# Spotlight on Sustainability: Managing Sources of Municipal Wastewater


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Founded in 1970, CIELAP is an independent, not-for-profit research and education organization whose mission is to provide leadership in the research and development of environmental law and policy that promotes the public interest and sustainability.

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# Executive Summary

Until recently, Canadians believed they had access to an abundant supply of clean and safe drinking water. However, tragedies in Walkerton, Ontario, and North Battleford, Saskatchewan, illustrate the consequences of neglecting a water supply. Municipal wastewater is one of the most significant sources of pollution and the largest source, by volume, of effluent discharged to Canadian water (National Water Research Institute, 2002). In order to protect Canada's waters, it is imperative to minimize wastewater discharges.

**Summary of Recommendations**

1. Adopt a user pays approach to rate charges for water and wastewater service.
2. Implement a volume-based rate-scheme to encourage conservation and "front-of-pipe" technologies.
3. Charge a rate that reflects the truer cost of water, including treatment, operation and capital costs.
4. Sewer-use bylaw restrictions should be based on total loadings rather than concentration to discourage dilution of wastes.
5. All municipalities with municipal sewage treatment plants should have a sewer-use bylaw with numeric limits on restricted (toxic) wastes.
6. Adoption of a sewer-use bylaw, with minimum standards, applied across Canada.
7. Require non-residential sources discharging waste into municipal sewers to implement a pollution prevention plan.

Historically, there has been a significant investment of senior government funds in water infrastructure. However, current funds from federal, provincial and territorial governments have declined, and in 1999-2000 contributed to 4.3 per cent of the resources required for sewage collection and disposal in Canada (Statistics Canada, 2004). Furthermore, much of the sewerage infrastructure in Canada has become damaged or obsolete. The infrastructure is insufficient to contend with demand or current (and likely future) environmental and anthropogenic contaminants. Further pressure on municipal infrastructure, resulting from rapid population growth and significant expansion in some water intensive sectors, requires the implementation of source control strategies, including sewer-use bylaws, pricing and pollution prevention plans to protect Canadian waters.

Not only is it important to implement pollution source control strategies across Canada, it is important to implement them consistently across jurisdictions, recognizing that all Canadians have an equal right to safe drinking water and that upstream municipalities can have a negative impact on municipalities downstream. The Canadian Institute for Environmental Law and Policy (CIELAP) recommends a minimum standard, strong enough to protect the environment and human health, be applied to all Canadian jurisdictions to limit, restrict and forbid certain substances from being discharged into the sewer system. CIELAP also recommends the user pay for water and sewage services on a volume basis. Finally, CIELAP encourages municipalities to require industrial dischargers to develop and implement pollution prevention plans.

## Introduction

Effluent from sewage treatment plants is one of the main sources, by volume, of pollution degrading Canadian waters. The average Canadian produces 63,000 L of domestic wastewater each year (Sierra Legal Defence Fund, 1999), which reaches the aquatic environment through sewage treatment plant bypasses, pass throughs, storm sewers, combined sewers and dry weather overflows.[1] Sewage sludge also reaches the land via landfilling and agricultural application and to the air through volatilization and incineration (Canadian Institute for Environmental Law and Policy, 1988).

Historically, sewage was deposited directly to receiving water bodies, which did not become a visible problem until the 1920's and 1930's, at which point wastewater treatment facilities were built to protect human health and the aquatic environment ([a]National Guide to Sustainable Municipal Infrastructure, 2003). However, presently municipal infrastructures are rapidly decaying without sufficient repair. Problems include a lack of funding, rapid population growth, stronger health and environmental requirements, inadequate inspection and maintenance, lack of consistency in design, construction, operational practices and standards, and a significant growth in some water intensive sectors (Winfield, 2003). In order to promote aquatic and human health, Canada needs to develop a preventative approach to manage sewage effluents, which should include: harmonized sewer-use bylaws across Canadian jurisdictions; pricing that incorporates the full cost of sewage treatment and disposal; and, the requirement of all industrial dischargers to prepare and implement pollution prevention plans.

1998 data suggests that of all municipalities in Canada with a population over 1000 people, 92 per cent of the population is serviced with potable water, 89 per cent with sewers and 86 per cent with sewage treatment (17 per cent with primary treatment, eight per cent with waste ponds, 25 per cent with secondary treatment and 36 per cent with tertiary treatment. For a description of each type of treatment see Box 1) (Sexton, 1999).

Canadians are serviced with three types of sewers: sanitary, storm and combined. Sanitary sewers transport wastewater from drains, toilets and sinks to treatment plants for treatment. Storm sewers capture rainfall and snowmelt from streets and building roofs and release the collected water directly into a waterway. Combined sewers carry both wastewater and stormwater, in the same pipe, to a sewage treatment plant for treatment. Although the subject matter of this paper is discharges into sanitary sewers, CIELAP remains concerned over the potential damages associated with combined sewer and dry weather overflows.

Household toxics in municipal wastewater can include human excrement, organic kitchen wastes, solvents, oil, laundry detergents and cleaners. Industrial and commercial toxics can include silver, chromium, solvents, inks and dyes, amongst others. Urban runoff from roads, roofs, yards, golf courses, parking lots and farms can include oil, grease, antifreeze, hydrocarbons, pesticides and nutrients (Environment Canada, 2001; Sierra Legal Defence

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[1] Dry weather discharges occur when combined sewers overflows during dry weather periods, often as a result of operating at maximum capacity and adding an additional connection or when the system operates above maximum capacity.

Fund, 1994). Conventional pollutants, which sewage treatment plants are designed to treat, include total suspended solids (TSS), particles of organic origin, animal excreta and nutrients. Thus, wastewater discharged into receiving waters are loaded with contaminants not treated by the traditional sewage treatment processes, often into a water source used for swimming and recreation, wildlife and fish habitat and upstream of other municipalities' input for drinking water, as illustrated in Figure 1.

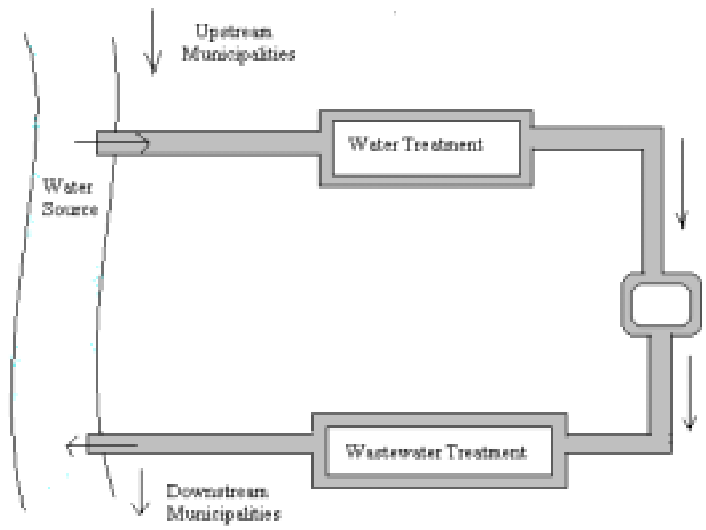


**Figure 1** Illustration of the relationship between upstream wastewater effluents and downstream drinking water sources (Chambers, 1997).

Sewage treatment plants typically monitor fecal coliform bacteria, TSS and biological oxygen demand (BOD). TSS can cause abrasions on gills of fish, settle and smother aquatic bottom dwelling organisms, create oxygen deficient environments and prevent sunlight from reaching plants. BOD is a measure of the amount of oxygen required by bacteria to decompose organic materials, which can lead to anoxic conditions. Fecal coliform bacteria from intestinal tracts of mammals are usually not pathogenic themselves[2] and are measured and used as an indicator for the potential contamination of other pathogens, including for

## Box 1: Municipal Wastewater Treatment

**Pre-treatment:** Screening process to remove grit and solid materials.
**Primary:** Physical process where solids are separated from liquids. Typically uses settling tanks, lagoons and holding ponds.
**Secondary:** Biological processes where microorganisms break down organic matter. Treatment provides oxygen to microorganisms through, for example, aeration, air-activated sludge and biological filters.
**Tertiary:** Variety of processes in addition to 2º treatment including for example mechanical or sand filtration and microstrainers.
**Nitrogen and Phosphorus Removal:** Biological or chemical process, generally occurs at 2º or 3º level.
**Disinfection:** Removal of pathogens, most commonly by chlorination or ultraviolet rays.

[2] Some strains of *E. coli* can cause intestinal illness, for example *E. coli* O157:H7, the culprit in the 2001 Walkerton tragedy, is found in the digestive tract of cattle.

example Hepatitis B, cholera and typhoid. High levels of coliform in swimming waters (greater then 200 organisms per 100 mL) increase the likelihood of developing illness, including fever, nausea, skin irritation or stomach cramps (Sierra Legal Defence Fund, 1994).

Sewage treatment plants are not designed to treat pollutants such as heavy metals, hydrocarbons and toxic chemicals. Toxic contaminants can include biomagnifying[3] metals, including mercury, arsenic, lead, silver, chromium and cadmium, biomagnifying hydrocarbons, oil and grease, synthetic organic chemicals and chlorine (People for Puget Sound, 1995). Other important sources of contaminants, that are potentially toxic, include endocrine disrupting substances, pharmaceuticals and personal care products and pathogens. Endocrine disrupting substances, like natural and synthetic hormones and some industrial chemicals, alter endocrine function, which negatively affects reproduction and development of animals. With the increasing age of the Canadian population and the further development and use of pharmaceuticals, the amount discharged into the environment, particularly through sewers, is projected to increase, posing threats of antibiotic resistance, chronic toxicity, biomagnification and bioaccumulation (National Water Research Institute, 2002). If wastewater is not disinfected, bacteria and pathogens can be released into the environment, which occurs frequently during and after rainfall. Beyond potential health impacts to humans, pathogens and bacteria can accumulate in shellfish tissue, which can, result in significant economic loss when the harvesting industry is required to shutdown. For example, in 1992, 3018 $km^2$ of Canadian coasts were closed for harvesting (Sierra Legal Defence Fund, 1994).

The pressures exerted on Canadian waters from wastewater effluent can be costly to Canadian human and aquatic health and economic vitality. A preventative approach not only promotes ecosystem health, but also is less costly and more efficient than a treatment or repair strategy. According to the United States Environmental Protection Agency, it is 40 times more expensive to remediate groundwater then to protect water at the source. Once waters are polluted, it is costly to locate new drinking water sources, to build new treatment facilities, and to clean up and rehabilitate polluted waters. Polluted waters also indirectly decrease property values and increase medical treatment. Preventing the contamination of water and promoting aquatic health can subsequently decrease the cost of drinking water treatment (Pollution Probe, 2004).

Preventing the production of sewage wastes and controlling the discharge of contaminants into the sewer system is crucial to ensuring a safe and clean source of drinking water to Canadians.

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[3] Biomagnification is the process by which the concentration of toxic chemicals accumulated in tissues of organisms' increases up the food chain.

## Government Responsibility and Legislation

The Canadian Constitution divides legislative responsibility between the Federal and Provincial governments. In relation to powers of water and water-related-matters, Section 91 and 92 of the *Constitution Act*, 1867 gives the federal government power over matters related to water quality protection, through their power over coastal and inland fisheries, and the province is responsible for natural resources and property matters. However, in practicality, primary responsibility for natural resources – including drinking water and sewage services – has been left to the provinces.

### Federal Government

The three main pieces of legislation concerned with sewage treatment are: the *Fisheries Act* (*FA*) the *Canadian Environmental Protection Act* (*CEPA*) and the *Canada Water Act*. The *FA* is the strongest federal law to protect water from pollution. Section 36(3) of the *FA* enables the government to fine one million dollars and/or imprisonment to dischargers of "deleterious" substances into water frequented by fish, and subsequently protects both fish and fish habitat.

*CEPA* manages risks associated with toxic substances listed within its legislation. The *Canada Water Act* allows the federal government to designate any waters as a "water quality management area" and can then use extensive powers to maintain the quality of water in that area. However, this power to designate areas has never been used. Other federal legislation that could be relevant to sewage is the *Canada Shipping Act*, the *Canadian Environmental Assessment Act* and the *Pleasure Craft Sewage Prevention Regulation*.

### Provincial Government

Provincial governments generally license permits relating to sewage discharge and are responsible for regulating and constructing municipal sewage treatment facilities. However, these permits are frequently granted on a status quo basis without regard to any standard and are often in violation of the permit's requirements (People of Puget Sound, 1995). A list of provincial and territorial legislation concerning the management of sewage can be found in Table One. Generally, however implementation and enforcement is left to municipalities, which in many cases is lacking.

**Table One** Provincial and territorial legislation relating to the management of sewage.

| Province or Territory | Legislation |
|---|---|
| Yukon | ▪ *Yukon Waters Act*<br>▪ *Public Health and Safety Act*<br>▪ *Environment Act* |
| Northwest Territories | ▪ *Northwest Territories Waters Act*<br>▪ *Public Health Act*<br>▪ *Environmental Protection Act*<br>▪ *Pesticide Act*<br>▪ *Transportation of Dangerous Goods* |
| Nunavut | ▪ *Environmental Protection Act*<br>▪ *Water Resources Agreement Act*<br>▪ *Planning Act* |
| British Columbia | ▪ *Waste Management Act*<br>▪ *Health Act*<br>▪ *Local Government Act* |
| Alberta | ▪ *Environmental Protection and Enhancement Act*<br>▪ *Water Act* |
| Saskatchewan | ▪ *Environmental Management and Protection Act* |
| Manitoba | ▪ *Public Health Act*<br>▪ *Environment Act* |
| Ontario | ▪ *Ontario Water Resources Act*<br>▪ *Environmental Protection Act*<br>▪ *Planning Act*<br>▪ *Sustainable Water and Sewage Systems Act*<br>▪ *Environmental Assessment Act*<br>▪ *Nutrient Management Act*<br>▪ *Municipal Water and Sewage Transfer Act* |
| Quebec | ▪ *Environmental Quality Act* |
| Newfoundland and Labrador | ▪ *Water Resources Act* |
| New Brunswick | ▪ *Clean Environment Act*<br>▪ *Clean Water Act* |
| Nova Scotia | ▪ *Environment Act*<br>▪ *Health Act* |
| Prince Edward Island | ▪ *Environmental Protection Act*<br>▪ *Water and Sewerage Act* |

**Municipalities**

Municipalities have the statutory mandate to provide sewage treatment, but operate wastewater treatment plants under a permit issued by the provincial government. In 1998, municipalities devoted nearly four billion dollars, or five per cent of their overall budgets, to pollution management of sewage and solid waste (Statistics Canada, 2003).

## Pollution Source Control Approach for Wastewater Management

The pollution source control approach is a preventative method of sewage management and is generally more efficient and cost effective than traditional treatment approaches, because the total volume to be treated is less and select contaminants are restricted or forbidden. As the *National Guide to Sustainable Municipal Infrastructure* ([b]2003) states, "…efficiency of the treatment and its costs are closely related to the quantity and quality of the wastewater to be treated." Thus, enforcing more stringent effluent discharge criteria is economical with respect to costs associated with infrastructure capacity, and promotes environmental health by preventing pollution discharges.

According to the [a]National Guide to Sustainable Municipal Infrastructure (2003), the main objectives of source control are to:

- Manage demand through user rates
- Protect sewer workers from toxic, flammable or explosive materials
- Protect the sewer infrastructure from corrosive materials, including for example acids, rocks and sand
- Protect the wastewater treatment processes from substances which may upset the treatment process
- Protect the environment from toxic organics and trace metals
- Improve the quality of biosolids

Strategies to promote these aforementioned objectives at the municipal level include: sewer-use bylaws, financial incentives and wastewater rates, clearly defined monitoring, enforcement and compliance, education and awareness programs, codes of practice or best management plans, integrated storm water management planning, construction and maintenance activities and pollution prevention plans ([a]National Guide to Sustainable Municipal Infrastructure, 2003; [b]National Guide to Sustainable Municipal Infrastructure, 2003).

The rest of the paper examines the significance of wastewater rates, sewer-use bylaws and pollution prevention plans in managing municipal wastewater. The need and importance of education programs have been addressed extensively in previous literature.

### Wastewater Rates

Consumer prices for water and wastewater services in Canada do not reflect the true cost of treatment, operational and capital costs; nor are services provided on a user pays basis. In 1996, the National Round Table on the Environment and the Economy estimated that the unmet water and wastewater infrastructure needs in Canada were between 38 and 40 billion dollars, and the following 20 years would require an additional 70 to 90 billion dollars in capital costs. Presently, only 50 per cent of the cost of maintaining and operating water and wastewater infrastructure is met through cost recovery (Burke *et al*., 2001).

In 1999, approximately 44 per cent of Canadians serviced by municipal water were not metered, consuming on average 457 L of water per day per person, 70 per cent more than those paying a volume based rate (Burke *et al*., 2001). Flat rates are fixed payments for each billing period, which are not related to volume. Flat rates can also be incorporated into property tax bills and frontage discharges. Flat rates give no incentive to conserve water and are most common in Newfoundland, Prince Edward Island, Quebec, British Columbia and the Yukon, with an average price of $22.40 per month.

In 1999, approximately 56 per cent of Canadian residences serviced with municipal water were metered and paid a volume-based rate. Generally, three types of volume based rate schemes exist in Canada: constant unit charges, declining block rates and increasing block rates. In 1999, 39 per cent of Canadians paid for water services on a constant unit charge basis, at an average rate of $\$0.96/m^3$. This price scheme applies a constant fee for each unit consumed and can involve a fixed charged component, above which a constant fee is applied for each successive unit. In 1999, 13 per cent of Canadian residences were serviced with declining block rates, where each successive block (set volume of water) is charged at a lower price per unit then the previous block. This rate scheme does not encourage water conservation, unlike an increasing block scheme that, in 1999, serviced 9.9 per cent of Canadians, where both block schemes paid an average of $\$1.12/m^3$ for the first block (Burke *et al*., 2001).

Often, sewage prices are incorporated into water charges, and are generally a flat rate, accounting for, on average, 39.4 per cent of the monthly water bill in 1999. However, some municipalities charge volume-based rates, whereby the charge is a fixed percentage of the customer's water bill. Figure 2 illustrates the average cost of sewage service in different provinces and territories for 25 $m^3$ of wastewater, which varies from $3.54 in Newfoundland to $23.77 in Manitoba, with a national average of $\$11.31/25m^3$ (Burke *et al*., 2001). Variations in price may reflect the cost of providing wastewater services and the subsidy level of different jurisdictions. For example, Newfoundland and British Columbia have an abundant supply of water for drinking and an abundant supply of receiving water for wastes; whereas, Prairie Provinces frequently experience water shortages and the Territories' climatic conditions, particularly permafrost, result in a higher cost of service.

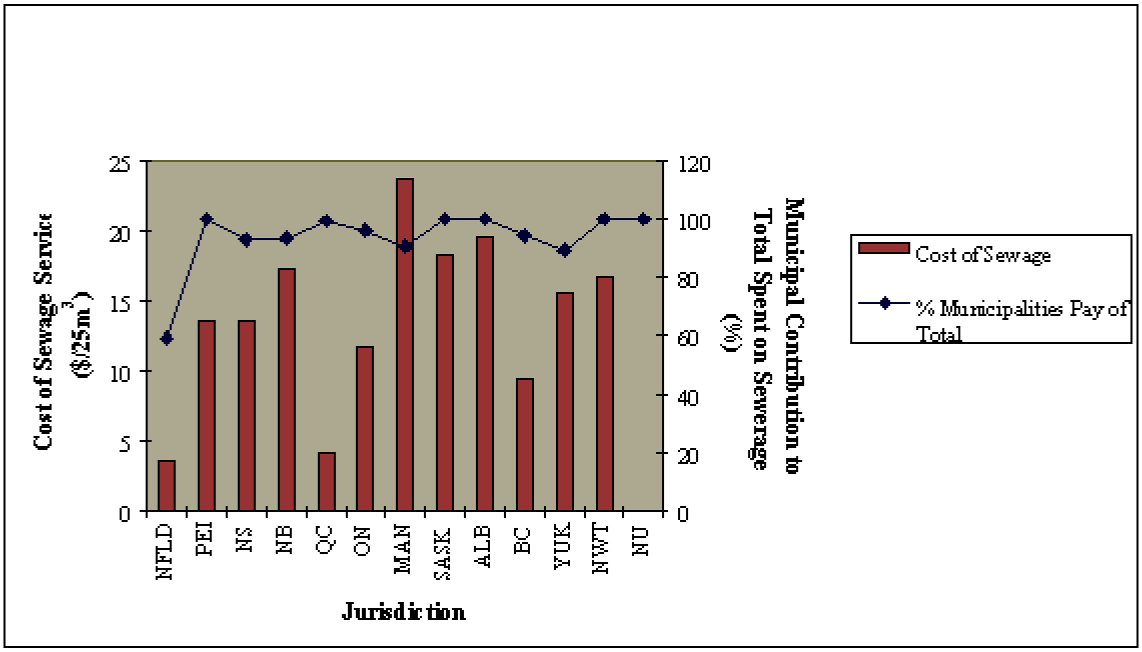


**Figure 2** Comparison of the average sewage service rate for 25 $m^3$ and the percentage that municipalities contribute to sewage collection and disposal for 13 different Canadian provinces and territories in 1999.

As illustrated earlier, there is an absence of appropriate price signals for water and wastewater services, which has resulted in over consumption and reduces the demand on "front-of-pipe" technologies[4] and abatement procedures (National Round Table on the Environment and the Economy, 1996). Furthermore, current prices do not reflect the social or environmental costs of abusive behaviours, including the cost of water table depletion, water pollution, replenishment measures and healthy aquatic ecosystem services. Since user fees do not cover the costs of treatment, operation and capital, consumers pay for these costs largely through tax revenue, which subsidizes municipal services. Figure 3 illustrates the percentage municipalities pay in comparison to provinces and territories. Again, because of this method of revenue generation, users or polluters do not pay for the services they use, and thus, have no incentive to alter their behaviour. In response, CIELAP offers the following recommendations:

**Recommendation 1** Adopt a user pays approach to rate charging for water and wastewater service.

**Recommendation 2** Implement a volume-based rate-scheme to encourage conservation and "front-of-pipe" technologies, including conservation and pollution abatement technologies.

[4] Front-of-pipe technologies occur prior to discharge into the municipal sewage system, and relate to the manufacturing process, with the goal to minimize the production and release of pollutants and waste.

**Recommendation 3** Charge a rate reflecting the truer cost of water, including treatment, operation and capital costs, to give a greater signal of the environmental, social and economic value of clean water.

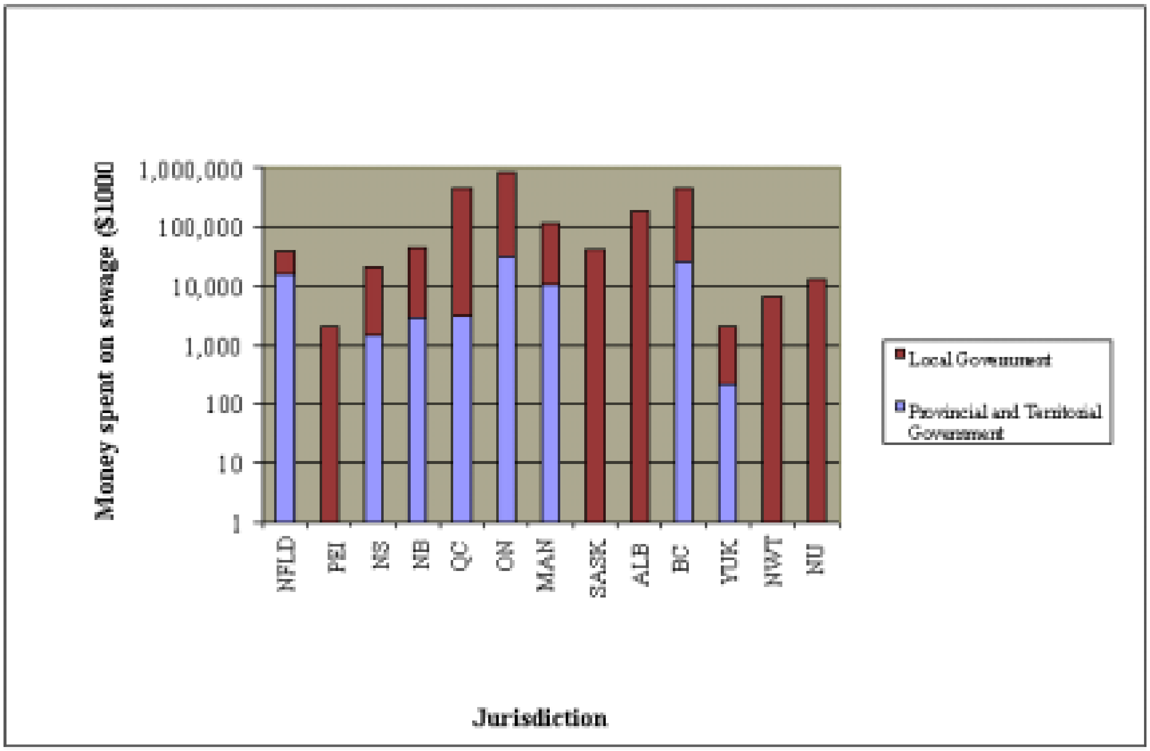


**Figure 3** Logarithmic scale comparison of the 1999 money spent on sewage collection and disposal of local governments and provincial/territorial governments.

***Sewer-Use Bylaws***

Under provincial *Municipal Acts*, municipalities are given the power to pass local bylaws, to regulate local matters, including what is discharged into the sewer. Sewer-use bylaws limit the amount of regulated pollutants that can legally be discharged. Sewer-use bylaws generally divide wastes into two broad categories; prohibited wastes are banned from being released into the sewer and discharge of restricted wastes is permitted, providing the concentration of the waste is under a certain limit. However, regulating based on concentration encourages diluting the waste with water and consequentially does not promote water conservation. Therefore, CIELAP recommends sewer-use bylaw restrictions be based on loadings of specified substances.

**Recommendation 4** Sewer-use bylaw restrictions and charges should be based on total loadings of specified substances rather than on concentration.

A survey of 43 municipal sewer-use bylaws selected from across Canada was compiled and made available on Envision Compliance's *Canadian Sewer Bylaw Database*. The 43 municipalities surveyed were selected to represent a range of geographical locations, proximity to a surface water source and the size of the community. The survey found a large discrepancy between municipalities regarding what is regulated and the allowed discharge concentrations for combined and sanitary sewers. Figures 4 and 5 illustrate these differences for select wastes. For example, of the 43 bylaws surveyed, only 18 regulated arsenic discharges, at an average discharge of 1.43 mg/L, but ranged from 0.2 mg/L to 10 mg/L. A total of nine municipal sewer-use bylaws set no limits on restricted wastes and one surveyed municipality, the Cape Breton Regional Municipality, with a population of 105, 968 (Statistics Canada, 2001), does not have a sewer-use bylaw[5]. Because municipalities are responsible for setting their sewer-use bylaws, differences exist in industrial pre-treatment requirements, the cost of treatment at the municipal sewage treatment plant and the effluent quality discharged into the ambient environment. A standard should be applied to all municipal systems to promote equity, both with respect to associated economic costs, as well as the quality of aquatic health and drinking water. It is imperative to recognize the diversity of receiving environments across Canada and the associated treatment costs. Thus, CIELAP recommends a minimum standard be applied to all systems and those located in sensitive areas should have stricter bylaws then the standard.

**Recommendation 5** All municipalities with municipal sewage treatment plants should have a sewer-use bylaw with numeric limits on restricted (toxic) wastes.

**Recommendation 6** A sewer-use bylaw standard should be applied across Canadian jurisdictions, beyond which, municipalities can chose to do better. This bylaw should be determined and agreed upon by provincial and territorial environmental ministers, and then implemented in municipalities. Permits granted by provinces and territories should also consider and reflect this standard.

[5] It should be noted that many municipalities in Canada that provide sewage services do not have a sewer-use bylaw.

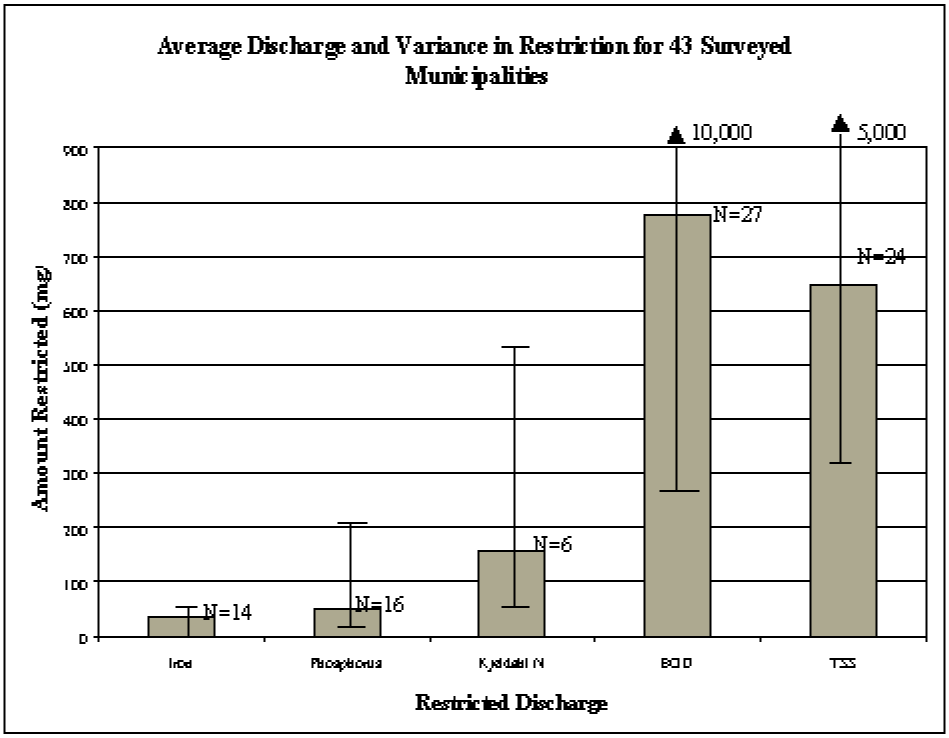


**Figure 4** Range of restrictions outlined in 43 different sewer-use bylaws in Canada.

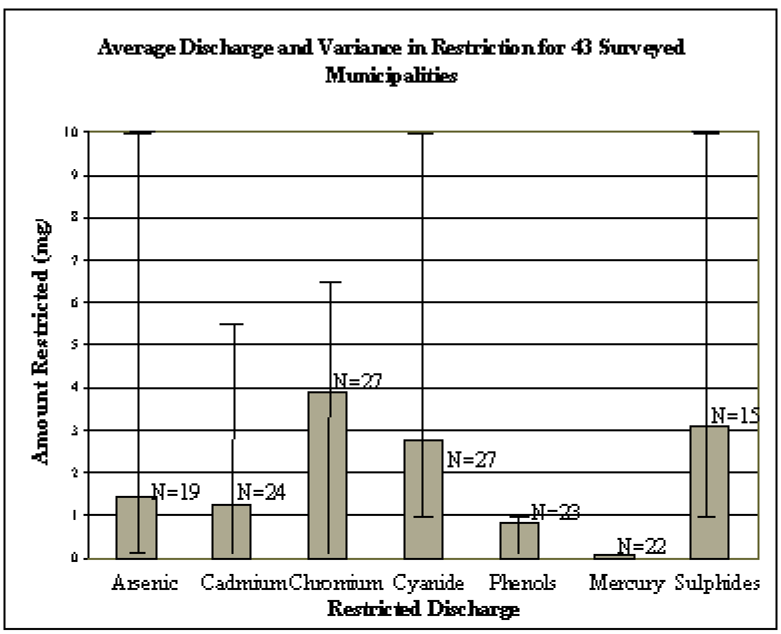


**Figure 5** Range of restrictions outlined in 43 different sewer-use bylaws in Canada.

### *Pollution Prevention Plans*

Pollution prevention plans seek to eliminate the creation of pollution, rather than managing or treating pollution after it has been generated. General steps involved in pollution prevention plans include baseline review, planning, implementation, monitoring, reporting and review, evaluation, improvement, commitment and policy. In Canada, Toronto is the only municipality that requires industrial dischargers to municipal sewer systems to prepare pollution prevention plans. Examples of industries required to prepare pollution prevention plans include metal finishing, industrial laundry, gas stations and auto repair, photo finishing and printing, dental and medical labs and soap, detergent, rubber and plastic producers (Toronto, 2001).

Pollution prevention plans in Toronto must include a list of pollutants the company releases and a plan to reduce their generation. Companies must also examine raw materials and chemicals used, operational practices and have a plan to reduce and/or eliminate the discharge of controlled substances, as stipulated in the Municipal bylaw and provincial permits. Industrial activities that may occur in order to comply with pollution prevention plan commitments, can include, for example, using less harmful substances, substituting raw materials, modifying industrial processes, reformulating products, improving operations and maintenance, and in process recycling of production materials (Toronto, 2000). Avoiding the production and subsequent discharge of harmful materials into the sewage system is more cost effective, environmentally more progressive and more sustainable then relying on treatment. Therefore, CIELAP encourages all municipalities to require industry to develop and adopt pollution prevention plans.

In July 2002, Environment Canada released, "Pollution Prevention Planning for Ammonia, Inorganic Chloramines and Chlorinated Wastewater Effluents in Municipal Wastewater Effluents," for public consultation, proposing that wastewater treatment facilities be required to prepare and implement pollution prevention plans when:

- Chlorine or chlorine compounds are used for disinfection OR where average ammonia concentrations of discharge exceeds 20mg/L AND
- Annual average effluent volume is 10,000 $m^3$ per day or more AND
- Effluent does not meet risk management objectives

The proposal recommends that pollution prevention plans capture the collection, treatment, disinfection, dechlorination and discharge of wastewater effluent and be prepared and implemented by 2006.

**Recommendation 7** Require the adoption of pollution prevention plans for all non-residential sources discharging waste into municipal sewers.

Sewage service is a largely unseen, and subsequentially an unacknowledged service provided to most Canadians. This lack of visibility has contributed to the degradation of the system and the environment. It is important for Canadian industry, policy makers and the public to take action before sewage becomes a visible problem. CIELAP recommends a survey of best practices be undertaken and made available to all municipalities. This survey should assess the state of sewage systems in individual municipalities, and give direction on further action.

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*Environmental Assessment Act*, R.S.O. 1990, c. E.18

*Environmental Management and Protection Act, 2002*, R.S.S. 2002, c. E-10.21.

*Environmental Protection Act*, R.S.A. 2000, c. E-12.

*Environmental Protection Act*, R.S.N.W.T. 1988, c. E-7.

*Environmental Protection Act (Nunavut)*, R.S.N.W.T. 1988, c. E-7.

*Environmental Protection Act*, R.S.O. 1990, c. E.19.

*Environmental Protection Act*, R.S.P.E.I. 1988, c. Q-1.

*Health Act*, R.S.B.C. 1996, c. 178.

*Health Act*, R.S.N.S. 1989, c. 195.

*Local Government Act*, R.S.B.C. 1996, c.323.

*Municipal Water and Sewage Transfer Act, 1997*, S.O. 1997, c. 6, Schedule A.

*Northwest Territories Waters Act*, R.S.N.W.T. 988, c. 17.

*Nutrient Management Act, 2002*, S.O. 2002, c. 4.

*Ontario Water Resources Act*, R.S.O. 1990, c. O.40.

*Pesticide Act*, R.S.N.W.T. 1988, c. P-4.

*Planning Act*, R.S.N.W.T. 1988, c. P-6.

*Planning Act*, R.S.O. 1990, c. P.13.

*Public Health Act*, R.S.M. 1997, c. P210.

*Public Health Act*, R.S.N.W.T. 1988, c. P-12.

*Public Health and Safety Act*, R.S.Y. 2002, c. 176.

*Sustainable Water and Sewage Systems Act, 2002*, S.O. 2002, c. 29.

*Transportation of Dangerous Goods*, R.S.N.W.T. 1991, c. 81.

*Water and Sewerage Act*, R.S.P.E.I. 2003, c. W-2.

*Waste Management Act*

*Water Act*, R.S.A. 2000, c. W-3.

*Water Resources Act*, S.N.L. 2002, c. W-4.01.

*Water Resources Agreement Act* (Nunavut), R.S.N.W.T. 1988, c. 17.

*Yukon Waters Act*, R.S.Y. 2003, c. 19.

***Municipal Bylaws***

Amherst, *Bylaw Public Sewers*, 1988.

Brandon, *Bylaw 5957/114/91*, 1991.

Calgary, *Bylaw 24M96*, 1996.

Canora, *Bylaw 90-09*, 1990

Carman, *Bylaw 91/1654*, 1991.

Charlottetown, *Bylaw Water and Sewer*, 1987.

Dauphin, *Bylaw 3205*, 1973.

Edmonton, *Bylaw 9675*, 1999.

Elliot Lake, *Bylaw 79-87*, 1979.

Fernie, *Bylaw 1593*, 1992.

Fort Frances, *Bylaw 48/92*, 1992.

Fort McMurray, *Bylaw 85/51*, 1986.

Fort St. John, *Bylaw 444*, 1973.

Fredericton, *Bylaw S-8*, 1990.

Georgetown, *Bylaw Water and Sewer*, 1987.

Halifax, *Bylaw W-100*, 1996.

Hay River, *Bylaw 1098*, 1984.

Iqaluit, *Bylaw 200*, 1989.

Labrador City, *Bylaw 156/80*, 1980.

Lévis, *Bylaw 26*, 1990.

Montréal, *Bylaw 87*, 1986.

Ottawa, *Bylaw 163-75*, 1994.

Peace River, *Bylaw 1415*, 1989.

Perth-Andover, *Bylaw 23*, 1980.

Prince Albert, *Bylaw 10 of 1995*, 1995.

Québec, *Bylaw 2797*, 1987.

Regina, *Bylaw 5601*, 1975.

Saskatoon, *Bylaw 5115*, 1971.

St. George's, *Bylaw 156/80*, 1980.

St. John's, *Bylaw 156/80*, 1980.

Summerside, *Bylaw Water and Sewer*, 1987.

Teslin, *Bylaw 14*, 1985.

Thunder Bay, *Bylaw 373-1992*, 1992.

Toronto, *Bylaw 457/2001*, 2000.

Vancouver, *Bylaw 5320*, *164*, 1970.

Vanier, *Bylaw 884*, 1981.

Victoria, *Bylaw 2231*, 1996.

Watson Lake, *Bylaw 39*, 1986.

Whitehorse, *Bylaw 99-02*, 1999.

Winnipeg, *Bylaw 7070/97*, 1998.

Yellowknife, *Bylaw 3529*, 1991.

## Appendix

Comparison of 43 different sewer-use bylaws across Canada.

| Units (mg/L) | MOE model bylaw 1998 | Whitehorse[1] | Teslin[1] | Watson Lake[1] | Hay River[2] | Yellowknife[2] | Iqaluit[3] | Fort St John[4] |
|---|---|---|---|---|---|---|---|---|
| **Population** | | 19058 | 123 | 912 | 3510 | 16541 | 5236 | 16034 |
| **Treatment** | | 2°/3° | L | | L/W | L | | AC and L |
| **Max Temp** | 60°C | 75° C | | | 75° C | | | 76.5° C |
| **pH low** | 6 | 5.5 | | | | | | 5.5 |
| **pH high** | 10.5 | 10.5 | | | | | | 9.5 |
| **Synthetic oil & grease** | | 100 | | | | | | |
| **Natural oil & grease** | 150 | 100 | No limits set in the Bylaw | No limits set in the Bylaw | No limits set in the Bylaw | No limits set in the Bylaw | No limits set in the Bylaw | 200 |
| **Phosphorus** | 10 | 10 | | | | | | |
| **Kjeldahl N** | 100 | 50 | | | | | | |
| **Phenols** | 1 | 1 | | | | | | |
| **BOD** | 300 | 300 | | | | | | 700 |
| **TSS** | 350 | 300 | | | | | | 400 |
| **COD** | | 600 | | | | | | |
| **Al** | | 50 | | | | | | |
| **As** | 1 | 1 | | | | | | |
| **Cadmium** | 0.7 | 0.1 | | | | | | |
| **Chromium** | 5 | 4 | | | | | | |
| **Cobalt** | 5 | 5 | | | | | | |
| **Copper** | 3 | 1 | | | | | | |
| **Cyanide** | 2 | 2 | | | | | | |
| **Fluoride** | 10 | 10 | | | | | | |
| **Iron** | | 4 | | | | | | |
| **Lead** | 2 | 1 | | | | | | |
| **Manganese** | | 5 | | | | | | |
| **Mercury** | 0.05 | 0.1 | | | | | | |
| **Molybdenum** | 5 | 5 | | | | | | |
| **Nickel** | 3 | 4 | | | | | | |
| **Selenium** | 5 | 5 | | | | | | |
| **Silver** | 5 | 5 | | | | | | |
| **Sulphates** | | 1500 | | | | | | |
| **Sulphides** | | 1 | | | | | | |
| **Zinc** | 3 | 2 | | | | | | |

| Vancouver[4] | Victoria[4] | Fernie[4] | Edmonton[5] | Calgary[5] | Peace River[5] | Fort McMurry[5] | Saskatoon[6] | Regina[6] |
|---|---|---|---|---|---|---|---|---|
| 545671 | 74125 | 4611 | 666104 | 878866 | 6240 | 34706 | 196811 | 178225 |
| 1° | SLMO | L and SP | AC and AS | AC and PR | AL | L | 2° and PR | AL, UV, 3° |
| 65° C | 65° C | | 75° C | 75° C | 65° C | 75° C | 65° C | 65° C |
| 5.5 | 5.5 | | 6 | 5.5 | 5.5 | 6 | 5.5 | 5.5 |
| 9.5 | 11 | | 10.5 | 10 | 9.5 | 10 | 9.5 | 9.5 |
| 15 | 15 | 200 | | 450 | | 500 | No industrial | |
| 150 | 100 | | 800 | 450 | 100 | | waste unless permitted | |
| | | | 200 | | | 100 | by City | |
| | | | 500 | | | | Engineer | |
| 1 | 1 | | 1 | 1 | | 0.1 | | 0.1 |
| | 300 | 700 | 10000 | 1200 | 300 | 1000 | | |
| 600 | 350 | 400 | 5000 | 1200 | 400 | 1000 | | |
| | 600 | | 20000 | 2400 | | 2000 | | |
| 50 | | | 50 | 50 | | | | |
| 1 | 0.2 | | 1 | 1 | | 1 | | |
| 1 | 0.1 | | 0.1 | 1 | | 0.05 | | 4 |
| 5 | 5 | | 4 | 3 | | 1 | | 5 |
| | 5 | | | 5 | | | | |
| 2 | 1 | | 1 | 3 | | 0.5 | | 4 |
| 1 | 1 | | 2 | 3 | | 1 | | 3 |
| 10 | | | 10 | 10 | | | | |
| 10 | 50 | | | 50 | | | | |
| 2 | 0.5 | | 1 | 1 | | 1 | | 5 |
| | 5 | | | 5 | | 1 | | |
| 0.1 | 0.05 | | 0.1 | 0.01 | | 0.1 | | |
| | 5 | | 5 | 5 | | | | |
| 3 | 1 | | 4 | 3 | | 0.5 | | 5 |
| | | | | 1 | | 1 | | |
| 1 | 2 | | 5 | 5 | | 1 | | |
| 1500 | 1500 | | 1500 | 1500 | | | | |
| 2 | 1 | | 1 | 3 | | 1 | | 3 |
| 4 | 3 | | 2 | 3 | | 1 | | 5 |

| Prince Albert[6] | Canora[6] | Winnipeg[7] | Dauphin[7] | Carman[7] | Brandon[7] | Ottawa[8] | Toronto[8] | Thunder Bay[8] |
|---|---|---|---|---|---|---|---|---|
| 34291 | 2200 | 619544 | 8085 | 2831 | 39716 | 774072 | 2481494 | 109016 |
| 1° | | S, 1°, AS, 2° | L | | SBR, L | | AS, PR | 1°, PR |
| 65°C | | 61°C | | 65°C | 65°C | 65°C | 60°C | 65°C |
| 5.5 | | 5.5 | | 5.5 | 5.5 | 5.5 | 6 | 5.5 |
| 9.5 | | 9 | | 10.5 | 9 | 9.5 | 11.5 | 9.5 |
| | 100 | 100 | Town Engineer | | | 15 | | 15 |
| 100 | 100 | | power to stop/ prevent | | | 150 | 150 | 150 |
| | | | discharge | 10 | | 10 | 10 | 10 |
| | | | into | | | 100 | 100 | 100 |
| | | | sewer; | 1 | | 1 | 1 | 1 |
| | | 300 | or else | 300 | 300 | 300 | 300 | 300 |
| | | 350 | liable for | 300 | | 350 | 350 | 350 |
| | | | injury of | | | | | |
| | | 50 | sewers | 50 | | 50 | 50 | 50 |
| | | 1 | or | 1 | | 1 | 1 | 1 |
| | | 0.5 | sewage | 1 | | 1 | 0.7 | 1 |
| | | 5 | disposal | 5 | | 5 | 4 | 5 |
| | | | plant | 5 | | 5 | 5 | 5 |
| | | 5 | | 1 | | 3 | 2 | 3 |
| | | 10 | | 2 | | 2 | 2 | 2 |
| | | | | 10 | | 10 | 10 | 10 |
| | | | | 50 | | 50 | | 50 |
| | | 2 | | 1 | | 5 | 1 | 5 |
| | | | | 5 | | 5 | 5 | 5 |
| | | 0.1 | | 0.1 | | 0.1 | 0.01 | 0.1 |
| | | | | 5 | | | 5 | 5 |
| | | 5 | | 1 | | 3 | 2 | 3 |
| | | | | 5 | | 5 | 1 | 5 |
| | | 5 | | 5 | | 5 | 5 | 5 |
| | | | | 1500 | | 1500 | | 1500 |
| | | 10 | | | | 2 | | |
| | | 5 | | 1 | | 3 | 2 | 3 |

| Fort Frances[8] | Elliot Lake[8] | Vanier[9] | Quebéc[9] | Montréal[9] | Lévis[9] | St John's[10] | St George's[10] | Labrador City[10] |
|---|---|---|---|---|---|---|---|---|
| 8315 | 11956 | 11054 | 169076 | 1039534 | 40407 | 99182 | 1354 | 7744 |
| 1° | AS, AMS | | | | | | | |
| 65°C | 65°C | 65°C | 65°C | 65°C | 65°C | 65°C | 65°C | 65°C |
| 5.5 | 6 | 6 | 5.5 | 6 | 5.5 | 5.5 | 5.5 | 5.5 |
| 9.5 | 10.5 | 9.5 | 9.5 | 10.5 | 9.5 | 9 | 9 | 9 |
| 15 | 15 | 15 | 15 | 30 | 30 | | | |
| 150 | 15 | 200 | 200 | 150 | 100 | 10 | 10 | 10 |
| 10 | 100 | 100 | | | 100 | 10 | 10 | 10 |
| 100 | | | | | | | | |
| 1 | 1 | 1 | 1 | 1 | 1 | 0.5 | 0.5 | 0.5 |
| 300 | 250 | 500 | 500 | | | 300 | 300 | 300 |
| 350 | 300 | 600 | 600 | | | 350 | 350 | 350 |
| | | | | | | | | |
| 50 | 50 | | | | | | | |
| 1 | 1 | 1 | 10 | 1 | 1 | | | |
| 1 | 2 | 2 | 2 | 2 | 2 | 0.5 | 0.5 | 0.5 |
| 5 | 5 | 5 | 5 | 5 | 5 | 0.05 | 0.05 | 0.05 |
| 5 | | | | | | | | |
| 3 | 5 | 5 | 5 | 5 | 5 | 0.3 | 0.3 | 0.3 |
| 2 | 2 | 5 | 5 | 10 | 2 | 2 | 2 | 2 |
| 10 | 10 | | | | | | | |
| 50 | 50 | | | | | 15 | 15 | 15 |
| 5 | 5 | 2 | 5 | 2 | 2 | 0.2 | 0.2 | 0.2 |
| 5 | | | | | | | | |
| 0.1 | 0.1 | 0.05 | 0.05 | 0.05 | 0.05 | 0.005 | 0.005 | 0.005 |
| 5 | | | | | | | | |
| 3 | 5 | 5 | 5 | 5 | 5 | 0.5 | 0.5 | 0.5 |
| 5 | | | | | | | | |
| 5 | | | | | | | | |
| 1500 | 1500 | | | | | | | |
| | 2 | | 5 | 5 | 5 | | | |
| 3 | 5 | 10 | 10 | 10 | 10 | 0.5 | 0.5 | 0.5 |

| Moncton[11] | Fredericton[11] | Perth-Andover[11] | Halifax[12] | Amherst[12] | Cape Breton Regional Municipality[12] | Charlottetown[13] | Summerside[13] | Georgetown[13] |
|---|---|---|---|---|---|---|---|---|
| 61046 | 47560 | 1908 | 359111 | 9470 | 105968 | 32245 | 14654 | 721 |
| 2° | AS | L | None | None | A | AMS | 1° | SP |
| 65°C | 75°C | ↑ | 65°C | 75°C | | 65°C | 65°C | 65°C |
| 6 | 6 | | | 5.5 | | 5.5 | 5.5 | 5.5 |
| 10.5 | 10.5 | | | 9.5 | | 9.5 | 9.5 | 9.5 |
| 15 | 15 | | | | | | | |
| 150 | 100 | No limits set in the Bylaw | 100 | No limits set in the Bylaw | Does not have a Sewer Use Bylaw | | | |
| | 100 | ↓ | 30 | ↓ | | | | |
| | | | | | | | | |
| 0.5 | 1 | | 1 | | | | | |
| 400 | 600 | | 300 | | | 300 | 300 | 300 |
| 475 | 500 | | 300 | | | | | |
| 400 | | | 100 | | | | | |
| | 50 | | 50 | | | | | |
| | 1 | | 1 | | | | | |
| 5.5 | 2 | | 0.1 | | | | | |
| 6.5 | 5 | | 4 | | | 3 | 3 | 3 |
| | | | 5 | | | | | |
| 5.5 | 5 | | 1 | | | 1 | 1 | 1 |
| 1 | 2 | | 2 | | | 2 | 2 | 2 |
| | 10 | | 10 | | | | | |
| | 50 | | 50 | | | | | |
| 6.5 | 5 | | 2 | | | | | |
| | | | 5 | | | | | |
| | 0.1 | | 0.1 | | | | | |
| | | | 5 | | | | | |
| 6.5 | 5 | | 2 | | | | | |
| | | | 5 | | | | | |
| | | | 2 | | | | | |
| | | | 1500 | | | | | |
| 3.5 | | | 2 | | | | | |
| 6.5 | 5 | | 3 | | | | | |

**Legend**

N= 43 municipalities

1= Yukon
2= Northwest Territories
3= Nunavut
4= British Columbia
5= Alberta
6= Saskatchewan
7= Manitoba
8= Ontario
9= Quebec
10= Newfoundland and Labrador
11= New Brunswick
12= Nova Scotia
13= Prince Edward Island

MOE= Ontario Ministry of the Environment 1998 Model Bylaw

AC= Aerated Cell
AMS= Anaerobic Multi Stage
L= Lagoon
MAD= Mesophilic Anaerobic Digestion
PR= Phosphorus Removal
S= Screening
SBR= Sequencing Batch Reactors
SLMO= Screened Long Marine Outfalls
SP= Settling Ponds
W= Wetlands