MEMO FOR RECORD
FROM: Andrew Tuthill
DATE: 30 Dec. 2003
SUBJECT: Visit to Canton, ME, following 18 Dec.2003 ice jam flood.

On 29 Dec. 2003, Andy Tuthill of CRREL met with Maine State Senator, Bruce Bryant, in Canton Maine. Bryant had contacted CRREL during the ice jam flood of 18-19 December. The purpose of the visit was to gather information on the recent event and discuss possible ice jam flood mitigation options.

Whitney Brook, a small tributary of the Androscoggin River, runs through the village of Canton. On 18 December, an ice jam on the Androscoggin several miles downstream inundated much of the floodplain and backed up Whitney Brook, flooding many homes in the villages of Gilbertville and Canton. Fig. 1 shows an aerial photo of the jam and Fig. 2 maps the ice jam location and affected areas. Some houses were flooded to depths of 4 ft above the first floor elevation and 40 families were evacuated. Several miles of Maine Route 140 were under water for several days and, in a few places, the roadway was completely washed out. Fig. 3 shows the high water mark on a mobile home just east of Whitney Brook. On the west side of the brook the flooding forced the evacuation of the Victorian Villa old peoples home. The unofficial damage estimate was $2.9 million. Breakup ice jams also caused flooding along the Androscoggin at Bethel, Rumford Center and Hanover, and on the Sandy River at Farmington, ME (Tuthill and Daly trip reports for 19 and 18 December, 2003).

The ice jam floods resulted from an unusually cold December accompanied by above average river discharges (Figs. 4 and 5). A thaw with nearly 3 inches of rain on December 18th broke up the Androscoggin ice cover below Rumford, and the ice jammed in the sharp bend below Canton Point along Stevens Island. The Dec. 18th peak discharge of 35,000 cfs at Rumford was by itself nearly sufficient to cause flood stage on the Androscoggin River (Fig. 3). The formation of the ice jam resulted in a quick rise to above flood stage. By Dec. 23, discharge had dropped to 11,000 cfs and stage had receded, allowing repairs and resumed traffic on Route 140. A prediction from the National Weather Service Northeast River Forecast Center for discharges in excess of 30,000 cfs for Dec. 25, caused concern about renewed flooding. By a simple calculation based on observed water temperature [1]and predicted river discharge, CRREL predicted that the jam would melt out in less than 1-1/2 days (Appendix A). This proved fairly accurate in that Senator Bryant reported that the jam was gone by the morning of Dec. 25th, even though the flow peaked at only 20,000.

On the morning of 29 Dec. Senator Bryant and Tuthill inspected the ice jam reach finding 12-ft- high shearwalls near the downstream end (Fig. 6). Route 140 was severely damaged where flow had been forced out of the river channel near the upstream end of the jam. The out of bank flow had also left much sediment in the floodplain. The trees lining the river bank appear to have kept most of the ice in the channel and they showed

[1] Bruce Bryant reported a water temp at Rumford of 32.4 ºF

evidence of this and past ice jams in the form of ice scars (Fig 7). Erosion patterns and matted grass and saplings marked an area where out of bank flow had returned to the river channel at the downstream end of the floodplain (Fig 1).

Conclusions

Breakup ice jam flooding in northern New England in the month of December is relatively unusual. As indicated by the hydrograph for the Androscoggin River at Rumford (Fig. 4), during the last month, river flows in the region have been 2-5 times higher than the long-term averages. At the same time, regional air temperatures during the first three weeks of December were well below average, with the exception of the thaws of Dec. 11 and Dec. 17 (Fig. 3). The low temperatures and high discharges resulted in above average frazil ice production and thicker-than-normal ice covers on the rivers. When the ice covers broke up on Dec 11 and again on Dec 17, discharge was sufficiently high that the added resistance to flow due to ice jams was enough to cause flooding at many locations. The moderate temperatures during the last week, caused the Canton jam to melt and release, reducing the threat of ice jam floods later this winter and spring. The Bethel jam had also released by Dec. 29, but the jam at Rumford Center remained in place.

Ice jam floods in Canton are not that uncommon. An event in the spring of 1986 caused stages at least 3 ft higher than the Dec. 18, 2003 event. Senator Bryant would like to explore possibilities to study the ice jam flood problem in Canton and the surrounding area. Such a study might include a comprehensive review of the ice jam flood history including hydro meteorological factors, frequency, high stages, and damages. Findings would from a basis in the selection of ice jam mitigation alternatives that might include, channel modifications, relocations, dikes and berms and possibly ice control structures.

Bryant hoped that ice jam flood advanced warning might also be improved. At present emergency response teams are working in the dark in this regard, never quite knowing what to expect next. In an open water situation, it is relatively straightforward to predict the timing and magnitude of peak stage, providing emergency managers some leadtime. Where ice jams are a factor, prediction of peak water levels is much more difficult, but to some extent possible, with knowledge of the pre-event ice conditions on the river. In addition to addressing of long-term solutions, a study could develop simple ice jam flood prediction tools that would be extremely useful to emergency responders.

Respectfully Submitted,

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Fig. 1. Ice jam on the Androscoggin River Dowmstream of Canton, ME on 19 December 2003.

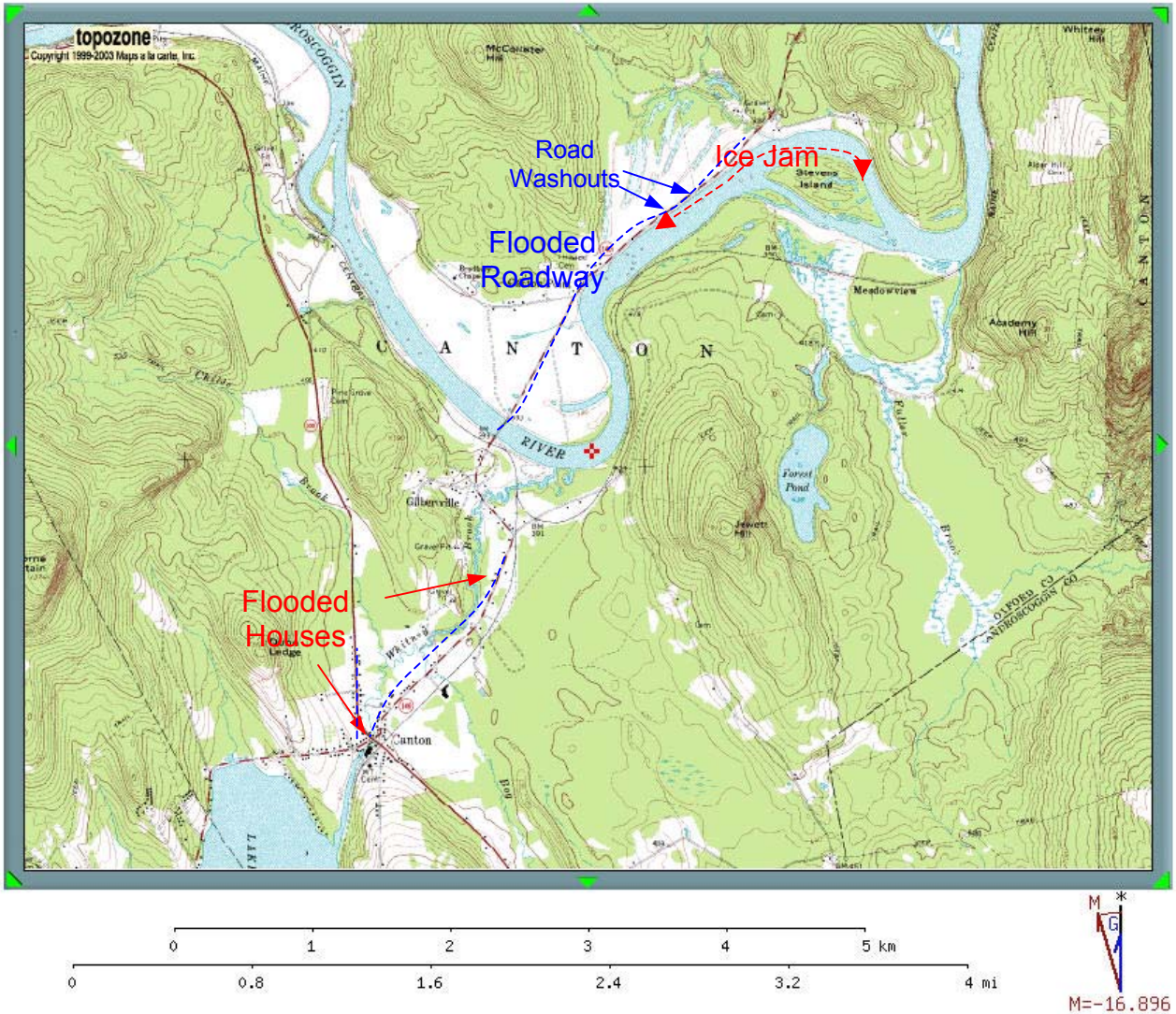

Fig. 2 Map showing ice jam location and affected areas.

Fig. 3. Peak stage elevation in Canton, just east of Whitney Brook

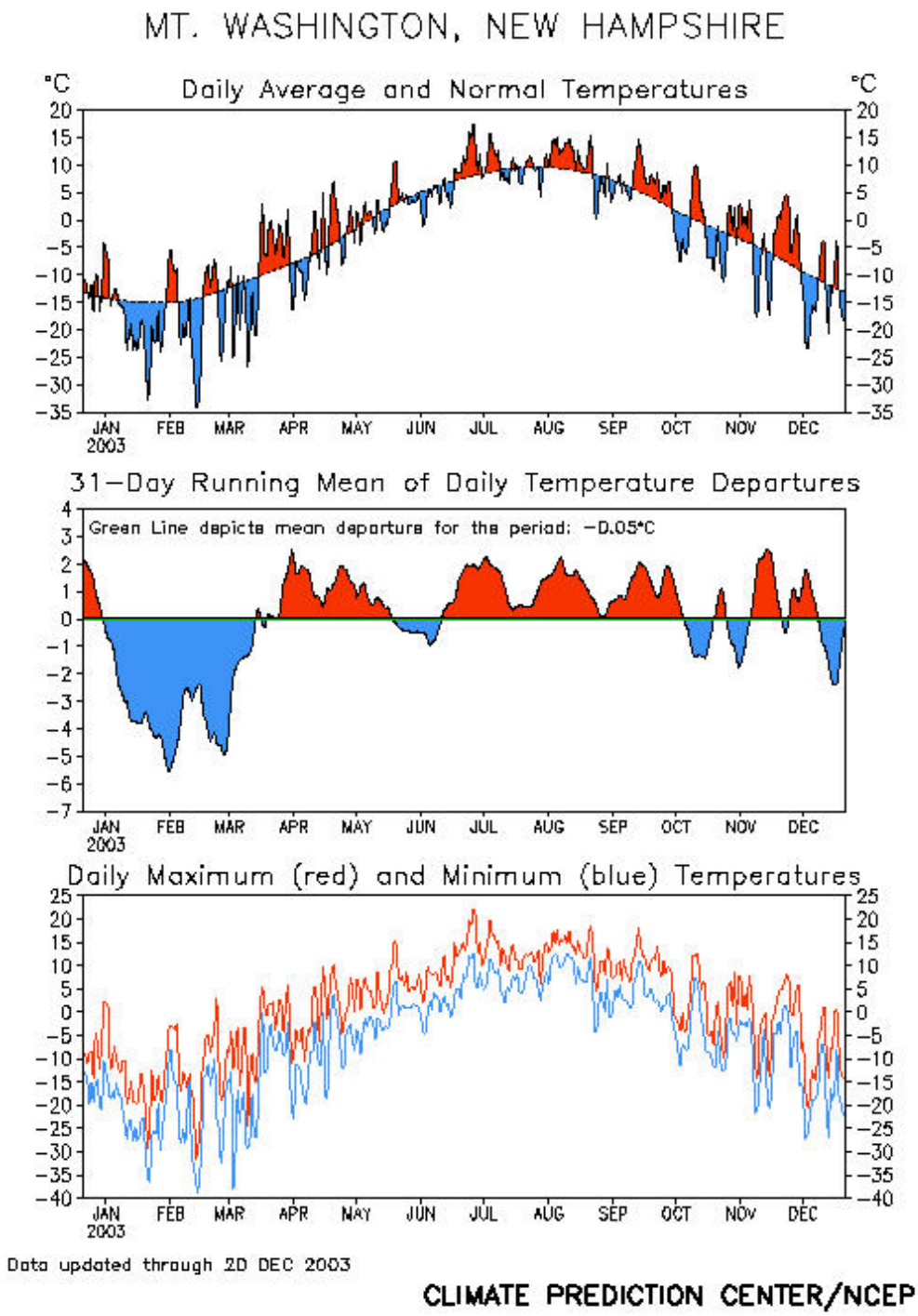

Fig 4. Recent air temperatures compared to long-term averages, for Mt. Washington, NH.

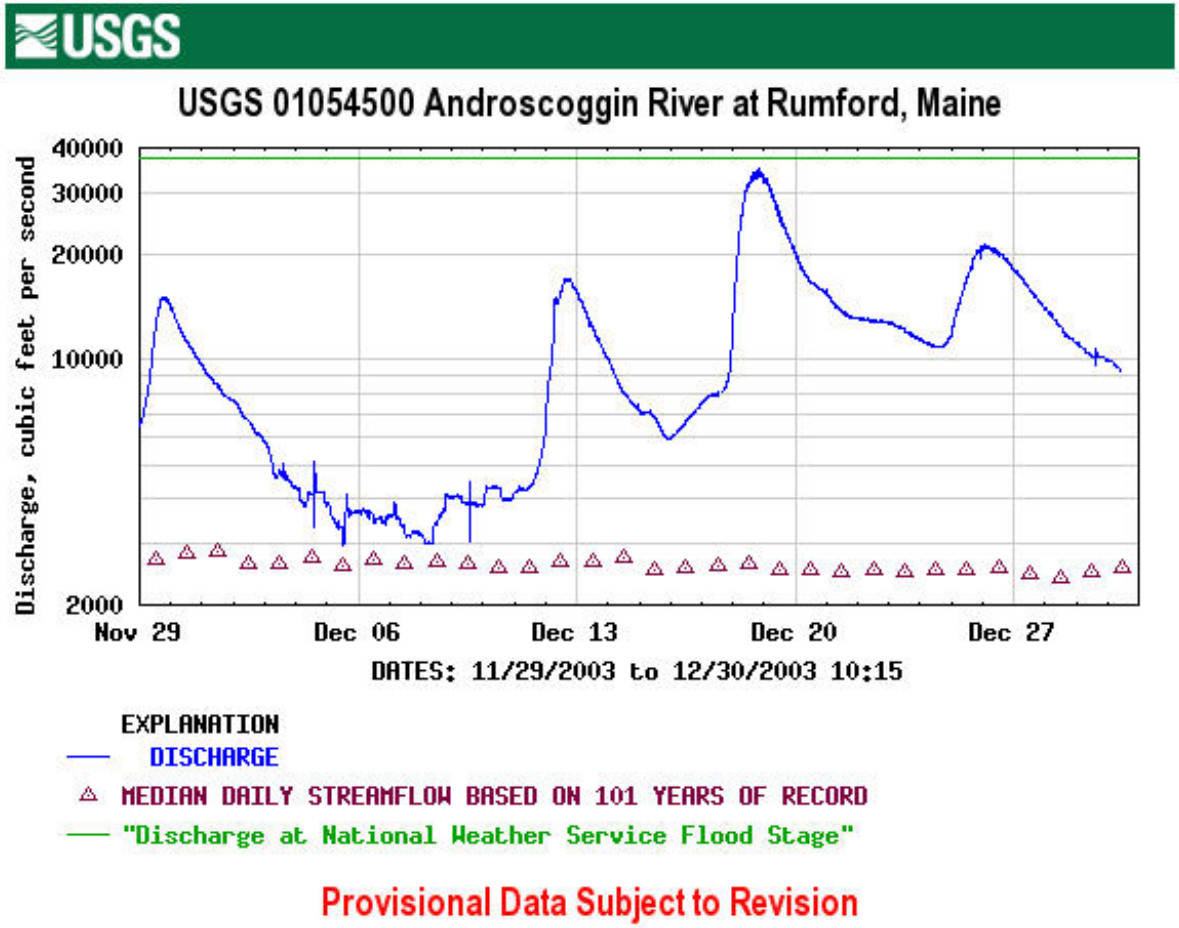

Fig. 5. Discharge hydrograph for Androscoggin River at Rumford, ME.

Fig. 6a. Ice jam shear walls looking upstream.

Fig. 6b. Looking downstream towards ice jam toe location.

Fig. 7 Ice jam tree scar along Route 140.

Appendix A: Ice Jam Melt Out Calculation made at on 24 Dec. 2003
based on: Lever, J. H. , Gooch, G. and S. Daly (2000) "Cazenovia Creek Ice Control Structure" ERDC/CRREL TR-00-14.

Estimated ice jam volume:

Ice Volume = avg. length x avg. width x avg. thickness x (1 - ice jam porosity)
= 1 mile x 400 ft x 10 ft x (1- 40%)
= 12 million ft^3

Estimated melt rate :

Melt rate = 1% x avg. river discharge in cfs x water temp in deg F above 32.00ºF
= 1% x 25,000 cfs x 0.4 ºF[2]
= 100 cubic feet of ice melted per second

Time required to melt out jam = ice volume in jam / melt rate
= 12 million ft^3 / 100 cfs = 120,000 sec = 33 hours.

The ice went out sometime on the morning of Dec. 25. Discharge topped out at about 20,000 cfs, never reaching the NWS predicted peak.

[2] Bruce Bryant reported a water temp at Rumford of 32.4 ºF