

GIS Technologies Help Hamilton Improve Emergency Preparedness for Water Systems

By Bert Posedowski
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The City of Hamilton, like many municipalities, is increasingly aware that GIS technologies can be valuable tools in emergency planning. They give first responders vital knowledge so they can react quickly and appropriately to deal with incidents. One incident in particular served to highlight the value that GIS can bring to an emergency event.

Hamilton's population of half a million people is served by one lake-based water system that provides 300 megalitres of drinking water to Hamilton's city core as well as to Dundas, Flamborough, Stoney Creek and Glanbrook. Four well-based water systems serve the communities of Greensville, Lynden, Freelon and Carlisle.

In August 2004, an interruption in the supply of water to the residential community of Rosedale, caused by unusually heavy water demand in the area, placed restrictions on water use in that community for a week. The medical officer of health issued a drinking water advisory, which is a warning not to use the water for any purposes. This advisory is normally issued in cases where a negative pressure is experienced in a watermain, since this condition can expose the pipeline to the ingress of contaminants and silt through cracks and joints in the system.



Bert Posedowski of the City of Hamilton addresses the Intergraph Users Conference in Mississauga last fall.

Normal water pressure was restored in short order, but it took a week before the watermains and the water supply could be tested sufficiently to permit the drinking-water advisory to be lifted. Meanwhile, there was much work to do.

The first requirement, of course, was notification. Staff mounted a campaign of notification that consisted of telephone and door-to-door notification, delivery of notices, media releases, live interviews on television and radio, and Web-site uplinks.

The City is normally prepared to handle water-supply shortages in communities of about 600 homes, since that reflects the size of the City's largest communal well system – systems more susceptible to this

type of service interruption. When the Rosedale incident unfolded, the notification campaign had to reach 3,200 homes.

For the duration of the advisory, City of Hamilton staff provided water from three temporary filling stations located within or near the affected area. Water was first handed out in collapsible containers, then by bottled water and then by a combination of the two. The demand for water far exceeded expectations. It was evident that the temporary water stations were serving not only the Rosedale residents but also residents from immediately outside the affected area, who were concerned that their water was impaired, and people far removed from the area but drawn to the event by curiosity.

When the incident was over, City staff held several meetings to analyze their response and to identify ways to improve preparation and service delivery in the future. One result was the enhancement of the City's emergency-response procedures, taking advantage of existing GIS technologies.

Faster Notification

When large-scale public notification is required on short notice, having people available and organized is extremely important. In this respect, a significant contribution was made, during the Rosedale event, by a local organization called Community Emergency Response Volunteers

(CERV). In 2003 the City of Hamilton joined in partnership with St. John's Ambulance to attract volunteers from the community to receive training and be prepared for any number of emergencies. During the Rosedale incident, CERV volunteers assisted greatly with notification to residents and help at the filling stations.

Despite the best efforts of CERV and City staff, the public were critical that the distribution of drinking water advisory notifications wasn't fast enough. And indeed, it took several hours from the time the first signs of a water stoppage were identified to the time when the medical officer of health issued the drinking water advisory and the notices were delivered.

In response, the City looked critically at the way staff responded to the Rosedale event and implemented several major improvements – many of which use the power of the City's GIS.

Coordinating small groups of volunteers in an area to efficiently deliver notices requires pre-planning. Team leaders must be assigned areas that are appropriate to their team size and yet small enough to be auditable by the team leader after the notice campaign. With the aid of GIS, team leaders can review a map of an affected area and delineate a notification sub-area. Once defined, a customized GIS map of the sub-area can be generated along with associated lists of resident names, addresses and phone numbers.

Moreover, the use of detailed maps and resident lists demonstrates the City's exercise of reasonable care in

the delivery of notices. The City is required to clearly communicate with affected residents that a drinking water advisory exists and that precautions must be exercised. Delivering a notice in a mailbox is not enough. By using these maps and lists, the team leaders have the information necessary to audit the notification process and to ensure that the areas are thoroughly canvassed.

Since the City's communal well areas are more susceptible to water outages, staff have pre-planned for notice distribution there. Each communal well area has been divided into sub-areas that can be readily canvassed by a small group of volunteers. To account for changes in residence, the City updates the maps and the resident lists semi-annually and provides the updated information to area supervisors.

Each supervisor in the Water Distribution Section has a laptop with GIS and Hansen Maintenance Management databases installed. Imbedded within the GIS is a complete library of operating procedures, including procedures for emergencies. When the user clicks on Water Distribution/ Emergency Response Plan, two documents appear: procedures to be followed for various incidents and an emergency contact list.

The emergency contact list is a vital document and contains the names and after-hours phone numbers for a variety of individuals including senior staff, treatment plant operators, Health Department staff, regulatory agents and private

contractors (excavation, spill response, water haulers, etc).

Other resources include what we call "battle boxes" – kits for volunteers and supervisors with everything needed for large-scale delivery of drinking-water advisories. Contained in the battle boxes are the communal well sub-area maps and resident lists, identification cards, clipboards, paper, pens, tape and flashlights.

Another important lesson we learned is that mundane details can slow the distribution of notices if they are not considered in advance. For example, how many notices should be printed? We thought that, in an area of 3,200 homes, we should print slightly more than 3,200 notices.

What we found in practice was that, when a bundle of notices arrive on site and a large number of team leaders are all collecting handfuls of notices for their teams, some teams will be short notices while others will have excess. Those that are short subsequently lose time and are distracted by the process of hunting down spare copies. The lesson learned is to print and deliver a quantity of notices well in excess of the number required for the affected area.

A Vital Link

When the City became aware of the problem in Rosedale it was initially thought that a large residential area of 3,200 homes had been affected. Through subsequent analysis it was determined that the affected area was much smaller. Unfortunately, by the time the true area was realized the drinking water notification had already been released.

That experience highlights the benefits associated with quickly and accurately determining the extent of the event. During the Rosedale incident, the City developed a software link to address this need.

Hamilton implemented its Hansen maintenance-management database almost 20 years ago and has developed advanced applications for it through the use of a unique bidirectional link between Hansen and Intergraph's Geomedia platform. The City has the ability to call up customer-service information based on a complaints code and apply it to a map within seconds. This gives a visual representation of how wide spread a problem may be.

The City had never used this link for emergency-management purposes. Soon after the drinking water notices were distributed in Rosedale, staff began to map water-pressure complaints received during the incident and were able to refine the limits of the affected area. Had the City implemented this link in the initial stages of the incident the data may have been sufficient for the medical officer of health to reduce the extent of the water advisory.

The City learned from this experience that the problem codes in Hansen were not being fully utilized, and this limited the power of the Hansen/GIS software link. Furthermore, call-centre staff were responding to customers in a manner that maximized the number of callers served but hampered the

inputting of data into Hansen. New procedures were implemented that improved data capture and staff were offered a broader understanding of how the data they input is used, which helped them better understand their role during a crisis.

Now, if someone calls with a water-related problem, the call-centre staff are asking more specific questions: Do you have low pressure or no pressure at all? Do you have a taste and odour problem? Is there discoloration? With such questions, the Hansen maintenance-management database is populated with more specific information that helps staff quickly identify an affected area by means of the bidirectional link.

We proved the value of this technology in the summer of 2005 when an area in Hamilton experienced an intermittent loss of water supply. Using the bi-directional link, staff were able to graphically display incoming customer complaints, quickly define the affected area and respond accordingly.

Conclusion

Since the Rosedale event, the City of Hamilton has improved its preparedness for water emergencies in several ways. It has developed detailed operating procedures that are accessible to supervisors in the field


at all times and it has developed a strategy to precisely locate an area affected by a water problem and have teams of volunteers organized and prepared to alert residents of trouble.

Having the geographic database and maintenance-management database necessary to do this, and using it effectively, makes all the difference.

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