PRIORITIZED ISSUES FOR 2024-2034

Overconsumption of water resources

ORGANISME
DE BASSIN VERSANT
de la rivière du Nord

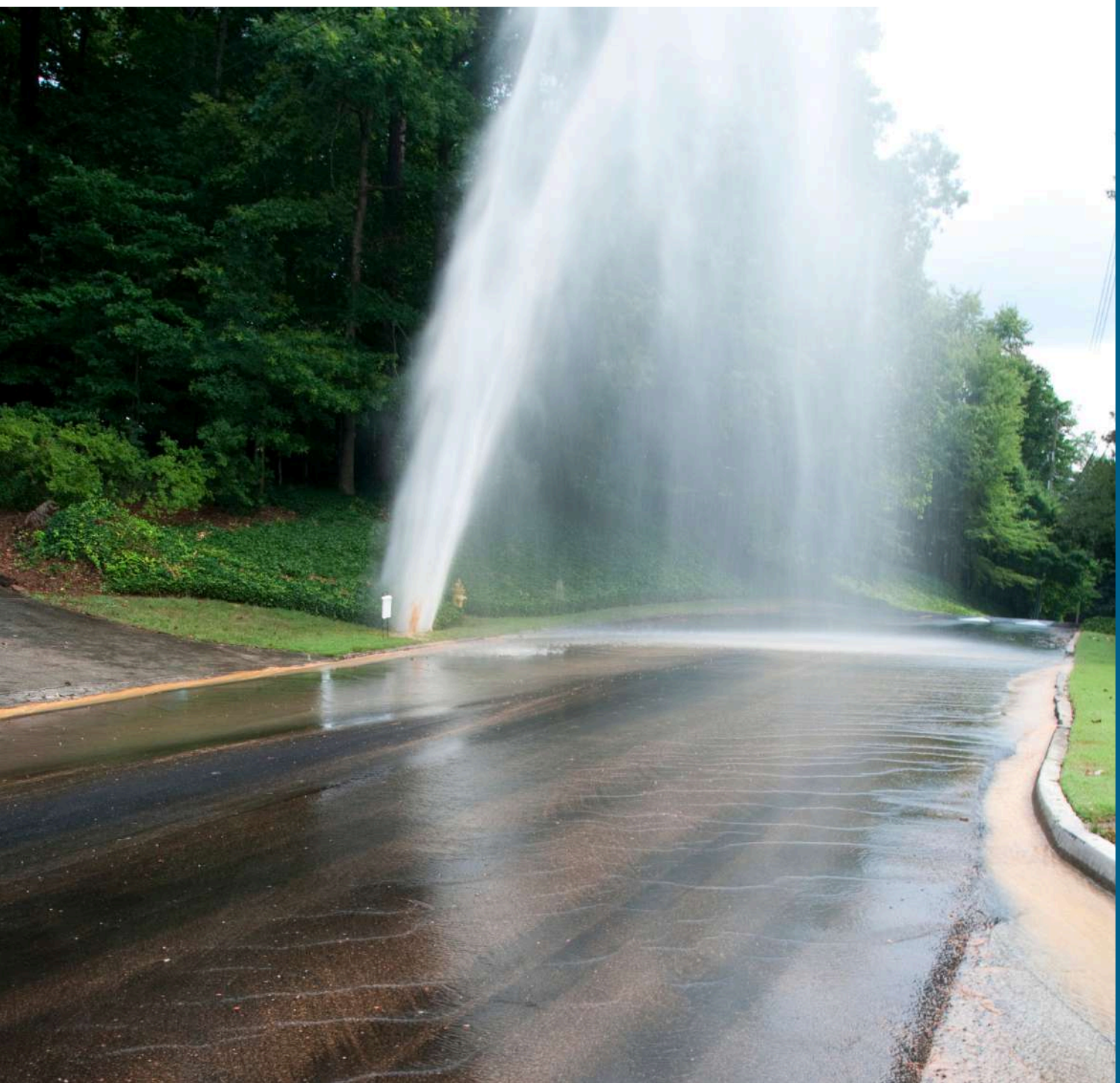


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1. Factual description

In the context of this report, the facts mainly present known information relating to the withdrawal and consumption of water resources in the Integrated Water Management Zone (ZGIE). Water resource overconsumption is presented in detail in the hypothesis of its presence in the region.

The average daily water consumption in Québec in 2018 was over 536 litres of potable water per person, exceeding the Canadian average by 20%. This statistic includes industrial and commercial sectors as well as leaks in distribution networks. Excluding these three uses, the daily water consumption is 268 litres per person—a quantity still considered quite high, as only 100 litres per person per day are necessary to live comfortably according to the World Health Organization (WHO) (Gouvernement du Québec, 2018a).

It is also important to define water consumption. Concretely, water consumption is the volume of water withdrawn or retained that is lost or not restored to the environment due to its evaporation, integration in a product, or any other reason. Withdrawn water is rarely consumed in its entirety. For example, for a municipality, domestic water consumption is evaluated at approximately 15%, the rest being returned into the environment through wastewater treatment facilities. For field irrigation, consumption is higher, at around 90%. Industrial water consumption varies according to the processes used. Water incorporated into products does not return to the environment, and the quantity of water used therefore represents the volume consumed (Gouvernement du Québec, 2022).

Major withdrawers in the ZGIE with active authorization per section 22 of the *Environment Quality Act* (chapter Q-2) mostly (82%) withdraw from groundwater (MELCCFP, 2023). Indeed, surface water is withdrawn by only 18% of major withdrawers. Figure 1 presents their distribution according to different areas of activity. The biggest consumers belong to the commercial and municipal categories (MELCCFP, 2023). The Laurentides groundwater knowledge project (PACES) showed that groundwater withdrawal volumes by major withdrawers (+ 75 m³/day) in the ZGIE increased from 2016 to 2019, rising from around 11 M m³/year to 17 M m³/year (Gagné et al., 2022).

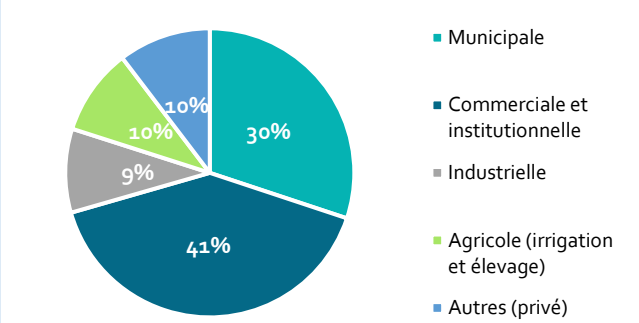


Figure 1. Distribution of major withdrawers in the Integrated Water Management Zone (ZGIE) with active provincial authorization by activity sector.

In contrast, surface water volumes withdrawn by major withdrawers (+ 75 m³/day) were quite stable between 2015 and 2019 (average of 24 M m³/year) (Gagné et al., 2022). In total, it is estimated that around 7 mm of groundwater and 10 mm of surface water are withdrawn annually in the ZGIE. Considering that the average recharge in the Laurentides is around 200 mm/year, withdrawal volumes for ground and surface waters analyzed in 2019 in the ZGIE are estimated at 3.5% and 5%, respectively. It is generally accepted that groundwater exploitation is sustainable as long as it does not exceed 10% of recharge (Gagné et al., 2022). Even if it does not seem to put significant human stress on groundwater volumes regionally, the situation may be different locally.

Indeed, knowledge of groundwater in the Laurentides has shown that the potential exchange between ground and surface water is average to high. This means that there is a combination of groundwater in surface water or that groundwater provides the base flow in watercourses (Gagné et al., 2022).

1.1 Municipal sector

Over 150,000 people are supplied with drinking water from a municipal ground or surface water source (Table 1) (MELCCFP, 2022). In total, 18 municipalities have a water distribution network located within the ZGIE and eight municipalities have a network located outside the zone. In the region, 47% of the quantities withdrawn by major municipal withdrawers with active authorization since 2014 are unknown, 41% withdraw over 379 m³/day, 3% between 75 and 379 m³/day, and 9% under 75 m³/day (MELCCFP, 2023).

Close to half of the population served by a municipal network is supplied by a groundwater source. The other half is supplied by surface water, whether from a river or lake. The main source of surface supply is the Rivière du Nord, as it provides water

to the Saint-Jérôme municipal network (approximately 62,000 people) and certain municipal networks in Mirabel (890 people). Sainte-Agathe-des-Monts serves nearly 9,700 people from Petit lac des Sables, and Brownsburg-Chatham supplies over 3,400 people from the Rivière de l'Ouest. Finally, Saint-Adolphe-d'Howard also withdraws lake surface water for approximately 350 people. Some municipalities with surface water intakes also have groundwater intakes, such as Saint-Jérôme, Mirabel, Brownsburg-Chatham, and Saint-Adolphe-d'Howard.

Table 1. Characteristics of municpal drinking water distribution networks in the Integrated Water Management Zone (ZGIE)

Water intake type	Number of municipal water withdrawals	Number of people served	Proportion of the population served by municipal withdrawals (%)
Groundwater	17	82,047	52
Lake	2	10,052	6
River	2	66,405	42
Total	21	158,504	100

The residential water consumption goal in litres per person per day (l/pers/d) for each municipality is 235 l/pers/d – the Canadian average (Gouvernement du Québec, 2018a). Residential consumption data (l/pers/d) for certain municipalities in the ZGIE are presented in Table 2 (Gouvernement du Québec, 2018a; Gouvernement du Québec, 2018b). It should be noted that the statistics are presented for the entire distribution network of municipalities and not only for the served population in the ZGIE. The data analysis in Table 2 shows that 75% of municipalities in the ZGIE had not reached this goal by 2018. Indeed, in 2018, the municipality with the highest average individual consumption was Saint-Adolphe-d'Howard with 593 l/pers/d for a served population of 863 inhabitants. This was monitored by the municipalities of Brownsburg-Chatham, Sainte-Marguerite-du-Lac-Masson, and Lachute with respective values of 439, 438, and 437 l/pers/d. Serving over 1500 people, Saint-Colomban has the lowest residential consumption at 173 l/pers/d.

The infrastructure leakage index (ILI) compares real water losses with unavoidable real losses. The goal for each municipal drinking water distribution network is to reach a moderate level of leakage (ILI < 4) (Gouvernement du Québec, 2018b). With the help of Table 2, we observe that only three municipal drinking water distribution networks out of the 20 in the region for which data are available exceeded this value in 2018: Sainte-Agathe-des-Monts, Sainte-Adèle, and Saint-Donat.

Residential

Out of a total population of around 206,680 inhabitants within the ZGIE, an estimated 158,504 are supplied water from a municipal network. Nearly 48,176 inhabitants are therefore estimated to be supplied from off-grid equipment—mostly individual tube wells.

Across the ZGIE, over 18,000 deep wells (or tube wells) were registered in the *Système d'information hydrogéologique du MELCCFP* between 1978 and 2023 (Gouvernement du Québec, 2023). It would be noted, however, that some deep wells may not be included and that surface wells are not registered. The direct use of a body of water in mountainous regions is also a considerable supply method in the ZGIE.

Table 2. Consumption by residences served by municipal aqueduct networks and infrastructure leakage index (ILI) in 2018 for municipalities for which data are available

Région administrative	Regional county municipality (RMC)	Municipality	Residential consumption (l/pers/d)	Population served by municipal aqueduct	No. of distribution networks	Leakage index
LAURENTIDES			255			3.6
	Argenteuil RMC	Brownsburg-Chatham	439	2,942	2	1.5
		Grenville-sur-la-Rouge	259	592	1	2.7
		Lachute	437	12,848	1	2.3
	Deux-Montagnes RMC	Saint-Placide	223	453	1	1.4
	La Rivière-du-Nord RMC	Prévost	374	7,331	3	1.4
		Saint-Colomban	173	1,573	3	1.5
		Sainte-Sophie	239	2,406	2	3
		Saint-Hippolyte	297	167	4	0.8
	Les Laurentides RMC	Sainte-Agathe-des-Monts	250	8,789	2	7.9
		Val-David	270	5,055	2	0.9
		Val-Morin	384	2,203	2	1.7
	Les Pays-d'en-Haut RMC	Estérel	219	72	1	1.0
		Sainte-Marguerite-du-Lac-Masson	438	1,133	1	2.3
		Morin-Heights	188	2,396	6	1.9
		Saint-Adolphe-d'Howard	593	863	2	3.1
		Sainte-Adèle	292	9,197	2	5.5
		Saint-Sauveur	242	7,145	2	2.2
	Mirabel	Mirabel	190	50,102	9	1.2
LANAUDIÈRE			253			2.0
	Matawinie RMC	Chertsey	238	535	1	1.5
		Saint-Donat	293	2,555	1	5.7

1.2 Agricultural sector

ZGIE farming is concentrated in the southern part of the region, mainly in the Argenteuil regional county municipality (RCM) and Mirabel. At the agricultural level (livestock breeding and irrigation), 30% of withdrawers with active provincial authorization since 2014 withdraw over 379 m³/d, 27% under 75 m³/d, 13% between these two values, and 30% an unknown quantity. These withdrawals are equally distributed between surface and ground sources (MELCCFP, 2023).

Wide-spaced crops

Nearly 90 km² of the ZGIE is occupied by wide-spaced crops (corn, soybeans) (FADQ, 2022). Crop irrigation is not considered an intensive practice within the ZGIE. Its practice is limited to a few types of horticultural production, mainly berries and vegetable crops (Caron, 2003). Where it is practiced, crop irrigation is supplied by surface watercourses or retention ponds designed for rainwater collection and drainage. Groundwater is not widely used at this time.

Livestock breeding

The number of agricultural businesses in animal production in the ZGIE is unknown but estimated at between 163 and 300. Water supply for animal watering is almost exclusively drawn from groundwater via private wells (Caron, 2003). In the Mirabel region, an estimated less than 6% of groundwater withdrawals are attributable to herd feeding, and the Geological Survey of Canada estimates that 17.1% of the groundwater volume pumped annually is linked to agricultural activities (livestock and crops) (Statistics Canada, 2001) (Savard, 2013).

Fish farming

Fish farms are considered major water consumers in the ZGIE. In 2004, 62% of the water used in fish farms came from surface water, while 38% came from groundwater (Richard Morin, 2006). One fish farm with three commercial fishing ponds is registered in the ZGIE.

1.3 Commercial and institutional sectors

Most commercial and institutional institutions in the ZGIE are supplied with water through the municipal network. However, there are a little over one hundred stores or services and a dozen institutions with an active water withdrawal site in the region. Twenty commercial sites withdraw from surface water, while the 96 others and the nine institutions all have a ground source. For this business sector, 24% of the withdrawn quantities are under 75 m³/d, 23% are over 379 m³/d, and 7% are between these two values. For the remaining 46%, data are unknown (MELCCFP, 2023).

1.4 Industrial sector

There are 11 industries with an active water withdrawal site in ZGIE North (MELCCFP, 2022). Out of withdrawers with active provincial authorization since 2014, 41% withdraw over 379 m³/d, 24% less than 75 m³/d, 14% between these two values, and 21 % an unknown quantity. Withdrawals are distributed equally between ground and surface supply (MELCCFP, 2023).

Pulp and paper

Two pulp and paper mills are found in the ZGIE, bordering the Rivière du Nord, in Saint-Jérôme and Lachute. Canada-wide, this industry is responsible for nearly 36% of total industrial water withdrawal. Around 73% of the water is used in the industrial process, while nearly 27% of the water is used in cooling, condensation, or steam systems (Statistics Canada, 2011). In 2013, the volume of water withdrawn annually by Québec paper mills was 393 M m³. Considering the annual volume withdrawn by all paper mills in Québec, the volume withdrawn by the two industries in the ZGIE could represent withdrawals on the order of several million cubic metres per year.

Mining industry

There are nearly thirty non-metallic surface mineral extraction sites in the region (MAMH, 2022; Institut de la statistique du Québec, 2021). Among these, four quarries have at least one active water withdrawal site (MELCCFP, 2022). For its Mirabel quarry, Lafarge Canada Inc. concrete products has a withdrawal site of over 379 m³/day of surface water located on a Rivière du Nord tributary. Uniroc Inc. also has a surface water withdrawal site of over 379 m³/day in this sector. Lafarge Canada Inc. also has three water withdrawal sites on the Rivière du Nord for its Sainte-Adèle quarry, two of which have withdrawal quantities of over 379 m³/day. Another quarry located in Mirabel includes two groundwater withdrawal sites. Located in the Rivière Sainte-Marie watershed, the quantities withdrawn by the two wells are between 75 and 379 m³/day and over 379 m³/day, respectively. The fourth, located in the Ruisseau McVean watershed, withdraws groundwater quantities of between 75 and 379 m³/day.

The groundwater resources characterization study in the St. Lawrence Lowlands indicates that quarries pump a volume equivalent to 37.4% of the groundwater used in the study area (Savard, 2013). This could be explained by the practice of well drying: the pumping of aquifer, river, or lake water outside of the mining site, which cannot be used in metal fabrication activities (RNC, 2009). Quarries therefore consume little water, but extract groundwater, which they discharge to the surface (RNC, 2009).

Water bottling and the food industry

Spring water bottling essentially withdraws groundwater as a primary resource. Annual extraction for bottling represents 3.4% of the water pumped annually in the fractured aquifer of the St. Lawrence Lowlands (Savard, 2013). Two industries withdraw groundwater quantities of over 379 m³/day, including Les Eaux Naya Inc., which has a total of three withdrawal sites in Mirabel. A study submitted in May 1999 concluded that the exploitation of one of the wells does not trigger any overpumping conditions and does not affect water quality in nearby wells (MDDEP, 2000). The other company is Société Laurentides Inc., which has had authorization since 2003 to build a groundwater well in the Chemin Saint-Jérusalem Sud area in Lachute. This belongs to Ice Spring River, a Canadian bottling company. The authorized flow is over 379 m³/day of groundwater and supplies the bottling plant that opened in 2015 (Ice River Spring, 2015). Trials showed that pumping from this well does not risk affecting the quality and availability of water in neighbouring wells. However, the Commission de protection du territoire agricole (CPTAQ) noted that, within the authorization request for agricultural lot use for purposes other than agriculture, few measures were put in place to protect neighbouring farmers from the impacts of this catchment on their wells.

1.5 Forestry sector

Although they can have an indirect impact on aquatic ecosystems, forestry management and logging activities use little water (Conseil de l'industrie forestière du Québec [CIFQ], 2015). Low volumes are sometimes used in soaking ponds and to water logs in outdoor yards during dry periods, but no data are available on the quantity of water used by these wood product factories in Québec. Wood processing industries, for their part, were responsible for around 8% of raw water use in Canada, while 92% of the water used is returned to the receiving environment after the treatment of water previously used in the fabrication process (CIFQ, 2015). Overall, water consumption in this sector is still considered minor and has greatly diminished since 1990, falling from 89 m^3/tonne to 53 m^3/tonne in 2013 (CIFQ, 2015). Productive forests cover around 67% of the ZGIE (Gouvernement du Québec, 2011e).

1.6 Recreation and tourism sector

Resorts, beaches, and camping

The vacation population represents over 50% of the total population for several municipalities in the ZGIE. In these municipalities, it is estimated that the flock of vacationers is responsible for close to 25% of water demand. This figure is obtained considering that a permanent resident corresponds to 365 days of water use and a vacationer, 120 days of water use per year. In addition to secondary residents, seasonal campers who rent sites for the summer season are also very common in the ZGIE. Various services are offered to campers, including electricity, water, and wastewater treatment. However, water management varies enormously from one establishment to the next.

Downhill skiing and snow tubing

There are nine downhill ski resorts in the region, including only one that does not produce artificial snow: Mont Alta. The Saint-Sauveur valley is particularly developed, with several hills offering winter activities. The volume and origin data for water withdrawn for this purpose are not available. A ski resort's annual water consumption can be estimated based on data collected at the Mount Orford resort in Estrie in 2004. A volume of approximately 360 million litres of water was used to produce close to 518,000 m^3 of snow, which covered around 85% of the skiable area, with an average thickness of 1.2 m of artificial snow (Demers, 2006). Furthermore, at the Mont-Tremblant resort, there were 1,037 snow cannons in 2008, which pumped up to 35,000 L of water per minute (Agence Science-Presse, 2008). It can therefore be said that these activities require large quantities of water for artificial snow production. In the ZGIE, ten surface water withdrawal sites belong to ski resorts (MELCCFP, 2022). The region's ski resorts generally withdraw around 379 m^3/day of water.

Pools, splash pads, water parks, and wellness centres (spas)

To meet the cooling needs of their citizens, a growing number of municipalities are building public facilities such as pools and splash pads. In addition, a few water slide parks are listed in the region. Many wellness centres are found in the ZGIE and offer diverse relaxation products. The volumes of water collected by pools, splash pads, water parks, and wellness centres are unknown and vary according to customer traffic and the size of the facility. Water parks use water recirculation systems that reduce their consumption. These facilities would also be supplied by municipal aqueduct networks.

Golf courses

The ZGIE has a dozen surface water withdrawal sites and two groundwater withdrawal sites belonging to a total of 22 golf courses, two private courses, and two practice fields. Withdrawn quantities vary greatly from one golf course to the next—from under 75 m^3/day for some to over 379 m^3/day for others (MELCCFP, 2022). A survey conducted by Julie Duhamel-Gingras (2008) on eight of the 25 golf clubs in the ZGIE concluded that each of them draws water from lakes or watercourses to irrigate their turf. However, the quantities used vary greatly from one club to the next, from 68 litres/m^2 to nearly 980 litres/m^2 of turf (Duhamel-Gingras, 2008). The volume of groundwater pumped annually to irrigate golf courses is estimated to correspond to 0.6% of the total pumping in the Lowlands (Murat et al., 2003). In addition, by extrapolating the collected data, golf courses in the ZGIE are estimated to represent a total demand of 5.14 billion litres of water per year.

2. Hypothesis of its presence

Current knowledge is inadequate to determine whether current water resource consumption in the ZGIE is optimal. In effect, little data on water resource waste by sector are available for the region. The variety of uses and use/consumption processes make ZGIE-wide estimates difficult to make.

The lack of knowledge on ground and surface water availability, the impact of the many major withdrawers, increased demand for the resource, and climate change generate concern among the region's water stakeholders. The overconsumption of water resources is therefore also perceived according to the consumption of the resource to the detriment of the capacity of water environments to support this consumption.

All in all, the region studied by PACES-LAULM does not show a water deficit. Precipitation there is largely in surplus and evapotranspiration is limited. However, due to the widespread presence of fractured rock in the Canadian Shield, which forms a low-productivity aquifer, and the minimal spread of granular aquifers located in valleys, certain regions of the study zone experience difficulties in supplying or limiting exploited flows. Current groundwater withdrawals in the region represent 1 mm/year, or 0.5% of the annual recharge (Gagné et al., 2022). Nevertheless, retention times show that, despite the presence of relatively young groundwater (a few decades old), a certain proportion of groundwater may remain in the aquifer for several millennia. The presence of this older groundwater should inspire prudence in the exploitation of the resource. In addition, this regional data can still hide significant local disparities due to the nature of the geological materials (contrast between low-productivity fractured rock and more productive granular aquifers) (Gagné et al., 2022).

The withdrawal of large amounts of groundwater can cause a reduction in surface water network exchanges and reduce water volumes in bodies of water (Barlow and Leake, 2012). Reduced surface water due to large groundwater withdrawals can happen in the region, but this phenomenon is extremely complex to quantify. Beyond reducing surface water volumes, cases of excessive withdrawal can sometimes lead to an inversion of water exchanges between groundwater and surface water (Barlow and Leake, 2012).

The surface water availability indicator in the current climate of the Ministry of the Environment, the Fight Against Climate Change, Wildlife and Parks (MELCCFP) presents an increased availability for the Rivière du Nord watershed. In the 2071-2100 outlook, however, the availability of surface water is evaluated as moderate (MELCCFP, 2022). Surface water withdrawals can reduce the quantity of water *in situ*, on top of potentially affecting reserves in the periphery of the withdrawal point (Barlow and Leake, 2012).

3. General location

The overconsumption of water resources is not recorded exhaustively in the ZGIE. However, the absence of water overconsumption location data does not mean that overconsumption does not exist. The multitude of uses seen in the ZGIE as well as the diverse types of users lead to high consumption across the entire region.

Water overconsumption is linked to several factors that increase water consumption in the province, including the following (Battaglia, 2020):

- **The feeling of resource abundance**
  The abundance of water in the ZGIE can lead to the population feeling that the resource is inexhaustible and that preserving it is unnecessary. According to accessible data, groundwater availability does not seem to be problematic in the ZGIE at this time.
- **Lack of knowledge**
  Without precise data on groundwater availability or the actual quantities withdrawn, study conclusions are based on approximations. Prevention is therefore difficult.
- **Increased development and rising withdrawal quantities**
  In the absence of fine-tuned knowledge of groundwater availability, it is difficult to limit development and increased withdrawals. This increase is at the root of the perception of the problem.
- **The low cost of the resource/free for all**
  The absence of consumer charges for water use reinforces the perception of availability.
- **The ease of access to the resource**
  Water use does not require effort (supply, access delays, cost) by the consumer.
- **Lack of awareness**
  Low population awareness is also a cause of overconsumption.

Cumulative uses

Water overconsumption can be caused by various uses, and these vary across different areas of activity and regions. It is also important to consider that the combination of these uses can lead to considerable pressure on water resources and jeopardize their long-term supply sustainability, for ground and surface water alike. In other words, the cumulative impacts of water withdrawals are in themselves one of the causes of water overconsumption, especially when they affect the environment's carrying capacity (MELCC, 2018). Table 3 presents a few of the main uses contributing to water overconsumption.

Climate change

It is expected that the evolution of hydroclimatic conditions will lead to more intense low flow periods. These longer dry episodes can strongly affect the available flows for withdrawals (Ouranos, 2020). This evolution could also disturb the direction and intensity of groundwater flows at sites identified as having permanent surface water inputs into groundwater (Baudron, Labelle, and Masse-Dufresne, 2022). Furthermore, a reduced recharge can have widespread repercussions on the water cycle in the entire zone under study (Gagné et al., 2022b).

In addition, climate change risks have significant repercussions on water withdrawals in the recreation and tourism sector. Ski and tubing resorts are likely to be required to increase artificial snow production to meet demand, leading to an increase in water withdrawals (Demers, 2006). Water parks are also vulnerable to water scarcity, as their use is continual during the summer season due to more intense evaporation. Similarly, golf courses, which need large quantities of water for irrigation and pond maintenance, might have to multiply their withdrawal volume.

Pool filling

Residential pool owners are also responsible for putting pressure on water availability. Filling pools during dry summer periods reduces water availability in water tables for other uses. In terms of private wells, municipalities face a growing demand for permits from isolated homeowners who want to modify their withdrawal systems due to water shortages.

Table 3 summarizes the main causes of water overconsumption by sector in the ZGIE (Gouvernement du Québec, 2021; Battaglia, 2020).

Table 3. Main causes of water resource overconsumption by sector

Sector	Location	Type of use leading to waste
Municipal	Interior	- Municipal buildings: water-cooled compressors (arenas) - Obsolete sanitation equipment: toilets, faucets, etc.
	Exterior	- Sewers and aqueducts: network rinsing, purges, obsolete infrastructure, etc. - Water losses in distribution networks: represent 25% of distributed water quantities - Public protection – fire services - Watering - Public throughfares: tank trucks and street sweepers - Splash pads, pools, skating rinks, gardens, parks
Residential	Interior	- Obsolete equipment and appliances (high water consumption): toilets, faucets, showers, boilers, etc. - Consumption habits: long showers, using garbage disposal units, inefficient dishwashers, letting water run while brushing teeth, to cool down or heat up, etc. - Leaks
	Exterior	Exterior uses during the summer season create demand spikes: - Lawn and garden watering - Pool and spa filling - Washing cars with hoses without an automatic shut-off - Outdoor cleaning
Commercial and institutional*	Interior	- Water cooling systems/water cooling devices (ACs and refrigeration systems) - Obsolete sanitation equipment: toilets, urinals, sinks - Waste, loss, leaks - Cleaning equipment - Kitchens - Cleaning - Customer use
	Exterior	- Watering - Wastewater
Industrial*	Interior	- Primary resource - Material transfer (industrial process) - Fabrication processes - Washing - Equipment cooling requirements, air conditioning and refrigeration (represent over 50% of ICI water demand) - Sanitation purposes
	Exterior	- Watering
Recreation and tourism	Interior	- Obsolete sanitation equipment: toilets, urinals, sinks, etc. - Customer use - Leaks
	Exterior	- Golf: watering and pond maintenance - Ski and snow tubing resorts: artificial snow production - Spas - Water parks
Agriculture	Exterior	- Inefficient irrigation practices - Excessive use of water for certain crops - Preference for certain water-intensive crops

4. Main consequences

Excessive ground or surface water consumption has effects on the environment and future groundwater regeneration. It may also have significant economic and social impacts. Indeed, effects are seen in ecosystems, biodiversity, and health. It also creates exorbitant treatment costs and conflicts related to its use.

4.1 Environmental

- Degraded water quality (diagnostic report – *Poor Water Quality*):
  - Release of contaminants (chemicals) used to treat water before consumption
  - Discharge of dirty water in very large quantities into the environment (wastewater discharge standards being much less severe than potability and swimming standards)
  - Saturation of sewage networks and wastewater treatment plants causing overflows or purges into the environment (reduction in sanitation efficiency)
- Impacts on biodiversity :
  - Endocrine disturbances in fauna caused by contaminants released into wastewater
  - Reduction in habitat quality
  - Declines in population health and biodiversity (Barlow and Leake, 2012)
- Increased greenhouse gases: energy-intensive water treatment processes for consumed water
- Excessive pressure on the resource:
  - Diminished river flow rates
  - Lowered water table levels
  - Reduced groundwater inputs into watercourses, wetlands, and lakes can in themselves lead to a loss of temperature stability and even abnormal freezing in certain watercourses in the winter
  - Effects on water temperature and ecosystem chemistry, which disturb fish and plant habitats

4.2 Social

- Conflicts of use in terms of withdrawal quantities (diagnostic report - *Competing water uses*);
- Consequences related to distribution and storage:
  - Drinking water treatment plant capacity exceedances can cause a reduction in treatment and water quality, possibly leading to increased health risks, up to boil water advisories and even do-not-consume advisories
  - Reduced pressure in distribution networks can cause problems for users and, especially, reduce fire-fighting capacity
  - Numerous leaks increase the risk of water contamination before, during, and after their repair
  - Resorting to water reserves for fires (at production or in the network) to respond to one-time requests such as watering increases the risk of complications in case of fire
- Pollutants/contaminants remaining in domestic drinking water can lead to health consequences which are still unknown: endocrine disturbances in humans, resistance to antibiotics, carcinogenic and proinflammatory molecules, etc.
- Water overconsumption leads to excessive water withdrawals from watercourses and tables, which are also impacted:
  - Supply issues due to residential and municipal wells running dry
  - Public health: lack of access to water can lead to health problems (unsanitary conditions, etc.)
  - Populations displaced to locations with more water
  - Food security: Limited water availability can hinder farm production, affecting food security and leading to food shortages
  - Limited regional potential and development

4.3 Economic

- Reduced water levels can translate into an increase in infrastructure costs related to supply, such as the construction of auxiliary withdrawal structures, the installation of supplemental filtration equipment, or the replacement of current infrastructure.
- Saturation of individual septic equipment
- Loss of revenue for certain cities that cannot develop more as they lack water
- Increased treatment costs:
    - Pumping/distribution energy costs and chemicals to make water potable
    - Wastewater collection and treatment before its discharge into the environment
- Increase in wastewater infrastructure costs: used potable water volumes in the sewage network occupy a volume that must be compensated through the construction of retention ponds to reduce the frequency of overflows

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