CEERD-RE 1 April 2004

MEMORANDUM FOR RECORD: Inspection of site conditions for flood early warning sensors at Bethel, Rumford Point, Mexico and Canton Maine,
24 March 2004

Customer: 207-743-6336
Project: FY04 Monitoring New England Ice Jams
PM: Kate White 603-646-4187
POC: Gordon Gooch (603-646-4253) and Troy Arnold (603-646-4489)

1. On Wednesday 24 March 2004, Troy Arnold and I drove to Bethel Maine at the request of Dan Schorr, Oxford EMA. The purpose of this visit was to meet with local officials, and to provide technical assistance on the location of four ice/flood alert systems along the Androscoggin River from the town of Bethel at the upstream location to Canton Maine on the most downstream location (Figure 1). The following is a description of the conditions we observed.
    a. We met Dan Schorr from Oxford Emergency Management, and Patty and Jeff Parsons (owners the Outdoor Adventure Center located on the left bank of the Androscoggin River) in Bethel Maine. Dan asked Jeff if the instrumentation could be located on their property in an effort to provide increased security for the system and easy access. Jeff was eager to help and assured us that he would work with us when we were ready to locate the system.
    b. We discussed the recent December 2003 flooding event and had Jeff point out the high water mark left behind by the flood on the first floor wall of his building (Figure 2). He told us that the second floor was built one foot above the 100-year flood level. Troy and I later measured the change in elevation from the Androscoggin river water surface to the flood level mark and obtained a change in elevation of 17 feet with an additional 5feet to what was referred to as a 100 year flood level. We estimated that the river was an average of 3 feet deep on Androscoggin River at the Rt. 2 bridge pier location. State Highway bridge maps should provide more accurate information on the distance from the bridge steel to the riverbed and also distances to the data collection and transmit antenna. If the preferred (RF) radio transmission system is used and mounted on the bridge railing, long runs of cable and trenching would not be unnecessary.
    c. We then drove downstream to the roadway along RT 26 in Bethel to document the flooded area at the confluence of the Adler River (Figure 3). Dan felt that the ice jam and resulting backwater effect of the Androscoggin River was the main cause of the flooding in the Adler River along Rt. 26 (Figure 4-6).
    d. We then proceeded to the Pleasant River and Bog Brook tributaries to the Androscoggin located approximately 4.5 and 8.0 miles upstream of the Rte 2 Bridge. These tributary locations respond early to rising stage on the Androscoggin River (Fig 7 -10). Andrew Tuthill (603-646-4225) gives

additional detail of the flooding events in trip reports dated 18 December , 22 December, 30 December, and 8-9 January.

2. The second site was located at Rumford Point Bridge where it crosses the Androscoggin River, approximately 13 miles downstream of Bethel. The site is approximately 2000 feet downstream of the confluence with the Ellis River (Fig 11-12). The Concord River flows into the Androscoggin River 1.8 miles downstream of this location. Water depths were 2-3 feet and riverbed conditions were similar to the Bethel location. The left bank bridge pier is approximately 650 feet from the church that was suggested as a secure location for instrumentation. (Fig 13).
3. Site three was located at the Rumford-Mexico town line approximately 11 miles downstream of site 2 (Figure 14). We met with fire chief Gary Wentzell who described the typical flooding they experienced in the town of Mexico along Main street and adjacent low lying areas (Fig 15-17). This bridge site was characterized by shallow water and not suitable for placement of a water level transducer due to the expected thick ice and freezing winter temperatures.
    a. Elevations taken from the riverbed to the Main Street low point indicate a 14-foot stage rise. Gary mentioned that a brick building at the far end of Main Street has had 1-2 feet of water above the sidewalk level. Measurements indicated that the base of this building was 3 feet higher than the lowest point on Main Street. Gary also noted that once the water level reached Carlton Street (approximately 12 feet of elevation change), the rate of rise on Main Street seemed to increase. A fenced-in pump house owned by the local paper company was located adjacent to the bridge and Gary and Dan felt that from past dealings with the company that they would be willing to provide access and allow instrumentation to be stored and mounted on the river side wall. The river channel adjacent to the building has been dredged in the past according to Gary, an indication of additional flow depth (Figure 18). Gary uses the top railing on the steps to the pump house as a flood level reference point.
4. Site four was located downstream from Rumford approximately 15 miles, in the town of Canton. Construction of a new bridge was under way over the Androscoggin River (Fig 19). Although the estimated water depth for a submerged transducer was greatest at this site (4-6 ft), the bridge orientation and sharp edge design on the downstream face of the pier would make it difficult to attach conduit, and the base of the pier was protected by rip rap. Another option discussed was to locate the sensor downstream of the new bridge and trench the conduit 1.5 feet into the bed to the location of a cluster of rocks along the right bank (Figure20). An existing phone pole at the site would be left to attach the instrumentation. The area is open and should provide good sunlight for a solar cell operation.
    a. We met with Jim Dyment, EMA director and LT. Fire chief of Canton. Jim pointed out past flooding areas on a map that included closing of Rt. 108 and Rt.140 on the right bank of the Androscoggin where Whitney Brook overflows its banks. He also mentioned the 1976 and 1987 events

that caused flooding along Rt. 140 to Stevens Island on the Androscoggin River (Fig 21).

5. The Bethel, Rumford Point, and Rumford-Mexico sites are limited in water depth if submerged water level probes are to be used (2-3 feet). Bed conditions around the piers are unknown and could provide additional time delays in the installation process. To reduce the possibility of freezing of the probe, we have been able to bury them in the bed sediments at a depth of 18 inches. This allows ground water that is slightly above the freezing point to infiltration to the probe and prevents freezing. Use of SCH 80 PVC conduit rather than a metal conduit should reduce the amount freezing below the water level of the river and to the sensor. A perforated 3foot section of pipe with a filter fabric wrap has been used to allow water to infiltrate but restrict unwanted fine sediments from entering the pipe.
6. To summarize:
    a. All survey information is available in my notebook.
    b. The Bethel bridge site will provide information for the Androscoggin River and Adler Brook.
    c. The Rumford-Mexico bridge site will provide information for the Androscoggin and Swift Rivers.
    d. Additional mapping that Dan will provide will allow us to determine if the sensor locations at Rumford Point and Canton will be adequate.
    e. All systems require a data logger and transmission system, but the most vulnerable element is the water level sensor. The water level sensor component of the early warning system falls into one of three types:
        i. Conduit attached to bridge pier with instrumentation cable connected to a submerged pressure transducer probe (Figure 22) (used by CRREL).
        ii. Conduit attached to the bridge pier with a gas bubbler tube sensing system Figure 23, a more recent pressure transducer-based system used by NED and the USGS)
        iii. Ultrasonic and microwave sensor with no water contact (Fig. 24 and 25). These are used by Corps of Engineers New England District (NED) and CRREL. The sensing range of the ultrasonic sensor is 32 feet and should fall within the stage range at the three bridges on the Androscoggin River and one site on the Swift River in Rumford/Mexico.
    f. The susceptibility of the monitoring sites to damage by ice, freezing, bed scour and debris damage throughout the year suggest that the **ultrasonic sensor** may be the most practical option. A separate report will be provided discussing this option.

Respectfully Submitted,

Gordon Gooch
Civil Engineering Technician
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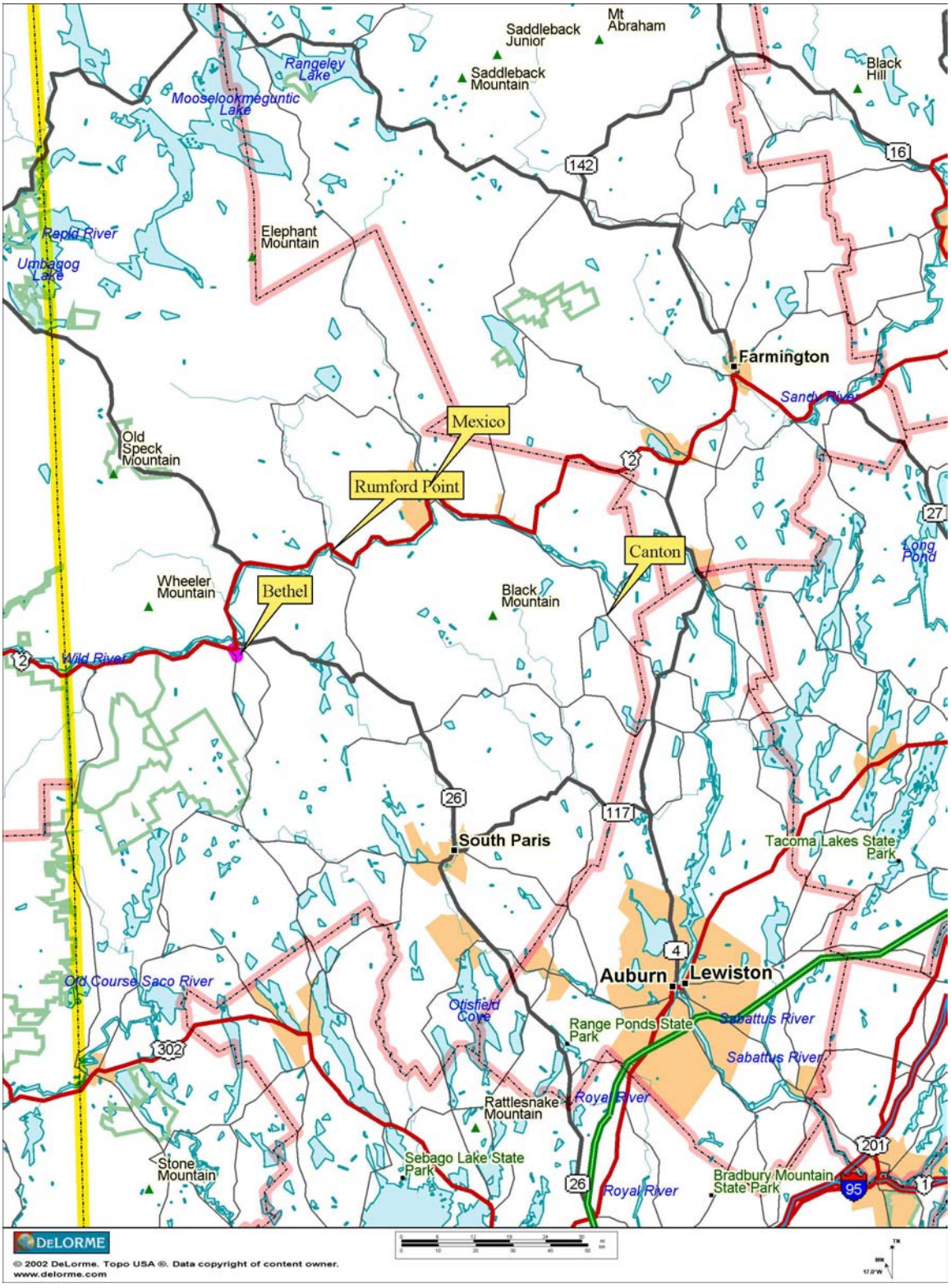

Figure 1. Proposed early warning river locations

Figure 2. Outdoor Adventure Center, Bethel, ME

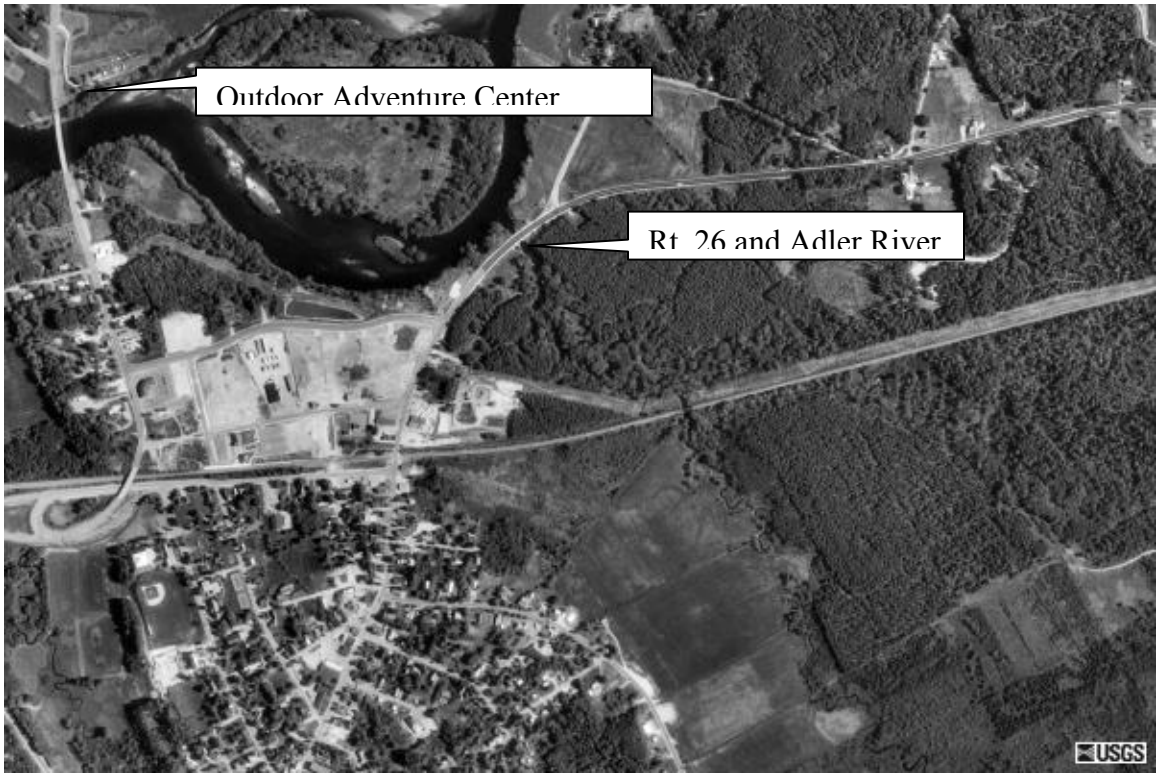

Figure 3. USGS Air Photo, Bethel Maine

Figure 4. Looking upstream at flood-susceptible area along RT 26 with the Androscoggin River on the right side of the photo

Figure 5. Confluence of the Adler River passing under Rt. 26, looking through the culvert to the Androscoggin River

Figure 6. Adler River from Rt. 26, looking upstream

Figure 7. Pleasant River looking downstream from Rt. 2 Bridge

Figure 8. Pleasant River looking upstream at Rt. 2 Bridge from left bank

Figure 9. Looking upstream at Bog Brook from Rt. 2 Bridge

Figure 10. Bog Brook Bridge on Rt. 2, looking downstream toward Androscoggin River confluence

Figure 11. Rumford Point bridge looking upstream from the right bank

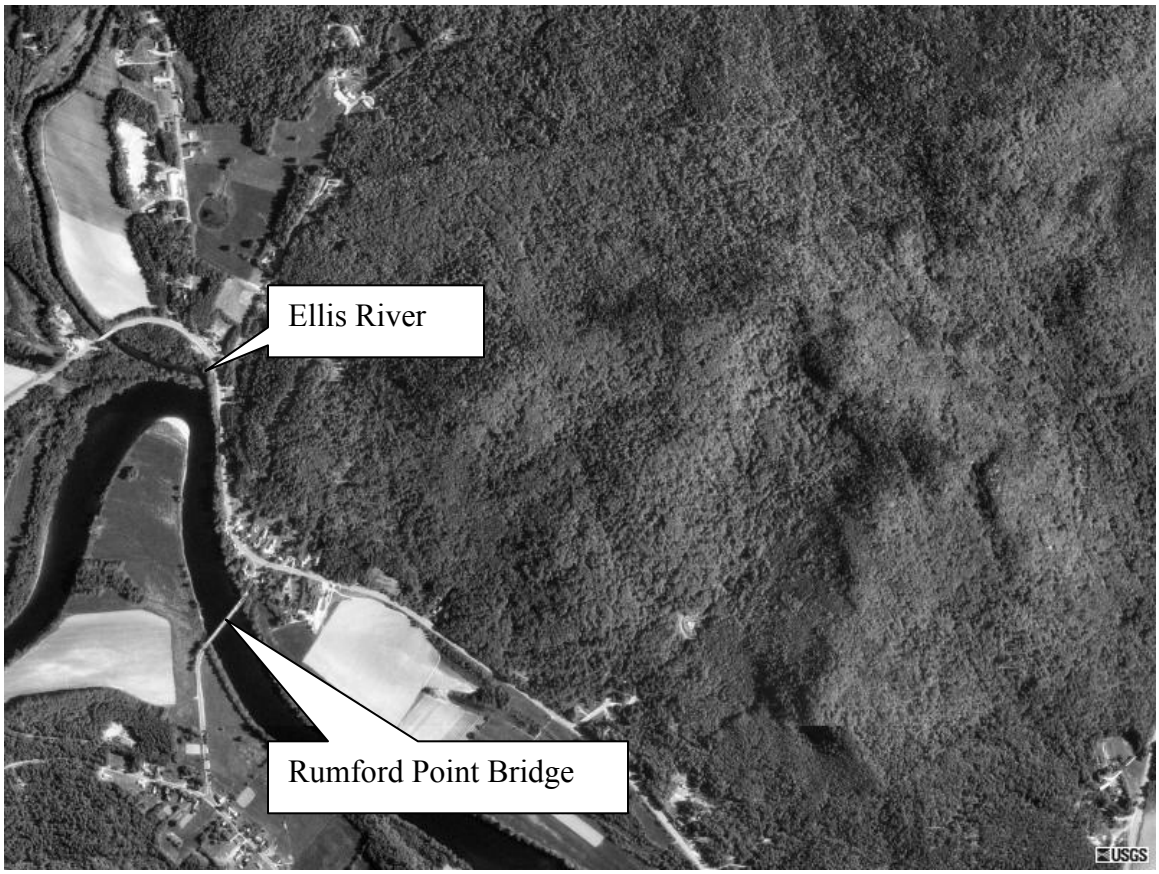

Figure 12. USGS Air Photo of Rumford Point Bridge on the Androscoggin River

Figure 13. Rumford Point church and bridge crossing

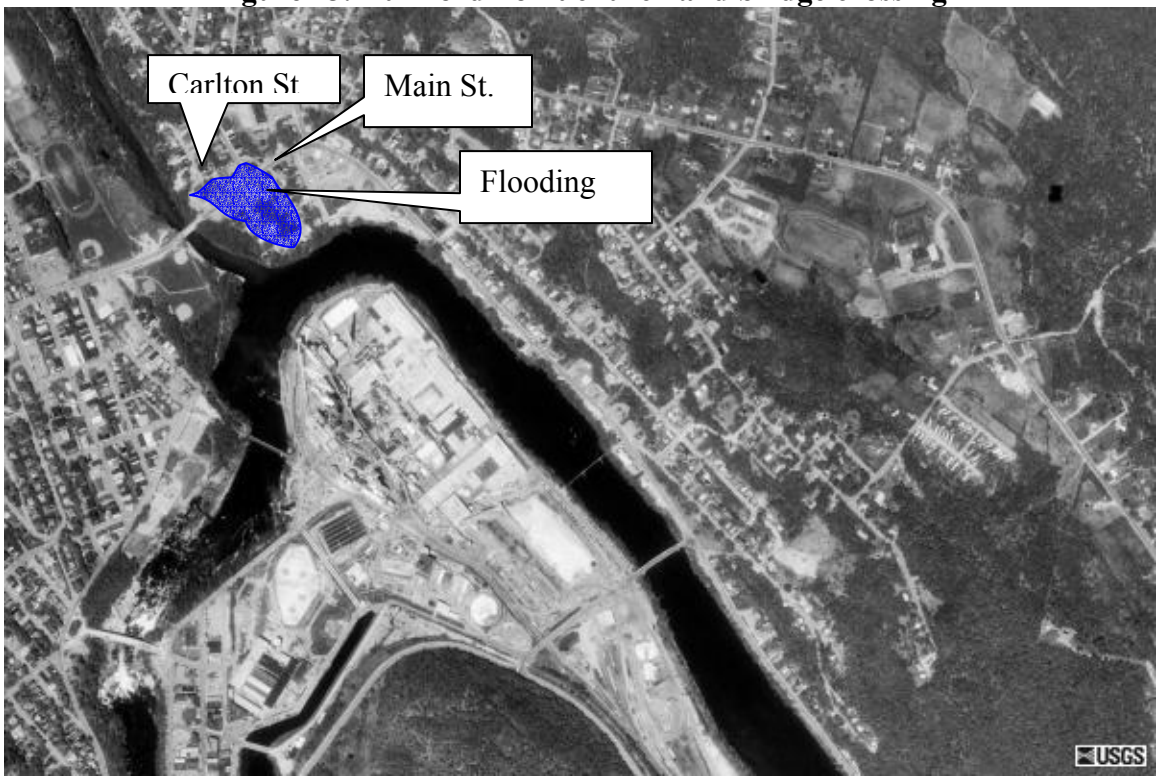

Figure 14. USGS air photo Rumford/ Mexico Maine

Figure15. Swift River looking upstream at the Main Street Bridge

Figure 16. Looking downstream on the Swift River at the confluence with the Androscoggin, with paper plant on the right bank of the Androscoggin River

Figure 17. Main Street in Mexico, ME

Figure 18. Pump house upstream of the Main Street Bridge, Rumford

Figure 19. New bridge at Canton on the Androscoggin River, looking from right bank (flow is from left to right).

Figure 20. Downstream of the new Canton bridge looking from the right bank (water depth approximately 3 feet at the larger rocks).

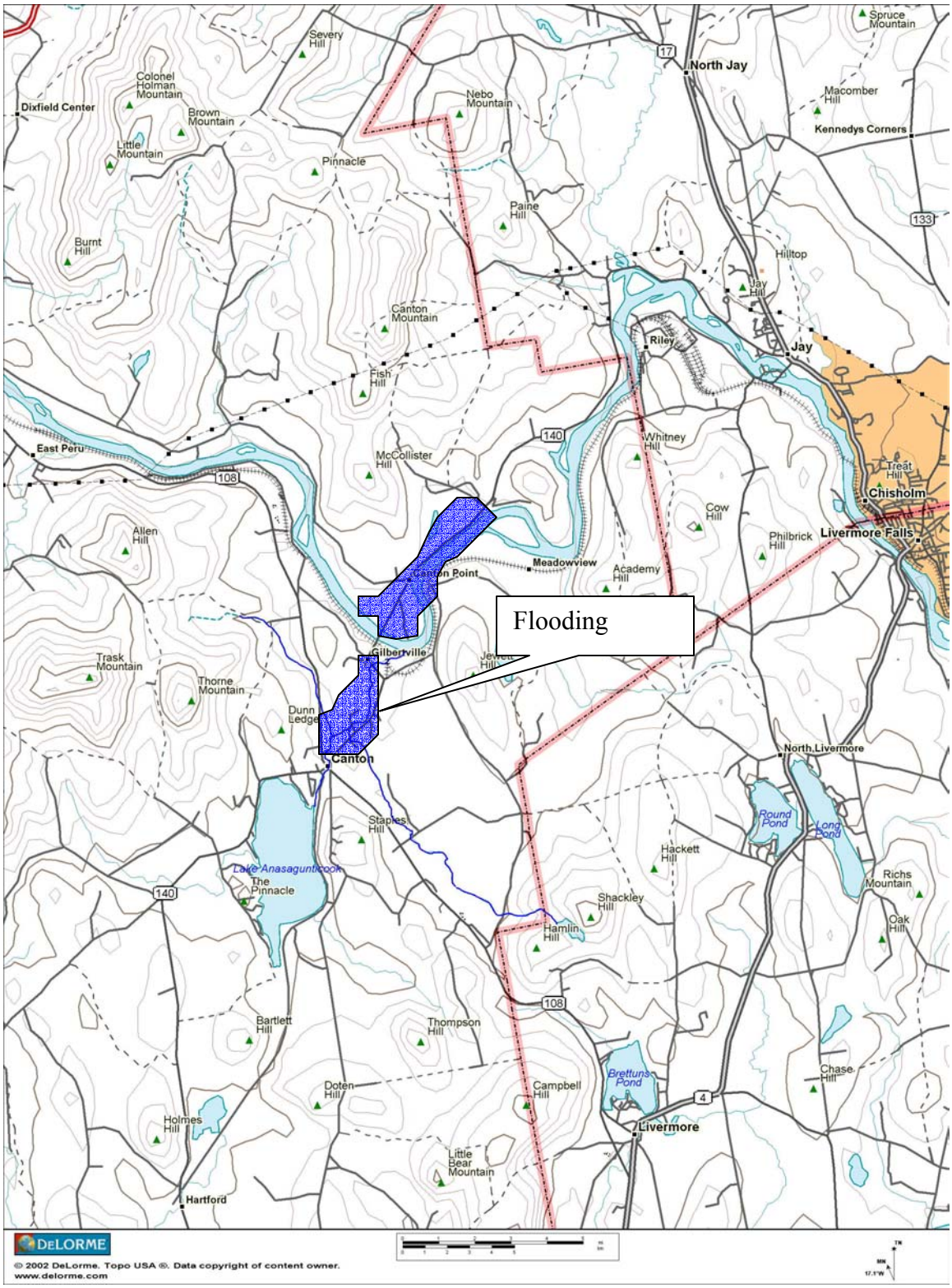

Fig 21 Map of Flooding along Whitney Brook and Androscoggin River Canton Maine

Figure 22 Submersible Pressure transducer.

Figure23. Gas bubbler water level system.

Figure 24. Ultrasonic sensor

Figure 25. Microwave water level system, range 0-115 feet