RICH FORK(BODENHEIMER)
STREAM/WETLAND RESTORATION
YEAR 3 MONITORING REPORT
DECEMBER 2006

FULL DELIVERY PROJECT

EXECUTIVE SUMMARY

The Rich Fork Mitigation Project restored 21.49 acres of riverine wetland and 3,398 linear feet of stream and preserved an additional 1,972 linear feet of perennial stream in Davidson County in the Yadkin River Basin (HUC 03040103030030) yielding 18.59 Wetland Mitigation Units and 3,792 Stream Mitigation Units. The project was initiated in spring of 2000 and construction was completed in the spring of 2004. The goal of the project is to re-establish an integrated wetland-stream complex that will restore ecosystem processes, structure, and composition to mitigate for wetland functions and values that have been lost as a result of anthropogenic disturbances in this region of the Yadkin River Basin.

Activities in 2006 reflect the third year of monitoring following construction. Included in this report are analyses of both hydrologic and vegetation monitoring results as well as local climatic conditions throughout the growing season. Monitoring activities included sampling vegetation survivability at six locations, monitoring groundwater elevations at six locations, and documenting general site conditions at six permanent photo documentation points within the wetland restoration area.

The wetland restoration components of the project were evaluated to determine their compliance with the success criteria established for vegetation and hydrology (soils did not require success criteria). Climatic data for the 2006 growing season were analyzed in comparison with historical data from Lexington, North Carolina to determine whether 2006 was a normal climatic year as a precursor to validating the results of the wetland monitoring. The historical data were collected from the NRCS, "Water and Climate Center, Climate Analysis for Wetlands by County" website. This evaluation concluded that 2006 was a normal year for rainfall during the growing season. Rainfall was within the 30th to 70th percentiles for the months of April, July, September, and October. Rainfall was less than the 30th percentile threshold in February, March, and May and was greater than the 70th percentile threshold in June, August, and November.

The site was planted at a density of 680 trees per acre. The target community for the majority of the wetland restoration is bottomland hardwood forest. There were six vegetative monitoring plots established throughout the planting areas. The 2006 vegetation monitoring of the planted areas revealed an average density of 633 trees per acre, which is well above the minimum requirement of 260 trees per acre needed to meet the success criteria at the end of the five-year monitoring period.

Wetland hydrology was monitored with groundwater gauges throughout the entire 2006 growing season. The results from the gauges indicated that the water table was within 12 inches of the soil surface for greater than 12.5 % of the growing season at all six monitoring gauges. This surpasses the success criteria set at having saturation for at least 8% of the growing season. The site gauges also closely mimic the hydroperiod of the reference wetland.

Soils in the restoration portion of the site have been determined to be Wehadkee and Chewacla. Since these soils are already considered hydric, no success criteria or monitoring is required.

The as-built survey was completed immediately prior to relocation of active flow into the channel in June 2004. Third year monitoring data were collected in October 2006 for cross-sectional area, planform, and profiles in four monitoring reaches and compared to the as-built condition. Four bankfull events occurred during the 2006 monitoring season. The permanent cross-sections, planform and profile showed minimal deviation from the as-built conditions, indicating that the streams are maintaining a stable form with respect to dimensions and features. Aquatic macroinvertebrates were sampled in August 2006 as a supplemental monitoring event, since extreme drought during the summer of 2005 created unsuitable conditions for collecting macroinvertebrate samples. The results show that the restored reaches of the project stream have higher number of taxa than the reference reach upstream of the project site. However, the entire stream suffered from the drought in 2005 and showed reduced macroinvertebrate populations as a result. The macroinvertebrates were monitored for the third monitoring year in October 2006, but the identification results are not yet available.

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1.0 WETLANDS

The wetland restoration components of the project were evaluated to determine their compliance with the success criteria established for vegetation and hydrology (soils did not require success criteria). Climatic data for the 2006 growing season were compared to historical data to determine whether 2006 was a normal year in terms of climate conditions as a precursor to validating the results of the wetland monitoring. The historical data were collected from the NRCS, Water and Climate Center, "Climate Analysis for Wetlands by County" website. This evaluation concluded that 2006 was a normal year for rainfall during the growing season. Rainfall was within the 30th to 70th percentile thresholds as the range of normal for the months of April, July, September, and October. Rainfall was less than the 30th percentile threshold in February, March, and May and was greater than the 70th percentile threshold in June, August, and November (Appendix B).

1.1 Vegetation - The 21.49-acre wetland restoration/creation/enhancement site was planted at a density of 680 trees per acre. There were six (6) vegetation-monitoring plots established throughout the planting areas. The 2006 vegetation monitoring of the planted areas revealed an average density of 633 trees per acre, which is well above the minimum requirement of 260 trees per acre (Appendix A). The 2006 vegetation monitoring counted more trees in plots 2, 3, 5, and 6 than had been counted in the previous year. This is the result of either a planted tree resprouting or the tree was overlooked during previous monitoring. For the 2006 monitoring, the trees had matured enough to precisely identify their species; previously, some trees were too small for clear identification. The average density for the Piedmont Bottomland Forest species was 633 trees per acre after three years (Table 1). Table 2 shows that the only plot with tree mortality between the 2005 and 2006 monitoring years was plot 4. A total of 6.5 trees per vegetation-monitoring plot are needed to meet the 260 trees per acre minimum requirement.

Table 1: Vegetation Monitoring Results

Plot #	Willow Oak	Swamp Chestnut Oak	Laurel Oak	Yellow Poplar	Swamp Blackgum	Black Willow	Silky Dogwood	Overcup Oak	Green Ash	Cherrybark Oak	Total (Year 3)	Total (at planting)	Density - Year 3 (Trees/Acre)
1		12		4					2		18	18	720
2		2	6					6		3	17	17	680
3	9	2	1						6		18	18	720
4		3	4			2	1	1	4		15	18	600
5		1							13		14	14	560
6	2	7	1	1					2		13	13	520
										Total Year 3 Average			**633**

Table 2: Vegetation History (Trees/Acre)

Plot #	Year 1	Year 2	Year 3	Year 4	Year 5
1	720	720	720		
2	560	600*	680*		
3	640	640	720*		
4	680	680	600		
5	520	520	560*		
6	480	480	520*		

* More trees/acre recorded in Year 3 because of either a resprout from a tree that was previously counted as dead or a missed tree from previous monitoring.

1.2 Hydrology Wetland hydrology was monitored throughout the entire 2006 growing season with groundwater gauges (Appendix B). The result of this monitoring indicated that the water table was within 12 inches of the soil surface for greater than 12.5 % of the growing season at all six monitoring gauges (Table 3). In addition, the site gauges closely mimic the hydroperiod of the reference wetland. Table 4 presents the hydroperiod history of each well over the course of the monitoring.

Table 3: Hydrologic Monitoring Results

Gauge #	5%	5% - 8%	8% -12.5%	>12.5%	No. of Days	Dates Meeting Success
1				X	64 and 45	3/14-5/16 and 8/30-10/14
2				X	32, 32, 69, 72	6/11-8/18 and 8/30-11/10
3				X	71, 38, 72	3/14-5/23 and 8/30-11/10
4				X	66 and 47	3/14-5/18 and 8/30-10/16
5				X	69, 38, 72	3/14-5/14 and 8/30-11/10
6				X	34, 32, 37, 72	6/12-7/18 and 8/30-11/10
Ref. Wetland				X	64, 33, 72	3/14-5/16 and 8/30-11/10

Table 4. Hydroperiod History

Gauge #	Pre-Restoration	Year 1	Year 2	Year 3	Year 4	Year 5
1	<5%	>12.5%	>12.5%	>12.5%		
2	<5%	>12.5%	>12.5%	>12.5%		
3	<5%	>12.5%	>12.5%	>12.5%		
4	<5%	>12.5%	>12.5%	>12.5%		
5	<5%	>12.5%	>12.5%	>12.5%		
6	<5%	>12.5%	>12.5%	>12.5%		
Ref. Wetland	>12.5%	>12.5%	>12.5%	>12.5%		

1.3 Soils - Soils in the restoration portion of the site have been determined to be Wehadkee and Chewacla. Wehadkee is a hydric soil shown on the state and federal hydric soils list and the Chewacla soils have hydric inclusions of poorly drained soils. The overburden and fill associated with the Chewacla soils was removed during construction to restore the hydric characteristics of the soil lost from filling and overbank flooding. As both soils are already considered hydric, no success criteria or monitoring was required.

2.0 STREAMS

The restored streams were monitored to evaluate their compliance with the success criteria established for physical (cross-section, planform and profile) and biological stability.

2.1 Physical - The as-built survey was completed immediately prior to relocation of active flow into the channel in June 2004. Third year monitoring data was collected in October 2006 for cross-sectional area, planform and profiles in four monitoring reaches and compared to the as-built condition (Appendix C). Four bankfull events occurred during this time. The permanent cross-sections (Table 5), planform (Table 6) and profile (Table 7) showed minimal deviation from the as-built conditions, indicating that the streams are maintaining a stable form with respect to dimensions and features.

Table 5. Bankfull Cross-Sectional Area

X-Section	As-Built	Year 1	Year 2	Year 3	Year 4	Year 5
XS-1 Main Stem Up	7.3	7.3	6.3	6.2		
XS-2 Main Stem Up	2.1	2.5	1.9	1.6		
XS-3 Main Stem Down	5.9	5.7	5.2	2.9		
XS-4 Main Stem Down	4.6	4.9	4.0	5.2		
XS-1 Tributary Up	1.8	1.6	2.7	1.2		
XS-2 Tributary Up	1.2	1.1	0.9	1.5		
XS-3 Tributary Down	2.6	2.7	1.6	1.3		
XS-4 Tributary Down	1.1	1.2	0.9	0.7		

Table 6. Planform (Sinuosity/Radius of Curvature)

Reach	As-Built	Year 1	Year 2	Year 3	Year 4	Year 5
Main Stem Up	1.2/13.9	1.2/13.9	1.2/13.5	1.2/13.8		
Main Stem Down	1.2/13.0	1.2/13.1	1.2/14.9	1.2/11.8		
Tributary Up	1.2/7.4	1.2/7.4	1.2/8.7	1.2/7.0		
Tributary Down	1.4/7.3	1.4/7.3	1.4/7.6	1.3/7.0		

Table 7. Profile (Average depth in feet from control elevation)

Reach	As-Built	Year 1	Year 2	Year 3	Year 4	Year 5
Main Stem Up	1.42	1.37	1.28	1.26		
Main Stem Down*	1.37	1.41	1.33	1.46		
Tributary Up	0.87	0.82	0.79	0.75		
Tributary Down	1.15	1.09	0.86	1.20		

*Values from previous years have been revised following an update of monitoring year 3 calculations

2.2 Biological Monitoring - Due to drought conditions during the summer of 2005, benthic macroinvertebrate sampling was conducted in August 2006 as a supplemental sample to the second year monitoring. During the August 2006 monitoring, the tributary was not sampled, because the channel was flooded. Benthic macroinvertebrate sampling for the third year monitoring occurred in October 2006, but the identification results have not yet been returned. During the October 2006 monitoring, the tributary was not sampled again, because the surrounding area, including the channel, was ponded. The biotic values on the project stream increased since the last monitoring; this indicates a presence of more tolerant species. There were also fewer EPT taxa during this monitoring event. These results are likely due to drought in 2005 and extreme conditions in 2006 (flooding followed by low flow) that have negatively impacted macroinvertebrate populations.

Table 8. Summary Benthic Macroinvertebrate Data

Sampling Location	Total No. of Organisms						Total Number of Taxa						Biotic Index Assigned Values					
Year	Pre	1	2**	3	4	5	Pre	1	2**	3	4	5	Pre	1	2**	3	4	5
Upstream*	24	33	18	N/A			9	10	4	N/A			6.61	7.47	7.84	N/A		
Main Channel	54	52	16	N/A			6	17	7	N/A			6.98	7.63	8.12	N/A		
Tributary	N/A	56	N/A	N/A			N/A	18	N/A	N/A			N/A	7.45	N/A	N/A		
Confluence	124	27	50	N/A			16	13	20	N/A			6.44	6.77	7.59	N/A		

*Upstream control site monitored pre-restoration; ** Second-year monitoring was not conducted (due to site conditions). A supplemental sample was completed in 2006.

3.0 MAINTENANCE/MANAGEMENT ACTIONS

Maintenance actions conducted during the 2006 growing season focused on the application of a herbicide around the base of many of the planted trees. This action resulted in decreased herbaceous competition with the trees and improved their opportunity for growth. The flooding of Rich Fork Creek during the 2006 monitoring year caused a debris blockage in the tributary, near the confluence with the mainstem, which created backwater conditions. This blockage will be removed as part of the continuing maintenance schedule at the Rich Fork Site.

4.0 CONCLUSIONS

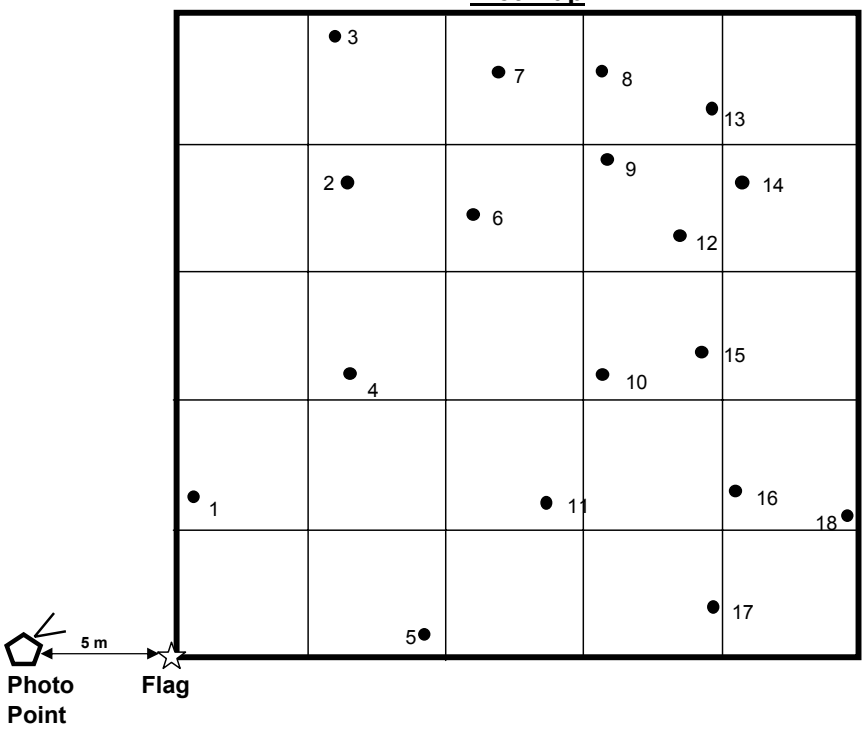
Findings from this monitoring year indicate that the project site is performing as designed. The data on tree size indicate that some trees have grown as much as an additional meter in height since the second year monitoring. The survival of the planted species exceeds the density requirement of the success criteria and non-target species were not identified in any of the vegetation monitoring plots. All six monitoring gauges exceeded the hydrologic success criteria of 8% of the growing season. Physical monitoring of the stream at four (4) permanent monitoring reaches documented minor changes in the cross sections and profiles and no changes in the planform from as-built conditions. The observable changes in the profiles and cross sections were minimal bed aggradation in both the tributary and the mainstem. This process resulted from the sediments brought onto the site from the flooding of Rich Fork Creek and the dead organic debris from the densely vegetated banks. On the mainstem, cross section 3 depicts a pool undergoing gradual aggradation. This condition will continue to be monitored. The tributary has also undergone some aggradation and slight channel adjustment, which is only evident on cross section 2 and is not pronounced enough to reveal itself in the planform/profile measurements. The majority of the stream is maintaining a stable form and the entire stream is accessing its floodplain. In-stream structures are stable and functioning as designed. Observations of stream bank vegetation indicate that live stake survivability is high and the herbaceous vegetation is well developed on the stream banks. Macroinvertebrates were sampled in August 2006 as a substitute for second year monitoring, when a drought preclude any benthic sampling.

Appendix A
Vegetation Monitoring Plot Data Sheets

Vegetation Monitoring Worksheet

Site: Rich Fork **Plot:** 1 **Date:** 10/9/2006

Plot Map



ID	Species	Height (m)	Collar Diameter (cm)	Comments (insect damage, disease, browsing)
1	Yellow Poplar (*Liriodendron tulipifera*)	1.1	1.1	healthy
2	Yellow Poplar (*Liriodendron tulipifera*)	0.5	0.8	healthy
3	Swamp Chestnut Oak (*Quercus michauxii*)	0.7	0.5	healthy
4	Swamp Chestnut Oak (*Quercus michauxii*)	0.8	0.8	healthy
5	Swamp Chestnut Oak (*Quercus michauxii*)	0.9	1.0	healthy
6	Yellow Poplar (*Liriodendron tulipifera*)	0.6	1.2	healthy
7	Yellow Poplar (*Liriodendron tulipifera*)	0.6	0.9	healthy
8	Swamp Chestnut Oak (*Quercus michauxii*)	0.4	0.5	top has died back
9	Swamp Chestnut Oak (*Quercus michauxii*)	0.5	0.7	top has died back
10	Swamp Chestnut Oak (*Quercus michauxii*)	0.4	0.7	top has died back
11	Green Ash (*Fraxinus pennsylvanica*)	1.4	1.9	healthy
12	Swamp Chestnut Oak (*Quercus michauxii*)	1.0	1.3	healthy
13	Swamp Chestnut Oak (*Quercus michauxii*)	0.5	0.7	top has died back
14	Swamp Chestnut Oak (*Quercus michauxii*)	0.9	0.8	healthy
15	Swamp Chestnut Oak (*Quercus michauxii*)	0.7	1.0	healthy
16	Swamp Chestnut Oak (*Quercus michauxii*)	0.8	0.6	healthy
17	Green Ash (*Fraxinus pennsylvanica*)	1.1	0.9	healthy
18	Swamp Chestnut Oak (*Quercus michauxii*)	1.1	1.5	healthy

Notes - Tree heights smaller than previous years reflect die back in tops of trees.
- Plot map updated annually to more accurately reflect tree locations.

Species	Percent of Total
Swamp Chestnut Oak (*Quercus michauxii*)	67%
Yellow Poplar (*Liriodendron tulipifera*)	22%
Green Ash (*Fraxinus pennsylvanica*)	11%

Density:

Total Number of Trees **18** / **0.025 acres** = **720** **trees / acre**

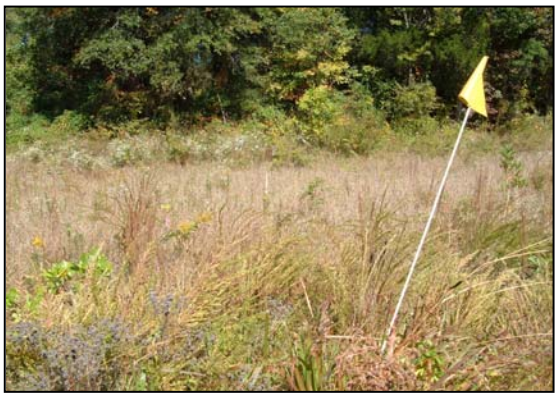
Survivability:

Total Number of Trees **18** / **18 trees** **x** **100** = **100** **% survivability**

Number of New Recruits : _____

Note : Flag located N 38° E, 27' from monitoring well

Previous

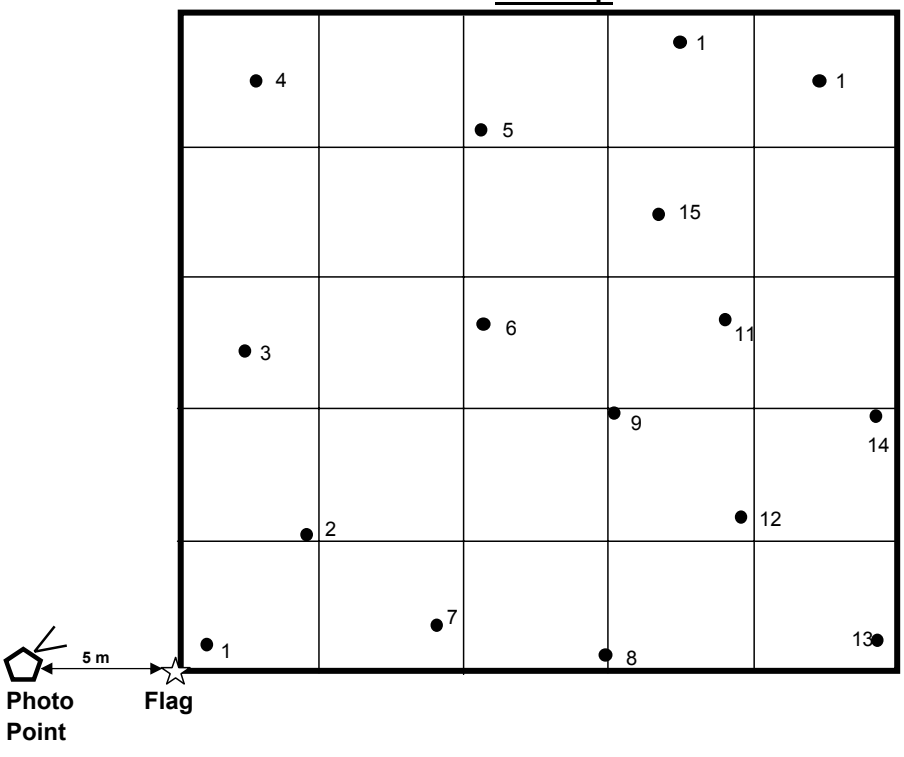


Current

Vegetation Monitoring Worksheet

Site: Rich Fork **Plot:** 2 **Date:** 10/9/2006

Plot Map



ID	Species	Height (m)	Collar Diameter (cm)	Comments (insect damage, disease, browsing)
1	Laurel Oak (*Quercus laurifolia*)	1.7	1.5	healthy
2	Laurel Oak (*Quercus laurifolia*)	1.5	2.2	healthy
3	Overcup Oak (*Quercus lyrata*)	0.9	1.2	healthy
4	Swamp Chestnut Oak (*Quercus michauxii*)	0.8	1.3	healthy
5	Overcup Oak (*Quercus lyrata*)	0.8	0.8	healthy
6	Laurel Oak (*Quercus laurifolia*)	1.1	0.6	healthy
7	Overcup Oak (*Quercus lyrata*)	0.9	1.0	healthy
8	Cherrybark Oak (*Quercus falcata*)	0.8	0.5	healthy
9	Overcup Oak (*Quercus lyrata*)	1.3	1.5	healthy
10	Cherrybark Oak (*Quercus falcata*)	1.7	1.8	healthy
11	Overcup Oak (*Quercus lyrata*)	0.7	0.8	healthy
12	Laurel Oak (*Quercus laurifolia*)	1.5	1.5	healthy
13	Swamp Chestnut Oak (*Quercus michauxii*)	2.3	3.1	healthy
14	Laurel Oak (*Quercus laurifolia*)	1.7	1.5	healthy
15	Laurel Oak (*Quercus laurifolia*)	1.9	2.1	healthy
16	Overcup Oak (*Quercus lyrata*)	1.0	1.1	healthy
17	Cherrybark Oak (*Quercus falcata*)	1.1	0.9	healthy

Notes - Tree heights smaller than previous years reflect die back in tops of trees.
- Plot map updated annually to more accurately reflect tree locations.

Species	Percent of Total
Swamp Chestnut Oak (*Quercus michauxii*)	12%
Cherrybark Oak (*Quercus falcata*)	18%
Laurel Oak (*Quercus laurifolia*)	35%
Overcup Oak (Quercus lyrata)	35%

Density:

Total Number of Trees **17** / **0.025 acres** = **680** **trees / acre**

Survivability:

Total Number of Trees **17** / **17 trees** x **100** = **100** **% survivability**

Number of New Recruits : _____

Note : Flag located W 270° N, 126' from monitoring well

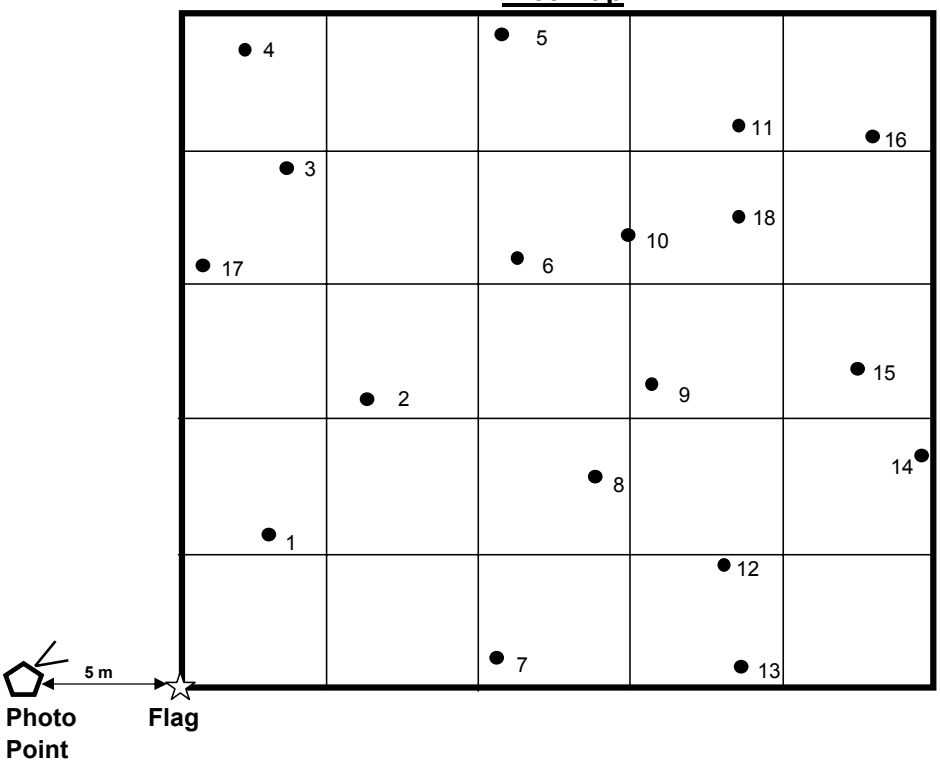
Previous

Current

Vegetation Monitoring Worksheet

Site: Rich Fork **Plot:** 3 **Date:** 10/9/2006

Plot Map



ID	Species	Height (m)	Collar Diameter (cm)	Comments (insect damage, disease, browsing)
1	Willow Oak (*Quercus phellos*)	1.2	2.0	healthy
2	Laurel Oak (*Quercus laurifolia*)	0.9	0.8	healthy
3	Willow Oak (*Quercus phellos*)	0.9	1.0	healthy
4	Willow Oak (*Quercus phellos*)	1.0	1.1	healthy
5	Swamp Chestnut Oak (*Quercus michauxii*)	0.8	0.7	healthy
6	Willow Oak (*Quercus phellos*)	1.1	0.9	healthy
7	Green Ash (*Fraxinus pennsylvanica*)	1.7	1.8	healthy
8	Green Ash (*Fraxinus pennsylvanica*)	2.2	2.5	healthy
9	Green Ash (*Fraxinus pennsylvanica*)	2.1	2.3	healthy
10	Willow Oak (*Quercus phellos*)	1.6	1.5	healthy
11	Willow Oak (*Quercus phellos*)	0.6	0.6	healthy
12	Green Ash (*Fraxinus pennsylvanica*)	2.4	3.4	healthy
13	Green Ash (*Fraxinus pennsylvanica*)	1.4	2.5	healthy
14	Swamp Chestnut Oak (*Quercus michauxii*)	1.7	2.6	healthy
15	Green Ash (*Fraxinus pennsylvanica*)	2.1	2.8	healthy
16	Willow Oak (*Quercus phellos*)	1.0	0.9	healthy
17	Willow Oak (*Quercus phellos*)	1.0	0.8	healthy
18	Willow Oak (*Quercus phellos*)	1.0	0.9	healthy

Notes - Tree heights smaller than previous years reflect die back in tops of trees.
- Plot map updated annually to more accurately reflect tree locations.

Species	Percent of Total
Swamp Chestnut Oak (*Quercus michauxii*)	11%
Willow Oak (*Quercus phellos*)	50%
Green Ash (*Fraxinus pennsylvanica*)	33%
Laurel Oak (Quercus laurifolia)	6%

Density:

Total Number of Trees **18** / **0.025 acres** = **720** **trees / acre**

Survivability:

Total Number of Trees **18** / **18 trees** x **100** = **100** **% survivability**

Number of New Recruits : _____

Note : Flag located N 38° E, 27' from monitoring well

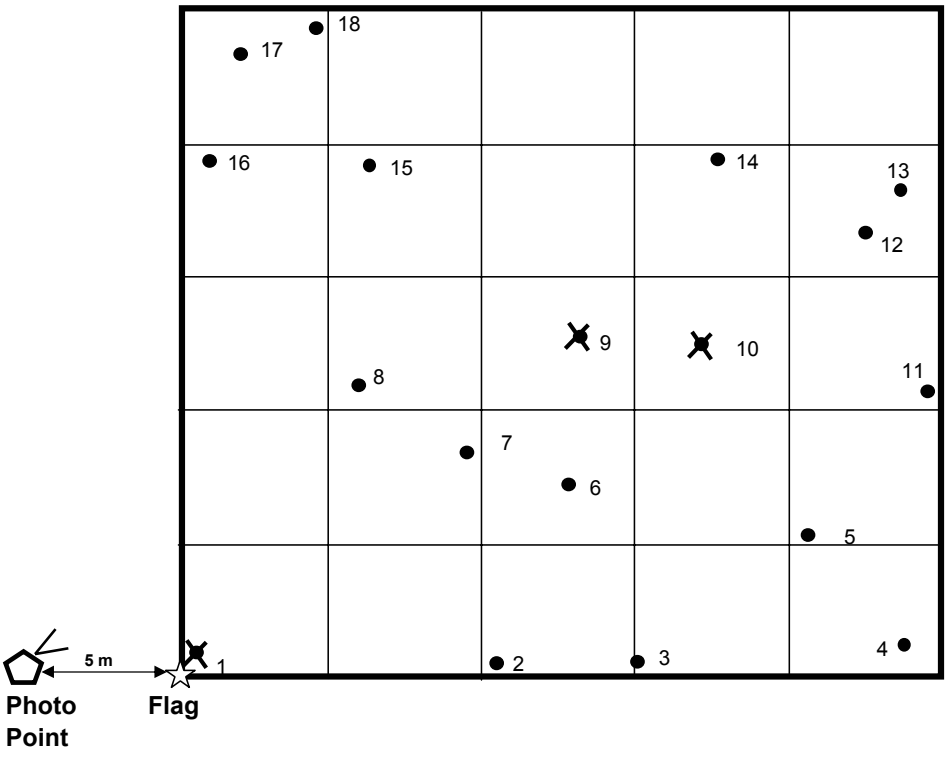
Previous

Current

Vegetation Monitoring Worksheet

Site: Rich Fork **Plot:** 4 **Date:** 10/9/2006

Plot Map



ID	Species	Height (m)	Collar Diameter (cm)	Comments (insect damage, disease, browsing)
1	Swamp Black Gum (*Nyssa sylvatica*)			dead
2	Laurel Oak (*Quercus laurifolia*)	1.1	1.0	healthy
3	Laurel Oak (*Quercus laurifolia*)	1.3	1.3	healthy
4	Black Willow (*Salix nigra*)	2.4	3.9	insect damage to all leaves
5	Swamp Chestnut Oak (*Quercus michauxii*)	1.0	1.3	healthy
6	Laurel Oak (*Quercus laurifolia*)	1.1	1.3	healthy
7	Swamp Chestnut Oak (*Quercus michauxii*)	1.4	2.0	healthy
8	Swamp Chestnut Oak (*Quercus michauxii*)	1.4	2.0	healthy
9	Yellow Poplar (*Liriodendron tulipifera*)			dead
10	Yellow Poplar (*Liriodendron tulipifera*)			dead
11	Overcup Oak (*Quercus lyrata*)	0.7	0.6	healthy
12	Silky Dogwood (*Cornus amomum*)	1.2	1.3	healthy multistem
13	Green Ash (*Fraxinus pennsylvanica*)	3.0	4.0	healthy
14	Green Ash (*Fraxinus pennsylvanica*)	2.6	3.1	healthy
15	Laurel Oak (*Quercus laurifolia*)	1.2	1.1	healthy
16	Green Ash (*Fraxinus pennsylvanica*)	1.7	2.1	healthy
17	Black Willow (*Salix nigra*)	3.0	2.9	healthy
18	Green Ash (*Fraxinus pennsylvanica*)	2.0	2.7	healthy

Notes - Tree heights smaller than previous years reflect die back in tops of trees.
- Plot map updated annually to more accurately reflect tree locations.

Species	Percent of Total
Swamp Chestnut Oak (*Quercus michauxii*)	20%
Green Ash (*Fraxinus pennsylvanica*)	27%
Overcup Oak (*Quercus lyrata*)	7%
Swamp Black Gum (*Nyssa sylvatica*)	0%
Silky Dogwood (*Cornus amomum*)	7%
Black Willow (*Salix nigra*)	13%
Yellow Poplar (*Liriodendron tulipifera*)	0%
Laurel Oak (*Quercus laurifolia*)	27%

Density:

Total Number of Trees **15** / **0.025 acres** = **600** **trees / acre**

Survivability:

Total Number of Trees **15** / **18 trees** **x** **100** = **83.3** **% survivability**

Number of New Recruits : _____

Note : Flag located E 158° S, 76' from monitoring well

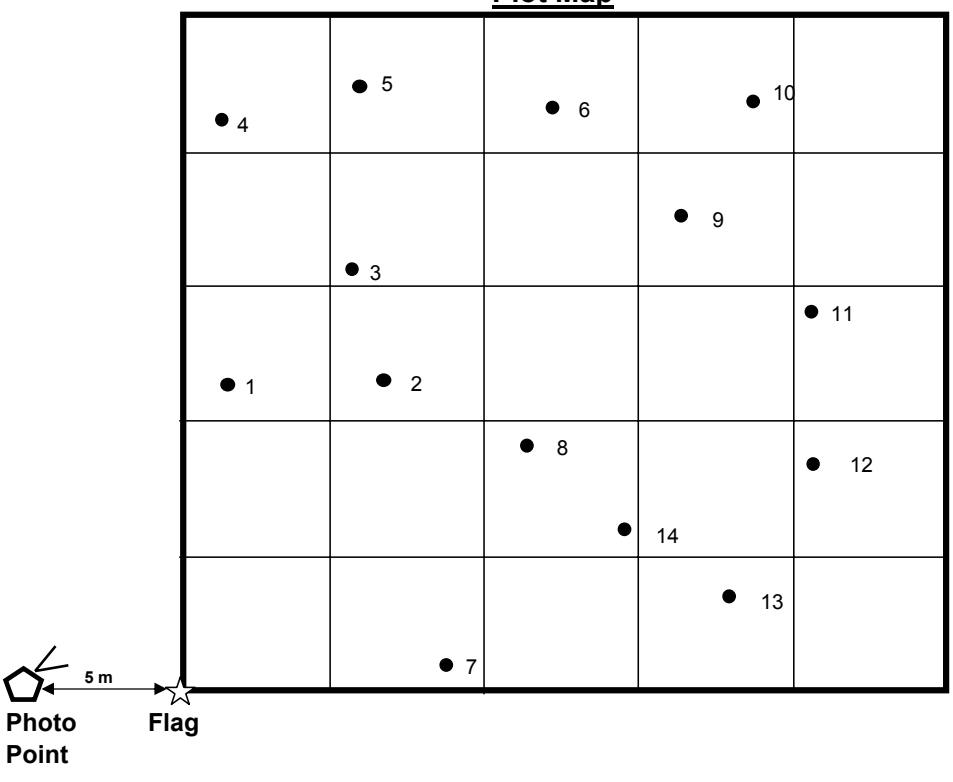
Previous

Current

Vegetation Monitoring Worksheet

Site: Rich Fork **Plot:** 5 **Date:** 10/9/2006

Plot Map



ID	Species	Height (m)	Collar Diameter (cm)	Comments (insect damage, disease, browsing)
1	Green Ash (*Fraxinus pennsylvanica*)	1.6	1.8	healthy
2	Green Ash (*Fraxinus pennsylvanica*)	1.5	1.5	healthy
3	Green Ash (*Fraxinus pennsylvanica*)	1.6	1.9	healthy
4	Green Ash (*Fraxinus pennsylvanica*)	1.5	2.0	healthy
5	Green Ash (*Fraxinus pennsylvanica*)	1.7	2.4	healthy
6	Green Ash (*Fraxinus pennsylvanica*)	1.5	2.0	healthy
7	Green Ash (*Fraxinus pennsylvanica*)	1.2	1.4	healthy
8	Green Ash (*Fraxinus pennsylvanica*)	1.1	1.3	healthy
9	Green Ash (*Fraxinus pennsylvanica*)	2.1	3.2	healthy
10	Swamp Chestnut Oak (*Quercus michauxii*)	1.1	1.1	healthy
11	Green Ash (*Fraxinus pennsylvanica*)	1.8	2.6	healthy
12	Green Ash (*Fraxinus pennsylvanica*)	2.0	2.8	healthy
13	Green Ash (*Fraxinus pennsylvanica*)	1.0	1.1	healthy
14	Green Ash (*Fraxinus pennsylvanica*)	0.8	0.9	healthy

Notes - Tree heights smaller than previous years reflect die back in tops of trees.
- Plot map updated annually to more accurately reflect tree locations.

Species	Percent of Total
Swamp Chestnut Oak (*Quercus michauxii*)	7%
Green Ash (*Fraxinus pennsylvanica*)	93%

Density:

Total Number of Trees **14** / **0.025 acres** = **560** **trees / acre**

Survivability:

Total Number of Trees **14** / **14 trees** x **100** = **100** **% survivability**

Number of New Recruits : _____

Note : Flag located N 38° E, 27' from monitoring well

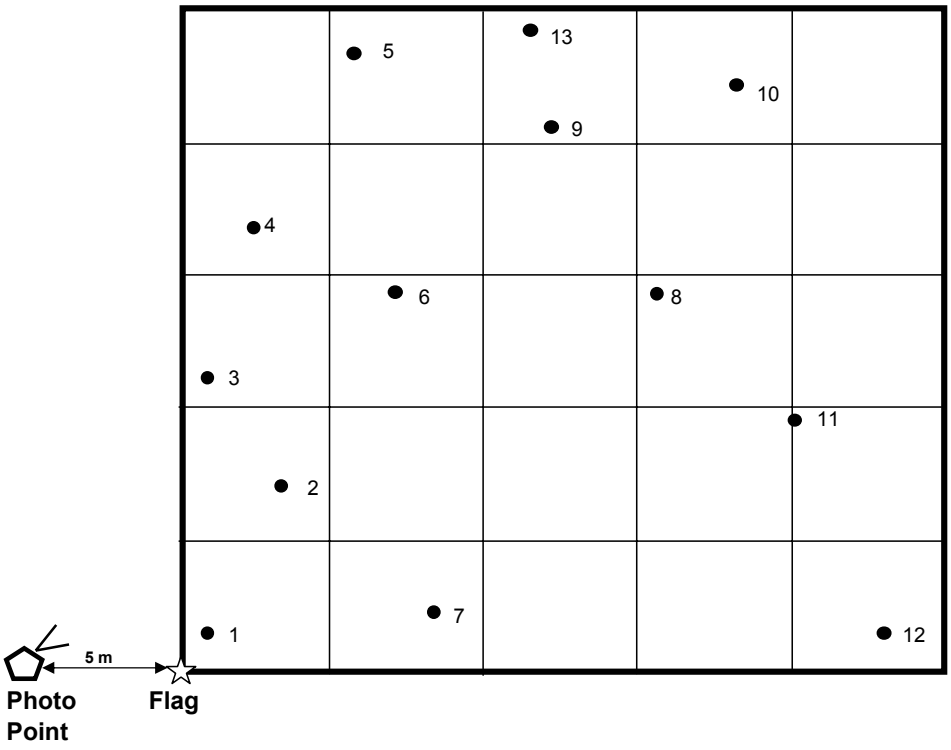
Previous

Current

Vegetation Monitoring Worksheet

Site: Rich Fork **Plot:** 6 **Date:** 10/9/2006

Plot Map



ID	Species	Height (m)	Collar Diameter (cm)	Comments (insect damage, disease, browsing)
1	Swamp Chestnut Oak (*Quercus michauxii*)	1.0	1.2	healthy
2	Swamp Chestnut Oak (*Quercus michauxii*)	0.8	1.4	healthy
3	Swamp Chestnut Oak (*Quercus michauxii*)	0.9	1.5	healthy
4	Swamp Chestnut Oak (*Quercus michauxii*)	0.3	0.8	top has died back
5	Swamp Chestnut Oak (*Quercus michauxii*)	1.2	2.0	healthy
6	Willow Oak (*Quercus phellos*)	0.7	1.0	healthy
7	Swamp Chestnut Oak (*Quercus michauxii*)	1.3	1.6	healthy
8	Green Ash (*Fraxinus pennsylvanica*)	1.3	1.6	healthy
9	Yellow Poplar (*Liriodendron tulipifera*)	0.5	0.7	healthy
10	Swamp Chestnut Oak (*Quercus michauxii*)	0.5	0.9	top has died back
11	Green Ash (*Fraxinus pennsylvanica*)	1.6	3.1	healthy
12	Willow Oak (*Quercus phellos*)	1.3	1.2	healthy
13	Laurel Oak (*Quercus laurifolia*)	0.5	0.4	healthy

Notes - Tree heights smaller than previous years reflect die back in tops of trees.
- Plot map updated annually to more accurately reflect tree locations.

Species	Percent of Total
Swamp Chestnut Oak (*Quercus michauxii*)	54%
Green Ash (*Fraxinus pennsylvanica*)	15%
Yellow Poplar (*Liriodendron tulipifera*)	8%
Willow Oak (*Quercus phellos*)	15%
Laurel Oak (*Quercus laurifolia*)	8%

Density:

Total Number of Trees **13** / **0.025 acres** = **520** **trees / acre**

Survivability:

Total Number of Trees **13** / **13 trees** **x** **100** = **100** **% survivability**

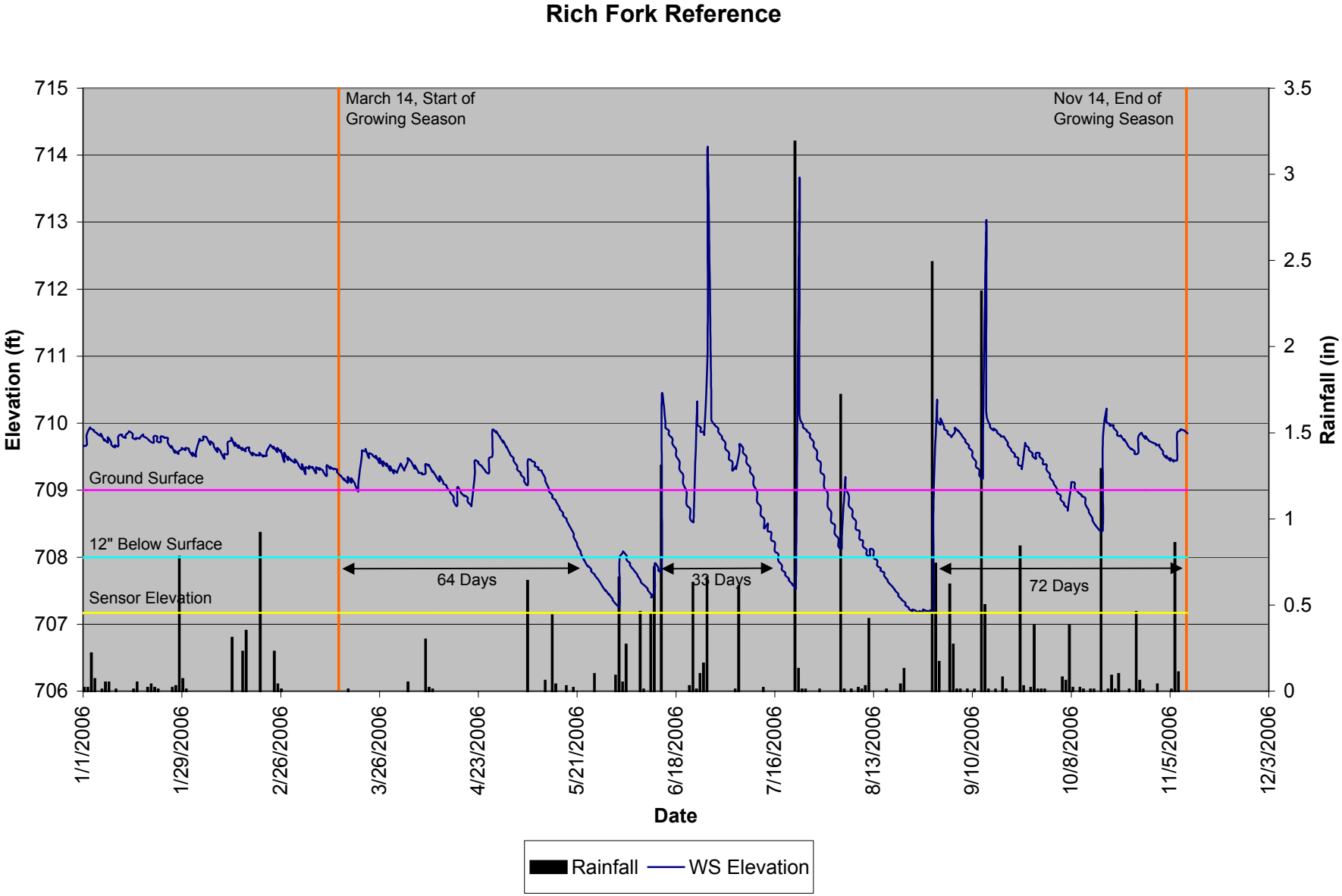
Number of New Recruits : _____

Note : Flag located N 38° E, 27' from monitoring well

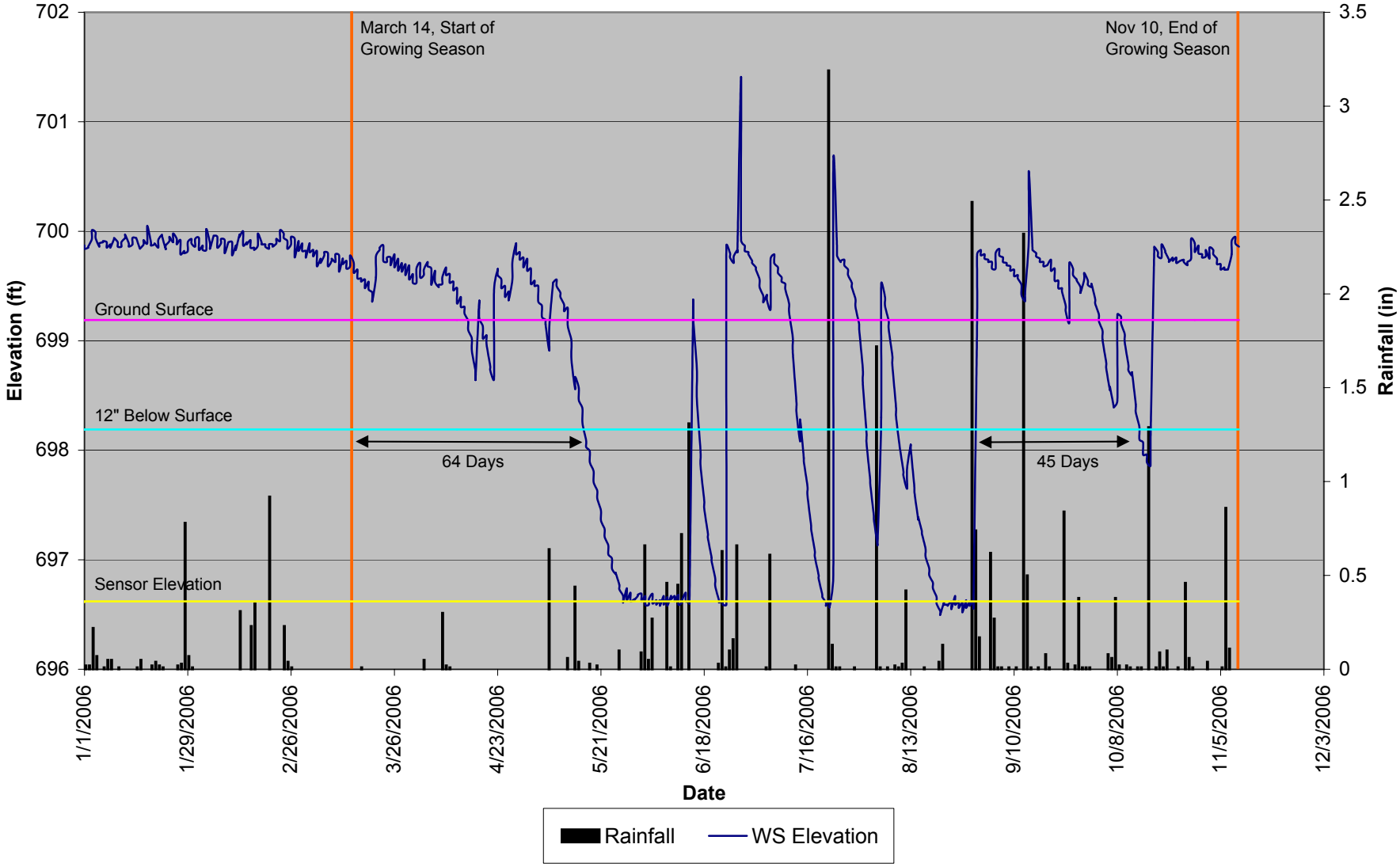
Previous

Current

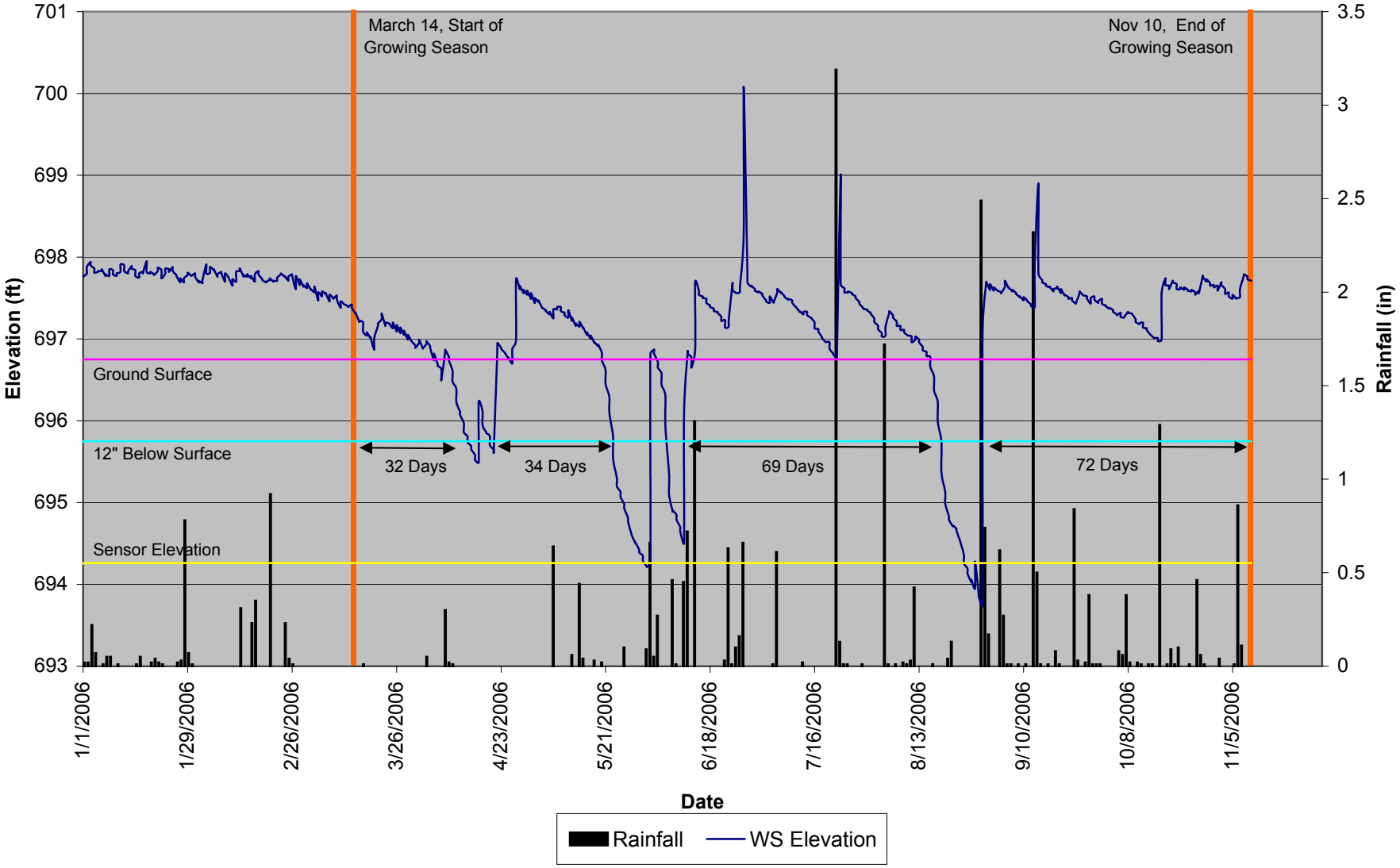
Appendix B
Hydrologic Monitoring and Hydroperiod


Rich Fork Reference
March 14, Start of Growing Season
Nov 14, End of Growing Season
Ground Surface
12" Below Surface
Sensor Elevation
64 Days
33 Days
72 Days
Elevation (ft)
Rainfall (in)
Date
Rainfall
WS Elevation
715
714
713
712
711
710
709
708
707
706
3.5
3
2.5
2
1.5
1
0.5
0
1/1/2006
1/29/2006
2/26/2006
3/26/2006
4/23/2006
5/21/2006
6/18/2006
7/16/2006
8/13/2006
9/10/2006
10/8/2006
11/5/2006
12/3/2006

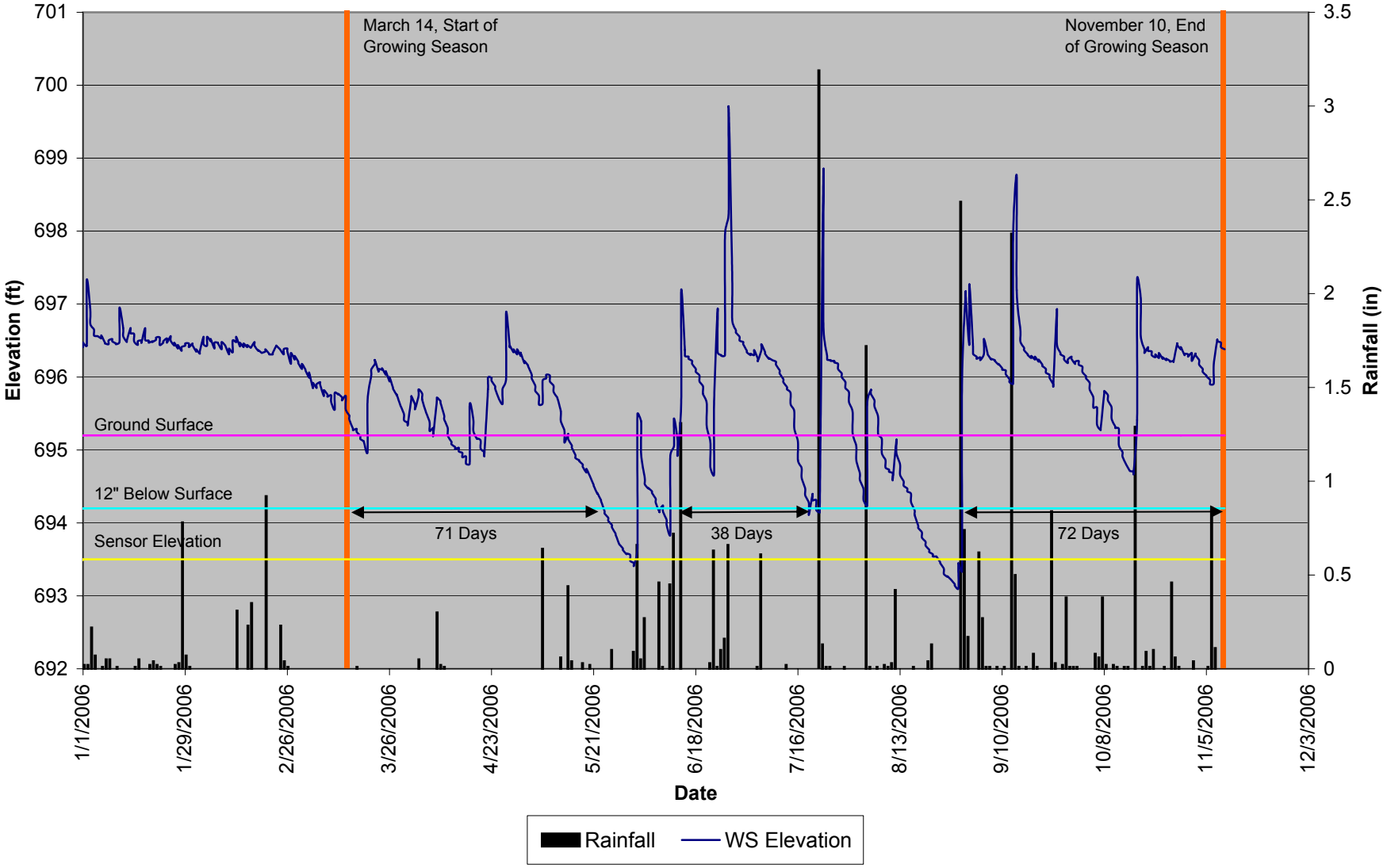
Rich Fork Gauge 1

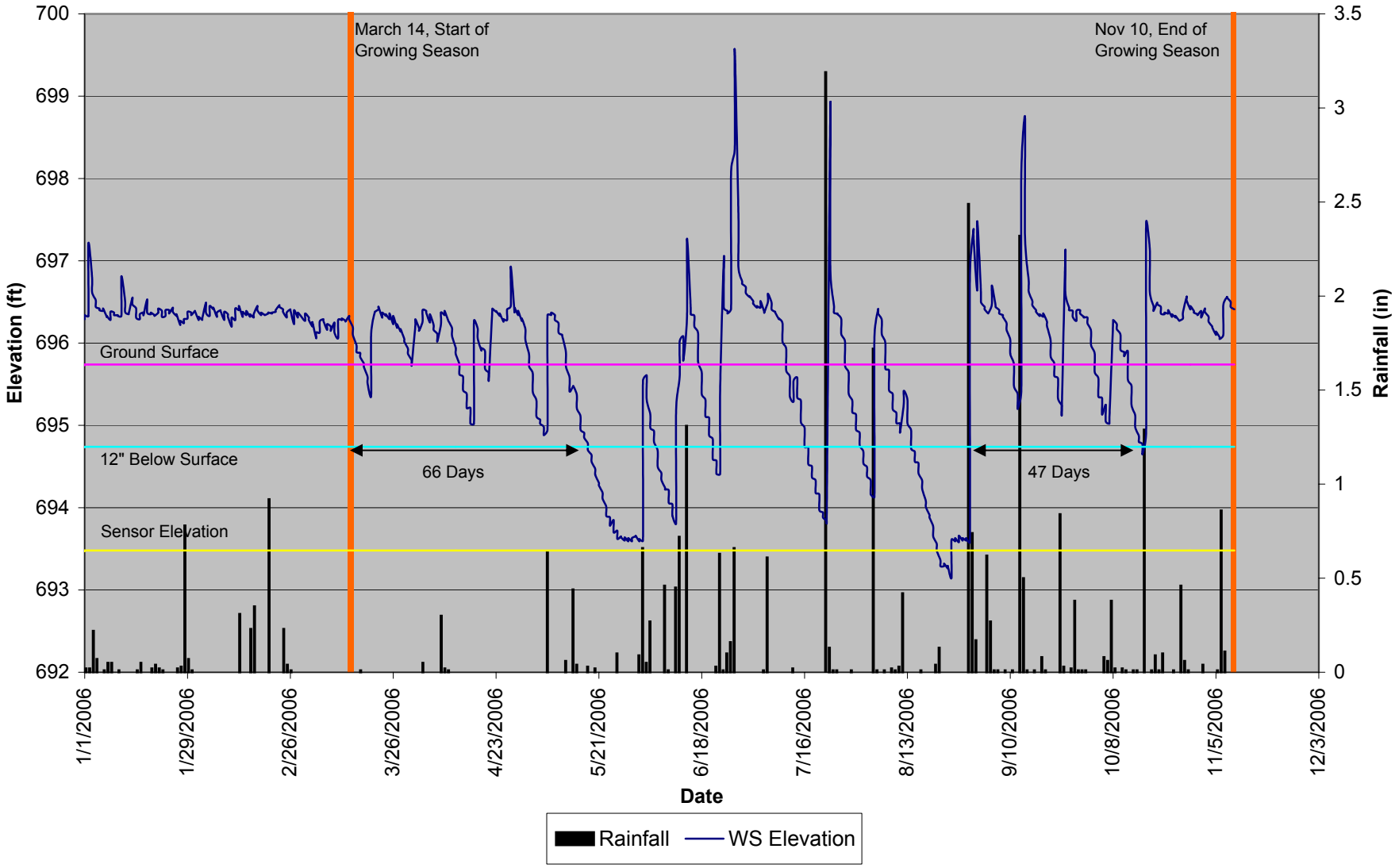


Rich Fork Gauge 2

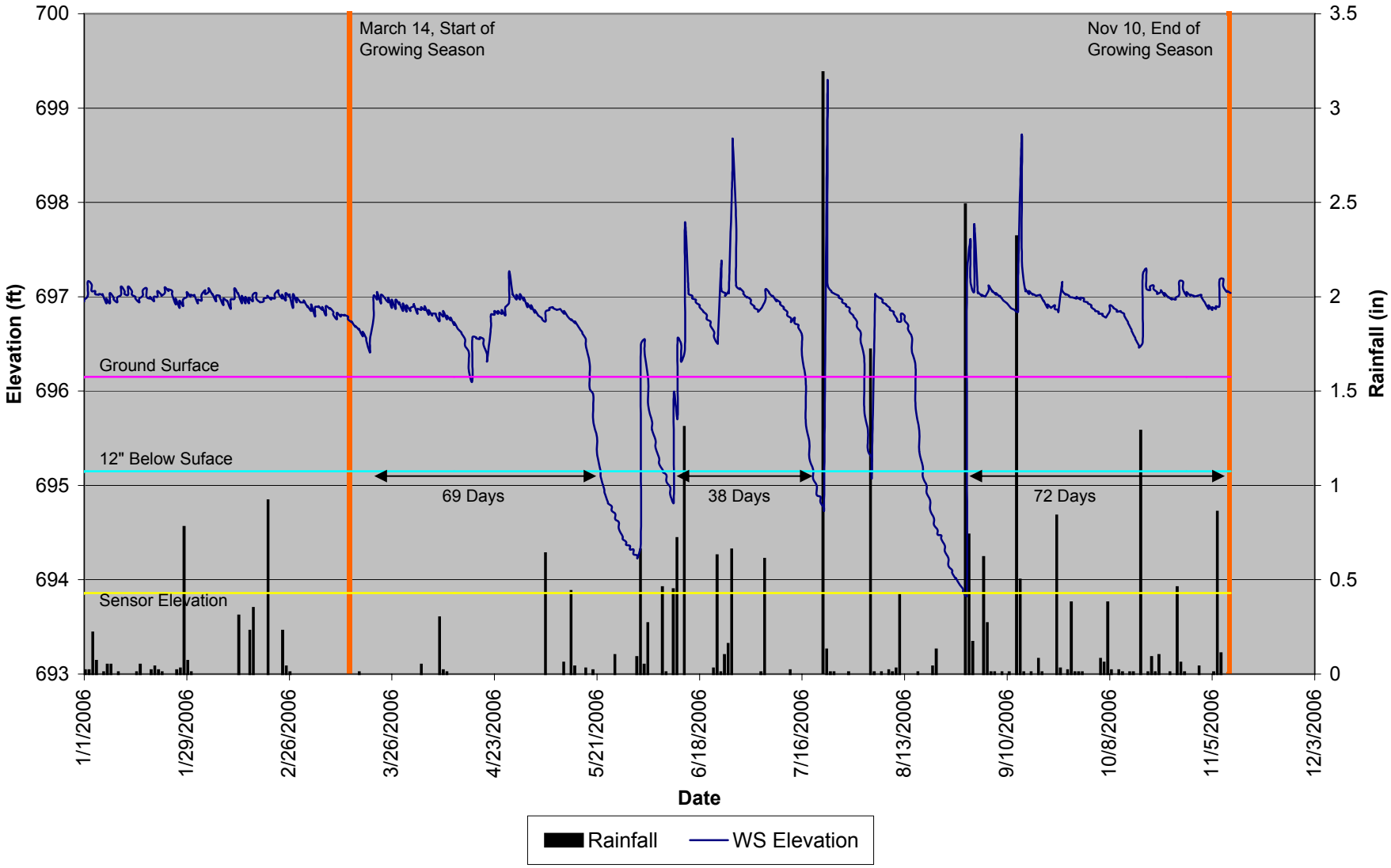


Rich Fork Gauge 3

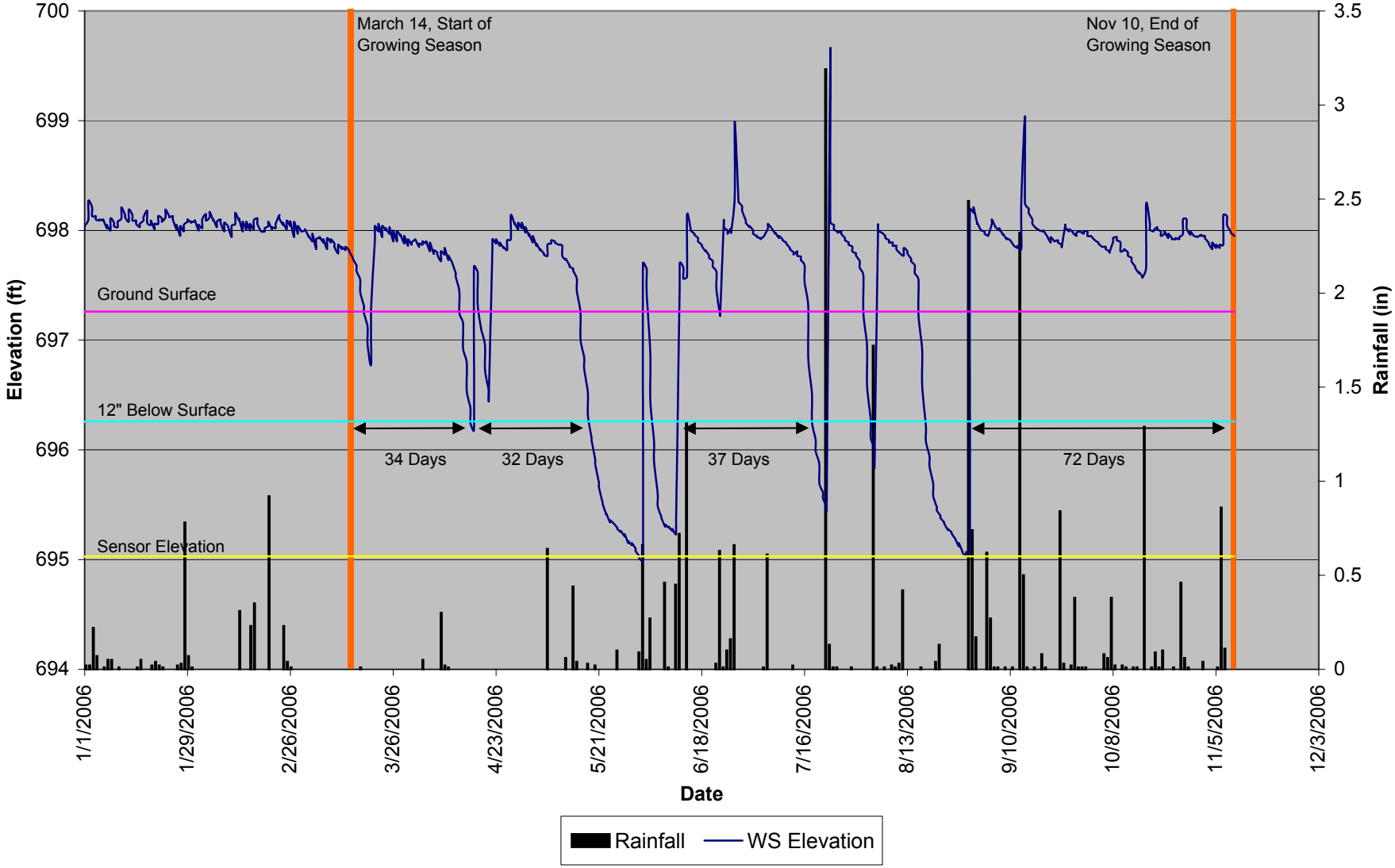



Rich Fork Gauge 4
March 14, Start of Growing Season
Nov 10, End of Growing Season
Ground Surface
12" Below Surface
Sensor Elevation
66 Days
47 Days
Elevation (ft)
Rainfall (in)
Date
700
699
698
697
696
695
694
693
692
3.5
3
2.5
2
1.5
1
0.5
0
1/1/2006
1/29/2006
2/26/2006
3/26/2006
4/23/2006
5/21/2006
6/18/2006
7/16/2006
8/13/2006
9/10/2006
10/8/2006
11/5/2006
12/3/2006
Rainfall
WS Elevation

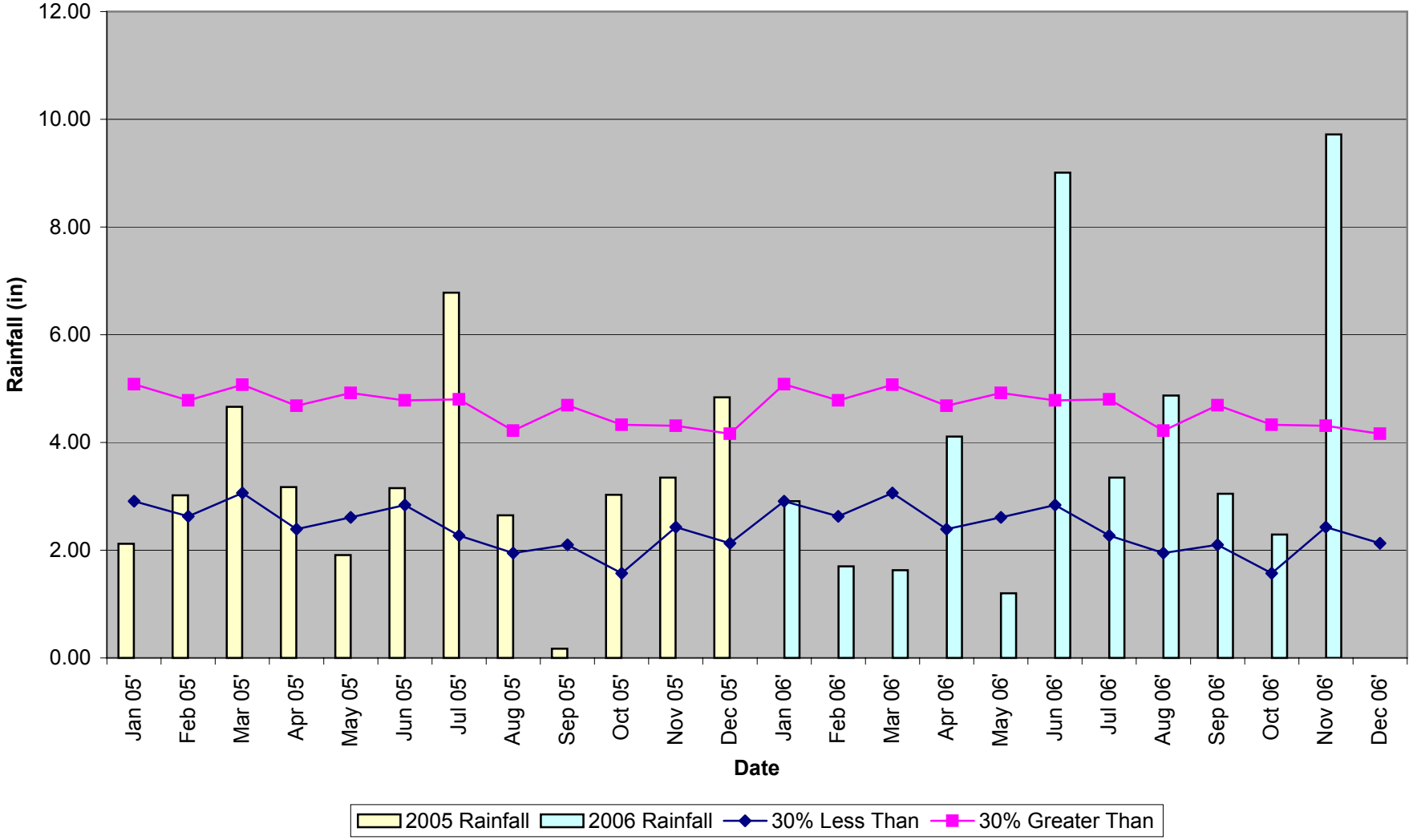
Rich Fork Gauge 5



Rich Fork Gauge 6



Rich Fork Site 30-70 Percentile Graph 2005-2006
Lexington, NC Monthly Rainfall

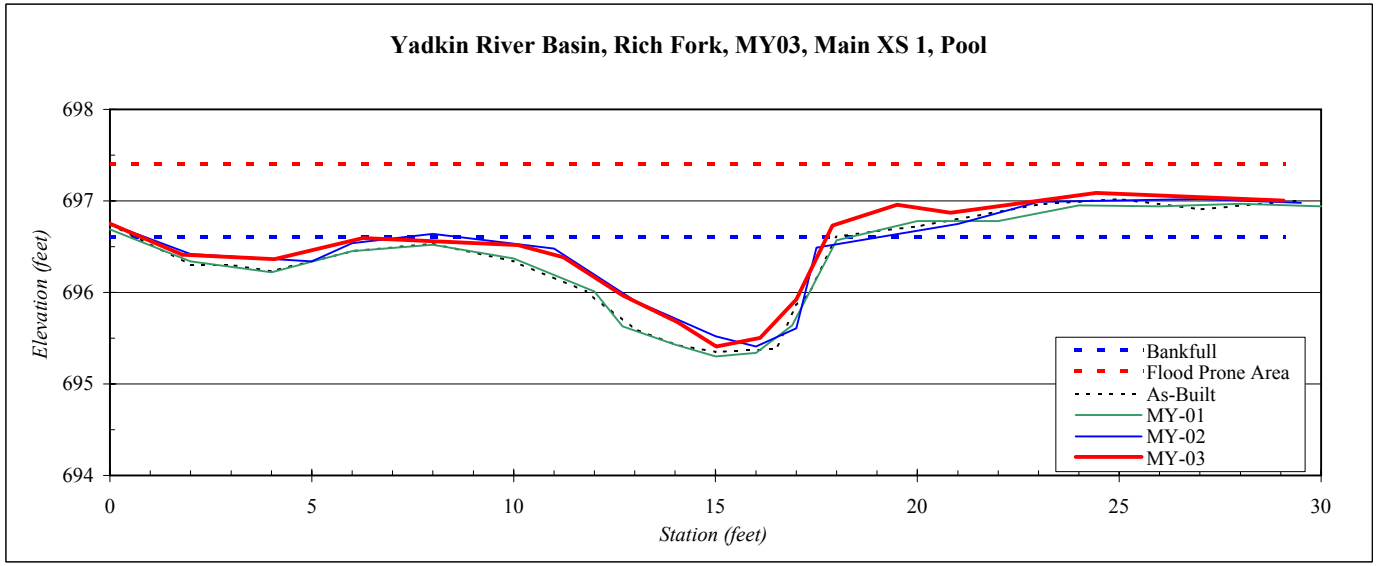


Appendix C
Stream Morphology

River Basin:	Yadkin
Watershed:	Rich Fork, MY03
XS ID	Main XS 1, Pool
Date:	11/1/2006
Field Crew:	A. Spiller & K. Knight

Station	Elevation
0.00	696.75
1.79	696.41
4.08	696.36
6.27	696.59
10.10	696.52
11.23	696.38
12.70	695.97
14.06	695.67
15.02	695.41
16.10	695.50
17.00	695.92
17.90	696.73
19.50	696.96
20.82	696.87
24.43	697.09
29.07	697.00

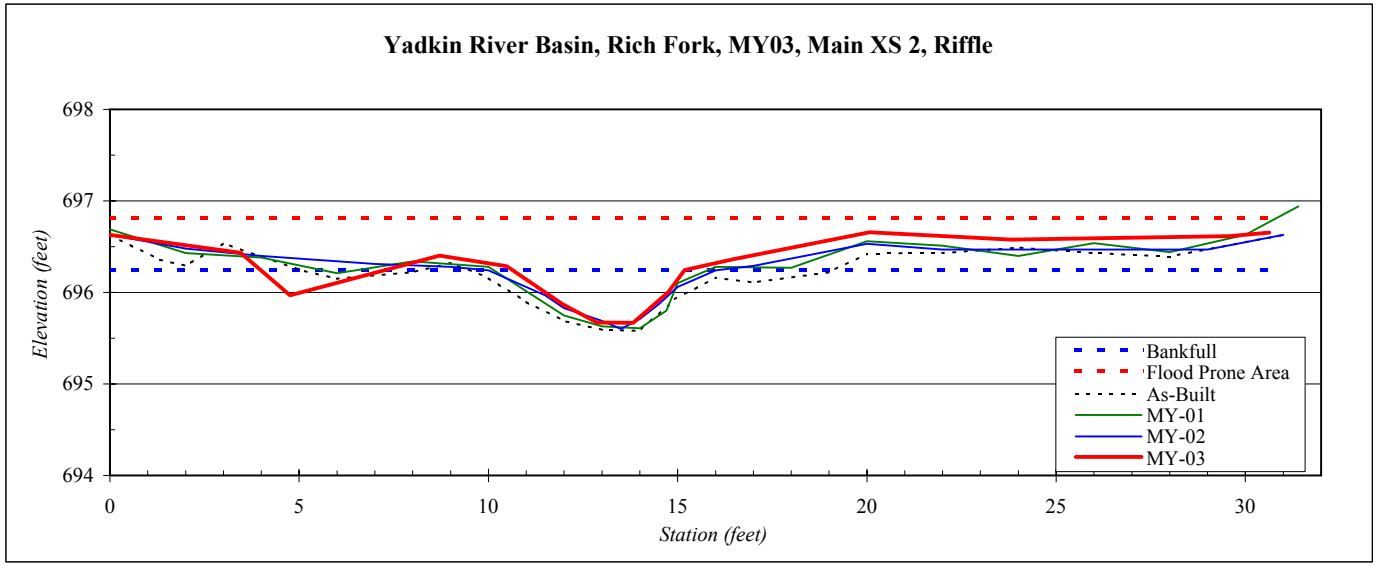
SUMMARY DATA	
Bankfull Elevation:	696.6
Bankfull Cross-Sectional Area:	6.2
Bankfull Width:	17.0
Flood Prone Area Elevation:	697.4
Flood Prone Width:	50.0
Max Depth at Bankfull:	1.2
Mean Depth at Bankfull:	0.4
W / D Ratio:	46.5
Entrenchment Ratio:	2.9
Bank Height Ratio:	1.0



River Basin:	Yadkin
Watershed:	Rich Fork, MY03
XS ID	Main XS 2, Riffle
Date:	11/1/2006
Field Crew:	A. Spiller & K. Knight

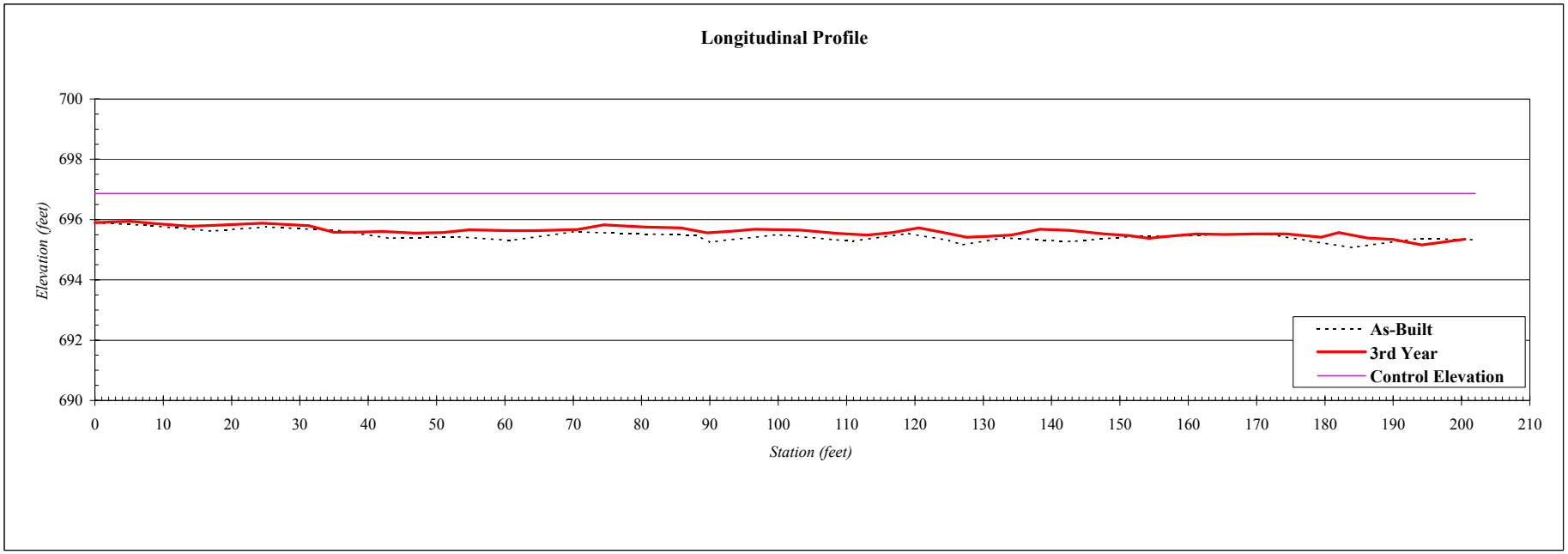
Station	Elevation
0.0	696.63
3.5	696.43
4.8	695.97
8.7	696.40
10.5	696.29
12.0	695.87
12.9	695.67
13.8	695.67
14.8	696.00
15.2	696.25
16.5	696.36
20.1	696.66
23.8	696.58
29.6	696.62
30.6	696.65

SUMMARY DATA	
Bankfull Elevation:	696.24
Bankfull Cross-Sectional Area:	1.6
Bankfull Width:	4.9
Flood Prone Area Elevation:	696.81
Flood Prone Width:	35.0
Max Depth at Bankfull:	0.6
Mean Depth at Bankfull:	0.3
W / D Ratio:	19.6
Entrenchment Ratio:	7.1
Bank Height Ratio:	1.0



River Basin:	Yadkin
Watershed:	Rich Fork Creek
Reach:	Mainstem
Profile ID:	Upstream
Date:	11/1/2006
Field Crew:	A. Spiller & K. Knight
Control Elevation:	696.86

Average Slope:	0.003
As-Built Avg. Depth:	1.42
3rd Year Avg. Depth:	1.26

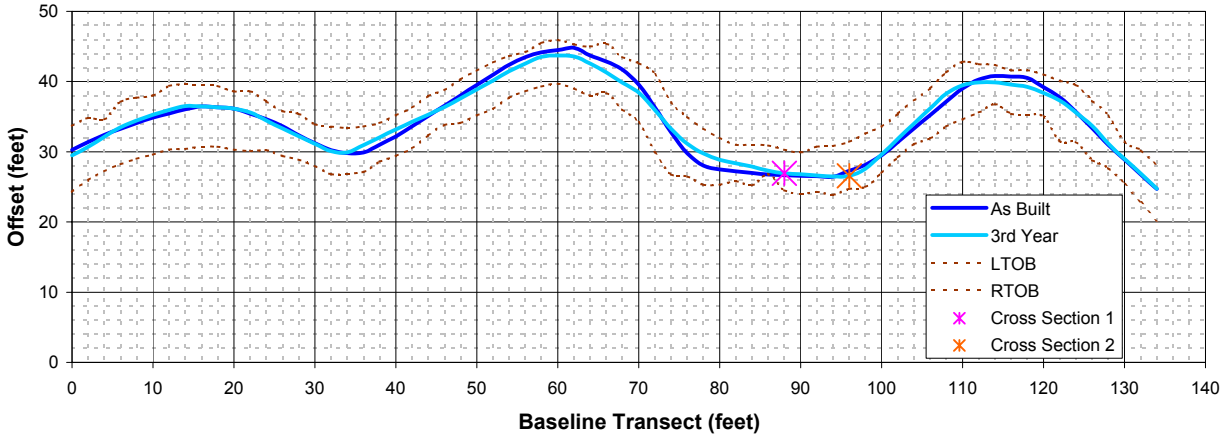


River Basin:	Yadkin
Watershed:	Rich Fork
Planform ID	Main Up
Date:	11/1/2006
Field Crew:	AS, KK

SUMMARY DATA	
Stream Segment Length:	160
Distance Between Survey Points:	134
Distance Between Stations:	2
Sinuosity:	1.2
Mean Radius of Curvature:	13.8
Belt Width:	18.9

View of mainstem upstream planform section looking downstream

Stream Type:	E5



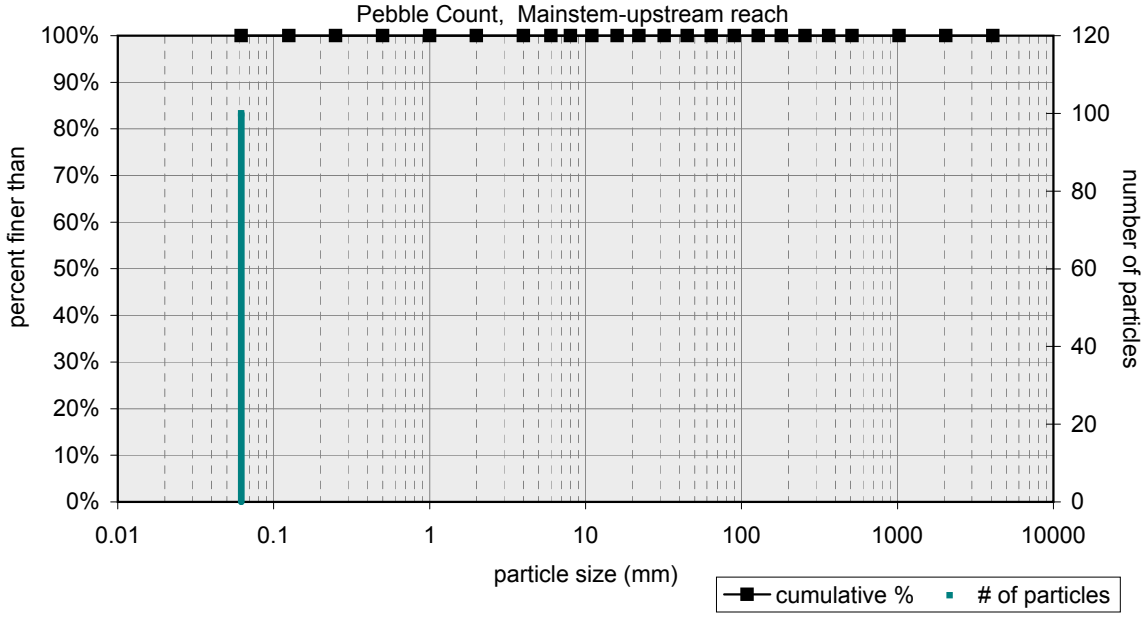
Comments:

Pebble Count of Channel Reach

Pebble Count,
Mainstem-upstream reach
Rich Fork Creek
High Point, NC
Note: **11/1/2006**

Material	Size Range (mm)		Count	
silt/clay	0	0.062	**100**	##
very fine sand	0.062	0.13		##
fine sand	0.13	0.25		##
medium sand	0.25	0.5		##
coarse sand	0.5	1		##
very coarse sand	1	2		##
very fine gravel	2	4		##
fine gravel	4	6		##
fine gravel	6	8		##
medium gravel	8	11		##
medium gravel	11	16		##
coarse gravel	16	22		##
coarse gravel	22	32		##
very coarse gravel	32	45		##
very coarse gravel	45	64		##
small cobble	64	90		##
medium cobble	90	128		##
large cobble	128	180		##
very large cobble	180	256		##
small boulder	256	362		##
small boulder	362	512		##
medium boulder	512	1024		##
large boulder	1024	2048		##
very large boulder	2048	4096		##
	total particle count:		100	

bedrock		
clay hardpan		
detritus/wood		
artificial		
	total count:	100



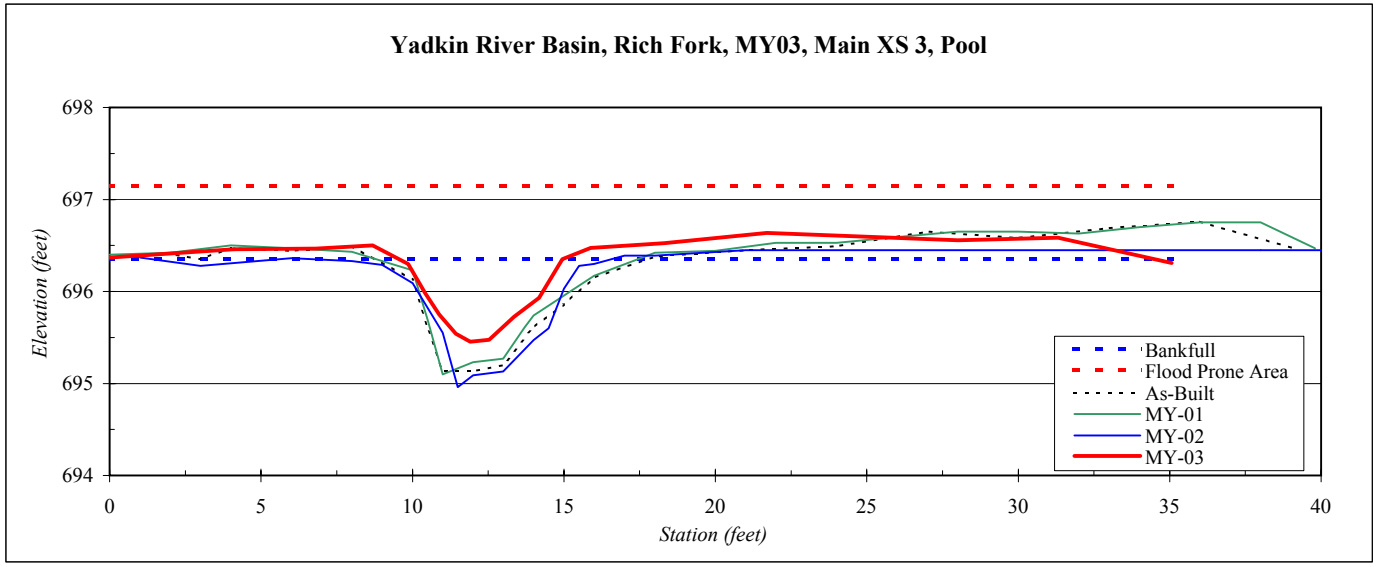
based on sediment particles only	size percent less than (mm)						particle size distribution		
	D16	D35	D50	D65	D84	D95	gradation	geo mean	std dev
	0.062	0.06	0.1	0	0	0	1.0	0.1	1.0

based on total count	percent by substrate type								
	silt/clay	sand	gravel	cobble	boulder	bedrock	hardpan	wood/det	artificial
	100%	0%	0%	0%	0%	0%	0%	0%	0%

River Basin:	Yadkin
Watershed:	Rich Fork, MY03
XS ID	Main XS 3, Pool
Date:	11/1/2006
Field Crew:	A. Spiller & K. Knight

Station	Elevation
0.0	696.37
4.1	696.46
6.8	696.47
8.7	696.50
9.9	696.30
10.4	695.98
10.9	695.75
11.4	695.54
11.9	695.45
12.5	695.47
13.4	695.73
14.2	695.93
14.9	696.35
15.9	696.47
18.3	696.53
21.7	696.64
24.7	696.60
28.0	696.56
31.3	696.59
35.1	696.31

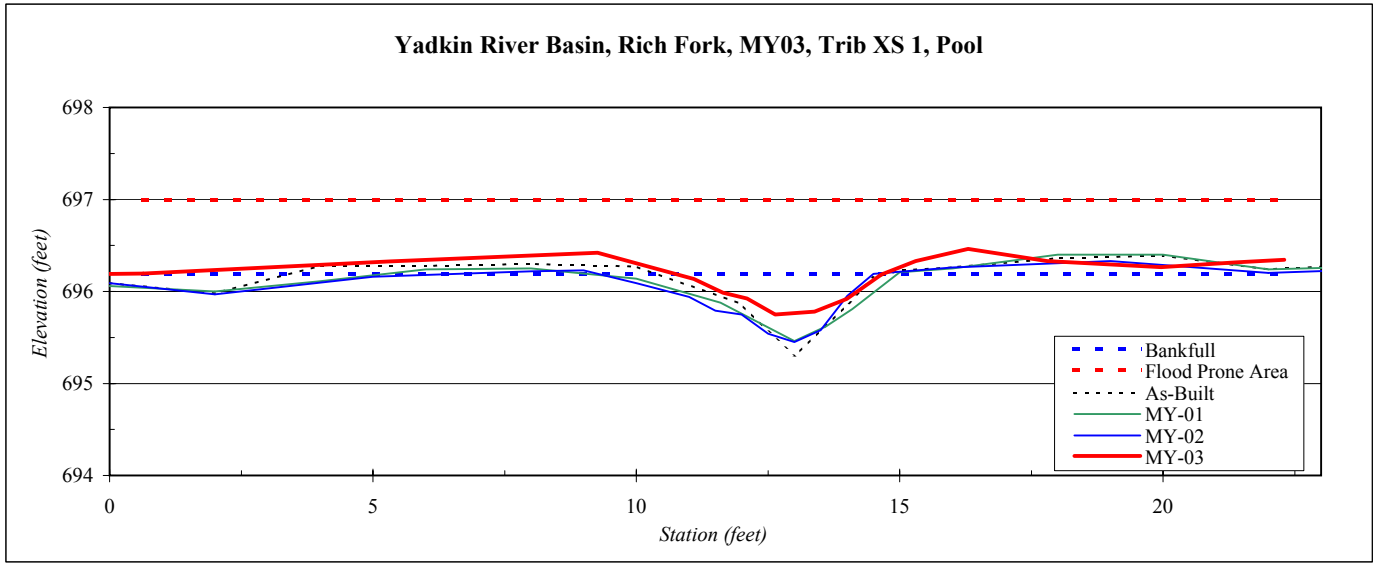
SUMMARY DATA	
Bankfull Elevation:	696.35
Bankfull Cross-Sectional Area:	2.9
Bankfull Width:	5.9
Flood Prone Area Elevation:	697.15
Flood Prone Width:	40.0
Max Depth at Bankfull:	0.9
Mean Depth at Bankfull:	0.5
W / D Ratio:	12.0
Entrenchment Ratio:	6.8
Bank Height Ratio:	1.0



River Basin:	Yadkin
Watershed:	Rich Fork, MY03
XS ID	Trib XS 1, Pool
Date:	11/1/2006
Field Crew:	A. Spiller & K. Knight

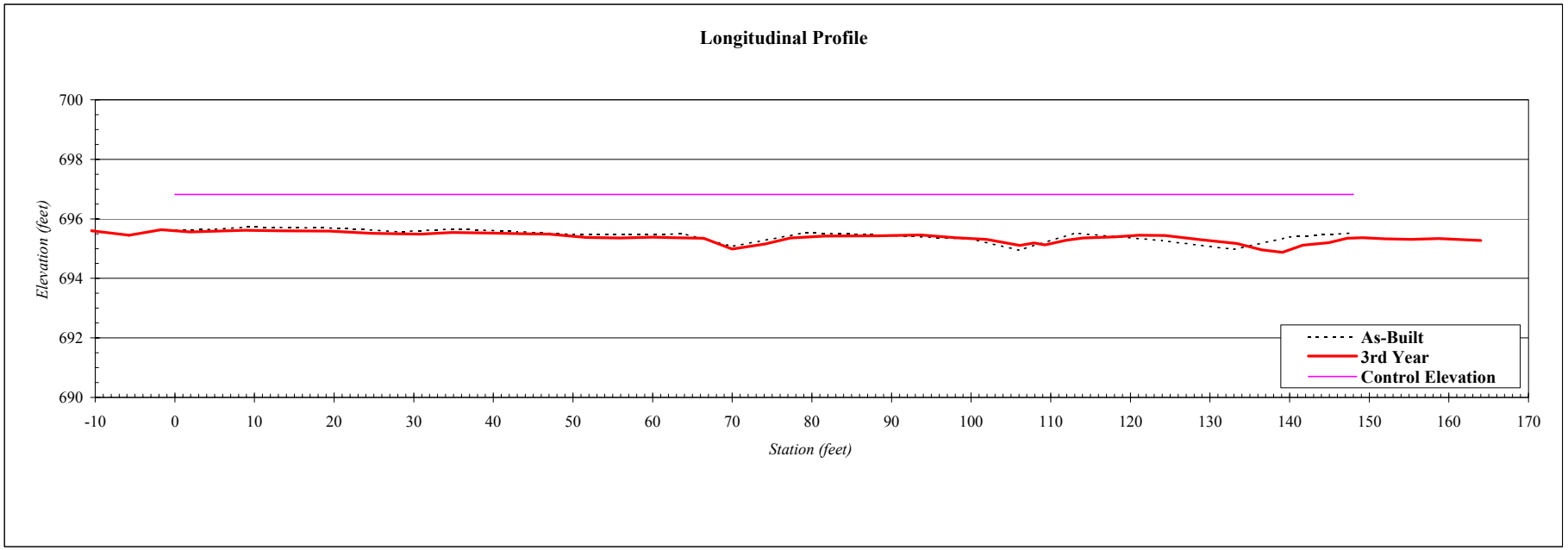
Station	Elevation
0.6	696.19
5.3	696.33
9.3	696.42
11.1	696.13
11.6	695.98
12.1	695.92
12.6	695.75
13.4	695.78
14.0	695.92
14.7	696.18
15.3	696.33
16.3	696.46
17.8	696.33
20.0	696.27
21.4	696.32
22.3	696.34

SUMMARY DATA	
Bankfull Elevation:	696.19
Bankfull Cross-Sectional Area:	1.2
Bankfull Width:	10.8
Flood Prone Area Elevation:	697.0
Flood Prone Width:	30.0
Max Depth at Bankfull:	0.4
Mean Depth at Bankfull:	0.1
W / D Ratio:	10.9
Entrenchment Ratio:	2.8
Bank Height Ratio:	1.0



River Basin:	Yadkin
Watershed:	Rich Fork Creek
Reach:	Mainstem
Profile ID:	Downstream
Date:	11/1/2006
Field Crew:	A. Spiller & K. Knight
Control Elevation:	696.82

Average Slope:	0.002
As-Built Avg. Depth:	1.37
3rd Year Avg. Depth:	1.46

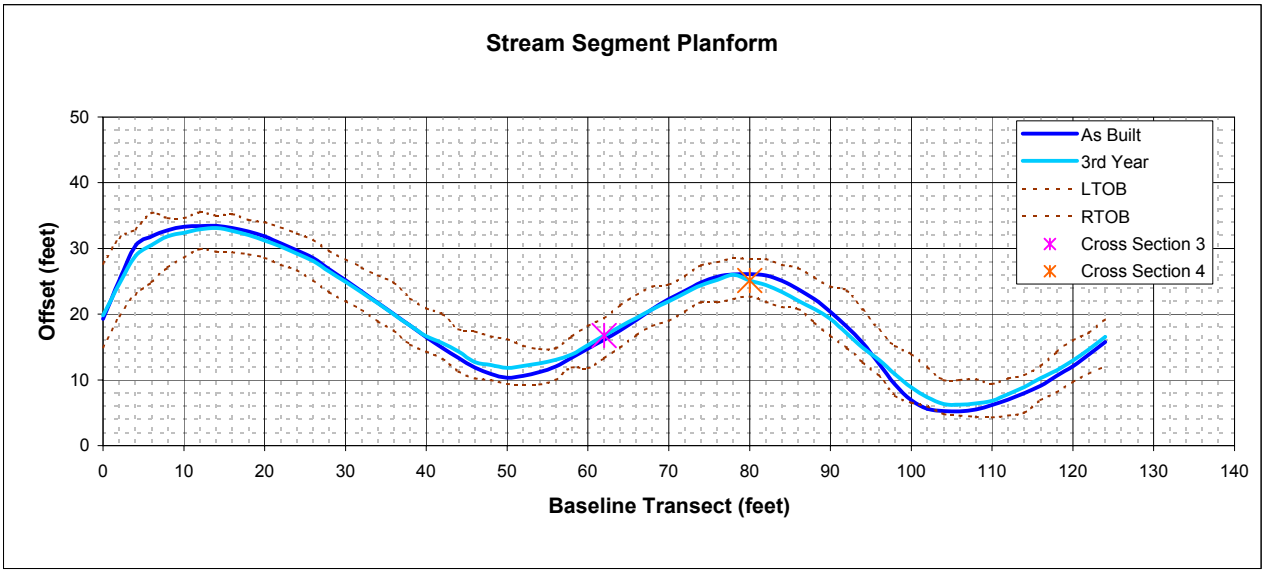


River Basin:	Yadkin
Watershed:	Rich Fork
Planform ID	Main Dwn
Date:	11/1/2006
Field Crew:	AS, KK

SUMMARY DATA	
Stream Segment Length:	151
Distance Between Survey Points:	124
Distance Between Stations:	2
Sinuosity:	1.2
Mean Radius of Curvature:	11.8
Belt Width:	26.9

View of mainstem downstream planform section looking downstream

Stream Type:	E5



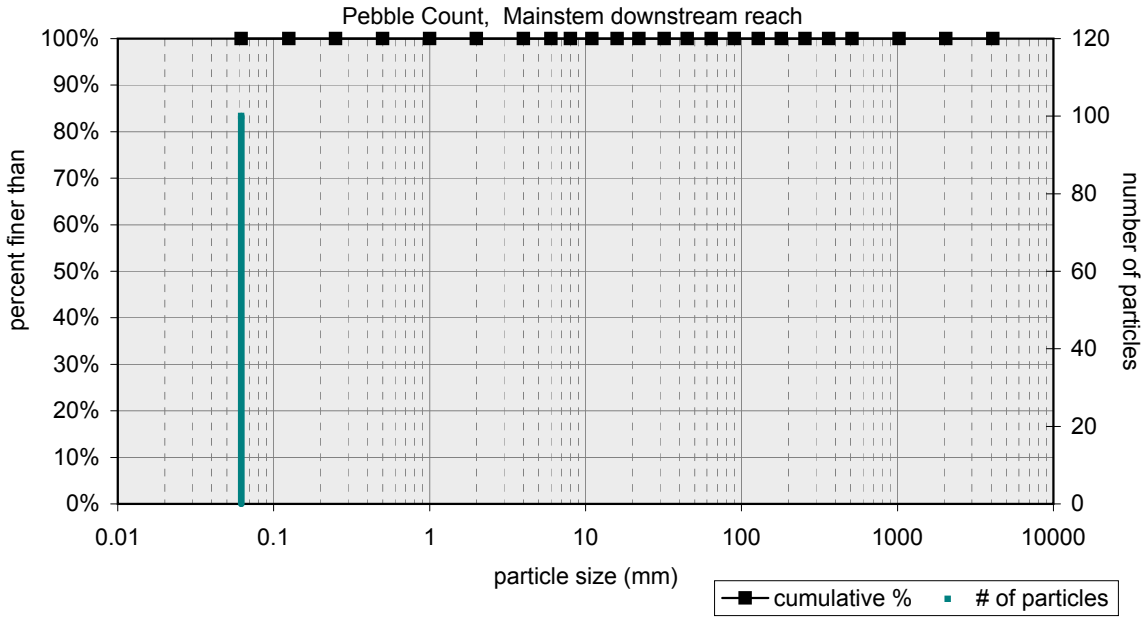
Comments:

Pebble Count of Channel Reach

Material	Size Range (mm)		Count	
silt/clay	0	0.062	**100**	##
very fine sand	0.062	0.13		##
fine sand	0.13	0.25		##
medium sand	0.25	0.5		##
coarse sand	0.5	1		##
very coarse sand	1	2		##
very fine gravel	2	4		##
fine gravel	4	6		##
fine gravel	6	8		##
medium gravel	8	11		##
medium gravel	11	16		##
coarse gravel	16	22		##
coarse gravel	22	32		##
very coarse gravel	32	45		##
very coarse gravel	45	64		##
small cobble	64	90		##
medium cobble	90	128		##
large cobble	128	180		##
very large cobble	180	256		##
small boulder	256	362		##
small boulder	362	512		##
medium boulder	512	1024		##
large boulder	1024	2048		##
very large boulder	2048	4096		##
	total particle count:		100	

bedrock		
clay hardpan		
detritus/wood		
artificial		
	total count:	100

Pebble Count,
Mainstem downstream reach
Rich Fork Creek
High Point, NC
Note: **11/1/2006**



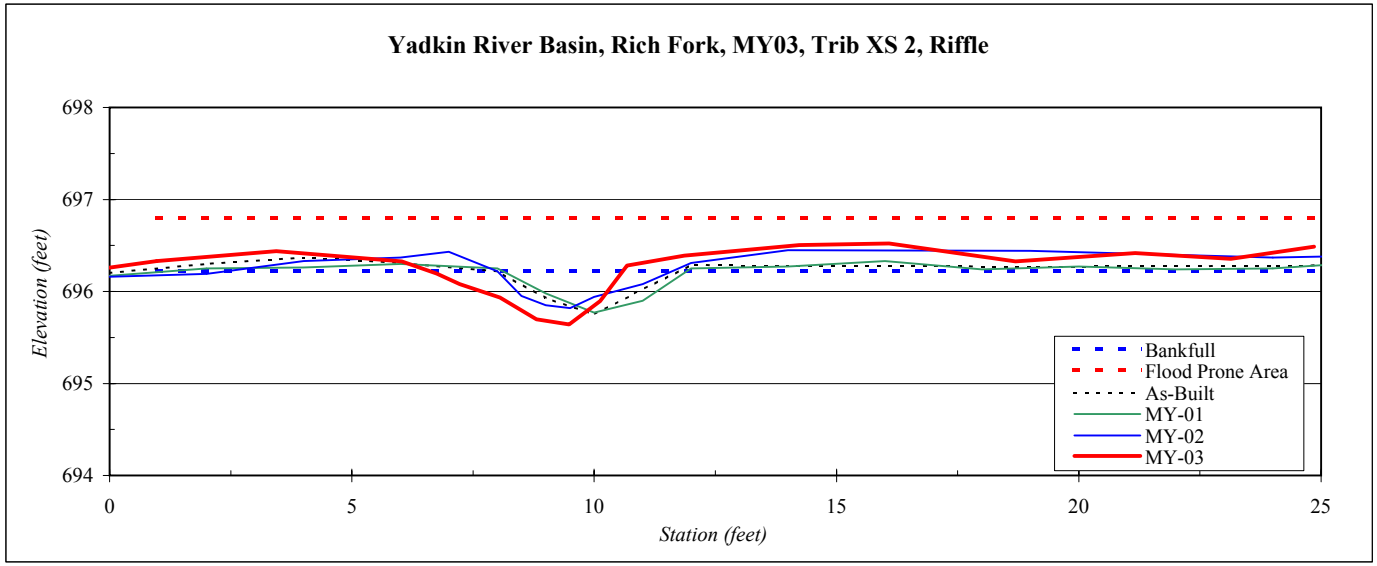
based on sediment particles only	size percent less than (mm)						particle size distribution		
	D16	D35	D50	D65	D84	D95	gradation	geo mean	std dev
	0.062	0.06	0.1	0	0	0	1.0	0.1	1.0

based on total count	percent by substrate type								
	silt/clay	sand	gravel	cobble	boulder	bedrock	hardpan	wood/det	artificial
	100%	0%	0%	0%	0%	0%	0%	0%	0%

River Basin:	Yadkin
Watershed:	Rich Fork, MY03
XS ID	Trib XS 2, Riffle
Date:	11/1/2006
Field Crew:	A. Spiller & K. Knight

Station	Elevation
1.0	696.33
3.4	696.44
6.0	696.33
6.8	696.19
7.2	696.08
8.1	695.93
8.8	695.70
9.5	695.64
10.1	695.90
10.7	696.28
11.9	696.39
14.2	696.50
16.1	696.52
18.7	696.33
21.2	696.42
23.1	696.35
24.9	696.49

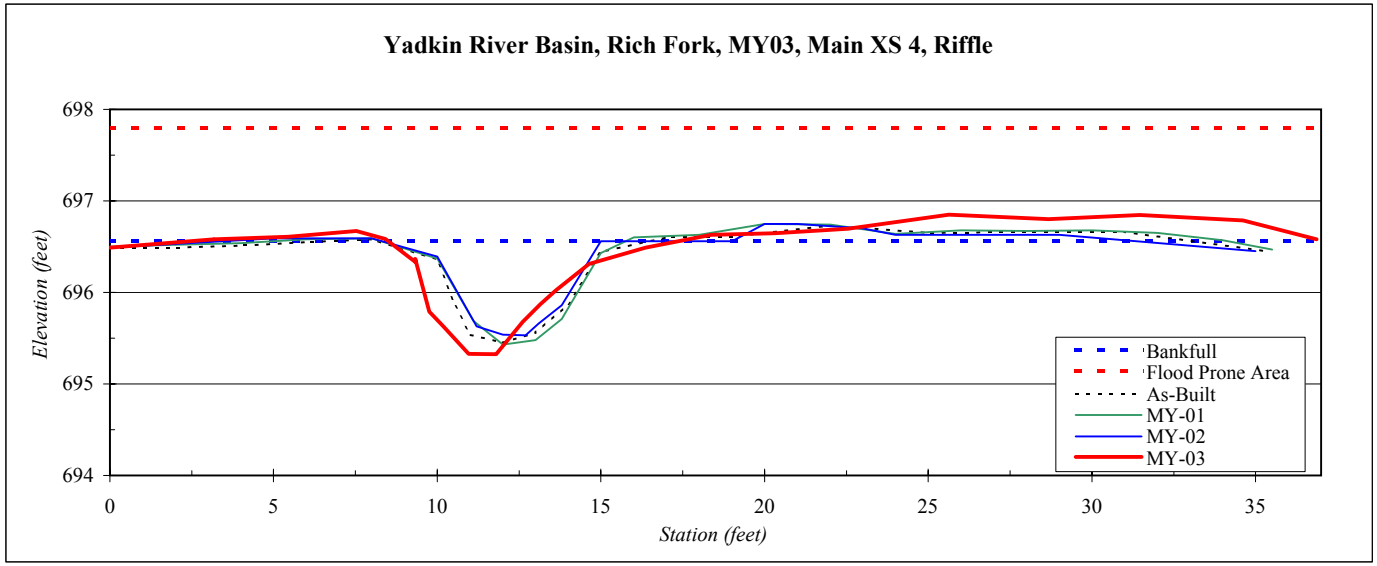
SUMMARY DATA	
Bankfull Elevation:	696.22
Bankfull Cross-Sectional Area:	1.5
Bankfull Width:	7.1
Flood Prone Area Elevation:	696.8
Flood Prone Width:	25.0
Max Depth at Bankfull:	0.6
Mean Depth at Bankfull:	0.2
W / D Ratio:	34.7
Entrenchment Ratio:	3.5
Bank Height Ratio:	1.0



River Basin:	Yadkin
Watershed:	Rich Fork, MY03
XS ID	Main XS 4, Riffle
Date:	11/1/2006
Field Crew:	A. Spiller & K. Knight

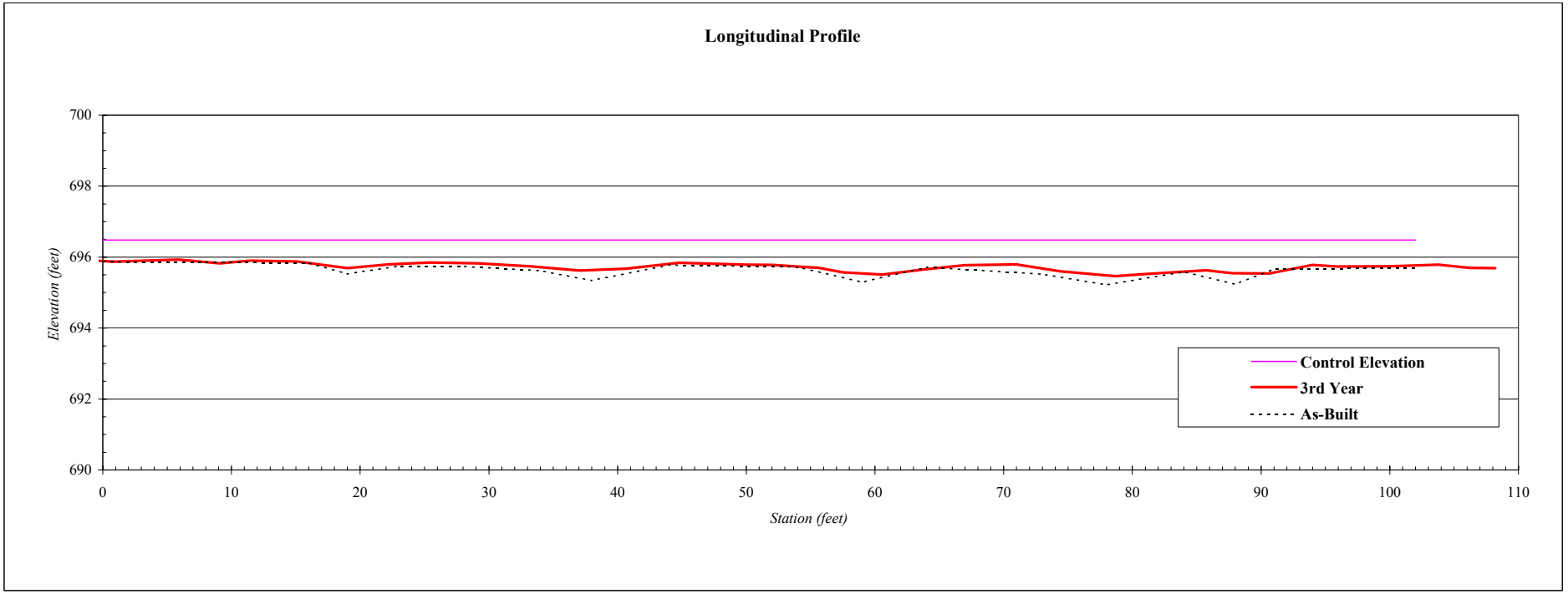
Station	Elevation
0.0	696.49
3.2	696.58
5.5	696.61
7.5	696.67
8.4	696.58
9.3	696.33
9.3	696.37
9.8	695.79
10.2	695.63
11.0	695.33
11.8	695.32
12.6	695.68
13.1	695.87
13.6	696.02
14.6	696.31
16.4	696.49
18.4	696.63
20.3	696.65
22.5	696.70
25.6	696.85
28.7	696.80
31.5	696.84
34.6	696.79
36.9	696.58

SUMMARY DATA	
Bankfull Elevation:	696.56
Bankfull Cross-Sectional Area:	5.2
Bankfull Width:	12.0
Flood Prone Area Elevation:	697.8
Flood Prone Width:	50.0
Max Depth at Bankfull:	1.2
Mean Depth at Bankfull:	0.4
W / D Ratio:	27.9
Entrenchment Ratio:	4.2
Bank Height Ratio:	1.0



River Basin:	Yadkin
Watershed:	Rich Fork Creek
Reach:	Tributary
Profile ID:	Upstream
Date:	11/1/2006
Field Crew:	A. Spiller & K. Knight
Control Elevation:	696.48

Average Slope:	0.003
As-Built Avg. Depth:	0.87
3rd Year Avg. Depth:	0.75

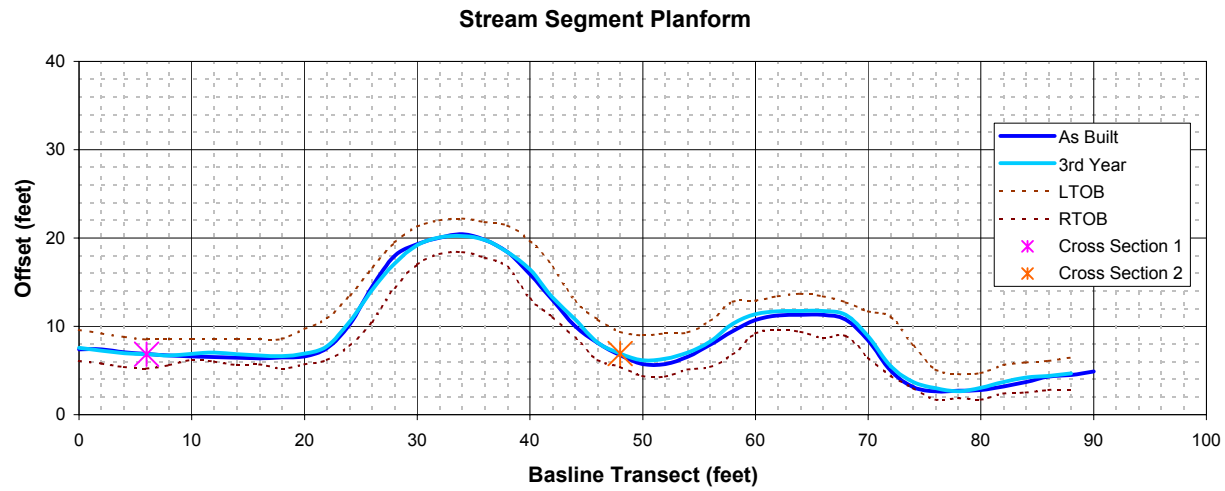


River Basin:	Yadkin
Watershed:	Rich Fork
Planform ID	Trib Up
Date:	11/1/2006
Field Crew:	AS, KK

SUMMARY DATA	
Stream Segment Length:	107
Distance Between Survey Points:	88
Distance Between Stations:	2
Sinuosity:	1.2
Mean Radius of Curvature:	7.0
Belt Width:	17.6

View of tributary upstream planform section looking downstream

Stream Type:	E5



Comments:

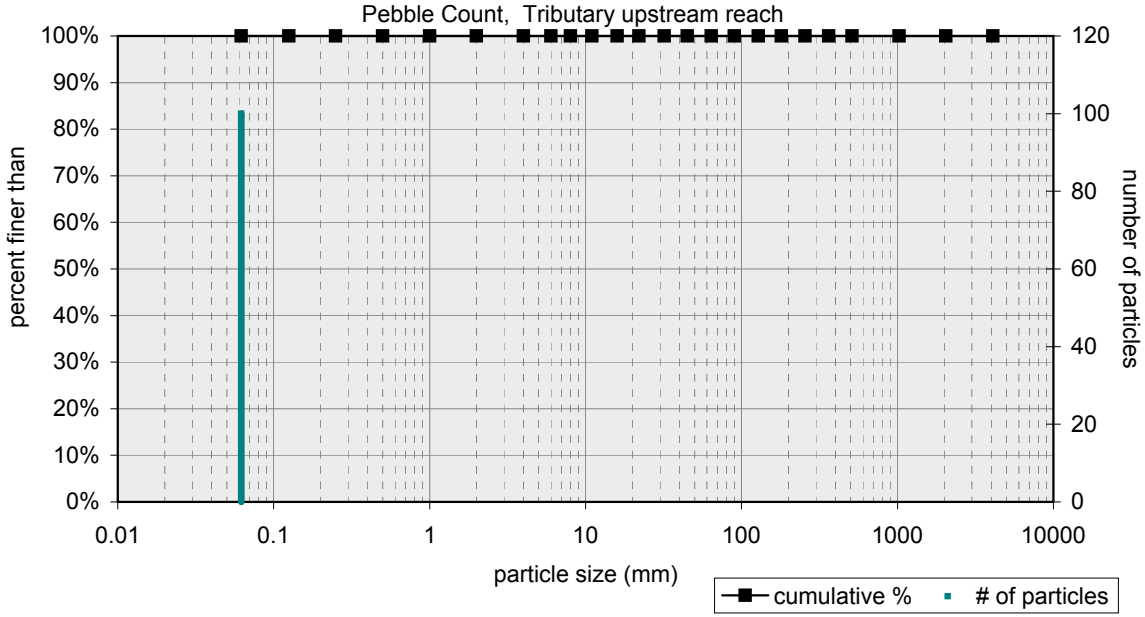
Due to blockage in tributary near the confluence with the mainstem, backwatered conditions existed in the tributary

Pebble Count of Channel Reach

Material	Size Range (mm)		Count	
silt/clay	0	0.062	**100**	##
very fine sand	0.062	0.13		##
fine sand	0.13	0.25		##
medium sand	0.25	0.5		##
coarse sand	0.5	1		##
very coarse sand	1	2		##
very fine gravel	2	4		##
fine gravel	4	6		##
fine gravel	6	8		##
medium gravel	8	11		##
medium gravel	11	16		##
coarse gravel	16	22		##
coarse gravel	22	32		##
very coarse gravel	32	45		##
very coarse gravel	45	64		##
small cobble	64	90		##
medium cobble	90	128		##
large cobble	128	180		##
very large cobble	180	256		##
small boulder	256	362		##
small boulder	362	512		##
medium boulder	512	1024		##
large boulder	1024	2048		##
very large boulder	2048	4096		##
	total particle count:		100	

bedrock		
clay hardpan		
detritus/wood		
artificial		
	total count:	100

Pebble Count,
Tributary upstream reach
Rich Fork Creek
High Point, NC
Note: **11/1/2006**



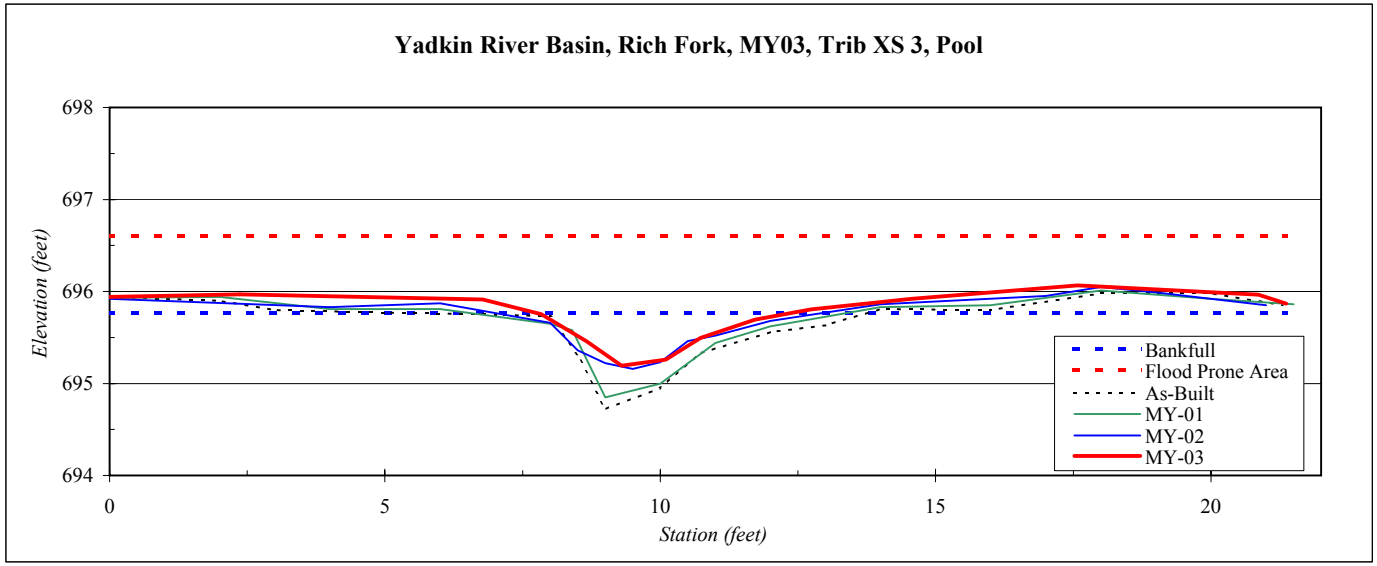
based on sediment particles only	size percent less than (mm)						particle size distribution		
	D16	D35	D50	D65	D84	D95	gradation	geo mean	std dev
	0.062	0.06	0.1	0	0	0	1.0	0.1	1.0

based on total count	percent by substrate type								
	silt/clay	sand	gravel	cobble	boulder	bedrock	hardpan	wood/det	artificial
	100%	0%	0%	0%	0%	0%	0%	0%	0%

River Basin:	Yadkin
Watershed:	Rich Fork, MY03
XS ID	Trib XS 3, Pool
Date:	11/1/2006
Field Crew:	A. Spiller & K. Knight

Station	Elevation
0.0	695.94
2.4	695.97
6.8	695.91
7.8	695.75
8.7	695.46
9.3	695.19
10.1	695.26
10.7	695.50
11.7	695.70
12.7	695.80
14.6	695.92
17.6	696.07
20.9	695.97
21.4	695.87

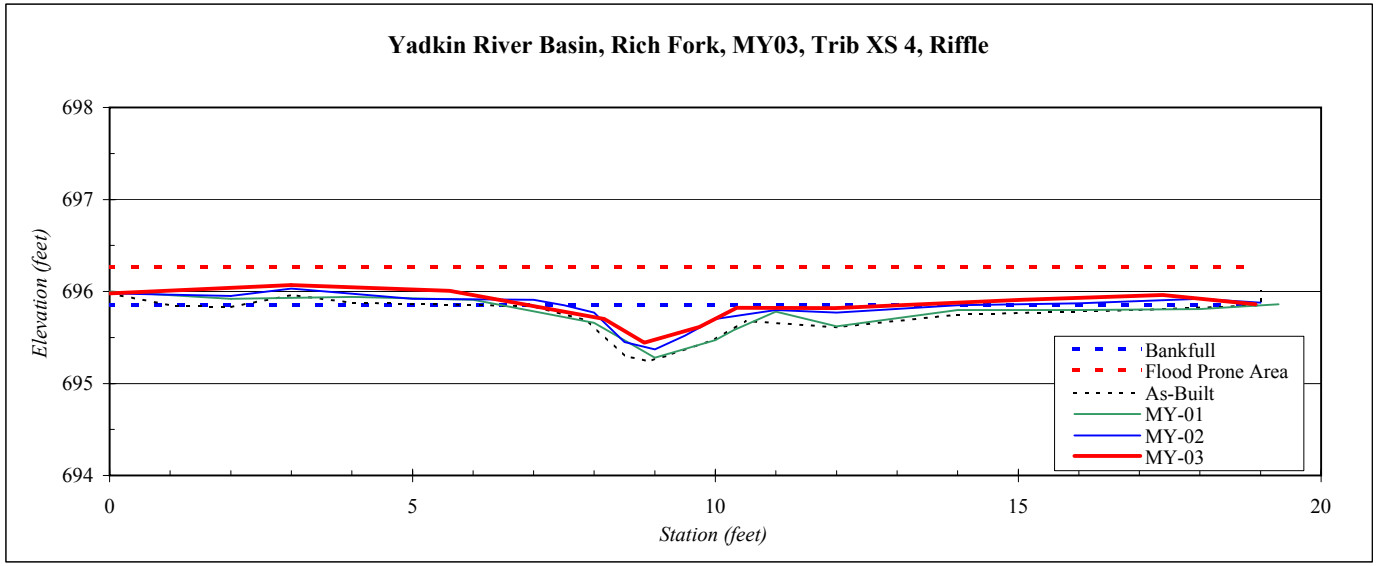
SUMMARY DATA	
Bankfull Elevation:	695.77
Bankfull Cross-Sectional Area:	1.3
Bankfull Width:	4.7
Flood Prone Area Elevation:	696.6
Flood Prone Width:	23.0
Max Depth at Bankfull:	0.6
Mean Depth at Bankfull:	0.3
W / D Ratio:	17.0
Entrenchment Ratio:	4.9
Bank Height Ratio:	1.0



River Basin:	Yadkin
Watershed:	Rich Fork, MY03
XS ID	Trib XS 4, Riffle
Date:	11/1/2006
Field Crew:	A. Spiller & K. Knight

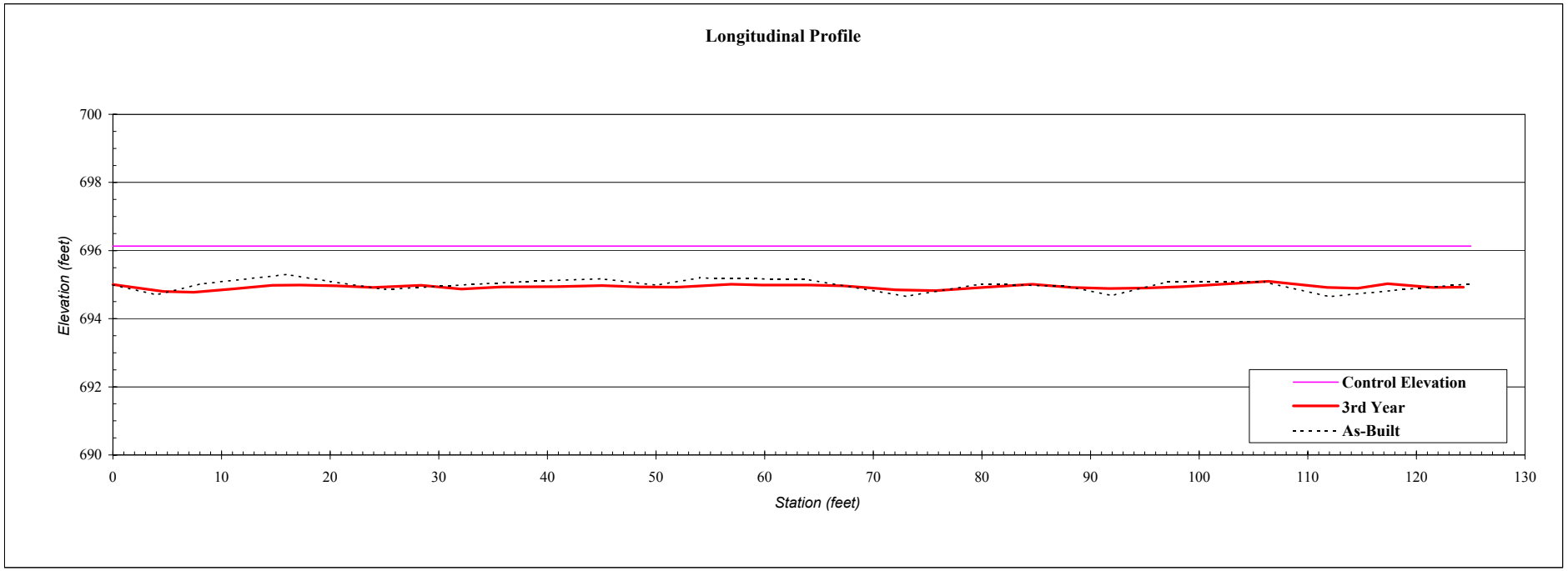
Station	Elevation
0.0	695.98
3.0	696.07
5.6	696.01
8.2	695.70
8.8	695.44
9.7	695.61
10.4	695.82
12.0	695.82
15.1	695.91
17.4	695.96
18.9	695.86

SUMMARY DATA	
Bankfull Elevation:	695.85
Bankfull Cross-Sectional Area:	0.7
Bankfull Width:	6.1
Flood Prone Area Elevation:	696.26
Flood Prone Width:	20.0
Max Depth at Bankfull:	0.4
Mean Depth at Bankfull:	0.1
W / D Ratio:	52.0
Entrenchment Ratio:	3.3
Bank Height Ratio:	1.0



River Basin:	Yadkin
Watershed:	Rich Fork Creek
Reach:	Tributary
Profile ID:	Downstream
Date:	11/1/2006
Field Crew:	A. Spiller & K. Knight
Control Elevation:	696.13

Average Slope:	0.001
As-Built Avg. Depth:	1.15
3rd Year Avg. Depth:	1.20

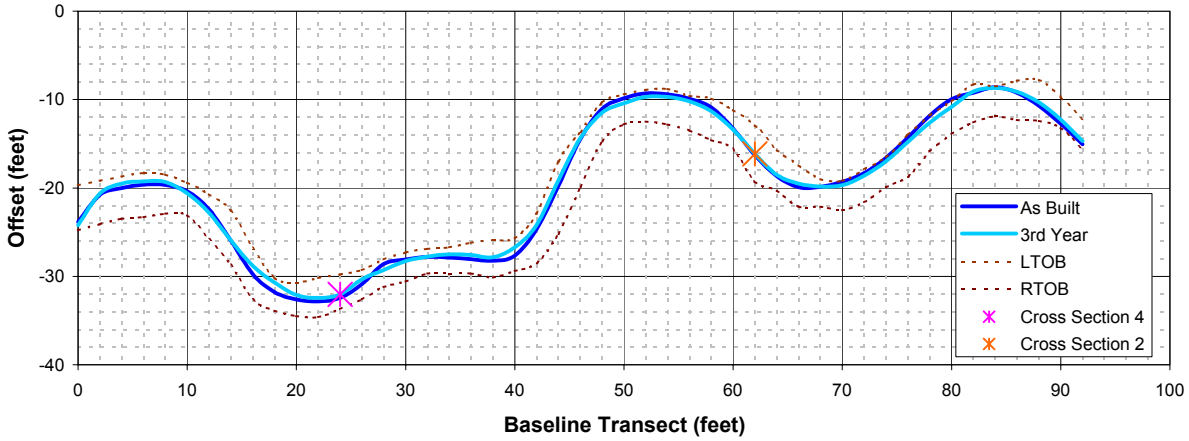


River Basin:	Yadkin
Watershed:	Rich Fork
Planform ID	Trib Dwn
Date:	11/1/2006
Field Crew:	AS, KK

SUMMARY DATA	
Stream Segment Length:	123
Distance Between Survey Points:	92
Distance Between Stations:	2
Sinuosity:	1.3
Mean Radius of Curvature:	7.0
Belt Width:	23.7

View of tributary downstream planform section looking downstream

Stream Type:	E5



Comments:

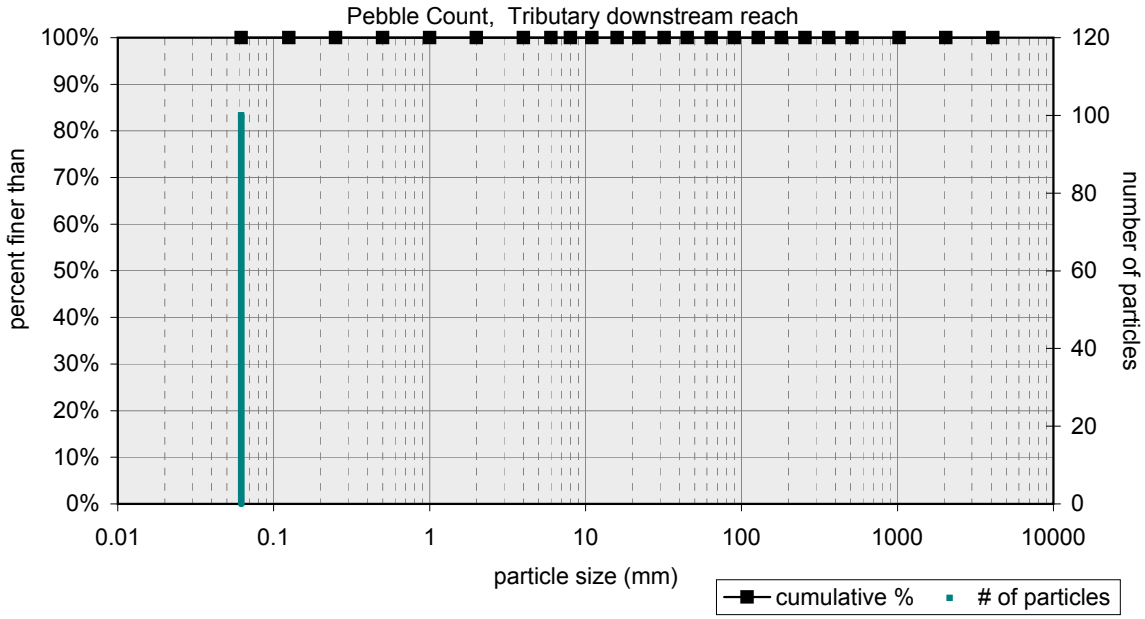
Due to blockage in tributary near the confluence with the mainstem, backwatered conditions existed in the tributary

Pebble Count of Channel Reach

Pebble Count,
Tributary downstream reach
Rich Fork Creek
High Point, NC
Note: **11/1/2006**

Material	Size Range (mm)		Count	
silt/clay	0	0.062	**100**	##
very fine sand	0.062	0.13		##
fine sand	0.13	0.25		##
medium sand	0.25	0.5		##
coarse sand	0.5	1		##
very coarse sand	1	2		##
very fine gravel	2	4		##
fine gravel	4	6		##
fine gravel	6	8		##
medium gravel	8	11		##
medium gravel	11	16		##
coarse gravel	16	22		##
coarse gravel	22	32		##
very coarse gravel	32	45		##
very coarse gravel	45	64		##
small cobble	64	90		##
medium cobble	90	128		##
large cobble	128	180		##
very large cobble	180	256		##
small boulder	256	362		##
small boulder	362	512		##
medium boulder	512	1024		##
large boulder	1024	2048		##
very large boulder	2048	4096		##
	total particle count:		100	

bedrock		
clay hardpan		
detritus/wood		
artificial		
	total count:	100



based on sediment particles only	size percent less than (mm)						particle size distribution		
	D16	D35	D50	D65	D84	D95	gradation	geo mean	std dev
	0.062	0.06	0.1	0	0	0	1.0	0.1	1.0

based on total count	percent by substrate type								
	silt/clay	sand	gravel	cobble	boulder	bedrock	hardpan	wood/det	artificial
	100%	0%	0%	0%	0%	0%	0%	0%	0%

Appendix D
Benthic Macroinvertebrate Report

UT to Rich Fork Stream and Wetland Restoration Project
Benthic Macroinvertebrate Sampling
August 3, 2006

Aquatic macroinvertebrates were sampled from the unnamed tributary to Rich Fork (UTRF) at the Rich Fork Stream and Wetland Restoration Site on August 3, 2006. This sample was a substitute for the second monitoring year, when a drought in 2005 prevented any sampling of macroinvertebrates.

The UTRF is a first order, low gradient stream that was restored in 2003. Based on the stream size, the North Carolina Qual-4 method was used to sample for macroinvertebrates. The North Carolina Division of Water Quality (NCDWQ) recommends this method for streams smaller than 4 meters wide and with a drainage area smaller than 3 square miles. This method is defined as four separate samples: one kick net, one sweep, one leaf pack, and one visual inspection (Standard Operating Procedures for Benthic Macroinvertebrates, Biological Assessment Unit, NCDWQ 2003). For this stream, a sand bag sample was used instead of a kick net due to low stream velocity. The visual inspection lasted 5 minutes for each location.

The site conditions on that day were hot and humid with temperatures reaching 95 degrees F. Water flowed in the UTRF starting at the beginning of the project reach, but flow ceased after approximately one-half of the way downstream on the project reach. The stream regained water from nearby seeps and site drainage just before the confluence with Rich Fork. The tributary to the UTRF was blocked before it joins the UTRF due to flood debris and did not have any baseflow at that time.

The sampling locations were based on those used in the first monitoring year and adjusted slightly to find sections of the stream with water. A reference sample was completed directly upstream of the project stream (Upper Reach Sample). This portion of the stream has grown over with cattails and has no defined substrate. There were signs of iron-fixing bacteria in the water. One sweep and one combined leaf pack/visual were all that could be completed here. The leaf pack and visual inspection were combined due to the lack of substrate material to sample.

The first project sample was completed approximately one-third of the way downstream (Main Channel Sample). The site was chosen because of the mature willows providing shade along the bank. The full Qual-4 was completed at this site. There were no noticeable riffles in the stream.

The stream was sampled again just before the restored reach joins Rich Fork (Confluence Sample). The stream had regained water at this point from site drainage. This site was also located near several willows that provided shade and potential habitat for stream organisms. The full Qual-4 was completed.

A sample within the tributary could not be completed due to obstructed flow in the channel (Tributary Sample).

The results from the sampling are in Table 1 and show a decrease in biotic value at all three of the locations sampled. The North Carolina biotic values on the restored reach were 8.12 and 7.59 and the reference reach had a value of 7.84. Any biotic value over 7.48 in the Piedmont is rated as poor under North Carolina guidelines. The EPT scores at all three sampled locations also decreased in 2006. Only the sample from the confluence had any EPT taxa (2 total). There are several factors that contributed to decreased macroinvertebrate populations in the project stream. A drought led to a dry streambed throughout much of the growing season in 2005, which would greatly impact existing macroinvertebrate communities. On July 22-23, 2006, there was a large flooding event where water reached as high as 3 feet in certain points on the project site. Yet at the time of sampling, the flow was stopping approximately halfway down the project channel. Only pool reaches were available for sampling along the restored portion of stream. These extreme events in 2005 and 2006 have negatively impacted the site's macroinvertebrate population.

Table 1: Aquatic Community Summary					
Sampling Location		**EPT**	**Biotic Index**	**Taxa Richness**	**# of Organisms**
Upper Reach (Reference)	**Pre-Restoration**	1	6.61	9	24
	Year 1 (2004)	1	7.47	10	33
	Year 2 (2006*)	0	7.84	4	18
	Year 3 (2006)				
	Year 4 (2007)				
	Year 5 (2008)				
Main Channel	**Pre-Restoration**	3	6.98	6	54
	Year 1 (2004)	3	7.63	17	52
	Year 2 (2006*)	0	8.12	7	16
	Year 3 (2006)				
	Year 4 (2007)				
	Year 5 (2008)				
Confluence	**Pre-Restoration**	3	6.44	16	124
	Year 1 (2004)	4	6.77	13	27
	Year 2 (2006*)	2	7.59	20	50
	Year 3 (2006)				
	Year 4 (2007)				
	Year 5 (2008)				
Tributary	**Pre-Restoration**	n/a	n/a	n/a	n/a
	Year 1 (2004)	4	7.45	18	56
	Year 2 (2006*)	n/a	n/a	n/a	n/a
	Year 3 (2006)				
	Year 4 (2007)				
	Year 5 (2008)				

Sampling for the third monitoring year occurred in October 2006 and the results have not yet been returned. This set of samples along with data from the fourth monitoring year in 2007 should give an indication if the benthic macroinvertebrates are recovering from the stresses in 2005 and 2006.

BENTHIC MACROINVERTEBRATES COLLECTED FROM UNNAMED TRIBUTARY TO RICH FORK, DAVIDSON COUNTY, NC, 8/3/06.

SPECIES	T.V.	F.F.G.	UPPER	MAIN	CONFLUENCE
NEMATODA	**6**			1	
MOLLUSCA					
Gastropoda					
Basommatophora					
Lymnaeidae		**SC**			
Fossaria sp.	***7**	**SC**	1	1	
Physidae					
Physella sp.	**8.8**	**CG**	2	11	6
ANNELIDA					
Oligochaeta	***10**	**CG**			
Tubificida					
Lumbricidae		**CG**			1
Tubificidae w.o.h.c.	**7.1**	**CG**			
Branchiura sowerbyi	**8.3**	**CG**		1	1
ARTHROPODA					
Crustacea					
Amphipoda		**CG**			
Crangonyctidae					
Crangonyx sp.	**7.9**	**CG**	13		
Hyalellidae					
Hyalella azteca	**7.8**	**CG**			2
Insecta					
Ephemeroptera					
Baetidae		**CG**			
Callibaetis sp.	**9.8**	**CG**			1
Caenidae		**CG**			
Caenis sp.	**7.4**	**CG**			3
Odonata					
Coenagrionidae		**P**			
Enallagma sp.	**8.9**	**P**			1
Ischnura sp.	**9.5**			1	
Libellulidae		**P**			
Pachydiplax longipennis	**9.9**				1
Coleoptera					
Dytiscidae		**P**			1
Laccophilus sp.	**10**	**P**			4
Hydrophilidae		**P**			
Enochrus sp.	**8.8**	**CG**			1
Hydrochus sp.	**6.6**	**SH**			11
Paracymus sp.		**CG**			1
Tropisternus sp.	**9.7**	**P**			1
Staphylinidae		**P**			1
Diptera					
Chironomidae					
Chironomus sp.	**9.6**	**CG**			1
Clinotanypus sp.		**P**		1	
Natarsia sp.	**10**			1	10
Polypedilum halterale gp.	**7.3**	**SH**			1
Procladius sp.	**9.1**	**P**			2
Tribelos fuscicorne					1
Tipulidae		**SH**			
Ormosia sp.	**6.3**	**CG**	2		
TOTAL NO. OF ORGANISMS			**18**	**17**	**51**
TOTAL NO. OF TAXA			**4**	**7**	**20**
EPT TAXA			**0**	**0**	**2**

Appendix E
Permanent Photo Documentation Points

Photo Location 1: View looking toward large cedar and restored channel at confluence with Rich Fork Creek

Photo Location 2, Photo 1: View looking toward large cedar and vegetation monitoring plot #6.

Photo Location 2, Photo 2: View looking toward vegetation-monitoring plot #1

Photo Location 3: View looking east along the wetland preservation area.

Photo Location 4: View looking east.

Photo Location 5: View looking north toward tree line of wetland preservation area.

Photo Location 6, Photo 1: View looking west toward large cedar.

Photo Location 6, Photo 2: View looking from Rich Fork toward photo point #2 at the spoil pile.