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Cost Recovery and Affordability in Small Drinking Water Treatment Plants in Alberta

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ABSTRACT

This paper investigates the cost of providing drinking water to municipalities with populations less than 1 000 in Alberta and presents the current unit costs, cost recovery ratios and affordability for a sample of 25 communities. Unit costs are found to vary considerably with the volume of treated water and the type of source water. Of the 25 communities investigated, only one community recovers the full cost of treating drinking water, while seven of communities recover their portion of the capital costs (i.e. accepting grants as a gift) as well as the marginal costs. Less than half of the communities recover the marginal cost of treating drinking water. The authors conclude that water rates designed to cover the marginal cost are possible for small communities if 2% of the Median Household Income (MHI) is considered an affordable proportion of income to be dedicated to drinking water.

INTRODUCTION

Urbanization, one of the cornerstones of modern living, requires large volumes of water to be pumped from natural water bodies (rivers, lakes and groundwater aquifers), treated and then supplied to households and commercial/industrial establishments. The infrastructure and operations of this massive undertaking comes with significant costs for land, buildings, equipment, energy, chemicals and personnel. As the local government is responsible for water supply in most jurisdictions, it is also responsible for the construction, operation, and maintenance of this infrastructure. Increased demand combined with continually improving water quality guidelines is increasing the cost of supplying water. Recovering the water supply costs is a challenge in small municipalities. Understanding the cost curves for small systems and having the ability to test cost recovery scenarios against affordability is crucial for proper management of small water systems.

Small systems represent the majority of regulated systems and face challenges. Researchers in Atlantic Canada found that small systems often lack the capacity to deal with new regulations designed for larger municipalities. They recommend that a scaled regulatory approach be considered to account for the differences in system sizes (Kot, Castleden, & Gagnon, 2011). In most jurisdictions, the majority of systems serve a very small proportion of the population, while a small number of systems serve the majority of the population. Ninety six percent of regulated systems in the U.S.A. serve populations of less than 3 300 (U.S. EPA, 2013). In Alberta, 83% of regulated systems serve populations of less than 1 500, but only account for approximately 5% of the population served by regulated systems (see Table 1).

Cost recovery is commonly recommended as a management principle for water systems. Australia, New Zealand, USA and the Canadian province of Ontario have all legislated municipalities to recover the full costs of supplying water (FCM/NRC, 2006). Full cost recovery is defined as having the end user pay for all costs associated with treating and supplying water. Some definitions limit full cost recovery to actual financial costs, while other definitions include the social costs that arise from externalities such as the costs relating to public health and ecosystem functioning (OECD, 2009). As municipalities move towards full cost accounting and full cost recovery, water systems in urban areas with large population bases are better equipped to recover the costs. Small water treatment systems, especially where the population served is less than 3 300 people, lack the economies of scale that the larger systems can exploit (U.S. EPA & NARUC, 1999). Canadian systems face a similar lack of economies of scale and meeting standards with a small population base to pay the full costs is a challenge (Statistics Canada, 2011a).

Balancing affordability in small water systems with system sustainability has proven to be difficult. Despite extensive work at all levels of industry and government in the USA, the policy issue of affordability and sustainability has not been fully resolved (Raucher et al, 2011). The same difficulty applies to Canada as well. In Canada, the *National Guide to Sustainable Municipal Infrastructure: Full Cost Recovery* recommends full cost recovery for water treatment systems, but acknowledges that small municipalities may still be dependent on national and provincial governments to fund capital costs and may experience higher water rates than larger municipalities (FCM & NRC, 2006). A recent survey by the Environmental Commission of Ontario (ECO) found that 41% of responding municipalities were not achieving full cost recovery in spite of the province's increased focus on long-term viability of water systems. The survey also notes that the municipalities that claimed to be operating at full cost recovery used varying cost recovery definitions. For example, the full cost recovery definition may actually refer to a community recovering only its portion of the capital and operational costs (ECO, 2014).

Since the public ultimately pays the full cost of water, a key policy issue is what proportion of the cost should be paid directly by residents and customers through water rates and property taxes versus indirectly through money grants from higher levels of government (Baird, 2010). In Canada, large capital subsidies have traditionally been provided to municipalities by the national and provincial governments, but often through stopgap funding regimes (Hukka & Katko, 2015). These ad hoc influxes of grant money can contribute to a "cargo cult" management style where a system manager waits for large but infrequent grants to pay for capital investments, instead of focusing on long-term sustainability, stable water revenue and asset management (Flora, 2004). The discussion on cost recovery should start with an analysis of the cost of service and be based on the principles of interclass, intraclass and intergenerational equity (Corssmit, 2014). Equity across income brackets is also an important consideration since clean drinking water is a public good that is essential for public health and preventing waterborne disease outbreaks (Dore, 2015). If water rates are too low to cover costs, then the infrastructure gap will continue to grow even while customers undervalue the benefits they receive from their drinking water (Hukka & Katko, 2015). While each individual customer determines if the water rate is affordable to him/her, the industry (utilities, regulators and decision makers) must make do with evaluating affordability according to some benchmark based on community level data (Lafrance, 2013).

RESEARCH, METHODS AND ANALYSIS

Small water system's unit costs were calculated so that the current cost recoveries could be analyzed. The impacts on affordability of meeting commonly recommended cost recovery scenarios were then tested.

Systems were invited to participate[6] if they met three criteria:

1. They serve less than 1 000 people,
2. They have a stand-alone treatment plant (i.e. not on a regional water pipeline), and
3. They serve a municipal community (towns, villages or hamlets).

Three quarters of regulated systems in Alberta serve populations of less than 1 000 people, while 38% serve populations of less than 1 000 and have stand-alone water treatment plants. When the study was further limited to municipal type systems, the number of eligible systems reduces to approximately one quarter of the regulated systems (24%). The authors were able to collect reliable data on 25 out of 155 eligible systems. The systems studied represent 16% of regulated systems meeting all three study criteria (Alberta Environment, 2012).

Six pieces of information were collected for each system[7]:

- Capital costs associated with the water treatment plant from previous 25 years.
- Annual operation and maintenance (O&M) cost
- Annual volume of water treated[8]
- Water rate structure
- Annual income generated by the water rates
- Local median household income

Capital costs include the cost of raw water intakes, groundwater wells, raw water pipelines and components of treatment systems. The reservoirs and distribution pumps are typically included in the capital costs since they are a part of the water treatment building and water production process. Separate reservoirs in the distribution system and distribution piping are excluded as capital cost information was not available for these components and they are more influenced by population density than by economies of scale (Folkman et al, 2012). All 25 systems investigated have a service population of less than 1 000 and were eligible for provincial government grants of 75% of the capital cost associated with water treatment processes. The community was responsible for the remaining portion of capital costs (Alberta Transportation, 2013). Minimal national funding was used in the systems studied. The provincial government also assists local municipalities by providing competitive interest rates on capital loans through the Alberta Capital Finance Authority. The subsidy resulting from the competitive market rates was not considered in the analysis.

Annual capital unit costs were calculated by taking the total capital costs over 25 years and then dividing by the annual water volume. This Straight-line Depreciation method is a common Tangible Capital Asset accounting practice and does not include interest charges or opportunity costs (FCM & NRC, 2006). A 25-year timeline for capital costs is a conservative estimation of the useful life of the treatment plant. The 25-year period is also the typical average debenture duration (Alberta Environment, 2006).

The operation and maintenance (O&M) costs are defined as the costs associated with the ongoing operation and maintenance of a water treatment plant as well as the associated administrative expenses (AWWA, 2012). Facility operators and administrators supplied the data on total annual costs, which included costs of operator salary, chemicals, electricity, natural gas, maintenance, and vehicle related expenses. Where operators are responsible for multiple facilities, the operator salaries were pro-rated according to budgeted time spent on each facility. Major upgrades intended to extend the life of a facility were classified as capital costs. Likewise, depreciation was captured in the capital costs analysis. The O&M unit costs were calculated by dividing the annual O&M cost by the annual water volume.

For the analysis, the 25 systems were classified into two categories of source water: groundwater (14 systems) and surface water (11 systems). Surface water also includes the subset of groundwater under the influence of surface water (4 of the 11 surface systems). Groundwater refers to groundwater sources that are not under the direct influence of surface water. All systems are in rural areas and distributed geographically across Alberta, with asymmetric representation from southern Alberta (17 systems) compared to the central (7 systems) and northern (1 system) regions of the province. The surface water treatment plants all employ filtration and chlorination as a minimum. The groundwater systems all chlorinate; in addition, 10 out of 14 groundwater systems also use filtration for aesthetic parameters such as iron and manganese. At the time of the study, 19 out of 25 systems met the Canadian Drinking Water Quality Guidelines (CDWQG) of a minimum 3.0 log reduction of *Cryptosporidium* and *Giardia* and a 4.0 log inactivation of viruses for surface water or 4.0 log inactivation of viruses for groundwater. The remaining 6 systems were in the process of developing upgrade plans to meet the CDWQG.

To calculate real cost estimates for a common year of 2013, capital costs were deflated by the Calgary and Edmonton Non-Residential Building Construction Price Index. All other financial data was deflated by the Alberta Consumer Price Index.

Median Household Incomes and populations were collected from 2010 National Household Survey and then deflated to 2013 dollars (Statistics Canada, 2013). Median Household Incomes ranged from $60 000 to $110 000. Of the 25 systems, five were large enough for Statistics Canada to publish the community's MHI. Seven systems had the census results published at the County or Municipal District level. The remaining 13 systems only had information published at the more generic Census Division level. The 2010 Median Household Incomes were adjusted to 2013 dollars using the Consumer Price Index.

Cost recovery scenarios. Cost recovery can be expressed as a percentage of total revenue generated. A system has a cost recovery percentage of greater than 100% if the revenues exceed the expenses. Three cost recovery scenarios are investigated. The three scenarios range from financial self-sufficiency to increasing dependency on grant funding:

1. Full cost recovery, which accounts for all the capital costs (using straight line depreciation) as well as the O&M costs.
2. Community cost recovery, which aims to recover only the community's portion of the capital cost as well as the O&M cost. The capital costs covered by various grants are excluded in order to represent the community's perspective that a grant does not have to be repaid.
3. Marginal cost recovery scenario, which is approximated by the ability to recover the O&M costs. The capital costs paid by grants and the community are considered a sunk cost and

extra capacity is assumed. In this scenario, the marginal cost of producing one more unit of water is approximately equal to the O&M unit cost.[5]

Full cost recovery is considered the industry best practice. It allows a community to build reserves and be financially self-sufficient (AWWA, 2012). Community cost recovery ensures that a community balances the budget and is able to pay for their debentures as well as the ongoing O&M costs. Marginal cost recovery ensures that proper price signals are identified to the customer, but marginal cost recovery does not cover capital costs, nor does it result in reserves for future upgrades. Marginal costs in this scenario can be described as Short Run Marginal Costs (Dore, 2015).

The authors hypothesized that cost recovery is a function of the volume and type of source water. Since economies of scale affect the cost, cost recovery ratios were expected to move towards parity as the volume of treated water increases. Surface water sources require additional treatment compared to groundwater and therefore higher costs and lower cost recovery were expected for surface water sources compared to groundwater sources.

Evaluation of affordability. To determine the affordability of the water rates, the price of water for a typical household was calculated using the community's water rate structure. The monthly household price of water was based on an average monthly rate using 24.3 m^3/house/month. This is calculated from the Canadian national average household size of 2.5 people using 320 L/person/day for residential uses (Statistics Canada, 2011b; Statistics Canada 2009). The average household price of water was then expressed as a percentage of Median

Household Incomes (% MHI). This comparison is widely used including in water rate surveys (AWWA & Raftelis, 2015), in policy analysis by organizations such as US EPA and National Rural Water Association (Beecher, 2003; Rubin, 2004), and academic research (Garcia et al, 2007). The AWWA Manual M1: Water Rates, Fees and Charges also includes % MHI in its discussion on defining affordability (AWWA, 2012).

Defining the threshold where a water rate moves from affordable to unaffordable is difficult. In spite of the vast volume of writing on affordability, starting with the US EPA's work in the 1990s, there is no clear consensus on a threshold; questionable threshold values ranged from 0.8% to 2.5% while unaffordable threshold values ranged from 1.5% to 2.5% of MHI (CCME, 2006). The University of North Carolina–Environmental Finance Centre (UNC-EFC) online dashboards' displays the affordability thresholds as the water bill costing less than 1% of the MHI. But the authors also caution that since there is no standard threshold, the percent of MHI should be used as only one of the multiple indicators within the Hydrodash model to compare rates (Berahzer et al, 2011). However, the Boise State University–Environmental Finance Centre acknowledges that because small systems are expected to have higher costs, their online dashboard displays affordability as up to 2.5% MHI (BSU-EFC, 2013).

Any analysis based on MHI does not take into account the distribution of income within a community. Furthermore MHI for small communities has a large margin of error due to the small sample size (Eskaf, 2013). The AWWA Affordability tool stresses that the percent of MHI does not account for decreasing populations, incomes concentrated at the upper and lower extremes, or economic distress (AWWA et al, 2013). These specific issues of income disparity are best addressed through a tool such as the easy to understand UNC-EFC's Water & Wastewater Residential Rates Affordability Assessment Tool (Barnes & Eskaf, 2014) or the more complicated but detailed spreadsheets included with AWWA's Affordability tool (2013). Progressive utilities can manage the balance between fixed charges and volumetric prices of two-part tariffs in order to meet their unique mix of triple bottom line goals of affordability (social), water conservation (environmental) and financial sustainability (economic) (Baird, 2010).[9]

Despite of all these shortcomings, the % MHI was used because it was one of the few pieces of data that is commonly available for small systems. Even for this commonly available statistic, only 5 of the 25 systems studied had the MHI published at the community level. Two affordability thresholds (1% and 2% of MHI) were used in the analysis to represent range of policy advice.

The goal of this paper was to understand the impact of the three proposed cost recovery scenarios on affordability. For each proposed cost recovery scenario, the resulting household water bill was calculated as a percentage of Median Household Income (% MHI) and compared against the chosen affordability thresholds of 1% and 2% of MHI.

RESULTS AND DISCUSSIONS

Capital unit cost curves. Source type and volume of treated water are major factors in determining the capital costs associated with the water treatment. The capital unit costs predicted by the line of best fit for surface water sourced treatment plants range from \$14.24 /m^3 for an annual volume of 1 000 m^3 to \$1.94 /m^3 for an annual volume of 100 000 m^3 (see Figure 1). For systems drawing on groundwater not under the influence of surface water, the capital unit costs predicted by the line of best fit range from \$4.0 /m^3 at an annual volume of 10 000 m^3 to \$0.71 /m^3 at an annual volume of 100 000 m^3 (see Figure 2). The 95% confidence intervals are shown for both equations. Capital costs for groundwater sources are at least half of the costs associated with treating surface waters sources. The constants in the capital unit cost equations equate to a large capital cost before any capacity is built. The equations predict that surface water treatment plants could face a \$36 /m^3 cost of entry while groundwater would have a lower but still substantial \$17 /m^3 cost of entry. Comparing the slopes of the equations shows that capital unit costs increase more dramatically with a -2.67 slope for surface water compared to the lower slope of -1.43 for groundwater. The lower constants and slope values for groundwater are likely due to the fact that smaller systems try to find lower cost groundwater sources if at all possible.

The capital costs were based on past capital cost data. While these costs were adjusted for inflation and expressed in 2013 dollars, future costs may actually be higher than predicted by these equations. Proper asset management would include a site-specific assessment of future capital costs that could be used to determine the required future capital.

O&M unit cost curves. Surface water O&M unit costs (see Figure 3) are significantly higher than groundwater O&M unit costs (see Figure 4). Equations for the best fit lines that relate annual volume to the O&M costs were derived from the data and are included in the figures, along with those that are provided by Statistics Canada (2011a). Both lines of best fit are higher than Statistics Canada's predictions. The study results start to agree with the respective Statistics Canada equations once the annual water volumes are higher than 100 000 m^3/year. At lower annual volumes, the divergence is significant. The 95% confidence intervals overlap with the Statistics Canada confidence intervals as the population increases in size. The Statistics Canada equations are most accurate for systems that have an annual average volume of 1 000 000 m^3/year. Groundwater water equation has a poor correlation (R^2=0.34), but the 95% confidence interval is tighter than surface water at comparable volumes, which has a better correlation coefficient (R^2=0.89). The groundwater equation had a poor correlation because treatment in the systems varied widely from chlorination to more elaborate treatment for parameters such as ammonia, manganese, iron, and arsenic.

Full cost recovery. The number of communities that meet each cost recovery scenario increases as the scenarios move to less economically sustainable options. Full cost recovery happens in only one system.[10] Ninety six percent of the systems (24 of 25 systems) studied recover less than 100% of the full system costs and thus do not achieve financial self-sufficiency (see Figure 5). There is a general increase towards full cost recovery as the volume of treated water increases. However there are still communities with significant populations that are at the low end of full cost recovery (see Figure 6). The sample size is too small to say definitely, but groundwater sources appear more likely to achieve full cost recovery than surface water sources. This apparent trend could be tested in future research with larger sample sizes.

Community cost recovery. In the community cost recovery scenario, two communities recover their portion of the costs. 23 of 25 systems recover less than 100% of their costs. Since the grant funding is accepted as a "free gift" and not included in the cost recovery analysis, the feasibility of cost recovery improves. The community cost recovery scenario most accurately reflects the financial reality of small systems where a debenture is taken out to cover the community's portion of the capital cost. However, community cost recovery scenario continues reliance on provincial and national grants. If provincial and national grant award structures change in the future, a community that is pursuing this cost recovery scenario would not have adequate reserves to maintain its infrastructure. Also, if future capital costs are higher than past costs, the system will not be able cover the future capital expenditures.

Marginal cost recovery. The third cost recovery scenario reflects the current situation for a third of the systems. Seven systems recover more than 100% of their marginal costs. Customers in these systems see the proper short-term price signals, but achieving marginal cost recovery will not build reserves for long-term capital upgrades and/or replacement. Customers in the other 18 systems do not even see the marginal cost associated with the supply of their water. As a result these customers may not value and conserve water appropriately.

Cost recovery scenarios and water bills as a function of median household incomes. To achieve full cost recovery, twelve of the systems studied would have to charge greater than the 2% MHI affordability threshold (see Figure 7). In the community cost recovery scenario, only eight systems would exceed the assessed affordability threshold. Meanwhile in the marginal cost recovery scenario, only five systems would exceed 2% MHI. If the more equity-based affordability threshold of 1% MHI is used, the situation becomes less tenable. All but one system would have to exceed the 1% MHI threshold for the full cost recovery scenario. Sixteen systems would have to charge more than 1% of MHI to achieve community cost recovery, compared to 13 systems for the marginal cost recovery scenario. By contrast, the costumers in the study communities currently pay between 0.4% and 1.6% of the MHI for their water. The current rates translate into monthly bills that range from $25 to $84 per month with an average of $51 per month. By comparison, an average homeowner within the City of Calgary would pay a monthly water bill of $53, which is based on a full cost recovery rate. While the homeowners in the small systems pay a similar amount for their monthly water bill, the costs to treat the water are considerably higher, as the smaller scale does not get the benefit of the economies of scale. Small water customers might value their water more if they understood that there is a gap between cost of water treatment and the revenue generated by their water rates.

Solutions. Regionalization, amalgamation of operations, viability studies and rate setting are all commonly suggested as ways to close the gap between the cost and the revenue generated. Alberta's grant program has encouraged regionalization by covering up to 90% of the capital costs associated with a regional pipeline compared to only 75% of a small community's capital cost for a stand-alone water treatment plant (Alberta Transportation, 2013). This has led to an increase in regional systems, but many of the systems studied remain with stand-alone treatment plants because of their remote location. In the absence of a piped connection, amalgamation of operations is something many communities are considering as a solution to reduce costs.

The economic sustainability of a community as a whole is also an important consideration. Alberta Municipal Affairs has a Viability Review Process that is used to determine if a community is financially viable. If the review finds that a community is not financially viable, the process recommends steps that would lead the community to financial viability (Alberta Municipal Affairs, 2013). Ontario's *Watertight* report (Swain et al, 2005) recommends that the province should assume control of a water system if the system is not financially viable. The province would then optimize the system to reduce the costs. If and when a treatment system reached a stage whereby it was clear that it would be financially viable, then control would be transferred back to the community. The expert panel defined that a system is not viable when full cost recovery leads to the price exceeding 2.5 times the provincial average unit cost of treating drinking water. Full information about the cost and cost recovery might help decision makers and the public to understand what is required to make a water system financially viable.

Moving forward with cost recovery requires careful rate design and proper coordination with customer assistance programs. Increasing water rates in an attempt to achieve cost recovery can lead to a negative spiral resulting in decreased water use and revenues, which in turn leads to further water rate increases (Brandes et al, 2010; CWN, 2014). The AWWA and UNC-EFC affordability tools mentioned previously can be used to assess the impact of rate changes on revenue. They can also be used to identify the relative affordability to the various residential customers. In pursuing cost recovery, utility managers could try to design their water rates to achieve a balance between the triple bottom line goals of affordability (social), water conservation (environmental) and financial sustainability (economic). If a customer sees their water bill reflect the costs associated with providing the water, they may better understand the value of water.

CONCLUSIONS

The following conclusions are drawn from this study:

1. The unit cost ($\$/m^3$) of both capital and O&M water treatment plants increases as the community's population decreases. Systems that use surface water as a source are found to be more expensive to build and operate than groundwater systems.

2. O&M costs for small systems are higher than the Statistics Canada prediction. This study agrees with Statistics Canada's recommendation to exercise caution in extending their equations to small systems. New cost equations are proposed based on small system costs. The proposed cost equations can be tested as more public data becomes available from small water systems from Alberta and Canada.

3. The capital unit costs can be estimated if the water source type and annual volume are known.

4. Even while regulators in Ontario and several other jurisdictions recommend full cost recovery, achieving full cost recovery will be difficult for many small systems. Affordability concerns will need to be addressed if full cost recovery is to be achieved.

5. Marginal cost recovery is a realistic interim goal for systems that are pursuing cost recovery. Although, marginal cost recovery rates do not provide reserves for long-term capital upgrades and/or replacement, they do ensure that proper price signals are identified to the customer in the short term. Marginal cost recovery appears to be feasible for many systems if municipalities are willing to increase the water rates up to 2% of the Median Household Income. Even with marginal cost pricing, very small systems will need to consider affordability through careful rate design and coordination with customer assistance programs.

6. Recognizing that access to clean drinking water is an essential public good, consideration of a system's ability to achieve cost recovery and affordability could be added to current funding mechanisms. For example, funding or low interest loan programs could be designed to focus on

systems that have good rate setting processes but would exceed affordability thresholds if they charged full cost recovery rates.

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FOOTNOTES

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5. The term "marginal costs" references the economics concept of the incremental cost associated with producing one extra unit of a good. If the systems are assumed to have extra capacity, then the next unit of a good does not result in additional capital costs. With no additional capital costs required, the marginal cost is approximated by the O&M unit cost. Further discussion on marginal cost pricing is available in AWWA M6: Principles of Water Rates, Fees and Charges (2012) and Dore (2015).

6. Systems were initially invited to participate in the study though industry and municipal associations conferences and electronic newsletters. Approximately one third of eligible systems

(50 of 154) were selected for direct invitations based on their source water type and location. The systems that were contacted directly account for the majority of the study participants. The goal was to have both source water type and geographical representation.

7. Publicly available information was supplemented by data collected by telephone conversations and emails to system operators and administrators. The data for each system is from a single year (either 2010, 2011 or 2013) with the exception of capital costs, which range from 1987 to 2013. Where a system identified an unusual year (i.e. water restrictions or flood) another year was selected to ensure the costs were representative.

8. The annual volume was estimated for two new systems to account for changes in production.

9. In drought years, additional volumetric charges could be added to reflect the scarcity of water (Dore, 2015; Maxwell, 2010).

10. This system had recently completed a comprehensive rate setting exercise and had lower than average costs.

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Figure 1 Capital unit costs of water treatment using surface water sources plotted against the annual volume

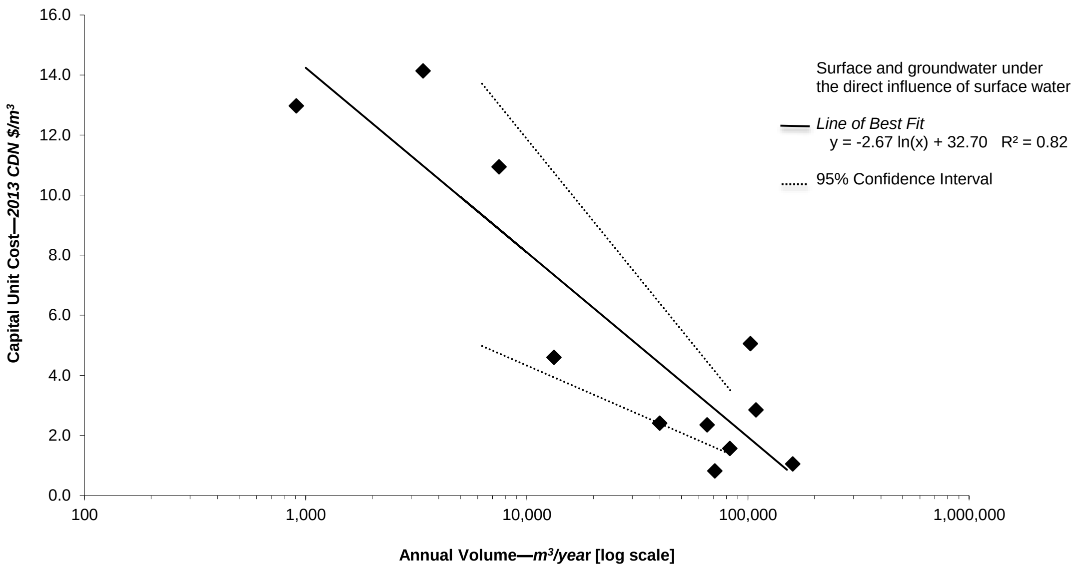

Figure 2 Capital unit costs of water treatment using groundwater water sources plotted against the annual volume

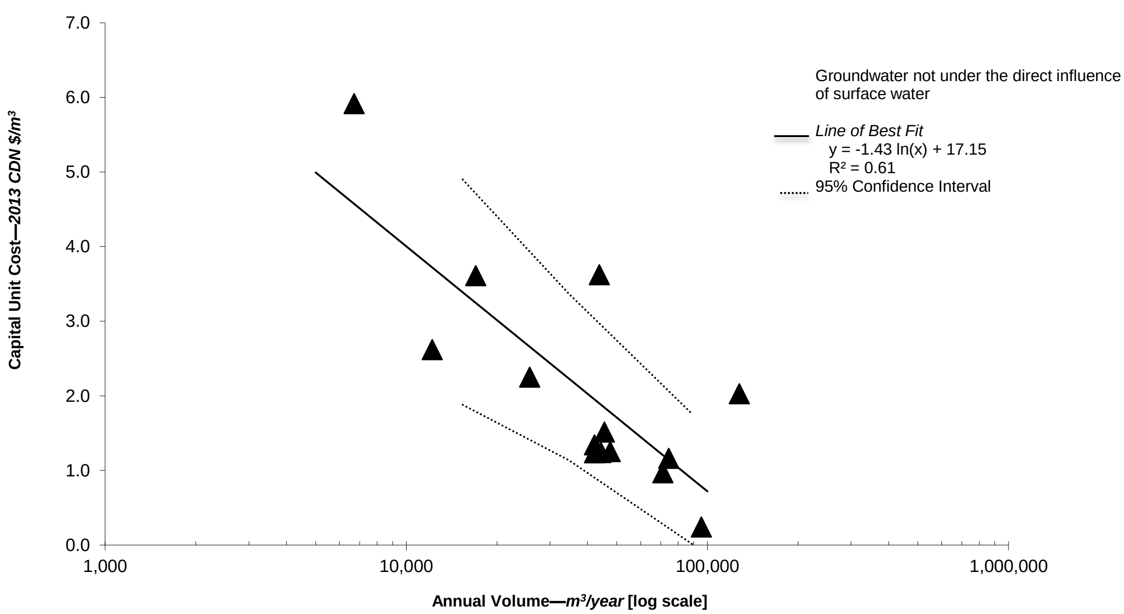

Figure 3 Operation and Maintenance unit costs of water treatment using surface water sources plotted against the annual volume

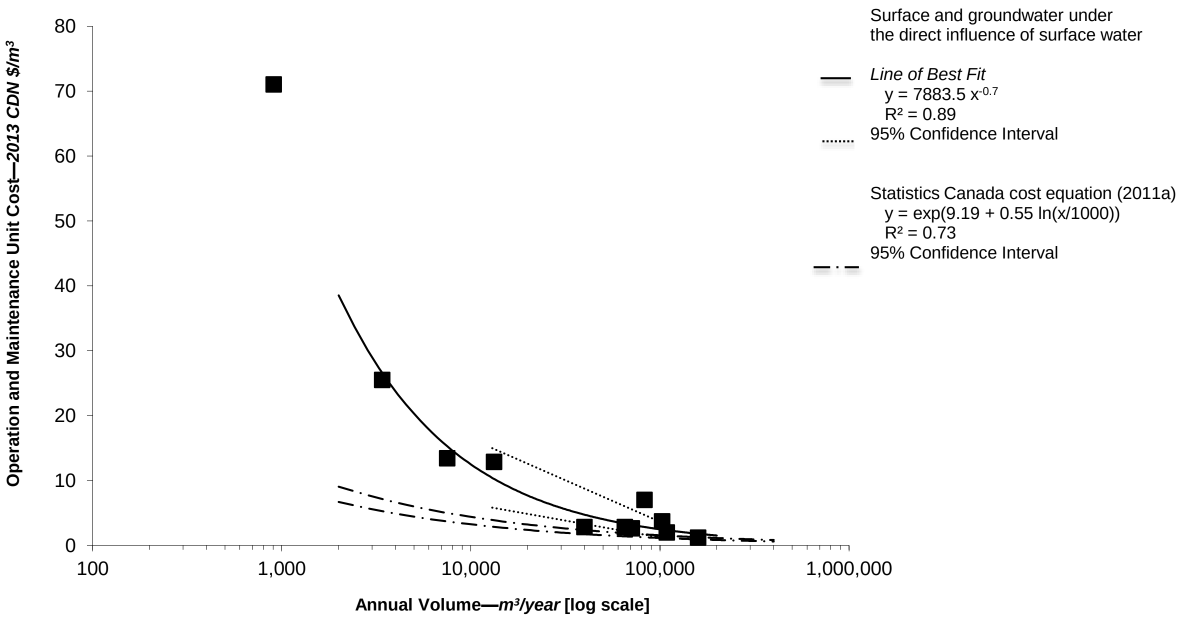

Figure 4 Operation and Maintenance unit costs of water treatment using groundwater water sources plotted against the annual volume

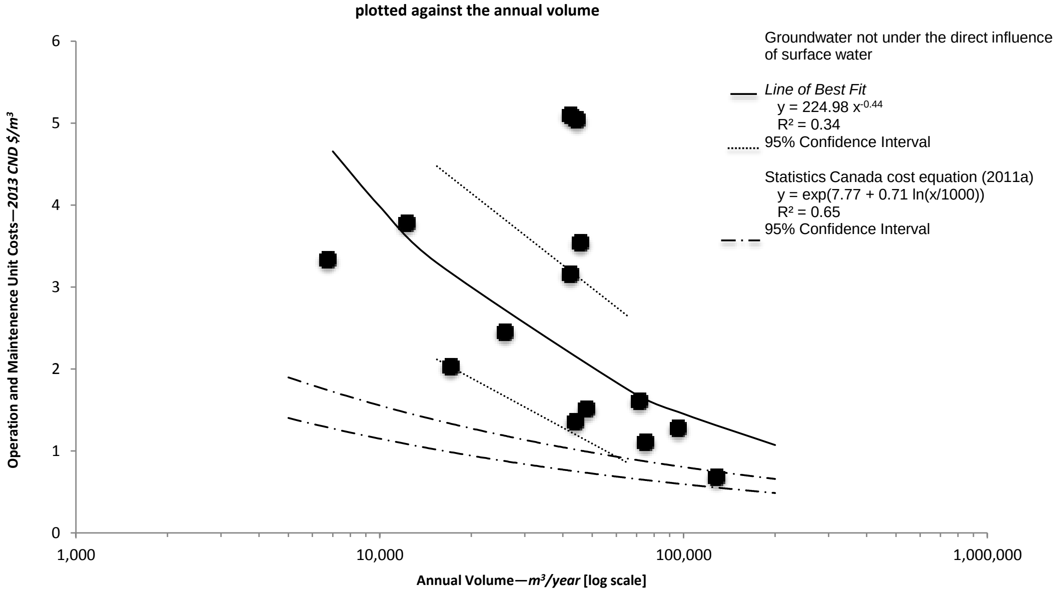

Figure 5 Percentage of systems that recover costs in the full, community and marginal cost recovery scenarios (n=25)

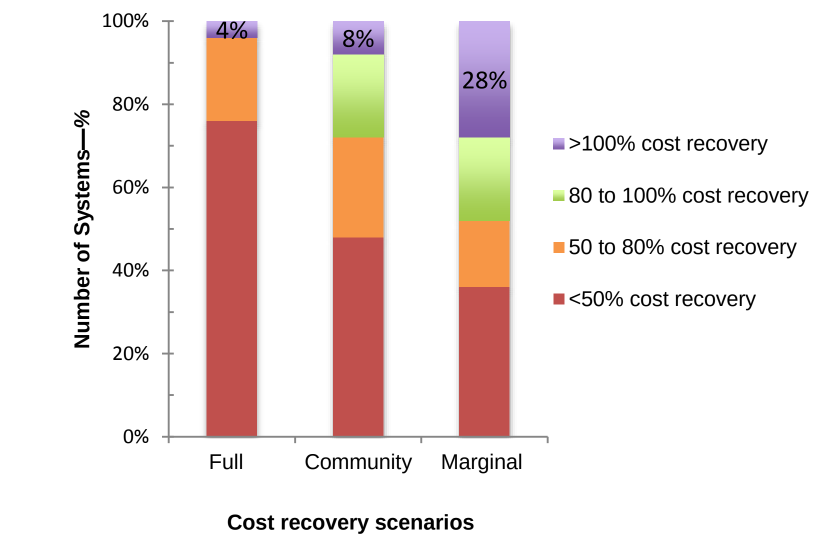

Figure 6 Percentage recovery of the full cost of treating water plotted against the annual volume

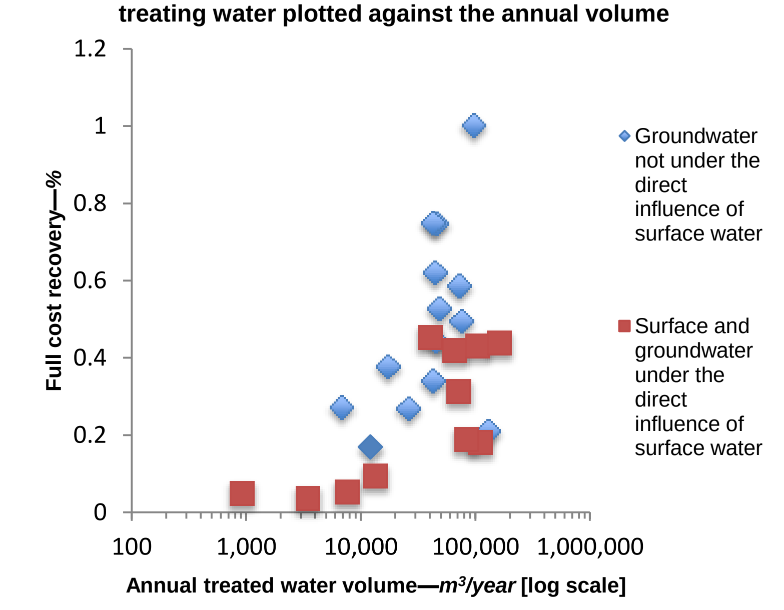

Figure 7 Predicted water bill price expressed as a percentage of Median Household Income in various cost recovery scenarios (n=25)

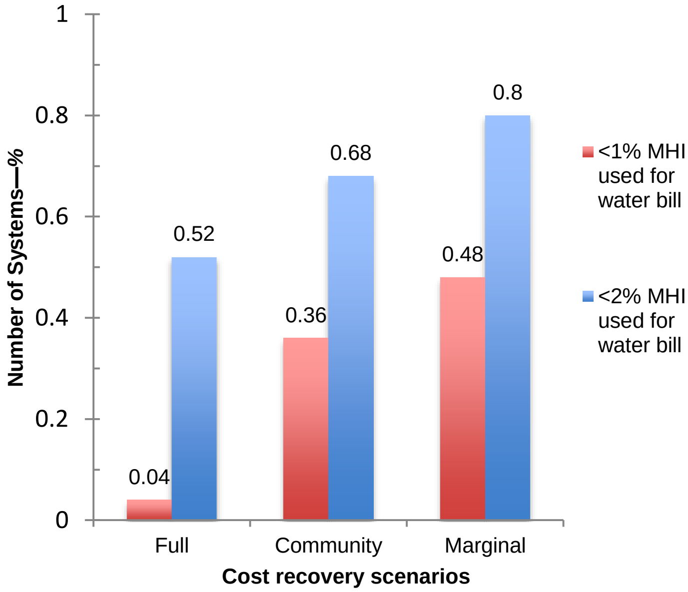

Table 1: Regulated Drinking Water System by Size in Alberta (Alberta Environment, 2011)

	Very Small	Small	Medium	Large	Total
Category population	500 or less	501-1 500	1 501-10 000	>10 000	
Systems–#	452	105	83	30	670
Systems–%	67%	16%	12%	4%	100%
Population served	~80 000	~80 000	330 000	2 800 000	3 300 000
Population–%	~2.5%	~2.5%	10%	84%	100%