Daniels Farm #2
Wetland Restoration Site
Franklin County, North Carolina

Tar-Pam 03020101
Contract # D05025

Monitoring Report
Year 4

Submitted to:

North Carolina
Department of Environment and
Natural Resources
Ecosystem Enhancement Program

Submitted by:

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ENVIRONMENTAL TECHNOLOGIES AND CONSTRUCTION, INC.

EXECUTIVE SUMMARY

The Daniels Farm #2 Wetland Restoration Project has restored, enhanced, and preserved a Piedmont Bottomland Hardwood wetland community along the Tar River in central Franklin County. This project hopes to improve water quality and protect aquatic habitat in a predominantly agricultural area with the restoration and enhancement of 19.7 acres of wetland and the preservation of 10.4 acres of wetland. The restoration site had undergone severe degradation from unrestricted agricultural activities and human-induced disturbances.

This monitoring report presents the data and findings from the fourth growing season 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 eleven locations, monitoring groundwater elevations at five locations, and documenting general site conditions at seven permanent photograph points within the wetland restoration area. In addition, daily precipitation was recorded. These data were evaluated and verified using the climatic data for Louisburg, North Carolina. Field investigations were conducted in June and November 2009. Supporting data and site photographs are included in the report appendices.

The 14.4 acres of wetland restoration were planted at a density of 680 trees per acre and the 5.2 acres of wetland enhancement were planted at a density ranging from 100 to 200 trees per acre. There were eleven vegetation monitoring plots established throughout the restoration area and one monitoring plot in the enhancement area. The 2009 vegetation monitoring of the restoration areas revealed an average density of 418 trees per acre, which is above the minimum requirement of 320 trees per acre needed to meet the success criteria at the end of the five-year monitoring period.

During the 2009 monitoring year, wetland hydrology was achieved at all four wells in the restoration area, the well in the preservation area, and the well in the reference wetland. Groundwater was within 12 inches of the soil surface in excess of 12 consecutive days (5% of the growing season) at each well, and all of the gauges exceeding the hydrological success criteria for more than 12.5% of the growing season.

The daily rainfall data depicted on the gauge data graphs were obtained from the on-site precipitation gauge. The precipitation gauge was installed on the site in 2003 prior to project implementation. The daily rainfall data obtained for Louisburg, North Carolina shows that Louisburg had average rainfall during the growing season in 2009 and correlated to the precipitation data recorded on-site.

Soils in the restoration portion of the site have been determined to be predominately Roanoke. Since this soil is already considered hydric, no success criteria or monitoring is required.

Site photographs were taken from seven permanent photo documentation points established along the property boundary. Photo documentation facilitates the qualitative evaluation of the conditions or changes in the restored wetland. The photo point locations were selected in order to document representative site conditions.

The results of the 2009 monitoring of the Daniels Farm #2 Wetland Restoration Project indicate that the site is on track to meeting the project success criteria.

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Appendices

1.0 SUMMARY

1.1 Vegetation

The 14.4 acres of wetland restoration were planted at a density of 680 trees per acre and the 5.2 acres of wetland enhancement were planted at a density ranging from 100 to 200 trees per acre. Eleven vegetation plots were established in order to encompass 2% coverage of the restored wetland acreage. The 2009 vegetation monitoring of the planted areas revealed an average density of 418 trees per acre, which is above the minimum requirement of 320 trees per acre (Appendix A). A total of eight trees per vegetation monitoring plot are needed to meet the 320 trees per acre minimum requirement.

Table 1: Vegetation Monitoring Results

Plot Number	Willow Oak	Swamp Chestnut Oak	Laurel Oak	Yellow Poplar	Bald Cypress	Overcup Oak	Green Ash	Cherrybark Oak	Unknown	Total - Year 4	Density - Year 4 (Trees/Acres)
1	3	7				1		2		13	520
2					4		11			15	600
3		2					1	2		5	200
4	1	1		1			1	2		6	240
5		1			2		3			6	240
6		3	1		1	4	4	1		14	560
7	1	7						4		12	480
8		4				3	3			10	400
9		1			4	2	7		1	15	600
10		4				2	2	2		10	400
11						3	3		2	8	320
									Total Average Density		418

Table 2: Vegetation History (Trees/Acre)

Plot #	Year 1	Year 2	Year 3	Year 4	Year 5
1	680	520	520	520	
2	680	600	600	600	
3	400	320	200	200	
4	600	400	280	280	
5	360	320	240	240	
6	640	520	560	560	
7	600	520	480	480	
8	680	440	400	400	
9	600	600	600	600	
10	720	560	440	400	
11	520	520	320	320	

1.2 Hydrology

The wetland wells used to monitor site hydrology were installed in early May 2006. The maximum number of consecutive days that the groundwater was within 12 inches of the surface was determined for each groundwater gauge. This number was converted into a percentage of the 236-day growing season. Table 3 presents the hydrological monitoring results for 2009. Wetland hydrology was achieved at all of the wells on the site; groundwater was within 12 inches of the soil surface in excess of 12 consecutive days (5% of the growing season) at each well (Tables 3 and 4). Based on these data, the site has exceeded the minimum duration of near surface saturation for the 2009 growing season from March 20th to November 11th (Appendix B). Climatic data for the 2009 growing season were analyzed in comparison to historical data to determine whether 2009 was a normal year in terms of climatic conditions; this is 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 2009 was an average year for rainfall during the growing season. Rainfall was within the 30th to 70th percentiles for the months of May, July, and September. Rainfall was less than the 30th percentile threshold in January, February, April, August, and October. March, June, and November rainfall was greater than the 70th percentile threshold (Appendix B).

A stream gauge was installed on the unnamed tributary to the Tar River (UTTR) in order to evaluate the influence of flooding on the site. During the 2009 growing season, there was a stream gauge malfunction and a portion of the year's data was lost. This is represented in the stream hydrograph. Still, there were three flood events flooding the wetland recorded in 2009.

Table 3: 2009 Hydrologic Monitoring Results

	Hydroperiod					
Well #	**<5%**	**5% - 8%**	**8% - 12.5%**	**>12.5%**	**Maximum Number of Consecutive Days**	**Dates Meeting Success**
1				X	112	March 20 – July 9
2				X	30	March 20 – April 18
3				X	52	May 5 – June 25
4				X	59	May 5 – July 2
Preservation Wetland				X	236	March 20 – November 11
Ref. Wetland				X	115	March 20 – July 12

Table 4. Hydroperiod History

Well #	**Pre-Restoration**	**Year 1**	**Year 2**	**Year 3**	**Year 4**	**Year 5**
1	<5%	>12.5%	>12.5%	>12.5%	>12.5%	
2	<5%	>12.5%	8% - 12.5%	8% - 12.5%	>12.5%	
3	<5%	>12.5%	>12.5%	>12.5%	>12.5%	
4	<5%	>12.5%	>12.5%	>12.5%	>12.5%	
5	<5%	>12.5%	>12.5%	>12.5%	>12.5%	
6	<5%	>12.5%	>12.5%	>12.5%	>12.5%	
7	<5%	>12.5%	>12.5%	>12.5%	>12.5%	
8	<5%	>12.5%	>12.5%	>12.5%	>12.5%	

2.0 DATA ANALYSIS

2.1 Vegetation

Vegetation on the site has remained stable during this past year. The herbaceous vegetation has not caused excessive stress on the planted stems, and many trees have grown above the herbaceous layer. The three plots with tree densities less than 320 trees per acre in 2008 maintained their current counts. The baseline data from Plots 3 and 5 indicate that these two plots were planted at lower than average densities. This means that the mortality of just a few trees can bring the density below the success criteria. Considering that all three plots below 320 trees per acre are in the same area, it is likely that across the entire site, this area was the most detrimentally affected by the drought in 2007. The planted trees on the rest of the site have had less mortality and are surviving at higher densities.

2.2 Hydrology

Wetland restoration on the site focused on the removal of hydrologic alterations, which included filling the primary ditches, plugging the lateral ditches, removing ditch spoil to restore natural drainage, installing water diversion features to redistribute the surface hydrology, placing restrictive berms to reduce runoff and enhance infiltration, and recreating microtopography across the site to enhance surface water retention and storage. Based on the hydrological results, this site has met and exceeded the criteria outlined in the wetland restoration plan. Plugging and filling ditches combined with the other hydrogical restoration methods have resulted in increased short-term surface and subsurface water storage and subsequent increase in the duration and elevation of the seasonally high water table.

2.3 Soils

Soils in the restoration portion of the site have been determined to be predominantly Roanoke with small inclusions of Altavista and Wahee. Roanoke is listed as a hydric soil on the state and federal hydric soils lists. As this soil is already considered hydric, no success criteria or monitoring are required.

3.0 MAINTENANCE/MANAGEMENT ACTIONS

There were no maintenance/management actions taken during 2009.

4.0 CONCLUSIONS

Findings from this monitoring year indicate that the site is on track to meet the success criteria developed for the project. The success criteria for vegetation states that there must be an average of 320 trees per acre of planted vegetation at the end of five years of monitoring and that non-target species must not constitute more than 20% of the woody vegetation based on permanent plots. The 2009 vegetation monitoring of the planted areas revealed an average density of 418 trees per acre, which is above the minimum requirement of 320 trees per acre. Non-target species did not constitute more than 20 percent of the woody vegetation based on the permanent vegetation monitoring plots.

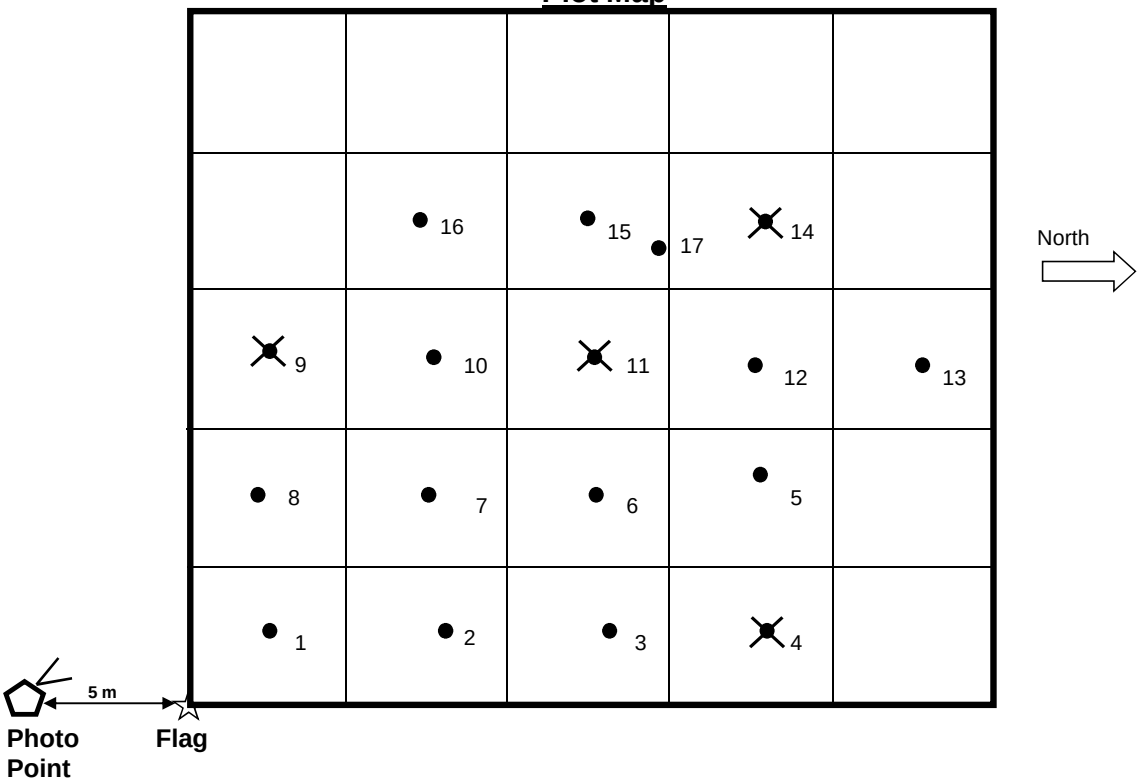
For the 2009 monitoring year, the site's gauges showed that the project is meeting the hydrologic success criteria of saturation within 12 inches of the surface continuously for at least 5% of the growing season. All of the gauges exceeded the hydrological success criteria for more than 12.5% of the growing season.

Appendix A
Vegetation Monitoring Plot Data Sheets

Vegetation Monitoring Worksheet

Site: Daniels II **Plot:** 1 **Date:** 6/18/2009

Plot Map



ID	Species	Height (m)	Vigor	Comment
1	Swamp chestnut oak (*Quercus michauxii*)	0.65	3	Top has died back
2	Cherrybark oak (*Quercus pagoda*)	0.83	3	
3	Swamp chestnut oak (*Quercus michauxii*)	0.43	3	Top has died back
4	Swamp chestnut oak (*Quercus michauxii*)			Dead
5	Willow oak (*Quercus phellos*)	0.22	2	Resprout from base
6	Cherrybark oak (*Quercus pagoda*)	0.18	2	Resprout from base
7	Willow oak (*Quercus phellos*)	0.45	3	
8	Swamp chestnut oak (*Quercus michauxii*)	0.53	2	Top has died back
9	Swamp chestnut oak (*Quercus michauxii*)			Dead
10	Willow oak (*Quercus phellos*)	0.15	2	Resprout from base
11	Unknown species			Dead
12	Swamp chestnut oak (*Quercus michauxii*)	0.85	4	
13	Swamp chestnut oak (*Quercus michauxii*)	1.23	4	
14	Unknown species			Dead
15	Swamp chestnut oak (*Quercus michauxii*)	1.26	4	
16	Swamp chestnut oak (*Quercus michauxii*)	0.92	4	
17	Overcup oak (*Quercus lyrata*)	1.20	4	

A few Oak and Green ash volunteers present within this plot

Vigor: 4=excellent, 3=good, 2=weak, 1=unlikely to survive year

Species	Percent of Total
Overcup oak (*Quercus lyrata*)	7.7%
Swamp chestnut oak (*Quercus michauxii*)	53.8%
Willow oak (*Quercus phellos*)	23.1%
Cherrybark oak (*Quercus pagoda*)	15.4%

Density:

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

Survivability:

Total Number of Trees **13** / **17 trees** x **100** = **76** **% survivability**

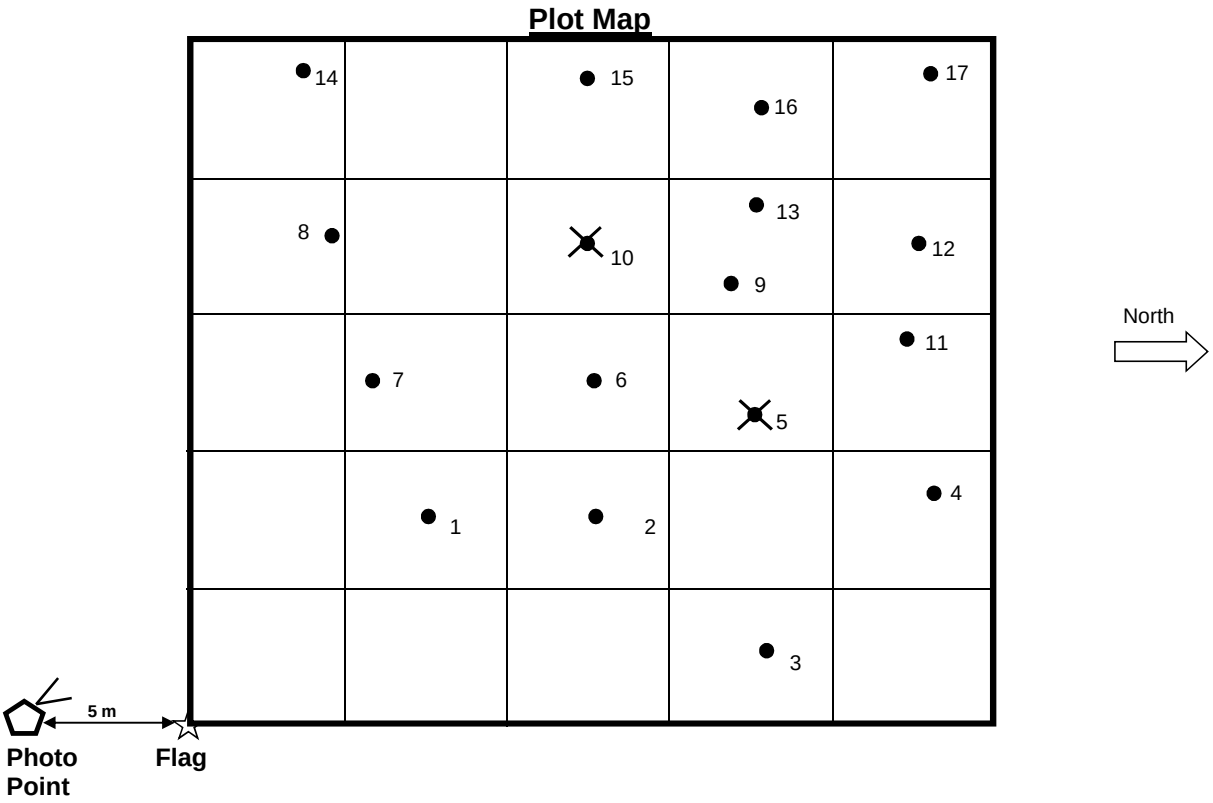
3rd Year Monitoring

4th Year Monitoring

Vegetation Monitoring Worksheet

Site: Daniels II **Plot:** 2 **Date:** 6/18/2009

Plot Map



ID	Species	Height (m)	Vigor	Comment
1	Bald cypress (*Taxodium distichum*)	1.33	4	
2	Green ash (*Fraxinus pennsylvanica*)	1.92	4	
3	Green ash (*Fraxinus pennsylvanica*)	0.92	3	
4	Green ash (*Fraxinus pennsylvanica*)	1.08	4	
5	Bald cypress (*Taxodium distichum*)			Dead
6	Green ash (*Fraxinus pennsylvanica*)	2.37	4	
7	Green ash (*Fraxinus pennsylvanica*)	1.02	3	Top has died back
8	Green ash (*Fraxinus pennsylvanica*)	0.86	3	
9	Green ash (*Fraxinus pennsylvanica*)	1.57	4	
10	Bald cypress (*Taxodium distichum*)			Dead
11	Bald cypress (*Taxodium distichum*)	1.27	4	
12	Green ash (*Fraxinus pennsylvanica*)	0.87	3	Top has died back
13	Bald cypress (*Taxodium distichum*)	1.00	3	
14	Green ash (*Fraxinus pennsylvanica*)	1.34	3	
15	Green ash (*Fraxinus pennsylvanica*)	1.42	3	
16	Green ash (*Fraxinus pennsylvanica*)	1.69	4	
17	Bald cypress (*Taxodium distichum*)	1.14	4	

Oak and Green ash volunteers present within this plot

Vigor: 4=excellent, 3=good, 2=weak, 1=unlikely to survive year

Species	Percent of Total
Green ash (*Fraxinus pennsylvanica*)	73.3%
Bald cypress (*Taxodium distichum*)	26.7%

Density:

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

Survivability:

Total Number of Trees **15** / **17 trees** x **100** = **88** **% survivability**

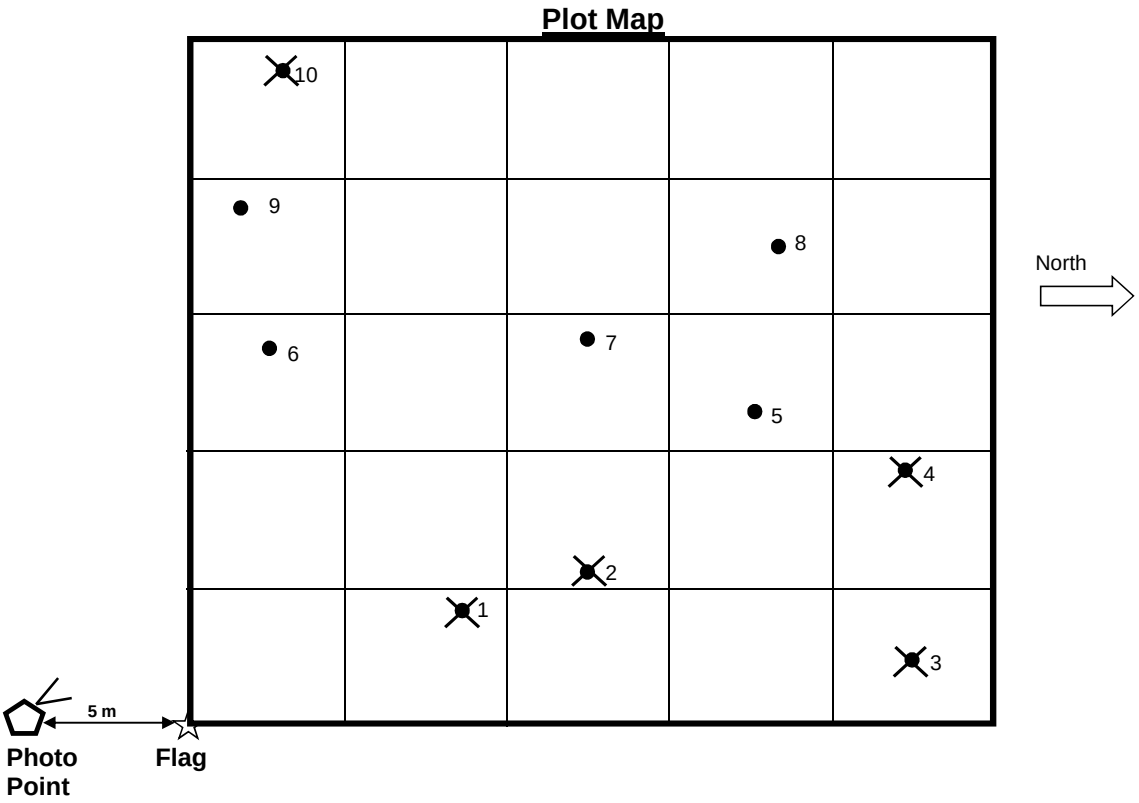
3rd Year Monitoring

4th Year Monitoring

Vegetation Monitoring Worksheet

Site: Daniels II **Plot:** 3 **Date:** 6/18/2009

Plot Map



ID	Species	Height (m)	Vigor	Comment
1	Unknown species			Dead
2	Overcup oak (*Quercus lyrata*)			Missing
3	Unknown species			Dead
4	Unknown species			Dead
5	Cherrybark oak (*Quercus pagoda*)	0.46	1	No leaves; Top has died back
6	Cherrybark oak (*Quercus pagoda*)	0.65	1	No leaves
7	Swamp chestnut oak (*Quercus michauxii*)	0.77	3	
8	Swamp chestnut oak (*Quercus michauxii*)	0.95	4	
9	Green ash (*Fraxinus pennsylvanica*)	0.71	3	Top has died back
10	Unknown species			Dead

Red maple and Green ash volunteers present within this plot

Vigor: 4=excellent, 3=good, 2=weak, 1=unlikely to survive year

Species	Percent of Total
Green ash (*Fraxinus pennsylvanica*)	20.0%
Swamp chestnut oak (*Quercus michauxii*)	40.0%
Cherrybark oak (*Quercus pagoda*)	40.0%

Density:

Total Number of Trees **5** / **0.025 acres** = **200** **trees / acre**

Survivability:

Total Number of Trees **5** / **10 trees** x **100** = **50** **% survivability**

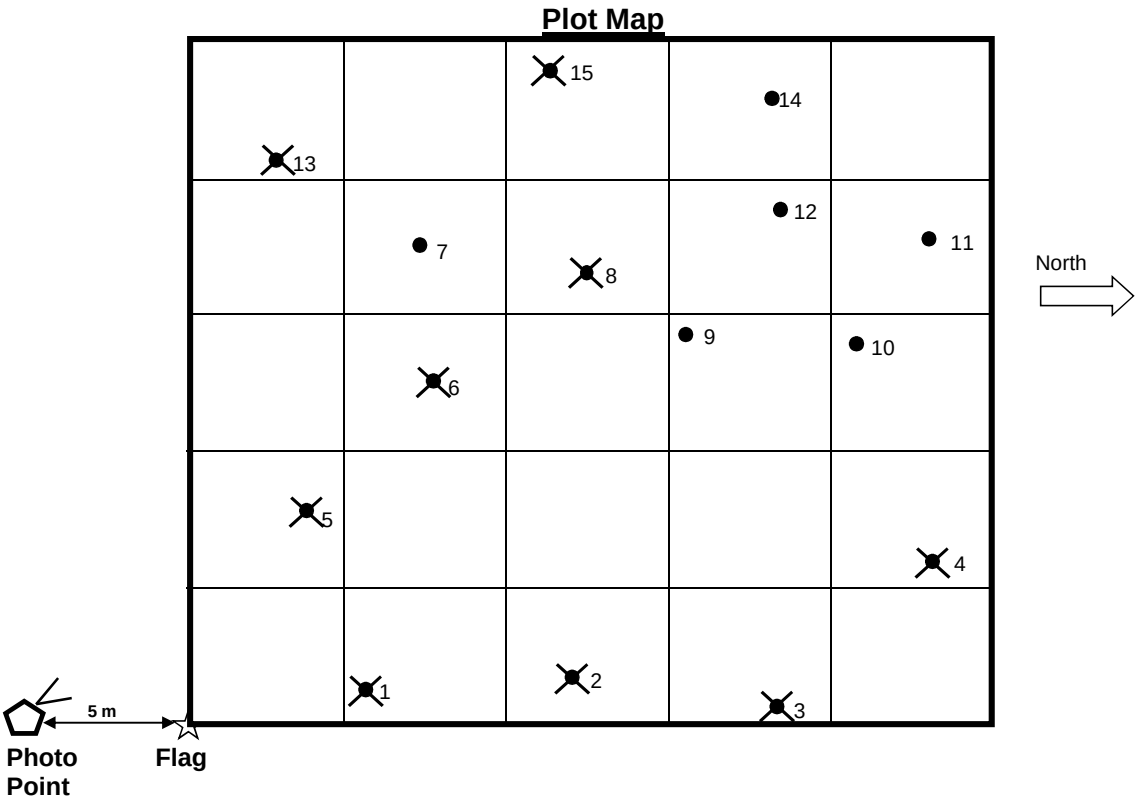
3rd Year Monitoring

4th Year Monitoring

Vegetation Monitoring Worksheet

Site: Daniels II **Plot:** 4 **Date:** 6/18/2009

Plot Map



ID	Species	Height (m)	Vigor	Comment
1	Unknown species			Dead
2	Unknown species			Dead
3	Willow oak (*Quercus phellos*)			Missing
4	Unknown species			Dead
5	Unknown species			Dead
6	Unknown species			Dead
7	Green ash (*Fraxinus pennsylvanica*)	1.62	4	
8	Unknown species			Dead
9	Tulip poplar (*Liriodendron tulipfera*)	0.45	4	
10	Willow oak (*Quercus phellos*)	1.28	4	
11	Swamp chestnut oak (*Quercus michauxii*)	0.75	4	
12	Cherrybark oak (*Quercus pagoda*)	1.19	4	
13	Bald cypress (*Taxodium distichum*)			Dead
14	Cherrybark oak (*Quercus pagoda*)	0.75	3	
15	Unknown species			Dead

Elm, *Baccharis*, Green ash, Red maple, and Coralberry volunteers

Vigor: 4=excellent, 3=good, 2=weak, 1=unlikely to survive year

Species	Percent of Total
Green ash (*Fraxinus pennsylvanica*)	16.7%
Tulip poplar (*Liriodendron tulipfera*)	16.7%
Swamp chestnut oak (*Quercus michauxii*)	16.7%
Willow oak (*Quercus phellos*)	16.7%
Cherrybark oak (*Quercus pagoda*)	33.3%

Density:

Total Number of Trees **6** / **0.025 acres** = **240** **trees / acre**

Survivability:

Total Number of Trees **6** / **15 trees** x **100** = **40** **% survivability**

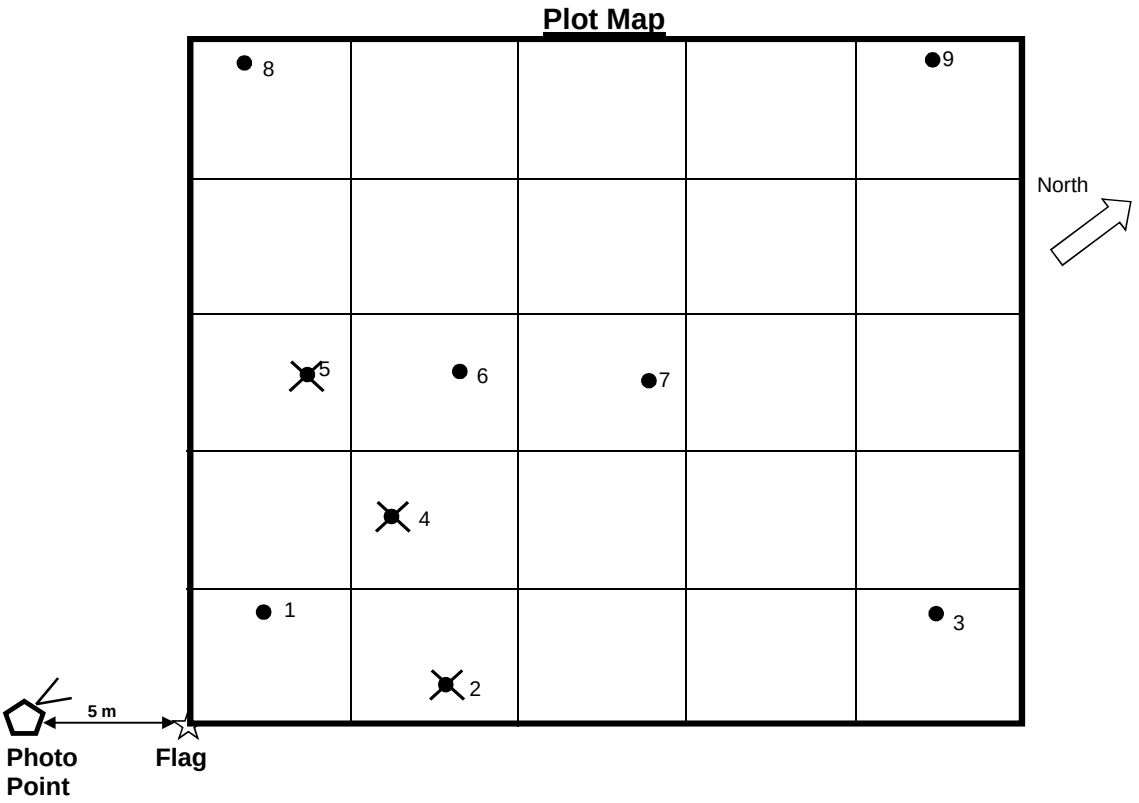
3rd Year Monitoring

4th Year Monitoring

Vegetation Monitoring Worksheet

Site: Daniels II **Plot:** 5 **Date:** 6/18/2009

Plot Map



ID	Species	Height (m)	Vigor	Comment
1	Bald cypress (*Taxodium distichum*)	1.49	3	
2	Unknown species			Dead
3	Green ash (*Fraxinus pennsylvanica*)	0.95	4	
4	Green ash (*Fraxinus pennsylvanica*)			Dead
5	Unknown species			Dead
6	Bald cypress (*Taxodium distichum*)	2.10	4	
7	Green ash (*Fraxinus pennsylvanica*)	0.92	3	Main stem has died back
8	Green ash (*Fraxinus pennsylvanica*)	1.46	3	
9	Swamp chestnut oak (*Quercus michauxii*)	1.63	4	

Elm, Red maple, and Green ash volutneers present

Vigor: 4=excellent, 3=good, 2=weak, 1=unlikely to survive year

Species	Percent of Total
Green ash (*Fraxinus pennsylvanica*)	50.0%
Swamp chestnut oak (*Quercus michauxii*)	16.7%
Bald cypress (*Taxodium distichum*)	33.3%

Density:

Total Number of Trees **6** / **0.025 acres** = **240** **trees / acre**

Survivability:

Total Number of Trees **6** / **9 trees** x **100** = **67** **% survivability**

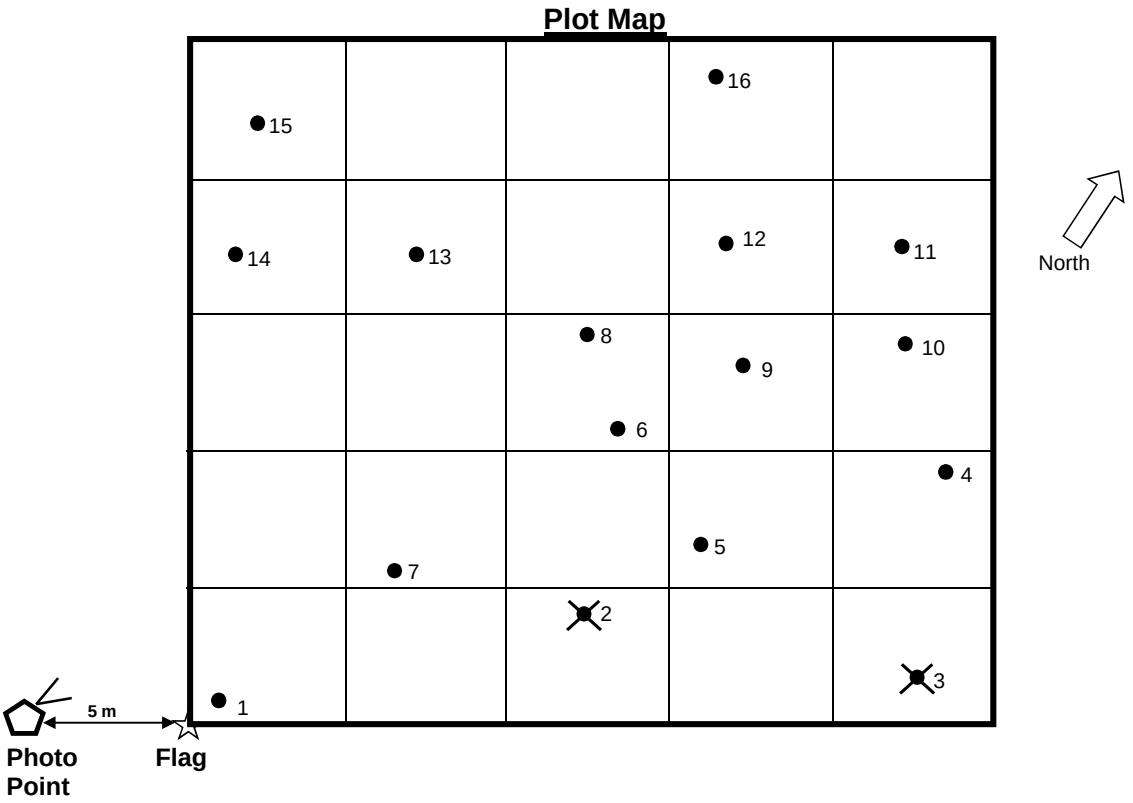
3rd Year Monitoring

4th Year Monitoring

Vegetation Monitoring Worksheet

Site: Daniels II **Plot:** 6 **Date:** 6/18/2009

Plot Map



ID	Species	Height (m)	Vigor	Comment
1	Bald cypress (*Taxodium distichum*)	1.38	4	
2	Cherrybark oak (*Quercus pagoda*)			Dead
3	Unknown species			Dead
4	Overcup oak (*Quercus lyrata*)	1.50	4	
5	Overcup oak (*Quercus lyrata*)	0.70	3	
6	Green ash (*Fraxinus pennsylvanica*)	0.81	3	
7	Swamp chestnut oak (*Quercus michauxii*)	0.35	2	Resprout from base
8	Green ash (*Fraxinus pennsylvanica*)	0.97	4	
9	Overcup oak (*Quercus lyrata*)	0.75	3	
10	Green ash (*Fraxinus pennsylvanica*)	2.14	4	
11	Green ash (*Fraxinus pennsylvanica*)	1.09	4	
12	Cherrybark oak (*Quercus pagoda*)	1.24	3	
13	Laurel oak (*Quercus laurifolia)*	1.02	4	
14	Swamp chestnut oak (*Quercus michauxii*)	0.96	4	
15	Swamp chestnut oak (*Quercus michauxii*)	1.10	4	
16	Overcup oak (*Quercus lyrata*)	1.04	4	

Sweetgum, Elm, Oak, and Green ash volunteers present

Vigor: 4=excellent, 3=good, 2=weak, 1=unlikely to survive year

Species	Percent of Total
Green ash (*Fraxinus pennsylvanica*)	28.6%
Overcup oak (*Quercus lyrata*)	28.6%
Swamp chestnut oak (*Quercus michauxii*)	21.4%
Cherrybark oak (*Quercus pagoda*)	7.1%
Bald cypress (*Taxodium distichum*)	7.1%
Laurel oak (*Quercus laurifolia*)	7.1%

Density:

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

Survivability:

Total Number of Trees **14** / **16 trees** x **100** = **88** **% survivability**

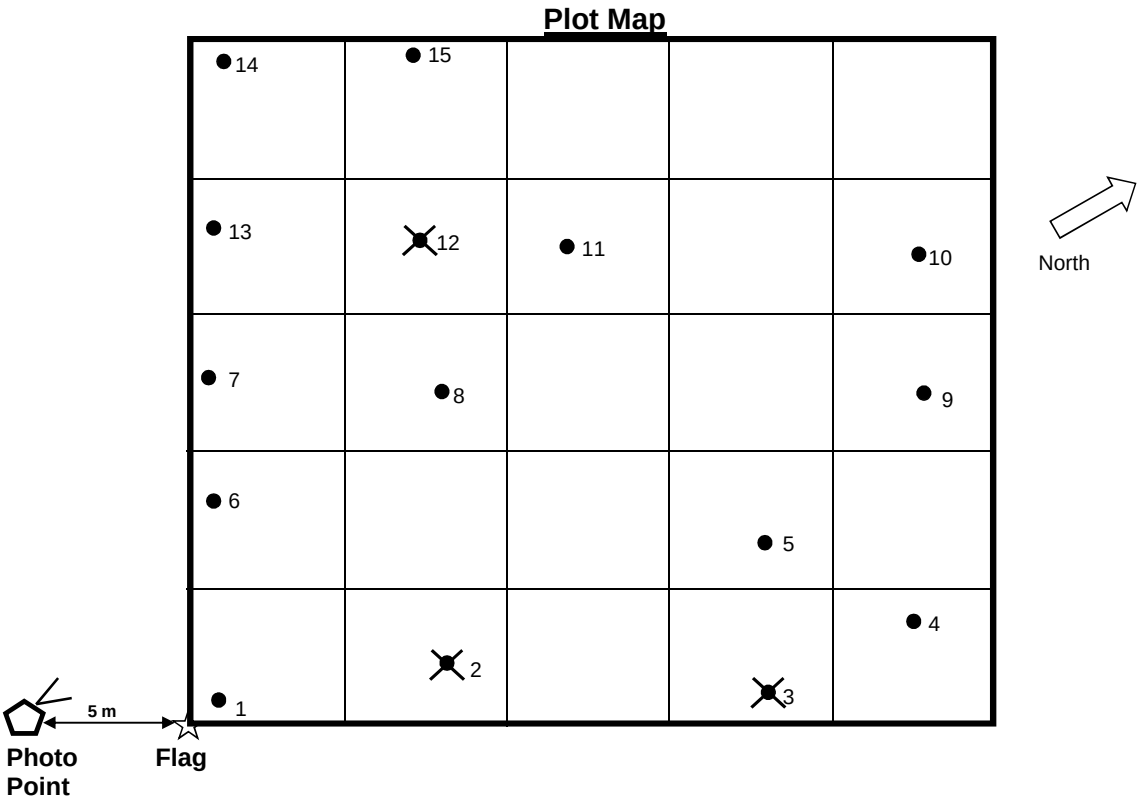
3rd Year Monitoring

4th Year Monitoring

Vegetation Monitoring Worksheet

Site: Daniels II **Plot:** 7 **Date:** 6/18/2009

Plot Map



ID	Species	Height (m)	Vigor	Comment
1	Swamp chestnut oak (*Quercus michauxii*)	1.12	4	
2	Unknown species			Dead
3	Unknown species			Dead
4	Swamp chestnut oak (*Quercus michauxii*)	0.95	4	
5	Cherrybark oak (*Quercus pagoda*)	0.90	4	
6	Cherrybark oak (*Quercus pagoda*)	0.60	4	
7	Cherrybark oak (*Quercus pagoda*)	0.31	2	Top has died back
8	Swamp chestnut oak (*Quercus michauxii*)	0.98	4	
9	Swamp chestnut oak (*Quercus michauxii*)	0.98	4	
10	Swamp chestnut oak (*Quercus michauxii*)	0.68	3	
11	Swamp chestnut oak (*Quercus michauxii*)	0.77	4	
12	Unknown species			Dead
13	Willow oak (*Quercus phellos*)	0.43	2	Resprout from base
14	Cherrybark oak (*Quercus pagoda*)	1.20	4	
15	Swamp chestnut oak (*Quercus michauxii*)	1.87	4	

Oak, Bald cypress, Red maple, and Green ash volunteers present

Vigor: 4=excellent, 3=good, 2=weak, 1=unlikely to survive year

Species	Percent of Total
Swamp chestnut oak (*Quercus michauxii*)	58.3%
Cherrybark oak (*Quercus pagoda*)	33.3%
Willow oak (*Quercus phellos*)	8.3%

Density:

Total Number of Trees **12** / **0.025 acres** = **480** **trees / acre**

Survivability:

Total Number of Trees **12** / **15 trees** x **100** = **80** **% survivability**

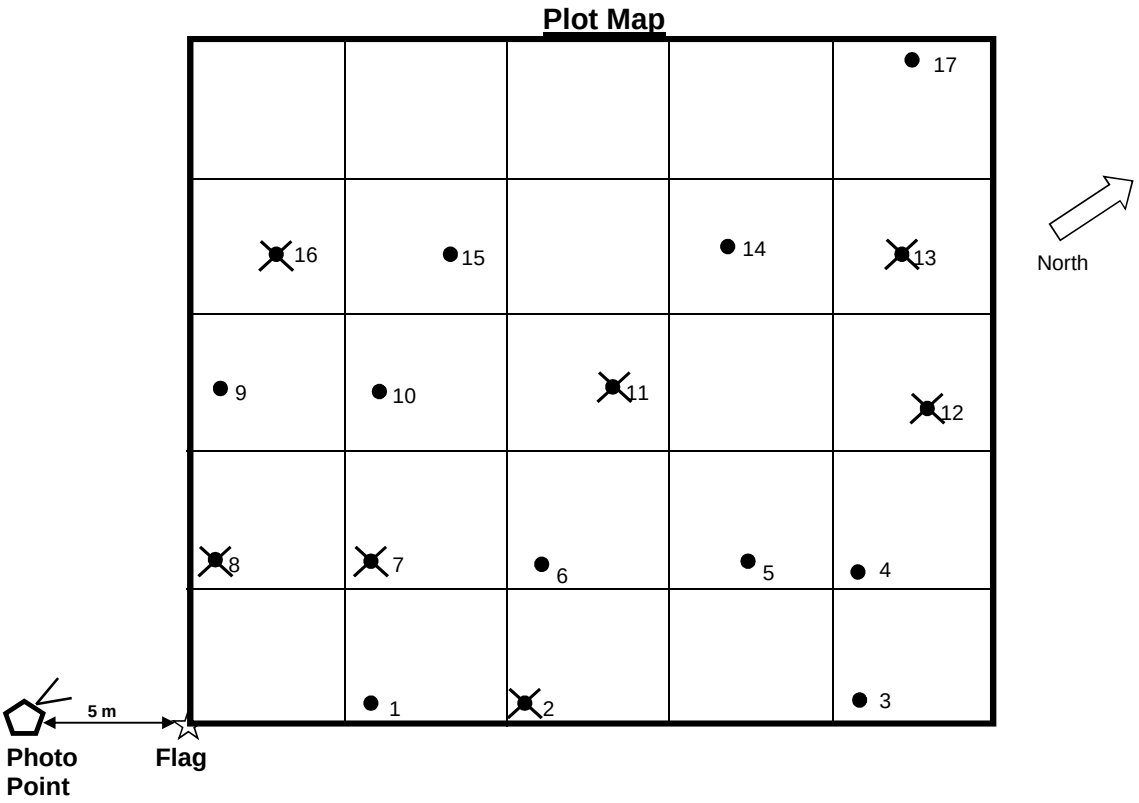
3rd Year Monitoring

4th Year Monitoring

Vegetation Monitoring Worksheet

Site: Daniels II **Plot:** 8 **Date:** 6/18/2009

Plot Map



ID	Species	Height (m)	Vigor	Comment
1	Swamp chestnut oak (*Quercus michauxii*)	0.98	4	
2	Unknown species			Dead
3	Green ash (*Fraxinus pennsylvanica*)	1.46	4	
4	Green ash (*Fraxinus pennsylvanica*)	1.09	4	
5	Swamp chestnut oak (*Quercus michauxii*)	0.81	3	
6	Green ash (*Fraxinus pennsylvanica*)	1.38	4	
7	Unknown species			Dead
8	Unknown species			Dead
9	Overcup oak (*Quercus lyrata*)	0.82	3	
10	Overcup oak (*Quercus lyrata*)	0.75	3	
11	Swamp chestnut oak (*Quercus michauxii*)			Dead
12	Unknown species			Dead
13	Unknown species			Dead
14	Swamp chestnut oak (*Quercus michauxii*)	1.07	4	
15	Swamp chestnut oak (*Quercus michauxii*)	0.72	3	
16	Unknown species			Dead
17	Overcup oak (*Quercus lyrata*)	0.63	3	Resprout from base

Vigor: 4=excellent, 3=good, 2=weak, 1=unlikely to survive year

Species	Percent of Total
Green ash (*Fraxinus pennsylvanica*)	30.0%
Overcup oak (*Quercus lyrata*)	30.0%
Swamp chestnut oak (*Quercus michauxii*)	40.0%

Density:

Total Number of Trees **10** / **0.025 acres** = **400** **trees / acre**

Survivability:

Total Number of Trees **10** / **17 trees** x **100** = **59** **% survivability**

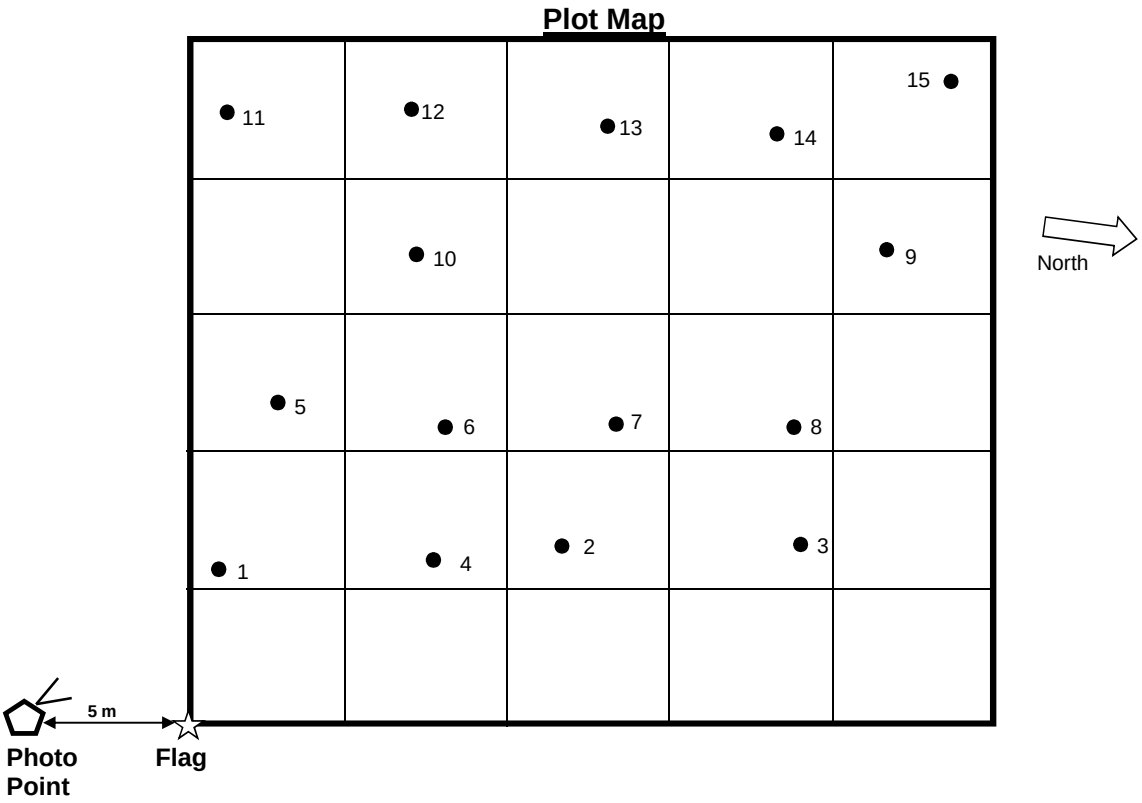
3rd Year Monitoring

4th Year Monitoring

Vegetation Monitoring Worksheet

Site: Daniels II **Plot:** 9 **Date:** 6/18/2009

Plot Map



ID	Species	Height (m)	Vigor	Comment
1	Green ash (*Fraxinus pennsylvanica*)	0.93	3	
2	Unknown species	0.77	3	
3	Swamp chestnut oak (*Quercus michauxii*)	0.95	3	
4	Bald cypress (*Taxodium distichum*)	1.10	4	
5	Green ash (*Fraxinus pennsylvanica*)	1.53	4	
6	Bald cypress (*Taxodium distichum*)	1.35	4	
7	Green ash (*Fraxinus pennsylvanica*)	0.98	4	
8	Green ash (*Fraxinus pennsylvanica*)	0.64	2	Top has died back
9	Bald cypress (*Taxodium distichum*)	1.75	4	
10	Green ash (*Fraxinus pennsylvanica*)	1.40	4	
11	Green ash (*Fraxinus pennsylvanica*)	1.69	4	
12	Overcup oak (*Quercus lyrata*)	2.08	4	
13	Overcup oak (*Quercus lyrata*)	1.96	4	
14	Bald cypress (*Taxodium distichum*)	1.78	4	
15	Green ash (*Fraxinus pennsylvanica*)	2.25	4	

Oak and Bald cypress volunteers present within this plot

Vigor: 4=excellent, 3=good, 2=weak, 1=unlikely to survive year

Species	Percent of Total
Green ash (*Fraxinus pennsylvanica*)	46.7%
Swamp chestnut oak (*Quercus michauxii*)	6.7%
Overcup oak (*Quercus lyrata*)	13.3%
Bald cypress (*Taxodium distichum*)	26.7%
Unknown species	6.7%

Density:

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

Survivability:

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

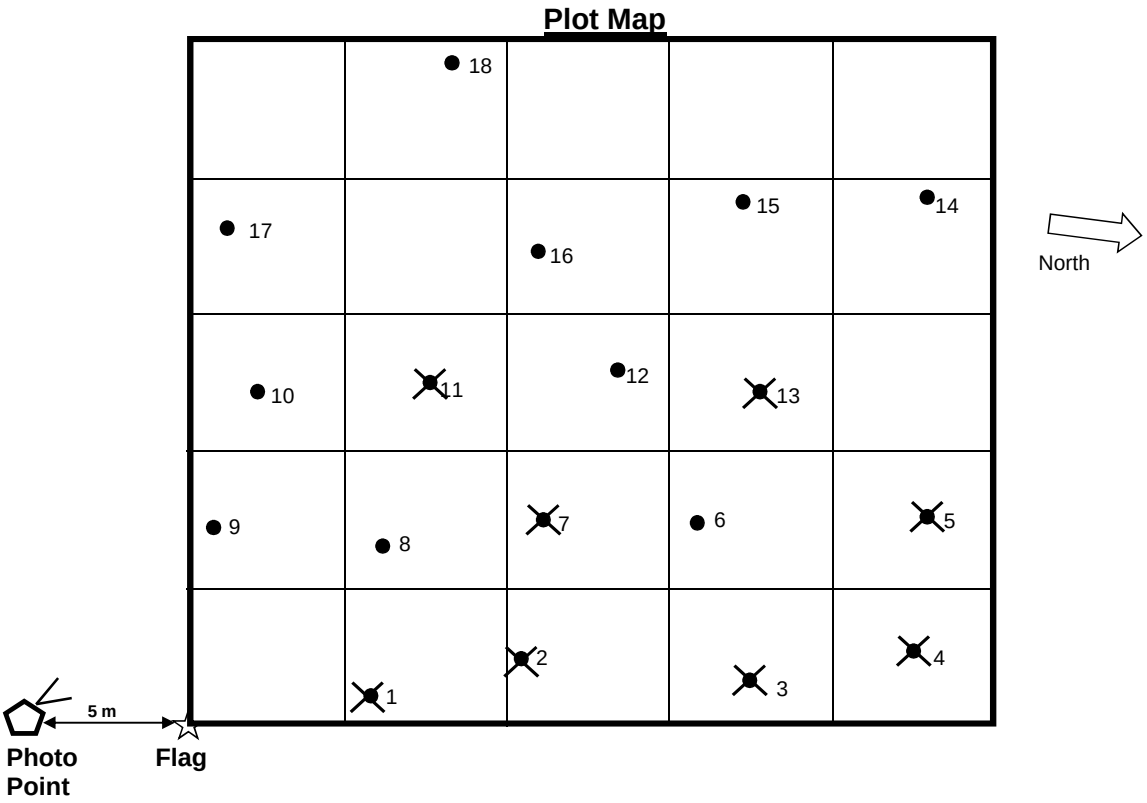
3rd Year Monitoring

4th Year Monitoring

Vegetation Monitoring Worksheet

Site: Daniels II **Plot:** 10 **Date:** 6/18/2009

Plot Map



ID	Species	Height (m)	Vigor	Comment
1	Cherrybark oak (*Quercus pagoda*)			Dead
2	Laurel oak (*Quercus laurifolia*)			Dead
3	Unknown species			Dead
4	Unknown species			Dead
5	Cherrybark oak (*Quercus pagoda*)			Dead
6	Cherrybark oak (*Quercus pagoda*)	0.81	3	
7	Unknown species			Dead
8	Cherrybark oak (*Quercus pagoda*)	0.66	3	
9	Swamp chestnut oak (*Quercus michauxii*)	0.88	3	Top died back
10	Swamp chestnut oak (*Quercus michauxii*)	1.14	3	
11	Cherrybark oak (*Quercus pagoda*)			Dead
12	Swamp chestnut oak (*Quercus michauxii*)	0.47	3	Top died back
13	Unknown species			Dead
14	Overcup oak (*Quercus lyrata*)	0.52	2	Resprout from base
15	Green ash (*Fraxinus pennsylvanica*)	1.14	3	
16	Overcup oak (*Quercus lyrata*)	0.84	3	
17	Green ash (*Fraxinus pennsylvanica*)	1.26	4	
18	Swamp chestnut oak (*Quercus michauxii*)	0.52	3	

Vigor: 4=excellent, 3=good, 2=weak, 1=unlikely to survive year

Species	Percent of Total
Green ash (*Fraxinus pennsylvanica*)	20.0%
Overcup oak (*Quercus lyrata*)	20.0%
Swamp chestnut oak (*Quercus michauxii*)	40.0%
Cherrybark oak (*Quercus pagoda*)	20.0%

Density:

Total Number of Trees **10** / **0.025 acres** = **400** **trees / acre**

Survivability:

Total Number of Trees **10** / **18 trees** x **100** = **56** **% survivability**

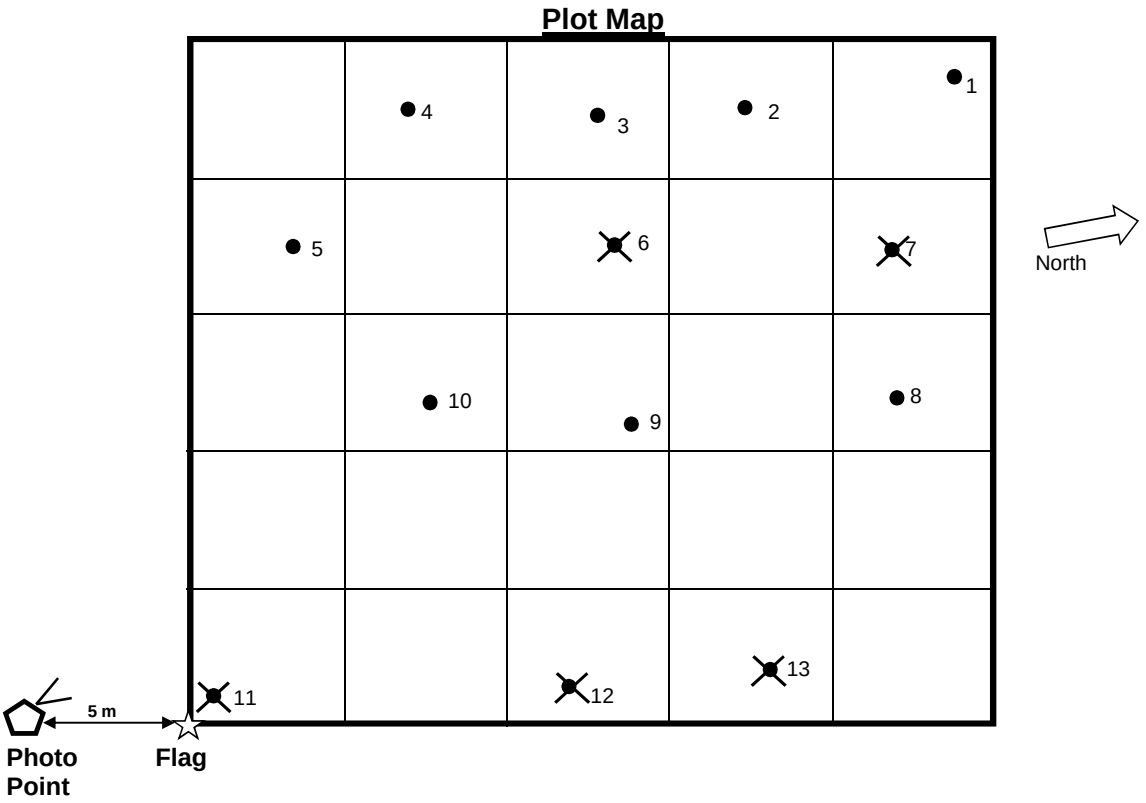
3rd Year Monitoring

4th Year Monitoring

Vegetation Monitoring Worksheet

Site: Daniels II **Plot:** 11 **Date:** 6/18/2009

Plot Map



ID	Species	Height (m)	Vigor	Comment
1	Overcup oak (*Quercus lyrata*)	0.77	4	
2	Unknown species	0.54	1	Main stem died back; No leaves
3	Green ash (*Fraxinus pennsylvanica*)	0.86	4	
4	Overcup oak (*Quercus lyrata*)	0.90	4	
5	Green ash (*Fraxinus pennsylvanica*)	1.27	3	Impacted by insects
6	Unknown species			Dead
7	Overcup oak (*Quercus lyrata*)			Missing
8	Green ash (*Fraxinus pennsylvanica*)	1.41	4	Resprout from beaver damage
9	Unknown species	0.83	4	
10	Overcup oak (*Quercus lyrata*)	0.60	3	Beaver damage
11	Swamp chestnut oak (*Quercus michauxii*)			Missing
12	Green ash (*Fraxinus pennsylvanica*)			Missing
13	Bald cypress (*Taxodium distichum*)			Missing

Vigor: 4=excellent, 3=good, 2=weak, 1=unlikely to survive year

Species	Percent of Total
Green ash (*Fraxinus pennsylvanica*)	37.5%
Overcup oak (*Quercus lyrata*)	37.5%
Unknown	25.0%

Density:

Total Number of Trees **8** / **0.025 acres** = **320** **trees / acre**

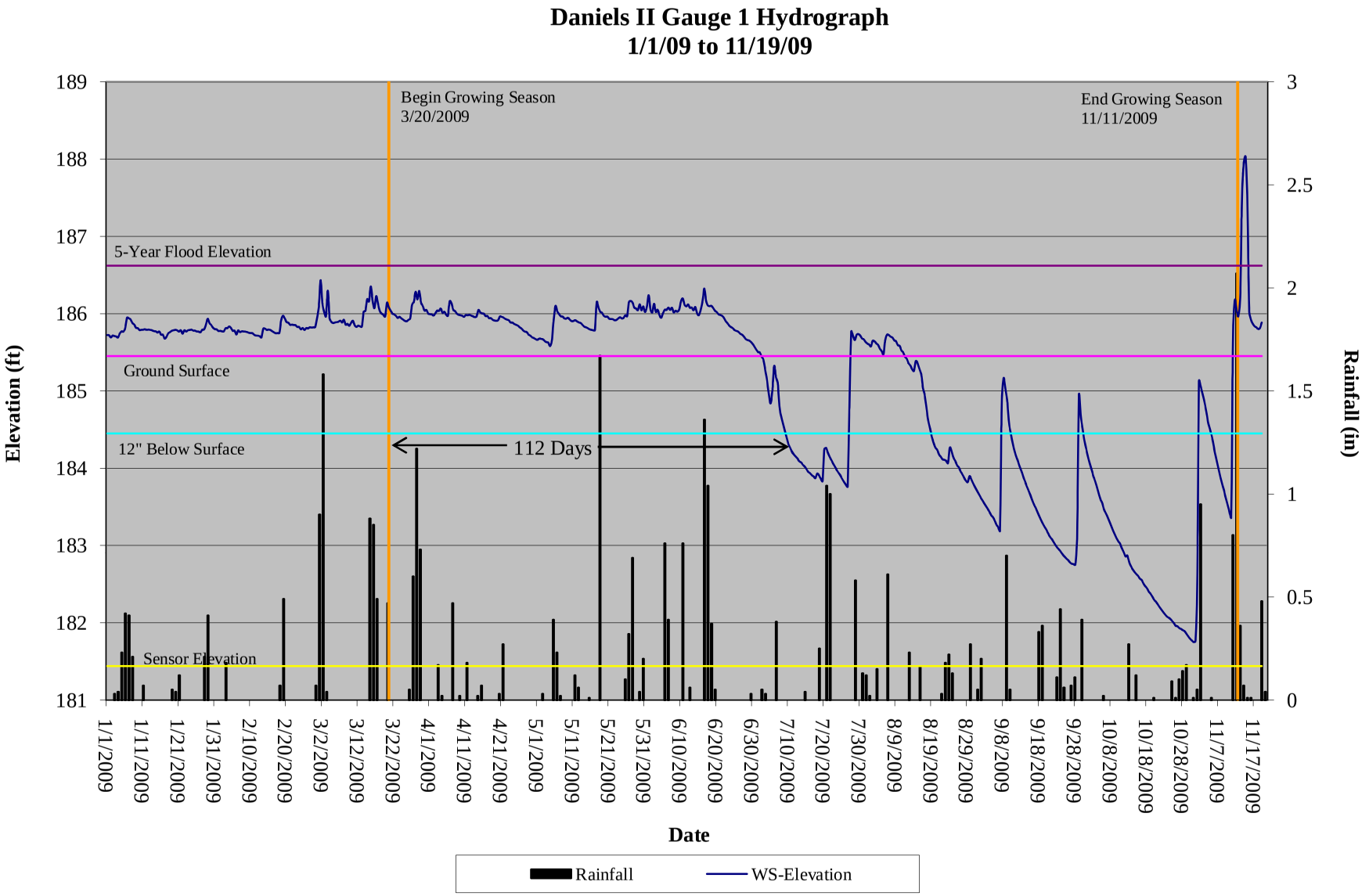
Survivability:

Total Number of Trees **8** / **13 trees** x **100** = **62** **% survivability**

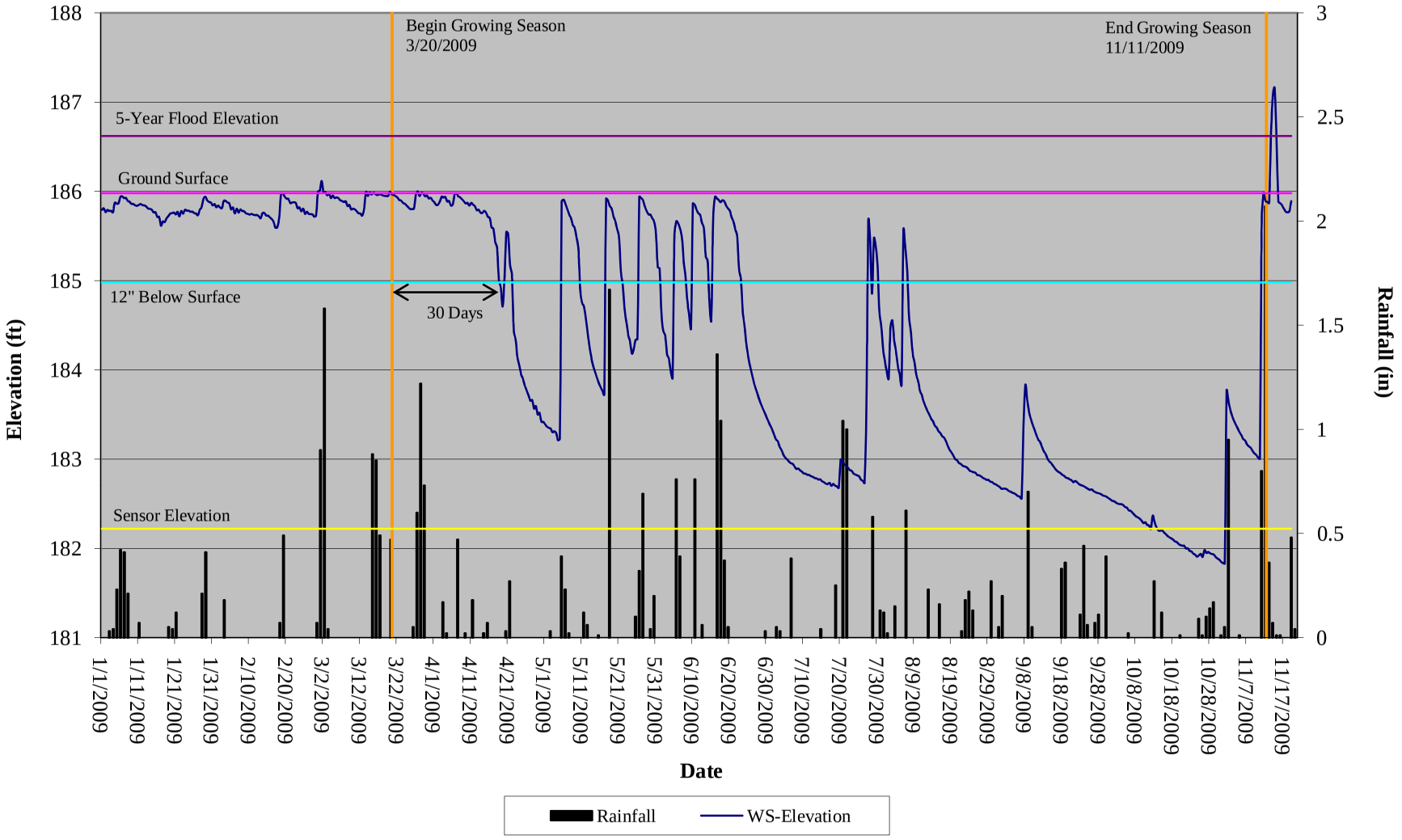
3rd Year Monitoring

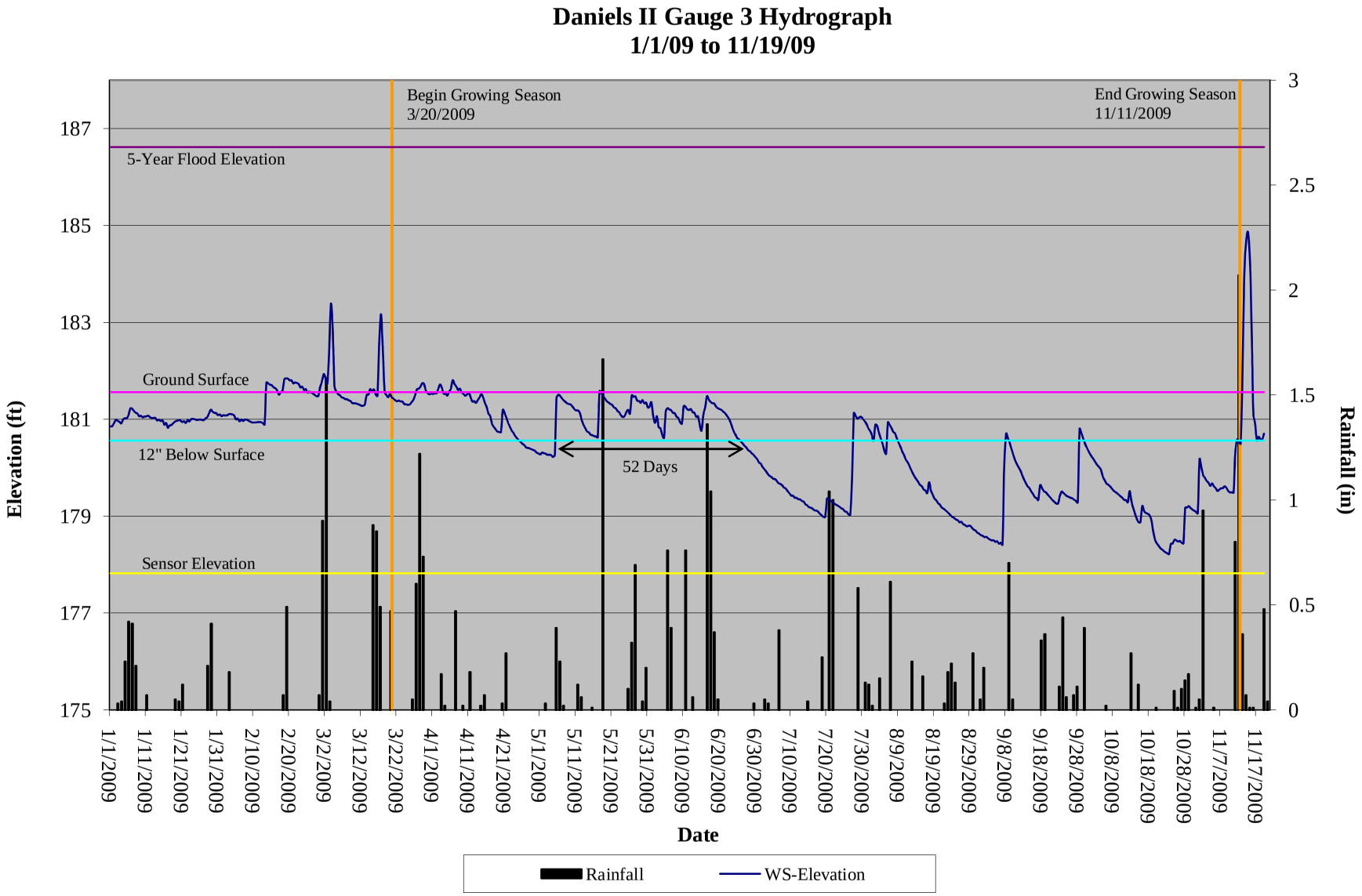
4th Year Monitoring

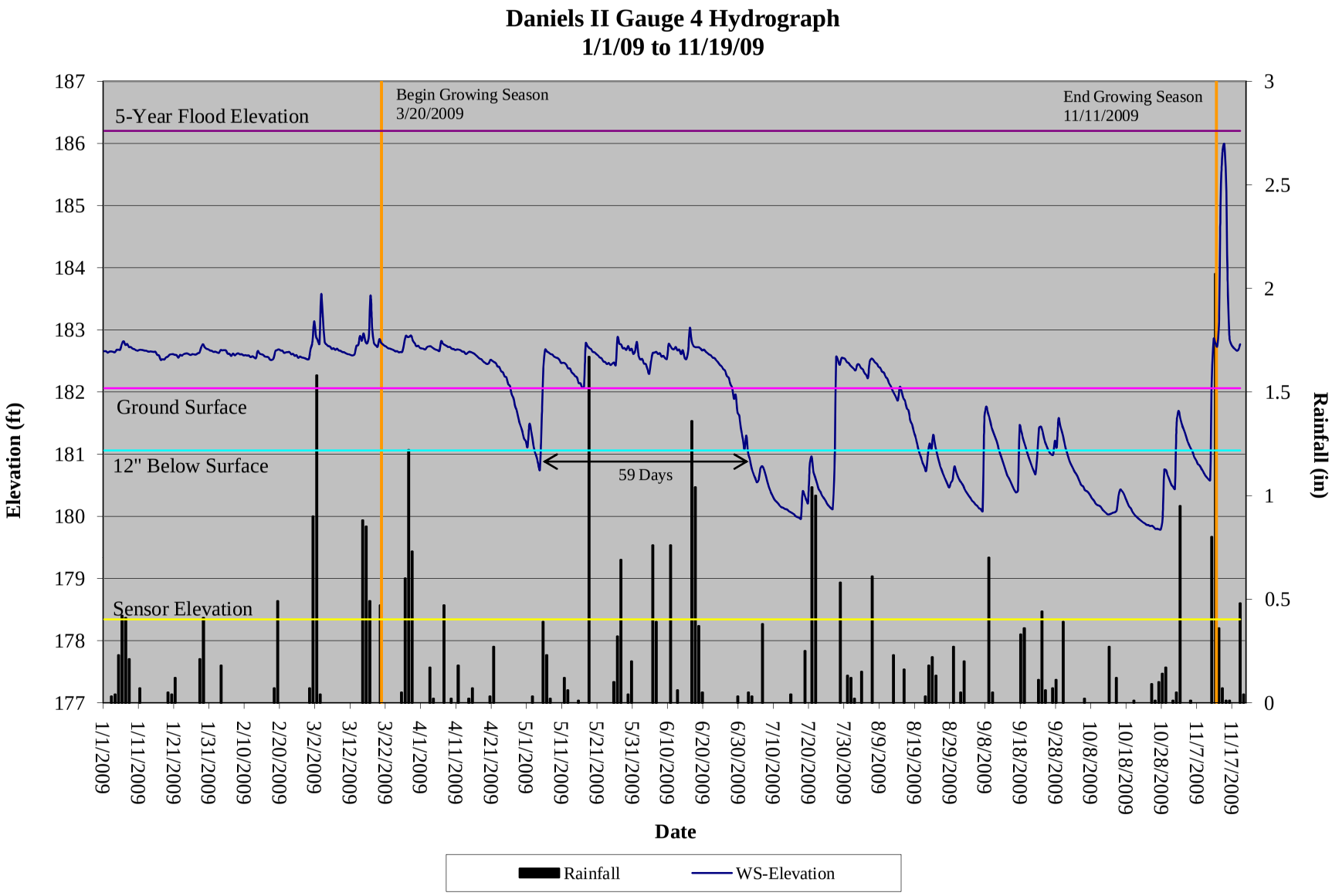
Appendix B
Hydrologic Monitoring and Hydroperiod


Daniels II Gauge 1 Hydrograph
1/1/09 to 11/19/09
Begin Growing Season
3/20/2009
End Growing Season
11/11/2009
5-Year Flood Elevation
Ground Surface
12" Below Surface
112 Days
Sensor Elevation
Elevation (ft)
Rainfall (in)
Date
189
188
187
186
185
184
183
182
181
3
2.5
2
1.5
1
0.5
0
1/1/2009
1/11/2009
1/21/2009
1/31/2009
2/10/2009
2/20/2009
3/2/2009
3/12/2009
3/22/2009
4/1/2009
4/11/2009
4/21/2009
5/1/2009
5/11/2009
5/21/2009
5/31/2009
6/10/2009
6/20/2009
6/30/2009
7/10/2009
7/20/2009
7/30/2009
8/9/2009
8/19/2009
8/29/2009
9/8/2009
9/18/2009
9/28/2009
10/8/2009
10/18/2009
10/28/2009
11/7/2009
11/17/2009
Rainfall
WS-Elevation

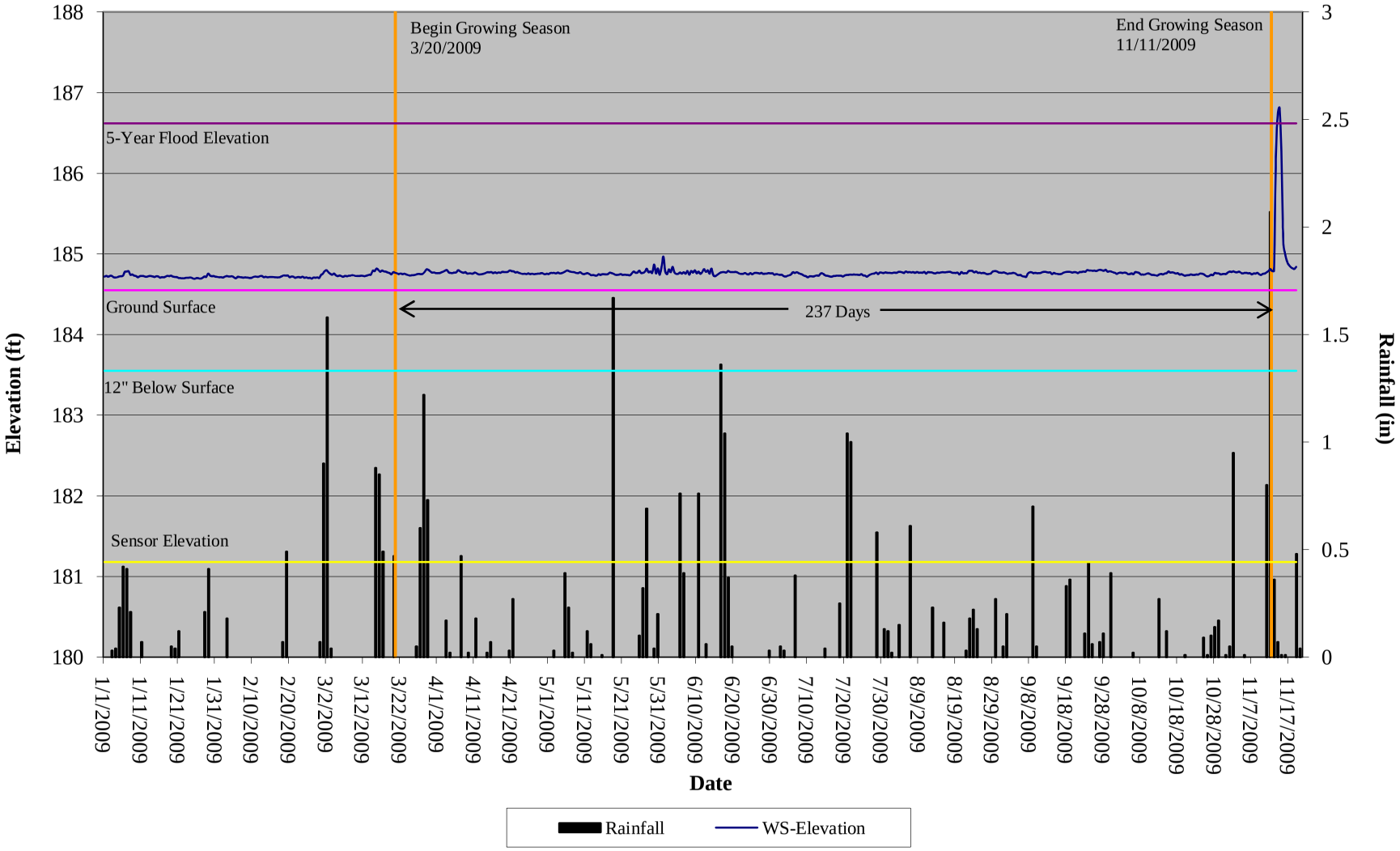
Daniels II Gauge 2 Hydrograph
1/1/09 to 11/19/09

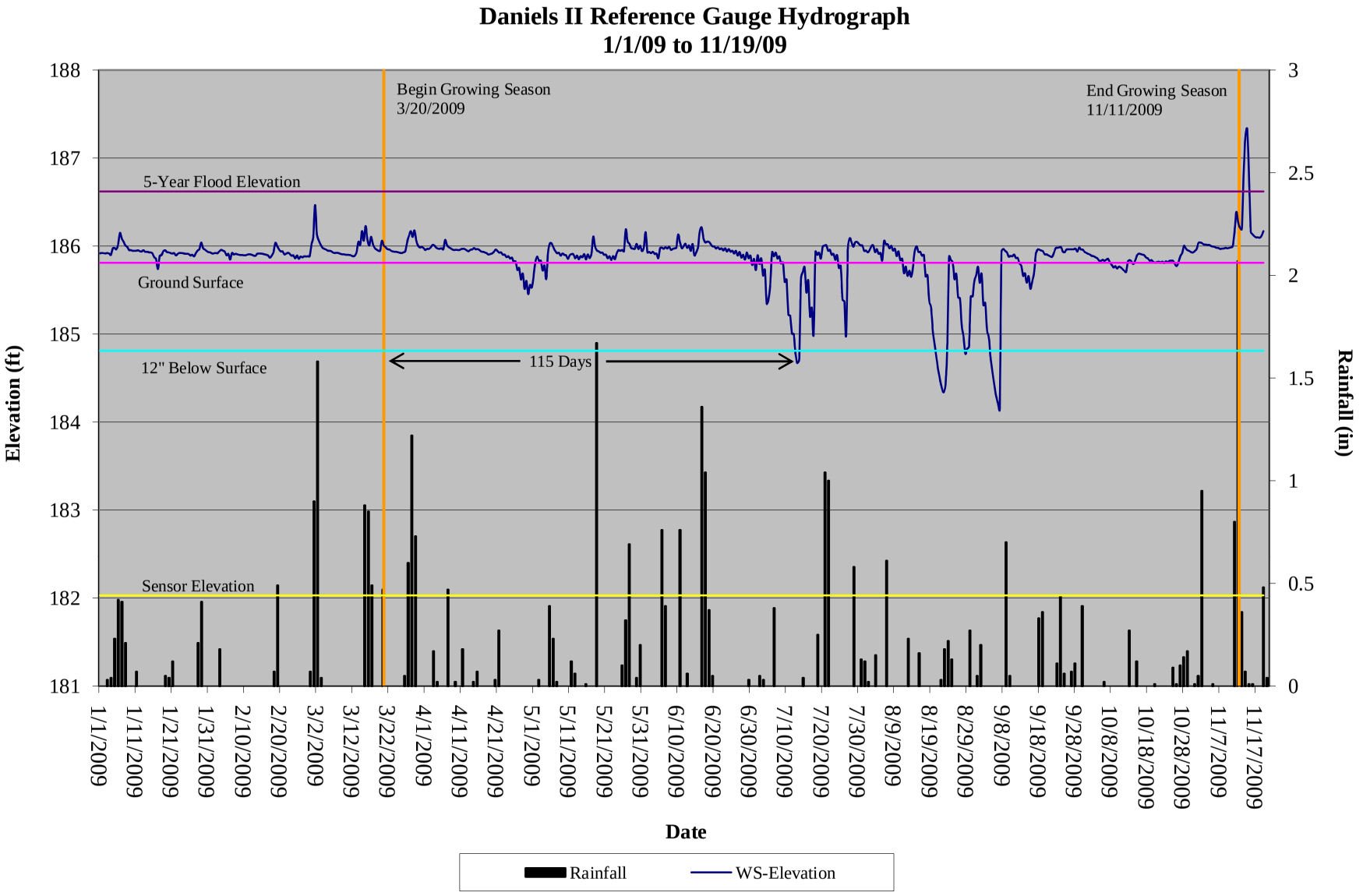



Daniels II Gauge 3 Hydrograph
1/1/09 to 11/19/09
Begin Growing Season
3/20/2009
End Growing Season
11/11/2009
5-Year Flood Elevation
Ground Surface
12" Below Surface
Sensor Elevation
52 Days
Elevation (ft)
Rainfall (in)
Date
Rainfall
WS-Elevation
187
185
183
181
179
177
175
3
2.5
2
1.5
1
0.5
0
1/1/2009
1/11/2009
1/21/2009
1/31/2009
2/10/2009
2/20/2009
3/2/2009
3/12/2009
3/22/2009
4/1/2009
4/11/2009
4/21/2009
5/1/2009
5/11/2009
5/21/2009
5/31/2009
6/10/2009
6/20/2009
6/30/2009
7/10/2009
7/20/2009
7/30/2009
8/9/2009
8/19/2009
8/29/2009
9/8/2009
9/18/2009
9/28/2009
10/8/2009
10/18/2009
10/28/2009
11/7/2009
11/17/2009

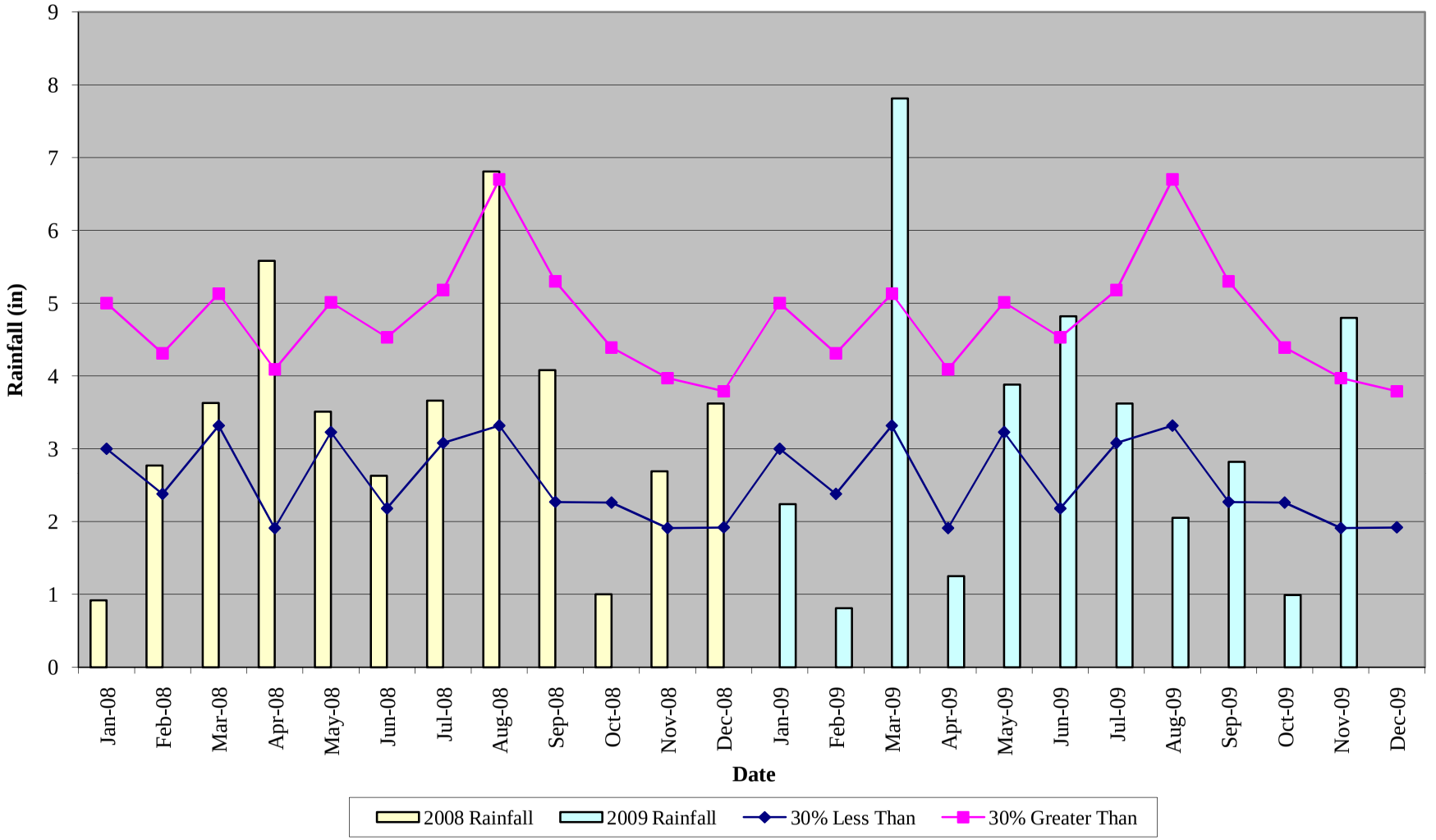

Daniels II Gauge 4 Hydrograph
1/1/09 to 11/19/09
5-Year Flood Elevation
Begin Growing Season
3/20/2009
End Growing Season
11/11/2009
Ground Surface
12" Below Surface
59 Days
Sensor Elevation
Elevation (ft)
Rainfall (in)
Date
Rainfall
WS-Elevation

Daniels II Gauge 5 (Preservation) Hydrograph
1/1/09 to 11/19/09




Daniels II Reference Gauge Hydrograph
1/1/09 to 11/19/09
Begin Growing Season
3/20/2009
End Growing Season
11/11/2009
5-Year Flood Elevation
Ground Surface
12" Below Surface
115 Days
Sensor Elevation
Elevation (ft)
Rainfall (in)
Date
Rainfall
WS-Elevation
188
187
186
185
184
183
182
181
3
2.5
2
1.5
1
0.5
0
1/1/2009
1/11/2009
1/21/2009
1/31/2009
2/10/2009
2/20/2009
3/2/2009
3/12/2009
3/22/2009
4/1/2009
4/11/2009
4/21/2009
5/1/2009
5/11/2009
5/21/2009
5/31/2009
6/10/2009
6/20/2009
6/30/2009
7/10/2009
7/20/2009
7/30/2009
8/9/2009
8/19/2009
8/29/2009
9/8/2009
9/18/2009
9/28/2009
10/8/2009
10/18/2009
10/28/2009
11/7/2009
11/17/2009

Daniels II 30-70 Percentile Graph 2008-2009
Louisburg, NC Monthly Rainfall



Appendix C
Permanent Photograph Points

Photo Point 1: View looking west with the enhancement wetland on the left. 6/19/09 – MY04

Photo Point 2: View looking south toward enhancement wetland. 6/19/09 – MY04

Photo Point 3A: View looking east toward Vegetation Plot # 5. 6/19/09 – MY04

Photo Point 3B: View looking south toward preservation wetland. 6/19/09 – MY04

Photo Point 4A: View looking east with enhancement wetland on the right. 6/19/09 – MY04

Photo Point 4B: View looking west with enhancement wetland on the left. 6/19/09 – MY04

Photo Point 5: View looking south. 6/19/09 – MY04

Photo Point 6A: View looking northwest toward Vegetation Plot #6. 6/19/09 – MY04

Photo Point 6B: View looking south. 6/19/09 – MY04

Photo Point 7: View looking north. 6/19/09 – MY04