

**WRITTEN TESTIMONY OF  
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NATIONAL WEATHER SERVICE  
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION  
U.S. DEPARTMENT OF COMMERCE**

**FOR AN OVERSIGHT HEARING ON DEVILS LAKE FLOODING**

**BEFORE THE  
COMMITTEE ON APPROPRIATIONS  
SUBCOMMITTEE ON ENERGY AND WATER DEVELOPMENT  
U.S. SENATE**

**February 11, 2009**

Good morning, Chairman and members of the Committee. I am Scott Dümmer of the National Oceanic and Atmospheric Administration's (NOAA's) National Weather Service. I am the Hydrologist-In-Charge of the North Central River Forecast Center, located in Chanhausen, Minnesota. Thank you for inviting me to discuss the National Weather Service (NWS) hydrologic forecast for the Devil's Lake region of North Dakota.

NOAA's vision is an informed society that uses a comprehensive understanding of the role of the oceans, rivers, lakes, coasts, and atmosphere in the global ecosystem to make the best social and economic decisions. NOAA pursues this vision through its mission to monitor, understand and predict changes in Earth's environment and conserve and manage coastal, marine, and freshwater resources to meet our nation's economic, social, and environmental needs. NOAA's programs provide the nation with services and information to protect lives and property, and improve management of weather and water sensitive sectors, such as energy, agriculture, transportation, recreation and emergency response. These services and information are built upon an infrastructure which includes environmental observations, analyses and predictions, forecasts, and sustained user interaction. NOAA's weather, water, and climate programs work to monitor conditions and provide forecasts to meet the nation's need for reliable and accurate information.

In my testimony today, I will discuss the latest NWS forecast and uncertainty information for the water levels at Devil's Lake, and describe the science and coordination required to produce our forecasts. First, I will provide a little background about the North Central River Forecast Center. The North Central River Forecast Center (NCRFC) is part of a network of thirteen River Forecast Centers across the United States. River Forecast Centers collect and process observations, and provide forecasts and information about water resources for major rivers and their tributaries across the country. My area of responsibility is highlighted in Figure 1. River Forecast Centers are also fully integrated with the larger network of Weather Service Forecast Offices and together we communicate and coordinate our forecasts and information with Federal, state and local officials who play an active role in water management and emergency response. It is our role to provide information to these officials to enable them to make the best decisions possible.

During this past fall (September, October, and November) precipitation was up to 200-300 percent of average across eastern North Dakota and northwestern Minnesota. The precipitation was spread across the entire three month period, as each of the three months recorded above average rainfall totals. This was the wettest fall on record for the cities of Devils Lake, Fargo and Grand Forks. Soil moisture observations taken just prior to the freeze-up in early December, revealed nearly saturated moisture levels in the upper 8 inches of soil across the Red River Valley, including those areas that feed into Devil's Lake.

The onset of winter came abruptly as temperatures plunged in early December. The quick, hard freeze occurring with minimal snow cover and near saturated soil moisture conditions allowed the frost to quickly penetrate the ground to a depth of two feet. Snow fell on 23 days in December, with 24.5 inches falling in Devils Lake after December 14. By the end of the month, new December snowfall records were established for Fargo and Grand Forks, with the water content of the snow pack at 170-300 percent of average levels. January precipitation and snowfall were near normal levels, while temperatures remained well below average.

Based on the fall and early winter weather, we identified a significant threat of major flooding this spring in the Red River of the North basin in northwestern Minnesota and eastern North Dakota (Figure 2). Devils Lake is located within this basin. We believe when this year's significant snowpack melts, it will make a major contribution to flooding in the Red River basin. Because of this threat, the NWS is actively coordinating with other Federal agencies, and state and local officials within the U.S. portion of the Red River basin, as well as providing information to appropriate authorities for Manitoba, Canada.

We began mentioning the potential for significant spring flooding in December, based on the hard freeze and above average snowfall. In January, we increased our coordination and conducted a conference via the internet with representatives from the U.S. Geological Survey's North Dakota Water Science Center, the U.S. Army Corps of Engineers' St. Paul District, the Department of Water Stewardship for the Government of Manitoba, and the North Dakota State Water Commission. The objective of the conference was to alert these agencies of the potential threat identified in our preliminary internal model runs, and the high probabilities of flooding in the Red River basin, including Devils Lake. We asked all of the conference participants to provide assistance in acquiring observations of snow water content throughout the area to help us produce the best possible outlook.

Our standard outlook available on the internet provides potential water levels out to three months (<http://www.weather.gov/water>). However, the Devils Lake River Basin is large and flat which results in an unusually long travel time for precipitation and/or snow melt to reach Devils Lake. Due to this long travel time and associated slow response in the level of Devils Lake, we provide to our users extended outlooks for this location through September, 2009. This particular service provides an early outlook which includes the possible height to which Devils Lake could rise during the spring and summer. An example of this product is in Figure 3. The "Exceedence Probability" graph represents the likelihood, or probability, of the lake exceeding a certain level for 5 ranges of probability, over the time period January 19-September 30, 2009. Current

extended range forecasts suggest the water levels at Devils Lake will peak in late June through early July (which is normal for this area).

In developing forecasts, the NWS also considers historical data provided by local entities. Devils Lake is a closed basin (where runoff terminates in the lake) below the 1459 ft level. According to the North Dakota State Water Commission<sup>1</sup>:

- Flooding in the Devils Lake Basin, which began in the 1990's and continues to the present [2008], has destroyed hundreds of homes and businesses and inundated thousands of acres of productive farmland.
- Since 1993, Devils Lake has risen about 25 feet and the volume of water in Devils Lake has quadrupled.
- The State of North Dakota has constructed an outlet to allow water from Devils Lake to flow into the Sheyenne River.
- At least twice in the last 4,000 years Devils Lake has risen to the 1459 ft level. This is the level at which Devils Lake will begin to divert water into the Sheyenne River.

In addition, according to the U.S. Geological Survey, Devils Lake began flowing into Stump Lake (an adjacent closed basin) in 1999. The two lakes have since merged and are rising together.

The current forecast calls for an almost 99 percent likelihood the water level at Devils Lake will exceed the recent record lake level of 1449.2 feet, set in May, 2006. There is also a 25 percent possibility the water level at Devils Lake will exceed 1452.1 feet, and a 2 percent possibility the water level will exceed a height of one foot below the current dike protection level of 1455.0 feet (Figure 3). In late January, we briefed this information to the U.S. Army Corps of Engineers Regional Interagency Levee Task Force, and other public officials. We continue to monitor the situation closely, update our forecasts using the latest information available to us, and provide briefings to Federal, state, and local officials.

Now I will talk briefly about some of the science behind our forecasts. Our river and lake level forecasting system, which integrates soil moisture, snow and ice pack, and seasonal precipitation and temperatures, continues to yield more complete and comprehensive forecast information through the implementation of the Advanced Hydrologic Prediction Service (AHPS). Complex environmental conditions and interactions are represented in our models to produce forecast and uncertainty information for specific river or lake locations. Through the implementation of AHPS, we are extending the range, quantifying the certainty, improving the timeliness and accuracy of our river forecasts and warnings, and making this information available in user friendly text and graphical products. AHPS provides forecasts of river and lake levels over time periods ranging from an hour to a season and for areas large and small, including river forecast information such as:

- How high the river or lake will rise,
- When the river will reach its peak, and
- How long the flooding will continue.

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<sup>1</sup> [http://www.swc.state.nd.us/4DLink9/4dcgi/GetContentPDF/PB-206/DL\\_Quick\\_Facts.pdf](http://www.swc.state.nd.us/4DLink9/4dcgi/GetContentPDF/PB-206/DL_Quick_Facts.pdf)

AHPS also provides better information to water managers and city officials, helping them make decisions about water allocation and economics such as:

- When and where to evacuate people, goods and industrial property from potential flood areas;
- How to use reservoir storage capacity and release to reduce flood impacts on people and businesses, including agricultural demands; and
- When to reinforce levees and at what level.

AHPS provides more accurate forecasts for flow conditions ranging from droughts to floods in a timely and user-friendly manner. AHPS enables our forecasters to use a combination of software and hardware tools to analyze data and create graphical displays of probability forecasts. There are currently 2,237 AHPS forecast points across the nation, 404 within my area of responsibility, including one at Devils Lake.

Our outlooks are for planning purposes and provide the probability of the lake exceeding various stages based on current conditions and 58 years (1948-2006) of observed precipitation and temperature data from January through September. We seldom see such a high probability of exceeding record levels. Our confidence is based on the excessive snowpack, the very wet soil conditions, and expected “average” precipitation and temperatures for the next nine months. We also believe there is more snow in and near shelterbelts which is not well represented in an “average” snowpack. Shelterbelts, also known as windbreaks, and are made up of one or more rows of trees or shrubs planted in a manner which provides shelter from the wind. They are commonly planted around the edges of fields on farms. They are also planted to help keep snow from drifting onto roadways and yards.

At this time, it is not possible to forecast how much additional snow will fall before the start of the normal melt cycle, but historically, an additional 20-25 inches of snow can be expected to fall by the end of March. By incorporating the past 58 years of climatological data, the outlooks already take into account the threat of above average precipitation, and this is represented by the forecasts for higher lake levels, but with a much lower probability the levels will rise that high. As conditions can change prior to snow melt, the NWS will continue to carefully monitor the situation. Snow melt typically occurs in late March or early April. We update our long-range forecasts every month, or more frequently if conditions warrant. Once snow melt begins, we will issue daily forecasts for the lakes and rivers in our area.

### **Concluding Remarks**

Mr. Chairman, this concludes my testimony. I thank you for the opportunity to discuss the NWS’s role in forecasting lake levels for Devils Lake. The threat for flooding this spring in that part of the country is high. The NWS will continue to monitor the situation closely and work with Federal, state and local officials to ensure they have the information needed to make the best decisions possible to prepare for flooding. I would be happy to answer any questions you or other Members of the Committee may have.

Figure 1. The National Weather Services' thirteen River Forecast Centers, with the North Central River Forecast Center highlighted.

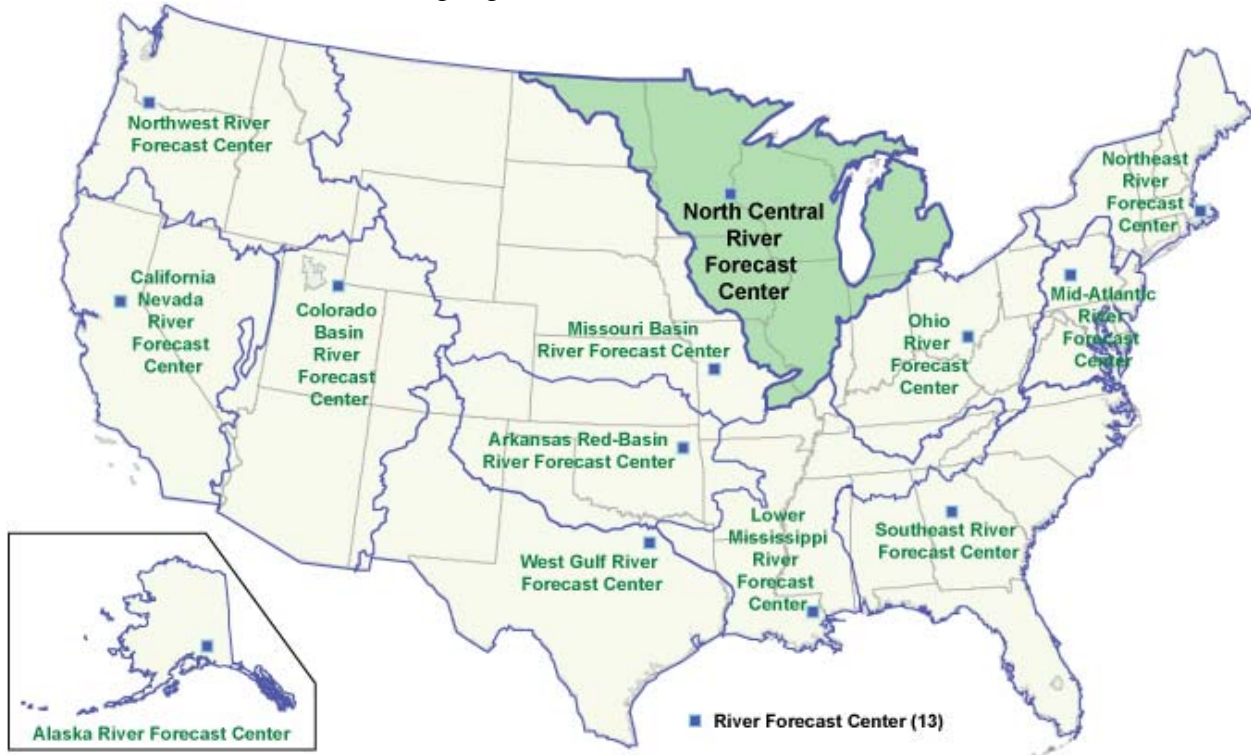


Figure 2. Image of the Red River of the North Basin.

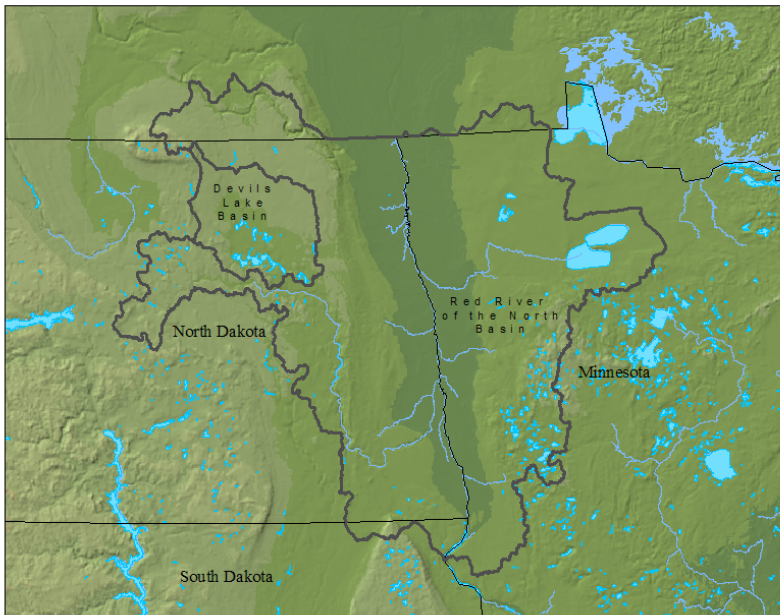


Figure 3. Forecast probability of exceeding specified lake levels on Devil's Lake for the period January 19, 2009 through September 30, 2009 (x-axis on the graph represents calendar date).

