Bureau of Reclamation
WaterSMART Small-Scale Water Efficiency Grant

Grant Proposal Title Page

Title:
Improving Water Efficiency Through Smart Water Meters

Applicant:
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1. TECHNICAL PROPOSAL

a. EXECUTIVE SUMMARY

Date: January 16th, 2024
Applicant: City of Sharon Springs, Wallace County, Kansas
Category A Applicant

The City of Sharon Springs, located in rural Northwest Kansas, will upgrade 425 residential and commercial water meters by installing advanced metering infrastructure (AMI) to collect water flow data and transmit it to the City analytics software system. The project will better manage the City's water supplies, promote conservation among its residential and commercial customers, and automate its meter readings. The project supports the guiding principles of the Kansas Water Plan as set forth by the Kansas Water Office.

Estimated Timeline:
Project Start Date: February 2025
Project Length: 12 months from Start Date
Estimated Completion Date: February 2026

Proposed project is NOT located on a Federal facility.

b. PROJECT LOCATION

The City of Sharon Springs' Improving Water Efficiency Through Smart Water Meters Project is located in rural Wallace County in Northwest Kansas. The U.S. Department of Agriculture (USDA) Economic Research Service (ERS) categorizes Wallace County as a Level Four Frontier and Remote (FAR) area, where a majority of the population lives 60 minutes or more from an urban area of 50,000 or more; and 15 minutes or more from urban areas of 2,500-9,999 people. The project latitude is 38.8978° N and longitude is 101.7521° W.

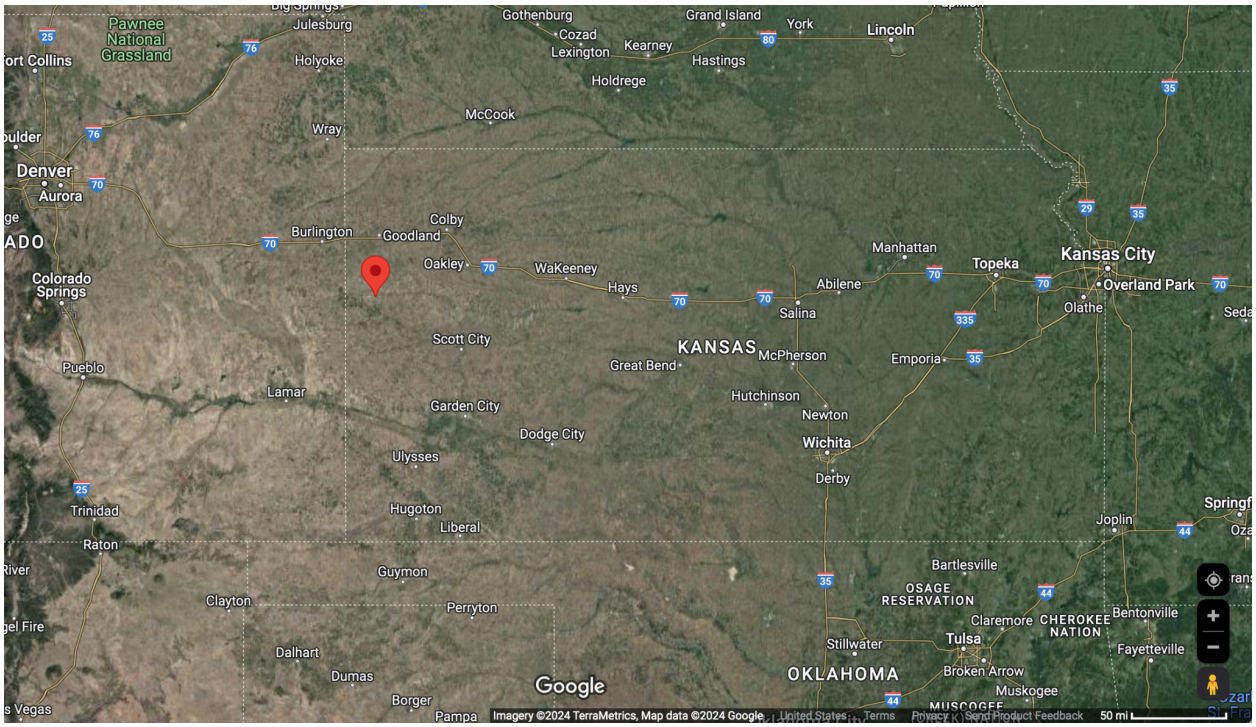

Image 1: The wideview image shows Sharon Springs, Kansas, located in Wallace County, pinned with a red marker in the northwest corner of Kansas, approximately 210 miles from Denver, Colorado, and 400 miles from Kansas City, Kansas. Wallace County is a Level Four Frontier and Remote area based on USDA data.

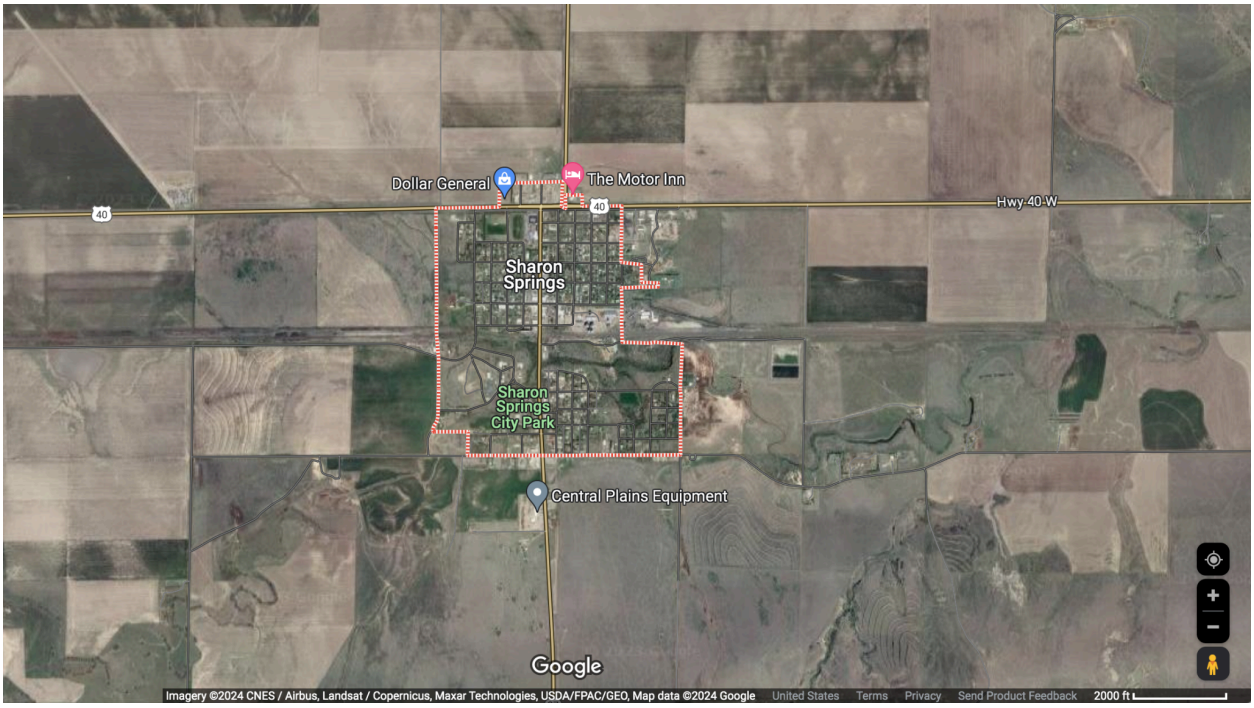

Image 2: A closer look at Sharon Spring, Kansas with the city limits outlined. This image shows the agricultural nature of the area surrounding the City.

c. TECHNICAL PROJECT DESCRIPTION

The City of Sharon Springs, Kansas will upgrade 425 residential and commercial manual read water meters by installing smart water meters, also known as advanced metering infrastructure (AMI) to collect water flow data and transmit it to the City's analytics software system.

The City plans to purchase a Badger Cellular Meter Reading System from Salina Supply Company, a regional provider.

The City plans to install the AMI system components in the existing meter pits. Once installed, metering data will be transmitted via a secure, dependable existing cellular network.

The Badger Cellular Meter Reading System will utilize BEACON Software as a Service (SaaS) and ORION Cellular Network as a Service (NaaS).

ORION Cellular endpoints are an evolution in AMI technology for water utilities, powering the Network as a Service (NaaS) approach. The innovative endpoints utilize existing cellular infrastructure for efficient and secure two-way communication of high-resolution meter reading data via cellular networks.

Each meter pit in the City will be outfitted with an ORION cellular endpoint, as well as with a high resolution LCD encoder. The endpoint captures readings every 15 minutes. Those 15-minute interval readings are then transmitted to the BEACON Software every six hours, or four times a day. The ORION cellular endpoints are 5.125 in. (130 mm) (H) 1.75 in. (44 mm) Diameter at top 2.625 in. (W) x 2.875 in. (D) at base 67 mm (W) x 73 mm (D) at base and operate with one non-replaceable lithium thionyl chloride D cell. They operate in temperatures ranging from −40 to 140° F.

Additionally, new composite meter box lids will be installed where they are needed throughout the City to best fit the new system.

BEACON Software as a Service (SaaS) will provide the City with an intuitive user interface and custom reporting capabilities so that the City's utility workers are able to see detailed meter data in one place to best manage operations and serve customers. BEACON SaaS also includes a web portal and smartphone app to provide consumers with easy access to personal water consumption data.

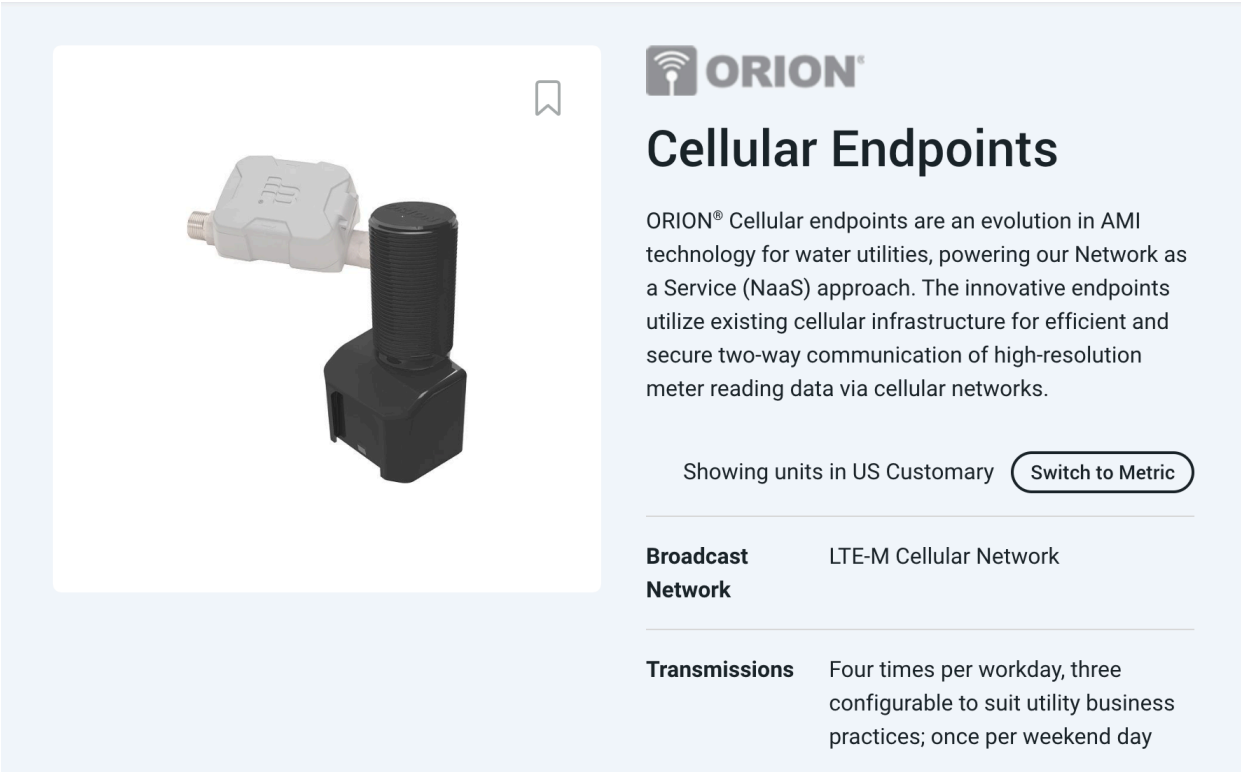

Image 3: Photo of ORION Cellular Endpoints to be installed in existing meter pits.

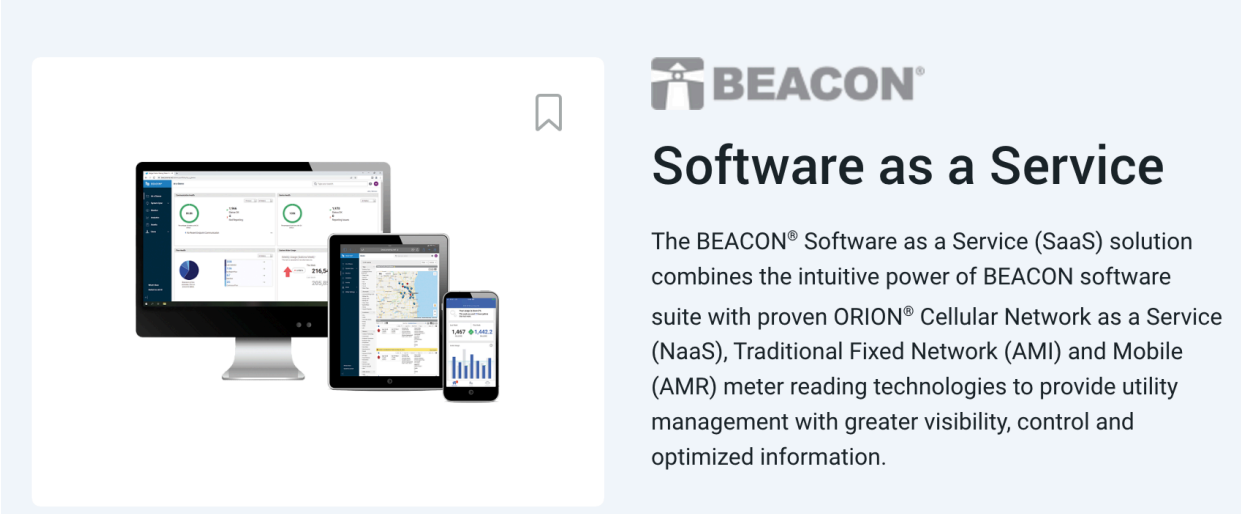

Image 4: Photo showing example of BEACON SaaS user interface where the City and its customers can see detailed meter data.

c. EVALUATION CRITERIA

i. PROJECT BENEFIT

Will the project result in more efficient management of the water supply?

Yes, the proposed project will result in more efficient management of the City's water supply. By investmenting in the City's existing infrastructure and installing a cellular meter reading system in the current meter pits, the City will be able to access real-time data on its water usage, thereby increasing water supply sustainability and stretching and securing water supplies for future generations.

Smart metering technology such as advanced metering infrastructure (AMI) measures and records water usage accurately and in real-time. Unlike traditional water meters, which require manual reading and are prone to human error, smart meters provide automated readings that are transmitted to the City for billing and analysis purposes. Specific to the Badger Cellular Meter Reading System utilizing BEACON Software as a Service (SaaS) and ORION Cellular Network as a Service (NaaS) that the City plans to use, meter readings are taken in 15-minute intervals.

More efficient management of the City's water supply will be a result of the project because AMI allows for accurate and timely measures of water consumption, improved leak detection and water loss prevention, real-time monitoring of water usage, and enhanced data analysis for water management and conservation initiatives.

Where any conserved water as a result of the project will go and how it will be used?

Sharon Springs, Kansas obtains its water supply from three drilled wells in Eagle Tail Creek valley in the southwestern part of town. Storage is provided by an elevated 50,000-gallon steel tank.

Although western Kansas has few rivers and lakes, a vast amount of life-sustaining water is found underground in aquifers. Known as groundwater, the water in aquifers is not in big underground lakes but in small, interconnecting pores in subsurface rocks and sediment.

In Wallace County groundwater is derived almost entirely from precipitation. Part of the water that falls as precipitation becomes surface runoff, part of it evaporates into the atmosphere, and part of it is absorbed by plants and later transpired into the

atmosphere. The rest, a very small part, percolates downward through the soil and underlying strata until it reaches the water table, where it becomes groundwater.

Recharge of groundwater from precipitation continually replenishes the groundwater resource but is doing so at much smaller rates in western Kansas than the rates of groundwater withdrawals. Only a tiny fraction of this region's meager rainfall ends up refilling the aquifer. In fact, the Kansas Geological Survey estimates that this district's portion of the aquifer gets used up at nine times the rate that it's replenished by precipitation. Groundwater re-development will take place over many years and will require multiple changes to the current groundwater withdrawals to increase water supply sustainability.

Conserved water as a result of this project specifically will aid in sustaining the High Plains Aquifer by decreasing withdrawals of stored groundwater, to stretch and secure water supplies for future generations in Wallace County.

What are the consequences of not making the improvement?

By not investing in the existing water infrastructure of the City and moving from a manual read system to an AMI system, the City and its residents risk wasting the precious resource of water. The High Plains aquifer, which underlies portions of eight states from South Dakota to Texas, is the primary source of water for western Kansas. Sharon Springs in Wallace County, Kansas is in Groundwater Management District (GWM) 1. Groundwater levels in the Ogallala portion of the aquifer (GMDs 1, 3 and 4) have dropped significantly since the start of widespread irrigation of cropland in the 1940s and 1950s. In some areas, less than 40% of the original aquifer thickness remains. Conservation from agriculture, industry, and municipalities is a must in the High Plains aquifer region to sustain the economy, as well as the basic livability of the area.

Is the project in an area that is experiencing, or recently experienced, drought or water scarcity? Will the project help address drought conditions at the sub-basin or basin scale?

Wallace County, Kansas's annual precipitation is stated at 17 inches. Yet, in both 2020 and 2022, annual precipitation totaled less than 12 inches. In 2022, seven western Kansas communities experienced their driest year on record, each receiving 10 inches of precipitation or less. Deserts are commonly defined as places that get fewer than 10 inches of rain a year. For nearly all of western Kansas, 2022 summer average

temperatures also ranked among the top 25 warmest on record. May-August 2022 was the 11th warmest summer in Wallace County on record. In 2023, Wallace County entered a Local Enhanced Management Area (LEMA) to reduce agricultural irrigation and attempt to sustain the depleting High Plains Aquifer. *(Image 5 and 6 show citations for above data.)*

Precipitation in Kansas, by County
2017-2022 and 1981-2010 Average

County	2017	2018	2019	2020	2021	2022	1981-2010 Average
Stevens	34.92	25.20	19.80	15.60	17.68	10.83	19.14
Sumner	33.47	35.30	50.70	31.40	29.00	26.75	34.98
Thomas	27.47	22.40	25.10	14.40	16.98	11.57	20.03
Trego	17.43	28.70	24.60	18.10	17.86	10.74	22.09
Wabaunsee	35.35	32.50	47.60	31.60	34.36	33.60	37.23
Wallace	23.15	19.90	21.70	11.40	18.75	11.64	19.77
Washington	29.65	38.00	42.70	27.40	25.83	28.99	31.88
Wichita	22.05	19.60	16.80	15.70	19.63	11.66	19.43
Wilson	32.78	39.00	58.60	37.50	46.10	32.66	42.64
Woodson	35.93	41.60	55.50	33.60	47.58	30.74	43.08
Wyandotte	45.55	32.70	49.60	33.80	38.89	31.57	40.73
Kansas	**29.03**	**31.83**	**36.02**	**25.84**	**27.25**	**21.24**	**29.02**

Source: Kansas State University, Research and Extension, Weather Data Library, http://climate.k-state.edu/precip/county/ (accessed March 17, 2023); National Oceanic and Atmospheric Administration, National Centers for Environmental Information, Climate at a Glance, https://www.ncdc.noaa.gov/cag/ (accessed March 17, 2023).

Precipitation in inches.

August 2022 Average Temperature Rankings

Download: CSV JSON XML

View Period (Months): All 1 2 3 4 5 6 7 8 9 10 11 12 18 24 36 48 60

Record Coolest | Bottom ⅙ | Bottom ⅓ | Normal | Top ⅓ | Top ⅙ | Record Warmest

Period	Value	1901-2000 Mean	Anomaly	Rank (1895-2023)	Coolest/Warmest Since	Record
May–Aug 2022 **4-Month**	72.7°F (22.6°C)	70.2°F (21.2°C)	2.5°F (1.4°C)	119th Coolest	Coolest since: 2021	1915
				11th Warmest	Warmest since: 2018	1934
	Ties: 1956					

Citing This Page

NOAA National Centers for Environmental information, Climate at a Glance: County Rankings, published January 2024, retrieved on January 15, 2024 from https://www.ncei.noaa.gov/access/monitoring/climate-at-a-glance/county/rankings

Will the proposed project positively impacts/benefit various sectors and economies within the applicable geographic area (e.g., impacts to agriculture, environment, recreation, and tourism)?

The High Plains Aquifer feeds about a quarter of U.S. crop production, according to the Department of Homeland Security, and water conservation at many levels in the semi-arid region is needed. Too much underground water is being used too fast.

Agriculture, industrial, and municipalities all play a role in the conservation, better management, and otherwise more efficient use of water supplies. The proposed project will positively affect the environment and economy in the region. Water drives western Kansas's economy. Residents, businesses, agriculture, and communities need access to clean, abundant sources of water to survive and thrive

ii. PLANNING EFFORTS SUPPORTING THE PROJECT

Plan Description and Objectives: *Is your project supported by a specific planning document or effort? If so, describe the existing plan. When was the plan developed? What is the purpose and objective of the plan?*

The City proposed project is supported by the Kansas Water Plan (KWP) and the Upper Smoky Hill Action Plan.

The KWP is one of the primary tools used by the State of Kansas to address current water resources, issues, and to plan for future needs. It guides the coordination of local, state, and federal actions. The KWP is updated every five years. The most recent KWP was published in 2022.

The KWP presents five guiding principles, which provide the foundation and framework for addressing water issues in Kansas, identifying the overarching challenges and the steps needed to meet those challenges.

Two guiding principles that apply to this application are:
- Conserve and Extend the High Plains Aquifer, and;
- Reduce Our Vulnerability to Extreme Events

The Upper Smoky Hill Action Plan is created by a Regional Advisory Committee (RAC) and has five developed priority goals and action plans. The Current Focus Area of the Upper Smoky Hill Action Plan is 'To develop a water use reduction plan to reduce the rate of depletion of groundwater resources, to sustain the long-term economy of the area. Increasing water use efficiency and flexibility, to achieve an overall reduction in water usage while maintaining economic viability.'

Priority Goal #3 of the Upper Smoky Hill Action Plan pertains directly to the project at hand, stating: "All municipal users within the planning region will be at or below the regional 2015 average gallons per capita per day (GPCD) within the next five years. All municipal users as defined by the Kansas Water Appropriation Act in the planning area will follow best management practices and implement a conservation plan."

Plan Development: *Who developed the planning effort? What is the geographic scope of the plan? If the planning effort was not developed by the Category A applicant, describe the Category A applicant's involvement in developing the planning effort.*

The KWP is developed by the Kansas Water Office (KWO), which was established in 1981 and serves as the water planning, policy, coordination and marketing agency for the state. 14 Regional Planning Areas (RPAs), established in 2014, are used for general planning purposes within the KWO. Each RPA consists of a Regional Advisory Committee (RAC) and a KWO planner.

Wallace County is located in the Upper Smoky Hill RPA, along with 6 other west central counties in Kansas.

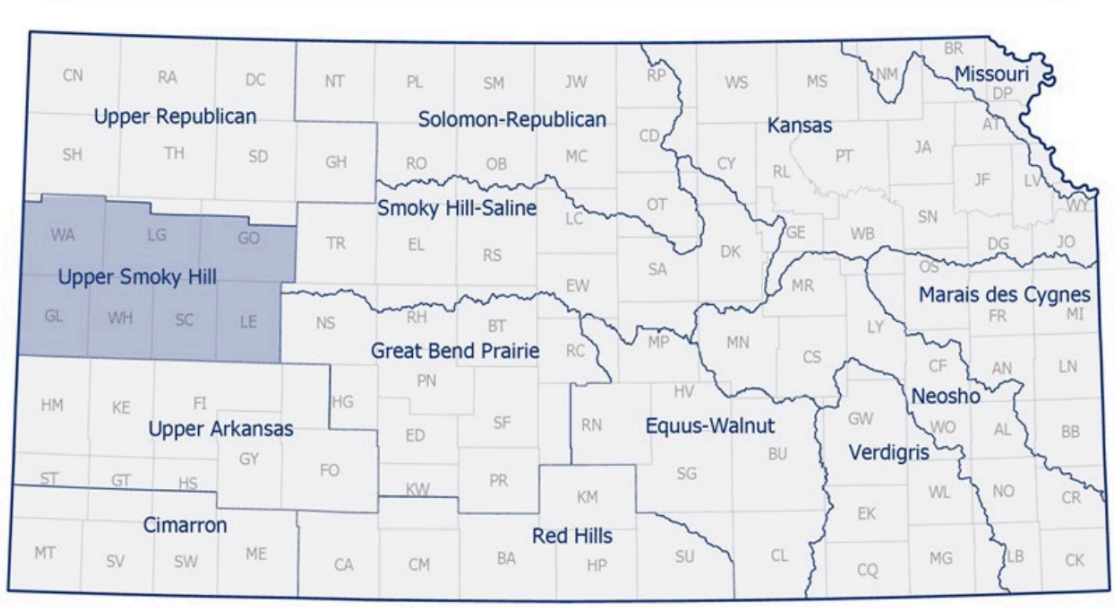

Image 7: Kansas map outlining the KWO's Regional Planning Areas (RPAs) and highlighting the Upper Smoky Hill RPA, which includes Wallace County.

Support for the Project: *Describe to what extent the proposed project is supported by the identified plan.*

The KWP's first goal is to "Conserve and Extend the High Plains Aquifer". It goes on to say, "This network of underground water sources serves as the primary water supply for much of central Kansas and most of western Kansas… It is not an overstatement to say that the future of habitability in much of western Kansas is at stake; water users of all kinds will need to adopt practices using less groundwater if these populations and economies are to remain viable."

Under the sub-category, ‘Reductions In All Uses’, the KWP states, “ Although irrigated agriculture accounts for most of the groundwater usage from the HPA, other types of uses will need to reduce withdrawals from the aquifer, as well. Livestock operations, industry, and municipalities must adapt to water-reduction strategies.”

Another goal of the KWP is to ‘Reduce Our Vulnerability to Extreme Events’. It goes on to say, “Effective water planning must account for the occurrence of extreme events, such as droughts and floods. As already evident from climate change, these events are becoming more intense and less predictable. The KWP acknowledges that employing state of the art science and technology is imperative to securing a safe, secure water supply for the state. Municipal conservation [and] public water supply emergency response plans… are among the essential tools.”

Priority Goal #3 of the Upper Smoky Hill Action Plan also directly pertains to the project at hand, asking “All municipal users within the planning region [to] be at or below the regional 2015 average gallons per capita per day (GPCD) within the next five years.” And to “follow best management practices and implement a conservation plan.”

iii. IMPLEMENTATION AND RESULTS

Describe the implementation plan for the proposed project. Please include an estimated project schedule that shows the stages and duration of the proposed work, including major tasks, milestones, and dates.

Timeline:

Start Date	End Date	Proposed Work/Major Task or Milestone
February 2025	March 2025	Funding and corresponding paperwork is complete
February 2025	March 2025	All equipment and supplies for AMI cellular meter reading system are ORDERED.
August 2025	September 2025	All equipment and supplies for AMI cellular meter reading system are IN HAND.
September 2025	February 2026	AMI cellular meter reading system is installed utilizing and upgrading existing infrastructure.

Proposals with a budget and budget narrative that provide a reasonable explanation of project costs will be prioritized under this criterion.

Budget and budget narrative are included in this application, but attached/uploaded separately.

Describe any permits and agency approvals that will be required along with the process and timeframe for obtaining such permits or approvals.

Identify and describe any engineering or design work performed specifically in support of the proposed project. What level of engineering design is the project currently? If additional design is required, describe the planned process and timeline for completing the design.

There are not currently any known permits, agency approval or engineering/design work needed for the project at hand. If such items arise, the City will diligently manage them.

Does the applicant have access to the land or water source where the project is located?

Yes, the City will invest in existing infrastructure by installing the AMI cellular meter reading system directly in the current meter pits, which are owned by the City. Besides the installation of new equipment in the existing meter pits, the AMI system will utilize existing cellular infrastructure for efficient and secure two-way communication of high-resolution meter reading data via cellular networks. The City will pay an annual software engagement fee to use the cellular network.

iv. NEXUS TO RECLAMATION

The City of Sharon Springs is located in Wallace County, Kansas, which is part of the Upper Smoky Hill Regional Planning Area (RPA) set forth by the Kansas Water Office (KWO). The Cedar Bluff Unit of the Pick-Sloan Missouri River Program is on the north side of the same Smoky Hill River, 18 miles southwest of Ellis, Kansas. It consists of an earthfill dam and reservoir and provides water to the Cedar Bluff National Fish Hatchery and to the city of Russell, Kansas. The unit also protects the downstream valley from floods.

Will the proposed work benefit a Reclamation Project area or activity?

While the project is small-scale, the City's added water efficiency, combined with other

regional adjustments to water consumption, do have the potential to positively affect the Cedar Bluff reclamation area, thereby benefiting municipal water Cedar Bluff provides, as well as recreation opportunities.

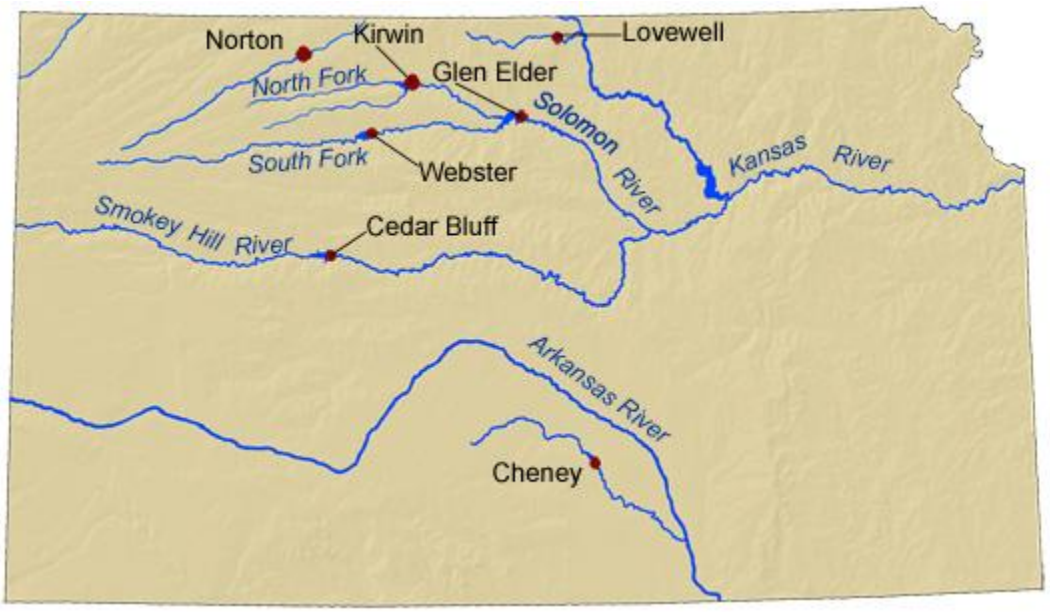

Image 8: Map highlighting Kansas waterways and showing the Cedar Bluff Unit of the Pick-Sloan Missouri River Program along the Smoky Hill River, as well as other Bureau of Reclamation projects.

v. PRESIDENTIAL & DEPARTMENT OF THE INTERIOR PRIORITIES

Does this proposed project strengthen water supply sustainability to increase resilience to climate change?

By investing in the City's existing infrastructure and upgrading the manual read meters to an AMI system, the proposed project aims to make more efficient use of water supplies.

The climate of the region is characterized by the highly variable precipitation and temperature common to mid-continent locations. Extreme weather events impact Kansas regularly. Climatologists have stated that climate change is occurring due to a global increase in anthropogenic greenhouse gas concentrations. As a result, Kansas is facing a warming trend in the future accompanied by a potential increase in the frequency, duration, and intensity of extreme events.

Kansas is one of the many states with a history of significant effects from drought. Adapting to changing conditions and minimizing harm from severe droughts is vital for Kansas water resource management and agriculture.

Drought mitigation planning is needed by all sectors that use water. Additional storage of water in reservoirs or aquifers would give Kansans greater ability to manage potential changes in precipitation timing, duration, and frequency, such as extended dry spells.

Conservation practices to extend and conserve groundwater resources, such as the proposed project, strengthen water supply sustainability and increase resilience to climate change.

Describe how the project benefits those disadvantaged or underserved communities.

The term "frontier and remote" is used to describe territory characterized by a combination of low population size and high geographic remoteness. The U.S. Department of Agriculture (USDA) Economic Research Service (ERS) categorizes Wallace County as a Level Four Frontier and Remote (FAR) area, where a majority of the population lives 60 minutes or more from an urban area of 50,000 or more; and 15 minutes or more from urban areas of 2,500-9,999 people. Level Four is the least populated and most remote of four possible levels.

Frontier areas, like Wallace County face unique challenges to providing access to health and human services compared to most other rural communities. These thinly populated regions cannot easily compete with the wages and amenities offered in metropolitan areas.

Rural communities are at higher risk than their urban counterparts for substance use, suicide, obesity, cigarette smoking, and death from unintentional injuries such as motor vehicle accidents. While many studies have identified health disparities for all rural communities, few have focused specifically on frontier and remote rural areas. According to a 2014 article in the Journal of Rural Mental Health, mental and behavioral health providers have recognized problems of substance abuse and domestic violence as significantly more prevalent in frontier areas.

By funding this proposed project in rural Kansas, the Bureau of Reclamation is advancing equity for all through the development and funding of programs that invest in disadvantaged or underserved communities.