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Constructing Ontario's Future

Financing Water and Sewer Systems in the GTA
What Should be Done?

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Financing Water and Sewer Systems in the Greater Toronto Area: What Should be Done?

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Executive Summary

Growing concern over the state of water and sewer infrastructure in the GTA and consequent environmental issues evolving from much of it has highlighted the importance of municipal capital investment (spending) and the way in which it is financed. As the GTA expands and grows older, resources must be devoted to the expansion, rehabilitation, or replacement of the water and sewer system. Of growing concern for health reasons are the pipes used to transport water and sewerage. All pipes – drinking water, sanitary and storm sewers – have a finite life and must be replaced or rehabilitated as they approach the end of their useful life. In proceeding with this rehabilitation and expansion of all aspects of water and sewer systems, there are two important financing challenges.

First, there is the challenge of determining the desired or optimal level of water and sewer infrastructure and the way in which it should be financed. Second, and of more importance is the challenge of setting correct prices (user fees) for the consumption of water. This is important because prices act as a conduit for revealing the true demand for – and therefore, indicating the efficient supply of – water and sewer infrastructure. Incorrectly set prices lead to an inefficient use of resources and result in too much infrastructure where prices do not capture all costs, and too little where they capture more than the costs of services consumed. Unfortunately, setting efficient prices is often short-changed and frequently over-looked in discussions of capital financing, yet it is probably the most important issue around local infrastructure spending and how it is financed.

The practice of financing water and sewer infrastructure has changed over the past fifteen years. Grants have declined dramatically as a funding source and reliance on reserves and development charges have increased in relative importance; a deliberate initiative to move towards ‘pay-as-you-go’ financing.

Water and sewer systems should be financed on the basis of benefits received. Here, the underlying principle is straightforward – those who benefit from a service pay for it. Financing on this basis has a number of advantages. Whenever a direct link exists between the users of a service and its funding, a more efficient use of resources ensues. Accountability, transparency, and fairness also follow.

Current water charges are characterized by two general structures: a fixed charge that varies by customer class (residential versus commercial) and property type rather than volume; and three volume based charges including a constant unit rate, a declining block rate, an increasing block rate, or a mix of these. Each has its strengths and weaknesses in its ability to generate an efficient and fair use of resources plus each has different incentives for leading to water conservation, an objective that is becoming more and more important. Sewer charges are almost always recovered through surcharges on water bills.

Recent initiatives at reforming the pricing of water and wastewater have emphasized the importance of meters. They have also emphasized the importance of implementing proper accounting, budgeting and information retrieval systems as well as the adoption of innovative pricing practices. All have argued for the inclusion of annual asset replacement costs in annual operating costs. Time of use prices to capture variations in costs according to the time of day or season of the year have been supported everywhere. Many have called for multipart pricing structures to improve consumption efficiency and at the same time recover all fixed costs of production.

Municipalities in the GTA currently use a range of instruments to finance water and sewer infrastructure – current operating revenues, reserves, borrowing, and development charges. Current operating revenues make little sense in terms of benefits received. Reserves create intergenerational inequities and have the potential to generate a level of capital spending that is not allocatively efficient. Borrowing makes considerable sense for financing the rehabilitation of existing water and sewer systems because the benefits from this infrastructure accrue to future users, thus leading to a funding system that is fair, efficient and accountable. Development charges are entirely appropriate for financing water and sewer infrastructure required to accommodate growth. Unfortunately, their current application is frequently inappropriate because development charges are imposed at a uniform rate across the entire municipality. This application fails to achieve an efficient allocation of resources because properties that cost less to service subsidize properties that are more expensive to service. Switching to a charge that varies by property or neighbourhood according to servicing cost leads to a better matching of beneficiaries and costs and an improved allocation of local resources.

At the same time, there are solid arguments for municipalities having access to new financing instruments, including revenue bonds (currently only permitted in Toronto under the new *City of Toronto Act*). These are desirable on allocative efficiency grounds for financing local capital or infrastructure projects that produce reliable annual revenue streams; for example, water and sewer systems.

Greater use of alternative financing and procurement (AFP) including public-private partnerships (P3s) could alleviate some financing concerns by passing the burden onto the private sector. These have a number of advantages. They offer new sources of capital, freeing government revenues for other purposes. They let the public sector draw on private-sector expertise to minimize costs, an advantage especially important to small municipalities. Their contractual structure can encourage a "life-cycle" approach to planning and budgeting through the use of long-term contracts that include maintenance costs, asset replacement cost, and asset management plans. They are a way of bringing competition into the public sector. Because the private sector operates in a competitive environment, it is almost always more innovative in infrastructure design, construction and facility management when compared with the public sector. Where the contracts are properly structured and based on performance measures, these arrangements can lead to improved local governance including increased accountability, transparency and value for money.

Recommendations

1. Install meters for water and sewers everywhere with the cost of installation borne by the property owner.
2. Implement volumetric water prices designed to improve the efficient use of local resources and encourage conservation.
3. Water prices should vary by time of day or season of the year.
4. Water prices should include the opportunity cost of water use.
5. The cost of replacing lead water pipelines should be shared between the property owner and the municipality.
6. Storm water drainage systems should be separated from sanitary sewer lines

wherever possible.

7. Annual asset replacement costs must be included in annual operating costs.
8. Asset management programs should be introduced and followed.
9. Revenue bonds for borrowing should be permitted for all municipalities.
10. Development charges should vary by neighbourhood or development.
11. Greater use should be made of alternative financing and procurement systems including the use of public-private partnerships.

Introduction

Growing concern over the state of water and sewer infrastructure in the GTA and consequent environmental issues evolving from much of it has highlighted the importance of municipal capital investment (spending) and the way in which it is financed. As the GTA expands and grows older, resources will have to be devoted to the expansion, rehabilitation, or replacement of the water and sewer system. In proceeding with this expansion and rehabilitation, there are two important challenges.

First, there is the challenge of determining the desired or optimal level of water and sewer infrastructure and the way in which it should be financed. Second, and of more importance is the challenge of setting correct prices (user fees) for the consumption of water. This is important because prices act as a conduit for revealing the true demand for – and therefore, indicating the efficient supply of – water and sewer infrastructure. Incorrectly set prices lead to an inefficient use of resources and result in too much infrastructure where prices do not capture all costs, and too little where they capture more than the costs of services consumed. Unfortunately, setting efficient prices is often short-changed and frequently over-looked in discussions of capital financing, yet it is probably the most important issue around local infrastructure spending and how it is financed.

The report is divided into the following sections. Part A illustrates the relative importance of capital spending on water and sewers from 1990 to 2005. Part B provides a similar illustration of the importance of grant revenue as a funding source for these expenditures over the same period of time. Part C lays out an analytical framework for evaluating funding options. Part D describes the range of water structures that may be used. Part E discusses the concept of full cost pricing. Part F emphasizes the importance of fund accounting and its implications for accountability and transparency. Part G takes the framework from Part C and uses it to emphasize the importance of equating prices with marginal cost and what is necessary to achieve this. Part H describes how sewer services are priced along with the problems currently created by this pricing practice. Part I discusses a number of instruments that may be used for funding water and sewer infrastructure. Part J summarizes the report and offers some guidance for future changes in pricing practices.

A. Capital spending

Table 1 records water and sewer capital spending as a percent of all municipal capital spending for the GTA and for the rest of the province for the years from 1990 to 2005. In the early nineties, capital spending on water and sewers accounted for a higher percentage of all municipal capital spending (around 17 percent in the GTA and 26 percent in the rest of the province) than it did in the mid 2000s (around 14 percent in the GTA and 15 percent in the rest of the province). This proportionate decrease, however, disguises the fact that spending on water and sewer infrastructure increased in relative

Table 1: Water and Sewer Capital Spending As A Percent of Total Municipal Capital Spending – 1990 to 2005

Year	GTA			Province excluding GTA		
	Sewer	Water	Both	Sewer	Water	Both
	%	%	%	%	%	%
1990	9.2	7.2	16.4	12.7	13.4	26.1
1991	10.3	7.6	17.9	13.9	12.9	26.8
1992	10.5	6.9	17.3	15.9	10.9	26.8
1993	9.4	7.1	16.5	14.1	13.8	27.9
1994	9.9	9.5	19.4	13.3	14.5	27.7
1995	7.6	11.6	19.2	12.5	13.6	26.2
1996	5.3	10.3	15.6	14.5	16.4	30.9
1997	14.4	9.7	24.2	12.2	14.4	26.6
1998	7.7	7.2	14.9	8.9	16.0	24.9
1999	4.2	7.1	11.3	10.3	12.7	23.0
2000	6.0	4.8	10.8	8.0	6.2	14.2
2001	4.9	5.2	10.0	5.9	5.6	11.6
2002	4.2	5.8	10.0	5.0	6.2	11.2
2003	4.3	6.5	10.8	4.5	3.6	8.2
2004	5.4	8.5	14.0	5.7	8.5	14.3
2005	6.8	6.4	13.2	6.1	8.8	14.8

Source: Calculated from data provided in the annual *Financial Information Returns (FIR)*, Provincial Ministry of Municipal Affairs and Housing, Ontario.

importance over the sixteen year period, rising from about .09 percent of Ontario's gross domestic product (GDPP) in the early nineties and 0.16 percent by the mid 2000s (calculated from FIR data and Statistics Canada data).

B. Capital Financing

Infrastructure financing for water and sewer systems in the GTA has for some time come from two primary revenue sources; first, provincial and on occasion, federal government grants; and second, locally generated revenues including borrowing, development charges, and operating revenues. Table 2 illustrates the

Table 2: Federal and Provincial Capital Grants For Water and Sewer As A Percent of Capital Spending on Water and Sewer – 1990 to 2005

Year	Sewer		Water		Both	
	GTA	Province excl. GTA	GTA	Province excl. GTA	GTA	Province excl. GTA
	%	%	%	%	%	%
1990	18.4	31.9	3.9	20.9	12.0	26.2
1991	8.3	33.6	4.9	29.5	6.9	31.6
1992	7.0	30.7	4.2	24.6	5.9	28.2
1993	5.7	30.3	3.6	28.7	4.8	29.5
1994	6.9	33.6	9.0	34.8	7.9	34.2
1995	16.5	38.4	9.6	39.7	12.4	39.1
1996	15.1	36.4	10.7	30.3	12.2	33.2
1997	1.7	25.0	4.5	13.2	2.8	18.6
1998	3.4	16.9	3.8	5.3	3.6	9.5
1999	3.3	14.8	1.8	13.8	2.4	14.2
2000	0.1	22.1	0.3	12.1	0.2	17.7
2001	0.1	3.9	0.0	4.3	0.0	4.1
2002	0.1	6.3	0.7	12.4	0.4	9.7
2003	0.4	10.2	1.5	36.5	1.1	21.9
2004	0.0	13.4	3.5	21.8	2.2	18.4
2005	0.1	17.1	2.0	18.7	1.0	18.0

Source: Same as Table 1.

changing importance of grants (almost solely provincial) over the period from 1990 to 2005. In particular, the following may be noted:

- grant funding for water and sewer systems has declined in both the GTA and the rest of the province excluding the GTA;
- grant funding for water and sewer systems in the GTA is almost non-existent while it accounts for around 20 percent of water and sewer infrastructure spending in the rest of the province.
- grant funding for both water and sewers increased substantially outside the GTA in 2003 and thereafter, a fallout from the 'Walkerton' disaster.

C. Framework for Evaluating Funding Options

Water and sewer infrastructure should be financed on the basis of benefits received (Kitchen 2003, 2006a and 2006b). This provides the greatest likelihood of securing an allocatively efficient and optimal level of local capital investment. The underlying principle of benefits received (Duff 2003) is straightforward: those who benefit from local infrastructure and the service it provides should pay for it. This model is particularly important because it has the ability or capacity to satisfy the following five important criteria

Efficiency[1] is achieved when the price or user fee per litre of water equals the extra cost of the last unit consumed. This is the well-known marginal cost pricing principle. The price per litre, by definition, is an expression of what consumers are willing to pay and marginal cost, by definition, measures the cost of resources used up in producing that litre. Perhaps this can be illustrated by reference to a simple example. Suppose the extra

[1] Economic efficiency is more than technical efficiency- the latter is a necessary but not sufficient condition for economic efficiency. Technical efficiency exists when a producing unit (firm, government, commission) operates in a way such that it is not possible to secure any additional output given the available inputs (labour, material and capital) and level of technology. In other words, technical efficiency is achieved when the output per unit of input is maximized or the cost per unit of output is minimized. This, it should be noted, is not concerned with whether one good or service generates more or fewer net benefits than another good or service. It simply concentrates on the efficient employment of inputs in the production of a specific good or service. Finally, as the level of technology advances, a technically efficient production process leads to increased output with the same inputs.

(marginal) cost of producing the last litre of water is 10 cents and customers are willing to pay 15 cents for it. This is not an efficient level of output because the value that customers place on this litre is greater than the cost of producing it. In other words, the community is the beneficiary of a net gain of 5 cents for this unit. Collectively, the community would be better off if water consumption increased as long as the price paid for each additional litre exceeded the cost of producing that litre; that is, for each of these units, marginal benefit would exceed marginal cost - a net gain. If, on the other hand, the marginal cost of producing the last litre is 10 cents and customers are only willing to pay 5 cents for it, this is not an efficient level of output either. The benefit that customers get from this unit is less than the cost of the resources used up in producing it and the community is worse off – worse off by 5 cents for this unit. As long as the extra cost of producing the unit is less than its price, too many resources are being devoted to its production. It follows, then, that resource efficiency is achieved where marginal cost equals price because this is the point where the community secures the greatest net gain.

The main economic reason for imposing correctly designed fees or prices is to provide the local government with an incentive for using its resources in the most efficient manner possible. The goal of maximizing efficiency in a local government's provision of services is not an objective dreamed up by some economist. It is simply common sense. Surely any community should allocate its scarce resources to those services that provide its people with as large a bundle as possible of services that they want. That is all that is meant by efficient resource use (Bird, 2001; Bird and Tsiopoulos, 1997, at 35-37).

Accountability is most easily achieved when there is a close link between the beneficiaries of a government service and payment for that service. The principal advantage of linking expenditures to user fees is that the cost of a service may be seen clearly by beneficiaries. Consumer demand, then, is based on some knowledge of service costs and a realization of what must be paid for its consumption - people know what they are getting for the fee charged and better able to judge whether the expenditure is appropriate. User fees assist local managers in determining efficient or optimum service levels – whenever a price or charge for a unit of service is linked to its per unit cost of provision, consumers have enough information to determine desired levels and hence, managers are able to provide these levels.

Transparency is an extension of the accountability argument. Transparency is enhanced when citizens/taxpayers have access to information and decision-making forums so that the general public is familiar with the way in which user fees are set. Emphasis on transparency is intended to mitigate the risk of corruption by making information available and by ensuring that all public policy decisions are made in an open and transparent manner (International Monetary Fund, 2001).

Fairness is achieved because those who consume the service pay for it, just as someone who benefits from a private good pays for it. Concerns about the tax burden on low-income individuals should be addressed through income transfers from the provincial or federal government and social assistance programs targeted to individuals in need. It is far more equitable and efficient to handle income distribution issues through income transfers or targeting (Boadway and Kitchen, 1999, chapters 8 and 9) than to tamper with pricing or taxing mechanisms to accommodate these concerns. International evidence tells us that attempts to hold down prices to address income distribution concerns inevitably leads to over use of the service and the rich being subsidized at the expense of the poor (Bird, 2001).

Finally, the *easiest financing system to administer* is one that is not confusing to understand and does not require an unnecessary amount of time and effort in administering it.

For water and sewer financing, the benefits model is especially appropriate: beneficiaries of the service can be identified; the service does not generate notable spillovers or externalities (such as benefits or costs for neighbouring communities); it is not income redistributional in nature;[2] non-users or non-beneficiaries are excluded from paying for it; and output and costs can be measured.

[2] While some elements of income redistribution are inherent in almost all public services, income redistributional services include welfare payments, children's aid, social housing, and income transfers to name the most obvious.

D. Water Rate Structures

User fees for water are characterized by two general structures. First, a fixed charge that does not vary with consumption but may vary by customer class (residential versus commercial) and property type, such as the number and types of rooms, the size of the lot, the number of water using fixtures, whether or not there is a swimming pool, and so on. For flat rate charges, meters are not required because the water price is not related to consumption.

Second, a variety of volume based charges are used. These require the use of meters and take one of three forms - constant unit rate, declining block rate, or increasing block rate.[3] Each of these is described here. Of importance for this discussion are the incentives that each structure creates for improving efficiency and leading to conservation practices, in particular.

Constant Unit Rate

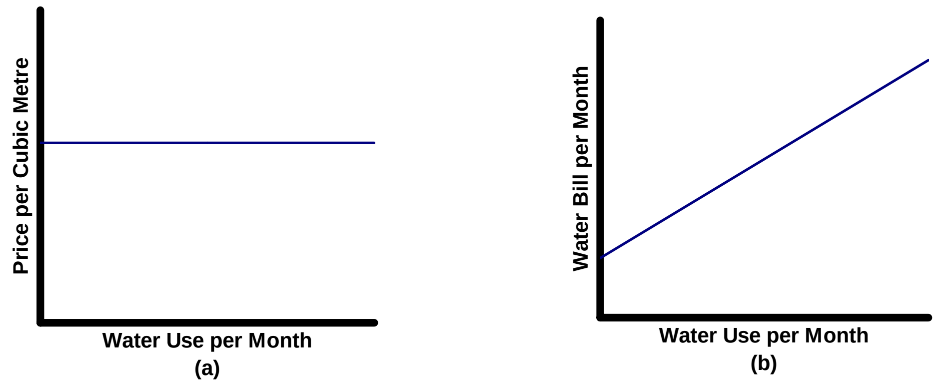
A constant unit rate is an equal charge per unit of consumption (cubic metre, for example) and seldom varies across classes of customers. It is the simplest form of a volumetric rate structure and is illustrated in Figure 1. It is an efficient pricing policy only if the marginal cost of water is constant. We know, however, that the marginal cost is not constant – it either rises or falls with quantity consumed. Since price must equal marginal cost for efficient use, this pricing structure is inefficient and it is ineffective in encouraging water conservation.

Declining Block Rate

A declining block rate, which is usually combined with a basic or fixed service charge per period, is a volumetric charge that decreases in discrete steps or blocks as the volume of water consumed increases. The fixed component of the charge often varies with the

[3] The figures in this section are borrowed from Strategic Alternatives et. al., May, 2001, chapter 6.

Figure 1: Graphic representation of (a) price per cubic metre, and (b) water bill per month for a single block rate.



size of the service connection. Minimum charges that correspond to a minimum amount of water consumption in each billing period are common in systems of this kind.

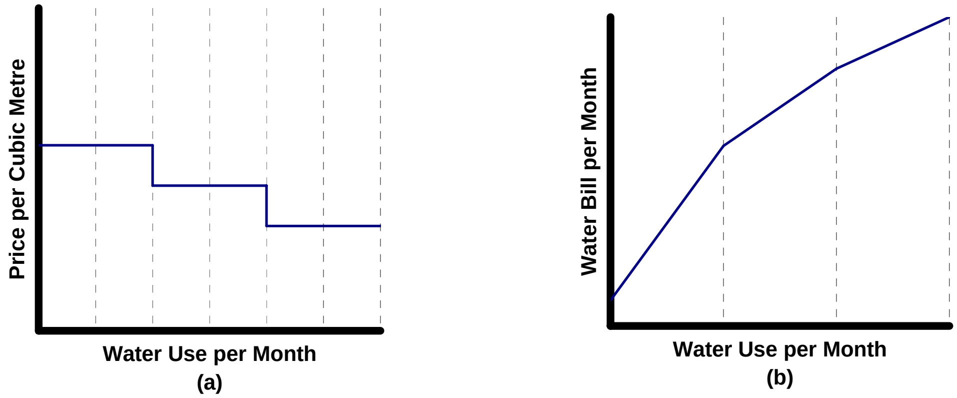
Figure 2 illustrates the concept of the declining block rate. Traditionally, the municipality sets the consumption limit for the first block to represent the largest amount of water that a consumer in a single-family dwelling might use. The second block would encompass the consumption of most middle-sized commercial customers, and the third (and any subsequent) block would encompass larger industrial users. A typical declining block rate system has at least three blocks, but declining block volumetric charge structures with only two blocks are also used.

Many critics argue that declining block rates do not promote water conservation since the price of water declines as more water is used. On the other hand, a declining block rate system may be an appropriate tool for water conservation if it is the small customers who are responsible for inefficient water use. Charging them a higher price gives them a greater incentive to conserve.

Increasing Block Rate

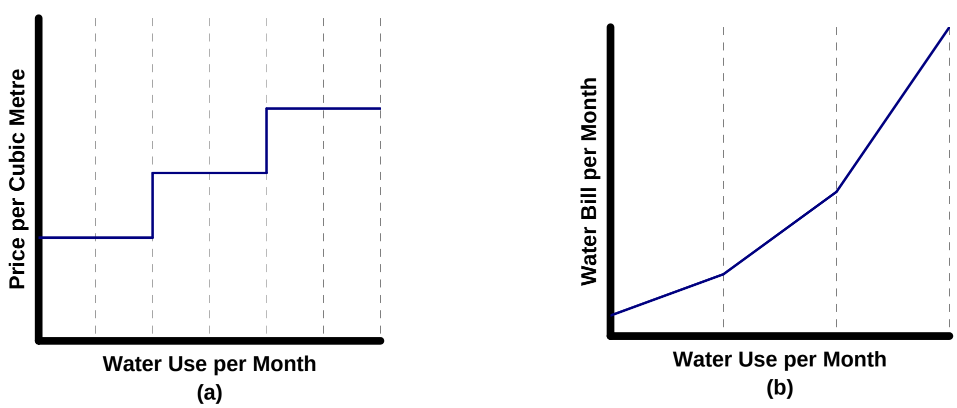
Figure 3 shows how a system with an increasing block rate works. The first block for a given class of customer is generally designed to cover the normal water use of an average

Figure 2: Graphic representation of (a) price per cubic metre of water used, and (b) water bill per month for declining block rate.



customer in that class. The rate increases with each subsequent block. This pricing tool may be appropriate for residential customers who as a customer class are the main cause of peak demand, and for industrial customers if limitations on the availability of water justify shifting the cost burden to the largest users. It should be possible to set the price differences from block to block in a way that would give the customer a clear and strong incentive to conserve water.

Figure 3: Graphic representation of (a) price per cubic metre of water used, and (b) water bill per month for increasing block rate.



The price differences might have to be large, however, since the demand for water, especially the residential demand, tends to be highly inelastic. Table 3 shows various estimates of price elasticity for water demand. The estimated coefficients range from -0.05 to -1.0, but the more recent studies tend to report lower coefficients than the earlier studies. What this tells us is that the quantity demanded of water tends to be insensitive to price changes, at least for current prices.

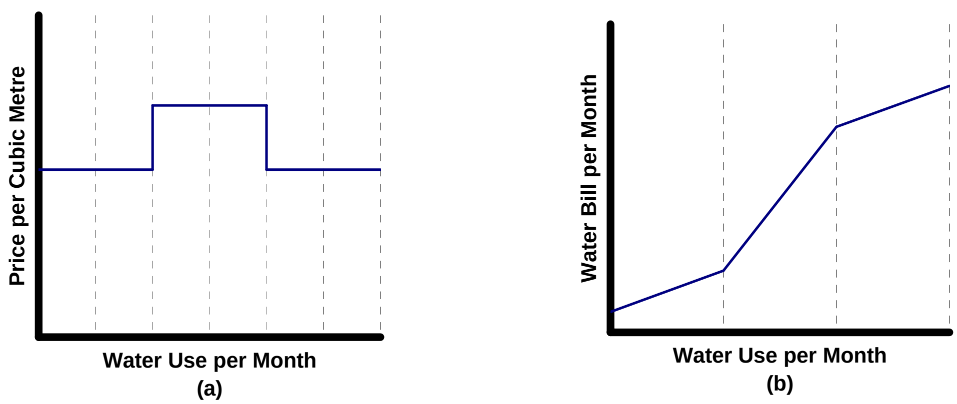
Table 3: Summary of Price Elasticity Studies

Source	Findings	
National Regulatory Research Institute (1991)	Residential: Industrial:	-0.20 to -0.40 -0.50 to -0.80
California Urban Water Agencies (1992)	Single-family residential Winter: Summer: Multi-family residential Winter: Summer: Commercial/Industrial:	 -0.10 to -0.20 -0.20 to –0.40 -0.05 to -0.20 0.00 to -0.20 -0.10 to –0.30
Canadian Water and Wastewater Association (1994)	In-house residential: Outdoor residential: Non-residential:	-0.2 to –0.4 up to –1.0 -0.5 to –0.8
California Urban Water Conservation Council (1997)	<u>Long Run Elasticities</u> Single family residential Winter: Summer: Multi-family residential Winter: Summer: <u>Short Run Elasticities</u> Single family residential Winter: Summer: Multi-family residential Winter: Summer:	 -0.10 to -0.30 -0.20 to –0.50 0.00 to -0.15 -0.05 to -0.20 0.00 to -0.10 -0.10 to -0.20 0.00 to -0.05 -0.05 to -0.10
National Regulatory Research Institute (1994) and Bauman, Boland and Hanemann (1998)	In-house residential Outdoor residential Commercial Industrial: Total municipal	-0.1 to –0.2 -0.4 to –0.7 -0.1 to –0.4 -0.4 to –1.0 -0.1 to –0.7
Source: "Financing Water Infrastructure", by Strategic Alternatives et al., Issue Paper 14 commissioned by the Walkerton Inquiry, May, 2001, page 32.		

Humpback Block Rates

A humpback block rate system of water charges combines increasing and decreasing block rates to produce the rate structure, shaped like an inverted "U", shown in Figure 4. Under this approach, the municipality applies its highest rate to the consumption block that captures the peak seasonal demand of residential customers. The intention is to encourage water conservation by residential customers by encompassing residential use within increasing block rates while offering large industrial users block rates that decline as use increases and thereby benefit from the economies of scale associated with providing water to customers of this kind.

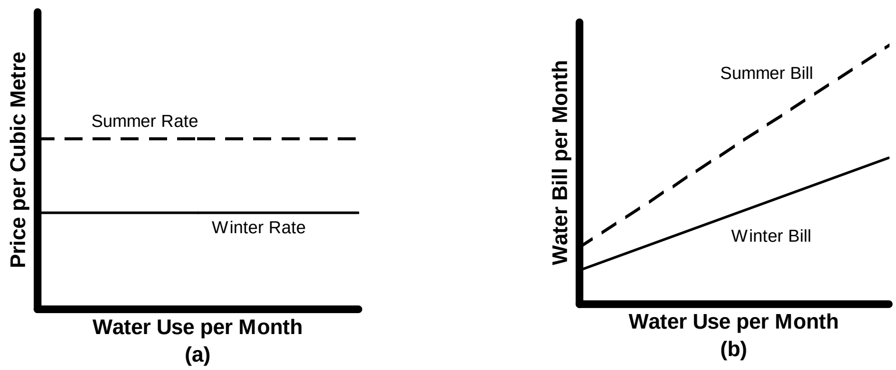
Figure 4: Graphic representation of (a) price per cubic metre of water used, and (b) water bill per month for humpback block rate.



Seasonal Rates

A seasonal-rate system, as Figure 5 shows, applies a high volumetric rate during the peak water-demand season and a lower rate during the remainder of the year. By targeting seasonal demand, seasonal rates promote water conservation. The economic rationale for a seasonal-rate system is that in order to meet peak demand, the municipality must maintain supply facilities that are larger than they need to be to meet demand for most of the year. A seasonal charge recovers the extra costs of this excess capacity directly from the component of demand that causes those costs.

Figure 5: Graphic representation of (a) price per cubic metre of water used, and (b) water bill per month for seasonal rate structure.

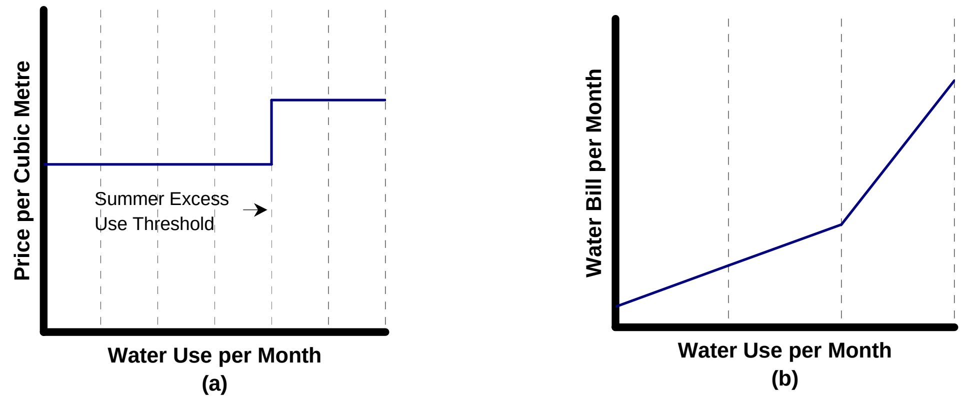


Excess Use Rate

An excess-use rate, as Figure 6 shows, is a high volumetric rate that applies to all consumption during the peak water-consumption season in excess of a threshold amount. The amount is set equal to the average off-peak-season consumption or a modest multiple of this consumption - for example, 1.3 times winter consumption. The municipality applies a base charge to all of a customer's off-peak-season consumption and to the portion of peak-season consumption that is below the threshold.

The difference between the base charge and the excess-use charge must be large enough to give customers a strong incentive to save water. One way to achieve a large seasonal change is to recover all capital costs for expansion from the peak season charge The problem with this approach is that it increases the risk that cost recovery will be inadequate, since peak-season demand tends to be more variable than demand during the balance of the year.

Figure 6: Graphic representation of (a) price per cubic metre of water used, and (b) water bill per month for excess use rate structure.



Mix of Rates

Municipalities often use variations or combinations of the pricing structures described above. Two-part pricing schemes, for example, are fairly common. They consist of a fixed charge designed to cover costs of meter reading, billing, customer accounting, and capital and maintenance costs of meters plus a constant commodity charge applied to all consumption. Other variants include "lifeline" rates, or low rates for low or fixed income households, and "vintage" rates, which distinguish between new and existing customers, or seasonal or peak demand rates to reflect increased cost of delivery or a desire to reduce consumption during certain seasons or times of the day. A few municipalities have combined components of residential and commercial pricing systems into one schedule.

E. Concept of Full Cost Pricing

Much has been written on full cost pricing for water and sewer services. In the analytical literature, this generally refers to designing a rate structure or pricing system that secures efficiency outcomes (section C above) while, at the same time, recovering all production and delivery costs. On a more practical note, however, all municipalities in the GTA can claim full cost recovery because the fund accounting system used for water and sewer systems records all water and sewer costs separately from other municipal costs, and includes all water and sewer revenues in this fund. Since all costs are recovered from revenues generated from the users of the system, full cost pricing exists. This is true regardless of the rate structure and says nothing about designing a pricing system that is intended to be efficient, accountable, transparent, and fair. This is discussed in the remainder of this report.

F. Fund Accounting, Accountability, and Transparency

Water and sewer operations (municipal departments or separate utilities) in the GTA are treated as separate business units for both operational and accounting purposes; that is, all water and sewer expenditures and all revenues received from water and sewer rates are recorded in a separate account. This is often referred to as utility fund and it is based on the principles of fund accounting.

Fund accounting offers two important advantages. First, it recognizes that water and sewer revenues are not fungible – that is, available for purposes other than those budgeted – and that data on budgeting and compliance are an important part of the stewardship responsibility of government. Second, distinct fund accounting and reporting is necessary to control resources for their designated use and to demonstrate compliance with legal and budgeting constraints affecting municipal governments (Kitchen, 2006a, at 59).

A separate fund for the water and sewer operation within a municipality is important because it leads to a more accountable and transparent system than might exist otherwise. Accountability is increased because there is a close link between those who benefit and those who pay. Transparency is enhanced because users can see where their money is being spent.

G. Water Rates and Marginal Costs

Although the efficiency advantages of marginal cost pricing are well documented and have been noted above, municipalities seldom implement marginal cost pricing. This is so for several reasons. First, marginal cost pricing is often perceived as being an unnecessarily complex approach that cannot guarantee the matching of revenues with anticipated costs and that could cause revenue instability.

Second, grants from provincial governments and occasionally from the Federal government, have provided an incentive for municipalities to build facilities that are larger than needed. For example, from 1974 to 1992, the Ontario government provided grants that covered up to 85 percent of all capital costs for municipal water systems. In addition, many municipalities have built plants designed to accommodate growth. Where growth estimates have been overly optimistic, these municipalities have been left with useless and expensive over capacity that lasts for decades (Report, 2005, at 53-54). In 1996, it was estimated that these factors combined had produced an overall plant capacity for Ontario municipalities that was 44 percent in excess of what was needed to meet needs at that time (Strategic Alternatives et. al., 2001, at 39).

If setting price equal to marginal cost leaves municipalities with insufficient funds to cover their annual operating costs, municipalities have tended to set prices below marginal cost so that consumption would increase in order to generate enough revenue to meet annual operating costs. Unfortunately, this practice has led to over-consumption and wasted resources. One estimate (2003) for Ontario municipalities indicated that water-related revenues only covered 64 percent of the full costs of providing water and wastewater services, although this percentage has been rising as the years pass. This shortfall has led to “rust-out, less reliable service, more leaks, increasing risk to public health and convenience, environmental damage and demand for subsidies” (Report, 2005, at 53).

Third, municipalities cannot implement marginal-cost pricing if they fail to collect sufficient cost information including calculations of the opportunity cost of using water, or if they have this information but fail to compile it in a manner that permits the calculation of marginal costs.

Fourth, municipalities cannot implement marginal-cost pricing if they fail to set rates to capture differences in cost that arise because of differences in distance from source of supply and differences in the level of use according to season of the year or time of day (Dewees, 2002).

Fifth, municipalities cannot implement this form of pricing if they do not include asset replacement costs in annual operating costs. Historically, annual asset replacement costs have been excluded from operating costs because municipalities relied on grants from senior levels of government (seen as free money to the municipality). This situation, by the way, is the same in most countries except for Australia and Brazil where water utilities are now required to recover a portion of capital costs from users (Mann, 1999).

Finally, marginal-cost pricing cannot be implemented if municipalities are unmetered. Meters are important because they provide customers with an incentive to consume less water while, at the same time, assuring customers that they are only paying for the water they consume. Conversely, failure to use meters means that customers have less incentive to conserve water. Indeed, this is observed in data showing that residential water consumption is considerably lower in municipalities with meters (volumetric charges) than in municipalities without meters (flat rate or assessment only) (Environment Canada, 1999). Metering has an added advantage in that it permits water delivery systems to get information about the leakage of water between its plant and its customers. This permits better use of repair and maintenance resources and improves accountability. Installation of meters also provides an excellent opportunity for educating customers on efficient water usage including the advantages of disconnecting run-off from roofs into sanitary sewer systems and redirecting it into storm sewer systems (Report, 2005, at 55).

To go one step further than simply calling for water meters, it has been suggested that universal metering be adopted. This would retrieve data for all billable services (electricity, gas, and so on) provided to homes and businesses with the information transmitted electronically to a central billing agency. This would be cost efficient because it would lower the costs of reading meters. As well, it has been suggested that for residents of multi-unit residential buildings or mobile home parks where there is one meter, sub-meters be installed for all residents or occupants. In the U.S., the use of sub-meters has led to a further reduction of 15 percent in water consumption (Report, 2005, at 56).

For the few Canadian studies that have examined the impact of meters on water consumption, the results have suggested a decline in water use with the introduction of water meters. The usual pattern is for water use to fall substantially after meters are installed and then to rebound somewhat as consumers become familiar with the new pricing scheme. The ultimate impact of metering depends on the post-metering water pricing regimes (Brooks and Peters, 1988). In general, these studies have concluded that a ten percent increase in price causes a two to four percent reduction in the indoor demand for water (Tate, 1990) while outdoor residential use in the summer declines by around ten percent (Strategic Alternatives et. al., 2001, at 33) or more (Renzetti, 2002, at 22 and 33). This suggests that differential prices are effective in reducing peak demand (Report, 2005, at 55) during the summer months. As well, different classes of users respond to higher prices in different ways with industrial users being more sensitive to water pricing than residential customers (Mayer et. al., 1999). All consumers, however, are more responsive to water prices over the long run if increases are deemed to be permanent - they invest in or buy equipment or appliances that use less water (Renzetti, 2002, at 29).

Because of alleged or perceived difficulties, marginal cost pricing is *not* the norm in the water supply industry; in general, average cost pricing prevails. This does not mean, however, that the concept of marginal cost pricing is of little use. Marginal cost pricing is important. A price that is less than marginal cost encourages consumption and wastes resources. Over the past few years, efforts to reduce water consumption in response to dry spells or the exhaustion of low cost sources of supply have led to the emergence of water pricing initiatives that emphasize economic incentives. This has been especially noted for the United States (Cuthbert and Lemoine, 1996; and Chesnutt, et al, 1997). These economic incentives frequently include conservation-oriented rate structures that target high volume users. In terms of marginal cost pricing, conservation pricing is justified if the opportunity cost of not conserving water is high.

Not only does failure to implement marginal cost pricing lead to an inefficient allocation of resources, it is unfair on the basis of benefits received. Customers whose price exceeds marginal cost subsidize those whose price is below marginal cost.

Subsidization of this kind is likely to generate income distributional patterns that differ considerably from those pursued under more direct government income transfer schemes. Furthermore, if the subsidy is capitalized into land values (Downing, 1973), then the properties that pay less than marginal cost will be priced higher than would be the case otherwise. More specifically, failure to use peak load prices for late afternoon and evening consumption, and seasonal prices for summer months generates excessive demand at these times and means that heavy users of water at certain times of the day or year are subsidized by users with lower demands during these times. This practice has led to investments in water facilities that are larger than would be the case if more efficient pricing policies were employed. Failure to differentiate by distance or location means that those further from source or who live in higher cost areas are subsidized by those closer to the source or who live in lower cost areas. In short, under-pricing water leads to a higher level of consumption than is allocatively efficient primarily because there is no incentive to restrict use and to use the service in an efficient manner. It has brought about investments in water treatment facilities that are larger than would exist under a more efficient pricing policy (Renzetti, 1999).

A 1992 simulation study substituted efficient prices for existing prices (Renzetti, 1992). It found that a reform of water prices to accommodate the price-equals-marginal-cost pricing principle would lead to welfare gains of approximately four percent for the Greater Vancouver Water District. A 1999 study by the same author looked at 77 water utilities in Ontario (Renzetti, 1999) and concluded that the marginal cost of water supply exceeded the price for water in every municipality studied. For example, the average price to residential customers was $0.32 per cubic metre while the estimated marginal cost was $0.87 per cubic metre. The average price for the non-residential sector was $0.734 per cubic metre and the estimated marginal cost was $1.492 per cubic metre. This large discrepancy between marginal cost and price, and hence between actual and efficient consumption levels, produced noticeable deadweight loss estimates per unit of output. Studies in other countries have come up with similar results (Easter et. al., 1993; and Munasinghe, 1992). These studies suggest that there is considerable scope for raising water prices and that this should be done if efficiency and fairness objectives are to be achieved.

H. Sewer Rates

Sewage collection and treatment expenses are almost always recovered through surcharges on water bills. For residential and most commercial/industrial customers, these rates are not based on sewage flow. Flat rate charges are the most common type. Not only are these used in municipalities with flat rate water charges, but they are also used in municipalities with metered water rates. For other municipalities, the sewage charge is a percent of the water bill.

Because sewage charges are unrelated to the volume of sewage discharged and treated, the efficiency condition is almost certain to be violated. The design of an optimal pricing scheme for sewage requires detailed knowledge of the incremental cost of collecting and treating it. A multi-part pricing structure best approaches the efficient pricing principle, "...with, for example, a connection fee to cover per unit average costs for transmission and treatment capacity, a front footage charge to cover collection costs, and a monthly fee, preferably related to water usage, to cover out-of-pocket operating charges" (Bird, 1976, at 125). In fact, one could vary the connection fee to reflect higher costs of servicing areas that are a considerable distance from the sewage treatment plant.

In practice, pricing schemes for sewage collection and treatment are far from optimal. Seldom is there any attempt to separate the costs associated with treatment, collection and transmission of sewage. In a few municipalities, particularly larger ones, a surcharge is imposed on industrial users because industrial waste is generally denser and contains a more damaging discharge and hence, is more expensive to treat. Flat rate charges are inefficient because they do not capture the marginal cost of the service. Charges prorated on the basis of the water bill are inefficient because they fail to reflect accurately the marginal cost of sewage disposal. The assumption that water is directly and positively correlated with sewage generation may not be accurate; for example, a large component of water consumption may be attributed to lawn sprinkling, car washing, swimming pools and many other household uses, almost all of which are unrelated to sewage generation.

The study cited earlier on 77 water utilities in Ontario (Renzetti, 1999) concluded that the average marginal cost of sewage treatment was $0.521 per cubic metre while the average price was $0.128 per cubic metre. Like the underpricing of water, the underpricing of sewage collection and treatment leads to a higher level of consumption than is allocatively efficient primarily because there is no incentive to restrict use. Underpricing has also led to investment in sewage treatment facilities that are larger than they would be under a more efficient pricing policy (Renzetti, 1999). A recent empirical study on pricing of sewage by Norwegian local governments (Borge and Rattso, 2003) showed that sound user charge financing of sewer services significantly reduced the cost of providing sewer services. Finally, some observers have suggested that underpricing of both water supply and sewage treatment discourages the development of alternative water and sewage treatment technologies (Gardner, 1997; and Postel, 1993).

Similar studies in other countries have also found that water and sewer rates are significantly lower than the marginal cost of production (Easter, Feder, Le Moigne and Duda, 1993; and Munasinghe, 1992). Most of these studies, like the Ontario study cited above, use the utilities' own cost accounting figures as the basis for their estimates. The estimates do not include costs such as the value of raw water withdrawn from the natural environment, the opportunity cost of land holdings, the opportunity cost of invested capital and the harm caused by pollution are not included. The presence of these costs implies that the gap between price and the full marginal cost of supply is larger than it was previously thought to be (Renzetti and Kushner, 2001). Thus, a recent study of water supply in the Regional Municipality of Niagara included in costs a competitive rate of return on assets, pollution externalities and the value of raw water supplies. It estimated that the wholesale price for water would have to increase by at least 15 percent and possibly by as much as 45 percent if all social costs were recovered (Renzetti and Kushner, 2001).

I. Some Specific Costs and Pricing

The discussion up to this point has concentrated on pricing water and sewer systems generally. There are, however, three specific cost issues that are often raised. All of them have specific implications for pricing. They include the cost of installing meters; the cost of replacing lead pipes; the cost of separating storm water from sewage. For each of these, the pricing principle should be the same as above; that is, those who benefit from the service or directly use the service should pay for it. Let us consider each in turn.

The cost of installing meters should be charged to the property owner and could be recovered directly through a one time charge or through the pricing structure with the cost amortized over a number of years.

Growing heath concerns have emerged over the continued use of lead metal service lines. These lines are the sections of pipe that connect homes to the watermains under the street. Up until 1952, these service lines were often made out of solid lead metal. While the Province banned their use in new construction as of 1953, there has been no formal plan for replacing these lines which are often the primary cause of unacceptably high levels of lead in drinking water. From a practical perspective, if the service line needs to be replaced, both the homeowner's portion (smaller section) and the municipality's portion (larger section) should be replaced at the same time. Typically, a lead service line replacement costs between $2,000 and $6,000 with the municipality's portion being about two-thirds. In financing this, the municipality's share should be recaptured through higher water rates for everyone with the homeowner's share funded either in the form of a one time charge or through future water rates with the cost amortized over a number of years.

Failure to separate storm water drainage systems from sanitary sewers also leads to larger sewage treatment plants than is otherwise efficient. For example, failure to separate downspouts from sanitary sewers, washing cars where the water runs down the street and ends up in the sewer system, backwashing and draining swimming pools that eventually empty into sanitary sewers all lead to larger sewage treatment plants than we need. To prevent this, municipalities must be vigilant in developing or creating separate storm water systems wherever possible. This could be funded through a special area property tax rate on each affected area. Separating down spouts from sanitary sewers should be the responsibility of the homeowner. Failure to do this should lead to an extra charge on the homeowner, either through an addition to the property tax bill or a charge on the water bill.

J. Financing Infrastructure

For the past two decades, municipal governments in the GTA have funded water and sewer infrastructure from a variety of sources. These include the traditional instruments of reserves, development charges, borrowing and capital grants. More recently, the province has introduced a couple of new initiatives including the use of revenue bonds in the City of Toronto (under the *City of Toronto Act*) but not elsewhere, and Public-Private Partnerships (P3s). The remainder of this section evaluates the use of each of these instruments in terms of when they are appropriate, and how they might be used if they are to satisfy the criteria for an efficient, fair, transparent and accountable financing structure.

J.1 Reserves

Reserves[4] are created when a portion (a fraction of one cent per litre of water, for example) of current user fee revenue is set aside annually in a special account(s) and accumulates until it is eventually withdrawn and used to finance or partially finance water and sewer projects. These reserves, while they are accumulating, are deposited in interest earning accounts. Financing water and sewer systems through reserves is essentially the reverse of financing through borrowing (discussed below). Instead of borrowing to finance capital expenditures now with debt repayment in the future, reserves reverse that timetable.

While reserves have grown in popularity over the past few years, their application is not without problems. In particular, asking current users to pay for infrastructure that will benefit future users creates intergenerational inequities and has the potential for leading to a level of capital spending that is not allocatively efficient.

4 This discussion of reserves differs from the discussion of development charge funds which also go into reserves – see the discussion under Development Charges.

J.2 Development Charges

Development charges are used by municipalities in the GTA and have been for the past decade or more. A development charge is fixed at a specific dollar value per lot (or per hectare or acre) and is imposed on a developer to finance the off-site capital cost[5] of new development. The charge is applied to the cost of capital facilities needed for new development, but under certain circumstances it may also apply to additional capital costs required to service redevelopment. Historically, charges have been levied to finance the so-called 'hard services' such as water supply systems, sewage treatment plants, trunk mains and roads (Kitchen, 2002 at 196-2000; Tomalty and Skaburskis, 1997; and Bird and Slack, 1993, at 105-110). Once the charges are collected, they are deposited in reserve funds and withdrawn when needed to finance the infrastructure that the new growth requires.

Under the benefits received principle, a development charge is fairest when it is easy to identify the beneficiaries of services provided by physical infrastructure; that is, when one can determine the cost of the eligible infrastructure for each property and all benefits from the infrastructure are confined to that property. Water and sewer systems are examples of capital expenditures whose beneficiaries are fairly easy to identify.

An efficient development charge must include the full cost of delivering the service. For municipal capital expenditures, this charge could consist of a capacity component, which covers the capital cost of constructing the facility, plus a location or distance/ density charge, which reflects the capital cost of extending the service to particular properties or neighbourhoods (Downing and McCaleb, 1987, at 51-52). Ideally, a charge on an individual property or on a neighbourhood should be designed to capture the extra cost of the capital facility required by that property or neighbourhood. Where the extra cost of providing services to different properties differs because of the location or type of property or the nature of the capital asset provided, the charge on each property or neighbourhood should differ if resources are to be allocated efficiently. The general practice in Canadian municipalities with a development charge, however, is to impose an

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5 On-site services such as local roads, sidewalks, street lighting, sewers, and water are the responsibility of the developer in most municipalities and are included in a subdivision approval plan.

identical charge on all properties of a particular type (single residential, or commercial, or industrial, for example) regardless of the location of the property within the community or neighbourhood in which it is located. While this practice has been adopted for administrative simplicity, it creates problems on efficiency grounds because residential dwellings in low density neighbourhoods are levied the same charge as residential dwellings in high density neighbourhoods, yet it is generally conceded that the marginal cost per property of infrastructure projects in low density areas is higher when compared with the marginal cost per property of identical projects in high density areas (more pipe). This creates an incentive to over-develop low density housing (urban sprawl) and under-develop high density housing relative to what is economically efficient (Slack, 2002).

Similarly, it is often more expensive to provide water and sewer systems to some parts of a city or region than it is to provide them to other parts of the city or region. Here, the application of the same charge to all properties in the same property category, regardless of location, is allocatively inefficient because some properties are over charged while others are under charged.

A more efficient development charge policy, in terms of securing correct prices for the provision of capital facilities, would allocate the costs of infrastructure, via the development charge, to new properties actually benefiting from these services. While it may be impractical to expect municipal officials to calculate the infrastructure cost for each new property site, there is no reason why these costs could not be calculated for each new development area or neighbourhood. In this way, development charges in each area could more closely approximate the true costs of providing infrastructure for that area and provide a disincentive to create sprawl.

J.3 Borrowing

Borrowing makes considerable sense for water and sewer systems because the benefits from this infrastructure accrue to future users. As such, this form of financing is fair, efficient and accountable. At the moment, many cities and regions have the capacity for more borrowing but are reluctant to do so. This is attributable to a number of factors, the greatest of which seems to revolve around the cost of borrowing – a number of municipal officials still remember the high interest costs of the eighties and early nineties – and a general desire on the part of many municipal officials to finance on a pay as you go basis rather than by borrowing (Kitchen 2006a) even when best practices suggest the latter.

J.4 Grants

Grants for water and sewer infrastructure have declined substantially since the early nineties. This is probably a good thing for a couple of reasons. First, much of the existing water and sewer infrastructure was built largely with large provincial grants, often covering around 85 percent of capital costs. Municipalities generally treated this as 'free' money and did not feel compelled to recover it through annual asset replacement costs. This is not peculiar to any particular country. The practice is wide spread. At the moment, few countries include asset replacement or depreciation expenses in the computation of operating costs (Kitchen, 2006b). This has led to at least two serious consequences. Failure to record a major cost component means that water prices are lower than they should be, leading to over-investment and more capacity that could otherwise be justified. As well, as the infrastructure deteriorates and needs to be replaced, there are no municipal revenues set aside for this replacement.

Second, when grants cover a large portion of infrastructure costs, there is little incentive to use efficient volumetric pricing schemes to reduce the demand for water. In addition, these grants have meant that municipalities have been slow to set up carefully thought out asset management programs.

Third, water and sewer systems provide goods that may be classified as 'private goods'; that is, specific beneficiaries can be identified and charged for the service and non-users can be excluded. As well, outputs can be easily measured and per unit costs readily calculated. All of this suggests that those who use the service should pay for it. Charging user fees to cover the full costs would be efficient, fair, accountable and transparent.

Economic arguments in support of capital grants for water and sewer systems are not strong. If they are to be used at all, their use should be conditional on the recipient government setting efficient user fees or prices. As well, recipients should have proper asset-management programs, along with requirements that asset replacement costs be included in the charge for services. The practice of fully expensing capital expenses in the year of acquisition and not depreciating the value of capital assets often leads to under-pricing of services and over-investment in infrastructure.

J.5 Revenue bonds

Revenue bonds are another tool that should be introduced for all municipalities. They have considerable merit for financing water and sewer infrastructure because the services generated by this infrastructure produce an annual revenue stream and the beneficiaries of the service can be identified. On the basis of benefits received, their major advantage is that they are fair, efficient, and accountable, as those who use the service pay for it.

J.6 Alternative Financing and Procurement (AFP)

AFP is an innovative way for the government to fund and deliver vital public infrastructure including water and sewer systems. This involves the direct participation of the private sector in a venture controlled by the public sector. The public sector's role is to facilitate, regulate, and guarantee provision of an asset and the private sector's role is to do one or more of the following with the public sector picking up whatever the private sector does not do - design, finance, build and operate the asset in a formalized partnership agreement. Traditionally, this has been referred to as a public-private partnership (P3) (Hrab 2003; Hrab 2003b; TD Bank financial Group 2006; Vander Ploeg 2006) and this is what it is called in most provinces and countries. It is especially appropriate for services with substantial capital costs and where there is a revenue stream.

Although there may be wide variation in the structure of an AFP or P3, it generally includes one of the following features:

- The private sector operates the facility for a fee. The public sector retains responsibility for capital costs.
- The private sector leases or purchases the facility from the public sector, operates the facility, and charges user fees.

- The private sector builds or develops a new facility, or enlarges or renovates an existing facility, and operates it for a number of years before transferring ownership to the public sector.
- The private sector builds and operates the facility and is responsible for capital financing. The public sector regulates and controls the operation.

A critical issue in the design of an AFP or P3 is the sharing of risks. In general, this depends on the type of partnership. The greater the private sector's share, the greater will be its expected rate of return. In principle, the party best able to deal with each type of risk at least cost should bear that risk (TD Bank Financial Group 2006). This capacity to share risk is a major advantage. For example, the risk of cost over-runs, scheduling delays, and service demand should be borne by the private sector; whereas, the risks associated with changes in regulations and legislation, including changes in local taxation and environmental standards – things that cannot be controlled by the private sector – should be assumed by the government (United Kingdom 1997; Nova Scotia 1997). Clearly, an effective and efficient public partnership agreement requires that both parties understand the risks that each is to assume because incorrect risk assignment can lead to increased costs for the private sector and higher risk premiums than should be the case, or higher costs associated with resolving disputes for the public sector (National Audit Office 2001).

AFPs and P3s provide a number of other advantages. They offer new sources of capital, freeing government revenues for other purposes. This is especially important when it is necessary to modernize crumbling infrastructure (Huang 2001). They let the public sector draw on private-sector expertise to minimize costs, an advantage especially important to small municipalities. Their contractual structure can encourage a "life-cycle" approach to planning and budgeting through the use of long-term contracts that include maintenance costs, asset replacement cost, and asset management plans (TD Bank financial Group 2006). They are a way of bringing competition into the public sector (Vander Ploeg 2006). Because the private sector operates in a competitive environment, it is almost always more innovative in infrastructure design, construction and facility management when compared with the public sector. Where AFP and P3 contracts are properly structured and based on performance measures, they can lead to improved local governance including increased accountability, transparency and value for money.

Private sector involvement is not without its critics. Indeed, the strongest opponents are public-sector unions (and their supporters) who view these arrangements as creeping privatisations, and regard them, perhaps rightly, as a threat to union membership. The strongest criticism, however, is that they are too costly. This perception arises, partially at least, because it is argued that private sector borrowing is more expensive than public sector borrowing. This view, however, is short sighted. Lower interest rates for public sector borrowing exist because they are assumed to be risk free, which, of course they are not. Risks exist as long as there are potential problems with cost overruns, scheduling delays, and so on – problems, by the way, that are common with public sector projects and lead to higher taxes in the future. The higher risks of private sector borrowing serve as protection against an unforeseen future cost on taxpayers. This higher rate of return protects the private sector just as "an extended warranty on a car or [an] insurance premium" protects an individual (TD Bank Financial Group 2006, at 13).

Other criticisms include a loss of accountability and the sacrifice of quality for profit. These concerns are important and cannot be understated. Their resolution, however, is not necessarily in retaining public sector provision, but rather in designing carefully negotiated contracts based on performance measures that reflect results and outcomes rather than inputs. As well, this concern is likely overstated because private sector providers operate in a competitive environment where poor quality, low standards and lack of accountability will lead to lost business and firm closures down the road.

Although there is little experience in Canada, evidence from the United Kingdom, where the use of P3s is fairly widespread, indicates that P3s delivered an average saving (ex post) of 17 to 20 percent compared to conventionally provided public infrastructure, even though private sector borrowing costs were higher (Partnerships UK 2003). Similar results have been noted in other countries (Hrab 2003 and 2003b; Grimsey and Lewis 2004). At the same time, P3s have led to improved efficiency, most notably in the presence of competition (Harris 2003; Hrab 2003; and Grimsey and Lewis 2004) and even where service provision has remained largely monopolistic, private participation has delivered better results than the public sector (Harris 2003), particularly where services have “private goods” characteristics. Water is a classic example of a service that has such characteristics.

There is no clear-cut recipe for projects that could be funded and delivered through an AFP or P3. The range can be large, but the complexity of contracts may put a floor under those that are practical. For example, the United Kingdom recently ruled out P3s for small projects costing less than 20 million pounds but deemed P3s to be valuable for major projects with high annual maintenance costs, or where private sector project management skills, innovative design and risk management expertise can provide substantial benefits (HM Treasury 2003; and Commission on Public Private Partnerships 2001).

Based on existing experience, local infrastructure projects that are suitable for AFPs and P3s include transportation projects; water and sewage systems; recreational facilities; urban regeneration projects; and convention centres (Hrab 2003; and Hrab 2003b). An AFP or P3 may be most appropriate when outcomes can be clearly defined (Grimsey and Lewis 2004), proper incentives can be introduced for encouraging private partners to get better value, and if there is clear communication and accountability between the private and public partners.

Because public-private partnerships are monopolistic in nature, there is a role for government in monitoring their behaviour. Governments should set the terms and conditions for service delivery, funding, quality of service, and establish performance standards or measures. Government could even lay out the pricing structure to be used for services provided by the infrastructure (volumetric pricing for water and sewers; tolls for roads; user fees for solid waste disposal) or set up a price regulation or monitoring system (Kitchen 2006a).

For an AFP or P3 to be successful, the most critical feature is the contract design and, within the contract, the sharing of risks. Structuring a contract is not an easy task. It requires a considerable amount of expertise and experience, something that individual municipalities are unlikely to have if left on their own. The Netherlands, United Kingdom, New Zealand, and Australia have considerable experience with successful P3s and this is largely because the central government took the initiative, early on, to put together the necessary ingredients for successful contracts. Canada, by comparison, lags behind although this appears to be changing. British Columbia is the furthest along in developing a robust P3 model and strategy. More recently, Ontario, Quebec, and Alberta have started to move forward with models of their own. All of this suggests that the basic ingredients, necessary expertise and experience for increased municipal participation in P3s are emerging.

K. Summary

Growing concern over the state of water and sewer infrastructure in the GTA and consequent environmental issues evolving from much of it has highlighted the importance of municipal capital investment (spending) and the way in which it is financed. As the GTA expands and grows older, resources must be devoted to the expansion, rehabilitation, or replacement of the water and sewer system. Of growing concern for health reasons are the pipes used to transport water and sewerage. All pipes – drinking water, sanitary and storm sewers – have a finite life and must be replaced or rehabilitated as they approach the end of their useful life. In proceeding with this rehabilitation and expansion of all aspects of water and sewer systems, there are at least two important financing challenges.

First, there is the challenge of determining the desired or optimal level of water and sewer infrastructure and the way in which it should be financed. Second, and of more importance is the challenge of setting correct prices (user fees) for the consumption of water. This is important because prices act as a conduit for revealing the true demand for – and therefore, indicating the efficient supply of – water and sewer infrastructure. Incorrectly set prices lead to an inefficient use of resources and result in too much infrastructure where prices do not capture all costs, and too little where they capture more than the costs of services consumed. Unfortunately, setting efficient prices is often short-changed and frequently over-looked in discussions of capital financing, yet it is probably the most important issue around local infrastructure spending and how it is financed.

The practice of financing water and sewer infrastructure has changed over the past fifteen years. Grants have declined dramatically as a funding source and reliance on reserves and development charges have increased in relative importance; a deliberate initiative to move towards ‘pay-as-you-go’ financing.

Water and sewer systems should be financed on the basis of benefits received. Here, the underlying principle is straightforward – those who benefit from a service pay for it. Financing on this basis has a number of advantages. Whenever a direct link exists between the users of a service and its funding, a more efficient use of resources ensues. Accountability, transparency, and fairness also follow.

Current water charges are characterized by two general structures: a fixed charge that varies by customer class (residential versus commercial) and property type rather than volume; and three volume based charges including a constant unit rate, a declining block rate, an increasing block rate, or a mix of these. Each has its strengths and weaknesses in its ability to generate an efficient and fair use of resources plus each has different incentives for leading to water conservation, an objective that is becoming more and more important. Sewer charges are almost always recovered through surcharges on water bills.

Recent initiatives at reforming the pricing of water and wastewater have emphasized the importance of meters. They have also emphasized the importance of implementing proper accounting, budgeting and information retrieval systems as well as the adoption of innovative pricing practices. All have argued for the inclusion of annual asset replacement costs in annual operating costs. Time of use prices to capture variations in costs according to the time of day or season of the year have been supported everywhere. Many have called for multipart pricing structures to improve consumption efficiency and at the same time recover all fixed costs of production.

Municipalities in the GTA currently use a range of instruments to finance water and sewer infrastructure – current operating revenues, reserves, borrowing, and development charges. Current operating revenues make little sense in terms of benefits received. Reserves create intergenerational inequities and have the potential to generate a level of capital spending that is not allocatively efficient. Borrowing makes considerable sense for financing the rehabilitation of existing water and sewer systems because the benefits from this infrastructure accrue to future users, thus leading to a funding system that is fair, efficient and accountable. Development charges are entirely appropriate for financing water and sewer infrastructure required to accommodate growth. Unfortunately, their current application is frequently inappropriate because development charges are imposed at a uniform rate across the entire municipality. This application fails to achieve an efficient allocation of resources because properties that cost less to service subsidize properties that are more expensive to service. Switching to a charge that varies by property or neighbourhood according to servicing cost leads to a better matching of beneficiaries and costs and an improved allocation of local resources.

At the same time, there are solid arguments for municipalities having access to new financing instruments, including revenue bonds (currently only permitted in Toronto under the new *City of Toronto Act*). These are desirable on allocative efficiency grounds for financing local capital or infrastructure projects that produce reliable annual revenue streams; for example, water and sewer systems.

Greater use of alternative financing and procurement (AFP) including public-private partnerships (P3s) could alleviate some financing concerns by passing the burden onto the private sector. These have a number of advantages. They offer new sources of capital, freeing government revenues for other purposes. They let the public sector draw on private-sector expertise to minimize costs, an advantage especially important to small municipalities. Their contractual structure can encourage a "life-cycle" approach to planning and budgeting through the use of long-term contracts that include maintenance costs, asset replacement cost, and asset management plans. They are a way of bringing competition into the public sector. Because the private sector operates in a competitive environment, it is almost always more innovative in infrastructure design, construction and facility management when compared with the public sector. Where the contracts are properly structured and based on performance measures, these arrangements can lead to improved local governance including increased accountability, transparency and value for money.

L. Recommendations

1. Install meters for water and sewers everywhere with the cost of installation borne by the property owner.
2. Implement volumetric water prices designed to improve the efficient use of local resources and encourage conservation.
3. Water prices should vary by time of day or season of the year.
4. Water prices should include the opportunity cost of water use.
5. The cost of replacing lead water pipelines should be shared between the property owner and the municipality.
6. Storm water drainage systems should be separated from sanitary sewer lines wherever possible.
7. Annual asset replacement costs must be included in annual operating costs.
8. Asset management programs should be introduced and followed.
9. Revenue bonds for borrowing should be permitted for all municipalities.
10. Development charges should vary by neighbourhood or development.
11. Greater use should be made of alternative financing and procurement systems including the use of public-private partnerships.

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