Utility Board Agenda

For Meeting of January 22, 2019
7:00 PM to 9:00 PM
City Council Chambers, City Hall

Board Members:	Tim O'Connell, Chairman, Vice Chairman, Tom DeBoer, Mary Grady, Stephen Milton, William Pokorny, Brian Thomas, and Kwan Wong
Council Liaison:	Mayor Debbie Bertlin, Council Liaison
Staff:	Jason Kintner, Public Works Director Chip Corder, Finance Director Francie Lake, Deputy Finance Director Patrick Yamashita, City Engineer Anne Tonella-Howe, Assistant City Engineer Brian McDaniel, Utilities Operations Manager Asea Sandine, Recording Secretary

Agenda topics

7:00 PM	Approve Minutes – October 9, 2018	All
	Water Replacement Program	Jason Kintner & Brian McDaniel
	2019 Work Plan	All
	Solid Waste Update	Jason Kintner
Transmitted via Email:	Agenda Meeting Minutes Work Plan	
Next Meeting:	March 12, 2019	

UTILITY BOARD
REGULAR MEETING MINUTES
OCTOBER 9, 2018

CALL TO ORDER:

Chair Tim O'Connell called the regular meeting of the Utility Board to order at 7:00 p.m. in the Council Chambers Room at City Hall, 9611 SE 36th Street, Mercer Island, WA.

ROLL CALL:
Present: Chair Tim O'Connell, Vice Chair Tom DeBoer, Stephen Milton, Will Pokorny, Brian Thomas, present. Council Liaison Mayor Debbie Bertlin, Kwan Wong, Mary Grady were absent.

City Staff: Jason Kintner, Public Works Director, Francie Lake, Deputy Finance Director, Brian Hartvigson, Right of Way Manager, Anne Tonella-Howe, Assistant City Engineer, Chip Corder, Assistant City Manager & Finance Director, and Asea Sandine, Recording Secretary were also present.

MINUTES:
Board Member DeBoer moved to approve the minutes from the September 11, 2018 meeting. Board Member Pokorny seconded the motion. The Board unanimously approved the minutes.

REGULAR BUSINESS:

WATER BUDGET & RATES

Lake presented staff's proposed smooth rate increase of 6.5% for 2019-2024. She noted that this rate increase provides funding needed to debt finance $7.6 million for the SCADA System Replacement and Meter Replacement projects and for capital reinvestment projects planned for 2023 and 2024. Lake shared that the operation budget was status quo and addressed the variances in salaries and wages as well as contractual services. Kintner noted that the salary increase is partly due to a couple of position reclassifications within the AFSCME bargaining unit. He shared that the SCADA and Meter Replacement projects are in early planning stages with preliminary combined cost estimates of $11.2 million for both water and sewer. Staff will present a Meter Replacement update at the December 2018 meeting.

Motion: Moved by Board Member Milton, seconded by Pokorny to recommend rate a 6.5% rate increase. The motion carried unanimously.

SEWER BUDGET & RATES

Lake presented staff's proposed sewer rate recommendation of 7.7% for 2019-2024. The 7.7% rate increase provides the funding needed to make annual debt payments on the $3.6 million SCADA System Replacement Project starting in 2020, as well as to invest an average of $2.5 million per year in sewer capital reinvestment projects (2019-2024).

Lake noted that that the King County Sewer Treatment rate is a pass-through charge, which is separately noted on the City's utility bill. She noted that one significant change is a service enhancement for the CCTV combo unit. Kintner noted that the cost of continuing to contract out the CCTV work continues to rise. In addition, Public Works implemented an Enterprise Asset Management system (EAM) and updated the General Sewer Plan. Utilizing Pipe Assessment and Certification Program (PACP) and Manhole Assessment and Certification Program (MACP) standards, CCTV inspections will help manage sewer assets more efficiently and effectively. Kintner expects CCTV program costs to decrease by bringing the work in-house.

Motion: Moved by Board Member Thomas and seconded by Board Member Pokorny to recommend a 7.7% rate increase. The motion carried unanimously.

DECEMBER DATES

Staff advised that there is a conflict with the Council Meeting on December 11th. Staff proposed the December 3rd or 10th meeting dates. The Board reached consensus to meet on December 10, 2018.

NEXT MEETING: November 13, 2018.

ADJOURNMENT: 8:31 PM

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Asea Sandine
Recording Secretary

Memorandum

CITY OF MERCER ISLAND, PUBLIC WORKS DEPARTMENT
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To: Utility Board

Date: January 17, 2019

From: Jason Kintner, Public Works Director
Brian McDaniel, Utility Operations Manager

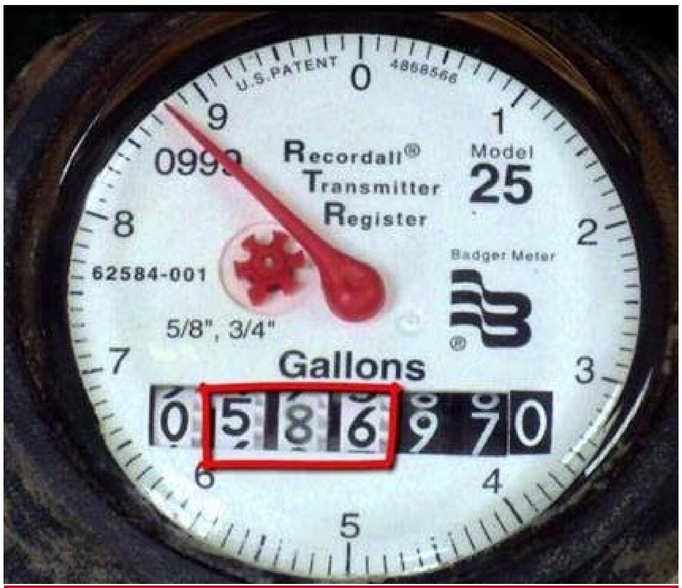
Re: Water Meter Replacement Program

BACKGROUND:
As required by WAC 246-290-820 – Distribution System Leakage Standard, the City reports the annual distribution system leakage percentage to the State. Any water that cannot be accounted for is considered distribution system leakage. The City is required to have a distribution leakage of ten percent or less for the last three-year average. Beginning in 2016, the City's average distribution system leakage has exceeded the requirements, therefore requiring the City to implement a water loss control action plan in accordance with WAC-246-290-810. The plan is required to assess the data collection and data accuracy.

The water system currently has a wide array of water meter manufacturers, types, and reading technologies of varying age. Water meter accuracy is the greatest at the beginning of its life and degrades with age and use. To assist with the evaluation of the City's meter replacement program, the City retained HDR to perform an analysis and provide recommendations on standardizing the meter program and addressing a key component of unaccounted water loss (Technical Memo, completed November 2018, is attached).

2019-2020 Meter Replacement Program:
More than 60% of the City's existing water meters are 15 years or older. With an aging utility, a standardized replacement program is needed. Over the course of the next 6-12 months, staff, with the assistance from HDR, will be evaluating these meters and technology platforms to identify a recommended standard for the utility.

On Tuesday night, HDR and staff will present the Technical Memo and begin discussions with the Utility Board regarding 2019-2020 Meter Replacement Program.



Water Meter Replacement Program Analysis

City of Mercer Island, WA

November 13, 2018

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Tables

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1 Introduction

The City of Mercer Island (City) operates a water utility meter reading program that involves manual reading of 82% of its service meters, with others being read through a radio read system. Water metering information is used in the City's utility billing system, from which utility billing statements are generated.

The City is evaluating options to improve its water metering practices, which will lead to development of a comprehensive meter replacement program. The goals of this effort include standardization of meter type/technology for future replacements and installation, implementation of a meter reading approach that will best support reduced water loss, improved water resource management, and identification of a recommended meter replacement cycle. The following steps are being undertaken to develop a new water metering program:

- Review the City's existing meter-reading practices and procedures.
- Identify and evaluate the current state of available meter reading procedures and technologies.
- Identify implementation issues and considerations important to designing a water meter master replacement program.
- Evaluate the business case and cost effectiveness of various implementation strategies.
- Develop recommendations and a comprehensive water meter replacement program.
- Conduct a water loss audit to identify other potential actions/improvements beyond meter replacement that would reduce the amount of non-revenue water.
- Conduct an analysis of potential strategies to integrate an automated meter reading / advanced metering infrastructure (AMR/AMI) system with the City's SCADA system to best leverage AMR/AMI system data for system analysis and operations. Prepare a vendor RFP for an AMR/AMI system.
- Support integration of AMR/AMI with the City's SCADA system.

This technical memorandum documents the initial steps of this effort which include:

- A review of the City's current metering and billing systems,
- An analysis of the current state of metering and AMR/AMI technology,
- A review of recent AMR/AMI implementations in western Washington; and,
- Recommendations for water meter replacement program alternatives to consider in the next step of the effort, the business case analysis.

The information presented in this memorandum is based on data provided to HDR Engineering, Inc., (HDR) by the City in early 2018, and information HDR has compiled during the course of conducting similar studies for other water utilities in western Washington.

2 Assessment of Current Metering Program

2.1 Water Service Meters

The City has a total of 7,866 water service meters installed throughout its service area as of January 9, 2018. Table 1 summarizes the meter breakdown by size and age of installation. Table 2 summarizes the meter breakdown by size and technology type.

Table 1. Summary of Water Service Meters

Meter Size (in)	Installation Age[1]				Total
	<5 years	5-9 Years	10-14 Years	≥ 15 Years	
5/8	322	138	152	2,351	2,963
3/4	385	122	146	1,463	2,116
1	199	126	396	1,147	1,868
1.5	243	205	167	46	661
2	36	101	49	45	231
3	7	8	4	0	19
4	4	4	0	0	8
Total	**1,196**	**704**	**914**	**5,052**	**7,866**

[1] Source: City Summary file: "1-1 All Active Meters.xls" (January 9, 2018)

Table 2. Summary of Water Service Meter Technology

Meter Type	Installation Age[1]				Total
	<5 years	5-9 Years	10-14 Years	≥ 15 Years	
Manual Read	747	411	257	5,052	6,467
Radio Read	449	293	657	0	1,399
Total	**1,196**	**704**	**914**	**5,052**	**7,866**

[1] Source: City Summary file: "1-1 All Active Meters.xls" (January 9, 2018)

Key summary facts regarding the City's installed meters are as follows:

- Approximately 95% of metered connections are for residential customers.
- Approximately 18% of meters use radio read technology; 82% of meters are manually read.
- Meter brands currently used (and their numbers): Rockwell/Sensus (5,408), Master Meter/Metron-Farnier (Spectrum) (759), Sensus (and other) Radio Read Meters (1,440), and Miscellaneous/Unknown (ex: Hydrant and Fire Meters) (259) for a total of 7,866 meters (as of Aug 2018).
- Nearly all radio read meters have a known brand, and all brands the City uses are compatible with most AMR/AMI technologies.
- Currently no standard schedule exists for meter inspection, testing, and change-out.

2.2 Meter Reading

Key summary facts regarding the City's current meter reading program are as follows:

- Consumption is measured bi-monthly (for most accounts) in units of CCF (one hundred cubic feet).
- Meters are organized geographically into 10 routes, formally named "Books."
- The City has four staff that spend more than 50% of their time on water meter activities including billing, customer inquiries, utility accounting, water consumption accounting, meter reading, and meter box maintenance.
    - One staff member is a 3 month seasonal employee, used only as needed.
    - In aggregate, it is estimated that meter reading is accomplished by approximately 1 full time equivalent (FTE).
    - In aggregate, it is estimated that other meter-related functions (e.g., billing, customer inquiries, consumption analysis, meter box maintenance) are accomplished by approximately 1.5 FTE.
- For over 20 years, the City has had one dedicated vehicle for meter reading activities, averaging approximately 3,950 miles per year.
- There are very few re-reads performed. City staff estimate this at much less than 1% of all meter readings.
- The City performs less than five lock-outs per month for non-payment.

2.3 Utility Billing and Related Processes

Key summary facts regarding the City's current billing processes are as follows:

- Utility bills are issued bi-monthly and are printed by an outside vendor.
- The typical time lag between meter reading and billing is two days. Billing occurs in 10 cycles based on the 10 meter routes.
- All meter reads that show on bills are valid. It is very rare that estimated reads are included in billing statements.
- Customer service spends approximately 40 hours per week responding to water customer calls regarding issues such as new service/turn-ons, requests for readings, high bill inquiries, billing questions, complaints, etc.
- The City uses the inHANCE (a division of HARRIS Utilities) customer information and billing system, in tandem with Invoice Cloud (an online bill presentment and payment portal).

3 Technology Options

3.1 Meter Reading Technologies

There are four basic approaches to meter reading:

- Manual Read
- Touch Read
- AMR, also known as Mobile Radio Read (Drive-By)
- AMI, also known as Fixed Network

The City currently uses a mix of manual read and radio read methods to accomplish the core business function of meter reading. Each of the aforementioned meter reading approaches are viable options for the City. However, each method utilizes a different mix of labor and technology. Manual read is the most labor intensive and very low-tech, while AMR and AMI rely on technology to minimize labor costs, but have much higher capital costs. At the same time, there are different ancillary benefits that may be derived from each technology (e.g., more frequent reads, leak detection, high-functioning customer service, etc.). The discussion below provides an overview of the AMR and AMI options. Touch read technology is not included in this analysis, as it has become dated and is not considered a cost-effective alternative to AMR/AMI.

3.1.1 AMR (Mobile Radio)

The AMR mobile radio system enables a meter reader to collect meter readings while walking or driving by a meter equipped with a radio frequency (RF) reading device. The mobile reading system requires the addition of an RF transmission device (also called a meter interface unit or MIU) to the encoder meter register. The RF device is powered by a battery.

As additional electronic components are added to the metering system, operating and capital costs rise. Electronics have a failure rate, typically of less than one percent per year. However, the major operations cost driver for such a system is the battery life of the RF device. The longer the battery life and life of the RF device, the more cost effective it becomes.

Additional benefits accrue in situations where the meter life is in lockstep with the RF device life so that both the meter and MIU can be replaced at the same time. RF device products are being offered with an estimated battery life of 10 to 20 years. Warranty coverage becomes an important component of owning and operating this type of system, so it is important to clearly define warranty terms ahead of implementation. Most vendors are currently offering 10 years of 100% warranty coverage, with pro-rated coverage for the following 10 years.

RF devices operate in two different transmitting modes. The first transmission mode is constant transmission from the MIU, and the RF reading device just happens to “bump into” the MIU signal. These systems have a lower production cost because only signal-sending electronics are needed. The battery life for such products is approximately 10-15 years, though some companies offer longer battery-life guarantees. The second transmitting mode requires the MIU to be “woken up” to transmit the meter reading data.

The battery life for these systems is in the 20 year range. These systems are generally more expensive because they contain sending and receiving electronics, but the additional service life may offset the additional capital cost.

Operation costs might also include software licensing and upgrade fees, and maintenance of reading equipment. Reading systems are offered in both licensed and unlicensed frequencies. Unlicensed frequencies operate in the 900 MHz range, and compete for space with other RF operated consumer products which may cause some problems in “capturing” meter readings. Licensed systems provide the utility with its own unique operating frequency, eliminating the interference issues associated with unlicensed frequency, thus making the system more reliable.

The meter reading productivity for a mobile RF system is significantly better than manual (visual) or touch read systems. The actual productivity achieved by a utility is based upon many, ever-changing factors such as meter population density, location of the RF device, weather, temporary obstructions, and average driving speed. Typically, drive-by reading productivity has been in the range of 5,000 to 10,000 reads per day, but current systems are demonstrating even higher reading performance. With flatter terrain and improved signal strength, less travel time is required and reading productivity increases. Some utilities read during late evening hours or off peak traffic hours to improve reading productivity even more. Given the initial capital cost of a mobile collector unit, it is better suited for high volume, repetitive work.

The RF handheld reading devices have a typical reading productivity of 800 to 1,500 reads per day. Often, these devices become part of fixed network AMI strategies, for use in special and final readings. It is often more cost effective to use the mobile, drive-by collector for routine meter reading functions and reserve the special and final readings for the handheld collectors. Special and final readings occur at various locations throughout the service territory and may average a few hundred per day, depending upon the size of the utility. It may be more cost-effective from an operations standpoint to have this division of labor and equipment rather than only using a mobile collector.

Mobile drive-by reading reliability is typically 98 percent or better. Many specifications have this requirement built into the purchase agreement. The initial reading reliability rate may be less during the early stages of implementation, normally due to non-product related issues. For example, meter readers getting used to the equipment and reading routes may result in lower reading rates. There may also be some RF device location issues affecting the range of the device. This problem occurs with higher frequency in large meter/vault locations than in residential and small commercial accounts. Temporary obstruction issues such as cars parked on or near the RF device, or the device being under water will also affect transmission range and the reading rate. Such items will need to be addressed and accounted for prior to pursing equipment related issues with the vendor.

Following the manufacturer’s installation instructions is an important consideration for reading reliability, especially in a pit set environment. For cast iron lids, maximum reading range is obtained by installing the RF device through the lid. If plastic or polymer concrete lids are used, the RF device may potentially be installed below the lid without significantly affecting reading range. Reading range claims for RF products need to be tempered with how it will actually affect the meter reading process. There may also be some degradation in the reading distance over time. However, unless the signal strength is so great that it enables the utility to consistently reduce its total drive time or mileage, the extra range may not be operationally beneficial.

3.1.2 AMI (Fixed Network)

Fixed network radio, or AMI, systems offer a truly fully automatic meter reading capability. The meter reading is “captured” through a system of collectors which transmits the meter reading back to the utility location. The RF devices are programmed to send the readings to the utility on at least a daily basis.

Additional capital costs for this reading system include an array of collectors and repeaters positioned throughout the service territory. The number of collection units required is mainly dependent upon the topography of the area. The typical range for a fixed network collector is one collector per square mile, with as little as one collector per four square miles in a flat terrain situation. Generally, collectors are placed upon public buildings, power poles, or water towers. A specialized system server for collecting the reading data and software for its operation is needed as well, adding to the initial cost of this option.

The above fixed network system description is sometimes referred to as a “standard” fixed network, meaning it is the arrangement of most fixed network systems. By comparison, there are currently two vendors who provide a “high powered” system, employing higher powered radio transmissions which serves to reduce the number of collectors needed throughout the service area.

Another variation on fixed network systems are mesh systems, which are currently not offered by a major vendor for water systems. With this type of system, radio signals are sent from one meter location to the next, and onward to other meters that essentially serve as repeaters, which ultimately convey the signals to collectors. Such systems usually employ lower profile collectors (installed at lower elevations than those involved with high power systems).

Additional operating costs include ongoing operational costs for the transmission of readings from the data collectors to the utility (e.g., through use of cell networks or leasing of fiber bandwidth), hardware and software licensing fees and memory and software upgrades, if not included in the annual licensing fees. Optional monitoring is an additional service available to utilities for a fee, where the vendor replicates the data received by the utility. Depending upon the location of collection units, owners of buildings and power poles may require some form of compensation for use of those facilities.

The reading productivity of the fixed network system is basically unlimited. As long as there is sufficient memory and software capacity in the collection and utility based components, the utility can collect as much usage data as it wants without sending a meter reader or other personnel into the field.

Regarding reliability, fixed network systems have the same RF device reliability ratings and considerations as the mobile systems. During initial project start up, some adjustments may need to be made, including relocation of the RF device to get more reliable, consistent readings. Due to temporary obstructions, meter readings at a property can be missed for several days. Meter reading policies should be established as to when to make an investigative field service call to address these missed readings. For a mobile system, if missed reads continue into the next reading period (monthly), a field service work order should be initiated to determine the cause of the missed read. For a fixed network system and due to the ability to read the meter daily, a missed read investigation may be required within 72 hours of no concurrent reads. A typical lag time policy (72 hours) may be required to address temporary obstructions and possible meteorological conditions.

Utilities throughout the country are encouraging their customers to become more cognizant of water use and conservation. The ability to capture more frequent meter reads at little or no cost creates the opportunity for utilities to provide better "real time" consumption information to consumers.

3.2 Comparison of Mobile and Fixed Network Systems

As the City looks to the future and the possibility of implementing a system-wide AMR or AMI system, there are a number of evaluation parameters the City should consider when reviewing meter reading options. The sections below provide comparative information on such systems. The City will want to review network communications in a broader context of all City field operations prior to selecting the network technology that would be used for AMI.

3.2.1 Operational Comparison

Table 3 provides a side-by-side comparison between an AMR and AMI system, from the perspective of labor requirements and some of the key benefits obtained from each.

Table 3. Operational Comparison of Meter Reading Alternatives

Parameter	AMR (Mobile Radio)	AMI (Fixed Network)
Eliminate estimated bills	Dependent upon meter reader capturing a read/visiting the property.	Almost all, unless reading system at meter location is not functioning a few days prior to billing date.
Reduce re-reads & customer requested field service calls	30 to 100 per day/person (re-reads require a physical visit to the meter location).	Unlimited (no physical visit to meter location required).
Customer Service transaction times	1 to 2 business days	<1 business day
Proactive high-bill tracking and notification	Same as manual/touch read, unless additional reading done for high-bill tracking purposes. RF device with profiling capability provides daily usage and leak detection.	Single to multiple daily reads enable this function.
Tamper & theft of service	Sets tamper flag if wire is cut or disconnected from register. Pick up at time of reading or report.	Identifies tamper same day and sends to collector unit. Utility able to identify next business day.

Table 3. Operational Comparison of Meter Reading Alternatives

Parameter	AMR (Mobile Radio)	AMI (Fixed Network)
Customize reading/billing dates	Account must stay within designated billing cycle.	Complete flexibility in establishing billing cycle to meet account needs. Rules and priorities need to be established.
Bill consolidation	Only for accounts within same reading cycle.	Can be extended to accounts regardless of cycle.
Provide consumption profiles for high bill investigations and conservation	Some capability, depending on system, including on site information.	Daily information available. Web access possible.
Ability to monitor for leaks in customer's premises	Same as manual/touch read, unless additional reading done for high-bill tracking purposes. Encoder with logging capability provides daily usage and leak detection. Some systems set flag for continuous usage.	Single to multiple daily reads enable this function.
Monitor for compliance with conservation or watering restrictions	No, unless special reading is conducted.	Able to monitor compliance remotely.
Support unaccounted-for water studies	More than Manual and Touch Read, but less than Fixed Network.	Provides daily, detailed data.
Support inflow/infiltration studies, hydraulic modeling	More than Manual and Touch Read, but less than Fixed Network.	Provides daily, detailed data.
Support cost of service rate modeling	More than Manual and Touch Read, but less than Fixed Network.	Provides daily, detailed data.
Improve resource planning	More than Manual Touch Read, but less than Fixed Network.	Provides daily, detailed data
Labor/Staffing requirements	Enables the meter reader to collect meter readings while walking or driving by a meter equipped with a RF transmitter. Typical reading productivity is on the order of 5,000-10,000 meters/reader/day.	Meter readings are collected automatically and transmitted back to a central utility. No labor is required to collect the reading data. Reading productivity is essentially unlimited.

3.2.2 Technical Parameters

It is also important to consider the technology that drives a particular AMR/AMI solution. There are different technology solutions and provided below is a brief listing of these options. These technology parameters were chosen because they are considered to be important features that will affect the productivity of the meter reader and the life-cycle cost of the meter reading equipment.

Radio Signal Transmission

- Direct Sequence Spread Spectrum (DSSS) – A technique where the transmitted energy is spread over a wide bandwidth. A conventional narrowband (NB) radio typically occupies 12.5 kHz of bandwidth, while a DSSS radio could occupy a 2 MHz bandwidth (160 times wider). Spreading the energy over a wide bandwidth reduces the energy density and thus interference to other narrowband users.
- Frequency Hopping (FH) – Another form of spread spectrum. An FH radio is a narrowband radio that changes its frequency periodically. The Federal Communications Commission (FCC) requires that the radio hop in at least 50 different channels before it repeats the same sequence. An FH receiver cannot suppress interference like a DSSS receiver, since it is a narrowband radio. FH applications avoid, rather than suppress, interference.

Signal Transmission Power

When transmitting a radio signal, there are limitations set by the FCC as to the strength of the signal that is allowed. Signals with a higher transmission power will have greater reliability and consistency. Therefore, meter interface units with a higher transmission power will allow the signal to travel farther and have less chance of interference.

- DSSS signal transmission is permitted by the FCC to transmit at power levels up to 1.0 watt.
- FH signal transmission can be up to 1.0 watt if it is transmitting on at least 50 channels, but only 0.7 watt if operating on less than 50 channels.

Signal Communications

There are two types of signal communication for RF meter interface units:

1. One-way communication means that the water meter transmits information at a fixed time interval regardless of whether anyone is receiving the information. For example, a one-way transmitter will transmit the meter information via radio signal every 14 seconds for 24 hours per day, 7 days per week, 52 weeks per year. Given that the signal will only be read about once every two months during the reading cycle, considerable battery life will be wasted making the other signal transmissions. To conserve battery life, the meter supplier limits the amount of information that is transmitted to just the bare minimum.
2. Two-way communication means that the meter reader sends a signal to the meter, the meter acknowledges that it is being interrogated, and then the meter returns a radio signal to the reader. The only time the battery is being used to transmit a radio signal is when a meter reader has asked for the information. Therefore, the life of the battery is extended and the meter can transmit much more information without draining the battery. Two-way communications also includes alert signals to the endpoints which notify the user that a successful transmission has been completed. With this confirmation, misreads are avoided. Other features include password protection, diagnostic capabilities and the ability to adjust features remotely without visiting each site. All true fixed network AMI systems are now two-way.

Battery Life

The 20 year warranty on the battery typically includes a 10-year full replacement warranty, and a 10-year pro-rated warranty. In many cases, at the end of the battery life, the utility will choose to upgrade the meter technology rather than replace the battery.

Field Replaceable Battery

Some manufacturers build their meters such that the battery is separable from the meter register and the transmitter. This type of meter allows the battery to be replaced in the field without having to remove the register or the transmitter. In contrast, some manufacturers build their meters so that the battery is integral with the meter register and/or transmitter. This design requires that the register and/or transmitter be removed in order to replace the battery. The trend in the industry is moving away from field replaceable batteries, due to concerns over water-tightness with some replaceable units.

Given this overview of some of the key technology features associated with AMI, Table 4 provides an overview of the major meter brands and the key technology features of each brand.

Table 4. Summary Overview of Major AMI Brands and Key Features

Vendor	Available Technology	Radio Signal Transmission[1]	Signal Transmission Power	Communi-cations	Battery Life	Field Replaceable Battery?
Badger	Touch Fixed Network Mobile Radio	Narrow Band	1 watt	Two-way	20 year Pro-Rated Warranty	No
Itron	Touch Fixed Network Mobile Radio	DSSS	500 mW	Two-way	20 year Pro-Rated Warranty	No
Master Meter	Touch Fixed Network Mobile Radio	DSSS	<1 watt	Two-way	20 year Pro-Rated Warranty	No
Mueller	Touch Fixed (Mesh) Network Mobile Radio	FH	Up to 2 watt	Two-way	20 year Pro-Rated Warranty	No
Neptune	Touch Fixed Network Mobile Radio	FH	<1 watt	Two-way	20 year Pro-Rated Warranty	Yes
Sensus	Touch Fixed Network Mobile Radio	DSSS	1-2 watts	Two-way	20 year Pro-Rated Warranty	Yes

FH = Frequency Hopping; DSSS = Direct Sequence Spreading Spectrum

3.2.3 Compatibility

Compatibility is an important feature because many utilities employ multiple brands of meters within their system. The more compatible an AMI technology solution is with various meter brands, the greater potential to minimize installation and operating costs. Provided below in Table 5 is a comparison of the major AMI vendors with some meter brands. Over the past five years, compatibility has greatly increased, with most AMI vendors capable of functioning with most major meter manufacturers.

Table 5. Compatibility of Major AMI and Select Meter Manufacturers for Mobile and Fixed Network Systems

AMI Brand	Meter Brand				
	Hersey	Sensus	Neptune	Badger	AMCO
Badger	Yes	Yes	Yes	Yes	Yes - Absolute Encoder / No – Digital
Itron	Yes	Yes	Yes	Yes	Yes
Master Meter	Yes	Yes	Yes	Yes	Yes
Mueller	Yes	Yes	Yes	Yes - ADE/ No-RTR	Yes - Absolute Encoder / No - Digital
Neptune	No	Yes	Yes	Yes - ADE/ No-RTR	No
Sensus	Yes	Yes	Yes	Yes - ADE/ No-RTR	Yes

Notes: Badger ADE = Absolute Digital Encoder / Badger RTR = Incremental Encoder

3.2.4 Technology Trends

Technology, by its very nature, is ever changing and improving. Given that, a key concern of the City is to avoid a technology that may become obsolete or unsupported in the future. Compatibility of devices between manufacturers provides added security concerning the City's technology choice. At the same time, the City would ideally like to understand where the technology is headed. Provided below is a brief overview of some technology trends that should be considered by the City.

Software as a Service (Saas)

An additional service that many AMI providers are now making available is "data hosting" or "software as a service", which is essentially a form of cloud computing wherein the vendor stores and manages the meter reading data, with the utility then able to access the data via a secured internet connection, so as to obtain data for billing or analysis purposes. This eliminates the need for the utility to purchase and maintain an on-site server for data storage and management.

Network as a Service (Naas)

There is also continued movement to making use of other existing communications networks for transmitting water meter information. This includes cellular-based communications options and Internet-of-Things (IoT) solutions (e.g., that utilize cable communications networks). The latter include systems deploying new communications technologies such as the LoRa-WAN and OpenWay RIVA protocols. This type of service eliminates the need for the utility to own and maintain its own communications network.

However, annual operating costs are greater and there are risks with systems that have not been fully deployed yet at other utilities.

4 AMI Implementation by Other Utilities

Other western Washington utilities have conducted the same type of evaluation that the City is undertaking. Brief summaries of some of these utilities are provided below.

4.1 City of Bellevue

- Number of Meters: ~40,000
- Current Metering Approach: Manual Read
- Billing System: CIS Infinity
- System Implemented: In contract negotiations currently for a City-wide AMI system.
- Deployment Approach: 2-Year deployment.
- Key Drivers for AMI:
  - Leak detection
  - Customer education
- Implementation Challenges/Notes:
  - Contracting process (currently underway) taking a long time

4.2 Sammamish Water Plateau

- Number of Meters: ~18,000
- Prior Metering Approach: Manual Read and Touch Read
- Billing System: Harris Northstar
- System Implemented: Mueller AMI
- Deployment Approach: 1.5-Year deployment
- Key Drivers for AMI:
  - Leak detection
  - Meter reading efficiency
- Implementation Challenges/Notes:
  - Completed meter box replacements and upgrades ahead of meter replacement

4.3 City of Olympia

- Number of Meters: ~19,200
- Prior Metering Approach: Manual and Touch Read
- Billing System: Sungard HTE
- System Implemented: Itron Fixed Network AMI (3 data collectors and 32 repeaters proposed)
- Deployment Approach:

  - 1-year deployment period
  - Contractor installation of meter interface units
- Key Drivers for AMI:
  - Meter reading efficiency
  - Improve accuracy of reads
  - Improved conservation effectiveness tracking
- Implementation Challenges/Notes:
  - Contracting process took a very long time, as City's legal department was not familiar with this type of procurement
  - Recommend conducting a pilot study as part of the procurement process, so as to experience coordination with the vendors
  - Considered data hosting services, but decided against this due to high cost

4.4 City of Renton

- Number of Meters: ~17,400
- Prior Metering Approach: Manual Read, with some Touch and Mobile Read
- Billing System: Springbrook
- System Implemented: Sensus Fixed Network AMI (3 data collectors)
- Deployment Approach:
  - 5-year deployment period (desired this so that not all batteries would "die" at the same time in the future)
  - City staff conducted installation of meter interface units
- Key Drivers for AMI:
  - Meter reading efficiency
  - Leak detection
  - Water accounting
- Implementation Challenges/Notes:
  - Most challenging part of contracting involved details regarding IT and new servers to be installed
  - In one part of City, had to resolve signal interference with local cell provider
  - Initial batch of "mushroom" tops to antennas was bad (they cracked)
  - Dealt with public concerns regarding exposure to radio frequencies

4.5 Woodinville Water District

- Number of Meters: ~14,000
- Prior Metering Approach: Manual Read
- Billing System: Munis

- System Implemented: Sensus Fixed Network AMI (4 data collectors and 3 repeaters proposed)
- Deployment Approach:
  - 3-month deployment period
  - Contractor installation of meter interface units
- Key Drivers for AMI:
  - Meter reading efficiency
  - Staffing limitations (re-direct staff to other priorities)
- Implementation Challenges/Notes:
  - Recommend conducting a pilot study as part of the procurement process, so as to experience coordination with the vendors
  - Implementing data hosting services

4.6 City of Mountlake Terrace

- Number of Meters: ~5,900
- Current Metering Approach: Manual Read
- Billing System: Munis
- System Implemented: Mueller Fixed Network AMI (mesh, requiring ~100 repeaters)
- Deployment Approach:
  - 1-year deployment period
  - City staff installation of meter interface units
- Key Drivers for AMI:
  - Meter reading efficiency
  - Increased water consumption data
- Implementation Challenges/Notes:
  - More repeaters required than anticipated
  - Initial software version had bugs and required patches
  - Installation by City crews has been cost-effective, but makes managing the vendor more challenging
  - Implemented data hosting services

5 Evaluation of Meter Reading Alternatives

The purpose of this analysis is to determine if implementation of AMR/AMI would support the objectives and desires of the City of Mercer Island, and if such a program would be feasible to implement.

5.1 Methodology

The City considered multiple alternatives (or scenarios) for AMR/AMI installation programs. The scenarios describe different AMI installation process variables that have the most significant impact on long-term life-cycle costs. The evaluation is comprised of two components:

- *Quantitative Analysis:* HDR developed a spreadsheet-based cost model that calculates the present value (PV) of implementation costs (both capital and operational) over a 20-year planning horizon. This allows direct monetary comparison of each program alternative.
- *Qualitative Analysis:* For those considerations that cannot be reasonably monetized, a brief qualitative analysis has been prepared that summarizes how the various scenarios impact a range of non-quantifiable criteria.

The key variables between the scenarios include:

Meter Technology – Two options are considered: mechanical meters and solid state (electronic) meters.

Meter Reading Technology – Three options are considered:

- Manual Read System – This is the as-is technology option. It is assumed that a manually read system would be maintained on a bi-monthly basis.
- AMR – Mobile radio read. This assumes all meters are converted to an AMR system.
- AMI – Fixed network system. This assumes all meters are converted to an AMI system. Three sub-types of AMI are considered: Standard, High Power, and Network-as-a-Service (NaaS).
  - Standard: uses a low-powered radio signal (up to 1 Watt) to communicate through a network of repeaters and collectors.
  - High Power: uses a high-powered radio signal (typically up to 2 Watts) to communicate through a network of repeaters and collectors. Since this system uses a higher powered radio signal than a standard system, it normally allows for the system to have less repeater and collector units.
  - NaaS: uses an existing communications network (e.g., cellular or other) for collection of data through a “network as a service”.

Deployment Approach – Two deployment (or installation) options are considered:

- City Installation – This assumes that a contractor will install certain AMR/AMI system components (e.g., collectors, repeaters, central computer and/or software), but the City will complete the installation of the MIUs at each meter location, utilizing existing staff and/or temporary/seasonal labor.

- Contractor Installation – This assumes the entire AMR/AMI system is installed by a contractor, including the MIUs.

Deployment Period – Two deployment period options have been considered. Although any length of time can be considered, based on a variety of factors including annual budgetary constraints, these options will illustrate the cost impacts of two ends of the spectrum.

- One Year – Complete installation in less than one year. Generally associated with Contractor installation labor.
- Three Years – Phased implementation over three years. Generally associated with City installation labor.

5.1.1 Scenarios

Five primary scenarios were evaluated in the cost model. The scenarios, including sub-scenarios, are as follows:

- **Scenario 1 – Manual Read System.** The current meter reading program continues. Most meters would continue to be read manually on a bimonthly basis.
    - Scenario 1a – Replacement with Mechanical Meters.
    - Scenario 1b – Replacement with Solid State Meters.
- **Scenario 2 – AMR, Full Deployment in 1 Year.** A full deployment of an AMR system. The system would be contractor installed in less than one year.
- **Scenario 3 – AMI, Full Deployment in 1 Year.** A full deployment of an AMI system. The system would be contractor installed in less than one year. Assumes mechanical meters. The following sub-scenarios are included:
    - Scenario 3a – Standard Fixed Network.
    - Scenario 3b – High Powered Fixed Network.
    - Scenario 3c – NaaS.
- **Scenario 4 – AMI, Full Deployment in 3 years.** Same as Scenario 3b but the deployment period would be three years and implemented by City staff. The Fixed Network portion of the system is assumed to be High Powered.
- **Scenario 5 – AMI, Solid State Meters.** Same as Scenario 3b but solid state meters are assumed. The Fixed Network portion of the system is assumed to be High Powered.

5.1.2 Key Cost Model Inputs

The cost model utilizes information provided by the City, as well as industry information and data gathered from other utility projects that HDR has worked on. The information provided and collected was inserted in the cost model to calculate present value capital and operational costs for each scenario over a 20-year period. Key parameters, and associated input values, considered in the cost model include the following:

1. Capital Cost Elements
   a. Meter Replacement
      i. Equipment Cost – A standard water meter's reliable life cycle is approximately 20 years. The City provided meter age data that informed a replacement schedule for scenarios that replace meters based on age (manual read scenarios). For all scenarios, equipment costs were broken down into four meter size categories:
         1. 3/4”: $100 mechanical, $120 solid state
         2. 1”: $150 mechanical, $175 solid state
         3. 1.5” – 2”: $400 mechanical, $450 solid state
         4. >2”: $1,000 mechanical, $2,000 solid state
      ii. Installation Cost – Meters can either be installed by the City or by a contractor. Contractor installation costs depend on meter size:
         1. 3/4”: $70
         2. 1”: $70
         3. 1.5” – 2”: $150
         4. >2”: $800
      iii. City installation costs were assumed to be half of the above costs.
   b. Transmitters
      i. Equipment Cost – All meters in an AMR or AMI scenario require a transmitter. Transmitter unit costs were assumed to be $75 in all situations.
      ii. Installation Cost – If installed by a contractor, transmitter installation cost is included in the meter installation cost. For City installation, assumed installation cost is $35.
   c. Meter Box Modifications
      i. Meter Boxes – AMI system installation requires modifications to meter boxes to accommodate the transmitter installed on the meter. All scenarios that require box modifications assumed 10% of installations required full box replacements, 40% of installations required only lid replacement, and 50% of installations only required a hold be drilled in the lid. Contractor installation costs of these modifications are:
         1. Full box replacement: $250
         2. Lid replacement: $60
         3. Lid hole drilling: $15
      ii. City installation costs for the above services are assumed to be 75% of contractor installation cost.
   d. “Centralized” Capital Costs

i. Fixed Network Components – There are three types of fixed networks considered in this analysis: Standard Power, High Power, and Network as a Service (Naas). Each network type has its own set of assumptions for number of collectors and repeaters, relative costs for the equipment and installation, and replacement rates.

1. *Collectors (applies only to high power and standard power):*
    a. High Power – 2 collectors at a unit price of $38,440 for equipment and installation.
    b. Standard Power – 15 collectors at a unit price of $8,600 for equipment and installation.
2. *Repeaters:* Repeaters are only employed in a high power system. This analysis assumes 2 repeaters at a unit price of $7,500.
3. *Other Costs (applies only to high power and standard power):* Various other costs such as communications infrastructure and field programmers/testers are required to implement an AMI system. These costs were grouped into a single category.
    a. High Power - $288,700
    b. Standard Power - $36,000
4. *Integrations/Portal:* The cost to develop necessary integrations between the AMR/AMI system and other data management platforms such as the City's customer information system, and development of a customer portal if desired. Costs for all AMI types are assumed to be $100,000.

ii. Project Management/Training – Each AMR/AMI system requires special expertise to operate. There are one-time costs associated with installation project management and training programs.

1. AMR - $200,000
2. Standard Power - $300,000
3. High Power - $300,000
4. NaaS - $400,000

2. Operational Cost Elements

a. Labor

i. Full-Time Equivalents (FTE) – Labor costs are estimated by using a number of FTEs required to do a job. The City's FTE value for meter reading and AMI activities is approximately $100,000.

ii. Meter Reading/AMI Maintenance – Meter reading activities for a manual read system were assumed to require 2.5 FTEs, based on the currently required labor. For AMR meter reading, the analysis assumes 0.5 FTEs. For AMI, no meter reading labor was calculated; rather, 0.5 FTE was allocated to AMI system maintenance.

1. For 1 year AMI installation schedules, year 1 was assumed to have the full 2.5 FTE for meter reading. The 0.5 FTE allocation for AMI maintenance was allocated in year 2. For 3 year implementation, the transition between manual meter readings was assumed to be 1 FTE in years 2 and 3, with 0.5 FTE allocated to AMI maintenance in the same year. In year 4, it was dropped to the 0.5 FTE for AMI maintenance only.

b. Vehicles – Operational vehicle costs were based on averages produced from City data. The costs provided by the City consider a fully manual read system. To scale the costs for AMR and AMI, the model assumes 20% of vehicle costs for AMR operations, and 10% vehicle costs for AMI operations.

i. <u>Maintenance</u> – Annual maintenance for manual read is assumed to be $720, and is scaled as described above for AMR and AMI.

ii. <u>Fuel</u> – Annual fuel costs for manual read are assumed to be $1,100, and are scaled as described above for AMR and AMI.

c. AMR/AMI Annual Costs

i. Service/Maintenance

1. AMR - $30,000

2. AMI (All types) - $65,000

ii. <u>Annual Customer Portal/Integrations Costs</u> – This category only applies to AMI installations and is assumed to be $50,000 annually for all AMI types.

iii. <u>NaaS Costs</u> – NaaS services have additional costs related to contracts with external service providers. The model assumes an annual cost of $25,565.

3. Additional Model Elements

a. Failure Schedules

i. <u>Transmitters</u> – Transmitter failure rates were based on information provided by AMI providers. Failure rates were assumed to be 0.5% of all transmitters annually for the first 5 years, 1% of all transmitters annually for years 6-10, and 1.5% failure annually from years 11-20.

ii. <u>Centralized AMI Equipment</u> – Centralized AMI equipment refers to collectors and repeaters. Like transmitters, this equipment can fail, and the model makes assumptions about the timing of failure and the costs associated with replacement.

1. High Power – For this analysis, a “unit failure” assumes the combined unit costs of a collector and repeater ($91,880). The model assumes 2 failures; 1 at year 10 and 1 at year 20.

2. Standard Power – Standard power only uses collectors in this analysis. The schedule assumes one failure at 5 years, 2 failures at 10 years, 4 failures at 15 years, and 5 failures at 20 years.

b. Transmitter Warranty – Vendors typically offer warranties on transmitters due to the potential of unexpected failure in the early years after installation. Warranty replacement cost (equipment only) is 0% for the first 10 years, 50% in years 11 through 15, and 75% in years 15 through 20. The model assumes no warranty coverage of centralized AMI equipment (i.e. replacement will always be full price).

c. Escalation – The model accounts for the changing price of equipment and services due to broader economic inflation. The escalation rate used in this model is 3% per year on all annual costs.

5.2 Results of Quantitative Analysis

The results of the quantitative cost analysis are presented in Figure 1, which provides a summary of the present value (PV) capital and operational costs of each scenario.

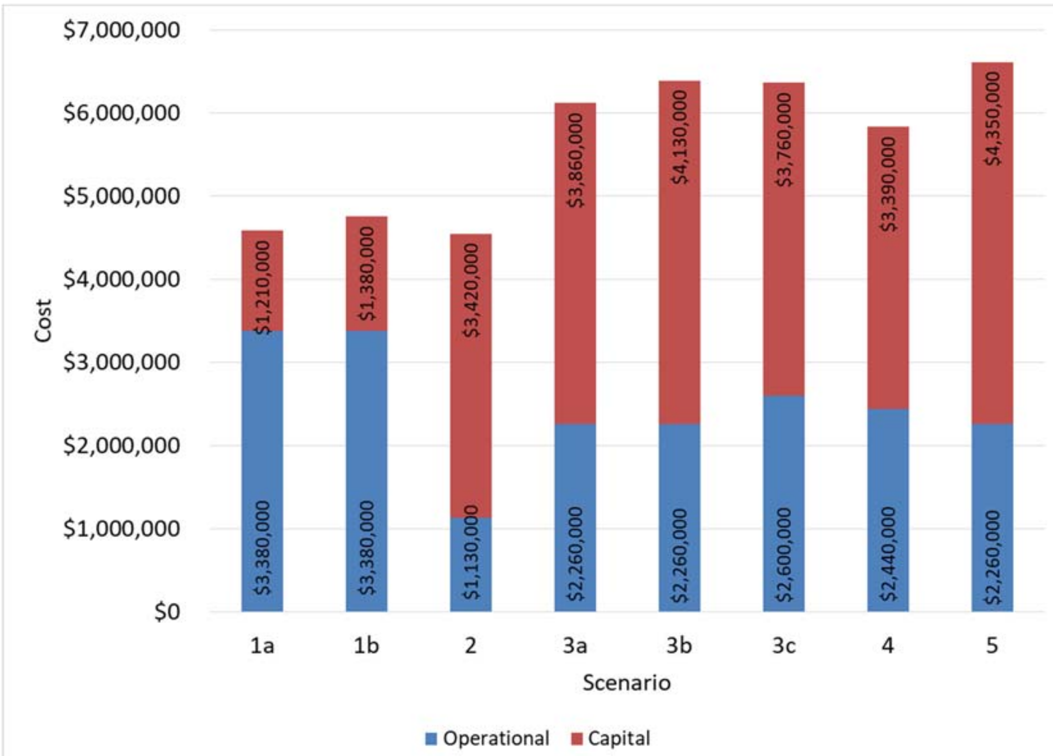

Figure 1. Summary of 20-Year Present Value Costs

A majority of costs in manual read scenarios (1a and 1b) are operational costs. Mobile and fixed network systems reduce operational costs, but capital costs increase more than double in all radio read scenarios due to AMR/AMI network infrastructure. Scenario 2 (AMR) has the lowest operational cost due to less expensive service/maintenance agreements and lack of integrations and customer portals. Both operational and capital costs are slightly decreased in a City-installed scenario (Scenario 4), relative to a contractor installed scenario (Scenario 3). The most expensive scenario is scenario 5, which is a 1 year, high powered fixed network contractor installation using solid state meters.

Table 6 provides a breakdown of the estimated operational and capital investments for each scenario during the first 5 years of implementation, as well as the total 20-year PV cost.

Table 6. Cost Summary

Scenario	Year 1	Year 2	Year 3	Year 4	Year 5	Total 5-Year Cost	Total 20-Year PV Cost
Scenario 1A: Manual read; 20 year replacement schedule; mechanical meters							
Years to Fully Deploy = 20 yrs							
Operating Cost	$260,000	$270,000	$270,000	$280,000	$290,000		
Capital Cost	$170,000	$180,000	$180,000	$190,000	$200,000		
Total Cost	$430,000	$450,000	$450,000	$470,000	$490,000	$2,290,000	$4,580,000
Scenario 1B: Manual read; 20 year replacement schedule; solid state meters							
Years to Fully Deploy = 20 yrs							
Operating Cost	$260,000	$270,000	$270,000	$280,000	$290,000		
Capital Cost	$200,000	$200,000	$210,000	$220,000	$220,000		
Total Cost	$460,000	$470,000	$480,000	$500,000	$510,000	$2,420,000	$4,750,000
Scenario 2: Mobile network; full deployment in 1 year							
Years to Fully Deploy = 1 yr							
Operating Cost	$140,000	$83,000	$86,000	$89,000	$91,000		
Capital Cost	$3,580,000	$2,000	$2,000	$2,000	$2,000		
Total Cost	$3,720,000	$85,000	$88,000	$91,000	$93,000	$4,077,000	$4,540,000
Scenario 3A: Fixed network; full deployment in 1 year; standard power							
Years to Fully Deploy = 1 yr							
Operating Cost	$220,000	$180,000	$180,000	$190,000	$190,000		
Capital Cost	$3,980,000	$2,000	$2,000	$2,000	$13,000		
Total Cost	$4,200,000	$182,000	$182,000	$192,000	$203,000	$4,959,000	$6,110,000
Scenario 3B: Fixed network; full deployment in 1 year; high power							
Years to Fully Deploy = 1 yr							
Operating Cost	$220,000	$180,000	$180,000	$190,000	$190,000		
Capital Cost	$4,220,000	$2,000	$2,000	$2,000	$2,000		
Total Cost	$4,440,000	$182,000	$182,000	$192,000	$192,000	$5,188,000	$6,380,000
Scenario 3C: Fixed network; full deployment in 1 year; Network-as-a-service							
Years to Fully Deploy = 1 yr							
Operating Cost	$250,000	$200,000	$210,000	$210,000	$220,000		
Capital Cost	$3,940,000	$2,000	$2,000	$2,000	$2,000		
Total Cost	$4,190,000	$202,000	$212,000	$212,000	$222,000	$5,038,000	$6,350,000
Scenario 4: Fixed network, full deployment in 3 years; city staff implementation, high power							
Years to Fully Deploy = 3 yrs							
Operating Cost	$220,000	$280,000	$290,000	$190,000	$190,000		
Capital Cost	$1,750,000	$920,000	$950,000	$2,000	$2,000		
Total Cost	$1,970,000	$1,200,000	$1,240,000	$192,000	$192,000	$4,794,000	$5,820,000
Scenario 5: Fixed network, full deployment in 1 year; high power; solid state meters							
Years to Fully Deploy = 1 yr							
Operating Cost	$220,000	$180,000	$180,000	$190,000	$190,000		
Capital Cost	$4,460,000	$2,000	$2,000	$2,000	$2,000		
Total Cost	$4,680,000	$182,000	$182,000	$192,000	$192,000	$5,428,000	$6,610,000

For manual read systems, approximately half the cost is borne in the first 5 years of the program. This is because many meters in the Mercer Island system are older than 15 years, and as such are replaced in the first 5 years of the program. For a mobile read system, approximately 90% of costs are borne in the first 5 years; for fixed network systems, approximately 80% of costs are borne in the first 5 years. The high upfront costs are due to the short deployment period compared to manual read systems, and the addition of network infrastructure.

5.3 Results of Qualitative Analysis

As previously described, there are various non-cost considerations that should be taken into account when deciding which meter reading strategy to employ. Considerations important to the city include:

"Freeing up" of Staff Resources – This reflects the degree to which a given alternative reduces staff time needed for meter reading activities; thereby freeing staff up to address other City priorities.

Resolution of Available Data – This refers to the amount of data, and resolution of data intervals, available for analysis purposes.

Support of Conservation Activities – This refers to the ability of data obtained from a given meter reading technology to be used in consumption trend evaluations and advanced leak detection.

Support to Leak Adjustment Processes – This refers to the ability of data obtained from a given meter reading technology to be used in identifying leaks proactively and assisting in addressing leak-related issues with customers.

Utility "Visibility" to Customers – This refers to maintaining a visible presence in the community through City staff collecting meter reads in the field.

Meter Access/Reader Safety – This refers to the difficult access and high traffic location of some meters, which pose safety risks to readers. While the City has not experienced any significant worker's compensation claims to date regarding meter-reading, it is acknowledged that this risk is greater for reading methods that involve readers stopping at every meter location and making physical contact with the meter or meter vault.

Public Perception (Technology vs. Manpower) – This refers to a general public perception that manual meter-reading is less accurate than a more automated approach.

Environmental Impact (Carbon Footprint) – The City is interested in being environmentally sensitive and promoting sustainable practices. Therefore, it is desired to implement programs with minimal environmental impacts. With regard to meter-reading, this can translate to the level of vehicle use (and therefore fuel use and automotive emissions) for routine operations. The amount of data obtained and its ability to be used for water conservation analysis is another environmental element of meter-reading.

Table 7 summarizes how the various meter reading approaches positively or negatively impact each non-cost consideration.

Table 7. Qualitative Analysis of Scenarios

Parameter	Manual Read	AMR Mobile System	AMI Fixed Network
“Freeing up” of Staff Resources	--	+	++
Resolution of Available Data	--	+	++
Support of Conservation Activities	0	+	++
Support to Leak Adjustment Processes	-	+	++
Utility “Visibility” to Customers	+	0	--
Meter Access/Reader Safety	--	+	++
Public Perception (Technology vs. Manpower)	--	++	++
Environmental Impact (Carbon Footprint)	--	-	++

Notes:
-- : Strongly negative impact
- : negative impact
0 : no impact
+ : positive impact
++ : strongly positive impact

6 Summary

A summary of the findings of this study is provided below, organized according to the assessment of the existing system, analysis of alternatives, and recommendations for next steps.

6.1 Assessment of Current Metering Program

- The City of Mercer Island has approximately 7,900 water service meters installed in the service area, approximately 82% of which are manually read. Approximately 64% of meters are 15 years old or older.
- The most significant issue addressed in this analysis is development of a comprehensive water meter replacement program. The City has not previously had a set replacement schedule and protocol.
- The City desires to:
  - Identify a recommended meter type/style to standardize upon for future replacements and installations.
  - Identify a recommended meter reading approach/technology to best support its goals of reducing water loss and effectively manage its resource.
  - Identify a recommended replacement cycle.

6.2 Alternative Analysis

Results of the present value cost analysis described in chapter 5 are summarized as follows:

- Manual read systems are the least expensive alternative, and provide the most equitable spread of costs throughout the implementation period.
- For fixed network AMI systems, a high percentage (80%-90%) of costs are borne in the first 5 years of implementation, due to the large initial installation capital costs.
- Transition to AMI would significantly reduce operational costs associated with meter reading activities. It is important to note that though this will result in operational savings for the meter reading program, it may not for the City as a whole, assuming those resources are reallocated.
- Mobile drive-by AMR operational costs (i.e. long term costs) are the lowest of all alternatives. However, an AMR system does not include any additional customer benefits beyond what manual read systems provide (e.g. access to daily water use data).
- The customer portals available with AMI systems increase operational costs, but provide a large amount of information that customers can access and use to help manage their own water use.
- In terms of non-quantifiable metrics, transitioning to a fixed network AMI system would provide the most benefits for both customers and the City, in terms of monitoring and managing water demand, supporting leak detection and other

conservation goals, providing real-time information to use during customer service interactions, and offering the potential for customer portals whereby customers can actively track their own usage and be alerted to abnormal usage patterns that could indicate the presence of leaks.

6.3 Recommended Next Steps

Based on this analysis, HDR provides the following recommendations to the City:

- Continue exploring implementation of AMR/AMI. Most water utilities have recognized the many benefits associated with moving away from manually reading meters, even though the upfront capital cost to implement a new approach is significant.
- Specifically, the City should pursue implementation of a fixed network AMI system. Although difficult to monetize, the numerous benefits associated with this type of system (including increased granularity of water consumption data with which water demand can be monitored and managed, ability to identify leaks much more rapidly than is currently possible, availability of information to support customer service interactions, and reduced operational costs of meter reading) outweigh the capital investment for such systems over the long term.
- The City should also undertake a full system meter replacement program to install new water meters over a period of time no longer than three years. More than two-thirds of the City's existing meters are more than 15 years old and it is likely that many of them are underreporting low flows, as is typical of residential meters as they age. It is possible that the increased revenues associated with new meters will offset a portion of the capital costs of the new meters and potentially part of an AMI system as well.
- As a next step, it is recommended that the City issue an "open" request for proposals (RFP), inviting vendors to propose a range of meters and AMI systems they have to offer that can meet the City's needs. This can be structured in a performance specification based format, without identifying a specific technology or brand, to ensure proposals from various vendors associated with different technologies can be compared. There are multiple reasons why this is the suggested next step:
  - Technology advancements are occurring continually in this arena. As such, it is not prudent to "pre-select" a particular AMI technology or vendor without first obtaining detailed proposals, including costs. This ensures that the City is making an informed decision on the most current information available.
  - This will help the City better understand key differences between the available AMI technologies, as applied to the City's unique water system characteristics. For example, the quantitative analysis contained in this report indicates that a Network as a Service (NaaS) AMI solution could be as much as ten percent greater in cost (over a 20-year period) than a more traditional standard or high powered fixed network system. However, through the open RFP process, the City will learn more precisely the number of collectors and repeaters the traditional technologies would entail to provide network coverage throughout the City's service area. The cost and maintenance requirements associated with owning such equipment can then be weighed against the annual cost of a NaaS system, which eliminates the need for the City to own and maintain the network

assets. Getting current proposals on NaaS systems will also allow the City to learn of the additional “smart city” type of functionality that can be provided by such systems. All of these benefits can then be considered in light of actual proposed costs.

- AMI system costs have trended downward in the past five years, due to increased compatibility between AMI systems and meters of various brands, and greater competition amongst the primary vendors that are active in the marketplace. While the cost assumptions used in this analysis are based on actual vendor proposals submitted for other western Washington utilities over the past two years, it is important for the City to obtain current year pricing from vendors to better inform its cost/benefit analysis.
- Regarding meters, it is recommended that pricing be obtained during the RFP process for both mechanical and solid state “smart” meters. While the latter are more expensive, new vendors have entered the US market that previously typically only sold products in Europe, and are offering competitive pricing and contracting terms. It is worth exploring such options before making a firm decision on meter type/brand.
- Installation costs can vary widely, based on labor and market conditions. As such, the decision of whether to proceed with a turn-key contractor-based installation or use of a City- and temporary-labor based approach cannot be fully determined without obtaining current installation pricing.

Utility Board
2019 Work Plan

Meeting Date	Agenda Item
January 8	Meter Replacement Program Kick-Off Work Plan/ Code of Ethics Solid Waste Update
February 12	
March 12	SCADA Implementation
April 9	Solid Waste Implementation & Transition Plan
May 14	
June 11	Board Elections CIP Preview - Work Look Ahead
July 9	Meter Replacement Program
August 13	
September 10	Storm Water Rate Update EMS Utility Rates
October 8	Water Rate Update Sewer Rate Update
November 12	Solid Waste Update

To Be Scheduled: