Agenda – Executive Policy Committee – November 14, 2023

Report – Standing Policy Committee on Water, Waste and Environment – October 30, 2023

Item No. 1 Advanced Water Metering Solution Business Case

STANDING COMMITTEE RECOMMENDATION:

On October 30, 2023, the Standing Policy Committee on Water, Waste and Environment concurred in the recommendation of the Winnipeg Public Service, as amended, and submitted the following to Council:

1. That the capital project, Water Meter Renewals, with an AACE Class 3 capital cost estimate of $135,000,000, be approved and advanced to 2024.

2. That, subject to approval of Recommendation 1, any financial implications of the funding source, Water Meter Renewal Reserve, be referred to the 2024 - 2027 Budget process.

3. That the Public Service seek out all opportunities for external funding available to assist with the capital project, in accordance with Council priority setting.

4. That the Winnipeg Public Service be directed to report back to the Standing Policy Committee on Water, Waste and Environment in 90 days with details on a proposed opt-out program.

5. That the Proper Officers of the City be authorized to do all things necessary to implement the intent of the foregoing.

Agenda – Executive Policy Committee – November 14, 2023

Report – Standing Policy Committee on Water, Waste and Environment – October 30, 2023

DECISION MAKING HISTORY:

STANDING COMMITTEE RECOMMENDATION:

On October 30, 2023, the Standing Policy Committee on Water, Waste and Environment concurred in the recommendation of the Winnipeg Public Service, with the following amendments:

- In Recommendation 3, delete the period after the words "capital project" and replace with ", in accordance with Council priority setting."

- Add the following new Recommendation 4 and renumber the remaining accordingly:

    "4. That the Winnipeg Public Service be directed to report back to the Standing Policy Committee on Water, Waste and Environment in 90 days with details on a proposed opt-out program."

and submitted the matter to the Executive Policy Committee and Council.

The following persons submitted communications with respect to the matter:

- David Grant
- Paul Medeiros
- Marianna Papamichail
- Gilles Lamoureux
- Ben Raber
- Lyle Barkman
- Margaret Friesen, Environmental Health Association of Manitoba
- Pierre Attalah

ADMINISTRATIVE REPORT

Title: Advanced Water Metering Solution Business Case

Critical Path: Standing Policy Committee on Water, Waste and Environment – Executive Policy Committee – Council

AUTHORIZATION

Author	Department Head	CFO	CAO
L. Szkwarek, CPA CGA	T. W. Shanks, M. Eng., P. Eng.	C. Kloepfer	M. Jack

EXECUTIVE SUMMARY

The City of Winnipeg has approximately 217,000 residential and commercial water meters. Over 130,200 (60 percent) are past their service life and need replacement. The Public Service recommends an Advanced Metering Infrastructure (AMI) to address meter accuracy, improve customer service, provide equity in the customer base, and create operational efficiencies.

In October 2021, the Public Service retained Diameter Services to review meter reading solutions including Direct Read, Automated Meter Reading (AMR) and AMI, and develop a business plan and Class 3 estimate for a water meter replacement program.

The business case projects AMI will improve accuracy in billing and increase annual revenue by $16.1 million once implementation is complete. Further, a reduction of $2.2 million in operating costs is projected annually post implementation. Financial benefits will be gained from increased water meter accuracy and reduced operating costs when the new meters are installed.

Based on the Class 3 estimate, the project cost is estimated at $135.0 million. The payback on the investment is projected to be 10 years. The project has a positive 20-year net present value of $55.6 million. Sufficient funding is forecasted in the Water Meter Renewal Reserve to fund the expected total capital expenditures for the project. The Public Service will also seek out all opportunities for external funding available to assist with the program.

Upon Council approval, the Public Service will begin development of request for proposals (RFPs) with an AMI system implementation anticipated to begin in 2025.

RECOMMENDATIONS

1. That the capital project, Water Meter Renewals, with an AACE Class 3 capital cost estimate of $135,000,000, be approved and advanced to 2024.

2. That, subject to approval of Recommendation 1, any financial implications of the funding source, Water Meter Renewal Reserve, be referred to the 2024 - 2027 Budget process.

3. That the Public Service seek out all opportunities for external funding available to assist with the capital project.

4. That the Proper Officers of the City be authorized to do all things necessary to implement the foregoing.

REASON FOR THE REPORT

Council approval is required to approve in-year capital budget and to commence a multi-year Advanced Metering Infrastructure program.

IMPLICATIONS OF THE RECOMMENDATIONS

If approved, the Water Meter Renewals capital project will be funded through the Water Meter Renewal Reserve.

HISTORY/DISCUSSION

On February 22, 2011, Council approved the Meter Infrastructure Program as part of the 2011 Annual Capital Budget. The program included the development of a business case for an advanced metering technology project and a 12-month pilot project.

On March 20, 2019, Council approved the Water Meter Replacement Program as part of the 2019 Capital Budget. This project was to review current water meter technology, validate the best replacement technology, and develop a plan and Class 3 estimate for implementation of a multi-year direct-read water meter replacement program.

On January 30, 2020, Council approved the 2020 to 2023 Water and Sewer Rate report which included the establishment of a Water Meter Renewal Reserve for replacement and renewal of aging water meters and a City-wide advanced metering system (AMS), and referenced an automated meter read pilot project with the objective to develop, test and evaluate policies and processes required for a larger AMS implementation.

As part of the 2020 Capital Budget, Council approved funding of $450,000 to review current water meter technology, validate the best replacement technology, and develop a plan and Class 3 estimate for implementation of a multi-year water meter replacement program.

The Public Service contracted with Diameter Services through a Request for Proposal (RFP No. 801-2020) process to review the City’s current inventory of water meters, analyze current meter reading and billing processes, and identify opportunities for improvements in functionality and efficiencies. Analysis included feasibility and benefits of using improved metering technologies commonly referred to as smart meters for the City.

BACKGROUND

1. Definitions

Direct Read: Meters that are not equipped with remote reading capabilities and require manual observation to obtain a meter reading.

Automated Meter Reading (AMR): Meters that include encoder receiver transmitters which transmit consumption data to a hand-held device and require nearby attendance to obtain meter reading data (e.g. drive or walk by).

Advanced Metering Infrastructure (AMI): An integrated system of smart meters, data management systems and communication networks that enable two-way communication between the utility and the customer.

2. Current Practice Direct Read Water Meter

The City of Winnipeg supplies and owns all the water meters within the City. Meters measure the water used by a customer and water and sewer charges are based on the amount measured. As of January 2023, there were 217,000 water meters with 203,500 in residential homes and 13,500 in commercial/industrial businesses. The majority of the meters are direct read meters.

The City's current residential meter reading practice relies on customers to submit three quarterly readings and the City to complete one annual read. The City's Summer Meter Reading Program requires City staff to gain access to a residential customer's home to read the meter. Commercial water meters are manually read by City staff each quarter.

Water meters under-register as they age due to wear on the mechanical components. Neptune's SEER® (Statistical Evaluation for the Enhancement of Revenue) analysis tool is specifically designed to identify Non-Revenue Water at the water meter level and estimates that a 20-year-old meter under-registers by 6.15 percent. The average age of Winnipeg's meter population is 20.4 years; whereas, the optimal service life for a residential direct read meter is 15 years. Over 60 percent of meters are past their optimal service life. The aging meter population presents an opportunity to implement an advanced metering system.

The Water and Waste Department (WWD) plans for routine meter maintenance and exchange programs in order to ensure meter failures are managed. The WWD also strives to achieve equity where customers with new meters don't subsidize the consumption of customers with older meters that under register. However, planned replacement of water meters, other than for repair or emergency situations, currently does not keep up with requirements, restricted by resource availability, meter supply inventory, and by the residential customer's hesitation to admit City staff into their homes.

The continued installation of direct read meters will result in an increasing percentage of billings with estimated consumption as gaining access to water meters becomes increasingly problematic (health and safety, customer concerns). Currently, approximately 31 percent of bills are based on estimated consumption and approximately six percent of customers fail to submit the minimum of one-meter reading per year. This can lead to an increase in administrative resource requirements, inaccurate billings, decreasing customer service and impact on City revenue due to aging meters. The cost of under-registration due to aging meters is estimated at $18 million in 2022.

3. Automated Meter Reading (AMR)

Approximately 7,500 AMR meters are installed upon construction in select new residential developments (Waverley West, Ridgewood South and Summerlea) and commercial establishments with higher-risk meter placement. AMR meters include encoder receiver transmitters (ERT) which transmit consumption data to a hand-held device. A City staff must walk or drive by the customer location to receive the consumption data. The City has realized expected benefits that support the overall introduction of automated meter reading practices such as improved meter reading and billing accuracy, early leak detection, reduced safety concerns and improved customer service.

Although installing AMR meters has provided benefits, it does not address the challenges of replacing existing meter infrastructure on a City-wide scale nor determining what technology is the right choice for the City.

4. Residential AMR Replacement Pilot Project

During the spring of 2019, the Public Service conducted a Residential Automated Meter Reading Replacement Pilot (Pilot) project in which direct read water meters within a designated area of Winnipeg were replaced with AMR meters.

The Pilot area encompassed a section of River Heights consisting of approximately 500 water meters. The age of the water meters averaged 22 years, ranging from one to 58 years. The selected area was representative of the age of water meters in the City as a whole.

Two primary objectives of the Pilot were to assess the accuracy of existing meters and customer communication procedures to support a large-scale meter exchange. Utilizing American Water Works Association (AWWA) standard for Cold-Water Meters Displacement Types (C700-20), test results were consistent with expectations that meter flows measure lower than the acceptable standards in aging meters. Test results also confirmed that meter accuracy declines once a meter is past its optimal service life.

The Pilot also confirmed the expected customer service improvements, such as improved meter reading and billing accuracy, and early detection of potential leaks.

For more details, see Appendix A: River Heights Automated Meter Reading Replacement Pilot.

ADVANCED METERING INFRASTRUCTURE (AMI) BUSINESS CASE OVERVIEW

Under the guidance of Diameter Services, a business case was completed supporting the implementation of an AMI solution with a City-owned network. AMI provides more functionality in terms of business drivers and better aligns with the City's long-term goals and objectives. The following summarizes benefits and functionality of the proposed AMI system.

Benefits

Customer

- Improvements in customer service by providing accurate and timely consumption information.
- Ability to transition to future monthly billing.
- Customers will no longer be required to read their meters and submit readings for billing purposes.

- Near elimination of estimated bills whereby customers receive an accurate bill paying only for the service they use.
- Customers will not be inconvenienced by in-person meter reading visits.
- Customers can be notified of increases in consumption that may mean a leak on their property. Notifications can occur before a bill is issued which can reduce the severity of the leak and financial impact.
- Customers can view detailed consumption online with greater frequency than the current water consumption for the previous 90 days. Customers can see the impact of conservation initiatives such as low flow fixtures/appliances or review seasonal variations, peak consumptions, etc.
- Move-in/move-out reads can be captured when needed without a City field visit or requiring the customer to submit a read.
- Improved theft detection which reduces the impact to all rate paying customers.

Water and Waste Department (WWD) operations and capital investment

- Transmit real time water meter readings with little to no delays, virtually eliminating the need for meter readers in the field aside from exceptions such as non-communicating meters. This significantly reduces health and safety risks, and costs associated with meter reading.
- Increased revenue from more accurate water meters and reduced water losses will help offset future rate increases.
- Obtain a best practice meter reading rate of >99 percent and reduce billing estimations to <1 percent.
- Early notification of water meter issues such as damaged or stopped meters, and irregular water consumption (high or low).
- Early meter failure detection. Currently meter failures can take six to nine months to detect given that meter readings are not regularly provided.
- Improve active leak detection services. AMI can capture hourly consumption information, assisting the utility to calculate how long and how much water leaked on a customer's service.
- Enable the utility to monitor unauthorized usage on accounts that have been disconnected for non-payment without a field visit to confirm water has been shut-off.
- Detect reverse flow at the water meter and alert staff to investigate. Reverse flow is a water quality concern as water from private property may enter the public system.
- Assist in sizing large meters correctly to reduce losses on low flow measurement.
- Improve analytical reporting and financial forecasting with real time consumption data.
- Support water conservation programs and lower carbon emissions associated with related City operations.

AMI Functionality

AMI, the current technology being implemented by larger utilities (Appendix B: Meter Reading Technology in Canada), enables meters to be read remotely from a central location using radio transmitters that are attached to each water meter. Water meter readings are transmitted automatically from the property via a radio Wide Area Network to a system of data collectors placed strategically throughout the community.

The radio transmitters are read by permanently installed radio collectors (receivers). They are equipped with lithium batteries designed to last 10 to 20 years, depending on the model and its frequency of transmission.

Radio data collectors send water meter consumption information to a data warehouse or Meter Data Management (MDM) software system for billing, reporting and analysis. Since the readings are captured remotely, customers do not need to submit a meter reading nor staff are required to collect meter readings. Readings and other information (leak alerts, tamper alerts) are typically collected from the meter and transmitted to the utility's offices on a predetermined schedule.

AMI technology would allow the City to collect actual and timely meter reads which will be used to accurately bill for service. The City could also consider moving to a monthly meter reading and billing process making water bills smaller and easier for customers to manage.

A City-owned AMI network continues to be the most utilized in industry. Planning the right amount and location of equipment is determined through a propagation study performed by the manufacturer of a proposed solution providing a theoretical performance of the system based on many factors including: the topography of the geographic area being covered, the strength and frequency of transmissions, location of the radio transmitter and the number and location of data collectors.

Three alternatives to AMI were reviewed:

- *AMI Cellular Technology*: An AMI system with cellular transmitters eliminates the need for data collectors to be installed. The radio transmitters transmit directly to an existing cellular network. As long as the property has cellular coverage, the radio transmitter can be heard. Benefits include eliminating the need to maintain a separate fixed network. Drawbacks include:
    - higher transmitter, software and cellular/backhaul costs that limit the applications used for this technology
    - on-going compatibility with cellular networks
    - the latency of a command could be delayed

- *Mobile AMR Technology*: Like an AMI system, AMR requires a radio transmitter connected to each water meter and requires meters to be read from mobile devices that are in relatively close proximity to the meter, for example, in a nearby vehicle. While AMR primarily solves the issue of obtaining a meter reading, it does not allow for future development of additional benefits.

- *Direct Read Meter Exchange*: This is no longer a viable or sustainable option. Most vendors have transitioned to encoder registers on meters and are no longer offering direct read meters. Investing in dated technology does not support best practices in meter management nor afford the benefits customers can expect with automated metering technology.

5. Financial Models

Three options were assessed using a financial model that incorporated initial capital and operating impacts: Option 1 - AMI with a City-owned network, Option 2 - AMR drive-by and Option 3 - AMI with a cellular network. Analysis included Operational revenue improvements and key utility functions, and Capital impacts.

5.1 Operational

Revenue Improvements

Revenue improvements were calculated using the City's meter inaccuracy number provided in its 2019 American Water Works Association (AWWA) water audit and with the presumption that mechanical meters will be 100 percent accurate upon installation. Estimated values for increased revenue range from $1.6 million in year one of the project increasing to $16.1 million in year five.

Although the optimal life of a mechanical meter is 15 years, the life expectancy can extend to 20 years. The potential water and sewer revenue improvements from the meter replacement is estimated at $175 million (non-discounted) over the extended 20-year life.

Since all options require the replacement of water meters, the revenue improvement is the same in all three options.

Utility Functions

Function	Consideration	Benefits
Meter Reading	The City relies on residential customers to provide three accurate meter reads per year and strives to obtain a company read from every residential customer once per year. Reliance on customer provided readings, which can be inaccurate or delayed, or ability to enter a customer's home, has proven increasingly unsuccessful.	Advanced technology will eliminate the need for customer reads.
Meter Maintenance	The majority of the City's water meter population is past its useful life. Water meters under-register as they age due to wear on the mechanical components and have higher repair and replacement costs Services including reading verification, investigations for unusual consumption and confirmation if water has been turned off require site visits by City staff.	Reductions in associated meter maintenance and repair orders, and verifying readings.
Billing and Customer Services	The City experiences billing errors, numerous bill adjustments and other impacts to customer service largely due to inaccurate, delayed or no meter readings.	Fewer meter read errors and bill adjustments, detailed and timely consumption data, proactive leak detection and overall improved customer service.

Function	Consideration	Benefits
IT Support Costs	Meter reading software and equipment currently in use requires limited IT support to operate and maintain.	Introduction of automated infrastructure technology will increase IT costs and would include meter reading and data collection software, network, data and cellular support costs.
Distribution System Management	Mechanical meters and manual meter readings do not provide the opportunity to improve distribution system management.	Ability to right size meters at each service to ensure maximum revenue capture, detect unauthorized consumption and minimize data errors.

Financial summary of operating impacts of utility functions summary:

	Option 1 AMI City Owned (in $000's)	Option 2 AMR Drive-by (in $000's)	Option 3 AMI Cellular (in $000's)
Meter Reading	900	555	900
Meter Maintenance	550	515	550
Billing and Customer Services	400	385	400
IT Support Costs	(615)	(15)	(1,300)
Distribution System Management	950	420	950
Total Estimated Financial Impact and Efficiencies	2,185	1,860	1,500

5.2 Capital

The capital cost for all three options assume a single, continuous project. Project management would be provided through a combination of internal (project support) and external (consulting) resources.

A project of this nature would include a broad scope including a combination of products, services and software applications. The main cost categories would include: (a) installation with consideration for more complex meter replacement situations; (b) AMI/AMR supply, network and implementation including software licensing; (c) water meter supply and exchange scheduling; (d) project support (consulting and internal); (e) IT support including interfacing the billing system to the vendor's various systems and (f) a contingency for unexpected installation, integration or product costs and inflationary price increases.

The inputs that determine the total cost of a project of this nature include AMR/AMI technology supply, water meter supply, installation services, and both external and internal project support. The estimated costs are detailed below:

	Option 1 AMI City Owned (in $000's)	Option 2 AMR Drive-by (in $000's)	Option 3 AMI Cellular (in $000's)
Installation	34,000	33,000	34,000
AMR/AMI Supply	32,000	29,000	32,000
Meter Supply	32,000	30,000	35,000
Project Support – Consulting	7,000	6,000	7,000
Project Support - Internal*	8,000	7,000	8,000
IT Support	2,000	1,000	2,000
Contingency	20,000	20,000	22,000
Total Capital Costs	**135,000**	**126,000**	**140,000**
Net Present Value	$55,600	$58,500	$44,700
Payback Period	11.2 years	10.6 years	11.6 years

*See Appendix C for project team members

5.3 Financial Benefits

Although there is an additional cost to deploy the AMI network and additional on-going software costs, an AMI system provides significantly more customer service and operational benefits than an AMR system. Appendix D: AMR/AMI Functionality provides a matrix of key functions substantiating that AMI provides the most comprehensive solution. The detailed information provided by an AMI solution benefits the Department beyond the immediate requirement to obtain meter readings. An AMI system with a cellular network shares the same benefits but at a higher cost.

Post implementation, the primary financial benefits of an AMI system with a City-owned fixed network are obtained in the following areas (annual dollars):

- Improved meter accuracy: additional revenue ranging from $1.6 million in year one to $16.1 million in year five.
- Reduction of operating costs estimated at $2.2 million per year upon substantial completion. Cost savings include operational efficiencies which may facilitate new activities for some staff. The WWD is committed to current collective agreements.
- Theft reduction ($855,000): The Department identifies tampering on 0.1 percent of the meter population annually.
- One-time high bill adjustments ($290,000): Reduced high bill adjustments due to improved metering and leak detection.
- Reduction of non-revenue water due to leaks in the distribution system ($776,000).

5.4 Funding

The Council-approved 2020 to 2023 Water and Sewer Rates report included the introduction of a Water Meter Renewal Reserve for replacement and renewal of aging water meters with advanced water meters. The reserve is funded through transfers from the Waterworks Fund and Sewage Disposal Fund via the Daily Basic Charge. Transfers to the reserve are forecasted to total $135.6 million by 2029 which is sufficient to fund the expected total capital and operating expenditures for the implementation of an AMI City-owned fixed network system project. The

Public Service will also seek out all opportunities for external funding available to assist with the program.

Annual transfers into the reserve will continue to fund an ongoing program to replace water meters once they have passed their useful life.

6.0 Implementation Strategy

Program Master Schedule

Project Phase	Duration
Contract Administration	8 months
Procurement	14 months
Start-up	12 months
Proof of Concept	4 months
Installation and Deployment	40 months
Close Out	6 months
Total	84 months/ 7 years

Key implementation considerations include:

- The project impacts every customer in the City of Winnipeg with water and/or wastewater service. Public communication will be a critical component of project planning and deployment.

- The Water and Waste Department does not have the internal resources to schedule and exchange 217,000 water meters. The procurement strategy includes contracting with a third party to perform the meter exchanges and provide training on the new technology for City staff. Meter installations in new developments and a future ongoing meter renewal program will continue to be performed by City staff.

- City of Winnipeg by-law changes are required to ensure authority is in place to allow:
    - The installation of additional devices in private premises (meter interface units and remote disconnect devices).
    - Updated penalties for tampering and theft of water (including damage to additional devices).
    - Authority to disconnect service or impose fines for non-access to the water meter.
    - New fees for customers who opt-out of AMI meter technology

FINANCIAL IMPACT

Financial Impact Statement

Date: September 11, 2023

Project Name:

ADVANCED WATER METERING SOLUTION BUSINESS CASE

First Year of Program **2024**

	2024	2025	2026	2027	2028	2029 and Beyond
Capital						
Capital Expenditures Required	$ 2,000	$ 10,000	$ 20,000	$ 44,000	$ 45,000	$ 14,000
Less: Existing Budgeted Costs	-	-	-	-	-	-
Additional Capital Budget Required	$ 2,000	$ 10,000	$ 20,000	$ 44,000	$ 45,000	$ 14,000
Funding Sources:						
Debt - Internal	$ -	$ -	$ -	$ -	$ -	$ -
Debt - External	-	-	-	-	-	
Grants (Enter Description Here)	-	-	-	-	-	-
Reserves, Equity, Surplus	2,000	10,000	20,000	44,000	45,000	14,000
Other - Enter Description Here	-	-	-	-	-	-
Total Funding	$ 2,000	$ 10,000	$ 20,000	$ 44,000	$ 45,000	$ 14,000
Total Additional Capital Budget Required	$ 135,000					
Total Additional Debt Required	$ -					
Current Expenditures/Revenues						
Direct Costs	$ -	$ 176,000	$ 462,000	$ 1,078,000	$ 1,672,000	$ 1,771,000
Less: Incremental Revenue/Recovery	-	1,600,000	4,200,000	9,800,000	15,200,000	16,100,000
Net Cost/(Benefit)	$ -	$ (1,424,000)	$ (3,738,000)	$ (8,722,000)	$ (13,528,000)	$ (14,329,000)
Less: Existing Budget Amounts	-	-	-	-	-	-
Net Budget Adjustment Required	$ -	$ (1,424,000)	$ (3,738,000)	$ (8,722,000)	$ (13,528,000)	$ (14,329,000)

Additional Comments:

This project is fully funded from the Water Meter Renewal Reserve, Account Distribution No. 443 181000 200751 20010034YY**.** Incremental revenue reflects estimated increase in water and sewer sales, and direct costs reflect dividend at 11%.

Lucy Szkwarek, CPA, CGA

Lucy Szkwarek, CPA, CGA
Manager Finance and Administration

5-Jul-23

CONSULTATION

This Report has been prepared in consultation with:

N/A

OURWINNIPEG POLICY ALIGNMENT

This report aligns with OurWinnipeg 2045 policies as follows:

Goal: Leadership and Good Governance

Objective 1: Establish and implement priority actions through evidence-informed decision-making processes.

Policy 1.6 Results-Based Budgeting: Invest City resources in prioritized, proactive, long term community-beneficial outcomes.

Goal: Environmental Resilience:

Objective 1: Prioritize the transition to a resilient, low-carbon future through demonstrated organizational and community leadership, and collaborative actions that mitigate and adapt to a changing climate.

WINNIPEG CLIMATE ACTION PLAN ALIGNMENT

This report aligns with Winnipeg Climate Action Plan as follows:

Strategic Opportunity #1 - Corporate Leadership

Key Direction 1.2 Understand and Integrate Business and Economic Implications of Climate Action into Decision Making Processes.

Key Direction 1.5 Reduce Employee Vehicle Kilometers Travelled (VKT) and associated GHGs.

WINNIPEG POVERTY REDUCTION STRATEGY ALIGNMENT

Consideration was given as to whether this report connects to the Winnipeg Poverty Reduction Strategy (PRS) and its Goals and Objectives, and it was determined that the PRS is not applicable to this specific report.

SUBMITTED BY

Department: Water and Waste
Division: Finance and Administration
Prepared by: Ashleigh Campbell, CPA, CA
Date: September 11, 2023
File No.: A-011 Advanced Metering Solution Business Case

APPENDICES

Appendix A: River Heights Automated Meter Reading Replacement Pilot
Appendix B: Meter Reading Technology in Canada
Appendix C: Project Team
Appendix D: AMR/AMI Functionality
Appendix E: Detailed Capital Sheet Water Meter Renewals

APPENDIX A
River Heights Automated Meter Reading Replacement Pilot

Residential AMR Replacement Pilot Project (Pilot) Background

The Public Service participated in a research project with the Water Research Foundation (WRF) and four other water utilities on selecting and implementing an Advanced Metering System (AMS). An AMS can include both AMR and Advanced Meter Infrastructure (AMI). The AMI is a two-way system that collects time-differentiated water consumption information using, for example communication towers, and is capable of providing that information to the utility on at least a daily basis.

The research project identified the importance of a well-planned implementation process. The report also stressed the importance of completing several activities prior to initiating an AMS project, such as understanding the current meter population and developing policies for handling issues that occur as part of the project.

Pilot Objective:
The objective of the Pilot was to develop, test and evaluate policies and procedures required for larger AMS implementation including:

- customer communication before and during the project;
- community engagement;
- organization change management;
- business rules, policies and workflow;
- customer service and frequently asked questions;
- risk management and quality assurance;
- identify potential complications and barriers to successful meter exchanges.
    - accessibility
    - lead services – increases possibility of damaging incoming service line
    - non-functional shut off valves

The project also provided the opportunity for the department to update meter accuracy data for residential meters of a variety of ages.

Pilot Area:
The Pilot area encompassed a section of River Heights consisting of approximately 500 water meters. This area included Queenston, Niagara and Waterloo Streets between Academy Road and Corydon Avenue. The age of water meters averaged 22 years, ranging from one to 58 years. Over 65 percent of the meters were past their optimal service life of 15 years. The selected area was representative of the age of water meters in the City as a whole (average meter age of 19.5 years with over 65 percent of meters operating past their optimal service life).

Financial Impact:
The Pilot utilized existing operating budgets. Equipment costs for the project were limited to AMR water meters. Minor plumbing expenses (replacing stop and waste valves) and customer communication remained the responsibility of the WWD.

Communication Plan:
Letters outlining the Pilot and requesting that customers call the WWD Utility Billing Centre to book an appointment for a meter exchange were developed and hand-delivered to customers in

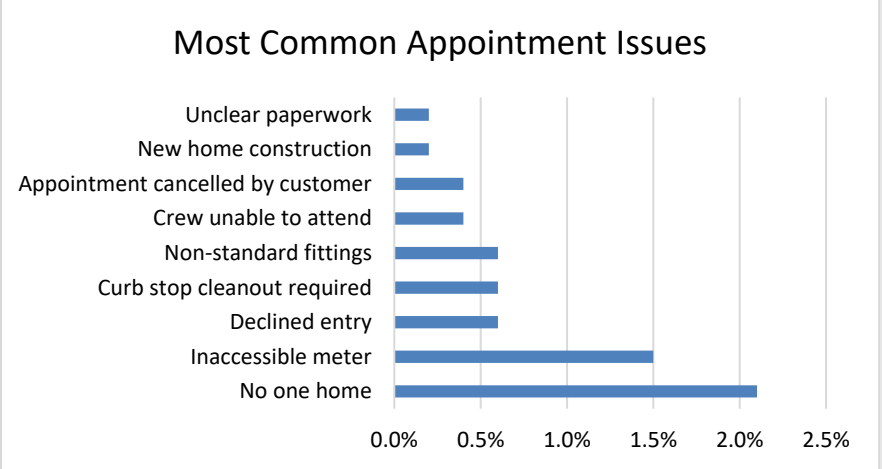
the designated project area between April 10, 2019 and April 15, 2019. A summary of the Pilot and Frequently Asked Questions (FAQs) along with WWD contact information was posted to the City's website. (Appendices A to C)

Within the FAQs and City website, included was information about safety and AMR meters. AMR meters are safe to be installed in homes and businesses and comply with Innovation, Science and Economic Development Canada regulatory limits. The automated water meter sends a signal to the City through a transmitter, which is similar or lower in strength to typical household devices (such as cell phones or Wi-Fi).

Residential AMR Replacement Pilot Project Results

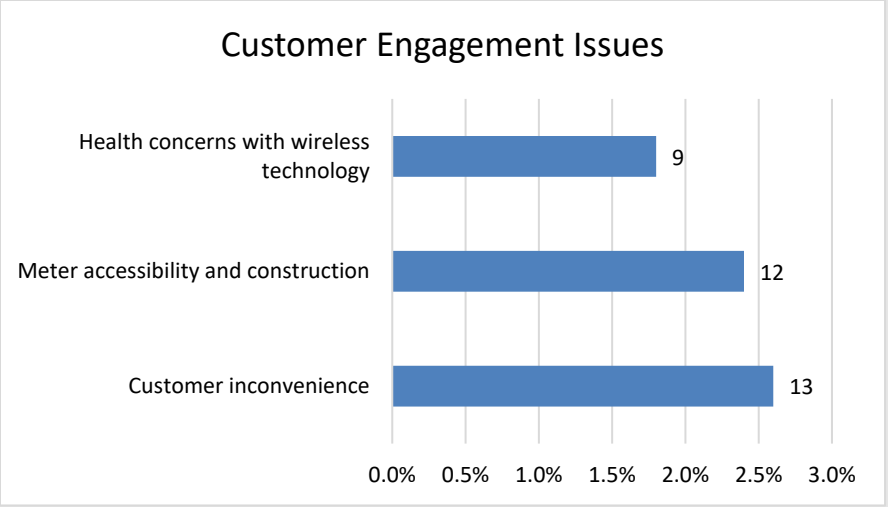
Meter Exchanges:
Dedicated WWD crews conducted meter exchanges seven days a week over a period of eight weeks, from April 15, 2019 to May 27, 2019. Field staff comprised of one to two Meters Office staff and one Water Services staff on any given day. Within the first four weeks, 398 of the meter exchanges were completed. A 95 percent exchange success rate was reached at the Pilot's conclusion. Total meter population was 493 with 467 exchanged to AMR. Of the remaining 26, AMR meters were not installed as the customer chose to maintain a direct read meter, opted out of the program, or had health concerns.

The two most common appointment issues that prevented WWD crews from exchanging the water meter were inaccessible meters or there was no one home.

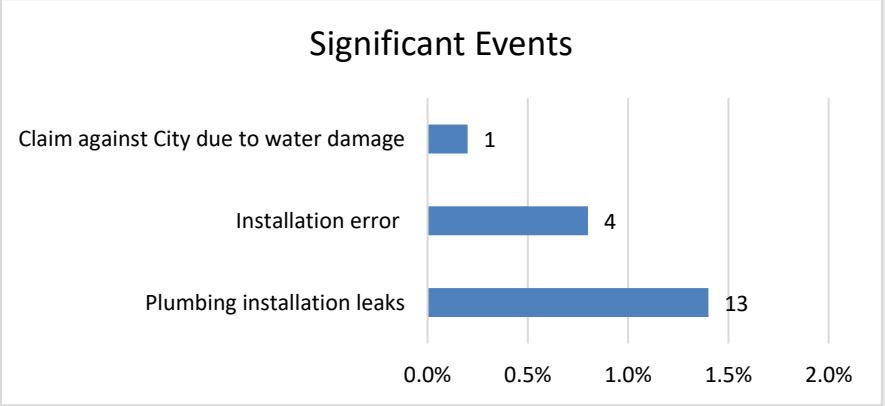


Second appointments were required for 25 customers. Of these second appointments, 23 or 92 percent had a successful second visit.

When attempting to book meter exchange appointments, customer engagement issues were encountered with 34 customers or approximately seven percent of the time. The main reasons were:



18 significant events were noted with plumbing installation leaks being most common:



Leaks were encountered primarily due to internal plumbing issues. Planning for a large-scale project would include a workflow to ensure resources are readily available to attend in a timely manner.

The most common internal problem encountered when completing meter installations was in relation to practices with field slips where meter and exchange information is documented. To reduce the risk of errors, future exchanges could require taking photos of all work completed. The City is currently moving towards electronic field slips, which will further mitigate the frequency of errors.

By-law Notice:
The Pilot resulted in the issuance of by-law notices to 26 customers. The main infractions noted were inaccessible meters, no response to meter exchange notices and non-standard fittings requiring plumbing changes. As of February 2021, 17 notices have been resolved and nine remain outstanding.

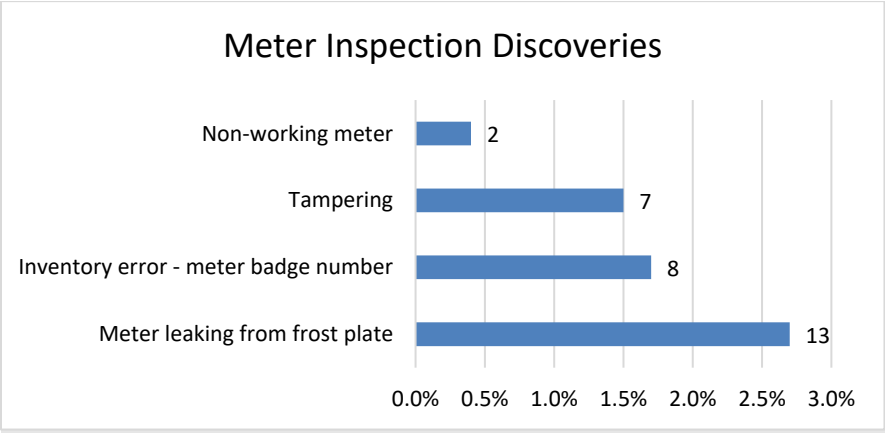
Meter Accuracy:
Meter accuracy is key to capturing all consumption. The accuracy of mechanical meters declines over time. On average, aging meters will gradually slow down and under-register,

resulting in lost revenue. An objective of the Pilot was to assess the accuracy of existing meters within the pilot area. The City tested 444 of the 473 or 94 percent of the uninstalled direct read meters to determine their accuracy levels.

Uninstalled meters ranged in age from newly installed up to 57 years of service with the average age being 21 years. The optimal service life of a meter is 15 years. Utilizing American Water Works Association (AWWA) standard for Cold-Water Meters Displacement Types (C700-20), test results were consistent with expectations, and meter flows measured lower than the acceptable standards as prescribed by AWWA.

The overall meter accuracy pass rate totaled 54 percent and fail rate was 46 percent. Test results did confirm that meter accuracy declines once a meter is past its optimal service life.

Meter Inspections:
This focused area-wide meter exchange provided an opportunity for the City to inspect the state of existing meters. Of the meters inspected, the meter leaking from frost plate was the primary discovery. Leaks such as these are one of the contributors to property damage.



Consumption Analysis:
The City has realized a 99.9 percent meter read success rate for AMR installations. Meter consumption is read once per month. System estimates and bill adjustments are no longer required for the Pilot area.

The City informed customers, prior to exchanging a meter, they might experience an increase on their water bill due to the increased accuracy of the new meter, and customers will only pay for water they consume.

Post meter exchange, an overall increase to average daily consumption was recorded. 30 days post installation, the average daily consumption increased by nine percent and after 365 days, the average daily consumption increase settled to seven percent. Results support that aging meters under-register consumption resulting in lost revenue to the City.

As an example, in 2020, residential customers in the City of Winnipeg consumed approximately 43.2 million cubic meters of water. A seven percent increase in residential consumption equates to an additional 3 million cubic meters of water or approximately $14 million in revenue.

Leak detection:
With an AMS, the City would have the ability to assist customers in identifying leaks as early as possible. During the Pilot, the City detected 36 potential leaks, eight percent of exchanged meters, prompting a written notification to each affected customer.

Undetected water leaks can affect a customer's bill and cause financial hardship. With an AMS the City could collect meter reads more frequently, which would assist in proactively identifying and notifying customers of potential leaks between billing cycles.

Since 2018, an average of 45 residential customers received high water bills over $10,000 each year with an average charge of $39,000. Approximately 81 percent of the high-water bills were the result of a customer submitting an incorrect meter reading. Multiple notifications are issued requesting clarification and, once received, the bill is promptly re-issued. The other 19 percent are often the result of an undetected leak and significant resources are then required to provide the needed customer service.

Overall Challenges and Lessons Learned:
One of the most important aspects of a successful meter exchange program is a solid customer communication plan that includes a focus on customer engagement. The Pilot's customer communication strategy included notifying residents of the program, informing them how to schedule an appointment using a dedicated phone line, updating web site content and including FAQs. It is important to communicate early and often. A large-scale meter exchange provides an opportunity to expand the communication planning to include a focus on customer engagement in order to educate the public and create excitement about the upcoming change. This would assist in increased participation and overall customer satisfaction.

A total of 9 (1.8 percent) customers expressed health concerns with AMR technology and had a direct read meter installed instead of an AMR meter. A City-wide AMS solution would require focused communication regarding continued compliance with Innovation, Science and Economic Development Canada regulatory limits. A formal opt-out program could be established to ensure consistency among customers and sustainability for the City. Some municipalities have implemented an opt-out program in which a customer has the option of retaining a direct read meter for a recurring fee.

Meter exchanges for the pilot project were coordinated through a combination of scheduled appointments and cold-calls (City staff attend unannounced). This method worked well on a small scale but would require improved documentation if utilized for a large-scale meter exchange.

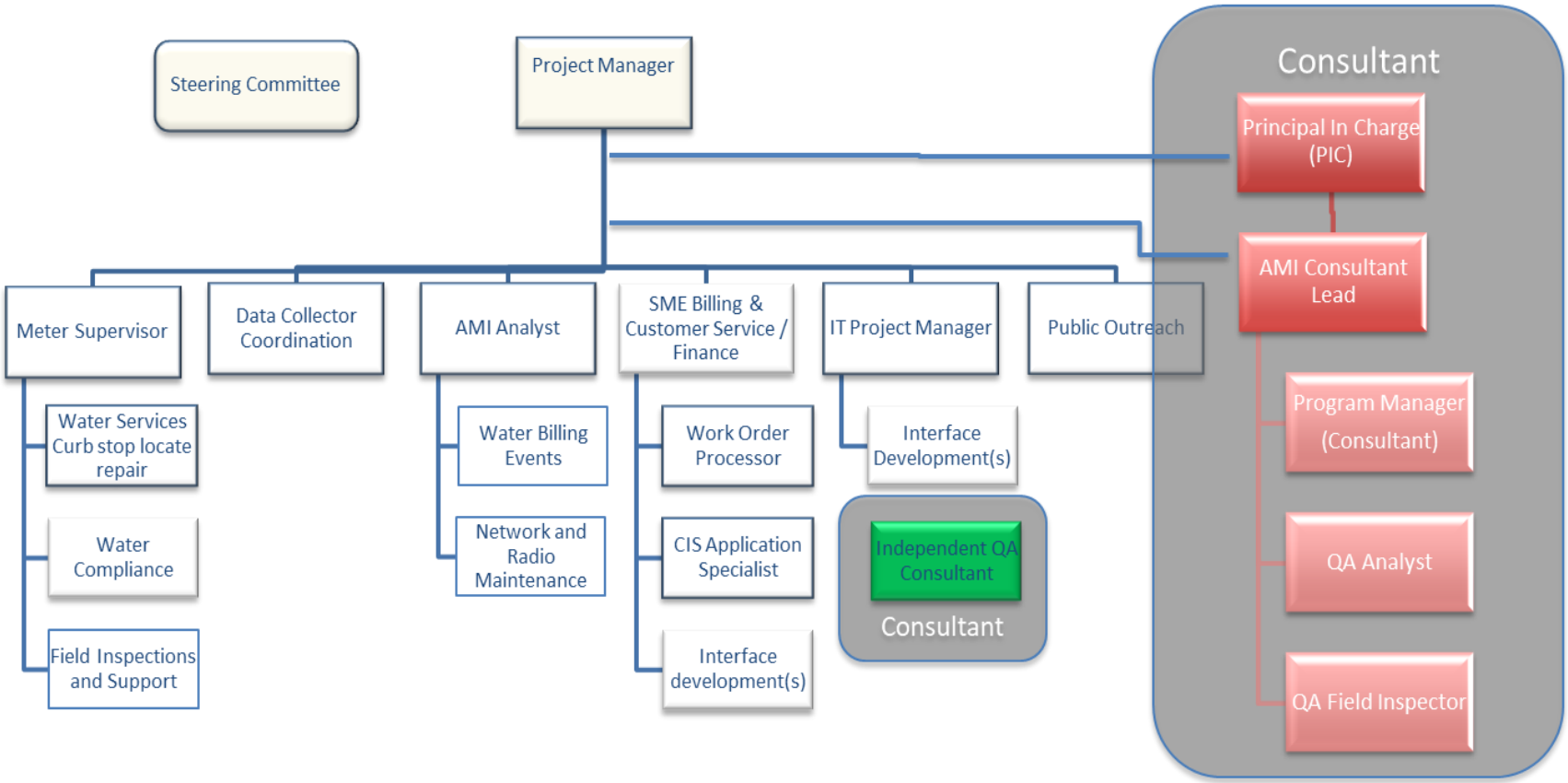
The meter exchange process is an opportunity to validate field data. Ensuring that system records match field findings during the meter exchange will assist in preventing meter exceptions or risks to billing. A large-scale exchange project will provide an opportunity to identify and remedy situations that result in lost revenue, such as tampering and non-working meters.

The development of Standard Operating Procedures (SOPs) for each work unit would be required. The Pilot utilized internal resources pulled from different branches which resulted in a few areas where work processes were inconsistent between the different work groups. This resulted in some inequity in service and discrepancies in how field data was recorded. For large-scale implementation, it would be beneficial to ensure that all field staff follow the same Standard Operating Procedures.

APPENDIX B
Meter Reading Technology in Canada

City/Province	Current Technology	Technology Age
Brandon, MB	AMR	Completed in 2003
Calgary, AB	AMR	Unavailable
Halifax, NS	AMI	Completed in 2019
Hamilton, ON	AMI	In progress
Ottawa, ON	AMI	To be completed in 2024
Regina, SK	AMI	To be completed in 2025
Saskatoon, SK	AMI	Completed in 2016

APPENDIX C
Project Team



APPENDIX D
AMR / AMI Functionality

	Requirement	AMI	AMR	Note
1	Supports increased billing frequency	✓	✓	
2	Customer leak notification	✓		
3	Improved handling of high water bill complaints	✓		
4	Reduce non-revenue water (NRW) due to meter accuracy	✓		1
5	Eliminate estimated bills	✓	✓	2
6	Improve safety - eliminate entry requirement for meter readings	✓	✓	
7	Revenue forecasting	✓		3
8	Move in/out reads	✓		
9	Improve NRW calculation	✓		
10	Distribution leak detection	✓		
11	Meter right sizing	✓		
12	Reverse flow detection	✓		
13	Verify curb stop status	✓		
14	Theft Detection (meter tampering)	✓		
15	Minimum 2 year of detailed consumption history	✓		
16	Detect open by-pass (theft/NRW)	✓		
17	Customer web portal	✓		4
18	Pressure monitors	✓		
19	Supports water conservation	✓		
20	Less vehicle miles	✓		
	Optional/Future			
21	Remote disconnect	✓		
22	Water quality monitors	✓		

Notes:

1 AMI offers near real time meter failure detection in addition to the ability to analyze consumption on groups of meters to determine if age (total consumption) is contributing to a degradation in accuracy.

2 Both solutions could accomplish this goal. AMI is more effective as multiple reads are always available. With AMR, if a meter reading is missed, a truck must be sent out again to obtain a reading.

3 Actual consumption trends are currently difficult to identify given quarterly meter readings and 30 percent estimations. AMI data allows for near 100 percent consumption data for all customers on a daily basis.

4 AMI can present hourly consumption data to the customer on the customer portal. The AMR data can be displayed on a web portal but it is the same information that would be presented on the water bill.

APPENDIX E
Detailed Capital Sheet WM Renewals

WATER & WASTE - WATERWORKS SYSTEM FUND

Project Name:	**Water Meter Renewals**
Standing Policy Committee:	Water, Waste and Environment
Dept ID:	200751
Department:	Water and Waste
Project:	2001003424
Lifecycle Activity:	Renewal
Service:	Water
OurWinnipeg:	Leadership and Good Governance

AUTHORIZATION	Previous Budgets	2024 Estimate	FORECAST 2025	2026	2027	2028	2029	Five-Year Forecast Total	Six-Year Total
Project Costs ($000's)	450	135,000	-	-	-	-	-	-	135,000
Financed by:									
Water Meter Renewal Reserve		135,000	-	-	-	-	-		135,000

CASH FLOW	2024	2025	2026	2027	2028	2029	Beyond 2029	Total
Project Costs ($000's)	2,000	10,000	20,000	44,000	45,000	14,000	-	135,000
Financed by:								
Water Meter Renewal Reserve	2,000	10,000	20,000	44,000	45,000	14,000		135,000

NET OPERATING IMPACT ($000's)	2024	2025	2026	2027	2028	2029
Operating costs						
Debt and finance charges						
Transfer to General Capital Fund						
Total Direct Costs	-	-	-	-	-	-
Less: Incremental Revenue/Recovery						
Net Cost/(Benefit)	-	-	-	-	-	-
Incremental Full Time Equivalent Positions	-	-	-	-	-	-

Class Estimate: 3

Strategic Priority Action Plan alignment:
None

The City of Winnipeg has approximately 217,000 residential and commercial water meters. Over 130,200 (60 percent) are past their optimal service life and need replacement. Funding from previous years was used to review meter reading solutions/technology, develop a business plan and a Class 3 estimate for implementation of a multi-year water meter replacement program. The Class 3 implementation cost is estimated at $135.0 million over 6 years.

Implementation of the water meter renewal project will be funded by the Water Meter Renewal Reserve. On January 30, 2020, Council approved the 2020 to 2023 Water and Sewer Rates report which included the establishment of a Water Meter Renewal Reserve to fund a program for the replacement and renewal of aging water meters and a City-wide advanced metering system. The reserve is funded through transfers from the water and sewer daily basic charge. Transfers to the reserve are forecasted to total $135.6 million by 2029 which is sufficient to fund the expected total capital expenditures.

This project may include one temporary capital funded full-time equivalent.

The optimal service life of a water meter is 15 years.