

Internal Monitoring Report

Policy # O-2E Sustainability

Date: July 23, 2019

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 the goal of a 20% reduction per capita residential use of water by 2020, which equates to 58 gallons/capita/day. (Residential is defined as single family and duplex dwellings.)
4. The water supply system shall be expanded so that the pumpage from individual unit wells shall not exceed 50% of the annual rated capacity of the unit well.
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.
6. Water rates will complement economic growth in Madison (as stated in 0-2D).

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.

Water 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 levels continue to vary on a seasonal basis, a direct result of demand (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 12 feet higher during the months of November

through April. Overall, aquifer levels appear to be increasing or rebounding with an increase of approximately 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. Levels during the winter 2018 and spring of 2019, however, were significantly higher than in past years. It will be interesting to see if these levels continue to rise in the near future. The water levels beneath the central part of our city during the last 30 years are displayed in Figure 1.

The static and pumping water levels in many of the Utility's wells varied slightly during the first six months of 2019. Variations however, were significantly less than those experienced during past years (i.e., 2012) when we were subject to extremely hot and dry summer conditions. Water levels in the Utility's wells continue to fluctuate seasonally and are greatly influenced by both pumping and precipitation events. A review of the recent water level data indicates that, with the exception of several wells, many of the water levels (static and pumping) are dropping as summer demands increase. The decrease in water levels is very minor and less than that experienced at this time last year. Sufficient water levels in all of the wells appear to be sustainable for the near future.

Total precipitation during the first half of 2019 was above average. Madison received 21.0 inches of precipitation from January through June, 2019 which is about 4.7 inches more (28.8% more) than the six month average of 16.3 inches. It is anticipated that precipitation amounts in the Madison area will continue to be above average into the near future. 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 well located between UW 29 and the Sycamore Landfill 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 twenty samplings conducted to date.

The April 2019 sampling indicates 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.

Madison Kipp Corporation/UW #8 Sentinel Well

The Madison Kipp Corporation (MKC) continues to run its groundwater extraction and treatment system at its Waubesa Street site. The remedial system is being utilized to remove volatile organic compound (VOC) mass and hydraulically contain VOC contaminated groundwater present in the upper bedrock aquifer beneath the site.

The Utility continues to work with MKC, their consultant, the WDNR, and the WGNHS on the area's groundwater contamination issues. Groundwater at and adjacent to the facility continues to be monitored routinely for VOCs. The most recent groundwater results from October, 2018 and April 2019 samplings indicate that PCE levels in the groundwater between the site source and UW 8 remain relatively constant. The southeastern extent of the plume appears stable with

the edge approximately 600 horizontal feet from UW 8. Levels within the extraction well's zone of contribution continue to decrease (improve).

The sentinel well planned for the UW 8 area has been postponed because of budgetary constraints. This deep monitoring well was to be installed at a location between the Madison Kipp Corporation groundwater contaminant plume and UW 8. Initial sampling would have provided MWU with deep groundwater quality information immediately north of the unit well. Subsequent routine sampling would have provided an early warning for any migrating contaminants. It is hopeful that this well can be installed in the near future.

UW 27 Radium Study/Monitoring Well

This study, including the groundwater monitoring well, has been put on hold until the appropriate funds become available

UW 19 - Radium Removal Study

A pilot scale test to remove iron, manganese and radium was recently completed at UW 19. The conclusions and results of this study will be utilized in designing the appropriate filter system for this site. The construction of the filter system has been postponed until the year 2023.

UW 14 - Chloride Study

The investigation into potential sources of chloride contamination at Well 14 is on-going. The monitoring activities of the two water table monitoring wells located in Spring Harbor Park were concluded in June of 2019. The data collected to date, which includes chloride and sodium concentrations, is being compiled. Results of the study should be available in the near future.

UW 31 - Zone 4 Production Well

Construction of the well facility at 4901 Tradewinds Parkway is now complete. This newly constructed well facility is able to provide 2.5 - 3.0 million gallons of water a day into Zone 4.

The WDNR continues to monitor the groundwater monitoring and remedial activities associated with the GE Health care site, a contaminated site located to the northeast of UW 31. There are no new updates to report for this site. To date, no TCE or any other volatile organic compounds have been detected at the Tradewinds Parkway well. The Tradewinds Parkway site is located over 6000 feet from the source of the TCE contamination.

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 the goal of a 20% reduction per capita residential use of water by 2020...*

MWU pumped a total of 4,413,214,000 gallons of water to the distribution system during the first half of 2019. This is approximately 2.5% less than the 4,526,942,000 gallons pumped during the first half of last year (2018).

Average Day: 24,382,000 gpd (last year 25,011,000 gpd)

Max Day: 29,660,000 gpd on June 5 (last year 34,750,000 gpd on May 30)

Min Day: 19,090,000 gpd on January 1 (last year 19,880,000 gpd on January 7)

As mentioned earlier in this report, precipitation for the first half of 2019 is currently above average. In addition, rainfall events have occurred on a fairly regular basis limiting the number of heavy pumpage days.

Residential consumption in gallons per capita by year:

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			

Goal: 2020 58.0 *

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

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

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

4. *The water supply system shall be expanded so that the pumpage from individual unit wells shall not exceed 50% of the annual rated capacity of the unit well.*

Our service level for capacity planning is 50% utilization and system expansion is being planned to accomplish this level. The Utility continues to propose and build additional booster

stations 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 2019 were very similar to those experienced in 2018. Through June 30, 2019, five different wells (11, 12, 14, 18, and 30) exceeded the 50% utilization rate (see table 1). The rates at two of the wells (11 and 12) can be decreased by increasing pumpage at adjacent sites. Rates at the other three well sites however, cannot be lessened without improvements to the Utility's infrastructure (14 and 30) and well boreholes (18). Well repair/reconstruction projects 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. Eight deep wells currently have VFDs - 7, 15, 17, 23, 25, 29, 30, and 31. Wells 6 and 13 are scheduled to get VFDs on their deep wells next 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 Wells 12 and 25. The booster pumps at Wells 9 and 27 are scheduled to get VFDs installed on their booster pumps next year.

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

- The connection of an existing booster pump located at UW 9 (Zone 4) to Zone 6E. This connection project, which is scheduled for 2020, will make UW 9 a two zone well. The transfer of water from Zone 4 to Zone 6E will allow the Utility to lower the utilization rates of several Zone 6E wells while increasing rates for 9 and 31.
- 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 a new well on the far west side of the city. The project would lower the utilization rates for all of the wells located in Zone 8. It is projected to occur in 2025.

Energy Conservation Assessment

Adam Luthin, a former graduate student with MWU, completed his work on his energy conservation and system optimization project. His work included:

- 1) Identifying pumping design criteria that optimized energy conservation.
- 2) Identifying projects with the highest potential for energy reduction.
- 3) Evaluating, recommending, and demonstrating energy conservation projects to MWU.
- 4) Laying the framework for system operational optimization.

A new graduate student will be brought on board shortly to identify additional opportunities for energy conservation.

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 City of Madison calculates the carbon footprint of all of its departments every two years. The Utility is waiting for the results of the most recent analysis conducted by the City. The Utility is in the process of doing an in house analysis for the year 2018.

6. Water rates will complement economic growth in Madison (as stated in O-2D).

The board recently removed this policy point from its Affordability Outcomes Policy (O2-D).

I report compliance.

Attachments:

Aquifer Water Level Graph

Unit Well Capacity Table

Figure 1: Aquifer Water Levels - State Capitol Well

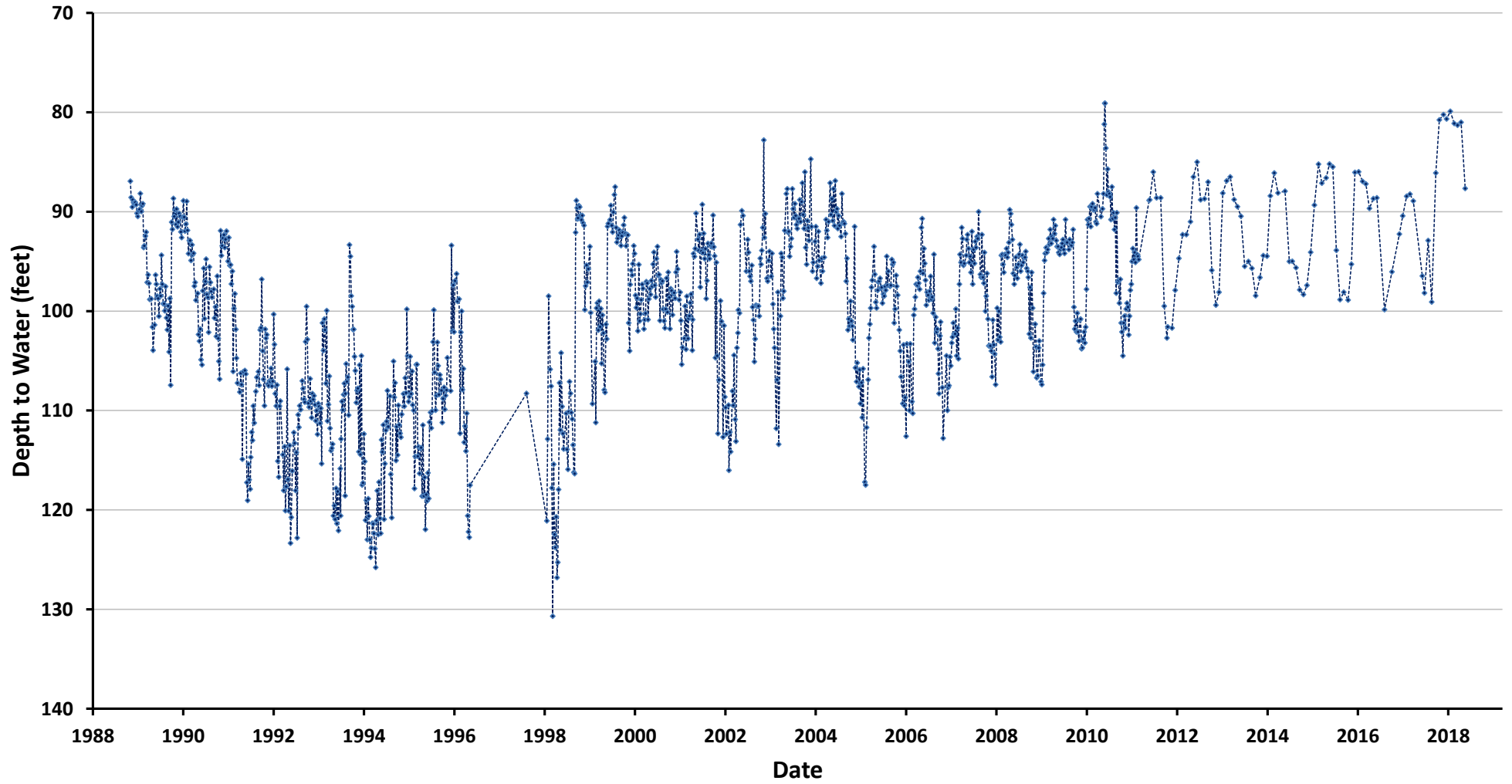


Table 1: 2019 Unit Well Capacity

Start Date: January 01, 2019

End Date: June 30, 2019

Unit Well	Well Capacity GPM	Total Daily Capacity MGD	Total Capacity To Date Mil Gal	Actual Pumpage To Date Mil Gal	% Well Utilization		Well Run Hours To Date	Well Rest Hours To Date	% Well At Rest To Date	% Well Running To Date
6	2,650	3.8	690.7	199.4	28.9%		1,246.1	3,097.9	71.3%	28.7%
7 *	2,200	3.2	573.4	279.5	48.7%		2,471.2	1,872.8	43.1%	56.9%
8	1,980	2.9	516.1	0.0	0.0%		0.0	4,344.0	100.0%	0.0%
9	1,640	2.4	427.4	111.6	26.1%		1,120.2	3,223.8	74.2%	25.8%
11	2,090	3.0	544.7	304.0	55.8%		2,379.9	1,964.1	45.2%	54.8%
12	2,160	3.1	563.0	342.1	60.8%		2,580.0	1,764.0	40.6%	59.4%
13	2,620	3.8	682.9	202.1	29.6%		1,284.3	3,059.7	70.4%	29.6%
14	2,450	3.5	638.6	393.1	61.6%		2,653.6	1,690.4	38.9%	61.1%
15 *	2,200	3.2	573.4	52.3	9.1%		787.7	3,556.3	81.9%	18.1%
16	2,400	3.5	625.5	256.7	41.0%		1,676.6	2,667.4	61.4%	38.6%
17 *	2,290	3.3	596.9	142.3	23.8%		1,551.8	2,792.2	64.3%	35.7%
18	1,620	2.3	422.2	237.7	56.3%		2,443.1	1,900.9	43.8%	56.2%
19	2,350	3.4	612.5	174.3	28.5%		1,223.0	3,121.0	71.8%	28.2%
20	2,025	2.9	527.7	218.7	41.5%		1,785.2	2,558.8	58.9%	41.1%
23 *	1,310	1.9	341.4	0.0	0.0%		0.0	4,344.0	100.0%	0.0%
24	2,025	2.9	527.8	182.7	34.6%		1,427.0	2,917.0	67.2%	32.8%
25 *	2,000	2.9	521.3	164.4	31.5%		1,724.3	2,619.7	60.3%	39.7%
26	2,250	3.2	586.4	230.7	39.3%		2,079.8	2,264.2	52.1%	47.9%
27	1,775	2.6	462.6	14.8	3.2%		128.2	4,215.8	97.0%	3.0%
28	2,300	3.3	599.5	234.7	39.2%		1,656.4	2,687.6	61.9%	38.1%
29 *	2,200	3.2	573.4	275.4	48.0%		4,165.6	178.4	4.1%	95.9%
30 *	2,400	3.5	625.5	331.9	53.1%		4,031.2	312.8	7.2%	92.8%
31 *	2,200	3.2	573.4	95.24	16.6%		1181.3	3162.7	72.8%	27.2%

* Denotes wells with variable frequency drives (VFDs)