Permit Fact Sheet

General Information

Permit Number:	WI-0063088-04-0
Permittee Name:	Madison Gas & Electric Compensatory Recharge
Address:	P.O. Box 1231
City/State/Zip:	Madison WI 53701-1231
Discharge Location:	NW ¼ of NW ¼ of Section 32, T7N, R9E
Receiving Water:	Groundwaters of the Yahara River and Lake Mendota Watershed
StreamFlow ($Q_{7,10}$):	N/A
Stream Classification:	N/A
Discharge Type:	Existing Intermittent

Facility Description

Madison Gas and Electric operates a groundwater recharge facility as part of a requirement under Water Loss Approval #3-SC-2003-13-2141LR. The facility operates by drawing surface water from the Odana Hills Golf Course pond and filtering it via a microfiltration system. The filtrate is then pumped to an infiltration gallery located within the golf course where the water percolates into the ground. The infiltration gallery is surrounded by a groundwater monitoring system consisting of four water table monitoring wells and two piezometer monitoring wells. Filter backwash is discharged to the sanitary sewer.

Substantial Compliance Determination

After a desktop review of all discharge monitoring reports, groundwater monitoring reports, compliance schedule items, and a site visit on September 11, 2023, this facility has been found to be in substantial compliance with their current permit.

Compliance determination entered by Compliance Engineer Kenzie Ostien on October 8, 2024.

Sample Point Designation		
Sample Point Number	**Discharge Flow, Units, and Averaging Period**	**Sample Point Location, Waste Type/Sample Contents and Treatment Description (as applicable)**
001	9.5 MG/yr in 2023	Discharge of microfiltration-treated pond water to the groundwater infiltration gallery.

Sample Point Designation For Groundwater Monitoring System			
System	**Sample Pt Number**	**Well Name**	**Comments**
Infiltration Gallery	801	MW-1 (801)	Infiltration area Non-point of standards water table well
	802	MW-2 (802)	Upgradient background well water table well
	803	MW-3 (803)	Downgradient Non-point of standards water table well
	804	MW-4 (804)	Downgradient Non-point of standards water table well
	805	MW-5 (805)	Downgradient Non-point of standards piezometer
	806	MW-6 (806)	Downgradient Non-point of standards piezometer

1 Land Treatment – Monitoring and Limitations

Sample Point Number: 001 - Infiltration Gallery

Monitoring Requirements and Limitations					
Parameter	**Limit Type**	**Limit and Units**	**Sample Frequency**	**Sample Type**	**Notes**
Flow Rate		MGD	Daily	Continuous	
Chloride		mg/L	Quarterly	Grab	
Nitrogen, Nitrite + Nitrate Total		mg/L	Quarterly	Grab	
Nitrogen, Total Kjeldahl		mg/L	Quarterly	Grab	
Nitrogen, Total		mg/L	Quarterly	Grab	
Fecal Coliform	Geometric Mean - Monthly	400 #/100 ml	Monthly	Grab	
pH Field		su	Quarterly	Grab	
Dissolved Oxygen		mg/L	Quarterly	Grab	
Conductivity		µmhos/cm	Quarterly	Grab	
Temperature		deg F	Quarterly	Grab	
Chloride, Max Applied to Any Zone		lbs/ac/yr	Annual	Total Annual	
Nitrogen, Max Applied On Any Zone		lbs/ac/yr	Annual	Total Annual	

Changes from Previous Permit:

The following parameters were removed from the monitoring requirements table: Sodium, Manganese, Arsenic Total Recoverable, Lead Total Recoverable, Iron Total Recoverable, Turbidity.

A limit of 400 # / 100 ml for Fecal Coliform has been added to the monitoring requirements and limitations table.

The monitoring frequency for chloride has been reduced from monthly to quarterly.

Explanation of Limits and Monitoring Requirements

Sodium, Manganese, Arsenic Total Recoverable, Lead Total Recoverable, Iron Total Recoverable, and Turbidity were removed from the monitoring requirements table because the concentrations were low enough to not be of concern to groundwater quality.

Per NR 206.08(2)(b)(4), Wis. Adm. Code, a limit of 400 # / 100 ml for Fecal Coliform has been added to the monitoring requirements and limitations table as there is the potential for the public using the golf course to be exposed to fecal coliform.

The monitoring frequency for chloride has been reduced from monthly to quarterly to be consistent with the other parameters monitored in the discharge.

2 Groundwater – Monitoring and Limitations

2.1 Groundwater Monitoring System for Infiltration Gallery

Location of Monitoring system: Adjacent to the Infiltration Gallery

Groundwater Monitoring Well(s) to be Sampled: MW-2 (802), MW-1 (801), MW-3 (803), MW-4 (804), MW-5 (805), MW-6 (806)

Groundwater Monitoring Well(s) Used to Evaluate Background Groundwater Quality: MW-2 (802)

Groundwater Monitoring Well(s) Used for Point of Standards Application: None

Parameter	Units	Preventative Action Limit	Enforcement Standard	Frequency
Depth To Groundwater	feet	N/A	N/A	Quarterly
Groundwater Elevation	feet MSL	N/A	N/A	Quarterly
Chloride	mg/L	125	250	Quarterly
Nitrogen, Nitrite + Nitrate Total	mg/L	2.0	10	Quarterly
Solids, Total Dissolved	mg/L	N/A	N/A	Quarterly
Fecal Coliform	#/100 ml	N/A	N/A	Quarterly
Dissolved Oxygen	mg/L	N/A	N/A	Quarterly
pH Field	su	N/A	N/A	Quarterly

Changes from Previous Permit:

The following parameters were removed from the monitoring requirements table: Sodium Dissolved, Manganese Dissolved, Arsenic Dissolved, Lead Dissolved, Iron Dissolved, Calcium Dissolved, Potassium Dissolved, Magnesium Dissolved, and Turbidity.

Explanation of Limits and Monitoring Requirements

See Groundwater Evaluation written by Hydrogeologist Zach Watson dated October 8, 2024 for explanation of changes in monitoring requirements and limitations for groundwater.

Attachments:

NR 140 Groundwater Evaluation Report by Hydrogeologist Zach Watson dated October 8, 2024.

Expiration Date:

A permit term of five years is proposed in this reissuance with an expiration date of December 31, 2029.

Prepared By: Zachary Watson Hydrogeologist Date: October 8, 2024

CORRESPONDENCE/MEMORANDUM

DATE: October 8, 2024 FILE REF: FIN 31792

TO: File

FROM: Zach Watson Hydrogeologist - SCR

SUBJECT: Groundwater Evaluation for Madison Gas and Electric Compensatory Recharge WI-0063088-03

General Information and Treatment System Description

Madison Gas and Electric operates a groundwater recharge facility as part of a requirement under Water Loss Approval #3-SC-2003-13-2141LR. The facility operates by drawing surface water from the Odana Hills Golf Course pond and filtering it via a microfiltration system. The filtrate is then pumped to an infiltration gallery located within the golf course where the water percolates into the ground. The infiltration gallery is surrounded by a groundwater monitoring system consisting of four water table monitoring wells and two piezometer monitoring wells.

Table 1 – Monitoring Requirements and Limitations – Outfall 001 Infiltration Gallery

Parameter	Current and Proposed Permit WI-0063088-03 and WI-0063088-04		
	Limit Type	Limits and Units	Sample Frequency
Flow Rate		MGD	Daily
Chloride		mg/l	***Quarterly**
***Sodium, Total Recoverable**		**mg/l**	**Monthly**
***Manganese, Total Recoverable**		**µg/l**	**Monthly**
Nitrogen, Nitrite+Nitrate Total		mg/l	Quarterly
Nitrogen, Total Kjeldahl		mg/l	Quarterly
Nitrogen, Total		mg/l	Quarterly
***Arsenic, Total Recoverable**		**µg/l**	**Quarterly**
***Lead, Total Recoverable**		**µg/l**	**Quarterly**
***Iron, Total Recoverable**		**µg/l**	**Quarterly**
Fecal Coliform	Geometric Monthly Average	400 # /100 ml	Monthly
pH Field		su	Quarterly
Dissolved Oxygen		mg/l	Quarterly
***Turbidity**		**NTU**	**Quarterly**
Conductivity		µmhos/cm	Quarterly
Temperature		deg F	Quarterly
Chloride		Lbs/ac/yr	Annual
Nitrogen, Total		Lbs/ac/yr	Annual

***Remove in upcoming permit**

Table 2 – Groundwater Monitoring System for Infiltration Area

Sample Point	Well Name	Current Permit and Proposed WI-0063088-03 and WI-0063088-04	
		Well Location	Well Designation
801	MW-1	Infiltration Area	Non-Point of Standards
802	MW-2	Background	Non-Point of Standards
803	MW-3	Downgradient	Non-Point of Standards
804	MW-4	Downgradient	Non-Point of Standards
805	MW-5	Downgradient	Non-Point of Standards
806	MW-6	Downgradient	Non-Point of Standards

Table 3 – Infiltration Area Groundwater Standards

Parameter	Current Permit WI-0063088-03		Proposed Permit WI-0063088-04	
	PAL	ES	PAL	ES
Depth to Groundwater	N/A	N/A	N/A	N/A
Groundwater Elevation	N/A	N/A	N/A	N/A
Chloride, Dissolved	125 mg/l	250 mg/l	125 mg/l	250 mg/l
***Sodium, Dissolved**	**136 mg/l**	**N/A**	**Remove**	**Remove**
***Manganese, Dissolved**	**60 µg/l**	**300 µg/l**	**60 µg/l**	**300 µg/l**
Nitrogen, Nitrite + Nitrate, Dissolved	2 mg/l	10 mg/l	2 mg/l	10 mg/l
pH Field	6.0 – 8.0 su	N/A	N/A	N/A
Solids, Total Dissolved	940 mg/l	N/A	N/A	N/A
***Arsenic, Dissolved**	**1 µg/l**	**10 µg/l**	**Remove**	**Remove**
***Lead, Dissolved**	**1.5 µg/l**	**15 µg/l**	**Remove**	**Remove**
***Iron, Dissolved**	**150 µg/l**	**300 µg/l**	**Remove**	**Remove**
***Calcium, Dissolved**	**N/A**	**N/A**	**Remove**	**Remove**
***Potassium, Dissolved**	**N/A**	**N/A**	**Remove**	**Remove**
***Magnesium, Dissolved**	**N/A**	**N/A**	**Remove**	**Remove**
Fecal Coliform	N/A	N/A	N/A	N/A
Dissolved Oxygen	N/A	N/A	N/A	N/A
***Turbidity**	**N/A**	**N/A**	**Remove**	**Remove**

***Remove in upcoming permit**

Geology

The bedrock underlying the treatment system is the Ordovician-aged Prairie Du Chien Group. The Prairie Du Chien Group is comprised of massive to medium bedded dolomite (Preliminary bedrock geology of Dane County, Wisconsin 2013). The overburden is mostly moraine deposits consisting of unstratified clay to gravel sediments (Map of Dane County, Wisconsin, showing physiographic areas and deposits of quaternary age 1964). Depth to bedrock is expected to be 100 – 150 feet below ground surface (Preliminary bedrock geology of Dane County, Wisconsin 2013). Monitoring wells MW-5 and MW-6 are screened in bedrock at depths of 170 – 180 and 160 – 170 feet below ground surface, respectively. The surface soils are the St. Charles and Dodge silt loams and the Sable silty clay loams (NRCS Soil Map).

Hydrogeology

Regional groundwater flow is to the northeast towards Lake Mendota and Monona (Water-table elevation

and unlithified aquifers in Dane County, Wisconsin 1999). Groundwater elevation is generally between 950 – 980 feet above mean sea level over the past fifteen years of monitoring. Groundwater elevations have exhibited a slight decline during the current permit term. Groundwater elevations at the two piezometers (MW-5 and MW-6) are lower at approximately 890 – 900 feet above mean sea level indicating a significant downward vertical gradient. Depth to water is approximately 20 – 50 feet below top of casing at the water table wells (MW-1 – MW-4) and 90 – 100 feet below top of casing at the piezometers (MW-5 and MW-6). Groundwater elevations are variable and impacted by the discharge to the infiltration gallery. A comparison of **Figures 1** and **2** show how groundwater mounds at MW-1 during the months when discharge is occurring and the ambient groundwater flow reestablishes during the non-discharge periods. **Figure 3** (Groundwater Elevation at MW-1) appears to show the impact of the loading of the infiltration gallery where groundwater elevation increases approximately 5 – 8 feet during June – December and then decreases during January – May. **Figure 4** shows the groundwater elevation at the water table monitoring wells and appears to show that MW-3 is affected more by the loading of the infiltration gallery. The change in groundwater elevation over the course of a few years appears to show that the upper and lower groundwater bodies are changing consistently between one another.

Land Treatment Effluent Quality and Loading Rates

Discharge to the infiltration gallery typically begins in June and ends in December. Discharge occurs seasonally due to increasing chloride concentrations during the late winter and through the spring related to road salt activities. Madison Gas and Electric monitors the conductivity of the pond water with the assumption that conductivity is primarily a function of the chloride concentration. Discharge begins once the conductivity is less than 500 microsiemens per centimeter. Discharge to the infiltration gallery from 2018 – 2023 ranged 9.5 – 25.4 MG/yr (**Table 4**). Total dissolved solids in the discharge are generally low ranging from an average concentration of 107 – 226 mg/l. Due to the chloride reduction efforts, the chloride concentrations are generally low with an annual average ranging between 40 – 60 mg/l (**Figure 5**). Total nitrogen concentrations are low and most often below 1 mg/l (**Figure 6**). Metals concentrations (i.e., lead, arsenic, iron) are typically non-detect with manganese being the most often reported metal at concentrations ranging from 59 – 325 µg/l.

Table 4 – Treated Pond Water Annual Average Concentrations and Total Flow Rates

Year	Flow Rate (MG/yr)	Average Total Dissolved Solids (mg/l)	Average Total Nitrogen (mg/l)	Average Chloride (mg/l)	Average Manganese (µg/l)
2018	25.4	107	0.67	44	122
2019	14.1	160	0.71	60	122
2020	19.4	169	1.41	55	325
2021	21.1	119	0.57	40	100
2022	20.7	150	0.48	44	143
2023	9.5	226	0.98	54	59

Background Groundwater Quality

Background groundwater quality is defined by the results from samples collected at MW-2. From 2006 – 2019 the results for chloride were variable and ranged between 15 – 300 mg/l. Significant increases began to occur in 2020 with a high concentration of 1,500 mg/l occurring in March 2021. The results for chloride have remained elevated at MW-2 since 2020 (**Figure 7**). Similarly, the results for sodium mirror those for chloride as they have a shared origin (road salt). The results for nitrite+nitrate ranged between 2 – 4.5 mg/l during the current permit term but have exhibited a decrease during the past three years (**Figure 8**). The results for

metals (i.e., arsenic, lead, manganese) are non-detect. Given the significantly elevated concentrations of chloride and the location of MW-2 adjacent to Highway 14, it is assumed that these results are related to road salting.

Downgradient Groundwater Quality

The results for chloride at the downgradient monitoring wells are much lower than those observed at the upgradient monitoring well. Chloride is highest at MW-4 where concentrations have generally fallen between 100 – 200 mg/l during the current permit term. The results for chloride at MW-1 and MW-3 are lower and most often below 50 mg/l during the current permit term. The results for chloride at MW-5 and MW-6 are less than 3 mg/l. The results for sodium generally mirror the results for chloride as this parameter shares its origin with road salt. The results for nitrite+nitrate are lowest at MW-1, MW-5 and MW-6. The results for nitrite+nitrate at MW-3 and MW-4 most often ranged between 1 – 3 mg/l. The results for metals (i.e., arsenic, lead, manganese) are non-detect at the water table monitoring wells. The results for manganese are elevated at MW-5 at concentrations of approximately 125 – 175 mg/l. The elevated results for manganese at MW-5 are likely related to this well (along with MW-6) being screened in a different groundwater body compared to MW-1 – MW-4.

Table 5 - Exceedance Review – April 1, 2019 – December 31, 2023

Sample Point	Well Name	Parameter	ES Exceedances	PAL/ACL Exceedances
801	MW-1	pH	N/A	13/19
802	MW-2	Chloride	19/19	16/19
		Dissolved Iron	0/19	1/19
		Nitrite+nitrate	0/19	11/19
		Sodium	N/A	15/19
		Total Dissolved Solids	N/A	13/19
803	MW-3	Dissolved Arsenic	0/19	1/19
		Nitrite+nitrate	0/19	4/19
804	MW-4	Dissolved Arsenic	0/19	1/19
		Chloride	0/19	13/19
		Nitrite+nitrate	0/19	2/19
		Total Dissolved Solids	N/A	1/19
805	MW-5	Nitrite+nitrate	0/19	1/19
		Total Dissolved Solids	N/A	1/19
806	MW-6	Dissolved Lead	0/19	1/19
		Dissolved Manganese	0/19	19/19

Treatment System Impact to Groundwater Quality

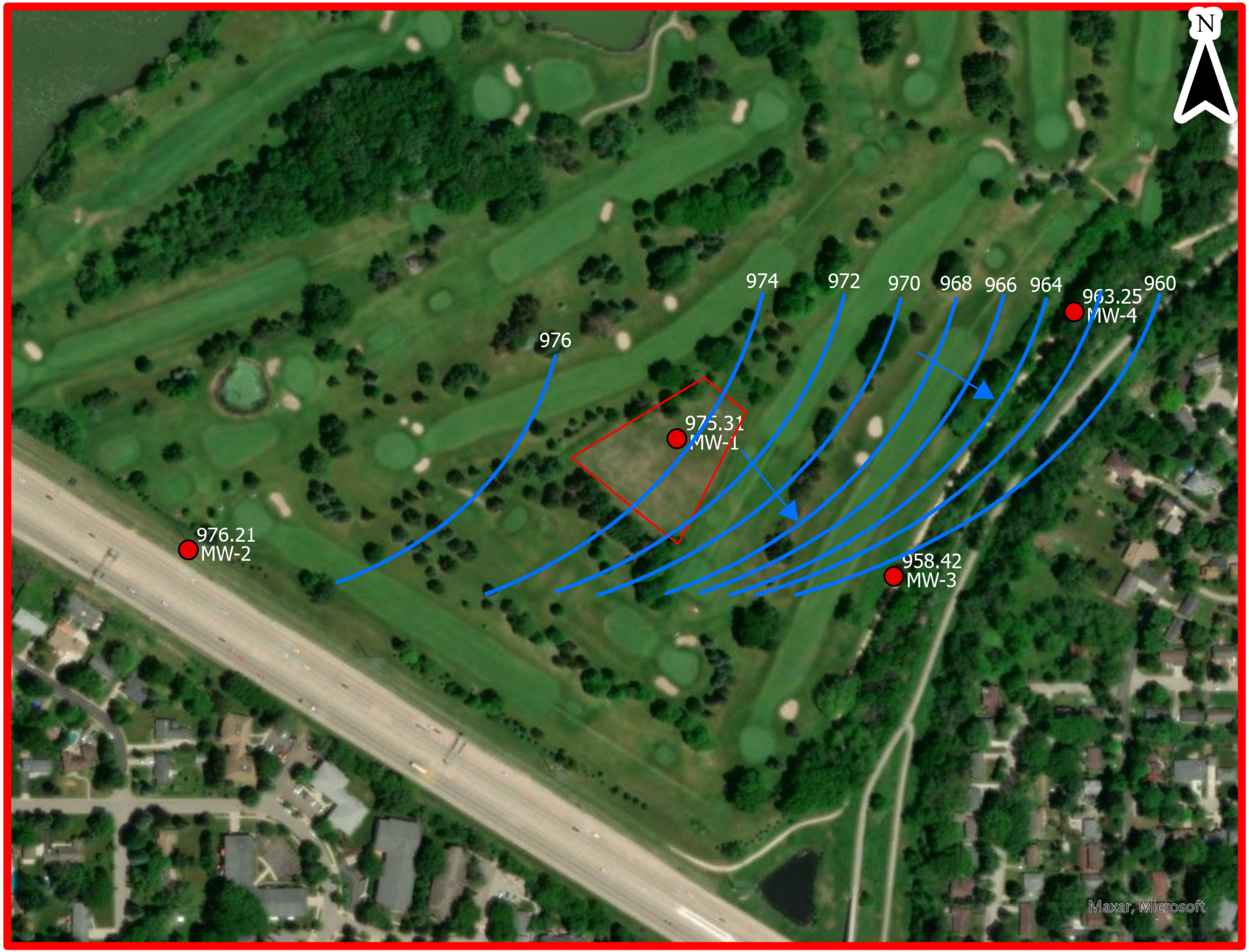
The local groundwater quality at MW-2 is likely influenced by its location adjacent to Highway 14. The elevated chloride concentrations are very likely to be attributable to the road salting activities. The results from MW-1, which is installed at the infiltration gallery, do not appear to show any clear groundwater quality impacts. In fact, the results for chloride and nitrite+nitrate are lower at MW-1 than at the background monitoring well MW-2 and downgradient monitoring well MW-4. The seasonal discharge has helped reduce the contribution of chloride to groundwater. The treated pond water does not appear to be a significant source of any contaminants of concern as long as the chloride management practices continue. Given the results from the treated pond water and the downgradient monitoring wells, the impact of discharging treated pond water on local groundwater quality is negligible.

Conclusions, Recommendations and Schedule Requirements

- The monitoring of manganese, arsenic, lead, iron, sodium, and turbidity at Outfall 001 (Infiltration Gallery) can be discontinued. Turbidity does not provide any useful information. The monitoring of manganese, arsenic, lead, iron and sodium during the current and prior permit terms has shown that the treated pond water is not a significant or concerning source for these parameters.
- The monitoring of manganese, arsenic, lead, iron, sodium, potassium, magnesium, calcium and turbidity at the monitoring wells can be discontinued. There are not currently any concerns regarding the impact from the discharge on these parameters in groundwater.
- The conditions that would make the use of Indicator Parameter PALs and Alternative Concentration Limits are not present for this surface water diversion. Therefore, no indicator parameter PALs or Alternative Concentration Limits are provided for groundwater quality standards in the upcoming permit.
- Chloride is the only contaminant of concern in the treated pond water. Madison Gas and Electric has managed their discharge to reduce the contribution of chloride to groundwater. If Madison Gas and Electric continues this practice, discharge of treated pond water to the infiltration gallery should not adversely impact local groundwater quality.
- A limit of 400 # / 100 ml for fecal coliform has been added to the permit as there is the potential for the public using the golf course to be exposed to fecal coliform. A limit of 400 # / 100 ml for fecal coliform has been determined to be protective to public health in instances where there may be acute direct contact with the discharged treated pond water.

Figure 1 – Infiltration Gallery Groundwater Flow Map – March 10, 2022

Water Table Flow Map
Madison Gas and Electric Compensatory Recharge
March 10, 2022



Site Location

Odana Hills Golf Course
4635 Odana Rd.
Madison WI, 53711

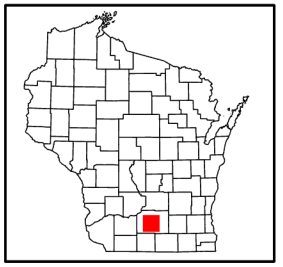
Legend

- Monitoring Well
- Water Table Contour (3/10/22 - 2' FAMSL)
- Groundwater Flow Direction
- Infiltration Gallery

Notes

Water table contours generated using elevation data collected on March 10, 2022. Water table elevations and contours are presented in feet above mean sea level.

Created By: watsoz
Date: 1/23/2024

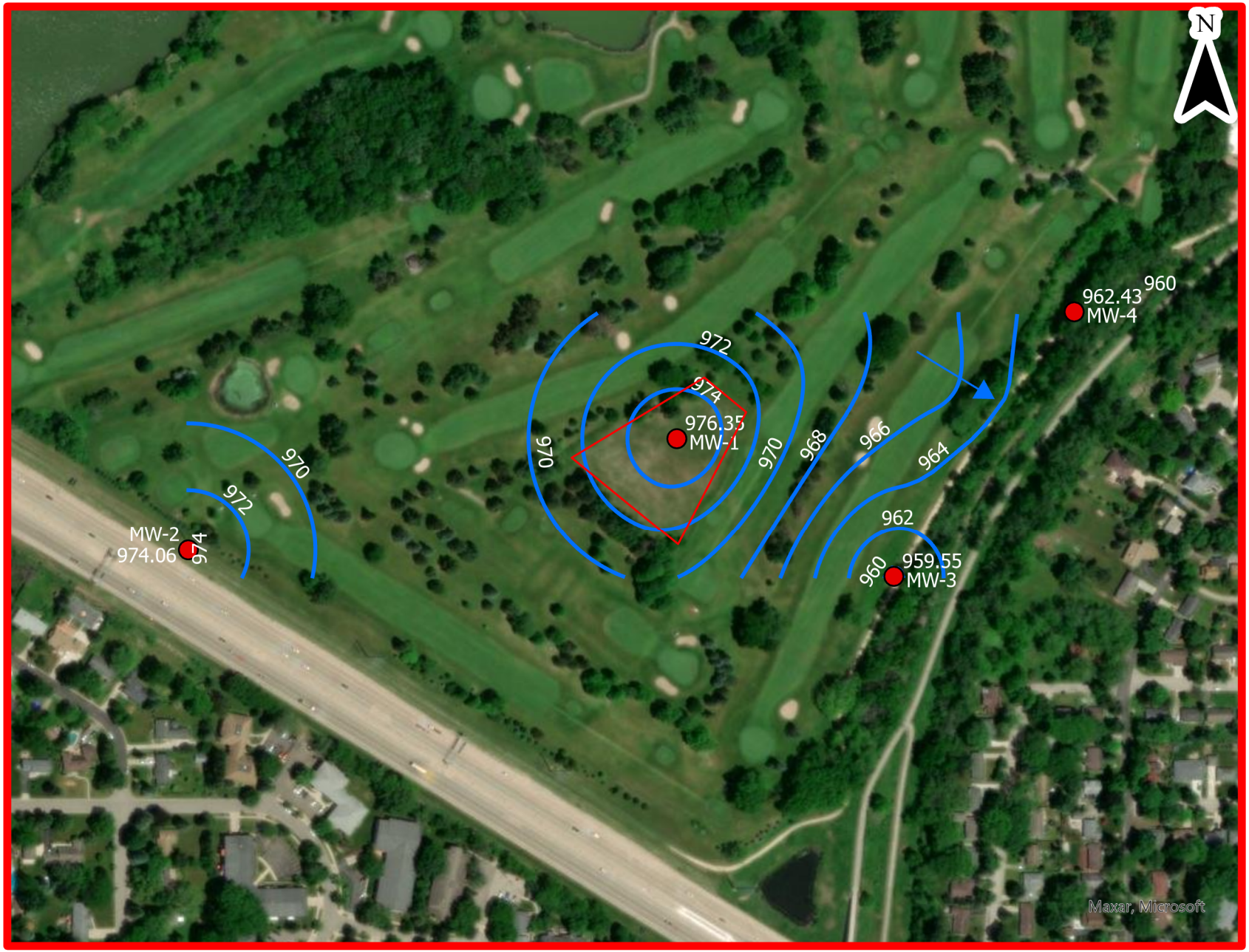


0 110 220 330 440 550 660 Feet

1:4,000

Figure 2 – Infiltration Gallery Groundwater Flow Map – October 3, 2023

Water Table Flow Map
Madison Gas and Electric Compensatory Recharge
October 3, 2023



Site Location

Odana Hills Golf Course
4635 Odana Rd.
Madison WI, 53711

Legend

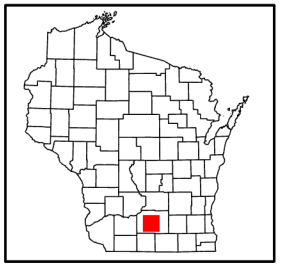
- Water Table Contour (10/3/23 - 2' FAMSL)
- Monitoring Well
- Groundwater Flow Direction
- Infiltration Gallery

Notes

Water table contours generated using elevation data collected on October 3, 2023. Water table elevations and contours are presented in feet above mean sea level.

Interpretation of groundwater flow direction generated in ArcGIS Pro.

Created By: watsoz
Date: 1/24/2024



0 110 220 330 440 550 660 Feet

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Figure 3 – Monitoring Wells – Groundwater Elevation MW-1

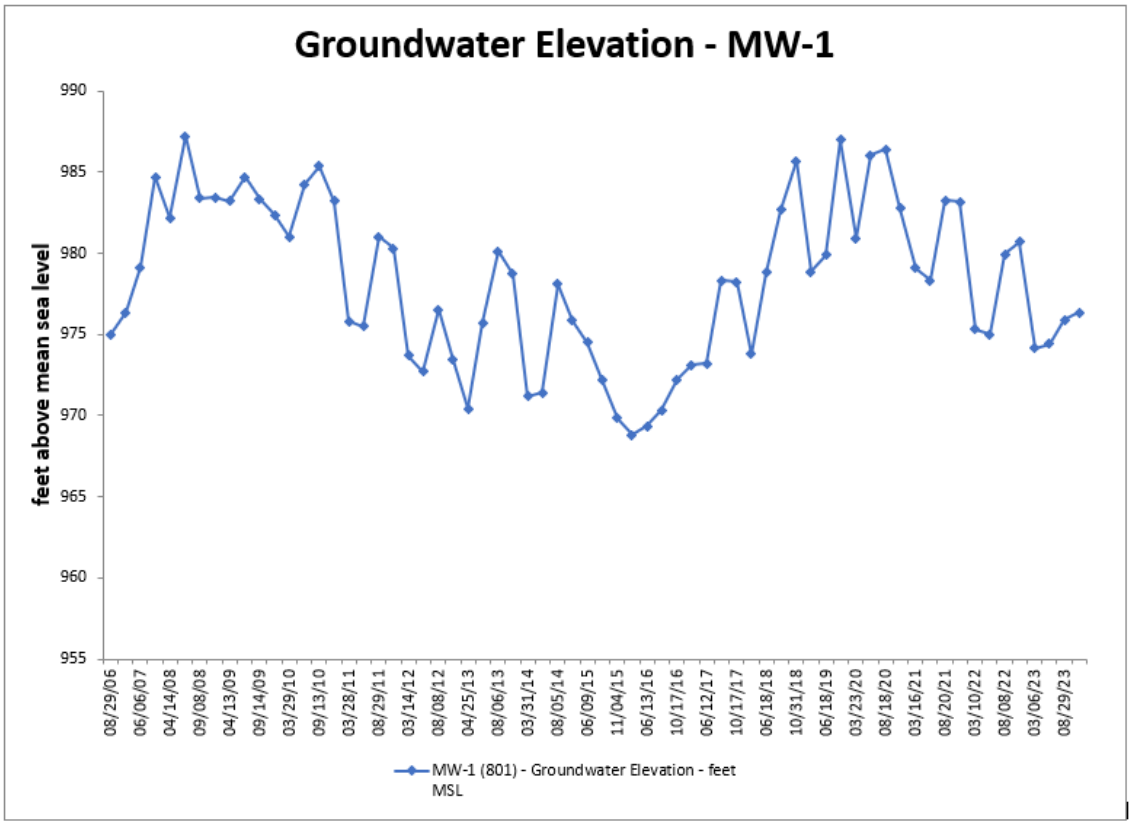

Figure 4 – Monitoring Wells – Groundwater Elevation

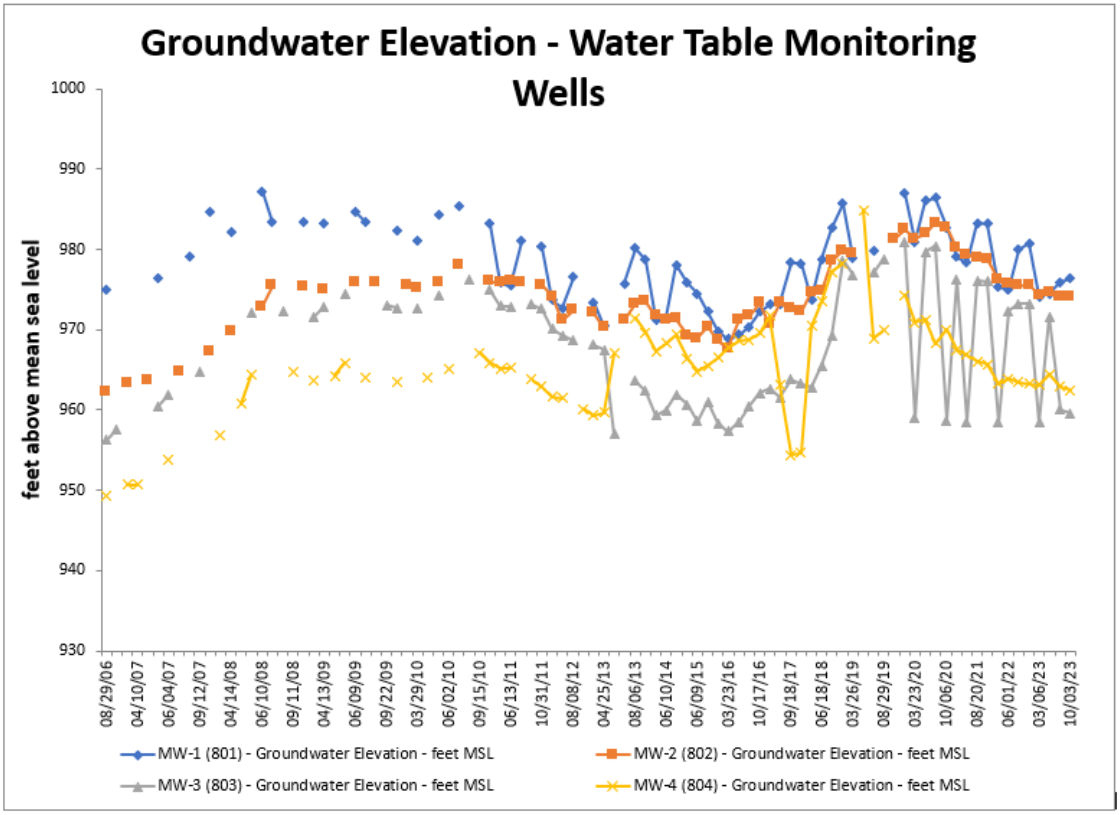

Figure 5 – Treated Pond Water – Chloride

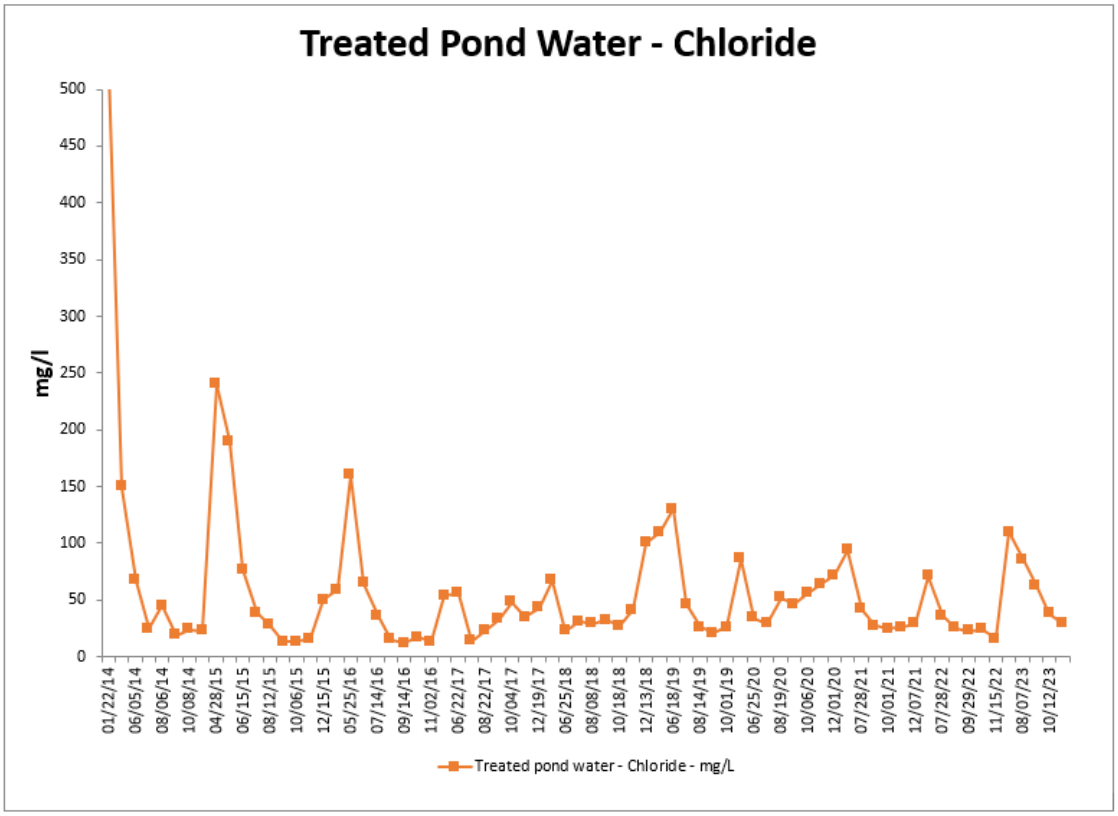

Figure 6 – Treated Pond Water – Total Nitrogen

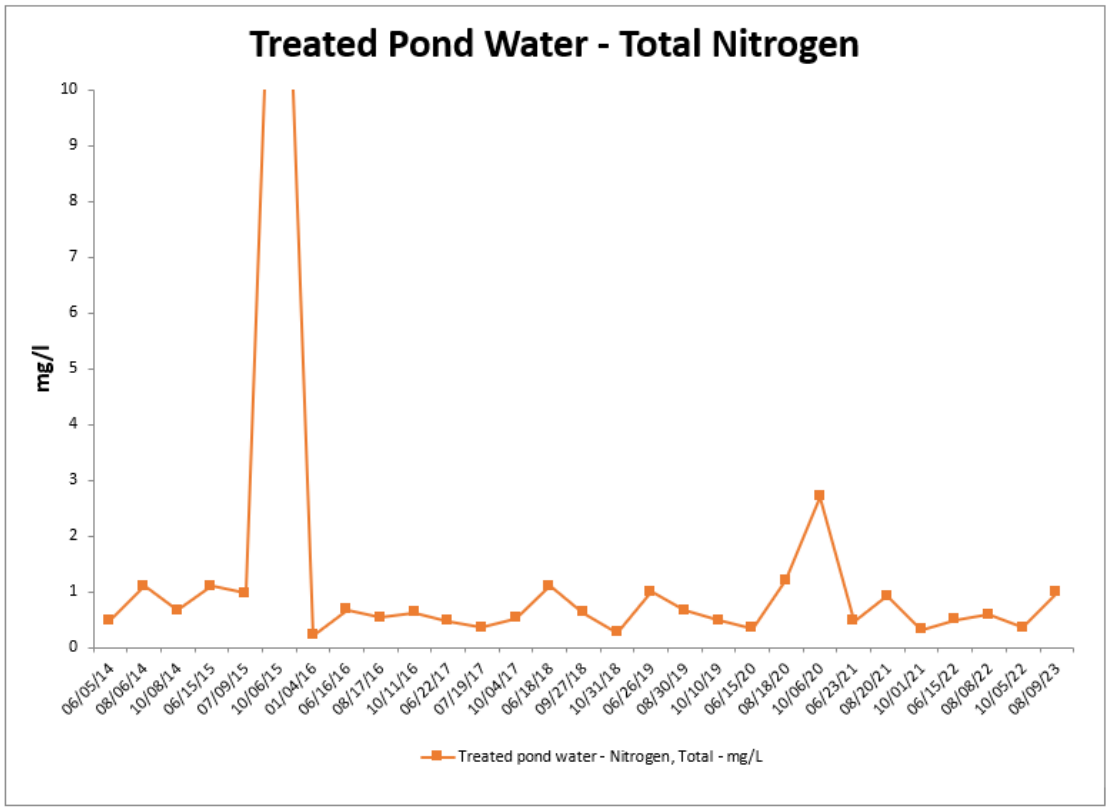

Figure 7 – Monitoring Wells – Chloride

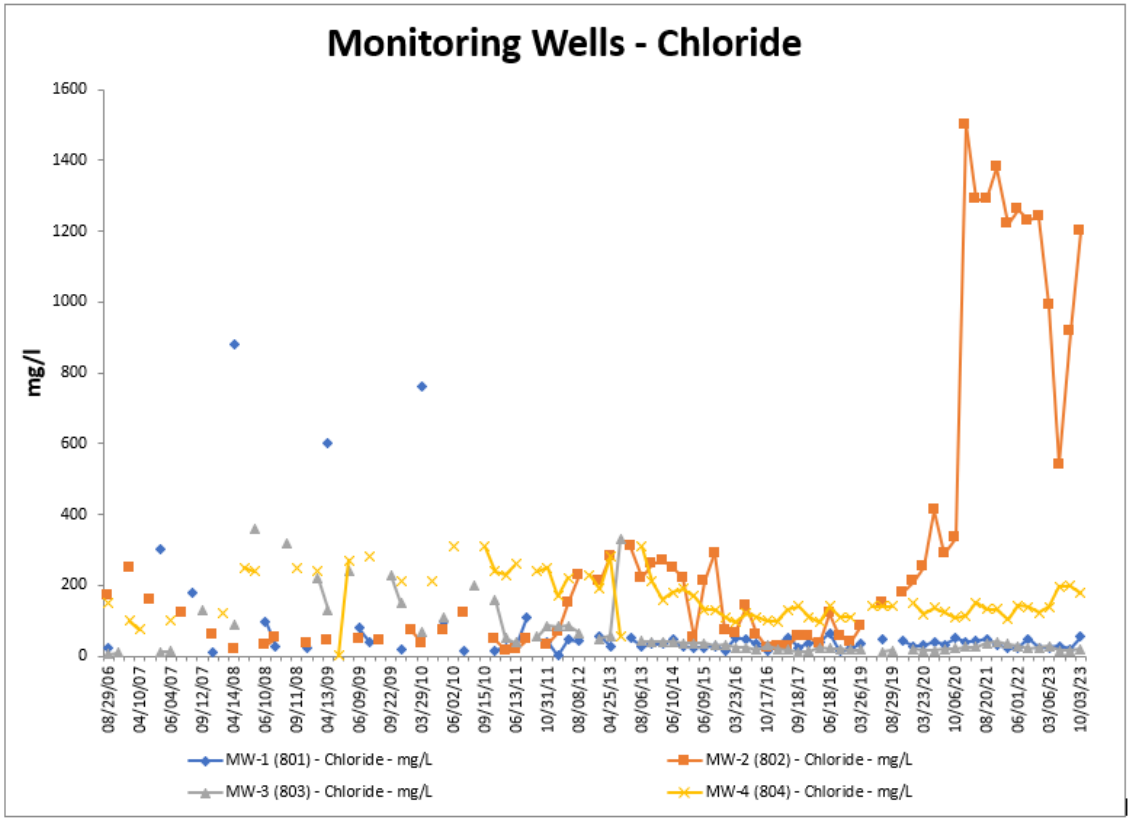

Figure 8 – Monitoring Wells – Nitrite+nitrate