CORRESPONDENCE/MEMORANDUM

State of Wisconsin

DATE: December 2, 2024

TO: Holly Heldstab– WCR/Eau Claire

FROM: Benjamin Hartenbower – WCR/Eau Claire

SUBJECT: Water Quality-Based Effluent Limitations for the Curtiss Wastewater Treatment Facility WPDES Permit No. WI-0031445

This is in response to your request for an evaluation of the need for 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 the Curtiss Wastewater Treatment Facility in Clark County. This municipal wastewater treatment facility (WWTF) discharges to the unnamed wetland tributary to the East Fork of the Popple River, located in the Popple River Watershed in the Black River Basin. The evaluation of the permit recommendations is discussed in more detail in the attached report.

Based on our review, the following recommendations are made on a chemical-specific basis at Outfall 001:

Parameter	Daily Maximum	Daily Minimum	Weekly Average	Monthly Average	Six-Month Average	Footnotes
Flow Rate						1,2
BOD_5			30 mg/L	20 mg/L		1,3
TSS			30 mg/L	20 mg/L		1,3
pH	9.0 s.u.	6.0 s.u.				1
Dissolved Oxygen		4.0 mg/L				1,3
Ammonia Nitrogen June - August September - May	 8.9 mg/L 8.9 mg/L			 6.7 mg/L		
E. Coli						2
Chloride						2
Phosphorus LCA Interim Limit HAC Interim Limit Final WQBEL				 1.0 mg/L 0.6 mg/L 0.225 mg/L	 0.075 mg/L	4
TKN, Nitrate+Nitrite, and Total Nitrogen						5
Acute WET						6
Chronic WET						6,7

Footnotes:

1. No changes from the current permit.
2. Monitoring only.
3. These limits are based on the Limited Aquatic Life (LAL) community of the immediate receiving water as described in s. NR 104.02(3)(b), Wis. Adm. Code.
4. Under the phosphorus MDV, a level currently achievable (LCA) interim limit of 1.0 mg/L should be effective upon permit reissuance. A compliance schedule may be included in the permit until the highest attainable condition (HAC) limit of 0.6 mg/L can be met. The final WQBELs remain at 0.225 mg/L as a monthly average and 0.075 mg/L as a six-month average.

Printed on Recycled Paper

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).
6. Three acute and two chronic WET tests are recommended in the reissued permit. Sampling WET concurrently with any chemical-specific toxic substances is recommended. Tests should be done in rotating quarters, to collect seasonal information about this discharge and should continue after the permit expiration date (until the permit is reissued).
7. The Instream Waste Concentration (IWC) to assess chronic test results is 9%. According to the State of Wisconsin Aquatic Life Toxicity Testing Methods Manual (s. NR 219.04, Table A, Wis. Adm. Code), chronic testing shall be performed using a dilution series of 100%, 30%, 10%, 3% & 1% and the dilution water used in WET tests conducted on Outfall 001 shall be a grab sample collected from the unnamed wetland tributary to the East Fork of the Popple River.

Additional limits to comply with the expression of limits requirements in ss. NR 106.07 and NR 205.065(7), Wis. Adm. Codes, are not required due to the non-continuous nature of the discharge.

Please consult the attached report for details regarding the above recommendations. If there are any questions or comments, please contact Benjamin Hartenbower at (715) 225-4705 or Benjamin.Hartenbower@wisconsin.gov or Diane Figiel at Diane.Figiel@wisconsin.gov.

Attachments (2) – Narrative & Map

PREPARED BY: _____ Date: 12/02/2024

Benjamin Hartenbower, PE,
Water Resources Engineer

E-cc:

Jenna Monahan, Wastewater Engineer – WCR/Eau Claire
Geisa Thielen, Regional Wastewater Supervisor – WCR/Eau Claire
Diane Figiel, Water Resources Engineer – WY/3
Chris Willger, Water Quality Biologist – WCR/Eau Claire
Kari Fleming, Environmental Toxicologist – WY/3
Michael Polkinghorn, Water Resources Engineer – NOR/Rhinelander
Nate Willis, Wastewater Engineer – WY/3

Attachment #1

Water Quality-Based Effluent Limitations for the Curtiss Wastewater Treatment Facility WPDES Permit No. WI-0031445

Prepared by: Benjamin P. Hartenbower

PART 1 – BACKGROUND INFORMATION

Facility Description:
The Curtiss WWTP currently consists of a two lagoons, three ponds, and a rock filter. The waste arrives via force main from the single lift station in the collection system. It flows by gravity through all the lagoons and ponds. It is then pumped into the rock filter. After which it is pumped to the effluent fountain before gravity flowing out through the effluent flow meter and discharge point. Both lagoons are aerated. There is a pump in the Lagoon #1 effluent manhole and an above ground recirculation line on Lagoon #1, designed to recirculate waste from the effluent of that lagoon back into the influent. This only operates seasonally. There is also a recirculation line that flows by gravity from the effluent fountain back into the influent of the two final ponds which run in parallel. Ferric is being dosed into the system for phosphorus removal. Outfall 001 is to an unnamed wetland tributary to the East Fork of the Popple River. The location is approximately 5096 feet east of Clark County Highway E and 3333 feet north of WI State Highway 29.

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

Existing Permit Limitations
The current permit, which expired on September 30, 2023, includes the following effluent limitations and monitoring requirements.

Parameter	Daily Maximum	Daily Minimum	Weekly Average	Monthly Average	Six-Month Average	Footnotes
Flow Rate						1,2
BOD_5			30 mg/L	20 mg/L		1,3
TSS			30 mg/L	20 mg/L		1,3
pH	9.0 s.u.	6.0 s.u.				1
Dissolved Oxygen		4.0 mg/L				1,3
Ammonia Nitrogen June - August				6.7 mg/L		
Chloride			400 mg/L, 800 lbs/day			
Phosphorus Interim MDV Interim Final WQBEL				 13.3 mg/L 1.0 mg/L 0.225 mg/L	 0.075 mg/L	4
Chronic WET						5

Footnotes:

1. These limitations are not being evaluated as part of this review. Because the water quality criteria (WQC), reference effluent flow rates, and receiving water characteristics have not changed, limitations for these water quality characteristics do not need to be re-evaluated at this time.
2. Monitoring only.
3. These limits are based on the Limited Aquatic Life (LAL) community of the immediate receiving water as described in s. NR 104.02(3)(b), Wis. Adm. Code.
4. Under the phosphorus MDV, a highest attainable condition (HAC) limit of 1.0 mg/L was effective October 1, 2022.
5. Chronic WET testing required: Apr - June 2020 and July - Sept 2022. The IWC for chronic WET was 9%.

Receiving Water Information

- Name: unnamed wetland tributary to the East Fork of the Popple River
- Waterbody Identification Code (WBIC): 1754750
- Classification used in accordance with chs. NR 102 and 104, Wis. Adm. Code: Limited Aquatic Life (LAL), non-public water supply.
- Low flows used in accordance with chs. NR 106 and 217, Wis. Adm. Code:

  $7\text{-}Q_{10}$ = 0 cfs

  $7\text{-}Q_2$ = 0 cfs

  Harmonic Mean Flow = 0 cfs
- Hardness = 205 mg/L as $CaCO_3$. This value represents the geometric mean effluent data. Effluent hardness is used in place of receiving water because there is no receiving water flow upstream of the discharge.
- % of low flow used to calculate limits in accordance with s. NR 106.06(4)(c)5., Wis. Adm. Code: Not applicable where the receiving water low flows are zero.
- Source of background concentration data: Background concentrations are not included because they do not impact the calculated WQBEL when the receiving water low flows are equal to zero.
- Multiple dischargers: None
- Impaired water status: The East Fork Popple River is listed as impaired for Total Phosphorus less than three miles downstream of the outfall location.

Effluent Information:

- Design Flow Rates(s):

  Annual Average = 0.112 MGD (Million Gallons per Day)

  For reference, the actual average flow from October 2018 to September 2024 during discharge occurences was 0.149 MGD.
- Hardness = 205 mg/L as $CaCO_3$. This value represents the geometric mean of 4 effluent samples collected from 07/01/2022 to 01/31/2023.
- 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 and nondomestic contributions from Abbyland Pork Plant and Wisconsin Drink, LLC.
- Additives: Ferric Chloride

- Effluent characterization: This facility is categorized as a minor municipality, so the permit application required effluent sample analyses for a limited number of common pollutants, as specified in s. NR 200.065, Table 1, Wis. Adm. Code, primarily metal substances plus Hardness. The permit-required monitoring for Ammonia Nitrogen, Chloride, and Phosphorus from October 2018 to September 2024 is used in this evaluation.

Chemical Specific Effluent Data at Outfall 001

	Chloride mg/L
1-day P_{99}	431
4-day P_{99}	331
30-day P_{99}	276
Mean	248
Std	63
Sample size	125
Range	19 - 478

Chemical Specific Effluent Data at Outfall 001

Sample Date	Copper µg/L
06/28/2022	3.2
07/01/2022	4.02
07/05/2022	2.48
07/08/2022	3.52
07/11/2022	3.73
07/14/2022	2.15
07/17/2022	8.51
07/20/2022	2.1
07/23/2022	<1.69
07/26/2022	2.56
07/29/2022	1.92
mean	3.11

"<" means that the pollutant was not detected at the indicated level of detection. The mean concentration was calculated using zero in place of the non-detected results.

Effluent data for substances for which a single sample was analyzed is shown in the tables in Part 2 below, in the column titled "MEAN EFFL. CONC.".

The following table presents the average concentrations and loadings at Outfall 001 from October 2018 to September 2024 for all parameters with limits in the current permit to meet the requirements of s. NR 201.03(6):

Parameter Averages with Limits

	Average Measurement	Average Mass Discharged
BOD_5	6.9 mg/L*	
TSS	7.8 mg/L*	
pH	7.29 s.u.	
Dissolved Oxygen	8.09 mg/L	
Ammonia Nitrogen	3.39 mg/L*	
Chloride	248 mg/L	318 lbs/day
Phosphorus	0.64 mg/L	

*Results below the level of detection (LOD) were included as zeroes in calculation of average.

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 1-Q_{10}

Daily maximum effluent limitations for toxic substances are based on the acute toxicity criteria (ATC), listed in ch. NR 105, Wis. Adm. Code. Previously daily maximum limits for toxic substances were calculated as two times the ATC. However, changes to ch. NR 106, Wis. Code, (September 1, 2016) require the Department to calculate acute limitations using the same mass balance equation as used for other limits along with the 1-Q_{10} receiving water low flow to determine if more restrictive effluent limitations are needed to protect the receiving stream from discharges which may cause or contribute to an exceedance of the acute water quality standards. The mass balance equation is provided below.

$$\text{Limitation} = \frac{(WQC)\,(Qs + (1-f)\,Qe) - (Qs - f\,Qe)\,(Cs)}{Qe}$$

Where:

WQC =Acute toxicity criterion or secondary acute value according to ch. NR 105, Wis. Adm. Code.

Qs = average minimum 1-day flow which occurs once in 10 years (1-day Q_{10}) if the 1-day Q_{10} flow data is not available = 80% of the average minimum 7-day flow which occurs once in 10 years (7-day Q_{10}).

Qe = Effluent flow (in units of volume per unit time) as specified in s. NR 106.06(4)(d), Wis. Adm. Code.

f = Fraction of the effluent flow that is withdrawn from the receiving water, and

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

If the receiving water is effluent dominated under low stream flow conditions, the 1-Q_{10} method of limit calculation produces the most stringent daily maximum limitations and should be used while making reasonable potential determinations. This is the case for the Curtiss Wastewater Treatment Facility.

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 = 0.00 cfs, (1-Q_{10} (estimated as 80% of 7-Q_{10})), as specified in s. NR 106.06(3)(bm), Wis. Adm. Code.

SUBSTANCE	REF. HARD. mg/L	ATC	MEAN BACK-GRD.	MAX. EFFL. LIMIT**	1/5 OF EFFL. LIMIT	MEAN EFFL. CONC.	1-day P_{99}	1-day MAX. CONC.
Arsenic		340		340	68	1.0		
Cadmium	205	65.90		65.90	13.18	<0.084		
Chromium (+3)	205	3251		3251	650	<0.7		
Copper	205	30.60		30.60	6.12	3.1		8.5
Lead	205	214.32		214.32	42.86	<1.08		
Nickel	205	862.5		862.5	172.5	3.7		
Zinc	205	225.87		225.87	45.17	<26		
Chloride		757		757			431	478

* * Per the changes to s. NR 106.07(3), Wis. Adm. Code, effective 09/01/2016 consideration of ambient concentrations and 1-Q_{10} flow rates yields a more restrictive limit than the 2 × ATC method of limit calculation.

Weekly Average Limits based on Chronic Toxicity Criteria (CTC)

RECEIVING WATER FLOW = 0.00 cfs (¼ of the 7-Q_{10}), as specified in s. NR 106.06(4)(c), Wis. Adm. Code.

SUBSTANCE	REF. HARD.* mg/L	CTC	MEAN BACK-GRD.	MAX. EFFL. LIMIT	1/5 OF EFFL. LIMIT	MEAN EFFL. CONC.	4-day P_{99}
Arsenic		152		152	30	1.0	
Cadmium	175	3.82		3.82	0.76	<0.084	
Chromium (+3)	205	238		238	48	<0.7	
Copper	205	19.16		19.16	3.83	3.1	
Lead	205	56.14		56.14	11.23	<1.08	
Nickel	205	135.0		135.0	27.0	3.7	
Zinc	205	225.87		225.87	45.17	<26	
Chloride		395		395			331

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

Monthly Average Limits based on Wildlife Criteria (WC)

The effluent characterization did not include any effluent sampling results for substances for which Wildlife Criteria exist.

Monthly Average Limits based on Human Threshold Criteria (HTC)

RECEIVING WATER FLOW = 0.00 cfs (¼ of the Harmonic Mean), as specified in s. NR 106.06(4), Wis. Adm. Code.

SUBSTANCE	HTC	MEAN BACK-GRD.	MAX. EFFL. LIMIT	1/5 OF EFFL. LIMIT	MEAN EFFL. CONC.	30-day P_{99}
Cadmium	880.0		880.0	176.0	<0.084	
Chromium (+3)	8400000		8400000	1680000	<0.7	
Lead	2240		2240	448	<1.08	
Nickel	110000		110000	22000	3.7	

Monthly Average Limits based on Human Cancer Criteria (HCC)

RECEIVING WATER FLOW = 0.00 cfs (¼ of the Harmonic Mean), as specified in s. NR 106.06(4), Wis. Adm. Code.

SUBSTANCE	HCC	MEAN BACK-GRD.	MAX. EFFL. LIMIT**	1/5 OF EFFL. LIMIT	MEAN EFFL. CONC.	30-day P_{99}
Arsenic	40.0		40.0	8.0	1.0	

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: Based on a comparison of the effluent data and calculated effluent limitations, limits are not required for toxic substances.

Chloride – Considering available effluent data from the current permit term (October 2018 to September 2024), the 30-day P_{99} concentration is 276 mg/L, the 4-day P_{99} concentration is 331 mg/L, and the 1-day P_{99} concentration is 431 mg/L, with a maximum concentration of 478 mg/L. These effluent concentrations are below the calculated WQBELs for Chloride, therefore no effluent limits are needed. To ensure that representative sample results are available at the next permit issuance, **monthly chloride monitoring is recommended to continute.**

Antidegradation and Antibacksliding
Since current pollutant minimization efforts with regard to industrial loading are expected to remain in place, the removal of chloride limits will not increase the concentration, level, or loading of chloride to the unnamed wetland tributary to the East Fork of the Popple River. Therefore, antidegradation would not be applicable. To be consistent with antibacksliding requirements, the current limits may be removed in accordance with s. NR 207.12(3)(b), Wis. Adm. Code.

PFOS and PFOA
The need for PFOS and PFOA monitoring is evaluated in accordance with s. NR 106.98, Wis. Adm. Code. PFOS and PFOA were not detected in the water supply. Based on the annual design flow, it is unlikely that the effluent will contain PFOS or PFOA. **Therefore, monitoring is not recommended.** If information becomes available that indicates PFOS or PFOA may be present in the effluent, the monitoring requirements may change.

Mercury – The permit application did not require monitoring for mercury because the Curtiss 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). 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 from 2020 was 0.18 mg/kg. **Therefore, no mercury monitoring is recommended at Outfall 001.**

PART 3 – 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. The current permit has monthly average limits. These limits are re-evaluated at this time due to the following changes:

- Subchapter IV of ch. NR 106, Wis. Adm. Code allows limits based on available dilution instead of limits set to twice the acute criteria.
- The maximum expected effluent pH has changed

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 = 0.633 and B = 90.0 for Limited Aquatic Life, and
pH (s.u.) = that characteristic of the effluent.

The effluent pH data was examined as part of this evaluation. A total of 130 sample results were reported from October 2018 to September 2024. The maximum reported value was 7.97 s.u. (Standard pH Units). The effluent pH was 7.93 s.u. or less 99% of the time. The 1-day P_{99}, calculated in accordance with s. NR 106.05(5), Wis. Adm. Code, is 7.97 s.u. The mean plus the standard deviation multiplied by a factor of 2.33, an estimate of the upper ninety ninth percentile for a normally distributed dataset, is 7.94 s.u. Therefore, a value of 7.97 s.u. is believed to represent the maximum reasonably expected pH, and therefore most appropriate for determining daily maximum limitations for ammonia nitrogen. Substituting a value of 7.97 s.u. into the equation above yields an ATC = 8.90 mg/L.

Daily Maximum Ammonia Nitrogen Effluent Limitations Calculation Method
In accordance with s. NR 106.32(2), Wis. Adm. Code daily maximum ammonia limitations are calculated using the 1-Q_{10} receiving water low flow if it is determined that the previous method of acute ammonia limit calculation (2×ATC) is not sufficiently protective of the fish and aquatic life. The more restrictive calculated limits shall apply.

The calculated daily maximum ammonia nitrogen effluent limits using the mass balance approach with the 1-Q_{10} (estimated as 80 % of 7-Q_{10}) and the 2×ATC approach are shown below.

Daily Maximum Ammonia Nitrogen Determination

	Ammonia Nitrogen Limit mg/L
2×ATC	17.79
1-Q_{10}	8.90

The 1-Q_{10} method yields the most stringent limits for the Curtiss Wastewater Treatment Facility.

Weekly and Monthly Average Limits based on Chronic Toxicity Criteria (CTC)
The ammonia limit calculation also warrants evaluation of weekly and monthly average limits based on chronic toxicity criteria for ammonia, since those limits relate to the assimilative capacity of the receiving water.

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 Limited Aquatic Life 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 <u>receiving water</u>,
E = 1.0,
$C = 8.09 \times 10^{(0.028 \times (25 - T))}$
T = the temperature (ºC) of the receiving water$\times 10^{(0.028 \times (25 - T))}$

The 4-day criterion is equal to the 30-day criterion multiplied by 2.5. The 4-day criteria are used in a mass-balance equation with the 7-Q_{10} (4-Q3, if available) to derive weekly average limitations. And the 30-day criteria are used with the 30-Q_5 (estimated as 85% of the 7-Q_2 if the 30-Q_5 is not available) to derive monthly average limitations. The stream flow value is further adjusted to temperature; 100% of the flow is used if the Temperature ≥ 16 ºC, 25% of the flow is used if the Temperature < 11 ºC, and 50% of the flow is used if the Temperature ≥ 11 ºC but < 16 ºC.

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

Weekly and Monthly Ammonia Nitrogen Limits – LAL

		April & May	June-August	September-November	December-March
Effluent Flow	Qe (MGD)	0.112	0.112	0.112	0.112
Background Information	7-Q_{10} (cfs)	0.00	0.00	0.00	0.00
	7-Q_2 (cfs)	0.00	0.00	0.00	0.00
	Ammonia (mg/L)	N/A	N/A	N/A	N/A
	Temperature (°C)	15.0	20.6	17.2	6.1
	pH (s.u.)	7.49	7.68	7.66	7.61
	% of Flow used	50	100	50	25
	Reference Weekly Flow (cfs)	0.00	0.00	0.00	0.00
	Reference Monthly Flow (cfs)	0.00	0.00	0.00	0.00
Criteria mg/L	4-day Chronic	69.54	40.64	51.53	104.64
	30-day Chronic	27.82	16.25	20.61	41.86
Effluent Limitations mg/L	Weekly Average	70	41	52	105
	Monthly Average	28	16	21	42

Effluent Data

The following table evaluates the statistics based upon ammonia data reported from October 2018 to September 2024, with those results being compared to the calculated limits to determine the need to include ammonia limits in the Curtiss Wastewater Treatment Facility permit for the respective month ranges.

Ammonia Nitrogen Effluent Data

Ammonia Nitrogen mg/L	April & May	June-August	September-November	December-March
1-day P_{99}	18.94	14.86	10.21	13.20
4-day P_{99}	10.69	8.23	6.01	7.43
30-day P_{99}	6.27	4.77	3.89	4.47
Mean*	4.37	3.29	2.94	3.18
Std	3.84	3.00	2.00	2.64
Sample size	25	41	30	36
Range	<0.06 - 11.2	0.11 - 9.88	0.15 - 7.3	0.058 - 14.4

*Values lower than the level of detection were substituted with a zero.

Based on this comparison, daily limits are required year-round.

The permit currently has monthly average limits. Where there are existing ammonia nitrogen limits in the permit, the limits must be retained regardless of reasonable potential, consistent with s. NR 106.33(1)(b), Wis. Adm. Code:

> (b) If a permittee is subject to an ammonia limitation in an existing permit, the limitation shall be included in any reissued permit. Ammonia limitations shall be included in the permit if the permitted facility will be providing treatment for ammonia discharges.

Conclusions and Recommendations

In summary, after rounding to two significant figures, the following ammonia nitrogen limitations are recommended. No mass limitations are recommended in accordance with s. NR 106.32(5), Wis. Adm Code.

Final Ammonia Nitrogen Limits

	Daily Maximum mg/L	Weekly Average mg/L	Monthly Average mg/L
June – August	8.9		6.7
September – May	8.9		

Additional limits to comply with the expression of limits requirements in ss. NR 106.07 and NR 205.065(7), Wis. Adm. Codes, are not required due to the non-continuous nature of the discharge.

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 102.04(5)(b), Wis. Adm. Code, allows the Department to make exceptions when it determines, in accordance with s. NR 210.06(3), Wis. Adm. Code, that wastewater disinfection is not required to meet *E. coli* limits and protect the recreational use. Section NR 210.06(3), Wis. Adm. Code, tasks the Department with determining the need for disinfection using a site-specific analysis based on potential risk to human or animal health. It sets out the factors that must be considered in determining the necessity to disinfect municipal wastewater or to change the length of the disinfection season.

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.

The Curtiss Wastewater Treatment Facility had previously been exempted from disinfection based on the limited aquatic life or limited forage fish community classification of the receiving water. Section NR 210.06(3)(g), Wis. Adm. Code, states that disinfection decisions may be made based on the hydrologic classifications listed in s. NR 104.02(1), Wis. Adm. Code (not on the water quality classifications - i.e., limited forage fish, limited aquatic life - that are defined in s. NR 104.02(3), Wis. Adm. Code). The hydrologic classification for unnamed wetland tributary to the East Fork of the Popple River is listed in ch. NR 104, Wis. Adm. Code, as continuous. Continuous streams have a higher likelihood of providing opportunities for full contact recreational activities. Therefore, disinfection should not be exempted based solely on this hydrological classification.

$$\text{Detention Time [days]} = \frac{Total\ Pond\ Volume[\text{MG}]}{180 - \text{d average flow rate[mgd]}}$$

The last permit term's flow data from 001 indicates that the detention time reached a minimum of 72 days. Since data shows that the facility does not provide > 180-day detention time, monitoring is needed in the reissued permit to determine if the discharge can meet bacteria limits during the recreation season without disinfection. *E. coli* monitoring should be conducted at a minimum of 1x weekly for one disinfection season during the permit term and the need for disinfection revisited at permit reissuance or if factors such as dilution or detention times change.

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.

Because the Curtiss Wastewater Treatment Facility currently has a limit that is more restrictive than 1.0 mg/L, this limit should be included in the reissued permit. This limit remains applicable unless a more stringent WQBEL is given.

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.

Section NR 102.06(3)(a), Wis. Adm. Code, specifically names river segments for which a phosphorus criterion of 0.100 mg/L applies. For other stream segments that are not specified in s. NR 102.06(3)(a), Wis. Adm. Code, s. NR 102.06(3)(b), Wis. Adm. Code, specifies a phosphorus criterion of 0.075 mg/L. The phosphorus criterion of 0.075 mg/L applies for the East Fork of the Popple River.

The conservation of mass equation is described in s. NR 217.13(2)(a), Wis. Adm. Code, for phosphorus WQBELs and includes variables of water quality criterion (WQC), receiving water flow rate (Qs), effluent flow rate (Qe), and upstream phosphorus concentrations (Cs) provided below.

$$\text{Limitation} = [(WQC)(Qs+(1-f)\ Qe) - (Qs-f\ Qe)\ (Cs)]/Qe$$

Where:

WQC = 0.075 mg/L for the East Fork of the Popple River
Qs = 100% of the 7-Q_2 of 0 cfs
Cs = background concentration of phosphorus in the receiving water pursuant to s. NR 217.13(2)(d), Wis. Adm. Code
Qe = effluent flow rate = 0.112 MGD = 0.173 cfs
f = the fraction of effluent withdrawn from the receiving water = 0

The effluent limit is set equal to criteria because the receiving water flow is equal to zero.

Effluent Data

The following table summarizes effluent total phosphorus monitoring data from October 2018 to September 2024.

	Phosphorus mg/L
1-day P_{99}	5.38
4-day P_{99}	3.07
30-day P_{99}	1.35
Mean	0.64
Std	1.25
Sample size	135
Range	0.041 - 9.72

Reasonable Potential Determination

Since the 30-day P_{99} of reported effluent total phosphorus data is greater than the calculated WQBEL, the discharge has reasonable potential to cause or contribute to an exceedance of the water quality criterion. Therefore, a WQBEL is required.

In accordance with s. NR 217.15(2), Wis. Adm. Code, there is reasonable potential for the discharge to cause or contribute to an exceedance of the water quality criteria. The data suggest that a compliance schedule will be necessary for the facility to meet the given phosphorus limits.

Limit Expression

According to s. NR 217.14 (2), Wis. Adm. Code, because the calculated WQBEL is less than or equal to 0.3 mg/L, the effluent limit of 0.075 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 0.225 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

Because the discharge is to a surface water that is to or upstream of a phosphorus impaired water, a mass limit is also required, pursuant to s. NR 217.14(1)(a), Wis. Adm. Code. This final mass limit shall be 0.075 mg/L × 8.34 × 0.112 MGD = 0.070 lbs/day expressed as a six-month average.

Multi-Discharge Variance Interim Limit

With the permit application, the Village of Curtiss has re-applied for the phosphorus multi-discharger variance (MDV). Conditions of the phosphorus MDV require the facility to comply with an interim phosphorus limit in lieu of meeting the final WQBEL. The recommended interim limit during the 2nd permit under MDV approval, pursuant to s. 283.16 (6) (a), Wis. Stats., is 0.6 mg/L as a monthly average. A compliance schedule may be appropriate to meet this interim limit but compliance with 0.6 mg/L shall be no later than the end of the reissued permit. The previous interim limit of 1.0 mg/L should not be exceeded during the compliance schedule.

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 Chapters NR 102 (Subchapter II – Water Quality Standards for Temperature) and NR 106 (Subchapter V – Effluent Limitations for Temperature) of the Wisconsin Administrative Code. The daily maximum effluent temperature limitation shall be 86 °F for discharges to surface waters classified as Limited Aquatic Life according to s. NR 104.02(3)(b)1, Wis. Adm. Code, except for those classified as wastewater effluent channels and wetlands regulated under ch. NR 103 and described in s. NR 106.55(2), Wis. Adm. Code, which has a daily maximum effluent temperature limitation of 120 ºF. The 120° F limit applies because the hydrologic classification is listed as wetland in ch. NR 104, Wis. Adm. Code.

Reasonable Potential
Since this facility provides hydraulic detention times greater than 72 days, elevated effluent temperatures are unlikely and discharge temperatures are expected to be similar to ambient conditions. Therefore, no reasonable potential for exceeding the daily maximum limit exists, and **no temperature limits or monitoring are recommended**.

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).*

- 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 LC50 (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 large wetland complex that the Curtiss Wastewater Treatment Facility discharges to includes an area of standing water of approximately 20 acres, therefore the recommended instream waste concentration is 9% as the discharge is to a waterbody without unidirectional flow. This is based on

dilution of 10 parts reciving 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.

- According to the *State of Wisconsin Aquatic Life Toxicity Testing Methods Manual*, a synthetic (standard) laboratory water may be used as the dilution water and primary control in acute WET tests, unless the use of different dilution water is approved by the Department prior to use. The primary control water must be specified in the WPDES permit.

- Receiving water must be used as the dilution water and primary control in chronic WET tests, unless the use of different dilution water is approved by the Department prior to use. The dilution water used in WET tests conducted on Outfall 001 shall be a grab sample collected from the receiving water location, upstream and out of the influence of the mixing zone and any other known discharge. The specific receiving water location must be specified in the WPDES permit.

- Shown below is a tabulation of all available WET data for Outfall 001. Efforts are made to ensure that decisions about WET monitoring and limits are made based on representative data, as specified in s. NR 106.08(3), Wis. Adm Code. Data which is not believed to be representative of the discharge was not included in reasonable potential calculations. The table below differentiates between tests used and not used when making WET determinations.

WET Data History

Date Test Initiated	Acute Results LC_{50} %				Chronic Results IC_{25} %					Footnotes or Comments
	C. dubia	Fathead minnow	Pass or Fail?	Used in RP?	*C. dubia*	Fathead Minnow	Algae (IC_{50})	Pass or Fail?	Use in RP?	
09/27/2005	>100	>100	Pass	No	58.51	>100		Fail	No	1
12/01/2005					81.15	>100		Fail	No	1
09/14/2006					25.73			Fail	No	1
06/25/2008	>100	>100	Pass	No						1
11/04/2009	>100	>100	Pass	No						1
05/19/2020					>100	>100		Pass	No	1
09/20/2020					29	>100		Pass	No	1
07/16/2024					>100	>100		Pass	Yes	

Footnotes:

1. *Data Not Representative.* WWTP, industrial contributions changes have occurred which renders data unrepresentative. High strength contributions from the Abbyland pork plant's truck wash station is hauled offsite and no longer enters the treatment plant. In addition, the treatment plant identified a waste stream coming from the industry in a different location than their sampling point and worked with Abbyland to combine all waste into a single influent point that is closely monitored, this began in 2021.

- According to s. NR 106.08, Wis. Adm. Code, WET reasonable potential is determined by multiplying the highest toxicity value that has been measured in the effluent by a safety factor, to predict the likelihood (95% probability) of toxicity occurring in the effluent above the applicable WET limit. The safety factor used in the equation changes based on the number of toxicity detects in the dataset. The fewer detects present, the higher the safety factor, because there is more uncertainty surrounding the predicted value. WET limits must be given, according to s. NR 106.08(6), Wis. Adm. Code, whenever the applicable Reasonable Potential equation results in a value greater than 1.0.

  Chronic Reasonable Potential = [(TUc effluent) (B)(IWC)]

  According to s. NR 106.08(6)(d), Wis. Adm. Code, TUa and TUc effluent values are equal to zero whenever toxicity is not detected (i.e. when the LC_{50}, IC_{25} or $IC_{50} \geq 100\%$).

  Chronic Reasonable Potential = 0 < 1.0, reasonable potential is not shown, and a limit is not required.

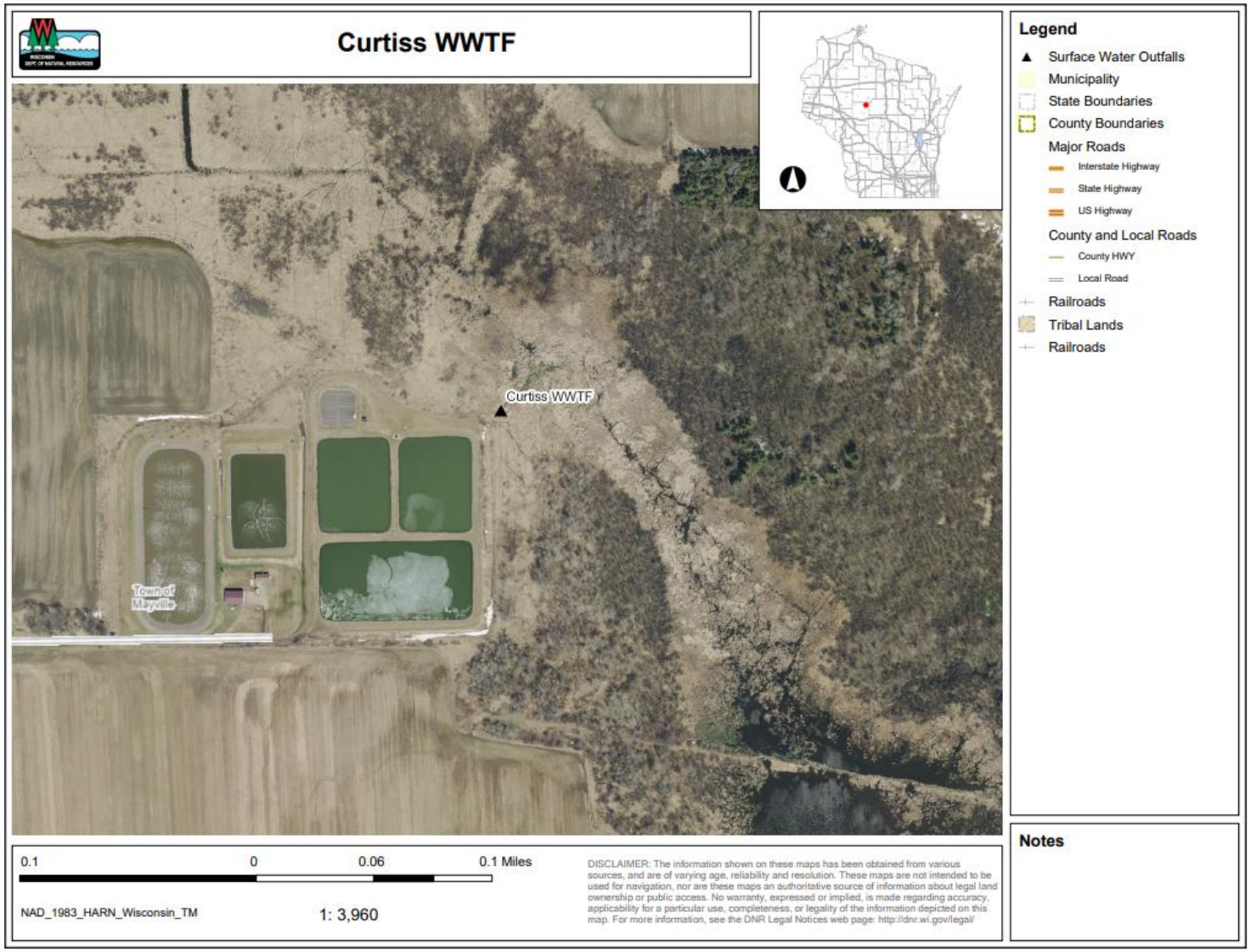
The WET checklist was developed to help DNR staff make recommendations regarding WET limits, monitoring, and other related permit conditions. The checklist indicates whether acute and chronic WET limits are needed, based on requirements specified in s. NR 106.08, Wis. Adm. Code. The checklist steps the user through a series of questions, assesses points based on the potential for effluent toxicity, and suggests monitoring frequencies based on points accumulated during the checklist analysis. As toxicity potential increases, more points accumulate, and more monitoring is recommended to ensure that toxicity is not occurring. A summary of the WET checklist analysis completed for this permittee is shown in the table below. Staff recommendations based on best professional judgment are provided below the summary table. For guidance related to reasonable potential and the WET checklist, see Chapter 1.3 of the WET Guidance Document: https://dnr.wisconsin.gov/topic/Wastewater/WET.html.

WET Checklist Summary

	Acute	Chronic
AMZ/IWC	Not Applicable. **0 Points**	IWC = 9% **0 Points**
Historical Data	Data not available in past 5 years. **5 Points**	One test used to calculate RP. No tests failed. **0 Points**
Effluent Variability	BOD_5, Chloride, and TSS exceedances. **5 Points**	Same as Acute. **5 Points**
Receiving Water Classification	<4 miles to WWSF (5 pts) **5 Points**	Same as Acute. **5 Points**
Chemical-Specific Data	Reasonable potential for Ammonia limits based on ATC; (5 pts) Arsenic, Copper, Nickel, and Chloride detected. (3 pts) Additional Compounds of Concern: none **8 Points**	No reasonable potential for limits based on CTC. Ammonia nitrogen limit carried over from the current permit. Arsenic, Copper, Nickel, and Chloride detected. (3 pts) Additional Compounds of Concern: none **3 Points**
Additives	No biocides and one water quality conditioner (1 pt) added.	All additives used more than once per 4 days.

Attachment #1

	Acute	Chronic
	Permittee has proper P chemical SOPs in place. **1 Point**	**1 Point**
Discharge Category	Two Industrial Contributors (6 pts) **6 Points**	Same as Acute. **6 Points**
Wastewater Treatment	Secondary or Better **0 Points**	Same as Acute. **0 Points**
Downstream Impacts	No impacts known. **0 Points**	Same as Acute. **0 Points**
Total Checklist Points:	**30 Points**	**20 Points**
Recommended Monitoring Frequency (from Checklist):	3 tests during permit term	2 tests during permit term
Limit Required?	No	No
TRE Recommended? (from Checklist)	No	No

- After consideration of the guidance provided in the Department's WET Program Guidance Document (2022) and other information described above, three acute and two chronic WET tests are recommended in the reissued permit. Sampling WET concurrently with any chemical-specific toxic substances is recommended. Tests should be done in rotating quarters, to collect seasonal information about this discharge and should continue after the permit expiration date (until the permit is reissued).

Attachment #2