



US Army Corps
of Engineers

**Frazil Ice Jam Survey and Report
Cannon River at Northfield, Minnesota.
December 3, 1991 and January 3, 1992.**

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CEMVP-ED-GH (1110-2-1403)

January 8, 1992
Pomerleau/rp/5640

MEMORANDUM FOR RECORD

SUBJECT: Ice Jam Survey, Cannon River at Northfield, Minnesota, December 3, 1991 and January 3, 1992.

1. An ice jam developed at the City Dam in Northfield, Minnesota in the early morning hours of December 3, 1991. After coordinating with Dave Christenson (CENCS-EM), Matt Bray and I drove to Northfield to assess the situation. By early afternoon the ice jam was beginning to cause flooding of some businesses along the Cannon river in downtown Northfield. The weather during this period of time was characterized by rapidly falling temperatures and the beginning of a snow storm. High winds and blowing and drifting snow made travel and field reconnaissance very difficult.
2. Upon arriving at Northfield, we visited the Public Safety Office and met Joel Rogers and Mike Schwalbe (CENCS-CO) who had arrived to assist the city in the actual flood fight. We met with Chief of Police, Mr. Petrie and Rich Revering, the Assistant City Engineer to discuss the situation. Mr. Revering stated that the last time there had been an ice jam at this location was about 25 years ago.
3. Mike and Joel departed to visit the affected area while Matt, Mr. Revering and I drove upstream a short distance to view river conditions upstream of the dam. Upstream of the dam, the river was flowing quite fast. The river was completely open and pans of frazil ice could be seen midstream. Very little shore ice or ice from upstream areas could be seen. It appeared that this ice jam was being caused entirely by frazil ice.
4. We inspected the area in town where the jam was occurring. I took still 35mm photos and Matt Bray shot some VHS video. It was quite evident from the Water Street bridge, just downstream of the dam, that frazil mounds were being formed. The surface of the ice completely covered the width of the river and looked not unlike a farmer's field after plowing, with the furrows normal to the flow of the river. The plunge pool below the dam was submerging the frazil and transporting it under the ice cover.

5. We drove through town accessing the river whenever possible in an attempt to find the downstream edge of the ice jam. There were several areas of open water downstream of Second Avenue. Between the sewage disposal facility and the Waterford bridge, there was evidence that the ice previously had been about one foot higher. We crossed over Cannon River near Waterford. At the crossing, as near the sewage disposal facility, the shore ice was intact, but the center of the river consisted of broken, shoved pieces. There was no evidence of frazil ice downstream of the sewage disposal facility.

6. After crossing the Waterford bridge we drove back up towards Northfield along the east side of the river and near Carleton College. The diminishing daylight, snow storm, and decreasing temperatures made reconnaissance difficult. At the confluence with Spring Creek, portions of the College soccer field was flooded, photographs were taken continuously. There was no readily available access to the river between Spring Creek and the Carleton Sport Stadium. At the stadium, trucks were hauling in sand for the flood fight.

7. We were unable to locate for certain the downstream edge of the jam in the field. However, based on available maps, it seemed that the downstream edge of the jam was near the confluence with Spring Creek.

8. We finished our reconnaissance of the area and returned to the Public Safety building. After a short debriefing and exchange of information, Matt and I departed and returned to the District office.

9. On the local evening news at 10:00PM, television station KARE (Channel 11) from Minneapolis, showed some live coverage from Northfield. The telecast showed that the top of the ice cover had built completely up to the downstream face of the dam and a small portion had even built over the dam and formed in the pool area. According to news accounts, the river stage peaked sometime after midnight.

10. On December 4, 1991 a stream gaging crew from the USGS Water Resources Division office in St. Paul measured the discharge at the USGS gage site. The gage site is located upstream of the dam, on the left bank downstream of the Fifth Street bridge. The discharge was measured at 834 CFS. At the time of the measurement, an elevation of 901.84 was recorded at the gage. The highwater elevation for the flood event at the gage was 902.8 (NGVD 1929). The USGS Gage at Northfield has been in operation since 1980.

11. On January 3, 1992 a survey of ice conditions at Northfield was conducted. Those involved in the effort were:

- a. Richard Pomerleau, US Army Corps of Engineers, St. Paul
- b. Marv Hrdlicka, US Army Corps of Engineers, St. Paul
- c. Farley Haase, US Army Corps of Engineers, St. Paul
- d. Qiz Hong Guo, University of Minnesota, SAFHL

12. After checking in with the City Engineers' office and the Public Safety office, we

proceeded to the area just downstream of the dam. The ice cover had dropped about 4 to 5 feet from its maximum elevation according to marks along the channel wall. Photos of the river were taken. Below the dam, the water was flowing on top of the ice. Portions of the ice cover had been eroded quite extensively since the flood event. The flow over the ice had developed a meander pattern. In some locations the flow was completely under the ice. In other locations, flow was on top as well as under the ice. A good deal of vertical relief was evident in the ice cover.

13. Using a FEMA Flood Insurance Study map with cross section locations shown, we made two surveys across the ice at locations which have cross-sections in the FEMA FIS HEC-2 model. The first measurement was taken at FEMA section "L", just upstream of the new footbridge. The second set of measurements was taken at the Second Avenue bridge. A plan view of the cross section locations and other pertinent data is attached to this memorandum. Data measured for these two sites are shown on the two "Ice Engineering Field Surveys" data forms.

14. After completing the surveys, we retraced the route driven on December 3 to assess river conditions downstream and to find the downstream limit of frazil accumulations. Should Northfield be subjected to another ice jam or above normal snow melt conditions, the capacity of the river downstream of the dam needs to be known.

15. At the Waterford bridge, the river was completely open. Some shore ice could be seen. There was no evidence of frazil being transported this far downstream. We accessed the river whenever possible. At the Carleton stadium, we parked the vehicle and walked along and on the river downstream to just past the Spring Creek confluence.

16. Just upstream of Spring Creek, the last deposit of frazil could be seen. Photos were taken. Downstream of Spring Creek, some frazil deposition could be seen under the broken shore ice cover, but the quantities were relatively small.

17. From visual observations, it was estimated that perhaps 50 to 75 percent of the channel still contained frazil mounds. The majority of the frazil mounds were 3 to 4 feet above the water surface. The river continued to form a meander pattern over and under the ice cover.

18. After completing our reconnaissance of the Spring Creek area, we returned to Northfield. This completed the survey efforts.

19. Based on the data collected, the following information is deemed pertinent to the Northfield ice jam situation.

- a. The City should be aware that the conveyance of the river downstream of the dam has been seriously compromised by the frazil accumulations. These deposits are now grounded and are not likely to be transported downstream intact.
- b. The pool ice cover above the dam is in very poor condition. It is very thin and

open in places. Should the river basin upstream experience an increase in runoff, the ice cover that exists could quite easily be destroyed. Should this occur, frazil ice production similar to the December 3 scenario could easily occur again.

- c. There does not appear to be any significant scour under the ice cover. The measurements taken do show channel bottom elevations somewhat lower than that of the HEC-2 model geometry. Any scour that may occur will not be significant in providing additional channel conveyance.

20. Overall, the ice jam measurement equipment performed quite satisfactorily.

/signed/

RICHARD POMERLEAU, P.E.

Hydraulic Engineer

Hydraulics Section

Geotechnical, Hydraulics

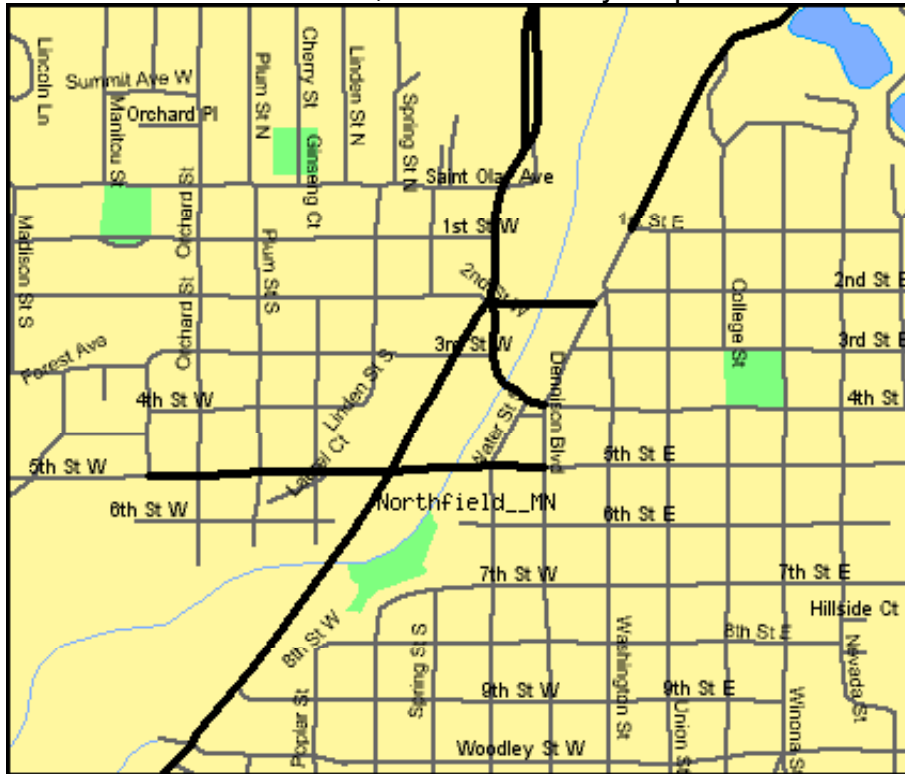
and Hydrologic Engineering Branch

Field Surveys: [Plot 1 \(PNG\)](#) · [Plot 1 \(HPGL\)](#) · [Plot 2 \(PNG\)](#) · [Plot 2 \(HPGL\)](#)

Northfield, Minnesota Location Map



Northfield, Minnesota City Map



Frazil Ice Jam at Northfield, Minnesota: December 1991–January 1992



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