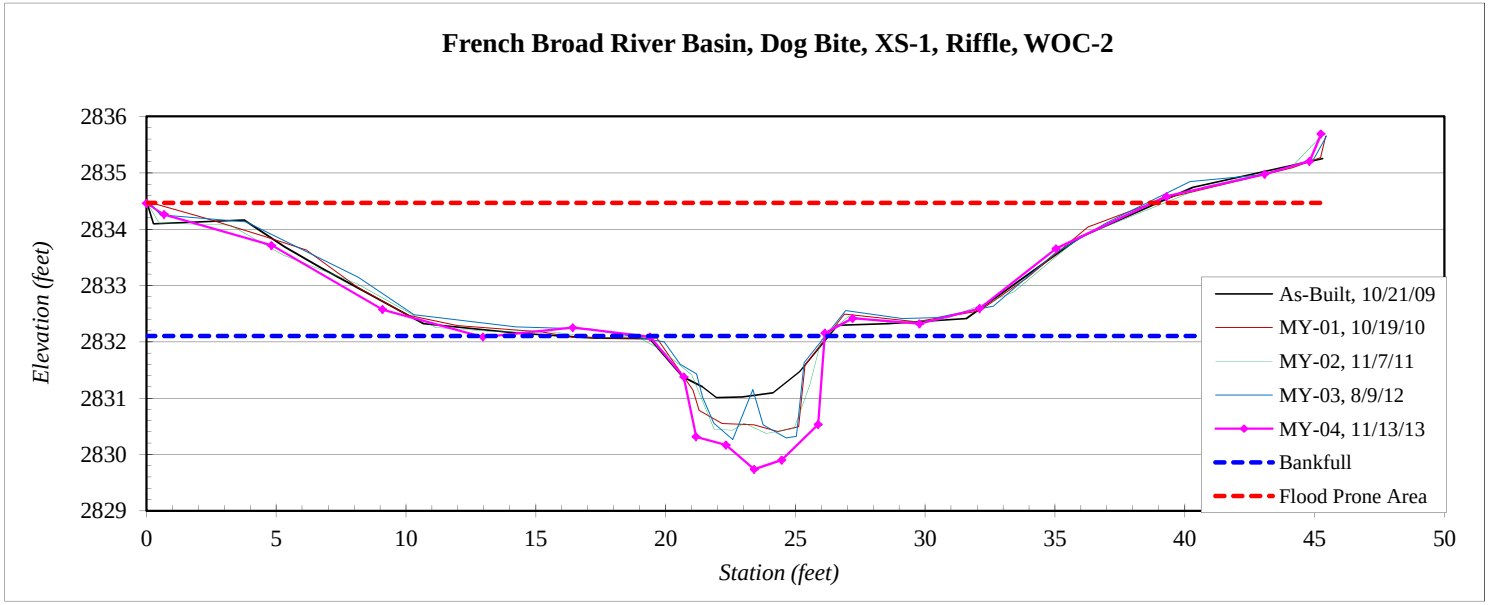
Appendix B2 – Cross-Section Plots

River Basin:	French Broad
Watershed:	Dog Bite
XS ID	XS-1, Riffle, WOC-2
Drainage Area (sq mi):	0.36
Date:	11/13/2013
Field Crew:	A. French, D. Carey

Station	Elevation
0.0	2834.46
0.7	2834.26
4.8	2833.71
9.1	2832.57
13.0	2832.09
16.4	2832.25
19.4	2832.09
20.7	2831.37
21.2	2830.31
22.3	2830.17
23.4	2829.74
24.5	2829.90
25.9	2830.53
26.1	2832.15
27.2	2832.42
29.8	2832.32
32.1	2832.59
35.0	2833.65
39.3	2834.58
43.1	2834.98
44.8	2835.21
45.3	2835.69

SUMMARY DATA	
Bankfull Elevation:	2832.1
Bankfull Cross-Sectional Area:	10.8
Bankfull Width:	7.0
Flood Prone Area Elevation:	2834.5
Flood Prone Width:	39
Max Depth at Bankfull:	2.4
Mean Depth at Bankfull:	1.5
W / D Ratio:	4.5
Entrenchment Ratio:	5.6
Bank Height Ratio:	1.0

Stream Type	C3b

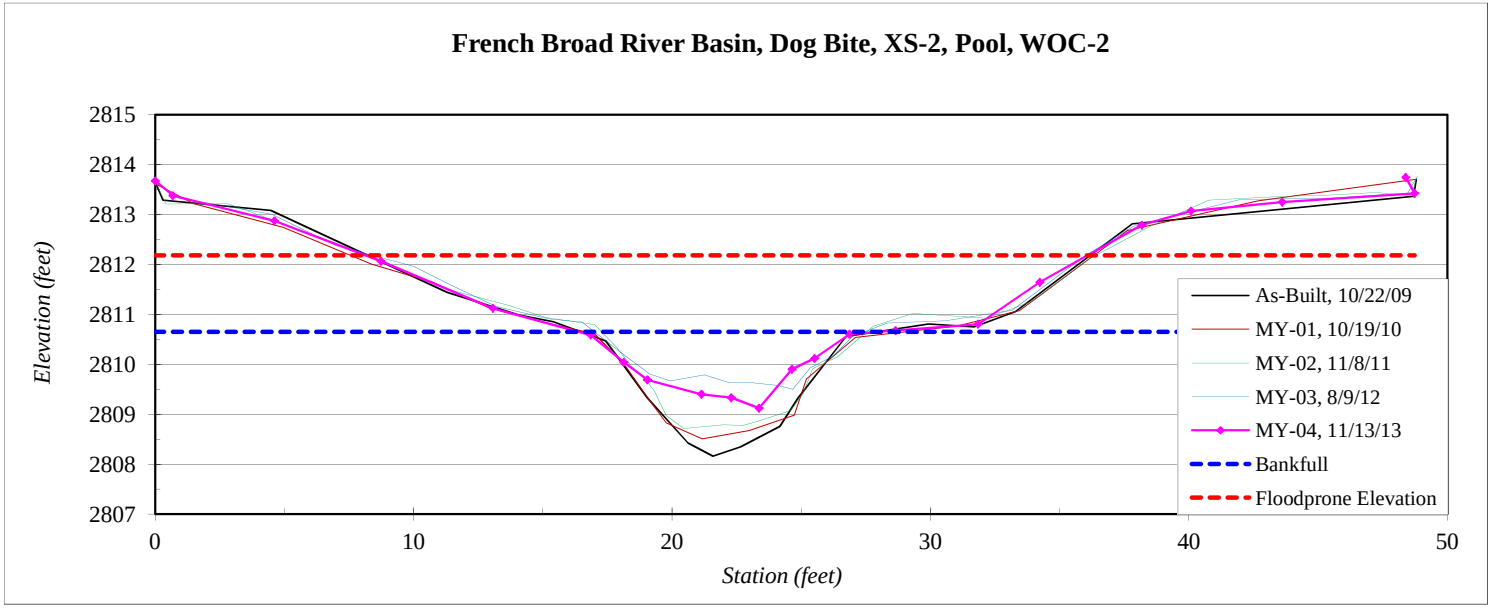


River Basin:	French Broad
Watershed:	Dog Bite
XS ID	XS-2, Pool, WOC-2
Drainage Area (sq mi):	0.36
Date:	11/13/2013
Field Crew:	A. French, D. Carey

Station	Elevation
0.0	2813.68
0.7	2813.38
4.6	2812.87
8.7	2812.07
13.1	2811.12
16.9	2810.59
18.1	2810.04
19.1	2809.69
21.1	2809.40
22.3	2809.33
23.4	2809.12
24.6	2809.90
25.5	2810.12
26.9	2810.60
28.7	2810.68
31.9	2810.80
34.2	2811.65
38.2	2812.79
40.1	2813.07
43.6	2813.25
48.7	2813.42
48.4	2813.74

SUMMARY DATA	
Bankfull Elevation:	2810.7
Bankfull Cross-Sectional Area:	8.9
Bankfull Width:	11.6
Flood Prone Area Elevation:	2812.2
Flood Prone Width:	-
Max Depth at Bankfull:	1.5
Mean Depth at Bankfull:	0.8
W / D Ratio:	-
Entrenchment Ratio:	-
Bank Height Ratio:	-

Stream Type	C3b

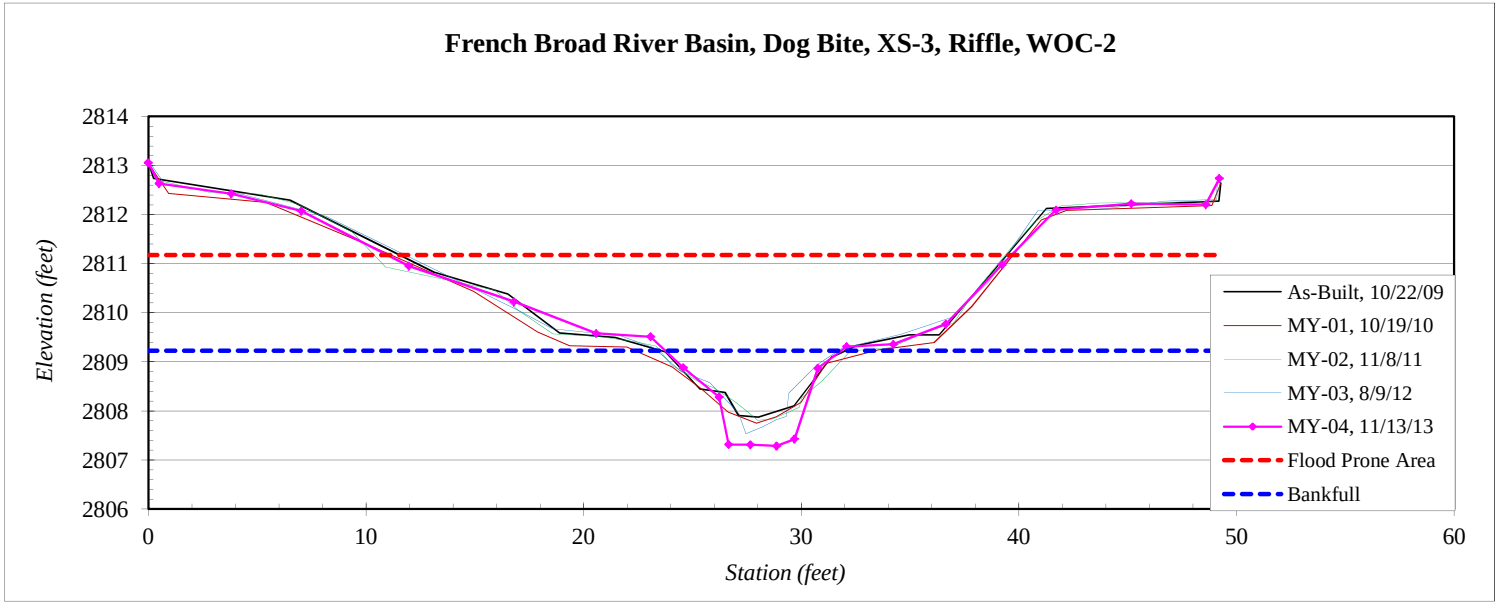


River Basin:	French Broad
Watershed:	Dog Bite
XS ID	XS-3, Riffle, WOC-2
Drainage Area (sq mi):	0.36
Date:	11/13/2013
Field Crew:	A. French, D. Carey

Station	Elevation
0.0	2813.06
0.5	2812.64
3.8	2812.43
7.0	2812.07
12.0	2810.95
16.8	2810.23
20.6	2809.58
23.1	2809.51
24.6	2808.88
26.2	2808.29
26.7	2807.32
27.7	2807.31
28.9	2807.28
29.7	2807.43
30.8	2808.87
32.1	2809.31
34.2	2809.36
36.6	2809.77
39.2	2810.98
41.7	2812.10
45.2	2812.23
48.6	2812.20
49.2	2812.74

SUMMARY DATA	
Bankfull Elevation:	2809.2
Bankfull Cross-Sectional Area:	9.0
Bankfull Width:	8.1
Flood Prone Area Elevation:	2811.2
Flood Prone Width:	29
Max Depth at Bankfull:	1.9
Mean Depth at Bankfull:	1.1
W / D Ratio:	7.3
Entrenchment Ratio:	3.6
Bank Height Ratio:	1.0

Stream Type	C3b

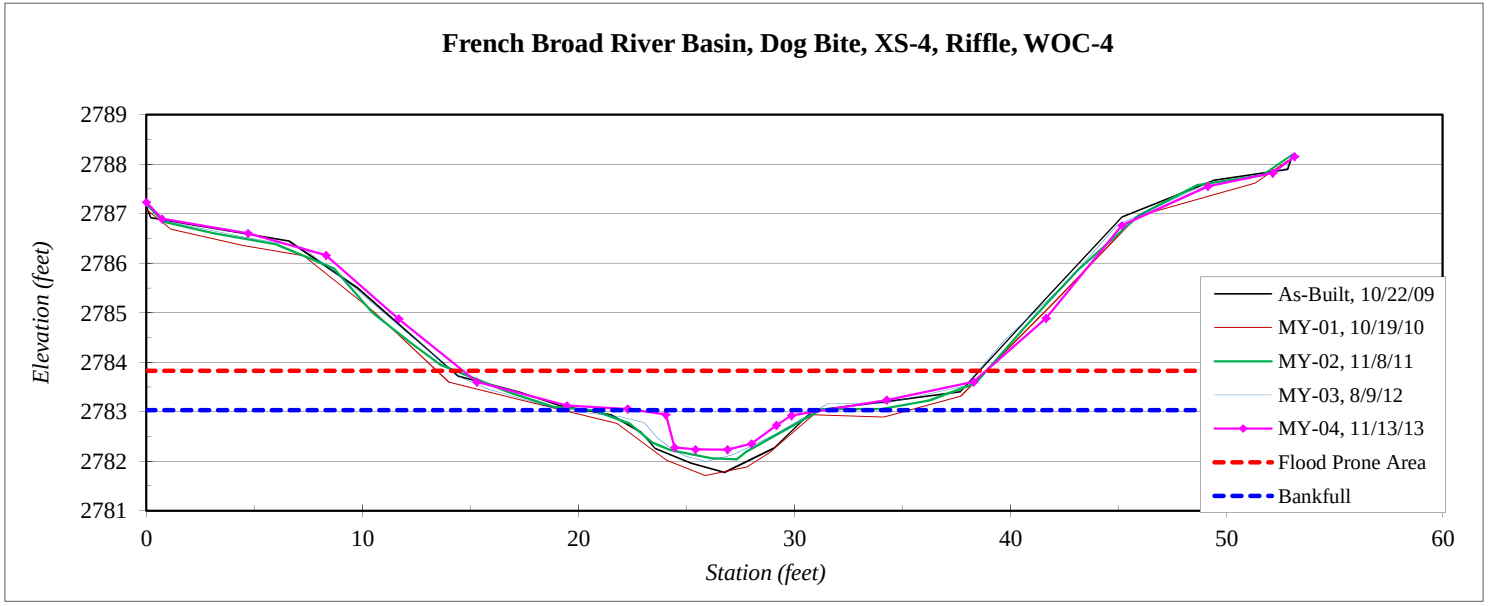


River Basin:	French Broad
Watershed:	Dog Bite
XS ID	XS-4, Riffle, WOC-4
Drainage Area (sq mi):	0.54
Date:	11/13/2013
Field Crew:	A. French, D. Carey

Station	Elevation
0.0	2787.24
0.7	2786.90
4.7	2786.61
8.3	2786.16
11.7	2784.88
15.3	2783.60
19.5	2783.13
22.3	2783.06
24.0	2782.94
24.5	2782.28
25.4	2782.24
26.9	2782.24
28.0	2782.35
29.2	2782.73
29.9	2782.92
34.3	2783.24
38.3	2783.60
41.6	2784.89
45.2	2786.76
49.1	2787.56
52.1	2787.82
53.1	2788.16

SUMMARY DATA	
Bankfull Elevation:	2783.0
Bankfull Cross-Sectional Area:	3.8
Bankfull Width:	8.7
Flood Prone Area Elevation:	2783.8
Flood Prone Width:	26
Max Depth at Bankfull:	0.8
Mean Depth at Bankfull:	0.4
W / D Ratio:	19.9
Entrenchment Ratio:	2.9
Bank Height Ratio:	1.0

Stream Type	C3b

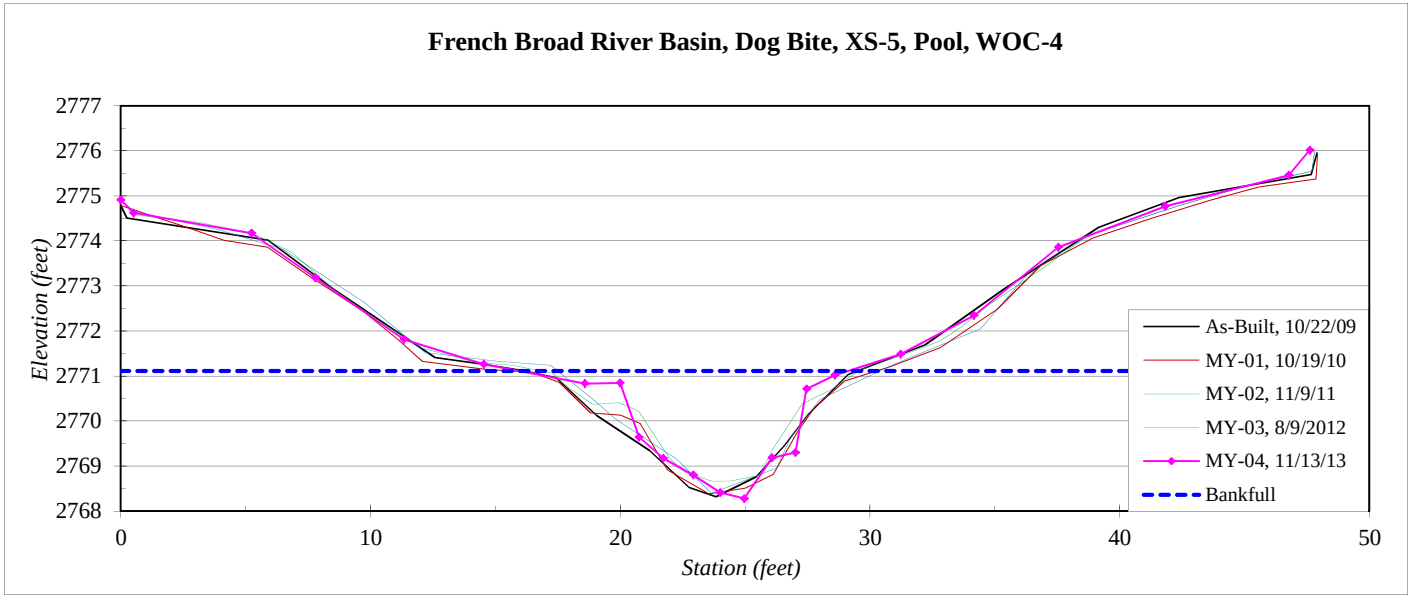


River Basin:	French Broad
Watershed:	Dog Bite
XS ID	XS-5, Pool, WOC-4
Drainage Area (sq mi):	0.54
Date:	11/13/2013
Field Crew:	A. French, D. Carey

Station	Elevation
0.0	2774.91
0.5	2774.62
5.2	2774.17
7.8	2773.18
11.3	2771.81
14.5	2771.26
18.6	2770.83
20.0	2770.85
20.8	2769.64
21.7	2769.17
22.9	2768.80
24.0	2768.41
25.0	2768.28
26.1	2769.18
27.0	2769.30
27.5	2770.71
28.6	2771.02
31.2	2771.49
34.2	2772.34
37.5	2773.86
41.83	2774.77
46.77	2775.46
47.62	2776.02

SUMMARY DATA	
Bankfull Elevation:	2771.1
Bankfull Cross-Sectional Area:	16.2
Bankfull Width:	13.2
Flood Prone Area Elevation:	-
Flood Prone Width:	-
Max Depth at Bankfull:	2.8
Mean Depth at Bankfull:	1.2
W / D Ratio:	-
Entrenchment Ratio:	-
Bank Height Ratio:	-

Stream Type	C3b

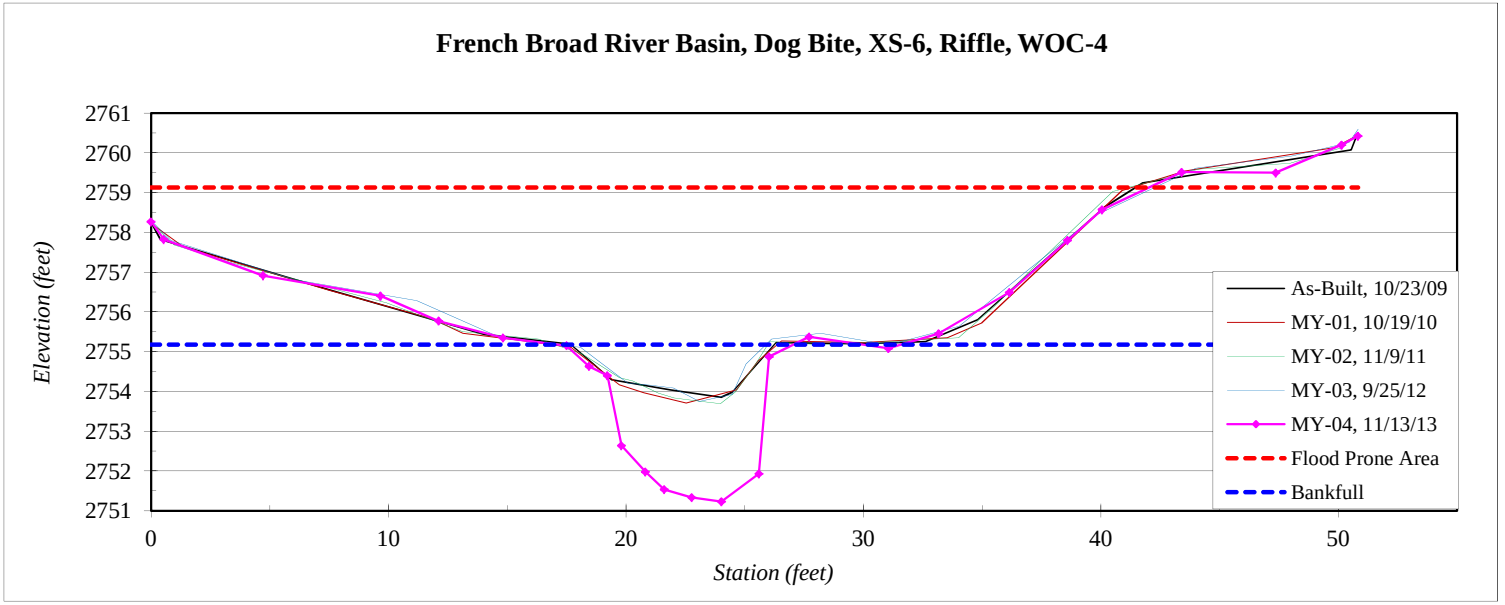


River Basin:	French Broad
Watershed:	Dog Bite
XS ID	XS-6, Riffle, WOC-4
Drainage Area (sq mi):	0.54
Date:	11/13/2013
Field Crew:	A. French, D. Carey

Station	Elevation
0.0	2758.27
0.5	2757.83
4.7	2756.91
9.7	2756.40
12.1	2755.77
14.8	2755.35
17.5	2755.15
18.4	2754.63
19.2	2754.40
19.8	2752.64
20.8	2751.98
21.6	2751.53
22.8	2751.34
24.0	2751.23
25.6	2751.93
26.0	2754.87
27.7	2755.37
31.1	2755.08
33.2	2755.46
36.1	2756.49
38.6	2757.80
40.0	2758.57
43.4	2759.52
47.4	2759.50
50.1	2760.20
50.8	2760.43

SUMMARY DATA	
Bankfull Elevation:	2755.2
Bankfull Cross-Sectional Area:	23.2
Bankfull Width:	10.0
Flood Prone Area Elevation:	2759.1
Flood Prone Width:	40
Max Depth at Bankfull:	3.9
Mean Depth at Bankfull:	2.3
W / D Ratio:	4.3
Entrenchment Ratio:	4.0
Bank Height Ratio:	1.0

Stream Type	C3b

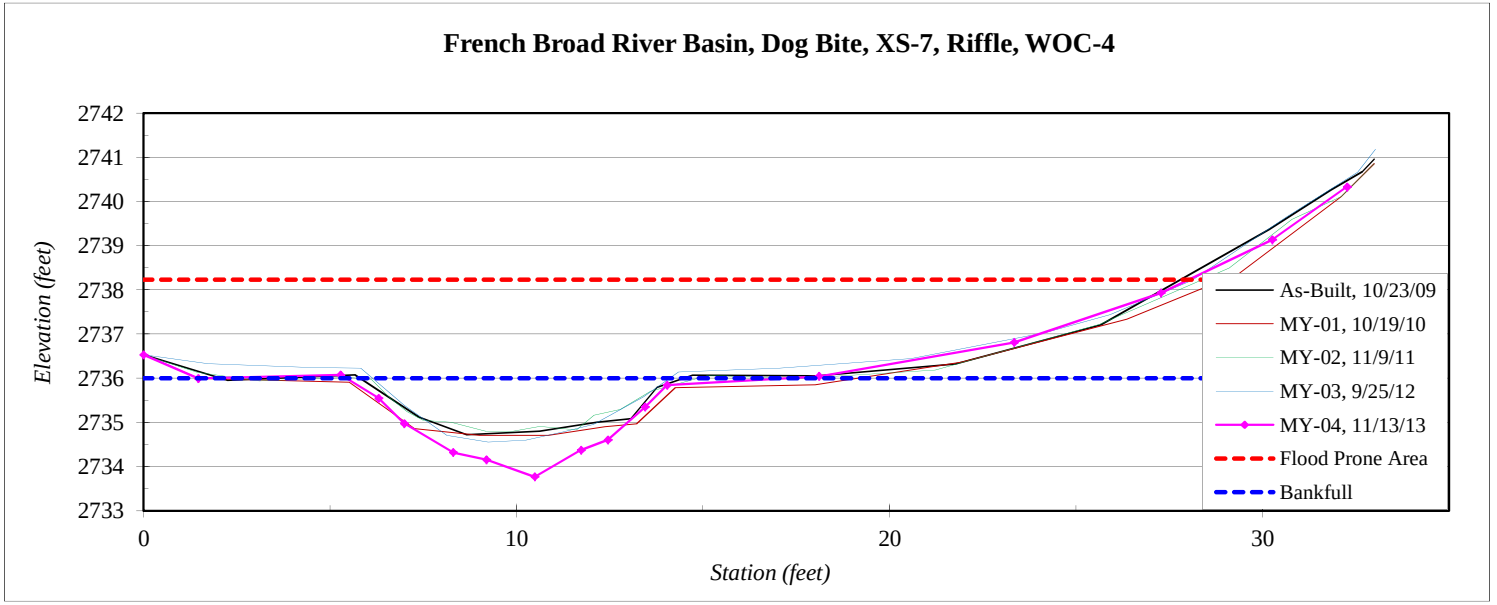


River Basin:	French Broad
Watershed:	Dog Bite
XS ID	XS-7, Riffle, WOC-4
Drainage Area (sq mi):	0.54
Date:	11/13/2013
Field Crew:	A. French, D. Carey

Station	Elevation
0.0	2736.53
1.5	2735.99
5.3	2736.08
6.3	2735.55
7.0	2734.97
8.3	2734.32
9.2	2734.16
10.5	2733.77
11.7	2734.37
12.5	2734.60
13.4	2735.35
14.0	2735.84
18.1	2736.04
23.3	2736.81
27.3	2737.93
30.3	2739.13
32.3	2740.33
32.7	2740.98

SUMMARY DATA	
Bankfull Elevation:	2736.0
Bankfull Cross-Sectional Area:	10.1
Bankfull Width:	8.3
Flood Prone Area Elevation:	2738.2
Flood Prone Width:	>25
Max Depth at Bankfull:	2.2
Mean Depth at Bankfull:	1.2
W / D Ratio:	6.8
Entrenchment Ratio:	3.0
Bank Height Ratio:	1.0

Stream Type	C3b

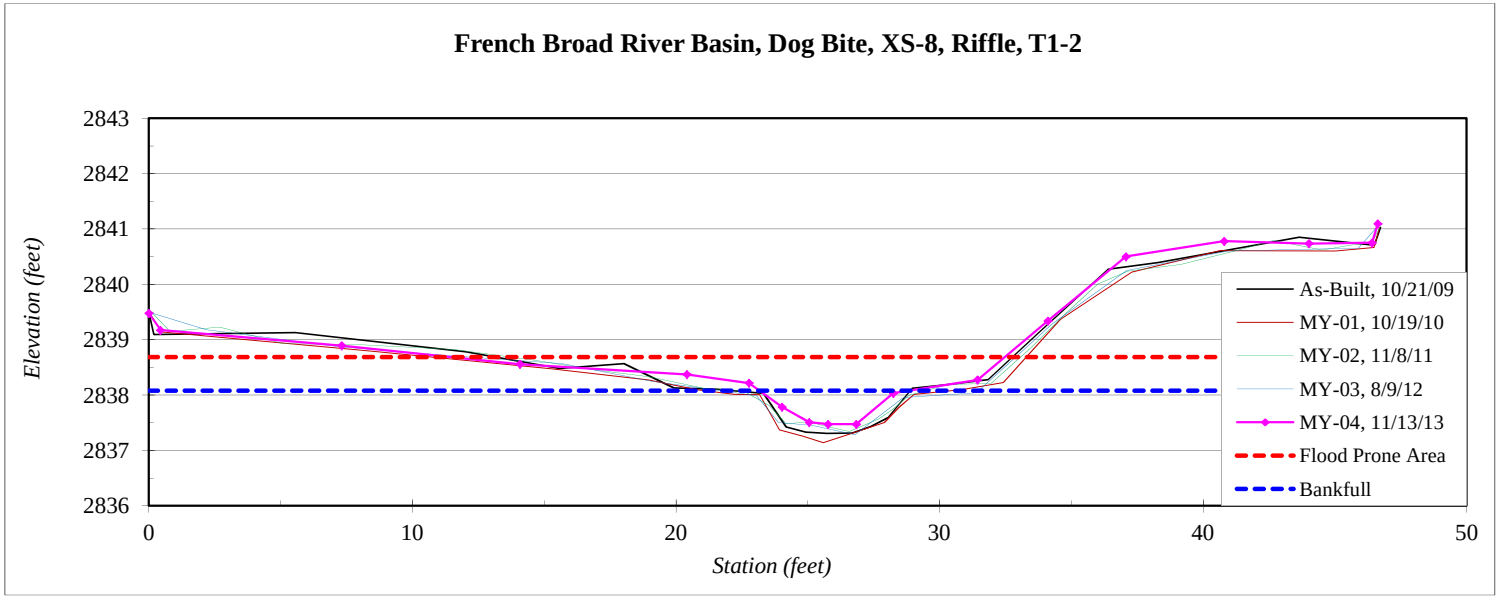


River Basin:	French Broad
Watershed:	Dog Bite
XS ID	XS-8, Riffle, T1-2
Drainage Area (sq mi):	0.08
Date:	11/13/2013
Field Crew:	A. French, D. Carey

Station	Elevation
0.0	2839.48
0.4	2839.17
7.3	2838.89
14.1	2838.56
20.4	2838.37
22.8	2838.22
24.0	2837.78
25.1	2837.51
25.8	2837.48
26.8	2837.48
28.3	2838.03
31.4	2838.28
34.1	2839.34
37.1	2840.50
40.8	2840.78
44.0	2840.74
46.4	2840.75
46.6	2841.09

SUMMARY DATA	
Bankfull Elevation:	2838.1
Bankfull Cross-Sectional Area:	2.0
Bankfull Width:	5.0
Flood Prone Area Elevation:	2838.7
Flood Prone Width:	20
Max Depth at Bankfull:	0.6
Mean Depth at Bankfull:	0.4
W / D Ratio:	12.5
Entrenchment Ratio:	4.0
Bank Height Ratio:	1.0

Stream Type	C3b

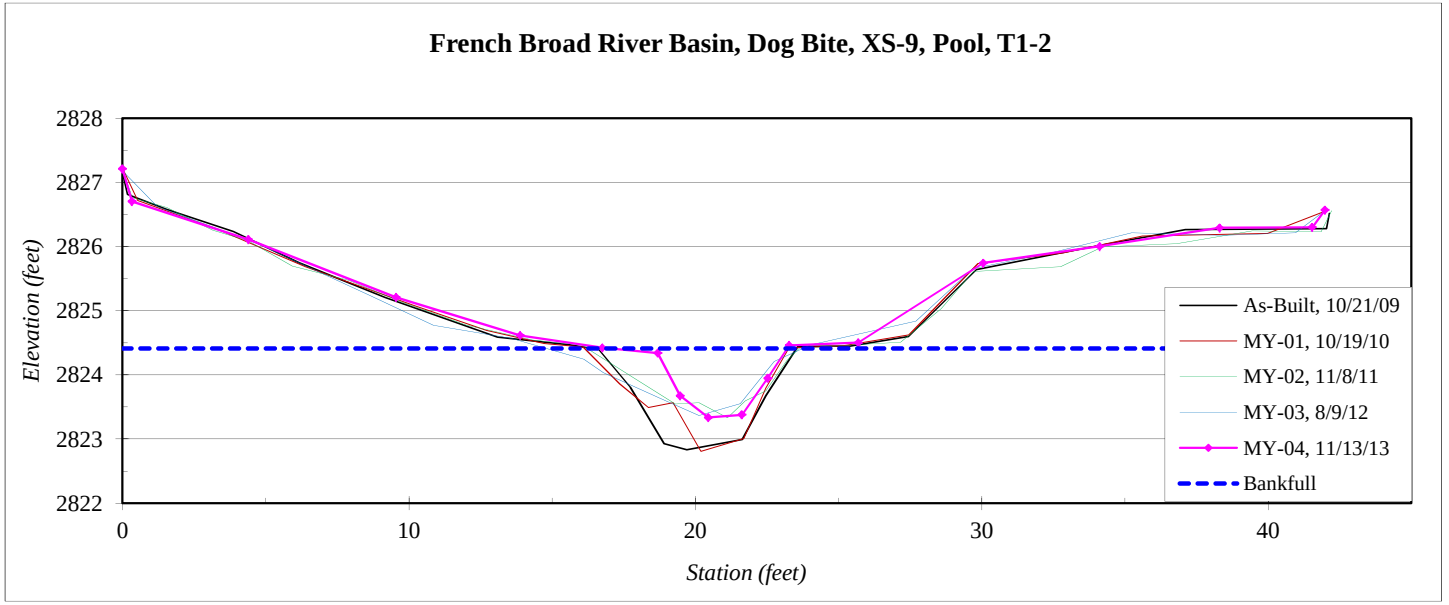


River Basin:	French Broad
Watershed:	Dog Bite
XS ID	XS-9, Pool, T1-2
Drainage Area (sq mi):	0.08
Date:	11/13/2013
Field Crew:	A. French, D. Carey

Station	Elevation
0.0	2827.21
0.3	2826.70
4.4	2826.11
9.6	2825.21
13.9	2824.62
16.8	2824.42
18.7	2824.34
19.5	2823.68
20.5	2823.34
21.6	2823.38
22.5	2823.95
23.3	2824.46
25.7	2824.50
30.1	2825.74
34.1	2826.00
38.3	2826.29
41.5	2826.30
42.0	2826.57

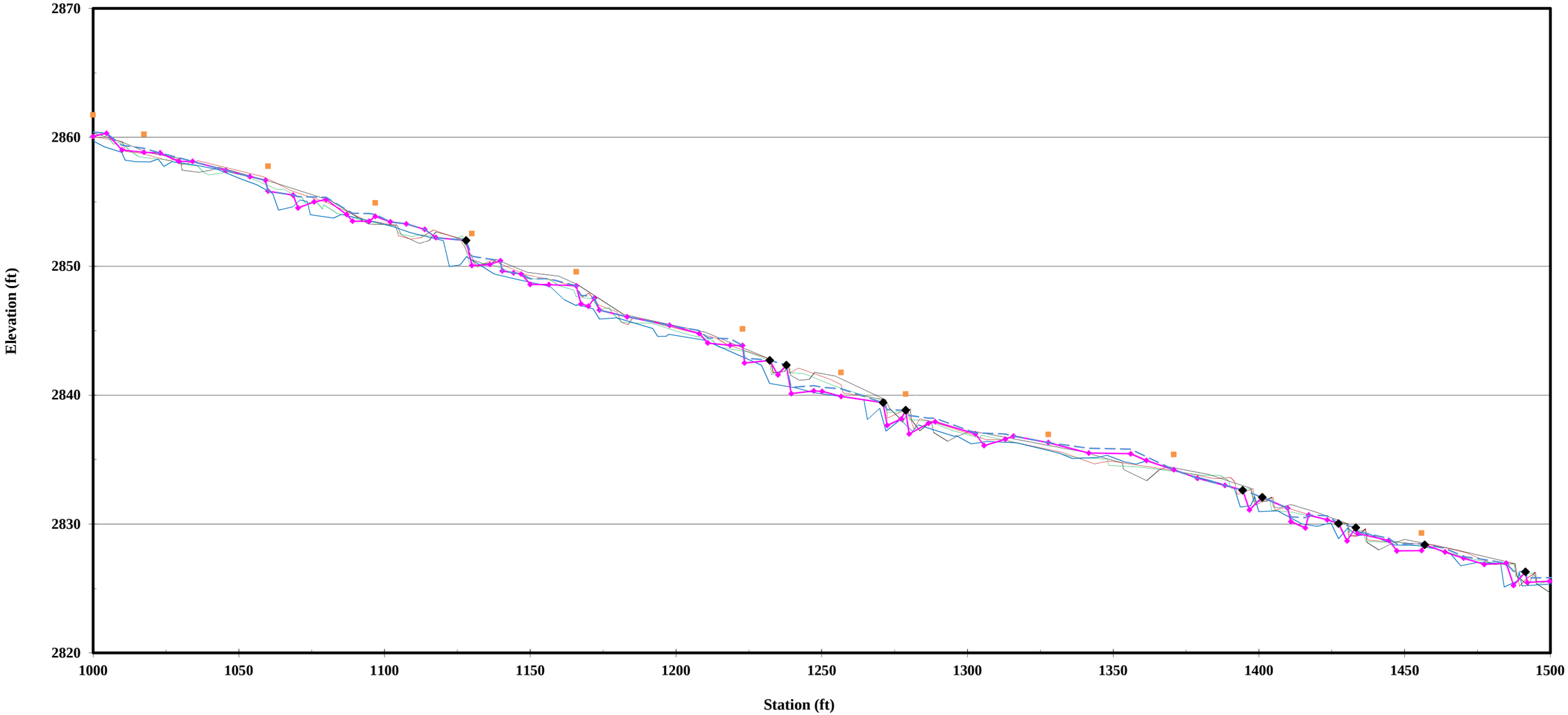
SUMMARY DATA	
Bankfull Elevation:	2824.4
Bankfull Cross-Sectional Area:	3.3
Bankfull Width:	6.2
Flood Prone Area Elevation:	2825.5
Flood Prone Width:	-
Max Depth at Bankfull:	1.1
Mean Depth at Bankfull:	0.5
W / D Ratio:	-
Entrenchment Ratio:	-
Bank Height Ratio:	-

Stream Type	C3b

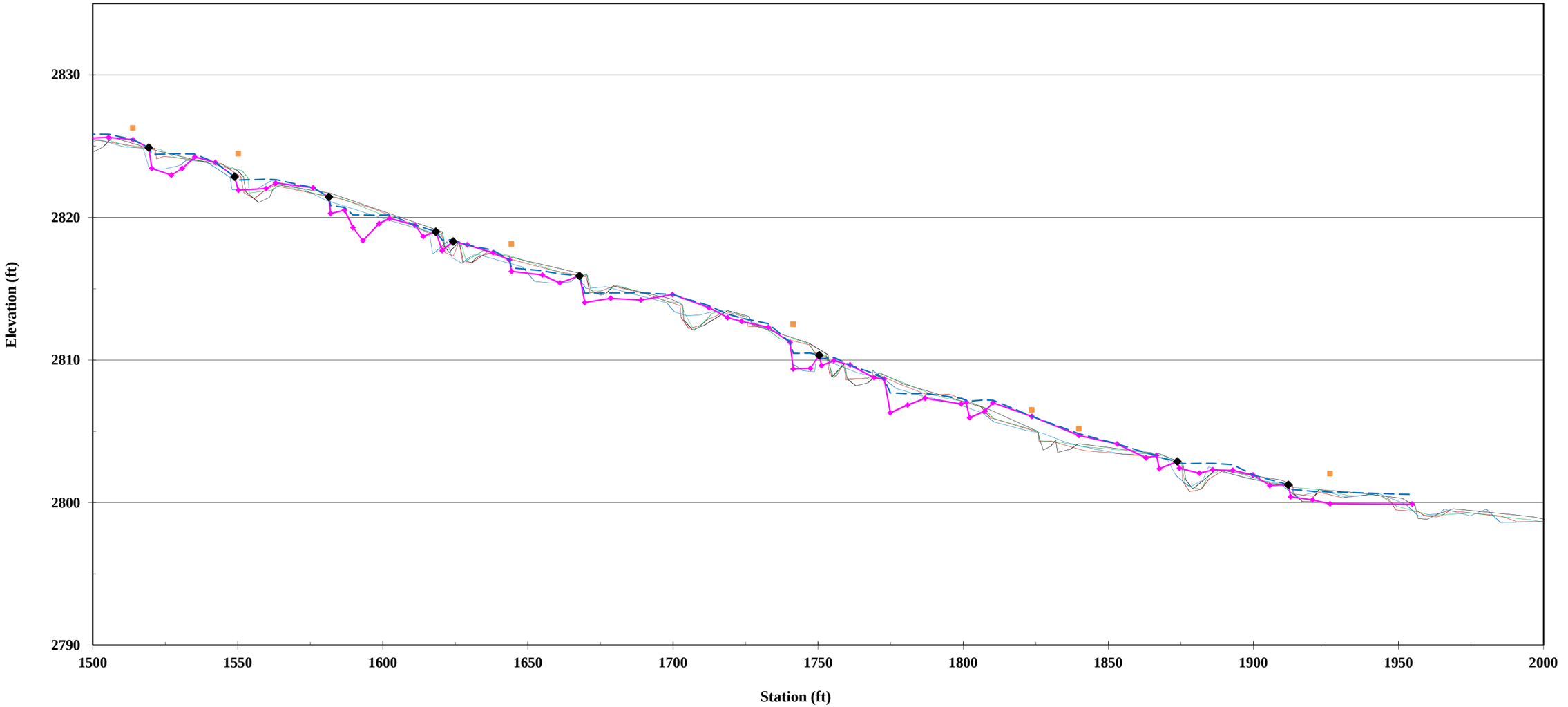


Appendix B3 – Longitudinal Profile

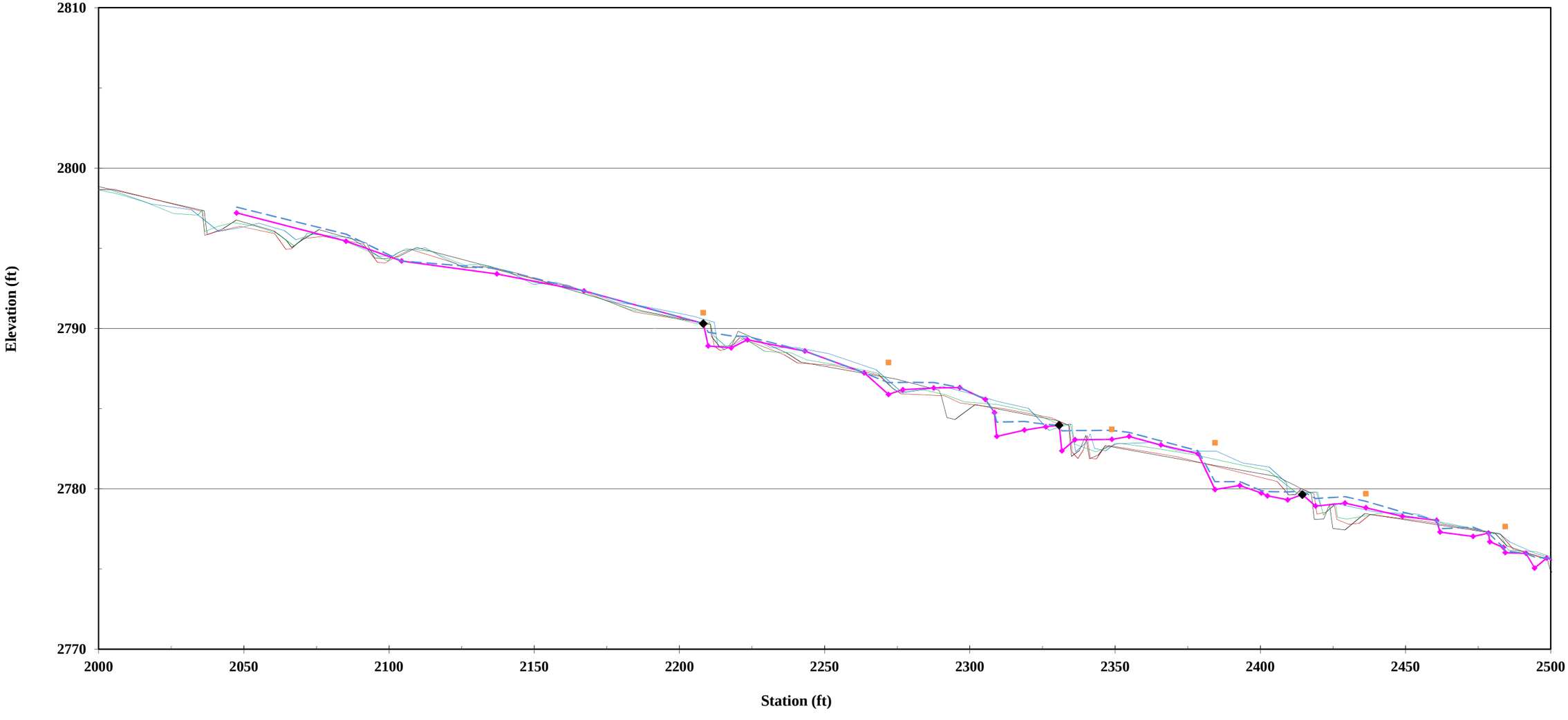
Dog Bite Site
Longitudinal Profile
White Oak Creek, MY04
Stations 10+00 - 15+00



Dog Bite Site
Longitudinal Profile
White Oak Creek, MY04
Stations 15+00 - 20+00

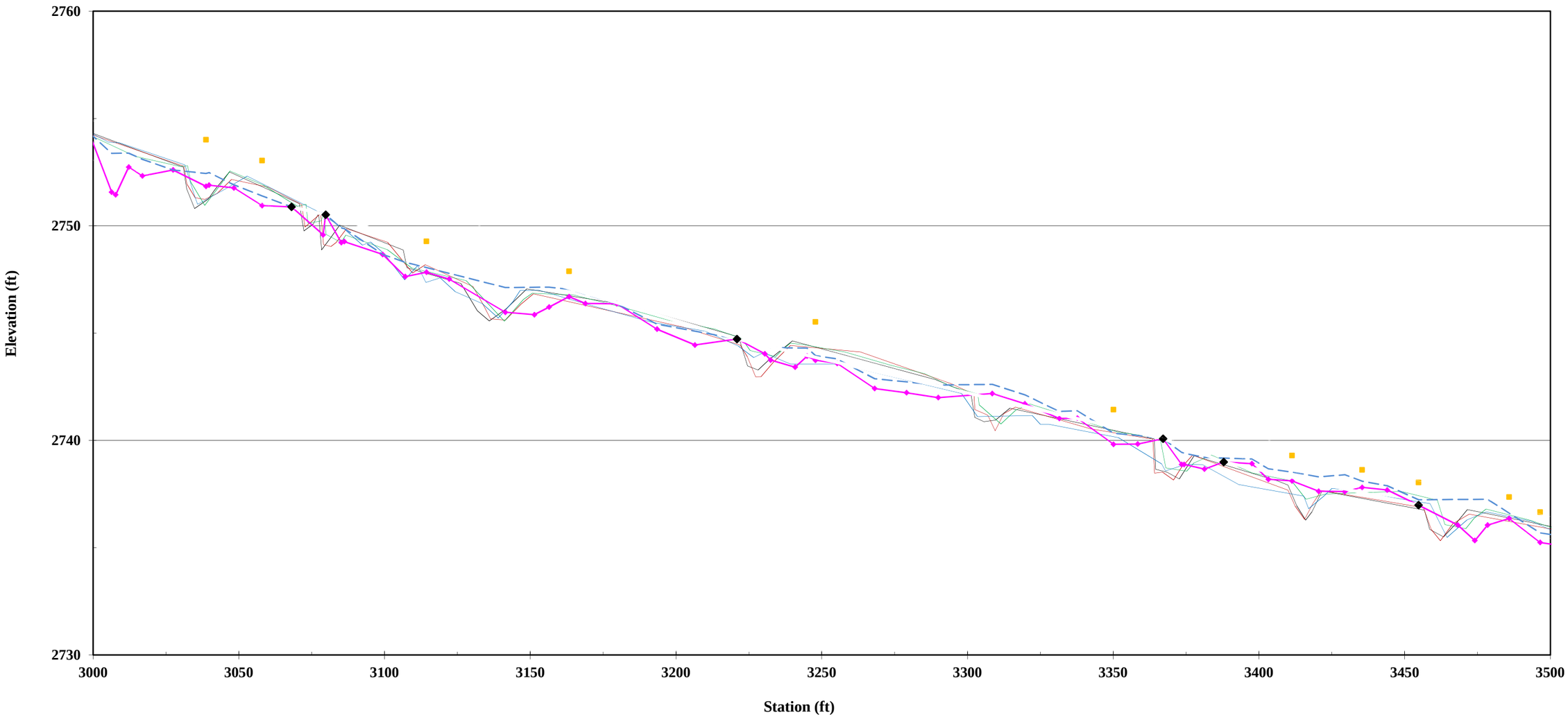


Dog Bite Site
Longitudinal Profile
White Oak Creek, MY04
Stations 20+00 - 25+00

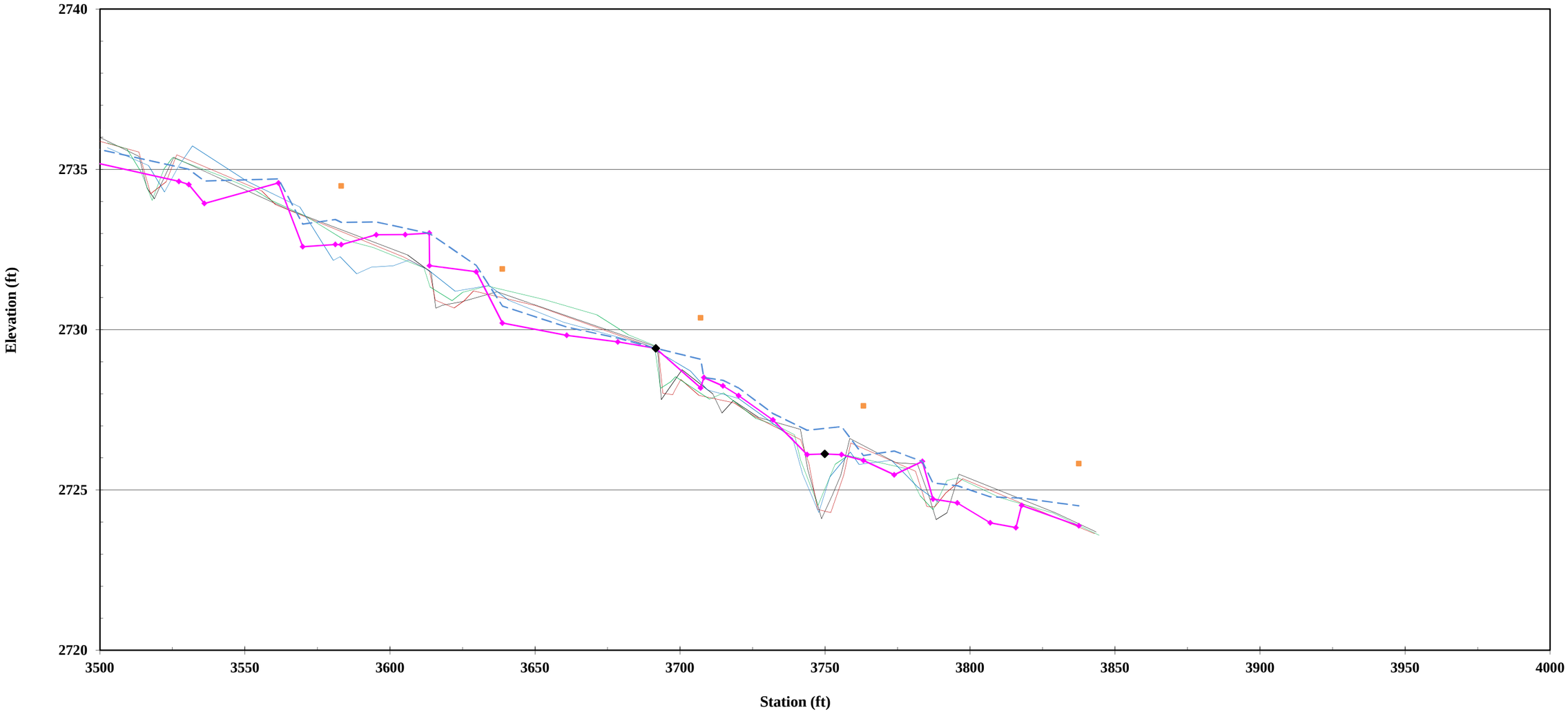


Dog Bite Site
Longitudinal Profile
White Oak Creek, MY04
Stations 25+00 - 30+00

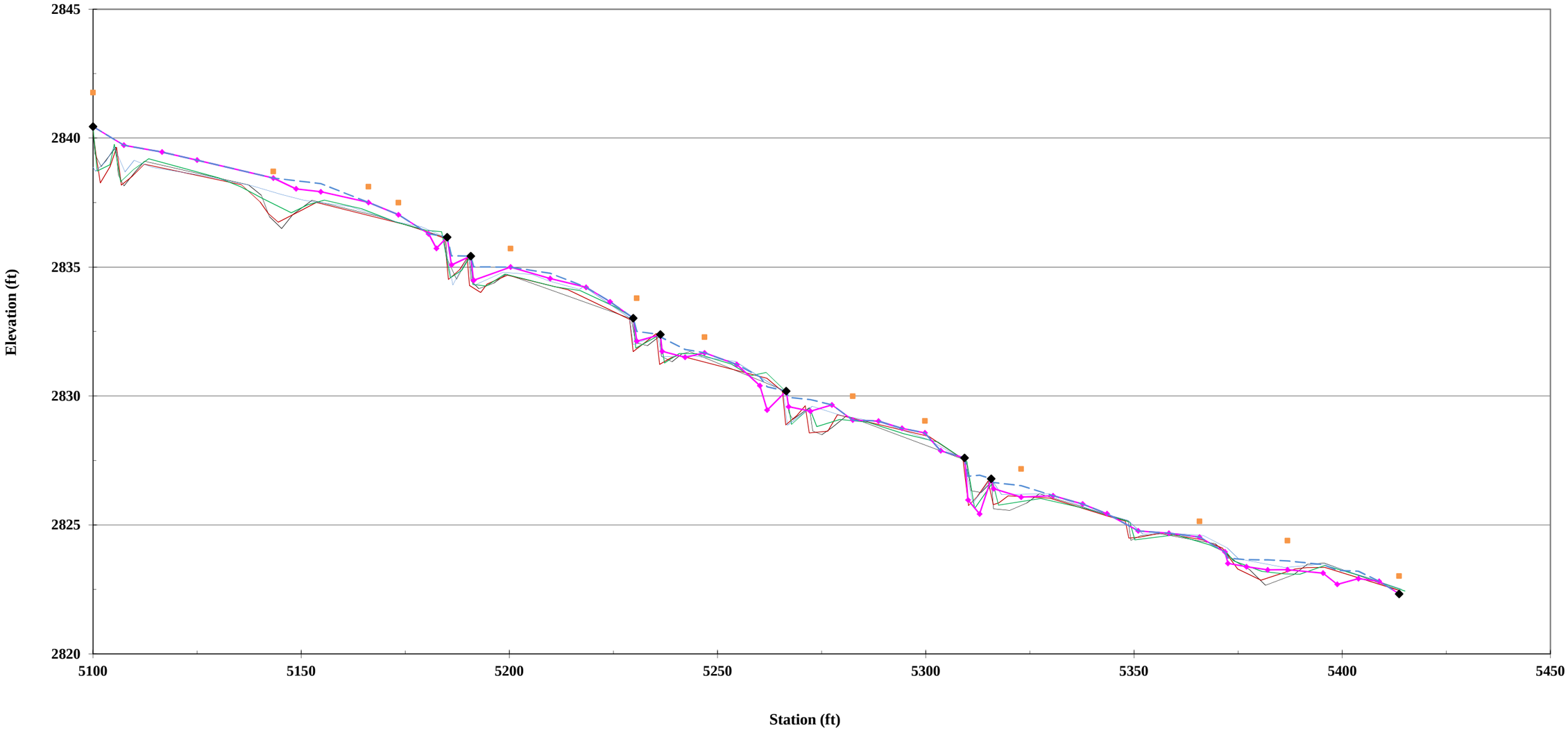
Dog Bite Site
Longitudinal Profile
White Oak Creek, MY04
Stations 30+00 - 35+00



Dog Bite Site
Longitudinal Profile
White Oak Creek, MY04
Stations 35+00 - 40+00



Dog Bite Site
Longitudinal Profile
T1, MY04
Stations 51+00 - 54+15

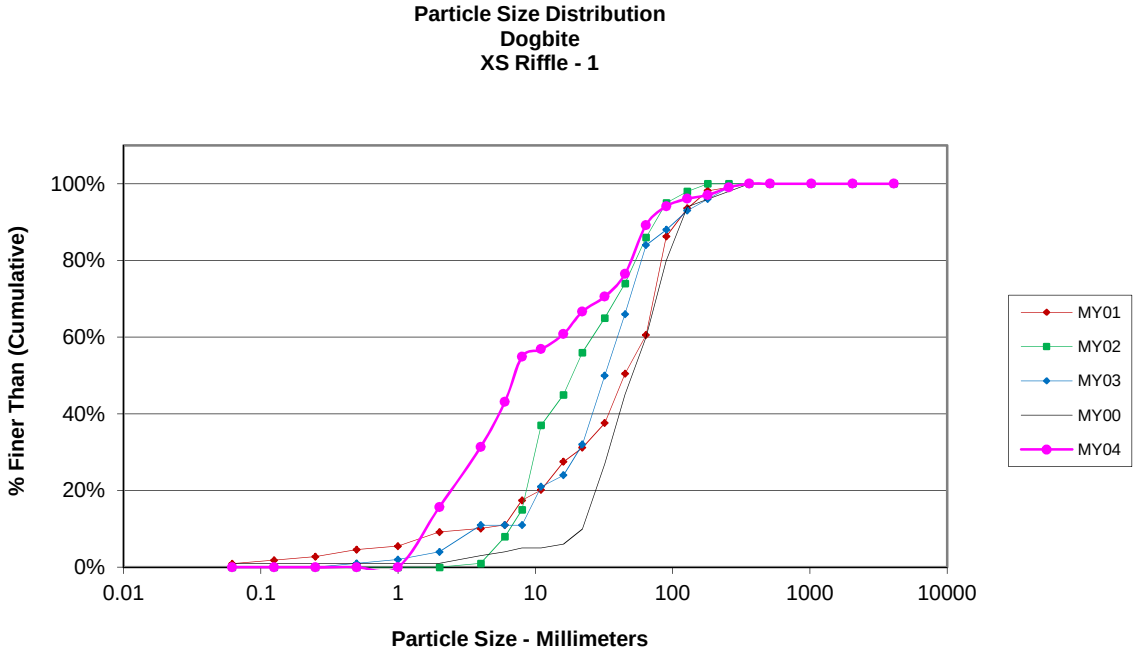


Appendix B4 – Pebble Count Data

Pebble Count Plots

Cross-Section Riffle 1 - MY04			
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	16
Very Fine	2 - 4		16
Fine	4 - 5.7	G	12
Fine	5.7 - 8	R	12
Medium	8 - 11.3	A	2
Medium	11.3 - 16	V	4
Coarse	16 - 22.6	E	6
Coarse	22.6 - 32	L	4
Very Coarse	32 - 45	S	6
Very Coarse	45 - 64		13
Small	64 - 90	C	5
Small	90 - 128	O	2
Large	128 - 180	B	1
Large	180 - 256	L	2
Small	256 - 362	B	1
Small	362 - 512	L	
Medium	512 - 1024	D	
Lrg- Very Lrg	1024 - 2048	R	
Bedrock	>2048	BDRK	
		Total	102

Note:



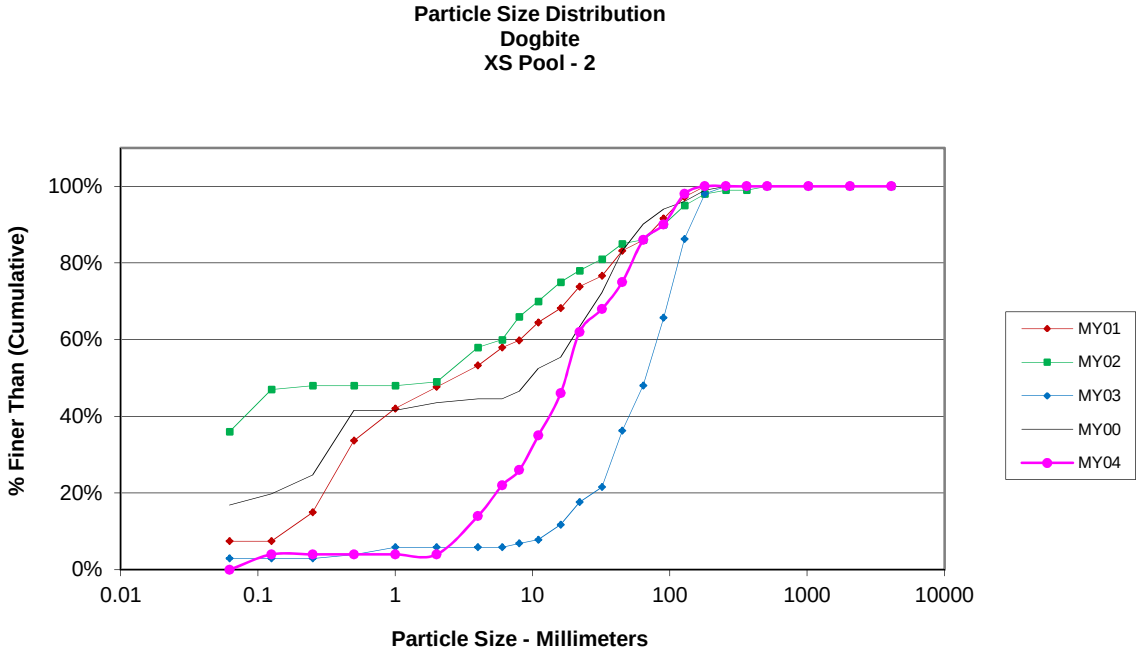
Size (mm)	
D16	2
D35	4.5
D50	7.1
D65	20
D84	55
D95	110

Size Distribution	
mean	10.5
dispersion	5.6
skewness	0.14

Type	
silt/clay	0%
sand	16%
gravel	74%
cobble	10%
boulder	1%
bedrock	0%
hardpan	0%
wood/det	0%
artificial	0%

Cross-Section Pool 2 - MY04			
Particle	Millimeter		Count
Silt/Clay	< 0.062	S/C	
Very Fine	.062 - .125	S	4
Fine	.125 - .25	A	
Medium	.25 - .50	N	
Coarse	.50 - 1	D	
Very Coarse	1 - 2	S	
Very Fine	2 - 4		10
Fine	4 - 5.7	G	8
Fine	5.7 - 8	R	4
Medium	8 - 11.3	A	9
Medium	11.3 - 16	V	11
Coarse	16 - 22.6	E	16
Coarse	22.6 - 32	L	6
Very Coarse	32 - 45	S	7
Very Coarse	45 - 64		11
Small	64 - 90	C	4
Small	90 - 128	O	8
Large	128 - 180	B	2
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:



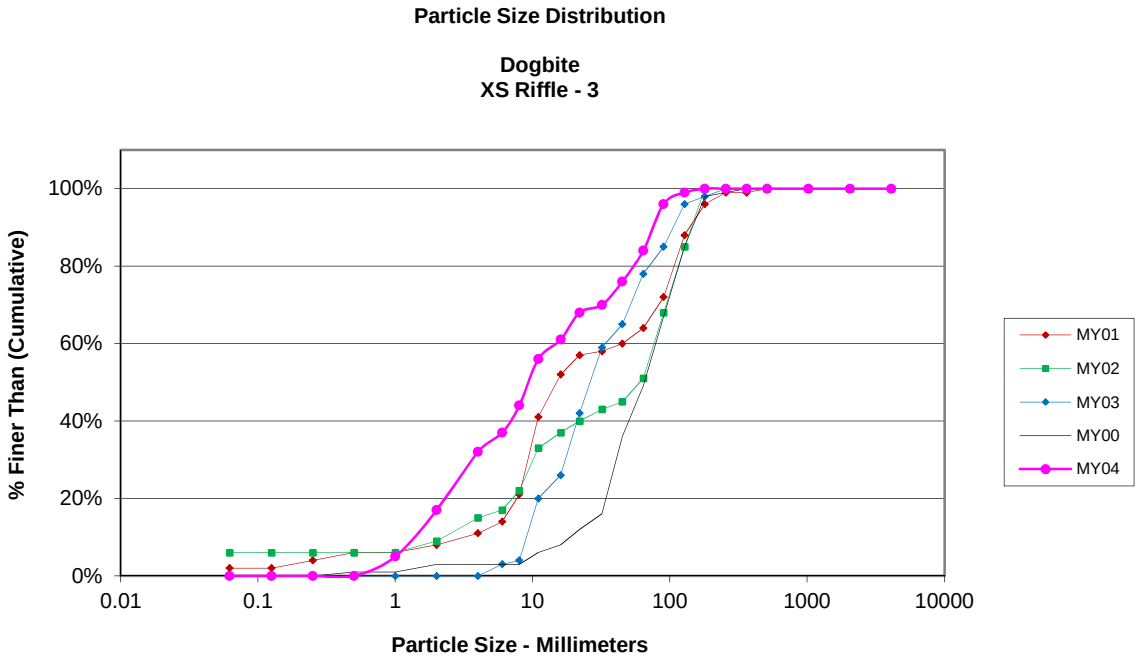
Size (mm)	
D16	4.5
D35	11
D50	18
D65	29
D84	63
D95	120

Size Distribution	
mean	16.8
dispersion	3.8
skewness	-0.03

Type	
silt/clay	0%
sand	4%
gravel	80%
cobble	16%
boulder	0%
bedrock	0%
hardpan	0%
wood/det	0%
artificial	0%

Cross-Section Riffle 3 - MY04			
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	5
Very Coarse	1 - 2	S	12
Very Fine	2 - 4		15
Fine	4 - 5.7	G	5
Fine	5.7 - 8	R	7
Medium	8 - 11.3	A	12
Medium	11.3 - 16	V	5
Coarse	16 - 22.6	E	7
Coarse	22.6 - 32	L	2
Very Coarse	32 - 45	S	6
Very Coarse	45 - 64		8
Small	64 - 90	C	12
Small	90 - 128	O	3
Large	128 - 180	B	1
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:



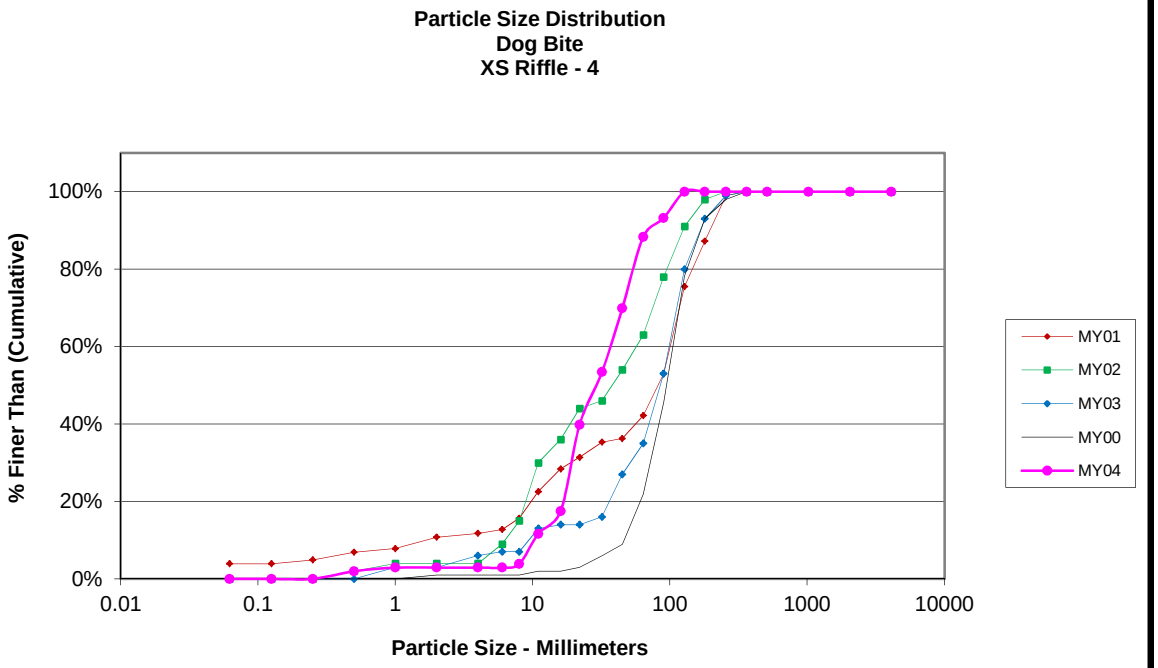
Size (mm)	
D16	1.9
D35	5.1
D50	9.4
D65	19
D84	64
D95	87

Size Distribution	
mean	11.0
dispersion	5.9
skewness	0.06

Type	
silt/clay	0%
sand	17%
gravel	67%
cobble	16%
boulder	0%
bedrock	0%
hardpan	0%
wood/det	0%
artificial	0%

Cross-Section Riffle 4 - MY04			
Particle	Millimeter		Count
Silt/Clay	< 0.062	S/C	
Very Fine	.062 - .125	S	
Fine	.125 - .25	A	
Medium	.25 - .50	N	2
Coarse	.50 - 1	D	1
Very Coarse	1 - 2	S	
Very Fine	2 - 4		
Fine	4 - 5.7	G	
Fine	5.7 - 8	R	1
Medium	8 - 11.3	A	8
Medium	11.3 - 16	V	6
Coarse	16 - 22.6	E	23
Coarse	22.6 - 32	L	14
Very Coarse	32 - 45	S	17
Very Coarse	45 - 64		19
Small	64 - 90	C	5
Small	90 - 128	O	7
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	103

Note:



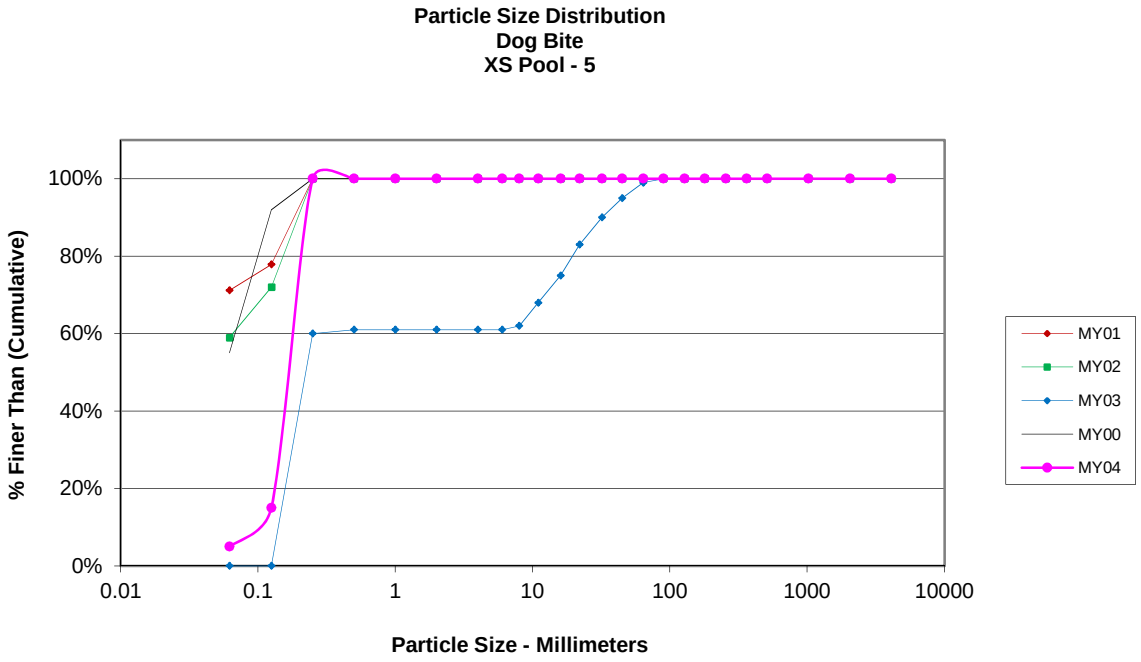
Size (mm)	
D16	15
D35	21
D50	29
D65	41
D84	59
D95	99

Size Distribution	
mean	29.7
dispersion	2.0
skewness	0.01

Type	
silt/clay	0%
sand	3%
gravel	85%
cobble	12%
boulder	0%
bedrock	0%
hardpan	0%
wood/det	0%
artificial	0%

Cross-Section Pool 5 - MY04			
Particle	Millimeter		Count
Silt/Clay	< 0.062	S/C	5
Very Fine	.062 - .125	S	10
Fine	.125 - .25	A	85
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:



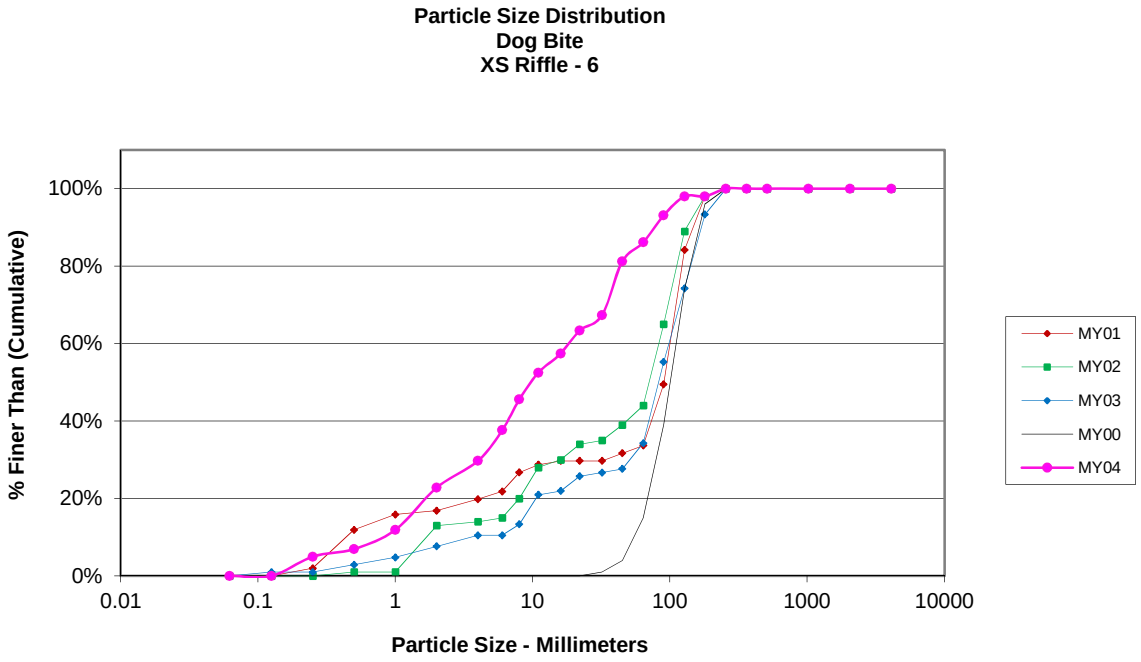
Size (mm)	
D16	0.13
D35	0.15
D50	0.17
D65	0.19
D84	0.22
D95	0.24

Size Distribution	
mean	0.2
dispersion	1.3
skewness	0.00

Type	
silt/clay	5%
sand	95%
gravel	0%
cobble	0%
boulder	0%
bedrock	0%
hardpan	0%
wood/det	0%
artificial	0%

Cross-Section Riffle 6 - MY04			
Particle	Millimeter		Count
Silt/Clay	< 0.062	S/C	
Very Fine	.062 - .125	S	
Fine	.125 - .25	A	5
Medium	.25 - .50	N	2
Coarse	.50 - 1	D	5
Very Coarse	1 - 2	S	11
Very Fine	2 - 4		7
Fine	4 - 5.7	G	8
Fine	5.7 - 8	R	8
Medium	8 - 11.3	A	7
Medium	11.3 - 16	V	5
Coarse	16 - 22.6	E	6
Coarse	22.6 - 32	L	4
Very Coarse	32 - 45	S	14
Very Coarse	45 - 64		5
Small	64 - 90	C	7
Small	90 - 128	O	5
Large	128 - 180	B	
Large	180 - 256	L	2
Small	256 - 362	B	
Small	362 - 512	L	
Medium	512 - 1024	D	
Lrg- Very Lrg	1024 - 2048	R	
Bedrock	>2048	BDRK	
		Total	101

Note:



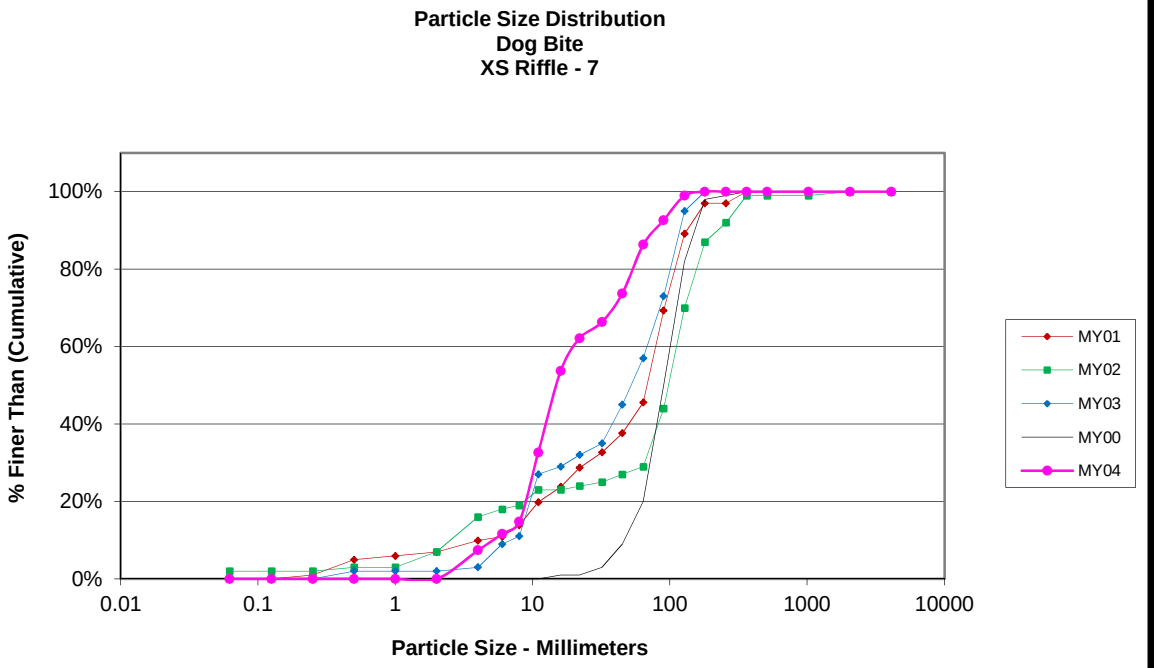
Size (mm)	
D16	1.3
D35	5.2
D50	9.8
D65	26
D84	55
D95	100

Size Distribution	
mean	8.5
dispersion	6.6
skewness	-0.05

Type	
silt/clay	0%
sand	23%
gravel	63%
cobble	14%
boulder	0%
bedrock	0%
hardpan	0%
wood/det	0%
artificial	0%

Cross-Section Riffle 7 - MY04			
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		7
Fine	4 - 5.7	G	4
Fine	5.7 - 8	R	3
Medium	8 - 11.3	A	17
Medium	11.3 - 16	V	20
Coarse	16 - 22.6	E	8
Coarse	22.6 - 32	L	4
Very Coarse	32 - 45	S	7
Very Coarse	45 - 64		12
Small	64 - 90	C	6
Small	90 - 128	O	6
Large	128 - 180	B	1
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	95

Note:



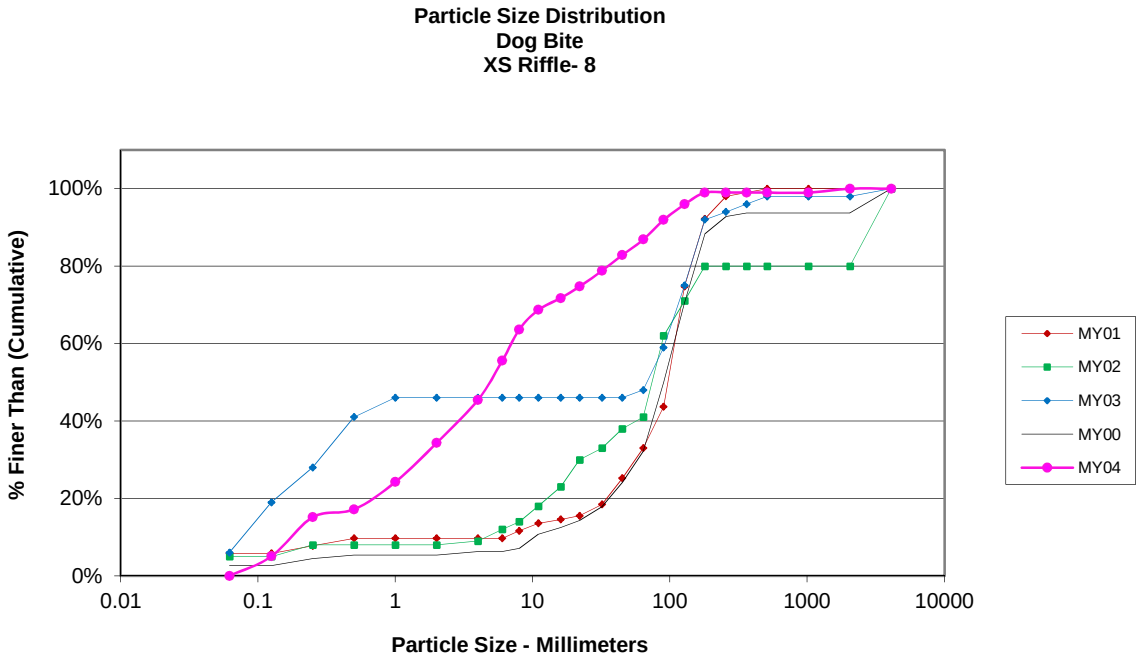
Size (mm)	
D16	8.2
D35	11
D50	15
D65	28
D84	60
D95	100

Size Distribution	
mean	22.2
dispersion	2.9
skewness	0.18

Type	
silt/clay	0%
sand	0%
gravel	86%
cobble	14%
boulder	0%
bedrock	0%
hardpan	0%
wood/det	0%
artificial	0%

Cross-Section Riffle 8 - MY04			
Particle	Millimeter		Count
Silt/Clay	< 0.062	S/C	
Very Fine	.062 - .125	S	5
Fine	.125 - .25	A	11
Medium	.25 - .50	N	2
Coarse	.50 - 1	D	7
Very Coarse	1 - 2	S	10
Very Fine	2 - 4		11
Fine	4 - 5.7	G	10
Fine	5.7 - 8	R	8
Medium	8 - 11.3	A	5
Medium	11.3 - 16	V	3
Coarse	16 - 22.6	E	3
Coarse	22.6 - 32	L	4
Very Coarse	32 - 45	S	4
Very Coarse	45 - 64		4
Small	64 - 90	C	5
Small	90 - 128	O	4
Large	128 - 180	B	3
Large	180 - 256	L	
Small	256 - 362	B	
Small	362 - 512	L	
Medium	512 - 1024	D	
Lrg- Very Lrg	1024 - 2048	R	1
Bedrock	>2048	BDRK	
		Total	100

Note:



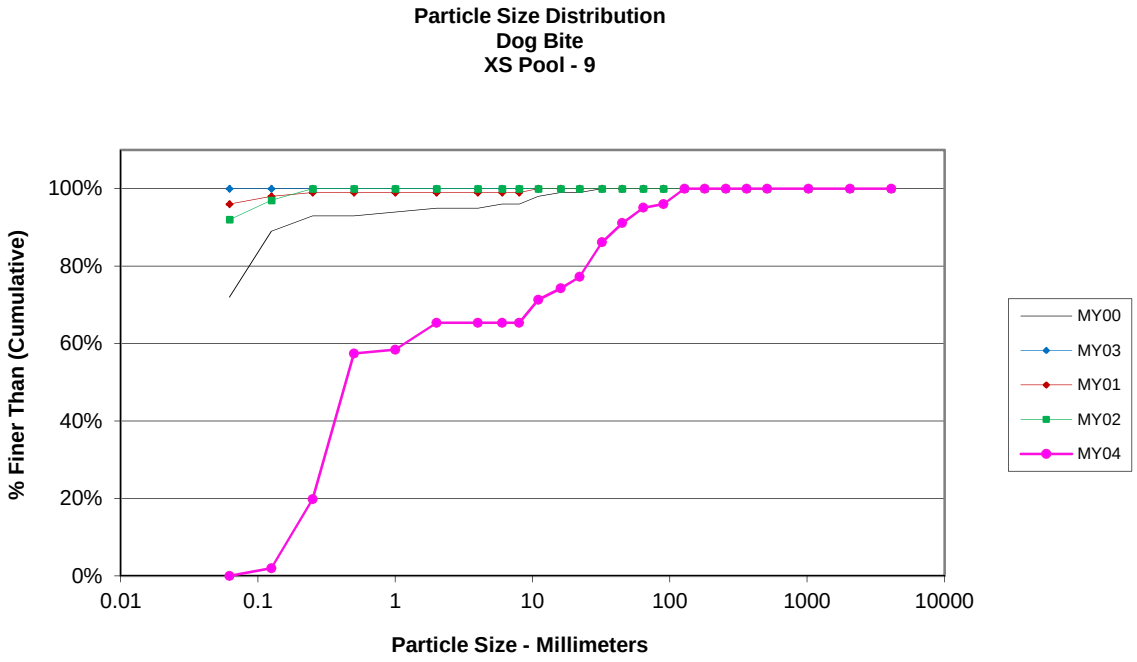
Size (mm)	
D16	0.25
D35	2
D50	4.7
D65	8.5
D84	49
D95	120

Size Distribution	
mean	3.5
dispersion	14.6
skewness	-0.08

Type	
silt/clay	0%
sand	35%
gravel	52%
cobble	12%
boulder	1%
bedrock	0%
hardpan	0%
wood/det	0%
artificial	0%

Cross-Section Pool 9 - MY04			
Particle	Millimeter		Count
Silt/Clay	< 0.062	S/C	
Very Fine	.062 - .125	S	2
Fine	.125 - .25	A	18
Medium	.25 - .50	N	38
Coarse	.50 - 1	D	1
Very Coarse	1 - 2	S	7
Very Fine	2 - 4		
Fine	4 - 5.7	G	
Fine	5.7 - 8	R	
Medium	8 - 11.3	A	6
Medium	11.3 - 16	V	3
Coarse	16 - 22.6	E	3
Coarse	22.6 - 32	L	9
Very Coarse	32 - 45	S	5
Very Coarse	45 - 64		4
Small	64 - 90	C	1
Small	90 - 128	O	4
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	101

Note:



Size (mm)	
D16	0.22
D35	0.33
D50	0.44
D65	1.9
D84	29
D95	64

Size Distribution	
mean	2.5
dispersion	34.0
skewness	0.52

Type	
silt/clay	0%
sand	65%
gravel	30%
cobble	5%
boulder	0%
bedrock	0%
hardpan	0%
wood/det	0%
artificial	0%

Appendix C
Current Conditions Plan View

LEGEND

EASEMENT BOUNDARY.....

AS-BUILT STATIONED

CENTERLINE AND TOP OF BANK.....

PHOTO POINT.....

CROSS-SECTION.....

BMP.....

STREAM GAUGE.....

IMAGE SOURCE: NC STATEWIDE ORTHOIMAGERY, 2010

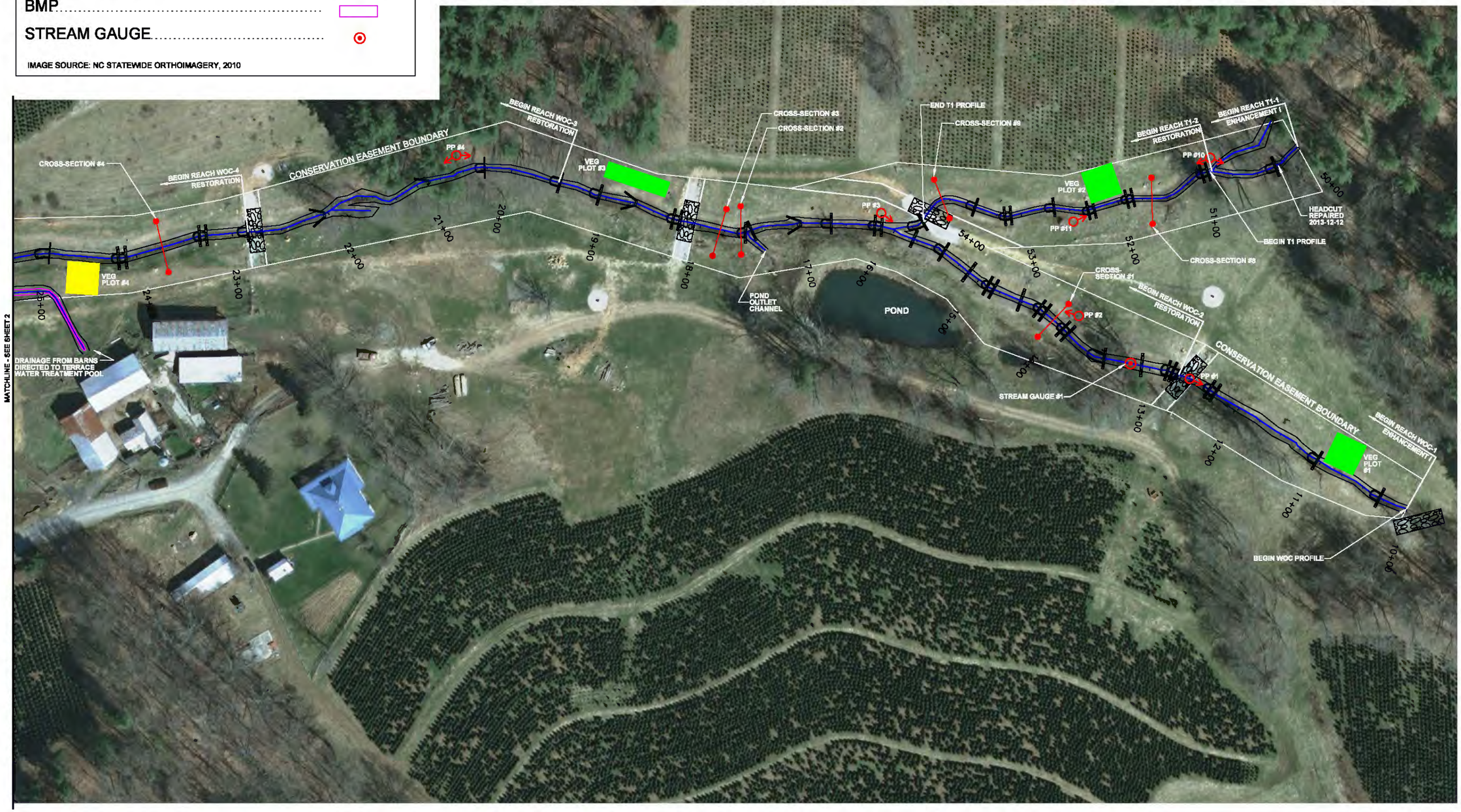
PROJECT CONDITION

VEG PLOT ACHIEVING DENSITY ABOVE 260 STEMS/ACRE.....

VEG PLOT WITH DENSITY BELOW 260 STEMS/ACRE.....

–50 –25 0 50 100

GRAPHIC SCALE



REVISIONS

NO.	DESCRIPTION	DATE	APPROVED
1	ESI		

Ecosystem Enhancement Program

KCI ASSOCIATES OF NC
ENGINEERS • PLANNERS • SCIENTISTS
4601 6IX FORKS ROAD
RALEIGH, NORTH CAROLINA 27609

DOG BITE STREAM RESTORATION PROJECT

BAKERSVILLE, MITCHELL COUNTY, NORTH CAROLINA

WOC STATION 10+00 TO STATION 25+25; T1

DATE: DECEMBER 2013

SCALE: 1" = 100'

CURRENT CONDITION PLAN VIEW MY 4 OF 5

LEGEND

EASEMENT BOUNDARY.....

AS-BUILT STATIONED

CENTERLINE AND TOP OF BANK.....

PHOTO POINT.....

CROSS-SECTION.....

BMP.....

STREAM GAUGE.....

IMAGE SOURCE: NC STATEWIDE ORTHOIMAGERY, 2010

PROJECT CONDITION

VEG PLOT ACHIEVING DENSITY ABOVE 260 STEMS/ACRE.....

VEG PLOT WITH DENSITY BELOW 260 STEMS/ACRE.....

-50 -25 0 50 100

GRAPHIC SCALE

REVISIONS

NO.	DESCRIPTION	DATE	APPROVED

Ecosystem Enhancement Program

KCI ASSOCIATES OF NC
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4601 6IX FORKS ROAD
RALEIGH, NORTH CAROLINA 27609

DOG BITE
STREAM RESTORATION PROJECT

BAKERSVILLE, MITCHELL COUNTY, NORTH CAROLINA

WOC STATION 25+25 TO STATION 40+82; T2

DATE: DECEMBER 2013

SCALE: 1" = 100'

CURRENT CONDITION PLAN VIEW MY 4 OF 5

SHEET 2 OF 2