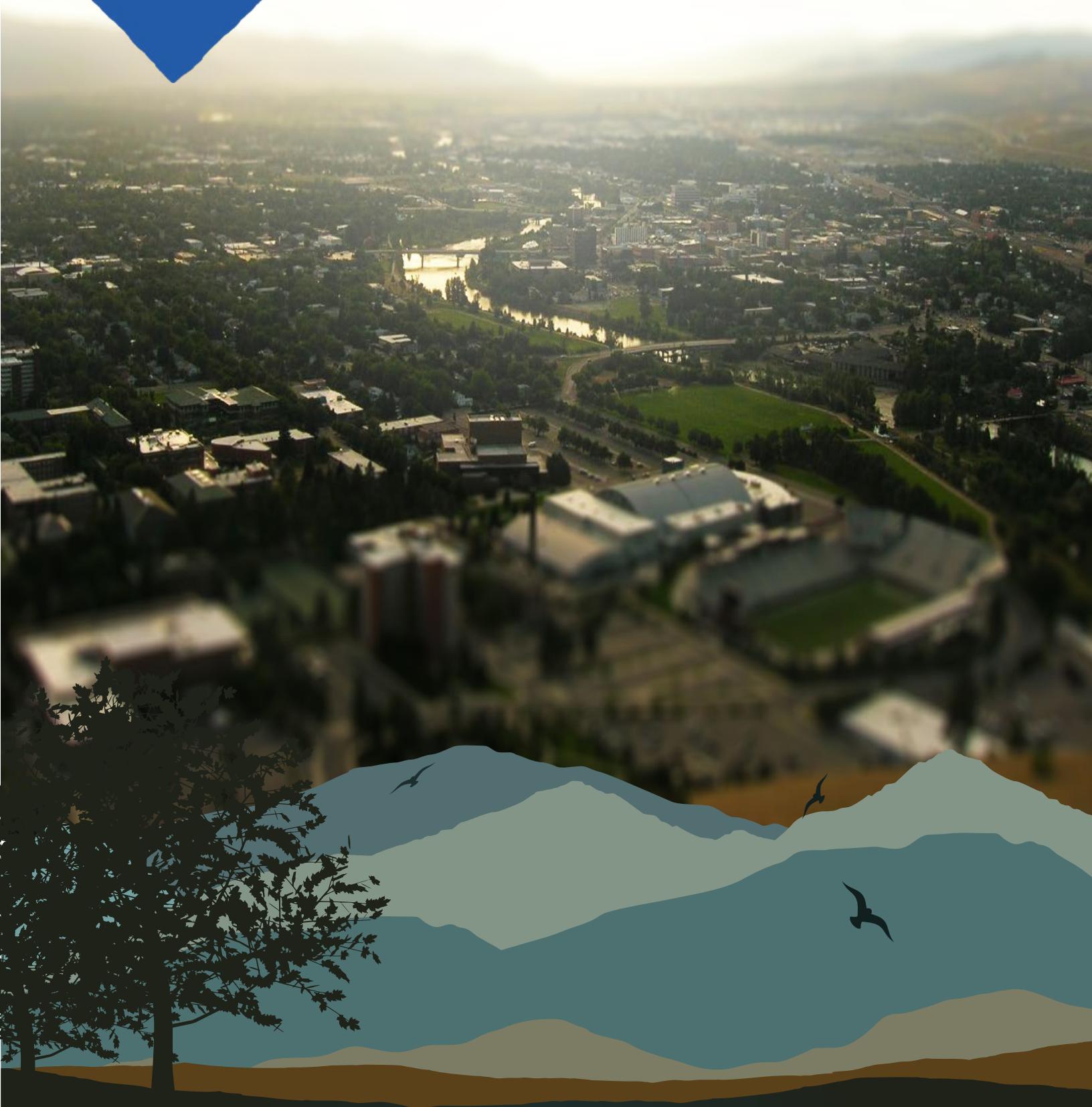




CITY OF MISSOULA
2018 Water System Master Plan



WATER MASTER PLAN PURPOSE

The purpose of the Water System Master Plan (WSMP) is to describe the existing system, define planning criteria and projected water demands, evaluate the existing facilities and infrastructure to identify capacity and operations related needs, identify system deficiencies (including fire flow, storage, and pressure), assess the reliability of the system, prepare a pipeline renewal plan, develop prioritized recommendations for improvement projects and prepare and document a comprehensive Capital Improvement Plan (CIP)

- Provide a description of the Missoula water system, including ownership history, water rights, and infrastructure
- Identify system deficiencies (fire flow, storage, pressure, etc.) under existing, 5-year, and 20-year growth scenarios
- Update and calibrate the hydraulic model of the system
- Complete a feasibility study of the Rattlesnake Wilderness dams
- Prepare a 5-year capital improvement plan

GOALS



Development and Growth: Implement growth and development strategies and policies that are consistent with other city utilities and provide water infrastructure to support continued sustainable growth in the community.



Long-term Water Supply and Water Rights: Evaluate the reliability and resiliency of the water supply, and provide recommendations for long-term water rights and water conservation strategies in alignment with the city's efforts toward sustainability.



Water System Leakage Reduction: Implement industry best practices to evaluate and report on system leakage over time. Implement strategies and policies that will reduce real water loss over time.



Key Water System Management and Operational Goals: Maintain or improve the level of service provided to customers, including enhancing city council and customer's knowledge of the water system and programs moving forward.

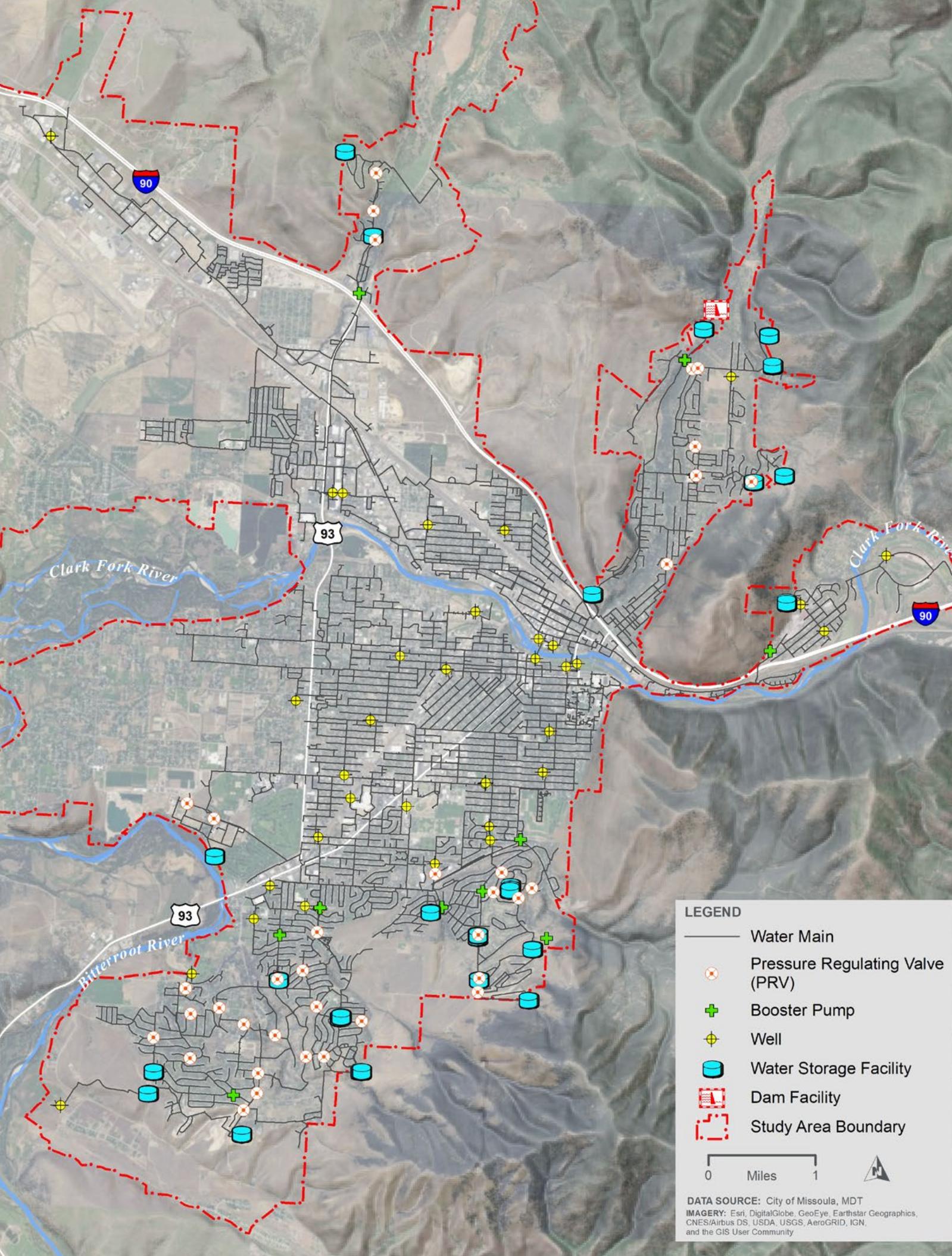


Water Quality: Ensure water quality criteria are met in the short and long-term, and provide adequate protection for the aquifer.

MISSOULA WATER SYSTEM HISTORY & TIMELINE

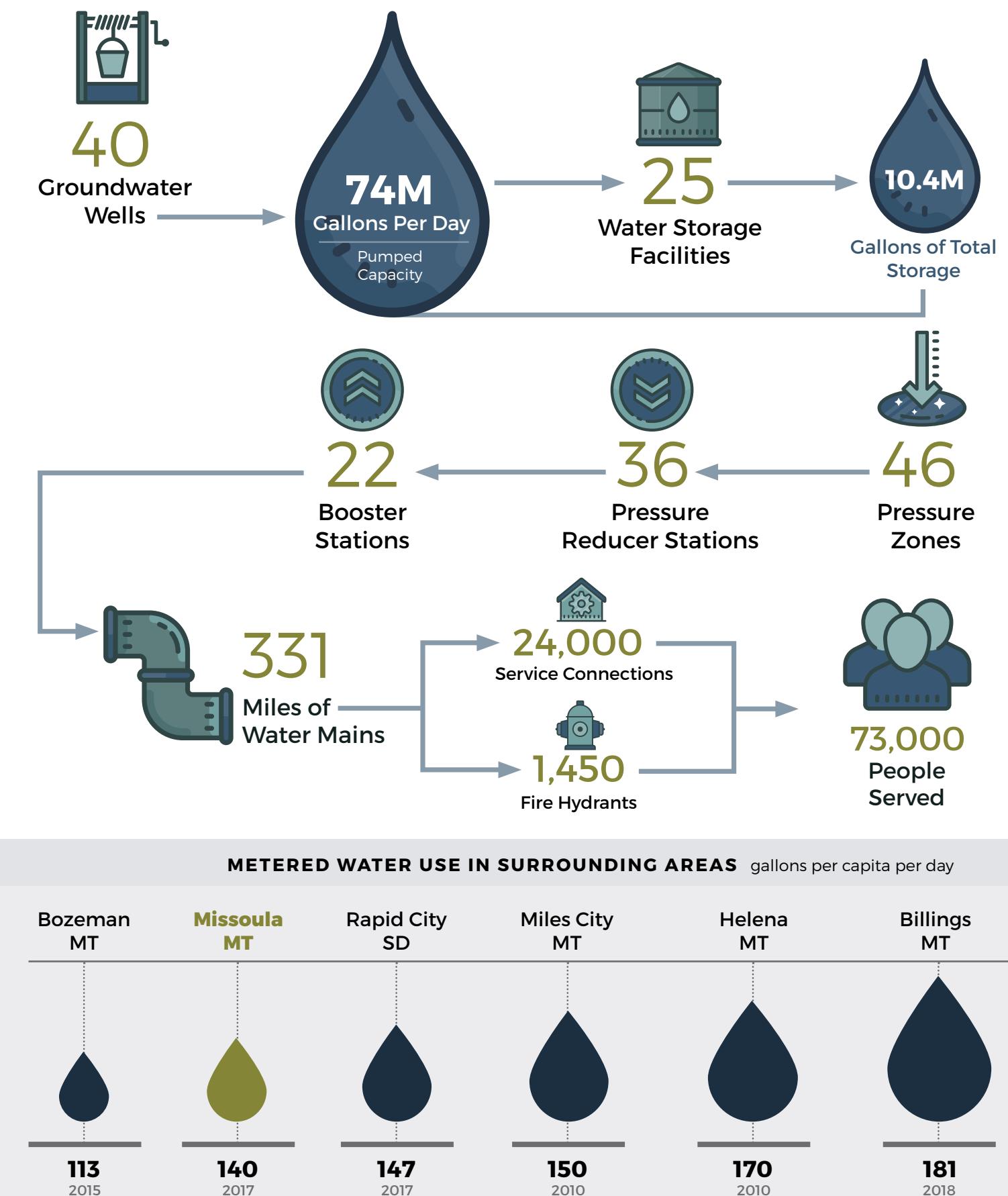
1860s	Early Missoula settlers use water from Rattlesnake Creek
1860s	Rattlesnake Creek Water Rights filing
1870s	
1885	Worden and Co. started constructing a water system
1895	Worden and Co. sold to Missoula Water Works and Milling Co.
1906	
1911-1923	Missoula Mercantile bought and renamed: Missoula Water Company
1930	W.A. Clark bought and renamed: Missoula Light and Water Company
1935	Rattlesnake Wilderness Dams constructed
1979	System was purchased by Montana Power Company
1983	Wells were drilled to augment Rattlesnake Creek supply
1991	Park Water Company purchased the utility
1999	Rattlesnake Creek discontinued as water source
2000	Park Water Company (PWC) acquired Clark Fork Water Company
2001	PWC acquired Fort Missoula system
2010	PWC acquired Linda Vista Water Company
2016	Carlyle Group purchased PWC
2017	Algonquin Power and Utilities Corp. purchased PWC
2018	City of Missoula took ownership of the water utility
	Water master planning process completed



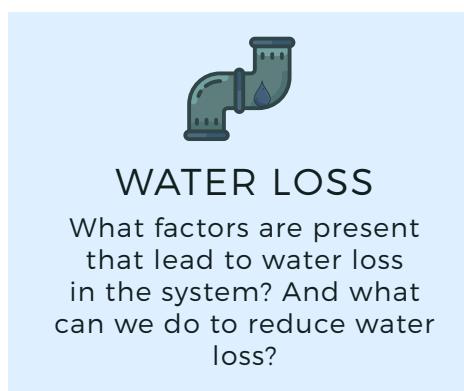
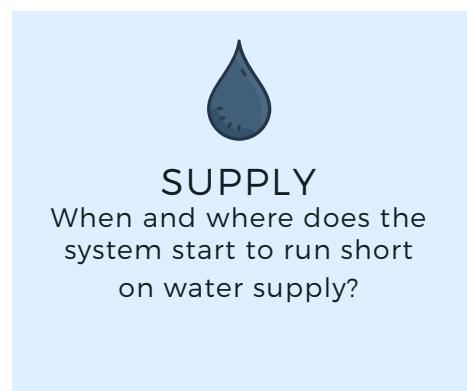
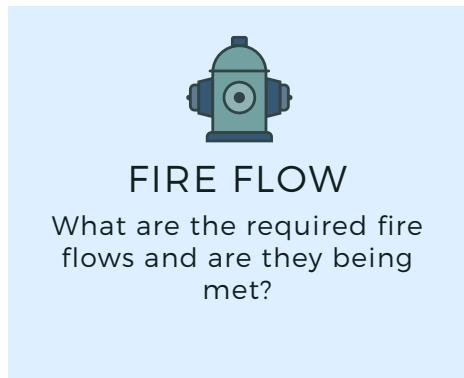
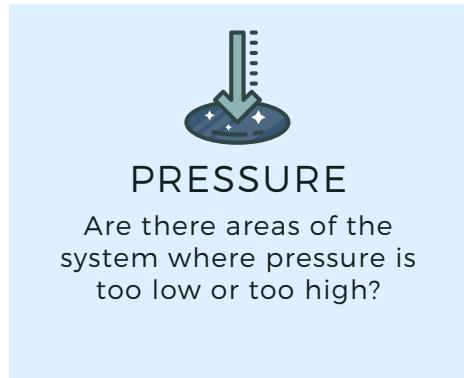


EXISTING WATER SYSTEM

101 million gallons per day of water rights at groundwater locations



EVALUATING THE WATER SYSTEM

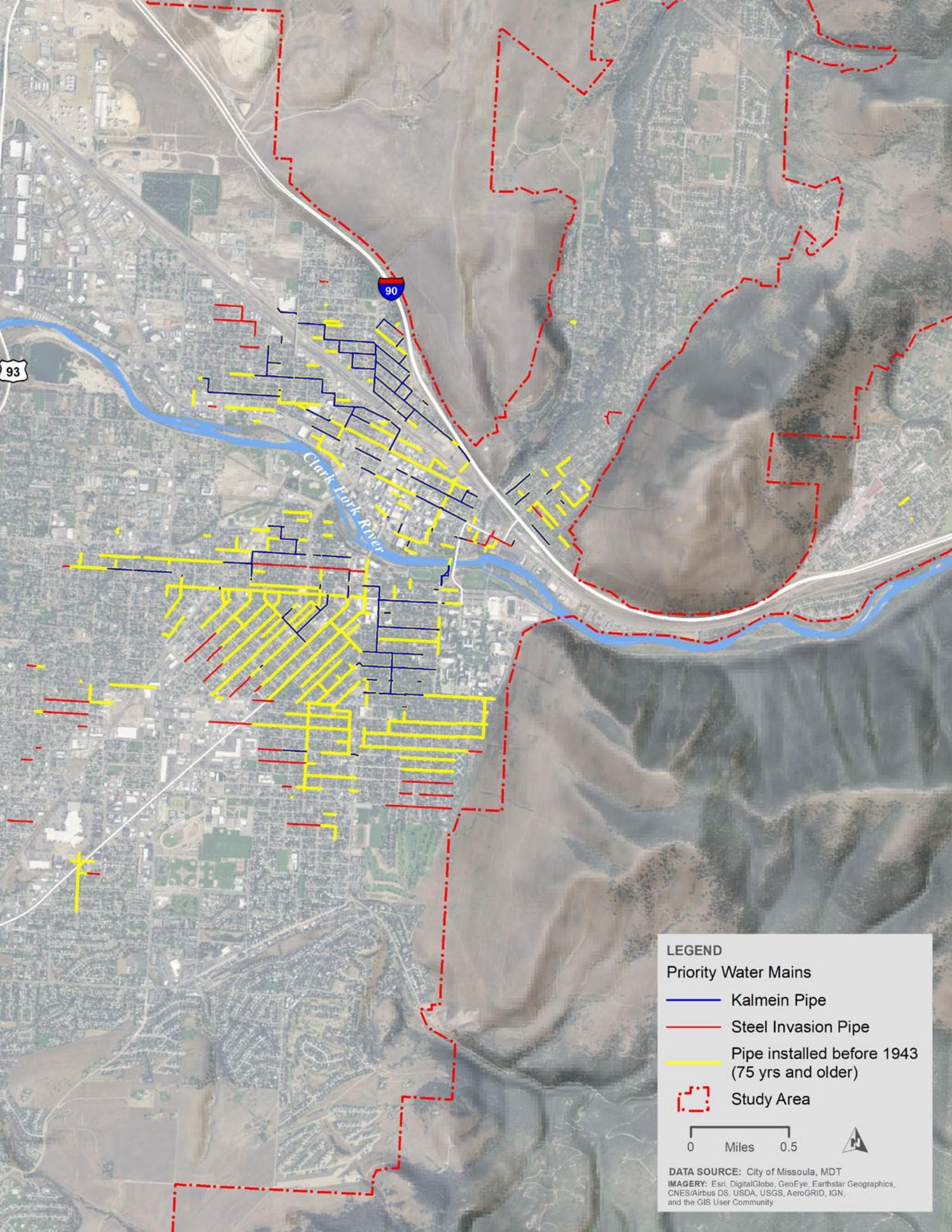


WATER MAIN REHABILITATION AND REPLACEMENT



Water mains are ranked based on a number of criteria that represent the likelihood and consequence of failure including number and location of leaks, pipe type, pipe age, pipe size, soil conditions, and community impacts.

The map to the right shows the water mains targeted for rehabilitation or replacement including steel invasion, kalamein, and pipes that are 75 years or older.



RATTLESNAKE WILDERNESS DAMS

TIMELINE



1911-1923

10 dams built on 8 lakes in present-day Rattlesnake Wilderness Area to augment water supply for City of Missoula

1983

City discontinued use of Rattlesnake Creek for water supply, maintained for emergency backup supply

2017

City acquired dams and water rights from Mountain Water Company

Originally built to augment water supply for the City of Missoula, these approximately 100-year old structures are approaching the end of their useful life. While it's difficult to predict when serious symptoms related to dam safety may appear, they would be inevitable in the future. Therefore, several options were evaluated for the dams including taking no action, rehabilitation, increasing storage, and decommissioning.

Those options were examined in terms of capital costs, life cycle costs, water rights, climate change, long-term community needs, regulatory agency requirements and goals, and environmental impacts.



CONSIDERATIONS

Preserve the Water Supply for Emergency Backup: The Rattlesnake Creek water source has been maintained as an emergency backup supply. It has limited value as a backup drinking water source because there is currently no means for water treatment, so any use of the source would require appropriate precautions.

Store Water for Late Season Flows in Rattlesnake Creek: Rattlesnake Creek is critical habitat for Bull Trout, which are a threatened species. Rattlesnake Creek flows are influenced by the snow pack and runoff from the watershed, and the flows diminish in late summer and early fall, often to less than 10 cfs. The dams provide a means to store spring runoff for release later in the season. This may help keep temperatures low as well.

Wilderness Area Considerations: As described in this report, the Wilderness Act of 1964 puts very strict limitations on wilderness areas in order to preserve the pristine, quiet, contemplative, and natural settings. Any alternative needs to closely examine the impacts of work and continued operation in a wilderness area.

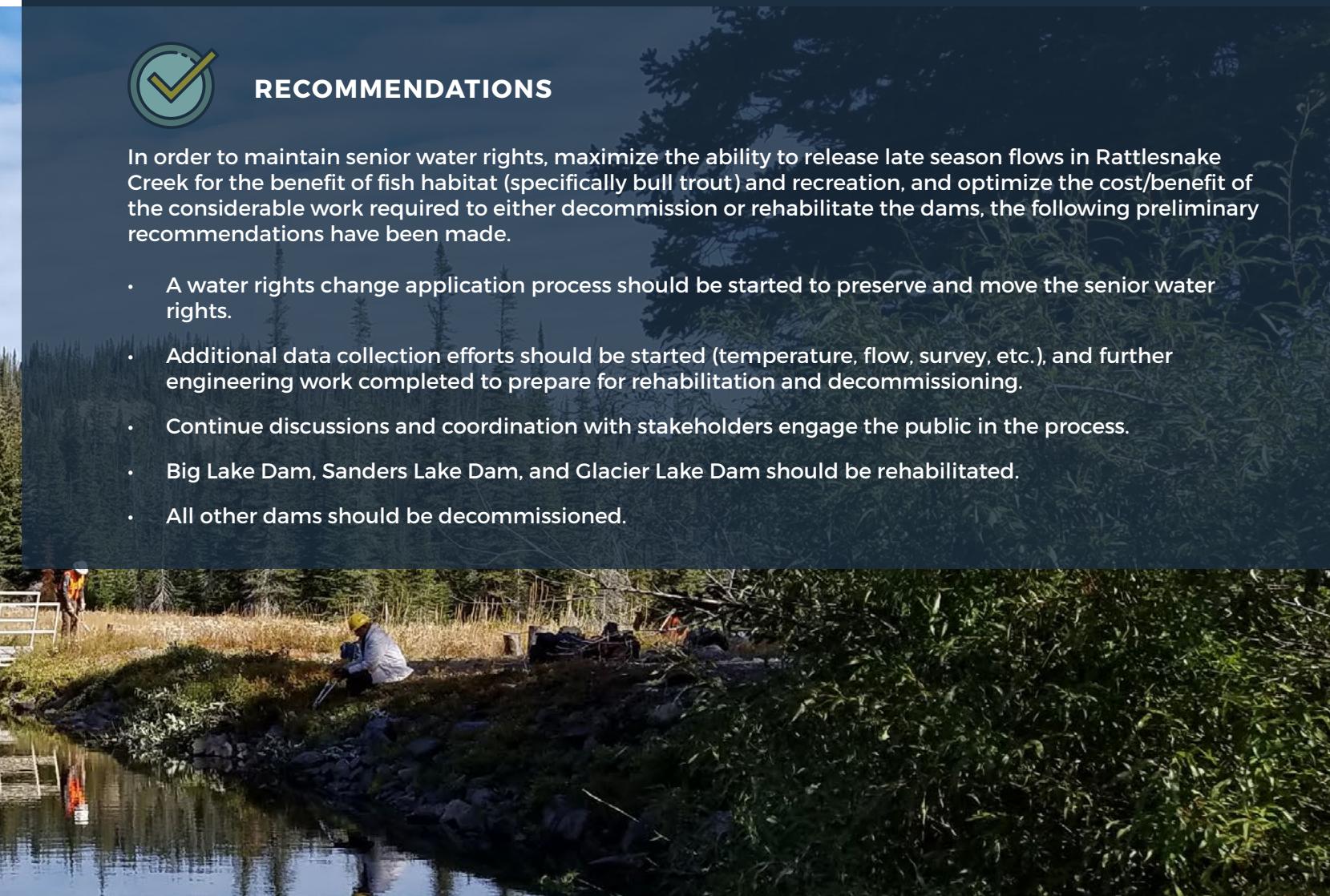
Water Rights Seniority: The City currently holds some of the most senior water rights in the basin at the Rattlesnake Dams. These rights have considerable value to the community and if the dams were decommissioned, those water right may be lost.



RECOMMENDATIONS

In order to maintain senior water rights, maximize the ability to release late season flows in Rattlesnake Creek for the benefit of fish habitat (specifically bull trout) and recreation, and optimize the cost/benefit of the considerable work required to either decommission or rehabilitate the dams, the following preliminary recommendations have been made.

- A water rights change application process should be started to preserve and move the senior water rights.
- Additional data collection efforts should be started (temperature, flow, survey, etc.), and further engineering work completed to prepare for rehabilitation and decommissioning.
- Continue discussions and coordination with stakeholders engage the public in the process.
- Big Lake Dam, Sanders Lake Dam, and Glacier Lake Dam should be rehabilitated.
- All other dams should be decommissioned.



PLANNING FOR THE FUTURE

UPDATING THE MODEL

THE CITY'S HYDRAULIC MODEL

Robust, calibrated, and highly accurate, including all infrastructure and actual customer meter data

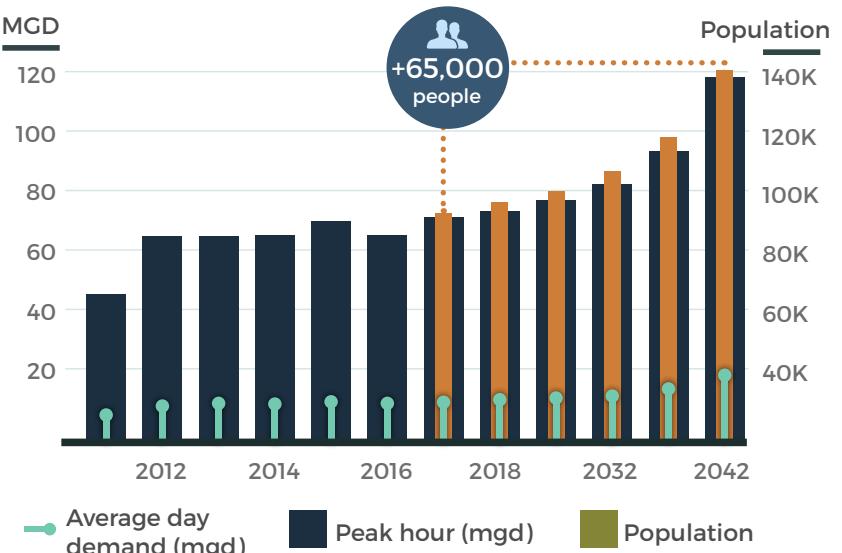
CALIBRATION PROCESS:

Comparing pressures in the model and the field and adjusting pipe roughness.

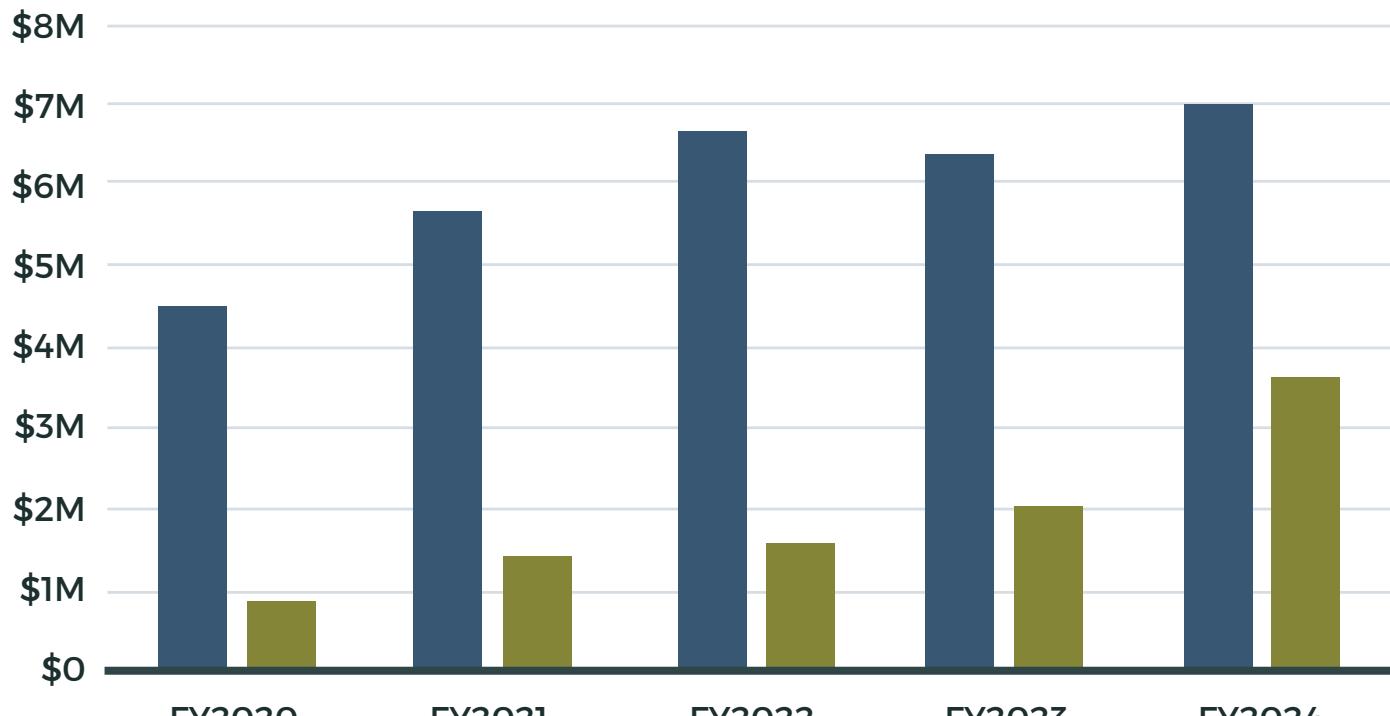
RESULTING MODEL:

Allows the City to perform simulations to evaluate system storage, fire flows, pressures, and velocities; and model what-if scenarios for new development or capital improvement

POPULATION VS. WATER DEMAND



CAPITAL IMPROVEMENT PLAN



Water Enterprise Fund

Growth and Development

KEY CAPITAL PROJECTS:

- Replace Upper Lincoln Hills Tank
- Replace Lower Lincoln Hills Tank
- 1 to 3 miles of water main rehabilitation or replacement annually
- New North Zone Water Tank
- New North Zone Well
- Crestline Tanks Abandonment
- New AMI water meter system
- Rattlesnake Intake Dam Removal (in partnership with Trout Unlimited)

