municipal water use 2001 STATISTICS

INTRODUCTION

Many Canadian communities are growing increasingly concerned about having enough water to meet present and future needs. Such concerns are heightened by the rising demand for water (both domestically and throughout the world), growing urban populations and the anticipated impacts of climate change. Complicating the issue is the high cost of maintaining, replacing or adding new water storage, treatment and distribution infrastructure.

Understanding how Canadian communities use water is a prerequisite to gauging Canada's progress toward the sustainable use of its water resources. To create proactive policies and programs that promote sustainable water use, policy makers and resource managers need to know, among other things, how much water municipalities are withdrawing, where this water comes from, how much water is used by different sectors and how efficiently they use it, what water treatments are applied, and how municipalities charge for their water-related services.

Compiling the Municipal Water Use Database (MUD) is done via the Municipal Water Use and Pricing (MUD) survey, which has been conducted once every two or three years by Environment Canada since 1983. The only national survey of its kind in Canada, the MUD survey collects information about water use and pricing by Canadian municipalities. The resulting geocoded data can be analyzed in several ways—by province and territory, economic sector or the size of municipal populations, among others.

This report summarizes some of the most important findings of the "use" portion of the 2001 survey. Some analysis of trends is also included. A companion report, due in the winter of 2005, will focus on the pricing of municipal water-related services.[1]

For an explanation of the terminology used in this report, please consult the glossary at the end.

METHODOLOGY

For 2001, the survey underwent certain changes from previous iterations. For one thing, where past surveys restricted themselves to communities having 1000 or more residents, the 2001 survey included a representative sample of 660 communities with fewer than 1000 residents each. In addition, the scope of the survey was enlarged to meet the demand of water managers at all levels of government for more detailed information about municipal water use. Finally, for the first time ever, the survey went on-line with full data collection and limited search capability.

The 2001 survey collected useful information from approximately 880 municipalities having more than 1000 residents each. All these communities were

[1] Both reports, the 2001 survey questionnaire, and both the municipal water use and pricing databases (and variable description documents) will be posted on Environment Canada's Freshwater Website at *www.ec.gc.ca/water*. Environment Canada will carry out a new, updated MUD survey in 2005. The 2005 survey will be an improved and simplified version of the one used in 2001 and will be primarily Web-based.

Environment Canada Environnement Canada

Canada

among the 957 surveyed in 1999. Imputing for non-response where possible brought the total survey base for 2001 to 1271 municipalities, representing 26.7 million Canadians.

Response rates to the 2001 survey varied considerably, depending on the question (see Table 1). Overall, response rates were relatively low. This may have been due to the length of the survey, its unfamiliar electronic format, the effect of municipal amalgamations, competition from more local or more specific surveys or data reporting requirements, and/or other factors.

The survey responses were supplemented with call-backs to large municipalities and Internet searches for readily available information. Some missing records were imputed from data collected in previous years, after adjusting for changes in the population in the intervening years. Where amalgamations had occurred, responses from the constituent municipalities were aggregated to develop the missing values.

Information from all these sources was compiled in the 2001 Municipal Water Use Database, which was used to generate the statistics for this report. Any returns from the 660 surveyed rural communities each having fewer than 1000 residents were excluded from the database to avoid skewing the results, and because it was not possible to impute values for non-responding municipalities in this group—a group not included in previous surveys. In the imputed version of the database, the source of each record (survey, call-back, imputed value etc.) is indicated.

In the 2001 survey, the phrasing of key questions followed as closely as possible that of previous years so as not to obscure any emerging trends. Consequently, the estimates presented in this report, as developed from the raw data, conform with those of recent past surveys. Some minor variations may be due to the inclusion of a few non-urban jurisdictions with populations exceeding 1000. Including these rural communities results in a lower (and likely more accurate) estimate for the percentage of Canadians receiving municipal water in 2001 (90.6%) versus the number generated by the 1999 survey sample (92.5%), which excluded some rural non-incorporated jurisdictions with more than 1000 residents each (see Table 2).

Most statistics presented in this report are population-weighted to make them more representative of the Canadian population.

Table 1: Water Flows and Metering Rates, by Province/Territory and Municipal Population

Province/ Territory	Percentage of flow from surface water	Total average daily flow (litres per capita)	Average daily residential flow (litres per capita)	Percentage of residential clients that are metered	Percentage of business clients that are metered
Newfoundland	95.1	971	664	0.0	47.4
P.E.I.	0.0	529	218	13.4	100.0
Nova Scotia	91.4	667	351	89.1	99.4
New Brunswick	79.7	1314	416	49.6	89.5
Quebec	93.4	777	395	16.2	32.8
Ontario	88.4	533	285	89.9	98.4
Manitoba	81.6	410	223	96.6	98.6
Saskatchewan	87.5	517	236	98.5	99.6
Alberta	93.9	519	282	82.3	98.9
British Columbia	84.6	651	425	26.5	93.9
Yukon	69.0	803	556	52.8	100.0
N.W.T.	100.0	424	204	97.3	n/a
Nunavut	100.0	105	88	76.7	20.0
Municipal Population					
Under 2000	61.2	715	446	42.4	53.2
2000 to 5000	57.3	732	466	35.4	55.5
5000 to 50 000	78.9	665	397	47.5	75.0
50 000 to 500 000	88.9	596	326	61.7	91.3
More than 500 000	99.6	614	300	69.0	81.8
Total	89.2	622	335	60.6	83.1
Responding Population	21 634 144	23 822 869	23 822 869	24 235 565	16 075 854

Source: Values derived from the 2001 Municipal Water Use Database, Sustainable Water Use Branch, Environment Canada.

Table 2: Residential Water Services, by Province/Territory and Municipal Population

Province/ Territory	Number of responding municipalities	Total population of responding municipalities	Water distribution	Water treatment	Sewage collection	Sewage treatment
			as % of responding population			
Newfoundland	49	305 479	90.6	84.2	87.4	19.8
P.E.I.	26	89 497	55.3	46.5	65.5	63.7
Nova Scotia	36	667 916	71.5	61.6	66.8	29.2
New Brunswick	132	593 850	59.1	50.7	65.1	61.0
Quebec	373	6 475 346	93.1	85.4	91.0	90.1
Ontario	218	10 903 641	90.2	86.4	86.9	86.9
Manitoba	59	888 046	89.7	88.8	91.0	90.6
Saskatchewan	84	651 876	96.5	95.3	96.5	96.0
Alberta	144	2 691 579	91.8	90.0	91.8	91.4
British Columbia	132	3 364 251	95.8	77.2	90.3	87.7
Yukon	3	21 221	87.4	5.0	77.9	76.0
N.W.T.	6	27 845	92.7	92.7	92.5	92.5
Nunavut	9	17 122	86.9	29.4	79.8	79.8
Municipal Population						
Under 2000	402	561 264	57.3	40.2	56.0	51.7
2000 to 5000	354	1 166 634	72.6	50.6	70.6	67.1
5000 to 50 000	431	5 801 801	77.8	64.5	74.3	71.8
50 000 to 500 000	74	9 707 825	94.9	88.2	90.8	86.2
More than 500 000	10	9 460 145	98.4	98.2	98.0	98.0
Total, 2001	1271	26 697 669	90.6	84.0	88.1	85.7
Total, 2001 (comparable to 1999[a])		25 803 093	92.5	n/a	90.0	87.5
Total, 1999		24 978 011	92.5	n/a	90.0	86.9

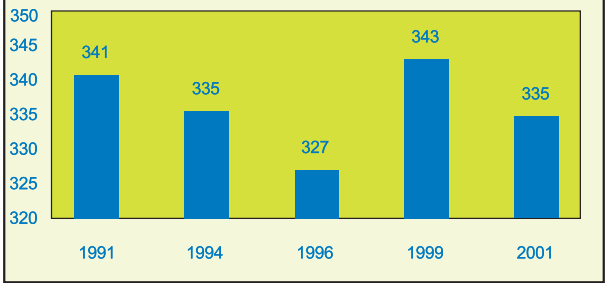
[a] Includes only those municipal populations that were included in the 1999 survey.
Source: Values derived from the 2001 Municipal Water Use Database, Sustainable Water Use Branch, Environment Canada.

SURVEY HIGHLIGHTS

AVERAGE PER CAPITA RESIDENTIAL WATER USE WAS THE SECOND LOWEST IN A DECADE.

In 2001, average residential water use per person fell to 335 litres per day—the second lowest rate since 1991—thus resuming a 10-year downward trend that has been interrupted only once (by a slight upswing in 1999; see Chart 1). This positive trend notwithstanding, Canadians still rank among the most prodigious consumers of water among OECD countries.

Chart 1: Average Daily Water Use, Residential Sector
(litres per capita)

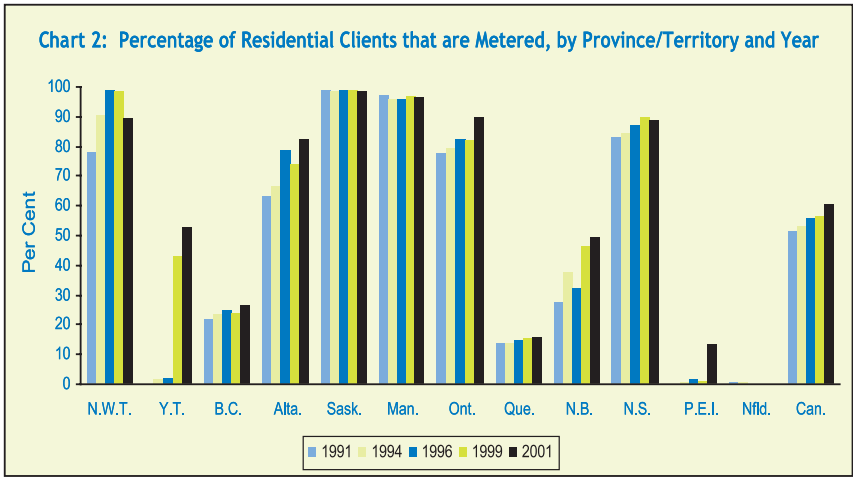


The survey results indicate that people living in larger communities use less water than do those living in smaller towns. For example, residential water use ranged from 300 litres per day in municipalities with a population of 500 000 or more, to 466 litres per day in municipalities with a population between 2000 and 5000 (see Table 1).

THE PERCENTAGE OF CANADIAN RESIDENCES EQUIPPED WITH WATER METERS CONTINUES TO GROW.

One factor that may explain the declining rate of residential water use is the introduction of more appropriate incentives for water conservation, such as water metering and volume-based pricing. By 2001, 61% of Canadian residences served by municipal water systems were metered, up from 56% in 1999 and 1996 (see Chart 2). The latest figures continue the steady upward trend in metering established during the previous decade.

The survey results also show that, as in previous years, homes in larger communities are more likely to be equipped with water meters than those in smaller communities (see Table 1). In 2001, the



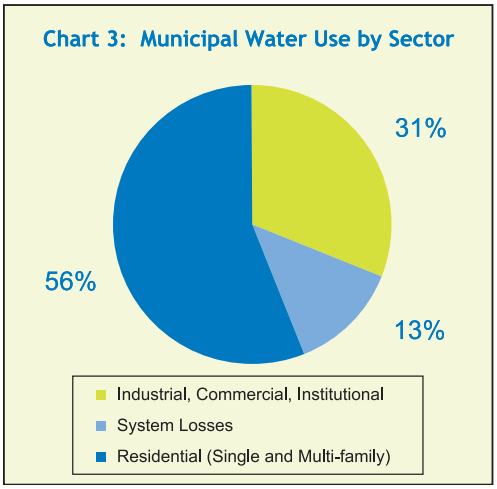
percentage of metered homes ranged from a low of 36% in municipalities with 2000 to 5000 people, to a high of 69% in municipalities with more than 500 000 people. Table 1 also shows that as the number of metered homes in a community increases, water use per capita decreases.

Furthermore, all surveys since at least 1991 indicate that, both nationally and provincially, Canadians use more water when they are charged a flat rate. The 2001 survey shows that in municipalities that charged according to the volume of water used (using 100% metering as a proxy[2]), the average daily consumption rate was 272 litres per person; in communities that charged a flat or fixed rate (using 0% metering as a proxy[3]), the corresponding figure was 74% higher (474 litres per person). These findings suggest that metering and volume-based pricing can be valuable demand-management tools for promoting the responsible use of water resources.

As municipalities get bigger, the residential share of total water use decreases.

In 2001, 56% of all the water used by responding municipalities (representing some 21.9 million Canadians) was consumed in the home, up from 52% in 1999. Commercial and industrial users accounted for 31% of the total (down from 35% in 1999), while the remaining 13% went to other uses or was lost in the system (generally due to leaks). The survey results also show that as municipalities get larger, a progressively smaller portion of the water flows to the residential sector, and progressively more is used by the commercial/industrial sector or is lost in the system. For example, in municipalities with fewer than 2000 residents, 70% of the water went to residential users, on average, while in municipalities with more than 500 000 residents the residential share dropped to 51% (see Table 3).

For the 978 municipalities that responded to this question (representing 23.8 million Canadians served water, or a total municipal population of 25.5 million), total water use (all sectors combined, including system losses) works out to a daily average of 622 litres per person served water (see Table 1). Daily per capita water use is generally lower in larger municipalities than in smaller ones. For example, municipalities with 2000 to 5000 residents used 732 litres per person per day, on average, whereas those with 50 000 to 500 000 residents used 596 litres per person per day. The sole exception involves municipalities with more than 500 000 people, where the average daily per capita use was 614 litres. Residential water use shows a similar downward trend as municipal population rises. The fact that per capita municipal water use generally goes down as the metering rate goes up (for residential and business clients alike) suggests



[2] That is, using data only from those municipalities that supplied all their customers with water meters, and assuming that any charges for water in these communities were based, at least in part, on the amount of water used.

[3] That is, using data only from those municipalities that supplied none of their customers with water meters, and assuming that all customers were billed a fixed charge, regardless of the amount of water they consumed.

Table 3: Water Use (as a Percentage of Water Served), by Province/Territory, by Sector, and Responding Population

Province/ Territory	Residential (%)	Commercial/ Industrial (%)	System Losses (%)	Responding Population
Newfoundland	73	21	6	279 376
P.E.I.	42	41	17	43 037
Nova Scotia	59	25	16	462 020
New Brunswick	50	41	9	309 203
Quebec	56	25	19	5 892 601
Ontario	53	35	12	8 157 365
Manitoba	55	36	9	775 398
Saskatchewan	46	44	10	613 659
Alberta	56	35	9	2 327 245
British Columbia	65	28	6	2 986 953
Yukon	68	32	n/a	17 635
N.W.T.	45	30	25	23 135
Nunavut	78	16	6	6 204
Municipal Population				
Under 2000	70	24	5	243 218
2000 to 5000	68	27	6	662 738
5000 to 50 000	61	31	9	4 035 190
50 000 to 500 000	57	33	10	8 344 616
More than 500 000	51	31	18	8 608 069
Total, 2001	56	31	13	21 893 832
Total, 1999	52	35	13	

Source: Values derived from the 2001 Municipal Water Use Database, Sustainable Water Use Branch, Environment Canada.

again that the use of water meters can help reduce water use in most municipalities[4].

Water meters are more common in industrial, commercial and institutional buildings than in residential ones.

For the 542 municipalities that responded to this question (representing over 16 million Canadians served water), 83% of their serviced businesses are equipped with water meters. Only 61% of residences are similarly equipped (according to the 24.2 million Canadians served water in the 1098 municipalities that responded to this question). The higher rate of metering of industrial/institutional/commercial customers holds true for all provinces. In addition, the proportion of industrial/commercial/institutional customers that are metered tends to be higher in larger communities. Table 1 shows that fully 91% of such buildings are metered in communities of 50 000 to 500 000 people, whereas in communities with fewer than 2000 people the figure drops to 53%.

[4] Although businesses that were metered apparently used less water, this does not necessarily mean that they used water more efficiently. Determining the efficiency of water use would require knowledge of specific commercial/industrial processes involving water—information that the present survey was not designed to capture.

The total number of Canadians who are served either by water distribution, sewage collection or sewage treatment continues to rise.

Comparing only those municipalities that were surveyed in both 1999 and 2001 shows that the number of Canadians in the responding municipalities rose from 25 million in 1999 to 25.8 million in 2001 (see Table 2). The percentage of the population receiving these services in 2001 (for the 1271 municipalities that responded) was 92.5% for water service and 90.0% for sewage collection; these two ratios remain unchanged from 1999. In the case of sewage treatment, there has been a slight increase: from 86.9% in 1999 to 87.5% in 2001.

The picture by size group, when all responding municipalities over 1000 population are included, shows that the percentage of the population that is connected to water distribution systems is seen to increase in step with population size (Table 2). The same observation can be made for those populations connected to sewage systems and those with wastewater treatment. This larger sample shows that 90.6% of residents in responding municipalities are served by municipal water distribution systems, 88.1% are served by sewers, and 85.7% are served by sewage treatment. Because they are based on a larger sample (comprising some 26.7 million Canadians), these figures more closely approximate the actual number of Canadians receiving these services than do the trend-consistent percentages discussed in the preceding paragraph.

Problems with water quality and water availability continue to exist in Canada.

In 2001, 38 of 312 responding municipalities, representing 24.5% of the responding population served water, indicated that they experienced water shortages. The problem was variously identified as existing at the water source, at a treatment facility or in the distribution system.

Based on information provided by the 312 responding municipalities, 54 of them, accounting for 25% of the populations served water, had some sort of water quality problem in 2001. Water quality problems were variously identified as microbiological, chemical, radiological or aesthetic. In addition, 43 of the 312 municipalities, accounting for 22.4%

of the population served water, reported one or more boil-water days in 2001.

Readers are advised that the response rate for questions dealing with water availability and water quality was relatively low (responding municipalities represented only 9.7 million Canadians served water). Consequently, the estimates reported here may not represent accurately the total Canadian population served municipal water.

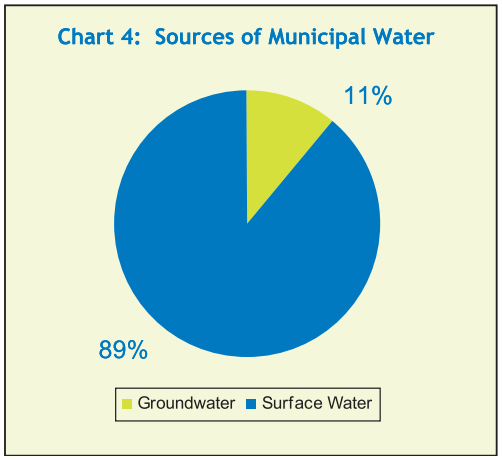
In 2001, Canadian municipalities addressed water quality problems in a variety of ways. According to the 242 municipalities responding to this portion of the survey (representing 8.9 million Canadians), the three most widely used treatments were coagulation/flocculation, granular filtration and sedimentation.[5] The percentage of the responding population affected by these three treatments was 79%, 74% and 72%, respectively.

Fluoridated water was served to as much as 74% of the responding population served. Smaller municipalities (under 5000 population) were more likely to supply untreated water (affecting as much as 32% of the group's population served), while those over 500 000 population were the least likely to serve water that had not been treated in some way (affecting as much as 11% of the group's population served). Readers are advised that the response rate for questions about water treatment was relatively low, casting some doubt on the accuracy of these figures.

In 2001 the water provided by Canadian municipalities to roughly 93% of the responding population was treated in some way prior to distribution; 7% of the responding population received untreated water (see Table 2). According to this same table (which was derived from "populations served" questions), of the population served water in the smallest size group (below 2000 population), 70% had it treated, while in the largest size group (over 500 000 population) 99.8% of those served water had it treated in some way.

In general, Canadian municipalities rely heavily on surface water, while groundwater remains an important source for smaller communities.

In 2001, 89% of the water supplied by municipalities came from surface sources, 11% from groundwater (see Chart 4). These figures are unchanged from 1999. Smaller communities relied more heavily on groundwater than did larger ones. For example, communities of between 2000 and 5000 people took 42.7% of their water from below ground, whereas those with more than 500 000 people obtained just 0.4% of their water in this way (see Table 1). The 2001 survey shows that many municipalities rely on some combination of surface and groundwater sources for their water supply.



It is known that 80% of Canadians live in urban areas, and that 85% of the population is located along the Canada-U.S. border. The latter figure is expected to rise to 90% during the next decade. This growth pattern will put additional stress on water sources in these southerly urban areas—sources that are already heavily used.

Increasingly, Canadian municipalities are promoting water conservation.

Instead of seeking new sources of supply, many Canadian municipalities are working to reduce the demand for water within their jurisdictions. Demand-control strategies employed by municipalities vary. Of the 967 municipalities that responded to this question, 12% advised their industrial, commercial and institutional clients about ways to reduce water use, 11% used public advertising to promote water conservation, 6% installed efficiency-enhancing equipment, 35% offered home audits, 8% offered water efficiency kits for sale, and 33% had instituted municipal bylaws to restrict lawn watering. Programs to install more water meters were being planned or were already under way in 5% of responding municipalities, while 21% reported using other (unspecified) demand-management measures (see Table 4).

[5] Municipalities could cite any treatment used by at least one facility within its jurisdiction.

Table 4: Water Conservation Measures,[a] as Percentages of Responding Municipalities, by Municipal Population

Municipal Population	Advising I/C/I clients[b]	Advising residential clients	Installing more water meters	Installing efficiency equipment	Providing home audits	Providing water-efficiency kits	Instituting lawn-watering bylaws	Other measures
Under 2000	7.2	4.1	2.5	1.6	19.8	3.5	21.1	10.0
2000 to 5000	9.5	9.9	4.5	3.3	34.7	7.0	28.1	19.0
5000 to 50 000	14.2	12.1	6.6	8.5	46.5	9.4	42.0	29.0
50 000 to 500 000	23.9	28.4	13.4	20.9	47.8	17.9	59.7	32.8
More than 500 000	55.6	66.7	11.1	44.4	55.6	55.6	77.8	55.6
National average	11.8	10.5	5.3	6.1	35.0	7.9	33.2	20.8

[a] Includes existing or planned measures.
[b] Industrial/commercial/institutional.
Source: Values derived from the 2001 Municipal Water Use Database, Sustainable Water Use Branch, Environment Canada.

As a rule, larger municipalities were more active in water conservation than their smaller counterparts. In small communities (less than 5000 people) the most widely practised demand-management measures were home audits and lawn-watering bylaws.

In 2001, on a national level, 5.3% of Canadian municipalities, on average, were engaged in installing new water meters. But among communities with populations of 50 000 to 500 000, the rate was more than twice as high, at 13%.

CONCLUSIONS

The 2001 survey results suggest that Canada is making steady progress towards the wise use of its water resources. Sustainable use of the resource is important to ensuring that there is enough water to meet the needs of all Canadians, now and in the future. It is also vital to preserving our aquatic ecosystems and the critical services they provide. Understanding how Canadian communities use water will help water managers balance the needs of the Canadian economy, Canadian society and the environment.

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GLOSSARY

Aggregated data Data created by summing up the separate values of related groups of data.

Coagulation A type of wastewater treatment that involves adding certain chemicals to the water to cause suspended solids to adhere to one another and precipitate to the bottom of the tank.

Data source The source of information gathered by a survey. Data sources for the Municipal Water Use and Pricing survey include municipalities, treatment plants and various water-management professionals.

Flat rate pricing Methods of charging fixed amounts for water or wastewater-related services, in which the charges are unrelated to the amount of water used or wastewater produced by a customer.

Flocculation A type of wastewater treatment that involves adding certain chemicals to the water to cause suspended solids to coalesce, aiding their removal.

Fluoridation A water treatment that involves adding fluoride (a naturally occurring element found in rocks and minerals) to municipal water to help prevent tooth decay.

Geocoding Spatially referencing statistical data by linking it to geographical information, such as longitude and latitude.

Granular filtration A type of wastewater treatment that filters out suspended solids by passing the water through a porous medium (such as sand) under gravity or pressure.

Home audit A service provided by some municipalities that assesses a homeowner's water-use habits and identifies opportunities for reducing water use.

Imputation The process of estimating a missing value that a survey respondent failed to provide. The estimate can be "imputed" from the subject's responses to similar surveys in previous years, for example, or calculated using various statistical methods.

Municipality A municipal-level jurisdiction (in an organisational sense and a spatial sense) as defined by Statistics Canada's Census Subdivisions. For the purpose of the Municipal Water Use and Pricing survey, municipalities may be grouped in some cases.

Municipal Water Use Database The municipally aggregated database created from municipal water use survey results, using imputed values where necessary.

OECD Organisation for Economic Co-operation and Development.

Population served The portion of the *responding population* receiving a particular water-related municipal service (i.e., water distribution, water treatment, wastewater collection or wastewater treatment, depending on the question).

Proxy A statistical variable that is similar enough to another to be used as a substitute for it, usually because it can be more readily measured than the original.

Responding municipality A municipality for which there was a response to a given question in the 2001 survey (for example, "What was the population served water distribution?"). A municipality that fails to respond to a particular survey question can still be considered a responding municipality if its response can be imputed from other available information (see *imputation*), or if the information was later acquired through call-backs or Internet searches.

Responding population The total population of responding municipalities (see *responding municipality*), as determined by Statistics Canada.

Sedimentation A type of wastewater treatment that allows suspended particles in undisturbed water to sink to the bottom of the tank under the influence of gravity.

Total Canadian population served The real on-the-ground total Canadian population receiving a given water-related municipal service.

Unweighted municipalities responding The number of municipalities responding to the Municipal Water Use and Pricing survey or any portion thereof.

Variable description document A text document that describes the tables and variables in a given database.

Volume-based pricing Methods of charging for water- or wastewater-related services that take into account the amount of water used or wastewater produced by a customer.

Weighting A statistical technique that takes into account the relative importance, or "weight," of individual elements in a data set instead of treating them all as equal. Calculations using weighted data (a weighted average, for example) often approximate reality more closely than do those using unweighted data.

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