

# 2007-2008 FROST/SNOW MONITORING REPORT

July 2008



Prepared for:

**South Washington  
Watershed District**

Prepared by:



# Memorandum

**To:** Matt Moore —South Washington Watershed District Administrator

**From:** Erik Anderson, Jessica Arendt, Matt Downing, Wendy Griffin, Tim Sundby, and Travis Thiel--Washington Conservation District

**Date:** July 1, 2008

**Re:** SWWD 2007-2008 Frost/Snow Monitoring: Cottage Grove Ravine Park, CDP 85, CDP 86, and MS-1

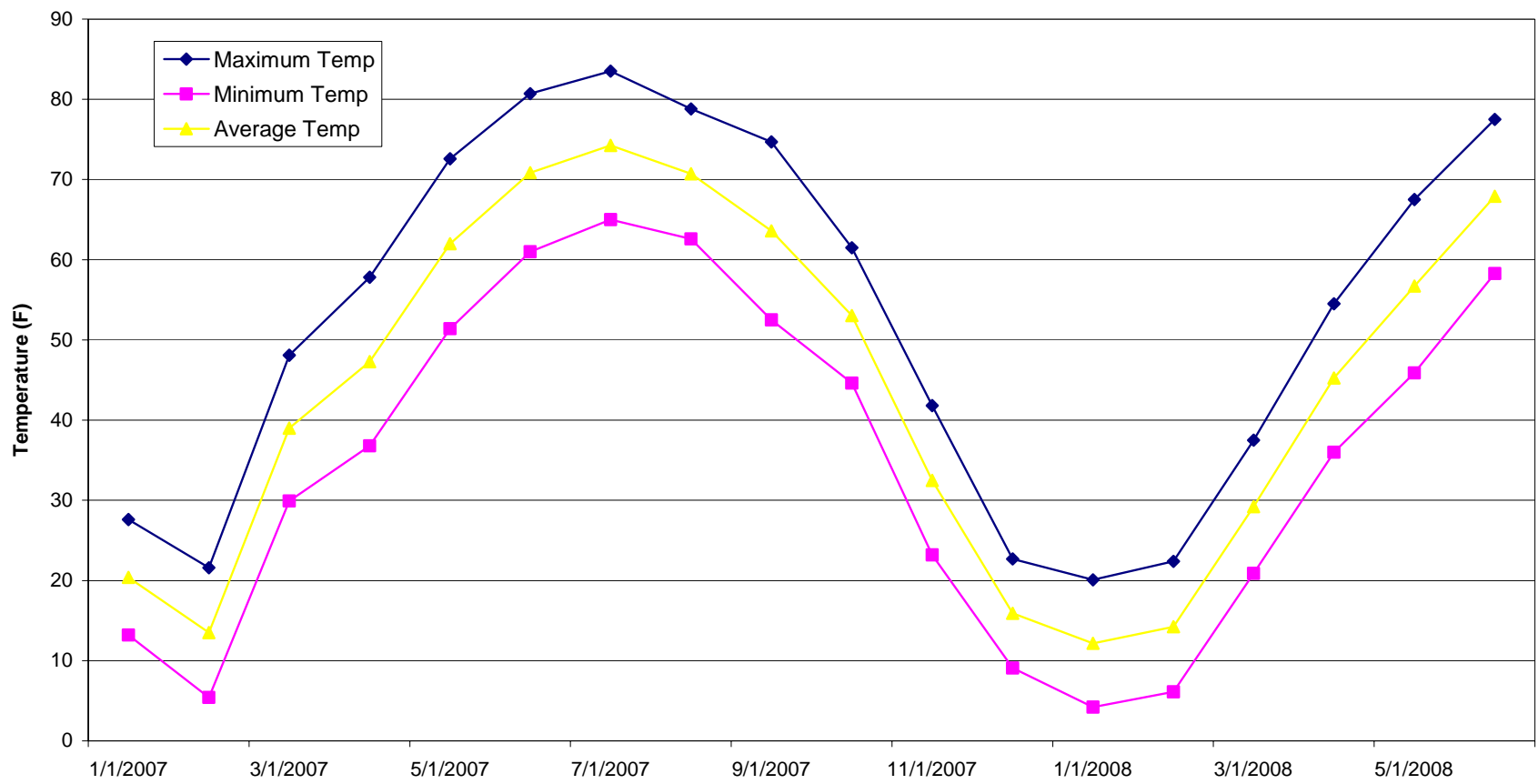
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At the request of the South Washington Watershed District (SWWD), the Washington Conservation District (WCD) conducted frost/snow monitoring at fourteen frost monitoring sites (Cottage Grove Ravine Park, CDP-85 locations {NH, NL, SH, SL, EH, EL, WH, WL}, CDP-86 locations {86-1, 86-2, 86-3, 86-4), and MS-1}. The following report summarizes our methods and results for monitoring conducted from November 27, 2007 to April 8, 2008. This report and the accompanying data will also be provided in an electronic format.

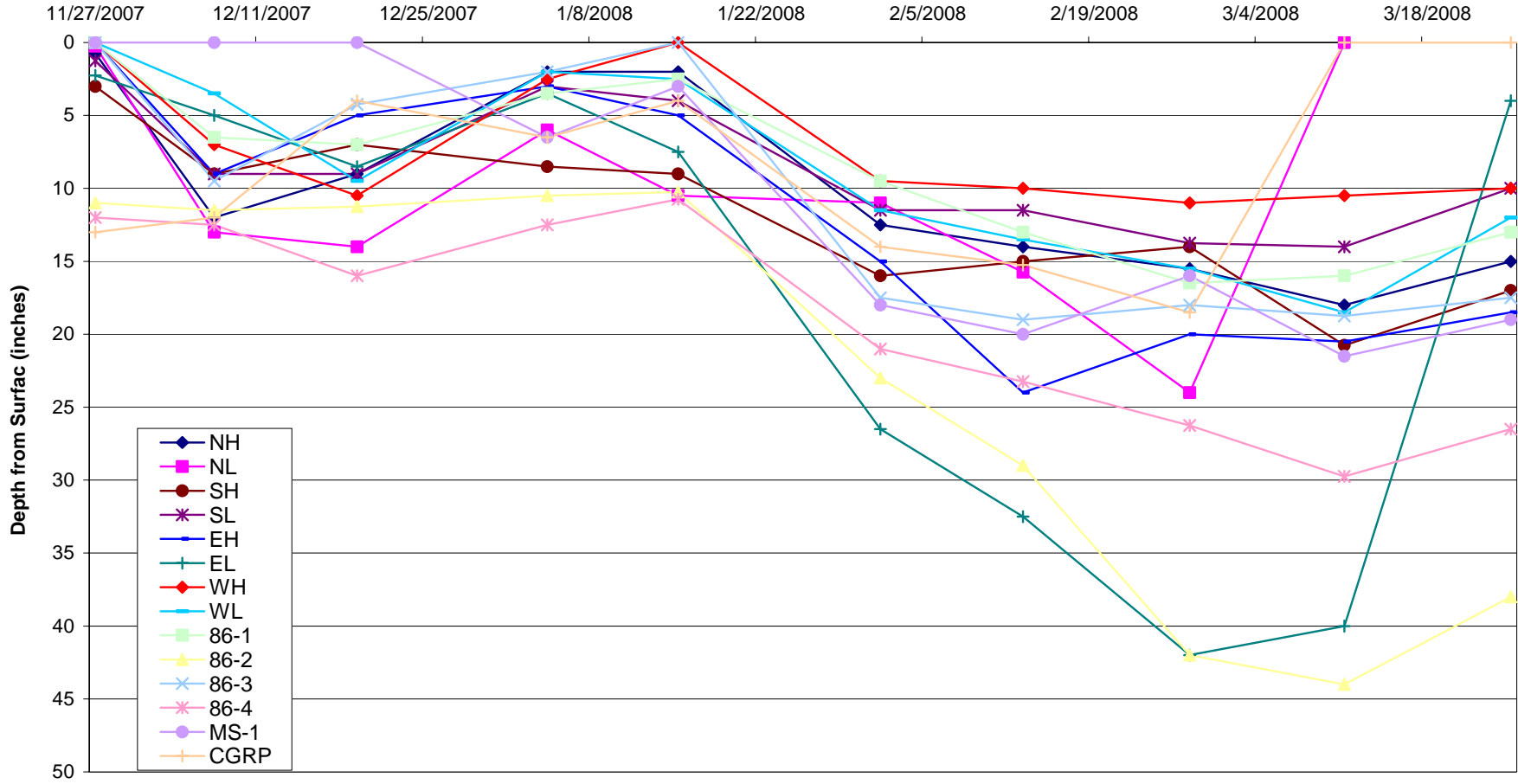
**Frost/Snow Monitoring Sites: Cottage Grove Ravine Park, CDP-85 (NH-North side/upper slope, NL-North side/lower slope, SH-South side/upper slope, SL-South side/lower slope, EH-East side/upper slope, EL-East side/lower slope, WH-West side/upper slope, WL-West side/lower slope, CDP-86 (86-1-tilled corn field in upland area, 86-2-tilled corn field between upland and lowland areas, 86-3-grassland ridge adjacent to lowland meadow, 86-4-tilled corn field adjacent to lowland meadow, and MS-1.**

Frost depth from surface, frost thaw from surface, snow depth, and water content of snow was measured at least every one to two weeks at each of the sites mentioned above within the SWWD depending on weather conditions. Frost depth from surface and frost thaw from surface was measured using a self-designed frost tube. The frost tubes were created using a 5-ft. sealed, rigid outer CPVC pipe and a pliable 4-ft. vinyl tube in the interior of the CPVC pipe. The vinyl tube was filled with a sand/fine gravel mixture and all gaps and holes were filled with a 0.10% fluorescein dye/water solution that was poured into the mixture. The dye/water mixture changes from green to red within the tube to indicate whether frozen or unfrozen soil exists. This slurry was used to mimic the effects that temperature would have on saturated ground. The CPVC pipe was placed in the ground to a depth of 4 ft. and 1 ft. was exposed on the surface for visibility. The inner tube was pulled from the outer tube and the frost/thaw measurements were recorded. Snow depth measurements were assessed by taking the average depth of snow measured at various locations within a 30-ft. radius of the frost tube. Water content was assessed by collecting a column of snow within the area where the average depth of snow was measured with a 4-inch diameter collector. This snow was allowed to melt and the water content was measured by pouring the melt water into a precipitation gage calibrated to measure the 4-inch diameter column collector. All snow depth and water content measurements at CDP-85 and CDP-86 were taken at one site to represent the snow depth and water content at all locations in this region. Missing data points that are within the following dataset are due to the NL frost tube being tampered with and needing to be fixed on 2/27/08. It was decided not to replace that tube, instead using it at the Cottage Grove Ravine site. The Cottage Grove frost tube was found to be missing on 3/11/08. The tube was replaced, and was found to be missing again for the remainder of the data collection period. The tubes were pulled on 4/8/08, which resulted with some tubes containing frost and others where frost was not present.

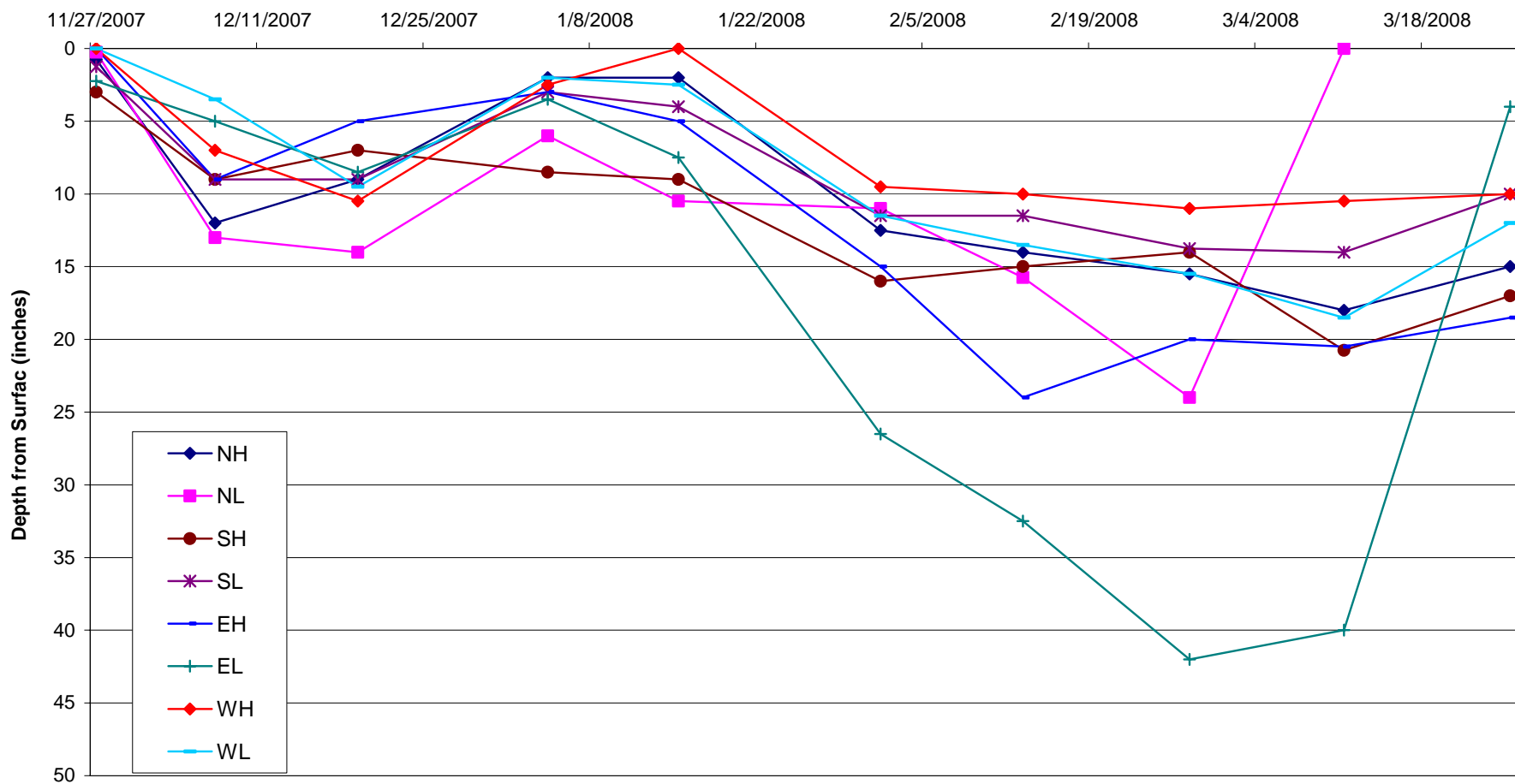
Monthly Air Temperatures at St. Paul WB Airport  
(Township 28, Range 22, Section 5)



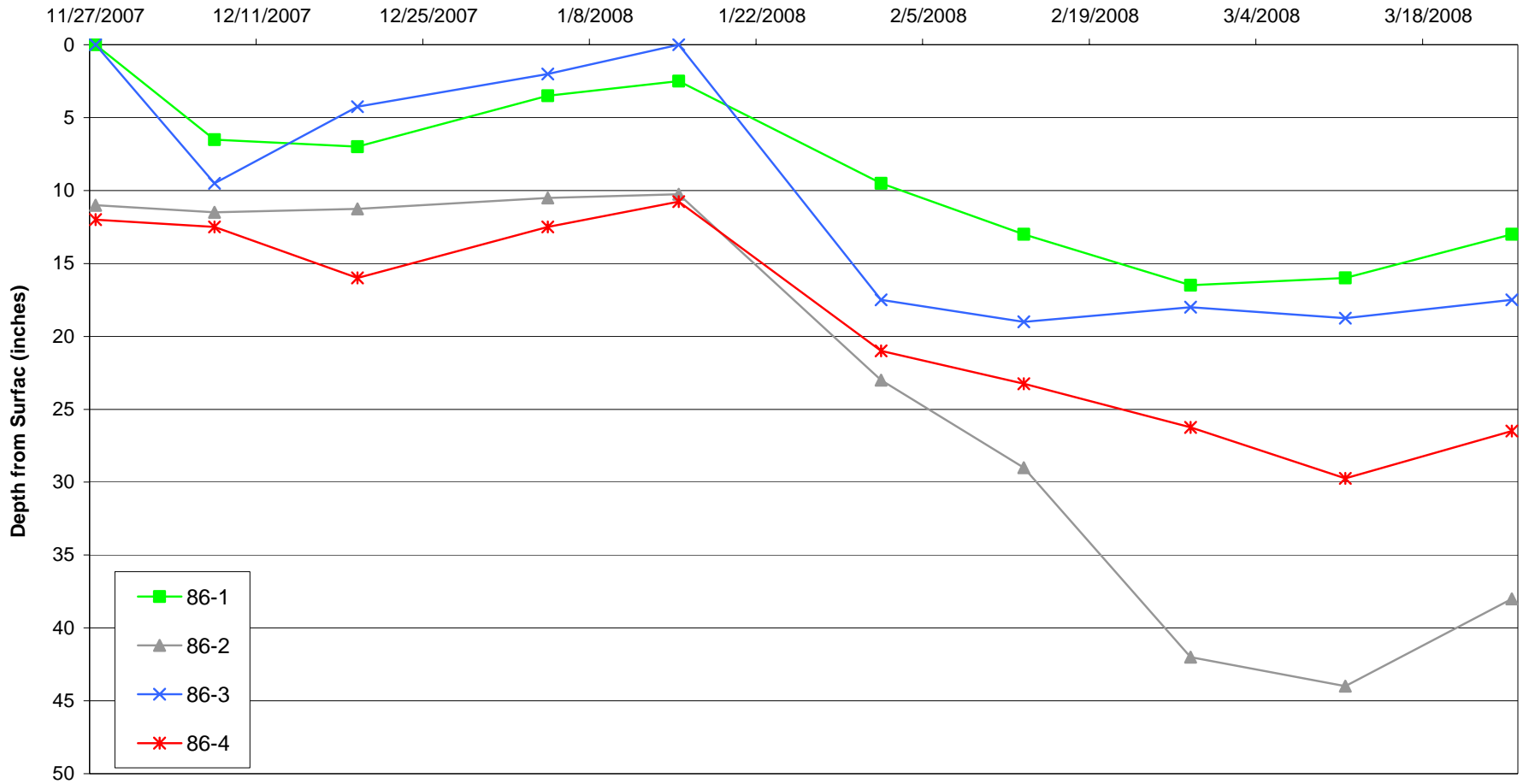
### Frost Depths at All Sites



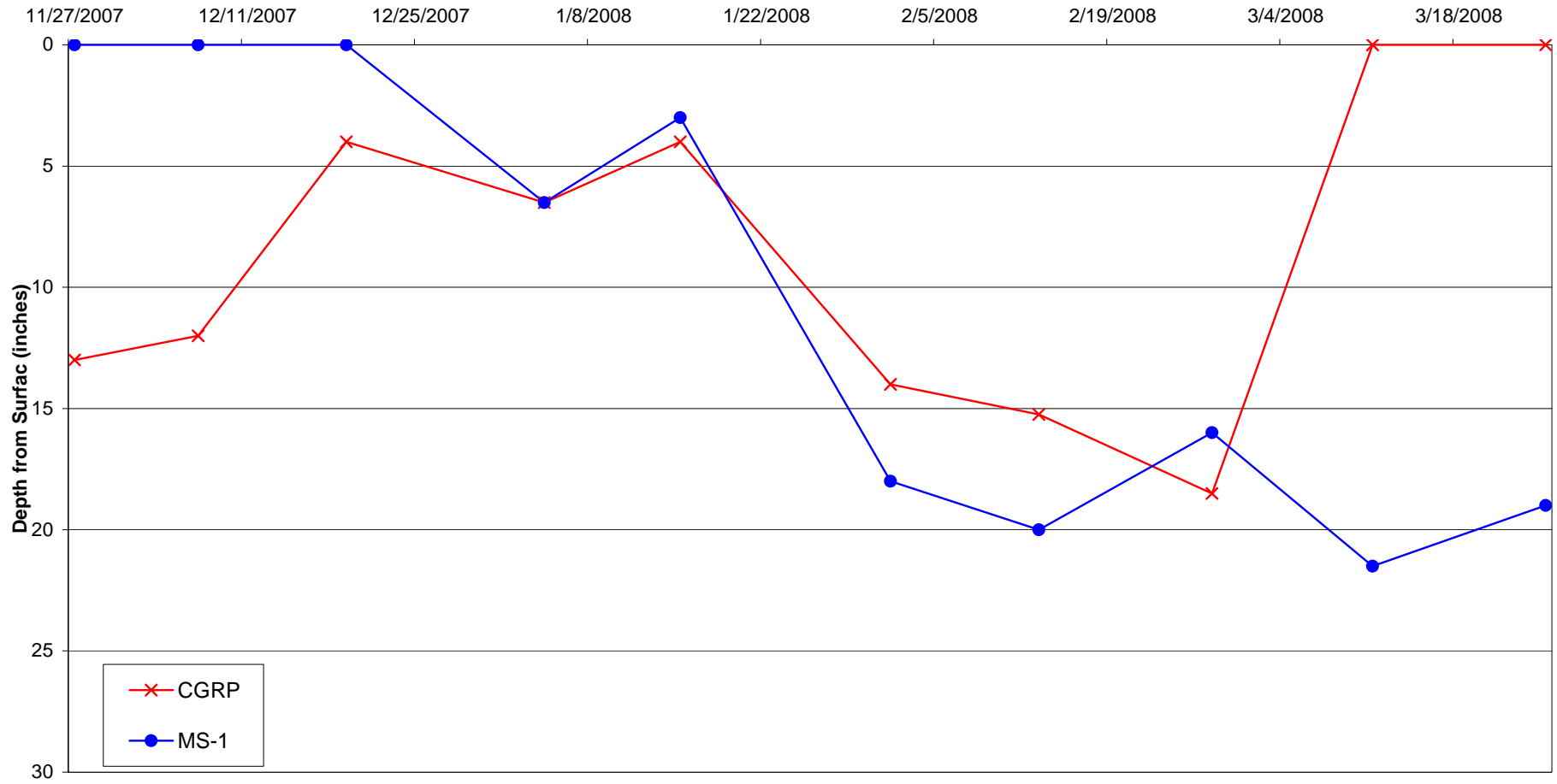
### Frost Depths at CDP 85



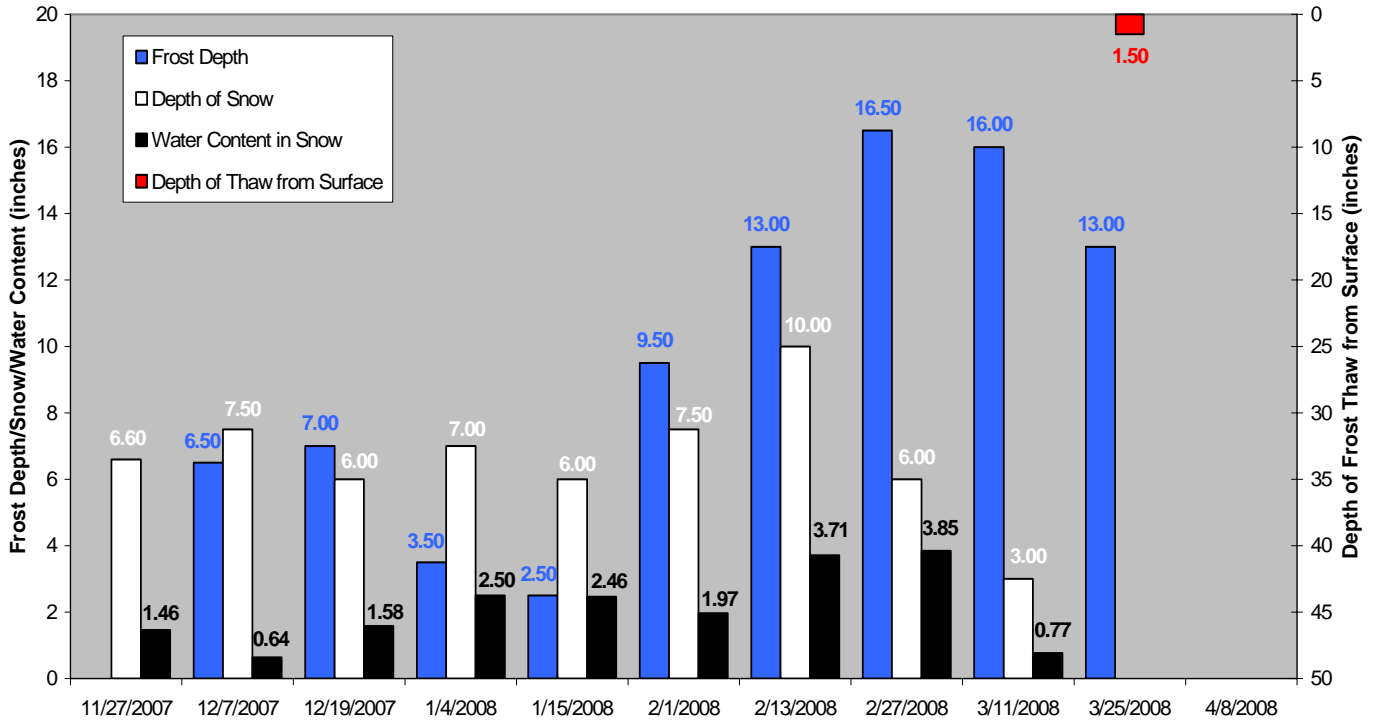
### Frost Depths at CDP 86



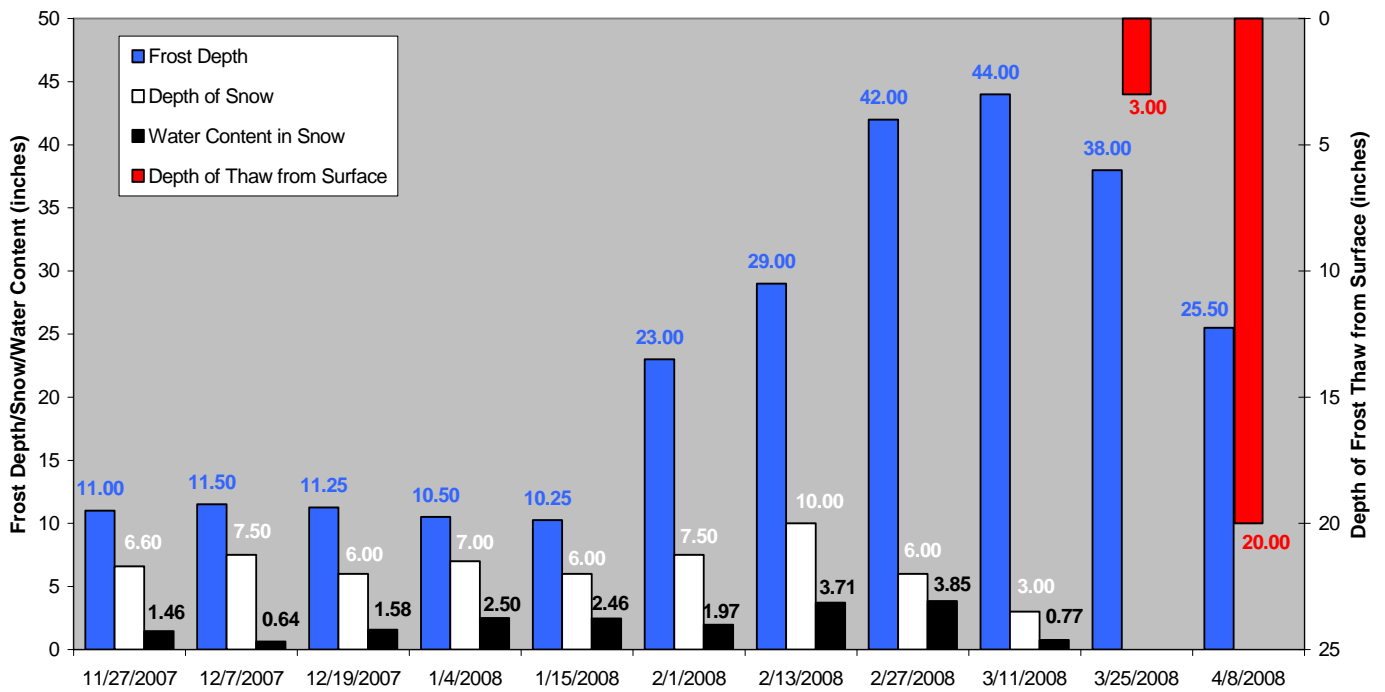
### Frost Depths at Cottage Grove Ravine Park and MS-1



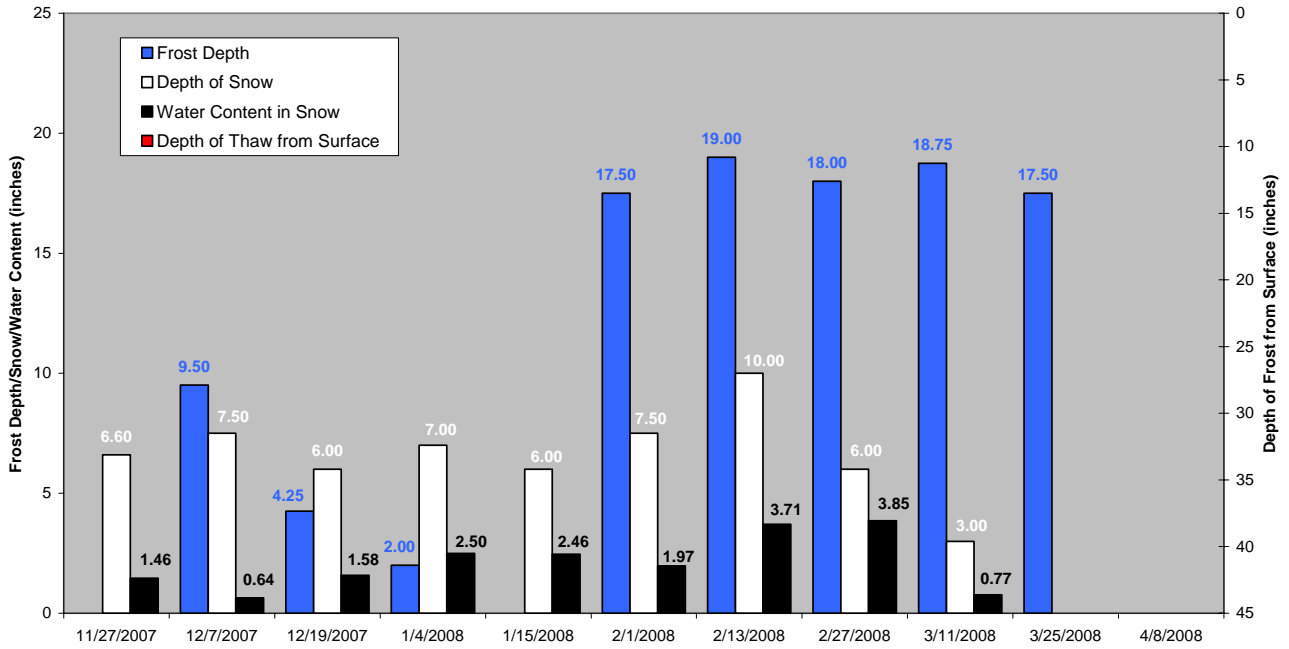
CDP 86-1 Tilled Upland Soybean Field



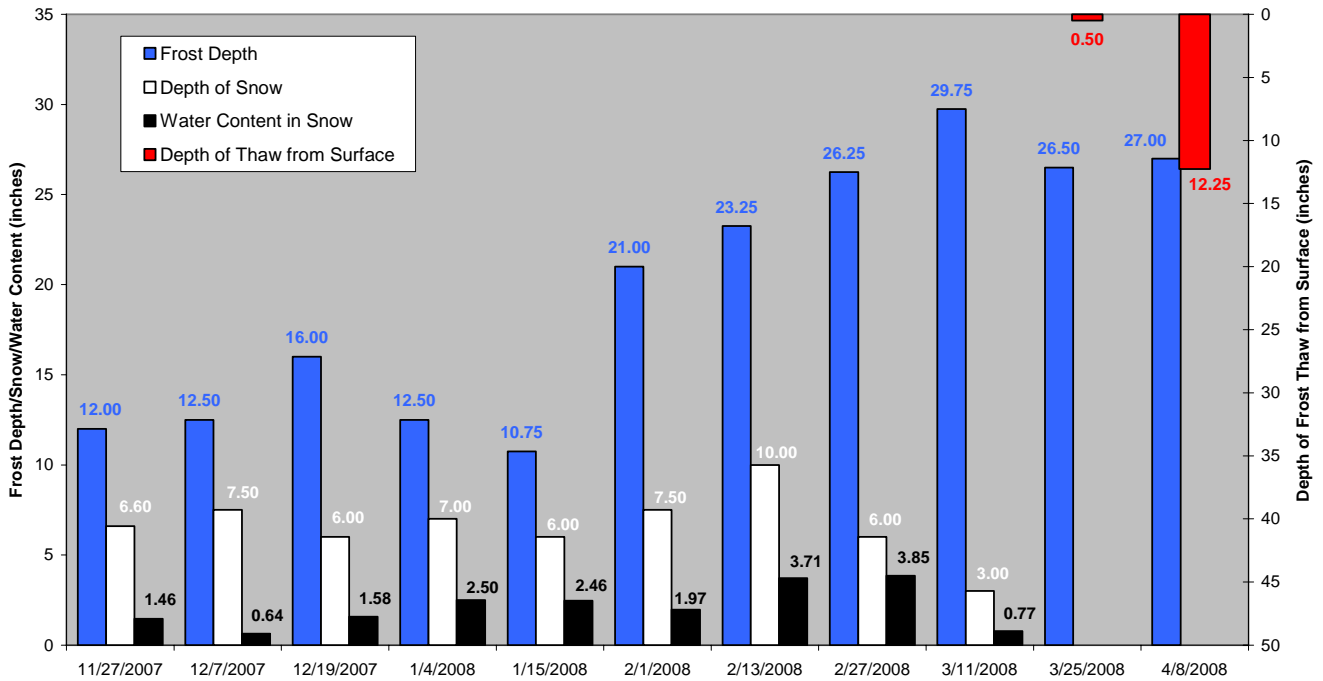
CDP 86-2 Tilled Soybean Field Between Upland and Lowland



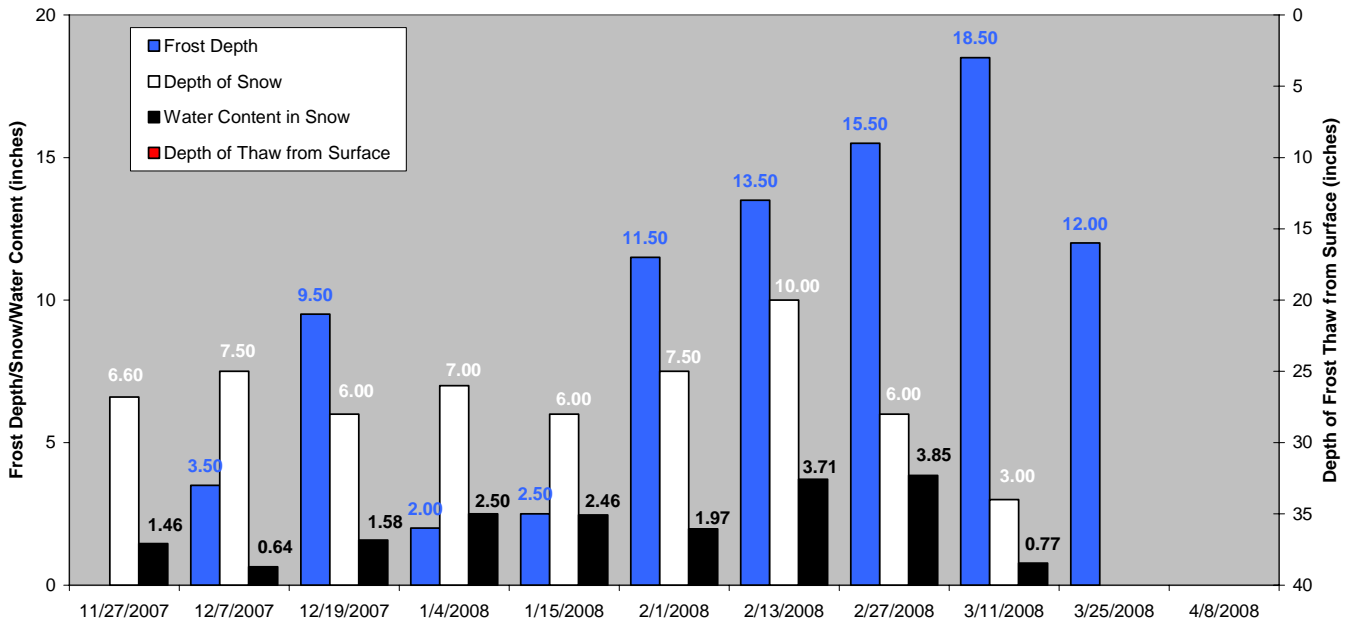
CDP 86-3 Lowland Grassy Ridge



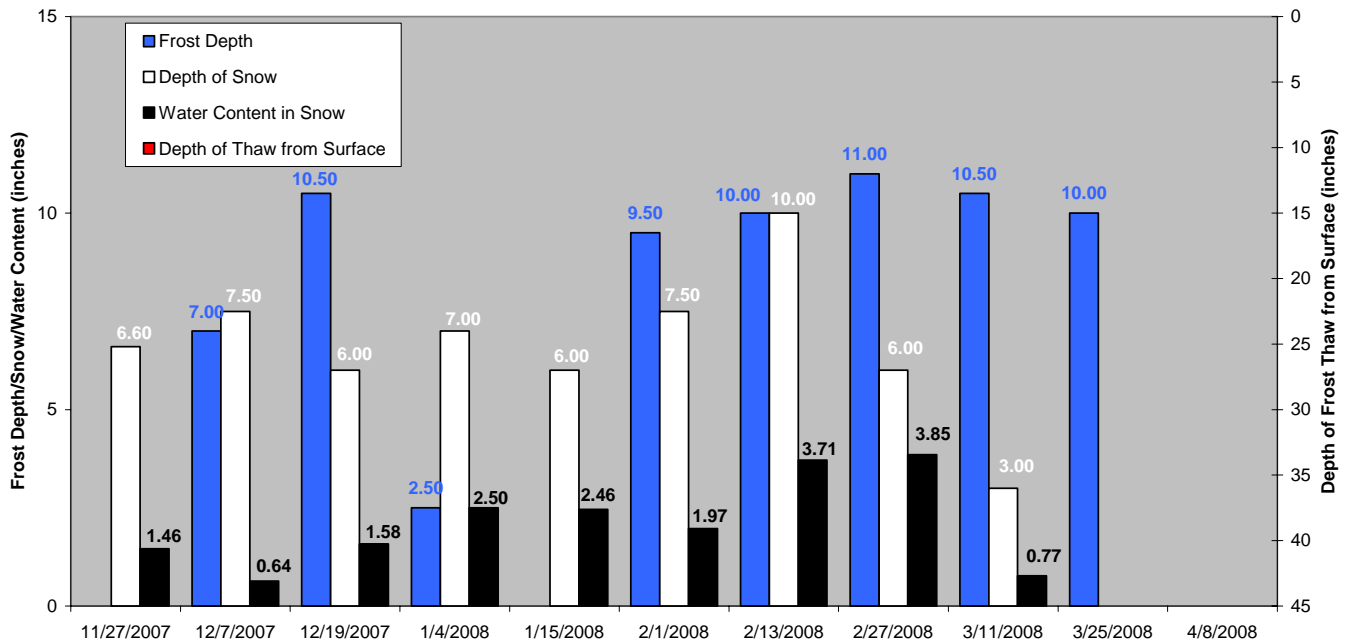
CDP 86-4 Tilled Lowland Soybean Field



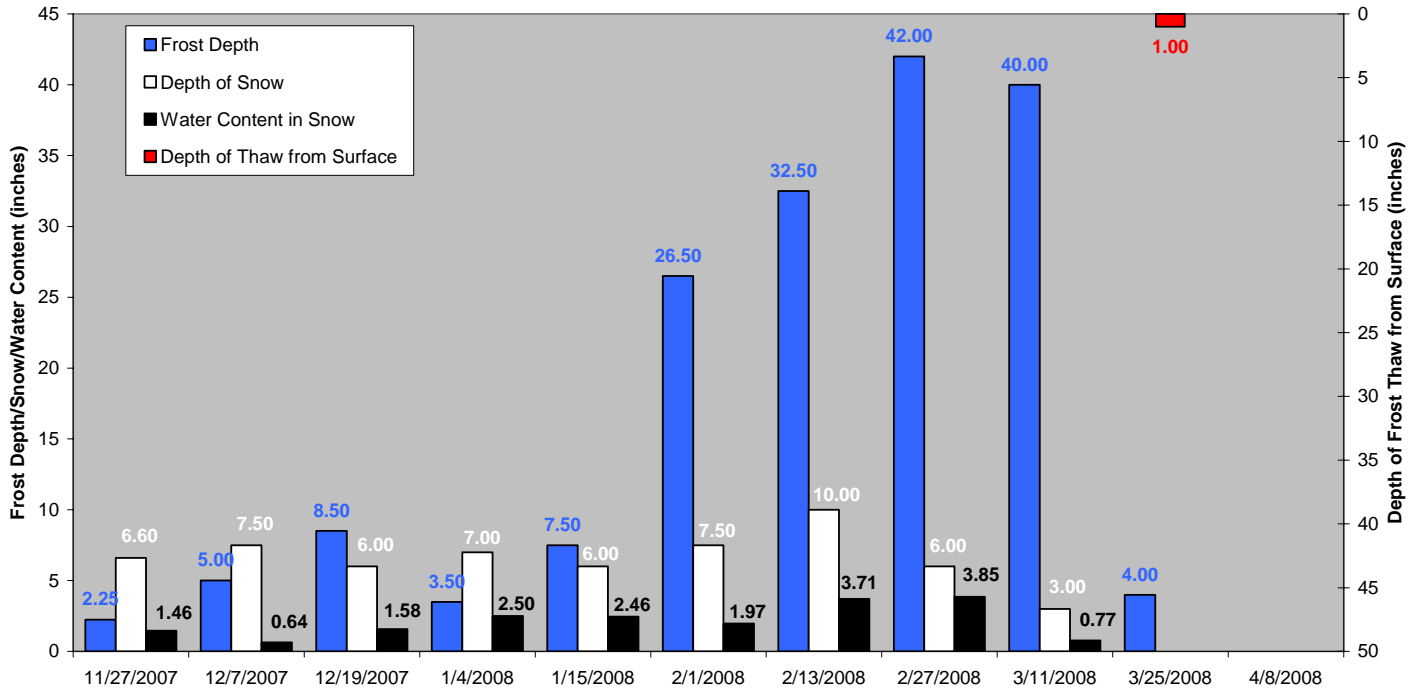
CDP 85 West Side/Low Slope



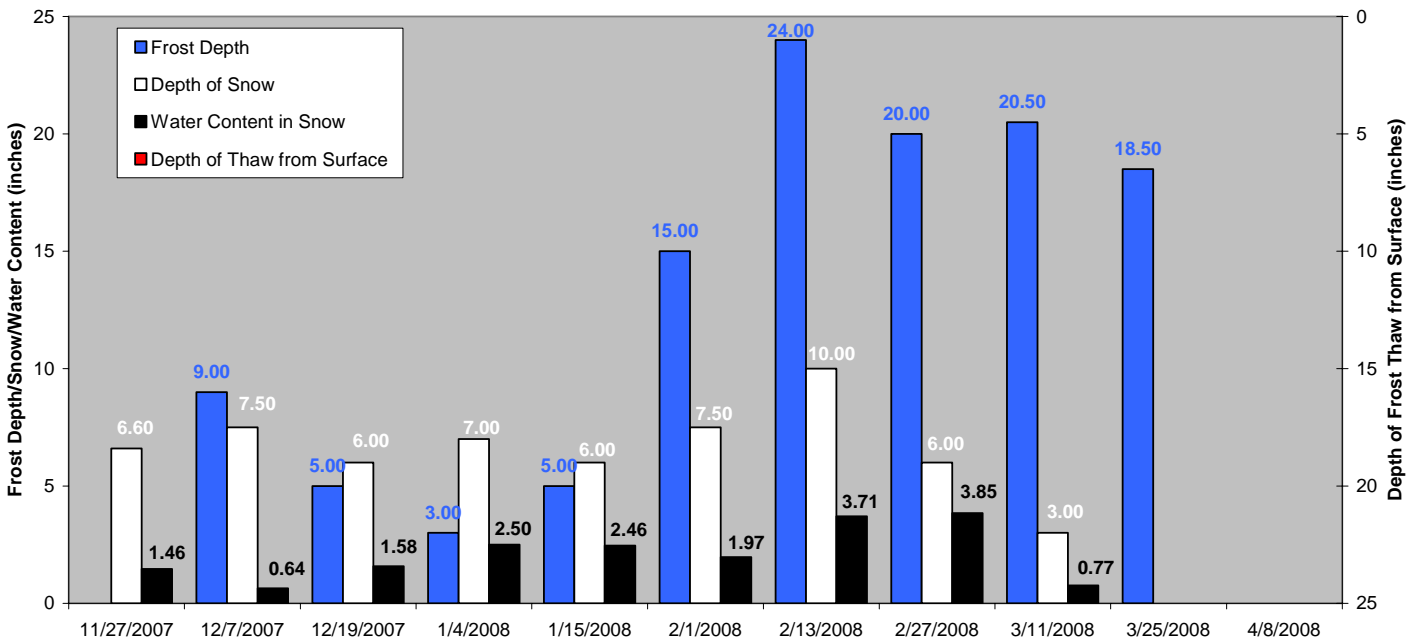
CDP 85 West Side/High Slope



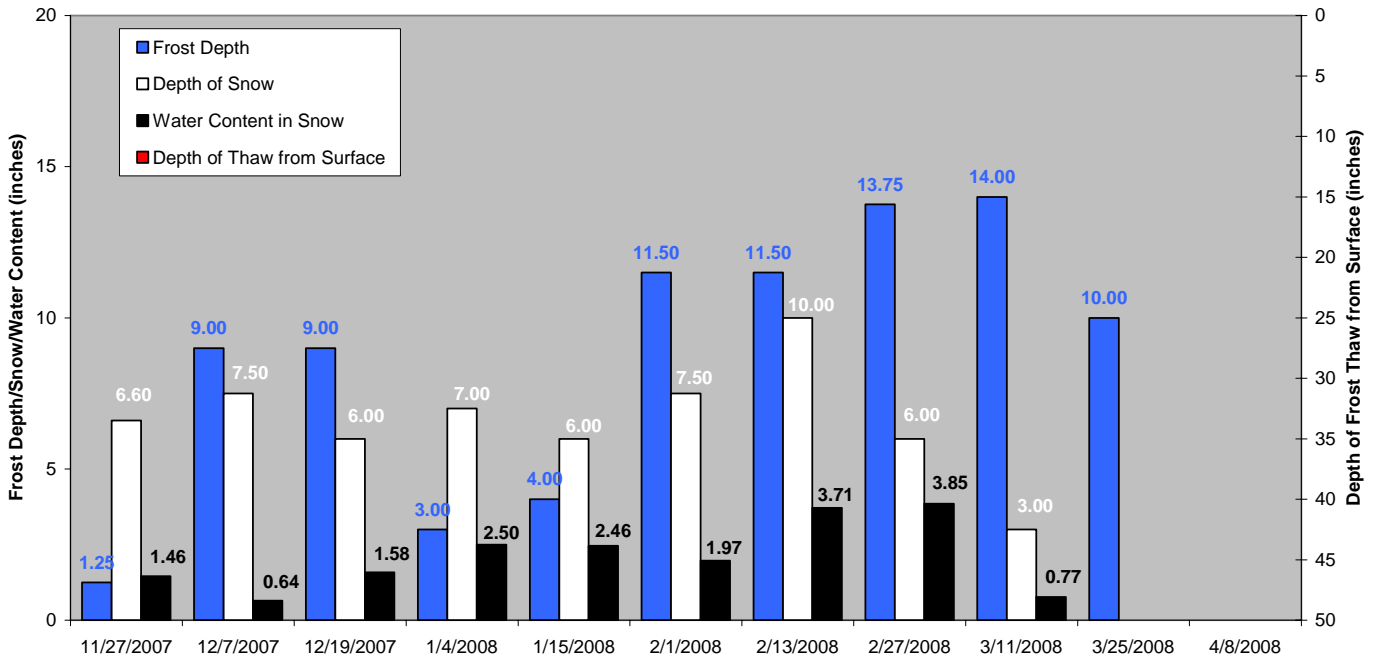
### CDP 85 East Side/Low Slope



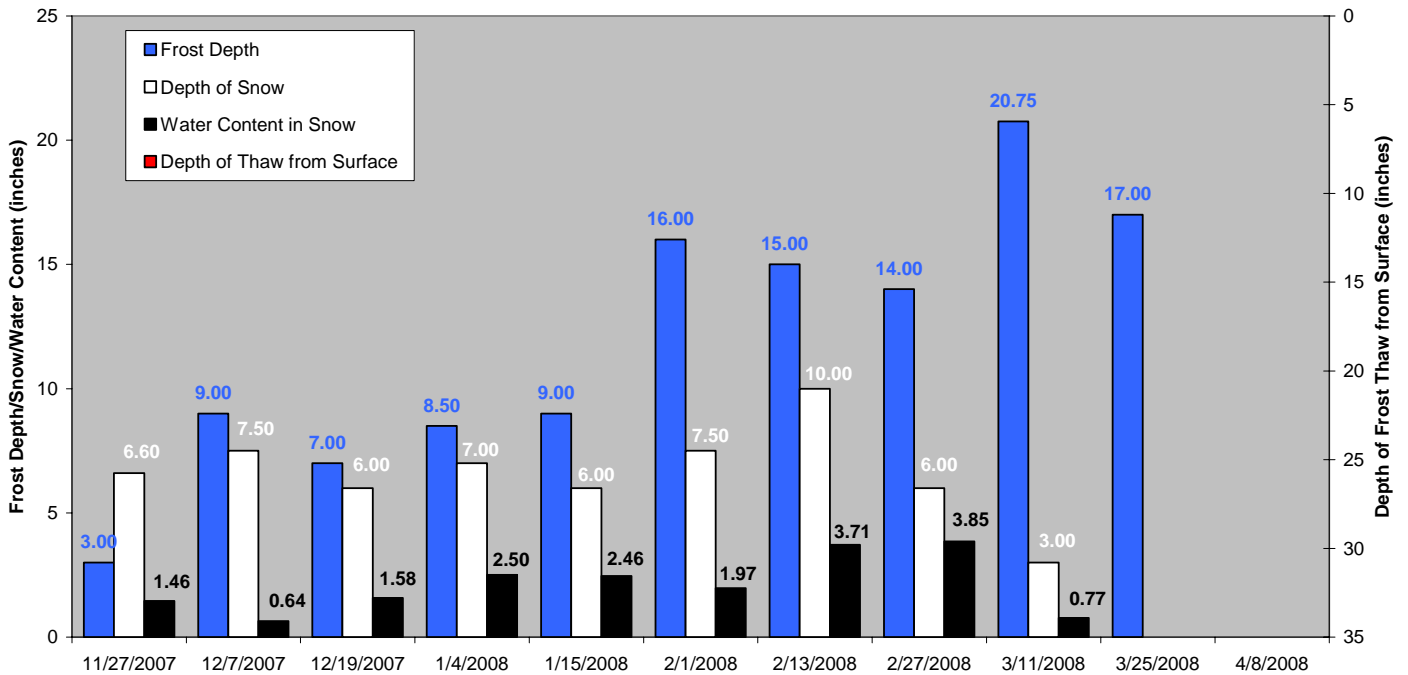
### CDP 85 East Side/High Slope



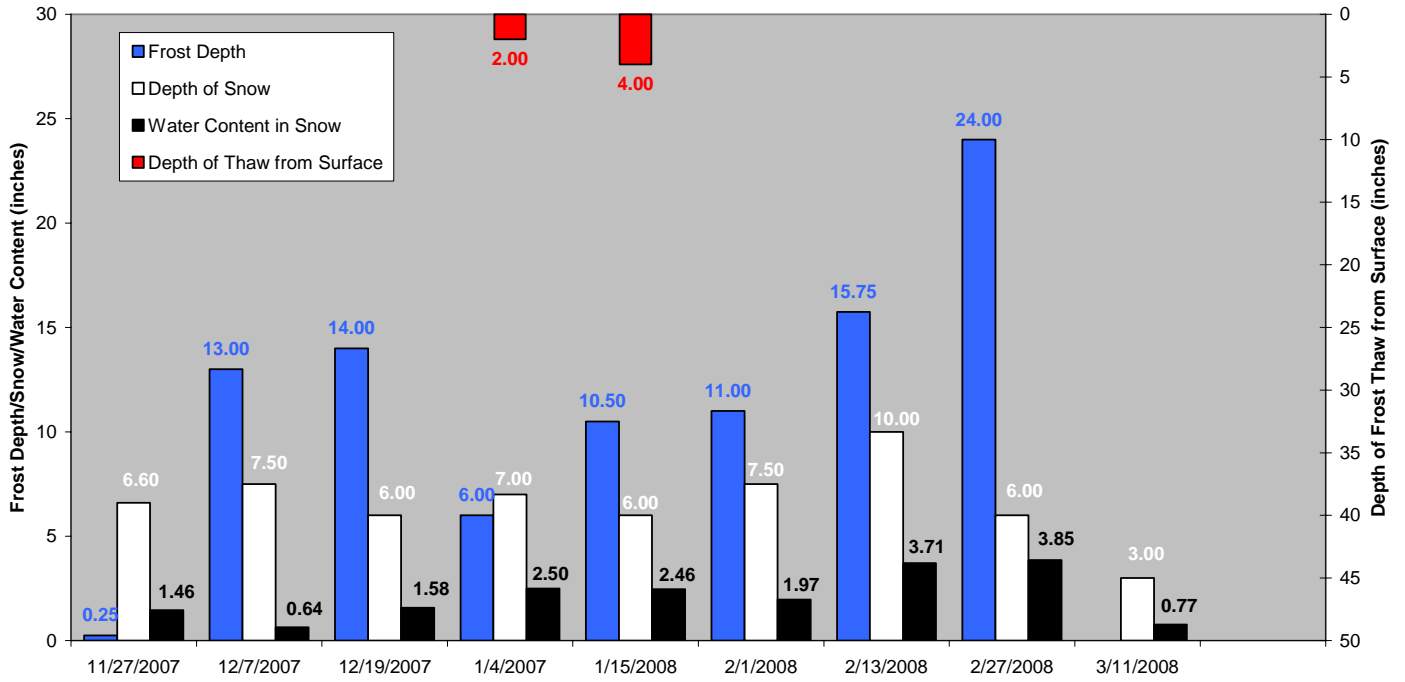
**CDP 85 South Side/Low Slope**



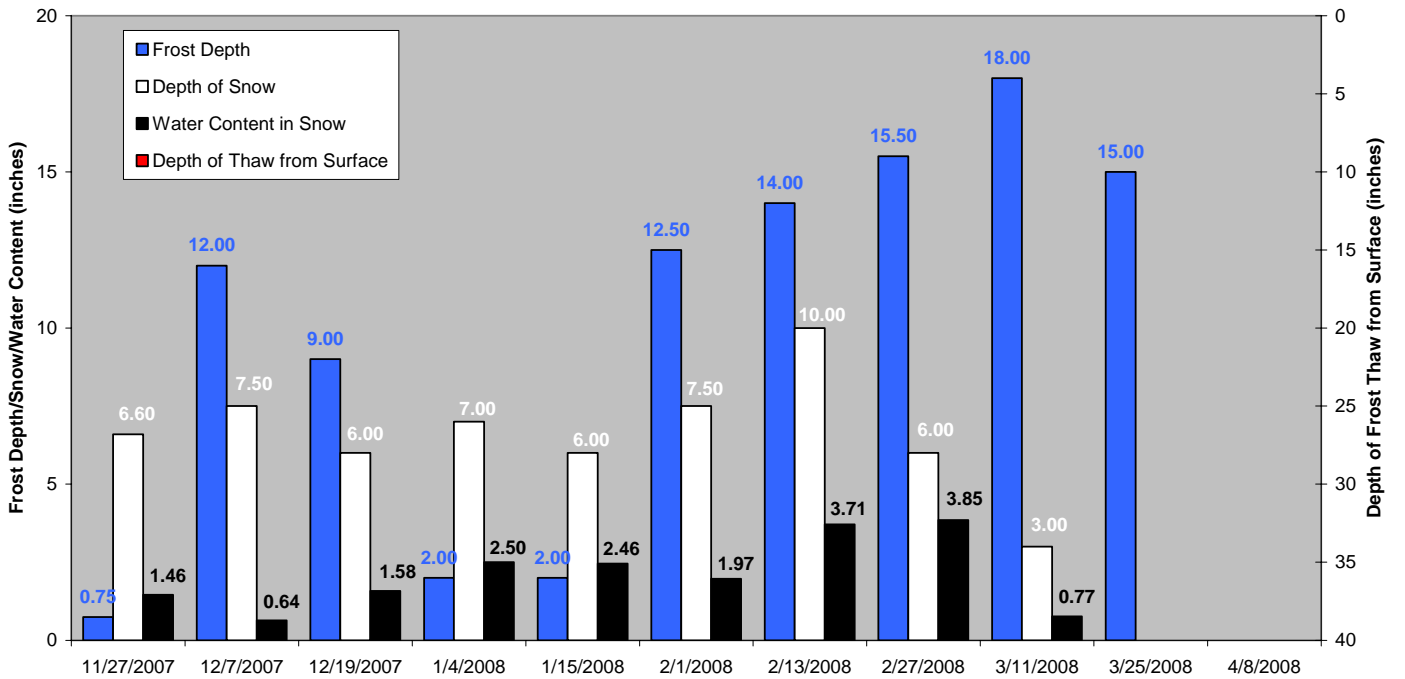
**CDP 85 South Side/High Slope**



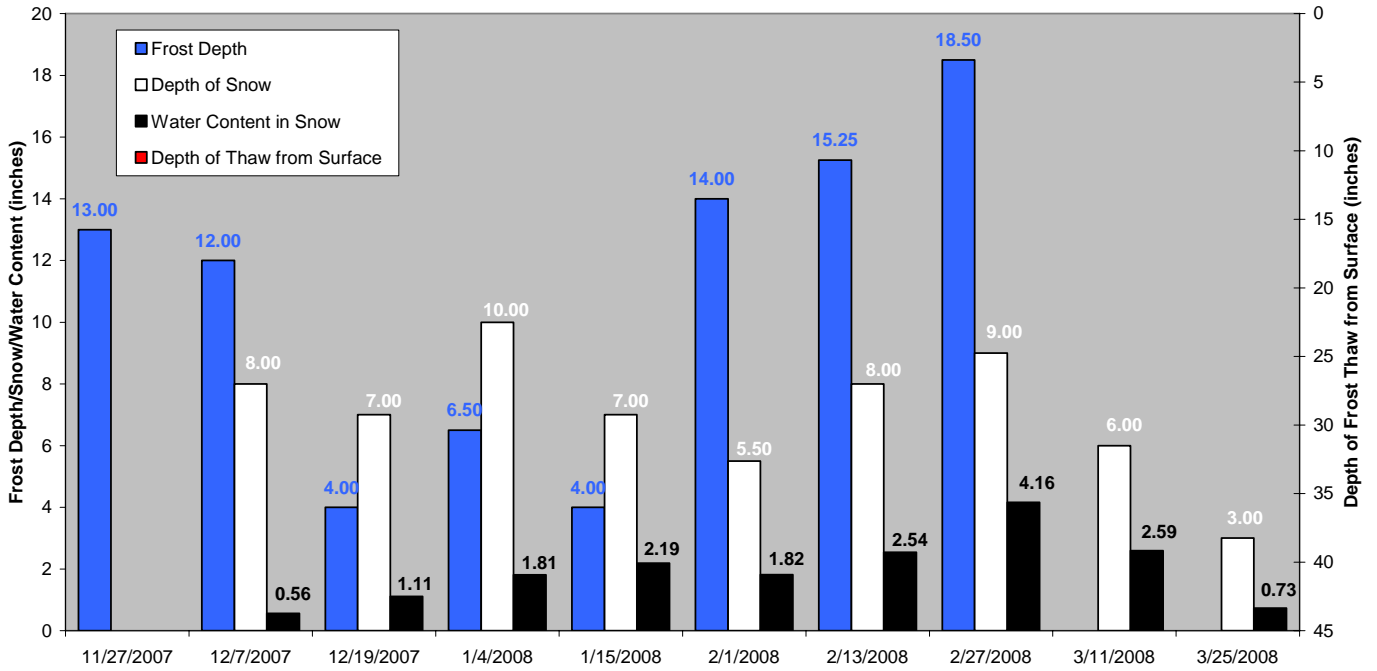
**CDP 85 North Side/Low Slope**



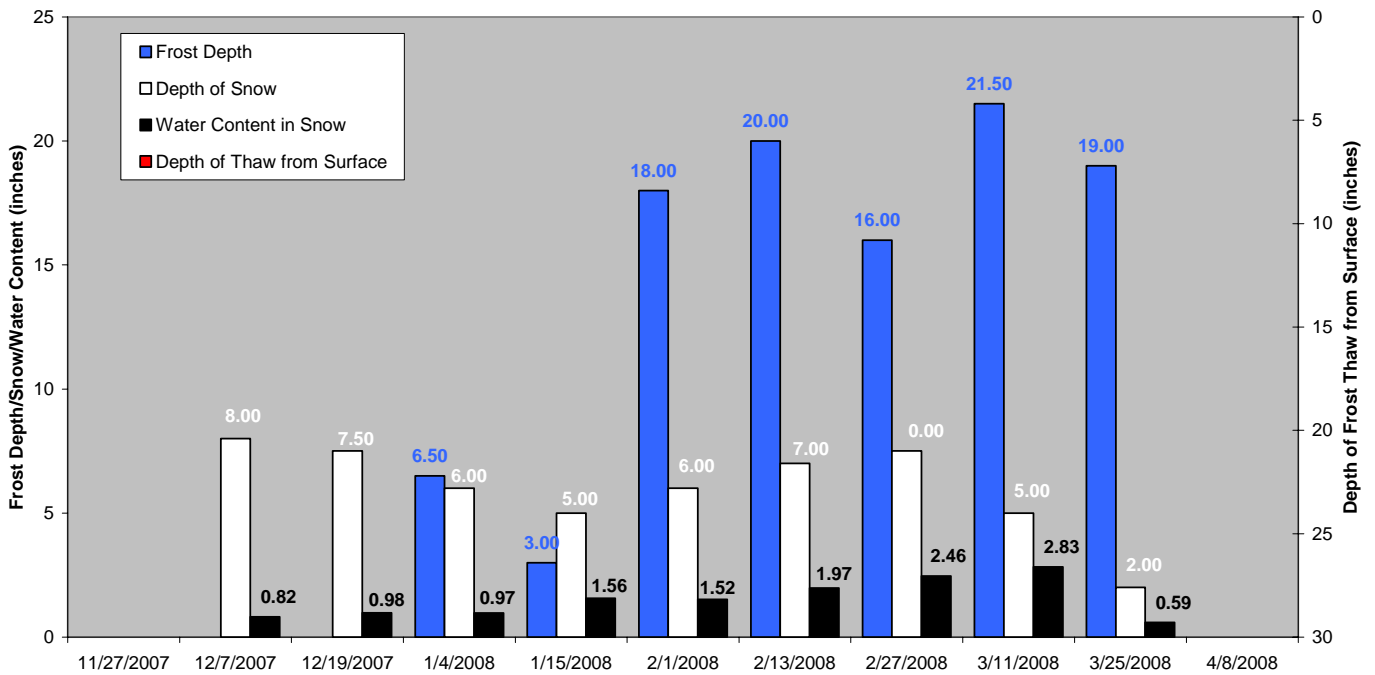
**CDP 85 North Side/High Slope**



Cottage Grove Ravine Park



MS-1



# **APPENDIX**

## **Frost Depth from Surface, Frost Thaw from Surface, Depth of Snow, and Water Content in Snow.**

**\*\*Snow depth and water content are measured at CGRP, the center of the South Basin of CDP 85, and MS-1**

**\*\*All measurements taken are in inches**

<b>CGRP</b>				
<b>Date</b>	<b>Frost</b>	<b>Top thawed</b>	<b>Snow</b>	<b>Water Content</b>
11/27/2007	13.00			
12/7/2007	12.00		8.00	0.56
12/19/2007	4.00		7.00	1.11
1/4/2008	6.50		10.00	1.81
1/15/2008	4.00		7.00	2.19
2/1/2008	14.00		5.50	1.82
2/13/2008	15.25		8.00	2.54
2/27/2008	18.50		9.00	4.16
3/11/2008	0.00		6.00	2.59
3/25/2008	0.00		3.00	0.73

<b>MS-1</b>				
<b>Date</b>	<b>Frost</b>	<b>Top Thawed</b>	<b>Snow</b>	<b>Water Content</b>
11/27/2007	0.00			
12/7/2007	0.00		8.00	0.82
12/19/2007	0.00		7.50	0.98
1/4/2008	6.50		6.00	0.97
1/15/2008	3.00		5.00	1.56
2/1/2008	18.00		6.00	1.52
2/13/2008	20.00		7.00	1.97
2/27/2008	16.00		7.50	2.46
3/11/2008	21.50		5.00	2.83
3/25/2008	19.00		2.00	0.59
4/8/2008	0.00		0.00	

<b>NH</b>		
<b>Date</b>	<b>Frost</b>	<b>Top Thawed</b>
11/27/2007	0.75	
12/7/2007	12.00	
12/19/2007	9.00	
1/4/2008	2.00	
1/15/2008	2.00	
2/1/2008	12.50	
2/13/2008	14.00	
2/27/2008	15.50	
3/11/2008	18.00	
3/25/2008	15.00	
4/8/2008	0.00	

<b>NL</b>		
<b>Date</b>	<b>Frost</b>	<b>Top Thawed</b>
11/27/2007	0.25	
12/7/2007	13.00	
12/19/2007	14.00	
1/4/2007	6.00	2.00
1/15/2008	10.50	4.00
2/1/2008	11.00	
2/13/2008	15.75	
2/27/2008	24.00	
3/11/2008	0.00	

<b>SH</b>		
<b>Date</b>	<b>Frost</b>	<b>Top Thawed</b>
11/27/2007	3.00	
12/7/2007	9.00	
12/19/2007	7.00	
1/4/2008	8.50	
1/15/2008	9.00	
2/1/2008	16.00	
2/13/2008	15.00	
2/27/2008	14.00	
3/11/2008	20.75	
3/25/2008	17.00	
4/8/2008	0.00	

<b>SL</b>		
<b>Date</b>	<b>Frost</b>	<b>Top Thawed</b>
11/27/2007	1.25	
12/7/2007	9.00	
12/19/2007	9.00	
1/4/2008	3.00	
1/15/2008	4.00	
2/1/2008	11.50	
2/13/2008	11.50	
2/27/2008	13.75	
3/11/2008	14.00	
3/25/2008	10.00	
4/8/2008	0.00	

<b>EH</b>		
<b>Date</b>	<b>Frost</b>	<b>Top Thawed</b>
11/27/2007	0.00	
12/7/2007	9.00	
12/19/2007	5.00	
1/4/2008	3.00	
1/15/2008	5.00	
2/1/2008	15.00	
2/13/2008	24.00	
2/27/2008	20.00	
3/11/2008	20.50	
3/25/2008	18.50	
4/8/2008	0.00	

<b>EL</b>		
<b>Date</b>	<b>Frost</b>	<b>Top Thawed</b>
11/27/2007	2.25	
12/7/2007	5.00	
12/19/2007	8.50	
1/4/2008	3.50	
1/15/2008	7.50	
2/1/2008	26.50	
2/13/2008	32.50	
2/27/2008	42.00	
3/11/2008	40.00	
3/25/2008	4.00	1.00
4/8/2008	0.00	

<b>WH</b>		
<b>Date</b>	<b>Frost</b>	<b>Top Thawed</b>
11/27/2007	0.00	
12/7/2007	7.00	
12/19/2007	10.50	
1/4/2008	2.50	
1/15/2008	0.00	
2/1/2008	9.50	
2/13/2008	10.00	
2/27/2008	11.00	
3/11/2008	10.50	
3/25/2008	10.00	
4/8/2008	0.00	

<b>WL</b>		
<b>Date</b>	<b>Frost</b>	<b>Top Thawed</b>
11/27/2007	0.00	
12/7/2007	3.50	
12/19/2007	9.50	
1/4/2008	2.00	
1/15/2008	2.50	
2/1/2008	11.50	
2/13/2008	13.50	
2/27/2008	15.50	
3/11/2008	18.50	
3/25/2008	12.00	
4/8/2008	0.00	

<b>SC of CDP85</b>				
<b>Date</b>	<b>Frost</b>	<b>Top Thawed</b>	<b>Snow</b>	<b>Water Content</b>
12/7/2007			6.60	1.46
12/19/2007			7.50	0.64
1/4/2008			6.00	1.58
1/15/2008			7.00	2.50
2/1/2008			6.00	2.46
2/13/2008			7.50	1.97
2/27/2008			10.00	3.71
3/11/2008			6.00	3.85
3/25/2008			3.00	0.77
4/8/2008			0.00	

This snow depth measurement is the average of the center of the south basin of CDP 85 and fields around CDP 85

<b>86-1</b>		
<b>Date</b>	<b>Frost</b>	<b>Top Thawed</b>
11/27/2007	0.00	
12/7/2007	6.50	
12/19/2007	7.00	
1/4/2008	3.50	
1/15/2008	2.50	
2/1/2008	9.50	
2/13/2008	13.00	
2/27/2008	16.50	
3/11/2008	16.00	
3/25/2008	13.00	1.50
4/8/2008	0.00	

<b>86-2</b>		
<b>Date</b>	<b>Frost</b>	<b>Top Thawed</b>
11/27/2007	11.00	
12/7/2007	11.50	
12/19/2007	11.25	
1/4/2008	10.50	
1/15/2008	10.25	
2/1/2008	23.00	
2/13/2008	29.00	
2/27/2008	42.00	
3/11/2008	44.00	
3/25/2008	38.00	3.00
4/8/2008	25.50	20.00

<b>86-3</b>		
<b>Date</b>	<b>Frost</b>	<b>Top Thawed</b>
11/27/2007	0.00	
12/7/2007	9.50	
12/19/2007	4.25	
1/4/2008	2.00	
1/15/2008	0.00	
2/1/2008	17.50	
2/13/2008	19.00	
2/27/2008	18.00	
3/11/2008	18.75	
3/25/2008	17.50	
4/8/2008	0.00	

<b>86-4</b>		
<b>Date</b>	<b>Frost</b>	<b>Top Thawed</b>
11/27/2007	12.00	
12/7/2007	12.50	
12/19/2007	16.00	
1/4/2008	12.50	
1/15/2008	10.75	
2/1/2008	21.00	
2/13/2008	23.25	
2/27/2008	26.25	
3/11/2008	29.75	
3/25/2008	26.50	0.50
4/8/2008	27.00	12.25