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PROBABILISTIC HYDROLOGIC OUTLOOK  
NATIONAL WEATHER SERVICE EASTERN NORTH DAKOTA/GRAND FORKS ND  
1046 AM CST Thu Feb 23 2023

...SPRING FLOOD AND WATER RESOURCES OUTLOOK...

...RED RIVER BASIN OUTLOOK FOR RIVER FLOOD POTENTIAL...

This outlook covers the Red River of the North  
and its Minnesota and North Dakota tributaries.

...MINOR TO ISOLATED MODERATE SPRING FLOODING IS EXPECTED ACROSS THE  
RED RIVER OF THE NORTH BASIN...

\* This 90-day outlook covers the period from 2/27/2023 to 5/28/2023.

.OUTLOOK SUMMARY...

\* Probabilities for exceeding Major, Moderate, Minor Flood Stage...

Major Flooding...

There is a medium risk (35 to 65 percent chance) of major flooding  
at Fargo/Moorhead on the Red River. Elsewhere, there is a low risk  
(less than 35 percent chance) of major flooding across the basin.

Moderate Flooding...

There is a high risk (greater than 65 percent chance) of moderate  
flooding at Fargo/Moorhead and Oslo on the Red River.

There is a medium risk (35 to 65 percent chance) of moderate  
flooding at Grand Forks/East Grand Forks, Drayton, and Pembina on the  
Red River. In North Dakota, there is a medium risk of moderate  
flooding at Abercrombie on the Wild Rice River and Harwood on the  
Sheyenne River.

There is a low risk (less than 35 percent chance) of moderate  
flooding elsewhere across the basin.

Minor Flooding...

There is a high risk (greater than 65 percent chance) of minor  
flooding at Wahpeton, Halstad, Grand Forks/East Grand Forks, Oslo,  
Drayton, and Pembina on the Red River. In North Dakota, there is a  
high risk of minor flooding at Abercrombie on the Wild Rice River and  
Enderlin and Mapleton on the Maple River. In Minnesota, there is a  
high risk of minor flooding at Sabin on the South Branch Buffalo  
River, Dilworth on the Buffalo River, Hendrum on the Wild Rice River,  
and Hallock on the Two Rivers River.

There is a medium risk (35 to 65 percent chance) of minor flooding  
at Kindred on the Sheyenne River and Hillsboro on the Goose River in  
North Dakota. In Minnesota, there is a medium risk of minor flooding  
at Hawley on the Buffalo River and Crookston on the Red Lake River.

There is a low risk (less than 35 percent chance) of minor flooding elsewhere across the basin.

#### .OUTLOOK DISCUSSION...

Hydrologic and climate conditions which affect each of the several factors that significantly determine the timing and magnitude of spring snowmelt flooding within the Red River of the North are discussed below:

##### \* FALL PRECIPITATION AND SOIL MOISTURE...

Fall precipitation was below normal across the basin, driest across the lower Sheyenne basin and southern Red River Valley. Soil moisture heading into freeze-up was lower than normal with moderate drought conditions persisting across much of the southern and central portions of the basin with abnormally dry conditions across the north.

##### \* RIVER FLOWS...

Base streamflows are near normal for this time of year.

##### \* FROST DEPTHS...

Frost depths are near normal and deepening as the season continues across northeastern ND (25 to 35 inches). However, they are generally shallower and more variable across southeastern ND and much of the MN portion (15 to 25 inches).

##### \* SNOWPACK CONDITIONS...

The current snowpack and associated water content ranges from normal to above normal across the basin. Since December 1, 2022, cumulative snowfall has been about average for much of northwestern MN while slightly above normal across eastern ND and the far southern Red River Valley. Associated water content generally ranges from 2.0 to 5.0 inches.

##### \* RIVER ICE...

Lake/river observations indicate ice cover is generally thinner and less consistent than normal, likely due to early snow cover.

##### \* FACTORS YET TO BE DETERMINED...

- Further snowpack growth,
- Rate of snowmelt/thaw,
- Heavy rain on snow or frozen ground during thaw or peak flood,
- Heavy rain on ice-covered rivers causing short-term ice jams.

##### \* SHORT TERM WEATHER FORECAST...

Well below normal temperatures will continue through the end of the work week before a relative warm up through the weekend (although still at or below normal values). A generally active weather pattern is also expected to continue with sporadic chances for precipitation with fast moving systems making their way through the region.

##### \* LONG TERM CLIMATE OUTLOOK...

Climate outlooks continue to favor below normal temperatures and

generally above normal precipitation chances through the rest of the winter and into the spring.

.NEXT SPRING FLOOD OUTLOOK...

The next 2023 spring flood outlook will be issued on Thursday, March 9, 2023.

.FLOOD OUTLOOK PROBABILITIES TABLES...

The following message has two sections: the first gives the current and normal/historical chances of river locations reaching their minor, moderate, and major flood category. The second gives the current chances of river locations rising above river stages listed.

...Red River Long-Range Probabilistic Outlook by Flood Category...

Valid from February 27, 2023 to May 28, 2023

In Table 1 below, the current (CS) and historical (HS), or normal, probabilities of exceeding minor, moderate, and major flood stages are listed for the valid time period.

CS values indicate the probability of reaching a flood category based on current conditions.

HS values indicate the probability of reaching a flood category based on historical, or normal, conditions.

When the value of CS is greater than HS, the probability of exceeding that level is higher than normal. When the value of CS is less than HS, the probability of exceeding that level is lower than normal.

...Table 1--Probabilities for Minor, Moderate, and Major Flooding  
Valid Period: 02/27/2023 - 05/28/2023

				: Current and Historical : Chances of Exceeding : Flood Categories : as a Percentage (%)					
Categorical Flood Stages (FT)				:					
Location	Minor	Mod	Major	: CS	HS	CS	HS	CS	HS
-----	-----	-----	-----	: ---	---	---	---	---	---
Red River of the North.....									
WAHPETON	11.0	13.0	15.0	: >95	59	30	28	10	17
HICKSON	30.0	34.0	38.0	: 28	26	11	14	<5	<5
FARGO	18.0	25.0	30.0	: >95	83	66	41	35	26
HALSTAD	26.0	32.0	37.5	: 67	39	28	22	8	12
GRAND FORKS	28.0	40.0	46.0	: >95	57	37	31	6	11
OSLO	26.0	30.0	36.0	: >95	63	>95	56	15	18
DRAYTON	32.0	38.0	42.0	: 77	49	38	32	5	12
PEMBINA	39.0	44.0	49.0	: 86	52	56	43	16	22

: Current and Historical  
: Chances of Exceeding  
: Flood Categories

				:	as a Percentage (%)					
				:	Categorical					
				:	Flood Stages (FT)					
Location	Minor	Mod	Major	:	Minor	Moderate		Major		
-----	-----	-----	-----	:	CS HS	CS HS	CS HS	CS HS	CS HS	
Minnesota Tributaries.....										
Note: The Roseau numbers consider the flow through its diversion										
SABIN	13.0	15.0	19.0	:	94	60	25	17	<5	<5
HAWLEY	8.0	9.0	11.0	:	39	40	22	25	<5	<5
DILWORTH	13.0	20.0	26.0	:	>95	68	27	21	<5	<5
TWIN VALLEY	10.0	12.0	14.0	:	9	17	<5	8	<5	<5
HENDRUM	20.0	28.0	32.0	:	91	53	25	22	<5	7
SHELLY	14.0	20.0	23.0	:	19	28	<5	11	<5	6
CLIMAX	20.0	25.0	30.0	:	26	23	8	12	<5	8
HIGH LANDING	12.0	12.5	13.0	:	<5	12	<5	9	<5	7
CROOKSTON	15.0	20.0	23.0	:	60	48	15	25	<5	9
ABOVE WARREN	67.0	71.0	75.0	:	5	12	<5	<5	<5	<5
ALVARADO	106.0	108.0	110.0	:	10	25	5	17	<5	<5
HALLOCK	802.0	806.0	810.0	:	66	62	21	39	<5	10
ROSEAU	16.0	18.0	19.0	:	<5	21	<5	13	<5	8

				:	Current and Historical					
				:	Chances of Exceeding					
				:	Flood Categories					
				:	as a Percentage (%)					
				:	Categorical					
				:	Flood Stages (FT)					
Location	Minor	Mod	Major	:	Minor	Moderate		Major		
-----	-----	-----	-----	:	CS HS	CS HS	CS HS	CS HS	CS HS	
North Dakota Tributaries.....										
ABERCROMBIE	10.0	12.0	18.0	:	83	42	63	34	16	20
VALLEY CITY	15.0	16.0	17.0	:	<5	10	<5	7	<5	6
LISBON	15.0	17.0	19.0	:	8	11	6	10	<5	7
KINDRED	16.0	19.0	20.5	:	41	21	13	11	6	10
WEST FARGO DVRSN	18.0	20.0	21.0	:	15	12	10	11	8	10
HARWOOD	84.0	86.0	91.0	:	46	26	36	21	14	10
ENDERLIN	9.5	12.0	14.0	:	85	26	20	11	<5	<5
MAPLETON	18.0	21.0	23.0	:	83	36	28	17	<5	5
HILLSBORO	10.0	13.0	16.0	:	45	19	15	10	<5	<5
MINTO	6.0	8.0	11.0	:	18	25	<5	7	<5	<5
WALHALLA	11.0	16.0	18.0	:	11	21	<5	<5	<5	<5
NECHE	18.0	19.0	20.5	:	18	27	15	26	8	20

LEGEND:

CS = Conditional Simulation (Outlook for current conditions)  
HS = Historical Simulation ( " " normal conditions)  
FT = Feet (above gage zero datum)

...Red River Long-Range Probabilistic Outlook by River Stage...

Valid from February 27, 2023 to May 28, 2023

LOCATION	95%	90%	75%	50%	25%	10%	05%
-----	-----	-----	-----	-----	-----	-----	-----
Red River of the North.....							
WHPETON	11.1	11.3	11.7	12.0	13.7	15.0	15.8
HICKSON	21.7	23.0	24.7	26.5	31.1	34.1	34.7
FARGO	21.9	23.3	24.1	27.2	31.5	34.3	36.7

HALSTAD	21.7	22.2	24.2	28.1	33.3	36.3	39.1
GRAND FORKS	31.0	32.1	34.5	38.5	42.2	44.4	47.5
OSLO	31.3	32.1	33.4	34.4	35.4	36.3	37.7
DRAYTON	29.9	30.8	32.1	36.3	40.0	40.8	42.1
PEMBINA	37.2	38.1	40.5	44.8	48.2	50.2	51.5
Minnesota Tribs:	95%	90%	75%	50%	25%	10%	05%
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South Fork Buffalo River.....							
SABIN	13.0	13.2	13.6	14.2	15.0	15.8	16.2
Buffalo River.....							
HAWLEY	5.4	5.7	6.3	7.4	8.9	9.5	10.1
DILWORTH	14.1	14.3	16.3	17.7	20.1	21.7	22.3
Wild Rice River.....							
TWIN VALLEY	5.4	5.8	6.5	7.6	8.6	9.8	10.8
HENDRUM	19.4	20.0	21.8	24.8	28.0	29.4	31.6
Marsh River.....							
SHELLY	9.4	9.9	10.8	11.6	13.0	16.3	17.3
Sand Hill River.....							
CLIMAX	11.9	11.9	12.6	16.0	20.4	23.9	27.8
Red Lake River.....							
HIGH LANDING	5.9	6.4	7.1	8.3	9.4	10.5	11.7
CROOKSTON	11.2	11.8	13.5	15.8	18.4	20.9	22.5
Snake River.....							
ABOVE WARREN	62.4	62.5	63.0	63.7	64.6	66.3	67.1
ALVARADO	98.4	98.6	99.6	101.2	103.5	106.0	108.1
Two Rivers River.....							
HALLOCK	799.1	799.3	800.6	803.4	805.7	808.1	808.8
Roseau River..... considering the flow through the Roseau diversion							
ROSEAU	7.6	7.9	8.5	10.1	12.6	14.5	15.5
North Dakota Tribs:	95%	90%	75%	50%	25%	10%	05%
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Wild Rice River.....							
ABERCROMBIE	8.5	9.5	10.8	13.3	17.3	19.0	21.9
Sheyenne River.....							
VALLEY CITY	8.0	8.5	9.6	11.6	12.6	13.6	14.4
LISBON	8.1	8.3	10.0	11.6	13.5	14.8	17.3
KINDRED	11.2	12.0	13.1	15.5	17.5	19.8	20.8
WEST FARGO DVRSN	12.5	13.0	13.0	15.1	17.2	19.8	21.3
HARWOOD	78.8	79.3	80.7	83.4	89.5	91.2	91.8
Maple River.....							
ENDERLIN	8.8	9.2	10.4	11.0	11.8	12.7	13.6
MAPLETON	15.8	16.8	18.6	19.8	21.6	22.3	22.8
Goose River.....							
HILLSBORO	5.6	6.0	7.8	9.6	12.2	14.0	14.6
Forest River.....							
MINTO	3.4	3.6	4.1	4.8	5.8	6.4	6.9
Pembina River.....							
WALHALLA	4.6	5.0	5.6	6.3	8.1	11.1	12.0
NECHE	7.1	8.2	9.6	11.4	15.3	20.3	20.9

#### .THE OUTLOOK PRODUCTION PROCESS...

This long range probabilistic outlook is based on a series of peak river levels or crests taken from the forecast hydrograph results of the NWS Community Hydrologic Prediction System (CHPS). The model is run for multiple scenarios starting at current river levels and soil conditions using 69 years (1949-2018) of past precipitation and temperature conditions that were experienced for those past

years during the time-frame of the outlook period. These crests can then be ranked from lowest to highest and assigned an exceedance probability. For example, for a series of 50 years, the lowest ranked crest has 49 crests above it and since 95 percent of the crests are above it, it is assigned a 95 percent probability of exceedance (POE).

A YouTube video on "How to Interpret River Outlook Products" is at:

[www.youtube.com/watch?v=pSoEgvsnpv4](http://www.youtube.com/watch?v=pSoEgvsnpv4)

The probabilities can be used for risk management by using them as an indication of the range of crests that may be expected during the valid period of the outlook. By providing a range of peak river level probabilities, the NWS is contributing to the area's Decision Support Services that help with long-range flood planning and response readiness. This outlook is a part of NOAA's National Weather Service's AHPS (Advanced Hydrologic Prediction Services).

#### .ADDITIONAL INFORMATION SOURCES...

The AHPS Long-Range Probabilistic Hydrologic Outlooks are issued each month typically between the first and second Friday after mid-month. However, Spring Flood and Water Resources Outlooks are issued several times leading up to the spring melt period, usually on Thursdays beginning in late February or early March and ending in early April, depending on the spring flooding conditions.

This outlook is also presented as graphs of the probability of stage exceedance for the full period and for weekly intervals during the period. These graphs, along with explanations for interpreting them, are available from the NWS Grand Forks AHPS web page:

[www.weather.gov/grandforks](http://www.weather.gov/grandforks) or [weather.gov/fgf](http://weather.gov/fgf)

then click on the "Rivers and Lakes" tab above the map.

Current river conditions for all river forecast points in the Red River of the North and Devils/Stump Lake basins are also available on our website, as well as 7-day forecasts when river levels at forecast points are in or near flood.

Additional Probabilistic Hydrologic Outlooks will be issued monthly throughout the rest of the year during the later part of the month or as conditions warrant.

Refer to the separate Devils Lake Probabilistic Hydrologic Outlook for Devils and Stump Lakes Probability of Exceedance levels and low-water non-exceedance levels.

If you have any questions, contact the NWS at 701-772-0720.

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