



City of Columbia

Advanced Metering Infrastructure Investment Grade Audit

Prepared for

City of Columbia

July 15, 2026

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The City of Columbia

July 15, 2026

Submittal

Advanced Metering Infrastructure Investment Grade Audit

Presented by

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AMERESCO 

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Investment Grade Audit

1. Executive Summary



ES.0 Executive Summary

Ameresco, Inc. (Ameresco) is pleased to present this Investment Grade Audit (IGA) report to the City of Columbia, Missouri (City). The audit evaluated City-operated water and electric metering infrastructure to identify potential utility improvement measures that would improve or restore degraded meter accuracy, improve revenue potential, and reduce operational cost.

In March 2025, the City of Columbia selected Ameresco through a competitive Request for Proposals (RFP) process that solicited proposals from Energy Services Companies. The RFP was issued in accordance with the Revised Statutes of Missouri (RSMo 8.231) for “Guaranteed Energy Cost Savings Contracts.” The RFP issued by the City contained provisions that allowed the City to expand the scope of services to other areas of the City. In August 2025, the City exercised that provision and amended the Agreement to include an investment grade audit of City’s electric meters and water meters including upgrades to an Advanced Metering Infrastructure (AMI) system. Under this agreement, Ameresco conducted a comprehensive audit that included:

- Analysis of the City’s electric and water metering database
- Field surveys of meters and related infrastructure (boxes, vaults, lids, etc.)
- Testing a random sample of residential water meters
- Evaluation of current meter reading process and operations

Throughout the past 8 months, Ameresco has partnered closely with City staff to complete the following activities:

- Facilitated technology workshops to evaluate various technologies.
- Coordinated vendor presentations and conducted evaluations of AMI systems, meters, and customer portal platforms.
- Developed a detailed Scope of Work for meter replacement, AMI deployment, and supporting software integration.
- Led bid procurement, pricing analysis, and vendor evaluations for meters, AMI systems, and software providers.

Based on the audit and evaluation process, Ameresco developed and presented a turnkey Scope of Work, including initial and life-cycle cost analyses for staff review and final selection. The City’s staff then selected their preferred solutions, which are incorporated into this Investment Grade Audit.

The AMI project is designed to achieve the following objectives:

- Improve transparency for residents regarding electric and water usage
- Reduce unaccounted-for water loss and improve system accuracy
- Replace aging meters that have exceeded their useful life expectancy
- Increase operational efficiency in meter reading and field response
- Enhance customer service and response times

The project includes the replacement of 52,976 electric meters and the replacement or retrofit of 52,747 water meters. Key project components include:

- Installation of a complete AMI system and associated software
- Installation of new solid-state electric meters. (residential / light commercial meters via remote disconnects)
- Installation of new solid-state water meters, including retrofit integrations for existing infrastructure
- Existing solid-state meters will be retrofitted with an AMI transmitter.
- Installation of AMI transmitters on all new and existing water meters
- Implementation of Meter Data Management (MDM) Software
- Integration of the AMI and MDM systems with City's existing Harris Advanced Utility Systems (AUS) billing platform
- Integration with City's current customer portal software (MyMeter)
- Replacement of structurally compromised or damaged water meter boxes and non-RF-compatible lids

All installation data, including GPS coordinates, and endpoint information will be captured and integrated into the City's billing system.

Approximately 30 City of Columbia staff members contributed to this effort. The Ameresco team extends its sincere appreciation to all who supported this engagement, with particular recognition of the Columbia Water & Light team for their collaboration, responsiveness, and invaluable technical contributions to the successful completion of this Investment Grade Audit.

ES.1 Project Measures

Based on the data collected from site surveys, laboratory tests, and data analyses, Ameresco recommends a comprehensive utility metering and data acquisition improvement project. The metering infrastructure improvements include the installation of solid-state water meters, electric meters, and an advanced metering infrastructure (AMI) system. This upgrade will provide the City with many benefits, including the ability to provide enhanced customer service to its citizens, accurately capture metered water & electrical consumption and potential increases in water and sewer billing revenues, electrical billing revenues, reduce overall operational costs, address long-term operational needs, and provide the IT infrastructure necessary to manage water & electrical consumption and distribution at a more advanced level.

ES.2 Project Performance

The project cost from Ameresco to implement this scope of work is \$41,816,610. The total projected revenue increase and operational cost savings from implementing the project is \$3,957,285 in Year 1. The total project cost includes materials, turnkey electric & water meter installation, AMI deployment, and performance and payment bonds. The total annual savings in Year 1 are a combination of the operational revenue enhancements and operating cost savings.

The project cash flow included herein is based on a 15-year term financing with a 4.00 percent

financing rate. The analysis uses the scheduled electric rates for Year 1 and then a 2.5 percent rate escalation for the duration of the performance period. The analysis uses the scheduled water/sewer rates for Year 1 and then a 2.0 percent rate escalation for the duration of the performance period. A 3.0 percent escalation factor is applied to O&M savings, as well as to AMI service fees and measurement and verification (M&V) costs to account for projected increases throughout the performance period.

Based on Ameresco's analyses, implementing this project will provide the following Year 1 benefits to the City of Columbia:

- Increase small meter water revenue by \$378,934 from meter accuracy correction.
- Increase small meter sewer revenue by \$63,854 from meter accuracy correction.
- Increase intermediate meter water revenue by \$29,177 from meter accuracy correction.
- Increase intermediate meter sewer revenue by \$15,576 from meter accuracy correction.
- Increase large meter water revenue by \$75,518 from meter accuracy correction.
- Increase large meter sewer revenue by \$35,448 from meter accuracy correction.
- Increase electric meter revenue by \$2,203,593 from meter accuracy correction.
- Provide annual operational and maintenance savings associated with metering and distribution system operations by \$1,155,185.
- Total Year 1 benefits are projected to be \$3,957,285.

In addition to the preceding monetary benefits, the project will also help the City address the following outstanding operational issues:

- Installing the AMI system will provide automation to the City's billing system and greatly reduce the burden on City staff.
- Automated meter reading by an AMI system will reduce estimated meter reading and meter accessibility issues and reduce billing errors.
- The AMI system will provide a customer web portal that customers can visit to see their historical utility consumption data.
- Replacing the meters will reduce failure risks and result in fewer service calls from customers.

ES.3 Conclusion

By implementing a performance contract based on this IGA, the City will improve accuracy of meter reading and billing, reduce meter reading costs, and upgrade aging infrastructure.

Ameresco recognizes the City is staffed with exceptional O&M personnel. Given this expertise, we do not recommend that Ameresco assume full O&M of the equipment installed as a part of the measures. Instead, Ameresco will provide training on the new systems during construction and video recordings that can be used for additional training during the project term.

Project Proforma
City of Columbia, MO

Ameresco Turnkey Price	\$	41,816,610
P&P Bond (Included)		
Harris Advanced Fees	\$	108,975

Financial Assumptions

Project Term:	15
Financing Term:	15
Financing Rate:	4.00%
Payments Per Year:	1
Discount Rate:	4.00%

Water Revenue Escalation Rate:	2.00%
Sewer Revenue Escalation Rate:	2.00%
Electrical Escalation Rate:	2.50%
Meter Hardware Maint. Escalation Rate:	3.00%
Operational Savings Escalation Rate:	3.00%

Buydown: \$ -

Total Amount Financed \$ 41,925,585

[illegible]

\$	6,553,068	\$	1,104,253	\$	504,566	\$	269,370	\$	1,305,957	\$	613,024	\$	39,514,668	\$	21,485,186	\$	71,350,093	\$	93,111	\$	3,248,867	\$	7,960,052	\$	1,337,871
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Notes:

1 This cash flow reflects an estimated tax exempt lease rate of 4.0%. The actual rate will increase or decrease based on market conditions and customer credit rating at the time of lease funding.

2 Revenues are based on current utility rate structures and usage information provided for purposes of this project.

3 The performance and payment bonds apply only to the installation portion of the contract and do not apply in any way to energy savings guarantees, payments or maintenance provisions, except that the performance bond shall guarantee that the installation will be free of defective materials and workmanship for a period of 12 months following completion and acceptance of the work

City of Columbia, Missouri
Investment Grade Audit

A.0 Introduction



A.0 Introduction

Based on data collected from site surveys, facility interviews, field and laboratory testing, and other sources, Ameresco identified a comprehensive utility metering and data acquisition measure that will help the City restore meter accuracy, recover lost revenue, increase operational efficiency, and address aging infrastructure concerns. This IGA provides the details of that analysis for the City of Columbia.

The organization of this report is as follows:

- [Section A.0 Introduction](#)
Overview of the IGA, including the baseline, project measures, financial analysis, and proposed project schedule.
- [Section B.0 Existing Utility Generation and Distribution System Conditions](#)
Description of the City's existing utility generation, production, collection, treatment, and distribution systems.
- [Section C.0 Proposed System Improvements](#)
Description of the proposed utility metering and data acquisition improvements.
- [Section D.0 Implementation of the Proposed System Improvements](#)
Project details and scope of work for implementing the proposed improvements.
- [Section E.0 Savings and Revenue Analysis](#)
Savings calculations, revenue impacts, and financial analysis for the proposed measures.
- [Section F.0 Appendix](#)
Supporting reference materials and supplemental information.

City of Columbia, Missouri
Investment Grade Audit

B.0 Existing Utility Generation and Distribution System Conditions



B.0 Existing Utility Generation and Distribution System Conditions

The utility analysis provided as part of this IGA report includes a review of the City-operated utility systems.

B.1 Electric Generation and Distribution System

Electricity generation is the process of making electricity from natural energy sources. It is the first step in delivering electricity to homes and businesses. After electricity is generated, it is transmitted, distributed, and sometimes stored by the power industry.

The electric transmission network supplies electricity to Columbia's grid from external providers. Columbia Water & Light operates within the control area of the Midcontinent Independent System Operator (MISO). MISO is an independent organization that manages the flow of electricity across much of the northern Midwest to ensure reliability and efficiency.

Electricity is generated at power plants using fossil fuels or renewable resources. Approximately 90% of Columbia's electricity is generated outside the City. Table B.1.1 shows the plant location, fuel type, and generation capacity for the outside energy suppliers for the City of Columbia.

Table B.1.1 Outside Energy Suppliers

Location	Fuel Type	Capacity (MW)
Sikeston	Coal	66.0
Iatan II	Coal	20.0
Prairie State	Coal	50.0
Crystal Lake	Wind	37.5
Bluegrass Ridge	Wind	6.3
Jefferson City Landfill	Landfill Gas	3.2
Truman Solar	Solar	10.0

Table B.1.2 shows the plant location, fuel type, and generation capacity for the local energy suppliers for the City of Columbia.

Table B.1.2 Local Energy Suppliers

Location	Fuel type	Capacity (MW)
Municipal Power Plant	Natural Gas	47.5
Columbia Energy Center	Natural Gas	144.0
Landfill Gas Plant	Landfill Gas	3.2
Bernadette Solar	Solar	0.3
Net Metering	Solar	4.0

Figure B.1.1 provides a breakdown of the energy generation sources by percentage of total generation capacity for the City.

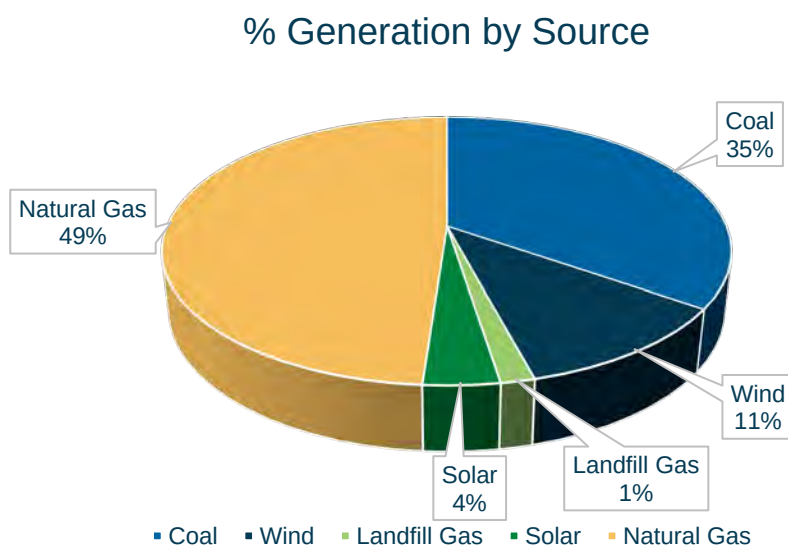


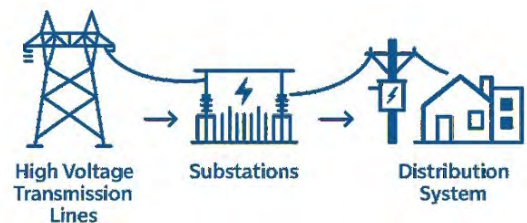
Figure B.1.1 Percentage of Total Generation by Source

Although coal currently represents 35% of the generation capacity, the City has adopted a renewable energy plan with goals to increase the renewable energy sources shown in Table B.1.3, Renewable Energy Targets, below. The City created an ordinance that requires Water & Light to generate or purchase electricity generated from eligible renewable energy sources at the levels presented. The cost of the renewable energy mandated in the ordinance must not increase electric rates more than 3% above the electric rates attributed to the cost of electricity generated from 100% non-renewable sources.

Table B.1.3 Renewable Energy Targets

Target Date for Renewable Energy Sources	% of Electric Retail Sales
December 31, 2012	5%
December 31, 2017	15%
December 31, 2022	25%
December 31, 2028	30%

As mentioned above, the electric transmission network supplies electricity to Columbia's grid from external providers. Columbia Water & Light (CWL) is responsible for the construction and maintenance of transmission lines, substations, and distribution lines.



Electricity is provided at each residential and commercial location throughout the City. The amount of electricity consumed by that user is recorded using an electric meter.

At present, Columbia Water & Light electric meters are not smart meters. They do not support two-way data communication and do not collect usage data at automated intervals. In addition, these meters are not capable of reporting customer power outages. Columbia began installing a residential Automatic Meter Reading (AMR) system in 1996, and these meters remain in service today. Meter readings are obtained once per month from the street via a radio signal using a handheld reading device.

The collected data is transferred from a handheld device to the City's secure computer network and into the billing system. The billing system, Advanced Utility Systems by Harris Corp., takes the consumption data for each account and applies the appropriate rate structures to generate the monthly electric bill. The rate structures will be described in detail in Section D.0, Savings and Revenue Analysis.

B.1.1 Electric Meter Design

An electric meter is a device used to determine the total electrical energy supplied to a load over a given period. Energy usage is typically reported in kilowatt-hours (kWh). Regardless of meter type, all electric meters perform the same fundamental task: they determine electrical power and accumulate that value over time.

Electrical energy is obtained by integrating real power with respect to time. Since power depends on both voltage and current, meters must measure these quantities and account for their interaction. In practice, meters continuously evaluate power and sum it to produce an energy value suitable for billing and analysis. Older analog meters measure energy using electromagnetic and mechanical effects rather than digital computation.

An induction-type meter includes:

- A voltage-sensing element connected across the supply
- A current-sensing element in series with the load
- A lightweight conductive disc mounted on a shaft
- A permanent magnet to regulate motion
- A mechanical counter to track accumulated energy

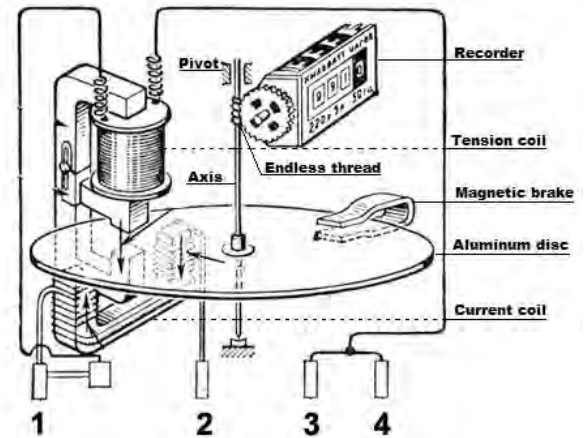


Figure B.1.1.1 Electromechanical Components²

When current flows:

- The voltage and current elements generate alternating magnetic fields
- These fields induce circulating currents within the aluminum disc
- The interaction between magnetic fields and induced currents produces rotational force proportional to real power
- The disc settles into a steady rotation speed that reflects load magnitude
- A mechanical register converts disc rotations into a cumulative energy reading

Each rotation matches a calibrated amount of energy, allowing long-term integration without electronic components.

Modern electronic meters eliminate moving parts and rely on sensors and microelectronics. They operate as follows:

- Voltage and current are sensed using precision electronic components such as voltage dividers, current transformers, or shunt resistors.
- The analog signals are converted into digital values by high-speed analog-to-digital converters.
- Instantaneous power is computed internally by multiplying sampled voltage and current values.
- The meter's processor mathematically sums power over time to calculate total energy consumption.
- Computed energy values are retained in memory and displayed numerically.



Electronic meters offer improved accuracy, reduced maintenance, and the ability to monitor additional electrical parameters beyond total energy.

Smart meters build on electronic meter designs by adding communication and advanced data handling. The enhanced capabilities of a smart meter include the following:

- Remote transmission of consumption data
- Time-based energy recording
- Utility-controlled service connect and disconnect
- Event logging for power quality and tamper detection
- Support for variable pricing structures



Figure B.1.1.3 Smart Electric Meter

While their energy calculation method remains digital, smart meters provide richer data sets that support grid management and customer analytics.¹

The market today includes a variety of vendors. The following list includes the leaders in the electric meter market in the United States. These vendors are focusing on smart metering and smart grid/smart city solutions.³

- Itron
- Landis+Gyr
- Aclara (Hubbell)
- Others (12% Market Share)
 - Gridspertise
 - Honeywell
 - Nansen (Sanxing Electric)
 - Networked Energy Services (NES)
 - Pietro Fiorentini
 - Sagemcom
 - Sensus (Xylem)



The City provided a detailed listing of the electric meters currently installed in the system. The graph below, Figure B.1.2.4, shows the percentage of each brand installed in the system.

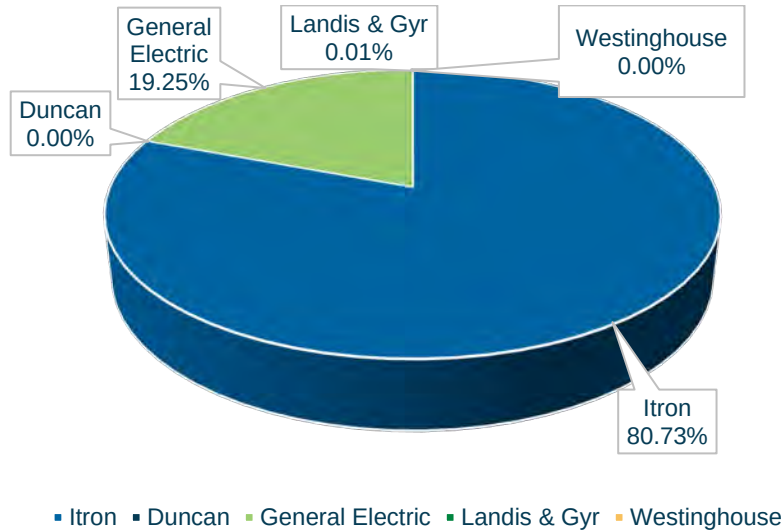


Figure B.1.1.4 % of Total by Brand Installed

Electric meters come in different sizes based on the application or end user. The following table, Table B.1.1.1, shows the typical electric meter sizes used in the electric meter industry.

Table B.1.1.1 Industry Standard Meter Sizes⁴

Phase Type	Form Number	Typical Service
Single Phase	1S	120V, 2-wire (residential)
	2S	120/240V, 3-wire (residential)
	14S	120V, 2-wire (residential)
	12S	120V, 2-wire (residential)
Three Phase, 3-Wire	3S	3-wire, 208Y/120V or 240V
	7S	3-wire, 208Y/120V or 240V
	4S	3-wire, 208Y/120V or 240V
Three Phase, 4-Wire (Wye)	5S	120/208V, 4-wire
	9S	120/208V, 4-wire
	10S	120/208V, 4-wire
	11S	120/208V, 4-wire
	15S	120/208V, 4-wire
	16S	120/208V, 4-wire
	24S	120/208V, 4-wire
	26S	120/208V, 4-wire
	29S	120/208V, 4-wire
	35S	120/208V, 4-wire
	36S	120/208V, 4-wire
	39S	120/208V, 4-wire

Phase Type	Form Number	Typical Service
Three Phase, 4-Wire (Delta)	45S	208/120V, 4-wire
	46S	208/120V, 4-wire
	56S	208/120V, 4-wire
	66S	208/120V, 4-wire
Transformer-Rated (CT-Metered)	3S, 4S, 5S, 6S, 7S, 8S, 9S, 10S, 11S, 15S, 16S, 17S, 24S, 25S, 26S, 29S, 32S, 35S, 36S, 39S, 44S, 45S, 46S, 56S, 66S	3-wire or 4-wire, high current

In order to develop the scope of work for this project, it was important to get the specifics for the meters in the system. This includes the nameplate or sizing details as shown on the meter in the picture below and in Table B.1.1.1 Industry Standard Meter Sizes.



Figure B.1.1.5 Sample Electric Meter Nameplate

The database provided by the City was detailed and included the electric meter information described above. Table B.1.2.2 below is a breakdown of the meter quantities by Form, Voltage and Class installed throughout the City.

Table B.1.1.2 Meter Quantities by Form/Voltage/Class

Form	Voltage	Class	Quantity
1S	120	100	185
2S	240	200	42,225
2S	240	320	1,016
3S	240	20	311
9S	480	20	1,286
12S	208	200	4,659
12S	240	200	1,121
12S	277	200	4
12S	480	200	387
16S	208	200	1
16S	277	200	5
16S	480	200	2,720
16S	480	320	60
45S	480	20	12

B.1.2 Field Conditions

In addition to the size data provided in Table B.1.2.2, and to determine what is necessary to complete a successful meter change out, an assessment of the existing field conditions is required. This includes completing a survey of a random sample of the electric meters. This allows the Ameresco engineering team to assess the environmental conditions, meter locations, and any safety concerns that could arise during the construction/implementation phase of this project.

The City provided the following location map, Figure B.1.2.1, to assist with locating meters on a given property during the field surveys. The meter account lists included a location code that corresponds to this map for each meter account.

A0 BK-FAR-L	A1 BK-FAR-L	A2 BK-L	A3 BK-L	A4 BK-MID	A5 BK-MID	A6 BK-R	A7 BK-R	A8 BK-FAR-R	A9 BK-FAR-R
B0 BK-FAR-L	B1 BK-FAR-L	B2 BK-L	B3 BK-L	B4 BK-MID	B5 BK-MID	B6 BK-R	B7 BK-R	B8 BK-FAR-R	B9 BK-FAR-R
C0 BK-FAR-L	C1 BK-FAR-L	C2 BK-L	C3 EXT-BK-L	C4 EXT-BK-MID	C5 EXT-BK-MID	C6 EXT-BK-R	C7 BK-R	C8 BK-FAR-R	C9 BK-FAR-R
D0 MID-FAR-L	D1 MID-FAR-L	D2 EXT-MID-L	D3 IN-BK-L	D4 IN-BK-MID	D5 IN-BK-MID	D6 IN-BK-R	D7 EXT-MID-R	D8 MID-FAR-R	D9 MID-FAR-R
E0 MID-FAR-L	E1 MID-FAR-L	E2 EXT-MID-L	E3 IN-MID-L	E4 IN-MID	E5 IN-MID	E6 IN-MID-R	E7 EXT-MID-R	E8 MID-FAR-R	E9 MID-FAR-R
F0 MID-FAR-L	F1 MID-FAR-L	F2 EXT-MID-L	F3 IN-MID-L	F4 IN-MID	F5 IN-MID	F6 IN-MID-R	F7 EXT-MID-R	F8 MID-FAR-R	F9 MID-FAR-R
G0 MID-FAR-L	G1 MID-FAR-L	G2 EXT-MID-L	G3 IN-FR-L	G4 IN-FR-MID	G5 IN-FR-MID	G6 IN-FR-R	G7 EXT-MID-R	G8 MID-FAR-R	G9 MID-FAR-R
H0 FR-FAR-L	H1 FR-FAR-L	H2 FR-L	H3 EXT-FR-L	H4 EXT-FR-MID	H5 EXT-FR-MID	H6 EXT-FR-R	H7 FR-R	H8 FR-FAR-R	H9 FR-FAR-R
I0 FR-FAR-L	I1 FR-FAR-L	I2 FR-L	I3 FR-L	I4 FR-MID	I5 FR-MID	I6 FR-R	I7 FR-R	I8 FR-FAR-R	I9 FR-FAR-R
J0 FR-FAR-L	J1 FR-FAR-L	J2 FR-L	J3 FR-L	J4 FR-MID	J5 FR-MID	J6 FR-R	J7 FR-R	J8 FR-FAR-R	J9 FR-FAR-R

Figure B.1.2.1 Meter Location Map

Meter replacements inside a residence or business take additional time to complete due to scheduling and accessing the meter (i.e., basements, furniture removal, etc.). Based on data provided by the City, approximately 8.09% of the meters are indoors. Note that some meters in the database did not have a location noted. Those meters will be located during the pre-construction phase of the project when GPS coordinates are collected for each meter.

In addition to the physical location of the meter, the following data is used to develop the scope of work for the meter replacements:

- Digital / Analog Meter
- Meter Manufacturer
- Analog Meter Factor
- Manufacturer Meter #
- Utility Serial # (if different from Manufacturer)
- Nominal Voltage
- # of Wires
- Form Number
- Accuracy Class
- Meter Base Condition

A random sample of residential meters was surveyed to confirm the Form, Voltage, and Class data provided in the database file and to gather data on existing conditions. The following are example photos taken at a group of random sample locations. A complete photo tour of the surveyed residential electric meters can be found in [Appendix F.3 – Small Meter Photo Tour](#).





A sample of the poly-phase meters was surveyed as well. The following are example photos taken at a group of random sample locations. A complete photo tour of the surveyed poly-phase electric meters can be found in [Appendix F.2 – Poly-phase Meter Photo Tour](#).





B.2 Water Production and Distribution System

Water treatment and distribution refer to the integrated processes used to produce safe, potable water and deliver it reliably to consumers. Water treatment involves removing physical, chemical, and biological contaminants from raw water sources—such as rivers, lakes, or groundwater—to meet public health and regulatory standards. Typical treatment processes include screening, coagulation and flocculation, sedimentation, filtration, disinfection, and chemical adjustment to control corrosion and improve water quality.

Once treated, water distribution systems convey the finished water from treatment facilities to end users through a network of storage facilities, pumps, valves, and transmission and distribution mains. Distribution systems are designed to maintain adequate pressure, ensure continuous supply, preserve water quality, and support fire protection and emergency demands.

Together, water treatment and distribution systems play a critical role in protecting public health, supporting economic development, and ensuring the reliable supply of safe drinking water to residential, commercial, and industrial users.

The City of Columbia's drinking water supply is derived from a system of groundwater production wells completed in an alluvial aquifer located beneath the floodplain adjacent to the Missouri River, southwest of the City limits. The aquifer consists primarily of unconsolidated sand and gravel deposits that were emplaced during historic glacial melt events, when retreating glaciers transported and deposited sediments along the river corridor.

This geologic unit is classified as an alluvium and, when saturated, functions as an alluvial aquifer capable of storing and transmitting significant volumes of groundwater. As water moves slowly through the sand and gravel matrix, the aquifer provides a degree of natural filtration, contributing to raw water quality prior to extraction. The aquifer is estimated to contain approximately 44 billion gallons of water and is continuously recharged by regional groundwater inflows.



Figure B.2.0.1 Alluvial Aquifer Creation



Figure B.2.0.2 McBaine Water Treatment Plant

The City's production wells are constructed to an average depth of approximately 110 feet, extending near the base of the aquifer to access stable and consistently available groundwater supplies. There are a total of 18 wells. Each well can produce 2 to 2.5 million gallons per day. The groundwater from the wells is pumped to the McBaine Water Treatment Plant. The plant is located at 7203 W Route K in Columbia. An aerial view of the plant is shown in Figure B.2.0.2. The plant was originally built in 1970. The plant was modified and expanded in 1994 and 2007.

The diagram below provides the process steps required to get the raw water from the aquifer ready for distribution to the residents and businesses of Columbia.



Figure B.2.0.3 Columbia Water Treatment Process⁵

Softened, filtered water is pumped from the water treatment plant to reservoirs at the West Ash, South Pump and Hillsdale pumping stations. The water is then pumped throughout the City to consumers. Water is stored in three water towers that provide capacity for peak water use and firefighting.

An improvement project that started in August 2024 is underway and will increase the plant's treatment capacity to 32 million gallons per day (MGD). The goal of the project is to increase the capacity of the plant while addressing aging infrastructure issues with the process equipment. The current project includes the following upgrades.



Figure B.2.0.4 McBaine WTP Expansion Project

The numbers in the Figure above include the following scope of work as outlined on the City's website.

1. Aerators Replacement: Improvements will alleviate a hydraulic imbalance when water is pumped into the plant. Filter media will also be replaced. Schedule: April 2025-May 2026
2. Lime System Upgrades: New equipment will improve lime feed for better softening. Schedule: April 2025-May 2026
3. Reclaim basin improvements: The reclaim tank pumps will be replaced. Old equipment and a lime silo will be removed. Schedule: April 2025-May 2026
4. Primary Clarifiers: Concrete will be repaired. All new clarifiers, all new weirs, all new bridges, electrical equipment. Access Point weir will be replaced with a pipe to take water to the secondary clarifier. Schedule: June 2024-July 2026
5. Secondary Clarifiers: All equipment will be replaced. There will be baffle curtains put in to help direct the water. New influent pipe with a chlorine gas injection port will take water to filters. Schedule: June 2024-July 2026
6. Filter Building Improvements: New filter media, air scour piping and underdrains will be installed that will more efficiently separate impurities from the anthracite filter. Schedule: January 2025-June 2026
7. Operation Building Improvements: A new HVAC system and ductwork will be installed. The building will also receive a new electrical control room. Schedule: June 2025-May 2026
8. New Chemical Feed Building: The new building will include a storage room for chlorine gas as well as separate feed rooms and new feed systems for Chlorine, Fluoride and Liquid Ammonium Sulfate. Schedule: August 2024-October 2025⁶

These improvements ensure that the City continues to provide the best possible drinking water quality to the residents and businesses of the City. As mentioned in the section on electric meters, the City does not know how the end user consumes the water; it only records the amount that is consumed based on the monthly readings from the installed water meter at that location.

B.2.1 Water Meter Design

Water meters are devices used to measure water consumption in residential, commercial, and industrial systems, and they can be categorized by measurement principle, installation method, service conditions, and data collection capability.

One common category is positive displacement meters, which measure water by repeatedly filling and emptying a chamber of known volume. These meters, such as nutating disc and oscillating piston designs, are widely used in residential applications because they provide high accuracy at low flow rates, although they create higher pressure loss and experience mechanical wear over time.

Velocity meters measure flow based on the speed of water passing through the meter and include turbine, propeller, single-jet, and multi-jet designs. However, most velocity meters lose accuracy at low flows and are sensitive to flow disturbances.

Turbine and propeller meters are well suited for commercial, industrial, and large-diameter pipe applications where high flow rates are expected, while single-jet and multi-jet meters are commonly used for smaller residential and light commercial services.

More advanced technologies include electromagnetic (mag) meters and ultrasonic meters, both of which have no moving parts and are capable of high accuracy over broad flow ranges.

Electromagnetic meters operate using Faraday's law of induction and are widely used for municipal, industrial, and wastewater applications where reliable performance and low maintenance are critical, though they require power and conductive fluid.

Ultrasonic meters measure flow by transmitting sound waves through the water and are commonly used in modern metering systems, including advanced metering infrastructure (AMI), due to their excellent accuracy, minimal pressure loss, and suitability for remote data collection.

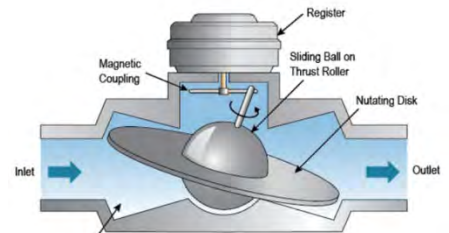


Figure B.2.1.1 Positive Displacement Water Meter⁷

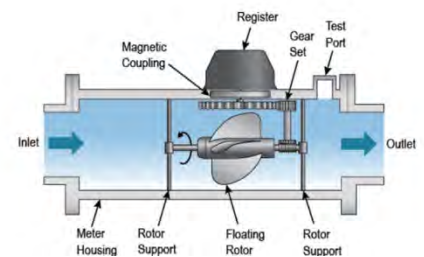


Figure B.2.1.2 Velocity Water Meter⁷

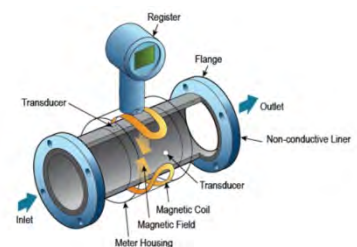


Figure B.2.1.3 Electromagnetic Water Meter⁷

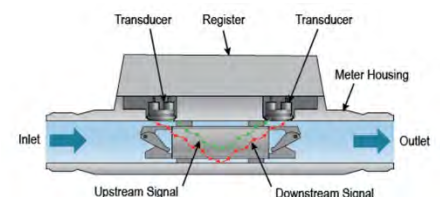


Figure B.2.1.4 Ultrasonic Water Meter⁷

Vortex flow meters, which detect vortices formed by a bluff body in the flow stream, are typically limited to industrial applications with steady, continuous flow conditions and are less effective at low flow rates.

Water meters may also be classified by installation type and service conditions. Inline meters are installed directly into the pipeline and measure total flow, while insertion meters place a sensor through the pipe wall and are often used on large pipelines to reduce installation cost and disruption.

Meters are further rated for cold water or hot water service, depending on operating temperature, and for clean or dirty water conditions, with technologies like magnetic and Doppler ultrasonic meters preferred for wastewater or solids-laden flows.

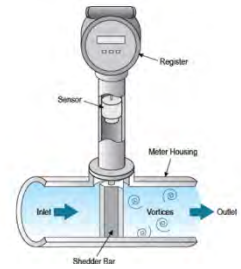


Figure B.2.1.5 Vortex Flow Water Meter⁷

Finally, water meters differ in how usage data is collected, ranging from manual read meters to automatic meter reading (AMR) systems and fully integrated advanced metering infrastructure (AMI) systems that enable two-way communication, real-time monitoring, leak detection, and system optimization.

The market today includes a variety of vendors. The following list includes the leaders in the water meter market in the United States.

Leading Companies in the United States (US) Water Meter Market:

- Badger Meter, Inc.
- Mueller Water Products, Inc.
- IDEX Corporation
- Sensus (Xylem Inc.)
- Aclara Technologies LLC
- Kamstrup A/S
- Neptune Technology Group Inc.
- Elster Group GmbH (Honeywell International Inc.)
- Master Meter, Inc.
- Zenner International GmbH & Co. KG

The City provided a detailed listing of the water meters currently installed in the system. The graph below, Figure B.2.2.6, shows the percentage of each brand installed in the system.

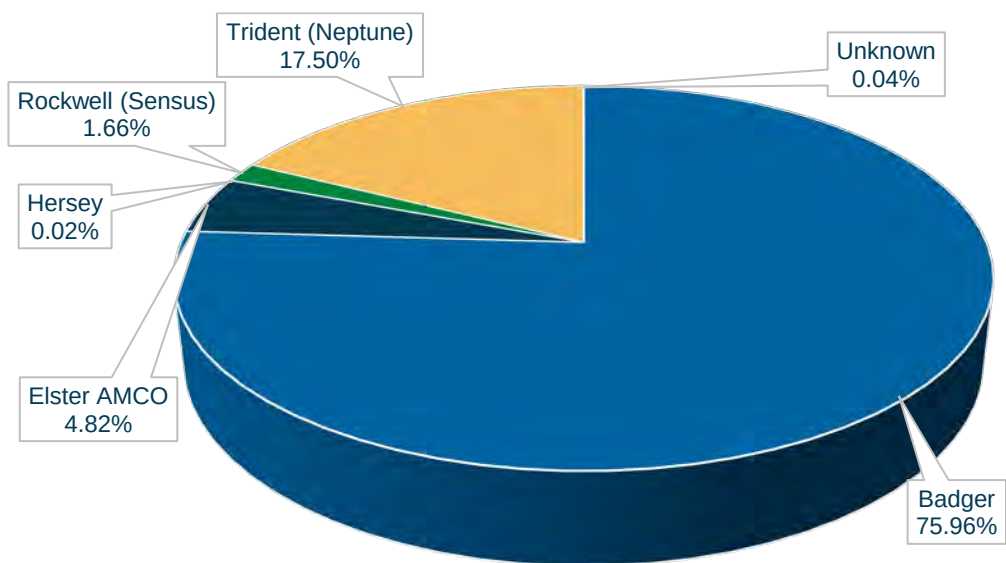


Figure B.2.1.6 % of Total by Water Meter Brand

Water meters come in different types and sizes based on the application or end user. The following table, Table B.2.1.1, shows the typical water meter sizes used in the water meter industry as reported by the American Water Works Association.

Table B.2.1.1 Typical Meter Types, Sizes and Lay Lengths

Meter Type	Nominal Size	Connection	Typical Lay Length (in)	AWWA Reference
Positive Displacement - Bronze	1/2"	Thread	7.5"	AWWA C700-02
	1/2" x 3/4"	Thread	7.5"	
	5/8"	Thread	7.5"	
	5/8" x 3/4"	Thread	7.5"	
	3/4"	Thread	9"	
	1"	Thread	10.75"	
	1.5"	Thread	12.625"	
	1.5"	Flange	13"	
	2"	Thread	15.25"	
	2"	Flange	17"	
Positive Displacement - Plastic	1/2"	Thread	7.5"	AWWA C710-02
	1/2" x 3/4"	Thread	7.5"	
	5/8"	Thread	7.5"	
	5/8" x 3/4"	Thread	7.5"	
	3/4"	Thread	9"	
	1"	Thread	10.75"	
Multi-Jet	5/8"	Thread	7.5"	AWWA C708-05
	5/8" x 3/4"	Thread	7.5"	
	3/4"	Thread	9"	

Meter Type	Nominal Size	Connection	Typical Lay Length (in)	AWWA Reference
	1"	Thread	10.75"	
	1.5"	Screw	12.625"	
	1.5"	Thread	13"	
	2"	Screw	15.25"	
	2"	Thread	17"	
Single-Jet	1.5"	Screw	12.625"	AWWA C712-02
	1.5"	Thread	13"	
	2"	Screw	15.25"	
	2"	Thread	17"	
	3"	Flange	24"	
	4"	Flange	29"	
	6"	Flange	36.5"	AWWA C704-08
Propeller	2"	Screw	14"	
	2"	Flange	14"	
	3"	Screw	16"	
	3"	Flange	18"	
	3"	Plain	17"	
	4"	Screw	20"	
	4"	Flange	20"	
	4"	Plain	17"	
	6"	Screw	22"	
	6"	Flange	22"	
	6"	Plain	21"	
	8"	Flange	24"	
	8"	Plain	23"	
	10"	Flange	26"	
	10"	Plain	25"	
Turbine	3/4"	Screw	9"	AWWA C701-07
	1"	Screw	10.75"	
	1.5"	Screw	12.75"	
	1.5"	Flange	13"	
	2"	Screw	15.5"	
	2"	Flange	17"	
	3"	Flange	24"	
	4"	Flange	29"	
	6"	Flange	36.5"	
	8"	Flange	43.75"	
	10"	Flange	60"	
Compound	2"	Flange	18"	AWWA C702-01
	3"	Flange	24"	
	4"	Flange	29"	AWWA C702

Meter Type	Nominal Size	Connection	Typical Lay Length (in)	AWWA Reference
Electromagnetic / Ultrasonic	6"	Flange	37"	AWWA C702
	8"	Flange	56"	AWWA C712
	1/2"	Thread	7.5"	AWWA C715-18
	1/2" x 3/4"	Thread	7.5"	
	5/8"	Thread	7.5"	
	5/8" x 3/4"	Thread	7.5"	
	3/4" Short	Thread	7.5"	
	3/4"	Thread	9"	
	1"	Thread	10.75"	
	1.5" Internal	Thread	12.625"	
	1.5" External	Thread	12.625"	
	2" Internal	Thread	15.25"	
	2" External	Thread	15.25"	
	1.5"	Flange	13"	
	2"	Flange	17"	
	3"	Flange	24"	
	4"	Flange	29"	
	6"	Flange	36.5"	
	8"	Flange	43.75"	
	10"	Flange	60"	

In order to develop the scope of work for this project, it was important to get the specifics for the meters in the system. The database account list provided a lot of detail such as the meter make, model, and size. The meters in the system are shown in **Table B.2.2.2 below**.

Table B.2.1.2 Meters in System by Size

Meter Size	Total Meters in System
5/8" x 1/2"	49,384
5/8" x 3/4"	260
1"	2,043
1.5"	496
2"	460
3"	60
4"	29
6"	15
Total:	52,747

B.2.2 Field Conditions

In addition to the size data provided in **Table B.2.2.2**, and in order to determine what is necessary to complete a successful meter changeout, an assessment of the existing field conditions is required. This includes completing a survey of a random sample of the small (5/8" and 1") and intermediate meters (1.5" and 2"). All of the meters 3" and larger were surveyed by the Ameresco engineering team. It was important to supplement the data provided in the database by collecting the meter lay length, box/lid or vault conditions, etc. This allows the engineering team to assess the environmental conditions, meter locations, and any safety concerns that could arise during the construction/implementation phase of this project.

The City provided the location map shown in the electric meter section above, Figure B.1.3.1, to assist with locating meters on a given property during the field surveys. The water meter account list included a location code that corresponds to this map for each meter account.

Meter replacements inside a residence or business take additional time to complete due to scheduling and accessing the meter (i.e. basements, furniture removal, etc.). Based on data provided by the City, there are approximately 11.63% of the meters indoors.

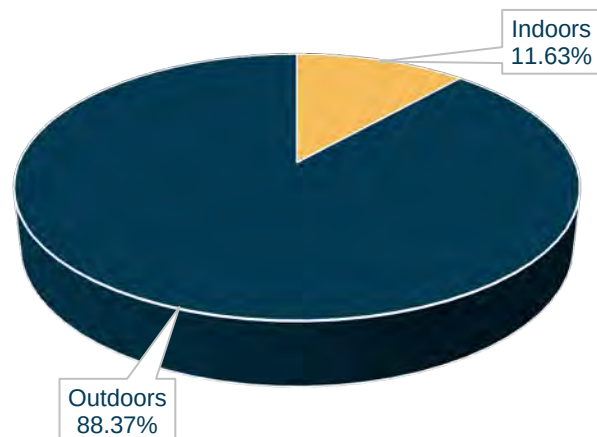


Figure B.2.2.1: 5 % of Total Meters by Location

In addition to the physical location of the meter, the following data is used to develop the scope of work for the small meter replacements:

- Confirm meter size
- Meter Brand / Model
- # of Meters in the Box
- Hazards (Dog, Ants, Snakes, etc.)
- Environmental Conditions (Flooded, Dirt, Trash)
- Box/Lid Materials
- Box/Lid Condition
- Box/Lid Measurements
- Box Depth / Depth to Meter
- Box Location (Grass, Concrete, etc.)
- Curb Stop Type / Setters

A random sample of residential water meters were surveyed to confirm the size and to assess the environmental conditions, box/lid conditions and any safety concerns. The following are example photos taken at a group of random sample locations. A complete photo tour of the surveyed residential water meters can be found in [Appendix F.3 – Small Water Meter Photo Tour](#).





In addition to the physical location of the meter, the following data is used to develop the scope of work for the intermediate and large meter replacements:

- Confirm meter size
- Meter Serial #(s)
- Meter Brand / Model
- Meter Type (Turbine, Compound, etc.)
- Hazards (Confined Space, Traffic Support Required)
- Environmental Conditions (Flooded, Dirt, Trash)
- Box/Lid/Vault Materials
- Box/Lid/Vault Condition

- Box/Lid/Vault Measurements
- Box/Vault Depth / Depth to Meter
- Box/Vault Location (Grass, Concrete, etc.)
- Inlet / Outlet Valve
- Bypass Installed
- Strainer
- Length of Spool Pieces
- Lay Length of Meter

The following are example photos taken at a group of the random sample locations for the intermediate and large meter locations. A complete photo tour of the surveyed intermediate and large water meters can be found in [Appendix F.4 – Intermediate Water Meter Photo Tour](#) and [Appendix F.5 - Large Water Meter Photo Tour.](#)







B.3 Wastewater Collection and Treatment

The water and sewer rates that are charged by the City consist of a combination of base charges and volumetric charges. These rates are established by a detailed analysis of the costs to own and operate the water treatment and distribution system and the wastewater collection and treatment systems. The AMI system will collect more accurate data so that both departments can more efficiently plan and operate these critical services for the residents and businesses of Columbia.

Wastewater collection and treatment systems are critical components of municipal infrastructure, designed to protect public health, preserve environmental quality, and ensure regulatory compliance. These systems convey wastewater from residential, commercial, and industrial sources to centralized treatment facilities where physical, chemical, and biological processes are used to remove contaminants prior to discharge or reuse.

A wastewater collection system is a network of pipes, structures, and appurtenances that transports wastewater by gravity and/or pressure to treatment facilities. Major components include gravity sewers, force mains, service laterals, manholes, cleanouts, lift stations, and pumping stations. Gravity sewers are typically designed to maintain self-cleansing velocities under peak flow conditions, while lift stations are used where topography does not allow continuous gravity flow.

Collection systems are commonly classified as:

- Separate sanitary sewer systems, which convey wastewater separately from stormwater;
- Combined sewer systems, which convey wastewater and stormwater in the same pipe; and
- Partially separated systems, which include elements of both.

Modern practice favors separate sanitary sewer systems to reduce hydraulic loading at treatment plants and minimize untreated discharges during wet-weather events.

Key design considerations for wastewater collection systems include anticipated flows, peak wet-weather conditions, infiltration and inflow (I/I), pipe material selection, corrosion resistance, maintenance accessibility, and long-term capacity needs. Proper system operation and maintenance are essential to prevent overflows, minimize odors, and extend infrastructure life.

Wastewater treatment plants are designed to remove solids, organic matter, nutrients, and pathogens from influent wastewater to meet regulatory discharge limits and protect receiving waters.

Preliminary treatment removes coarse materials that could damage downstream equipment or interfere with treatment processes. Typical unit processes include bar screens, grinders, grit chambers, and flow measurement devices. These processes protect plant infrastructure and improve overall operational reliability.

Primary treatment focuses on the removal of settleable and floatable solids through sedimentation. Primary clarifiers allow heavier solids to settle as sludge while lighter materials rise to the surface and are removed as scum. Primary treatment can remove a significant portion of total suspended solids (TSS) and biochemical oxygen demand (BOD).

Secondary treatment uses biological processes to remove dissolved and colloidal organic matter. Common systems include activated sludge, oxidation ditches, trickling filters, sequencing batch reactors (SBRs), and biological nutrient removal (BNR) processes. Secondary treatment significantly reduces BOD, TSS, and ammonia and is a regulatory requirement for most municipal discharges.

Tertiary or advanced treatment processes are implemented when higher effluent quality is required. These processes may include filtration, nutrient removal (nitrogen and phosphorus), membrane systems, carbon adsorption, and advanced disinfection. Advanced treatment is often used to meet stringent discharge limits or support water reuse applications.

Disinfection is applied to reduce pathogenic organisms prior to discharge or reuse. Common methods include chlorination/dechlorination, ultraviolet (UV) radiation, and ozonation. The choice of disinfection method depends on regulatory requirements, safety considerations, and operational complexity.

Treatment processes generate residual solids, commonly referred to as sludge or biosolids. Biosolids are stabilized through processes such as aerobic digestion, anaerobic digestion, or lime stabilization to reduce pathogens and odors. Final biosolids management options include land application, landfilling, composting, or energy recovery, depending on regulatory constraints and local practices.

Effective wastewater management requires coordination between collection systems and treatment facilities to ensure hydraulic and process compatibility under both dry-weather and wet-weather conditions. Systems must comply with applicable federal, state, and local regulations, including discharge permits, biosolids regulations, and overflow control requirements. Planning for future growth, climate variability, and system resilience is increasingly important in modern wastewater infrastructure design.

Wastewater collection and treatment systems play a vital role in maintaining public health and environmental protection. Proper planning, design, operation, and maintenance of these systems ensure reliable service, regulatory compliance, and long-term sustainability of municipal wastewater infrastructure.

The Columbia Sewer Utility is divided into three divisions: Engineering, Sewer Collection System Maintenance, and the Columbia Wastewater Treatment Plant.

The Engineering division is responsible for planning, designing, and overseeing the construction of community-approved infrastructure projects included in the Capital Improvements Program (CIP). These responsibilities encompass all phases of project delivery, including surveying, engineering design, right-of-way acquisition, contracting, and construction inspection.

In addition to capital project delivery, the Engineering division administers two residential cost reimbursement programs. These programs provide financial assistance to homeowners for costs associated with correcting defects, repairing or removing improper connections, and eliminating sources of inflow and infiltration to the sanitary sewer system.

Engineering staff also conduct plan reviews and inspections for sewer infrastructure constructed as part of private development projects to ensure compliance with applicable federal, state, and local standards. The division maintains and updates sewer system maps, design criteria, and technical specifications for use by consultants, developers, and other stakeholders.

Sewer capital improvement projects are prioritized through a comprehensive public involvement process and funded as part of the City's annual budget. Projects are designed to meet the highest practicable safety and performance standards, with careful consideration given to public input, as well as environmental and economic impacts.

The Sewer Collection System Maintenance includes an aggressive preventive maintenance program that ensures that sewer mains remain in proper working order and prevent many problems before they occur. In addition, cleaning crews respond to stoppage complaints.

Access to sewer cleanout locations is essential for these operations. While some cleanouts are located within public rights-of-way, others may be located in residential yards. Limited or obstructed access to these cleanout points can slow maintenance activities and reduce the overall efficiency of the cleaning cycle.

Sewer line cleaning is performed using high-pressure water jetting equipment. This process involves propelling a specialized cleaning nozzle through underground sewer mains using a high-pressure hose, effectively removing accumulated debris such as grease, grit, and sediment. When necessary, hydraulic root-cutting equipment is attached to the jetting hose to remove tree roots that may obstruct flow.

The Sewer Utility operates three dedicated sewer cleaning crews, each assigned to a designated service area within the system. Crews methodically clean one sub-area at a time before moving on to the next. After all sub-areas within a service area have been completed, the cycle restarts at the first sub-area to support continuous, routine system maintenance.

Reliable access to sewer cleanout locations is critical to these operations. While many cleanouts are located within public rights-of-way, some are situated within residential properties. Restricted or obstructed access to these locations can delay maintenance activities and reduce the overall efficiency of the cleaning program.

The jetting process also produces airflow within the sewer system. If a home's plumbing vent pipes are blocked or undersized, this airflow can occasionally cause small amounts of water to be displaced from toilets or drains. As a precaution, residents are encouraged to keep toilet lids closed while sewer cleaning activities are taking place.

The Sewer Utility utilizes a modern closed-circuit television (CCTV) inspection system to evaluate the internal condition of sewer mains and service line connections. The system is equipped with a color, self-propelled camera featuring pan-and-tilt capabilities that allow the camera head to rotate up to 90 degrees in any direction. As the camera travels through the sewer lines, real-time video is transmitted to monitoring and recording equipment housed within a dedicated inspection vehicle.

This technology allows staff to quickly identify structural defects, blockages, and other system deficiencies without the need for excavation. By accurately locating and documenting problem areas, the utility can efficiently determine appropriate corrective measures, reducing disruption, minimizing costs, and improving overall system maintenance and reliability.

The repair crew is responsible for maintaining and repairing sewer mains and associated structures throughout the system. These activities often require deep excavations, with some repairs performed at depths of up to 22 feet. Sewer mains are typically selected for repair after closed-circuit television (CCTV) inspections identify poor structural conditions following a blockage or reveal deficiencies during routine system cleaning.

One of the Sewer Utility's major ongoing initiatives is the rehabilitation of aging sewer infrastructure using cured-in-place pipe (CIPP) technology. This trenchless method involves inserting a flexible liner saturated with resin into the existing sewer main. Steam is then introduced to expand and cure the liner, forming a hardened, seamless pipe within the original structure.

The CIPP process significantly reduces root intrusion, which is a common cause of sewer backups and overflows, and also minimizes inflow and infiltration into the collection system. Compared to traditional open-cut replacement methods, CIPP offers substantial time and disruption savings. Excavating, removing, and replacing approximately 300 feet of sewer main can take two to three weeks, whereas the same length can often be rehabilitated using CIPP in as little as two to three hours, with minimal surface disturbance. The Utility has lined 590,493 linear feet of sanitary sewer pipes, including 452,984 since 2012.

The Columbia Wastewater Treatment Plant (WWTP) is responsible for adequate treatment of wastewater and wastewater biosolids (sludge) by complying with Federal and State standards imposed for effluent discharged to the environment. The WWTP is located at 4900 West Gillespie Bridge Road.



Figure B.3.0 Aerial of the Columbia Wastewater Treatment Plant

Sanitary sewers convey wastewater from residences and businesses throughout the City to the raw wastewater pumping station at the Columbia Wastewater Treatment Plant (WWTP). The majority of wastewater reaches the plant by gravity flow; however, more than 25 pump stations operate throughout the collection system to lift and route flows that cannot be conveyed solely by gravity. Routine sewer cleaning and closed-circuit television (CCTV) inspections are conducted to maintain the condition and reliability of the collection system. Ongoing development within the City continues to expand the system, adding approximately nine miles of sewer mains and 170 sewer structures annually.

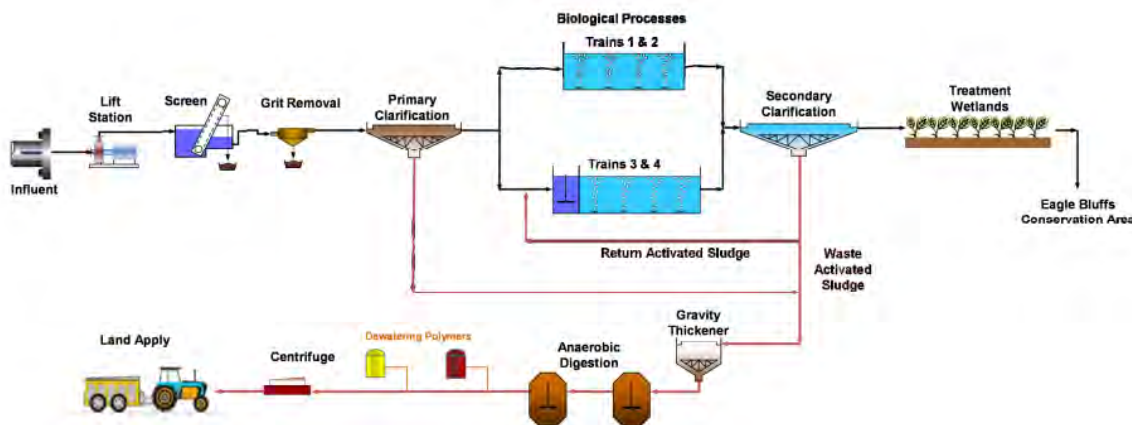


Figure B.3.1 Process Flow Schematic of the Columbia WWTP Process

Upon arrival at the WWTP, wastewater first passes through bar screens located in the Raw Wastewater Pump Building. These screens allow wastewater to pass while removing large debris such as rags, wipes, and other refuse. Screenings are collected and transported to the landfill for disposal. Screened wastewater is then pumped to a hydrocyclone grit separator, where centrifugal forces separate heavier inorganic materials, such as sand and grit, from lighter organic matter. The removed grit is transported to the City landfill for environmentally responsible disposal.

Following screening and grit removal, wastewater flows to the primary settling basins. In these basins, smaller suspended particles settle out of the wastewater by gravity. The clarified primary effluent exits the basins and proceeds to secondary treatment. Mechanical scrapers collect settled solids, known as primary sludge, from the basin bottoms and pump them to anaerobic digesters for further treatment. Floating materials, including grease and scum, are removed by surface skimmers and are likewise conveyed to the anaerobic digesters.

Secondary treatment occurs in aeration basins, where large volumes of air are introduced to a mixture of primary effluent and beneficial microorganisms. These microorganisms consume organic pollutants present in the wastewater. Vigorous mixing of air, activated sludge, and wastewater accelerates biological activity, allowing treatment processes to operate efficiently. Oxygen levels, microorganism concentration, and organic loading are continuously monitored and adjusted to respond to daily variations in influent conditions.

From the aeration basins, wastewater flows to final settling basins, where biological solids settle out of the treated water by gravity. Approximately 90 to 95 percent of the settled activated sludge is returned to the aeration basins to maintain adequate microorganism populations. The remaining 5 to 10 percent, referred to as waste activated sludge, is directed to biosolids treatment.

The treated effluent then travels through a 2.25-mile-long, 72-inch-diameter pipeline to WTU-4, the first of the City's four constructed wetland treatment units located in the McBaine Bottoms, where additional polishing treatment occurs. All treated effluent is ultimately discharged to the Missouri Department of Conservation's Eagle Bluffs Conservation Area. Effluent discharges must meet National Pollutant Discharge Elimination System (NPDES) permit requirements and are monitored daily. The City's in-house laboratory staff performs sampling and analysis to support both process control and regulatory compliance.

Primary sludge from the primary settling basins is pumped directly to the anaerobic digesters. Waste activated sludge from the final settling basins is first thickened using centrifuges, then conveyed to the digesters. Within the digesters, primary and activated sludges undergo anaerobic digestion, a biological process in which microorganisms break down organic material in the absence of oxygen. This process stabilizes the sludge, significantly reduces odors, and meets Environmental Protection Agency requirements for pathogen reduction.

Anaerobic digestion produces methane gas, which is captured and utilized as a renewable energy source. The recovered gas is used as fuel in boilers to heat water, which in turn supplies heat for certain plant buildings and maintains optimal temperatures within the digesters, improving digestion efficiency and gas production.

Following digestion, stabilized sludge, commonly referred to as biosolids, is dewatered and applied to both City-owned and private agricultural land using standard manure-spreading equipment. Biosolids are managed in an environmentally responsible manner as a beneficial fertilizer and soil conditioner. All biosolids application sites are closely monitored, including testing for nutrients, metals, regulated compounds, and fecal coliform bacteria. Soil testing is conducted prior to biosolids application to ensure appropriate nutrient management and environmental protection.

To address Columbia's growing wastewater treatment capacity needs and to protect the water quality of Perche Creek, the City of Columbia constructed a series of wetlands wastewater treatment cells during the 1990s. These constructed wetlands treat wastewater using the same natural processes found in native wetland systems, where biological, physical, and chemical interactions remove nutrients and organic matter. By relying on naturally occurring biological mechanisms, the wetland treatment system provides an effective and environmentally sustainable approach to wastewater treatment.

By the late 1980s, Columbia's growing population was approaching the capacity limits of its existing wastewater treatment facility. In 1987, the City initially proposed a conventional expansion of the treatment plant along with construction of an effluent pipeline to the Missouri River. This approach, however, did not align with community expectations. Residents expressed strong support for a more environmentally sensitive solution. Following additional engineering evaluations, the City adopted an alternative approach that utilized constructed wetlands to provide advanced wastewater treatment.

Constructed wetlands function in a manner similar to natural wetland systems. The roots and stems of wetland vegetation provide surfaces for naturally occurring microorganisms to thrive. Nutrients in the wastewater support plant growth, while organic matter serves as a food source for microorganisms. Through these biological interactions, wastewater is naturally treated as it moves through the wetland system. Unlike natural wetlands, constructed wetlands used for wastewater treatment are engineered to control flow paths and hydraulic loading. They are designed to accommodate a defined volume of wastewater, with wetland size determined by the level of treatment required to return water to the environment without adverse impacts. Treated effluent from the Columbia Wastewater Treatment Plant is conveyed to the constructed wetlands for final polishing, with a combined treatment capacity of 25.2 million gallons per day (MGD).

In 1992, a cooperative groundwater monitoring effort was initiated through a partnership between the City of Columbia, the U.S. Geological Survey (USGS), and the Missouri Department of Conservation. This program monitors groundwater conditions in the McBaine Bottoms surrounding the City's wetland treatment units and within the Eagle Bluffs Conservation Area.

The purpose of this monitoring program is to evaluate long-term water quality trends throughout the McBaine Bottoms, track changes in groundwater conditions near the public water supply well field and conservation lands and provide the City with the information necessary to protect its drinking water resources and ensure continued water quality protection.

The City's constructed wetlands program was initiated following overwhelming voter approval of a bond issue in 1990, which passed with 95 percent support. This approval enabled the City to begin construction of the wetlands in 1991. The constructed wetlands consist of multiple treatment units located along the MKT Trail corridor near Perche Creek and the community of McBaine. Three wetland treatment units were completed in 1994, with a fourth unit added in 2001. Each treatment unit is subdivided into individual cells, allowing maintenance activities to be performed without interrupting treatment operations across an entire unit. Collectively, Columbia's constructed wetlands encompass approximately 130 acres of treatment water surface area.

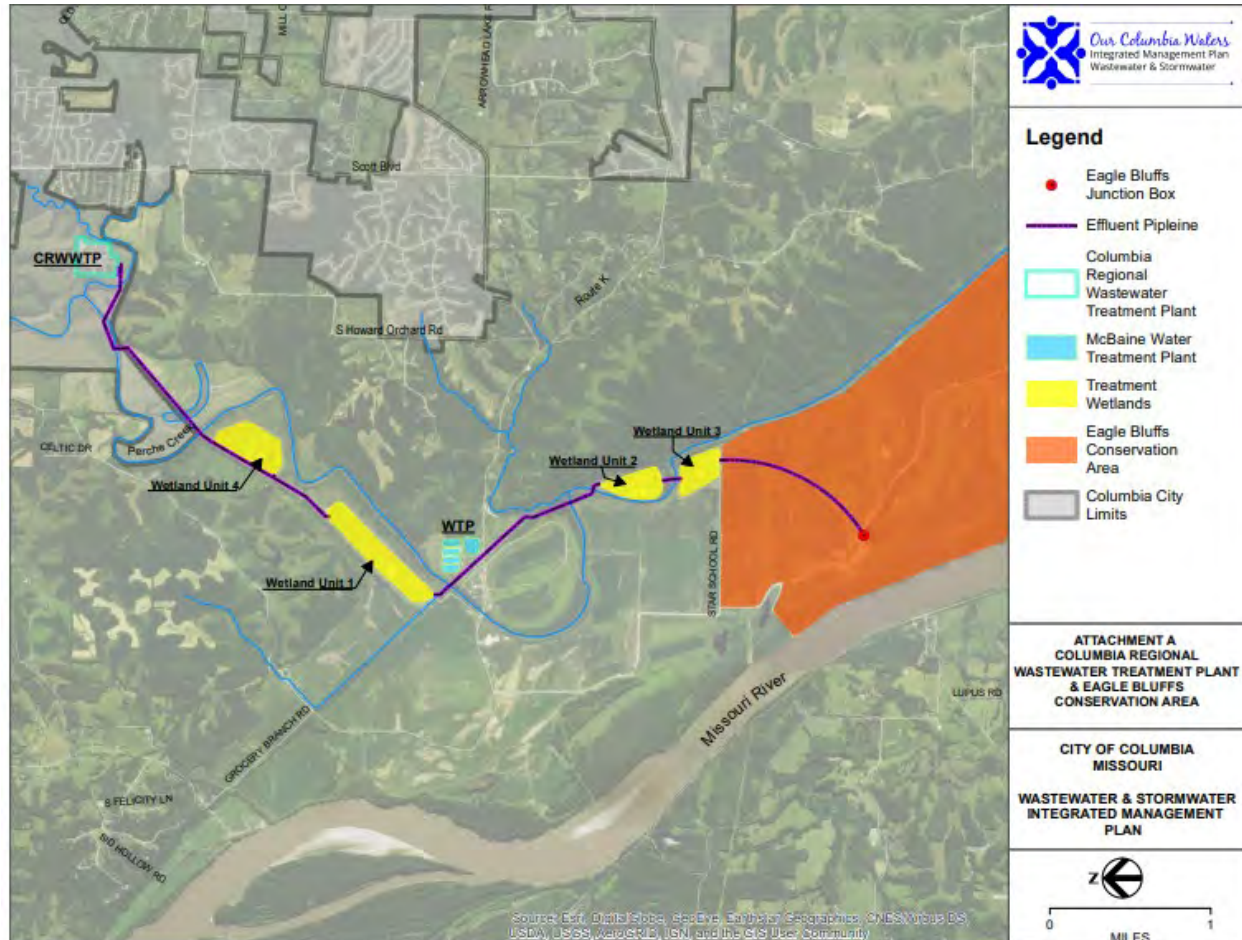


Figure B.3.2 Wetlands Site Plan

Each constructed wetland unit is engineered with a minimum of 12 inches of compacted clay liner to prevent wastewater from leaching into the surrounding soils. This liner is overlain by 6 to 12 inches of topsoil, and cattails are planted throughout the units. Cattails were selected for their ability to thrive in the local climate and their rapid, dense growth characteristics, which enhance treatment performance. To protect the wetlands from flooding associated with the Missouri River, each treatment unit is encircled by flood control berms that are stabilized with grass vegetation.

The combination of Columbia's wastewater treatment plant and constructed wetlands provides sufficient treatment capacity to support anticipated population growth and continued economic development well into the future.

In addition to meeting wastewater treatment needs, treated effluent from the constructed wetlands provides significant environmental benefits through a partnership with the Missouri Department of Conservation (MDC). Under a unique cooperative agreement between the City of Columbia and MDC, the design of the Eagle Bluffs Conservation Area was modified to utilize effluent from the City's constructed wetlands as its primary water source. Eagle Bluffs is located immediately south of the constructed wetlands, bounded by the Missouri River to the west and Perche Creek to the east. MDC acquired the conservation area in 1989 as part of a statewide wetland restoration and management initiative, and the site was completed in 1995. Today, Eagle Bluffs encompasses approximately 4,400 acres of wetlands, including emergent marshes and seasonally flooded moist-soil ponds.

Eagle Bluffs serves as an important educational and recreational resource for the region, offering opportunities for wildlife observation, environmental education, and outdoor recreation.

The constructed and restored wetlands also provide valuable habitat for a wide variety of resident and migratory wildlife species, particularly marsh birds and waterfowl. Bald eagles are frequently observed within the Eagle Bluffs area, making the site a popular destination for bird watchers. The proximity of the MKT and Katy hiking and biking trails further enhances public access and recreational enjoyment of this unique natural resource.

Unlike the electric and water systems, the wastewater system does not have an independent metering system to measure the amount of wastewater sent from the residents and businesses to the wastewater treatment plant. The amount of wastewater is assumed to be the same as the metered water consumption. However, the operations and maintenance of each of these independent utilities contribute to the rate structures used to bill the end users of these utilities. The rates structures and system revenues will be discussed in detail in section D.0 Savings and Revenue Analysis of this report.

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C.0 Proposed System Improvements



C.0 Proposed System Improvements

The graphic below in Figure C.1.1 illustrates the progressive evolution of meter reading technologies, highlighting the industry's transition from labor-intensive manual methods to fully automated Advanced Metering Infrastructure (AMI). This evolution reflects increasing operational efficiency, improved data accuracy, enhanced customer service, and expanded system intelligence for utilities.

Manual meter reading represents the earliest and most traditional approach to utility usage data collection. Under this model, utility personnel physically visit each service location to visually read mechanical register dials and manually record consumption data.

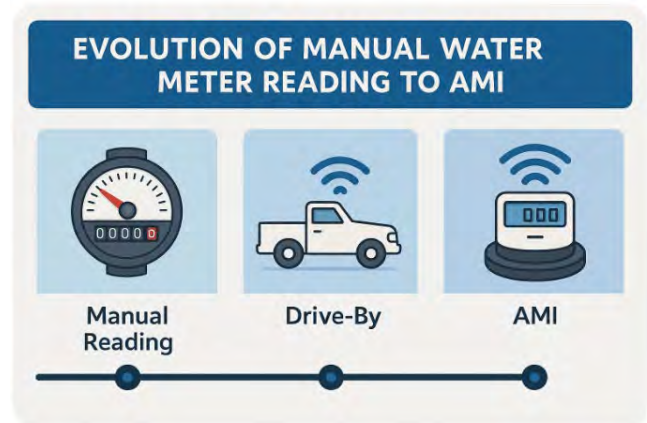
While reliable and straightforward, manual reading is highly labor dependent and introduces several operational limitations. Reading cycles are typically limited to monthly or bi-monthly intervals, resulting in infrequent data points. Access challenges, weather conditions, and human transcription errors can lead to missed or estimated reads. Additionally, manual reading provides little visibility into short-term consumption trends, leaks, or abnormal usage patterns between billing cycles.

Despite these limitations, manual reading laid the foundation for structured billing processes and established baseline practices are still referenced by many utilities today.

Drive-by meter reading represents a transitional step toward automation. In this model, meters are equipped with radio transmitters that broadcast consumption data. Utility staff collect readings by driving through service areas with mobile receiving equipment, eliminating the need to physically access individual meters.

This approach significantly improves workforce productivity and safety while reducing reading time and costs. Drive-by systems allow for more consistent data collection and reduce estimated billing due to inaccessible meters. However, data collection remains periodic and dependent on vehicle routes and schedules. This activity is very costly when compared to the AMI system.

While drive-by reading improves efficiency over manual methods, it does not provide continuous data availability or real-time system insight. Operational awareness remains limited to discrete collection events rather than ongoing monitoring.



Advanced Metering Infrastructure represents the most mature and data-rich stage of meter reading evolution. AMI systems utilize fixed communication networks to automatically transmit meter data at frequent intervals, often hourly or more frequently, directly to utility information systems.

AMI enables near real-time visibility into usage, supporting proactive leak detection, power outages, demand analysis, pressure management, and system optimization. Utilities gain access to high-resolution consumption data that improves revenue assurance, reduces non-revenue water, and enhances emergency response capabilities.

From a customer perspective, AMI supports improved transparency through usage dashboards, alerts, and more accurate billing. For utilities, AMI establishes a foundational platform for smart water initiatives, analytics integration, and long-term infrastructure planning.

The progression from manual reading to drive-by systems and ultimately to AMI reflects a broader shift toward digital transformation in the electric and water sectors. Each stage builds upon the last, increasing automation, data frequency, and operational intelligence. AMI represents not only advancement in meter reading technology but a strategic investment in system resiliency, efficiency, and customer engagement.

C.1 Advanced Metering Infrastructure

Advanced Metering Infrastructure (AMI) refers to an integrated system of smart meters, communication networks, and data management systems that enables two-way communication between utilities and customers. Unlike traditional metering systems, AMI supports automated meter reading, near real-time data collection, remote connect and disconnect capabilities, outage detection, and enhanced billing accuracy. AMI is a foundational technology for modern grid operations, supporting demand response, grid modernization, and improved customer engagement.

The proposed system improvements are broken down into the following categories:

- Advanced Metering Infrastructure (AMI) Network
- Electric Meters
- Water Meters
- Software

Each component will be described in detail below.

C.1.1 AMI Network

Advanced Metering Infrastructure (AMI) systems rely on communication networks to transmit consumption data from field meters to utility head-end systems. The selection of an AMI network type is a critical design decision that directly affects system reliability, scalability, data latency, lifecycle costs, and long-term operational flexibility. AMI network architectures generally fall into several well-established categories, each with distinct characteristics, advantages, and considerations.

Fixed RF mesh networks are one of the most widely deployed AMI communication architectures

in the water industry. In a mesh network, individual meters act as both data Access Points and relay points, transmitting information from meter to meter until it reaches a fixed Access Point or gateway connected to the utility backhaul network.

This architecture provides strong redundancy, as data can dynamically reroute around obstructions or failed devices. RF mesh systems are particularly effective in dense urban or suburban environments where meter density supports multiple transmission paths. Utilities benefit from frequent interval data, high system availability, and reduced reliance on third-party communication services.

However, RF mesh networks require sufficient endpoint density to function optimally and may require supplemental infrastructure in low-density or geographically challenging service areas. Initial capital costs can be higher due to Access Point installation and network planning requirements, but ongoing operating costs are generally stable and predictable.

Cellular AMI networks utilize licensed cellular carrier infrastructure to transmit meter data directly to the utility's head-end system. Each meter or endpoint module communicates independently through a commercial cellular network, typically using LTE-M or NB-IoT technologies optimized for low-power devices.

Cellular networks offer rapid deployment, broad geographic coverage, and minimal utility-owned infrastructure. This model is particularly attractive for rural systems, small utilities, or service territories with irregular meter density. Cellular AMI also supports scalable expansion without the need to deploy additional Access Points or network hardware.

Key considerations include recurring data subscription costs, long-term carrier dependency, and potential variability in coverage quality. While cellular technologies continue to mature, utilities must account for evolving carrier standards and lifecycle alignment between metering assets and communication modules.

Power Line Communication (PLC) networks transmit data over existing electrical power infrastructure, using power lines as the communication medium. PLC is most commonly deployed by electric utilities and is less prevalent in water-only systems unless operated in coordination with an electric utility.

PLC networks benefit from leveraging existing infrastructure, reducing the need for additional RF spectrum or wireless equipment. In integrated water and electric utilities, PLC can provide close alignment between electric and water metering platforms.

However, PLC performance can be affected by electrical noise, network topology, and transformer boundaries. Implementation complexity and limited applicability for standalone water utilities often make PLC a niche solution rather than a primary AMI network choice.

LPWAN technologies, such as LoRaWAN, are increasingly considered for water AMI applications. These networks are designed to support low-bandwidth, long-range communication with minimal power consumption, making them well-suited for battery-powered meters.

LPWAN networks can be utility-owned or hosted by third-party providers. They offer flexible deployment options and are effective in both urban and rural environments. Data transmission intervals are typically less frequent than RF mesh systems, but sufficient for most billing, leak

detection, and operational use cases.

Utilities must carefully evaluate network scalability, security architecture, and vendor ecosystem maturity when considering LPWAN solutions. Proper gateway placement and network design are essential to ensure reliable coverage.

Hybrid AMI networks combine multiple communication technologies to address diverse geographic and operational requirements within a single service territory. For example, a utility may deploy RF mesh in urban areas while using cellular or satellite connectivity in remote or hard-to-reach locations.

Satellite-supported AMI is typically reserved for extremely remote facilities, such as reservoirs, pressure reducing stations, or isolated service connections. While offering near-universal coverage, satellite communication comes with higher costs and longer data latency, making it complementary rather than primary in most deployments.

Hybrid architectures provide flexibility and resilience but require careful system integration and vendor coordination to maintain consistent data management and cybersecurity standards.

AMI network types vary significantly in architecture, cost structure, performance, and operational impact. No single solution is universally optimal; instead, network selection should align with utility-specific factors such as service area density, terrain, staffing resources, long-term asset strategy, and desired data resolution. A thorough evaluation of network options enables utilities to deploy AMI systems that are reliable, scalable, and aligned with both current needs and future smart water initiatives.

The City of Columbia selected the Itron Gen 5 Riva Network for the AMI Infrastructure solution for this project. Figure C.1.1.1 Itron AMI Network below shows how the communication infrastructure and meter components work together to form the AMI network.

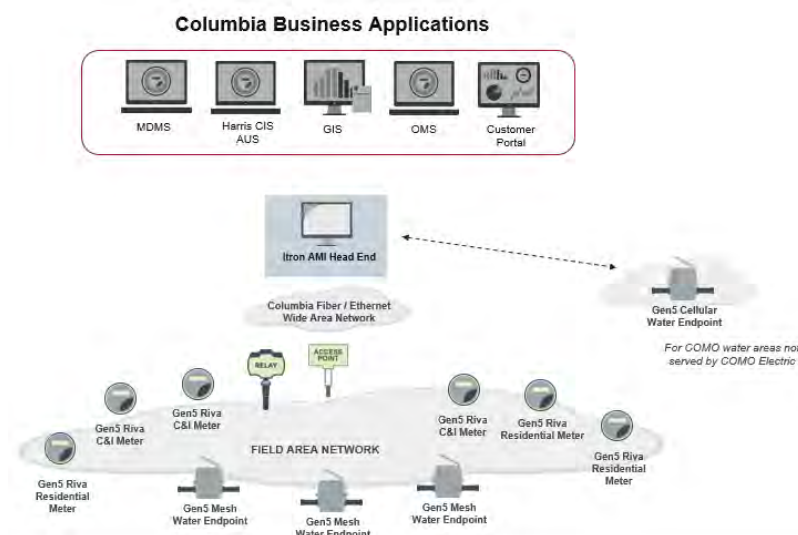


Figure C.1.1.1 Itron AMI Network

The AMI network is customized for the electric and water meter accounts served by the City. The solution consists of a hybrid, mesh and cellular, network. There are areas of the City where the account is water only, as shown in Figure C.1.1.2 below. The **Red** lines show the electric service area. The **Blue** lines show the water service area. These locations would be covered by a cellular endpoint and data transmission would be directly to the Itron AMI Head End.

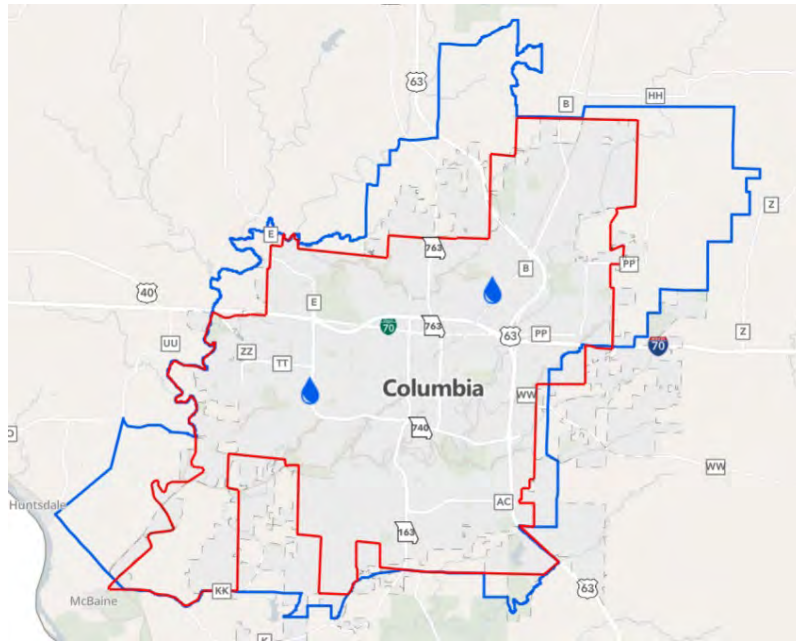


Figure C.1.1.2 Columbia Electric and Water Service Areas

The infrastructure components of this AMI system include the following:

- Access Points (Ethernet)
- Relays (Cellular)
- Socket Access Points (Cellular)
- Endpoints/Transmitters

The Endpoints will be discussed in the Electric and Water Meter sections below.

C.1.1.1 Access Points (Ethernet)

The Itron Access Point 5 (AP 5) provides the central network resource for delivering data generated by endpoint devices at the network edge and IT/OT systems—enabling high-performance applications, network control, and monitoring. Its flexible communication features extend the reach and coverage of the network to thousands of customer sites, and it supports up to 5,000 endpoints per access point. The AP 5 offers multiple paths to each endpoint device through sophisticated mesh network routing that ensures greater reliability and redundancy. The following Table C.1.1.1.1 provides the specifications for the Access Point 5. The key features of the Access Point are as follows;



- Up to 2400 Kbps data speeds
- 10 ms latency (10-millisecond delay)
- Open standards-based two-way communications and interfaces
- IPv6; IEEE 802.15.4g, Wi-SUN compatible
- Ethernet and cellular WAN options including 4G LTE
- Dynamically adaptive data rates to ensure maximum performance while ensuring backwards compatibility
- Integrated, open standards-based security
- Public key-based authentication and AES-256 encryption (*The gold standard for data security and is currently considered virtually unbreakable*)
- Increased system performance and data throughput
- 900 MHz radio
- 32 MB RAM and 32 MB flash

Table C.1.1.1 Access Point Specifications

Communications	Data rate: 50 to 2400 Kbps Frequencies: 902-928 MHz or 860-880 MHz Spread spectrum technology: FHSS Modulation: FSK, OFDM – adaptive gear shifting Transmitter output: 900 MHz–30 dBm (1 W), 870 MHz (500 mW ERP) Output impedance: 50 ohms WAN: Cellular, Ethernet, and Satellite Cellular — 4G LTE
Protocols/Security	Addressing: Internet Protocol version 6 (IPv6) Security: Secure Hash Algorithm 256 bit (SHA-256) and RSA-1024 or ECC-256 Encryption: Advanced Encryption Standard (AES-128 or AES-256)
Physical Interfaces	Antenna connectors: N Type, Female
Power	Power Input range: 96 to 277 VAC, 50 to 60 Hz
Environmental	Operating temperature: -30°C to +70°C (-22°F to +158°F) Humidity: 0% to 95%, non-condensing
Mechanical	Cellular/Ethernet: Dimensions: 35.0 cm (13.78") L x 21.1 cm (8.32") W x 9.2 cm (3.62") H Weight: 4.4 kg (9.8 lb) Enclosure: IP65, white, aluminum Access Point 5.0 does not have an active 2.4 GHz radio. It is recommended that the provided weatherproof cap be installed on the unused 2.4 GHz antenna port
Mounting Kit Options	Wooden pole Concrete pole Light pole Wall
Approvals	FCC: Part 15.247 Industry Canada: RSS-247 EU: ETSI EN 303 204
Memory	32 MB/32 MB Flash/RAM

C.1.1.2 Relays (Cellular)

The Relay 5 works with the AP 5 to deliver data generated by endpoint devices at the network edge and IT/OT systems— enabling high performance applications, network control and monitoring. Its flexible communication features extend the reach and coverage of the network. The Relay 5 provides multi-hop capability between Itron-enabled endpoint devices and the AP 5 for seamless integration. The following Table C.1.1.2 provides the specifications for the Relay 5. The key features of the Relay are as follows;



- Up to 2400 Kbps data speeds
- 10 ms latency
- Open standards-based two-way communications and interfaces
- IPv6; IEEE 802.15.4g, Wi-SUN compatible
- Increased system performance and data throughput
- 900 MHz radio
- » 32 MB RAM and 32 MB flash

Table C.1.1.2 Relay Specifications

Communications	Data rate: 50 to 2400 Kbps Frequencies: 902-928 MHz or 860-880 MHz Spread spectrum technology: FHSS Modulation: FSK or OFDM - adaptive gear shifting Transmitter output: 900 MHz - 1 W, 870 MHz - 500 mW ERP Output impedance: 50 ohms
Protocols/Security	Addressing: Internet Protocol version 6 (IPv6) Security: Secure Hash Algorithm 256 bit (SHA-256) and RSA-1024 or ECC-256 Encryption: Advanced Encryption Standard (AES-128 or AES-256)
Physical Interfaces	Antenna connectors: N Type, Female
Power	Power Input range: 96 to 277 VAC, 50 to 60 Hz
Environmental	Operating temperature: -40°C to +85°C (-40°F to +185°F) Humidity: 0% to 95%, non-condensing
Mechanical	Dimensions: 35.0 cm (13.78") L x 21.1 cm (8.32") W x 9.2 cm (3.62") H Weight: 3.67 kgs (8.1 lbs) Enclosure: IP65, white, aluminum Relay 5.0 does not have an active 2.4 GHz radio. It is recommended that the provided weatherproof cap be installed on the unused 2.4 GHz antenna port
Mounting Kit Options	Wooden pole Concrete pole Light pole Wall
Approvals	FCC: Part 15.247 Industry Canada: RSS-247 EU: ETSI EN 303 204
Memory	32 MB/32 MB Flash/RAM

C.1.1.3 Socket Access Points (Cellular)

The Itron SocketAP 5 provides the central network resource for delivering data generated by endpoint devices at the network edge and IT/OT systems, thereby enabling high performance applications, network control, and monitoring. Its flexible communication features extend the reach and coverage of the network to hundreds of customer sites which dramatically lowers network infrastructure costs. The SocketAP 5 offers multiple paths to each endpoint device through sophisticated mesh network routing that ensures greater reliability and redundancy. The key features for the SocketAP 5 are listed below:



- Up to 2400 kbps data speeds
- As low as 10-millisecond latency
- Open standards-based two-way communications and interfaces
- IPv6; IEEE 802.15.4g, Wi-SUN compliant
- 4G LTE cellular backhaul
- Dynamically adaptive data rates to ensure maximum performance while ensuring backwards compatibility
- Integrated, open standards-based security
- Public key-based authentication and AES-256 encryption
- Increased system performance and data throughput
- 900 MHz radio
- 32 MB RAM and 32 MB flash

Table C.1.1.3 Socket Access Point Specifications

Communications	Data rate: 50-2400 kbps Frequency: 902-928 MHz Spread spectrum technology: FHSS Modulation: FSK, OFDM — adaptive gear shifting Transmitter output: 900 MHz-30 dBm Output impedance: 50 ohms WAN — Cellular- 4G LTE FCC ID: QWS-NIC511-LTE
Protocols/Security	Addressing: Internet Protocol version 6 (IPv6) Security: Secure Hash Algorithm 256 bit (SHA-256) and RSA-1024 or ECC-256 Encryption: Advanced Encryption Standard (AES-128 or AES-256)
Physical Interfaces	1 mesh antenna connector SMA, Female 1 cell antenna connector SMA, Female
Power	Power Input range: 96 to 277 VAC, 50 to 60 Hz
Environmental	Operating temperature: -30°C to +70°C (-22°F to +158°F) Humidity: 0% to 95%, non-condensing Indoor/Outdoor UL50, IP65, and exceeds NEMA 3R
Mechanical	Dimensions: 9.6" x 4.8" x 8.4" (LxWxH) Weight: 4 lbs, 9 oz
Meter forms supported	Ringed or Ringless 1S, 2S, 12S/25S, 16S, 6S/9S/36S This product is designed for ANSI Meter sockets and is intended for the North America market
Battery Backup	Built-in battery with 15-year life provides 10 minutes of backup power

Table C.1.1.3.1 provides the specifications for the Socket Access Point.

C.1.2 Electric Meters

The electric meters for this project are separated into groups as follows:

- Residential / Light Commercial
- Poly-Phase

Each meter class will be described below.

C.1.2.1 Residential / Light Commercial Electric Meters

In addition to providing full smart meter functionality, each Gen5 Riva Meter is embedded with robust Distributed Intelligence (DI) capability that processes and analyzes data in real time at the edge to provide insights to more accurately control and manage the grid. Harness a unified, intelligently connected network platform with DI to unlock new applications in smart energy, water and communities. Itron's DI platform utilizes an app store model, similar to a smart phone. This ensures rapid, continuous innovation, choice, and new value across a broad ecosystem of apps from multiple vendors. This model offers significant Return On Investment improvements along with the ability to easily add additional smart utility and city use cases as business needs evolve. The key features of this electric meter includes:



- Energy Quantities
 - Watt hours (Wh): delivered, received, unidirectional, net
 - Volt-ampere hours (VAh): delivered, received, net
 - Volt-ampere reactive (VARh): delivered, received, net, Q1, Q2, Q3, Q4
- Automated Meter Reading
 - Receive and transmit meter billing data including interval data, register reads
 - Transmit recorded events and exceptions with each interval to the head-end software, which interprets them and logs appropriate messages (such as time adjustments)
- Demand Measurement
 - Max Watts Delivered, Received, Net, and Uni-directional
 - Max VA Delivered, Received
 - Max VAR Delivered, Received, Net, Q1, Q2, Q3, Q4
 - Min Power Factor Delivered, Received

- Real-Time Meter Event and Alarm Retrieval
 - Automated alarms received by the head-end system via e-mail to a specific user or group of users
 - Automated data and alarms deliverable from DI applications
- Remote Disconnect/Reconnect
 - Support integrated disconnect switch
 - Perform remote disconnects/reconnects through the system
- Integration & Installation
 - Fully integrated solution under-the-cover allows for plug and play installation in the field
 - Shipped from the factory as one complete unit, ready for field deployment
- Technical Data
 - Meets applicable standards:
 - ANSI C12.1 – 2008 (American National Standard for Electricity Meters – Code for Electricity Metering)
 - NSI C12.20 – 2010 (American National Standard for Electricity Meters – 0.2 and 0.5 Accuracy Classes)
 - ANSI/IEEE C62.45 – 2002 (Guide to Surge Testing on Low-Voltage AC Power Circuits)
 - ANSI MH 10.8 – 2005 Specification for Bar Code
 - ANSI ASQZ 1.4 – 2008 Sampling Procedures and Tables for Inspection by Attributes
 - IEC 61000-4-2 2008
 - IEC 61000-4-4 2012
 - IEEE C37.90.1 – 2004 SWC Surge Testing
 - IEEE C62.45 Recommended Practice on Surge Testing for Equipment Connected to Low Voltage (1000V or less) AC Power Circuits C62.45 2002
 - NEMA SG-AMI 1 – 2009 Requirements for AMI Meter Upgradeability
 - UL 2735
- Radio Specifications
 - Radio Output Power: 1W

- Profiles
 - Supports three independent profiles:
 - Load Profile – 16 channels and programmable to support 5, 10, 15, 30 or 60-minute intervals
 - Instrumentation Profile – 16 channels and programmable to support 5, 10, 15, 30 or 60-minute intervals
 - Voltage Profile – 16 channels and programmable to support 5, 10, 15, 30 or 60-minute intervals
- Distributed Intelligence Data
 - Voltage and current waveforms
 - Sub-second RMS voltages and currents
 - Per second directional per phase Wh, VARh
 - Per second directional per phase W, VAR
 - Per second per phase VAh, VA
 - Per second temperature
- Time of Use
 - 8 rates plus Total
 - 25-year DST calendar
 - 50 Holidays/Special days
- Arc Detection
 - Meters support the ability to detect micro-arcing at the meter socket
- Power Outage Notification (PON)
 - Standard – 25 second hold up (10 second momentary filter + 15 second transmit window). Meter transmits only its own PONs during 15s window.
 - Extended Last Gasp – 75 second hold up (60 second momentary filter + 15 second receive/transmit window). Meter transmits its own PON and receives/transmits neighboring PONs during 15s window.

The Residential / Light Commercial meters are available in the following forms, voltage, class and amp ratings.

Table C.1.2.1.1 Residential / Light Commercial Electric Meter Size Availability

Meter Form	Volt Service	Meter Class	Test Amps	Register Description
1S	120v	200	30	Gen5 RF with or without Disconnect
2S	240v	200	30	Gen5 RF with or without Disconnect
12S	120v	200	30	Gen5 RF with or without Disconnect
25S	120v	200	30	Gen5 RF with or without Disconnect
2S	240v	320	50	Gen5 RF without Disconnect
12S	120v	320	50	Gen5 RF without Disconnect
25S	120v	320	50	Gen5 RF without Disconnect

Table C.1.2.1.2 provides the specifications for these meters.

Table C.1.2 1.2 Residential / Light Commercial Electric Meter Specifications

Power Requirements	Voltage Rating: 120V, 240V Operating Voltage: $\pm 20\%$ (60Hz) Frequency: 60Hz ($\pm 3\text{Hz}$) Battery Voltage: 3.6 V nominal
Operating Environment	Temperature: -40° to $+85^{\circ}\text{C}$ Humidity: 0% to 95% relative humidity
Transient/Surge Suppression	IEC 61000-4-4-2004-07 ANSI C62.45-2002
Accuracy	ANSI C12.20 0.5 accuracy class
General	Energy calculation: Bi-directional (Wh, VAh, VARh and VARh Q1-Q4))
Time Reference When Off Network	Network sync: Network time Line sync: Power line frequency Crystal sync
Display	Eight-digit liquid crystal display Six-digit data height: 10.16 mm Annunciator height: 2.24 mm Display duration: 1-15 seconds Two-digit code number height: 6.01 mm Four-segment electronic load emulator
Operating System	Linux
IP Rating	54

C.1.2.2 Poly-Phase Electric Meters

In addition to providing full electric smart meter functionality for commercial & industrial (C&I) customers, each Gen5 Riva Polyphase Meter is embedded with robust Distributed Intelligence capability that processes and analyzes data in real time at the edge to provide insights to control and manage the grid more accurately. Improve grid efficiency, reliability and safety while transforming customer service and adapting to an evolving energy landscape. The key features of this electric meter includes:

- Flexible Two-Way Communications
 - Bi-directional Distributed Intelligence applications



- Execute all supported meter reading, configuration update and firmware download functionality
 - Customize targeted meter firmware updates
 - Support on-demand readings from the meter
- Upgradable Firmware
 - Customize firmware upgrades with the ability to automatically roll-back if activation fails
 - Create multiple firmware images including primary and pending
- Bi-Directional Metering
 - Store received and delivered data metrics in the meter
 - Support customers who own renewable energy facilities or participate in vehicle to grid systems with real-time data being sent back to the utility
- Energy Quantities
 - Wh (total and per phase) Delivered, Received Net and Uni-Direction
 - VARh (total and per phase) Delivered, Received and Net
 - VARh Q1-Q4
 - VAh (total and per phase) Delivered, Received and Net
- Demand Measurements
 - Max Watts (total and per phase) Delivered,
- Net and Uni-Directional
 - Max VAR (total and per phase) Delivered,
- Received and Net
 - Max VA (total and per phase) Delivered and Received
 - Max VAR Q1, Q2, Q3, Q4
 - Min Power Factor Delivered and Received
- Automated Meter Reading
 - Receive and transmit meter billing data including interval data, register reads
 - Transmit recorded events and exceptions with each interval to the head-end software, which interprets them and logs appropriate messages (such as time adjustments)

- Real-Time Meter Event and Alarm Retrieval
 - Automated alarms received by the head-end system via e-mail to a specific user or group of users
- Tamper Detection
 - Detect and report exceptions for events such as magnetic fraud attacks
 - Communicate tamper indications in real time through the system
- Option Availability
 - Manual demand reset
 - 2 KYZ and 1 KY Output
- Integration & Installation
 - Fully integrated solution under-the-cover allows for plug and play installation in the field
 - Shipped from the factory as one complete unit, ready for field deployment
- Profiles
 - Supports three independent profiles:
 - Load Profile – 16 channels and programmable to support 5, 10, 15, 30 or 60-minute intervals
 - Instrumentation Profile – 16 channels and programmable to support 5, 10, 15, 30 or 60-minute intervals
 - Voltage Profile – 16 channels and programmable to support 5, 10, 15, 30 or 60-minute intervals
- Distributed Intelligence Data
 - Voltage and current waveforms
 - Sub-second RMS voltages and currents
 - Per second directional per phase Wh
- Time of Use
 - 8 rates plus Total
 - 25-year DST calendar
 - 50 Holidays/Special days
- Arc Detection
 - Meters support the ability to detect micro-arcing at the meter socket

- Power Outage Notification (PON)
 - Standard Feature – 15 second last gasp
 - Optional Feature – 75 second extended last gasp
- Meets applicable standards:
 - ANSI C12.1 – 2008 (American National Standard for Electricity Meters – Code for Electricity Metering)
 - NSI C12.20 – 2010 (American National Standard for Electricity Meters – 0.2 and 0.5 Accuracy Classes)
 - ANSI/IEEE C62.45 – 2002 (Guide to Surge Testing on Low-Voltage AC Power Circuits)
 - ANSI MH 10.8 – 2005 Specification for Bar Code
 - ANSI ASQZ 1.4 – 2008 Sampling Procedures and Tables for Inspection by Attributes
 - IEC 61000-4-2 2008
 - IEC 61000-4-4 2012
 - IEEE C37.90.1 – 2004 SWC Surge Testing
 - IEEE C62.45 Recommended Practice on Surge Testing for Equipment Connected to Low Voltage (1000V or less) AC Power Circuits C62.45 2002
 - NEMA SG-AMI 1 – 2009 Requirements for AMI Meter Upgradeability
 - UL 2735

The Poly-Phase meters are available in the following forms, voltage, class and amp ratings.

Table C.1.2.2.1 Poly-Phase Meter Size Availability

Forms	Class	Elements	Wires	Voltage	Test
1S	100	1	2	120v-480v	15
2S	200	1.5	3	120v-480v	30
2S	320	1.5	3	120v-480v	50
3S	20	1	2	120v-480v	2.5
4S	20	2	3	120v-480v	2.5
9S (8S)	20	3	4	120v-480v	2.5
9S (8S)/36S	20	3	4/3	120v-480v	2.5
45S/5S	20	2.5	3	120v-480v	2.5
12S	200	2	3	120v-480v	30
12S	320	2	3	120v-480v	50
16S (14S, 15S, 17S)	200	3	4	120v-480v	30
16S (14S, 15S, 17S)	320	3	4	120v-480v	50

The specifications for the Poly-Phase meters are shown in Table C.1.2.2.2 Poly-Phase Specifications below.

Table C.1.2.2.2 Poly-Phase Specifications

Power Requirements	Voltage rating: 120v-480v Frequency: 60 Hz (50 Hz) Operating voltage: $\pm 20\%$ (60Hz); $\pm 10\%$ (50 Hz) Operating range: ± 3 Hz Battery voltage: 3.6 V nominal Battery operating range: 3.4 V-3.8 V
Operating Environment	Temperature: -40° to +85°C Humidity: 0% to 95% relative humidity
Transient/Surge Suppression	IEC 61000-4-4-2004-07 ANSI C62.45-2002
Accuracy	ANSI C12.20 0.2 accuracy class
General	Demand calculation: Block or Rolling Energy calculation: Bi-directional (Wh, VAh, VARh and VARh Q1-Q4))
Time Reference When Off Network	Line sync: Power line frequency Crystal sync: 5.8 PPM @ 25°C; 110 PPM over full temperature range
Display	Eight-digit liquid crystal display Six-digit data height: 10.16 mm Annunciator height: 2.24 mm Display duration: 1-15 seconds Two-digit code number height: 6.01 mm Three-segment electronic load indicator
Operating System	Linux

C.1.3 Water Meters

Unlike the electric meter that has the communication device embedded in the meter, the water meter requires an endpoint to communicate with the network. This section covers the following:

- Endpoints / Transmitters
- Water Meters

C.1.3.1 Endpoints / Transmitters

Itron does not produce a water meter. However, they are compatible with most of the major water meter manufacturers on the market. The City has selected the Badger E-Series 9-Dial meter for this project. The following table shows the Itron compatible endpoints for this meter.

Table C.1.3 1 Itron / Badger Compatibility Matrix

Register model	Meter model	Hardware revision	Firmware revision	Size from	Size to	Meter type	Compatible Encoder ERTs by group
ADE4	Any meter that accepts ADE registers			All	All	All	A, E, F, G, H, I
ADE 6 dial	E-Series			All	All	UltraSonic	A, E, F, G, H, I
ADE 9 dial	E-Series			All	All	UltraSonic	F, H, I
HR E LCD16	Any meter that accepts HR E registers		12	All	All	All	A, E, F, G, H, I
HR E Mechanical 8 dial	Any meter that accepts HR E registers			All	All	All	F, H, I
HR E Mechanical 6 dial	Any meter that accepts HR E registers			All	All	All	A, E, F, G, H, I
ADE	M500022 Mag Meter			All	All	All	A, E, F, G, H, I

The selected ERT for this project is the “I” model in the Badger/Itron compatibility matrix and shown below.

I	500W Pit Module	ERW-1601-001
	500W Remote Module	ERW-1601-002

Gen5 500W Encoder Receiver Transmitter (ERT) Modules offer advanced two-way communications designed for Itron’s Gen5 solution as well as Itron’s industry-leading mobile solutions. Gen5 500W ERT Modules enable easy migration from mobile to network operations as your business needs evolve.

The key functions of the Gen5 500W ERT Modules are as follows:

- Functional Specifications
 - Power Source: Four or two “A” cell lithium batteries warranted for 20 years.
 - Maximum meter register pulse frequency. (pulse version only): 4 Hertz
 - Operating temperature: -40°F to +158°F (-40°C to +70°C) for remote applications.
 - -4°F to +140°F (-20°C to +60°C) for pit applications.
 - Storage temperature: -40°F to +158°F (-40°C to +70°C) for a maximum of 1,000 hours.
 - Humidity limits: 0 to 100% (submersible).
 - Maximum register cable dimension: 300 feet with Itron-approved cable and splice connectors.
- Minimum Software Required for Gen5 Network Operation
 - Gen3, Gen4, or Gen5 Constantly Powered Device (CPD) hardware with firmware 5.0
 - UtilityIQ® 4.15
 - Itron Security Manager (ISM) 4.2
 - Field Deployment Manager (FDM) 4.3
- Programming Mode Options
 - Gen5 500W network mode should be chosen when being read by a Gen5 network. Output power is +27 dBm.
 - 100W mobile mode should be chosen when being read by legacy mobile readers.
- Mobile Meter Reading Compatibility
 - Field Collection System (FCS) 4.2.3
 - Itron Mobile 2.2



- Mobile Collection 3.8.2
- Battery Life and Design Life
 - All 500W ERT Modules are designed for a 20-year total life.
- Operational
 - All 500W ERT Modules operate without the need for an FCC or IC license.
 - Data integrity: Verified in every message.
- Physical
 - All 500W ERT Modules have encapsulated electronics for protection against environmental hazards and tampering. All 500W ERT Module housings are made of gray polycarbonate.

As mentioned in Section B.2.3 Water Generation and Distribution System Field Conditions, there are meters located outside in meter pits and inside residences and businesses. This project will include a combination of pit and wall mount (remote) endpoints based on the location of the water meter.

C.1.3.1 Water Meters

The next generation E-Series G2® Ultrasonic meter uses solid-state technology in a compact, tamper protected, weatherproof and UV-resistant housing, suitable for residential applications. Electronic metering provides information—such as rate of flow and status and alarm indication—and data not typically available through traditional, mechanical meters and registers. Electronic metering minimizes measurement errors due to sand, suspended particles and pressure fluctuations. The key features of the E-Series meter includes the following:



- Flow tube design prevents obstruction of flow, and provides greater turn-down ratio for extended flow ranges and increased revenue
- No moving parts for increased performance and maximized revenue
- Easy-to-read, 9-digit LCD display for consumption, rate of flow, unit of measure, pressure, temperature, alarm conditions (reverse-flow, no usage, empty pipe, exceeding max flow, suspected leak, pressure*, temperature, end of life and measurement error) and firmware version
- High resolution industry standard ASCII encoder protocol sends alarms and data to ORION® endpoints and BEACON® Software as a Service (SaaS) suite to establish a smart water solution for better visibility and management
- Pressure* and temperature data and alarms reported at meter and through ORION endpoints and BEACON SaaS

- Field programmable registration and maintains an hourly internal logging capacity of 160 days of data
- Maximum flow reporting analytics available to improve meter right sizing and monitor irrigation events
- Single and dual outputs include encoder, scaled/unscaled, 4-20 mA and BadgerTouch® (TRPL)

* available with optional integrated pressure sensor

As water flows into the measuring tube, ultrasonic signals are sent consecutively in forward and reverse directions of flow. Velocity is then determined by measuring the time difference between the measurement in the forward and reverse directions. Total volume is calculated from the measured flow velocity using water temperature and pipe diameter.

The LCD screen toggles to total volume, unit of measure, rate of flow, pressure*, temperature, firmware and alarm conditions (reverse-flow, no usage, empty pipe, exceeding max flow, suspected leak, pressure*, temperature, end of life and measurement error).

The specifications for the E-Series meters are shown in the tables below. Table C.1.3.1.1 Small Meter Sizes 5/8" to 1", Table C.1.3.1.2 Intermediate Meter Sizes 1.5" to 2", and Table C.1.3.1.3 Large Meter Sizes 3" to 8".

Table C.1.3.1.1 Small Meter (5/8" to 1") Specifications

E-Series G2 Ultrasonic	5/8 in.	5/8 x 3/4 in.	3/4 in. (7-1/2 in.)	3/4 in. (9 in.)*	1 in.
Normal Test Flow Limits	0.08...30 gpm (0.02...6.81 m ³ /hr)	0.08...30 gpm (0.02...6.81 m ³ /hr)	0.10...35 gpm (0.02...7.95 m ³ /hr)	0.10...35 gpm (0.02...7.95 m ³ /hr)	0.16...62 gpm (0.04...14.08 m ³ /hr)
Minimum Test Flow Limits	0.04 gpm (0.009 m ³ /hr)	0.04 gpm (0.009 m ³ /hr)	0.04 gpm (0.009 m ³ /hr)	0.04 gpm (0.009 m ³ /hr)	0.075 gpm (0.017 m ³ /hr)
Safe Maximum Operating Condition (SMOC)	30 gpm (6.81 m ³ /hr)	30 gpm (6.81 m ³ /hr)	35 gpm (7.95 m ³ /hr)	35 gpm (7.95 m ³ /hr)	62 gpm (14.08 m ³ /hr)
Typical Pressure Loss	3 psi @ 15 gpm (0.21 bar @ 3.4 m ³ /hr)	2.6 psi @ 15 gpm (0.18 bar @ 3.4 m ³ /hr)	4.2 psi @ 25 gpm (0.29 bar @ 5.7 m ³ /hr)	4.2 psi @ 25 gpm (0.29 bar @ 5.7 m ³ /hr)	4.1 psi @ 40 gpm (0.28 bar @ 9.1 m ³ /hr)
Residential Fire Service Applications**	—	—	3/4 in. (7-1/2 in.)	3/4 in. (9 in.)	1 in.
UL Approval for Residential Fire Service Meters - File No. EX15653	NA	NA	UL 327B	UL 327B	UL 327B
UL Test Flow Limits (at ±1.5% accuracy)	NA	NA	2...30 gpm (0.45...6.81 m ³ /hr)	2...30 gpm (0.45...6.81 m ³ /hr)	2...50 gpm (0.45...11.36 m ³ /hr)
Typical UL Pressure Loss	NA	NA	3 psi @ 25 gpm (0.29 bar @ 5.7 m ³ /hr)	3 psi @ 25 gpm (0.29 bar @ 5.7 m ³ /hr)	4.1 psi @ 40 gpm (0.28 bar @ 9.1 m ³ /hr)
Normal Test Flow Limits	NA	NA	0.50...35 gpm (0.11...7.95 m ³ /hr)	0.50...35 gpm (0.11...7.95 m ³ /hr)	0.16...62 gpm (0.04...14.08 m ³ /hr)
Minimum Test Flow Limits	NA	NA	0.04 gpm (0.009 m ³ /hr)	0.04 gpm (0.009 m ³ /hr)	0.075 gpm (0.017 m ³ /hr)
Safe Maximum Operating Condition (SMOC)	NA	NA	35 gpm (7.95 m ³ /hr)	35 gpm (7.95 m ³ /hr)	62 gpm (14.08 m ³ /hr)

Table C.1.3.1.2 Intermediate Meter (1.5" to 2") Specifications

E-Series Ultrasonic Residential Fire Service Certified under UL 327B Residential Fire Service Meters - File No. 15653, Control No. 4DP3	1-1/2 in. (40 mm)	2 in. (50 mm)
AWWA C715 Normal Test Flow Limits ($\pm 1.5\%$ accuracy)	1.25...100 gpm (0.28...22.7 m ³ /hr)	1.5...160 gpm (0.34...36.3 m ³ /hr)
Minimum Test Flow Limits ($\pm 3\%$ accuracy)	0.40 gpm (0.09 m ³ /hr)	0.50 gpm (0.11 m ³ /hr)
Safe Maximum Operating Condition (SMOC)	100 gpm (22.7 m ³ /hr)	160 gpm (36.3 m ³ /hr)
UL 327B Normal Test Flow Limits ($\pm 1.5\%$ accuracy)	3...100 gpm	4...160 gpm
Typical Pressure Loss	3.8 psi (0.26 bar)	5.2 psi (0.36 bar)
Reverse Flow, Maximum Rate	12 gpm (2.73 m ³ /hr)	18 gpm (4.09 m ³ /hr)
Operating Performance	In the normal temperature range of 45...122° F (7...50° C), new meter consumption measurement is accurate to: • $\pm 1.5\%$ over the normal flow range • $\pm 3.0\%$ from the extended low flow range to the minimum flow value	
Storage Temperature	-40...140° F (-40...60° C)	
Maximum Ambient Storage (Storage for One Hour)	150° F (66° C)	
Measured-Fluid Temperature Range	34...140° F (1...60° C)	
Humidity	0...100% condensing	
Maximum Operating Pressure of Meter Housing	175 psi (12 bar)	
Register Type	Straight reading, permanently sealed electronic LCD; digits are 0.28 in. (7 mm) high	
Register Display	• Consumption (up to nine digits) • Rate of flow • Alarms (empty pipe, temperature, exceeding max flow, sensor error, reverse flow, suspected leak, 30 day no usage, end of life) • Unit of measure factory programmed for gallons, cubic feet and cubic meters	
Register Capacity	• 100,000,000 gallons • 10,000,000 cubic feet • 1,000,000 cubic meters	
Totalization Display Resolution	• Gallons: 0.X • Cubic feet: 0.XX • Cubic meters: 0.XXX	
Battery	3.6-volt lithium thionyl chloride; battery is fully encapsulated within the register housing and is not replaceable; 20-year battery life	

Table C.1.3.1.3 Large Meter (3" to 8") Specifications

E-Series G2 Ultrasonic Meter Size	2 in.		3 in.		4 in.		6 in.		8 in.
	2 × 10 in. (51 × 254 mm)	2 × 17 in. (51 × 432 mm)	3 × 12 in. (76 × 305 mm)	3 × 17 in. (76 × 432 mm)	4 × 14 in. (102 × 356 mm)	4 × 20 in. (102 × 508 mm)	6 × 18 in. (152 × 457 mm)	6 × 24 in. (152 × 610 mm)	8 × 20 in. (203 × 508 mm)
Normal Test Flow Limits	0.70–260 gpm		0.75–560 gpm		1.5–1100 gpm		2.2–2000 gpm		4–3500 gpm
Minimum Test Flow Limits	0.35 gpm		0.37 gpm		0.75 gpm		1.1 gpm		2.0 gpm
Safe Maximum Operating Condition (SMOC)	260 gpm		560 gpm		1100 gpm		2000 gpm		3500 gpm
Typical Pressure Loss	4 psi @ 220 gpm	4.8 psi @ 220 gpm	2.6 psi @ 350 gpm		2.1 psi @ 630 gpm		1.5 psi @ 1400 gpm	1.8 psi @ 1400 gpm	2.4 psi @ 2800 gpm
Totalization Display Resolution	2 inch, 3 inch, 4 inch meters - Gallons: 0.1 - Cubic feet: 0.01 - Cubic meters: 0.001						6 inch, 8 inch meters - Gallons: 1.0 - Cubic feet: 0.1 - Cubic meters: 0.01		
Operating Performance	In normal temperature range of 45 to 122 °F (7 to 50 °C), new meter consumption measurement is accurate to: 100% ±1.5% over the normal test flow limits 100% ±3.0% for the minimum test flow limits								
Storage Temperature	–40 to 140 °F (–40 to 60 °C)								
Maximum Ambient Storage (Storage for One Hour)	150 °F (66 °C)								
Measured Fluid Temperature Range	34 to 140 °F (1 to 60 °C)								
Humidity	0–100% condensing; meter is capable of operating in fully submerged environments								
Maximum Working Pressure of Meter Housing	175 psi (12 bar)								
Maximum Operating Pressure of Pressure Sensor	175 psi (12 bar)								
Pressure Sensor Accuracy	±2% of full scale pressure, up to 175 psi (12 bar)								
Register Type	Straight reading, permanently sealed electronic LCD; digits are 0.28 in. (7 mm) high								
Register Display	- Consumption (up to nine digits) - Rate of flow - Alarms - Pressure					- Temperature - Firmware version - Unit of measure factory programmed for gallons, cubic feet and cubic meters			
Scaled/Unscaled Output*	Solid-state relay with 4–20mA output; open drain MOSFET with encoder output								
Max. Voltage	30V DC								
Current	100 mA								
Pulse Width	50 ms (programmable 25–100 ms)								
Analog 4–20 mA Output*	Two-wire/passive								
Input Voltage Range	9–50V DC supply								
Current	4–20 mA								
Max. Load Resistance (Ohms)	50 Ohms + 50 Ohms (supply voltage – 9V)								
Battery	3.6-volt lithium thionyl chloride battery is fully encapsulated within the register housing and is not replaceable. 20-year battery life; 15-year battery life for dual output meters								

NOTE: See Pressure Loss Chart on page 4 for typical pressure loss over complete UL 327B flow range.

* Applicable to meters with dual output options

C.1.4 AMI Software

Advanced Metering Infrastructure (AMI) software enables two-way communication between utility meters and enterprise systems, providing timely, granular consumption and operational data. While the core AMI platform is shared, its benefits manifest differently for electric and water utilities based on operational needs, regulatory drivers, and asset characteristics. In both sectors, AMI software serves as a foundational technology for operational efficiency, system reliability, customer engagement, and long-term infrastructure planning.

AMI software eliminates manual meter reading and supports remote service functions such as connects, disconnects, and voltage monitoring. By reducing field visits and enabling automated workflows, electric utilities lower operating costs, improve crew safety, and increase workforce productivity. Additionally, automated data validation improves billing accuracy, reducing customer disputes and revenue leakage.

For water utilities, AMI software significantly reduces labor and vehicle costs associated with manual meter reading, particularly in hard-to-access or geographically dispersed service territories. Remote meter reads also improve staff safety and operational efficiency. Automated reads and data checks improve billing accuracy and reduce estimated usage, helping address customer trust and revenue stability.

Electric AMI software provides high-resolution interval data that improves load forecasting, system planning, and power quality monitoring. Integration with outage management systems (OMS), distribution management systems (DMS), and geographic information systems (GIS) enables a comprehensive, real-time view of grid conditions, supporting faster decision-making and proactive maintenance.

Water AMI software delivers detailed consumption data that enhances visibility into system demand, seasonal usage patterns, and network performance. Integration with customer information systems (CIS) and asset management platforms allows water utilities to better understand system behavior, prioritize infrastructure investments, and manage limited water resources more effectively.

AMI software plays a critical role in improving electric system reliability by providing outage detection, last-gasp notifications, voltage alarms, and restoration confirmation. These capabilities accelerate outage identification, improve crew dispatch accuracy, and reduce restoration times. Post-event analytics using AMI data help utilities identify chronic problem areas and strengthen grid resilience.

While water utilities do not experience outages in the same manner as electric systems, AMI software provides event detection capabilities such as continuous flow alarms, pressure anomalies, and service interruptions. These insights enable faster identification of main breaks, service disruptions, or abnormal consumption events, reducing water loss and minimizing service impacts to customers.

AMI software enables advanced demand-side management programs, including time-of-use (TOU) rates, critical peak pricing, and automated demand response. Access to interval data allows electric utilities to influence customer behavior during peak periods, reduce system stress, defer capital investments, and support renewable energy integration.

For water utilities, AMI software supports conservation initiatives by providing detailed usage data that helps identify excessive consumption and inefficiencies. Interval data enables customer outreach programs, drought response measures, and tiered rate structures designed to encourage responsible water use and long-term resource sustainability.

AMI software improves transparency by providing customers with timely, detailed usage information through online portals and mobile applications. Customers benefit from faster outage notifications, more accurate bills, and personalized energy insights. These capabilities enhance customer satisfaction while reducing inbound call volumes and operational burden on customer service teams.

Water customers benefit from improved visibility into daily and hourly water usage, enabling early detection of leaks, running fixtures, or irrigation system issues. Proactive alerts and accurate billing strengthen customer trust and reduce high-bill complaints. Improved communication and transparency enhance public perception and customer satisfaction.

Electric AMI software includes analytics to detect non-technical losses such as energy theft, meter tampering, and billing inconsistencies. Early identification of abnormal usage patterns enables targeted investigations, protecting revenue and improving system integrity.

For water utilities, AMI software is a powerful tool for identifying non-revenue water losses caused by leaks, meter inaccuracies, or unauthorized usage. Continuous flow and leak detection features allow utilities to reduce water loss, recover revenue, and extend asset life by identifying issues early.

AMI software provides a scalable platform that supports advanced grid initiatives, including distributed energy resources (DERs), electric vehicle (EV) integration, advanced distribution management systems (ADMS), and smart grid automation. As the electric grid grows more complex, AMI software serves as a core data and analytics foundation.

For water utilities, AMI software supports long-term modernization efforts such as condition-based maintenance, pressure management, and data-driven capital improvement planning. The platform enables a transition from reactive to predictive operations while supporting future analytics and automation initiatives.

Advanced Metering Infrastructure software delivers significant, sector-specific benefits for both electric and water utilities. Electric utilities gain enhanced grid visibility, reliability, and demand management capabilities, while water utilities benefit from improved conservation, leak detection, and non-revenue water reduction. Across both sectors, AMI software improves operational efficiency, strengthens customer engagement, and establishes a scalable foundation for continued system modernization. As utilities face increasing operational, financial, and regulatory pressures, AMI software is a strategic investment that delivers long-term value.

The AMI Software components included in this project are as follows:

- Itron UIQ (Electric and Water Meter Reading Head-End)
- Harris SmartWorks Compass
- Harris Advanced Utility Systems (Billing Software)
- My Meter AMI Customer Portal (Harris/VertexOne)

The Figure below shows the communication paths between the software packages.

Architecture Overview

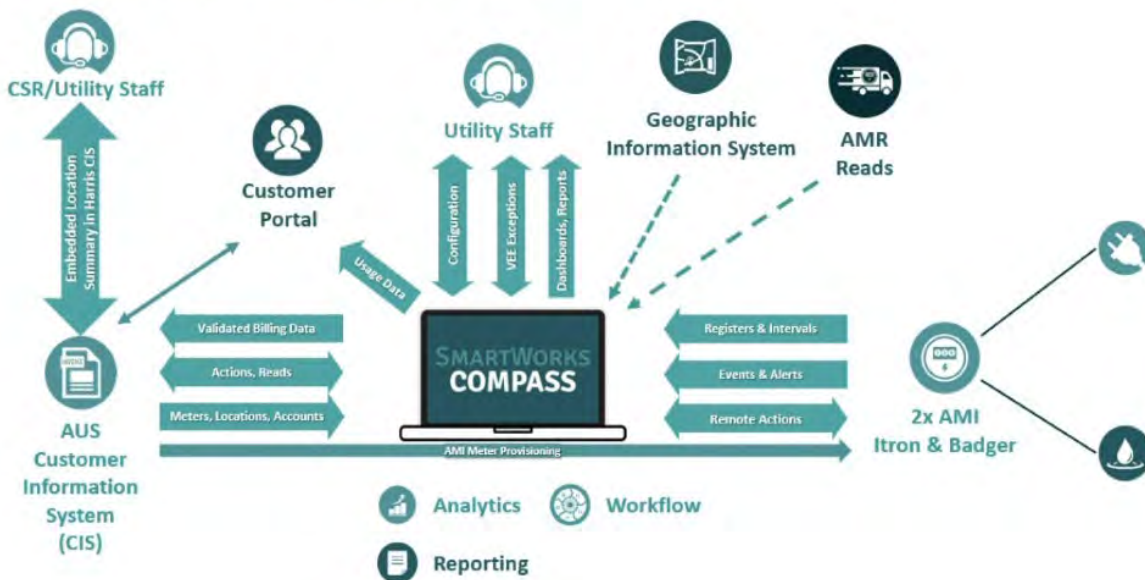


Figure C.1.4.1 Software Architecture Overview

Each component will be discussed in detail below.

C.1.4.1 Itron UIQ (Electric and Water Meter Reading Head-End)

The Itron Utility IQ Software has multiple components required in order to read the electric and water meters in the system. These components are listed below:

- Itron Communication Tester
- Itron Utility IQ (Electric and Water)
 - Advanced Metering Manager
 - Firmware Upgrader
 - Meter Program Configuration

C.1.4.1.1 Itron Communications Tester

The Communications Tester is an Itron software tool that, in conjunction with a Field Service Unit (FSU), is used for field and lab testing of devices equipped with Itron NICs that communicate across the mesh network. Communications Tester enables engineers and technicians to transmit and receive messages to and from these devices, log the data, and analyze the results. For example, operators can perform register reads, firmware upgrades, and they can read meter tables, check configuration options, collect radio frequency statistics data, and exercise other troubleshooting features. Communications Tester also supports user-created compound commands, session logging, and results export.

The FSU communicates wirelessly with UtilOS firmware-enabled electricity meters, Access Points (APs), Relays, and devices such as Gas Interface Management Units (IMUs), streetlight controllers, and Bridges that have Itron NICs installed.

The Communications Tester and the FSU can be used anywhere in the deployment area—from a vehicle or on foot—to communicate with any Itron device.



Communications Tester performs the following basic tasks:

- Transmits messages through the FSU to the destination device and receives messages from devices through the FSU (See the figure below).
- Provides tools for logging and analyzing received messages.
- Performs a range of radio frequency, configuration, and network diagnostic tests, including register reads and firmware upgrades.

C.1.4.1.2 Itron Utility IQ (Electric and Water)

The UtilityIQ® head-end system is a suite of software applications designed to fully manage the AMI solution. The head end supports electricity, gas and water devices and has everything needed to manage the network, read schedules, events, endpoint configurations, administration and reporting. The modules included in this project are described below.

- Advanced Metering Manager

Part of the UtilityIQ® AMI application suite, Advanced Metering Manager (AMM) supports full meter provisioning and reading as well as on-demand tasks such as pinging and remote service operations. Maximize infrastructure investment with an automated, reliable and scalable utility network. Measure, collect and analyze energy usage and improve communications with customers, suppliers and service providers, whether you distribute electricity, gas or water services. With AMM and network-enabled meters, two-way real-time networking becomes cost-effective for the mass deployment of Advanced Metering. As part of Itron's implementation of an IP-based smart grid network, AMM is part of a multi-application network that meets the future bandwidth and latency requirements of utilities. It can virtually eliminate human error and maximize efficiencies through automation, innovative rate structures, rapid response to outages, improved security monitoring and increased reliability.

By creating a two-way connection with customers, your system can respond in the utility's best interests while accommodating customer preferences. AMM can change usage patterns in response to changes in price or peak-demand periods, letting all stakeholders collaborate in demand response programs to maximize cost efficiencies and reduce energy consumption.

By enabling real-time, automated monitoring of the distribution network for increasing efficiency, AMM improves system responsiveness, promotes conservation and isolates outages before a single customer calls, making it a more reliable network overall. Gain enhanced control over all activity across the entire distribution system.

AMM lets utilities read all major types and varieties of electricity, water and gas meters remotely and efficiently on configurable schedules. It manages meter data for value billing, operations, demand response, marketing, load forecasting and customer service. Securely accessed by an intuitive Web-based interface or advanced web APIs, AMM supports remote disconnect/reconnect services, Demand Reset and Meter Program Management. Realtime, on-demand readings and “pings” enable customer service personnel to extend immediate support for billing inquiries and outage/restoration.

- Firmware Upgrader

Firmware Upgrader, a software application within the application suite, allows utilities to upgrade the firmware on NICs, Access Points, Relays, Bridges and partner meters. Itron updates firmware images to incorporate new functionality, and the Firmware Upgrader supports three primary features:

- Upload a firmware image to the application and add important metadata.
- Distribute a firmware image to a set of specified devices, install the new firmware and verify that the installation was successful.
- Audit the firmware version of network devices on a regular basis to ensure compliance.

Firmware Upgrader analyzes the network and automatically optimizes the upgrade for speed and efficiency. The upgrade process is designed to use minimal network bandwidth and to avoid interference with routine operations such as regular meter reading. During firmware distribution, the communication channel between the Firmware Upgrader and each NIC or device is encrypted using AES-256 and is authenticated using Hashed Message Authentication Check (HMAC) for non-repudiation. The system manages the process of installing the new firmware, which includes verification of the image and automatic reversion to the previously running firmware version if errors are detected in the upgraded firmware.

- MPC (Over the air meter programming)

Recognizing the need to program and configure a broad range of meters at scale, Itron provides the Meter Program Configurator (MPC). Part of Itron’s AMI suite, MPC enables wireless, remote programming of electricity meters on a mass scale. MPC operates in two primary programming types: Programming of Itron network interface cards (NICs) in energy-only digital meters and native (e.g., C12.19, DLMS/COSEM) programming for advanced digital meters.

With programming of NICs, each program is created and modified in MPC. The following program attributes can be created or edited:

- Data log channels and associated sources
- Self-read enable / disable
- Self-read channels and sources
- Self-read offset time
- Interval width

With native programming (for example, using C12.19 tables) MPC stores, distributes, and executes program and configuration changes on each meter. Native meter programs are composed in the meter manufacturer's software and imported into MPC. Each program is then distributed across the Itron network and installed on each target meter.

Meter Program Configurator tracks meter configuration jobs as projects. Each project consists of a configuration file, a specific list of meters, and a project runtime configuration. Meter Program Configurator provides a way to control which meters are reprogrammed and when, allowing utilities to easily track meters and their associated programs. Without rolling a single truck, utilities can use Meter Program Configurator to reprogram millions of meters in response to the dynamic energy environment, rapidly introduce new initiatives, and respond to changes in customer demand. Meter Program Configurator helps utilities streamline their operations and increase operational efficiencies.

When Meter Program Configurator successfully configures and validates a meter with a new program, it automatically notifies Advanced Metering Manager (AMM) of the change. In addition, the meter re-initializes and sends its program to AMM for verification and approval. Because AMM received the program change directly from MPC, it automatically approves the new initializing meters.

C.1.4.2 Harris SmartWorks Compass

SmartWorks Compass is a utility decision management solution that delivers the benefits of smart infrastructure investments to electric, water and gas utilities. Comprised of robust analytics, metrics, visualization and automation tools, SmartWorks Compass enables utilities to maximize return on investments in their smart infrastructure by seamlessly converting massive volumes of data into powerful insights and automated actions.

SmartWorks Compass is designed specifically to improve *decision yield*, a metric formally defined as the combination of precision, consistency, speed, agility and cost in making decisions. This entails rapid integration with multiple systems for source data, deep analytics to assess conditions, automation to execute the required actions and visualization of metrics to show quantified results.

In addition to improving the effectiveness and efficiency of the Customer Service organization, SmartWorks Compass can directly engage the customer by serving up usage data via web

portal technology. This empowers the customer with information presented either through the utility's own web page or through a separate portal, resulting in reduction in calls and call times for your CSR department. SmartWorks Compass plays a significant role in enabling price response through TOU rates or critical peak pricing while it can also be used to monitor conditions and initiate direct load control.

The modules included in this project are described below.

C.1.4.2.1 Meter Sense Meter Data Management (MDM)

MeterSense is a comprehensive Meter Data Management (MDM) system that gathers data from multiple meter data collection systems, cleanses the data, provides long term storage with robust audit trail of any changes to data and delivers billing determinants as required. The system makes this data available for support of Customer Services processes. Where needed, MeterSense validates the installation and provision of smart metering in order to identify problems before they affect your business.

MeterSense incorporates the following, where configured:

- System Interfaces (quoted specific to the project) for:
 - Synchronization with CIS or other system of record for meter, location, and other information
 - Import of meter data from AMI and/or meter data collection systems
 - Delivery of billing determinants
- Validation, Estimation and Editing (VEE)
 - Configurable routines to identify gaps and fill with estimates based on configurable layered techniques, using historical data or standard class profiles, where needed
 - Configurable routines to identify bad data and replace with estimates
 - Audit trail of all changes to the data
 - Exception handling processes that allow users to investigate discrepancies, with supporting information placed at their fingertips
 - Intelligent routines to identify usage patterns that warrant further investigation, e.g. continuous consumption or threshold-based monitoring
- Reporting & Analysis for meter data
 - Meter data reports
 - Event reporting

The solution focuses on streamlining the following core functions:

- AMI Deployment Support

Assesses new meters as they are deployed as assets, checking that they are delivering data and are provisioned correctly. Problems are identified before they start affecting your business.

- AMI Health & Performance

Assess data delivered by AMI for completeness and accuracy. Tracks the numbers of reads and measures them against any service level commitments from the AMI vendor.

- VEE / Billing Support

Cleanses the incoming meter data to ensure high quality data for billing and analysis. Calculates billing determinants and delivers those determinants to the Customer Information System for billing.

- Customer Service Support

Places data at the fingertips of Customer Service personnel so that they are equipped to handle incoming customer calls, reducing call times and increasing first call resolution.

Key AMI analysis features, subject to AMI data availability:

- Map View with filtering and color coding
- Meter Communication Route
- Dependent Meters
- Meters with Most Dependents
- Color Coding Access Points by Number of Meters
- Color Coding Meters by Number of Hops
- View Access Points on Map
- Meters with Intermittent Dependents
- Meters per Access Point Report
- Long Hop Report

C.1.4.2.2 KPI Dashboard

The Key Performance Indicator (KPI) Dashboard provides a snapshot view of distribution system performance within one or more configurable, personalized screens. It enables utilities to monitor and easily share information regarding operations and processes. The KPI Dashboard is equipped with many KPIs and multiple dashboards out of the box. These standards dashboards utilize data that is readily accessible in SmartWorks Compass.

Utilities and their consultants are able to extend the KPI Dashboards by collecting data from other systems and creating new KPIs and new dashboards. This could include data from any accessible system, e.g. CIS, MDM, SCADA, OMS.

The KPI Dashboard calculates key metrics based on the data, tracks how those metrics change over time, and monitors the results against key thresholds. Metrics are displayed through powerful visualization tools that enable utilities to drill down and view the detailed underlying data; explore the root cause of any significant changes; and view trends through a movie / time lapse feature. It also enables utilities to easily share information with others so that utilities can react quickly by mobilizing resources.

Key features:

- Graphical dashboard display of KPIs
- Drillable links to underlying data and metrics
- Time lapse / movie view of key metrics over time
- Scheduled KPI reports at regular intervals
- Share KPIs (on a scheduled- or exception-basis)

C.1.4.2.3 VEE Acceptance Prediction

MeterSense MDMS dramatically improves the quality of data by processing every single interval through its comprehensive Validating, Estimation and Editing (VEE) routines. The VEE process selectively fills gaps and fixes data anomalies based on user configuration and also selectively presents certain validation exceptions for manual review, again based on user configurable parameters. Register and Intervals reads are processed through an extensible validation engine for validating, editing, and estimating data received from the AMI. VEE can be customized along multiple lines of categorization, including down to the individual meter level. Data is stored both in its raw, incoming form and its cleansed, processed form, with an audit trail of any changes.

MeterSense enables the multi-threaded processing of meter read data. Rather than scheduling the processing once per day as a batch job, the VEE Job Scheduler is a daemon process that runs 24x7 and handles all VEE in the system. In cases where meter data is delivered more in real time via the MultiSpeak interval data interface, or even in near-real time via frequent file delivery, this design makes validated meter data available for downstream processing (such as billing or web presentment) much sooner than it was previously.

C.1.4.2.4 Transformer Load Analysis

The SmartWorks Transformer Loading Analysis module continually analyses loads on distribution transformers and identifies those at risk of failure, resulting in improved system reliability and better asset utilization. “What-if” scenario planning determines the optimum replacement size for overloaded transformers, and helps determine if existing transformers have sufficient capacity for newly constructed locations.

The system performs a complex set of calculations and analysis, yet presents the results in a simple, intuitive fashion. The algorithms have a thoroughly researched and generally useful set of default parameters, but also permit a high degree of flexibility for advanced users. Power factor

corrections, load growth adjustments, optimal operating band definitions and even notification settings are all easily configured to produce results that are the most meaningful to the utility.

Key features:

- Improved System reliability with reduced downtime & reduced restoration costs
- Increased customer satisfaction
- Reduce physical losses by operating transformers within their optimal loads
- Reduce asset costs by right-sizing underutilized transformers.

C.1.4.3 Harris Advanced Utility Systems (Billing Software)

Harris Advanced Utility Systems (AUS) is a specialized utility billing and customer information software provider serving public and private utilities. Operating as a division of Harris Computer Systems, AUS focuses exclusively on solutions that support utility billing, customer service operations, and revenue management. Since its founding in 1997, the company has developed software tailored to the operational, regulatory, and customer service requirements of utility organizations across North America and the Caribbean.

The primary objective of Harris Advanced Utility Systems is to support the meter-to-cash process for utility providers. This includes capturing consumption data, calculating charges, issuing bills, managing customer accounts, processing payments, and supporting collections activities. The software is designed to improve billing accuracy, operational efficiency, and customer engagement while ensuring compliance with regulatory and reporting standards.

AUS solutions are built specifically for utilities rather than generalized financial or enterprise systems, allowing them to accommodate complex rate structures, service types, and billing scenarios unique to the utility industry.

The City will be contracting directly with Harris Advance Utility Systems for this project.

C.1.4.4 My Meter AMI Customer Portal (Harris / VertexOne)

MyMeter® by VertexOne is a digital customer engagement and self-service platform developed for electric, water, and gas utilities. The solution is designed to enhance communication between utilities and their customers by providing secure, online access to account information, billing data, and consumption insights. Rather than functioning as a billing engine, MyMeter operates as a front-end portal that integrates with a utility's existing Customer Information System (CIS) and metering infrastructure.

The primary purpose of MyMeter is to improve the customer experience by increasing transparency, accessibility, and convenience. The platform allows customers to independently manage many routine interactions with their utility, thereby reducing reliance on call centers and in-person service counters. For utilities, MyMeter supports customer engagement strategies, operational efficiency, and proactive communication.

MyMeter is commonly deployed as part of a broader digital transformation initiative, where utilities

seek to modernize how customers interact with billing, usage data, and service notifications.

MyMeter is a cloud-hosted solution accessible through standard web browsers as well as native mobile applications. Its responsive design enables consistent functionality across desktops, tablets, and smartphones, ensuring customers can access information at any time and from any device.

Security and data privacy are central to the platform's design. Customer information is protected through secure authentication, and only relevant data is exposed to end users through the portal's interface.

MyMeter provides customers with access to historical and near-real-time consumption data, depending on the utility's metering technology. Usage is displayed in graphical and comparative formats that help customers understand trends, identify high-consumption periods, and make informed decisions about energy or water use.

Customers can view current and past bills, review billing details, and submit payments electronically. Additional options often include enrollment in paperless billing, automatic payment programs, and access to bill history, all of which promote timely payments and reduce administrative overhead for utilities.

The platform enables users to manage core account details such as contact information, service locations, and multiple accounts under a single login. This self-service functionality improves customer convenience while minimizing routine service requests handled by utility staff.

MyMeter by VertexOne is a customer engagement and self-service solution that enhances transparency, convenience, and communication between utilities and their customers. By integrating with existing billing and metering systems, MyMeter allows utilities to modernize the customer experience without disrupting core operations. Its focus on usage visibility, digital billing, and proactive communication makes it a valuable tool for utilities seeking to improve service delivery, reduce operational costs, and support long-term customer satisfaction.

The City will be contracting directly with MyMeter / VertexOne for this project.

City of Columbia, Missouri
Investment Grade Audit

D.0 Implementation of the Proposed System Improvements



D.0 Implementation of the Proposed System Improvements

The implementation of the Proposed System Improvements will be described in detail below. The project scope of work will be broken down into the following components:

- Advanced Metering Infrastructure (AMI) Network
- Electric Meters
- Water Meters
- Software
- Training
- Construction Schedule

D.1 Advanced Metering Infrastructure

Ameresco worked with Columbia Water and Light and the Itron team to develop an AMI system solution for this project. Itron used the list of electric and water accounts provided by the City to develop a propagation study. This study determines the ideal locations for each of the Access Points and Relays. For this project, the Socket Access Points will be used to fill in any gaps during the construction phase of the project where an Access Point or Relay does not provide the adequate number of hops per node.

The following assumptions were used to develop the propagation study:

- Access Points and Relay antennas will be installed at City stated heights or a minimum of 8 meters above ground level
- Access Points and Relays will be installed with 3 dBi omni-directional antennas
- City will provide ethernet connections for all Access Points. In the case where ethernet connections are not available in a timely manner, the City will provide cellular cards
- Relays and any required Socket Access Points will require cellular service connections
- All water meters will use through-the-lid mounting kits with RF friendly lids and have the ability to hop through each other
- Meter hop counts were limited to a maximum of 13 hops in the RF model
- Access Points and Relays will be installed with battery packs
- The RF spectrum is 902-928 MHz
- Radio power output is 1 watt

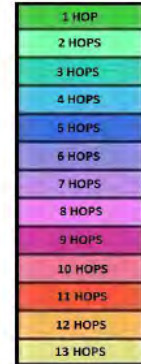
- RF Propagation model uses Landsat data at 10-meter resolution
- There are 5,051 water meters outside of the mesh network area that will utilize the Cellular 500w endpoint

Access Point

The following maps show the results of the propagation study which includes:

- Access Points (Ethernet) = 23
- Relays (Cellular) = 29
- Socket Access Points (Cellular) = 11

The Access Point and Relay equipment will be supplied by Ameresco. The City has elected to install the equipment at the designated locations identified by the propagation study. This includes any power requirements and the ethernet backhaul.



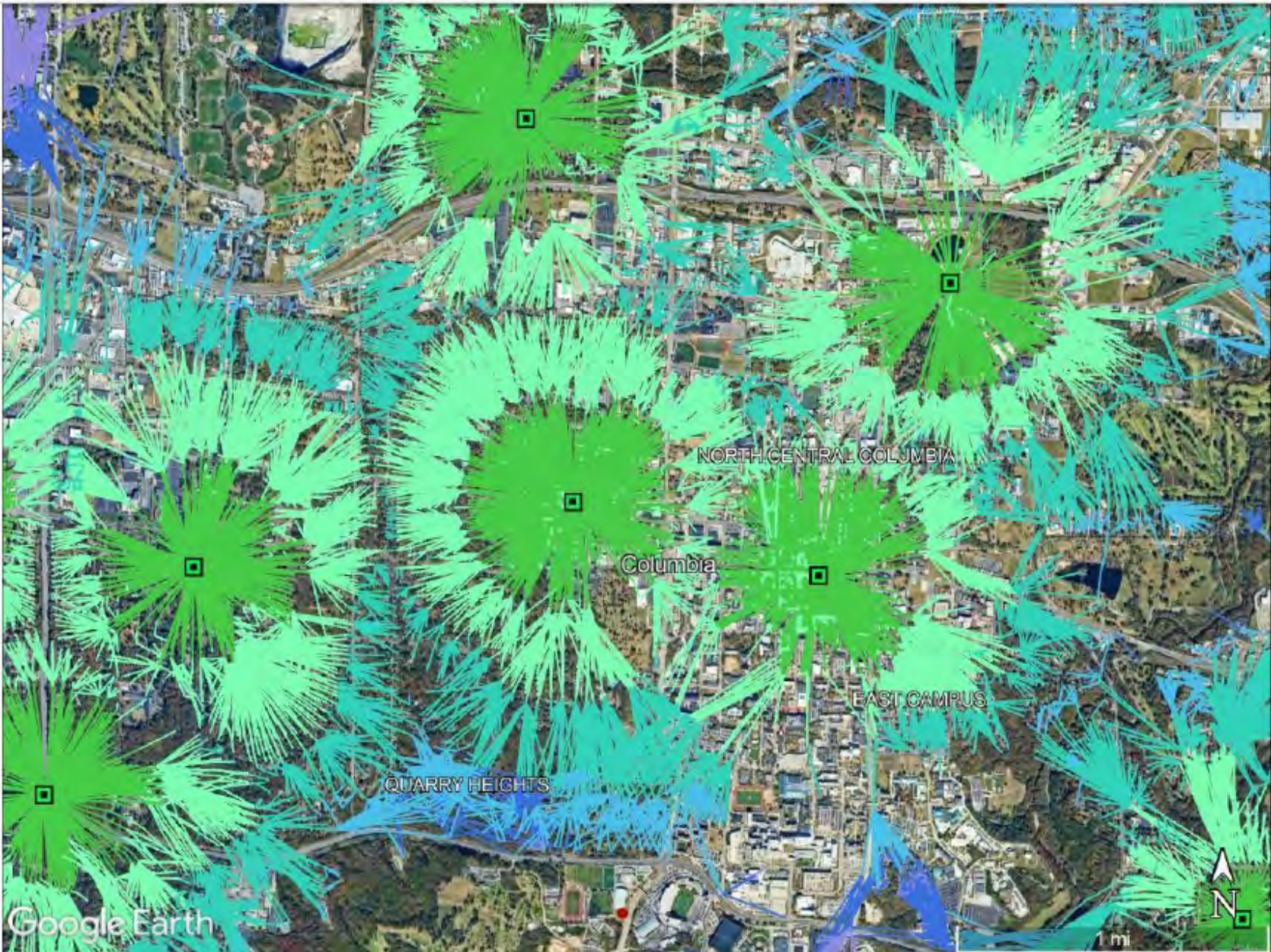
Columbia Water and Light staff will be installing the Access Points and Infrastructure for this project. The City will be responsible for site surveys and installing network equipment in accordance with the standard installation manual and Itron specifications at locations and elevations specified in the Field Network Design document. This includes the following:

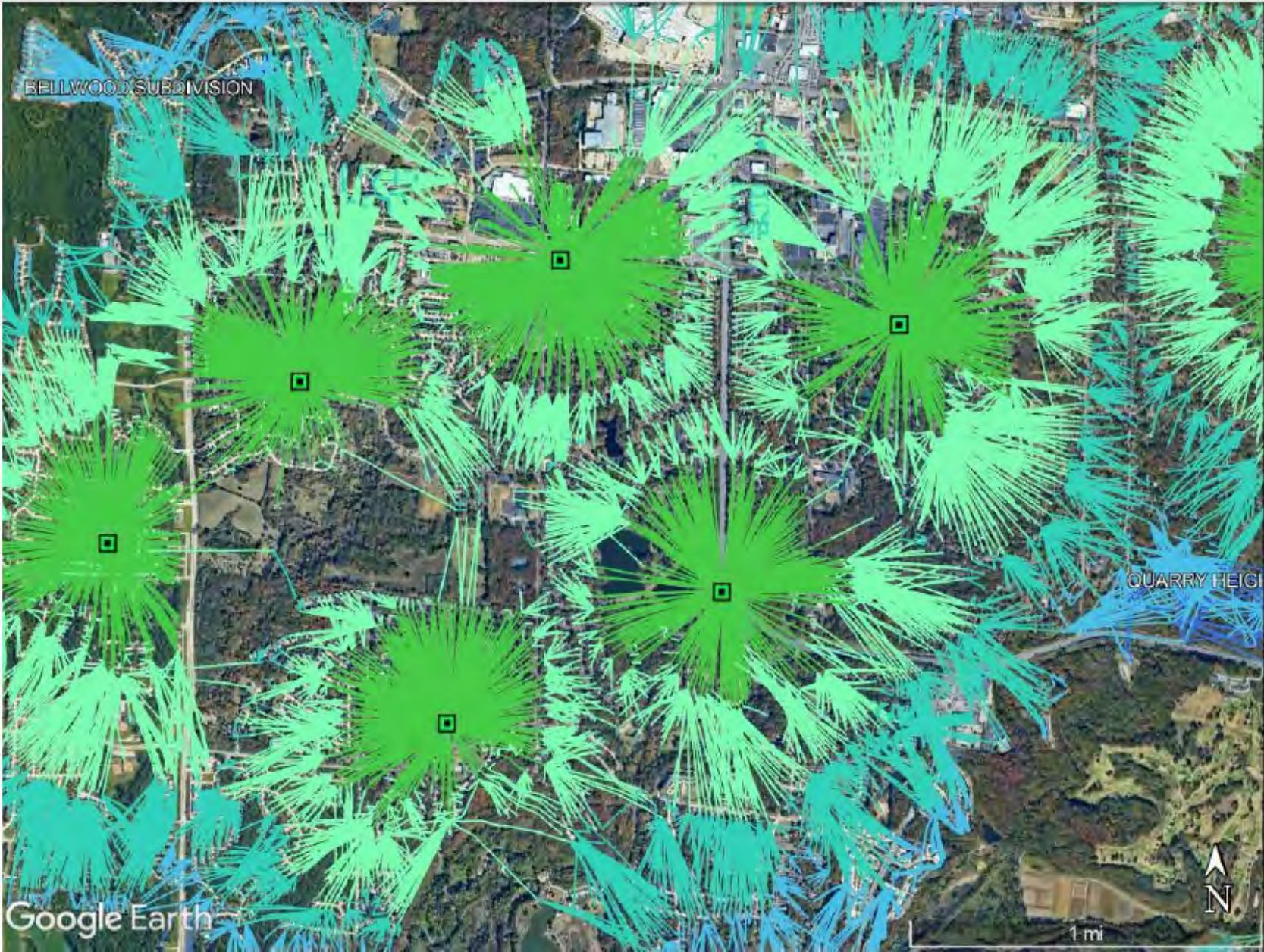
- The City will provide/confirm polling frequency and other data collection / communication requirements that will affect RF Mesh bandwidth requirements.
- The City will provide most accurate data, reasonably available, that can be used to determine where Access Points and Relays should be attached including, without limitation, the furnishing of documents, maps and other such material that depict the location, address (including zip code, if available), height above ground (if available) and latitude and longitude position coordinates (required) of all meter locations, the City facilities, transmission and distribution rights of way, substations and administrative buildings.
- The City will help Itron understand the specific placement criteria and installation techniques acceptable to the City for the installation of Access Points and Relays on The City facilities.
- The City will complete all required site surveys in the deployment area to validate the Initial Field Network Design and recommended installation locations.
- The City will provide Itron site survey results including lat/long coordinates.
- The City will investigate cellular coverage during site survey process by reviewing Network HW installation location environment for the presence and RSSI levels of backhaul cellular carrier taking into account the City's preference for any particular cellular carrier(s).
- Following completion of site surveys, the City will review recommended installation locations with Itron and seek approval from the City on any proposed location changes.

- The City will secure and pay for all internal and external approvals, improvements, and modifications for attachment of Access Points and Relays, including local construction permits, franchises, licenses, or other fees. This step must be completed prior to Field Network deployment.
- The City will determine and provide the method of power connection (direct line connect or photocell adaptor) for Access Points and Relays at any given location.

The City acknowledges that timely installation and commissioning of the project network infrastructure is critical to overall project success. The City will make commercially reasonable efforts to complete the installation, configuration, and full operation of the required network within forty-five (45) business days from receipt of all necessary equipment.

Refer to Table D.1.1 for the list of locations by GPS coordinates.





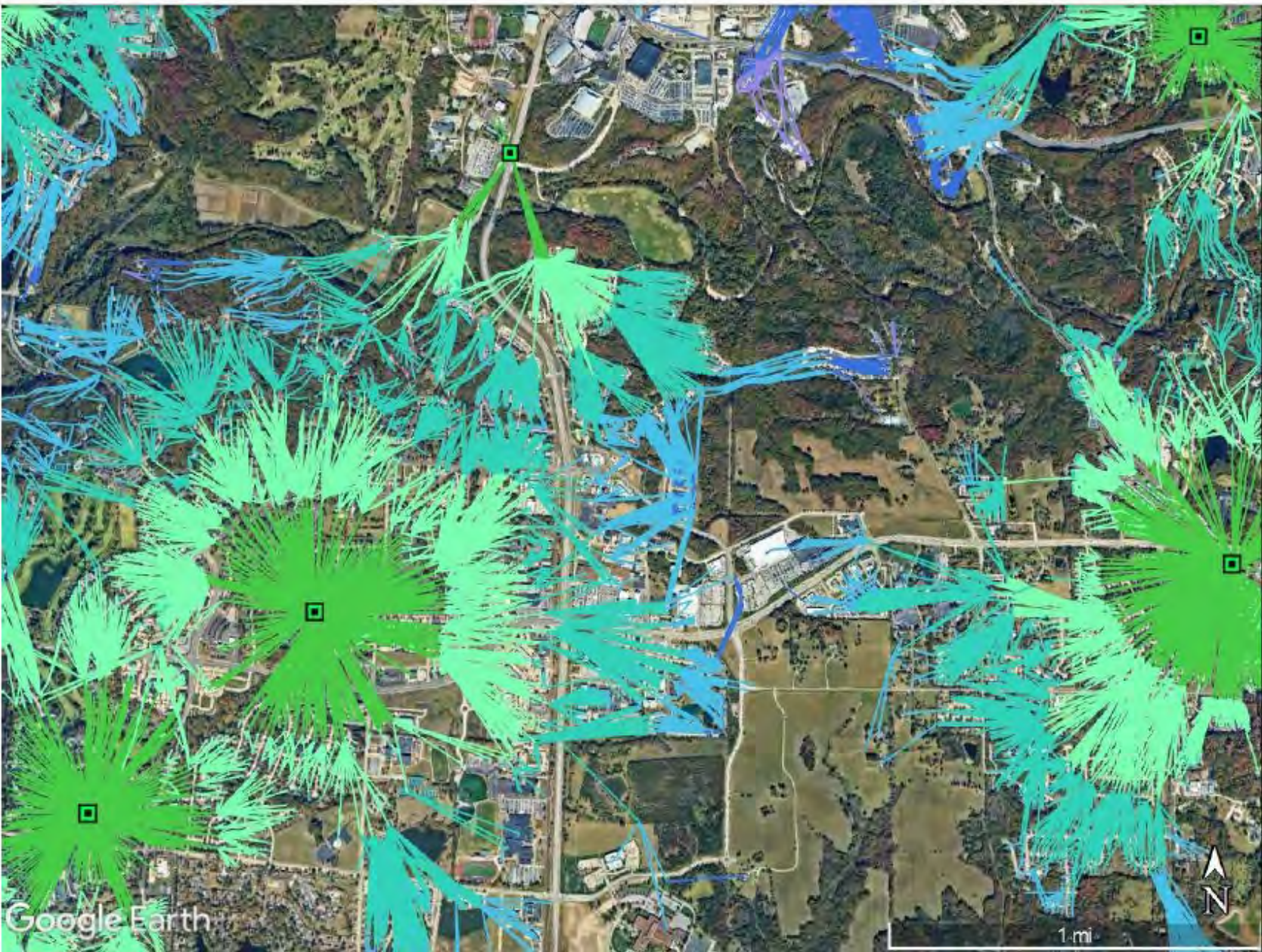


Table D.1.1.1.1 Ideal Access Point and Relay Locations

Device	Id	Lat	Long
Access Point	AP_1	38.97260894	-92.34257039
Access Point	AP_2	38.94592477	-92.33918674
Access Point	AP_3	38.95163693	-92.36245118
Access Point	AP_4	38.93565684	-92.38575106
Access Point	AP_5	38.94939455	-92.39330283
Access Point	AP_6	38.90265074	-92.35889145
Access Point	AP_7	38.93790129	-92.30081966
Access Point	AP_8	38.9764975	-92.26482349
Access Point	AP_9	38.91056853	-92.34778
Access Point	AP_10	38.88692553	-92.41876879
Access Point	AP_11	38.95125642	-92.3250392
Access Point	AP_12	38.9503298	-92.27894643
Access Point	AP_13	38.98585357	-92.28999342
Access Point	AP_14	38.92858883	-92.34002713
Access Point	AP_15	39.0201771	-92.2607409
Access Point	AP_16	38.940973	-92.371531
Access Point	AP_17	38.9644793	-92.31778693
Access Point	AP_18	38.94288453	-92.40279236
Access Point	AP_19	38.9541926	-92.3798259
Access Point	AP_20	38.912418	-92.30032
Access Point	AP_21	38.97562114	-92.38010095
Access Point	AP_22	38.90117326	-92.40518705
Access Point	AP_23	38.95950454	-92.35266522
Relay	RLY_1	38.98917159	-92.25560202
Relay	RLY_2	39.00414561	-92.28449466
Relay	RLY_3	39.02104614	-92.26940887
Relay	RLY_4	39.01543521	-92.27691548
Relay	RLY_5	38.99749641	-92.28004824
Relay	RLY_6	38.90543485	-92.29179442
Relay	RLY_7	38.91410555	-92.31401057
Relay	RLY_8	38.88112115	-92.42132126
Relay	RLY_9	38.88624824	-92.44240791
Relay	RLY_10	38.88632474	-92.45611461
Relay	RLY_11	38.8720968	-92.45109482
Relay	RLY_12	38.86475251	-92.45135432
Relay	RLY_13	38.88804035	-92.46780069
Relay	RLY_14	38.87726751	-92.46036652
Relay	RLY_15	38.98294365	-92.32691889
Relay	RLY_16	38.89065711	-92.44975954
Relay	RLY_17	38.88579162	-92.43690213

Device	Id	Lat	Long
Relay	RLY_18	38.88425409	-92.42725658
Relay	RLY_19	38.92345551	-92.33968907
Relay	RLY_20	38.89123693	-92.29323632
Relay	RLY_21	38.92322211	-92.29371316
Relay	RLY_22	38.97250855	-92.35648179
Relay	RLY_23	38.91029675	-92.37219356
Relay	RLY_24	38.96244193	-92.29342132
Relay	RLY_25	38.8517592	-92.4423178
Relay	RLY_26	39.02907971	-92.2656863
Relay	RLY_27	39.02928261	-92.27656442
Relay	RLY_28	38.93516785	-92.32312404
Relay	RLY_29	38.93165079	-92.31149992

D.2 Electric Meters

The database provided by the City in November 2025 included an account list of all of the electric meters in the system. Ameresco will provide 52,976 electric meters. Ameresco will install a total of 51,493 electric meters. The Form 1S, 9S, & 45S meters will be installed by the Customer per manufactures specifications. There are a total of 185 Form 1S that will be converted to 2S, 1,286 meters of Form 9S, and 12 Form 45S. All 1,016 Form 2S Class 320 electric meters have been removed from the Scope of Work. The quantity breakdown for meters to be installed by the size is shown in the Table D.2.1 below. These quantities are based on the database provided by the Customer and field work completed by the Ameresco engineering team. Deviations, additions, and substitutions will be handled on a case-by-case basis.

Table D.2.1 Electric Meters to be Replaced by Ameresco

Form	Voltage	Class	Quantity
2S	240	200	42,225
3S	240	20	311
12S	208	200	4,659
12S	240	200	1,121
12S	277	200	4
12S	480	200	387
16S	208	200	1
16S	277	200	5
16S	480	200	2,720
16S	480	320	60

The details of the scope of work for the electric meters are provided below:

- The manufacturer of the replacement meters shall be Itron Gen 5 electric meters. Replacement shall be based on universal voltage meter of compatible form factor. Existing socket to remain.
- Ameresco will supply the utility tags for resealing the meters to prevent tampering and will install the tags after replacement.
- Electric meters are equipped with AMI communication capability as delivered.
- For safety reasons, the Ameresco installation crew shall be competent personnel as defined by and in accordance with the current OSHA regulations and NFPA 70E (2015) standards for electrical safety in the workplace.
- Ameresco shall assess the condition of existing electric meter prior to replacement. If the installer finds that meter replacement is not possible due to safety concerns or code issues, the installer will not proceed with replacement. Ameresco will document the condition, and meter will be placed in the Return to Utility condition.
- Prior to work, Ameresco must consult with the property owner or tenant (as applicable) on premise of the power shut down. If shut down is not possible at the time of the site visit, Ameresco shall move on to the next account on the list and return later after scheduling the 2nd site visit.
- For residential customers, Ameresco shall perform the work during regular hours, unless specifically authorized by Customer.
- For the commercial customers, Ameresco shall plan to perform the work after business hours to prevent disruption. These will be scheduled by appointment.
- Ameresco shall verify meter number at electric meter installation(s) prior to starting work.
- The Ameresco installer shall attempt to inform property owner or tenant (as applicable) of disruption immediately prior to isolating service.
- Immediately after disconnecting or isolating service, the installer shall inspect the meter for signs of substantial active usage of the service. If there are signs that the service is in substantial use (e.g., large consumption/demand registrations), Ameresco shall note this (time, location, address, etc.) and move on to the next meter. Locations with an electric meter that cannot be isolated must be scheduled by appointment.
- The Ameresco installer shall verify meter size and points of connection prior are consistent with documentation and replacement equipment prior to removing existing meter from service.
- The installer will take a “before” photo of meter installation with structure in background.
- The installer will note the position of the status of the service (e.g., disconnects, etc.). Shutoff services shall be noted and returned to the utility.

- The installer will record the final reading at the meter to be removed from service. Document with “Final Read” photograph.
- The installer shall remove existing meter and return to the Customer for disposal.
- The installer shall install the replacement electric meter in compliance with NEC and manufacturer requirements.
- The installer shall restore the service status to the condition in which it was found.
- The installer shall document that the meter is registering and that registration is positive.
- The installer shall capture GPS coordinates with sub meter accuracy to at least the fifth decimal place.
- Ameresco will coordinate with the billing software company for testing of the meter exchange file.
- Ameresco will perform meter and AMI commissioning per manufacturer requirements, verifying meter operation and AMI communication.
- The installer shall document installation with “New Meter” photograph.
- At a minimum, the change out report shall include the following information for each existing and replacement equipment:
 - Date and time of service.
 - Account number.
 - Service address.
 - Meter ID number.
 - Meter form.
 - Wire count.
 - Meter class and brand.
 - Meter type (self-contained, transformer-rated (CT), transformer-rated (CT/VT), etc.).
 - Radio number.
 - Register reading, energy.
 - Register reading, demand (where applicable).
 - Multiplier.
 - GPS location with sub-one meter accuracy.
 - Pre- and post-installation photo documentation of meter view toward property (capture front door where possible)

- When a meter exchange is completed, the installer shall leave the premises in a clean manner as close as possible to the manner in which it was found with no tools, trash, large dirt piles, or other debris either on the property or within the meter box.

D.3 Water Meters

The database provided by the City in October 2025 included an account list of all of the water meters in the system. Ameresco will provide and install a total of 33,041 new water meters as listed below with an Itron 500W Transmitter. There are 19,706 existing Badger E-Series meters that will be retrofitted with an Itron 500W Transmitter. The quantity breakdown for each meter size is shown in the Table D.3.1 below. Deviations, additions, and substitutions will be handled on a case-by-case basis.

Table D.3.1 Water Meters to be Replaced/Retrofitted by Ameresco

Meter Size	Meters to Replace - Qty	Meters to Retrofit - Qty	Total Meters in System
5/8" x 1/2" Solid State Meter	31,502	17,882	49,384
5/8" x 3/4" Solid State Meter	75	185	260
1" Solid State Meter	950	1,093	2,043
1.5" x 13" Solid State Meter	186	310	496
2" x 10" Solid State Meter	171	0	171
2" x 17" Solid State Meter	53	236	289
3" x 10.5" Solid State Meter	1	0	1
3" x 11.75" Solid State Meter	56	0	56
3" x 12" Solid State Meter	3	0	3
4" x 12" Solid State Meter	8	0	8
4" x 13.5" Solid State Meter	1	0	1
4" x 13.75" Solid State Meter	16	0	16
4" x 14" Solid State Meter	4	0	4
6" x 17.75" Solid State Meter	5	0	5
6" x 18" Solid State Meter	10	0	10
Total:	33,041	19,706	52,747

The details of the scope of work for the electric meters are provided below:

- All new replacement meters will be Badger E-Series meters. All are solid-state water meters.
- All transmitters will be Itron 500W and will have either a remote antenna (indoor accounts) or pit antennas (outdoor accounts).
- All outdoor endpoints will be equipped with a through the lid antenna mounting kit.
- General scope for the meter replacement is as follows:
 - Attempt occupant notification.

- Clean debris and dirt from the meter and piping inside the pit as necessary.
 - Pump water out of the pit as needed.
 - Observe status of service shut-off valve prior to work.
 - Check for indication of flow.
 - Shut off water service at service shut-off valve.
 - Remove existing meter and install new meter.
 - Turn on water service at service shut-off valve.
 - Clear air from the line and verify operation by opening downstream valve. (outside hose spigot)
 - Verify the meter is not leaking and there is an indication of flow.
 - Restore service shut-off valve to the original position.
 - Provide miscellaneous material and labor required to install the new meter such as adapters, couplings, bushings, etc., so long as the work can be performed in the existing pit.
 - Ameresco will be responsible for line breaks two feet upstream and two feet downstream of the replaced meter for up to 7 days from meter installation. Measurement will be pulled from the meter coupling on the compromised side of the line.
 - Ameresco will turn over the existing water meters to the Customer for salvage.
 - Ameresco will collect required installation data for uploading to the Customer's billing system.
- When replacing the meters, Ameresco will collect the following data for existing and replacement equipment:
 - Date and time of service
 - Account number
 - Service address
 - Meter ID number
 - Radio ID number
 - Meter size
 - Meter brand and Meter type
 - Register reading
 - Pre- and post-installation photo documentation (8-10 photos)
 - Non-functioning service shut-off/curb-stop valves for small water meters (5/8"x3/4", 1", 1.5" and 2") will be replaced as field conditions require.

- For any meters 3" and larger where an external antenna is required, a hole will be drilled through the existing metal lids so that the external antenna can be mounted.
- The scope includes replacing existing metal lids for the small meters (sizes 5/8"x3/4" through 2") with AMI-ready meter lid.
 - Replacement lid shall be Nicor Read-Rite Model with Worm Gear Lock in either with a diameter of 12" or 14.5"
- The scope includes replacing existing structurally damaged plastic meter boxes for the small meters (size 5/8"x3/4" and 1") with AMI-ready meter box and lid.
 - Replacement lid shall be Nicor Read-Rite Model with Worm Gear Lock in either with a diameter of 12" or 14.5"
- Individual meter box installation will require the following:
 - Meter box replacement will be concurrent with site meter replacement.
 - General scope for the meter box replacement is as follows:
 - Dig and remove existing meter box.
 - New meter box will be installed in a 'like for like' manner to match existing conditions.
 - Set new box, ensuring meter and shutoff valves are centered in box for ease of service.
 - Backfill around box.

The following additional clarifications, exclusions, and Customer responsibilities are applicable to this measure:

- A successful and complete meter installation is defined as any meter installed to manufacturer specifications where the data has been accurately transferred into the utility billing database and read one or more times electronically over the AMI network.
- At the point of a successful and complete meter installation, the installation labor warranty begins, and system benefits may be realized.
- A completed and functional AMI system is defined as the meters being installed and capable of sending signals to the antenna, these devices receiving those signals and transmitting the information to the Itron meter data management system, and the Itron meter data management system accurately sending the information to the Customer's utility billing system.
- Due to external conditions, not all meters will read in the Itron meter data management system every day, therefore not all data will be uploaded into the portal daily.
- Ameresco will be providing and distributing post-installation door hangers.

- Ameresco will provide storage containers (Conex boxes – up to 40 foot long) for meters and boxes/lids inventory. Customer will allow Ameresco to set Conex boxes at Customer's sites. Ameresco plans to use up to 10 Conex boxes during construction. Staging location for the Conex boxes will be the City Water and Light Distribution Headquarters located at 1514 Business Loop 70 E, Columbia, MO 65201.
- Customer will provide a container for existing meters that will be salvaged or recycled at the City Water and Light Distribution Headquarters located at 1514 Business Loop 70 E, Columbia, MO 65201.
- Customer will provide a trash dumpster for use by Ameresco located at the City Water and Light Distribution Headquarters located at 1514 Business Loop 70 E, Columbia, MO 65201.
- Customer will provide an area for disposal of spoils/dirt/debris from this scope of work located at the City Water and Light Distribution Headquarters located at 1514 Business Loop 70 E, Columbia, MO 65201 or other locations selected by the Customer during the construction phase of this project.
- Ameresco will be responsible for inventory control of meters and boxes/lids.
- Customer will assist Ameresco in unloading pallets off delivery trucks using Customer's forklift or other machines required to unload materials for this project off delivery trucks. Ameresco will attempt to provide at least a 24-hour notice of any deliveries.
- For all meter gaskets and washers, Customer prefers rubber washers.
- As a general rule, when doing repairs on pipe and fittings, Ameresco will use like for like materials. No galvanized fittings or piping to be used.
- If applicable, Customer to assist in identification of any underground utility services in the area around the meter box or vault locations when requested by Ameresco. Relocation or rerouting of utility lines is not included.
- Any deficiencies in existing utility infrastructure that are identified are excluded but will be reported to the Customer.
- Any existing water leaks found prior to beginning the meter replacement or retrofit will be reported to the Customer for future repair by Customer.
- Ameresco will be responsible for leaks at the meter that are discovered within 7 days following meter replacement.
- Ameresco will not be responsible for failures of the following, pressure reducing valve (PRV), check valve, backflow device.
- Repair of line breaks beyond two feet upstream and two feet downstream of the replaced meter are not included. Measurement will be pulled from the meter coupling on the compromised side of the line.

- Lowering or relocating water service lines associated with water meters is not included.
- Any repositioning or leveling of existing meter boxes for cosmetic appearance different than as-found condition is not included.
- Installation of meter re-setters or risers with the new meters is not included.
- Installation of check valves or other backflow prevention devices with the new meters is not included.
- Additional repairs, replacements, or any modifications to existing meter pits or vaults not already listed and defined above or in the meter box or vault replacement scopes of work are not included.
- Concrete, asphalt, and sidewalk repairs due to meter access, rework of meter boxes, repair of leaks, or replacement of meters is not included.
- Any cutting or removal of tree roots or shrubbery so that meter can be replaced or to gain access to the meter is not included. The cost for any arborist or specialist required for this work will be provided by the Customer.
- Abatement of any hazardous materials or hazardous material testing is excluded.
- Return to Utility (RTU) is a classification given to specific water meters during construction that requires action from the Customer before the project scope can be finished. The RTU will clearly define the required action the Customer will need to address. To maintain the defined construction schedule by Installation Group, the Customer will make reasonable efforts to address all RTUs within a 2-week period from the date each specific meter or issue was classified as RTU. Throughout the construction period, Ameresco will maintain a log of all RTUs that has at a minimum date issued, date cleared, and specific action required and will review this log at the weekly construction meeting with the Customer.
- Pre-functional testing of the AMI system will be performed as part of the installation process. Documentation of meter, radio, and receiver installation will include the address, meter size, meter model, meter number, and transmitter number for the new meter. Photo documentation will be provided to document that the meter and transmitter have been installed and oriented correctly. Transmitter mounting will be verified to be secure for the type of installation.
- Functional testing for the meters is provided at installation. Verification that the meter, register, and transmitter have been activated and are registering will also be performed on site. Verification that the AMI system is communicating with the newly installed meter will be performed on site at installation. Comparison of typical pre- and post-install readings will provide verification that meters are metering and reporting consistent with expectations.
- Billing and AMI software multipliers will be reviewed for consistency with installation. Anomalous account activity, such as zero readings, notably low readings, and

notably high readings, will be evaluated on an individual basis to determine if there are any metering, reading, or billing errors associated with the outlier profiles.

- AMI signal strength will be examined, and low signal strength transmitters will be individually evaluated to determine if installation or equipment failures are to blame. Data exchange files will be evaluated to ensure that items such as number of digits and billing units are consistent between the AMI system and the billing system. This is especially important where meters by different manufacturers are installed in the system and when metering, billing, and rate structure units differ. Much of this information will be available in near real-time in the Ameresco installation tracking software.
- The performance testing and commissioning matrix for the project is provided in Table D.3.2. Pre-functional and functional reports will be modified during the design and construction phases, based on actual system design and installation. Results of pre-functional and functional testing will be included in the O&M manuals.
- The commissioning process consists of two main steps: pre-functional check and functional testing. Pre-functional check is the verification process before, during, and after construction to ensure the systems are installed according to design. This process includes verification of installed equipment according to engineering specifications and submittals, verification of installation work according to manufacturer's specifications, inspections for equipment or installation flaws and inconsistency, and other related inspection work. Pre-functional checks must be performed before a full functional test can be performed. Each Ameresco employee will be responsible for their own individual checks prior to installing the equipment. Ameresco will be responsible for the project-wide pre-functional checks during and after construction to ensure the system installed is as designed.
- The second step in the commissioning process, the functional test, is the process of testing the installed systems to ensure they operate as designed and can achieve the performance as intended. In the functional test, operation of each piece of equipment and its operation as part of a system (such as water flow, data communication, etc.) is verified. Results of the tests will be recorded and any discrepancies with design values will be noted. Necessary modifications will be performed to rectify a performance level that does not conform to design. Generally, Ameresco will be responsible for conducting and supervising the commissioning. City of Columbia maintenance personnel are also encouraged to be involved in the process, as it is a great training opportunity and will help in transitioning the O&M responsibilities.

Table D.3.2. Performance Testing and Commissioning Summary

Description	Equipment / Systems to be Performance Tested	Observations, Tests and Inspections During Construction (Pre-Functional)	Pre-Functional Responsibility	Observations, Tests and Inspections Prior to Acceptance (Functional)	Functional Responsibility	Testing Documentation
Measure 1. Utility Metering and Data Acquisition Improvements	AMI System and Water Meters	Verify installation of the AMI components, the electric and water meters. Verify that individual meter data is importing to the correct account number in the billing system. Verify that accurate readings are properly recorded from the field all the way through the billing system.	Columbia Light & Water, Wesco, USS and Ameresco	Commission the AMI system to have 98.5% coverage of the covered electric and water meters. Commission the AMI system to have 98.5% read rate over a 4-day period for the covered meters. If Ameresco does not achieve a read rate of 53,182 electric meters and 51,956 water meters over a rolling four-day period, then Ameresco will add additional Access Points, relays or cellular radios to achieve the read rate. Integrate the AMI system with the billing software.	Columbia Light & Water, Wesco, USS and Ameresco	A full commissioning report will be provided to the City after installation is complete.

- Upon completion of the pre-functional testing and prior to completion of the functional performance testing, Ameresco will submit Certificates of Substantial Completion for measures that provide a performance and financial benefit to the City. The Certificates of Substantial Completion will have accompanying punch lists; all punch list items that could directly affect the potential to generate accuracy improvements must be completed prior to functional performance testing. Note that the warranty periods for equipment / systems in operation will begin upon execution of the Certificates of Substantial Completion for each measure.
- Upon completion of all punch list items that could potentially affect a measure's ability to improve accuracy, the functional performance tests will be completed. Upon successful completion of these tests, the measures are deemed to have the potential to achieve the estimated benefits. Ameresco will then formally request from the City an inspection of the work completed. A Certificate of Acceptance of Construction Completion and Inspection will accompany the formal inspection request. The Certificate of Acceptance of Construction Completion and Inspection formally acknowledges that the work, or a portion thereof, has been completed and is being accepted.
- Some measures may not be able to be completed at that time due to circumstances beyond Ameresco's control. In these instances, a percentage complete will be assigned to the measure, and a punch list of outstanding items will be included. Typically, these items will not have an impact on the savings or the potential to achieve savings because the functional performance test will have been completed prior to requesting the final inspection. All outstanding punch list items will be completed as soon as possible.
- O&M manuals will be provided upon completion of all functional performance tests and upon completion of the as-built documentation. All necessary training will be provided as outlined herein.
- Documentation to be provided includes O&M manuals, which (in printed form) will be contained in a sturdy binder with 8.5-inch by 11-inch sheets of paper and consist of the following sections and information, where applicable:
 - Section I – System Description
 - A detailed description of each system, including its major components and function.
 - Control strategies and sequences describing startup, modes of operation, and shutdown.
 - Procedures for the operation of every system, including all required emergency instructions and safety precautions.
 - Reduced scale schematic or piping and instrument diagram drawings depicting system overviews.

- Section II – Equipment Data Sheets
 - Manufacturer’s O&M manuals.
 - Name, address, and telephone number of the manufacturer’s local representative for each type of equipment for replacement parts and service.
 - Section III – Maintenance
 - This section will be modified for each project based on the maintenance requirements of the contract.
 - Section IV – Test Reports
 - Pre-functional reports – equipment start-up reports and commissioning data sheets.
 - Functional reports – system start-up reports and functional performance tests.
 - Other reports as applicable.
 - Section V – Warranties / Guarantees
 - A typewritten warranty, on company letterhead, for each system installed. The warranty will state the system and components covered, the duration of the warranty period, and emergency contact phone numbers for service and repair.
 - Warranties / guarantees from Ameresco or equipment supplier.
- Table D.3.3 provides a summary of the O&M plans for this project. Detailed descriptions of the included scope for each measure are presented below.
 - Ameresco will provide a one-year warranty on workmanship for the project from the start of the performance period. Equipment manufacturers will provide additional warranties on their respective equipment. Warranty forms will be provided to the City with the O&M manual.

Table D.3.3 Operations and Maintenance Summary

Description	Operations Responsibilities		Maintenance Responsibilities		Warranty
	Ameresco	City	Ameresco	City	
Proposed System Improvements	None	City of Columbia will contract directly with the AMI vendor for remote hosting and operations of the AMI system.	None	City will perform routine O&M for the electric and water meters as needed. City will contract directly with the AMI vendor for annual maintenance of the AMI system.	Ameresco provides a one-year warranty on workmanship after construction. Manufacturer's warranty will pass through to the City. Itron and Badger have standard warranty programs that will be passed through to the City. Itron provides a limited warranty on the Access Points and Relays.

D.4 Software

In addition to the AMI infrastructure and metrology, Ameresco will supply and install software to make the system function and for the City to be able to access and use the data recorded by the AMI system. Ameresco will provide and install the Itron Utility IQ Electric and Water Meter Reading Software along with the Harris SmartWorks Compass MDM. The City will be contracting directly with the Harris Advanced Utility Systems CIS Software and the VertexOne MyMeter Customer Portal for all software implementation and integration.

The scope of work for the software installation and integration includes the following:

- Integrate data from a total of 52,976 electric meters and 52,747 water meters to the City's Harris Advanced Utility Systems CIS software, the Itron UIQ software, and the Harris SmartWorks MDM. Provide, set up, and install the Itron UtilityIQ Electric and Water meter reading software.
- Coordination and integration of the Itron UIQ software with the City's CIS software (Harris Advanced Utility Systems).
- Provide, set up, and install the Harris SmartWorks Compass Framework (MDM) software.
- Coordination and integration of the Harris SmartWorks Compass Framework (MDM) with the City's CIS software (Harris Advanced Utility Systems).
- Provide oversight and management on behalf of the City for the integration of the Harris Advanced Utility Systems software with the MyMeter (VertexOne) City Portal. All tasks requiring City access to platform are the responsibility of the City.
- City will contract separately with Harris Advanced Utility Systems and will be financially responsible for any fees charged by Harris Advanced Utility Systems for setup, integration, hosting, or ongoing annual services between Harris Advanced Utility Systems and Itron UtilityIQ Software, MyMeter City Portal and Harris SmartWorks MDM.
 - o Initial one-time setup and construction integration fees along with Year 1 AMI annual integration fee totaling \$108,975 as detailed below:
 - MyMeter AMI – Implementation Fee - \$29,325
 - CIS – AMI Integration – Implementation Fee (includes discovery sessions) - \$79,650
 - o Annual Fees for the MyMeter and Advanced Utility Systems Software fees totaling \$62,000 as detailed below:
 - MyMeter AMI – Additional Annual Fee - \$40,000
 - CIS – AMI Integration – AMI Integration Annual Fee - \$10,000
 - REST API Fee – REST API Annual Fee - \$12,000
 - Annual Escalation Rate – 5%

- City will contract separately with Wesco and will be financially responsible for any fees charged by Wesco for ongoing annual services.
 - o Annual Fees from Wesco for the Itron UtilityIQ Software totaling \$159,300 as detailed below:
 - Itron Communication Tester (3 Units @ \$900 each unit) - \$2,700
 - Itron UtilityIQ (Water & Electric) - \$156,600
 - Annual Escalation Rate – 3%
- City will contract separately with United Systems & Software (USS) and will be financially responsible for any fees charged by USS for ongoing annual services.
 - o Annual Fees from USS for the Itron cellular water endpoints totaling \$10,730 as detailed below:
 - Itron APN-UIQ Cellular Water Module (5,051 Nodes / \$2.12/Node) - \$10,730
 - Annual Escalation Rate – 3%
 - o Included in Ameresco contract cost are the first 10 years of Itron Water Endpoints Cellular SaaS Fees for 5,051 Nodes. For all future years, City will be responsible for these annual cellular fees
- City will contract separately with Harris SmartWorks Compass Framework MDM and will be financially responsible for any fees charged by Harris for ongoing annual services.
 - o Annual Fees for the Harris Software totaling \$368,887 as detailed below:
 - Harris SmartWorks Compass Framework (MDM) - Annual Fee - \$328,895
 - Harris Transformer Load Analysis - \$39,992
 - Annual Escalation Rate – 5%

The following Integrations are included in the project scope for the Harris SmartWorks Compass Framework MDM portion of the project:

The implementation project will accomplish the following high-level objectives:

- 1) Install, configure and implement the SmartWorks Software.
 - a) The **SmartWorks Compass** solution will be installed at the **SmartWorks Hosting Facility**.
- 2) Initiate within SmartWorks Software the collection and management of register and interval read data from AMI Meters.
- 3) Integrate with:
 - a) Itron AMI head end to import register and interval reads, import meter events/alarms, and initiate remote actions
 - b) Advanced Utility Systems (AUS) CIS to import meter and location data and provide billing determinants
 - c) ESRI GIS for integration with base maps URL and data for transformers and water loss
- 4) Deliver system training designed to develop Customer competency with the use and configuration of the SmartWorks Software.
- 5) Provide support during User Acceptance Testing.

Roles and Responsibilities

The activities to be carried out are detailed in each section of this SOW. The table below defines the associated roles and responsibilities at a high level. References to the corresponding sections of the SOW are included when a more detailed description is required.

Task	Responsible Party
Define scope of work with CIS Vendor under a separate agreement. Note: This includes development of the integrations listed in this SOW as well as integration with the AMI head end system for meter provisioning	Customer
Establish detailed Project Plan	Ameresco, SmartWorks, and Customer
Ensure resources are available to carry out tasks defined in section 5.6 Customer Resource Involvement	Customer
Engage in tasks defined in section 5.6 Customer Resource Involvement	Ameresco, SmartWorks, and Customer
Ensure resources are available to perform work as defined in SOW	Ameresco, SmartWorks, and Customer

Task	Responsible Party
Ensure assistance and cooperation by Third-Party Vendors (including AMI, CIS and GIS)	Ameresco, SmartWorks, and Customer
Participate in weekly project calls	Ameresco, SmartWorks, and Customer
Configure Virtual Private Network (VPN) to enable customer access to the SmartWorks Hosting Facility (applications on the SmartWorks Hosting Facility may not be exposed on the internet)	Customer
Perform initial install in SmartWorks Hosting Facility	Infrastructure specialist SmartWorks
Install Software Modules as per section 2 SmartWorks Compass Implementation Scope	SmartWorks
Provide deliverables as defined in section 2.7 Project Deliverables and Work Products	SmartWorks
Provide AMI infrastructure and meter data	Ameresco & Customer
Provide input data for integration points as defined in section 3 Software Integrations	Ameresco, SmartWorks, and Customer
Install and configure integration points as defined in section 3 Software Integrations	SmartWorks
Perform data validation for each DataSync iterations and confirm validity of AMI data	Ameresco, SmartWorks, and Customer
Identify User Roles and User Groups. Confirm User Authentication method and assist with configuration: - Option 1: Framework-Manager - Option 2: LDAP or SAML Authentication Only - Option 3: LDAP or SAML Authentication and Role Membership	Ameresco, SmartWorks, and Customer
Perform Unit Testing	SmartWorks
Perform Functional and Integration Testing	SmartWorks
Provide user training	SmartWorks
Perform User Acceptance Testing	Ameresco, SmartWorks, and Customer

Task	Responsible Party
Provide support during User Acceptance Testing	SmartWorks
Perform configuration updates once training has been delivered and User Acceptance Testing is completed Note: Guidance will be provided by SmartWorks until the project is deemed completed.	Ameresco, SmartWorks, and Customer

SmartWorks will deploy two (2) instances of the SmartWorks Software in the SmartWorks Hosting Facility in the United States: one (1) Test instance and one (1) Production instance.

The intent of a test environment is to test new or existing functionality with a minimal set of data representative of the meter population prior to a production update.

The Test and Production environment specifications are shown in the Server Specification Assumptions table below. The use of the Test instance as a copy of production with a full set of data and corresponding full dataset processing is not included in the scope of work. Server specifications and associated hosting costs, if applicable, included in scope are based on these assumptions. Changes to the environment may be brought into scope using the change order process.

Server Specification Assumptions

	Live Storage	Meter Population	Integrations	VEE
Test instance	12 months	As listed in this Agreement	Integrations defined in Agreement, not real time. Real-time integrations only enabled/active as required e.g. DataSync, real-time events, remote actions	The test environment is designed to be used for functional testing with meter data refreshed by database imported on an annual basis, as needed. Regular VEE processing will not be performed.
Production instance	36 months	As listed in this Agreement	All integrations defined in Agreement.	Enabled

Meter Configuration

The SmartWorks Software will be capable of importing, processing and storing meter usage data based on the interval length and channels submitted with our proposal and defined below. Changes to meter counts, configuration of intervals or number of channels may be brought into scope using the change order process.

Consumption Data

Service	Number of Meters	UOM	Daily Register Read (Billing Determinant)	Interval Length for interval reads
Electric Residential	43,426	kWh	Daily Midnight Register	15
		kWh_RCVD	Daily Midnight Register	N/A
Electric Commercial	10,566	kWh	Daily Midnight Register	15
		kWh_RCVD	Daily Midnight Register	15
		kVAH	Daily Midnight Register	15
Water	52,747	GAL	Daily Midnight Register	60

Voltages

Service	Number of Meters	Voltage	Interval Length for interval reads
Electric Residential	43,426	Voltage A-Phase	15
Electric Commercial	10,566	Voltage A-Phase	15
		Voltage B-Phase	15
		Voltage C-Phase	15

Other Meter Data

Service	Number of Meters	Other Meter Data	Interval Length for interval reads
Electric Residential	43,426	Amperage	15
		TBD	15
Electric Commercial	10,566	Amperage	15
		TBD	15
Water Residential	52,747	Temperature	60
		Pressure	60

SmartWorks Compass Modules

The following SmartWorks Compass Software modules will be installed and configured as part of the scope of this engagement. However, Customer will be responsible for determining which modules get utilized and will be responsible for all associated ongoing fees.

SmartWorks Compass, including the following modules:

- **MeterSense MDMS**
- **KPI Dashboard**
- **VEE Acceptance Prediction Functionality**
- **Automated Connect/Disconnect**
- **Advanced Leak Detection**
- **Water Loss Analysis**
- **AI Baseline Forecasting**
- **Automated Move-In/Move-out**
- **Transformer Loading Analysis**

MeterSense MDM

SmartWorks will install and configure **MeterSense MDM** module.

Module Functionality includes:

- Support meter deployment
- Reports to help ensure that meters are provisioned correctly and communicating in the field
- Monitor AMI Performance
- Report on number of reads delivered compared to AMI Service Level Agreement
- Enable Meter-to-Cash

- Validation of reads, billing determinants and customer service support
- Alert via Meter Events
- Store and report on Tamperers, Leaks, error and other meter flags

Pre-Requisites & Assumptions

- Meter reads are imported from the AML.
- Meter events are imported from the AML.
- Meters installation/removal are synchronized with the system of record (CIS Synchronization Integration).
- After installation of **MeterSense** MDM by SmartWorks, meter reads validation routines (VEE – Validate, edit, estimate) as defined in SmartWorks User-Guide VEE will be available for configuration.
- Data will be presented in the **MeterSense** MDM reports based on the modules identified in this Statement of Work and the availability of the data described in Software Integrations.

KPI Dashboard

SmartWorks will install and configure the **KPI Dashboard** module. The KPI Dashboard enables the user to configure one or more dashboards to display information on Key Performance Indicators (KPIs). A KPI is a metric that is represented by a One-Dimension or Two-Dimension Visualization component:

- One-Dimension KPI Visualization includes: Numeric, Thermometer, or Speedometer
- Two-Dimension KPI Visualization includes: Area, Bar, Column, Scatter, Pie, or Table

For each KPI, a panel of information is available. This includes:

- Value of the KPI displayed as a numeric value, speedometer graphic or thermometer graphic.
- If a drilldown link was defined when the KPI was registered, clicking anywhere on the value will launch a window with the drilldown page.
- Color coded value (red/yellow/green), depending on settings.
- Max/min statistics and trend area.
- Secondary KPI value, where configured. If the secondary KPI value has been defined with a drilldown link, clicking on the value will launch a window with the drilldown page.

Information on a KPI can be shared via email on a scheduled basis or threshold-driven exception basis.

A set of standard KPIs are made available with the application. These are arranged into a set of standard dashboards. It may be that not all dashboards or KPIs are applicable to a utility depending on available information, modules deployed, and integrations performed. Users may configure their own dashboards from the available KPIs.

Pre-Requisites & Assumptions

- Deployment of the **Compass Framework**, if not already in place.
- Population of any data required for calculation of KPIs as per this SOW.

VEE Acceptance Prediction functionality

This functionality is provided as an Extension to the MeterSense module from the SmartWorks Compass Suite. It improves the efficiency for users processing register read failures as part of the Validation, Estimation and Editing (VEE) process.

This Extension includes the following functionality:

- SmartWorks Athena AI Machine Learning solution for VEE Acceptance Prediction
- Provide recommendations as to whether register read validation failures should be accepted. These recommendations may be followed manually or executed automatically based on configurable level of confidence. For example, the system may be configured to automatically accept each register read failure, when Athena has greater than 90% confidence that the user would choose to accept the read failure. Athena's recommendation and confidence level are based on an AI model that was trained from past user behavior and takes into account the complex nature of each new read failure. In this way, Athena mimics the judgement of utility personnel that have manually reviewed read failures in the past.
- Acceptance Prediction setup
- Acceptance Prediction filtering in Register Read VEE Failures screens
- Acceptance prediction parameter in Register Read Validation Routines Setup.

Users can perform the following actions:

- Create, setup, copy, edit, import, and export AI algorithm configurations
- Modify the data elements used by the AI algorithms
- Train or re-train algorithms
- View performance data for AI algorithms
- Compare different AI algorithms, and compare versus past handled validation failures to compare how the algorithm predicts versus what a human did
- For viewing Register Read Validation Failures, user can use Acceptance Prediction confidence thresholds for filtering the list of Register Read Validation Failures. This therefore allows confidence threshold filtering for manual acceptance of multiple failures at one time from this screen.
- When configuring Validation Parameters, users can set Acceptance Prediction confidence thresholds to define which Register Read failures will be set to Auto-Accept.

Pre-Requisites & Assumptions

1. Customer has deployed, or is deploying, the MeterSense MDM module from the SmartWorks Compass suite.
2. Customer is using a recent distro (within 6 months of date of implementation) of 5.0 (update to that distro will probably be required) and no earlier than April 2021.
3. Customer is on PostgreSQL 10 or Oracle 19c or higher.
4. Customer has configured and enabled Register Reads validation routines.
5. Customer has a minimum of 6 months of historical activity that includes review and manual acceptance of Register Read failures.

Automated Connect/Disconnect

The Automated Disconnect/Reconnect module is for the operation of a service switch independent of the Move-In/Move-Out process. It is most commonly used for situations with credit issues, with disconnect actions triggered by failure to pay and reconnect actions triggered by payments made.

The solution for automation of service disconnection & reconnection includes the following functions:

- Automated execution of Service Disconnect operation (open the service switch at the meter) for “Failure to Pay” Service Orders that have been set up in the Customer Information System.
 - o Check if account is flagged as special/protected for non-disconnect, e.g. due to life support or other medical situations.
 - o Logic to accommodate seasonality (e.g. no disconnect during Christmas holidays) or weather (e.g. no disconnect when the temperature is above or below a specified comfort/safety threshold).
 - o Scheduled timing of connection operations, e.g. disconnect process to begin at 8:00am.
 - o Throttling of Disconnect operations, e.g. to spread out a large number of disconnects in batches over period of several hours, to avoid a flood of calls to Customer Service at the same time.
 - o Auto re-try for failed switch operations, e.g. up to 3 attempts.
 - o Audit trail recording confirmation of successful operation at time of execution.
- Automated execution of Service Connect operation (close the service switch at the meter) for “Payment Made” Service Orders that have been set up by in the Customer Information System.
 - o Frequent checking of CIS for Service Orders indicating payments have been made.
 - o Immediate execution of connection operations as soon as Service Order is identified.
 - o Auto re-try for failed switch operations, e.g. up to 3 attempts.
 - o Audit trail recording confirmation of successful operation at time of execution.
 - o Manual execution of Service Reconnection, when desired.
- KPI Dashboards of processes, including
 - o Actions performed.
 - o Number of Successes, number of failures.
 - o Time saved or \$ saved by automating this process

Implementation

- SmartWorks will implement and configure the above functionality.
- SmartWorks will train customer on module functionality and uses.
- SmartWorks will support customer testing.

Pre-Requisites & Assumptions

- Deployment of the Compass Framework by SmartWorks, if not already in place.

- Population of any data required.
- Services Switches are integral with the meters. If installed separately as disconnect collars, a change order will be issued for the configuration services.
- AMI has enabled remote actions using MultiSpeak to operate the Service Switches.
- Service Orders are created when payments are made by credit challenged customers that have been disconnected.
- If remote actions are using other means than MultiSpeak, a change order will be issued.

Advanced Leak Detection

SmartWorks Compass provides an analytical software solution that identifies leaks both from meter events or from usage patterns by using our VEE (Validation, Estimation, Editing) engine. A detailed report and KPI dashboards are provided to track, analyze, and prioritize potential customer leaks. Notifications can be prioritized and configured and sent by email or integration with a third party like Twilio for SMS/text to speech phone calls.

Functionality Delivered:

- Import Leak Events from AMI meters or calculate ongoing continuous usage from VEE Continuous Usage Method.
- Monitor for Continuous Consumption via VEE Configurations on Continuous Consumption.
- Provide notification summary reports to utility personnel
- Customer notification:
 - o Send notifications via email to customers
 - o Optional: Read Receipts for emails (10h)

AND/OR

- o by text or text to phone call via a 3rd party system like Twilio.

AND/OR

- o Create a custom PDF and store the file in a directory (or FTP file to customer directory) for printing out mailers

AND/OR

- Create Leak Detection Service Order in CIS (10-20h depending on the CIS)
 - o For each account identified in existing Compass report, query CIS to determine if a corresponding Service Order already exists for the Service Order type provided by Customer.
 - o If the expected Service Order does not already exist, create a new Service Order in CIS (this is typically done for very large leaks of a broken pipe amount.)

AND/OR

- Create Leak Notification Alert in CIS (10-20h depending on the CIS and if above is also in scope (less if above is in scope)

- o For each account identified with continuous consumption, add an alert on the account in CIS
 - o Enable a rule to set the end date or delete the alert when the continuous consumption ends.
- Registered Report: Leak Notifications generated over a selected period of time (default to last 7 days)
- Registered Report: Customers that have received Leak Notification but the leak still persists for a selected period of time (default to 3 days).
- Leak Detection KPI Dashboard, displaying.
 - o Leaks Detected: Number of locations with a suspected leak.
 - o Average Leak Time: Average time of leak, based on Continuous Consumption statistics.
 - o Average Leak Volume: Average leak volume, takes the average of each interval that reported a Continuous Consumption failure.
 - o Leak Notifications Sent: Leak Notifications sent to customers. This KPI is based on a rule specifically created for customers that emails the leak notification to customers, reported on a daily basis. Customer will import customer/account/location information from the CIS.
 - o Leak Events Yesterday: Total Volume of all leak events over the past 24 hours.
 - o Total Leak Volume: Total Volume of all reported Continuous Consumption failures over the previous 6 months time span.
 - o Average Leak Volume: Average leak volume of all reported Continuous Consumption Failures over the previous 6 months.

Implementation

- SmartWorks will implement and configure the above functionality.
- SmartWorks will train Customer on module functionality and uses.
- SmartWorks will support customer testing.

Pre-Requisites & Assumptions

- Deployment of the Compass Framework by SmartWorks, if not already in place.
- Utilization of Leak Notifications from meters requires meter-generated leak notifications to be delivered to the SmartWorks Compass Framework via standard Advanced Metering Infrastructure integration methods. (remove if using below)
- Utilization of usage data analysis for leak notification requires hourly (or finer) interval usage data to be delivered to the SmartWorks Compass Framework via standard Advanced Metering Infrastructure integration methods. (remove if using above)
- Map views require latitude/longitude information for each meter to be available via synchronization with the system of record.
- Customer communications for notification of leaks is assumed to leverage existing customer communication approaches, email or text communications from SmartWorks Compass, using email address provided via synchronization from the utility's system of record.

- Synchronization exists with CIS for association of meters with locations and accounts, plus the status of the account (active/inactive).
- Synchronization of customer contact details (email, phone number, cell number) by account so that they are accessible by Compass for any customer communications sent by Compass.
- Customer communication for notification will be managed by the CIS, based on the Service Order created
- Customer must provide the Service Order type to be used for Leak Detections
- CIS must have accessible API's or other method for entering Service Orders or Alerts.

Water Loss Analysis

Calculate and continually monitor losses to the greatest level of detail enabled by the utility's existing metering in the distribution network. The utility is able to focus efforts in the areas of greatest loss, immediately identify increases in loss, and reap greater loss reduction without increasing field costs.

- Map Views that display DMA "meters", overlaid on the GIS basemap and color coded:
 - o by absolute loss or
 - o by percentage loss
- Key Performance Indicator Dashboard, with KPIs including:
 - o Total Production, Total Loss Volume, Total Loss Percentage
 - o Historical loss metric as above for last year
 - o Number of DMAs/Zones above X % loss
- Loss Summary View
 - o Loss Summary View
 - Tabular report
 - o Setup parameters to be configured by the user:
 - Date Range, DMA Group, potentially filtered to display a selected quantity of meters above/below defined thresholds
 - o One row per DMA and columns for:
 - Area/Zone ID
 - Numbers of Consumer and Contributors
 - Total Volumes for Consumers and Contributors
 - Total Loss Volume
 - Total Loss %
 - Area/Zone usage as % of total (i.e. relative size of area)
 - Other metrics may be added depending on available data
 - o Drilldowns hyperlinked from the Summary Report to include:
 - Map of the DMA
 - List of Consumers, potentially with
 - Consumption in the defined date range
 - Consumption compared to last year
 - Percentage increase/decrease from last year.

- Average daily consumption

Implementation

- SmartWorks will implement and configure the above functionality.
- SmartWorks will train customer on module functionality and uses.
- Configured reports listed above
- Modify datasync as needed
- SmartWorks will support customer testing.
- Provide one 4-hour online training session.

Pre-Requisites & Assumptions

- Deployment of the Compass Framework by SmartWorks, if not already in place.
- Population of any data required.
- District metered areas or zones are defined, with contributing and consuming meters plus storage volumes or flows known for each zone. It is assumed that areas/zones can be isolated so that loss can be calculated for each area/zone. However, if any area/zones can not be isolated, they can be grouped together for purposes of loss calculation.
- Up-to-date information on distribution hierarchy is known and associations of contributing meters to consuming meters is available via ongoing synchronization. Customer's System of Record (CIS or GIS) must provide: (a) a list of parent and child meters, (b) a date-driven relationship (meter hierarchy) with corresponding multipliers. In the case when active/inactive dates are not available, these dates can be inferred during the DataSync process. Customer understands that the accuracy for the historical loss analysis may be affected.
- It is assumed that contributing meters and consuming meters deliver interval usage data, in intervals between 15 & 60 minutes. For bulk/master meters and storage flows, this data is typically provided by an integration to a SCADA system. For meters that do not deliver interval usage data, SmartWorks will quote the cost of performing an automatic calculation to spread longer term measured usage (e.g. monthly or weekly volume) into equal hourly volumes. These pro-rated hourly volumes will be used in the loss calculations.
- It is assumed that the customer can provide an accessible URL to the base map for their ESRI-Based GIS system, to act as the base map for the SmartWorks geo-spatial views. It is assumed that area/zones are visible as a layer in this GIS map.

AI Baseline Forecasting

The AI-Baseline & Forecast module applies Machine Learning to the creation of usage baselines and forecasts.

The process includes the following steps.

- Define training data sets, including historical usage data, weather data and data on other variables that impact usage.
- Define the ML model type and parameters.
- Train & Test the Machine Learning model.

- Use the model to produce baseline/forecast profiles.

Implementation

The default use-case (one) implemented as part of the AI Baseline & Forecast module is Usage Tracking. SmartWorks performs the setup for this use-case following the steps mentioned above. The utility can then adjust the models or create their own models and train them to improve accuracy or leverage new types of data. Users can refine models or create new models to address new use-cases. Additional use-cases can be implemented by SmartWorks for additional cost/effort not included in the base module. These additional use-cases can include: Usage Trending, Measurement & Verification, Customer Usage Prediction, Energy Procurement Planning. SmartWorks can also work with the utility in defining new use-cases required, if any.

Module Pre-Requisites & Assumptions

- Deployment of the Compass Framework by SmartWorks, if not already in place.
- Data has been imported into Compass for any independent variables to be used in the baseline or forecast algorithms.

Automated Move-In/Move-Out

SmartWorks Compass Automated Move-In/Move-Out (MIMO) module automates the process of populating and resolving MIMO service orders with start reads and final reads to save the CSRs the time to do it manually.

Virtual Disconnect is enabled by monitoring for usage on inactive accounts and proactively notifying the utility is usage is discovered.

KPI Dashboards provide tracking of the MIMO processes in general and the effort saved by automating them.

- KPI Dashboards of processes including:
 - o Actions performed
 - o Number of successes, number of failures
 - o Effort saved due to automation of these processes
- Rule for determining start reads and final reads for transition customers, including:
 - o Identifying open MIMO Service Orders
 - o Determining the appropriate final read for Move-Out Service orders
 - o Determining the appropriate start read for Move-In Service Orders
 - o Populating the MIMO Service Orders with the appropriate reads
- User Interface in Compass for single customer On-Demand Reads in the context of a Move
- Virtual Disconnect through identifying Usage on Inactive Accounts
 - o User Interface to interrogate the system and generate report of usage on Inactive Accounts
 - o Exception based reporting through scheduling of the report.

Implementation

- SmartWorks will implement and configure the above functionality.

- SmartWorks will train customer on module functionality and uses.
- SmartWorks will support customer testing.

Pre-Requisites & Assumptions

- Deployment of the Compass Framework by SmartWorks, if not already in place.
- Population of any data required.
- The CIS DataSync is in place and working. If this is not in place, another statement of work will need to be issued.
 - For Virtual Disconnect reporting, it is assumed that meters status are set to “OFF” as part of the DataSync process.
- Where Meter Actions such as On Demand Read or Remote Connect/Disconnect are required, the AMI remote actions are in place and working. If this is not in place, another statement of work will need to be issued.
- Move-In and Move-Out transitions will be recorded in the CIS as Service Orders (SO). Customer will provide a detailed list of these actionable Service Orders (SO) for automated Move-In / Move-Out processes. CIS is the system of record for whether a SO is actionable, considering items such as:
 1. Validating that SO is supported by meter type
 2. Life support/special needs customers
 3. Landlord/Tenant agreements
 4. Holidays
 5. Weather
- It is assumed that each CIS service order is tied to only one (1) meter.
- It is assumed that each CIS service order is tied to only one (1) remote action type (e.g. On-Demand read, Remote Connect, Remote Disconnect)
- It is assumed that the CIS provider allows and technically enables service order integration via MultiSpeak calls.

Transformer Loading Analysis

The SmartWorks Transformer Loading Analysis module continually analyzes loads on distribution transformers and identifies those at risk of failure, resulting in improved system reliability and better asset utilization. SmartWorks Transformer Loading Analysis uses AMI data, power factor and distribution network mapping to analyze transformer loads in relation to their ratings. Analytical calculations are run in the background so that detailed dashboards can be viewed on demand. You can interrogate the system to identify reliability risks and plan their mitigation strategy or leave it to the system to monitor loads on a continual basis, then serve up notifications based on configurable parameters.

- KPI Dashboard of Overloaded and Underloaded transformers, based on combination of
 - Peak level
 - % time above OOB
 - Drill downs from KPIs.
- Transformer Loading Dashboard

- o KPIs for
 - Qty of Tfrs peaking above 200%
 - Qty of Tfrs >10% over OOB
 - Qty of Tfrs >90% below OOB
- Map of Transformers by Load
- Map of Transformer-Meter relationships
- Transformer Contributors graph
- Watch-list of transformers implemented with Markers (Optional, extra services required to setup/train)
- Prioritized Replacement list implemented with Task Manager (Optional, extra services required to setup/train)

Implementation

- SmartWorks will implement and configure the above functionality.
- SmartWorks will train customer on module functionality and uses.
- SmartWorks will support customer testing.

Transformer Loading integration

SmartWorks Compass will require data from the GIS to support the transformer loading analysis. GIS will be required to provide transformer asset data as per table below. This integration will be established using a flat file transfer.

	Compass
Transformer assets, including kVA rating	X
Relationship between transformer and location	X

Pre-Requisites & Assumptions

- Deployment of the Compass Framework by SmartWorks, if not already in place.
- Population of any data required for Transformer Loading calculations, including interval reads for meters
- To enable the Transformer Load functionality, one of the utilities' System of Record documented in the Software Integrations section must provide:
 - o transformer assets, including KVA rating
 - o end point meter assets
 - o date-driven relationship between transformer and location date-driven relationship between end point meters and locations

MDM Software Integrations to AMI Head End System (Itron)

SmartWorks Software will integrate with the AMI Head End System to:

- **Meter reads:** Import the current day's readings as well as older reads that were previously missed. Interval and register read data will be received from AMI Head End system.
- **Meter events:** Import meter event data from AMI Head End. Examples include alerts such as tamper, leak, etc. Specific alarms will be defined between Itron and Customer.
- **Remote action:** Where the functionality is supported by the meters or compatible others, SmartWorks Software will integrate with the AMI Head End to perform On Demand reads and Remote Connects & Disconnects.
- **Voltage:** Min/Max/Average or Instantaneous. Nominal Voltage threshold (for high and low).
 - o Core Reports in Compass do not look at the data in the Voltage table. Voltage analysis module would need to be included in the scope of work or custom reports would need to be created using specific data in the Voltage table. Voltage Module and custom reports are not in scope but can be brought into scope using the Change Management Process.
- **Other Meter Data:** Other meter data can include any interval data that is not consumption data.
 - o It is assumed that Other Meter Data types be kept to a minimum as to not cause performance concerns for the Compass system. Core Reports in Compass do not look at the data in the OMD table. Custom reports would need to be created using specific data in the OMD table. These custom reports are not in scope but can be brought into scope using the Change Management Process.

Integration	Initiator	Type(s)	Protocol	Frequency
Meter Reads	AMI	CMEP Read File	sFTP	1-3 times/day
Meter Events	AMI	CMEP Event File	sFTP	1-3 times/day
Meter Events	AMI	Real Time events (to be defined)	MultiSpeak® methods	Near Real Time
Remote Actions	AMI	OnDemand read	MultiSpeak® methods	Near Real Time
Remote Actions	AMI	Remote Connect	MultiSpeak® methods	Near Real Time
Remote Actions	AMI	Remote Disconnect	MultiSpeak® methods	Near Real Time

Assumptions:

- If flat files are used for providing meter data, the files are expected to be delivered by 5:00am (local time) or an agreed upon time suitable to SmartWorks and Customer in

order for the SmartWorks Software to perform the VEE process. The AMI Head End may deliver files at multiple times during the day in order to collect the maximum amount of meter data.

- It is assumed that the applicable AMI Head End version will be installed on the Customer system in time for SmartWorks to perform its development and testing activities.
- It is assumed that interval reads provided by the AMI will scale to the register reads provided by the AMI (i.e. sum of interval reads will add up with the difference between register reads, after multiplier will pass at 95%). Failing to meet these may result in poor data quality in the MDM
- It is assumed that there will not be more than 5% missing intervals reads per day. Failing to meet these will result in performance issues when MDM tries to fill in gaps
- It is assumed that compound meters are two separate encoder heads and AMI Modules on one physical meter. Compass is Meter ID centric, therefore the system of record for meter information should see the High and Low sides of these meters as separate meter numbers. Compass can handle a single Meter ID assuming that the CIS can associate the High and Low sides of the meter using the Alt_Meter_ID and 'H' and 'L' suffixes in the DataSync.

Customer Information System (CIS) (AUS Infinity)

In collaboration with Customer or Customer's agent(s), SmartWorks will provide the following integrations with Customer's CIS. The integrations will require ongoing support from the CIS vendor through the SmartWorks integration project.

Summary of integrations

Integration	Initiator	Type	Protocol	Frequency
DataSync	CIS	API	API	
DataSync	MDM	Queries API	API	1-3 times/day
Billing	CIS	Billing Request	MultiSpeak® 4.1	TBD during discovery
Billing	MDM	Billing Response	MultiSpeak® 4.1	TBD during discovery
Remote Action	CIS	OnDemand read request	MultiSpeak® 4.1	Near Real Time
Remote Action	MDM	OnDemand read response	MultiSpeak® 4.1	Near Real Time
Remote Action	CIS	Remote Disconnect request	MultiSpeak® 4.1	Near Real Time

Integration	Initiator	Type	Protocol	Frequency
Remote Action	MDM	Remote Disconnect response	MultiSpeak® 4.1	Near Real Time
Remote Action	CIS	Remote Connect request	MultiSpeak® 4.1	Near Real Time
Remote Action	MDM	Remote Connect response	MultiSpeak® 4.1	Near Real Time
Work Order Creation	MDM	2 rules to be defined	MultiSpeak® 4.1	TBD during discovery

CIS Synchronization Integration

Import of customer and meter data into the SmartWorks Software for validation of AMI data. A daily full periodic synchronization activity will occur.

The minimum information to be provided from the CIS will include the following:

METERS: List of meters with identifiers, meter types, etc.
METER COORDINATES: Meter latitude and longitude information
LOCATION: List of location(account) numbers, service addresses
METER LOCATION: A date-driven cross reference between meter and location number (i.e. when a meter is installed and removed from a location)
METER CONNECTION STATUS: State of the meter (ON/OFF)
METER ALIAS: Descriptive information related to the meter, combining meter/location attributes
BILLING SCHEDULE: Cycle/Route schedule indicating billing period and reading period
ACCOUNTS: Customer Account information (such as account name, account ID, occupant code)
ACCOUNT SERVICES: A date-driven cross reference between account and location (i.e. customer move in/out information)
CUSTOMERS: List of customers with identifiers and names, email address
CUSTOMER/ACCOUNTS CROSS REFERENCE: A date-driven cross reference between account and customers

Assumptions:

- It is expected that when a radio is installed or removed from a meter, a cross reference between meter ID and associated radio ID will be maintained in the CIS and provided during DataSync.
- This integration will be established using a REST API. Any delays with the availability of this integration will impact the project timeline. In the case of significant delays, Customer has the option to pause the project until the integration is available or follow Change Management process described in section 4.3 to keep the SmartWorks Project team engaged until the files are available.
- It is assumed there will be multiple iterations of the DataSync (typically 3-4) where the list of fields to be provided by the CIS via the API, will be finalized after discovery and prior to UAT. Customer is responsible for validating the data as a result of each DataSync iteration.
- Depending on Customer requirements, the synchronization will occur between 1 to 3 times per day and will be scheduled to occur after the CIS Customer database has been updated.
- Integration with the AMI head end system for the purpose of facilitating synchronization of the meter status (meter provisioning) between the AMI head end system and CIS is not included in the scope of this project. This integration enables the identification of meters that should be transmitting data to the MDM. It is therefore assumed that a direct integration will be made between the AMI head end system and the CIS. It is expected that Customer and AMI provider will work collaboratively to develop this integration.
- It is assumed that the MDM instance will point to 1 instance of CIS during the implementation phase of the project. The MDM will be redirected to the production instance of the CIS as part of the Go-Live activities.

Billing Interface (MultiSpeak®)

Customer will initially bill using register reads, not time-based determinants for most meters. Customer CIS will apply the correct rate to each register.

AUS and SmartWorks Software will use a MultiSpeak® web service (synchronous SOAP call) call to request and receive the latest available read. [CIS Vendor] will apply the correct rate to each register.

Assumptions:

It is assumed that all reads required for the purpose of billing will be provided by the AMI system. Should **SmartWorks Compass** be required to perform calculation (e.g. Power Factor, Peak Demand, TOU, Net Billing), the services can be brought into scope using the change order process.

- Where TOU blocks/buckets are used for billing the blocks/buckets will be passed to **SmartWorks Compass** from the AMI. **SmartWorks Compass** will pass the blocks/buckets as generated at the meter level and passed to **SmartWorks Compass** through the AMI out to the Client's CIS.

- It is assumed that C&I meters will be configured to capture and report peak demand values for each demand interval. These demand values provided by the AMI system will be used by SmartWorks Compass for the purpose of billing demand. Should SmartWorks Compass be required to perform the calculation of the peak demand for each meter, the services can be brought into scope using the change order process.
- The SmartWorks Software will also support City's Net Billing. Net billed clients have meters with multiple registers. For these clients, the MVRS file will contain records for both registers and The SmartWorks Software will provide the information for each register as received from the AMI headend. The SmartWorks Software will not perform the activity to calculate a net usage.

For electric meters, a new rule will be created to identify the monthly peak demand for billing purposes.

- It is assumed that the demand will be **reset daily** at the meter level and that a daily peak demand value will be provided by the AMI. If the AMI is not providing daily peak demand values and these need to be calculated by Compass, this would be considered additional effort.
- It is assumed that the CIS will provide an attribute to identify meters that will require the monthly peak demand calculation.
- It is assumed that the CIS will provide the last bill read date/time value in DataSync to notify the MDM in the determination of the reading period for billing.
- The rule will be scheduled to calculate once per day

Meter Action Initiation from CIS

- On Demand reads
 - In the context of Move
 - In the context of a Remote Connect/Disconnect
- Remote Disconnect/Remote Connect
 - In the context of a Move
 - In the context of a Disconnect for Non-Payment

The SmartWorks Software will provide the ability for a user to use the CIS to initiate a remote meter action (On Demand read, Remote Connect, Remote Disconnect).

MultiSpeak® methods will be used to accomplish this integration. The SmartWorks Software will act as the server end of MultiSpeak® an asynchronous command for a remote meter action from the CIS. The SmartWorks Software will broker the transaction by integrating with the AMI head end system.

Service Order Creation from MDM

The SmartWorks Software will have a MultiSpeak® interface with the CIS that allows the

Process Automation rules to create service orders.

- The SmartWorks Software will query the CIS to confirm if a Service Order already exists for the location/account,
- If a Service Order does not already exist, a Services Order will be created. Customer is responsible for providing Service Order type for each use case.

As part of the scope of this integration, SmartWorks will deliver up to two (2) mutually agreed upon business rules that will each enable the automation of one (1) Service Order type and one (1) resulting action.

Example of Use Cases:

- Non-Communicating meter
- Leak Detected
- Meter tamper

These business rules shall be identified prior to Functional and Process Training. If identification of these business rules are not identified prior to Functional and Process Training and cause project delays, this may require going through the change order process.

Geographic Information System (GIS) Integration - ESRI

Base Map

The SmartWorks Software will be configured so that meter data will be overlaid on top of one or more ESRI “Base Maps” via URL live link. With this capability, the Customer will be able to view meter data together with their other data layers within SmartWorks Software.

Customer will create URL and provide a custom base map to SmartWorks for configuration of **MeterSense**. This scope of integration assumes Customer is hosting ESRI on a web server and can provide a URL.

Transformer

Customer GIS will be the system of record for the transformer-to-location relationships. SmartWorks will implement a flat file transfer integration to import the GIS transformer asset data required to support transformer loading analysis, as listed in the table below.

	Compass
Transformer assets, including kVA rating	X
Relationship between transformer and location	X
Meters to feeder relationships and corresponding multipliers	X

SmartWorks Compass will receive from the ESRI GIS the connectivity model to include relationships between meters and transformers and corresponding CT/PT multipliers, if applicable. This data will be made available using flat files on at least a daily basis. If active/inactive dates for the relationships in the connectivity model are not available, historical relationships will be inferred by SmartWorks Compass based on the DataSync date; this may impact the accuracy of the transformer report if the relationship change didn't occur on the same date as the DataSync date.

Meter Hierarchy

For the purpose of the Loss Analysis module, it is assumed that SmartWorks Compass will receive a connectivity model to include meter relationships and corresponding multipliers. This data will be made available using flat files. If active/inactive dates are not available, the historical relationships will be inferred by SmartWorks Compass based on the DataSync date; this may impact the accuracy of the loss analysis if the relationship change didn't occur on the same date as the DataSync date.

The Weather Network

The SmartWorks Software will integrate weather data services with daily feed of observed weather data received from the Weather Network weather station determined to be closest to Customer's location.

The following weather data, if provided by the weather station, will be imported into SmartWorks Software:

- Temperature (Hourly)
- Humidity (Hourly)
- Wind Speed (Hourly)
- Wind Direction (Hourly)
- Weather Conditions (Hourly)
- Precipitation (Daily)

This data is automatically downloaded from SmartWorks' data provider for a weather station or stations in the Customer's service area and is automatically inserted into the SmartWorks Software database.

Implementation Phases	Objectives	Key Work Products and Activities	Deliverables
Phase I Initiation and Build Key Milestones - Kick Off Meeting Held - Project Plan Reviewed/Updated	- To Kick Off project and establish successful working relationship - To obtain detailed agreement on Project Plan - To install and perform base configuration work	- Kick Off Meeting - Implementation Questionnaire - Milestone Acceptance Document – sec 5.7.1 - Initial Configuration complete - Physical Architecture Recommendation	- SmartWorks Software installation - Software Overview Training Session
Phase II Analysis Key Milestones - Integration Documents signed - Functional and Integration Requirement Document signed	- To demonstrate base configuration functionality - Conduct Discovery Sessions - To obtain an agreement on what is remaining to be delivered	- Discovery Session(s) Summary - Milestone Acceptance Document – sec 5.7.1	Functional and Integration Requirements Document

Implementation Phases	Objectives	Key Work Products and Activities	Deliverables
Phase III Development Key Milestones Solution Feature / Code / Configuration Complete	- To configure according to requirements and build the Solution components - To write associated test cases that Customer would execute for acceptance of the Solution	- Test Scenarios / Cases - User Acceptance Test Scripts - Base Solution Installed and Configured - Milestone Acceptance Document	- SmartWorks Software configuration - SmartWorks Software integration
Phase IV Testing Key Milestones User Acceptance Testing Complete	- To move the Solution to a known state of quality and ready for deployment - To train customer on their Solution	- Functional Testing Results - Integration Testing Results - UAT Acceptance Criteria - Accepted Solution per UAT - Milestone Acceptance Document	- Functional and Process Training - User Acceptance Testing Support
Phase V Deployment Key Milestones Solution Live	To move the Solution into a production environment state and transition support to the operations team	- Go-Live Approach Document - Solution Live	Installation Acceptance

D.5 Training

D.5.1 Itron AMI Application Training

Itron will deliver end user UIQ application training by web conferencing (e.g., WebEx) designed to cover basic UIQ functionality as a set of structured training courses. The Table D.5.1.1 below gives a description of each course. The City will need to provide Itron with four (4) weeks written notice prior to scheduling any end user application training at a mutually convenient date and time.

Standard class size is a minimum of six (6) students and will be delivered once over 4 days. Class size can be expanded to a maximum of twelve (12) students for an additional fee per student. Additional class sessions may also be purchased for a minimum of six (6) students.

In addition to the courses below, field training will be performed. The City will need to provide a facility suitable to comfortably accommodate the maximum class size identified, a projections system that allows for presentation of class training materials, Wi-Fi access to accommodate requirements for a network connection in the delivery of training, student-issued PCs pre-loaded with requisite applications and/or enabled with remote access to required Production Environment, and any required Test Equipment to execute hands-on segments of presented training.

Table D.5.1.1 Itron Training Courses

Course Description	Course Overview
UIQ.101: Introduction to the GenX UIQ Advanced Metering Solution	Overview of the capabilities of the GenX UIQ Advanced Metering Management (AMM) software, including key terms and concepts, how to monitor and manage electric, gas, and water meters, and Network Devices. An overview of Home Area Networking (HAN) is included along with discussions of metering and system integration basics.
AMM.200: AMM System Operator	This course provides information about how to use the Advanced Meter Management (AMM) system to manage Smart Grid devices. It describes the user interface and device states, and how to perform day-to-day operator tasks such as searching for devices, viewing device status, checking device connectivity, provisioning devices remotely, and generating reports. Home Area Network (HAN) messaging is also discussed.
AMI.250: AMM System Manager	This course describes how to configure the Advanced Meter Management (AMM) software used to effectively monitor and manage your GenX Smart Grid devices. Details about meter programs, scheduling meter reads, managing background jobs and schedule and read events are covered. Importing device and location information, viewing, creating, and editing data export jobs, monitoring network and device events, generating reports, and performing user administration tasks round out the course.

Course Description	Course Overview
NC.200: Network Center	Core project team This course provides an overview of the capabilities of the Itron Network Center software, including key terms and concepts, how it is used to baseline performance of neighborhood area networks (NAN) devices, to perform basic troubleshooting tasks, and how to interpret the data and results in associated reports.
FWU.00: Firmware Upgrader	Core project team, Billing, Meter Op, CSR, IT This course provides an overview of the capabilities of the Firmware Upgrader (FWU). Learn how to use the Firmware Upgrader. Learn the principles of the firmware upgrade process as well as how to configure, schedule and run firmware upgrades.
MPC.200: Meter Program Configurator Training	Core project team MPC (Meter Program Configurator) course reviews the principles of meter programs and the use of the product on creating and performing over the air meter program updates.
SEC.101: Introduction to GenX Security	This lecture course covers the fundamentals of the ITRON GENX Hardware and Software security solution. In this course you will learn the ways that hackers attack and friendlies can misuse the system and how ITRON addresses these concerns with a layered security approach.
SEC.200: FSU-SAM	This course provides an overview of the capabilities of the Secure Access Manager (SAM) used in conjunction with the Field Service Unit (FSU). It includes an overview of ITRON's basic field security technology and tools. Students will learn the features, benefits and limitations enforced using the tools. Students will also learn how to use install, configure, and use SAM.
G5R.101: Introduction to Gen5Riva Meters with the Meter Lifecycle	Core, Billing, Meter Op, CSR This course provides an overview of the lifecycle of the Gen5Riva Meters. It includes the lifecycle of the device from manufacturing, through delivery, normal use, and retirement. Details of the features and functionality in the meters are also included.
G5R.110: Introduction to Gen5Riva Meters with Power Outage and Power Return Notification	This course outlines and explains the details of the power outage process for the Gen5Riva meter. It includes details of not only the process on the meter but how the power outage messages are passed through the mesh and into the head-end system.
G5R.130: Overview of Gen5Riva Single and Polyphase Meters and Field Tool Options	This course provides an in-depth overview of the features and functionality of the Gen5Riva Single and Polyphase meters, along with an overview of the field tools needed to deploy, use, and troubleshoot Gen5Riva meters. This lecture-only course introduces the Hardware and Software needed for this Project. Those products include Itron Mobile Radios, Field Service Units, Field Deployment Manager (FDM), FDM Mobile Tools client, and Communications Tester (CT), and the UIQ Suite.

Course Description	Course Overview
TLS.210: Communication Tester	This course provides a hands-on laboratory for managing communications Network Interface Cards (NIC) using Field Service Units (FSU) and Communications Tester. It focuses on deployment, configuration, and management of the FSU hardware. Includes onsite Field Training with a Field Engineer participating.
500W.101: Intro to 500W Devices and UtilityIQ	This lecture-only course provides an introduction to the ITRON 500W Software and Hardware solutions. It covers the architecture, scaling, and performance of the ITRON 500W Battery powered devices as well as security and the lifecycle of these devices.
500W.110: 500W Hardware Devices and Features	This lecture only course introduces the three battery powered device types supported in the ITRON GenX 500W solution. It introduces the three (3) types of devices and the supported features with each device. Note that depending on RPU familiarity with Itron 500W ERT devices, this course may not be required.
500W.200: Using and Managing 500W Devices with UtilityIQ	This hands-on course provides students with experience using troubleshooting the 500W devices in UIQ. It covers the use of the devices with AMM, NC, FWU, and MPC.

D.5.2 SmartWorks Compass Training

The SmartWorks Compass Training and Discovery Sessions will be required in order for the City to learn about and then utilize the various modules included with this software suite. The following Table D.5.2.1 outlines the training schedule and details.

Table D.5.2.1 SmartWorks Compass Software Training

Activity	Location	Attendees	Length
Kick Off Introduction Meeting	Remote	Core project team, Executive Sponsors	1-2 hours
SmartWorks Compass demo	Onsite* (with Discovery)	Core project team, Billing, Meter Op, CSR, IT	1 hour
Discovery Sessions	Onsite*	Core project team, Billing, Meter Op, CSR, IT 3 rd Parties (CIS, AMI)	1.5 days
Workshop 1: Compass Overview and Introduction to VEE	Remote	Core project team	1 hours
Navigation Training Sessions	Onsite*	Core project team, Billing, Meter Op, CSR, IT	2 days
Workshop 2: Initial VEE Parameter Defaults	Remote	Core project team	2 hours
Workshop 3: Data Validation	Remote	Core project team	0.5 day
Workshop 4: Roles and Groups configuration	Remote	Core project team	1 hour
Workshop 5: Addressing VEE Exceptions	Remote	Core, Billing, Meter Op, CSR	2 hours
Processes and System review Session	Onsite*	Core project team, Billing, Meter Op, CSR, IT 3 rd Parties (CIS, AMI, etc.)	2 days
Workshop 6: Fine Tuning VEE Routines	Remote	Core, Billing, Meter Op, CSR	2 hours
SmartWorks Compass Functional and Process Training	Remote/Onsite	Core, Billing, Meter Op, CSR	2 days
Test scripts review	Remote	Core, Billing, Meter Op, CSR	1 hour
UAT Acceptance Testing Support	Remote	Core, Billing, Meter Op, CSR, IT	10 days

Note: Onsite* sessions will take place when safe and appropriate. The onsite sessions can be replaced with remote online sessions upon agreement between SmartWorks and Customer.

The purpose of each meeting is provided below:

Course Description	Course Overview
Kick Off Introduction Meeting	The purpose of this remote meeting is to introduce project team members and review the MDM project at a high level. Topics include scheduling, methodology, milestones, communication plan and short-term focus.
SmartWorks Compass demo	High level review of SmartWorks Compass features and functionalities. The purpose of this demo is to prepare Customer to engage in discussions during the Discovery Sessions.
Discovery Sessions	Preliminary requirements for the CIS Data mapping (DataSync) and billing (Meter to Cash), as well as for the AMI integration (Implementation Questionnaire) are reviewed during these sessions. The Solution Architecture Diagram and infrastructure components such as VPN connection are also scheduled as part of the initial discovery sessions. The VPN discussions should have started remotely, prior to Discovery. These sessions are technical and participation from Customer's subject matter experts as well as third party vendors are expected to ensure optimal efficiency during the initial phases of the project. Meeting the dependencies identified during the initial discovery sessions is critical for the scheduling of subsequent project activities.
Workshop 1: Compass Overview and Introduction to VEE	The purpose of this session is to introduce the core team to SmartWorks Compass functionality and to the existing Validation Routines available within SmartWorks Compass. The Overview Training Session is held with the core user group when initial configuration is complete. This session occurs during the Pilot phase and is held remotely, in preparation for the Onsite Discovery Session, enabling users to navigate the SmartWorks Software prior to the decision-making process that will take place during the Discovery Session. The Overview Training Session provides users an overview of current system functionality. Upon conclusion of this session, users are able to navigate SmartWorks Compass platform and understand existing configuration.

Course Description	Course Overview
Navigation Training Sessions	The Functional and Navigation Training Session is held once initial configuration of DataSync and AMI read import is complete. The purpose of this training session is to introduce the Core project team to the SmartWorks Compass application, enabling users to navigate the SmartWorks Software prior to the decision-making process that will take place during the following remote workshops and onsite sessions. The Navigation Training Session provides users an overview of current system functionality. Upon conclusion of this session, users are able to navigate SmartWorks Compass platform and understand existing configuration. Topics typically covered in this training include: • SmartWorks Compass Navigation training • Data Setup • Meter Reads & Validating, Estimating, Editing – VEE • Using Maps and Reports • Advanced Reporting and KPI Dashboards • System Administration
Workshop 2: Initial VEE Parameter Defaults	This workshop will guide Customer personnel through the initial configuration of VEE routines within the SmartWorks Compass platform. The session will focus on enabling core validation rules, estimation logic, and editing workflows tailored to the Customer's meter population and business requirements.
Workshop 3: Data Validation	This workshop is held once initial configuration of DataSync and AMI read import is completed. The purpose of this Workshop is to review data within SmartWorks compass, including the review of validation reports. Following this workshop, it is expected that users will proceed with validation of the data from the CIS DataSync and AMI integrations, by comparing to their existing CIS and AMI systems.
Workshop 4: Roles and Groups configuration	The purpose of this Workshop is to determine who will be the user groups of the SmartWorks Compass solution, their access level and which permissions will be assigned to each group.
Workshop 5: Addressing VEE Exceptions	This workshop provides Customer personnel with the tools and knowledge required to effectively manage and resolve VEE (Validation, Estimation, and Editing) Exceptions within the SmartWorks Compass platform. The session emphasizes hands-on investigation of exception reports and refinement of VEE parameters to ensure optimal system performance.
Processes and System review Session	The purpose of the Process and System review Session is to demonstrate existing functionality of the SmartWorks Software using Customer data and elicit feedback for updates to that functionality. Emphasis is placed on understanding Customer's existing business process. The impact to the process due to SmartWorks Software is documented in the Functional and Integration Requirement Document. Customization (custom reports) as well as purchased Modules (see section 2.5) are discussed during this session.

Course Description	Course Overview
Workshop 6: Fine Tuning VEE Routines	The purpose of this workshop is to fine-tune the VEE Parameter configuration within the SmartWorks Compass platform. It is expected that all necessary VEE routines are enabled from this point through transition to support, ensuring a stable and effective validation, estimation, and editing process.
SmartWorks Compass Functional and Process Training	During the Functional and Process Training, up to 12 users will be provided training on the SmartWorks Software. This training includes a refresher of System Navigation as well as a review of the main business functions and use cases applicable to Customer. This training will also cover customization and features related to Modules purchased by the customer. Topics typically covered in this training include: • SmartWorks Compass Refresher training • Billing & Customer Service Functions • Sessions specific to each SmartWorks Compass module defined in section 2.5 • Process Automation Overview
Test scripts review	This session will be used to review SmartWorks test scripts with Customer and how to monitor testing progress using test scripts dashboard. It is Customer responsibility to create, update and adapt the test scripts for the purpose of their User Acceptance Testing phase.
UAT Acceptance Testing Support	Customer is expected to focus and engage in User Acceptance Testing for a period of 10 days, with the remote support from the SmartWorks project team. It is important to note that this testing period excludes any time allocated for issues resolution. The allocation of these 10 testing days may be distributed over a timeframe ranging from 2 to 4 weeks, with the specific scheduling to be determined during the UAT planning phase, involving collaboration among both the Project Managers, the Customer and SmartWorks.

D.6 Construction Schedule

A construction schedule can be found on the pages immediately following.

ID	Task Name	Duration	Start	Finish	May	Jun	Qtr 3, 2026 Jul	Aug	Sep
1	Columbia (COMO)	639 days?	Fri 09/18/26	Wed 03/28/29					
2	Contract	1 day	Fri 09/18/26	Fri 09/18/26					
3	Notice to Proceed	8 days	Mon 09/21/26	Wed 09/30/26					
4	Pre Deployment Phase (Planning)	31 days	Thu 10/01/26	Thu 11/12/26					
5	Purchase Orders to Vendors/Subcontractor	31 days	Thu 10/01/26	Thu 11/12/26					
6	Wesco (Access Points/ Relays)	10 days	Thu 10/01/26	Wed 10/14/26					
7	Wesco (Electric Meters)	10 days	Thu 10/01/26	Wed 10/14/26					
8	USS (Water Meter Erts)	10 days	Thu 10/01/26	Wed 10/14/26					
9	Badger Meters (Water Meters)	10 days	Thu 10/01/26	Wed 10/14/26					
10	Smart Works (MDM)	10 days	Thu 10/01/26	Wed 10/14/26					
11	Issue Sub-Contracts (Installation Team)	30 days	Thu 10/01/26	Wed 11/11/26					
12	Key Stake Holder Kick Off Meeting	1 day	Thu 11/12/26	Thu 11/12/26					
13	Materials Procurement- (phase released)	334 days	Fri 09/18/26	Thu 01/13/28					
14	First Material Release	81 days	Thu 10/15/26	Wed 02/10/27					
15	Wesco (Access Points/ Relays)	44 days	Thu 10/15/26	Wed 12/16/26					
16	Wesco (Electric Meters)	79 days	Thu 10/15/26	Mon 02/08/27					
17	USS (Water Meter Erts)	80 days	Thu 10/15/26	Tue 02/09/27					
18	Badger Meters (Water Meters)	81 days	Thu 10/15/26	Wed 02/10/27					
19	Second Material Release	72 days	Tue 02/09/27	Wed 05/19/27					
20	Wesco (Electric Meters)	70 days	Tue 02/09/27	Mon 05/17/27					
21	USS (Water Meter Erts)	70 days	Wed 02/10/27	Tue 05/18/27					
22	Badger Meters (Water Meters)	70 days	Thu 02/11/27	Wed 05/19/27					
23	Third Material Release	72 days	Tue 05/18/27	Mon 08/30/27					
24	Wesco (Electric Meters)	70 days	Tue 05/18/27	Thu 08/26/27					
25	USS (Water Meter Erts)	70 days	Wed 05/19/27	Fri 08/27/27					
26	Badger Meters (Water Meters)	70 days	Thu 05/20/27	Mon 08/30/27					
27	Fourth Material Release	71 days	Mon 08/30/27	Thu 12/09/27					
28	Wesco (Electric Meters)	70 days	Mon 08/30/27	Wed 12/08/27					
29	USS (Water Meter Erts)	70 days	Mon 08/30/27	Wed 12/08/27					
30	Badger Meters (Water Meters)	70 days	Tue 08/31/27	Thu 12/09/27					
31	Infrastructure Installation & Commissioning (COMO Self Performing)	97 days	Fri 09/18/26	Fri 02/05/27					
32	Access/Relay Point Survey (final installation location's locked in)	4 days	Fri 09/18/26	Wed 09/23/26					
33	Access/Relay Point Location Approval from COMO	15 days	Thu 09/24/26	Wed 10/14/26					
34	Receive Access/ Relay Point Materials	1 day	Thu 12/17/26	Thu 12/17/26					
35	Installation Access/Relay Point(s)	30 days	Fri 12/18/26	Tue 02/02/27					
36	Commissioning of Access/Replay Point(s) (USS/ Itron)	3 days	Wed 02/03/27	Fri 02/05/27					
37	Integration / Implementation Phase	326 days	Wed 09/30/26	Thu 01/13/28					
38	MDM Implementation	326 days	Wed 09/30/26	Thu 01/13/28					
39	Project Overview	1 day	Wed 09/30/26	Wed 09/30/26					
40	Contract Execution	1 day	Wed 09/30/26	Wed 09/30/26					
41	Compass Installation	1 day	Thu 10/01/26	Thu 10/01/26					
42	Project Kick off (remote)	1 day	Thu 10/01/26	Thu 10/01/26					
43	Onsite Discovery	15 days	Thu 10/15/26	Wed 11/04/26					
44	Draft of Agenda - Onsite Discovery	5 days	Thu 10/15/26	Wed 10/21/26					
45	Questionnaires and Drafts of documents	10 days	Thu 10/15/26	Wed 10/28/26					

Project: Columbia MO Master P
Date: Fri 05/29/26

Task

Split

Milestone

Summary

Project Summary

Inactive Task

Inactive Milestone

Inactive Summary

Manual Task

Duration-only

Manual Summary Rollup

Manual Summary

Start-only

Finish-only

External Tasks

External Milestone

Deadline

Progress

Manual Progress

ID	Task Name	Duration	Start	Finish	May	Jun	Qtr 3, 2026	Jul	Aug	Sep
46	Onsite Discovery session - 2 days	4 days	Fri 10/30/26	Wed 11/04/26						
47	VPN Build	15 days	Thu 11/05/26	Wed 11/25/26						
48	Integration Points document completed	5 days	Thu 11/05/26	Wed 11/11/26						
49	VPN build complete	10 days	Thu 11/12/26	Wed 11/25/26						
50	Initial CIS Integration	5 days	Fri 11/27/26	Thu 12/03/26						
51	Connectivity with CIS established	3 days	Fri 11/27/26	Tue 12/01/26						
52	DataSync information from CIS available	1 day	Wed 12/02/26	Wed 12/02/26						
53	Initial DataSync Completed	1 day	Thu 12/03/26	Thu 12/03/26						
54	Initial AMI Integration	18 days	Tue 02/23/27	Thu 03/18/27						
55	Connectivity with AMI established	3 days	Tue 02/23/27	Thu 02/25/27						
56	Initial Meter Data load files available for Compass	10 days	Fri 02/26/27	Thu 03/11/27						
57	MultiSpeak Config for Remote actions with AMI	3 days	Fri 02/26/27	Tue 03/02/27						
58	Initial AMI Integration Completed	5 days	Fri 03/12/27	Thu 03/18/27						
59	Workshops & Training Sessions	15 days	Fri 03/12/27	Thu 04/01/27						
60	Introduction to VEE - Workshop	1 day	Fri 03/12/27	Fri 03/12/27						
61	Compass Navigation Training - Onsite	9 days	Fri 03/19/27	Wed 03/31/27						
62	Agenda and Training Preparation	5 days	Fri 03/19/27	Thu 03/25/27						
63	Onsite Navigation Training - 2 days	4 days	Fri 03/26/27	Wed 03/31/27						
64	Data Validation Training - Workshop	1 day	Thu 04/01/27	Thu 04/01/27						
65	Final Requirements & Requirements Documents	30 days	Thu 04/01/27	Wed 05/12/27						
66	Process and System Review - Preparation and Agenda	5 days	Thu 04/01/27	Wed 04/07/27						
67	Process and System Review - Onsite Sessions	5 days	Thu 04/08/27	Wed 04/14/27						
68	Requirement Documents - Review and Sign Off	20 days	Thu 04/15/27	Wed 05/12/27						
69	Final CIS Configurations	61 days	Wed 04/14/27	Mon 07/12/27						
70	Finalize DataSync Configurations	60 days	Thu 04/15/27	Mon 07/12/27						
71	Finalize Billing Configurations	30 days	Thu 04/15/27	Thu 05/27/27						
72	Final AMI Configurations	35 days	Wed 04/14/27	Wed 06/02/27						
73	Finalize MeterData Configurations	35 days	Thu 04/15/27	Thu 06/03/27						
74	Finalize Remote Actions Configurations	20 days	Thu 04/15/27	Wed 05/12/27						
75	Modules Implementation	120 days	Thu 04/15/27	Tue 10/05/27						
76	Automated Connect/Disconnect	90 days	Thu 04/15/27	Mon 08/23/27						
77	Automated Move-In/Move-Out	90 days	Thu 04/15/27	Mon 08/23/27						
78	Advanced Leak Detection	90 days	Thu 04/15/27	Mon 08/23/27						
79	Water Loss Analysis	90 days	Thu 04/15/27	Mon 08/23/27						
80	AI Baseline Forecasting	120 days	Thu 04/15/27	Tue 10/05/27						
81	Transformer Loading Analysis	90 days	Thu 04/15/27	Mon 08/23/27						
82	Final Workshops & Training	124 days	Thu 04/15/27	Mon 10/11/27						
83	Roles and Group Configuration	1 day	Thu 04/15/27	Thu 04/15/27						
84	Addressing VEE Exceptions & Fine Tuning	1 day	Tue 07/13/27	Tue 07/13/27						
85	Functional and Process Training	4 days	Wed 10/06/27	Mon 10/11/27						
86	UAT Preparation and Internal Testing	10 days	Tue 10/12/27	Mon 10/25/27						
87	UAT Test Scripts Review	3 days	Tue 10/12/27	Thu 10/14/27						
88	Pre UAT Testing by SmartWorks	10 days	Tue 10/12/27	Mon 10/25/27						
89	UAT - User Acceptance Testing	10 days	Tue 10/26/27	Mon 11/08/27						
90	UAT Support	10 days	Tue 10/26/27	Mon 11/08/27						

Project: Columbia MO Master P
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Task

Split

Milestone

Summary

Project Summary

Inactive Task

Inactive Milestone

Inactive Summary

Manual Task

Duration-only

Manual Summary Rollup

Manual Summary

Start-only

Finish-only

External Tasks

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D.0 Implementation of the Proposed System Improvements | 135

City of Columbia, Missouri
Investment Grade Audit

E.0 Savings and Revenue Analysis



E.0 Savings and Revenue Analysis

The savings and revenue analysis for this project is broken into the following sections:

- Electric Revenue Increase
- Water Revenue Increase
- Sewer Revenue Increase
- Operations and Maintenance Savings
- Savings and Revenue Summary
- Measurement and Verification

Each section will be described in detail below.

E.1 Electric Revenue Increase

To calculate the potential revenue increase from replacing older electromechanical electric meters, the baseline energy consumption must be established. Electric meter consumption and revenues are presented below. Table E.1.1 lists the annual electric consumption by service type as provided in the Electric Sales Report by the City. The baseline annual electric consumption is 1,166,426,410 kWh.

Table E.1.1 Electric Consumption (kWh) Summary

Service Type	2023 Consumption (kWh)	2024 Consumption (kWh)	2025 Consumption (kWh)	Baseline Consumption (3-Year Average) (kWh)
Residential - Gas Heat	250,473,654	247,524,061	252,464,603	250,154,106
Residential - Electric Heat	150,878,676	146,996,587	158,091,243	151,988,835
Residential - Heat Pump	36,562,595	35,366,819	37,619,428	36,516,281
Small General Service - Gas Heat	75,238,104	71,214,678	72,719,573	73,057,452
Small General Service - Electric Heat	24,067,057	22,773,101	24,130,823	23,656,994
Small General Service - Heat Pump	508,463	506,507	491,507	502,159
Small General Service - Optional Demand	6,447,075	5,975,560	5,902,412	6,108,349
Large General Service	357,969,737	350,277,533	361,282,899	356,510,056
Industrial	260,576,724	270,739,709	268,455,657	266,590,696
Industrial - Interruptible	1,330,655	1,248,938	1,444,851	1,341,481
Total:	1,164,052,740	1,152,623,493	2,316,676,233	1,166,426,410

Table E.1.2 lists the annual revenue from the electric utility. The baseline annual electric revenue is \$148,476,676 a year.

Table E.1.2 Electric Revenue (\$) Summary

Service Type	2023 Consumption (\$)	2024 Consumption (\$)	2025 Consumption (\$)	Baseline Consumption (3-Year Average) (\$)
Residential - Gas Heat	\$34,663,376	\$38,983,206	\$40,724,177	\$38,123,586
Residential - Electric Heat	\$19,455,667	\$21,522,565	\$23,711,470	\$21,563,234
Residential - Heat Pump	\$4,544,177	\$4,992,774	\$5,450,964	\$4,995,972
Small General Service - Gas Heat	\$10,346,057	\$11,054,345	\$11,579,000	\$10,993,134
Small General Service - Electric Heat	\$3,119,668	\$3,317,447	\$3,615,713	\$3,350,943
Small General Service - Heat Pump	\$64,925	\$72,717	\$70,865	\$69,502
Small General Service - Optional Demand	\$682,019	\$695,659	\$714,334	\$697,337
Large General Service	\$36,970,032	\$41,103,055	\$43,585,538	\$40,552,875
Industrial	\$24,908,648	\$29,085,008	\$29,741,027	\$27,911,561
Industrial - Interruptible	\$228,112	\$206,474	\$221,012	\$218,533
Total:	\$134,982,680	\$151,033,247	\$286,015,927	\$148,476,676

The energy rate used in this revenue increase calculation is a blended rate. The total Baseline Consumption Revenue is divided by the Baseline Consumption Usage for each service type to get to a \$/kWh. Table E.1.3 below lists the blended rates used in this analysis by service type.

Table E.1.3 Blended Utility Rate by Service Type

Service Type	3-Year Average Blended Rate (\$/kWh)
Residential - Gas Heat	\$0.1524
Residential - Electric Heat	\$0.1419
Residential - Heat Pump	\$0.1368
Small General Service - Gas Heat	\$0.1505
Small General Service - Electric Heat	\$0.1416
Small General Service - Heat Pump	\$0.1384
Small General Service - Optional Demand	\$0.1142
Large General Service	\$0.1137
Industrial	\$0.1047
Industrial - Interruptible	\$0.1629

Projected electric revenue increases from meter replacement are calculated based on the increase in metered consumption. Increased meter accuracy will result in increased billed consumption. Customer's total electrical revenues for fiscal year 2024 were \$157,394,924. Customer has a total of 53,992 electric meters, which equates to an average of \$2,915.15 per year per meter. According to Customer's database, there are 34,554 solid state Itron electric meters and 19,438 non-solid state meters of various manufacturers in the system. Using industry standards, Ameresco calculated a 3% accuracy gain for all non-solid state meters and a 0.5% accuracy gain for all solid state meters. Based on those calculations, the accuracy gain resulted in Year 1 revenue increase of \$2,203,593 which is approximately 1.4% of the total 2024 electric revenues. These electric revenues will be stipulated for all future years.

The electric rates for the City of Columbia are provided in [Appendix F.6 - Electric Rate Structures](#) for reference purposes.

E.2 Water Revenue Increase

In order to calculate the potential revenue increase from replacing older mechanical water meters, the baseline water consumption must be established. Table E.2.1 presents the total metered water consumption by rate based on review of the database files provided by the City in October 2025. The baseline annual water consumption for all meter sizes is 4,583,221 CCF per year.

Table E.2.1 Baseline Water Consumption by Rate and Size Category

Service Type	2023 Consumption (CCF)	2024 Consumption (CCF)	2025 Consumption (CCF)	Baseline Consumption (CCF)
Small Water Meter - Apr to Dec - Tier 1	878,104	926,493	1,022,566	942,387
Small Water Meter - Apr to Dec - Tier 2	225,921	209,216	217,173	217,437
Small Water Meter - Apr to Dec - Tier 3	2,424,902	1,382,345	1,640,504	1,815,917
Small Water Meter - Jan to Mar	355,840	380,641	415,240	383,907
Intermediate Water Meter - Apr to Dec - Tier 1	225,535	231,886	221,389	226,270
Intermediate Water Meter - Apr to Dec - Tier 2	46,960	42,000	38,134	42,364
Intermediate Water Meter - Apr to Dec - Tier 3	16,711	12,062	11,784	13,519
Intermediate Water Meter - Jan to Mar	78,127	86,829	82,048	82,335
Large Water Meter - Apr to Dec - Tier 1	479,600	501,931	584,315	521,949
Large Water Meter - Apr to Dec - Tier 2	125,651	134,453	124,580	128,228
Large Water Meter - Apr to Dec - Tier 3	22,915	21,138	33,484	25,846
Large Water Meter - Jan to Mar	170,289	174,057	204,839	183,062
Total:	5,050,555	4,103,051	4,596,056	4,583,221

The water rate for the end user varies based on the time of year. Consumption charges are associated with the amount of water a household uses each billing period. The City of Columbia charges per 100 cubic feet (ccf), which is approximately 748 gallons. The City uses an inclining block structure, which means the customer's rate per ccf increases when that customer should exceed certain thresholds.

In the current rate structure, all non-summer usage (October through May) is charged at the Tier 1 rate. During the summer months (June through September), the individualized tiers are based on the customer's winter average consumption (WAC). The winter average consumption is the customer's average water use during the immediate preceding billing periods of January, February, and March, and is updated annually.

- Summer Tier 1: Usage of 0% to 70% of customer's WAC
- Summer Tier 2: Usage of 71% to 170% of customer's WAC
- Summer Tier 3: Usage exceeding 170% of customer's WAC

In the proposed rate structure, the Water Utility is looking to make two changes. First, the tiers would be applied year-round rather than only during the summer months. Second, the first tier would extend to 100% of the customer's winter average consumption. The proposed percentage increase in tiered charges means customers who have consistent usage each month won't see their bills fluctuate with the seasons.

- Tier 1: Usage of 0% to 100% of customer's WAC
- Tier 2: Usage of 100% to 200% of customer's WAC
- Tier 3: Usage exceeding 200% of customer's WAC

The proposed rates were used in this revenue analysis. Table E.2.2 presents the rates used in the water revenue increase calculations. The full water rate structures can be found in [Appendix F.7 - Water and Sewer Rate Structures](#) for reference purposes.

Table E.2.2 Water Rates by Consumption Group and Rate Tier

Service Type	Rate Structure (\$/CCF)
Small Water Meter - Apr to Dec - Tier 1	\$2.30
Small Water Meter - Apr to Dec - Tier 2	\$6.33
Small Water Meter - Apr to Dec - Tier 3	\$10.20
Small Water Meter - Jan to Mar	\$2.30
Intermediate Water Meter - Apr to Dec - Tier 1	\$2.30
Intermediate Water Meter - Apr to Dec - Tier 2	\$6.33
Intermediate Water Meter - Apr to Dec - Tier 3	\$10.20
Intermediate Water Meter - Jan to Mar	\$2.30
Large Water Meter - Apr to Dec - Tier 1	\$2.30
Large Water Meter - Apr to Dec - Tier 2	\$6.33
Large Water Meter - Apr to Dec - Tier 3	\$10.20
Large Water Meter - Jan to Mar	\$2.30

Table E.2.3 shows the calculated revenue for the baseline consumption based on these rates. The calculated revenues below do not include the monthly base charges or any other non-consumption-based charges. The baseline annual water revenue for all meter sizes totals \$26,761,893 per year.

Table E.2.3 Water Baseline Revenue Summary

Service Type	2023 Revenue (\$)	2024 Revenue (\$)	2025 Revenue (\$)	Baseline Revenue (\$)
Small Water Meter - Apr to Dec - Tier 1	\$2,019,638	\$2,130,934	\$2,351,901	\$2,167,491
Small Water Meter - Apr to Dec - Tier 2	\$1,430,083	\$1,324,339	\$1,374,706	\$1,376,376
Small Water Meter - Apr to Dec - Tier 3	\$24,734,000	\$14,099,916	\$16,733,144	\$18,522,353
Small Water Meter - Jan to Mar	\$818,432	\$875,474	\$955,052	\$882,986
Intermediate Water Meter - Apr to Dec - Tier 1	\$518,731	\$533,338	\$509,195	\$520,421
Intermediate Water Meter - Apr to Dec - Tier 2	\$297,255	\$265,858	\$241,387	\$268,167
Intermediate Water Meter - Apr to Dec - Tier 3	\$170,456	\$123,036	\$120,197	\$137,896
Intermediate Water Meter - Jan to Mar	\$179,692	\$199,707	\$188,710	\$189,370
Large Water Meter - Apr to Dec - Tier 1	\$1,103,081	\$1,154,441	\$1,343,925	\$1,200,482
Large Water Meter - Apr to Dec - Tier 2	\$795,371	\$851,087	\$788,591	\$811,683
Large Water Meter - Apr to Dec - Tier 3	\$233,730	\$215,611	\$341,537	\$263,626
Large Water Meter - Jan to Mar	\$391,665	\$400,331	\$471,130	\$421,042
Total:	\$32,692,132	\$22,174,072	\$25,419,475	\$26,761,893

Ameresco performed accuracy tests on the existing 5/8"x1/2" water meters to determine how much additional metered water the City could potentially realize after replacing those meters. Ameresco pulled a total of 68 samples of 5/8"x1/2" water meters for testing by an independent testing facility for measurement. The sample size of 68 meters was selected from a sampling design of 10 percent precision with 90 percent confidence interval. Complete results of the bench tests are provided in Table E.2.4 shows the test results for each meter in the sample.

The American Water Works Association (AWWA) recommends calculating the weighted average accuracy at a water consumption profiles of 15 percent low flow, 70 percent mid flow, and 15 percent high flow. Following this calculation, the weighted average accuracy of the 5/8"x3/4" meters is 96.9 percent.

The new water meters have a weighted average accuracy of at least 98.5 percent. The difference in metered water from the existing meter accuracy is the additional amount of water that the City is expected to meter at the end-users. This additional billed water will generate additional revenue for water service for the City according to the water rate. The analysis was performed for each tier of the selected baseline at an aggregate level. The small meter accuracy will be applied to calculate the additional water and sewer revenues from the 1" and larger meters.

The calculations for the revenue increase for all of the water meters, uses the formulas below. See [Appendix F.8 - Savings and Revenue Calculations \(Electronic\)](#) for details of the calculation.

Post Water Consumption

$$= \text{Baseline Water Consumption} \times \left(1 + \left[\frac{\text{Post Accuracy} - \text{Base Accuracy}}{\text{Base Accuracy}} \right] \right)$$

$$\text{Base Water Consumption Revenue} = \sum_{\text{Rate Tier}} \sum (\text{Base Water Consumption} \times \text{Water Rate})$$

$$\text{Post Water Consumption Revenue} = \sum_{\text{Rate Tier}} \sum (\text{Post Water Consumption} \times \text{Water Rate})$$

Additional Water Revenue

$$= \text{Post Water Consumption Revenue} - \text{Base Water Consumption Revenue}$$

Table E.2.4 Small Meter Test Results

AWWA Standard Tests										
						Min.	Inter.	Max.		
Meter Size: 0.625 x 0.75 (5/8" x 3/4")						Weighted Factors:	15.0%	70.0%	15.0%	
Meter Type: PD (Positive Displacement)										
Test Dates: 11/17/2025										
Water Utility: Columbia, Missouri Projects										

Ref #	Manufacturer	Serial #	READING	Minimum Flow		Intermediate Flow		High Flow		Weighted Average Accuracy (%)
				Rate (gpm)	Accuracy (%)	Rate (gpm)	Accuracy (%)	Rate (gpm)	Accuracy (%)	
1	Badger Meter	84780686	192,389	0.25	100.0%	2.00	100.0%	15.00	100.7%	100.1%
2	Badger Meter	54113	78,213	0.25	100.0%	2.00	100.0%	15.00	99.1%	99.9%
3	Badger Meter	19636692	104,279	0.25	100.0%	2.00	101.0%	15.00	99.8%	100.7%
4	Badger Meter	89475481	149,008	0.25	0.0%	2.00	102.0%	15.00	99.7%	86.4%
5	Badger Meter	18724127	93,042	0.25	100.0%	2.00	101.0%	15.00	99.6%	100.6%
6	Badger Meter	29533154	196,509	0.25	93.0%	2.00	101.0%	15.00	99.6%	99.6%
7	Badger Meter	55851	23,206	0.25	99.3%	2.00	101.4%	15.00	99.2%	100.8%
8	Badger Meter	211141019	8,201	0.25	96.1%	2.00	100.5%	15.00	99.2%	99.7%
9	Badger Meter	221053527	2,199	0.25	99.1%	2.00	101.4%	15.00	99.6%	100.8%
10	Badger Meter	22179110	22,134	0.25	100.1%	2.00	101.2%	15.00	99.6%	100.8%
11	Badger Meter	231281511	11,725	0.25	100.7%	2.00	101.4%	15.00	99.9%	101.1%
12	Badger Meter	54213	191,109	0.25	99.6%	2.00	101.6%	15.00	99.5%	101.0%
13	Badger Meter	87990016	323,336	0.25	100.0%	2.00	102.0%	15.00	99.7%	101.4%
14	Badger Meter	89475249	550,179	0.25	96.0%	2.00	100.0%	15.00	98.7%	99.2%

Ref #	Manufacturer	Serial #	READING	Minimum Flow		Intermediate Flow		High Flow		Weighted Average Accuracy (%)
				Rate (gpm)	Accuracy (%)	Rate (gpm)	Accuracy (%)	Rate (gpm)	Accuracy (%)	
15	Badger Meter	85048594	135,000	0.25	0.0%	2.00	93.0%	15.00	99.9%	80.1%
16	Badger Meter	1963417	155,547	0.25	100.0%	2.00	102.0%	15.00	99.9%	101.4%
17	Badger Meter	196392	95,550	0.25	99.0%	2.00	102.0%	15.00	99.8%	101.2%
18	Badger Meter	85048520	230,954	0.25	0.0%	2.00	98.0%	15.00	100.6%	83.7%
19	Badger Meter	44865	40,542	0.25	85.0%	2.00	99.0%	15.00	98.7%	96.9%
20	Badger Meter	53921	41,819	0.25	98.5%	2.00	101.7%	15.00	99.6%	100.9%
21	Badger Meter	231281302	5,038	0.25	100.3%	2.00	100.8%	15.00	99.4%	100.5%
22	Neptune	W24190	313,182	0.25	96.0%	2.00	101.0%	15.00	99.9%	100.1%
23	Neptune	45065160	163,648	0.25	98.0%	2.00	100.0%	15.00	99.4%	99.6%
24	Neptune	W31180	504,753	0.25	95.0%	2.00	99.0%	15.00	98.7%	98.4%
25	Neptune	W4448	295,839	0.25	98.0%	2.00	104.0%	15.00	100.1%	102.5%
26	Neptune	W30218	109,483	0.25	99.0%	2.00	105.0%	15.00	100.1%	103.4%
27	Neptune	W30480	182,891	0.25	98.0%	2.00	103.0%	15.00	99.8%	101.8%
28	Neptune	W31485	97,150	0.25	97.0%	2.00	102.0%	15.00	99.3%	100.8%
29	Neptune	35953184	182,149	0.25	97.0%	2.00	102.0%	15.00	99.9%	100.9%
30	Neptune	35950503	271,373	0.25	88.0%	2.00	103.0%	15.00	99.9%	100.3%
31	Neptune	W26148	316,884	0.25	99.0%	2.00	101.0%	15.00	100.2%	100.6%
32	Neptune	W27691	229,028	0.25	0.0%	2.00	97.0%	15.00	99.9%	82.9%
33	Neptune	W32498	187,933	0.25	99.0%	2.00	101.0%	15.00	99.7%	100.5%
34	Neptune	W32544	304,248	0.25	99.0%	2.00	101.0%	15.00	99.5%	100.5%
35	Neptune	W31347	194,151	0.25	98.0%	2.00	101.0%	15.00	99.5%	100.3%

Ref #	Manufacturer	Serial #	READING	Minimum Flow		Intermediate Flow		High Flow		Weighted Average Accuracy (%)
				Rate (gpm)	Accuracy (%)	Rate (gpm)	Accuracy (%)	Rate (gpm)	Accuracy (%)	
36	Neptune	W2623	160,173	0.25	98.0%	2.00	101.0%	15.00	99.4%	100.3%
37	Neptune	W1609	414,972	0.25	96.0%	2.00	100.0%	15.00	100.2%	99.4%
38	Neptune	W28387	311,152	0.25	100.0%	2.00	95.0%	15.00	100.6%	96.6%
39	Neptune	W2177	431,312	0.25	99.0%	2.00	101.0%	15.00	100.0%	100.6%
40	Neptune	26551	194,303	0.25	100.0%	2.00	103.0%	15.00	100.0%	102.1%
41	Neptune	W2098	163,170	0.25	94.0%	2.00	100.0%	15.00	61.7%	93.4%
42	Neptune	28912	189,374	0.25	96.0%	2.00	100.0%	15.00	5.8%	85.3%
43	Neptune	19013962	452,655	0.25	0.0%	2.00	4.0%	15.00	99.7%	17.8%
44	Rockwell	19320346	94,655	0.25	0.0%	2.00	86.0%	15.00	98.3%	74.9%
45	Rockwell	21775949	78,025	0.25	0.0%	2.00	93.0%	15.00	95.5%	79.4%
46	Elster	58974	42,667	0.25	88.0%	2.00	102.0%	15.00	99.4%	99.5%
47	Elster	59481	92,238	0.25	97.0%	2.00	102.0%	15.00	99.1%	100.8%
48	Elster	29279	33,277	0.25	88.0%	2.00	101.0%	15.00	99.4%	98.8%
49	Neptune	25088121	270,474	0.25	85.0%	2.00	99.0%	15.00	98.2%	96.8%
50	Badger Meter	15204574	67,654	0.13	83.1%	0.40	96.5%	15.00	99.0%	94.9%
51	Badger Meter	63393	63,801	0.13	103.8%	0.40	101.1%	15.00	99.3%	101.2%
52	Badger Meter	17581952	140,148	0.13	99.6%	0.40	99.3%	15.00	100.1%	99.5%
53	Badger Meter	17922884	55,373	0.13	97.6%	0.40	99.2%	15.00	100.8%	99.2%
54	Badger Meter	16532674	40,682	0.13	876.0%	0.40	550.6%	15.00	892.8%	650.7%
55	Badger Meter	63854	37,834	0.13	102.2%	0.40	95.3%	15.00	99.1%	96.9%
56	Badger Meter	65387	42,328	0.13	99.2%	0.40	100.8%	15.00	100.4%	100.5%

Ref #	Manufacturer	Serial #	READING	Minimum Flow		Intermediate Flow		High Flow		Weighted Average Accuracy (%)
				Rate (gpm)	Accuracy (%)	Rate (gpm)	Accuracy (%)	Rate (gpm)	Accuracy (%)	
57	Badger Meter	64854	84,206	0.13	97.4%	0.40	100.1%	15.00	100.0%	99.7%
58	Badger Meter	17765948	29,861	0.13	99.8%	0.40	100.0%	15.00	101.2%	100.2%
59	Badger Meter	15165011	27,412	0.13	100.5%	0.40	101.3%	15.00	102.5%	101.4%
60	Badger Meter	67239	37,591	0.13	100.8%	0.40	99.7%	15.00	99.9%	99.9%
61	Badger Meter	18013131	63,157	0.13	100.6%	0.40	100.3%	15.00	99.2%	100.2%
62	Badger Meter	64017	114,825	0.13	98.1%	0.40	98.4%	15.00	98.5%	98.4%
63	Badger Meter	17056891	41,486	0.13	99.3%	0.40	99.6%	15.00	100.0%	99.6%
64	Badger Meter	66171	85,754	0.13	99.1%	0.40	100.3%	15.00	101.1%	100.2%
65	Badger Meter	62768	165,195	0.13	103.4%	0.40	103.4%	15.00	99.1%	102.8%
66	Badger Meter	66208	55,247	0.13	99.0%	0.40	99.2%	15.00	99.7%	99.2%
67	Badger Meter	17924687	20,161	0.13	98.3%	0.40	100.0%	15.00	99.7%	99.7%
68	Badger Meter	46000	124,970	0.13	104.1%	0.40	101.7%	15.00	98.2%	101.5%
					87.4%		98.7%		97.7%	96.9%
									Without outlier	96.9%

Table E.2.5 presents the calculated consumption by installing the new solid-state meters.

Table E.2.5 Water New Calculated Revenue Summary

Service Type	2023 Consumption (CCF)	2024 Consumption (CCF)	2025 Consumption (CCF)	New Consumption (CCF)
Small Water Meter - Apr to Dec - Tier 1	892,603	941,791	1,039,450	957,948
Small Water Meter - Apr to Dec - Tier 2	229,652	212,671	220,759	221,027
Small Water Meter - Apr to Dec - Tier 3	2,464,942	1,405,170	1,667,592	1,845,901
Small Water Meter - Jan to Mar	361,716	386,926	422,096	390,246
Intermediate Water Meter - Apr to Dec - Tier 1	226,725	233,357	222,806	227,629
Intermediate Water Meter - Apr to Dec - Tier 2	49,907	44,702	40,803	45,137
Intermediate Water Meter - Apr to Dec - Tier 3	17,349	12,611	12,178	14,046
Intermediate Water Meter - Jan to Mar	79,417	88,263	83,403	83,694
Large Water Meter - Apr to Dec - Tier 1	480,998	503,429	586,849	523,759
Large Water Meter - Apr to Dec - Tier 2	133,259	142,425	133,026	136,236
Large Water Meter - Apr to Dec - Tier 3	24,281	22,526	34,762	27,190
Large Water Meter - Jan to Mar	173,101	176,931	208,221	186,084
Total:	5,133,949	4,170,800	4,671,945	4,658,898

Table E.2.6 presents the calculated increased consumption by installing the new solid-state meters.

Table E.2.6 Calculated Water Consumption Increase Summary

Service Type	2023 Consumption (CCF)	2024 Consumption (CCF)	2025 Consumption (CCF)	Increased Consumption (CCF)
Small Water Meter - Apr to Dec - Tier 1	14,499	15,298	16,884	15,561
Small Water Meter - Apr to Dec - Tier 2	3,730	3,455	3,586	3,590
Small Water Meter - Apr to Dec - Tier 3	40,040	22,825	27,088	29,984
Small Water Meter - Jan to Mar	5,876	6,285	6,856	6,339
Intermediate Water Meter - Apr to Dec - Tier 1	1,190	1,471	1,417	1,359
Intermediate Water Meter - Apr to Dec - Tier 2	2,948	2,702	2,669	2,773
Intermediate Water Meter - Apr to Dec - Tier 3	637	548	394	526
Intermediate Water Meter - Jan to Mar	1,290	1,434	1,355	1,359
Large Water Meter - Apr to Dec - Tier 1	1,398	1,498	2,534	1,810
Large Water Meter - Apr to Dec - Tier 2	7,608	7,972	8,446	8,008
Large Water Meter - Apr to Dec - Tier 3	1,366	1,387	1,278	1,344
Large Water Meter - Jan to Mar	2,812	2,874	3,382	3,023
Total:	83,394	67,749	75,889	75,678

Table E.2.7 shows the consumption increase multiplied by the appropriate rate structure to calculate the revenue increase by replacing the water meters.

Table E.2.7 Calculated Water Consumption and Revenue Increase Summary

Service Type	Increased Consumption (CCF)	Rate Structure (\$/CCF)	Revenue Increase (\$)
Small Water Meter - Apr to Dec - Tier 1	15,561	\$2.30	\$35,789.32
Small Water Meter - Apr to Dec - Tier 2	3,590	\$6.33	\$22,726.54
Small Water Meter - Apr to Dec - Tier 3	29,984	\$10.20	\$305,838.65
Small Water Meter - Jan to Mar	6,339	\$2.30	\$14,579.75
Intermediate Water Meter - Apr to Dec - Tier 1	1,359	\$2.30	\$3,126.58
Intermediate Water Meter - Apr to Dec - Tier 2	2,773	\$6.33	\$17,553.20
Intermediate Water Meter - Apr to Dec - Tier 3	526	\$10.20	\$5,370.13
Intermediate Water Meter - Jan to Mar	1,359	\$2.30	\$3,126.85
Large Water Meter - Apr to Dec - Tier 1	1,810	\$2.30	\$4,162.80
Large Water Meter - Apr to Dec - Tier 2	8,008	\$6.33	\$50,693.41
Large Water Meter - Apr to Dec - Tier 3	1,344	\$10.20	\$13,709.19
Large Water Meter - Jan to Mar	3,023	\$2.30	\$6,952.19
Total:	75,678	\$58,830.48	\$483,628.62

E.3 Sewer Revenue Increase

Sewer from the end-users is collected through the sewer system. Sewer is billed based on water consumption. The sewer baseline was established based on the reported sewer consumption in the database provided by the City in October 2025. Table E.3.1 shows the sewer baseline summary. The baseline annual water consumption for all meter sizes is 2,728,371 CCF per year.

Table E.3.1 Baseline Sewer Consumption by Size Category

Service Type	2023 Consumption (CCF)	2024 Consumption (CCF)	2025 Consumption (CCF)	Baseline Consumption (CCF)
Small Water Meters	1,384,908	1,494,265	1,670,421	1,516,531
Intermediate Water Meters	380,704	374,104	355,014	369,941
Large Water Meters	786,401	812,277	927,019	841,899
Total:	2,552,013	2,680,646	2,952,454	2,728,371

The proposed sewer rates were used in this revenue analysis. Table E.3.2 presents the rates used in the sewer revenue increase calculations. The full sewer rate structures can be found in [Appendix F.7 - Water and Sewer Rate Structures](#) for reference purposes.

Table E.3.2 Water Rates by Consumption Group

Service Type	Rate Structure (\$/CCF)
Small Water Meters	\$2.55
Intermediate Water Meters	\$2.55
Large Water Meters	\$2.55

Table E.3.3 shows the calculated revenue for the baseline sewer consumption based on these rates. The calculated revenues below do not include the monthly base charges or any other non-consumption-based charges. The baseline annual sewer revenue for all meter sizes totals \$6,957,347 per year.

Table E.3.3 Water Baseline Revenue Summary

Service Type	2023 Revenue (\$)	2024 Revenue (\$)	2025 Revenue (\$)	Baseline Revenue (\$)
Small Water Meters	\$3,531,516	\$3,810,376	\$4,259,573	\$3,867,155
Intermediate Water Meters	\$970,795	\$953,965	\$905,286	\$943,349
Large Water Meters	\$2,005,323	\$2,071,307	\$2,363,898	\$2,146,843
Total:	\$6,507,634	\$6,835,648	\$7,528,757	\$6,957,347

Projected sewer revenue increases from meter replacement are calculated in a similar fashion as the water revenue increase. Since the sewer service is billed based on the water consumption, the water meter accuracy data listed in Table E.2.4 is used in this calculation as well. The calculations for the revenue increase for all of the water meters, uses the formulas below. See [Appendix F.8 - Savings and Revenue Calculations \(Electronic\)](#) for details of the calculation.

Post Wastewater Consumption

$$= \text{Baseline Wastewater Consumption} \times \left(1 + \left[\frac{\text{Post Accuracy} - \text{Base Accuracy}}{\text{Base Accuracy}} \right] \right)$$

Base Wastewater Consumption Revenue

$$= \sum_{\text{Code Tier}} (\text{Base Water Consumption} \times \text{Wastewater Rate})$$

Post Wastewater Consumption Revenue

$$= \sum_{\text{Code Tier}} (\text{Post Wastewater Consumption} \times \text{Wastewater Rate})$$

Additional Wastewater Revenue

$$= \text{Post Wastewater Consumption Revenue} \\ - \text{Base Wastewater Consumption Revenue}$$

Table E.3.4 presents the calculated consumption by installing the new solid-state meters.

Table E.3.4 Sewer New Calculated Revenue Summary

Service Type	2023 Consumption (CCF)	2024 Consumption (CCF)	2025 Consumption (CCF)	New Consumption (CCF)
Small Water Meters	1,407,776	1,518,938	1,698,003	1,541,572
Intermediate Water Meters	386,990	380,281	360,876	376,049
Large Water Meters	799,386	825,690	942,326	855,801
Total:	2,594,152	2,724,909	3,001,204	2,773,422

Table E.3.5 presents the calculated increased sewer consumption by installing the new solid-state meters.

Table E.3.5 Calculated Sewer Consumption Increase Summary

Service Type	2023 Consumption (CCF)	2024 Consumption (CCF)	2025 Consumption (CCF)	Increased Consumption (CCF)
Small Water Meters	22,867	24,673	27,582	25,041
Intermediate Water Meters	6,286	6,177	5,862	6,108
Large Water Meters	12,985	13,412	15,307	13,901
Total:	42,139	44,262	48,751	45,051

Table E.3.6 shows the consumption increase multiplied by the appropriate rate structure to calculate the revenue increase by replacing the water meters.

Table E.3.6 Calculated Sewer Consumption and Revenue Increase Summary

Service Type	Increased Consumption (CCF)	Rate Structure (\$/CCF)	Revenue Increase (\$)
Small Water Meters	25,041	\$2.55	\$63,853.95
Intermediate Water Meters	6,108	\$2.55	\$15,576.45
Large Water Meters	13,901	\$2.55	\$35,448.39
Total:	45,051	\$58,830.48	\$114,878.79

E.4 Operations and Maintenance Savings

Table E.4.1 lists the stipulated metering O&M savings included in the savings analysis . The savings amounts were provided by the City and reflect the average annual labor and materials cost to the City for servicing and replacing failing water meters.

Table E.4.1 Operations and Maintenance Savings

Savings Category	Qty	\$/Unit	\$ Savings
Replacement Meter Materials			
Electric Meters	1	\$150,000	\$150,000
Field Personnel (See Notes Below)			
Meter Reading - AMR	1	\$57,033	\$57,033
Meter Reading - Manual	1	\$259,376	\$259,376
Service Orders	1	\$438,776	\$438,776
Office Personnel			
Correcting Customer Bills	1	\$250,000	\$250,000
Total			\$1,155,185

Notes for Field Personnel

Breakdown of read collections averages per month

Total = 90,276 AMR readings

54,500 electric

35,776 water

Seven (7) Meter Readers collecting

Manually water meter readings; 17,350

Audit verifications (rereads) 742

E.5 Savings and Revenue Summary

Table E.5.1 provides the annual savings and revenue dollars included in the sections above for a 15-year period. The revenue dollars are escalated at 2% per year for water and sewer and 2.5% for the electric. The O&M savings are escalated at 3% per year.

Table E.5.1 Savings and Revenue Summary

	Small Water Revenue	Small Sewer Revenue	Int Water Revenue	Int Sewer Revenue	Large Water Revenue	Large Sewer Revenue	Electric Meter Revenue	O&M Savings	Annual Total
Year 1	\$378,934	\$63,854	\$29,177	\$15,576	\$75,518	\$35,448	\$2,203,593	\$1,155,185	\$3,957,285
Year 2	\$386,513	\$65,131	\$29,760	\$15,888	\$77,028	\$36,157	\$2,258,683	\$1,189,841	\$4,059,001
Year 3	\$394,243	\$66,434	\$30,355	\$16,206	\$78,569	\$36,881	\$2,315,150	\$1,225,536	\$4,163,373
Year 4	\$402,128	\$67,762	\$30,963	\$16,530	\$80,140	\$37,618	\$2,373,029	\$1,262,302	\$4,270,471
Year 5	\$410,171	\$69,118	\$31,582	\$16,860	\$81,743	\$38,370	\$2,432,354	\$1,300,171	\$4,380,369
Year 6	\$418,374	\$70,500	\$32,213	\$17,198	\$83,378	\$39,138	\$2,493,163	\$1,339,176	\$4,493,140
Year 7	\$426,742	\$71,910	\$32,858	\$17,542	\$85,045	\$39,921	\$2,555,492	\$1,379,351	\$4,608,860
Year 8	\$435,276	\$73,348	\$33,515	\$17,892	\$86,746	\$40,719	\$2,619,380	\$1,420,732	\$4,727,608
Year 9	\$443,982	\$74,815	\$34,185	\$18,250	\$88,481	\$41,533	\$2,684,864	\$1,463,354	\$4,849,465
Year 10	\$452,862	\$76,311	\$34,869	\$18,615	\$90,251	\$42,364	\$2,751,986	\$1,507,254	\$4,974,512
Year 11	\$461,919	\$77,838	\$35,566	\$18,988	\$92,056	\$43,211	\$2,820,785	\$1,552,472	\$5,102,835
Year 12	\$471,157	\$79,394	\$36,278	\$19,367	\$93,897	\$44,076	\$2,891,305	\$1,599,046	\$5,234,520
Year 13	\$480,580	\$80,982	\$37,003	\$19,755	\$95,775	\$44,957	\$2,963,588	\$1,647,018	\$5,369,657
Year 14	\$490,192	\$82,602	\$37,743	\$20,150	\$97,690	\$45,856	\$3,037,677	\$1,696,428	\$5,508,339
Year 15	\$499,996	\$84,254	\$38,498	\$20,553	\$99,644	\$46,773	\$3,113,619	\$1,747,321	\$5,650,658
Totals	\$6,553,068	\$1,104,253	\$504,566	\$269,370	\$1,305,957	\$613,024	\$39,514,668	\$21,485,186	\$71,350,093

E.6 Measurement and Verification

The long-term success of any comprehensive guaranteed performance program depends on the development of an accurate and successful measurement and verification (M&V) plan. The main objective is to develop a cost-effective plan that quantifies and verifies the performance results of the measures. Ameresco subscribes to using industry standard M&V protocols that have been developed in response to the need for reliable and consistent measurement practices.

Ameresco used the International Performance Measurement and Verification Protocol (IPMVP) for the development of M&V procedures for this project.

The protocols help allocate various risks associated with achieving cost savings, anticipate revenue increases, and allow risk reduction and better risk management. The M&V options description, provided herein, was developed by summarizing the IPMVP and contains excerpts taken from that document. The protocols have several benefits:

- Define the role of verification in contracts and implementation.
- Discuss procedures with varying levels of accuracy and cost for verifying baseline and project installation conditions and long-term savings/revenue enhancement performance.
- Provide techniques for calculating operational savings, individual technology savings, future billable revenue projections, and stipulated savings.
- Provide procedures that are consistent, industry-accepted, impartial, and reliable.
- Provide procedures for the investigation and resolution of disagreements related to performance issues.

Table E.6.1 below provides the proposed M&V plan for the project.

Table E.6.1 Measurement and Verification Plan

M&V Requirements	Description
Conservation Measure	Advanced Metering Infrastructure (AMI) Implementation and Water Meter Replacement
IPMVP Option	Option A - Partially Measured Retrofit Isolation
Baseline M&V Requirements	Average weighted accuracy for 5/8"x3/4" water meters prior to implementation.
Post-Retrofit M&V Requirements	Average weighted accuracy for 5/8"x3/4" water meters after implementation
Measurement and Metering	Ameresco will pull a statistical sample of 15 new 5/8"x3/4" water meters, meters and test their accuracy in a testing facility. The sample size is based on a 90% confidence level and 10% precision.
Stipulated Variables	Projected water revenue increases will be calculated from the baseline consumption and the water rates for each year of the performance period. The 5/8" x 3/4" test results will be applied to the 1" and larger meters to calculate the additional water and sewer revenues from the larger meters. Customer and Ameresco agree to stipulate the Operations and Maintenance savings for the performance period
Performance Period M&V Requirements	Ameresco will perform the accuracy tests for the new water meters at the end of Year 1, Year 2, and Year 3 of the Performance Period, unless otherwise directed.

The M&V protocol is based on the guidelines of the IPMVP Option A. Option A involves verifying that the measure has the potential to perform and to generate revenues. Performance verification techniques include engineering calculations with one-time representative measured values, resulting in measured verification of performance. Post-installation water meter accuracy will be determined based on a post-retrofit test of a representative sample of water meters.

Average accuracy for the new 5/8"x3/4" meters will also be applied to the 1" and larger meters. Cost savings calculated in Table E.4.1 Operations and Maintenance Savings and Electric Meter Revenue are stipulated and agreed upon with the City. No M&V will be done for these cost savings.

Measured Variables:

- Average accuracy of existing 5/8"x3/4" water meters (performed during project development).
- Average accuracy of new 5/8"x3/4" water meters (post installation).

Stipulated Variables:

- Baseline consumption profile to be used as post-retrofit consumption profile for the electric meter revenue increase calculations for duration of the performance period.
- Electric rates as provided in Table E.6.3 below for the M&V period
- Baseline consumption profile to be used as post-retrofit consumption profile for accuracy improvement calculations for duration of the performance period.
- Average accuracy for the new 5/8"x3/4" meters will be applied to the 1" and larger meters
- Annual metering O&M cost savings

Average accuracies of the existing water meters were determined during the IGA. Ameresco will perform another statistical accuracy test on the new water meters in Year 1, Year 2, and Year 3 after final acceptance of the project.

For each year of testing for the small 5/8"x3/4" water meters, Ameresco will select 15 random samples from this size group for testing, which is the quantity of meters to achieve the required post-measurement requirements of 90 percent confidence and 10 percent precision. The meters will be removed from service, sent to a testing lab for testing following the American Water Works Association (AWWA) guidelines, and returned to the City. New meters will be installed in place of the test meters. Average accuracy for the low flow, medium flow, and high flow will be aggregated assuming a 15 percent / 70 percent / 15 percent usage in each range, as was used to establish baseline efficiency during the IGA. The verification will be deemed satisfied if the aggregate average accuracy of the sample meters is at least 98.5 percent.

Should the average test results for the sample set of meters return less than 98.5 percent, Ameresco will calculate the projected revenue shortfall. The lost revenue will be calculated between the average tested accuracy and 98.5 percent guaranteed accuracy using the baseline water consumption for the 5/8"x3/4" and larger meters and the water and sewer rates shown in each year of the 15-year project term in Table E.6.4 below.

If the total meter measure annual project benefits are less than the meter guarantee, Ameresco, at its sole discretion, will either replace all the meters in an identifiable defective population of meters, or compensate the City for the difference in the projected revenue.

Table E.6.3 Electric Rates by M&V Period

Electric Rates										
	Residential - Gas Heat	Residential - Electric Heat	Residential - Heat Pump	Small General Service - Gas Heat	Small General Service - Electric Heat	Small General Service - Heat Pump	Small General Service - Optional Demand	Large General Service	Industrial	Industrial - Interruptible
Year 1	\$0.1524	\$0.1419	\$0.1368	\$0.1505	\$0.1416	\$0.1384	\$0.1142	\$0.1137	\$0.1047	\$0.1629
Year 2	\$0.1562	\$0.1454	\$0.1402	\$0.1543	\$0.1451	\$0.1419	\$0.1171	\$0.1165	\$0.1073	\$0.1670
Year 3	\$0.1601	\$0.1491	\$0.1437	\$0.1581	\$0.1488	\$0.1454	\$0.1200	\$0.1195	\$0.1100	\$0.1711
Year 4	\$0.1641	\$0.1528	\$0.1473	\$0.1621	\$0.1525	\$0.1490	\$0.1230	\$0.1224	\$0.1128	\$0.1754
Year 5	\$0.1682	\$0.1566	\$0.1510	\$0.1661	\$0.1563	\$0.1528	\$0.1261	\$0.1255	\$0.1156	\$0.1798
Year 6	\$0.1724	\$0.1605	\$0.1548	\$0.1703	\$0.1602	\$0.1566	\$0.1292	\$0.1286	\$0.1185	\$0.1843
Year 7	\$0.1767	\$0.1646	\$0.1586	\$0.1745	\$0.1642	\$0.1605	\$0.1324	\$0.1319	\$0.1214	\$0.1889
Year 8	\$0.1812	\$0.1687	\$0.1626	\$0.1789	\$0.1683	\$0.1645	\$0.1357	\$0.1352	\$0.1245	\$0.1936
Year 9	\$0.1857	\$0.1729	\$0.1667	\$0.1834	\$0.1725	\$0.1686	\$0.1391	\$0.1385	\$0.1276	\$0.1985
Year 10	\$0.1903	\$0.1772	\$0.1708	\$0.1880	\$0.1768	\$0.1728	\$0.1426	\$0.1420	\$0.1308	\$0.2034
Year 11	\$0.1951	\$0.1816	\$0.1751	\$0.1927	\$0.1813	\$0.1772	\$0.1462	\$0.1455	\$0.1340	\$0.2085
Year 12	\$0.2000	\$0.1862	\$0.1795	\$0.1975	\$0.1858	\$0.1816	\$0.1498	\$0.1492	\$0.1374	\$0.2137
Year 13	\$0.2050	\$0.1908	\$0.1840	\$0.2024	\$0.1904	\$0.1861	\$0.1536	\$0.1529	\$0.1408	\$0.2191
Year 14	\$0.2101	\$0.1956	\$0.1886	\$0.2075	\$0.1952	\$0.1908	\$0.1574	\$0.1567	\$0.1443	\$0.2246
Year 15	\$0.2153	\$0.2005	\$0.1933	\$0.2127	\$0.2001	\$0.1956	\$0.1614	\$0.1607	\$0.1479	\$0.2302

Table E.6.4 Water and Sewer Rates by M&V Period

	Water Rate - Tier 1	Water Rate - Tier 2	Water Rate - Tier 3	Sewer Rate
Year 1	\$2.30	\$6.33	\$10.20	\$2.55
Year 2	\$2.35	\$6.46	\$10.40	\$2.60
Year 3	\$2.39	\$6.59	\$10.61	\$2.65
Year 4	\$2.44	\$6.72	\$10.82	\$2.71
Year 5	\$2.49	\$6.85	\$11.04	\$2.76
Year 6	\$2.54	\$6.99	\$11.26	\$2.82
Year 7	\$2.59	\$7.13	\$11.49	\$2.87
Year 8	\$2.64	\$7.27	\$11.72	\$2.93
Year 9	\$2.69	\$7.42	\$11.95	\$2.99
Year 10	\$2.75	\$7.56	\$12.19	\$3.05
Year 11	\$2.80	\$7.72	\$12.43	\$3.11
Year 12	\$2.86	\$7.87	\$12.68	\$3.17
Year 13	\$2.92	\$8.03	\$12.94	\$3.23
Year 14	\$2.98	\$8.19	\$13.19	\$3.30
Year 15	\$3.03	\$8.35	\$13.46	\$3.36

Ameresco has no control over the water quality within the City's distribution system. Poor water quality can cause a meter to fail. If there are signs of scoring from particles or debris or accumulation of deposits as determined by a third-party laboratory, then the test results for those meters will be removed from the average and the City will be responsible for replacements of those meters.

Further, Ameresco has no control over the consumption of the individual end consumers. If the meters fail due to volumes more than the manufacturer's warranty limits, the test results will be removed from the average and the City will be responsible for meter replacement.

A well-designed and properly executed maintenance program is a crucial element to long-term system performance and savings. To maximize the savings and equipment performance, the measures should be maintained under an ongoing, structured service program for the life of the contract, and ideally beyond. Ameresco has a vested interest in the equipment performance and maintenance required to realize all possible accuracy improvements, which form the basis of our guarantee. Typically, the equipment and systems Ameresco proposes can be maintained and serviced by a variety of service entities, including maintenance personnel currently employed by the City of Columbia and/or a combination of service providers.

Upon project completion, Mr. Jared Hughes, Ameresco's Director of Performance Assurance, will assign a primary point of contact for the City to coordinate warranty services and execution of the M&V plan. This individual will retain overall responsibility for these efforts for the project.

City of Columbia, Missouri
Investment Grade Audit

F.0 Appendix



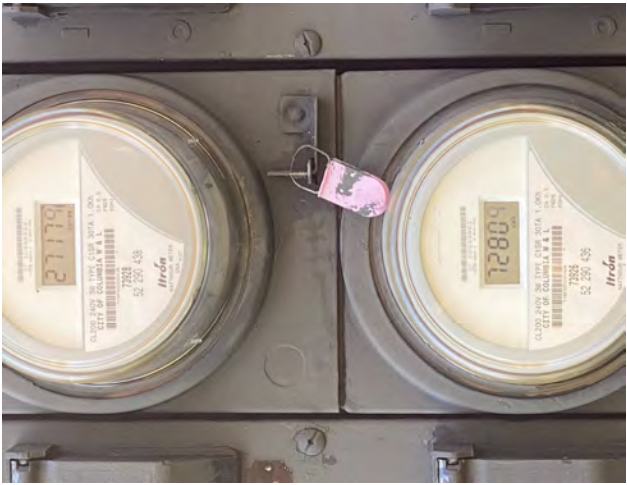
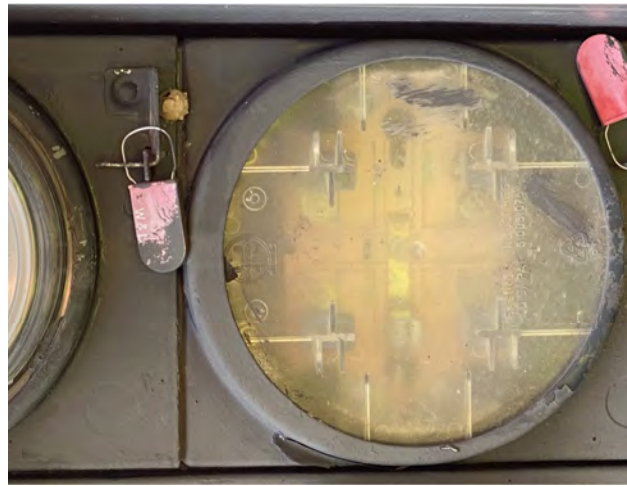
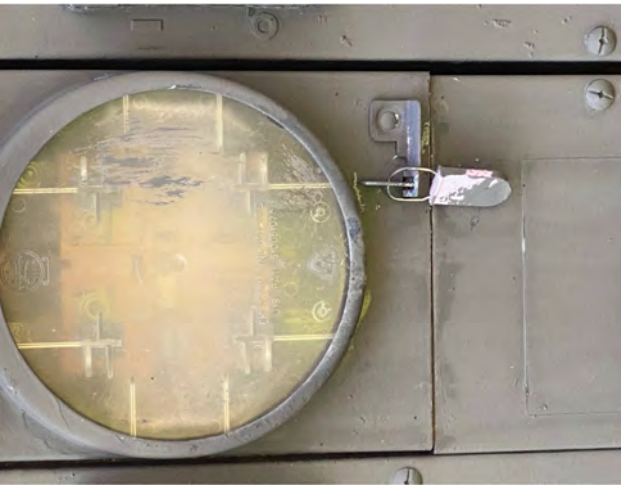
F.0 Appendix

The following appendices have been included as part of the IGA report presented to the City of Columbia.

- F.1 Residential / Light Commercial Electric Meter Photo Tour
- F.2 Poly-Phase Electric Meter Photo Tour
- F.3 Small Water Meter Photo Tour
- F.4 Intermediate Water Meter Photo Tour
- F.5 Large Water Meter Photo Tour
- F.6 Electric Rate Structures
- F.7 Water Rate Structures
- F.8 Savings and Revenue Calculations (Electronic)
- F.9 Product Warranties

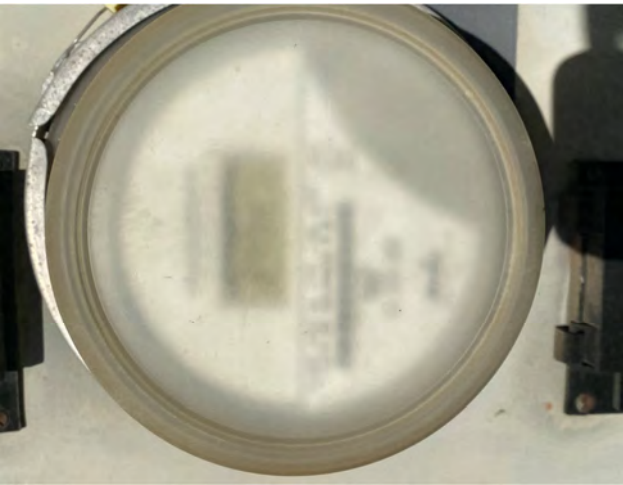
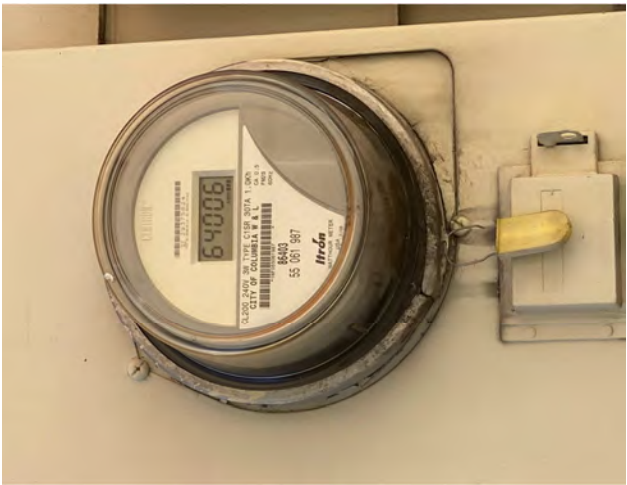
F.1 Residential / Light Commercial Electric Meter Photo Tour



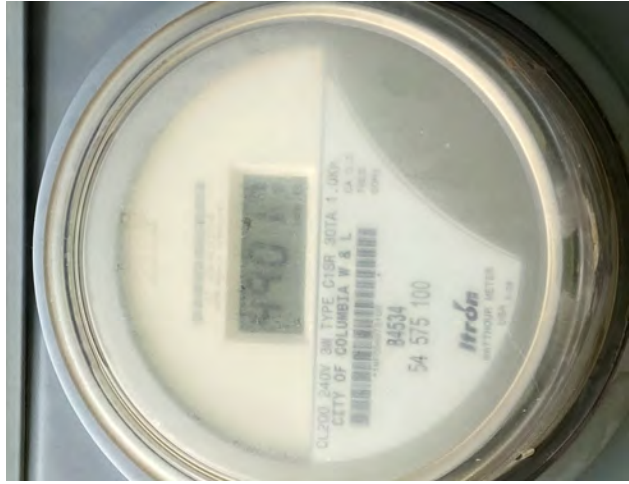


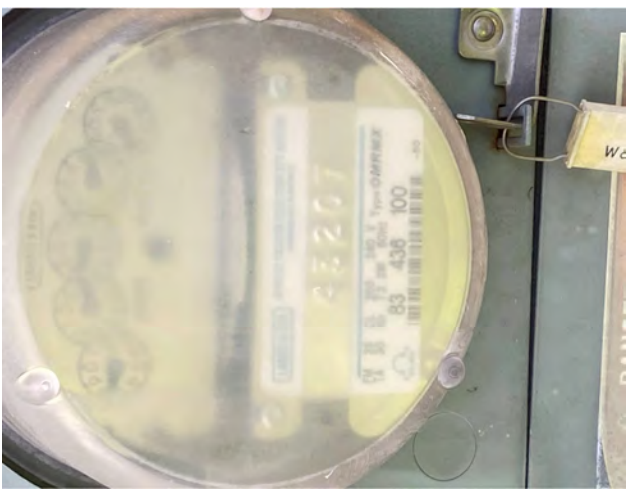


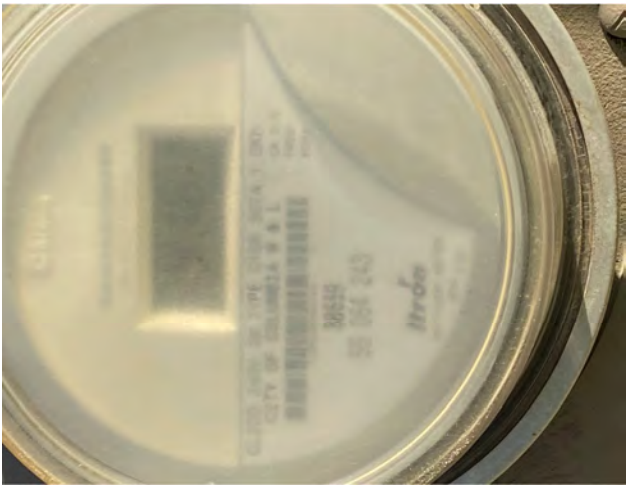








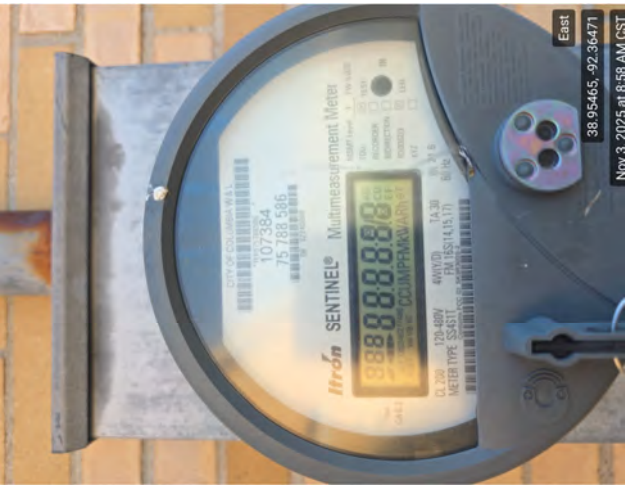
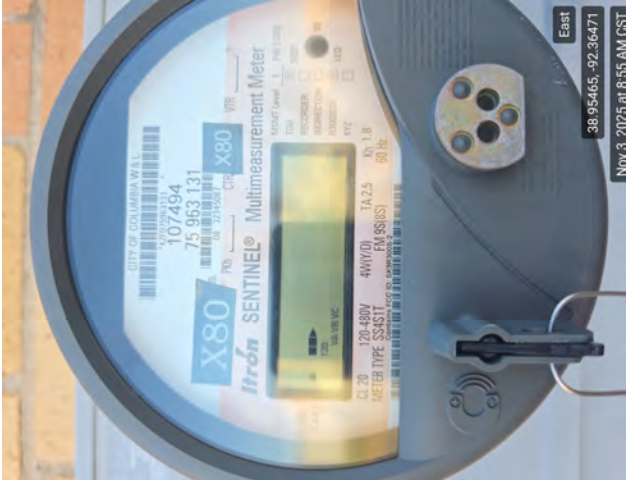


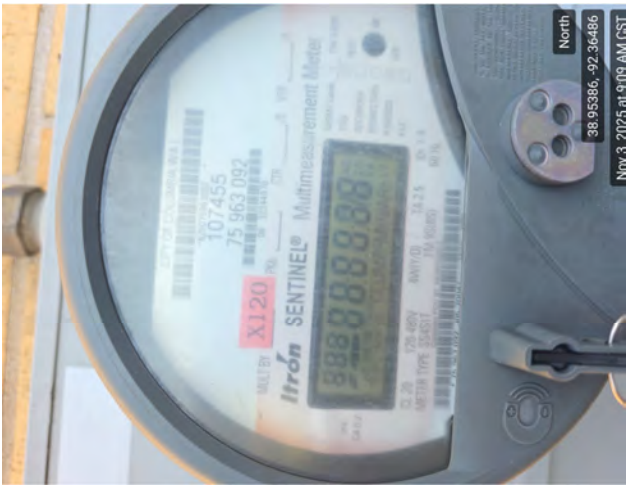


F.2 Poly-Phase Electric Meter Photo Tour











East
38.95386, -92.36486
Nov. 3. 2025 at 9:14 AM CST



East
38.95386, -92.36486
Nov. 3. 2025 at 9:15 AM CST



North
38.94962, -92.33558
Nov. 3. 2025 at 9:42 AM CST



North
38.94962, -92.33558
Nov. 3. 2025 at 9:42 AM CST



Southwest
38.96785, -92.34522
Nov. 3. 2025 at 10:18 AM CST



Southwest
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Nov. 3. 2025 at 10:18 AM CST



Southwest
38.96787, -92.34528
Nov. 3. 2025 at 10:19 AM CST



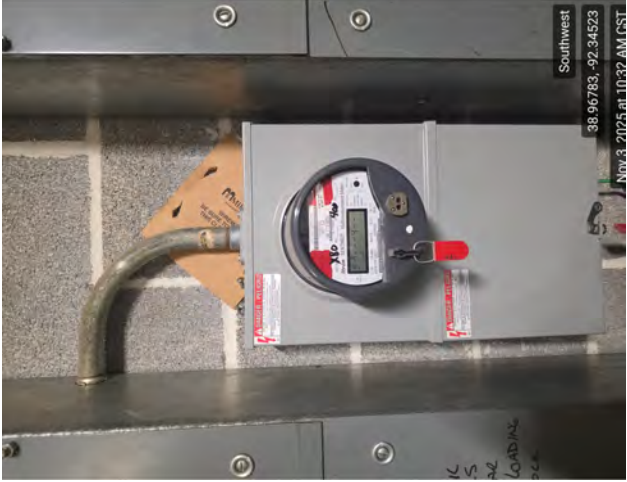
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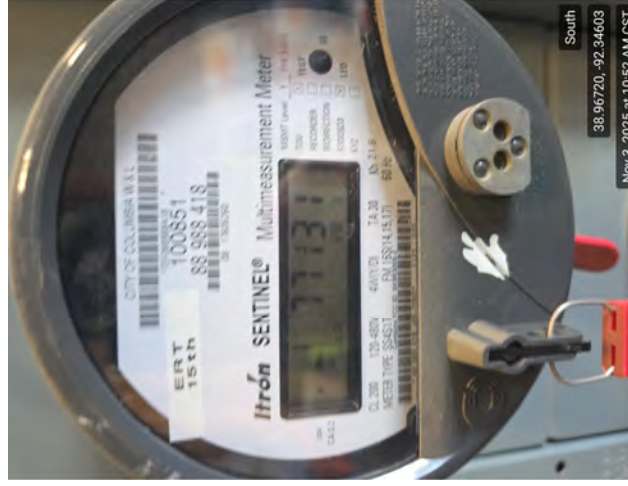
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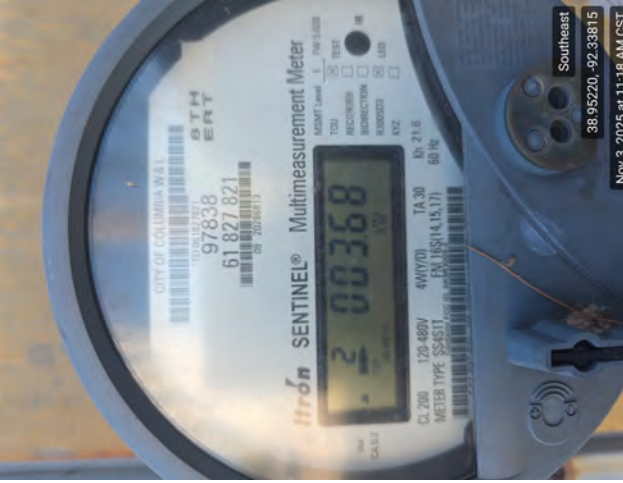




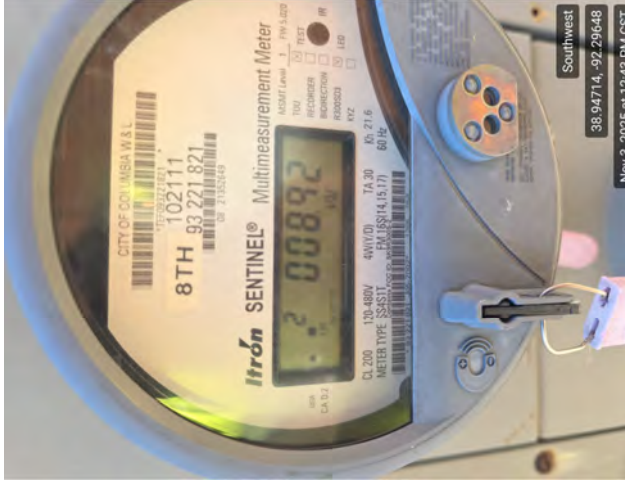


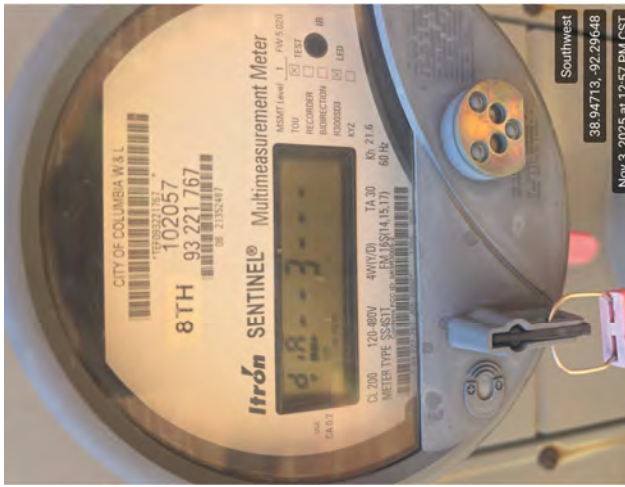
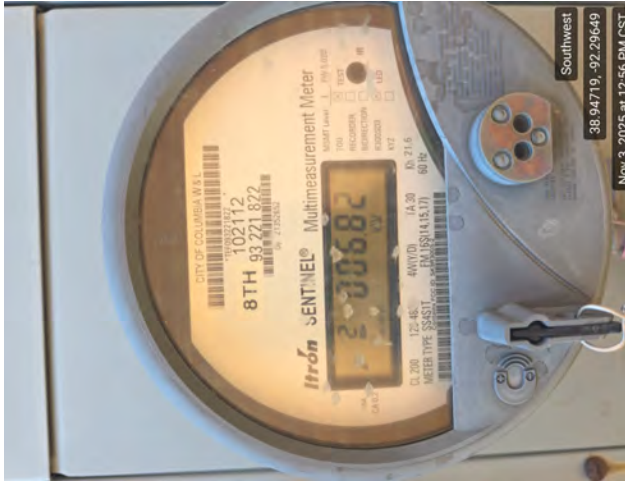
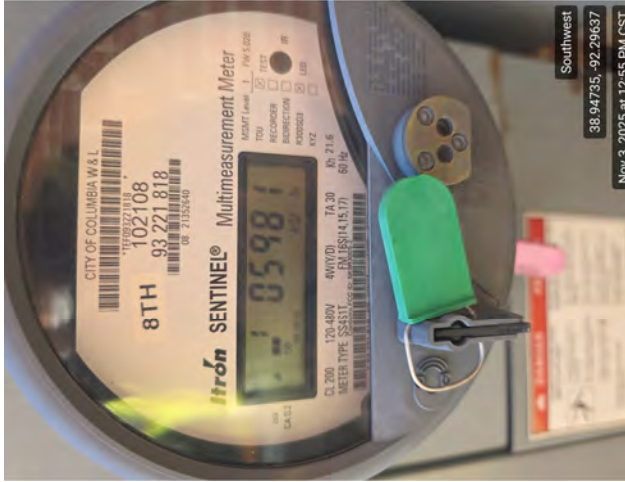
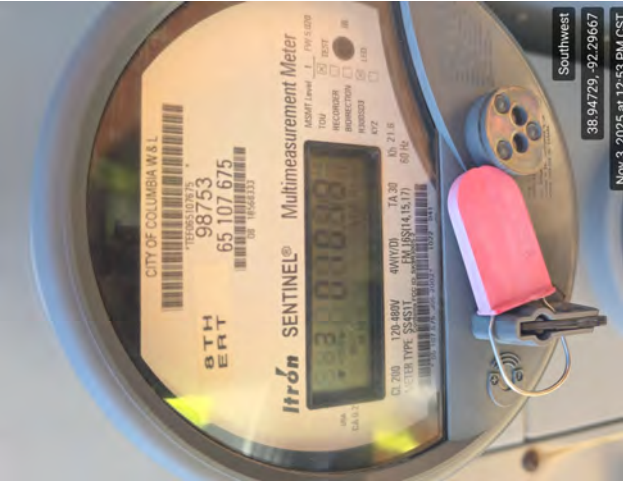
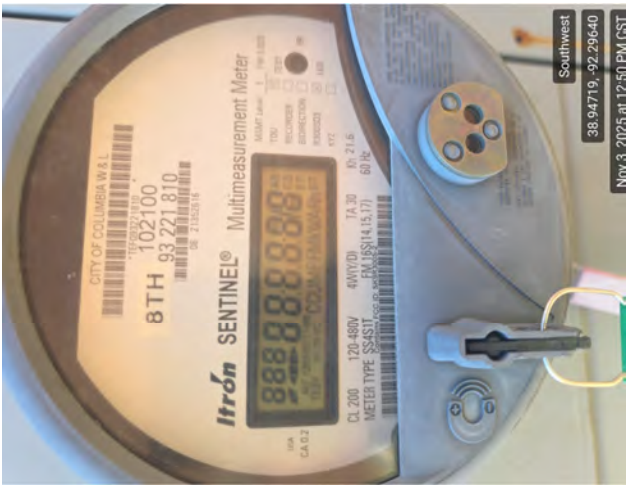


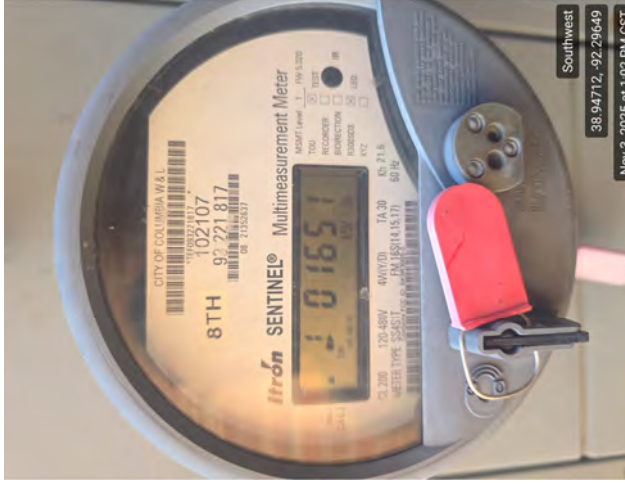
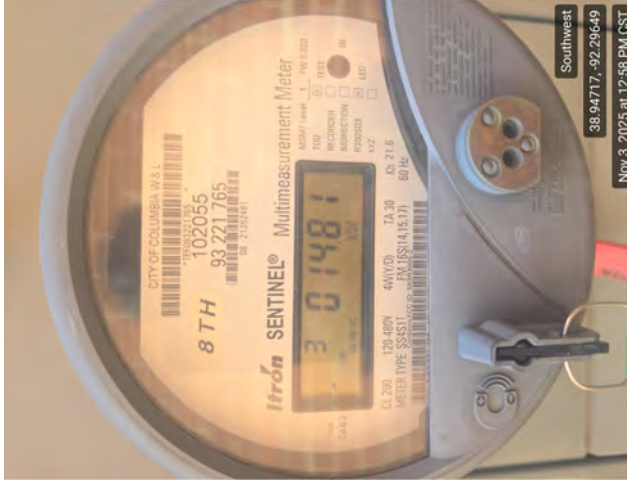


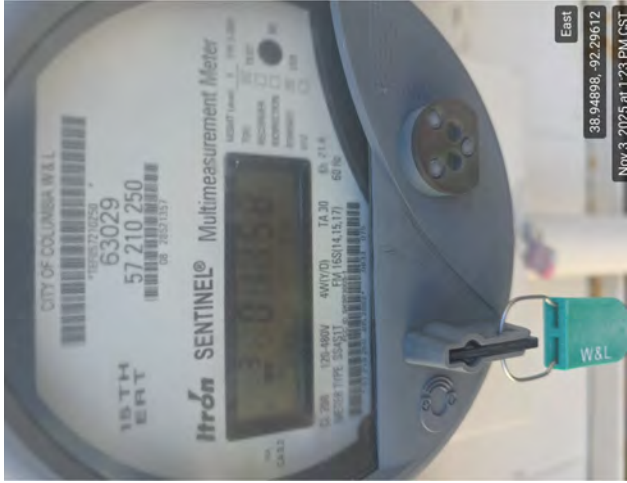














South
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Nov. 3. 2025 at 1:37 PM CST



Northeast
38.95042, -92.29638
Nov. 3. 2025 at 1:39 PM CST



Northeast
38.95060, -92.29636
Nov. 3. 2025 at 1:40 PM CST



Northwest
38.95041, -92.29612
Nov. 3. 2025 at 1:41 PM CST



Northwest
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Nov. 3. 2025 at 1:41 PM CST



South
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Nov. 3. 2025 at 1:42 PM CST



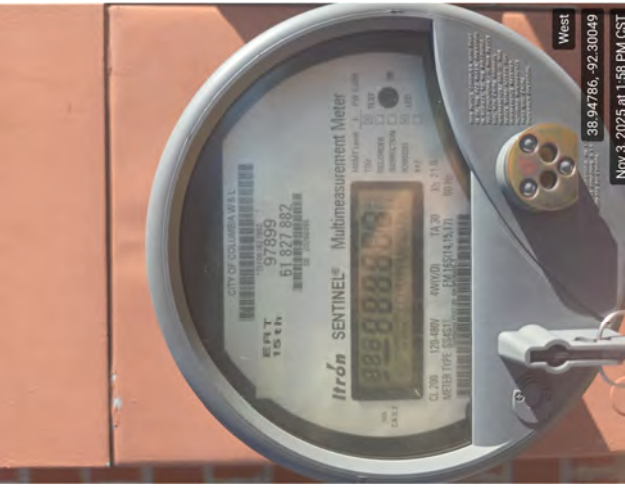
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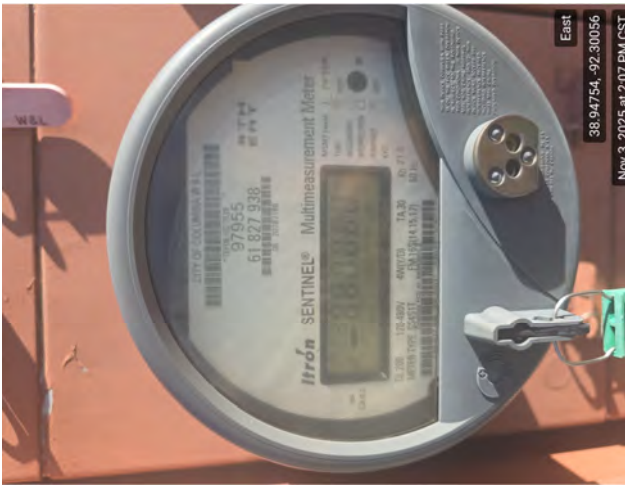
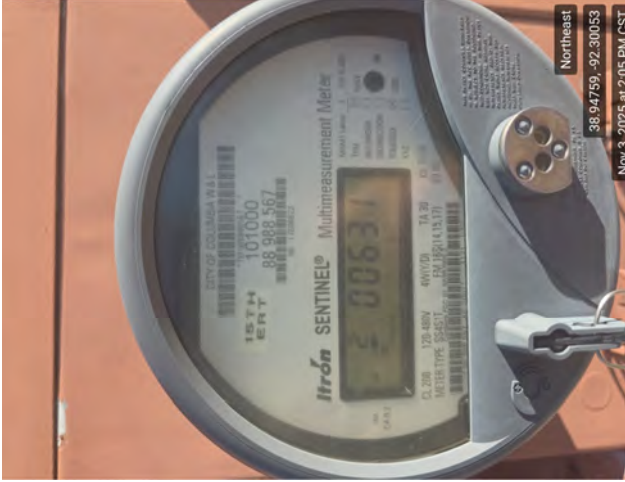


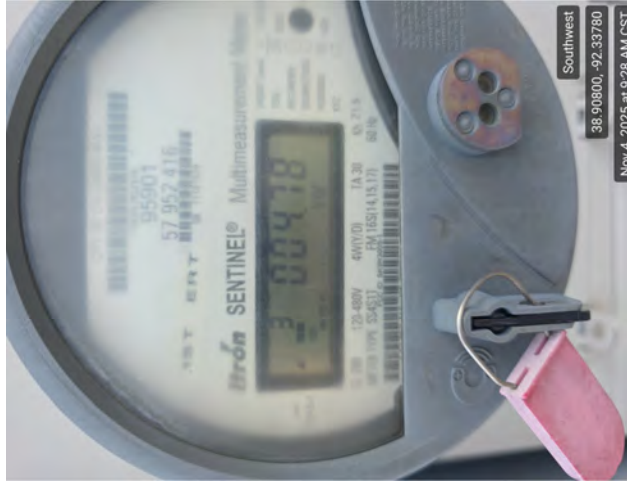
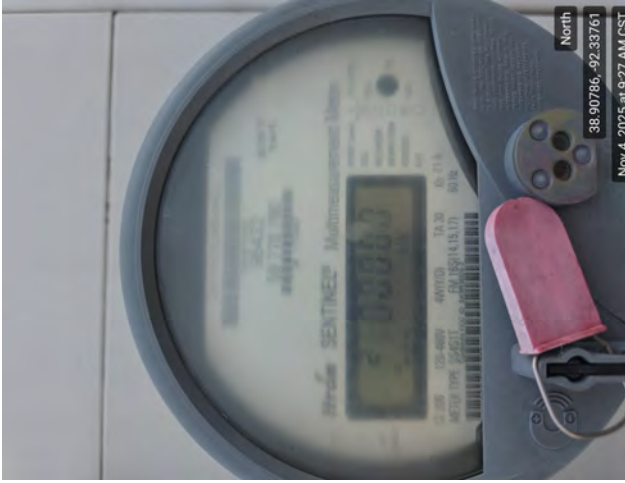
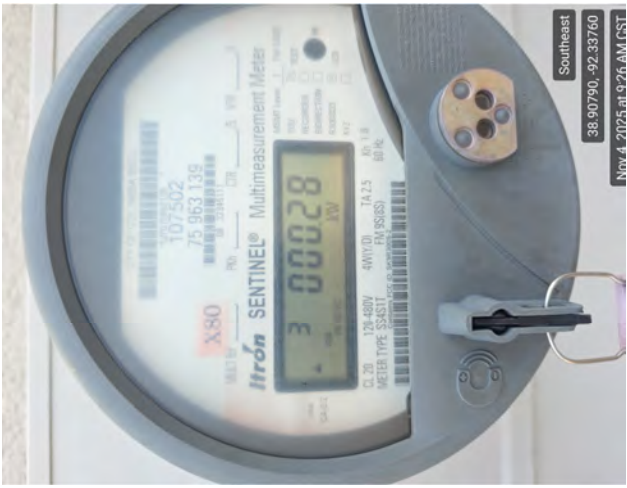
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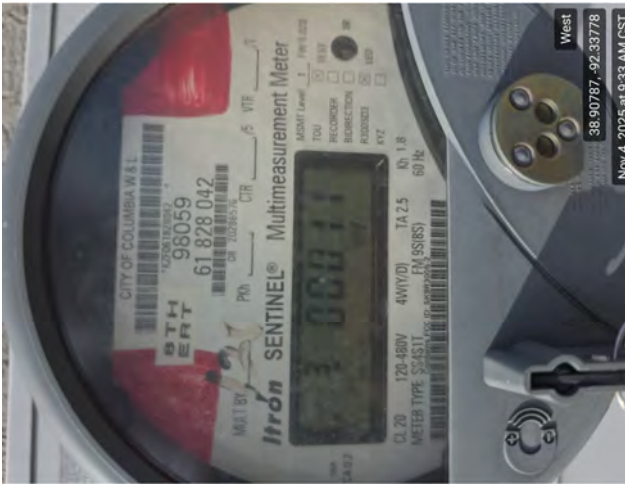
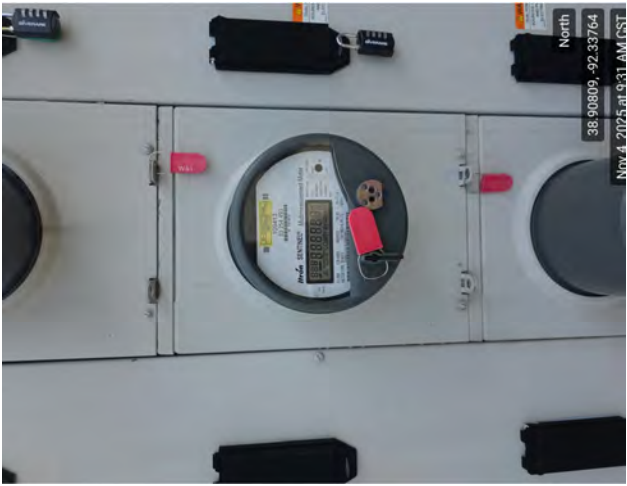


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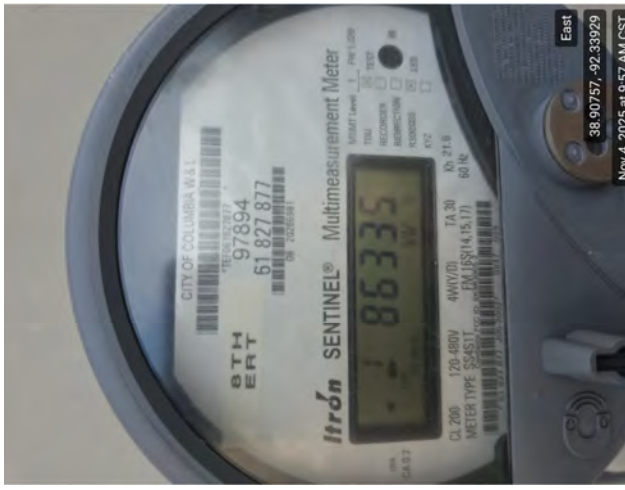
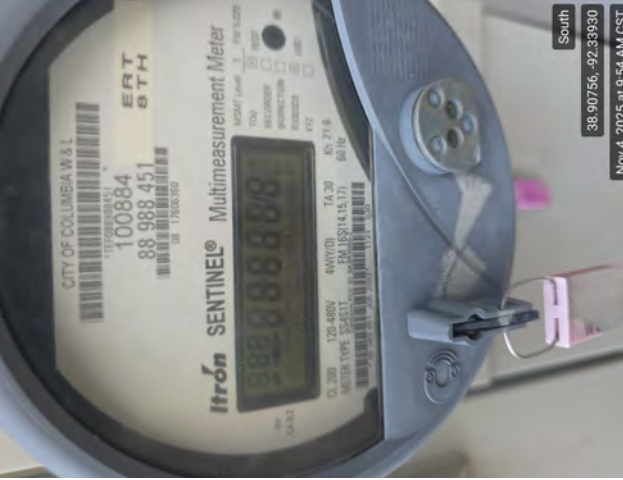


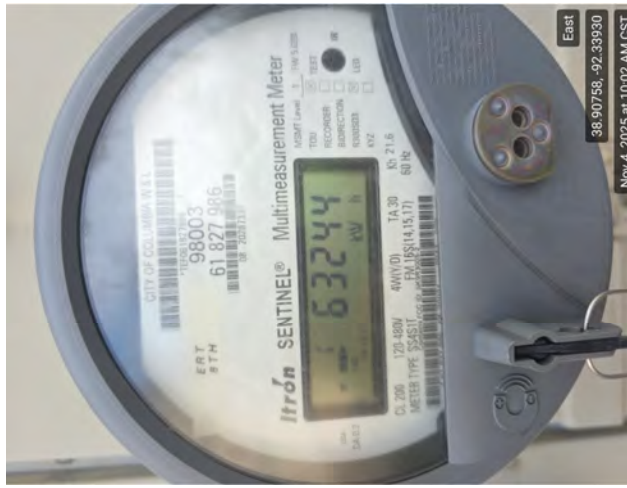




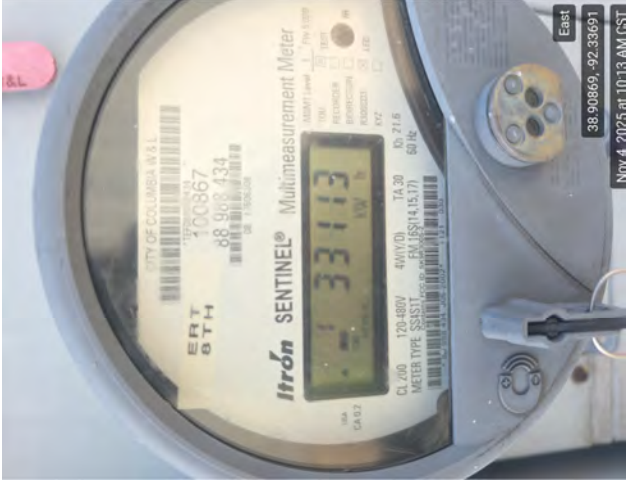


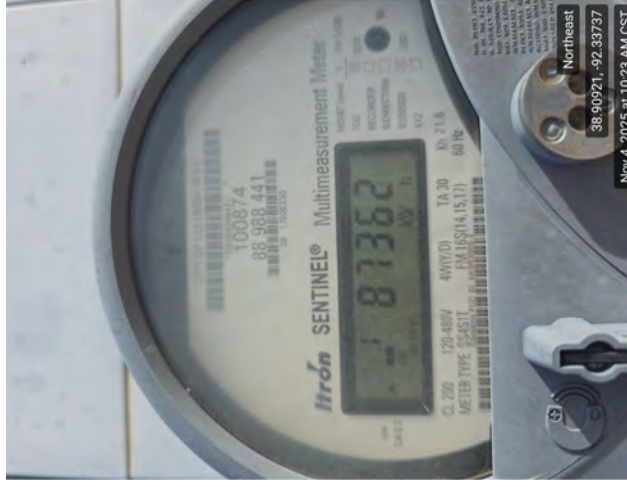
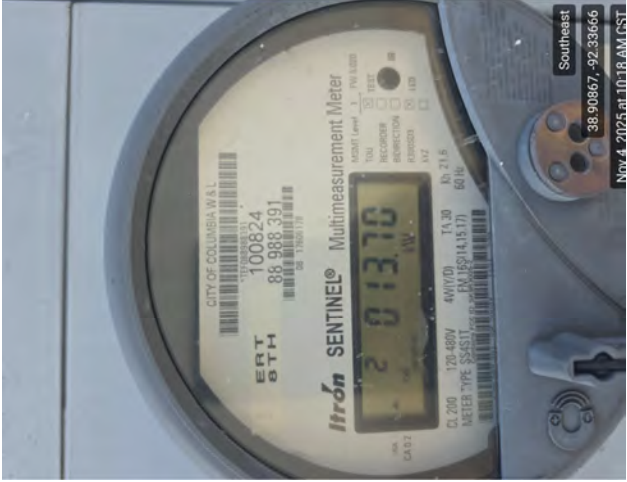


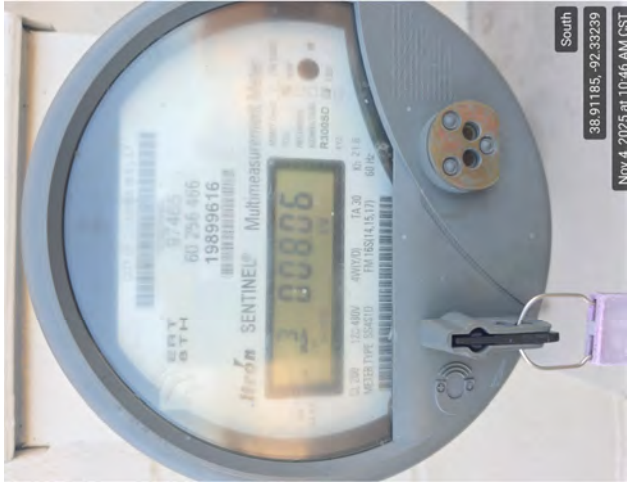
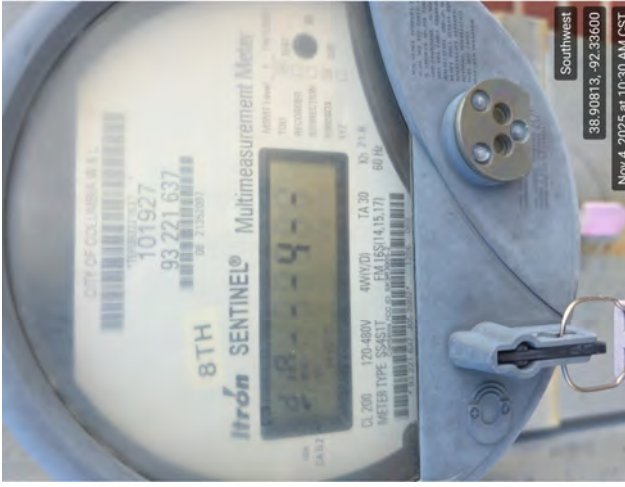


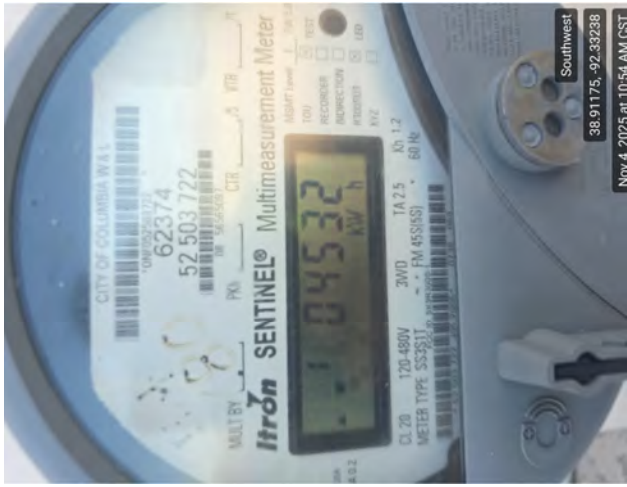


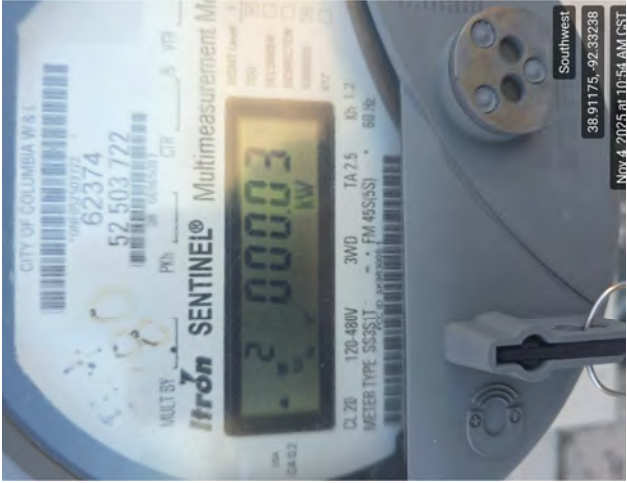




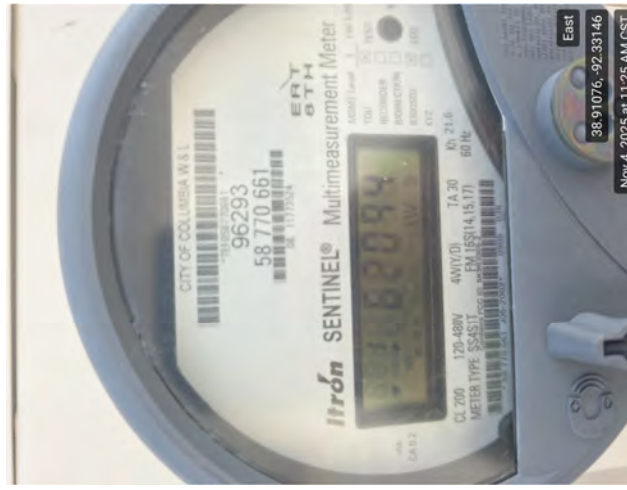


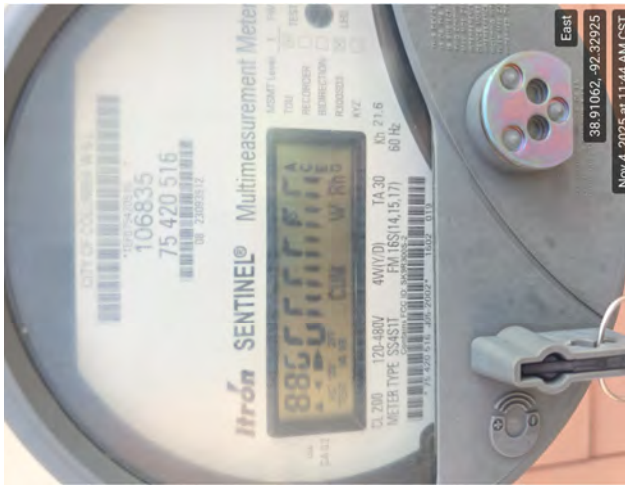
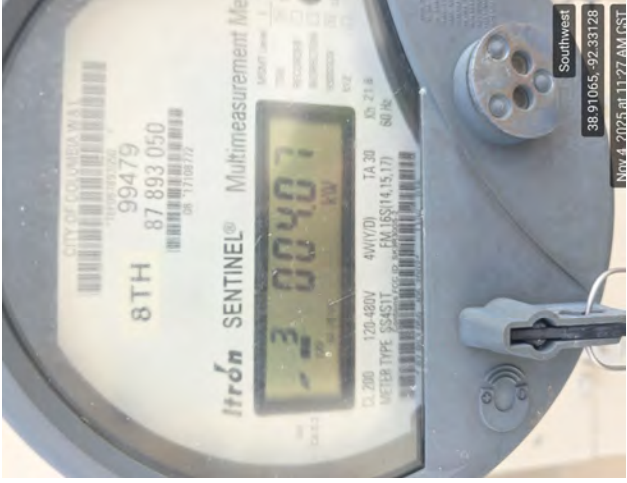


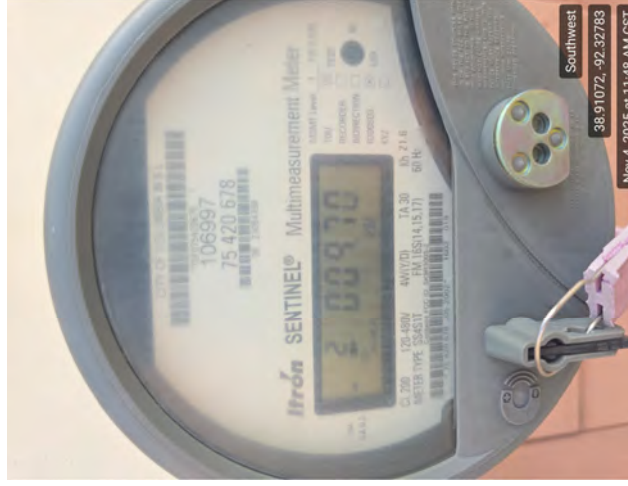
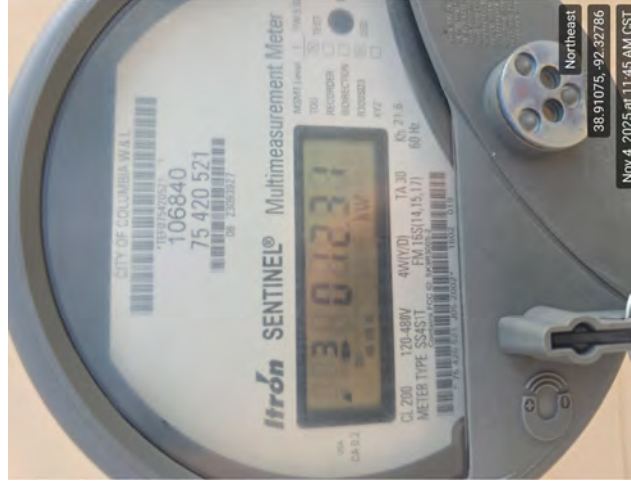
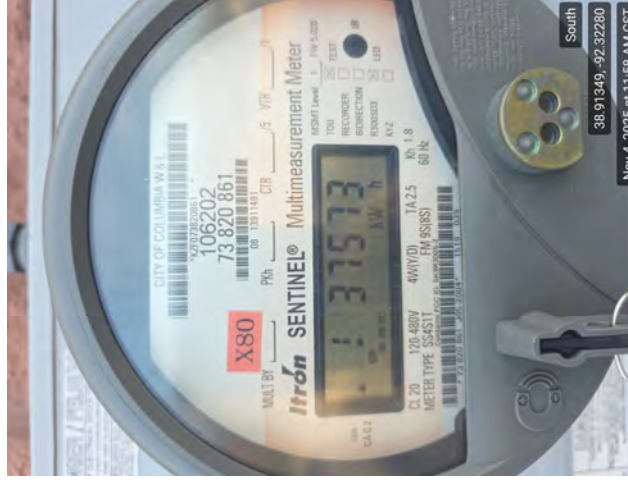
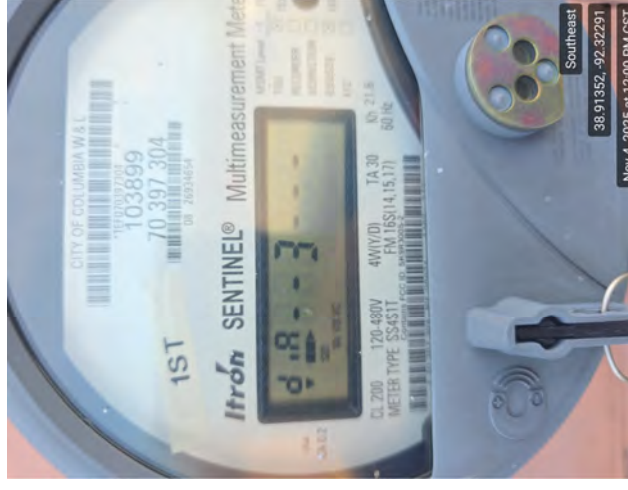


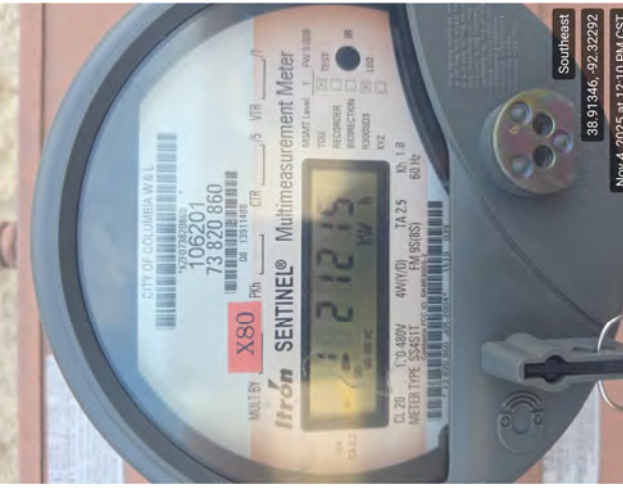


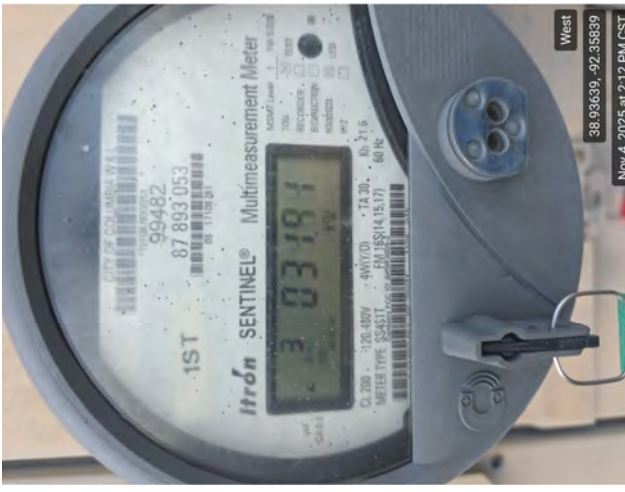
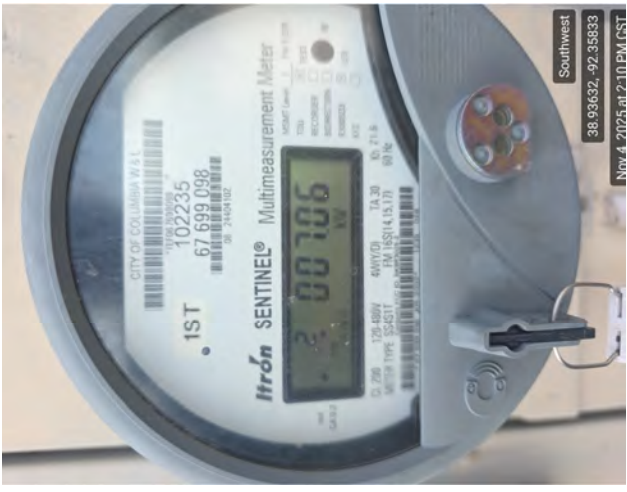
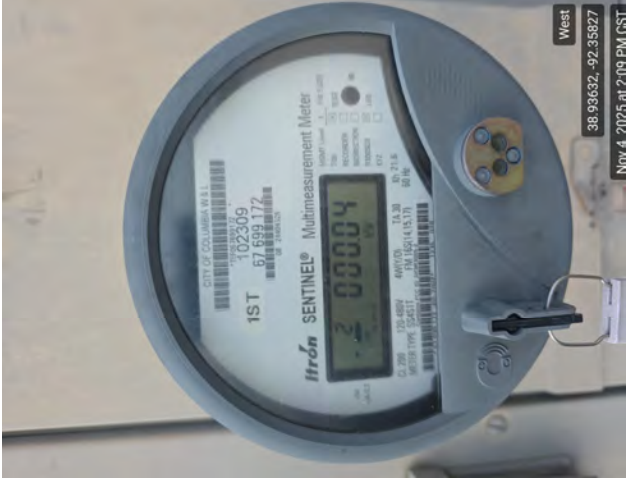














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38.93605, -92.35836

Nov. 4. 2025 at 2:17 PM CST



Southwest

38.93610, -92.35832

Nov. 4. 2025 at 2:18 PM CST



Southwest

38.93607, -92.35832

Nov. 4. 2025 at 2:19 PM CST



East

38.93574, -92.35882

Nov. 4. 2025 at 2:22 PM CST



Northeast

38.93574, -92.35882

Nov. 4. 2025 at 2:22 PM CST



South

38.93388, -92.35955

Nov. 4. 2025 at 2:23 PM CST



South

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Nov. 4. 2025 at 2:23 PM CST



Southwest

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Nov. 4. 2025 at 2:24 PM CST

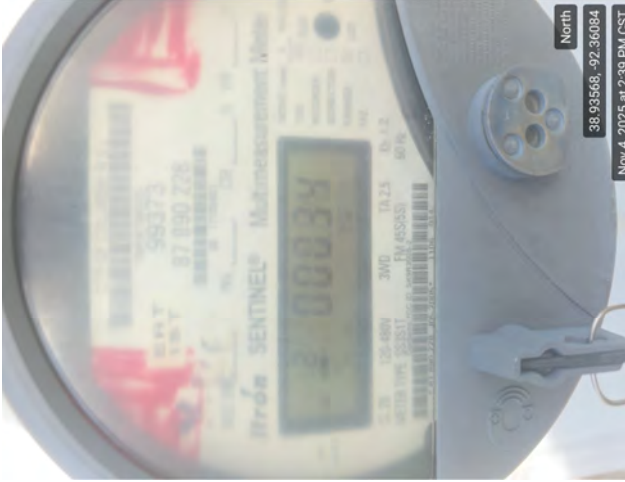
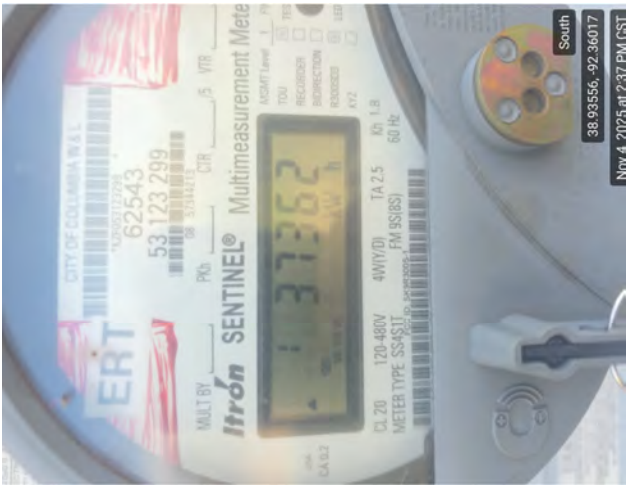
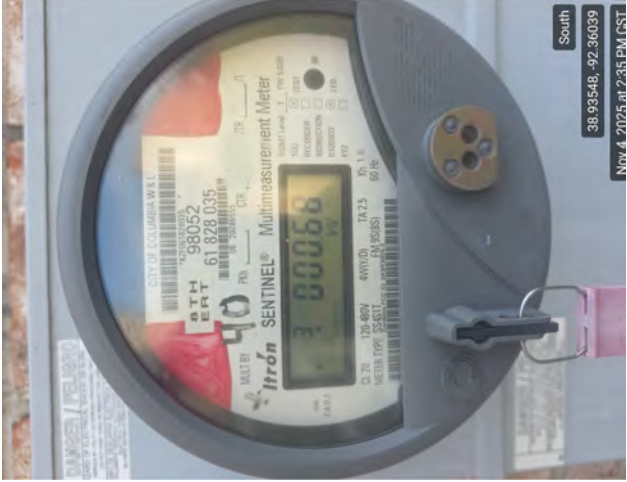


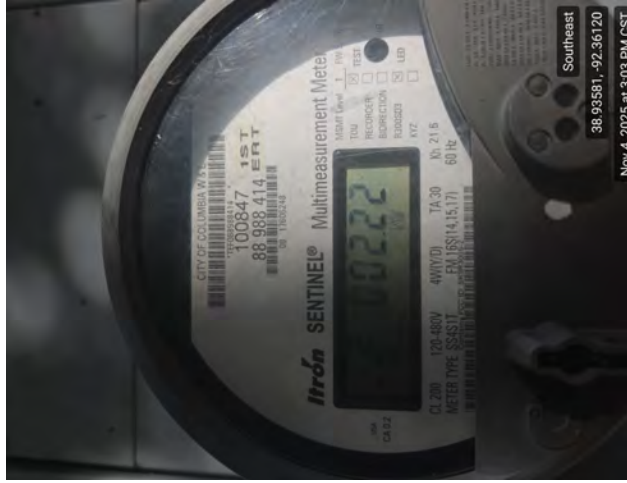
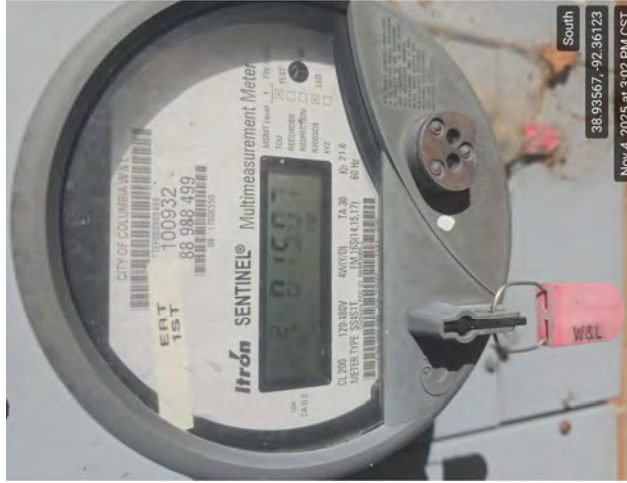
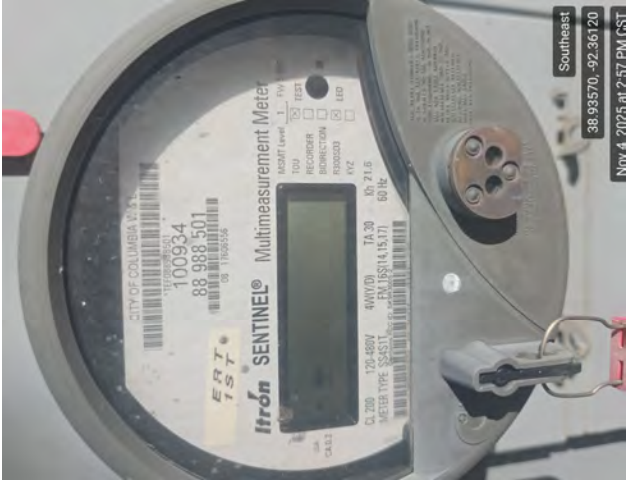
Southwest

38.93557, -92.35917

Nov. 4. 2025 at 2:24 PM CST

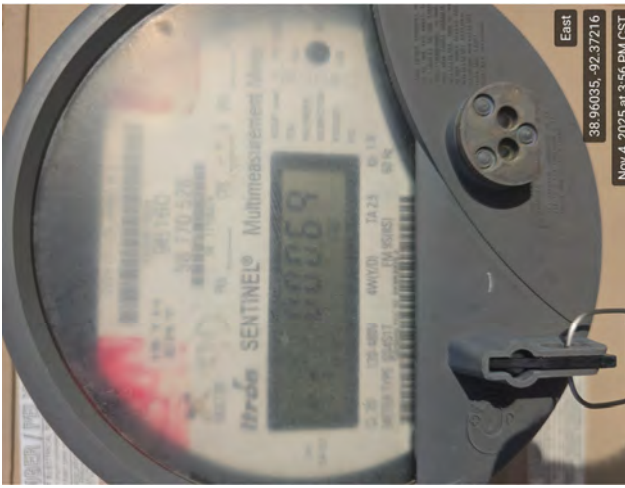




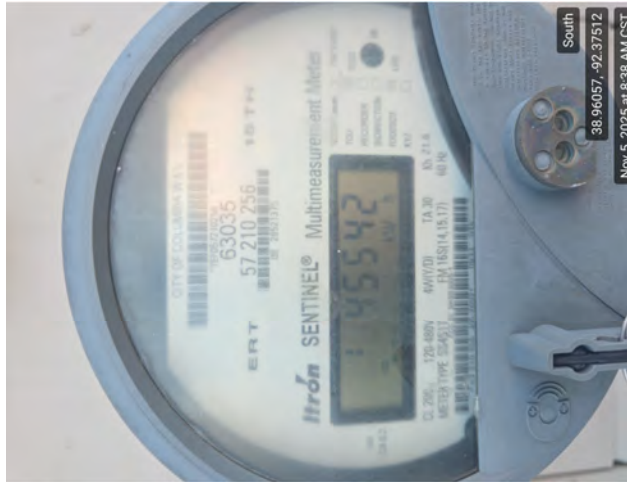
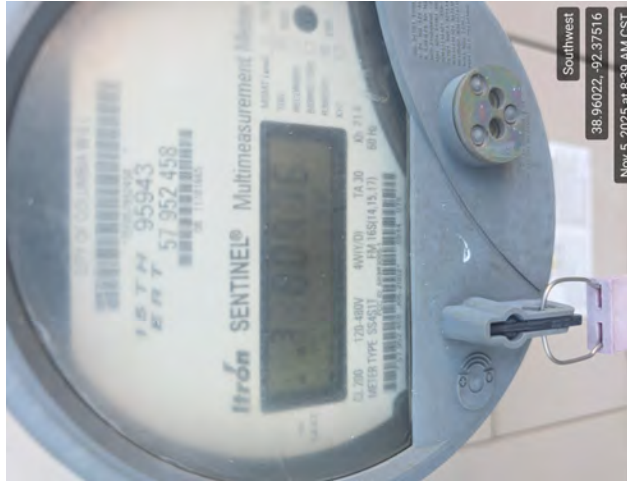
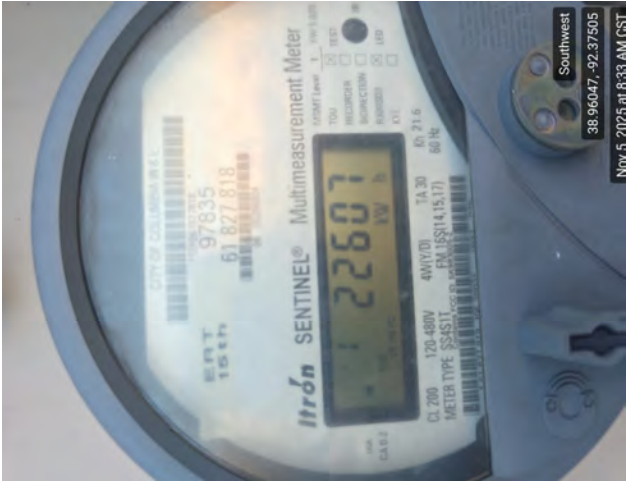
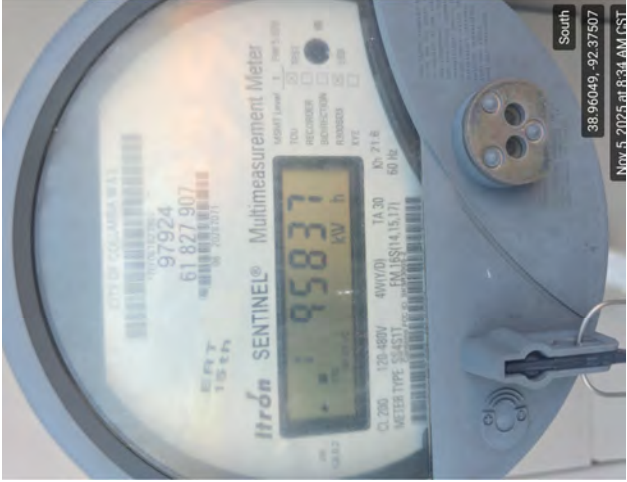


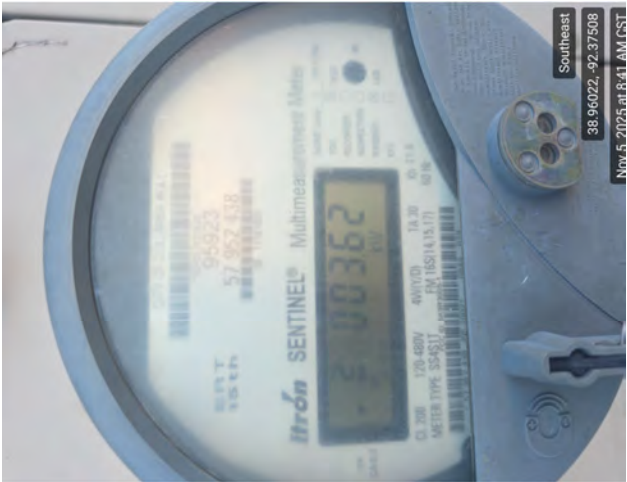
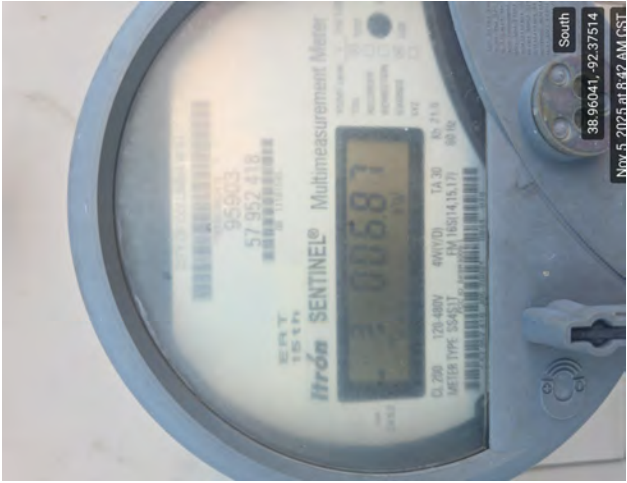






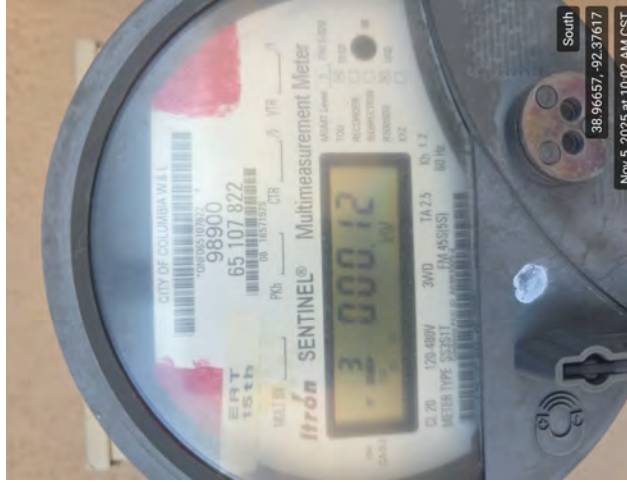
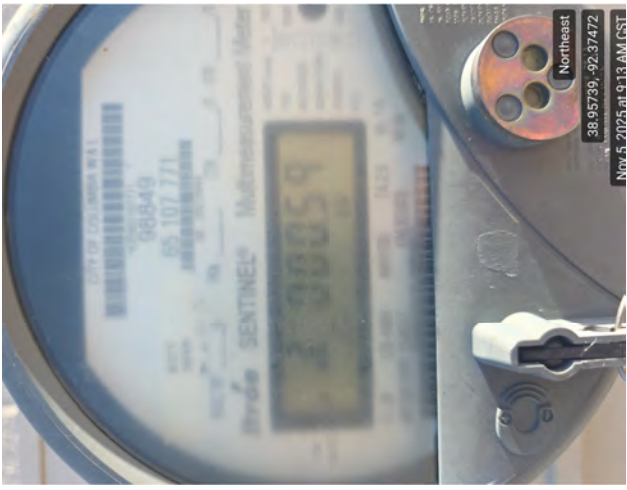




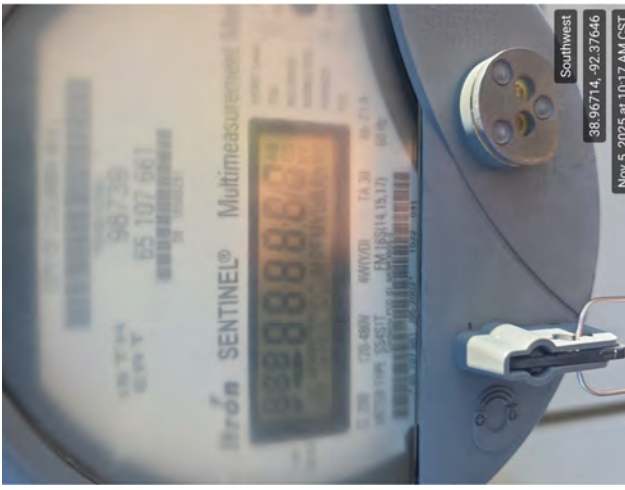
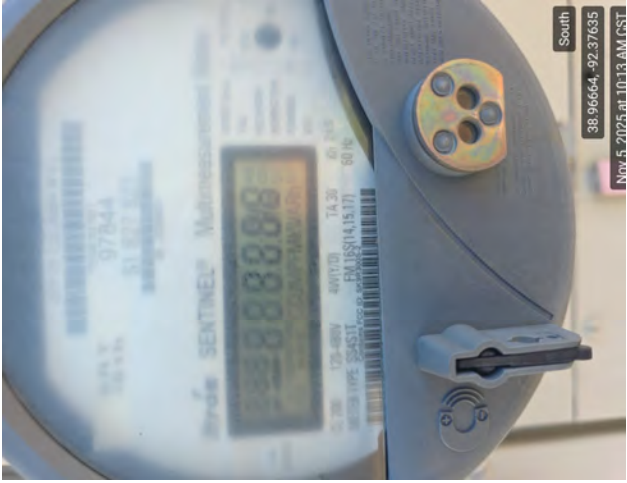
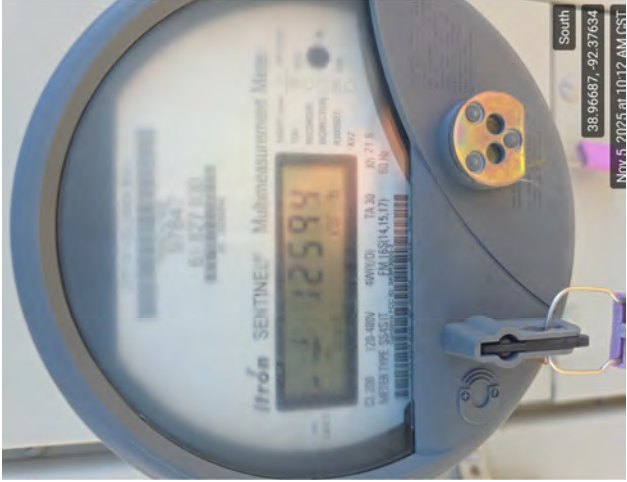


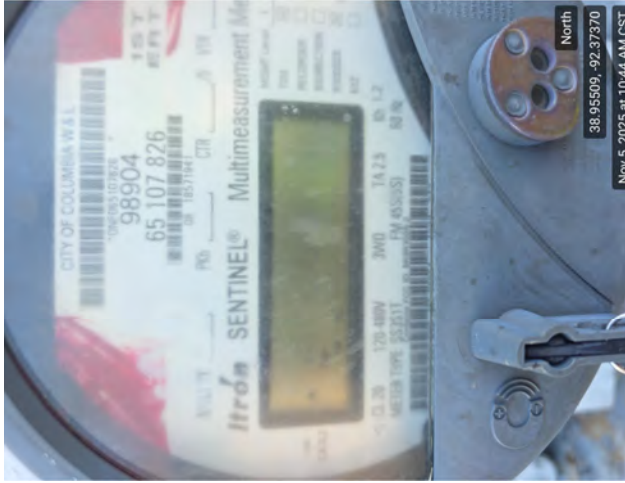
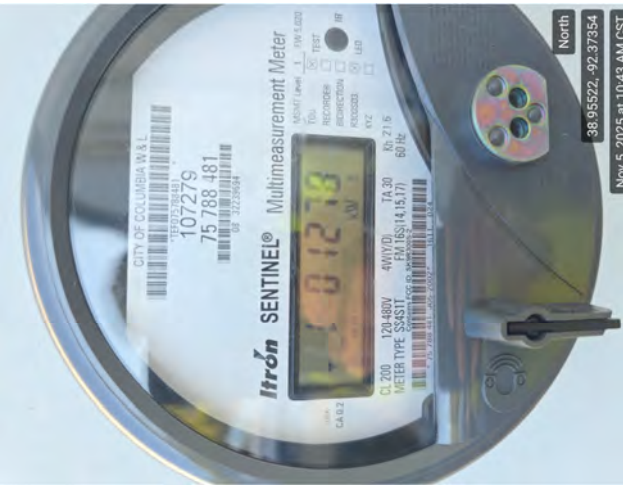
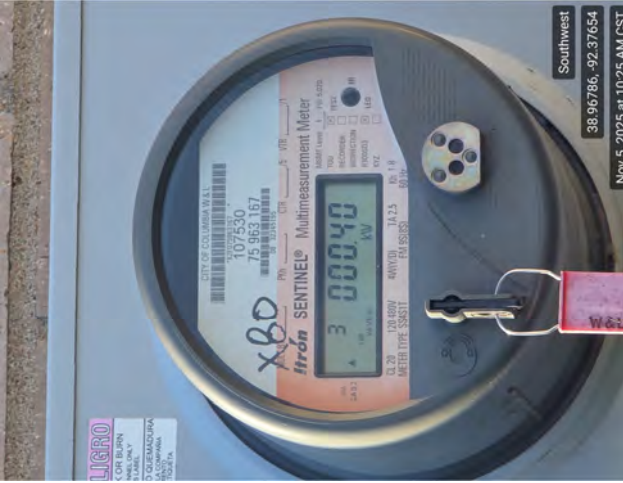
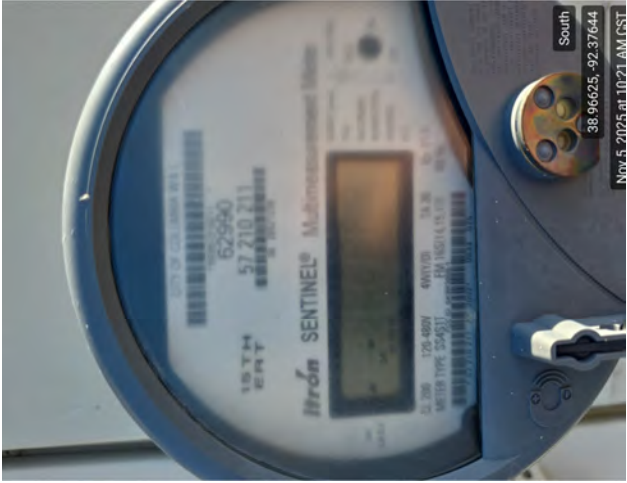


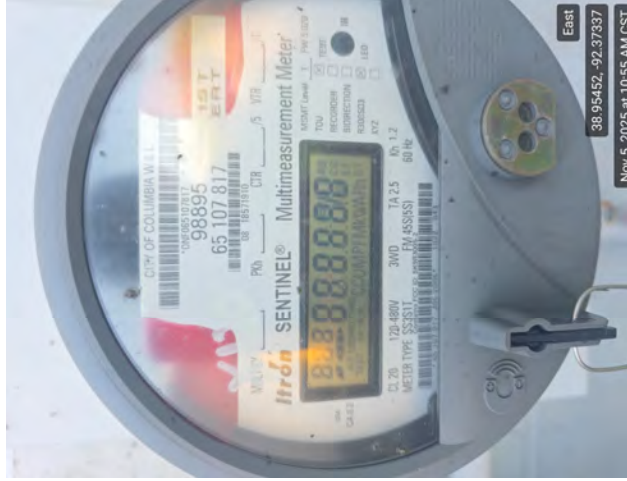
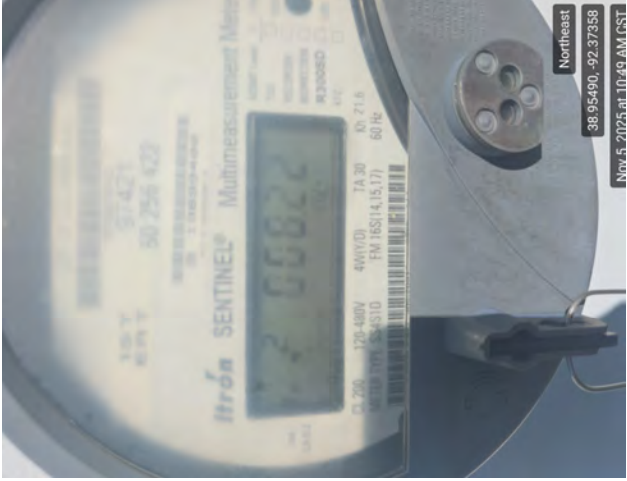


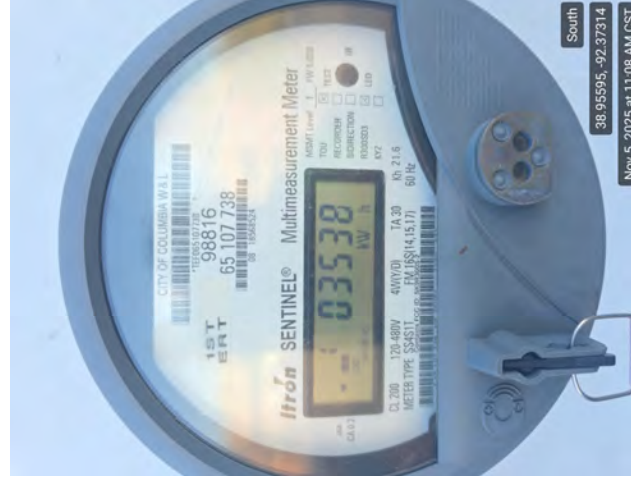


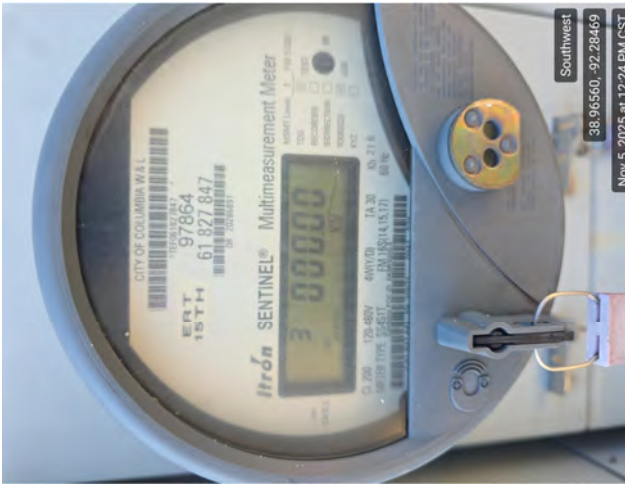


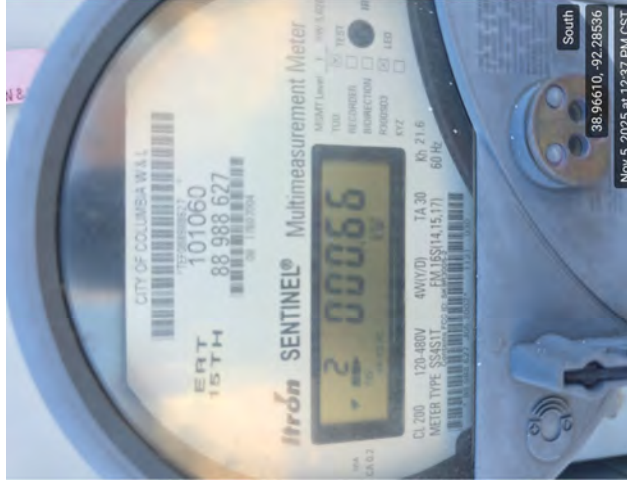
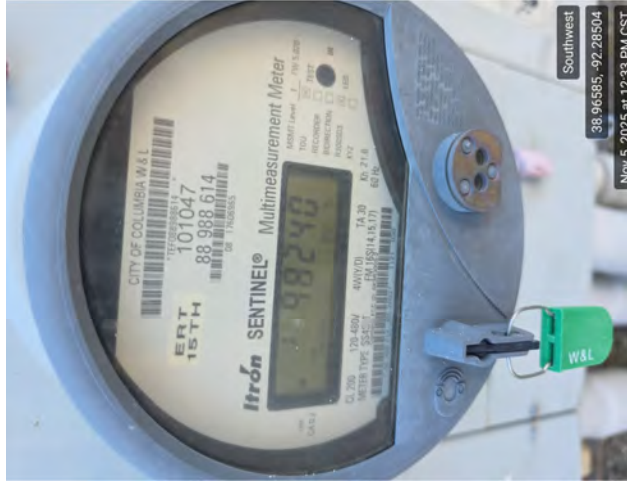


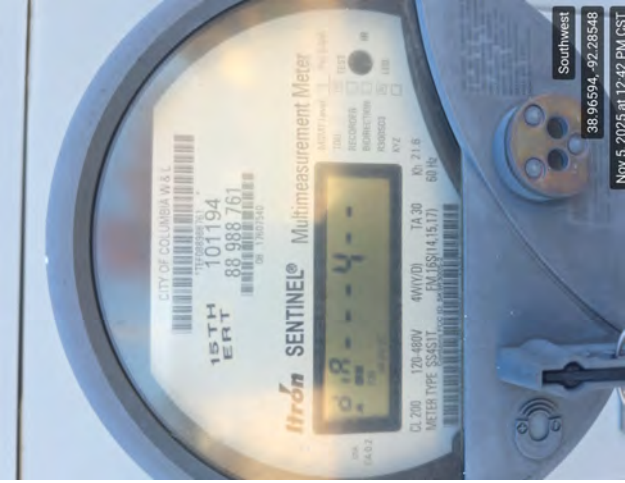


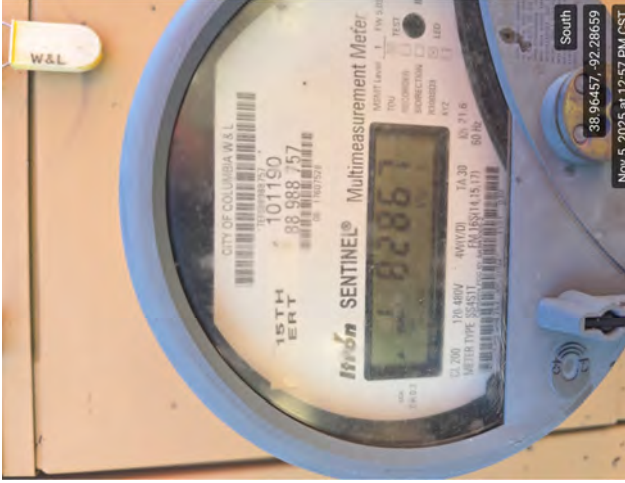
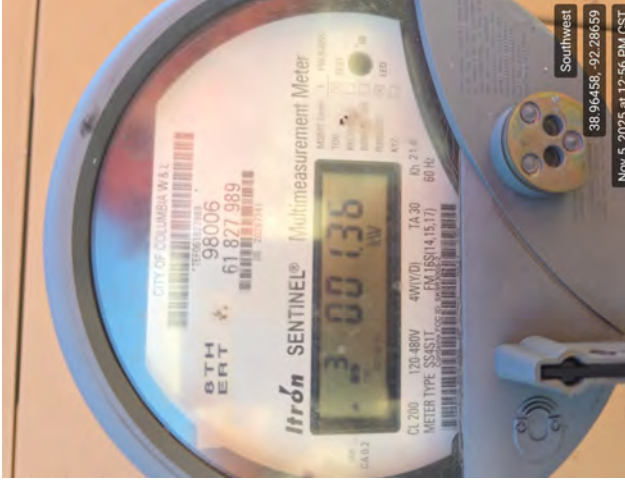
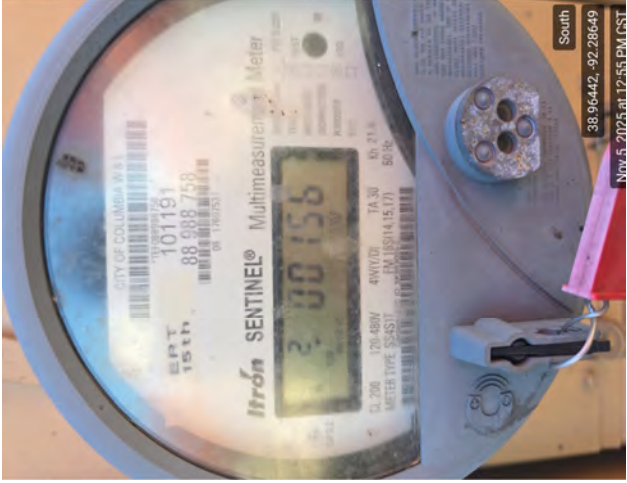


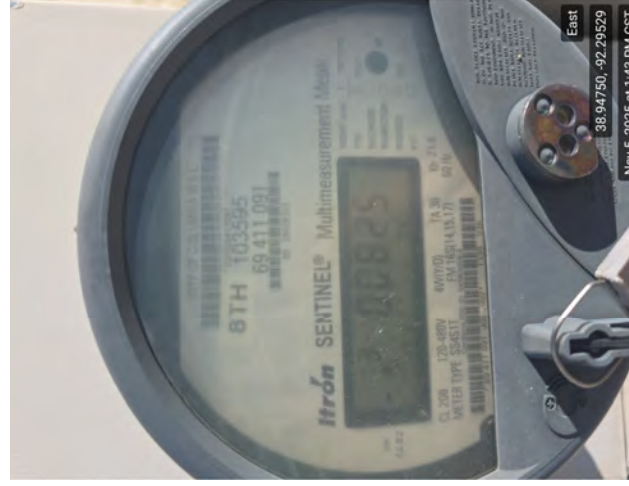


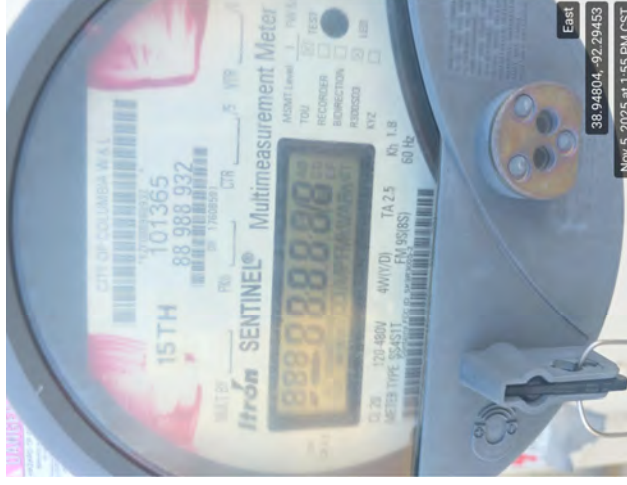


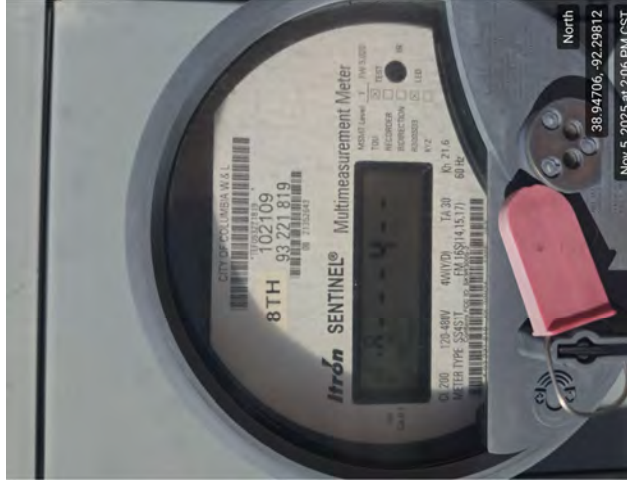
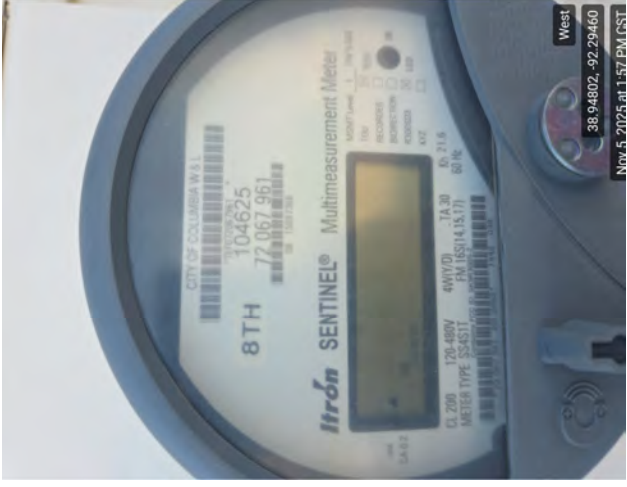
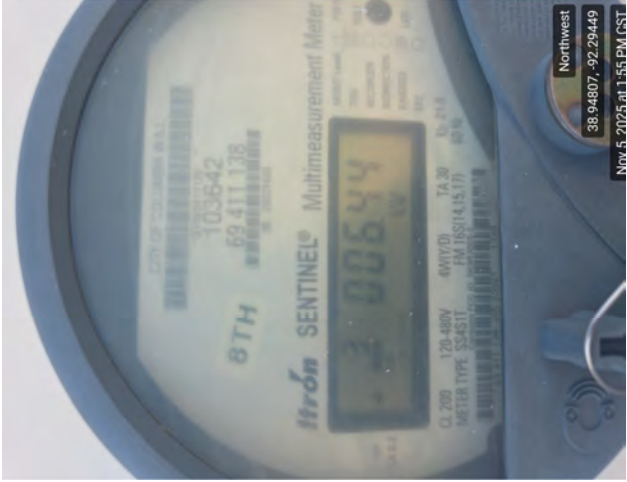


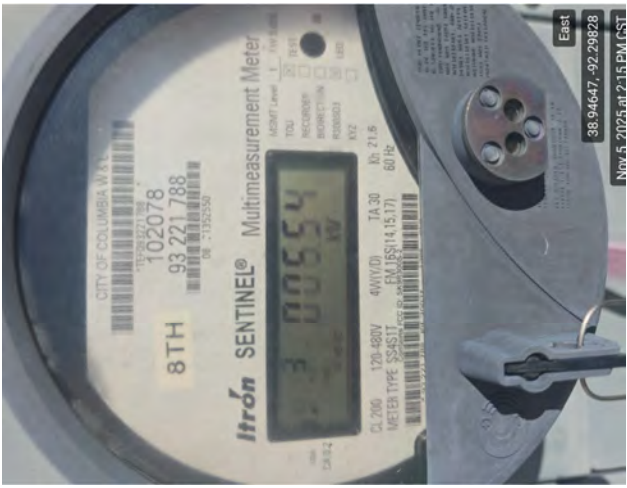
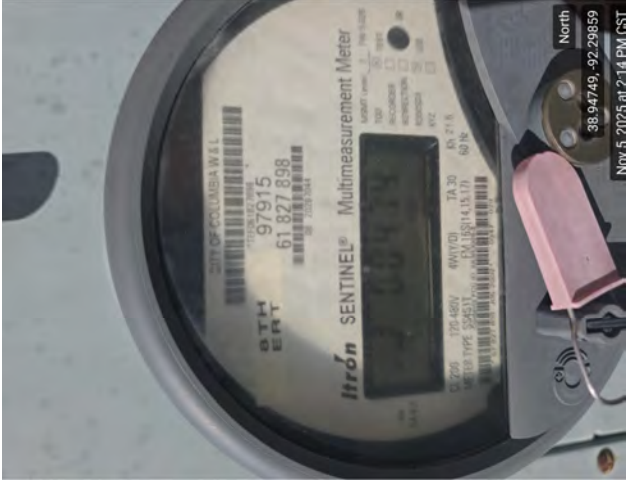
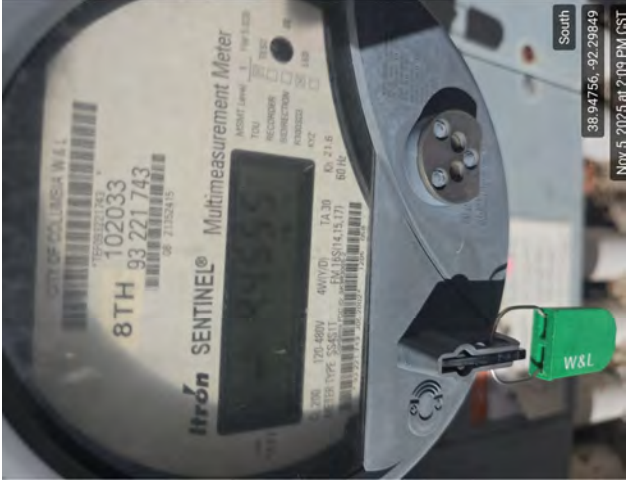




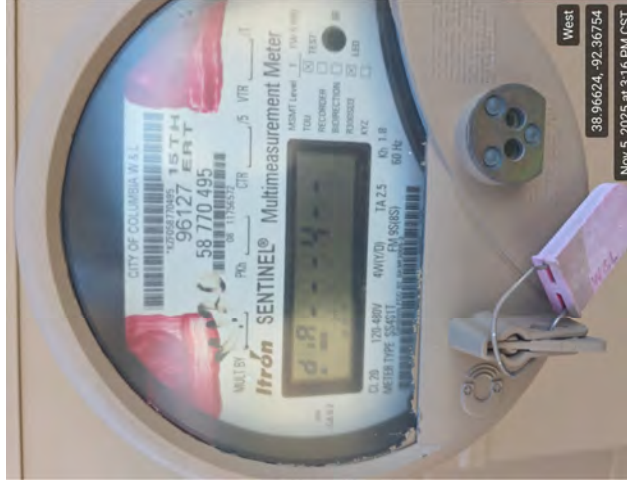
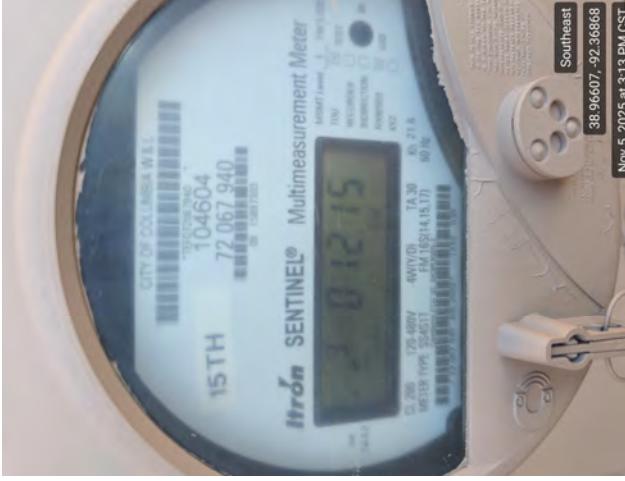




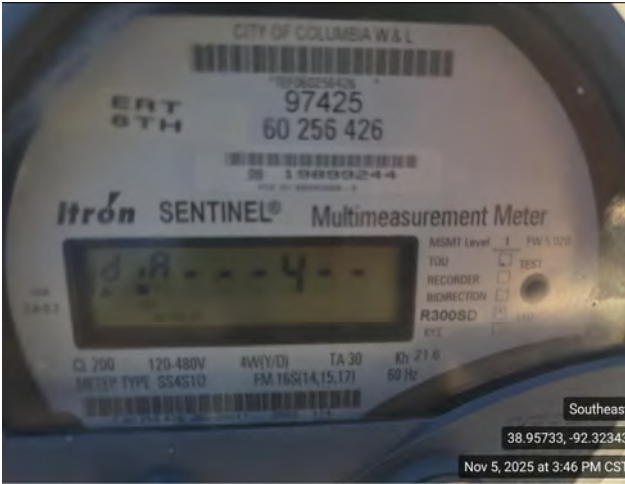












F.3 Small Water Meter Photo Tour







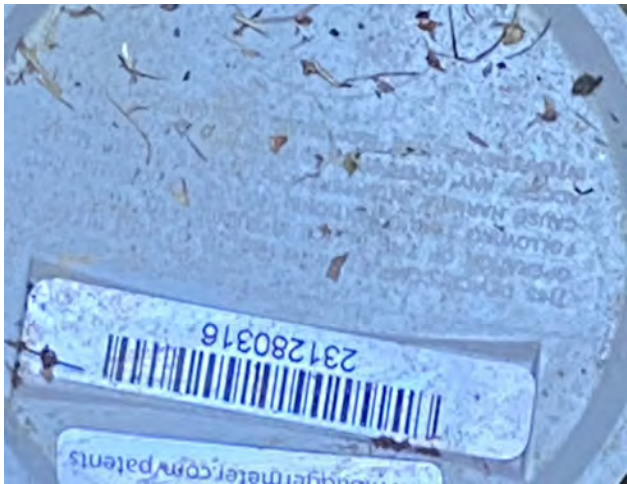
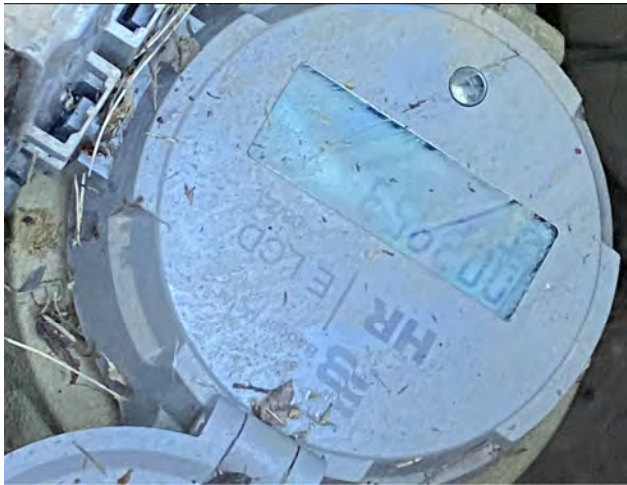






















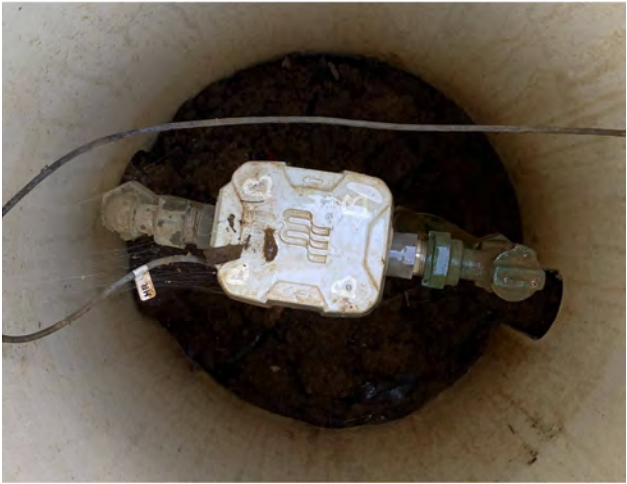
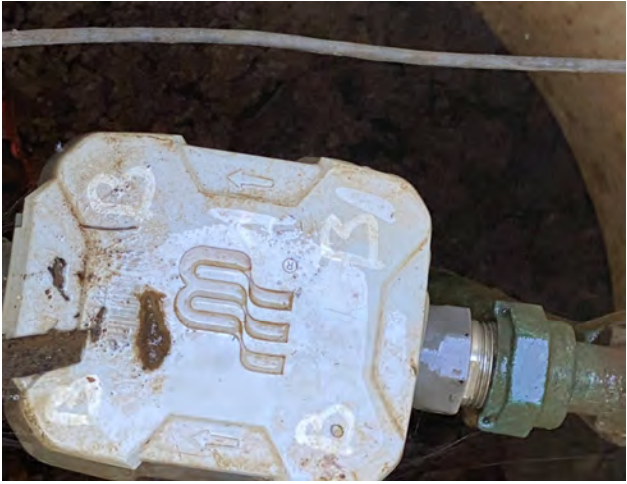




































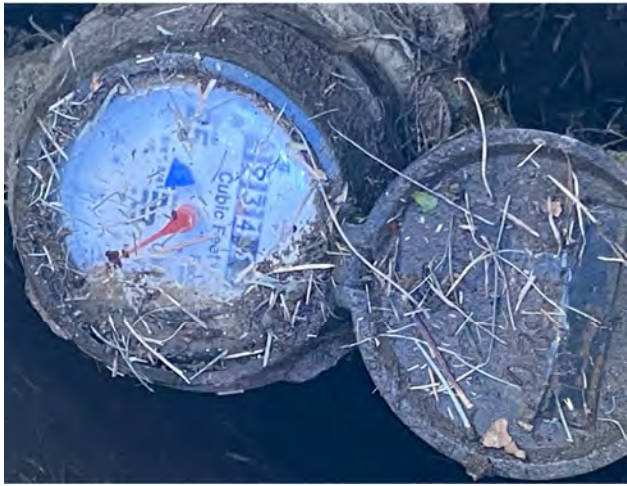










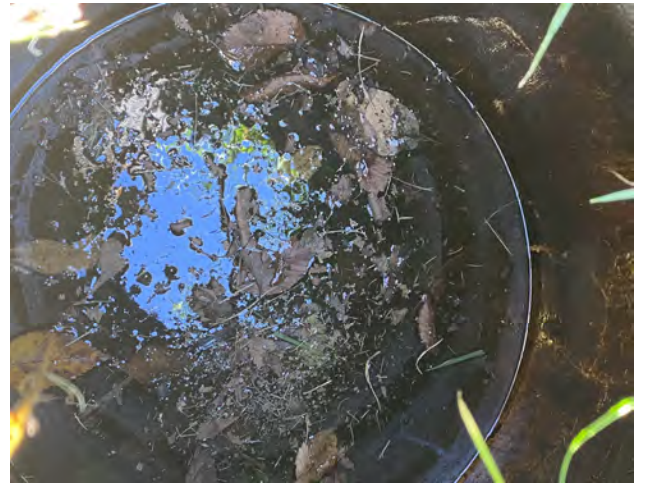




























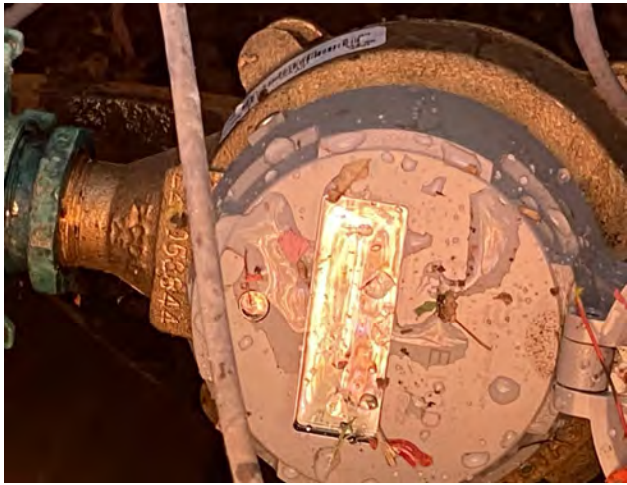
























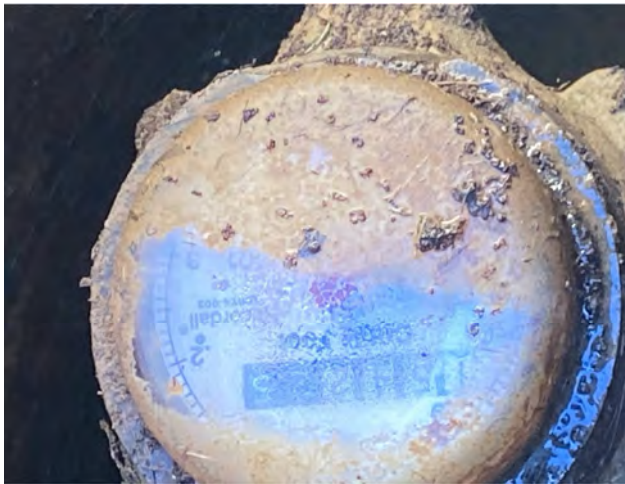












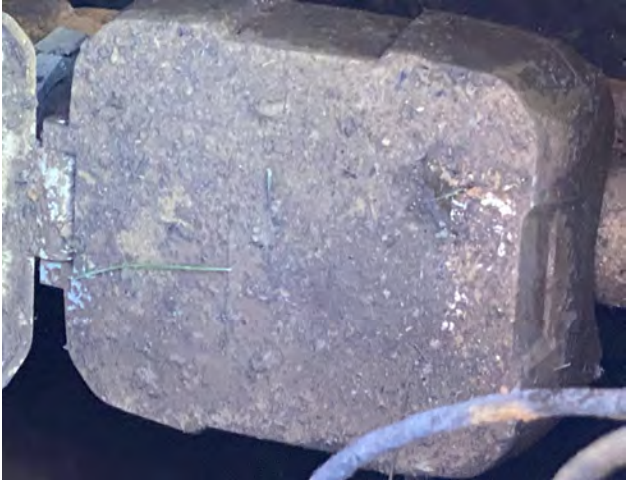






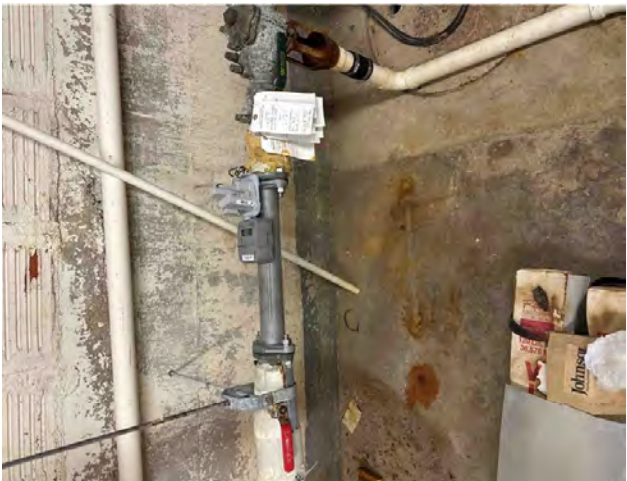
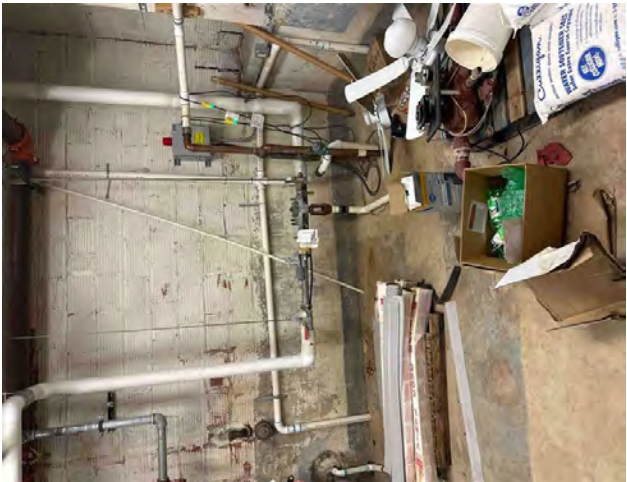


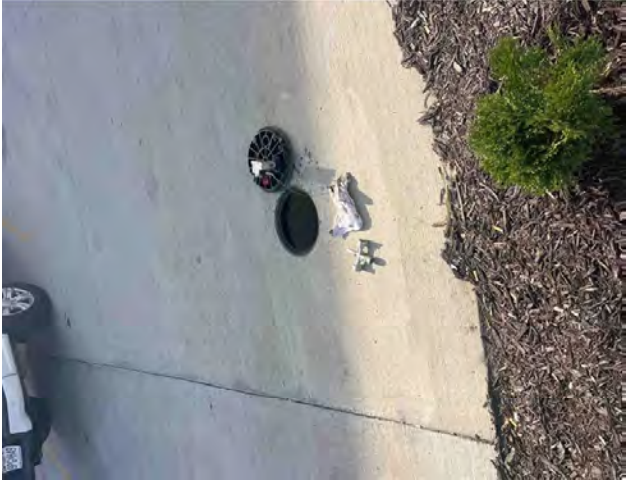




F.4 Intermediate Water Meter Photo Tour

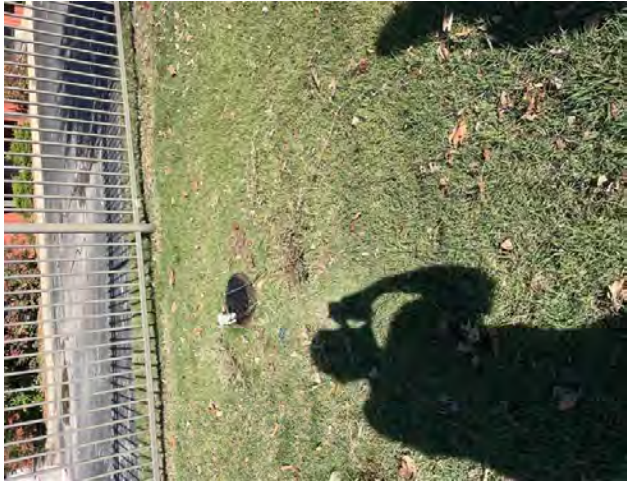


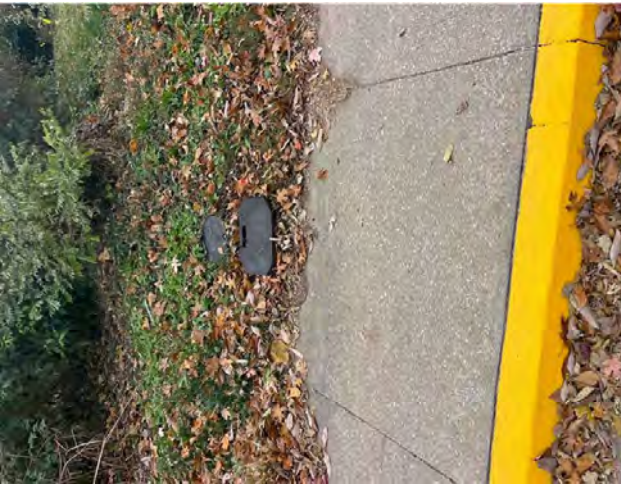






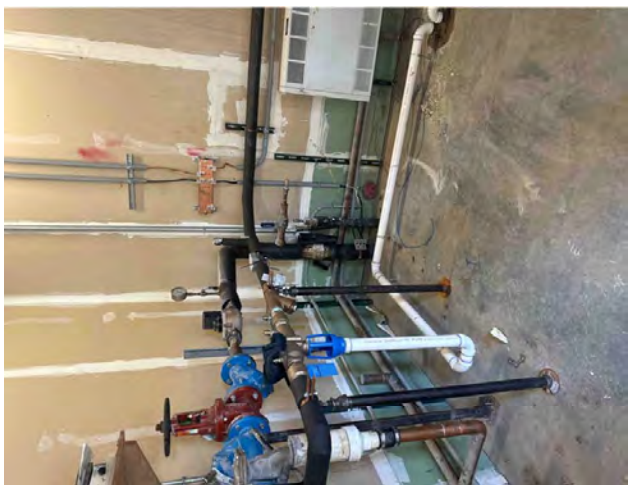


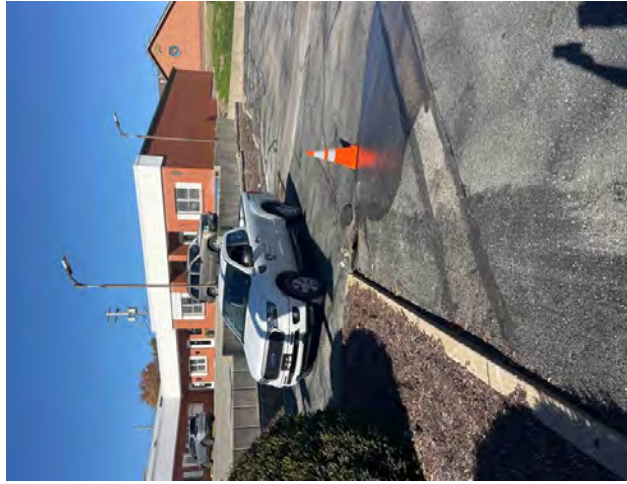
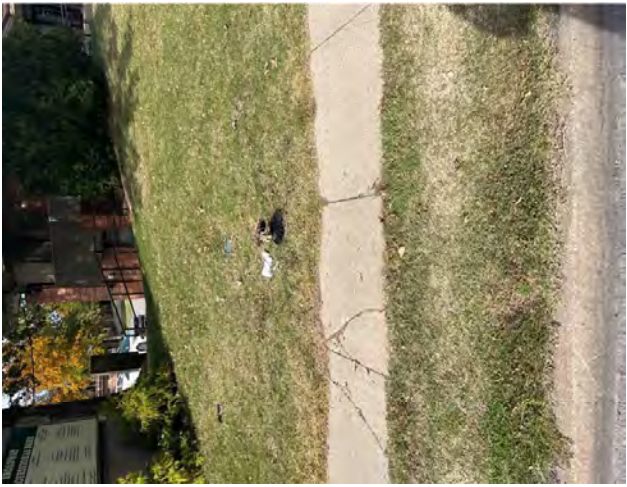




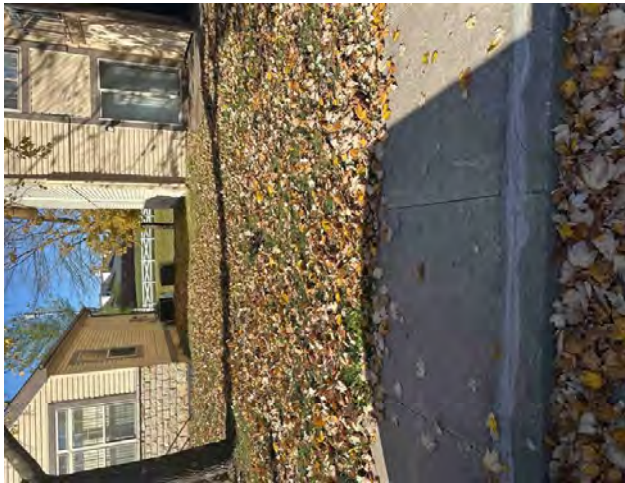


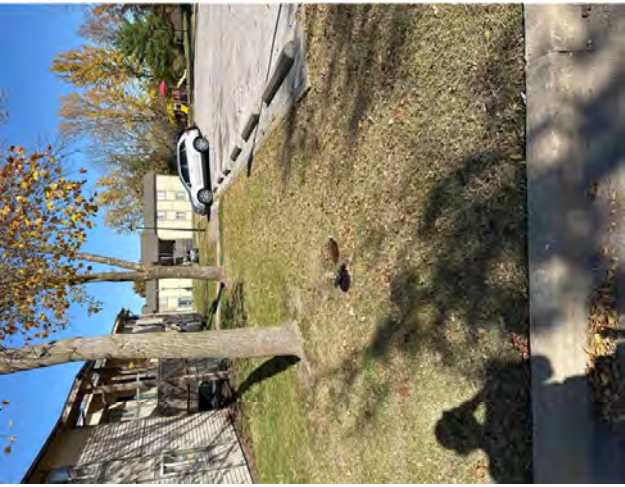


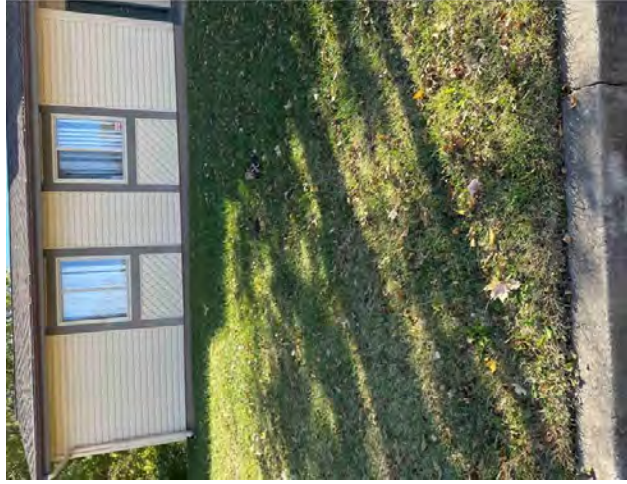




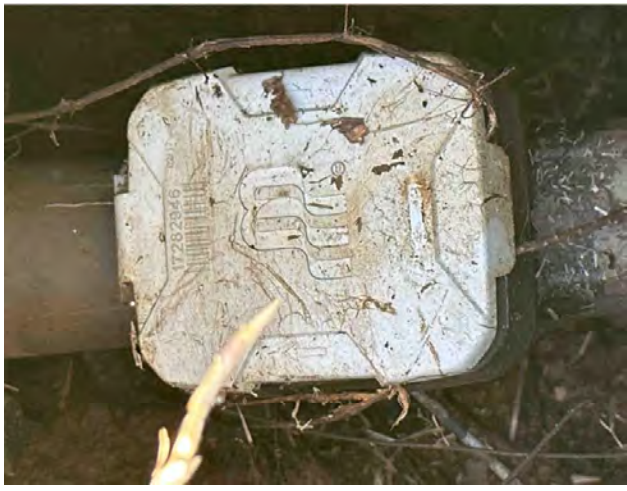




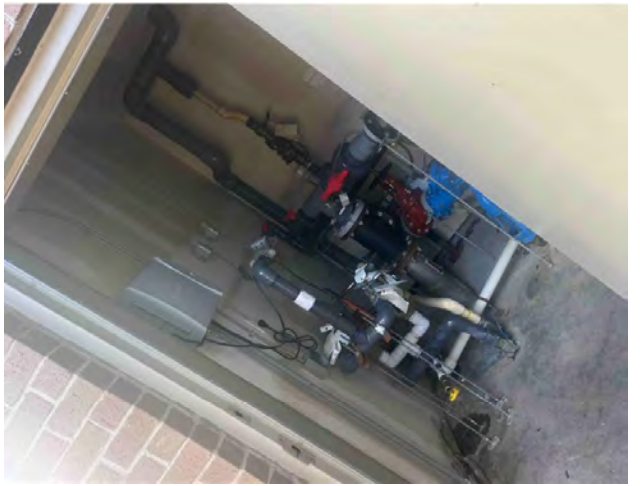


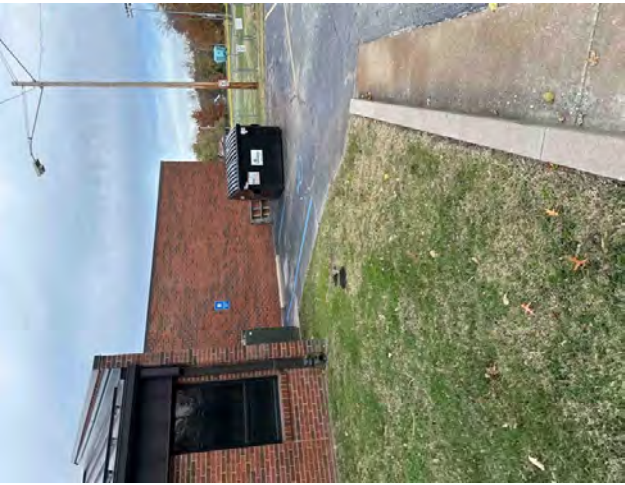


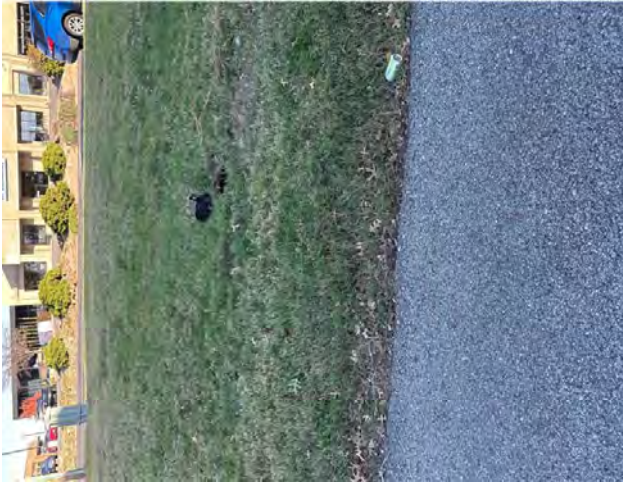


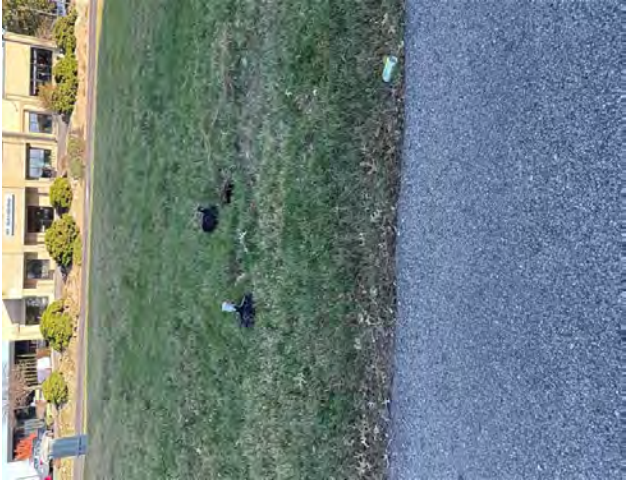


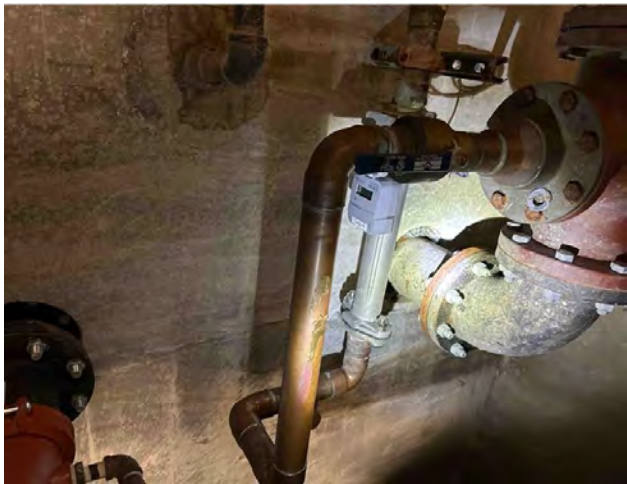


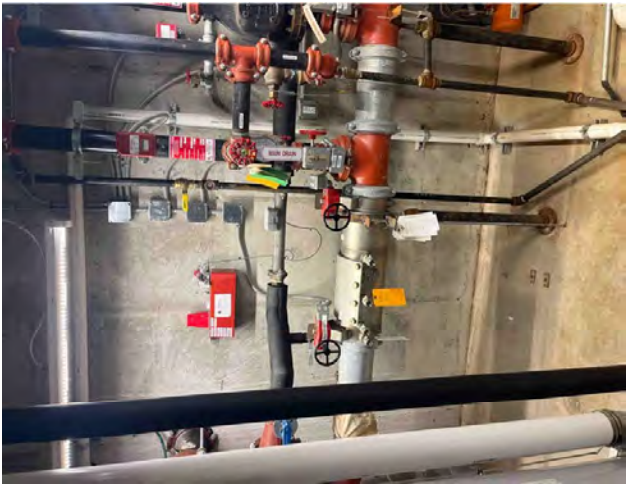






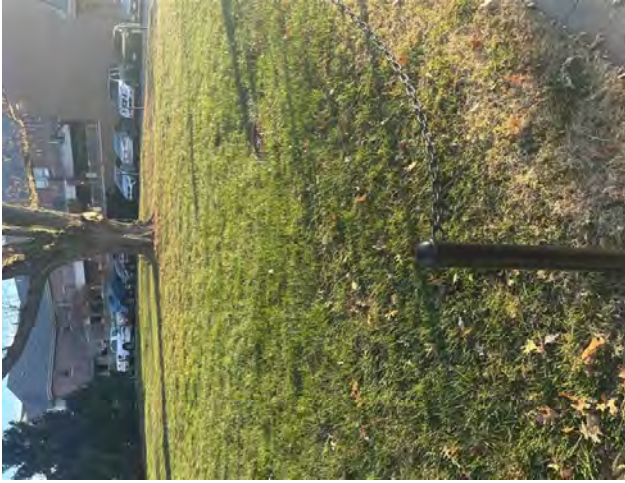




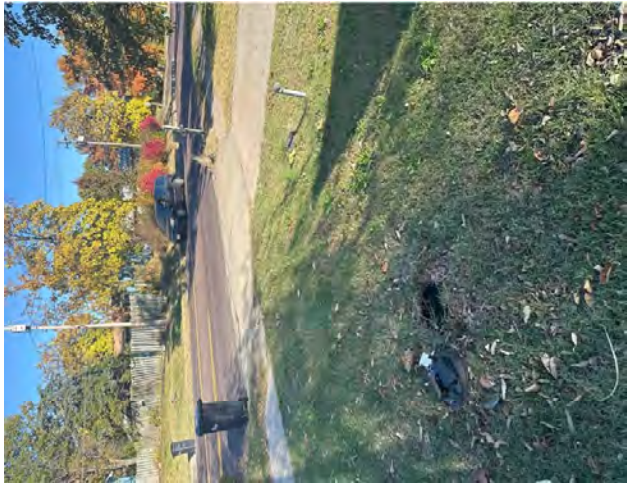


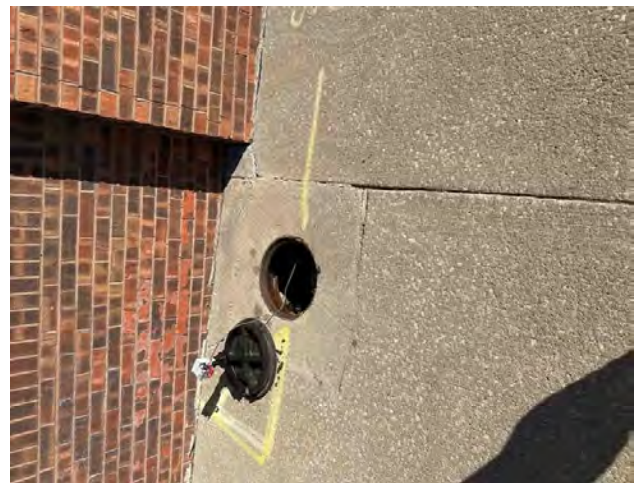




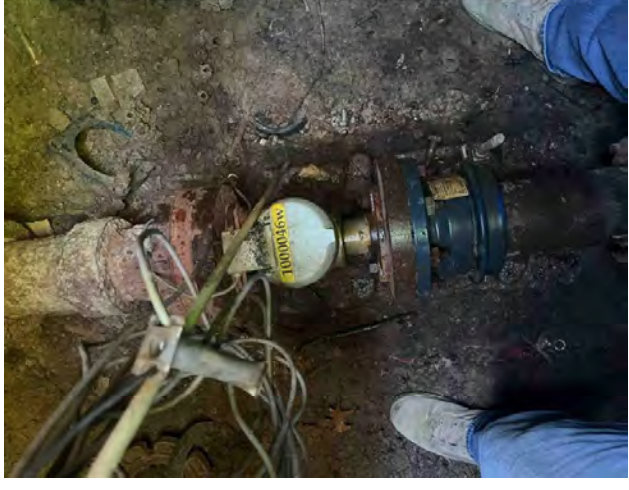
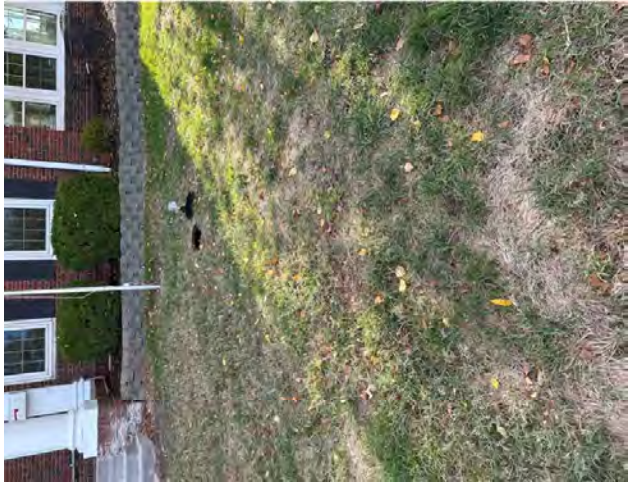


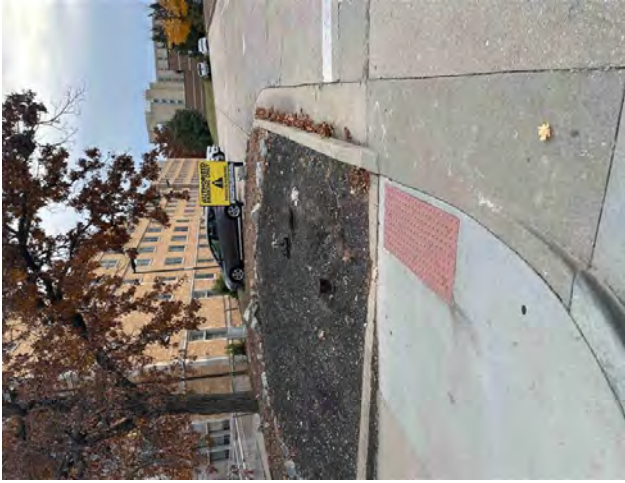




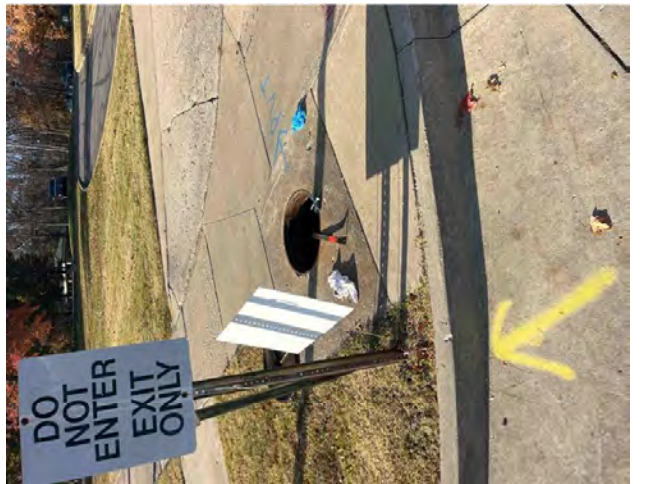


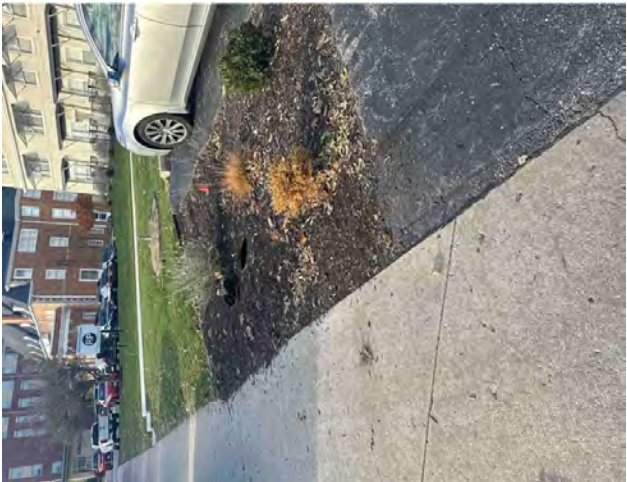


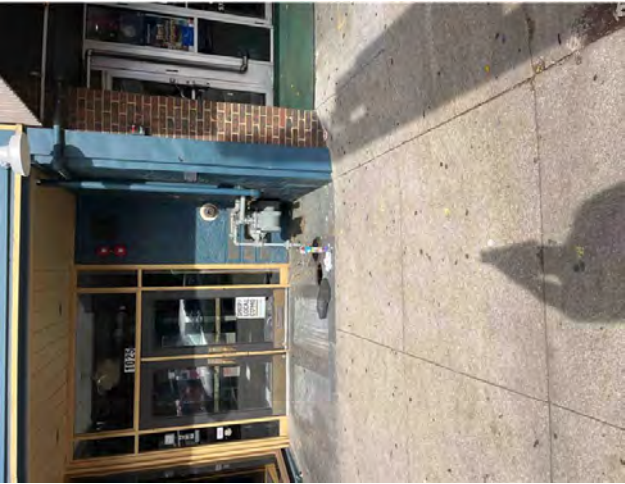


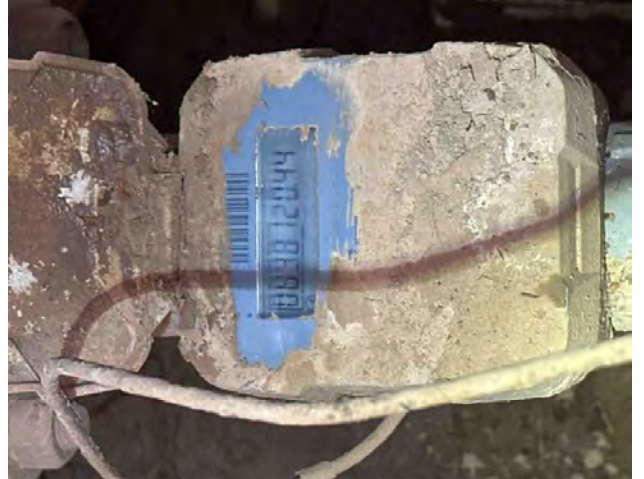


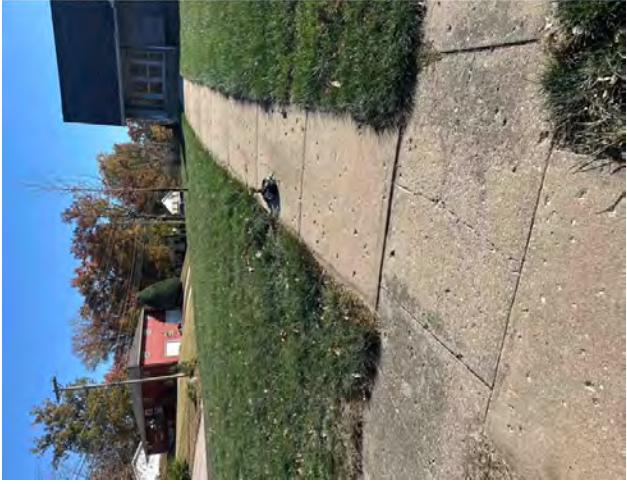




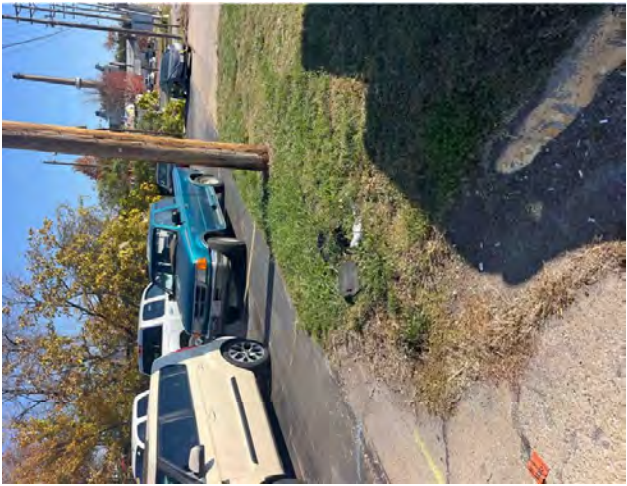


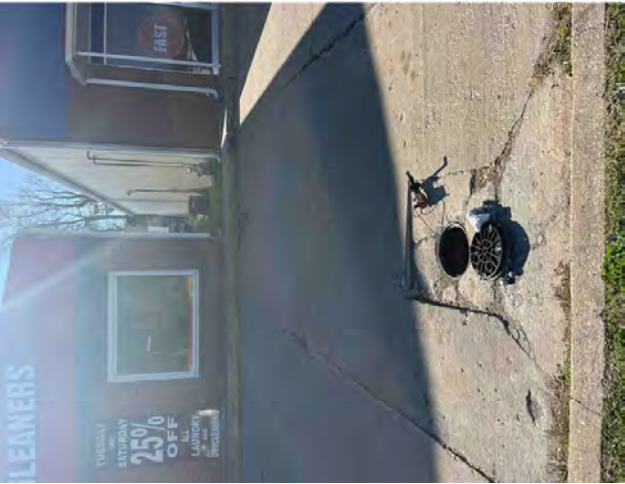




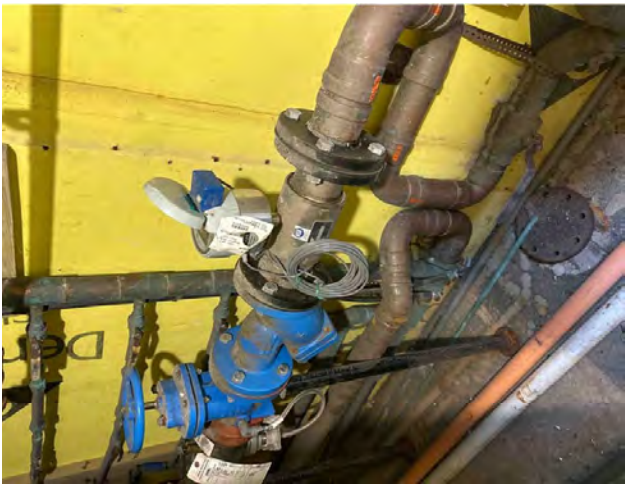








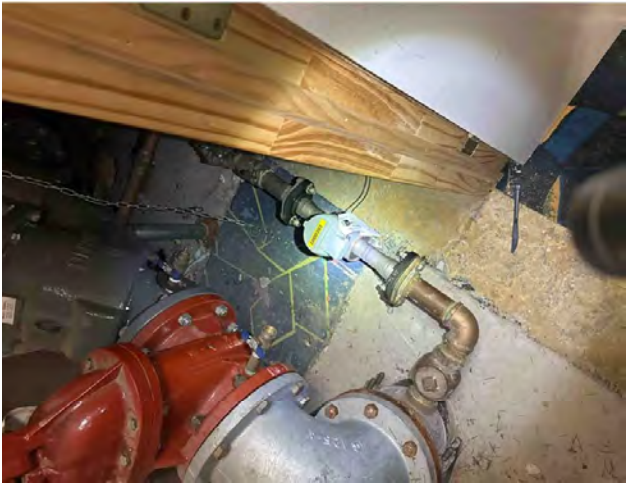




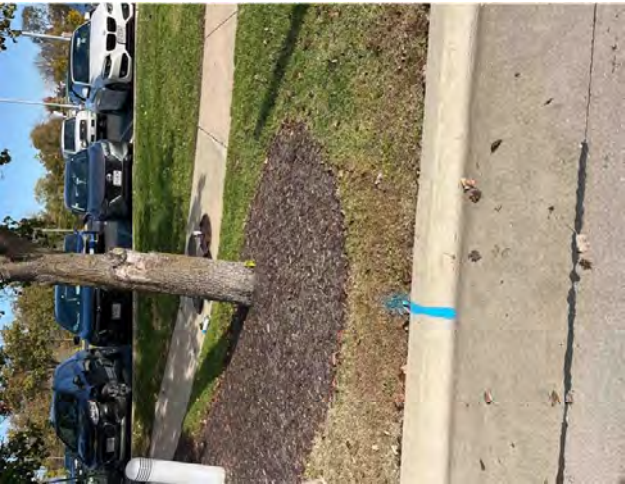


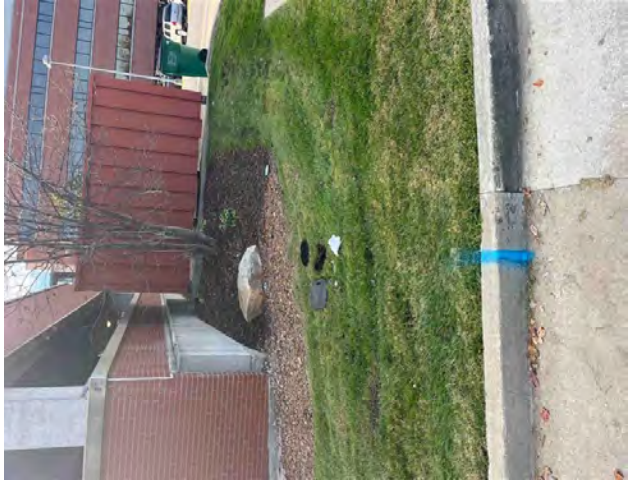




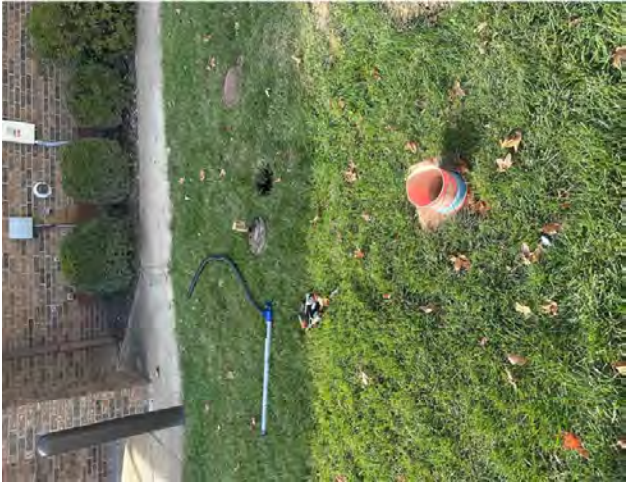


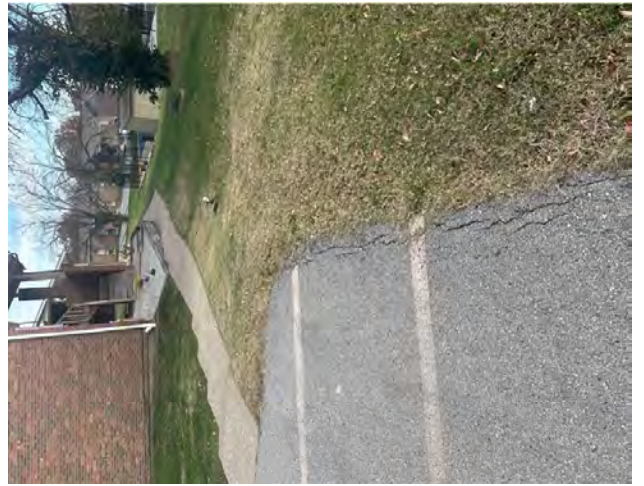


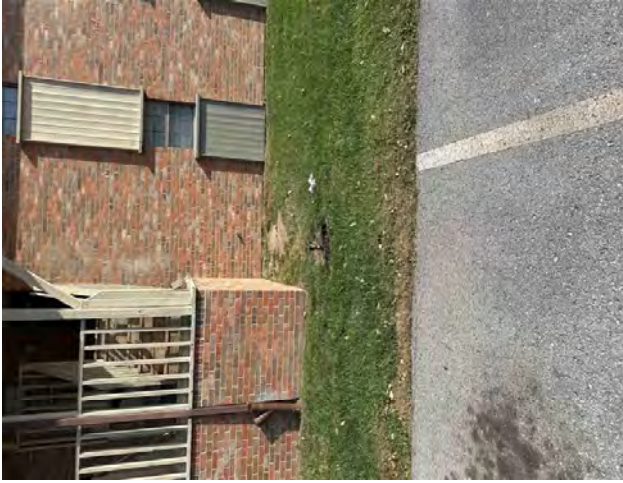


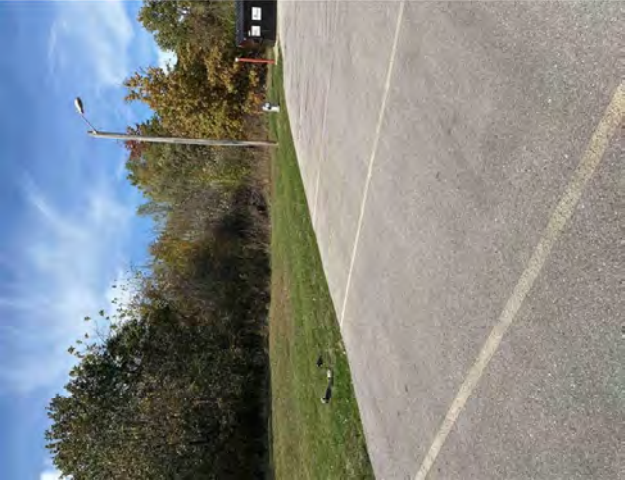




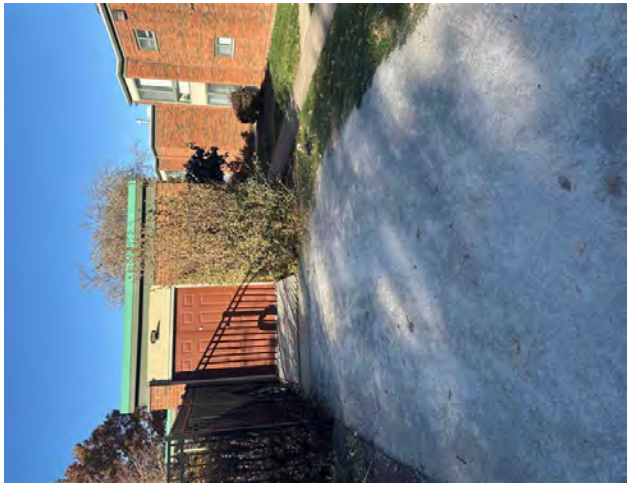


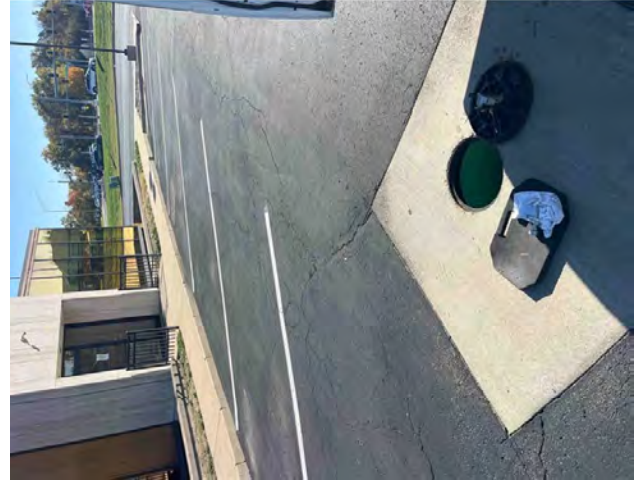










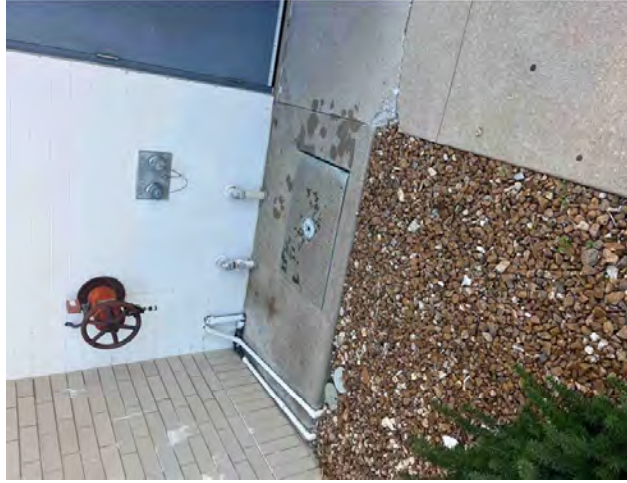


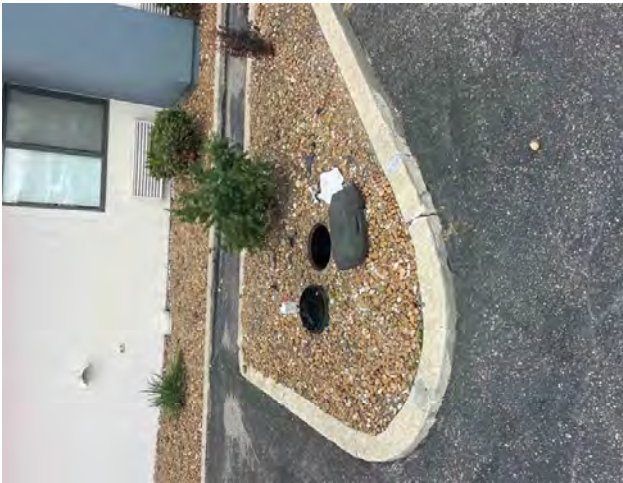
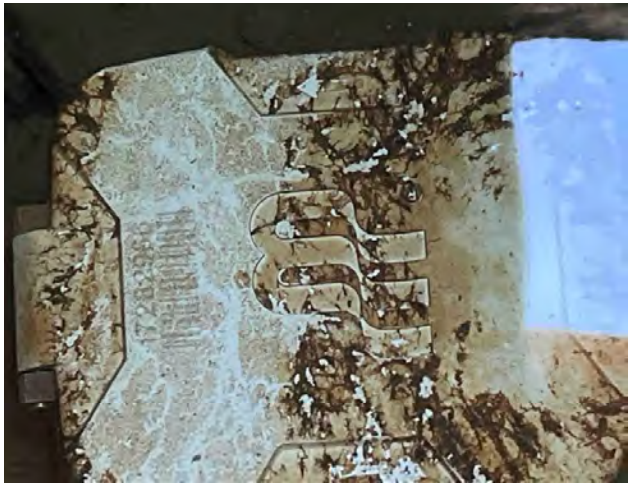






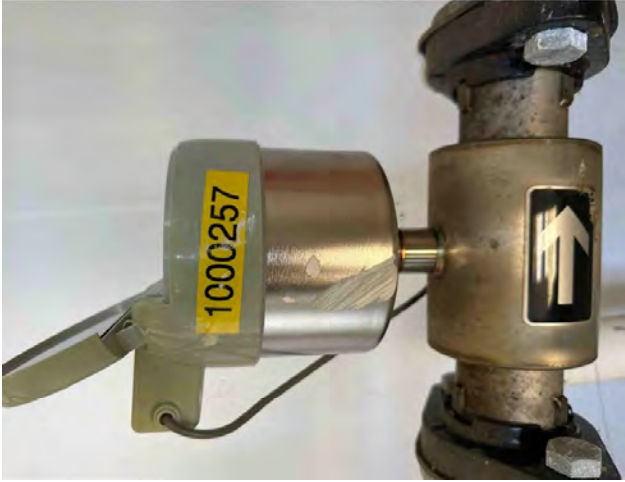








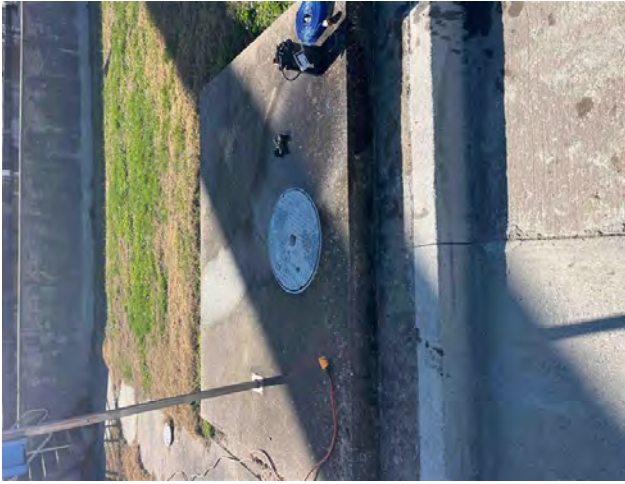


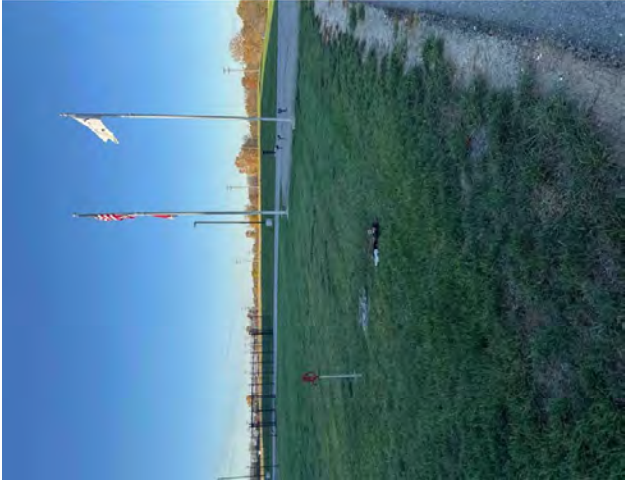




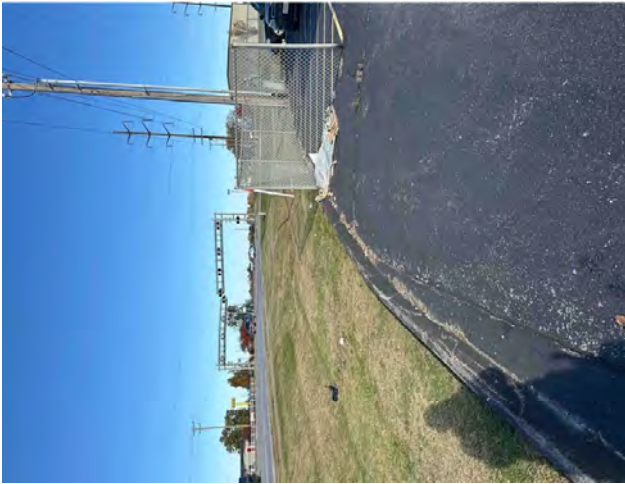










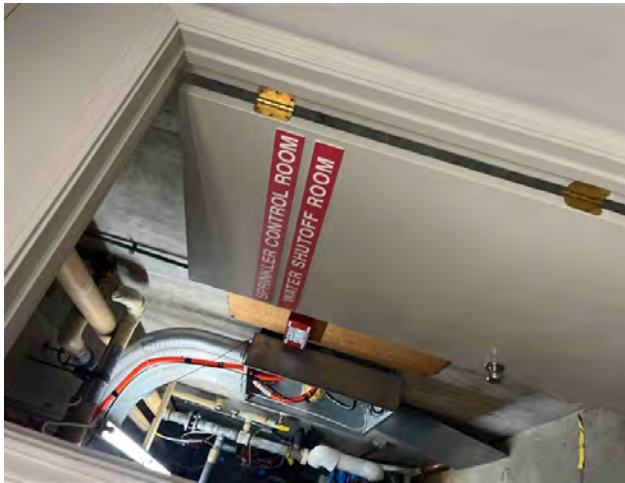


F.5 Large Water Meter Photo Tour





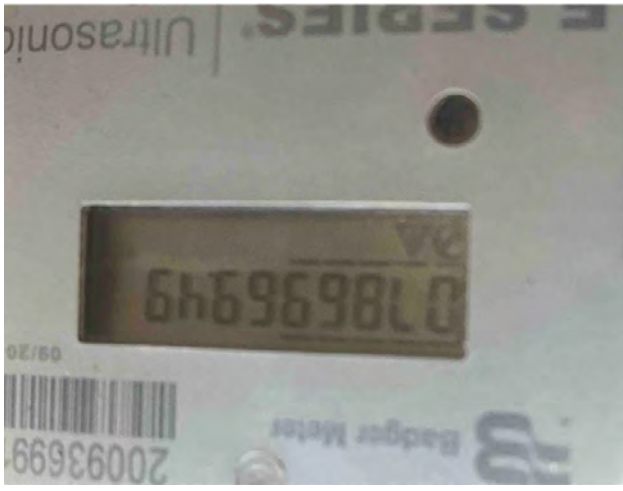


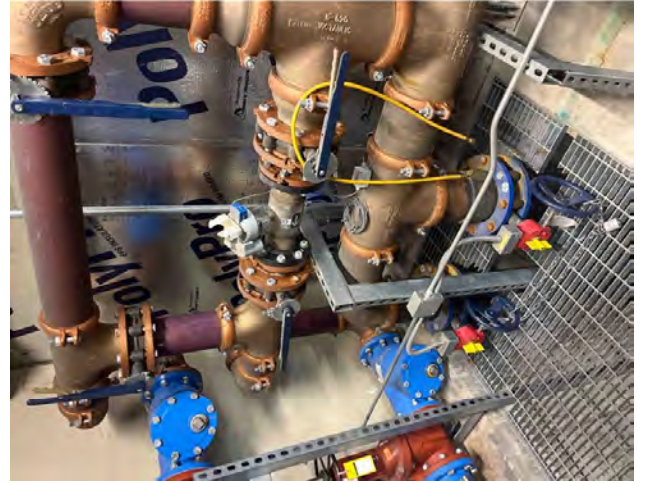




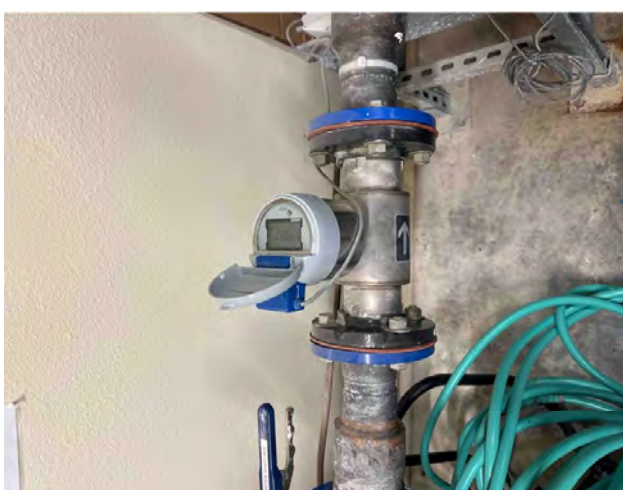
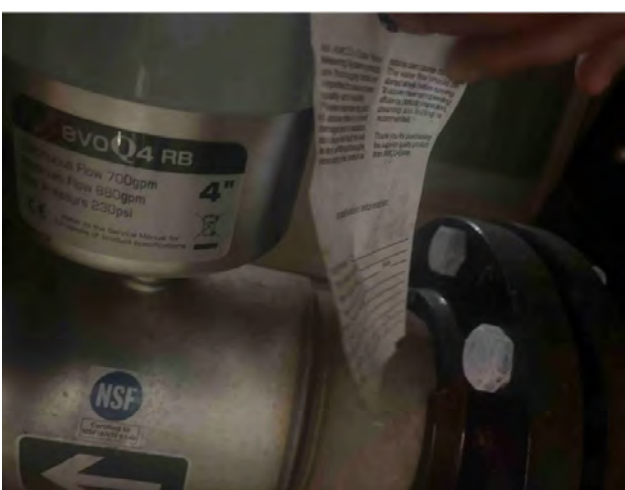




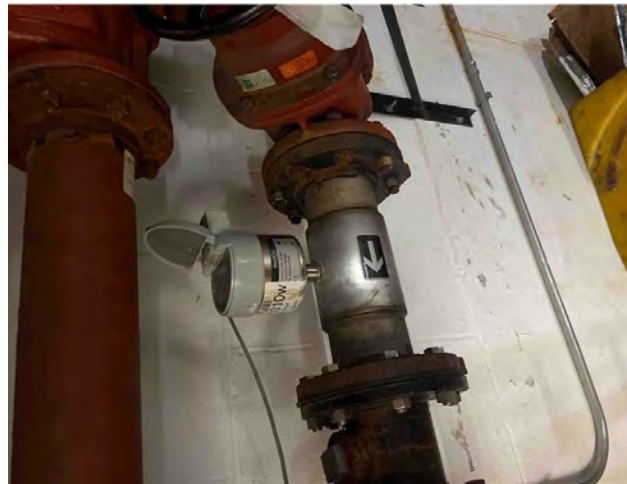


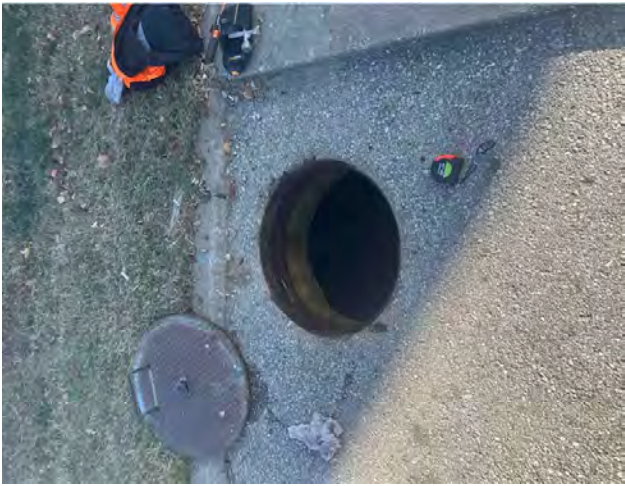








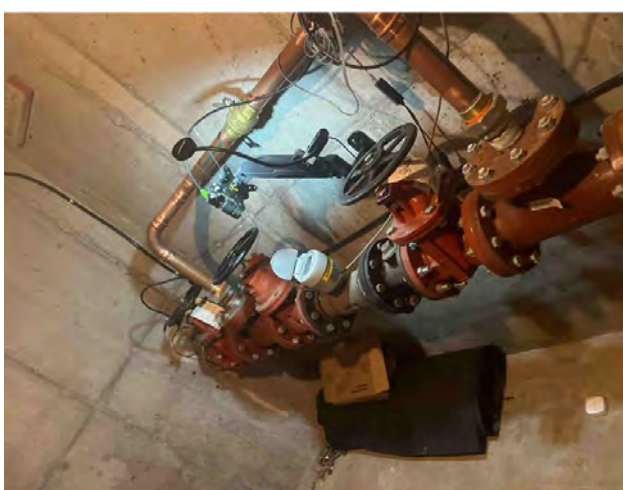


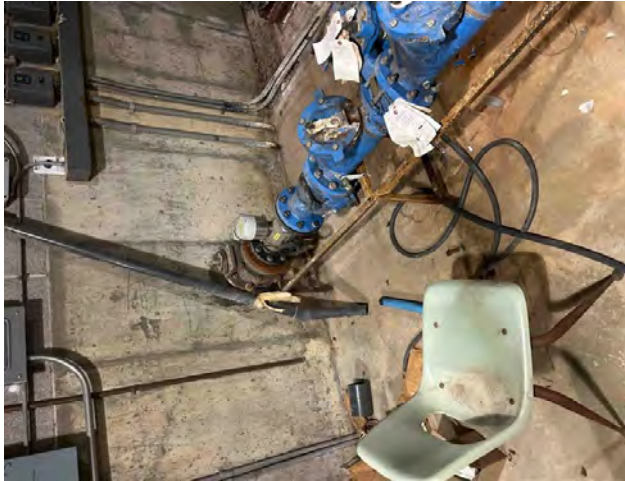


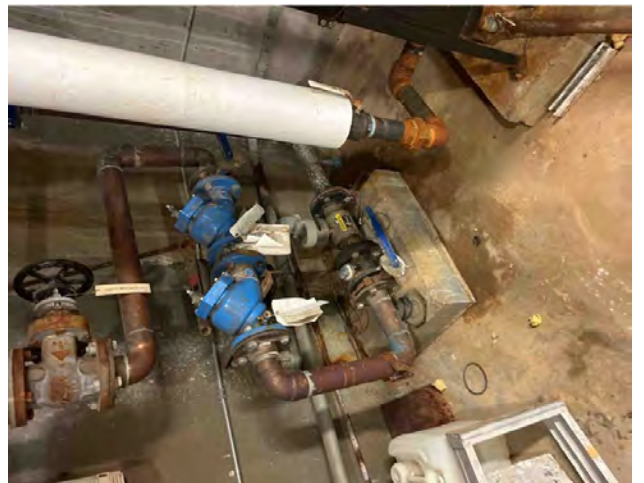




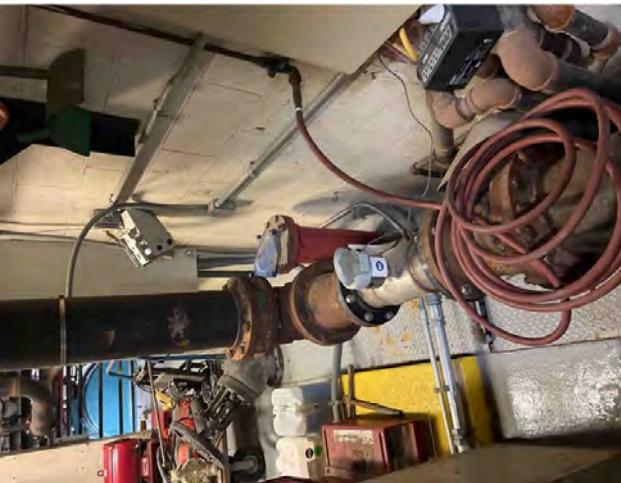










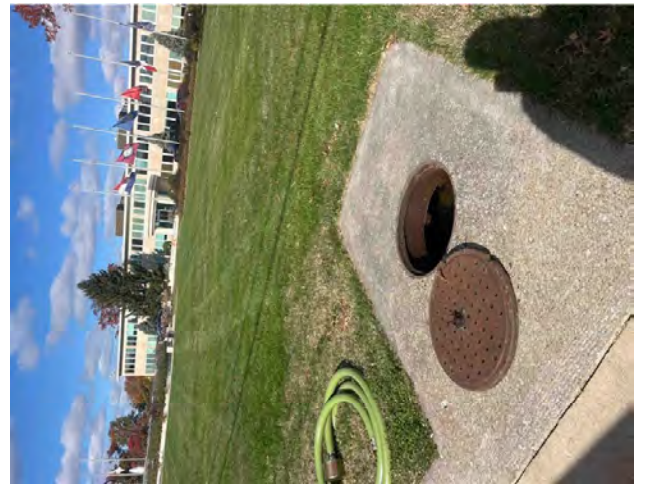






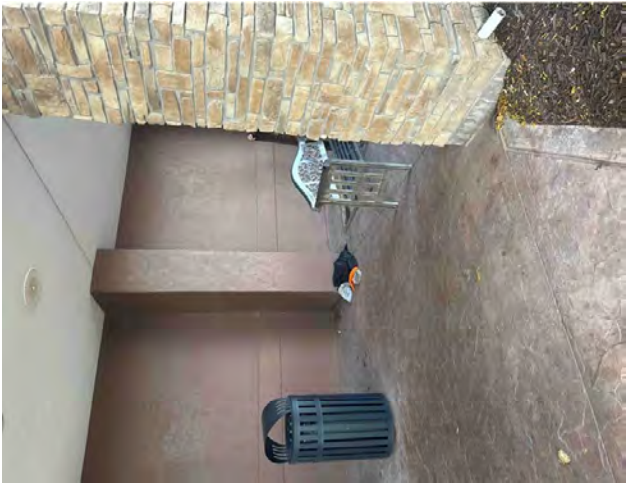
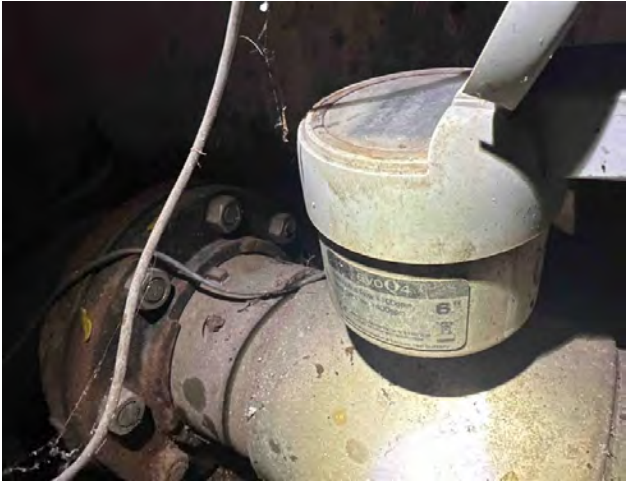










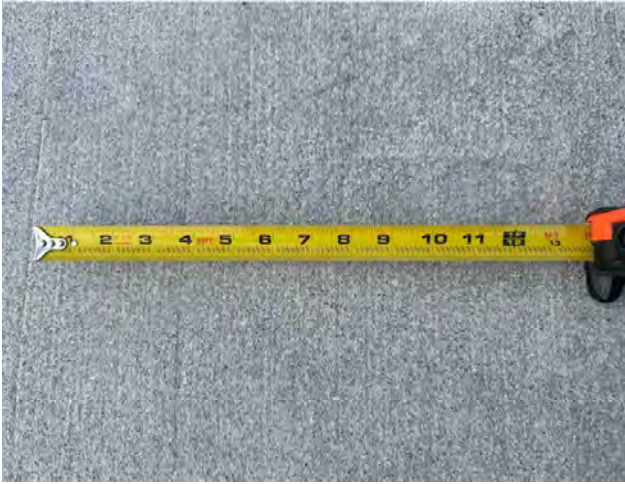


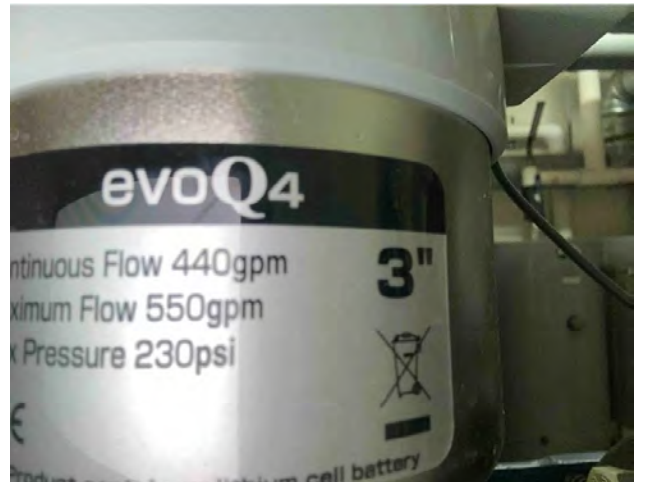
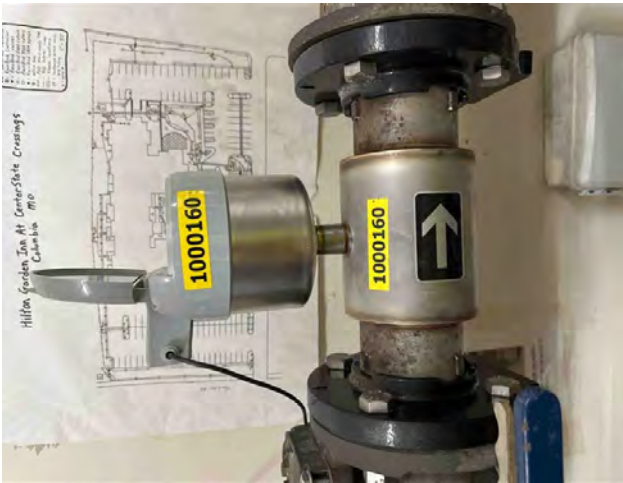


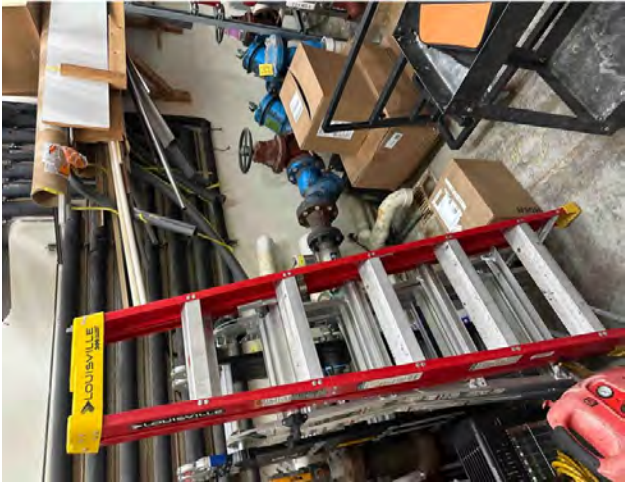




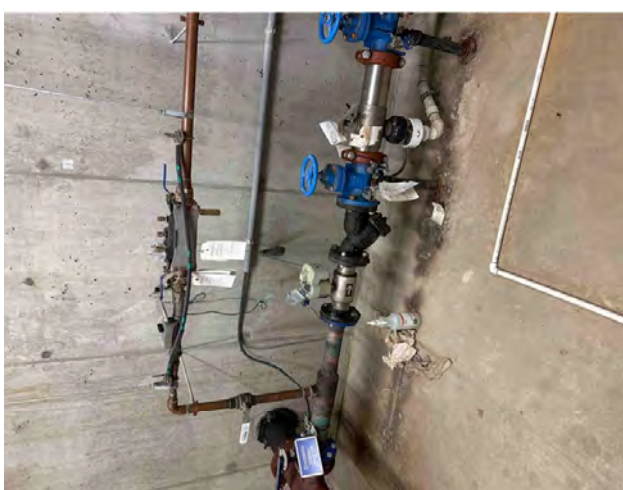








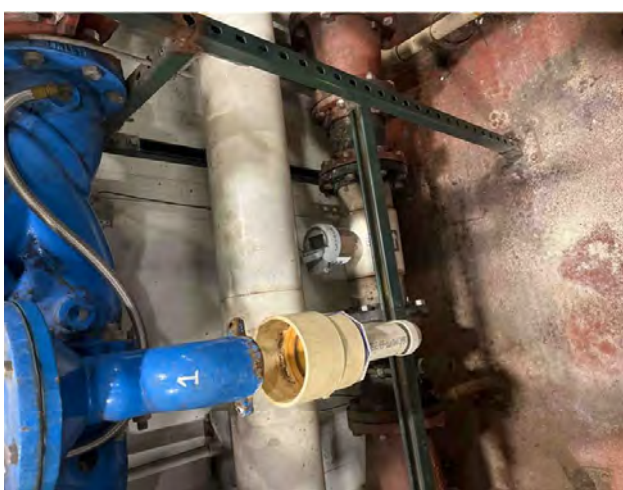


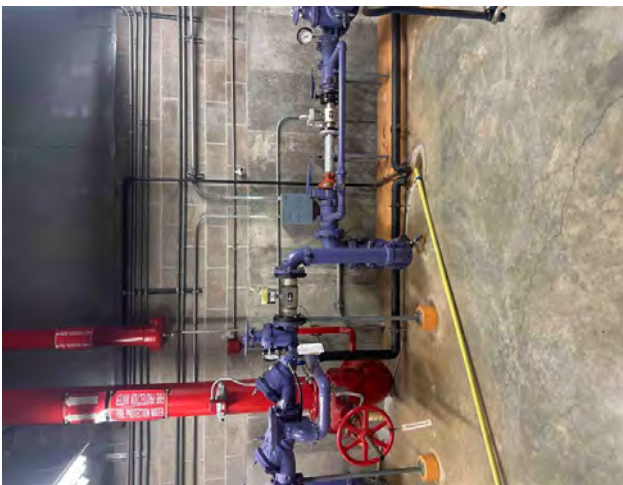






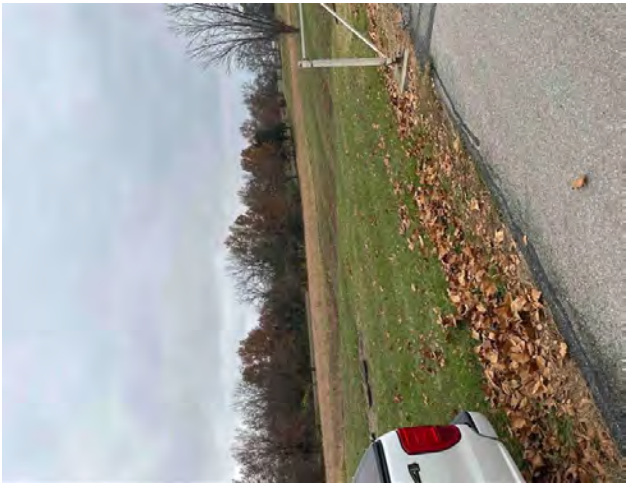




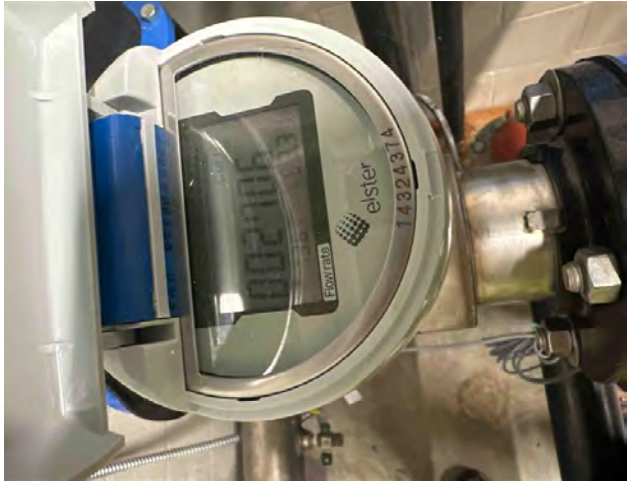
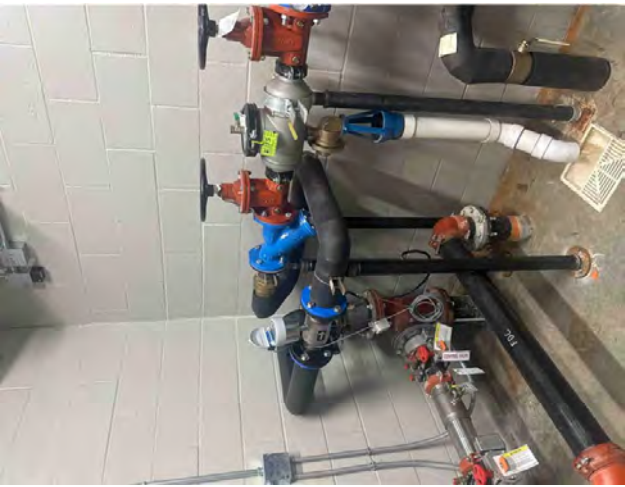


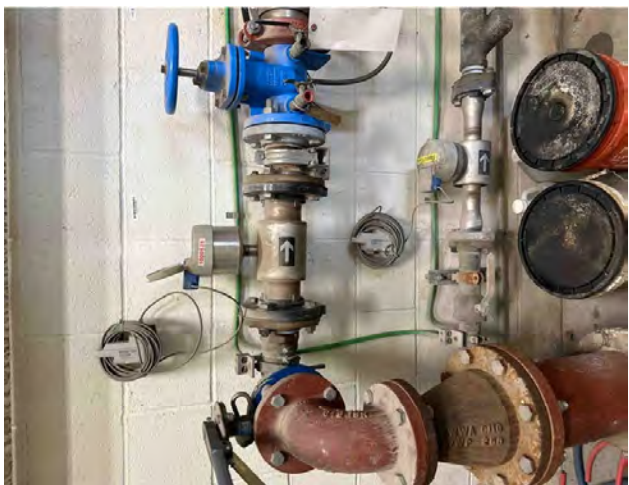
















F.6 Electric Rate Structures

Electric Rates

New electric rates approved for the FY2026 budget

The Electric Utility has implemented a 2% increase in the customer charge and cost per kWh rates. The new rates took effect Oct. 1, 2025.

Rates effective October 1, 2025

This information taken from Columbia Ordinance – [Chapter 27, Section 27-112 and 27-113](#) . The City Council has the sole authority to set rates and charges for Columbia Water & Light services. The city reviews these rates and charges annually.

Residential

This schedule is available to customers where service is supplied to a residential dwelling for single-phase service under provisions of the City’s Ordinance Section 27-112 and 27-113.

Standard customer charge: \$22.44 per month

Non-standard meter charge: \$35.72 (for customers who request a mechanical meter)

Rate

Energy Charge	Usage	Rate beginning Oct. 1, 2025
Summer	First 300 kWh	9.07 cents per kWh
	Next 450 kWh	11.11 cents per kWh
	next 1,250 kWh	13.15 cents per kWh
	All remaining kWh	15.19 cents per kWh
Non-summer	First 300 kWh	9.07 cents per kWh
	Next 450 kWh	11.11 cents per kWh
	All remaining kWh	12.24 cents per kWh

Summer months: June through September

Non-summer months: October through May

Minimum monthly bill

The minimum monthly bill/customer charge will be \$22.44 for a standard meter and \$35.72 for a non-standard meter.

In lieu of gross receipts tax payments and sales tax

In addition to the charge based on monthly rates as computed above, the total monthly charge for service shall include applicable sales taxes and an in lieu of gross receipts tax payment equal to 7.5268% of the monthly rate charge. Sales taxes shall be applied to the total of the monthly rate charge and the in lieu of gross receipts tax payment.

Power Cost Adjustment

The Power Cost Adjustment rider applies to all kWh consumption billed on this schedule. For more information, see the Power Cost Adjustment section below.

Rate discount adjustments

Electric space heating

When the customer has permanently installed a minimum of 5 kilowatts approved electric space heating equipment which is the sole source of comfort heating — decorative fireplaces excluded — for the areas to be heated, the rate per kWh for the non-summer season will be:

Usage	Rate Beginning Oct. 1, 2025
First 300 kWh	9.07 cents per kWh
Next 450 kWh	11.11 cents per kWh
All remaining kWh	10.20 cents per kWh

Residential heat pumps

Electric customers with heat pumps help Columbia Water & Light reduce summer peak demand which saves the utility money. This savings is passed on to our customers.

What is a heat pump?

A heat pump is a single appliance that can provide both your heating and cooling. During the summer, the heat pump works like a conventional air conditioner, cooling the home. In winter, the heat pump reverses its flow and heats your home by extracting heat from the outside air and pumping it to your house. Usually a heat pump is an add-on system that

improves the efficiency of your conventional gas or electric furnace. When the weather is very cold, the heat pump shuts off and your furnace takes over.

One feature in many models is a variable speed compressor that alters its power usage based on the need for heating or cooling. When needs are minimal, the compressor runs at slower speeds. Variable speed units provide better humidity control during the cooling season and are much quieter for year-round operation.

What is the heat pump rate?

Available for residential heat pump service to any customer receiving service at the same location and meeting the standards set forth for this type service. The monthly rate below would apply for the months of **October through May** to permanently installed heat pumps that are the primary source of comfort heating for the non-summer season.

Fee	rate Beginning Oct. 1, 2025
Customer Charge	\$22.44 per month*
first 300 kWh	9.07 cents per kWh
next 450 kWh	11.11 cents per kWh
all remaining kWh	9.69 cents per kWh

*for customers requesting a non-standard (mechanical) meter the customer charge is \$35.72

Are there any special eligibility requirements?

RULES and REGULATIONS

- You must be a Columbia Water & Light electric customer who applies for this rate.
- You must have a working heat pump (rated 16 SEER) installed that does not exceed 100 kilowatts.
- Your building must have a minimum of R-50 insulation in the ceiling and at least R-19 insulation in floors next to unheated areas like crawl spaces. Duct work in unheated areas must also be insulated to an R-13 level.
- Heat pumps must heat at least 50% of conditioned air space.

- The City of Columbia has the right to inspect the equipment at any time. Violations of any of the Rules and Regulations will cause the customer to be put on the regular residential electric rate.

Need help financing a new heat pump?

Columbia Water & Light offers [rebates](#) and [low-interest energy efficiency loans](#) to help our customers fund this type of energy improvement.

Special rules

Special rules and regulations specifying the equipment that qualifies for service under this rate, and the conditions of service hereunder are outlined in the Department Rules entitled “Heat Pump Rules and Regulations”

Minimum monthly bill

The minimum monthly bill/customer charge will be \$22.44 for a standard meter and \$35.72 for a non-standard meter.

In lieu of gross receipts tax payments and sales tax

In addition to the charge based on monthly rates as computed above, the total monthly charge for service shall include applicable sales taxes and an in lieu of gross receipts tax payment equal to 7.5268% of the monthly rate charge. Sales taxes shall be applied to the total of the monthly rate charge and the in lieu of gross receipts tax payment.

Power Cost Adjustment

The Power Cost Adjustment rider applies to all kWh consumption billed on this schedule. For more information, see the Power Cost Adjustment section below.

Small general electric service rate

Availability

This schedule is available to small commercial customers for services applied to single or three phase standard service voltages under the provisions of City Ordinance Section 27-114. This rate is not available to customers that exceed 25 kW demand during June, July, August, or September.

Rate

Charge	Usage	rate Beginning Oct. 1, 2025
Minimum Customer Charge (Single-phase)		\$22.44 per month
Minimum Customer Charge (Three-phase)		\$33.66 per month
Summer	first 500 kWh	9.41 cents per kWh
	next 1,000 kWh	11.45 cents per kWh
	all remaining kWh	14.00 cents per kWh
Non-summer	first 500 kWh	9.41 cents per kWh
	all remaining kWh	11.45 cents per kWh

Summer months: June through September

Non-summer months: October through May

Minimum monthly bill

Single phase service, \$22.44 per month; three phase service, \$33.66 per month.

In lieu of gross receipts tax payments and sales tax

In addition to the charge based on monthly rates as computed above, the total monthly charge for service shall include applicable sales taxes and an in lieu of gross receipts tax payment equal to 7.5268% of the monthly rate charge. Sales taxes shall be applied to the total of the monthly rate charge and the in lieu of gross receipts tax payment.

Power Cost Adjustment: The Power Cost Adjustment rider applies to all kWh consumption billed on this schedule. For more information, see the Power Cost Adjustment section below.

Rate discount adjustments

Electric space heating customers: For customers using electric heating as the sole means of comfort heating, the monthly rate per kilowatt-hour billed during non-summer season for energy shall be:

Usage	Rate Beginning Oct. 1, 2025
First 300 kWh	9.41 cents per kWh
Next 450 kWh	11.45 cents per kWh
All remaining kWh	10.64 cents per kWh

High efficiency heat pumps: For customers having permanently installed heat pump which is the primary source of comfort heating and which conforms to the special rules and regulations outlined in the Department Rules entitled “Heat Pump Rules and Regulations”, the monthly rate per kilowatt hour billed during the non-summer season for energy shall be:

Usage	Rate Beginning Oct. 1, 2025
First 300 kWh	9.41 cents per kWh
Next 450 kWh	11.45 cents per kWh
All remaining kWh	10.02 cents per kWh

Optional schedule

Availability: Small commercial customers, that do not exceed 25 KW demand during June, July, August, or September, may voluntarily be placed on a demand billing rate as follows:

Rate

Demand Charge	Summer rate	non-summer rate
Customer Charge	\$47.99	\$47.99
DEMAND CHARGE		

All kW (per kW)	\$17.83	\$14.29
ENERGY CHARGE		
All kWh (per kWh)	6.00 cents	5.50 cents

Billing demand: The maximum 30-minute KW demand measured during the billing month, but not less than 75 percent of the maximum billing demand during the billing months of June, July, August and September of the preceding 11 month billing period.

Large general electric service rate

Availability

This schedule is available to large general service customers for a period of not less than 1 year. Customers that exceed twenty-five (25) kW demand during June, July, August, or September will automatically be placed on this rate for a period of one year. Customers that exceed seven hundred fifty (750) kw demand during June, July, August, or September will automatically be removed from this rate and placed on the Industrial Service Rate for a period of one year. Reevaluation of application will be performed in October of each year.

Rate

Charge	summer	Non-summer
Monthly Customer Charge	\$66.30	\$66.30
DEMAND CHARGE		
Minimum demand charge – 25 kW or less	\$431.46	\$350.37
All additional kW (per kW)	\$17.26	\$14.01
ENERGY CHARGE		
All kWh (per kWh)	5.81 cents	5.06 cents

Billing demand

The maximum 30 minute kw demand measured during the billing month, but not less than 75% of the maximum billing demand during the billing months of June, July, August and September of the preceding 11 month billing period.

In lieu of gross receipts tax payments and sales tax

In addition to the charge based on monthly rates as computed above, the total monthly charge for service shall include applicable sales taxes and an in lieu of gross receipts tax payment equal to 7.5268% of the monthly rate charge. Sales taxes shall be applied to the total of the monthly rate charge and the in lieu of gross receipts tax payment.

Power Cost Adjustment

The Power Cost Adjustment rider applies to all kWh consumption billed on this schedule. For more information, see the Power Cost Adjustment section below.

Power factor

The customer will at all times maintain a power factor of not less than eighty-five (85) percent lagging. If the power factor is less than eighty-five (85) percent and the customer does not expeditiously take corrective action, the department can, at its option, discontinue service or can install necessary corrective equipment on its lines to improve the customer's power factor to at least eighty-five (85) percent and will charge the customer for the total installed cost for same (including material, labor and overhead costs) or can make an equal charge (on an estimated basis) as a contribution towards the cost of corrective facilities to be installed elsewhere in its system.

Load shedding program

Any large general service customer may elect to reduce electrical consumption when requested to do so by the utility during load shedding periods. Large general service customers who wish to participate in the utility's load shedding program shall inform the utility in writing no later than April 15 of each year. The application of this service will be limited to customer's whose billing demand from one (1) account is two hundred fifty (250) kw and above during the summer months of July and August and whose billing demand from multiple accounts is one thousand (1,000) kw and above during the summer months of July and August. Customers participating in this program shall not participate in the load control program. More specific terms of the load shedding program shall be defined in a separate agreement between the customer and the city.

Monthly rate: Credit for demand shedding will be computed as follows:

- Performance rate. If the electric utility requests customer to shed load, the performance rate shall be calculated at \$3.00 per month for each kw shed on average for the load shedding periods during the months of June through September. Customers shall receive a monthly credit based upon the performance rate beginning in October. The performance rate shall be applied to each month's bill for a period of one year.
- If there is no load shedding event in a given year, the credit shall be reduced to 50% of the performance rate and shall remain at that level until the customer sheds demand as part of this program in any subsequent year or until the customer's participation in the program ends, whichever occurs first. If the performance rate cannot be determined, the credit shall be \$75.00 each month for a customer with one account in the load shedding program and shall be a total of \$150.00 each month for a customer with more than one account in the load shedding program. If a customer with more than one account is participating in this program, the agreement shall specify which account is to receive the credit.

Metering: The utility will install all recording demand meters to measure the customer's energy load during the periods the utility requests the customer to reduce the load. The utility shall pay for the first meter installed. Customer shall be responsible for all costs associated with all other recording demand meters installed by the utility for the customer's participation in the program. Customer, at customer's expense, shall also be responsible for installing and maintaining a telephone line connection to each meter for use by the utility.

Demand reduction: The customer shall receive a credit on the customer's monthly bill beginning in October of each year based on the customer demand shedding performance (not to exceed fifty (50) percent of customer's load prior to shedding, as defined in the agreement).

A customer participating in the load shedding program shall remain in the program for an initial period of one (1) year.

Energy storage rider

1. Available: The energy storage rider is available to any customer receiving electric service under the large general service rate that has installed energy storage facilities approved by the utility as being capable of sustaining at least fifty (50) kw in equivalent energy capacity for continued load reduction for a minimum of four (4) hours.

2. Energy charge: Energy supplied for the period beginning 12:00 midnight and ending at 6:00 a.m. shall be charged at the rate of 4.592 cents per kwh during the summer months and 4.00 cents per kwh during the non-summer months. Energy charged at this rate will be subject to the fuel adjustment allowance in [section 27-118](#).
3. Demand charge: For a period of twenty (20) hours each day the monthly measured demand will be excluded for the purpose of the billing of demand as set forth in subsection (f) while under this rider. The measured demand period will exclude Saturday and Sunday of each week. The four-hour measured demand period will be a continuous four-hour period between the hours of 2:00 p.m. and 8:00 p.m. The demand charge periods, shall be set forth in a written agreement between the utility and the customer as set forth in subsection (7) hereof.
4. Billing demand: The maximum thirty-minute kw demand measured during the billing month, but not less than seventy-five (75) percent of the maximum billing demand during the billing months of June, July, August and September of the preceding eleven (11) months. If there has been a significant change in operation from the previous year, the director may reduce a customer's ratchet amount to fifty (50) percent until a new maximum billing demand is set during the forthcoming June, July, August and September.
5. Metering: The utility will install all recording demand and energy meters necessary to measure the demand period. The customer shall pay the cost of any meter(s) required to be installed to measure the demand for the energy storage rider. The payment of such cost shall be non-refundable once the meter is installed.
6. Load shedding program: The load shedding program does not apply to the energy storage rider.
7. Contract: Customers wishing to receive service on the energy storage rider must first enter into an agreement with the city that includes provisions concerning: emergency use of the system; a description of the energy storage system; listed hours in which demand charges are excluded; and length of the term of the contract.
8. In lieu of gross receipts tax payments and sales tax: In addition to the charge based on the rates set forth in this subsection, the total monthly charge for service shall include applicable sales taxes and an in lieu of gross receipts tax payment equal to 7.5268 percent of the monthly rate charge. Sales taxes shall be applied to the total of the monthly rate charge and the in lieu of gross receipts tax payment.

Interruptible service rate

1. Available: Customers receiving service on the large general service rate or the industrial service rate and having at 500 kw of load that is interruptible are eligible to place a contracted firm demand on the interruptible service rate. Interruptible loads are specific areas of a customer's service that can be identified and metered and can be entirely removed from service during periods requested by the utility. Arrangements for interruptible service require a signed agreement between the customer and the city. The rate is not available for temporary, standby, breakdown, supplementary or resale service.
2. Application: The interruptible service rate shall apply to identifiable load where the service is supplied at one point of delivery and measured through one meter. At the time of interruption the meter reading for that period should register zero. If the customer is unable to interrupt the total load at the utility's request, a charge of \$36.40 per kilowatt will be charged on the kilowatt load registered on the meter during that period. If the customer continues to violate the terms of the interruptible agreement, the customer will be removed from the interruptible rate and put on a rate based on the customer's loads during the previous summer period. The customer will not be allowed to reapply for the interruptible rate for one year. Customers with auxiliary power connected to the interruptible load will be allowed up to one percent of the interruptible kilowatt load on the meter before the charge for the auxiliary load will be billed at thirty-six dollars and forty cents (\$36.40) per kilowatt on a monthly basis during the interruptible period.
3. Monthly rate charge: The monthly rate per kilowatt hour shall be as follows, subject to fuel adjustments as provided in [section 27-118](#):

	summer	non-Summer
Customer charge (per month)	\$66.30	\$66.30
Demand charge (per kilowatt)	\$11.11	\$9.02
Energy charge (per kilowatt hour)	\$0.0464	\$0.0432

Industrial electric service rate

Availability

All large commercial customers that exceed seven hundred fifty (750) kW demand during June, July, August, or September will automatically be placed on the Industrial Service Rate. Not available for temporary, standby, breakdown, supplementary, or resale service.

Rate

Charge	summer	Non-summer
Monthly Customer Charge	\$204.00	\$204.00
DEMAND CHARGE		
First 750 kW or less billing demand	\$18,841.95	\$14,634.45
All additional kW	\$25.12	\$19.51
ENERGY CHARGE		
All kWh	5.19 cents	4.44 cents

Billing demand

The maximum 30 minute kW demand measured during the billing month, but not less than 75% of the maximum billing demand during the billing months of June, July, August and September of the preceding 11 month billing period.

In lieu of gross receipts tax and sales tax

In addition to the charge based on monthly rates as computed above, the total monthly charge for service shall include applicable sales taxes and an in lieu of gross receipts tax payment equal to 7.5268% of the monthly rate charge. Sales taxes shall be applied to the total of the monthly rate charge and the in lieu of gross receipts tax payment.

Power Cost Adjustment: The Power Cost Adjustment rider applies to all kWh consumption billed on this schedule. For more information, see the Power Cost Adjustment section below.

Primary service

When the customer owns and maintains all equipment, except metering equipment, necessary to take service at 13,800 volts or higher, total rate charges will be reduced by ten cents (\$0.10) times the highest thirty-minute kW demand during the billing cycle.

Primary metering

If, at the option of the department, service is metered at primary voltage, the measured demand and kwh will each be decreased by 2%.

Power factor

The customer will at all times maintain a power factor of not less than 90% lagging. If power factor is less than 90%, the measured kW demand will be multiplied by the ratio of 90% divided by the actual power factor to determine the adjusted measured demand to be used for determination of billing demand. Columbia Water & Light may, at its option, use for adjustment the power factor determined: 1.) By test during periods of maximum demand; or 2.) By measurement of the average monthly power factor.

Load shedding program

Any large general service customer may elect to reduce electrical consumption when requested to do so by the utility during load shedding periods. Large general service customers who wish to participate in the utility's load shedding program shall inform the utility in writing no later than April 15 of each year. The application of this service will be limited to customer's whose billing demand from one account is 750 kw and above during the summer months of July and August and whose billing demand from multiple accounts is one thousand (1,000) kw and above during the summer months of July and August. More specific terms of the load shedding program shall be defined in a separate agreement between the customer and the city.

Monthly rate: Credit for demand shedding will be computed as follows:

- Performance rate. If the electric utility requests customer to shed load, the performance rate shall be calculated at \$3.00 per month for each kW shed on average for the load shedding periods during the months of June through September. If there is no load shedding event in a given year, the credit shall be reduced to 50% of the performance rate and shall remain at that level until the customer sheds demand as part of this program in any subsequent year or until the customer's participation in the program ends, whichever occurs first.

Metering: The utility will install all recording demand meters to measure the customer's energy load during the periods the utility requests the customer to reduce the load. The utility shall pay for the first meter installed. Customer shall be responsible for all costs

associated with all other recording demand meters installed by the utility for the customer's participation in the program. Customer, at customer's expense, shall also be responsible for installing and maintaining a connection to each meter for use by the utility.

A customer participating in the load shedding program shall remain in the program for an initial period of one year.

Energy storage rider

1. Available: The energy storage rider is available to any customer receiving electric service under the industrial service rate that has installed energy storage facilities approved by the utility as being capable of sustaining at least five hundred (500) kw in equivalent energy capacity for continued load reduction for a minimum of four (4) hours.
2. Energy charge: Energy supplied for the period beginning 12:00 midnight and ending at 6:00 a.m. shall be charged at the rate of 3.76 cents per kwh during the summer months and 3.37 cents per kwh during the non-summer months. Energy charged at this rate will be subject to the fuel adjustment allowance in [section 27-118](#).
3. Demand charge: As set forth in separate agreement between the utility and customer, for a period of twenty (20) hours each day the monthly measured demand will be excluded for the purpose of the billing of demand as set forth in subsection (f) while under this rider. Measured demand period will exclude Saturday and Sunday of each week.
4. Billing demand: The maximum thirty-minute kw demand measured during the billing month, but not less than seventy-five (75) percent of the maximum billing demand during the billing months of June, July, August and September of the preceding eleven (11) months. If there has been a significant change in operation from the previous year, the director may reduce a customer's ratchet amount to fifty (50) percent until a new maximum billing demand is set during the forthcoming June, July, August and September.
5. Metering: The utility will install all recording demand meters necessary to measure the demand period. The customer shall pay a non-refundable fee to cover the actual costs for the metering required for the energy storage rider.
6. Load shedding program: The load shedding program does not apply to the energy storage rider.
7. Contract: Customers wishing to receive service on the energy storage rider must first enter into an agreement with the city that includes provisions concerning:

emergency use of the system; a description of the energy storage system; listed hours in which demand charges are excluded; and length of the term of the contract.

8. In lieu of gross receipts tax payments and sales tax: In addition to the charge based on the rates set forth in this subsection, the total monthly charge for service shall include applicable sales taxes and an in lieu of gross receipts tax payment equal to 7.5268 percent of the monthly rate charge. Sales taxes shall be applied to the total of the monthly rate charge and the in lieu of gross receipts tax payment.

Off-peak discount

1. Available: The off-peak discount is available to any customer receiving electric service under the industrial service rate that has a load factor at or in excess of seventy-five (75) percent of their summer peak load. The load factor will be calculated using the customer's highest one-half hour kw demand that is coincident with the annual system peak of the electric utility. Qualifying customers must notify the water and light department, in writing, that the customer wants to receive the off-peak discount.
2. Energy charge: Energy supplied for the period beginning 12:00 midnight and ending at 6 a.m. shall be charged at the rate of 3.99 cents per kwh during the summer months and 3.45 cents per kwh during the non-summer months. Energy charged at this rate will be subject to the fuel adjustment allowance in [section 27-118](#).
3. Demand charge: During the hours beginning 10 p.m. and ending the following 9 a.m., the monthly measured demand will be excluded for the purpose of the billing of demand as set forth in subsection (f) while under this rider.
4. Metering: The customer will provide the city a dedicated private phone line for the installation and operation of remote reading/recording demand and energy meter to measure the time of day readings necessary for monitoring loads and billing.
5. Load shedding program: Customers receiving the off-peak discount are not eligible for the demand discount outlined in subsection (j).
6. In lieu of gross receipts tax payments and sales tax: In addition to the charge based on the rates set forth in this subsection, the total monthly charge for service shall include applicable sales taxes and an in lieu of gross receipts tax payment equal to 7.5268 % of the monthly rate charge. Sales taxes shall be applied to the total of the monthly rate charge and the in lieu of gross receipts tax payment.

Interruptible service rate

1. Available: Customers receiving service on the large general service rate or the industrial service rate and having at least 500 kw of load that is interruptible are eligible to place a contracted firm demand on the interruptible service rate. Interruptible loads are specific areas of a customer's service that can be identified and metered and can be entirely removed from service during periods requested by the utility. Arrangements for interruptible service require a signed agreement between the customer and the city. The rate is not available for temporary, standby, breakdown, supplementary or resale service.
2. Application: The interruptible service rate shall apply to identifiable load where the service is supplied at one point of delivery and measured through one meter. At the time of interruption the meter reading for that period should register zero. If the customer is unable to interrupt the total load at the utility's request, a charge of \$36.40 per kilowatt will be charged on the kilowatt load registered on the meter during that period. If the customer continues to violate the terms of the interruptible agreement, the customer will be removed from the interruptible rate and put on a rate based on the customer's loads during the previous summer period. The customer will not be allowed to reapply for the interruptible rate for one year. Customers with auxiliary power connected to the interruptible load will be allowed up to one percent of the interruptible kilowatt load on the meter before the charge for the auxiliary load will be billed at \$36.40 per kilowatt on a monthly basis during the interruptible period.
3. Monthly rate charge: The monthly rate per kilowatt hour shall be as follows, subject to fuel adjustments as provided in [section 27-118](#):

	summer	non-Summer
Customer charge (per month)	\$66.30	\$66.30
Demand charge (per kilowatt)	\$10.28	\$8.23
Energy charge (per kilowatt hour)	\$0.04784	\$0.04468

Special outdoor lighting

Availability

This schedule is available for electrical service to sport field lighting, carnival, circus or holiday decorative lighting or similar temporary or seasonal use under provisions of the City's Ordinance Section 27-121.

Type of service

The type of service shall be single or three phase, sixty-hertz, at one of the department's standard service voltages.

Rate

Charges:

Customer Charge – \$57.22 per month

All kWh – 13.64 cents per kWh

Minimum monthly bill

Single or Three Phase Service shall be \$57.22

In lieu of gross receipts tax payments and sales tax

In addition to the charge based on monthly rates as computed above, the total monthly charge for service shall include applicable sales taxes and an in lieu of gross receipts tax payment equal to 7.5268% of the monthly rate charge. Sales taxes shall be applied to the total of the monthly rate charge and the in lieu of gross receipts tax payment.

Power Cost Adjustment

The Power Cost Adjustment rider applies to all kWh consumption billed on this schedule. For more information, see the Power Cost Adjustment section below.

Primary service

When the customer owns and maintains all equipment, except metering equipment, necessary to take service at thirteen thousand eight hundred (13,800) volts or higher:

- 5% reduction in total rate charges if service is metered at primary voltage;
- 3% reduction in total rate charges if service is metered at secondary voltage.

Rules & regulations

Service will be furnished under, and this schedule shall be subject to, the City of Columbia's Ordinance.

Power Cost Adjustment

The City of Columbia has adopted a Power Cost Adjustment (PCA) beginning Oct. 1, 2023. The PCA accommodates monthly fluctuations in power costs by making adjustments that reflect the true cost of power each month.

The [Power Cost Adjustment Procedureopens PDF file](#) is used to calculate the monthly PCA that is applied to each kilowatt-hour (kWh) of energy sold by the electric utility.

Under the Electric section on the back of their bill, customers will find a line item designated PCA-Residential or PCA-Commercial. This line displays the PCA rate for the month along with the customer's net kilowatt hour usage. A negative number indicates a credit on the customer's bill.

- [Frequently Asked Questions](#)

Power Cost Adjustment Factor History

Negative numbers, indicating a credit on the customers' bills, appear (in red and parentheses).

mONTH	2023	2024	2025	2026	2027
jANUARY	—	\$0.002623	\$0.013134	\$0.013605	
fEBRUARY	—	\$0.004511	\$0.013335	\$0.013605	
mARCH	—	\$0.009275	\$0.013335	\$0.013605	
aPRIL	—	\$0.005246	\$0.013335	\$0.013605	
mAY	—	\$0.012794	\$0.013335		
jUNE	—	\$0.013335	\$0.013335		
jULY	—	\$0.013335	\$0.013335		
aUGUST	—	\$0.010778	\$0.013335		
SEPTEMBER	—	\$0.013335	\$0.013335		

OCTOBER	(\$0.000267)	\$0.008649	\$0.013605		
NOVEMBER	(\$0.000003)	\$0.011131	\$0.013605		
DECEMBER	\$0.001886	\$0.012423	\$0.013605		

F.7 Water and Sewer Rate Structures

Sewer Rates - City Website

Wednesday, August 6, 2025 2:53 PM

Sewer Rates

Rates Effective September 17, 2018

This information taken from Columbia Ordinance – Chapter 22, [Section 22-263](#). The City Council has the sole authority to set rates and charges for utility services. The City reviews these rates and charges annually.

Volume Charge

- \$ 2.55* volume charge per ccf (ccf = 100 cubic feet) for both Residential and Non-Residential customers

One base charge shall be charged per user for each meter and based on the size of the meter as follows:

Water Meter Size (inches)	Meter Capacity	Capacity Difference	Base Charge by Meter Capacity
5/8	20	1	\$12.37*
3/4	30	1.5	\$18.57*
1	50	2.5	\$30.95*
1 1/2	100	5	\$61.88*
2	160	8	\$99.01*
3	320	16	\$198.03*
4	500	25	\$309.41*
6	1,000	50	\$618.84*
8	1,600	80	\$990.13*
10	2,300	115	\$1423.31*
12	4,300	215	\$2660.99*

*Customers outside the City Limits are charged 1.5 times the base rate and the volume charge.

For questions about your sewer utility bill, please contact Utility Customer Service at 573.874.7380.

From <<https://www.como.gov/utilities/utility-rates/#tab3>>

Water Rates - 2025

Wednesday, August 6, 2025 2:35 PM

Water Rate Study Video:

https://gocolumbiamo.granicus.com/player/clip/3747?view_id=13&redirect=true

Water Rates Inside City Limits

New water rate structure proposed for the FY2026 budget

As part of the City of Columbia Fiscal Year 2026 budget, the Water Utility is proposing a new water rate structure that will increase revenue 12%. However, the City of Columbia expects water bills to decrease for residential customers who have consistent water usage throughout the year.

For additional information on water rates, please visit the Proposed [Water Rates for 2026](#) page.

How will my water rate be affected by this change?

Columbia residents can get an estimate as to how the proposed rate structure would affect them. Use the calculator below to see how your rates will be affected. For information on how to use the tool, please see the [Water User Calculator Manual](#) opens PDF file.

The City's utility billing portal ([MyUtilityBill.CoMo.gov](#)) includes an interactive dashboard that allows customers to track their historic water usage.

- [Water Bill Calculator](#)

Rates effective October 1, 2024

This information taken from Columbia [Ordinance Chapter 27, Section 27-122 and Section 27-16](#) opens PDF file. The City Council has the sole authority to set rates and charges for Columbia Water & Light services. The City reviews these rates and charges annually.

Residential

Residential

This schedule is available for water to residential customers, commercial multiple-family facilities and multiple commercial facilities served with one meter, inside the city limits.

Water usage charges are in addition to minimum monthly base and fire flow charges, which are based on meter size. Water usage is measured in hundred cubic feet (ccf). There are approximately 748 gallons per 1 ccf.

Water usage charges

	Current Charge (per cCF)	Proposed charge (per CCF)
Tier 1	\$3.22	\$2.30
Tier 2	\$4.44	\$6.33
Tier 3	\$6.89	\$10.20

Tiers are based on the customer's winter average consumption (WAC). Winter average consumption is the average water use during January, February and March and is updated annually.

In the current structure, tiered rates are calculated June through September. All usage October through May is charged at the Tier 1 rate.

- Tier 1, 0% – 70% of winter average consumption
- Tier 2, 71% – 170% of winter average consumption

- Tier 3, usage exceeding 170% of winter average consumption

In the proposed structure, tiers would be applied year-round and the percentages for each tier's calculation would be increased.

- Tier 1, 0% – 100% of winter average consumption
- Tier 2, 100% – 200% of winter average consumption
- Tier 3, usage exceeding 200% of winter average consumption

Exceptions

For water service metered separately for lawn irrigation, \$6.89 per ccf will be assessed on all water consumption occurring during the period from June 1 through September 30 as defined in section 27-16.

In the proposed rate structure, water service metered separately for lawn irrigation would be assessed \$10.20 per ccf on all water consumption.

Monthly base charges

Base charges are fixed monthly rates based on the customer's meter size. Base charges cover the utility's cost of connecting the water infrastructure to a customer. The City also has a fire flow charge to cover the cost of providing water for fire protection. The fire flow charge does not apply to lawn irrigation meters.

Meter Size	Current Base Charges	Proposed Base charges
5/8 inch and 3/4 inch	\$14.07	\$14.32
1 inch	\$21.84	\$27.46
1 1/2 inch	\$42.96	\$51.39
2 inch	\$64.04	\$106.27
3 inch	\$196.30	\$194.17
4 inch	\$408.20	\$363.79
6 inch	\$869.71	\$642.05

Backflow prevention charge

In addition to the charges listed above, there is a charge of **\$2.00** for each backflow device at a customer location as outlined in Section 27-57 Cross Connections.

Taxes

Bills computed under this rate schedule are subject to increase by a proportionate part of any existing, new, or increased rate of gross receipts tax or other similar tax levied by a municipality or other governmental authority.

Commercial

Commercial

This schedule is available for water to Commercial customers inside the city limits who use **500 ccf or less** per month average during non-summer months (October through May).

Water usage charges are in addition to minimum monthly base and fire flow charges, which are based on meter size. Water usage is measured in hundred cubic feet (ccf). There are approximately 748 gallons per 1 ccf.

Water usage charges

	Current Charge (per cCF)	Proposed charge (per CCF)
Tier 1	\$3.22	\$2.30

Tier 2	\$4.44	\$6.33
Tier 3	\$6.89	\$10.20

Tiers are based on the customer's winter average consumption (WAC). Winter average consumption is the average water use during January, February and March and is updated annually.

In the current structure, tiered rates are calculated June through September. All usage October through May is charged at the Tier 1 rate.

- Tier 1, 0% – 70% of winter average consumption
- Tier 2, 71% – 170% of winter average consumption
- Tier 3, usage exceeding 170% of winter average consumption

In the proposed structure, tiers would be applied year-round and the percentages for each tier's calculation would be increased.

- Tier 1, 0% – 100% of winter average consumption
- Tier 2, 100% – 200% of winter average consumption
- Tier 3, usage exceeding 200% of winter average consumption

Exceptions

For water service metered separately for lawn irrigation, \$6.89 per ccf will be assessed on all water consumption occurring during the period from June 1 through September 30 as defined in section 27-16.

In the proposed rate structure, water service metered separately for lawn irrigation would be assessed \$10.20 per ccf on all water consumption.

Monthly base charges

Base charges are fixed monthly rates based on the customer's meter size. Base charges cover the utility's cost of connecting the water infrastructure to a customer. The City also has a fire flow charge to cover the cost of providing water for fire protection. The fire flow charge does not apply to lawn irrigation meters.

The size of the water meter and the customer's water usage are on Page 1 of the Utilities bill.

Meter Size	Current Base Charges	Proposed Base charges
5/8 inch and 3/4 inch	\$14.07	\$14.32
1 inch	\$21.84	\$27.46
1 1/2 inch	\$42.96	\$51.39
2 inch	\$64.04	\$106.27
3 inch	\$196.30	\$194.17
4 inch	\$408.20	\$363.79
6 inch	\$869.71	\$642.05

Backflow prevention charge

In addition to the charges listed above, each backflow prevention device at a customer location will be charged **\$2.00** as outlined in Section 27-57 Cross Connections.

Taxes

Bills computed under this rate schedule are subject to increase by a proportionate part of any existing, new, or increased rate of gross receipts tax or other similar tax levied by a municipality or other governmental authority.

Large commercial

Large commercial

This schedule is available for water to Commercial customers inside the city limits who use **more than 500 ccf** per month average during non-summer months (October through May).

Water usage charges are in addition to minimum monthly base and fire flow charges, which are based on meter size. Water usage is measured in hundred cubic feet (ccf). There are approximately 748 gallons per 1 ccf.

Water usage charges

	Current Charge (per cCF)	Proposed charge (per CCF)
Tier 1	\$3.22	\$2.30
Tier 2	\$4.44	\$6.33
Tier 3	\$6.89	\$10.20

Tiers are based on the customer's winter average consumption (WAC). Winter average consumption is the average water use during January, February and March and is updated annually.

In the current structure, tiered rates are calculated June through September. All usage October through May is charged at the Tier 1 rate.

- Tier 1, 0% – 70% of winter average consumption
- Tier 2, 71% – 170% of winter average consumption
- Tier 3, usage exceeding 170% of winter average consumption

In the proposed structure, tiers would be applied year-round and the percentages for each tier's calculation would be increased.

- Tier 1, 0% – 100% of winter average consumption
- Tier 2, 100% – 200% of winter average consumption
- Tier 3, usage exceeding 200% of winter average consumption

Exceptions

For water service metered separately for lawn irrigation, \$6.89 per ccf will be assessed on all water consumption occurring during the period from June 1 through September 30 as defined in section 27-16.

In the proposed rate structure, water service metered separately for lawn irrigation would be assessed \$10.20 per ccf on all water consumption.

Monthly base charges

Base charges are fixed monthly rates based on the customer's meter size. Base charges cover the utility's cost of connecting the water infrastructure to a customer. The City also has a fire flow charge to cover the cost of providing water for fire protection. The fire flow charge does not apply to lawn irrigation meters.

The size of the water meter and the customer's water usage are on Page 1 of the Utilities bill.

Meter Size	Current Base Charges	Proposed Base charges
5/8 inch and 3/4 inch	\$14.07	\$14.32
1 inch	\$21.84	\$27.46
1 1/2 inch	\$42.96	\$51.39
2 inch	\$64.04	\$106.27
3 inch	\$196.30	\$194.17
4 inch	\$408.20	\$363.79
6 inch	\$869.71	\$642.05

Backflow prevention charge

In addition to the charges listed above, each backflow prevention device at a customer location will be charged **\$2.00** as outlined in Section 27-57 Cross Connections.

Taxes

Bills computed under this rate schedule are subject to increase by a proportionate part of any existing, new, or increased rate of gross receipts tax or other similar tax levied by a municipality or other governmental authority.

Water Rates Outside City limits

Rates effective October 1, 2024

This information taken from Columbia [Ordinance Chapter 27, Section 27-122 and Section 27-16](#)[opens PDF file](#). The City Council has the sole authority to set rates and charges for Columbia Water & Light services. The City reviews these rates and charges annually.

Residential

Residential

This schedule is available for water to residential customers, commercial multiple-family facilities and multiple commercial facilities served with one meter, outside the city limits.

Water usage charges are in addition to a minimum monthly charge, which is based on meter size. Water usage is measured in hundred cubic feet (ccf). There are approximately 748 gallons per 1 ccf.

	Current Charge (per cCF)	Proposed charge (per CCF)
Tier 1	\$4.283	\$3.06
Tier 2	\$5.905	\$8.42
Tier 3	\$9.164	\$13.57

Tiers are based on the customer's winter average consumption (WAC). Winter average consumption is the average water use during January, February and March and is updated annually.

In the current structure, tiered rates are calculated June through September. All usage October through May is charged at the Tier 1 rate.

- Tier 1, 0% – 70% of winter average consumption
- Tier 2, 71% – 170% of winter average consumption
- Tier 3, usage exceeding 170% of winter average consumption

In the proposed structure, tiers would be applied year-round and the percentages for each tier's calculation would be increased.

- Tier 1, 0% – 100% of winter average consumption
- Tier 2, 100% – 200% of winter average consumption
- Tier 3, usage exceeding 200% of winter average consumption

Exceptions

For water service metered separately for lawn irrigation, \$9.164 per ccf will be assessed on all water consumption occurring during the period from June 1 through September 30.

In the proposed rate structure, water service metered separately for lawn irrigation would be assessed \$13.57 per ccf on all water consumption.

Non-summer months: October through May

- All water usage @ \$4.283 per ccf

Monthly base charges

Base charges are fixed monthly rates based on the customer's meter size. Base charges cover the

utility's cost of connecting the water infrastructure to a customer. The City also has a fire flow charge to cover the cost of providing water for fire protection. The fire flow charge does not apply to lawn irrigation meters.

Meter Size	Monthly Base Charge
5/8 inch and 3/4 inch	\$16.60
1 inch	\$26.80
1 1/2 inch	\$53.89
2 inch	\$81.68
3 inch	\$252.69
4 inch	\$529.94
6 inch	\$1,130.77

Fire flow charge

The fire flow charge is an additional charge to cover the cost of providing water for public fire protection. The charge is based on meter size.

meter size	fire flow charge
5/8 inch and 3/4 inch	\$2.11
1 inch	\$2.25
1 1/2 inch	\$3.25
2 inch	\$3.50
3 inch	\$8.40
4 inch	\$12.97
6 inch	\$25.95

Backflow prevention charge

In addition to the charges listed above, each backflow prevention device at a customer location will be charged **\$2.66** as outlined in Section 27-57 Cross Connections.

Taxes

Bills computed under this rate schedule are subject to increase by a proportionate part of any existing, new, or increased rate of gross receipts tax or other similar tax levied by a municipality or other governmental authority.

Commercial

Commercial

This schedule is available for water to Commercial customers **outside the city limits** who use **500 ccf or less** per month average during non-summer months (October through May).

Water Usage Rate is in addition to monthly base charges. Water usage is measured in hundred cubic feet (ccf). There are approximately 748 gallons per 1 ccf.

Water Usage

Summer

- Tier 1, 0% – 70% of winter average consumption: \$4.283 per ccf
- Tier 2, 71% – 170% of winter average consumption: \$5.905 per ccf
- Tier 3, usage exceeding 170% of winter average consumption: \$9.164 per ccf

Exception

Winter average consumption is the average water use during the immediate preceding billing periods of January, February and March.

For water service metered separately for lawn irrigation, \$8.326 per ccf will be assessed on all water consumption occurring during the period from June 1 through September 30.

Beginning Oct. 1, 2024, the lawn irrigation rate will be \$9.164 per ccf.

Non-summer

- All water usage @ \$4.283 per ccf

Monthly Base Charge

Meter Size	Monthly Base Charge
5/8 inch and 3/4 inch	\$16.60
1 inch	\$26.80
1 1/2 inch	\$53.89
2 inch	\$81.68
3 inch	\$252.69
4 inch	\$529.94
6 inch	\$1,130.77

Fire Flow Charge

The fire flow charge is an additional charge to cover the cost of providing water for public fire protection. The charge is based on meter size.

meter size	fire flow charge
5/8 inch and 3/4 inch	\$2.11
1 inch	\$2.25
1 1/2 inch	\$3.25
2 inch	\$3.50
3 inch	\$8.40
4 inch	\$12.97
6 inch	\$25.95

Backflow Prevention Charge

In addition to the charges listed above, each backflow prevention device at a customer location will be charged **\$2.66** as outlined in Section 27-57 Cross Connections..

Taxes

Bills computed under this rate schedule are subject to increase by a proportionate part of any existing, new, or increased rate of gross receipts tax or other similar tax levied by a municipality or other governmental authority.

Large commercial

Large commercial

This schedule is available for water to Large Commercial customers **outside the city limits** who use **more than 500 ccf** per month average during non-summer months (October through May).

Water Usage Rate is in addition to monthly base charge. Water usage is measured in hundred cubic feet (ccf). There are approximately 748 gallons per 1 ccf.

Water Usage

Summer

- Tier 1, 0% – 70% of winter average consumption: \$4.283 per ccf
- Tier 2, 71% – 170% of winter average consumption: \$5.905 per ccf
- Tier 3, usage exceeding 170% of winter average consumption: \$9.164 per ccf

Winter average consumption is the average water use during the immediate preceding billing periods of January, February and March.

Exception

For water service metered separately for lawn irrigation, \$9.164 per ccf will be assessed on all water consumption occurring during the period from June 1 through September 30.

Non-summer

- All water usage @ \$4.283 per one hundred cubic feet (1 CCF)

Monthly base charge

Meter Size	Current Monthly Base Charge	Beginning Oct. 1, 2024
1 inch	\$25.78	\$26.80
1 1/2 inch	\$51.82	\$53.89
2 inch	\$78.54	\$81.68
3 inch	\$242.96	\$252.69
4 inch	\$509.56	\$529.94
6 inch	\$1,087.28	\$1,130.77
8 inch	\$1,799.49	\$1,871.47

Fire Flow Charge

The fire flow charge is an additional charge to cover the cost of providing water for public fire protection. The charge is based on meter size.

Meter Size	Fire Flow Charge
5/8 inch and 3/4 inch	\$2.11
1 inch	\$2.25
1 1/2 inch	\$3.25
2 inch	\$3.50
3 inch	\$8.40
4 inch	\$12.97
6 inch	\$25.95
8 inch	\$25.95

Backflow Prevention Charge

In addition to the charges listed above, each backflow prevention device at a customer location will be charged **\$2.66** as outlined in Section 27-57 Cross Connections.

Taxes

Bills computed under this rate schedule are subject to increase by a proportionate part of any existing, new, or increased rate of gross receipts tax or other similar tax levied by a municipality or other governmental authority.

Columbia Regional Airport

Columbia Regional Airport

Availability

This schedule is available for water furnished to customers at the Columbia Regional Airport.

Water Usage Rate is in addition to monthly base charge. Water usage is measured in hundred cubic feet (ccf). There are approximately 748 gallons per 1 ccf.

All water @ \$4.66 per one hundred cubic feet (1 ccf).

Monthly base charge

Meter Size	Monthly Base Charge
5/8 inch and 3/4 inch	\$12.48
1 inch	\$20.15
1 1/2 inch	\$40.52
2 inch	\$61.41
3 inch	\$189.99
4 inch	\$398.45
6 inch	\$850.20

Taxes

Bills computed under this rate schedule are subject to increase by proportionate part of any existing, new, or increased rate of gross receipts tax or other similar tax levied by municipality or other governmental authority.

Backflow Prevention Charge

In addition to the charges listed above, there is a charge of **\$2.00** for each backflow device at a customer location as outlined in Section 27-57 Cross Connections.

Former Water #1 and #2 Customers

Rates Effective October 1, 2024

This information taken from Columbia [Ordinance Chapter 27, Section 27-122 and Section 27-16opens PDF file](#). The City Council has the sole authority to set rates and charges for Columbia Water & Light services. The City reviews these rates and charges annually.

Residential (#1 & #2)

Residential (#1 & #2)

This schedule is available for water to residential customers, commercial multiple-family facilities and multiple commercial facilities, served with one meter, outside the city limits and **within former boundaries of dissolved Public Water Supply Districts No. 1 and No. 2.**

Water usage charges are in addition to a monthly base charge, which is determined by meter size. Water usage is measured in hundred cubic feet (ccf). There are approximately 748 gallons per 1 ccf.

Water Usage

Summer: June through September

- Tier 1, 0% – 70% of winter average consumption: \$3.726 per ccf
- Tier 2, 71% – 170% of winter average consumption: \$5.137 per ccf

- Tier 3, usage exceeding 170% of winter average consumption: \$7.972 per ccf

Winter average consumption is the average water use during the immediate preceding billing periods of January, February and March.

Exception

For water service metered separately for lawn irrigation, \$7.972 per ccf will be assessed on all water consumption occurring during the period from June 1 through September 30.

Non-summer: October through May

- \$3.726 per one hundred cubic feet (1 ccf)

Monthly Base Charge

Meter Size	Monthly Base Charge
5/8 inch and 3/4 inch	\$14.44
1 inch	\$23.31
1 1/2 inch	\$46.88
2 inch	\$71.05
3 inch	\$219.82
4 inch	\$461.02
6 inch	\$983.68

Fire Flow Charge

The fire flow charge is an additional charge to cover the cost of providing water for public fire protection. The charge is based on meter size.

Meter Size	Fire Flow Charge
5/8 inch and 3/4 inch	\$1.84
1 inch	\$1.96
1 1/2 inch	\$2.82
2 inch	\$3.04
3 inch	\$7.30
4 inch	\$11.28
6 inch	\$22.57

Backflow Prevention

In addition to the charges listed above, each backflow prevention device at a customer location will be charged **\$2.31** as outlined in Section 27-57 Cross Connections.

Taxes

Bills computed under this rate schedule are subject to increase by proportionate part of any existing, new, or increased rate of gross receipts tax or other similar tax levied by municipality or other governmental authority.

Commercial (#1 & #2)

Commercial (#1 & #2)

Former Water District Customers Outside City Limits

This schedule is available for water to Commercial customers **outside the city limits, and within the former boundaries of dissolved Public Water Supply District No. 1 and No. 2, who use 500 ccf or**

less per month average during non-summer months (October through May).

Water Usage Rate is in addition to monthly base charges. Water usage is measured in hundred cubic feet (ccf). There are approximately 748 gallons per 1 ccf.

Water Usage

Summer

- Tier 1, 0% – 70% of winter average consumption: \$3.726 per ccf
- Tier 2, 71% – 170% of winter average consumption: \$5.137 per ccf
- Tier 3, usage exceeding 170% of winter average consumption: \$7.972 per ccf

Winter average consumption is the average water use immediate preceding billing periods of January, February and March.

Exception

For water service metered separately for lawn irrigation, \$7.972 per ccf will be assessed on all water consumption occurring during the period from June 1 through September 30.

Non-summer

- All water usage is \$3.726 per one hundred cubic feet (1 CCF)

Monthly Base Charge

Meter Size	Monthly Base Charge
5/8 inch and 3/4 inch	\$14.44
1 inch	\$23.31
1 1/2 inch	\$46.88
2 inch	\$71.05
3 inch	\$219.82
4 inch	\$461.02
6 inch	\$983.68

Fire Flow Charge

The fire flow charge is an additional charge to cover the cost of providing water for public fire protection. The charge is based on meter size.

Meter Size	Fire Flow Charge
5/8 inch and 3/4 inch	\$1.84
1 inch	\$1.96
1 1/2 inch	\$2.82
2 inch	\$3.04
3 inch	\$7.30
4 inch	\$11.28
6 inch	\$22.57

Backflow Prevention

In addition to the charges listed above, each backflow prevention device at a customer location will be charged **\$2.31** as outlined in Section 27-57 Cross Connection.

Taxes

Bills computed under this rate schedule are subject to increase by proportionate part of any existing,

new, or increased rate of gross receipts tax or other similar tax levied by municipality or other governmental authority.

Large commercial (#1 & #2)

Large commercial (#1 & #2)

This schedule is available for water to Large Commercial customers **outside the city limits, and within the former boundaries of dissolved Public Water Supply District No. 1 and No. 2, who use more than 500 ccf** per month average during non-summer months (October through May).

Water Usage Rate is in addition to monthly base charges. Water usage is measured in hundred cubic feet (ccf). There are approximately 748 gallons per 1 ccf.

Water usage

Summer

- Tier 1, 0% – 70% of winter average consumption: \$3.726 per ccf
- Tier 2, 71% – 170% of winter average consumption: \$5.137 per ccf
- Tier 3, usage exceeding 170% of winter average consumption: \$7.972 per ccf

Winter average consumption is the average water use during the immediate preceding billing periods of January, February and March.

Exception

For water service metered separately for lawn irrigation, \$7.972 per ccf will be assessed on all water consumption occurring during the period from June 1 through September 30.

Non-summer

- All water usage @ \$3.726 per one hundred cubic feet (1 CCF)

Monthly base charge

Meter Size	Monthly Base Charge
1 inch	\$23.31
1 1/2 inch	\$46.88
2 inch	\$71.05
3 inch	\$219.82
4 inch	\$461.02
6 inch	\$983.68
8 inch	\$1,628.04

Fire flow charge

The fire flow charge is an additional charge to cover the cost of providing water for public fire protection. The charge is based on meter size.

Meter Size	Fire Flow Charge
1 inch	\$1.96
1 1/2 inch	\$2.82
2 inch	\$3.04
3 inch	\$7.30
4 inch	\$11.28
6 inch	\$22.57
8 inch	\$22.57

Backflow prevention

In addition to the charges listed above, each backflow prevention device at a customer location will be charged **\$2.31** as outlined in Section 27-57 Cross Connections.

Taxes

Bills computed under this rate schedule are subject to increase by proportionate part of any existing, new, or increased rate of gross receipts tax or other similar tax levied by municipality or other governmental authority.

From <<https://www.como.gov/utilities/utility-rates/#tab3>>

F.8 Savings and Revenue Calculations (Electronic)

Please see the external Excel files that were sent with this document.

F.9 Product Warranties



E-Series® Ultrasonic Plus Meter

with Integrated Valve
5/8 x 3/4 inch, 3/4 inch

PRODUCTS

This warranty shall apply to all Badger Meter E-Series® Ultrasonic Plus lead-free meters with integrated valve, sizes 5/8 x 3/4 inch and 3/4 inch, when used to measure potable water, and the internal register/encoder and battery used with these meters (collectively "Product"), sold on or after August 21, 2024. This warranty is not transferable and is extended only to utilities, municipalities, other commercial users and authorized distributors, hereafter referred to as "Customer," and does NOT apply to consumers or any person or entity who is not an original customer of Badger Meter or its authorized distributors.

MATERIALS AND WORKMANSHIP

Badger Meter, Inc. ("Badger Meter") warrants Product to be free from defects in materials and workmanship for the time period stated.

Lead-Free Housing	20 years and 6 months after shipment
Battery ¹	20 years and 6 months after shipment (prorated)
Transducers ¹	20 years and 6 months after shipment (prorated)
Encoder Register ¹	20 years and 6 months after shipment (prorated)
Valve and Valve Power Module ¹	20 years and 6 months after shipment (prorated) or a maximum of 240 valve actuation cycles,* whichever comes first

*A cycle is defined as the valve going from the unactuated state to the actuated state and returning to the unactuated state.

¹ Badger Meter will repair or replace, at its discretion, a non-performing Product at no cost during the first ten (10) years, and at a prorated price during the last ten (10) years of the warranty. Badger Meter will apply these prorated price discounts to the Product list prices at the time of Product return and according to the following prorated price discount schedule: Years 11 through 12 - 75% discount; Years 13 through 15 - 50% discount; Year 16 - 40% discount; Year 17 - 30% discount; Year 18 - 20% discount; and Years 19 through 20 - 10% discount. Replacement Products are warranted for and under the balance of the original applicable Product warranty.

METER ACCURACY

The Product will meet or exceed all applicable specifications outlined in AWWA Standard C715 in addition to meeting the meter accuracy as set forth in the Operating Performance Specifications of the Badger Meter current published product data sheet ([ESM-DS-02022-EN](#)) for twenty (20) years after shipment from Badger Meter.

EXTENDED LOW-FLOW METER ACCURACY

Badger Meter further warrants the Product will meet extended minimum test flow accuracy of $\pm 3\%$ for the published ranges set forth in the Badger Meter current published product data sheet for twenty (20) years after shipment from Badger Meter.

PRODUCT RETURNS

Any Product proved to the satisfaction of Badger Meter to have failed the foregoing warranties will, at the option of Badger Meter, be repaired or replaced without charge to the Customer. Any eligible Product repaired or replaced by Badger Meter will retain the original Product's warranty based on the original Product purchase date, at Badger Meter's sole discretion. The Badger Meter obligation hereunder shall be limited to such repair and replacement and shall be conditioned upon Badger Meter receiving written notice of any alleged defect within ten (10) days after its discovery. This exclusive remedy shall not be deemed to have failed its essential purpose so long as Badger Meter is willing and able to replace defective products or issue a credit to purchaser within a reasonable time of proof to Badger Meter that a defect is involved. Product returns must be shipped by the Customer prepaid F.O.B. to the nearest Badger Meter factory or distribution center. The Customer shall be responsible for all direct and indirect costs associated with removing the original Product and reinstalling the repaired or replacement Product.

LIMITS OF LIABILITY

This warranty shall not apply to Product repaired or altered by parties other than Badger Meter, or read by equipment not explicitly approved or licensed by Badger Meter. The foregoing warranty applies only to the extent that the Product is installed, serviced and operated strictly in accordance with AWWA Standard C715 and AWWA M6 Manual, as applicable. The warranty shall not apply and shall be void with respect to Product exposed to conditions other than those detailed in the Badger Meter Product technical and/or operational literature, or which, as determined at Badger Meter's sole discretion, have affected the ability of the Product to perform, including, but not limited to: exposure to adverse installation conditions; misuse; vandalism; negligence; accident; acts of God; alteration; improper installation, operation or repair; damage from passage of high-speed air slugs; damage by water quality conditions, including but not limited to: aggressive water, foreign matter, biofilms, or extreme corrosivity; damage caused by actions not in accordance with the intended use; or other circumstances which are beyond the reasonable control of Badger Meter, as determined at Badger Meter's sole discretion. With respect to product not manufactured by Badger Meter, the warranty obligations of Badger Meter shall in all respects conform and be limited to the warranty extended to Badger Meter by the supplier of product.

THE FOREGOING WARRANTIES ARE EXCLUSIVE AND IN LIEU OF ALL OTHER EXPRESS AND IMPLIED WARRANTIES WHATSOEVER, INCLUDING BUT NOT LIMITED TO IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE (except warranties of Title).

Any description of Product, whether in writing or made orally by Badger Meter or its agents, specifications, samples, models, bulletins, drawings, diagrams, engineering sheets, or similar materials used in connection with any Customer's order are for the sole purpose of identifying Product and shall not be construed as an express warranty. Any suggestions by Badger Meter or its agents regarding use, application or suitability of Product shall not be construed as an express warranty unless confirmed to be such in writing by Badger Meter.

Exclusion of Consequential Damages and Disclaimer of Other Liability

Badger Meter liability with respect to breaches of the foregoing warranty shall be limited as stated therein. Badger Meter liability shall in no event exceed the contract price. BADGER METER SHALL NOT BE SUBJECT TO AND DISCLAIMS: (1) ANY OTHER OBLIGATIONS OR LIABILITIES ARISING OUT OF BREACH OF CONTRACT OR OF WARRANTY (2) ANY OBLIGATIONS WHATSOEVER ARISING FROM TORT CLAIMS (INCLUDING NEGLIGENCE AND STRICT LIABILITY) OR ARISING UNDER OTHER THEORIES OF LAW WITH RESPECT TO PRODUCTS SOLD OR SERVICES RENDERED BY BADGER METER, OR ANY UNDERTAKINGS, ACTS OR OMISSIONS RELATING THERETO, AND (3) ALL CONSEQUENTIAL, INCIDENTAL AND CONTINGENT DAMAGES WHATSOEVER.

SMART WATER IS BADGER METER

E-Series is a registered trademark of Badger Meter, Inc. Other trademarks appearing in this document are the property of their respective entities. Due to continuous research, product improvements and enhancements, Badger Meter reserves the right to change product or system specifications without notice, except to the extent an outstanding contractual obligation exists. © 2024 Badger Meter, Inc. All rights reserved.

www.badgermeter.com



Activated Product and Service Warranty

This Addendum sets forth or references the sole and exclusive warranties offered by Itron in connection with Activated Products and Services. This Addendum forms an integral part of and supplements the terms and conditions of the Agreement. All capitalized terms used in this Addendum shall have the meanings assigned to them in the main body of the Agreement or relevant EULA or EUSA, as applicable, unless otherwise defined in this Addendum.

1 Activated Itron Equipment

1.1 Warranty and Remedy.

Itron warrants to Sales Channel Partner and Customer that Activated Itron Equipment will be free from defects in materials and workmanship and will conform in all material respects to the applicable Itron published specification during the warranty set forth on the attached Activated Itron Equipment Warranty Table, an Activation Notice, or valid Itron price quote ("Warranty Period"). As Sales Channel Partner's and Customer's sole and exclusive remedy for a breach of the foregoing warranty, Itron will, at its option and expense: (i) repair or replace faulty Activated Itron Equipment under warranty after it has been returned to an Itron-designated repair facility during the Warranty Period in accordance with Itron's then current RMA policy and procedures, (ii) provide Sales Channel Partner or Customer with a firmware or software fix to correct the nonconformity, or (iii) if Itron determines (in its reasonable judgment) that it is unable to provide a remedy specified in item (i) or (ii) of this section, Itron will provide Sales Channel Partner or Customer with a refund of the purchase price for the applicable Activated Itron Equipment, less the straight line depreciation amount. Sales Channel Partner or Customer will pay the cost of returning Activated Itron Equipment to the Itron designated repair facility and Itron will pay the cost of returned repaired or replacement Activated Itron Equipment to Sales Channel Partner or Customer. Repaired and replacement Activated Itron Equipment will be warranted for the remainder of the Warranty Period, or sixty (60) days from the ship date of the repaired or replaced Activated Itron Equipment, whichever is longer. Additional warranty terms for specific Activated Itron Equipment may be specified in the attached Activated Itron Equipment Warranty Table.

1.2 Exclusions.

The above warranty and additional warranty terms in the attached Activated Itron Equipment Warranty Table do not cover Activated Itron Equipment in poor operating condition due to: (a) changes made to Activated Itron Equipment without Itron's prior written consent; (b) use with cables, mounting kits, antennas, battery backups and other devices, third party software or firmware that Itron has not provided to Sales Channel Partner or Customer or approved in writing by Itron for use with Activated Itron Equipment; (c) Sales Channel Partner's, Customer's or a third party's misuse, abuse, negligence, or failure to install, test, handle or operate Itron Equipment in accordance with the related Itron User Documentation; (d) a Force Majeure event; or (e) incorrect data, or data entry or output by Sales Channel Partner, Customer or a third party not under Itron's control. Additional warranty exclusions for specific Activated Itron Equipment may be specified in the attached Activated Itron Equipment Warranty Table. If requested by Sales Channel Partner or Customer, Itron may repair Activated Itron Equipment damaged by any of the foregoing, subject to payment of applicable fees.

2 Activated Itron Software.

The sole and exclusive warranties offered by Itron in connection with Activated Itron Software are set forth in the applicable EULA.



3 **Activated Maintenance Services and Service Offerings.**

The sole and exclusive warranties offered by Itron in connection with Activated Maintenance Services and Services Offerings are set forth in the applicable EUSA.

4 **Activated Professional Services.**

Itron warrants to Sales Channel Partner that Professional Services will be provided by personnel with the requisite experience, skills, knowledge, training, and education and in a timely, professional, and workmanlike manner in accordance with the applicable Statement of Work. As Sales Channel Partner’s exclusive remedy for any material noncompliance by Itron with the express warranties provided in this Section, Itron shall correct the noncompliance within a reasonable period of time under the circumstances, if Sales Channel Partner gives Itron written notice (which notice must describe the noncompliance in sufficient detail to enable Itron to provide the required corrective action) within ninety (90) days of performance of the applicable noncompliant Professional Services. If Itron, in its sole discretion, is unable to correct the noncompliance, its sole obligation will be to refund to Sales Channel Partner a pro-rata amount paid for the nonconforming Professional Services.

5 **Survival.**

The express warranties set forth in this Addendum survive expiration or termination of the Agreement.

6 **Itron Activated Equipment Warranty Table**

Itron Equipment or Repair Service	Warranty Period and Additional Warranty Terms						
100W+ series water module (including battery) 500W series water module (including battery)	Each 100W+ and 500W series water module (including battery) (each, a “Water Module” and collectively, the “Water Modules”) receives a 20-year warranty consisting of 10 years of warranty coverage under <u>Section 12</u> (“Itron Equipment Warranty”) followed by 10 years of discounts against replacement products, as described below: Warranty Period: 10 years from date of shipment. Discount Period: If a Water Module (including battery) fails during the ten-year period following expiration of the applicable Warranty Period (the “Discount Period”), subject to applicable warranty exclusions under <u>Section 13</u> (“Itron Equipment Warranty Exclusions”), Itron will provide Customer with a discount off Itron’s then-current list price for any available Itron water module to replace the failed Water Module (including battery) per the discounts set forth below: <table><tr><th>Discount Period</th><th>Discount</th></tr><tr><td>Years 1 through 5</td><td>50%</td></tr><tr><td>Years 6 through 10</td><td>25%</td></tr></table> Itron does not guarantee that replacement Water Modules will be backwards compatible.	Discount Period	Discount	Years 1 through 5	50%	Years 6 through 10	25%
Discount Period	Discount						
Years 1 through 5	50%						
Years 6 through 10	25%						



Itron Equipment or Repair Service	Warranty Period and Additional Warranty Terms
	Warranties on the applicable Water Modules shall be void if (a) such Water Module is used in connection with a third-party reading system that has not been approved by Itron in writing; or (b) Customer utilizes the two (2) battery version of such 500W Water Module in mobile mode for more than two (2) consecutive years.
CGR ACT Module (CAM)	Warranty Period: 5 years from date of shipment.
Itron Leak Sensor	
CENTRON Electric Meter	Warranty Period: 3 years from date of shipment.
Intellis Gas Meter	
SENTINEL Electric Meter	
QUANTOMETER (MZ) Gas Meter	Warranty Period: 2 years from date of shipment.
ROTARY (DELTA) Meter	
TURBINE (FLUXI) Gas Meter	
Repairs or updates for out-of-warranty electricity meters	Additional Warranty Terms: Itron shall perform the repairs or updates with reasonable care and in a diligent and competent manner. Itron's sole obligation in connection with repair or update failures shall be, at its option, to correct or re perform repairs/updates or refund to Customer the amount paid for the repairs/updates. Customer must report any deficiencies in repair work to Itron in writing within 90 days of shipment to receive the remedies described herein.
Repairs or updates for out-of-warranty Socket Based Routers, Pole Mounted Routers and Routing Nodes	Additional Warranty Terms: Itron shall perform the repairs or updates with reasonable care and in a diligent and competent manner. Itron's sole obligation in connection with repair or update failures shall be, at its option, to correct or re perform repairs/updates or refund to Customer the amount paid for the repairs/updates. Customer must report any deficiencies in repair work to Itron in writing within 90 days of shipment to receive the remedies described herein.
All other Itron Equipment not listed above.	Warranty Period: 1 year from date of shipment.

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