

Internal Monitoring Report

Policy # O-2E Sustainability

Date: July 27, 2021

Frequency: Twice a year

Policy Language:

Madison residents will benefit from a sustainably managed ground water supply to ensure that water is available to protect public health, and to maintain and improve the economy and environment in Madison, now and in the future.

Accordingly,

- 1. Aquifers and wells will be monitored and the data evaluated to identify trends in water levels and potential contaminants.*
- 2. Appropriate city, county, state and federal agencies will be called upon to enforce all pollution control and prevention measures within their authority, in order to protect water quality in the well head protection area of each unit well.*
- 3. The adopted Conservation Plan shall be monitored and evaluated regarding progress to fulfill its goals. Plan goals should include reductions in energy use, avoiding the cost of additional wells, and minimizing complications related to over-pumping the groundwater system.*
- 4. To prevent over pumping and improve redundancy, the Utility's service level for capacity planning shall be 50% utilization for each unit well. Therefore, the Utility shall strive to limit the average pumpage to 50% of the annual rated capacity of each well. This can be achieved through water conservation, water supply system expansion, and operating procedures.*
- 5. The Utility shall track the carbon footprint of Utility operations using quantitative tools (for example, energy intensity analysis) so that sustainability may be considered in planning for water treatment facilities, distribution system improvements, and other infrastructure projects.*

General Manager's interpretation and its justification:

This policy prescribes certain activities intended to ensure the long term environmental, public health, and economic sustainability of Madison's water supply. Our actions relating to these objectives are detailed below.

Data directly addressing the General Manager's interpretation:

- 1. Aquifers and wells will be monitored and the data evaluated to identify trends in water levels and potential contaminants.*

Aquifer Levels

The water levels in the aquifers beneath Madison continue to be monitored on a routine basis. A deep groundwater monitoring well located in the basement of the State Capitol has provided

water levels since 1946. A review of the monthly data indicates aquifer levels continue to vary on a seasonal basis, a direct result of discharge (COM pumping) and recharge (precipitation.)

As in past years, winter water levels were higher than those experienced during the summer months. On average, levels were as much as 5 feet higher during the months of November through April. Overall, aquifer levels appear to be increasing or rebounding with an increase of approximately 18 -20 feet since 2005. This is a good indication that the local aquifers are in the process of rebounding/recovering to pre-pumping levels. Recent data suggest that this rebound might be slowing or leveling off. To date, levels in 2021 were slightly lower than those experienced during the past 2 years. The water levels beneath the central part of our city during the last 30 years are displayed in Figure 1 and the overall trend line has been trending upwards.

Water Levels – Water Utility Wells

The static and pumping water levels in many of the Utility's wells varied slightly during the first six months of 2021. However, almost all of the wells experienced progressively lower water levels as the year developed. Late May and early June were very hot and dry with MWU pumping a higher than normal volume of water. We had precipitation in late June/early July and many of the water levels (static and pumping) have increased/rebounded slightly.

Longer term, static and pumping levels in most of the MWUs wells have been increasing over the last 10 years. Levels continue to fluctuate seasonally and are greatly influenced by both pumping and precipitation events. Sufficient water levels in all of the wells appear to be sustainable for the near future.

Total precipitation during the first half of 2021 was below average. Madison received 11.8 inches of precipitation from January through June, 2021 which is about 4.6 inches less (28% less) than the six month average of 16.4 inches. Although it is anticipated that precipitation amounts in the Madison area will be above average into the near future, there will be periods of lower than normal precipitation. This is important to note as the aquifers are recharged to a great extent by precipitation events.

UW 29 Sentinel Well

Water from the sentinel monitoring well located between UW 29 (829 N. Thompson Drive) and the Sycamore Landfill, located to the north-west, continues to be monitored for both inorganic and volatile organic compounds on a semi-annual basis. Sampling is typically conducted in April and October of each year with 24 sampling events conducted to date.

The well was sampled on April 29 of this year. Sampling results indicate that the migration of contaminants from the Sycamore landfill is **not** a significant threat to water quality at Unit Well 29 at this time. This well continues to pump at half capacity on a 24/7 basis (1.5 mgpd).

UW 8 Sentinel Well

The Utility is in the process of siting and installing a deep monitoring well by early fall this year at a location between the Madison Kipp Corporation (MKC) groundwater contaminant plume

and UW 8. This well will be drilled and screened at a depth below the Eau Claire shale layer. This will be the first monitoring well in the area set within the lower aquifer. A location adjacent to the school appears to be an ideal location (Figure 2.) Here it can be sampled in tandem with MKC's shallower well nest MW-25, which is screened above the Eau Claire shale.

Initial sampling of this well will provide MWU with deep groundwater quality information immediately north of the unit well. Subsequent routine sampling will provide an early warning (sentinel system) for any migrating contaminants.

UW 18 Borehole Rehabilitation

The specific capacity and the flow rates at UW 18 had dropped significantly over the last 10 years. The pore spaces near the surface of the borehole had become severely plugged with deposits, limiting its permeability. As a result, the pump was pulled and the borehole was treated both mechanically and chemically. The well was out of service from March 3 through June 12 of this year for the rehabilitation work. The project proved successful, restoring the specific capacity of the well and increasing its flow rate by about 600 gpm.

UW 19 – Radium/Iron/Manganese Removal Study

A pilot scale test to remove radium, iron, and manganese has been completed at UW 19. The conclusions and results of this study will be utilized in designing the appropriate filter system for this site. The design work, including plans & specs, for the filter system is scheduled to be completed in 2022 with construction in 2023.

UW 14 - Chloride Study

A mitigation study regarding the chloride contamination at Well 14 is scheduled for later this year. During this study, water from the bore hole will be sampled and analyzed for chloride at various intervals or depths utilizing a packer and pump sampling system. If the chloride entry points/depths within the borehole can be determined, a remedial option might be devised to restrict these areas within the well. A project page and email distribution list have been developed to keep neighbors and customers up to date on any future progress.

UW 15 – PFAS Removal

UW 15 has been out of service since March of 2019 because of PFAS concerns. The Utility is reviewing possible remedial options that might be applicable at this site. A consultant, TRC/Evoqua, was recently hired to conduct a feasibility study on the removal of PFAS from the water at UW 15. The results of this study will be used to determine possible treatment techniques, designs, and system costs. The Utility is currently waiting for a draft of the final report.

2. Appropriate city, county, state and federal agencies will be called upon to enforce all pollution control and prevention measures within their authority...

The Utility continues to work with the Mayor's office, City Engineering, Public Health, the WDNR, and the WGNHS in addressing contaminated groundwater issues within the City limits.

3. The adopted Conservation Plan shall be monitored and evaluated regarding progress to fulfill its goals. Plan goals should include ...

MWU pumped a total of 4.3 billion gallons of water to the distribution system during the first half of 2021 (Table 2). This is approximately 1.2% more than what was pumped at this point last year. 2021 average, max and min day volumes:

2021 Average Day: 23.9 mgpd (last year 23.5 mgpd)
2021 Max Day: 36.1 mgpd on June 10 (last year 30.1 mgpd - June 18)
2021 Min Day: 19.6 mgpd on January 11 (last year 18.8 mgpd – April 19)

As mentioned earlier in this report, precipitation for the first half of 2021 has been below average. In addition, rainfall events have occurred on an irregular basis resulting in periods of higher than normal pumpage.

Residential consumption in gallons per capita by year:

Year	Single Family ¹	Multi Family ²	All Residents ³
1980–2000	81.5		
2002–2007	71.8		
2008	69.8		
2009	67.8		
2010	65.0		
2011	65.2		
2012	70.3		
2013	61.0		
2014	62.2		
2015	60.9	55.0	
2016	55.4	46.7	51.4
2017	55.4	46.0	51.1
2018	53.0	44.3	48.9
2019	50.8	43.1	47.1
2020	55.5	45.1	50.5
2021	In Progress		

Goal: 2020 58.0 *

¹ Average per-person daily consumption for Single family only (includes duplexes).

² Average per-person daily consumption for multi-family residents only (includes apartments).

³ Average per-person daily consumption for **all** Madison residents - includes people living in both single-family homes, duplexes and apartments.

4. To prevent over pumping and improve redundancy, the Utility's service level for capacity planning shall be 50% utilization for each unit well.....

Our service level for capacity planning is 50% utilization. One of the ways to accomplish this level is through system expansion and/or modification. The Utility continues to propose and build additional booster stations, PRVs, and new well facilities to help achieve this goal. In addition, variable frequency drives (VFDs) are being added to existing motors/pumps each year to optimize system flows.

Overall, utilization rates during the first half of 2021 were very similar to those experienced in 2020. Through June 30, 2021, three different wells (11, 12, and 30) slightly exceeded the 50% utilization rate (see table 1). The overall well utilization rate is 38%. Well repair/reconstruction projects/weather and the necessary use of seasonal wells on a year round basis continue to significantly influence individual well rates.

The addition of VFDs on the deep wells at a number of its sites has allowed the Utility to directly minimize the utilization rates of these wells. In addition, they will help in lowering the Utility's electrical costs. Fifteen deep wells currently have VFDs. Wells 11, 16, and 20 are scheduled to get VFDs on their deep wells later this year.

Indirectly, VFDs on booster pumps have also allowed us to minimize deep well pumping at some sites. MWU recently installed VFDs on the booster pumps at Well 18. The booster pumps at BS 128 are scheduled to get VFD installs later this year.

MWU continues to automate the operations at a number of its well sites utilizing its SCADA system. Certain wells and boosters now operate on a time basis, insuring that a certain amount of run time/volume is produced on a daily basis. This, where implemented, has allowed us to control utilization rates significantly. We will continue to expand the automated operations where possible in the near future.

MWU is also currently planning/working on several construction projects which will affect utilization rates:

- The reconstruction of UW 12, making it a two zone well, will allow optimization of utilization rates for the wells in the far west pressure zones (Zones 7 and 8). This project is scheduled for 2024.
- The construction of Booster Station 129 on the Far East side of the city. The addition of this facility will reduce utilization rates at UW 25, the only well site located in Zone 3. This project has not been officially scheduled.
- The installation of several Pressure Reducing Valve (PRV) stations to allow the transfer of water between pressure zones. The valves would be equipped with electronic actuators controlled through the Utility's SCADA system. Two of these stations, which can be installed using MWU personnel, are planned for 2022.

5. The Utility shall track the carbon footprint of Utility operations using quantitative tools (for example, energy intensity analysis) so that sustainability may be considered in planning...

The Utility has budgeted for an UW student intern position in the current budget and is planning to hire the intern this fall to track the carbon footprint of our operations.

Attachments:

Aquifer Water Level Graph
UW 8 Sentinel Well Proposed Location
Unit Well Capacity Table
Year to Date Well Production Report