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Position of Polytechnique Montréal experts on the planned discharge of wastewater from the City of Montréal's southeast interceptor

Montréal, October 8, 2015 – Polytechnique Montréal faculty includes professors who are experts on the collection and treatment of wastewater, on the treatment and distribution of drinking water, and on drinking water source protection. We wish to contribute to the discussion by providing scientific evidence from our various areas of expertise. The five signatories are professors in the Department of Civil, Geological and Mining Engineering and are all members of the Centre de recherche, développement et validation des technologies et procédés de traitement des eaux (research, development and validation centre for water treatment technologies and processes – CREDEAU).

Sarah Dorner is an associate professor and holds the Canada Research Chair on Source Water Protection. Michèle Prévost is a full professor and holds the NSERC Industrial Chair in the treatment and distribution of drinking water. Professor Prévost served on the Walkerton Commission as an expert adviser. Professors Prévost and Dorner are actively involved in defining quality standards for drinking water and the protection of drinking water sources in Québec and abroad. They are working in collaboration with municipalities and governments to improve the quality of drinking water and to protect drinking water sources. Raymond Desjardins is a full professor, founder and first director of CREDEAU. He teaches the fundamentals of urban engineering, covering the treatment and distribution of drinking water and the collection and treatment of wastewater. Yves Comeau, full professor, specializes in wastewater treatment. He is Director of Polytechnique's Environmental Engineering Laboratory and served on the Québec Committee on new wastewater treatment technologies. Benoit Barbeau is a full professor and also holds an NSERC Industrial Chair in the treatment and distribution of drinking water and is the current Director of CREDEAU.

Is the planned work on the interceptor justified?

The southeast interceptor is a critical infrastructure that transports wastewater to the City of Montréal's wastewater treatment plant from sectors stretching from the borough of LaSalle up to the borough of Rivière-des-Prairies–Pointe-aux-Trembles. The City of Montréal has announced repair, maintenance and equipment installation work, including the building of a snow chute in the Ville-Marie/Southwest district. The work on the southeast interceptor proposed by the City of Montréal is necessary due to the deterioration of certain elements within the interceptor. Debris from deteriorating bands may cause problems inside the interceptor, such as blockages causing avoidable and prolonged discharges of wastewater into the river, a reduction in the interceptor's capacity that increases overflows of wastewater, and major breakdowns of pumps

and other equipment in the treatment plant, which may cause prolonged discharges of large quantities of wastewater into the river (over 6,000 litres per second, on average).

The City of Montréal had planned to proceed with the installation of a snow chute to meet regulatory requirements and to treat contaminated snow transported to the treatment plant. The proposed work aims, therefore, to keep the interceptor functioning by performing preventive maintenance that will ensure its proper operation, maintain snow treatment capacity, and increase capacity for the conveyance of wastewater. This will improve the quality of the wastewater discharged annually into the river. Finally, it must always be remembered that the proper operation of collectors and interceptors is essential to limit sewer backups that affect citizens. **Combining the repair of a critical infrastructure with the installation of a snow chute will minimize the duration of discharges into the river during construction and the number and duration of discharges after construction.**

Are discharges of untreated wastewater permitted and frequent in Québec?

The discharge of untreated wastewater is allowed at wastewater treatment plants and at locations along the sewer system under all regulations and guidelines, in Québec (ROMAE, Article 8), in Canada [Canadian Council of Ministers of the Environment (CCME) 2009] and in the United States (Clean Water Act, USEPA). The *Règlement sur les ouvrages municipaux d'assainissement des eaux usées* (regulation respecting municipal wastewater treatment works, Government of Québec 2014) frames the requirements for the treatment and discharge of wastewater. Article 8 explicitly allows municipalities to temporarily discharge untreated wastewater during periods of work. Discharges of untreated wastewater are allowed in the system (at overflow structures) and at the plant in the event of an emergency, during the snow melt period, when performing work to modify, repair or maintain a facility, and following an infiltration of water into the structure resulting from the spring thaw. **Overflow discharges are permitted in combined networks (networks carrying a mixture of human, industrial and stormwater waste to the treatment plant) and are limited (not eliminated) based on the capacities of the networks and the receiving environment.** Authorizations for untreated wastewater discharges at the plants and on the networks are granted under certain conditions, for example, when preventive work is necessary, when an unexpected failure or break occurs, or when another major emergency warrants it.

It is important to stress that combined sewer overflow (CSO) discharges are common in Québec's wastewater collection systems. **In 2013, 45,512 events of untreated wastewater overflow discharges were listed** by the MAMOT [Ministère des Affaires Municipales et Occupation du Territoire (MAMOT) 2014]. The vast majority of these overflow discharges occur during rainstorms (61%), snow melt (15%) and emergency situations (14%). Repair work such as that planned by the City of Montréal are included in the "emergency" category. A total of 522 discharges lasting for more than 48 hours was reported for one year, including 122 at the wastewater treatment plant (bypasses). Interception and treatment facilities are only able to

convey a portion of the flow during rainstorms, in accordance with the requirements and standards at the time of their design.

It should also be noted that other rivers in the Montréal area are constantly contaminated by wastewater discharges through untreated wastewater bypasses from plants and multiple overflows during rainstorms. The levels of contamination of drinking water by microbiological and chemical contaminants (pharmaceuticals, hormones, etc.) in these rivers confirm the significant and sustained nature of these discharges of untreated wastewater**.**

Can the waste be stored or treated at overflow points where the untreated wastewater will be discharged?

The southeast interceptor is very large, with a diameter of 2.9 to 5.5 metres buried at a depth of up to 45 metres. Commissioned in 1989, its construction required several years. Wastewater interceptors are large structures that are not duplicated (no redundancy). Such a redundancy would be very costly and municipalities therefore do not adopt this practice. **Renewing existing infrastructure is already a considerable challenge and current needs across Canada are not met by investment programs. This so-called infrastructure deficit** is especially present in the case of infrastructure for the collection of wastewater and the distribution of drinking water.

It is essential to maintain existing critical infrastructure to maintain their functionality. **If emergency or planned work is needed, untreated wastewater must either be temporarily discharged into rivers, stored or treated at the discharge point.** In the case of the southeast interceptor, it is important to understand that the wastewater flows involved are substantial due to the population served. This amounts to 12,000 litres per second, or 12 tonnes of water per second, or the equivalent of a tanker truck every second. Considering the size of this infrastructure, it is quite simply impossible to install an additional interceptor or a short-term holding tank that is capable of storing the wastewater for an extended period of work (several days). Moreover, two-thirds of this network conveys human, industrial and stormwater waste at the same time, causing rapid and frequent changes in water levels in the interceptor. The flows carried by the interceptor cannot be pumped and directed to temporary storage and treatment facilities. **One needs only to consider the size of the pumps and associated piping to realize that this type of temporary installation is not an option for these high flow rates. The size and number of the pumps and treatment equipment that would be required are unrealistic.** In addition, installation of these systems would require lengthy work to then only be used for a few days. It is difficult to justify these considerable investments to citizens while the maintenance and rehabilitation of existing infrastructures already pose a major financial challenge for Canadian municipalities.

During the work, it is also essential to maintain safe working conditions for the people involved, especially the workers, by drying the interceptor during the work period. The work will be performed in a confined and deep environment that poses health and safety risks that must be controlled.

What will the impacts of the discharges be?

When discharges are inevitable, the negative impacts must be limited. It is not possible to assert that such discharges will have no impact on the receiving environment and its uses. However, it is important to quantify the impacts of such discharges and, above all, to compare the impacts of inaction in terms of the maintenance or repair of critical infrastructures such as an interceptor. Moreover, it is essential to compare the impacts of the emergency discharges with the volume of discharges already present. In other words, do the emergency discharges significantly increase the current levels of contamination and do they impact the risk level for drinking water, recreational uses and aquatic life?

International regulations and guidelines specify that the main impacts to be considered are:

1) The impact on drinking-water intakes

The impacts on the production of drinking water depend on the level of contamination at the water intake and the treatment capacities in place at the drinking water treatment plants. The main goal of drinking water treatment plants is to disinfect, namely to remove microorganisms that may cause illness. Several plants are located downstream from the proposed discharge. Some plants are located on the South Shore, in St. Lambert, Varennes, Longueuil, Verchères, Contrecoeur and, on the North Shore, in Lavaltrie and Berthierville. In normal times, these plants are affected by contaminated waste generated from discharges from treatment plant effluents, from overflows during rainstorms and the snow melt period, and from agricultural runoff. The plants are adapted to meet local disinfection needs. Indeed, an ambitious program drinking water plant was conducted in the last 15 years, in response to the strengthening of drinking water quality standards [Government of Québec in 2012, Québec 2001]. In this regard, Québec compares well at the national and international levels with drinking water treatment plants that provide adequate disinfection.

The increase in the bacterial load at the water intake can be easily calculated based on concentrations of fecal coliform bacteria that are measured in the waste and treated water. The reduction of this indicator by the Jean-R.-Marcotte treatment plant is well documented: the current treatment reduces the concentrations of fecal coliforms from about 4 million/100 mL fecal coliforms present in the water to 1 million/100 mL in the treated wastewater. **Based on the proportion of treated and untreated discharges, it can be estimated that the microbial contaminant loads would be increased by a <u>maximum</u> factor of 2.4 during the planned work.** This result may seem surprising but it was predictable because the Jean-R.-Marcotte treatment plant is not equipped with a disinfection process. Ozone disinfection is currently being installed and will ensure effective and major disinfection that will significantly reduce the level of microbial contamination downstream from the discharge point of the Jean-R.-Marcotte treatment plant.

The potential increase in risks to water intakes associated with untreated wastewater discharges during the proposed work can then be estimated. We expect that this impact will be minimal, firstly because of the marginal increase in the load discharged (2.4 times) and secondly because of the level of dilution in the river. Drinking-water treatment plants are designed and operated to deal with variations of raw water quality. Treatment choices are made with a safety margin so that they are able to respond to changes in raw water quality. A change of less than one order of magnitude (10 times) in raw water quality is not considered a significant risk. Research has shown

that daily fluctuations of more than two orders of magnitude (100 times) in fecal contamination are frequently observed at drinking water intakes impacted by overflows.

2) The impact on recreational uses.

It is recommended that discharges take place outside of seasons during which recreational uses, especially water-contact activities, are common. Advisories to users are recommended. Information on concentrations of fecal coliforms before the installation of the southeast interceptor is available [Deschamps *et al*. 2001], under conditions similar to those that will be present during the work.

3) The impact on aquatic life.

We cannot comment on the impact of the increased discharges on aquatic life. The impact will be difficult to measure and its scope will depend on concentrations. It is important to remember that the current treatment at the Jean-R.-Marcotte treatment plant does not remove products considered toxic for the receiving environment, including ammonia, pharmaceuticals, endocrine disruptors and hormones. The physico-chemical treatment processes currently in place treat solids (coarse and fine), phosphorus and some metals and organic matter. Ozonation will significantly reduce the load of pathogenic micro-organisms and some organic trace compounds. **It is therefore incorrect to assert that the untreated wastewater discharges during the construction work will increase the concentration of compounds such as ammonia, pharmaceuticals, hormones and endocrine disruptors in the river. It is wrong to suggest that these compounds would be in higher concentrations in drinking-water intakes downstream.**

Could we be better prepared to assess the impact of emergency overflows on downstream water intakes?

The *Règlement sur le prélèvement des eaux et leur protection* (regulation on the sampling and protection of water — RPEP) was adopted in 2014 [Government of Québec 2014]. It aims specifically to protect drinking water intakes. The first step is to characterize the vulnerability of all water intakes to various sources of contamination. The second step will be to implement plans to protect the drinking water intakes. Plans for vulnerability studies will provide the elements necessary to scientifically address concerns raised by the impact of discharges on drinking water intakes downstream. Professors Prévost and Dorner contributed to the development of this regulation and to the *Guides de réalisation des études de vulnérabilité* (guidance for conducting vulnerability studies [Ministère du Développement Durable 2015, Prévost *et al.* 2011]). Unfortunately, funding to perform these vulnerability studies has not yet been announced by the government.

Beneficial impacts of this media event

Media interest in the wastewater discharges planned by the City of Montréal will have the merit of sparking interest in the control of wastewater discharges into waterways. It is normal for citizens to be concerned about the impacts of such discharges. It would be desirable that this

concern will yield support for the reinvestment in infrastructure to protect the environment and human health.

Evaluation of the investments needed to reduce these discharges is underway in Québec, but it is estimated that these are considerable — around $1.5 billion solely for the City of Montréal. The interest shown by the public and its future commitment will facilitate the implementation of the recent regulations on water protection, as well as the reduction of sources of contaminants and the upgrading of wastewater treatment plants.

Sources:

Professor Benoît Barbeau (expertise) (resume)
Professor Yves Comeau (expertise) (resume)
Professor Raymond Desjardins (expertise)
Professor Sarah Dorner (expertise)
Professor Michèle Prévost (expertise) (resume)
POLYTECHNIQUE MONTRÉAL

Links with the City of Montréal

Professors Yves Comeau and Sarah Dorner do not receive direct research funding from the City of Montréal. Professor Raymond Desjardins regularly teaches operators of the City of Montréal's drinking-water facilities but does not receive research funding from the City of Montréal. Professors Michèle Prévost and Benoit Barbeau hold an NSERC Industrial Chair in drinking-water funded by the cities of Montréal, Laval and Repentigny as well as Veolia Water Technologies Canada Inc.

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