



## MEMORANDUM

Date: June 18, 2024

To: Mayor Satya Rhodes Conway  
City of Madison Common Council  
City of Madison Finance Committee  
City of Madison Water Utility Board

From: Pete Holmgren, PE – Chief Engineer  
Krishna Kumar, General Manager

Subject: Renewal for 2024-2027 of the Memorandum of Agreement  
between Madison Water Utility and the University of Wisconsin  
for the purpose of continued drinking water research

## RECOMMENDATION:

Staff recommends the renewal of a three-year Memorandum of Agreement (MOA), from 2024 to 2027, with Madison Water Utility (MWU) the University of Wisconsin (UW) to continue drinking water research with the goal to improve system water quality; increase energy efficiency; protect public health; and improve system operations and efficiency.

## BACKGROUND:

The collaborative research partnership between MWU and UW-Madison's Department of Civil and Environmental Engineering has been in place since September 2002. Since that time, 13 graduate students have completed an Master's Thesis having practical value to the utility and a 14th graduate student is working toward completion in December 2024.

There have been three general areas of research covered by these thesis reports to date:

- Free chlorine residual and control of microbial growth in the distribution system.
- Unidirectional flushing strategies for control of turbidity spikes in the distribution system.
- Energy saving strategies for system operational optimization.

Since its inception, the studies through this program have yielded significant annual savings in salaries and energy expenses for MWU. Savings are also expected to increase annually as system optimization and the research program continue to expand. Some key findings and/or cost savings for MWU to date in each of the general areas noted above are as follows:

- The chlorine residual and microbial control research led to a policy requiring a chlorine residual of at least 0.3 mg/L throughout MWU's distribution system. Prior to the

research, MWU maintained a “non-zero” chlorine concentration throughout the distribution system. This reduced need for follow-up microbial sampling and improved customer confidence in water quality.

- Unidirectional flushing research showed that approximately 60% of the distribution system could be unidirectionally flushed at a frequency of once every 2 to 3 years, instead of annually. This provided scientific support for a significant savings in person-hours and labor costs needed for unidirectional flushing. This also reduced the number of customer complaints and the costs of responding to those complaints.
  - **Current estimated annual MWU wage savings: \$90,000**
- Energy savings are best achieved by reducing the amount of drawdown, which can be achieved by installing variable frequency drives (VFDs) on deep well pumps. This was demonstrated by initially installing a VFD at Unit Well 30. Subsequent purchases and installations of VFD's were completed at Unit Wells 6, 9, 11, and 13; those five facilities are estimated to save over 840 MWh annually using VFD's, with overall payback periods of less than 5 years. VFDs could furthermore be installed with a payback period of 10 years or less on approximately half of the deep well pumps in the system.
  - **Current estimated annual MWU energy savings: Over \$75,000**
- Energy cost savings are best achieved by pumping at hours of reduced electrical costs, known as off-peak pumping, in MWU's various pressure zones. Off-peak pumping avoids surcharges from the energy companies that can cost approximately \$2,000 per month, per site. For example, findings showed that off-peak pumping in Pressure Zone 8 can save approximately 40% of the annual electricity costs in this portion of the system. About half of the well sites in MWU's system are now successfully run on schedules that avoid peak energy costs.
  - **Current estimated annual MWU energy savings: Over \$200,000**

Furthermore, intangible benefits to this collaborative research partnership between MWU and UW are the relationship building and knowledge resource sharing. Informal discussions of issues facing MWU, involvement in UW's Senior Capstone projects, and membership on the Water Quality Technical Advisory Committee provide invaluable benefit to MWU.

Please refer to the attachment summary of all projects and outcomes to date for greater detail.

### Scope of Work

The workflow for each Master's Thesis is as follows:

- Upon matriculation of the graduate student into the graduate program, the principal investigator (PI) meets with MWU staff and the graduate student to identify a research project having practical value for the utility and meeting the expectations of a successful Master's Thesis. An informal and flexible scope of work is defined for the specific project.
- The thesis work is conducted over a period of 1½ to 2 years, resulting in a final deliverable of the Master's Thesis.
- The following items are included in the scope:
  - Monthly meetings of the project team, including the PI, graduate student, and utility staff. These include:
    - Review of results obtained and challenges encountered since the previous progress meeting.
    - Identification of tasks to be performed before the next progress meeting.
    - Adjustments to scope of work, as needed.

- These typically revert from monthly meetings to twice a month once the student is within 2 months of the expected graduation date.
- Weekly meetings between the PI and graduate student.
- The student receives office space at both the university and the utility.
- The student receives access to utility-owned facilities, data, and software.
- Deliverables provided by the graduate student:
  - Draft thesis for utility review prior to thesis exam.
  - Final thesis for utility archives upon successful completion of thesis exam.
  - Presentation of project summary to the Water Utility Board at one of their monthly meetings, after successful completion of the thesis exam.

Intangible benefits to this collaborative research partnership between MWU and UW is the relationship building and knowledge resource sharing. Informal discussions of issues facing MWU, participation in Senior Capstone projects, and membership on the Utility Water Quality Technical Advisory Committee provide invaluable benefit to MWU.

Other areas of study being considered by MWU for the coming years include (but definitely are not limited to):

- System Pressure Optimization
- Leakage Management
- Water Conservation
- Asset Management
- Emerging Contaminants

#### **FISCAL IMPACTS:**

This MOA will be funded annually out of the Water Utility General Operating Budget based on the cost schedule attached to the MOA. Maximum costs per academic year shall be:

- 9/1/2024 – 8/31/2025: \$58,574
- 9/1/2025 – 8/31/2026: \$60,383
- 9/1/2026 – 8/31/2027: \$62,276
- **3-Year Total:            \$181,233**

#### **LEGISLATIVE PATH:**

- Common Council:    6/18/2024 (Introduction)
- Finance Committee: 6/24/2024
- Water Utility Board: 6/25/2024
- Common Council:    7/2/2024 (Final Action)

#### **ATTACHMENTS:**

1. Memo (this document)
2. DRAFT of MWU-UW MOA and Cost Schedule
3. Summary of MWU and UW Research Projects