CITY OF
SALMON ARM

File: 5220-2022-31

TO:	His Worship Mayor Harrison and Members of Council
FROM:	Robert Niewenhuizen, Director of Engineering and Public Works
PREPARED BY:	Gabriel Bau, City Engineer and Jon Mills, Engineering Assistant
DATE:	October 10, 2023
SUBJECT:	Universal Water Metering – Implementation Plan Option Decision

STAFF RECOMMENDATION

THAT: **Council authorize staff to finalize the implementation plan for the Universal Water Metering Program with Option B, as outlined in the Econics memorandum 'Options for Universal Metering in the City of Salmon Arm' dated March 24, 2023. This option represents a gradual implementation of Universal Water Metering over a ten (10) year period.**

BACKGROUND

In the face of serious droughts and forest fires, fresh water for human consumption, agriculture, industry and ecological needs has become a much more precious resource, requiring the implementation of mechanisms to manage water consumption and maintain the integrity of the water system.

In 2022, the City selected Econics Services Inc. (Econics) to prepare a Universal Water Metering (UWM) plan for the City of Salmon Arm. The intent of this memo is to present two potential implementation options for Council's consideration and seek direction to finalize the UWM implementation plan.

Appendix A includes the Econics memorandum 'Options for Universal Water Metering in the City of Salmon Arm'.

Appendix B contains background information about the current state of the City's water metering and billing system and water conservation initiatives that support the need for universal water metering.

The table below summarizes Econics proposed options.

Option	Implementation	Preliminary cost
A	One-time capital project implemented over 1-2 years.	$6.5M
B	Implementation phased in over 10 years.	$8.9M

Pros and cons of each option are as follows:

Option	Logistics	Procurement	Communication	Water Savings	Cost
A One-time capital project	More easily and cost effectively managed due to short timeline and large numbers	Simplest (single process))	Simplest (since all water customers are targeted)	Same end result; quickest to achieve	Lowest
B 10-year phase-in	Likely more complex; depends on phasing approach	More complex (multiple processes)	Likely more complex; depends on phasing approach	Same end result; longer to achieve	Highest

Based on current projections for borrowing requirements for other larger projects, such as the WPCC Stage IV expansion, staff believe it is prudent to avoid borrowing funds for this project where possible. Phasing of the project (Option B) may allow the project to proceed with reasonable utility rate increases and lower upfront borrowing, to be confirmed during the Water Utility Rate Study to be completed as part of the next steps.

Link to the City's Corporate Strategic Plan:

- The UWM project is currently a long-term priority (6-9 years: 2028 to 2031).
- Full implementation of Option B (timeline of 10 years) would be achieved by 2033, if starting in 2024.
- UWM is a critical component of the Climate Action Initiatives and Asset Management Program, both of which short-term priorities in the Corporate Strategic Plan.

STAFF COMMENTS

Main reasons to implement UWM:

1. Equity and fairness. An estimated 18% of residential properties are excessive users that are not paying for the cost of the water they use and are being subsidized by other residents (see Appendix B Section 5 for more information).

2. Improved knowledge of water consumption. Currently 56% of residential properties do not have meters so property owners, as well as City staff, do not have a way to monitor and manage consumption (see Appendix B Sections 2 and 4 for more information).

3. Reduced stress on the City's water system. Daily water consumption in the summer months can be 3 to 4 times winter consumption. This puts excessive stress on our water system, increasing operation and maintenance costs (see Appendix B Sections 1 and 6 for more information).

4. Combating drought. Reduced water consumption will help ensure the availability of water for essential needs within the City and beyond its borders. It will also help maintain habitat for fish and wildlife (see Appendix B Section 8 for more information).

5. Cost savings. Estimated operational cost savings for water treatment and supply: $70,000-$100,000 per year (see Appendix B Section 7 for more information).

6. Deferral of capital expenditures. Implementing UWM will help defer capital expenditures required to replace, upgrade and expand the water treatment and supply system (see Appendix B Section 7 for more information).

7. Staff capacity. The excessive water use program requires significant staff time with limited results. As a result, other tasks are delayed. In addition, comprehensive enforcement for excessive use and multistage restrictions is beyond current staff capacity. UWM is expected to reduce staff time required for these activities (see Appendix B Section 4 for more information).

8. Improved service levels. By implementing UWM, the need for longer and more severe water restrictions could potentially diminish, improving water supply service levels (see Appendix B Sections 6 and 7 for more information).

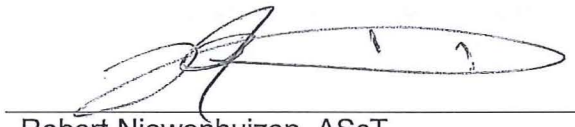
9. Water utility rate structure. Implementing a tiered-rate metered billing structure will encourage more sustainable use of this precious resource. The current annual flat rate structure does not accomplish this.

Next steps:

1. Finalize the UWM Implementation plan, based on Council's direction.
2. Determine project funding and staff needs.
3. Conduct a Water Utility Rate Study in 2024 (cost estimate $50,000) to determine new water consumption unit rates, which could include the cost of implementing UWM.
4. Amend City bylaws to:
    a. Specify that radio frequency (RF) water meter heads are to be installed for residential properties.
    b. Ensure that the Water Rates and Waterworks Regulation bylaw reflects current standards and conditions.
    c. Specify tiered fines in relation to the multistage outdoor water use restrictions.
    d. Specify fines for properties exceeding the ½ acre restriction for irrigation and fines for other contraventions of the Water Rates and Waterworks Regulation bylaw.

Staff recommends proceeding with Option B as this option provides a more fiscally viable transition to UWM, despite the higher total cost.

Respectfully submitted,



Robert Niewenhuizen, AScT
Director of Engineering and Public Works

econics

MEMO

To: Gabriel Bau Baiges, City Engineer, City of Salmon Arm
From: Rebecca Mersereau, Director of Consulting, Econics
cc: Kirk Stinchcombe, Managing Director, Econics
Date: 24 March, 2023
Re: Options for Universal Metering in the City of Salmon Arm

PURPOSE

This memo summarizes recent analysis completed by Econics to evaluate different approaches to universal water metering for City of Salmon Arm. The intent is that this will support a Council "in principle" decision on a preferred approach to enable continued planning.

BACKGROUND

About the Project

Through a competitive process in mid-2022, the City selected a consulting team comprised of Econics and Associated Engineering to prepare a Universal Water Meter Implementation Plan. Since July, City staff have worked with our team to identify and evaluate viable pathways to complete metering and transition to a more equitable billing approach where users pay for water based on the amount they consume.

In consultation with Public Works, Engineering, and Finance staff, two options have been short-listed. City staff then determined that, prior to preparing more detailed implementation and communication plans (the next steps in the project), it is important to seek direction from City Council on its preferred approach.

Linkages to Corporate Policies and Priorities

This project was undertaken to advance the City's corporate priority of exploring universal water metering in the Corporate Strategic Plan. Other linkages to corporate plans and strategies are identified in Table 1, below.

Table 1: Linkages Between Water Metering and Salmon Arm Corporate Policies and Priorities

Plan	Policy and Priority Linkages
Official Community Plan	• OCP Goal 1 Natural Environment: Protect and enhance the natural environment, particularly environmentally sensitive areas and all watercourses. • OCP Goal 14 Infrastructure: Manage the infrastructure, including potable water, stormwater, sewage treatment, and solid waste, consistent with best practices. • OCP Policy 4.6.2: Continue to promote water conservation strategies such as the Water Wise program, incorporation of innovative irrigation technologies, the installation of low flush toilets and low flow aeration faucets, and xeriscaping (i.e., drought resistant landscaping) for all developments.
20-year Infrastructure Plan	Metering will help defer capital projects planned to increase the capacity of the water system to meet growing demand (e.g., pump upgrades, expanding treatment capacity)

2021 Community Water Conservation Plan	Metering and charging for water use by volume will directly support each of the five goals in the City's 2021 Community Water Conservation Plan, several of which will be difficult to achieve without metering: • Goal #1: Delay infrastructure upgrades due to increased demand • Goal #2: Reduce peak demand • Goal #3: Quantify non-revenue water • Goal #4: Spread awareness of water conservation efforts • Goal #5: Increase information available for decision making

Benefits of Universal Metering

In Canada, as of 2009 (the most recent year for which reliable national statistics are available), 72.1% of single-family residential homes had a water meter.[1] There are three main benefits of metering: reduced water consumption, an ability to charge for water use by volume (considered more equitable), and improved control of sources of non-revenue[2] water, including leakage. For Salmon Arm, a key benefit is reducing water use during peak times. This will reduce system demand so capital projects required to expand it may be deferred.

Status of Metering in Salmon Arm

The City of Salmon Arm has already made considerable progress implementing water meters through a regulatory bylaw that requires installation of meters for new industrial, commercial, institutional (ICI) and residential construction. The status of metering for accounts served by the City in 2022 is outlined in Table 2, below.

Table 2: Metering Coverage for all Account Types (2022)

Customer Category	Metered Accounts	Unmetered Accounts
Single family residential	2,307	3,372[3]
Residential multi-family, and mobile homes	54	2
ICI, farm, and First Nations	486	17
Total	2,847	3391
	6,238	

Achieving Universal Metering in Salmon Arm

To estimate costs and assess the benefits of achieving universal metering in Salmon Arm, three assumptions have been made:

- meter reading and billing will occur bi-monthly to align with best practices and encourage conservation,

[1] Environment Canada (2011). 2011 Municipal Water Use Report: Municipal Water Use 2009 Statistics. Cat. no.: En11-2/2009E-PDF, Ottawa, ON. Retrieved from https://www.ec.gc.ca/doc/publications/eau-water/COM1454/index-eng.htm

[2] *Non-revenue water* is water that has been treated and pumped through the distribution system but is generally not billed and therefore does not contribute to utility revenues. It can include "real losses" such as leaks, overflows, flow tests and fire hydrant testing, or "apparent losses" from errors in meter reading and data handling or other factors.

[3] Of the unmetered residential accounts, it is assumed that 334 will have meters installed in the ground at the property line rather than inside the dwelling.

- new meter installations will use more advanced radio-frequency transmitters[4] rather than the touch pad technology currently used (see Appendix A for an overview of meter types and technology),
- existing meters in the second half of their service life and existing data readers of all ages will be upgraded to allow Salmon Arm to maximize the benefits of water metering by having more data to support leak detection and conservation strategies, and reduce operational costs associated with reading meters.

Anticipated Savings in Operational Costs from the use of Radio-Frequency Technology

The use of radio-frequency technology instead of the existing touch pad meters is expected to reduce the time required for staff to collect data from the meters by approximately 75%. With the current level of metering coverage in Salmon Arm, these savings are equivalent to approximately $10,000 annually. If all properties are metered with radio-frequency devices as prescribed in this Implementation Plan, the associated time savings would be equivalent to roughly $50,000/year (when compared with the continued use of touch pad technology).

UNIVERSAL METERING OPTIONS

Overview of Options

Two options are under consideration for implementing universal metering:

A. a one-time capital project implemented over 1-2 years, or
B. a capital project phased in over 10 years.

For both options, it is assumed a volume-based billing structure is introduced for all metered accounts by year four at the latest (and applied to accounts as they are metered between years 5-10 for Option B). For Option B, it is assumed the meters that will result in the highest water savings for the least cost will be implemented first, to 'front-load' the benefits.

Estimated Water Savings

Both options will produce the same water savings after implementation is completed. Based on best-available research, water savings resulting from universal metering and the transition to volume-based billing are estimated to total 15-20% per year. This is equivalent to water savings of 548 - 730 million litres per year for Salmon Arm.[5]

Due to the shorter implementation timeline, Option A will result in the expected water savings being realized sooner. Option A is expected to reach maximum water savings by 2028, compared to 2033 for Option B. This difference in timing is unlikely to have a significant impact on the City's water conservation goals (e.g., deferring an upgrade to the treatment plant). However, it may help defer the replacement of other capital infrastructure, such as pumps, that are already under pressure during peak water-use times in the summer months.

[4] In some communities, concerns about radio-frequency transmitters have been raised. There are strategies to address this when pursuing universal metering, such as providing an option to residents to use touch pad technology instead (at a fee to reflect the higher costs for data acquisition).
[5] The baseline water production used to estimate water savings is the average total annual production from 2017-2021 (3,651 megalitres).

Estimated Implementation Costs

Achieving universal metering through a single capital project (Option A) on the shortest timeline possible is the most cost-effective approach due to efficiencies in procurement, logistics and communication, installation, and avoidance of construction cost escalation.

Preliminary order-of magnitude cost estimates for Option A were produced with input from the City's current water meter supplier (see Table 3 below). The estimate is approximately $6.7 million over two years. The cost estimate for Option B (Table 4) is 20% higher, at approximately $8 million spread over ten years (not accounting for inflation).[6] The cost estimates include physical meter components, installation, and project management.

Table 3: Preliminary Order-of-magnitude Cost Estimates for Option A

Component	2024	2025
New urban residential meters installations (inside dwellings)	$1,367,100	$1,367,100
New rural residential meter installations (in-ground at property lines)	$584,500	$584,500
New industrial, commercial, institutional (ICI) installations	$25,500	$25,500
Residential retrofits (for existing meters >10 years + all readers)	$461,600	$461,600
ICI, multi-family retrofits (for existing meters >10 years + all readers)	$157,950	$157,950
Administration costs (procurement, communications)	$52,338	$52,338
Water rate study	$50,000	$0
Contingency (20%)	$538,848	$538,848
Sub-total	*$3,258,086*	*$3,208,086*
Total estimated cost		**$6,466,171**

Table 4: Preliminary Order-of-magnitude Cost Estimates (in 2022 dollars) for Option B

2024	2025	2026	2027	2028	2029	2030	2031	2032	2033
$691,617*	$641,617	$641,617	$641,617	$641,617	$641,617	$641,617	$641,617	$641,617	$641,617
						Sub-total			*$6,466,171*
						Escalation factor (20%)			*$1,293,234*
						Total estimated cost			**$7,759,405****

Notes: *The estimated cost of the water rate study ($50,000) is accounted for in 2024.
**If accounting for inflation (assuming 3%/year beginning in 2025), the estimated cost of Option B is $8,886,505.

Additional Considerations

Ease of implementation is also a factor when considering implementation approaches, since greater complexity can add to additional operational costs (through added staff time), or project management costs incurred by a contractor. Table 5 below provides a cursory comparison the two options in terms of logistics, procurement, and communication needs, in addition to the water savings and costs implications discussed above.

[6] The cost estimate for Option B was generated by spreading costs over 10 years and applying a multiplication factor of 20% to account for a reduction in economies of scale.

Table 5: Heat Map Comparing Implementation Considerations, Water Savings, and Cost

Option	Logistics	Procurement	Communication	Water Savings	Cost
Option A (one-time project)	More easily & cost-effectively managed externally due to short timeline & large numbers	Simplest (single process)	Simplest (since all water customers are targeted)	Same end result; quickest to get there	Lowest
Option B (10-year phase in)	Likely more complex; depends on phasing approach	More complex (multiple processes)	Likely more complex; depends on phasing approach	Same end result; longer to get there	Highest

Legend: Good ranking | Medium ranking | Poor ranking

CONCLUSION

Universal metering and charging by volume support a corporate strategic priority. Metering is also necessary to successfully implement the City's 2021 Community Conservation Plan and defer capital projects required to meet growing water demand. Direction from Council on the implementation approach for universal metering will enable staff and the consulting team to develop a detailed implementation plan and communication strategy. This memo provides a summary of two options provided for Council's consideration.

While both options will result in the same water savings of 15-20% per year, Option A (the one-time capital project) will result in the savings being realized approximately five years sooner. Option A is also considerably less expensive, and simpler in terms of logistics, procurement, and communication. Option B (a ten-year phase in) is provided as an alternative, recognizing that Council may have competing capital investment priorities.

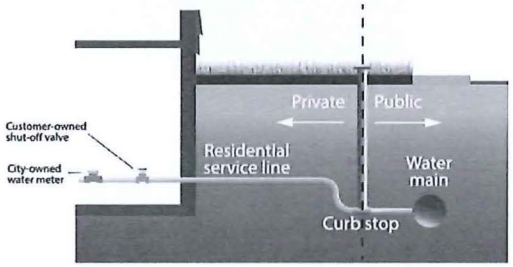
APPENDIX A: BACKGROUNDER ON WATER METER TYPES AND TECHNOLOGY

There are three components of what is commonly referred to as a 'water meter':

1. the housing or casing,
2. the meter (i.e., measuring device), and
3. the data transmitting device.

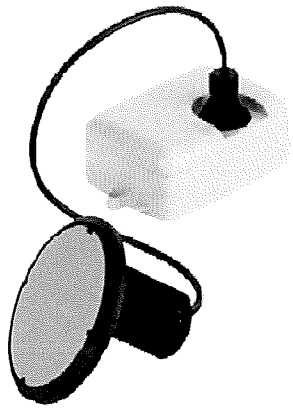
There are two types of housing or casing described and pictured immediately below, both of which will be used to complete universal metering in Salmon Arm. There are also multiple types of data transmitters. To implement universal metering, Salmon Arm will be transitioning from touch pad readers to radio-frequency transmitters (both described and pictured on the next page), to help realize the maximum benefits of metering.

1. Housing or casing to house the meter

Type	Overview
Indoor 'urban' installations 	**Description** • Meters installed in the dwelling/building, often located in basements and/or behind wall panels • Common in urban settings **Pros** • Lower cost installation **Cons** • May not capture (i.e., measure) water use diverted from the service line before it reaches the building • May make data collection more difficult and costly depending on the meter and data transmitting device
Pit set 'rural' installations  	**Description** • Meters installed close to the property line, where the private service line connects to the public distribution line • Used in some rural/large lot settings to measure water used for irrigation diverted directly from the service line **Pros** • Ensures all water use is measured **Cons** • Can be costly to install, especially in cold climates (due to the need for deeper pits) and depending on the ease of locating service lines (the estimated cost per pit set installation is $3,500 compared to $900 for indoor installations)

2. Meter to measure/record water use

3. Device to transmit data

Type	Overview
Touch pad readers 	**Description** • Data is transmitted from the water meter to the device when it physically touches a component of the meter **Pros** • Provides the volume of water consumed by each account since the last reading (usually conducted every 3 to 6 months), enabling comparison of water use between accounts and over time **Cons** • The need to access each meter to take readings consumes significant staff time • May require coordination with property owners if meter components are inside • Data is limited and does not provide intel for leak detection or understanding daily or weekly water-use behaviours
Radio-frequency transmitter 	**Description** • Data is transmitted from the water meter when the radio-frequency transmitter is within range of the meter, typically accomplished by 'drive-by' data collection from a car **Pros** • Does not require coordination with property owners or entry onto private property • Data collection is significantly more efficient (and can potentially be combined with other functions such as solid waste collection) • Collects much more data (e.g., the time of day for water use), enabling leaks to be detected and more sophisticated and effective water conservation strategies **Cons** • Requires retrofitting in some Salmon Arm properties that were metered in the past with touch pads

Appendix B – Factors Supporting UWM

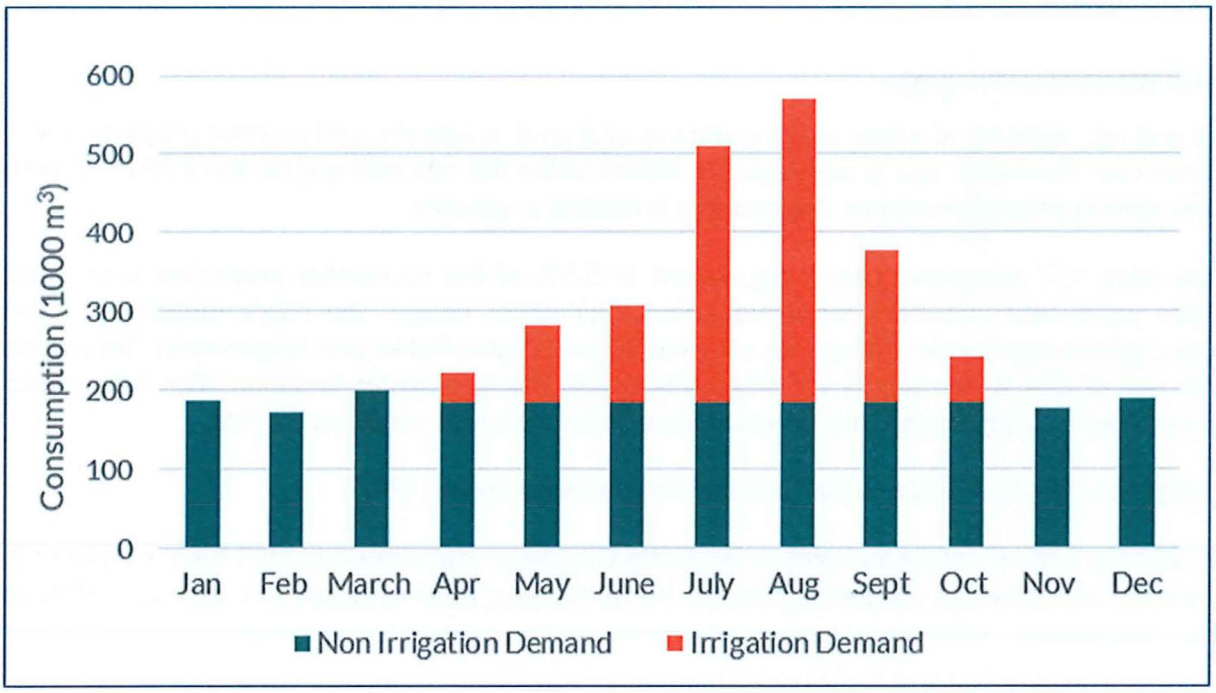
1. Water Conservation Policy and Plan

In 2021 the City prepared an updated Water Conservation Policy and Water Conservation Plan. The plan indicates that one of the City's major conservation challenges is seasonal water usage, specifically due to outdoor irrigation during the summer months. In the summer, the average monthly water consumption typically increases by almost 3 times the average winter consumption (Figure 1) and daily peak consumption can be 4 times or higher daily winter consumption.

The plan identifies the implementation of universal water metering (UWM) in conjunction with usage-based billing (metered billing) as the optimal strategy for achieving the City's conservation goals, prolonging the current capacity and lifespan of water and sanitary infrastructure and reducing system risks.

Specifically, usage-based billing incentivizes consumers to reduce non-essential water use, resulting in reduced water consumption. The greatest risk to the City's water system continues to be peak water consumption related to irrigation in the summer months.

Figure 1: 2022 Average Monthly Water Demand



2. Current State of Water Meter Installations

The City's Subdivision and Servicing Bylaw 4293 requires all new residential dwellings to install water meters. Additionally, existing properties without a water meter are required to install one as a condition for building permits where plumbing work is involved. To date, these requirements have resulted in 44% of residential properties (approximately 2,500 out of 5,700) having water meters, leaving 56% unmetered.

Apart from this, the City' meter installation program for industrial, commercial and institutional (ICI) properties has resulted in 96% of ICI properties being metered.

3. Current State of Utility Billing

The majority of residential properties are billed an annual flat rate based on 39 m3/month water and sanitary sewer use, whereas ICI properties are billed bi-monthly, based on actual consumption determined by meter readings. Approximately 3% of residential households are on metered-billing as a result of having a home-based business that requires the use of City water, or because the property owner has opted-in for metered billing due to excessive use.

Residential water meters are typically read twice annually, in the spring and fall. These meters are read manually by Public Works utilities staff going house-to-house, and are used to inform the Excessive Water Use Program (described below in more detail). Manual readings are required as radio-frequency heads are not currently installed on residential water meters.

ICI water meters are read on a bi-monthly basis. These meters are installed with a radio-frequency (RF) head which allows Public Works utilities staff to collect the consumption data in a more efficient way by driving by each property. This data is then available for billing purposes without the need for manual entry.

The implementation of radio frequency heads for residential properties as part of UWM will allow a more efficient data collection.

4. Excessive Water Use Program

In the spring and fall, residential meter reading data is analyzed to identify and monitor properties with excessive water use. Excessive use is assessed in relation to the flat rate billing quantity of 39 m3/month and letters are sent to properties where this quantity is double or greater.

In 2023 there were 137 excessive users, equivalent to 5.5% of the residential properties with water meters. Letters were sent informing residents about their water usage, the City's multistage water restrictions, and where applicable, the clause in Bylaw 1274 - Water Rates and Waterworks Regulation restricting the use of City water supply for properties exceeding ½ acre for irrigation. The letters also provided an estimate of utility costs if the property were to be switched to metered billing.

Of the 137 letters sent in June 2023, only 55 responses were received (40%).

Additionally, as only 44% of residential properties using City water have meters, staff have no ability to effectively monitor and manage excessive use for the remaining 56% of properties that do not have meters.

As a result of this program, some properties have:

- found and repaired leaks,
- discontinued irrigating more than ½ acre with City water,
- disclosed rental suites requiring increased billing,
- been identified as businesses and switched to metered-billing,
- reduced water consumption.

With regard to the last point, it is worth mentioning the following response from one of the excessive use properties in August 2023:

"We were, frankly, unaware of how much water we were consuming, primarily because we didn't pay attention to how much our irrigation system used. Once we learned this fact, we were able to reduce the irrigation consumption."

This property received an excessive use letter in June 2023 and began monitoring water consumption by recording their water meter readings. They reduced their consumption from 127 m3/month to 21 m3/month.

The action taken by this property highlights the benefit of metered billing, whereby property owners can use the actual consumption data provided in the utility invoices to make decisions about their consumption, determine what reductions can be made, and monitor the results. This ultimately benefits both the property owner and the City.

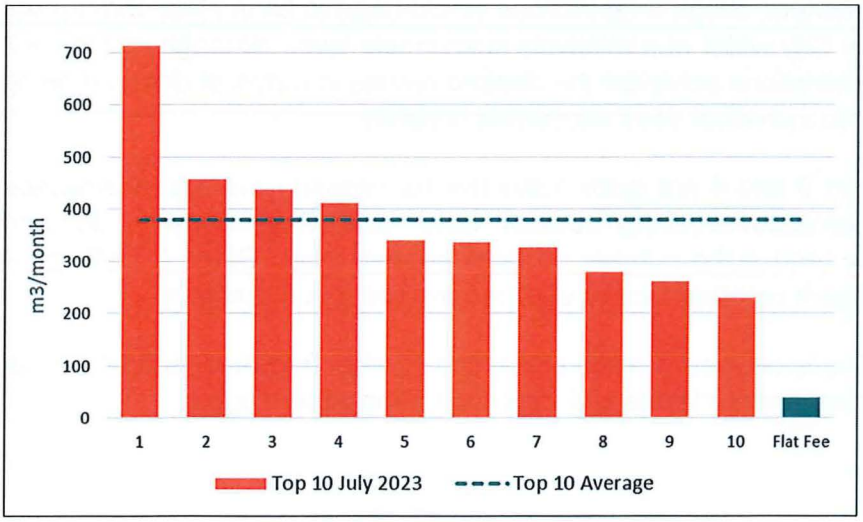
In summary, the excessive use program has derived some positive results; however the manual meter readings, data analysis, letter preparation and follow-up with residents are very time-intensive tasks for Public Works and Engineering staff, with limited results. It is a reactive activity conducted annually, whereas UWM would provide property owners with more frequent consumption data and an incentive to proactive reducte consumption, with less intensive involvement of City staff.

5. Equity and Fairness for Consumers

The residential water meter data analysis and excessive use program have highlighted the inequities that exist in the current flat rate billing methodology. Based on the most recent data (spring 2022 to spring 2023), 18% of metered residential properties consumed an average of 65 m3/month; exceeding the flat rate billing quantity by 1.7 times. The average consumption for the remaining 82% was 19 m3/month; less than 50% of the flat rate billing quantity. Similar percentages could exist for the unmetered residential properties. Based on this data, many properties could realize savings in their utility expenses when UWM is implemented.

Additionally, there are properties using well in excess of the flat rate billing quantity. For example, in July 2023, ten excessive-use properties consumed an average of almost 10 times the flat rate quantity, with the highest consumption being 713 m3/month (Figure 2). The average size of these properties is 16 acres, potentially indicating irrigation in excess of the ½ acre permitted by the Water Rates and Waterworks Regulation Bylaw.

Figure 2: Top 10 Excessive Use Properties July 2023



Installing water meters and transitioning all residential properties to metered billing will ensure that consumers of City water are paying for what they use, and that home-based businesses using City water for their operations are paying for their business water requirements, rather than being subsidized by other residential property owners.

6. Multistage Water Restrictions

Multistage outdoor water use restrictions were implemented in 2023 and all four stages were activated between July and September. Water consumption data shows that the greatest reductions were achieved in Stage 3 (lawn irrigation allowed 1 day per week), and especially in Stage 4 (lawn irrigation not allowed) Data also shows that consumption increased during Stage 2 (lawn irrigation allowed 2 days/week) over Stage 1 (lawn irrigation allowed 3 days/week), but this is likely due to higher temperatures and less rainfall (Figure 3).

The following observations can be made from the data presented in Figure 3:

- In Stage 1, the average consumption in June of 16,610 m3 neared the total capacity of the City's reservoirs (17,345 m3) and subsequently exceeded this capacity* in early July. Daily demand began exceeding reservoir capacity at the beginning of June, quite excessively on certain days, prompting the need to move to Stage 2 restrictions.
- In Stage 2, the average daily consumption of 18,653 m3 exceeded the total capacity of the City's reservoirs by 7.5%, with daily demands being well in excess on certain days. The lack in reduction in demand, despite the higher restrictions, prompted the need to move to Stage 3.
- In Stage 3, the average daily consumption of 15,644 m3 fell to 90% of the reservoir capacity, however consumption continued to slightly exceed capacity on certain days.
- Only in Stage 4 did the average daily demand of 10,898 m3 fall significantly below the reservoir capacity at 63%, and there were no days where capacity was exceeded.
- This level of reduced demand continued upon returning to Stage 3 at the end of August as temperatures were lower and there were higher amounts of rainfall.

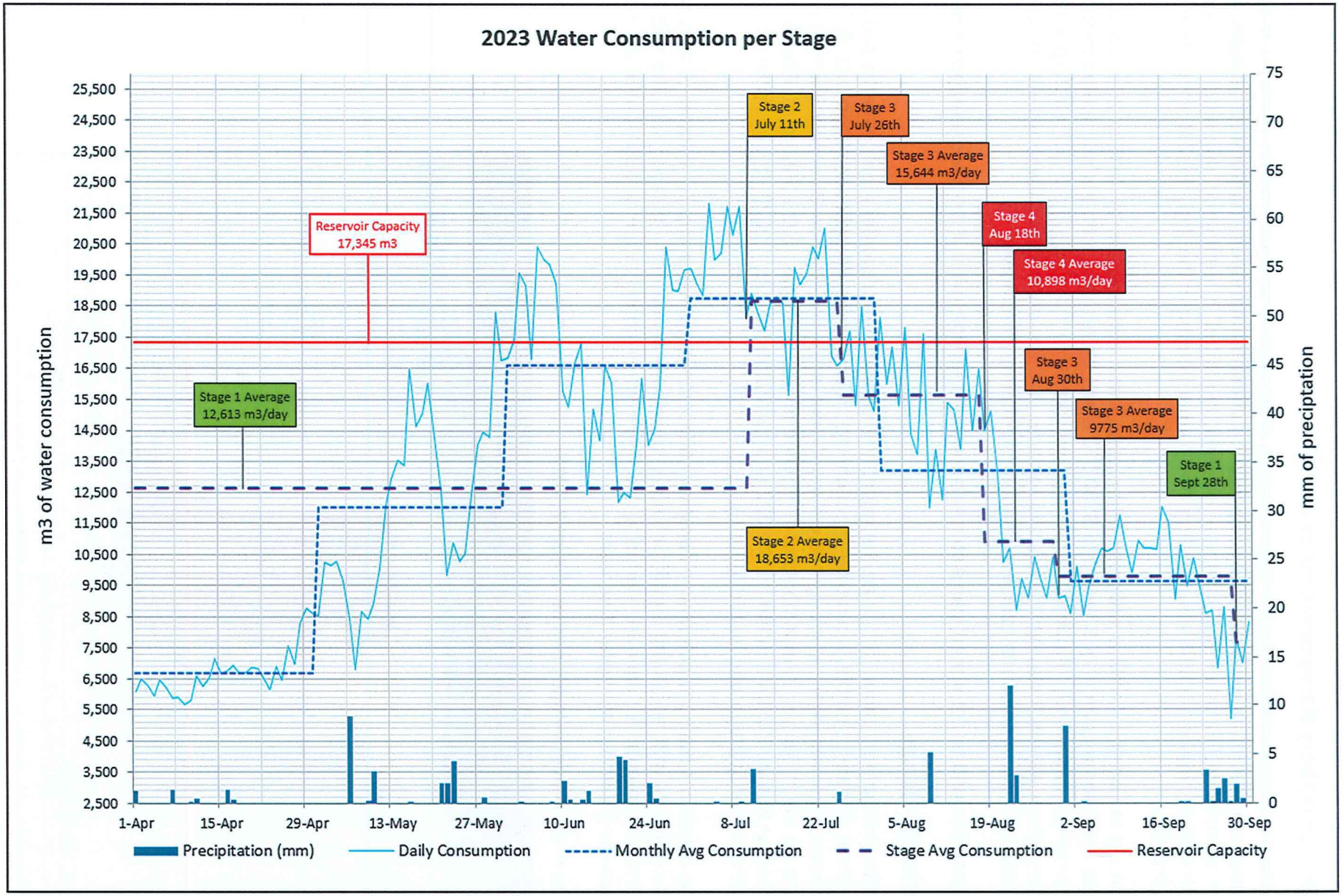
* When demand exceeds reservoir capacity, the pumps need to work continuously to meet demand and keep the reservoirs filled to the required fire-flow levels. This puts excess strain on the system, and increase operation and maintenance costs.

Initial conclusions indicate that, at a minimum, Stage 3 restrictions would need to be in place throughout the summer to keep current demand on City water at a relatively sustainable level, although as Figure 3 indicates, it was only in Stage 4 that restrictions achieved the desired results in terms of demand being well below the reservoir capacity, with no individual days exceeding capacity.

From a service level perspective, Stage 3 and 4 are quite restrictive for property owners, businesses involved in landscaping and other services requiring outdoor water use. Reductions in demand anticipated with UWM could potentially reduce the number of days required under Stage 3 or Stage 4 restrictions, however this is also contingent on other factors such as drought and forest fires.

Further adjustments as to what irrigation is allowed in each stage and at what frequency will be further analyzed, so as to work toward optimizing service levels and demand on the water supply.

Figure 3: 2023 Daily Water Consumption per Stage – May 1st to September 30th



7. Service Delivery Management Policy and Programs

The observed upward trend of peak water usage is anticipated to continue over time (refer to the City of Salmon Arm Water Conservation Plan, July 2022), putting greater stress on the water system. Higher water demand will shorten the timelines for capacity-related infrastructure upgrades and increase operational and maintenance costs, resulting in an overall increase in the lifecycle cost of the water supply infrastructure.

According to Econics, UWM is anticipated to reduce water consumption by 15% to 20%. As a result, annual operational savings of $70,000 to $100,000 could be realized with this anticipated reduction in consumption. Additionally, reduction in demand will preserve the longevity of our existing water and sanitary sewer assets, delaying the need to replace, upgrade and expand these assets, including an estimated deferral of the water treatment plant expansion by 23 to 33 years.

Reduced demand on the system can also mean improved service levels, if the risk of outages is reduced.

8. Climate Change

Climate change predictions for our area suggest an increase in average daily temperatures and drought conditions. British Columbia is currently experiencing province-wide drought conditions, with 80% of the province's water reservoirs at drought levels 4 or 5 (out of 5). The Salmon River and South Thompson Basins (in which Salmon Arm is contained) reached level 5 in August 2023 (Figure 4). Shuswap Lake reached an historic low level in the fall of 2022 and has not recovered in 2023. It is currently 0.5 m lower than the 5-year average lake level (Figure 5).

These conditions have the potential to negatively affect the City's water supply, in terms of both quantity and quality, as well as having significant negative impact on salmon migration and the wildlife that depends on salmon for survival. Reducing the City's water consumption through UWM will serve to reduce our impact on our water reservoirs

Figure 4: BC Drought Conditions as of Sept 7, 2023

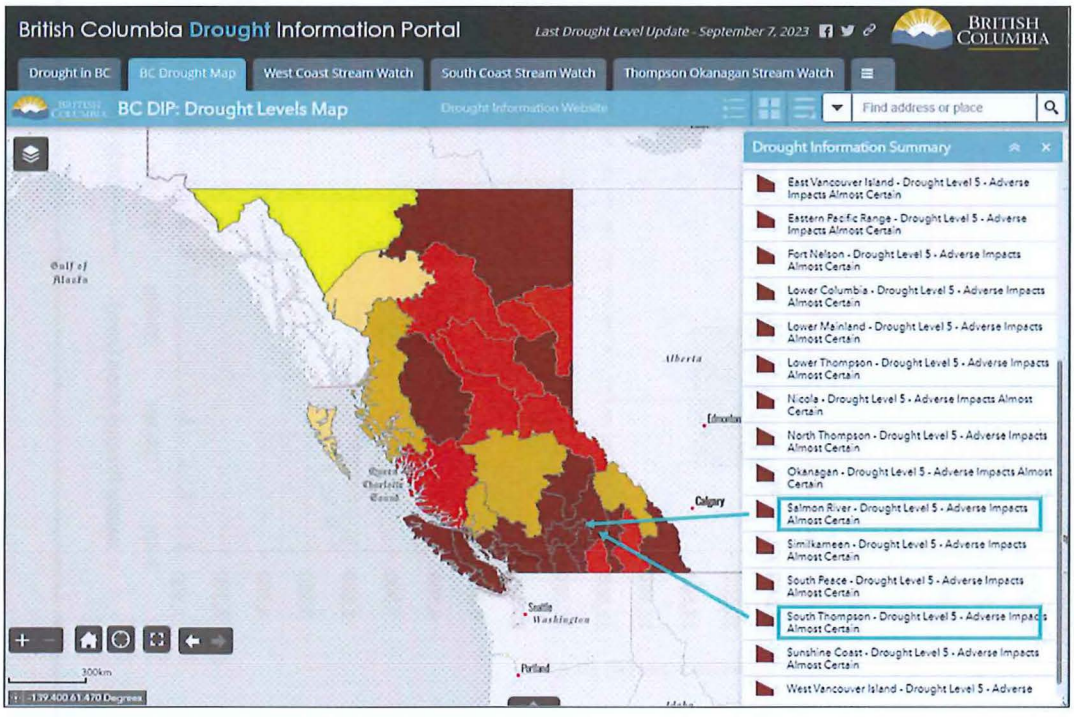


Figure 5: Shuswap Lake Levels 2017 – 2023