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Communal Water and Wastewater Service provision in Ontario

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Introduction

The Province of Ontario is promoting the infilling and increasing of populations through the use of various policy documents. The primary guiding document being the 2014 Provincial Policy Statement or PPS for short, which is used to inform the policy direction that planning decisions will take. In this document are a number of key points that influence the drinking and waste water servicing of an area. The PPS directly establishes a hierarchy of servicing for the province of Ontario to follow. It is prescribed that municipal servicing is the most preferred option, followed by communal servicing, and finally the last servicing method is privately owned and operated systems. This hierarchy is somewhat counter intuitive, due to the amount of regulation that is faced when a proponent suggests using a communal system to supply their development with drinking water and treat the wastewater. These regulations have come into power since the events that made up the Walkerton Tragedy in 2000. They have been created to protect drinking water sources, which will in turn prevent more unfortunate events form happening. These pieces of legislation are primarily focused on protecting the drinking water, whether it is at its source, or through the treatment process however there is lacking attention paid to another potential issue for drinking water security. Wastewater treatment receives little legislative attention, regulated only under sections of the Ontario Water Resources Act, Environmental Protection and the Ontario Building Code this facet of development receives only a portion of the attention paid to drinking water, but may have serious effects if neglected. This paper has been written from a rural context, where communal systems may be required or preferred instead of private systems and publicly operated treatment is not an option. With this in mind, septic systems are described as being a very affordable treatment option, as well as scalable for use at a variety sizes. The simplicity of the system makes it one of the cheaper options, thus it is the primary focus of the wastewater discussion that will ensue. This paper offers discussion of wastewater treatment and concerns surrounding communal systems from a variety of angles. To begin, an overview of the policies that will be used to determine

the efficacy of the development proposed to use a communal system will be described. Construction and concerns that needs to be accounted for when considering septic system design will be discussed following the policy outline. Economic concerns will be mentioned in moderate detail, but management options and environmental issues are discussed at length. The research has not been conducted solely using literature, which is to say that primary research using key informant interviews has been carried out. With the nature of wastewater come concerns over the impacts that may be noticed in the surrounding environment. These concerns need to be taken into consideration, and a framework for doing so will be suggested. A discussion of the methodology used to select key informants is provided as well as the development of the interview frameworks that were employed to gather the information. The results of these interviews are presented and analyzed, with complete transcripts of the interview as well as the interview frameworks which are provided in the Appendices to this document.

Policy Interactions

In the Ontario context the direction that local official plans must take is informed by the Provincial Policy Statement. The most recent version of the PPS was publish in 2014, and directs the subordinate Official Plans as follows:

1.6.6.1 Planning for sewage and water services shall:

a) direct and accommodate expected growth or development in a manner that promotes the efficient use and optimization of existing: 1. municipal sewage services and municipal water services; and 2. private communal sewage services and private communal water services, where municipal sewage services and municipal water services are not available;

1.6.6.3 Where municipal sewage services and municipal water services are not provided, municipalities may allow the use of private communal sewage services and private communal water services.

1.6.6.4 Where municipal sewage services and municipal water services or private communal sewage services and private communal water services are not provided, individual on-site sewage services and individual on-site water services may be used

provided that site conditions are suitable for the long-term provision of such services with no negative impacts. In settlement areas, these services may only be used for infilling and minor rounding out of existing development.

1.6.6.6 Subject to the hierarchy of services provided in policies 1.6.6.2, 1.6.6.3, 1.6.6.4 and 1.6.6.5 planning authorities may allow lot creation only if there is confirmation of sufficient reserve sewage system capacity and reserve water system capacity within municipal sewage services and municipal water services or private communal sewage services and private communal water services. The determination of sufficient reserve sewage system capacity shall include treatment capacity for hauled sewage from private communal sewage services and individual on-site sewage services.

Another consideration that must be taken into account when developing a private sewage system is the Ontario Building Code, this document outlines the specific design standards that must be upheld when creating a new system, as well as when connections into an older system are proposed.

The local Official Plan is the next level of policy that will determine the outcome of a development proposal. This document will be present for each municipality, and while it cannot stipulate anything that is in opposition to the PPS, it may require that more strict guidelines be followed. This document will be implemented at the municipal, county or region level, and combinations thereof. Often times, the municipal Official Plan is informed by a Plan developed by the higher level of government, be it

County or Regional, which requires that the municipal Official Plans be developed in concordance with these upper-level initiatives. This document will include the local requirements that surround servicing; type (Municipal, communal or private), density, location, etc.

Official Plans in turn influence the design and outline of Zoning By-laws, which are documents that outline areas where specific land-uses may or may not occur and to what extent they may occur. For example in most cases, there are various levels of residential land use. These levels of development are often delineated design aspects such as dwelling size, number of units and height requirements. This document will not likely speak directly to the servicing that an area must use, but provisions will relate to the type of development that can occur in an area, or requirements such as the lot-size requirements for the area.

Septic System Design Considerations

The basic design of a septic system involves a tank buried in the ground, where wastewater gathers and impurities are separated from the water through gravity separation (Canter & Knox 1985). Following the separation, the remaining liquid is transferred from the tank into the surrounding soil where percolation through the soil matrix further filters this water (Canter & Know 1985). This sort of system is quite simple in terms of technology, the performance of these systems relies on their proper design, installation, use and maintenance, surrounding soil conditions and climate. Septic systems can be used to service small communities with flow rates of up to 100 000 gpd. As a reference, a typical household discharges wastewater at a rate of 40-45 gpd per person (Canter and Knox 1985). These systems are appealing for use for a variety of reasons: required maintenance is typically pumping the septage every three to five years, these systems tend to be cheaper on an individual or community scale, the simplicity

of the technology means that they can be quite reliable, very low energy consumption and septic systems tend to reduce the amount of sludge produced by the users when compared the sludge amounts produced through centralized treatment systems. Even this simple and presumably more reliable system still has potential drawbacks such as: potential for groundwater contamination, if systems are not maintained this can result in the contamination of nearby wells and cleaners used in the maintenance of the systems can contaminate the surrounding groundwater (Canter & Knox 1985). Proper placement of the septic system on the site needs to be carried out in order to ensure proper function. The basic considerations when locating a septic system include assessing the slope of the area and setbacks from built structures and natural features (Canter & Knox 1985).

Contamination from septic systems can originate from two main sources, the wastewater that the system is treating and the cleaners that are used during the maintenance process. Bacterial counts tend to be lower in septic systems than in community systems, potentially due to the fact that there is shorter incubation time between the house and septic system, compared to the distance between the house and a centralized treatment plant (Canter & Knox 1985). Ground water pollution concerns relate to the quality of the effluent from the tank, and the efficiency of the surrounding soil to be able to remove the contaminant load (Canter and Know 1985). The authors note that it in many cases in rural communities there is a reliance on both septic systems and private wells. The problems faced by septic tanks can be magnified by this reliance on wells for the provision of drinking water. As the authors later describe, perhaps one section of the septic systems may not be functioning properly, this can lead to contamination through various means. Contamination from nitrates can lead to unpleasant tastes in drinking-water, organic contaminants can persist within in the subsurface and for some of these chemicals they may be carcinogenic, metal contamination can be toxic depending on the type and concentration of the contaminant, inorganic contaminants can cause a number of health problems like heart and kidney issues or even intestinal troubles. Chlorides are a naturally occurring component of in

surface and ground water, a component that is also found in waste water from both household and community scale facilities. The municipal and private treatment systems are largely ineffective in removing chlorides from the wastewater, and the concentration of these anions is largely indicative of the quality of the water-source. The mobility of this element and its ability to persist within a solution allow it to be used as a way to detect the pollution that may be stemming from septic systems.

Metals in the out-flows from septic tanks may be responsible for contaminating shallow water sources. Common contaminants include arsenic, iron, lead, mercury and manganese while less common contaminants may be cadmium, copper and zinc. The lead and cadmium may be the result of deteriorating plumbing materials in older homes as these materials were historically used in the plumbing industry. Soil factors such as pH, redox potential and soil type influence the ability of these contaminants to move throughout the soil medium.

A variety of organic compounds may also be able to contaminate ground water sources, a number of these such as acetone, thrichloroethylene have been detected by researchers studying ground water contamination in New Jersey at a landfill site that has accepted septic tank wastes (Canter & Know 1985). It is inconclusive where the contaminants have come from, but it is concerning that they are present in the ground water because a number of organic chemicals are known to be carcinogenic. The potential for these contaminants to have been introduced through a septic systems through improper disposal is likely.

Regular maintenance and inspections of these systems are an effective way to ensure that they are working optimally. As development progresses closer to where these systems are employed it is suggested that the users are encouraged to switch to the municipal sewer system to reduce the overall number of septic systems in use at a given time (Canter & Know 1985). Further, joining of these systems may allow for the potential for contamination to be reduced according to the researchers. This point

will be discussed later by contrasting with interview responses which brought up opposing points. For new systems being constructed there are a number of approaches that the researchers offer as a means to reduce the possibility that the systems will not work properly and well into the future.

Canter and Know (1985) suggest that options such as: approval of site design, alternating the loading of the septic bed so that one half is used until it is saturated and then the other half of the bed is used until saturation occurs reduces the chances that compaction of the soil surrounding the septic bed will occur, annually removing he scum and grease from a septic bed will ensure that it is does not make its way into the soil where it fills the pore spaces required or proper operation, removal of half of the sludge rather than an entire clean-out, and finally utilizing zoning by-laws and other land use planning tools to ensure that only suitable sites are used. More radically, keeping waste water commonly referred to as "black-water" – that is to say water used for the disposal of toilet wastes – from entering the system will ensure that only less contaminated grey-water which will reduce the pressure put on a septic system in terms of nutrient loading, etc. Additionally, this will allow for the septic to treat more dilute and less noxious materials. The use of composting toilets, incinerators, or low volume toilets will keep the more difficult to treat materials from entering into the septic systems in the first place (Canter & Know 1985).

Ground water monitoring would allow for the opportunity to detect any contamination that might be stemming from the use of septic systems. Determining the location of monitoring wells, selection of the contaminants to be monitored for, selection of the required number of samples are all factors that need to be accounted for when deciding on the monitoring regime.

Considerations For Communal Servicing

Funding Opportunities and Economic Considerations

In light of the fact that Canada is increasingly intensifying in terms of the population in urban areas, rural communities still play a vital role in the country's economic, environmental and social prosperity. Rural communities are responsible for roughly 13 percent of the gross national product in addition to more than half of Canada's exports (Federation of Canadian Municipalities 2013). In terms of the social benefits of rural communities, there are increased opportunities for recreation and other improvements to quality of life for Canadians. The typical reliance on resource and manufacturing industries is something that rural economies need to diversify and expand upon, which will require infrastructure improvements and provision. This increased provision of services will cause increased challenges to be faced by the municipalities where revenue may not be as great as other centres, as expanding or developing services requires capital investment that may not be available or accessible. This research and advocacy group focuses largely upon provision of communications infrastructure but the same can be said for water and waste water servicing. New development will require increased drinking and waste water capacity in order to provide servicing to the business. Increasing the capacity of the drinking and waste water facilities requires investment that some rural communities may not be able to provide due to small tax base, or other funding obligations. The Federation of Canadian Municipalities (FCM) (2013) advocates for rural communities to have increased funding from the government in order to meet the needs of the future, as an increase in funding or an increase in the ease with which funding can be accessed would allow for expansion of services to occur more readily. As an example the current Small Communities Component fund of the larger Building Canada Fund, has a population threshold

above 100,000. That is to say that a municipality with a population less than 100,000 may not have access to the funding opportunity. This is problematic because municipalities with smaller populations presumably do not have access to the same tax base, and will have increased difficulties obtaining the necessary funds. In order to ensure proper access to government funding, the FCM advocates for "base plus per capita" calculation, similar to the methods used to determine funding through the Gas Tax Fund (Federation of Canadian Municipalities 2013). This style of funding which does not hinge on the acceptance of an application which potentially encourages competition between smaller and larger municipalities will benefit rural communities moving forwards. The FCM (2013) advocates for more funding to be directed towards the provision of the drinking and waste water servicing, while at the same time acknowledging shortfalls in terms of expertise and financial resources.

In addition to the issues surrounding the funding required to develop the systems, there are concerns surrounding their ongoing maintenance as well. The financial viability of the water utilities is often called into question when proponents are seeking approval for developing a new small drinking water and waste system (Rubin 2004). Gathering information relating to the fees of the small water treatment facilities can be a difficult task since the fees that are paid by the user not often stated explicitly. In numerous cases the costs are included in rental or maintenance fees. This makes collection of data difficult, since in many cases the utility provider does not separate the costs of the service from the rest of the fees collected from the users. Rubin (2004) states that 40 percent of the households in the United States do not directly pay a water bill, while in mobile home developments, nearly 52 percent of residents do not directly pay a water bill. This is interesting to note, especially within the context which small water treatment systems exist. It has been suggested that the economy of scale that can be achieved by using water services that provide to a greater number of customers is more favourable than those which serve smaller communities (Rubin 2004). It is acknowledged though that there are cases where if the area which is being serviced exceeds a certain point, the larger economy of scale is not as

efficient as a series of smaller more targeted systems. Furthermore, Rubin (2004) suggests that of the 800 large water utilities serving greater than 10 000 people, 29 percent of them do not receive adequate revenues to cover their expenses. Using this data set, Rubin (2004) concluded that smaller water utility systems can in fact be profitable.

The findings of the research concluded that the connection between the size of the utility and its ability to recover costs at a profitable rate are not statistically significant. Interestingly, the smallest and largest utilities in the study were the most likely to have revenues that amounted to less than the expenditures for the service provider. This issue is not isolated to these size classes, but rather all of the size classes or utilities investigated in this study had half of their samples gathering less than the long-term sustainable ratio of revenues to expenses which is described as 1.15 (Rubin 2004). This study shows that there is no case to ground claims that there is insufficient revenue to sustain small water treatment facilities, but rather illustrates that this is an issue for water treatment facilities of all sizes (Rubin 2004).

For the smallest systems in the study, the average expenses and average revenues were the highest, and as the systems progressed in size to the 50 000 person mark the average expenses per person steadily declined (Rubin 2004). Once this threshold was crossed the expenses per person steadily increased again through the 500 000 people class (Rubin 2004). Average revenue per person followed a very similar trend to average expenses per person, the systems with the highest cost per customer showed the greatest profit person, while the systems with the lowest costs showed the lowest profit. It has been stated that the smallest water facilities which were serving less than 100 people had high expenses per customer so it is interesting to note that there no significant difference between this class and the class serving 100 000 people (Rubin 2004). While this study was conducted at a larger scale, the results

can be used to infer the notion that it is plausible the smallest scale water facilities will be unprofitable and unappealing to developers, but as the scale of systems gets larger their feasibility increases as well.

While the size of the utilities system may create inefficiencies and unnecessary costs, Brubaker (2011) suggests that Canadian municipalities have little experience with the operating and financing of private drinking and waste water facilities. Challenges mount when this lack of expertise is combined with a need for increased financing caused by the aging of infrastructure and difficulties faced in upgrading the systems. Canadian municipalities begin to face a potentially bleak future in terms of their water servicing if these issues are not dealt with properly. In the 2008/2009 fiscal year, there were violations of provincial standards by more than half of the 700 drinking water systems within Ontario (Brubaker 2011). The infractions were related to improper operation of the equipment, insufficient procedural documentation, inadequate maintenance of chlorine residuals in distribution systems and above standard levels of E. coli and chemical contaminants. It is suggested that the sewage treatment systems are among the worst polluters, with releases of 150 billion litres of raw sewage and 1.35 trillion litres of partially treated sewage annually (Brubaker 2011). These figures represent what can be described as the current state of the drinking and waste water treatment procedures in the province. However, over time these figures could worsen, due to the perpetual postponement of maintenance and upgrades that has been occurring since the 1970s (Brubaker 2011). Also, downgrading responsibilities from the province without proportionate increases in funding can be attributed to the continued neglect that these systems experience. Politicians have historically allocated the funding that they can access, towards more tangible and appealing projects than drinking and wastewater systems. There have been efforts made to increase the standards to which wastewater is treated to reflect those of the United States (Brubaker 2011). That is to say that wastewater in Canada will need to be treated with at least secondary treatment measures in all facilities. At the time this study was completed there were 949 treatment facilities across the country did not meet this level of treatment, the 399 worst systems will

need are proposed to be upgraded by 2020 while the remaining 550 will be allowed more time to comply (Brubaker 2011). However, as of 2010 the Environmental Commissioner for Ontario has called for more rigorous standards which will further increase costs and complexity of the systems imposing further pressure onto and already stressed system. Concerns around the expertise that will be available to operate these systems are beginning to surface. A mixture of difficulties retaining more extensively trained personnel as well as an aging workforce are creating troubling circumstances for utilities providers to cope with (Brubaker 2011). The troubles faced by inexperience are more widespread than the immediate operators of the facilities themselves, they extend into the realms of planning and management as well. This last set of lacking experience may lead to increased difficulty in efficiently overseeing the improvements that these facilities will require (Brubaker 2011). Not only will lacking knowledge put a strain on the continued operation of these facilities, but the knowledge that the revenue generated by the water utility only amounted to 70 percent of the expenditures for the system and an even smaller percentage of the total cost of service provision which would include the maintenance and upgrades for the facilities (Brubaker 2011). It is estimated that Ontario would need $34 billion to cover the costs of the proposed upgrades between the years 2005 and 2019 however a funding-gap of $18 billion has been identified for this same time period (Brubaker 2011). That is to say that there is a $1.2 billion per year investment deficit for upgrades to municipally operated drinking and waste water treatment facilities (Brubaker 2011).

It is suggested that the best option for the making of these deficits in terms of funding and expertise lies with the private sector. Water utilities provide unique investment opportunities due to the fact they have few competitors and provide an essential service. These factors lead to the investments being protected from the market fluctuations that make other investment options more risky. Investment into this market attracts long-term investors such as pension funds which work well with the long term nature of the industry. In the United States, teacher and other public sector investment funds are

working towards achieving infrastructure investments in the range of 1-5 percent of the total portfolio (Brubaker 2011). As of 2006 in Canada there were two large pension funds that were seeking to increase their infrastructure investments to 10 percent of the total asset value of the fund (Brubaker 2011). There is a justified need in terms of investment opportunities within the country, as a number of Canadian corporations are investing their money into infrastructure projects abroad. The Ontario Teacher's Pension Plan and Canadian Pension Plan Investment Board have invested in utilizes located in Chile and the United Kingdom and an Oakville based company, owns 19 water and waste water facilities in the United Stated (Brubaker 2011). By encouraging private investment into infrastructure projects the utilities providers will no longer need to depend on the availability of funding that can be affected by financial crises or even political agendas. Private funding will also reduce competition for the already lacking public funding that is available for utilities upgrades (Brubaker 2011). Also, risk is transferred from ratepayer and taxpayer with investments from private sources. This risk can be described as including the dangers of projects being over budget or not performing as described. Rather than the municipality being the person responsible for these shortfalls, the investment group or groups will be the ones who are required to ensure the project progresses and performs properly. Brubaker (2011) suggests similarly to Smith (2003), that private funding can ensure that the project is completed in a timely and efficient fashion, giving the public consumers more value for less of their own direct investment. Private sector leadership in these projects will ensure that priority is given to realistic and attainable projects since there is the opportunity for increased expertise and experiential learning to be employed if the investment group has had experience with this sort of development in the past. There were 19 projects that were undertaken using the public-private partnership framework in Canada since 2004 (Brubaker 2011). Of these projects 17 have been completed on time or early, and offered considerable savings and gains in efficiency for taxpayers (Brubaker 2011). The appeal for public-private partnerships to increase involvement in small sale water utilities however may seem unappealing to the

private sector. It has been suggested that public-private partnerships are best utilized where the project costs a minimum of $40 million, there are other suggestions for the lowest value of projects but this is the absolute minimum (Brubaker 2011). There have been projects valued under $25 million which have been followed through using private investment (Brubaker 2011). In some cases private sector funding has been sufficient to independently cover the cost of the project, and there have been recommendations made to bundle projects together in order to increase the total cost to be closer to the price-floor that has been mentioned previously. It is often stated that governments have access to better loans and interest rates however this idea is misleading. In the event of the project being over budget the burden is placed on the taxpayers when publicly sought loans are used (Brubaker 2011). Private investment would relieve the taxpayers of risks related to cost overages. Public borrowing is a revenue source that can suffer from diminishing returns. The more debt a government borrows, the poorer its credit score ends up being, resulting in increased interest rate. To contrast this, the concerns that are often brought forward surrounding the interest rates that may be made available to the private sector might be offset by the savings that can be had when the project is completed ahead of schedule or in a more efficient fashion (Brubaker 2011).

A number of the private firms that provide water servicing options to public entities have research and development departments that allow for the creation of new technologies that will further streamline the continued provision of services. These research and development departments have been described as being funded with between $95 and $150 million dollars, the benefits of the advances that are stimulated by this funding will eventually be passed to the governments that are using their services (Brubaker 2011). In the case of Moncton, who entered into a public-private partnership to develop a new water treatment facility, they were able to reduce the overall size of the building by 40 percent using a treatment technology that the company who won the bidding process had access to which led to considerable saving throughout the project (Brubaker 2011).

These large, international firms may not be the only solution to the issues surrounding water provision and treatment. Smaller more specialized firms may be able to better serve isolated communities such as the First Nations. These communities may benefit from services such as operator training, support programs and quick response times, data collection and the production of reports.

In Canada, the public is often left in the dark about the performance of the drinking and waste water services that are in use. This lack of education leads to the opposition that is often faced when the suggestion of privatizing the utility are made (Brubaker 2011). Municipalities tend to lack the expertise necessary to navigate the legal, technical and financial aspects of a public-private partnership. There are organizations available in Canada to assist in the navigation of these processes by providing model contracts, and information for carrying out the bidding process. Using the assistance of these agencies will lead to greater comfort for the bidders as this will ensure that the municipality will have access to sound information that will not result in the bid falling apart at the last minute (Brubaker 2011). Following the awarding of the contract, and in order to promote the use of private investment for utilities upgrades, federal and provincial governments may consider penalties for facilities that do not meet the standards in terms of deliverables and deadlines (Brubaker 2011).

Management Options and Issues

This is a viable in-road for the use of communal drinking water systems as the technical expertise will be provided by the developer or owner of the system, and the financial burden will be shifted from the municipality to the developer. Partnerships between the upper levels of government and the municipal level will allow for the determination of acceptable timeframes and instances where communal systems can be used. The use these systems will allow for the increased emphasis to be placed on best-practices

for a sustainable future to be accommodated, while reducing the burden placed on an already strained municipal funding system.

In light of the challenges that are faced in the provision of safe drinking water, and the treatment of waste water, utilities providers have begun to seek out alternative options for the provision of this service. This privatization also allows for the increased ability for the service provider to capitalize on industry advances which can result in increased efficiency and reduced costs. Also, the shift from public management to private management allows for opportunities to streamline the provision of the service and reduce inefficiencies that may have been present under public ownership. Historically, in the United States water services were mostly privately owned and operated during the 1800s (Smith 2003). As time moved forwards, the emphasis shifted towards the public management of these services. Smith (2003) provides a few different options for the privatization of the water service. They vary in degree of public ownership and level of risk that is assumed by the private operator.

To begin, outsourcing describes the contracts that are formed between a public entity and a private entity where the deliverable of the contract is not something that the public body can readily provide (Smith 2003). The private body will provide a certain service for the public body to satisfy that contractual agreement that has been created. A typical example of this occurs with respect to the contracting of engineering services from a municipality to a private firm. The municipality may lack the expertise in-house to be able to handle project so the private firm is given the responsibility of providing the needed deliverable.

Contract operations describe the entering into a contract between a private owner and a public entity for the operation and maintenance of one or more components of the utility. In the American context these contracts have a time frame of anywhere between one and 20 years, with short term contracts having high rates of renewal (Smith 2003).

Design, build, operate describes the transfer of responsibility to the firm awarded the contract through a bidding process and the ensuing assumption of risk for budget overruns, which results in incentive to design and build simple and effective treatment facilities (Smith 2003). Following the development of the facility responsibility for the operation and service delivery is transferred to the successful firm. This framework is also well suited in places where upgrades to existing facilities are required (Smith 2003). This framework is very similar to the next wherein the responsibility to design, build, own, operate and finance are all transferred to the developer. Here the largest difference lies in the funding for the project, which is provided by the proponent as opposed to the public corporation (Smith 2003).

Asset lease describes a public-private partnership where the assets in question are leased to a private firm for the continued provision of the service. The next step from leasing of an asset is outright asset transfer, wherein privatization occurs to the truest of extents (Smith 2003). Here, the ownership of public assets is transferred to the private firm who in turn assumes all responsibility for the continued provision of the service.

By utilizing any of the previously mentioned methods for privatizing - to varying degrees - the public utility, a number of benefits can be realized (Smith 2003). Operational efficiencies or reduced operating costs can result through the use of the expertise that a company specializing in the provision of the service can provide (Smith 2003). Rather than having a public corporation who may be responsible for providing various and diverse services, the private firm specializing in this case in the provision of water utilities can lead to cost savings due to the specialization. By privatizing public services, they can be removed from the influences of political changes and changing agendas. If the owner of the facility is solely focused on the business of providing drinking water and wastewater services they will be able to accomplish this regardless of the dynamic political climate surrounding them. Collaboration between the facility's designer and the operator of the facility can result in another area where costs can be

saved (Smith 2003). This collaboration can streamline processes and help keep costs down while designing new facilities.

While there are numerous benefits to privatizing water-related utilities, there are a number of ways that privatization may be detrimental. While the ability to save money through specialization can be a benefit it also opens up a level of risk. In other words, if the private service provider is irresponsible they may seek to reduce costs in such a way that reduces the quality of the service (Smith 2003). This will in time, lead to the issues with the service. The loss of control that results from privatizing the utility can also be detrimental in some cases. Smith (2003) notes that the asset lease and transfer frameworks can result in tensions if the agenda of the private company and the public body run counter to each other. In many cases it is the profit driven, private company that propagates the increased tensions. Financing the development can become an issue as well, Smith (2003) notes that many private firms seek a return on the equity of a project in the range of 10 to 15 percent, which means that the loans and financing options with comparably higher interest rates that these corporations have access to can make these sorts of projects less desirable. Public organizations can receive funding that makes developing this sort of service facility much easier, as they often have access to more appealing interest rates (Smith 2003). The deterioration of the facility can be problematic as well. If the private partner does not maintain the facility to the standards required, or even carry out proper maintenance, the facility can fall into disrepair leading to service quality and performance compromises. In the Canadian context, if the deterioration is severe enough, the facility becomes the responsibility of the municipality.

Furthermore, when deciding to privatize the service, there are three categories of considerations that need to be taken into account according to Smith (2003). Operational considerations include mainly determining if the type of service to be privatized can in fact be improved through carrying out this change in management. For example, if the facility is too small in terms of the number of households it

services, which has an impact the size and complexity of the system, it may not be cost effective to reduce staff and increase automation which are some of the more common cost saving measures. Economic considerations must also be taken into account and foremost among them is whether or not the service can benefit from privatization. In order to determine this, a feasibility study needs to be carried out which would include developing a baseline cost estimate which would determine what the provision of the service would cost moving into the future using the current delivery method. This figure would then be adjusted to include the annual maintenance that the facility requires as well as the upcoming maintenance and repairs that are foreseeable (Smith 2003). These costs are calculated using the time frame of the proposed contract in order to evaluate whether or not there is an opportunity for the privatization of the service to allow for a reduction in any of these costs. Determining whether the privatization will result in savings or not can be carried out in one of two ways either using a "bottoms-up" approach or a more historical style of analysis (Smith 2003). The "bottoms-up" approach entails using engineers and economists to estimate the comprehensive fee that the developer should charge. This is a very labour and cost intensive process, more so than the historical analysis. By looking at similar projects that have been undertaken, a cost estimate can be developed. This is often less accurate than the previous methodology since information may be missing, incomplete or inaccessible. Also, what worked in one case may not work in another which is to say that the savings in one jurisdiction may not be able to be replicated in another. In either case it is important that all of the relevant costs to be accounted for in order to get the most accurate estimate (Smith 2003). Finally, the policy consideration that needs to be included in the decision is the acceptance/opposition to privatization. In some cases there are groups who are opposed to the privatization of services, while there may be others who advocate for this approach as a means to increase efficiency.

Under any of the management options discussed previously, there are opportunities for issues to arise. With respect to the provision of drinking and wastewater services, one of the most pressing concerns is

the spread of water-borne disease which is a risk that must be mitigated with the utmost care. In Canada there is no agency responsible for monitoring the collection of water-borne disease outbreak (Moffat & Struck 2011). This absence of monitoring and data collection is problematic since this leads to difficulties when trying inform new policies and practices. Investigation of water-borne illness is troublesome due to the fact that it is often under reported, the pathogens may be transmitted by other means as well, and these events do tend to be rare. The team of Moffat and Struck (2011) suggest that for the years between 1993 and 2007, between 50 and 75 percent of the outbreaks may have emanated from small drinking water facilities that service fewer than 500 people. Lack of source water protection is one of the pathways through which pathogens can enter the drinking water (Moffat & Struck 2011). This can occur through animal contamination with respect to surface water outbreaks, while septic system malfunction is the main cause of the groundwater related outbreaks. Weather events also influence the potential for an outbreak to occur. In high water events such as the spring thaw or extreme rain events transportation of pathogens into the source water can occur, since the common contaminants can often survive the cold winter weather until the melt occurs (Moffat & Struck 2011). Most water-borne disease outbreaks occur through unprotected and untreated groundwater wells (Moffat & Struck 2011). Surface water systems are more often treated prior to delivery, however the adequacy and susceptibility to failure of these systems makes them more at risk for disease outbreaks. Small drinking water systems are often faced with inadequate funding and unsuitable infrastructure and training in the current context (Moffat & Struck 2011). In order to prevent disease outbreaks to the fullest extent multiple, robust barriers need to be employed to ensure that drinking water is treated properly. These efforts need to work in conjunction with source water protection efforts in order to secure and maintain the quality of drinking water.

Environmental Concerns

In the North American context centralizing water and waste water treatment infrastructure began in the mid 1800s with the proliferation of waterborne diseases such as typhoid and cholera. This shift in management can be attributed to improving the regulation and oversight of the treatment facilities, which in turn led to an improvement in the rates with which these illnesses were transferred (Mitchell 2006). The increased emphasis that was placed on concentrating the treatment of the water and water can be credited with changes in the ecosystem of the area surrounding the utility through modifications to the flow rates of the watercourses which impacts the flora and fauna and changes in the contaminant and nutrients levels flowing through the ecosystem (Mitchell 2006). These changes can be exacerbated with the increasing population that an area might be experiencing, that is to say that as a population increases these issues will too increase in severity (Mitchell 2006). Changes to the ways in which the water as a resource is managed can prove beneficial in terms of reducing the negative environmental effects from a centralized utility. By allowing for decentralization in appropriate locations and instances, the effects of highly concentrated, and high volumes of wastewater and water takings will allow the ecosystem to have a better opportunity to handle the outcomes of either process. Mitchell (2006) suggests that by incorporating the following principles decentralizing the utility can be accomplished:

1. Give consideration to the surface and subsurface, natural and man-made features of an area and acknowledging them as being part of the larger system
2. Consider the water-takings for the area – both ecological and anthropogenic
3. Consider the locale in terms of ecological, social and economic perspectives
4. Use an inclusive planning process with an emphasis on public engagement
5. Maintain sustainability as a priority in terms of ecological, economic and social needs at various time-scales.

The key to implementing a framework such as this is ensuring that the focus is placed on minimizing the impacts while maximizing the efficiencies of the system as a whole (Mitchell 2006). By maintaining a focus on these notions, the efficiencies that can be realized will collectively improve the aspects of the entire systems including ecosystem protection, energy usage, groundwater management, maintaining biodiversity, pollution prevention and public health protection. While the historical emphasis when designing water and wastewater treatment facilities has been placed on centralization, this Mitchell (2006) offers a number of other benefits that will continue to offer improvements to the ecology surrounding a proposed development.

These points were offered for use in the Australian context, but they are quite applicable in the Ontario context as well. By giving consideration to the water cycle as it relates to a specific area in terms of the natural, manmade, surface and subsurface components, will ensure that the effects that may be noticed by upstream and downstream consumers of the resource. This point will take into consideration aspects of development such as impermeable surface, climate change and the impact of extreme weather events. This point seems very similar to the proceeding consideration; bearing in mind the ecological and water takings for the area. This point requires that attention be given to the amount of water that the proposed development is projected to require and comparing that to the amount of water that will be required to maintain the current ecosystem surrounding the development. This will ensure that the water taking for the development does not negatively impact the surrounding ecosystem, while still meeting the needs of the development. Considering the locale through the lenses of the ecology, economy and the social aspects will give the decision makers an opportunity to determine the suitability or need for this development. If the cost is too high in terms of the ecosystem, or the benefits are not high enough with respect to the social or economic variables then this may not be a suitable opportunity to utilitze this sort of development. Using a planning process that incorporates public input will help to determine the need for development. Arnstein (1969) was a strong advocate for the inclusion of the

public into the planning process in varying degrees of involvement, and while some of the proverbial rungs on the ladder that were proposed may not be applicable, it is still important to gain an understanding of the public's opinion towards this development. Finally, placing an emphasis on sustainability will ensure that the long term use and integrity of the infrastructure and the resource will be maintained.

Methodology

Key Informant Interviews were used as the primary means of information gathering for this project, since there is little direct research that has been carried out to investigate the topic of small water treatment facilities. The interviews were appropriate to employ for the gathering of data since this research project is based off of qualitative data that sought to determine to perspectives and opinions of people involved with small water treatment facilities (USAID 1996). Following the recommendations for conducting the interviews as outlined by the United Sated Agency for International Development (1996), the process began with the formulation of questions. A set of questions was created and developed into an interview framework, which was tailored to each of the groups that were being interviewed in order to ensure that the subject was able to provide as much information relevant to their expertise as possible. The subject groups were public health officials, planning staff, local government, and owner/operators. The interviews were largely conducted over the telephone due to travel constraints, however if there were opportunities to meet and carry out the discussion in person arrangements were made for this to happen. Prior to the interviews, emails were sent out to each key informant in order to establish a rapport, in terms of the reputability of the study and the research team conducting the investigation. Once contacts were made, and the interview was being carried out, the interview framework served as the tool which guided the conversation. This follows the recommendations of the USAID (1996) guidelines, where it is encouraged to delve deeper into

responses where there is the opportunity for the key informant to provide more information. The responses were recorded using a digital recording device, and transcripts were created that captured the key points of the discussion. Contrary to the recommendations of USAID (1996), the most extensive notes were taken following the interview and upon the creation of the transcripts in order to allow the researcher to be fully engaged in the discussion as it was occurring. The recording of the transcripts was carried out in a conscientious manner in order to keep the results from becoming biased (USAID 1996). Reliability if the key informants was largely not a concern due to the fact that they are industry professionals and only required to comment on topics where they had sufficient expertise (USAID 1996).

Results And Discussion

Interviews were carried out primarily over the telephone, with some of them taking place in person. The contacts for the interview were planners or municipal staff with experience with these sorts of developments, private owners/operators, Health unit officials, and members of local government. For this paper, responses were primarily received from Health unit officials, with a smaller portion being in the planning or related field, one private operator and one engineering firm who has experience working with kinds of systems. As such, response rates were lower than anticipated, but the interviews that were carried out yielded insight into the current operation of the private drinking water and waste water systems.

Health unit officials were able to comment on the monitoring and risk assessment aspects of these treatment systems. While drinking water is actively tested for quality, there is very little work that goes into ensuring that the septic systems are working at their most optimal level. Once the proper approvals have been received from the various levels of government concerned with the development of these systems, the health unit conducts the risk assessment of the system which will determine the sampling requirements in terms of frequency and parameters that need to be followed. The source of the

drinking water plays a role in determining the frequency at which the water must be tested. In one location along Lake Erie, sandpoint wells are used in some cases as a means of obtaining drinking water. Concerns over using this source of water have been raised with respect to its security since the highly permeable sandy soil that the water is being drawn from may have the potential for surface water interaction or other means of contamination. The use of this sort of well receives heavy scrutiny from a water quality perspective but the interview subject argued that the test results for the water drawn from them should lead to a revision of the restrictive policies. While there are examples systems that are utilizing the groundwater (more than just sandpoint wells) there are sites that use the surface water from Lake Erie as the means to service the development. Historically, the water has been treated to quality standards in order to ensure that the water is safe for consumption, but these standards do not accommodate the aesthetic standards that are imposed upon a publicly operated system. This may in some cases lead to water that is technically safe to safe drink, but does not look appealing to the consumer. In this jurisdiction there are few septic systems that are in use for this context, holding tanks are more prevalent for waste water disposal. Furthermore, the wells are deemed to be sufficiently located in order to ensure that here is no interaction between neighbouring drinking water. The regulations that are in place to ensure that the use of the wells on a scale such as this are deemed to be succeeding in their efforts to protect the ecosystems nearby to these utilities systems. In cases where extreme weather events occur flooding results in the discharge of sewage from the municipal plant. There are sites where the location of the wells is quite close to the major waterbody in the area, and are affected by the high water that may result from the storm. This happens the most commonly in the spring time, when the runoff that results from the meltwater overwhelms the waterbodies causing them to flood the bank. At times where there has been a sewage discharge, these wells may be affected by the waste contained in the water through the influence of the surface water on the groundwater source.

Luckily, the nature of these wells is such that they experience the highest use in times when there is reduced risk of high water events.

Compliance with the recommendations set out by the health inspectors is now investigated on a four year rotation. Across the interviews that were conducted with Health unit officials, inspections occurred every two years for high risk systems and every four years for low risk systems. This is to say that every four years a particular system will be inspected ensure that it is operating as per the directives that have been issued by the health official. This individual mentioned that there is little need for the inspections to be carried out more often than this for this particular jurisdiction. The standards that the small drinking water systems are being required to meet are in fact being met, thus business as usual is a potential plan for moving forwards.

The risk assessment process ensures that the drinking water system is going to be regulated and tested in a fashion that suits the development. If the system is located in an area that may be more at risk of contamination, then the testing requirements will be more rigorous compared to a system located in an area that is not likely to experience contamination. However, should the owner/operator feel that the testing regime is unreasonable there is an appeal process where Medical Officer of Health can overturn the decision by the health official. Further, in the event that there is a proven record of favourable testing results, the directive issued by the health official can be altered to reflect the test results. The testing regime may be reduced, or in some cases increased depending on the test results that are received for the location in question.

Since the regulations coming into power following the Walkerton tragedy, there has been little emphasis placed on using these utilities methods as a means of servicing new development. The increased work resulting from the regulation has been a deterrent for some small businesses that could not afford the increased costs associated with running this sort of system.

Farming communities may not be in favour of the increased development pressure that may be faced by increasing the reliance on these sorts of servicing means. The increased ability for an area to expand may lead to increased conflict between development proponents and the agricultural community.

In some jurisdiction there has been an increase in the depth to which new wells need to be drilled, the cause is difficult to say but local knowledge held by the drillers is sufficient to ensure that wells will be installed for use well into the future.

In the cases examined for this research the current regulations have been able to prevent issues from arising. Across all of the interviews conducted with Health unit officials, there were no cases where adverse effects on human or ecological health were noted.

Municipal officials and planning department staff approach developments using these sorts of systems as a means of servicing with an amount of caution. The official plans tend be written in such a way as to direct development to areas that have municipal servicing already, or lead to the development being based on a lot fabric sufficient to accommodate the use of private wells and/or septic systems. Further, if the developer is serious about using communal systems as a means of servicing the proposed development, then an extensive servicing options review is often required in order to prove that he developer should be allowed to use a communal system for the servicing of the proposed development. Should the developer satisfy the municipal requirements to begin the development using the agreed upon servicing option, they may be required to enter into a responsibility agreement. These contracts ensure that there will be sufficient funds in place should the utility become the responsibility of the municipality. The concern surrounding how to continue to provide the utility to the residents/customers in the event of the developer not being responsible for the service is often cited as a roadblock for development using these communal systems. It has been acknowledged that there is a cost savings to the municipality due to the fact that the development is not relying on the municipal

system, and tends to exist as a separate entity while still paying some amount of municipal taxes. Municipalities have the option to enforce the standards outlined in the regulations, or more strict standards should they see fit. In once jurisdiction that was examined, the regulations from the municipality are more strict than those imposed by the provincial government. The municipality requires standards that are from the Ontario Regulation 318, which are higher than its successor Ontario Regulation 319.

Concern was noted for human and ecological health, even since the inception of the increased regulation which followed the Walkerton tragedy. Even with the development of Source Water Protection Plans, it has been cautioned that there will be little impact on the overall groundwater quality. While this is a step in the right direction, it is suggested that more drastic measures need to be taken to ensure the ongoing health and protection of the resource.

Municipal staff and Health unit officials held a similar belief that the cost to the end user will likely be the same if not higher in terms of the servicing. The concept of economies of scale leads to the notion that the smaller number of people using the service will make it more difficult to maintain, thus they are required to pay more. However, representatives from these groups have acknowledged that there are cases where it is not feasible to provide municipal servicing to outlying settlements. The cost to extend the service is potentially too great, and the geography of the area may increase the difficulties that may be faced should there be attempts made to extend the municipal system.

There were recommendations made to increase the treatment standard that may be used by these systems, in terms of large scale septic systems. It has been suggested that the treatment standard for these systems be increased to a level approaching tertiary treatment, which would decrease the chances of adverse effects being noticed in the area surrounding a large scale septic system. If there are fewer nutrients or contaminants in the water that leaves the runs of a septic system, there is less chance

for the potential inundation of soil to impact the soils attenuation abilities. Currently, the major criteria that is determined in the office of the official responsible for issuing the permit is the amount of nitrate that may leave the site where the septic system is in use. Currently the requirement is that there is no level of nitrate leaving the site, which can presumably be achieved if the site is large enough to accommodate the effluent. There is little concern given to the direction of flow of the groundwater, which has the ability to transfer the contaminants to nearby sensitive features such as wetlands, streams, rivers, lakes or even poorly located wells. Depending on the location and geology of the area, there may be sufficient groundwater available to dilute the effluent before it is able to affect the nearby water features. It was suggested that reducing the number of private systems may be beneficial to the surrounding area. Incorporating the smaller, private systems into larger communal systems may reduce the opportunities for failure or contamination to occur.

If these systems are to be used in the future to encourage growth, consideration needs to be given to the future of the municipality. It was recommended that concerns about incorporation of these systems into the municipal system should it be extended to a point near enough to the development in question should be accounted for. This may be especially important if a municipality had allowed the development of several communal systems outside of the existing margins, and in the future that municipality was to expand to a point where these systems may be incorporated into the public utility.

The interview conducted with the owner/operator and the engineer with experience in developing the communal systems from both a municipal and private context yielded more points for consideration. The owner/operator has the benefit of exemplary site conditions, and has used them to the fullest extent employing treatment methods that are far more sophisticated than a septic system. Here, rotating bacterial contactors are used to treat the sewage. The system first treats the wastewater which is then discharged to the geology below the site. There are two aquifers at this location, the uppermost

aquifer receives the treated wastewater while the lowest aquifer is the source of the drinking water for the site. Between the two aquifers there is a hardpan layer that prevents interaction of the water sources. Here, the unique nature of the site has allowed for a novel treatment method to be developed, a fact that the owner does not overlook, they acknowledged that fact that the geological-situation of the site has allowed for this unique opportunity to be capitalized upon. They also advocate for a reduction in the regulation that is imposed on the development of a new system even if there is an existing system with similar condition already in operation. They feel that there should be existing design standards or outlines that are accessible to developers wishing to employ communal systems that will meet the needs of the site that is being considered. This will in theory reduce the difficulties that may be faced when the developer is working through the process to determine how to service the development. It is also cautioned that over engineering may make the use of these systems unrealistic. Also, it may be problematic having a municipal engineer approve a system that was designed by another professional as the current process dictates.

This owner estimates that the drinking water service is provided at 40 percent of the cost that a municipal system may be able to provide, similarly the sewer service is provided at 50 percent of the cost a potential municipality may be able to provide. Thus even with a reduced number of customers, it is possible to provide a service of similar quality to that of a municipal system at a reasonable price.

One of the common notions that was received during the interviews was the idea that the small systems are unlikely to be cost effective at providing the service to customers. This idea is held by various researchers as outlined previously and even contradicted by others, it is interesting to note that the private operator who took part in this research suggested that this is a feasible servicing option. They suggested that they are able to serve their customers efficiently and set aside a given amount of money collected in the fees to cover the cost of upkeep for the system. While Brubaker (2011) would suggest

this to be a relatively lucrative investment option, counter to the notions held by some key informants in the research, the private operator's firsthand experience makes a convincing case for promoting communal service delivery.

The local government that offered comments into this project had similar thoughts to those that have been discussed previously. The concerns regarding the responsibility of the system, especially in light of the increased penalties following the Walkerton Tragedy were foremost in this discussion. While it was difficult to determine a cost estimate, it was suggested that the smaller scale of the development would result in fewer people being able to share the cost of the system resulting increased payments by the customers. It was also suggested that in the end, should the owner default on the system and the municipality assumes responsibility for the provision of the water and wastewater service, the cost is still transferred to the end user. It was also suggested that the status of development in a municipality may influence their perceptive of development using this sort of utility. That is to say that a municipality that is having great difficulty encouraging development may be more will to accept the risk that comes with these utilities systems, while a municipality that is faced with a more favourable situation will not be as eager to entertain development proposals containing communal systems. Over engineering of the systems was also suggested as having the potential to make communal systems cost prohibitive if they are forced to comply with unrealistic standards. The effects that the communal system may have on the surrounding ecosystem and ecology are often mitigated or accounted for through the Official Plans or other relevant planning documents that are imposed on development.

Conclusions

In summary, decisions surrounding communal systems in Ontario are quite complex. Careful consideration needs to be paid to determining the proper use and system for an area. In an urban context where service extensions are likely easier to carry out, rural communities are faced with a more complex scenario. Factors such as the funding opportunities available to the communities and the expertise to guide this sort of development all need to be considered against the environmental aspects of the development. Concerns surrounding the operation and management of these sorts of systems can be remedied using any of the numerous suggestions made above. There is a source of research that allays concerns surrounding the economic feasibility of these systems, which is often cited as a reason to avoid development of this nature. Source Water Protection legislation is a component of the Ontario Water Resources Act which has been developed to maintain the quality and quantity of drinking water at its source. The efforts of this legislation are admirable, but as commented on by the one of the key informants, will not likely be able to protect the water resource on its own. More attention needs to be paid to the wastewater portion of the system, especially in light of the issues that may be leading the incredible algae blooms in the Great Lakes. While septic systems are not to blame on their own, this is one context of regulation that can be used to help assist in long term quality of our drinking water. By employing a framework such as what will follow, a number of the key issues will be taken into account during the planning and development phase of the development.

1. Give consideration to the surface and subsurface, natural and man-made features of an area and acknowledging them as being part of the larger system
2. Consider the water-takings for the area – both ecological and anthropogenic
3. Consider the locale in terms of ecological, social and economic perspectives
4. Use an inclusive planning process with an emphasis on public engagement

5. Maintain sustainability as a priority in terms of ecological, economic and social needs at various time-scales.

Great care must be taken to ensure that the proper context is in existence for a communal system to be used, but once this context is established development of this nature might be beneficial to areas looking to stimulate expansion in their jurisdiction.

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Appendix A

Interview Transcripts

Private Owner/Operator

Pine Meadows

Key points:

- Approved in late 80's early 90's
- 10 mg/Ml of nitrates at property line
- No require to test effluent at unit
- Starting testing effluent at unit – part of ongoing usage
- Ground water 340' deep drinking wells, 8''casing 6'' casing both sealed to protect from
- Sand and gravel to 30'
- Hardpan around 30' – sewage aquifer
- Drinkgin water comes from second deepest aquifer
- Add chlorine to drinking water
- Approval process – pump test – monitoring of wells, flow tests
- Determine cone of influence to determine effects on well
- No pumping and storage at permanent development
- Storage in campground
- If using first aquifer would require filtration and UV
- Unit approval - C of A – Environmental Compliance approval from Moe (timeline)
- Maintenance agreement registered on title
- RBC – time 2 tested before it goes to weeping bed.
- 29 monitoring wells around property, down to 8 presently examined four times a year
- Nitrates between 6 and 12, average per year: under 10

- No additional compliance for sewage – no operators required due to underground discharge
- Units need to be sampled at specific times to avoid misleading results – according to usage, treatment time, other outside factors
- Suspended solids higher during day time, settles overnight
- Wells tested and sewage treatment tested 4 times a year
- Feability study: specific field leads to difficulties – different from most other developments (seniors residences and campground
- Not designed for single family homes
- Aging infrastructure: no grants or additional funding – no responsibility agreement.
    - Instead has a long term maintenance agreement
    - Why does every system need ot be re-invented?
    - MOE should specify or outline design criteria – remove "uniqueness" of cases, implement specific units. Septics are the same, anywhere so why does each system need to redesigned?
    - Costs from this redundancy are transferred to the buyers
- "Development is size X, here is unit Y that will suit your needs" needs site specific placement (eg depending on geology)
- Rotating bacterial contactor (RBC)
- Load is predictable – no swimming pools or industries
- People want projects like this, cannot be built anywhere else in Ontario
    - Farmers move into this development for the counry feel
        - Customers want "country feel" can be provided in developments like this
- City mice vs country mice
- 40% cost of drinking water compared to municipal

- 50% cost of sewer service compared to municipal
- Chlorine contact time in pipe – water mains are oversized – no additional tanks for increase contact time
- Over engineering may make these developments unfeasible
- Should be monitored
    - Health unit has nothing to do with monitoring of non-municipal,residential system vs non municipal, seasonal system
    - Tests campground everyday – due to high volume of use
- People tend not to be very concerned on the nature of the system that delivers their water/carries the sewage
- When power goes out, the wells shut down (no drinking water) and sewage pumps shut down as well. If generators installed on wells then they need to be on sewage pumps as well
- Similar quality compared to municipal systems
- Determine risks in your own system – reduce where you can. Risk in this system was: development built on slope, owner installed back flow prevention valves to ensure that water is not taken back into system (soapy water not sucked back into fawcet) pressure tank installed to ensure that excessive water pressure does not damage system
- These systems provide market opportunities to developers
- Costs increase if managed under engineering/management firm
- Development taxed on rural rate – taxes for city houses, farms rural houses – latter rate reduced due to private management
- Run reserve fund of 7% Reserve fund of 7% deposited every month to ensure that repairs can be made.

- Service and operation costs are profitable enough to owner makes 15% from maintenance $420/month
- Taxes till collected from these developments (~$100 000 for example)
- Engineers design plant that another person is responsible for** municipal engineer responsible for work designed by someone totally different
- These developments might be suitable in places where effluent is not contaminated by restaurants, industry
- Certification process gets redundant – recertification leads to replication of courses (1 day per year – long-term owners have already taken all of the courses)
- Class 1 operator – can train another class 1 operator in training, and vice versa – training each other, best option?
- Regulations may not be applicable all the time
- Is it run as industry, or in best interest of potential developers?
- Responsibility agreement, liability insurance, liability and responsibility makes this development too cumbersome
- Legislation changes have not been passed to operators until recently. Had to seek them out themselves
- No environmental issues – discharge through groundwater/aquifer (clean up wording)
- Weeping bed, gravel sand, dilutes sewage prior to entry to discharge aquifer
- No requirement to check weeping beds, springs (surface water not tested) but owner tests them on their own
- Expertise of health inspectors brought into question – most recent inspector had been working with swimming pools prior to inspection this one
- Do it right, then you get to more of it

- Water will not degrade enough in pipes, in the event of power outage
- No concerns surrounding climate change
- No impact on surrounding ecology – at same time of year, level of water is same every year since it was drilled
- MOE/implementing agency needs to clarify their requirements and streamline the process
- Someone needs to take responsibility
- Make grants available to private operators to promote upgrades
- Less contaminiation from this particular development compared to agriculture?

Mayor

Guelph-Eramosa

- Not much “wiggle room” in regulation
- Regulations can be circumvented - paying for temporary membership in community group to get around regulation
- Rates affect people, and perception
- Additional water regulation has lead to hiring new staff (two for this municipality)
- Limited innovation in regulation, more control over system the better
- Directed to municipal sewer and water systems for new development
- Whatever the rule is, the municipality must follow it
- Responsibility agreements, not entered in this municipality
- Difficult to determine if costs are reduced or not. User pay user fee, affected by age of system
- Older system higher costs
- May be useful in cases where private septics have been relied upon, aging infrastructure may be failing.

- When rules changed in 2000s, municipal park defaulted on ownership. Closed park due to increased cost of operation
- Municipally owned system – tax payers would have been charged for bringing the system up to standard
- Planning costs are covered by applicant initially, transferred into home-price
- Some people on old system may need to cover some of the costs, exiting users are still responsible for upgrade costs
- Should not build any of these systems anywhere – costs/ownership transferred to municipality, not favoured by councillor – responsibility agreement assists with this risk
- Costs of responsibility agreement/bankrupt system may still go back user – amoritized over time for users
- The greater the need the greater the risk
- Costs must be borne by user, not municipality
- public perception – these developments not popular – would likely face opposition
    - not necessarily related to water – density driven
- reception depends on council opinion, need of development,
- no marked risk for this municipality
    - walkerton has lead to questions like “what is one life worth?”
- todays rules and testing are strong enough to protect users
- private systems and municipal systems are comparable in terms of risk
- source water protection and related regulation protects the direct users but levies fees against entire tax base
- weather can affect these systems, but hasn’t happened in this jurisdiction
- if system encounters troubles, effluent must be shipped to treatment facility

- extreme rains can lead to discharge
- climate change:
  - over engineering for structures can make development cost prohibitive
  - bad planning or climate change?
- May be some effects on surrounding ecosystem,development and changing landscapes must have some sort of effect. Mitigated through planning documents, etc.
- Site plan control ensures that water runoff is not increased resulting in flooding out neighbours, increased water on adjoining properties

Health Inspector

Lambton County

-
- Risk assesments and corrective measure are directed toward owners
- Owner/operator has responsibiitly to provide safe drinking water to users
- Billing based solely on use and
- MOE responsible for monitoring and enforcement of municipal systems
- Qual and quant can be maintained, proper education can ensure this
- No knowledge of adverse samples/readings, dry wells
- Feasible to monitor the systems in current framework
- Some systems have improved with inception of Org 319, increased sampling regimes, proper well decommissioning, proper sampling/upgraded sampling; some wells were already operating to standards
- Unsure about public perception
- Treatment systems, sampling and adverse sample costs are passed to users.

- Educational material available to owners through courses and training,
- Public health never been at risk from contamination
- Municipal vs privately owned systems: municipally owned bears more responsibility to maintain and monitor water quality, private may not have this same burden
- No effects by fluctuating water levels
- Weather extremes have had no reported effects – covered in risk assessments
- Climate change is taken into consideration during risk assessments; changes in weather, property, industry (built environment), impermeable surface, observational assessments.
- Use of these facilities has not had report effects on surrounding ecosystem

Regulatory Compliance Officer

Innisfil

- OP has clauses – preference to public system communal systems allowed through town approval
- Zoning by-laws in line with OP
- Responsibility agreements – none that they are aware of
- Reduction in monitoring costs: not necessarily
- Qual and quant of water: maintained same as municipal systems – yes levels are maintained
- Cost saving for municipality: operations wise – increased cost, public health reduced sampling costs, maintained sampling requirements from Oreg 318
- Tax revenue – no comment
- Cost savings – increase noticed prior to Walkerton no treatment in some cases, has been increased in cost following incident
- Testing Costs are not looking for reductions – maintaining 318 requirements

- More stringent - similar to reg 170 – biweekly testing

- Systems are meeting requirements, UV treatment may leave more room for failure. Knowledge of operators may lead to issues. No requirement of abundant mechanical knowledge. UV light notifications may not be responded to as quickly as with 170 systems.
- Quality of service, increased quality of these systems' drinking water. Not a result of privatizing it
- Public confidence in service delivery – no difference
- End user costs – in campground obviously lower
- Legislation no covering residential developments
- 2 Trailer parks, communal systems
  - No concerns wrt to monitoring, same as municipal system
  - Still require certified operators
- How is operating system for 125 users cheaper for end users, than connecting to municipal systems?
- Town has grown around communal system, and in time might connect to future expansion of municipal system
- Municipality has enough knowledge to provide emergency support, but generally speaking there is not much input on their part
- Education – not much necessarily available to homeowners; new development being quite open about nature or development wrt to if something is happening in location x call person A.
  - New development has municipal servicing taken to border of development, from there the private owners have control
- Responsibility agreement benig negotiated for new development that is in progress
- Public perception: not too concerned

- No worries about public's health
- Human and ecological health (North American wide)– not being managed to a high enough standard in any case. Source protection policies good start – applicability too small; ultimate result will be minimal to water table. Steps in right direction
- Proper care needs to be taken, otherwise you shouldn't be operating – big responsibility
- Fluctuating water levels: not noticed in systems – local residents have had issues (tend to be shallower wells)
- Weather extremes: not that they were aware of
- Climate change: unsure if it has been accounted for in new development. Treatment and provision from the town, dispersion by owners. Sourcing the water has not used this as a concern. Historical case: should have secure resource, high water table
- Use of this type of system may effect ecology, through interruption of transport pathways, opens up development to many new locations
- Impermeable surface: not take into consideration

Health Inspector

Haldimand Norfolk

- Context – notification that they are going to be providing water, risk assessment – questionnaire re: source, treatment, distribution system
- Source can be surface water, dug, drilled or sandpoint well, cistern
    - Sandpoint well – well drilled into sand – can be 2'' pipe, driven in with a sledge hammer in some cases, works like normal well from this point
- Source security gets taken into account

- Sandpoint wells should be deemed secure
    - Not deemed secure due to proximity or potential for surface water
    - 20 or more feet, many cases water quite suitable for drinking
- Larger sites draw from Lake Erie
- Health unit not notified unless there is an adverse test result
    - Operators are required to follow what the regs say, health units tend not to make more in depth recommendations
- Big systems - Engineers report required by MOE; small drinking water systems do not require an engineers report.
- No responsibility agreements – response: regarding responsibilities that the owner is required to fulfill – approach health unit for risk assessment or MOE for permission to take water for example
- Not feasible to service lake front
    - Nanticoke to Jarvis, Port Rowan to St. Williams examples of places that are connected with municipal systems
- Qual and quant is maintained now, job of health inspectors to enforce standards
    - In past – reliance on chlorine was quite heavy
    - Municipal supply is required to meet aesthetic standards, where small systems do not – only concerned with potability
- No interaction between wells – spaced well enough. Maintained by standards
    - Potential may be there for interaction
- 250 systems in Haldimand-Norfolk district
- Half full-time-equivalent was funded for the health unit in this case at beginning
    - Into reassessment stage now – feasible under current circumstances

- Reg 252 followed initial take over and application trial of reg 170
    - MOE assumed responsibility for all SDWS in Ontario, began to apply the new Reg 170 then realized that it would not work in small cases – best suited for larger more complex systems
    - 252 and 318 came into effect to return responsibility to MHLTC, after risk assessment completed system is regulated under 319
- Compliance reporting is now under consideration in this jurisdiction – every four years the health inspectors return to ensure that owners are complying. Need for returning to sites more often than every four years
- Meeting standards – in experience they do not exceed municipal systems
    - May be lucky and have chosen site with excellent natural water
- Quality of service increased for end user over time – compared to pre-regs
- Septics are more often holding tanks in this area
    - Some parks have installed large-sale or wastewater treatment systems
    - Have centralized collection facility
    - Larger scale systems are under MOE approval and regulation
- Public has become more confident in the drinking water provided – but hard to break habits, people still bring in bottled water. Should be a push to use the water that these places are treating
- More confidence in MOE systems
- Site specific in terms of cost to end user
- Information packets are available to public, tend not to be too concerned though
- Operators/owners are given training or material regarding their system
- Users tend not to be very concerned as long as there is water available for use

- Case where private individual has begun to buy up a number of developments that are or have been serviced by these systems, and then consolidated them all together in order to make one larger integrated system – few approvals.
    - Public opinion is not based on servicing more concerned about beach use
- In one case municipality is trying to drive the owner out of the development in terms of servicing. Attempting to impose more regulation/taxing but owner is already in compliance of appropriate regs
- Bad results are caught quickly and corrected as soon as possible, risks re mitigated in order to keep public safe. Risk may be there but it accounted for to the best of their ability
- Handled responsibly – source water protection should help protect overall
    - Do not have as large an impact as a public system
- Rains flood municipal system – may have to discharge slightly treated sewage
    - Water quality may be reduced in rain events
    - Septics not affected if constructed properly, need to be maintained or in some cases have been replaced with holding tanks
- Historically water tables are dropping
    - May become an issue depending on how deep the well is drilled
    - Local knowledge – local drillers have idea how deep to drill
- Flooding can be an issue – in some cases where parks are along river- dug wells in floodplain
    - "Shore-well" – clear water in wells that are close to riverbank, not close enough to be drawing directly from river maybe some influence
    - Seasonaility of development works in their favour – not in high demand when high water is frequent

- Many owners like to treat large amounts of water and store with residual chlorine in order to have reserve in the event of system going offline
- Climate change not taken into consideration – only required to meet reg. requirement
- Ecological effects have not been noticed, unlikely to be enough of an effect
    - Natural features are regulated and protected for this reason
- Farmers drawing from river likely to be bigger impact
- Impermeable surfaces are not a major concern in this area

Health Inspector

Peel Region

- Anything open to public covered under 319
    - Exceptions are "businesses where you need directions to get to bathroom"
- Risk assessment – high medium low; issues directive and requirements for operator to meet
- Health inspectors will still notify other agencies f infraction – gas station that has paved over well – not decommissioned properly
- Labs charge $80-$300 for testing regime
- More cost effective to install treatment system – may be cases where untreated water is safe, testing requirements will make usage unfeasible
- NSF 55 approved – has failsafes to ensure that system is working properly all the time; some owners do not understand what systems is telling them – alarm may be going off without the actions being taken
    - Cannot force owner to change treatment systems, only recommend upgrades
- Baseline samples are taken before system is installed
- In order to keep costs down, private systems need to get tested at certified lab not health unit

- Inspected every 2 years for high risk systems, medium and low are inspected every 4
- Appeal process if operator not satisfied. Can notify medical officer of health, leading to appeal process. Does not happen frequently, operator will still need to uphold directive.
- Operators must notify the health unit about which lab they are going to use for testing, both lab and owner needs to notify the health inspectors
- Human error may cause issues with testing – samples not obtained properly
- Most adverse results are noticed during spring melt
- Developers will hookup to municipal service wherever possible, but it is pricey. Personal preference weighs in as well.
- Municipal development surrounding existing development has lead to municipal hookup
- Often times, owners will take extra samples to ensure safety. Smaller operations may conveniently forget samples.
- Owners may be given signage to advertise the fact that they do not test water, thus it is not safe for drinking
- Bed and breakfasts are regulated as well
- Within jurisdiction a wealth of educational material is provided to owners and interested customers
    - Largely information that is publicly available
- Consistency across health units may have lead to issues where interaction between jurisdictions occurred – but why are my rules some more strict?
    - Differences were dealt with within jurisdiction – each place had to enforce their directive
    - Directives can be changed if circumstances allow – fewer sampling requirements if there are enough positive readings

- Now into upkeep phase of implementation, there have been adequate funds provided through out process
- Some cost reduction, although obtaining appropriate approvals may be a costly process
- Meeting standards
- Health inspectors do not oversee septic installation
    - Shifted to building department
- Quality is comparable to municipal system
- Systems under 170 are very well operated, if adverse occurs, operators take corrective actions and notify the health unit what is going on
- Lake water and well water can be comparable to each other as long a source is clean – even across municipal system and private system
- Educational sessions were held to notify operators and public about changes once the regs were developed and getting implemented
- There have been less than five – possibly – of these systems developed since the regs came into power. Chip-trucks or bed and breakfasts mainly, development generally directed to use municipal service
- Smaller businesses are deterred by the regulation. Some bed and breakfasts closed once regs came into power
- Fees are encompassed in maintenance fees for developments – may not be specifically stated, but the charge is passed to end user
- Costs may deter potential customers if too excessive
- Owners must receive training and thus education about the system
- When issuing a directive, the inspector must deliver it to the owner. The owner can copy the contractor/operator from there

- Public tends not to be concerned about where their water comes from
- Farming communities may not be very supportive of the expansion of larger cities by utilizing these systems – not specifically these systems but development that is related to them
- Regs have been able to prevent issues from arising - health risks to people
- Wells can be grandfathered, owners may not have incentive to properly decommission or upgrade. This leads to potential for issues to arise
- The more complex system operators seem to be more enthusiastic, and the owners are better educated
- In very extreme cases, corrective measures may need to be taken during weather extremes
- Historical property uses are taken into account – old chicken barns have led to increased sampling on one site

Norfolk County

Planner

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- Four existing zoning by-laws in jurisdiction
- Official plan – pertains to servicing
- There are cost savings, but there are risks with self monitoring of the systems
    - Property owners do not have monitoring records, difficult to provide information to officials
- Public works provides comments on applications that suggest this servicing option

Planner

Huron County

- PPS [Symbol] County OP [Symbol] Local/Municipal OP

- Hierarchy of service preference
- Municipal systems are preferred, where this isn't available, communal systems are approved over private systems
- Huron Haven development – lease-hold
- Local OP:
    - Concerns "residential park" – supports PPS, and acknowledges MOE involvement
    - Lakeshore residential – hook up to or extend municipal then communal then private
        - 5 or less lots for small development – 2005 PPS contained 5 lot limit for development connected to "individual" septic systems, 6 triggers communal system regulation
- MOE recommended responsibility agreement for expansion to occur at these developments
    - Protects municipalities in the event of take over – ensures proper construction, etc
    - Lawyers and experts deal with these agreements
- Different kinds of developers – experienced developers may know process. Inexperienced developers may be lacking resources and knowledge of process
- Many people have their own wells, can test their own water. Sharing water increases testing requirements – up to 5 limit. Communal system needs to provide municipal grade water to the users, leading to greater cost due to fewer people to spread cost across. Securities charge interest, and are another cost that the developer must handle
- No drinking problems anywhere in Huron County of note
- Municipality doesn't necessarily save money, although impractical to provide municipal servicing to entire community in a rural area. Will be a need to provide servicing in a scale of levels (partial to complete municipal servicing).
- More testing when there are more than 6 people using a well and/waste system

- Not feasible to service far-removed clusters f development
- Municipality stands to gain taxes for the lowered amount of service that is provided to these development – no infrastructure cost to municipality where the privatization occurs
- Approvals come from MOE, health unit – funding is appropriate and fits well into portfolios of organizations
- Private systems are meeting the requirements – no problems have been mentioned/noticed
- Unclear whether quality has increased under privatization of service
- Confidence has not changed – average person unlikely to think about the water.
- Perceived increase in value for municipally serviced lot
- Most people think to the extent of drilling their well – one time expense as opposed to annual fee
- End user costs not likely to be less with private systems. Cost to individual household is higher since there are fewer houses – less cost sharing
- Knowledge is low – not much more that there is to know, nor care to know. Information is easy to find if you are interested
- Easy to get in touch with right people to find information or to get problem fixed
- Health unit has abundant information available to public
- Public reaction effected more by other issues (tree-cutting, roads, traffic, etc) as opposed to servicing
- Public knows little about difference between individual vs communal systems
- No issues to date but: potential for issues in cases where septic design is too simplistic – increase standards towards tertiary septic systems. If water is in the soil media, biological processes hat require oxygen cannot function.
- Guidelines based on assumptions:

- When water comes out of runs, there should be no additional nitrates leaving your property
    - A permit issued if the area is big enough and soil suitable, not too concerned with location of systems or direction of groundwater movement
- How do you ensure that a well is not impacted by a particular septic system?

- Communal systems have higher standards, MOE involved in approvals. Individual systems are more likely to be causing the issues noted above
- Amount of groundwater is likely to dilute potential contaminants in the event that they even make it through the soil medium
- Public framework has high bar for managing resources and mitigating risks, private systems are handled at the individual level. The risk may not be evident for new ownersmoving into the development
- Communal systems meet standards and requirements similar to municipal. Individual private systems likely to be more the concern
- No noted water issues in jurisdiction
- No systems are perfect, bypasses are avoided wherever possible. Inevitable if too much water enters system at one time.
    - Flooding may occur in cases where lagoons are used; settled solids are not likely to be in the water that overflows
    - Droughts hav not impacted systems to date. Groundwater much more abundant, irrigation doesn't occur to same extent in jurisdiction. No supply issue
- MOE should be responsible for accounting for climate change
    - All systems are designed to accommodate the 100 year storm (eg. Hurricane Hazel)
    - Intensity and frequency may have impact on systems

- Communal systems have not had impacts through usage, development of system has had more impact. What do you need to do to site your system (cut down trees, footprint, etc)?
- Individual systems more vulnerable to failure, leading to pollution events. Difficult to pinpoint shoreline pollution on lakeshore septic failure, more often agriculture or even fauna blamed for pollution.
- Impermeable surfaces more encompassed in stormwater management plan, siting the communal system affected by placement of stormwater management ponds
- Potential for issues related to development patterns
    - Might encourage sprawl, and reduce emphasis on increased development density
- Servicing strategy required in order to justify the servicing option proposed
- If communal systems are encouraged around municipality (serviced municipally), makes it difficult to enforce planning decisions
- Difficulties surrounding the piecemeal approach to servicing, many communal systems around a centre, how they get integrated in the future

Appendix B

Interview Frameworks

Private Water Systems in Ontario: Structured Interview Questions for Politicians

1. Can you discuss the regulatory context within which private waters system development is undertaken with your jurisdiction? Is there anything particular within your official plans for zoning by-laws that relate to this type development?

2. Can you discuss any responsibility agreements that have been undertaken with your jurisdiction? Could you give some background on the nature of these agreements?

3. Is there a reduction in monitoring and enforcement costs as a result of the private system as opposed to development of a municipally serviced system?

4. Do private systems maintain the quantity and quality of the drinking water supply? Do you have any examples of positive or negative impacts as a result of this development?

5. Is there a recognized cost saving for the municipality in terms of not having the obligation to provide these services?

6. Is adequate tax revenue still collected while not having the obligation to undertake the responsibilities associated with ownership? Do you believe there is a recognized cost savings for the municipality?

7. There was a transfer of cost from the province (MOECC) to the municipality (local health unit) regarding monitoring. Is this an excessive cost for the municipality? Is it feasible to monitor all of the systems?

8. Are private systems meeting and/or exceeding municipal drinking water and wastewater requirements?

9. Has the quality of the services increased as a result of privatizing drinking water and/or wastewater systems?

10. Has there been any change in the public's confidence in service delivery as a result of private water systems?

11. Are end user costs (client) less under a private system?

12. What has the reaction of the public been regarding this type of development?

13. Have there been cases where the public's health has been at risk from contamination stemming from these facilities?

14. Have there been instances where weather extremes have affected these water treatment facilities? (flooding/high water table, draught)?

15. Has climate change been taken into consideration with regards to these water treatment facilities?

16. Has the use of these facilities had an impact on the ecology of the surrounding area?

17. Has the amount of impermeable surface in the landscape been taken into consideration relating to these systems?

Private Water Systems in Ontario: Structured Interview Questions for Planners

1. Can you discuss the regulatory context within which private waters system development is undertaken with your jurisdiction? Is there anything particular within your official plans for zoning by-laws that relate to this type development?

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11. Are end user costs (client) less under a private system?

12. How much do clients understand their systems and what information is available?

13. What has the reaction of the public been regarding this type of development?

14. Have there been cases where the public's health has been at risk from contamination stemming from these facilities?

15. Are water resources managed appropriately to preserve human and ecological health? Are they managed better than under a pubic ownership framework?

16. Have there been cases where fluctuating water levels have affected water-takings and sewage discharge?

17. Have there been instances where weather extremes have affected these water treatment facilities? (flooding/high water table, draught)?

18. Has climate change been taken into consideration with regards to these water treatment facilities?

19. Has the use of these facilities had an impact on the ecology of the surrounding area?

20. Has the amount of impermeable surface in the landscape been taken into consideration relating to these systems?

Private Water Systems in Ontario: Structured Interview Questions for Private Operators

1. Describe your experience with the approval process for your operating system. What areas were most difficult to navigate? What areas were easiest? Do you have any recommendation to improve the approval process for private operators?

2. Did you have to enter into a responsibility agreement with the municipality? If so, describe the nature of it. If not, why did you not have to?

3. Are transaction costs minimized by using private facilities to provide and handle water servicing to the public? (costs of monitoring, approval, and compliance)

4. Was there a significant cost in the approval process (hiring consultants etc.)? Was there any aspect in particular that was very costly in terms of finances or time?

5. How are private systems performing in terms of meeting/exceeding/failing the legislative requirements?

6. Are the costs higher with private as opposed to public owners?

7. Is the time and technical requirements associated with ongoing maintenance and operational costs excessive under a private ownership model?

8. How much do clients understand their systems and what information is available?

9. Has there been any change in the public's confidence in service delivery as a result of private water systems?

10. Has the quality of the services increased as a result of privatizing drinking water and/or wastewater systems?

11. Are end user costs less under a private system?

12. Have there been cases where the public's health has been at risk from contamination stemming from these facilities?

13. Is there a reduction in monitoring and enforcement costs as a result of the private system? (drinking water samples for example)

14. As an operator, do you believe that the presence of private water systems presents market opportunities for private developers?

15. How do you believe these systems affect competiveness in the market place?

16. Are service and operation costs unprofitable?

17. Do private systems maintain the quantity and quality of the drinking water supply?

18. Is there a cost associated with the risk of changing legislation requiring more strict compliance measures?

19. Do you believe there is a recognized cost saving for the municipality in terms of not having the obligation to provide these services?

20. Are water resources managed appropriately to preserve human and ecological health? Are they managed better than under a pubic ownership framework?

21. Have there been instances where weather extremes have affected these water treatment facilities? (flooding/high water table, draught)?

22. Has climate change been taken into consideration with regards to these water treatment facilities?

23. Has the use of these facilities had an impact on the ecology of the surrounding area?

24. Has the use of these facilities been faced with challenges related to water quality and/or quantity (excluding weather extremes)?

25. Has the amount of impermeable surface in the landscape been taken into consideration relating to these systems?

Private Water Systems in Ontario: Structured Interview Questions for Local Health Unit Officials

1. Can you discuss the regulatory context within which private waters system development is undertaken with your jurisdiction? Is there anything particular within your official plans for zoning by-laws that relate to this type development?

2. Can you discuss any responsibility agreements that have been undertaken with your jurisdiction? Could you give some background on the nature of these agreements?

3. Is there a reduction in monitoring and enforcement costs as a result of the private system as opposed to development of a municipally serviced system?

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17. Has the use of these facilities had an impact on the ecology of the surrounding area?

18. Has the amount of impermeable surface in the landscape been taken into consideration relating to these systems?