Annual Report of the Great Lakes Regional Water Use Database

Representing 2020 Water Use Data

Prepared by the Great Lakes Commission for the
Great Lakes-St. Lawrence River Water Resources Regional Body and the
Great Lakes-St. Lawrence River Basin Water Resources Council

Great Lakes Commission
des Grands Lacs

Acknowledgments

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Preface

This is the Annual Report of the Great Lakes-St. Lawrence River Regional Water Use Database, representing 2020 water use data. These data are provided by the Great Lakes-St. Lawrence River states and provinces to the Great Lakes Commission (GLC), which serves as the database repository under the Great Lakes-St. Lawrence River Basin Water Resources Compact (Compact) and the Great Lakes St. Lawrence River Basin Sustainable Water Resources Agreement (Agreement).

The Great Lakes-St. Lawrence River Regional Water Use Database has been operational since 1988. It was created by the states and provinces in response to a provision of the 1985 Great Lakes Charter (Charter) that called for the establishment and maintenance of a regional system for the collection of data on major water uses, diversions and consumptive uses in the binational Great Lakes-St. Lawrence River Basin (the basin). The Charter (a precursor to the Compact and Agreement) was a nonbinding, "good faith" agreement signed by the Great Lakes governors and premiers that set forth a series of principles and procedures for strengthening water management activities in the basin. The Charter envisioned a centralized database as an important tool to support a regional water resources management program that guides the future development, management, and conservation of the water resources of the basin. In 1987, GLC was selected to serve as the repository for the regional water use database and has provided maintenance and operation of the database since that time.

In 2008, to help implement needed improvements in jurisdictional water use data collection and reporting programs, in its role as Secretariat to the Regional Body and Compact Council, the Great Lakes St. Lawrence Governors & Premiers (GSGP, formerly the Council of Great Lakes Governors), through its Great Lakes Water Use Information Initiative, led the states and provinces through a process that culminated in the drafting of new water use data collection and reporting protocols. The Compact Council and Regional Body adopted these protocols in 2009. The protocols offer guidance to ensure that water use data provided to the database by the states and provinces is accurate, of the highest quality, and reported in a consistent manner. Modifications to the reporting protocols were instituted via Compact Council and Regional Body resolutions in 2016 to support the advancement of the regional water use database.

While the updated data protocols were an important step in support of a more robust regional water management regime, it is recognized that improvements in data collection, reporting, quality, accuracy, and compatibility must continue to occur. The following section describes the progress made in 2021 to improve data quality and describes the quality of data for the 2020 annual report.

Overview

Improving Data Quality

Together with the GSGP, the GLC is working with the states and provinces to improve data collection, reporting, quality, accuracy, and compatibility. To guide the preparation of 2020 data and this report, several steps have been made to improve data quality.

Starting with the 2014 water use year, the GLC collected information from each jurisdiction that describes water use data and includes information related to data sources, compliance rates by water use sector, the year for which the data is collected, significant changes in the data between the current year and previous years, and reasons for those changes. To achieve this, the GLC created an online data management system that assists in the creation of metadata. For this report, the states and provinces submitted metadata along with associated 2020 water use data to the GLC. Project staff met by phone with representatives from each jurisdiction to discuss changes in compliance and reported water use. Implementing this process has resulted in improvements to the database in both compliance and data quality.

The GLC will continue to work with the states and provinces to identify additional areas for improvement. While this report contains the best available information as of its publishing date, the states and provinces may continue to update their data in the online water use database (https://waterusedata.glc.org/). Discrepancies between the data online and those summarized in this report may appear. *In all cases, the online database will contain the most current available data*.

In compiling this report, the report authors noted specific steps taken by each jurisdiction to improve reporting compliance and data quality. The states and provinces have reporting programs in place that require users to report their water use each year to their jurisdiction. The reporting compliance, (i.e., the percentage of users submitting the required reports to the jurisdiction), varies across the Basin by jurisdiction and sector, affecting the quality of the data. Table 1 summarizes reporting compliance rates by jurisdiction. While several jurisdictions reported modest compliance challenges associated with the COVID-19 pandemic, it was not anticipated to result in consequential changes in overall reported water use or water balance. Illinois, Minnesota, and New York reported 100 percent compliance in data reporting.

Beyond compliance, the number of reported users can also vary from year to year due to user changes in status as a threshold facility. Only water use from facilities that withdraw more than 100,000 gallons per day (or 380,00 liters/day) averaged over a 30-day period are included in reporting, per the Compact and Agreement. Some facilities that tend to withdraw water in volumes close to the trigger level may therefore change from being a threshold facility from one year to the next, based on weather conditions, business operations, or other factors. Water use sectors that see more interannual variability in use, like self-supply irrigation, may have greater changes in the number of threshold facilities than other use sectors. 2020 was a relatively dry year in portions of the basin, resulting in an increase in the number of threshold facilities in many jurisdictions. This may inflate the relative change in water use, since the previous water use of these facilities was not included in the report. These changes are discussed in the jurisdiction report sections.

Table 1. Percent Reporting Compliance to the Jurisdiction by Water Use Sector

Sector	IL	IN	MI	MN	NY*	OH	ON	PA	QC	WI
Public Water Supply	100	100	99	100	95	99	99	98	93	100
Self-Supply Commercial & Institutional	100	87	85	100	86	100	96	100	82	94
Self-Supply Irrigation	100	92	60	100	95	99	95	94	70	96
Self-Supply Livestock	-	80	60	100	90	100	90	90	56	94
Self-Supply Industrial	100	88	85	100	95	100	90	100	81	97
Self-Supply Thermoelectric Power Production (Once-through cooling)	100	100	95	100	100	100	100	-	-	100
Self-Supply Thermoelectric Power Production (Recirculated cooling)	-	100	95	100	95	100	-	-	-	100
Off-Stream Hydroelectric Power Production	-	-	N/A	100	100	-	-	-	-	-
In-Stream Hydroelectric Water Use	-	N/A	N/A	100	100	-	98	-	-	-
Other Self-Supply	100	80	85	100	100	100	92	100	50	97

A blank indicates that the jurisdiction did not report any water use figures for that particular sector. N/A indicates that facilities are not required by jurisdiction policy to report water use for that particular sector.

**New York's reported compliance rates reflect compliance of all permitted facilities; the compliance was 100% for facilities that used water above the reporting threshold in all sectors.*

Great Lakes Regional Water Use for 2020

The Great Lakes-St. Lawrence River Basin – the world's largest freshwater system – spans an area of 289,600 square miles (750,000 square kilometers). Its total volume is 6.5 quadrillion gallons (25 quadrillion liters), an amount that would fill nine billion Olympic size swimming pools.[1]

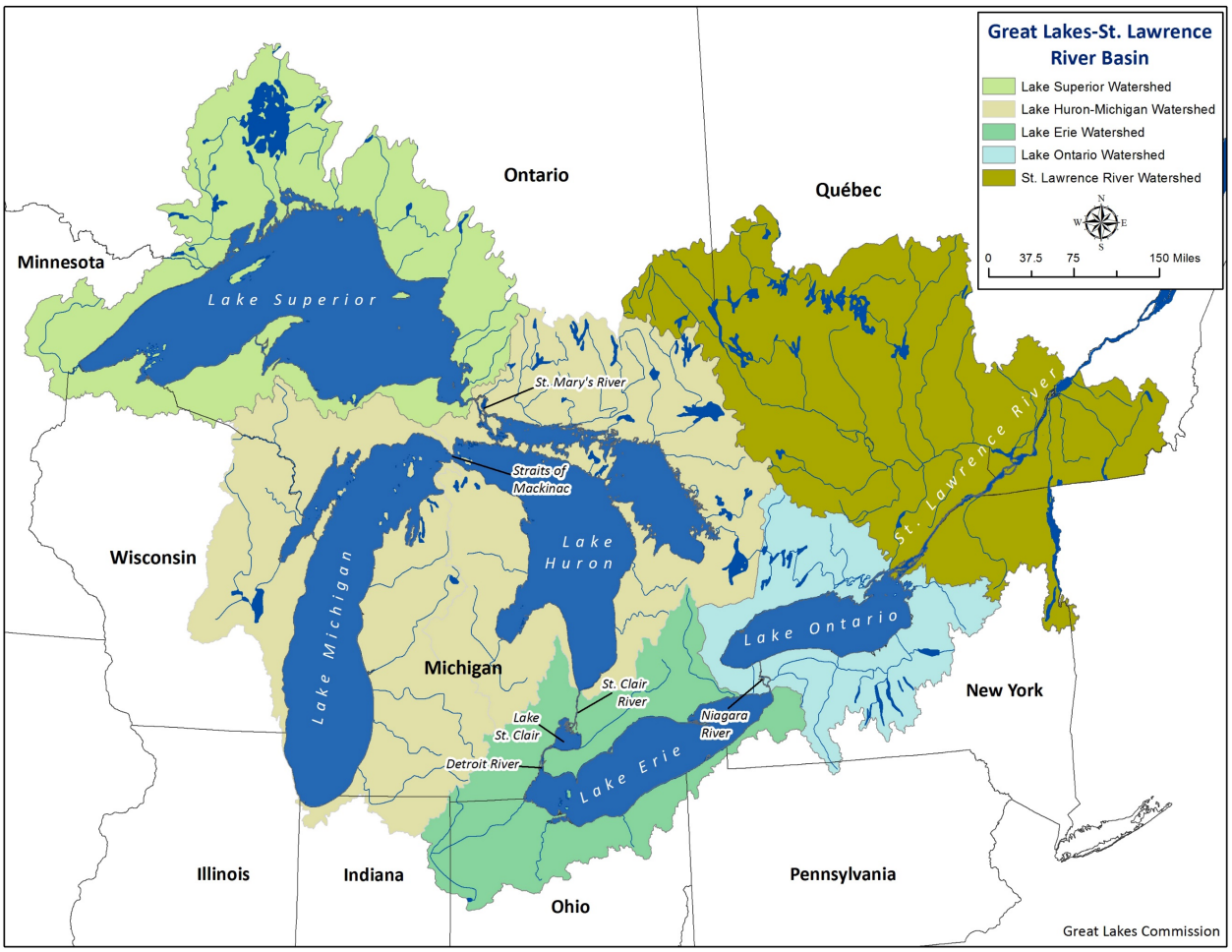

Figure 1. Great Lakes-St. Lawrence River basin

Water Withdrawals

In 2020, the total reported withdrawal amount for the Great Lakes-St. Lawrence River basin, excluding in-stream hydroelectric water use, was 37,856 million gallons per day (mgd) or 143,300 million liters per day (mld). In-stream hydroelectric power water use accounted for 93 percent of the water use in the region, but is not considered a withdrawal in the traditional sense because it includes "run of the river" use, where the water remains in the water body and has negligible water consumption. Therefore, despite being an important water use for the Great Lakes-St. Lawrence River region (e.g., New York produced more hydroelectric power than any other state east of the Rocky Mountains in 2020[2]), in-stream hydroelectric power use is typically excluded from discussion of water use trends and impacts.

[1] An Olympic size swimming pool holds at least 2.5 million liters.
[2] U.S. Energy Information Administration. 2021. http://www.eia.gov/state/?sid=NY

Off-stream hydroelectric power generation is considered a withdrawal since the water is removed to a retention area or a reservoir that serves as a storage system. This storage substantially increases the surface area of the water body, and in so doing, increases the evaporation resulting in a consumptive use of water. After being used for power generation, the water is returned to the original water source. Both off-stream and in-stream totals are mentioned in the watershed and jurisdiction summaries in this report[3], but only off-stream hydroelectric power generation is typically incorporated in discussion, figures, and overall water withdrawal totals.

The 2020 water withdrawal total represents a decrease of approximately 3 percent from the 2019 reported total withdrawal amount of 38,859 mgd (147,098 mld). It is normal to see some fluctuation in water use from year to year, but some sectors, like self-supply irrigation, may exhibit greater variability due to the influence of weather patterns that increase or decrease seasonal use. It should be noted withdrawals are not a measure of water consumed or lost to the Basin, as much of the withdrawn water is returned to the Basin after use. Approximately five percent of the total reported amount withdrawn (1,997 mgd or 7,559 mld) was consumed or otherwise lost from the Basin.

Water withdrawals for all water use sectors, excluding the in-stream hydroelectric water use sector, are presented in Figure 2 below. The water use sectors are defined in Appendix A. Self-supply thermoelectric power production, public water supply, and self-supply industrial use are the primary water use sectors (i.e., those withdrawing the largest volumes of water).

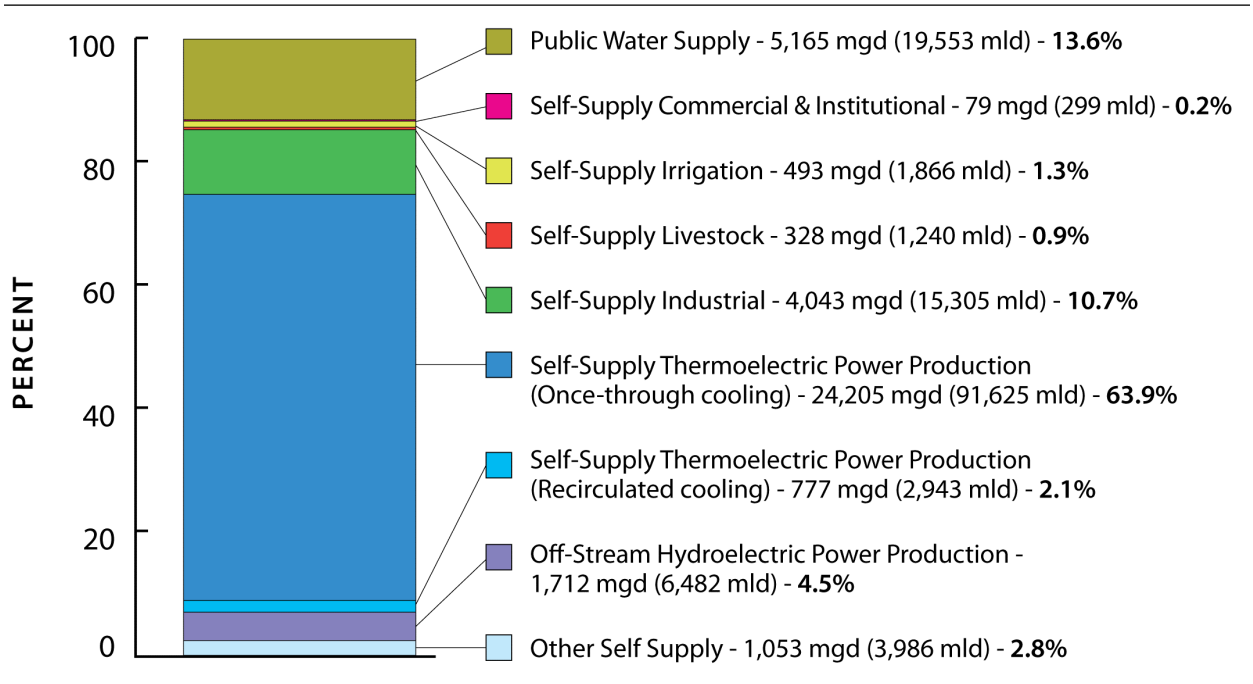

Figure 2. Water withdrawals by water use sector (excluding in-stream hydroelectric water use)

[3] Under the 2009 water use data collection and reporting protocols, the reporting of in-stream hydroelectric power production data became optional, so the database and report do not represent this water use by all jurisdictions.

The Lake Ontario watershed had the greatest withdrawal amount, followed closely by Lake Michigan and then Lake Huron. Figure 3 shows withdrawals by watershed broken down by water source: Great Lakes surface water (GLSW), other surface water (OSW) and groundwater (GW). In most watersheds, Great Lakes surface water was the predominant source of water withdrawals, with the exception being the Lake Superior watershed, which had other surface water as the main source of water withdrawal.

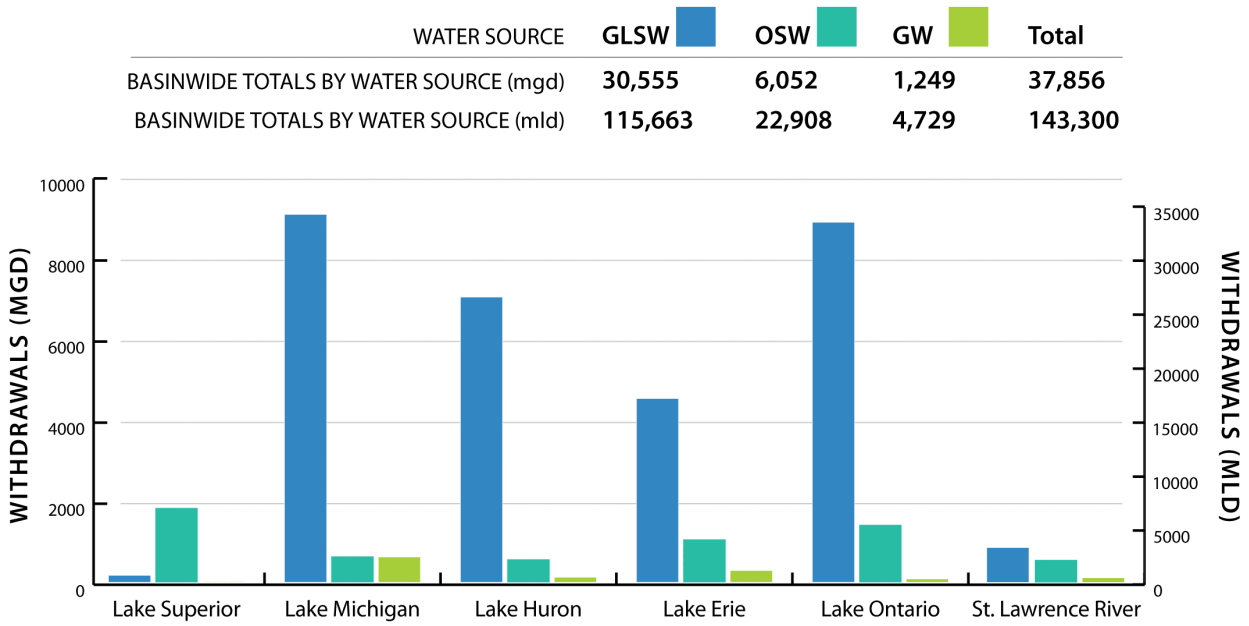

Figure 3. Water withdrawals by watershed (excludes in-stream hydroelectric water use)

Figure 4 shows total withdrawals, excluding in-stream hydroelectric water use, by jurisdiction. Ontario, which has the largest land area of the 10 jurisdictions (108,680 square miles or 281,377 square kilometers in the basin over five watersheds), was the largest withdrawer of Great Lakes water. Facilities in Ontario withdrew 15,362 mgd (58,152 mld) or 41 percent of the total withdrawal amount across all jurisdictions. In contrast, Pennsylvania, which has the least land area (508 square miles or 1316 square kilometers), withdrew just 30 mgd (114 mld).

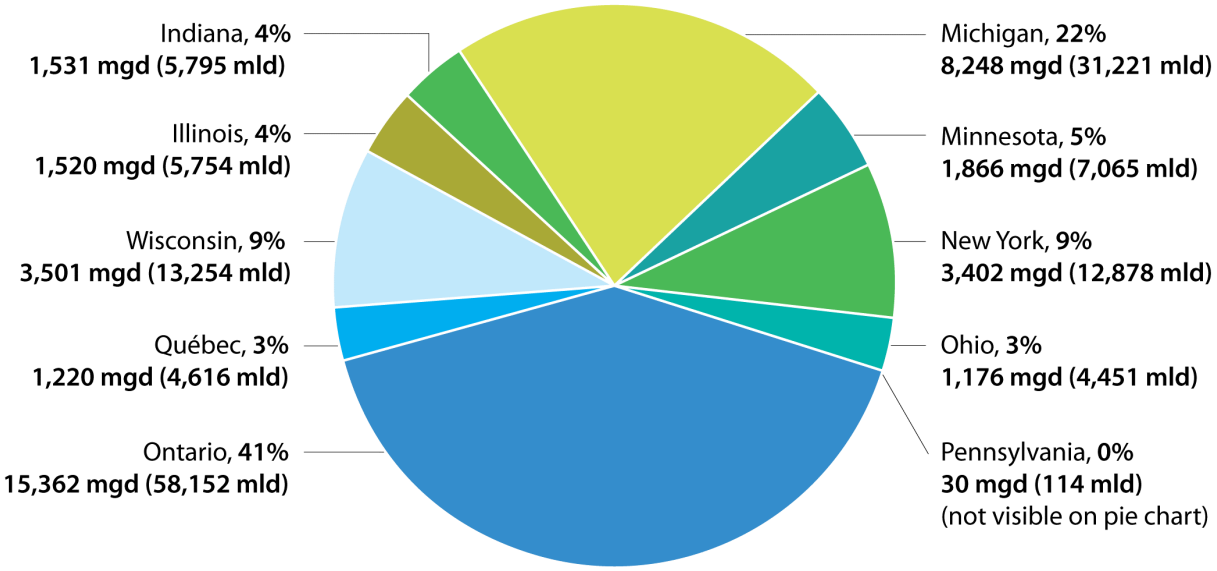

Figure 4. Water withdrawals by jurisdiction (excludes in-stream hydroelectric water use)

Figure 5 shows total water withdrawals by jurisdiction over the past five years (excluding in-stream hydroelectric water use). Water use in each jurisdiction has generally stayed steady or decreased over the past five years. Variances from this general trend are typically explained by one or two large water users in those jurisdictions using more or less water from previous years.

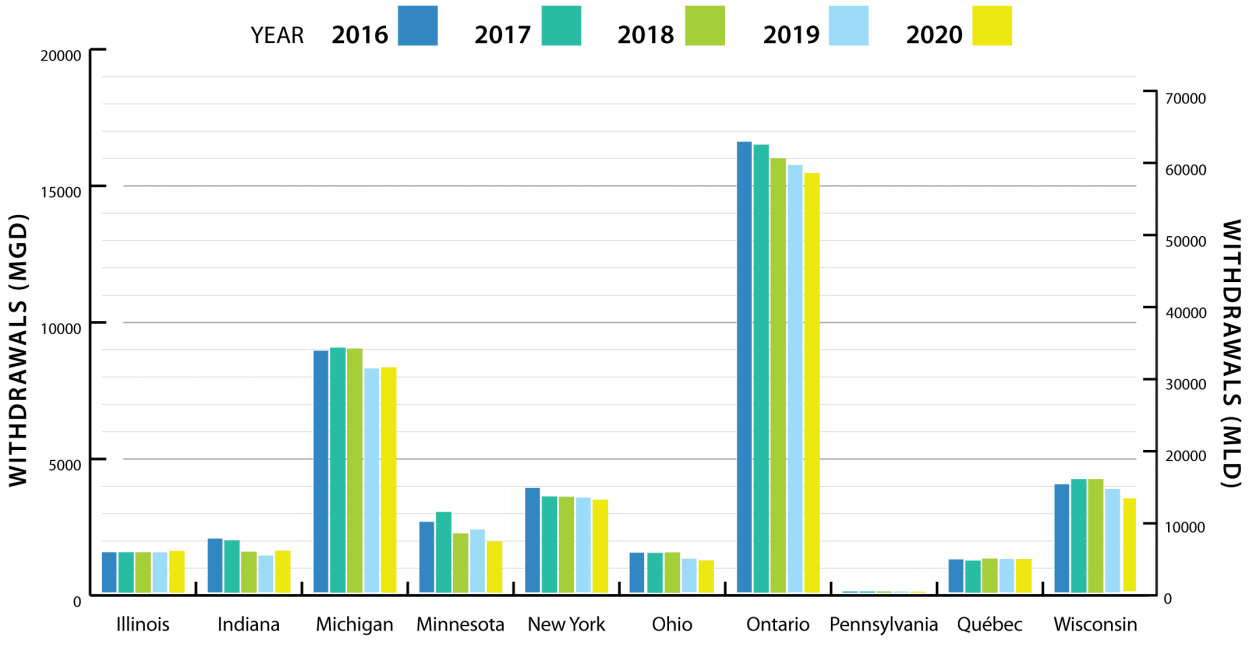

Figure 5. Water withdrawals by jurisdiction over the past five years (excludes in-stream hydroelectric water use)

Diversions and Consumptive Uses

Diversions and consumptive uses of water are key components of the regional water use database. See Appendix B for the Compact's and Agreement's definitions of these terms. Water use data from diversions and consumptive uses are considered particularly informative for assessing the cumulative hydrologic effects of Great Lakes basin water use since they represent water not returned to the source watershed.

The total reported 2020 diversion out of the Great Lakes-St. Lawrence River Basin was 1,159 mgd or 4,387 mld. More than 85 percent (997 mgd, 3775 mld) of this amount was associated with the Illinois diversion, which takes water from Lake Michigan and discharges it into the Mississippi River watershed. The reported amount associated with the Illinois diversion decreased by less than 2 percent compared to the 2019 reported amount of 1,015 mgd (3,841 mld). Smaller diversions throughout the region make up the balance of the total, and some of the diverted water is returned to the source watershed as return flow.

There are also diversions into the Basin[4], including the Long Lac and Ogoki diversions (incoming diversions from the Hudson Bay watershed into northern Lake Superior), which contributed 2,735 mgd (10,354 mld) to the Basin in 2020. This is a decrease from the 2019 reported amount of 3,473 mgd (13,147 mld). Although this decrease is over 20 percent less than the long-term average inflow from the Long Lac and Ogoki Diversions, the 2020 diversion is still well within the range of flow variability observed from 1944-2015. The flow from these diversions has ranged from 1,643 mgd (6,219 mld) to 5,181 mgd (19,612 mld).[5] When conditions in the Long Lac and Nipigon (downstream of Ogoki) watersheds are wet, the diversions are often reduced, and water that otherwise would have been diverted into Lake Superior is instead directed through natural outlets that flow toward Hudson Bay. Conversely, when conditions are dry in the downstream watersheds, the diversion flow may be higher.

Overall, the net diversion, or outgoing diversions plus incoming diversions and returns (reported as negative numbers), was a gain of 1,620 mgd (6,133 mld), meaning that more water was diverted into the Basin than was diverted out of the Basin.

Consumptive use is the portion of the water withdrawn or withheld from the Basin that is lost from or otherwise not returned to the Basin due to evaporation, incorporation into products, or other processes. Consumptive use is most often calculated by applying a consumptive use coefficient to the reported withdrawal amount. The database documents the consumptive use coefficient used for each water withdrawal and the consumptive use that was determined through measurement. Figure 6 shows total consumptive use by jurisdiction over the past five years. Because each water use sector has different consumptive use factors, changes in the makeup of each jurisdiction's water withdrawals can impact consumptive use.

The total reported consumptive use for the Basin for 2020 was 1,997 mgd (7,559 mld) – a 5 percent increase from the 2019 total consumptive use amount of 1,899 mgd (7,189 mld). The public water supply and self-supply industrial sectors had the greatest consumptive use, accounting for over half of total consumptive use. The self-supply irrigation sector accounted for most of the increase from 2019 consumptive use, increasing by 32 percent (increase of106 mgd or 400 mld) due to relatively hot and dry weather conditions

[4] The Great Lakes Regional Water Use Database records incoming diversions with a negative sign and outgoing diversions with a positive sign.
[5] Information on the flow variability of the Long Lac and Ogoki diversions was provided by Ontario Power Generation.

in many portions of the basin. At 832 mgd (3,151 mld), the Lake Michigan watershed had the largest consumptive use of watersheds.

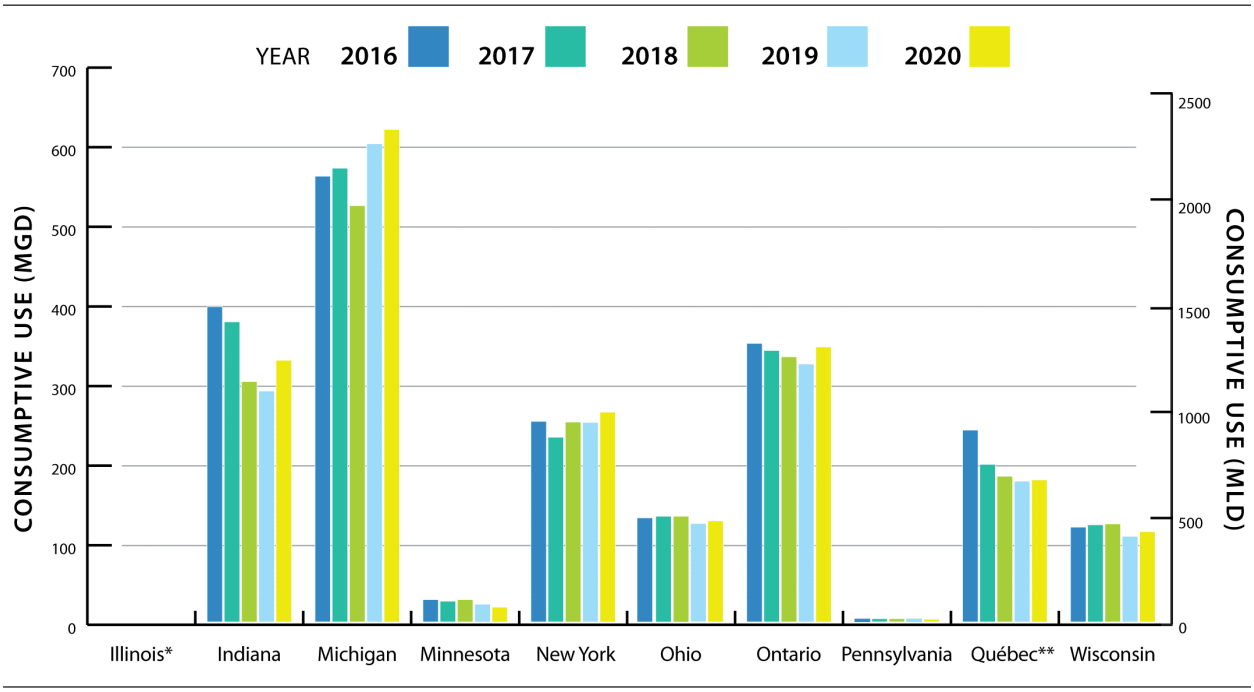

Figure 6. Consumptive use by jurisdiction over the past five years.

** Illinois's consumptive use is negligible. Water loss associated with the Illinois diversion is reported in Table 2a.*

*** Québec's consumptive use variability is the result of changes to the jurisdiction's reporting accuracy, including consumptive use factor for public water supply, which is Québec's primary reported water use.*

Considering both consumptive use and diversions, the Basin lost a total of 377 mgd (1,426 mld) in 2020. By comparison, the Basin gained a total of 444 mgd (1,682 mld) in 2019. Based on this change in water loss and in accordance with the Compact and Agreement protocols, an Interim Cumulative Impact Assessment was conducted as part of the Annual Report of the Great Lakes Regional Water Use Database Representing 2020 Water Use Data. The Interim Cumulative Impact Assessment is provided as Appendix C. Tables 2a to 4b summarize water withdrawals, diversions, and consumptive uses by watershed, sector, and jurisdiction for 2020.

Table 2a. Basin 2020 Water Use Data Summary by Watershed in mgd

Watershed	Withdrawals				Diversions		Consumptive Use
	GLSW	OSW	GW	Total	Intrabasin	Interbasin	
Lake Superior	171	32,417	17	32,605	0	-2,720	30
Lake Michigan	9,076	636	624	10,335	0	1,071	832
Lake Huron	25,896	15,700	125	41,722	42	0	157
Lake Erie	60,532	1,679	289	62,500	5,625	-19	396
Lake Ontario	50,024	99,664	83	149,771	-5,666	43	374
St. Lawrence River	174,108	56,855	112	231,075	0	5	208
Total	319,808	206,951	1,249	528,008	0	-1,620	1,997

In millions of gallons per day; Water Sources: Great Lakes surface water (GLSW), other surface water (OSW) and groundwater (GW); totals may not sum exactly due to rounding

Table 2b. Basin 2020 Water Use Data Summary by Watershed in mld

Watershed	Withdrawals				Diversions		Consumptive Use
	GLSW	OSW	GW	Total	Intrabasin	Interbasin	
Lake Superior	647	122,714	63	123,423	-1	-10,297	114
Lake Michigan	34,357	2,406	2,361	39,124	1	4,055	3,151
Lake Huron	98,028	59,433	474	157,935	157	0	593
Lake Erie	229,140	6,355	1,092	236,587	21,291	-72	1,498
Lake Ontario	189,363	377,268	314	566,945	-21,449	162	1,415
St. Lawrence River	659,071	215,219	424	874,714	0	19	789
Total	1,210,605	783,395	4,729	1,998,729	0	-6,133	7,559

In millions of liters per day; Water Sources: Great Lakes surface water (GLSW), other surface water (OSW) and groundwater (GW); totals may not sum exactly due to rounding

Table 3a. Basin 2020 Water Use Data Summary by Sector in mgd

Sector	Withdrawals				Diversions		Consumptive Use
	GLSW	OSW	GW	Total	Intrabasin	Interbasin	
Public Water Supply	3,902	776	487	5,165	0	847	575
Self-Supply Commercial and Institutional	6	63	9	79	0	2	12
Self-Supply Irrigation	5	150	338	493	0	0	435
Self-Supply Livestock	0	262	66	328	0	0	15
Self-Supply Industrial	2,342	1,374	327	4,043	0	39	532
Self-Supply Thermoelectric Power Production (Once-through cooling)	23,321	883	1	24,205	0	0	210
Self-Supply Thermoelectric Power Production (Recirculated cooling)	748	27	3	777	0	0	176
Off-Stream Hydroelectric Power Production	0	1,712	0	1,712	0	0	0
In-Stream Hydroelectric Water Use	289,253	200,899	0	490,152	0	-2,735	0
Other Self Supply	232	803	18	1,053	0	228	44
Total	319,808	206,951	1,249	528,008	0	-1,620	1,997

In millions of gallons per day; Water Sources: Great Lakes surface water (GLSW), other surface water (OSW) and groundwater (GW); totals may not sum exactly due to rounding

Table 3b. Basin 2020 Water Use Data Summary by Sector in mld

Sector	Withdrawals				Diversions		Consumptive Use
	GLSW	OSW	GW	Total	Intrabasin	Interbasin	
Public Water Supply	14,770	2,939	1,844	19,553	0	3,206	2,175
Self-Supply Commercial and Institutional	25	239	36	299	0	7	44
Self-Supply Irrigation	17	569	1,280	1,866	0	0	1,646
Self-Supply Livestock	0	992	248	1,240	0	-1	56
Self-Supply Industrial	8,864	5,203	1,238	15,305	0	147	2,014
Self-Supply Thermoelectric Power Production (Once-through cooling)	88,279	3,341	5	91,625	0	0	794
Self-Supply Thermoelectric Power Production (Recirculated cooling)	2,830	103	10	2,943	0	0	665
Off-Stream Hydroelectric Power Production	0	6,482	0	6,482	0	0	0
In-Stream Hydroelectric Water Use	1,094,942	760,487	0	1,855,429	0	-10,354	0
Other Self Supply	878	3,040	68	3,986	0	861	165
Total	1,210,605	783,395	4,729	1,998,729	0	-6,133	7,559

In millions of liters per day; Water Sources: Great Lakes surface water (GLSW), other surface water (OSW) and groundwater (GW); totals may not sum exactly due to rounding

Table 4a. Basin 2020 Water Use Data Summary by Jurisdiction (includes in-stream hydro) in mgd

Jurisdiction	Withdrawals				Diversions		Consumptive Use
	GLSW	OSW	GW	Total	Intrabasin	Interbasin	
Illinois	1,520	0	0	1,520	0	997	0
Indiana	1,355	71	104	1,531	0	80	329
Michigan	6,585	1,098	565	8,248	0	0	619
Minnesota	84	3,908	5	3,997	0	15	19
New York	154,263	82,284	41	236,588	0	45	263
Ohio	681	417	78	1,176	0	-27	127
Ontario	151,400	118,539	259	270,198	0	-2,735	345
Pennsylvania	26	2	3	30	0	0	3
Québec	762	381	77	1,220	0	3	178
Wisconsin	3,132	252	117	3,501	0	2	113
Total	319,808	206,951	1,249	528,008	0	-1,620	1,997

In millions of gallons per day; Water Sources: Great Lakes surface water (GLSW), other surface water (OSW) and groundwater (GW); totals may not sum exactly due to rounding

Table 4b. Basin 2020 Water Use Data Summary by Jurisdiction (includes in-stream hydro) in mld

Jurisdiction	Withdrawals				Diversions		Consumptive Use
	GLSW	OSW	GW	Total	Intrabasin	Interbasin	
Illinois	5,754	0	0	5,754	0	3,775	1
Indiana	5,131	270	395	5,795	0	302	1,244
Michigan	24,926	4,156	2,140	31,221	0	0	2,342
Minnesota	318	14,793	20	15,131	0	56	71
New York	583,949	311,479	155	895,583	0	171	997
Ohio	2,579	1,578	294	4,451	0	-102	480
Ontario	573,111	448,718	982	1,022,811	0	-10,354	1,307
Pennsylvania	97	6	10	114	0	0	12
Québec	2,884	1,441	292	4,616	0	10	675
Wisconsin	11,857	955	442	13,254	0	8	429
Total	1,210,605	783,395	4,729	1,998,729	0	-6,133	7,559

In millions of liters per day; Water Sources: Great Lakes surface water (GLSW), other surface water (OSW) and groundwater (GW); totals may not sum exactly due to rounding

Lake Watershed Summaries

Lake Superior

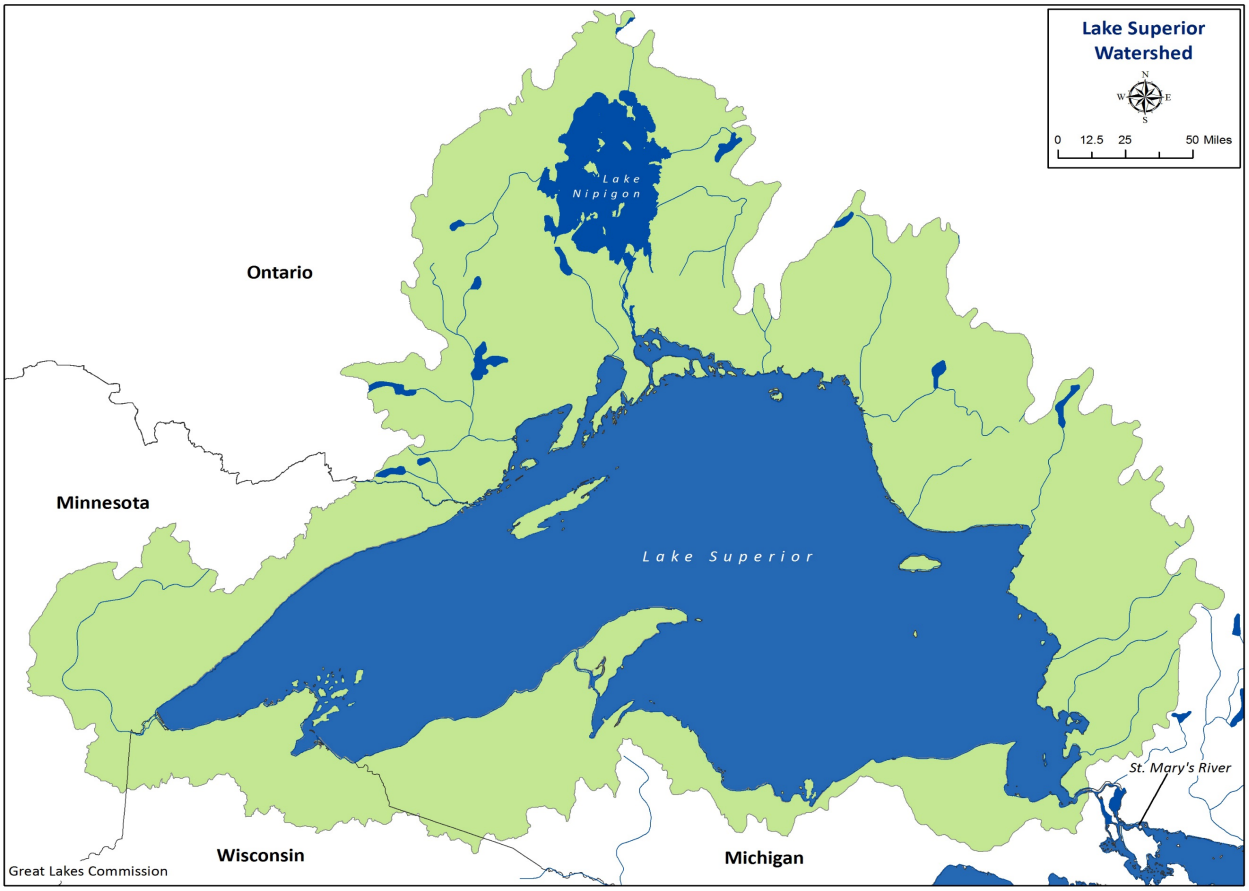

Figure 7. Lake Superior Watershed

Overview of Watershed Characteristics

Lake Superior is the largest of the Great Lakes and the world's third-largest freshwater lake by volume, holding about 2,900 cubic miles (12,100 cubic kilometers) of water. Lake Superior can hold all the water in the other Great Lakes, plus three more Lake Eries.[6] Its surface area is roughly the size of South Carolina, or approximately 31,700 square miles (82,103 square kilometers).

Basic Stats of Lake Superior

Length: 350 mi/563 km

Breadth: 160 mi/257 km

Elevation: 600 ft/183 m

Depth: 483 ft/47 m average, 1,330 ft/406 m maximum

Volume: 2,900 cubic mi/12,100 cubic km

Lake surface area: 31,700 square mi/ 82,100 square km

Watershed drainage area: 49,300 square mi/127,700 square km

Outlet: St. Marys River to Lake Huron

Retention/replacement time: 191 years

Approximate population in watershed: United States - 412,656; Canada 168,437. Total: 581,093

[6]Great Lakes Commission, Lake Superior. https://www.glc.org/lakes/lake-superior

Water Withdrawals

Four jurisdictions – Michigan, Minnesota, Ontario, and Wisconsin – share the Lake Superior watershed and collectively withdrew 2,018 mgd (7,639 mld) in 2020, excluding the reported in-stream hydroelectric water use of 30,587 mgd (115,784 mld). This represents a 20 percent decrease from the 2019 total withdrawal amount of 2,535 mgd (9,596 mld). The off-stream hydroelectric power production sector represented over 80 percent of all withdrawals from the watershed excluding in-stream hydroelectric power production, with 1,648 mgd or 6,239 mld withdrawn for off-stream hydroelectric power. The self-supply industrial sector (205 mgd or 777 mld) and self-supply thermoelectric power production, once-through cooling sector (72 mgd or 274 mld) made up the bulk of remaining water use.

Other surface waters within the Lake Superior watershed were primarily used to generate electricity with in-stream hydroelectric power. Excluding in-stream hydroelectric water use, 91 percent (1,831 mgd or 6,929 mld) of the total reported withdrawal amount from the watershed came from other surface waters. The remaining withdrawals came directly from Lake Superior (8 percent: 171 mgd or 647 mld) and groundwater (1 percent: 17 mgd or 63 mld).

Water Diversions and Consumptive Uses

The reported net water gain[7] (2,690 mgd or 10,184 mld) in the Lake Superior watershed was largely attributable to the Long Lac and Ogoki diversions in Northern Ontario, incoming interbasin diversions that totaled 2,735 mgd or 10,354 mld. On average, these diversions into the basin are about twice the volume of the Illinois diversion out of the Basin, though in 2020 they were closer to three times the Illinois diversion volume. Outgoing interbasin diversions totaling 15 mgd (56 mld) were reported in Minnesota, associated almost exclusively with the self-supply industrial sector. A small amount of the outgoing diversion (0.03 mgd or 0.1 mld) was also reported for the self-supply irrigation sector. Additionally, an incoming intrabasin transfer of less than 1 mgd was reported, associated with Ontario's public drinking water supply.

The total watershed consumptive use for all four jurisdictions was 30 mgd (114 mld). Self-supply industrial use (22 mgd or 83 mld) was the largest contributor to total consumptive use for the watershed, followed by public water supply (6 mgd or 23 mld). Total consumption in 2020 decreased by 22 percent (9 mgd or 33 mld) from 2019, primarily associated with decreased industrial water use and consumptive use.

[7] Incoming diversions are reported as negative values in the database and on tables in this report.

Table 5a. Lake Superior Watershed 2020 Water Use Data Summary in mgd

Sector	Withdrawals				Diversions		Consumptive Use
	GLSW	OSW	GW	Total	Intrabasin	Interbasin	
Public Water Supply	41	3	13	56	0	0	6
Self-Supply Commercial and Institutional	1	1	0	2	0	0	0
Self-Supply Irrigation	0	0	1	1	0	0	1
Self-Supply Livestock	0	24	2	26	0	0	0
Self-Supply Industrial	74	131	1	205	0	15	22
Self-Supply Thermoelectric Power Production (Once-through cooling)	55	17	0	72	0	0	1
Self-Supply Thermoelectric Power Production (Recirculated cooling)	0	0	0	0	0	0	0
Off-Stream Hydroelectric Power Production	0	1,648	0	1,648	0	0	0
In-Stream Hydroelectric Water Use	0	30,587	0	30,587	0	-2,735	0
Other Self Supply	0	7	0	7	0	0	0
Total	171	32,417	17	32,605	0	-2,720	30

In millions of gallons per day; Water Sources: Great Lakes surface water (GLSW), other surface water (OSW) and groundwater (GW); totals may not sum exactly due to rounding

Table 5b. Lake Superior Watershed 2020 Water Use Data Summary in mld

Sector	Withdrawals				Diversions		Consumptive Use
	GLSW	OSW	GW	Total	Intrabasin	Interbasin	
Public Water Supply	154	11	48	213	-1	0	23
Self-Supply Commercial and Institutional	4	2	0	7	0	0	1
Self-Supply Irrigation	0	1	2	3	0	0	3
Self-Supply Livestock	0	91	8	100	0	0	0
Self-Supply Industrial	280	494	3	777	0	56	83
Self-Supply Thermoelectric Power Production (Once-through cooling)	208	65	1	274	0	0	3
Self-Supply Thermoelectric Power Production (Recirculated cooling)	0	0	0	0	0	0	0
Off-Stream Hydroelectric Power Production	0	6,239	0	6,239	0	0	0
In-Stream Hydroelectric Water Use	0	115,784	0	115,784	0	-10,354	0
Other Self Supply	0	25	0	25	0	0	0
Total	647	122,714	63	123,423	-1	-10,297	114

In millions of liters per day; Water Sources: Great Lakes surface water (GLSW), other surface water (OSW) and groundwater (GW); totals may not sum exactly due to rounding

Lake Michigan

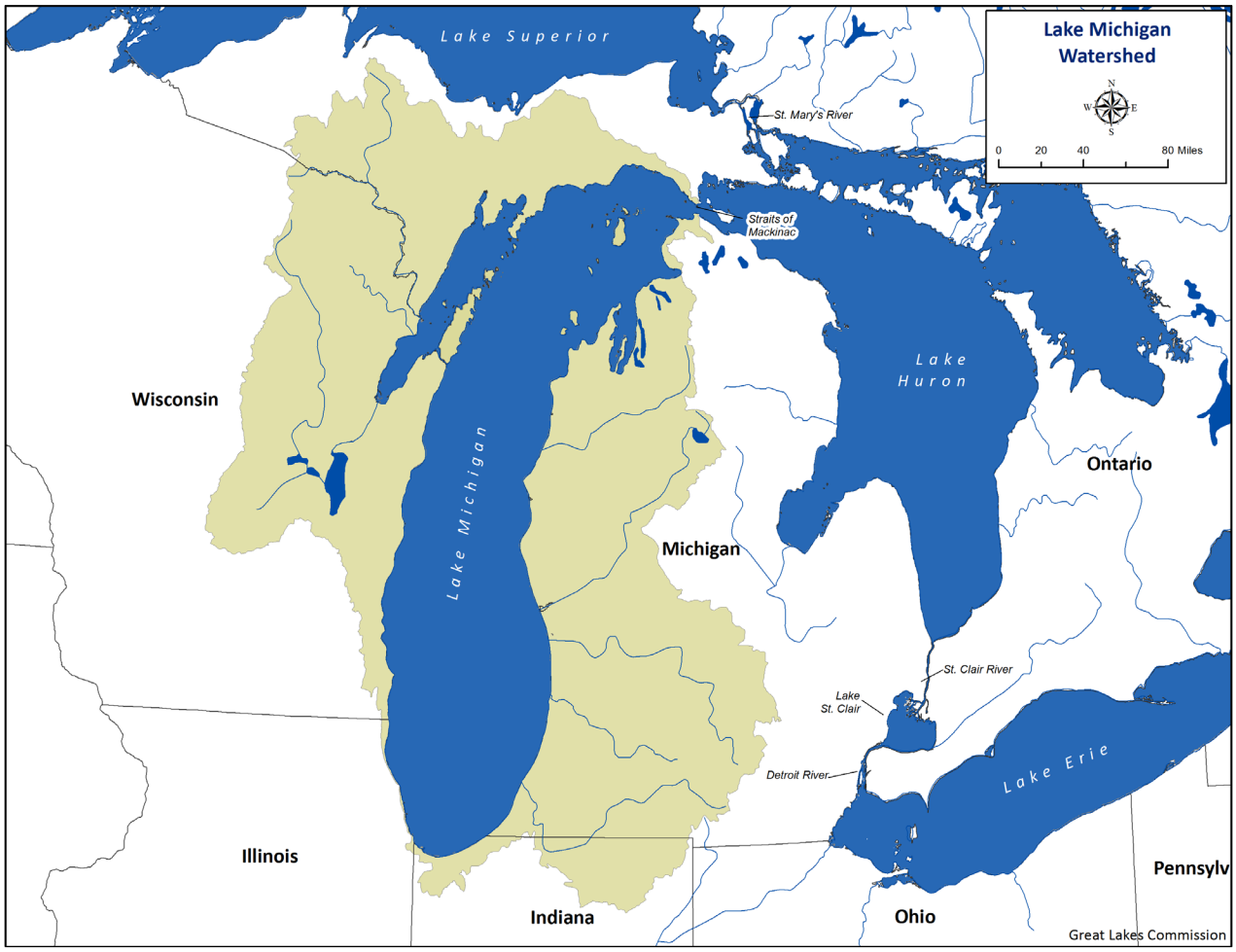

Figure 8. Lake Michigan Watershed

Overview of Watershed Characteristics

Lake Michigan is the only Great Lake situated entirely within the United States. It is the second largest of the Great Lakes by volume, holding about 1,180 cubic miles (4,918 cubic kilometers) of water. Its surface area is roughly the size of West Virginia, approximately 22,300 square miles (57,753 square kilometers). More than 13 million people call the Lake Michigan watershed home.

Basic Stats of Lake Michigan

Length: 307 mi/494 km

Breadth: 118 mi/190 km

Elevation: 577.5 ft/176 m

Depth: 279 ft/85 m average, 923 ft/281 m maximum

Volume: 1,180 cubic mi/4,918 cubic km

Lake surface area: 22,300 square mi/57,753 square km

Watershed drainage area: 45,600 square mi/ 118,095 square km

Outlet: Straits of Mackinac to Lake Huron

Retention/replacement time: 62 years

Approximate population in watershed: 13,325,057

Water Withdrawals

Four jurisdictions share the Lake Michigan watershed – Illinois, Indiana, Michigan, and Wisconsin – and collectively withdrew 10,335 mgd (39,124 mld) in 2020, a 2 percent increase from the 10,086 mgd (38,181 mld) water withdrawal in 2019. No in-stream hydroelectric use was reported. The primary water uses were self-supply thermoelectric power production, once-through cooling (6,317 mgd or 23,912 mld); self-supply industrial use (1,600 mgd or 6,057 mld); and public water supply (1,456 mgd or 5,510 mld). Surface water from Lake Michigan was the primary source of water withdrawals in the watershed, accounting for 88 percent of total withdrawals (9,076 mgd or 34,357 mld).

Water Diversions and Consumptive Uses

Reported net water loss from the Lake Michigan watershed totaled 1,904 mgd (7,207 mld). This represents 18 percent of total withdrawals and a 3 percent increase in Lake Michigan water loss from 2019. Water loss primarily consisted of the Illinois diversion of 997 mgd or 3,775 mld and consumptive use, which totaled 832 mgd (3,151 mld) between the four Lake Michigan jurisdictions. Diversions, including the Illinois Diversion, decreased slightly from 2019, but consumptive use increased by 11 percent (81 mgd or 305 mld). The sectors that represented the majority of consumptive use in the watershed were self-supply irrigation (301 mgd or 1,140 mld), self-supply industrial use (285 mgd or 1,077 mld), and self-supply thermoelectric power production, recirculated cooling (120 mgd or 455 mld). The biggest contributor to the increase in consumptive use was the self-supply irrigation sector, which increased consumptive use by 30 percent, an increase of 69 mgd or 261 mld from 2019 consumptive use.

Table 6a. Lake Michigan Watershed 2020 Water Use Data Summary in mgd

Sector	Withdrawals				Diversions		Consumptive Use
	GLSW	OSW	GW	Total	Intrabasin	Interbasin	
Public Water Supply	1,213	20	222	1,456	0	822	83
Self-Supply Commercial and Institutional	3	4	6	13	0	2	1
Self-Supply Irrigation	0	57	287	344	0	0	301
Self-Supply Livestock	0	186	25	210	0	0	10
Self-Supply Industrial	1,338	189	73	1,600	0	24	285
Self-Supply Thermoelectric Power Production (Once-through cooling)	6,165	151	1	6,317	0	0	33
Self-Supply Thermoelectric Power Production (Recirculated cooling)	133	24	2	159	0	0	120
Off-Stream Hydroelectric Power Production	0	0	0	0	0	0	0
In-Stream Hydroelectric Water Use	0	0	0	0	0	0	0
Other Self Supply	224	4	8	236	0	224	0
Total	9,076	636	624	10,335	0	1,071	832

In millions of gallons per day; Water Sources: Great Lakes surface water (GLSW), other surface water (OSW) and groundwater (GW); totals may not sum exactly due to rounding

Table 6b. Lake Michigan Watershed 2020 Water Use Data Summary in mld

Sector	Withdrawals				Diversions		Consumptive Use
	GLSW	OSW	GW	Total	Intrabasin	Interbasin	
Public Water Supply	4,593	77	840	5,510	1	3,110	316
Self-Supply Commercial and Institutional	13	16	22	50	0	7	3
Self-Supply Irrigation	1	215	1,085	1,301	0	0	1,140
Self-Supply Livestock	0	703	93	796	0	0	36
Self-Supply Industrial	5,063	716	278	6,057	0	90	1,077
Self-Supply Thermoelectric Power Production (Once-through cooling)	23,336	573	4	23,912	0	0	123
Self-Supply Thermoelectric Power Production (Recirculated cooling)	504	90	8	602	0	0	455
Off-Stream Hydroelectric Power Production	0	0	0	0	0	0	0
In-Stream Hydroelectric Water Use	0	0	0	0	0	0	0
Other Self Supply	847	17	32	895	0	847	1
Total	34,357	2,406	2,361	39,124	1	4,055	3,151

In millions of liters per day; Water Sources: Great Lakes surface water (GLSW), other surface water (OSW) and groundwater (GW); totals may not sum exactly due to rounding

Lake Huron

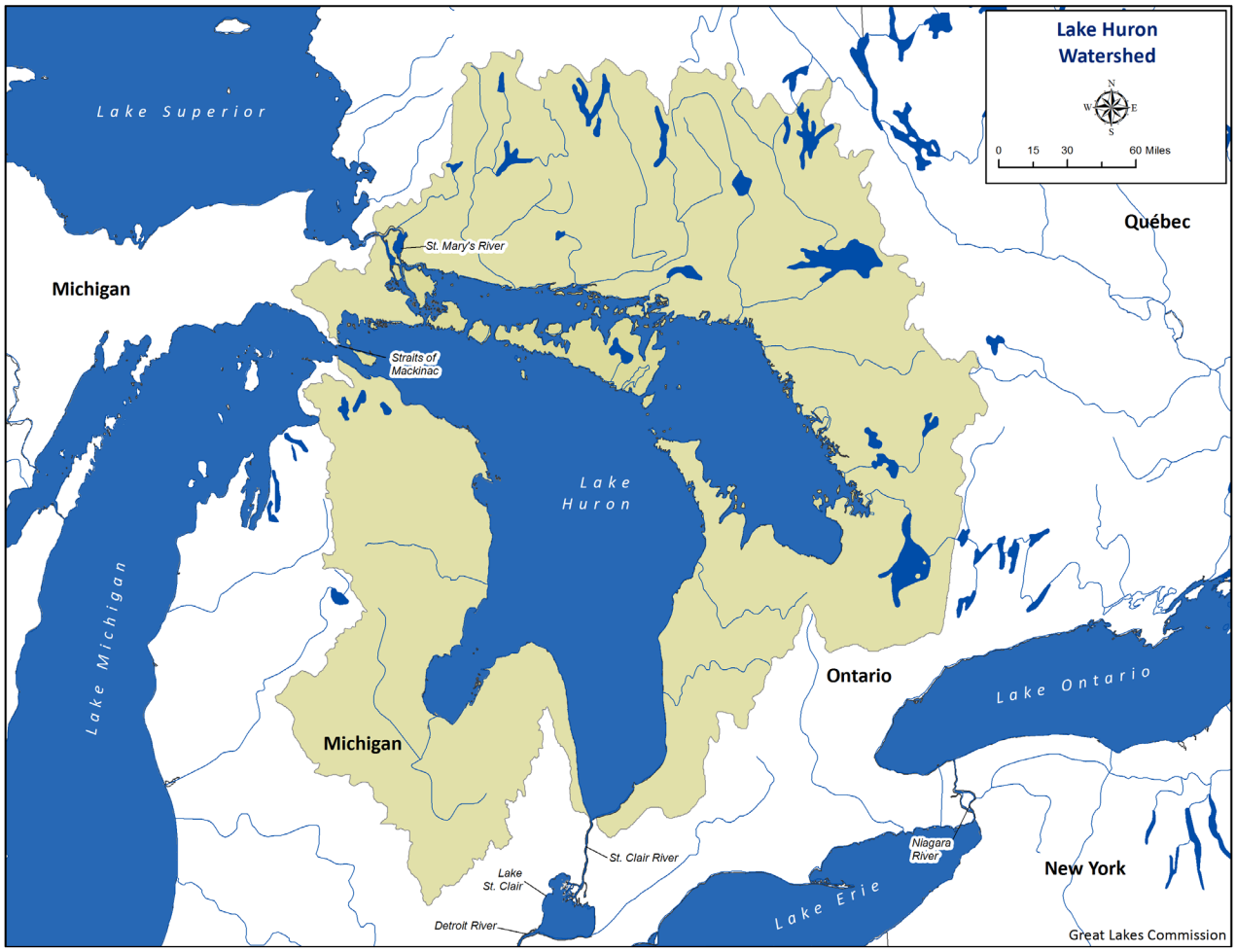

Figure 9. Lake Huron Watershed

Overview of Watershed Characteristics

By surface area, Lake Huron is the second largest of the Great Lakes. It covers 23,000 square miles (59,600 square kilometers), making it the third largest freshwater lake on Earth by surface area. By volume however, Lake Huron is only the third largest of the Great Lakes.

Basic Stats of Lake Huron

Length: 206 mi/332 km

Breadth: 183 mi/295 km

Elevation: 577.5 ft/176 m

Depth: 195 ft/59 m average, 750 ft/ 229 m maximum

Volume: 849 cubic mi/3,538 cubic km

Lake Surface Area: 23,000 square mi/ 59,565 square km

Watershed Drainage Area: 50,700 square mi/131,303 square km

Outlet: St. Clair River to Lake Erie

Retention/replacement time: 21 years

Approximate population in watershed: United States - 1,642,289; Canada - 1,486,864. Total: 3,129,153

Water Withdrawals

Only two jurisdictions – Michigan and Ontario – share the Lake Huron watershed and collectively withdrew 7,724 mgd (29,238 mld) in 2020, excluding the reported in-stream hydroelectric water use (33,998 mgd or 128,697 mld). This is a nominal (1 percent) decrease from the 2019 water withdrawal amount of 7,807 mgd (29,555 mld).

The primary water use was self-supply thermoelectric power production, once-through cooling (7,127 mgd or 26,979 mld), accounting for 92 percent of the water use in the watershed. Self-supply industrial use (313 mgd or 1,184 mld) and public water supply (216 mgd or 817 mld) made up most of the remaining water use. Excluding in-stream hydroelectric water use, Lake Huron surface water was the source of 91 percent of the total withdrawals in the watershed.

Water Diversions and Consumptive Uses

Reported net water loss from the Lake Huron watershed was 198 mgd (751 mld), a 17 percent increase in net water loss from 2019. Total consumptive use was 157 mgd or 593 mld, accounting for over 75 percent of the net water loss. Self-supply thermoelectric power production, once-through cooling (62 mgd or 236 mld); self-supply industrial (34 mgd or 128 mld); and self-supply irrigation (30 mgd or 114 mld) were the main consumptive uses in the watershed. Consumptive use increased by 22 percent from 2019 consumptive use, primarily due to increased industrial sector withdrawal and consumptive use.

The remainder of the net water loss consisted of an intrabasin transfer for public water supply in Ontario. This intrabasin diversion represented a loss from the Lake Huron watershed and a corresponding gain to the Lake Erie and Ontario watersheds, and thus did not have an impact on overall Great Lakes-St. Lawrence River basin water loss (all water diverted remained in the basin). Over 90 percent of the diversion was into the Lake Erie watershed.

Table 7a. Lake Huron Watershed 2020 Water Use Data Summary in mgd

Sector	Withdrawals				Diversions		Consumptive Use
	GLSW	OSW	GW	Total	Intrabasin	Interbasin	
Public Water Supply	124	52	40	216	42	0	26
Self-Supply Commercial and Institutional	1	3	1	4	0	0	1
Self-Supply Irrigation	0	9	25	34	0	0	30
Self-Supply Livestock	0	13	10	24	0	0	1
Self-Supply Industrial	14	251	48	313	0	0	34
Self-Supply Thermoelectric Power Production (Once-through cooling)	6,896	231	0	7,127	0	0	62
Self-Supply Thermoelectric Power Production (Recirculated cooling)	0	3	1	4	0	0	3
Off-Stream Hydroelectric Power Production	0	0	0	0	0	0	0
In-Stream Hydroelectric Water Use	18,861	15,137	0	33,998	0	0	0
Other Self Supply	0	2	0	3	0	0	0
Total	25,896	15,700	125	41,722	42	0	157

In millions of gallons per day; Water Sources: Great Lakes surface water (GLSW), other surface water (OSW) and groundwater (GW); totals may not sum exactly due to rounding

Table 7b. Lake Huron Watershed 2020 Water Use Data Summary in mld

Sector	Withdrawals				Diversions		Consumptive Use
	GLSW	OSW	GW	Total	Intrabasin	Interbasin	
Public Water Supply	468	196	153	817	157	0	100
Self-Supply Commercial and Institutional	2	11	2	16	0	0	2
Self-Supply Irrigation	1	34	94	128	0	0	114
Self-Supply Livestock	0	51	39	90	0	0	2
Self-Supply Industrial	53	949	182	1,184	0	0	128
Self-Supply Thermoelectric Power Production (Once-through cooling)	26,105	874	0	26,979	0	0	236
Self-Supply Thermoelectric Power Production (Recirculated cooling)	0	12	2	14	0	0	12
Off-Stream Hydroelectric Power Production	0	0	0	0	0	0	0
In-Stream Hydroelectric Water Use	71,396	57,301	0	128,697	0	0	0
Other Self Supply	2	6	2	10	0	0	0
Total	98,028	59,433	474	157,935	157	0	593

In millions of liters per day; Water Sources: Great Lakes surface water (GLSW), other surface water (OSW) and groundwater (GW); totals may not sum exactly due to rounding

Lake Erie

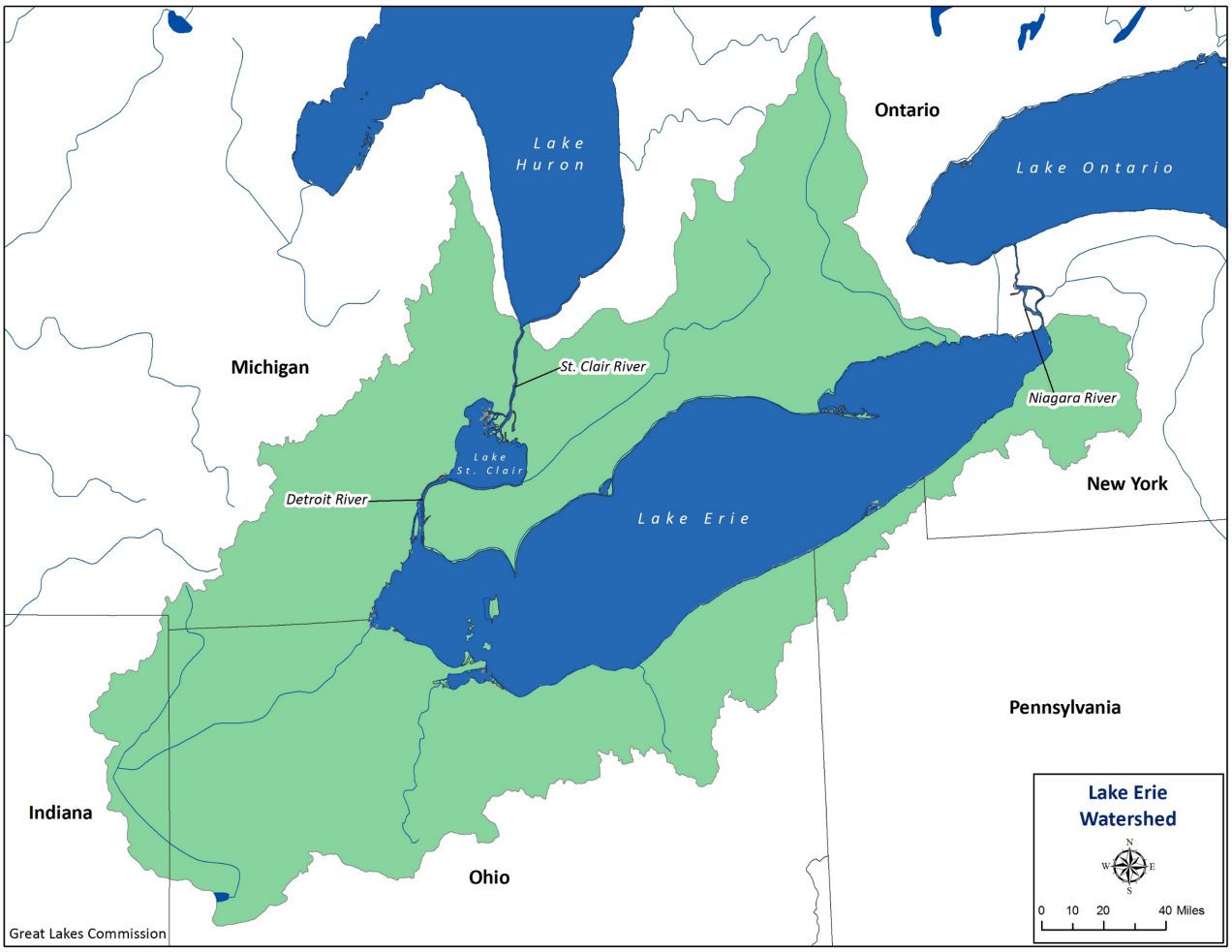

Figure 10. Lake Erie Watershed

Overview of Watershed Characteristics

By surface area, Lake Erie is the 12th largest freshwater lake in the world. The shallowest of the Great Lakes, it has an average depth of 62 feet (19 meters) and a maximum depth of 210 feet (64 meters). The lake holds about 116 cubic miles (4,863 cubic kilometers) of water. Lake Erie is warmer than the other Great Lakes, which contributes to its biological productivity. However, its small volume relative to the other Great Lakes and overall average shallow depth makes it more ecologically sensitive. The watershed is home to more than 12 million people.

Basic Stats of Lake Erie

Length: 241 mi/388 km

Breadth: 57 mi/92 km

Elevation: 569.2 ft/173.5 m

Depth: 62 ft/19 m average, 210 ft/64 m maximum

Volume: 116 cubic mi/483 cubic km

Lake surface area: 9,910 square mi/ 25,655 square km

Watershed drainage area: 22,700 square mi/58,788 square km

Outlets: Niagara River and Welland Canal

Retention/replacement time: 2.7 years

Approximate population in watershed: United States - 9,987,517; Canada - 2,193,219. Total: 12,180,736

Water Withdrawals

Six jurisdictions – Indiana, Michigan, New York, Ohio, Ontario, and Pennsylvania – share the Lake Erie watershed and collectively withdrew 5,877 mgd (22,245 mld) in 2020, excluding reported in-stream hydroelectric water use, which accounted for an additional 56,623 mgd (214,342 mld). There was a 9 percent decrease in water withdrawals from the 2019 total withdrawal amount of 6,455 mgd (24,434 mld). Aside from water used for in-stream hydroelectric power generation purposes, the primary water uses were self-supply thermoelectric power generation, once-through cooling (totaling 3,135 mgd or 11,868 mld); public water supply (1,493 mgd or 5,651 mld), and self-supply industrial use (951 mgd or 3,600 mld).

Lake Erie surface water was the source of 77 percent of the total withdrawals in the watershed. However, Lake Erie surface water was not used in Indiana, with other surface water and groundwater making up the water sources, primarily supporting the public water supply sector.

Water Diversions and Consumptive Uses

Reported net water loss from the Lake Erie watershed totaled 6,001 mgd (22,717 mld). The largest loss from the Lake Erie watershed was due to the Welland Canal intrabasin diversion, which diverted 5,664 mgd (21,442 mld) to the Lake Ontario watershed for navigation purposes. Because the diversion is entirely to Lake Ontario, there is no net change or water loss from the Great Lakes-St. Lawrence River basin. The Welland Canal was constructed in 1830 as a ship canal connecting Lake Erie to Lake Ontario. Figure 11 shows the flow through the Welland Canal over the past five years.

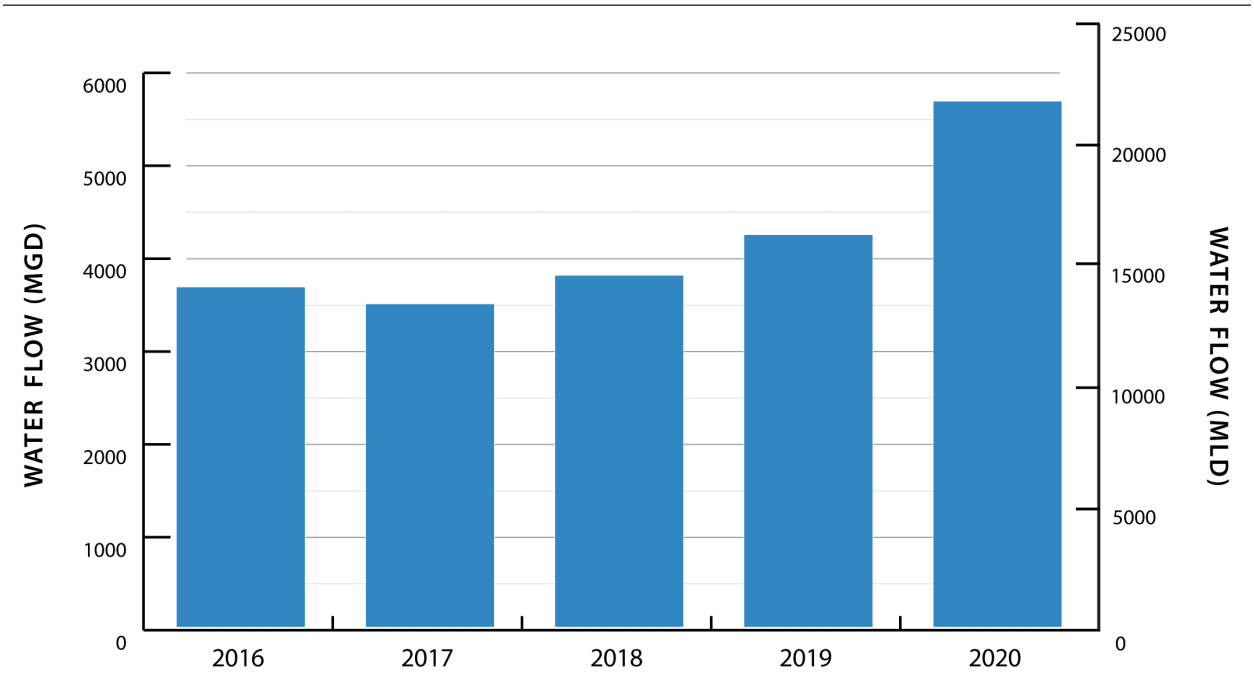

Figure 11. Flow through the Welland Canal over the past five years.

Additionally, incoming intrabasin diversions were reported in Ontario and Michigan for the public water sector, totaling 40 mgd (151 mld), though Michigan's diversion represented a small portion of the total (less than 1 mld).

Interbasin diversions, both into and out of the Basin, were also reported, resulting in a gain[8] (for the Lake Erie watershed and Great Lakes-St. Lawrence River basin) of 19 mgd (72 mld).

Consumptive use in the Lake Erie watershed totaled 396 mgd (1,498 mld), a decrease of 5 percent compared to 2019. The major consumptive uses were for public water supply (193 mgd or 729 mld) and the self-supply industrial sector (85 mgd or 322 mld).

[8] Incoming diversions are reported as negative values in the database and on tables in this report.

Table 8a. Lake Erie Watershed 2020 Water Use Data Summary in mgd

Sector	Withdrawals				Diversions		Consumptive Use
	GLSW	OSW	GW	Total	Intrabasin	Interbasin	
Public Water Supply	1,180	181	133	1,493	-40	9	193
Self-Supply Commercial and Institutional	1	3	1	4	0	0	0
Self-Supply Irrigation	1	37	15	53	0	0	47
Self-Supply Livestock	0	5	8	13	0	0	1
Self-Supply Industrial	433	394	124	951	0	0	85
Self-Supply Thermoelectric Power Production (Once-through cooling)	2,737	398	0	3,135	0	0	33
Self-Supply Thermoelectric Power Production (Recirculated cooling)	178	0	0	179	0	0	30
Off-Stream Hydroelectric Power Production	0	0	0	0	0	0	0
In-Stream Hydroelectric Water Use	56,000	623	0	56,623	0	0	0
Other Self Supply	2	38	8	49	5,664	-28	6
Total	60,532	1,679	289	62,500	5,625	-19	396

In millions of gallons per day; Water Sources: Great Lakes surface water (GLSW), other surface water (OSW) and groundwater (GW); totals may not sum exactly due to rounding

Table 8b. Lake Erie Watershed 2020 Water Use Data Summary in mld

Sector	Withdrawals				Diversions		Consumptive Use
	GLSW	OSW	GW	Total	Intrabasin	Interbasin	
Public Water Supply	4,466	684	502	5,651	-151	36	729
Self-Supply Commercial and Institutional	2	10	3	15	0	0	2
Self-Supply Irrigation	5	139	57	200	0	0	180
Self-Supply Livestock	0	20	30	50	0	-1	3
Self-Supply Industrial	1,640	1,491	469	3,600	0	0	322
Self-Supply Thermoelectric Power Production (Once-through cooling)	10,360	1,508	0	11,868	0	0	124
Self-Supply Thermoelectric Power Production (Recirculated cooling)	674	2	0	676	0	0	115
Off-Stream Hydroelectric Power Production	0	0	0	0	0	0	0
In-Stream Hydroelectric Water Use	211,983	2,359	0	214,342	0	0	0
Other Self Supply	9	143	32	185	21,442	-106	23
Total	229,140	6,355	1,092	236,587	21,291	-72	1,498

In millions of liters per day; Water Sources: Great Lakes surface water (GLSW), other surface water (OSW) and groundwater (GW); totals may not sum exactly due to rounding

Lake Ontario

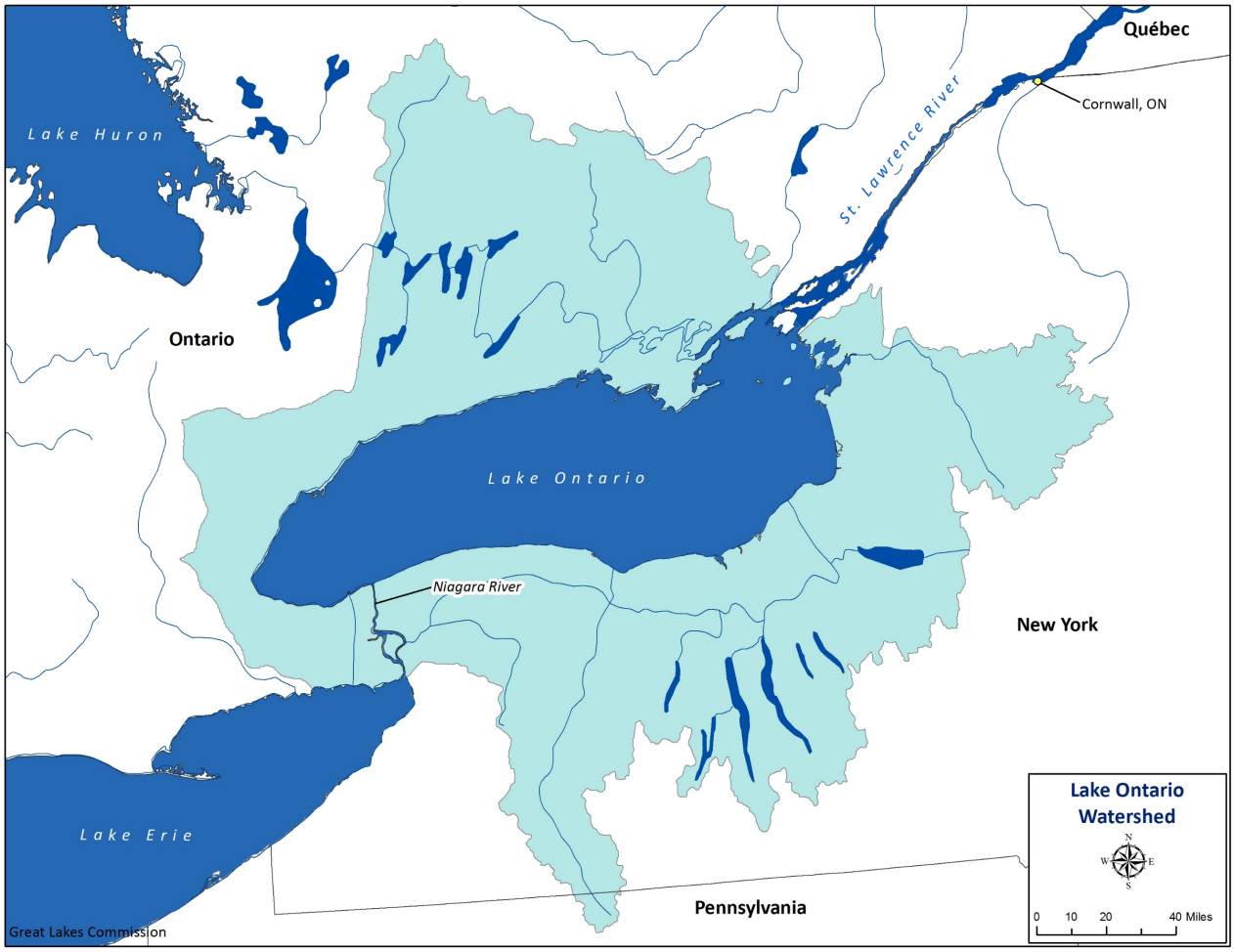

Figure 12. Lake Ontario Watershed

Overview of Watershed Characteristics

Lake Ontario is the easternmost of the Great Lakes and the smallest in surface area (covering 7,340 square miles or 18,960 square kilometers). It is extremely deep (802 feet or 244 meters maximum) and while smaller than Lake Erie in surface area, exceeds it in volume by nearly three and a half times (393 cubic miles or 1,639 cubic kilometers). By surface area, Lake Ontario is the 14th largest lake in the world and is the 11th largest lake in the world by volume.

Basic Stats of Lake Ontario

Length: 193 mi/311 km

Breadth: 53 mi/85 km

Elevation: 243.3 ft/74.2 m

Depth: 283 ft/86 m average, 802 ft/ 244 m maximum

Volume: 393 cubic mi/1,639 cubic km

Lake surface area: 7,340 square mi/19,009 square km

Watershed drainage area: 23,400 square mi/ 60,601 square km

Outlet: St. Lawrence River to the Atlantic Ocean

Retention/replacement time: 6 years

Approximate population in watershed: United States - 2,783,742; Canada – 7,385,657. Total: 10,169,399

Water Withdrawals

Three jurisdictions – New York, Ontario, and Pennsylvania – share the Lake Ontario watershed and collectively withdrew 10,377 mgd (39,283 mld) of water in 2020, excluding in-stream hydroelectric water use. Reported in-stream hydroelectric water use accounted for an additional 139,394 mgd (527,662 mld). There was a nominal (less than 1 percent) decrease in water withdrawn from the 2019 withdrawal amount of 10,426 mgd (39,467 mld). Aside from withdrawals for in-stream hydroelectric power generation purposes, the primary water uses were for self-supply thermoelectric power generation, once-through cooling (7,525 mgd or 28,484 mld); public water supply (896 mgd or 3,392 mld), and other self-supply uses (749 mgd or 2,836 mld).

Excluding the in-stream hydroelectric power sector, Lake Ontario surface water was the source of approximately 86 percent of the total withdrawals in the watershed, with nearly 14 percent of withdrawals coming from other surface water and less than 1 percent from groundwater.

Water Diversions and Consumptive Uses

The Lake Ontario watershed reported a net water gain of 5,250 mgd (19,872 mld)[9] in 2020, up 37 percent from the 2019 water gain of 3,829 mgd or 14,493 mld. The net water gain in the Lake Ontario watershed was predominately attributable to the Welland Canal (5,664 mgd or 21,442 mld), which diverts water into Lake Ontario from the Lake Erie watershed for navigation purposes. While this represents a net gain for the Lake Ontario watershed, it has a net zero effect for the Great Lakes-St. Lawrence River basin. An additional incoming intrabasin diversion of 2 mgd (7 mld) was reported in the Lake Ontario watershed, associated with the public water supply sector in Ontario.

Outgoing interbasin diversions of 43 mgd (162 mld) from Lake Ontario were reported in New York, associated with the Erie Barge Canal and public water supply for the City of Rome. Consumptive use in the Lake Ontario watershed totaled 374 mgd (1,415 mld), which is comprised primarily of consumptive use for public water supply (112 mgd or 426 mld); self-supply thermoelectric power production, once-through cooling (81 mgd or 307 mld); and self-supply industrial use (73 mgd or 277 mld).

[9] Incoming diversions are reported as negative values in the database and on tables in this report.

Table 9a. Lake Ontario Watershed 2020 Water Use Data Summary in mgd

Sector	Withdrawals				Diversions		Consumptive Use
	GLSW	OSW	GW	Total	Intrabasin	Interbasin	
Public Water Supply	684	195	17	896	-2	11	112
Self-Supply Commercial and Institutional	0	42	1	42	0	0	8
Self-Supply Irrigation	2	36	8	47	0	0	42
Self-Supply Livestock	0	14	12	26	0	0	3
Self-Supply Industrial	318	229	46	592	0	0	73
Self-Supply Thermoelectric Power Production (Once-through cooling)	7,441	84	0	7,525	0	0	81
Self-Supply Thermoelectric Power Production (Recirculated cooling)	436	0	0	436	0	0	22
Off-Stream Hydroelectric Power Production	0	64	0	64	0	0	0
In-Stream Hydroelectric Water Use	41,143	98,250	0	139,394	0	0	0
Other Self Supply	0	749	0	749	-5,664	32	33
Total	50,024	99,664	83	149,771	-5,666	43	374

In millions of gallons per day; Water Sources: Great Lakes surface water (GLSW), other surface water (OSW) and groundwater (GW); totals may not sum exactly due to rounding

Table 9b. Lake Ontario Watershed 2020 Water Use Data Summary in mld

Sector	Withdrawals				Diversions		Consumptive Use
	GLSW	OSW	GW	Total	Intrabasin	Interbasin	
Public Water Supply	2,589	739	64	3,392	-7	41	426
Self-Supply Commercial and Institutional	0	158	2	160	0	0	29
Self-Supply Irrigation	9	138	32	179	0	0	160
Self-Supply Livestock	0	53	44	97	0	0	11
Self-Supply Industrial	1,202	867	173	2,241	0	0	277
Self-Supply Thermoelectric Power Production (Once-through cooling)	28,167	318	0	28,484	0	0	307
Self-Supply Thermoelectric Power Production (Recirculated cooling)	1,651	0	0	1,651	0	0	83
Off-Stream Hydroelectric Power Production	0	242	0	242	0	0	0
In-Stream Hydroelectric Water Use	155,745	371,917	0	527,662	0	0	0
Other Self Supply	0	2,836	0	2,836	-21,442	121	123
Total	189,363	377,268	314	566,945	-21,449	162	1,415

In millions of liters per day; Water Sources: Great Lakes surface water (GLSW), other surface water (OSW) and groundwater (GW); totals may not sum exactly due to rounding

St. Lawrence River

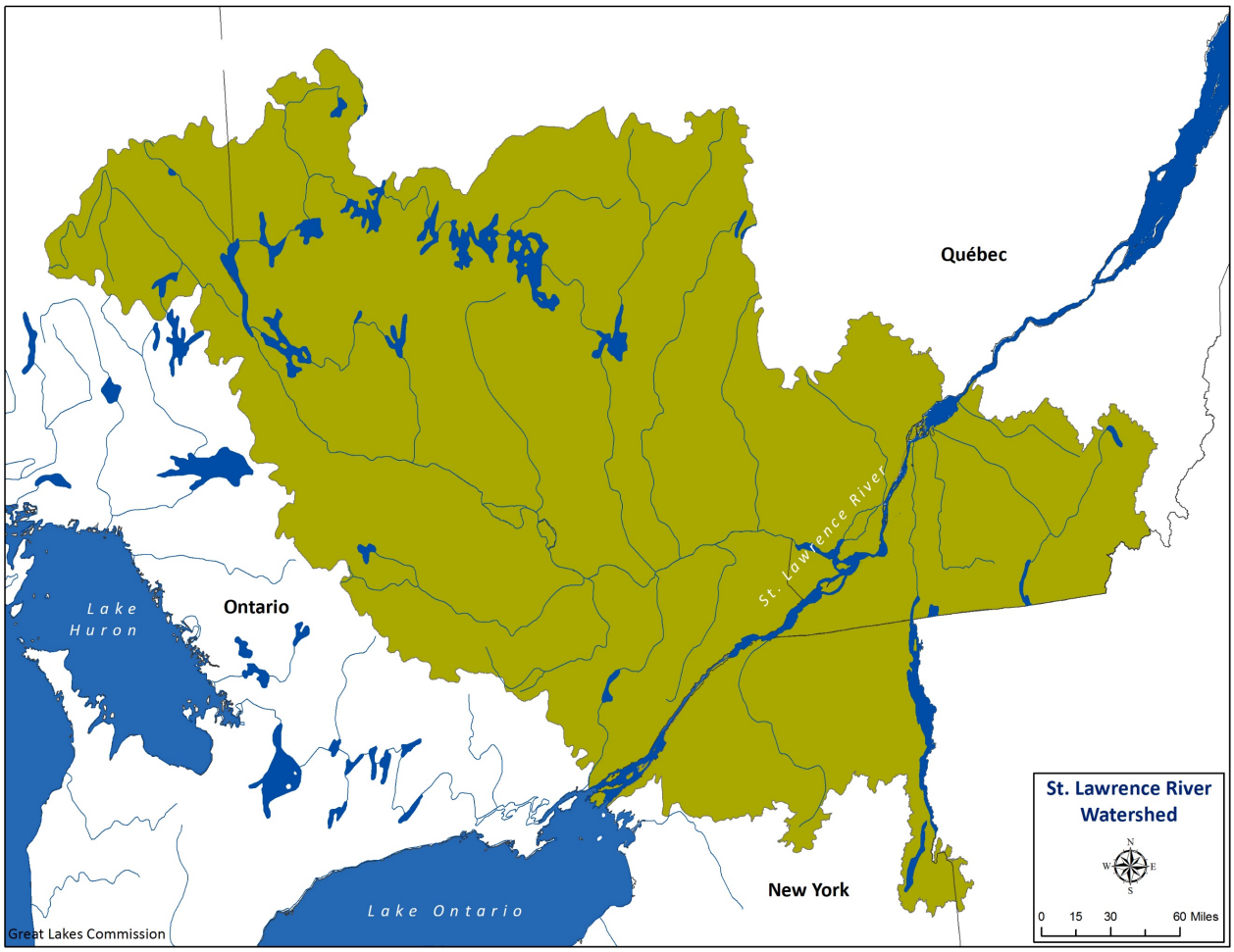

Figure 13. St. Lawrence River Watershed

Overview of Watershed Characteristics

Running 744 miles (1,198 kilometers) in length, the St. Lawrence River is considered a major river of North America. Mostly located in the province of Québec, it links the Great Lakes to the Atlantic Ocean.

Basic Stats of the St. Lawrence River

Length: 744 mi/1,197 km

Elevation: 245 ft/74.7 m at the source and 0 ft/0 m at the mouth

Average annual flow (Montréal): 7,660 cubic meters/second

Volume: 393 cubic mi/1,639 cubic km

Watershed drainage area: 519,000 square mi/1,344,200 square km

Outlet: Gulf of St. Lawrence/Atlantic Ocean

Water Withdrawals

Three jurisdictions – New York, Ontario, and Québec – share the St. Lawrence watershed and collectively withdrew 1,525 mgd (5,771 mld) of water in 2020, excluding in-stream hydroelectric water use, which accounted for an additional 229,551 mgd (868,943 mld). The 2020 withdrawals are a slight (less than 2 percent) decrease from the 2019 withdrawal total of 1,549 mgd (5,865 mld). Aside from in-stream hydroelectric, the primary water uses were public water supply (1,049 mgd or 3,969 mld) and self-supply industrial use (382 mgd or 1,445 mld).

Excluding in-stream hydroelectric use, St. Lawrence River surface water was the source for 56 percent of the watershed's total withdrawal amount. Other surface water within the St. Lawrence River watershed accounted for 36 percent of the total, with 7 of the total withdrawal coming from groundwater sources.

Water Diversions and Consumptive Uses

Reported net water loss in the St. Lawrence River watershed in 2020 totaled 213 mgd (808 mld), a 1 percent increase from 2019 water loss of 211 mgd or 799 mld. This net loss includes diversions of 5 mgd (19 mld) for public supply purposes in New York and Québec and a combined consumptive use amount of 208 mgd (789 mld). The largest consumptive uses were the for the public water supply sector at 153 mgd (581 mld) and self-supply industrial sector at 34 mgd (127 mld).

Table 10a. St. Lawrence River Watershed 2020 Water Use Data Summary in mgd

Sector	Withdrawals				Diversions		Consumptive Use
	GLSW	OSW	GW	Total	Intrabasin	Interbasin	
Public Water Supply	660	325	63	1,049	0	5	153
Self-Supply Commercial and Institutional	1	11	2	14	0	0	2
Self-Supply Irrigation	1	11	3	15	0	0	13
Self-Supply Livestock	0	19	9	28	0	0	1
Self-Supply Industrial	165	181	36	382	0	0	34
Self-Supply Thermoelectric Power Production (Once-through cooling)	27	1	0	28	0	0	0
Self-Supply Thermoelectric Power Production (Recirculated cooling)	0	0	0	0	0	0	0
Off-Stream Hydroelectric Power Production	0	0	0	0	0	0	0
In-Stream Hydroelectric Water Use	173,249	56,302	0	229,551	0	0	0
Other Self Supply	5	3	1	10	0	0	5
Total	174,108	56,855	112	231,075	0	5	208

In millions of gallons per day; Water Sources: Great Lakes surface water (GLSW), other surface water (OSW) and groundwater (GW); totals may not sum exactly due to rounding

Table 10b. St. Lawrence River Watershed 2020 Water Use Data Summary in mld

Sector	Withdrawals				Diversions		Consumptive Use
	GLSW	OSW	GW	Total	Intrabasin	Interbasin	
Public Water Supply	2,500	1,232	237	3,969	0	19	581
Self-Supply Commercial and Institutional	3	43	6	52	0	0	8
Self-Supply Irrigation	2	43	10	55	0	0	50
Self-Supply Livestock	0	73	34	107	0	0	4
Self-Supply Industrial	625	686	135	1,445	0	0	127
Self-Supply Thermoelectric Power Production (Once-through cooling)	102	5	0	107	0	0	1
Self-Supply Thermoelectric Power Production (Recirculated cooling)	0	0	0	0	0	0	0
Off-Stream Hydroelectric Power Production	0	0	0	0	0	0	0
In-Stream Hydroelectric Water Use	655,818	213,125	0	868,943	0	0	0
Other Self Supply	20	13	3	36	0	0	18
Total	659,071	215,219	424	874,714	0	19	789

In millions of liters per day; Water Sources: Great Lakes surface water (GLSW), other surface water (OSW) and groundwater (GW); totals may not sum exactly due to rounding

Jurisdiction Reports

Illinois

The Illinois portion of the Lake Michigan watershed is only about 100 square miles, which accounts for less than 0.2 percent of the total area of the state. The Lake Michigan coastline of Illinois is 63 miles long, which is less than 0.4 percent of the 1,640 miles of Lake Michigan shoreline. Despite its small size, the Illinois Lake Michigan service area is home to half the total population of Illinois and the lake is the largest public drinking water supply in the state, serving nearly seven million people.

The total withdrawal amount from the basin for Illinois in 2020 was 1,520 mgd (5,754 mld), an approximately 3 percent increase from 2019 (1,482 mgd or 5,612 mld). The largest uses of reported water were public water supply at 771 mgd or 2,919 mld (51 percent of the total withdrawal amount) and thermoelectric power production, once-through cooling at 494 mgd or 1,870 mld (32 percent of the total withdrawal amount). The source for all withdrawals was Lake Michigan surface water.

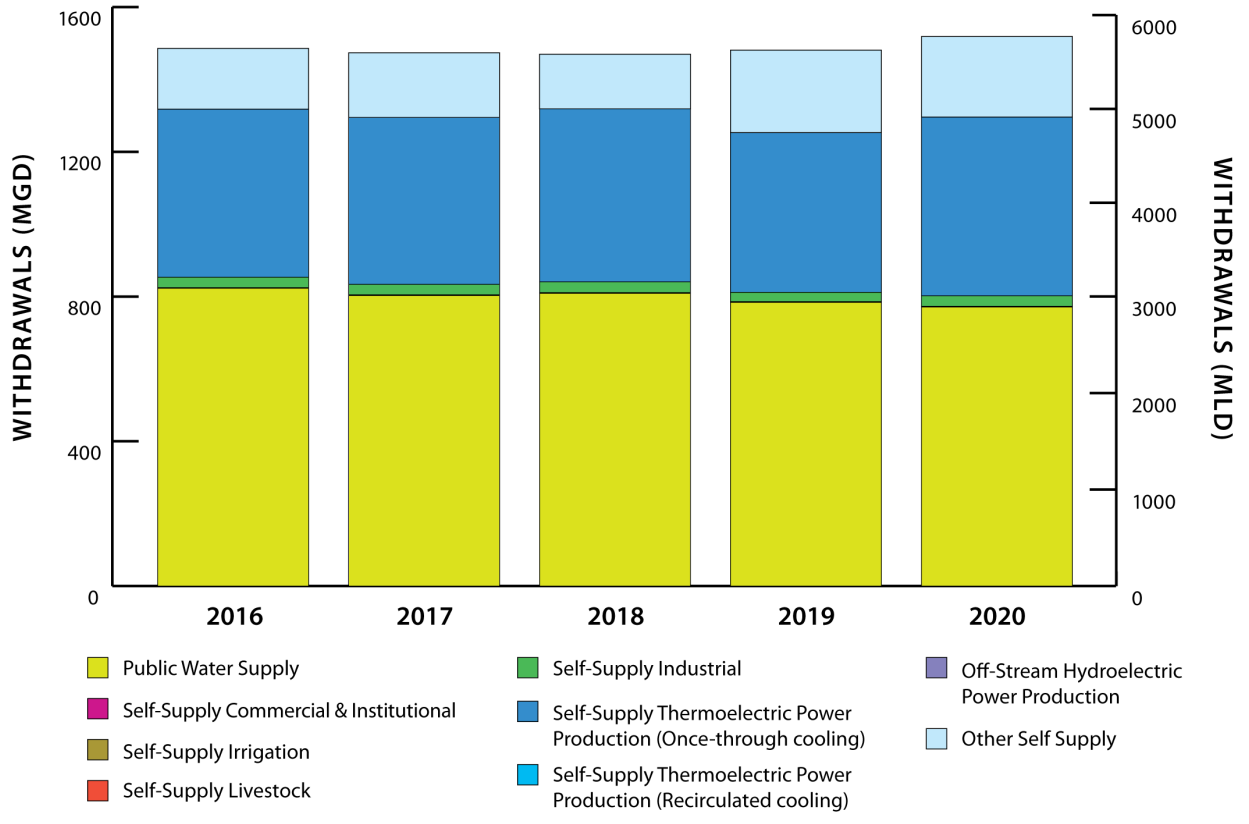

Figure 14. Illinois water withdrawals by sector the last five years

A total of 997 mgd (3,775 mld) were diverted through the Illinois Diversion. The Illinois Diversion diverts water from Lake Michigan through the Chicago Area Water System (CAWS) into the Mississippi River watershed and is comprised of three elements: public water supply, stormwater runoff, and direct diversion.

The amount of water diverted for public water supply was 771 mgd (2,919 mld), with an additional 2.4 mgd (9.2 mld) diverted for the industrial and commercial and institutional sectors.

Direct diversion occurs at three lakefront structures: the Chicago River Controlling Structure, the O'Brien Lock and Dam and the Wilmette Pumping Station. Direct diversion consists of four elements: lockage, leakage, discretionary flow, and navigational makeup. Lockage is used in moving vessels to and from Lake Michigan through locks and only occurs at the Chicago River Controlling Structure and the O'Brien Lock and Dam. Leakage is water estimated to pass through or around the three lakefront structures. Discretionary flow is used to dilute effluent from sewage discharges and improve water quality in the CAWS. Navigational makeup is used to maintain navigational depths in the CAWS. The total direct diversion was 224 mgd (847 mld). Consumptive use in Illinois is negligible: less 0.02 percent of water withdrawn is lost through consumptive use, totaling less than 1 mgd.

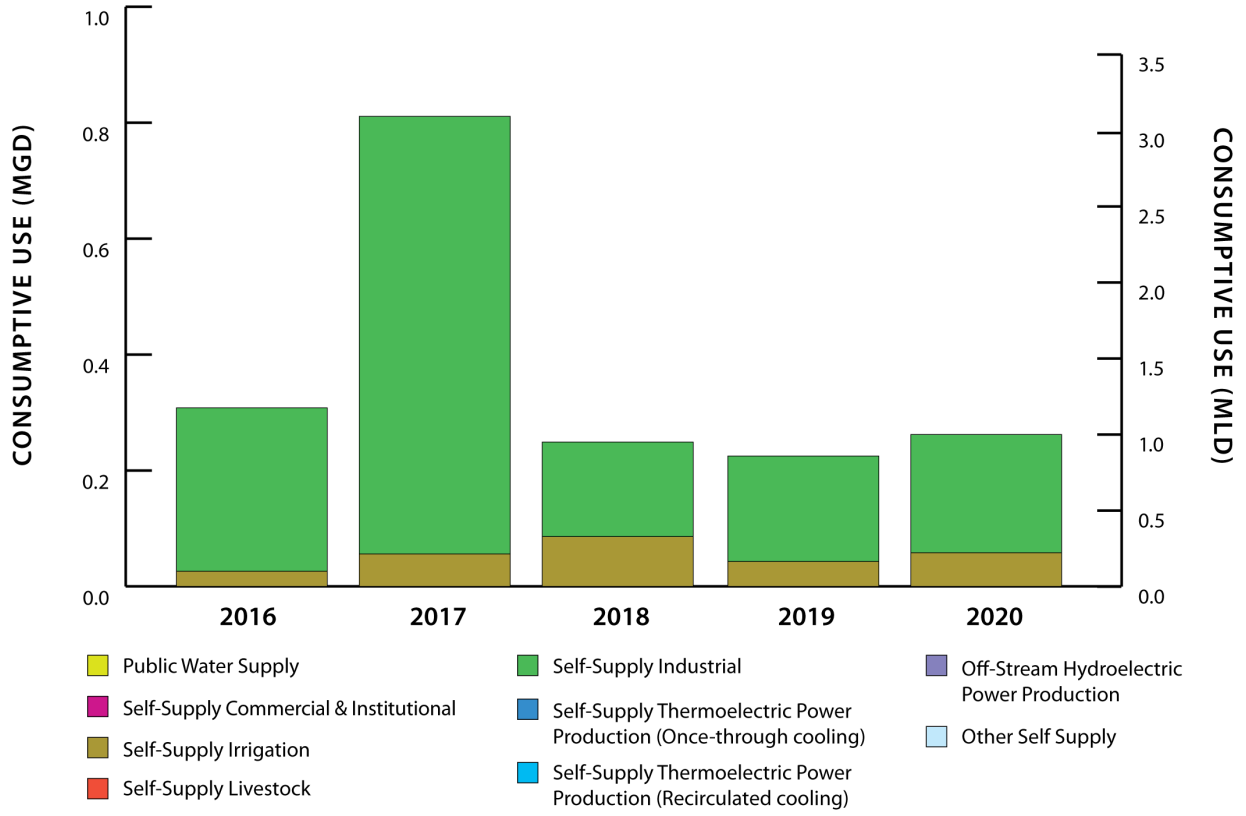

Figure 15. Illinois consumptive use by sector the last five years

Data collected for this report came from the Illinois State Water Survey and from monthly pumpage reports and annual user reports submitted to the Illinois Department of Natural Resources. This data was generated with a 100 percent reporting compliance from permitted water withdrawal facilities.

Notable changes from 2019 water use by Illinois facilities include:

- A 12 percent (52 mgd or 197 mld) increase in water withdrawal for self-supply thermoelectric power production (one-through cooling), consistent with normal fluctuations in use
- An 11 percent increase in water withdrawal (3 mgd or 11 mld) and 12 percent increase in consumptive use (less than 1 mld) for the self-supply industrial sector, attributable to normal fluctuations in operations and comparable to 2018 reported use.

Table 11a. Illinois 2020 Water Use Data Summary in mgd

Sector	Withdrawals				Diversions		Consumptive Use
	GLSW	OSW	GW	Total	Intrabasin	Interbasin	
Public Water Supply	771	0	0	771	0	771	0
Self-Supply Commercial and Institutional	2	0	0	2	0	2	0
Self-Supply Irrigation	0	0	0	0	0	0	0
Self-Supply Livestock	0	0	0	0	0	0	0
Self-Supply Industrial	29	0	0	29	0	1	0
Self-Supply Thermoelectric Power Production (Once-through cooling)	494	0	0	494	0	0	0
Self-Supply Thermoelectric Power Production (Recirculated cooling)	0	0	0	0	0	0	0
Off-Stream Hydroelectric Power Production	0	0	0	0	0	0	0
In-Stream Hydroelectric Water Use	0	0	0	0	0	0	0
Other Self Supply	224	0	0	224	0	224	0
Total	1,520	0	0	1,520	0	997	0

In millions of gallons per day; Water Sources: Great Lakes surface water (GLSW), other surface water (OSW) and groundwater (GW); totals may not sum exactly due to rounding

Table 11b. Illinois 2020 Water Use Data Summary in mld

Sector	Withdrawals				Diversions		Consumptive Use
	GLSW	OSW	GW	Total	Intrabasin	Interbasin	
Public Water Supply	2,919	0	0	2,919	0	2,919	0
Self-Supply Commercial and Institutional	7	0	0	7	0	7	0
Self-Supply Irrigation	0	0	0	0	0	0	0
Self-Supply Livestock	0	0	0	0	0	0	0
Self-Supply Industrial	111	0	0	111	0	2	1
Self-Supply Thermoelectric Power Production (Once-through cooling)	1,870	0	0	1,870	0	0	0
Self-Supply Thermoelectric Power Production (Recirculated cooling)	0	0	0	0	0	0	0
Off-Stream Hydroelectric Power Production	0	0	0	0	0	0	0
In-Stream Hydroelectric Water Use	0	0	0	0	0	0	0
Other Self Supply	847	0	0	847	0	847	0
Total	5,754	0	0	5,754	0	3,775	1

In millions of liters per day; Water Sources: Great Lakes surface water (GLSW), other surface water (OSW) and groundwater (GW); totals may not sum exactly due to rounding

Indiana

The state of Indiana uses the water resources of the Lake Michigan and Lake Erie watersheds. Indiana's portion of Lake Michigan encompasses a total of 241 square miles. Four Indiana counties lie partially within Indiana's portion of the Lake Michigan watershed, but three (Lake, Porter and LaPorte counties) constitute more than 99.5 percent its land area. Abundant freshwater from Lake Michigan has promoted the development of an extensive urban and industrial belt along Indiana's coastline. Water supplies in Indiana's noncoastal counties in the Lake Michigan watershed are drawn primarily from groundwater. Indiana also shares a portion of the Maumee River watershed that flows into Lake Erie. The Maumee River watershed encompasses 1,283 square miles of northeast Indiana. Six Indiana counties lie partially within this watershed.

In 2020, the total reported water withdrawal amount from the Basin for Indiana was 1,531 mgd (5,795 mld), a 12 percent increase from the 2019 reported withdrawals (1,3645 mgd or 5,164 mld). The largest uses were self-supply industrial (1,279 mgd or 4,841 mld) and public water supply (166 mgd or 629 mld).

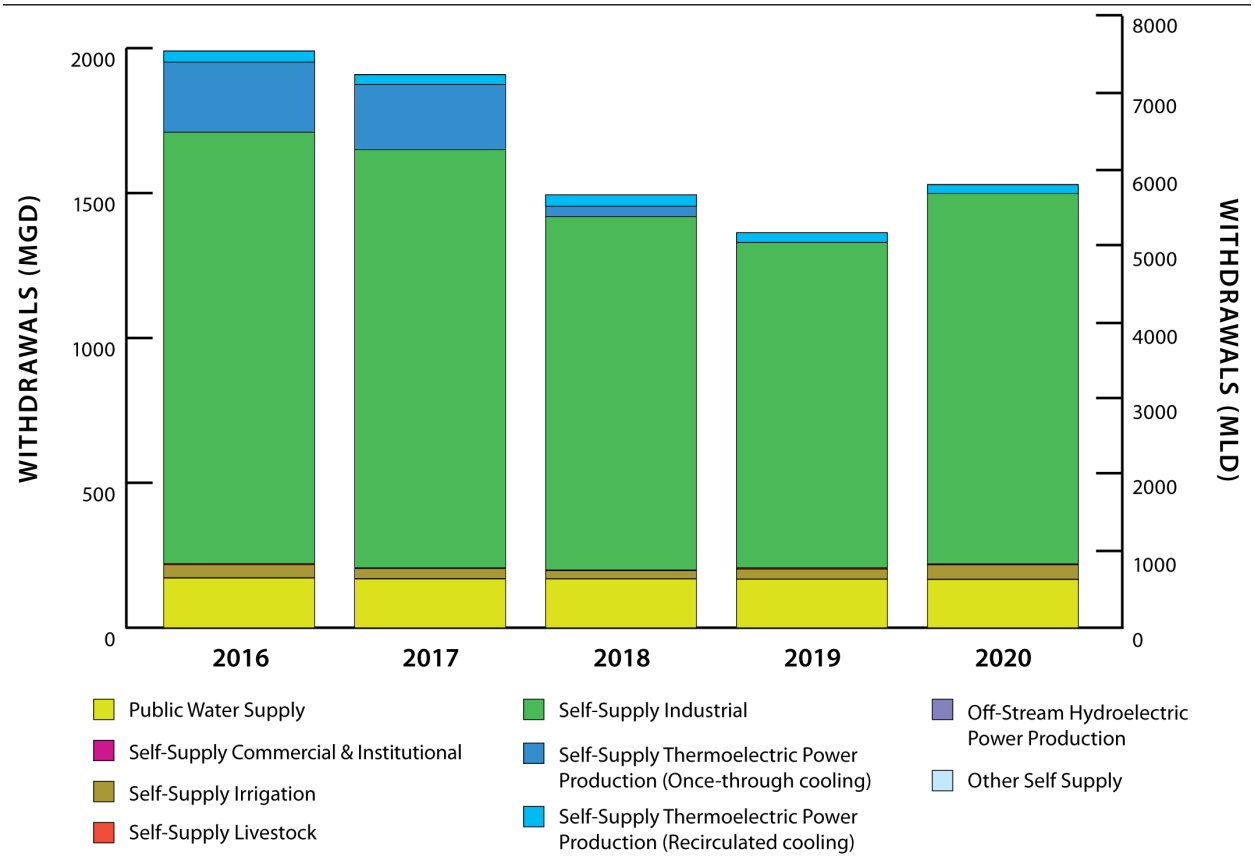

Figure 16. Indiana water withdrawals by sector the last five years

The total reported diversion amount for Indiana was 80 mgd (302 mld). Because a 65-square-mile portion of Indiana drains into the Illinois River (as a result of the Illinois Diversion), water transferred from the Lake Michigan watershed into this area is considered a diversion of water from the Great Lakes-St. Lawrence River Basin. Most reported diversions for Indiana (47 mgd or 178 mld) were distributed for

public supply purposes from Lake Michigan surface water and discharged to the Illinois Diversion area, with approximately 1 mgd (5 mld) reported as a diversion from groundwater in the Lake Michigan basin for public supply. The industrial sector was responsible for about 23 mgd (89 mld) of the reported diversion from the Lake Michigan watershed to the Illinois River.

In the Lake Erie watershed, a portion of the city of Fort Wayne's public water supply distribution system is outside of the Great Lakes Basin in the Upper Wabash watershed. The water distributed through that portion of the system (about 8 mgd or 30 mld, almost exclusively from other surface water with less than 0.01 percent from groundwater) was reported as a diversion from the Lake Erie watershed.

Consumptive use in Indiana totaled 329 mgd (1,244 mld), with the self-supply industrial sector in the Lake Michigan watershed (253 mgd or 954 mld) representing 77 percent of all consumptive use.

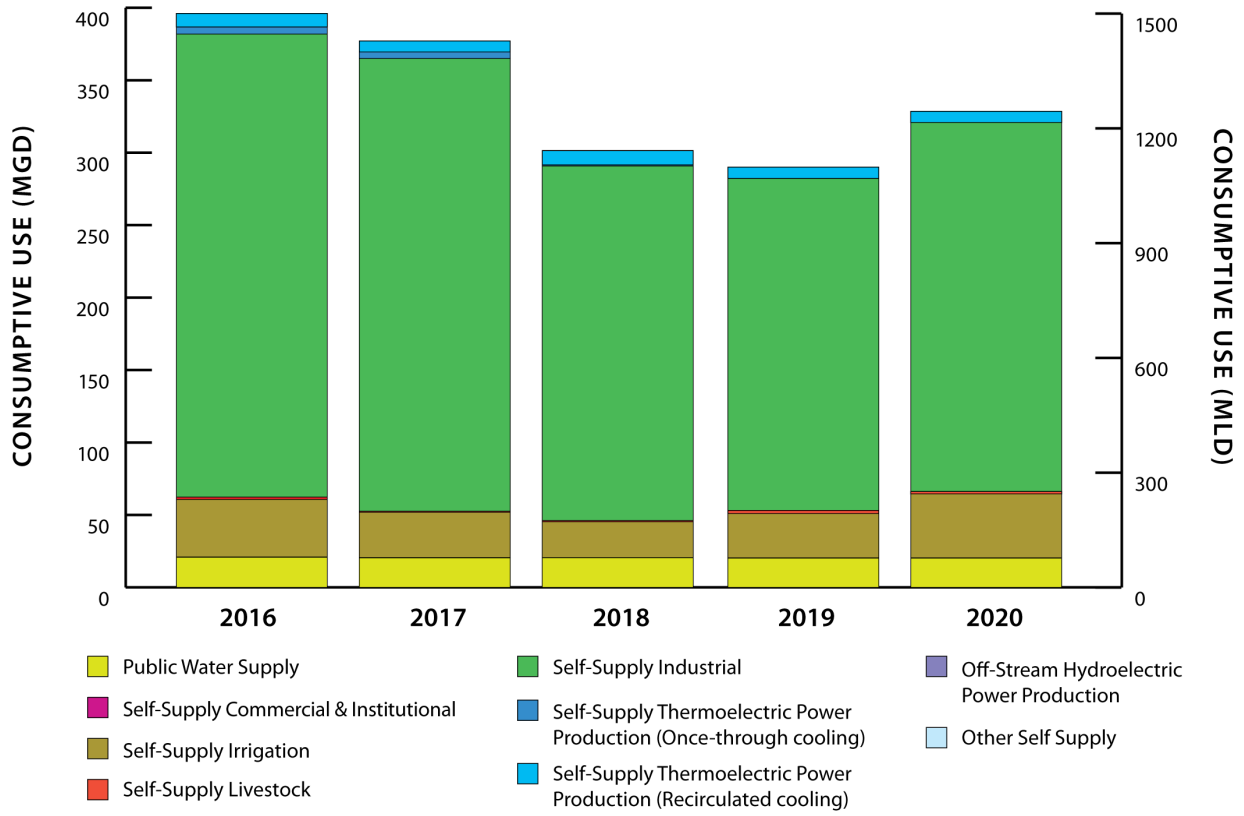

Figure 17. Indiana consumptive use by sector the last five years

Data collected for this report came from the Indiana Department of Natural Resources. These data were generated with reporting compliance rates from permitted water withdrawal facilities ranging from 80 to 100 percent depending on the water use sector. Data was not estimated for facilities that did not report. Indiana does not require in-stream hydroelectric water users to register or report this use.

Notable changes from 2019 water use by Indiana facilities include:

- A 44 percent (15 mgd or 57 mld) increase in water withdrawal for self-supply irrigation and a corresponding 44 percent increase in irrigation consumptive use (14 mgd or 51 mld), associated with weather conditions, an increase in threshold facilities, and increased compliance.
- A 14 percent (156 mgd or 591 mld) increase in self-supply industrial water withdrawal and a similar (11 percent) increase in consumptive use, primarily due to increased use at a steel plant.
- A 10 percent (4 mgd or 14 mld) decrease in self-supply thermoelectric power production (recirculated cooling) water withdrawal, primarily due to a decreasing water use trend at one facility.

Table 12a. Indiana 2020 Water Use Data Summary in mgd

Sector	Withdrawals				Diversions		Consumptive Use
	GLSW	OSW	GW	Total	Intrabasin	Interbasin	
Public Water Supply	84	36	45	166	0	56	20
Self-Supply Commercial and Institutional	0	0	2	2	0	0	0
Self-Supply Irrigation	0	6	43	49	0	0	44
Self-Supply Livestock	0	1	3	4	0	0	2
Self-Supply Industrial	1,263	7	9	1,279	0	23	255
Self-Supply Thermoelectric Power Production (Once-through cooling)	0	0	0	0	0	0	0
Self-Supply Thermoelectric Power Production (Recirculated cooling)	8	21	1	31	0	0	8
Off-Stream Hydroelectric Power Production	0	0	0	0	0	0	0
In-Stream Hydroelectric Water Use	0	0	0	0	0	0	0
Other Self Supply	0	0	1	1	0	0	0
Total	1,355	71	104	1,531	0	80	329

In millions of gallons per day; Water Sources: Great Lakes surface water (GLSW), other surface water (OSW) and groundwater (GW); totals may not sum exactly due to rounding.

Table 12b. Indiana 2020 Water Use Data Summary in mld

Sector	Withdrawals				Diversions		Consumptive Use
	GLSW	OSW	GW	Total	Intrabasin	Interbasin	
Public Water Supply	319	138	172	629	0	213	76
Self-Supply Commercial and Institutional	0	0	6	6	0	0	1
Self-Supply Irrigation	0	23	164	187	0	0	167
Self-Supply Livestock	0	3	10	14	0	0	6
Self-Supply Industrial	4,780	27	34	4,841	0	89	964
Self-Supply Thermoelectric Power Production (Once-through cooling)	0	0	0	0	0	0	0
Self-Supply Thermoelectric Power Production (Recirculated cooling)	32	79	6	117	0	0	29
Off-Stream Hydroelectric Power Production	0	0	0	0	0	0	0
In-Stream Hydroelectric Water Use	0	0	0	0	0	0	0
Other Self Supply	0	0	3	3	0	0	0
Total	5,131	270	395	5,795	0	302	1,244

In millions of liters per day; Water Sources: Great Lakes surface water (GLSW), other surface water (OSW) and groundwater (GW); totals may not sum exactly due to rounding

Michigan

Home to more than 10 million people, Michigan borders four of the Great Lakes (Superior, Michigan, Huron and Erie). Virtually the entire land area of the state lies within the Great Lakes Basin and Michigan has over 3,200 miles of Great Lakes shoreline – more freshwater coastline than any other state.[10]

In 2020, the total reported water withdrawal amount from the basin for Michigan was 8,248 mgd (31,221 mld), a nominal increase from the 2019 total water withdrawal amount of 8,217 mgd (31,106 mld). The largest use was self-supply thermoelectric power production (once-through cooling), with 5,975 mgd (22,617 mld) withdrawn, over 70 percent of Michigan's total withdrawal. 47 percent of Michigan's total withdrawal amount came from the Lake Michigan watershed (3,872 mgd or 14,657 mld), mainly used for thermoelectric power production. Another 46 percent of the total withdrawal amount (3,813 mgd or 14,432 mld) came from the Lake Erie watershed, followed by the Lake Huron watershed at 523 mgd or 1,981 mld (6 percent) and the Lake Superior watershed at 40 mgd or 152 mld (less than 0.5 percent).

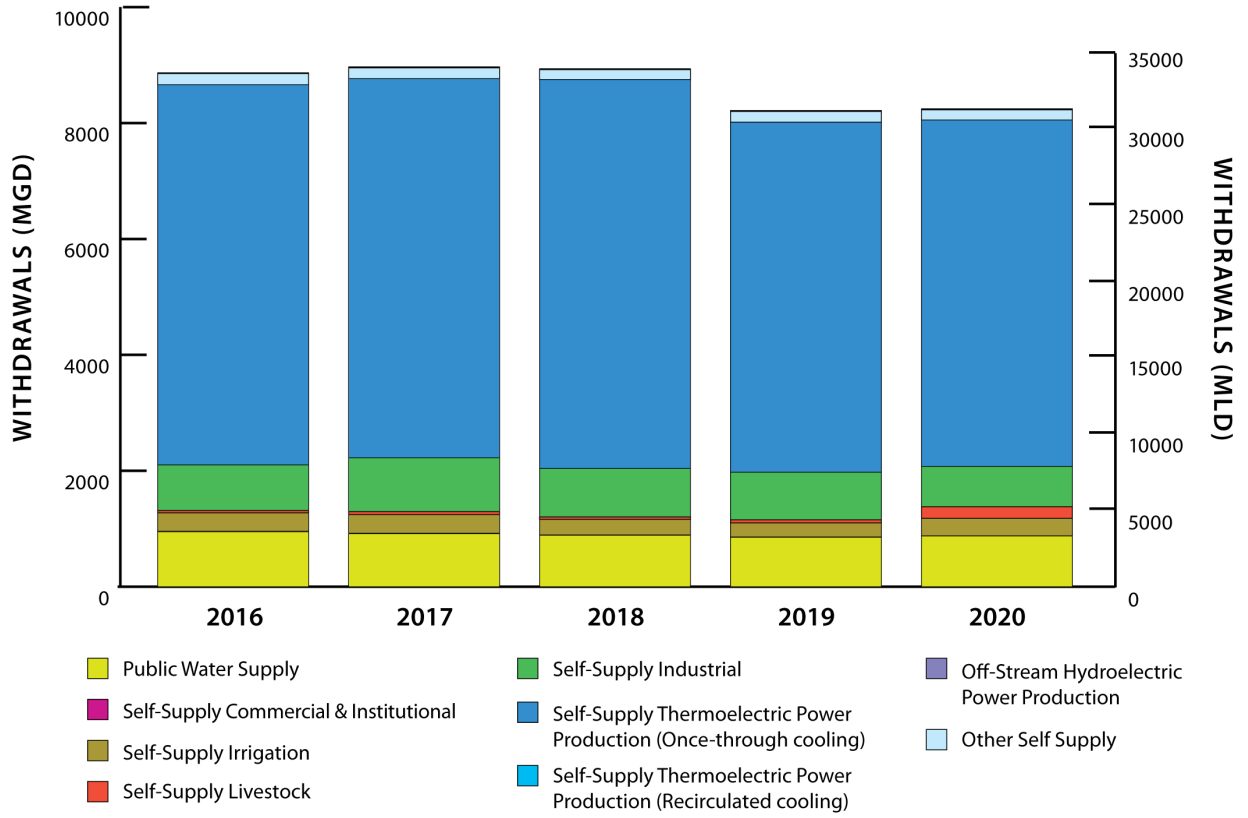

Figure 18. Michigan water withdrawals by sector the last five years

[10] National Oceanic and Atmospheric Administration (NOAA) Office for Coastal Management, Shoreline Mileage of the United States. https://coast.noaa.gov/data/docs/states/shorelines.pdf

The total amount of consumptive use in Michigan was 619 mgd or 2,342 mld (approximately seven percent of the total withdrawal amount), with self-supply irrigation being the largest contributor to consumptive use at 271 mgd (1,027 mld).

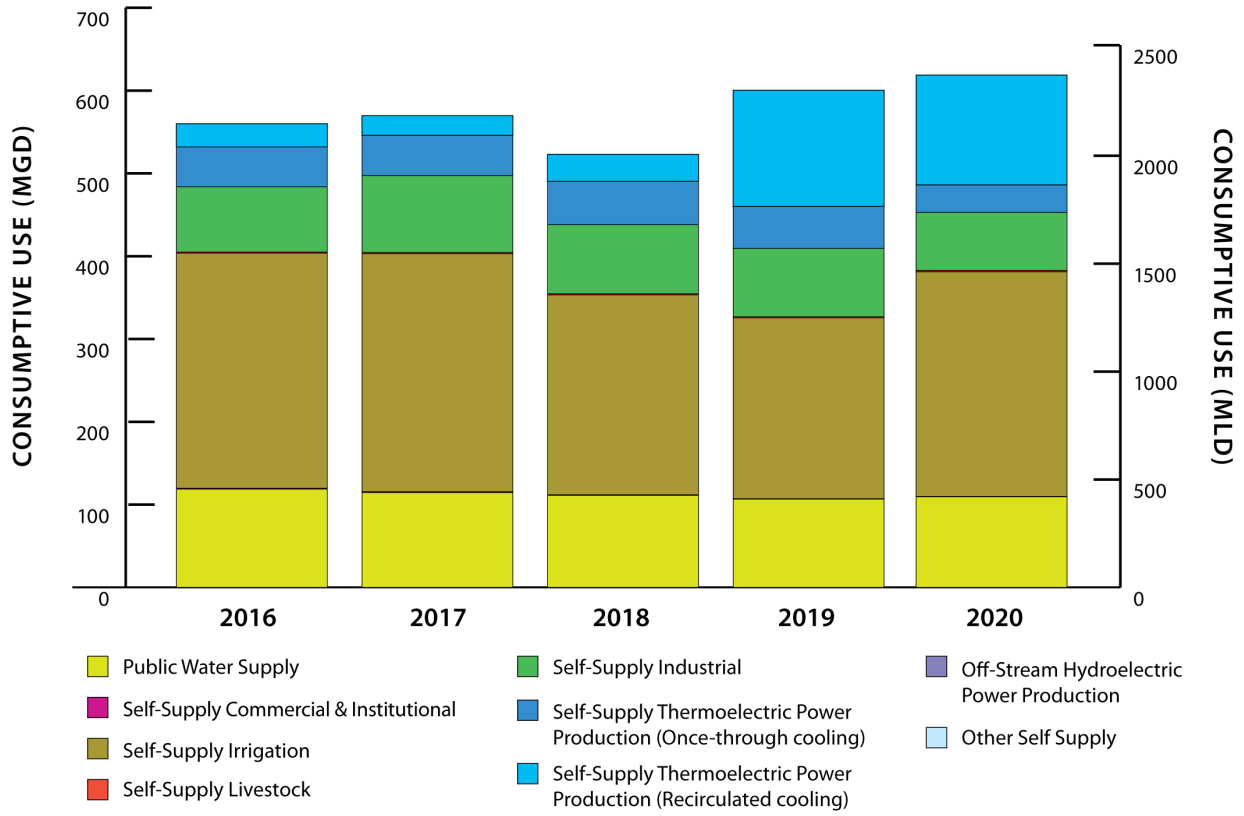

Figure 19. Michigan consumptive use by sector the last five years

Data collected for this report came from user reports to the Michigan Department of Environment, Great Lakes, and Energy, either directly or via the Michigan Department of Agriculture and Rural Development. These data were generated with estimated reporting compliance rates ranging from 60 to 99 percent of total water users, depending on the water use sector. The irrigation and livestock sectors saw declines in compliance due to challenges associated with a new reporting system. Water use for hydroelectric power generation is exempt from reporting requirements under Michigan statute.

Notable changes from 2019 water use by Michigan facilities include:

- A 276 percent (146 mgd or 553 mld) increase in self-supply livestock withdrawals, with a 48 percent (less than 1 mgd or 2 mld) increase in consumptive use for the sector. The withdrawal increase is largely attributable to increased water use at a fish hatchery, which has negligible consumptive use.
- A 24 percent (59 mgd or 222 mld) increase in withdrawal for self-supply irrigation and corresponding 24 percent increase in consumptive use (53 mgd or 200 mld) for the sector, primarily attributable to weather conditions requiring greater irrigation.

- A 15 percent (126 mgd or 475 mld) decrease in self-supply industrial sector withdrawals and an associated 13 mgd (47 mld) reduction in consumptive use due to decreased production, likely associated with the COVID-19 pandemic.
- A 34 percent (18 mgd or 66 mld) decrease in consumptive use for self-supply thermoelectric power production (once-through cooling), largely due to a reported decreased consumptive use rate at two facilities.
- A 21 percent (4 mgd or 14 mld) increase in withdrawals for other self-supply due to changes in needs for temporary construction dewatering projects.

Table 13a. Michigan 2020 Water Use Data Summary in mgd

Sector	Withdrawals				Diversions		Consumptive Use
	GLSW	OSW	GW	Total	Intrabasin	Interbasin	
Public Water Supply	670	13	193	876	0	0	109
Self-Supply Commercial and Institutional	0	0	3	3	0	0	0
Self-Supply Irrigation	1	65	236	301	0	0	271
Self-Supply Livestock	0	191	8	199	0	0	2
Self-Supply Industrial	220	368	111	699	0	0	70
Self-Supply Thermoelectric Power Production (Once-through cooling)	5,526	448	1	5,975	0	0	33
Self-Supply Thermoelectric Power Production (Recirculated cooling)	167	6	1	174	0	0	133
Off-Stream Hydroelectric Power Production	0	0	0	0	0	0	0
In-Stream Hydroelectric Water Use	0	0	0	0	0	0	0
Other Self Supply	0	7	13	20	0	0	0
Total	6,585	1,098	565	8,248	0	0	619

In millions of gallons per day; Water Sources: Great Lakes surface water (GLSW), other surface water (OSW) and groundwater (GW); totals may not sum exactly due to rounding

Table 13b. Michigan 2020 Water Use Data Summary in mld

Sector	Withdrawals				Diversions		Consumptive Use
	GLSW	OSW	GW	Total	Intrabasin	Interbasin	
Public Water Supply	2,538	47	730	3,315	0	0	414
Self-Supply Commercial and Institutional	1	1	10	13	0	0	1
Self-Supply Irrigation	2	245	894	1,141	0	0	1,027
Self-Supply Livestock	0	724	29	753	0	0	7
Self-Supply Industrial	832	1,393	419	2,644	0	0	265
Self-Supply Thermoelectric Power Production (Once-through cooling)	20,919	1,694	4	22,617	0	0	126
Self-Supply Thermoelectric Power Production (Recirculated cooling)	632	24	4	660	0	0	502
Off-Stream Hydroelectric Power Production	0	0	0	0	0	0	0
In-Stream Hydroelectric Water Use	0	0	0	0	0	0	0
Other Self Supply	2	26	49	77	0	0	0
Total	24,926	4,156	2,140	31,221	0	0	2,342

In millions of liters per day; Water Sources: Great Lakes surface water (GLSW), other surface water (OSW) and groundwater (GW); totals may not sum exactly due to rounding

Minnesota

The Minnesota portion of the Lake Superior watershed encompasses approximately 6,800 square miles.[11] Major river watersheds in the basin include the Cloquet, Nemadji and St. Louis River systems, as well as the north shore tributaries to Lake Superior.

Excluding in-stream hydroelectric water use (2,131 mgd or 8,066 mld), the total withdrawal amount from the basin for Minnesota was 1,866 mgd (7,065 mld), a decrease of 19 percent from the total withdrawn amount for 2019 (2,318 mgd or 8,775 mld). This change in withdrawal amount is largely due to a decrease in water use for off-stream hydroelectric power production, which is the sector with the greatest water use (1,648 mgd or 6,239 mld in 2020). The second largest use sector is self-supply industrial at 148 mgd (561 mld), which also decreased its withdrawal from 2019 and contributed to the overall decrease in Minnesota water use.

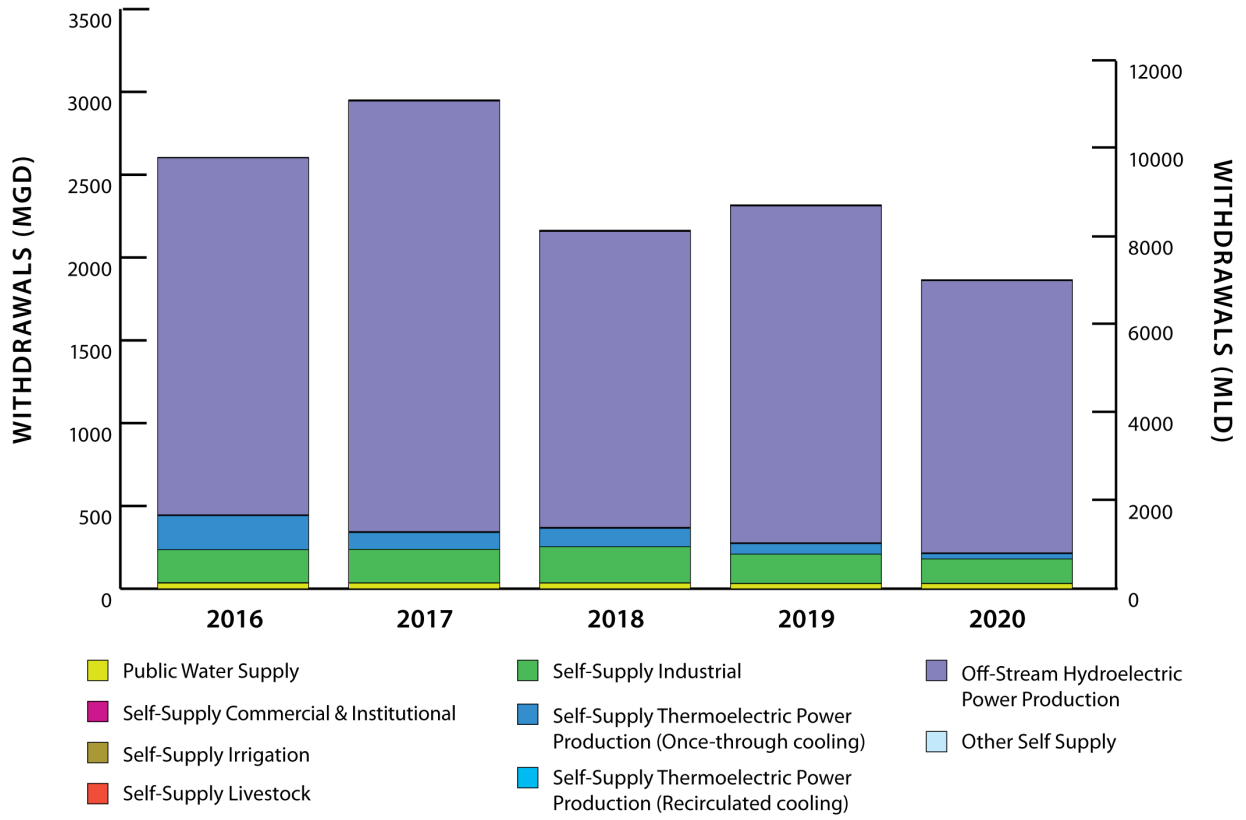

Figure 20. Minnesota water withdrawals by sector the last five years (excluding in-stream hydroelectric water use)

95 percent of total withdrawals came from other surface water within the Lake Superior watershed (1,777 mgd or 6,727 mld), while less than 5 percent, or 84 mgd (318 mld), came directly from Lake Superior. Less than 1 percent of withdrawals (5 mgd or 20 mld) were groundwater withdrawals. The large relative use of

[11] Minnesota Pollution Control Agency. https://www.pca.state.mn.us/water/watersheds

'other surface water' comes from water withdrawals for off-stream hydroelectric power production along the St. Louis River.

The total reported diversion amount of 15 mgd (56 mld) was almost exclusively for self-supply industrial purposes. A small amount of the outgoing diversion (0.03 mgd or 0.1 mld) was also reported for the self-supply irrigation sector. Total consumptive use was 19 mgd (71 mld), the majority of which was for industrial purposes (15 mgd or 56 mld).

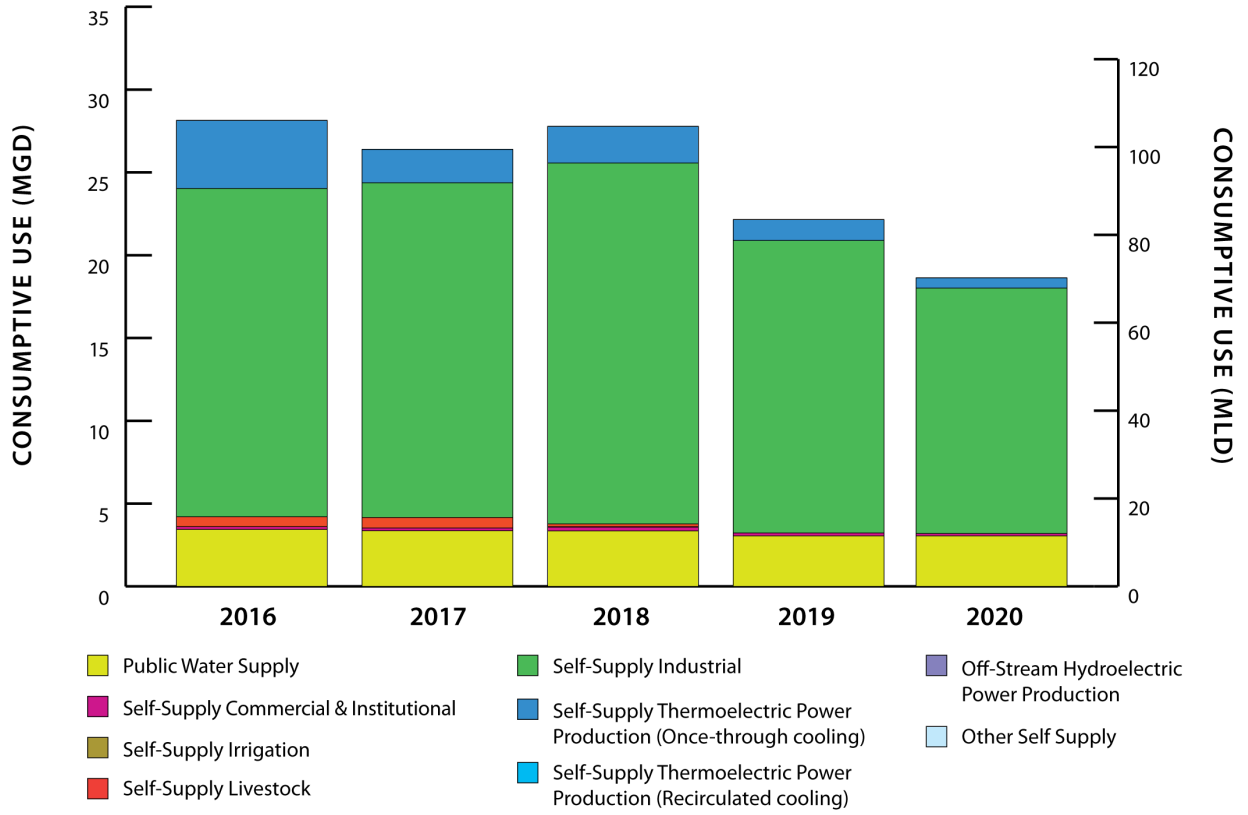

Figure 21. Minnesota consumptive use by sector the last five years

The water use data was provided by the Minnesota Department of Natural Resources, which collected measured water use data from water withdrawal permit holders with 100 percent reporting compliance from permitted water withdrawal facilities.

Notable changes from 2019 water use by Minnesota facilities include:

- A 50 percent (32 mgd or 120 mld) decrease in water withdrawals for self-supply thermoelectric power production (once-through cooling) due to decreased use at two utilities, consistent with standard fluctuations and market demand.
- A 16 percent (28 mgd or 197 mld) decrease in self-supply industrial sector water withdrawals, with corresponding decreases in consumptive use (3 mgd or 11 mld decrease). This reduction is largely attributed to reduced water use for mining.

- A 19 percent (391 mgd or 1480 mld) decrease in withdrawal for off-stream hydroelectric power production, a change resulting from normal fluctuations in river flow.
- A 15 percent (2 mgd or 7 mld) increase in the total diversions. Increases in both the self-supply industrial and self-supply irrigation sector diversions are attributable to normal fluctuations in operations.

Table 14a. Minnesota 2020 Water Use Data Summary in mgd

Sector	Withdrawals				Diversions		Consumptive Use
	GLSW	OSW	GW	Total	Intrabasin	Interbasin	
Public Water Supply	24	1	5	31	0	0	3
Self-Supply Commercial and Institutional	1	0	0	1	0	0	0
Self-Supply Irrigation	0	0	0	0	0	0	0
Self-Supply Livestock	0	0	0	0	0	0	0
Self-Supply Industrial	45	103	0	148	0	15	15
Self-Supply Thermoelectric Power Production (Once-through cooling)	14	17	0	31	0	0	1
Self-Supply Thermoelectric Power Production (Recirculated cooling)	0	0	0	0	0	0	0
Off-Stream Hydroelectric Power Production	0	1,648	0	1,648	0	0	0
In-Stream Hydroelectric Water Use	0	2,131	0	2,131	0	0	0
Other Self Supply	0	7	0	7	0	0	0
Total	84	3,908	5	3,997	0	15	19

In millions of gallons per day; Water Sources: Great Lakes surface water (GLSW), other surface water (OSW) and groundwater (GW); totals may not sum exactly due to rounding

Table 14b. Minnesota 2020 Water Use Data Summary in mld

Sector	Withdrawals				Diversions		Consumptive Use
	GLSW	OSW	GW	Total	Intrabasin	Interbasin	
Public Water Supply	91	5	19	116	0	0	12
Self-Supply Commercial and Institutional	4	1	0	5	0	0	1
Self-Supply Irrigation	0	0	0	0	0	0	0
Self-Supply Livestock	0	0	0	0	0	0	0
Self-Supply Industrial	170	391	0	561	0	56	56
Self-Supply Thermoelectric Power Production (Once-through cooling)	53	65	1	119	0	0	2
Self-Supply Thermoelectric Power Production (Recirculated cooling)	0	0	0	0	0	0	0
Off-Stream Hydroelectric Power Production	0	6,239	0	6,239	0	0	0
In-Stream Hydroelectric Water Use	0	8,066	0	8,066	0	0	0
Other Self Supply	0	25	0	25	0	0	0
Total	318	14,793	20	15,131	0	56	71

In millions of liters per day; Water Sources: Great Lakes surface water (GLSW), other surface water (OSW) and groundwater (GW) totals may not sum exactly due to rounding

New York

Approximately 80 percent of New York state's fresh surface water, over 700 miles of shoreline, and nearly 48 percent of New York land, are contained in the watersheds of Lake Erie, Lake Ontario, and the St. Lawrence River, including the Lake Champlain and Lake George watersheds. More than four million New Yorkers depend on the fresh water of these watersheds for drinking water.[12]

Excluding in-stream hydroelectric water use (233,186 mgd or 882,705 mld), the total withdrawal amount from the basin for New York was 3,402 mgd (12,878 mld), an approximately 3 percent decrease from 2019 water use (3,489 mgd or 13,208 mld). Most withdrawals were from the Lake Ontario watershed, with 2,919 mgd (11,048 mld) withdrawn, 86 percent of New York's total withdrawal from the basin.

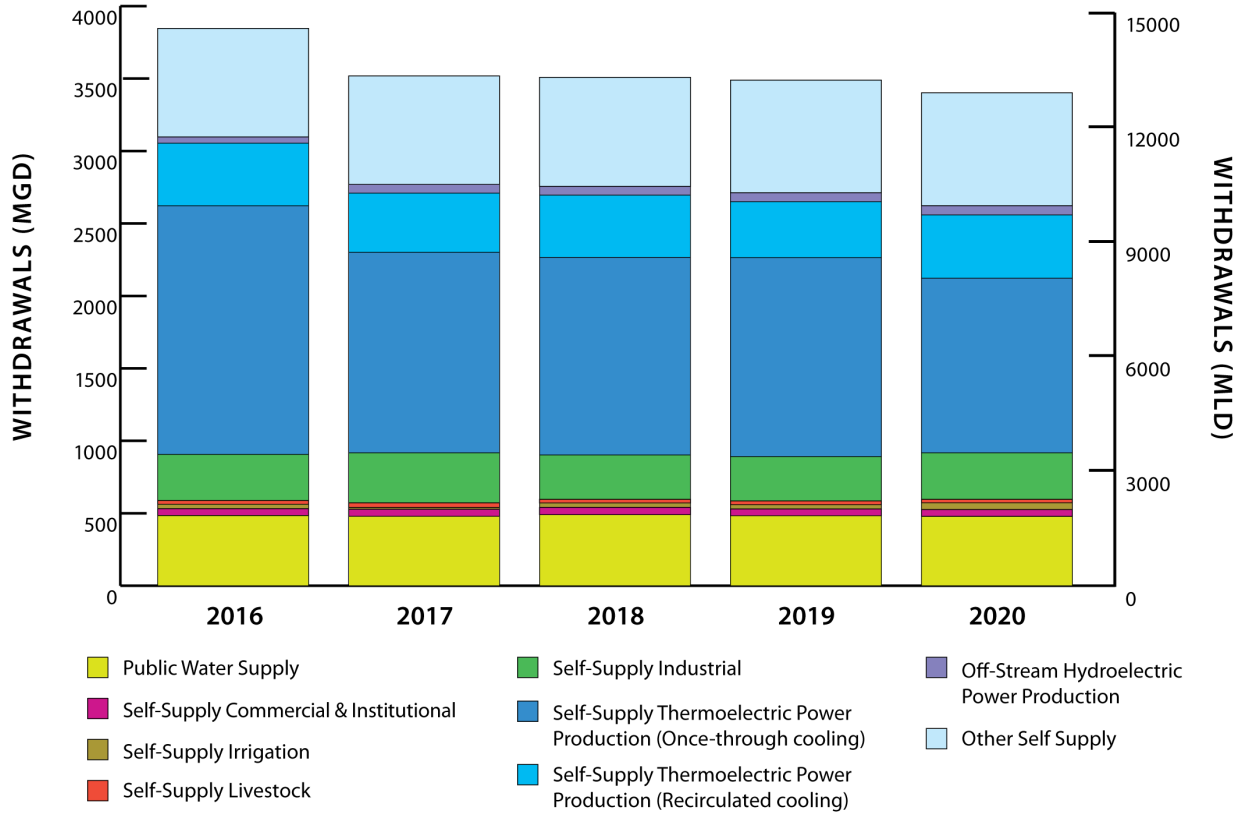

Figure 22. New York water withdrawals by sector the last five years (excluding in-stream hydroelectric water use)

The self-supply thermoelectric power production sectors (both once-through and recirculated cooling) withdrew 1,642 mgd (6,214 mld), which represented 48 percent of the total withdrawal amount. Other self-supply was the next largest water use sector, withdrawing 779 mgd (2,949 mld) and accounting for 23 percent of the total withdrawals. For the Lake Erie and Lake Ontario watersheds, Great Lakes surface water

[12] Great Lakes Basin Advisory Council. 2010. Our Great Lakes Water Resources: Conserving and Protecting Our Water Today for Use Tomorrow Final Report. http://www.dec.ny.gov/docs/regions_pdf/glbacfrpt.pdf

was the primary source of water, when in-stream hydroelectric is excluded. For the St. Lawrence River watershed, other surface water was the primary source of water, when in-stream hydroelectric is excluded.

The 2020 total (net) diversion amount for New York was 45 mgd (171 mld), the majority of which (32 mgd or 121 mld) was from Lake Ontario for the Erie Barge Canal. The balance of the diversion, 13 mgd or 50 mld, was for public supply[13]. The total consumptive use amount was 263 mgd (997 mld). The largest consumptive uses were attributed to the self-supply industrial sector at 69 mgd (259 mld) and public water supply at 60 mgd (226 mld).

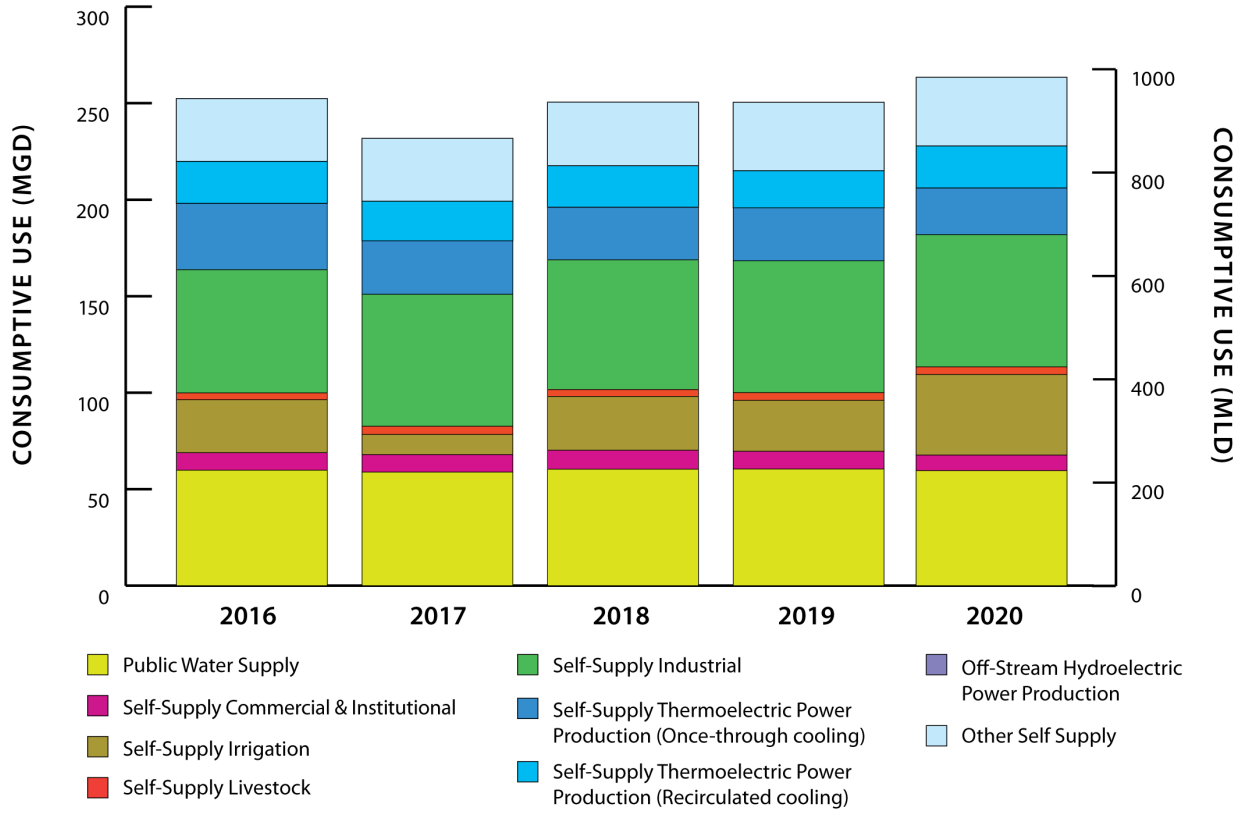

Figure 23. New York consumptive use by sector the last five years

The water use data was provided by the New York State Department of Environmental Conservation. The data collected was metered and reported by each user. Reporting compliance varied among the water use sectors from 86 percent for the self-supply commercial and institutional sector to 100 percent for the hydroelectric power production, self-supply thermoelectric power production (once-through cooling), and other self-supply sectors. These compliance rates encompass all facilities, including those with water use under the reporting threshold. New York has focused on enhanced permit management and QA/QC practices, and in 2020, achieved 100 percent reporting compliance for all sectors among facilities with water use above the reporting threshold. New York's five-year implementation of permits for water withdrawal was completed during 2017. The permits include an ongoing requirement to report water use, which should

[13] 11 mgd for City of Rome from Lake Ontario, 2 mgd for City of Glens Falls from the St. Lawrence River

support continued improvement in compliance. Additionally, reporting facilities are required to complete a water conservation program and corresponding report section that includes conservation and efficiency measures. These measures include source metering, water auditing, leak detection and repair, recycling and reuse, and reductions during periods of drought.

Notable changes from 2019 water use by New York facilities include:

- A 58 percent (17 mgd or 65 mld) increase in water withdrawals and consumptive uses (15 mgd or 58 mld) for self-supply irrigation due to changes in demand associated with weather and increased reporting compliance.
- A 13 percent (51 mgd or 191 mld) increase in water withdrawals for the self-supply thermoelectric power production (recirculated cooling) sector, which is consistent with typical fluctuations.
- A 12 percent (168 mgd or 635 mld) decrease in water withdrawals for self-supply thermoelectric power production (once-through cooling), which can be attributed to normal fluctuations.
- An 8 percent (1 mgd or 4 mld) increase in diversions for the public water supply sector, which is consistent with typical fluctuations in water use.

Table 15a. New York 2020 Water Use Data Summary in mgd

Sector	Withdrawals				Diversions		Consumptive Use
	GLSW	OSW	GW	Total	Intrabasin	Interbasin	
Public Water Supply	297	166	16	478	0	13	60
Self-Supply Commercial and Institutional	0	47	1	48	0	0	8
Self-Supply Irrigation	1	37	9	46	0	0	42
Self-Supply Livestock	0	14	10	24	0	0	4
Self-Supply Industrial	130	185	5	321	0	0	69
Self-Supply Thermoelectric Power Production (Once-through cooling)	1,122	84	0	1,205	0	0	24
Self-Supply Thermoelectric Power Production (Recirculated cooling)	436	0	0	436	0	0	22
Off-Stream Hydroelectric Power Production	0	64	0	64	0	0	0
In-Stream Hydroelectric Water Use	152,278	80,908	0	233,186	0	0	0
Other Self Supply	0	779	0	779	0	32	36
Total	154,263	82,284	41	236,588	0	45	263

In millions of gallons per day; Water Sources: Great Lakes surface water (GLSW), other surface water (OSW) and groundwater (GW); totals may not sum exactly due to rounding

Table 15b. New York 2020 Water Use Data Summary in mld

Sector	Withdrawals				Diversions		Consumptive Use
	GLSW	OSW	GW	Total	Intrabasin	Interbasin	
Public Water Supply	1,123	627	60	1,810	0	50	226
Self-Supply Commercial and Institutional	0	177	4	181	0	0	31
Self-Supply Irrigation	2	141	33	176	0	0	158
Self-Supply Livestock	0	54	38	91	0	0	15
Self-Supply Industrial	492	701	20	1,214	0	0	259
Self-Supply Thermoelectric Power Production (Once-through cooling)	4,245	318	0	4,563	0	0	91
Self-Supply Thermoelectric Power Production (Recirculated cooling)	1,651	0	0	1,651	0	0	83
Off-Stream Hydroelectric Power Production	0	242	0	242	0	0	0
In-Stream Hydroelectric Water Use	576,435	306,270	0	882,705	0	0	0
Other Self Supply	0	2,949	0	2,949	0	121	135
Total	583,949	311,479	155	895,583	0	171	997

In millions of liters per day; Water Sources: Great Lakes surface water (GLSW), other surface water (OSW) and groundwater (GW); totals may not sum exactly due to rounding

Ohio

Ohio's portion of the Lake Erie watershed drains 11,649 square miles and is home to 4.65 million people. Ohio's 312-mile shoreline includes the cities of Toledo, Sandusky, and Cleveland. Agricultural row crops account for 59 percent of the land use in the Ohio watersheds draining to Lake Erie, followed by urban residential and commercial land use at a combined 16 percent. Another 16 percent are forested lands and wetlands, and pastureland makes up another five percent of total land use.[14]

The 2020 total reported withdrawal amount from the basin for Ohio was 1,176 mgd (4,451 mld), a 6 percent decrease from the total withdrawal amount for 2019 (1,246 mgd or 4,716 mld). The primary water use sectors included public water supply, withdrawing 515 mgd or 1,948 mld and representing 44 percent of the total withdrawal amount, and self-supply thermoelectric power production (once-through and recirculated cooling) at 415 mgd (1,571 mld), accounting for 35 percent of the total withdrawal amount. The source for 57 percent of the total withdrawal amount was Lake Erie. However, within specific sectors, other surface water was the predominant source of water, with 86 percent of self-supply irrigation water withdrawals and 66 percent of self-supply thermoelectric power production (once-through cooling) water withdrawals coming from other surface water.

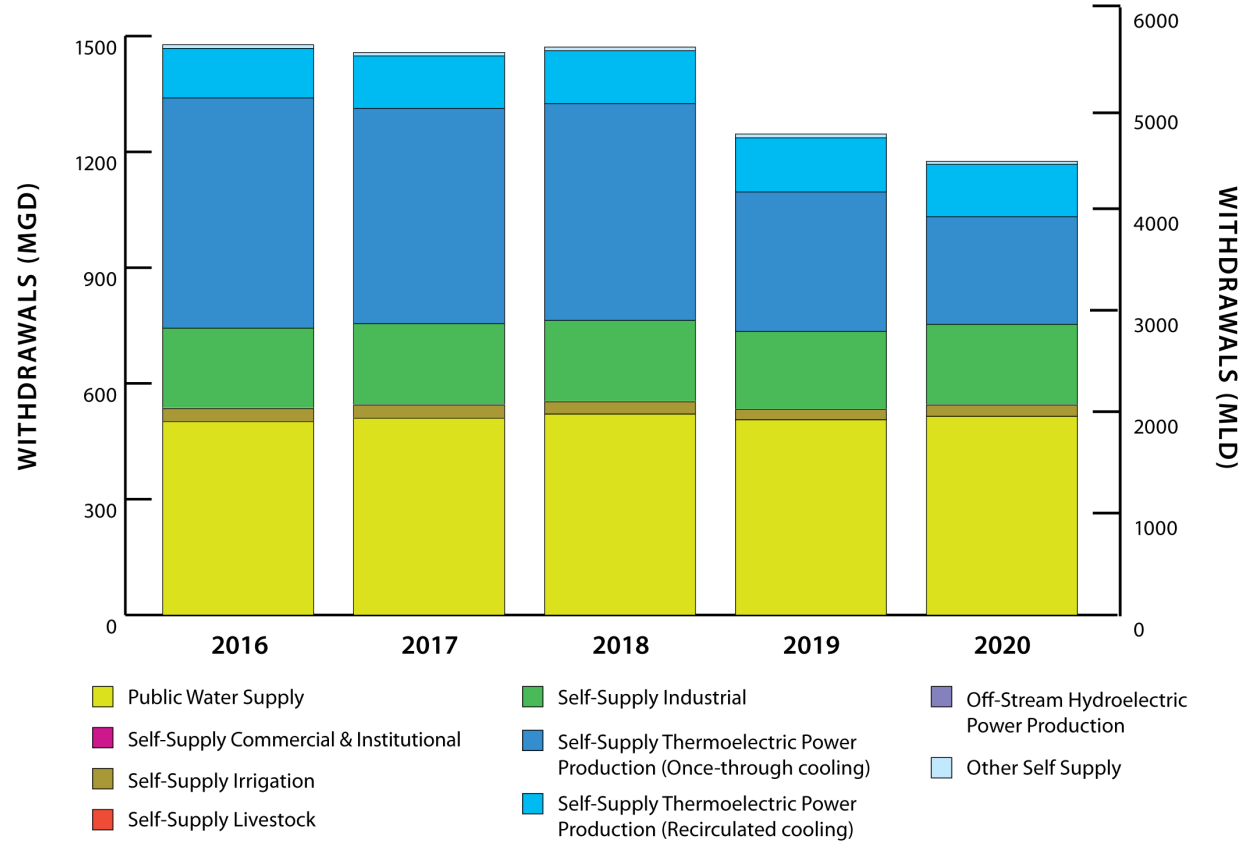

Figure 24. Ohio water withdrawals by sector the last five years

[14] Ohio Environmental Protection Agency. 2010. Ohio Lake Erie Phosphorus Task Force Final Report. http://www.epa.ohio.gov/portals/35/lakeerie/ptaskforce/Task_Force_Final_Report_April_2010.pdf

The total (net) diversion amount was 27 mgd (102 mld) into the Lake Erie watershed.[15] Diversions out of the Lake Erie watershed totaled 12 mgd (47 mld), all for public water supply purposes, and were offset by 40 mgd (150 mld) of incoming diversions, primarily associated with other self-supply (28 mgd or 106), and diversion returns (10 mgd or 40 mld). Additional small incoming diversions were reported for self-supply livestock (less than 0.5 mgd or 1 mld) and public water supply (net 1 mgd or 2 mld). Total consumptive use was 127 mgd (480 mld). 61 percent of the total consumptive use was attributed to the public water supply sector.

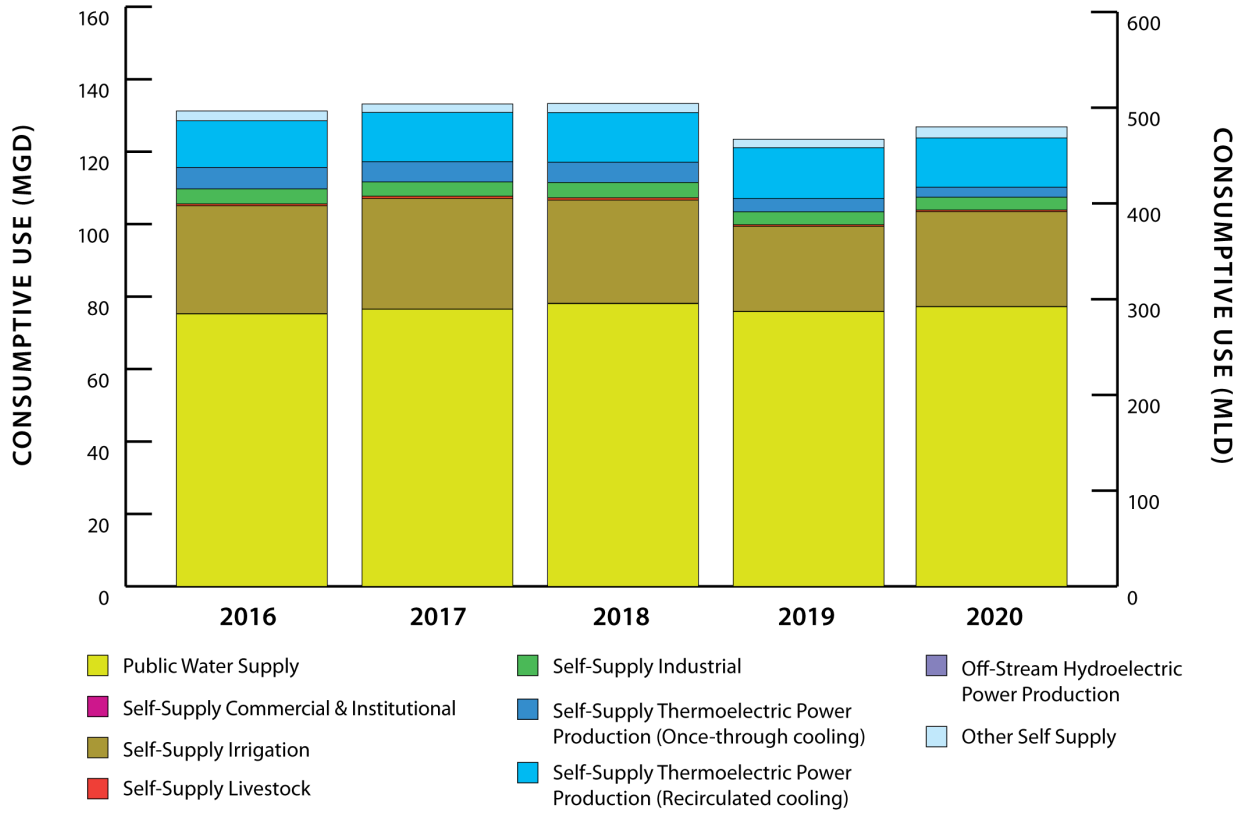

Figure 25. Ohio consumptive use by sector the last five years

The water use data was provided by the Ohio Department of Natural Resources with a 99 to 100 percent reporting compliance, depending on the sector. 2019 water use was reported as estimated 2020 water use for two small public water supply facilities that did not report in 2020.

Notable changes from 2019 water use by Ohio facilities include:

- A 23 percent (83 mgd or 314 mld) decrease in water withdrawals for the self-supply thermoelectric power production (once-through cooling) sector due to several units at a plant going offline in preparation for facility closure in 2022.

[15] Incoming diversions are reported as negative values in the database and on tables.

- A 19 percent (2 mgd or 7 mld) decrease in water use for other self-supply, largely attributable to decreased water use at tourist attractions. Consumptive use for the other self-supply sector increased by 31 percent (less than 1 mgd or 3 mld), likely because the facilities that decreased in withdrawals had relatively low consumptive use coefficients, while other facilities with higher consumptive use coefficients increased water withdrawals based on normal fluctuations in operations.
- A 12 percent (3 mgd or 12 mld) increase in water withdrawals and consumptive use (3 mgd or 10 mld) for self-supply irrigation due to changes in demand associated with weather and additional facilities increasing water use above the reporting threshold.

Table 16a. Ohio 2020 Water Use Data Summary in mgd

Sector	Withdrawals				Diversions		Consumptive Use
	GLSW	OSW	GW	Total	Intrabasin	Interbasin	
Public Water Supply	383	104	28	515	0	1	77
Self-Supply Commercial and Institutional	0	0	0	0	0	0	0
Self-Supply Irrigation	1	25	3	29	0	0	26
Self-Supply Livestock	0	0	1	1	0	0	0
Self-Supply Industrial	65	98	45	208	0	0	4
Self-Supply Thermoelectric Power Production (Once-through cooling)	95	184	0	279	0	0	3
Self-Supply Thermoelectric Power Production (Recirculated cooling)	136	0	0	136	0	0	14
Off-Stream Hydroelectric Power Production	0	0	0	0	0	0	0
In-Stream Hydroelectric Water Use	0	0	0	0	0	0	0
Other Self Supply	2	5	1	8	0	-28	3
Total	681	417	78	1,176	0	-27	127

In millions of gallons per day Water Sources: Great Lakes surface water (GLSW), other surface water (OSW) and groundwater (GW); totals may not sum exactly due to rounding

Table 16b. Ohio 2020 Water Use Data Summary in mld

Sector	Withdrawals				Diversions		Consumptive Use
	GLSW	OSW	GW	Total	Intrabasin	Interbasin	
Public Water Supply	1,448	395	105	1,948	0	5	292
Self-Supply Commercial and Institutional	1	0	0	2	0	0	0
Self-Supply Irrigation	2	95	13	110	0	0	99
Self-Supply Livestock	0	0	2	2	0	-1	2
Self-Supply Industrial	245	372	171	788	0	0	13
Self-Supply Thermoelectric Power Production (Once-through cooling)	358	698	0	1,056	0	0	11
Self-Supply Thermoelectric Power Production (Recirculated cooling)	515	0	0	515	0	0	51
Off-Stream Hydroelectric Power Production	0	0	0	0	0	0	0
In-Stream Hydroelectric Water Use	0	0	0	0	0	0	0
Other Self Supply	9	17	3	30	0	-106	12
Total	2,579	1,578	294	4,451	0	-102	480

In millions of liters per day; Water Sources: Great Lakes surface water (GLSW), other surface water (OSW) and groundwater (GW); totals may not sum exactly due to rounding

Ontario

More than 98 percent of Ontario residents live within the Great Lakes-St. Lawrence River Basin. Ontario's portion of the Great Lakes forms the longest freshwater coastline in the world, stretching more than 6,200 miles (10,000 kilometers) across five major watersheds in the Great Lakes-St. Lawrence River system: Lake Superior, Lake Huron, Lake Erie, Lake Ontario, and the St. Lawrence River watersheds.[16]

Excluding in-stream hydroelectric water use (reported amount of 254,836 mgd or 964,658 mld), a total of 15,362 mgd or 58,152 mld was withdrawn from the basin, a nominal decrease from 2019 water use. Self-supply thermoelectric power production (once-through cooling) accounted for 86 percent of the withdrawal amount with 13,199 mgd (49,962 mld). The next largest water use sectors were public supply at 1,122 mgd (4,247 mld) and self-supply industrial at 961 mgd (3,638 mld). Lake Ontario water withdrawals (7,459 mgd or 28,235 mld) and Lake Huron water withdrawals (7,201 mgd or 27,257 mld) collectively accounted for over 95 percent of water use in Ontario. Great Lakes surface water was the primary source for withdrawals in the Lake Superior, Lake Huron, Lake Erie, and Lake Ontario watersheds, while other surface water was the primary source for withdrawals in the St. Lawrence River watershed.

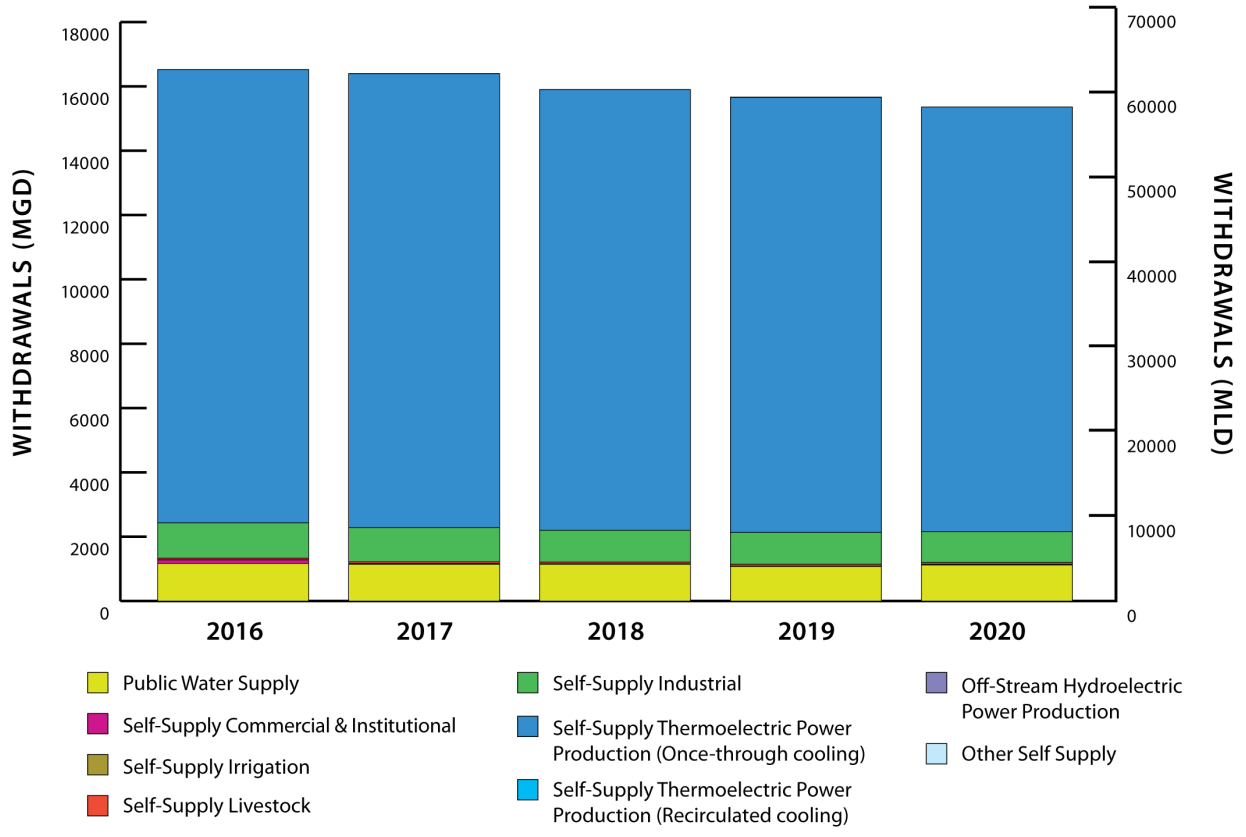

Figure 26. Ontario water withdrawals by sector the last five years (excluding in-stream hydroelectric water use)

[16] Ontario's Great Lakes Strategy, 2016. https://www.ontario.ca/page/ontarios-great-lakes-strategy

No diversions out of the Great Lakes-St. Lawrence River basin were reported for Ontario, while 2,735 mgd (10,354 mld) of water was diverted into the Lake Superior basin[17], associated with the Long Lac and Ogoki diversions. The Welland Canal is entirely within Ontario and functions as two intrabasin transfers (one out of the Lake Erie Basin and one into the Lake Ontario Basin). These transfers effectively cancel each other out, resulting in a net zero intrabasin transfer. For more information about the volume of these transfers, see the Lake Erie Basin section above. Similarly, additional intrabasin diversions for public drinking water supply between Lakes Huron, Erie, and Ontario were reported but did not result in a net transfer.

The total consumptive use amount was approximately 345 mgd (1,307 mld). The three water use sectors representing the largest consumptive uses were public water supply at 135 mgd (510 mld), self-supply thermoelectric power at 119 mgd (450 mld), and self-supply industrial at 79 mgd (299 mld). Use associated with intrabasin diversions accounted for less than 2 percent of the total consumptive use with 6 mgd (21 mld) of consumptive use.

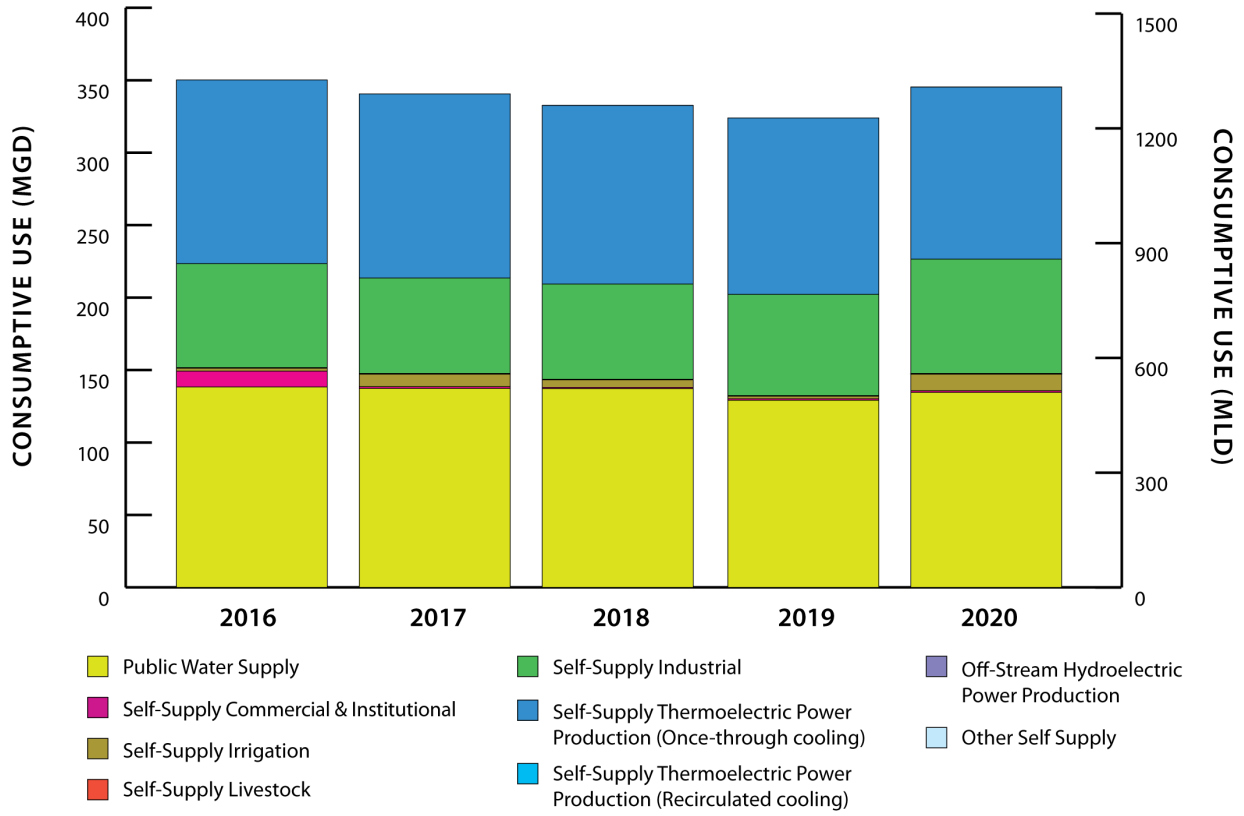

Figure 27. Ontario consumptive use by sector the last five years

The data was provided by the Ontario Ministry of Northern Development, Mines, Natural Resources and Forestry and the Ontario Ministry of Environment, Conservation and Parks and was collected primarily through the provincial water taking and reporting system. Some estimates based on the 2019 reported use

[17] Incoming diversions are reported as negative values in the database and on tables.

were used in the absence of 2020 data, including for the intrabasin diversions for public water supply, and for in-stream hydroelectric water use. Reporting compliance varied among water use sectors from 90 percent for the self-supply livestock and self-supply industrial sectors to 100 percent for self-supply thermoelectric power production (once-through cooling).

Notable changes from 2019 water use by Ontario facilities include:

- An increase (11 mgd or 43 mld) in water withdrawals in the self-supply irrigation sector, with corresponding increases in consumptive use for irrigation (10 mgd or 37 mld) associated with drier conditions in areas of the basin requiring increased use, including several facilities that previously withdrew water at levels below the reporting threshold. These amounts have since been corrected to account for a data reporting and processing error and are reflected in the database as a 175 percent increase (4 mgd or 14 mld) in water withdrawals, with a corresponding increase in consumptive use (3 mgd or 12 mld).
- A 43 percent (3 mgd or 13 mld) decrease in water withdrawals in the other self-supply sector, largely attributable to a facility being reclassified as a self-supply industrial sector facility.
- A 12 percent (9 mgd or 34 mld) increase in consumptive use in the self-supply industrial sector, despite a 3 percent decrease in water withdrawals for the sector, because several facilities with increased use were facilities with relatively high consumptive use coefficients.
- A 21 percent (738 mgd or 2,794 mld) decrease in amount of water diverted into the Great Lakes basin, though changes in diversions are also associated with other water balance needs. The 2020 reported diversions are over 20 percent less than the long-term average diversions.

Table 17a. Ontario 2020 Water Use Data Summary in mgd

Sector	Withdrawals				Diversions		Consumptive Use
	GLSW	OSW	GW	Total	Intrabasin	Interbasin	
Public Water Supply	791	232	99	1,122	0	0	135
Self-Supply Commercial and Institutional	1	7	1	9	0	0	1
Self-Supply Irrigation	2	4	7	13	0	0	11
Self-Supply Livestock	0	31	23	54	0	0	0
Self-Supply Industrial	458	376	127	961	0	0	79
Self-Supply Thermoelectric Power Production (Once-through cooling)	13,173	26	0	13,199	0	0	119
Self-Supply Thermoelectric Power Production (Recirculated cooling)	0	0	0	0	0	0	0
Off-Stream Hydroelectric Power Production	0	0	0	0	0	0	0
In-Stream Hydroelectric Water Use	136,975	117,861	0	254,836	0	-2,735	0
Other Self Supply	0	2	2	4	0	0	0
Total	151,400	118,539	259	270,198	0	-2,735	345

In millions of gallons per day; Water Sources: Great Lakes surface water (GLSW), other surface water (OSW) and groundwater (GW); totals may not sum exactly due to rounding.

** The intrabasin diversions reported effectively cancel each other out, resulting in a net zero intrabasin transfer. For more information about the volume of these transfers, see the Lake Basin sections above.*

Table 17b. Ontario 2020 Water Use Data Summary in mld

Sector	Withdrawals				Diversions		Consumptive Use
	GLSW	OSW	GW	Total	Intrabasin	Interbasin	
Public Water Supply	2,995	878	374	4,247	0	0	510
Self-Supply Commercial and Institutional	2	27	4	34	0	0	4
Self-Supply Irrigation	9	15	27	51	0	0	43
Self-Supply Livestock	0	116	88	204	0	0	2
Self-Supply Industrial	1,733	1,425	480	3,638	0	0	299
Self-Supply Thermoelectric Power Production (Once-through cooling)	49,864	98	0	49,962	0	0	450
Self-Supply Thermoelectric Power Production (Recirculated cooling)	0	0	0	0	0	0	0
Off-Stream Hydroelectric Power Production	0	0	0	0	0	0	0
In-Stream Hydroelectric Water Use	518,508	446,151	0	964,658	0	-10,354	0
Other Self Supply	0	8	8	16	0	0	0
Total	573,111	448,718	982	1,022,811	0	-10,354	1,307

In millions of liters per day; Water Sources: Great Lakes surface water (GLSW), other surface water (OSW) and groundwater (GW); totals may not sum exactly due to rounding.

** The intrabasin diversions reported effectively cancel each other out, resulting in a net zero intrabasin transfer. For more information about the volume of these transfers, see the Lake Basin sections above.*

Pennsylvania

The Pennsylvania portion of the Lake Erie watershed spans 511 square miles and is home to approximately 237,000 people concentrated along the 77 miles of Lake Erie coastline[18]. Pennsylvania also contains 99 square miles in the Lake Ontario basin, encompassing the headwaters of the Genesee River. Approximately 2,400 people live in Pennsylvania's portion of the Lake Ontario basin. The largest land uses in Pennsylvania's portion of the basin are agriculture and forest.[19]

The total withdrawal amount from the basin for Pennsylvania was 30 mgd (114 mld), a 21 percent reduction from the 2019 reported withdrawal of 38 mgd (143 mld). 91 percent (27 mgd or 103 mld) of the total withdrawal amount was used for public water supply purposes.

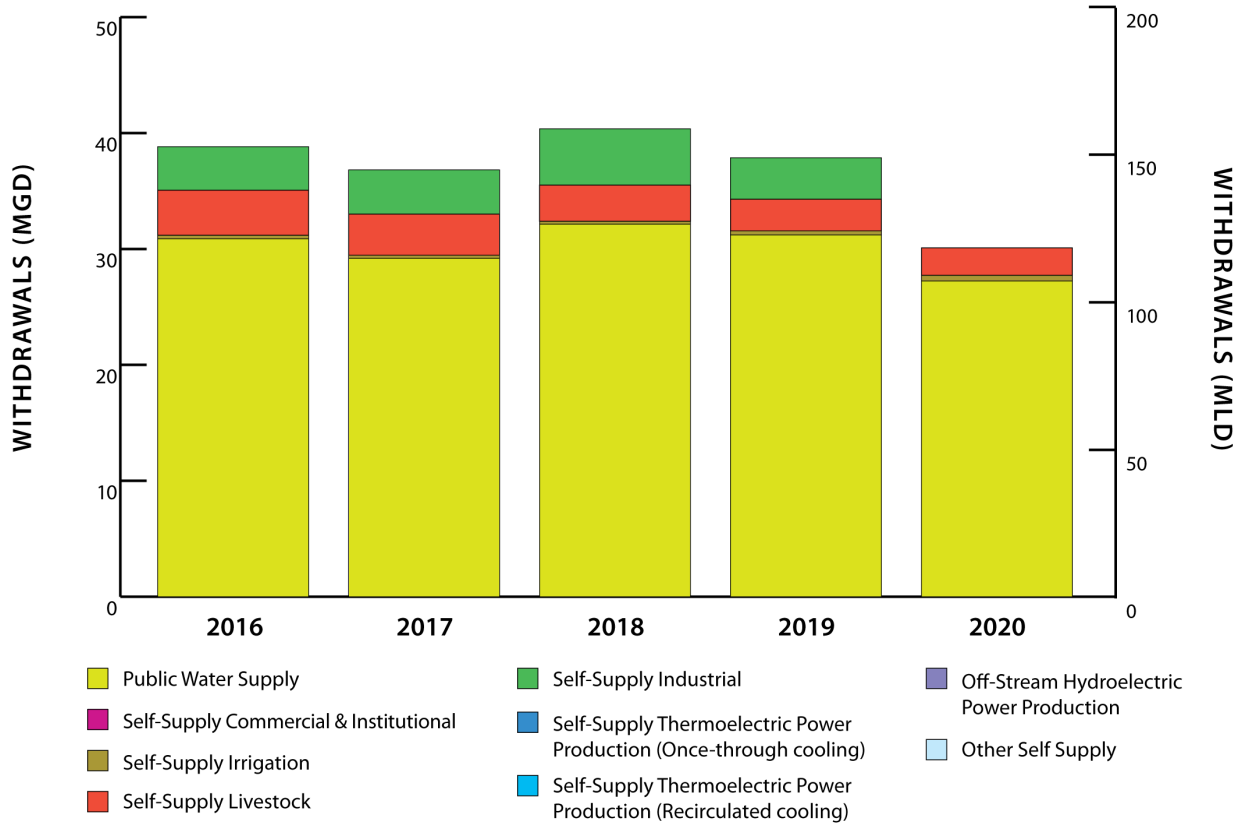

Figure 28. Pennsylvania water withdrawals by sector the last five years

[18] Pennsylvania Department on Environmental Protection Coastal Resources Management Program, https://www.dep.pa.gov/Business/Water/Compacts%20and%20Commissions/Coastal%20Resources%20Management%20Program/Pages/About-the-Program.aspx

[19] Pennsylvania Department of Environmental Protection, Pennsylvania's Watershed Regions: Great Lakes, http://files.dep.state.pa.us/Water/Division%20of%20Planning%20and%20Conservation/StateWaterPlan/WaterAtlas/05-great_lakes_region.pdf

No diversions were reported in 2020. The total consumptive use was 3 mgd (10 mld). The public water supply sector made up the majority (83 percent) of the total consumptive use.

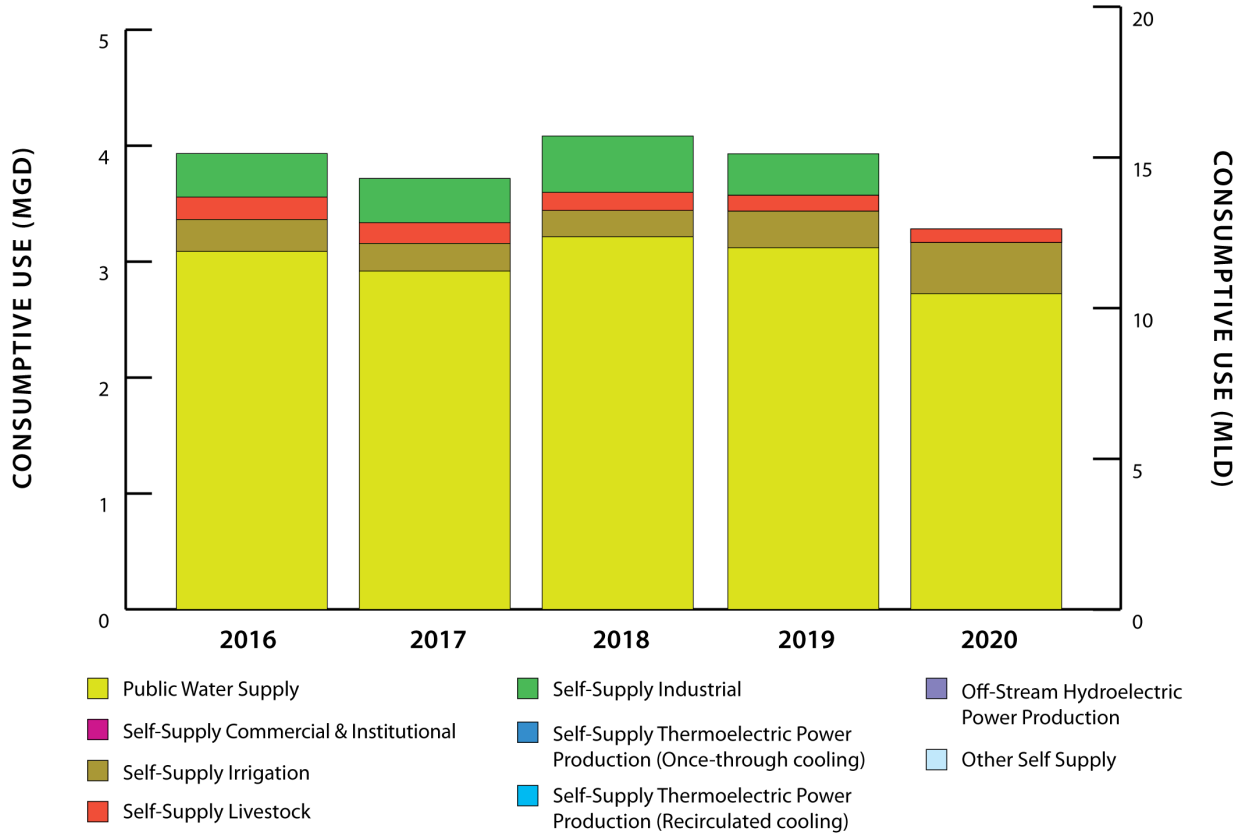

Figure 29. Pennsylvania consumptive use by sector the last five years

The water use data was provided by the Pennsylvania Department of Environmental Protection (DEP). Reporting compliance varied among water use sectors from 90 percent for the self-supply livestock sector to 100 percent for the self-supply commercial and institutional, self-supply industrial, and other self-supply sectors. Depending upon sector, withdrawals were either metered, partially metered, or calculated.

Notable changes from 2019 water use by Pennsylvania facilities include:

- A 13 percent (4 mgd or 15 mld) decrease in water use for public water supply associated with normal fluctuations in use.
- No water use for the self-supply industrial sector was recorded for reporting, after 4 mgd or 14 mld was reported in 2019. One large facility went out of business and another facility reported water use below the threshold.

Although several other sectors experienced substantially large relative changes in water withdrawal from 2019, these changes fell within typical fluctuations and the large relative differences could largely be attributed to the small total volume of water withdrawn.

Table 18a. Pennsylvania 2020 Water Use Data Summary in mgd

Sector	Withdrawals				Diversions		Consumptive Use
	GLSW	OSW	GW	Total	Intrabasin	Interbasin	
Public Water Supply	26	0	2	27	0	0	3
Self-Supply Commercial and Institutional	0	0	0	0	0	0	0
Self-Supply Irrigation	0	0	0	0	0	0	0
Self-Supply Livestock	0	1	1	2	0	0	0
Self-Supply Industrial	0	0	0	0	0	0	0
Self-Supply Thermoelectric Power Production (Once-through cooling)	0	0	0	0	0	0	0
Self-Supply Thermoelectric Power Production (Recirculated cooling)	0	0	0	0	0	0	0
Off-Stream Hydroelectric Power Production	0	0	0	0	0	0	0
In-Stream Hydroelectric Water Use	0	0	0	0	0	0	0
Other Self Supply	0	0	0	0	0	0	0
Total	26	2	3	30	0	0	3

In millions of gallons per day; Water Sources: Great Lakes surface water (GLSW), other surface water (OSW) and groundwater (GW); totals may not sum exactly due to rounding

Table 18b. Pennsylvania 2020 Water Use Data Summary in mld

Sector	Withdrawals				Diversions		Consumptive Use
	GLSW	OSW	GW	Total	Intrabasin	Interbasin	
Public Water Supply	97	0	6	103	0	0	10
Self-Supply Commercial and Institutional	0	0	0	0	0	0	0
Self-Supply Irrigation	1	1	0	2	0	0	2
Self-Supply Livestock	0	5	4	9	0	0	0
Self-Supply Industrial	0	0	0	0	0	0	0
Self-Supply Thermoelectric Power Production (Once-through cooling)	0	0	0	0	0	0	0
Self-Supply Thermoelectric Power Production (Recirculated cooling)	0	0	0	0	0	0	0
Off-Stream Hydroelectric Power Production	0	0	0	0	0	0	0
In-Stream Hydroelectric Water Use	0	0	0	0	0	0	0
Other Self Supply	0	0	0	0	0	0	0
Total	97	6	10	114	0	0	12

In millions of liters per day; Water Sources: Great Lakes surface water (GLSW), other surface water (OSW) and groundwater (GW); totals may not sum exactly due to rounding

Québec

Much of Québec's population lives in the Great-Lakes St. Lawrence River watershed. The portion of the St. Lawrence River included in the Great Lakes-St. Lawrence Basin Agreement territory includes the Montréal metropolitan area that represents nearly 50 percent of Québec's population. Some of the tributaries with the greatest flow within that portion are the Outaouais (Ottawa) River, the Richelieu River, and the St. François River.

The total withdrawal amount from the basin for Québec was 1,220 mgd (4,616 mld), a marginal (less than two percent) decrease from the 2019 withdrawal total of 1,235 mgd (4,675 mld). 72 percent of the withdrawal was used for public water supply purposes at 881 mgd (3,335 mld). The self-supply industrial sector made up 24 percent of total withdrawals with 295 mgd (1,117 mld) used.

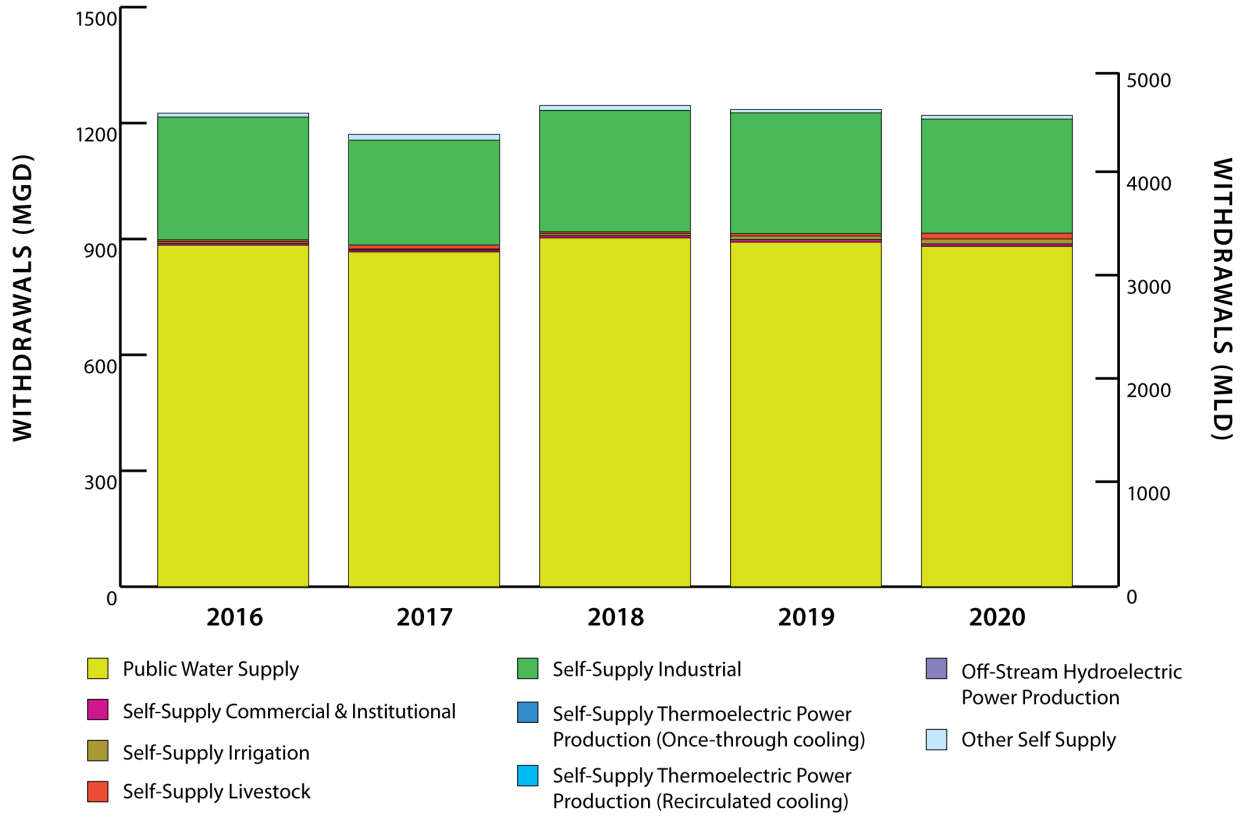

Figure 30. Québec water withdrawals by sector the last five years

The total diversion amount was 3 mgd (10 mld) for public supply purposes from the St. Lawrence River. The total consumptive use was 178 mgd (675 mld) or 15 percent of the total withdrawal amount. The primary water use sectors contributing to the total consumptive use were public supply at 132 mgd (499 mld) and self-supply industrial at 29 mgd (109 mld).

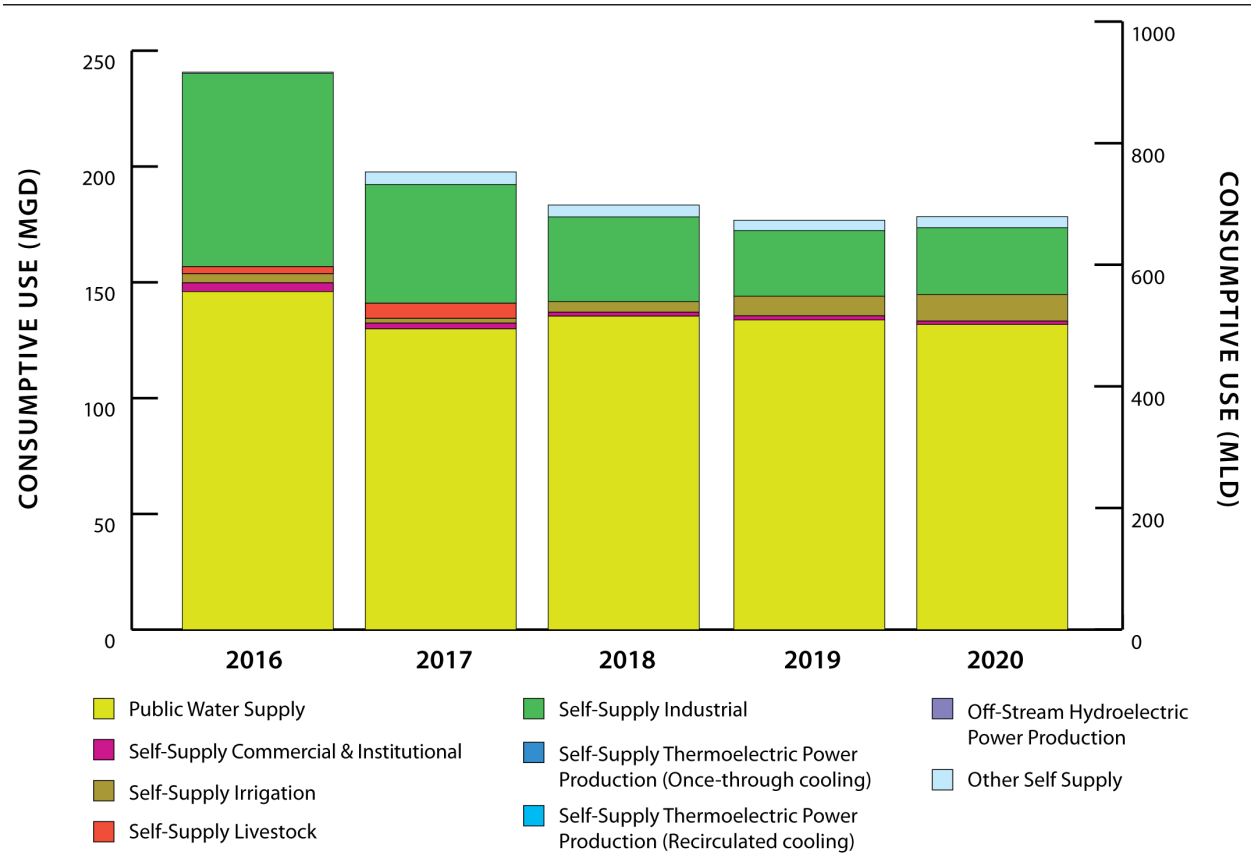

Figure 31. Québec consumptive use by sector the last five years

Starting with 2012 data, the province of Québec began its data collection program which gathers estimated or metered water use data reported by water users. Québec began collecting water use reports from the irrigation (agricultural users), livestock, and aquaculture sectors in 2016. Due to new sectors reporting and a relatively new legal system for water withdrawals, Québec data quality and compliance rates are a continual focus for improvement. As a result of these ongoing efforts, reporting compliance rates increased in all sectors except other self-supply in 2020, including three sectors where compliance rates increased by 20 percentage points compared to the previous year. Compliance rates varied among water use sectors from 50 percent in the other self-supply sector to 93 percent for public water supply.

Notable changes from 2019 water use by Québec facilities include:

- A 154 percent (9 mgd or 34 mld) increase in water withdrawals for the self-supply livestock sector, which can be attributed to weather and increased reporting compliance. New reported withdrawals were associated with new water withdrawals and existing water users that did not report in past years coming into compliance.
- A 36 percent (3 mgd or 13 mld) increase in water withdrawals for the self-supply irrigation sector and associated 36 percent (3 mgd or 11 mld) increase in consumptive use for the sector. Similar to the self-supply livestock sector, the change can be attributed to a combination of weather patterns and increased reporting compliance.

Table 19a. Québec 2020 Water Use Data Summary in mgd

Sector	Withdrawals				Diversions		Consumptive Use
	GLSW	OSW	GW	Total	Intrabasin	Interbasin	
Public Water Supply	624	204	53	881	0	3	132
Self-Supply Commercial and Institutional	1	5	1	6	0	0	1
Self-Supply Irrigation	0	10	2	13	0	0	11
Self-Supply Livestock	0	12	3	15	0	0	0
Self-Supply Industrial	131	147	17	295	0	0	29
Self-Supply Thermoelectric Power Production (Once-through cooling)	0	0	0	0	0	0	0
Self-Supply Thermoelectric Power Production (Recirculated cooling)	0	0	0	0	0	0	0
Off-Stream Hydroelectric Power Production	0	0	0	0	0	0	0
In-Stream Hydroelectric Water Use	0	0	0	0	0	0	0
Other Self Supply	5	3	0	9	0	0	5
Total	762	381	77	1,220	0	3	178

In millions of gallons per day; Water Sources: Great Lakes surface water (GLSW), other surface water (OSW) and groundwater (GW); totals may not sum exactly due to rounding.

Table 19b. Québec 2020 Water Use Data Summary in mld

Sector	Withdrawals				Diversions		Consumptive Use
	GLSW	OSW	GW	Total	Intrabasin	Interbasin	
Public Water Supply	2,363	770	202	3,335	0	10	499
Self-Supply Commercial and Institutional	3	18	3	24	0	0	6
Self-Supply Irrigation	2	37	9	48	0	0	43
Self-Supply Livestock	0	44	12	57	0	0	0
Self-Supply Industrial	496	557	64	1,117	0	0	109
Self-Supply Thermoelectric Power Production (Once-through cooling)	0	0	0	0	0	0	0
Self-Supply Thermoelectric Power Production (Recirculated cooling)	0	0	0	0	0	0	0
Off-Stream Hydroelectric Power Production	0	0	0	0	0	0	0
In-Stream Hydroelectric Water Use	0	0	0	0	0	0	0
Other Self Supply	20	13	1	35	0	0	18
Total	2,884	1,441	292	4,616	0	10	675

In millions of liters per day; Water Sources: Great Lakes surface water (GLSW), other surface water (OSW) and groundwater (GW); totals may not sum exactly due to rounding.

Wisconsin

Wisconsin has more than 1,000 miles of Great Lakes shoreline along Lake Michigan and Lake Superior. More than 25 percent of the state's land area lies within the basin, where half the population of the state also lives. Over 1.6 million Wisconsin residents get their drinking water from Lake Michigan or Lake Superior.[20]

The total reported water withdrawal amount from the basin for Wisconsin was 3,501 mgd (13,254 mld), an eight percent decrease from the 2019 water withdrawal total of 3,802 mgd (14,394 mld). Ninety-nine percent of withdrawals came from the Lake Michigan watershed, the majority of which were Lake Michigan surface water withdrawals. The primary water use sectors were self-supply thermoelectric power production (once-through cooling), public water supply, and self-supply industrial.

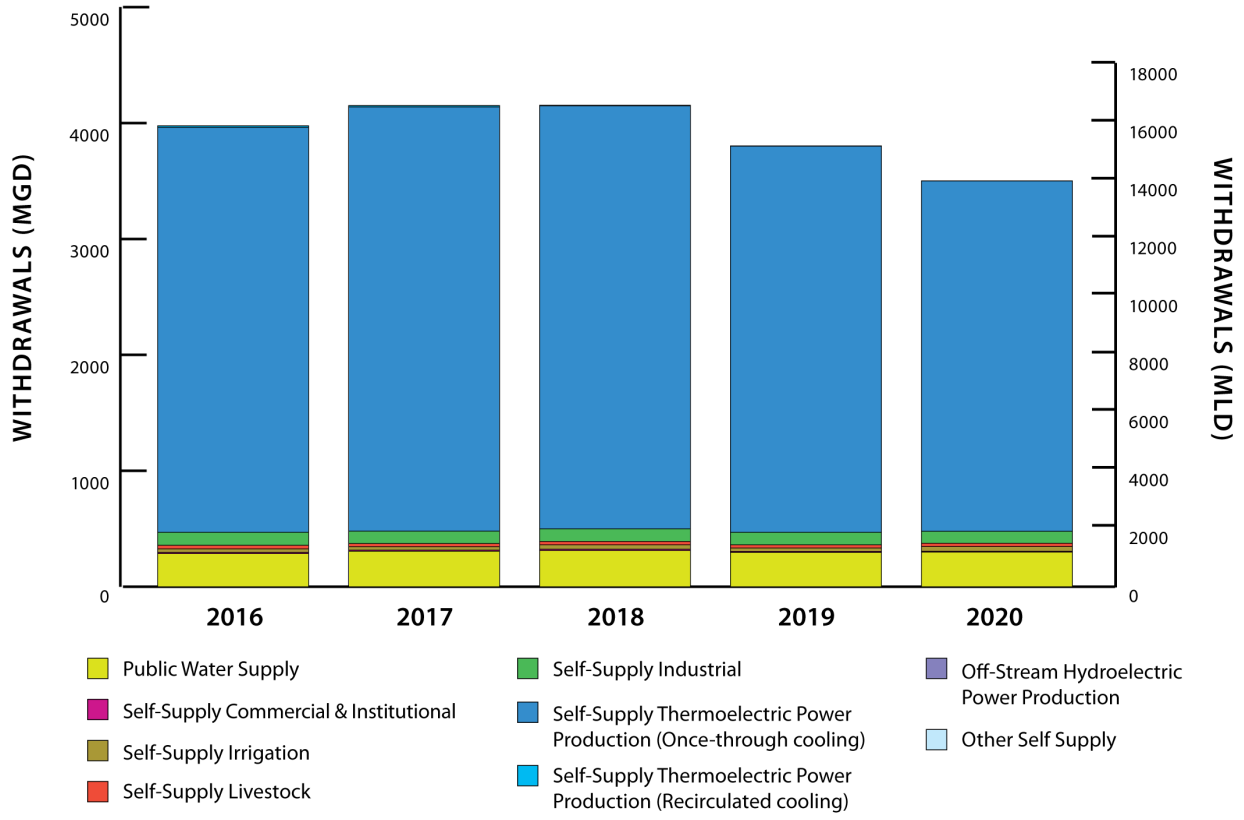

Figure 32. Wisconsin water withdrawals by sector the last five years

The net reported diversion was 2 mgd (8 mld) from the Lake Michigan watershed. Diversions out of the Lake Michigan watershed totaled 7 mgd (26 mld), 98 percent of which was for public water supply purposes. The remainder of the diversions were each less than 0.2 mgd (less than 0.4 mld) and were associated with the self-supply commercial and institutional, self-supply irrigation, and self-supply

[20] Wisconsin Department of Natural Resources. 2019. https://storymaps.arcgis.com/stories/746865c012064b6e8f0a89a4affe6499

livestock sectors. Of the total diversion amount, 5 mgd (17 mld) was returned to the Lake Michigan basin. The total consumptive use was 113 mgd (429 mld). The primary consumptive uses came from public water supply, self-supply thermoelectric power production (once-through cooling), and self-supply irrigation.

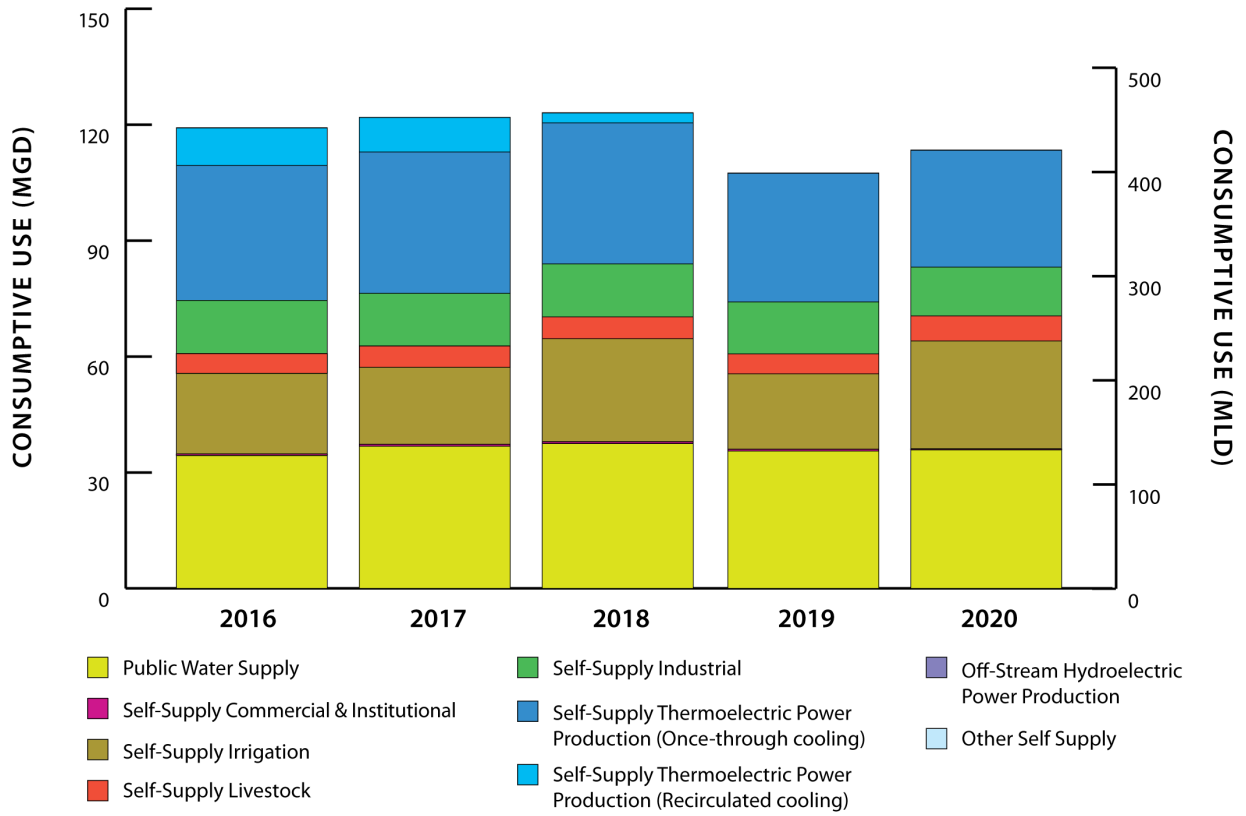

Figure 33. Wisconsin consumptive use by sector the last five years

The water use data was provided by the Wisconsin Department of Natural Resources. Reporting compliance varied among water use sectors from 94 percent for the commercial and institutional sector to 100 percent for the self-supply thermoelectric power production and public water supply sectors. Data was not estimated for the facilities that did not report water use.

Notable changes from 2019 water use by Wisconsin facilities include:

- A 43 percent (12 mgd or 45 mld) increase in self-supply irrigation water withdrawal due to dry weather conditions, especially compared to 2019, which was one of the wettest years on record. Consumptive use associated with irrigation also increased by 43 percent, contributing to a 6 percent increase in total consumptive use.
- A 9 percent (309 mgd or 1,171 mld) decrease in water withdrawal for self-supply thermoelectric power production (once-through cooling) and associated 9 percent decrease in consumptive use for the sector, both attributed to decreased use at a power plant.

Table 20a. Wisconsin 2020 Water Use Data Summary in mgd

Sector	Withdrawals				Diversions		Consumptive Use
	GLSW	OSW	GW	Total	Intrabasin	Interbasin	
Public Water Supply	232	20	47	299	0	2	36
Self-Supply Commercial and Institutional	1	4	2	7	0	0	0
Self-Supply Irrigation	0	3	37	40	0	0	28
Self-Supply Livestock	0	12	17	29	0	0	6
Self-Supply Industrial	1	89	13	103	0	0	13
Self-Supply Thermoelectric Power Production (Once-through cooling)	2,898	124	0	3,022	0	0	30
Self-Supply Thermoelectric Power Production (Recirculated cooling)	0	0	0	0	0	0	0
Off-Stream Hydroelectric Power Production	0	0	0	0	0	0	0
In-Stream Hydroelectric Water Use	0	0	0	0	0	0	0
Other Self Supply	0	0	1	1	0	0	0
Total	3,132	252	117	3,501	0	2	113

In millions of gallons per day; Water Sources: Great Lakes surface water (GLSW), other surface water (OSW) and groundwater (GW); totals may not sum exactly due to rounding.

Table 20b. Wisconsin 2020 Water Use Data Summary in mld

Sector	Withdrawals				Diversions		Consumptive Use
	GLSW	OSW	GW	Total	Intrabasin	Interbasin	
Public Water Supply	877	77	177	1,131	0	8	136
Self-Supply Commercial and Institutional	5	15	7	27	0	0	1
Self-Supply Irrigation	0	11	140	151	0	0	106
Self-Supply Livestock	0	46	65	111	0	0	24
Self-Supply Industrial	5	336	50	390	0	0	48
Self-Supply Thermoelectric Power Production (Once-through cooling)	10,969	469	0	11,438	0	0	114
Self-Supply Thermoelectric Power Production (Recirculated cooling)	0	0	0	0	0	0	0
Off-Stream Hydroelectric Power Production	0	0	0	0	0	0	0
In-Stream Hydroelectric Water Use	0	0	0	0	0	0	0
Other Self Supply	0	1	4	5	0	0	0
Total	11,857	955	442	13,254	0	8	429

In millions of liters per day; Water Sources: Great Lakes surface water (GLSW), other surface water (OSW) and groundwater (GW); totals may not sum exactly due to rounding.

Appendices

Appendix A. Water Use Sector Definitions

Public Water Supply

Water distributed to the public through a physically connected system of treatment, storage, and distribution facilities serving a group of largely residential customers that may also serve industrial, commercial, and other institutional operators. Water withdrawn directly from the basin and not through such a system shall not be considered to be used for Public Water Supply purposes.

Self-Supply Commercial and Institutional

Commercial uses include water used by motels, hotels, restaurants, office buildings and institutions, both civilian and military, that would not otherwise be consider Public Water Supplies. This category also includes water for mobile homes, hospitals, schools, air conditioning and other similar uses not covered under a public supply. In addition, this category includes amusement and recreational water uses such as snowmaking and water slides.

Self-Supply Irrigation

Water artificially applied on lands to assist in the growing of crops and pastures or in the maintenance of recreational lands, such as parks and golf courses.

Self-Supply Livestock

Water used by animals such as horses, cattle, sheep, goats, hogs and poultry. Water used in fish hatchery operations is also included under this category.

Self-Supply Industrial

Industrial water includes water used in the manufacture of metals, chemicals, paper, food and beverage, and other products, as well as mining water use. Mining water use includes water used in the extraction or washing of minerals, for example solids, such as coal and ores, and liquids such as crude petroleum and natural gas. Water used in quarrying and milling is also included in the industrial category. Brine extraction from oil and gas operations is not included. Withdrawals and consumptive uses for industrial and mining purposes (including dewatering operations) recorded under another category (e.g., public supply) will not be recorded here. Once initially reported, water used in a closed cycle (recirculation) will not be reported as a withdrawal. "Make-up water[1]" will be reported once upon entering the system. Other situations should be evaluated on a case-by-case basis.

Self-Supply Thermoelectric Power Production (Once-through cooling)

Cooling water and ancillary water use such as boiler make-up water and contact cooling water at electrical power generating facilities that use once-through cooling systems. Withdrawals and consumptive uses already recorded under another category (e.g., public supply) will not be reported here.

[1] For industrial boiler systems, make-up water is the raw water, softened water or demineralized water required for steam generation. http://www.pdhcenter.com/courses/m165/m165content.pdf

Self-Supply Thermoelectric Power Production (Recirculated cooling)

Cooling water and ancillary water use such as boiler make-up water and contact cooling water at electrical power generating facilities that use water recirculating cooling tower systems. Include water used as Combined Cycle Gas Turbine (CCGT) power plants in this category. Withdrawals and consumptive uses already recorded under another category (e.g., public supply) will not be reported here. Once initially reported, water used in a closed cycle (recirculation) will not be reported as a withdrawal. "Make-up water" will be reported once upon entering the system.

Off-Stream Hydroelectric Power Production

Water removed from a stream channel and used to drive turbines that generate electric power. This category also includes "off-stream use" for pumped-storage systems [e.g., reservoir storage] that return water to the source.

In-Stream Hydroelectric Water Use

This category includes "run of the river" use, which is not considered a water withdrawal or consumptive use. Reporting for this category is voluntary.

Other Self Supply

Water used for purposes not reported in the above categories. Examples include, but are not limited to, withdrawals for fish/wildlife, environmental, navigation and water quality purposes. Specifically, water used to maintain levels for navigation, for fish and wildlife habitat creation and enhancement (excluding fish hatchery operations included in category four), for flow augmentation (or diversion), for sanitation, pollution confinement, and other water quality purposes, and agricultural activities (services) other than those directly related to irrigation.

Appendix B. General Definitions from the Compact and Agreement

Basin or Great Lakes-St. Lawrence River Basin means the watershed of the Great Lakes and the St. Lawrence River upstream from Trois-Rivières, Québec.

Consumptive Use means that portion of the water withdrawn or withheld from the basin that is lost or otherwise not returned to the basin due to evaporation, incorporation into products or other processes.

Diversion means a transfer of water from the basin into another watershed, or from the watershed of one of the Great Lakes into that of another by any means of transfer, including but not limited to a pipeline, canal, tunnel, aqueduct, channel, modification of the direction of a water course, a tanker ship, tanker truck or rail tanker but does not apply to water that is used in the basin or a Great Lake watershed to manufacture or produce a product that is then transferred out of the basin or watershed.

Divert has a corresponding meaning.

Withdrawal means the taking of water from surface water or groundwater.

Source Watershed means the watershed from which a withdrawal originates. If water is withdrawn directly from a Great Lake or from the St. Lawrence River, then the Source Watershed shall be considered to be the watershed of that Great Lake or the watershed of the St. Lawrence River, respectively. If water is withdrawn from the watershed of a stream that is a direct tributary to a Great Lake or a direct tributary to the St. Lawrence River, then the Source Watershed shall be considered to be the watershed of that Great Lake or the watershed of the St. Lawrence River, respectively, with a preference to the direct tributary stream watershed from which it was withdrawn.

Appendix C. Interim Cumulative Impact Assessment

Introduction

This interim cumulative impact assessment, as part of the 2020 Annual Water Use Report, covers the years 2019 and 2020 and was prepared to fulfill the requirements of the Great Lakes-St. Lawrence River Basin Sustainable Water Resources Agreement and the companion Great Lakes-St. Lawrence River Basin Water Resources Compact following an increase in water loss from Basin of more than 50 million gallons per day (mgd) from 2019 to 2020. Water loss is defined as consumptive uses and diversions less return flow. It reflects water not being returned to the source watershed. A full cumulative impact assessment covering 2016 to 2020 will be developed by the Great Lakes St. Lawrence Governors & Premiers following the publication of this report.

The approach used for this interim assessment is similar to that of the 2011-2015 Cumulative Impact Assessment. The analysis focuses on the hydrologic effects of consumptive uses and diversions on water supply and flow at both the watershed (i.e., lake basin) and Great Lakes-St. Lawrence River basin scales. Aspects of the water budget from 2019 and 2020 are provided and compared for the assessment, as described below.

1. *Basin Inflows*

   The inflows include annual averages for precipitation on the surface of the Great Lakes (obtained from the National Oceanic and Atmospheric Administration [NOAA] Great Lakes Environmental Research Laboratory [GLERL] monthly hydrologic data), surface water runoff to the Great Lakes (obtained from NOAA GLERL monthly hydrologic data[1]), incoming diversions (as reported to the Great Lakes Water Use Database), and connecting channel flows (obtained from U.S. Geological Survey [USGS] National Water Information System[2]) into each of the Great Lakes or the St. Lawrence River, except for Lake Superior which is the headwater to the system. Precipitation on the St. Lawrence River is not included in the basin inflows due to the relatively small surface area and lack of available data. Surface runoff to the St. Lawrence River is not included in the water budget due to lack of available data.

2. *Basin Outflows*

   Outflows include evaporation from the surface of the Great Lakes (obtained from NOAA GLERL monthly hydrologic data), connecting channel flows out of each of the Lakes and the St. Lawrence River flow (obtained from USGS National Water Information System and Environment and Climate Change Canada[3]), and outgoing diversions and consumptive uses (as reported to the Great Lakes Water Use Database). The St. Lawrence River is the outflow for Lake Ontario and for the entire Basin. Evaporation from the St. Lawrence River is not included in the basin inflows due to the relatively small surface area and lack of available data.

The 2011-2015 Cumulative Impact Assessment includes more detailed information on the definitions, methodology, assumptions, uncertainty, data sources used as well as specific factors affecting each

[1] Runoff for September to December 2020 was not available at the time of report preparation; monthly runoff for those months was imputed with average runoff from 2010-2019 multiplied by a correction factor based on January to August 2020 comparison to 10-year monthly average.
[2] When available, annual average flow for the calendar year (as opposed to water year) was used to align with other water budget flow data. Exceptions to data availability (lack of annual average data, provisional data, and/or data gaps) are noted in the watershed sections.
[3] When available, annual average flow for the calendar year (as opposed to water year) was used to align with other water budget flow data. Exceptions to data availability (lack of annual average data, provisional data, and/or data gaps) are noted in the watershed sections.

watershed. The report can be referenced for clarification of the methods used in this assessment and is available at http://glslregionalbody.org/ or http://www.glslcompactcouncil.org/. The next five-year Cumulative Impact Assessment, covering 2016 to 2020, must be issued by 2023.

The most recent data submitted to the Great Lakes-St. Lawrence Regional Water Use Database indicate a reported increase in incremental water losses[4] to the basin between 2019 to 2020 of 1,270 cubic feet per second [cfs]. In 2019, more water entered the basin from incoming diversions than left from outgoing diversions and consumptive uses, while the basin lost water in 2020 when looking at diversions and consumptive uses. However, for both 2019 and 2020, diversions and consumptive uses were very small compared to total inflows or total outflows, including natural inflows and outflows. A more detailed description of the changes from 2019 to 2020 are provided in the diversion and consumptive uses section of the 2020 Annual Water Use Report.

Approach

This interim assessment focuses on the hydrologic effects of consumptive uses and diversions on water supply and flow, relative to other aspects of the water budget, at watershed and basin scales. Water flows can be natural or anthropogenic and annual variability can be due to weather, human activities, or both. Although water withdrawals are a component of the water budget, this assessment excludes withdrawals that do not have a hydrologic effect (i.e., are returned to the basin/not lost to consumptive use).

Inflows are presented as positive numbers and outflows are presented as negative numbers[5]. This follows scientific convention and allows for flows to be compared across categories and to water supply. It is not intended to communicate a value judgement on the effect of these flows on the basin. All flows are given in cubic feet per second (cfs).

Great Lakes-St. Lawrence River Basin

Figure A shows diversions and consumptive uses for the Basin in 2019 and 2020. Net diversions are positive (or incoming) flows, mainly due to the Long Lac and Ogoki diversions which divert water – from the Hudson Bay watershed into the Lake Superior watershed for power generation purposes – at a greater rate than all outgoing diversions. As shown on Figure B, in 2019, the consumptive use was less than the net (incoming) diversions, meaning consumptive use and diversions had a net positive flow into the basin. The net flow of diversions and consumptive use was negative in 2020, as consumptive use exceeded the net diversion amount. This shift is attributed mainly to a decrease in incoming diversions from 2019 to 2020, though consumptive use also increased in that time span. Of the 1,270 cfs change in flow, 1,119 cfs was associated with decreased diversion and 151 cfs was associated with increased consumptive use.

The cumulative hydrologic effect of consumptive uses and diversions is small relative to other inflows (runoff and precipitation) and outflows (evaporation and the St Lawrence River) in the basin. In 2019 and 2020, flow related to consumptive uses and diversions was less than 0.2 percent of both other inflows and other outflows across the Great Lakes-St. Lawrence Basin.

[4] Incremental water loss is defined as the change in the sum of net diversions and consumptive uses.
[5] Because the Annual Report focuses on water use, it follows a different convention: withdrawals, consumptive use, and outgoing diversions are reported as positive numbers and incoming diversions are reported as negative numbers.

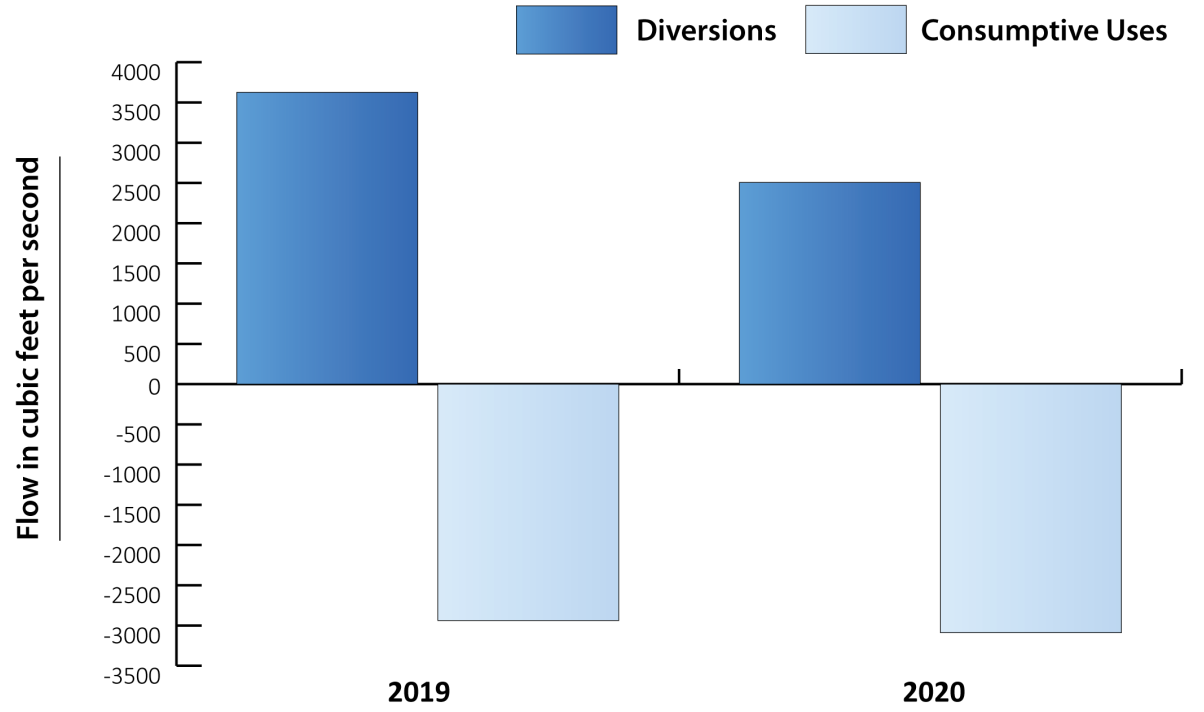

Figure A. Diversions and consumptive uses for the Great Lakes – St. Lawrence basin

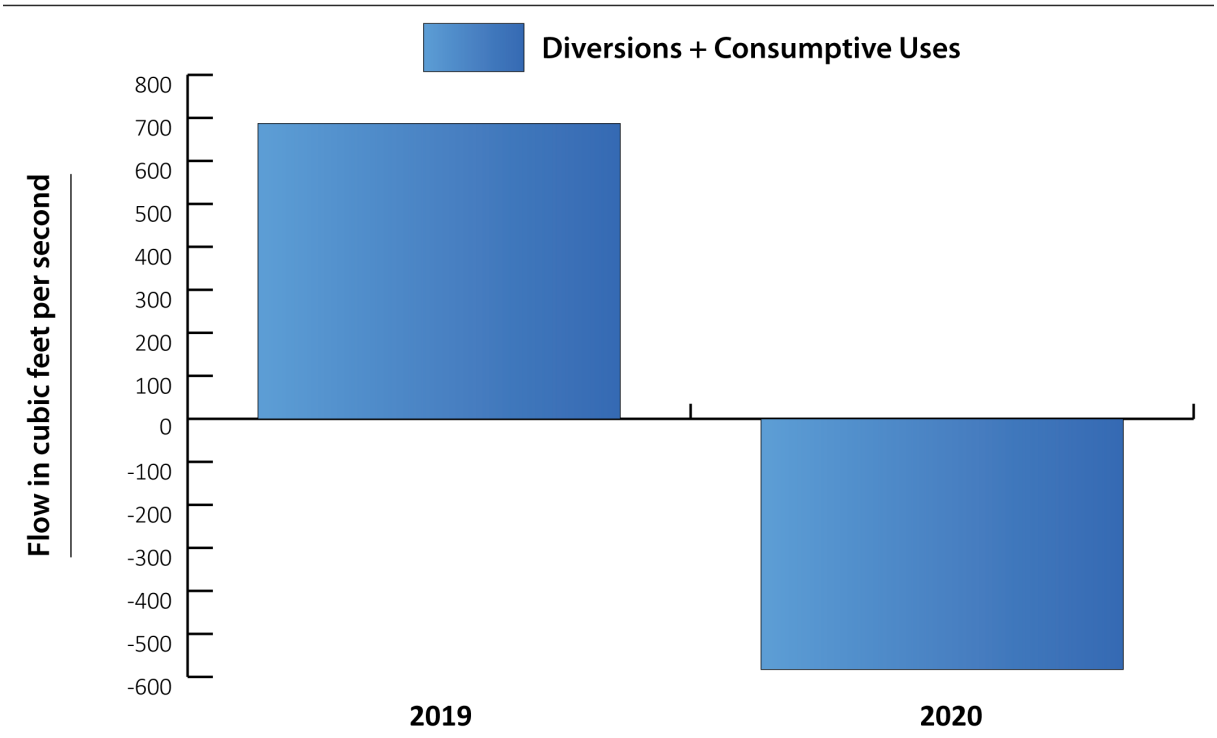

Figure B. Net diversions and consumptive uses for the Great Lakes – St. Lawrence River basin.

Water Budget Component	Average 2019 flow (cfs)	Average 2020 flow (cfs)
Runoff	233,364	215,134
Precipitation	297,613	244,958
Evaporation	-172,263	-193,161
St. Lawrence River	-475,970	-444,843
Interbasin Diversions	3,626	2,508
Consumptive Use	-2,938	-3,090

Table A. Water budget average flows for the Great Lakes-St. Lawrence River basin

Lake Superior Watershed

The data in Tables B and C and Figure C summarize the components of the Lake Superior water budget and the relative hydrologic effect of consumptive uses and diversions in the watershed. St. Marys River flow data incorporated in this report includes provisional data. Annual and monthly average flows were not available for the full duration of interest (i.e., 2019 and 2020) at the time of report preparation, so daily flow rates were averaged to calculate annual flow. There was one 52-day data gap in the dataset that was filled with estimated values from historical river flow to minimize the effect of the data gap on the average annual flow[6].

Surface water runoff data from the NOAA GLERL hydrologic data includes the Ogoki Diversion, so the annual average flow associated with the Ogoki Diversion was subtracted from the Lake Superior annual average runoff flow to avoid double-counting.

Water Budget Component	Average 2019 flow (cfs)	Average 2020 flow (cfs)
Runoff	59,173	56,882
Precipitation	102,898	79,967
Evaporation	-58,810	-67,002
St. Marys River	-94,000	-90,900
Diversions	5,354	4,209
Consumptive Use	-60	-47

Table B. Water budget average flows for the Lake Superior basin

In the Lake Superior basin, diversions are an inflow, with more water being diverted into the basin than being diverted out. Consumptive uses decreased by 22 percent from 2019 to 2020 and diversions decreased by 21 percent. The hydrologic effect of average consumptive uses and diversions are small relative to other inflows (precipitation and surface runoff) and outflows (evaporation and St. Marys River flow) in the Lake Superior basin, though have a larger effect than the average across the entire Great Lakes-St. Lawrence

[6] Each missing day in the data gap was imputed with that day's average flow from 2016 to 2019.

Basin. The percentage of flow related to consumptive uses and diversions decreased from 2019 to 2020 for both inflows and outflows.

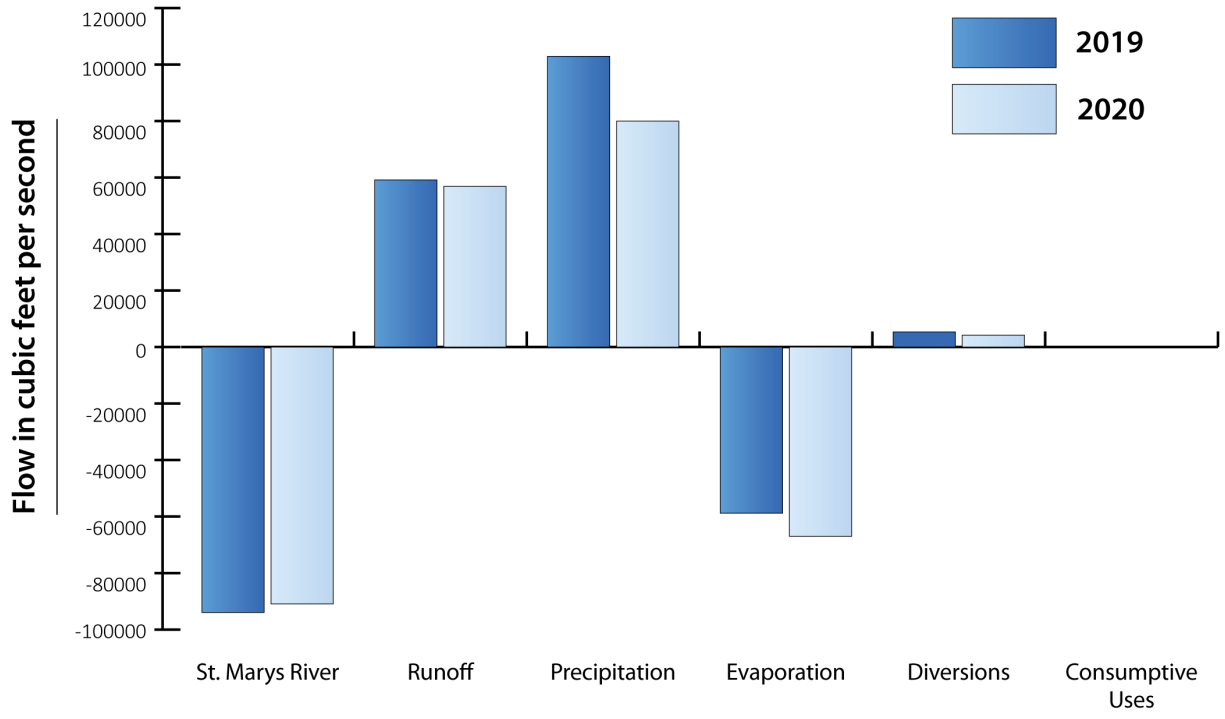

Figure C. Water budget average flows for the Lake Superior basin

Water Budget Comparison	2019	2020
Consumptive Uses + Diversions as a percentage of other inflows	3.3	3.0
Consumptive Uses + Diversions as a percentage of other outflows	3.5	2.6

Table C. Relative hydrologic effect of consumptive uses and diversions in the Lake Superior basin (directional aspect of flow removed)

Lake Michigan-Lake Huron Watershed

The data in Tables D and E and Figure D summarize the components of the Lake Michigan-Lake Huron water budget and the relative hydrologic effect of consumptive uses and diversions in the watershed. St. Marys River flow data incorporated in this report includes provisional data. Annual and monthly average flows were not available for the full duration of interest (i.e., 2019 and 2020) at the time of report

preparation, so daily flow rates were averaged to calculate annual flow. There was one 52-day data gap in the dataset that was filled with estimated values from historical river flow to minimize the effect of the data gap on the average annual flow[7].

Water Budget Component	Average 2019 flow (cfs)	Average 2020 flow (cfs)
St. Marys River	94,000	90,900
Runoff	90,640	78,526
Precipitation	141,479	119,976
Evaporation	-73,441	-82,590
St. Clair River	-228,500	-224,900
Diversions	-1,749	-1,722
Consumptive Use	-1,362	-1,530

Table D. Water budget average flows for the Lake Michigan-Lake Huron basin

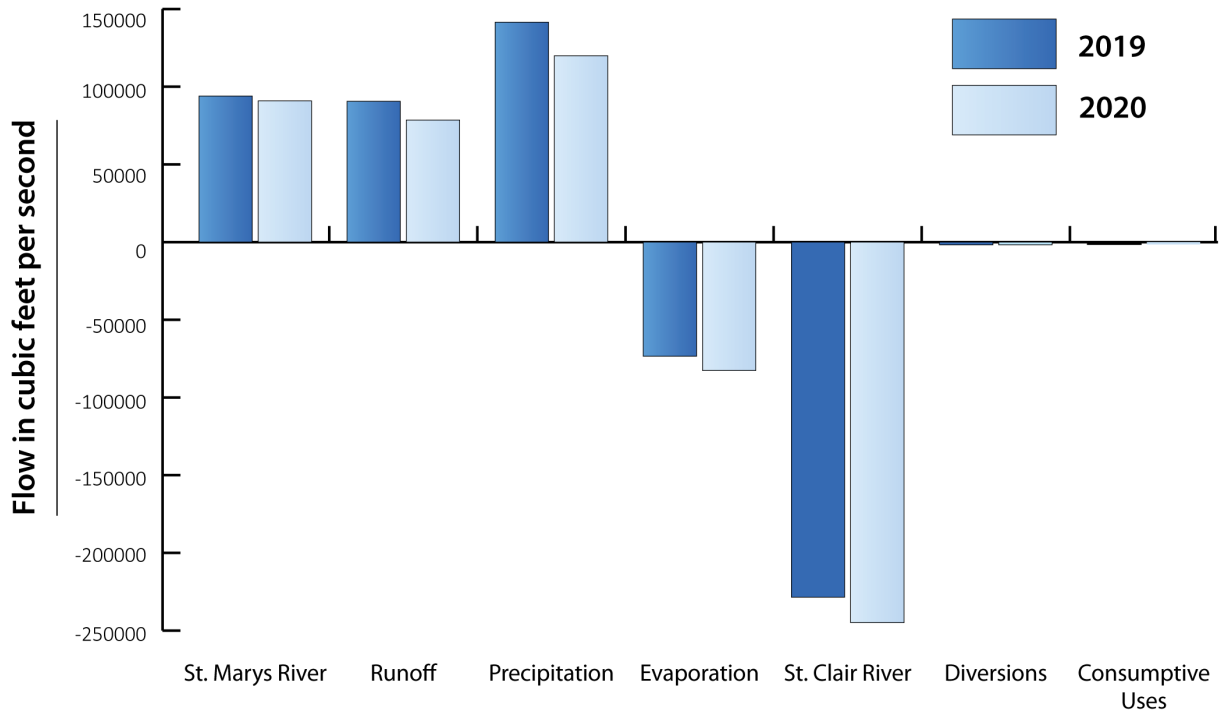

Figure D. Water budget average flows for the Lake Michigan-Lake Huron basin

In the Lake Michigan-Lake Huron basin, diversions are an outflow, meaning more water is diverted out than enters the basin through return flow or incoming diversions. Consumptive uses increased by 12 percent

[7]Each missing day in the data gap was imputed with that day's average flow from 2016 to 2019.

from 2019 to 2020 and diversions decreased by less than 2 percent. The hydrologic effect of average consumptive uses and diversions are small – approximately 1 percent – relative to other inflows (precipitation, surface runoff, and St. Marys River flow) and outflows (evaporation and St. Clair River flow) in the Lake Michigan-Lake Huron basin. The percentage of flow related to consumptive uses and diversions was consistent from 2019 to 2020 for both inflows and outflows.

Water Budget Comparison	2019	2020
Consumptive Uses + Diversions as a percentage of other inflows	1.0	1.1
Consumptive Uses + Diversions as a percentage of other outflows	1.0	1.0

Table E. Relative hydrologic effect of consumptive uses and diversions in the Lake Michigan-Lake Huron basin (directional aspect of flow removed)

Lake Erie Watershed

The data in Tables F and G and Figure E summarize the components of the Lake Erie water budget and the relative hydrologic effect of consumptive uses and diversions in the watershed.

Water Budget Component	Average 2019 flow (cfs)	Average 2020 flow (cfs)
Detroit River	239,900	258,500
Runoff	33,923	33,308
Precipitation	30,376	26,751
Evaporation	-25,615	-28,535
Niagara River	-258,800	-265,100
Diversions	-6,448	-8,673
Consumptive Use	-644	-612

Table F. Water budget average flows for the Lake Erie basin

Diversions are an outflow in the Lake Erie basin, meaning more water leaves the watershed through outgoing diversions than comes in from returns and incoming diversions. The predominant component of Lake Erie diversions is the Welland Canal intrabasin diversion. Although the Welland Canal affects the Lake Erie water budget, there is no net change or water loss from the Great Lakes-St. Lawrence River basin associated with Welland Canal diversion because the diversion is entirely to Lake Ontario.

Consumptive uses decreased by 5 percent from 2019 to 2020, while diversions increased by 35 percent. The hydrologic effect of average consumptive uses and diversions are small relative to inflows (precipitation, surface runoff, and Detroit River flow) and other outflows (evaporation and Niagara River flow) in the Lake Erie basin. The percentage of flow related to consumptive uses and diversions increased from 2019 to 2020 for both inflows and outflows.

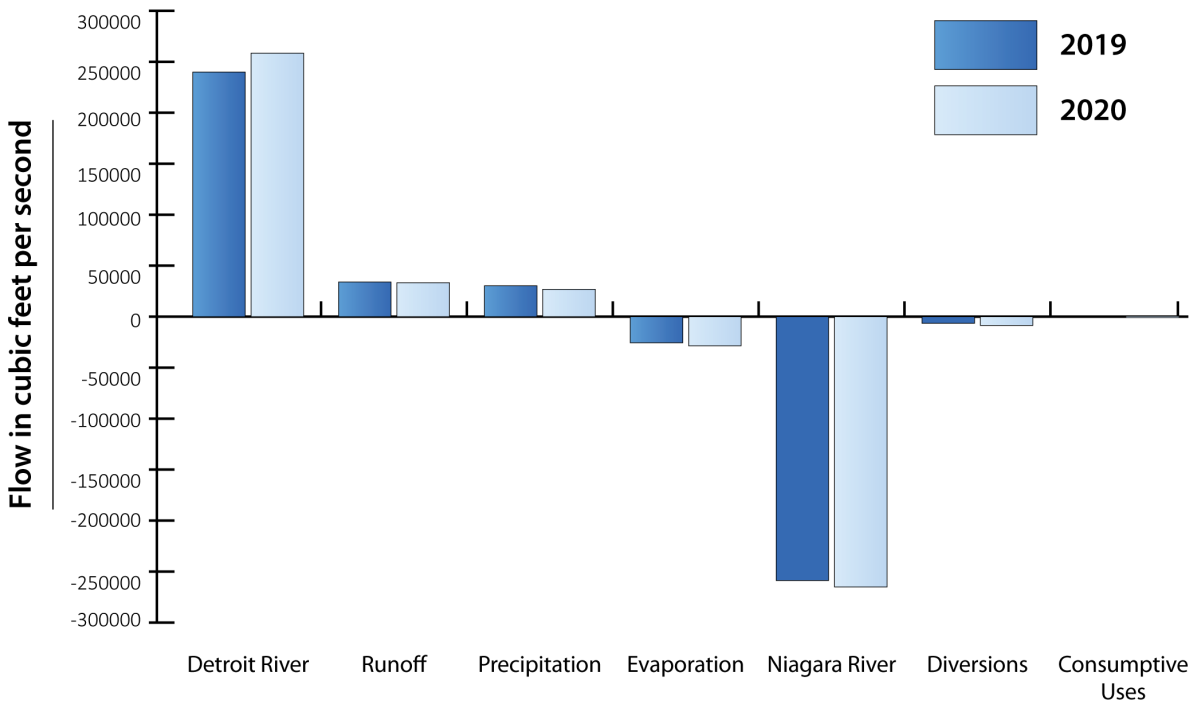

Figure E. Water budget average flows for the Lake Erie basin

Water Budget Comparison	2019	2020
Consumptive Uses + Diversions as a percentage of other inflows	2.3	2.9
Consumptive Uses + Diversions as a percentage of other outflows	2.5	3.2

Table G. Relative hydrologic effect of consumptive uses and diversions in the Lake Erie basin (directional aspect of flow removed)

Lake Ontario Watershed

The data in Tables H and I and Figure F summarize the components of the Lake Ontario water budget and the relative hydrologic effect of consumptive uses and diversions in the watershed.

Water Budget Component	Average 2019 flow (cfs)	Average 2020 flow (cfs)
Niagara River	258,800	265,100
Runoff	49,628	46,418
Precipitation	22,859	18,283
Evaporation	-14,397	-14,851
St. Lawrence River	-312,500	-314,300
Diversions	6,477	8,701
Consumptive Use	-554	-578

Table H. Water budget average flows for the Lake Ontario basin

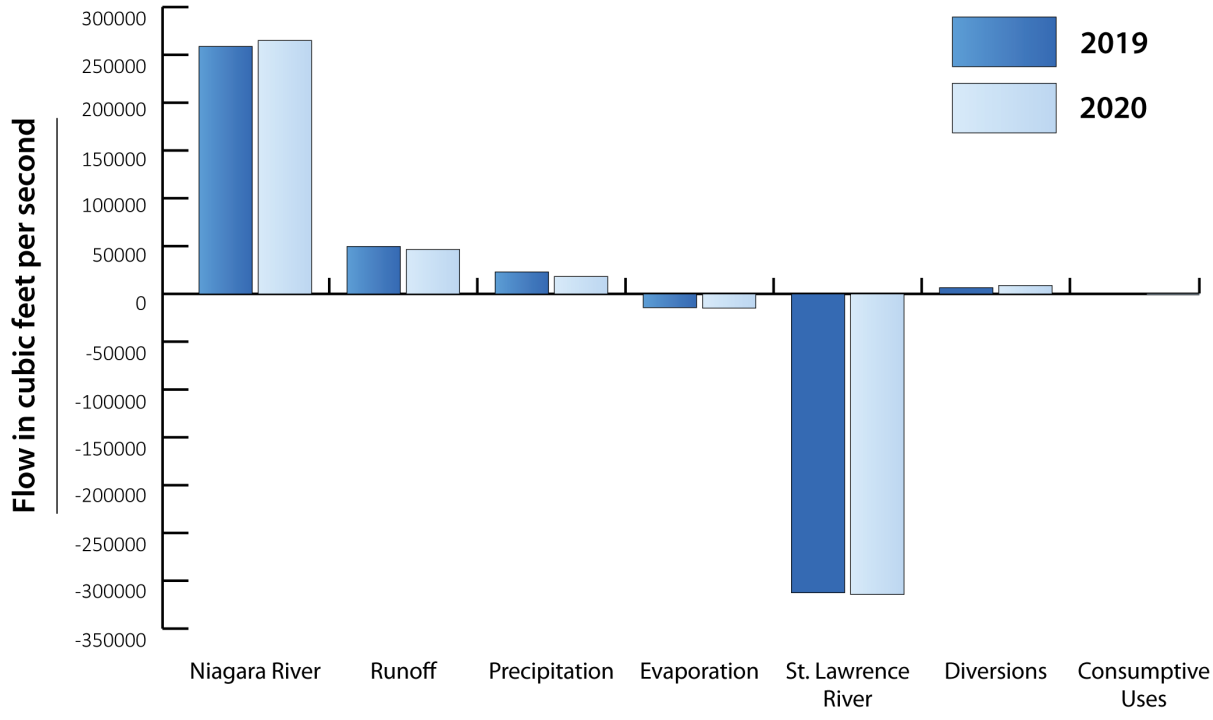

Figure F. Water budget average flows for the Lake Ontario basin

Diversions are an inflow in the Lake Ontario basin, meaning more water enters the watershed through incoming diversions than leaves from outgoing diversions. The predominant component of Lake Ontario diversions is the incoming Welland Canal intrabasin diversion. Although the Welland Canal affects the

Lake Ontario water budget, there is no net change or water gain from the Great Lakes-St. Lawrence River basin associated with Welland Canal diversion because the diversion is entirely from Lake Erie.

Consumptive uses increased by 4 percent from 2019 to 2020 and diversions increased by 34 percent. The hydrologic effect of average consumptive uses and diversions are small relative to other inflows (precipitation, surface runoff, and Niagara River flow) and outflows (evaporation and St. Lawrence River flow) in the Lake Ontario basin. The percentage of flow related to consumptive uses and diversions increased from 2019 to 2020 for both inflows and outflows.

Water Budget Comparison	2019	2020
Consumptive Uses + Diversions as a percentage of other inflows	1.8	2.5
Consumptive Uses + Diversions as a percentage of other outflows	1.8	2.5

Table I. Relative hydrologic effect of consumptive uses and diversions in the Lake Ontario basin (directional aspect of flow removed)

St. Lawrence River Watershed

The data in Figure F and Tables H and I summarize the components of the St. Lawrence River water budget and the relative hydrologic effect of consumptive uses and diversions in the watershed. Precipitation, evaporation, and runoff are not included in the water budget due to lack of available data. Therefore, outside of diversions and consumptive uses, the water budget considerations are limited to the inflow and outflow of the St. Lawrence River, measured at Cornwall, Ontario and calculated at Trois-Rivières, Québec, respectively. The inflow and outflow data have different sources: average annual inflow data was obtained from the USGS National Water Information System, while Environment and Climate Change Canada provided average daily outflow data. Due to a server problem, data beyond June 2020 was not available for the outflow at Trois-Rivières, Québec. This data gap and one 24-day data gap week were imputed with the average flow from the entire gap period from 2016 to 2019.

Water Budget Component	Average 2019 flow (cfs)	Average 2020 flow (cfs)
St. Lawrence River at Cornwall	312,500	314,300
St. Lawrence River at Trois-Rivières	-475,970	-444,843
Diversions	-8	-8
Consumptive Use	-319	-322

Table J. Water budget average flows for the St. Lawrence River

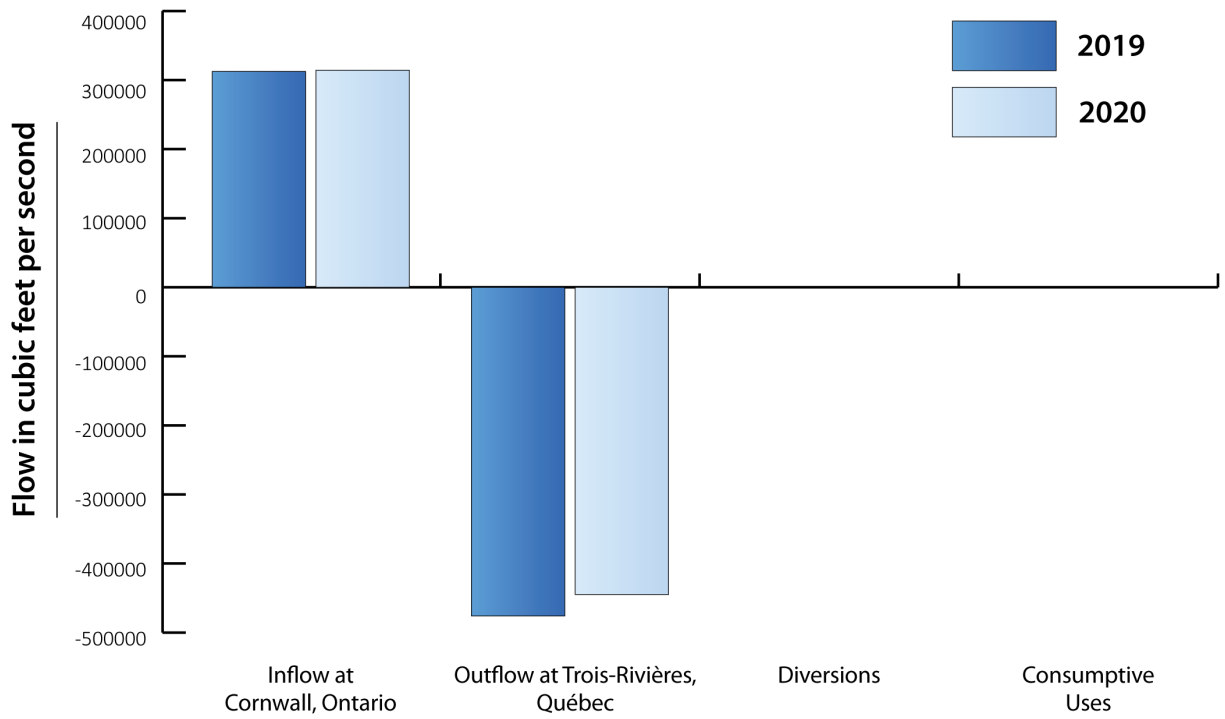

Figure G. Water budget average flows for the St. Lawrence River

Diversions are an outflow in the St. Lawrence River basin, meaning more water leaves the watershed through outgoing diversions than comes in from returns and incoming diversions. Consumptive uses increased by 1 percent from 2019 to 2020 and diversions decreased by 2 percent. The hydrologic effect of average consumptive uses and diversions are very small relative to St. Lawrence River flows at Cornwall and Trois-Rivières.

Water Budget Comparison	2019	2020
Consumptive Uses + Diversions as a percentage of other inflows	0.1	0.1
Consumptive Uses + Diversions as a percentage of other outflows	< 0.1	<0.1

Table K. Relative hydrologic effect of consumptive uses and diversions in the St. Lawrence River basin (directional aspect of flow removed)