Madison Metropolitan Sewerage District
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June 10, 2024

Nick Bower, P.E.
Capital Area Regional Planning Commission
Senior Environmental Engineer
100 State Street, Suite 400
Madison, WI 53703

RE: AREAWIDE WATER QUALITY MANAGEMENT PLAN AMENDMENT MODIFICATION FOR WPDES PERMIT WI-0024597-09-2, OUTFALL 005

Dear Mr. Bower,

Attached is the Madison Metropolitan Sewerage District's request to modify the amendment to the Areawide Water Quality Management Plan in response to our phosphorus compliance at Outfall 005, Badger Mill Creek.

During this analysis, we have found that the proposed amendment will comply with the water quality standards under Wis Admin. Code NR 102 and therefore meets the requirements of Wis. Stat. S. 283.83.

We appreciate your guidance through this process.

Sincerely,

Martin Griffin, Director of Ecosystem Services

Attachment: Areawide Water Quality Management Plan Amendment Modification for WPDES Permit WI-0024597-09-2, Outfall 005

CC:

Capital Area Planning Commission, Jason Valerius
Wisconsin Department of Natural Resources, James Zellmer, Tim Asplund, Alixandra Burke
Madison Metropolitan Sewerage District, Michael Mucha, Eric Dundee
Stafford Rosenbaum, LLC, Vanessa Wishart, Paul Kent

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AREAWIDE WATER QUALITY MANAGEMENT PLAN AMENDMENT MODIFICATION FOR WPDES PERMIT WI-0024597-09-2, OUTFALL 005

The Madison Metropolitan Sewerage District (District) protects public health and the environment through its ownership, operation, and management of a wastewater collection and treatment system. The District serves over 430,000 residents, businesses and industries in the Dane County region. Resources recovered from the District's wastewater treatment system include treated effluent (reclaimed fresh water), biosolids, struvite and energy. Currently, treated effluent from the District's operations is returned to two local streams (Outfall 001 is to Badfish Creek and Outfall 005 is to Badger Mill Creek).

In 2023, the District submitted a Final Compliance Alternatives Plan (FCAP) to the Wisconsin Department of Natural Resources (WDNR) for compliance with phosphorus requirements in its Wisconsin Pollution Discharge Elimination System (WPDES) permit at Outfall 005. The FCAP recommends ceasing to return effluent to Outfall 005. The discontinuance of this discharge at Outfall 005 would eliminate the human-made condition in Badger Mill Creek and return to the District's historic operating conditions under which all treated effluent is returned to Outfall 001 to Badfish Creek. The Wisconsin Department of Natural Resources (WDNR) and the community were engaged during the FCAP alternatives review process. On November 1, 2023, WDNR accepted the recommendation for phosphorus compliance to discontinue the discharge at Outfall 005 and return all treated effluent to Outfall 001 at Badfish Creek under WPDES Permit No. WI-0024598-09-02.

As explained further below, the District's discharge to Outfall 005 was the subject of an amendment to the Dane County Water Quality Plan in 1997. This letter constitutes the District's formal request to modify the amendment to the Areawide Water Quality Management Plan (AWWQMP) to reflect the recommendation of the FCAP.

Historical Background:

Historically, the City of Verona owned and operated a wastewater treatment plant that discharged treated effluent to the Sugar River. When the City of Verona faced the need for significant upgrades at their facility, they made the decision to regionalize with the District. In 1993, The District annexed the City of Verona wastewater treatment plant. At that point, facility planning began, which was finalized in October of 1994. Subsequently, construction began on a pumping station at the site of the former treatment plant and a forcemain was constructed to route wastewater from Verona to the District's Nine Springs Wastewater Treatment plant. The District then took over ownership and operation of the City of Verona wastewater treatment plant. In January of 1995, wastewater began being pumped to the District's Nine Springs

Wastewater Treatment plant, the City of Verona plant was disassembled, and all treated effluent flowed to Outfall 001 at Badfish Creek.

During the 1990s, there was the belief that groundwater pumping would lower surface or near surface aquifers which could reduce the baseflow in streams. At that time, references to the Dane County Groundwater model speculated that by 2020, local streams would not be functional. This was an impetus for the development of Outfall 005. Since 1998, the District has voluntarily pumped treated effluent to Badger Mill Creek. This effluent is pumped through an approximately 10-mile long force main and enters the stream at a cascade aerator. The changes to Verona's wastewater treatment and subsequent District voluntary discharge were included in Dane County Regional Planning Commission's Resolutions 670, 738 and 796.

However, subsequent to the Regional Planning Commission's resolutions referenced above, significant hydrologic changes have occurred that were not predicted. The most notable changes are improved farming practices and stormwater regulations put in place by WDNR, Dane County and local municipalities. Specifically, as discussed in the FCAP, the hypotheses of depleted water resources has not been realized in the Badger Mill Creek watershed as originally predicted. Rainfall has increased, flooding is occurring upstream of the District's effluent return, drinking water withdrawn from deep wells has decreased by over 3-million gallons per year instead of increasing as originally predicted, and stream flows are higher than predicted in the Dane County Groundwater model. Ordinances have been adopted that require storage of flood flows, infiltration and planning. The outcomes are shown in the January 2016 USGS "Changes in Streamflow Characteristics in Wisconsin as Related to Precipitation and Land Use" report (Gebert et al. 2016) and by the findings of the Dane County Groundwater model. In contrast to the predictions, the baseflow in local streams, including the Sugar River, has increased over the past twenty-five years.

Legal Background:

In the 2015 budget bill, 2015 Wis. Act 55, the Wisconsin Legislature enacted a new statutory section that significantly curtailed the authority of what is now the Capital Area Regional Planning Commission (CARPC) and the WDNR with respect to amendments to AWWQPs in Dane County. The new statutory section, Wis. Stat. § 283.83(1m), imposes several limitations including requiring WDNR to base decisions regarding AWWQP amendments on "whether the proposed revision complies with the water quality standards under s. 281.15." § 283.83(1m)(a). Further, subsection (1m)(b) mandates that WDNR and any person contracting with WDNR, such as CARPC, "may not require information concerning a proposed revision to the areawide water quality management plan for the area consisting of Dane County other than information that is reasonably necessary to determine whether the proposed revision complies with water quality standards under s. 281.15." Finally, subsection (1m)(f) provides that while WDNR may contract with another party to provide "advisory services" related to the review of a proposed revision to an AWWQP, WDNR "may not delegate its authority to approve or reject proposed revisions."

It is important to note that this statutory framework was not in place when the initial plan amendment for Badger Mill Creek was issued in 1997. Since that time, the criteria relevant to an AWWQP amendment in Dane County have been significantly limited. In sum, this new statutory framework for an AWWQP amendment expressly directs that: (1) any decisions on plan amendments in Dane County are limited to a review of water quality standards; (2) information other than water quality standards may not be required; (3) and it is ultimately WDNR not CARPC that makes the final decision whether to approve or reject a proposed revision. Wis. Stat. § 283.83(1m).

As stated above, the standard by which an amendment to an AWWQP in Dane County is reviewed is based on compliance with the water quality standards under Wis. Stat. § 281.15. Section 281.15(1) requires WDNR to promulgate rules setting standards for water quality applicable to waters of the state. "Water quality standards shall consist of the designated uses of the waters or portions thereof and the water quality criteria for those waters based upon the designated use." *Id.* In accordance with this mandate, the WDNR has established water quality standards at Wis. Admin. Code chs. NR 102-105. Chapter NR 102 "describes the designated use categories" for waterbodies in the state "and the water quality criteria necessary to support these uses." Section NR 102.04 lays out the different designated use categories (ex. fish and aquatic life uses, recreational use, public health and welfare, and wildlife use) as well as the water quality criteria necessary to meet the designated uses.

Pursuant to the mandate under Wis. Stat. § 283.83(1m), the question relevant to this AWWQP amendment request is the following: will the amendment request comply with water quality standards under § 281.15, *i.e.* will the discontinuance of discharge from the District to Badger Mill Creek impact compliance with the water quality criteria necessary to meet the waterbody's designated uses. The following analysis confirms that the proposed amendment request is consistent with the water quality standards under Wis Admin. Code NR 102.

Water Quality Standards:

Fish and Aquatic Life Use:
In 1975, WDNR classified a portion of Badger Mill Creek from the old Verona wastewater treatment plant at Bruce Street down to State Highway 69 as "intermediate fish and aquatic life" (equivalent of limited forage fishery) and the remainder of the stream as fish and aquatic life (FAL). Over the years, updated classifications have been proposed but no reclassifications have been promulgated. In 2008, WDNR fisheries management designated Badger Mill Creek from its mouth at the Sugar River upstream to the uppermost STH 18/151 crossing as a "Class II" trout water for fisheries management purposes, but the water resources designation was not changed.

With respect to the fish and aquatic life designated use, "[e]xcept for natural conditions, all waters classified for fish and aquatic life shall meet" water quality criteria for a number of parameters, including dissolved oxygen, pH, toxic substances, temperature, and bacteria. As

explained below, the proposed AWWQP amendment complies with the applicable water quality criteria for Badger Mill Creek.

Dissolved Oxygen – NR 102.04(4)(a):
A waterbody designated by WDNR as limited forage fish shall attain a minimum dissolved oxygen (DO) concentration of 3 mg/L at all times. For full fish and aquatic life waters the criteria is 5 mg/l and for cold water streams the criteria is 6 mg/l (except for the winter months when it is 7 mg/l).

The District maintains a stream sampling program which includes dissolved oxygen. Monthly, District crews take grab samples along the effluent streams. The first sampling site downstream of the District's effluent return is at Hwy PB (BM5) and samples are taken along Badger Mill Creek with the downstream most site being Hwy 69 (BM9). A map showing these locations is included as Attachment 1. On three occasions the district discontinued or reduced effluent from Outfall 005 for short periods. During these periods, the District continued its sampling program. This has provided the District with comparison data of DO in the stream with effluent and without effluent. For clarity, only comparable periods with and without effluent are shown.

MMSD instream monitoring DO: (June 2021 off, Feb-Apr 2023 off, Feb 2024 partial return)

	BM5, Hwy PB (mg/l)	BM9, Hwy 69 (mg/l)
1/8/2020	10.3	10.9
2/5/2020	8.99	9.5
4/7/2020	8.56	9.08
5/6/2020	8.87	11.1
6/3/2020	6.81	7.89
1/5/2021	8.54	10.3
2/3/2021	9.89	12.6
3/11/2021	9.9	10.2
4/6/2021	7.55	10.1
5/5/2021		9.57
6/2/2021	6.72*	10.6*
1/12/2022	9.33	9.76
2/9/2022	9.03	11
3/9/2022	10.2	10.7
4/13/2022	7.67	
5/4/2022	9.43	13.1
6/1/2022	7.72	9.87
1/18/2023	9.93	11.5
2/8/2023 *Shutdown began 2/7	9.99*	12.3*
3/8/2023	10.2*	12.3*
4/12/2023	7.53*	11.6*
5/10/2023	7.51	9.25
6/14/2023	7.52	11.9
1/23/2024	10.2	12
02/14/2024 Partial return	9.82	11.5

Figure 1 - Instream Dissolved Oxygen at BMC sites

All of these data points, with and without effluent, are above the criteria for LFF waterways. In addition, they exceed the criteria for full fish and aquatic life as well as for coldwater communities. A more complete data set is shown in the Figure 2, which includes the data obtained through the sampling program from 2020 to 2024 for both Highway PB (BM5) and Highway 69 (BM9). A map showing these locations is included as Attachment 1.

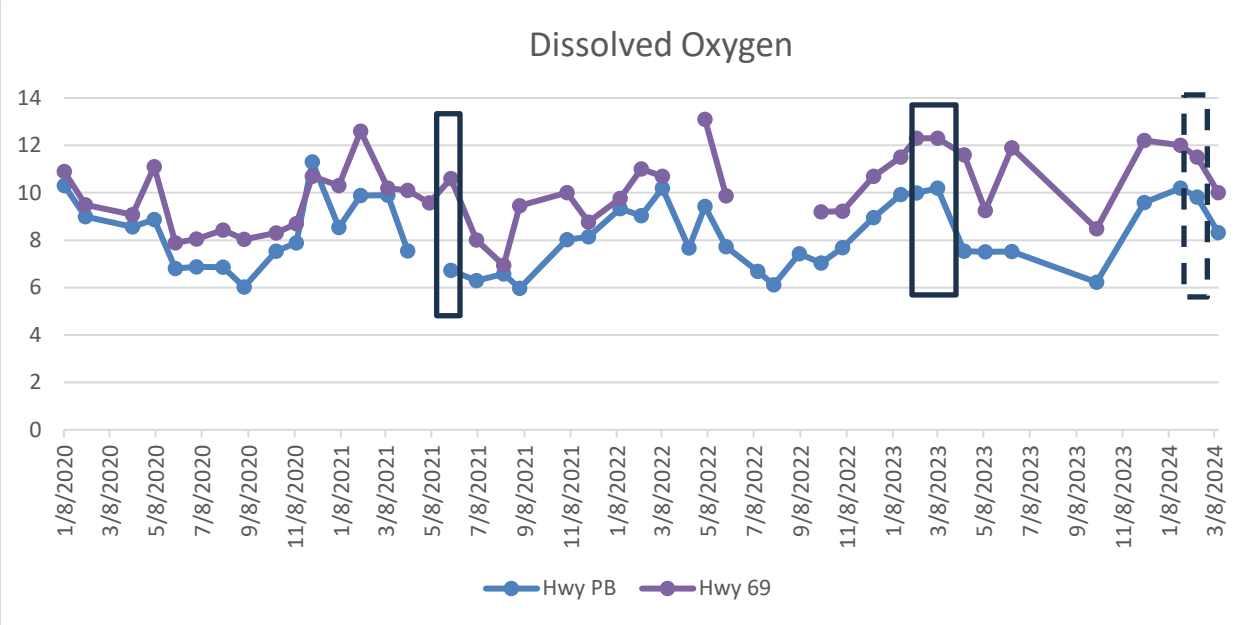


Figure 2 - Dissolved Oxygen at BMC sites 2020-2024

**In the graphs, a solid rectangle highlights periods of ceased effluent: 05/19/2021 to 6/3/2021; 02/07/2023 to 04/16/2023.*

***In the graphs, a dashed rectangle highlights periods when flow reduced to 1.5 cfs (ramp down from 02/09/2024 to 02/23/2024.*

As Badger Mill Creek flows downstream, it generally gains DO. The DO at Hwy 69 is above the criteria for LFF, full fish and aquatic life and coldwater communities with and without effluent return. In addition to DO, it should be noted that when effluent is discontinued, the Biochemical Oxygen Demand, which impacts DO, is also discontinued.

pH – NR 102.04(4)(c):

The pH shall be within the range of 6.0 to 9.0, with no change greater than 0.5 units outside the estimated natural seasonal maximum and minimum.

The pH range of the stream with or without effluent return remains in the range of 6.0 to 9.0. Figure 3 shows the instream grab sample results for pH which have been taken by the District during its monthly sampling program. This graph includes data for the Sugar River upstream of the confluence with Badger Mill Creek. The pH of the effluent is lower than that of the Sugar River upstream of the confluence with Badger Mill Creek. The pH of Badger Mill Creek slowly increases after the effluent return and by the confluence is similar to that of the Sugar River.

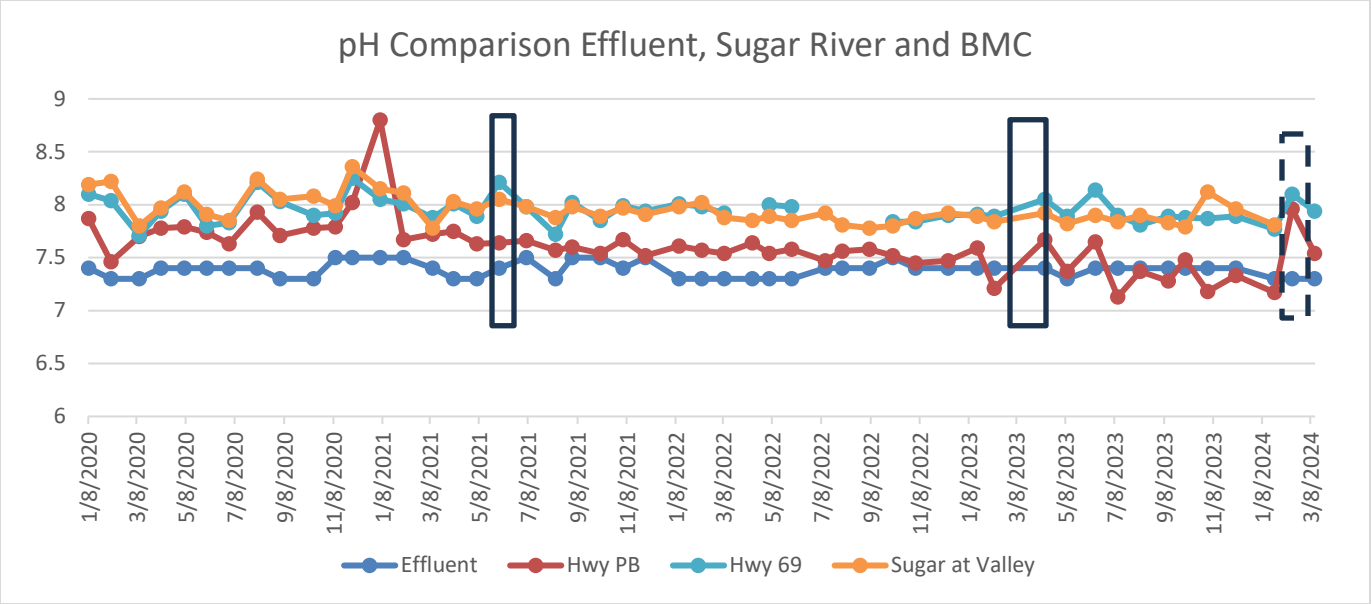


Figure 3 - pH Comparison 2020-2024 Sugar River, BMC and Effluent

**In the graphs, a solid rectangle highlights periods of ceased effluent: 05/19/2021 to 6/3/2021; 02/07/2023 to 04/16/2023.*

***In the graphs, a dashed rectangle highlights periods when flow reduced to 1.5 cfs (ramp down from 02/09/2024 to 02/23/2024.*

Toxic Substances – NR 104.04(d):
Unauthorized concentrations of substances are not permitted that alone or in combination with other materials present are toxic to fish or other aquatic life. Surface waters shall meet the acute and chronic criteria as set forth in or developed pursuant to ss NR 105.05 and 105.06.

Once the District effluent return is ceased, any toxic substances contained in the District's effluent will cease to flow to Badger Mill Creek. The District's permit currently contains variances to the water quality standards for both Mercury and Chloride and requirements for many other parameters.

Temperature- NR 104.04(e):
Water quality criteria for temperature shall be determined and applied pursuant to NR 102 subch. II. Heated effluent shall not cause lethality, inside or outside of the mixing zone, to animal, plant or other aquatic life.

Because the effluent temperatures exceed the sublethal standards (Figure 4) allowed by WDNR for LFF waters, the District's permit includes alternative effluent limits for temperature. In addition, the effluent is more in excess of the criteria for other classifications including Small Warm Water and Coldwater criteria. With respect to the criteria for coldwater communities, the District's effluent is up to 20 degrees Fahrenheit warmer than allowed (Figure 4). Because

the effluent temperatures are too warm, MMSD was required to apply for and DNR and EPA need to approve Alternative Effluent Limits. Discontinuing the effluent return to Badger Mill Creek will remove these extreme temperatures.

In addition to the warmer winter temperatures, WDNR trout fishery data notes that for cool-cold mainstem trout streams, the daily maximum mean temperature should be between 68.5 and 72 degrees Fahrenheit. For the current WPDES Permit term, the months of July, August and September have maximum mean temperatures that exceed that criteria.

Without the District's effluent, Badger Mill Creek will experience more natural fluctuation of temperature. Effluent pumping takes approximately 10-hours to get from the Nine Springs Wastewater Treatment Plant to the effluent return location. Through years of instream temperature monitoring, the District did not find significant (more than 0.5 degree) temperature changes from the Nine Springs Plant to the effluent return location. Therefore, warmer water that has been sitting in tanks at the treatment plant arrives in the stream 10-hours after it leaves the plant. That tends to stabilize temperatures throughout the day rather than a natural system where daily warming would cease once the sun went down.

	MMSD effluent daily mean maximum Temperature (deg F) current permit term	WDNR Thermal Criteria LFF & Effluent exceeds by (deg)	WDNR Thermal Criteria Small Warm & Effluent exceeds by (deg)	WDNR Thermal Criteria Cold & Effluent exceeds by (deg)
January	57.87	54 (3.9)	50 (7.9)	47 (10.9)
February	57.89	54(3.9)	50(7.9)	45(12.8)
March	56.5	54(2.5)	54 (2.5)	53(3.5
April	59.95	64	65	59(1)
May	64.69	75	70	59(5)
June	69.15	75	72	67(2.2)
July	72.23	75	74	68(4.2)
August	74.39	77	78	68(6.4)
September	72.71	92	87	52(20.7)
October	71.67	54 (17.5)	54(17.5)	52(19.5)
November	66.32	54 (12.3)	50(16.3)	50(16.3)
December	61.84	54 (7.8)	50(11.8)	46(15.8)

Figure 4 - Effluent temperature comparison to WDNR Criteria (yellow indicates effluent is too warm to meet criteria, brackets include the magnitude of the excursion above standard.

Thus, removing the thermal load from the effluent appears to allow more natural year-round stream temperatures.

Other criteria:

Surface waters must meet the criteria that correspond to the particular subcategories of waterbodies found in NR 102.04(3)(a)-(e) as well as the narrative criteria in NR 102.04(1).

As explained above, the proposed AWWQP amendment complies with the specific dissolved oxygen criteria for the fish and aquatic life subcategories of LFF, warm water communities, and coldwater communities. Further, the plan amendment removes the discharge to Badger Mill Creek and therefore will not lead to noncompliance with any of the narrative criteria under NR 102.04(1).

Recreational Use:

Bacteria NR 104.04(6)(a):
All of the *Escherichia coli* (*E. coli*) criteria in Table A apply unless bacteria site-specific criteria have been adopted pursuant to subd. **2.**

Table A	
E. coli (counts[1] per 100 mL)	
Geometric Mean[2]	Statistical Threshold Value[3]
126	410
1. For determining attainment or compliance, counts are considered equivalent to either colony forming units or most probable number. 2. The geometric mean shall not be exceeded in any rolling 90–day period during the recreation season. 3. The statistical threshold value shall not be exceeded more than 10 percent of the time during any rolling 90–day period during the recreation season.	

The District's monitoring has historically included F.Coli. Our reporting is changing to E.Coli, which is a subset of F.Coli. There is not a clear comparison between these two tests as samples are incubated at different temperatures, allowing for differing rates of bacterial growth. Therefore, this analysis will be completed using F.Coli (Fecal Coliform) data.

Fecal Coliform Bacteria is one type of coliform bacteria that is found mainly in animal digestive tracts and feces. Fecal coliforms are a more specific indicator of fecal contamination of water. Wastewater contains fecal coliform bacteria and many other sources are also present in local streams. Wastewater is disinfected to minimize the number of coliform bacteria that are released in treated effluent. The District's permit requires that District effluent remain below a geometric mean (average) count of 400 per 100 ml on a monthly average basis and below 780 per 100 ml on a weekly average basis during the months of March through November each year.

The instream sampling shows that without effluent contribution (during the shutdown period of February and March 2023 and in February 2024 when effluent was reduced to accommodate construction), fecal coliform bacteria in the stream is significantly lower when compared to the same time periods in other years (Figure 5). Discontinuing the effluent return is therefore likely to have a positive impact on the bacteria concentrations in BMC.

	Effluent Limit	CTH PB	Hwy 69
1/12/2022		1370	40
2/9/2022		1970	1060
3/9/2022	780	882	300
1/18/2023		984	283
2/8/2023*shut down began 2/7		380	88
3/8/2023		18	7
01/23/2024		820	1470
02/14/2024		232	132

Figure 5 - FCOLI from MMSD instream sampling – yellow highlighted data includes period without effluent – blue was period when effluent return was 1.5 MGD.

Public Health and Welfare Use:

General Criteria

The criteria developed pursuant to NR 105.08 and NR 105.09 must be met. NR 105.08 and NR 105.09 establish human threshold criteria and human cancer criteria.

Because the proposed AWWQP amendment discontinues the discharge to Badger Mill Creek, it will not impact compliance with the human health general criteria.

Taste and Odor Criteria

All surface waters providing public drinking water supplies or classified as coldwater or warm water sport fish communities must meet the taste and odor criteria specified or developed pursuant to NR 102.14. NR 102.14 establishes taste and odor criteria for substances that impart tastes and odors to waters and to aquatic organisms.

Because the proposed AWWQP amendment discontinues the discharge to Badger Mill Creek, it will not impact compliance with the human health taste and odor criteria.

Temperature Criteria

To protect humans from being scalded, the water temperature of a discharge may not exceed 120 degrees F unless specifically authorized under provisions in subchs. V or VI of ch. NR 106.

Because the proposed AWWQP amendment discontinues the discharge to Badger Mill Creek, it will not impact compliance with the human health temperature criteria.

PFOS and PFOA Criteria
All surface waters must meet criteria of 8 ppt for PFOS and either 95 ppt for surface waters not classified as public drinking water supplies or 20 ppt for surface waters classified as public drinking supply waters.

Because the proposed AWWQP amendment discontinues the discharge to Badger Mill Creek, it will not impact compliance with the human health PFOS and PFOS criteria.

Wildlife Use:

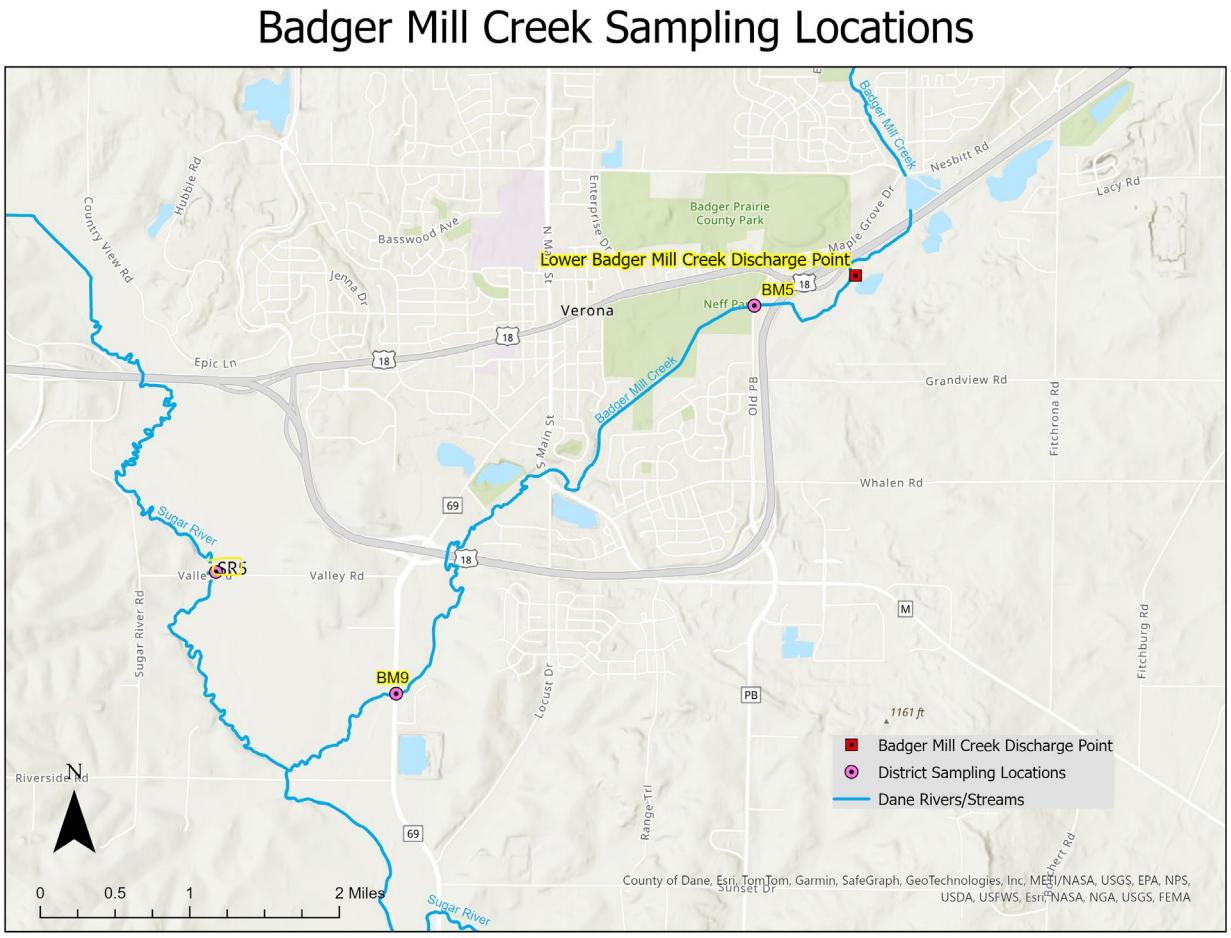
Wildlife Criteria
The wildlife criteria specified in NR 105.07 must be met. NR 105.07 establishes specific criteria for substances that protect wildlife from adverse effects resulting from ingestion of surface waters.

Because the proposed AWWQP amendment discontinues the discharge to Badger Mill Creek, it will not impact compliance with the wildlife criteria.

Conclusion

In conclusion, this analysis shows that the elimination of the Badger Mill Creek Effluent return will comply with water quality standards under NR 102. Therefore, the requested plan amendment meets the requirements of Wis. Stat. s. 283.83 and should be granted**.**

Attachment 1: Map of Monitoring Locations



Key	Location
SR5	Upstream Sugar River
BM5 – CTH PB	HWY PB – Badger Mill Creek
BM9 – Hwy 69	Hwy 69 Badger Mill Creek