Appendix A: Business Cases

Alternate formats are available as per the Accessibility for Ontarians with Disabilities Act by contacting Water Services at 519-822-1260 extension 5627.

1.0 ROYAL FLUSH TOILET REPLACEMENT PROGRAM

Direct Savings - Residential

Aspect	5-Year Program	10-Year Program
Total Number of Rebates	6,500	10,500
Average Annual Participation Rate	1,300	1,050
Rebate per Fixture	$50	$50
Total Rebate Cost	$325,000	$525,000
Total Marketing Cost	$40,000	$80,000
Total Program Costs	$365,000	$605,000
Water Savings per Participant, litres per day	20	20
Customer Payback Period	Instant	Instant
Program Savings Rate, litres per day	130,000	210,000

Cost Effectiveness	
Cost per litre per day of savings	$2.88
Equivalent Cost of Supply per litre per day	$4.682
Benefit : Cost Ratio	1.6 : 1.0

Program Description

The City will provide a rebate of $50 per toilet to residents replacing an inefficient toilet (flushing with 6.0 litres or more) with a WaterSense®-certified model that flushes with no more than 4.8 litres. Participating homes must be built prior to 2014, before the Ontario Building Code began requiring 4.8-litre toilets. This program will be accessible for all sectors of the City. A limit of 2 toilet rebates per household is noted. Previous program participants are able to participate as long as they are decreasing their flush volume and/or replacing a non WaterSense® certified model. It is anticipated that program marketing costs will be about $10,000 per year. Currently, the total rebate costs are funded on a cost recovery basis through the use of approved development charges.

It is anticipated that about 1,500 customers will participate in the program during the first year with the number of participants declining by 100 each year. Annual monitoring and maintenance costs and staff requirements are included in Section 14.4, in the report document.

Assumptions

- Participants would replace toilets even without the program; the program rebate influences the participant's choice to purchase a qualifying fixture; since there is no cost premium associated with purchasing a qualifying fixture, the customer payback is instantaneous
- 80 percent of toilets replaced as part of program flush at 6.0 litres

- 20 percent of toilets replaced as part of program flush at 13.25 litres
- Average flush volume of replaced toilet fixtures is 7.45 litres
- Average flush volume of new toilets is 4.8 litres
- Average savings per flush is 2.65 litres (i.e., 7.45 litres – 4.8 litres)
- Average of 3.0 persons per household
- Average of 5.0 flushes per capita per day (American Water Works Association, Research Foundation, Residential End Uses of Water, 1999)
- New toilet is flushed an average of 50 percent of the time
- Water savings per toilet is 20 litres per day (i.e., 2.65 litres times 3 persons times 5 flushes/person/day times 50 percent)
- Maximum rebate is 20 litres per day times $4.682 = $93.64 per fixture
- Since there is no retail cost differential between an efficient toilet model and an inefficient toilet model, the payback to program participants is instant

2.0 BLUE BUILT HOME PROGRAM

Direct Savings / Research & Innovation - Residential

10-Year Program

Aspect	5-Year Program	10-Year Program
Total Number of Rebates	200	275
Average Annual Participation Rate	40	27.5
Average Rebate per Participant	$180	$180
Total Rebate Cost	$36,000	$49,500
Total Marketing Cost	$25,000	$50,000
External Consultant (first two years of program)	$10,000	$10,000
Total Program Costs	$71,000	$109,500
Minimum Water Savings per Participant, litres per day	50	50
Customer Payback Period	instant	instant
Program Savings Rate, litres per day	10,000	13,750

Cost Effectiveness	
Cost per litre per day of savings	$7.96
Equivalent Cost of Supply per litre per day	$4.682
Benefit : Cost Ratio	0.6 : 1.0

Program Description

The revised Blue Built Home program will allow both new and existing homes (including multi-residential) to be certified as a Blue Built Home if they can achieve an average indoor water demand of no more than 150 litres per capita per day. Note that because the Blue Built Home designation is intended to drive the adoption of water efficient fixtures, appliances, and practices in the residential customer sector, the demand criteria to qualify as a Blue Built Home may be lowered in the future as technology improves and average per capita demands decline. For example, the Water Research Foundation's 2016 *Residential End Uses of Water, Version 2* projects that average indoor per capita demands will eventually decline to only 139 litres per capita per day. Rebate costs associated with toilets are currently funded through approved development charges. Further, cost recovery for the additional rebate costs outlined below will be included in the review of the Development Chargers by-law in 2019.

Some examples of Blue Built Home rebates include:

- $75 for installation of a 4.0 litre or less per flush toilet,
- $100 for the installation of a hot-water re-circulation system,
- $20 for the installation of a waterless floor drain,
- $2,000 for the installation of a rainwater harvesting system, and

- $1,000 for the installation of a greywater re-use system.

Existing homes may wish to apply for a Blue Built Home designation to demonstrate their commitment to the environment or to the City's goal to use less water per capita than other comparable Canadian cities, or to help bolster the home's value for resale. Existing homes can apply by contacting the City and providing information regarding the number of persons living in the home. The City can verify the applicant's water demands by reviewing water billing data and/or conducting a home inspection. Homes that meet the average indoor demand criteria of 150 litres per capita per day will be granted the Blue Built Home designation.

Because the new Blue Built Home program is intended to promote the implementation of innovative water efficiency options, not all rebate levels will be cost-effective to the City. The inclusion of innovative measures will be considered on a case-by-case basis.

It is anticipated that program marketing costs will be about $5,000 per year and that the program will be re-evaluated after 10 years. Annual monitoring and maintenance costs and staff requirements are included in Section 14.4, in the report document.

Assumptions

- Average rebate per participant will be $180
- Average indoor water saving per Blue Built home is 50 litres per day vs. "built to code" new home
- 50 participants in first year; participation declines by 5 homes per year
- A limited number of rainwater harvesting and greywater reuse systems are expected to be installed as part of this program, at least during the first few years
- An external consultant will be retained for the first two years to assist with program development at a cost of $5,000 per year
- Since there is no additional cost to the owner of the new home, the payback to program participants is instant
- While there would be some cost to owners of existing homes to replace fixtures and/or appliances with efficient models, it is anticipated that retrofits will be completed when the original fixture/appliance has reached the end of its lifecycle and requires replacing. Since there is generally little or no retail cost differential between efficient plumbing fixtures/appliances inefficient products, the payback to program participants will be instant or very short

3.0 HOME VISITS / AUDITS PROGRAM

Direct Savings - Residential

5-Year Program

Aspect	5-Year Program
Total Number of Audits	1,500
Average Annual Participation Rate	300
Average Cost per Participant	$65
Total Audit Cost	$97,500
Total Marketing Cost	$25,000
Total Program Costs	$122,500
Water Savings per Participant, litres per day	43
Customer Payback Period	Instant
5-Year Program Savings Rate, litres per day	322,500

Cost Effectiveness	
Cost per litre per day of savings	$0.38
Equivalent Cost of Supply per litre per day	$4.682
Benefit : Cost Ratio	12.3 : 1.0

Program Description

The City will provide a free one-hour home visit/audit to residents to provide educational materials, to replace inefficient showerheads and faucet aerators, and to recommend water saving initiatives such as replacing inefficient toilets, checking home for leaks, and reducing overall water use through behavioural changes. Note that the program savings have been estimated based on data provided by eMERGE and must be verified through field measurements or by completing a customer water billing analysis. It is anticipated that program marketing costs will be about $5,000 per year and that the program will be re-evaluated after 5 years. Annual monitoring and maintenance costs and staff requirements are included in Section 14.4, in the report document.

Assumptions

- Cost of home audit is $65
- Average of 3.0 persons per household
- Average demand of 180 litres per capita per day
- Average demand of 540 litres per home per day
- Program participation saves 8 percent or 43 litres per home per day
- Maximum cost per audit is 43 litres per day times $4.682 = $201 per audit
- Number of program participants is 300 per year
- Since there is no cost to the homeowner, the payback to program participants is instant

4.0 MULTI-RESIDENTIAL AUDIT PROGRAM

Direct Savings – Multi-Residential

10-Year Program

Aspect	5-Year Program	10-Year Program
Total Number of Audits	40	55
Average Annual Participation Rate	8	5.5
Average Cost per Audit	$1,500	$1,500
Total Auditing Cost	$60,000	$82,500
Total Marketing Cost	$25,000	$50,000
External Consultant Costs	$10,000	$10,000
Total Program Costs	$95,000	$142,500
Water Savings per Audit, litres per day	1,350	1,350
Customer Payback Period	varies	varies
Program Savings Rate, litres per day	54,000	74,250

Cost Effectiveness	
Cost per litre per day of savings	$1.92
Equivalent Cost of Supply per litre per day	$4.682
Benefit : Cost Ratio	2.4 : 1.0

Program Description

The City will provide funding to companies that complete multi-residential building audits (alternatively, the City may have internal staff complete audits). The building audits will include data logging the building's main water meter to develop a 24-hour diurnal water demand profile that can be used to identify unusual water demand patterns or excessive leakage in the building, average per suite water demands, etcetera, and the potential water savings that might be achieved by installing efficient new plumbing fixtures. Participating buildings would also be eligible to participate in the Royal Flush program. The budget includes $10,000 in the first year for an outside consultant if needed. Program marketing costs are expected to be approximately $5,000 per year. Annual monitoring and maintenance costs and staff requirements are included in Section 14.4, in the report document.

Assumptions

- Participation starts at 10 buildings per year and declines by 1 building per year
- Savings based on 50-suite building with average occupancy of 1.5 persons per suite, average demand of 180 litres per capita per day, 10 percent water savings achieved through program participation (not including potential participation in Royal Flush program)
- 50 suites times 1.5 person/suite times 180 litres/capita/day times 10 percent = 1,350 litres/building

savings

- Cost of program of $1,500 per site, including data logging main building water meter, developing a 24-hour diurnal water demand curve, and inspection of a small number of suites to identify the efficiency of plumbing fixtures
- Maximum audit cost for 1,350 litres per day times $4.682 = $6,320 per building
- Cost of building audit is $1,500 per site
- Since the savings achieved at participating sites may vary significantly, the payback to program participants will vary

5.0 MULTI-RESIDENTIAL SUB-METERING PROGRAM

Direct Savings – Multi-Residential

10-Year Program

Aspect	5-Year Program	10-Year Program
Total Number of Audits	100	200
Average Annual Participation Rate	20	20
Average Cost per Audit	$125	$125
Total Auditing Cost	$12,500	$25,000
Total Marketing Cost	$25,000	$50,000
External Consultant Costs	$20,000	$20,000
Total Program Costs	$57,500	$95,000
Water Savings per sub-meter, litres per day	54	54
Customer Payback Period	varies	varies
Program Savings Rate, litres per day	54,000	10,800

Cost Effectiveness	
Cost per litre per day of savings	$8.80
Equivalent Cost of Supply per litre per day	$4.682
Benefit : Cost Ratio	0.5 : 1.0

Program Description

It is commonly accepted that people tend to use less of a resource if they have to pay for it. Many multi-residential buildings are serviced by a single municipal water meter and the cost of water is blended into monthly rental fees (i.e., the individual living units are not metered). Installing water meters on individual living units, where practical based on the layout of the water supply piping, would provide a financial incentive for customers to reduce water demands. Note that it is not typically practical to install individual water meters in existing high-rise multi-residential apartment buildings because of the water supply piping layout (buildings tend to use multiple risers to service suites – each suite may be serviced by two cold and two hot water risers).

In some cases a single water meter installed in a meter pit located at the property line services one or more of multi-unit housing complexes. Depending on the design of the water supply piping it can be possible to either:

a) sub-meter each multi-unit housing complex (a single water meter servicing all of the individual housing units located in the complex), or
b) sub-meter the individual living units within each multi-unit housing complex.

The sub-metering data will alert the property owner/manager if any of the complex buildings have high water demands or if any of the individual living units have high water demands that might indicate leakage, the use of

inefficient plumbing products, or inefficient water-use habits.

Based on the results of a similar program being implemented in the Region of Waterloo it is estimated that the total average cost per installation would be about $500 with half the cost related to buying the water meter and half the cost related to installation. It is assumed that Guelph's program would offer approximately the same level of rebate as the Region of Waterloo: 50 percent of the cost of the meter or about $125 per meter installed. This rebate would be provided directly to the property owner/manager or to a third-party agent of the property owner/manager.

The savings achieved by this program will depend on whether housing complexes or individual living units are sub-metered, the current level of customer efficiency, the type of billing program implemented by the property owner/manager, the response from the customer, etcetera. While it is not possible to accurately estimate the level of savings that will be achieved by this program, for calculation purposes it is assumed that sub-meters will be installed on individual living units, with three persons per unit each using 180 litres per day, and a program savings of 10 percent – 3 persons x 180 litres per capita per day x 10 percent savings = 54 litres per living unit per day savings.

Assume that 20 sub-meters will be installed in each year of program for a total of 200 sub-meters.

Program marketing costs are expected to be approximately $5,000 per year. Participating buildings would also be eligible to participate in the Royal Flush program. The budget includes $10,000 in each of the first two years for an outside consultant if needed for program initiation and auditing services. Annual monitoring and maintenance costs and staff requirements are included in Section 14.4, in the report document. Further, cost recovery for the additional rebate costs outlined above will be included in the review of the Development Chargers by-law in 2019.

Assumptions

- Program participation of 20 sub-meters per year.
- Existing living unit has occupancy of 3 persons with each person using 180 litres per day.
- 10 percent of existing demand can be saved by installing individual water meters: 3 persons per house times 180 litres per capita per day times 10 percent = 54 litres per day savings per living unit.
- Above savings projection do not include potential savings related to participation in Royal Flush program
- Cost of program of $125 per sub-meter installation.
- Max rebate is 54 litres per day times $4.682 = $253 per meter
- Since the savings achieved at participating sites may vary significantly, the payback to program participants will vary.

6.0 WATER SMART BUSINESS PROGRAM

Direct Savings – Industrial/Commercial/Institutional

10-Year Program

Aspect	5-Year Program	10-Year Program
Total Number of Participants	75	150
Average Daily Savings per Participant, litres per day	10,000	10,000
Total program savings, litres per day	750,000	1,500,000
Rebate, Cost per litres per day savings	$0.75	$0.75
Average Rebate per Participant	$7,500	$7,500
Total program rebate costs	$562,500	$1,125,000
Total Marketing Cost	$25,000	$50,000
Average Consultant Costs per Audit	$7,000	$7,000
Total Consultant Cost	$525,000	$1,050,000
Total Program Costs	$1,112,500	$2,225,000
Water Savings per Audit, litres per day	54	54
Customer Payback Period	varies	varies

Cost Effectiveness	
Cost per litre per day of savings	$1.48
Equivalent Cost of Supply per litre per day	$4.682
Benefit : Cost Ratio	3.2 : 1.0

Program Description

The City will fund the completion of water audits at industrial, commercial, and institutional facilities with the express intention of identifying cost-effective water efficiency measures for participating facilities to implement. The City expects to continue to retain an external consultant to complete audits and facilitate the program. It is proposed for 2017 that this external consultant position be replaced by a full time staff member to provide better value for current dollars spent. This staff member would be supported by a consultant limited to performing the audits, as required. The program includes the cost of completing audits (estimated as an average of $7,000 per facility) and providing a one-time financial rebate to facilities implementing water efficiency measures at a rate of $0.75 per litre per day of verified and sustained water savings. It is estimated that the average savings per participating site will be 10,000 litres per day.

All potential water efficiency improvements will be eligible for inclusion in the program, for example reducing once-through cooling, replacing water-cooled equipment with air-cooled models, improving cooling tower efficiency, etcetera. Program marketing costs are expected to be approximately $5,000 per year. Annual

monitoring and maintenance costs and staff requirements are included in Section 14.4, in the report document. Further, cost recovery for the additional rebate costs outlined above will be included in the review of the Development Chargers by-law in 2019.

Assumptions

- The City will complete an average of 15 building audits per year
- Average cost of completing the audit is $7,000 per site (includes site monitoring costs, data analysis, and reporting)
- An average savings of 10,000 litres per day will be saved at each participating facility
- Recommended rebate is $0.75 per litre per day of savings
- Average rebate of $7,500 per facility (i.e., 10,000 litres per day times $0.75 per litres per day)
- Since the cost and savings achieved at participating sites may vary significantly, the payback to program participants will vary

7.0 MUNICIPAL FACILITY UPGRADE PROGRAM

Direct Savings – Municipal Operations

10-Year Program

Aspect	5-Year Program	10-Year Program
Total Number of Facilities Upgraded	5	10
Average Daily Savings per Facility, L/day	21,970	21,970
Total program savings	109,850	219,700
Average Cost per Facility Upgrade	$49,413	$49,413
Total Upgrade Costs	$247,065	$494,130
Program Management Cost per Year	$10,883	$10,883
Total program Management Costs	$54,415	$108,830
Total Marketing Cost	nil	nil
Total Program Costs	$301,480	$602,960
City Payback Period	varies	varies

Cost Effectiveness	
Cost per litre per day of savings	$2.74
Equivalent Cost of Supply per litre per day	$4.682
Benefit : Cost Ratio	1.7 : 1.0

Program Description

In July of 2013, the City began reviewing the water demand data for City-managed facilities. In 2014 Guelph conducted water audits at sixteen of the City's largest water-use facilities. Site visits, historical water demand data analysis, and seven-day water demand data logging were used to identify potential water efficiency measures, to estimate the water savings potential at each facility, and to calculate the associated implementation costs. Both seasonal and year-round facilities were included in the program.

Potential water savings opportunities identified at seasonal facilities include:

- Replacement of toilets, faucet aerators, showerheads with WaterSense® Certified fixtures
- Urinal replacement/repair
- Installing controls for filling of wading pools
- Transitioning of splash pads to sensor-operated features only
- Investigation into noted increases in irrigation demands and optimization of these irrigation systems

Potential opportunities at year-round facilities include:

- Replacement of toilets, faucet aerators, showerheads with WaterSense® Certified fixtures

- Installation of rainwater harvesting systems where appropriate
- Investigation and repair of potential leaks
- Improved control of backwashing at pools
- Batch controllers for Zamboni filling
- Water softener upgrades
- Adjust and/or repair flush valves and sensors for toilets and urinals
- Add controls to reduce cooling tower blowdown volumes
- Improve the efficiency of reverse osmosis systems

It is expected that the City will continue to lead by example and implement water-saving measures in its facilities. Efforts should be made to coordinate with other planned retrofits at these facilities in order to save on implementation costs. While this program is expected to reduce water demands at City facilities, it is also intended as a research initiative where potential new measures can be tried and tested before they are considered for broader implementation.

The City typically upgrades/improves the water efficiency of one municipal facility per year at an average cost of about $49,413. The average savings achieved by completing these upgrades is about 21,970 litres per facility per day. The City currently spends an average of about $10,883 annually to manage water efficiency upgrade activities at municipal facilities. Annual monitoring and maintenance costs and staff requirements are included in Section 14.4, in the report document.

Assumptions

- The City will continue to upgrade one municipal facility each year
- Since the costs and savings achieved at upgraded sites may vary significantly, the payback to the City will vary from site to site

8.0 WATER LOSS MANAGEMENT PROGRAM

Direct Savings – Municipal Operations

Ongoing Program

Aspect	5-Year Program	10-Year Program
Total Number of Leak Repairs	varies	varies
Average Daily Savings, L/day	1,433,000	3,962,000
Average Program Cost per Year	$304,000	$159,500
Program Management Cost per Year	included	included
Total program Management Costs	included	included
Total Program Costs	$1,520,000	$1,595,000
Total Marketing Cost	nil	nil
City Payback Period	varies	varies

Cost Effectiveness	
Cost per litre per day of savings	$0.40
Equivalent Cost of Supply per litre per day	$4.682
Benefit : Cost Ratio	11.6 : 1.0

Program Description

The City of Guelph Water Services Department has developed a standard approach to reducing distribution system water loss and the implementation of District Metering Areas (DMA's). This development has been significantly supported through the Province of Ontario's Showcasing Water Innovation (SWI) program and a specific project awarded to the Water Services Department. It is also based on a thorough understanding of industry best practices and trends.

The City will continue to implement its water loss management program using district metering areas where practical based on the layout of the water distribution system, and sounding/correlation and/or field sensors and triangulation in areas where the use of district metering areas is not practical.

Every distribution system has some level of leakage. If the City spends too little to reduce system leakage, the volume and value of water lost each year will increase; if the City spends too much, the cost of the program will outweigh the savings. Between these two extremes is an economic level of leakage where program costs and program savings are optimized. The City's goal is to reduce and maintain leakage levels at the economic level of leakage for their system. While it is anticipated that the rate of water loss in Guelph's distribution system will be reduced over the next few years, the City will eventually reach its Economic Level of Leakage, after which water loss reduction efforts (and costs) will simply maintain this level of leakage. It is estimated that over the next 5 years the City will reduce water loss by approximately 1,433 cubic meters per day below the current

rate. The City will be developing new district metering areas in 2017 using approved capital funds of $1,520,000. Between 2018 and 2021 all program costs will be allocated from other budgets, and between 2022 to 2026 program costs will remain level at $15,000 per year. Annual monitoring and maintenance costs and staff requirements are included in Section 14.4, in the report document.

Assumptions

- The rate of water savings will vary from year to year depending on the number and size of system leaks, and how quickly they are identified and repaired
- No system is free from leakage; new leaks form as existing leaks are repaired. The goal is to achieve and maintain the economic leakage level. There will continue to be annual program costs even when the economic leakage level is reached, however, further reductions in leakage rates would not be expected
- Reducing system leakage to the economic leakage level is an operational Best Practice. This measure is not implemented solely based on cost-effectiveness related to water savings
- Since the costs to find/repair leaks may vary significantly from location to location, the payback to the City will also vary from leak to leak