Water Treatment Plant Reverse Osmosis Pilot Study

Project Feasibility Report

March 24, 2026

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II. CERTIFICATION PAGE

CERTIFICATION

I hereby certify that this report was prepared by me or under my direct supervision and that I am a duly registered professional engineer under the laws of the state of Minnesota.

Mark Hardie

Mark Hardie, PE
License Number: 26665
Senior Project Manager

Date: March 12, 2026

III. PROJECT CONTACTS

TITLE	NAME	PHONE	EMAIL
Mayor	Najwa Massad	507.387.9693	nmassad@mankatomn.gov
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Associate Director of Public Utilities	Kyle Hinrichs	507-387-8588	Khinrichs@mankatomn.gov
Water Treatment Plant Superintendent	Aaron DuChene	507-387-8666	Aduchene@mankatomn.gov

IV. EXECUTIVE SUMMARY

The pilot study will help determine operating parameters and characteristics of the membrane filtration system that is proposed as a future project at the Mankato Water Treatment Plant. The Minnesota Department of Health (MDH) requires pilot studies for reverse osmosis membrane systems prior to approval and installation due to a change in the treatment process at a surface water treatment plant.

The City of Mankato is anticipating a 3-month pilot study due to MDH's requirements that the study demonstrate proof of treatment over the range of water quality and tests long enough to demonstrate cleaning procedures. The pilot will test Ultrafiltration and Reverse Osmosis for a period of 3 months, with the opportunity to extend longer if additional data collection is warranted. This study is planned to start in late spring 2026, running into the summer months to test a wide range of raw water temperatures. The major findings from the pilot study will address the following:

- Identify the suitable membrane element based on raw water quality and treatment projections.
- Compare and confirm whether pre-treatment (oxidation of iron/manganese) is necessary prior to the membrane processes.
- Quantify removal of targeted contaminants including dissolved iron, manganese, ammonia, nitrate, fluoride, hardness, total dissolved solids, total organic carbon, among other constituents.
- Determine and confirm design RO recovery and reject percentage.
- Determine and confirm design flux rate of membranes over a wide range of water temperatures.
- Confirm array staging (i.e., 2-stage system). Identify acceptable membrane pressures.
- Select RO pre-feed membrane conditioning chemicals (e.g. antiscalant) and determine/optimize required dosing. Identify membrane fouling potential based on water quality and pilot study performance.
- Determine anticipated cartridge filter life and membrane operating pressure for operational and maintenance (O&M) cost projections.
- Determine anticipated clean in place (CIP) frequency.
- Confirm RO bypass rate and verify finished blended water quality to meet finished water quality objectives for alkalinity buffer capacity.

V. PROJECT INTRODUCTION

The operation of a pilot will allow Mankato to determine if the construction and operation of an RO facility is compatible with our water quality as well as fiscally comparable to upgrading to current technology. The final report will provide details of percent removals and finished water quality results as well as the overall cost of operation vs conventional lime softening.

The existing water treatment plant receives water from (2) Ranney collector wells and (2) deep aquifer wells (Mt Simon Aquifer). These well sources are pumped and blended for a combined raw water source. The existing treatment consists of lime softening, recarbonation, ultrafiltration membranes, and chlorine disinfection.

A recent facility plan identified concerns at the WTP regarding aging equipment and capacity concerns at the WTP. To improve treatment, meet future demands, and conduct life cycle replacements of existing equipment, the facility plan recommends replacing the lime softening system with reverse osmosis.

Providing the pilot is successful, Mankato plans to implement a full-scale Reverse Osmosis system which would replace the traditional lime softening system. This technology would provide greater quality water, the volume needed to capture the recent growth, as well as provide the highest level of protection as future regulations may change.

The proposed project would take place over the summer of 2026. Council has authorized the utilization of HR Green to oversee the pilot protocol.

VI. PUBLIC ENGAGEMENT

No public engagement is required.

VII. APPROVALS/PERMITS

Approvals and permits are required from various agencies for the construction of the project. They include:

- Minnesota Department of Health Plan approval $250.00
- Electrical permit

VIII. PROJECT COST ESTIMATE AND FINANCING

Estimated projections for the cost of this project are summarized below.

ITEM	COST
Pilot Rental	$202,000.00
Contingency	$25,000.00
Engineering	$48,000.00
TOTAL PROJECT COST	**$275,000.00**

Funding for the proposed improvements is shown in the table below.

FUNDING SOURCE	AMOUNT	PERCENT
Wate Plant Capital	$275,000.00	100%
TOTAL FUNDS	**$275,000.00**	**100.00%**

IX. POSSIBLE SCHEDULE

The following is a possible schedule for the proposed improvements:

3/23/2026	Feasibility Report and Authorization to bid.
3/24/2026	Publish bids to qualified vendors – 21 day minimum.
5/11/2026	Bid Award
6/1/2026	Begin the three-month pilot.
10/1/2026	Pilot Study Report finalized.
10/26/2026	Resolution finalizing the 2025 facility plan with the pilot study recommendations.

X. CONCLUSION AND RECOMMENDATIONS

At the conclusion of pilot testing, optional as needed, a membrane autopsy will be performed, and a laboratory cleaning analysis, if determined to be beneficial, and all data will be evaluated. A pilot report will be completed by the RO system supplier to recommend design parameters for the full-scale system including design blended water quality and membrane projections for initial installation and 5-year operational time. A certified engineer report including the results of the pilot study and the basis of design for the full-scale design will be prepared by HR Green and sent to Minnesota Department of Health for their review and approval.

We recommend the Council accept this project feasibility report and approve of the competitive bidding for qualified vendors.

XI. APPENDIX

- Figure No. 1 – Pilot Study Proposal
- Figure No. 2 – Pilot Study Services Agreement