

LOCATION: DISTRIBUTION AND TREATMENT

CLASSIFICATION: 3

INTRODUCTION:

There is an existing SOP for dealing with recurring freezing services, on a 3-priority system, during a typical winter. However, during the winter of 2014/2015, the extremely cold weather created a situation in which the existing SOP was completely inadequate, and additional measures were required. The emergency became one which the Water Distribution department alone did not have the resources to handle. The following are the components of this emergency response plan, and the detailed information required to implement the plan is included in a binder entitled “Frozen Services Emergency Response Binder”, located in the same location as the Water Distribution SOP binder.

THE 2014/2015 EVENT BY THE NUMBERS:

The freezing event itself was primarily limited to late January to the end of March 2015.

- 317 total frozen services.
- Approximately 2200 homes running water.
- More than 50 watermain breaks November 2014 to March 2015 inclusive. (Typically 20 to 40 yearly total)
- About 1.4 km of watermain replaced, including services.
- Total Cost: Approximately \$ 2.1 Million.

One of the figures in the “Frozen Services Emergency Response Binder” shows the locations where watermains were replaced, as well as the locations of the main breaks. Another figure shows the location of the frozen services, and another, the location of streets which were asked to run water.

INITIALIZING THE PLAN AND PREVENTATIVE MEASURES

Transition from SOP to ERP

The decision to move from the implementation of the normal SOP to the implementation of the ERP should be determined by the Director of Operations in consultation with the City Manager, Manager of Water and Wastewater, and the Water Distribution Supervisor. The following is meant to guide that decision:

- If all three priority levels of the SOP have been implemented, the temperature is still below freezing and the forecast remains cold, and additional freezing is anticipated or witnessed, including mains as well as services.
- Tracking of negative degree days: By adding the cumulative average temperature from the start of November, and by comparison to effects seen in

the winter of 2014/2015, the implementation of the SOP will likely be required to be implemented by about the time the cumulative negative degrees days reaches -200. The ERP will likely be required to be implemented by about the time the cumulative negative degrees days reaches -400. This observation is very general and the amount of snow cover would also be a large factor.

Resources:

The following resources were required in 2014/2015 in addition to the water distribution department. These resources need to be added at the appropriate time as the plan is implemented:

- Considerable extra time required by the Director of Operations and the Manager of Water and Wastewater, who, in addition to keeping senior staff and Council and the public informed, were required to make decisions to undertake action, usually on an immediate emergency basis.
- Two administrative assistants at Public Works to receive calls and transfer that information to the frozen service tracking spreadsheet, and also document work done by hose crews on the same sheet.
- The involvement of the staff of IT to provide up to date “run water” maps on the website, as well as the billing department, who coordinated handing out “run water” notices, as well as setting billing policy and answering billing questions.
- Additional supplementary City staff for hose crews, operating electrical thawing units, and delivering door to door notices, and other duties. (Note that for adequate speed of delivery and response, as many as 8 persons are needed for door-to-door notices. Smaller numbers could not always deliver the notices in time to make a difference.) Required supplementary staff was generally as follows: one or more from Wastewater Treatment, one or more from Water Treatment, one from Wastewater Collection, two staff from Parks, one staff from Engineering, and Public Works staff, whose numbers (and equipment) varied between the help needed but balanced against the need for Winter Control. At any given time, at least one, and often two “hose crews” of two people each were in operation.
- Considerable contractor assistance was required, under the emergency provisions of the purchasing bylaw, paid on a time and material basis. Three watermain contractors were required as well as a private Vactor and plumbers
- A consulting Engineer coordinated the replacement of broken watermain sections, and the installation of temporary watermains. This allowed Water staff to focus on “triage” efforts to isolate sections of main where the watermain was split, to fix localized main breaks, and to co-ordinate hose crew and other efforts.
- Suppliers of materials needed included Carson’s, Porter’s, and Evan’s. Additionally hose was purchased from a wide range of locations, even far outside Owen Sound (the City has stored thousands of feet of hose for future events)
- Flowmetrix provided leak detection services where needed.

- Thawing equipment needed included the “Magikist”, “Steam Johnny”, and “KT-190” electrical units. For watermains and valves, the Public Works steamer was used with dedicated hose for potable use.
- Other heavy equipment in the Water and Public Works divisions were dedicated greatly to the issue. As mentioned, Public Works assisted to the extent possible given the need to run Winter Control.

Notice to Run Water:

A drawing showing the affected streets where a run-water notice should be provided can be found in the “Frozen Services Emergency Response Binder”. The areas selected to run water are where there are shallow mains, and especially where dead ends occur, and near normally-closed valves between pressure zones. People are asked to run water via:

1. Door to door notices, which, when time is of the essence, must be handed out within a day.
2. Media releases.
3. The City website, which shows the run-water area map, and the website should be referenced in the media releases.

In addition to the affected areas, where residential users should run water, certain special facilities should be designated as “run water” locations, regardless of location. These are:

1. Schools
2. Nursing Homes
3. Other health care i/c hospital, dentist offices
4. Group homes
5. Funeral homes
6. Necessary institutional (Police, Fire, etc)
7. Churches
8. City facilities

Examples of both the door to door notices and media releases can be found in the “Frozen Services Emergency Response Binder”. They emphasize the need to run water at a minimum rate 24/7, and not to stop in spite of temporary warm weather, until advised to do so. Other Media Releases provide important tips to the public.

The Water Treatment Plant daily flows will increase. Flows should be monitored daily as areas are brought into the “run water” mode. It can be expected that flows will increase from on or about 8000 CMD (about 30% capacity) to about 13000 CMD (about 50% capacity). This should be closely monitored, and can create serious concerns once spring runoff occurs, discussed in a later section.

MITIGATIVE MEASURES TO MAINTAIN OR RESTORE SERVICE

Database:

A spreadsheet was developed to track the frozen service status. It can be found in the “Frozen Services Emergency Response Binder”. This was maintained by the administrative assistants at Public Works who received calls, in daily consultation with the Water Distribution supervisor as work progressed. The City’s IT department is working on a ticket system on a GIS base to do that more efficiently.

Provision of Water Stations for those with No Service:

As a stopgap measure until services could be thawed or hooked up to a neighbour’s hose, the “Frozen Services Emergency Response Binder” includes a media release to inform people that free water would be made available at the Recreational Centre, the Bayshore Community Centre, and the Water Depot (who volunteered to assist). Additionally showers were made available at the YMCA at the Recreational Centre.

Prioritization of Service:

Early on in the process, the need to prioritize the restoration of service was identified. The following was the prioritization system:

1. People who are vulnerable due to medical conditions and the elderly
2. Locations which required make up water for hot water heating systems
3. Businesses
4. Others

Note that special attention would also be paid to institutional users such as those listed in the earlier section. However they would specifically have been asked to run water early, and at a good rate, in order to try to prevent the freezing in the first place.

Thawing Water Services:

Water Distribution has the “Magikist”, “Steam Johnny”, and “KT-190” electrical units. Service can be restored with these units, but the following are considerations:

- The “Magikist is a very effective unit for thawing services, but it is time consuming to use. It can take a half day to a full day for a service to be thawed with it. The Steam Johnny is considered a backup alternative to the Magikist; the Magikist units are maintenance intensive and break down frequently.

- The KT-190 electrical units can be effective at thawing services, but can only thaw between two points of electrical connection (the curb stop and the internal plumbing) and can only be effective if a good electrical connection is maintained.

In general, thawing water services is time intensive. As a result, depending on how fast services are freezing and the extent of backlog, it can make more sense to dedicate staff to hose crews instead.

House to House hose connections:

Often the only feasible alternative to restore service to a household is to run hose from an adjacent house with water. In some cases the hose may even be run from a fire hydrant. The following are considerations:

- House to house hose connections can refreeze, especially if the person connected forgets to continue to run water. This was a major public education issue; persons on hose must keep running water to prevent the service from freezing.
- The water is not considered potable. During the 2014/2015 event, an attempt was made to make a case-by-case decision about potability, but this led to some public confusion, therefore in the future the policy should be for blanket non-potability. Please see the notice attached in the "Frozen Services Emergency Response Binder".

Temporary Watermains:

In circumstances where watermains in some areas are frozen and damaged thoroughly, temporary watermain may be laid in those areas. This was required in the 5th Ave, 800 block area, and the adjacent "Snake Alley" area (5th Ave "A" East) in 2014/2015. The following are considerations:

- The temporary watermain is installed in generally the same way as is done for normal construction purposes.
- People on temporary watermain must run water constantly to prevent freezing.
- Temporary watermain should be insulated where possible, such as by bales of straw.
- Temporary watermain should be considered non-potable, and appropriate door to door notice given. However precautionary samples could still be taken to document actual water bacteriological quality. One issue with temporary watermain is that constant refreezing creates the need to continually work on it, and associated shutdowns. This makes assuring quality more difficult.

Billing while running water or while on hose connections:

The Finance department provided a report to Council summarizing a policy regarding how to invoice affected households. It is included in the “Frozen Services Emergency Response Binder”.

Frozen Hydrants:

As the water distribution department encounters frozen hydrants, an updated list of frozen hydrants should be maintained and provided regularly to the fire department. Please see the list attached in the “Frozen Services Emergency Response Binder”. Hydrants being used as temporary water supplies, or being run regularly to prevent freezing, should also be flagged on the same list as “in use: out of service”. The fire department should be made aware that many other hydrants may also be frozen, and they should have consideration for that in their planning.

ISOLATION AND RESTORATION

Isolation of Damaged Intersections: Cut and Cap

In the winter of 2014/2015, various intersections were “lost”, meaning:

- Pipes and valves in the intersection were frozen, and some were split. Sometimes this was evidenced by watermain breaks in the intersection, or valves which were frozen which could not be thawed, or damaged valves.
- At intersections where that had occurred, Water Distribution could not be confident of maintaining control of flow at the intersection once it thawed, due to the unknown conditions of the pipes and valves at those intersections.

When the intersection was “lost” in this manner, the decision was made to:

- Thaw valves and leave them closed in an attempt to maintain control of the situation when the damaged pipes thaw, releasing water to the area.
- Failing the restoration of valves, if that was not possible, the watermain was cut and capped near the intersection, at a point known to be providing water (ie, near a service location that was running).

The “Frozen Services Emergency Response Binder” includes figures which were drawn up in the field to document those intersections that were cut and capped on a triage basis.

Once the pipes thawed, each intersection was restored as a minor construction project on a time and material basis. See the next section.

Emergency Repairs on a Time and Material Basis:

Various general watermain contractors were brought in on a time and material basis to execute emergency repairs, replaced frozen damaged watermain, and also replacing services in the affected areas:

- The abovementioned isolated intersections
- The sections of watermain that failed; in some cases a good portion, or all of, a city block.

One of the figures in the “Frozen Services Emergency Response Binder” shows the locations where watermains were replaced, as well as the locations of the main breaks. In general, shallow frozen damaged watermain (almost always cast iron) was replaced by PVC watermain with 1.8 metres cover. Where 1.8 metres of cover could not be achieved for whatever reason, the appropriate amount of insulation was installed. Services were replaced because, generally speaking, where the mains were shallow, so were the service pipes.

WRAPPING UP THE EMERGENCY

Notice to Stop Running Water

The Notice to stop running water was issued via media release on April 15, 2015. Generally speaking, the notice to stop running water is a judgment call issued based on observed frost conditions, and forecasted temperatures. However consideration should be given to the impact of Spring Runoff on the Water Treatment Plant, which may cause the Notice to be issued earlier; see below.

The Water Treatment Plant cannot effectively run at capacity, or even a reasonable fraction of capacity, when raw water quality is adversely affected by the spring runoff. When that happens, the plant must use treated water to backwash filters very frequently, which can result in the net production of the plant decreasing to less than 5000 CMD. This can cause the storage reservoir to be drawn down to levels less than 50% even when there is no run-water request in place. During the run-water scenario, plant demand was about 13,000 CMD, compared to average demand of 8,000 CMD. The duration of the event can vary, but often goes on for days. This could be a serious concern during future events.

Gathering Hose

The amount of hose needed to provide temporary service to hundreds of homes is substantial. Usually about 100 feet of hose is required to service a home. The City has stored more than 15,000 feet of hose from the 2014/2015 event. Gathering hose will take two crews about two weeks.

MISCELLANEOUS CONSIDERATIONS

Existing Watermains left out of Commission for Extended Periods

In certain areas, where some mains were isolated by “cut and cap” or other measures, some existing watermain was left out of service and unpressurized for a period of time, then put back into service. This raised the following water quality concerns:

1. Could the pipe have been adversely impacted by contaminated water, especially sewage, during that time?
2. Would the disinfection procedures as defined by AWWA for construction and commissioning of new watermain be adequate for existing mains which, among other things, can be heavily tuberculated?

The solution selected to address these concerns was two-fold:

1. Take a Sample First : A bacteriological sample was taken after flushing the main, then re-isolating the main, but prior to superchlorination. The purpose of that sample was simply to establish if there was any evidence of contamination.
2. Disinfection procedures in accordance with AWWA procedures for new pipe were undertaken, but at greater chlorine concentrations as an additional precaution.

Relationship with Road Maintenance Activities

In certain locations it has been speculated that the freezing of watermains may be related to two road maintenance activities:

1. Snow clearing on the edges of some streets, may reduce snow cover which was protecting a watermain from freezing.
2. Crack sealing activities may be helpful. In the winter salt water runoff can penetrate the ground in cracked areas. Salt water can be cooled to temperatures lower than freezing, and this may contribute to deeper penetration of frost and pipe freezing in such areas. This is a speculative theory but may have merit.