

# TOWARD SUSTAINABLE MUNICIPAL WATER MANAGEMENT

2013-2016 Montréal's Green CiTTS Report  
Great Lakes and St. Lawrence Cities Initiative





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# BACKGROUND

The Great Lakes and St. Lawrence Cities Initiative (Cities Initiative) is a binational coalition of mayors and other local representatives working actively with federal, state and provincial governments to promote the protection and restoration of the Great Lakes and the St. Lawrence River. Montréal has been an active member of the Cities Initiative since 2006.

A number of programs have been put forward under the Cities Initiative, including Green CiTTS (Cities Transforming Towards Sustainability)<sup>1</sup>, which supports efforts by cities in the Great Lakes and St. Lawrence region to chart a course towards a more sustainable future. In the past 10 years, other programs have included the Water Conservation Framework, Stormwater Management, Sustainable Municipal Water Management, and more recently, the Municipal Adaptation and Resiliency Service.



1. Great Lakes and St. Lawrence Cities Initiative. "Green CiTTS", *Initiatives*, [online]. [[glscities.org/initiatives/green-citts](http://glscities.org/initiatives/green-citts)] (Consulted on January 25, 2017).

## Montréal Urban Agglomeration



# SUSTAINABLE MUNICIPAL WATER MANAGEMENT

To promote its members' progress in moving towards **sustainable municipal water management (SMWM)**, an advisory committee created under the Green CiTTS program drafted a report entitled *Sustainable Municipal Water Management: Measuring Progress and Reporting Publicly*<sup>2</sup> (Framework), which operationalizes this new trend in municipal water management. In June 2012, the report was presented at the general meeting in Québec City, in support of the commitment by members of the Cities Initiative to apply sustainable municipal water management principles (see box). This includes activity sectors such as water conservation, regional planning, awareness promotion, pollution reduction, habitat protection and restoration, and adaptation to climate change.

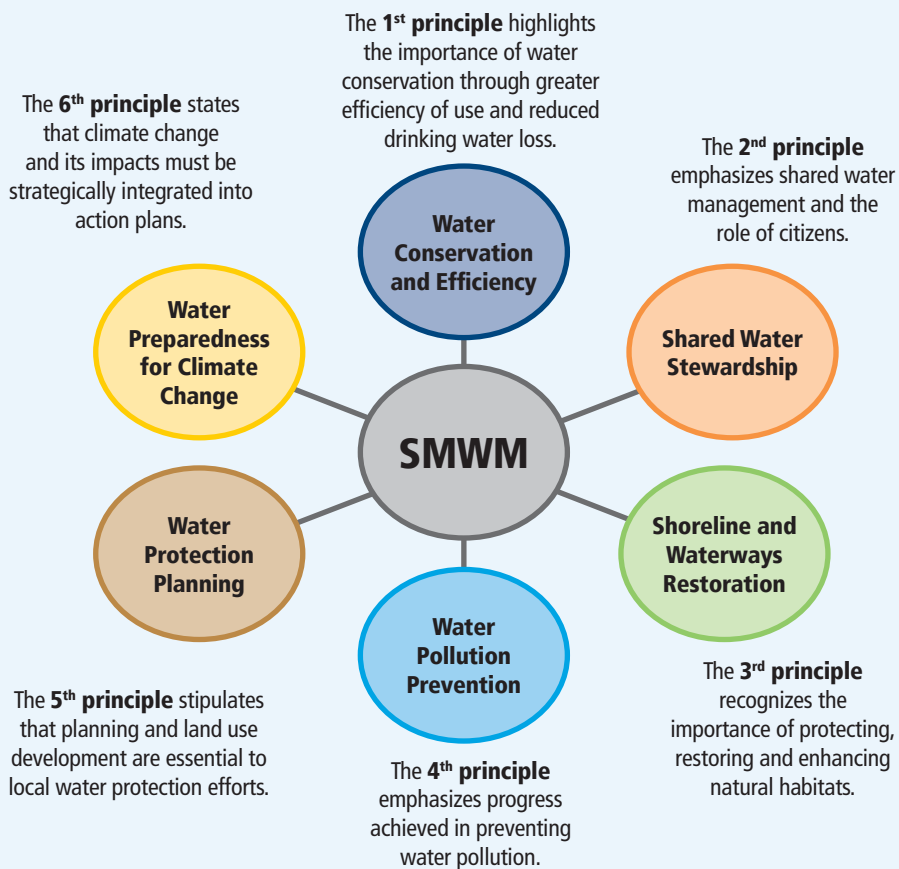
The Framework is based on six sustainable municipal water management principles, subdivided into 25 milestones. For each milestone, one or more indicators are used to measure a municipality's progress while taking into account local specificities. The Framework states: "this evaluation is not meant to compare one municipality's performance against another but rather to chart the progress within each municipality towards sustainable municipal water management."<sup>2</sup>

2. Great Lakes and St. Lawrence Cities Initiative. *Sustainable Municipal Water Management: Measuring Progress and Reporting Publicly*, [online], June 2012, page 6. [[glsccities.org/wp-content/uploads/2015/05/SMWM\\_Green-CiTTs-Report\\_2012.pdf](http://glsccities.org/wp-content/uploads/2015/05/SMWM_Green-CiTTs-Report_2012.pdf)].

*"We the members of the Great Lakes and St. Lawrence Cities Initiative commit to upholding the principles of Sustainable Municipal Water Management. We will strive to continuously improve our performance in each of the six areas identified by the principles, recognizing that each municipality's progress may be different. We will use the Sustainable Municipal Water Management Scorecard and report publicly on progress towards achieving the SMWM principles."*

*From the June 2012 Declaration*

## GUIDING PRINCIPLES OF SUSTAINABLE MUNICIPAL WATER MANAGEMENT





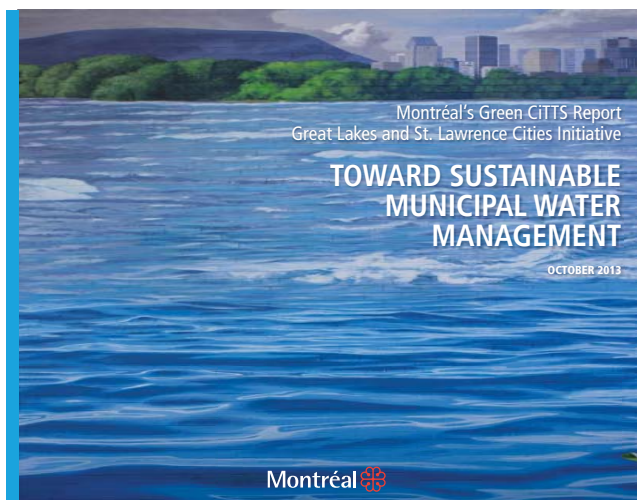
# MONTREAL'S REPORT

## REVIEW OF THE 2013 REPORT

In October 2013, Montréal tabled its first report, entitled *Toward Sustainable Municipal Water Management*. The report presented the first overview of efforts and interventions that had impacts on water, be it in relation to drinking water consumption, public awareness promotion, access to shorelines and waterways, pollution of aquatic environments, or climate change impacts.

During the June 2014 annual meeting in Thunder Bay, Montréal received the Green CiTTS Award for its excellent progress report. Four other cities also presented a first report, in accordance with the Cities Initiative Framework: Durham, Evanston, Milwaukee, and St-Catherines.

Montréal's achievements were evaluated on the basis of 18 of 25 milestones, using indicators referring largely to specific objectives or commitments formally adopted by the city. The seven remaining milestones were not retained due to missing or incomplete data. It's important to mention that Montréal, historically, has lagged behind other cities when it comes to water conservation, access to waterways, rehabilitation of interior waterways, or measures to manage stormwater at the source. The 2013 Report nevertheless demonstrated the city's determination to adopt best practices in sustainable municipal water management, since significant overall progress has been observed across 12 milestones (see Table on page 8).



## 2016 REPORT

Montréal has made a commitment to report on its progress every three years. This interval facilitates the assessment of progress in sustainable municipal water management, since it can take several years for actions deployed by the city to become detectable. This report thus covers the period from 2013 to 2016. It is presented as follows.

- The 2016 Report uses the same chart that was used in 2013.
- The Assessment Scorecard Chart illustrates the trend between 2013 and 2016 in regards to the milestones retained. The colour code for the 2013 trends was improved, as it now refers, where applicable, to the degree to which the city has attained a measurable objective.
- For each milestone, a more detailed presentation includes a description of indicators and highlights for the 2013-2016 period, along with expectations for the years to come.
- An additional two milestones were assessed, bringing the number of milestones assessed to 20 out of the 25 proposed under the Framework.



Credit: © Tourisme Montréal, Stéphan Poulin

# ASSESSMENT SCORECARD CHART

PRINCIPLES	MILESTONES	2013	2016
<b>1. Water Conservation and Efficiency</b>	1.1 Promote Water Conservation		
	1.2 Install Water Meters		
	1.3 Set the Right Price		
	1.4 Minimize Water Loss		
	1.5 Increase Water Use and Recycling		
<b>2. Shared Water Stewardship</b>	2.1 Raise Public Awareness		
	2.2 Engage the Public		
<b>3. Shoreline and Waterways Restoration</b>	3.1 Protect and Restore Shorelines/Riparian Corridors, and Control Erosion		
	3.2 Increase Public Access to Shorelines, Riverbanks, and Waterfronts		
	3.3 Protect Habitats and Biodiversity		
<b>4. Water Pollution Prevention</b>	4.1 Prevent Pollutants from Entering the Sewage Collection System		
	4.2 Improve the Quality of the Wastewater Treatment Plant Effluent		
	4.3 Reduce Stormwater Entering Waterways		
	4.4 Monitor Waterways and Sources of Pollution		
	4.5 Improve Beach Quality		
	4.6 Reduce Sodium Chlorine Entering Waterways		
<b>5. Water Protection Planning</b>	5.1 Adopt Council-endorsed Commitment to Sustainable Water Management		
	5.2 Integrate Water Policies into Land Use Plan		
	5.3 Collaborate on Watershed-Scale		
	5.4 Adopt Green Infrastructure		
	5.5 Value Ecological Functions		
<b>6. Water Preparedness for Climate Change</b>	6.1 Conduct a Vulnerability Assessment		
	6.2 Address Vulnerability - Climate Change Adaptation Plan		
	6.3 Adapt Emergency Response Plan to Climate Change		
	6.4 Reduce Greenhouse Gas Emissions (GHG)		

## CONTINUOUS IMPROVEMENT INDICATORS

Significant progress or goal attained or surpassed\*



Significant progress or goal attained or surpassed\*



Decline



Not applicable or goal not adopted



\*When an indicator contains a measurable goal adopted by the city.

## STATED OBJECTIVE INDICATORS

Milestone adopted or completed



Milestone being adopted



Milestone not considered





# MONTREAL WATER PLAN

The *Montréal Water Plan* (Plan de l'Eau) is based on the philosophy of sustainable development. Officially presented to citizens in March 2015, it is the culmination of decades of demands by civil society stakeholders in Québec and Montréal in response to growing environmental awareness.

Its development stems from a concerted approach by the central city and all the boroughs with shorelines. The success of this transversal project depends on cooperation and partnership between organizations working in the areas of water, the environment, and sports and recreation. The *Montréal Water Plan* thus continues the work already initiated, adapting it to today's environmental requirements.

The *Montréal Water Plan* calls for:

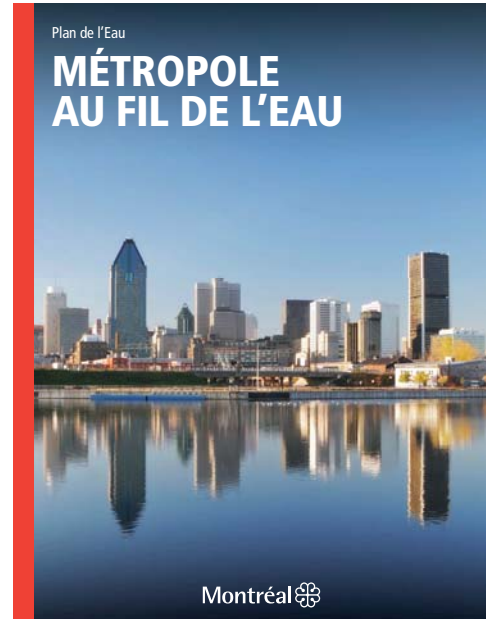
- Financial means to allow partners to increase water-based recreational and sporting activities;
- Rest areas and lookouts along the Rivière des Prairies;
- Pleasant and accessible beaches for the entire family in eastern Verdun;
- A safe and modern swimming area at the Old Port, amid a spectacular urban setting;
- Protected shorelines;
- Access to safer stationary wave surfing with a reduced impact on the environment;
- Illicit connection corrections for continued improvement of water quality;
- Renaturalized streams turned into true green infrastructures.

## LIENS

Montréal Water Plan (Plan de l'eau – in French only)  
[ville.montreal.qc.ca/berges/assets/documents/Plan-de-leau.pdf](http://ville.montreal.qc.ca/berges/assets/documents/Plan-de-leau.pdf)

Support program for local outdoor activities initiatives  
(Programme de soutien aux initiatives locales d'activités de plein air – in French only)

[ville.montreal.qc.ca/portal/page?\\_pageid=9237,107865574&\\_dad=portal&\\_schema=PORTAL](http://ville.montreal.qc.ca/portal/page?_pageid=9237,107865574&_dad=portal&_schema=PORTAL)



A support program for local outdoor activities connected with the *Montréal Water Plan* was adopted in April 2015 to meet the growing public need to reappropriate shorelines. With a total budget of \$325,000, this five-year program (2015 to 2019) is meant to support initiatives put forward by non-profit organizations (NPO) and boroughs. The objectives of the *Montréal Water Plan's* support program for local outdoor activities initiatives (Programme de soutien aux initiatives locales d'activités de plein air) are to:

- Promote the establishment of safe and non-motorized outdoor water activities, including kayaking, sailing, and canoeing;
- Encourage outdoor water events (non-motorized);
- Promote a greater sense of belonging and civic pride;
- Encourage Montréal's population to practice physical and sporting activities;
- Allow Montrealers to reappropriate their shorelines.

## **ACHIEVEMENTS UNDER THE *MONTREAL WATER PLAN***

In the first two years, some 20 organizations and four boroughs staged 23 activities and events in the Greater Montréal Blue Network with support from the program, including the Défi Canot à glace Montréal, Montréal en Eau-Vive, Relais rivière, and several regatas, to go along with introductory kayaking, rowing and sport fishing courses, and other nautical activities. More than half of the activities and events took place in the Rivière des Prairies and St- Lawrence River basins. Some 90% of projects are recurring and supported for a period of three years until 2019.



Project "kayak outings on our waterways"  
Credit: © Éco de la Pointe-aux-Prairies

# PRINCIPLE 1

## WATER CONSERVATION AND EFFICIENCY

Each day, Montréal's population benefits from an abundant supply of quality water from the St. Lawrence River and the Rivière des Prairies, which provide all the water necessary. However, aging infrastructures and excessive use have resulted in water consumption largely surpassing the North American average. In recent years, therefore, Montréal initiated a major shift meant to renew its water infrastructures and promote more responsible use of water under the *Montréal Water Strategy 2011-2020* (Stratégie montréalaise de l'eau 2011-2020).

Over the years, Montréal has set a number of objectives for reducing drinking water production. By reducing production by 17% as part of the *Water Conservation Framework*, Montréal met the objective set under the Cities Initiative, which was to reduce drinking water production by 15% by 2015, compared to 2000. Currently, the city continues to pursue the objectives of the Québec Strategy for Drinking Water Conservation (QSDWC), including that of reducing per-capita drinking water consumption by 20% by 2017, compared to 2001. Adopted in 2016, the new *Montréal Community Sustainable Development Plan (Sustainable Montréal 2016-2020)* includes the *Montréal Water Strategy's* objective of reducing drinking water production by 20% between 2011 and 2020.



# Milestone 1.1

## Promote Water Conservation

Indicator: Change in the Total Volume of Water Produced Annually

### COMMITMENTS

- Reduce per-capita drinking water consumption by 20% by 2017, compared to 2001, as part of the QSDWC.
- Reduce drinking water produced by Montréal drinking water production plants by 20% between 2011 and 2020, as part of the *Montréal Water Strategy* and the *Sustainable Montréal 2016-2020*.

### HIGHLIGHTS

- The objective set under the QSDWC has already been surpassed, as drinking water production across the Montréal agglomeration dropped by more than 28% between 2001 and 2016, from 1,120 litres to 801 litres per capita, per day.
- Compared to the municipal objective of a 20% reduction between 2011 and 2020, drinking water production dropped by 10% at the end of 2016, which is consistent with the expected trend.

### MILESTONE PROGRESS

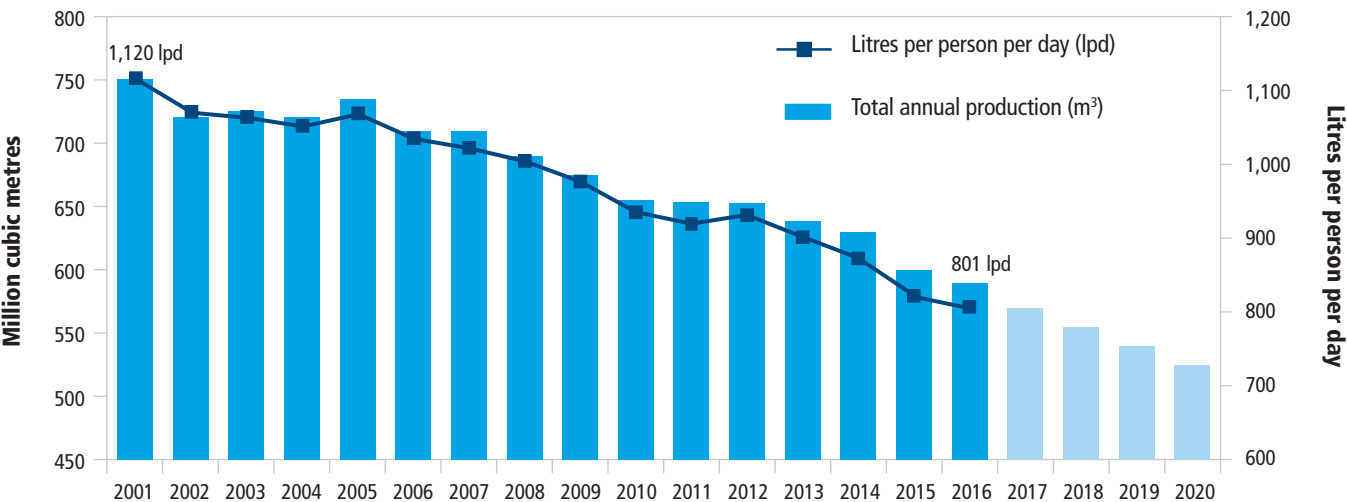
2013 2016

### OUTLOOK

Under the *Montréal Water Strategy*, various means have been deployed to maintain this downward trend in water production and consumption:

- Systemic detection of leaks, and replacement and rehabilitation of water mains (see milestone 1.4);
- Sectorization and regulation of pressure and measurement of flow in different sectors to increase water main service lives and reduce failures (see milestone 1.4);
- Installation of meters in industrial, commercial and institutional sectors (ICIs) (see milestone 1.2);
- Application of water consumption by-laws.

Figure 1. Change in Montréal’s Drinking Water Production





# Milestone 1.2

## Install Water Meters

Indicator: Install Water Meters in ICIs

### COMMITMENT

The city implemented the *Water Meter Installation Program* (WMIP) in industrial, commercial and institutional sectors (ICIs), with installations beginning in July 2012. The WMIP will produce a water budget consistent with the best practices set out by the American Water Works Association (AWWA), for purposes of measuring the performance of infrastructure restoration and drinking water conservation programs.

### HIGHLIGHTS

- About 10,000 program-compliant meters installed by the end of 2016.
- Awarding of a contract to supply a remote water meter reading system at the end of 2015, with implementation at the end of 2016.
- Positioning of Montréal as a leading water meter user thanks to its internal expertise, recognized province-wide.

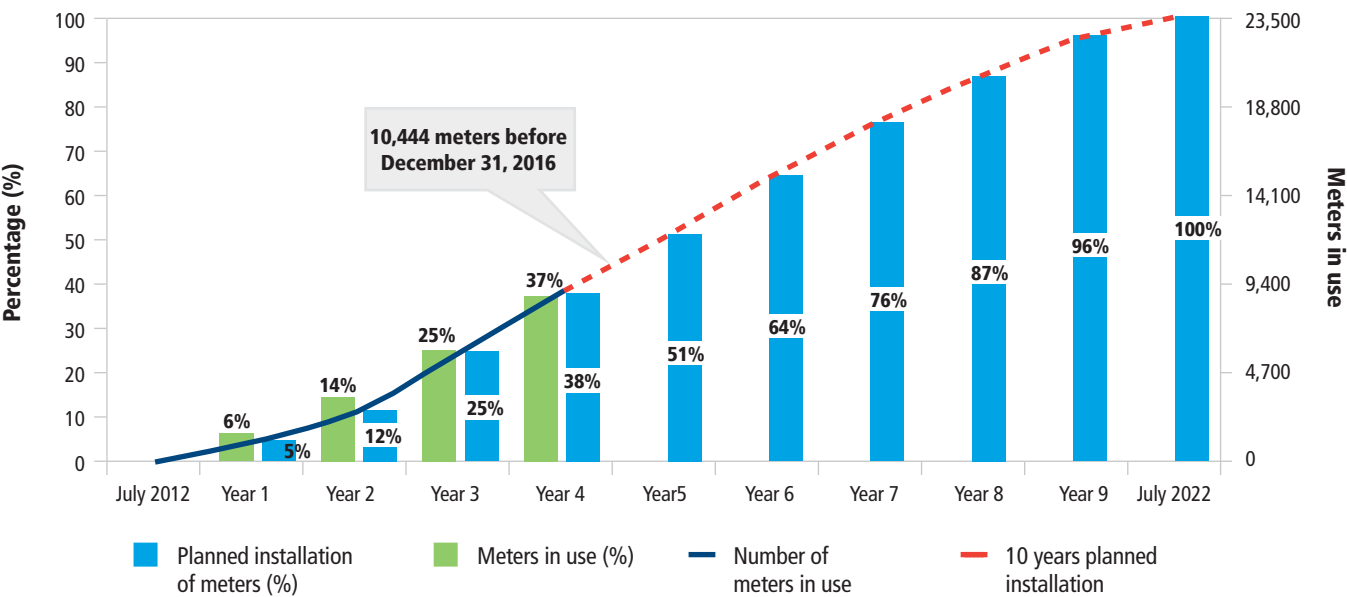
### MILESTONE PROGRESS

2013  2016

### OUTLOOK

- Some 23,500 meters are slated for installation in July 2022.
- The WMIP will lead to reduced water consumption in ICIs, thus contributing to the objective of reducing drinking water production.
- This program contributes to better consumption estimates and makes annual water budgets more accurate.
- This program makes it possible to establish a volume-based rates that encourage more efficient water use in ICIs.

Figure 2. Growth of the Water Meter Installation Program (WMIP)



# Milestone 1.3

## Set the Right Price

Indicator: Total Water Costs

### COMMITMENT

In accordance with the requirements set out under the *Stratégie québécoise d'économie d'eau potable*, the Service de l'eau has been recording total water provision costs. These costs cover the entire water cycle, from intake to discharge into the river. This includes drinking water production and distribution activities, as well as wastewater and stormwater collection and treatment, and system maintenance for fire safety purposes.

### HIGHLIGHTS

- The costs of water services are essentially fixed, that's to say independent of the quality of the water consumed. They are associated with maintaining infrastructures in good condition, current operations, and the personnel required to deliver effective and accessible services 24 hours a day, 365 days a year. In 2015, fixed costs were estimated to be in the order of 94% of the total costs of municipal water services.
- Variable costs are essentially comprised of the costs associated with chemical products and energy. These are directly linked to the volume of water produced. In 2015, they represented 6% of total costs.
- In 2015, the total cost for municipal water services was \$1.72 per m<sup>3</sup> of water distributed to users<sup>3</sup>, totalling \$360 per person, or close to \$1 per day. These costs are divided between the ICI and residential sectors and do not include the maintenance deficit.
- Costs have increased by 1.6% annually since 2012, which is comparable to the inflation rate for the same period.

3. The water distributed is equivalent to the water from drinking water production plants minus the loss in the supply system. This thus represents 70% of the water produced, since an estimated 30% of the water produced is lost.

### MILESTONE PROGRESS



### OUTLOOK

- The city will acquire more in-depth qualitative knowledge related to the infrastructure maintenance deficit in order to integrate it into the cost of water services.

Figure 3. Costs of Water Services in 2015

#### Variable costs: 6%

Costs for each additional cubic metre produced (energy and chemical products)



#### Fixed costs: 94%

Costs to ensure the operation and maintenance of production and water treatment infrastructures, distribution system maintenance costs to ensure access to water and fire safety requirements, and staffing costs

# Milestone 1.4

## Minimize Water Loss

Indicator: Estimated Percentage of Water Loss in Distribution System

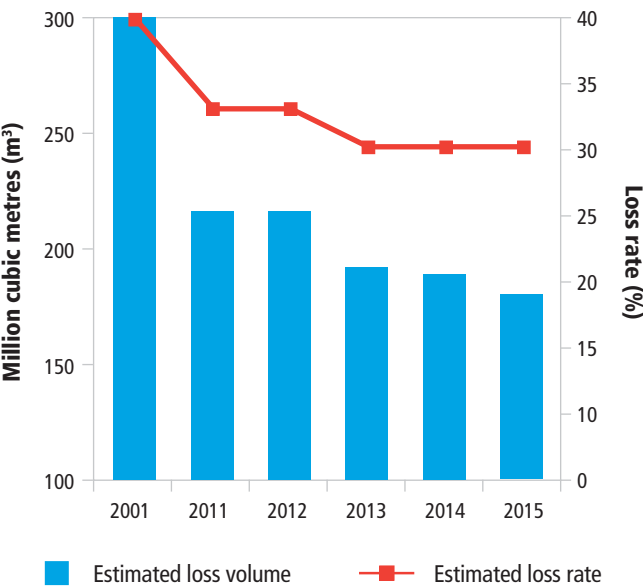
### COMMITMENT

The Service de l’eau has been submitting reports on total water consumption to city council since 2011. Produced according to AWWA’s international standards, this report estimates water loss in the distribution system with the goal of achieving a 20% loss rate in the system, according to the QSWDC.

### HIGHLIGHTS

- Since 2013, an estimated 30% of all water distributed by the Montréal urban agglomeration’s six drinking water production plants has been lost. While the loss percentage remains stable, it’s important to note that the volume of water lost decreases with reduced water consumption.

Figure 4. Estimated Annual Drinking Water Loss



### MILESTONE PROGRESS

2013 2016

- The team created by the Service de l’eau in 2012 to search for leaks became fully operational in 2014. By then, it had detected 270 leaks and transmitted the information to boroughs for repairs. In 2015, close to 400 leaks were detected.
- The system optimization team has been working to create pressure regulation sectors (PRS) since its creation in 2012. Three PRS sectors were implemented in 2014 and 2015, and three more were added in 2016. Pressure regulation serves to reduce failures and leak flow while maintaining good hydraulic performance.
- The distribution system’s renewal rate has increased significantly, to 1.5% of the system in 2014 and 1.3% in 2015. This is a significant increase compared to the annual average of 0.7% between 2006 and 2013.

### OUTLOOK

- The 2015 deployment of a remote leak detection system in the downtown area now makes it possible to detect leaks in quasi-real time and transmit information on a daily basis concerning the location of leaks in this key sector.
- The System Pressure Regulation and Sectorization Project and meter installation in ICIs will yield more precise data on water production and estimated loss.
- The Service de l’eau’s goal is to maintain a distribution system renewal rate of 1.5% per year in order to make up the maintenance deficit and sustainably reduce the loss rate.



# PRINCIPLE 2

## SHARED WATER STEWARDSHIP

Increasing public awareness is essential to a better understanding of water-related issues and municipal efforts to manage the complete water cycle responsibly. Public awareness also means increasing public involvement in water conservation, because community participation is essential to sustainable water management.





## Milestone 2.1

### Raise Public Awareness

Indicator: Activities to Raise Public Awareness

#### COMMITMENT

- Create a squad (*La Patrouille bleue*) to raise public awareness and apply local drinking water consumption by-laws.

#### HIGHLIGHTS

Since 2010, the Service de l'eau has partnered with the NPO Regroupement des éco-quartiers with the goal of creating *La Patrouille bleue*. Consisting of some 20 university students, the patrollers tours the city's different districts over four weeks in the spring.

*La Patrouille bleue*:

- Raises awareness of Montréal residents and ICIs about drinking water consumption by-laws and suggests installation of low-flow equipment to ensure responsible water use;
- Encourages property owners to manage stormwater more effectively at the source by diverting downpipe water and promoting rain barrel use;
- Advises residents of existing regulations designed to protect buildings from sewer backups.

Since the unit was created, its members have personally spoken with over 60,000 residents and hundreds of businesses and institutions about conserving drinking water. In 2015 and 2016, they visited more than 10,000 homes to raise awareness about downpipe water diversion to permeable surfaces and thus reduce the volume of stormwater entering the sewage system.

The four annual blue squads also gave over 100 young people work experience in the water sector and allowed them to build their communication and awareness skills in this area.

#### MILESTONE PROGRESS

2013



2016

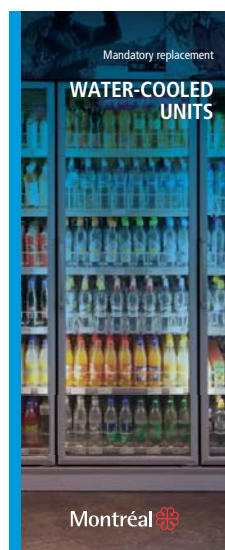


Awareness day with the éco-quartier Mercier-Hochelaga-Maisonneuve

The Service de l'eau and the boroughs are also conducting a variety of communication and awareness campaigns aimed at ensuring better compliance with the *By-law on water use*. Special emphasis has been placed on the obligation to replace cooling/air conditioning appliances that use drinking water in a recirculation loop within the delays set out under the law, since each of these appliances consumes thousands of litres of water per day. In addition, several boroughs actively enforce the by-law. Since 2013, more than 1,000 notices to occupants have been issued for infractions related to watering periods.

## OUTLOOK

The Service de l'eau intends to pursue its awareness activities through *La Patrouille bleue* and communications campaigns, and to support the boroughs in the application of the *By-law on water use*.



*La Patrouille bleue, 2016 edition*



# Milestone 2.2

## Engage the Public

Indicator: Support for Civic Initiatives

### COMMITMENT

- Promote joint efforts by communities and the city to carry out local initiatives related to the protection of water and the environment.

### HIGHLIGHTS

Each year the city teams up with various private or NPOs to give citizens an opportunity to organize and stage cleanup drives, many of which target shorelines. The city has also created a Web platform to make it easier to register and track the various drives organized by communities. Here are two examples.

### MILESTONE PROGRESS

2013  2016 

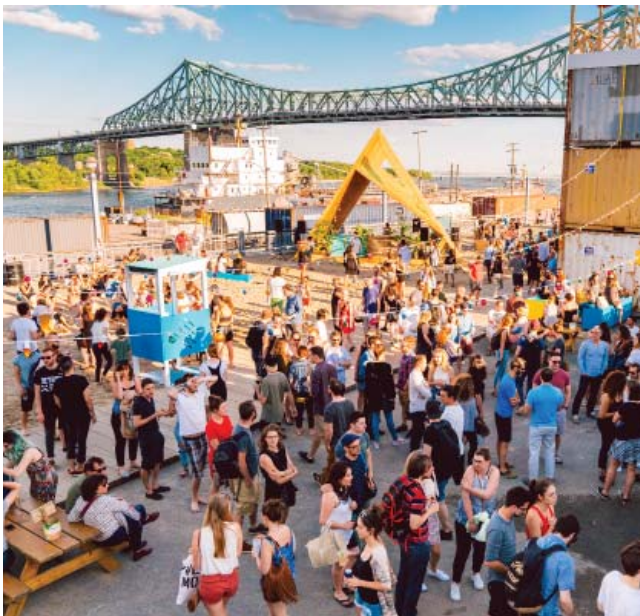
- As part of the 3<sup>rd</sup> edition of St. Lawrence Week in 2015, the David Suzuki Foundation and Comité ZIP Jacques-Cartier presented the **St. Lawrence River: Our Living River** campaign, in collaboration with RBC Royal Bank. About 100 participants collected more than 50 bags of garbage along the shores of the river.
- In 2016, the LaSalle borough, in collaboration with Héritage Laurentien, the Table de développement social and the Labatt Brewing Company, staged a major shoreline cleanup operation (**Grand nettoyage des berges**) that saw more than 300 people comb about 6.5 km of shoreline and collect 23.5 m<sup>3</sup> of garbage.



Credit: © Éco de la Pointe-aux-Prairies

Other activities included:

- **Le Grand Splash**, an annual event held for the past 30 years by the Montréal baignade citizens committee to raise awareness among citizens and elected officials about the importance of access to water;
- **Village au Pied-Du-Courant**, a citizens' initiative that offers an exceptional window onto the river, is transformed each year to offer Montrealers a unique space for life;
- The **Aquahacking 2016** summit drew 350 participants, 20 speakers and expert panelists to the Palais des Congrès de Montréal. Beforehand, teams of developers put forward technological solutions to better preserve the St. Lawrence River.



Village au Pied-Du-Courant  
Credit: © Jean-Michael Seminario

The city also offers the **Faire Montréal** collaborative platform making it easier for citizens to present projects. Since 2013, several projects related to water and the environment have been carried out or are in progress. They include:

- *ILEAU* (local interventions in environmental and urban planning), a project aimed at using multiple new developments and practices to counter urban heat islands in Eastern Montréal;
- *Projet Bornéo - eau de source urbaine* is aimed at adding a device to fire hydrants that lets people drink water without interfering with the work of firefighters.

## OUTLOOK

Montréal offers a Web platform that makes it easier to register a group in the cleanup drive calendar and promotes participation in the drives. The platform will be reviewed and improved in 2017 for the benefit of all. Innovative improvement projects can still be presented through the Faire Montréal interface.

The city presented its third Montréal Community Sustainable Development Plan, *Sustainable Montréal 2016-2020*. This document attests to the collective work accomplished over the last 10 years and serves as a reminder of the challenges and priorities that must remain the focus of community efforts to make Montréal a sustainable city. To become a partner, Montréal-based organizations are invited to implement actions under the *Partner Organization Action Plan*. One of the actions relates specifically to the reduction of drinking water consumption, and stormwater management.



# PRINCIPLE 3

## SHORELINE AND WATERWAYS RESTORATION

The St. Lawrence River Basin is one of the planet's largest fresh water ecosystems, draining over 20% of world reserves. The vast range of habitats and species that it hosts also make it one of North America's richest natural heritage sites. Riverbanks, coasts and shorelines are essential to the survival of ecosystems and to maintaining biodiversity along waterways.

The United Nations' Secretariat of the Convention on Biological Diversity (CBD) has been based in Montréal for more than 20 years. This international centre of expertise on biodiversity encourages cities and local governments to take action in favour of biodiversity and get involved in protecting it, in the knowledge that local action is essential.

In terms of protection measures, the city adopted the *Policy on the Protection and Enhancement of Natural Habitats* (PPENH) in December 2004.





# Milestone 3.1

## Protect and Restore Shorelines/ Riparian Corridors, and Control Erosion

Indicator: Protected Area of the Agglomeration Territory

### COMMITMENT

Montréal is committed to protecting 8% of the entire agglomeration territory, including 6% of its land area (including wetlands and inland water bodies), under the *Policy on the Protection and Enhancement of Natural Habitats* (PPENH).

The *Metropolitan Land Use and Development Plan* calls for protected habitats to form 10% of the territory's surface area.

### HIGHLIGHTS

The Montréal agglomeration territory's surface area spans 50,089 hectares (ha). At the time of the last report, in 2013, 5.75% or 2,885 ha (including wetlands and inland water bodies) of the agglomeration's surface area was protected. In 2016, the protected surface area increased to 6.06% or 3,035 ha. By including protected areas in the major watercourses surrounding the island, over 17% of this area is now protected. This objective is comparable with international standards.

### MILESTONE PROGRESS



### OUTLOOK

Efforts will be made in the next three years to stabilize and restore public shorelines and increase physical and visual access to the water. Major structuring projects favouring the enhancement of shorelines are envisioned:

- Define an overall plan to create a large regional park in Montréal's West Island enhancing Green and Blue Belts;
- Enhancement of the Bertrand Stream through the creation of a "Discovery" path along the shore;
- Enhancement of Lapierre Island, located in the De Montigny Stream's Greenway Ecoterritory.

# Milestone 3.2

## Increase Public Access to Shorelines, Riverbanks, and Waterfronts

Indicator: Increased Physical or Visual Public Access

### HIGHLIGHTS

An intention to give Montrealers renewed access to shorelines and water bodies is at the heart of the *Montréal Water Plan* presented in 2015. Several projects aimed at meeting that goal are now under planning:

- Redevelopment of access points to waves for surfing, kayaking and canoeing, including in the Parc des Rapides and on stationary natural waves (Vague à Guy and Habitat 67);
- Two new beaches are planned for 2017: the urban beach in Verdun, and the beach in eastern portion of Pointe-aux-Trembles;
- Unique visual access to the St. Lawrence River from the Clock Tower Beach, an non-swimming urban beach at the Old Port of Montréal;
- New riverfront developments following the construction of the new Champlain Bridge, including bicycle paths and lookouts;
- Rest areas and lookouts along the Rivière des Prairies.

### OUTLOOK

The city will continue studying the options for physical and visual contact with the shorelines and water bodies in non-ecologically sensitive areas.

The creation of the Green and Blue Belt of Greater Montréal (Trame verte et bleue du Grand Montréal) in 2013 was aimed at using an integrated approach to enhance natural environments, built environments and landscapes for recreation and tourism. This green and blue belt is part of the *Metropolitan Land Use and Development Plan* (PMAD), and it calls for major investments in five projects: the Oka-Mont-Saint-Hilaire bicycle and pedestrian path, the Parc-plage du Grand Montréal, the Parc de la Rivière-des-Mille-Îles, the Mont-Saint-Bruno greenway, and the Chateauguay-Léry greenway.

### MILESTONE PROGRESS

2013  2016

These projects will have a major impact on the development of metropolitan bicycle and navigable networks as well as increase the number of access points to water for recreational purposes (swimming, boat launches, shoreline recreational activities, mooring docks, etc.).



"Vague à Guy" stationary natural wave  
Credit: © Réseau de suivi du milieu aquatique, Ville de Montréal

## Milestone 3.3

### Protect Biodiversity and Habitats

Indicator: Actions Supporting Biodiversity

#### HIGHLIGHTS

- Montréal released a report on biodiversity in May 2013. This outlined the current situation, along with achievements to date. It also recommended various approaches for preparing a biodiversity strategy and action plan.
- The Ville de Montréal website offers a wealth of information on biodiversity and local biodiversity management.
- The city adopted a program to manage ecosystems in large parks, which serves to define natural spaces and guide developments or the implementation of activities, without compromising ecological integrity.

#### OUTLOOK

The goals identified in 2013 remain the same:

- Promote greater local and international recognition of the need to protect biodiversity;
- Seize opportunities to protect and acquire land of ecological value through gifts, servitudes, purchases, etc.;
- Take advantage of opportunities for partnerships to protect aquatic and land-based habitats;
- Pursue the war on invasive species;
- Continue activities to promote environmental education in large parks, particularly among children.

#### MILESTONE PROGRESS

2013



2016



Northern map turtles sunbathing in the Lacoursière park pond on Île des Soeurs

Credit: © Réseau de suivi du milieu aquatique, Ville de Montréal



# PRINCIPLE 4

## WATER POLLUTION PREVENTION

Water pollution prevention means treating the Montréal agglomeration's wastewater through three primary strategies:

- Controlling the discharge of pollutants into the municipal sewer system and water bodies at the source by enforcing by-laws and sewer-use fees for large discharges, as well as by prohibiting objectionable discharges;
- Aquatic habitat quality monitoring programs, including illicit connection screening and correction;
- Wastewater interception, collection and treatment at the municipal physical/chemical wastewater treatment plant that will soon also provide ozonation treatment.



# Milestone 4.1

## Prevent Pollutants from Entering the Sewage Collection System

Indicator: Activities Related to the Regulation and Sewer-Use Fees

### COMMITMENT

**CMM By-law 2008-47** (Communauté métropolitaine de Montréal) on wastewater disposal has been in full force since 2012. Montréal enforces the by-law across the Montréal agglomeration territory. Note that prior to the entry into force of *By-law 2008-47*, wastewater discharges into the sewer system and water bodies had been controlled, since 1986, under *CUM By-law 87* (Communauté urbaine de Montréal).

**By-law RCG 08-041**, a companion regulation to *By-law 2008-47*, governs the issuance of industrial wastewater discharge permits and sewer-use fees for major discharge sources. The Service de l'environnement:

- Studies industrial plans;
- Approves treatment and prevention projects;
- Reponds to resident complaints;
- Inspects establishments;
- Frequently tests their effluents.

### MILESTONE PROGRESS

2013



2016



This program is aimed at billing establishments making large discharges into the public sewer system (100,000 m<sup>3</sup> or more per day), to prevent the public and other businesses from having to shoulder such costs.

### HIGHLIGHTS

Some 26 new discharge permits were issued in 2016, whereas an average of 28 permits were issued annually between 2013 and 2015. The number of complaints processed concerning the quality of water bodies and discharges decreased slightly to 216. On average, 269 complaints per year were filed between 2013 and 2015. The number of regulatory violation notices requiring remedial action dropped to 196 in 2016, compared to an average of 331 for 2013-2015.

**Table 1. Activities Related to Regulation and Sewer-Use Fees**

HIGHLIGHTS	2013	2014	2015	2016
Number of new discharge permits issued	33	26	26	10
Number of industrial projects approved, including for treatment systems	91	54	165	57
Number of complaints processed (water bodies or discharges quality)	279	330	197	216
Number of regulatory violation notices requiring remedial action	393	343	256	196
Number of charges filed in Municipal Court	28	12	30	40
Number of violators convicted	2	5	9	20
Total fines	\$30,000	\$60,000	\$142,000	\$337,000
Revenue generated by industrial sewer-use fees	\$4.03M	\$3.75M	\$3.78M	\$4.25M

The majority of the parameters analyzed demonstrate a reduction in annual load over the years. Thus, the Service de l'environnement has monitored metals cited in *By-law 87* since the late 1980s, and reductions were noted in subsequent years. The results since 2002, for the most part, do not show any significant annual variation. However, results for copper, lead and zinc have shown a steady decrease in the past 10 years.

Figures 5 and 6 on the next page present a few of the wastewater results at the intake of the Jean-R. Marcotte Wastewater Treatment Plant, including both the northern and southern tributaries. In order to present either an improvement or a deterioration in the discharge results for the parameters, the year 2002 was used as the year of reference, and the results are presented in relation to their variation with 2002.

Figure 5 shows the percentage variation of annual load compared to 2002 for five inorganic contaminants (four metals and one non-metal) recently cited in *By-law 2008-47*. The results demonstrate a peak reduction between 2006 and 2008 for tin, molybdenum and selenium, along with a steady reduction in silver between 2004 and 2012.

Note that after Service de l'environnement personnel observed high cobalt levels in the supply system, a company manufacturing purified terephthalic acid (PTA) was identified as the primary source of the discharge. This company began operating in 2004 and increased its production capacity in recent years; it has since built a wastewater treatment plant, which opened in 2015. Cobalt test results in the coming years should show a marked reduction of this metal in wastewater.

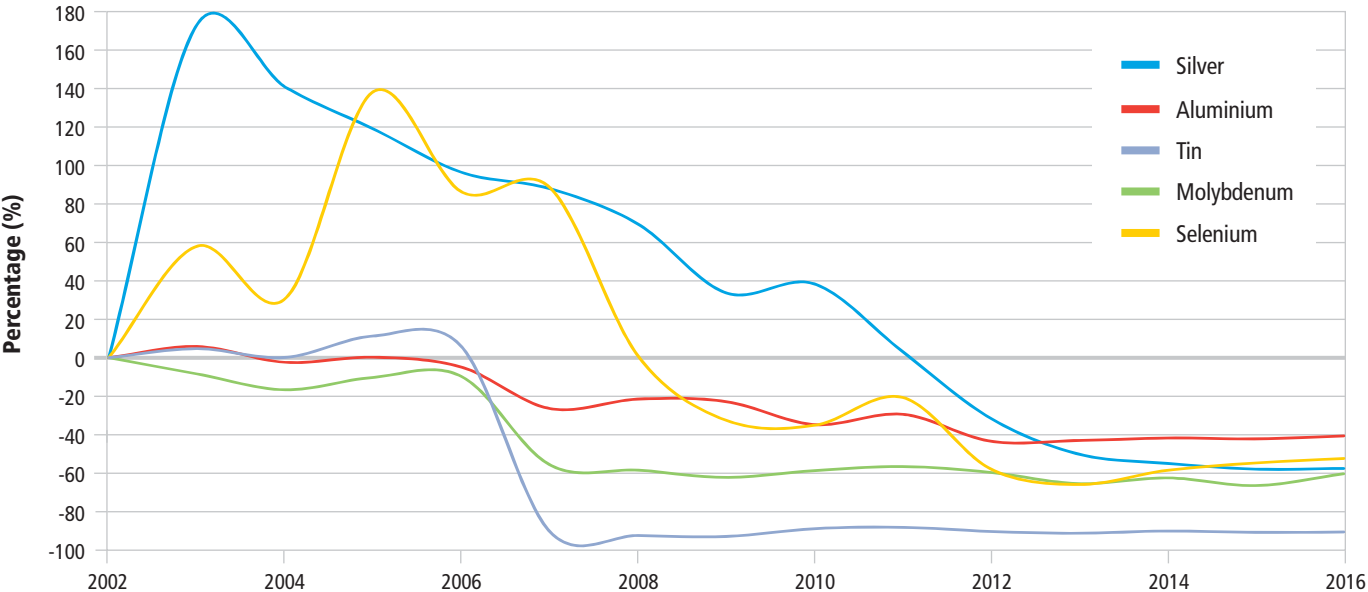
Figure 6 shows other monitoring parameters, including for cyanide, chemical oxygen demand, fluorine, total oils and grease, mercury, total phosphorus and phenols. With the exception of an increase in annual loads of fluorine and phenol compared to 2002, the other parameters show a slight or medium reduction.

## OUTLOOK

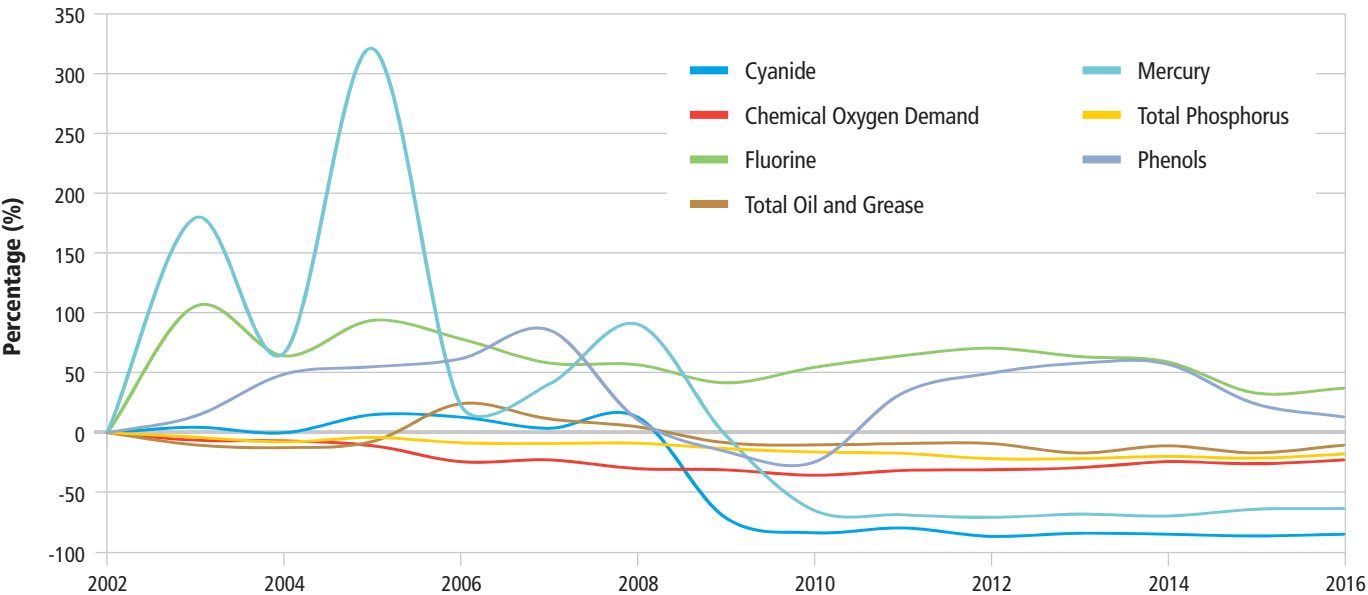
The efforts deployed prior to the 2012 report made it possible to cut discharges of heavy metals, oil and grease and suspended solids generated by key firms targeted by the Service de l'environnement by 85 to 95%. Once new discharge standards came into effect in 2012, institutional compliance audits and data studies demonstrated changes in discharge levels by industrial sector, while identifying standards posing challenges to compliance and technical needs. Based on the results obtained, priorities and effective compliance strategies may be adjusted accordingly, with necessary regulatory changes made where required.



**Figure 4. Variation in Annual Discharges of Effluent Loads Compared to 2002 (Silver, Aluminium, Molybdenum, Selenium and Tin)**



**Figure 6. Variation in Annual Discharges of Effluent Loads Compared to 2002 (Cyanide, Chemical Oxygen Demand, Fluorine, Total Oil and Grease, Mercury, Total Phosphorus and Phenols)**



# Milestone 4.2

## Improve the Quality of the Wastewater Treatment Plant Effluent

Indicator: Jean-R. Marcotte Wastewater Treatment Plant Results Compared with Discharge Standards Set Out in Provincial and Federal By-laws

### COMMITMENTS

The *Montréal Water Strategy* includes a goal to improve the quality of wastewater discharged from the Jean-R. Marcotte Wastewater Treatment Plant into the St. Lawrence River as follows:

- Annually meet the discharge standards set out in the *Regulation respecting municipal wastewater treatment works* and the federal *Wastewater Systems Effluent Regulations* for the following control parameters: suspended solids, phosphorus, pH and acute toxicity;
- Disinfect treated wastewater with ozone.

### MILESTONE PROGRESS

2013  2016 



Projected site of the ozonation disinfection unit at the Jean-R. Marcotte Wastewater Treatment Plant

## HIGHLIGHTS

### Suspended Solids (SS) Discharge Standard and Other Discharge Requirements

For the years 2013 to 2015, the plant complied with the suspended solids discharge standard and all the other discharge requirements.

### Phosphorus (TP) Discharge Standard and Other Discharge Requirements

For the years 2013 to 2015, the Wastewater Treatment Plant complied with the phosphorus discharge standard and the other discharge requirements.

**Table 2. Wastewater Treatment Plant Results for Suspended Solids Discharge\***

CRITERIA	STANDARD AND REQUIREMENTS	2013	2014	2015	UNIT
Nothern and southern tributaries		101.4	100.5	106.8	mg/L
Effluent	$\leq 20$	18.4	15.9	14.8	mg/L
Average annual removal rate	$\geq 75$	81.9	84.2	86.1	%
Minimum average weekly removal rate	$\geq 65$	76.0	77.3	80.7	%
Maximum average weekly concentration	$< 30$	23.3	21.4	19.8	mg/L
Maximum weekly effluent load	$< 107,800$	65,286	69,630	49,726	kg/d
Annual effluent load	$< 77,000$	43,661	37,879	32,544	kg/d

\*Additional information is available in the annual reports submitted to the MDDELCC and ECCC as well as results from the Wastewater Treatment Plant.

**Table 3. Wastewater Treatment Plant Results for Total Phosphorus Discharge**

CRITERIA	STANDARD AND REQUIREMENTS	2013	2014	2015	UNIT
Northern and southern tributaries		1.50	1.50	1.64	mg/L
Effluent	$\leq 0.50$	0.48	0.36	0.40	mg/L
Average annual removal rate	$\geq 75$	73.9	76.2	75.8	%
Minimum average weekly removal rate	$\geq 60$	62.8	67.5	67.1	%
Maximum average weekly concentration	$< 0.75$	0.47	0.50	0.49	mg/L
Maximum weekly effluent load	$< 2,090$	1,368	1,291	1,184	kg/d
Annual effluent load	$< 1,393$	934	852	872	kg/d



### pH Discharge Standard

The pH discharge standard came into force on January 1, 2014. For the years 2014 and 2015, the Wastewater Treatment Plant complied with the pH discharge standard.

### Acute Toxicity Discharge Standard

The discharge standard for acute toxicity came into force on January 1, 2014. Testing on effluent from the Wastewater Treatment Plant only began in April 2014. For the years 2014 and 2015, no acute toxicity was measured in rainbow trout (*Oncorhynchus mykiss*) and daphnia (*Daphnia magna*).

### Wastewater Disinfection Project

Disinfection of wastewater treated at the plant reduces the risk posed by pathogens during summer recreational and tourism activities downstream of the Island of Montréal. It also protects St. Lawrence River flora and fauna.

Following numerous studies, thousands of tests and pilot trials, the city concluded that ozonation was the best method for disinfecting wastewater. In March 2015, the city confirmed the execution of work aimed at implementing a wastewater disinfection unit by ozonation at the Treatment Plant. The selection of ozonation as a disinfection method was subject to public hearings, and it was favourably received by the environmental and municipal communities and the general public. This project received financial support from the federal and provincial governments.

**Table 4. Variation in pH Test Results at the Wastewater Treatment Plant**

CRITERIA	STANDARD	2014	2015
Effluent	from 6.0 to 9.5	from 7.0 to 7.8	from 6.2 to 7.7

**Table 5. Acute Toxicity Tests on Effluent from the Wastewater Treatment Plant**

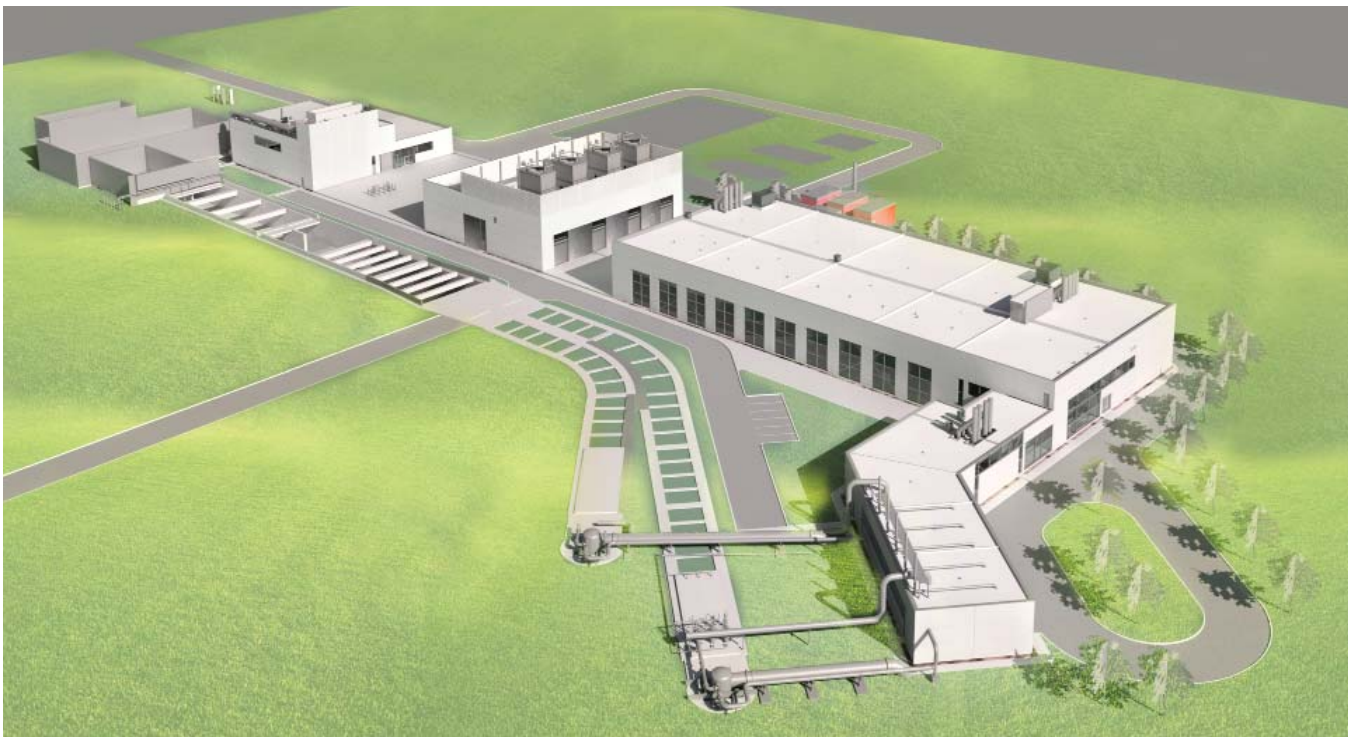
FREQUENCY	STANDARD	2014*	2015
1 test per month	Rainbow trout	Non lethal 9 tests	Non lethal 12 tests
	Daphnia	Non lethal 9 tests	Non lethal 12 tests

\* Testing began in April 2014.

## OUTLOOK

Initially scheduled to come on line in 2016, the ozonation unit will come on line gradually in 2018, with continuous operation starting in 2019. The goals are to:

- Make effluent from the Wastewater Treatment Plant compliant with the discharge requirement of 9,000 cfu per 100 mL of fecal coliform prescribed by the Ministère du Développement durable, de l'Environnement et de la Lutte contre les changements climatiques (MDDELCC);
- Eliminate pathogenic microorganisms such as bacteria and viruses, odors and colour, but also other organic pollutants such as pharmaceutical and personal care products;
- Improve municipal wastewater quality before it is discharged into the St. Lawrence River in order to reduce the risk of infection due to contact with the water during recreational activities on the section of the river downstream of the Island of Montréal, which is currently affected by discharges from the Wastewater Treatment Plant;
- Improve the overall quality of the aquatic environment inhabited by the fauna and flora by reducing the level of pollutants in the effluent load.



New Ozonation Wastewater Disinfection Unit

# Milestone 4.3

## Reduce Stormwater Entering Waterways

Indicator: Reduce Frequency and Volume of Overflows

### COMMITMENTS

- Comply with MDDELCC overflow requirements, which entail no increases in the frequency of discharges.
- Apply pan-Canadian standards for urban effluents and comply with the *Regulation respecting municipal wastewater treatment works*.
- Invest in the monitoring, control and reduction of overflows through automation and the addition of hydraulic works.
- Promote surface developments based on the concept of sustainable stormwater management with the goal of reducing the volume of stormwater runoff captured by sewers.

### HIGHLIGHTS

The Island of Montréal is surrounded by a network of interceptors that collect all the island’s wastewater. Sewer networks downstream of these interceptors are for the most part combined systems. During exceptionally heavy rains, the Wastewater Treatment Plant and the interceptors reach full capacity, causing overflows as wastewater and stormwater are discharged from 36 overflow structures at the junction between the combined collectors and the interceptors. There are other discharge points consisting of overflow pipes in local systems. In total, there are 170 discharge and effluent overflow points.

These overflow points are subject to control and supervision. For the period from 2013 to 2015, performances on MDDELCC requirements across all overflow structures were as follows:

- Compliance with overflow requirements: 99%;
- Execution of the monitoring program: 96%.

### MILESTONE PROGRESS



In cases where systems are being expanded (development and redevelopment), the city provides technical assistance to stakeholders developing compensation measures for attaining or exceeding MDDELCC requirements set out in section 32 of the *Environment Quality Act* (EQA). The impact of urbanization must not increase runoff and overflow volumes from sewer systems during heavy rains.

The wastewater drainage and collection plan under development will establish planned actions on the sewer system over a 25-year horizon. A set of actions targeting sewer systems and drainage developments must be justified and optimized in order to meet multiple current and future performance and service-level obligations concerning protection against flooding, control of overflows from combined sewer systems in case of heavy rain, and the protection of outlet waterways.

The city is currently updating its monitoring system by installing and implementing telemetry at the final discharge points not yet covered. This will make it possible to better characterized discharge conditions on a continuous basis.

The city operates a real-time integrated and automated control system (CIDI) to manage control rooms and retention structures and carry out system, rain and weather readings. This technology has led to major operational gains with a positive impact on overflows. Moreover, the CIDI optimizes available hydraulic capacity at all times.



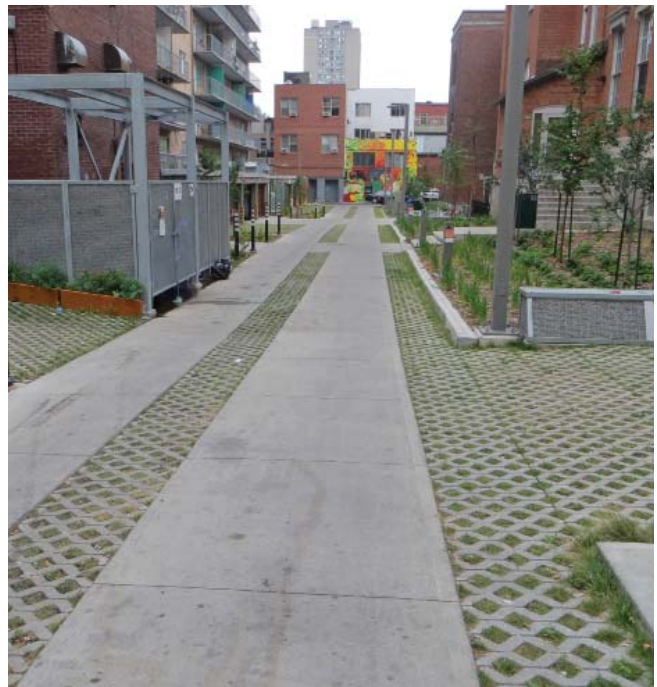
In the past 10 years, the city has built five underground retention structures with a capacity of more than 36,000 m<sup>3</sup>.

The city has embarked on an intensive sewer and water system rehabilitation program with the goal of eliminating its maintenance deficit. Among its benefits is the reduction of excess flow from sewer systems. Reducing excess flow creates a residual capacity, with a corresponding benefit for overflows.

- At the local level and upstream of sewer systems, the city must establish and implement development standards favouring stormwater retention and infiltration in both the public and private sectors.
- On a smaller scale, citizens can also help reduce the volume of runoff from their property. Since 2010, the city has promoted the installation of rain barrels and the diversion of downpipe flows to permeable surfaces.
- Current regulations pertaining to stormwater retention on private property make it possible to avoid a public investment of \$11M per year. All urban projects exceeding 1,000 m<sup>2</sup> must comply with a peak flow limit of 90% during heavy rains.

## OUTLOOK

- The city, in partnership with higher levels of government, is in the process of designing and building four major retention structures with a total storage capacity of close to 140,000 m<sup>3</sup>, which will help relieve the system while reducing overflow frequency.
- The Service de l'eau has begun reviewing regulations concerning stormwater retention on private lots to incorporate performance criteria for green infrastructures.



Green laneway created downtown in 2013  
as part of a Quartier 21 project

## Milestone 4.4

### Monitor Waterways and Sources of Pollution

Indicator: Monitor the Quality of Montréal's Water Bodies

#### COMMITMENTS

Every summer for the past 20 years, the Service de l'environnement's Réseau de suivi du milieu aquatique (water quality monitoring network) has sampled the city's water bodies at various key points in and around the Montréal agglomeration territory.

- Draft a report on the overall quality of Montréal's water bodies based on observations and on-site test results.
- Identify problem areas for which improvement is required and step up ongoing cleanup activities, notably through the screening and correction of numerous illicit connections between stormwater and sewer systems on the part of the territory served by separate sewer systems.

#### MILESTONE PROGRESS

2013

2015\*

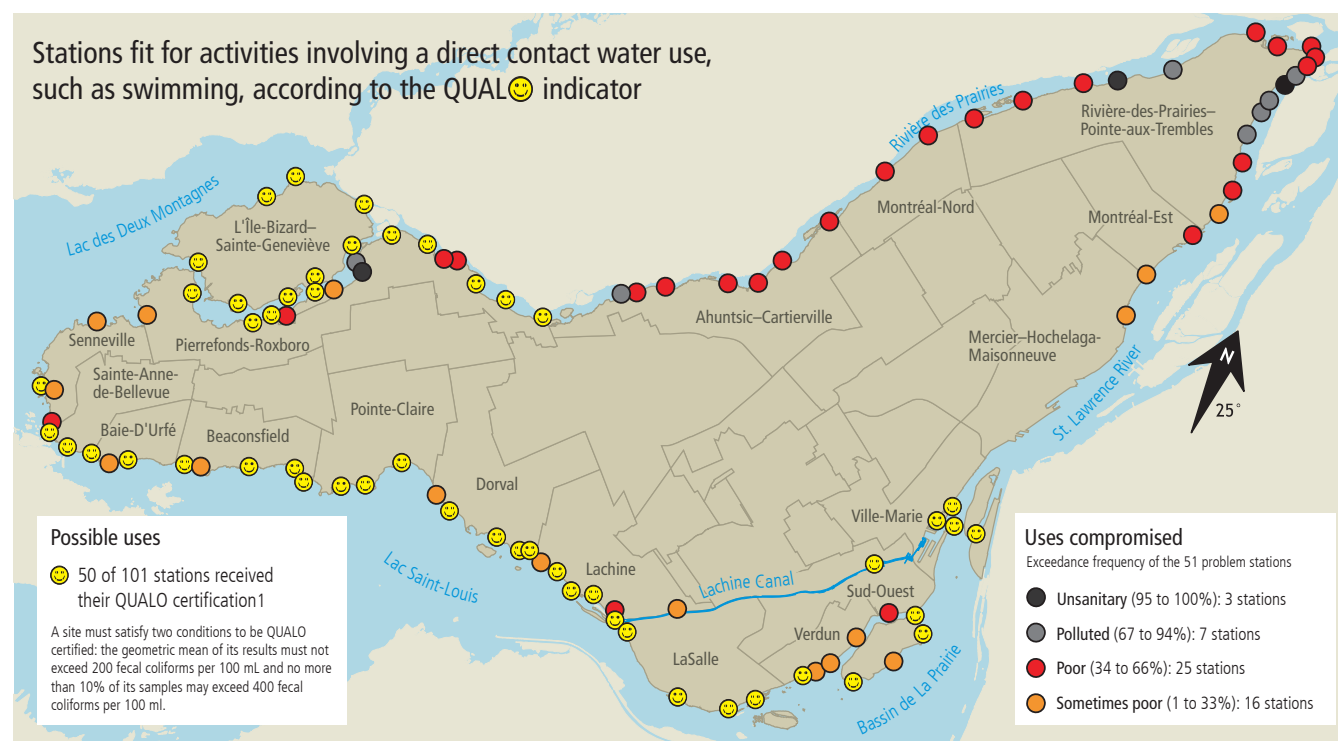
\*2016 data were not available when this report was produced.

#### HIGHLIGHTS

##### QUALO PROGRAM – SHORELINE WATER QUALITY

In 2015, the program was conducted over 20 weeks (May 21 to October 3) at 101 sampling stations on Rivière des Prairies, Lac Saint-Louis, Bassin de La Prairie, the St. Lawrence River and Île Bizard. Barely 50% of these stations were conducive to direct-contact water activities (criteria 200 COLI or fecal coliform per 100 mL), compared to the historical average of 59% since the program was established.

Figure 7. QUALO 2015 Program Report



Source: Portrait of the Quality of Montréal's Water Bodies, 2015 Environmental assessment report.

## RUISSO PROGRAM – WATER QUALITY IN STREAMS AND INLAND WATERS

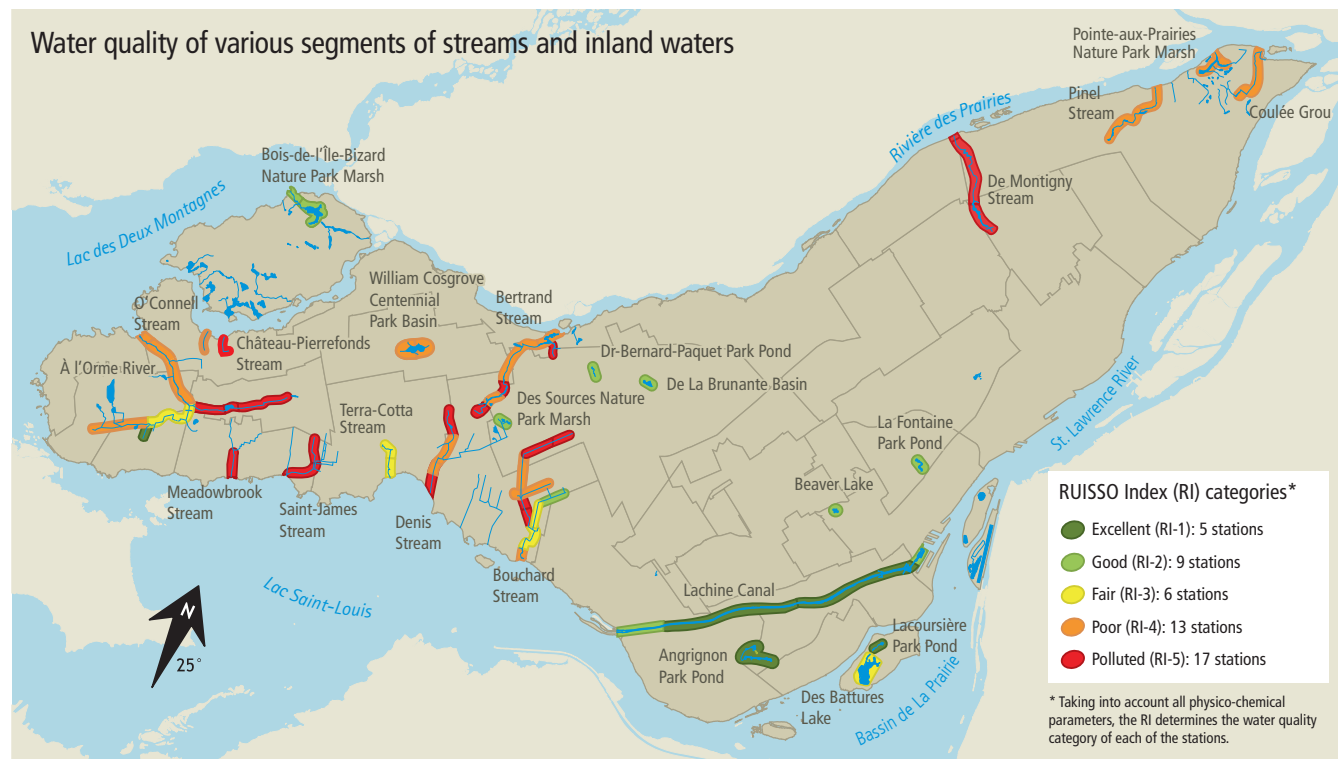
In 2015, a total of 50 sampling stations were created to monitor some 24 water bodies under this program. In general, water bodies fed by a distribution system, artesian wells or river water are of good quality, and these include urban ponds, marshes and wetlands. The quality of water bodies fed by rainwater varies from satisfactory to polluted. In some cases, the deterioration measured may result from the presence of illicit connections in several collector sewers feeding these water bodies; in others, it may stem from a chronic or occasional shortage of water supplying them; and finally, the deterioration may result from the poor quality of water from collectors affected by the presence of snow deposits, drainage from highways, or nearby work operations.



Presence of dye in Bertrand Stream

Credit: © Réseau de suivi du milieu aquatique, Ville de Montréal

### Figure 8. RUISSO 2015 Program Report



Source: Portrait of the quality of Montréal's water bodies, 2015 Environmental assessment report.



## COURDO PROGRAM – WATER QUALITY IN SURROUNDING WATERCOURSES

Watercourses quality around the Island of Montréal has risen sharply since the 1970s, following the installation of treatment equipment. Studies conducted between 1977 and 1997, and subsequent studies in 2004, 2011, 2012 and 2014 made it possible to specify the route followed by the dispersion plume from the Jean-R. Marcotte Wastewater Treatment Plant to Lanoraie.

In 2014, only the discharge impact area downstream from the Jean-R. Marcotte Wastewater Treatment Plant was sampled, with the goal of documenting the impact on water quality in the St. Lawrence River. At the time, samples were taken from 25 stations on seven occasions between June and October. As was the case in 2012, the 2014 data indicates that the impact area was limited to the river's center, along the north of the Îles de Verchères, and that it did not affect the north of the river, where the waters presented different characteristics.



Water samples being taken from the St. Lawrence River  
Credit: © Réseau de suivi du milieu aquatique, Ville de Montréal

**Figure 9. Overview of the Effluent Study Area**



Source: Portrait of the Quality of Montréal's Water Bodies, 2012 Environmental assessment report.

### PLUVIO PROGRAM – DETECTION WORK ON CONTAMINATED STORMWATER SEWER SYSTEMS

The Montréal agglomeration territory has a total of 587 stormwater sewer systems. To date, 190 of these systems have been identified as problematic. The study on the origin of the contamination in the latter systems was completed in 2015. In 94 of these systems, the contamination source was either diffuse or animal in origin. Detailed detection efforts and corrective operations continue at the remaining 96 stormwater sewer systems. The 397 systems deemed non-problematic are not likely to be affected by illicit connections. Through this program, boroughs and reconstituted cities can fix illicit connections on their territory.

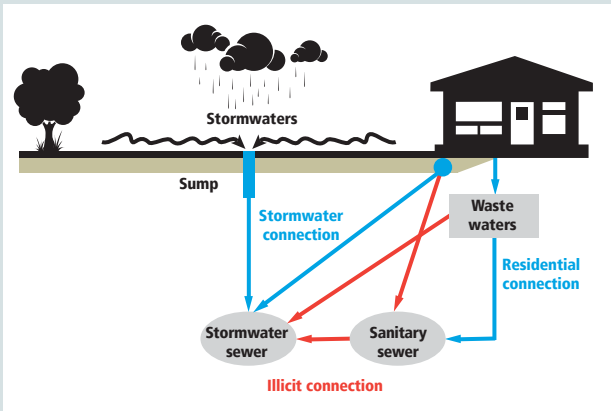
### OUTLOOK

Key challenges in coming years are:

- Monitoring and improving the Montréal agglomeration territory’s water quality, to restore more activities in our waterways;
- Better knowledge of general water quality, notably downstream of the Jean-R. Marcotte Wastewater Treatment Plant, in relation to the upcoming implementation of an ozonation unit;
- Improved water quality in water bodies and stormwater sewer systems, notably through ongoing screening and correction of illicit connections.

### What is an illicit connection?

An illicit connection is a connection or defect that allows sanitary waste waters to discharge elsewhere than in a domestic or combined sewer system, i.e., into a stormwater system, through the ground, a ditch or in a water body, with the exception of septic tanks.



**Table 6. Condition of Stormwater Sewer Systems\***

	2013	2014	2015
Non-problematic systems	380	406	397
Problematic systems	180	182	190
<b>Details concerning problematic systems</b>			
No illicit connection or corrected connection	61	72	94
Corrections to validate	11	5	12
Pending corrections	74	81	54
Pending analysis	34	24	30

\*The number of stormwater sewer systems evolves on par with sampling.

# PLANNED DISCHARGES OF WASTEWATER INTO THE ST. LAWRENCE RIVER IN 2015





# Maintenance and Repair Work on the Montréal Wastewater System's Southeast Interceptor Sewer

## HIGHLIGHTS

From November 11 to 14, 2015, Montréal carried out major maintenance work on the southeast interceptor as well as construction work on a snow chute. The project involved three main components:

- Removal of four series of deteriorated support rings in the western section of the southeast interceptor;
- Execution of critical maintenance work, including the replacement of cofferdam grooves upstream of the southern well valve, the inspection and maintenance of different structures (instrumentation, physical condition, and presence of deposits);
- Construction of a new snow chute at the Riverside structure.

As was the case with previous discharges, the city first secured a certificate of authorization from the MDDELCC and notified Environment and Climate Change Canada (ECCC) of the work to come. Exceptionnally, the Minister of ECCC intervened, issuing a ministerial order under the Fisheries Act, requiring that changes be made to the work and the monitoring programs established by the city.

Through the optimal supervision and coordination of work operations, it was possible to limit the closure of the southeast interceptor to 89 hours. In addition, less than 70 hours after the closure, service was restored on part of the interceptor, and wastewater collected on more than half the length of the interceptor was directed to the Jean-R. Marcotte Wastewater Treatment Plant. This made it possible, in turn, to execute all the work requiring a dewatering of the duct



Shoreline inspection and cleaning  
Credit: © Contrôle des rejets industriels, Ville de Montréal

and an absence of wastewater runoff so as to ensure worker safety while minimizing the duration of the discharge to less than four days as well as the volume of the discharge.

To complete all the activities required under the ministerial order, the city:

- Performed a visual inspection of the effluent plume;
- Implemented an emergency plan for unexpected discharges into the sewer system by large industrial, institutional or commercial institutions;
- Presented to ECCC monitoring data and results before, during and immediately after the work operations and during the following spring. These monitoring efforts, using water samples from the St. Lawrence River from Montréal to Sorel, were aimed at characterizing the quality of untreated wastewater effluent at discharge points along the river, as well as surface water, sediment and plants in the receiving environment;
- Participated in an exhaustive review of events leading to the discharge of untreated wastewater effluent.

The results of more than 10,000 lab tests and observations demonstrated that:

- The deterioration of water quality was limited to a corridor measuring roughly 250 m off the southern shores of the Island of Montréal, and about 10 km downstream of Montréal;
- The quality of the river water affected by the wastewater discharge returned to its original state within a period of four to 10 days following the end of the discharge;
- No drinking water outlets were affected;
- The discharge had no measurable short- or medium-term effect on sediment quality, plants and water toxicity in the receiving environment.



Sign placed on the floating dock behind the Natatorium  
Credit: © Réseau de suivi du milieu aquatique, Ville de Montréal

## OUTLOOK

In order to facilitate the process of securing authorization and complying with the legal obligations applied to all cities and municipalities in Canada, the city has sought clarification from ECCC concerning the application of the federal *Wastewater Systems Effluent Regulations* governing wastewater discharges into the system.

The city continues to rigorously plan maintenance and repair work by prioritizing efforts to reduce the risk of an overflow. It is complying with provincial regulatory provisions and concurrently informing ECCC of the planned work that could give rise to untreated wastewater discharges.

The discharge episode was widely covered by the media, with the public expressing concern about the impacts on natural habitats and the situation with urban wastewater discharges. The city shares this concern, and through its *Montréal Water Plan*, it intends to give Montrealers renewed access to shorelines and a water quality compatible with multiples uses, including swimming and recreational boating.



# PRINCIPLE 5

## WATER PROTECTION PLANNING

Development choices reflect the social, economic and environmental concerns of a city and its inhabitants. Long neglected, sustainable water management is now playing a growing role in land-use planning. Water-related goals help guide decisions of municipal departments in formulating by-laws, zoning regulations, incentives, etc. Such goals also encourage public and private stakeholders to factor drinking water consumption, stormwater runoff management and aquatic habitat protection into development planning.



# Milestone 5.1

## Adopt Council-endorsed Commitment to Sustainable Water Management

### COMMITMENT FULFILLED

The 2013 Report referred to certain policy documents that set out sustainable municipal wastewater management practices: the *Policy of the Protection and Enhancement of Natural Habitats*, the *Montréal Water Strategy* and the *Montréal Community Sustainable Development Plan 2010-2015*. The first two policies remain in force, and in 2016, the adoption of *Sustainable Montréal 2016-2020* – the third Montréal Community Sustainable Development Plan – further confirmed the municipal administration’s commitment to sustainable development. Also worth mentioning is the *Montréal Water Plan*, which makes the reappropriation of shorelines a municipal priority (see p. 9).



## Milestone 5.2

### Integrate Water Policies into Land Use Plan

#### COMMITMENT FULFILLED

In accordance with the *Metropolitan Land Use and Development Plan* (PMAD)<sup>4</sup> in force since 2012, the Montréal urban agglomeration adopted a Land Use and Development Plan in 2015 (Plan)<sup>5</sup>, in accordance with the *Act respecting land use planning and development* of the Government of Québec.

#### LAND USE AND DEVELOPMENT PLAN

The Plan establishes land use and development principles for the Montréal agglomeration for the next 10 years. These principles pertain to the quality of the living environment, the dynamism of the agglomeration and areas of activity, the enhancement of land that holds interest, the allocation of land, and its occupation density. The Plan also includes the following sustainable water management objectives:

- Climate change adaptation measures through the greening of lands and buildings and effective stormwater management;
- Increase in the proportion of protected land from 5.8% to 10% of the Montréal agglomeration territory;
- Enhancement of the archipelago and landscape features of the agglomeration through the creation of stronger links between the city and the water, notably through shoreline paths, gateways to the city, and interesting views;
- Consolidation of the Green and Blue Belt of Greater Montréal, notably through the enhancement of shoreline equipment and infrastructures and efforts to ensure a complementarity between shoreline recreational and tourism activities and nautical activities.

4. The PMAD sets out the principles, objectives and criteria for ensuring that Greater Montréal remains competitive and attractive from the perspective of sustainable land use development across metropolitan territory. It acts on elements that influence the way urbanization is structured across the metropolitan region, including land use planning, transportation and the environment.

5. Schéma d'aménagement et de développement de l'agglomération de Montréal, January 2015.

#### MILESTONE PROGRESS

2013



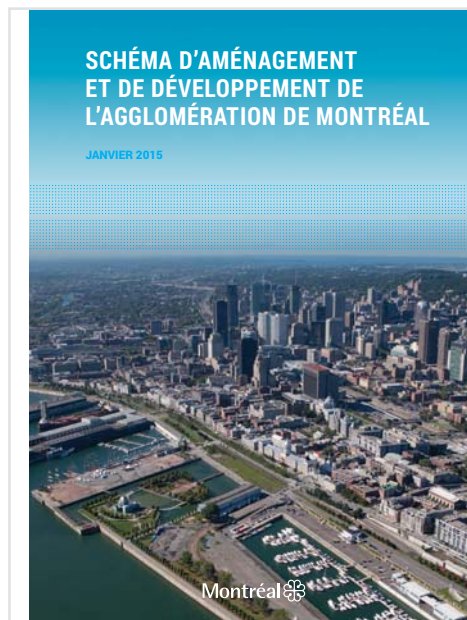
2016



#### OUTLOOK

The implementation of the Land Use and Development Plan is based on various areas of action.

- It is first carried out by complying with the urban plans of municipalities within the Montréal urban agglomeration and their urban planning by-laws.
- The development or review of several plans and policies favouring the fulfilment of the Plan's objectives.



# Milestone 5.4

## Adopt Green Infrastructure

Indicator: Green Infrastructure Projects

### COMMITMENT

The *Montréal Water Strategy* emphasizes stormwater collection, retention and infiltration into the soil in order to reduce overflows in the combined sewer system. Green infrastructures are among the measures used to promote stormwater management upstream of the drainage system.

### HIGHLIGHTS

- The implementation of green infrastructures continues in the public and private sectors. However, an assessment of their functional and financial performance based on the type of infrastructure (actual capacity and cost per cubic metre of retention/infiltration) has yet to be carried out as envisaged in the 2013 Report.
- In 2014, the Service de l'eau produced a guide to green infrastructures in order to help municipal professionals assess green infrastructure options put forward in urban projects, on the basis of costs and performance related to stormwater retention/infiltration.
- Some boroughs have urban planning by-laws requiring that in-ground plants cover at least 20% of a property's area. This area may include a green roof or permeable pavers.
- In 2013, the city published a technical guide to facilitate the approval and completion of green roofs on municipal buildings. As of September 2016, 28 green roof projects on buildings managed by the city were submitted in seven boroughs. On average, however, the green part of the roof occupies a relatively small part in proportion to the building's total surface area.

### MILESTONE PROGRESS

2013  2016 

- The Service de l'eau played an active part on the working committee responsible for drafting the *Guide d'intégration de la gestion durable des eaux pluviales dans l'aménagement d'un site* (Guide to integrating sustainable stormwater management into site development) published by the Centre d'expertise et de recherche en infrastructures urbaines (CERIU) in 2016.
- The Service de l'eau is collaborating with the Direction de l'urbanisme on integrating stormwater management into the development sectors under planning (e.g., requalification of the Assomption industrial sector, and the Lachine-Est and Louvain-Est development projects).
- The drainage and wastewater collection plan under development will establish planned actions on the systems over a 25-year horizon. In tandem with a set of actions on the systems, the development plan will assess the impact and justify the scope of the green surface and infrastructure developments to eventually integrate into the urban fabric in proximity to the drainage basins.

### OUTLOOK

The companion document to the Land Use and Development Plan contains a requirement stipulating that planning by-laws in the boroughs and reconstituted cities must integrate measures to deal with soil impermeability and heat island effects caused by roofs, for example by requiring green islands, the use of permeable pavement in parking lots, or white roofs.



In 2016, a city council committee further studied sustainable building development, notably through green roofs and stormwater management. After analyzing the proposals and comments stemming from public hearings, the committee is expected to table its recommendations to city council in April 2017.

In September 2016, city council appointed a committee to evaluate the feasibility of launching a “Water Square” pilot project (multipurpose public space with surface stormwater retention). The committee’s recommendations should be tabled in 2017.

The Service de l’eau developed a draft by-law concerning stormwater retention on private lots. Performance criteria make it possible to consider local circumstances (hydrology, topography, soil type, etc.), when designing green infrastructure.

The draft *Canopy Action Plan 2012-2021* (Plan d’action Canopée) is designed to increase Montréal’s tree cover from 20% to 25%, with 300,000 trees to be planted over a 10-year period. This effort will help improve air quality and reduce smog, heat island effects, and runoff.

*The Service de l’eau intends to implement a master drainage plan whereby an optimal and efficient combination of green infrastructures and added underground hydraulic works will guide efforts to upgrade our sewer system in the long term.*

### Green Infrastructures on avenue Papineau

Closely associated with the Saint-Michel Environmental Complex, the redevelopment project on avenue Papineau constitutes an experiment on the integration of optimal surface runoff management. In 2017, a connected series of bioretention basins will be built along the east side of avenue Papineau over distance of two kilometres to collect stormwater runoff on the road and the sidewalks. By permanently integrating a green infrastructure on public property into a key transportation project, the city is innovating and thus meeting its sustainable development objectives while reducing heat island effects through a massive greening effort. In 2018, a monitoring program will track the condition of the green infrastructures, thus allowing the city to foster expertise for the benefit of its citizens.





# PRINCIPLE 6

## WATER PREPAREDNESS FOR CLIMATE CHANGE

The three key elements involved in preparing for climate change are: (1) identifying potential risks, sectors and populations affected, (2) identifying and implementing reduction or adaptation measures and (3) developing/deploying response plans. Cities play key roles in contending with climate change through their responsibilities for urban planning, infrastructure, transportation systems, economic development, the environment, etc.

From this perspective, the city has joined several coalitions of cities aimed at promoting collaboration and sharing advances, including:

- 100 Resilient Cities Network (December 2014)  
Sharing expertise and opportunities for continued improvement of risk management practices, notably in regards to climate change adaptation.
- Global Covenant of Mayors for Climate & Energy (April 2015)  
Worldwide coalition of mayors and local elected officials from more than 7,100 cities committed to reducing greenhouse gases at the local level, improving resilience in the face of climate change, and publicly measuring and sharing progress.
- C40 (December 2016)  
Organization including 90 forward-looking cities committed to fighting climate change



# Milestone 6.1

## Conduct a Vulnerability Assessment

Indicator: Geographical Vulnerability Assessment

### COMMITMENT

Under the *Climate Change Adaptation Plan for the Montréal Urban Agglomeration 2015-2020*, the Service de l'environnement conducted a geographical analysis of the agglomeration territory's vulnerability to climate change.

### HIGHLIGHTS

In order to establish climate variations to which the Montréal agglomeration is already vulnerable, a multidisciplinary team conducted a non-exhaustive review of extreme climate events with known impacts dating back 30 years. The review was carried out by consulting documents held by the Centre de sécurité civile de Montréal, Public Safety Canada, and Environment Canada, as well as other scientific and university reports. To specify the impacts of the events identified, various media archives were also consulted.



### MILESTONE PROGRESS

2013



2016



Climate projections for southern Québec issued by Ouranos were subsequently consulted, and climate data from recent decades were analyzed to identify evolving climate trends in Montréal. This analysis is essentially based on meteorological data from the weather station at Montréal-Trudeau International Airport and hydraulic data from the White Horse Rapids on the Rivière des Prairies.

By combining past observations with climate projections, six climate variations whose impacts on the Montréal agglomeration and its population are exacerbated or are likely to be exacerbated by climate change were identified:

- Higher average temperatures;
- Heavy rainfalls;
- Heat waves;
- Destructive storms (wind, hail, snow, freezing rain);
- Droughts;
- River Floods.

The trend towards increased episodes of heavy rainfalls and shifting high water periods is likely to exert an impact on sustainable water management. In fact, given that the territory is served in large part by a combined sewer system, the rapid influx of a large volume of water on the territory increases the risk of overflow, flooding and sewer backup. What's more, a rise in the water levels of watercourses in certain sectors of the Montréal agglomeration can cause flooding with varying degrees of severity.



### Heavy rainfalls

The vulnerability to heavy rainfalls in the Montréal agglomeration is determined by analyzing geographic zones with a potential for water accumulation, as well as infrastructures and population groups that are vulnerable to the impacts of these variations.

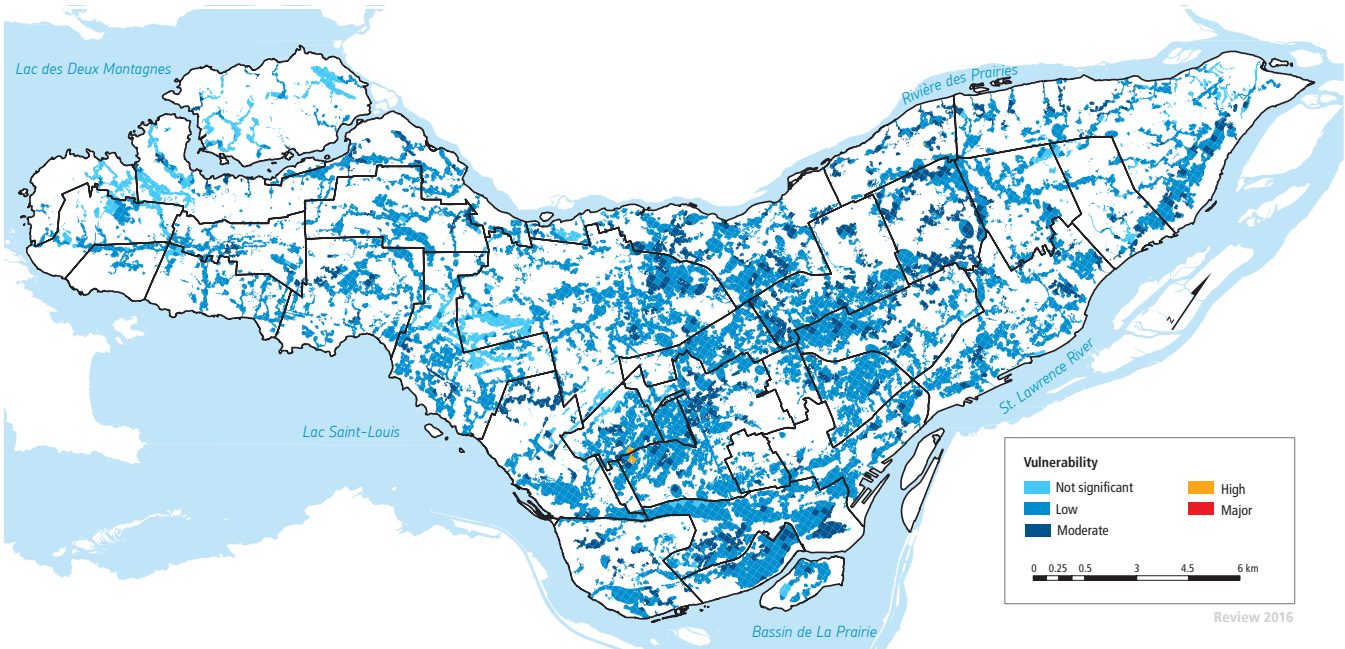
The map below demonstrates that a large part of the agglomeration has a minor or moderate vulnerability to heavy rainfalls and that the more vulnerable zones are in the central and eastern portions of the island. Only a few zones are deemed to present high vulnerability. These are located in areas with vulnerable populations due to low-lying infrastructures at risk of stormwater accumulation.

### River floods

Climate change alters the hydraulic cycle by increasing periods of heavy rain and drought. These changes in the water cycle have an effect on river floods. Flooding occurs when a river's flow or level exceeds a critical threshold.

The risk of river floods in the Montréal agglomeration mainly concerns the boroughs and reconstituted cities bordering the Rivière des Prairies. Those bordering the St. Lawrence River are not as vulnerable to this variation. In fact, the flow of the St. Lawrence River is regulated upstream, which considerably reduces the risk of flooding. The map on the next page shows the sectors that are vulnerable to river floods.

**Figure 10. Vulnerability to Heavy Rainfalls in the Montréal Agglomeration**



Source: Climate Change Adaptation Plan for the Montreal Urban Agglomeration 2015-2020, November 2015.

In 2014-2015, the Service de l'eau also improved its knowledge of the systems making it possible to better understand the impacts of river floods and heavy rainfalls, thanks to the following programs:

- Assessment of the combined drainage system based on the methodology featured in the Engineers Canada Protocol (PIEVC);
- Participation in the study on the vulnerability of water intakes on the St. Lawrence River, commissioned by Ouranos and Natural Resources Canada.

## OUTLOOK

An interim report on the climate change adaptation plan is expected in 2017-2018 (including a validation or update on the vulnerability study). In addition, as a member of the Global Covenant of Mayors, the city, during its second year of membership in 2017, must complete the climate change vulnerability analysis using the standardized platform called the *Climate Risk and Adaptation Framework and Taxonomy* (CRAFT). This process makes it possible to conduct comparative analyses and will lead to opportunities for collaboration between cities presenting the same risks.

**Figure 11. Vulnerability to River Floods in the Montréal Agglomeration**



Source: Climate Change Adaptation Plan for the Montreal Urban Agglomeration 2015-2020, November 2015.

# Milestone 6.2

## Address Vulnerability – Climate Change Adaptation Plan

Indicators: Adaptation Plan Adopted by Municipal Bodies and Progress Implementing Adaptation Measures

### COMMITMENT

Montréal’s Service de l’environnement made a commitment to produce a climate change adaptation plan for the urban agglomeration. Published at the end of 2015, this plan constitutes a point of departure for an iterative approach that will be improved over the years, as data on the changing climate and the inherent risks are collected and the effectiveness of actions deployed is demonstrated. The first climate change adaptation plan covers the period from 2015 to 2020.

### HIGHLIGHTS

Adaptation measures are at the heart of the Montréal urban agglomeration’s first plan. They are aimed at mitigating vulnerabilities across the territory, and they reflect the manner in which municipal actors are adjusting to a changing climate or will continue to do so.



### MILESTONE PROGRESS

2013  2016 

For each hazard, three to six key measures were established through a collaboration between central services, reconstituted cities and boroughs, and specialists in development, green spaces, buildings, water management, sports, etc. These key measures in turn include several actions implemented by central services, reconstituted cities and boroughs.

The actions in this initial climate change adaptation plan were chosen to meet the following criteria.

- **Implementation already begun or planned**  
Some plans, strategies and by-laws already include measures that contribute to climate change adaptation. The adaptation plan represents an opportunity to consolidate these actions.
- **Short-term feasibility, between now and 2020**  
Implementing these measures requires relatively little time, so it can be done by the end of the period covered by this plan.
- **Potential for adaptation to more than one climate hazard**  
Some actions have co-benefits that allow them to boost resilience to more than one hazard.

Finally, another criterion was added for adaptation measures slated to be implemented at the local level by boroughs and reconstituted cities. In fact, boroughs and cities must act in accordance with the determination of local vulnerability presented.



Key measures established for heavy rains and flooding are presented below.

### Key measures for heavy rainfalls

- Harvest rainwater
- Increase infrastructures' and buildings' resilience to runoff water
- Minimize sealed surfaces
- Ensure the capacity of stormwater and combined sewer system
- Increase and preserve tree and plan cover
- Develop emergency measures for heavy rainfalls

### Key measures for river floods

- Increase infrastructures' and buildings' resilience to river floods
- Develop emergency measures for flood-prone areas
- Increase the stability of river banks facing erosion

## OUTLOOK

As part of the *Climate Change Adaptation Plan for the Montréal Urban Agglomeration 2015-2020*, the Service de l'eau is committed to carrying out several actions related to water management on the agglomeration territory. These actions are included in the *Montréal Water Strategy* and the *Montréal Water Plan*.

- Continue to implement a pluviometry network for system measurements and measurements of discharges into waterways so as to oversee the evolution of climate change and the performance of storm sewer and drainage systems.
- Auscultation and maintenance of primary and secondary sewer mains.

- Increase in annual renewal rates in the distribution and sewer systems.
- Master drainage plan including hydraulic tests on all watersheds, thus making it possible to sequence the implementation of retention structures and meet the objectives of the MDDELCC.
- Conduct a vulnerability assessment on the combined drainage system, based on the Engineers Canada protocol (done in 2014-2015).
- Construction of underground retention structures.
- Harmonization of regulations pertaining to stormwater retention for large surfaces with the *By-law concerning the piping of drinking water, wastewater, and storm water C-1.1*
- Guide on the role of green infrastructures in urban projects in Montréal and follow-up with the administrative units concerned.

The Service de l'environnement has also pledged to carry out the following water management actions on the Montréal agglomeration territory

- Programme PLUVIO – assess water quality in the stormwater sewer systems.
- Strengthen the ecological management of green spaces across Montréal territory.

# Milestone 6.3

## Adapt Emergency Response Plan to Climate Change

### COMMITMENT

All the boroughs and reconstituted cities within the Montréal urban agglomeration are working jointly with the Centre de sécurité civile to ensure the protection of their residents. In order to achieve this, they are playing an active part in analyzing risks and devising emergency, succession and mission plans (PURM) in the event of downpours and flooding (among others). The Centre de sécurité civile also has several continuous monitoring tools meant to rapidly detect problem situations and take proactive action.

### HIGHLIGHTS

Civil security officials are equipped with planning and response tools to predict and contend with various emergencies that might occur on the territory. These response plans are based on assessments of potential risks, on solutions adapted to situations, and on various more vulnerable populations. A priority scale determines the level of importance attached to the management of each of the risks identified.

#### Special Response Plan (PPI) for floods

This Plan serves to predict and plan actions under city or borough authority during floods to protect residents, property and the environment. A rise in water levels in the Rivière des Prairies and the St. Lawrence River can cause flooding with varying degrees of severity. Some 18 telemetric stations installed in strategic locations around the Island of Montréal track changing water levels and quickly detect a situation that could become problematic. According to the thresholds established, actions and preventive measures are put in place by various officials before flooding occurs.

### MILESTONE PROGRESS

2013  2016 

#### Heavy Rain/Tornado/Strong Winds

Several boroughs and reconstituted cities are vulnerable to downpours, tornados or strong winds, which can cause sewer backup and contamination, power outages, fire, local flooding, etc. To ensure public protection and the protection of private and public goods, these municipalities have put forward emergency response plans and allocated resources in order to better manage this type of situation (public disaster alerts, emergency social services, resources deployed to secure affected areas, etc.). The Ahuntsic-Cartierville borough has developed a response guide for heavy rains meant to facilitate emergency operations on public land.

### OUTLOOK

Emergency measures planning serves not only to mitigate the risk of a state of emergency by measuring the human and economic impacts of a disaster, but also to review and improve the measures and tools deployed during such events. Well planned emergency measures protect the public and living environments and help minimize damages. As part of the *Climate Change Adaptation Plan for the Montréal Urban Agglomeration 2015-2020*, the Centre de sécurité civile upheld its commitment to annually update the Special Response Plan for floods, also producing a Special Response Plan for heavy rainfalls for 2020.

# Milestone 6.4

## Reduce Greenhouse Gas Emissions (GHG)

Indicator: Change in GHG Emissions Due to Wastewater Treatment and Drinking Water Production

### COMMITMENT

In 2010, the city succeeded in meeting its chief objective of reducing GHG emissions from municipal activities by 20%. In 2013, the city renewed its commitment to further reduce GHG emissions by setting a new target of 30% by 2020, compared to 2002.

### HIGHLIGHTS

In 2013, the Service de l'environnement published the most recent GHG inventory for municipal activities in 2010. The next inventory will be published in 2017 for the year 2015. The final GHG inventory for the Montréal community in 2013 (including public and ICI emissions) was published in 2016. Note that emissions due to municipal activities represent about 2% of emissions by the Montréal community.

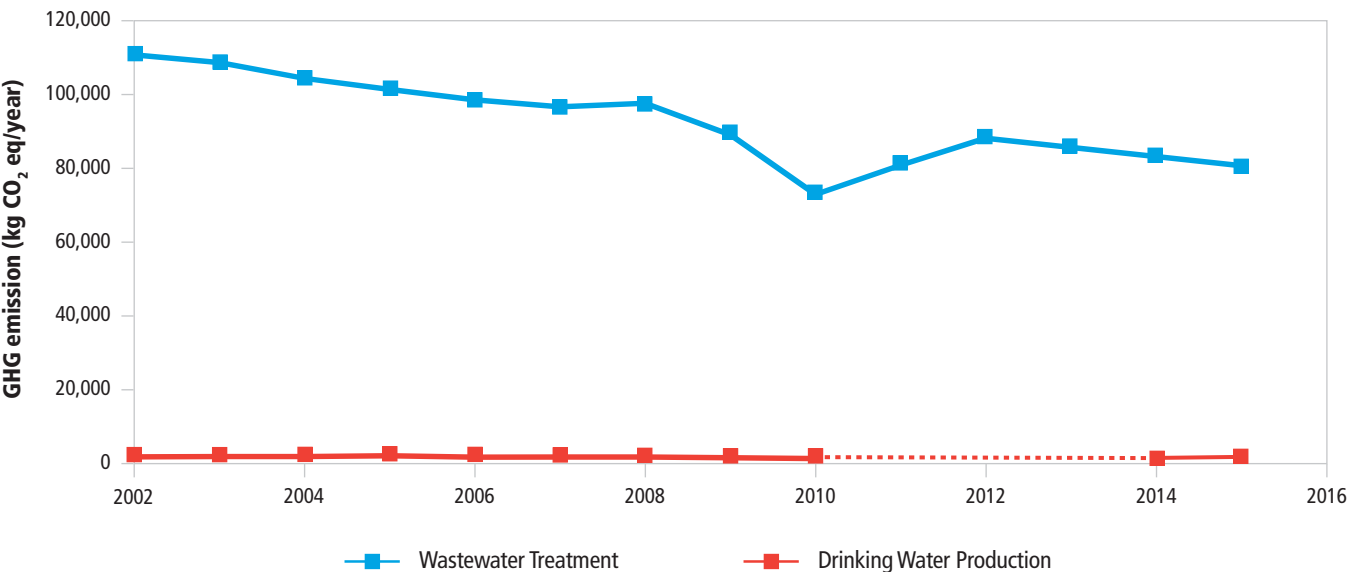
### MILESTONE PROGRESS

2013 2016

Drinking water production and wastewater treatment accounted for GHG emissions equivalent to 1,142 and 80,861 tons of CO<sub>2</sub> in 2015, respectively. These emissions represent 0.1% and 33.7% of total emissions due to municipal activities (equivalent to 239,735 tons of CO<sub>2</sub>).

*To date, only preliminary figures are available for emissions due to wastewater treatment and drinking water production. Once published in 2017, the inventory of emissions due to municipal activities in 2015 will take precedence over the figures presented below.*

Figure 12. GHG Emissions Due to Municipal Activities Related to Water





## Wastewater Treatment

Most emissions (69.9%) were caused by sludge incineration. The rest were essentially due to fossil fuel combustion (29.7%), primarily used for incinerating sludge and heating buildings during peak winter demand. In addition, light fuel oil is also used as sludge incineration fuel and diesel for emergency generators. Finally, GHG emissions from electricity consumption account for 0.4% of the total. While electricity consumption associated with this activity is high, related GHG emissions are minimal due to Québec's low GHG electricity emission factor.

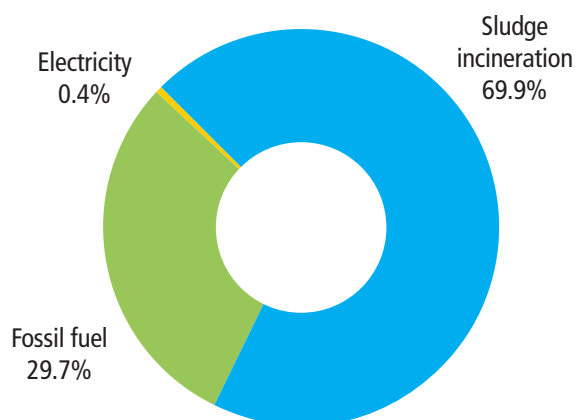
Over the 2002-2015 period, a 27% reduction in GHGs was achieved, due largely to a 9% reduction in the amount of sludge incinerated, along with a reduction in the use of light fuel oil (52%) and natural gas (18%). Furthermore, changes to incinerator burners in 2005 diminished the amount of natural gas needed for post-combustion of gas.

## Drinking Water Production

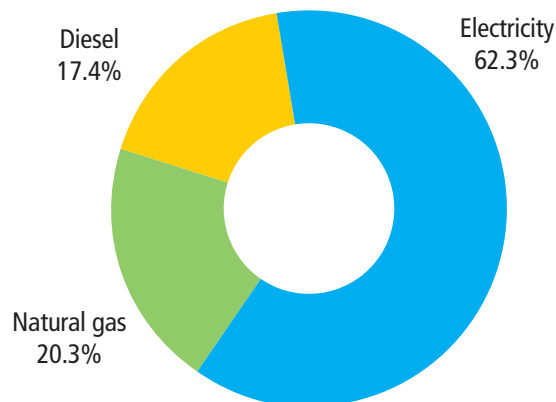
Some 62.3% of GHG emissions due to drinking water production stems from electricity consumption of plants, reservoirs and pumping stations. Natural gas consumption at drinking water production plants in Pointe-Claire and Dorval account for 20.3% of GHG emissions. Finally, diesel consumption for emergency generators accounts for 17.4% of the total.

Over the 2002-2015 period, a 45% reduction in GHG emissions due to drinking water production was achieved, owing largely to a reduction in natural gas consumption by plants (60%). In addition, as discussed in Milestone 1.1, drinking water production in the Montréal agglomeration decreased by 17% between 2002 and 2015, which in turn probably helped reduce GHG emissions associated with this production.

**Figure 13. GHG Emissions Due to Wastewater Treatment**



**Figure 14. GHG Emissions Due to Drinking Water Production**



## OUTLOOK

No GHG reduction objective for waste water treatment was set out in the reduction plan for corporate GHG emissions for 2013-2020. Wastewater disinfection by ozonation is expected to be deployed in 2018, which will lead to a significant rise in electric power consumption. However, the increase in GHG emissions due to this new activity will be marginal compared to total emissions due to wastewater treatment, due, still, to Québec's low GHG electricity emission factor.

The 45% reduction in GHG emissions due to drinking water production in 2015 compared to 2002 may be attributed mainly to the efforts deployed to reduce total drinking water production. However, electricity consumption in 2020 is expected to be similar to that of 2015. In fact, the reduction in GHGs may be offset by the gradual adoption of disinfection processes by ozonation and ultraviolet rays, which will lead to increased energy consumption.

Efforts to reduce GHG emissions due to municipal activities present many major challenges that will require the population as a whole to adopt new lifestyles and ways of doing things. Only through the mobilization of citizens, municipalities, governments, organizations and companies will it be possible to meet these objectives.



Filter room at the Pointe-Claire drinking water plant

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<b>\$M</b>	Million dollars	<b>NH</b>	Un-ionized ammonia
<b>AWWA</b>	American Water Works Association	<b>PMAD</b>	Metropolitan Land Use and Development Plan
<b>CBD</b>	Convention on Biological Diversity	<b>PPENH</b>	Policy on the Protection and Enhancement of Natural Habitats
<b>CiTTs</b>	Green Cities Program	<b>PPI</b>	Special Response Plan
<b>CMM</b>	Communauté métropolitaine de Montréal	<b>QSDWC</b>	Québec Strategy for Drinking Water Conservation
<b>CO<sub>2</sub> eq</b>	Carbon dioxide equivalent	<b>SMWM</b>	Sustainable municipal water management
<b>COD</b>	Chemical oxygen demand	<b>SS</b>	Suspended solids
<b>DBOD</b>	Carbonaceous biological oxygen demand	<b>t</b>	Ton
<b>ECCC</b>	Environment and Climate Change Canada	<b>TP</b>	Total phosphorus
<b>EQA</b>	Environment Quality Act		
<b>GHG</b>	Greenhouse gas		
<b>GLSLCI</b>	The Great Lakes and St. Lawrence Cities Initiative		
<b>ha</b>	Hectare		
<b>lc</b>	Illicit connections		
<b>ICIs</b>	Industrial, commercial and institutional sectors		
<b>ICLEI</b>	International Council for Local Environmental Initiatives		
<b>km</b>	Kilometre		
<b>m<sup>3</sup></b>	Cubic metre		
<b>MAMOT</b>	Ministère des Affaires municipales et de l'Occupation du territoire		
<b>MDDELCC</b>	Ministère du Développement durable, de l'Environnement et de Lutte contre les changements climatiques		
<b>NPO</b>	Non-profit organizations		



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## PRINCIPLE 5 WATER PROTECTION PLANNING

- Canopy Action Plan 2012-2021 (in French)  
[ville.montreal.qc.ca/pls/portal/docs/page/grands\\_parcs\\_fr/media/documents/pac\\_juin\\_2012\\_final.pdf](http://ville.montreal.qc.ca/pls/portal/docs/page/grands_parcs_fr/media/documents/pac_juin_2012_final.pdf)
- Green roof construction – Technical guide (in French)  
[ville.montreal.qc.ca/pls/portal/docs/PAGE/AFFAIRES\\_FR/MEDIA/DOCUMENTS/TOITSVEGETALISES\\_CAHIEREXPLICATIF\\_JANVIER2014.PDF](http://ville.montreal.qc.ca/pls/portal/docs/PAGE/AFFAIRES_FR/MEDIA/DOCUMENTS/TOITSVEGETALISES_CAHIEREXPLICATIF_JANVIER2014.PDF)
- Guide to integrating sustainable wastewater management in site development (in French)  
[www.ceriu.qc.ca/publications/guide-integration-de-la-gestion-durable-des-eaux-pluviales-dans-amenagement-un-site](http://www.ceriu.qc.ca/publications/guide-integration-de-la-gestion-durable-des-eaux-pluviales-dans-amenagement-un-site)
- Land Use and Development Plan in 2015 (Schéma d'aménagement et de développement de l'agglomération de Montréal - in French)  
[ville.montreal.qc.ca/portal/page?\\_pageid=9517,133997570&\\_dad=portal&\\_schema=PORTAL](http://ville.montreal.qc.ca/portal/page?_pageid=9517,133997570&_dad=portal&_schema=PORTAL)
- Montréal Water Strategy 2011-2020 (in French)  
[ville.montreal.qc.ca/portal/page?\\_pageid=6497,92021655&\\_dad=portal&\\_schema=portal](http://ville.montreal.qc.ca/portal/page?_pageid=6497,92021655&_dad=portal&_schema=portal)
- Policy on the Protection and Enhancement of Natural Habitats  
[servicesenligne.ville.montreal.qc.ca/sel/publications/PorteAccesTelechargement?Ing=En&systemName=7761565&client=Serv\\_corp](http://servicesenligne.ville.montreal.qc.ca/sel/publications/PorteAccesTelechargement?Ing=En&systemName=7761565&client=Serv_corp)
- Sustainable Montréal 2016-2020  
[ville.montreal.qc.ca/portal/page?\\_pageid=7137,78111572&\\_dad=portal&\\_schema=PORTAL](http://ville.montreal.qc.ca/portal/page?_pageid=7137,78111572&_dad=portal&_schema=PORTAL)

## PRINCIPLE 6 WATER PREPAREDNESS FOR CLIMATE CHANGE

- Assessment of the Vulnerability to Climate Change of Montréal's Combined Sewer System (in French)  
[pievc.ca/sites/default/files/montreal\\_stormwater\\_july\\_2015.pdf](http://pievc.ca/sites/default/files/montreal_stormwater_july_2015.pdf)
- By-law 11-010  
[ville.montreal.qc.ca/sel/sypre-consultation/afficherpdf?idDoc=23084&typeDoc=1](http://ville.montreal.qc.ca/sel/sypre-consultation/afficherpdf?idDoc=23084&typeDoc=1)
- Centre de sécurité civile - Flooding  
[ville.montreal.qc.ca/portal/page?\\_pageid=9657,125797610&\\_dad=portal&\\_schema=PORTAL](http://ville.montreal.qc.ca/portal/page?_pageid=9657,125797610&_dad=portal&_schema=PORTAL)
- Climate Change Adaptation Plan for the Montréal Urban Agglomeration 2015-2020  
[ville.montreal.qc.ca/pls/portal/docs/PAGE/ENVIRO\\_FR/MEDIA/DOCUMENTS/2017\\_PACCAM\\_2015-2020\\_report.PDF](http://ville.montreal.qc.ca/pls/portal/docs/PAGE/ENVIRO_FR/MEDIA/DOCUMENTS/2017_PACCAM_2015-2020_report.PDF)
- Developing a climate change adaptation plan. Guide for Québec municipalities (in French)  
[www.mddelcc.gouv.qc.ca/programmes/climat-municipalites/Plan-adaptation.pdf](http://www.mddelcc.gouv.qc.ca/programmes/climat-municipalites/Plan-adaptation.pdf)
- Government of Canada – Historical Climate Data  
[climate.weather.gc.ca/index\\_e.html](http://climate.weather.gc.ca/index_e.html)
- Government of Canada – Water Level and Flow  
[wateroffice.ec.gc.ca](http://wateroffice.ec.gc.ca)
- Sewer backup (in French)  
[ville.montreal.qc.ca/portal/page?\\_pageid=6497,54251578&\\_dad=portal&\\_schema=portal](http://ville.montreal.qc.ca/portal/page?_pageid=6497,54251578&_dad=portal&_schema=portal)

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Special thanks go out to our colleagues in the following departments for their help in updating the report entitled *Toward Sustainable Management of Municipal Waters* 2013-2016: Service de l'eau; Service de l'environnement, Service des grands parcs, du verdissement et du Mont-Royal; Service de la diversité sociale et des sports; Service de la mise en valeur du territoire; Service des infrastructures, de la voirie et des transports; Service de la concertation des arrondissements; Bureau du développement durable..



