

Permit Fact Sheet

General Information

Permit Number:	WI-0062103-04-1 *Permit Modification
Permittee Name:	Badger State Ethanol LLC
Address:	820 West 17th St
City/State/Zip:	Monroe WI 53566
Discharge Location:	Honey Creek via City of Monroe Stormwater Pond
Receiving Water:	Honey Creek, located in the Honey and Richland Creek Watershed (SP01) of the Sugar-Pecatonica River Basin.
StreamFlow (Q _{7,10}):	7-Q ₁₀ = 1.8 cfs
Stream Classification:	Warm water sport fish community, non-public water supply.

Facility Description

Badger State Ethanol (BSE) is a grain ethanol facility in the City of Monroe. The BSE property is located at NW 1/4 & NE 1/4 Section 4, T1N, R7E west of the City of Monroe in Green County. This plant produces approximately 85 MG/year of fuel-grade ethanol per year from corn. Production of ethanol from corn results in production of dried distillers grains and related co-products that are marketed as animal feed supplements and began making antiseptic used in hand sanitizers during the Covid-19 pandemic. The effluent consists of combined cooling tower blowdown, RO system reject and softener blowdown. Water quality additives are added to the waste stream to control biofouling and scaling. The effluent discharges to a detention pond system constructed by the city of Monroe that also receives storm water run-off from the surrounding area. The detention pond then empties into Honey Creek. This facility is categorized as a minor industry, discharging less than 1.0 mgd and is not a primary industry. Therefore, the permit application required effluent sample analyses for a limited number of common pollutants.

Nathan Wells determined after a virtual inspection that the facility was in substantial compliance with their permit. He completed a Substantial Compliance Determination on November 3, 2020.

Permit Modification -01: Permit modification completed to remove temperature limits that were set to become effective in 2024. The permittee has collected additional data and ensured that the data is representative with the probe in the appropriate location. The department has completed a review of the submittal and determined that temperature limits are not warranted but additional sampling must continue. Monitoring for temperature will continue with reporting daily temperature data at both the facility (reported at Sampling Point 001) and the stormwater pond outlet in April and May. The pond data shall be reported in the comments field of the April and May eDMR. The rest of the year the permittee will report on the eDMR at Sample Point 001, temperature data 3/week at the facility temperature probe.

Sample Point Designation		
Sample Point Number	Discharge Flow, Units, and Averaging Period	Sample Point Location, WasteType/sample Contents and Treatment Description (as applicable)
001	0.125 MGD Max annual average (1/1/2018-12/31/2018)	Representative grab samples shall be collected at the process area sink, of the combined cooling tower blowdown, reverse osmosis system reject, and softener blowdown. Sampling for compliance with temperature maximum occurs at the discharge from the

Sample Point Designation		
Sample Point Number	Discharge Flow, Units, and Averaging Period	Sample Point Location, Waste Type/sample Contents and Treatment Description (as applicable)
		stormwater pond or at a location closer to the plant. Flow is monitored using a magmeter just prior to the sample port. Temperature grab samples shall be taken in the plant.

1 Surface Water - Proposed Monitoring and Limitations

Sample Point Number: 001- Non Process Discharges

Monitoring Requirements and Limitations					
Parameter	Limit Type	Limit and Units	Sample Frequency	Sample Type	Notes
Flow Rate		MGD	Daily	Total Daily	
Temperature Maximum			3/Weekly	Measure Grab	Monitoring frequency effective June through March.
Temperature Maximum			Daily	Measure Grab	Monitoring frequency effective April and May. See Stormwater Pond Temperature section.
Temperature Maximum	Weekly Avg	72 deg F	3/Weekly	Measure	Effluent limit effective in April annually.
Temperature Maximum	Weekly Avg	66 deg F	3/Weekly	Measure	Effluent limit effective in November annually.
Temperature Maximum	Weekly Avg	76 deg F	3/Weekly	Measure	Effluent limit effective in December annually.
pH Lab	Daily Min	6.0 su	Weekly	Grab	
pH Lab	Daily Max	9.0 su	Weekly	Grab	
Suspended Solids, Total	Daily Max	40 mg/L	Weekly	Grab	
Suspended Solids, Total	Monthly Avg	40 mg/L	Weekly	Grab	
Chlorine, Total Residual	Daily Max	38 ug/L	Weekly	Grab	
Chlorine, Total Residual	Weekly Avg	24 ug/L	Weekly	Grab	
Chlorine, Total	Monthly Avg	24 ug/L	Weekly	Grab	

Monitoring Requirements and Limitations					
Parameter	Limit Type	Limit and Units	Sample Frequency	Sample Type	Notes
Residual					
Phosphorus, Total	Monthly Avg	0.28 mg/L	Weekly	Grab	
Phosphorus, Total	6-Month Avg	0.092 mg/L	Weekly	Grab	
Phosphorus, Total	6-Month Avg	0.099 lbs/day	Weekly	Calculated	
Copper, Total Recoverable	Daily Max	140 ug/L	Monthly	Grab	
Copper, Total Recoverable	Weekly Avg	116 ug/L	Monthly	Grab	
Copper, Total Recoverable	Monthly Avg	116 ug/L	Monthly	Grab	
Copper, Total Recoverable	Daily Max	0.095 lbs/day	Monthly	Calculated	
Copper, Total Recoverable	Weekly Avg	0.13 lbs/day	Monthly	Calculated	
Hardness, Total as CaCO ₃		mg/L	Quarterly	Grab	
Acute WET		TUa	See Listed Qtr(s)	Composite	
Chronic WET	Monthly Avg	3.2 TUc	See Listed Qtr(s)	Composite	

Changes from Previous Permit

A Chronic WET limit of 3.2 TUc was added. Final total phosphorus limits of 0.28mg/L monthly average, 0.92 mg/L & 0.099 6-month average were included. ~~Temperature maximum limits for April 72, November 66 and December 76 were added.~~ Limits were added to copper, TSS and residual chlorine due to the change in the rules for the expression of limits.

Temperature monitoring at the facility 3/week June through March and daily April through May added. Additional temperature monitoring at the pond discharge daily April through May is required and shall be submitted to the department via excel spreadsheet.

Explanation of Limits and Monitoring Requirements

Water Quality Based Limits and WET Requirements and Disinfection (if applicable)

Refer to the WQBEL memo for the detailed calculations, prepared by the Water Quality Bureau dated October 23, 2020 used for this reissuance.

Temperature

Temperature requirements (as applicable) are based on the Thermal Rules which are effective 10/1/2010 and detailed in NR 102 – Water Quality Standards for Temperature and NR 106 – Effluent Limits for Temperature. The facility will be collecting temperature maximum data at a location past the storm water ponds and closer to the Honey Creek receiving water. ~~After 1 or 2 years of data collection the department will reevaluate the need for limits in April, November and~~

~~December. Any changes to the limits or monitoring frequency will require the permittee to request a permit modification.~~ Based on this analysis, no thermal limits are required since there is sufficient cooling occurring in the stormwater pond and drain tile prior to the discharge entering Honey Creek. Monitoring for temperature in the plant will be required at the sample frequency of 3/week June through March. In April and May, the permittee will report daily temperature at both the facility Sampling Point 001 and the stormwater pond outfall. The stormwater pond data will be reported in the comments field of the eDMR. The Sample Type and Frequency are subject to update at the next permit reissuance depending on the type of temperature meter used.

Phosphorus

Phosphorus requirements (as applicable) are based on the Phosphorus Rules which are effective 12/1/2010 and detailed in NR 102 – Water Quality Standards for Wisconsin Surface Waters and NR 217 – Effluent Standards and Limitations for Phosphorus.

For the reasons explained in the April 30, 2012 paper entitled ‘Justification for Use of Monthly, Growing Season and Annual Average Periods for Expression of WPDES Permit Limits for Phosphorus Discharges in Wisconsin’, WDNR has determined that it is impracticable to express the phosphorus WQBEL for the permittee as a maximum daily, weekly or monthly values. The final effluent limit for phosphorus is expressed as a six-month average. It is also expressed as a monthly average equal to three times the derived WQBEL. This final effluent limit was derived from and complies with the applicable water quality criterion.

Because the discharge is to a surface water that is upstream of a receiving water that listed as phosphorus impaired, a mass limit is also required, pursuant to s. NR 217.14(1)(a), Wis. Adm. Code

Copper

Daily maximum effluent limitations for toxic substances are based on the acute toxicity criteria (ATC), listed in ch. NR 105, Wis. Adm. Code. The maximum effluent concentration and the 1-day P99 of the effluent data exceed the calculated daily maximum limit of 140 mg/L, therefore daily maximum concentration and mass limits are required to continue. Similarly, the 4-day P99 concentration is 156 mg/L which exceeds the calculated weekly maximum limit of 116 mg/L, therefore weekly average concentration and mass limits are required. The acute mass limitation is in accordance with s. NR 106.07(2)(b), Wis. Adm. Code. The chronic mass limitation of 0.13 lb/day is in accordance with s. NR 106.07(2)(c), Wis. Adm. Code.

Whole Effluent Toxicity

Whole effluent toxicity (WET) testing requirements and limits (if applicable) are determined in accordance with ss. NR 106.08 and NR 106.09 Wis. Adm. Code, as revised August 2016. (See the current version of the Whole Effluent Toxicity Program Guidance Document and checklist and WET information, guidance and test methods at <http://dnr.wi.gov/topic/wastewater/wet.html>)

WET Testing Frequency:

Acute: April 1 – June 30, 2021, July 1 – September 30, 2022, October 1 – December 31, 2024.

Chronic: July 1 – September 30, 2021, October 1 – December 31, 2022, January 1 – March 31, 2023, April 1 – June 30, 2024, July 1 – September 30, 2025.

INDUSTRIAL EFFLUENT LIMITS -In accordance with the federal regulation 40 CFR 122.45(d), limits in this permit are to be expressed as daily maximum and monthly average limits whenever practicable. Minor changes have been made to chlorine and copper limits.

Parameter	Daily Maximum	Weekly Average	Monthly Average
TSS	40 mg/L		40 mg/L
Residual chlorine	38 µg/L	24 µg/L	24 µg/L
Copper	140 µg/L 0.095 lb/day	116 µg/L 0.13 lb/day	116 µg/L

pH

The pH limits are based on chs. NR 102 Wis. Code pH standards. Samples are tested at on-site laboratory.

Technology Based Effluent Limits

The discharge does not contain any process wastewater so TBELs do not apply to this discharge.

2 Compliance Schedules

2.1 Permit Application Submittal

The permittee shall file an application for permit reissuance in accordance with NR 200, Wis. Adm. Code.

Required Action	Due Date
Permit Application Submittal: Submit a complete permit application to the Department no later than 180 days prior to permit expiration.	07/04/2025

Explanation of Compliance Schedules

The requirement to submit an application for reissuance of the WPDES 180 days prior to the expiration date of this permit is included as a reminder of the application due date.

2.2 Temperature Limits Compliance

This compliance schedule requires the permittee to achieve compliance by the specified date.

Required Action	Due Date
Preliminary Compliance Report: Submit a preliminary compliance report, including a summary of effluent temperatures, indicating alternatives to achieve the final temperature limits. Informational Note: Refer to NR 106 Subchapters V & VI or NR 102.26, Wis. Adm. Code, for information regarding the re-evaluation of limits.	01/31/2022
Action Plan: Submit an action plan for complying with the effluent limitation. If construction is required, include plans and specifications with the submittal. Alternately, after the permittee has collected at least 11 results per month and the representative effluent data shows effluent values below the calculated WQBEL, the permittee may request the Department make a determination of the need for a limit under section NR 106.05, Wis. Adm. Code. If the Department determines that effluent limitations are unnecessary based on the procedures in s. NR 106.05, Wis. Adm. Code, the Department shall notify the permittee that the limitations will not become effective, pursuant to s. NR 106.04(4), Wis. Adm. Code and the compliance schedule shall be discontinued. A permit modification is required to implement these changes.	01/01/2023
Complete Actions: Complete actions necessary to achieve compliance with effluent temperature	01/01/2024

limits.	
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Explanation of Compliance Schedules

The facility will be testing for temperature maximum at a new location closer to the receiving stream that will produce a new set of effluent temperature data. This schedule allows time to collect a sufficient number of data points to reevaluate the potential of the discharge to exceed limitations.

Special Reporting Requirements

None

Other Comments:

Attachments:

Modification Attachment:

Temperature Limit Memo Addendum prepared by Sarah Luck dated 2/5/2024

Proposed Expiration Date:

12/31/2025

Justification Of Any Waivers From Permit Application Requirements

Prepared By:

Brenda Howald Wastewater Specialist

Date: 10/8/2020

cc: **Nathan Wells**

Modification Prepared by: Jennifer Jerich, Wastewater Specialist

Dated: 2/8/2024

DATE: February 5, 2024

SUBJECT: Thermal Water Quality-Based Effluent Limitations Addendum for Badger State Ethanol LLC
WPDES Permit No. WI-0062103-04-1

The Department has received additional information from the permittee specifically related to effluent flows and temperatures. Therefore, an updated evaluation of thermal water quality-based effluent limitations is presented below. The recommendations in this addendum replace those in the WQBEL memo dated October 23, 2020.

Facility Description:

Badger State Ethanol LLC (BSE) is a grain ethanol facility located in the City of Monroe. Production of ethanol from corn results in the production of dried distillers grains and related co-products that are marketed as animal feed supplements. Badger State Ethanol LLC began making antiseptic used in hand sanitizers during the 2020 Covid-19 pandemic. The effluent consists of combined cooling tower blowdown, reverse osmosis (RO) system reject, and softener blowdown. Water quality additives are added to the waste stream to control biofouling, foaming, and scaling. The effluent discharges to a detention pond system constructed by the City of Monroe that also receives stormwater runoff from the surrounding area. The detention pond then drains into Honey Creek via a drain tile for approximately 0.20 miles (1,056 feet). The discharge from this facility is categorized as a secondary industrial discharge.

Receiving Water Information:

- Name: Honey Creek
- Water Body Identification Code (WBIC): 790500
- Classification used in accordance with chs. NR 102 and 104, Wis. Adm. Code: Warm water sport fish community, non-public water supply.
- Low Flows used in accordance with chs. NR 106 and 217, Wis. Adm. Code: The following 7-Q₁₀ and 7-Q₂ values are estimated by USGS at the SW1/4SE1/4 sec. 33, T. 2 N., R. 7 E., Green County, just above Outfall 001 approximately 1.6 miles west of Monroe (documented in a memo dated November 27, 1996 from USGS to the city of Monroe).
 - 7-Q₁₀ = 1.8 cfs (cubic feet per second)
 - 7-Q₂ = 2.0 cfs
- % of low flow used to calculate limits in accordance with s. NR 106.06 (4) (c) 5., Wis. Adm. Code: 25%

Effluent Information:

- Flow Rate:
 - Maximum annual average = 0.14 MGD (Million Gallons per Day). This is the maximum 12-month rolling average from January 2021 – October 2023.
 - For reference, the actual average flow from January 2021 – October 2023 was 0.13 MGD.

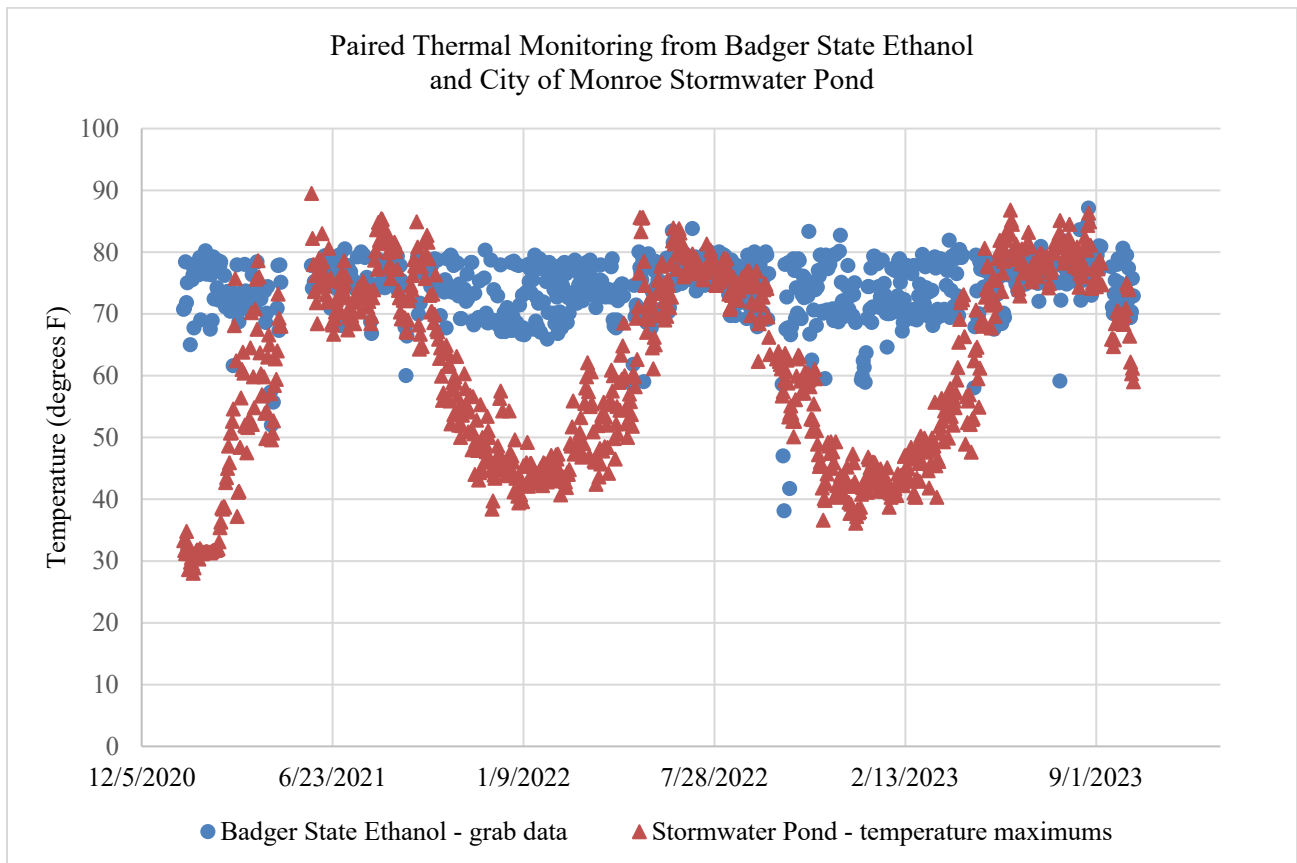
THERMAL

Weekly average thermal effluent limits were triggered for the months of April, November, and December as discussed in the WQBEL memo dated October 23, 2020. The facility was given a compliance schedule in the permit before limits become effective beginning April 2024. During the compliance schedule, the facility collected thermal data from the stormwater pond that is an intermediate discharge point between the facility and the receiving water, Honey Creek, from January 18, 2021 through October 10, 2023.

During the sampling period, two sites at the pond were used (see site map in Attachment #1). Sampling Site #1, located on the northeast side of the stormwater pond, was the initial sampling site but was the target of tampering due to its proximity to a park parking lot, picnic shelter, skate park, and playground. In July 2021, Sampling Site #2, located on the southwest side of the stormwater pond, which is closer to where Badger State Ethanol effluent enters the pond, was used from July 2021 onwards (as noted in the thermal compliance report from Badger State Ethanol dated 3/31/22). Continuous thermal data was collected at the stormwater pond during the study period of January 18, 2021 through October 10, 2023.

Temperature grab samples were also collected at the facility from a sample port located near where the discharge pipe goes underground to carry the effluent to the stormwater pond; samples were pulled from this port and taken to the lab for analysis. Due to the current configuration at the facility, Badger State Ethanol staff have stated it is not possible to collect continuous temperature data at the sample port which is why grab samples have been employed. As noted in the facility description, three streams of water account for the discharge from the facility. It was estimated by facility staff that approximately 95% of the effluent is from the cooling tower water that is regulated at 80°F and continuously monitored for temperature. The second source, which accounts for approximately 5% of the effluent, is from reverse osmosis reject water, and the third source is a fractional percent from water softener regeneration. This helps account for the generally consistent temperatures exiting the facility as seen in the graph below.

The graph below shows the data collected from both the stormwater pond and Badger State Ethanol. Note that data from May 2021 were excluded from the dataset since known tampering occurred during that time which rendered the data unrepresentative.



Thermal Limits Calculation

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 at the facility from January 2021 through October 2023.

The table below summarizes the maximum temperatures reported during monitoring of the stormwater pond from January 2021 through October 2023 (excluding May 2021), as well as the calculated limits and adjusted calculated limits that account for the drain tile distance. In addition to cooling that is expected to occur in the stormwater pond, discharge from the stormwater pond travels via a drain tile an additional 0.20 miles (1,056 feet). A heat loss equation is used to adjust the calculated limit based upon the length of the pipe before discharge to waters of the state. Under s. NR 106.55(5), Wis. Adm. Code, the default cooling rate is estimated as 1° F for every 400 feet of storm sewer/storm water conveyance channel. The adjusted limits are shown in the table below. The complete thermal table is provided in Attachment #2.

Month	Representative Highest Monthly Effluent Temperature		Calculated Effluent Limits		Adjusted Thermal Limits (accounting for heat loss)	
	Weekly Maximum	Daily Maximum	Weekly Average Effluent Limitation	Daily Maximum Effluent Limitation	Weekly Average Effluent Limitation	Daily Maximum Effluent Limitation
	(°F)	(°F)	(°F)	(°F)	(°F)	(°F)
JAN	73	78	90	120	93	120
FEB	45	49	83	120	86	120
MAR	57	76	80	120	82	120
APR	69	79	69	120	71	120
MAY	79	86	79	120	82	120
JUN	81	90	88	103	91	105
JUL	82	85	95	95	97	98
AUG	83	86	99	101	101	104
SEP	78	85	89	106	92	109
OCT	72	82	80	120	82	120
NOV	55	61	69	120	72	120
DEC	51	58	80	120	83	120

Reasonable Potential

Permit limits for temperature are recommended based on the procedures in s. NR 106.56, Wis. Adm. Code.

- An acute limit for temperature is recommended for each month in which the representative daily maximum effluent temperature for that month exceeds the acute WQBEL. The representative daily maximum effluent temperature is the greater of the following:
 - (a) The highest recorded representative daily maximum effluent temperature.
 - (b) The projected 99th percentile of all representative daily maximum effluent temperatures.
- A sub-lethal limitation for temperature is recommended for each month in which the representative weekly average effluent temperature for that month exceeds the weekly average WQBEL. The representative weekly average effluent temperature is the greater of the following:
 - (a) The highest weekly average effluent temperature for the month.
 - (b) The projected 99th percentile of all representative weekly average effluent temperatures for the month.

Comparing the representative highest effluent temperature to the calculated effluent limits (adjusted for heat loss) determines the reasonable potential of exceeding the effluent limits. Based on this analysis, **no thermal limits are required** since there is sufficient cooling occurring in the stormwater pond and drain tile prior to the discharge entering Honey Creek.

Discussion

It is clear from the data that cooling of the effluent is occurring via the stormwater pond prior to reaching Honey Creek. However, during the sampling at the stormwater pond, it was noted that tampering of the temperature probes occurred. In fact, data from May 2021 was excluded in this evaluation due to documented probe tampering and unrepresentative data. Other thermal data during April and May is also questionable due to the data often not showing any heat loss between the grab sample collected in the plant and the temperature reading at the pond. This lack of difference may be accurate and related to seasonality and the characteristics of the pond (it is relatively shallow – estimated at three feet deep by facility staff); however, it is recommended that continuous thermal sampling continue at the stormwater pond in April and May and grab samples continue at the facility in order to further evaluate heat loss and to attempt to determine a correlation based on the paired data for consideration at the next permit reissuance. It should also be noted that discharge flow rates have increased over the last three years which impact the thermal limits. The facility noted in a phone conversation that flows have increased because all copper, which was previously used to help cool the water, was removed from the system and flows were increased to aid in cooling instead.

Summary

Badger State Ethanol monitored temperatures at the City of Monroe stormwater pond (where effluent is discharged prior to entering Honey Creek) from January 18, 2021 through October 10, 2023. Additionally, discharge from the stormwater pond travels through approximately 0.20 miles (1,056 feet) of drain tile before being discharged to the receiving water. New temperature limits were calculated based on these factors.

No thermal limits are recommended, but it is recommended that daily maximum temperature monitoring continue to be reported at the stormwater pond in April and May, continued temperature grab samples collected daily at the facility in April and May, and reduced frequency temperature grab samples at the facility June through March so that thermal limits can be re-evaluated at the next permit reissuance. If there is an increase in flows and/or temperatures, additional thermal limits may apply.

If there are any questions or comments, please contact Sarah Luck at (608) 843-3876 or Sarah.Luck@wisconsin.gov.

Attachments (2) – Site Map and Thermal Table

PREPARED BY: *Sarah Luck* Date: February 5, 2024
Sarah Luck
Water Resources Engineer

E-cc: Kenzie Ostien, Wastewater Engineer – SCR/Fitchburg
Jennifer Jerich, Permit Drafter – SCR/Horicon
Diane Figiel, Water Resources Engineer – WY/3

Attachment #1
Site Map and Sampling Locations



Attachment #2

Temperature limits for receiving waters with unidirectional flow

(calculation using default ambient temperature data)

Facility:	Badger State Ethanol	7-Q₁₀:	1.8 cfs	Temp Dates	Flow Dates
Outfall(s):	001	Dilution:	25%	Start:	01/01/21 01/01/21
Date Prepared:	2/2/2024	f:	0	End:	10/10/23 10/31/23
Design Flow (Q_e):	0.14 MGD	Stream type:	Small warm water sport or forage fis ▾		
Storm Sewer Dist.	1056 ft	Q_s:Q_e ratio:	2.1 :1		
		Calculation Needed?	YES		

Month	Water Quality Criteria			Receiving Water Flow Rate (Q _s) (cfs)	Representative Highest Effluent Flow Rate (Q _e)		f	Representative Highest Monthly Effluent Temperature		Calculated Effluent Limit		Adjusted Thermal Limits	
	T _a (default)	Sub-Lethal WQC	Acute WQC		7-day Rolling Average (Q _{es1}) (MGD)	Daily Maximum Flow Rate (Q _{ea}) (MGD)		Weekly Average	Daily Maximum	Weekly Average Effluent Limitation	Daily Maximum Effluent Limitation	Weekly Average	Daily Maximum
	(°F)	(°F)	(°F)		(MGD)	(MGD)		(°F)	(°F)	(°F)	(°F)	(°F)	(°F)
JAN	33	49	76	1.80	0.114	0.164	0	73	78	90	120	93	120
FEB	34	50	76	1.80	0.139	0.222	0	45	49	83	120	86	120
MAR	38	52	77	1.80	0.147	0.164	0	57	76	80	120	82	120
APR	48	55	79	1.80	0.150	0.162	0	69	79	69	120	71	120
MAY	58	65	82	1.80	0.142	0.181	0	79	86	79	120	82	120
JUN	66	76	84	1.80	0.243	0.282	0	81	90	88	103	91	105
JUL	69	81	85	1.80	0.254	0.453	0	82	85	95	95	97	98
AUG	67	81	84	1.80	0.229	0.293	0	83	86	99	101	101	104
SEP	60	73	82	1.80	0.234	0.264	0	78	85	89	106	92	109
OCT	50	61	80	1.80	0.170	0.191	0	72	82	80	120	82	120
NOV	40	49	77	1.80	0.131	0.155	0	55	61	69	120	72	120
DEC	35	49	76	1.80	0.130	0.204	0	51	58	80	120	83	120