North Muddy Creek
Stream & Wetland Restoration

Year 3 Final Monitoring Report
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TABLE OF CONTENTS

1.0 SUMMARY 1

2.0 INTRODUCTION 3

2.1 Project Description 3

2.2 Project Purpose 11

2.3 Project History and Schedule 12

3.0 STREAM MONITORING 13

3.1 Stream Success Criteria 13

3.2 Stream Morphology Monitoring Plan 13

3.2.1 Cross-Sections 13

3.2.2 Longitudinal Profile 13

3.2.3 Substrate 14

3.2.4 Hydrology 14

3.2.5 Photo Reference Stations 14

3.3 Stream Morphology Monitoring Results 14

3.3.1 Cross-Sections 14

3.3.2 Longitudinal Profile 14

3.3.3 Substrate 15

3.3.4 Hydrology 15

3.3.5 Photo Reference Stations 15

3.4 Stream Conclusions 16

4.0 HYDROLOGY 18

4.1 Hydrologic Success Criteria 18

4.2 Description of Hydrology Monitoring Efforts 18

4.3 Results of Hydrology Monitoring 19

4.3.1 Site Data 21

4.3.2 Climate Data 21

5.0 VEGETATION 23

5.1 Vegetation Success Criteria 23

5.2 Description of Species and Vegetation Monitoring 23

5.3 Results of Vegetation Monitoring 23

5.4 Vegetation Observations and Conclusions 26

6.0 CONCLUSIONS AND RECOMENDATIONS 28

7.0 REFERENCES..... 29

LIST OF FIGURES

Figure 1. Vicinity Map 4
Figure 2. USGS Map 5
Figure 3. Monitoring Plan View 6
Figure 4. 2011 Precipitation for North Muddy Creek Site 22

LIST OF TABLES

Table 1. Project Mitigation Structure and Objectives 11
Table 2. Project Activity and Reporting History 12
Table 3. Project Contacts 12
Table 4. Crest Gauge Data 15
Table 5. Stream Areas Requiring Observation 16
Table 6. Summary of Morphologic Monitoring Parameters 16
Table 7. Hydrologic Monitoring Results 20
Table 8. Comparison of Normal Rainfall to Observed Rainfall 21
Table 9. Planted Tree Species 23
Table 10. Results of 2011 Vegetation Monitoring by Plot 24
Table 11. Summary of Vegetation Monitoring Results 24
Table 12. Estimated Herbaceous Total Percent Cover 25
Table 13. Volunteer Tree Species 26

APPENDICES

Appendix A. Current Condition Plan View
Appendix B. 2011 Profile, Cross-Section, and Substrate Data
Appendix C. Morphologic Monitoring Parameters
Appendix D. 2011 Site Photos
Appendix E. 2011 Gauge Data
Appendix F. Invasive Exotic Vegetation Control at Morgan Creek and North Muddy Creek Stream Restoration Sites Baseline Report

1.0 SUMMARY

This Annual Report details the monitoring activities during the 2011 (Year 3) growing season on the North Muddy Creek Mitigation Site. Construction of the site, including planting of trees, was completed in December 2008. The 2011 data represents results from the third year of hydrology and vegetation monitoring for both streams and wetlands.

The stream design for the North Muddy Site involved restoration, enhancement, and preservation associated with five independent stream reaches. Wetland components included riparian and non-riparian wetland restoration, enhancement, and preservation. After construction, it was determined that the project generated 3,974 linear feet of stream restoration, 673 linear feet of stream enhancement, and 3,313 linear feet of stream preservation. Wetlands included 11.4 acres of riparian restoration, 3.7 acres of riparian enhancement, 2.5 acres of riparian preservation, and 2.6 acres of non-riparian restoration.

This Annual Report presents the data from 9 cross sections, 3,160 linear feet of longitudinal profile, 3 crest gauges, 8 automated groundwater monitoring stations, 3 automated rain gauges, 11 vegetation monitoring plots, and photographic reference locations; as specified in the approved Mitigation Plan (EBX, 2009).

The Year 3 stream channel data continues to indicate that the restored stream is generally stable and is providing the intended habitat and hydrologic functions. With the exception of some isolated areas of stream bed aggradation and degradation, stream bank erosion, grade control degradation, and thalweg migration; the longitudinal profiles, cross sections, and visual assessments indicate little adjustment in stream dimension since the As-built conditions. Since project completion at least two bankfull events have occurred within the project site; however no bankfull events were recorded during Year 3 monitoring.

Data from the groundwater monitoring stations resulted in all stations exceeding saturation of the upper soil surfaces for seven percent of the growing season. Burke County weather station data in conjunction with on-site rain gauges documented precipitation and was used to validate groundwater monitoring station data. Overall, on-site rainfall was on average below normal during the majority of the growing season.

Vegetation plot (VP) monitoring during Year 3 indicates survival rates between 283 and 1,214 planted stems per acre with an average of 714 planted stems per acre for the entire restoration site documenting that the site overall has achieved the interim success criterion of 320 stems per acre. The increase in survival rates since the Year 2 monitoring is the result of a supplemental planting effort in the spring of 2011. Overall, planted stems are surviving well at the project site with the majority of plots on track to meet the final success criteria. Only one plot does not meet the interim success criterion (VP4 at UT6). When planted and natural stems are combined the average stem density for the entire restoration site is approximately 1,500 stems per acre, which is well above the interim success criterion of 320 stems per acre at the end of the Year 3 monitoring period. With respect to each restoration area, UT1 has an average of 688 planted stems per acre, UT5 has 1,052, and UT 6 has 618. Additionally, an intensive exotic invasive

plant control effort was initiated in the summer of 2011 with follow up treatments planned during subsequent monitoring years.

2.0 INTRODUCTION

2.1 Project Description

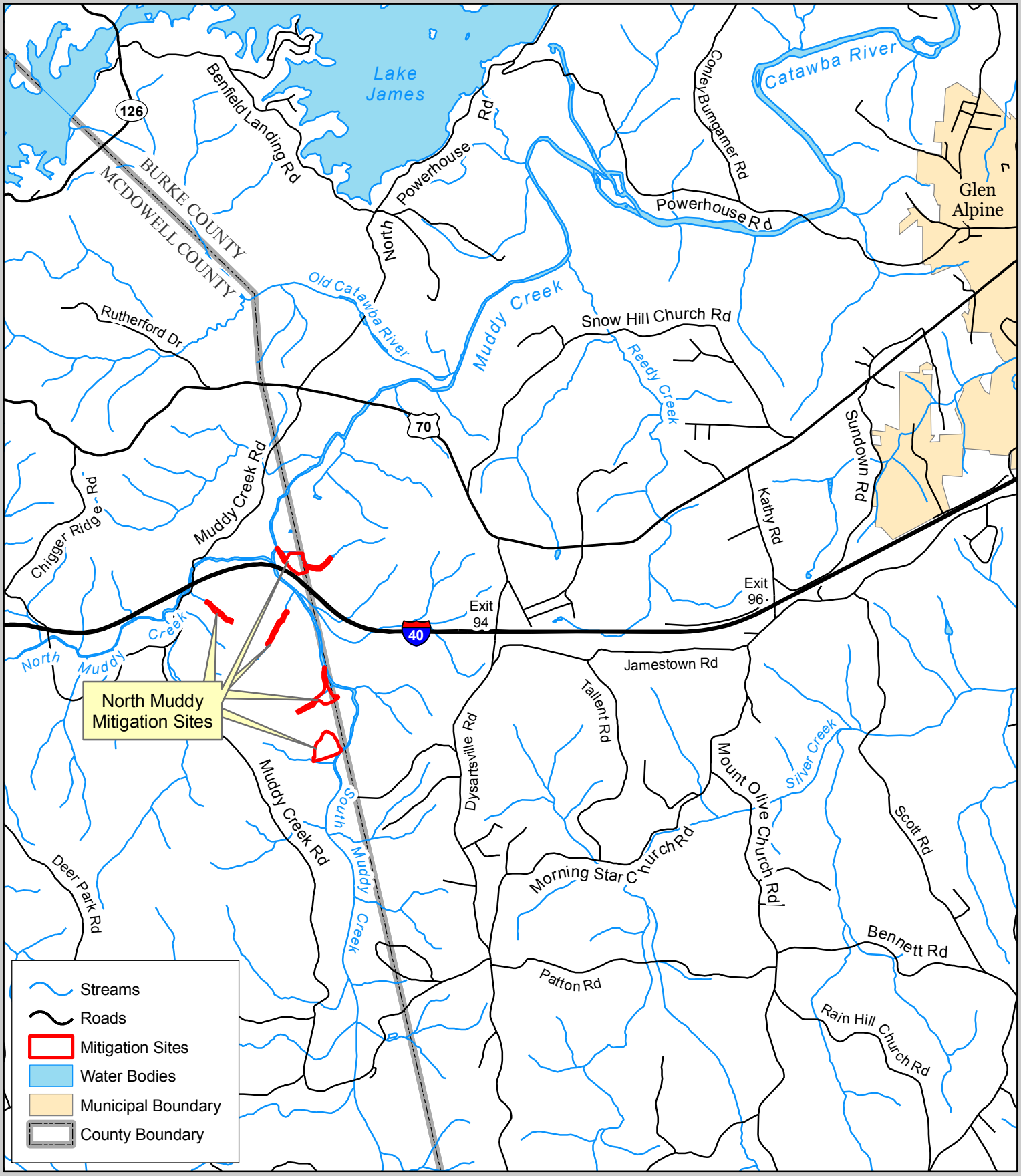
The North Muddy Creek Stream and Wetland Mitigation Site was identified and developed through the North Carolina Ecosystem Enhancement Program (NC EEP) full delivery process. The site is located along the McDowell/Burke County line approximately nine miles east of Marion, North Carolina **(Figure 1)**. The project streams lie within the Catawba River Basin (Hydrologic Unit Code 03050101040020) and the North Carolina Division of Water Quality (NCDWQ) sub-basin 03-08-30.

The mitigation site consists of five distinct stream systems totaling 7,960 linear feet and three adjacent wetland areas encompassing 20.2 acres. The five distinct unnamed tributaries (UT) are identified as UT1, UT2, UT4, UT5, and UT6. Unnamed Tributary 1 (UT1) is located just north of Interstate 40 on the McDowell/Burke County line, whereas UT2, UT4, UT5, and UT6 are located south of Interstate 40 on the McDowell/Burke County line. The USGS Marion East and Glen Alpine topographic quadrangles **(Figure 2)** shows UT1 drains to Muddy Creek, UT2 drains to North Muddy, and the subsequent streams drain to South Muddy Creek. All five reaches drain watersheds consisting of predominately forest and agricultural land. On-site topography, soils, and existing wetlands demonstrated that the site historically supported wetlands. The site is defined by conservation easements surrounding the streams and adjacent riparian buffers that total approximately 34.8 acres.

Channel restoration (improved pattern, dimension, and longitudinal profile) was completed on UT1, UT6, and the lower portion of UT5. Stream enhancement activities (improved dimension and longitudinal profile) were limited to the middle reach of UT5. The headwater reaches of UT2, UT4, and UT5 were protected under preservation criteria.

Prior to restoration UT1 and adjacent wetlands were highly disturbed due to the presence of livestock, channelization, and ditching. The lower reach of UT5 had been channelized and portions of the riparian wetland had been impaired due to historical agricultural practices. Channelization, ditching, and riparian disturbances associated with historical agricultural practices had severely degraded UT6 and the associated wetlands.

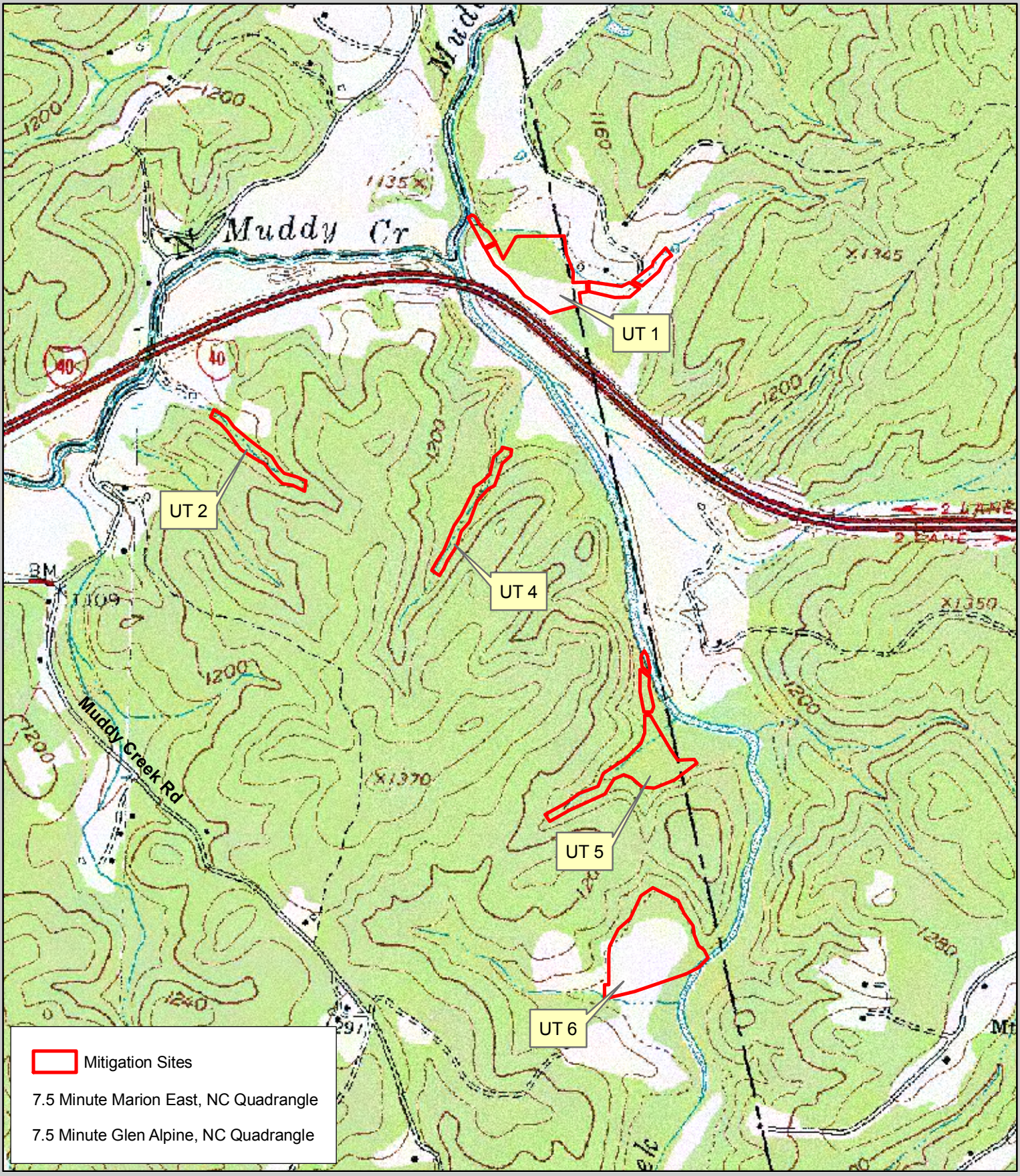
The 2011 monitoring season represents Year 3 of the monitoring period. Monitoring during 2011 included stream, wetland, and vegetation monitoring stations **(Figure 3)** as approved in the Mitigation Plan (EBX, 2009).



EBX

EQUINOX ENVIRONMENTAL CONSULTATION & DESIGN

Figure 1
North Muddy Mitigation Site
Project Vicinity Map

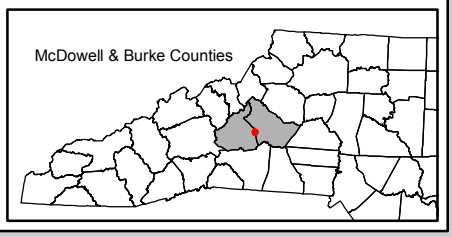


EBX

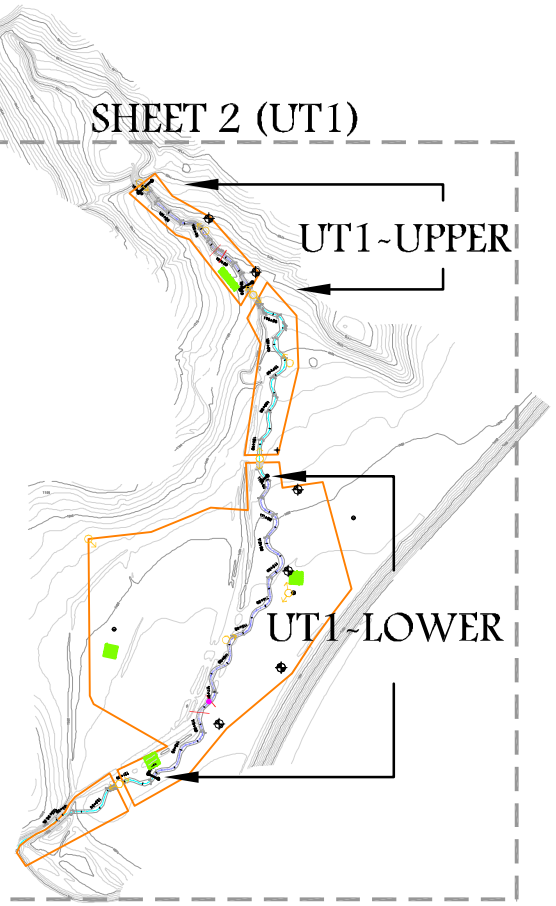
EQUINOX ENVIRONMENTAL CONSULTATION & DESIGN

Figure 2
North Muddy Mitigation Site
USGS Map

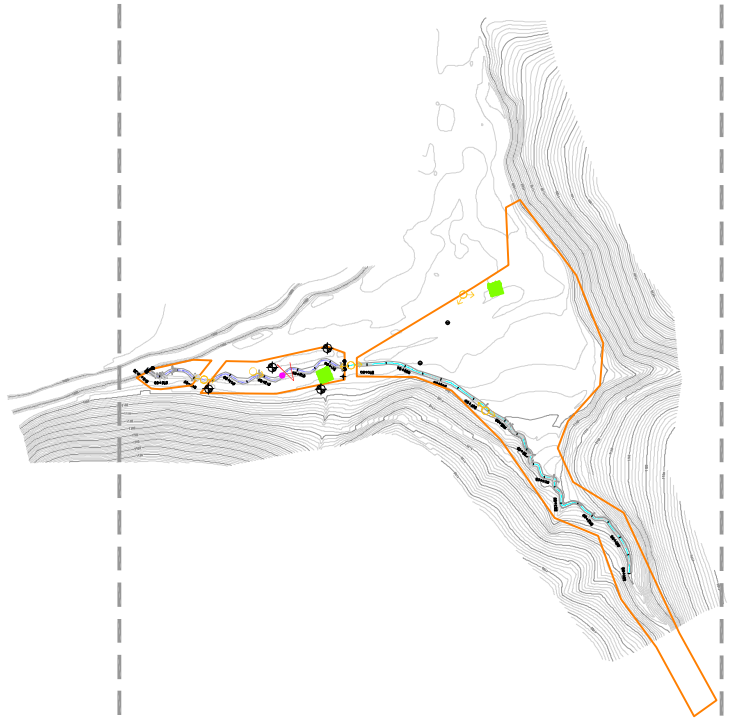
0 750 1,500 3,000 Feet



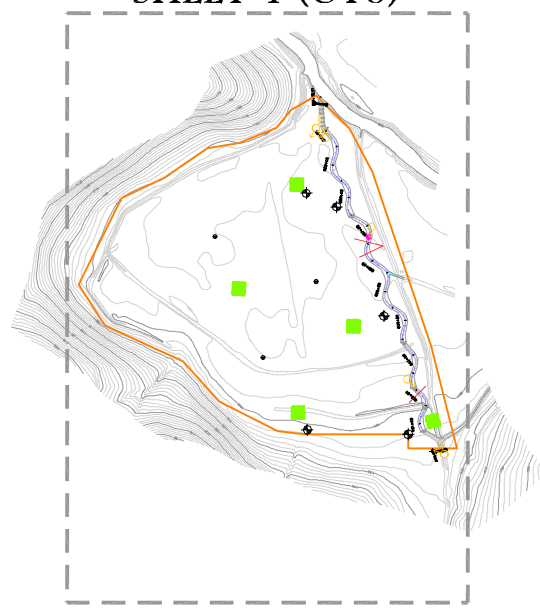
SHEET 2 (UT1)



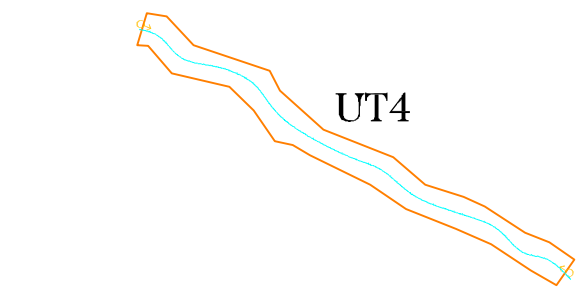
SHEET 3 (UT5)

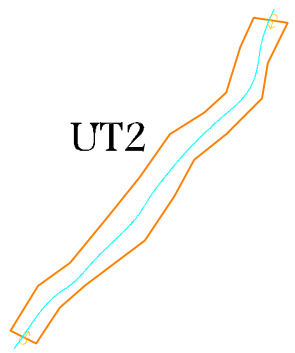


SHEET 4 (UT6)



SHEET 5 (UT2 & UT4)





LEGEND

- Vegetation Monitoring Plots
- Easement Boundary
- Stream
- Longitudinal Profile Reach
- Longitudinal Profile Begin/End
- Cross Section
- Crest Gauge
- Wetland Gauge
- Rain Gauge
- Photo Point
- Constructed Riffle
- A-Vane
- Cross Vane
- J-Hook
- Log Sill
- Root Wad
- Control Point

SCALE 1" = 500'

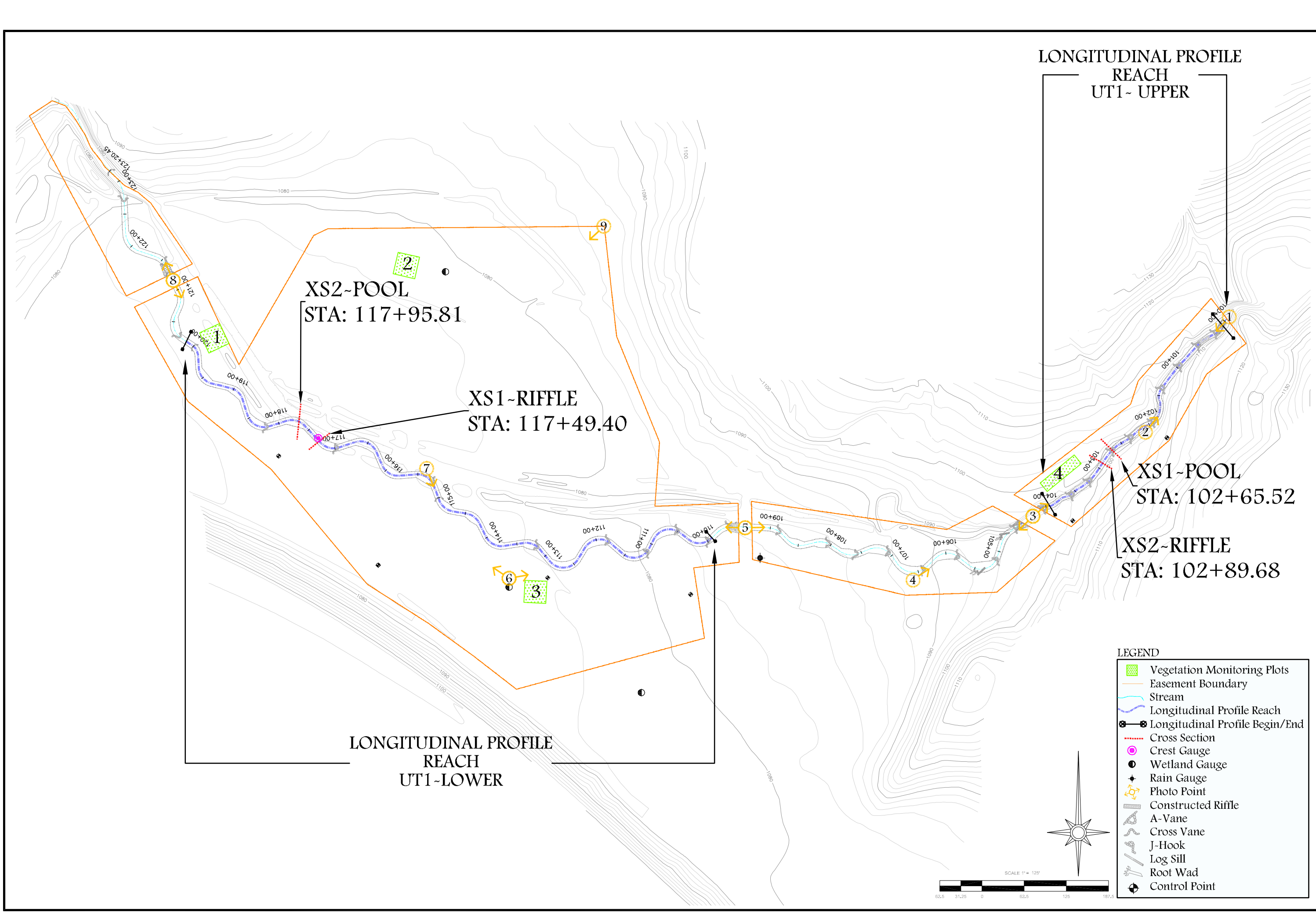
250 125 0 250 500 750

North Muddy Creek

Burke & McDowell Counties, NC

Monitoring Plan View
FIGURE 3

Sheet:
1
of 5



North Muddy Creek

Burke & McDowell Counties, NC

UT1 Monitoring Plan View
FIGURE 3

Sheet:
2
of 5

LONGITUDINAL PROFILE
REACH
UT5

XS2~RIFFLE
STA: 512+36.17

XS1~POOL
STA: 512+16.30

LEGEND

- Vegetation Monitoring Plots
- Easement Boundary
- Stream
- Longitudinal Profile Reach
- Longitudinal Profile Begin/End
- Cross Section
- Crest Gauge
- Wetland Gauge
- Rain Gauge
- Photo Point
- Constructed Riffle
- A-Vane
- Cross Vane
- J-Hook
- Log Sill
- Root Wad
- Control Point

SCALE 1"= 150'

75 37.5 0 75 150 225

North Muddy Creek

Burke & McDowell Counties, NC

UT5 Monitoring Plan View
FIGURE 3

Sheet:
3
of 5

LONGITUDINAL PROFILE
REACH
UT6

XS3~RIFFLE
STA: 606+56.85

XS2~POOL
STA: 606+25.85

XS1~RIFFLE
STA: 601+87.17

600+00
601+00
602+00
603+00
604+00
605+00
606+00
607+00
608+00
609+00
610+00
610+92.11

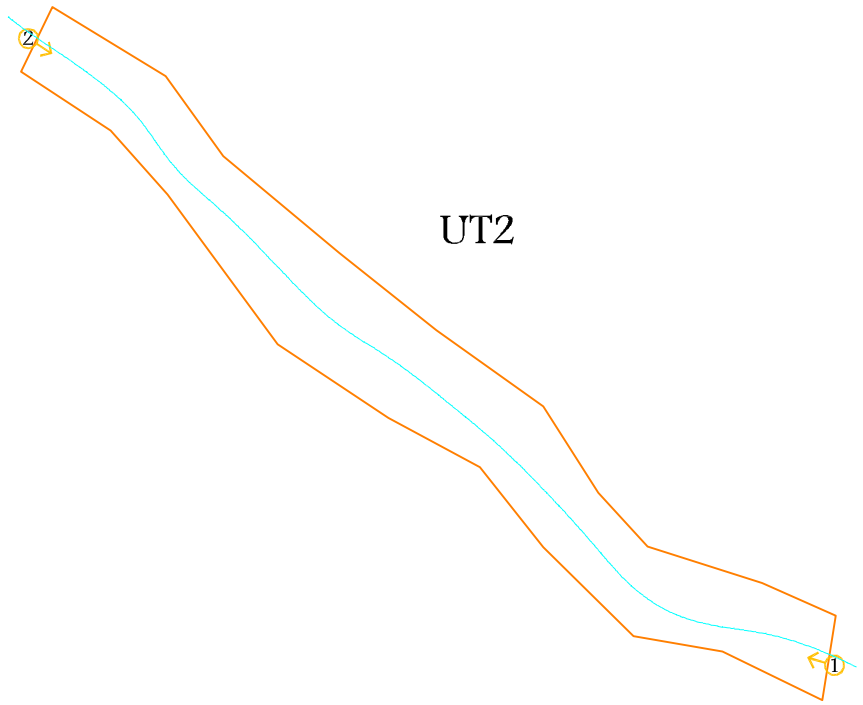
LEGEND
- Vegetation Monitoring Plots
- Easement Boundary
- Stream
- Longitudinal Profile Reach
- Longitudinal Profile Begin/End
- Cross Section
- Crest Gauge
- Wetland Gauge
- Rain Gauge
- Photo Point
- Constructed Riffle
- A-Vane
- Cross Vane
- J-Hook
- Log Sill
- Root Wad
- Control Point

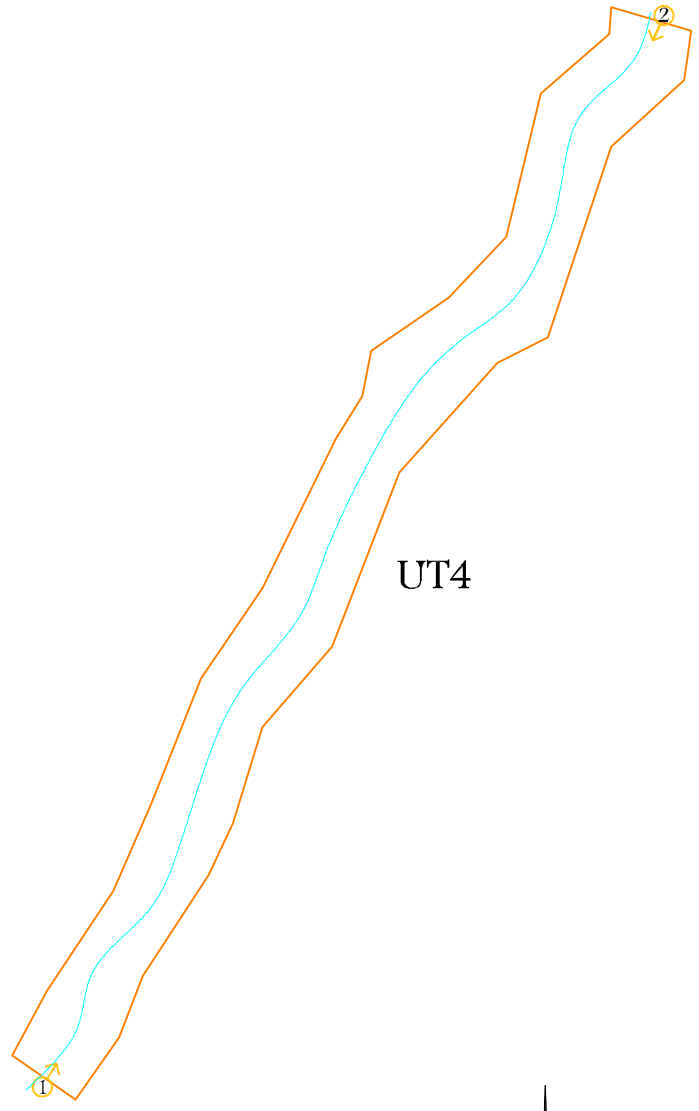
SCALE 1"= 100'

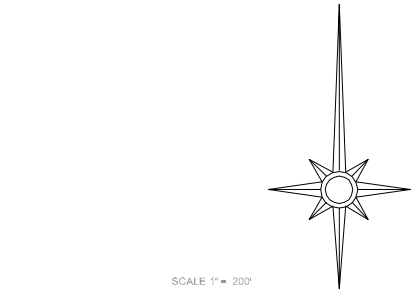
North Muddy Creek
Burke & McDowell Counties, NC

UT6 Monitoring Plan View
FIGURE 3

Sheet:
4
of 5







LEGEND

- Easement Boundary
- Preservation Stream
- Photo Point

North Muddy Creek

Burke & McDowell Counties, NC

UT2 & UT4 Monitoring Plan View FIGURE 3

Sheet:

5 of 5

2.2 Project Purpose

The objective of the project was to provide 5,014 stream mitigation units (SMU's), 12.0 acres of riparian wetland mitigation units (WMU's), and 2.4 acres of non-riparian WMU's for the NC EEP full delivery process in the Catawba 03-08-30 Basin. In conjunction with providing mitigation credits; riparian habitat, aquatic habitat, and water quality improvements are expected as a result of the ecological restoration and enhancement practices.

The North Muddy Creek Mitigation Report (EBX, 2009) documented 3,974 linear feet of stream restoration, 337 linear feet of stream enhancement Level I, 336 linear feet of stream enhancement Level II, and 3,313 linear feet of stream preservation resulting in 4,996 SMU's **(Table 1)**. Wetland mitigation components stated within the Mitigation Report documented 11.4 riparian restoration acres, 3.7 riparian enhancement acres, 2.5 riparian preservation acres, and 2.6 non-riparian restoration acres resulting in 16.4 WMU's **(Table 1)**.

Table 1. Project Mitigation Structure and Objectives

Reach Name	As-Built Length (feet)	Riparian Wetland (acres)	Non-Riparian Wetland (acres)	Total Wetland (acres)	Restoration Approach
UT1	2,257				Restoration
UT2	1,172				Preservation
UT4	1,421				Preservation
UT5	550				Restoration
UT5	337				Enhancement I
UT5	336				Enhancement II
UT5	720				Preservation
UT6	1,167				Restoration
UT1 - Wetland		3.3		6.6	Restoration
UT1 – Wetland		3.0			Enhancement
UT1 – Wetland		0.3			Preservation
UT5 – Wetland		0.7		2.9	Enhancement
UT5 – Wetland		2.2			Preservation
UT6 - Wetland		8.1	2.6	10.7	Restoration
Total Site	7,960	17.6	2.6	20.2	
Total Mitigation Units	4,996	13.8	2.6		

Annual monitoring of the site is required to demonstrate successful mitigation based on criteria established in the Restoration Plan (EBX, 2007) and through a comparison to As-built and reference conditions. The success criteria components adhere to guidance provided by the United States Army Corps of Engineers (USACE) – Wilmington District (USACE, 2003) and recommendations from the NC EEP. Stream, hydrology, and vegetation monitoring are conducted annually for five years or until success criteria have been met. This Annual Monitoring Report details the results of the monitoring efforts for Year 3 at the North Muddy

Creek Stream and Wetland Mitigation Site. Results from the Year 3 monitoring efforts are included within the following sections and **Appendix A**.

2.3 Project History and Schedule

The project was constructed in the summer and fall of 2008 and the five year monitoring is expected to be completed in the winter of 2013 **(Table 2)**. **Table 3** lists the project contacts.

Table 2. Project Activity and Reporting History

Month / Year	Activity
September 2007	Restoration Plan
September 2008	Construction Completed
December 2008	Planting Completed
March 2009	Supplemental Planting
April 2009	Mitigation Plan / As-Built Report
December 2009	Year 1 Annual Monitoring Report
December 2010	Year 2 Annual Monitoring Report
April 2011	Supplemental Planting
June – July 2011	Exotic Invasive Plant Control
December 2011	Year 3 Annual Monitoring Report
December 2012	Year 4 Annual Monitoring Report (Scheduled)
December 2013	Year 5 Annual Monitoring Report (Scheduled)

Table 3. Project Contacts

Contact	Provider Information
Full Delivery Service Contractor Norton Webster	Environmental Banc & Exchange 909 Capability Drive Suite 3100 Raleigh, North Carolina 27606 (919) 829-9909
Designer William Wilhelm	Kimley-Horn and Associates, Inc. 4651 Charlotte Park Drive, Suite 300 Charlotte, North Carolina 28217 (704) 333-5131
Construction/Seeding Contractor Robert Grady	RFG Construction Inc. 1907 Cambridge Drive Kinston, North Carolina 28504 (252) 523-2405
Planting Contractor Robert Cato	Superior Wildlife Services 2105 Sparre Drive Kinston, North Carolina 28504 (252) 939-0465
Monitoring Contractor Steve Melton	Equinox Environmental Consultation & Design, Inc. 37 Haywood Street, Suite 100 Asheville, North Carolina 28801 (828) 253-6856

3.0 STREAM MONITORING

3.1 Stream Success Criteria

As stated in the Mitigation Plan, the stream geometry will be considered successful if the cross-section geometry, profile, and sinuosity are stable or reach a dynamic equilibrium. While the channels may not adhere to the design or reference ratios of stream geometry, the streams will be considered stable if the following key indicators are present:

- *Stream Type*: Maintenance of the design stream type or progression toward or conversion to a stable stream type such as B, C, or E will indicate stability.
- *Bank Height Ratio*: Bank height ratio between 1.0 and 1.2 will indicate that flood flows have access to the active floodplain and that higher flows do not apply excessive stresses to stream banks.

A minimum of two bankfull events is required during the 5-year monitoring period. If two bankfull events do not occur the monitoring period may be extended at the discretion of the UACOE.

3.2 Stream Morphology Monitoring Plan

The stream monitoring program will document annual system development and progress towards achieving the success criteria. Monitoring will occur annually for 5-years or until the final success criteria are achieved, whichever is longer. The locations of the individual stream monitoring components are shown in **Figure 3**.

3.2.1 Cross-Sections

A total of nine cross-sections were installed during the As-built monitoring efforts. Cross-sections for UT1 include one riffle and one pool for each of the two monitored reaches. The UT5 restoration reach includes one riffle and one pool cross-section and UT6 includes two riffles and one pool cross-section. Each cross-section was marked on both banks with permanent iron pins to establish known elevations and stationing for comparisons between annual data collection efforts. Annual cross-sectional survey points include all present breaks in slope; including top of bank, bankfull, inner berm, and thalweg. Cross-sectional photos are collected annually to visually document left and right bank conditions.

3.2.2 Longitudinal Profile

Four permanent longitudinal profile reaches were established during the As-built monitoring efforts. UT1 includes an upper (UT1-Upper) and lower reach (UT1-Lower), whereas UT5 and UT6 include the entire lengths of the restoration reaches. The beginning and end of each longitudinal profile reach was marked on both banks with permanent iron pins to establish benchmarks for annual data comparison and analysis. Longitudinal profile measurements include thalweg, water surface, bankfull, and top of low bank. Annual thalweg and water surface measurements are collected at the head and tail of each bedform type.

3.2.3 Substrate

Bed substrate assessment sites were established at each permanent cross-section. Annual pebble counts are collected utilizing methods adapted from Harrelson et al. (1994). A minimum of 100 particles are selected and measured from each channel feature type sampled. Sampled materials are placed into size classes using the traditional Wentworth scale classes subdivided based on phi scale. These classes are grouped into broader sediment size categories (e.g. sand, gravel or cobble) and are utilized to compare substrate progression from As-built conditions.

3.2.4 Hydrology

Crest gauges installed on each restoration reach tributary are utilized to document bankfull events during the monitoring period. Crest gauges are checked during each site visit to document the highest flow between visits. Gauge height readings are recorded and digital images of floodplain debris lines and sediment deposition are collected to document annual bankfull events.

3.2.5 Photo Reference Stations

A total of 23 representative photo stations were established throughout the site to subjectively evaluate overall trends in project progression and general site conditions over the duration of the monitoring effort. Additionally, the entire site is visually assessed annually to document any identified areas of concern. Representative photos are collected to document areas of concern identified during the visual site assessment.

3.3 Stream Morphology Monitoring Results

The Year 3 annual stream morphology data were collected between February and November 2011. Reference station photos were collected in January 2011 prior to leaf out to document the general conditions of the site. The Year 3 cross-section, longitudinal profile, and substrate data collection efforts occurred in February and April 2011. Visual assessments and bankfull documentation was noted during each site visit during the annual monitoring effort. A final quantitative site assessment and data collection effort occurred in November 2011.

3.3.1 Cross-Sections

Cross-sectional data collected during the Year 3 monitoring effort have been compared with the previous data sets **(Appendices B & C)**. The Year 3 channel cross-sectional data shows minimal differences between years indicating that the overall stream dimensions have remained stable.

3.3.2 Longitudinal Profile

Longitudinal profile surveys were conducted along four separate reaches of the restoration project, totaling approximately 3,109 linear feet. The surveys conducted included reach UT1-Upper from STA 100+10 to STA 103+97 (387 linear feet), reach UT1-Lower from STA 109+95 to STA 120+58 (1,063 linear feet), reach UT5 from STA 510+59 to STA 516+39 (580 linear

feet), and reach UT6 from STA 600+05 to STA 610+84 (1,079 linear feet). The longitudinal profiles documented bed elevations, stream features, and in-stream grade control structures as compared to the As-built profiles **(Appendices B & C)**. With the exception of some isolated areas of stream bed aggradation and degradation, stream bank erosion, grade control degradation, and thalweg migration; stream profiles between monitoring years indicate little adjustment.

3.3.3 Substrate

Pebble count data collected during Year 3 indicates little change in substrate size composition between years. Substrate composition within the stream channels is primarily silt/clay and fine sand particles within both the riffle and pool habitat types. The Year 3 pebble count data summary plots are included in **Appendix B**.

3.3.4 Hydrology

Since project completion at least two bankfull events have occurred within the project site. An initial bankfull event occurred in May 2009 which registered 0.05 feet above bankfull at UT6 **(Table 4)**. A significant bankfull event occurred on all reaches in January 2010. No bankfull events occurred during the Year 3 monitoring period.

Table 4. Crest Gauge Data

Month / Year Recorded	UT1 (ft above bkf)	UT5 (ft above bkf)	UT6 (ft above bkf)
May 2009	0.00	0.00	0.05
January 2010	>4.00	3.50	>4.00

3.3.5 Photo Reference Stations

The Year 3 reference station photos are included in **Appendix D**. Stream areas of concern (SPA) identified through the morphological monitoring and visual assessments include isolated areas of stream bed aggradation and degradation, stream bank erosion, and grade control degradation **(Table 5)**. Representative photos of these areas taken during the Year 3 monitoring effort are included in **Appendix D**.

Table 5. Stream Areas Requiring Observation

SPA	Feature	Reach	STA	Description	Recommendation
1	Riffle	UT1	105+00	Riffle down cutting	Continue to monitor
2	Pool	UT1	105+25	Reduced pool depth due to aggradation	Continue to monitor
3	Riffle	UT1	105+70	Riffle down cutting	Continue to monitor
4	Riffle	UT1	107+90	Riffle down cutting	Continue to monitor
5	Riffle	UT1	110+40	Riffle down cutting	Continue to monitor
6	Pool	UT5	510+75	Reduced pool depth due to aggradation	Continue to monitor
7	Stream Bank	UT5	515+10	Bank scour	Continue to monitor
8	Stream Bank	UT5	515+50	Bank scour	Continue to monitor
9	Rock Vane	UT5	515+80	Grade control structure piping	Continue to monitor
10	Pool	UT6	601+00	Reduced pool depth due to aggradation	Continue to monitor
11	Riffle	UT6	601+30	Riffle down cutting	Continue to monitor
12	Pool	UT6	601+60	Reduced pool depth due to aggradation	Continue to monitor
13	Pool	UT6	602+25	Reduced pool depth due to aggradation	Continue to monitor
14	Riffle	UT6	603+75	Riffle down cutting	Continue to monitor

3.4 Stream Conclusions

The Year 3 morphological monitoring and visual assessments primarily indicate a stable system when compared to the As-built conditions. While the majority of pools and riffles were of appropriate depth, stream areas of concern identified during Year 3 were primarily associated with isolated cases of pool aggradation and riffle degradation. These areas will continue to be monitored during subsequent monitoring years and recommendations will be made if these areas become problematic to project success. **Table 6** summarizes the riffle morphologic parameters between monitoring years; details of the morphologic parameters are provided in **Appendices B & C**.

Table 6. Summary of Morphologic Monitoring Parameters

Unnamed Tributary 1 – Upper Reach				
Parameter	**As-Built**	**Year 1**	**Year 2**	**Year 3**
Bankfull Cross-Section Area Abkf (sq ft)	4.2	4.2	3.9	3.5
Bankfull Width Wbkf (ft)	6.0	5.8	5.8	5.6
Bankfull Width / Depth Ratio	8.6	8.0	8.5	8.9
Bankfull Mean Depth Dbkf (ft)	0.7	0.7	0.7	0.6
Bankfull Max Depth Dmax (ft)	1.2	1.2	1.2	1.1

Table 6 Continued. Summary of Morphologic Monitoring Parameters

Unnamed Tributary 1 – Lower Reach				
Parameter	**As-Built**	**Year 1**	**Year 2**	**Year 3**
Bankfull Cross-Section Area Abkf (sq ft)	3.1	3.1	3.1	3.0
Bankfull Width Wbkf (ft)	5.5	6.2	6.4	6.5
Bankfull Width / Depth Ratio	9.9	12.2	12.9	14.3
Bankfull Mean Depth Dbkf (ft)	0.6	0.5	0.5	0.5
Bankfull Max Depth Dmax (ft)	1.0	1.0	0.9	0.9

Unnamed Tributary 5				
Parameter	**As-Built**	**Year 1**	**Year 2**	**Year 3**
Bankfull Cross-Section Area Abkf (sq ft)	5.4	5.0	5.0	5.1
Bankfull Width Wbkf (ft)	7.2	7.2	7.6	8.5
Bankfull Width / Depth Ratio	9.7	10.3	11.6	14.0
Bankfull Mean Depth Dbkf (ft)	0.7	0.7	0.7	0.6
Bankfull Max Depth Dmax (ft)	1.2	1.2	1.2	1.2

Unnamed Tributary 6				
Parameter	**As-Built**	**Year 1**	**Year 2**	**Year 3**
Average Bankfull Cross-Section Area Abkf (sq ft)	6.1	7.7	7.7	7.6
Average Bankfull Width Wbkf (ft)	10.5	10.5	10.8	10.9
Average Bankfull Width / Depth Ratio	14.5	14.7	15.2	15.7
Average Bankfull Mean Depth Dbkf (ft)	0.7	0.7	0.7	0.7
Average Bankfull Max Depth Dmax (ft)	1.3	1.4	1.6	1.6

4.0 HYDROLOGY

4.1 Hydrologic Success Criteria

As stated in the Restoration Plan, the hydrology success criteria for the site is based on improvements to the frequency and duration of saturated soils as compared to the reference wetlands. The groundwater hydrology of the reference sites serve as the target for groundwater conditions since these areas met wetland criteria prior to construction. They also are in similar landscape positions and should have hydrological responses similar to the restored wetlands. The minimum requirement for the restoration of wetland hydrology will also be based on the USACE guidelines (USACE, 1987) including saturation of the upper surface soils (12 inches) for 7 percent of the growing season. The growing season for McDowell County extends from March 28 to November 4 (222 days). The growing season is based on the fifty percent probability of a 28°F or greater minimum temperature between these dates (NRCS, October 2009).

4.2 Description of Hydrology Monitoring Efforts

Prior to the 2009 growing season, eight Infinities automated groundwater gauges were installed within the wetland project areas **(Figure 3)**. The UT1 wetland project includes two gauges within the restoration sites and one reference gauge within a fully functional wetland immediately adjacent to the project site. The UT5 wetland project contains one gauge within the enhancement wetland and one within the preservation wetland. Finally, three gauges were installed within the UT6 wetland restoration area. Additionally, prior to the growing season an Ecotone automated rain gauge was installed at each project area. The monitoring protocol for the site specified that automated monitoring stations be downloaded and checked for malfunctions on a bi-monthly basis. During the 2010 growing season, the UT5-01 groundwater gauge malfunctioned during the initial portion of the growing season. Additionally, rain gauge malfunctions at UT1 and UT5 resulted in data gaps for rainfall events occurring during the growing season.

Automated Gauges
Groundwater gauges were installed to a minimum depth of 23 inches below the ground surface. Automated gauges compensate for changes in atmospheric pressure and were set to record water elevation above the bottom of the sensor twice daily at 08:00 and 20:00 hours. Automated rain gauges were installed within open areas to prevent overhead interference with daily rain recordings. Gauges automatically record rainfall with a tipping bucket calculated to record to 0.01 of an inch.

Data Interpretation
Unless erroneous readings were observed between the two daily groundwater readings, the 08:00 daily reading was utilized for the daily hydrology level. For days in which a significant difference between the 08:00 and 12:00 reading was observed (N = 2), the data were compared to prior and post ground water levels to eliminate erroneous readings. Rainfall readings were summed to obtain the monthly totals.

During monitoring years in which below normal precipitation results in groundwater gauges not meeting hydrologic requirements, the groundwater hydrology from the reference gauges will be utilized to compare the restoration and enhancement gauges for determination of a positive correlation.

4.3 Results of Hydrology Monitoring

The following Year 3 hydroperiod statistics were calculated for each monitoring station following the third growing season: 1) most consecutive days and percent of the growing season that the water table was within 12 inches of the soil surface; 2) cumulative number of days and percent of growing season that the water table was within 12 inches of the soil surface; and 3) number of times the water table rose to within 12 inches of the soil surface **(Table 7)**. Individual groundwater graphs and raw hydrograph data collected from the monitoring gauges are provided in **Appendix E**.

During Year 3, all groundwater gauges met the success criteria as stated in the Restoration Plan **(Table 7)**. Gauge data results for the UT1 wetland project ranged from approximately 16 to 32 percent hydroperiod attainment during the growing season with the reference gauge (UT1 – 1) meeting criteria for 30.2 percent of the season. Gauge data for the UT5 wetland project, including the reference gauge (UT5 – 1), resulted in a consecutive hydroperiod range between 30 and 33 percent during the growing season. The consecutive hydroperiod ranged from 61 to 71 percent for the UT6 wetland project gauges.

Table 7. Hydrologic Monitoring Results

2011 Max Hydroperiod (Growing Season March 28 – November 4, 222 Days)															
Gauge ID	Year 3 Consecutive		Year 2 Consecutive		Year 1 Consecutive		Year 3 Cumulative		Year 2 Cumulative		Year 1 Cumulative		Year 3	Year 2	Year 1
	Days	Percent of Growing Season	Days	Percent of Growing Season	Days	Percent of Growing Season	Days	Percent of Growing Season	Days	Percent of Growing Season	Days	Percent of Growing Season	Occurrences		
UT1 – 1	67	30.2	42	18.9	51	23.0	136	61.3	129	58.1	150	67.6	7	11	8
UT1 – 2	71	32.0	41	18.5	88	39.6	149	67.1	95	42.8	155	69.8	5	11	5
UT1 - 3	35	15.8	14	6.3	22	9.9	48	21.6	34	15.3	86	38.7	5	6	17
UT5 – 1	74	33.3	74	33.3	96	43.2	176	79.3	182	82.0	178	80.2	5	3	3
UT5 - 2	66	29.7	82	36.9	89	40.1	108	48.6	129	58.1	136	61.3	8	7	5
UT6 - 1	153	68.9	222	100.0	112	50.5	213	95.9	222	100.0	192	86.5	2	1	2
UT6 - 2	157	70.7	222	100.0	115	51.8	183	82.4	222	100.0	197	88.7	3	1	3
UT6 - 3	136	61.3	222	100.0	111	50.0	201	90.5	222	100.0	191	86.0	4	1	2

4.3.1 Site Data

Groundwater depths and daily precipitation for individual monitoring gauges are graphed in **(Appendix E)**. This hydrography demonstrates the reaction of groundwater levels to specific rainfall events at each monitoring location.

4.3.2 Climate Data

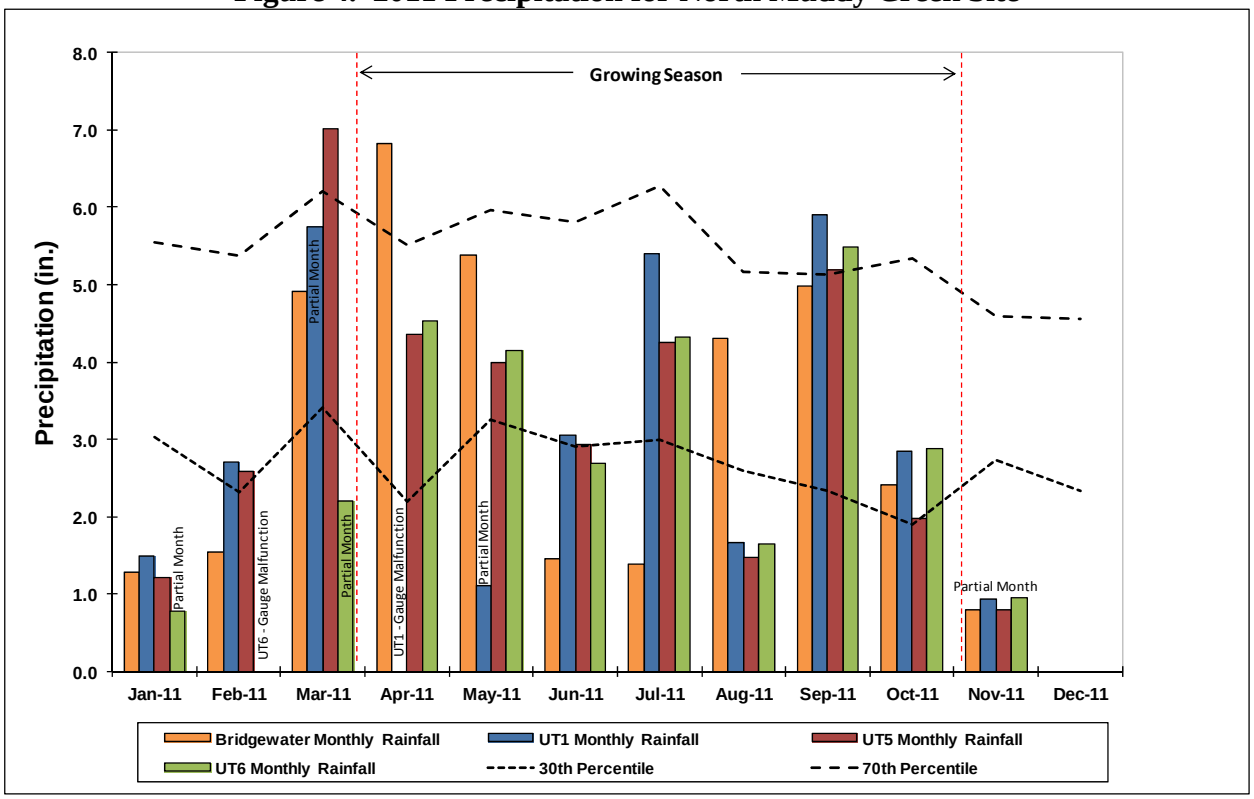
On-site monthly rainfall for 2011 was compared to historical and observed precipitation recorded for Burke County **(Table 8 and Figure 4)**. Historical and observed precipitation data reported herein is from the Burke County Bridgewater hydro station (NRCS, 2002 & NC CRONOS, November, 2011). The Bridgewater station recorded rainfall amounts during 2011 that exceeded the historical averages in April, whereas rainfall amounts during January, February, June, July, and October were below average. While the on-site gauge at UT5 recorded similar total rainfall (35.78) as that recorded at the Bridgewater station (35.31), monthly differences were noted. In particular, above average rainfall was recorded in March and May and was normal in April and July. Additionally, below average rainfall was recorded in August at the project site.

Table 8. Comparison of Normal Rainfall to Observed Rainfall

Month	Average (inches)	Normal Limits (inches)		Burke Precipitation (inches)	UT1 Precipitation (inches)	UT5 Precipitation (inches)	UT6 Precipitation (inches)
		30 Percent	70 Percent				
January	4.22	3.03	5.54	1.29	1.50	1.22	0.78**
February	3.95	2.32	5.37	1.55	2.70	2.58	*
March	4.96	3.41	6.20	4.92	5.74**	7.01	2.20**
April	4.08	2.20	5.52	6.82	*	4.36	4.54
May	4.86	3.26	5.96	5.38	1.11**	4.00	4.15
June	4.52	2.90	5.80	1.46	3.06	2.93	2.69
July	4.82	2.99	6.27	1.39	5.40	4.25	4.33
August	4.17	2.60	5.17	4.30	1.67	1.47	1.65
September	4.24	2.34	5.13	4.99	5.90	5.20	5.48
October	3.88	1.90	5.34	2.41	2.85	1.97	2.88
November	3.85	2.74	4.59	0.80***	0.93***	0.79***	0.95***
December	3.67	2.33	4.55	---	---	---	---
Annual	---	45.23	56.10	---	---	---	---
Total	51.23	---	---	35.31	30.85	35.78	29.65

*Gauge malfunction no data collected.
**Gauge malfunction for portion of the month.
***Data from November 1st to November 11th.

Figure 4. 2011 Precipitation for North Muddy Creek Site



4.4 Hydrologic Conclusions

Data collected from the groundwater monitoring gauges in 2011 indicate that all of the hydrologic monitoring stations recorded saturation of the upper surface soils (12 inches) for at least 7 percent of the growing season. Saturation of the upper surface soils ranged from 35 (15.8%) to 71 (32.0%) consecutive days during the growing season for the UT1 wetland project. The cumulative number of days groundwater levels were recorded within or above 12 inches of the soil surface ranged from 48 to 149 at UT1. Upper surface soil saturation for UT5 ranged from 66 (29.7) to 74 (33.3%) consecutive days during the growing season with the cumulative days ranging from 108 to 176. Wetland hydrology attainment was greatest for the UT6 project with soil saturation ranging from 136 (61.3%) to 157 (70.7%) consecutive days and cumulative days ranging from 183 to 213 days during the growing season.

The Bridgewater weather station and on-site rainfall data indicated that the 2011 growing season rainfall amounts were on average below normal for most of the growing season.

5.0 VEGETATION

5.1 Vegetation Success Criteria

Successful establishment of vegetation for the North Muddy Creek Stream and Wetland Restoration Project should be the survival of 320 planted stems per acre by the end of Year 3 such that the site will achieve the final requirement of 260 planted stems per acre by Year 5.

5.2 Description of Species and Vegetation Monitoring

Eleven plots, or approximately 1% of all three restoration areas combined, were established within the project easement area: ten standard (10m x 10m) plots and one non-standard (5m x 20m) plot **(Figure 3)**. Four plots were established at UT1, two at UT5, and five at UT6. Vegetation monitoring plots at UT1 comprise 1% of the restoration area for this tributary, 2.5% for UT5, and 1% for UT6, respectively. These plots were established in accordance with the CVS-EEP Level II monitoring protocol (Lee et al. 2008) within the planted restoration areas. Approximately 0.025-acre in size, vegetation plots were monitored to determine the success of planted vegetation and the overall trajectory of woody plant restoration and regeneration at the project site. Plots were placed within the applicable planting zones to capture the heterogeneity of the designed vegetative communities. However, given that several planting zones were too narrow to accommodate the standard or non-standard plots, all vegetation plots were placed within riparian, wetland, and upland planting zones. An additional supplemental planting effort occurred in April 2011 within areas previously noted with low stem densities. A total of 10 tree species were planted on the site **(Table 9)**. Taxonomic nomenclature follows Weakley (2008).

Table 9. Planted Tree Species

Common Name	Scientific Name	FAC Status
Willow Oak	*Quercus phellos*	FACW-
Water Oak	*Quercus nigra*	FAC
Swamp Chestnut Oak	*Quercus michauxii*	FACW-
Cherrybark Oak	*Quercus pagoda*	FAC+
Shagbark Hickory	*Carya ovata*	FACU
River Birch	*Betula nigra*	FACW
Common Pawpaw	*Asimina triloba*	FAC
American Sycamore	*Platanus occidentalis var. occidentalis*	FACW-
Green Ash	*Fraxinus pennsylvanica*	FACW
Buttonbush	*Cepalanthus occidentalis*	OBL

5.3 Results of Vegetation Monitoring

Planted stem counts for each of the 11 vegetation monitoring plots were recorded by species **(Table 10)**. Year 3 monitoring documented survivability ranging from 283 to 1,214 planted stems per acre across all vegetation plots. The average planted stem density for the entire restoration site is 714 stems per acre. With respect to each restoration reach, UT1 had an

average of 688 planted stems per acre, UT5 had 1,052 stems per acre, and UT6 had 617 planted stems per acre **(Table 11)**. Overall, the average planted stems per acre in Year 3 increased from the previous year which is primarily the result of the recent supplemental planting effort.

Table 10. Results of 2011 Vegetation Monitoring by Plot

Species	UT1				UT5		UT6				
	Plot ID				Plot ID		Plot ID				
	VP1	VP2	VP3	VP4	VP1	VP2	VP1	VP2	VP3	VP4	VP5
Asimina triloba					5		1		3		1
Betula nigra	3						2	5	2		3
Carya ovata									4		
Cephalanthus occidentalis	6	10	1	7	8	2		9		1	7
Fraxinus pennsylvanica			2		1	2	7	2		4	1
Platanus occidentalis var. occidentalis	2	5				2	1		1	1	
Quercus michauxii	5	4	2		6	3		1	4	1	2
Quercus nigra	1		4	2					2		
Quercus pagoda	1					4					
Quercus phellos	5		2	6	2	16	2	2	4		1

Table 11. Summary of Vegetation Monitoring Results

Reach ID	Plot ID	Stems Planted	2011 Stems	Percent Survival	Stems per Acre					
					Stems Planted	2009	2010	2011*	2012	2013
						Year 1	Year 2	Year 3	Year 4	Year 5
UT1	VP1	26	23	89%	1,053	890	890	931		
	VP2	20	19	95%	810	809	809	769		
	VP3	15	11	73%	607	405	405	445		
	VP4	16	15	94%	648	567	607	607		
UT5	VP1	26	22	85%	1,053	891	850	890		
	VP2	35	30	86%	1,417	1,215	1,255	1,214		
UT6	VP1	16	13	81%	648	567	567	526		
	VP2	14	19	136%	567	567	486	769		
	VP3	23	20	87%	931	729	769	809		
	VP4	17	7	41%	688	243	121	283		
	VP5	30	15	50%	1,215	688	486	607		

Average stems per acre: 714
Range of stems per acre: 283-1,214
*Increases between Year 2 and Year 3 are the result of an additional supplemental planting effort in April 2011.

A visual estimate of herbaceous vegetation cover within the monitoring plots is provided to assess the overall stability of the restoration site **(Table 12)**. On average, herbaceous vegetation coverage is 91% within the plots. Observations of herbaceous cover throughout the project area were noted during the visual assessment and are documented in **Appendix A;** representative photos are included in **Appendix D**. Herbaceous cover in low density areas is expected to

increase as a result of natural recruitment from adjacent wooded areas and no remedial action is recommended at this time. Herbaceous cover typically consists of annual ragweed (*Ambrosia artemisiifolia)*, orchard grass (*Dactylis glomerata*), dogfennel (*Eupatorium capillifolium*), daisy fleabane (*Erigeron annuus*), Queen Anne's lace (*Daucus carota*), arrowleaf tearthumb (*Persicaria sagittata*), hollow-stem Joe-pyeweed (*Eutrochium fistulosum*), rush species (*Juncus sp*), blackberry (*Rubus sp*), American hog-peanut (*Amphicarpaea bracteata*), narrow-leaved sunflower (*Helianthus angustifolius*), and goldenrod (*Solidago sp.*).

Table 12. Estimated Herbaceous Total Percent Cover

Reach ID	Plot ID	Estimated Herbaceous Cover (%)
UT1	VP1	100%
	VP2	100%
	VP3	95%
	VP4	90%
UT5	VP1	85%
	VP2	90%
UT6	VP1	50%
	VP2	95%
	VP3	90%
	VP4	100%
	VP5	100%

Commonly encountered woody volunteer species are also documented throughout the five-year monitoring period **(Table 13)**. Volunteer plant recruitment was highest at UT 1 with an average of 1,447 stems per acre followed by UT5 with an average of 587 stems per acre. Some of the most common recruits include American sycamore, green ash, Eastern box elder, red maple, and tag alder.

Table 13. Volunteer Tree Species

Reach ID	Common Name	Scientific Name	FAC Status
UT1	Eastern Box Elder	*Acer negundo var. negundo*	FACW
	Eastern Red Maple	*Acer rubrum var. rubrum*	FAC
	Buttonbush	*Cephalanthus occidentalis*	OBL
	American Persimmon	*Diospyros virginiana*	FAC
	Green Ash	*Fraxinus pennsylvanica*	FACW
	Yellow Poplar	*Liriodendron tulipifera var. tulipifera*	FACU
	American Sycamore	*Platanus occidentalis var. occidentalis*	FACW-
	Black Cherry	*Prunus serotina var. serotina*	FACU
	Willow Oak	Quercus phellos	FACW-
	Smooth Sumac	*Rhus glabra*	UPL
	Common Elderberry	*Sambucus canadensis*	FACW-
UT5	Tag Alder	*Alnus serrulata*	FACW
	River Birch	*Betula nigra*	FACW
	Sweet Gum	*Liquidambar styraciflua*	FAC+
	Yellow Poplar	*Liriodendron tulipifera var. tulipifera*	FACU
	American Sycamore	*Platanus occidentalis var. occidentalis*	FACW-
UT6	Eastern Red Maple	*Acer rubrum var. rubrum*	FAC
	Tag Alder	*Alnus serrulata*	FACW
	Buttonbush	*Cephalanthus occidentalis*	OBL
	Yellow Poplar	*Liriodendron tulipifera var. tulipifera*	FACU
	Pine	*Pinus sp.*	FACU
	American Sycamore	*Platanus occidentalis var. occidentalis*	FACW-
	Willow Oak	Quercus phellos	FACW-
	Smooth Sumac	*Rhus glabra*	UPL

5.4 Vegetation Observations and Conclusions

Overall, planted stems are surviving at the North Muddy Creek Stream and Wetland Restoration Site. The majority (72%) of planted stems for the entire restoration site had good or excellent vigor scores, with only 7% of planted stems reported as dead or missing. Vegetation damage during Year 3 was primarily documented for buttonbush and sycamore, a considerable amount of which was attributed to insects and vine strangulation.

All but one of the vegetation monitoring plots meets the interim success criteria **(Appendix A)**. VP4 at UT6, which only had 283planted stems per acre does not meet the survival of 320 planted stems per acre by the end of Year 3 such but could potentially still achieve the final requirement

of 260 planted stems per acre by Year 5. However, when all sites are combined the planted stem density for the entire restoration site is 714 stems per acre which is well above the success criteria. Additionally, when planted and natural stems are combined, the average stem density for the entire restoration site is over 1,500 stems per acre.

Intensive control efforts were initiated in Year 3 to control invasive exotic plants such as multiflora rose (*Rosa multiflora*), Japanese honeysuckle (*Lonicera japonica*), sericea lespedeza (*Lespedeza cuneata*), privet (*Ligustrum sp*.), and kudzu (*Pueraria montana var. lobata*) within the easement boundary **(Appendix A)**. Follow up treatments are scheduled throughout the remainder of the monitoring period. **Appendix A** depicts those areas treated for invasive exotic plants during Year 3. **Appendix F** contains the baseline report which provides a summary of the invasive exotic management activities conducted during this period.

6.0 CONCLUSIONS AND RECOMENDATIONS

- Morphologic data and observations of stream conditions at the site primarily indicate stable conditions between As-built and Year 3 monitoring. Areas of concern identified within the stream reaches will be monitored during subsequent years and recommendations made if these areas prevent criteria attainment as specified in the Restoration Plan (EBX, 2007).

- Data collected from the groundwater monitoring gauges in 2011 indicate that all of the wetland project components are currently meeting wetland threshold hydrology. Overall, the Bridgewater hydro station and on-site rain gauges indicated that the 2011 rainfall amounts were on average below normal for the majority of the growing season. The Bridgewater station data exceeded historical limits in April, whereas rainfall amounts during January, February, June, July, and October were below average. On-site rain gauges documented above average rainfall in March and May with below average amounts in June, August, and October.

- Vegetation monitoring efforts have documented the average number of planted stems per acre for the entire restoration site to be 714 stems per acre for the 2011 monitoring year. UT1 had an average of 688 planted stems per acre, UT5 had 1,052, and UT6 had 617 planted stems per acre. Due to the additional supplemental planting in April 2011, the majority of the monitoring plots indicate an increase in survivability between years. While vegetation plot 4 at UT6 was the only plot not on track to meet the final success criteria when all sites are combined the planted stem density for the entire restoration site is well above the success criteria of 320 stems per acre. Lastly, the invasive exotic plant control efforts will be monitored with follow up control efforts planned during subsequent monitoring years.

- Stream, hydrologic, and vegetation monitoring are scheduled to continue through 2013.

7.0 REFERENCES

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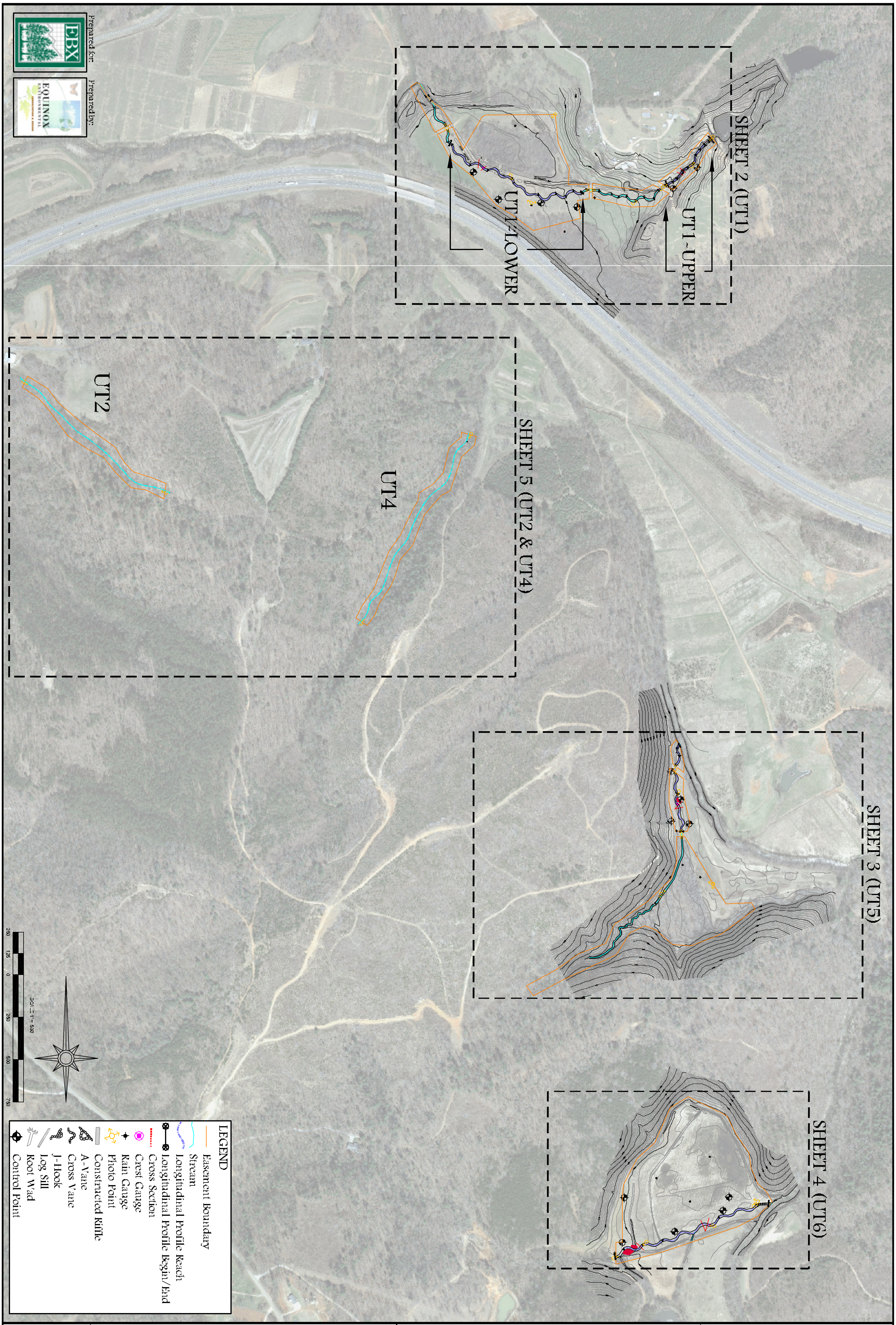

Sheet:
1
of 5
Date:
November, 2011

Current Condition Plan View
Final
YEAR 3 Monitoring-2011
OVERVIEW

North Muddy Creek

Burke & McDowell Counties, NC

Notes:
1. Coordinate System is State Plane Feet NAD 83
2. Base map information provided by Kimley Horn.
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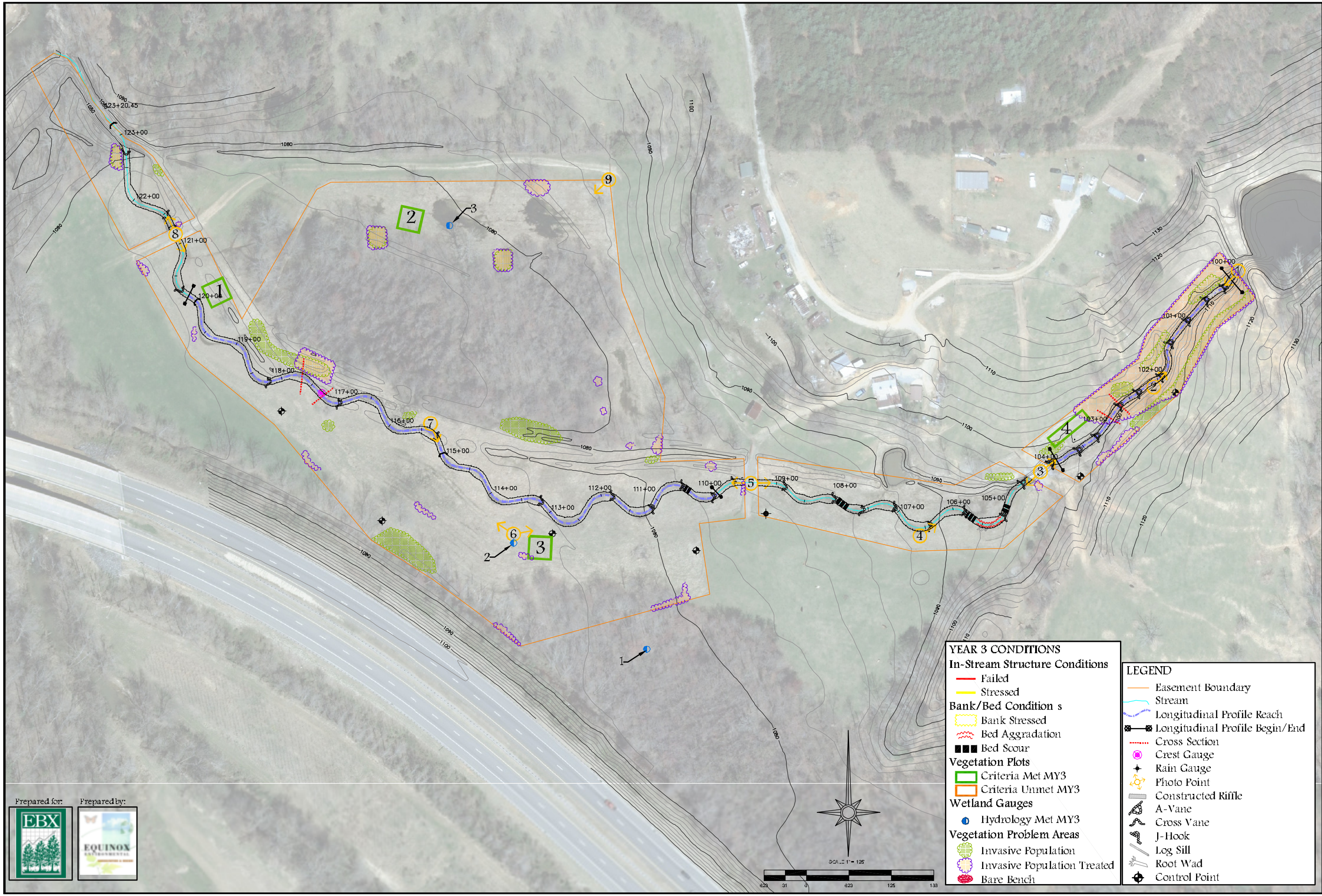
3. Aerial photography is McDowell County 2010



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3. Aerial photography is McDowell County 2010.

North Muddy Creek

Burke & McDowell Counties, NC

Current Condition Plan View
Final
YEAR 3 Monitoring-2011
UT1

Sheet:
2
of 5

Date:
November, 2011

YEAR 3 CONDITIONS

In-Stream Structure Conditions
- Failed
- Stressed

Bank/Bed Condition s
- Bank Stressed
- Bed Aggradation
- Bed Scour

Vegetation Plots
- Criteria Met MY3
- Criteria Unmet MY3

Wetland Gauges
- Hydrology Met MY3

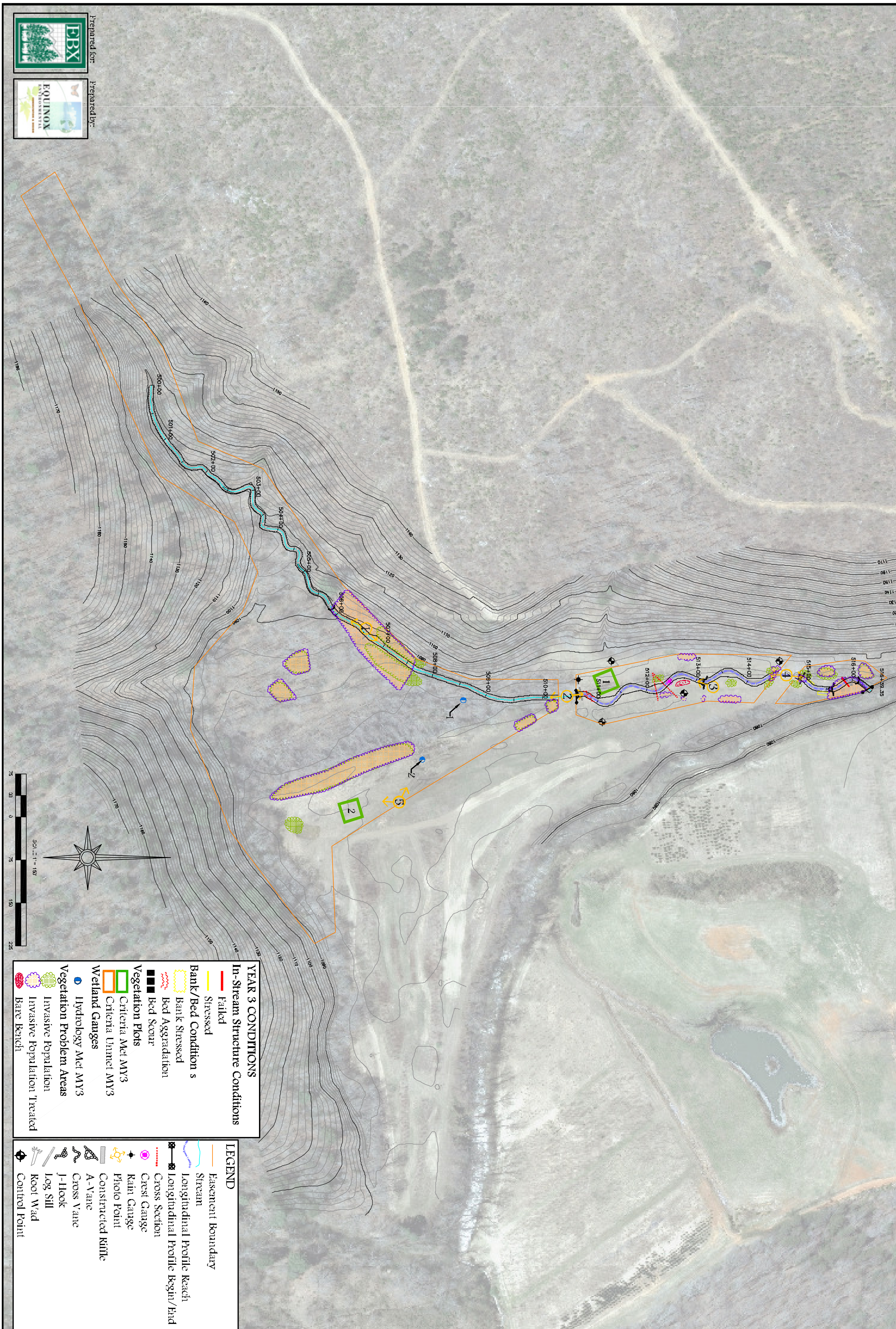
Vegetation Problem Areas
- Invasive Population
- Invasive Population Treated
- Bare Bench

LEGEND
- Easement Boundary
- Stream
- Longitudinal Profile Reach
- Longitudinal Profile Begin/End
- Cross Section
- Crest Gauge
- Rain Gauge
- Photo Point
- Constructed Riffle
- A-Vane
- Cross Vane
- J-Hook
- Log Sill
- Root Wad
- Control Point

SCALE 1" = 125
623 31 0 623 125 188

Prepared for: EBX

Prepared by: EQUINOX ENVIRONMENTAL

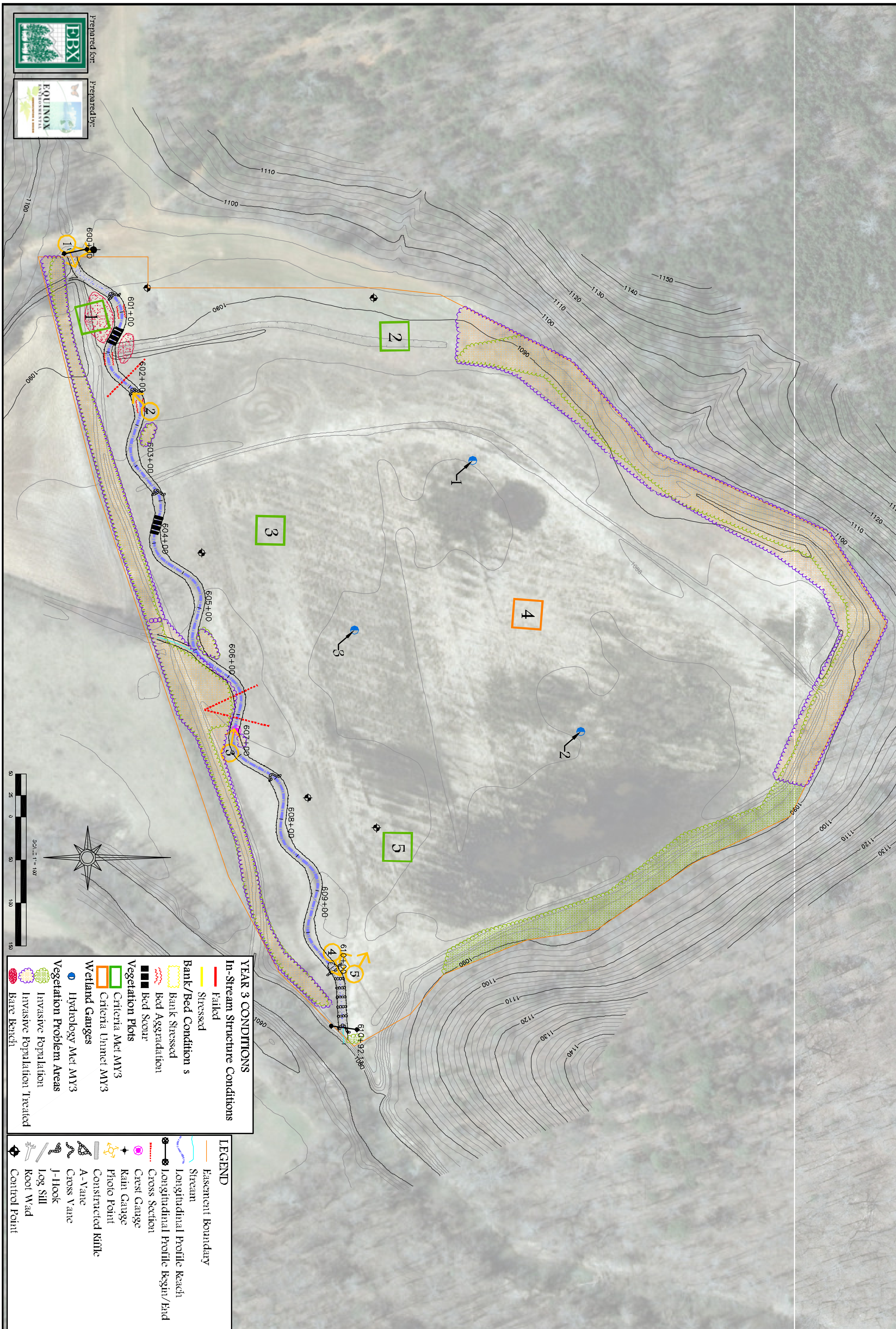

Prepared for:
EBX
Prepared by:
EQUINOX
YEAR 3 CONDITIONS
In-Stream Structure Conditions
Failed
Stressed
Bank/Bed Condition s
Bank Stressed
Bed Aggradation
Bed Scour
Vegetation Plots
Criteria Met MY3
Criteria Unmet MY3
Wetland Gauges
Hydrology Met MY3
Vegetation Problem Areas
Invasive Population
Invasive Population Treated
Bare Bench
LEGEND
Easement Boundary
Stream
Longitudinal Profile Reach
Longitudinal Profile Begin/End
Cross Section
Crest Gauge
Rain Gauge
Photo Point
Constructed Riffle
A-Vane
Cross Vane
J-Hook
Log Sill
Root Wad
Control Point

Notes:
1. Coordinate System is State Plane Feet NAD 83
2. Base map information including stationing provided by Kimley Horn.
Dwg title: ACAD-018336001-BASE3.dwg
3. Aerial photography is McDowell County 2010

North Muddy Creek
Burke & McDowell Counties, NC

Current Condition Plan View
Final
YEAR 3 Monitoring-2011
UT5

Sheet: 3 of 5
Date: November, 2011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FBX
Prepared by:
EQUINOX
YEAR 3 CONDITIONS
In-Stream Structure Conditions
Failed
Stressed
Bank/Bed Condition s
Bank Stressed
Bed Aggradation
Bed Scour
Vegetation Plots
Criteria Met MY3
Criteria Unmet MY3
Wetland Gauges
Hydrology Met MY3
Vegetation Problem Areas
Invasive Population
Invasive Population Treated
Bare Bench
LEGEND
Easement Boundary
Stream
Longitudinal Profile Reach
Longitudinal Profile Begin/End
Cross Section
Crest Gauge
Rain Gauge
Photo Point
Constructed Riffle
A-Vane
Cross Vane
J-Hook
Log Sill
Root Wad
Control Point

North Muddy Creek

Burke & McDowell Counties, NC

Current Condition Plan View
Final
YEAR 3 Monitoring-2011
UT6

Sheet: 4 of 5

Date: November, 2011

Notes:
1. Coordinate System is State Plane Feet NAD 83
2. Base map information including stationing provided by Kimley Horn. Dwg title: ACAD-018336001-BASE3.dwg
3. Aerial photography is McDowell County 2010

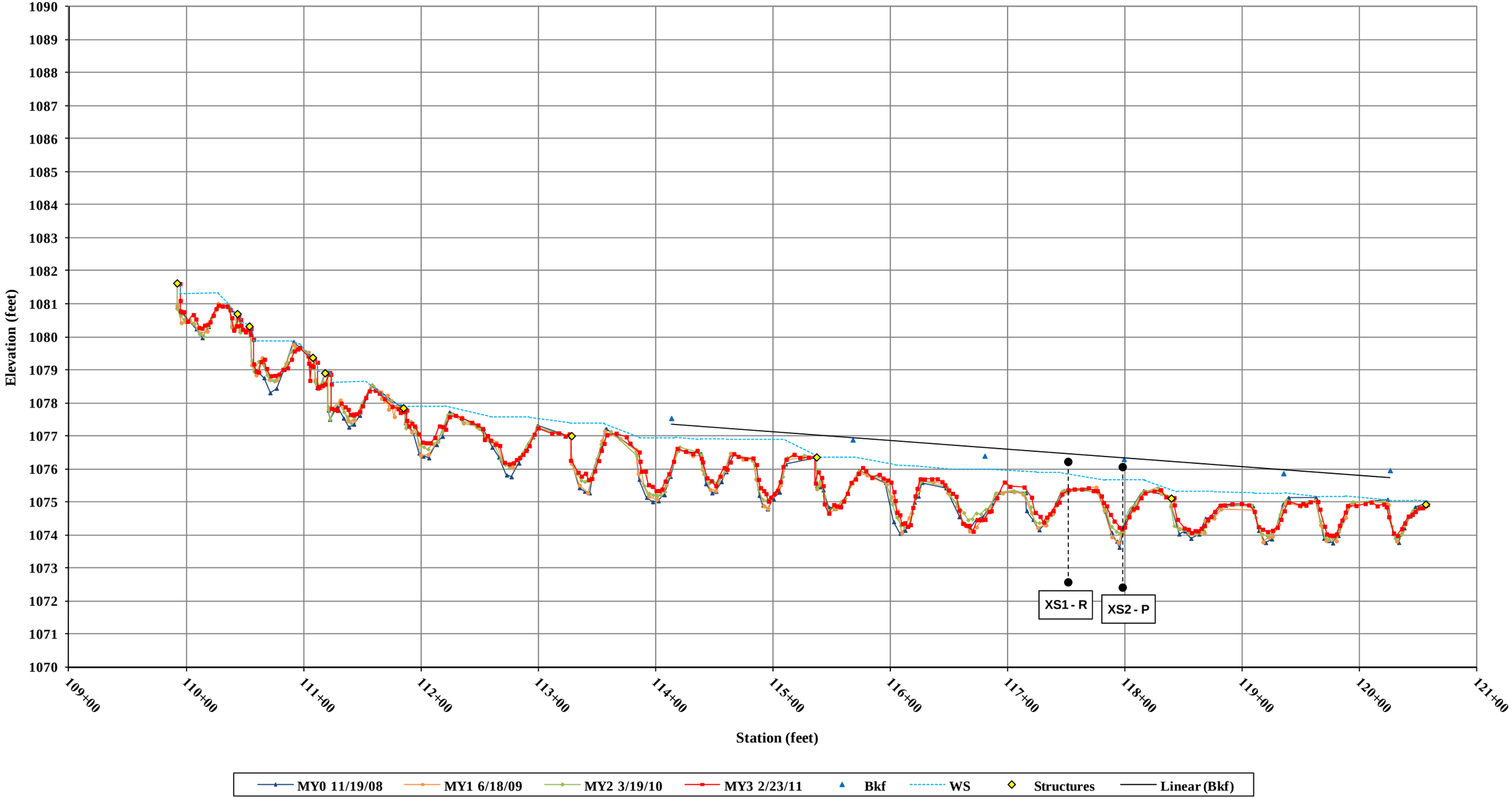
Sheet: 5 of 5 Date: November, 2011	Current Condition Plan View Final YEAR 3 Monitoring-2011 UT2 & UT4	**North Muddy Creek** Burke & McDowell Counties, NC	Notes: 1. Coordinate System is State Plane Feet NAD 83 2. Base map information provided by Kimley Horn. Dwg title: ACAD-018336001-BASE3.dwg 3. Aerial photography is McDowell County 2010

APPENDIX B

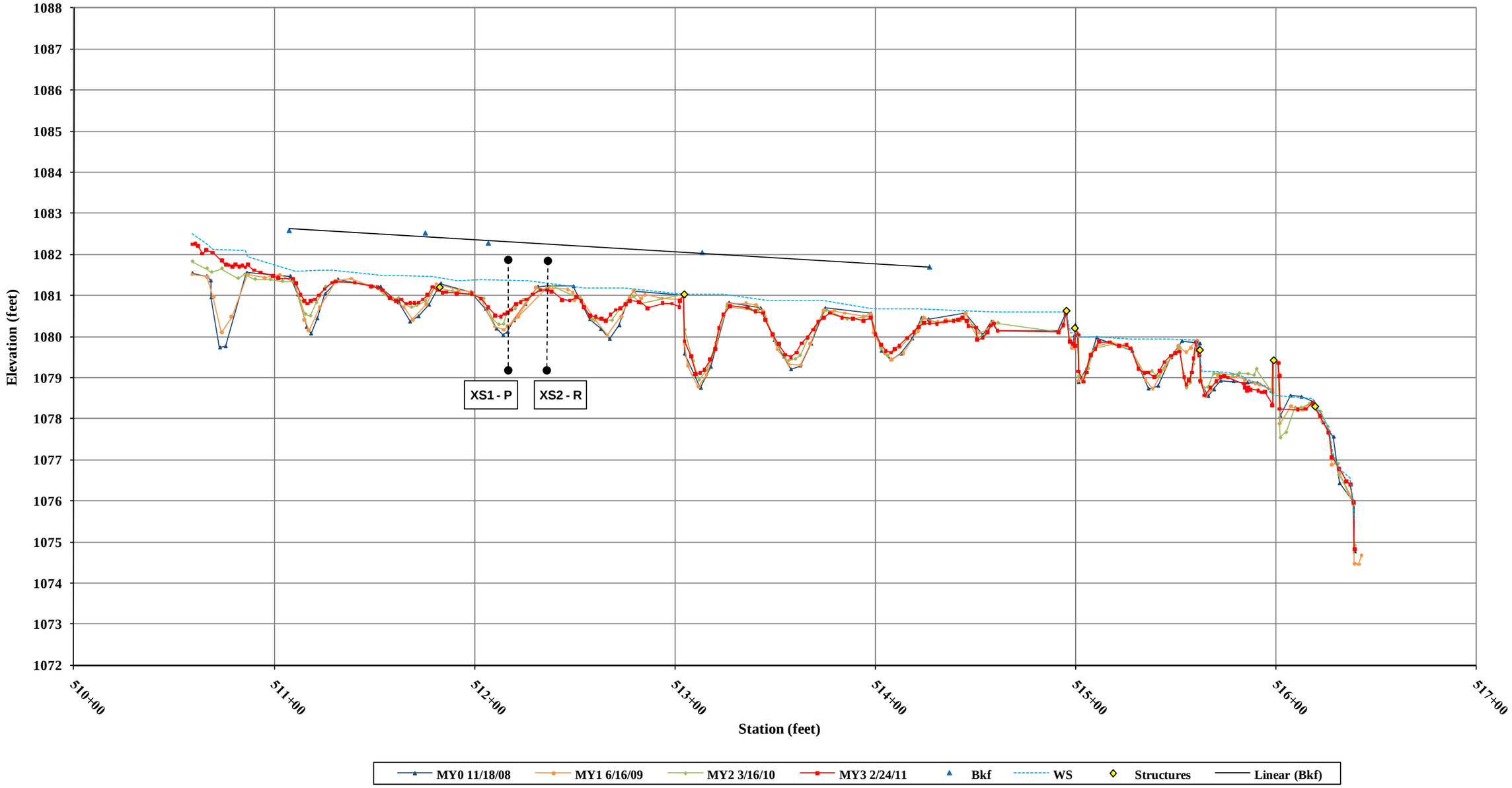
2011 Profile, Cross-Section, and Substrate Data

North Muddy Creek UT1-Upper
Longitudinal Profile

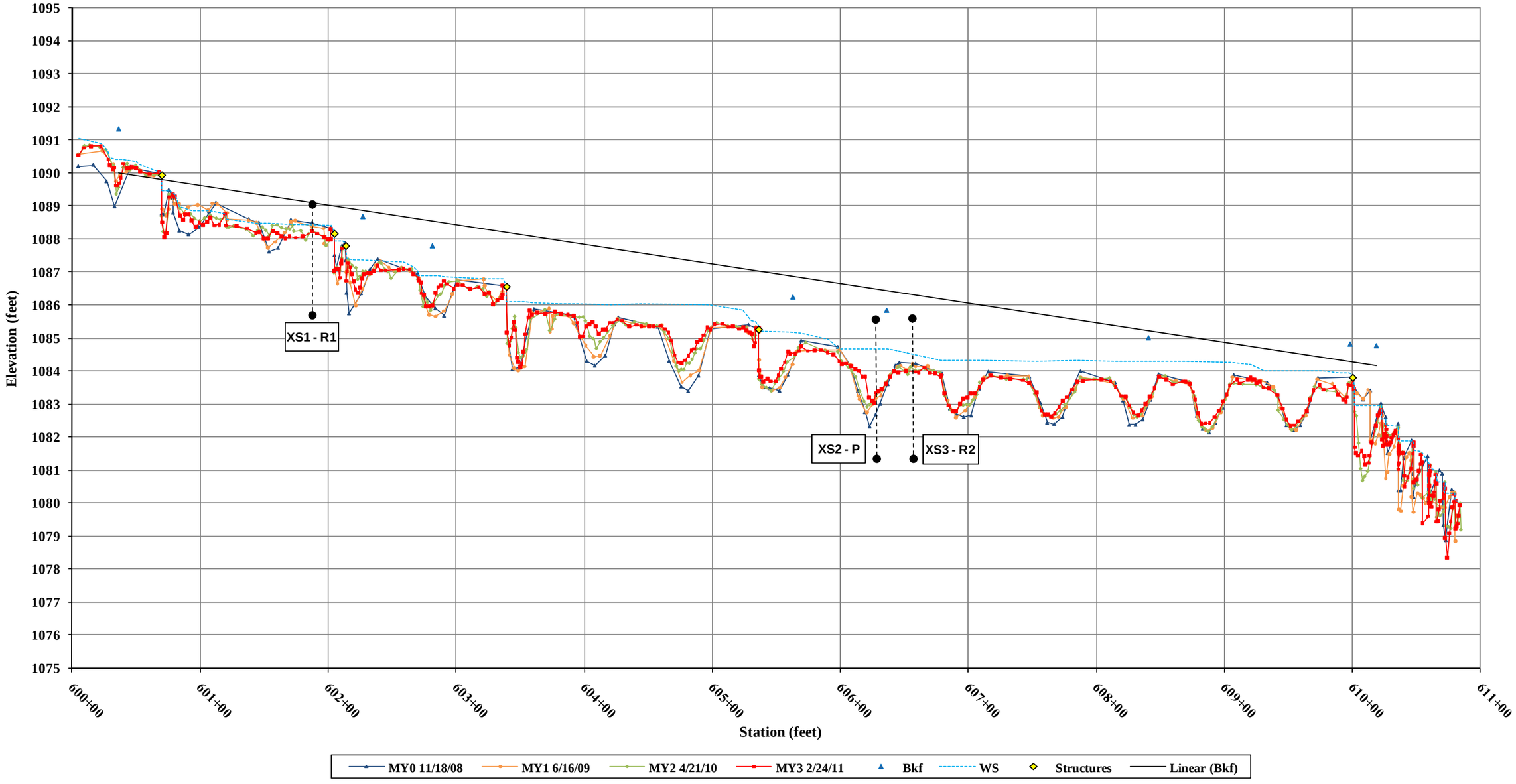
North Muddy Creek UT1-Lower
Longitudinal Profile



North Muddy Creek UT5
Longitudinal Profile



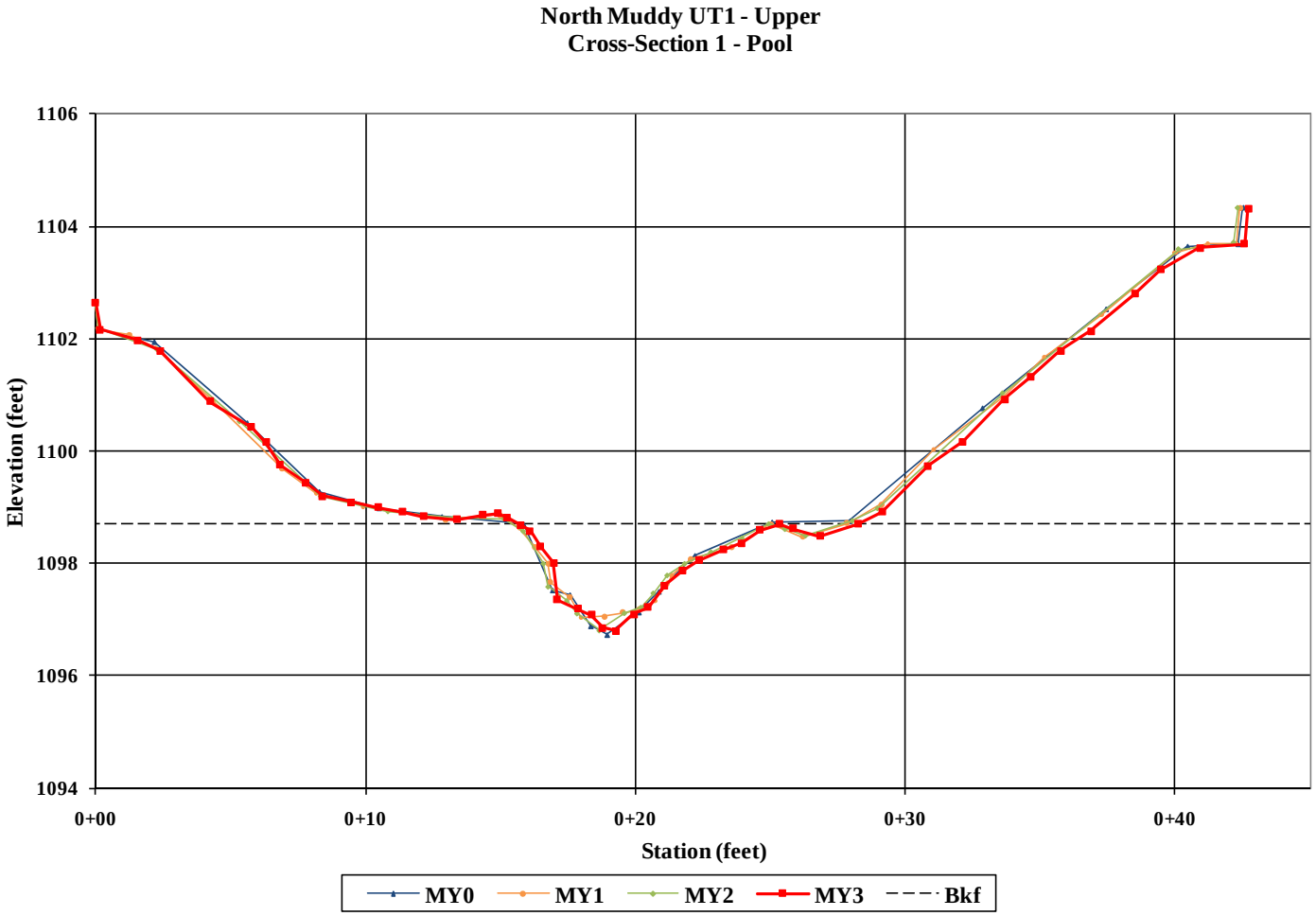
North Muddy Creek UT6
Longitudinal Profile



UT1 Upper – Cross-Section 1 – Pool

Looking at Left Bank

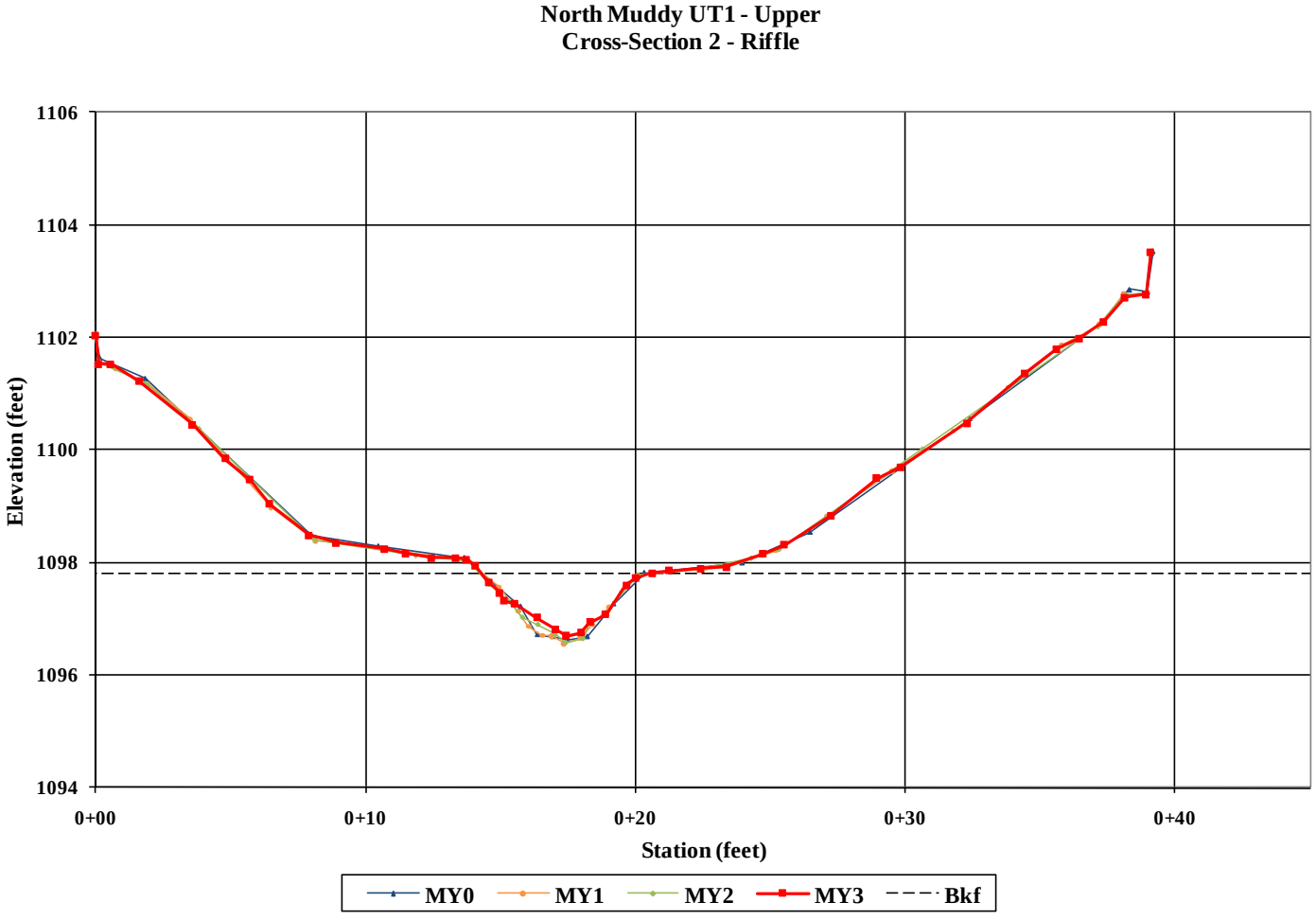
Looking at Right Bank



UT1 Upper – Cross-Section 2 – Riffle

Looking at Left Bank

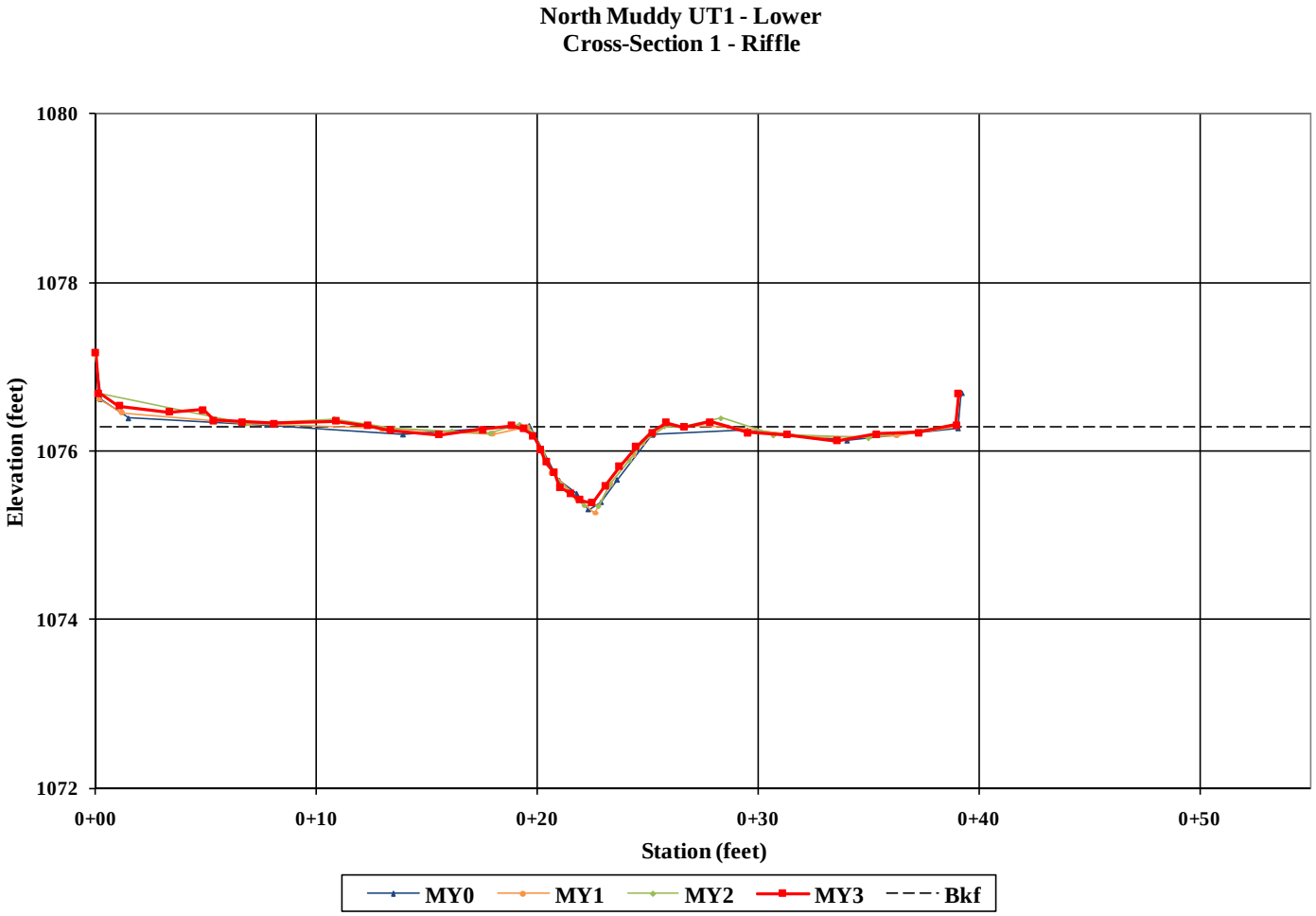
Looking at Right Bank



UT1 Lower – Cross-Section 1 – Riffle

Looking at Left Bank

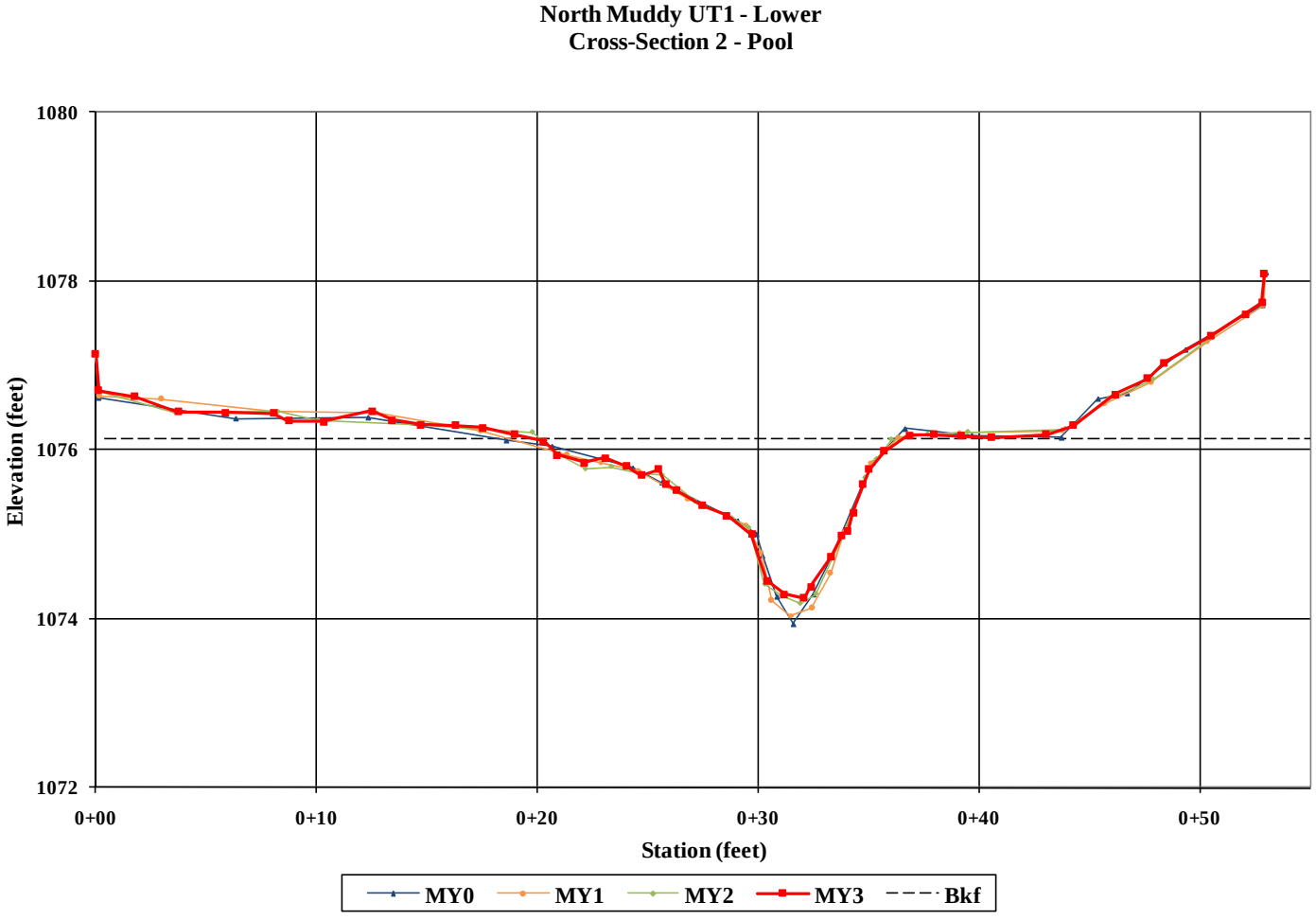
Looking at Right Bank



UT1 Lower – Cross-Section 2 – Pool

Looking at Left Bank

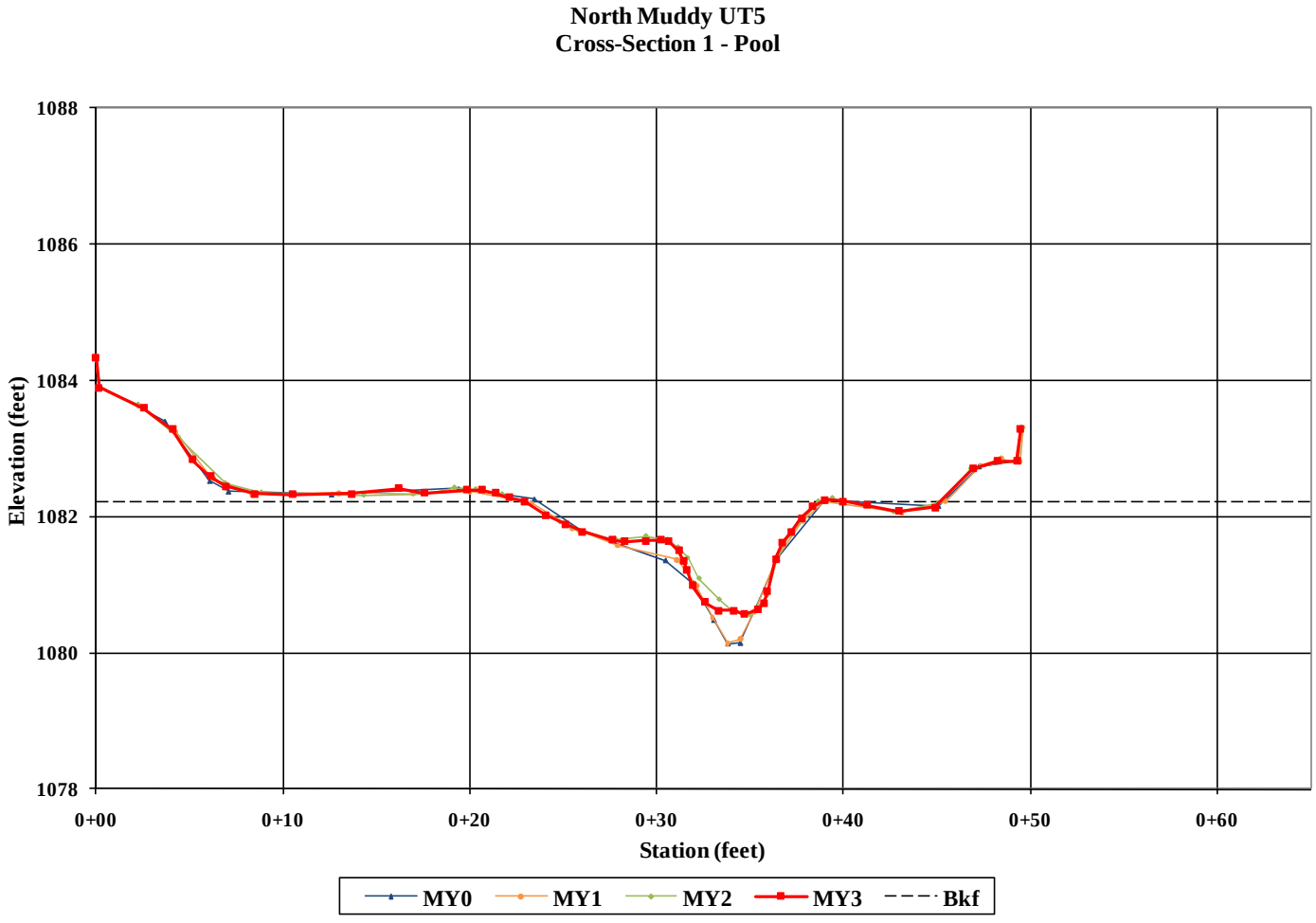
Looking at Right Bank



UT5 – Cross-Section 1 – Pool

Looking at Left Bank

Looking at Right Bank

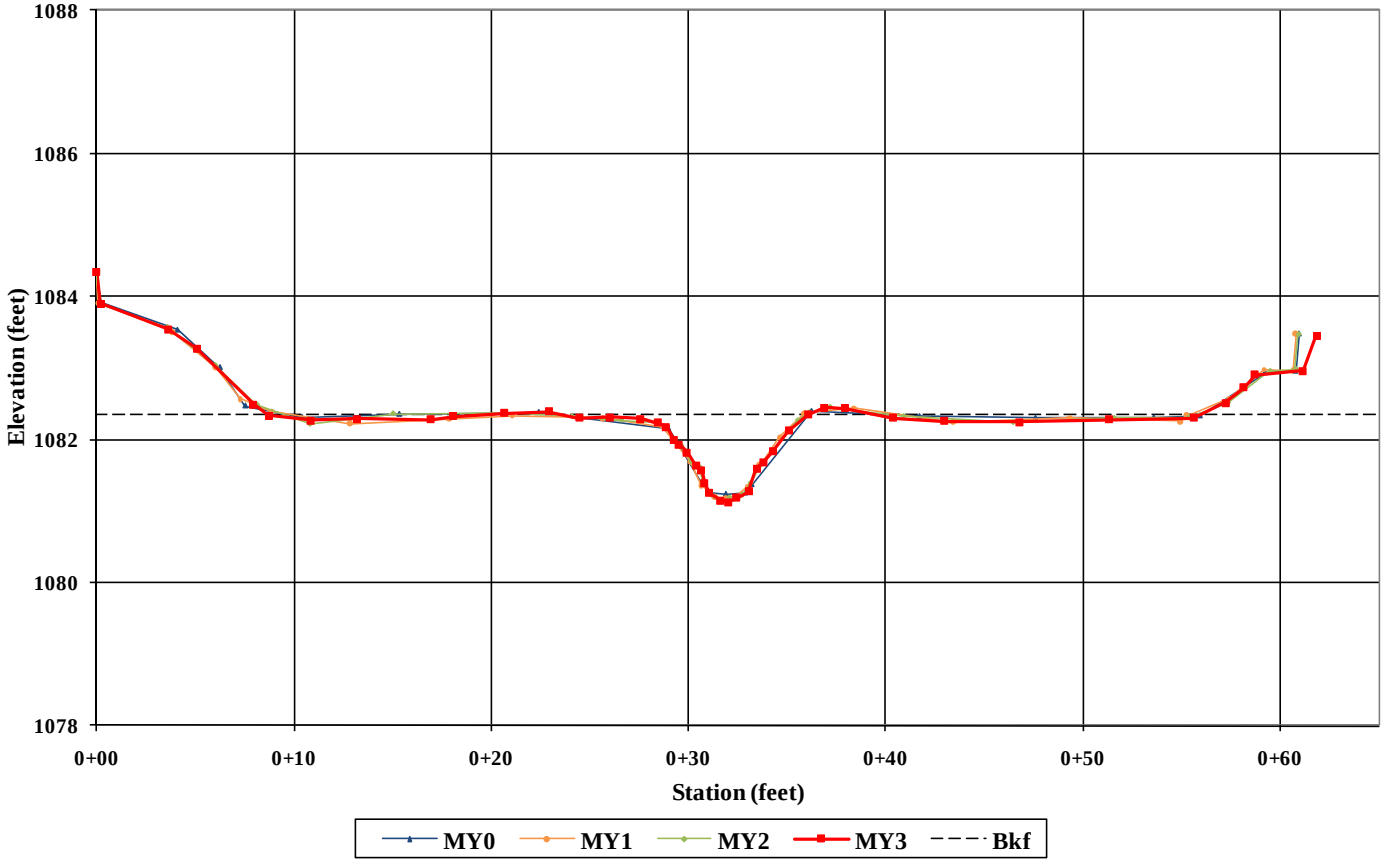


UT5 – Cross-Section 2 – Riffle

Looking at Left Bank

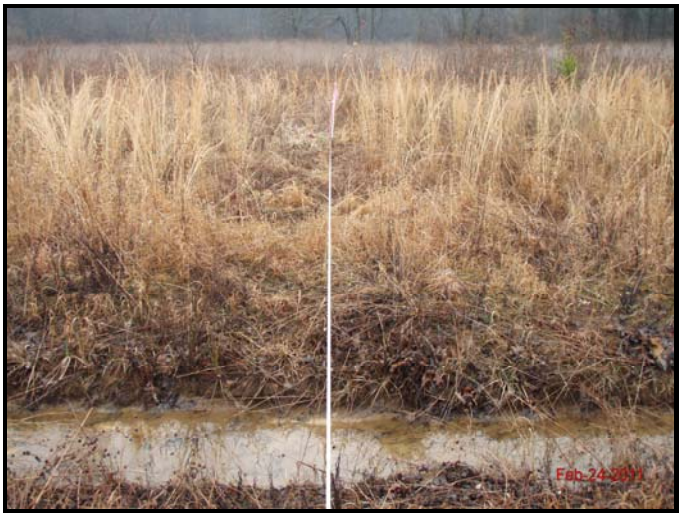
Looking at Right Bank

North Muddy UT5
Cross-Section 2 - Riffle

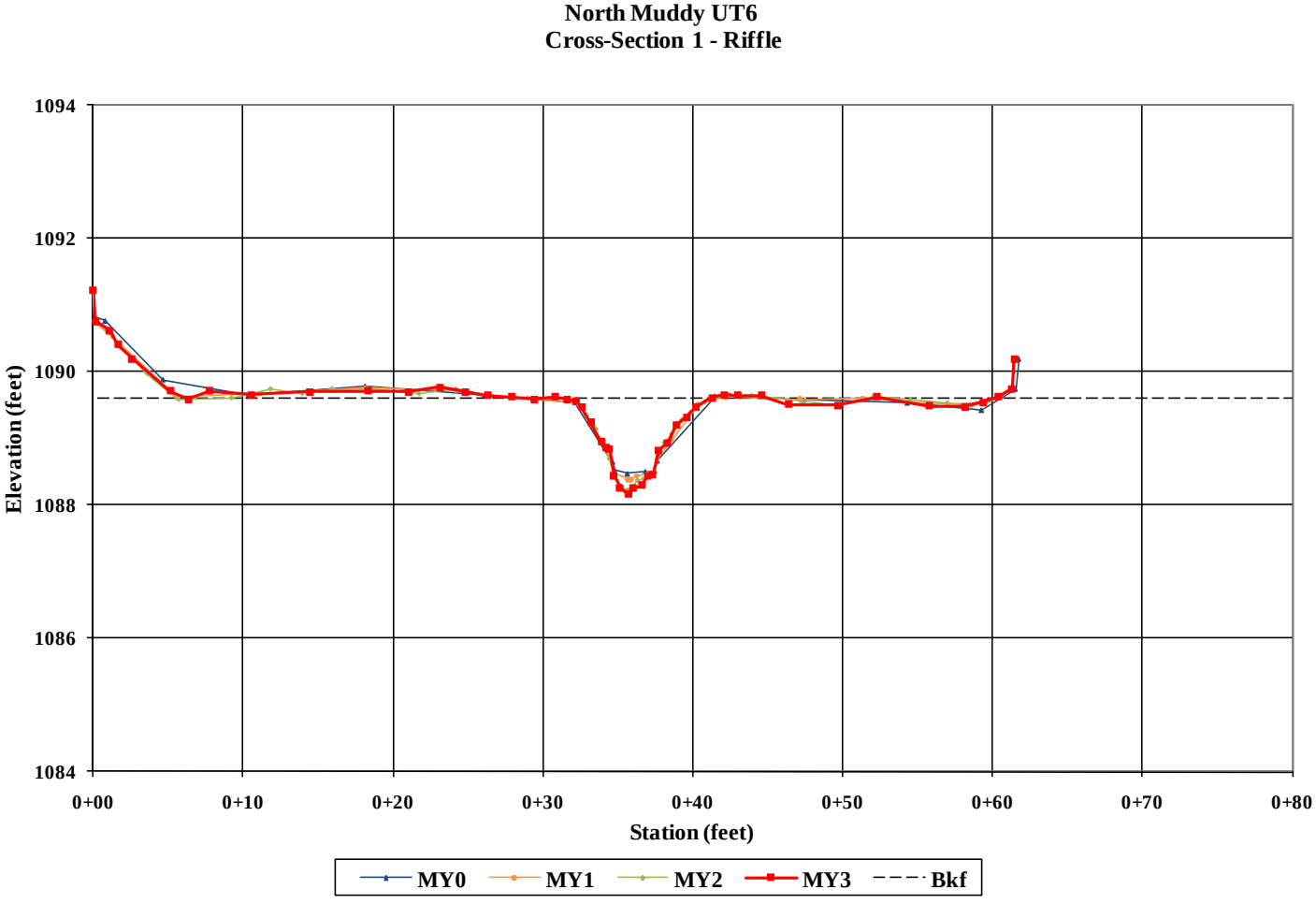


UT6 – Cross-Section 1 – Riffle

Looking at Left Bank



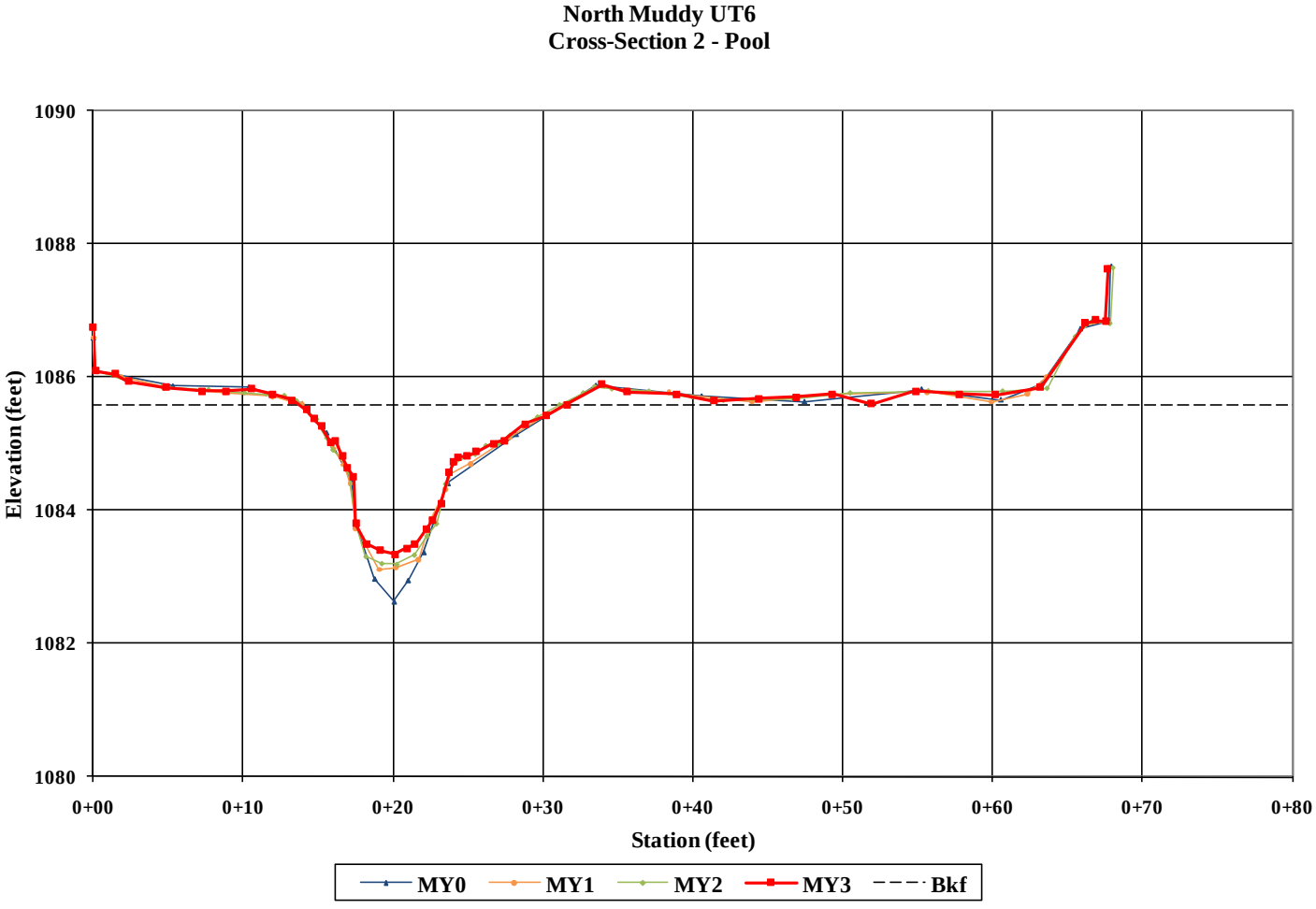
Looking at Right Bank



UT6 – Cross-Section 2 – Pool

Looking at Left Bank

Looking at Right Bank

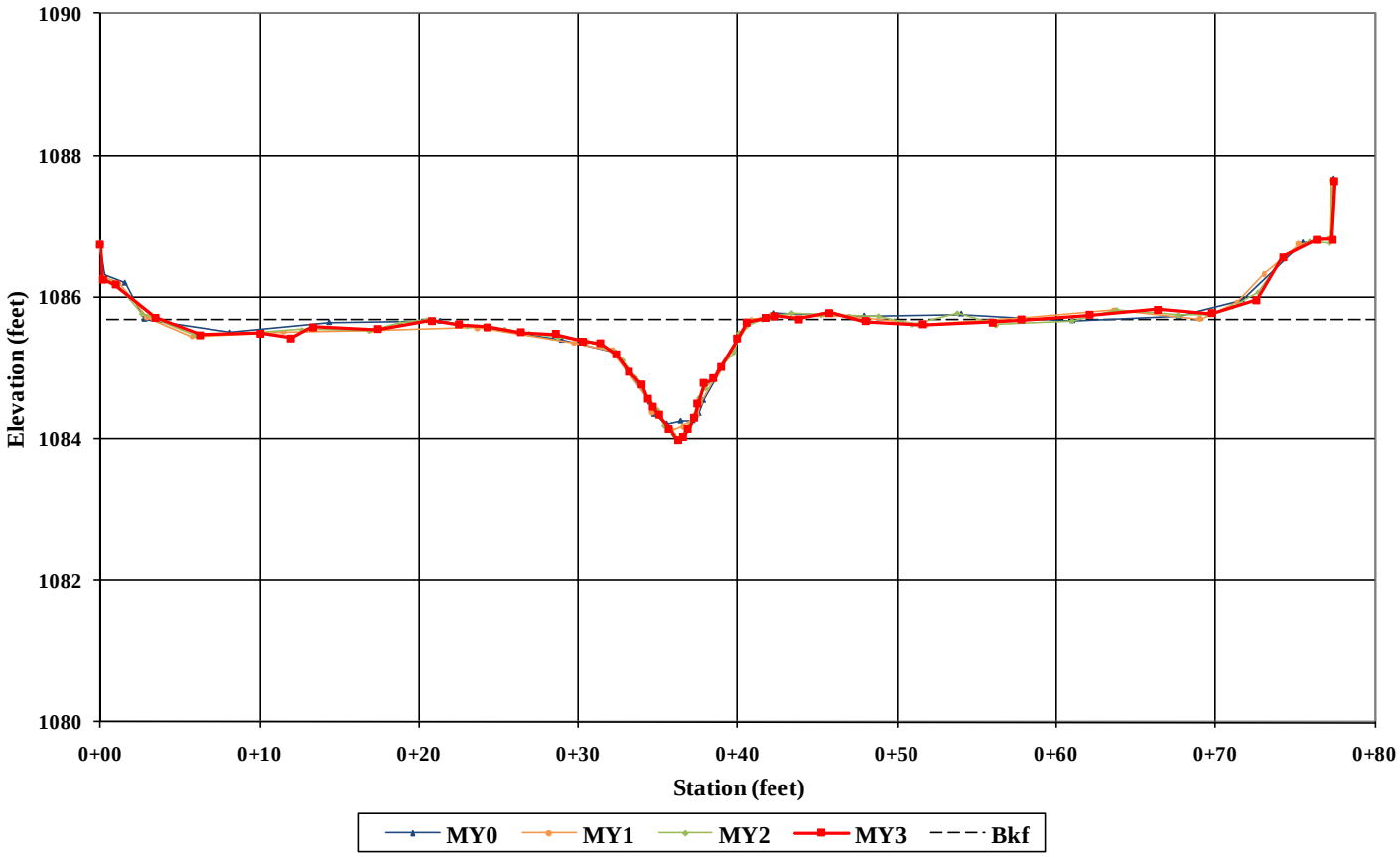


UT6 – Cross-Section 3 – Riffle

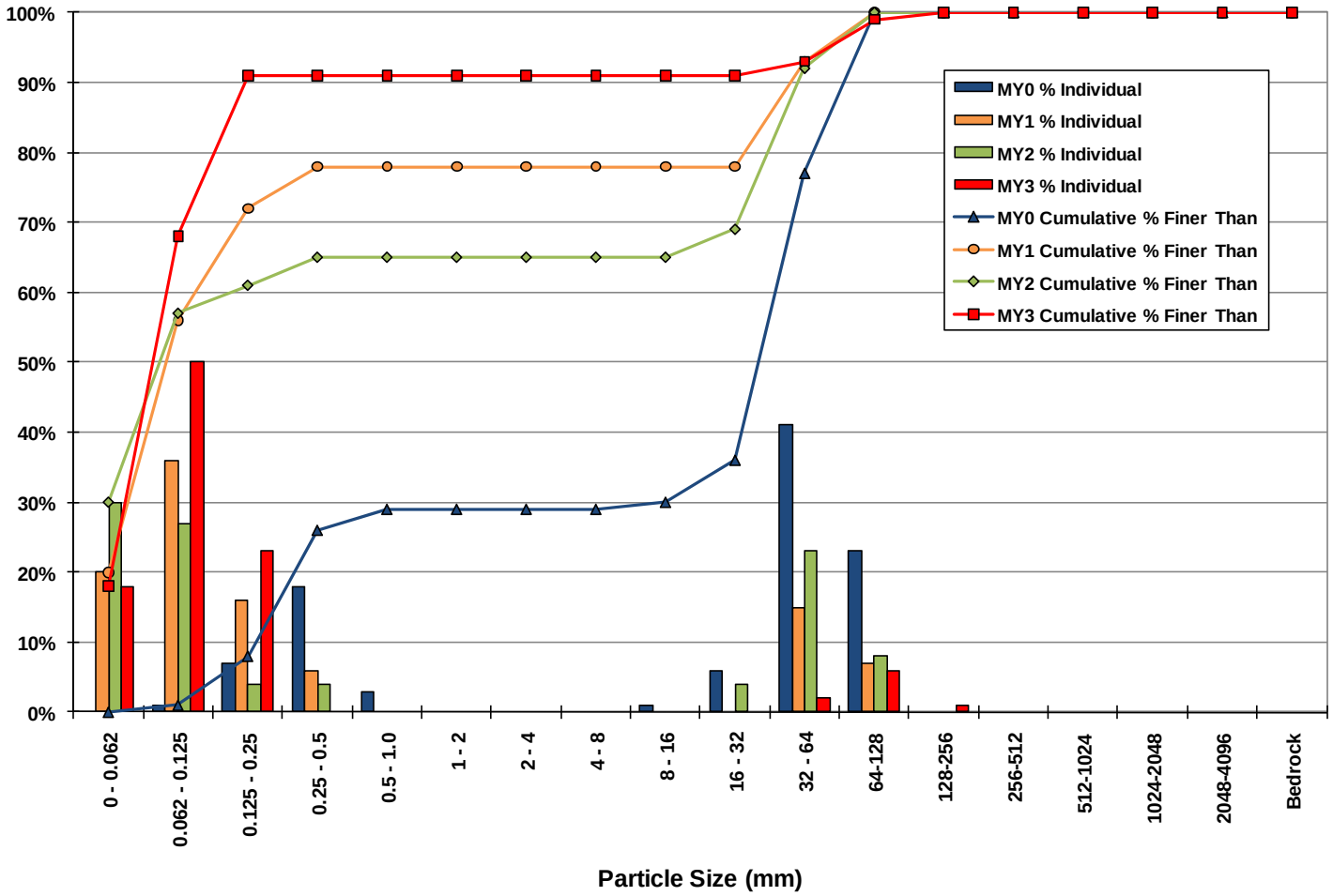
Looking at Left Bank

Looking at Right Bank

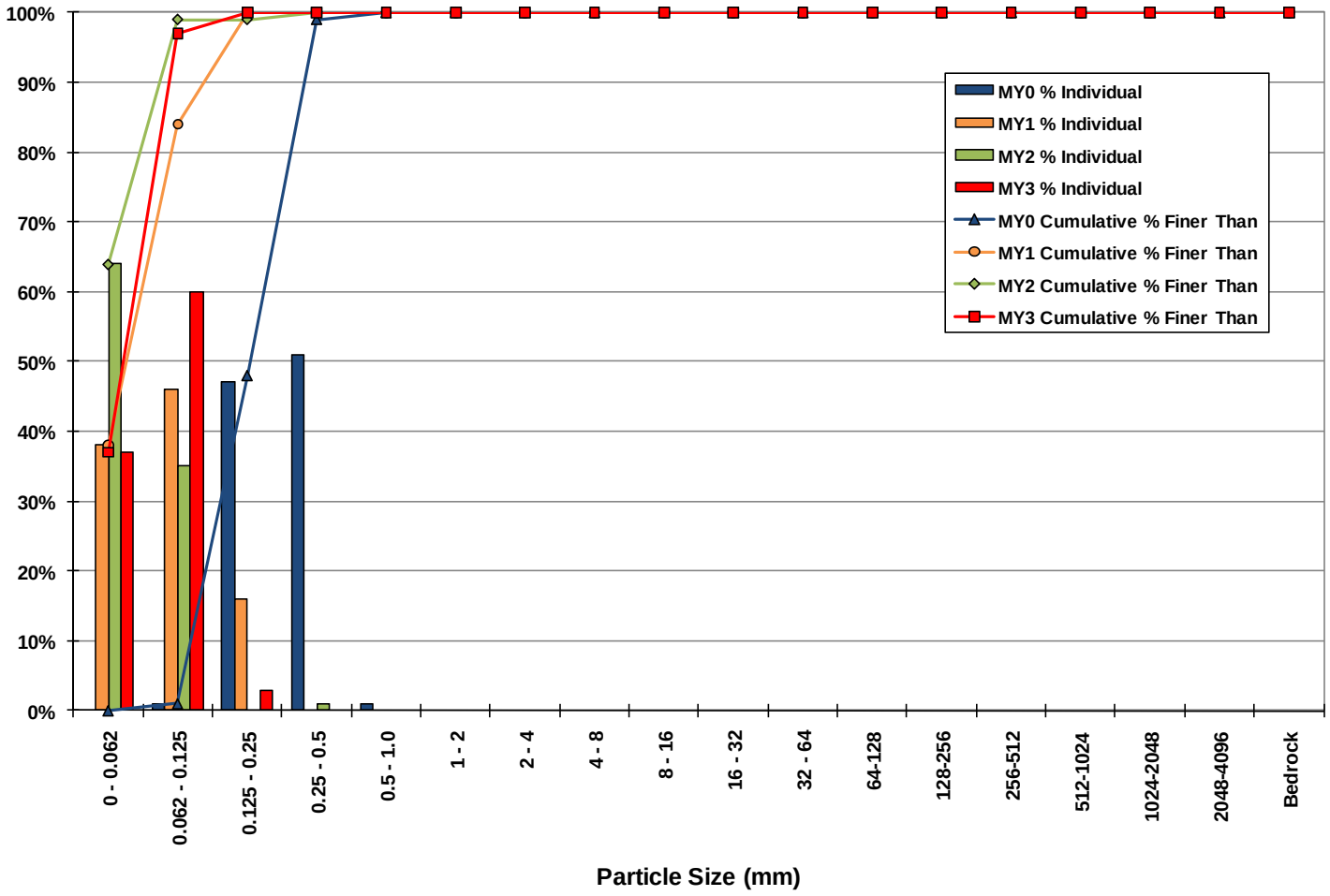
North Muddy UT6
Cross-Section 3 - Riffle



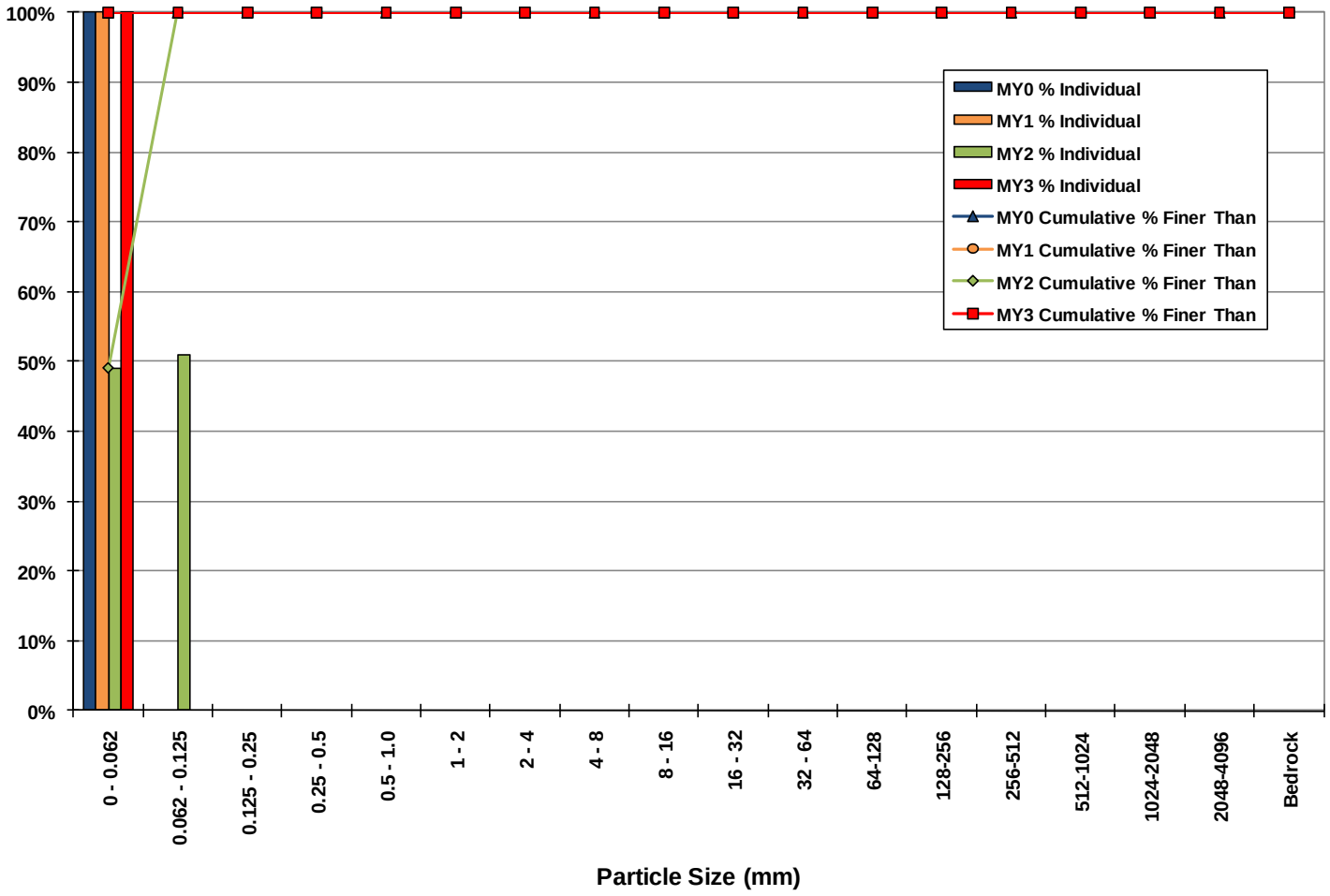
UT1 Upper – Cross Section 1 – Pool
Pebble Count



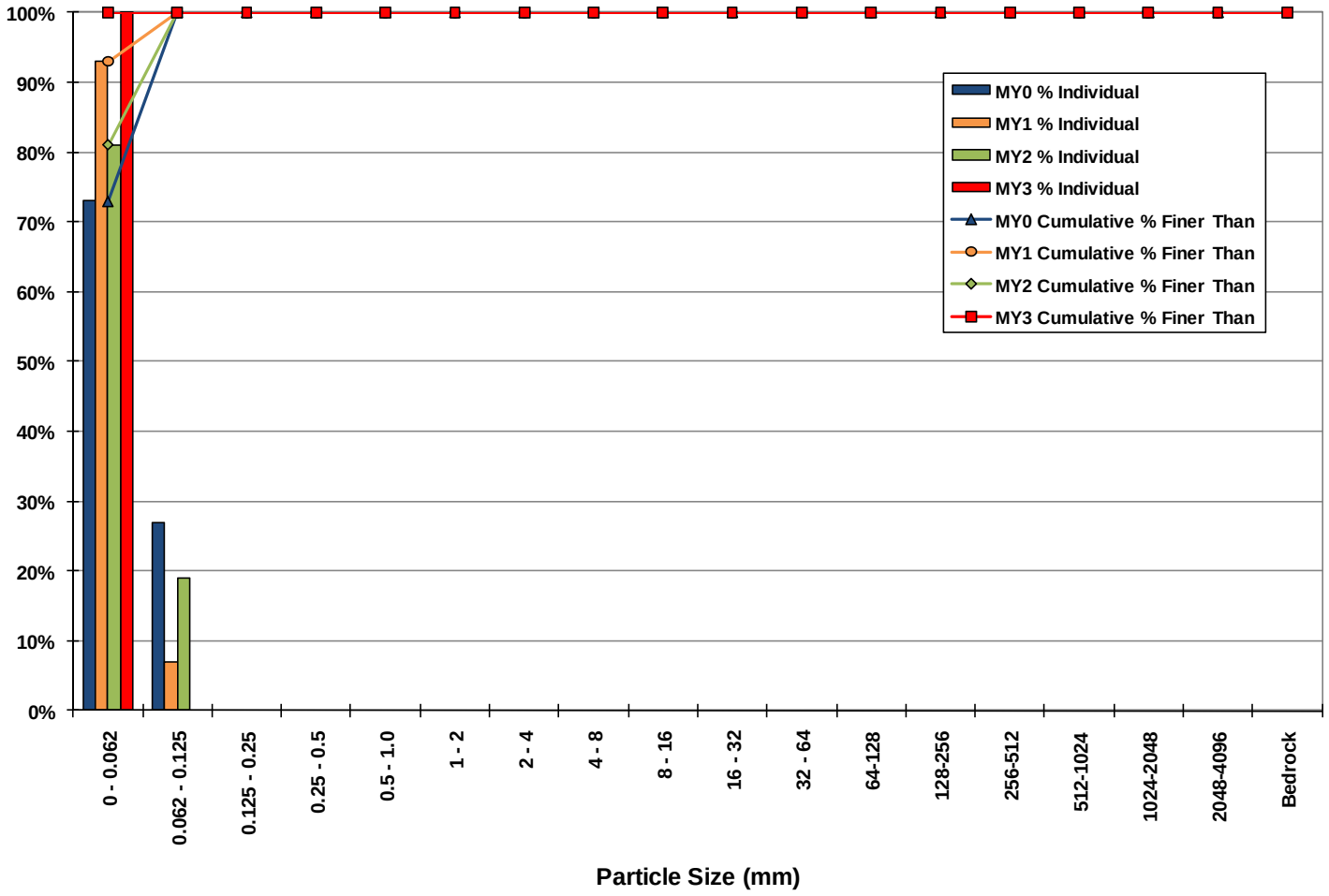
UT1 Upper – Cross Section 2 – Riffle
Pebble Count



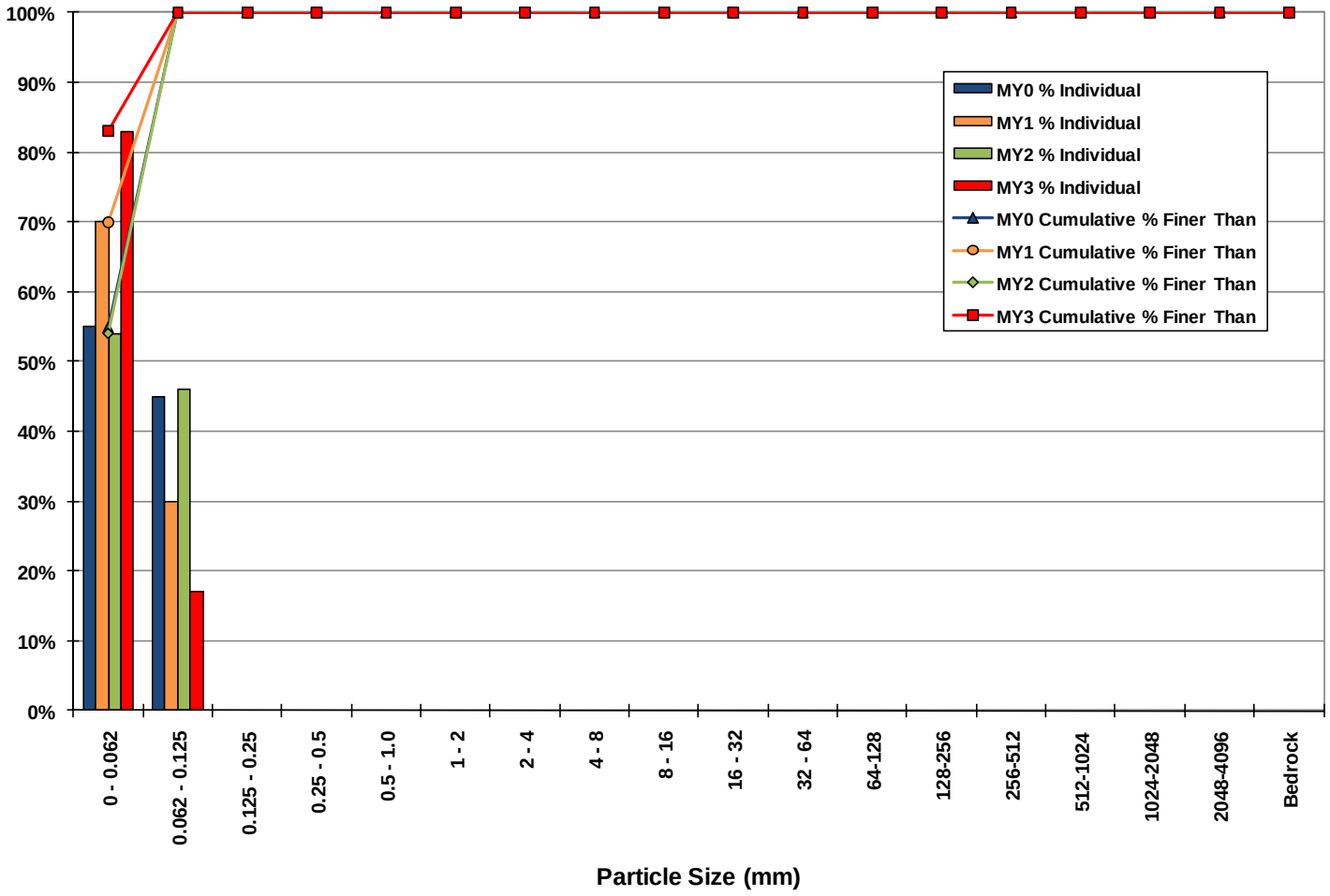
UT1 Lower – Cross Section 1 – Riffle
Pebble Count



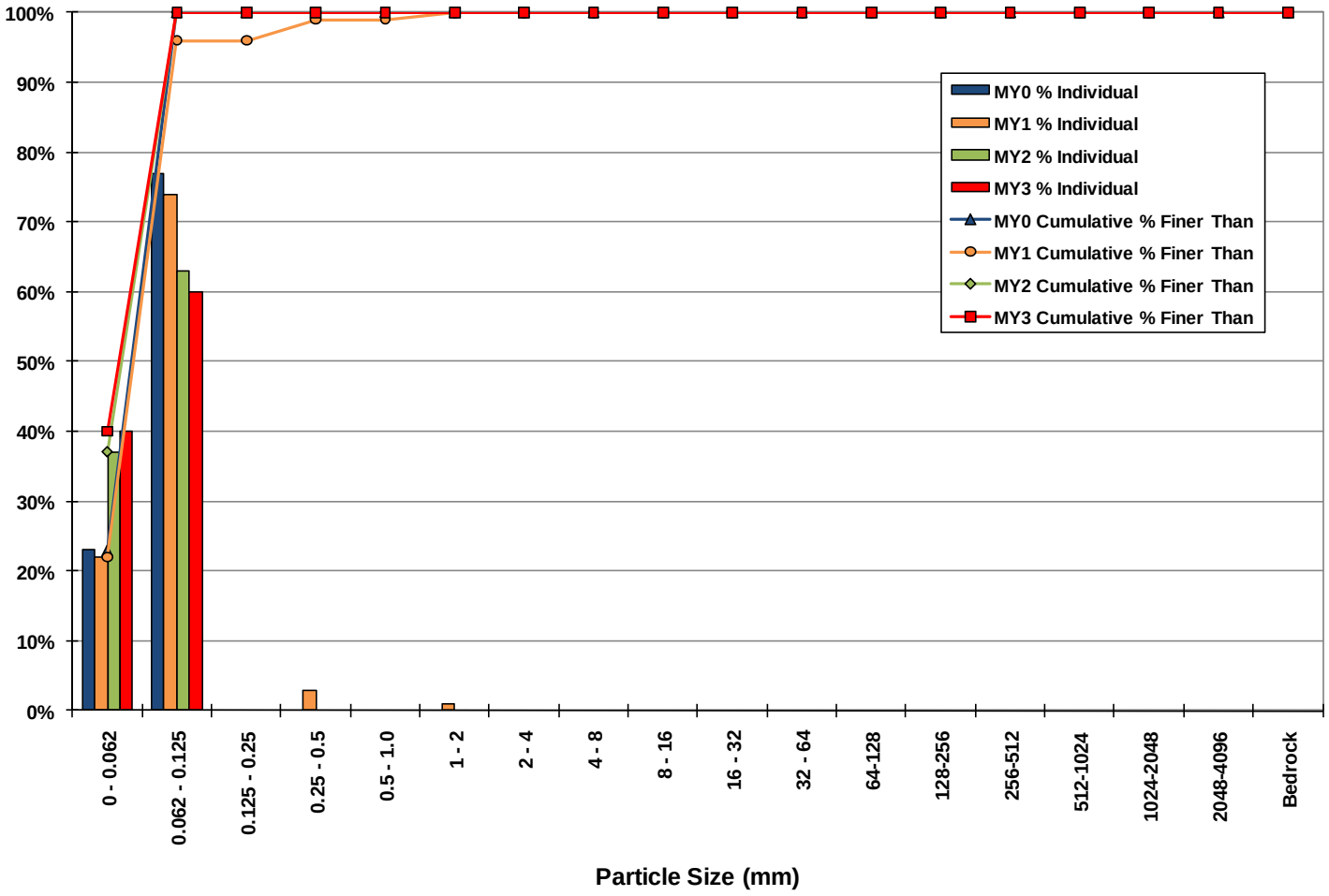
UT1 Lower – Cross Section 2 – Pool
Pebble Count



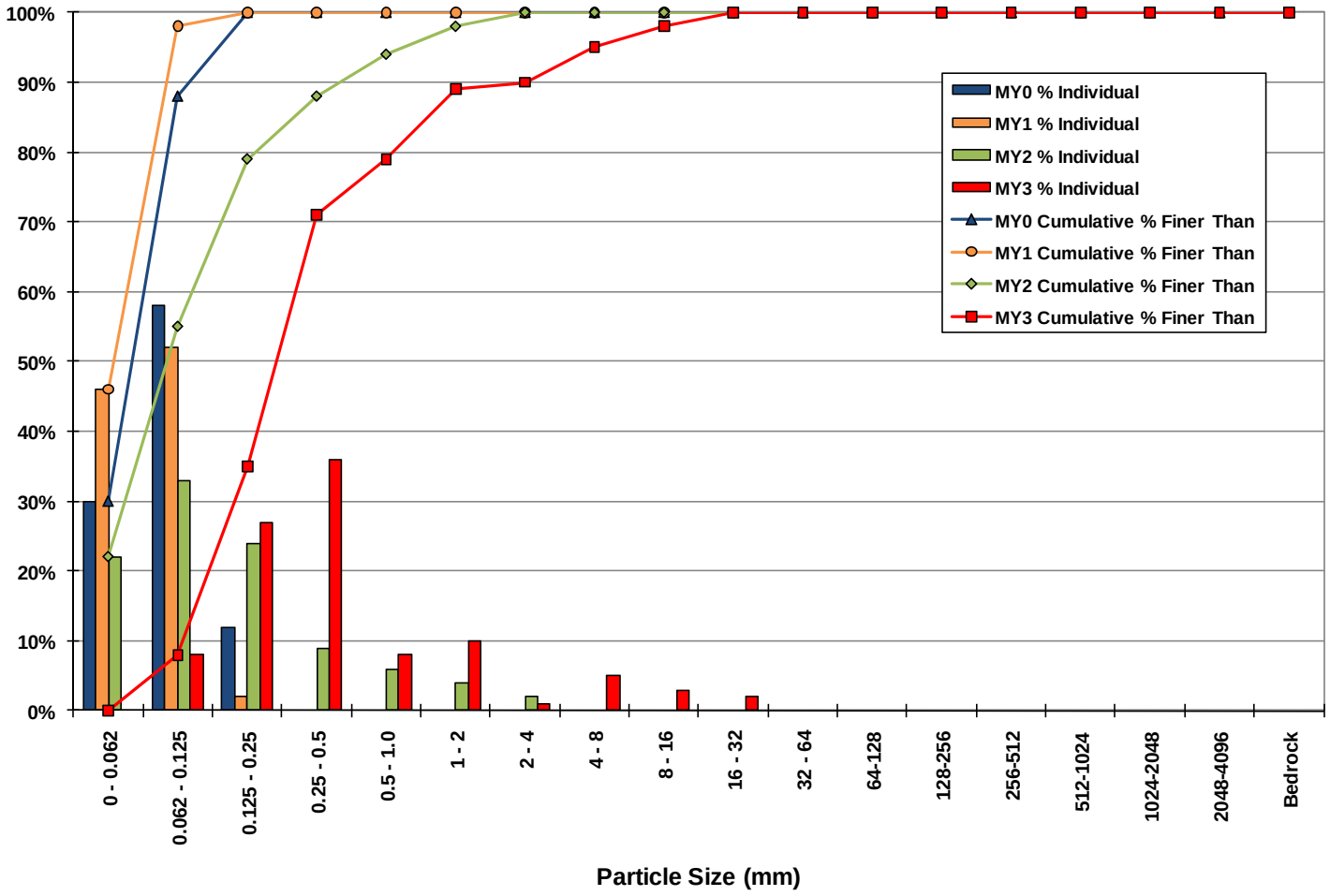
UT5 – Cross Section 1 – Pool
Pebble Count



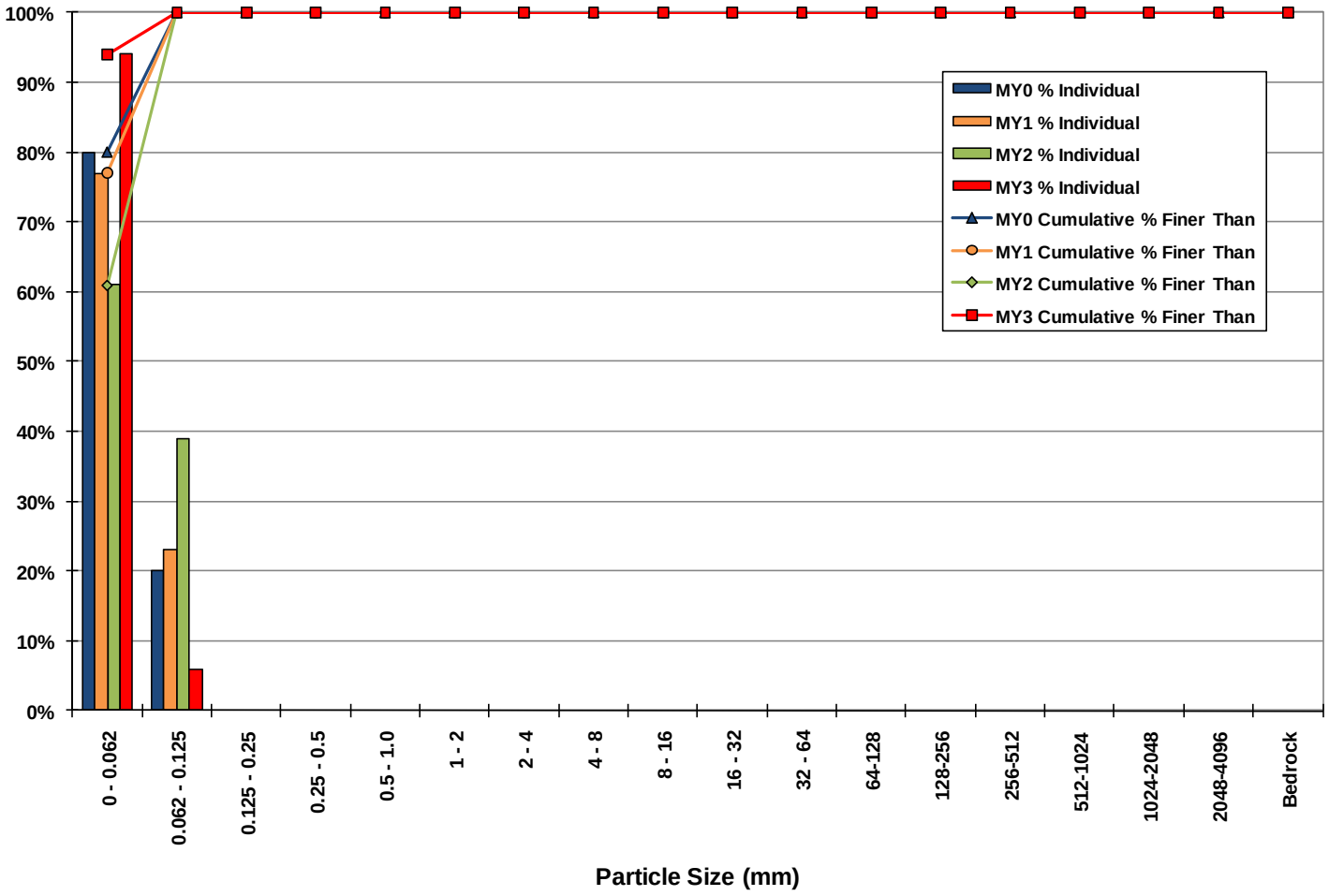
UT5 – Cross Section 2 – Riffle
Pebble Count



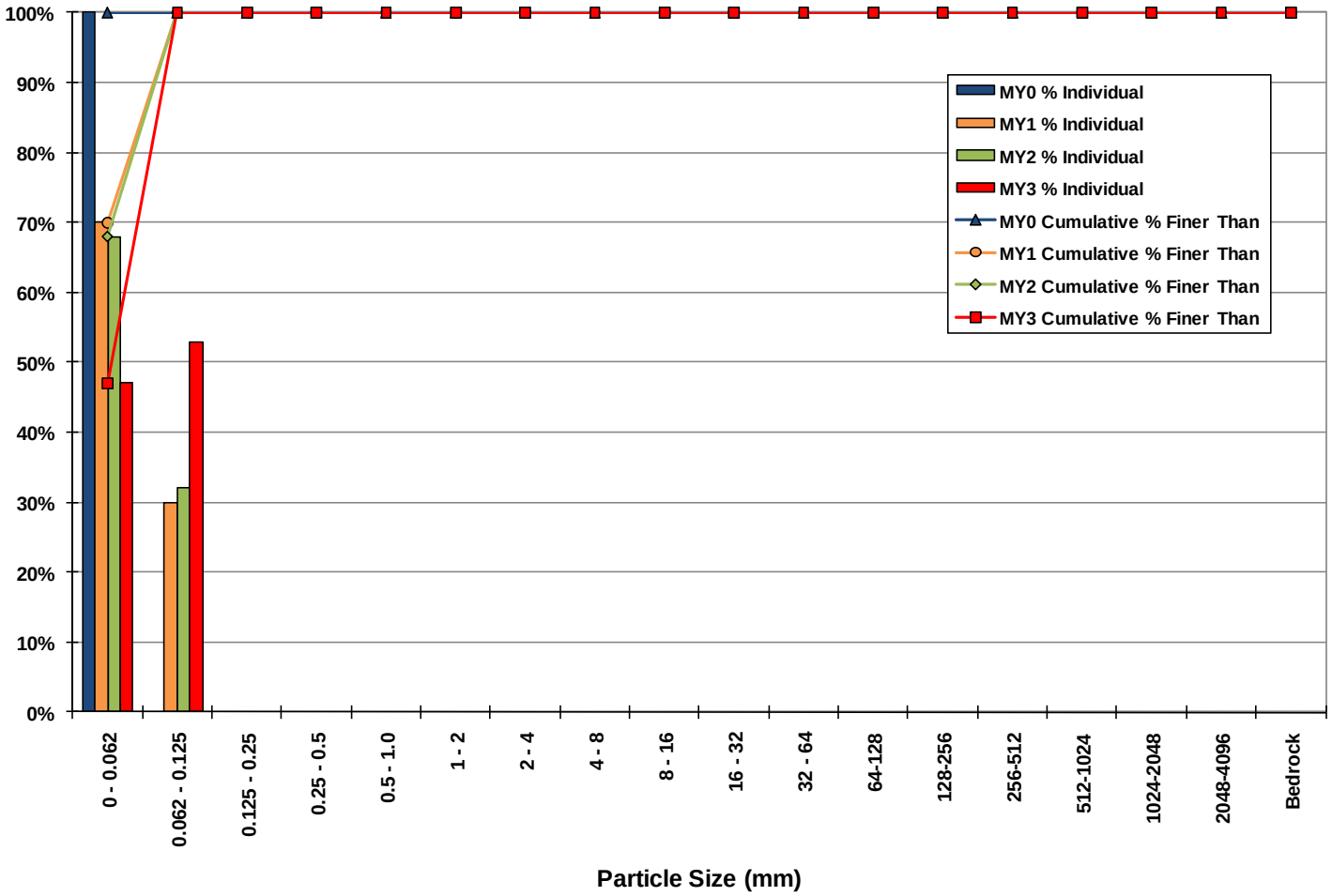
UT6 – Cross Section 1 – Riffle
Pebble Count



UT6 – Cross Section 2 – Pool
Pebble Count



UT6 – Cross Section 3 – Riffle
Pebble Count



APPENDIX C

2011 Morphologic Monitoring Parameters

Unnamed Tributary 1 – Upper Reach												
Parameter	**Cross Section 1 Pool**						**Cross Section 2 Riffle**					
Dimension	Base	MY1	MY2	MY3	MY4	MY5	Base	MY1	MY2	MY3	MY4	MY5
BF Width (ft)	9.2	9.3	9.5	9.6			6.0	5.8	5.8	5.6		
Floodprone Width (ft)	23.4	24.1	23.7	23.8			21.0	21.5	20.5	20.3		
BF Cross Sectional Area (ft^2)	9.0	8.7	8.8	9.0			4.2	4.2	3.9	3.5		
BF Mean Depth (ft)	1.0	0.9	0.9	0.9			0.7	0.7	0.7	0.6		
BF Max Depth (ft)	2.0	1.7	1.9	1.9			1.2	1.2	1.2	1.1		
Width/Depth Ratio	9.3	9.9	10.3	10.3			8.6	8.0	8.5	8.9		
Entrenchment Ratio	2.5	2.6	2.5	2.5			3.5	3.7	3.6	3.6		
Wetted Perimeter (ft)	10.3	10.2	10.5	10.8			6.6	6.4	6.3	6.1		
Hydraulic Radius (ft)	0.9	0.9	0.8	0.8			0.6	0.7	0.6	0.6		

Unnamed Tributary 1 – Lower Reach												
Parameter	**Cross Section 1 Riffle**						**Cross Section 2 Pool**					
Dimension	Base	MY1	MY2	MY3	MY4	MY5	Base	MY1	MY2	MY3	MY4	MY5
BF Width (ft)	5.5	6.2	6.4	6.5			15.7	15.0	16.7	17.2		
Floodprone Width (ft)	>50.0	>50.0	>50.0	>50.0			>50.0	>50.0	>50.0	>50.0		
BF Cross Sectional Area (ft^2)	3.1	3.1	3.1	3.0			13.2	13.2	13.3	12.9		
BF Mean Depth (ft)	0.6	0.5	0.5	0.5			0.8	0.9	0.8	0.8		
BF Max Depth (ft)	1.0	1.0	0.9	0.9			2.2	2.1	2.0	1.9		
Width/Depth Ratio	9.9	12.2	12.9	14.3			18.7	17.0	21.0	22.8		
Entrenchment Ration	>9.0	>8.1	>7.9	>7.6			>3.2	>3.3	>3.0	>2.9		
Wetted Perimeter (ft)	5.9	6.6	6.7	6.9			16.6	15.9	17.6	18.0		
Hydraulic Radius (ft)	0.5	0.5	0.5	0.4			0.8	0.8	0.8	0.7		

Unnamed Tributary 5												
Parameter	**Cross Section 1 Pool**						**Cross Section 2 Riffle**					
Dimension	Base	MY1	MY2	MY3	MY4	MY5	Base	MY1	MY2	MY3	MY4	MY5
BF Width (ft)	15.4	15.7	15.6	15.9			7.2	7.2	7.6	8.5		
Floodprone Width (ft)	>50.0	>50.0	>50.0	>50.0			>60.0	>60.0	>60.0	>60.0		
BF Cross Sectional Area (ft^2)	13.4	13.1	11.2	11.8			5.4	5.0	5.0	5.1		
BF Mean Depth (ft)	0.9	0.8	0.7	0.7			0.7	0.7	0.7	0.6		
BF Max Depth (ft)	2.1	2.1	1.7	1.7			1.2	1.2	1.2	1.2		
Width/Depth Ratio	17.6	18.8	21.7	21.4			9.7	10.3	11.6	14.0		
Entrenchment Ratio	>3.3	>3.2	>3.2	>3.1			>8.3	>8.4	>7.9	>7.1		
Wetted Perimeter (ft)	16.2	16.5	16.3	16.6			7.6	7.6	8.1	8.9		
Hydraulic Radius (ft)	0.8	0.8	0.7	0.7			0.7	0.7	0.6	0.6		

Unnamed Tributary 6																		
Parameter	**Cross Section 1 Riffle**						**Cross Section 2 Pool**						**Cross Section 3 Riffle**					
Dimension	Base	MY1	MY2	MY3	MY4	MY5	Base	MY1	MY2	MY3	MY4	MY5	Base	MY1	MY2	MY3	MY4	MY5
BF Width (ft)	9.3	9.8	9.8	10.5			17.6	17.6	17.3	17.9			11.6	11.1	11.7	11.2		
Floodprone Width (ft)	>100	>100	>100	>100			>100	>100	>100	>100			>100	>100	>100	>100		
BF Cross Sectional Area (ft^2)	6.5	6.1	6.3	6.3			20.9	19.5	18.8	17.8			5.6	9.2	9.0	8.9		
BF Mean Depth (ft)	0.7	0.6	0.6	0.6			1.2	1.1	1.1	1.0			0.7	0.8	0.8	0.8		
BF Max Depth (ft)	1.2	1.2	1.4	1.5			3.0	2.5	2.4	2.2			1.4	1.6	1.7	1.7		
Width/Depth Ratio	13.3	15.9	15.3	17.3			14.8	15.9	15.9	18.1			15.7	13.5	15.1	14.1		
Entrenchment Ratio	>10.7	>10.2	>10.2	>9.6			>5.7	>5.7	>5.8	>5.6			>8.6	>9.0	>8.6	>8.9		
Wetted Perimeter (ft)	9.7	10.3	10.4	11.1			19.0	18.8	18.5	19.1			12.1	11.6	12.2	11.8		
Hydraulic Radius (ft)	0.7	0.6	0.6	0.6			1.1	1.0	1.0	0.9			0.7	0.8	0.7	0.8		

Unnamed Tributary 1 – Upper Reach																		
Parameter	**Baseline**			**MY1**			**MY2**			**MY3**			**MY4**			**MY5**		
Pattern	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med
Channel Beltwidth (ft)	18.2	31.2	21.4	18.2	31.2	21.4	18.2	31.2	21.4	18.2	31.2	21.4						
Radius of Curvature (ft)	27.8	89.4	36.9	27.8	89.4	36.9	27.8	89.4	36.9	27.8	89.4	36.9						
Meander Wavelength (ft)	30	54	38	30	54	38	30	54	38	30	54	38						
Meander Width Ratio	3.57			3.69			3.69			3.82								
Profile																		
Riffle Length (ft)	7.82	33.04	17.06	4.68	20.84	10.08	7.37	43.77	19.01	7.66	43.23	16.9						
Riffle Slope (ft/ft)	0.0134	0.0735	0.0317	0.0146	0.1044	0.0290	0.0176	0.1060	0.0331	0.0186	0.1002	0.0276						
Pool Length (ft)	3.36	32.88	9.54	3.63	18.90	8.94	4.46	31.87	8.19	3.65	31.86	8.02						
Pool Spacing (ft)	8.98	44.60	18.26	8.16	34.83	16.33	10.03	60.52	29.81	6.96	60.84	22.57						
Additional Reach Parameters																		
Valley Length (ft)	369			369			369			369								
Channel Length (ft)	386			388			389			392								
Sinuosity	1.05			1.05			1.05			1.06								
Water Surface Slope (ft/ft)	0.0322			0.0328			0.0332			0.0328								
BF Slope (ft/ft)	0.0341			0.0340			0.0319			0.0326								
Rosgen Classification	B/C5			B/C6			B/C6			B/C5								

Unnamed Tributary 1 – Lower Reach																		
Parameter	**Baseline**			**MY1**			**MY2**			**MY3**			**MY4**			**MY5**		
Pattern	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med
Channel Beltwidth (ft)	28.5	82.1	55.7	28.5	82.1	55.7	28.5	82.1	55.7	28.5	82.1	55.7						
Radius of Curvature (ft)	18.2	26.3	21.9	18.2	26.3	21.9	18.2	26.3	21.9	18.2	26.3	21.9						
Meander Wavelength (ft)	86	113	101	86	113	101	86	113	101	86	113	101						
Meander Width Ratio	10.13			8.98			8.70			8.57								
Profile																		
Riffle Length (ft)	15.35	31.11	22.27	9.78	36.29	22.37	6.77	33.11	23.29	10.67	31.44	25.36						
Riffle Slope (ft/ft)	0.0000	0.0350	0.0053	0.0003	0.0241	0.0050	0.0004	0.0311	0.0070	0.0002	0.0365	0.0061						
Pool Length (ft)	8.19	41.82	31.80	4.17	36.32	25.79	6.40	40.79	26.21	5.83	40.07	26.10						
Pool Spacing (ft)	27.09	70.09	57.33	28.99	78.41	58.27	26.48	69.18	56.72	27.39	67.83	55.71						
Additional Reach Parameters																		
Valley Length (ft)	833			833			833			833								
Channel Length (ft)	1062			1063			1064			1067								
Sinuosity	1.27			1.28			1.28			1.28								
Water Surface Slope (ft/ft)	0.0062			0.0062			0.0060			0.0064								
BF Slope (ft/ft)	0.0067			0.0070			0.0061			0.0061								
Rosgen Classification	C6			C6			C6			C6								

Unnamed Tributary 5																		
Parameter	**Baseline**			**MY1**			**MY2**			**MY3**			**MY4**			**MY5**		
Pattern	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med
Channel Beltwidth (ft)	28.3	55.5	41.4	28.3	55.5	41.4	28.3	55.5	41.4	28.3	55.5	41.4						
Radius of Curvature (ft)	14.7	25.5	22.2	14.7	25.5	22.2	14.7	25.5	22.2	14.7	25.5	22.2						
Meander Wavelength (ft)	77	105	88	77	105	88	77	105	88	77	105	88						
Meander Width Ratio	5.75			5.75			5.45			4.87								
Profile																		
Riffle Length (ft)	13.64	22.74	17.96	16.19	24.41	21.24	9.29	25.23	18.17	7.57	27.26	17.11						
Riffle Slope (ft/ft)	0.0005	0.0105	0.0058	0.0054	0.0129	0.0065	0.0015	0.0129	0.0063	0.0040	0.0078	0.0046						
Pool Length (ft)	7.57	30.38	21.59	5.16	26.03	20.24	6.71	36.46	18.50	6.63	30.05	14.69						
Pool Spacing (ft)	34.70	53.09	45.90	27.25	51.85	45.48	23.39	56.50	44.70	25.35	52.73	47.06						
Additional Reach Parameters																		
Valley Length (ft)	507			507			507			507								
Channel Length (ft)	578			583			581			584								
Sinuosity	1.14			1.15			1.15			1.15								
Water Surface Slope (ft/ft)	0.0027 – 0.0331			0.0031 – 0.0321			0.0034 – 0.0209			0.0043 – 0.0321								
BF Slope (ft/ft)	0.0019			0.0025			0.0023			0.0028								
Rosgen Classification	*C6			*C6			C5			C5								

*Low width/depth ratio C stream type.

Unnamed Tributary 6																		
Parameter	**Baseline**			**MY1**			**MY2**			**MY3**			**MY4**			**MY5**		
Pattern	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med
Channel Beltwidth (ft)	30.6	60.7	48.1	31.8	60.9	48.4	29.5	60.0	47.3	29.5	60.0	47.3						
Radius of Curvature (ft)	20.2	38.1	30.1	16.7	31.8	27.0	12.4	30.2	25.5	12.4	30.2	25.5						
Meander Wavelength (ft)	111	126	117	109	127	116	105	138	117	105	138	117						
Meander Width Ratio	4.15	5.17	4.66	4.36	4.93	4.65	4.04	4.83	4.43	4.22	4.50	4.36						
Profile																		
Riffle Length (ft)	22.91	35.94	28.92	12.59	34.27	28.14	21.80	41.70	28.80	18.38	45.77	26.64						
Riffle Slope (ft/ft)	0.0001	0.0173	0.0085	0.0006	0.0380	0.0030	0.0003	0.0153	0.0054	0.0003	0.0150	0.0039						
Pool Length (ft)	3.84	38.32	26.58	3.19	36.78	25.57	5.92	35.10	16.56	3.97	31.99	14.46						
Pool Spacing (ft)	8.24	74.02	59.15	11.70	77.07	61.97	6.80	76.16	55.53	5.84	85.65	50.87						
Additional Reach Parameters																		
Valley Length (ft)	955			955			955			955								
Channel Length (ft)	1072			1094			1110			1117								
Sinuosity	1.12			1.15			1.16			1.17								
Water Surface Slope (ft/ft)	0.0066 – 0.0436			0.0070 – 0.0395			0.0072 – 0.0390			0.0065 – 0.0448								
BF Slope (ft/ft)	0.0089			0.0086			0.0066			0.0066								
Rosgen Classification	C6			C6			C6			C5								

APPENDIX D

2011 Site Photos

Unnamed Tributary 1 Permanent Photo Points

Unnamed Tributary 1 – Permanent Photo Point 1
Looking Downstream
January 19, 2011

Unnamed Tributary 1 – Permanent Photo Point 2
Looking Upstream
January 19, 2011

Unnamed Tributary 1 Permanent Photo Points

Unnamed Tributary 1 – Permanent Photo Point 3
Looking Upstream
January 19, 2011

Unnamed Tributary 1 – Permanent Photo Point 3
Looking Downstream
January 19, 2011

Unnamed Tributary 1 Permanent Photo Points

Unnamed Tributary 1 – Permanent Photo Point 4
Looking Upstream
January 19, 2011

Unnamed Tributary 1 – Permanent Photo Point 5
Looking Upstream
January 19, 2011

Unnamed Tributary 1 Permanent Photo Points

Unnamed Tributary 1 – Permanent Photo Point 5
Looking Downstream
January 19, 2011

Unnamed Tributary 1 – Permanent Photo Point 6
Looking 80 Degrees
January 19, 2011

Unnamed Tributary 1 Permanent Photo Points

Unnamed Tributary 1 – Permanent Photo Point 6
Looking 300 Degrees
January 19, 2011

Unnamed Tributary 1 – Permanent Photo Point 7
Looking Upstream
January 19, 2011

Unnamed Tributary 1 Permanent Photo Points

Unnamed Tributary 1 – Permanent Photo Point 8
Looking Upstream
January 19, 2011

Unnamed Tributary 1 – Permanent Photo Point 8
Looking Downstream
January 19, 2011

Unnamed Tributary 1 Permanent Photo Points

Unnamed Tributary 1 – Permanent Photo Point 9
Looking 220 Degrees
January 19, 2011

Unnamed Tributary 2 Permanent Photo Points

Unnamed Tributary 2 – Permanent Photo Point 1
Looking Downstream
January 6, 2011

Unnamed Tributary 2 – Permanent Photo Point 2
Looking Upstream
January 6, 2011

Unnamed Tributary 4 Permanent Photo Points

Unnamed Tributary 4 – Permanent Photo Point 1
Looking Downstream
January 19, 2011

Unnamed Tributary 4 – Permanent Photo Point 2
Looking Upstream
January 19, 2011

Unnamed Tributary 5 Permanent Photo Points

Unnamed Tributary 5 – Permanent Photo Point 1
Looking Upstream
January 6, 2011

Unnamed Tributary 5 – Permanent Photo Point 1
Looking Downstream
January 6, 2011

Unnamed Tributary 5 Permanent Photo Points

Unnamed Tributary 5 – Permanent Photo Point 2
Looking Upstream
January 6, 2011

Unnamed Tributary 5 – Permanent Photo Point 2
Looking Downstream
January 6, 2011

Unnamed Tributary 5 Permanent Photo Points

Unnamed Tributary 5 – Permanent Photo Point 3
Looking Upstream
January 6, 2011

Unnamed Tributary 5 – Permanent Photo Point 4
Looking Upstream
January 6, 2011

Unnamed Tributary 5 Permanent Photo Points

Unnamed Tributary 5 – Permanent Photo Point 4
Looking Downstream
January 6, 2011

Unnamed Tributary 5 – Permanent Photo Point 5
Looking 180 Degrees
January 6, 2011

Unnamed Tributary 5 Permanent Photo Points

Unnamed Tributary 5 – Permanent Photo Point 5
Looking 305 Degrees
January 6, 2011

Unnamed Tributary 6 Permanent Photo Points

Unnamed Tributary 6 – Permanent Photo Point 1
Looking 35 Degrees
January 19, 2011

Unnamed Tributary 6 – Permanent Photo Point 1
Looking Downstream
January 19, 2011

Unnamed Tributary 6 Permanent Photo Points

Unnamed Tributary 6 – Permanent Photo Point 2
Looking Upstream
January 19, 2011

Unnamed Tributary 6 – Permanent Photo Point 3
Looking Upstream
January 19, 2011

Unnamed Tributary 6 Permanent Photo Points

Unnamed Tributary 6 – Permanent Photo Point 4
Looking Downstream
January 19, 2011

Unnamed Tributary 6 – Permanent Photo Point 5
Looking Upstream
January 19, 2011

Unnamed Tributary 6 Permanent Photo Points

Unnamed Tributary 6 – Permanent Photo Point 5
Looking 310 Degrees
January 19, 2011

Unnamed Tributary 1 Vegetation Plots

UT1 – Vegetation Plot 1

UT1 – Vegetation Plot 2

Unnamed Tributary 1 Vegetation Plots

UT1 – Vegetation Plot 3

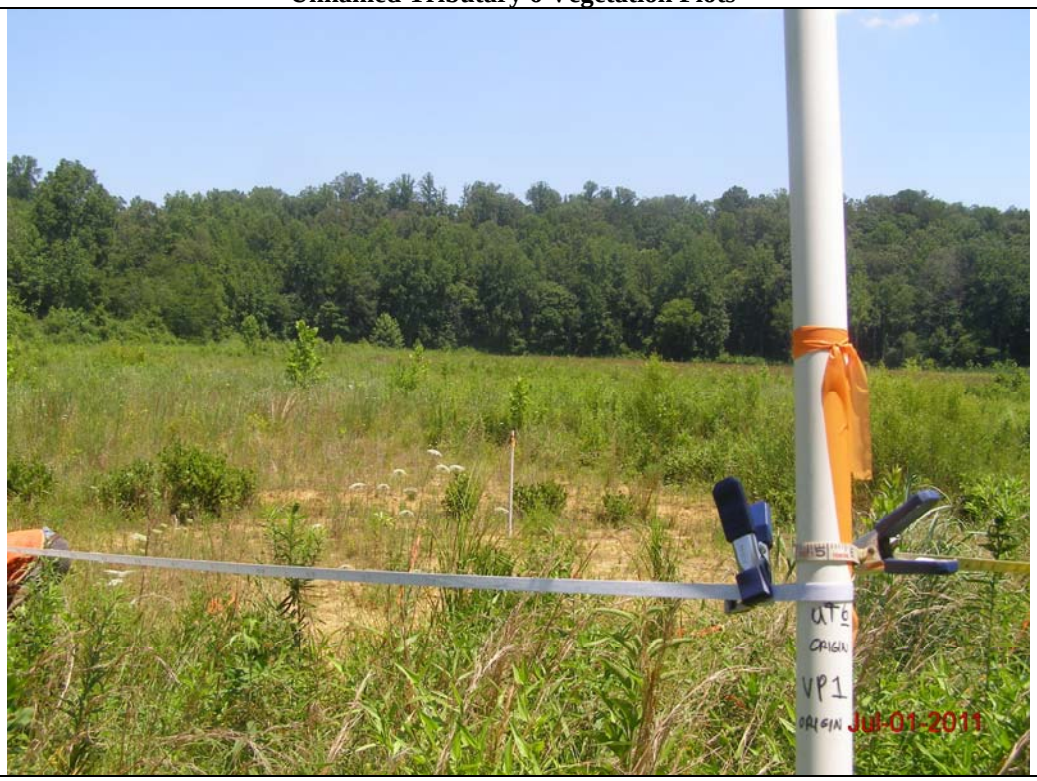
UT1 – Vegetation Plot 4

Unnamed Tributary 5 Vegetation Plots

UT5 – Vegetation Plot 1

UT5 – Vegetation Plot 2

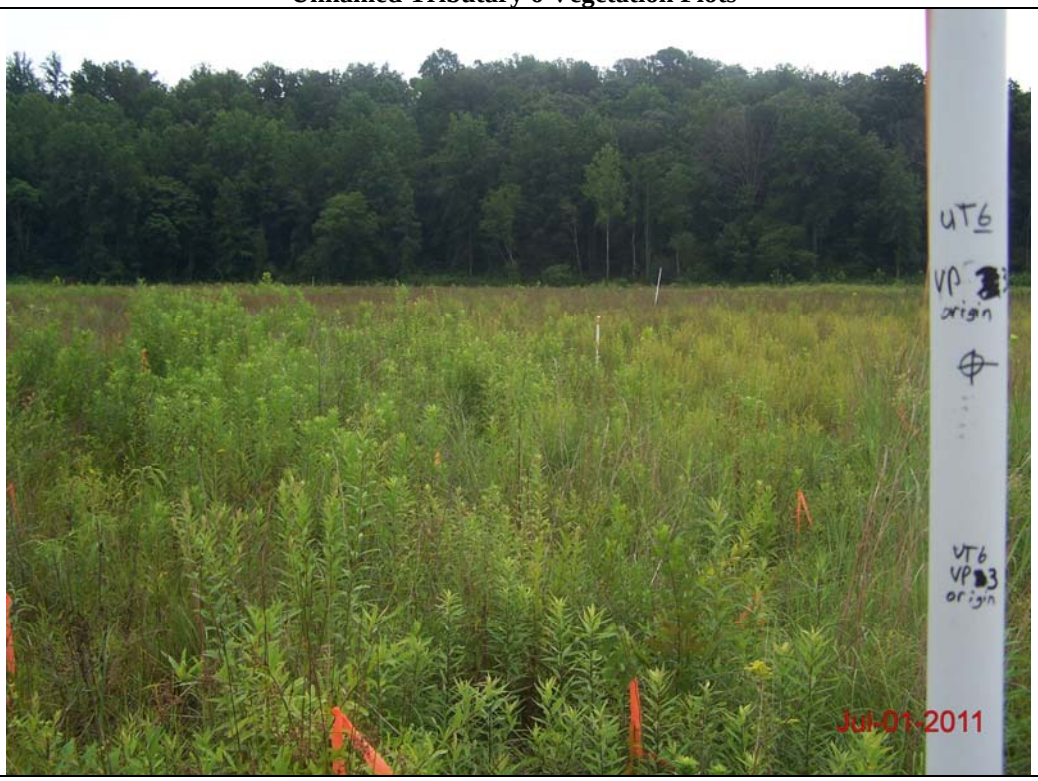
Unnamed Tributary 6 Vegetation Plots



UT6 – Vegetation Plot 1

UT6 – Vegetation Plot 2

Unnamed Tributary 6 Vegetation Plots



UT6 – Vegetation Plot 3

UT6 – Vegetation Plot 4

Unnamed Tributary 6 Vegetation Plots

UT6 – Vegetation Plot 5

Unnamed Tributary 1 Representative Photos of Stream and Vegetation Areas Requiring Observation

SPA2 UT1 Sta. 105+25 – Pool Aggradation

UT1 – Isolated Area of kudzu *Pueraria montana* post initial treament

Unnamed Tributary 1 Representative Photos of Stream and Vegetation Areas Requiring Observation

UT1 – Isolated Area of multiflora rose *Rosa multiflora* and Japanese honeysuckle *Lonicera japonica* post initial treatment

UT1 – Isolated Area of Chinese privet *Ligustrum sinense* to be treated

Unnamed Tributary 5 Representative Photos of Stream and Vegetation Areas Requiring Observation

SPA7 UT5 Sta. 515+10 – Bank Scour

SPA8 UT5 Sta. 515+50 – Bank Scour

Unnamed Tributary 5 Representative Photos of Stream and Vegetation Areas Requiring Observation

SPA9 UT5 Sta. 515+80 – Grade Control Degradation

UT5 – Isolated Area of Japanese honeysuckle *Lonicera japonica* post initial treatment

Unnamed Tributary 6 Representative Photos of Stream and Vegetation Areas Requiring Observation

SPA11 UT6 Sta. 601+30 – Riffle Bed Scour

SPA12 UT6 Sta. 601+60 – Pool Aggradation

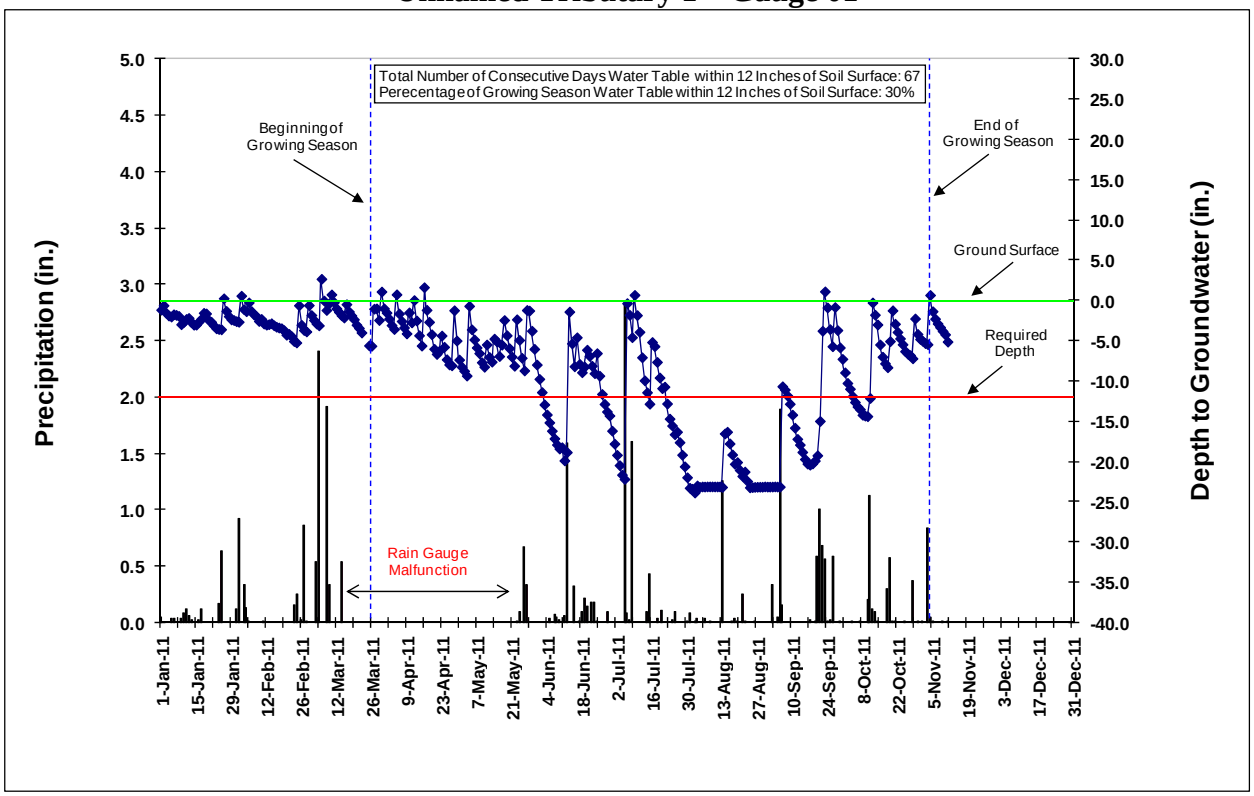
Unnamed Tributary 6 Representative Photos of Stream and Vegetation Areas Requiring Observation

UT6 – Isolated Area of Japanese honeysuckle *Lonicera japonica* post initial treatment

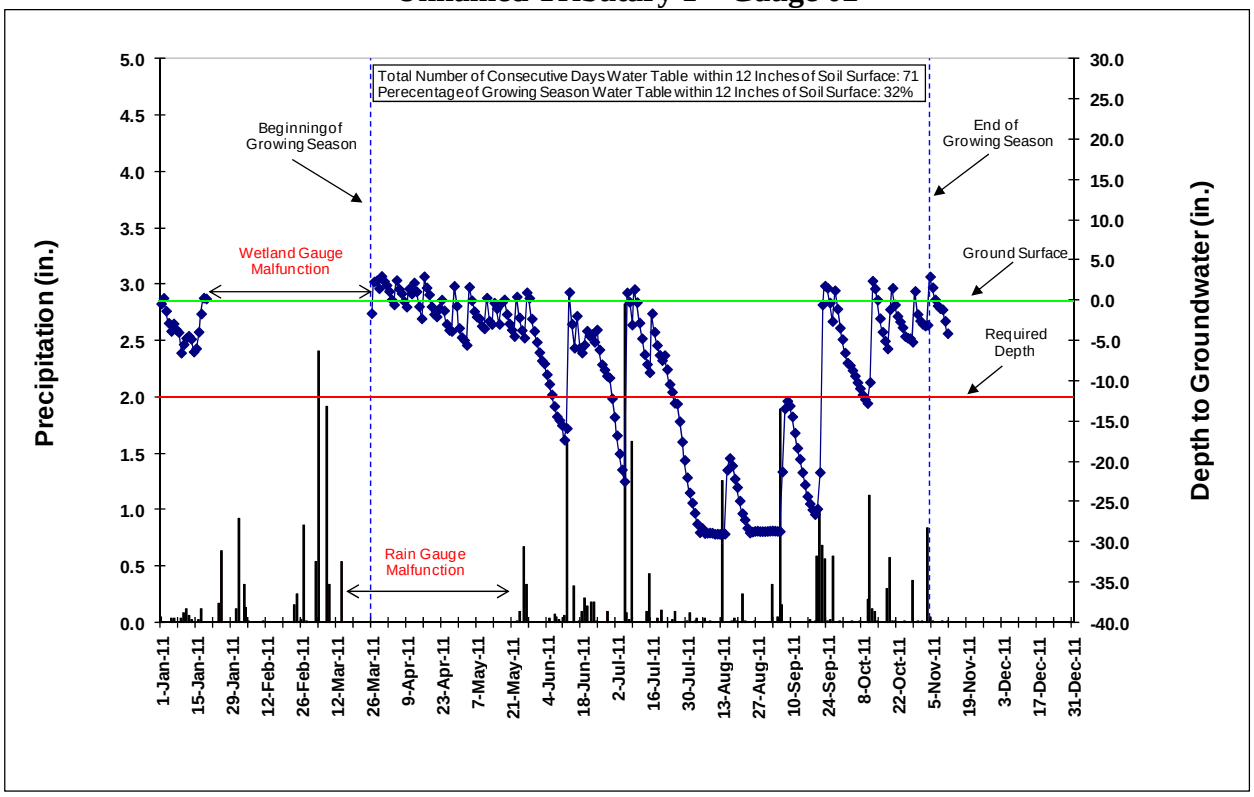
APPENDIX E

2011 Gauge Data

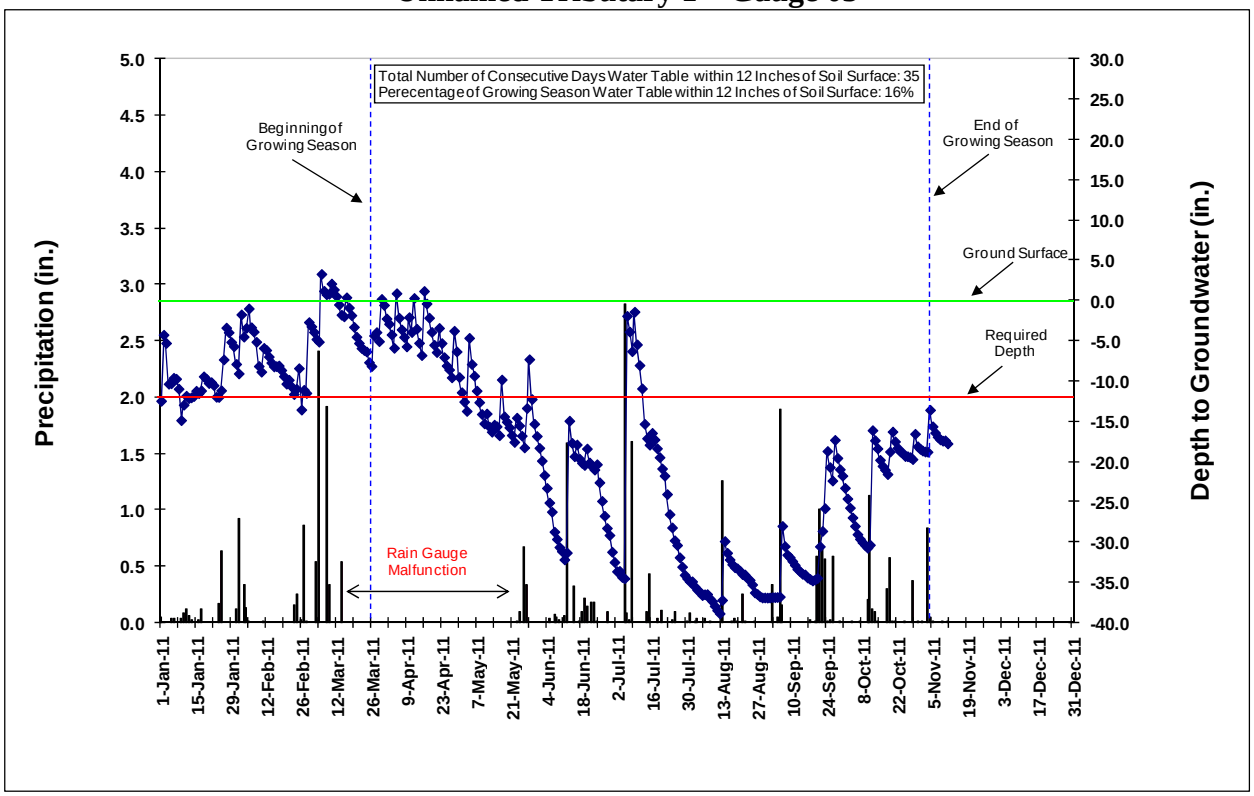
Unnamed Tributary 1 – Gauge 01



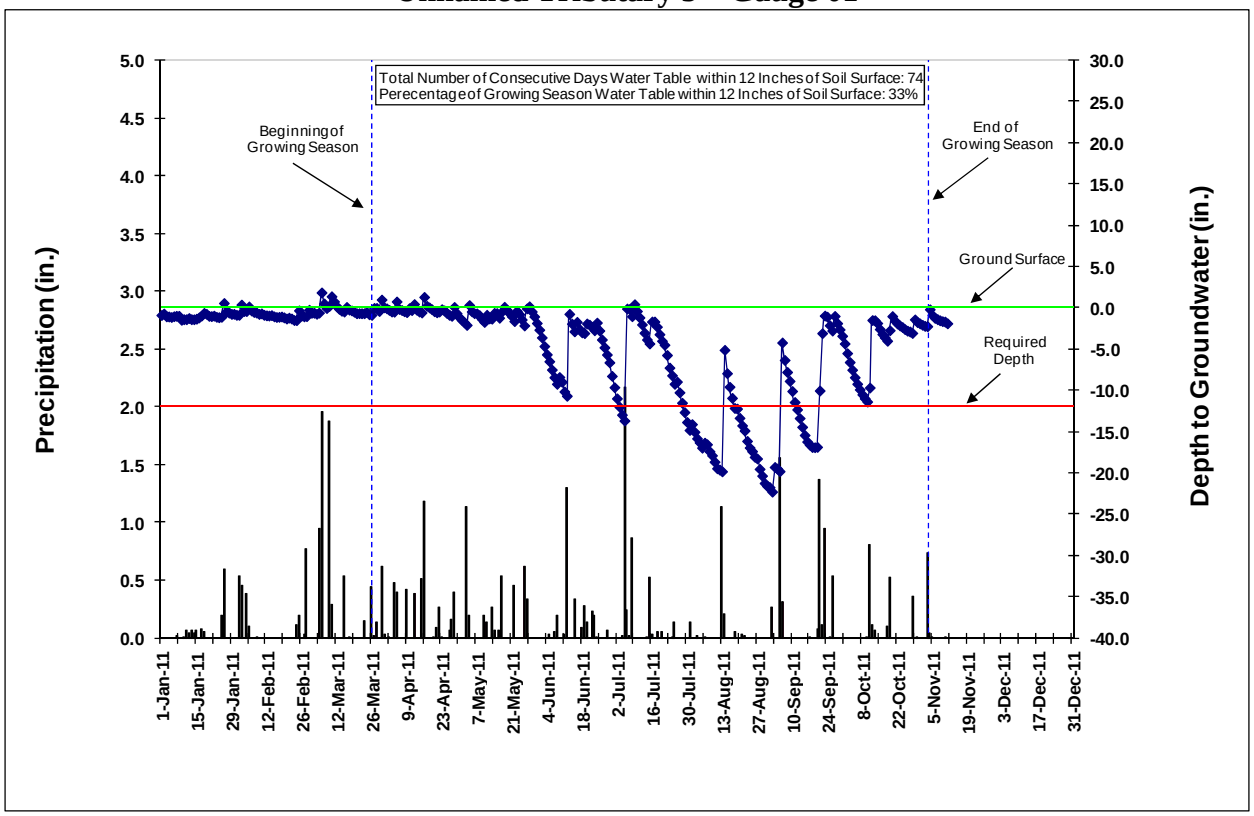
Unnamed Tributary 1 – Gauge 02



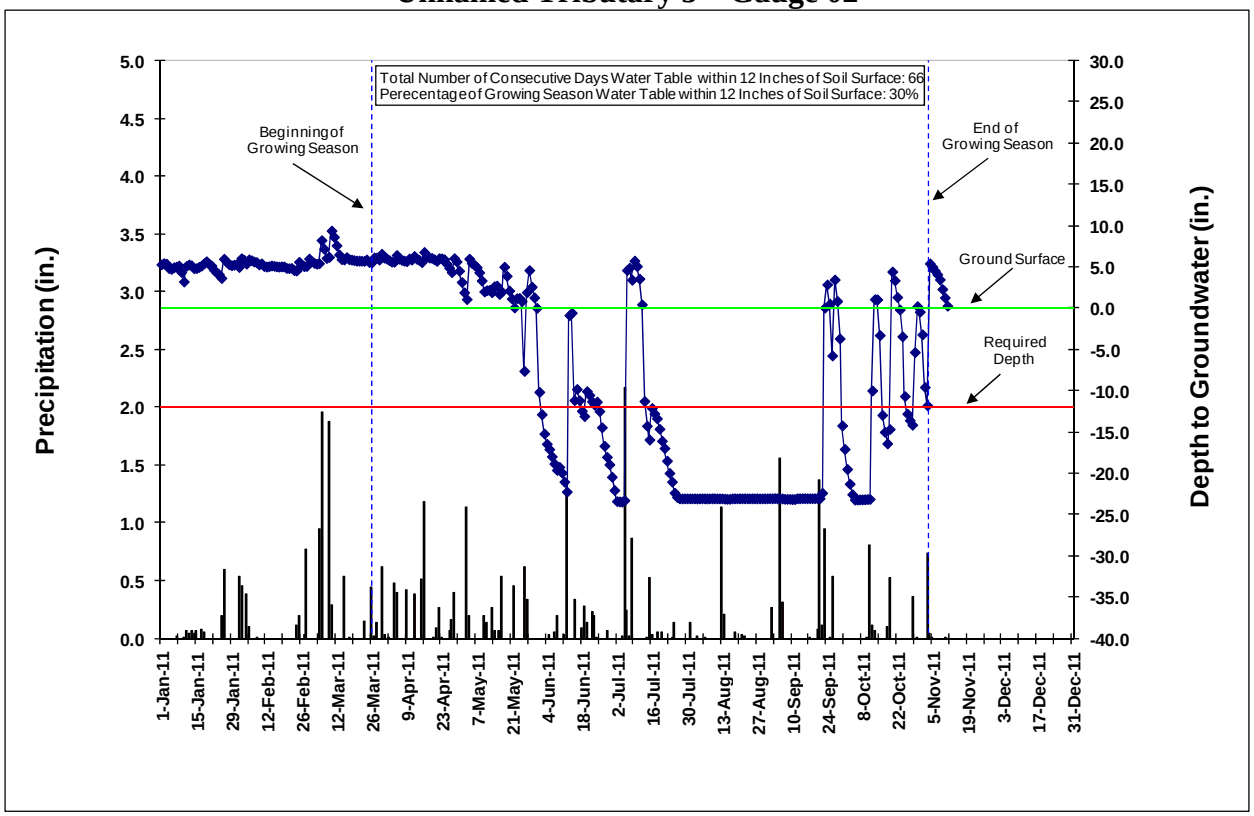
Unnamed Tributary 1 – Gauge 03



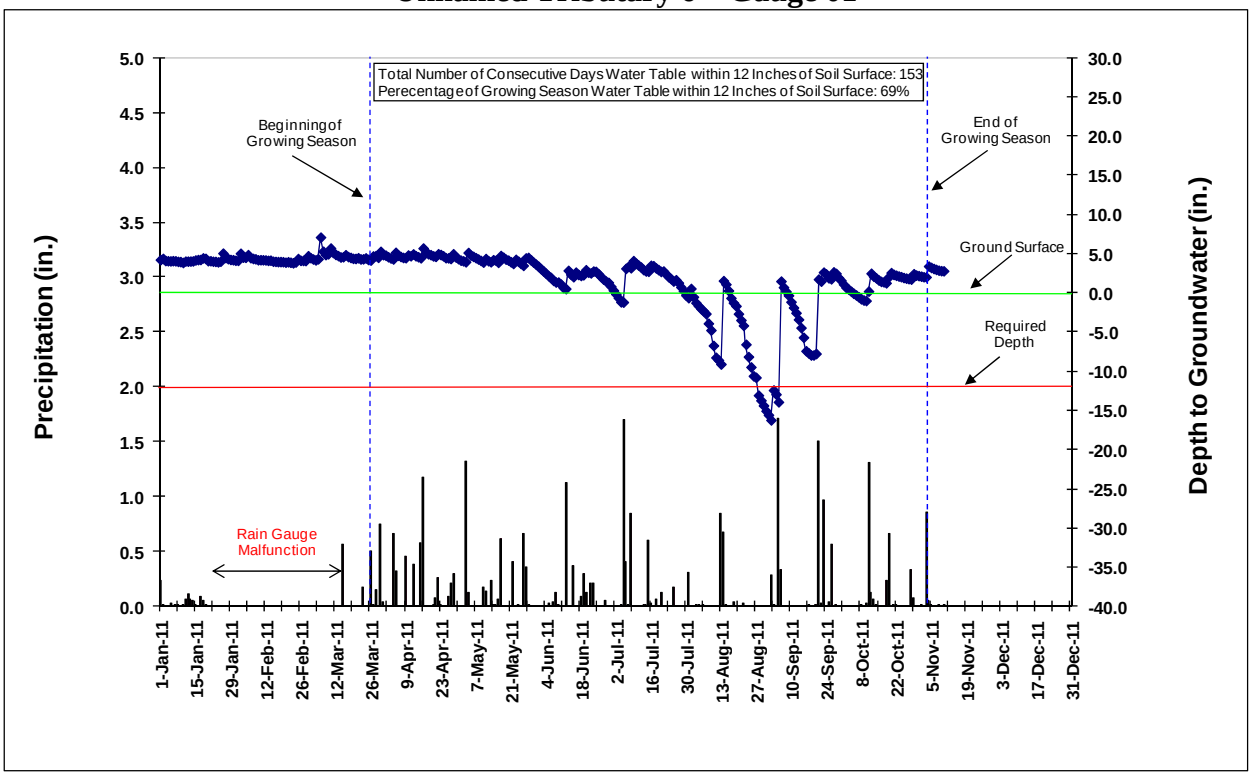
Unnamed Tributary 5 – Gauge 01



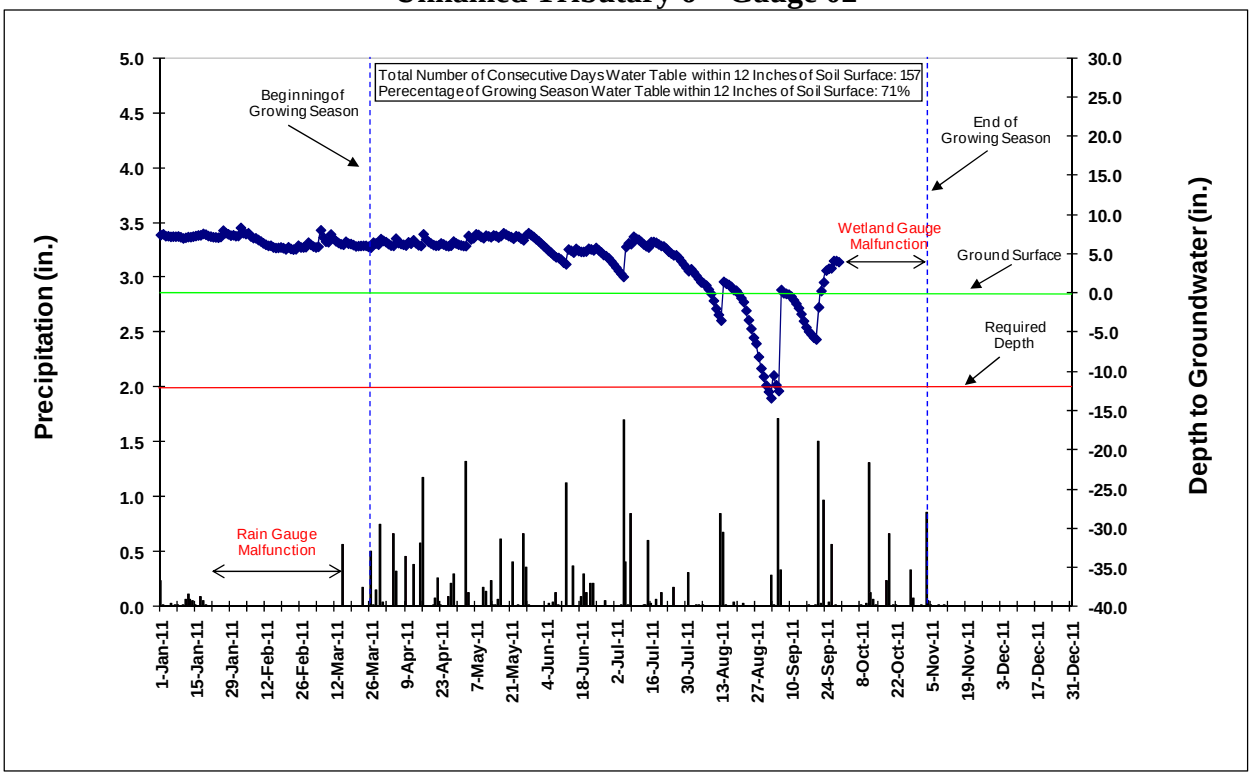
Unnamed Tributary 5 – Gauge 02



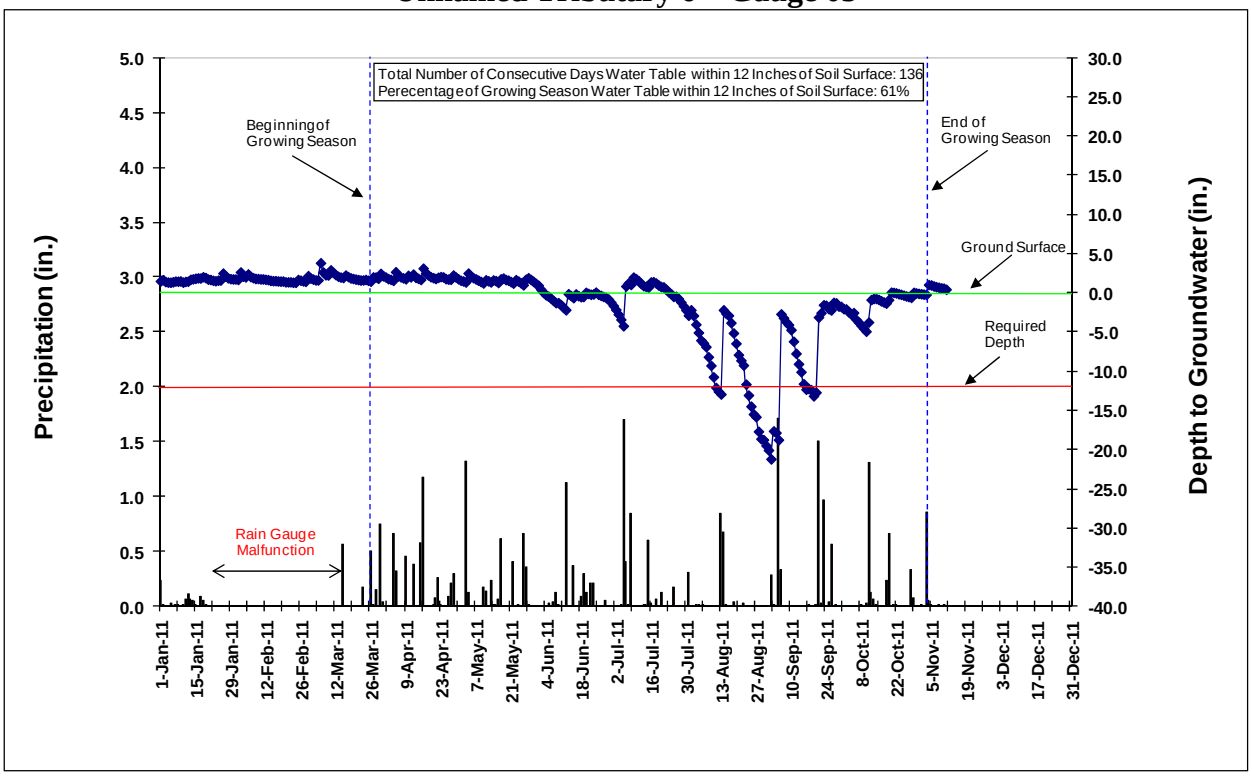
Unnamed Tributary 6 – Gauge 01



Unnamed Tributary 6 – Gauge 02



Unnamed Tributary 6 – Gauge 03



Date	Time	Gauge Number and Water Level (inches)							
dd-mmm-yyyy	hh:mm:ss	UT1 - 01	UT1 - 02	UT1 - 03	UT5 - 01	UT5 - 02	UT6 - 01	UT6 - 02	UT6 - 03
01-Jan-2011	08:00:00	-1.14	-0.40	-12.46	-0.87	5.32	4.24	7.62	1.51
01-Jan-2011	20:00:00	0.16	0.73	-4.56	-0.43	5.58	4.51	7.56	1.75
02-Jan-2011	08:00:00	-0.60	0.31	-4.25	-0.70	5.46	4.38	7.40	1.67
02-Jan-2011	20:00:00	-1.11	-0.30	-4.45	-0.90	5.52	4.25	7.31	1.54
03-Jan-2011	08:00:00	-1.54	-1.29	-5.28	-1.03	5.39	4.12	7.30	1.44
03-Jan-2011	20:00:00	-1.63	-1.67	-6.09	-1.04	5.13	4.10	7.31	1.43
04-Jan-2011	08:00:00	-1.87	-2.79	-10.34	-1.05	4.85	4.09	7.26	1.37
04-Jan-2011	20:00:00	-1.73	-2.45	-10.13	-1.05	5.00	4.10	7.23	1.37
05-Jan-2011	08:00:00	-2.00	-3.80	-10.28	-1.12	4.77	4.07	7.29	1.35
05-Jan-2011	20:00:00	-1.84	-2.90	-8.82	-1.03	4.78	4.12	7.26	1.39
06-Jan-2011	08:00:00	-1.71	-2.87	-9.60	-1.02	4.96	4.10	7.23	1.41
06-Jan-2011	20:00:00	-1.70	-3.09	-9.64	-0.99	5.13	4.11	7.25	1.46
07-Jan-2011	08:00:00	-1.79	-3.62	-9.72	-0.97	5.03	4.08	7.26	1.50
07-Jan-2011	20:00:00	-1.71	-3.46	-10.17	-0.91	5.27	4.09	7.28	1.50
08-Jan-2011	08:00:00	-1.92	-3.95	-10.96	-0.97	5.17	4.01	7.10	1.48
08-Jan-2011	20:00:00	-2.21	-4.45	-13.92	-1.11	5.22	3.97	7.18	1.44
09-Jan-2011	08:00:00	-2.95	-6.50	-14.86	-1.45	4.37	3.98	7.04	1.51
09-Jan-2011	20:00:00	-2.60	-5.59	-13.92	-1.46	3.50	3.95	7.03	1.44
10-Jan-2011	08:00:00	-2.65	-5.45	-12.95	-1.38	3.23	3.87	7.13	1.36
10-Jan-2011	20:00:00	-2.48	-4.85	-11.88	-1.38	3.77	3.99	7.11	1.46
11-Jan-20110	08:00:00	-2.30	-4.66	-11.82	-1.38	5.13	4.05	7.22	1.46
11-Jan-2011	20:00:00	-2.02	-4.31	-10.93	-1.24	4.93	4.05	7.2	1.56
12-Jan-2011	08:00:00	-2.17	-4.40	-12.13	-1.24	5.30	4.04	7.25	1.48
12-Jan-2011	20:00:00	-2.39	-3.86	-12.47	-1.30	5.35	4.10	7.19	1.76
13-Jan-2011	08:00:00	-2.66	-4.78	-12.03	-1.38	5.20	4.05	7.22	1.72
13-Jan-2011	20:00:00	-2.71	-4.08	-11.51	-1.38	5.17	4.16	7.26	1.81
14-Jan-2011	08:00:00	-3.01	-6.36	-11.86	-1.39	4.84	4.07	7.30	1.78
14-Jan-2011	20:00:00	-2.93	-4.64	-11.32	-1.35	4.98	4.18	7.33	1.82
15-Jan-2011	08:00:00	-3.00	-5.95	-11.21	-1.32	4.85	4.19	7.48	1.85
15-Jan-2011	20:00:00	-1.91	-2.59	-10.68	-1.07	4.98	4.35	7.41	1.98
16-Jan-2011	08:00:00	-2.63	-3.90	-11.52	-1.17	5.00	4.24	7.49	1.91
16-Jan-2011	20:00:00	-1.47	-0.80	-11.02	-0.56	5.43	4.37	7.43	2.00
17-Jan-2011	08:00:00	-2.28	-1.64	-11.18	-0.94	5.17	4.25	7.54	1.89
17-Jan-2011	20:00:00	-1.70	-0.39	-10.12	-0.54	5.49	4.45	7.61	2.02
18-Jan-2011	08:00:00	-1.53	0.33	-9.42	-0.62	5.44	4.46	7.62	2.05
18-Jan-2011	20:00:00	-1.05	0.64	-8.66	-0.56	5.52	4.43	7.51	2.08
19-Jan-2011	08:00:00	-1.61	0.23	-9.73	-0.73	5.69	4.39	7.62	1.94
19-Jan-2011	20:00:00	-2.06	Data Gap	-10.38	-0.85	5.69	4.25	7.42	1.88
20-Jan-2011	08:00:00	-2.45	Data Gap	-10.25	-0.98	5.35	4.10	7.33	1.75
20-Jan-2011	20:00:00	-2.31	Data Gap	-8.28	-0.86	5.04	4.23	7.46	1.8
21-Jan-2011	08:00:00	-2.65	Data Gap	-10.15	-1.01	5.18	4.09	7.26	1.69
21-Jan-2011	20:00:00	-2.85	Data Gap	-10.10	-0.85	4.89	4.05	7.25	1.64
22-Jan-2011	08:00:00	-3.10	Data Gap	-10.52	-0.95	4.66	4.03	7.18	1.60
22-Jan-2011	20:00:00	-3.08	Data Gap	-11.03	-1.00	4.88	4.03	7.07	1.53
23-Jan-2011	08:00:00	-3.46	Data Gap	-11.96	-1.10	4.31	4.01	7.16	1.54
23-Jan-2011	20:00:00	-3.29	Data Gap	-11.85	-1.07	4.67	3.99	7.14	1.54
24-Jan-2011	08:00:00	-3.54	Data Gap	-11.98	-1.14	4.12	3.95	7.12	1.61
24-Jan-2011	20:00:00	-3.29	Data Gap	-11.37	-1.08	4.68	4.00	7.16	1.57
25-Jan-2011	08:00:00	-3.58	Data Gap	-11.16	-1.10	3.66	4.03	7.21	1.63
25-Jan-2011	20:00:00	-1.40	Data Gap	-9.57	-0.35	5.31	4.39	7.47	1.92
26-Jan-2011	08:00:00	0.28	Data Gap	-7.32	0.58	5.99	5.06	8.02	2.51
26-Jan-2011	20:00:00	-0.51	Data Gap	-4.89	-0.07	6.11	4.80	8.01	2.44
27-Jan-2011	08:00:00	-1.29	Data Gap	-3.37	-0.43	5.67	4.50	7.70	2.11
27-Jan-2011	20:00:00	-1.57	Data Gap	-3.17	-0.48	5.47	4.49	7.71	2.08
28-Jan-2011	08:00:00	-1.94	Data Gap	-3.95	-0.58	5.32	4.36	7.56	1.91
28-Jan-2011	20:00:00	-2.08	Data Gap	-5.20	-0.63	5.54	4.35	7.51	1.91
29-Jan-2011	08:00:00	-2.35	Data Gap	-5.15	-0.74	5.20	4.25	7.39	1.80
29-Jan-2011	20:00:00	-2.28	Data Gap	-4.27	-0.68	5.35	4.28	7.45	1.81
30-Jan-2011	08:00:00	-2.44	Data Gap	-5.68	-0.73	5.26	4.22	7.44	1.77
30-Jan-2011	20:00:00	-2.41	Data Gap	-5.34	-0.74	5.26	4.23	7.41	1.75

Date	Time	Gauge Number and Water Level (inches)							
dd-mmm-yyyy	hh:mm:ss	UT1 - 01	UT1 - 02	UT1 - 03	UT5 - 01	UT5 - 02	UT6 - 01	UT6 - 02	UT6 - 03
31-Jan-2011	08:00:00	-2.57	Data Gap	-7.88	-0.85	5.33	4.15	7.31	1.76
31-Jan-2011	20:00:00	-2.62	Data Gap	-8.08	-0.84	5.02	4.17	7.31	1.75
01-Feb-2011	08:00:00	-2.64	Data Gap	-9.06	-0.85	4.99	4.14	7.34	1.71
01-Feb-2011	20:00:00	-1.75	Data Gap	-7.68	-0.54	5.12	4.35	7.44	1.75
02-Feb-2011	08:00:00	0.59	Data Gap	-1.73	0.39	6.06	5.05	8.37	2.66
02-Feb-2011	20:00:00	-0.45	Data Gap	-2.58	-0.21	5.98	4.73	7.95	2.30
03-Feb-2011	08:00:00	-1.08	Data Gap	-4.49	-0.39	5.85	4.55	7.70	2.12
03-Feb-2011	20:00:00	-1.40	Data Gap	-3.03	-0.50	5.52	4.48	7.62	2.05
04-Feb-2011	08:00:00	-1.33	Data Gap	-3.40	-0.40	5.40	4.53	7.58	2.03
04-Feb-2011	20:00:00	0.07	Data Gap	-1.42	0.25	5.90	4.85	7.73	2.36
05-Feb-2011	08:00:00	-0.24	Data Gap	-0.99	0.16	5.92	4.87	7.70	2.42
05-Feb-2011	20:00:00	-0.79	Data Gap	-2.12	-0.12	6.01	4.63	7.43	2.25
06-Feb-2011	08:00:00	-1.32	Data Gap	-3.33	-0.34	5.81	4.48	7.28	2.07
06-Feb-2011	20:00:00	-1.49	Data Gap	-2.43	-0.40	5.78	4.45	7.20	2.05
07-Feb-2011	08:00:00	-1.73	Data Gap	-3.87	-0.50	5.66	4.38	7.07	1.93
07-Feb-2011	20:00:00	-1.66	Data Gap	-3.14	-0.42	5.72	4.42	7.17	1.95
08-Feb-2011	08:00:00	-1.95	Data Gap	-5.13	-0.58	5.58	4.33	7.05	1.83
08-Feb-2011	20:00:00	-2.24	Data Gap	-5.23	-0.67	5.47	4.26	6.95	1.85
09-Feb-2011	08:00:00	-2.54	Data Gap	-8.14	-0.74	5.30	4.21	6.83	1.82
09-Feb-2011	20:00:00	-2.24	Data Gap	-6.78	-0.68	5.42	4.22	6.74	1.94
10-Feb-2011	08:00:00	-2.29	Data Gap	-8.84	-0.68	5.43	4.22	6.64	1.77
10-Feb-2011	20:00:00	-2.41	Data Gap	-9.25	-0.75	5.38	4.19	6.47	1.74
11-Feb-2011	08:00:00	-2.86	Data Gap	-5.89	-0.85	5.11	4.21	6.41	1.77
11-Feb-2011	20:00:00	-2.51	Data Gap	-5.60	-0.77	5.26	4.18	6.31	1.71
12-Feb-2011	08:00:00	-3.00	Data Gap	-6.15	-0.91	5.04	4.19	6.22	1.72
12-Feb-2011	20:00:00	-2.75	Data Gap	-5.90	-0.88	5.18	4.15	6.12	1.70
13-Feb-2011	08:00:00	-2.94	Data Gap	-6.97	-0.94	5.09	4.14	6.08	1.68
13-Feb-2011	20:00:00	-2.72	Data Gap	-6.84	-0.89	5.24	4.16	6.08	1.61
14-Feb-2011	08:00:00	-2.83	Data Gap	-7.70	-0.89	5.18	4.16	6.10	1.59
14-Feb-2011	20:00:00	-2.92	Data Gap	-7.73	-0.97	5.19	4.05	5.94	1.58
15-Feb-2011	08:00:00	-3.08	Data Gap	-8.19	-1.04	5.13	4.03	5.88	1.55
15-Feb-2011	20:00:00	-3.11	Data Gap	-7.88	-1.05	5.12	4.01	5.82	1.56
16-Feb-2011	08:00:00	-3.26	Data Gap	-8.16	-1.11	5.07	4.01	5.80	1.55
16-Feb-2011	20:00:00	-3.23	Data Gap	-7.91	-1.06	5.09	4.01	5.84	1.53
17-Feb-2011	08:00:00	-3.36	Data Gap	-8.08	-1.09	5.04	3.98	5.82	1.51
17-Feb-2011	20:00:00	-3.35	Data Gap	-8.16	-1.06	5.09	4.00	5.87	1.46
18-Feb-2011	08:00:00	-3.45	Data Gap	-8.64	-1.06	5.07	3.98	5.88	1.49
18-Feb-2011	20:00:00	-3.50	Data Gap	-8.85	-1.07	5.12	3.98	5.84	1.46
19-Feb-2011	08:00:00	-3.68	Data Gap	-9.40	-1.16	5.06	3.97	5.79	1.50
19-Feb-2011	20:00:00	-4.04	Data Gap	-9.82	-1.23	5.01	3.89	5.71	1.44
20-Feb-2011	08:00:00	-4.25	Data Gap	-10.33	-1.30	4.87	3.91	5.63	1.40
20-Feb-2011	20:00:00	-4.28	Data Gap	-9.82	-1.25	4.89	3.89	5.77	1.36
21-Feb-2011	08:00:00	-4.15	Data Gap	-9.85	-1.19	4.86	3.96	5.90	1.40
21-Feb-2011	20:00:00	-4.23	Data Gap	-9.89	-1.19	4.96	3.94	5.77	1.40
22-Feb-2011	08:00:00	-4.43	Data Gap	-10.67	-1.30	4.88	3.90	5.69	1.40
22-Feb-2011	20:00:00	-4.80	Data Gap	-11.16	-1.41	4.79	3.83	5.59	1.35
23-Feb-2011	08:00:00	-5.04	Data Gap	-11.63	-1.48	4.61	3.83	5.60	1.35
23-Feb-2011	20:00:00	-5.17	Data Gap	-11.76	-1.50	4.60	3.79	5.55	1.33
24-Feb-2011	08:00:00	-5.22	Data Gap	-10.97	-1.49	4.56	3.93	5.64	1.34
24-Feb-2011	20:00:00	-3.38	Data Gap	-10.71	-1.10	5.16	4.05	5.84	1.42
25-Feb-2011	08:00:00	-0.60	Data Gap	-8.41	-0.31	5.62	4.37	6.11	1.70
25-Feb-2011	20:00:00	-2.39	Data Gap	-11.19	-0.90	5.47	4.15	5.91	1.63
26-Feb-2011	08:00:00	-3.02	Data Gap	-13.55	-0.93	5.28	4.14	5.88	1.61
26-Feb-2011	20:00:00	-3.29	Data Gap	-12.00	-0.97	5.21	4.08	5.90	1.53
27-Feb-2011	08:00:00	-3.67	Data Gap	-11.09	-1.04	5.10	4.13	5.88	1.52
27-Feb-2011	20:00:00	-3.67	Data Gap	-10.34	-1.01	5.18	4.09	5.87	1.51
28-Feb-2011	08:00:00	-3.85	Data Gap	-11.49	-1.01	5.12	4.11	5.92	1.47
28-Feb-2011	20:00:00	1.08	Data Gap	-7.08	0.83	6.51	5.06	6.99	2.46

Date	Time	Gauge Number and Water Level (inches)							
dd-mmm-yyyy	hh:mm:ss	UT1 - 01	UT1 - 02	UT1 - 03	UT5 - 01	UT5 - 02	UT6 - 01	UT6 - 02	UT6 - 03
01-Mar-2011	08:00:00	-0.58	Data Gap	-2.68	-0.23	6.01	4.73	6.50	2.19
01-Mar-2011	20:00:00	-1.34	Data Gap	-2.69	-0.48	5.86	4.53	6.32	1.98
02-Mar-2011	08:00:00	-1.81	Data Gap	-3.21	-0.60	5.71	4.48	6.21	1.88
02-Mar-2011	20:00:00	-2.08	Data Gap	-3.35	-0.66	5.63	4.36	6.11	1.77
03-Mar-2011	08:00:00	-2.43	Data Gap	-3.92	-0.60	5.50	4.31	5.99	1.75
03-Mar-2011	20:00:00	-2.64	Data Gap	-4.32	-0.65	5.43	4.20	5.93	1.65
04-Mar-2011	08:00:00	-2.86	Data Gap	-4.79	-0.73	5.38	4.20	5.88	1.64
04-Mar-2011	20:00:00	-3.03	Data Gap	-5.08	-0.72	5.35	4.16	5.97	1.56
05-Mar-2011	08:00:00	-3.09	Data Gap	-5.12	-0.59	5.45	4.34	5.96	1.64
05-Mar-2011	20:00:00	0.11	Data Gap	-0.29	0.53	6.55	5.25	6.69	2.49
06-Mar-2011	08:00:00	2.69	Data Gap	3.30	1.86	8.25	7.10	8.06	3.83
06-Mar-2011	20:00:00	0.79	Data Gap	1.69	1.02	8.29	5.77	7.74	3.14
07-Mar-2011	08:00:00	-0.01	Data Gap	1.20	0.52	7.20	5.30	7.14	2.65
07-Mar-2011	20:00:00	-0.67	Data Gap	1.01	0.18	6.41	5.05	6.79	2.40
08-Mar-2011	08:00:00	-1.18	Data Gap	0.76	-0.03	6.08	4.88	6.61	2.29
08-Mar-2011	20:00:00	-1.44	Data Gap	0.46	-0.11	5.91	4.78	6.52	2.16
09-Mar-2011	08:00:00	-0.37	Data Gap	0.82	0.23	6.21	4.98	6.55	2.28
09-Mar-2011	20:00:00	1.77	Data Gap	2.39	1.85	9.82	6.30	8.36	3.56
10-Mar-2011	08:00:00	0.75	Data Gap	2.10	1.40	9.41	5.71	7.54	2.93
10-Mar-2011	20:00:00	0.48	Data Gap	1.78	1.19	9.18	5.39	7.31	2.73
11-Mar-2011	08:00:00	-0.21	Data Gap	1.37	0.77	8.64	5.14	7.00	2.60
11-Mar-2011	20:00:00	-0.65	Data Gap	1.05	0.44	8.13	4.95	6.77	2.41
12-Mar-2011	08:00:00	-0.98	Data Gap	0.53	0.19	7.61	4.90	6.66	2.31
12-Mar-2011	20:00:00	-1.16	Data Gap	0.26	0.05	7.11	4.77	6.57	2.15
13-Mar-2011	08:00:00	-1.42	Data Gap	-0.50	-0.13	6.51	4.74	6.46	2.11
13-Mar-2011	20:00:00	-1.66	Data Gap	-0.93	-0.25	6.12	4.61	6.37	2.01
14-Mar-2011	08:00:00	-1.84	Data Gap	-1.77	-0.36	5.94	4.57	6.29	2.01
14-Mar-2011	20:00:00	-2.01	Data Gap	-2.23	-0.40	5.86	4.51	6.28	1.94
15-Mar-2011	08:00:00	-2.12	Data Gap	-1.97	-0.45	5.90	4.60	6.22	1.96
15-Mar-2011	20:00:00	0.24	Data Gap	0.67	0.47	6.38	4.99	6.82	2.43
16-Mar-2011	08:00:00	-0.46	Data Gap	0.40	0.11	6.18	4.85	6.61	2.26
16-Mar-2011	20:00:00	-1.00	Data Gap	-0.03	-0.10	6.01	4.68	6.45	2.08
17-Mar-2011	08:00:00	-1.37	Data Gap	-0.88	-0.22	5.93	4.62	6.36	2.07
17-Mar-2011	20:00:00	-1.63	Data Gap	-1.08	-0.27	5.89	4.53	6.30	1.96
18-Mar-2011	08:00:00	-1.86	Data Gap	-1.83	-0.32	5.88	4.51	6.31	1.90
18-Mar-2011	20:00:00	-2.09	Data Gap	-2.31	-0.35	5.86	4.42	6.23	1.82
19-Mar-2011	08:00:00	-2.34	Data Gap	-3.28	-0.47	5.82	4.40	6.18	1.82
19-Mar-2011	20:00:00	-2.66	Data Gap	-3.79	-0.56	5.78	4.33	6.02	1.72
20-Mar-2011	08:00:00	-3.01	Data Gap	-4.50	-0.66	5.76	4.38	6.01	1.75
20-Mar-2011	20:00:00	-3.27	Data Gap	-4.98	-0.65	5.75	4.39	6.04	1.67
21-Mar-2011	08:00:00	-3.42	Data Gap	-5.28	-0.65	5.76	4.47	6.05	1.69
21-Mar-2011	20:00:00	-3.68	Data Gap	-5.47	-0.62	5.76	4.35	6.03	1.65
22-Mar-2011	08:00:00	-3.98	Data Gap	-5.91	-0.66	5.75	4.32	6.07	1.63
22-Mar-2011	20:00:00	Data Gap	Data Gap	-6.09	-0.64	5.72	4.27	6.04	1.62
23-Mar-2011	08:00:00	Data Gap	Data Gap	-6.15	-0.66	5.73	4.33	6.09	1.64
23-Mar-2011	20:00:00	Data Gap	Data Gap	-6.40	-0.65	5.76	4.30	6.16	1.60
24-Mar-2011	08:00:00	Data Gap	Data Gap	-6.34	-0.50	5.90	4.45	6.09	1.70
24-Mar-2011	20:00:00	Data Gap	Data Gap	-7.11	-0.69	5.68	4.30	5.98	1.60
25-Mar-2011	08:00:00	Data Gap	Data Gap	-7.67	-0.78	5.60	4.26	5.96	1.60
25-Mar-2011	20:00:00	-5.58	-1.80	-7.71	-0.80	5.55	4.23	5.89	1.50
26-Mar-2011	08:00:00	-5.63	-1.59	-8.15	-0.86	5.54	4.18	5.85	1.48
26-Mar-2011	20:00:00	-3.86	0.00	-4.83	-0.20	5.91	4.63	6.26	1.60
27-Mar-2011	08:00:00	-1.02	2.34	-4.34	-0.01	6.15	4.70	6.49	2.03
27-Mar-2011	20:00:00	-2.01	1.91	-4.65	-0.31	5.98	4.60	6.35	1.91
28-Mar-2011	08:00:00	-0.98	2.47	-3.93	-0.01	6.14	4.74	6.39	2.01
28-Mar-2011	20:00:00	-1.97	1.93	-4.32	-0.27	5.98	4.61	6.35	1.89
29-Mar-2011	08:00:00	-2.43	1.50	-5.06	-0.39	5.88	4.53	6.23	1.86
29-Mar-2011	20:00:00	-2.63	1.17	-5.59	-0.38	5.82	4.47	6.20	1.74
30-Mar-2011	08:00:00	1.11	3.03	0.19	1.00	6.60	5.29	6.94	2.48
30-Mar-2011	20:00:00	-0.30	2.79	0.27	0.26	6.23	5.01	6.90	2.29

Date	Time	Gauge Number and Water Level (inches)							
dd-mmm-yyyy	hh:mm:ss	UT1 - 01	UT1 - 02	UT1 - 03	UT5 - 01	UT5 - 02	UT6 - 01	UT6 - 02	UT6 - 03
31-Mar-2011	08:00:00	-0.98	2.41	-0.56	0.06	6.12	4.86	6.71	2.16
31-Mar-2011	20:00:00	-0.74	2.44	-1.03	0.07	6.08	4.84	6.69	2.08
01-Apr-2011	08:00:00	-1.50	1.91	-2.24	-0.07	6.01	4.79	6.56	2.01
01-Apr-2011	20:00:00	-1.99	1.46	-2.52	-0.16	5.89	4.65	6.39	1.86
02-Apr-2011	08:00:00	-2.26	1.15	-2.89	-0.25	5.83	4.60	6.32	1.81
02-Apr-2011	20:00:00	-2.80	0.34	-3.21	-0.35	5.73	4.45	6.16	1.65
03-Apr-2011	08:00:00	-3.05	0.10	-4.22	-0.46	5.64	4.45	6.11	1.72
03-Apr-2011	20:00:00	-3.37	-0.53	-5.03	-0.44	5.62	4.32	6.08	1.58
04-Apr-2011	08:00:00	-3.55	-0.51	-5.88	-0.47	5.63	4.31	6.08	1.59
04-Apr-2011	20:00:00	-4.15	-1.41	-6.52	-0.48	5.61	4.26	5.96	1.69
05-Apr-2011	08:00:00	0.76	2.52	0.90	0.77	6.45	5.17	7.01	2.69
05-Apr-2011	20:00:00	-0.77	1.89	-0.40	0.08	6.13	4.86	6.64	2.28
06-Apr-2011	08:00:00	-1.62	1.43	-2.15	-0.14	5.99	4.79	6.44	2.17
06-Apr-2011	20:00:00	-2.17	1.01	-2.92	-0.17	5.92	4.64	6.43	2.08
07-Apr-2011	08:00:00	-2.55	0.88	-3.60	-0.27	5.85	4.63	6.32	2.03
07-Apr-2011	20:00:00	-3.04	-0.01	-4.04	-0.33	5.80	4.47	6.27	1.93
08-Apr-2011	08:00:00	-3.36	-0.11	-4.53	-0.41	5.76	4.51	6.22	1.91
08-Apr-2011	20:00:00	-3.75	-0.72	-5.05	-0.43	5.72	4.44	6.16	1.83
09-Apr-2011	08:00:00	-4.09	-0.79	-5.70	-0.52	5.70	4.48	6.12	1.79
09-Apr-2011	20:00:00	0.21	2.10	-1.92	0.61	6.29	5.01	6.68	2.31
10-Apr-2011	08:00:00	-1.48	1.48	-2.07	-0.05	6.02	4.82	6.54	2.23
10-Apr-2011	20:00:00	-2.26	1.09	-3.35	-0.20	5.91	4.71	6.43	2.06
11-Apr-2011	08:00:00	-2.72	0.84	-3.92	-0.28	5.89	4.72	6.36	2.04
11-Apr-2011	20:00:00	-3.81	-0.56	-4.66	-0.37	5.82	4.54	6.29	1.96
12-Apr-2011	08:00:00	0.05	2.21	0.31	0.46	6.33	4.97	6.79	2.38
12-Apr-2011	20:00:00	-1.69	1.58	-1.44	-0.12	6.08	4.84	6.44	2.07
13-Apr-2011	08:00:00	-2.49	1.11	-3.51	-0.23	5.98	4.73	6.42	1.97
13-Apr-2011	20:00:00	-3.67	-0.13	-4.47	-0.35	5.87	4.66	6.21	1.87
14-Apr-2011	08:00:00	-4.32	-0.74	-5.27	-0.46	5.84	4.60	6.15	1.84
14-Apr-2011	20:00:00	-5.28	-2.03	-5.91	-0.52	5.70	4.46	6.08	1.72
15-Apr-2011	08:00:00	-5.60	-2.24	-6.79	-0.57	5.58	4.47	6.07	1.71
15-Apr-2011	20:00:00	-6.16	-3.02	-7.34	-0.56	5.44	4.34	6.15	1.67
16-Apr-2011	08:00:00	1.65	2.99	1.18	1.32	6.81	5.71	7.55	3.14
16-Apr-2011	20:00:00	0.07	2.13	0.10	0.50	6.48	5.37	7.21	2.72
17-Apr-2011	08:00:00	-1.16	1.60	-0.38	0.24	6.27	5.16	6.90	2.51
17-Apr-2011	20:00:00	-2.37	0.81	-1.31	0.09	6.17	4.99	6.63	2.28
18-Apr-2011	08:00:00	-2.65	0.73	-2.14	0.05	6.14	4.98	6.59	2.28
18-Apr-2011	20:00:00	-3.94	-0.79	-3.20	-0.11	6.08	4.84	6.39	2.05
19-Apr-2011	08:00:00	-4.19	-0.76	-3.91	-0.17	6.10	4.86	6.37	2.05
19-Apr-2011	20:00:00	-5.94	-2.59	-4.76	-0.36	5.96	4.67	6.27	1.88
20-Apr-2011	08:00:00	-6.00	-1.70	-5.51	-0.41	5.93	4.71	6.18	1.93
20-Apr-2011	20:00:00	-7.12	-2.87	-5.83	-0.54	5.83	4.65	6.15	1.80
21-Apr-2011	08:00:00	-6.64	-2.00	-6.41	-0.54	5.73	4.65	6.09	1.83
21-Apr-2011	20:00:00	-7.95	-3.51	-6.34	-0.74	5.50	4.45	5.98	1.70
22-Apr-2011	08:00:00	-6.25	-1.01	-3.41	-0.46	6.06	4.99	6.12	1.98
22-Apr-2011	20:00:00	-3.64	0.86	-3.74	-0.08	6.07	4.89	6.48	2.09
23-Apr-2011	08:00:00	-4.35	0.09	-5.29	-0.16	6.03	4.88	6.39	2.07
23-Apr-2011	20:00:00	-5.57	-0.90	-6.40	-0.29	5.95	4.79	6.30	1.98
24-Apr-2011	08:00:00	-5.75	-1.24	-7.04	-0.31	5.93	4.72	6.26	2.03
24-Apr-2011	20:00:00	-7.71	-3.68	-7.56	-0.62	5.62	4.49	6.09	1.81
25-Apr-2011	08:00:00	-7.30	-2.93	-8.09	-0.62	5.38	4.48	6.09	1.81
25-Apr-2011	20:00:00	-8.71	-4.69	-8.69	-0.91	5.09	4.33	5.96	1.75
26-Apr-2011	08:00:00	-7.95	-3.68	-8.58	-0.85	4.89	4.46	6.03	1.74
26-Apr-2011	20:00:00	-9.13	-4.94	-9.34	-1.09	4.65	4.30	5.97	1.66
27-Apr-2011	08:00:00	-8.06	-3.81	-9.55	-0.97	4.37	4.38	6.10	1.72
27-Apr-2011	20:00:00	-9.25	-4.94	-9.84	-1.01	4.67	4.45	6.22	1.81
28-Apr-2011	08:00:00	-1.21	1.80	-3.76	0.11	6.06	4.98	6.64	2.27
28-Apr-2011	20:00:00	-4.29	0.24	-5.84	-0.55	5.83	4.62	6.42	1.97
29-Apr-2011	08:00:00	-4.98	-0.67	-6.33	-0.66	5.66	4.56	6.39	2.01
29-Apr-2011	20:00:00	-7.56	-3.56	-8.08	-1.08	5.19	4.35	6.26	1.79

Date	Time	Gauge Number and Water Level (inches)							
dd-mmm-yyyy	hh:mm:ss	UT1 - 01	UT1 - 02	UT1 - 03	UT5 - 01	UT5 - 02	UT6 - 01	UT6 - 02	UT6 - 03
30-Apr-2011	08:00:00	-7.34	-3.42	-9.51	-1.14	4.54	4.35	6.23	1.78
30-Apr-2011	20:00:00	-9.10	-5.65	-10.43	-1.50	3.86	4.16	6.13	1.59
01-May-2011	08:00:00	-8.24	-4.56	-11.4	-1.48	3.17	4.16	6.14	1.60
01-May-2011	20:00:00	-9.77	-6.46	-12.31	-1.84	2.61	4.08	6.04	1.48
02-May-2011	08:00:00	-8.73	-4.93	-12.56	-1.76	1.92	4.08	6.06	1.51
02-May-2011	20:00:00	-10.47	-7.45	-13.19	-2.18	1.49	3.93	5.97	1.36
03-May-2011	08:00:00	-9.33	-5.54	-13.72	-2.07	1.10	3.96	6.05	1.38
03-May-2011	20:00:00	-1.97	1.34	-6.83	0.62	6.05	5.22	7.12	2.58
04-May-2011	08:00:00	-0.67	1.69	-4.64	0.33	6.00	5.14	7.34	2.51
04-May-2011	20:00:00	-3.24	0.78	-6.53	-0.37	5.59	4.84	6.94	2.14
05-May-2011	08:00:00	-3.59	0.01	-7.90	-0.44	5.47	4.80	6.90	2.10
05-May-2011	20:00:00	-4.97	-1.50	-8.52	-0.61	5.33	4.60	6.91	1.95
06-May-2011	08:00:00	-4.84	-1.34	-9.35	-0.65	5.27	4.65	7.05	1.93
06-May-2011	20:00:00	-6.23	-2.79	-10.01	-0.65	5.14	4.46	7.57	1.77
07-May-2011	08:00:00	-5.83	-2.02	-11.20	-0.68	4.97	4.48	7.55	1.77
07-May-2011	20:00:00	-7.46	-3.71	-12.11	-0.99	4.68	4.33	7.39	1.60
08-May-2011	08:00:00	-6.54	-2.23	-12.63	-0.89	4.34	4.31	7.47	1.61
08-May-2011	20:00:00	-8.69	-4.83	-13.41	-1.37	3.87	4.11	7.26	1.42
09-May-2011	08:00:00	-7.67	-3.16	-14.10	-1.35	3.35	4.13	7.22	1.45
09-May-2011	20:00:00	-9.48	-5.33	-14.90	-1.75	2.82	3.92	7.10	1.30
10-May-2011	08:00:00	-8.23	-3.48	-15.26	-1.72	2.03	3.92	7.06	1.25
10-May-2011	20:00:00	-10.11	-5.74	-15.94	-2.21	1.50	3.82	6.91	1.07
11-May-2011	08:00:00	-5.47	0.34	-14.04	-0.85	2.18	4.37	7.38	1.66
11-May-2011	20:00:00	-8.03	-3.11	-15.66	-1.39	2.03	4.13	7.24	1.53
12-May-2011	08:00:00	-7.02	-2.55	-15.66	-1.29	2.21	4.09	7.29	1.53
12-May-2011	20:00:00	-8.95	-4.22	-16.36	-1.64	2.13	3.95	7.14	1.40
13-May-2011	08:00:00	-7.60	-2.94	-16.30	-1.32	1.93	3.96	7.17	1.39
13-May-2011	20:00:00	-7.54	-4.06	-13.31	-0.87	2.48	4.29	7.15	1.60
14-May-2011	08:00:00	-4.74	-0.29	-15.42	-0.62	2.67	4.22	7.41	1.64
14-May-2011	20:00:00	-6.64	-2.07	-15.99	-0.83	2.67	4.11	7.31	1.54
15-May-2011	08:00:00	-5.09	-0.98	-15.63	-0.64	2.74	4.15	7.34	1.55
15-May-2011	20:00:00	-7.88	-3.89	-16.72	-1.19	2.34	3.92	7.15	1.35
16-May-2011	08:00:00	-6.91	-2.93	-16.74	-1.21	1.72	3.89	7.14	1.32
16-May-2011	20:00:00	-8.19	-3.95	-17.24	-1.49	1.22	3.83	7.09	1.27
17-May-2011	08:00:00	-5.50	-0.25	-9.82	-0.46	2.01	4.76	7.34	1.78
17-May-2011	20:00:00	-1.57	0.99	-14.00	0.39	4.93	4.66	7.81	2.04
18-May-2011	08:00:00	-2.43	0.12	-14.40	0.12	5.02	4.54	7.69	1.88
18-May-2011	20:00:00	-4.32	-1.46	-14.61	-0.19	4.58	4.42	7.55	1.78
19-May-2011	08:00:00	-4.32	-1.70	-15.06	-0.24	3.92	4.29	7.52	1.69
19-May-2011	20:00:00	-6.74	-3.86	-15.49	-0.65	3.01	4.18	7.35	1.54
20-May-2011	08:00:00	-5.92	-2.86	-15.75	-0.64	2.14	4.17	7.33	1.61
20-May-2011	20:00:00	-8.06	-5.15	-16.52	-1.03	1.58	3.96	7.22	1.44
21-May-2011	08:00:00	-6.98	-3.64	-16.71	-1.02	1.17	3.96	7.20	1.43
21-May-2011	20:00:00	-9.58	-6.64	-17.59	-1.65	0.92	3.76	7.00	1.20
22-May-2011	08:00:00	-8.11	-4.43	-17.57	-1.61	0.09	3.74	6.99	1.24
22-May-2011	20:00:00	-10.65	-7.67	-9.15	-2.36	0.26	4.37	6.68	1.60
23-May-2011	08:00:00	-2.34	0.48	-14.56	-0.36	1.21	4.27	7.32	1.68
23-May-2011	20:00:00	-5.03	-1.79	-15.86	-0.73	1.82	4.08	7.26	1.51
24-May-2011	08:00:00	-4.90	-2.12	-15.52	-0.77	1.24	4.02	7.24	1.49
24-May-2011	20:00:00	-8.31	-5.04	-16.5	-1.43	1.03	3.80	7.06	1.25
25-May-2011	08:00:00	-7.12	-3.69	-16.79	-1.42	0.86	3.75	6.99	1.27
25-May-2011	20:00:00	-10.36	-6.87	-18.13	-2.21	0.11	3.57	6.80	1.06
26-May-2011	08:00:00	-8.69	-4.63	-18.25	-2.14	-7.60	3.50	6.79	1.02
26-May-2011	20:00:00	-11.48	-8.08	-8.46	-2.88	-3.67	4.13	6.64	1.33
27-May-2011	08:00:00	-1.18	1.00	-13.35	-0.07	1.94	4.45	7.41	1.74
27-May-2011	20:00:00	-1.11	0.71	-11.59	0.18	4.55	4.55	7.61	1.92
28-May-2011	08:00:00	-1.25	0.31	-7.29	0.18	4.61	4.51	7.70	1.92
28-May-2011	20:00:00	-3.92	-2.12	-11.05	-0.36	3.93	4.27	7.47	1.76
29-May-2011	08:00:00	-3.76	-2.27	-12.24	-0.44	2.60	4.20	7.45	1.70
29-May-2011	20:00:00	-6.99	-5.25	-14.61	-1.04	1.98	3.99	7.21	1.48

Date	Time	Gauge Number and Water Level (inches)							
dd-mmm-yyyy	hh:mm:ss	UT1 - 01	UT1 - 02	UT1 - 03	UT5 - 01	UT5 - 02	UT6 - 01	UT6 - 02	UT6 - 03
30-May-2011	08:00:00	-6.01	-3.80	-15.31	-1.05	1.30	3.93	7.22	1.47
30-May-2011	20:00:00	-9.47	-7.68	-16.64	-1.88	1.12	3.73	6.95	1.23
31-May-2011	08:00:00	-7.96	-5.16	-16.83	-1.84	0.04	3.66	6.93	1.20
31-May-2011	20:00:00	-11.41	-9.13	-18.39	-2.76	-8.53	3.43	6.68	0.95
01-Jun-2011	08:00:00	-9.74	-6.44	-18.30	-2.65	-10.14	3.38	6.67	0.96
01-Jun-2011	20:00:00	-12.84	-10.15	-20.19	-3.81	-11.75	3.13	6.43	0.55
02-Jun-2011	08:00:00	-11.38	-7.46	-19.89	-3.59	-12.85	3.09	6.37	0.45
02-Jun-2011	20:00:00	-14.19	-10.39	-22.26	-5.09	-14.45	2.82	6.07	0.05
03-Jun-2011	08:00:00	-12.91	-7.83	-21.68	-4.64	-15.19	2.79	6.06	0.06
03-Jun-2011	20:00:00	-15.40	-11.47	-23.88	-6.29	-16.28	2.56	5.81	-0.21
04-Jun-2011	08:00:00	-14.16	-9.18	-23.28	-5.64	-16.43	2.50	5.78	-0.26
04-Jun-2011	20:00:00	-16.45	-12.62	-25.60	-7.36	-17.02	2.24	5.52	-0.44
05-Jun-2011	08:00:00	-15.14	-10.37	-25.10	-6.47	-17.07	2.19	5.45	-0.43
05-Jun-2011	20:00:00	-17.50	-13.57	-27.44	-8.51	-18.00	2.04	5.22	-0.67
06-Jun-2011	08:00:00	-16.18	-11.69	-26.23	-7.49	-17.95	1.97	5.20	-0.69
06-Jun-2011	20:00:00	-18.33	-14.61	-28.42	-9.49	-18.74	1.66	4.95	-0.94
07-Jun-2011	08:00:00	-17.13	-13.13	-28.71	-8.41	-18.83	1.58	4.88	-0.98
07-Jun-2011	20:00:00	-19.32	-16.06	-30.12	-10.64	-19.64	1.48	4.61	-1.20
08-Jun-2011	08:00:00	-17.89	-14.40	-29.62	-9.21	-19.59	1.38	4.62	-1.25
08-Jun-2011	20:00:00	-19.24	-15.66	-30.75	-8.43	-19.05	1.45	4.55	-1.25
09-Jun-2011	08:00:00	-18.39	-14.86	-30.62	-8.38	-19.23	1.38	4.54	-1.26
09-Jun-2011	20:00:00	-19.47	-16.43	-31.23	-9.81	-19.90	1.16	4.41	-1.41
10-Jun-2011	08:00:00	-18.23	-15.49	-31.13	-8.96	-19.92	1.12	4.33	-1.51
10-Jun-2011	20:00:00	-20.56	-18.05	-32.08	-11.48	-20.87	0.62	4.02	-1.82
11-Jun-2011	08:00:00	-19.86	-17.31	-32.16	-10.13	-21.02	0.66	3.94	-1.86
11-Jun-2011	20:00:00	-21.29	-19.10	-32.94	-12.11	-22.13	0.24	3.71	-2.18
12-Jun-2011	08:00:00	-18.83	-15.87	-31.31	-10.66	-22.22	0.53	3.73	-2.16
12-Jun-2011	20:00:00	0.02	2.03	-12.89	-0.13	-0.12	3.10	5.40	-0.24
13-Jun-2011	08:00:00	-1.38	1.03	-14.93	-0.74	-0.84	2.86	5.62	-0.11
13-Jun-2011	20:00:00	-5.07	-1.47	-16.89	-1.67	-0.03	2.49	5.44	-0.31
14-Jun-2011	08:00:00	-5.33	-2.91	-17.69	-1.91	-0.55	2.36	5.46	-0.35
14-Jun-2011	20:00:00	-8.56	-6.50	-19.22	-2.72	-7.21	2.11	5.25	-0.55
15-Jun-2011	08:00:00	-8.17	-5.88	-19.35	-2.85	-11.13	2.05	5.22	-0.61
15-Jun-2011	20:00:00	-5.96	-1.62	-17.23	-1.62	-2.88	2.94	5.61	-0.31
16-Jun-2011	08:00:00	-4.57	-1.91	-17.89	-1.70	-9.78	2.64	5.70	-0.14
16-Jun-2011	20:00:00	-8.24	-6.68	-19.76	-2.48	-10.66	2.37	5.49	-0.32
17-Jun-2011	08:00:00	-7.88	-5.90	-19.65	-2.55	-11.15	2.33	5.43	-0.37
17-Jun-2011	20:00:00	-10.07	-7.99	-20.57	-3.07	-11.83	2.18	5.28	-0.48
18-Jun-2011	08:00:00	-8.91	-6.49	-20.17	-2.98	-12.42	2.22	5.31	-0.49
18-Jun-2011	20:00:00	-9.19	-6.39	-21.16	-3.13	-12.89	2.17	5.21	-0.52
19-Jun-2011	08:00:00	-8.22	-5.51	-20.43	-3.07	-13.07	2.30	5.31	-0.47
19-Jun-2011	20:00:00	-6.51	-2.79	-19.40	-1.90	-10.94	2.64	5.63	-0.14
20-Jun-2011	08:00:00	-6.11	-3.77	-18.39	-1.90	-10.05	2.95	5.36	0.06
20-Jun-2011	20:00:00	-8.44	-4.82	-20.21	-2.03	-10.43	2.70	5.72	-0.08
21-Jun-2011	08:00:00	-6.89	-4.37	-20.12	-2.04	-10.51	2.62	5.72	-0.08
21-Jun-2011	20:00:00	-9.96	-7.72	-22.04	-2.91	-11.64	2.42	5.52	-0.31
22-Jun-2011	08:00:00	-8.11	-4.19	-20.61	-2.32	-11.29	2.54	5.63	-0.19
22-Jun-2011	20:00:00	-11.03	-8.08	-22.41	-3.23	-12.00	2.47	5.46	-0.27
23-Jun-2011	08:00:00	-9.03	-5.15	-21.00	-2.72	-11.67	2.77	5.50	-0.15
23-Jun-2011	20:00:00	-7.11	-3.10	-20.31	-1.86	-10.99	2.77	5.82	0.04
24-Jun-2011	08:00:00	-6.54	-3.62	-20.34	-1.79	-11.31	2.73	5.81	0.09
24-Jun-2011	20:00:00	-10.55	-7.55	-23.07	-2.73	-12.27	2.48	5.6	-0.15
25-Jun-2011	08:00:00	-9.34	-6.10	-22.58	-2.75	-12.47	2.43	5.52	-0.20
25-Jun-2011	20:00:00	-12.68	-10.43	-25.36	-3.90	-13.75	2.11	5.26	-0.50
26-Jun-2011	08:00:00	-11.61	-7.94	-24.89	-3.84	-14.43	2.07	5.24	-0.33
26-Jun-2011	20:00:00	-13.93	-10.84	-27.00	-4.91	-16.04	1.83	5.02	-0.48
27-Jun-2011	08:00:00	-12.85	-8.60	-26.74	-4.79	-16.67	1.74	4.92	-0.46
27-Jun-2011	20:00:00	-14.83	-11.11	-28.69	-6.08	-17.86	1.61	4.74	-0.62
28-Jun-2011	08:00:00	-13.79	-9.36	-28.26	-5.66	-18.00	1.49	4.76	-0.59
28-Jun-2011	20:00:00	-15.83	-11.73	-29.48	-7.07	-18.81	1.39	4.58	-0.76

Date	Time	Gauge Number and Water Level (inches)							
dd-mmm-yyyy	hh:mm:ss	UT1 - 01	UT1 - 02	UT1 - 03	UT5 - 01	UT5 - 02	UT6 - 01	UT6 - 02	UT6 - 03
29-Jun-2011	08:00:00	-14.29	-9.59	-29.13	-6.60	-18.92	1.33	4.50	-0.79
29-Jun-2011	20:00:00	-16.91	-14.10	-31.07	-9.07	-20.2	0.79	4.20	-1.12
30-Jun-2011	08:00:00	-16.17	-12.16	-31.21	-8.25	-20.42	0.82	4.11	-1.19
30-Jun-2011	20:00:00	-18.82	-15.89	-32.42	-10.69	-21.75	0.26	3.81	-1.61
01-Jul-2011	08:00:00	-17.79	-14.47	-32.48	-9.62	-22.03	0.34	3.73	-1.63
01-Jul-2011	20:00:00	-20.20	-17.66	-33.50	-12.12	-23.61	-0.32	3.38	-2.09
02-Jul-2011	08:00:00	-19.18	-16.75	-33.63	-10.97	-23.37	-0.14	3.31	-2.13
02-Jul-2011	20:00:00	-21.49	-19.48	-34.24	-13.32	-23.38	-0.87	2.98	-2.63
03-Jul-2011	08:00:00	-20.45	-19.02	-33.58	-11.99	-23.41	-0.63	2.88	-2.72
03-Jul-2011	20:00:00	-22.52	-21.01	-33.92	-14.35	-23.42	-1.45	2.54	-3.41
04-Jul-2011	08:00:00	-21.63	-21.00	-34.35	-12.95	-23.43	-1.15	2.49	-3.39
04-Jul-2011	20:00:00	-23.08	-22.26	-34.69	-14.55	-23.39	-1.64	2.24	-4.11
05-Jul-2011	08:00:00	-22.17	-22.46	-34.51	-13.66	-23.26	-1.18	2.12	-4.20
05-Jul-2011	20:00:00	1.93	2.08	-0.60	0.88	3.99	3.83	5.57	0.74
06-Jul-2011	08:00:00	-0.33	0.98	-1.91	-0.09	4.62	3.12	5.94	0.87
06-Jul-2011	20:00:00	-1.79	0.24	-2.79	-0.61	4.76	3.50	5.97	1.23
07-Jul-2011	08:00:00	-1.79	-0.19	-3.87	-0.14	4.90	3.38	6.40	1.26
07-Jul-2011	20:00:00	-4.50	-2.74	-4.78	-0.81	4.22	3.21	6.34	1.12
08-Jul-2011	08:00:00	-4.56	-3.01	-6.30	-1.02	3.45	3.19	6.30	1.07
08-Jul-2011	20:00:00	2.86	2.55	1.45	0.85	5.81	4.39	6.84	1.92
09-Jul-2011	08:00:00	0.69	1.40	-1.39	0.44	5.76	4.11	7.24	2.00
09-Jul-2011	20:00:00	-1.86	0.38	-3.33	-0.23	5.35	3.85	7.01	1.83
10-Jul-2011	08:00:00	-1.82	-0.22	-5.46	-0.38	5.10	3.77	6.99	1.80
10-Jul-2011	20:00:00	-4.20	-2.60	-6.63	-1.00	4.30	3.61	6.85	1.57
11-Jul-2011	08:00:00	-3.90	-2.77	-8.03	-1.16	3.58	3.54	6.85	1.56
11-Jul-2011	20:00:00	-7.84	-6.02	-10.09	-1.97	2.07	3.29	6.64	1.27
12-Jul-2011	08:00:00	-7.06	-4.71	-10.92	-2.01	0.46	3.29	6.58	1.19
12-Jul-2011	20:00:00	-10.89	-8.34	-14.47	-2.95	-2.52	3.03	6.32	0.93
13-Jul-2011	08:00:00	-9.92	-6.69	-15.32	-3.02	-11.25	2.96	6.26	0.91
13-Jul-2011	20:00:00	-12.54	-9.48	-17.12	-3.89	-13.29	2.82	6.15	0.80
14-Jul-2011	08:00:00	-11.41	-7.91	-17.11	-3.84	-14.24	2.79	6.04	0.82
14-Jul-2011	20:00:00	-13.78	-10.46	-19.00	-4.94	-15.85	2.61	5.86	0.59
15-Jul-2011	08:00:00	-12.83	-8.93	-17.91	-4.32	-15.91	2.74	5.86	0.72
15-Jul-2011	20:00:00	-7.27	-1.36	-15.56	-2.03	-8.99	3.52	6.44	1.28
16-Jul-2011	08:00:00	-5.16	-1.60	-16.44	-1.66	-12.09	3.52	6.57	1.39
16-Jul-2011	20:00:00	-5.87	-3.44	-17.23	-1.68	-12.93	3.48	6.61	1.37
17-Jul-2011	08:00:00	-5.67	-3.91	-17.26	-1.66	-12.76	3.46	6.58	1.42
17-Jul-2011	20:00:00	-8.70	-7.00	-18.49	-2.36	-13.19	3.21	6.45	1.26
18-Jul-2011	08:00:00	-7.63	-5.56	-18.36	-2.28	-13.35	3.17	6.47	1.25
18-Jul-2011	20:00:00	-10.93	-8.97	-19.94	-3.17	-14.33	3.01	6.27	1.04
19-Jul-2011	08:00:00	-9.57	-6.77	-19.46	-3.19	-14.61	2.96	6.27	1.00
19-Jul-2011	20:00:00	-12.25	-9.55	-21.12	-4.13	-15.64	2.79	6.07	0.83
20-Jul-2011	08:00:00	-10.89	-7.42	-20.87	-4.00	-16.06	2.73	6.07	0.81
20-Jul-2011	20:00:00	-12.18	-7.92	-22.05	-4.74	-16.53	2.78	6.05	0.75
21-Jul-2011	08:00:00	-10.70	-6.80	-21.76	-4.48	-16.95	2.78	6.00	0.75
21-Jul-2011	20:00:00	-14.06	-10.58	-24.39	-6.17	-18.15	2.48	5.74	0.50
22-Jul-2011	08:00:00	-12.80	-8.55	-24.04	-5.72	-18.47	2.42	5.73	0.47
22-Jul-2011	20:00:00	-15.85	-12.19	-26.78	-7.89	-19.72	2.12	5.43	0.15
23-Jul-2011	08:00:00	-14.68	-10.38	-26.54	-7.24	-19.96	2.05	5.33	0.13
23-Jul-2011	20:00:00	-16.73	-12.95	-28.54	-9.00	-20.80	1.86	5.19	-0.11
24-Jul-2011	08:00:00	-15.53	-11.36	-28.19	-8.18	-21.01	1.80	5.10	-0.12
24-Jul-2011	20:00:00	-17.82	-14.41	-30.30	-10.31	-22.16	1.55	4.89	-0.41
25-Jul-2011	08:00:00	-16.61	-12.73	-29.78	-9.21	-22.35	1.50	4.88	-0.45
25-Jul-2011	20:00:00	-17.60	-13.73	-30.73	-9.02	-22.82	1.72	4.88	-0.40
26-Jul-2011	08:00:00	-16.30	-12.82	-30.37	-8.94	-22.88	1.67	4.88	-0.44
26-Jul-2011	20:00:00	-18.73	-15.77	-31.8	-11.26	-22.97	1.31	4.63	-0.71
27-Jul-2011	08:00:00	-17.60	-15.00	-31.89	-10.24	-23.03	1.30	4.55	-0.73
27-Jul-2011	20:00:00	-20.26	-17.98	-32.91	-12.87	-23.04	0.67	4.21	-1.15
28-Jul-2011	08:00:00	-19.16	-17.54	-33.06	-11.50	-23.04	0.75	4.13	-1.18
28-Jul-2011	20:00:00	-21.65	-20.02	-34.00	-14.14	-23.04	0.03	3.79	-1.62

Date	Time	Gauge Number and Water Level (inches)							
dd-mmm-yyyy	hh:mm:ss	UT1 - 01	UT1 - 02	UT1 - 03	UT5 - 01	UT5 - 02	UT6 - 01	UT6 - 02	UT6 - 03
29-Jul-2011	08:00:00	-20.60	-19.82	-34.07	-12.64	-23.04	0.25	3.70	-1.66
29-Jul-2011	20:00:00	-22.91	-21.85	-34.64	-15.19	-23.04	-0.55	3.41	-2.12
30-Jul-2011	08:00:00	-21.96	-21.97	-34.52	-13.83	-23.04	-0.30	3.30	-2.18
30-Jul-2011	20:00:00	-24.05	-23.62	-34.99	-16.03	-23.05	-1.30	2.95	-2.80
31-Jul-2011	08:00:00	-23.26	-23.86	-34.88	-14.80	-23.04	-0.62	2.85	-2.86
31-Jul-2011	20:00:00	-23.71	-24.99	-35.37	-15.36	-23.03	0.94	3.01	-2.33
01-Aug-2011	08:00:00	-23.38	-25.12	-34.88	-14.09	-23.04	0.56	3.10	-2.17
01-Aug-2011	20:00:00	-21.67	-26.09	-35.52	-16.17	-23.04	-0.73	2.82	-2.75
02-Aug-2011	08:00:00	-11.72	-26.38	-35.51	-15.03	-23.04	-0.51	2.71	-2.88
02-Aug-2011	20:00:00	-23.86	-27.35	-35.98	-17.19	-23.03	-1.90	2.36	-3.84
03-Aug-2011	08:00:00	-11.51	-27.73	-35.93	-15.81	-23.05	-1.26	2.28	-4.01
03-Aug-2011	20:00:00	-22.97	-28.48	-36.26	-17.56	-23.04	-2.16	1.98	-5.16
04-Aug-2011	08:00:00	-23.16	-28.79	-36.17	-16.30	-23.04	-1.64	1.86	-5.05
04-Aug-2011	20:00:00	-23.07	-29.48	-36.65	-18.33	-23.04	-2.87	1.55	-6.61
05-Aug-2011	08:00:00	-23.10	-28.29	-36.59	-16.95	-23.03	-2.02	1.42	-6.04
05-Aug-2011	20:00:00	-23.08	-28.89	-36.76	-17.36	-23.04	-2.72	1.32	-6.96
06-Aug-2011	08:00:00	-23.11	-28.90	-36.48	-16.34	-23.04	-2.30	1.27	-6.37
06-Aug-2011	20:00:00	-23.09	-28.88	-36.71	-17.66	-23.03	-2.96	1.05	-7.50
07-Aug-2011	08:00:00	-23.09	-28.86	-36.46	-16.53	-23.05	-2.65	1.02	-6.86
07-Aug-2011	20:00:00	-23.09	-28.86	-37.05	-18.82	-23.03	-4.54	0.64	-9.17
08-Aug-2011	08:00:00	-23.09	-28.84	-36.99	-17.39	-23.04	-3.88	0.51	-8.16
08-Aug-2011	20:00:00	-23.09	-28.86	-37.41	-19.40	-23.04	-5.80	0.04	-10.49
09-Aug-2011	08:00:00	-23.09	-28.86	-37.34	-17.88	-23.03	-4.74	-0.03	-9.26
09-Aug-2011	20:00:00	-23.10	-28.95	-37.86	-20.19	-23.05	-7.76	-0.74	-12.29
10-Aug-2011	08:00:00	-23.10	-28.99	-37.92	-18.65	-23.03	-6.71	-0.93	-10.71
10-Aug-2011	20:00:00	-23.08	-29.02	-38.4	-21.00	-23.04	-9.40	-1.86	-13.66
11-Aug-2011	08:00:00	-23.10	-28.97	-38.46	-19.44	-23.04	-8.23	-1.94	-12.08
11-Aug-2011	20:00:00	-23.11	-28.99	-38.87	-21.13	-23.03	-9.94	-2.68	-14.10
12-Aug-2011	08:00:00	-23.10	-29.00	-38.86	-19.60	-23.04	-8.57	-2.72	-12.56
12-Aug-2011	20:00:00	-20.98	-28.95	-37.64	-21.40	-23.04	-10.52	-3.55	-14.52
13-Aug-2011	08:00:00	-23.16	-28.97	-37.20	-19.81	-23.04	-9.08	-3.45	-12.91
13-Aug-2011	20:00:00	-21.66	-28.97	-31.08	-9.39	-23.08	0.50	0.06	-3.04
14-Aug-2011	08:00:00	-16.51	-28.98	-29.88	-5.09	-23.07	1.56	1.49	-2.17
14-Aug-2011	20:00:00	-16.48	-23.32	-30.95	-7.35	-23.07	1.27	1.15	-2.57
15-Aug-2011	08:00:00	-16.30	-21.04	-31.34	-7.92	-23.09	1.10	1.26	-2.62
15-Aug-2011	20:00:00	-18.13	-20.34	-32.06	-9.58	-23.08	0.51	1.14	-2.68
16-Aug-2011	08:00:00	-17.76	-19.57	-32.17	-9.56	-23.09	0.30	1.11	-2.87
16-Aug-2011	20:00:00	-19.60	-20.64	-32.65	-11.21	-23.09	-0.66	0.90	-3.58
17-Aug-2011	08:00:00	-19.13	-20.50	-32.77	-10.91	-23.04	-0.65	0.85	-3.80
17-Aug-2011	20:00:00	-20.85	-21.90	-33.03	-12.64	-23.03	-2.00	0.51	-5.45
18-Aug-2011	08:00:00	-20.29	-22.14	-33.14	-12.13	-23.03	-1.26	0.44	-5.11
18-Aug-2011	20:00:00	-20.85	-22.87	-33.24	-12.69	-23.02	-1.91	0.35	-6.30
19-Aug-2011	08:00:00	-20.07	-23.19	-33.26	-12.21	-23.04	-1.66	0.36	-6.44
19-Aug-2011	20:00:00	-21.61	-24.37	-33.57	-13.91	-23.03	-3.21	0.04	-8.42
20-Aug-2011	08:00:00	-21.05	-24.87	-33.56	-13.33	-23.03	-2.66	-0.05	-7.88
20-Aug-2011	20:00:00	-22.44	-26.00	-33.98	-14.93	-23.03	-4.13	-0.49	-9.99
21-Aug-2011	08:00:00	-21.79	-26.43	-33.98	-14.24	-23.03	-3.47	-0.58	-8.60
21-Aug-2011	20:00:00	-22.66	-27.14	-34.22	-15.64	-23.03	-5.11	-1.05	-11.19
22-Aug-2011	08:00:00	-21.25	-27.21	-34.03	-14.87	-23.03	-4.15	-1.09	-9.22
22-Aug-2011	20:00:00	-22.95	-27.93	-34.50	-16.75	-23.04	-7.29	-2.05	-12.77
23-Aug-2011	08:00:00	-22.42	-28.25	-34.49	-16.13	-23.04	-6.56	-2.20	-11.65
23-Aug-2011	20:00:00	-23.11	-28.81	-34.88	-17.68	-23.03	-9.13	-3.30	-14.77
24-Aug-2011	08:00:00	-23.21	-28.83	-34.70	-16.93	-23.04	-8.14	-3.40	-13.04
24-Aug-2011	20:00:00	-23.09	-28.76	-35.60	-18.48	-23.04	-10.51	-4.53	-15.90
25-Aug-20101	08:00:00	-23.18	-28.71	-35.27	-17.37	-23.03	-9.45	-4.50	-14.45
25-Aug-2011	20:00:00	-23.07	-28.67	-35.78	-19.13	-23.04	-11.78	-5.88	-16.85
26-Aug-2011	08:00:00	-23.15	-28.64	-36.26	-18.06	-23.04	-10.59	-5.64	-15.45
26-Aug-2011	20:00:00	-23.08	-28.61	-36.57	-19.47	-23.03	-12.08	-6.63	-17.10
27-Aug-2011	08:00:00	-23.14	-28.61	-36.44	-18.25	-23.03	-10.78	-6.39	-15.80
27-Aug-2011	20:00:00	-23.06	-28.63	-36.72	-20.45	-23.03	-13.17	-8.23	-17.88

Date	Time	Gauge Number and Water Level (inches)							
dd-mmm-yyyy	hh:mm:ss	UT1 - 01	UT1 - 02	UT1 - 03	UT5 - 01	UT5 - 02	UT6 - 01	UT6 - 02	UT6 - 03
28-Aug-2011	08:00:00	-23.13	-28.66	-36.75	-19.51	-23.04	-13.05	-8.09	-17.66
28-Aug-2011	20:00:00	-23.03	-28.64	-36.83	-21.83	-23.02	-14.33	-9.79	-19.05
29-Aug-2011	08:00:00	-23.13	-28.66	-36.89	-20.33	-23.04	-13.71	-9.56	-18.61
29-Aug-2011	20:00:00	-23.04	-28.64	-36.89	-22.65	-23.03	-15.01	-10.95	-19.76
30-Aug-2011	08:00:00	-23.09	-28.66	-36.88	-21.23	-23.03	-14.35	-10.61	-18.72
30-Aug-2011	20:00:00	-23.04	-28.64	-36.89	-23.10	-23.04	-15.60	-12.09	-19.97
31-Aug-2011	08:00:00	-23.12	-28.64	-36.90	-21.59	-23.04	-15.04	-11.74	-19.46
31-Aug-2011	20:00:00	-23.05	-28.63	-36.87	-23.40	-23.04	-16.00	-12.85	-20.85
01-Sep-2011	08:00:00	-23.12	-28.61	-36.89	-21.72	-23.02	-15.57	-12.54	-20.05
01-Sep-2011	20:00:00	-23.10	-28.61	-36.85	-23.88	-23.03	-16.55	-13.79	-21.59
02-Sep-2011	08:00:00	-23.11	-28.59	-36.84	-22.27	-23.03	-16.21	-13.35	-21.18
02-Sep-2011	20:00:00	-23.02	-28.60	-36.84	-24.24	-23.04	-12.73	-14.45	-20.14
03-Sep-2011	08:00:00	-23.09	-28.60	-36.85	-19.28	-23.01	-12.39	-10.45	-17.61
03-Sep-2011	20:00:00	-23.05	-28.63	-36.82	-20.63	-23.03	-13.17	-11.88	-18.12
04-Sep-2011	08:00:00	-23.11	-28.63	-36.83	-19.47	-23.03	-12.92	-11.68	-17.83
04-Sep-2011	20:00:00	-23.07	-28.64	-36.79	-21.44	-23.04	-14.36	-13.06	-19.06
05-Sep-2011	08:00:00	-23.12	-28.66	-36.78	-19.79	-23.03	-13.90	-12.44	-18.73
05-Sep-2011	20:00:00	-18.80	-28.68	-29.12	-6.22	-14.11	1.21	-0.56	-2.92
06-Sep-2011	08:00:00	-10.65	-21.25	-28.00	-4.20	-23.05	1.50	0.46	-2.69
06-Sep-2011	20:00:00	-10.96	-15.06	-29.61	-5.09	-23.09	0.94	0.14	-2.52
07-Sep-2011	08:00:00	-11.07	-13.41	-30.51	-6.32	-23.10	0.73	0.03	-3.18
07-Sep-2011	20:00:00	-12.06	-13.16	-31.15	-7.41	-23.10	0.38	-0.08	-3.54
08-Sep-2011	08:00:00	-11.80	-12.47	-31.58	-7.77	-23.10	0.19	-0.04	-3.69
08-Sep-2011	20:00:00	-13.19	-13.48	-31.80	-8.73	-23.11	-0.24	-0.19	-4.16
09-Sep-2011	08:00:00	-12.83	-13.07	-31.89	-8.86	-23.10	-0.31	-0.13	-4.05
09-Sep-2011	20:00:00	-14.61	-14.80	-32.25	-10.03	-23.10	-1.08	-0.39	-4.48
10-Sep-2011	08:00:00	-14.18	-14.42	-32.36	-10.08	-23.12	-1.14	-0.39	-4.70
10-Sep-2011	20:00:00	-16.23	-16.61	-32.74	-11.51	-23.12	-2.12	-0.77	-5.82
11-Sep-2011	08:00:00	-15.80	-16.43	-32.85	-11.41	-23.12	-1.86	-0.84	-6.17
11-Sep-2011	20:00:00	-17.39	-18.00	-33.20	-12.65	-23.11	-2.77	-1.20	-7.96
12-Sep-2011	08:00:00	-17.19	-18.31	-33.35	-12.31	-23.02	-2.54	-1.31	-7.72
12-Sep-2011	20:00:00	-18.48	-19.59	-33.58	-13.74	-23.03	-3.63	-1.78	-9.81
13-Sep-2011	08:00:00	-17.90	-19.68	-33.62	-13.36	-23.03	-3.38	-1.87	-9.06
13-Sep-2011	20:00:00	-19.42	-21.10	-33.92	-14.83	-23.03	-4.62	-2.50	-11.08
14-Sep-2011	08:00:00	-18.81	-21.34	-33.95	-14.43	-23.02	-4.44	-2.63	-10.07
14-Sep-2011	20:00:00	-20.33	-22.72	-34.03	-15.90	-23.02	-5.87	-3.46	-12.42
15-Sep-2011	08:00:00	-19.69	-22.86	-34.03	-15.41	-23.02	-5.67	-3.53	-11.58
15-Sep-2011	20:00:00	-20.51	-23.79	-34.29	-16.30	-23.03	-6.97	-4.18	-12.47
16-Sep-2011	08:00:00	-20.26	-24.31	-34.41	-16.20	-23.02	-7.39	-4.32	-12.30
16-Sep-2011	20:00:00	-20.88	-24.96	-34.5	-16.87	-23.01	-8.01	-4.83	-12.96
17-Sep-2011	08:00:00	-20.39	-25.23	-34.59	-16.60	-23.02	-7.67	-4.86	-12.21
17-Sep-2011	20:00:00	-20.90	-25.77	-34.69	-17.18	-23.02	-8.42	-5.33	-13.27
18-Sep-2011	08:00:00	-20.24	-25.97	-34.77	-16.86	-23.02	-7.93	-5.23	-12.35
18-Sep-2011	20:00:00	-20.60	-26.38	-34.75	-17.42	-23.02	-8.62	-5.76	-13.7
19-Sep-2011	08:00:00	-19.88	-26.55	-34.67	-16.89	-23.02	-7.93	-5.63	-13.14
19-Sep-2011	20:00:00	-20.00	-26.70	-34.56	-17.42	-23.02	-8.66	-6.07	-14.06
20-Sep-2011	08:00:00	-19.23	-25.86	-34.46	-16.85	-23.01	-7.74	-5.86	-12.69
20-Sep-2011	20:00:00	-18.96	-24.93	-34.45	-17.02	-23.01	-7.86	-5.95	-12.67
21-Sep-2011	08:00:00	-14.96	-21.33	-30.53	-10.02	-23.02	1.75	-1.76	-3.10
21-Sep-2011	20:00:00	-1.88	0.57	-28.04	-2.45	-21.45	1.62	0.57	-2.48
22-Sep-2011	08:00:00	-3.76	-0.52	-28.62	-3.07	-22.36	1.49	0.32	-2.54
22-Sep-2011	20:00:00	-5.58	-2.22	-29.80	-3.68	-21.98	1.32	0.30	-2.81
23-Sep-2011	08:00:00	1.13	1.83	-25.80	-0.94	0.07	2.64	1.42	-1.52
23-Sep-2011	20:00:00	1.26	2.33	-17.40	-0.33	2.54	2.75	2.43	-1.35
24-Sep-2011	08:00:00	-0.87	1.57	-18.69	-1.08	2.88	2.41	2.93	-1.58
24-Sep-2011	20:00:00	-2.97	0.67	-20.29	-1.81	1.53	2.06	3.03	-1.87
25-Sep-2011	08:00:00	-3.56	-0.28	-20.70	-2.12	0.55	1.91	3.16	-2.03
25-Sep-2011	20:00:00	-5.67	-2.04	-22.02	-2.67	-1.36	1.72	3.11	-2.23
26-Sep-2011	08:00:00	-5.68	-2.57	-22.37	-2.76	-5.73	1.78	3.21	-2.18
26-Sep-2011	20:00:00	-6.31	-3.18	-22.81	-2.83	-9.70	1.75	3.32	-2.20

Date	Time	Gauge Number and Water Level (inches)							
dd-mmm-yyyy	hh:mm:ss	UT1 - 01	UT1 - 02	UT1 - 03	UT5 - 01	UT5 - 02	UT6 - 01	UT6 - 02	UT6 - 03
27-Sep-2011	08:00:00	-0.82	1.25	-17.31	-0.99	3.47	2.67	4.15	-1.22
27-Sep-2011	20:00:00	-3.30	-0.06	-19.05	-1.63	2.32	2.54	4.13	-1.37
28-Sep-2011	08:00:00	-3.68	-1.04	-19.55	-1.86	0.87	2.48	4.15	-1.29
28-Sep-2011	20:00:00	-5.85	-3.03	-20.81	-2.39	-0.90	2.10	4.06	-1.40
29-Sep-2011	08:00:00	-5.83	-3.40	-20.96	-2.62	-3.66	1.92	4.01	-1.70
29-Sep-2011	20:00:00	-7.63	-5.00	-21.75	-3.18	-11.38	1.67	Data Gap	-1.74
30-Sep-2011	08:00:00	-7.25	-4.81	-21.75	-3.39	-14.21	1.59	Data Gap	-1.74
30-Sep-2011	20:00:00	-8.95	-6.48	-22.90	-3.94	-15.90	1.28	Data Gap	-1.92
01-Oct-2011	08:00:00	-8.93	-6.49	-23.27	-4.33	-17.06	1.10	Data Gap	-2.02
01-Oct-2011	20:00:00	-10.25	-7.89	-24.29	-5.05	-18.64	0.83	Data Gap	-1.98
02-Oct-2011	08:00:00	-10.24	-7.74	-24.60	-5.49	-19.48	0.68	Data Gap	-2.06
02-Oct-2011	20:00:00	-11.45	-8.86	-25.63	-6.24	-20.68	0.44	Data Gap	-2.32
03-Oct-2011	08:00:00	-10.96	-8.04	-25.73	-6.57	-21.27	0.46	Data Gap	-2.43
03-Oct-2011	20:00:00	-12.41	-9.57	-26.88	-7.29	-22.25	0.15	Data Gap	-2.68
04-Oct-2011	08:00:00	-11.87	-8.67	-26.95	-7.51	-22.54	0.19	Data Gap	-2.73
04-Oct-2011	20:00:00	-13.31	-10.11	-27.97	-8.31	-23.20	-0.14	Data Gap	-2.88
05-Oct-2011	08:00:00	-12.61	-9.36	-28.00	-8.41	-23.18	-0.06	Data Gap	-2.53
05-Oct-2011	20:00:00	-13.92	-10.69	-28.90	-9.17	-23.16	-0.40	Data Gap	-3.39
06-Oct-2011	08:00:00	-13.17	-10.17	-29.02	-9.20	-23.18	-0.28	Data Gap	-3.40
06-Oct-2011	20:00:00	-14.34	-11.44	-29.52	-9.95	-23.16	-0.67	Data Gap	-3.74
07-Oct-2011	08:00:00	-13.51	-10.91	-29.61	-9.89	-23.16	-0.51	Data Gap	-3.74
07-Oct-2011	20:00:00	-15.00	-12.09	-29.95	-10.59	-23.16	-0.94	Data Gap	-4.13
08-Oct-2011	08:00:00	-14.20	-11.71	-30.04	-10.49	-23.16	-0.76	Data Gap	-4.16
08-Oct-2011	20:00:00	-15.21	-12.75	-30.42	-11.17	-23.15	-1.17	Data Gap	-4.61
09-Oct-2011	08:00:00	-14.30	-12.27	-30.37	-10.97	-23.14	-0.92	Data Gap	-4.53
09-Oct-2011	20:00:00	-15.33	-13.32	-30.74	-11.64	-23.12	-1.33	Data Gap	-5.11
10-Oct-2011	08:00:00	-14.37	-12.76	-30.71	-11.36	-23.12	-0.99	Data Gap	-4.90
10-Oct-2011	20:00:00	-15.20	-13.61	-30.99	-11.92	-23.12	-1.28	Data Gap	-5.31
11-Oct-2011	08:00:00	-12.11	-10.15	-30.34	-9.66	-23.11	0.22	Data Gap	-3.73
11-Oct-2011	20:00:00	-7.27	-1.52	-26.57	-5.85	-19.12	1.65	Data Gap	-2.23
12-Oct-2011	08:00:00	-0.25	2.44	-16.11	-1.48	-9.97	2.49	Data Gap	-0.86
12-Oct-2011	20:00:00	-2.21	1.64	-17.80	-1.76	-0.06	2.07	Data Gap	-0.92
13-Oct-2011	08:00:00	-1.77	1.48	-17.36	-1.50	1.10	2.11	Data Gap	-0.72
13-Oct-2011	20:00:00	-2.77	0.77	-18.03	-1.77	1.42	1.95	Data Gap	-0.79
14-Oct-2011	08:00:00	-2.98	0.08	-18.37	-1.85	1.07	1.91	Data Gap	-0.73
14-Oct-2011	20:00:00	-5.03	-1.65	-19.44	-2.33	0.15	1.74	Data Gap	-0.84
15-Oct-2011	08:00:00	-5.47	-2.22	-19.79	-2.57	-3.26	1.63	Data Gap	-0.85
15-Oct-2011	20:00:00	-6.97	-3.68	-20.57	-2.94	-10.19	1.50	Data Gap	-0.95
16-Oct-2011	08:00:00	-6.99	-3.90	-20.54	-3.17	-12.93	1.46	Data Gap	-1.02
16-Oct-2011	20:00:00	-8.07	-4.96	-21.09	-3.43	-14.11	1.38	Data Gap	-1.13
17-Oct-2011	08:00:00	-7.81	-5.02	-21.02	-3.59	-14.98	1.40	Data Gap	-1.17
17-Oct-2011	20:00:00	-8.90	-6.23	-21.65	-3.85	-15.81	1.30	Data Gap	-1.30
18-Oct-2011	08:00:00	-8.30	-5.97	-21.56	-3.99	-16.38	1.27	Data Gap	-1.32
18-Oct-2011	20:00:00	-7.60	-4.40	-20.75	-3.47	-15.96	1.48	Data Gap	-1.19
19-Oct-2011	08:00:00	-5.05	-1.09	-18.76	-2.72	-14.64	2.03	Data Gap	-0.88
19-Oct-2011	20:00:00	0.50	2.42	-14.55	-0.54	4.52	2.76	Data Gap	0.03
20-Oct-2011	08:00:00	-1.22	1.56	-16.28	-1.00	4.44	2.58	Data Gap	0.08
20-Oct-2011	20:00:00	-2.48	0.37	-17.06	-1.35	4.02	2.41	Data Gap	0.06
21-Oct-2011	08:00:00	-2.89	-0.51	-17.50	-1.57	3.38	2.35	Data Gap	0.05
21-Oct-2011	20:00:00	-3.69	-1.53	-18.01	-1.74	2.53	2.26	Data Gap	-0.02
22-Oct-2011	08:00:00	-3.91	-1.94	-18.29	-1.90	1.35	2.24	Data Gap	-0.01
22-Oct-2011	20:00:00	-4.48	-2.46	-18.65	-1.99	0.68	2.17	Data Gap	-0.07
23-Oct-2011	08:00:00	-4.71	-2.61	-18.75	-2.14	-0.16	2.14	Data Gap	-0.12
23-Oct-2011	20:00:00	-5.29	-3.24	-18.99	-2.24	-1.27	2.07	Data Gap	-0.19
24-Oct-2011	08:00:00	-5.44	-3.34	-18.92	-2.34	-3.41	2.06	Data Gap	-0.20
24-Oct-2011	20:00:00	-6.20	-4.23	-19.29	-2.45	-7.12	1.96	Data Gap	-0.26
25-Oct-2011	08:00:00	-6.29	-4.44	-19.32	-2.59	-10.65	1.95	Data Gap	-0.30
25-Oct-2011	20:00:00	-6.71	-4.91	-19.48	-2.67	-12.24	1.87	Data Gap	-0.39
26-Oct-2011	08:00:00	-6.60	-4.63	-19.35	-2.77	-12.78	1.87	Data Gap	-0.40
26-Oct-2011	20:00:00	-6.92	-5.14	-19.57	-2.80	-13.31	1.78	Data Gap	-0.48

Date	Time	Gauge Number and Water Level (inches)							
dd-mmm-yyyy	hh:mm:ss	UT1 - 01	UT1 - 02	UT1 - 03	UT5 - 01	UT5 - 02	UT6 - 01	UT6 - 02	UT6 - 03
27-Oct-2011	08:00:00	-6.79	-4.70	-19.45	-2.87	-13.57	1.80	Data Gap	-0.48
27-Oct-2011	20:00:00	-7.07	-5.24	-19.76	-2.93	-13.93	1.74	Data Gap	-0.50
28-Oct-2011	08:00:00	-7.18	-5.15	-19.70	-3.05	-14.12	1.74	Data Gap	-0.58
28-Oct-2011	20:00:00	-5.54	-2.31	-18.32	-2.48	-12.77	2.02	Data Gap	-0.30
29-Oct-2011	08:00:00	-2.24	1.17	-16.55	-1.40	-5.32	2.44	Data Gap	0.06
29-Oct-2011	20:00:00	-3.41	-0.71	-17.68	-1.55	0.58	2.31	Data Gap	0.00
30-Oct-2011	08:00:00	-4.16	-1.70	-18.11	-1.73	0.25	2.26	Data Gap	-0.02
30-Oct-2011	20:00:00	-4.46	-2.27	-18.37	-1.80	0.16	2.20	Data Gap	-0.07
31-Oct-2011	08:00:00	-4.78	-2.51	-18.43	-1.89	-0.42	2.19	Data Gap	-0.07
31-Oct-2011	20:00:00	-4.77	-2.73	-18.57	-1.93	-1.24	2.15	Data Gap	-0.13
01-Nov-2011	08:00:00	-5.02	-2.92	-18.64	-2.06	-3.17	2.12	Data Gap	-0.12
01-Nov-2011	20:00:00	-4.99	-3.10	-18.76	-2.08	-5.37	2.08	Data Gap	-0.18
02-Nov-2011	08:00:00	-5.29	-3.13	-18.76	-2.19	-9.55	2.05	Data Gap	-0.17
02-Nov-2011	20:00:00	-5.23	-3.14	-18.79	-2.17	-11.02	2.02	Data Gap	-0.22
03-Nov-2011	08:00:00	-5.44	-3.04	-18.79	-2.23	-11.77	2.03	Data Gap	-0.21
03-Nov-2011	20:00:00	-4.97	-2.75	-16.41	-2.08	-10.77	2.53	Data Gap	-0.04
04-Nov-2011	08:00:00	0.68	2.97	-13.58	-0.18	5.43	3.41	Data Gap	1.05
04-Nov-2011	20:00:00	-0.50	2.36	-14.77	-0.59	5.29	3.29	Data Gap	0.99
05-Nov-2011	08:00:00	-1.33	1.63	-15.63	-0.88	5.03	3.24	Data Gap	1.00
05-Nov-2011	20:00:00	-1.75	0.75	-16.07	-1.06	4.82	3.13	Data Gap	0.91
06-Nov-2011	08:00:00	-2.27	0.12	-16.40	-1.22	4.56	3.10	Data Gap	0.87
06-Nov-2011	20:00:00	-2.43	-0.35	-16.67	-1.28	4.38	3.01	Data Gap	0.82
07-Nov-2011	08:00:00	-2.86	-0.64	-16.93	-1.38	4.11	2.99	Data Gap	0.78
07-Nov-2011	20:00:00	-2.97	-0.88	-17.06	-1.41	3.92	2.92	Data Gap	0.70
08-Nov-2011	08:00:00	-3.32	-0.97	-17.26	-1.51	3.49	2.89	Data Gap	0.71
08-Nov-2011	20:00:00	-3.36	-1.10	-17.32	-1.54	3.10	2.83	Data Gap	0.66
09-Nov-2011	08:00:00	-3.79	-1.12	-17.41	-1.62	2.32	2.82	Data Gap	0.63
09-Nov-2011	20:00:00	-3.91	-1.91	-17.36	-1.64	1.79	2.79	Data Gap	0.62
10-Nov-2011	08:00:00	-4.21	-2.54	-17.37	-1.67	1.29	2.80	Data Gap	0.60
10-Nov-2011	20:00:00	-4.52	-3.57	-17.57	-1.74	0.93	2.72	Data Gap	0.55
11-Nov-2011	08:00:00	-5.11	-4.08	-17.76	-1.88	0.30	No Data	Data Gap	0.45

Date (dd-mmm-yyyy)	Crest Gauges			On-Site Auto Rain Gauges			Bridgewater Weather Station
	UT1 (ft above bkf)	UT5 (ft above bkf)	UT6 (ft above bkf)	UT1 (in)	UT5 (in)	UT6 (in)	Rainfall (in)
1-Jan-2011				0.05		0.24	
2-Jan-2011						0.01	0.2
3-Jan-2011							
4-Jan-2011							
5-Jan-2011				0.04		0.03	
6-Jan-2011							0.03
7-Jan-2011				0.03	0.02	0.02	
8-Jan-2011						0.01	0.03
9-Jan-2011							
10-Jan-2011				0.03	0.01	0.01	
11-Jan-2011				0.08	0.07	0.07	
12-Jan-2011				0.12	0.04	0.11	0.05
13-Jan-2011				0.06	0.06	0.06	
14-Jan-2011				0.02	0.04	0.05	0.03
15-Jan-2011					0.06	0.02	0.05
16-Jan-2011							
17-Jan-2011				0.02	0.08	0.09	
18-Jan-2011				0.12	0.05	0.05	0.09
19-Jan-2011						0.01	0.02
20-Jan-2011							
21-Jan-2011							
22-Jan-2011							
23-Jan-2011							
24-Jan-2011							
25-Jan-2011				0.17	0.20	*	
26-Jan-2011				0.63	0.59	*	0.53
27-Jan-2011							0.26
28-Jan-2011							
29-Jan-2011							
30-Jan-2011							
31-Jan-2011							

*Rain gauges malfunctioned and no data was recorded during rain events documented for UT1 and UT5.

Date (dd-mmm-yyyy)	Crest Gauges			On-Site Auto Rain Gauges			Bridgewater Weather Station
	UT1 (ft above bkf)	UT5 (ft above bkf)	UT6 (ft above bkf)	UT1 (in)	UT5 (in)	UT6 (in)	Rainfall (in)
1-Feb-2011				0.12	0.53	*	
2-Feb-2011				0.92	0.45	*	0.93
3-Feb-2011							0.01
4-Feb-2011				0.34	0.38	*	0.01
5-Feb-2011				0.13	0.10	*	0.11
6-Feb-2011				0.01		*	0.02
7-Feb-2011							
8-Feb-2011					0.01	*	
9-Feb-2011							
10-Feb-2011							
11-Feb-2011							
12-Feb-2011				0.01		*	
13-Feb-2011							
14-Feb-2011							
15-Feb-2011							
16-Feb-2011							
17-Feb-2011							
18-Feb-2011							
19-Feb-2011							
20-Feb-2011							
21-Feb-2011							
22-Feb-2011							
23-Feb-2011							
24-Feb-2011				0.15	0.11	*	0.01
25-Feb-2011				0.25	0.20	*	0.46
26-Feb-2011							
27-Feb-2011				0.02	0.03	*	
28-Feb-2011				0.86	0.77	*	

*Rain gauges malfunctioned and no data was recorded during rain events documented for UT1 and UT5.

Date (dd-mmm-yyyy)	Crest Gauges			On-Site Auto Rain Gauges			Bridgewater Weather Station
	UT1 (ft above bkf)	UT5 (ft above bkf)	UT6 (ft above bkf)	UT1 (in)	UT5 (in)	UT6 (in)	Rainfall (in)
1-Mar-2011				0.01		*	
2-Mar-2011							
3-Mar-2011							
4-Mar-2011							0.84
5-Mar-2011				0.54	0.95	*	
6-Mar-2011				2.40	1.96	*	
7-Mar-2011							
8-Mar-2011							1.65
9-Mar-2011				1.92	1.87	*	0.21
10-Mar-2011				0.34	0.29	*	
11-Mar-2011							
12-Mar-2011							
13-Mar-2011							
14-Mar-2011							0.43
15-Mar-2011				0.54	0.53	0.57	0.01
16-Mar-2011							
17-Mar-2011				*	0.01		
18-Mar-2011							
19-Mar-2011							
20-Mar-2011							
21-Mar-2011							0.04
22-Mar-2011							
23-Mar-2011				*	0.15	0.17	
24-Mar-2011							0.04
25-Mar-2011							0.39
26-Mar-2011				*	0.44	0.50	0.03
27-Mar-2011				*	0.02	0.02	0.17
28-Mar-2011				*	0.14	0.15	0.10
29-Mar-2011							0.50
30-Mar-2011				*	0.62	0.75	0.45
31-Mar-2011				*	0.03	0.04	0.06

*Rain gauge malfunctioned and no data was recorded during rain events.

Date (dd-mmm-yyyy)	Crest Gauges			On-Site Auto Rain Gauges			Bridgewater Weather Station
	UT1 (ft above bkf)	UT5 (ft above bkf)	UT6 (ft above bkf)	UT1 (in)	UT5 (in)	UT6 (in)	Rainfall (in)
1-Apr-2011							0.03
2-Apr-2011				*	0.01		
3-Apr-2011							0.02
4-Apr-2011				*	0.48	0.66	
5-Apr-2011				*	0.39	0.32	1.01
6-Apr-2011							
7-Apr-2011							
8-Apr-2011							0.07
9-Apr-2011				*	0.42	0.45	0.01
10-Apr-2011							0.06
11-Apr-2011							0.35
12-Apr-2011				*	0.38	0.38	0.33
13-Apr-2011							0.02
14-Apr-2011							0.05
15-Apr-2011				*	0.51	0.58	1.28
16-Apr-2011				*	1.18	1.18	0.97
17-Apr-2011							0.32
18-Apr-2011							
19-Apr-2011							
20-Apr-2011				*	0.01	0.02	
21-Apr-2011				*	0.09	0.08	0.24
22-Apr-2011				*	0.26	0.26	0.02
23-Apr-2011				*	0.01	0.01	0.20
24-Apr-2011							
25-Apr-2011							0.04
26-Apr-2011				*	0.07	0.09	0.11
27-Apr-2011				*	0.16	0.21	0.81
28-Apr-2011				*	0.39	0.3	0.88
29-Apr-2011							
30-Apr-2011							

*Rain gauges malfunctioned and no data was recorded during rain events documented for UT5 and UT6.

Date (dd-mmm-yyyy)	Crest Gauges			On-Site Auto Rain Gauges			Bridgewater Weather Station
	UT1 (ft above bkf)	UT5 (ft above bkf)	UT6 (ft above bkf)	UT1 (in)	UT5 (in)	UT6 (in)	Rainfall (in)
1-May-2011							
2-May-2011							
3-May-2011				*	1.14	1.32	
4-May-2011				*	0.19	0.12	0.58
5-May-20111							0.30
6-May-2011							
7-May-2011							
8-May-2011							
9-May-2011							0.18
10-May-2011				*	0.19	0.18	
11-May-2011				*	0.14	0.14	0.33
12-May-2011							
13-May-2011				*	0.27	0.23	
14-May-2011				*	0.07	0.02	0.22
15-May-2011				*		0.01	0.14
16-May-2011				*	0.07	0.07	
17-May-2011				*	0.53	0.61	0.21
18-May-2011							0.23
19-May-2011							
20-May-2011							
21-May-2011							0.46
22-May-2011				*	0.45	0.41	0.01
23-May-2011				0.01			0.46
24-May-2011				0.10		0.01	
25-May-2011							0.63
26-May-2011				0.67	0.62	0.66	0.84
27-May-2011				0.33	0.33	0.36	0.01
28-May-2011						0.01	0.78
29-May-2011							
30-May-2011							
31-May-2011							

*Rain gauges malfunctioned and no data was recorded during rain events documented for UT5 and UT6.

Date (dd-mmm-yyyy)	Crest Gauges			On-Site Auto Rain Gauges			Bridgewater Weather Station
	UT1 (ft above bkf)	UT5 (ft above bkf)	UT6 (ft above bkf)	UT1 (in)	UT5 (in)	UT6 (in)	Rainfall (in)
1-Jun-2011							
2-Jun-2011							
3-Jun-2011							
4-Jun-2011							
5-Jun-2011				0.03	0.03	0.03	
6-Jun-2011							0.21
7-Jun-2011				0.07	0.05	0.04	0.01
8-Jun-2011				0.05	0.19	0.12	
9-Jun-2011				0.02		0.01	
10-Jun-2011							
11-Jun-2011				0.06	0.03		0.24
12-Jun-2011				1.59	1.30	1.13	
13-Jun-2011							
14-Jun-2011							0.27
15-Jun-2011				0.32	0.33	0.37	
16-Jun-2011							
17-Jun-2011				0.01			0.03
18-Jun-2011				0.09	0.09	0.09	0.20
19-Jun-2011				0.22	0.28	0.30	0.15
20-Jun-2011				0.14	0.13	0.13	0.13
21-Jun-2011							0.12
22-Jun-2011				0.18	0.23	0.21	
23-Jun-2011				0.18	0.19	0.21	
24-Jun-2011				0.01	0.01		
25-Jun-2011							
26-Jun-2011							
27-Jun-2011							0.10
28-Jun-2011				0.09	0.07	0.05	
29-Jun-2011							
30-Jun-2011							

Date (dd-mmm-yyyy)	Crest Gauges			On-Site Auto Rain Gauges			Bridgewater Weather Station
	UT1 (ft above bkf)	UT5 (ft above bkf)	UT6 (ft above bkf)	UT1 (in)	UT5 (in)	UT6 (in)	Rainfall (in)
1-Jul-2011							
2-Jul-2011							
3-Jul-2011							
4-Jul-2011					0.02	0.01	0.22
5-Jul-2011				2.82	2.17	1.7	
6-Jul-2011				0.08	0.24	0.41	
7-Jul-2011				0.02	0.02	0.02	0.75
8-Jul-2011				1.60	0.86	0.85	0.10
9-Jul-2011							
10-Jul-2011							
11-Jul-2011							
12-Jul-2011							
13-Jul-2011						0.02	
14-Jul-2011				0.09	0.01	0.01	
15-Jul-2011				0.43	0.52	0.6	0.03
16-Jul-2011					0.03	0.03	
17-Jul-2011							0.01
18-Jul-2011				0.04	0.05	0.07	
19-Jul-2011							0.09
20-Jul-2011				0.11	0.05	0.13	
21-Jul-2011							
22-Jul-2011							
23-Jul-2011							0.18
24-Jul-2011				0.02	0.01		
25-Jul-2011				0.10	0.13	0.17	
26-Jul-2011							
27-Jul-2011							
28-Jul-2011							
29-Jul-2011							
30-Jul-2011				0.01			
31-Jul-2011				0.08	0.14	0.31	0.01

Date (dd-mmm-yyyy)	Crest Gauges			On-Site Auto Rain Gauges			Bridgewater Weather Station
	UT1 (ft above bkf)	UT5 (ft above bkf)	UT6 (ft above bkf)	UT1 (in)	UT5 (in)	UT6 (in)	Rainfall (in)
1-Aug-2011							0.43
2-Aug-2011				0.01			0.05
3-Aug-2011				0.03	0.02	0.02	0.02
4-Aug-2011						0.02	0.05
5-Aug-2011							0.31
6-Aug-2011				0.04	0.01	0.01	0.01
7-Aug-2011							0.31
8-Aug-2011				0.01			
9-Aug-2011							
10-Aug-2011							0.41
11-Aug-2011							0.55
12-Aug-2011							0.41
13-Aug-2011				1.26	1.13	0.85	0.41
14-Aug-2011					0.21	0.67	0.55
15-Aug-2011						0.01	0.01
16-Aug-2011							
17-Aug-2011				0.01			0.05
18-Aug-2011				0.03	0.05	0.04	
19-Aug-2011				0.01			0.41
20-Aug-2011							0.14
21-Aug-2011				0.25	0.03		0.02
22-Aug-2011				0.01	0.02	0.03	0.16
23-Aug-2011							
24-Aug-2011							
25-Aug-2011							
26-Aug-2011				0.01			
27-Aug-2011							
28-Aug-2011							
29-Aug-2011							
30-Aug-2011							
31-Aug-2011							

Date (dd-mmm-yyyy)	Crest Gauges			On-Site Auto Rain Gauges			Bridgewater Weather Station
	UT1 (ft above bkf)	UT5 (ft above bkf)	UT6 (ft above bkf)	UT1 (in)	UT5 (in)	UT6 (in)	Rainfall (in)
1-Sep-2011							0.27
2-Sep-2011				0.33	0.27	0.29	
3-Sep-2011						0.01	
4-Sep-2011				0.05			1.75
5-Sep-2011				1.89	1.56	1.71	0.37
6-Sep-2011				0.16	0.31	0.33	
7-Sep-2011							
8-Sep-2011							
9-Sep-2011							
10-Sep-2011							
11-Sep -2011							
12-Sep -2011							
13-Sep-2011							
14-Sep-2011							
15-Sep-2011							
16-Sep-2011							
17-Sep-2011				0.02	0.01	0.01	
18-Sep-2011							
19-Sep-2011				0.01			0.02
20-Sep-2011				0.58	0.08	0.01	1.38
21-Sep-2011				1.00	1.37	1.51	
22-Sep-2011				0.68	0.11	0.03	0.96
23-Sep-2011				0.56	0.95	0.97	
24-Sep-2011				0.01			0.02
25-Sep-2011				0.02	0.01	0.04	0.12
26-Sep-2011				0.58	0.53	0.56	0.10
27-Sep-2011							
28-Sep-2011						0.01	
29-Sep-2011				0.01			
30-Sep-2011							

Date (dd-mmm-yyyy)	Crest Gauges			On-Site Auto Rain Gauges			Bridgewater Weather Station
	UT1 (ft above bkf)	UT5 (ft above bkf)	UT6 (ft above bkf)	UT1 (in)	UT5 (in)	UT6 (in)	Rainfall (in)
1-Oct-2011							
2-Oct-2011							
3-Oct-2011							
4-Oct-2011				0.01			
5-Oct-2011							
6-Oct-2011							
7-Oct-2011				0.01			
8-Oct-2011						0.01	
9-Oct-2011							
10-Oct-2011				0.20	0.01	0.03	0.88
11-Oct-2011				1.13	0.80	1.31	0.11
12-Oct-2011				0.12	0.11	0.13	0.16
13-Oct-2011				0.09	0.06	0.07	0.02
14-Oct-2011				0.01		0.01	
15-Oct-2011							
16-Oct-2011							
17-Oct-2011							
18-Oct-2011				0.30	0.10	0.23	0.78
19-Oct-2011				0.57	0.52	0.66	0.11
20-Oct-2011				0.01			
21-Oct-2011				0.01		0.01	
22-Oct-2011						0.01	
23-Oct-2011							
24-Oct-2011							
25-Oct-2011				0.01			
26-Oct-2011							
27-Oct-2011							
28-Oct-2011				0.37	0.36	0.33	0.35
29-Oct-2011						0.08	
30-Oct-2011				0.01	0.01		
31-Oct-2011							

Date (dd-mmm-yyyy)	Crest Gauges			On-Site Auto Rain Gauges			Burke County Weather Station
	UT1 (ft above bkf)	UT5 (ft above bkf)	UT6 (ft above bkf)	UT1 (in)	UT5 (in)	UT6 (in)	Rainfall (in)
1-Nov-2011				0.01		0.01	
2-Nov-2011							
3-Nov-2011				0.84	0.73	0.86	
4-Nov-2011				0.05	0.04	0.05	0.80
5-Nov-2011				0.01	0.01	0.01	
6-Nov-2011							
7-Nov-2011							
8-Nov-2011						0.01	
9-Nov-2011				0.01			
10-Nov-2011					0.01	0.01	
11-Nov-2011				0.01			
12-Nov-2011							
13-Nov-2011							
14-Nov-2011							
15-Nov-2011							
16-Nov-2011							
17-Nov-2011							

APPENDIX F

Invasive Exotic Vegetation Control at Morgan Creek and North Muddy Creek Stream Restoration Sites Baseline Report

Invasive Exotic Vegetation Control at Morgan Creek and North Muddy Creek Stream Restoration Sites
Year 3, August 2011
Baseline Report

Purpose

Several occurrences of invasive exotic plant infestations were observed at the Morgan Creek and North Muddy Creek Stream Restorations Sites following construction and riparian area planting. In an effort to eliminate competition and prevent the establishment and further invasion of non-native plants within easement areas, control activities were conducted from June 1 – July 22, 2011. This Baseline Report provides a summary of management activities conducted during this period.

Baseline Conditions

Prior to management activities, invasive exotic plant infestations at Morgan Creek was 4.5 acres and 3.0 acres occurred at the North Muddy Creek Site. Target species include:

- Privet *(Ligustrum sinense)*
- Multiflora Rose *(Rosa multiflora)*
- Japanese Honeysuckle *(Lonicera japonica)*
- Oriental Bittersweet *(Celastrus orbiculatus)*
- Autumn Olive *(Elaeagnus umbellata)*
- Kudzu *(Pueraria Montana)*
- Tree of Heaven *(Ailanthus altissima)*
- Princess Tree *(Paulownia tomentosa)*
- Shrubby Lespedeza *(Lespedeza bicolor)*

Summary of Control Activities

Seven days were spent treating invasive exotic plants at Morgan Creek and tributaries while three days were spent at the North Muddy Creek site (Figure 1 & Figure 2). In general, foliar herbicide application was used on reaches where vegetation was less than 8 feet high. Vegetation too high to safely spray with backpack sprayers was treated with cut stump applications using hand clippers. Cut stump applications were also made on trees with large diameters (greater than 2 inches) using a chainsaw. All herbicide applications were applied and/or supervised by certified NCDA&CS Pesticide Applicators, License #026-26135 and #026-29539.

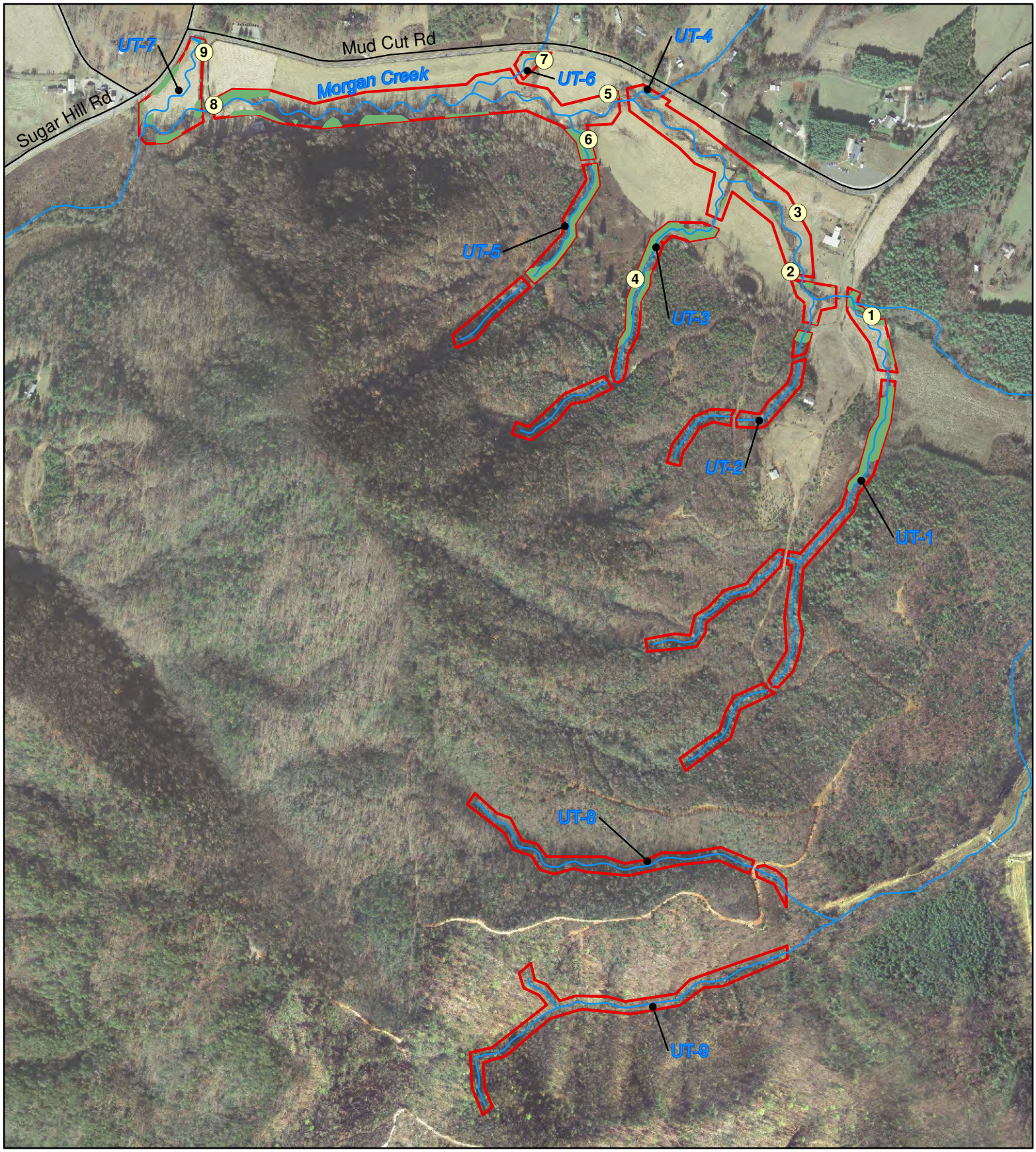
Follow-up re-treatment is necessary at all reaches. In some instances, invasive exotic vegetation was so dense that the entire area could not be treated and re-treatment is required on plants that were not accessible. In other instances, target species intertwined and growing adjacent to non-target vegetation were not treated. In these situations, semi-evergreen and early emergent target plants will need to be treated in early spring 2012 before non-target plants leaf out. Although invasive exotic plants were treated prior to the production of viable seeds, seed banking, root propagation, recruitment, and other means of reproduction may occur for which re-treatment will also be necessary. Table 1 summarizes the reaches treated, application method employed, herbicide volume used, herbicide concentrations used, and other relevant information.

It should be noted that some herbicide unintentionally came in contact with non-target vegetation in some areas, but did not appear to be a detriment to native plant succession. Utmost care was taken to prevent damage to non-target species, but herbicide drift and dripping is unavoidable where non-native vines are climbing up trees or are intertwined with native vegetation. These areas will be monitored to ensure proper revegetation of native plants occurs overtime.

Table 1: Treatment Records

Date	Site	Reaches	Target Species	Application Method	Herbicide	Herbicide Mixture Used (gal)	Concentration (%)	Volume Herbicide Used (oz)	Weather	Temp (°F)	Wind Speed (mph)	Notes
6/1/2011	Morgan Creek	UT-1, Morgan Ck	Privet, Multiflora Rose, Japanese Honeysuckle, Oriental Bittersweet	foliar	Garlon 3A	25	3%	100	Sunny	95	4	Large (>3" DBH) Privet and climbing Honeysuckle need retreatment at UT-1
6/8/2011	North Muddy Creek	UT-5, UT-4, UT-2	Shrubby Lespedeza, Privet, Multiflora Rose, Japanese Honeysuckle, Oriental Bittersweet	foliar	Garlon 3A	10	3%	40	Sunny, then T-storms	91	1	T-storm downpour 30 minutes after treating UT-2
6/14/2011	Morgan Creek	UT-2, Morgan Ck	Privet, Multiflora Rose, Japanese Honeysuckle, Kudzu, Autumn Olive	foliar	Garlon 3A	20	3%	80	Sunny morning, cloudy afternoon	81	5	Honeysuckle needs retreatment at UT-2
6/21/2011	Morgan Creek	UT-3	Paulownia, Tree of Heaven, Privet, Multiflora Rose, Japanese Honeysuckle	cut stump	Garlon 3A	0.3	25%	8	Sunny	89	2	Chainsaw cut stump on dozens of Paulownia and Tree of Heaven >12" DBH
6/24/2011	Morgan Creek	UT-6, Morgan Creek	Privet, Multiflora Rose, Japanese Honeysuckle, Oriental Bittersweet, Kudzu, Tree of Heaven	foliar	Garlon 3A	19	3%	76	Sunny, partly cloudy	89	10	Extensive Bittersweet along forest edge of Morgan Ck needs follow up
6/29/2011	North Muddy Creek	UT-6	Privet, Japanese Honeysuckle, Multiflora Rose	foliar	Garlon 3A	12.5	3%	50	Sunny, then T-storms	86	2	Cut 100's of 1" diam Honeysuckle vines, Privet & Honeysuckle need retreatment
7/7/2011	Morgan Creek	UT-5	Tree of Heaven, Privet, Japanese Honeysuckle, Multiflora Rose	cut stump	Garlon 3A	0.3	25%	8	Sunny	87	1	Chainsaw cut stump on dozens of Tree of Heaven >12" DBH and large Privet
7/14/2011	Morgan Creek	Morgan Ck, UT-5, UT-3	Multiflora Rose, Privet, Japanese Honeysuckle, Kudzu, Oriental Bittersweet	foliar	Garlon 3A	15	3%	56	Sunny	82	8	
7/14/2011	Morgan Creek	Morgan Ck, UT-5, UT-3	Tree of Heaven, Multiflora Rose, Privet, Japanese Honeysuckle	cut stump	Garlon 3A	0.06	25%	2	Sunny	82	8	Cut stump smaller diameter vegetation with hand clippers
7/22/2011	North Muddy Creek	UT-1	Kudzu, Privet, Multiflora Rose, Japanese Honeysuckle	foliar	Garlon 3A	18	3%	72	Sunny, then T-storms	93	1	Dense kudzu on the furthest upstream reach needs retreatment

Figure 1: Morgan Creek Stream Restoration Site



Morgan Creek
Photos of Invasive Plant Control

UT-1, Photo 1, looking west
November 12, 2010

UT-1, Photo 1, looking west
August 3, 2011

Morgan Creek, Photo 2, looking east
May 24, 2011

Morgan Creek, Photo 2, looking east
August 3, 2011

Morgan Creek, Photo 3, looking west
April 16, 2010

Morgan Creek, Photo 3, looking west
August 3, 2011

UT-3, Photo 4, looking northeast
August 8, 2008

UT-3, Photo 4, looking northeast
August 3, 2011

Morgan Creek, Photo 5, looking east
April 16, 2010

Morgan Creek, Photo 5, looking east
August 3, 2010

UT-5, Photo 6, looking northwest
April 16, 2010

UT-5, Photo 6, looking northwest
August 3, 2011

UT-6, Photo 7, looking north
November 19, 2010

UT-6, Photo 7, looking north
August 3, 2011

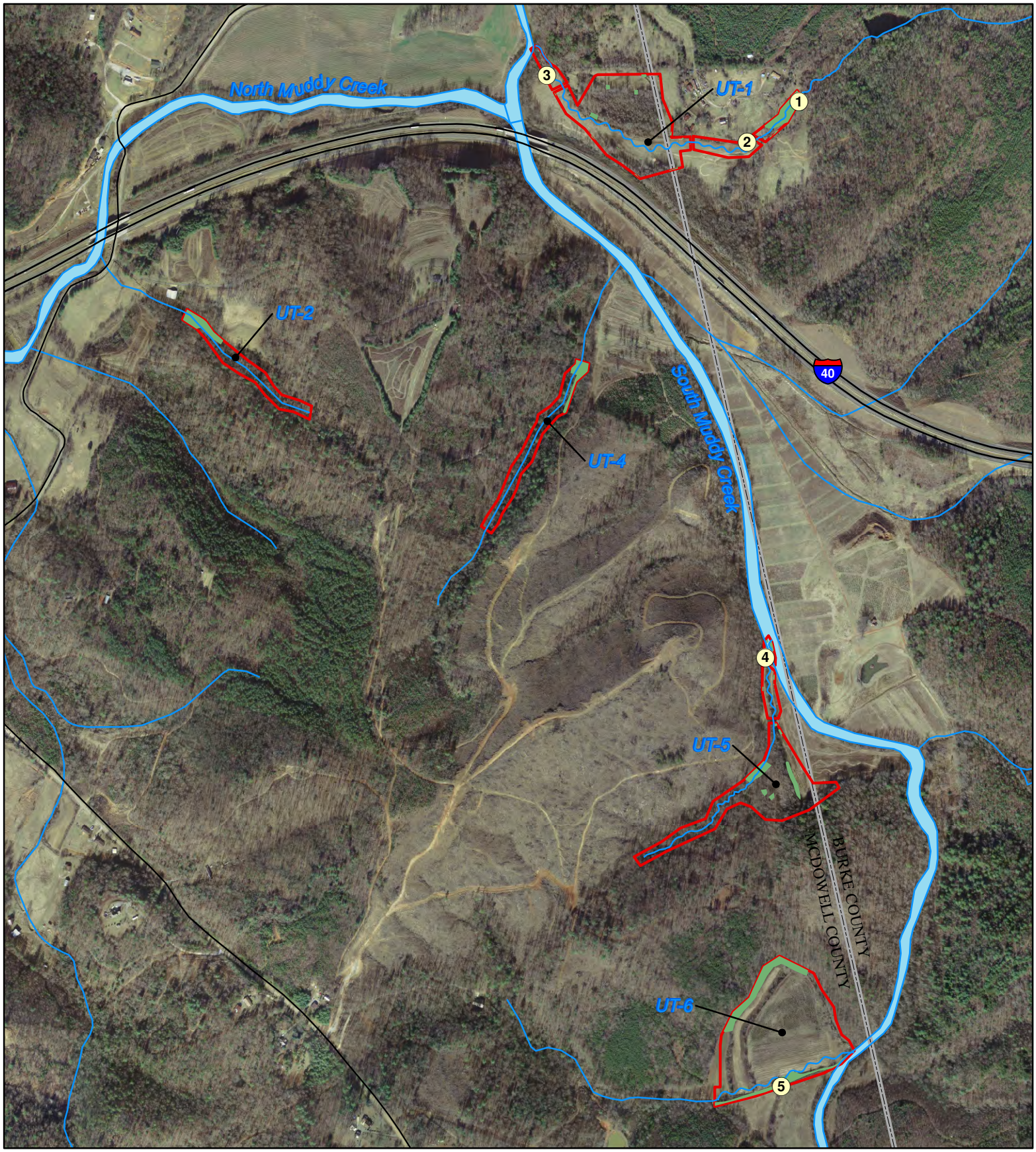
Morgan Creek, Photo 8, looking south
November 12, 2010

Morgan Creek, Photo 8, looking south
August 3, 2011

UT-7, Photo 9, looking north
April 16, 2010

UT-7, Photo 9, looking north
August 3, 2011

Figure 2: North Muddy Creek Stream Restoration Site



North Muddy Creek
Photos of Invasive Plant Control

UT-1, Photo 1, looking northeast
April 26, 2010

UT-1, Photo 1, looking northeast
August 3, 2011

UT-1, Photo 1, looking south
August 3, 2011

UT-1, Photo 1, looking southwest
August 3, 2011

UT-1, Photo 2, looking southwest
April 26, 2010

UT-1, Photo 2, looking southwest
August 3, 2011

UT-1, Photo 3, looking northwest
November 19, 2009

UT-1, Photo 3, looking northwest
August 3, 2011

UT-5, Photo 4, looking north
April 26, 2010

UT-5, Photo 4, looking north
August 3, 2011

UT-6, Photo 5, looking south
February 9, 2009

UT-6, Photo 5, looking south
August 3, 2011