6 April 2003

TO: Engineering Seniors (Senior Design)
From: John Garver, Director of Environmental Studies
RE: Monitor Mohawk River levels

Monitoring ice jam floods on the Mohawk River

For some time now, flooding on the Mohawk River has been a concern to those living in the Stockade and other places along the river's edge. The worst flooding that we’ve seen occurs with ice jams that form at the onset of breakup (generally in mid March). These ice jams get stuck in places where the channel narrows, and where there are obstructions to the channel (i.e. bridges). In mid March of 2003, a 5-mile long jam was stuck in front of the Stockade. This particular jam did little damage because there was so little water. When breakup occurs, emergency crews monitor the river level (by eye on a marked stick along the river edge), and call in the levels to a central dispatch. It is not uncommon for jams to cause spectacular and rapid buildup of water behind them. River rises in excess of 10 feet in under an hour or so are possible (this happened in 1964 and closed Rt. 5). Therefore, this is a real threat to the residents along the River. The challenge for the police is to evacuate on short notice.

The crucial measurement here is river stage, which is the elevation of the river level above a certain datum. In the case of the Mohawk, feet about mean sea level is the common metric, but "feet above normal" is also used. “Bank full” is about 8 feet above the normal river level: anything higher causes flooding. Although visual monitoring can be used, this method is time consuming and not reliable because after hours observations are commonly incomplete. A better method is a continuous measurement of stage elevation by pressure transducers. These pressure transducers have millimeter accuracy, and can feed continuous measurements to a monitoring computer. A requirement of this type of system is that the monitors have power and that they have a direct and protected connection to the river.

The goal of this project would be to install a series of pressure transducers (perhaps only one or two in the beginning) along the course of the Mohawk so that one could see real-time river elevations along part of the Mohawk. For example, envision one monitor in the Stockade (i.e. the Union College Boathouse) and one monitor several miles upstream (i.e Lock 8 about 4 miles upstream). Naturally a river has a normal gradient, so an upstream monitor would show a slightly higher elevation than a downstream monitor. Once this difference is calculated, the two outputs can be equalized. In normal flow conditions, these two stage elevations should be the same. However, once ice-jam flooding starts, irregular flow starts and the important measurement would be the difference or deviation from normal elevations. If this output could go directly to the internet, then the coordination of emergency response could be optimized. It would be important for the software
to display the real-time river levels (must be less than 15 minute delay), but also allow a user-imputed time range (i.e. a planner wants to determine how flood levels rose over the last 24 hr.).

This proposal involves a mixture of hardware and software issues aimed at helping local emergency responders. The Environmental Studies program has two high-quality pressure transducers (actually have temperature and conductivity in real time as well), so the important issue is setting up the system and programming how the data are transmitted, displayed, and stored. Note that this system will be important in a scientific sense, because it will allow us to study ice/flood dynamics. I am not aware of another system like this in the country, but there are plenty of real-time (or near real-time) monitors that show stage elevation (in fact the nearest one to the Stockade is at the Cohoes Falls and is run by the U.S. Geological Survey - see example output below). Unfortunately this one is too far downstream (15 miles or so) to do any good for protecting places significantly upriver. The Cohoes Falls site show river stage, and then it show "Q" which is discharge in Cubic feet per second (with a 15 minute delay). This discharge is calculated from Stage elevation because they know the river cross-section.

Even if only one monitor were to be installed (Union College Boathouse), it would be extremely useful for the city and for the Crew team. If there are any questions that I can help with, I'd be delighted. I hope that in a year from now, the local media picks up on this wonderful project that College has done for the city!!

cheers,

John Garver

Important Links:
1) Example of USGS monitor at Cohoes (15 minute delay) (see graph below)
http://waterdata.usgs.gov/ny/nwis/uv?site_no=01357500
2) Web pages on ice jamming, and flooding on the Mohawk (Union research): http://zircon.union.edu/Mohawk_River/Mohawk-www