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REPORT TO MAGIC LAKE ESTATES WATER AND SEWER LOCAL SERVICES COMMITTEE MEETING OF FRIDAY 28 OCTOBER 2011

SUBJECT **WATER LOSS MANAGEMENT UPDATE**

ISSUE

A significant proportion of the water supplied into the Magic Lake Estates water system is lost to leakage, and new information is available about the extent of water losses in the system.

BACKGROUND

Leakage losses have been considered a threat to the reliability and sustainability of the Magic Lake Estates Water Local Service for several years. Water loss reduction was a primary purpose of a major watermain replacement project in 2001-2003, which resulted in the replacement of approximately one third of the distribution system. Overnight minimum flow rates through the Captains and Frigate tanks are monitored to estimate leakage rates. In an engineering study of the system in 2007 by Capital Regional District (CRD) staff, the minimum overnight flow rate was reported to be 3.0 litres per second (l/s), or about 40 percent of total annual water production. Overnight flow was attributed largely to leakage, although it was not possible to determine the proportion of leakage occurring in the distribution system (as opposed to leaks on private property) since customer connections were unmetered.

Customer Meters

Between 2008 and 2010, water meters were retrofitted to all customer connections to the water system. When the metering program was completed, the overnight flow rate had decreased to less than 2.0 l/s, and the total annual flow through the two treatment plants has decreased by 14% since 2007.

Every customer meter has been read every three months since January 2011, enabling an accurate estimate of non-revenue water (the difference between the total amount of water measured entering the distribution system through the treatment plants, and the total amount of water measured leaving the system through the customer meters). Non-revenue water for the period of January to September was 30,345 m^3 (1.3 l/s), and the annual total is projected to be 39,000 m^3. Distribution system leakage is likely one of the largest components of non-revenue water however, watermain flushing, fire hydrant usage and measurement error are also components of non-revenue water. There are ten automated watermain flushing stations in the system for the purpose of maintaining adequate chlorine residual in the system, which are estimated to use up to 20,000 m^3/yr.

Water System Review Study

A Water System Review conducted this year by AECOM Ltd. as part of the system upgrade project concluded, based on overnight flow rates, that leakage losses account for approximately 1.9 l/s, 60,000 cubic metres per year (m^3/yr), or about 30% of annual water production. In its demand projection for full build-out of the Magic Lake Estates subdivision, AECOM estimates an annual average demand of 6.9 l/s, or 220,000 m^3/yr. This projection is based on the assumption that demand grows in proportion to the number of lots connected to the system (i.e. there are no changes in demand per connection due to water loss reduction or water conservation, and there are no changes in the average household size or seasonal occupancy).

Locating Water Losses

Little is known about the locations of water losses in the distribution system. Overnight minimum flow rates can be measured through pressure reducing stations into each of the four pressure zones by manually isolating the main pressure reducing valves and forcing water to flow through temporary metered bypasses late at night. Pressure reducing stations are not equipped to continuously measure flows.

Locating water losses within a pressure zone is difficult. Most losses are likely to result from a large number of small leaks at pipe joints, valves and service connections to the mains. These small leaks are difficult to locate and are typically not cost-effective to repair. Larger leaks occur from time to time, and are usually located and repaired quickly. If a significant new leak is suspected due to a sudden increase in overnight flow into the system, its location is often evident as a wet area on the ground surface. If not, it may be located by the following or similar sequence of steps:

- Check overnight flows through the tanks (monitored on SCADA) to eliminate one to three pressure zones.
- Check customer meters for continuous flow or very high usage (may be read by radio).
- Isolate pressure zones at PRVs to determine overnight flow in each zone.
- Isolate sections of main, and measure overnight flows using temporary metered bypasses.
- Use acoustic leak detection equipment to pinpoint the leak in a section of main.
- Excavate to expose the suspected leak location.

Since the process of locating a leak often requires multiple staff with specialized skills and equipment working outside regular hours, only large leaks are typically located in this manner, at a significant unplanned cost. Smaller leaks are typically considered to be acceptable losses until watermains are eventually replaced.

ALTERNATIVES

1. That the Magic Lake Estates Water and Sewer Local Services Committee include a budget of $15,000 in the 2012 Capital Plan for installation of flow meters on the ten automated flushing stations in the system, with funding from the Capital Reserve Fund.

2. That the Magic Lake Estates Water and Sewer Local Services Committee include in the 2012 budget a new continuous supplementary of $20,000 to establish an ongoing water loss measurement program, and include a budget of $105,000 for installation of flow meters on the ten automated flushing stations, five pressure reducing stations and one booster pump station in the system, with funding from the Capital Reserve Fund.

3. That the Magic Lake Estates Water and Sewer Local Services Committee receive this report.

IMPLICATIONS

Alternative 1

Water use by automated flushing stations is now estimated to account for roughly half of non-revenue water, and ten percent of overall water production. Although these stations serve an important water quality purpose, their operation could be optimized through increased monitoring of flows if a residential meter assembly is retrofitted to each station. The meters may be read automatically using the same process as customer meters, at no additional annual cost.

Alternative 2

Implementing a formal water loss measurement program would require new effort that is currently not budgeted. A modest program may include quarterly measurement of distribution leakage in each pressure zone, and further effort to locate losses in the zone with the highest loss rate per metre of watermain. Such a program could be implemented without infrastructure upgrades, by isolating main

pressure reducing valves and measuring flows through metered bypass lines at night. Additional work in the zone with the highest leakage rate may include further isolation and direct measurement of losses in watermain sections between line valves, and acoustic leak location. It is likely that at least some of the work would require the use of staff from Greater Victoria and a specialized contractor. An annual budget for such a program may be in the range of $10,000 to $30,000.

Distribution loss measurement could be improved by retrofitting pressure reducing valve stations to continuously measure flows. Since most stations lack the clearance to install meters on the main (100mm or 150mm) valves, it is likely that compound meters would need to be installed in new vaults in the ground immediately upstream or downstream of each pressure reducing station, as well as the Bosun Booster Pump Station. Fitted with radio reading transceivers, the meters could then be read automatically every three months. Manual reading would still be required to measure minimum overnight flow rates. The capital cost of installing these meters would likely be in the order of $15,000 per site, or $90,000.

Flow data could also be obtained by connecting zone meters to the SCADA system; however, implementing SCADA at each pressure reducing or booster pump site would likely require additional capital investment in the order of $200,000, and would introduce new annual costs for five electrical services and up to six telephone lines (unless reliable radio communications to the water treatment plant can be established).

Alternative 3

Water losses are estimated to have decreased by roughly one third in the past four years. It is now projected that the overall water demand at full build-out of the utility (220,000 m^3) will be less than the actual water demands between about 2003 and 2007, without any future reduction in water losses. Water losses will likely continue to decrease as original watermains are replaced, and household water demand will likely continue to decrease as existing plumbing fixtures and appliances are gradually replaced with new ones that meet current water efficiency standards. Such reductions will likely offset any increase in average household size or occupancy that may occur. The risk of a water supply shortfall in the foreseeable future will be low if the overall leakage rate remains below 2.0 l/s, and total water demand per customer connection remains below 180 m^3/yr (including non-revenue water).

CONCLUSION

Water losses in the Magic Lake Estates water system have decreased by at least 30 percent since 2007. There is no need to monitor water distribution losses in the four individual pressure zones at this time; however, further reductions in non-revenue water may be possible by metering and optimizing automated flushing stations.

RECOMMENDATION

That the Magic Lake Estates Water and Sewer Local Services Committee include a budget of $15,000 in the 2012 Capital Plan for installation of flow meters on the ten automated flushing stations in the system, with funding from the Capital Reserve Fund.

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Concurrence

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