US Army Corps of Engineers

Ice Reconnaissance Report
Red River of the North Basin
February, 2003

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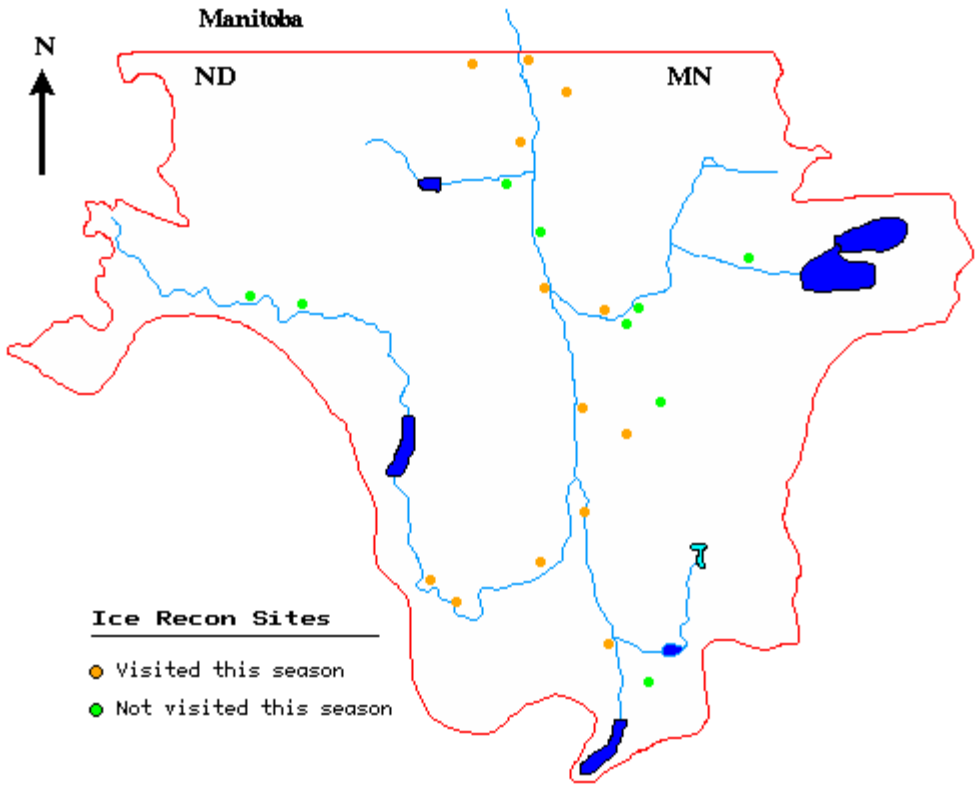
GENERAL

A field reconnaissance to assess ice conditions in the Red River of the North Basin, was conducted from February 25 to February 28, 2003. The purpose of the reconnaissance effort was to collect river ice data and prepare a report for the St. Paul District Readiness Branch. Ice and snow depth measurements were taken at 13 locations. Observations were recorded and photographs were taken at selected locations.

Air temperatures in the Red River Valley this winter season have been above normal for most of the winter. Colder than normal air temperatures became common after January 10th. The last week of February, during the reconnaissance period, temperatures dropped below normal.

From February 25th to February 28th snow was visible only in roadside ditches and in sheltered areas. In open fields south of Fargo, North Dakota, only traces of snow were visible. Snow in the fields become more prevalent north of Fargo. Culverts were generally observed to be snow-covered. Larger ditches and judicial drains appeared to be about half-full of snow.

Red River of the North Ice Measurement Sites



BACKGROUND

Prior to each year's reconnaissance, Data Collection Platforms (DCPs) are queried for current stage readings. This data is compared to stage readings from previous years to determine if there are any areas requiring special consideration. Some remote sensing gages have a tendency to become stuck. These sites are noted and the gage house is checked during the trip. The *River Ice Summary Table* product from the River Ice Network provides some advance information of winter conditions in the basin. Inspection of these resources indicated that no significant observations had been made for the 2002-2003 winter season.

Snow, frost depth , and precipitation data from the St. Paul District field sites, the National Weather Service and other agencies were reviewed prior to the reconnaissance.

DCP Stage readings typical for the first two weeks in February

Year	Wahpeton	Halstad	Fargo	Grand Forks	Drayton	Crookston
1990	3.90	4.31	13.81	14.78	9.82	
1991	3.46	3.36	13.53	14.73	9.64	
1992	3.71	4.41	14.01	15.02	10.14	
1993	4.24	5.25	14.51	15.61	11.22	
1994	5.4	6.4	14.8	16.1	11.6	

1995	5.4	6.4	14.3	16.0	12.4	6.9
1996	5.15	3.2	14.7	12.27	6.73	8.0
1997	6.38	7.42	15.0	16.4	12.0	8.24
1998	5.2	6.3	14.6	16.3	12.0	8.1
1999	6.22	8.35	15.37	16.2	11.75	6.22
2000	5.2	6.2	16.0	16.2	11.5	6.7
2001	6.40	7.66	15.27	16.96	12.10	8.25
2002	5.73	7.2	14.5	16.56	11.25	6.5
2003	5.2	5.5	15.7	15.4	10.6	5.2

St Paul District Weekly Winter Bulletin

Location	Week of	Snow Depth (inches)	Water Content (inches)	Lake or River Ice Thickness (inches)	Frost Depth (inches)
Lake Traverse	02FEB2003	1.5	0.29	23	29
	09FEB2003	2.0	0.34	24	30
	16FEB2003	2.5	0.35	26	33
	23FEB2003	0.5	0.04	27	34
Baldhill Dam	02FEB2003	9.0	1.43	25	38
	09FEB2003	9.0	1.46	25	38
	16FEB2003	10.5	1.70	29	40
	23FEB2003	11.0	1.71	28	43
Orwell Dam	02FEB2003	1.5	0.23	22	30
	09FEB2003	2.0	0.24	23	32
	16FEB2003	2.5	0.30	23	32
	23FEB2003	1.0	0.06	25	33
Lake Winnibigoshish	02FEB2003	6.0	1.50	27	27
	09FEB2003	7.0	1.50	30	32
	16FEB2003	8.0	1.50	31	32
	23FEB2003	8.0	1.50	34	34
Gull Lake	02FEB2003	2.0	0.34	24	
	09FEB2003	2.0	0.38	26	
	16FEB2003	2.0	0.41	27	
	23FEB2003	3.0	0.43	28	
Leech Lake	02FEB2003	5.0	0.77	28	29
	09FEB2003	5.0	0.90	28	30
	16FEB2003	6.0	1.07	30	33
	23FEB2003	6.0	1.17	32	36
Cross Lake	02FEB2003	1.0	0.25	20	

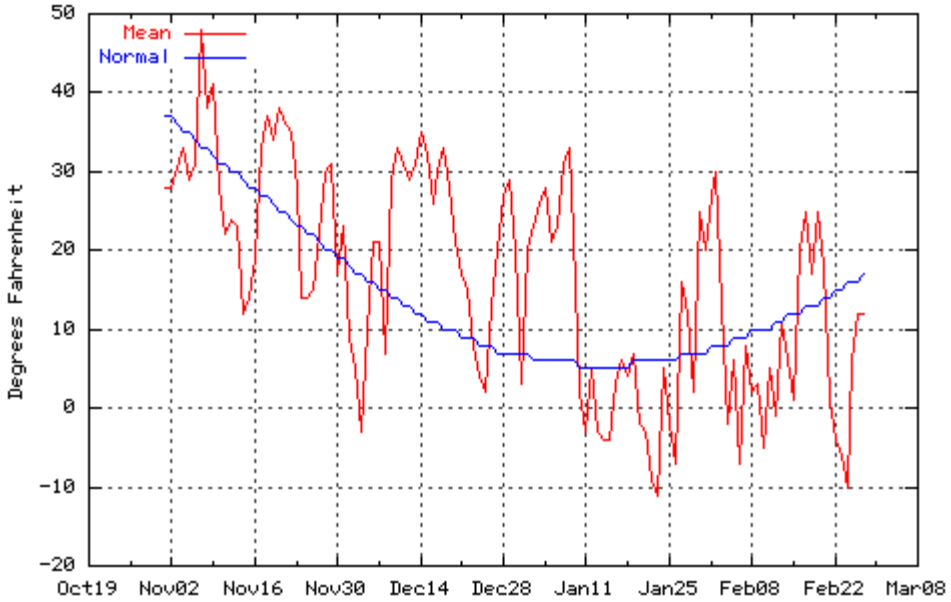
Pokegama Lake	02FEB2003	3.0	0.50	26	27
	09FEB2003	3.0	0.50	30	32
	16FEB2003	4.0	1.00	30	32
	23FEB2003	3.0	0.75	32	34
Big Sandy Lake	02FEB2003	1.0	0.30	24	30
	09FEB2003	1.0	0.35	30	30
	16FEB2003	2.0	0.40	30	32
	23FEB2003	2.0	0.45	32	36
Lac Qui Parle	02FEB2003	12.5	1.00	22	38
	09FEB2003	10.0	0.97	18	38
	16FEB2003	11.0	1.78	18	38
	23FEB2003	5.8	1.45	20	39
Notes: M = Missing ? = Indeterminate					

Accumulated Freezing Degree Days

Daily air temperatures, snow depths, and Accumulated Freezing Degree Day (AFDD) data are updated daily on the Districts's Water Control Web Server. This information is used to continuously monitor conditions during the winter season to track ice growth potential. Plots of air temperatures, snow depths, and AFDD data for Fargo and Grand Forks are shown below. The raw AFDD data for Fargo, ND and Grand Forks, ND are available by clicking on the city name hyperlink.

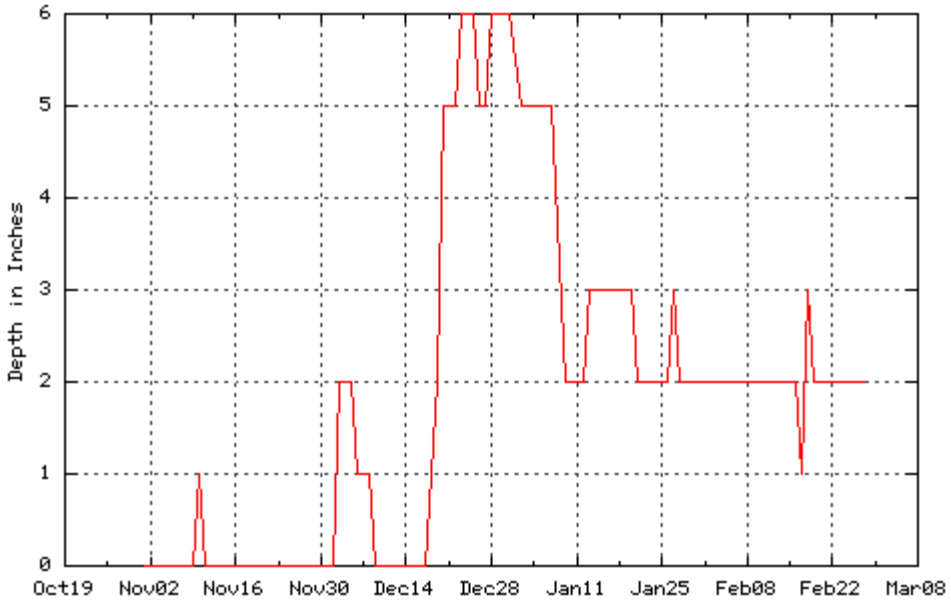
Fargo, North Dakota

Seasonal data for Fargo, ND
Daily and Normal Average Air Temperature

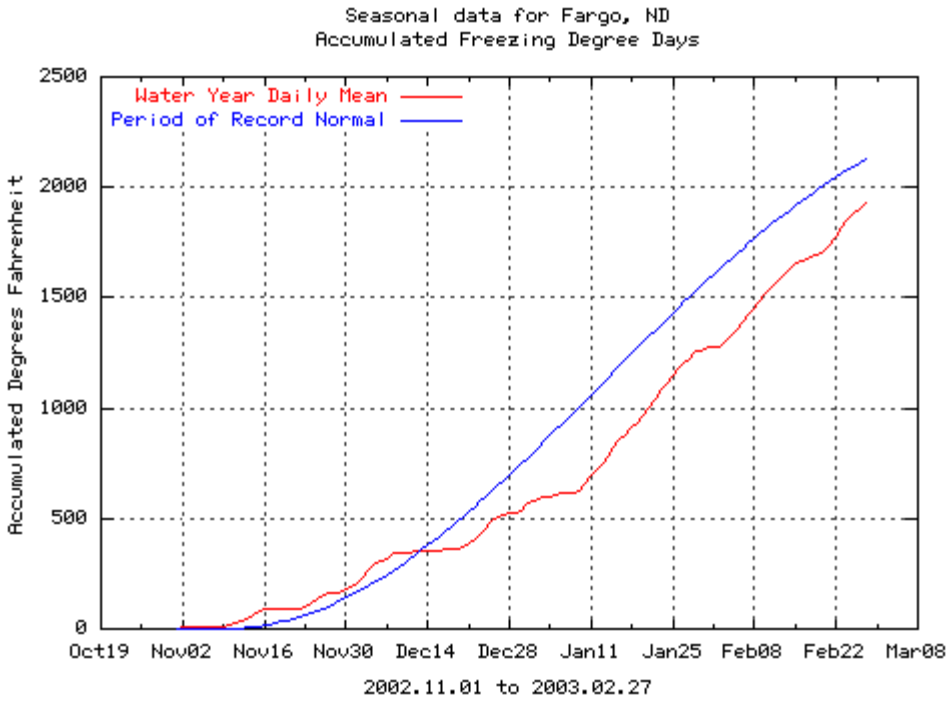


2002.11.01 to 2003.02.27

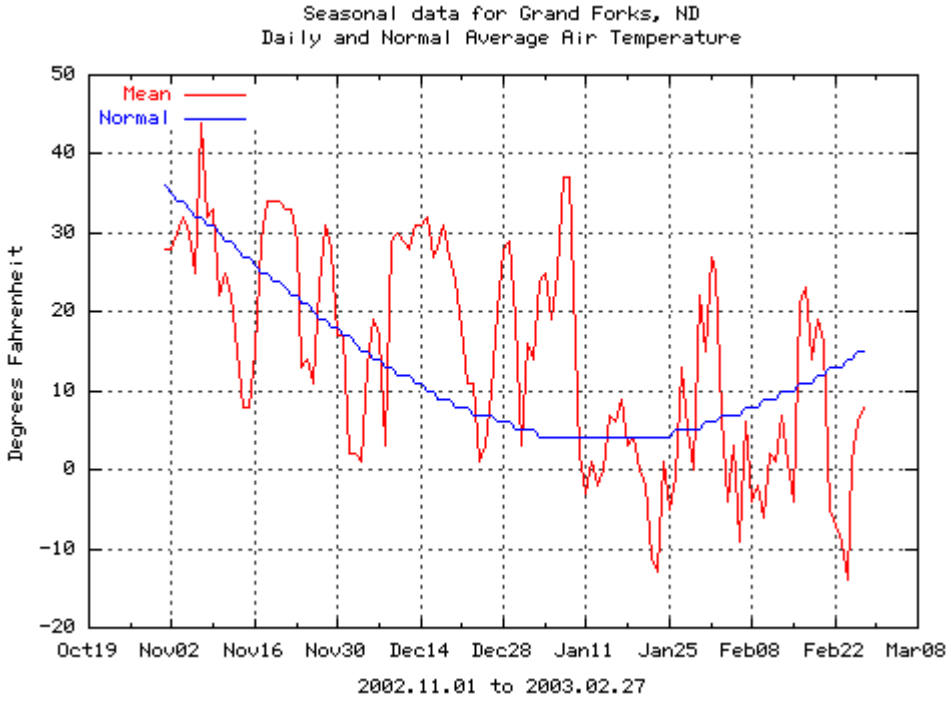
Seasonal data for Fargo, ND
Snow Depth on the Ground

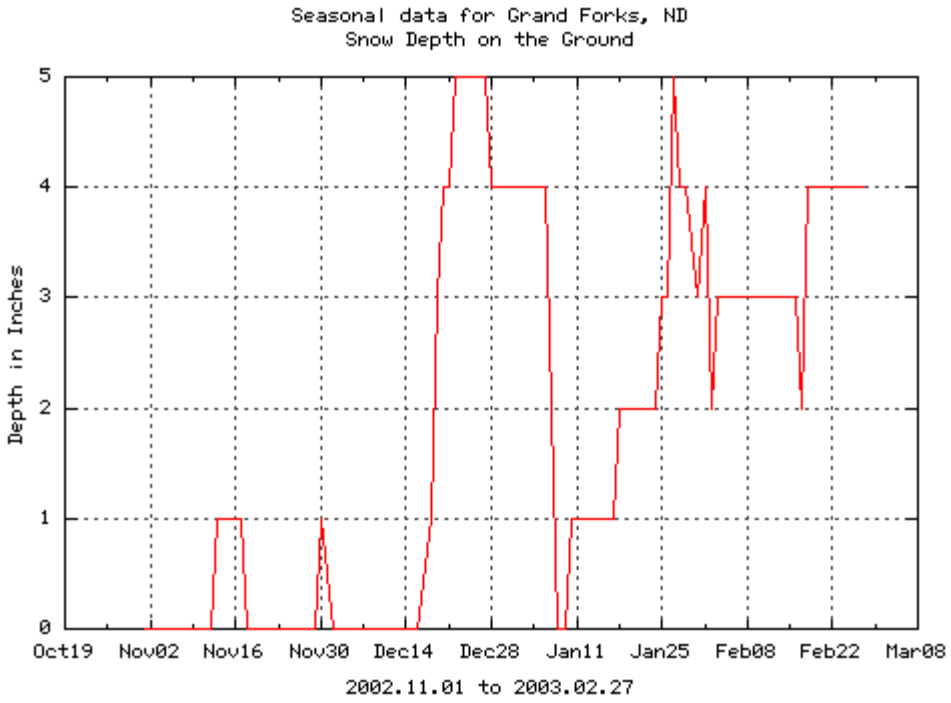


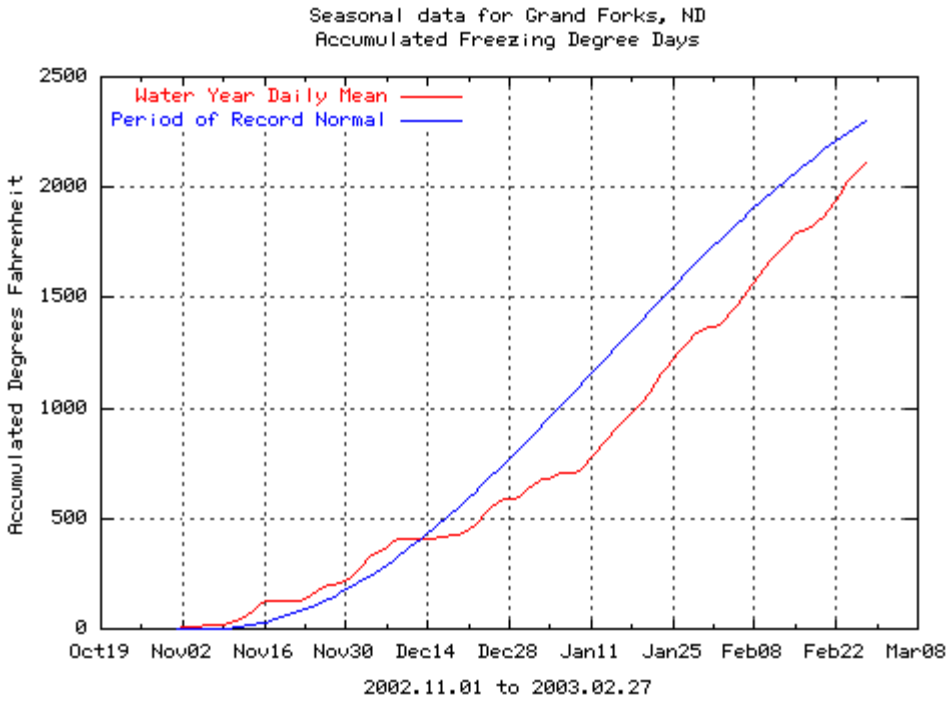
2002.11.01 to 2003.02.27



Grand Forks, North Dakota







GENERAL OBSERVATIONS FOR THE RED RIVER VALLEY:

a. All of the rivers were well within bank. Along the mainstem of the Red River of the North, stages appear to be somewhat lower than usual for this time of year.

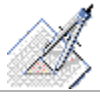
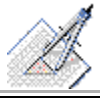
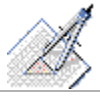
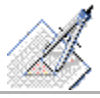
b. The amount of ice cover fall since freezeup was noticed only at Pembina. Usually the ice cover fall is noticed at Grand Forks and increases as one travels north.

c. Snow cover on the Red River of the North and tributaries was 100-percent. With the least amount of snow cover observed south of Fargo, North Dakota.

ICE MEASUREMENTS

Snow and ice measurements are now available in SHEF format. Ice measurement summaries are shown in the following table.

Red River of the North Drainage Basin Ice Reconnaissance
Summary February 25 to February 28, 2003

River Name	Location	Site Data	Gage Reading	Ice Thickness (feet)	Water Depth (feet)	Top Width (feet)	Snow Cover (feet)
Red River of the North	Wahpeton, ND Breckenridge, MN		5.19	1.8	3.9	100	0.05
Red River of the North	Halstad, MN		5.49	1.98	8.5	200	0.5
Red River of the North	Fargo, ND Moorhead, MN		15.72	2.24	11.6	156	0.15
Red River of the North	Grand Forks, ND		15.41	1.80	11.2	236	0.35
Red River of the North	Drayton, ND		10.6	1.5	11.3	309	0.58
Red River of the North	Pembina, ND		10.68	2.1	10.3	258	0.52
Red Lake River	Crookston, MN		5.15 (Gage)	1.57	13.6	198	0.85
Sheyenne River	near Kindred, ND		3.46 (Gage)	1.53	1.65	56	0.35
Sheyenne River	Fort Ransom, ND		3.1	1.45	3.6	73	0.45
Sheyenne River	Lisbon, ND		-12.9	1.85	10.2	141	0.45

Two Rivers	Hallock, MN		6.83 (DCP)	1.0	N-A	47	0.60
Pembina River	Neche, ND		-27.6	3.0	5.3	51	0.26
Wild Rice River	SW of Ada, MN		-13.75	2.2	N-A	57	0.25

Photographs and Site Specific Observations in chronological order

	**Red River of the North at Wahpeton, ND**: Measured 0.05 foot of snow on top of 0.2 foot of snow ice followed by clear, black lake ice for a total ice thickness of 1.8 feet. The USGS gage reading was 5.19 feet. View the engineering drawing. *February 27, 2003 at 14h23*
No Photo	**Red River of the North at Halstad, MN**: Observed a half a foot of snow on top of the ice, 100-percent coverage. Measured 1.98 feet of Clear black lake ice. No visible sign of old Highway bridge or bridge supports. View the engineering drawing. *February 26, 2003 at 17h50*
No Photo	**Red River of the North at Fargo, ND**: Measured 2.24 of clear, black, lake ice topped with 0.12 foot of snow ice. Ice cover is solid with no fall observable. View the engineering drawing. *February 27, 2003 at 15h37*
	**Red River of the North at Grand Forks, ND**: Measured 0.35 foot of snow. Observed 0.18 foot of snow ice on top of clear, black lake ice measured at 1.8 feet thick. View to view the engineering drawing. *February 25, 2003 at 15h00*
	**Red River of the North at Drayton, ND**: 100-percent cover snow covers the river. Measured one ice thickness of 1.5 feet in clear, black lake ice. View the engineering drawing. *February 26, 2003 at 08h45*
	**Red River of the North at Pembina, ND**: Half foot of snow cover is typical. River ice thickness of 2.1 foot measured. Ice cover fall less than half-foot since initial freezeup. View the engineering drawing. *February 26, 2003 at 11h05*
	**Red Lake River at Crookston, MN**: At the Broadway Avenue Bridge 0.85 foot of uncompacted snow was found on top of 1.57 feet of solid clear, black lake ice. The DCP reading was 5.15 feet. View the engineering drawing. *February 26, 2003 at 15h32*
No Photo	**Sheyenne River near Kindred, ND**: Observed 0.35 foot of snow on top of 1.53 foot of clear black lake ice just upstream of the Gol Bridge near Kindred. View the engineering drawing. *February 27, 2003 at 13h30*

No Photo	**Sheyenne River at Fort Ransom, ND**: Measured 0.45 foot of snow on top of clear black lake ice. *February 27, 2003 at 11h00*
	**Sheyenne River at Lisbon, ND**: 0.45 foot of snow on top of 1.85 foot of clear black lake ice just upstream of the Highway bridge in the pool created by the Lisbon dam. Tailwater gage reads 2.12 feet. View the engineering drawing. *February 27, 2002 at 11h45*
	**South Branch Two Rivers at Hallock, MN**: Ice surface cracked and discontinuous. Water flowing on top of ice in areas upstream of bridge. View the engineering drawing. *February 26, 2003 at 13:07*
No Photo	**Pembina River at Neche, ND**: Measured 3.0 feet of ice thickness. River is frozen completely from top to bottom - bottomed out on measurement. Observed 0.3 foot of snow ice on top of clear, black lake ice. View the engineering drawing. *February 26, 2003 at 10h40*
	**Wild Rice River at Ada, MN**: Measured 2.2 feet of ice...no water visible. 0.25 foot of snow cover is very typical of entire river in this reach. View the engineering drawing. *February 26, 2003 at 17h00*

EVALUATION:

According to the National Weather Service, the summer of 2002 was the fourth wettest on record. November and December were dry months with very little if any precipitation or snow. Frost depths are deeper than average. Temperatures in the Red River of the North basin have been milder than normal, resulting in ice thickness that are below normal.

Comparing the ice thickness computations provided by the AFDD products to the thicknesses measured on this trip and measurements taken at Corps of Engineers field sites indicates that the AFDD thickness computations match very well with the of observed values if a coefficent between 13 and 15 is used.

The clear, black lake ice observed is indicitive of strong, competent ice and very little degradation of the ice cover can be expected prior to breakup in most areas. Based on field tests conducted during the winter season of 1998-1999 by researchers from the US Army Cold Regions Research and Engineering Laboratory (CRREL), with some snow cover on the ice, even at breakup the ice cover can be expected to retain the vast majority of its compressive and flexural strength. Areas which no snow on the ice cover will be more prone to absorb solar energy and candle more quickly resulting in reduced mechanical strenght.

There are some exceptions, and these areas are those where flows from upstream reservoirs and significant drainage systems can thin the ice cover from the bottom. The areas which would be expected to experience thin ice and open water is the South Branch Two Rivers between Lake Bronson and Hallock, MN.

CONCLUSION:

Based on the information collected, and barring any major meteorlogical event, the ice jam potential is somewhat less than normal along throughout the basin. Historically speaking, ice jamming is not a major concern on the Red River of the North once flood stages are reached, but rather on the tributaries. Since most ice jams are driven by local meteorlogical events, ice jams are still possible.

Ice jamming at bridges during the initial phases of breakup could be more prevalent due to locally thicker ice at bridges. Locations where there are both highway and railroad bridges are in close proximity, severe bends, and changes in river slope could experience ice jams should weather conditions produce a more rapid than usual snowmelt or rain.

The prudent thing to do is monitor the AFDD or daily average air temperature. When the AFDD goes negative (air temperatures stay above freezing), ice movement within a short time can be realized. Locations where ice jams have historically occurred, however should be alert to rapidly changing weather/climate changes.