Edmonton's Changing Water Use

Water Use Trends and Design Guidelines

Discussion Paper

EPCOR Water Services Inc.

One Water Planning

Prepared: June 2021

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Edmonton's Changing Water Use Discussion Paper (June, 2021)

The Water Use Discussion Paper has been prepared to summarize the changing water use patterns of EPCOR's residential, multi-residential, commercial and regional customers.

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Executive Summary

This discussion paper provides data and trends on the changing water use patterns of EPCOR's residential, commercial, multi-residential and regional customers.

Key recommendations include:

- The use of a long-range planning residential per capita water consumption/sanitary generation metric for the design of area-level water transmission and sanitary trunk infrastructure.
- The reduction of the average generation rate of industrial, commercial and institutional (ICI) customers from 20,000 to 15,000 L/ha/d due increases in efficiency of the customer class.

Water use in the commercial customer category is highly variable. It is comprised primarily of low to average water users, along with a few very large water users. The discussion paper provides analysis of the ICI customer category by zoning as well as by industry type, to provide consultants flexibility with design metrics when the customer types in developments are known.

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Document Revision History

Version Number	Date	Authors	Change Description
1.0	3-June-2021	S. Gerlach H. Zarski	-

1. Purpose and Audience

Changing water use patterns due to efficiency have fundamentally changed how residential, multi-residential and commercial customers interact with the municipal water and sanitary sewer systems.

Declining per person water use in the city of Edmonton is a key consideration for long-range water and sanitary system planning. Municipal infrastructure systems are planned collaboratively between EPCOR Water Services Inc. (EWSI) and external stakeholders. As such, it is beneficial for all planning partners to be aware of the changing water consumption trends, and to align and right-size planning strategies moving forward to prevent system overdesign.

This discussion paper provides information about changing water use patterns in each of EWSI's four customer categories, and projects future changes. EWSI also proposes updated design guidelines for use in area and customer-level planning for water and sanitary servicing. With this information, internal and external stakeholders will have a better understanding of customer water use, and be empowered to apply the updated design guidelines to future analyses and planning exercises.

The intended audience and use of this report is:

- Greenfield and Infill Developers:
  - To validate the use of lower water consumption metrics to design consultants.
- Engineering Design Consultants:
  - For use in area and site-level planning to right-size water and sewer infrastructure design.
- EWSI One Water Planning and City of Edmonton Planning:
  - To centralize and validate water planning metrics for use in water and sewer design and approval.
- Regional Stakeholders
  - To consider alignment in planning guidelines between EWSI and:
    - Edmonton Metropolitan Region Board
    - Regional Water Customer Group
    - Alberta Capital Region Wastewater Commission
    - Other external stakeholders such as individual wholesale customers
- Other interested stakeholders interested in municipal water use, including:
  - General public
  - Universities
  - Water industry associations
  - Other municipalities or water utilities

2. Edmonton's Changing Water Use

EWSI is responsible for providing reliable drinking water, wastewater and drainage services to over one million people in the city of Edmonton and greater Edmonton region. It is essential that EWSI not only delivers these services to customers today, but also plans for safe, sustainable, and reliable service into the future.

Increased efficiency of the customer base is advantageous for many reasons including sustainability of supply, deferral of water and wastewater treatment infrastructure upgrades, and minimizing environmental impacts. However, changing water use also has an impact on many aspects of utility management including water and sanitary sewer infrastructure design, operation and maintenance.

EWSI plans for future infrastructure requirements using an integrated resource planning process. A key input of the long-range planning process is forecasting future water use and the corresponding sanitary generation. A detailed understanding of Edmonton's current water use behaviors in homes and businesses and the growth of the customer base are essential for forecasting future water demand and successful long range planning.

This discussion paper distinguishes between water demand and water consumption. Water demand designates the volume of drinking water that is produced at the water treatment plants and enters the water distribution system. Water consumption is the water sold to in-city customers (residential, multi-residential and commercial customers) as well as regional customers. Water demand includes unbilled authorized consumption (i.e. water used for firefighting, water main flushing, etc.), apparent water losses, and real water losses.

2.1. Edmonton Region Water Demand

EWSI monitors both in-city water demand and total water demand. In-city water demand is water used within the city of Edmonton boundaries. Total water demand is in-city Edmonton water demand plus water sold to regional wholesale customers. Of EWSI's total water demand, approximately 70% is in-city demand, i.e. demand within Edmonton from residential, multi-residential, and commercial customers. The remaining 30% is used in the surrounding greater Edmonton regional water service area (Figure 1).

EDMONTON REGION WATER SERVICE AREA

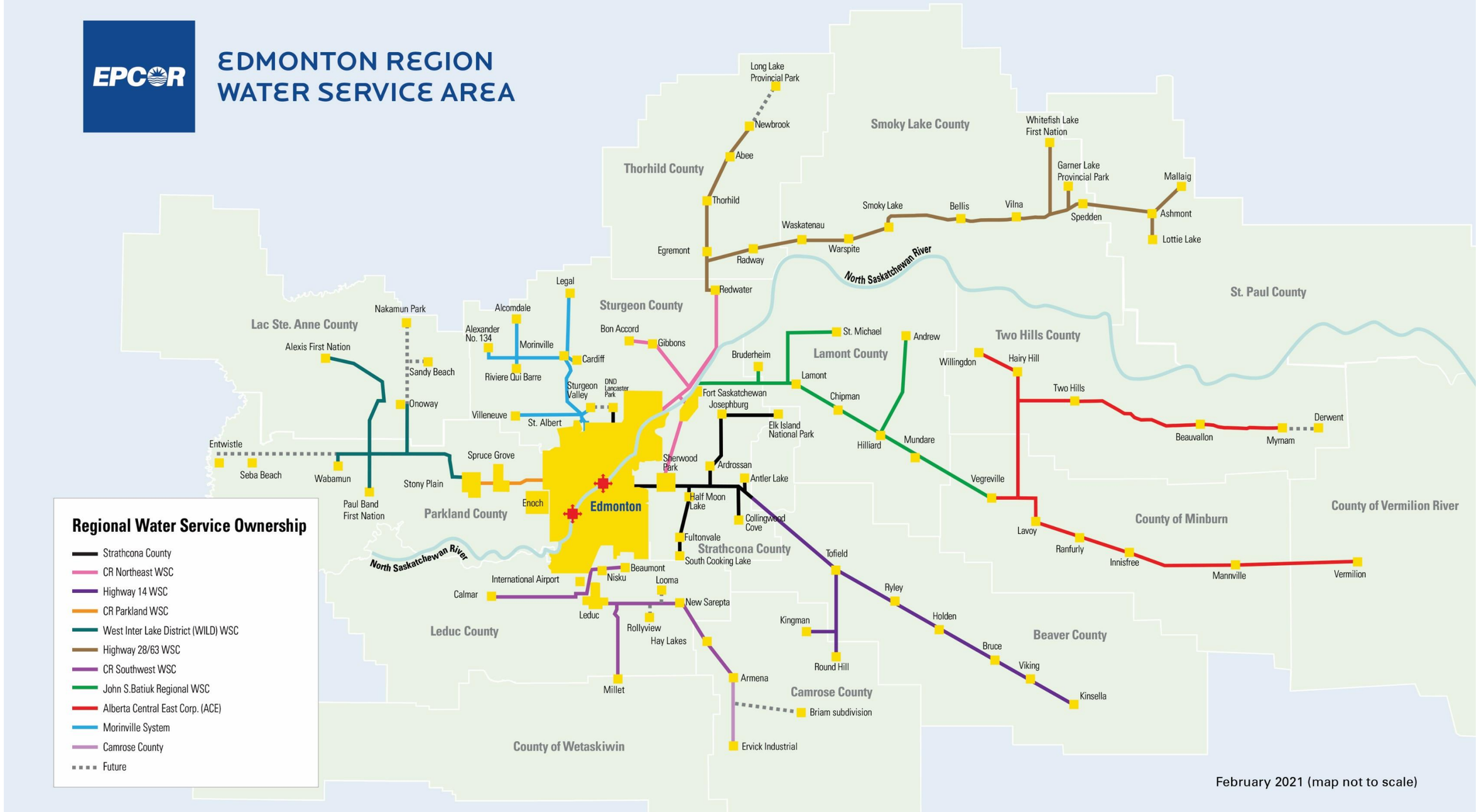


Figure 1: Edmonton Region Water Service Area Map

EWSI has experienced growth in total water demand despite water efficiency improvements across the entire Edmonton region. Figure 2 shows the total Edmonton region water demand is increasing over time. However, this is due in large part to continual growth in regional (outside Edmonton) water demand due to both population growth and an expanding regional service area. The segment representing in-city water demand has stayed relatively flat since the 1980s. In other words, though both Edmonton and the surrounding region are growing in population, only regional water demand has reflected this growth over the time scale shown in Figure 2.

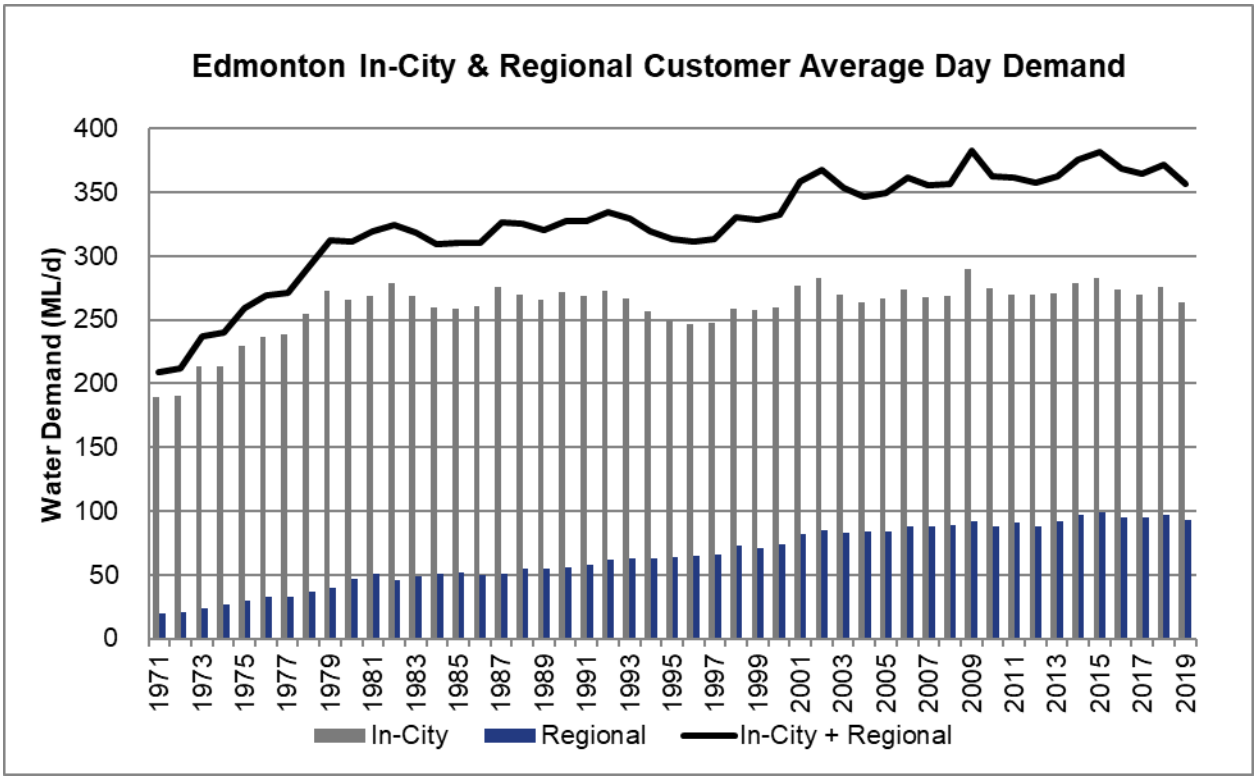


Figure 2: Edmonton In-City and Region Average Day Demand

Two noticeable inflections are apparent in the total demand curve (solid line of Figure 2): 1) at the start of the 1980s, and 2) at the start of the 2000s. Demand rose until the 1980s, levelled off until 2000, then there was another rise in demand to a slightly higher level.

The early period of increase between 1970 and the early 1980s can be attributed to economic factors. Fueled by the oil boom of the 1970's, Edmonton's population flourished in this decade, and total water demand greatly increased.

In the early 1980s, the worldwide economic recession reduced net migration to the city and region. Edmonton experienced its lowest growth of modern times, and another recession occurred in 1986. This low population growth and economic activity resulted in flat total water demand.

During the 1990s, low population growth as well as changes to water efficiency occurred. The 1992 USA Energy Policy Act dictated a maximum of 6 litres per flush for new toilets. At the same time, Edmonton City Council adopted a Water Conservation Policy and the utility launched its formal water efficiency programs to delay an E.L. Smith water treatment plant expansion.

Total water demand increased gradually during the 2000s due to strong population and economic growth in Edmonton and the greater Edmonton region.

From 2011 to 2016, the Edmonton census metropolitan area (CMA) grew at the second fastest rate in the country at 13.9%, only behind Calgary at 14.6%. Based on the City of Edmonton's CMA fall 2020 forecast [1], the Edmonton region is projected to grow by just over 20% to 1.7 million people by 2030.

In 2020, the COVID-19 pandemic amplified an existing period of slower growth that arose from Alberta's energy sector challenges. The COVID-19 pandemic is forecast to continue impacting in-city growth over the near term.

Uncertainty in future growth trends and demographic shifts in water use due to long-term impacts of COVID-19 will be monitored into the future.

While partially offset by increased Edmonton and region customer efficiency, total demand is predicted to modestly increase in the coming years if the Edmonton area returns to its historically high population growth.

2.2. City of Edmonton Water Demand

On an overall Edmonton region basis, it is clear that total demand is increasing over time. However, to effectively understand water use in Edmonton, it is important to consider historic population growth and the corresponding total water demand and per capita (per person) water consumption.

Prior to 1980, in-city total water demand in Edmonton grew proportionately with population and economic growth. In Figure 3 below, both total water demand and population show significant increases over this time period. However, the relationship between population increase and water demand increase has broken in recent decades due to increased customer efficiency.

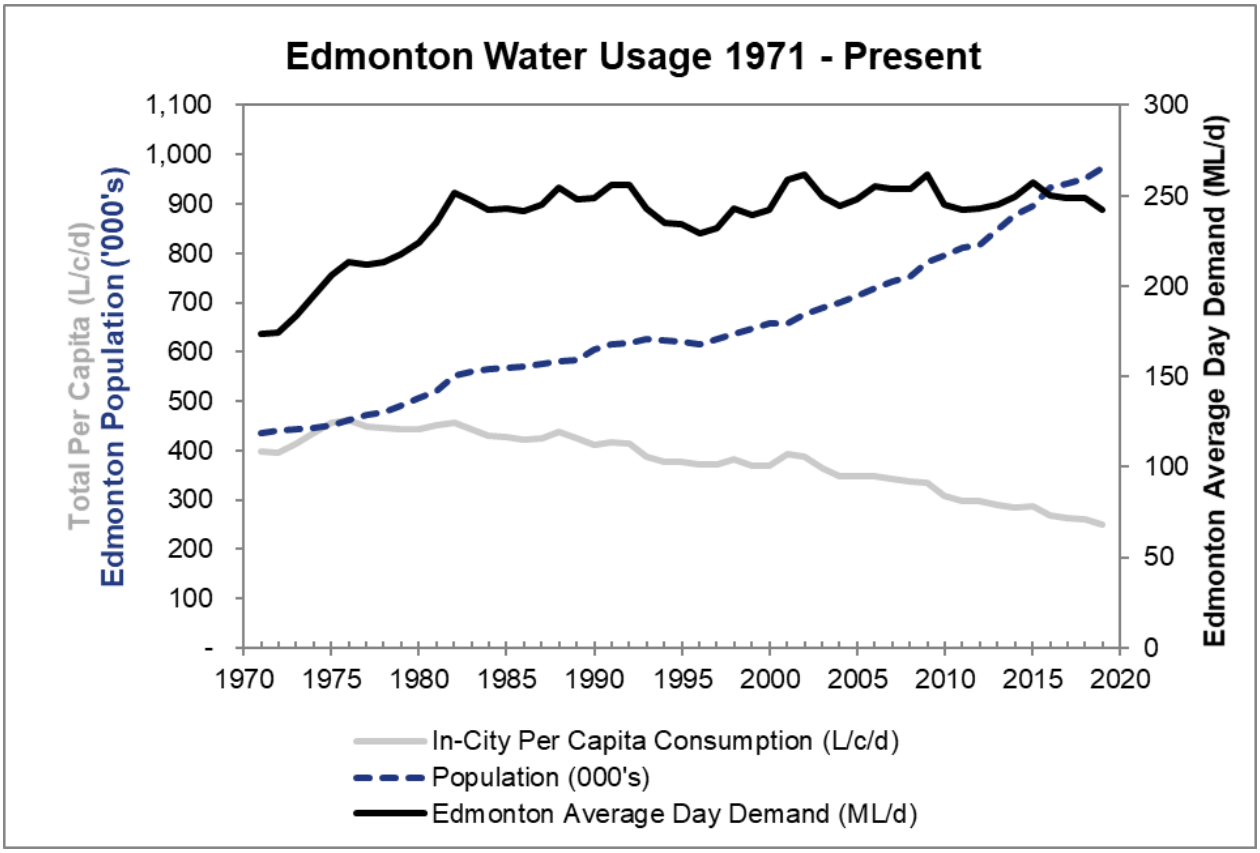


Figure 3: Edmonton In-City Water Usage – Effects of Efficiency

Today, in-city total water demand is roughly what it was in the early 1980s, even though Edmonton has grown by approximately 400,000 people since that time. This is because Edmonton residents are using less water per capita each year; this has offset the population growth over the past four decades.

3. Our Customer Types

Each of EWSI's water customers are classified into one of four categories: residential, multi-residential, commercial, and regional. These categories are described below.

- **Residential:**
  - Buildings with four or less domestic dwelling units (e.g. single-family dwellings, duplexes, etc.). Water consumption is mainly for indoor domestic purposes, however water use increases over the summer for outdoor water use.
- **Multi-Residential:**
  - Buildings with five or more domestic dwelling units (e.g. low-rise or high-rise apartment complexes). Water consumption is mainly for domestic indoor purposes.
- **Commercial:**
  - All non-domestic water customers (i.e. commercial, industrial, or institutional). Water end uses will vary by business type and scale.
  - For the purpose of discussing water use, this category is referred to as **Industrial, Commercial, and Institutional (ICI)**.
- **Regional:**
  - Wholesale water supply customers serviced by EWSI in the surrounding metropolitan region.

Figure 4 below shows the water consumption trends of EWSI's four customer categories since 1991. Total residential, regional, and multi-residential water consumption has increased, while commercial consumption has decreased.

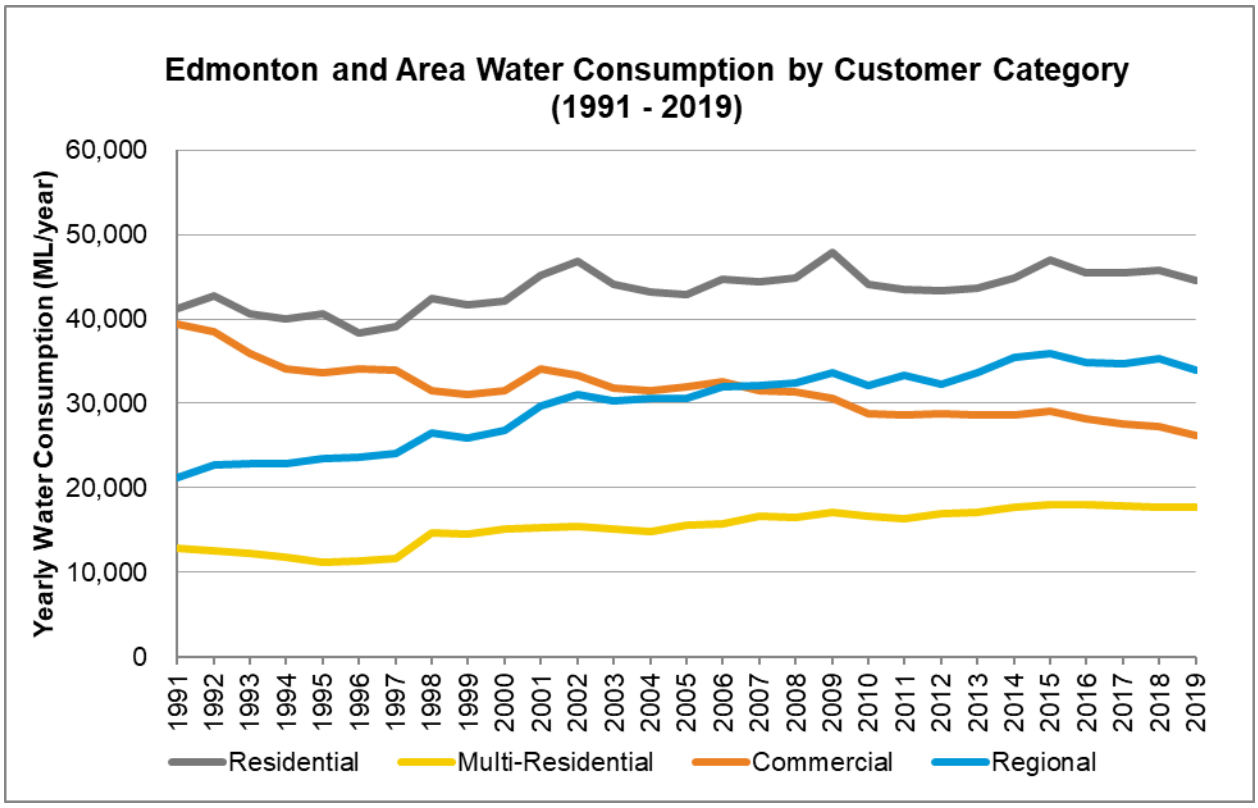


Figure 4: Edmonton and Area Water Consumption by Customer Category

Since 1991, total regional consumption has grown by 60%, multi-residential by 39%, residential by 8% and commercial has declined by 34%.

Figure 5 below compares the proportion of total water consumption, and number of accounts for each of EWSI's four customer categories.

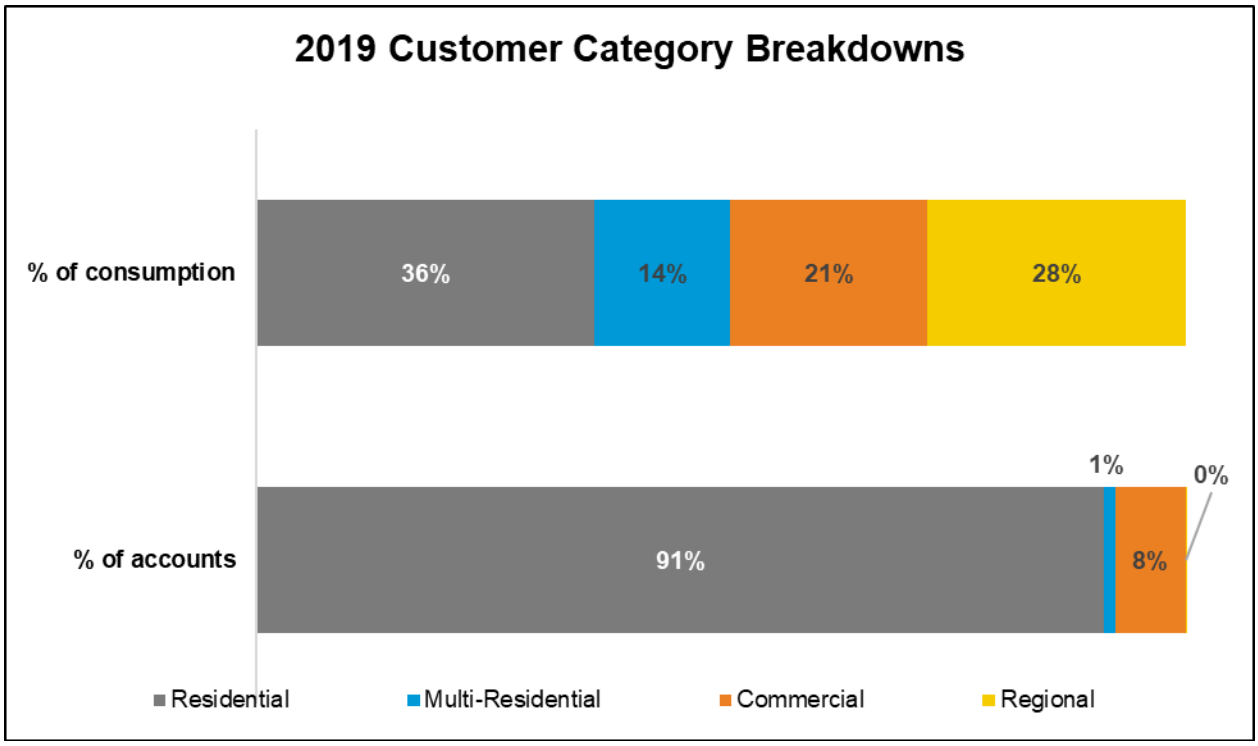


Figure 5: 2019 EWSI Water Customer Category Breakdowns

The following sections provide additional detailed information about EWSI's customer categories and provide guidance to accurately design water and sanitary systems for new customers.

4. Residential Customers

4.1. Residential Customer Profile

4.1.1. Characterization

Residential is EWSI's largest individual customer category. It has the largest number of customers and the largest proportion of water consumption of the four customer categories (Figure 5).

4.1.2. Consumption Per Service

Although total residential water consumption in Edmonton has increased over time due to population growth (Figure 3), the amount of water used per active customer service (household) has decreased (Figure 6).

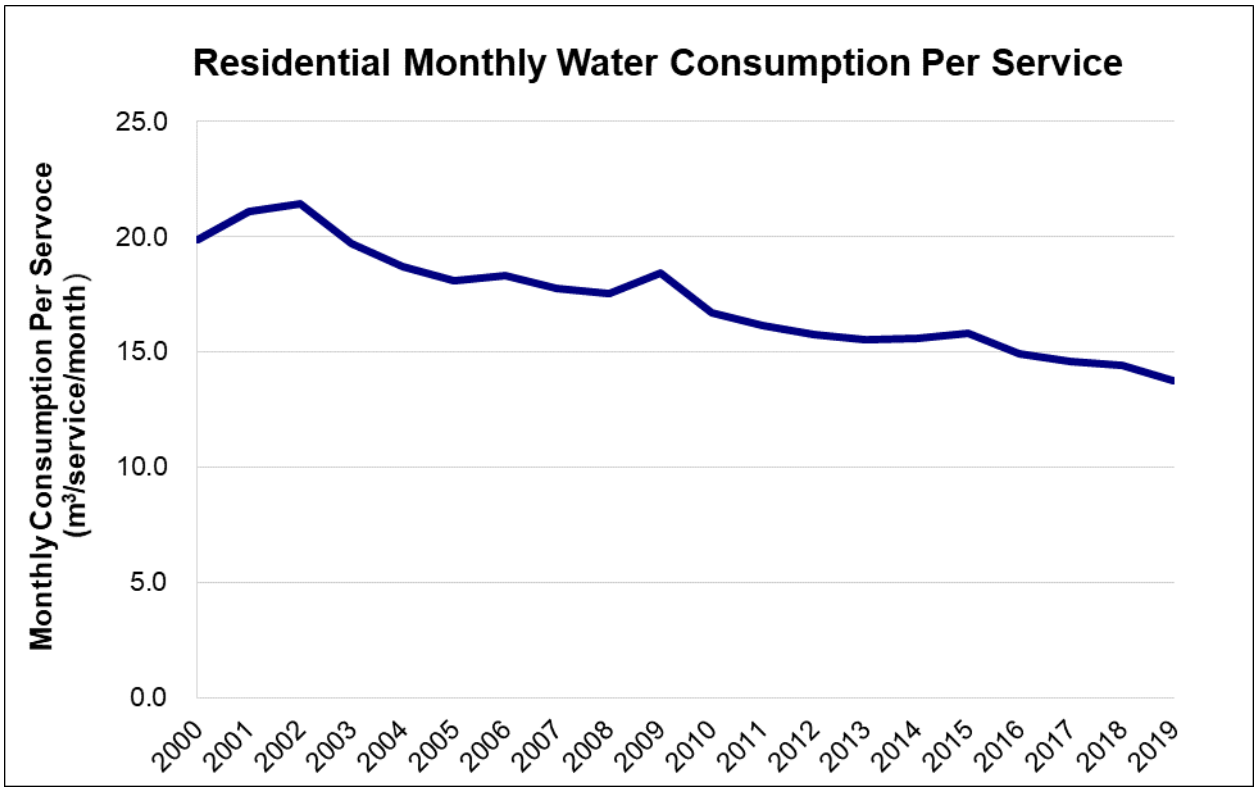


Figure 6: Residential Per Service Water Consumption

Residential per service consumption in Edmonton reached a high of 21.4 m^3/month in 2002. Since this time, consumption has fallen to 13.8 m^3/month in 2019 (a reduction of 36%). Water reductions per customer are anticipated to continue into the future due to passive water savings as customers replace toilets and washing machines with higher efficiency models.

Edmonton residents have historically used less water than other Canadian cities due to EWSI's universal metering practices, short summers with relatively low outdoor water usage, and increasing block rates that discourage high usage (Table 1).

Table 1: Historical and Current Residential Rate Blocks

Year Range	Residential Water Rate Blocks (Based on monthly consumption)
Before 2012	0 to 60 m^3 Over 60 m^3
2012 - Present	0 m^3 to 10 m^3 10.1 m^3 to 35 m^3 Over 35 m^3

4.1.3. Base Consumption vs. Seasonal Consumption

Residential water use in Edmonton varies by season. During the winter months, consumption is primarily used for indoor domestic purposes. Indoor usage is referred to as the base water consumption.

Water use increases during spring and summer months due to lawn irrigation and other outdoor uses. This is referred to as the seasonal water consumption.

In summer months, monthly consumption is comprised of both a base and seasonal component of water consumption. In winter months with little or no outdoor water usage, monthly consumption is primarily comprised of base consumption.

4.1.3.1. Base (Indoor) Consumption

"End uses" of water refer to a breakdown of total household water usage into categories such as toilets, showers, faucets, washing machines, etc. Figure 7 below provides an estimated breakdown of residential water use in Edmonton using the results from the Residential End Uses of Water Study 2 [2].

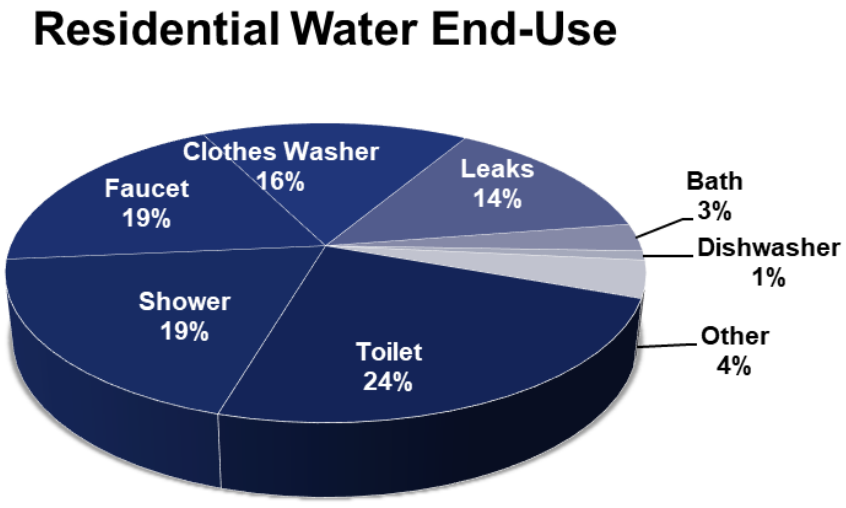


Figure 7: Estimated Residential Water End Use in Edmonton

4.1.3.2. Seasonal (Outdoor) Consumption

Seasonal water usage in Edmonton is highly correlated with the summer temperature and precipitation. During hot, dry summers like 2002, 2009, and 2015, seasonal consumption increased (Figure 8).

Over the past several years, outdoor seasonal water usage has also followed a decreasing trend, likely due to smaller lot sizes in developing areas (less outdoor irrigation) and more efficient watering behaviors.

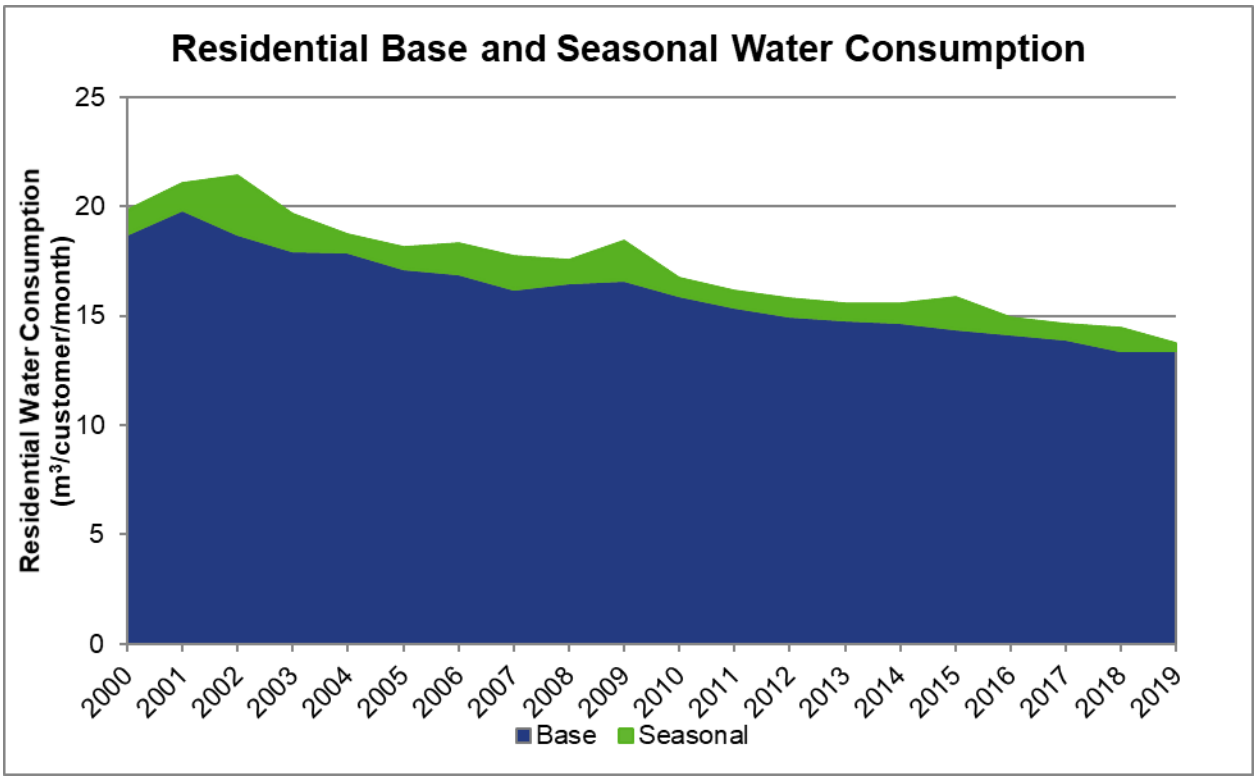


Figure 8: Residential Base and Seasonal Water Consumption

Seasonal consumption per residential service peaked in 2002, a significant drought year. In contrast, 2019 had the most rainy days in the past twenty years in Edmonton, and therefore had the lowest seasonal consumption.

The 3-year average ratio of seasonal to total water usage is 5% in the city of Edmonton for residential users.

The impact of climate change on seasonal water use must be monitored due to increasing uncertainty of future precipitation patterns. EWSI will continue its involvement in climate change research to stay current on trends and data. EWSI's integrated resource planning initiatives will continue to monitor new climate research and climate patterns into the future and recommend strategies for outdoor water use as operationally required.

4.1.4. Mapped Residential Water Consumption

EWSI geographically maps residential water consumption across Edmonton to understand how customer demographics affect residential water usage patterns. The use of mapping provides insights into trends that help EWSI classify and understand existing data to better forecast future water consumption. Understanding

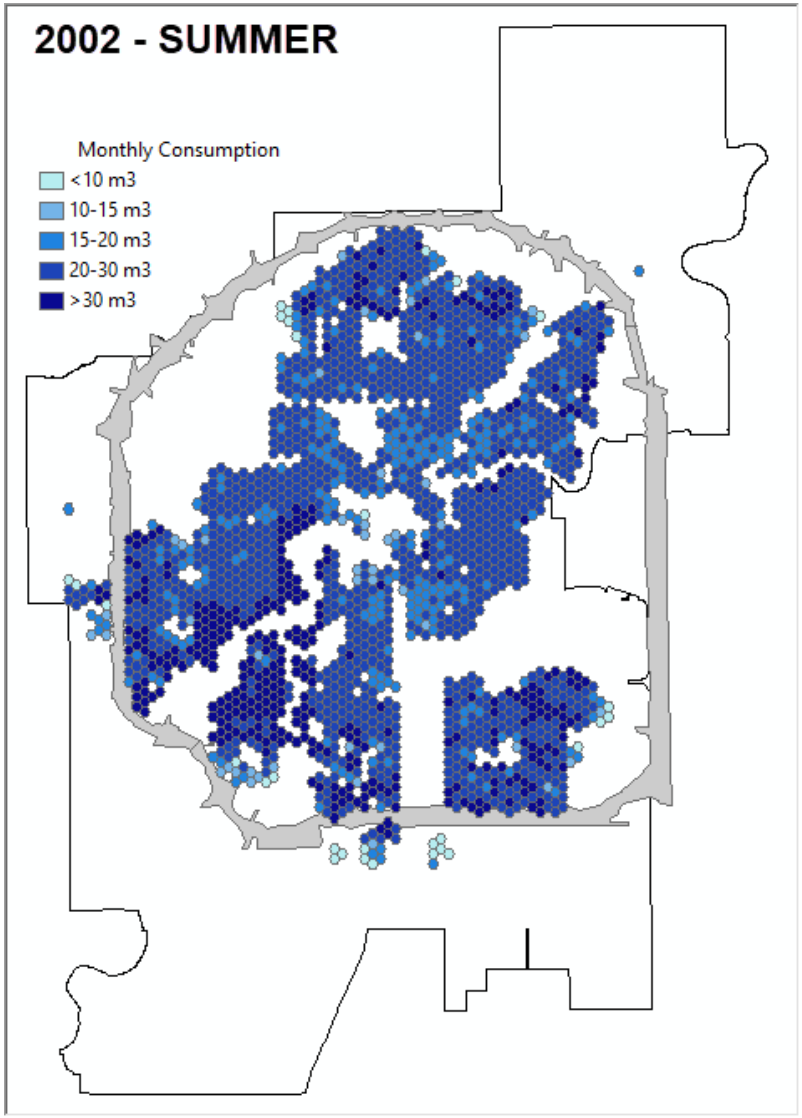
geographic variation in water consumption also informs design and operational exercises. It also allows EWSI to develop targeted water conservation messaging for high water users.

The following series of figures illustrate residential water consumption across Edmonton. EWSI publishes water consumption maps like those shown below to Edmonton's open data portal on a regular basis to allow customers to compare their usage to other areas in Edmonton. Multiple years of data are available on the open data portal, and illustrate the changing water consumption trends year-to-year.

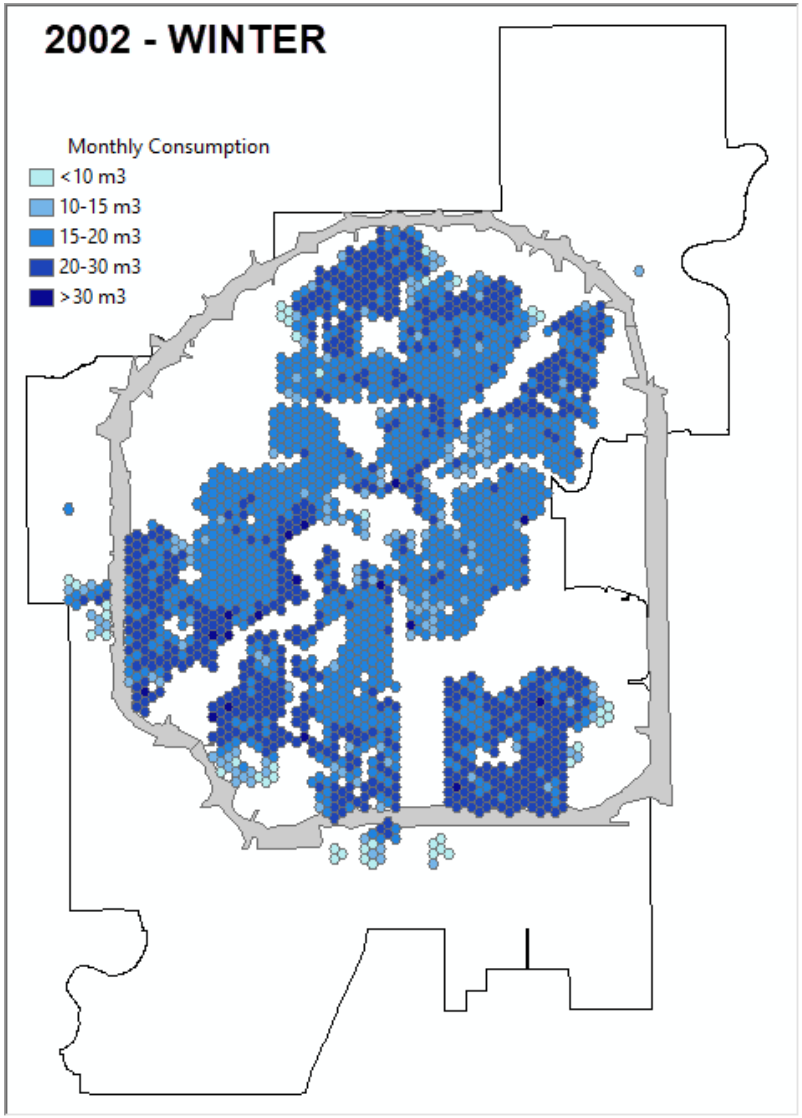
The series of figures below compare summer and winter water consumption of residential customers from 2002, 2009, and 2019 respectively. 2002 and 2009 are both significant high water consumption years due to hot and dry weather conditions. 2019 is the most recent analysis year.

When comparing the mapped consumption across the different years, it is clear that there are widespread decreases in base water consumption between winter 2019, 2009 and 2002. As discussed, 2002 was a notable year with respect to residential water consumption: due to hot temperatures and record low rainfall, outdoor residential water use peaked.

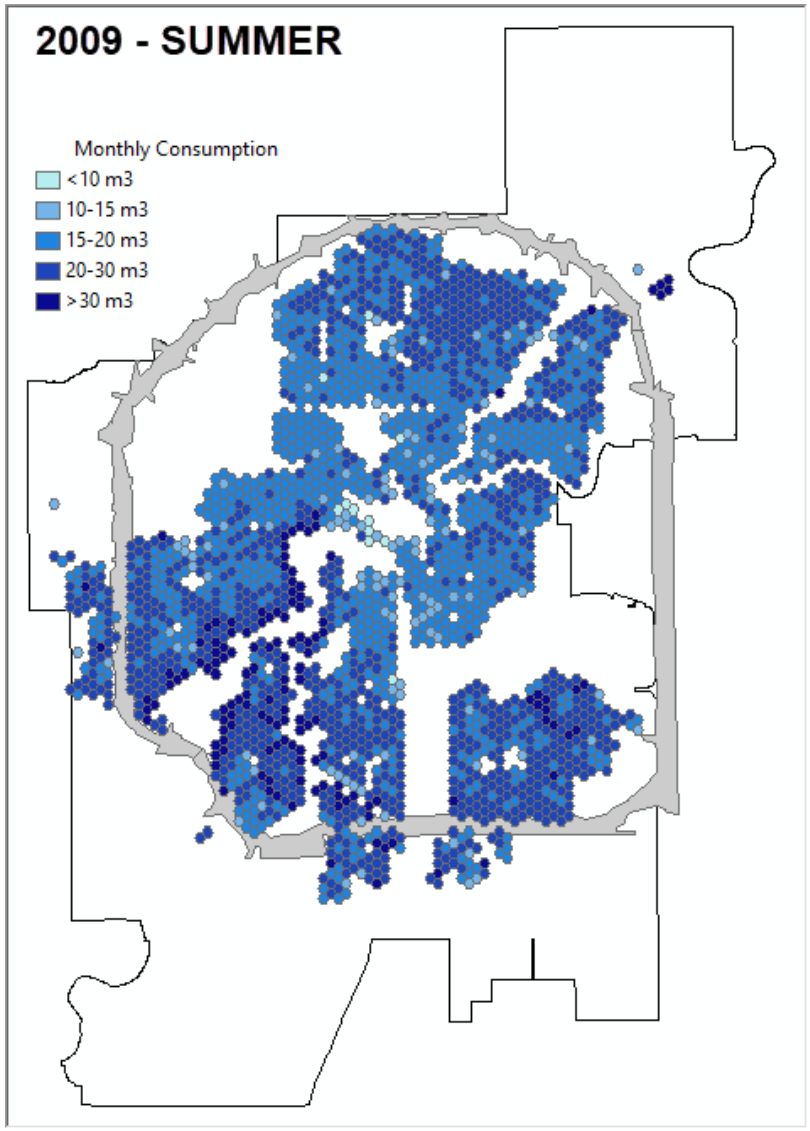
Each set of summer-winter figures also highlights the seasonal peak usage, showing how consumption increases across the city in warmer summer months.



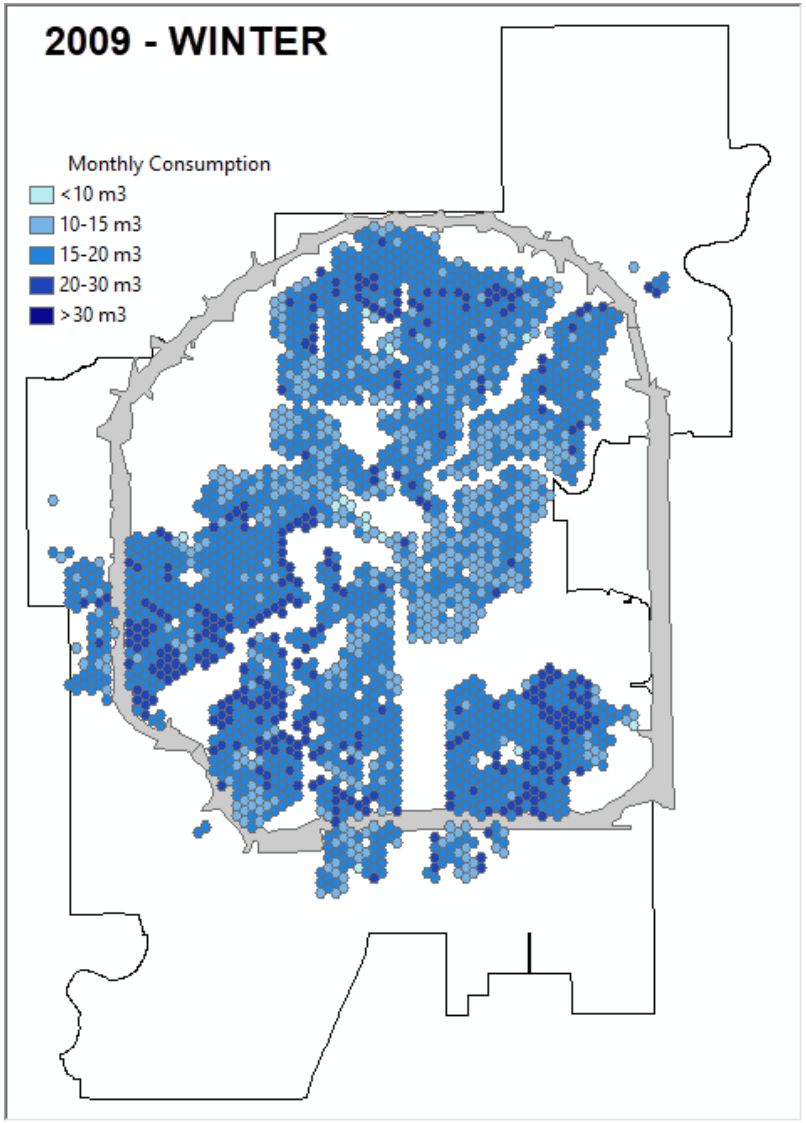
2002 Residential Summer Average Water Consumption



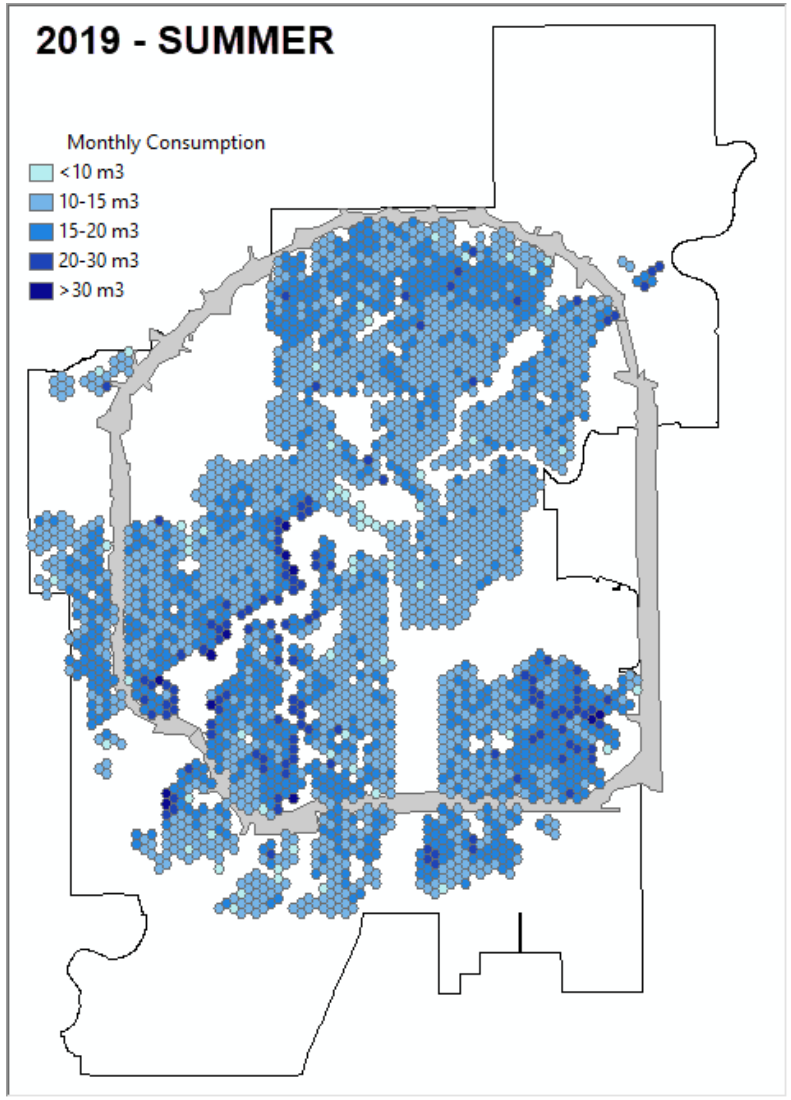
2002 Residential Winter Average Water Consumption



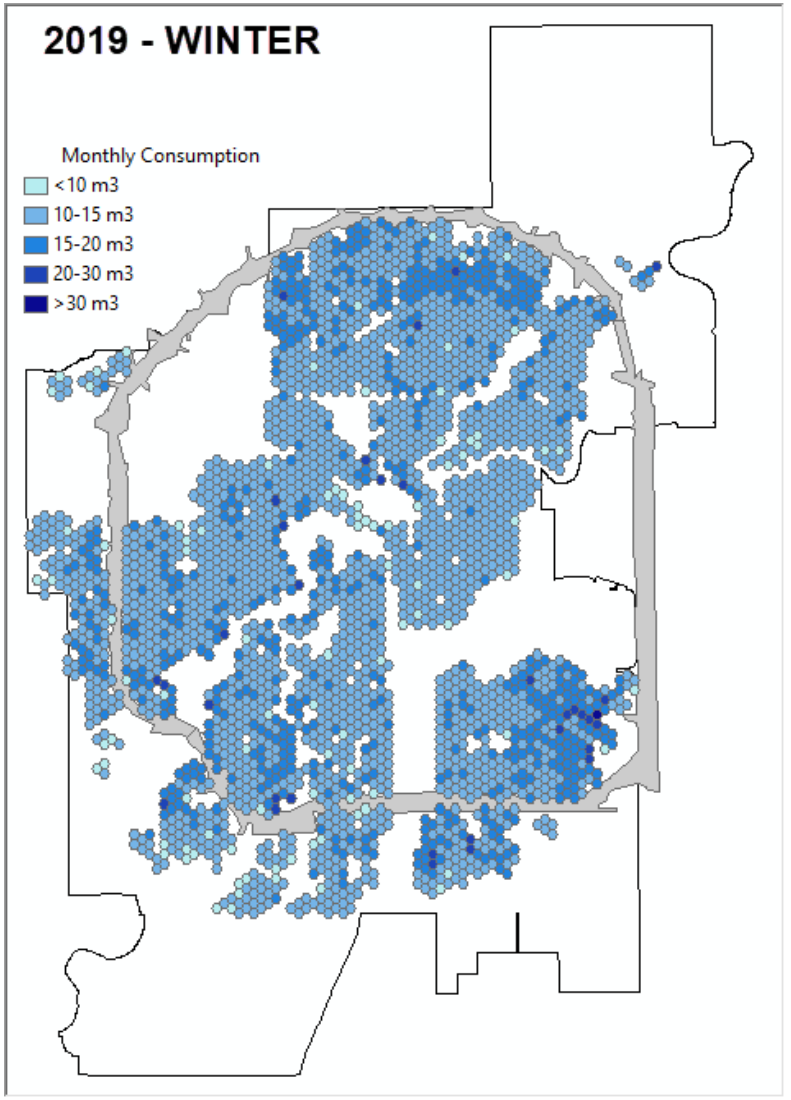
2009 Residential Summer Average Water Consumption



2009 Residential Winter Average Water Consumption



2019 Residential Summer Average Water Consumption



2019 Residential Winter Average Water Consumption

Table 2: Visual Comparison of Summer and Winter Mapped Water Consumption

As shown in the figures showing 2019 water consumption above, the majority of Edmonton's residential areas consume 10 to 15 m^3/month and are thus considered efficient water users. Comparatively, areas of high consumption are clustered around the river valley areas, as well as in Mill Woods area (southeast Edmonton).

High water use can be attributed to a number of factors including number of people per home (large families or group homes), homes with inefficient water fixtures (toilets and washing machines installed prior to 1994), homes with leakage, high value homes with high discretionary water use (i.e. luxury items such as hot tubs, pools, etc.), or houses with larger lawns and increased irrigation requirements.

It is predicted that the high consumption areas around the river valley correlate with high discretionary water use including outdoor use, whereas high use areas in Mill Woods correlate to areas that have not yet seen widespread upgrades to high-efficiency appliances. The following section provides more information on the changing consumption trends based on neighbourhood characteristics.

4.1.5. Per Capita Water Consumption Trends

EWSI monitors per capita water consumption at various levels. Two important examples are at the citywide level and the neighbourhood level.

4.1.5.1. Citywide Per Capita Consumption

Two key metrics used to measure and monitor municipal water use are: 1) total per capita water consumption, and 2) residential per capita water consumption.

Total per capita water consumption is typically calculated on a per day basis and is the volume of water delivered through the water distribution system to Edmonton customers divided by the municipality's population. Figure 9 below shows Edmonton's historical total per capita water consumption since 1971. Total per capita water consumption in Edmonton has been decreasing since the 1980s and in 2019 was 271 l/c/d.

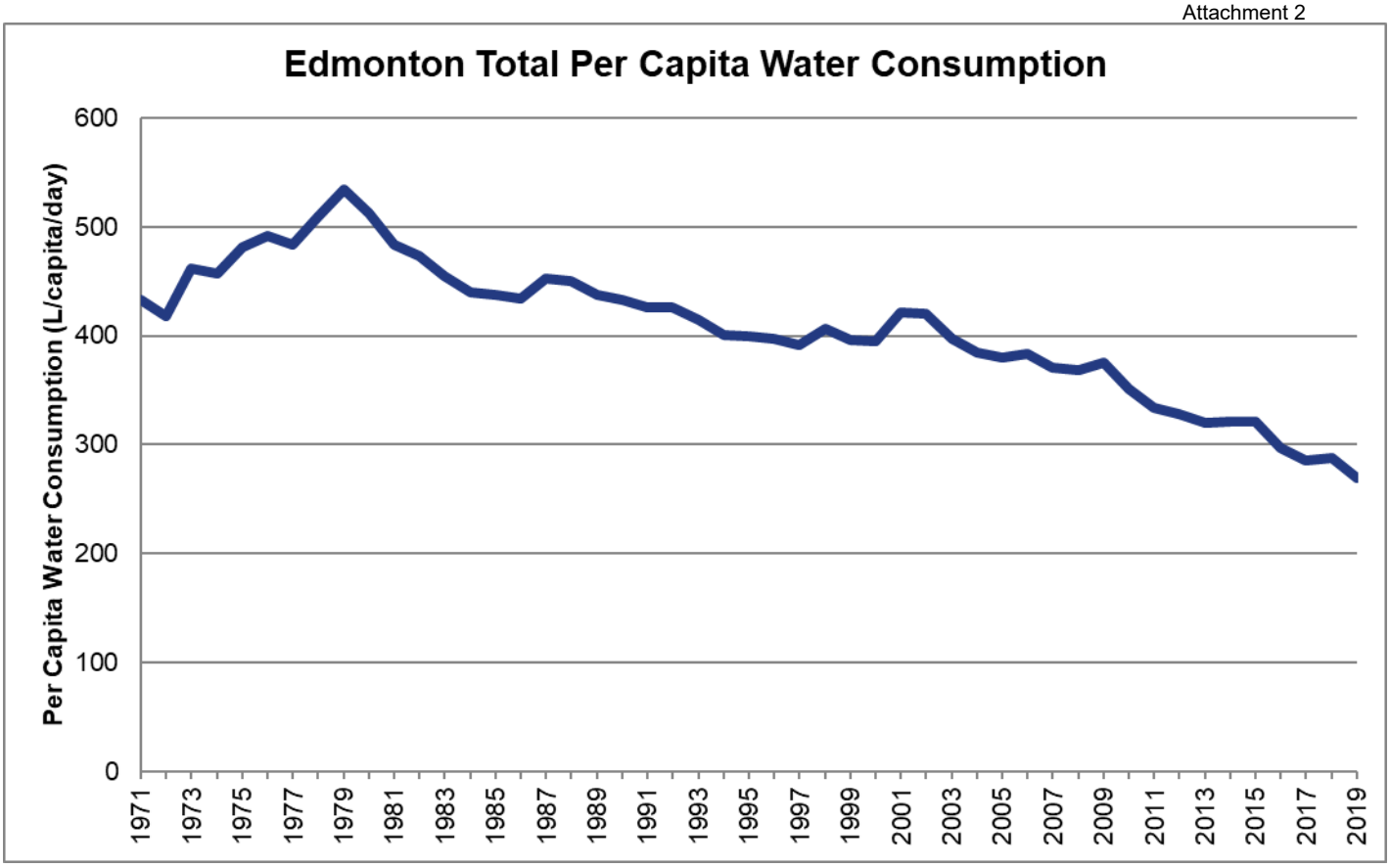


Figure 9: Edmonton Total Per Capita Water Consumption

Residential per capita water consumption is the water consumption of the residential and multi-residential sector divided by the municipality's population.

Residential per capita water consumption is an important design criteria for water and wastewater systems, particularly linear infrastructure design.

The adoption of water efficient fixtures in homes and businesses has led to passive water efficiency gains in homes since the mid-1990s. Many appliances and other water-using fixtures are now efficient by default, and in many cases inefficient fixtures are no longer available for purchase.

Residential average per capita water consumption in Edmonton in 2019 was 176 L/capita/day; however, per capita water consumption in some of the newest developing neighbourhoods is below 150 L/capita/day. Efficient fixtures and appliances (primarily high-efficiency toilets and washing machines) have contributed to significant water reductions in indoor residential water consumption and there is still potential for additional savings [2].

The average residential per capita consumption values for each decade beginning in 1971 are presented below in Table 3. A list of average yearly total and residential per capita water consumption since 2008 can be accessed via the City of Edmonton open data portal.

Table 3: Edmonton Average Per Capita Water Consumption by Decade

5-Year Interval	5-Year Average Per-Capita Water Consumption (L/capita/day)		
	Average	Winter**	Summer***
1995 – 1999	231	221	246
2000 – 2004*	241	228	259
2005 – 2009	226	213	244
2010 – 2014	201	193	211
2015 – 2019	185	178	197
2019	176	172	181

*The 2000-2004 time period includes the years 2002 and 2003 which featured the two highest residential per-capita consumption years since residential consumption data is available (1991). These years featured hot and dry weather that increased residential water usage.
**Winter months are defined as January – April and October – December
***Summer months are defined as May – September

The declining per capita water consumption due to customer water use efficiency has made a tangible impact on EWSI's long range planning. Some examples include:

- The E.L. Smith water treatment plant expansion was delayed from 1992 to 2006 due to successful reductions in peak summer water demands.
- Reduced area-level water consumption forecasts have allowed for right-sized water transmission mains.
- Water consumption has a direct correlation to dry weather flows in the sanitary collection system. Area-level planning at EWSI considers the impact of declining consumption on dry weather flows in the collection system, pump stations, and at the wastewater treatment plants.

4.1.5.2. Neighbourhood Per Capita Consumption

EWSI also monitors per capita and per-service residential water consumption in terms of city of Edmonton neighbourhood classification, i.e.:

- central core,
- mature (built prior to 1970),
- established (built 1970-1990), and
- developing (built after 1990),

Figure 10 shows existing neighbourhoods with residential water customers classified according to these definitions. Per capita residential water consumption for these neighbourhood types is visualized in Figure 11. Neighbourhoods with classifications not listed above are excluded from the figure.

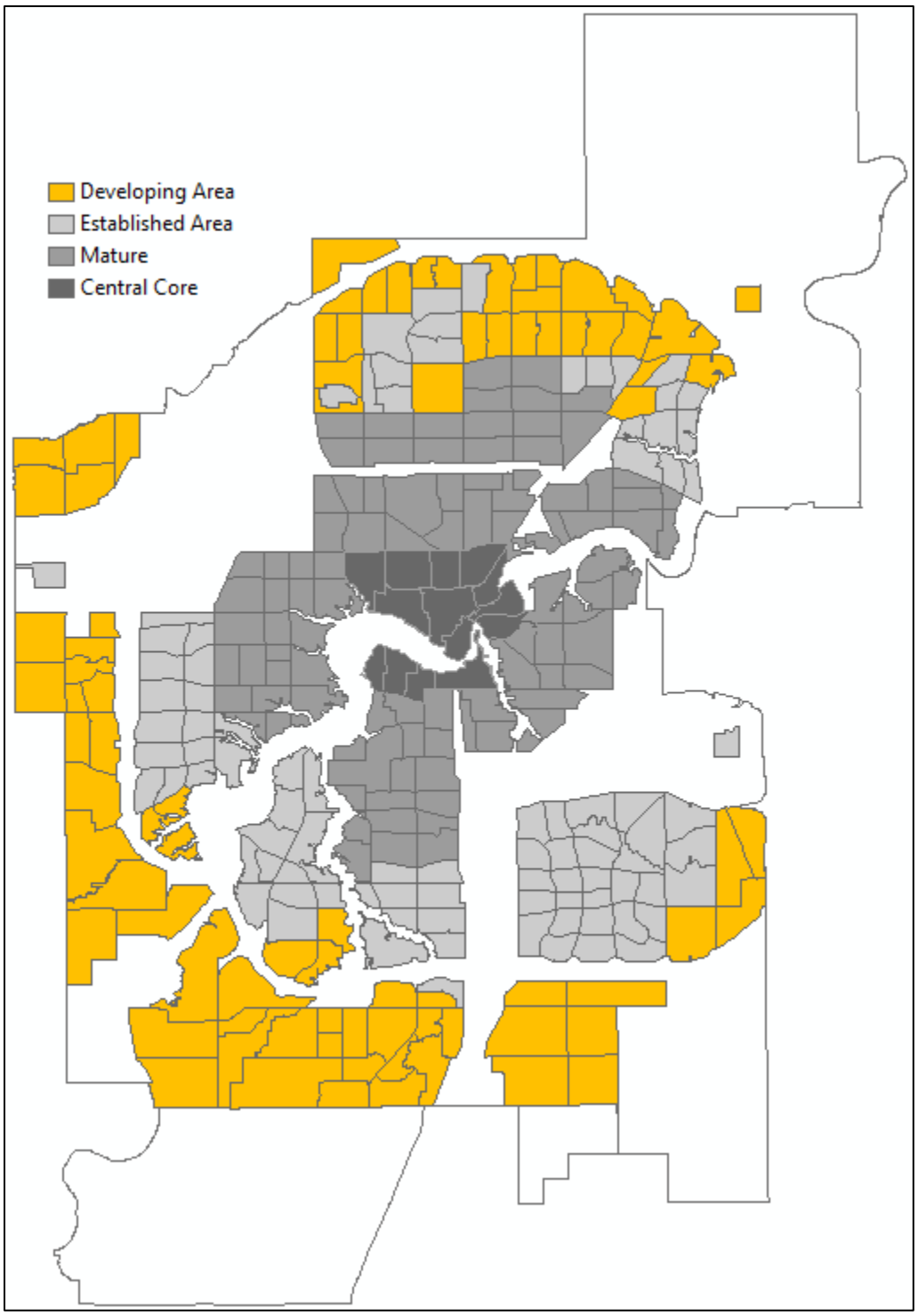
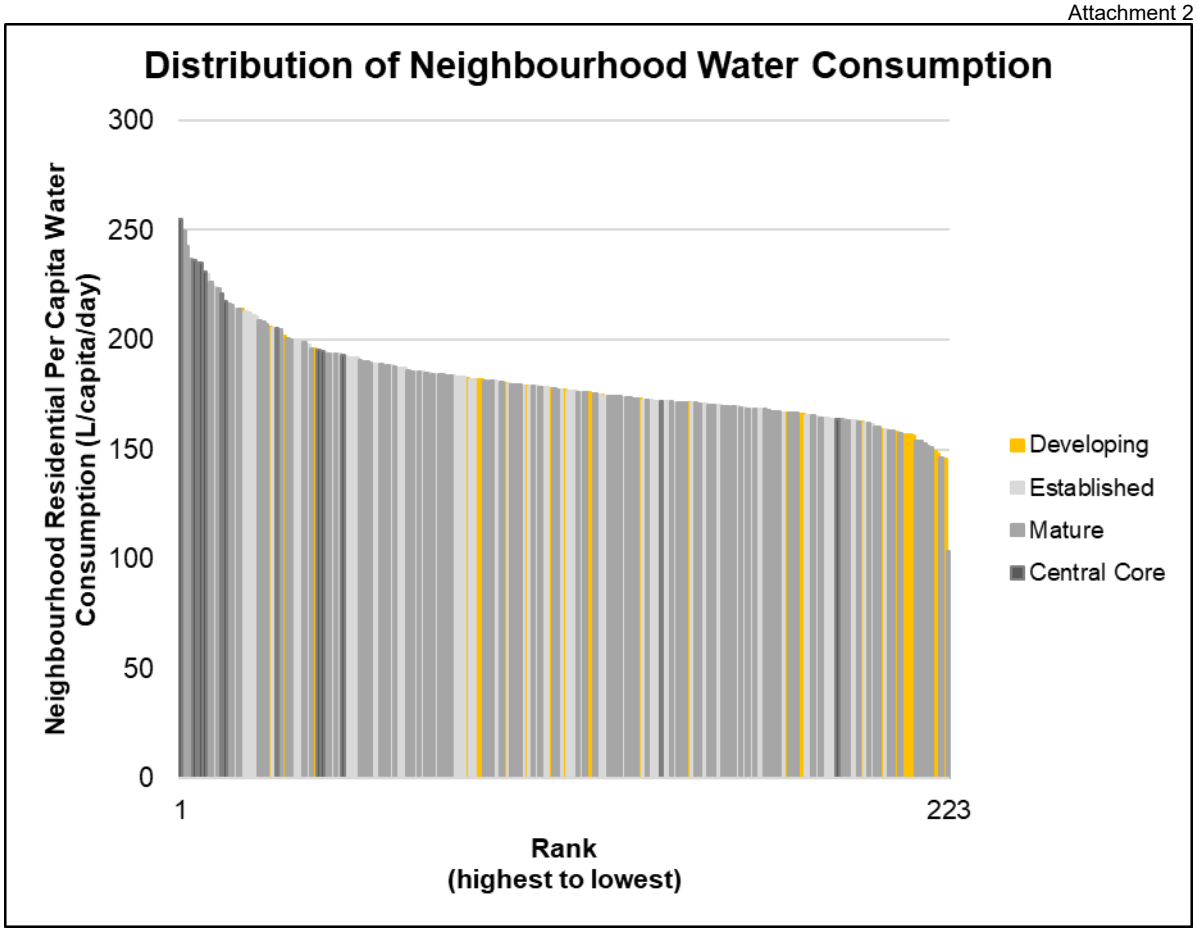


Figure 10: Residential Neighbourhood Classification Map



*Based on 2019 water consumption data for residential and multi-residential customers.
*Excludes developing neighbourhoods < 90 % complete based on City of Edmonton 2019 Low Density Lot Registration Report [3]

Figure 11: Residential Per Capita Consumption by Neighbourhood Type

The age of water fixtures and appliances can have a significant effect on overall household water consumption and rate of future decline. The age of water fixtures can be approximated by the age of neighbourhood development. For example, EWSI has determined that established neighbourhoods (1970-1990 vintage) have had the highest average annual rate of consumption decline out of the four neighbourhood classifications over the past five years, followed by the mature and core areas.

Developing neighbourhoods show the slowest rate of consumption decline. These trends are projected to continue over the near term. Figure 11 shows that developing neighbourhoods often have low per capita water consumption (175 L/capita/day and lower, with minimal exceptions). Low water consumption in developing neighbourhoods is attributed to a number of factors, including:

- Newer developments are installed with high-efficiency fixtures and appliances.
- In areas of high-density single- or multi-family development, smaller lot sizes lead to reduced irrigation requirements.

Research suggests that daily indoor per capita water use for new homes built with high-efficiency fixtures and appliances is currently 140 L/capita/day. Additional indoor reductions can be expected as future fixtures and appliances become more efficient than today's models and customer side leakage is reduced [2].

4.2. Residential Growth Projections

Residential population growth is anticipated in developing areas in the northeast, west, southeast and southwest including the 2019 annexation areas. In order for Edmonton to grow to a population of 2 million, the Edmonton City Plan increases focus on infill and densification of the core, mature and established areas.

Total consumption of the customer class is projected to increase slowly over the coming years, as growth will be partially offset by increased efficiencies of the current housing stock.

4.3. Residential Design Metrics

EWSI recommends using per capita water consumption combined with population to determine residential water consumption in a planned development area. Area planning typically considers the ultimate buildout condition that will occur decades into the future. Since per capita water consumption is decreasing, and will continue to decrease into the future, it is prudent to assume a reduced per capita consumption value when building these long-range area development plans (e.g. District Plans, Area Structure Plans, and Neighbourhood Structure Plans).

Therefore:

For area-level planning of water transmission mains and sanitary trunk sewers, a reduced **per capita metric of 160 L/capita/day** is recommended for the residential portion of ultimate area water consumption.

For stage-level and site-level hydraulic analyses, continued use of the latest design and construction standards (Volume 4: Water) is recommended.

The 160 L/capita/day value is more representative of newly-constructed dwellings that use high-efficiency fixtures and appliances. Consultants and planners should use the reduced metric of 160 L/capita/day when conducting area planning for sanitary trunk and water transmission mains. This encompasses large area planning calculations, such as district areas, ASP areas, and NSP areas (neighbourhoods). Please contact EWSI One Water Planning if guidance is required on when the use of this reduced metric is appropriate.

Two important and closely-related metrics in long-range area planning are the per capita water consumption (called average day demand, ADD, in the water standards) and the per capita sanitary sewage generation rate ("G" in the drainage standards). In 2020 and 2021, both the sanitary sewage generation rate and the per capita water consumption standard metrics (respectively) were lowered to 220 L/capita/day to reflect EWSI's efficient residential customer base. EWSI anticipates that this metric will be reduced in the future. It is recommended to continue usage of the current standard 220 L/capita/day at this time for stage-level and site-level hydraulic analysis to align with the design and construction standards.

The reduction to 220 L/capita/day in the 2021 water design and construction standards update was an incremental step toward the planning value of 160 L/capita/day for area planning. EPCOR is currently exploring alternative approaches to support the planning assumptions for residential water consumption. A single residential design standard is no longer appropriate considering the increased focus on infill development in the updated City Plan and the range of consumption patterns that are seen across the city. Additional consultation will occur with UDI, IDEA and the City of Edmonton Planners in the coming year to determine how best to manage within the context of the Design and Construction standards.

5. Multi-Residential

5.1. Multi-Residential Customer Profile

5.1.1. Characterization

EWSI defines a multi-residential service as a service supplied to premises used primarily for domestic purposes; where more than four separate dwelling units are metered by a single water meter. This includes apartment buildings, condominiums, townhouses, mixed use developments, and other properties where multiple dwelling units may reside.

The multi-residential customer category is the smallest in terms of total consumption, and second-smallest in terms of number of accounts (Figure 5). The multi-residential customer category is also relatively new; prior to 1991 multi-residential customers were included in the commercial customer category.

Multi-residential water consumption is considered “domestic” use. Combining multi-residential and residential water consumption represents overall domestic water consumption.

5.1.2. Account Growth

The number of multi-residential water accounts has been steadily increasing over the last decade (Figure 12).

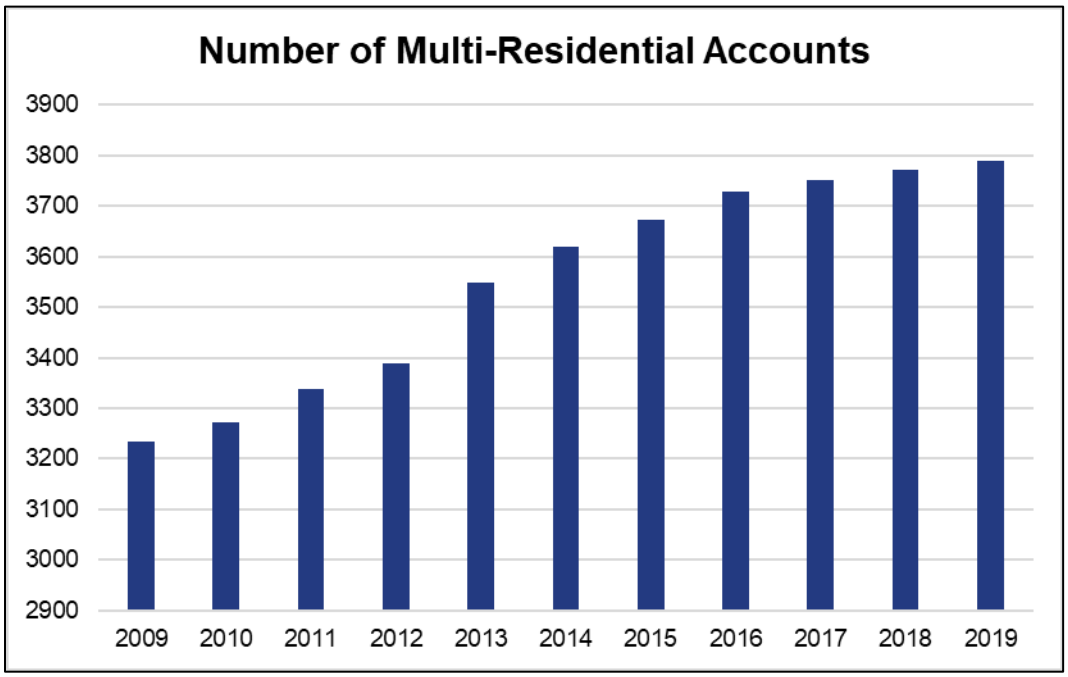


Figure 12: Number of Multi-Residential Accounts 2009 - 2019

There has been noticeable growth of multi-residential accounts in developing areas. There has also been steady growth observed in central core, mature, and established neighbourhoods. This data is shown below in Table 4 and Figure 13 below.

Table 4: Average Annual Percent Growth (2009-2019)

Neighbourhood Type	2009-2019 Average Customer Growth
Central Core	1.3 %
Mature	1.0 %
Established	0.6 %
Developing	10.6 %

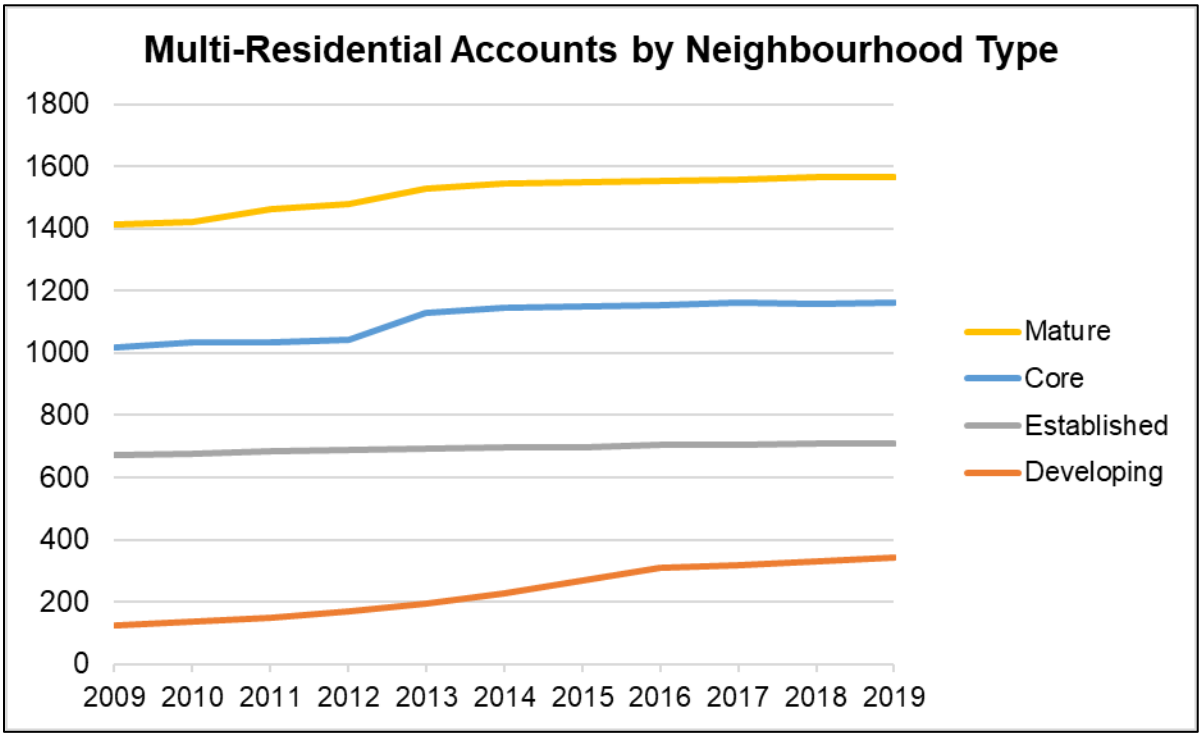


Figure 13: Multi-Residential Accounts by Neighbourhood Type

5.1.3. Average Dwelling Unit Consumption

As explained in Section 5.1.1, a domestic premise requires five or more dwelling units metered by a single water meter to be defined as a multi-residential service. It follows from this that a multi-residential water service can include a range of building types, from a low-rise apartment building with as low as five dwelling units, up to a high rise apartment complex with hundreds of dwelling units.

As a result of this customer-to-customer size variation, monthly water consumption for multi-residential buildings can vary greatly between premises. Generally, the water consumption will be proportional to the number of dwelling units in the building; the more dwelling units, the more water that building will consume each month. This is shown in Figure 14 below.

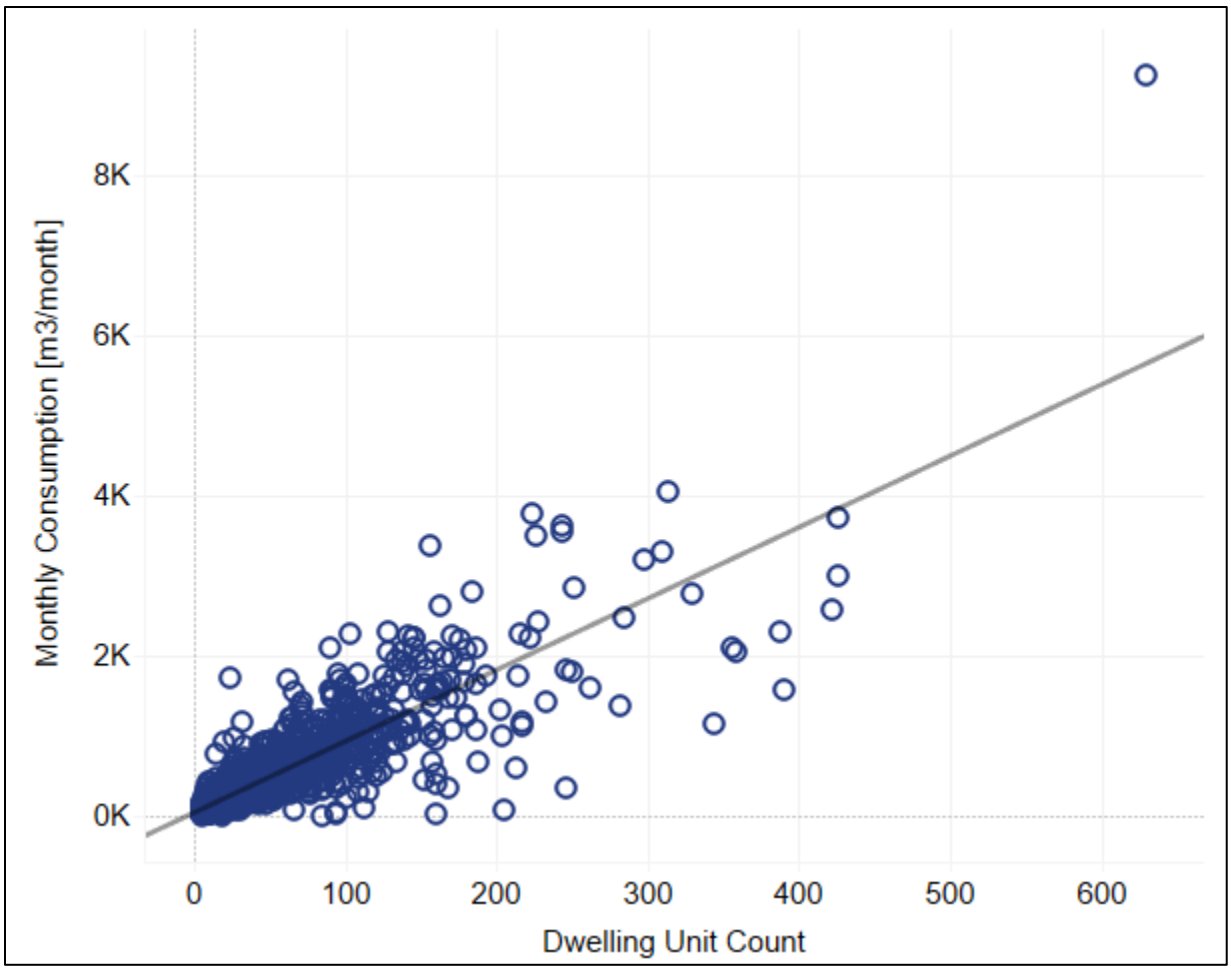


Figure 14: 2019 Multi-Residential Dwelling Unit Consumption by Building Size

As a result of the variability, it is more effective to compare multi-residential customers in terms of average dwelling unit consumption (dwelling unit level), rather than average service consumption (building level). Essentially, water consumption is normalized by dividing the total service consumption by the number of dwelling units.

Dwelling unit consumption is decreasing over time (Figure 15) across the entire multi-residential customer category. This is primarily attributed to increases in water efficiency over time, and is similar to the decreasing trend shown in single-family residential customers.

New multi-residential buildings will be outfitted with best-in-class fixtures and building mechanical systems that will reduce average water use over time.

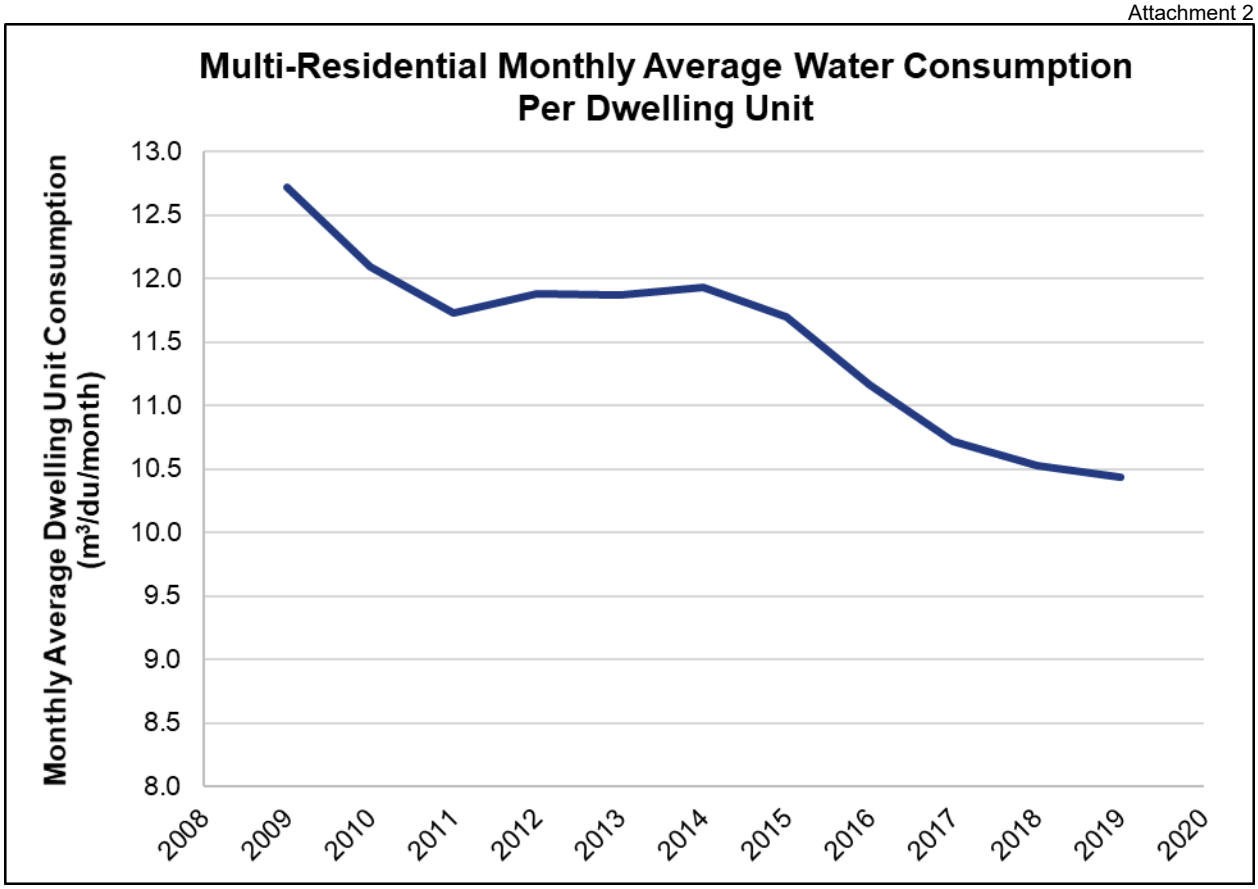


Figure 15: Multi-Residential Water Consumption Per Dwelling Unit

Compared to residential, multi-residential consumption per dwelling unit is lower and less seasonal in nature. Multi-residential household size (i.e. occupants) tends to be smaller, contributing to some of the differences in average water use per dwelling unit between the multi-residential and residential classes [4].

Figure 16 and Figure 17 below presents the average monthly water consumption per dwelling unit for multi-residential buildings in Edmonton.

The main conclusion from the data in Figure 16 is that average dwelling unit consumption slightly decreases as the building dwelling unit count increases. Figure 17 shows that the majority of dwelling unit consumption is between 0 – 20 m^3/du/month, and occurs primarily in buildings with 5 – 25 dwelling units.

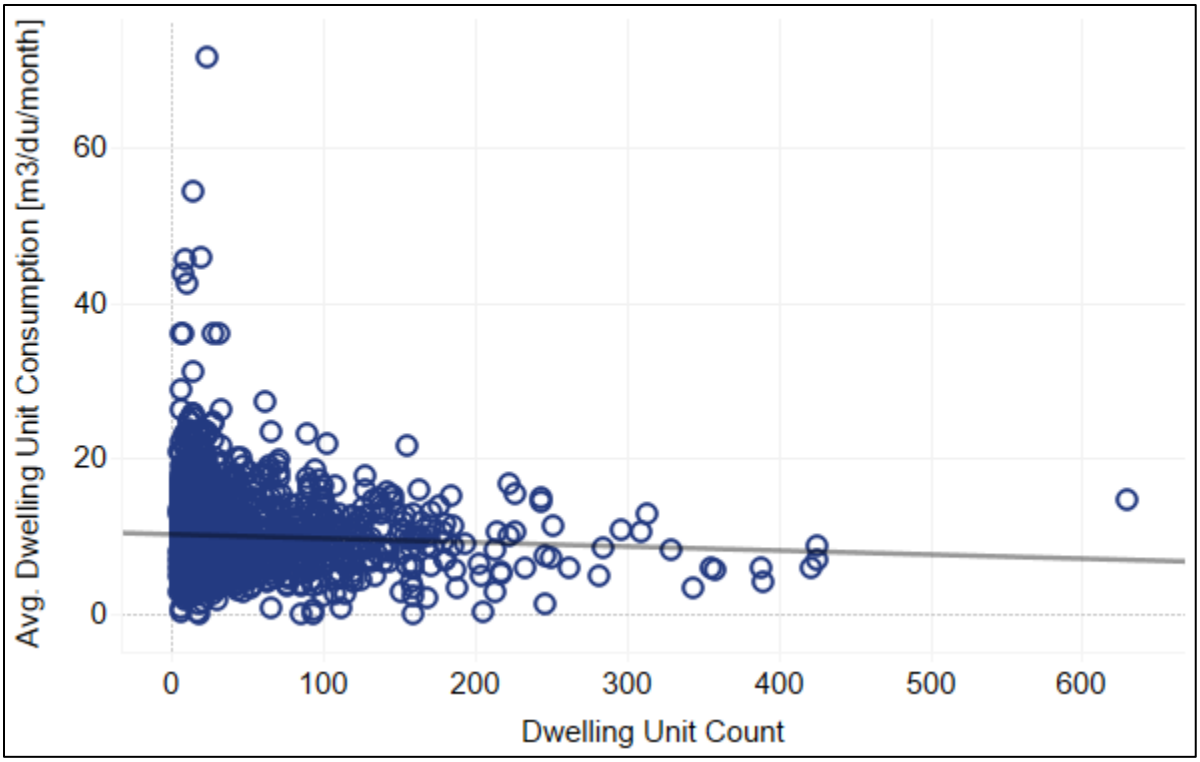


Figure 16: Plot of Multi-Residential Dwelling Unit Consumption

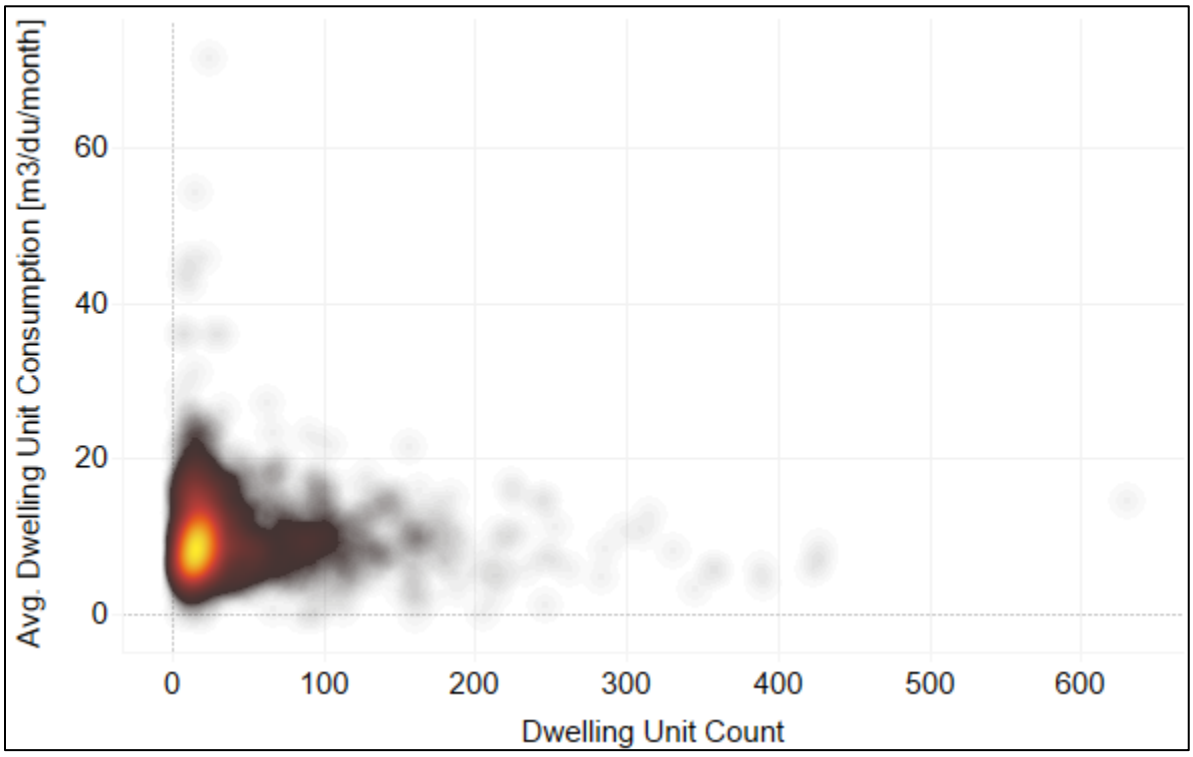


Figure 17: Heat Map of Multi-Residential Dwelling Unit Consumption

Figure 18 below summarizes the data presented from Figure 16 and Figure 17 differently by grouping the data into building sizes (e.g. 5-9 units, 10-14 units, etc.). The number of accounts associated with each building size is shown above each data column (n = #). The figure shows that the majority of EWSI multi-residential services

have between 5 – 25 dwelling units, and that dwelling unit consumption becomes more variable as the building size increases.

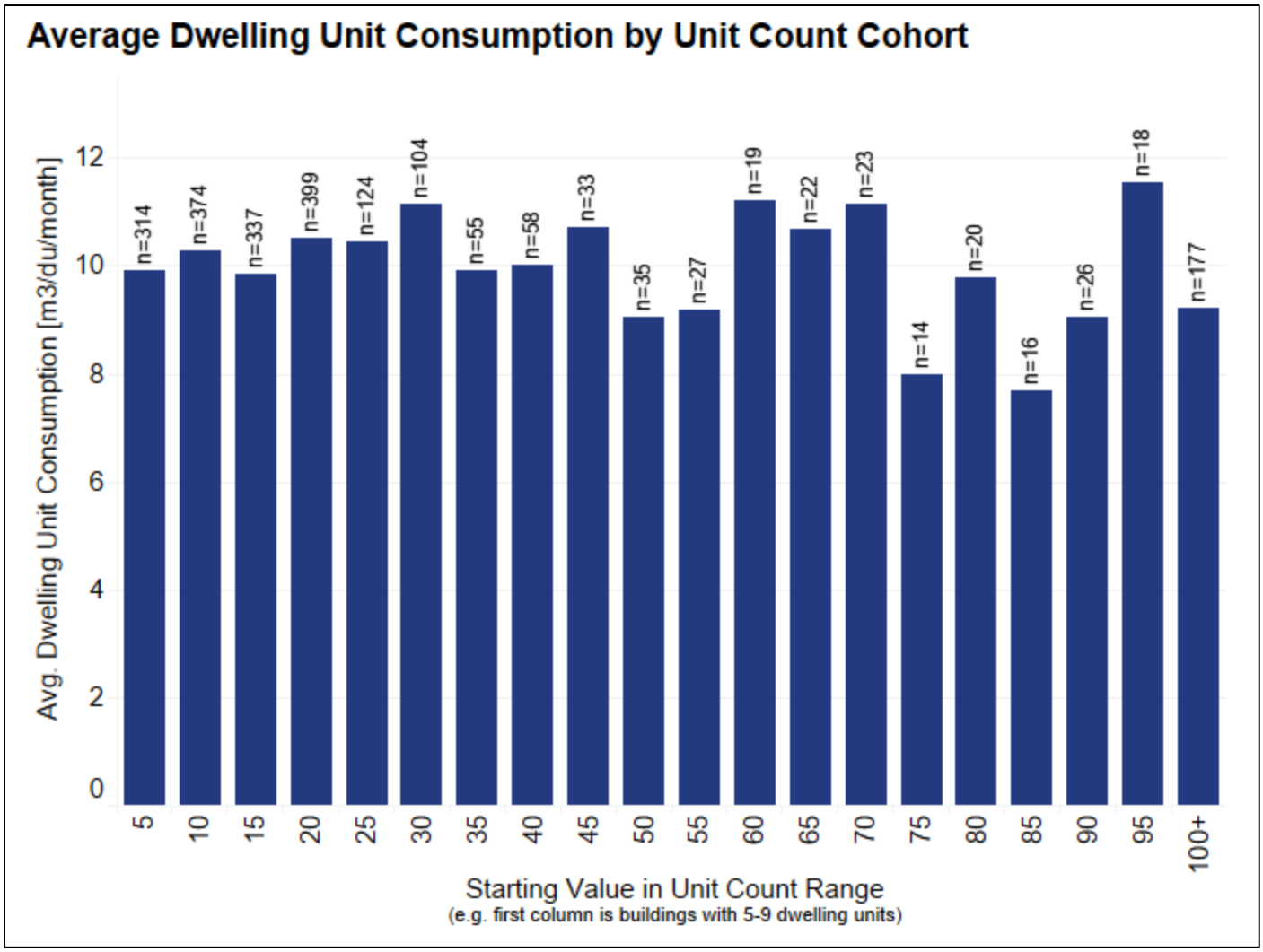


Figure 18: 2019 Average Dwelling Unit Consumption by Unit Count Cohort

5.2. Multi-Residential Growth Projections

From a water resources planning perspective, it is important to learn how the projected growth of the multi-residential market share may affect overall and per capita water consumption.

Part of the City Plan strategy is the shift from low-density outward growth to densification and infill development. To achieve this, new developments must be designed to specific density targets, and developers will need to focus attention on infill multi-residential projects. This projected shift will increase the share of multi-residential housing in the overall housing market, specifically in the core, mature and established areas.

As areas densify by increasing average number of units per hectare, average dwelling unit water consumption tends to decrease [4].

Over time, a shift away from residential development into denser multi-residential development is expected to reduce per capita water demands.

The increase in efficiency of the multi-residential customer class will offset a portion of the increased total water consumption due to new account growth. Historically, gains in efficiency have not been able to outpace new account growth, so total water consumption in this category has continued to increase. This trend is expected to continue into the future.

5.3. Multi-Residential Design Metrics

Future water consumption for multi-residential properties is typically calculated as the product of:

1. net dwelling units per hectare,
2. average number of people per dwelling unit (du), and
3. per capita daily water consumption.

The per capita water consumption metric for long-range multi-residential area planning is the same as the residential metric: 160 L/capita/day.

For long-range area planning purposes, a reduced **per capita metric of 160 L/capita/day** is recommended for the multi-residential portion of ultimate area water consumption.

Dwelling unit consumption represents the product of number 2 and 3 in the list above (avg. people / unit and per-capita daily water consumption).

Based on the analysis completed by One Water Planning, it was determined that 10 m^3/du/month is a suitable alternate water consumption design guideline for infill or site-level multi-residential developments. As efficiency improvements are also impacting the multi-residential sector, this guideline will be monitored into the future.

Designers and planners may use an average monthly dwelling unit consumption of **10 m^3/du/month** in place of the combination of average number of people per dwelling unit and daily per-person water consumption for infill and site-level planning applications.

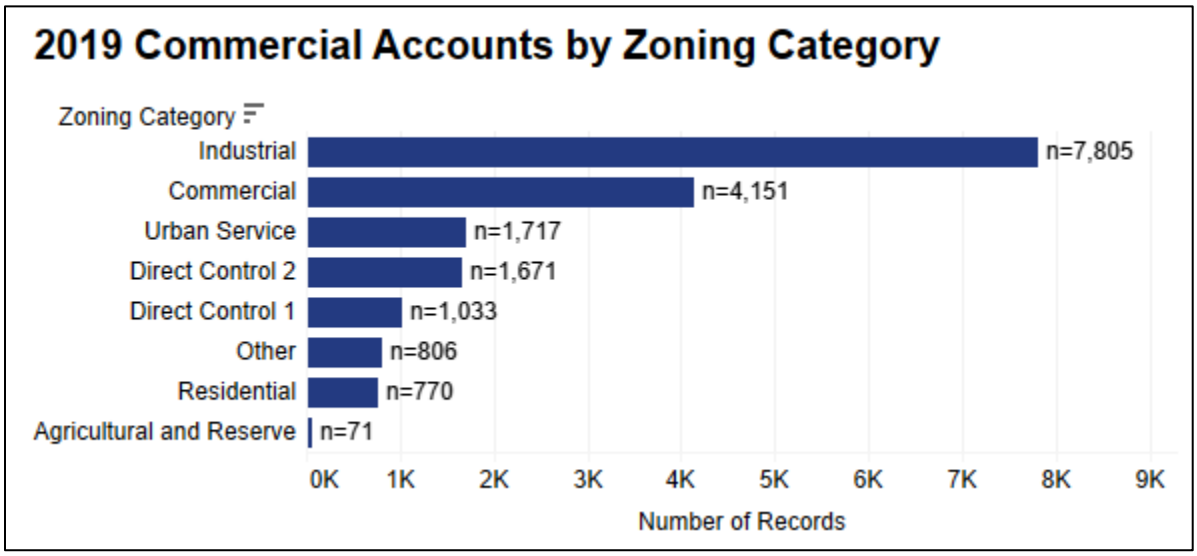
6. Industrial, Commercial, Institutional

6.1. Commercial Customer Profile

6.1.1. Characterization

The commercial customer category is comprised of industrial, commercial, and institutional (ICI) water users. Water use in the ICI category can range from one single employee washroom up to intense manufacturing industries that require large volumes of water. As a result, the commercial customer class has the largest consumption range of all customer classes, with monthly customer consumption ranging from less than 10 m^3/month to upwards of 5,000 m^3/month.

In order to better understand commercial customers, EWSI classifies customers against other contextual information (e.g. North American Industry Classification System (NAICS) codes, city of Edmonton zoning, city of Edmonton land use type, etc.). Figure 19 shows a visual representation of the number of ICI water accounts associated with each city of Edmonton zoning category.



*The "Other" category includes "Special Areas" zoning types and other zones not classified into any pre-existing categories.

Figure 19: ICI Number of Accounts by Edmonton Zoning Type

6.1.1.1. Top 500 Accounts

The top 500 water-consuming ICI water customers account for 60% of total commercial water consumption (Figure 20). EWSI continually monitors the top 500 water consuming ICI accounts since they make up such a large proportion of overall water consumption for the commercial customer category.

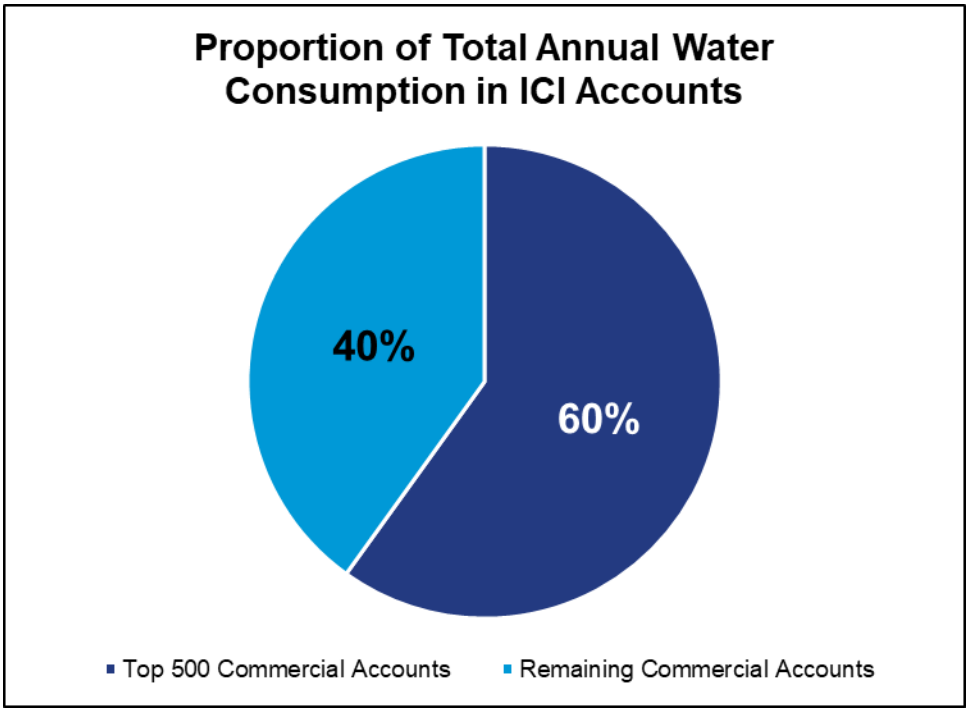


Figure 20: Top 500 ICI Water Customers

6.1.2. Consumption Per Service

The commercial customer category water consumption per service has experienced a significant reduction over the past two decades in Edmonton. In fact, commercial consumption is the only one of the four EWSI customer categories that has seen a decrease in both total consumption and per service consumption. As of 2019, commercial per service water consumption had decreased by 48% from 2002 levels to just below 100 m^3/month.

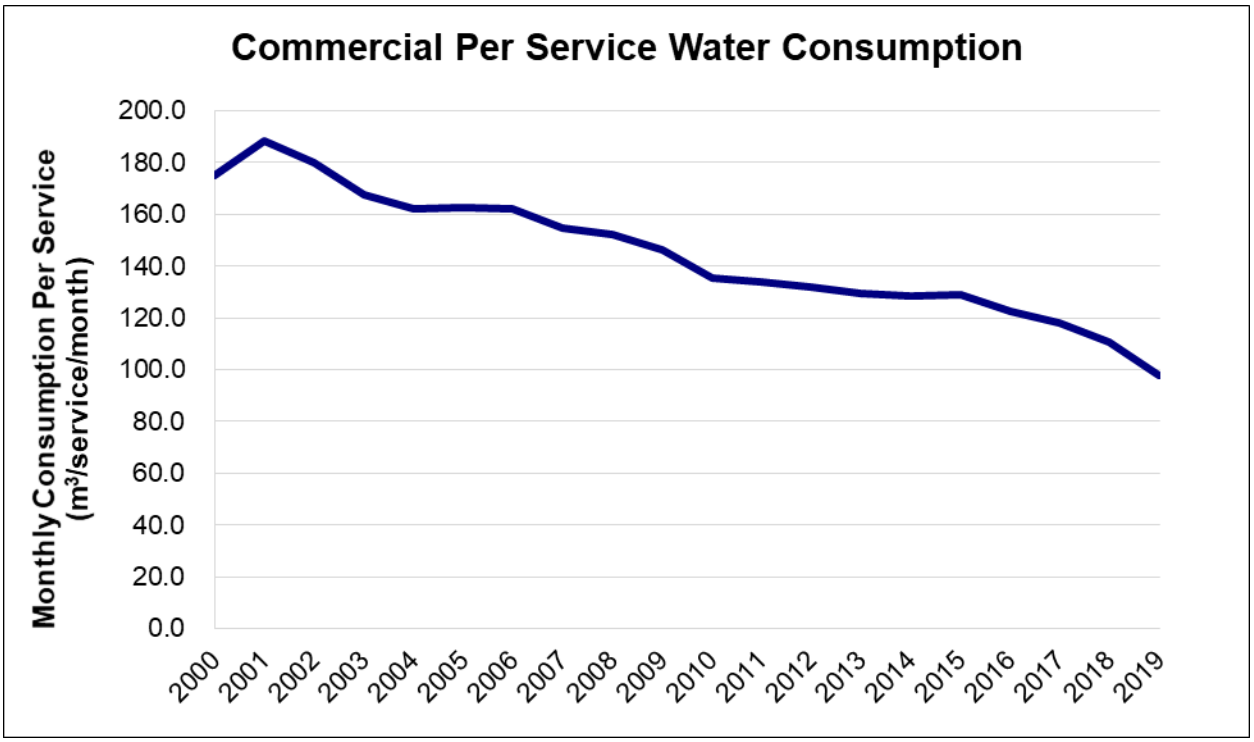


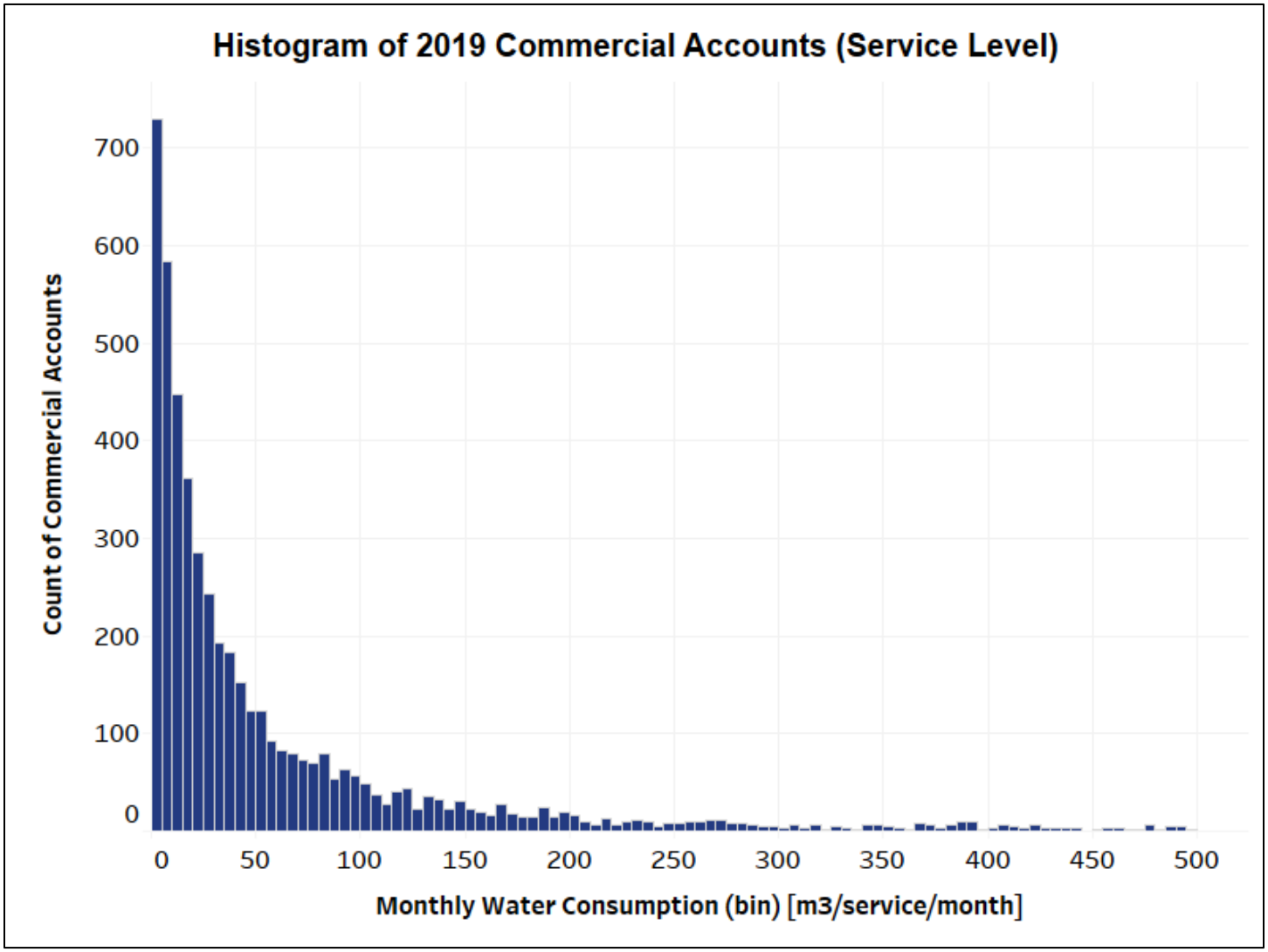
Figure 21: Commercial Per Service Water Consumption

Some possible explanations for this dramatic reduction include:

- There is a strong business case for water efficiency in the commercial sector, especially businesses for which water is a main business input.
    - Reducing water consumption reduces costs. Various industry types across Edmonton have shown a decrease in average water consumption over time.

- The majority of new commercial customers are low water users (0 to 25 m^3/month). These low-consumption customers dominate the category and lower the average.
    - New ICI customers have a high likelihood to consume less than 100 m^3/month. This is shown below in the histogram (Figure 22) outlining the distribution of ICI water accounts.

- Some high water use customers have relocated out of Edmonton.
    - Notable high water using business types that have left Edmonton are: brewery or beverage processing, meat packing plant, and plastics manufacturing.



*Excludes accounts over 500 m^3/service/month for clarity.

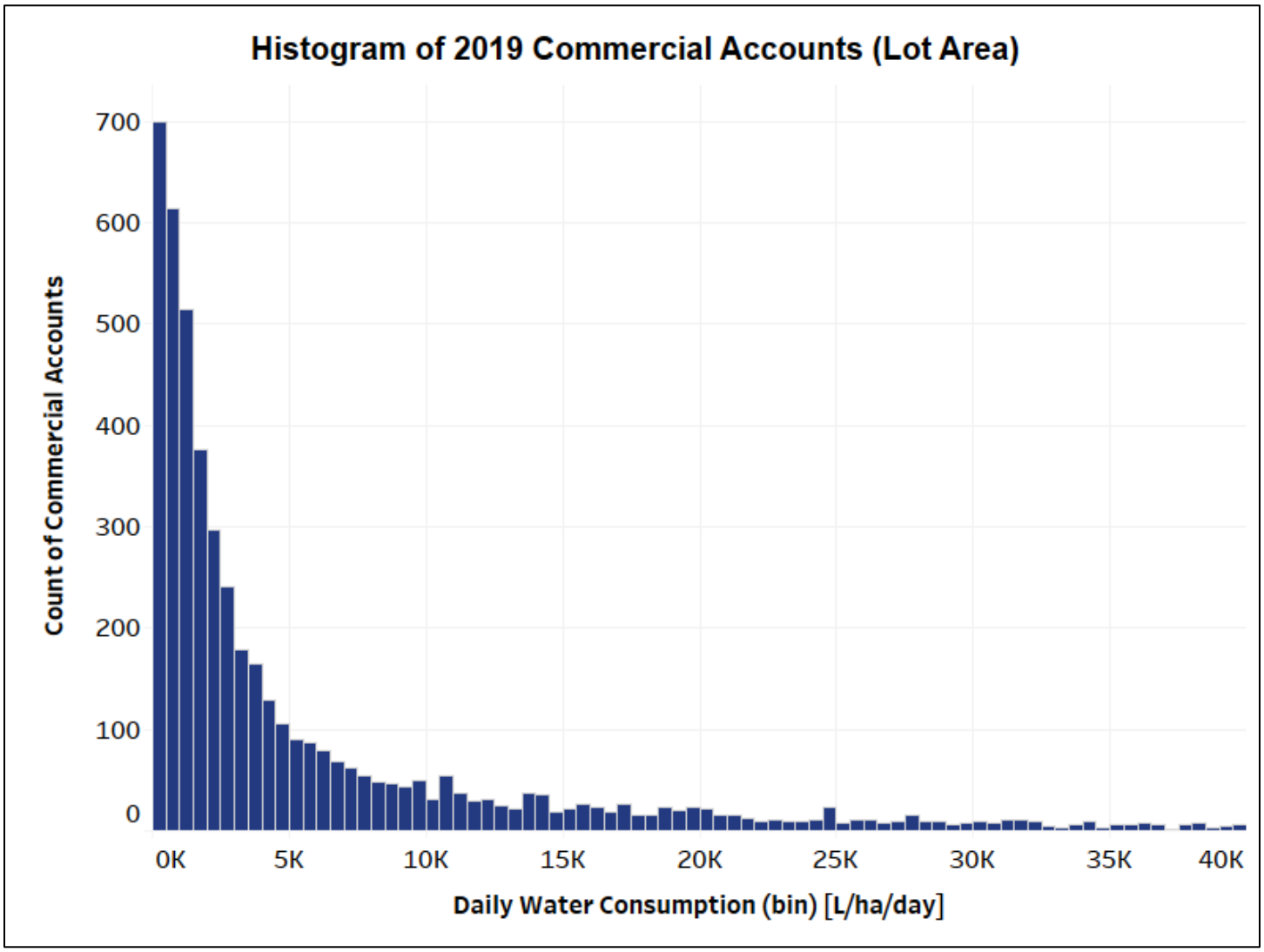
Figure 22: Histogram of 2019 Commercial Accounts (Service Level)

6.1.3. Consumption by Lot Area

Another useful way to report ICI water consumption is by gross lot area (parcel area). Gross lot area is generally known during site-level design. Reporting ICI water consumption by lot area allows for flexibility based on specific lot characteristics; EWSI design metrics for commercial customers are presented in this format due to its flexibility.

A discussion of proposed design guidelines is presented in Section 6.3.

Commercial customers are likely to consume less than 15,000 L/ha/day. Figure 23 below is a histogram showing the distribution of all ICI water accounts.



*Excludes lot consumption over 40,000 L/ha/day for clarity.

Figure 23: Histogram of 2019 Commercial Accounts (Lot Area)

6.1.4. Consumption by Industry Type

In order to understand the highly variable commercial consumption category, EWSI conducts data analyses by specific business type and overall industry type.

EWSI assigns standardized North American Industry Classification System (NAICS) codes to all ICI customers within the commercial water customer category. NAICS codes define the type of business. There are many unique NAICS codes, so EWSI groups the NAICS codes into 30 generalized industry groupings.

A full listing and associated design metrics for these industries are provided in Section 6.3.

Figure 24 shows EWSI's ten largest water-consuming industries, sorted by annual water consumption. The industries of education, retail shopping and office combined account for more than 30% of total ICI consumption.

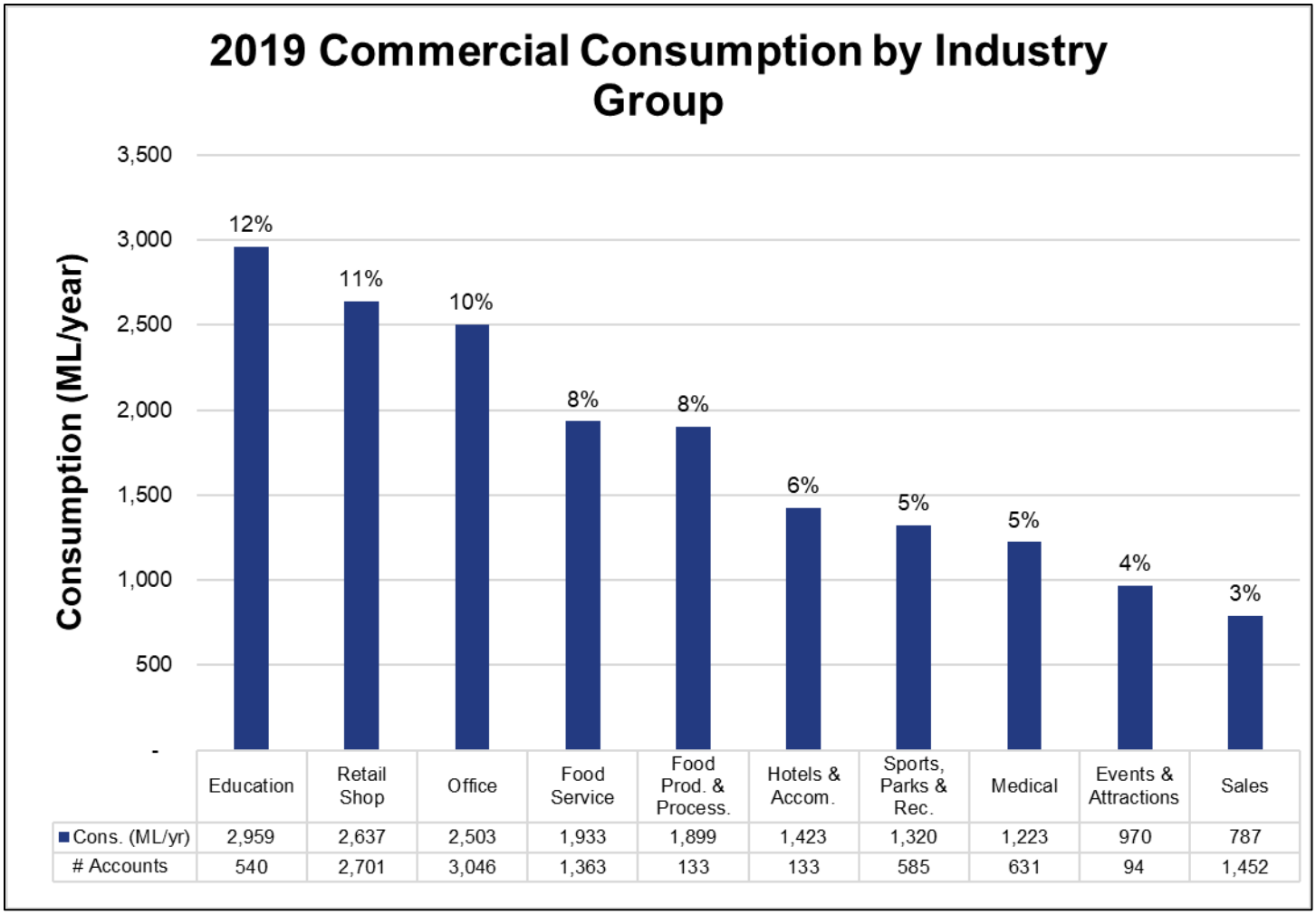


Figure 24: 2019 Commercial Water Consumption by Industry Group

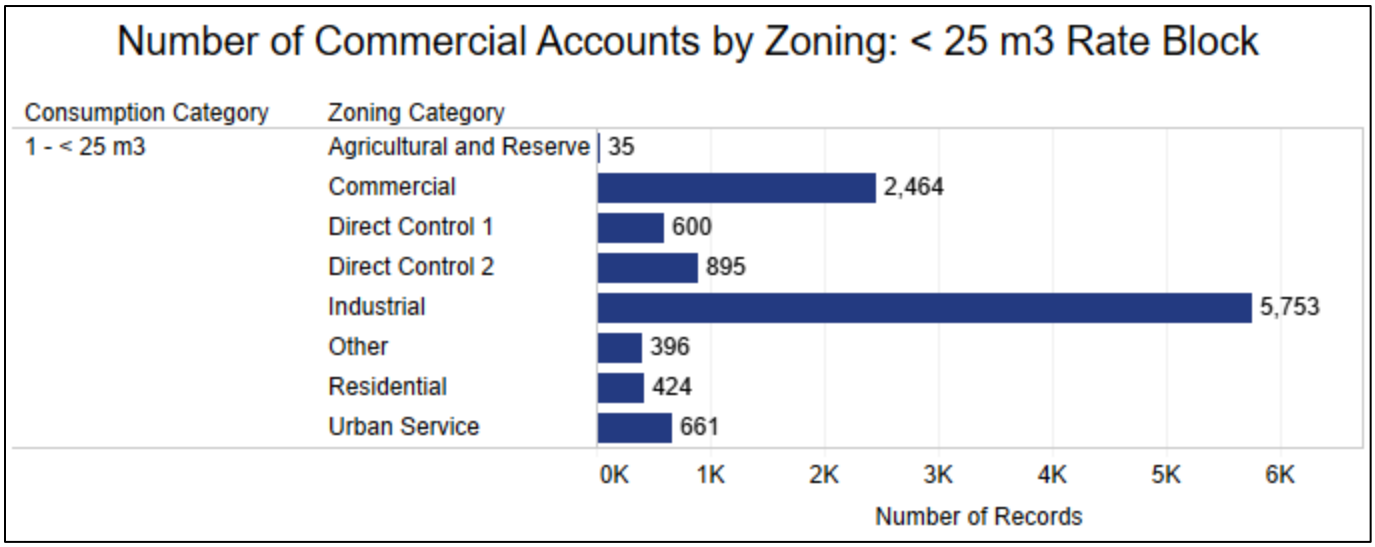
6.1.5. Consumption Range by Zoning

EPCOR further classifies commercial customers into five separate monthly water consumption ranges.

The categories are:

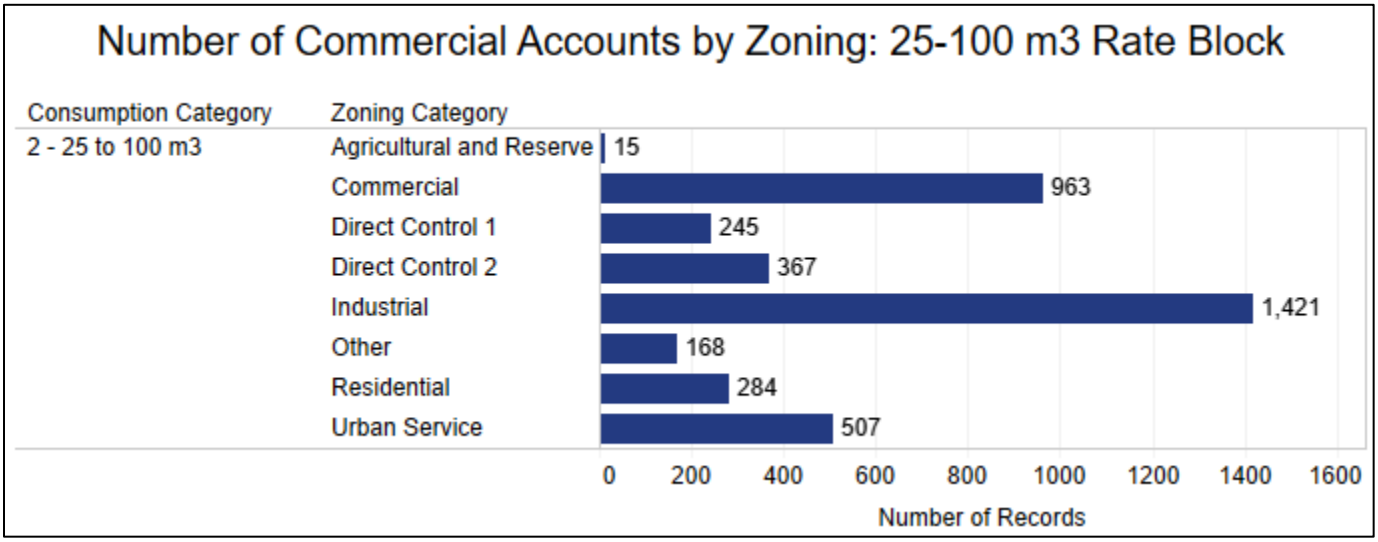
- < 25 m^3/month,
- 25 to 100 m^3/month,
- 100 to 1000 m^3/month,
- 1000 to 5000 m^3/month, and
- > 5000 m^3/month.

An analysis of 2019 commercial customers shows the occurrence by land zoning in each monthly water consumption range. These results are presented in the group of figures below.



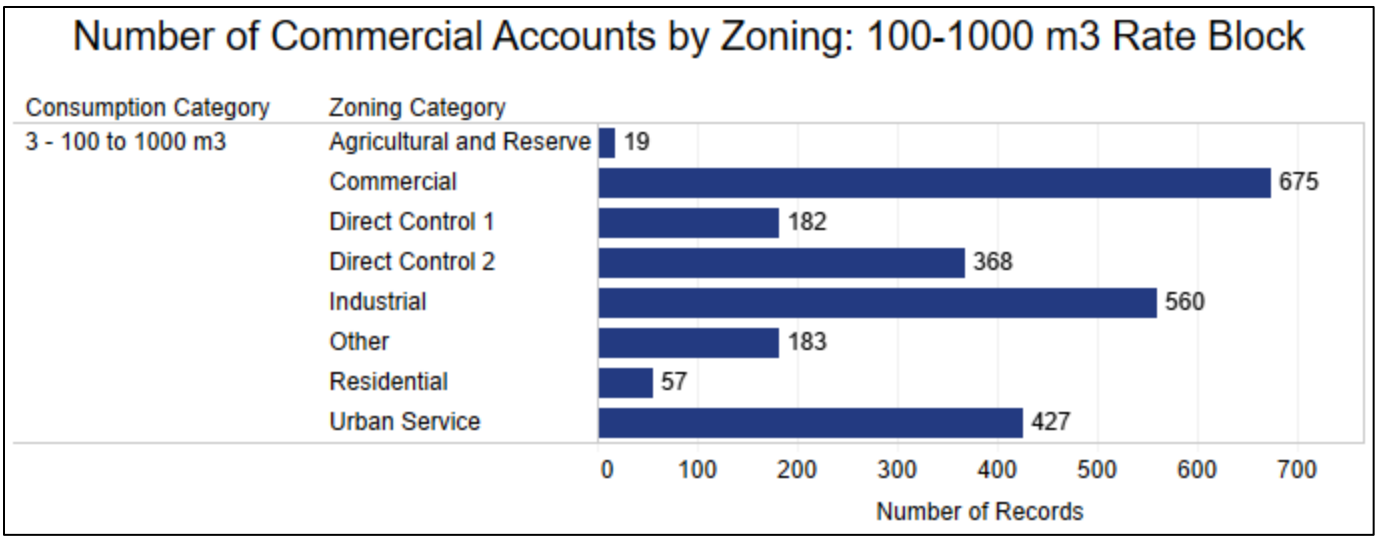
*The "Other" category includes "Special Areas" zoning types and other zones not classified into any pre-existing categories.

Figure 25: Number of Commercial Accounts by Zoning: < 25 m³ Rate Block



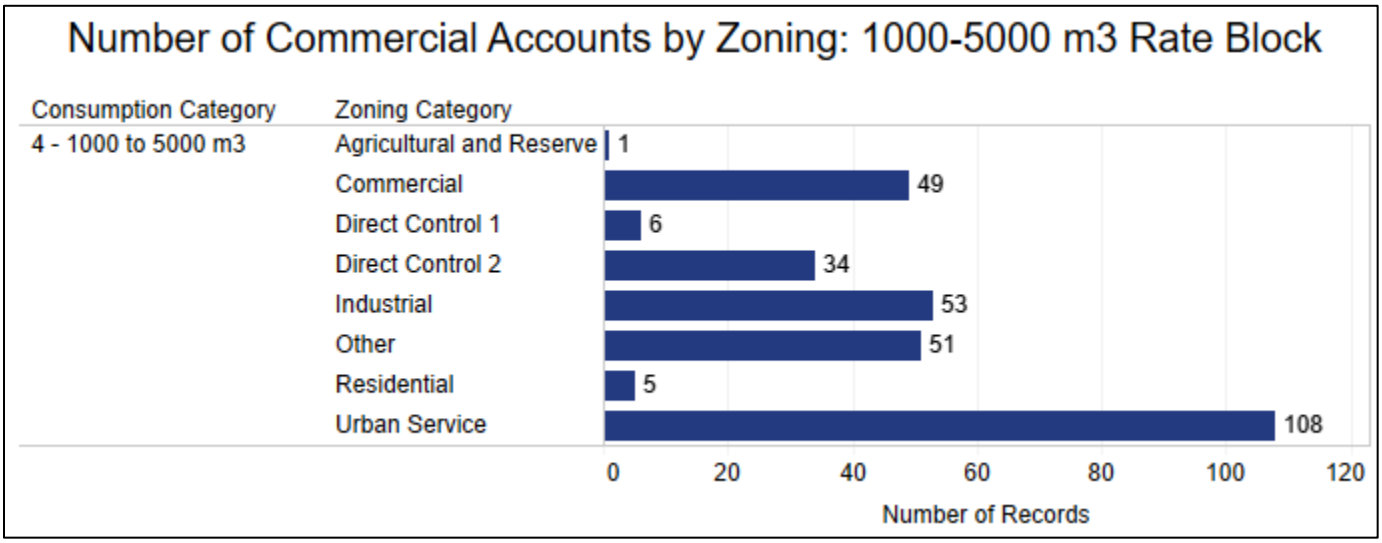
*The "Other" category includes "Special Areas" zoning types and other zones not classified into any pre-existing categories.

Figure 26: Number of Commercial Accounts by Zoning: 25 – 100 m³ Rate Block



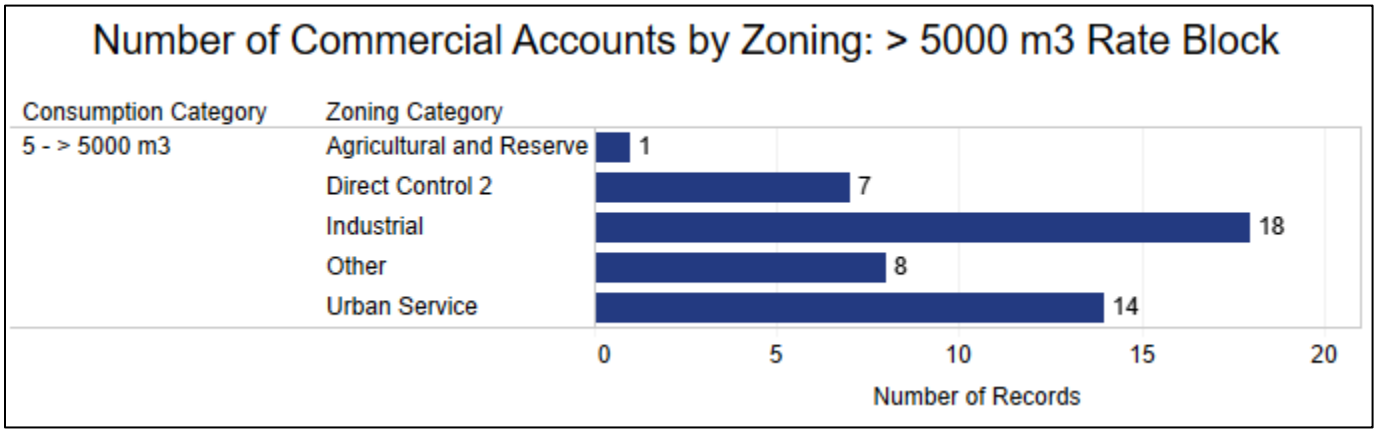
*The "Other" category includes "Special Areas" zoning types and other zones not classified into any pre-existing categories.

Figure 27: Number of Commercial Accounts by Zoning: 100 – 1000 m^3 Rate Block



*The "Other" category includes "Special Areas" zoning types and other zones not classified into any pre-existing categories.

Figure 28: Number of Commercial Accounts by Zoning: 1000 – 5000 m^3 Rate Block



*The "Other" category includes "Special Areas" zoning types and other zones not classified into any pre-existing categories.

Figure 29: Number of Commercial Accounts by Zoning: > 5000 m^3 Rate Block

6.1.6. Consumption by Lot Area and Industry Type

It is also useful to normalize industry consumption to lot area. Below is a ranked list of industries based on the daily consumption per lot hectare. Listing of these detailed metrics are included in Table 7.

By consumption per hectare, the highest rate-of-use industries are:

1. Laundry services
2. Hotels and accommodations
3. Car washes
4. Seniors care
5. Food service

By consumption per hectare, the lowest rate-of-use industries are:

1. Warehousing and Storage
2. Utilities
3. Transportation
4. Temporary Shelters & Family Services
5. Sports, Parks & Recreation

6.1.7. Effect of Large Lot Size

Some high per service water using industries have relatively low rates of per hectare water use. This is due to large lot sizes common in some industries. For example, business types with a large field, storage yard, or outdoor recreation component may have a disproportionately large lot size that may skew the water use per hectare water consumption lower than expected.

To reduce the low skewing effect of water use per lot hectare, the water consumption by roof area was analyzed using roofline data from the City of Edmonton Open Data portal. Roof area represents the area of buildings on the lot only, and in most cases is smaller than the overall lot area.

If there is a significant difference between the water consumption per hectare on an overall lot basis and a roof area only basis, the business is one where large lot sizes are present.

The industries listed below have high water use per roof hectare and low water use by lot hectare (i.e. large lot sizes skew per hectare consumption lower than expected):

- Cement Manufacturing
- Education
- Transportation
- Sports, Parks & Recreation,
- Car Wash
- Plastic Product Manufacturing
- Chemical Manufacturing

When using lot area to estimate water consumption for a new ICI customer, it is important to determine whether the customer is situated on a lot size that is typical for that industry.

For example, grade schools in Edmonton typically have large lots that include fields, playgrounds, and parking lots. As a result, water use per lot hectare is typically lower than expected. However, sometimes other forms of grade schools or other places of education do not have large lots. In scenarios like this, it is prudent to either

use a higher water use per lot hectare design value, or to seek new normalizing factors, such as student enrollment data.

EWSI has used annual student enrollment data to calculate water use per student; this data was used to design a targeted water conservation program in schools. EWSI is able to analyze specific customer data or alternate normalizing factors upon request.

6.2. Commercial Growth Projection

It is projected that reductions to ICI consumption will continue into the future due to increases in cooling tower cycles, changes in technologies that reduce or eliminate water from certain processes, and a changing customer use profile.

There is an economic benefit for small commercial businesses, industrial customers, and institutions to implement water efficient processes or equipment. By increasing water efficiency, businesses reduce water consumption, therefore also reducing costs. Over time, it is expected that water consumption in the ICI category will continue decreasing due to the financial incentive to decrease water usage.

EWSI has observed that the majority of ICI growth is concentrated towards low water users, i.e. customers that use between 0 and 25 m^3/month. This causes a decrease in average per-service consumption as shown in Figure 22. This effect, combined with a gradual decrease in large water-using customers over the same time period, has led to a continual decrease in total water consumption in the ICI category. It is expected that this trend will continue.

If major growth is experienced in future industrial areas such as Edmonton Energy and Technology Park, it is possible that the increase in new customers may offset the decrease in per-service consumption. This scenario is more likely if the new customers in these areas are business types with high water use, such as refineries or processing plants.

6.3. Commercial Design Metric

Due to the declining ICI customer water use trend previously presented in this section, the following design guidelines are proposed for design of water and sanitary sewer for new ICI customers in Edmonton.

The design guidelines presented in this report are divided into two planning scenarios: 1) the ICI customer type is not known, and 2) the ICI customer type is known.

When specific business type information is not known (i.e. area planning), typically one aggregate number is used to represent all ICI customers in the planning area.

However, when more specific business type information is known (i.e. site planning), more specific design guidelines can be used (i.e. industry-specific consumption guidelines).

6.3.1. Customer Type Not Known

Water consumption and generation rates for ICI end uses is currently set at 20,000 L/ha/day as per Volume 3 (Drainage). This value is accurate as an aggregate statistic of the entire ICI customer base. 20,000 L/ha/d represents the 85th percentile of combined ICI customer consumption data, which includes high water use businesses. An 85th percentile value of 20,000 means that 85% of ICI lots in the city of Edmonton use less water than 20,000 L/ha/day, and 15% use more water.

Since ICI water consumption is decreasing, and will continue to decrease into the future, it is prudent to assume a reduced per hectare water consumption value when building these long-range area development plans.

For long-range area planning purposes, if customer type is not known, the aggregate per-hectare consumption of **15,000 L/ha/day** may be used.

15,000 L/ha/day represents the 80th percentile of the full ICI customer consumption data. Please contact EWSI One Water Planning if guidance is required on when the use of this reduced metric is appropriate

6.3.1.1. Zoning Known

If the specific industry category is not known, but zoning information is available, the data in Table 5 and Table 6 can be used for water and sanitary design.

Table 5: Water Consumption by Zoning Category (per Hectare)

Zoning Group*	Water Consumption by Lot Area (L/ha/day)				Average Lot Area (ha)
	25th percentile	Median	75th percentile	90th percentile	
Agricultural and Reserve	60	630	2,140	4,130	9.200
Commercial	2,540	7,460	20,540	45,250	0.250
Direct Control 1	2,450	7,380	23,070	63,140	0.250
Direct Control 2	1,570	4,020	14,790	40,010	0.880
Industrial	700	1,480	3,270	7,350	1.120
Residential	1,350	5,990	16,280	26,540	0.550
Special Areas	3,730	16,210	67,130	155,180	0.530
Urban Service	680	1,510	3,840	9,230	2.850

*Zoning group defined by City of Edmonton Bylaw 12800
*Special Areas and Direct Control Zonings may include a variety of water customer types (including industrial) due to the range of permitted uses.
* Apply metrics to gross lot area.
*EPCOR's consumption data calculated daily demand based on total annual consumption / total days billed per year. As such, daily consumption data assumes 7-day operation each week.

Table 6: Water Consumption by Zoning Category (per Service)

Zoning Group*	Water Consumption per Service (L/day)			
	25th percentile	Median	75th percentile	90th percentile
Agricultural and Reserve	250	1,180	4,560	9,030
Commercial	260	790	2,860	9,380
Direct Control 1	310	690	2,020	6,970
Direct Control 2	410	1,710	6,000	14,230
Industrial	300	800	2,140	5,260
Residential	250	730	1,410	2,900
Special Areas	920	3,720	14,280	39,020
Urban Service	930	2,480	4,400	9,960

*Zoning group defined by City of Edmonton Bylaw 12800
*Special Areas and Direct Control Zonings may include a variety of water customer types (including industrial) due to the range of permitted uses.
*EPCOR's consumption data calculated daily demand based on total annual consumption / total days billed per year. As such, daily consumption data assumes 7-day operation each week.

Instead of analyzing the results on an overall basis for all ICI parcels, it is more informative to analyze each general zoning category. The percentile values vary greatly between zoning categories. 15,000 L/ha/day is a fair representation of all ICI customers averaged together, but it is not suitably applied to each individual zoning category. For example, less than 10% of industrial-zoned parcels are above 15,000 L/ha/day, whereas more than 25% of commercial-zoned parcels are above the value.

The commercial, direct control, and special areas zoning categories have the highest median water consumption statistics in Table 5 above. In commercial zones, this can be attributed to the small lot sizes (0.25 ha average lot size). Smaller lot size means the total lot consumption is distributed over a smaller area, leading to higher consumption per area values. Direct control zoning is used for site specific design in special residential areas (DC1) and mixed commercial areas (DC2, e.g. Jasper Avenue) where it is typical to see unique or uncharacteristic water consumption trends. Special areas zoning is similar, with a variety of specific zoning types and unique customers leading to uncharacteristic water consumption.

6.3.2. Customer Type Known

The commercial customer class has significant variability in consumption depending on the industry type. Table 7 and Table 8 below should be used when industry information is available for the site in question. The table provides water consumption summary statistics for EWSI's 30 industry groupings.

Table 7: ICI Design Metrics by Industry Group (per Hectare)

EPCOR Industry	Water Consumption by Lot Area (L/ha/day)			
	25th percentile	Median	75th percentile	90th percentile
Automotive Service	1,080	2,010	3,520	6,030
Brewery & Beverage	2,030	8,490	29,040	61,860
Car Wash	13,260	28,690	41,860	69,640
Cement Manufacturing	1,410	20,400	40,400	42,880
Chemical Manufacturing	730	1,640	3,940	9,930
Construction	550	1,410	2,900	6,940
Education	850	1,410	2,880	6,390
Events & Attractions	1,230	2,490	7,130	20,570
Food Production & Processing	8,090	15,550	62,980	155,610
Food Service	11,470	22,420	45,310	108,830
Government	3,090	7,270	28,360	65,560
Hotels & Accommodations	26,500	47,360	94,790	165,800
Laundry Services	33,610	59,060	88,610	336,190
Manufacturing	770	1,550	3,380	6,680
Medical	2,840	6,130	12,530	29,370
Other	970	3,200	15,190	28,590
Office	1,020	3,340	11,480	36,390
Personal Care Services	4,660	7,940	16,940	30,000
Plastic Product Manufacturing	900	1,730	3,030	4,710
Public Safety	3,040	5,730	7,610	10,950
Religious Buildings	1,220	2,470	5,260	10,780
Research	650	1,780	2,690	8,900
Retail Shopping	1,500	6,150	16,430	30,320
Sales	620	1,330	2,970	7,640
Seniors Care	8,030	24,890	49,710	79,690
Sports, Parks & Recreation	550	1,990	5,170	11,710
Temporary Shelters & Family Services	1,960	7,110	19,270	53,370
Transportation	550	1,140	2,420	5,230
Utilities	110	580	2,290	5,450
Warehousing and Storage	210	440	1,300	3,060

* Apply metrics to gross lot area.

* EPCOR calculates daily consumption based on total annual consumption divided by total days billed per year. As such, daily consumption data assumes 7-day operation each week.

Table 8: ICI Design Metrics by Industry Group (per Service)

EPCOR Industry	Water Consumption per Service (L/day)			
	25th percentile	Median	75th percentile	90th percentile
Automotive Service	210	390	880	1,980
Brewery & Beverage	1,030	3,550	7,480	8,690
Car Wash	3,130	9,070	17,650	25,430
Cement Manufacturing	13,080	18,610	25,850	30,970
Chemical Manufacturing	800	1,560	3,950	15,550
Construction	200	520	1,270	4,170
Education	2,270	3,080	4,600	6,610
Events & Attractions	490	1,050	2,280	13,600
Food Production & Processing	850	2,870	22,730	134,480
Food Service	1,490	3,300	7,170	11,440
Government	880	5,460	10,410	37,400
Hotels & Accommodations	10,740	25,500	47,800	81,880
Laundry Services	1,780	2,770	24,900	182,000
Manufacturing	340	830	1,880	3,920
Medical	350	800	1,700	6,600
Other	280	1,060	2,330	5,910
Office	240	820	2,470	8,990
Personal Care Services	260	600	1,670	2,290
Plastic Product Manufacturing	1,340	2,160	3,360	7,500
Public Safety	1,420	1,770	3,840	10,760
Religious Buildings	310	640	1,270	2,670
Research	240	760	3,230	5,140
Retail Shopping	340	960	2,420	6,750
Sales	290	770	2,260	4,970
Seniors Care	3,310	11,770	44,820	62,350
Sports, Parks & Recreation	320	790	3,460	24,910
Temporary Shelters & Family Services	330	790	2,710	4,850
Transportation	410	1,040	2,240	4,190
Utilities	50	160	840	1,920
Warehousing and Storage	140	500	1,450	3,290

* EPCOR calculates daily consumption based on total annual consumption divided by total days billed per year. As such, daily consumption data assumes 7-day operation each week.

7. Regional

7.1. Regional Customer Characterization

7.1.1. Characterization

EWSI's regional customer class is the smallest of the customer categories by number of accounts, but second-largest in terms of consumption volume.

EWSI's regional wholesale customers are:

- Strathcona County
- Capital Region Parkland Water Services Commission (CRPWSC)
- Capital Region Southwest Water Services Commission (CRSWSC)
- Capital Region Northeast Water Services Commission (CRNWSC)
- St. Albert
- Morinville
- Sturgeon County
- Department of National Defense
- Enoch Cree Nation

7.1.2. Water Consumption Trends

Regional customer water consumption has grown at the fastest rate of all the customer categories. This notable increase is due to the population growth of the existing regional customers and the addition of new customers (i.e. towns and municipalities) to the regional water commission lines over time. Table 9 displays the average annual growth since the 1970s. It is clear that average annual consumption growth has decreased over time.

Table 9: Growth in Annual Regional Water Consumption

Decade	Growth Over Decade
1971 - 1980	10.0%
1981 - 1990	2.1%
1991 - 2000	2.8%
2001 - 2010	1.9%
2011 - 2019	0.7%

While annual regional water consumption growth has decreased over time, cities in the Edmonton region continue to grow at high population rates. For example, Spruce Grove, Fort Saskatchewan, Leduc and Beaumont were among the listing of top 15 municipalities with the highest population growth in Canada in the 2016 Federal Census.

7.2. Regional Growth Projection

The regional water commissions currently provide water to the majority of large towns and municipalities in the greater Edmonton region. It is expected that regional water consumption growth will continue to modestly rise as water efficiency gains partially offset high growth in the municipalities' customer base. EWSI will continue to monitor the water consumption trends for each regional customer into the future.

8. Conclusion

This discussion paper presents up-to-date water consumption data and trends, and discusses design metric alternatives for the design of water and sanitary linear infrastructure. It is recommended that EPCOR One Water Planning engage with UDI and City of Edmonton Planning to discuss how the suggested design changes will impact current and future planning.

9. Appendix 1: Summary of Recommended Planning Metrics

Refer to flow chart attached:

EWSI Water Customer Design Guidelines Overview For Discussion

Residential and Multi-Residential

Area/Neighbourhood-Level Planning

Per Capita Water Use:

160 L/capita/day

Stage/Site-Level Hydraulic Analysis

Per Capita Water Use:

220 L/capita/day

Multi-Residential Alternate for Infill or Site-Level Developments:

10 m^3/dwelling unit/month

Residential Water Peak Factors:

MDD = 1.5 x ADD
PHD = 3.0 x ADD

Important Considerations

Per capita (person) residential consumption has been decreasing over time and will continue to decrease in the future.

Residential reductions are largely due to increasingly efficient fixtures and appliances (primarily toilets and washing machines) that require no behavioral changes to reduce water consumption.

Similar to efficiency gains in the residential customer category, new multi-residential buildings are outfitted with best-in-class fixtures and building mechanical systems that will reduce average water use.

Compared to residential, multi-residential consumption per dwelling unit is lower and less seasonal in nature

As areas densify by increasing average number of units per hectare, average dwelling unit water consumption tends to decrease.

Industrial, Commercial, Institutional

Is the business type known?

Y → Refer to water consumption by industry type statistics table

N → Zoning known?

Y → Refer to water consumption by zoning type statistics table

N → Aggregate per hectare value → **15,000 L/ha/day**

EPCOR Industry	Water Consumption by Lot Area (L/ha/day)			
	25th percentile	Median	75th percentile	90th percentile
Automotive Service	1,080	2,010	3,520	6,030
Brewery & Beverage	2,030	8,490	29,040	61,860
Car Wash	13,260	28,690	41,860	69,640
Cement Manufacturing	1,410	20,400	40,400	42,880
Chemical Manufacturing	730	1,640	3,940	9,930
Construction	550	1,410	2,900	6,940
Education	850	1,410	2,880	6,390
Events & Attractions	1,230	2,490	7,130	20,570
Food Production & Processing	8,090	15,550	62,980	155,610
Food Service	11,470	22,420	45,310	108,830
Government	3,090	7,270	28,360	65,560
Hotels & Accommodations	26,500	47,360	94,790	165,800
Laundry Services	33,610	59,060	88,610	336,190
Manufacturing	770	1,550	3,380	6,680
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Office	1,020	3,340	11,480	36,390
Personal Care Services	4,660	7,940	16,940	30,000
Plastic Product Manufacturing	900	1,730	3,030	4,710
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Religious Buildings	1,220	2,470	5,260	10,780
Research	650	1,780	2,690	8,900
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Sales	620	1,330	2,970	7,640
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Sports, Parks & Recreation	550	1,990	5,170	11,710
Temporary Shelters & Family Services	1,960	7,110	19,270	53,370
Transportation	550	1,140	2,420	5,230
Utilities	110	580	2,290	5,450
Warehousing and Storage	210	440	1,300	3,060

* Apply metrics to gross lot area.

Zoning Group*	Water Consumption by Lot Area (L/ha/day)				Average Lot Area (ha)
	25th percentile	Median	75th percentile	90th percentile	
Agricultural and Reserve	60	630	2,140	4,130	9.200
Commercial	2,540	7,460	20,540	45,250	0.250
Direct Control 1	2,450	7,380	23,070	63,140	0.250
Direct Control 2	1,570	4,020	14,790	40,010	0.880
Industrial	700	1,480	3,270	7,350	1.120
Residential	1,350	5,990	16,280	26,540	0.550
Special Areas	3,730	16,210	67,130	155,180	0.530
Urban Service	680	1,510	3,840	9,230	2.850

*Zoning group defined by City of Edmonton Bylaw 12800

*Special Areas and Direct Control Zonings may include a variety of water customer types (including industrial) due to the range of permitted uses.

The n^{th} percentile means that n% of ICI parcels in the City of Edmonton use less water than the stated L/ha/d value.

EPCOR calculates daily consumption based on total annual consumption divided by total days billed per year. As such, daily consumption data assumes 7-day operation each week.

EPCOR Water Services Inc.
One Water Planning
June, 2021
Edmonton, Alberta

10. Appendix 2: Glossary of ICI Industry Types

Industry Type	Description	Example NAICS Codes
Automotive Service	Businesses related to repair or servicing of automobiles.	Automotive Oil Change & Lubrication Shops, General Automotive Repair
Brewery & Beverage	Businesses related to brewing or manufacturing beverages	Breweries, Bottled Water Manufacturing
Car Wash	Standalone car washes.	Car Washes
Cement Manufacturing	Businesses directly involved in cement manufacturing.	Cement Manufacturing, Other Concrete Prod Manufacturing
Chemical Manufacturing	Businesses related to manufacturing, production, or refining of chemicals or businesses related to support activities for the oil and gas industry.	Pharmaceutical Preparation Manufacturing, Support Activities For Oil & Gas Operations
Construction	Businesses related to contracting services and other construction activities.	Plumbing Contractors, Roofing Contractors
Education	Schools and other places where educational services are offered.	Elementary & Secondary Schools, Colleges & Universities
Events & Attractions	Businesses related to events, attractions, or casinos.	Theatre Companies & Dinner Theatres, Museums, Casinos
Food Production & Processing	Businesses related to the production and processing of food. This does not include eating and drinking establishments.	Rendering & Meat Byproduct Processing, Commercial Bakeries
Food Service	Eating and drinking places, both full-service (“sit-down restaurants”) and limited-service (“fast food restaurants”).	Full-Service Restaurants, Limited-Service Restaurants, Caterers
Government	Businesses related to government (federal, provincial, or municipal).	Legislative Bodies, Other General Government Support.
Hotels & Accommodations	Businesses related to hotels and accommodation services.	Hotels & Motels (except casino hotels)
Laundry Services	Businesses related to commercial laundry services.	Coin-Operated Laundries & Drycleaners, Dry-Cleaning & Laundry Services, Industrial Launderers.
Manufacturing	Businesses related to the manufacturing of physical materials. This category excludes manufacturing of cement, food/drink, plastic products, and chemicals.	Machine Shops, Fabricated Structure Metal Manufacturing
Medical	Businesses related to medical services, such as hospitals, medical clinics, and other offices of health practitioners.	General Medical & Surgical Hospitals, Offices of Dentists
Office	Businesses or customers where the primary business activities are completed in an office building or office setting.	Commercial Banking, Insurance Agencies & Brokerages

Industry Type	Description	Example NAICS Codes
Other	All other businesses that do not fall into another industry category or that were unknown business types at the time of the analysis.	N/A
Personal Care Services	Businesses related to personal care services.	Beauty Salons, Barber Shops, Nail Salons
Plastic Product Manufacturing	Businesses related to the manufacturing and production of various plastic products.	Plastic Material & Resin Manufacturing, All Other Plastic Prod Manufacturing
Public Safety	Business related to protective services such as police or fire services	Police Protection, Fire Protection
Religious Buildings	Businesses related to places of worship or other related religious organizations.	Religious Organizations
Research	Businesses related to market or academic research.	Research & Development in Biotechnology
Retail Shopping	Businesses related to retail shopping.	Convenience Stores, Furniture Stores, Beer Wine & Liquor Stores
Sales	Businesses related to wholesale purchasing of materials or businesses without a retail storefront.	New Car Dealers, Industrial Machinery Merchant Wholesale
Seniors Care	Businesses related to seniors care facilities.	Homes For The Elderly, Nursing Care Facilities
Sports, Parks & Recreation	Businesses related to sports, parks, or recreation facilities such as recreation centers, sports arenas, etc.	Fitness & Recreational Sport Centres, Golf Courses & Country Clubs, Sports & Recreation Instruction
Temporary Shelters & Family Services	Businesses related to family services or shelters for disadvantaged populations.	Child Day Care Services, Funeral Homes & Funeral Services, Temporary Shelters
Transportation	Businesses generally related to transportation of goods or people. This includes delivery, freighting, hauling, postal, and other courier-type services. Also includes taxi and other commuting services.	Motor Vehicle Towing, Other Specialized Trucking Long Distance, Couriers, Postal Service
Utilities	Customers related to utilities such as electricity, water, gas, etc.	Septic Tank & Related Services, Electric Power Distribution
Warehousing and Storage	Businesses related to warehousing and storage.	Refrigerated Warehousing & Storage, General Warehousing & Storage, Mini-Warehouse & Self-Storage Unit Operators

11. References

[1] City of Edmonton, "Attachment 1. Summary of Key Fall 2020 Forecast Indicators," 2020. [Online]. Available: https://www.edmonton.ca/business_economy/documents/PDF/Summary_of_Key_Forecast_Indicators_Fall_2020.pdf. [Accessed March 2021].

[2] W. B. DeOreo, "Residential End Uses of Water Study, Version 2," Water Research Foundation, 2016.

[3] City of Edmonton, "Edmonton's Developing Neighbourhoods: 2019 Low Density Residential Lot Registration Report," 2019. [Online]. Available: https://www.edmonton.ca/city_government/documents/PDF/Low_Density_Lot_Registration_Annual_Report.pdf. [Accessed March 2021].

[4] J. C. Kiefer and L. R. Krentz, "Water Use in the Multi-Family Housing Sector," Water Research Foundation, 2018.