Permit Fact Sheet

General Information

Permit Number	WI-0060763-10-0
Permittee Name and Address	VILLAGE OF LONE ROCK P O Box 78 458 South Tamarack Street, Lone Rock, WI 53556
Permitted Facility Name and Address	Lone Rock Wastewater Treatment Facility SWQ, NWQ, SEC 12, T8N, R2E, BUENA VISTA TWP, LONE ROCK, WISCONSIN
Permit Term	October 01, 2025 to September 30, 2030
Discharge Location	SW ¼ of NW ¼ of Section 12, T8N, R2E, Buena Vista Township
Receiving Water	Groundwaters of the Lower Wisconsin River Basin and via an indirect discharge to Cruson Slough (Bear Creek, LW14) in Richland County
Stream Flow ($Q_{7,10}$)	Cruson Slough does not exhibit a unidirectional flow at the point of discharge, a ten-to-one dilution ratio is used in accordance with s. NR 106.06(4)(b)2, Wis. Adm. Code
Stream Classification	Cruson Slough: Warm Water Sport Fish community, non-public water supply
Discharge Type	Existing, Continuous
Annual Average Design Flow (MGD)	0.057 MGD
Industrial or Commercial Contributors	None
Plant Classification	A4 - Ponds, Lagoons and Natural Systems; SS - Sanitary Sewage Collection System
Approved Pretreatment Program?	N/A

Facility Description

Lone Rock Wastewater Treatment Facility (WWTF) consists of two aerated lagoons operated in series followed by an effluent holding pond, with treated effluent discharged to a rotation through four distinct areas between two, one-acre seepage cells. Four groundwater monitoring well surround the site and are monitored quarterly. The seepage cell discharge is considered an indirect surface water discharge due to groundwater flow direction and the proximity of the seepage cells to the adjacent Cruson Slough. See the Water Quality Based Effluent Limitation for Lone Rock Wastewater Treatment Facility, dated May 20, 2025, and Groundwater Evaluation, dated July 11, 2025, for more information.

Lone Rock WWTF commenced a set of planned facility improvements in 2025, including removal of legacy sludge, a new headworks and control building with influent screening and septic tank, replacement of the aeration systems in both lagoons, installation of new baffle walls, replacement of process piping and control structures, and installation of new effluent distribution headers and pipe supports to the seepage cells. The upgrades are expected to be completed by 2027.

Substantial Compliance Determination

Enforcement During Last Permit: A notice of noncompliance was issued in May of 2023 for effluent limit exceedances. The facility has completed all previously required actions as part of the enforcement process.

After a desk top review of all discharge monitoring reports, CMARs, land application reports, compliance schedule items, and a site visit on May 22, 2024, this facility has been found to be in substantial compliance with their current permit.

Sample Point Descriptions

Sample Point Designation		
Sample Point Number	**Discharge Flow, Units, and Averaging Period**	**Sample Point Location, Waste Type/Sample Contents and Treatment Description (as applicable)**
701	0.046 MGD (January 2020 – January 2025 Average)	Influent: 24-hr time proportional composite sampler with an intake located in the wet well, after the influent ultrasonic flow meter and comminutor.
001	0.049 MGD (January 2020 – January 2025 Average)	Effluent: Representative grab samples shall be collected from the manhole prior to discharging to the seepage cells. An ultrasonic flow meter is located in the effluent manhole.
002	N/A – Lagoon System Did not remove sludge during the previous permit term Plans to remove sludge during the current permit term	Representative composite grab lagoon sludge samples shall be collected from each pond, #1, #2, and #3 and then combine for one sample. If a lagoon is scheduled for desludging, a composite grab sample of just that lagoon sludge may be needed prior to land spreading.

Permit Requirements

Sample Point Designation For Groundwater Monitoring Systems			
System	**Sample Pt Number**	**Well Name**	**Comments**
seepage cells monitoring system	801	MW-1 (801) BACKGROUND WELL	Approximately 400 feet east northeast of the northern seepage cell. Non-Point of Standards
	802	MW-2 (802) DOWNGRADIENT WELL	Approximately 40 feet southwest of the seepage cells. Non-Point of Standards
	803	MW-1A (803) DOWNGRADIENT WELL	Approximately 110 feet south of the seepage cells. Non-Point of Standards
	804	MW-2A (804) DOWNGRADIENT WELL	Approximately 50 feet west of the seepage cells. Non-Point of Standards
	805	MW-1P (805)	To be installed per the compliance schedule, adjacent to MW-1.

Sample Point Designation For Groundwater Monitoring Systems			
System	**Sample Pt Number**	**Well Name**	**Comments**
		UPGRADIENT	Non-Point of Standards, Piezometer
	806	MW-2P (806) DOWNGRADIENT	To be installed per the compliance schedule, adjacent to MW-2. Non-Point of Standards, Piezometer

1 Influent – Monitoring Requirements

1.1 Sample Point Number: 701- INFLUENT

Monitoring Requirements and Limitations					
Parameter	**Limit Type**	**Limit and Units**	**Sample Frequency**	**Sample Type**	**Notes**
Flow Rate		MGD	Daily	Total Daily	
BOD5, Total		mg/L	Weekly	24-Hr Comp	
Suspended Solids, Total		mg/L	Weekly	24-Hr Comp	
Nitrogen, Total Kjeldahl		mg/L	Monthly	24-Hr Comp	
Nitrogen, Organic Total		mg/L	Monthly	Calculated	
Nitrogen, Ammonia (NH3-N) Total		mg/L	Monthly	24-Hr Comp	

Changes from Previous Permit:

Influent limitations and monitoring requirements were evaluated for this permit term and the following changes were made from the previous permit.

Flow: The sample frequency and sample type have changed from "Continuous" to "Daily" and "Total Daily", respectively, for eDMR reporting purposes.

The sample type for other parameters has changed from "24-Hr Flow Prop Comp" to "24-Hr Comp", to accurately reflect that the composite sampler is time proportional, not flow proportional.

Explanation of Limits and Monitoring Requirements

Influent monitoring is needed to assess loading to the facility and treatment performance. The required parameters and sampling frequency are appropriate for a land treatment system as outlined in ch NR 206, Wis. Adm. Code.

2 Land Treatment – Monitoring and Limitations

2.1 Sample Point Number: 001- EFFLUENT @ WET WELL

Monitoring Requirements and Limitations					
Parameter	**Limit Type**	**Limit and Units**	**Sample Frequency**	**Sample Type**	**Notes**
Flow Rate		MGD	Daily	Total Daily	
BOD5, Total	Monthly Avg	50 mg/L	Weekly	Grab	
Suspended Solids, Total		mg/L	Weekly	Grab	
pH Field		su	Weekly	Grab	
Nitrogen, Organic Total		mg/L	Monthly	Calculated	
Nitrogen, Ammonia (NH3-N) Total		mg/L	Monthly	Grab	
Nitrogen, Total Kjeldahl		mg/L	Monthly	Grab	
Nitrogen, Nitrite + Nitrate Total		mg/L	Monthly	Grab	
Nitrogen, Total		mg/L	Monthly	Calculated	
Solids, Total Dissolved		mg/L	Monthly	Grab	
Chloride		mg/L	Monthly	Grab	
Phosphorus, Total		mg/L	Monthly	Grab	
Zone Used		Number	Daily	Numeric Description	Report the zone of the seepage cell loaded each day. See 'Seepage Cell Zone Loading Information' section.

Changes from Previous Permit:

Effluent limitations and monitoring requirements were evaluated for this permit term and the following changes were made from the previous permit.

Flow: The sample frequency and sample type have changed from “Continuous” to “Daily” and “Total Daily”, respectively, for eDMR reporting purposes.

Total Phosphorus: Monitoring for total phosphorus is included in the permit.

Explanation of Limits and Monitoring Requirements

All requirements for land treatment of municipal wastewater are determined in accordance with ch. NR 206, Wis. Adm. Code. All categorical limits are based on s. NR 206.08(1), Wis. Adm. Code. More information on the limitations can be found in the Groundwater Evaluation for Lone Rock Wastewater Treatment Facility, dated July 11, 2025, prepared by Zach Watson, and used for this reissuance.

Total Phosphorus: Monitoring is included to assist in evaluating the potential impact of the discharge on surface water phosphorus concentrations.

Monitoring Frequencies: The Monitoring Frequencies for Individual Wastewater Permits guidance (April 12, 2021) recommends that standard monitoring frequencies be included in individual wastewater permits based on the size and type of the facility, in order to characterize effluent quality and variability, to detect events of noncompliance, and to ensure consistency in permits issued across the state. Guidance and requirements in administrative code were considered when determining the appropriate monitoring frequencies for pollutants that have final effluent limits in effect during this permit term. The monitoring frequencies have not changed from the previous permit term.

3 Groundwater – Monitoring and Limitations

3.1 Groundwater Monitoring System for Seepage Cells

Location of Monitoring system: SWQ, NWQ, SEC 12, T8N, R2E, BUENA VISTA TWP

Groundwater Monitoring Well(s) to be Sampled: MW-1 (801) BACKGROUND WELL, MW-2 (802) DOWNGRADIENT WELL, MW-1A (803) DOWNGRADIENT WELL, MW-2A (804) DOWNGRADIENT WELL, MW-1P (805) UPGRADIENT, MW-2P (806) DOWNGRADIENT

Groundwater Monitoring Well(s) Used to Evaluate Background Groundwater Quality: MW-1 (801) BACKGROUND WELL

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	N/A	N/A	Quarterly
Nitrogen, Nitrite + Nitrate (as N) Dissolved	mg/L	2.0	10	Quarterly
Nitrogen, Ammonia Dissolved	mg/L	0.97	9.7	Quarterly
Nitrogen, Organic Dissolved	mg/L	2.5	N/A	Quarterly
Chloride Dissolved	mg/L	125	250	Quarterly
pH Field	su	8.1	N/A	Quarterly
Solids, Total Dissolved	mg/L	265	N/A	Quarterly
Phosphorus, Total Dissolved	mg/L	N/A	N/A	Quarterly

Changes from Previous Permit:

Groundwater limitations and monitoring requirements were evaluated for this permit term and the following changes were made from the previous permit.

Nitrite + Nitrate and Chloride: The PAL alternative concentration limits are no longer applicable. PALs and ES based on NR 140, Wis. Adm. Code have been included.

Ammonia: The ES per NR 140, Wis. Adm. Code has been included.

Organic Nitrogen, pH, and Total Dissolved Solids: The PALs have been updated based on background water quality.

Total Dissolved Phosphorus: Monitoring for total dissolved phosphorus is included in the permit.

Explanation of Limits and Monitoring Requirements

Groundwater limits and requirements are determined in accordance with ch. NR 140, Wis. Adm. Code. Indicator parameter Preventive Action Limit (PAL) values are established per s. NR 140.20, Wis. Adm. Code. Alternative Concentration Limits as allowed under s. NR 140.28, Wis. Adm. Code, are established on a case-by-case basis.

For more information, please refer to the Groundwater Evaluation for Lone Rock Wastewater Treatment Facility, dated July 11, 2025, prepared by Zach Watson, and used for this reissuance.

Total Dissolved Phosphorus: Monitoring is included to assess the amount of dissolved phosphorus contributed to groundwater from the discharge to the seepage cells.

4 Land Application - Monitoring and Limitations

Municipal Sludge Description						
Sample Point	**Sludge Class (A or B)**	**Sludge Type (Liquid or Cake)**	**Pathogen Reduction Method**	**Vector Attraction Method**	**Reuse Option**	**Amount Reused/Disposed (Dry Tons/Year)**
002	B	Liquid	Fecal Coliform	Injection or Incorporation	Land Application	N/A – Lagoon System
Does sludge management demonstrate compliance? **Yes.**						
Is additional sludge storage required? **No.**						
Is Radium-226 present in the water supply at a level greater than 2 pCi/liter? **No.** If yes, special monitoring and recycling conditions will be included in the permit to track any potential problems in landapplying sludge from this facility						
Is a priority pollutant scan required? **No, design flow is less than 5 MGD.** Priority pollutant scans are required once every 10 years at facilities with design flows between 5 MGD and 40 MGD, and once every 5 years if design flow is greater than 40 MGD.						

4.1 Sample Point Number: 002- LAGOON SLUDGE

Monitoring Requirements and Limitations					
Parameter	**Limit Type**	**Limit and Units**	**Sample Frequency**	**Sample Type**	**Notes**
Solids, Total		Percent	Once	Composite	
Arsenic Dry Wt	Ceiling	75 mg/kg	Once	Composite	
Arsenic Dry Wt	High Quality	41 mg/kg	Once	Composite	
Cadmium Dry Wt	Ceiling	85 mg/kg	Once	Composite	
Cadmium Dry Wt	High Quality	39 mg/kg	Once	Composite	
Copper Dry Wt	Ceiling	4,300 mg/kg	Once	Composite	
Copper Dry Wt	High Quality	1,500 mg/kg	Once	Composite	
Lead Dry Wt	Ceiling	840 mg/kg	Once	Composite	

Monitoring Requirements and Limitations					
Parameter	**Limit Type**	**Limit and Units**	**Sample Frequency**	**Sample Type**	**Notes**
Lead Dry Wt	High Quality	300 mg/kg	Once	Composite	
Mercury Dry Wt	Ceiling	57 mg/kg	Once	Composite	
Mercury Dry Wt	High Quality	17 mg/kg	Once	Composite	
Molybdenum Dry Wt	Ceiling	75 mg/kg	Once	Composite	
Nickel Dry Wt	Ceiling	420 mg/kg	Once	Composite	
Nickel Dry Wt	High Quality	420 mg/kg	Once	Composite	
Selenium Dry Wt	Ceiling	100 mg/kg	Once	Composite	
Selenium Dry Wt	High Quality	100 mg/kg	Once	Composite	
Zinc Dry Wt	Ceiling	7,500 mg/kg	Once	Composite	
Zinc Dry Wt	High Quality	2,800 mg/kg	Once	Composite	
Nitrogen, Total Kjeldahl		Percent	Once	Composite	Once when land application occurs.
Nitrogen, Ammonium (NH4-N) Total		Percent	Once	Composite	Once when land application occurs.
Phosphorus, Total		Percent	Once	Composite	Once when land application occurs.
Phosphorus, Water Extractable		% of Tot P	Once	Composite	Once when land application occurs.
Potassium, Total Recoverable		Percent	Once	Composite	Once when land application occurs.
PCB Total Dry Wt	Ceiling	50 mg/kg	Once	Composite	Once in 2026.
PCB Total Dry Wt	High Quality	10 mg/kg	Once	Composite	Once in 2026.
PFOA + PFOS		ug/kg	Once	Calculated	Report the sum of PFOA and PFOS. See PFAS Permit Sections for more information.
PFAS Dry Wt			Once	Grab	Perfluoroalkyl and Polyfluoroalkyl Substances based on updated DNR PFAS List. See PFAS Permit Sections for more information.

Changes from Previous Permit:

Sludge limitations and monitoring requirements were evaluated for this permit term and the following changes were made from the previous permit.

The sample frequency has changed from “Annual” to “Once”. See the Land Application permit sections for monitoring requirements.

PCB: Monitoring is required once in 2026.

PFAS: Monitoring is required once pursuant to s. NR 204.06(2)(b)9, Wis. Adm. Code.

Explanation of Limits and Monitoring Requirements

Requirements for disposal, including land application of municipal sludge, are determined in accordance with ch. NR 204, Wis. Adm. Code. Ceiling and high-quality limits for metals in sludge are specified in s. NR 204.07(5). Requirements for pathogens are specified in s. NR 204.07(6) and in s. NR 204.07 (7) for vector attraction requirements. Limitations for PCBs are addressed in s. NR 204.07(3)(k).

List 2 Nutrient: Monitoring for list 2 (nutrients) is highly recommended at the same time as the monitoring of List 1 (metals) in year 2 of the permit (2026). Results will assist in the determination of the acres needed for land application of sludge should it be necessary. The number of acres needed is also required for the Land Application Management Plan Schedule (see schedules for more information). List 2 nutrient sampling is required when land application occurs.

PFAS: The presence and fate of PFAS in municipal and industrial sludges is an emerging public health concern. EPA has developed a draft risk assessment to determine future land application rates and released this risk assessment in January 2025. The department is evaluating this new information. Until a decision is made, the “Interim Strategy for Land Application of Biosolids and Industrial Sludges Containing PFAS” may be followed.

Collecting sludge data on PFAS concentrations from a wide range of wastewater treatment facilities will help protect public health from exposure to elevated levels of PFAS and determine the department’s implementation of EPA’s recommendations. To quantitate this risk, PFAS sampling has been included in this WPDES permit pursuant to ss. NR 214.18(5)(b) and NR 204.06(2)(b)9, Wis. Adm. Code.

Change in form submittal: In prior permit reissuances when it has been noted in the application that sludge would not be removed during the permit term, the department required sampling during the second year of the permit term and the sludge characteristic report (3400-049) would be generated only during that year. Due to moving to electronic submittal of forms via Switchboard, forms 3400-049 (“Characteristics Report”), 3400-052 (“Other Methods of Disposal”) and 3400-055 (“Annual Land Application”) will now be generated by the department and the permittee will be required to submit all three reports each year of the permit term. This change was adopted to provide the permittee flexibility because many lagoon desludging projects can be unexpected, are delayed or staggered over multiple years. Additionally, it is used to officially report that no land application of sludge has occurred, and annual submittal of the forms is required per the standard requirements section.

5 Schedules

5.1 Groundwater Monitoring Well - Installation

Required Action	Due Date
Plans and Specifications: Submit plans and specifications for installation of monitoring wells MW-1P (805) and MW-2P (806).	03/31/2026
Installation: Complete well installation in accordance with ch NR 141, Wisconsin Administrative Code. (Note: Documentation of well construction must be submitted to the Department within 60 days of well installation.)	09/30/2026

Explanation of Schedule

The schedule allows time for the installation of the piezometer wells. Piezometer wells MW-1P and MW-2P should be installed adjacent to MW-1 and MW-2, respectively. The data collected at these monitoring wells will be utilized to assess the vertical hydraulic gradients, change in groundwater quality over depth and to approximate how/if groundwater flows into Cruson Slough (Smith Lake).

5.2 Land Treatment Management Plan

A management plan is required for the land treatment system.

Required Action	Due Date
Land Treatment Management Plan Submittal: Submit an update to the management plan to optimize the land treatment system performance and demonstrate compliance with ch. NR 206, Wis. Adm. Code. The land treatment system shall be operated in accordance with the approved management plan.	09/30/2027

Explanation of Schedule

An up-to-date Land Treatment Management Plan is required that documents how the permittee will manage the land disposal system consistent with ch. NR 206 and s. NR 110.25, Wis. Adm. Code.

5.3 Nutrient Removal – Optimization Plan

Required Action	Due Date
Optimization Plan: The permittee shall prepare an Optimization Plan and submit it for department approval. The plan shall include an evaluation of the collection system, lagoons, and land treatment system and propose actions to optimize performance to control nutrient discharges. The plan shall contain a schedule for implementation of the proposed actions. Once the plan is approved by the department, the permittee shall take the steps called for in the Optimization Plan and follow the schedule of implementation as approved.	03/31/2026
Progress Report #1: Provide a progress report summarizing actions completed since the previous submittal to optimize the treatment system for nutrient reduction and removal. The report shall comment on the success of the optimization actions based on data and observations of the treatment system performance.	09/30/2026
Progress Report #2: Provide a progress report as defined above.	09/30/2027
Progress Report #3: Provide a progress report as defined above.	09/30/2028
Progress Report #4: Provide a progress report as defined above.	09/30/2029
Progress Report #5: Provide a progress report as defined above.	09/30/2030

Explanation of Schedule

This schedule has been included to support compliance with water quality standards for nutrients including nitrogen and phosphorus downstream of the land treatment units.

5.4 Desludging Management Plan

Required Action	Due Date
Desludging Management Plan Submittal: The permittee shall submit an updated management plan for approval if removal of the sludge will occur during this permit term. At a minimum, the plan shall address how the sludge will be sampled, removed, transported, and disposed of. No desludging may occur unless approval by the Department is obtained. Daily logs shall be kept that record where the sludge has been disposed. The plan is due a minimum of sixty (60) days prior to desludging.	

Explanation of Schedule

If the lagoons are to be de-sludged during this permit term, an updated management plan needs to be submitted, at minimum, 60 days prior to desludging. At minimum, the plan should address how the sludge will be sampled, removed, transported, and disposed of. An outline is available to assist in plan development.

5.5 Land Application Management Plan

A management plan is required for the land application system.

Required Action	Due Date
Land Application Management Plan Submittal: If the permittee proposes to land apply sludge, an updated management plan shall be submitted and approved by the Department. The management plan shall be consistent with the requirements of this permit, and s. NR 204.07, Wis. Adm. Code. At a minimum, the plan shall describe how the application rate has been calculated as well as how the sludge will be land applied and incorporated. Record keeping and tracking of site loadings shall also be described. Requests for land application site approvals shall also be included. The plan is due a minimum of sixty (60) days prior to land applying.	

Explanation of Schedule

If the permittee wishes to land apply sludge from the lagoons during the permit term, they must submit a plan detailing how the land application of sludge will comply with relevant code and permit requirements. The plan must be submitted at least 60 days prior to the sludge being applied.

Attachments

NR 140 Groundwater Evaluation Report, dated July 11, 2025

Water Quality Based Effluent Limitations Memo, dated May 20, 2025

Justification Of Any Waivers From Permit Application Requirements

No waivers requested or granted as part of this permit reissuance.

Prepared By: BetsyJo Howe, Wastewater Specialist **Date:** 8/4/2025

CORRESPONDENCE/MEMORANDUM

DATE: July 11, 2025 FILE REF: FIN 7191

TO: File

FROM: Zach Watson Hydrogeologist - SCR

SUBJECT: Groundwater Evaluation for Lone Rock Wastewater Treatment Facility

General Information and Treatment System Description

The Village of Lone Rock owns and operates the Lone Rock Wastewater Treatment Facility serving a population of approximately 830. The annual average design flow is 0.057 million gallons per day (MGD). The average daily discharge in 2024 was 0.045 MGD. Treatment consists of two aerated lagoons operated in series followed by an effluent holding pond, with treated effluent discharged to a rotation through four distinct areas between two one-acre seepage cells. Four groundwater monitoring wells surround the site and are monitored quarterly. The seepage cell discharge is considered an indirect surface water discharge due to groundwater flow direction and the proximity of the seepage cells to the adjacent Smith Lake.

Lone Rock WWTF commenced a set of planned facility improvements in 2025, including removal of legacy sludge, a new headworks and control building with influent screening and septic tank, replacement of the aeration systems in both lagoons, installation of new baffle walls, replacement of process piping and control structures, and installation of new effluent distribution headers and pipe supports to the seepage cells. The upgrades are expected to be complete by 2027.

Removal of legacy sludge is expected to increase the hydraulic detention time of the lagoons, improving treatment capabilities for nitrogen ammonia, BOD5, and TSS. The remaining improvements are expected to improve the overall performance of the plant for parameters typically addressed by aerated lagoon treatment and provide more even distribution of effluent to the seepage cells.

Table 1 – Monitoring Requirements and Limitations – Seepage Cells (Outfall 001)

Parameter	Current and Proposed Permit WI-0060763-09 and WI-0060763-10		
	Limit Type	Limits and Units	Sample Frequency
Flow Rate		MGD	Daily
BOD5, Total	50 mg/l	mg/l	Weekly
Total Suspended Solids		mg/l	Weekly
pH Field		su	Weekly
Total Organic Nitrogen		mg/l	Monthly
Total Ammonia Nitrogen		mg/l	Monthly
Total Kjeldahl Nitrogen		mg/l	Monthly
Nitrite+Nitrate Nitrogen		mg/l	Monthly
Total Dissolved Solids		mg/l	Monthly

Chloride		mg/l	Monthly
***Total Phosphorus**		**mg/l**	**Monthly**
Zone Used		Number	Daily

***Recommended changes from current permit**

Table 2 – Seepage Cells (Outfall 001) Groundwater Monitoring System

Sample Point	Well Name	Current Permit and Proposed WI-0060763-09 and WI-0060763-10	
		Well Location	Well Designation
801	MW-1	Background	Non-Point of Standards
802	MW-2	Downgradient	Non-Point of Standards
803	MW-1A	Downgradient	Non-Point of Standards
804	MW-2A	Downgradient	Non-Point of Standards
***805**	**MW-1P**	**Upgradient**	**Non-Point of Standards Piezometer**
***806**	**MW-2P**	**Downgradient**	**Non-Point of Standards Piezometer**

***Recommended changes for upcoming permit**

Table 3 – Seepage Cells (Outfall 001) Groundwater Standards

Parameter	Current Permit WI-0060763-09		Proposed Permit WI-0060763-10	
	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
Nitrite+nitrate Dissolved	3.2 mg/l	N/A	***2 mg/l**	***10 mg/l**
Ammonia Dissolved	0.97 mg/l	N/A	0.97 mg/l	***9.7 mg/l**
Organic Nitrogen Dissolved	2.3 mg/l	N/A	***2.5 mg/l**	N/A
Chloride Dissolved	140 mg/l	N/A	***125 mg/l**	***250 mg/l**
pH Field	6.5 – 8.5 su	N/A	***6.1 – 8.1 su**	N/A
Total Dissolved Solids	280 mg/l	N/A	***265 mg/l**	N/A
***Phosphorus Dissolved**	N/A	N/A	N/A	N/A

***Recommended changes for upcoming permit**

Geology

The bedrock underlying the treatment system are Cambrian-aged sandstones. Depth to bedrock is expected to be more than 100 feet below ground surface. The surface sediments are expected to be modern stream sediments comprised of sand and gravely sand. Local topography is generally flat.

Hydrogeology

The seepage cells are approximately 400 – 750 feet from the edge of Smith Lake/Cruson Slough. Smith Lake is a part of the greater Cruson Slough. Depth to groundwater is approximately 10 – 15 feet below ground surface. Groundwater is closer to the ground surface upgradient of the treatment system. Groundwater flow at the site is to the southwest towards Smith Lake (**Figure 1** and **Figure 2**). Groundwater elevations range between 688 – 694 feet above mean sea level (**Figure 7**). **Figure 7** also provides the annual precipitation measured at Lone Rock Tri County AP (WI) USC00014291 Weather Station. The groundwater elevations

appear to correlate with precipitation rates. Smith Lake is considered a seepage lake and water elevations are maintained by a dam located at the northwestern edge of Cruson Slough. Given the proximity of the seepage cell discharge to Smith Lake, this discharge is considered an indirect discharge to surface water. The degree to which groundwater flows into Smith Lake should be further resolved by the addition of stream level height monitoring at Smith Lake and the installation of piezometers adjacent to water table monitoring wells. It is possible that the slough is gaining or losing at this location and this additional information will help answer whether this discharge should be considered solely a groundwater discharge or an indirect discharge to surface water.

Land Treatment Effluent Quality and Loading Rates

As calculated from certified eDMR reporting, the total annual discharge to the seepage cells ranged between 14 – 25 MG/yr during the past five years (**Table 4**). Nitrogen is mostly in the form of ammonia and then to a lesser extent organic nitrogen (**Figure 3**). Total Kjeldahl nitrogen concentrations averaged between 25.8 – 54.4 mg/l. Nitrite+nitrate is most often present at concentrations less than 1 mg/l. The concentration of chloride in the effluent most often falls between 80 – 140 mg/l. (**Figure 4**). The concentration of BOD is more variable (**Figure 5**) and averaged 21.6 – 92.5 mg/l (**Table 5**). Total dissolved solids are generally low and averaged between 372 – 493 mg/l.

Table 4 – Seepage Cells (Outfall 001) Hydraulic Loading

Year	Annual Total Discharge (MG/yr)	Average Daily Discharge (gal/day)
2020	25.2	0.069
2021	14.0	0.038
2022	14.3	0.039
2023	18.6	0.051
2024	16.3	0.045

Table 5 – Seepage Cells (Outfall 001) Annual Average Concentrations

Year	TDS (mg/l)	Total Kjeldahl Nitrogen (mg/l)	Nitrite+Nitrate (mg/l)	BOD (mg/l)	Chloride (mg/l)
2020	372	25.8	0.4	21.6	82.6
2021	475	34.6	1.8	75.2	115.2
2022	458	42.1	1.0	92.5	120.4
2023	480	54.4	0.3	64.8	127.8
2024	493	51.1	0.3	68.1	111.9

Background Groundwater Quality

Background groundwater quality is defined by the results from samples collected at MW-1. Monitoring well MW-1 is approximately 400 feet east northeast of the northern seepage cell. As evidenced by the total dissolved concentrations most often being below 100 mg/l (**Figure 8**), there are few dissolved constituents upgradient of the seepage cells. The results indicate that there are few anthropogenic sources of chloride (**Figure 9**), ammonia (**Figure 10**), and nitrite+nitrate (**Figure 11**).

Downgradient Groundwater Quality

Downgradient monitoring wells MW-2, MW-1A and MW-2A are located at the southwest corner of the seepage cells. MW-2 is approximately 40 feet southwest, MW-2A is approximately 50 feet west and MW-1A is approximately 110 feet south of the seepage cells. The results for chloride and total dissolved solids at the downgradient monitoring wells are highly variable and a function of the discharge to the seepage cells. The results for chloride and total dissolved solids most often oscillate between the results at the background monitoring well (MW-1) and the effluent. The results for ammonia are elevated at all downgradient monitoring wells but highest at MW-2 where they occasionally are more than three times the NR 140 ES of 9.7 mg/l (**Figure 10**). The results for nitrite+nitrate at downgradient monitoring wells are also elevated at MW-1A and MW-2A. Nitrite+nitrate is always low or non-detect at MW-2.

Treatment System Impact to Surface Water Quality

Given the proximity to surface water, an analysis of applicable water quality-based effluent limits (WQBEL) was developed as if this were a direct surface water discharge to Smith Lake and the greater Cruson Slough. Based on this review, in addition to the existing limits and monitoring in the current permit, effluent limits and monitoring were recommended for BOD5, total suspended solids, E. coli, ammonia nitrogen and phosphorus. Monitoring was also suggested for nitrite+nitrate, total Kjeldahl nitrogen, total nitrogen and hardness as $CaCO_3$.

Monthly average limits for BOD and TSS of 30 mg/l would apply. It is expected that the suspended solids and particulate organic matter will be filtered out of the effluent as it migrates into shallow groundwater through the surface soils and the sandy lithology. Therefore, TSS and BOD are expected to be treated prior to reaching Smith Lake.

Bacterial standards for E. coli would apply. E. coli and other bacteria are expected to be filtered out as they sorb to soil and sand particles. However, there is still potential for E. coli and other bacteria to migrate through groundwater and into surface water. Given the expected E. coli survival in the groundwater with limited energy resources, the groundwater flow rates, and distance to Smith Lake, it is not expected there would be a bacteria contribution from the Lone Rock WWTF discharge to Smith Lake.

Monthly average ammonia limitations are dependent upon the time of year; April – May (46 mg/l), June – September (18 mg/l), and October – March (50 mg/l). A comparison between the concentration of ammonia in the effluent and the downgradient monitoring wells show that ammonia is partly treated and diluted as it migrates through groundwater towards Smith Lake. The results for ammonia at downgradient monitoring wells have been at times higher than the June – September ammonia limit of 18 mg/l. The additional dilution expected downgradient of the monitoring wells is anticipated to bring ammonia concentrations below the monthly average limit of 18 mg/l.

A monthly average phosphorus limit of 0.12 mg/L, six-month average of 0.040 mg/L, and annual average of 0.19 lb/day limits would apply. It is expected that much of the phosphorus discharged will be absorbed or precipitated before it enters groundwater and Smith Lake. Given the distance to surface water, monitoring for total and dissolved phosphorus at the effluent and groundwater monitoring wells is recommended in the reissued permit to assist in evaluating the potential impact of the Lone Rock WWTF discharge on surface water phosphorus concentrations.

Treatment System Impact to Groundwater Quality

An assessment of the treatment system impact on groundwater quality is inhibited to some degree by the topographic and property boundaries surrounding the treatment system. The downgradient monitoring wells are approximately 50 – 100 feet from the treatment system and there are no monitoring wells beyond the typical design management zone boundary of 250 feet. Therefore, the results seen at these nearby downgradient monitoring wells are elevated relative to what would be seen further downgradient. The variability in the results for all dissolved parameters are likely a function of the varying discharge between seepage cells, the proximity of the wells to the seepage cells and the rapid groundwater flow in the unconsolidated river sand sediments.

The results for chloride in the discharge are most often below the NR 140 PAL of 125 mg/l and subsequently the results for chloride at downgradient monitoring wells are below the discharge concentration and the NR 140 PAL. The discharge to the seepage cell system has resulted in exceedances of the groundwater standards for ammonia. The results for ammonia at MW-2 have ranged up to 28.4 mg/l during the past ten years. Additionally, monitoring well MW-2A has had ammonia concentrations reach 13.4 mg/l during the past five years. Overall, there are routine exceedances of the NR 140 PAL for ammonia due to the consistent discharge of ammonia at concentrations well above the NR 140 ES. While the results for nitrate in the discharge to the seepage cells are low, the results for nitrate at downgradient monitoring wells indicate that there is nitrification of the ammonia occurring as it migrates through the seepage cells into groundwater. The results for nitrite+nitrate were almost always above the NR 140 ES for nitrite+nitrate at MW-2A between the period 2015 – 2023. The results for nitrite+nitrate are lower but still at times well above the NR 140 ES. Overall, the discharge of the effluent has resulted in nitrogen contamination to the local groundwater.

Indicator Parameter PALs

Indicator Parameter Preventive Action Limits (PALs) are developed following the procedures described in s. NR 140.20(2), Wis. Adm. Code and "Calculating Preventive Action Limits and Evaluating Groundwater Quality Exemptions for Groundwater Dischargers". Indicator parameters do not have Enforcement Standards. The PAL for an indicator parameter is a benchmark for evaluating site specific trends. When significant increases in the trends are observed, the facility and the department's response action under s. NR 140.24 Wis. Adm. Code should be to investigate the source of the compound. The indicator PALs for this facility were calculated using whichever of the two following methods provides a greater PAL.

- ∑ [Background groundwater quality + (Standard Deviation of results x 3)]
- ∑ [Background groundwater quality + Minimum Increase (NR 140.20 Table 3)]

Indicator parameter PALs for the current permit term were calculated using monitoring data from MW-1 during the prior permit term. The indicator parameter PALs for use in the upcoming permit WI-0060763-10 are presented in **Table 3** and were calculated using results from MW-1 (June 1, 2020 – March 31, 2025).

Alternative Concentration Limits

Alternative concentration Limits (ACLs) can be developed and provided for a groundwater monitoring system to replace the PAL or ES (s. NR 140.28, Wis. Adm. Code). ACLs are provided if the conditions at the background monitoring well(s) indicate that it is appropriate. The methodology and considerations for developing and providing ACLs are outlined in the guidance document "Calculating Preventive Action Limits and Evaluating Groundwater Quality Exemptions for Groundwater Dischargers". Individual ACLs for chloride and nitrite+nitrate are not provided in the upcoming permit term as the background concentrations are low.

Conclusions, Recommendations and Schedule Requirements

- Additional monitoring requirements due to the characterization as an indirect discharge to surface water.
    - Add monitoring for total phosphorus at the discharge to the seepage cells and dissolved phosphorus at the groundwater monitoring wells.
    - Reinstate the groundwater water enforcement standards for chloride, ammonia and nitrite+nitrate.
    - Install piezometer monitoring wells MW-1P and MW-2P adjacent to MW-1 and MW-2, respectively. The data collected at these monitoring wells will be utilized to assess the vertical hydraulic gradients, change in groundwater quality over depth and to approximate how/if groundwater flows into Smith Lake.

Figure 1 – Water Table Flow Map – January 30, 2025

Water Table Flow Map (January 30, 2025) - Lone Rock WWTF

Site Location

Lone Rock WWTF
223 W Buck Run Rd
Lone Rock, WI 53556

Legend

- Water Table Contour (1/30/2025 - 1' FAMSL)
- Groundwater Flow Direction

Notes

Water table contours generated using elevation data collected on January 30, 2025. Water table elevations and contours are presented in feet above mean sea level.

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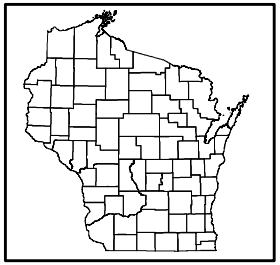
Date: 4/15/2025



0 60 120 180 240 300 360 Feet

1:2,458

Figure 2 – Water Table Flow Map – June 30, 2024

Water Table Flow Map (June 30, 2024) - Lone Rock WWTF

Site Location

Lone Rock WWTF
223 W Buck Run Rd
Lone Rock, WI 53556

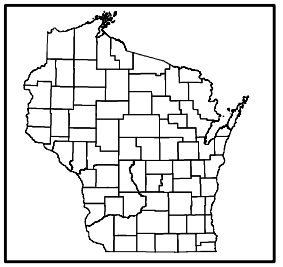
Legend

- Water Table Contour (6/30/2024 - 1' FAMSL)
- Groundwater Flow Direction

Notes

Water table contours generated using elevation data collected on June 30, 2024. Water table elevations and contours are presented in feet above mean sea level.

Created By: watsoz
Date: 4/29/2025



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1:2,458

Figure 3 – Effluent Nitrogen Species

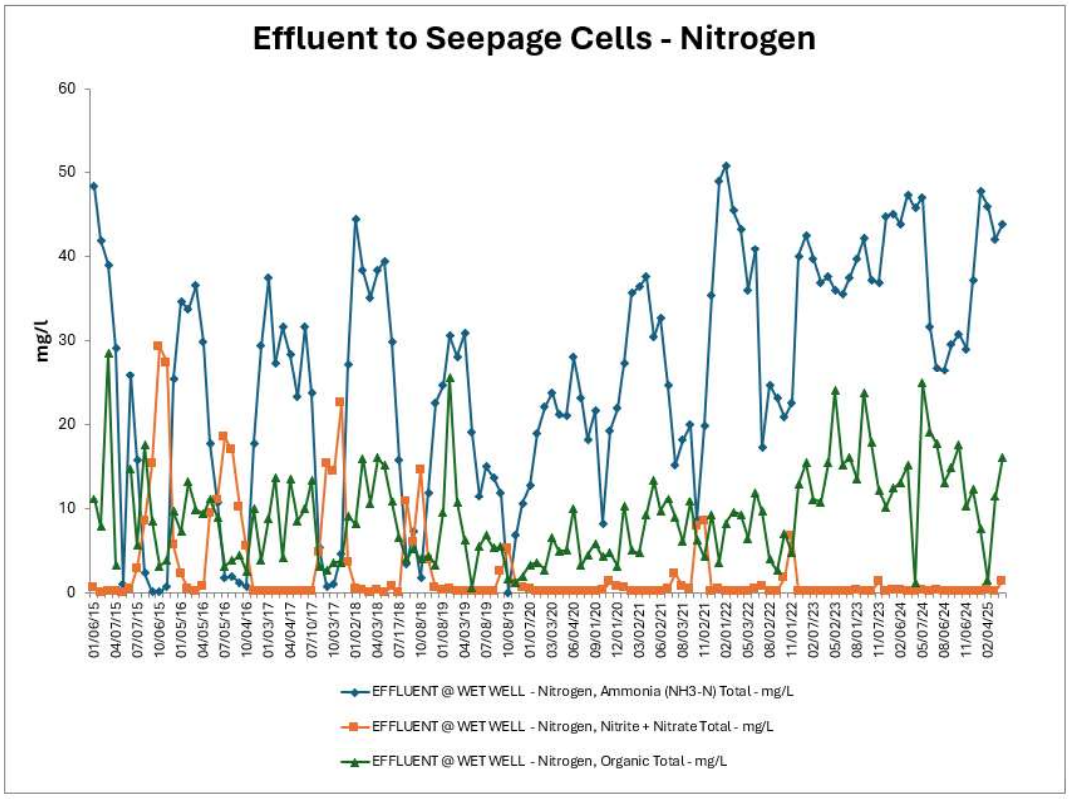


Figure 4 – Effluent Chloride

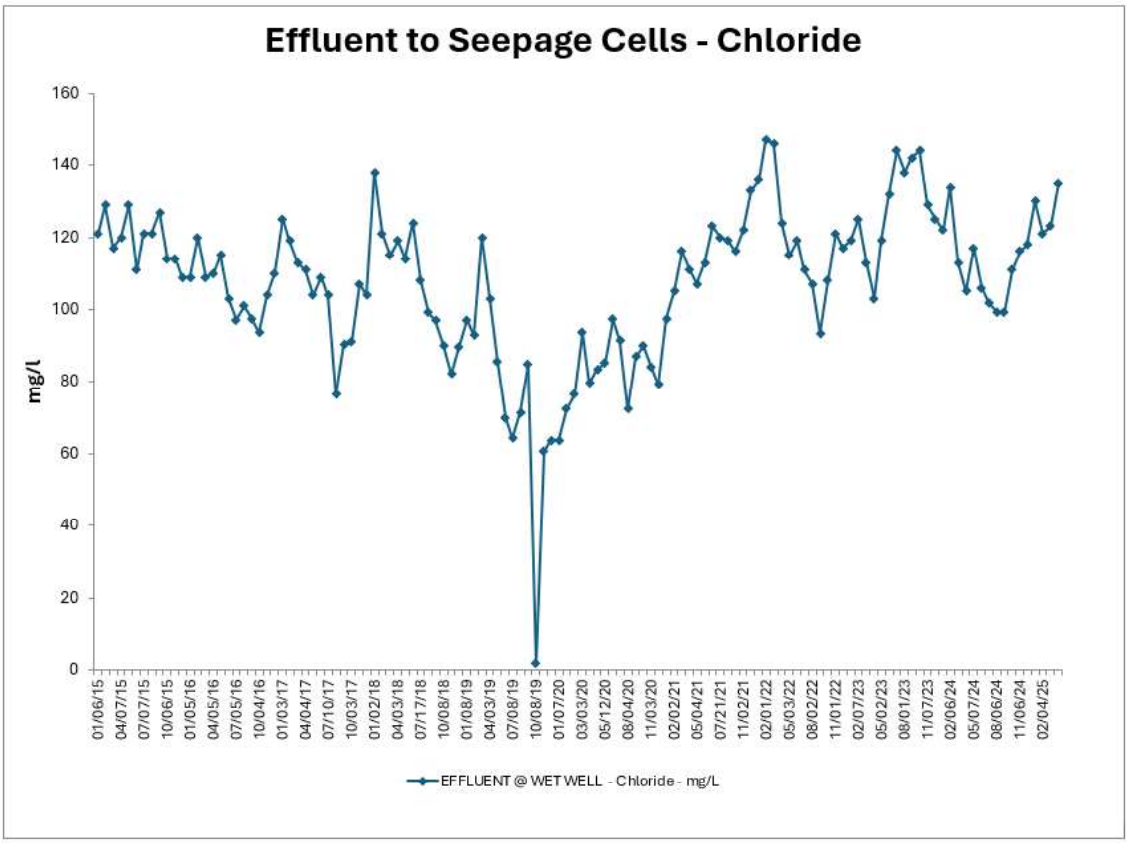


Figure 5 – Effluent BOD5

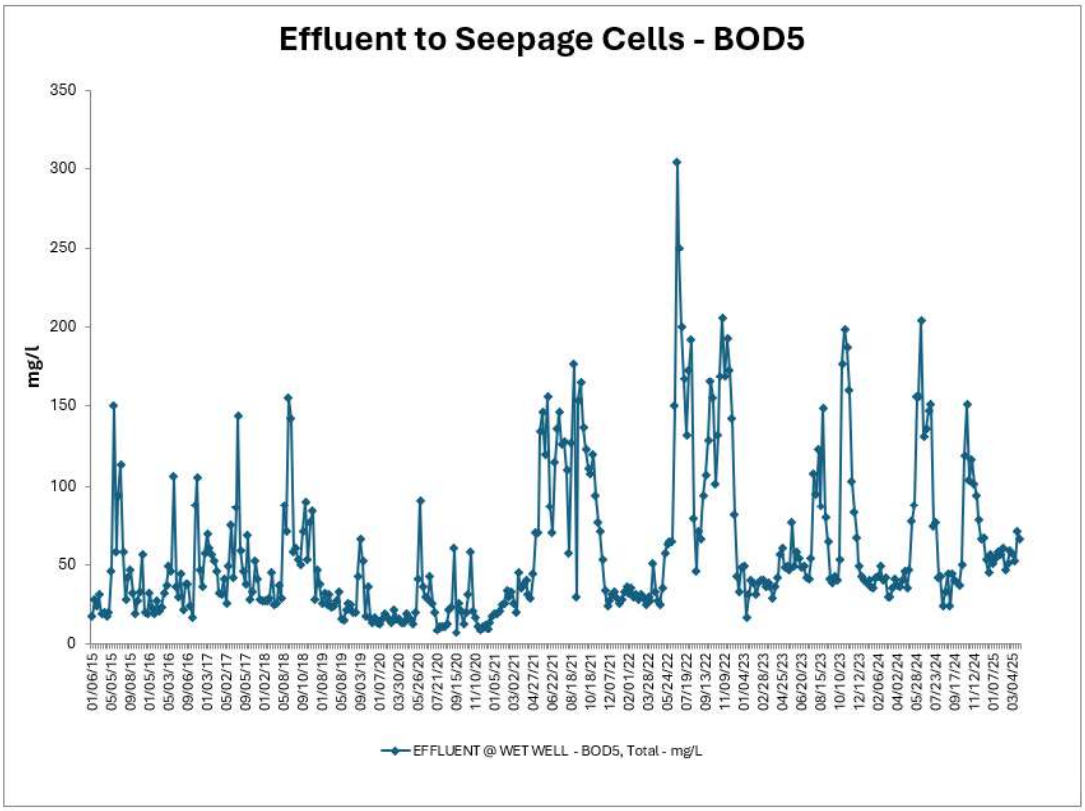


Figure 6 – Effluent pH

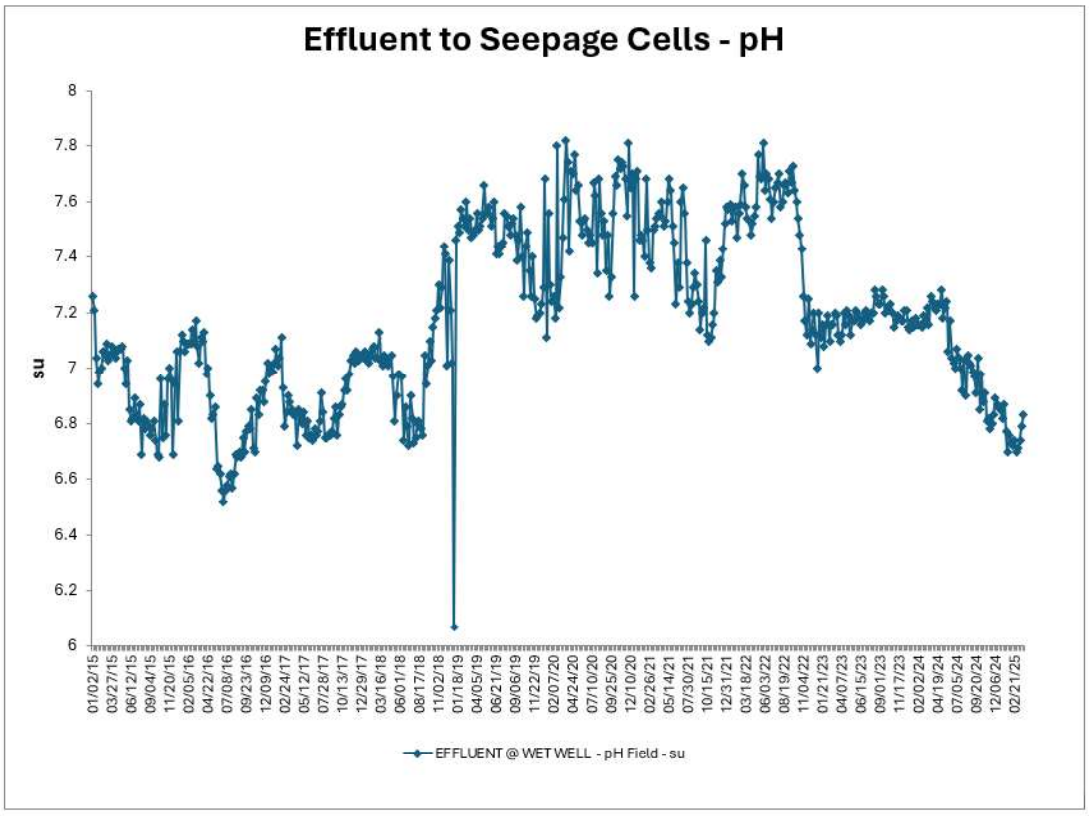


Figure 7 – Groundwater Monitoring Wells Groundwater Elevation

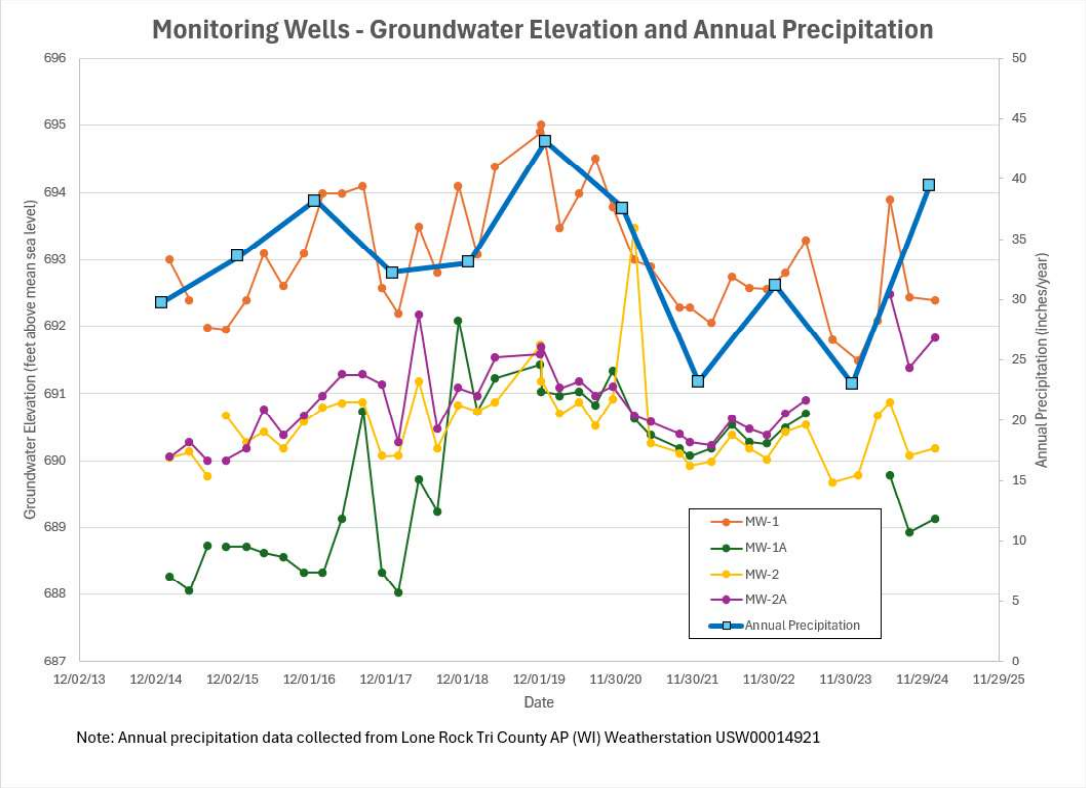


Figure 8 – Groundwater Monitoring Wells Total Dissolved Solids

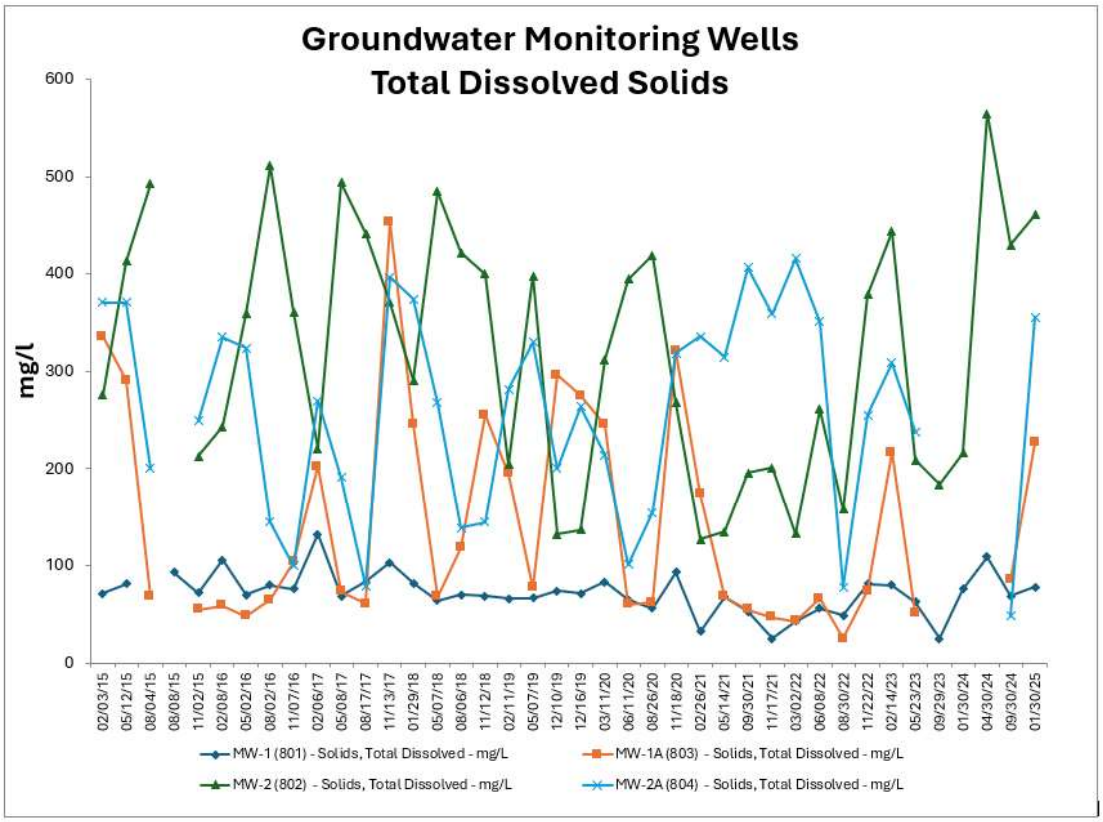


Figure 9 – Groundwater Monitoring Wells Chloride

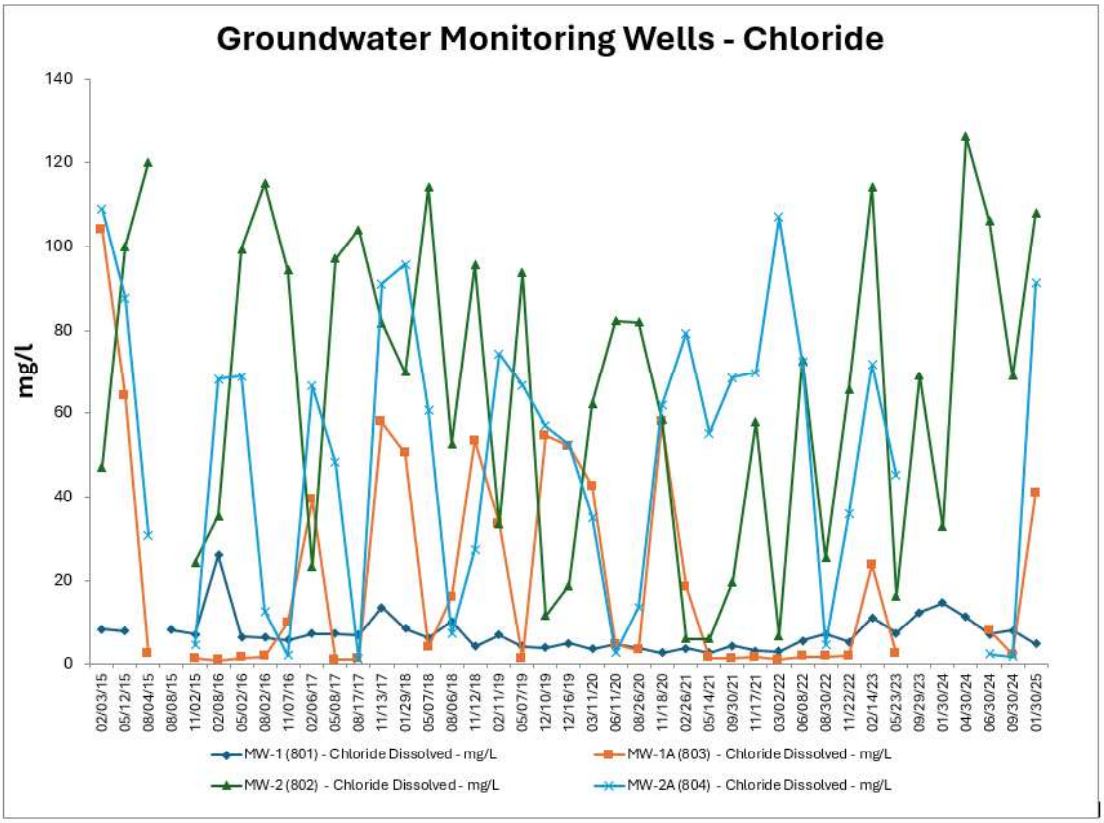


Figure 10 – Groundwater Monitoring Wells Ammonia

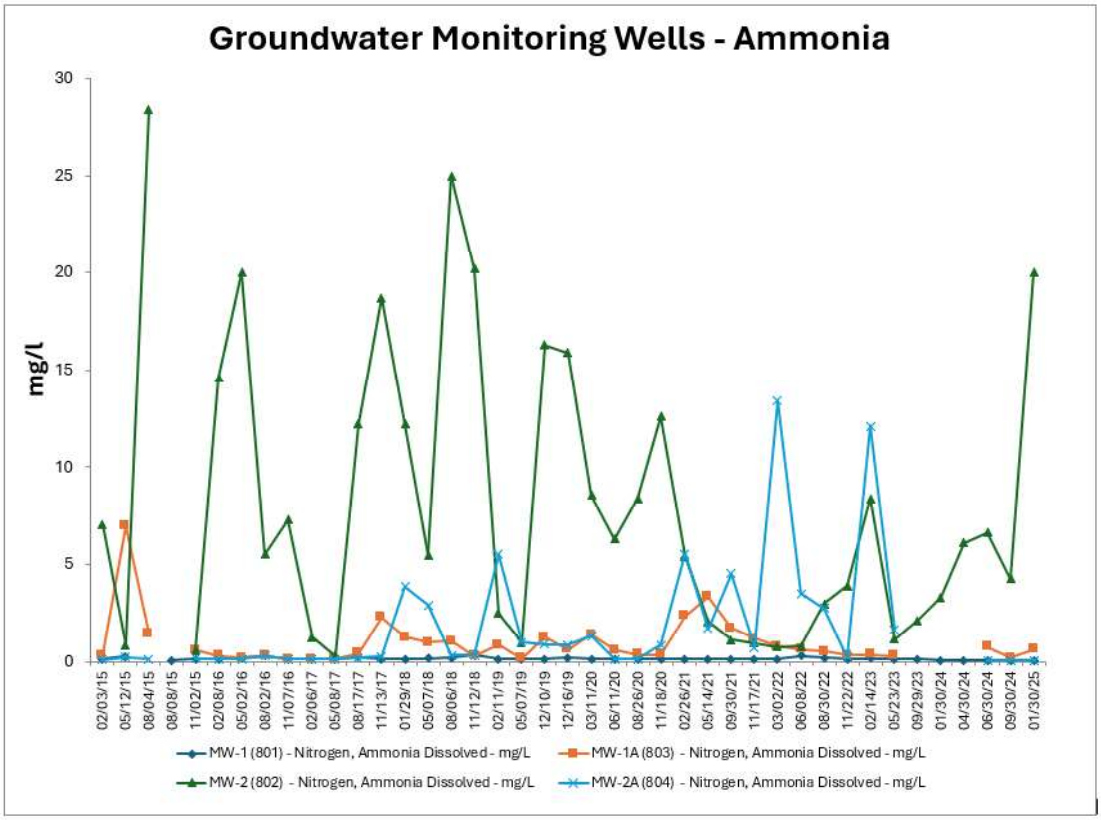


Figure 11 – Groundwater Monitoring Wells Nitrite+nitrate

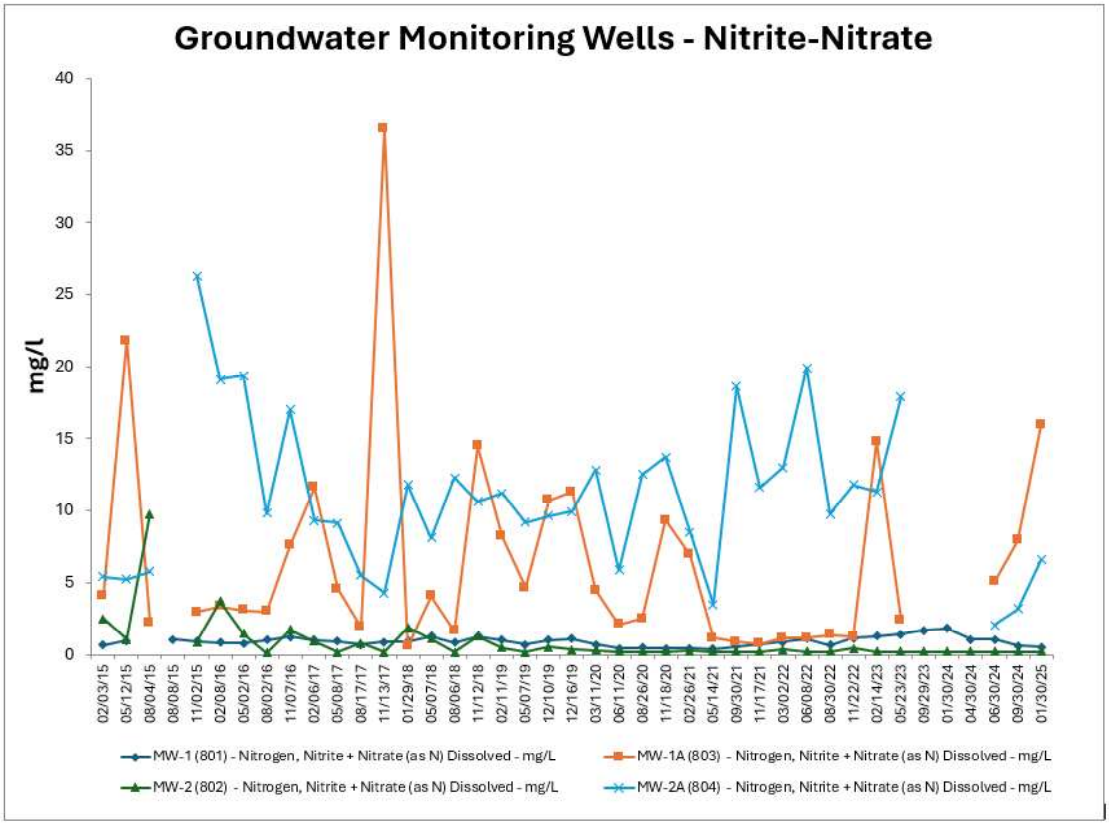
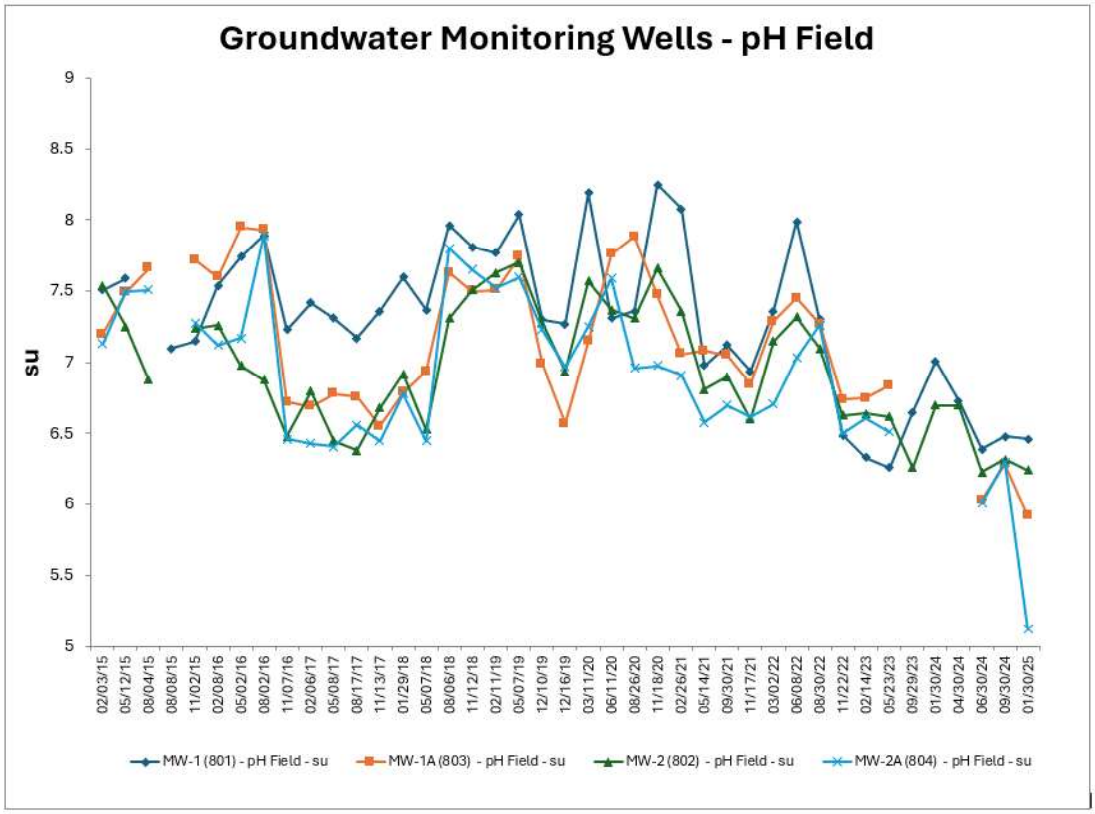


Figure 12 – Groundwater Monitoring Wells pH



CORRESPONDENCE/MEMORANDUM

State of Wisconsin

DATE: May 20, 2025

TO: Zach Watson, Hydrogeologist – SCR/Dodgeville

FROM: Sarah Luck – SCR/Fitchburg

SUBJECT: Water Quality-Based Effluent Limitations for Lone Rock Wastewater Treatment Facility
WPDES Permit No. WI-0060763-10-0

This is in response to your request for an evaluation of the water quality-based effluent limitations (WQBELs) using chapters NR 102, 104, 105, 106, 207, 210, 212, and 217 of the Wisconsin Administrative Code (where applicable), for the discharge from Lone Rock Wastewater Treatment Facility in Richland County. **This municipal wastewater treatment facility (WWTF) is currently a seepage cell system adjacent to Cruson Slough which empties into the Wisconsin River. Given the proximity to surface water, an analysis of any applicable WQBELs was requested.** The facility is located outside the Wisconsin River TMDL area. The evaluation of limits is discussed in more detail in the attached report.

Based on our review, the following limits would be needed if this were a direct surface water discharge to Cruson Slough on a chemical-specific basis:

Parameter	Daily Maximum	Daily Minimum	Weekly Average	Monthly Average	Six-Month Average	Annual Average	Footnotes
Flow Rate							1
BOD_5			45 mg/L	30 mg/L			2
TSS			45 mg/L	30 mg/L			2
pH	9.0 s.u.	6.0 s.u.					2
Ammonia Nitrogen							1
E. coli May – September				126 #/100 mL geometric mean			3
Chloride							1
Hardness, Total as $CaCO_3$							4
Phosphorus				0.12 mg/L	0.040 mg/L	0.019 lbs/day	-
TKN, Nitrate+Nitrite, and Total Nitrogen							5

Footnotes:

1. Monitoring only.
2. These limits are based on the Warm Water Sport Fish community of the immediate receiving water as described in s. NR 210.05(1), Wis. Adm. Code.
3. Additional final limit: No more than 10 percent of *E. coli* bacteria samples collected in any calendar month may exceed 410 count/100 mL.
4. Hardness monitoring is recommended because of the relationship between hardness and calculated limits based on acute and chronic toxicity criteria.
5. As recommended in the Department's October 1, 2019 *Guidance for Total Nitrogen Monitoring in Wastewater Permits*, annual total nitrogen monitoring is recommended for all minor municipal permittees. Total Nitrogen is the sum of nitrate (NO_3), nitrite (NO_2), and total Kjeldahl nitrogen (TKN) (all expressed as N).

No WET testing is required because information related to the discharge indicates low risk for toxicity.

The recommended limits meet the expression of limits requirements in ss. NR 106.07 and NR 205.065(7), Wis. Adm. Code, and additional limits are not required.

Please consult the attached report for details regarding the above recommendations. If there are any questions or comments, please contact Sarah Luck (Sarah.Luck@wisconsin.gov) or Diane Figiel (Diane.Figiel@wisconsin.gov).

Attachments (3) – Narrative, Site Map, and Thermal Table

PREPARED BY: Sarah Luck _____ Date: May 20, 2025

Sarah Luck
Water Resources Engineer

E-cc: Jordan Main, Wastewater Engineer – SCR/Fitchburg
BetsyJo Howe, Permit Drafter – SCR/Fitchburg
Lisa Creegan, Regional Wastewater Supervisor – SCR/Fitchburg
Diane Figiel, Water Resources Engineer – WY/3
Nate Willis – Wastewater Engineer – WY/3

Attachment #1

Water Quality-Based Effluent Limitations for
Lone Rock Wastewater Treatment Facility

WPDES Permit No. WI-0060763-10-0

PART 1 – BACKGROUND INFORMATION

Facility Description

Lone Rock Wastewater Treatment Facility consists of two aerated lagoons operated in series followed by an effluent holding pond, with treated effluent discharged to either of two effluent seepage areas covering an area of about two acres. The discharge is rotated between four distinct areas of the two seepage cells. Four groundwater monitoring wells around the site are monitored quarterly. Due to the proximity of sloughs of the Wisconsin River in the direction of groundwater flow from the facility, the effluent discharge is considered an indirect surface water discharge.

Attachment #2 is a map of the area showing the approximate location of Outfall 001.

Existing Permit Limitations

The current permit, which expired on December 31, 2024, included the following limitations and monitoring for effluent ("Sample Point 001 – Effluent at Wet Well, Absorption Pond (Seepage Cell)").

Parameter	Daily Maximum	Daily Minimum	Weekly Average	Monthly Average	Six-Month Average	Footnotes
Flow Rate						1
BOD_5				50 mg/L		-
TSS						1
pH						1
Ammonia Nitrogen						1
Chloride						1
Nitrogen, Organic Total						1
Solids, Total Dissolved						1
TKN, Nitrate+Nitrite, and Total Nitrogen						1

Footnote:

1. Monitoring only.

Receiving Water Information

- Name: Cruson Slough
  Note: Smith Lake is also part of Cruson Slough. Given that Cruson Slough behaves as a lake (see note below under "Flow" bullet), limits calculated for Cruson Slough are considered to be protective of Smith Lake.

- Waterbody Identification Code (WBIC): 1236300 (Cruson Slough) and 1236400 (Smith Lake)
- Classification used in accordance with chs. NR 102 and 104, Wis. Adm. Code: Warm Water Sport Fish (WWSF) community, non-public water supply.
- Flow: A ten-to-one dilution ratio will be used for calculating effluent limitations based on chronic or long-term impacts, in accordance with s. NR 106.06(4)(b)2, Wis. Adm. Code, because the receiving water does not exhibit a unidirectional flow at the point of discharge.
  Based on discussions with Department biologists, Cruson Slough exhibits lake /reservoir characteristics due to a water control structure on the downstream side (see blue rectangle on Site Map in Attachment #2). The water control structure is maintained by the Department, and work was completed to improve it in 2023.
- Hardness = 72 mg/L as $CaCO_3$. This value represents the geometric mean of 45 samples from the Wisconsin River at the Wisconsin Dells (SWIMS Station #573052) collected February 1977 to January 1992. This value is an approximation for Cruson Slough since no hardness data is available for Cruson Slough or Smith Lake.
- Source of background concentration data: No data is currently available for Cruson Slough; however, monitoring of some parameters will be taking place beginning summer of 2025. For this evaluation, the background concentrations were assumed to be negligible, and a value of zero is used in the computations. Background data for calculating effluent limitations for ammonia nitrogen are described later.
- Multiple dischargers: None.
- Impaired water status: Neither Cruson Slough nor Smith Lake are impaired. However, the Wisconsin River, located approximately 2.5 miles downstream of the outfall, has been listed on the state's 303(d) impaired waters list since 1998 for PCBs in fish tissue. This portion of the Wisconsin River is located outside the Wisconsin River TMDL area.

Effluent Information

- Flow rate:
  Design annual average = 0.057 million gallons per day (MGD)
  For reference, the actual average flow from January 2020 through January 2025 was 0.049 MGD.
- Hardness = 300 mg/L as $CaCO_3$. This value is estimated based on similar municipal wastewater treatment facilities in the area (Spring Green WWTF and Avoca WWTF) with no industrial contributors since no hardness data is available for the effluent.
- Acute dilution factor used in accordance with s. NR 106.06(3)(c), Wis. Adm. Code: Not applicable – this facility does not have an approved Zone of Initial Dilution (ZID).
- Water source: Domestic wastewater with water supply from wells.
- Additives: Dow AgroSciences LLC CROSSBOW Herbicide and Aquafix VitaStim Sludge Reducer.
- Effluent characterization: This facility is categorized as a minor municipality groundwater discharge. There is limited effluent monitoring data available from Outfall 001 (effluent at wet well).

PART 2 – WATER QUALITY-BASED EFFLUENT LIMITATIONS FOR TOXIC SUBSTANCES – EXCEPT AMMONIA NITROGEN

Permit limits for toxic substances are required whenever any of the following occur:

1. The maximum effluent concentration exceeds the calculated limit (s. NR 106.05(3), Wis. Adm. Code)
2. If 11 or more detected results are available in the effluent, the upper 99th percentile (or P_{99}) value exceeds the comparable calculated limit (s. NR 106.05(4), Wis. Adm. Code)

3. If fewer than 11 detected results are available, the mean effluent concentration exceeds 1/5 of the calculated limit (s. NR 106.05(6), Wis. Adm. Code)

Acute Limits based on 2 × ATC

Daily maximum effluent limitations for toxic substances are based on the acute toxicity criteria (ATC), listed in ch. NR 105, Wis. Adm. Code. For discharges to lakes, daily or acute limits are calculated as equal to 2 × ATC.

Chronic Limits

Chronic limits for lake discharges are based on an estimated 10:1 lake: effluent mixing zone unless a previous mixing zone study has established a more appropriate mixing zone. Chronic limits based on CTC, WC, HTC, or HCC are derived as follows:

Limitation = 11(WQC) - 10 (Cs)

Where:

WQC =Water quality criterion or secondary acute value according to ch. NR 105

Cs = Background concentration of the substance (in units of mass per unit volume) as specified in s. NR 106.06(4)(e).

The following tables list the calculated WQBELs for this discharge along with the results of effluent sampling. All concentrations are expressed in terms of micrograms per Liter (µg/L), except for hardness and chloride (mg/L).

Daily Maximum Limits based on Acute Toxicity Criteria (ATC)

RECEIVING WATER FLOW = 10 to 1 Mixing Zone, 2xATC

SUBSTANCE	REF. HARD.* mg/L	ATC	MAX. EFFL. LIMIT	1/5 OF EFFL. LIMIT	MEAN EFFL. CONC.	1-day P_{99}	1-day MAX. CONC.
Arsenic		340	679.6	135.9			
Cadmium	300	36.3	72.7	14.5			
Chromium	300	4434	8867.5	1773			
Copper	300	43.8	87.5	17.5			
Lead	300	309	618.2	123.6			
Nickel	268	1080	2160.6	432			
Zinc	300	315	629.2	125.8			
Chloride (mg/L)		757	1514.0			165	147

* The indicated hardness may differ from the effluent hardness because the effluent hardness exceeded the maximum range in ch. NR 105, Wis. Adm. Code, over which the acute criteria are applicable. In that case, the maximum of the range is used to calculate the criterion.

Weekly Average Limits based on Chronic Toxicity Criteria (CTC)

RECEIVING WATER FLOW = 10 to 1 Mixing Zone

SUBSTANCE	REF. HARD. mg/L	CTC	WEEKLY AVE. LIMIT	1/5 OF EFFL. LIMIT	MEAN EFFL. CONC.	4-day P_{99}
Arsenic		152.2	1674	334.8		
Cadmium	72	1.90	20.90	4.2		

Attachment #1

SUBSTANCE	REF. HARD. mg/L	CTC	WEEKLY AVE. LIMIT	1/5 OF EFFL. LIMIT	MEAN EFFL. CONC.	4-day P_{99}
Chromium	72	100.95	1110	222.1		
Copper	72	7.81	85.9	17.18		
Lead	72	20.39	224.3	44.9		
Nickel	72	39.53	435	87.0		
Zinc	72	90.32	994	198.7		
Chloride (mg/L)		395	4345			136

Monthly Average Limits based on Wildlife Criteria (WC)
RECEIVING WATER FLOW = 10 to 1 Mixing Zone

SUBSTANCE	WC	MO'LY AVE. LIMIT	1/5 OF EFFL. LIMIT
Mercury (ng/L)	1.3	14.30	2.86

Monthly Average Limits based on Human Threshold Criteria (HTC)
RECEIVING WATER FLOW = 10 to 1 Mixing Zone

SUBSTANCE	HTC	MO'LY AVE. LIMIT	1/5 OF EFFL. LIMIT
Cadmium	370	4070	814.0
Chromium (+3)	3818000	41998000	8399600
Lead	140	1540	308.0
Nickel	43000	473000	94600

Monthly Average Limits based on Human Cancer Criteria (HCC)
RECEIVING WATER FLOW = 10 to 1 Mixing Zone

SUBSTANCE	HCC	MO'LY AVE. LIMIT	1/5 OF EFFL. LIMIT
Arsenic	13.3	146.3	29.26

In addition to evaluating the need for limits for each individual substance for which HCC exist, s. NR 106.06(8), Wis. Adm. Code, requires the evaluation of the cumulative cancer risk. Because no effluent limits are needed based on HCC, determination of the cumulative cancer risk is not needed per s. NR 106.06(8), Wis. Adm. Code.

Conclusions and Recommendations
Lone Rock Wastewater Treatment Facility has not collected data on any toxic substances other than chloride, so reasonable potential for other toxics cannot be evaluated at this time.

Chloride – Considering available effluent data from the current permit term (January 2020 through January 2025), the 1-day P_{99} chloride concentration is 165 mg/L, and the 4-day P_{99} of effluent data is 136

mg/L. These effluent concentrations are below the calculated WQBELs for chloride; therefore, **no effluent limits are needed. Chloride monitoring is recommended to continue.**

Mercury – The permit application did not require monitoring for mercury because Lone Rock Wastewater Treatment Facility is categorized as a minor facility as defined in s. NR 200.02(8), Wis. Adm. Code. In accordance with s. NR 106.145(3)(a)3, Wis. Adm. Code, a minor municipal discharger shall monitor, and report results of influent and effluent mercury monitoring once every three months if, "there are two or more exceedances in the last five years of the high-quality sludge mercury concentration of 17 mg/kg specified in s. NR 204.07(5), Wis. Adm. Code." A review of the past five years of sludge characteristics data reveals that all the sample results are within expected analytical ranges and well below the 17 mg/kg level. The average concentration in the sludge of three samples collected from April 2021 to December 2024 (with one non-detect) was 0.58 mg/kg, with a maximum reported concentration of 0.92 mg/kg. Therefore, **no mercury monitoring is recommended at Outfall 001**.

PFOS and PFOA – The need for PFOS and PFOA monitoring is evaluated in accordance with s. NR 106.98(2), Wis. Adm. Code. Based on the type of discharge, the effluent flow rate, and lack of indirect dischargers, **PFOS and PFOA monitoring is not recommended.** The Department may re-evaluate the need for sampling at the next permit reissuance if new information becomes available that suggests PFOS or PFOA may be present in the discharge.

PART 3 – WATER QUALITY-BASED EFFLUENT LIMITATIONS FOR BOD_5, TSS, pH, AND DISSOLVED OXYGEN

BOD_5 & DO

In establishing biological oxygen demand (BOD_5) limitations, the primary intent is to prevent a lowering of dissolved oxygen (DO) levels in the receiving water below water quality standards as specified in ss. NR 102.04(4)(a) and (b), Wis. Adm. Codes. The 26-lb method (13-lb method for cold water community streams) is the most frequently used approach for calculating BOD_5 limits when resources are not available to develop a detailed water quality model. This simplified model was developed in the 1970's by the Wisconsin Committee on Water Pollution on the Fox, Wisconsin, Oconto, and Flambeau Rivers. Further studies throughout the 1970's proved this model to be relatively accurate. The model has since then been used by the Department on many occasions when resources are not available to perform a site-specific model. The "26" value stems from the following equation:

$$\frac{26\ {}^{\text{lbs}}/_{\text{day}}}{{}^{\text{ft}^3}/_{\text{sec}}} * \frac{1\,\text{day}}{86{,}400\,\text{sec}} * \frac{454{,}000\,\text{mg}}{\text{lbs}} * \frac{1\,\text{ft}^3}{28.32\,\text{L}} = 4.8 = 2.4 * 2\ {}^{\text{mg}}/_{\text{L}}$$

The 4.8 mg/L has been calculated by taking 2.4 mg/L which is the number one receives when converting 26 lbs of BOD/day/cfs into mg/L, multiplied by 2.0 which is the change in the DO level for warm water community streams. A typical background DO level for Wisconsin waters is 7.0 mg/L, so a 2.0 mg/L decrease is allowed to meet the 5.0 mg/L standard for WWSF community streams. The above relationship is temperature dependent, and an appropriate temperature correction factor is applied. The 26-lb method is based on a typical 24°C summer value for warm water streams. Adjustments for temperature are made using the following equation:

$$k_t = k_{24}\left(0.967^{(T-24)}\right)$$

Where k_{24} = 26 lbs of BOD/day/cfs

Calculations based on Full Assimilative Capacity at 7-Q_{10} Conditions:

$$WA\ Limit\ \left(\frac{mg}{L}\right) = 2.4 * (DO_o - DO_{std}) * \frac{7Q_{10} + Q_e * (1-f)}{Q_e} * 0.967^{T-24}$$

Where:

Q_e = effluent flow = 0.057 MGD = 0.088 cfs
DO_{stream} = background dissolved oxygen = 7.0 mg/L
DO_{eff} = 5.0 mg/L
DO_{std} = dissolved oxygen criteria from s. NR 102.04(4) = 5.0 mg/L
7-Q_{10} = 0.88 cfs (using 10:1 dilution)
f = 0
DO_o = Initial mixed river DO = $\frac{DO_{eff} * Q_e + DO_{stream} * (7 - Q_{10} - Q_e * f)}{Q_e * (1-f) + 7 - Q_{10}}$ = 7.0 mg/L
T = Receiving water temperatures from s. NR 102.25, Wis. Adm. Code, Table 4 - Ambient Temperatures and Water Quality Criteria for Temperature for Inland Lakes and Impoundments (Southern)

The table below shows the calculated weekly average BOD_5 WQBELs during May – October and November – April. Monthly receiving water temperatures are from s. NR 102.25, Wis. Adm. Code, and are averaged over discharge periods:

Calculated Weekly Average BOD_5 WQBELs

Parameter	May – October	November – April
Effluent Flow (MGD)	0.057	0.057
Flow 7-Q_{10} (cfs)	0.88	0.88
Receiving Water Temperature (°F)	67	40
Receiving Water Temperature (°C)	15	4.5
Effluent DO (mg/L)	5.0	5.0
Background DO (mg/L)	7.0	7.0
Mix DO (mg/L)	6.8	6.8
DO Criterion (mg/L)	5.0	5.0
f	0	0
Concentration Limits (mg/L)	**65**	**92**
Mass Limits (lbs/day)	**31**	**44**

The calculated weekly average BOD_5 limits using the 26-lb method are significantly higher than the categorical effluent limitations that are listed in s. NR 210.05(1), Wis. Adm. Code. For a receiving water that is classified as fish and aquatic life, a publicly owned treatment works shall meet the following limits:

Recommended BOD_5, TSS, pH and DO Limits

	Daily Minimum	Daily Maximum	Weekly Average	Monthly Average
BOD_5			45 mg/L	30 mg/L
TSS			45 mg/L	30 mg/L

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	Daily Minimum	Daily Maximum	Weekly Average	Monthly Average
pH	6.0 s.u.	9.0 s.u.		
Dissolved Oxygen	N/A			

When categorical BOD_5 limits are given, mass limits are not required.

Additionally, **a daily minimum limit for dissolved oxygen is not required** since limiting discharge levels of BOD_5 ensures that the water quality criterion for dissolved oxygen is met.

PART 4 – WATER QUALITY-BASED EFFLUENT LIMITATIONS FOR AMMONIA NITROGEN

The State of Wisconsin promulgated revised water quality standards for ammonia nitrogen in ch. NR 105, Wis. Adm. Code, effective March 1, 2004, which includes criteria based on both acute and chronic toxicity to aquatic life.

Daily Maximum Limits based on Acute Toxicity Criteria (ATC)
Daily maximum limitations are based on acute toxicity criteria in ch. NR 105, Wis. Adm. Code, which are a function of the effluent pH and the receiving water classification. The acute toxicity criterion (ATC) for ammonia is calculated using the following equation:

$$\text{ATC in mg/L} = [A \div (1 + 10^{(7.204 - pH)})] + [B \div (1 + 10^{(pH - 7.204)})]$$

Where:

A = 0.411 and B = 58.4 for a Warm Water Sport fishery, and
pH (s.u.) = that characteristic of the effluent.

There was no effluent pH data available to calculate a daily maximum limit. However, presented below is a table of daily maximum limitations corresponding to various effluent pH values for informational purposes.

Daily Maximum Ammonia Nitrogen Limits – WWSF

Effluent pH s.u.	Limit mg/L	Effluent pH s.u.	Limit mg/L	Effluent pH s.u.	Limit mg/L
$6.0 \leq pH \leq 6.1$	108	$7.0 < pH \leq 7.1$	66	$8.0 < pH \leq 8.1$	14
$6.1 < pH \leq 6.2$	106	$7.1 < pH \leq 7.2$	59	$8.1 < pH \leq 8.2$	11
$6.2 < pH \leq 6.3$	104	$7.2 < pH \leq 7.3$	52	$8.2 < pH \leq 8.3$	9.4
$6.3 < pH \leq 6.4$	101	$7.3 < pH \leq 7.4$	46	$8.3 < pH \leq 8.4$	7.8
$6.4 < pH \leq 6.5$	98	$7.4 < pH \leq 7.5$	40	$8.4 < pH \leq 8.5$	6.4
$6.5 < pH \leq 6.6$	94	$7.5 < pH \leq 7.6$	34	$8.5 < pH \leq 8.6$	5.3
$6.6 < pH \leq 6.7$	89	$7.6 < pH \leq 7.7$	29	$8.6 < pH \leq 8.7$	4.4
$6.7 < pH \leq 6.8$	84	$7.7 < pH \leq 7.8$	24	$8.7 < pH \leq 8.8$	3.7
$6.8 < pH \leq 6.9$	78	$7.8 < pH \leq 7.9$	20	$8.8 < pH \leq 8.9$	3.1
$6.9 < pH \leq 7.0$	72	$7.9 < pH \leq 8.0$	17	$8.9 < pH \leq 9.0$	2.6

Weekly and Monthly Average Limits based on Chronic Toxicity Criteria (CTC)

Weekly and monthly average limits based on chronic toxicity criteria for ammonia are also calculated to determine the weekly and monthly average limits to meet the requirements of s. NR 106.07(3), Wis. Adm. Code.

Weekly average and monthly average limits for ammonia nitrogen are based on chronic toxicity criteria in ch. NR 105, Wis. Adm. Code. The 30-day chronic toxicity criterion (CTC) for ammonia in waters classified as a Warm Water Sport Fish Community is calculated by the following equation, according to subchapter IV of NR 106, Wis. Adm. Code.

$$CTC = E \times \{[0.0676 \div (1 + 10^{(7.688 - pH)})] + [2.912 \div (1 + 10^{(pH - 7.688)})]\} \times C$$

Where:

pH = the pH (s.u.) of the receiving water,
E = 0.854,
C = the minimum of 2.85 or $1.45 \times 10^{(0.028 \times (25 - T))}$ – (Early Life Stages Present), or
$C = 1.45 \times 10^{(0.028 \times (25 - T))}$ – (Early Life Stages Absent), and
T = the temperature (ºC) of the receiving water – (Early Life Stages Present), or
T = the maximum of the actual temperature (ºC) and 7 - (Early Life Stages Absent)

The 4-day criterion is equal to the 30-day criterion multiplied by 2.5. The 4-day criteria are used to derive weekly average limitations, and the 30-day criteria are used to derive monthly average limitations, both by a mass-balance using a ten-to-one dilution ratio.

Section NR 106.32 (3), Wis. Adm. Code, provides a mechanism for less stringent weekly average and monthly average effluent limitations when early life stages (ELS) of critical organisms are absent from the receiving water. This applies only when the water temperature is less than 14.5 ºC, during the winter and spring months. Burbot, an early spawning species, are not believed to be present in Cruson Slough based on conversations with local fisheries biologists and raw fish data in the Fisheries Management Information System. So "ELS Absent" criteria apply from October through March, and "ELS Present" criteria will apply from April through September for a warm water classification.

The "default" basin assumed values are used for Temperature, pH and background ammonia concentrations, because minimum ambient data is available. These values are shown in the table below, with the resulting criteria and effluent limitations.

Weekly and Monthly Ammonia Nitrogen Limits – WWSF

		Spring	Summer	Winter
		April & May	June – Sept.	Oct. - March
Effluent Flow	Qe (MGD)	0.057	0.057	0.057
	Ammonia (mg/L)	0.06	0.06	0.085
	Temperature (°C)	14	21	10
	pH (s.u.)	7.54	7.97	7.73
	Dilution Factor	10	10	10
Criteria mg/L	4-day Chronic			
	Early Life Stages Present	**10.53**	**4.30**	8.65
	Early Life Stages Absent	10.58	4.30	**11.57**
	30-day Chronic			
	Early Life Stages Present	**4.21**	**1.72**	3.46

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		Spring	Summer	Winter
		April & May	June – Sept.	Oct. - March
	Early Life Stages Absent	4.23	1.72	**4.63**
Effluent Limitations mg/L	Weekly Average			
	Early Life Stages Present	**115**	**47**	
	Early Life Stages Absent			**126**
	Monthly Average			
	Early Life Stages Present	**46**	**18**	
	Early Life Stages Absent			**50**

Conclusions and Recommendations
Reasonable potential for ammonia nitrogen cannot be evaluated at this time. **Monitoring is recommended in order to assess the need for limits at the next permit reissuance.**

PART 4 – WATER QUALITY-BASED EFFLUENT LIMITATIONS FOR BACTERIA

Section NR 102.04(5), Wis. Adm. Code, states that all surface waters shall be suitable for supporting recreational use and shall meet *E. coli* criteria during the recreation season. Section NR 210.06(2)(a)1, Wis. Adm. Code, includes two limits which must be included in permits for facilities which are required to disinfect:

1. The geometric mean of *E. coli* bacteria in effluent samples collected in any calendar month may not exceed 126 counts/100 mL.
2. No more than 10 percent of *E. coli* bacteria samples collected in any calendar month may exceed 410 counts/100 mL.

These limits apply during May through September and would need to be met prior to the effluent entering Cruson Slough.

PART 5 – PHOSPHORUS

Technology-Based Effluent Limit
Subchapter II of Chapter NR 217, Wis. Adm. Code, requires municipal wastewater treatment facilities that discharge greater than 150 pounds of total phosphorus per month to comply with a monthly average limit of 1.0 mg/L, or an approved alternative concentration limit. Considering the effluent flow rate (0.057 MGD), it is unlikely that the discharge exceeds this threshold. **No technology-based limit is recommended** at this time.

In addition, the need for a WQBEL for phosphorus must be considered.

Water Quality-Based Effluent Limits (WQBEL)
Revisions to administrative rules regulating phosphorus took effect on December 1, 2010. These rule revisions include additions to s. NR 102.06, Wis. Adm. Code, which establish phosphorus standards for surface waters. Subchapter III of NR 217, Wis. Adm. Code, establishes procedures for determining WQBELs for phosphorus, based on the applicable standards in ch. NR 102, Wis. Adm. Code.

At this time, Cruson Slough is considered a shallow seepage lake. Section NR 102.06(4)(b)5., Wis. Adm. Code, specifies a phosphorus criterion of 0.040 mg/L. For discharges to inland lakes and reservoirs,

effluent limits shall be set equal to the criterion pursuant to s. NR 217.13(3), Wis. Adm. Code. Therefore, **the phosphorus WQBEL is 40 µg/L.**

Limit Expression
Since the calculated WQBEL is less than or equal to 0.3 mg/L, **the effluent limit of 0.04 mg/L may be expressed as a six-month average**. If a concentration limitation expressed as a six-month average is included in the permit, **a monthly average concentration limitation of 0.120 mg/L,** equal to three times the WQBEL calculated under s. NR 217.13, Wis. Adm. Code, **shall also be included** in the permit. The six-month average should be averaged during the months of May – October and November – April.

Mass Limits
A mass limit is also required, pursuant to s. NR 217.14(1)(a), Wis. Adm. Code, because the discharge is to a surface water which is a lake. **This final mass limit shall be 0.040 mg/L × 8.34 × 0.057 MGD = 0.019 lbs/day expressed as an annual average pursuant to s. NR 217.14(1)(c), Wis. Adm. Code.**

PART 6 – WATER QUALITY-BASED EFFLUENT LIMITATIONS FOR THERMAL

Surface water quality standards for temperature took effect on October 1, 2010. These regulations are detailed in chs. NR 102 (Subchapter II – Water Quality Standards for Temperature) and NR 106 (Subchapter V – Effluent Limitations for Temperature) of the Wisconsin Administrative Code. Daily maximum and weekly average temperature criteria are available for the 12 different months of the year depending on the receiving water classification.

In accordance with s. NR 106.53(2)(b), Wis. Adm. Code, the highest daily maximum flow rate for a calendar month is used to determine the acute (daily maximum) effluent limitation. In accordance with s. NR 106.53(2)(c), Wis. Adm. Code, the highest 7-day rolling average flow rate for a calendar month is used to determine the sub-lethal (weekly average) effluent limitation. These values were based off actual flow reported from January 2020 through January 2025 and are shown in the table below.

Temperature Effluent Data & Limits by Month

Month	Calculated Effluent Limit	
	Weekly Average Effluent Limitation (°F)	Daily Maximum Effluent Limitation (°F)
JAN	-	120
FEB	-	120
MAR	-	120
APR	-	120
MAY	-	120
JUN	-	120
JUL	114	120
AUG	-	99
SEP	-	120

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Month	Calculated Effluent Limit	
	Weekly Average Effluent Limitation (°F)	Daily Maximum Effluent Limitation (°F)
OCT	-	120
NOV	109	102
DEC	-	120

No thermal data for the effluent in available. However, since this facility provides extended hydraulic detention times and since there is no significant industrial heat load, elevated effluent temperatures are unlikely, and discharge temperatures are expected to be similar to ambient conditions. Therefore, **no effluent limits or monitoring are recommended for temperature.** The complete thermal table used for the limit calculation is provided in Attachment #3.

PART 7 – WHOLE EFFLUENT TOXICITY (WET)

WET testing is used to measure, predict, and control the discharge of toxic materials that may be harmful to aquatic life. In WET tests, organisms are exposed to a series of effluent concentrations for a given time and effects are recorded. Decisions below related to the selection of representative data and the need for WET limits were made according to ss. NR 106.08 and 106.09, Wis. Adm. Code. WET monitoring frequency and toxicity reduction evaluation (TRE) recommendations were made using the best professional judgment of staff familiar with the discharge after consideration of the guidance in the *Whole Effluent Toxicity (WET) Program Guidance Document* (2022).

At this time there is not enough information about the quality of the effluent to complete the WET checklist (i.e., reasonable potential for limits cannot be determined). Chapter 1.11 (WET Testing of Minor Municipal Discharges) of the *WET Program Guidance Document* was consulted instead. Since this is a minor municipal discharge (< 1.0 MGD) comprised solely of domestic wastewater with extended detention time and groundwater filtration, toxic compounds are not expected to be at levels of concern. Therefore, **no acute nor chronic WET testing is recommended at this time. This will be re-evaluated in the future as more effluent data becomes available.**

For informational purposes:

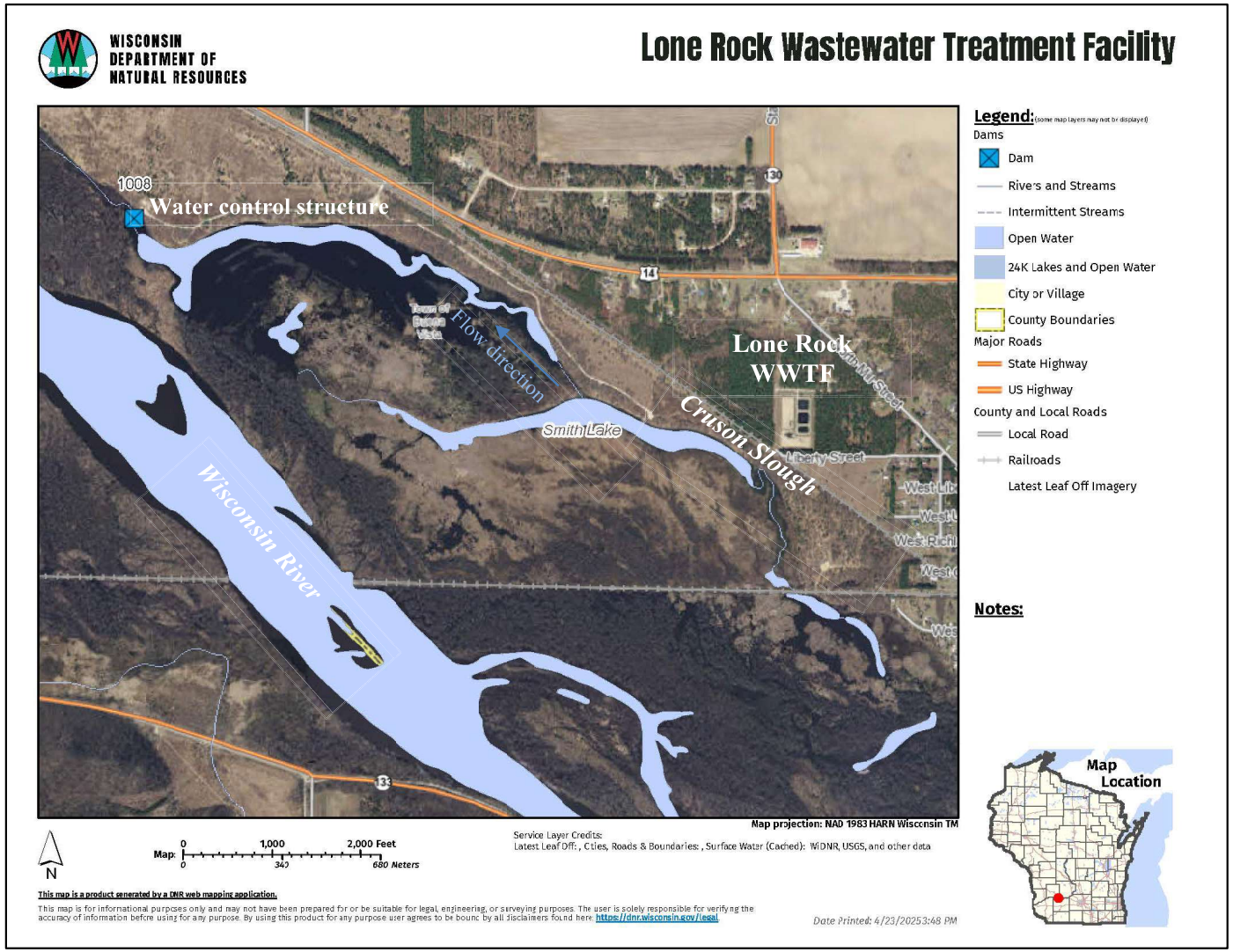
- Acute tests predict the concentration that causes lethality of aquatic organisms during a 48 to 96-hour exposure. To assure that a discharge is not acutely toxic to organisms in the receiving water, WET tests must produce a statistically valid LC_{50} (Lethal Concentration to 50% of the test organisms) greater than 100% effluent, according to s. NR 106.09(2)(b), Wis. Adm Code.

- Chronic tests predict the concentration that interferes with the growth or reproduction of test organisms during a seven-day exposure. To assure that a discharge is not chronically toxic to organisms in the receiving water, WET tests must produce a statistically valid IC_{25} (Inhibition Concentration) greater than the instream waste concentration (IWC), according to s. NR 106.09(3)(b), Wis. Adm Code. The IWC is an estimate of the proportion of effluent to total volume of water (receiving water + effluent). The IWC is calculated according to the following equation, as specified in s. NR 106.03(6), Wis. Adm

Code:

The IWC is 9% based on dilution of 10 parts lake water to 1 part effluent, as specified in s. NR 106.06(4)(b)2, Wis. Adm. Code, or a factor of 1 in 11 to calculate the IWC.

Attachment #2
Site Map



Attachment #3

Temperature limits for receiving waters without unidirectional flow

(calculation using default ambient temperature data)

Facility: Lone Rock WWTF

Outfall(s): 001

Date Prepared: 4/23/2025

Design Flow (Qe): 0.057 MGD

Lake Type: Southern Inland Lakes

Discharge Type: Inland lake or impoundment shore disch

Flow Dates

Start: 01/01/20

End: 01/31/25

Maximum area of mixing zone allowed (coefficient "A"): 15,708 ft^2

Month	Water Quality Criteria			Representative Highest Effluent Flow Rate (Qe)		B	e^{-a} (for SL-WQBEL)	e^{-a} (for A-WQBEL)	Representative Highest Monthly Effluent Temperature		**Calculated Effluent Limit**	
	Ta (default)	Sub-Lethal WQC	Acute WQC	7-day Rolling Average (Qesl)	Daily Maximum Flow Rate (Qea)				Weekly Average	Daily Maximum	**Weekly Average Effluent Limitation**	**Daily Maximum Effluent Limitation**
	(°F)	(°F)	(°F)	(MGD)	(MGD)				(°F)	(°F)	(°F)	(°F)
JAN	35	49	77	0.10	0.11	0.405	0.125	0.148			NA	120
FEB	39	52	78	0.08	0.11	0.405	0.066	0.137			NA	120
MAR	41	55	78	0.10	0.22	0.405	0.117	0.369			NA	120
APR	49	60	80	0.08	0.10	0.405	0.074	0.107			NA	120
MAY	58	68	82	0.08	0.13	0.405	0.064	0.196			NA	120
JUN	70	75	86	0.08	0.15	0.667	0.024	0.150			NA	120
JUL	77	80	87	0.12	0.15	0.667	0.080	0.150			114	120
AUG	76	80	87	0.10	0.40	0.667	0.052	0.483			NA	99
SEP	67	73	85	0.07	0.09	0.555	0.029	0.049			NA	120
OCT	54	61	81	0.09	0.16	0.405	0.095	0.247			NA	120
NOV	42	50	78	0.10	0.42	0.405	0.119	0.596			109	102
DEC	35	49	77	0.07	0.13	0.405	0.046	0.186			NA	120