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TO:	CHAIR AND MEMBERS CIVIC WORKS COMMITTEE MEETING OF MONDAY, SEPTEMBER 23, 2013
FROM:	JOHN LUCAS, P.ENG. DIRECTOR, WATER AND WASTEWATER
SUBJECT	WATER EFFICIENCY PROGRAM: LEAK DETECTION THROUGH DISTRICT METERED AREAS EW3772-13

RECOMMENDATION

That on the recommendation the Director of Water and Wastewater and concurred by the Managing Director, Environmental & Engineering Services & City Engineer, the following report **BE RECEIVED** for information with respect to the Water Efficiency Program pilot project on City wide district metered area for active leak detection; it being noted that a business case for expanding the pilot project will be included with the 2014 Water Budget submission.

PREVIOUS REPORTS PERTINENT TO THIS MATTER

- [Update to the Water Efficiency Program, July 19, 2010, Environment and Transportation Committee, Agenda Item #14](#)
- [Water and Sewer Audit Staff Response, December 19, 2011, Civic Works Committee, Agenda Item #11](#)
- [Water Conservation and the Future of Water and Wastewater Rates, April 2, 2012, Civic Works Committee, Agenda Item #31](#)

BACKGROUND

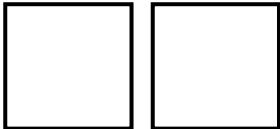
Background:

Non-revenue water (NRW) is tracked by municipalities all over the world as a key performance indicator and is the difference between the amount of water pumped into the City’s water distribution system and the amount sold. Since 2006, the City’s non-revenue water has increased by over 1 million cubic meters or just over 4%. NRW is water that does not go through a revenue meter. This unaccounted for water is still treated and pumped into the City’s distribution system and is largely made up of leakage, theft, firefighting, construction water, water meter inaccuracies, watermain breaks, and water quality maintenance activities. It is normal to expect a certain amount to be unaccounted for in the daily operation of a municipal drinking water system. Based on a 2011 study conducted by the AWWA, the average in North America is 21.4% for systems servicing more than 50,000 customers noting that the State of California recommends 10% as a target level.

London NRW Performance

2006	2007	2008	2009	2010	2011	2012
7.4%	7.7%	7.4%	9.0%	10.2%	10.8%	11.2%

As shown above, during the period between 2006 and 2008 London’s NRW was stable around 7.5%. Since 2006 that amount has increased by almost 4%. The resulting cost of the increase in NRW between 2006 and 2012 (7.4 % to 11.2%) is an additional \$1Million of purchased water

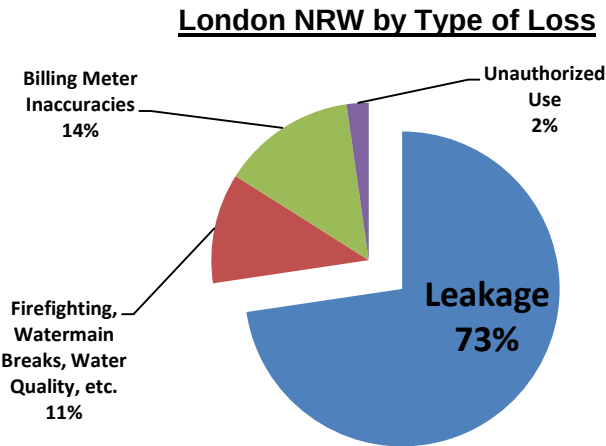


to a present total of \$2.17Million of annual NRW. As the cost to purchase water from the Elgin and Lake Huron Primary Supply Systems increases, the significance of NRW in the annual operating budget is greater and its overall reduction presents an opportunity to reduce the annual expenditures of the water system. These activities will also “build” more capacity in the water system to accommodate growth without needing to construct new pipes or facilities. It is important to point out that it is not financially viable or practical to attempt to reduce NRW to zero. Activities like theft of water that contribute to NRW are difficult to find and even more difficult to prove. Other activities like firefighting, construction water, watermain breaks, and water quality maintenance can be reduced with enhanced capital replacement and rehabilitation programs; but there will always be some unaccounted water as part of the day to day operation of the system.

Although the London value has slowly crept up over the past 4 years, it has been mitigated by various actions undertaken to manage the amount of NRW:

Cause of NRW	Action
Leakage	Implementation of pilot DMA program, ongoing “normal” leak detection activities
Theft	No specific preventative action taken
Firefighting	Additional education campaigns by Fire Services to prevent fires from occurring – this is a public safety driven initiative, but reduced fires across the City has benefits to the annual Water budget
Construction Water	Additional checks and controls were introduced into the building permit and meter installation process with London Hydro
Meter Inaccuracies	The 10 year Meter Replacement Program, initiated in 2006, has helped reduce the number of old water meters and transition to automated meter reading technology
Watermain Breaks	Increased capital replacement and rehabilitation of watermains in 2005 for 10 years
Water Quality Maintenance	Ongoing operational efficiencies, capital replacement, and rehabilitation of watermains

In most municipalities, leakage makes up the largest portion of NRW and most are higher than London’s at around 90%. Through leakage reduction, London can also reduce the volume associated with watermain breaks and catch leaks before they proliferate and cause the pipe to rupture. As shown by the chart below, active leak detection activities have the potential to reduce the most significant portion of non-revenue water which will lead to lower annual purchase of water costs. Water loss experts give a range of 25% to 40% as good targets for the prevention of leakage in the initial stages of an overall reduction plan. These estimates would bring London near the pre-2009 NRW volumes with the additional benefit of finding and preventing future leakage from occurring.



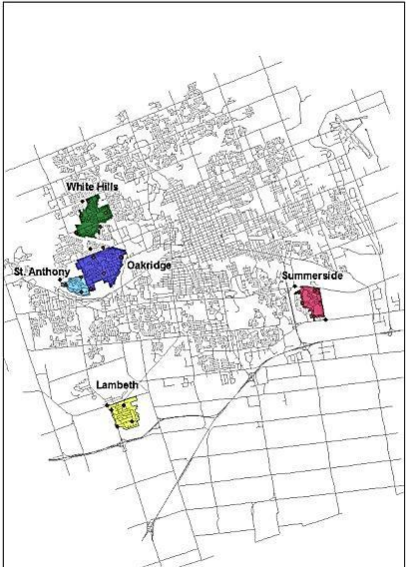
Pilot Project:

After a careful examination of the projected rate increases in London’s treated water purchases, it became apparent that more aggressive leakage reductions could be cost effective. Best practices indicate that considerable savings can be achieved with the installation of properly

designed district metered areas (DMA) throughout the City, which is a common practice in many European communities and is starting to catch on here in North America. DMA's divide distribution systems into areas where the pressures and the volume of water that enters the area are checked against the volume of water billed. When a significant difference occurs, targeted leak detection activities are undertaken to find the leaks that may be causing the difference. The leaks are then quickly repaired and the overall NRW starts to decrease. There are significant efficiencies associated with identifying a leakage problem and managing it within discrete areas as opposed to trying to find leaks across the entire City.

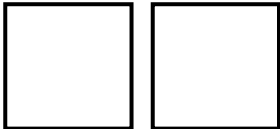
A pilot project was undertaken between 2011 and 2012 in which 5 DMAs were created across the City at a cost of approximately \$250,000 to implement. The five pilot areas were selected to benefit from a comprehensive analysis of different conditions and included examination of various soil conditions, pipe materials, pressure zones, and age of infrastructure. Two teams of consultants and contractors managed the installation and technical measurement of the leakage. City staff participated in all phases of the design and implementation, including the actual leak detection. As of this fall all of the repairs on the previously discovered leaks have been made, but in order to complete the pilot, the areas must be re-measured, and repairs made on any new leaks that have developed.

A brief summary of the areas and results:

	White Hills – found fully corroded copper bypass in check valve chamber and water running into drain
	Lambeth – 1 leak found on service at property line, 1 leak found on fire hydrant, also found broken irrigation heads (private property)
	Oakridge – 4 leaks found on watermains
	St. Anthony's – found closed valves in distribution system, no leaks found
	Summerside – 1 leak found on service line at property line
	Photo of leak in Oakridge area – the water here was flowing into a dry well and was draining away unnoticed. Estimates have this leak representing 31,000m ³ over a year, 0.07% of all pumped water, or 0.6% all NRW, and approximately \$13,000 in 2013 purchased water costs.

City Wide DMAs:

A key factor that must be considered is that without action, leakage will continue to rise from year to year. A recent study by R.V. Anderson conducted for the Water Engineering Division has identified the rate for future degradation of our existing pipe infrastructure. Through modeling based on main break rates, pipe material, and age (among other factors) they have been able to demonstrate a more rapid failure of our water pipes in the coming years. Increased rehabilitation and replacement programs will help slow the increase, but further preventative action is required. From a purchase of water perspective, this is especially important when the potential for additional leakage is considered in conjunction with the proposed rate increases from the two regional water systems in 2014, 2015, and 2016.



The leakage volumes found in the pilot were approx. 105m³ per day averaged across each of the 5 district metered areas. Based on the results of the pilot project, staff has undertaken a review and business case development for the design and implementation of a City-wide DMA program plan. When conducting the analysis and comparing to industry benchmarks the volume of leakage found in the pilot is a good comparison noting that the Province estimates average leakage of 165m³ per day in any one district. The business case was then developed using the pilot leakage values and the annual savings in water loss, revenues, and operating expenditures were calculated. In the initial stages of the plan, it can be expected to find 25% to 40% of leakage, but as the full program is implemented and staff becomes more comfortable with the day to day operation, future leakage prevention will increase the amount that can be practically found.

The table below outlines forecasted savings based on a conservative increase in the cost to purchase water and a 5 year staged implementation of the program. The numbers use only the leakage component of London’s annual NRW volume, representing approximately 75% of the total. The projection is approximately \$190,000 of compounded annual savings until the DMAs are fully operational or about 400,000m³ per year. After full implementation the DMA’s will help identify future leakage through early detection and contribute to the overall operation and maintenance of the system. What has not been considered in the table is the likelihood of increased leakage in the “do nothing” scenario. As discussed previously, without an active reduction program the leakage volume will continue to rise each year, meaning that the financial analysis is conservative.

NRW Leakage Forecast Scenarios						
Year	Do Nothing		With DMA		Improvement over Do Nothing	
	m3	\$	m3	\$		
2014	3,937,858	\$ 1,772,036	3,516,958	\$ 1,582,631	\$	189,405
2015	3,937,858	\$ 1,850,793	3,096,057	\$ 1,455,147	\$	395,646
2016	3,937,858	\$ 1,929,550	2,675,157	\$ 1,310,827	\$	618,724
2017	3,937,858	\$ 1,929,550	2,254,256	\$ 1,104,585	\$	824,965
2018	3,937,858	\$ 1,929,550	1,833,356	\$ 898,344	\$	1,031,206
Total	19,689,290	\$ 9,411,481	13,375,783	\$ 6,351,534	\$	3,059,946

Added Benefits:

Installing district meter areas changes the typical management approach of leakage and water main breaks from being reactive to proactive, but the main goal of the DMA program remains the overall reduction of water leakage in the distribution system. With its implementation, the Water Services Area will gain additional benefits that build efficiency into the day to day operations and maintenance activities. By looking at the program as one component of the overall business, staff found ways in which the City-wide DMA program can add further value to the existing services provided. At full implementation preliminary numbers suggest that enough water can be saved to accommodate 20,000 new homes in London without the need to construct any transmission mains, pump stations, or treatment plants.

Further benefits of the plan include:

- the collection of more accurate and timely water use data that can be tied into the hydraulic model;
- better calibration of the hydraulic model without the need to conduct special flushing programs;
- better knowledge of the distribution system;
- areas of increased pressure in the distribution system;
- reduced pumping and treatment costs;
- reduced property damage – both public and private;
- reduced risk of contamination;
- reduced water main breaks

The program requires the repurposing of existing staff which will benefit the customer with more consistent service delivery and continue to deliver affordable water rates.

Conclusions:

NRW is on the rise in London, and will increase future costs if left unchecked.

A pilot project to identify leaks within discrete areas has been successful.

Through the implementation of a City-wide district meter area program, London can take advantage of existing staff and technology investments to reduce the volume of water purchased. These actions have the potential to reduce the annual operating budget by a compounded amount of \$190,000 in each year of the 5 year implementation plan with the goal of offsetting the capital investment. Preliminary evaluations have estimated a reduction of purchased water by around 2 Million cubic meters through the reduction of leakage in the program. Subsequent annual reductions will continue to add value to the program with additional data and knowledge gained from day to day operations of the DMAs and reduces operating expenditures.

A City-wide district meter area program Business Case will be included in the 2014 Water Budget submission.

Acknowledgements:

This report was prepared by Matt Feldberg, Water Demand Manager.

SUBMITTED BY:	RECOMMENDED BY:
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REVIEWED & CONCURRED BY:	
JOHN BRAAM, P.ENG. MANAGING DIRECTOR, ENVIRONMENTAL & ENGINEERING SERVICES & CITY ENGINEER	

CC: John Simon, Division Manager, Water Operations