East Tarboro Canal Stream Restoration Project
Edgecombe County
North Carolina
EEP Project No. 123
CU: 03020103
SCO# 030603101

Year 3 of 5 Monitoring Report
Data Collection: May through October 2010
Submission Date: March 31, 2011

Prepared for:

North Carolina Department of Environment and Natural Resources
Ecosystem Enhancement Program
Parker Lincoln Building
2728 Capital Boulevard, Suite 1H-103
Raleigh, NC 27606

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Prepared by:

Rummel, Klepper & Kahl, LLP
900 Ridgefield Drive
Suite 350
Raleigh, NC 27609

2.0 Table of Contents

3.0 EXECUTIVE SUMMARY/PROJECT ABSTRACT

Project goals and objectives for the East Tarboro Canal stream restoration project included:

Project goals are:

- Provide a stable stream channel that neither aggrades nor degrades while maintaining its dimension, pattern, and profile with the capacity to transport its watershed's water and sediment load.
- Improve water quality and reduce erosion.
- Improve aquatic habitat with the use of natural material stabilization structures such as root wads, rock vanes, woody debris, and a riparian buffer.
- Provide a native stream buffer that will increase bank stability, improve wildlife habitat, and eliminate or reduce exotic invasive plant infestations and increase the aesthetic value by transforming the unvegetated ditch into a function stream buffer.

While project objectives included:

- Restore approximately 2,900 linear feet of East Tarboro Canal.
- Restore the natural riparian buffer.
- Construct a new floodplain at a lower elevation.

Thirteen (13) permanent vegetation plots were established and used in annual vegetation monitoring. The vegetative success criteria are based on the US Army Corps of Engineers Stream Mitigation Guidelines (USACE, 2003) that require 260 stems per acre after five (5) years for stream restoration and 320 stems per acre after five (5) years for buffer restoration. Planted areas on Reach 2 are being monitored for Riparian Buffer Restoration (RBR) assets. This site was instituted prior to October 2007 and, therefore, will generate RBR credit within the conservation easement where planted hardwood stem density requirements are met and a minimum of 50' and a maximum of 200' from top of bank. There is 9.6 acres that are eligible for RBR credit if density requirements are met. Currently, the site is not meeting the minimum success requirements for neither the stream restoration planting or buffer restoration planting accruing 250 stems per acre overall. Monitoring for 2010 revealed that vegetation plots VP2, VP4, VP6, VP8, VP10, VP12, and VP13 fall below the minimum success requirements for stream restoration and no plots were successful for RBR. VP1 along with Reach 1 have been removed from the project, conservation easement has been lifted, and the property has been returned to the Town of Tarboro. Areas along Reach 2 have been subject to beaver impacts resulting in the loss of planted stems. The beaver infestation has caused damage within plots VP2, VP4, VP8, and VP10. Vegetation plots VP3, VP5, VP7, VP9 and VP11 meet or exceed minimum success requirements. Vegetation plot locations are identified in Figure 2. East Tarboro Canal Stream Restoration Project is scheduled for supplemental planting during February 2011.

The majority of the stream is functioning well and holding grade while maintaining bedform features. Overall the project is performing adequately. However, the stream has two areas of concern that require immediate repair. Channel dimension and pattern are similar to as-built conditions with the exception of the structure failure at station 21+50 and the section of stream that has been rerouted between Station 11+00 and 13+00 both identified on Figure 2. The section of stream that has been rerouted is due to beaver activity and sediment accumulation in the constructed channel. The rerouted section now flows through the created wetland depression located to the east of VP 2 on Figure 2. The problems associated with beaver infestation have been reported to EEP and remedial action is underway. Bankfull events have been recorded onsite during 2010 and can be viewed in Appendix E. (Reach 1 was removed from monitoring for 2010 Monitoring Year 3).

Wetland restoration or enhancement was not a part of the East Tarboro Canal Stream Restoration Site. Therefore, no wetland monitoring is required.

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

4.0 METHODOLOGY

Stream monitoring was completed by utilizing total station survey along with Rosgen Level II techniques to determine stream stability and performance. The annual cross-sectional survey included points surveyed at breaks in slope, bankfull, inner berm, edge of water, and thalweg, if the features were present. Longitudinal profile survey was conducted for the entire length of the restored channel for Reach 2. Measurements included thalweg, water surface, and bankfull. All surveys were complete using existing onsite benchmarks.

Vegetative sample plots were quantitatively monitored during the first growing season. Twelve (12) $100m^2$ plots are used for monitoring. For Monitoring Year 3, 2010, Reach 2 (VP2- VP 13) were sampled. Species composition, density, vigor and survival were monitored. Each plot corner is permanently located with rebar. Year 3 vegetation monitoring was completed in October 2010 utilizing the Carolina Vegetation Survey (CVS) – EEP protocol Level 1 (version 4.1). Baseline data provided was not completed utilizing the CVS-EEP protocol, therefore some data will be skewed.

Photo monitoring was conducted by walking each stream reach and taking photos at each predetermined photo point location using a digital camera.

5.0 References

USACOE (2003). *Stream Mitigation Guidelines*. USACOE, USEPA, NCWRC, NCDENR-DWQ.

USACOE (1987). *Corps of Engineers Wetlands Delineation Manual*. Tech report Y-87-1. AD/A176.

Rosgen, D.L. (1996) *Applied River Morphology*. Wildland Hydrology books, Pagosa Springs, CO.

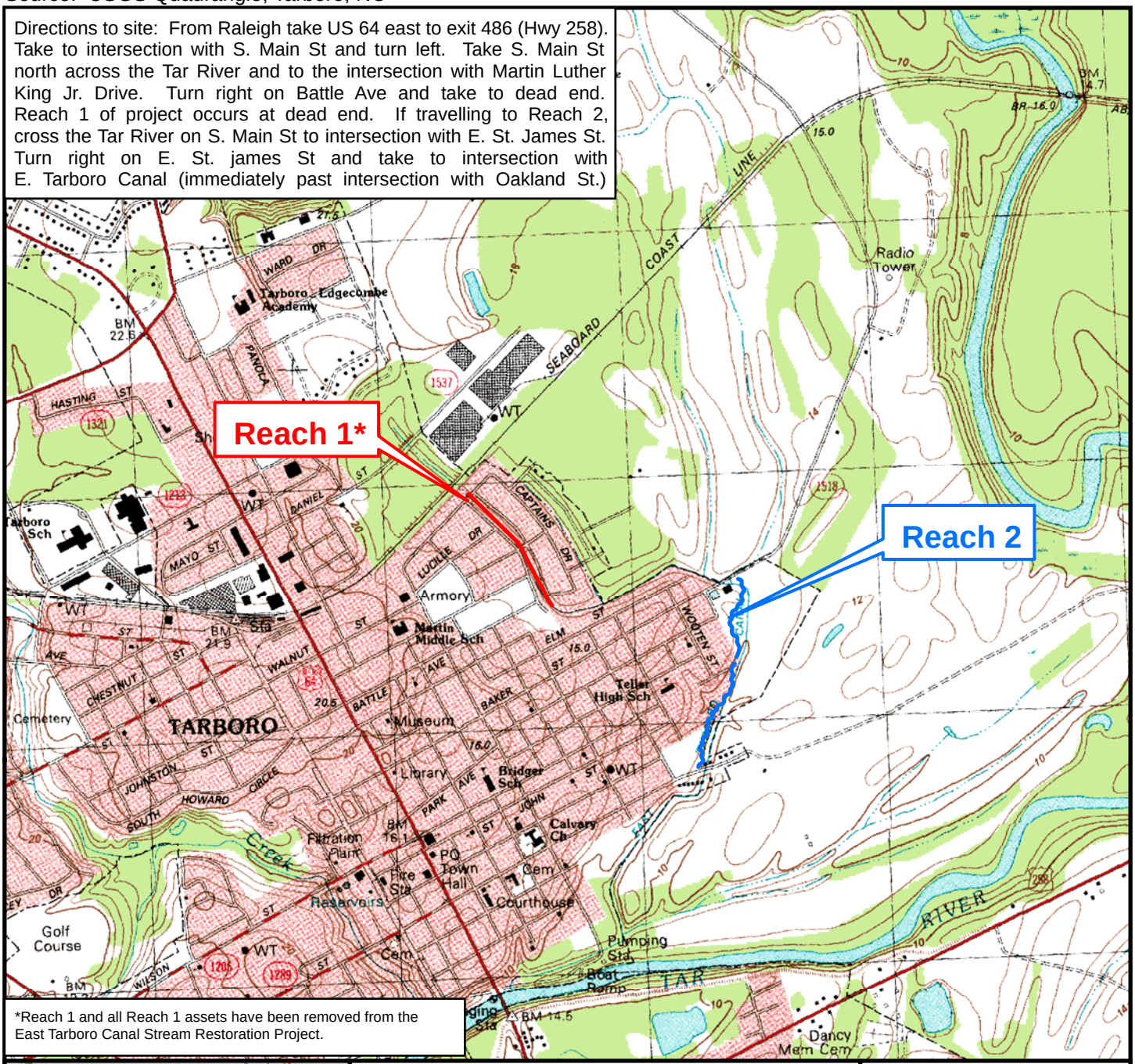
Lee, M.T., R.K. Peet, S.D. Roberts, T.R. Wentworth. (2006). CVS-EEP Protocol for Recording Vegetation Version 4.0

6.0 Project Condition and Monitoring Data Appendices

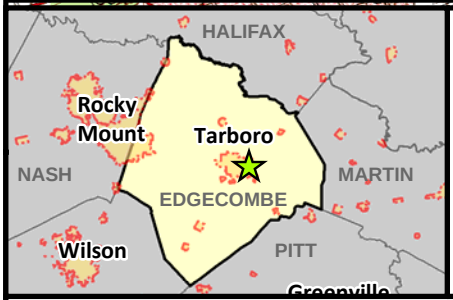
APPENDIX A

Source: USGS Quadrangle, Tarboro, NC

Directions to site: From Raleigh take US 64 east to exit 486 (Hwy 258). Take to intersection with S. Main St and turn left. Take S. Main St north across the Tar River and to the intersection with Martin Luther King Jr. Drive. Turn right on Battle Ave and take to dead end. Reach 1 of project occurs at dead end. If travelling to Reach 2, cross the Tar River on S. Main St to intersection with E. St. James St. Turn right on E. St. james St and take to intersection with E. Tarboro Canal (immediately past intersection with Oakland St.)



*Reach 1 and all Reach 1 assets have been removed from the East Tarboro Canal Stream Restoration Project.



N
W E
S

0 2,000 4,000 Feet

Ecosystem Enhancement PROGRAM

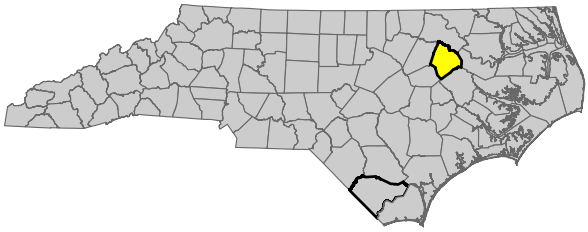


FIGURE 1
Site Location Map
East Tarboro Canal Stream Restoration Project
EEP No. 123
Edgecombe County, North Carolina
February 2011

Table 1. Project Components and Mitigation Credits
East Tarboro Canal, EEP No. 123

Mitigation Credits

	Stream (LF)		Riparian Wetland (acres)		Non-Riparian Wetland (acres)		Buffer	Nitrogen Nutrient Offset	Phosphorous Nutrient Offset
Type	R	RE	R	RE	R	RE			
Totals	2,989						418,176 sq. ft.		

Project Components

Project Component	Stationing/Location	Existing Footage/Acreage	Approach	Restoration or Restoration Equivalent	Restoration Footage or Acreage	Mitigation Ratio
Reach 2	10+00 to 39+89		Priority 2		2989	1:1

Component Summation

Restoration Level	Stream (Linear Feet)	Riparian Wetland (acres)	Non-riparian Wetland (acres)	Buffer (acres)	Upland (acres)
Restoration	2,989			418,176 sq. ft	

Table 2. Project Activity and Reporting History
East Tarboro Canal Stream Restoration - EEP Project No. 123

Activity or Report	Data Collection Complete	Actual Completion or Delivery
Restoration Plan	NA	January 2005
Final Design - 90%	NA	May 2005
Construction	Jan 2007	February 2007
Temporary S&E mix applied to entire project area	Jan 2007	Jan 2007
Permanent seed mix applied to entire project area	Jan 2007	Jan 2007
Containerized and B&B plantings	Jan 2007	Jan 2007
Mitigation Plan / As-built (Year 0 Monitoring - baseline)	April 2007	June 2007
Year 1 Monitoring	Nov 2008	Jan 2009
Year 2 Monitoring	Oct 2009	Nov 2009
Year 3 Monitoring	Oct 2010	Nov 2010
Supplemental Planting		February 2011
Year 4 Monitoring	NA	NA
Year 5 Monitoring	NA	NA

Table 3. Project Contacts Table East Tarboro Canal Stream Restoration - EEP Project No. 123	
Designer Primary project design POC	Earth Tech 701 Corporate Center Drive Suite 475 Raleigh, NC 27607
Construction Contractor Construction contractor POC	Shamrock Environmental Corporation P.O. Box 14987 Greensboro, NC 27415 Mike Granson (336)-375-1989
Planting Contractor Planting Contractor POC	Shamrock Environmental Corporation P.O. Box 14987 Greensboro, NC 27415 Mike Granson (336)-375-1989
Seeding Contractor Seeding Contractor POC	Shamrock Environmental Corporation P.O. Box 14987 Greensboro, NC 27415 Mike Granson (336)-375-1989
Seed Mix Sources	contact Shamrock Environmental Corporation
   Nursery Stock Suppliers	Mellow Marsh Farm 1312 Woody Store Road Siler City, NC 27344 (919) 742-1200
Monitoring Performers (MY1, MY2, MY3)	Rummel, Klepper, and Kahl, LLP 900 Ridgefield Drive Suite 250 Raleigh, NC 27609
Stream Monitoring POC Vegetation Monitoring POC Wetland Monitoring POC	Pete Stafford (919)878-9560 Pete Stafford (919)878-9560 NA

Table 4. Project Baseline Information and Attributes East Tarboro Canal Restoration Site - EEP Project No. 123			
Project Information			
Project Name	East Tarboro Canal		
Project County	Edgecombe		
Project Area	N/A		
Project Coordinates (Lat and Long)	35.907617,-77.5217		
Project Watershed Summary Information			
Physiographic Region	Coastal Plain		
River Basin	Tar		
USGS HUC 8 Digit 03020103	USGS HUC 14 Digit 03020103010010		
NCDWQ Subbasin	030303		
Project Drainage Area	2.78 sq mi		
Project Drainage impervious cover estimate (%)	10 percent		
CGIA Land Use Classification			
Reach Summary Information			
Parameters	Reach 2		
Length of Reach	2,989 LF		
Valley Classification	N/A		
Drainage Area	2.78 sq mi		
NCDWQ Stream Identification Score			
NCDWQ Water Quality Classification	East Tarboro Canal (C, NSW)		
Morphological Description (stream type)	C5		
Evolutionary Trend	N/A		
Underlying Mapped Soils	Roanoke (Ro)		
Drainage Class	Poorly Drained		
Soil Hydric Status	Hydric A		
Slope	.00179		
FEMA Classification	Zone AE		
Native Vegetation Community	N/A		
Percent Composition Exotic Invasive Vegetation	N/A		
Wetland Summary Information			
There are no delineated or restored wetlands as part of this project.			
Regulatory Considerations			
Regulation	**Applicable?**	**Resolved?**	**Supporting Documentation**
Waters of the United States – Section 404	Yes	Yes	Upon Request
Waters of the United States – Section 401	Yes	Yes	Upon Request
Endangered Species Act	Yes	Yes	Upon Request
Historic Preservation Act	Yes	Yes	Upon Request
Coastal Zone Management Act (CZMA) Coastal Area Management Act (CAMA)	No		
FEMA Floodplain Compliance	Yes	Yes	Upon Request
Essential Fisheries Habitat	No		

APPENDIX B

FIGURE 2

Current Conditions Plan View
Reach 2

East Tarboro Canal
Stream Restoration Project
EEP No. 123
Edgecombe County, North Carolina

Legend

- Stream Thalweg
- Cross Section
- Beaver Activity
- Photo Point

Vegetation Monitoring Counts

- Less Than 320 Stems per Acre
- More Than 320 Stems per Acre

0 200 400 Feet

Ecosystem Enhancement Program

February 2010

Table 5 - Visual Stream Morphological Stability Assessment
Reach ID - Reach 2
Assessed Length – 2989 LF

Major Channel Category	Channel Sub-Category	Metric	Number Stable, Performing as Intended	Total Number in As-built	Number of Unstable Segments	Amount of Unstable Footage	% Performing as Intended	Number with Stabilizing Woody Vegetation	Footage with Stabilizing Woody Vegetation	Adjusted % for Stabilizing Woody Vegetation
1. Bed	1. Vertical Stability (Riffle and Run Units)	1. Aggradation			1	350	88 %			
		2. Degradation			0	0	100%			
	2. Riffle Condition	1. Texture/Substrate	42	44			95%			
	3. Meander Pool Condition	1. Depth	42	42			100%			
		2. Length	41	42			97%			
	4. Thalweg Condition	1. Thalweg at upstream of meander bend	NA	NA			NA			
		2. Thalweg centering at downstream of meander	NA	NA			NA			
2. Bank	1. Scoured/Eroding	Bank lacking vegetative cover from pour growth and/or scour and erosion			1	100	97%	NA	NA	98%
	2. Undercut	Banks undercut/overhanging			0	0	100%	NA	NA	98%
	3. Mass Wasting	Bank slumping, caving, or collapse			1	100	97%	NA	NA	98%
				Totals	2	200	93%	NA	NA	98%
3. Engineered Structures	1. Overall Integrity	Structures physically intact with no dislodged boulders or logs	17	19			89%			
	2. Grade Control	Grade Control exhibiting maintenance of grade across the ill	8	8			100%			
	2a. Piping	Structures Lacking any substantial flow underneath sills or arms	10	11			91%			
	3. Bank Protection	Bank erosion within the structures extent of influence does not exceed 15%	10	11			91%			
	4. Habitat	Pool forming structures maintaining – Max Pool Depth: Mean Bankfull Depth Ratio $\geq$ 1.6 Rootwads/logs providing some cover at base flow.	40	42			95%			

Table 6 – Vegetation Condition Assessment
Planted Acreage - NA

Vegetation Category	Definitions	Mapping Threshold	CCPV Depiction	Number of Polygons	Combined Acreage	% of Planted Acreage
1. Bare Areas	Very Limited Cover of both woody and herbaceous material	No bare areas located onsite	NA	NA	NA	No bare areas located onsite
2. Low Stem Density Areas	Woody stem densities clearly below target levels based on MY3, 4, or 5 stem count criteria	100 m^2 0.0247 acre	RED	7	.17 acre	N/A
3. Areas of Poor Growth Rates or Vigor	Areas with woody stems of a size class that are obviously small given the monitoring year	100 m^2 0.0247 acre	RED	7	.17 acre	N/A

Stream Photo Station Photos (all photos recorded on October 19, 2010)

Photo Station 5. Beginning of Reach 2 Downstream

Photo Station 6. Beginning of Reach 2 Upstream

Photo Station 7. Wilson Street Crossing Upstream

Photo Station 8. Wilson Street Crossing – Downstream

Photo Station 9. Culvert Upstream

Photo Station 10. Pool Culvert Downstream

Photo Station 11. Reach 2 End of Project

Stream Problem Area Photos (all photos recorded on October 19, 2010)

SP1 – Area of stream reroute and aggradation - Station 34+00 – Reach 2

SP2 – Structure Failure - Sta. 21+50 - Reach 2

SP3 – Soil Erosion Station – Station 34+00 – Reach 2

SP4 – Beaver Ponding – Locations depicted in CCPV – Reach 2

Vegetation Plot Photos (all photos recorded on October 19, 2010)

Vegetation Plot 2

Vegetation Plot 3

Vegetation Plot 4

Vegetation Plot 5

Vegetation Plot 6

Vegetation Plot 7

Vegetation Plot 8

Vegetation Plot 9

Vegetation Plot 10

Vegetation Plot 11

Vegetation Plot 12

Vegetation Plot 13

Vegetation Problem Areas Photos

VPA1 - Beaver Harvest – Adjacent to Vegetation Plot 10 – Reach 2

VPA2 – Cattails – Station 34+00 – Reach 2

(Photos recorded on October 19, 2010)

APPENDIX C

Table 7. Vegetation Plot Criteria Attainment Stream Criteria			
Tract	**Vegetation Plot ID**	**Vegetation Survival Threshold Met?**	**Tract Mean**
Reach 1*	VP1*	Did not Monitor for 2010*	NA
Reach 2	VP2	N	42%
Reach 2	VP3	Y	
Reach 2	VP4	N	
Reach 2	VP5	Y	
Reach 2	VP6	N	
Reach 2	VP7	Y	
Reach 2	VP8	N	
Reach 2	VP9	Y	
Reach 2	VP10	N	
Reach 2	VP11	Y	
Reach 2	VP12	N	
Reach 2	VP13	N	

*Reach 1 and all Reach 1 assets have been removed from the East Tarboro Canal Stream Restoration Project

Table 7a. Vegetation Plot Criteria Attainment Buffer Criteria			
Tract	**Vegetation Plot ID**	**Vegetation Survival Threshold Met?**	**Tract Mean**
Reach 1*	VP1*	Did not Monitor for 2010*	NA
Reach 2	VP2	N	16%
Reach 2	VP3	N	
Reach 2	VP4	N	
Reach 2	VP5	N	
Reach 2	VP6	N	
Reach 2	VP7	N	
Reach 2	VP8	N	
Reach 2	VP9	N	
Reach 2	VP10	N	
Reach 2	VP11	N	
Reach 2	VP12	N	
Reach 2	VP13	N	

*Reach 1 and all Reach 1 assets have been removed from the East Tarboro Canal Stream Restoration Project

Table 8. CVS Vegetation Plot Metadata
East Tarboro Canal EEP No: 123

Report Prepared By	William (Pete) Stafford
Date Prepared	11/4/2010 10:49
Database Name	EastTarboroCanal.mdb
Database Location	C:\Documents and Settings\pstafford\Desktop\CVS Veg Data
Computer Name	STAFFORDP
Description Worksheets In This Document	
Metadata	Description of database file, the report worksheets, and a summary of project(s) and project data.
Proj, planted	Each project is listed with its PLANTED stems per acre, for each year. This excludes live stakes.
Proj, total stems	Each project is listed with its TOTAL stems per acre, for each year. This includes live stakes, all planted stems, and all natural/volunteer stems.
Plots	List of plots surveyed with location and summary data (live stems, dead stems, missing, etc.).
Vigor	Frequency distribution of vigor classes for stems for all plots.
Vigor by Spp	Frequency distribution of vigor classes listed by species.
Damage	List of most frequent damage classes with number of occurrences and percent of total stems impacted by each.
Damage by Spp	Damage values tallied by type for each species.
Damage by Plot	Damage values tallied by type for each plot.
Planted Stems by Plot and Spp	A matrix of the count of PLANTED living stems of each species for each plot; dead and missing stems are excluded.
Project Summary	
Project Code	123
Project Name	East Tarboro Canal
Description	Stream Restoration Project
River Basin	Tar-Pamlico
Length(ft)	2933
Stream-to-edge width (ft)	
Area (sq m)	
Required Plots (calculated)	

Table 9 - Planted and Total Counts (Species by Plot with Annual Means)

			CURRENT DATA (MY3 2010)																								ANNUAL MEANS							
			Plot 1**		Plot 2		Plot 3		Plot 4		Plot 5		Plot 6		Plot 7		Plot 8		Plot 9		Plot 10		Plot 11		Plot 12		Plot 13		Current Mean		MY2 (2009)		MY1 (2008)		AB (2007)***	
Scientific Name	Common Name	Type	P	T	P	T	P	T	P	T	P	T	P	T	P	T	P	T	P	T	P	T	P	T	P	T	P	T	P	T	P	T	P	T
Alnus serrulata	Tag Alder	Shrub																	1	1						1			2	2	2	3	2	1		
Betula nigra	**River Birch**	Tree																									2	1	2	1	2	2	2	2		
Cornus amomum	**Silky Dogwood**	Tree																										1	5	1	5	5	5	0		
Cornus florida	**Dogwood**	Tree												1							1	1							1	2	1	1	1	1		
Fraxinus pennsylvanica	**Green Ash**	Tree						3			1	2				2	1	1		1		1							3	10	3	3	3	2		
Hamamelis	Witch Hazel	Shrub																							1				1	1	1	1	1	0		
Itea virginica	Sweetspire	Shrub														1							1		1	2	1		5	3	5	12	5	3		
Myrica sp.	Wax Myrtle	Shrub			3	3			3	1			1	1							2	2	2	2	2	2		2	21	13	21	1	21	13		
Nyssa biflora	**Black Gum**	Tree							3		2	2							3	3						1			10	6	10	13	10	8		
Quercus laurifolia	**Laurel Oak**	Tree							2												1	1							3	1	3	1	3	3		
Quercus lyrata	**Overcup Oak**	Tree					1	1								2													1	3	1	4	1	1		
Quercus pagoda	**Cherrybark Oak**	Tree					2	2							1	1			4	4									7	7	7	8	7	7		
Quercus palustris	**Pin Oak**	Tree											1	1	1	1													2	2	2	1	2	2		
Quercus phellos	**Willow Oak**	Tree																					2	2					4	2	4	2	4	2		
Rosa palustris	Swamp Rose	Shrub					1	1			1				2	1	1	1			1	1	1	1		1			7	6	7	4	7	7		
Salix caroliniana	**Willow**	Tree									4	4																	4	4	4	4	4	4		
Taxodium distichum	**Bald Cypress**	Tree			1	1																							1	1	1	1	1	1		
Unknown					2		3	1	1		4		2		6		4		1		6		5	4	8		5	1	47	6	47	14	47	47		
Viburnumsp.	Viburnum	Shrub			2				1	1			2	2		1														4						
		Plot Area (acres)	0.025		0.025		0.025		0.025		0.025		0.025		0.025		0.025		0.025		0.025		0.025		0.025											
		Species Count		0	4	2	4	5	5	2	5	3	4	4	4	7	3	2	4	4	5	5	5	4	1	6	2	5	18	19	18	18	18	18		
		Stem Count		0	8	4	7	8	10	2	12	8	6	5	10	9	6	2	9	9	11	6	11	9	10	7	9	6	113	75	113	80	113	113		
Stream Restoration Criteria		Stems/Acre		0	320	160	280	320	400	80	480	320	240	200	400	360	240	80	360	360	440	240	440	360	400	280	360	240	363	250	363	320	230	363		
		Species Count		0	1	1	3	3	2	0	3	3	1	2	2	4	1	1	2	3	2	3	2	1	0	1	1	3	12	12	12	10	12	12		
		Stem Count		0	1	1	2	6	5	0	7	8	1	2	2	6	1	1	7	8	2	3	2	2	0	1	2	2	33	40	33	39	32	33		
Buffer Restoration Criteria		Stems/Acre		0	40	40	80	240	200	0	280	320	40	80	80	240	40	40	280	320	80	120	80	80	0	40	80	80	110	133	110	172	107	110		

*Bolded tree species are counted toward riparian bugger success criteria

**Reach 1 and all Reach 1 assets have been removed from the East Tarboro Canal Stream Restoration Project

***MY1 Data used for Baseline

APPENDIX D

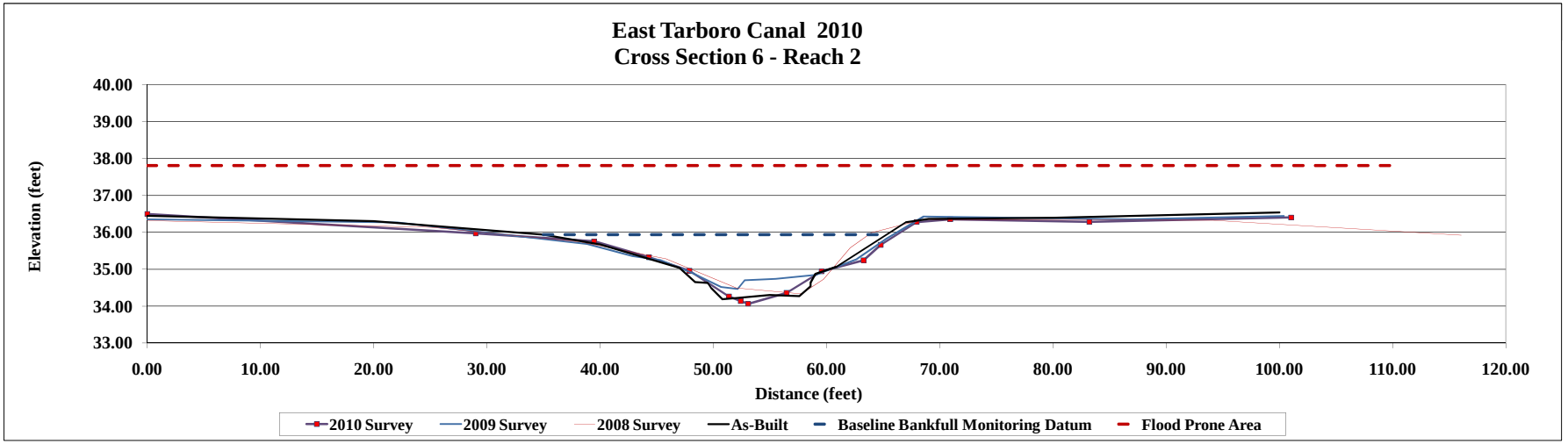
Project Name	East Tarboro Canal
Watershed	Mill Creek, MY3
Cross Section	6
Drainage Area	NA
Date	May-10
Crew	Tutt, Stafford

Photo of Cross-Section #6 - Looking Downstream

Picture Taken October 19 2010

As-Built Survey			2008			2009			2010			2011			2012		
As-Built Survey			2008 Survey			2009 Survey			2010 Survey			2011 Survey			2012 Survey		
Station	Elevation	Notes	Station	Elevation	Notes	Station	Elevation	Notes	Station	Elevation	Notes	Station	Elevation	Notes	Station	Elevation	Notes
0.00	36.45	LPIN	0.00	36.32		0.00	36.35		0.00	36.50							
20.00	36.30		25.08	36.14		22.07	36.27		29.01	35.97							
35.00	35.94	BKF	38.26	35.74		38.88	35.68		39.47	35.76							
40.00	35.67		45.82	35.29		42.86	35.35		44.32	35.32							
47.00	35.04		52.03	34.49		45.30	35.25		47.88	34.96							
48.40	34.65		57.78	34.33		48.03	34.92		51.39	34.26							
49.50	34.63	LEW	59.72	34.73		50.69	34.52		52.41	34.14							
49.80	34.49		62.08	35.58		52.16	34.46		53.08	34.07							
50.80	34.19	TW	63.97	35.99		52.77	34.70		56.47	34.36							
52.00	34.22		68.53	36.35		55.50	34.74		59.56	34.95							
55.00	34.30		94.15	36.33		59.02	34.84		63.27	35.25							
57.60	34.27		116.05	35.92		62.67	35.27		64.78	35.66							
58.60	34.54					65.29	35.83		67.95	36.28							
58.60	34.64	REW				68.58	36.43		70.94	36.35							
59.00	34.87					86.79	36.35		83.20	36.28							
60.90	35.07					100.38	36.44		101.03	36.40							
67.00	36.27																
69.00	36.36																
80.00	36.39																
100.00	36.54	RPIN															

Summary Data	
Bankfull Elv.	35.94
BF Area	27.2
BF Width	35.8
Flood Prone Elv.	37.81
Flood Prone Width	101
Max Depth	1.9
Mean Depth	0.8
W/D Ratio	47
ER	2.8
Bank Height Ratio	
Stream Type	C5



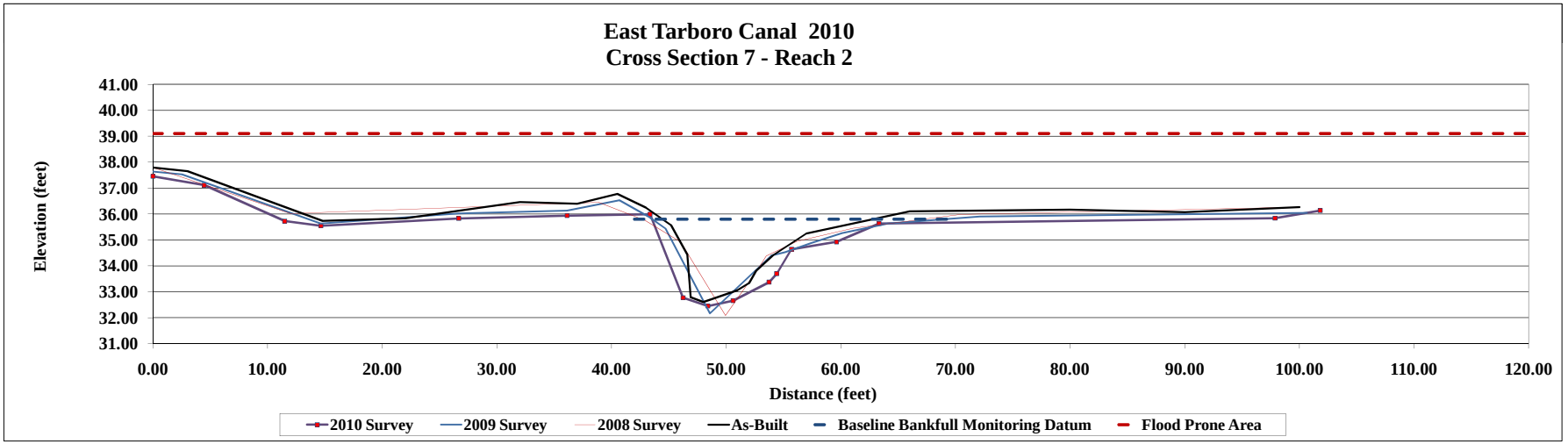
Project Name East Tarboro Canal
Watershed Mill Creek, MY3
Cross Section 7
Drainage Area NA
Date May-10
Crew Tutt, Stafford

Photo of Cross-Section #7 - Looking Upstream

Picture Taken October 19 2010

As-Built Survey As-Built Survey			2008 2008 Survey			2009 2009 Survey			2010 2010 Survey			2011 2011 Survey			2012 2012 Survey		
Station	Elevation	Notes	Station	Elevation	Notes	Station	Elevation	Notes	Station	Elevation	Notes	Station	Elevation	Notes	Station	Elevation	Notes
0.00	37.79	LPIN	0.00	37.79		0.00	37.63		0.00	37.45							
3.00	37.65		12.00	36.02		2.53	37.53		4.47	37.11							
14.80	35.73		38.87	36.45		14.64	35.63		11.49	35.72							
22.00	35.83		42.91	35.76		26.68	36.02		14.66	35.54							
32.00	36.46		46.03	34.92		36.11	36.13		26.67	35.83							
37.00	36.39		49.94	32.08		40.69	36.53		36.11	35.94							
40.50	36.77		52.84	33.91		43.26	35.89		43.36	35.99							
43.00	36.24		53.48	34.38		44.70	35.44		46.24	32.77							
45.20	35.57		56.17	34.94		48.57	32.17		48.41	32.45							
46.60	34.43	LEW	61.09	35.45		53.95	34.40		50.59	32.66							
46.90	32.79		70.47	35.99		55.15	34.52		53.74	33.37							
48.00	32.60	TW	100.00	36.26		57.45	34.88		54.40	33.69							
49.00	32.75					60.11	35.27		55.69	34.64							
51.00	33.06					64.10	35.63		59.63	34.92							
52.00	33.33					72.13	35.90		63.34	35.63							
52.60	33.81					100.66	36.04		97.87	35.84							
54.10	34.41	REW							101.81	36.13							
57.00	35.25																
66.00	36.10	BKF															
80.00	36.17																
90.00	36.07																
100.00	36.26	RPIN															

Summary Data	
Bankfull Elv.	35.8
BF Area	41.8
BF Width	68.8
Flood Prone Elv.	39.1
Flood Prone Width	101.8
Max Depth	3.3
Mean Depth	0.6
W/D Ratio	113.2
ER	1.5
Bank Height Ratio	
Stream Type	C5



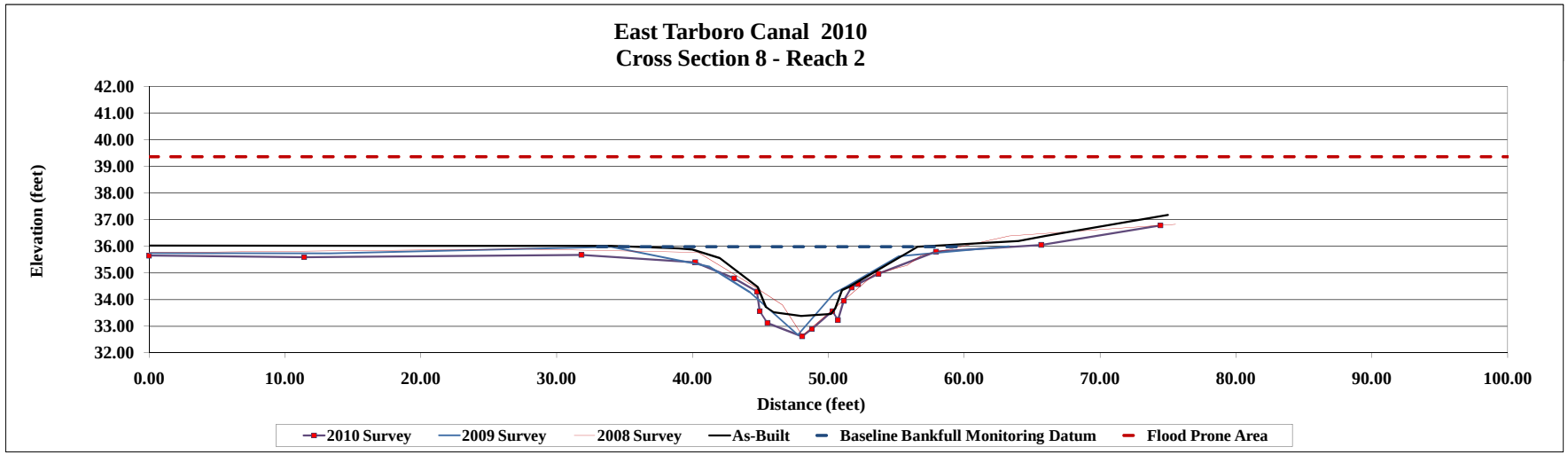
Project Name East Tarboro Canal
Watershed Mill Creek, MY3
Cross Section 8
Drainage Area NA
Date May-10
Crew Tutt, Stafford

Photo of Cross-Section #8 - Looking Upstream

Picture Taken October 19 2010

As-Built Survey			2008			2009			2010			2011			2012		
As-Built Survey			2008 Survey			2009 Survey			2010 Survey			2011 Survey			2012 Survey		
12.00	Elevation	Notes	Station	Elevation	Notes	Station	Elevation	Notes	Station	Elevation	Notes	Station	Elevation	Notes	Station	Elevation	Notes
0.00	36.03	LPIN	0.00	35.76		0.00	35.74		0.00	35.65							
20.00	36.02		27.39	35.90		13.34	35.73		11.42	35.59							
34.00	36.02		40.41	35.77		34.02	35.98		31.83	35.68							
39.00	35.92		44.41	34.53		41.21	35.24		40.20	35.40							
40.00	35.88		46.63	33.80		44.22	34.27		43.06	34.80							
42.00	35.56		48.09	32.65		47.75	32.68		44.75	34.30							
44.80	34.47	LEW	52.77	34.69		50.42	34.23		44.95	33.56							
45.40	33.71		53.36	34.95		51.31	34.48		45.52	33.12							
46.00	33.52		55.78	35.28		55.22	35.63		48.07	32.62							
48.00	33.38	TW	56.84	35.66		63.30	36.00		48.79	32.90							
50.20	33.46		63.32	36.38		74.01	36.86		50.29	33.56							
50.50	33.66		75.55	36.82					50.71	33.23							
51.00	34.35								51.14	33.95							
51.50	34.47	REW							51.71	34.46							
56.60	35.98	BKF							52.18	34.58							
64.00	36.20								53.70	34.97							
66.00	36.39								57.93	35.80							
75.00	37.18	RPIN							65.67	36.05							
									74.45	36.78							

Summary Data	
Bankfull Elv.	35.98
BF Area	44.6
BF Width	68.8
Flood Prone Elv.	39.36
Flood Prone Width	74.5
Max Depth	3.4
Mean Depth	0.7
W/D Ratio	87.9
ER	1.2
Bank Height Ratio	
Stream Type	C5



Project Name	East Tarboro Canal
Watershed	Mill Creek, MY3
Cross Section	9
Drainage Area	NA
Date	May-10
Crew	Tutt, Stafford

As-Built Survey
As-Built Survey

Station	Elv	Notes
0.00	34.41	LPIN
20.00	34.44	
37.00	34.39	
42.00	34.61	
45.00	35.08	
47.00	34.51	
48.20	34.00	
49.20	32.08	LEW
51.00	31.03	TW
51.80	31.10	
53.10	31.71	
54.50	31.73	
55.00	32.08	REW
58.00	32.74	
63.00	34.00	
67.00	34.24	BKF
80.00	34.07	
90.00	34.10	
100.00	34.25	
101.40	34.25	RPIN

2008
2008 Survey

Station	Elv	Notes
0.00	34.40	
31.81	34.84	
38.72	34.32	
39.90	33.24	
54.34	30.37	
57.17	32.15	
58.59	33.23	
60.90	33.91	
65.70	34.41	
76.79	34.12	
99.09	34.35	

2009
2009 Survey

Station	Elv	Notes
0.00	34.22	
10.00	34.22	
34.76	34.19	
50.10	30.60	
54.90	32.61	
55.85	32.99	
58.96	33.90	
65.41	34.26	
77.54	34.01	
97.90	34.21	

2010
2010 Survey

Station	Elv	Notes
0.00	34.37	
36.60	34.72	
38.71	34.04	
42.51	30.83	
44.18	29.53	
51.94	30.94	
54.41	33.40	
56.98	33.59	
59.22	34.40	
76.82	34.16	
90.46	34.32	
98.99	34.49	

2011
2011 Survey

Station	Elv	Notes

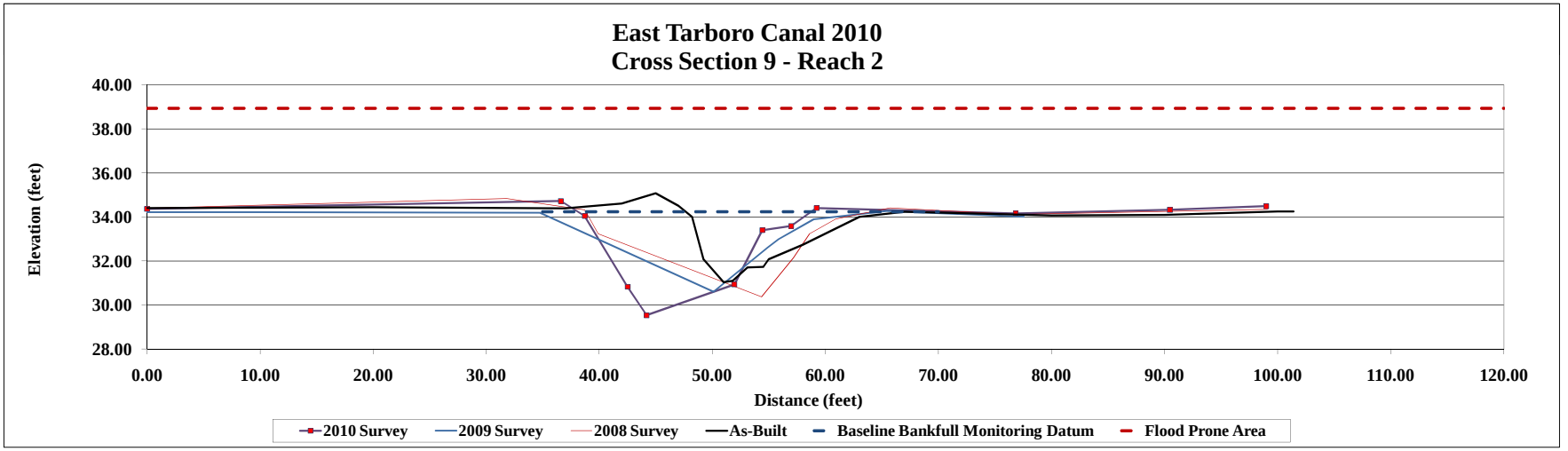
2012
2012 Survey

Station	Elv	Notes

Summary Data	
Bankfull Elv.	34.24
BF Area	52.6
BF Width	29.7
Flood Prone Elv.	38.94
Flood Prone Width	99
Max Depth	4.7
Mean Depth	1.8
W/D Ratio	16.8
ER	3.3
Bank Height Ratio	
Stream Type	C5

Photo of Cross-Section #9 - Looking Downstream

Picture Taken October 19 2010



Project Name	East Tarboro Canal
Watershed	Mill Creek, MY3
Cross Section	10
Drainage Area	NA
Date	May-10
Crew	Tutt, Stafford

Photo of Cross-Section #10 - Picture not taken to spec. due to flooding caused by beaver dam.

Picture Taken October 19 2010

As-Built Survey
As-Built Survey

Station	Elv	Notes
0.00	33.78	LPIN
10.00	33.86	
20.00	33.83	
36.00	33.92	
38.00	33.82	
41.00	33.37	
44.00	32.82	
45.10	32.25	
45.60	31.68	LEW
45.60	31.52	
46.80	31.13	TW
48.00	31.21	
49.60	31.26	
50.80	31.28	
51.20	31.67	REW
53.00	32.36	
55.30	32.99	
59.00	33.76	BKF
66.00	33.83	
71.00	33.89	
82.00	34.21	
92.00	34.14	
100.00	33.84	RPIN

2008
2008 Survey

Station	Elv	Notes
0.00	33.78	
25.81	34.00	
38.28	33.73	
40.74	33.33	
44.20	32.16	
45.45	31.53	
46.60	30.99	
51.25	31.75	
51.99	32.46	
52.72	32.62	
53.86	32.89	
54.66	33.16	
59.39	33.85	
99.61	34.07	

2009
2009 Survey

Station	Elv	Notes
0.00	33.79	
32.90	33.86	
40.35	33.58	
43.73	33.01	
45.54	32.59	
46.89	31.04	
53.95	32.69	
56.42	33.00	
58.23	33.70	
76.34	33.94	
100.78	33.88	

2010
2010 Survey

Station	Elv	Notes
0.00	33.76	
28.37	33.68	
36.85	33.71	
42.70	33.17	
45.92	32.75	
46.32	31.64	
48.42	31.00	
50.40	31.36	
52.83	32.36	
53.21	32.58	
55.07	32.85	
57.84	33.22	
61.29	33.71	
101.06	33.87	

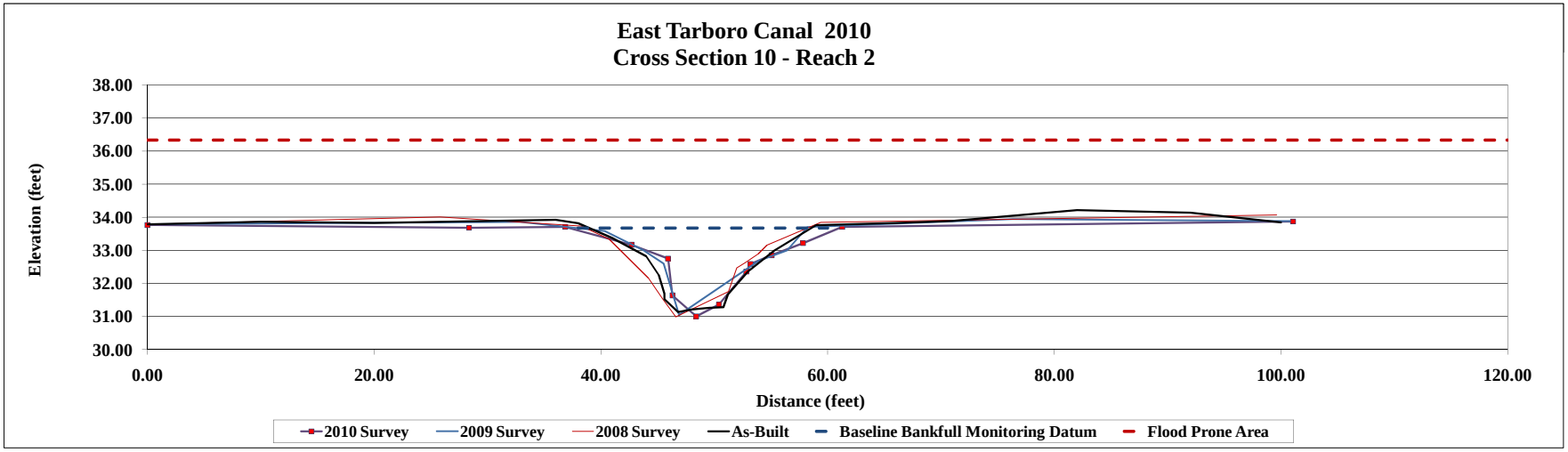
2011
2011 Survey

Station	Elv	Notes

2012
2012 Survey

Station	Elv	Notes

Summary Data	
Bankfull Elv.	33.67
BF Area	23.3
BF Width	23.8
Flood Prone Elv.	36.33
Flood Prone Width	101.1
Max Depth	2.7
Mean Depth	1
W/D Ratio	24.4
ER	4.2
Bank Height Ratio	
Stream Type	C5



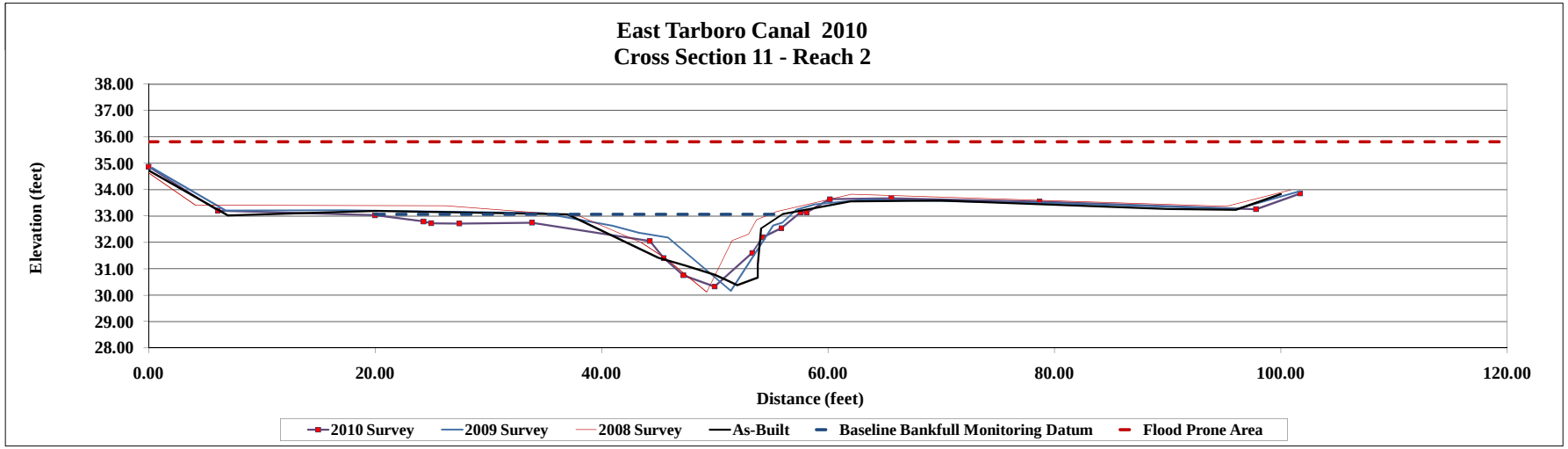
Project Name	East Tarboro Canal
Watershed	Mill Creek, MY3
Cross Section	11
Drainage Area	NA
Date	May-10
Crew	Tutt, Stafford

Photo of Cross-Section #11 - Looking Downstream

Picture Taken October 19 2010

As-Built Survey			2008			2009			2010			2011			2012		
As-Built Survey			2008 Survey			2009 Survey			2010 Survey			2011 Survey			2012 Survey		
Station	Elv	Notes	Station	Elv	Notes	Station	Elv	Notes	Station	Elv	Notes	Station	Elv	Notes	Station	Elv	Notes
0.00	34.73	LPIN	100.86	33.99		0.00	34.72		0.00	34.87							
7.00	33.02		95.21	33.37		0.31	34.83		6.10	33.21							
20.00	33.19		62.08	33.82		6.82	33.21		19.99	33.03							
37.00	33.06	BKF	55.44	33.17		17.23	33.22		24.28	32.79							
45.00	31.42		53.68	32.85		34.84	33.11		24.95	32.73							
47.40	31.13	LEOW	52.99	32.31		40.96	32.63		27.45	32.71							
50.00	30.77		51.53	32.06		43.29	32.37		33.86	32.75							
51.00	30.58		49.29	30.12		45.86	32.19		44.26	32.05							
52.00	30.38	TW	45.72	31.37		51.42	30.16		45.49	31.41							
53.80	30.67		43.52	32.00		55.18	32.64		47.23	30.75							
53.80	31.15	REOW	38.01	33.01		55.96	32.75		49.99	30.33							
54.10	32.53		26.25	33.39		57.21	33.24		53.30	31.60							
56.00	33.08		4.14	33.41		58.84	33.44		54.22	32.19							
62.00	33.56		0.00	34.63		63.32	33.62		55.89	32.54							
70.00	33.59					80.80	33.48		57.58	33.13							
90.00	33.27					96.16	33.27		58.12	33.14							
96.00	33.24					101.71	33.94		60.18	33.64							
100.00	33.83	RPIN							65.60	33.67							
									78.69	33.55							
									97.81	33.26							
									101.71	33.85							

Summary Data	
Bankfull Elv.	33.06
BF Area	32.6
BF Width	39.9
Flood Prone Elv.	35.82
Flood Prone Width	101.7
Max Depth	2.8
Mean Depth	0.8
W/D Ratio	48.9
ER	2.5
Bank Height Ratio	
Stream Type	C5



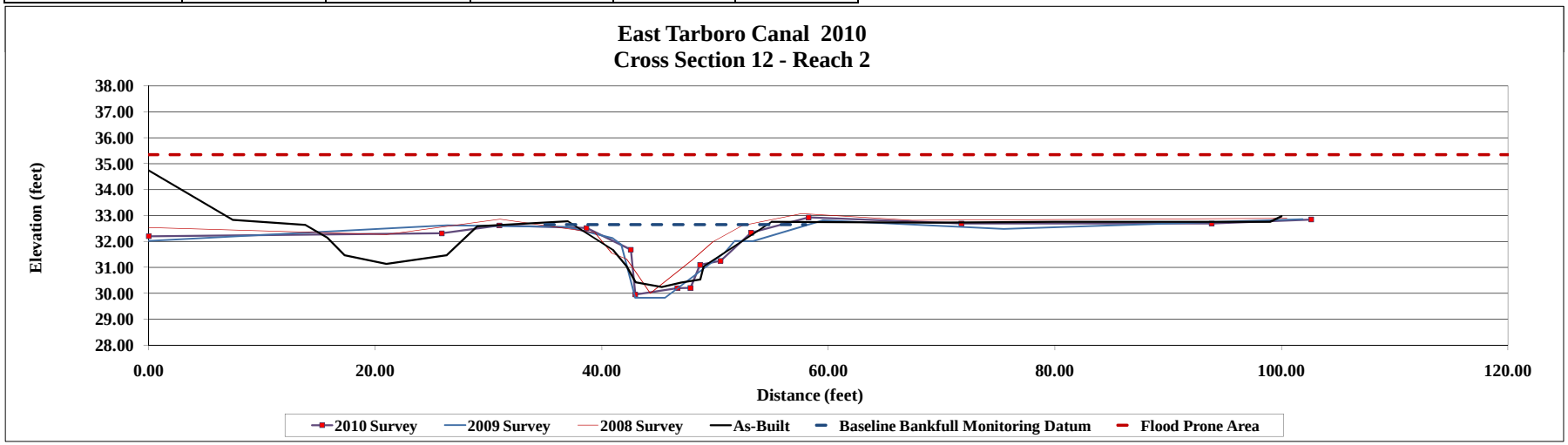
Project Name	East Tarboro Canal
Watershed	Mill Creek, MY3
Cross Section	12
Drainage Area	NA
Date	May-10
Crew	Tutt, Stafford

Photo of Cross-Section #12 - Looking Downstream - Unable to stretch tape across stream due to beaver flooding

Picture Taken October 19 2010

As-Built Survey As-Built Survey			2008 2008 Survey			2009 2009 Survey			2010 2010 Survey			2011 2011 Survey			2012 2012 Survey		
Station	Elv	Notes	Station	Elv	Notes	Station	Elv	Notes	Station	Elv	Notes	Station	Elv	Notes	Station	Elv	Notes
0.00	34.74	LPIN	0.00	32.54		0.00	32.02		0.00	32.20							
7.40	32.83		21.01	32.26		26.33	32.62		25.88	32.31							
13.80	32.64		31.01	32.86		36.95	32.55		30.97	32.62							
15.80	32.13		39.38	32.34		40.97	32.13		38.66	32.52							
17.30	31.47		40.89	31.55		41.73	31.88		42.56	31.68							
21.00	31.13		42.18	31.32		42.96	29.83		42.96	29.95							
26.30	31.47		42.76	30.97		45.59	29.83		46.67	30.20							
29.00	32.58		44.28	30.00		50.82	31.56		47.83	30.20							
37.00	32.78		48.01	31.29		51.74	32.02		48.68	31.10							
41.00	31.67		49.82	31.98		53.33	32.00		50.49	31.25							
42.20	31.04	LEW	52.41	32.61		59.54	32.82		53.19	32.33							
43.00	30.42		57.65	33.07		75.48	32.48		58.27	32.93							
45.30	30.24	TW	67.42	32.81		101.87	32.86		71.75	32.69							
47.00	30.41		100.49	32.90					93.85	32.69							
48.70	30.53								102.65	32.85							
49.00	31.04	REW															
55.00	32.76	BKF															
69.00	32.72																
80.00	32.76																
99.00	32.76																
100.00	32.97	RPIN															

Summary Data	
Bankfull Elv.	32.65
BF Area	34.2
BF Width	55.9
Flood Prone Elv.	35.35
Flood Prone Width	102.7
Max Depth	2.7
Mean Depth	0.6
W/D Ratio	91.4
ER	1.8
Bank Height Ratio	
Stream Type	C5



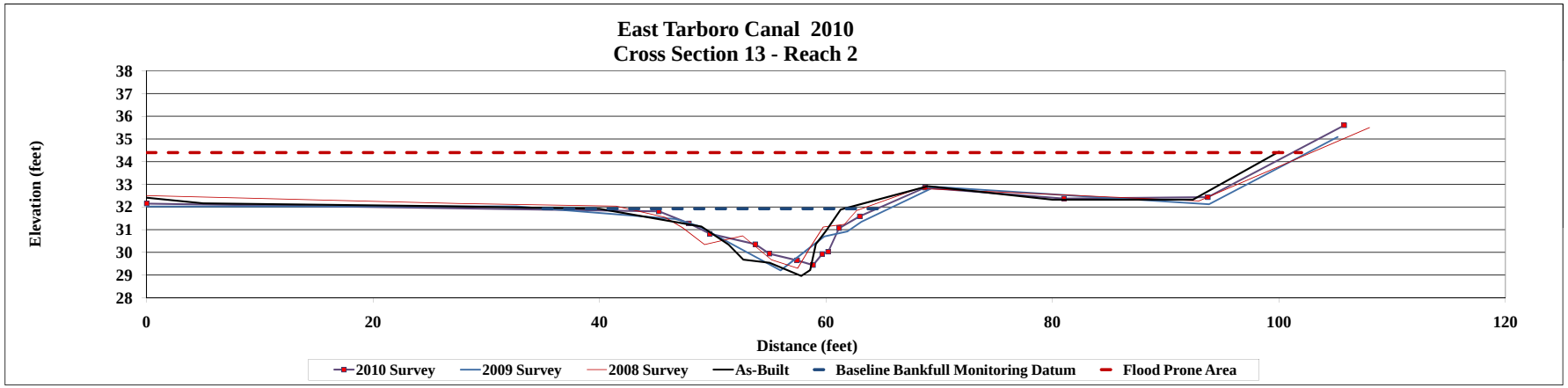
Project Name	East Tarboro Canal
Watershed	Mill Creek, MY3
Cross Section	#13
Drainage Area	NA
Date	May-10
Crew	Tutt, Stafford

Photo of Cross-Section #13 - Looking Upstream

Picture Taken October 19 2010

As-Built Survey As-Built Survey			2008 2008 Survey			2009 2009 Survey			2010 2010 Survey			2011 2011 Survey			2012 2012 Survey		
Station	Elv	Notes	Station	Elv	Notes	Station	Elv	Notes	Station	Elv	Notes	Station	Elv	Notes	Station	Elv	Notes
0	32.41	LPIN	0.00	32.50		0.00	32.02		0	32.1491							
5	32.16		27.52	32.15		32.66	32.03		45.2	31.8066							
26	32.04		41.46	32.04		46.73	31.47		47.9	31.2745							
40	31.92	BKF	45.78	31.55		48.77	31.15		49.74	30.8204							
49	31.14		47.33	31.09		55.98	29.21		53.8	30.3593							
51.4	30.34	LEW	49.27	30.34		59.84	30.70		55	29.9394							
52.7	29.68		52.64	30.73		61.89	30.92		57.45	29.6481							
55	29.54		55.19	29.67		63.12	31.35		58.9	29.4379							
57.8	28.96	TW	57.49	29.30		69.6	32.89		59.7	29.9288							
58.6	29.22		58.70	30.30		93.82	32.12		60.2	30.0276							
59.1	30.36	REW	59.76	31.12		105.18	35.08		61.2	31.0628							
60	30.95		61.62	31.24					63.0	31.5896							
61.3	31.89		62.70	31.84					68.7	32.8511							
69	32.92		68.18	32.82					81.0	32.3745							
80	32.32		92.94	32.27					93.7	32.4328							
92.4	32.32		108.00	35.50					105.8	35.6026							
100	34.44	RPIN															

Summary Data	
Bankfull Elv.	31.92
BF Area	25
BF Width	34.2
Flood Prone Elv.	34.4
Flood Prone Width	101.2
Max Depth	2.5
Mean Depth	0.7
W/D Ratio	46.8
ER	3
Bank Height Ratio	
Stream Type	C5



East Tarboro Canal
Longitudinal Profile
Reach 2
Station 00 to 1600

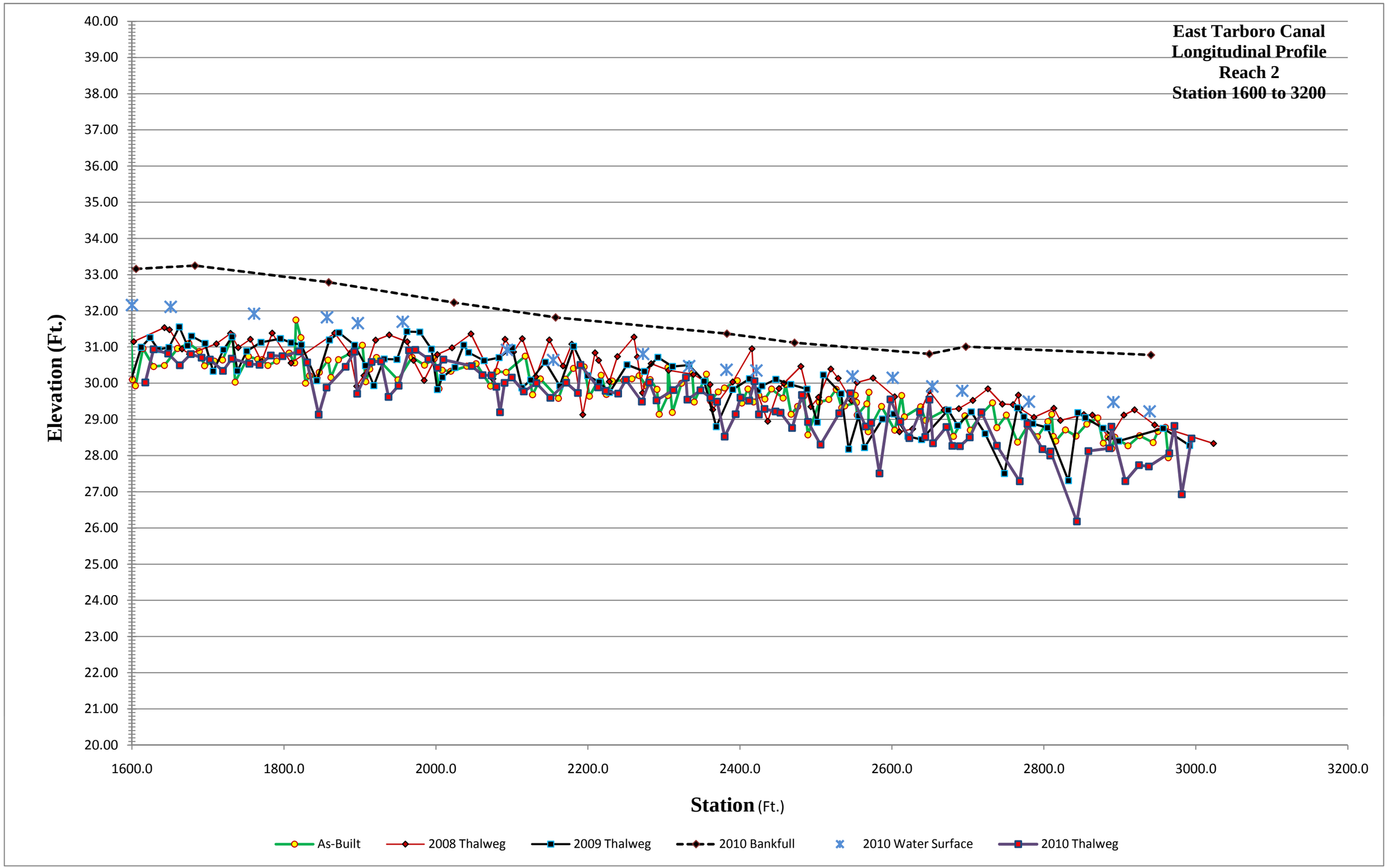
Elevation (Ft.)

42.00
41.00
40.00
39.00
38.00
37.00
36.00
35.00
34.00
33.00
32.00
31.00
30.00
29.00
28.00
27.00
26.00
25.00
24.00
23.00
22.00

0.0 200.0 400.0 600.0 800.0 1000.0 1200.0 1400.0 1600.0

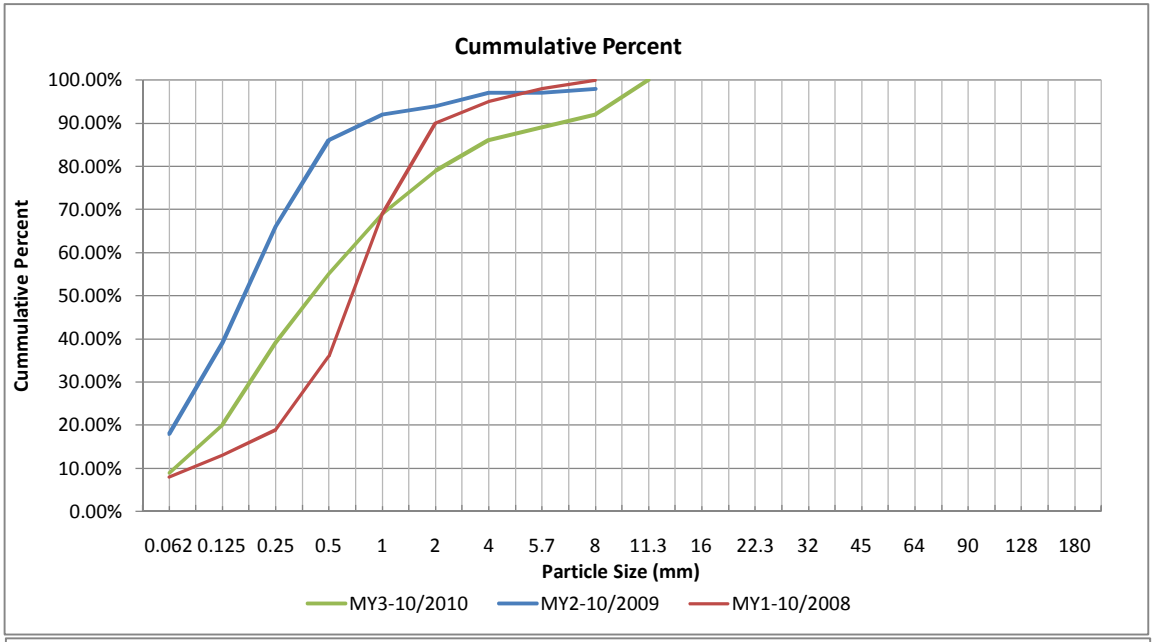
Station (Ft.)

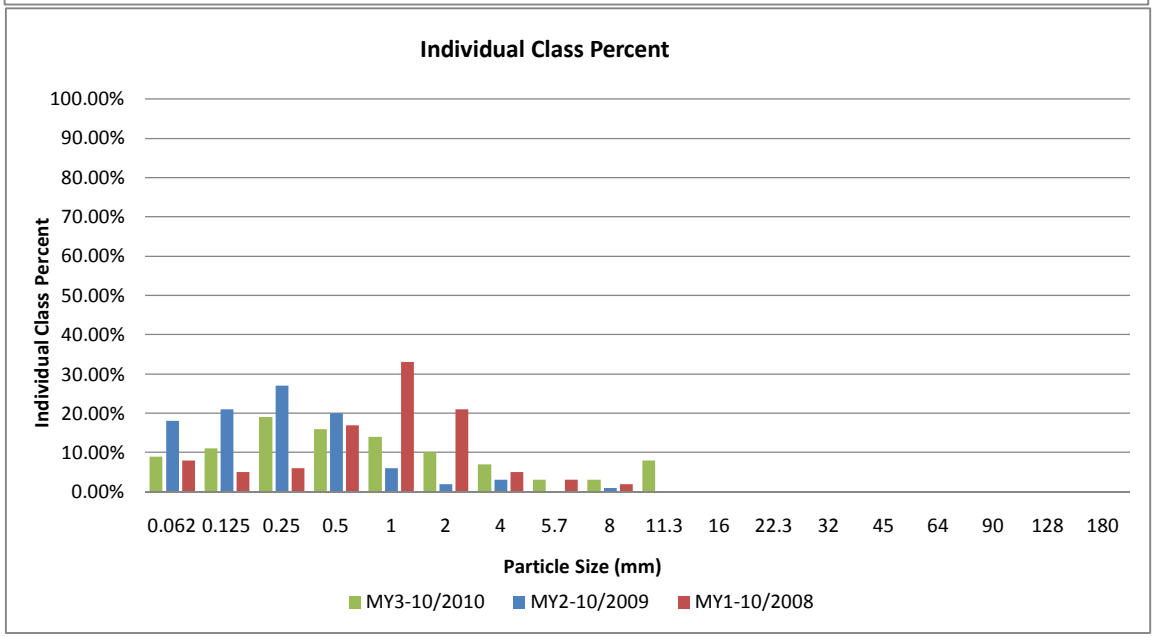
As-Built
2008 Thalweg
2009 Thalweg
2010 Bankfull
2010 Water Surface
2010 Thalweg


East Tarboro Canal
Longitudinal Profile
Reach 2
Station 1600 to 3200
Elevation (Ft.)
40.00
39.00
38.00
37.00
36.00
35.00
34.00
33.00
32.00
31.00
30.00
29.00
28.00
27.00
26.00
25.00
24.00
23.00
22.00
21.00
20.00
1600.0
1800.0
2000.0
2200.0
2400.0
2600.0
2800.0
3000.0
3200.0
Station (Ft.)
As-Built
2008 Thalweg
2009 Thalweg
2010 Bankfull
2010 Water Surface
2010 Thalweg

Project Name: East Tarboro Canal Cross Section: 6 Monitoring Year 3 - 2010					
Desc.	**Material**	**Size (MM)**	**Count**	**% of Total**	**Cumulative %**
SAND	silt/clay	0.062	9	9.00%	9.00%
	very fine sand	0.125	11	11.00%	20.00%
	fine sand	0.25	19	19.00%	39.00%
	medium sand	0.5	16	16.00%	55.00%
	coarse sand	1	14	14.00%	69.00%
	very coarse sand	2	10	10.00%	79.00%
GRAVEL	very fine gravel	4	7	7.00%	86.00%
	fine gravel	5.7	3	3.00%	89.00%
	fine gravel	8	3	3.00%	92.00%
	medium gravel	11.3	8	8.00%	100.00%
	medium gravel	16			
	coarse gravel	22.3			
	coarse gravel	32			
	very coarse gravel	45			
	very coarse gravel	64			
COBBLE	small cobble	90			
	medium cobble	128			
	large cobble	180			
	very large cobble	256			
BOULDER	small boulder	362			
	small boulder	512			
	medium boulder	1024			
	large boulder	2048			
TOTAL % of whole count:			**100**	**100%**	**100%**

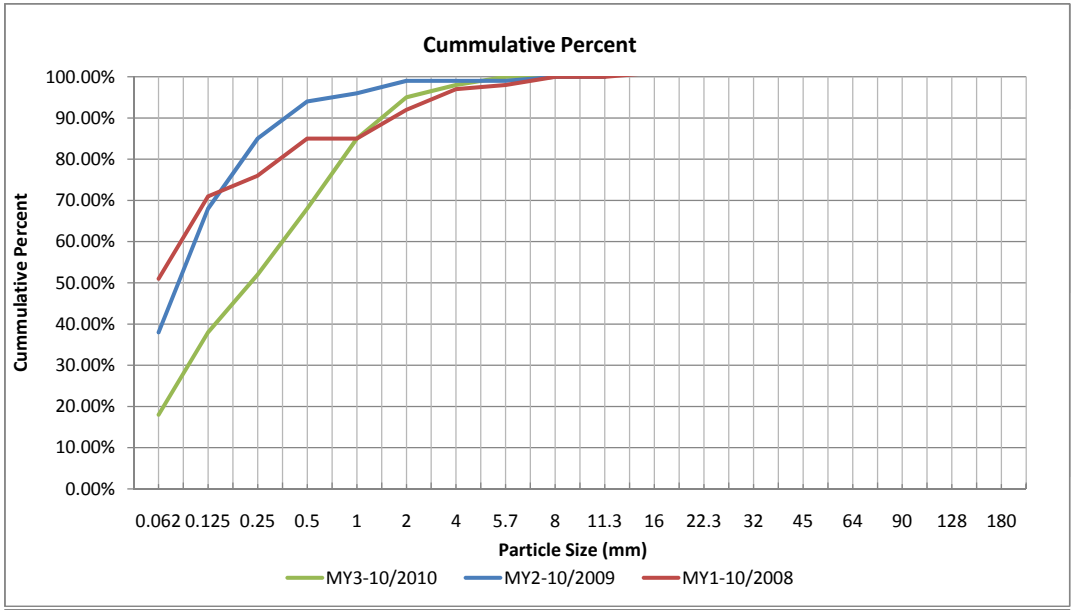
Sumamry Data	
D50	0.4
D84	3.3
D95	9

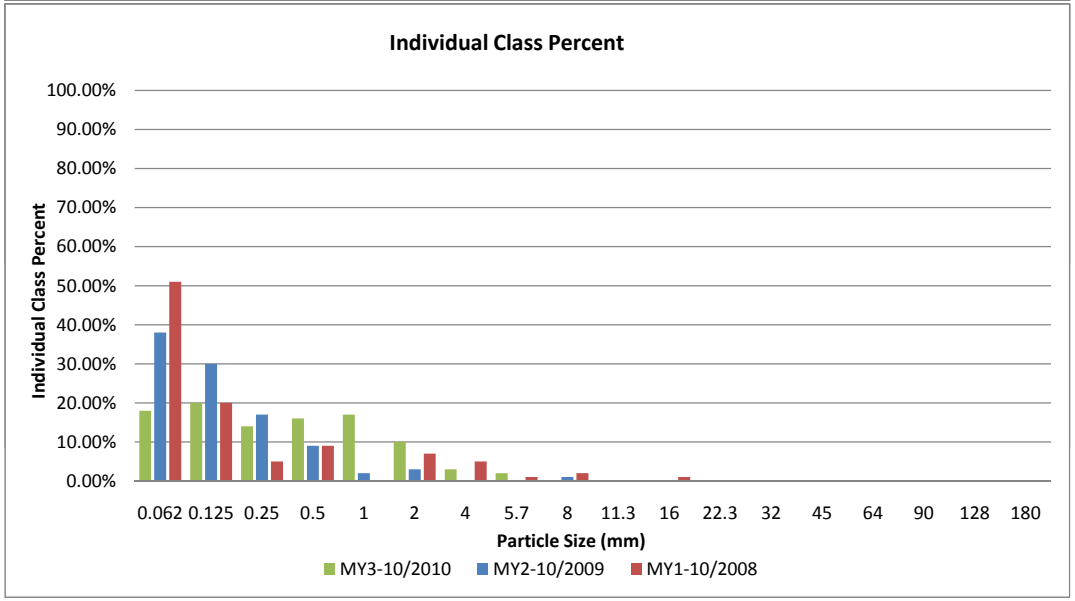




Project Name: East Tarboro Canal Cross Section: 7 Monitoring Year 3 - 2010					
Desc.	**Material**	**Size (MM)**	**Count**	**% of Total**	**Cumulative %**
SAND	silt/clay	0.062	18	18.00%	18.00%
	very fine sand	0.125	20	20.00%	38.00%
	fine sand	0.25	14	14.00%	52.00%
	medium sand	0.5	16	16.00%	68.00%
	coarse sand	1	17	17.00%	85.00%
	very coarse sand	2	10	10.00%	95.00%
GRAVEL	very fine gravel	4	3	3.00%	98.00%
	fine gravel	5.7	2	2.00%	100.00%
	fine gravel	8	0	0.00%	100.00%
	medium gravel	11.3	0	0.00%	100.00%
	medium gravel	16	0	0.00%	
	coarse gravel	22.3	0	0.00%	
	coarse gravel	32	0	0.00%	
	very coarse gravel	45	0	0.00%	
	very coarse gravel	64	0	0.00%	
COBBLE	small cobble	90	0	0.00%	
	medium cobble	128	0	0.00%	
	large cobble	180	0	0.00%	
	very large cobble	256	0	0.00%	
BOULDER	small boulder	362	0	0.00%	
	small boulder	512	0	0.00%	
	medium boulder	1024	0	0.00%	
	large boulder	2048	0	0.00%	
TOTAL % of whole count:			**100**	**100%**	**100%**

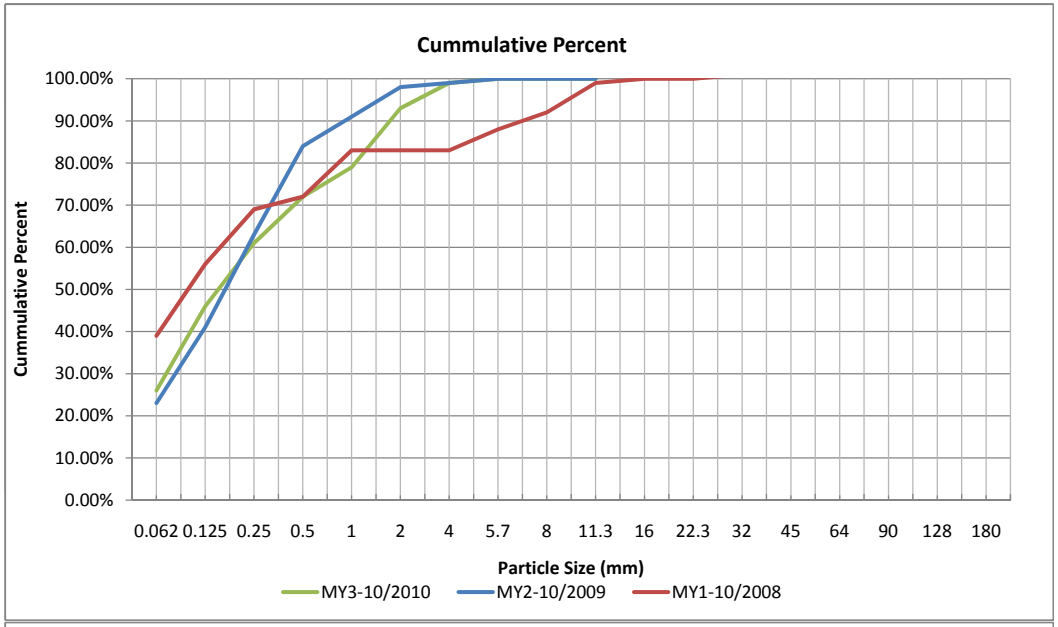
Sumamry Data	
D50	0.23
D84	0.96
D95	2

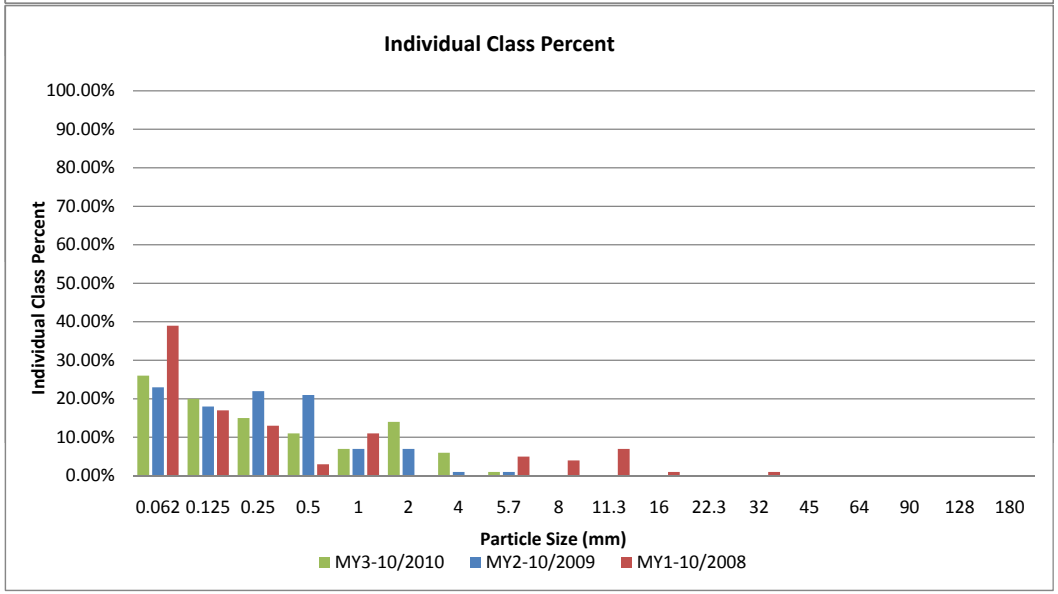




Project Name: East Tarboro Canal Cross Section: 8 Monitoring Year 3 - 2010					
Desc.	**Material**	**Size (MM)**	**Count**	**% of Total**	**Cumulative %**
	silt/clay	0.062	26	26.00%	26.00%
	very fine sand	0.125	20	20.00%	46.00%
	fine sand	0.25	15	15.00%	61.00%
SAND	medium sand	0.5	11	11.00%	72.00%
	coarse sand	1	7	7.00%	79.00%
	very coarse sand	2	14	14.00%	93.00%
	very fine gravel	4	6	6.00%	99.00%
	fine gravel	5.7	1	1.00%	100.00%
	fine gravel	8	0	0.00%	100.00%
	medium gravel	11.3	0	0.00%	100.00%
GRAVEL	medium gravel	16	0	0.00%	
	coarse gravel	22.3	0	0.00%	
	coarse gravel	32	0	0.00%	
	very coarse gravel	45	0	0.00%	
	very coarse gravel	64	0	0.00%	
	small cobble	90	0	0.00%	
COBBLE	medium cobble	128	0	0.00%	
	large cobble	180	0	0.00%	
	very large cobble	256	0	0.00%	
	small boulder	362	0	0.00%	
BOULDER	small boulder	512	0	0.00%	
	medium boulder	1024	0	0.00%	
	large boulder	2048	0	0.00%	
TOTAL % of whole count:			**100**	**100%**	**100%**

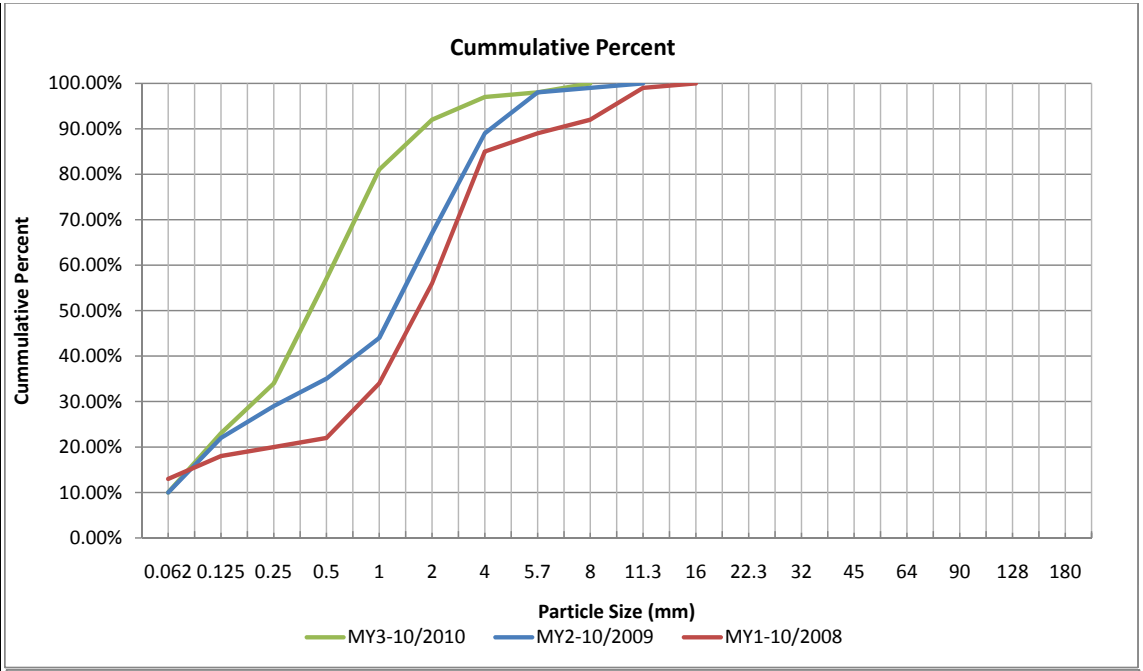
Sumamry Data	
D50	0.062
D84	1.3
D95	2.5

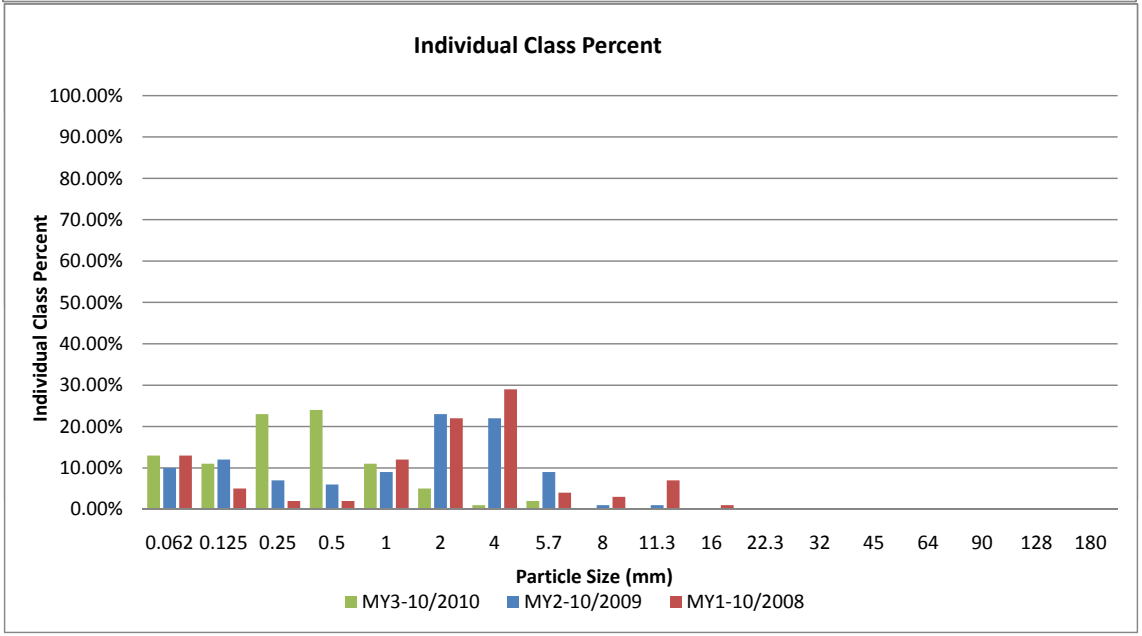




Project Name: East Tarboro Canal Cross Section: 9 Monitoring Year 3 - 2010					
Desc.	**Material**	**Size (MM)**	**Count**	**% of Total**	**Cumulative %**
SAND	silt/clay	0.062	10	10.00%	10.00%
	very fine sand	0.125	13	13.00%	23.00%
	fine sand	0.25	11	11.00%	34.00%
	medium sand	0.5	23	23.00%	57.00%
	coarse sand	1	24	24.00%	81.00%
	very coarse sand	2	11	11.00%	92.00%
GRAVEL	very fine gravel	4	5	5.00%	97.00%
	fine gravel	5.7	1	1.00%	98.00%
	fine gravel	8	2	2.00%	100.00%
	medium gravel	11.3	0	0.00%	
	medium gravel	16	0	0.00%	
	coarse gravel	22.3	0	0.00%	
	coarse gravel	32	0	0.00%	
	very coarse gravel	45	0	0.00%	
	very coarse gravel	64	0	0.00%	
COBBLE	small cobble	90	0	0.00%	
	medium cobble	128	0	0.00%	
	large cobble	180	0	0.00%	
	very large cobble	256	0	0.00%	
BOULDER	small boulder	362	0	0.00%	
	small boulder	512	0	0.00%	
	medium boulder	1024	0	0.00%	
	large boulder	2048	0	0.00%	
TOTAL % of whole count:			**100**	**100%**	**100%**

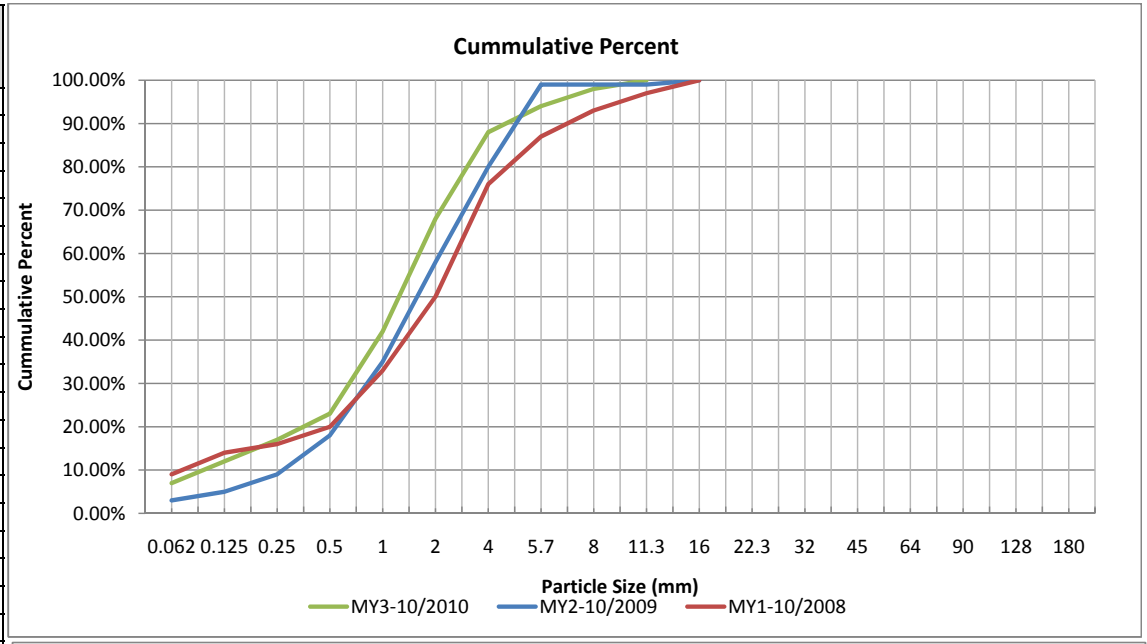
Sumamry Data	
D50	0.4
D84	1.2
D95	3

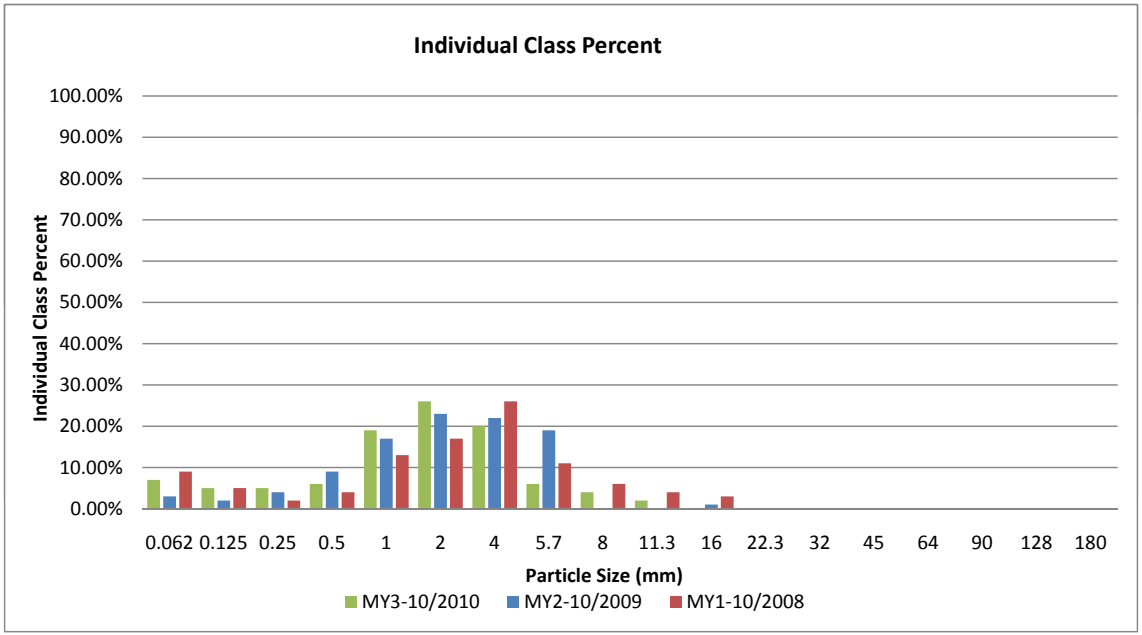




Project Name: East Tarboro Canal Cross Section: 10 Monitoring Year 3 - 2010					
Desc.	**Material**	**Size (MM)**	**Count**	**% of Total**	**Cumulative %**
SAND	silt/clay	0.062	7	7.00%	7.00%
	very fine sand	0.125	5	5.00%	12.00%
	fine sand	0.25	5	5.00%	17.00%
	medium sand	0.5	6	6.00%	23.00%
	coarse sand	1	19	19.00%	42.00%
	very coarse sand	2	26	26.00%	68.00%
GRAVEL	very fine gravel	4	20	20.00%	88.00%
	fine gravel	5.7	6	6.00%	94.00%
	fine gravel	8	4	4.00%	98.00%
	medium gravel	11.3	2	2.00%	100.00%
	medium gravel	16	0	0.00%	
	coarse gravel	22.3	0	0.00%	
	coarse gravel	32	0	0.00%	
	very coarse gravel	45	0	0.00%	
	very coarse gravel	64	0	0.00%	
COBBLE	small cobble	90	0	0.00%	
	medium cobble	128	0	0.00%	
	large cobble	180	0	0.00%	
	very large cobble	256	0	0.00%	
BOULDER	small boulder	362	0	0.00%	
	small boulder	512	0	0.00%	
	medium boulder	1024	0	0.00%	
	large boulder	2048	0	0.00%	
TOTAL % of whole count:			**100**	**100%**	**100%**

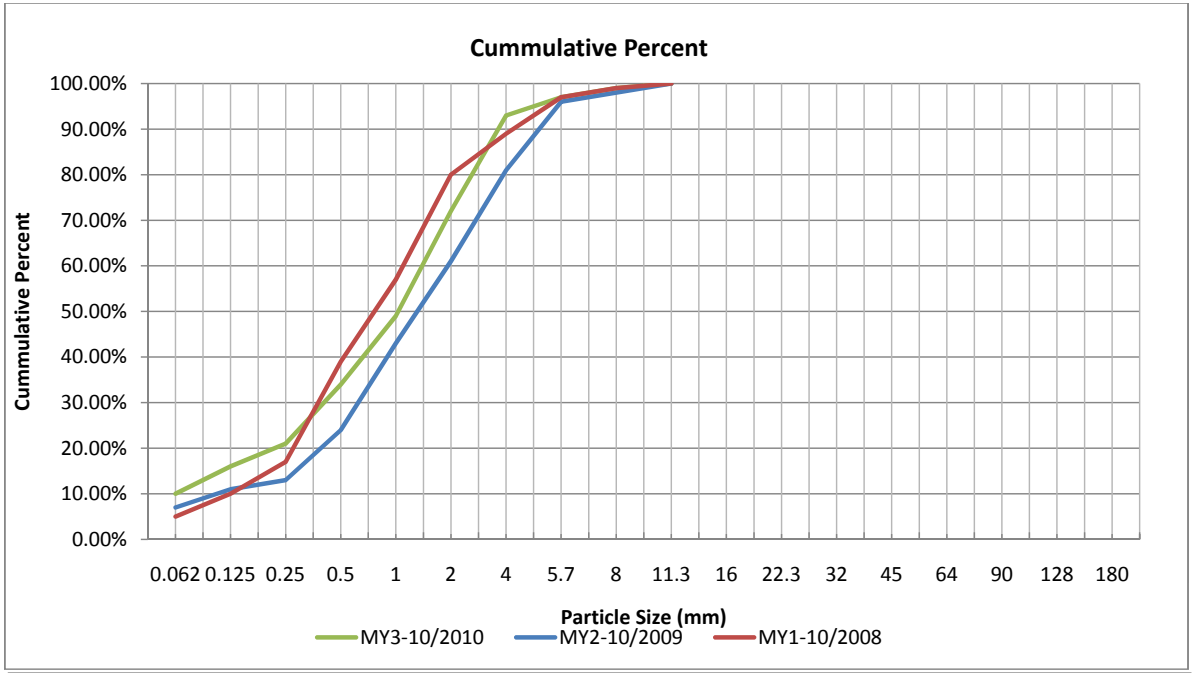
Sumamry Data	
D50	1.2
D84	3.5
D95	6.4

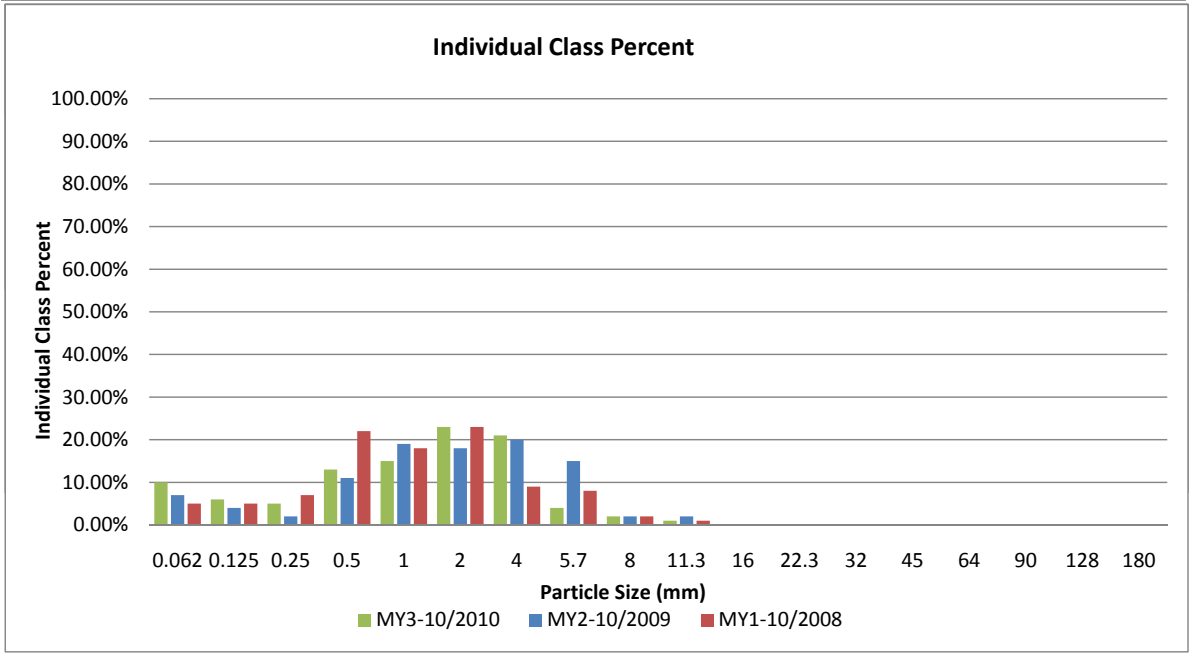




Project Name: East Tarboro Canal Cross Section: 11 Monitoring Year 3 - 2010					
Desc.	**Material**	**Size (MM)**	**Count**	**% of Total**	**Cumulative %**
SAND	silt/clay	0.062	10	10.00%	10.00%
	very fine sand	0.125	6	6.00%	16.00%
	fine sand	0.25	5	5.00%	21.00%
	medium sand	0.5	13	13.00%	34.00%
	coarse sand	1	15	15.00%	49.00%
	very coarse sand	2	23	23.00%	72.00%
GRAVEL	very fine gravel	4	21	21.00%	93.00%
	fine gravel	5.7	4	4.00%	97.00%
	fine gravel	8	2	2.00%	99.00%
	medium gravel	11.3	1	1.00%	100.00%
	medium gravel	16	0	0.00%	
	coarse gravel	22.3	0	0.00%	
	coarse gravel	32	0	0.00%	
	very coarse gravel	45	0	0.00%	
	very coarse gravel	64	0	0.00%	
COBBLE	small cobble	90	0	0.00%	
	medium cobble	128	0	0.00%	
	large cobble	180	0	0.00%	
	very large cobble	256	0	0.00%	
BOULDER	small boulder	362	0	0.00%	
	small boulder	512	0	0.00%	
	medium boulder	1024	0	0.00%	
	large boulder	2048	0	0.00%	
TOTAL % of whole count:			**100**	**100%**	**100%**

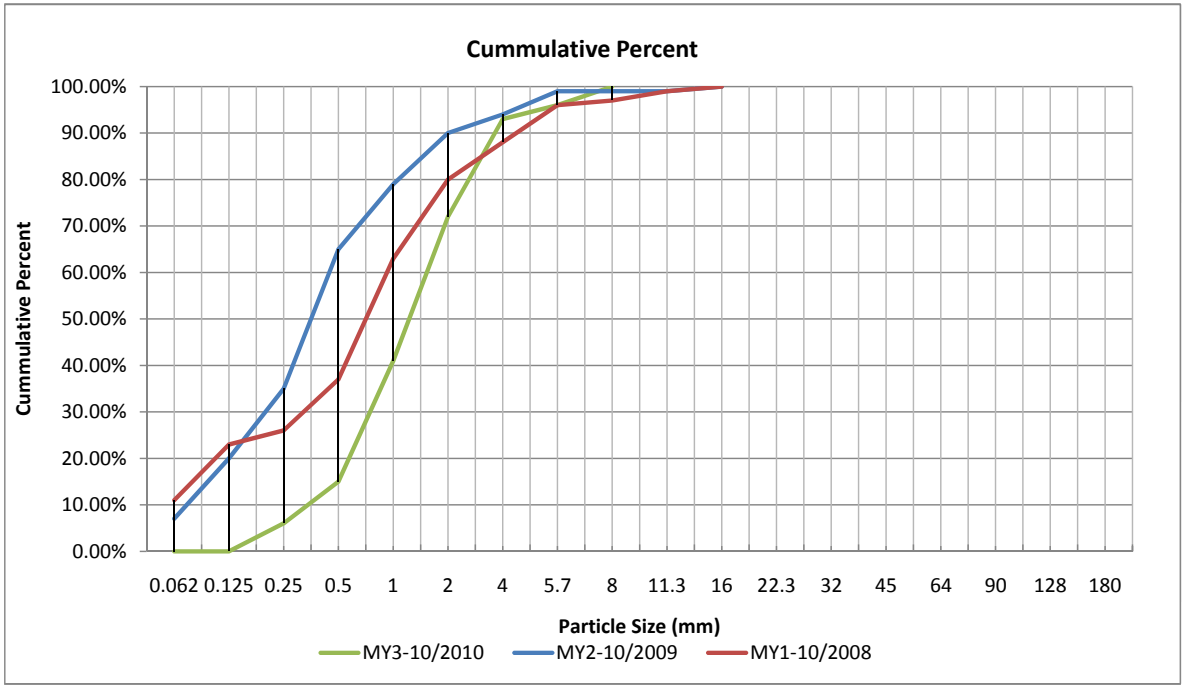
Sumamry Data	
D50	1
D84	3
D95	4.9

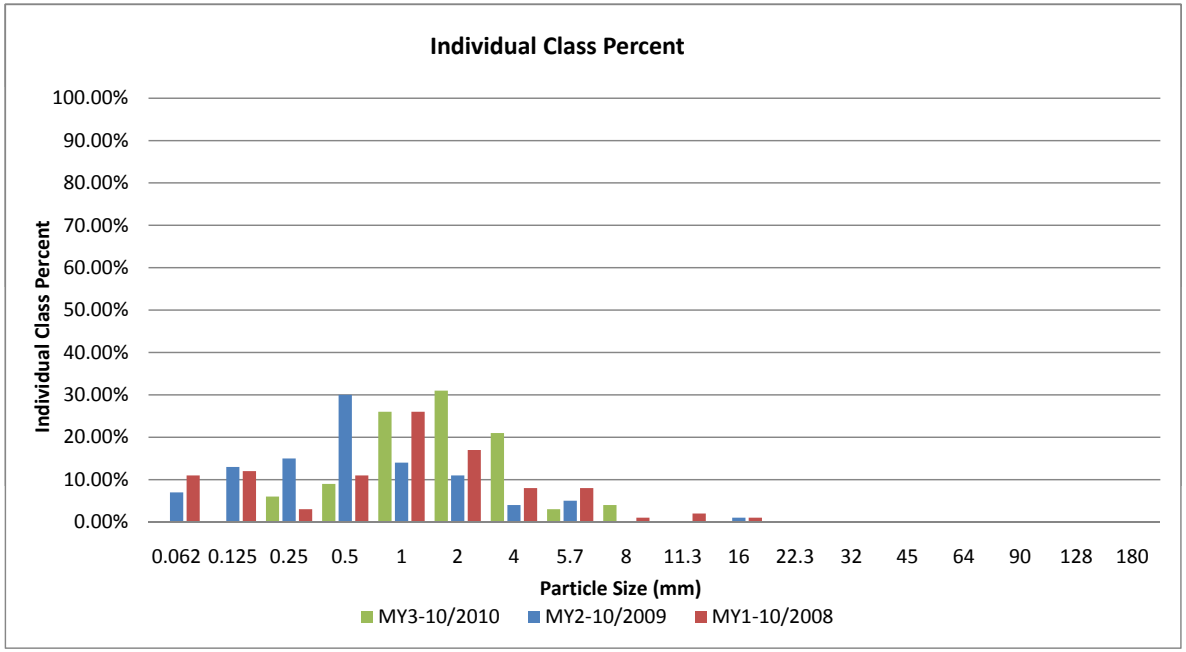




Project Name: East Tarboro Canal Cross Section: 12 Monitoring Year 3 - 2010					
Desc.	**Material**	**Size (MM)**	**Count**	**% of Total**	**Cumulative %**
SAND	silt/clay	0.062	0	0.00%	0.00%
	very fine sand	0.125	0	0.00%	0.00%
	fine sand	0.25	6	6.00%	6.00%
	medium sand	0.5	9	9.00%	15.00%
	coarse sand	1	26	26.00%	41.00%
	very coarse sand	2	31	31.00%	72.00%
GRAVEL	very fine gravel	4	21	21.00%	93.00%
	fine gravel	5.7	3	3.00%	96.00%
	fine gravel	8	4	4.00%	100.00%
	medium gravel	11.3	0	0.00%	
	medium gravel	16	0	0.00%	
	coarse gravel	22.3	0	0.00%	
	coarse gravel	32	0	0.00%	
	very coarse gravel	45	0	0.00%	
	very coarse gravel	64	0	0.00%	
COBBLE	small cobble	90	0	0.00%	
	medium cobble	128	0	0.00%	
	large cobble	180	0	0.00%	
	very large cobble	256	0	0.00%	
BOULDER	small boulder	362	0	0.00%	
	small boulder	512	0	0.00%	
	medium boulder	1024	0	0.00%	
	large boulder	2048	0	0.00%	
TOTAL % of whole count:			**100**	**100%**	**100%**

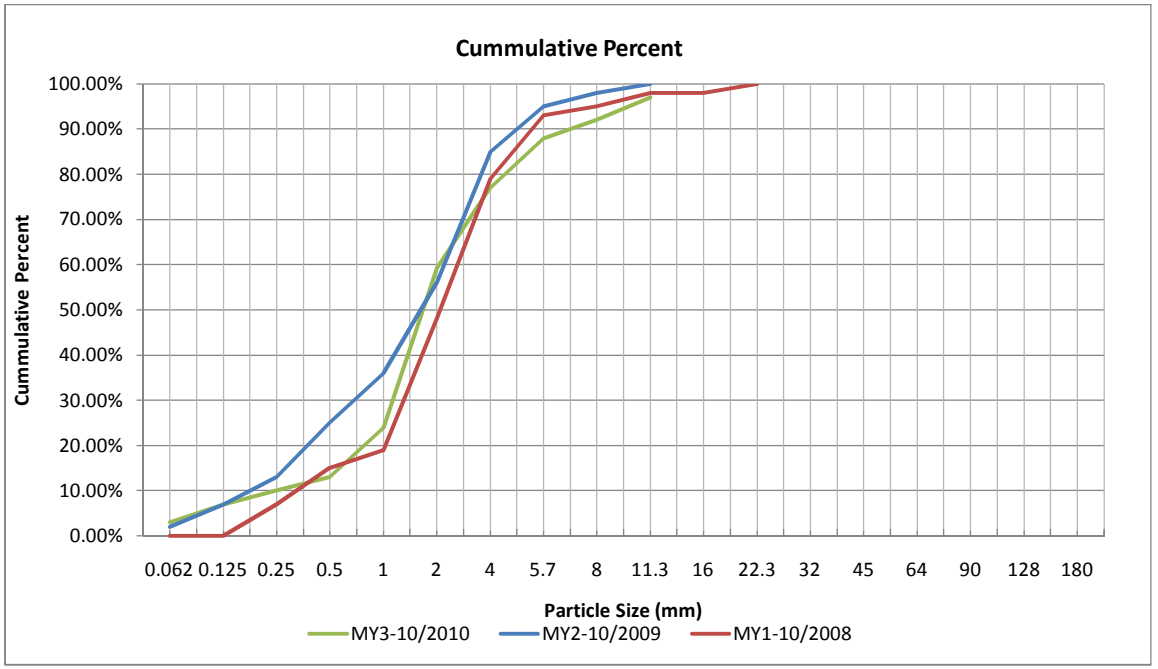
Sumamry Data	
D50	1.2
D84	3
D95	5.2





Project Name: East Tarboro Canal Cross Section: 13 Monitoring Year 3 - 2010					
Desc.	**Material**	**Size (MM)**	**Count**	**% of Total**	**Cumulative %**
SAND	silt/clay	0.062	3	3.00%	3.00%
	very fine sand	0.125	4	4.00%	7.00%
	fine sand	0.25	3	3.00%	10.00%
	medium sand	0.5	3	3.00%	13.00%
	coarse sand	1	11	11.00%	24.00%
	very coarse sand	2	35	35.00%	59.00%
GRAVEL	very fine gravel	4	18	18.00%	77.00%
	fine gravel	5.7	11	11.00%	88.00%
	fine gravel	8	4	4.00%	92.00%
	medium gravel	11.3	5	5.00%	97.00%
	medium gravel	16	3	3.00%	
	coarse gravel	22.3	0	0.00%	
	coarse gravel	32	0	0.00%	
	very coarse gravel	45	0	0.00%	
	very coarse gravel	64	0	0.00%	
COBBLE	small cobble	90	0	0.00%	
	medium cobble	128	0	0.00%	
	large cobble	180	0	0.00%	
	very large cobble	256	0	0.00%	
BOULDER	small boulder	362	0	0.00%	
	small boulder	512	0	0.00%	
	medium boulder	1024	0	0.00%	
	large boulder	2048	0	0.00%	
TOTAL % of whole count:			**100**	**100%**	**100%**

Sumamry Data	
D50	1.7
D84	5.2
D95	9.7



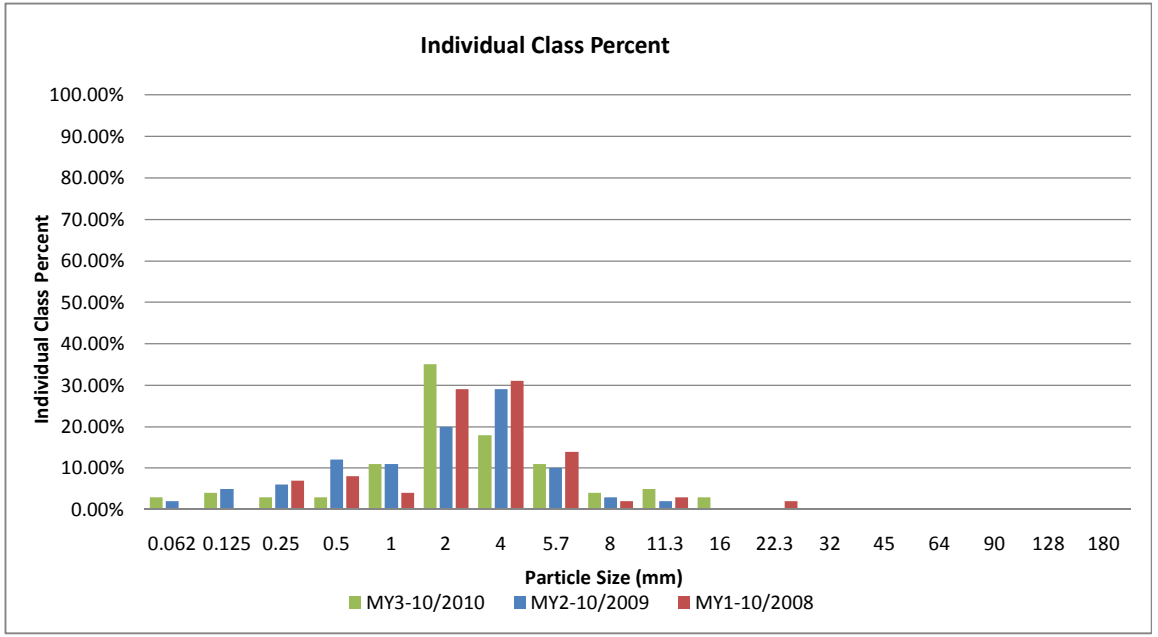


Table 10a. Baseline Stream Data Summary
East Tarboro Canal Stream Restoration Site - EEP Project No. 123
Reach 2 (2989 feet)

Parameter	USGS Gage Data			Regional Curve Interval			Pre-Existing Condition			Project Stream Reference			Design			As-Built		
Dimension	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med
BF Width (ft)						14.55	14	17	15	10.8	11	10.9	Na	Na	20	17.66	30.32	20.6
Flood Prone Width (ft)						24.34	22.8	25.4	24.1	8.3	9.6	9	Na	Na	29.25	20.52	31.22	26.73
BF Cross Sectional Area (SF)						1.63	1.5	1.72	1.61	0.77	0.87	0.82	Na	Na	1.46	.89	1.41	1.25
BF Mean Depth (ft)							2.2	2.37	2.32	1.24	1.45	1.34	Na	Na	2.5	1.75	3.5	2.69
BF Max Depth (ft)							8.2	11.4	9.4	12.6	14.1	13.4	Na	Na	13.7	13.23	34.07	16.22
Width/Depth Ratio							1.5	1.7	NA	9.1	9.3	Na	2.2	6	Na	1.75	5.52	4.65
Entrenchment Ratio							17.6	31.1	21.75	Na	Na	Na	Na	Na	Na	19.2	30.78	21.88
Bank Height Ratio							.87	1.36	1.14	Na	Na	Na	Na	Na	Na	0.88	1.29	1.19
Wetted Perimeter (ft)																		
Hydraulic Radius (ft)																		
Pattern																		
Channel Beltwidth (ft)							29	47	39	12.5	25	18.8	22	46	34	20.58	52.64	36.53
Radius of Curvature (ft)							75	560	220	14.4	39.8	23.3	40	72	56	22.99	71.49	37.54
Meander Wavelength (ft)							154	226	190	39	64	50.4	72	170	Na	100.91	147.43	129.22
Meander Width ratio							10.3	15.1	12.7	3.6	5.9	4.6	1.1	2.3	1.7	0.374	0.956	0.663
Profile																		
Riffle Length							Na	Na	Na	Na	Na	Na	Na	Na	Na	Na	Na	64.25
Riffle Slope							.002	.0044	.0002	0	.0055	.0022	0	.0036	Na	Na	Na	.00543
Pool Length							Na	Na	23.3	Na	Na	13	Na	Na	24	49.66	113.74	70.29
Pool Spacing							44	133	90	16	45	32.3	32	86	59	72.09	416.51	206.2
Substrate																		
d50 (mm)																.05	2	1.14
d84 (mm)																1.88	18.06	4.49
Additional Reach Parameters																		
Valley Length (ft)									2722						2722			2722
Channel Length (ft)									2946			280			2946			2946
Sinuosity									1.03			1.3	1.2	1.4	1.1			1.19
Water Surface Slope									.0007	0	.0055	.003	0	.0036				.00185
BF Slope							0	.0044	Na			Na			Na			.00179
Rosgen Classification									G5c			C5			C5			C5
*Habitat Index																		
*Macrobenthos																		

Table 11a. Morphology and Hydraulic Monitoring Summary**
East Tarboro Canal Stream Restoration Site - EEP Project No. 123
Reach 2 (2933 feet)

Parameter	Cross Section 6				Cross Section 7				Cross Section 8				Cross Section 9				Cross Section 10			
Based on fixed baseline bankfull elv.	MY0	MY1	MY2	MY3	MY0	MY1	MY2	MY3	MY0	MY1	MY2	MY3	MY0	MY1	MY2	MY3	MY0	MY1	MY2	MY3
Record elevation (datum) used	35.94*	*	*	35.94*	36.1*	*	*	36.1*	35.98*	*	*	35.98*	34.24*	*	*	34.24*	33.76*	*	*	33.76*
Bankfull Width (ft)	30.32	36.6	35.51	35.8	22.54	26.8	23.54	92.2	20.6	12.7	15.13	62.6	19.36	34.7	14.0	29.7	20.6	22.7	19.52	72
Floodprone Width (ft)	100	115	99.1	101	100	85.5	63.4	101.8	75	51.7	69.5	74.5	101.4	78.6	87.4	99	100	92.4	98.8	101.1
Bankfull Mean Depth (ft)	0.89	.67	0.72	0.8	1.39	1.1	0.83	0.7	1.12	0.95	0.95	0.7	1.41	0.5	1.7	1.8	1.25	0.95	1.02	0.4
BF Cross Sectional Area(ft)	26.95	24	25.46	27.2	31.22	30	19.6	66.7	22.99	12.1	14.30	44.6	27.34	22.19	23.3	52.6	25.78	21.6	19.96	27.5
BF Width/Depth Ratio	34.07	55.7	49.5	47.0	16.22	23.9	29	127.5	18.39	13.3	16.0	87.9	13.73	66.9	8.4	16.8	16.48	23.8	19.1	188.7
BF Entrenchment Ratio	3.3	3.1.1	0.7	2.8	4.44	3.2	2.6	1.1	3.64	4.1	4.6	1.2	5.24	12.3	6.3	3.3	4.85	4.1	5.1	1.4
BF Bank Height Ratio (ft)																				
Hydraulic radius (ft)		0.7	0.7	0.8		1	0.7	0.7		0.8	0.9	0.7		1	1.5	1.6		0.9	1.0	0.4
Cross Sectional Area between Bank Pins ft)																				
D50 (mm)	1.05	0.67	0.16		0.05	.062	.082		0.05	0.1	.17		1.95	1.7	1.2		2	2	1.6	
Parameter	**Cross Section 11**				**Cross Section 12**				**Cross Section 13**											
Based on fixed baseline bankfull elv.	MY0	MY1	MY2	MY3	MY0	MY1	MY2	MY3	MY0	MY1	MY2	MY3								
Record elevation (datum) used	33.06*	*	*	33.06*	32.76*	*	*	32.76*	31.92*	*	*	31.92*								
Bankfull Width (ft)	18.93	15.1	18.77	39.9	18.13	15.6	17.98	55.9	21.52	9.6	10.99	34.2								
Floodprone Width (ft)	100	97.3	93.2	101.7	100	89.5	82.6	102.7	100	38	47.1	0.7								
Bankfull Mean Depth (ft)	1.41	1.2	0.96	0.8	1.37	0.8	0.79	0.6	1.24	1.4	1.04	0.7								
BF Cross Sectional Area(ft)	26.71	18.2	18.01	32.6	24.83	12.9	14.28	34.2	26.73	13.5	11.43	25								
BF Width/Depth Ratio	13.43	12.6	19.5	48.9	13.23	18.9	22.6	91.4	17.35	6.9	10.6	46.8								
BF Entrenchment Ratio	5.28	6.4	5.3	2.5	5.52	5.7	4.6	1.8	4.65	3.9	4.3	3.0								
BF Bank Height Ratio (ft)																				
Hydraulic radius (ft)	1.28	1.1	0.9	0.8	1.29	0.8	0.7	0.6	1.15	1.1	0.9	0.7								
Cross Sectional Area between Bank Pins ft)																				
D50 (mm)	N/A	0.76	1.3		1.14	0.71	.35		1.97	2.1	1.6									

*It is uncertain if the monitoring datum has been consistent over the monitoring history, which may influence calculated values. Additional data from a prior performer is being acquired to provide confirmation. Values will be recalculated in a future submission based on a consistent datum if determined to be necessary.
**Cross Sections 1 through 5 are located on Reach 1. Reach 1 and all Reach 1 assets have been removed from the East Tarboro Canal Stream Restoration Project.

Exhibit Table 11b. Monitoring Data – Stream and Data Summary
East Tarboro Canal Stream Restoration Site - EEP Project No. 123
Reach 2 (2989 LF)

Parameter	Baseline						MY-01 (2008)						MY-02 (2009)						MY-03 (2010)						MY-04 (2011)						MY-05 (2012)					
Dimension and Substrate*	Min	Mean	Med	Max	SD4	N	Min	Mean	Med	Max	SD4	N	Min	Mean	Med	Max	SD4	N	Min	Mean	Med	Max	SD4	N	Min	Mean	Med	Max	SD4	N	Min	Mean	Med	Max	SD4	N
Bankfull Width (ft)	17.66		20.6	30.32															29.7		50.5	72														
Floodprone Width (ft)																			74.5		96.7	102.7														
BF Mean Depth (ft)	1.46		1.25	1.41															0.4		0.73	1.8														
BF Max Depth (ft)	2.5		2.69	3.5															1.9		3.2	4.7														
BF Cross Sectional Area (ft2)	20.52		26.73	31.22															29.7		55.4	92.2														
Width/Depth Ratio (ft)	13.23		16.22	34.07															16.8		70.4	188.7														
Entrenchment Ratio (ft)	1.75		5.52	4.65															1.4		3.2	4.7														
Bank Height Ratio (ft)																																				
Profile																																				
Riffle Length (ft)			64.25																		58.9															
Riffle Slope (ft)			.00543																		.0062															
Pool Length (ft)			70.29																		153.3															
Pool Max Depth (ft)																																				
Pool Spacing (ft)			206.2																		148.9															
Rosgen Classification			C5																		C5															
*Habitat Index																																				
Pattern																																				
Channel Beltwidth (ft)	20.58		36.53	52.64																																
Radius of Curvature (ft)	22.99		37.54	71.49																																
Rc: Bankfull width (ft/ft)																																				
Meander Wavelength (ft)	100.91		129.22	147.32																																
Meander Width Ratio	0.374		.663	0.956																																
Additional Reach Parameters																																				
Rosgen Classification			C5																		C5															
Channel Thalweg length (ft)			2933																		2993															
Sinuosity			1.19																		1.19															
Water Suface Slope (Channel) (ft/ft)			.00185																		.00205															
BF Slope (ft/ft)			.00179																		.00187															
Ri% / Ru% / P% / G% / S%																																				
SC% / Sa% / G%/ C% / B% / Be%																																				
D16 /d35 / d50 / d84 / d95																																				
% Reach with Eroding Banks																																				
Channel Stability or Habitat Metric																																				
Biological or Other																																				

APPENDIX E

Verification of Bankfull Events

Table 12. Verification of Bankfull Events			
Date of Data Collection	**Date of Occurrence**	**Method**	**Photo#**
10/19/2010	September 2010	Photo of wrack line	Photo Station 5 Appendix B