



September 9, 2024

DNR No. DC0238

Mr. Nick Bower, PE Environmental Engineer
Capital Area Regional Planning Commission
100 State Street; Suite 400
Madison, WI 53703

Subject: [Water Quality Management Letter for Dane County Water Quality Plan Amendment Request #2308 – MMSD \(“Nine Springs WWTP Effluent Revision” for WPDES Permit WI-0024597-09-2, Outfall 005\)](#)

Dear Mr. Bower,

On June 10, 2024, the Wisconsin Department of Natural Resources (Department) received notice of Water Quality Management Plan Amendment Request #2308 from the Capital Area Regional Planning Commission (CARPC) for the Madison Metropolitan Sewerage District (MMSD) to revise the point of discharge for treated effluent from the Nine Springs Wastewater Treatment Plant. MMSD’s application and the [Commission staff’s analysis report](#) of the proposed amendment have been submitted to the Department’s Surface Water Integrated Monitoring System (SWIMS). A public hearing was held on the proposed amendment at the July 11, 2024, CARPC meeting and the Commission voted to recommend denial of the amendment on August 8, 2024¹.

Amendment Area and Background

MMSD has submitted a request for an amendment to the Dane County Water Quality Plan. The proposed amendment will revise the point of discharge locations of treated effluent from the Nine Springs Wastewater Treatment Plant. Currently, treated effluent from District operations is returned to two local streams (Outfall 001 to Oregon Branch of Badfish Creek, Outfall 005 to Badger Mill Creek). The proposed amendment will cease the discharge of effluent via Outfall 005 (See Figure 1). This change is being made in order to comply with phosphorus limits as outlined in MMSD’s chosen alternative in the Final Compliance Alternative Plan submitted to the Department in May 2023.

In 1995, the Verona WWTP regionalized with MMSD, ceasing direct discharge from the Verona WWTP to Badger Mill Creek and instead sending wastewater to the Nine Springs Wastewater Treatment Plant. This required an amendment to the Dane County Water Quality Plan. During that process, the Dane County Regional Planning Commission (DCRPC; predecessor to CARPC) strongly supported the regionalization of wastewater collection and treatment but had concerns about potential long-term adverse impacts of diverting water from the Sugar River Basin to the Yahara Basin. To mitigate these concerns and reverse adverse hydrologic impacts already evident in Badger Mill Creek at that time, a proposal that provided for the return and discharge of highly treated effluent from the Nine Springs Wastewater Treatment Plant to the headwaters of Badger Mill Creek was ultimately approved. DCRPC passed

¹ CARPC meeting minutes and recordings can be found online at <https://www.carpcwaterqualityplan.org/2024/08/08/dcwqp-amendment-discontinuance-of-effluent-discharge-to-badger-mill-creek/>

Resolutions No. 738 (May 1995) and No. 796 (January 1997), and in February 1997, the Department officially approved of the change to the Dane County Water Quality Management Plan.

Environmentally Sensitive Areas and Water Quality Concerns

The main branch of Badger Mill Creek is designated as a Class II trout stream by the Department for fish management purposes, in accordance with s. NR 1.02(7), Wis. Adm. Code. Badger Mill Creek flows 9.5 miles through the southwest side of the City of Madison and bisects the City of Verona. Residential and agricultural land uses are the two predominant land uses in the 29.6 square mile watershed; however, ongoing development in Madison and Verona continues to change land use and impact surface water flow and levels in the area. Upstream of the MMSD effluent discharge point, Badger Mill Creek is intermittent as it flows through the City of Madison and generally only flows when there is significant runoff. Downstream of the MMSD discharge point, Badger Mill Creek flows 4.9 miles until its confluence with the Upper Sugar River.

Although the stream historically received wastewater discharges, by 1995 both public and private wastewater discharges to Badger Mill Creek were removed. In August 1998, MMSD began returning treated wastewater effluent to Badger Mill Creek, an action formalized as an amendment to the Dane County Water Quality Management Plan. This was done to address concerns that by sending wastewater generated in Verona to MMSD for treatment, the effluent discharge to the Lower Rock Basin reduced water quantity in the Sugar-Pecatonica Basin resulting from the groundwater withdrawals in Verona and the southwest City of Madison. As a result, the quantity of water generated/pumped out of the basin is returned to the Sugar-Pecatonica Basin via Badger Mill Creek restoring the water balance between the Upper Sugar River and Yahara River watersheds, improving habitat, offsetting the impacts on baseflow in Badger Mill Creek, and improving the fishery potential by removing low baseflow as a limiting condition.

Since 1998, Badger Mill Creek has been the focus of several monitoring efforts. The Department has conducted fish shocking and aquatic insect sampling to study long-term trends and conditions. MMSD has conducted annual monitoring of fish assemblages at two stations in the Sugar River and two in Badger Mill Creek. This monitoring indicates that the stream can maintain a thermally sensitive fish assemblage. As part of Wisconsin's 303(d) Program, between 2014 and 2022, Badger Mill Creek was evaluated every two years for total phosphorus, biology, and temperature. The total phosphorus sample data far exceeded 2018 WisCALM listing criteria for the Fish and Aquatic Life use; however, available biological data did not indicate impairment (i.e. no macroinvertebrate or fish Index of Biotic Integrity (IBI) scored in the "poor" condition category). Chloride, temperature, fish and aquatic insect data indicated otherwise good conditions; however, Badger Mill Creek was listed as impaired for total phosphorus due to instream total phosphorus concentrations greatly exceeding the total phosphorus criteria contained in ch. NR 102.06(3)(b), Wis. Adm. Code. Badger Mill Creek is listed as impaired under category 5A of the 303(d) list, meaning available information indicates that at least one designated use is not met or is being threatened. The high total phosphorus concentrations in Badger Mill Creek can also have detrimental impacts to downstream waters.

Due to a variety of factors, numbers of trout have increased in Badger Mill Creek, and as a result Badger Mill Creek is listed with a designated use and attainable use of "Coldwater – stocked with reproduction". While the numbers of trout have increased and available biological data do not indicate impairment, the presence of pollution intolerant (thermally sensitive) Coldwater indicator species such as mottled sculpin, brook stickleback, and aquatic insects indicative of healthy trout streams, have declined since the introduction of MMSD's effluent. Overall monitoring has revealed increased levels of chlorides, total phosphorus, dissolved phosphorus, and ammonia in Badger Mill Creek with total phosphorus clearly exceeding water quality criteria. While trout habitat has improved, certain Coldwater indicator species

suggest that overall water quality and stream health may be deteriorating because of the diversion of treated wastewater to Badger Mill Creek.

MMSD's current permitted effluent limits for the Badger Mill Creek discharge were set at the point of discharge using chapters 102, 104, 105, 106, 207, 210, and 217 of the Wisconsin Administrative Code, as well as historical and current information about fish and aquatic life residing in the stream. The Department recognizes the discrepancy between the Coldwater use designation and the historically assigned limited forage fish (LFF) use designation applied to a portion of the stream. Over the years the Department and MMSD have implemented permit limits in an attempt to also be protective of the downstream designated uses in the Upper Sugar River Watershed. This resulted in limits that were more stringent than LFF-based limits but less stringent than those that would be typically calculated to protect a Coldwater designation. To date, MMSD's effluent quality substantially complies with permit requirements for Badger Mill Creek. Thermal limits were introduced to the permit in a later evaluation and current permit thermal requirements are based on an Alternative Effluent Limitation (AEL) authorized under subch. VI of ch. NR 106, Wis. Adm. Code.

Wastewater Collection and Treatment System

The Department is currently drafting the next reissuance of MMSD's Wisconsin Pollutant Discharge Elimination System (WPDES) permit.² Any issues pertaining to wastewater collection and treatment will be addressed through the permit reissuance process.

Local Review & Public Involvement

A public hearing was held on the proposed amendment at the July 11, 2024, meeting of the Capital Area Regional Planning Commission. Representatives from MMSD gave a presentation in favor of the proposed amendment. During the public hearing portion of the meeting, one (1) participant spoke in favor of the proposed amendment and nine (9) participants spoke against it.

During the meeting, several Commissioners had questions seeking clarification on various topics, including: decision factors by MMSD, cost implications, details on the Stakeholder Group for Health and Resiliency of Badger Mill Creek, CARPC and DNR's legal authorities, classification of Badger Mill Creek, request for flow data, downstream flooding in Badfish Creek, the viability of adaptive management in the Sugar River watershed, phosphorus regulations, impacts on water quality and overall health of Badger Mill Creek, timelines, WPDES discharge permit compliance, and interbasin water transfer. Representatives for MMSD and several public participants provided answers and response commentary to the best of their ability.

CARPC also received written public comments from 39 entities/individuals during a 30-day comment period, extending from June 10, 2024, through July 10, 2024, following MMSD's submittal. Many comments were received from residents and members of the Upper Sugar River Watershed Association, Southern WI Trout Unlimited, Friends of Badfish Creek Watershed, and Friends of Badger Mill Creek Environmental Corridor. Comments were also received on behalf of the Village of Cottage Grove, the City of Verona, the City of Madison, and the MMSD Commission.

In summary, the majority of the comments expressed concerns about potential impacts on the water quality and ecosystem of Badger Mill Creek upon discontinuing the effluent, especially as it pertains to trout habitat. Residents of Badfish Creek voiced concerns that the redirected effluent could negatively

² Current WPDES Permit No. WI-0024597-09-2, expires March 31, 2025. More information about permits on public notice can be found at: <https://dnr.wisconsin.gov/topic/Wastewater/PublicNotices.html>

affect the water quality of Badfish Creek due to the increased flow and additional phosphorus. The City of Verona and other commenters asserted that MMSD's amendment proposal is not consistent with the Sewer Service Area policies and procedures, citing that the Water Quality Management Plan requires protection of the public interest in waterways. The City of Madison and MMSD Commission asserted that alternatives such as tertiary treatment and adaptive management were considered and deemed not practicable as they are not cost-effective options. The MMSD Commission stated that discontinuing the effluent discharge to Badger Mill Creek is the most fiscally responsible and sustainable option for long-term permit compliance.

Following the public hearing, CARPC staff conducted a thorough review of MMSD's application and supplemental materials, along with other available information and submitted a Staff Analysis document to the full Commission on July 30, 2024, with a draft recommendation to approve the amendment with conditions. At their August 8, 2024, meeting, the Capital Area Regional Planning Commission unanimously voted to recommend that the Department deny the proposed amendment.

Administrative Decision

Following the Department's review of all submitted material, including MMSD's application, CARPC's staff analysis, comments received during the public comment period and hearing, and the CARPC commission's recommendation, the Department finds the proposed amendment is *consistent with adopted policies and procedures of the Areawide Water Quality Management Plan under chapter NR 121, Wis. Adm. Code and section 283.83, Wis. Stats., and is hereby conditionally approved*. The Department's conditions are largely consistent with those listed in the CARPC staff review, with minor modifications, as listed below.

Required conditions include:

1. MMSD shall work with the Department, CARPC, and other interested governmental and non-governmental stakeholders to complete the following two items in order to ensure that Badger Mill Creek will maintain its currently attained designated uses pursuant to s. 281.15, Wis. Adm. Code, and that dissolved oxygen (DO) concentrations will not deviate further from desired levels such that water quality would be degraded below levels needed to maintain the designated uses.
 - a. Conduct additional trial periods of effluent flow cessation to collect more data representing a wider range of conditions. This might be a single, longer-term period or a series of short-term periods during underrepresented stream flow and temperature conditions. The design of the trial(s) should be decided in consultation with Department staff to ensure scientific accuracy and conducted in such a way as to avoid lasting damage to either the creek biota or MMSD infrastructure.
 - b. Using the additional data collected under (a), conduct a thorough analysis using appropriate modeling or statistical techniques to predict DO and stream temperature under a full range of flow and temperature conditions without the supplemental effluent flow. The results of this analysis shall be evaluated by Department staff to determine if the modeling is accurate enough to establish confidence in the predictions without the need for additional trial periods of supplemental flow cessation.

Modeling efforts can consist of forecast modeling or regression analysis accounting for the impacts of flow and temperature on DO; however, if initial modeling results indicate that water quality is expected to be degraded below levels needed to maintain the designated uses, additional analysis may be warranted to account for other factors impacting DO. More robust geostatistical and mechanistic

models such as QUAL2E, QUASAR, SIMCAT, TOMCAT, Mike-11, or ISIS could better simulate and predict water quality fluctuations and account for confounding influences beyond just flow and temperature. The reductions in total phosphorus and ammonia loads that would also occur due to the cessation of effluent flow may positively impact DO levels.

2. If it is determined that water quality is expected to be degraded below levels needed to maintain the designated uses, MMSD shall work with the Department, CARPC and other interested governmental and non-governmental stakeholders to evaluate and implement appropriate mitigation measures. Mitigation measures could include, but are not limited to, providing partial or periodic supplementation of flow during identified critical conditions, the removal of biochemical oxygen demand sources from Badger Mill Creek, addressing sediment oxygen demand through removal of instream sediment, implementing stream restoration projects to promote zones of turbulence and aeration, enhancing riparian vegetation, and reducing phosphorus and nitrogen runoff from agricultural and urban areas.

Furthermore, the Department supports the following *recommendations* proposed by CARPC, with minor modifications:

1. MMSD, CARPC, the Department, and other interested governmental and non-governmental stakeholders should work with the Wisconsin Geological and Natural History Survey (WGNHS) to recalibrate the model of Badger Mill Creek utilizing additional detail on geology, changes in land use, hydrology (including the removal of the effluent contribution), and climate change, utilizing the Groundwater Flow Model for Dane County, to help identify other opportunities for maintaining baseflow. This analysis could further explore concerns about potential long-term diversion of water from the Sugar River Basin.
2. MMSD should conduct additional public outreach and education regarding the anticipated effects of the amendment.

Rationale/Justification for Decision

Under the authority of s. 283.83, Wis. Stats., ch. NR 121, Wis. Adm. Code, lays out procedures for approval and content of areawide water quality management plans. The stated purpose of that code chapter is to establish a required areawide planning process that systematically evaluates alternative means of achieving state and federal water quality goals and related standards.

To arrive at this decision regarding MMSD's June 10, 2024, plan amendment request, the Department evaluated the cumulative effect of the effluent discharge on applicable numeric and narrative water quality criteria and standards, pursuant to s. 283.83(1m) Wis. Stats., along with relevant plan amendment provisions found in ch. NR 121, Wis. Adm. Code.

In reviewing MMSD's June 10, 2024, amendment request, the main decision before the Department was whether MMSD's amendment request to discontinue the effluent discharge to Badger Mill Creek complied on balance with all applicable water quality standards. Section 283.83(1m)(b), Wis. Stats. mandates that the Department and 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."

In this case, consideration of water quality standards includes the following: DO levels, total phosphorus, pH, presence of toxic substances, temperature, presence of bacteria, taste and odor of the water, and

PFOS and PFOA criteria. In their amendment request, MMSD provides sufficient evidence that pH will remain within the normal range of 6.0 to 9.0 once effluent discharge has ceased. They also credibly argue that once effluent discharge is ceased, any toxic substances or bacteria contained in the effluent will cease to flow to Badger Mill Creek. Likewise, any PFOS and PFOA additions or impacts to water taste/odor will no longer be a concern when effluent is ceased. The Department agrees that many of these water quality standards will likely show a net improvement without the addition of treated wastewater effluent. However, temperature, DO levels, and aquatic life impacts are discussed further below.

The long-term water quality monitoring and biological assessments of Badger Mill Creek paint a complicated narrative. The increase in stream baseflow afforded by the effluent discharge has improved fish habitat and appears to help maintain adequate temperature and DO levels for trout. Higher flow rates promote higher concentrations of DO, but as flow rates decrease and temperatures increase DO concentrations can drop. Section NR 102.04(4)(a)2., Wis. Adm. Code, requires that surface waters shall attain a minimum DO concentration of 5 mg/L at all times, and s. NR 102.04(4)(a)3., Wis. Adm. Code, requires a minimum DO concentration of 6.0 mg/L at all times with a minimum DO concentration of 7.0 mg/L when Coldwater fish are spawning.

While USGS data indicates that there are periods when DO levels drop below the minimum of 5 mg/L, overall adequate DO levels appear to be maintained to support a trout fishery. Complicating this is biological data indicating that some Coldwater indicator species have declined. In weighing its decision, the Department also considered s. NR 102.04(4)(a)3.c., Wis. Adm. Code, which states “dissolved oxygen concentrations and diurnal patterns may not be altered from natural background levels to such an extent that Coldwater populations are adversely affected.” While “natural background” is not explicitly defined in ch. NR 102, Wis. Adm. Code, “natural conditions” is defined in s. NR 102.03(3), Wis. Adm. Code, to mean “the normal daily and seasonal variations in climatic and atmospheric conditions, and the existing physical and chemical characteristics of a water or the course in which it flows.”

The Department concurs with the CARPC staff analysis dated July 30, 2024, that the proposed amendment, when considered in whole, is likely consistent with water quality standards under Wis. Stat. s. 281.15. There was an approximate three-month period in both 2022 and 2023 when the daily minimum DO, a single water quality standard, fell below 6.0 mg/L. This appears to correlate with summertime, warm water temperatures. CARPC staff performed a preliminary analysis using existing data from the USGS baseflow monitoring station (USGS 05435943) and found a statistically significant relationship between flow, DO, and temperature. It confirmed that an incremental flow decrease (5 cubic feet per second) would result in a small decrease in DO and that as temperature increases, DO further decreases. While these findings are not conclusive as to the impact of the proposed amendment, they point toward the need to collect additional data and evaluate through forecast modeling or regression analysis what sort of compliance with water quality standards could be expected under varying conditions or, if existing water quality parameters are not already in compliance, to show that water quality would not be degraded below levels needed to maintain the designated uses over the existing observational record.

Therefore, consistent with the CARPC staff recommendation, the Department is recommending a conditional approval subject to the conditions outlined above. The Department's conditions reflect conditions from both the CARPC staff and Commission. The Commission did have two additional conditions that the Department is not adopting for the reasons outlined below:

CARPC Commission Recommendation: *“Since the proposed amendment only transfers the phosphorus from one watershed to another and that present phosphorus levels in Badger Mill*

Creek are not harming aquatic life, we recommend that the DNR reconsider granting MMSD a variance regarding phosphorus into Badger Mill Creek in the public interest.”

All variances to water quality standards, including those for phosphorus, shall meet the provisions in s. 283.15, Wis. Stats. and must be approved by the U.S. EPA prior to being included in a WPDES permit. Regardless, if the present phosphorus concentrations are harming aquatic life or not, MMSD’s discharge to Badger Mill Creek does not meet the eligibility requirements for a phosphorus variance. Furthermore, while phosphorus impacts to aquatic life may not be evident in the immediate receiving water (Badger Mill Creek), concentrations can contribute to the accumulation of phosphorus and nutrients in downstream waters, leading to larger water quality and aquatic life impacts.

CARPC Commission Recommendation: *“Further, the Commission would like to encourage MMSD to work with the Wisconsin DNR, CARPC, and other interested governmental and non-governmental stakeholders to revisit other options to satisfy phosphorous requirements. This may include a further look at adaptive management as an alternative method to reduce phosphorus.*

The Department has worked with MMSD to explore the viability of alternative compliance strategies to achieve their water quality-based effluent limitations for total phosphorus. These options are explained more fully in the Final Compliance Alternatives Plan (FCAP) received by the Department on May 31, 2023, and are not directly relevant to the amendment request at issue. This FCAP included an evaluation of both water quality trading and the watershed adaptive management option. Under water quality trading, MMSD could work with other pollutant sources in the Badger Mill Creek to reduce discharges of total phosphorus to effectively offset MMSD’s continued discharge of total phosphorus above their water quality-based effluent limit. MMSD’s water quality-based effluent limit for total phosphorus is calculated based on assimilative capacity within Badger Mill Creek, so there is no ability, per both state and federal requirements, to expand the geographic extent available for water quality trading beyond the Badger Mill Creek HUC12 watershed. Analysis has indicated that due to the small size of the watershed and the rapid and ongoing urbanization of the watershed that there are limited opportunities for MMSD to find the needed reductions from other total phosphorus sources to completely offset the mass of total phosphorus associated with MMSD’s effluent discharge.

The watershed adaptive management option is a voluntary compliance strategy available to permittees to achieve the total phosphorus water quality criteria in contained s. NR 102.06 Wis. Adm. Code. Per s. NR 217.18(2), Wis. Adm. Code, if requested by the permittee in the permit application for reissuance and, if approved by the Department, the permittee may implement the watershed adaptive management approach. In this case, MMSD has indicated that they do not wish to pursue the watershed adaptive management option.

Statewide AWQM Plan Amendment

This amendment is a formal update to the state’s Areawide Water Quality Management Plan and the Dane County Water Quality Plan and will be forwarded to the US Environmental Protection Agency to meet the requirements of the Clean Water Act of 1987 (Public Law 92-500 as amended by Public Law 95-217) and outlined in the federal regulations 40 CFR, Part 35. This review is an integrated analysis action under s. NR 150.20(2)(a)3., Wis. Adm. Code. By means of this review, the Department has complied with ch. NR 150, Wis. Adm. Code, and with s. 1.11, Wis. Stats. The approval of this amendment to the Areawide

Water Quality Management Plan does not constitute approval of any other local, state, or federal permits that may be required associated with the cessation of effluent discharge or any potential mitigation measures that may be employed.

Appeal Rights:

Wisconsin Statutes and Administrative Rules establish time periods within which requests to review Department decisions must be filed. For judicial review of a decision pursuant to ss. 227.52 and 227.53, Wis. Stats., a party has 30 days after the decision is mailed, or otherwise served by the Department, to file a petition with the appropriate circuit court and serve the petition on the Department. Such a petition for judicial review must name the Department of Natural Resources as the respondent.

To request a contested case hearing pursuant to s. 227.42, Wis. Stats., a party has 30 days after the decision is mailed, or otherwise served by the Department, to serve a petition for hearing on the Secretary of the Department of Natural Resources. All requests for contested case hearings must be made in accordance with s. NR 2.05(5), Wis. Adm. Code, and served on the Secretary in accordance with s. NR 2.03, Wis. Adm. Code. The filing of a request for a contested case hearing does not extend the 30-day period for filing a petition for judicial review.

Sincerely,



Tim Asplund
Monitoring Section Manager
Bureau of Water Quality



Jason Knutson, P.E.
Wastewater Section Manager
Bureau of Water Quality

e-cc:

- Adrian Stocks – Bureau Director, DNR
- Tim Ryan – Field Operations Director, DNR
- Michael Sorge – Water Resources Field Supervisor, DNR
- Ashley Brechlin – Wastewater Engineer, DNR
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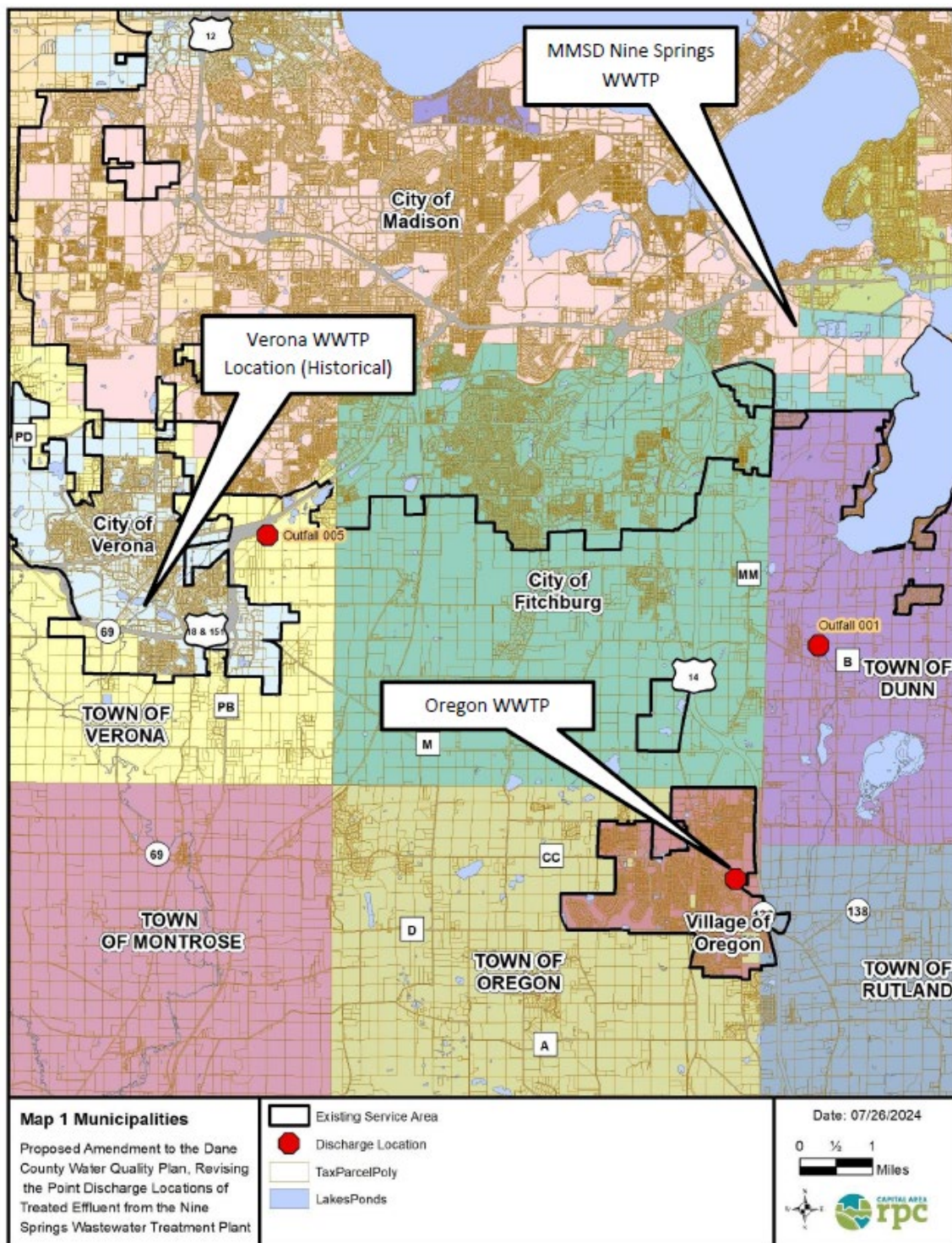


Figure 1 Location Current and Historic Wastewater Treatment Plant Outfalls