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PROBABILISTIC HYDROLOGIC OUTLOOK  
NATIONAL WEATHER SERVICE EASTERN NORTH DAKOTA/GRAND FORKS ND  
1046 AM CST Thu Mar 9 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.

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

\* This 90-day outlook covers the period from 3/13/2023 to 6/11/2023.

.OUTLOOK SUMMARY...

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

Major Flooding...

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

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

Elsewhere, there is a low risk of major flooding across the basin.

Moderate Flooding...

There is a high risk (greater than 65 percent chance) of moderate  
flooding at Fargo/Moorhead, Halstad, Grand Forks/East Grand Forks,  
Oslo, Drayton, and Pembina on the Red River. In North Dakota, there  
is a high risk of moderate flooding at Abercrombie on the Wild Rice  
River, Enderlin and Mapleton on the Maple River, and Harwood on the  
Sheyenne River.

There is a medium risk (35 to 65 percent chance) of moderate  
flooding at Wahpeton on the Red River. In North Dakota, there is a  
medium risk of moderate flooding at Hillsboro on the Goose River. In  
Minnesota, there is a medium risk of moderate flooding at Sabin on  
the South Branch Buffalo River, Hawley and Dilworth on the Buffalo  
River, and Hendrum on the Wild Rice River.

Minor Flooding...

There is a high risk (greater than 65 percent chance) of minor  
flooding at Wahpeton on the Red River. In North Dakota, there is a  
high risk of minor flooding at Kindred on the Sheyenne River and  
Hillsboro on the Goose 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 Hickson on the Red River. In North Dakota, there is a medium risk of minor flooding at the West Fargo Diversion on the Sheyenne River. In Minnesota, there is a medium risk of minor flooding at Climax on the Sand Hill River and Crookston on the Red Lake River.

#### .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 currently running near normal to even deeper than normal. Deepest across northeastern North Dakota (30 to 35 inches) while slightly shallower and more variable across southeastern North Dakota and much of the Minnesota portion of the basin (20-30 inches).

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

After a wet and snowy beginning to winter, January and early February brought less than normal snowfall and precipitation to the basin. A more active pattern returned for the second half of February and first part of March. Snowfall is running near normal for most areas while 20 to 25 inches above normal across the Devils Lake and Sheyenne basins in addition to the far southern Red River Basin. Associated water content ranges from 2.0 to 5.0 (highest across southeastern North Dakota).

##### \* 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...

Near to below normal temperatures are expected for the next week with a winter storm expected to impact the entire basin this weekend.

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

Overall below normal temperatures are expected to continue through the remainder of March with near normal temperatures. Below normal

temperatures may continue further into the spring with no strong signal either way for above, below, or near normal precipitation.

.NEXT SPRING FLOOD OUTLOOK...

At this time, we are expecting to issue an additional 2023 spring flood outlook on Thursday, March 23, 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 March 13, 2023 to June 11, 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: 03/13/2023 - 06/11/2023

Location	Categorical			: Current and Historical					
	Flood Stages (FT)			: Chances of Exceeding					
	Minor	Mod	Major	: Flood Categories					
				: as a Percentage (%)					
				Minor	Moderate	Major			
				CS	HS	CS	HS	CS	HS
Red River of the North.....									
WAHPETON	11.0	13.0	15.0	>95	64	61	34	21	18
HICKSON	30.0	34.0	38.0	50	28	19	16	<5	<5
FARGO	18.0	25.0	30.0	>95	85	>95	40	68	27
HALSTAD	26.0	32.0	37.5	>95	38	78	22	32	12
GRAND FORKS	28.0	40.0	46.0	>95	60	73	31	14	11
OSLO	26.0	30.0	36.0	>95	63	>95	57	36	18
DRAYTON	32.0	38.0	42.0	>95	49	75	33	10	12
PEMBINA	39.0	44.0	49.0	>95	52	86	43	40	22

: Current and Historical  
: Chances of Exceeding  
: Flood Categories

Location	Categorical			: as a Percentage (%)					
	Flood Stages (FT)			Minor		Moderate		Major	
	Minor	Mod	Major	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	>95	60	45	17	<5	<5
HAWLEY	8.0	9.0	11.0	63	39	41	23	<5	<5
DILWORTH	13.0	20.0	26.0	>95	69	54	21	<5	<5
TWIN VALLEY	10.0	12.0	14.0	16	17	<5	8	<5	<5
HENDRUM	20.0	28.0	32.0	>95	55	56	22	7	7
SHELLY	14.0	20.0	23.0	34	28	<5	11	<5	6
CLIMAX	20.0	25.0	30.0	64	25	28	12	8	8
HIGH LANDING	12.0	12.5	13.0	<5	12	<5	9	<5	7
CROOKSTON	15.0	20.0	23.0	64	53	15	27	6	9
ABOVE WARREN	67.0	71.0	75.0	6	12	<5	<5	<5	<5
ALVARADO	106.0	108.0	110.0	13	28	7	17	<5	<5
HALLOCK	802.0	806.0	810.0	67	62	25	41	<5	10
ROSEAU	16.0	18.0	19.0	8	24	<5	14	<5	9

Location	Categorical			: Current and Historical					
	Flood Stages (FT)			Minor		Moderate		Major	
	Minor	Mod	Major	CS	HS	CS	HS	CS	HS
-----									
North Dakota Tributaries.....									
: Chances of Exceeding									
: Flood Categories									
: as a Percentage (%)									
ABERCROMBIE	10.0	12.0	18.0	>95	42	>95	34	43	20
VALLEY CITY	15.0	16.0	17.0	19	10	11	7	8	6
LISBON	15.0	17.0	19.0	30	11	13	10	10	7
KINDRED	16.0	19.0	20.5	90	22	53	11	16	10
WEST FARGO DVRSN	18.0	20.0	21.0	61	12	25	11	23	10
HARWOOD	84.0	86.0	91.0	>95	26	>95	21	51	10
ENDERLIN	9.5	12.0	14.0	>95	26	72	11	10	<5
MAPLETON	18.0	21.0	23.0	>95	38	95	18	11	5
HILLSBORO	10.0	13.0	16.0	77	19	39	10	<5	<5
MINTO	6.0	8.0	11.0	28	25	<5	7	<5	<5
WALHALLA	11.0	16.0	18.0	9	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 March 13, 2023 to June 11, 2023

LOCATION	95%	90%	75%	50%	25%	10%	05%
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Red River of the North.....							
WAHPETON	11.7	11.7	12.2	13.2	14.9	15.7	16.8
HICKSON	25.8	26.0	27.4	30.0	33.3	35.1	36.1
FARGO	25.7	27.2	28.9	31.8	34.0	36.5	38.5

HALSTAD	28.0	29.9	32.3	35.3	38.3	39.5	40.0
GRAND FORKS	36.6	37.4	40.0	42.6	44.2	46.6	49.9
OSLO	33.9	34.1	34.7	35.6	36.3	37.3	38.6
DRAYTON	34.6	35.5	38.0	40.0	41.0	42.2	43.3
PEMBINA	41.6	43.0	45.7	47.8	49.9	51.8	52.5
Minnesota Tribs:	95%	90%	75%	50%	25%	10%	05%
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South Fork Buffalo River.....							
SABIN	13.5	13.9	14.3	14.9	15.4	16.3	16.7
Buffalo River.....							
HAWLEY	6.8	7.3	7.8	8.6	9.5	10.3	10.6
DILWORTH	16.8	18.1	18.9	20.3	21.6	22.8	23.3
Wild Rice River.....							
TWIN VALLEY	6.2	6.5	7.3	8.3	9.2	10.8	11.6
HENDRUM	24.1	25.9	27.1	28.7	30.5	31.8	32.5
Marsh River.....							
SHELLY	10.3	11.0	11.5	13.0	14.7	17.3	19.1
Sand Hill River.....							
CLIMAX	15.6	16.7	19.3	21.7	25.4	29.0	31.3
Red Lake River.....							
HIGH LANDING	6.1	6.7	7.3	8.2	9.4	10.6	11.9
CROOKSTON	11.5	12.1	13.8	15.8	18.6	22.2	23.8
Snake River.....							
ABOVE WARREN	62.6	62.7	63.2	63.9	64.5	66.4	67.3
ALVARADO	98.4	98.7	99.7	101.9	104.1	107.5	108.3
Two Rivers River.....							
HALLOCK	799.3	800.2	801.7	803.5	806.0	808.3	809.2
Roseau River..... considering the flow through the Roseau diversion							
ROSEAU	8.1	8.3	9.0	9.9	12.0	15.7	17.6
North Dakota Tribs:	95%	90%	75%	50%	25%	10%	05%
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Wild Rice River.....							
ABERCROMBIE	13.0	13.8	15.2	17.4	20.0	22.6	24.1
Sheyenne River.....							
VALLEY CITY	10.4	11.7	12.4	13.3	14.2	16.3	18.7
LISBON	11.3	12.0	13.4	14.1	15.1	18.9	19.7
KINDRED	15.2	16.1	17.8	19.2	19.9	21.1	21.2
WEST FARGO DVRSN	15.1	15.2	17.2	19.2	19.9	21.3	21.3
HARWOOD	87.5	88.9	89.6	91.0	91.5	92.0	92.1
Maple River.....							
ENDERLIN	11.3	11.4	11.9	12.6	13.0	14.0	14.4
MAPLETON	21.0	21.2	21.7	22.0	22.4	23.1	23.5
Goose River.....							
HILLSBORO	7.8	8.6	10.1	12.2	13.6	14.7	15.4
Forest River.....							
MINTO	4.0	4.2	4.6	5.2	6.2	7.0	7.2
Pembina River.....							
WALHALLA	5.1	5.4	6.0	6.7	8.2	10.4	12.2
NECHE	8.3	9.5	10.5	12.2	15.5	19.6	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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