The National Sewage Report Card (Number Two)

Rating the Treatment Methods and Discharges of 21 Canadian Cities

• A Sierra Legal Defence Fund Report •

Prepared for the United Fishermen and Allied Workers' Union, Local 24 and Georgia Strait Alliance

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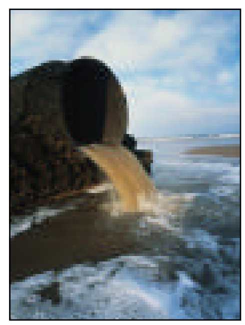

The volume of untreated sewage discharged by the cities in this report would fill the House of Commons every three minutes.

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The Sierra Legal Defence Fund (SLDF) is a charitable environmental organisation specialising in environmental litigation. SLDF provides free legal services to public interest groups throughout Canada. Its goals are: to enhance public access to the legal system; to set important legal precedents that will strengthen existing laws; and to provide professional advice on the development of environmental legislation.

Canada's Sewage Problem: Still A National Disgrace


PHOTO: HOFFMAN/GREENPEACE

When Sierra Legal Defence Fund published the first *National Sewage Report Card* in 1994, we said the ongoing discharge of raw sewage into Canada's waters was a national disgrace. It still is.

This first Sewage Report Card grew from an investigation of the effects of sewage effluent on local Vancouver waters, initiated by the Sierra Legal Defence Fund in response to the concerns of local environmental groups. The information obtained, particularly in regard to the volume of raw sewage that was being discharged, was so surprising that the Sierra Legal Defence Fund decided to investigate other urban centres across Canada.

We evaluated 21 cities in all, from Vancouver to St. Johns, assigning them a letter grade based on the quality of their sewage treatment as determined by various criteria, including level of sewage treatment, volume of raw sewage discharged, and permit and regulation compliance. The reports revealed some shocking environmental violations, and although there has been substantial progress in some cities over the past five years, the lack of discernible progress in many cities is alarming. Of the 21 cities documented in this report, five (Victoria, Saint John, Halifax, St. John's and Dawson City) dump a combined total of 365 million litres of untreated sewage directly into the nation's rivers, lakes and seas every day. Eleven other cities dump an average of 437 million litres of untreated sewage per day through by-passes and combined sewer overflows. In Montreal, Charlottetown and Vancouver, a further 2.4 billion litres of effluent is discharged daily which has received only primary treatment – little more than settling and skimming off large debris. That's 3.25 billion litres per day – nearly 38,000 litres per second – enough to fill the House of Commons every three and a half minutes. In fact, whilst considerable advances have been made in Edmonton, Regina, Saskatoon, Quebec City, Fredericton, Yellowknife and Whitehorse, only one city – Calgary – is using truly effective, environmentally sound technology in its effluent treatment.

Over *one trillion* litres of primary or untreated sewage is collectively dumped into our waters every year by cities evaluated in this report. This volume would cover the entire 7800 kilometre length of the Trans-Canada Highway to a depth of nearly 20 metres – six stories high.

The information we uncovered is particularly disturbing when you consider what sewage really is – a foul mix of water, human excrement, grease, motor oil, paint thinner,

Over **one trillion** litres of untreated sewage — a foul mix of water, human excrement and over 200 toxic pollutants — is dumped into our waters every year by cities evaluated in this report.

antifreeze, and many kinds of toxic industrial and household waste. If sewage really were nothing but human waste, as many people think it is, it would be relatively simple to transform this into high quality fertilizer and drinking-quality water suitable for release into natural aquifers. However, sewage is not just human waste. Studies show that typical municipal sewage contains some 200 synthetic chemicals. Just one drop of oil can render 25 litres of water unsafe for drinking. One gram of polychlorinated biphenyls (PCBs), a substance used in everything from cosmetics to pesticides, is enough to make one billion litres of water unfit for freshwater life.

Sewage is a national environmental issue that has been largely ignored for many years. In a country that takes pride in its untouched wilderness and pristine waters, the measures taken to protect the natural environment from our own waste are sadly inadequate. Most people assume progress has been made, and in recent years it has. However, the casual assumption that whatever we pour down the drain and flush down the toilet is always suitably treated is mistaken. As revealed by this report, huge quantities of sewage never arrive at a treatment plant. Why is this unacceptable situation allowed to continue, considering that dumping of raw sewage is illegal?

Under the federal *Fisheries Act*, discharge of substances "deleterious to fish" into fish-bearing waters is a major offence punishable by fines of up to $1 million and/or imprisonment. Many Canadian municipalities are chronic offenders. Yet charges are rarely laid. The provincial and federal governments continue to turn a blind eye.

In British Columbia, for example, in the 15 years prior to the first *National Sewage Report Card*, only three prosecutions were initiated by the federal government against municipalities for violations of the *Fisheries Act* – despite the fact that Vancouver, Victoria, and many smaller communities in the province openly dump raw sewage into prime salmon habitat. In standard toxicity tests, sewage effluent from Vancouver and Victoria regularly killed all the test fish in minutes.

Sierra Legal Defence Fund (SLDF), on behalf of the Georgia Strait Alliance and the United Fishermen and Allied Workers' Union, filed private prosecutions in 1993 and 1995 against the Greater Vancouver Regional District. The charges included alleged violations of the federal *Fisheries Act* and the provincial *Waste Management Act*. In both cases, the BC Attorney General took over, then dropped the charges. A prosecution against the Capital Regional District for *Fisheries Act* violations, laid in 1999, has not yet been dropped.

The average Canadian generates approximately 63,000 litres of wastewater each year. This report shows just how much of that waste is poorly treated or totally untreated. Sewage is a collective responsibility, since it originates with every one of us. A society as wealthy as Canada can afford to adequately treat its own waste, but it's a matter of priorities.

Public demands play an important role in ensuring that money is spent where it is urgently needed and that laws are strictly enforced. Concerned citizens, once aware of the appalling lack of adequate sewage treatment, may be motivated to create the public pressure necessary to make this issue a top priority.

From Sea to Stinking Sea

Our sewage problems are comprehensive and countrywide - 'from sea to stinking sea'.

- Halifax and St. John's on the east coast, and Victoria on the west coast, have no sewage treatment at all. Together, they discharge about 122 billion litres of raw sewage into the Atlantic and Pacific Oceans each year.
- Vancouver, although served by four sewage treatment plants, still discharges approximately 28 billion litres of raw sewage annually as combined sewer overflows into the Pacific Ocean and the salmon-bearing waters of the Fraser River. Its largest plant discharges approximately 104 billion litres of primary treated effluent into Georgia Strait every year.
- Eight of the cities either violate provincial permits or hold no permits whatsoever.
- Sewage containing faecal coliform bacteria has made the Red River downstream of Winnipeg one of the most degraded watercourses in the prairie provinces.
- In Quebec, almost 20% of soft clam and blue mussel harvesting zones have been closed due to municipal sewage pollution.

WHAT YOU WILL FIND IN THIS REPORT

Although some of the 20 cities we looked at in our first report in 1994 have since made improvements in the quality of their sewage treatment, it is shocking how many cities have taken no action whatsoever. As well, it seems that for every city that does make changes, there is another city still causing environmental damage. For example, at the request of the Yukon Conservation Society, this year we looked at Dawson City as well as Whitehorse. While the larger city has made substantial improvements to its sewage treatment, it was disappointing to discover that Dawson City has followed Victoria's lead, claiming there is no need to treat the community's sewage and investing tax dollars in providing free cable TV hook ups instead.

EVALUATIONS

The Evaluations section forms the central body of this report. We have compared 21 Canadian cities in terms of the quality of their sewage treatment and assigned each a letter grade between A and F. The cities are generally arranged by province from west to east, followed by the territories. The main criteria for these evaluations include: the level of sewage treatment provided, the volume of raw sewage discharged, process for disinfection, and compliance with permits and regulations. For example, a B grade would only be given to a city with a minimum of secondary treatment and ultraviolet (UV) disinfection, which involves treating the sewage with ultraviolet light to kill pathogenic organisms; an A grade could only be achieved with tertiary treatment and UV disinfection. The grade also reflects factors that are difficult to quantify, such as the sensitivity and health of the receiving environment, a city's commitment to improvement, and evidence of effective measures taken since the 1994 report. However, as the level of treatment of sewage effluent increases, so, too, does the amount of contaminated sludge created. Therefore, this time we have asked each city for information about its sludge disposal method. (Although we have listed agricultural use of sewage sludge as a minus for the cities engaged in this practice, the overall grade still deals primarily with effluent treatment.) Where no discernible progress has been made in five years, cities were downgraded. This type of evaluation necessarily involves a degree of subjectivity, for which the authors take full responsibility.

CONTACTS

In the evaluations of each of the 21 cities, a member of the local government and an environmental group are listed. The address and phone number of the government representative are provided to help readers voice their concerns or learn more about the issue of sewage treatment. The environmental groups listed are involved in local sewage issues, or are interested in helping raise the issue of sewage treatment to a broader, national level; or both. Some groups see their role in relation to the report as distributors of information, while others will actively promote the report and demand better sewage treatment in their particular area.

WHY SEWAGE IS A PROBLEM

Following the evaluations of the cities are six short chapters which discuss a number of topics relating to sewage treatment. Why Sewage is a Problem section outlines the environmental impacts of sewage effluent and its effects on the food chain, up to and including humans. Information about substances found in sewage effluent which are capable of affecting the endocrine system of fish, birds, reptiles, amphibians and humans can be found in the Endocrine Disruption 101 section.

TYPES OF TREATMENT

The Types of Treatment section provides a general description of the processes involved in conventional methods of disinfection and preliminary, primary, secondary and tertiary treatment, as well as a look at some interesting alternatives to conventional treatment.

SUCCESS STORIES

The Sewage Success Stories section profiles communities currently using innovative, environmentally sound sewage treatment technologies.

SLUDGE

In 1994, the *National Sewage Report Card* focused exclusively on the environmental and human health implications of raw and inadequately treated sewage discharges into our waters. As the quality of effluent treatment improves, more sludge is formed. The greater the volume of solid waste, the more contaminants are captured, creating another disposal problem. In this edition, we look at some of the threats sludge disposal may pose in the Sludge Happens section.

SOURCE CONTROL

The Source Control section describes ways in which communities attempt to regulate the substances entering municipal sewerage systems, and argues for the necessity of true elimination of pollutants at source.

OUR LAWS

Environmental Laws and Their (Lack of) Enforcement is the final section of the report. The unacceptable state of sewage treatment in the 21 cities surveyed is shown to be primarily a result of an unwillingness on the part of governments to enforce relevant laws.

RESEARCH METHODS

The information compiled in this report was collected by SLDF for the United Fishermen and Allied Workers' Union, Local 24, and Georgia Strait Alliance. Most of the data on sewage treatment in the individual cities was obtained through a questionnaire sent to municipal or regional governments, follow-up interviews, and, in some cases, through additional written or verbal requests for specific information.

Along with their responses to the questionnaire, some cities sent technical reports on their sewage facilities and on the receiving water quality; some of these documents proved very helpful. Other scientific papers and publications were also used.

The government body responsible for sewage treatment in each city was given an opportunity to identify inaccuracies in the data compiled. Many responded with corrections, comments and up-to-date figures if values had changed since the original questionnaire was returned. The environmental groups listed as sources of information for particular cities were also invited to inspect the information for accuracy and to comment on the draft evaluations. However, where errors or inaccuracies occur, these are the sole responsibility of the Sierra Legal Defence Fund.

Why Sewage Is A Problem

Sewage is not just made up of human excrement and water. It contains over 200 chemicals and other toxic pollutants which enter the sewer system from households, businesses and industrial operations. It also includes debris such as gravel, grit, tampons, condoms, rags and hair. In some sewerage systems, urban runoff is collected in the same pipes as domestic sewage, thus adding a new batch of harmful ingredients to the sewage soup. If not properly treated, this toxic waste material eventually finds its way into the surrounding environment – usually a body of water. However, adequate treatment will remove many of these toxic substances from sewage effluent and capture them in the sludge (solid waste left over after treatment of liquid waste).

When untreated or inadequately treated sewage is dumped or overflows into lakes, rivers and oceans, it contaminates our already fragile ecosystems, and can cause disease or death for many species. It also exerts a domino effect on the entire food chain. Some of the toxic pollutants accumulate in fish and other aquatic organisms. Sewage pollutes surface water and, in some cases, ground water. As contamination spreads and vital food, water, and other natural resources become increasingly toxic, humans, too, feel the impact of this ecological imbalance.

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How Sewage Is Measured

The three main components of sewage usually measured to assess its environmental impact are: 1) the quantity of total suspended solids present; 2) the amount of oxygen used up by bacteria which decompose organic material found in sewage (referred to as biological oxygen demand or BOD); and 3) the levels of faecal coliform bacteria. These are known as "conventional" pollutants and are unavoidable when processing human waste in a municipal sewerage system.

Suspended solids are particles of matter which float in the liquid sewage. These solids, when present in significant amounts, can prevent sufficient sunlight from reaching underwater plant life, greatly reducing growth and productivity. When algae growth is inhibited, for example, a food shortage can develop for organisms higher up the food chain, upsetting the delicate balance of the entire ecosystem. Suspended solids in flowing waters can cause abrasions on the gills of fish and exposed membranes of other aquatic organisms. And when these solids eventually settle on the river, lake or sea bed, they smother bottom-dwelling organisms and create oxygen-deficient conditions. Toxic pollutants found in sewage effluent bind to sinking particles and make the bottom uninhabitable for many species of organisms that are normally found in that environment.

Since suspended solids partially consist of organic material, they contribute to an increase in the *biological oxygen demand* (BOD) of sewage effluent. When sewage is dumped into a river or harbour, the dissolved oxygen in the water column is depleted as a result of the biological activity involved in breaking down organic material by bacteria in the sewage. The more organic material dumped into these waters, the more oxygen is used up, and the less chance these environments have of recovering, even after the discharge of pollutants is terminated. When the dissolved oxygen reaches very low levels, aquatic organisms die.

Among the various types of organisms found in sewage are the disease-causing organisms or pathogens. *Faecal coliform*, a type of bacteria found in the intestinal tracts of warm-blooded mammals, is measured as a sign of the extent of sewage contamination. Faecal coliform itself is not hazardous to humans; however, it provides an indication of the amount of faecal matter present, which may be contaminated with other pathogens, such as hepatitis B, cholera, and typhoid. When high levels of faecal coliform are present, swimming and other recreational uses of water are prohibited. An acceptable level of faecal coliform is approximately 200 organisms per 100 millilitre. Higher concentrations pose a health hazard to humans coming into direct contact with the water.

Filter-feeding bivalve shellfish such as oysters, clams, and mussels tend to accumulate sewage bacteria in their tissue. Eating contaminated bivalves is known to cause illness in humans. Contamination from sewage discharges have caused many Canadian shellfish industries, such as those near Saint John, to close. An extensive area of the coast around Victoria has also been closed indefinitely to commercial harvesting of clams, mussels, and free-swimming pink and spiny scallops because of high levels of faecal coliform.

PHOTO: PERRY ZAVITZ

Miranda Holmes, the author of this report, stands on a contaminated beach at Belcarra Regional Park in Port Moody, B.C. where shellfish harvesting is closed due to high levels of faecal coliform.

Other Contaminants

If sewage were only a mixture of human waste and conventional pollutants, our treatment problems could be easily solved. However, in addition to, and in many ways far more worrying than the conventional pollutants analysed to judge water contamination, are the numerous toxic substances found in sewage effluent. These include – but are by no means limited to – mercury, lead, phenols and chlorinated organics from domestic and industrial sewage discharges, and hydrocarbons and pesticide residues in stormwater runoff.

In 1997, Environment Canada and the Quebec Ministry of Environment and Wildlife analysed the winter effluent from a representative sample of 15 sewage treatment plants in the province. Although results varied according to the level of industrial discharge into the sewerage system, nearly a third of effluents were deemed to be acutely toxic. All effluents revealed some level of chronic toxicity, with one, unnamed facility producing effluent so chronically toxic that it poses a threat to aquatic fauna regardless of the receiving environment. Chromium and copper content frequently exceeded limits for water quality. Whenever used, ultra trace analyses detected polychlorinated biphenyls (PCBs), polycyclic aromatic hydrocarbons (PAHs), dioxins, and furans. These substances are of major concern for a number of reasons. Most disturbingly, many do not break down and *persist* in the environment for a very long time.

In a 1997 Environment Canada analyses, a third of the sewage treatment plants polled had effluents that were deemed to be acutely toxic.

Some heavy metals and synthetic chemicals accumulate in organisms and are passed on up the food chain to predator species. Concentration of toxic substances increases with each successive level of the food chain. This process, known as *biomagnification* or *bioaccumulation*, is one of the ways through which contaminants in sewage effluent can reach and affect humans. For example, the plankton eaten by a fish may carry minute amounts of mercury, which accumulates as it binds to the fat tissues of the fish and as the fish eats more plankton. By the time that fish is caught and consumed by a human, the mercury level in that fish could be hundreds of thousands or millions of times higher than the mercury level in the plankton. High concentrations of mercury affect the brain functions in humans and can result in death.

Organic compounds such as PAHs, deposited on streets by automobiles and washed into the sewerage system by rainfall, also biomagnify. The presence of PAHs has been linked to liver lesions and cancer in fish. As pollution increases from PAHs and other persistent organic pollutants known to be toxic to aquatic organisms and, ultimately, to humans, more and more ecological communities will be affected, and the overall imbalance amongst the species on which we rely for food will also grow.

Since the 1994 *National Sewage Report Card* was published, there has been a great deal of scientific research which indicates that all the toxic substances listed above, and many others, are capable of disrupting the *endocrine system* of fish, birds, reptiles, amphibians and mammals. The endocrine system is responsible for many functions, including growth, development, reproduction, and the immune system. Natural hormones, such as oestrogen, testosterone and adrenaline play a pivotal role in the functioning of the endocrine system. We now know that some synthetic chemicals are capable of mimicking these natural hormones – particularly oestrogen, which is crucial to both male and female development – and permanently altering that development. These chemicals can cross the placenta and begin to cause harm from the moment of conception. (For more detailed information, see the Endocrine Disruption 101 section.)

Many heavy metals and synthetic organic compounds are not removed by conventional sewage treatment methods. These substances either bond with the suspended solids and then sink to become contaminated sludge, or are poured out into the receiving water where they can accumulate and affect surrounding environs in a number of ways. The concentration of these toxic substances in sewage effluent can be reduced through source control, i.e. limiting what industrial and domestic contributors can put into the regular sewage system.

Bypasses and Overflows

Although effluent from treatment plants is the primary source of the toxic pollutants listed above, it is not the only source of sewage contamination. Overflows and bypasses from sewage systems are also a hazard, resulting in the release of raw, untreated sewage into the natural environment. These types of discharges are not often acknowledged as a significant source of sewage, but, in some cities, they occur regularly and can contain high levels of toxic pollutants.

Bypasses are used when a treatment facility is overloaded. Instead of allowing sewage to back up into basements and onto streets, the flow is deliberately redirected and discharged without treatment. Bypasses are occasionally used during maintenance activities when the treatment plant is temporarily out of operation.

Another type of overflow of considerable concern in some areas is the *combined sewer overflow*. A combined sewer system is one that conveys both domestic sewage, stormwater and urban runoff in the same pipe (see Figure 1). Combined sewer systems are generally found in older cities and were built at a time when the cost of laying pipe big enough to deal with both domestic sewage and stormwater seemed exorbitant, and the main substance washed by rainfall from the streets and into the sewerage system was horse excre-

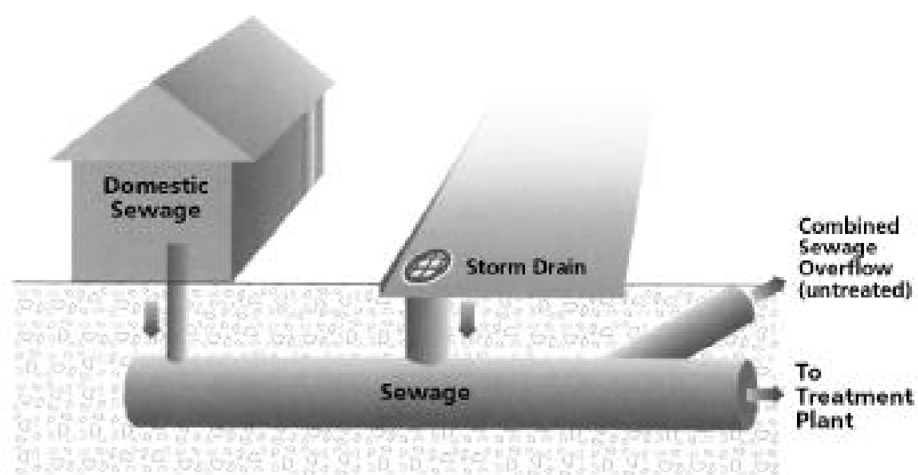


Figure 1 *Combined sewer systems carry both domestic sewage and runoff in one pipe to the treatment plant. When the flow is too large, excess is diverted through an overflow pipe and discharged untreated straight into a nearby body of water.*

ment. During heavy rainfalls, the sewer pipes fill up and can no longer accommodate the volume of sewage flow. In that case, overflow pipes take the excess flow from the main sewer directly to a nearby body of water.

Combined sewer overflows now spew a toxic mix of urban runoff, waste from households, and commercial and industrial contaminants into the environment without any treatment whatsoever. These overflows are a major source of the total volume of untreated wastewater discharged from our cities into surrounding waters. In Vancouver, Toronto, Edmonton, Winnipeg, Hamilton and Ottawa, where considerable portions of the sewerage systems are combined, overflows total nearly 60 billion litres per year. Of the 21 cities evaluated in this report, only three claim that overflows of raw sewage do not occur.

Separate Problems

Although combined sewer systems bring with them the problems of overflows, the alternative of separate sewers for stormwater runoff and domestic sewage can also have significant adverse effects. In this type of system, stormwater and urban runoff are not usually treated at all but run straight into the receiving water, even when the domestic system is not overloaded and could treat this discharge. As a result, heavy metals and toxic synthetic chemicals that collect in storm drains are constantly being discharged raw.

Sewage effluent is a significant cause of water pollution in Canada. Investments in new technologies and more advanced systems are urgently needed to ensure continued human health and environmental stability.

Solid Problems

Sludge is the solid waste left over after sewage is treated and effluent is discharged. It is a basic fact of civil engineering that the higher the level of treatment given to the effluent, the greater the volume of the sludge created and the greater the amount of heavy metals and other toxic pollutants transferred from the effluent to the sludge. Thus, relatively little and relatively clean sludge is created by primary treatment and, without effectively enforced and stringent source control measures, very large amounts of very contaminated sludge can be created as a result of tertiary treatment. (See the Sludge Happens section.)

Endocrine Disruption 101

Synthetic chemicals released into the environment are capable of mimicking natural hormones and severely disrupting the endocrine system in wildlife.

Since the first *National Sewage Report Card* was published in 1994, hundreds of scientific studies have been released which support the theory that some synthetic chemicals released into the environment are capable of disrupting the endocrine system in fish, reptiles, amphibians, birds and mammals.

The exquisitely evolved endocrine system is responsible for many functions, including growth, development, reproduction, and the immune system. Natural hormones, such as oestrogen, testosterone and adrenaline play pivotal roles.

We now know that some synthetic chemicals are capable of mimicking natural hormones (particularly oestrogen which is crucial to both male and female development) and permanently altering that development. These chemicals can cross the placenta and begin to cause harm from the moment of conception. Many chemicals known or suspected of disrupting the endocrine system are ingredients in pesticides and detergents, along with organochlorines such as dioxins, furans and PCBs, heavy metals, and products of incomplete combustion such as hydrocarbons. (See list below for more details.)

Although there are myriad ways for humans to be affected by endocrine disrupting chemicals, for the purpose of this report we will look at the impacts these substances – discharged by industries and in sewage effluent – are having on aquatic life.

UK research has revealed that many synthetic chemicals commonly found in the effluent of sewage treatment plants cause gender confusion in fish – in some rivers 100% of roach fish had both male and female sex organs. When caged rainbow trout were placed in effluent from sewage plants, after only one week's exposure, the male trout began producing vitellogenin, an egg protein only females should produce. Amongst the chemicals identified as a cause of this phenomenon were nonylphenols, substances widely used in plastics, pesticides, many industrial and domestic detergents, and some shampoos and other personal care products.

Recently published Department of Fisheries and Oceans research in New Brunswick indicates that juvenile salmon which come into contact with nonylphenols during the crucial transformation from fresh to saltwater simply do not make it. (Although the nonylphenol exposure in question was in a pesticide used for budworm spraying, the researcher points out that similar or higher levels of nonylphenols can be found in the effluent from most sewage treatment plants.) Other studies suggest that nonylphenol contamination can kill juvenile salmon within a few days.

No level of treatment will make endocrine disrupting chemicals disappear once they have been released into the sewage system. Either they will be discharged directly into a river, lake or ocean in inadequately treated effluent or they will be captured in the sludge. Ultimately, the only way to protect future generations of fish, birds, reptiles, amphibians and mammals from the harm caused by these substances is for governments to legislate the elimination of endocrine disrupting chemicals from industrial processes and from discharge into our environment and our bodies.

PHOTO: BELTRA/GREENPEACE

Between 1969 and 1984 levels of PCBs in polar bears quadrupled. At the current rate of increase, by the year 2005 a polar bear corpse will have to be treated as hazardous waste.

How Toxic Sewage Is Affecting Us

A considerable amount is known about the health implications for mammals that eat fish and other organisms contaminated with endocrine disrupting chemicals.

- An 11-year study of children in the Great Lakes region whose mothers ate two to three PCB-contaminated fish meals a month during pregnancy reveals that the most highly exposed children were more than three times as likely to have low full-scale IQ, low verbal comprehension, be highly distractible, and be twice as likely to be behind at least two years in reading comprehension. Pollution exposures were associated with lower general intellectual ability, worse short-term and long-term memory, and decreases of focused and sustained attention. Most of these findings have been replicated in other studies.
- In the Arctic, thousands of miles from any industry, Inuit women whose diet is primarily harvested from the sea produce breast milk with the highest levels of PCBs, DDT and other contaminants on the planet.
- Beluga whales in the St. Lawrence are so contaminated with organochlorine pollutants that their bodies must by law be treated as hazardous waste. They suffer from tumours, ulcers, skeletal disorders, widespread viral and other problems, including an alarming inability to reproduce, which is pushing them towards extinction.
- Between 1969 and 1984 levels of PCBs in polar bears quadrupled. At the current rate of increase, by the year 2005 the average polar bear will have 50 parts per million of PCBs in its fatty tissue, at which point their corpses will have to be treated as hazardous waste. In 1998, scientists in Norway found a statistically significant number of hermaphrodite polar bear cubs, and there is concern that this phenomenon is the result of PCB contamination.
- In the late 1980s an estimated 40% of northern Europe's harbour seal population was killed by a distemper virus. Dutch research revealed that PCB and dioxin contamination had damaged the seals' immune systems to the point where they were unable to fight off the disease.

Safe Shopping

Households are responsible for a surprising amount of the endocrine disrupting chemicals found in our aquatic ecosystems

Individually and collectively, we can all make decisions which will lessen the contaminants going into the sewage system and improve the quality of effluent and sludge. Whether it's adding chlorine bleach to our laundry, using turpentine to clean paint brushes in the kitchen sink, dropping clothes off at the dry-cleaners or letting that last bit of motor oil drop on the drive, the things we do have an impact.

PHOTO: GREENPEACE

Nothing that goes down our sinks or toilets or into storm drains magically disappears. Depending on the level of treatment at our local sewage plant, contaminants will either be discharged directly into a body of water or captured in the process and stored in the effluent. What goes around comes around. Those same contaminants may reappear in the water we drink, accumulated in the tissue of the fish and shellfish we eat, or captured in the sludge which many municipalities are giving away to farmers.

Households are responsible for a surprising amount of the endocrine disrupting chemicals found in our aquatic ecosystems. For example, nonylphenols and other members of that chemical family are a common sudsing agent in domestic detergents, dish washing soaps and shampoos. Unfortunately, household cleaning products seldom list all ingredients. Sudsing agents, known as surfactants, are often identified by generic terms such as “non-ionic surfactant” or “cleaning agent”, which is not much help. Without contacting the manufacturer, it is difficult to know which laundry and cleaning products contain these substances. There is currently no legislation to guarantee full disclosure of formulas on product labels.

It is easier with hair colourings, conditioners, shampoos and styling aids, as these generally do list all ingredients. Although the lists are sometimes long and filled with tongue-twisting names, if it says octoxynol or nonoxynol, the product contains an endocrine disrupting chemical. (A number of Salon Selectives and Jhirmack hair products have been found to contain these chemicals, as does Liquid Ivory Soap, Gillette Foamy Shaving Cream and most spermicidal jellies and creams.)

Pesticides pose another problem for concerned shoppers. It is impossible to know exactly what’s in the formula as this is currently protected as a trade secret. However, two of the pesticides most commonly sold in Canada do contain endocrine disrupting chemicals. Weed’N’Feed (among many others) contains 2,4-D; and Weedex A is one commercially available pesticide containing atrazine. Aside from the damage herbicides, insecticides and fungicides can do to aquatic ecosystems if residues are washed into storm drains, they also pose a threat to children, pets and numerous non-target species which actually control problems naturally.

Two of the pesticides most commonly sold in Canada contain endocrine disrupting chemicals: Weed’N’Feed contains 2,4-D; and Weedex A contains atrazine. When these chemicals wash into storm drains they can cause damage to aquatic ecosystems.

Solvents are another thing we don’t always think about before we use. These chemicals, used in dry cleaning and commonly found in home workshops and hobby rooms, are extremely toxic and their use should be avoided wherever possible.

An excellent source of information about the hazards of household cleaning products, pesticides and solvents (and the least toxic alternatives to each) is the *Household De-Tox* section of Georgia Strait Alliance’s web page. A series of informative fact sheets can be downloaded at http://onenw.org/~gsa/detoxfactsheets.html.

Some basic rules to remember about making our sewage safer:

- Never pour toxic waste down the sink, toilet or storm drains.
- Replace the toxic cleaning products under your kitchen sink with safer alternatives.
- Avoid toxic synthetic pesticides and weed killers.
- Buy clothes which do not require dry cleaning. Treat clothing stains at home with natural products. Find a clothes cleaner who does non-solvent cleaning.
- Use only water based paints to minimise toxic emissions and allow clean up with water. Give unused paint to friends or charities.
- Leave your car – a major source of PAHs – at home whenever possible.
- Buy only recycled motor oil and use every drop. Return container to service station for recycling.
- Use every drop of solvents, anti-freeze, brake fluid and transmission fluid. Make sure containers are safely disposed of at a household hazardous waste facility.

For more information about the Georgia Strait Alliance Household De-Tox Project
call (250) 753-3459 or e-mail gsa@island.net
or write to 195 Commercial Street, Nanaimo, B.C. V9R 5G5

Chemicals Considered To Have Reproductive And Endocrine Disruptive Effects

No level of treatment will make endocrine disrupting chemicals disappear once they have been released into the sewage system. Ultimately, the only way to protect future generations is for the elimination of endocrine disrupting chemicals from industrial processes and discharge.

HEAVY METALS

Cadmium (50% of production used for nickel/cadmium batteries, remainder used for coatings, pigments and stabilisers in plastics, alloys; found in fossil fuels and emitted during combustion)
Lead (lead batteries, paints, pipes, under-sealing of cars, leaded crystal, fishing sinkers and shotgun shot)
Mercury (used in some production of chlorine, nickel/cadmium batteries

PESTICIDES (Commercial and/or domestic)

Fungicides: benomyl, hexachlorobenzene, mancozeb, maneb, metiram-complex, tributyltin, vinclozilin, zineb, ziram
Herbicides: 2,4-D, 2,4,5-T, alachlor, amitrole, atrazine, metribuzin, nitrofen, trifluralin
Insecticides and nematocides: aldicarb, beta-HCH, carbaryl, chlordane, cypermethrin, DBCP, DDT/DDE/DDD, dicofol, dieldrin, endosulfan, esfenvalerate, ethyl parathion, fenvalerate, heptachlor and h-epoxide, Kelthane, lindane, malathion, methomyl, methoxychlor, mirex, oxychlordane, parathion, permethrin and other synthetic pyrethroids, toxaphene, transnonachlor.

PERSISTENT ORGANOCHLORINES

Dioxins and furans (unwanted by-products of the manufacture and industrial uses of chlorine, such as production of PVC plastic and chlorine-bleached paper, and the incineration of chlorine contaminated waste, including sewage sludge)
Polychlorinated biphenyls or PCBs (widely used for decades in electrical transformers, cosmetics, varnishes, inks, carbonless copy paper, pesticides and for general weatherproofing and fire resistant coatings for wood and plastic; production banned in many countries, continues in Russia)
Hexachlorobenzene or HCB (by-product of processes involving organochlorines or elemental chlorine, e.g. manufacture of pentachlorophenol, vinyl chloride and tetrachloroethylene, and incineration of chlorinated wastes; known or suspected by-product in the manufacture of 20 pesticides, including atrazine and simazine)
Octachlorostyrene (formed under similar circumstances as HCB and dioxins and furans)
Pentachlorophenol (fungicide extensively used on textiles and as a wood preservative)

PLASTICS INGREDIENTS & SURFACTANTS

Bisphenol A (a breakdown product of polycarbonate plastic, which is used to line food cans, as well as dental fillings and plastics used to coat children's teeth - shown to leach out of all uses)
Phthalates/Polycarbons/Styrenes (used to make plastic soft and/or flexible);
Penta- to Nonylphenols (used in detergents, shampoos and other personal care products, the pulp and paper and textile industries, some plastic products, paints, pesticides, herbicides and spermicides).

AROMATIC HYDROCARBONS:

Polycyclic aromatic hydrocarbons or PAHs (products of incomplete combustion of fossil fuels).

(Source: World Wildlife Fund)

Types of Treatment

Conventional sewage treatment is generally considered to include three basic levels. A city may treat its sewage to the first level of purification, to the highest, or none at all. Each treatment level can be achieved by a number of different processes. The following sections provide general descriptions of each level of sewage treatment and some commonly used methods.

Halifax and St. John's, NFLD discharge their sewage with no treatment whatsoever. Half of sewage the discharges in Saint John, NB receive no treatment.

Preliminary Treatment

In *preliminary treatment*, also referred to as pre-treatment, grit and solid material are screened out before sewage receives further treatment or is released into the environment. Although a series of screens can provide fairly thorough removal of larger debris, preliminary treatment is usually no more than a process which makes sewage effluent less offensive to the eye, without significantly reducing the level of suspended solids, biological oxygen demand (BOD), toxic pollutants, or bacteria. When sewage is said to be 'treated', it has usually undergone at least a settling process to remove some solids and BOD. However, sewage that has merely been screened still represents a serious environmental and health hazard and therefore should not be considered treated.

Victoria and Dawson City use only preliminary treatment before discharging their sewage.

Preliminary treatment merely screens unsightly garbage from the effluent.

Primary treatment

Primary treatment is usually defined as a physical process in which the sewage flow is slowed down and the solids are separated from the liquids. A large portion of the suspended solids settles naturally due to gravitation. This thicker part of the wastewater – the sludge – is then removed from the bottom and disposed of in a variety of ways. Floatable solids, oil, and grease are usually skimmed off the surface of the wastewater, which is then discharged into the receiving environment.

Settling tanks are commonly used for the primary stage of sewage treatment. Lagoons (constructed or naturally occurring holding ponds) also provide effective sedimentation conditions and, in some cases, meet secondary treatment standards. For smaller cities with the space necessary for lagoons, this is a popular method of sewage treatment.

Conventional primary treatment generally removes 25-40% of BOD and 40-60% of total suspended solids. So-called Enhanced Primary Treatment uses chemicals to accelerate sedimentation, reducing these two contaminants by about 50% and 90% respectively. The settling process reduces faecal coliform levels by 45-55%.

Charlottetown and Vancouver's largest sewage facilities use primary sewage treatment only. Montreal has physico-chemical (chemically-aided) primary treatment, which provides slightly higher than primary-level removal of BOD and suspended solids, as well as phosphate removal.

Primary treatment: solids are separated from liquids in a settling tank.

Secondary treatment

Air-activated sludge lowers the disolved oxygen content and faecal coliform levels.

Secondary treatment is the step following primary treatment. Also known as biological treatment, it further reduces the amount of solids by fostering the consumption of organic material by organisms in the wastewater. The fundamental process involved at the secondary level is biological oxidation. In this process, oxygen is provided to aid micro-organisms in breaking down organic matter, considerably reducing the suspended solids and BOD.

Oxygen is a critical component of this treatment stage. Because high oxygen demand in sewage poses a serious threat to the aquatic environment, the degradation of organic material *before* discharge reduces the toxicity of the effluent. If oxygen is not available when organic material begins to break down, anaerobic (non-oxygen requiring) processes of decay will produce compounds such as methane, hydrogen sulphide, and ammonia which are toxic to aquatic biota.

Air-activated sludge and biological filters are just two of the many ways in which sewage can be exposed to biological processes. *Air-activated sludge* is a treatment method whereby air is blown through the sewage (aeration) as it sits in a sedimentation tank. As a community of numerous types of micro-organisms develops, the organic material is consumed and the clearer liquid is periodically decanted off and fresh sewage allowed into the tank. As this process continues and the settled sludge mixes with newer sewage, organisms build up and gradually a culture develops, capable of oxidising organic material in the sewage within 4-8 hours. At this point the sludge is considered activated. After mixing and aeration, the sludge is transferred into a final settling tank where the clarified liquid is removed for discharge and the activated sludge is settled out and either removed for further treatment and disposal or returned to the first tank for re-use in the activation stage (see Figure 2).

Biological filters are made up of layers of stones, gravel and sand, and depend on biological processes similar to those of the activated sludge method. Organisms living on the

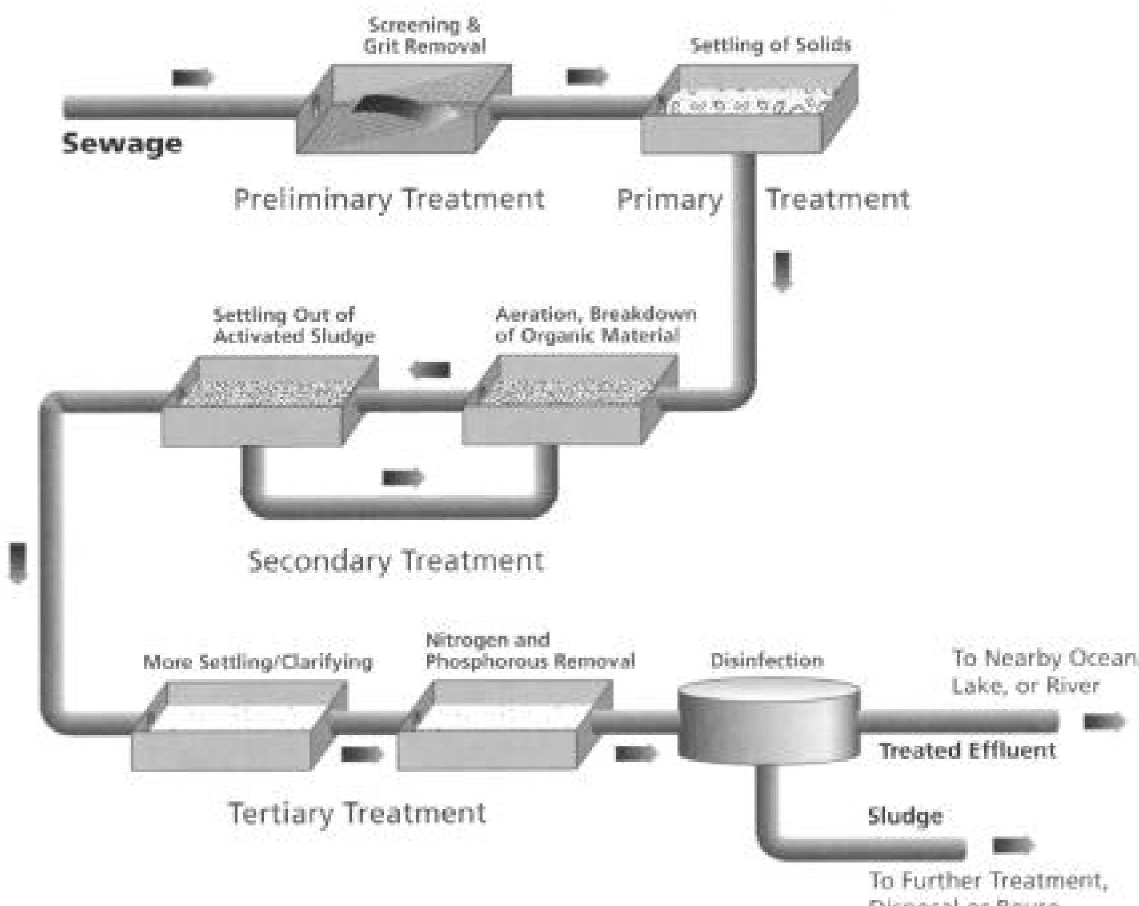


Figure 2 *Illustration of the steps involved in conventional sewage treatment. This system uses activated sludge as the method of secondary treatment. Not all steps of the treatment process are followed at every treatment facility.*

surfaces of the rocks and stones break down the sewage as it flows through the layers. Although activated sludge usually achieves lower levels of suspended solids than biological filters and further reduces BOD, it does not remove as much nitrogen, nor does it have as large a range of organisms which work to break down organic material. The activated sludge method is less expensive and requires less space than filters, and so is generally more popular.

Secondary treatments such as biological filters use a range of organisms to break down organic material and remove nitrogen.

Because of the increased quantity of solids removed in secondary treatment, considerably more sludge is produced than in primary treatment processes. Sludge is sometimes simply discharged into the aquatic environment after treatment, as is the liquid effluent. It may also be incinerated, removed to landfills, or – depending on its level of toxicity – deposited on fields as a soil conditioner. If heavy metals and persistent toxic substances are prevented from entering the sewerage system, sludge can be a very useful resource, rather than yet another source of pollution, although the topic of sludge disposal continues to raise a host of environmental issues.

Secondary treatment provides an 85-90% reduction in BOD and suspended solids, and removes 90-99% of coliform bacteria. If these conventional pollutants were the only environmental problem present in sewage effluent discharges, secondary treatment could be deemed adequate.

The cities of Toronto, Edmonton and Brandon are among several cities evaluated in this report that treat their sewage to the secondary level.

Tertiary Treatment

Tertiary treatment is similar to, but more thorough than, secondary treatment. This stage involves secondary-level treatment processes to achieve advanced reductions of suspended solids and BOD. Substances such as nitrogen, phosphorus and ammonia may also be removed during tertiary treatment. The particular technologies used in tertiary treatment depend on specific characteristics of the sewage. For example, additional clarifiers such as micro-strainers or sand filters can further remove suspended solids and reduce BOD. Some advanced forms of filtration can remove some metals, chemicals and other types of contaminants.

Nitrogen and phosphorus removal can be an additional component of the treatment process at the secondary or tertiary level. Both of these nutrients are essential to plants, but, in excess, can cause undesirable plant growth such as algae blooms. Ammonia is a compound of nitrogen that imposes an additional oxygen demand and is also very toxic to fish and other aquatic organisms. Both nitrogen and phosphorus can be removed from wastewater by biological and/or chemical processes. Governments set permissible levels of nitrogen and phosphorus according to the characteristics of the receiving environment and the sources of wastewater.

Calgary is an example of a large municipality which treats its sewage to the tertiary level using activated sludge accompanied by clarifiers, digesters, and phosphorus removal.

Although methods exist for the treatment and removal of toxic compounds, the complex nature of the substances involved make it necessary to consider the specific characteristics of the wastewater. Methods which can be used include activated carbon and chemical oxidation. It is also possible, although very expensive, to remove dissolved inorganic substances using chemical precipitation, ion exchange, ultra-filtration, reverse osmosis or electrodialysis.

Few Canadian communities currently use tertiary treatment, but as populations increase and, with them, demands on the natural environment, this higher level of treatment will by necessity become more widely practised. Calgary is an example of a large municipality which treats its sewage to the tertiary level using activated sludge accompanied by clarifiers, digesters, and phosphorus removal. Edmonton is now at 30% tertiary treatment and plans to reach 100% by 2005.

Disinfection

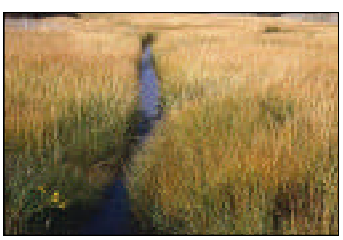
Chlorination of sewage to kill disease-causing micro-organisms is highly toxic to aquatic organisms. UV disinfection is an alternative which uses the energy of light to kill micro-organisms and does not have a negative impact on aquatic organisms.

Disinfection helps eliminate many different types of disease-causing micro-organisms (pathogens) in sewage, and makes water safe for recreational activities. It can be a step in any treatment process.

Chlorination is the most common disinfection method used. Chlorine is effective in killing bacteria and micro-organisms, such as faecal coliform. It is not, however, completely effective in destroying viruses and other parasites which can harm humans. Chlorine is also highly toxic to aquatic organisms, even in small amounts. In recognition of this fact, Environment Canada in 1989 listed chlorinated wastewater effluents on the first Priority Substances List compiled under section 12 of the *Canadian Environmental Protection Act.* In 1994, it was officially designated as "toxic". Despite this, many Canadian cities, including Toronto, Hamilton, Saskatoon, Ottawa, Charlottetown and Saint John continue to disinfect their effluent with chlorine. These cities alone discharge nearly 744 billion litres of chlorinated wastewater effluent into our lakes, rivers and oceans every year. Even after a commonly used process of de-chlorination (which itself involves highly toxic chemicals), organic compounds related to chlorine can form and aquatic life can be affected by long-term exposure to these toxic pollutants. Disinfection by ultraviolet rays is an alternative to chlorination. This process uses the energy of light to deactivate pathogenic organisms. UV disinfection does not have a negative impact on the aquatic environment. It does, however, require adequate lighting, a considerable amount of space and relatively clear effluent in order to be effective. These factors, combined with the added complication that the process works less effectively when flow rates are variable, make this method more expensive than chlorination. Calgary, Regina, Fredericton and Whitehorse are Canadian cities currently using UV disinfection.

Effluent becomes 'disinfected' naturally as micro-organisms die off in the receiving environment and the organic matter decays. However, the huge volumes of sewage discharged by larger communities prevent natural disinfection from occurring rapidly enough to allow for swimming and other forms of recreation.

Alternative technologies



Wetlands treatment: a high quality and environmentally sound alternative to conventional treatment.

An innovative and environmentally sound alternative to conventional tertiary treatment is the use of *wetlands*. Wetlands are capable of providing a very high level of sewage treatment. Micro-organisms, plants and insects that inhabit marsh environments work to purify the sewage flowing through them. Disinfection occurs naturally as harmful bacteria die off in the wetland environment. To avoid contamination of natural wetlands many North American communities are constructing wetlands to reproduce the natural biological processes of marshes in a treatment facility.

The constructed wetland concept can be taken a step further and compacted into a series of greenhouses in a system known as *Solar Aquatics*. The sewage effluent moves through a series of tanks while plants, butterflies and other bugs go to work on it. The result is drinking-quality water which can be reintroduced into natural aquifers. This "sewage plant" can also be an invaluable science lab for universities and colleges. Alternatively, the greenhouses can be used to grow orchids or other non-food crops, thereby generating employment opportunities and income.

'Excremental' Progress At A Glance

	1994 Grade	+/-	**1999 Grade**	Comments
Victoria	F	**–**	**F-**	No change (preliminary screening, no treatment)
Vancouver	D-	**+**	**C-**	Two plants upgraded from primary to secondary treatment
Edmonton	B-	**+**	**B+**	30% upgrade from secondary to tertiary, switch to UV disinfection
Calgary	A-	**+**	**A**	100% UV disinfection added to 100% tertiary treatment
Regina	C+	**+**	**B**	Switch from chlorine to UV disinfection
Saskatoon	D	**+**	**C+**	Upgrade from primary to secondary treatment
Brandon	C	**–**	**D**	No discernible improvement despite $$ spent
Winnipeg	C-	**–**	**C**	Switching from chlorine to UV disinfection
Hamilton	C+	**–**	**C-**	No discernible improvement in quality of treatment
Toronto	B-	**–/+**	**C/B***	No discernible progress/good plans formalised
Ottawa	B	**–**	**C**	No discernible improvement in treatment
Montreal	F/C	**–**	**F+**	100% of population now connected, no progress on treatment
Quebec City	C		**C**	Combined sewer overflow events reduced
Saint John	D-	**–**	**E**	No discernible improvement in treatment
Fredericton	C	**+**	**B**	Switch from chlorine to UV disinfection
Charlottetown	D-	**–**	**E**	No discernible improvement in treatment
Halifax	F	**+**	**E-/C***	No discernible progress/good plans formalised
St. John's	F	**–**	**F-**	No change (no treatment)
Yellowknife	B-	**+**	**B+**	30% reduction in volume
Whitehorse	D	**+**	**B-**	From 2% secondary treatment in 1994 to 100% in 1999
Dawson	N/A	N/A	**F-**	No change (preliminary screening, no treatment)

1999 GRADE:

F-

1994 GRADE: F

FOR MORE INFORMATION CONTACT

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United Fishermen and Allied Workers' Union

#130 - 111 Victoria Drive,
Vancouver, B.C. V5l 4C4

Tel: (604) 255-1336

E-mail:
bucksuzuki@ufawu.org

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Georgia Strait Alliance

195 Commercial Street
Nanaimo, B.C. V9R 5G5

Tel: 250-753-3459

Email: gsa@island.net
Web site: onenw.org/~gsa

TO VOICE YOUR CONCERNS CONTACT

•

Geoff Young, Chairperson, CRD

PO Box 1000,
524 Yates Street
Victoria, B.C. V8W 2S6

Tel: (250) 360-3125

Raw Sewage Discharged:

45 billion litres
100% of total flow

Victoria

(Victoria Metropolitan Area of the Capital Regional District - CRD)

Population: Approximately 322,000

Population served by sewage treatment plant: Nearly 100%

Volume generated: Approximately 45 billion litres

Treatment: Virtually none at two largest outfalls (Macaulay Point and Clover Point), which offer preliminary screening of solids larger than 6mm prior to discharge. Maliview has primary treatment. Central Saanich, Bazan Bay, Magic Lake, Buck Lake and Port Renfrew have secondary treatment.

Receiving Water: Strait of Juan de Fuca

Permits: Permits issued under the BC *Waste Management Act*. Macaulay Point and Clover Point are almost in compliance with daily discharge, BOD and faecal coliform requirements, but out of compliance with requirement to hold sufficient land in reserve for construction of sewage treatment facility. According to CRD documents, Central Saanich, Bazan Bay, Sidney, Maliview, Magic Lake, Buck Lake and Port Renfrew all exceed one or more permit requirements.

Overflows Annually: Some overflows and bypasses occur; an average of 200 to 300 million litres are discharged as overflows.

Toxicity Testing: None is required. (Previous testing indicates sewage is always toxic to fish.)

Sludge Disposal: Sludge is transported to a landfill; leachate is piped back into the sewer system.

Sewage-related charges: Yes. In February 1999, a private prosecution was laid by Sierra Legal Defence Fund (on behalf of the United Fishermen and Allied Workers' Union, Local 24) against the CRD for violation of the federal *Fisheries Act* and the BC *Waste Management Act*. The Attorneys General office has appointed an independent council who is attempting to take over the case. It may be dropped, as were previous sewage-related private prosecutions laid against the Greater Vancouver Regional District (GVRD).

Additional Facts: The CRD has just negotiated a deadline extension until July 2000 with the Ministry of Environment for delivery of a Liquid Waste Management Plan which was to include a schedule for upgrading the main outfalls to primary treatment by 2002 and to secondary by 2007-2008. In addition to the two main raw sewage outfalls at Macaulay and Clover Points, the CRD operates eight treatment plants (seven secondary and one primary) in other areas of the regional district. Upgrading to secondary treatment was to occur gradually and be done within a reasonable time frame. In 1991 the CRD was to at least upgrade to primary treatment (which they still do not have) in a “reasonable time-frame”, projected to be 15-20 years.

Changes Since 1994: None. The CRD has set no land aside for the construction of a sewage treatment facility nor does it appear to have any intention of doing so, even though it is required to so under the terms of its permit and has committed to this since 1986. The District continues to maintain there is no need for secondary treatment, and says it is examining other (cheaper and less effective) options. Numerous consultants have been commissioned to write reports supportive of this position. The CRD seems to believe the requirements of the federal and provincial governments can be satisfied by implementing some form of sewage treatment which, according to CRD chair Geoff Young, will carry them through to the future, to a time when they think they may need to upgrade further (i.e. to secondary). The time line for future upgrade has now been extended to the year 2020.

WHY THIS GRADE:

– all sewage is discharged raw
– a source control program implemented in 1995 has, according to CRD reports, resulted in no discernible improvement in quality of effluent
– effluent tests show it is toxic to fish
– although sewage effluent is discharged into a large body of water with strong currents and tidal movements, bacterial and metal pollution extends from one to two kilometres away from the Macaulay Point outfall; the two CRD outfalls are partially responsible for high faecal coliform levels that cause an extensive area to be closed to shellfish harvesting

1999 GRADE:

C-

1994 GRADE: D-

FOR MORE INFORMATION CONTACT

•:

United Fishermen and Allied Workers' Union

#130 - 111 Victoria Drive,
Vancouver, B.C. V5l 4C4

Tel: (604) 255-1336

E-mail:
bucksuzuki@ufawu.org

TO VOICE YOUR CONCERNS CONTACT

•:

Councillor George Puil, Chairperson,

Greater Vancouver Regional District

4330 Kingsway
Burnaby, B.C. V5H 4G8

Tel: (604) 432-6200

Raw Sewage Discharged:

24 billion litres from combined sewer overflows.

Vancouver

(Greater Vancouver Regional District - GVRD)

Population:	Approximately 1.8 million
Percentage of population served by sewage treatment plant(s):	100%
Volume generated:	416 billion litres
Treatment:	Three plants receive secondary treatment, two receive primary treatment; chlorine disinfection with de-chlorination year round at North Langley, May to October at Annacis, Lulu and Lions Gate; no disinfection at Iona.
Receiving Waters:	Fraser River, Georgia Strait and Burrard Inlet.
Permits:	Permits are issued by the Ministry of Environment, Lands and Parks, all plants are in compliance with their permits.
Combined Sewer %:	Approximately 20%
Overflows Annually:	Overflows occur about 140 times per year into Vancouver Harbour and the Fraser River, about 45 times into English Bay and False Creek.
Toxicity Testing:	Effluent is subjected to 96-hour LC50 tests by independent laboratories as a permit requirement. Primary effluent is almost always toxic to fish; secondary effluent from Annacis shows improved fish bioassay test results.
Sludge Disposal:	GVRD markets its sludge as the soil conditioner Nutrifor, for use on agricultural and range land, forests, reclaimed mines, landfills and highway margins. Sludge is tested for heavy metals as a measure for other pollutants and retreated if it exceeds permit
Sewage-related charges:	Yes. In 1993, a private prosecution was initiated by Sierra Legal Defence Fund (on behalf of Georgia Strait Alliance) against the GVRD for violations of the federal *Fisheries Act* related to combined sewer overflows. The charges were taken over by the BC Attorney General's office. Nearly two years and more than 20 adjournments later the province dropped the charges. In 1995, a private prosecution was initiated by SLDF (on behalf of the United Fishermen and Allied Workers' Union) against the GVRD for violations of both the *Fisheries Act* and the BC *Waste Management Act* related to discharges from the Annacis Island sewage treatment plant on the Fraser River. The charges were taken over and dropped by the BC Attorney General's office.

Additional Facts: Department of Fisheries and Oceans studies reveal that the impacts of discharge from the Iona sewage plant (the largest single source of municipal pollution in BC) are greater and extend further from outfall pipe than previously supposed. In one test, all fish placed 2.2km from the outfall died within 9 minutes. Despite this, the GVRD has no plans to upgrade to secondary treatment at Iona.

Changes Since 1994: The Annacis and Lulu Island plants have been upgraded to secondary treatment. Operational improvements have reduced combined sewer overflow discharge from 62 billion litres per year in 1993 to 24 billion litres in 1998.

WHY THIS GRADE:

+ the Annacis Island and Lulu Island plants have been upgraded to secondary treatment
+ CSO discharges have been reduced from 62 billion litres per year to 24 billion litres
– Although the Iona Island plant is the single biggest source of pollution in Georgia Strait, there are no plans to upgrade this or the Lion's Gate plant beyond primary treatment
– outfalls discharge large volumes of sewage effluent into fish bearing waters
– agricultural use of sludge while cumulative impacts still unknown

1999 GRADE:

B+

1994 GRADE: B-

FOR MORE INFORMATION CONTACT

•

Toxics Watch

10511 Saskatchewan Drive
Edmonton, Alberta
T6E 4S1

Tel: (780) 433-8711

E-mail: toxwatch@freenet.edmonton.ab.ca

TO VOICE YOUR CONCERNS CONTACT

•

Mayor Bill Smith

City Hall, 2nd Floor
1 Sir Winston Churchill Square
Edmonton, Alberta
T5J 2R7

Tel: (780) 496-8100

Raw Sewage Discharged:

2.42 billion litres

Edmonton

Population:	630,000
Percentage of population served by sewage treatment plant(s):	100%
Volume generated:	Approximately 100 billion litres per year
Treatment:	Secondary treatment with some biological nutrient removal (30%); UV disinfection
Receiving Water:	North Saskatchewan River
Permits:	Alberta Environmental Protection (AEP), operation permit held by the City of Edmonton. Effluent consistently meets standards.
Combined Sewer %:	16% (19 combined sewer overflow locations)
Overflows Annually:	Approximately 40 per year
Toxicity Testing:	No formal toxicity testing program for effluent. Sludge used in Nutri-Gold program is tested for heavy metals.
Sludge Disposal:	About 15,000 tonnes of sludge are applied free of charge to farmland in and around Edmonton under the Nutri-Gold program.
Sewage-related Charges:	None.

Additional Facts: A sewer use bylaw regulates non-hazardous industrial discharges, and wastewater is regularly sampled. Companies exceeding allowable limits must agree to bring wastewater into compliance. If constituents are treatable, but above the concentration of strong domestic wastewater, an over-strength surcharge fee is levied. Bylaw includes conventional and priority pollutants. Unannounced inspections occur at 2000 sites each year. In May 1999, more than 430 businesses were inspected in “Operation Clean Sweep”, an unannounced campaign to stop businesses discharging waste material into storm drains.

Changes Since 1994: Installation of UV disinfection, as well as biological nutrient removal in 30% of tanks. Entire system will be upgraded to tertiary by 2005. Authorities have developed a $120-140 million plan to increase the annual capture and treatment of wet weather flows in the sewer system from 56% to 86%; plan should be completed by 2020. A new co-composting facility due to open in 2000 will use sludge (including stockpiles) to produce a soil amendment product able to meet standards set by AEP and the U.S. Environmental Protection Agency.

WHY THIS GRADE:

+ switch from chlorine to UV disinfection
+ plans to upgrade to 100% tertiary treatment by 2005
+ sewer use by-law includes priority pollutants
+ conducts surprise inspections to combat dumping of toxic substances in storm drains
+ plan to increase capture of overflows from 56% to 86% by 2020
– combined sewer overflows still discharge raw sewage
– no toxicity testing program for effluent
– sludge is currently used on farmland, a practice which will continue with new co-composting facility despite unresolved questions about cumulative impacts

Calgary

Population: 819,127

Percentage of population served by sewage treatment plant(s): 100% served by two plants – Bonnybrook and Fish Creek

Volume generated: 169.22 billion litres per year

Treatment: 100% tertiary with ultraviolet (UV) disinfection

Receiving Water: Bow River

Permits: Approvals to Operate, issued by Alberta Environmental Protection (AEP), are held by the City of Calgary. Effluent consistently meets standards.

Combined Sewer %: None, both systems are completely separated

Overflows Annually: None.

Toxicity Testing: Sludge is regularly monitored for heavy metals and nutrient levels, and concentrations are always within AEP guidelines. (Toxicity testing of effluent will begin by 2001.)

Sludge Disposal: Sludge is treated with an anaerobic digestion process, then pumped to storage lagoons for gravity settling, thickening and additional biological treatment. In summer, sludge is transported to farmlands to be injected under soil surface to grow crops such as alfalfa, canola, oats, barley and wheat (use for root crops, vegetable or fruit crops, or dairy pasture is not permitted). This service is carried out by Calgro, a City of Calgary venture.

Sewage-related Charges: None.

Additional Facts: AEP's current effluent limits for sewage treatment plant effluents, discharging into a flowing river, are the most stringent in North America. The City's industrial inspectors and bylaws enforcement officers sample and analyse industrial effluents to ensure the compliance. Violators are heavily fined.

Changes Since 1994: UV disinfection is now used at both treatment plants. Replacement of chemical phosphorus and nitrogen removal with biological removal completed at Bonnybrook, the largest plant, in 1998.

WHY THIS GRADE:

+ 100% of sewage flow receives tertiary treatment
+ 100% of effluent is disinfected with UV
+ facilities are in compliance with permits
+ there are no combined sewer overflows or releases of untreated sewage
+ biological phosphorus and nitrogen removal in sludge aeration tanks at Bonnybrook Plant

– sewer use by law regulates discharge of many toxic substances, but levels exceed guidelines for discharge into fish bearing waters set by Canadian Council of Resource and Environment Ministers

1999 GRADE:

A

1994 GRADE: A-

FOR MORE INFORMATION CONTACT

•

Calgary Ecocenter

PO Box 61171,
Kensington Postal Outlet
Calgary, Alberta T2N 4S6

Tel: (403) 277-5085

Email:
bordent@cadvision.com

TO VOICE YOUR CONCERNS CONTACT

•

Mayor Al Duerr

PO Box 2100, Station M
Calgary, Alberta T2P 2M5

Tel: (403) 268-5622

Raw Sewage Discharged:

None

1999 GRADE:

B

1994 GRADE: C+

FOR MORE INFORMATION CONTACT

•

Saskatchewan Environmental Society

P.O. Box 1372
Saskatoon, Saskatchewan
S7K 3N9

Tel: (306) 665-1915

Email: saskenv@link.ca

TO VOICE YOUR CONCERNS CONTACT

•

Mayor Doug Archer

PO Box 1790
Regina, Saskatchewan
S4P 3C8

Tel: (306) 777-7339

Raw Sewage Discharged:

55 million litres of chlorine-disinfected but otherwise untreated sewage

Regina

Population:	187,500
Percentage of population served by sewage treatment plant(s):	100%
Volume generated:	25.5 billion litres
Treatment:	Enhanced secondary treatment with phosphorus removal, UV disinfection April-October
Receiving Water:	Wascana Creek, a tributary of the Qu'Appelle River
Permits:	Regina holds a Permit to Operate issued by Saskatchewan Environment and Resource Management; facilities are in compliance.
Combined Sewer %:	Less than 1%
Overflows Annually:	During heavy rainstorms, domestic and storm sewer system design allows water to overflow from storm system to domestic. In 1998, 55 million litres of sewage overflowed and was disinfected with chlorine (to be replaced with sodium hypochlorite) before discharge. A small, unknown percentage of the City still has combined sewer systems, no measurements available for overflow events.
Toxicity Testing:	Effluent tested twice a year for heavy metals and other toxic substances, and is always in compliance with permit. Sludge cake tested annually by Saskatchewan Research Council Laboratories for herbicides, insecticides and other toxic substances and is always well below detection limits.
Sludge Disposal:	Anaerobic digestion followed by de-watering. Sludge cake from primary treatment plant used as cover for finished slopes of City landfill; small amount applied to agricultural land as demonstration project; now stockpiled on site. Sludge from secondary system, along with alum and lime sludge from phosphorous removal stage, stockpiled on site.
Sewage-related Charges:	None

Additional Facts: Methane gas produced by bacteria in digesters used to mix digester contents and to fire boiler in primary treatment plant. Excess gas flared off in summer

Changes Since 1994: Chlorine disinfection replaced with UV, modernisation of control system, pumping station upgrade, two lagoons drained for refurbishing and replacement of aeration systems.

WHY THIS GRADE:

+ switch from chlorine to UV disinfection
+ in compliance with permits
+ no plans to land spread secondary treatment sludge
+ a sewer use bylaw regulates the amount of conventional and toxic pollutants which may be discharged into the system

– bylaw allows for discharges of some metals which far exceed CCREM guidelines for substances discharged into fish bearing water (cadmium, for example, is set at nearly 4000 times higher than the suggested guideline)

Saskatoon

Population:	Approximately 200,000
Percentage of population served by sewage treatment plant(s):	100%
Volume generated:	18.25 billion litres per year
Treatment:	Secondary, with bio-remediation; chlorine disinfection, no de-chlorination
Receiving Water:	South Saskatchewan River
Permits:	Permits to Operate issued by Saskatchewan Environment & Public Safety are held by City of Saskatoon; all facilities are now operating in compliance with permits, including suspended solids, phosphorus and nitrogen.
Combined Sewer %:	None. During storm situations the treatment load increases, i.e. stormwater overflows into the plant system, but not vice-versa.
Overflows Annually:	None, although there is a spill response team to deal with such a situation.
Toxicity Testing:	Sludge is routinely tested for heavy metal contamination, as well as virus and micro-organism levels. Most sludge & testing is done in the plant's laboratory.
Sludge Disposal:	Most of the recovered sludge is spread on agricultural fields as soil conditioner.
Sewage-related Charges:	None

Additional Facts: Saskatoon's bio-remediation (BR) system has brought it far below its permitted levels for contaminants. Nitrogen is treated 75% of the year.

Changes Since 1994: In 1994, Saskatoon was operating on primary treatment, which has been upgraded to secondary. In 1996, $50 million bio-remediation facilities were installed.

WHY THIS GRADE:

+ sewage treatment has been upgraded from primary to secondary treatment with biological remediation
+ in compliance with all permits
+ no combined sewer overflows
+ no raw sewage released in any form of overflow from sewerage system
+ sludge tested for heavy metals and other contaminants
– chlorine disinfection, no de-chlorination
– effluent is discharged into the South Saskatchewan River, a sensitive aquatic environment
– agricultural use of sludge despite unresolved questions about cumulative impacts

1999 GRADE:

C+

1994 GRADE: D

FOR MORE INFORMATION CONTACT

•

Saskatchewan Environmental Society

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Saskatoon, Saskatchewan
S7K 3N9

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TO VOICE YOUR CONCERNS CONTACT

•

Mayor Henry Dayday

222 Third Avenue North
Saskatoon, Saskatchewan
S7K 0J5

Tel: (306) 975-3240

Raw Sewage Discharged:

None

1999 GRADE:

D

1994 GRADE: C

FOR MORE INFORMATION CONTACT

•

Manitoba Eco-Network

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TO VOICE YOUR CONCERNS CONTACT

•

Mayor Reg Atkinson

City of Brandon

410 9th Street
Brandon, Manitoba
R7A 6A2

Tel: (204) 729-2202

Raw Sewage Discharged:

44 million litres
(largely the result of four major rainfalls)

Brandon

Population:	Approximately 40,000
Percentage of population served by sewage treatment plant(s):	100%
Volume generated:	Approximately 8.03 billion litres per year
Treatment:	Secondary treatment, chlorine disinfection
Receiving Water:	Assiniboine River
Permits:	Brandon holds a *Manitoba Environment Act* Licence and is frequently out of compliance for biochemical oxygen demand, solids, ammonia and faecal coliform.
Combined Sewer %:	Approximately 30%
Overflows Annually:	Approximately 44 million litres.
Toxicity Testing:	Not required.
Sludge Disposal:	Soil injection after stabilisation in a lagoon system for one year. Tested for variety of heavy metals and top priority pollutants.
Sewage-related Charges:	None, despite numerous threats of prosecution and fines from Manitoba Environment.

Additional Facts: Brandon is currently building and will operate an industrial wastewater treatment plant for the Maple Leaf Meats hog processing plant. This is expected to begin operation by September 1999. There have been no Clean Environment Commission hearings called by the provincial government on this very large project despite the largest number of interventions ever in Manitoba for a single project. The environment process has been fast-tracked and done in stages. The plant will discharge up to 5.2 million litres of wastewater per day, after BOD, solids and ammonia removal, and UV disinfection. No phosphate removal will be included, even though the City admits the plant will add at least one more tonne of phosphate a week to the river. The Assiniboine River at Brandon is already highly eutrophic and phosphate levels are well above the Western provinces guideline to avoid eutrophication. Cyanobacteria are a major component in the photosynthetic biota of the river during the summer months. The very potent liver and nerve toxins associated with these floating organisms are a public health concern. In May 1999 further submissions to Manitoba Environment indicate that the Brandon Sewage Treatment plant and the Maple Leaf Plant could exceed the 100% assimilative capacity of the river for ammonia. The City is proposing further upgrades to the treatment plant to try to achieve higher nitrification rates. Brandon University has conducted some acute toxicology tests and students have observed the death of all organisms within 24 hours with aeration in the sewage effluent.

Changes Since 1994: An upgrade at the Wastewater Treatment facility in 1994/95 had little impact on effluent quality. A further $1 million upgrade in 1999 also failed to make significant improvements. City currently building and will operate an additional plant for Maple Leaf Meats (see above). Commitment to installing UV disinfection never met. At one point, chlorination system had to be discontinued because it could not meet free chlorine licence requirements if chlorination took place at levels necessary to reduce bacterial loadings. According to City officials, UV disinfection will be in place at the sewage treatment facility by the end of 2000.

WHY THIS GRADE:

+ sewage receives secondary treatment
+ fairly stringent sludge testing
– no toxicity testing
– sampling equipment and protocols specified in licence not in place or carried out
– chlorine disinfection (UV disinfection proposed in order to secure federal approval for licence not yet installed)
– effluent discharged into a sensitive river environment
– money spent since 1994 has failed to improve quality of effluent; no discernible progress in five years

1999 GRADE:

C

1994 GRADE: C-

FOR MORE INFORMATION CONTACT

•

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TO VOICE YOUR CONCERNS CONTACT

•

Mayor Glen Murray

2nd Floor, Council Building
510 Main Street
Winnipeg, Manitoba
R3B 1B9

Tel: (204) 986-2196

Raw Sewage Discharged:

17.4 billion litres

Winnipeg

Population:	621,887
Percentage of population served by sewage treatment plant(s):	100%
Volume generated:	137.42 billion litres (including land drainage sewers, sanitary sewer overflows, treated effluent and CSOs)
Treatment:	Secondary
Receiving Water:	Red River (two plants), Assiniboine River (one plant)
Permits:	Manitoba Environment Act licence will be required for each pollution control plant. The final licensing process is in progress, and all of the licence requirements are being met.
Combined Sewer %:	Approximately 40%
Overflows Annually:	23
Toxicity Testing:	City periodically tests effluent for conventional pollutants. Sludge sampling is conducted weekly. University of Manitoba Agriculture Department has also been taking test plots of fields where the sludge has been applied for the last 10 years. Testing done on many parameters including heavy metals, PCBs, pH and nutrients.
Sludge Disposal:	Anaerobic digester, followed by de-watering to 75% liquid/25% solids. Sludge is made available to farmers at no cost as a 'soil conditioner' and 'fertiliser' through the Wingro program at a max application rate on agricultural fields of 56 dry tonnes per ha.
Sewage-related Charges:	None

Additional Facts: Studies on the effects of ammonia and combined sewer overflows on the rivers have been postponed by the City until July 2000.

Changes Since 1994: The City has initiated a program for effluent disinfection at all three pollution control plants. An ultraviolet disinfection facility will commence operation in July 1999 at the south plant. Abandoned lagoons have been converted to polishing ponds at the west plant to evaluate their effectiveness as a method of disinfection using natural sunlight. Ammonia removal and nitrification studies scheduled for completion July 2000. Sewer by-law updated to include polluter pays surcharge for biological oxygen demand (BOD) and total suspended solids (TSS). City has created a reserve fund for environmental projects with revenues of approximately $7 million per year.

WHY THIS GRADE:

+ sewage receives secondary treatment
+ plans to use natural sunlight (UV) to disinfect effluent from all three plants
– effluent discharged into Red and Assiniboine Rivers flows into Lake Winnipeg (then Nelson River, then Hudson Bay); resulting in beach closures on Lake Winnipeg due to high faecal coliform counts
– at $7 million per year it will take between 76 and 170 years to cover costs of necessary upgrades, estimated at between $535 million and $1.19 billion
– failure to complete ammonia and CSO reports by 1997 (now looking at 2000 deadline)

Hamilton-Wentworth

(Regional Municipality)

Population: 450,000 (urban and rural)

Percentage of population served by sewage treatment plant(s): 90% (100% of urban))

Volume generated: 120 billion litres per year

Treatment: 95% of flow receives secondary treatment and phosphorus removal; 5% receives tertiary treatment through added filtration; chlorine disinfection May to October, no de-chlorination.

Receiving Water: Windermere Basin to Hamilton Harbour on Lake Ontario

Permits: Provincial Certificates of Approval are issued to the municipalities. Quality of effluent significantly higher than permit requirements.

Combined Sewer %: Approximately 35%.

Overflows Annually: Sewer overflows are not currently measured.

Toxicity Testing: Effluent parameter testing perform, no toxicity testing is done.

Sludge Disposal: Digested, then applied to rural agricultural land.

Sewage-related Charges: None.

Additional Facts: The lack of data about the considerable volume of overflows annually makes the statement that 95% of sewage receives secondary and 5% tertiary somewhat questionable. However, Hamilton is taking some belated steps to address its CSO problem, installing equipment over the next three to five years which will provide information about the quality and volume of discharges. In 1997 the municipality conceded that the Woodward Sewage Treatment Plant needs improvement in efficiency and capacity, that they must improve the quality of their effluent, and that sedimentation of Windemere Basin is a serious concern. The City has a sewer use bylaw (based on 1988 Ontario model) which sets limits for heavy metals and other parameters. The City enters into compliance agreements for non-treatable parameters and into over-strength agreements for treatable parameters with cost recovery as set through bylaw rates.

Changes Since 1994: Sludge, no longer incinerated, is now used on agricultural land. As part of the RAP, two combined sewer overflow tanks have been built, with three more scheduled in the next three years and a fourth proposed. These are expected to result in substantial improvements in water quality in Red Hill Creek (the immediate point of discharge which feeds into Hamilton Harbour). Preliminary treatment facility is being expanded, primary treatment capacity increasing by 50%, improvements being made to secondary treatment.

WHY THIS GRADE:

+ sewage receives secondary and some tertiary treatment
+ sludge no longer incinerated
– sludge applied to agricultural land
– volume of combined sewer overflows not measured
– no toxicity testing
– chlorine disinfection, no de-chlorination

1999 GRADE:

C-

1994 GRADE: C+

FOR MORE INFORMATION CONTACT

•

Conserver Society of Hamilton

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TO VOICE YOUR CONCERNS CONTACT

•

Terry Cooke, Chairperson

Regional Municipality of Hamilton-Wentworth

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Raw Sewage Discharged:

Unknown Amount

1999 GRADE:

C/B*

1994 GRADE: B-

FOR MORE INFORMATION CONTACT

•

Safe Sewage Committee

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•

Pollution Probe

12 Madison Avenue Toronto, Ontario M5R 2S1

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Web site: www.pollutionprobe.org

Raw Sewage Discharged:

9.5 billion litres

Toronto

Population: Approximately 2,400,000

Percentage of population served by sewage treatment plant(s): 100% directly or indirectly (NB: a few areas of the newly amalgamated City of Toronto are still not connected to the municipal drainage system and using septic tanks but the remaining sludge is eventually transferred to plants for final treatment and disposal).

Volume generated: Approximately 454.3 billion litres/year in 1998.

Treatment: Secondary treatment with phosphorous removal; chlorine disinfection; no de-chlorination; pilot UV disinfection project at Main Sewage Treatment Plant.

Receiving Water: Three plants discharge 442.3 billion litres/year into Lake Ontario, one discharges 12 billion litres into Don River.

Permits: Provincial Certificates of Approval outlining effluent quality are held by the Ashbridges Bay, Humber and Highland Creek plants; North Toronto operates on Ministry of Environment guidelines. In 1998 all plants were in compliance. Discharges to the municipal sewer system are regulated by the City Sewer By-law and controlled by the City Industrial Waste Control Branch.

Combined Sewer %: Approximately 27%

Overflows: In 1998, 4.5 billion litres of sewage bypassed secondary treatment and were discharged with only primary treatment and chlorine disinfection. Combined sewer overflow events occur 30-50 times a year and result in approximately 9.5 billion litres of untreated sewage and runoff being discharged into receiving waters.

Toxicity Testing: Under City Sewer By-Law terms, toxicity testing is done on raw sewage discharge samples for toxic organics and heavy metals, as well as on stabilised sewage sludge, as quality control measures prior to its land application (heavy metals, E Coli counts, etc.) Periodic MoE acute toxicity testing of final effluent from treatment plants is also performed..

Sludge Disposal: In 1998, 63,600 dry tonnes of sludge separated from sewage during the treatment process is incinerated (72%) and or “beneficially used” through agricultural land application (28%). General direction of City Council for future sludge disposal method is land application, not incineration.

Sewage-related Charges: None, although plants may be in daily contravention of the *Fisheries Act.*

* *In setting the evaluation criteria for the 1999* National Sewage Report Card, *it was decided that cities which had failed to make any discernible improvement in the quality of their sewage treatment should be downgraded from their 1994 grade. Although the actual improvements in place in Toronto are minimal as we go to press, the planned improvements are both ambitious and commendable. We have, therefore, given the Toronto a split grade: C for its current treatment and B for its soon-to-be-implemented upgrades.*

Additional Facts: The decision to move from sludge incineration to land application has prompted a number of environmental initiatives. City Council is about to approve a complete ban on municipal pesticide use (with the exception of controlling narrowly defined emergency infestations), which will reduce stormwater toxicity. Phase out is due for completion in 2000 and will be followed by programs and by-laws for pesticide use on private property. A well intended but somewhat flawed sewer use bylaw has been drafted, which, in the current draft (#4), allows for contaminant discharges much higher than those outlined in the Canadian Council of Resource and Environment Ministers guidelines. Efforts to force industrial dischargers to initiate pre-treatment or other pollution prevention plans lack enforceable timelines or penalties. Hopefully, these concerns will be addressed in the final draft.

Changes Since 1994: The City is committed to ending sludge incineration by 2000. A Multi-Stakeholder Committee with community participants was formed to deal with issues related to the move from incineration to land application. A sewer use bylaw has been drafted to regulate toxic substances allowed into sewerage system and promote pre-treatment or other pollution prevention plans for industrial users. Plans approved to upgrade to UV disinfection by 2005.

WHY THIS GRADE:

+ sewage receives secondary treatment with phosphorous removal
+ all facilities are in compliance with Certificates of Approval
+ Toronto runs an extensive monitoring program as part of its source control program
+ pilot UV disinfection project in place at the Main Sewage Treatment Plant, plans to implement full UV disinfection by 2005.
+ sludge incinerator to be shut down
– chlorine disinfection, no de-chlorination
– raw sewage is released through combined sewer overflows
– a large volume of raw sewage and treated effluent is discharged into the Don River, a severely degraded environment, and Lake Ontario, a body of water recognised as a contaminated ecosystem by the Canadian and US governments
– although a good plan is being formalised, no discernible progress has been made in five years

TO VOICE YOUR CONCERNS CONTACT

•

Mayor Mel Lastman

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•

Councillor Jack Layton
Chair, Environmental Task Force

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1999 GRADE:

C

1994 GRADE: B

FOR MORE INFORMATION CONTACT

•

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TO VOICE YOUR CONCERNS CONTACT

•

Bob Chiarelli, Chairperson
Regional Municipality of Ottawa-Carleton

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Raw Sewage Discharged:

4 million litres

Ottawa

(Regional Municipality of Ottawa-Carleton)

Population: 750,000

Percentage of population served by sewage treatment plant(s): 90%

Volume generated:	143.45 billion litres per year
Treatment:	Secondary treatment with phosphorus removal, chlorine disinfection, no de-chlorination
Receiving Water:	Ottawa River
Permits:	Certificates of Approval from Ontario Ministry of Environment are held by the municipality, effluent generally in compliance
Combined Sewer %:	8% of total area of system
Overflows Annually:	In 1998, there were two raw sewage by-passes to the Ottawa River. The by-passes occurred during storm events as a result of power failure and equipment malfunction. Approximately 4,000,000 million litres of raw sewage by-passed the treatment plant
Toxicity Testing:	Municipality regularly tests sludge samples for metals, nitrogen and phosphorus, as well as for a variety of other parameters to ensure compliance with provincial guidelines. Sludge is tested for pH and phosphorus before land application. Some well water testing conducted as part of sludge land application program. Although effluent is not routinely tested for toxicity, a test was conducted in 1998 as part of the Environmental Effluent Monitoring Program The pre-chlorinated effluent was found not to be toxic to rainbow trout and daphnia magna. Additional testing of chlorinated effluent is being conducted due to anomalies in the sample results.
Sludge Disposal:	Treated in anaerobic digesters, de-watered, methane gas captured as fuel, then sludge is trucked to farms to be used as agricultural fertiliser or as interim cover at the landfill site.
Sewage-related Charges:	RMOC was charged by the Ontario Ministry of Environment for violation of the *Ontario Water Resources Act* for a 1997 spill of incompletely treated sewage into a drainage ditch near spray irrigation fields. Clean- up was completed and a $30,000 fine paid.

Changes Since 1994: Disinfection of effluent changed from annual to seasonal disinfection in 1997. Chlorination occurs from May 15th to November 15th. In February 1998, ROC opened a co-generation plant to burn methane from anaerobic digesters for power and heat.

WHY THIS GRADE:

+ sewage receives secondary treatment with phosphorus removal
+ methane from sludge treatment captured and used for electricity and heat
– chlorine disinfection
– large volume of raw sewage discharged
– sludge used on agricultural land despite unresolved questions about impacts

Montreal

Urban Community (MUC)

Population:	1.8 million
Percentage of population served by sewage treatment plant(s):	100%
Volume generated:	927 billion litres
Treatment:	Chemically aided primary treatment, phosphate removal; no disinfection
Receiving Water:	St Lawrence River
Permits:	No provincial permits held or required for water or air pollution, power to regulate these delegated by province to MUC. Montreal's plant meets objectives set by Quebec Ministry of Environment for 80% phosphorus removal (these objectives not enforceable by law). One provincial permit held for operation of the landfill which receives the ash from sludge incineration.
Combined Sewer %:	About 66%
Overflows Annually:	79 CSO events in 1998, volume of discharge not monitored.
Toxicity Testing:	None done on a regular basis.
Sludge Disposal:	De-watered, incinerated, ash taken to landfill
Sewage-related Charges:	None

Additional Facts: In 1997, Great Lakes United, World Wildlife Fund, la Societe pour Vaincre la Pollution (SVP) and the Society to Overcome Pollution (STOP) published a report card on the MUC sewage treatment plant which showed that it had become one of the biggest sources of pollution in the St. Lawrence River. As a result, the MUC has established a multi-stakeholder committee to address pollution concerns. The committee includes federal, provincial and municipal government representatives, environmental groups and community organisations. Combined sewer overflows have been identified as a priority issue.

Changes Since 1994: Almost none. Although 100% of the population now receives sewage treatment, the treatment is still primary, there is still no disinfection, and unmeasured combined sewer overflows still occur.

WHY THIS GRADE:

+ 100% of population now receiving sewage treatment
– combined sewer overflow events frequent and unmeasured
– no discernible progress on treatment, which is still primary
– no toxicity testing done
– no disinfection
– sludge incinerated

1999 GRADE:

F+

1994 GRADE: F/C*

** A split grade was given in 1994 in acknowledgement of upgrades due to be completed in 1995.*

FOR MORE INFORMATION CONTACT

•

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TO VOICE YOUR CONCERNS CONTACT

•

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Web site: www.cum.qc.ca

Raw Sewage Discharged:

Unknown Amount

1999 GRADE:

C

1994 GRADE: C

FOR MORE INFORMATION CONTACT

•

Ami(e)s de la terre de Québec

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TO VOICE YOUR CONCERNS CONTACT

•

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ext, 267

Raw Sewage Discharged:

Unknown Amount

Quebec City

Quebec Urban Community (QUC)

Population:	515,000
Percentage of population served by sewage treatment plant(s):	97%
Volume generated:	Approximately 130 billion litres per year
Treatment:	Secondary treatment with UV disinfection
Receiving Water:	St. Lawrence River
Permits:	No permits are required.
Combined Sewer %:	35-50%
Overflows Annually:	Approximately 50 times in the summer.
Toxicity Testing:	None done on a regular basis.
Sludge Disposal:	Incineration.
Sewage-related Charges:	None.

Changes Since 1994: A project has been implemented which has reduced combined sewer overflow events, although these still occur frequently in summer months and volume is not monitored.

WHY THIS GRADE:

+ secondary treatment
+ UV disinfection in summer months
+ CSO events reduced
– CSO events still occur regularly and volume not monitored
– sludge incinerated
– no permits
– no toxicity testing

Saint John

Population:	71,000
Percentage of population served by sewage treatment plant(s):	47%
Volume generated:	16.6 billion litres per year (6.6 billion litres of treated effluent, 10 billion litres of untreated wastewater)
Treatment:	Secondary treatment; two plants disinfect with chlorine (one year round, one April to September), no de-chlorination; no disinfection at remaining two plants
Receiving Water:	St. John River and Bay of Fundy
Permits:	Certificates of Approval of Operation issued to Saint John by provincial Department of the Environment. All four plants in compliance with permits.
Combined Sewer %:	75%
Overflows Annually:	Although overflows occur, volume is not measured.
Toxicity Testing:	City tests several times daily for conventional pollutants, pH, and temperature. Saint John Laboratory Services schedules monthly testing of sludge for heavy metals, pH, phosphorus and nitrogen.
Sludge Disposal:	Two plants dispose sludge in lagoon. Of the two, one de-waters then takes sludge to a compost facility, where it is used as a soil additive for commercially packaged peat moss or used by gardening centres as a nitrogen supplement for soil. The second, composting, plant treats 95% domestic and 5% light industrial waste. Legally, these products must be labelled as containing municipal sludge and the City assumes this is done.
Sewage-related Charges:	None

Additional Facts: Saint John's sewage effluent ends up in the Bay of Fundy where tidal movement is immense. Thus pollutants are flushed out of the area very quickly and it is difficult to track the environmental effects of toxic substances. However, discharging 53% of sewage as raw effluent into this environment is clearly undesirable, regardless of tidal flow.

Changes Since 1994: Although 3% more of the population receives sewage treatment, untreated wastewater discharge has increased from 8.5 billion litres per year to 10 billion litres. Between 1993 and 1998 over $10 million (cost shared by federal, provincial and municipal governments) was spent on infrastructure improvements with no measurable decrease in environmental degradation.

WHY THIS GRADE:

+ some sewage receives secondary treatment
– 53% of sewage receives no treatment whatsoever
– two plants use chlorine disinfection, with no de-chlorination
– City pays composting facility to take sludge which is used in commercially sold peat moss and conditioned soil
– no discernible improvement in quality of treatment in past five years

1999 GRADE:

E

1994 GRADE: D-

FOR MORE INFORMATION CONTACT

•

ACAP Saint John
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TO VOICE YOUR CONCERNS CONTACT

•

Mayor Shirley McAlary
PO Box 1971, City Hall
Saint John, NB E2L 4L1
Tel: (506) 658-2912

Raw Sewage Discharged:

10 billion litres +/-

1999 GRADE:

B

1994 GRADE: C

FOR MORE INFORMATION CONTACT

•

ACAP Saint John

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TO VOICE YOUR CONCERNS CONTACT

•

Mayor Walter Brown

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New Brunswick E3B 4Y7

Tel: (506) 460-2020

Raw Sewage Discharged:

585 million litres

Fredericton

Population: 47,000

Percentage of population served by sewage treatment plant(s): 98%

Volume generated: 6.31 billion litres (plant), 400 million litres (lagoons)

Treatment: Secondary treatment with UV disinfection

Receiving Water: St. John River

Permits: Fredericton holds New Brunswick Department of the Environment Certificates of Approval for all treatment facilities. The City is in compliance with all certificates.

Combined Sewer %: Less than 5%

Overflows Annually: 585 million litres during spring runoff or heavy rain fall.

Toxicity Testing: Effluent is tested by provincial Department of Environment once a year for conventional pollutants (suspended solids, biological oxygen demand, etc.); plant tested for conventional pollutants daily; lagoons tested for conventional pollutants monthly; sludge testing done by an independent lab, quarterly for phosphorus and nitrogen, occasionally for phenols and metals. Halifax Hospital tests sludge quarterly for metals and conventional pollutants.

Sludge Disposal: Sludge is composted, then used for various land applications.

Sewage-related Charges: None.

Additional Facts: Composted sludge is used for mine reclamation and sod farming, or mixed with wood chips for potting soil and with poor quality soil to make “high grade”.

Changes Since 1994: Major plant expansion 1995; new pre-treatment and primary clarifier; new sludge de-watering and lime stabilisation equipment; UV disinfection

WHY THIS GRADE:

+ UV disinfection has replaced chlorine disinfection
+ sewer use bylaw restricts contaminants discharged into sewerage system
+ in compliance with permits
– although sewage receives secondary treatment, it is being discharged into a river already degraded from upstream sources including pulp mills, food processing plants, other industrial operations, and siltation caused by runoff from clearcut logging.
– some agricultural use of sludge despite unknown cumulative impacts

Charlottetown

Population:	32,531
Percentage of population served by sewage treatment plant(s):	Approximately 98%
Volume generated:	7.70 billion litres per year
Treatment:	Primary treatment, chlorine disinfection May to December, no de-chlorination.
Receiving Water:	Hillsborough River
Permits:	No permits are held or required. No provincial regulations for sewage plant discharges.
Combined Sewer %:	10.7%
Overflows Annually:	Not measured.
Toxicity Testing:	City monitors weekly for pH, biochemical oxygen demand, total suspended solids, settled solids removal, and residual chlorine. Daily test for chlorine residuals during disinfection period. No micro-biological tests done.
Sludge Disposal:	Tenders offered to private contractors, who pump out sludge and apply it to dormant land for future agricultural use. No testing done for heavy metals or other toxic pollutants.
Sewage-related Charges:	None, despite the fact that discharges enter fish habitat and may violate *Fisheries Act* daily.

Additional Facts: In wet weather the plant becomes hydraulically upset and the effluent is below primary treatment standards. Digester gas is used to power a generator which provides electricity (50-65% of requirement) for the plant. According to the PEI Department of Environment the plant meets the requirements for "ocean discharge" and the "assimilative" capacity of the receiving body (Hillsborough River) of water.

Changes Since 1994: No information provided on upgrades or plans to upgrade.

WHY THIS GRADE:

– sewage receives only primary treatment
– effluent disinfected with chlorine from May to December only and is not de-chlorinated
– there are no provincial regulations governing sewage discharges
– combined sewer overflows are known to occur, but are not measured
– shellfish closures occur due to high faecal coliform levels in the estuary at the confluence of the Hillsborough, North, and West Rivers; high faecal coliform counts are due to surface runoff and effluent from the treatment facility.
– no testing done for heavy metals or other toxic pollutants
– sludge is used on agricultural land

1999 GRADE:

E

1994 GRADE: D-

FOR MORE INFORMATION CONTACT

•

P.E.I. Environmental Network

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C1A 1H9

Tel: (902) 566-4696
Email: peien@isn.net
Website:
www.isn.net/~network

TO VOICE YOUR CONCERNS CONTACT

•

Edward Rice, Chairperson

Charlottetown Area Pollution Control Commission

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C1A 2T3

Tel: (902) 628-6647

•

Joe Coady, Director of Public Services

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Tel: (902) 566-5548

Raw Sewage Discharged:

Unknown Amount

1999 GRADE:

E-/C*

1994 GRADE: F

FOR MORE INFORMATION CONTACT

•

Ecology Action Centre
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Halifax, Nova Scotia
B3J 2B3
Tel: (902) 429-2202
Email: eac_hfx@istar.ca
Web site:
www.chebucto.ns.ca/Environment/EAC/EAC-Home.html

Raw Sewage Discharged:

43.8 billion litres

Halifax

Regional Municipality

Population: 354,000. Halifax Regional Municipality, incorporated in 1996, includes the cities of Halifax (100,000) and Dartmouth (70,000), town of Bedford (12,000) and the county of Halifax (172,000).

Percentage of population served by sewage treatment plant(s): Halifax/Dartmouth, 0; remainder of area, 100% (30% central sewage plants, 70% home on-site septic/field bed systems).

Volume generated: 68.2 billion litres annually (does not include rural home on-site sewage).

Treatment: Halifax/Dartmouth, none; Eastern Passage, primary; Bedford/Sackville, secondary; Aerotech Park, secondary; North Preston, secondary; Springfield Lake, secondary; Uplands Park, secondary; Lakeside-Timberlea, enhanced secondary; Lively, tertiary; Fall River, tertiary

Receiving Water: Halifax Harbour (salt) and a number of HRM inland fresh water bodies.

Permits: All HRM treatment facilities operate under Nova Scotia Department of the Environment approval permits.

Overflows Annually: All Halifax/Dartmouth sewage is discharged raw and untreated through 40 outfall pipes. Bedford facility has a surge tank, claimed to be 100% effective.

Combined Sewer %: With the exception of peninsula Halifax and a small area of Dartmouth totalling 30% of HRM populations, all central sewage collection systems have separate domestic sewage and stormwater systems.

Toxicity Testing: Treatment facilities regularly undergo discharge effluent testing for chemical/biological parameters, including faecal coliform and Microtox toxicity testing. In order to receive Department of Environment approval, sludge to be composted is tested for heavy metals.

Sludge Disposal: Recovered sewage sludge from treatment plants is disposed of at Aerotech sludge lagoon, remainder sits at the bottom of Halifax Harbour. Every 5-7 years, the sludge is removed from the lagoon, de-watered and composted. The raw sewage discharge to Halifax Harbour results in sludge deposits, which the City claims are removed by tidal flushing, although this statement is challenged by many.

Sewage-related Charges: No charges have ever been laid against the HRM, despite the fact that it is in daily violation of the *Fisheries Act.*

* *The improved grade of 'E-' for the Halifax Regional Municipality is based largely on the fact that incorporation brought the municipality some sewage treatment. The 'C' acknowledges the rejection of the 'megaproject' mentality in the HRM's still-to-be-implemented upgrade plans.*

Additional Facts: Halifax is 200 years old this year. Problems inherent in the age of the infrastructure have been compounded by neglect and bad management. However, citizen groups such as the Ecology Action Centre, which have been pushing for the clean up of Halifax Harbour for decades, are optimistic that improvements will soon be in place.

Changes Since 1994: A $315 million plan is on the table to build three to five primary treatment plants designed to fit unobtrusively into the community. This replaces a previous $400 million plan to build one large primary treatment plant on McNabs Island, a designated regional park. So far $40 million is in place for construction costs. HRM hopes a combination of provincial and federal funding, along with private partnering, will cover the costs of building the plants one at a time. A water rate increase has been approved by Council. Construction of first plant is expected to begin within two years.

WHY THIS GRADE:

- + "megaproject" plan to construct plant in regional park abandoned
- + a source control program to divert toxic substances from sewer system is being developed
- – only considering primary treatment, when much higher standard is needed
- – no plan to fast track separation of pipes for storm water and municipal sewage; separation to be done as part of general maintenance, which will take decades and will undoubtedly lead to overflow events

TO VOICE YOUR CONCERNS CONTACT

•

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•

Maurice Lloyd

Halifax Harbour Solutions Project Chief

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1999 GRADE:

F-

1994 GRADE: F

FOR MORE INFORMATION CONTACT

•

St. John's Harbour ACAP Incorporated

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Web site: www.thezone.net/stjacap

TO VOICE YOUR CONCERNS CONTACT

•

Mayor Andy Wells

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A1C 5M2

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Raw Sewage Discharged:

33.2 billion litres

St. John's

Population:	Approximately 100,000
Percentage of population served by sewage treatment plant(s):	0
Volume generated:	Approximately 33.2 billion litres/year
Treatment:	None
Receiving Water:	St. John's Harbour
Permits:	St. John's has never been required to obtain a permit for its sewerage system. It does not meet provincial Water and Sewer Regulations for biological oxygen demand and suspended solids.
Combined Sewer %:	Approximately 20%
Overflows:	Yes, but no precise data
Toxicity Testing:	Periodic faecal coliform testing of harbour water, no toxicity testing of effluent.
Sludge Disposal:	Landfill.
Sewage-related Charges:	None, despite daily violations of *Fisheries Act*.

Additional Facts: St. John's is an ACAP (Atlantic Canada Coastal Action Program) "hot spot". ACAP is part of the Canadian federal government's Green Plan and aims to improve the water quality management in designated watersheds.

Changes Since 1994: The City of St. John's has instituted a $30 annual tax dedicated towards the construction of a sewage treatment system which is estimated to cost close to $100 million. The tax raises about $1.5 million annually. This amount was matched by the provincial government in 1997, 1998 and 1999, and by the federal government in 1997. The $10.5 million has been used to do preliminary infrastructure work prior to the construction of a sewage treatment plant. Although long-term funding must be secured from all three levels of government to complete this project, to date only the municipal level has made this commitment.

WHY THIS GRADE:

– sewage receives no treatment
– no permit is held
– there is no sewer use by-law regulating discharges to the sewerage system
– St. John's violates provincial regulations
– St. John's Harbour is significantly degraded by sewage effluent; bacteria such as faecal coliform are at a level that poses a health risk to humans who come into regular contact with the water
– both the waters and sediments near outfall contain high levels of heavy metals and other persistent toxins, such as ammonia, known to kill fish.

Yellowknife

Population: Approximately 17,000

Percentage of population served by sewage treatment plant(s): 100% (80% serviced by sewage lines, 20% by pump out trucks)

Volume generated: 2.16 billion litres per year.

Treatment: Secondary treatment involving lagoons and wetlands, UV disinfection occurs naturally in non-winter months; discharged once a year, usually late summer or autumn.

Receiving Water: Great Slave Lake

Permits: Yellowknife holds a North West Territories Water Board licence, which sets parameters for testing for faecal coliform, biological oxygen demand, suspended solids, oil and grease, and pH. The City is in compliance with this licence.

Combined Sewer %: None. Storm sewers go directly into lakes within municipal boundaries.

Overflows Annually: Very rare - estimated one in five years

Toxicity Testing: Testing done for substances listed under Permits once a month by Taiga Environmental Laboratory, Department of Indian Affairs and Northern Development (DIAND). During annual discharge, which takes 3-4 weeks, testing done every two weeks, beginning two weeks prior to discharge and continuing for a month afterwards.

Sludge Disposal: Taken to sewage lagoon

Sewage-related Charges: None

Additional Facts: The current sewage lagoon has been used since 1980 and, with reduced volumes (see below), could last another 20 years.

Changes Since 1994: Work carried out to increase sewage lagoon capacity (e.g. clearing debris); water conservation plan has cut sewage volume from 10.5 million litres per day to 5.9 million; City has utilised computerised leak detection, eliminated home owner water bleeders and eliminated City main line bleeders.

WHY THIS GRADE:

+ sewage receives secondary treatment
+ a process of natural biological disinfection takes place
+ facility is in compliance with its license
+ Great Slave Lake is a large body of water supporting relatively few people; the water quality is good
+ no combined sewer overflows
+ water conservation plan has reduced sewage flow by 56%
– stormwater discharged untreated
– there is no sewer use by-law to control contaminants at source

1999 GRADE:

B+

1994 GRADE: B-

FOR MORE INFORMATION CONTACT

•

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TO VOICE YOUR CONCERNS CONTACT

•

Mayor David Lovell

Or

Garry Craig, Director of Public Works

City of Yellowknife

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Raw Sewage Discharged:

None

1999 GRADE:

B-

1994 GRADE: D

FOR MORE INFORMATION CONTACT

•

Yukon Conservation Society

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TO VOICE YOUR CONCERNS CONTACT

•

Mayor Katherine Watson

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Raw Sewage Discharged:

None

Whitehorse

Population:	22,000
Percentage of population served by sewage treatment plant(s): 85%	
Volume generated:	5.8 billion litres per year.
Treatment:	Primary lagoons, followed by secondary treatment in constructed, non-aerated lagoons and natural long term storage impoundment where natural UV disinfection should occur.
Receiving Water:	Yukon River*
Permits:	Yukon Territory Water Licence. In 1998, the City was granted a water licence permitting a trial discharge to Pot Hole Lake hydraulically connected to the ground water and Yukon River.
Overflows Annually:	In Fall 1998, City discharged 1.9 billion litres of treated effluent over a two-month period to the ground water via Pot Hole Lake. 1999 and 2000 are expected to see similar discharges of two to three months' duration each year.
Toxicity Testing:	Testing for conventional pollutants conducted on treated effluent prior to 1998 discharge and is conducted on a regular basis during treatment process.
Sludge Disposal:	No sludge recovered
Sewage-related Charges:	A charge laid in the 1980s after a direct discharge from the pump station was dropped after the City formed a Technical Committee to establish design criteria and options for sewage treatment.

Additional Facts: The proposal to discharge into Pot Hole Lake could – in a best case scenario – achieve tertiary treatment. However, it could also cause ground water contamination, and slumping of the river bank which in turn would destroy a salmon spawning area. Engineering tests to date to affirm that the lake will allow this seepage are inadequate since there are thick sediments as well as the sludges to be added.

* Changes Since 1994: Construction of non-aerated lagoons and natural long-term storage impoundment in 1996/97 has so far eliminated direct discharges into Yukon River. Construction of discharge piping from long-term impoundment to Pot Hole Lake was completed in 1998. A spillway and river diffusers remain to be built. Bleeder reduction programs are ongoing,-these are helpful to reduce the excess water to the system. (If Pot Hole Lake proves to be a viable long-term discharge point, extension of discharge piping to Yukon River will not be required.)

WHY THIS GRADE:

+ all sewage now receives secondary treatment
+ natural UV disinfection
+ no raw sewage discharges
– no sewer use by-law or other source control program
– plans for pothole discharge could destroy salmon spawning area

Dawson City

Population: 1700 in winter (can double in summer with seasonal visitors)

Percentage of population served by sewage treatment plant(s): 80%

Volume generated: Approximately 1 billion litres per year.

Treatment: Preliminary screening and direct discharge.

Receiving Water: Yukon River

Permits: Yukon Territory Water Licence, which states that secondary treatment facility must be built by 2000. City has applied for an amendment.

Combined Sewer %: None.

Toxicity Testing: 96-hour LC50 bioassay at 100% concentration must be non-toxic. Effluent consistently failed this permit requirement, although results have improved with changes in shipping procedures to Vancouver laboratory.

Sludge Disposal: No sludge recovered

Sewage-related Charges: Dawson City was charged with altering fish habitat under Section 35.1 of the *Fisheries Act*, for construction of a berm, and convicted in January 1996.

Additional Facts: Dawson City has had 10 years to design and construct the treatment facility required by the year 2000. Instead, expenditure of efforts has focused on proving that direct discharge to the Yukon River has no impact. A dye study conducted by the Department of Indian Affairs and Northern Development (DIAND) shows a direct flow of sewage from the effluent discharge pipe into the shore of the town, to an eddy at the ferry landing (where people swim), and then a straight flow continuing down the edge of the river, to an eddy at the Han fishery and then continuing far down the bank. The dye study shows there is no dispersion and dilution until well past Dawson City and the downstream uses of the river. DIAND has conducted a Canadian Environmental Assessment Act screening and determined that Dawson City's plan to study their impacts instead of building a facility will "cause significant adverse environmental effects that cannot be justified". Although the Yukon Territorial Government will provide financial aid for sewage treatment, Dawson City considers cable TV a greater priority and has spent $900,000 to provide free cable hook ups to the town.

Community Initiatives: Training in water sampling using test kits for faecal coliform has been done by Yukon Conservation Society with community members.

WHY THIS GRADE:

– sewage discharged with no treatment other than screening
– does not meet permit requirements
– has ignored 10-year deadline to construct secondary treatment facility by 2000
– effluent is discharged into Yukon River, a sensitive aquatic environment

1999 GRADE:

F-

Not Graded in 1994

FOR MORE INFORMATION CONTACT

•

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TO VOICE YOUR CONCERNS CONTACT

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Raw Sewage Discharged:

1 billion litres
All sewage discharged untreated.

Sewage Success Stories

Examples of Communities Using Innovative and Environmentally Sensitive Treatment Methods

The perception of sewage as an unpleasant disposal problem lies at the core of conventional methods of sewage treatment. However, with the rapid depletion of our natural resources, environmentally sound technologies are being developed to meet the need for treating sewage as a renewable resource.

Instead of employing mechanical and chemical methods to purify wastewater, alternative technologies rely heavily on natural biological processes. Spray irrigation, constructed wetlands and systems such as the Solar Aquatics "living machine" are just some of the many innovative methods currently available. The use of such processes, or a combination of alternative and conventional methods where appropriate, can result in more effective and environmentally sensitive wastewater management.

In Canada, few communities use alternative or innovative sewage treatment methods – despite the success and extensive use of such methods in the United States. As the following examples illustrate, however, there are exceptions.

The Bear River solar aquatic sewage treatment facility.

BEAR RIVER, NOVA SCOTIA

In 1995, the residents of the picturesque community of Bear River, Nova Scotia decided to do something different when it came time to install sewage treatment.

Instead of constructing a traditional sewage treatment plant (which provincial regulations dictated must be located many kilometres from the community to minimise the impact of noise and odour on other developments), they opted to build a Solar Aquatics wastewater treatment plant. When the cost of laying kilometres of pipes was factored in, a Solar Aquatics plant was actually cheaper than building a traditional facility.

The plant, with a capacity to treat nearly 25 million litres per year of sewage from up to 100 homes, has become a major tourist attraction for the town, bringing in an estimated 2000 visitors a year. It also set an important precedent: federal/provincial cost sharing was provided for construction, lack of which has been a major stumbling block for many communities desiring an alternative means of sewage treatment.

More information about the facility can be obtained from the Annapolis County web page (www.annapoliscounty.ns.ca/pubworks.htm). Also, their email address is: pworks@annapoliscounty.ns.ca.

ERRINGTON, BRITISH COLUMBIA

In 1996, the owners of a 50-unit mobile home park near Errington, BC also chose Solar Aquatics to clean up their sewage from a failed septic system. Although a Solar Aquatics greenhouse was not the cheapest option, they chose it because it was odourless and would fit right next to homes within the community. The system has been operating successfully for three years with a great deal of involvement from local growers of wetland restoration and bedding plants. The system has some new experiments underway to optimise the plant growing capacity of the greenhouse. As well, the National Research Council is funding tests of a new advanced final filter which could make even cleaner water at less cost, and a fish and plant system known as a bioponics system is being tested for technology and operating efficiency. More information can be obtained from Kim Rink of Eco-Tek (ecotek@imag.net).

VERNON, BRITISH COLUMBIA

Vernon's land-based sewage treatment serves the city's 32,500 residents.

As reported in 1994, the city of Vernon uses a 'land-based wastewater reclamation system' in which treated 'reclaimed water' (sewage effluent) irrigates about 2500 acres of agricultural, recreational and silvicultural lands. The flow undergoes secondary treatment through trickling filters, is chlorinated and then is stored until the summer months when it is required for spray irrigation. If there is more effluent than is needed for irrigation, it can be released into Okanagan Lake. If discharge to the lake is necessary, the effluent is treated to the tertiary level with chemically induced phosphorus removal. Effluent has only been discharged twice for short periods into the lake since 1984.

Approximately 32,500 people are served by Vernon's sewage treatment system and about 4.6 billion litres (1992 figure) are treated annually. This system is well suited to a medium-size community that has access to an area upon which the effluent can be deposited.

Vernon is situated in a very dry region and irrigating with effluent helps conserve water. Land application of the sewage effluent also prevents the deposit of phosphorus in the local water. (The nutrient phosphorus promotes plant growth. Excessive levels of phosphorus, however, can lead to abnormal growth in plant species and have a negative impact on streams and lakes as well as inhibiting recreational activities.) Vernon's wastewater treatment method is an example of how sewage effluent can be a valuable resource, rather than unusable refuse.

MOOSE JAW, SASKATCHEWAN

Moose Jaw is another community using its sewage effluent to irrigate farm land surrounding the city. Its treatment system is designed for 'zero discharge', and, although it does not always achieve this goal, the effluent discharged into the Qu'Appelle River system is of tertiary quality and is in compliance with existing regulations.

The treatment facility serves about 35,000 people and irrigates approximately 3000 acres of farmland. Although the initial capital cost of the spray irrigation system was higher than that of a chemical phosphorus removal facility, the operating costs are lower and the reuse of water to maintain productive and successful farms is beneficial to the whole community.

HAY RIVER, N.W.T.

Sewage from Hay River is treated through a partially-constructed wetlands system. After conventional secondary treatment and 10-day lagoon retention, the flow enters naturally existing wetlands which have been slightly modified by dikes to direct the flow toward an outfall. The plants, insects and micro-organisms living in the marsh purify the effluent to a very high degree. For instance, sewage effluent after conventional secondary treatment generally has a biological oxygen demand of 45 micrograms per litre; the maximum BOD reading at the Hay River wetlands facility after treatment is almost 10 times lower than that level.

The Hay River wetlands treatment system serves close to 4000 people and handles about 450 million litres annually. Effluent from the Hay River treatment system enters a drainage ditch which runs into Great Slave Lake. The capital and operating costs of this facility, as with most wetlands system, are considerably less than those of conventional methods that would achieve the same effluent quality. The success of Hay River's facility has prompted interest from numerous communities in Alaska, Yukon and the North West Territories.

BOYNE RIVER ECOLOGY CENTRE, SHELBURNE, ONTARIO


Digestion cells and solar aquatics at the Boyne River Ecology Centre

Like Bear River in Nova Scotia, this outdoor education centre uses a Solar Aquatics system, referred to as "a living machine". The sewage is directed through a series of tanks, each containing populations of organisms that act to break down the waste material. At the Boyne River School, the sewage passes through four digestion cells in which some solids settle out and organisms are allowed to begin to break down organic matter. It then enters a series of 17 tanks inhabited by different types of organisms, beginning with algae and ending with snails and fish. A constructed marsh and pond further clarify the water until, at the end of the treatment process, it is of legally potable quality, The effluent is recycled back to the toilets after treatment.

The facility is constructed in the form of a water sculpture and is situated in the central atrium of the school. The school's treatment system serves up to 500 people. This system functions as the school's only sewage treatment facility and also provides the students with both a centrepiece for their atrium and an excellent educational tool from which to learn about biological processes.

The "living machine" uses processes that occur in natural freshwater wetlands. "Living machines" can be designed to treat many types of industrial, domestic and commercial wastes. There are currently 10 sites in operation or being developed in six states in the U.S.

Sludge Happens

Sludge is the solid waste left over after treatment of sewage and other industrial effluents. It is defined by the Harper Collins *Dictionary of Environmental Science* as a "viscous, semisolid mixture of bacteria- and virus-laden organic matter, toxic metals, synthetic organic chemicals, and settled solids removed from domestic and industrial waste water at a sewage treatment plant". Ironically, as the quality of effluent treatment improves, the volume and contamination of sludge increases, creating another disposal problem.

When John Stauber and Sheldon Rampton of the US Center for Media and Democracy needed a title for their book about the public relations industry, they came up with *Toxic Sludge Is Good For You*. It was meant to be a joke. Then they got a phone call from the director of public information at the Water Environment Federation (WEF). She informed them that there was nothing "toxic" about sludge, which, by the way, should now be referred to as "bio-solids". (As a result of successful lobbying by the WEF and its PR firm, bio-solids, a word made up to improve public perception of sewage sludge as a commodity, has now been added to Webster's Dictionary.) The authors decided to look into her claims that there were many "beneficial uses" for bio-solids.

As the quality of effluent treatment improves, the volume and toxic contamination of sludge increases, creating another disposal problem.

Their investigation into the PR campaign for 'beneficial use' of sewage sludge "revealed a murky tangle of corporate and government bureaucracies, conflicts of interest, and a cover-up of massive hazards to the environment and human health. The trail began with the WEF – formerly known as the 'Federation of Sewage Works Associations' – and led finally to Hugh Kaufman, the legendary whistle-blower at the hazardous site control division of the [US] Environmental Protection Agency, who is attempting to raise the alarm about the so-called 'beneficial use' of sewage sludge, a boondoggle he refers to as 'sludge-gate'… the mother lode of toxic waste."

According to researchers at Cornell University and the American Society of Civil Engineers, sewage sludge typically contains: Polychlorinated biphenyls (PCBs), chlorinated pesticides such as DDT, dieldrin, aldrin, endrin, chlordane, heptachlor, lindane, mirex, kepone, 2,4,5-T, and 2,4-D, chlorinated compounds such as dioxins, polycyclic aromatic hydrocarbons (PAHs), heavy metals such as cadmium, lead and mercury (all known endocrine disrupters), bacteria, viruses, protozoa, parasitic worms, fungi, and sundry other substances, including asbestos, petroleum products and industrial solvents.

Disposal of sludge has long posed a problem for municipal sewage treatment plants. Landfills fill up quickly, are increasingly expensive and difficult to find, and pose a threat of groundwater contamination. Many municipalities burned their sludge, but concerns about the health problems resulting from the inherent air pollution have brought incineration into disrepute. Some large cities, including New York, used to deal with sludge by loading it on to barges and dumping it at sea, until international laws banned this practice. Using sludge to create methanol or energy may be the most environmentally friendly method, but it is also the most expensive.

It is not surprising, therefore, that more and more sewage plants began to look at land-spreading of sludge as a cheap method of disposal.

American cities began to market their waste long before the US EPA in 1992 modified its "Part 503" technical standards which regulate sludge application on farm-lands, and reclassified sludge from its previous designation as hazardous waste to "Class A" fertiliser. Milwaukee's sewage sludge has been dried and sold as Milorganite, a lawn and garden fertiliser, for 70 years. (Its use was banned in Maryland in 1982 after it was found to contain high levels of cadmium.) Other US cities followed suit, marketing their own "fertiliser", such as Nu-Earth from Chicago, Hou-actinite from Houston and Nitrohumus from Los Angeles.

In Canada we have Calgary's Calgro, Winnipeg's Wingrow and Vancouver's

Calgary Case Study

The City of Calgary achieved the highest grade for effluent treatment in the 1994 *National Sewage Report Card*, an honour which it has achieved again in 1999. Calgary has also, since 1983, run a state-of-the-art sewage sludge land spreading program.

Every year, 18 million dry kilograms of Calgro (the trade name of the soil conditioner produced from sewage sludge) are applied to 1300 unseeded hectares of agricultural land. By weight, Calgro typically contains approximately 5.5% nitrogen, 4% phosphorus and 0.35% potassium.

However, As Section 8(1) of Calgary's Sewer Service Bylaw allows for discharge into the sewerage system of wastewater containing, amongst other things, aluminum, arsenic, cad-mium, chromium, copper, hydrocarbons, lead, mercury, phenol compounds, silver and tetrachloroethylene, and, given that the city's tertiary treatment is designed to remove a maximum amount of contaminants from effluent, it is likely that Calgro also contains these and other substances.

In recognition of the fact that there may be heavy metals and other toxic pollutants in Calgro, the City takes numerous precautions that many other cities engaged in land spreading of sludge do not take. Officials are careful to ensure that sludge is applied only to fields where alfalfa, canola, oats, barley and wheat are grown. It cannot be applied to root crops, vegetable or fruit crops, tobacco crops or dairy pasture. In addition, the City recommends that farmers avoid grazing on lands treated with Calgro for three years following application. As these are all known pathways for contaminants to reach humans, these precautions are admirable. However, it is not known at this time what, if any, health implications there are for the consumption of breads made from grain grown on contaminated soil, oil made from canola grown on contaminated soil or livestock nourished with feed grown on contaminated soil.

Calgary officials point out that regular analyses of sludge nutrients and heavy metals are always well within Alberta Environmental Protection guidelines. This begs the question: Are the guidelines stringent enough?

Within the limits of our current knowledge, Calgary operates its sludge-spreading program with some of the toughest standards in North America and for that it should be commended.

Unfortunately, the 20th century has been riddled with ideas that seemed good but turned out to be bad. It is all too possible that land spreading of "toxic sludge" will not be good for us. How disastrous the experiment will be remains to be seen.

Nutrifor, to name only three of the cities currently utilising land spreading as a sludge disposal method. Toronto is in the process of revising its sewer use by-law in preparation for an expanded sludge land spreading program.

If sewage sludge contained nothing more than human waste, it *could* make an excellent fertiliser and soil conditioner. But, as noted above, it contains many toxic substances which the best by-law in the world cannot keep completely out of the sewerage system.

Land spreading of sludge, therefore, presents some very serious concerns. Heavy metals and toxic organic pollutants which may be present in this material can contaminate land for a very long time. For example, grapes are still grown today in vineyards which grew grapes for Roman wines, and lead used by Romans persists in that soil 2000 years later. In addition, there are concerns about the impacts on human health from growing crops or grazing livestock on soil "conditioned" with sewage sludge.

Grapes are still grown today in vineyards which grew grapes for Roman wines, and lead used by Romans persists in that soil 2000 years later.

Much research has been involved in establishing parameters for the land spreading of sludge. However, some of the assumptions made are fundamentally flawed. For example, standards set for "safe" levels of contaminants in food are based on questionable risk assessments which frequently ignore other exposures and always overlook the possible impacts of exposures to combinations of contaminants.

Many scientists believe there are too many unknowns involved for sewage (or other industrial) sludge to be disposed of in this manner.

According to Cornell University's Waste Management Institute, "US federal regulations governing the land application of sewage sludges do not appear adequately protective of human health, agricultural productivity or ecological health." Issues of concern include: pollution allowed to reach maximum 'acceptable' levels; no safety of uncertainty factors; exposure pathways evaluated separately, cancer risk set at 1-in-10,000 instead of 1-in-1,000,000; soil ingestion rate may be too low; pollutant intake through foods may be underestimated; many pollutants not considered; ground and surface water calculations flawed; not protective of agricultural productivity; inadequate assessment of pathogen risks, ecological impacts inadequately assessed; inadequate enforcement and oversight; no labelling of sludge products.

It is impossible to compare federal standards in Canada and the US, because there are currently no country-wide standards in Canada for sludge spreading. At the moment, standards are set by individual municipalities, usually within provincially determined guidelines.

Land spreading of sludge presents some very serious concerns. Heavy metals and toxic organic pollutants which may be present in sludge can contaminate land for a very long time.

Source Control

Effective source control is essential to achieve any significant improvement in the health of the environment.

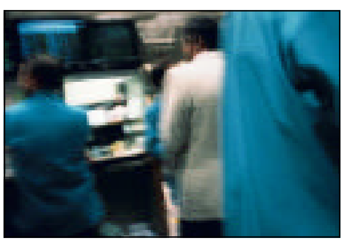
Source control is the regulation and/or elimination of substances entering the municipal sewerage system and is a vital component of any treatment and disposal process. By restricting the type and volume of material discharged into the wastewater flow, source control programs function as an alternative to the conventional practice of removing or treating pollutants at the 'end of the pipe'.

This preventative approach to waste management is more effective and considerably less expensive than attempts to rehabilitate polluted ecosystems. Effective source control reduces the overall wastewater flow, conserving water and energy. With smaller volumes to process, sewerage systems can work more efficiently.

If persistent toxic pollutants were prevented from entering the sewage flow, the characteristics of wastewater and the type of treatment required would change drastically. Some chemicals used to remove toxic pollutants are environmentally harmful in themselves, but are no longer needed when persistent contaminants do not enter the system. The effluent discharged into the environment would be significantly less toxic; and the sludge, which would no longer contain high levels of untreatable substances, would become a useful resource. In this form, sludge could be used as soil conditioner on fields, as landfill for projects such as mine reclamation, composted and sold as fertiliser for smaller gardens, or applied in reforestation projects.

Sources of Waste

Households, industrial and commercial operations, and stormwater run-off are the three main sources of wastewater in a conventional municipal sewerage system. Industrial/commercial activities contribute a variety of contaminants such as silver from photo-finishing outlets, chromium from electroplating plants, solvents from dry-cleaning services and auto-body shops, and ink and dyes from printing plants. These substances are all individually harmful and, together, form an effluent which is often toxic to aquatic organisms and sometimes to humans. Households add human excrement, organic kitchen wastes, solvents, oils, laundry detergent and bleaches, and other types of cleansers to this noxious mixture. Contaminants deposited on street surfaces by automobiles, such as oil, grease, anti-freeze, and cancer-causing hydrocarbons, are washed by stormwater into the sewerage system, or straight into local waters through storm outfalls.



Education plays a powerful role in encouraging individuals and companies to see waste as a valuable resource rather than useless refuse.

Educating Polluters

In order to be effective, source control programs must include educational, legislative and enforcement components. The control and elimination of persistent toxic pollutants at source require a change in behaviour and a shift in the way waste is regarded. Education plays a powerful role in encouraging individuals and operators of industrial plants to see waste as a valuable resource rather than useless refuse. Public education campaigns which make it clear to householders that their actions can have a negative impact on the aquatic environment, and detail alternative ways to dispose of waste, could help bring about behavioural changes.

Through public education campaigns, people can also be made aware of the link between vehicle use and the toxic pollutants that collect on street surfaces and are washed into the sewerage system. Anti-littering programs, combined with regular street cleaning, could help eliminate the larger debris which is left on roads and finds its way into storm drains.

Industrial and commercial operators must also be made aware of alternative pre-treatment technologies and disposal methods. For example, methods exist for many industries to capture and reuse heavy metals and other toxic chemicals which are part of their manufacturing process, and often money spent on installing these technologies is recouped fairly quickly from material costs. (The Body Shop Canada has installed a Solar Aquatics sewage treatment facility at its Toronto headquarters. This international cosmetics company is an example of a corporation making a true effort to be as environmentally responsible as possible.)

Legislation

As important as education is for promoting source control, legislation, combined with comprehensive monitoring and strict enforcement, is essential to achieve effective elimination and regulation of pollutants at source. Legislation often comes in the form of municipal sewer use by-laws or provincial regulations, in which standards are prescribed for substances entering the sewerage system.

Many municipalities' by-laws are outdated and little attention is paid to the environmental impact of toxic substances discharged into the sewer system.

Surcharges are a common method of regulation among the municipalities surveyed. The sewer use by-law, or other type of relevant legislation, contains a general set of standards for sewage characteristics such as biological oxygen demand, suspended solids, nitrogen, phosphorus, temperature, and some heavy metals, with which operators are meant to comply. Some substances are completely prohibited and are not allowed to enter the system in any form. In the event that industries and businesses do not meet these requirements, a surcharge is levied against them. The surcharge is meant to discourage operators from discharging waste in excess of the legal limits. Failure to pay the surcharge fees or to upgrade equipment in order to meet the required standards is a violation of the regulation or by-law.

A system of permits is an alternative to broad-based regulations, and a way to set particular standards for individual operations. For example, the Greater Vancouver Regional District's sewer use by-law states that any operation which discharges more than 10,000 litres per day must do so under a permit which specifies allowable concentrations levels of various substances. If an operator fails to meet the standards prescribed in the permit, he or she is in violation of the municipal sewer use by-law and, in British Columbia, the provincial *Waste Management Act*.

Unfortunately, many municipalities' by-laws are outdated and do not effectively limit the kinds of contaminants found in today's municipal sewerage systems. Historically, sewer use by-laws were limited to regulating the size of pipe which could be connected to the system, or to protect the infrastructure and worker safety by banning discharges of corrosive, flammable or explosive material. Little attention was paid to the environmental impact of toxic substances discharged into the system.

Improvements in wastewater treatment have been the driving force behind the increasing number of municipal source control/sewer use bylaws which have been drafted and enacted since the 1994 *National Sewage Report Card*. These bylaws restrict the amount of contaminants which can enter the system, some looking at wide range of heavy metals and toxic chemicals, including nonylphenols, hydrocarbons, phthalates and other endocrine disrupting chemicals. With the increased volume of sludge created by upgraded effluent treatment and the inherent disposal problems, more and more communities are looking at land spreading as an option.

As the table below illustrates, whether or not a municipality has a sewer use bylaw is not as important as the restrictions imposed by that by-law. For example, limits for some highly toxic substances in both Calgary and Fredericton's existing and Toronto's proposed sewer use bylaws greatly exceed the parameters set by the Canadian Council of Resource and Environment Ministers (CCREM) for discharge into aquatic ecosystems. In some cases the bylaws allow for discharges into the municipal sewerage system 10,000 times higher than those laid out by the CCREM.

Some city bylaws allow for discharges 10,000 times higher than those laid out by the Canadian Council of Resource and Environment Ministers.

SUBSTANCE	CCREM Guideline	Calgary	Fredericton	Toronto
Aluminum	.0075 mg.L	50 mg.L	50 mg.L	50 mg.L
Arsenic	.05 mg.L	1.0 mg.L	1.0 mg.L	1.0 mg.L
Cadmium	.001 mg.L	1.0 mg.L	2.0 mg.L	0.7mg.L
Chromium	.02 mg.L	3.0 mg.L	5.0 mg.L	2.0 mg.L
Copper	.0025 mg.L	3.0 mg.L	5.0 mg.L	2.0 mg.L
Lead	.0035 mg.L	1.0 mg.L	5.0 mg.L	1.0 mg.L
Mercury	.0001 mg.L	.01 mg.L	0.1 mg.L	.01 mg.L
Silver	.0001 mg.L	5.0 mg.L	N/A	5.0 mg.L
PCBs	.000001 mg.L	N/A	N/A	.001 mg.L
Tetrachloroethylene	0.260mg.L	0.7 mg.L	N/A	1 mg.L

While it is true that with Calgary's tertiary treatment a very large percentage of these contaminants will be removed from effluent and Fredericton's secondary treatment will remove a reasonable number of contaminants, thus preventing their discharge into aquatic ecosystems; the pollutants will then be deposited in the sludge, which is currently being used as a soil conditioner on farms near Calgary and composted to be used in potting soil or as a soil conditioner on land near Fredericton. Toronto, which presently incinerates and discharges into the air the contaminants from 78% of its sludge, developed the draft by-law from which these figures were taken in preparation for a move towards 100% land spreading of sludge.

No Penalty for Polluters?

Even if municipal sewer use bylaws and provincial regulations were enacted to ban substances such as those in the table above, and keep other toxic contaminants from entering into the municipal sewerage system, the regulations will be meaningless without effective enforcement. Lax enforcement presents a greater obstacle to effective source control than ineffective legislation. Prosecution of offenders is generally seen as a last resort. Municipal or district authorities prefer to negotiate with offenders and to reach an agreement to upgrade pre-treatment facilities, rather than file charges or levy fines. Unfortunately, many offenders postpone improvements while continuing to violate regulations and discharge waste which cannot be adequately treated at the municipal plant. Strict enforcement of permits would motivate industrial and commercial users to meet these standards in the first place.

In order to enforce source control regulations, an extensive monitoring program must be in place. Many municipalities lack the staff to perform tests to ensure standards are being met, and monitoring is often conducted only in response to a complaint. Without regular and thorough monitoring at the municipal, provincial and federal levels of government, violations will continue to go unchecked and offenders will continue to pollute the environment without penalty.

Without monitoring and strict enforcement, permits, surcharge programs and regulations will not succeed in changing the characteristics of municipal waste.

Effective Source Control

Contaminants which cannot be treated properly by the municipal treatment facilities should not be allowed to enter the sewerage system. In the short term, industrial and commercial users must be made legally responsible for the pre-treatment of their waste so that the substances discharged into the sewerage system are similar to those found in conventional domestic waste. Strict legislation is needed to discourage householders from dumping hazardous substances or persistent toxic pollutants down household drains, toilets or storm drains.

In the long term, it must be recognised that no amount of legislation restricting the substances which can or cannot be discharged into the sewerage system will prevent some householders, businesses and industries from ignoring the law and improperly disposing of toxic waste. It is therefore essential that the federal government play its part by phasing out the use of dangerous chemicals. For example, the use of the endocrine-disrupting chemical nonylphenol as a sudsing agent in domestic detergents was banned in the UK many years ago, although it is still commonly used in North America in domestic detergents, as well as industrial detergents, shampoos and other hair care products. Wherever safer alternatives exist the phase out should be completed as quickly as possible.

Effective source control is essential to achieve any significant improvement in the health of the environment.

No amount of legislation will prevent householders and businesses from disposing of toxic wastes down the drain. It is essential that the federal government phase out the use of dangerous chemicals.

A History Of Inaction

Environmental Laws & Their (Lack of) Enforcement

Laws meant to protect the environment from the negative effects of sewage effluent do exist. The problem is not a lack of mechanisms for achieving responsible sewage treatment, but a failure to enforce these laws strictly enough. The following sections outline the responsibilities of different levels of government to ensure these laws are followed, and their general failure to do so.

The Federal Laws

The *Fisheries Act*, originally passed at the turn of the century, is Canada's strongest protection from water pollution. Section 36(3) provides for penalties of up to $1 million and/or imprisonment for every day "deleterious" substances are discharged into "waters frequented by fish".

Raw municipal sewage has repeatedly been found by courts to constitute a "deleterious" substance. Even effluent samples from secondary treatment plants occasionally fail the standard test[1] accepted by the courts and the federal Department of Fisheries and Oceans (DFO) as the appropriate test to determine the "deleterious" nature of an end-of-the-pipe sample.

The problem is not a lack of mechanisms for achieving responsible sewage treatment, but a failure to enforce these laws strictly enough.

The *Fisheries Act* is enforced federally by both DFO and Environment Canada, and by provincial Ministries of Environment. Under Canada's constitution, the province has primary responsibility for natural resource and property matters; however, the federal government also has overlapping jurisdiction in relation to its powers over "coastal and inland fisheries". This joint jurisdiction has been informally divided in some provinces by special agreement, but the legal responsibilities of both levels of government remain.

Although it is DFO's prerogative and duty to enforce the *Fisheries Act*, it is a power used very rarely, and generally in the case of isolated spills rather than chronic offenders. Of the 21 cities investigated in this report, only one – Dawson City – has ever been charged by DFO. This is despite the fact that the Greater Vancouver Regional District openly admits it is in chronic violation of the Act, and the fact that Victoria, Halifax, St. John's and a number of smaller municipalities continually discharge untreated sewage directly into the oceans.

Most provincial governments either take full responsibility for enforcing the *Fisheries Act*, or their duty in this area is concurrent with, but separate from, that of the federal government. Unfortunately, the provinces' collective prosecution record is no better that that of the federal government. For example, in British Columbia, the provincial government has never charged a municipality for normal sewage discharges. In fact, both times Sierra Legal Defence Fund investigated and laid private prosecutions for *Fisheries Act* violations against the Greater Vancouver Regional District, the charges were taken over by the provincial Attorney General's office and, after numerous delays, eventually dropped. A private prosecution laid against the Capital Regional District in 1998 is currently with the Attorney General's office and there is no sign that it will be pursued.

There are two other federal statutes which contain sections pertaining to sewage discharges. The *Canada Water Act* entitles the government to designate any waters as a "water quality management area", and to then use extensive powers to maintain the quality of water in that area. This part of the Act could be (but is not) used to address sewage pollution.

The *Canadian Environmental Protection Act* (*CEPA*) also has unused potential to apply to municipal sewage. Part IV governs the dumping of waste into the ocean and requires that permits be obtained before sewage disposal takes place. Despite this, St. John's is just one of numerous coastal communities which have no permit to discharge sewage into the ocean, nor are they required by their provincial law to have one.

Another relevant section of *CEPA* is section 12, which provides for the listing of certain substances to be given priority in assessment of their toxicity. Under the terms of the *CEPA*, the federal Environment Minister can investigate substances that may contaminate the environment and cause adverse effects on the environment or on human health. If, as a result of an investigation, a substance is determined to be toxic, then the federal government can make regulations to control or eliminate the use of that substance in Canada. Chlorinated Wastewater Effluent (CWWE) was listed in 1989 on the first Priority Substances List (which contained a total of 44 substances). In 1994 the assessment of CWWE was completed. Laboratory and *in situ* testing found that concentrations of CWWE discharged from municipal wastewater treatment facilities killed fish and caused changes in the structure of benthic invertebrate communities.

As a result of extensive study, the Minister of Environment determined that "chlorinated wastewater effluents discharged into the Canadian environment by municipal wastewater treatment plants have caused harmful effects to freshwater biota". CWWE was designated as "toxic" as defined under paragraphs 11(a) of *CEPA*, as a substance which enters "the environment in a quantity or concentration or under conditions having or that may have an immediate or long-term effect on the environment." When CWWE was listed as toxic in 1994 there were approximately 400 municipal waste water treatment plants discharging chlorinated wastewater effluents into aquatic systems across Canada. Despite this widespread release of what was then determined to be toxic effluent, five years has passed, and no federal regulations have been drafted to address the problem. In fact, CWWE was only formally added to the Schedule I list of Toxic Substances under CEPA in March of 1999.

Provincial practice is often to licence the status quo and sewage treatment plants are issued permits without regard to any basic standard. Victoria, for instance, discharges all its sewage untreated and holds a permit which allows it to do so.

The Provincial Laws

Responsibility for municipal sewage treatment, in terms of regulation and construction, lies primarily with provincial governments. Most provinces maintain legislative control through waste control statutes which apply directly to sewage effluent. In British Columbia, for example, the *Waste Management Act* requires all municipalities to have a provincially approved Liquid Waste Management Plan. Discharges without such a plan are illegal. Similar legislation exists in most provinces.

Unfortunately, this regulatory system is full of flaws. Numerous cities throughout Canada have no permits whatsoever. Some have permits, but are chronically in violation of the requirements, without any consequence. In many cases, provincial practice is to licence the status quo – sewage treatment plants are issued permits allowing discharges of existing volumes and quality without regard to any basic standard. Victoria, for instance, discharges all its sewage untreated and holds a permit which allows it to do so. Saint John dumps 60% of its sewage untreated and consistently meets the permit requirements at all four of its treatment plants. Without basic standards for receiving water and effluent

Conflict of Interest and "Independent Counsel"

Dealing with Private Prosecutions

Attorneys General have the ability to intervene in, and drop ("stay"), private prosecutions. This ability has existed for several hundred years, as has the citizen's right to lay charges and conduct private prosecutions. In some Canadian jurisdictions, such as Ontario, the ability to intervene and stay has been exercised with the dignified restraint one might expect in relation to such a powerful tool. Unfortunately, in other provinces the opposite is true. In Alberta and British Columbia, the Attorney General's policy is to intervene in *all* private prosecutions. The overwhelming majority of such environmental cases in recent years have then been stayed prior to reaching trial.

Clearly the provincial government could be viewed with deep suspicion when it intervenes in sewage cases and stays them. The Attorney General sits at the same Cabinet table as the Minister responsible for cost-sharing in the construction and improvement of sewage treatment facilities. A prosecution proving that sewage treatment was inadequate could embarrass the whole government.

To avoid the appearance of bias, in recent years some Attorneys General have hired "independent counsel" (sometimes called "special prosecutors") to deal with private prosecutions. These "independent counsel" are normally hired in the legal services marketplace, from private sector law firms. Of course, they are subject to the same pressure as any other lawyers; they are business people and have to make a living from their work. Their appointment as "independent counsel" begs two very important questions: As a business person, would you do something your client didn't want you to do? If you did, would you expect your client to hire you in the future?

The obvious answers to these questions are supported by the history of "independent counsel" in dealing with environmental private prosecutions. In almost every case in which an "independent counsel" has been hired, the prosecution has been stayed. Often, reasons for the stay are not given to the public, nor to the citizen that laid the charge. Although hiring "independent counsel" may deal with the *public perception* of bias, it doesn't necessarily remove the *reality* of bias.

It is far better to remove the bias by not intervening in private prosecutions in the first place. As noted above, dignified restraint is the norm in some provinces, and there is no mad rush of illegitimate private prosecutions. In fact, when Sierra Legal Defence Fund laid a private prosecution against the City of Kingston for violations of the *Fisheries Act* related to the discharge of toxic leachate from an old landfill site, the Ontario Attorney General's Office left the prosecution in SLDF's hands *and* laid charges of their own which were argued jointly in court. (The City was found guilty and fined $120,000.)

If the concern to be addressed by Attorneys General intervention is protection of the innocent accused, courts are well-endowed to provide the necessary protection. The courts have the Canadian Charter of Rights and Freedoms, the common law doctrine of malicious prosecution, and the inherent ability to protect any and all accused from abuse of process.

The courts also have independence.

quality, merely licensing a plant has little real significance.

Provincial governments are in a difficult position in terms of enforcement against municipalities. Cost-sharing agreements or legislation order most provinces to contribute 25-50% or more of the cost of constructing sewage treatment works. Thus, the absence of adequate treatment facilities is sometimes an indication of provincial reluctance to provide funds. In such cases, prosecution of permit offenders by the provincial government may be an unrealistic expectation; it would be pressuring itself to fund improvements to the system. This raises an unresolved conflict-of-interest question in instances, such as the one mentioned above, when provincial authorities take over and drop private prosecutions of municipalities for violations of the *Fisheries Act.*

Not surprisingly, provinces charge very few offenders. An examination of the prosecution records of Ontario and British Columbia provides some indication of the lack of provincial commitment to enforcement. Although there were nearly 100 non-compliance violations by Ontario municipal sewage treatment facilities in 1996 and

1997, no charges were laid. In British Columbia, during the same period, 76 municipal sewage treatment plants were cited on the provincial non-compliance list, some for several test periods in a row. Of the municipalities in violation, no municipality was charged by the province.

Some provincial politicians take the position that enforcement is not a constructive approach because "taxpayers' dollars are better spent on treatment than on fines". Unfortunately, this attitude usually leads to no dollars being spent at all.

Although the past two decades have seen a proliferation of statutes designed to protect the environment, their enforcement has been erratic.

Municipal governments

The responsibility of municipal governments is the most direct, in that it is municipal governments which have the statutory mandate to provide sewage treatment, and which have the ability to generate the necessary funds through taxation. According to the 'polluter pays' principle, it is the people of any given city who should foot the bill for treating their sewage. Developers, for instance, are required to cover the full costs of services required when land is rezoned for development. The same rationale should apply to existing residents. The amount of money needed for sewage treatment in large cities may be substantial; however, there are many taxpayers, all of whom use the sewerage system.

Municipal governments also have the power, usually through a provincial *Municipal Act*, to control discharges *into* the sewerage systems. Many have taken advantage of these powers to pass Sewer Use By-laws. While these by-laws are meant to reduce the toxicity of effluent and establish an important principle of source control, many municipalities have no better records than the federal and provincial governments. Some by-laws are too general and are therefore unenforceable. Others are not enforced, because municipalities do not have the resources, human or financial, to effectively audit those who discharge into the municipal system.

Towards a Solution

If environmental laws are to be credible, they must be strictly enforced. Failure to enforce can be construed as indifference on the part of the government, resulting in a cavalier attitude toward environmental offences.

Although the past two decades have seen a proliferation of statutes designed to protect the environment, their enforcement has been erratic. Environmental legislation, and its enforcement, must become broader and more wide-ranging before issues such as sewage disposal can be effectively addressed.

Laws must prohibit pollution altogether, rather than simply permitting specified amounts of pollutants into the environment. These are the directions in which public pressure must now be applied. Until legislation and enforcement improve, the environmental cost of pollution – including the cost of illegal disposal of sewage – will continue to be borne by the general public and not by the municipal corporations responsible for illegal dumping.

Laws must prohibit pollution altogether, rather than simply permitting specified amounts of pollutants into the environment.

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[1]Failing the test: The standard test for determining whether a substance is "deleterious" to fish is an acute toxicity 96-hr LC50, which involves placing 10 fish (usually rainbow trout) into an aquarium containing the suspect substance and another 10 fish into an untreated control tank containing fresh water. If more than 50% of the fish in the "treated" tank die within 96 hours, the substance is deemed acutely toxic. The courts have recognised that an acutely toxic substance is a "deleterious substance" as defined in the federal Fisheries Act. However, Department of Fisheries and Oceans scientists admit that the test is incapable of identifying chronic, or sub-lethal, effects (i.e. the substance may not kill fish outright, but could cause semi-permanent effects such as loss of equilibrium or temporary blindness which may make fish more susceptible to predation, or permanent and irreversible damage or death may occur many days or weeks after the 96 hour deadline has passed. Much more stringent testing is needed.

Office of the Auditor General of Canada and the
Commissioner of the Environment and Sustainable Development

NEWS RELEASE

Government Handling of Toxic Substances

Insufficient understanding and inadequate management of risks posed to Canadians

OTTAWA, 25 MAY 1999 - In his Report tabled today in the House of Commons, the Commissioner of the Environment and Sustainable Development, Brian Emmett, raises fundamental concerns about the federal government's ability to detect and understand the effects of toxic substances on Canadians and ecosystems. He also concludes that the federal government is not taking sufficient action to ensure that the risks to Canadians posed by toxic substances are being dealt with.

There are 23,000 chemicals used in Canada. They are present in food preservatives, agricultural and household pesticides, dry cleaning, fuels and other products. Most provide important benefits to Canadians and do not pose a risk to their health and the environment. But many do. Industrial chemicals and pesticides have been linked to cancer, birth defects and lowered resistance to disease.

"Understanding the risks posed by toxic substances is the first step toward protecting Canadians," said Brian Emmett. "But the federal government's knowledge of their effects is incomplete and the risks are
still unknown. Furthermore, the departments responsible for managing the risks are themselves deeply divided on how it should be done. They even disagree on the importance of the risks."

The Commissioner identifies a growing gap between new demands for scientific information and the ability of the federal department to meet these demands. For example, many pesticides used in Canada today were evaluated when environmental and human health standards were less stringent. The government has not kept its long-standing commitment to re-evaluate them against today's tougher standards.

Other findings include the following:

- The government does not collect data on the release of many toxic substances. There are no reliable data on sales and use of pesticides. In fact, of countries responding to an OECD survey, only Canada and the Slovak republic do not track pesticide sales.
- Voluntary programs to reduce the release of toxic industrial chemicals may not be sufficient to manage priority toxic substances.
- Monitoring for the presence and effects of toxic substances in the environment is incomplete and inconsistent.

The Commissioner urges federal departments to work together to conduct scientific research and monitoring and to take action to manage the risks posed by toxic substances. "Departments have considerable collective expertise and have shown collaboration in the past," said Brian Emmett.

The chapters "Understanding the Risks from Toxic Substances: Cracks in the Foundation of the Federal House" and "Managing the Risks of Toxic Substances: Obstacles to Progress" are available on the Office of the Auditor General of Canada Web site (www.oag-bvg.gc.ca). They are also featured in a "Selected Observations" video, which can be obtained by contacting our Office Distribution Centre at (613) 952-0213, ext. 5000 or fax at (613) 952-0696. Other key environmental issues, such as climate change (Chapter 3) and biodiversity (Chapter 4) were examined in the 1998 Report, which are also available on this site.

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