

DANIEL'S FARM
WETLAND RESTORATION
MONITORING YEAR 1 REPORT
JANUARY 2005

FULL DELIVERY PROJECT

CONSULTANT: KCI

EXECUTIVE SUMMARY

The Daniels Farm Wetland Restoration Project is located on the Clyde Daniels Farm, south-southeast of Louisburg in Franklin County, North Carolina. The restoration of 31.72 acres of non-riverine wetlands was completed following construction in March 2004. The site will be monitored for five years or until the success criteria is met.

This first year monitoring report presents the data and findings developed following the first growing season. Activities in 2004 reflect the first year of monitoring following construction. Included in this report are analyses of both hydrologic and vegetation monitoring results, as well as local climate conditions throughout the growing season. Monitoring activities included sampling vegetation survivability at nine locations, monitoring ground water elevations at eight locations and documenting general site conditions at five permanent photo documentation points within the wetland restoration area. In addition, project site daily precipitation was recorded. This data was evaluated and verified using the North Carolina climatic data for Louisburg, North Carolina. Field investigations were conducted in November 2004. Supporting data and site photographs are included in the report appendices.

The 31.72-acre wetland restoration site was planted at a density of 436 trees per acre. There were nine (9) vegetation-monitoring plots established throughout the planting areas instead of the eight originally discussed in the as built. The additional plot was established to monitor the survival and growth of the bald cypress and water tupelo. Vegetation survival rates at the site are above the minimum success criteria. The 2004 vegetation monitoring of the planted areas revealed an average density of 404 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. The average density for the Low Elevation Seeps species (Zone 1) was 440 trees per acre after one year and the Non-riverine Wet Hardwood Forest species (Zone 2) was 394 trees per acre.

During the 2004 monitoring year wetland hydrology was achieved at all eight wells at the site; ground water was within 12 inches of the soil surface in excess of 12 days (5 % of the growing season) at each well. Based upon this data the site has exceeded the minimum duration of near surface saturation of 12 days with the water table within 12 inches of the soil surface for the 2004 growing season. The result of this monitoring also indicates that the water table is within 12 inches of the soil surface for greater than 12.5 percent of the growing season.

The daily rainfall data depicted on the gauge data graphs was obtained from the onsite precipitation gauge. The precipitation gauge was installed on the site in 2003 prior to project implementation. The daily rainfall data obtained from the NC climatic data for Louisburg, North Carolina shows that in 2004 Louisburg experienced a normal rainfall during the growing season.

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

Site photographs were taken from five (5) permanent photo documentation points established along the property boundary. Photo documentation is intended to facilitate 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.

Maintenance and management issues will be addressed promptly as they arise to promote project success. Areas of the site that exhibited decreased seedling survivability will be replanted before February 1, 2005. Green ash and overcup oak will be planted in the wetter areas among the existing trees to promote species diversity. A pre-emergent and herbicide may be used to reduce herbaceous competition.

TABLE OF CONTENTS

1.0 Summary1

2.0 Data Analysis2

3.0 Maintenance/Management Actions3

4.0 Conclusions3

Tables

Table 1. Vegetation Monitoring Results1

Table 2. Hydrologic Monitoring Results2

Appendices

- Appendix A - Vegetation Monitoring Plot Data Sheets**
- Appendix B - Hydrologic Monitoring and Hydroperiod**
- Appendix C – Permanent Photo Documentation Points**

1.0 SUMMARY

1.1 Vegetation

The 31.72-acre wetland restoration site was planted at a density of 436 trees per acre. Originally there were eight vegetation-monitoring plots established throughout the planting areas, covering both vegetative communities however a ninth plot was established to monitor the bald cypress and water tupelo community. The 2004 vegetation monitoring of the planted areas revealed an average density of 404 trees per acre, which is well above the minimum requirement of 260 trees per acre (Appendix A). The average density for the Low Elevation Seeps species (Zone 1) was 440 trees per acre after one year and Non-riverine Wet hardwood Forest species (Zone 2) 394 trees per acre. Vegetation-monitoring plots # 6, 7 and 8 showed the highest number of trees surviving (13, 13, and 14, respectively) while only eight surviving trees were counted in vegetation-monitoring plots # 3, 4 and 5. Eight surviving trees per plot represent a density of 320 trees per acre. 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

Planting Zone	Plot #	Willow Oak	Swamp Cestnut Oak	Laurel Oak	Yellow Poplar	Swamp Blackgum	Water Tupelo	Bald Cypress	Overcup Oak	Green Ash	Cherry bark Oak	American Elm			Total (1 year)	Total (at planting)	Density (Trees/Acres)
1	1	2	7												9	11	360
	8	1	6	2	3							1			13	11	520
															Zone 1 Average		440
2	2		3	4		2									9	11	360
	3		2			6									8	11	320
	4	1	3			4									8	11	320
	5		3			5									8	11	320
	6	4	4			5									13	13	520
	7		12			2									14	14	560
	9						2	7							9	11	360
															Zone 2 Average		394
															Total Average		404

1.2 Hydrology

Wetland hydrology was achieved at all eight wells at the site; ground water was within 12 inches of the soil surface in excess of 12 days (5 % of the growing season) at each well (Table 2). Based upon this data the site has exceeded the minimum duration of near surface saturation of 12 days with the water table within 12 inches of the soil surface for the 2004 growing season (Appendix B). The result of this monitoring also indicates that the water table is within 12 inches of the soil surface for greater than 12.5 percent of the growing season. 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 235-day growing season. Table 2 presents the hydrological monitoring results for 2004.

Table 2: Hydrologic Monitoring Results

Well No	Hydroperiod				Number of Days	Dates Meeting Success
	<5%	5% - 8%	8% -12.5%	>12.5%		
1				X	138	June 26 – November 11
2				X	236	March 20 – November 11
3				X	138	June 26 – November 11
4				X	124	July 10 – November 11
5				X	116	July 18 – November 11
6				X	129	July 5 – November 11
7				X	101	August 2 – November 11
8				X	89	August 14 – November 11

2.0 DATA ANALYSIS

2.1 Vegetation

Several factors influenced the seedling survival on the Daniels Restoration Site. These factors include the timing of the soil ripping prior to planting, the presence of surface water for long duration and the explosion of herbaceous vegetation. Ripping was conducted after earth-moving activities had ceased to increase the infiltration of the compacted soils. Ripping is a beneficial practice prior to planting hardwoods, however due to the clay soils it would have been better to rip the site 2 to 6 months prior to planting to allow for settling. This 2 to 6 month settling period would have allowed several inches of rain to fall and reduce the soil clumps and large air pockets left by ripping. Many areas on the site were wet during monitoring. Surface water and very high water table depths were observed over some areas near monitoring wells # 2, 3, 4, and 5. Even though this land is “wet”, water moves through the site and does not stagnate. Therefore, the water stays oxygenated and the seedlings don’t smother or rot. Additionally, many areas of the site were vegetated with herbaceous species at a density that out competed tree growth. Few trees can survive and thrive with this level of competition. However, survival is probably better than was observed during this monitoring since the herbaceous vegetation had not been hurt by killing frosts. Survivability may also be better than expected since hardwoods tend to “damp off”, or die back to the root and resprout. This is a defense mechanism that allows the root to “prune” the top to a size that can be supported by the surviving roots. It is easy to see that small sprouts are impossible to find in 3 to 6 feet of grass and weeds. It appears that the taller 30 – 36 inch swamp chestnut oak seedlings had a higher survivability than the smaller 12-inch seedlings even though many parts of the site were wetter than the species prefers. This indicates that the herbaceous vegetation was particularly stressful on the much smaller planting materials.

2.2 Hydrology

Historically, wetland restoration on the site focused on the removal of hydrologic alterations including the filling of the primary ditches and grassed waterways, plugging the lateral ditches, removing ditch spoil to restore natural seepage areas, placing water diversion features to redistribute the surface hydrology, placing restrictive berms to reduce runoff and enhance infiltration and recreating microtopography across site to enhance surface water retention and storage. Based on the hydrological results, this site has met and exceeded the criteria outlined in the wetlands restoration plan. Ditch plugging, filling and the other hydrological 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 Roanoke and Toisnot, both hydric soils on the state and federal hydric soils lists. NRCS verified the limits of hydric soils and confirmed their status as Prior Converted wetland. As soils are already considered hydric, no success criteria or monitoring is required.

3.0 MAINTENANCE/MANAGEMENT ACTIONS

Areas of the site that exhibited decreased seedling survivability will be supplemented with additional plantings before February 1, 2005. DWQ pre-approved species such as green ash and overcup oak will be incorporated into the plantings in the wetter areas since they are more tolerant of standing water than other species. Green ash seedlings will not exceed 15 percent of the total species planted. Since cherry bark oak is available from the North Carolina Forest Service this year it will be incorporated in the plantings to achieve greater diversity. Cherry bark oak will be planted on the higher areas of the site and high spots within the wetter areas.

A pre-emergent will be broadcast sprayed in mid-March to control the herbaceous vegetation. This allows 6 weeks for at least an inch of rainfall to settle the soil around the roots of the newly planted seedlings but before the buds begin to swell in the spring. An herbicide will be backpacked to each seedling and a ring sprayed around each tree as necessary throughout the growing season. Care will be taken to avoid spraying the tree leaves since it will kill the seedlings. The seedlings will be marked with flagging or pin flags prior to spraying. This would be done in early June and possible near the first of August.

Hydrology for the site has met and exceeded the restoration criteria for the first year monitoring.

4.0 CONCLUSIONS

Findings from this monitoring event indicate that the project site is a success. The success criteria for the survival of the planted species must be 260 stems/acre at the end of five years of monitoring. The 2004 vegetation monitoring of the planted areas revealed an average density of 404 trees per acre, which is well above the minimum requirement of 260 trees per acre. Non-target species do not constitute more than 20 percent of the woody vegetation based on permanent vegetation-monitoring plots. The long-term success of the wetlands restoration project will be improved by incorporating several additional maintenance activities to enhance vegetation survival growth and diversity throughout the year. This includes replanting areas that exhibited decreased seedling survivability with more water tolerant species such as green ash and overcup oak.

For the 2004 monitoring year, all eight gauges met the hydrologic success criteria of at least 5 % of the growing season. Additionally, all eight gauges exceeded the hydrological success criteria for more than 12.5% of the growing season.

Appendices

Appendix A
Vegetation Monitoring Plot Data Sheets

Species	Percent of Total
Swamp Chestnut Oak (<i>Quercus michauxii</i>)	78
Willow Oak (<i>Quercus phellos</i>)	22

Density:

Total Number of Trees 9 / 0.025 acres = 360 trees / acre

Survivability:

Total Number of Trees 9 / 9 trees X 100 = 100 % survivability

Number of New Recruits : _____

Note : Flag located W 72° N, 16' from monitoring well



Previous



Current

Species	Percent of Total
Swamp Chestnut Oak (<i>Quercus michauxii</i>)	33
Laurel Oak (<i>Quercus laurifolia</i>)	44
Swamp Black Gum (<i>Nyssa sylvatica</i>)	22

Density:

Total Number of Trees 9 / 0.025 acres = 360 trees / acre

Survivability:

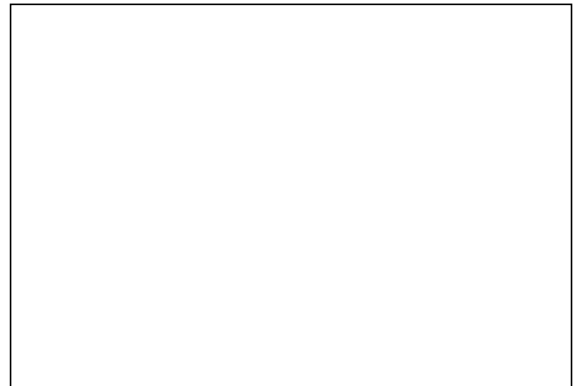
Total Number of Trees 9 / 9 trees X 100 = 100 % survivability

Number of New Recruits : _____

Note : Flag located E 104° S, 43' from monitoring well



Previous



Current

Species	Percent of Total
Swamp Chestnut Oak (<i>Quercus michauxii</i>)	25
Swamp Black Gum (<i>Nyssa sylvatica</i>)	75

Density:

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

Survivability:

Total Number of Trees 8 / 8 trees X 100 = 100 % survivability

Number of New Recruits : _____

Note : Flag located S 220° W, 63' from monitoring well



Previous



Current

Species	Percent of Total
Swamp Chestnut Oak (<i>Quercus michauxii</i>)	38
Willow Oak (<i>Quercus phellos</i>)	13
Swamp Black Gum (<i>Nyssa sylvatica</i>)	50

Density:

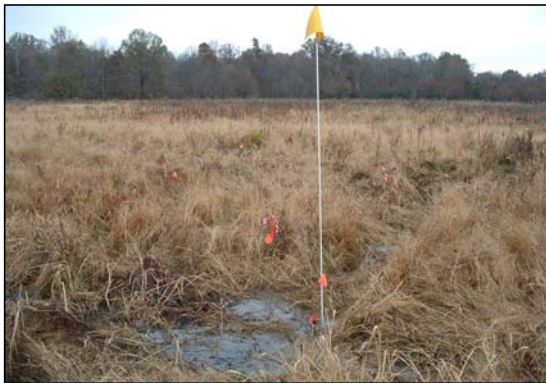
Total Number of Trees 8 / 0.025 acres = 320 trees / acre

Survivability:

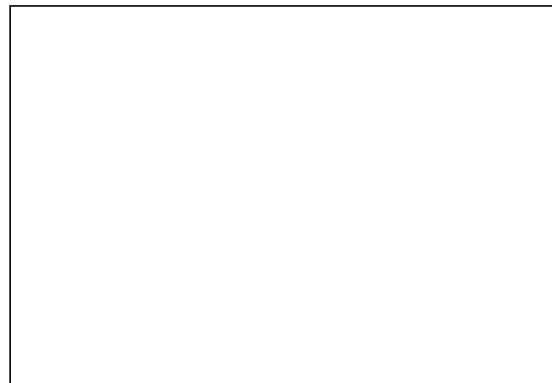
Total Number of Trees 8 / 8 trees x 100 = 100 % survivability

Number of New Recruits : _____

Note : Flag located N 45° E, 99' from monitoring well



Previous



Current

Species	Percent of Total
Swamp Chestnut Oak (<i>Quercus michauxii</i>)	38
Swamp Black Gum (<i>Nyssa sylvatica</i>)	63

Density:

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

Survivability:

Total Number of Trees 8 / 8 trees X 100 = 100 % survivability

Number of New Recruits : _____

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



Previous



Current

Species	Percent of Total
Swamp Chestnut Oak (<i>Quercus michauxii</i>)	31
Willow Oak (<i>Quercus phellos</i>)	31
Swamp Black Gum (<i>Nyssa sylvatica</i>)	38

Density:

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

Survivability:

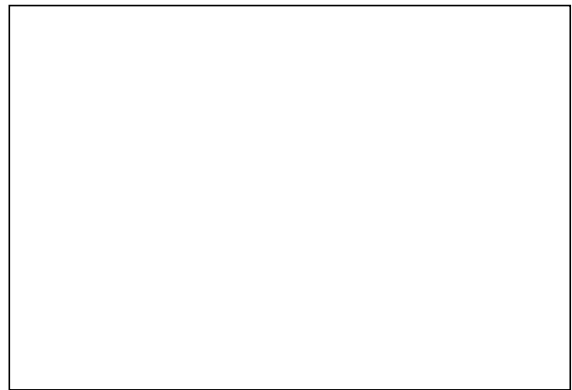
Total Number of Trees 13 / 13 trees X 100 = 100 % survivability

Number of New Recruits : _____

Note : Flag located E 174° S, 150' from monitoring well



Previous



Current

Species	Percent of Total
Swamp Chestnut Oak (<i>Quercus michauxii</i>)	86
Swamp Black Gum (<i>Nyssa sylvatica</i>)	14

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 12° E, 42' from monitoring well



Previous



Current

Species	Percent of Total
Swamp Chestnut Oak (<i>Quercus michauxii</i>)	46
Willow Oak (<i>Quercus phellos</i>)	8
Laurel Oak (<i>Quercus laurifolia</i>)	15
Yellow Poplar (<i>Liriodendron tulipifera</i>)	23
American Elm (<i>Ulmus americana</i>)	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 W 328° N, 27' from monitoring well



Previous



Current

Species	Percent of Total
Water Tupelo (<i>Nyssa sylvatica</i> var. <i>biflora</i>)	22
Bald Cypress (<i>Taxodium distichum</i>)	78

Density:

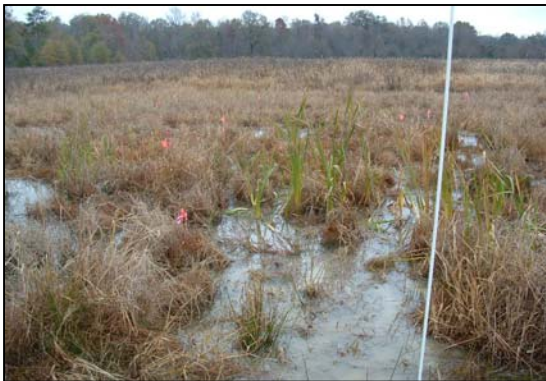
Total Number of Trees 9 / 0.025 acres = 360 trees / acre

Survivability:

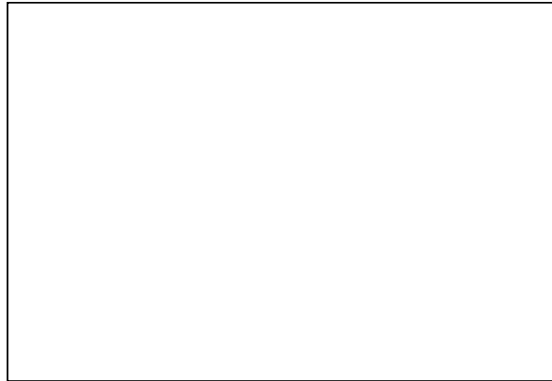
Total Number of Trees 9 / 9 trees x 100 = 100 % survivability

Number of New Recruits : _____

Note : Flag located W 72° N, 16' from monitoring well



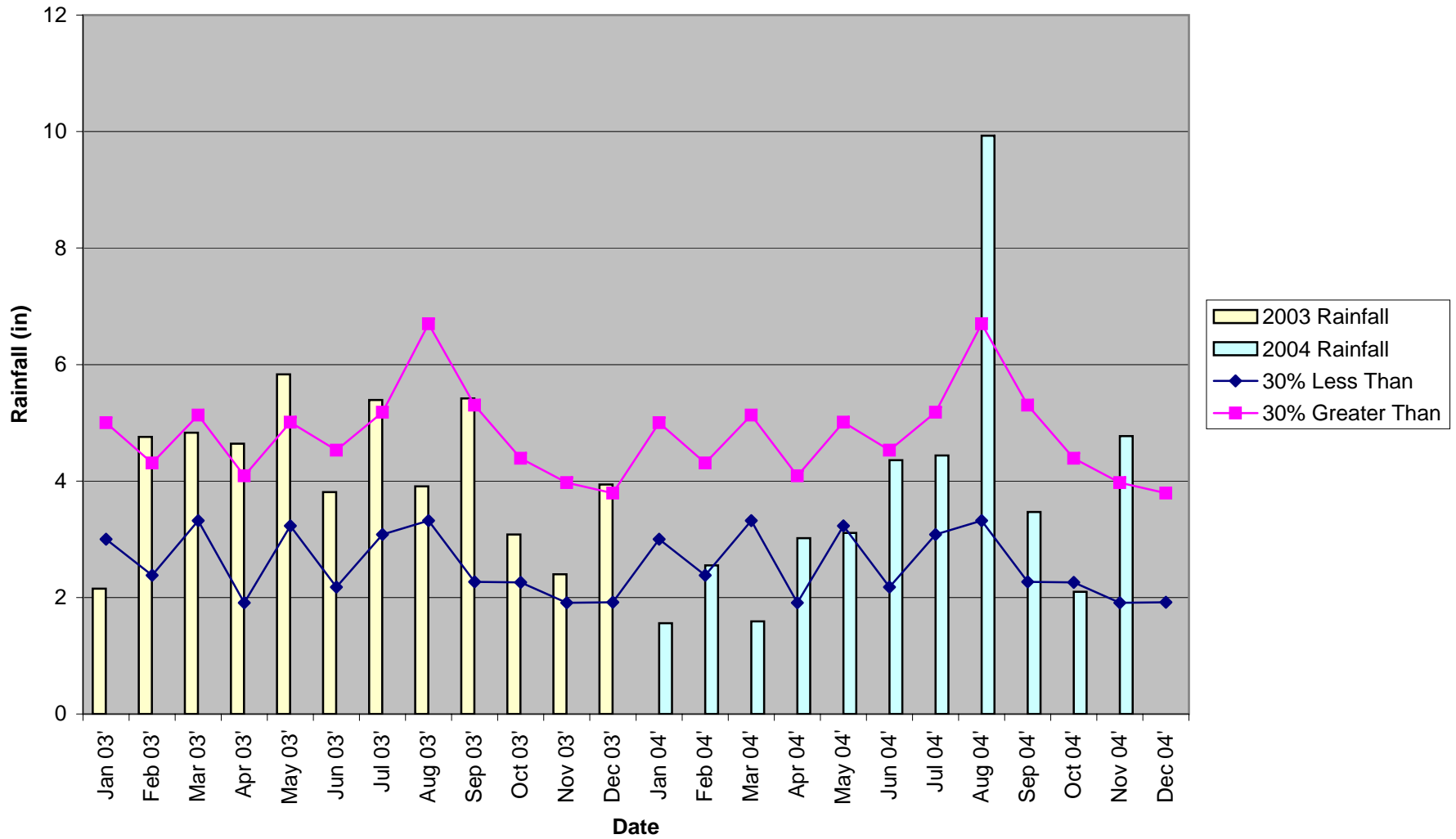
Previous



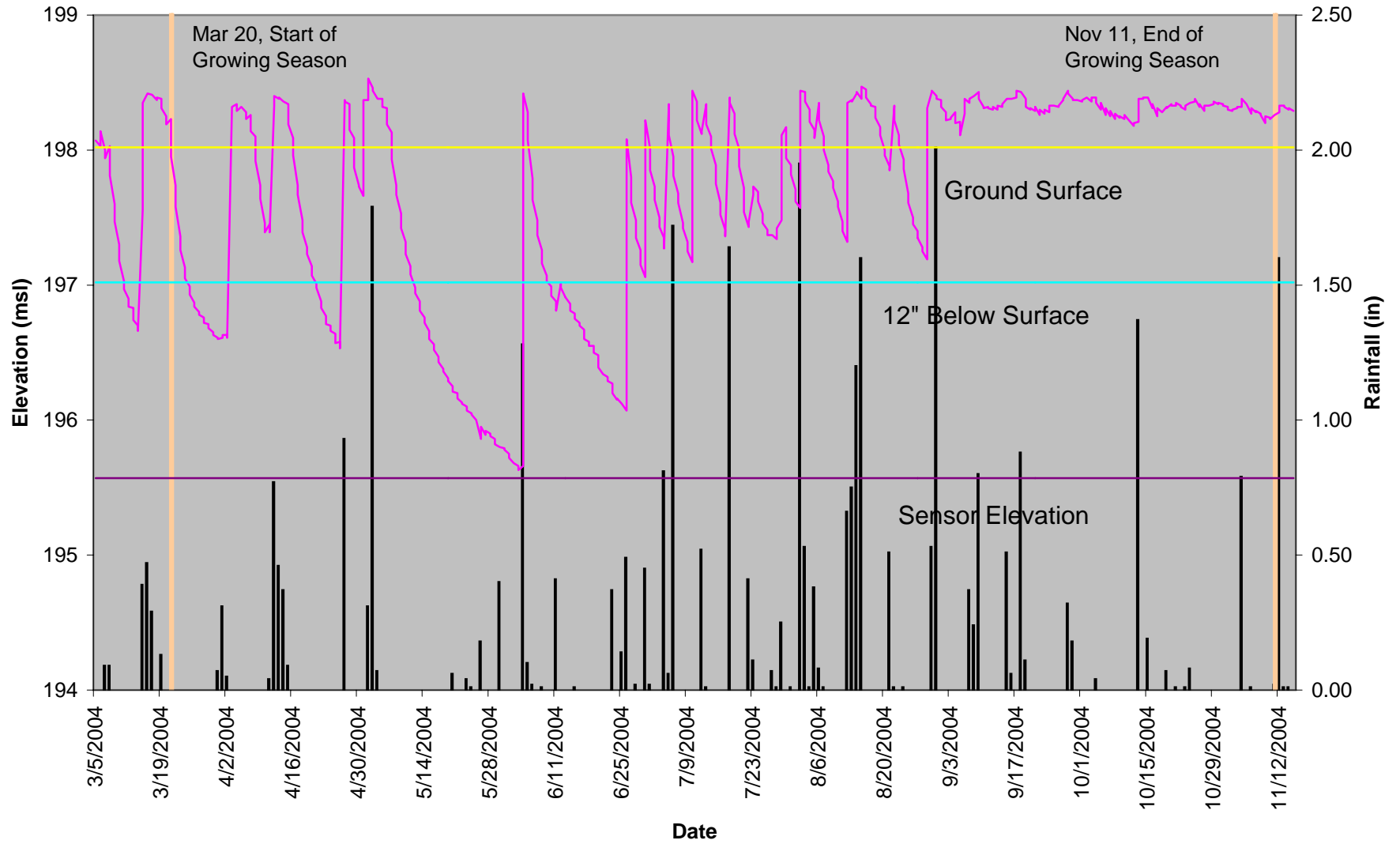
Current

Appendix B
Hydrologic Monitoring and Hydroperiod

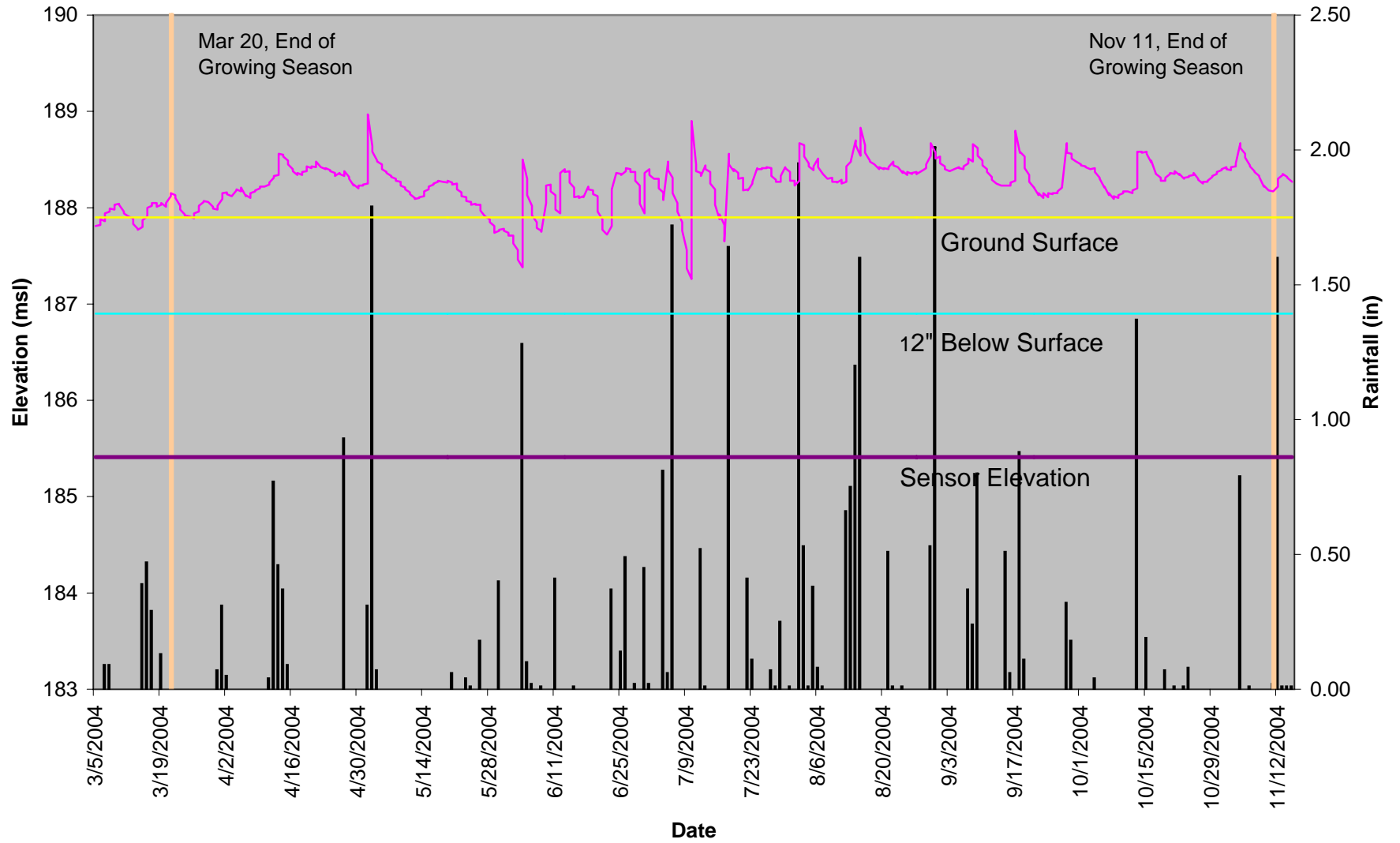
**Daniels Property 30-70 Percentile Graph 2003-2004
Louisburg, NC Monthly Rainfall**



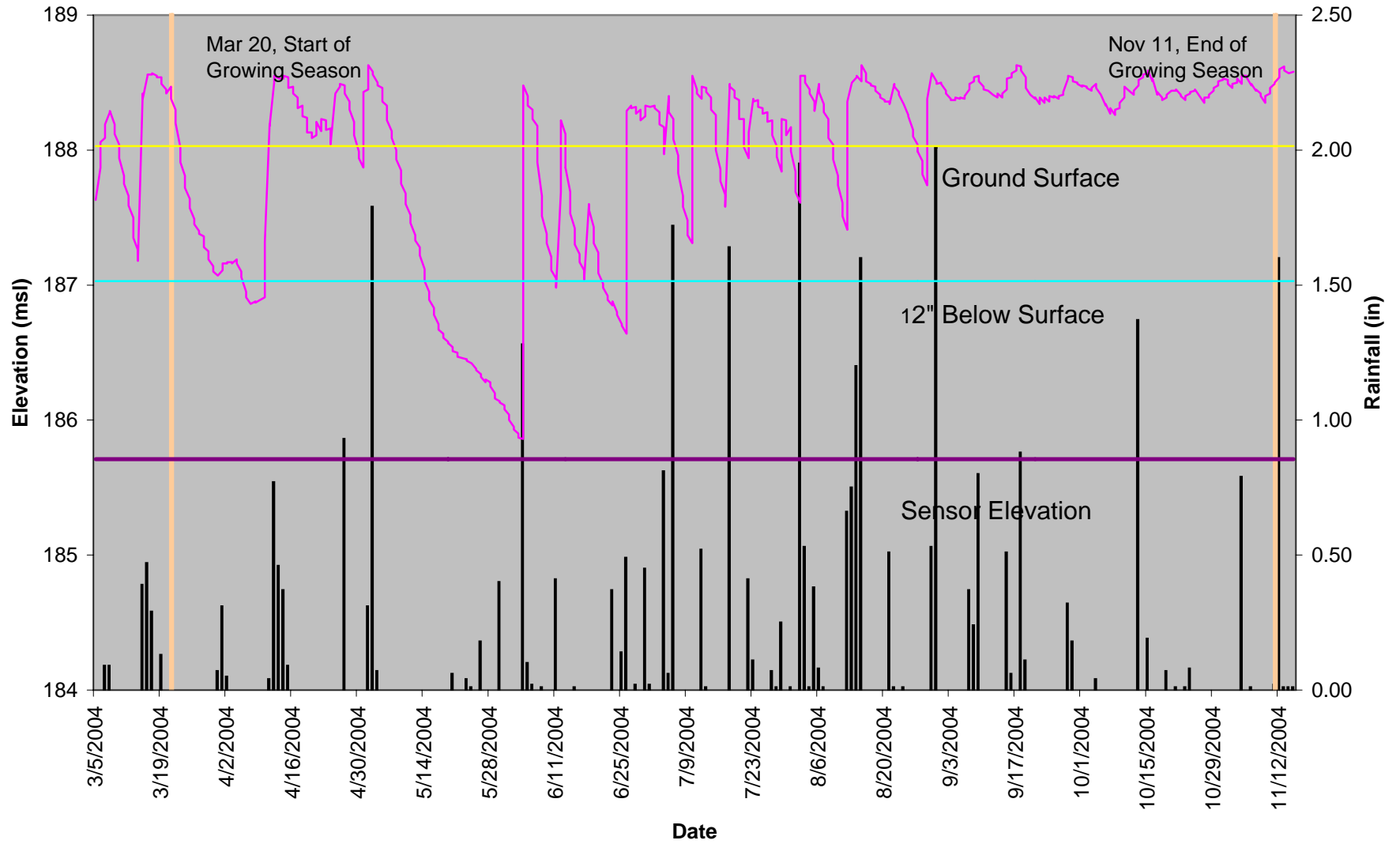
Daniels Farm Gauge 1



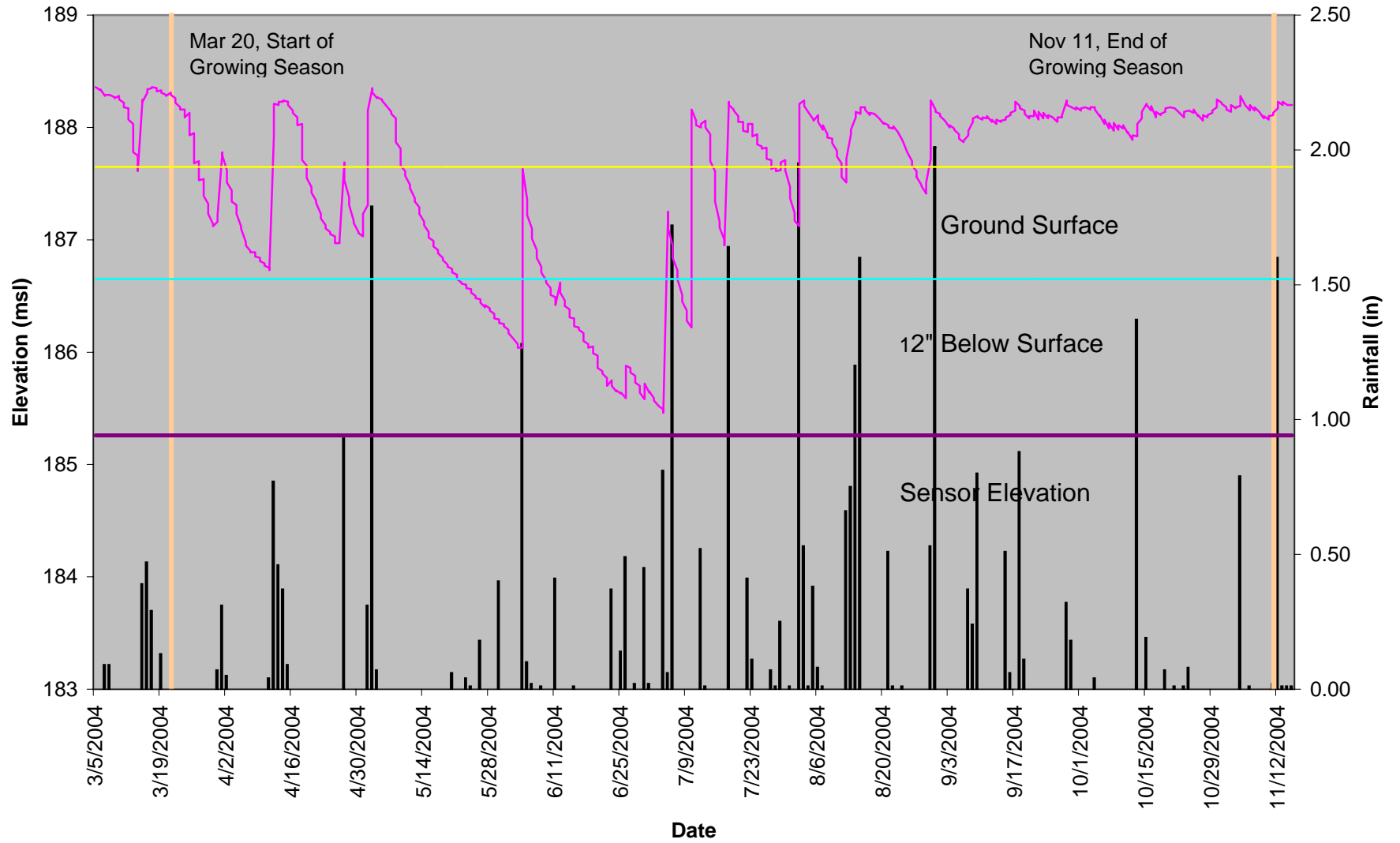
Daniels Farm Gauge 2



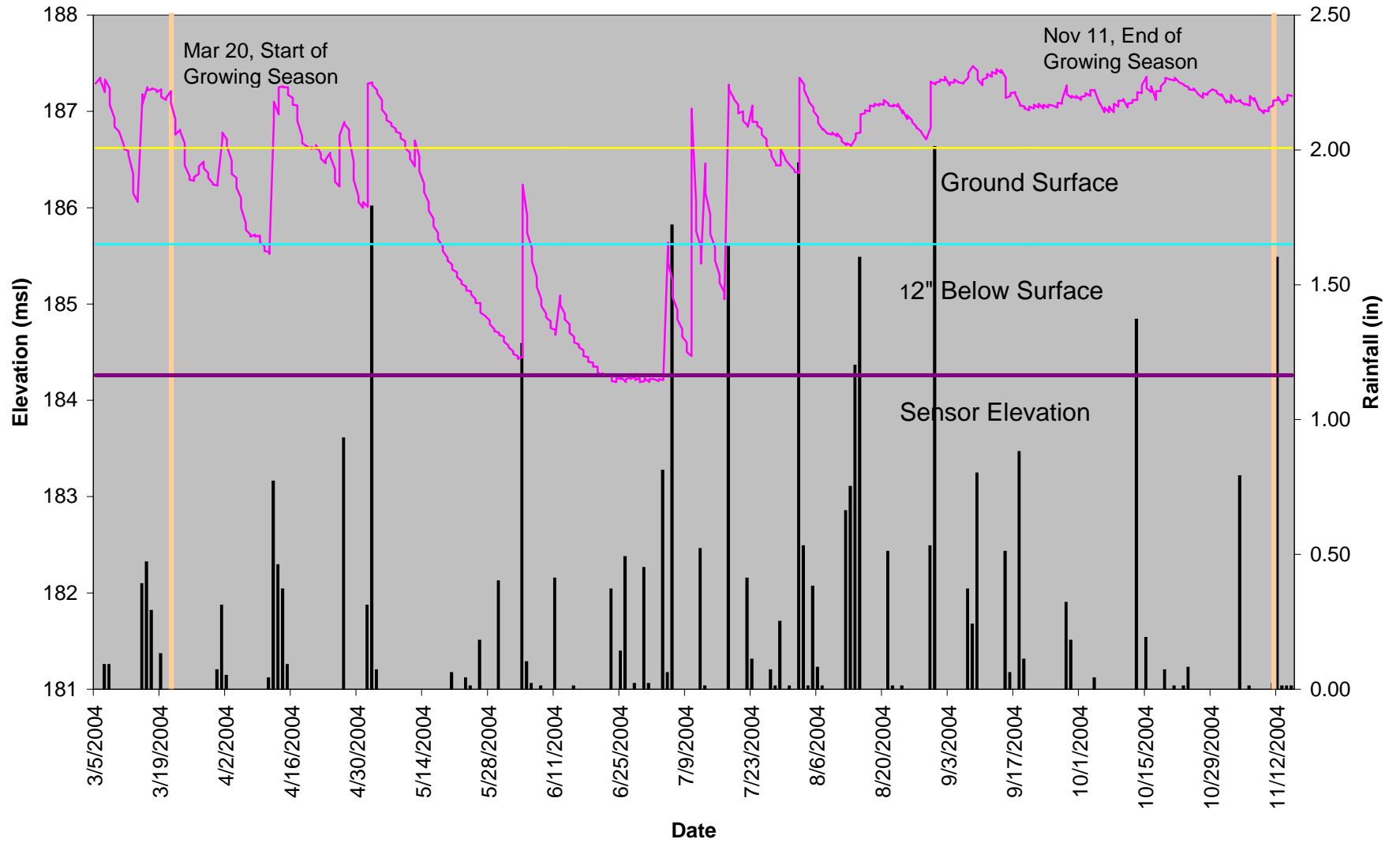
Daniels Farm Gauge 3



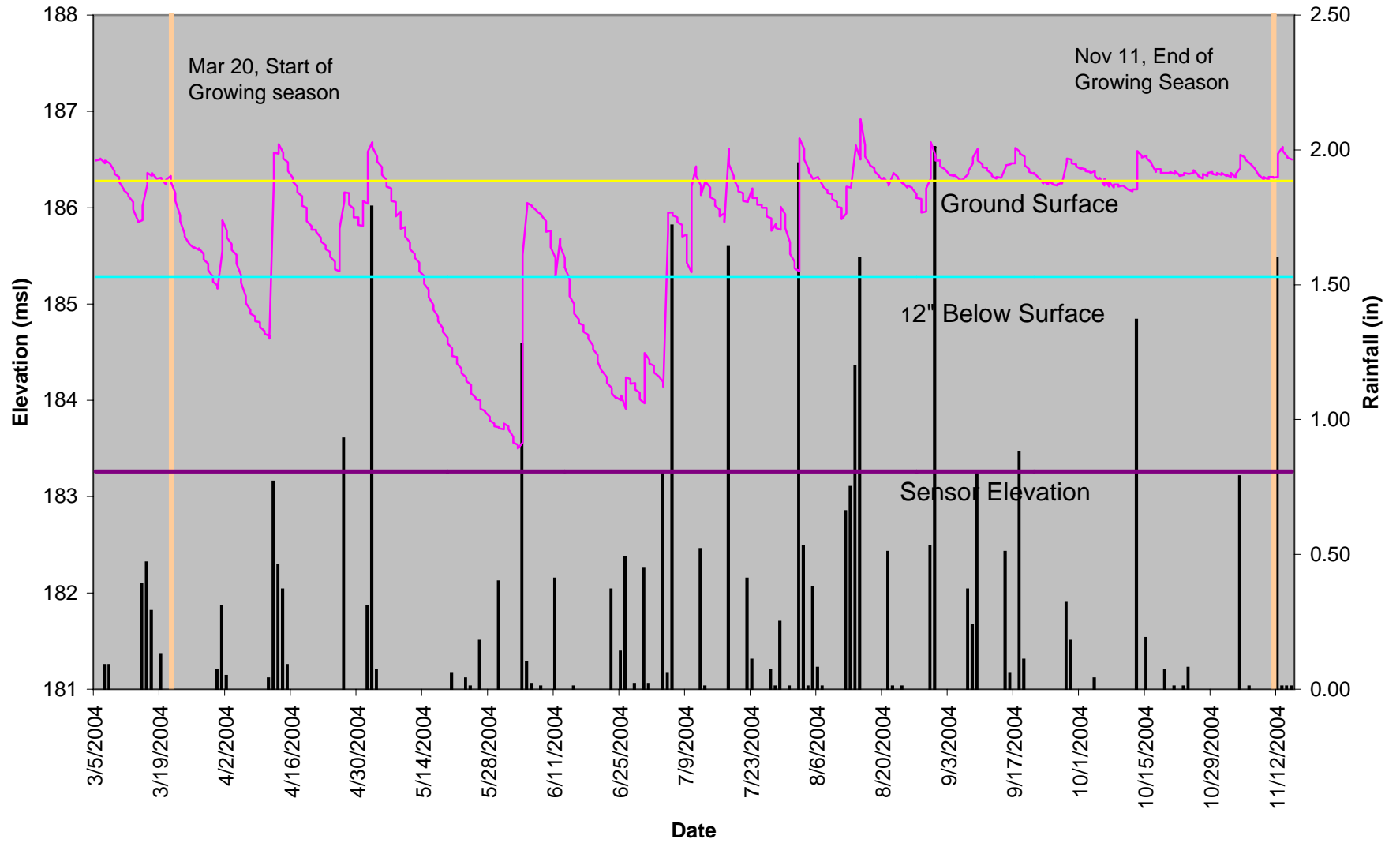
Daniels Farm Gauge 4



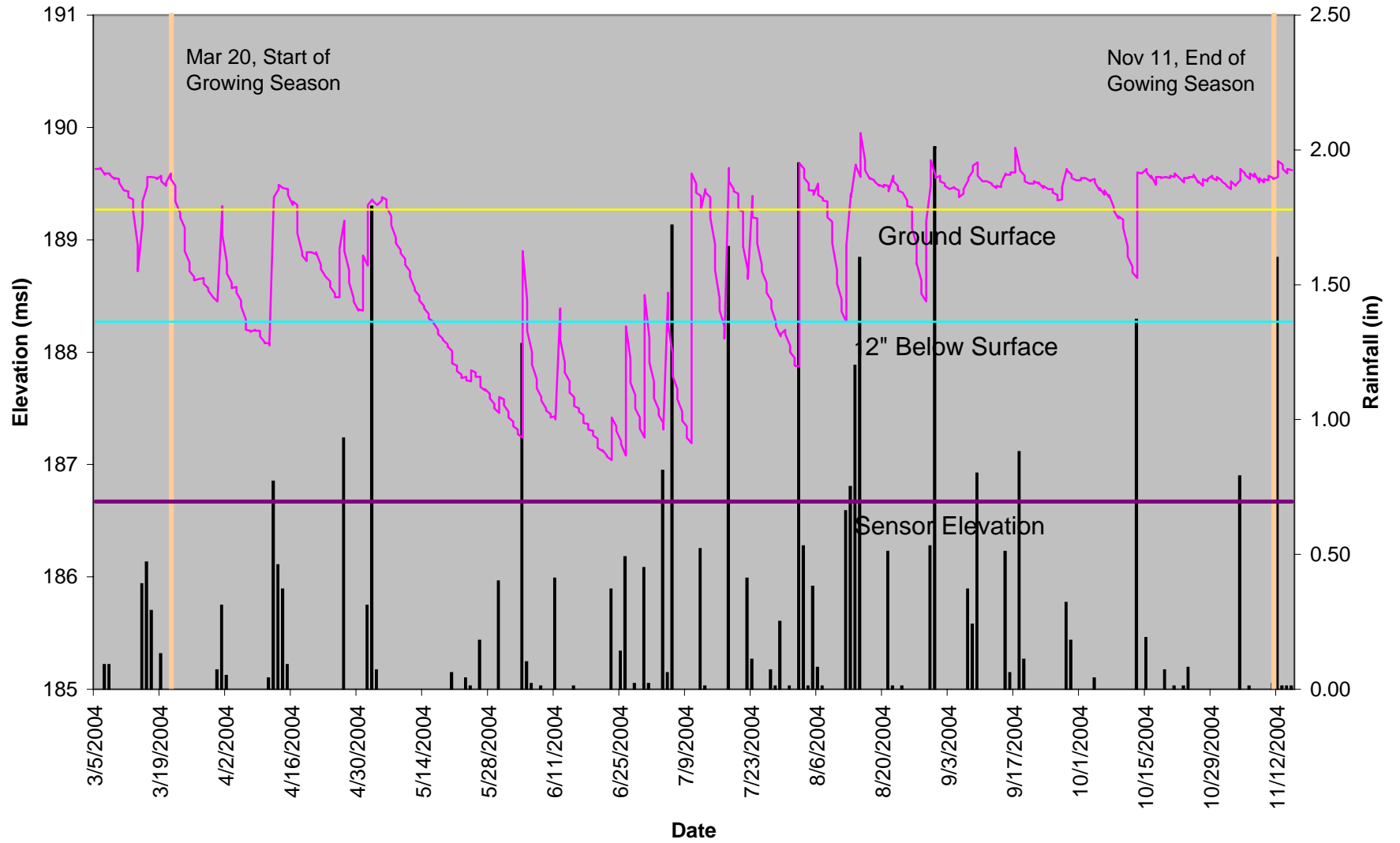
Daniels Farm Gauge 5



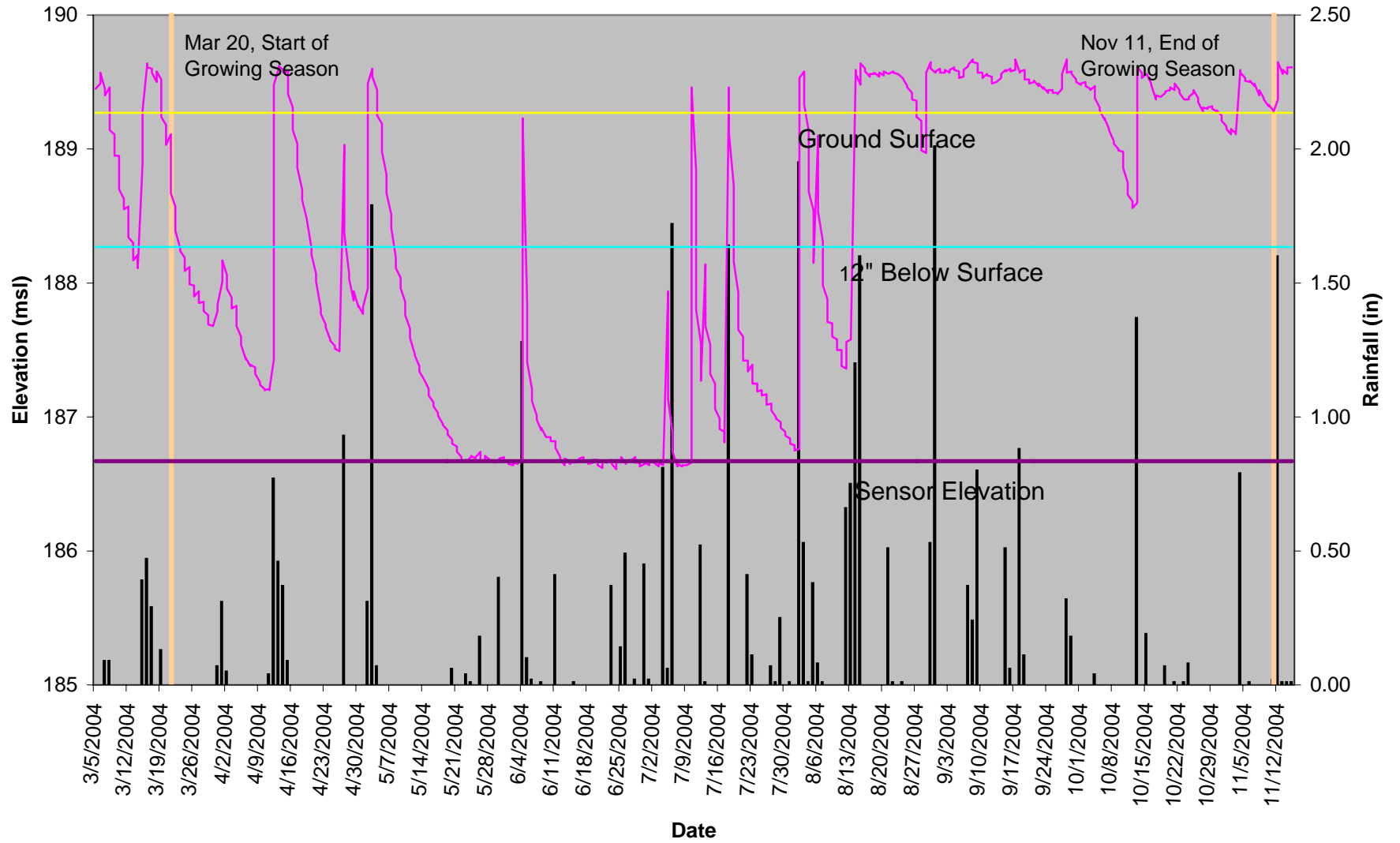
Daniels Farm Gauge 6



Daniels Farm Gauge 7



Daniels Farm Gauge 8



Appendix C
Permanent Photo Documentation Points



Photo Location 1: View looking toward vegetation plot # 8 identified by the yellow flag.



Photo Location 2: View looking toward vegetation plot # 1 identified by the yellow flag.



Photo Location 3: View looking toward vegetation plot # 4.



Photo Location 4: View looking toward vegetation plot # 5 identified by the yellow flag.



Photo Location 5: View looking toward vegetation plot # 6 identified by the yellow flag. The upland area shown to the left of the yellow flag is non-wetland.