SUMMARY NOTES OF THE OCTOBER 12, 2011 MEETING OF THE MENOMONEE RIVER WATERSHED-BASED PERMIT FRAMEWORK GROUP

INTRODUCTION

The October 12, 2011 meeting of the Menomonee River Watershed-Based Permit (WBP) Framework Group was convened at the City of Brookfield City Hall at 9:10 a.m. The meeting was called to order by Theresa Caven, Project Engineer of the City of Brookfield Department of Public Works. Attendance was taken by circulating a sign-in sheet.

In attendance at the meeting were the following individuals:

Thomas M. Grisa, Chairman	Director, City of Brookfield Department of Public Works
Michael G. Hahn, Secretary	Chief Environmental Engineer, Southeastern Wisconsin Regional Planning Commission
Joseph E. Boxhorn	Senior Planner, Southeastern Wisconsin Regional Planning Commission
Joseph Burtch	Assistant City Engineer, City of West Allis
Theresa Caven	Project Engineer, City of Brookfield
Mike Flaherty	Director, Village of Elm Grove Department of Public Works
Sharon L. Gayan	Milwaukee River Basin Supervisor, Wisconsin Department of Natural Resources
Nancy Greifenhagen	Engineering Technician, Village of Menomonee Falls
Dennis Grzezinski	Senior Counsel, Midwest Environmental Advocates
Bryan D. Hartsook	Water Resources Engineer, Wisconsin Department of Natural Resources
Andrew A. Holschbach	Land Conservation Director, Ozaukee County
Lauren Justus	Engineering Assistant, Village of Germantown
Laura L. Kletti	Principal Engineer, Southeastern Wisconsin Regional Planning Commission
Mark Lloyd	Deputy Director of Public Works, City of Mequon
Mike Maki	Stormwater Engineer, City of Wauwatosa
Jeff Martinka	Executive Director, Southeastern Wisconsin Watersheds Trust, Inc.
Katherine McNelly-Bell	Environmental Scientist/Compliance Manger, Kapur and Associates, Inc. (representing the Southeastern Wisconsin Professional Baseball Park District)
Kate Morgan	Water Policy Director, 1000 Friends of Wisconsin
Jeffrey S. Nettesheim	Director of Utilities, Village of Menomonee Falls
Kevin P. O'Brien	Environmental Compliance Manager, Milwaukee County Department of Transportation and Public Works
Timothy J. Thur	Chief Sewer Design Manager, City of Milwaukee Department of Public Works
Bill Wehrley	City Engineer, City of Wauwatosa

Mr. Hahn thanked the attendees for their participation. He noted the importance of participation from the municipalities and indicated that the WBP framework process will only work with the municipalities' input. He observed that there were several people in attendance who were not at the last meeting and asked everyone to introduce themselves.

REVIEW SUMMARY NOTES OF THE AUGUST 24, 2011 WATERSHED-BASED PERMIT FRAMEWORK GROUP MEETING

Mr. Hahn reviewed the summary notes of the August 24, 2011 meeting of the Group. He noted that for the benefit of those communities that did not attend the preceding meeting, he would review the summary notes in detail. He stated that he does not anticipate reviewing the summary notes from future Group meetings in this amount of detail.

Mr. Hahn reminded the Group that the framework development process is being documented in a SEWRPC Staff Memorandum that has been developed in two parts. He stated that at the August 24, 2011 meeting, the Group reviewed a portion of the first part of the Staff Memorandum, dated August 3, 2011. He indicated that review of the first part of the Staff Memorandum would be completed at this meeting, in addition to review of the second part, dated August 18, 2011.

Mr. Hahn also mentioned that the ongoing third-party total maximum daily load (TMDL) studies being conducted by the Milwaukee Metropolitan Sewerage District (MMSD) for the Kinnickinnic, Menomonee, and Milwaukee River watersheds and the Milwaukee Harbor estuary will eventually be incorporated in municipal separate storm sewer system (MS4) permits.

Mr. Hahn said that the first part of the Staff Memorandum identified a series of issues related to the development of the WBP framework. He noted that the first issue identified was how the permitting framework should be structured to address communities that are located in multiple watersheds. He stated that he had received a preliminary electronic mail response from Mary Anne Lowndes of the Wisconsin Department of Natural Resources (WDNR) staff in which she indicated that the least complicated way to address a single municipality within multiple watersheds, where only some of the watersheds are under a TMDL, would be through an individual permit. Her email message also indicated that this may require discussions with the U.S. Environmental Protection Agency (USEPA) relative to compliance with the Federal Clean Water Act and Wisconsin's delegated authority for stormwater permitting. Mr. Hartsook explained that this answer was given within the context of the State's Phase II municipal stormwater general permit. He added that within that context, a WBP could be considered an individual permit and that he would provide clarification of that issue.

[Secretary's Note: On November 28, 2011, the WDNR Water District South and Central Office staffs, Sweet Water Executive Director, and SEWRPC staff met to discuss watershed-based permit-related issues that arose during the August 24 and October 12, 2011 meetings of the Menomonee River Watershed Group. The issue of possible watershed-based permit formats was discussed. During that meeting Russell Rasmussen, WDNR Deputy Division Administrator for Water, said that he views a watershed-based permit as a general/individual permit hybrid. Kevin Kirsch, WDNR Water Resources Engineer, said he had received a sample permit from the State of Oregon that combined general permit features and requirements with total maximum daily load wasteload allocations for specific point sources. The consensus of those at the meeting was that that type of permit structure would be a good starting point for the Menomonee River Group framework.

Mr. Rasmussen indicated that most workable approach would be for each party to the WBP to have its entire municipal or jurisdictional area covered under the permit. That could be accomplished with 1) general conditions and features applicable to all MS4s within a WBP (e.g., achievement of 20 percent total suspended solids reduction from areas of existing development) and 2) specific conditions and features applicable to individual MS4s.]

Mr. Hahn stated that Ms. Lowndes had also responded to the question of how a waste load allocation under an approved TMDL would affect a municipality's implementation of a WBP where only a portion of the municipality's MS4 is within the TMDL area. He asked Mr. Hartsook to summarize the electronic mail response. Mr. Hartsook stated that requirements in the area of the municipality outside of the portion covered by the TMDL would be tied to existing performance standards. For total suspended solids (TSS), municipalities would need to meet the 20 percent reduction standard in the non-TMDL portions of the communities and the TMDL waste load allocations (WLAs) in the portions covered by the TMDL. Mr. Nettesheim commented that this would be good as it is better to have science-based requirements for each watershed. He noted that this makes it easier to sell the requirements to elected officials. Mr. Hahn commented that this may result in concerns arising that development may be less restricted in some areas than in others. He added that this issue might arise independently of a WBP being issued.

Mr. Hartsook stated that the final Menomonee River watershed TMDL is scheduled to be completed in December 2012. He continued that because the waste load allocations are required to be reflected in the next permit issued after TMDLs are available, he anticipates that TMDLs will be incorporated into the permit when it is issued in 2017. He noted that this will provide additional time to work out the details of incorporating the TMDL into the MS4 permits.

Mr. Martinka announced that Sweet Water, MMSD, WDNR, and CDM will be holding the first stakeholder meeting on the TMDLs for the Milwaukee River Basin (consisting of the three watersheds and the Harbor estuary) in late November. He indicated that all of the MS4s will be invited to participate. Ms. Gayan added that WDNR will have staff present at this meeting who will discuss the Rock River TMDL and how aspects of that project might translate into the Milwaukee Basin TMDL.

Mr. Hahn noted that the issue of which communities have been participating in the permit framework development process is discussed on page 4 of the summary notes. He stated that Exhibit B in the summary notes from the August 24, 2011 meeting is a memorandum that was sent to the counties and several municipalities that had not attended previous Group meetings, that describes the WBP development process, and that invites those units of government to participate. He noted that the memorandum indicated that participation in the framework development process does not indicate any commitment to ultimately participate in a WBP. He stated that to date only Greendale had formally opted out of the WBP process, and that none of the other communities contacted have replied indicating a lack of interest in the process. He stated that those communities will be notified of subsequent Group meetings.

In reference to the discussion of the benefits of having group MS4 permits at the bottom of page 4 of the August 24, 2011 summary notes, Mr. Hahn noted that they provide the ability to move some pollutant allocations among communities without conducting a trade. He asked whether this had been done in the State. Ms. Gayan responded that this has not been done in the Menomonee River watershed and noted that the WDNR has never received a proposal to do this from any community. Mr. Hahn noted that another potential benefit of a WBP that was discussed was whether communities could be charged a reduced permit fee for participation in a group permit. Mr. Hartsook replied that this is currently precluded by the population-based fee structure set forth in NR 216. He added that to change the permit fee structure would require a change in NR 216. Ms. Gayan noted that NR 216 is now open for revision and that this could be discussed within WDNR as a potential change. She indicated that Mr. Hartsook had estimated what the municipalities' fees would be, if charges were apportioned on a proportional population basis and the municipal group was treated as a single municipality with a total fee based on the fee schedule in NR 216. Mr. Hahn asked Mr. Hartsook to provide this analysis to the Commission staff. Mr. Hartsook replied that he would provide it. Mr. Hahn commented that the issue of whether an economic benefit would derive from a WBP has not been resolved.

[Secretary's Note: An email containing Mr. Hartsook's estimates is attached hereto as Exhibit A. During the November 28 meeting with WDNR staff, Central Office personnel

indicated reluctance to reduce permit fees for a WBP group based on existing challenges to funding the stormwater permitting program at the State level.]

Regarding the eleventh issue identified in the Staff Memorandum -- whether the targeted performance standard procedure in Section NR 151.004 of the *Wisconsin Administrative Code* would be applied to mandate agricultural compliance with a more-stringent water quality performance standard or load allocation stated in a TMDL if it is determined that meeting the NR 151 performance standards will not achieve water use objectives and water quality criteria. Mr. Hahn noted that the preliminary electronic mail response from Ms. Lowndes of the WDNR staff confirmed Ms. Gayan's response at the preceding meeting that cost-share funding would be required before TMDL load allocations could be applied to an agricultural source. Mr. Thur asked whether this would mean that the MS4s might see their WLAs under the TMDL become more stringent over time if the MS4 WLAs are achieved and water quality goals are not met. Ms. Gayan replied that the nonpoint source load allocations (from sources that are not required to have permits) and permitted point source WLAs are both components of the TMDL and the allocations would not be subject to change once they have been determined.

Mr. Hahn remarked that the TMDLs may impose conditions on MS4s that are more stringent than the ones that they are currently required to meet. Ms. Gayan stated that load allocations will be discussed at the stakeholder meetings for the Milwaukee Basin TMDL. She noted that the reductions in TSS discharges required by WLAs in the Rock River TMDL have been as high as 70 percent for some communities. She added that the allocations have not yet been calculated under the Milwaukee River Basin TMDL studies. Mr. Martinka asked when the municipalities in the Rock River watershed would need to achieve the WLAs in the TMDL. Mr. Hartsook replied that this is one of the details that will need to be determined in the implementation plan and strategy that is currently being developed for the Rock River TMDL. He speculated that the key for the communities will be showing continuing progress toward meeting their WLAs through each successive permit cycle.

Regarding the issue of the time frame for implementation of TMDL waste load allocations, Mr. Grzezinski remarked that infrastructure replacement projects offer opportunities to implement management practices to reduce stormwater runoff pollution, and that not implementing such measures now and in the near future will only make it more difficult to achieve TMDL waste load allocations in the future.

Mr. Wehrley asked whether there is enough agricultural land in the Menomonee River watershed for water quality trading to be a viable approach for municipalities to meet their WLAs. He asked whether meeting WLAs would require municipalities to make reductions even if all the agricultural land in the watershed were converted to green space. Mr. Hahn said that the answers to these questions can only be determined through the TMDL process.

[Secretary's Note: The attached Exhibit A-1 summarizes modeled nonpoint source pollution loading information developed for year 2000 conditions under the Water Quality Initiative and set forth in Table 6 of the August 18, 2011 partial preliminary draft of SEWRPC Staff Memorandum (Part 2), "Development of a Framework for a Watershed-Based Municipal Stormwater Permit for the Menomonee River Watershed." The information is provided to give an indication of the amount of watershed-wide rural nonpoint source pollution loads relative to urban nonpoint source loads (a rough approximation of the loads from MS4s in the watershed). For total suspended solids, which are currently regulated under the MS4 permits within the watershed, the total rural load is 12 percent of the urban load. For phosphorus and fecal coliform bacteria, the two other pollutants for which TMDLs are being developed, the rural to urban percentages are 14 and 3, respectively.

The amounts of the rural loads available for trading would be less than the percentages in the table because of the practical inability to reduce those loads to zero and the anticipated need within a water quality trading framework to reduce the

loads to meet the performance standards of Chapter NR 151 of the *Wisconsin Administrative Code* before claiming long-term credit for further reductions achieved through trades. When TMDLs are in place, they may take the place of the NR 151 standards.]

Mr. Hahn asked whether the provision currently in the *Wisconsin Administrative Code* related to controlling stormwater runoff pollution to the maximum extent practicable would no longer be applicable once a TMDL is in place. Mr. Hartsook replied that this provision would probably remain applicable. Mr. Hahn replied that the option will then still be available to invoke the maximum extent practicable clause if a municipality has made its best effort to comply with the stormwater runoff performance standards. Mr. Hartsook commented that communities will need to capitalize on measures that can be installed as part of redevelopment projects.

[Secretary's Note: During the November 28 meeting with WDNR staff, Mr. Rasmussen addressed a question regarding the applicability of the NR 151 "maximum extent practicable" provision once TMDLs are in place. He indicated that if a TMDL allocation cannot be met, two available options would be 1) to redo the TMDL to reallocate among pollution sources and 2) to implement water quality trades. Mr. Kirsch added a third option, which would be to perform a use attainability analysis for the particular water body.**]**

Mr. Wehrley asked whether municipalities would seek as a group to make water quality trades with agricultural producers or whether the communities would act individually. Mr. Boxhorn responded that the WDNR's draft water quality framework envisions that there would be a broker to facilitate trading. He added that while WDNR staff has stated that the Department will not act as the broker, they noted that in one trading pilot program in the State, a county land conservation department acted as the broker.

Ms. Gayan noted that the implementation process for the TMDL will take a long time.

Mr. Martinka commented that there needs to be benefit to the municipalities for participating in a watershed-based stormwater permit. He added that if water quality trading is not the benefit, it needs to be something else.

The summary notes for the August 24, 2011 meeting were approved by the consensus of the Group.

CONTINUATION OF REVIEW AND DISCUSSION OF AUGUST 3, 2011 PARTIAL PRELIMINARY DRAFT OF SEWRPC STAFF MEMORANDUM, "DEVELOPMENT OF A FRAMEWORK FOR A WATERSHED-BASED MUNICIPAL STORMWATER PERMIT FOR THE MENOMONEE RIVER WATERSHED"

At the request of Mr. Grisa, Mr. Hahn continued the review of the draft SEWRPC Staff Memorandum. He began by reviewing the remaining issues relative to development of the framework in the first part of the Staff Memorandum.

Mr. Hahn drew the Group's attention to the eighth issue identified in the August 3, 2011 Staff Memorandum—whether excluding non-MS4 point sources and combined sewer overflows (CSOs) from the WBP would preclude such sources from executing water quality trades. Ms. Gayan replied that the current group permit allows reallocations of loads among MS4s and that a WBP would allow trades between MS4s. Mr. Hartsook added that once the TMDL is in place it will allow point-source-to-point-source trades and point-source-to-nonpoint-source trades. He noted that the TMDL might not allow nonpoint-source-to-nonpoint-source trades. WDNR staff also suggested that MS4s would not be able to trade with agricultural nonpoint sources prior to establishment of TMDLs, but they also indicated that WDNR might consider enabling MS4 to agriculture trades as an incentive for establishing a watershed-based permit. Mr. Hahn asked for confirmation from the WDNR about these trading issues, noting that the inability to make trades between MS4s and agricultural nonpoint sources would

significantly limit the attractiveness of participating in a watershed-based permit. Mr. Boxhorn noted that the draft WDNR water quality trading framework does have provisions for trading in the absence of a TMDL. Mr. Hartsook answered that he would pursue answers to these questions. Ms. Gayan indicated that she would ask Kevin Kirsch of the WDNR staff to attend the next Group meeting.

[Secretary's Note: Commission staff reviewed the WDNR's draft July 1, 2011 water quality trading framework. The trading framework allows for trading in the absence of a TMDL when water quality-based effluent limitations have been calculated pursuant to an administrative rule such as section NR 217.13 of the *Wisconsin Administrative Code*. The trading framework envisions that most cases of trading that occur under this provision will require that the trade be made with a site upstream from the discharge point to prevent violation of water quality criteria outside the mixing zone. This is illustrated in the example from the trading framework, attached herein as Exhibit B. In the absence of calculated water quality-based effluent limitations, trading would not be allowed under the draft trading framework.

During the November 28 WDNR/Sweet Water/SEWRPC meeting, and in discussions prior to that meeting, WDNR Central Office staff indicated that MS4s could trade with agricultural nonpoint sources. In general, there should be enough regulatory flexibility to enable water quality trades to be executed between different sources.]

Mr. Grisa asked what the point of the WBP is if water quality trading may be allowable under the trading framework without a WBP. He commented that there needs to be benefit that can be achieved only under the watershed-based permit.

Mr. Hahn drew the Group's attention to the ninth issue identified in the Staff Memorandum—what green infrastructure measures would be most effective in improving water quality and how the WBP framework could promote implementation of such measures. He noted that the Group will not be able to fully resolve this issue at this time because both USEPA and MMSD will need to weigh in on these questions. He posed the question of how to ensure that green infrastructure is maintained so that it continues to function over the long term and asked if there are opportunities for sites to receive reductions in stormwater utility fees for installation of these practices, especially residential sites. Mr. Thur responded that the City of Milwaukee provides a fee reduction for commercial and industrial sites with green infrastructure, but not for residential sites.

Mr. Hahn offered the example of a developer's proposal to construct rain gardens on individual lots in a subdivision for the purpose of meeting Kenosha County runoff reduction requirements. The County staff expressed concerns regarding long-term maintenance of the rain gardens, considering both the commitments to rain garden maintenance of the initial owners and possible new future owners. The SEWRPC staff, which at that time had a role in assisting the County with stormwater management reviews, suggested a procedure to ensure maintenance of the private rain gardens, including imposing deed restrictions to ensure that the subsequent property owners continue to maintain the rain gardens. That approach did not completely allay the County's concerns and the development proposal was revised to eliminate the private rain gardens.

Mr. Hahn asked whether it would be worth establishing a residential credit toward stormwater utility fees for installation of green infrastructure. He asked whether this would require revising rates. He also noted that it would establish a tracking system that would enable the municipality to claim credit toward meeting its performance standard or TMDL wasteload allocation goal. Mr. Thur responded that for residential properties, this would require a lot of effort on the part of the municipalities, especially in terms of staff time, to make sure that the practices remain in place. Mr. Hahn asked whether this was the case for commercial and industrial properties. Mr. Thur answered that in the case of commercial and industrial properties, the practices installed are often tied to stormwater management plans. He added that these properties are also charged higher stormwater utility fees, so there are greater financial incentives to maintain the practices. Mr. Hahn commented that the feasibility of

providing credits to residences that install green infrastructure may be an issue that the permit framework process cannot resolve.

Mr. Grzezinski suggested that it may help to have communities work together on residential installation of green infrastructure, either by offering a single contract for inspections of installations or through making available standard designs that homeowners can install.

Mr. Grisa indicated that he disagreed with Mr. Hahn's conclusion regarding providing credits to residences that install green infrastructure being addressed by the permit framework. He explained that he would like his community to be able to receive credit for these practices. In addition, he stated that he feels it is important to recognize these efforts, even if this must be done subjectively. He noted that the framework should allow for some uncertainties or should suggest that credit be given for a certain percentage of installed green infrastructure.

Mr. Martinka suggested that the USEPA should indicate their stance on this issue. Mr. Hahn said that he was not trying to discourage such green infrastructure installation, but that there would need to be a method of inventorying and tracking the effectiveness of private property installations.

Mr. Grzezinski suggested that it might be more cost-effective to contract with a private consultant or nonprofit group to perform inspections to ensure that green infrastructure practices are installed and functioning.

Mr. Hahn next drew the Group's attention to the tenth issue identified in the Staff Memorandum—how the expiration date of the existing Menomonee River group permit, the permit expiration dates of additional participating communities, and the anticipated date when the TMDLs will be complete can be synchronized under a single WBP. He noted that synchronizing the permit terms will depend upon when the expiration dates occur.

Mr. Hartsook offered to provide a list of expiration dates for MS4 discharge permits in the Menomonee River watershed.

> [Secretary's Note: The permit expiration dates provided by Mr. Hartsook were added to Table 1 of the Staff Memorandum. Subsequent to the meeting, Mr. Hartsook told Commission staff that Washington County and the Village of Richfield requested, and were granted, exemptions from the MS4 permit requirements under Section NR 216.023 of the *Wisconsin Administrative Code*. This information was also added to Table 1. In addition, entries were added to the table for the Southeastern Wisconsin Professional Baseball Park District and Wisconsin State Fair Park. The revised table is attached hereto as Exhibit C.]

Mr. Hartsook stated that after the TMDLs are in place, the WDNR may issue individual permits with common conditions for MS4s whose permits expire. He indicated that as an alternative, the Department may issue a WBP in mid-cycle or allow municipalities to continue to operate under an expired permit until the WBP would be issued. He noted that all of the municipalities have stormwater programs that are operating. Mr. Hahn asked whether the chosen permit alternative would depend upon the latest date of permit expiration for a participating community. Mr. Hartsook responded that the expiration dates may influence the choice. He emphasized that the Department would like to have all of the watershed communities on the same permit cycle.

> [Secretary's Note: As seen in Exhibit C, the permits for municipalities that have been active in the Menomonee River WBP Group process expire in 2012 and 2013. During the November 28 WDNR/Sweet Water/SEWRPC meeting, the following two options were discussed for addressing procedures for issuing a WBP:

1. Reissue the MS4 permit(s) and then revoke and reissue as a watershed-based permit following development of a framework, assuming municipal acceptance of a WBP approach,

2. Allow the existing permits to expire, continue coverage under the expired permit, and reissue as a watershed-based permit following development of a framework, assuming municipal acceptance of a WBP approach.

The consensus of those in attendance at the meeting was that Option 2 would be best. Either of these options would lead to adoption of a single permit expiration date for all parties to the WBP.]

Mr. Hahn drew the Group's attention to the section of the August 3, 2011 Staff Memorandum on possible watershed-based permitting structures. He stated that the text in the Staff Memorandum directly quotes from the August 2007 USEPA report "Watershed-based National Pollutant Discharge Elimination System (NPDES) Permitting Technical Guidance." He indicated that the guidance described three WBP types: coordinated individual permits, integrated municipal NPDES permit coverage, and multisource WBPs. He described the three permit types and concluded that the multisource WBP structure was the most appropriate permit structure for a watershed-based municipal stormwater permit for the Menomonee River watershed. Mr. Grisa stated that he agreed and asked whether representatives of the USEPA had indicated whether they concurred with this conclusion. Mr. Hahn replied that he has not heard from them on this issue, but that he will follow up with USEPA.

[Secretary's Note: Following the meeting, Commission staff spoke by telephone with Robert Newport of the USEPA staff. In that phone call, Mr. Newport indicated that he intends to attend the December 14, 2011 meeting of the permit group. That will provide an opportunity for him to comment on this issue.]

REVIEW AND DISCUSSION OF AUGUST 18, 2011 PARTIAL PRELIMINARY DRAFT OF SEWRPC STAFF MEMORANDUM (PART 2), "DEVELOPMENT OF A FRAMEWORK FOR A WATERSHED-BASED MUNICIPAL STORMWATER PERMIT FOR THE MENOMONEE RIVER WATERSHED"

At Mr. Hahn's request, Mr. Boxhorn reviewed the second part of the August 18, 2011 draft SEWRPC Staff Memorandum, which addresses the surface water inventory. He stated that the guidance from USEPA suggests conducting a water quality inventory as a first step in doing a watershed-based analysis. He noted that characterization of water quality presented in the Staff Memorandum drew heavily on the analyses presented in SEWRPC Technical Report No. 39, (TR No. 39) which analyzed and assessed water quality in six watersheds as part of the update of the regional water quality management plan for the Greater Milwaukee watersheds. He stated that the inventory seeks to examine three issues: 1) the extent to which surface waters are able to achieve the uses designated for them pursuant to the Federal Clean Water Act, 2) what pollutants are reducing water quality in those surface waters not supporting their designated uses, and 3) the extent to which these pollutants are being contributed through discharges from MS4 systems. He noted that the inventory presented in the Staff Memorandum also addresses water quality in watersheds adjacent to the Menomonee River watershed because, with three exceptions, all of the municipalities in the watershed are in two to five watersheds. He indicated that permit conditions for a WBP may need to address water quality in these adjacent watersheds.

Mr. Boxhorn drew the Group's attention to Table 5 of the Staff Memorandum. He stated that, for several water quality constituents, it presents the results of a comparison of conditions in streams of the Menomonee River watershed to the applicable State water quality criteria. He noted that this table was updated from the analyses presented in TR No. 39 with data collected between the date of the last data used in TR No. 39 (2001) and early 2011.

Mr. Boxhorn then reviewed Table 8 of the Staff Memorandum. He stated that for several water quality constituents, that table presents the results of a comparison of conditions in streams of the adjacent watersheds to the applicable State water quality criteria. He noted that for the Kinnickinnic River, Milwaukee River, Oak Creek, and Root River watersheds, this table presents the analyses given in TR No. 39. He indicated that there have been no recent analyses of water quality in the Fox River watershed. He added that he used data from a 1995 update of the regional water quality management plan and from WDNR priority watershed plans to evaluate conditions in the Fox River watershed. He noted that the priority watershed studies were conducted in the early 1990s. Mr. Boxhorn stated that the inventory in Table 8 is also based on pollutant load estimates that were developed under the 2007 regional water quality management plan update (Kinnickinnic River, Milwaukee River, Oak Creek, and Root River watersheds), the priority watershed program (Fox River watershed), and at those waters that are listed as being impaired on the State's 303(d) list (all pertinent watersheds).

Mr. Boxhorn stated that the analyses presented in Tables 5 and 8 indicate that most of the streams in the Menomonee River watershed and adjacent watersheds appear to be meeting the applicable water quality criteria for dissolved oxygen, with only localized instances of noncompliance. He noted that the Upper and Middle Root River subwatersheds were exceptions to this. He explained that dissolved oxygen concentrations collected at sampling stations along the Root River were commonly-to-usually below the applicable standard.

Mr. Boxhorn stated that the analyses presented in Table 5 indicate that water temperatures in most of the streams of the Menomonee River watershed were almost always in compliance with the acute and sublethal temperature criteria. He stated that Noyes Park Creek and a portion of Underwood Creek were exceptions. He noted that both of these streams contained reaches that are channelized and concrete-lined and that this can act to increase water temperatures. He drew the conclusion that municipal stormwater discharges were probably not the stressor causing the temperature exceedences in these streams.

Mr. Wehrley asked whether the water temperature data for Underwood Creek reflected conditions before or after the removal of the concrete lining in a portion of the Creek. Mr. Boxhorn answered that he was not sure, but thought that there may be data from before and after the concrete lining was removed. He added that he would examine whether it would be possible to conduct a before and after comparison.

> [Secretary's Note: The continuous temperature data for Underwood Creek were collected between June 2010 and July 2011, after completion of Phase I construction. Because of this, no continuously-collected water temperature data are available from prior to the removal of the concrete lining. Thus, the type of comparison that was suggested is not possible because of the differences in how data were collected before and after the concrete lining was removed.]

Mr. Boxhorn noted that continuously-recorded temperature data were not available for the other watersheds.

Mr. Boxhorn stated that the analyses presented in Tables 5 and 8 indicate that chloride concentrations in streams in the Menomonee River watershed and adjacent watersheds were almost always in compliance with the State's acute and toxic water quality criteria; however, he noted that he believes that these results overestimate the degree of compliance with these criteria. He explained that most of the chloride data that were available were collected as a part of MMSD's water quality sampling program. He noted that MMSD does not normally collect samples during the winter deicing season, when salts are most likely to be applied to area roads. He continued that a recent paper reporting work conducted by the U.S. Geological Survey did show evidence of chloride concentration spikes in surface water in southeastern Wisconsin during the winter. He added that samples collected by MMSD from stormwater outfalls also occasionally show high concentrations of chlorides. Mr. Boxhorn concluded that the Group may want to consider whether chloride should be addressed as a pollutant in a WBP.

[Secretary's Note: The study referred to in the last paragraph is: S.R. Corsi, D.J. Graczyk, S.W. Geis, N.L. Booth, and K.D. Richards, "A Fresh Look at Road Salt: Aquatic Toxicity and Water-Quality Impacts on Local, Regional and National Scales," *Environmental Science and Technology,* Volume 44, 2010.]

Mr. Boxhorn noted that municipalities have expended considerable effort to reduce the amount of road salt applied during deicing; however, he expressed concern about applications on private property. Mr. Grisa asked what the effect of chloride concentration spikes were on aquatic biota during cold weather. Mr. Boxhorn answered that his understanding is that toxic effects begin to be seen at concentrations of chloride above 250 milligrams per liter. He added that he could see what is available in the toxicology literature regarding the effect of cold temperatures on chloride toxicity.

[Secretary's Note: An appendix examining the toxicity of chloride and relating it to winter chloride concentrations in streams of the Menomonee River watershed was added to the second part of the Staff Memorandum. This appendix is attached herein as Exhibit C-1.]

Mr. Grisa noted that high chloride concentrations in surface waters may be transient events. He commented that he would not want to risk human safety in order to control chloride that is not greatly harming the environment. He pointed out that the main alternative to applying deicing salts is to apply sand. He commented that this simply exchanges one pollutant for another. Mr. Hahn replied that there are two reasons for concern about chlorides. First, the Commission staff has documented a trend toward increasing chloride concentrations in surface waters throughout the Southeastern Wisconsin Region, and second, chloride is a conservative pollutant that is not removed through any natural or man-made treatment process.

Mr. Boxhorn stated that the analyses presented in Tables 5 and 8 indicate that concentrations of total phosphorus generally exceed the State's water quality criteria. He noted that the compliance percentages in Table 8 reflect comparisons of total phosphorus concentrations to a planning standard recommended in the initial regional water quality management plan. He explained that for most of the streams examined, this planning standard concentration is higher than the State's water quality criteria. He indicated that this means that the analysis presented in Table 8 overestimates the amount of compliance with the State's current water quality criteria for phosphorus. He noted that even with this overestimate, the analyses show that phosphorus is a problem in all of the streams examined. He drew the Group's attention to Table 6 of the draft Staff Memorandum, which presents estimates of pollutant loads for the Menomonee River watershed. He reported that these estimates indicate that about half of the phosphorus loadings to streams in the Menomonee River watershed are being contributed through MS4 systems. He concluded that phosphorus is a pollutant that should be considered in a WBP. He commented that the chemistry of phosphorus may be advantageous for controlling phosphorus, noting that phosphate in nature is usually particulate or adsorbed to particles, which means that reductions in TSS will lead to reductions in total phosphorus.

Mr. Grisa asked whether there were any estimates of natural or predevelopment concentrations of total phosphorus and TSS in the surface waters being discussed. Mr. Boxhorn answered that he was not aware of any such studies.

Mr. Wehrley asked whether the limits place on phosphorus in fertilizer will result in a measurable reduction in phosphorus concentrations in streams. Mr. Boxhorn replied that he thought there would be reductions, although it is likely to require a long time period to notice because of the variability of phosphorus concentrations in surface waters.

Mr. Boxhorn stated that the analyses presented in Tables 5 and 8 indicate that concentrations of fecal coliform bacteria generally exceed the applicable water quality criteria in most of the watersheds.

Mr. Boxhorn stated that the State has not promulgated numerical water quality criteria for TSS. He indicated that because of this, the Staff Memorandum examines this constituent by summarizing concentrations. He noted that while mean concentrations in the streams examined are generally below 30 milligrams per liter, concentrations are highly variable with maximum concentrations being one to two orders of magnitude higher. He noted that urban nonpoint sources appear to be major sources of TSS.

Mr. Boxhorn summarized the conclusions of the second part of the Staff Memorandum, noting that water quality problems related to fecal coliform bacteria, total phosphorus, and TSS are present in the Menomonee River watershed and the adjacent watersheds. He indicated that discharges of urban stormwater account for a large portion of the loads of these pollutants. He noted that the Staff Memorandum also concludes that water quality problems related to low concentration of dissolved oxygen are present in the Root River watershed. He added that chloride may also be causing problems during the winter deicing season; however, currently insufficient data are available to assess the magnitude of this problem.

Mr. Boxhorn distributed a copy of the illicit discharge detection and elimination (IDDE) requirements from Chapter NR 216.07(3)(i) of the *Wisconsin Administrative Code* to the Group. He noted that they require field analysis of stormwater outfalls to include sampling for pH, total chlorine, total copper, total phenol, and detergents; however, they also allow a permitted MS4 to use alternative tests for constituents such as ammonia, potassium, and bacteria, with the concurrence of the WDNR. He asked the Group what tests they have found to be most effective locating illicit discharges in their IDDE programs.

[Secretary's Note: A copy of the referenced *Wisconsin Administrative Code* section is attached hereto as Exhibit D.]

Mr. Grisa asked whether residual chlorine can be detected due to its rapid volatilization. Mr. Thur responded that the City of Milwaukee has found water main breaks by testing for chlorine. He added that in their experience ammonia and detergents have been best for detecting illicit connections. Mr. Boxhorn asked whether monitoring fluoride has been useful. Mr. Grisa pointed out that some communities, including the City of Brookfield, do not fluoridate their municipal water. Mr. Hartsook distributed a summary of illicit discharge screening for Menomonee River watershed MS4 permitted communities for 2010.

[Secretary's Note: A copy of the summary Mr. Hartsook distributed is attached herein as Exhibit E.]

Mr. Hartsook noted that the Cities of Greenfield and West Allis test for fluoride. He indicated that the combination of testing for ammonia and testing for detergents using the methylene blue test seems to be the most effective for detecting illicit discharges. He added that the City of Greenfield also tests the ammonia to potassium ratio. Mr. Boxhorn asked whether Greenfield has successfully differentiated between sanitary wastewater and wash water using the ammonia to potassium ratio. Mr. Hartsook replied that he did not know. Ms. Morgan asked what size outfalls are screened in field analysis. Mr. Hartsook replied that 36-inch diameter and larger outfalls and outfalls discharging runoff from an industrial drainage area of two or more acres are screened. Mr. Maki noted that test results are dependent, in part, on the methods used and asked whether a uniform testing procedure should be developed and included in the permit. Mr. Grisa replied that the purpose of the testing is to identify illicit connections. He added that standardized test procedures may not be necessary in order to accomplish this. Mr. Hartsook indicated that he agreed with this.

Mr. Hartsook noted that follow up procedures and responses to the detection of an illicit discharge vary greatly among the communities. He suggested that it might be good to establish uniform response procedures under a WBP. Ms. Justus indicated that she would send the Village of Germantown's illicit discharge response procedure to the Commission staff.

[Secretary's Note: Following the meeting Ms. Justus provided the Villages IDDE. It is attached as Exhibit F.]

Mr. Boxhorn noted that he had discussed the State's water quality criteria for water temperature with WDNR staff and would make some changes to the Staff Memorandum description of the temperature criteria based upon those discussions.

NEXT STEPS

Mr. Hahn stated that the Group would review and expand upon the annotated version of the MS4 permit provided by Robert Newport of the USEPA staff.

The Group set the next meeting for 9:00 a.m. on December 14, 2011 at the Brookfield City Hall.

Ms. Morgan suggested holding a meeting of the education and outreach group at 10:00 a.m. on November 15, 2011 the Brookfield City Hall.

ADJOURNMENT

There being no further business, the meeting was adjourned by unanimous consent at 12:10 p.m.

REVISIONS MADE TO PARTIAL PRELIMINARY DRAFT OF SEWRPC STAFF MEMORANDUM (PART 2) FOLLOWING DISCUSSIONS WITH AMANDA MINKS OF THE WDNR STAFF

SEWRPC staff discussed the State's water quality criteria for temperature with Amanda Minks of the WDNR staff in order to clarify the role of the ambient temperature in the criteria. Ms. Minks indicated that the ambient temperature is not intended as a criterion that is not to be exceeded. Instead, it is used for calculating the acute and sublethal temperature criteria and for calculating effluent limitations in Wisconsin Pollutant Discharge Elimination System discharge permits.

[Secretary's Note: The second bullet point on page 8 was revised to read (In this Secretary's Note and in subsequent Notes, unless indicated otherwise, revised and added text is indicated in bold letters for clarification only. The Staff Memorandum text will not be bold):

"In 2010, the State promulgated water quality-based criteria for temperature. This rule specifies three temperature criteria—ambient, acute, and sublethal—that are to be applied simultaneously.[7] **The ambient temperature is used to calculate corresponding values of the acute and sublethal criteria and for setting effluent limitations for discharge permits. The acute and sublethal criteria are used for assessment purposes and evaluation of the attainment of water use objectives.** In accordance with this, where continuously recorded data were available, daily maximum water temperatures were compared to the applicable acute temperature criterion and the average of daily maximum **temperatures** over a calendar week were compared to the applicable sublethal temperature criterion."

The footnote in the above passage was not changed.

The first full paragraph on page 12 was revised to read:

"Table 5 show comparisons of water temperature in the streams of the Menomonee River water shed to **two** criteria: the acute and the sublethal. As previously described, daily maximum water temperatures were compared to the applicable acute temperature criterion and the average of daily maximum temperatures over a calendar week were compared to the applicable sublethal temperature criterion."

The column headed “Ambient” was removed from Table 5.

The column headed “Ambient” was removed from Table 8.]

#159622 V1 - MNR WBP FRAMEWORK SUMMARY NOTES 10/12/11 - 2
300-1099
MGH/LLK/JEB/pk
11/07/11

Exhibit A

Boxhorn, Joseph E.

From: Hartsook, Bryan D - DNR [Bryan.Hartsook@wisconsin.gov]
Sent: Thursday, October 20, 2011 8:52 AM
To: Boxhorn, Joseph E.
Subject: FW: SE Region MS4 Billing Summary
Attachments: RE: SE Region MS4 Billing Summary; SER_MS4_BillingSummary.xls

---

ook, Bryan D - DNR
sday, October 05, 2011 10:45 AM
ini, Jim K - DNR
Sharon L - DNR
FW: SE Region MS4 Billing Summary

Jim,

We've been asked by municipalities participating in the Menomonee River watershed-based permitting framework group whether or not participating in a watershed-based group permit would reduce their permit fee amount. Currently, everyone is billed according to the fee structure in NR 216. Has the prospective of reducing fees for a group permit been discussed before?

For example, there are 8 municipalities in the current Menomonee group permit. Totaling a population of 179,347. The NR216 fee corresponding to this total population would then be $12,000 (for populations between 100,000 and 199,000). Right now, each of the eight communities pays a separate fee relative to their separate populations. This amount totals $30,250.

I am assuming what the group is proposing is to have the total fee be the lesser amount based on the whole population of the permit group, and then weight the amount due from each municipality by a factor of their own population over the total of the group. So under this pay scheme, Brookfield with a population of 38,649 would end up paying (38,649/179,347)*$12,000, or $2586. Right now Brookfield pays $6,500.

The least populated of the Menomonee group, Butler, would pay (1,881/179,347)*$12,000, or $126, versus the $250 they pay right now.

Seems sort of fair considering the fact that the intent of the permit fee is to offset DNR's operating costs of the program and it theoretically takes less total time to administer a group than it does its separate entities. Less this email of course :)

Anyway, has this been considered before? Is anyone else in the state doing this that you are aware of?

Thanks!

Bryan

---

ook, Bryan D - DNR
sday, October 05, 2011 10:26 AM
Sharon L - DNR
SE Region MS4 Billing Summary

Sharon,

All 90 permitted MS4s in SER are billed according to the fee structure found in NR 216 by total population. It appears that no discounted fees were awarded for group permits. Attached is the billing list in order of lowest to highest population.

Sorry about the delay. It took me longer than I expected to find the population field in the database. Turns out "NO_EMP_AMT" stands for population. Of course.

Bryan D. Hartsook
Water Resources Engineer, Southeast Region
Wisconsin Department of Natural Resources
141 NW Barstow St. Room 180
Waukesha, WI 53188
(☎) phone: (262) 574-2129
(☎) fax: (262) 574-2117
(✉) e-mail: Bryan.Hartsook@wisconsin.gov

Exhibit A-1

COMPARISON OF MODELED URBAN AND RURAL NONPOINT SOURCE LOADS IN THE MENOMONEE RIVER WATERSHED: 2000

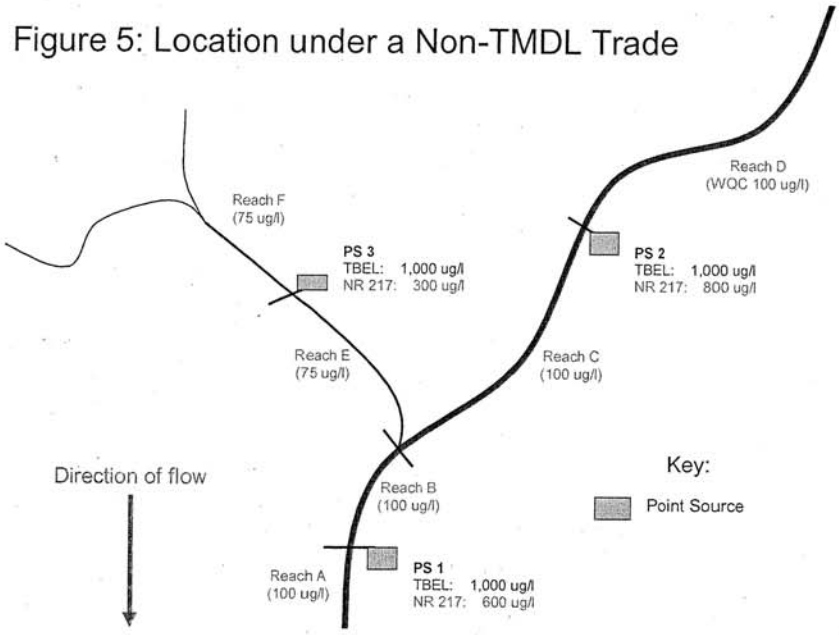
Pollutant	Urban Nonpoint Sources	Rural Nonpoint Sources	Rural Load As a Percentage of Urban Load
Total Suspended Solids (pounds)	15,738,270	1,950,230	12
Total Phosphorus (pounds)	29,040	4,070	14
Biochemical Oxygen Demand (pounds)	993,390	175,850	18
Fecal Coliform Bacteria (trillions of cells)	14,112	393	3
Total Nitrogen (pounds)	209,340	118,410	57
Copper (pounds)	1,768	106	6

Source: SEWRPC.

2.3.2 Trading to meet Non-TMDL WQBELs

If a facility desires to trade to meet the effluent requirements stemming from a non-TMDL WQBEL (for phosphorus see NR 217.13) in most cases the trade will need to occur upstream of the discharge point to prevent the violation of water quality criteria outside the mixing zone. This is because derivation of the WQBEL includes consideration of upstream concentrations. In cases where a discharger is a small percentage of the relative load at the point of discharge, the point source may have the option to trade with downstream sources within the reach without creating local violations of the water quality criteria. This requires evaluation on a case by case basis.

Figure 5: Location under a Non-TMDL Trade



Explanation of Figure 5:

Figure 5 shows the technology effluent limits (TBELs) and the calculated WQBELs based on water quality criteria. Trades can occur as follows:

Point Source: PS1 may trade with sources in reaches B, C, D, E, and F.

Point Source 2: Assuming that PS2 is only 10% of the load (calculated through a quantification of phosphorus loads); PS2 could trade with sources in reach D and can likely trade with downstream in reach C since PS2 is not a significant contributor.

Point Source 3: Assuming that PS3 is 60% of the load going into reach E. To prevent a local violation of water quality standards, PS 3 should trade with sources draining to reach F.

Exhibit C

Table 1

MUNICIPAL SEPARATE STORM SEWER SYSTEM (MS4)
PERMIT HOLDERS IN THE MENOMONEE RIVER WATERSHED

Municipality	Permit Number	Current Group Permit Designation	Permit Expiration Date	Other Watersheds in Which Municipality is Located[a]
Milwaukee County	S050113	- -	December 15, 2011	Kinnickinnic River, Milwaukee River, Root River, Oak Creek
Ozaukee County	S050075	- -	December 31, 2010	Milwaukee River, Sauk/Sucker Creeks
Washington County	- -[b]	- -		Milwaukee River, Rock River
Waukesha County	S050075	- -	December 31, 2010	Fox River, Rock River, Root River
City of Brookfield	S050130-1	Menomonee River watershed	February 28, 2012	Fox River
City of Greenfield	S050130-1	Menomonee River watershed	February 28, 2012	Root River, Oak Creek
City of Mequon	S050091-1	Mequon/Thiensville	June 30, 2011	Milwaukee River
City of Milwaukee	S049018-3	- -	March 31, 2013	Kinnickinnic River, Milwaukee River, Root River, Oak Creek
City of New Berlin	S050059-1	Root River watershed	July 1, 2013	Fox River, Root River
City of Wauwatosa	S050130-1	Menomonee River watershed	February 28, 2012	- -
City of West Allis	S049913-1	- -	November 1, 2013	Root River
Village of Butler	S050130-1	Menomonee River watershed	February 28, 2012	- -
Village of Elm Grove	S050130-1	Menomonee River watershed	February 28, 2012	- -
Village of Germantown	S050130-1	Menomonee River watershed	February 28, 2012	Milwaukee River
Village of Greendale	S050059-1	Root River watershed	July 1, 2013	Root River
Village of Menomonee Falls	S050130-1	Menomonee River watershed	February 28, 2012	Fox River
Village of Richfield	- -[c]	- -	- -[c]	Fox River, Milwaukee River, Rock River
Village of West Milwaukee	S050130-1	Menomonee River watershed	February 28, 2012	Kinnickinnic River
Town of Brookfield	S050105-1	Upper Fox River watershed	October 29, 2014	Fox River
Town of Lisbon	S050105-1	Upper Fox River watershed	October 29, 2014	Fox River
Southeastern Wisconsin Professional Baseball Park District	S049921	- -	September 30, 2012	- -
Wisconsin State Fair Park	S049930	- -	July 31, 2012	- -

[a] *Excluding the Lake Michigan direct drainage area.*

[b] *In December 2006, Washington County was granted a waiver of the requirement to obtain permit coverage under Section NR 216.023 of the* Wisconsin Administrative Code.

[c] *In July 2008, the Village of Richfield was granted a waiver of the requirement to obtain permit coverage under Section NR 216.023 of the* Wisconsin Administrative Code.

Source: SEWRPC.

Exhibit C-1

SEWRPC Staff Memorandum (Part 2)

DEVELOPMENT OF A FRAMEWORK FOR A WATERSHED-BASED MUNICIPAL STORMWATER PERMIT FOR THE MENOMONEE RIVER WATERSHED

Appendix A

During review of the second part of the draft SEWRPC Staff Memorandum, "Development of a Framework for a Watershed-Based Municipal Stormwater Permit for the Menomonee River Watershed," by the Menomonee River Watershed-Based Permit (WBP) Framework Group, a question arose as to what effects concentration spikes of chloride occurring during cold weather are likely to have upon aquatic biota within the Menomonee River watershed. This appendix presents the results of a literature review to address this question. Specifically, this appendix presents the results of a review of the literature regarding the acute toxicity of sodium chloride to freshwater aquatic organisms, compares the results of this review to estimates of chloride concentrations during the winter deicing season at locations within the Menomonee River watershed, and discusses whether aquatic organisms are likely to experience toxic effects in streams in the watershed.

ACUTE TOXICITY OF SODIUM CHLORIDE TO FRESHWATER AQUATIC ORGANISMS

Table A-1 presents data on the acute toxicity of sodium chloride to freshwater aquatic organisms. These results are taken from the toxicological and ecological literature. With two exceptions the tests use the LC50, the concentration at which 50 percent of the organisms die over the duration of the test, as the measure of acute toxicity.[1] A higher LC50 indicates lower toxicity to the organism, while a lower LC50 indicates greater sensitivity to the toxin. The table presents results for several exposure times; however, the majority of results listed come from 96-hour (four-day) acute toxicity tests. This is in keeping with standard toxicological procedures. The results are presented in terms of both the concentration of sodium chloride and an equivalent concentration of chloride. This was done to facilitate comparison of the toxicological data to estimates of chloride concentrations in streams and to the State's acute toxicity criterion for fish and aquatic life. In the discussion that follows, the LC50s will be expressed in terms of chloride concentrations.

Some patterns are apparent in values presented in Table A-1. LC50 There is considerable variation in LC50 values. For 96-hour tests, they range from 425 milligrams of chloride per liter (mg Cl/l) for the mayfly, *Callibaetis coloradensis*, to 13,085 mg Cl/l for the American eel, *Anguilla rostrata*. With the exception of the LC50 value for *C. coloradensis*, these values are all higher than the State's acute toxicity criterion for chloride of 757 milligrams per liter. LC50 values for fish species tend to be higher than those for many invertebrate species, suggesting that they are less sensitive to acute chloride toxicity. LC50 values also vary among tests for the same species. This may be due to several factors, including differences in test conditions, genetic variation within species, and differences among statistical techniques used to calculate the LC50 value from the raw toxicology data.

Few data are available on the effects of temperature upon the acute toxicity of sodium chloride. The one study that examined this found that the mayfly *Hexigenia limbata* was more sensitive to chloride at a higher water temperature than at a lower temperature. It is important to note that the temperatures used in this study, 28ºC and

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[1] *The two exceptions occur in six-hour toxicity tests and use LC40 and LC47 endpoints. These reflect the concentrations at which 40 percent and 47 percent, respectively, of organisms die during the course of the test. LC50 values for these organisms in six-hour acute toxicity tests would be higher than the values shown.*

18ºC, were both higher than what would be expected to be observed in streams of the Menomonee River watershed during the winter deicing season.

With one exception, the most sensitive organisms listed in Table A-1 have LC50 values in 96-hour toxicity tests starting at about 1,400 mg Cl/l.[2] Based on this, it was decided to use 1,400 mg Cl/l as a threshold for acute toxicity effects in further analysis and discussion. It should be noted that this threshold is considerable higher than the State of Wisconsin's acute toxicity criterion for fish and aquatic life for chloride of 757 mg/l and represents a threshold at which substantial acute toxic effects would be expected to occur.

The LC50 values listed in Table A-1 are for toxicity associated with sodium chloride. The toxicity of chloride can vary depending upon the cations with which it is associated. Sodium chloride-based deicers were shown to have lower toxicity to rainbow trout, the water flea *Ceriodaphnia dubia*, and the alga *Selenastrum capricornatum* than other chloride-based deicers such as calcium chloride and magnesium chloride and acetate-based deicers.[3] For example, the LC50 for sodium chloride for *C. dubia* was 6,583 mg/l. Lower LC50s were seen for this organisms for other chloride-based deicers with an LC50 for calcium chloride of 3,828 mg/l and LC50's for magnesium chloride ranging between 660 mg/l and 4,950 mg/l, depending on the particular deicer formulation. By comparison, LC50s for *C. dubia* for acetate-based deicers range between 660 mg/l and 4,670 mg/l.[4]

It is important to note that the LC50 values listed in Table A-1 reflect the toxicity of sodium chloride. Commercial deicers also contain trace amounts of metals and other substances. For example, one study found that sodium chloride-based deicers contained trace amounts of copper, zinc, cyanide, and sulfate.[5] Some of these substances can cause acute toxicity in aquatic organisms at low concentrations. Toxic effects related to the presence of these substances in deicers are not reflected in the LC50 values in Table A-1.

LC50 values represents a substantial toxic effect to organism populations. While the LC50 values are useful measures of acute toxicity, they do not represent thresholds below which concentrations are safe or harmless in aquatic habitats. It should be kept in mind that appreciable acute toxic effects can be expected to occur at chloride concentrations that are lower than the LC50s. In addition, appreciable acute toxic effects can be expected to occur over shorter periods of time than the test period associated with a particular LC50. Because of this, it is important to recognize that evaluations of toxicity that utilize LC50s as an indicator of toxicity refer to concentrations at which substantial incidences of toxic effects are likely to be occurring, as opposed to concentrations at which toxic effects begin to appear.

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[2]*The LC50 of the one exception, the mayfly* Callibaetis coloradensis, *is below the range of chloride concentrations that can be calculated from specific conductance using the regression relationship described in the next section.*

[3]*B. Mussato and T. Guthrie, "Anti-icers: Chemical Analysis and Toxicity Test Results," Prepared for Insurance Corporation of British Columbia, 2000, cited in Colorado Department of Transportation, "Evaluation of Selected Deicers Based Upon a Review of the Literature," Report No. CDOT-DTD-R-2001-15, October 30, 2001.*

[4]*An important caution in interpreting these comparisons is that they do not take into account any differences in how they are used. It is possible that a more toxic deicer may produce fewer toxic effects in nature due to less of the deicer being required to remove ice from roads.*

[5]*Mussato and Gutherie,* op. cit.

AMBIENT CHLORIDE CONCENTRATIONS IN STREAMS OF THE MENOMONEE RIVER WATERSHED DURING THE WINTER DEICING SEASON

Whether toxicity resulting from road salt constitutes a water quality problem within the Menomonee River watershed depends, in part, on whether concentrations of chloride in streams of the watershed reach the toxic levels identified in Table A-1 for appreciable periods of time during the winter deicing season. A reasonable hypothesis is that much of the chloride loading to these streams consists of pulses that occur either while deicing operations are conducted during winter storms or when ice melt and snowmelt during thaws carries accumulated salt into streams. Under this sort of scenario, it might be expected that chloride concentrations would spike fairly rapidly, followed by a rapid decrease to a relatively nontoxic level. If chloride loading during winter follows this sort of pattern, aquatic organisms might be exposed to high concentrations of chloride for relatively brief periods.

Unfortunately, chloride concentrations in streams of the Menomonee River watershed are rarely directly measured during the winter deicing season. Few data exist and those that do are not collected with enough frequency to allow characterization of the sort of spikes hypothesized in the previous paragraph. Because of this, measurements of specific conductance were chosen as a surrogate for chloride concentration.

Continuously-collected specific conductance data are available from six monitoring stations in the Menomonee River watershed which were established as part of a joint Milwaukee Metropolitan Sewerage District (MMSD)-U.S. Geological Survey (USGS) real-time water quality monitoring program. Under this program, real-time sensors measure specific conductance, dissolved oxygen concentration, turbidity, water temperature, flow, and river level at five-minute intervals under all weather conditions. The data are transmitted to MMSD and USGS offices. While the five-minute interval data are retained for only 120 days, summary data consisting of daily minimum, maximum, and mean values are archived and available from the USGS's NWIS database. Table A-2 lists the monitoring stations from this program that are located in the Menomonee River watershed and lists the periods of record for specific conductance monitoring at these stations. The table also identifies the extent of gaps in the records during the winter deicing season in which specific conductance data were not collected.

A regression model is available that relates specific conductance to chloride concentration in Wisconsin streams[6] The model was developed using simultaneously collected measurements of specific conductance and chloride concentration from 17 Wisconsin streams, including several in the Milwaukee area. The equation developed in this model is:

$$Cl = 0.363 \text{ X } Sc - 271.$$

In this equation, Cl indicates chloride concentration in milligrams per liter and Sc indicates specific conductance in microSeimens per centimeter (μS/cm). Based on graphical examination of the data, it was determined that the relationship is valid for chloride concentrations greater than 230 mg Cl/l, which is equivalent to a specific conductance of 1,380 μS/cm. The regression has an R^2 value of 0.997, indicating that this relationship accounts for over 99 percent of the variation in the data within the valid range.

This regression model was used to estimate minimum, maximum, and mean daily chloride concentrations at monitoring stations in the Menomonee River watershed using the daily summary values of specific conductance collected as part of the MMSD-USGS real-time monitoring program. For all values of minimum, maximum, and mean daily specific conductance that were equal to or greater than 1,380 μS/cm, the concentration of chloride was estimated using the regression equation. For each monitoring station, the record of estimated chloride

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[6] *Corsi, S.R., D.J. Graczyk, S.W. Geis, N.L. Booth, and K. D. Richards, "A Fresh Look at Road Salt: Aquatic Toxicity and Water-Quality Impacts on Local, Regional, and National Scales,"* Environmental Science & Technology, *Volume 44, 2010.*

concentrations was examined to identify periods in which the daily minimum chloride concentration was equal to or greater than 1,400 mg Cl/l for four or more days. This value was chosen as the screening value because it both exceeds the State's acute toxicity criterion for fish and aquatic life for chloride and reflects the low end of the LC50 values identified for freshwater organisms in the 96-hour acute toxicity studies summarized in Table A-1.

There were two stations, one along Honey Creek and one in Underwood Creek, at which periods were detected when the daily minimum concentration of chloride exceeded 1,400 mg Cl/l for four or more days. These periods are summarized in Table A-3. At the monitoring station along Honey Creek, there were nine periods between November 2008 and March 2011during which the daily minimum concentration of chloride exceeded 1,400 mg Cl/l for four or more days. The lengths of these periods ranged from four to 19 days. These periods often occurred in rapid succession. For example, four periods occurred during the time between December 22, 2010 and February 28, 2011, accounting for 42 out of 69 days. The summary statistics presented in Table A-3 suggest that chloride concentrations in Honey Creek were quite variable during these periods. For example, during the period December 22-25, 2010 the daily minimum chloride concentrations at the Honey Creek monitoring station ranged between 1,566 mg Cl/l and 5,718 mg Cl/l. Maximum daily chloride concentrations at this station during the same period ranged between 2,226 mg Cl/l and 7,933 mg Cl/l. The average chloride concentrations detected in these streams during these periods ranged between 1,917 mg Cl/l and 3,742 mg Cl/l. At the monitoring station along Underwood Creek, one period during which the daily minimum concentration of chloride exceeded 1,400 mg Cl/l for four or more days occurred between February 2010 and July 2011. Chloride concentrations at that station were above 1,400 mg Cl/l for nine consecutive days.

Daily minimum chloride concentrations at three other monitoring stations—the Little Menomonee River near Freistadt, the Menomonee River at Pilgrim Road, and the Menomonee River at N. 70th Street—did not exceed 1,400 mg Cl/l for periods of four or more days during the period of record.

Two conclusions emerge from this examination of winter deicing season chloride concentrations calculated from specific conductance. First, concentrations of chloride during the winter in Honey and Underwood Creeks, as calculated from specific conductance, achieve levels that are well within the range of chloride concentrations that were found to result in the deaths of 50 percent of test organism in 96-hour toxicity tests. In both streams, chloride concentrations during the winter deicing season appear to remain at levels that are associated with acute toxic effects for extended periods of time. Thus, for these streams, the rapid-spike model previously hypothesized does not appear to give a good description of chloride concentrations during the winter.

Second, the results suggest that chloride concentrations probably reach higher levels in smaller streams that are located in highly urbanized areas than they do in larger streams and streams located in less urbanized areas. Comparisons of discharge at streamflow monitoring gauges in the Menomonee River watershed show that on average discharge at the monitoring stations along Honey and Underwood Creek account for 6 and 14 percent, respectively, of the discharge at the gauge along the Menomonee River at N. 70th Street.[7] In addition, the subwatersheds drained by these streams are highly urbanized. By contrast, discharge at the gauge along the Menomonee River at Pilgrim Road—one of the sites where calculated chloride concentrations did not exceed 1,400 mg Cl/l for periods of four or more days during the period of record—accounts for 29 percent of the discharge at the gauge along Menomonee River at N. 70th Street. The higher volume of discharge at this station may result in greater dilution of chloride. In addition, rural land uses comprise a greater percentage of the areas upstream of this site than they do for the Honey Creek and Underwood Creek stations.

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[7]*See Map 32 in SEWRPC Technical Report No. 39,* Water Quality Conditions and Sources of Pollution in the Greater Milwaukee Watersheds, *November 2007.*

LIKELY EFFECTS OF POTENTIALLY TOXIC CONCENTRATIONS OF CHLORIDE TO ORGANISMS IN THE MENOMONEE RIVER

As described above, chloride concentrations in some streams of the Menomonee River watershed reach toxic levels during the winter deicing season for extended periods of time. The likelihood that toxic effects are occurring in these streams also depends upon what organisms are present in the streams during the winter deicing season. It should be noted that, to some extent, the organisms listed in Table A-1 for which the acute toxicity of sodium chloride has been characterized reflect species that are suitable for toxicity testing. These are organisms that are readily available, that can be maintained under laboratory conditions, and that have well-understood physiological and nutritional requirements. How much they reveal about potential toxic effects in streams of the Menomonee River watershed depends on at least two factors: 1) how representative these species are of the biota found in streams of the watershed, and 2) whether sensitive life history stages of these species are present in streams during the winter deicing season.

The species for which sodium chloride toxicity has been characterized, as listed in Table A-1, were compared to the species records reviewed as part of the analyses made for the recent update of the regional water quality management plan for the Greater Milwaukee watersheds.[8] Four fish species listed in Table A-1—bluegill, brook trout, fathead minnow, and goldfish—have been detected in fisheries surveys of the watershed. In species other than fish, one frog species—wood frog—and two macroinvertebrate species—the scud *Gammarus pseudolimnaeus,* and the caddisfly *Hydropsyche betteni*—have also been reported as being present. In addition, organisms belonging to five additional macroinvertebrate genera—caddisflies in the genera *Hydroptila* and *Pycnopsyche,* mayflies of the genus *Callibaetis*, midges of the genus *Chironomus,* and snails of the genus *Physa*—have been collected from streams in the Menomonee River watershed. It is important to note that organisms were identified only to the level of genus in many of the macroinvertebrate surveys, so it is possible but not certain that these particular test species are also present in the watershed. At least seven to 12 of the species listed on Table A-1 have been reported as being present in streams of the Menomonee River watershed. Given this, Table A-1 can be held as including a reasonable representation of aquatic organism species typical of the Menomonee River watershed.

A brief review of available literature regarding the life histories of the species listed in Table A-1 indicates that many of the species listed would be expected to be present in streams during the winter deicing season. Three of the fish species that are listed in the table and present in streams of the watershed—bluegill, brook trout, and goldfish—have life spans that last several years.[9] While fathead minnows typically live for only one to two years, spawning occurs in the spring and eggs hatch within about a week of spawning.[10] Thus, all four of these species may be present in streams as adults during the winter deicing season. The remaining vertebrate listed in the table—the wood frog—typically would not be present in streams during the winter deicing season. These animals normally hibernate in terrestrial and wetland forest habitats.[11]

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[8] *SEWRPC Technical Report No. 39,* Water Quality Conditions and Sources of Pollution in the Greater Milwaukee Watersheds, *November 2007.*

[9] *George Becker,* Fishes of Wisconsin, *University of Wisconsin Press, 1983.*

[10] Ibid.

[11] *A.H. Wright and A.A. Wright,* Handbook of Frogs and Toads of the United States and Canada, *3rd edition, Cornell University Press, 1949.*

Life history information was available for some of the invertebrates listed in Table A-1. Two groups of caddisflies listed in the table, the species *Hydropsyche betteni* and members of the genus *Pyconpsyche*, overwinter in waterbodies as late-instar larvae.[12] In northern areas like Wisconsin, the mayfly *Hexagenia limbata* typically completes its life cycle over two years. While some populations may overwinter as eggs during the first winter, they are typically present in waterbodies as larvae during the second.[13] The scud *Gammarus lacustris* has a 15-month lifespan with reproduction occurring in or around the month of February.[14] Thus, this species is present in streams as adults for much of the winter. The isopod *Lirceus fontinalis* overwinters as adults or large juveniles.[15] The water flea *Daphnia pulex* overwinters both as resting eggs and as adults in the water column.[16]

Some of the invertebrate species that are present in waterbodies during the winter may experience less exposure to dissolved chloride than would be indicated based on ambient concentrations either because they remove themselves from the water column or enter a diapause, or resting, stage during winter. Nymphs of mayflies in the genus *Callibaetis* are thought move to areas of deeper water and overwinter in mats of vegetation.[17] Larvae of midges of the genus *Chironomus* often overwinter in diapause.[18]

Based on the available life history information, it is likely that organisms are present in streams of the Menomonee River watershed during the winter deicing season. Given that concentrations of chloride in some streams of watershed appear to reach levels associated with substantial incidences of toxic effects as measured by LC50 concentrations for extended periods of time, it is likely that inputs of chlorides from deicers are causing some toxic effects to aquatic organisms in streams of the watershed.

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[12] *S. Alexander and L.A. Smock, "Life Histories and Production of* Cheumotopsyche analis *and* Hydropsyche betteni, *(Trichoptera: Hydropsychidae) in an Urban Virginia Stream,* Northeastern Naturalist, *Volume 12, 2005; R. J. Mackay,* The Life Cycle and Ecology of *Pycnopsyche gentilis* (McLachlan), *P. luculenta* (Betten), and *P. scabripennis* (Rambur), (Trichoptera: Limnephilidae) in West Creek, Mont. St. Hilaire, Quebec, *Ph.D. Dissertation, McGill University, Montreal, Quebec, April 1992.*

[13] *B.P. Hunt, "The Life History and Economic Importance of a Burrowing Mayfly,* Hexagenia limbata *in Southern Michigan Lakes,"* Michigan Conservation Department Bulletin of the Institute of Fisheries Research, *No.4, 1953.*

[14] *H.B.N. Hynes and F. Harper, "The Life Histories of* Gammarus lacustris *and* Gammarus psuedolimnaeus *in Southern Ontario,* Crustaceana, *Supplement No. 3: Studies on Peracarida, 1972.*

[15] *X. Zhao, M.G. Fox, D.C. Lasenby, A.C. Armit, and D.N Kuthamale, "Substrate Selection and Seasonal Variation in Abundance and Size Composition of Isopod* Lirceus fontinalis *in Ontario Streams, Canada,"* Chinese Journal of Oceanography and Limnology, *Volume 25, 2007.*

[16] *W. Lampert, K.P. Lampert, and P. Larsson, "Coexisting Overwintering Strategies in* Daphnia pulex*: A Test of Genetic Differences and Growth Responses,"* Limnology and Oceanography, *Volume 55, 2010.*

[17] *K. E. Gibbs, "Ovoviviparity and Nymphal Seasonal Movements of* Callibaetis *spp. (Ephemeroptera: Baetidae) in a Pond in Southwestern Canada,"* Canadian Entomologist, *Volume 111, 1979.*

[18] *B.R. Goddeeris, A.C. Vermeulen, E. DeGeest, H. Jacobs, B. Baert, and F. Ollevier, "Diapause Induction in the Third and Fourth Instar of* Chironomus riparius *(Diptera) from Belgian Lowland Brooks,"* Archiv fur Hydrobiolgie, *Volume 150, 2001.*

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* * *

MGH/JEB/pk
#159554 V1 - CHLORIDE TOXICITY INSERT FOR MNR WBP MINUTES
11/02/11

Table A-1

ACUTE TOXICITY OF SALT (SODIUM CHLORIDE) TO FRESHWATER AQUATIC ORGANISMS

Species	Common Name	NaCl Concentration (mg/l)	Chloride Concentration (mg/l)	Exposure Time (hours)	Response[a]	Reference
Salvelinus fontinalis	Brook trout	50,000	30,330	0.25	LC50	Phillips, 1944
Lepomis macrochirus	Bluegill	20,000	12,132	6.00	LC47	Waller, *et al.*, 1996
Oncorhynchus mykiss	Rainbow trout	20,000	12,132	6.00	LC40	Waller, *et al.*, 1996
Chironomus attenuatus	Midge	9,995	6,063	6.00	LC50	Thornton and Sauer, 1972
Lepomis macrochirus	Bluegill	14,100	8,553	24.00	LC50	Doudoroff and Katz, 1953
Daphnia magna	Water flea	7,754	4,704	24.00	LC50	Cowgill and Milazzo, 1990
Cirrhinius mrigalo	Indian carp fry	7,500	4,550	24.00	LC50	Gosh and Pal, 1969
Labeo rohoto	Indian carp fry	7,500	4,550	24.00	LC50	Gosh and Pal, 1969
Catla catla	Indian carp fry	7,500	4,550	24.00	LC50	Gosh and Pal, 1969
Daphnia pulex	Water flea	2,724	1,652	24.00	LC50	Cowgill and Milazzo, 1990
Ceriodaphnia dubia	Water flea	2,724	1,652	24.00	LC50	Cowgill and Milazzo, 1990
Daphnia pulex	Water flea	2,042	1,239	48.00	LC50	Gardner and Royer, 2010
Daphnia pulex	Water flea	1,812	1,099	48.00	LC50	Gardner and Royer, 2010
Anguilla rostrata	American eel, (black eel stage)	21,571	13,085	96.00	LC50	Hinton and Eversole, 1978
Anguilla rostrata	American eel, (black eel stage)	17,969	10,900	96.00	LC50	Hinton and Eversole, 1978
Gambusia affinis	Mosquito fish	17,500	10,616	96.00	LC50	Wallen, *et al.*, 1957
Hydropsyche betteni	Caddisfly	13,308	8,073	96.00	LC50	Kundman, 1998
Lepomis macrochirus	Bluegill	12,964	7,864	96.00	LC50	Trama, 1954
Oncorhynchus mykiss	Rainbow trout	11,112	6,743	96.00	LC50	Spehar, 1987
Pimephales promelas	Fathead minnow	10,831	6,570	96.00	LC50	Birge, *et al.* 1985
Culex sp.	Mosquito	10,254	6,222	96.00	LC50	Dowden and Bennett, 1965
Lepomis macrochirus	Bluegill	9,627	5,840	96.00	LC50	Birge, *et al.* 1985
Gammarus pseudolimnaeus	Scud	7,700	4,670	96.00	LC50	Blasius and Merritt, 2002
Pimephales promelas	Fathead minnow	7,681	4,659	96.00	LC50	Wisconsin State Laboratory of Health, 1995
Pimephales promelas	Fathead minnow	7,650	4,640	96.00	LC50	Adelman, *et al.*, 1976
Carassius auratus	Goldfish	7,341	4,453	96.00	LC50	Adelman, *et al.*, 1976
Anaobolia nervosa	Caddisfly	7,014	4,255	96.00	LC50	Sutcliffe, 1961

Table A-1 (continued)

Species	Common Name	NaCl Concentration (mg/l)	Chloride Concentration (mg/l)	Exposure Time (hours)	Response[a]	Reference
Limnephilus stigma	Caddisfly	7,014	4,255	96.00	LC50	Sutcliffe, 1961
Daphnia magna	Water flea	6,709	4,071	96.00	LC50	Wisconsin State Laboratory of Health, 1995
Chironomus attenuatus	Midge	6,637	4,026	96.00	LC50	Thornton and Sauer, 1972
Hexagenia limbata	Mayfly	6,300	3,822	96.00	LC50 at 18ºC	Chadwick, 1997
Daphnia magna	Water flea	6,031	3,658	96.00	LC50	Cowgill and Milazzo, 1990
Lepidostoma sp.	Caddisfly	6,000	3,640	96.00	LC50	Williams, *et al.*, 2000
Hydroptila angusta	Caddisfly	5,526	3,352	96.00	LC50	Hamilton *et al.*, 1975
Cricotopus trifascia	Midge	5,192	3,149	96.00	LC50	Hamilton *et al.*, 1975
Rana sylvatica	Wood frog (tadpoles)	5,109	3,099	96.00	LC50	Sanzo and Hecnar, 2006
Cirrhinius mrigalo	Indian carp fry	4,980	3,021	96.00	LC50	Gosh and Pal, 1969
Labeo rohoto	Indian carp fry	4,980	3,021	96.00	LC50	Gosh and Pal, 1969
Catla catla	Indian carp fry	4,980	3,021	96.00	LC50	Gosh and Pal, 1969
Lirceus fontinalis	Isopod	4,896	2,970	96.00	LC50	Birge, *et al.*, 1985
Physa gyrina	Snail	4,088	2,480	96.00	LC50	Birge, *et al.*, 1985
Daphnia magna	Water flea	3,939	2,390	96.00	LC50	Arambasic, *et al.*, 1995
Pycnopsyche guttifer	Caddisfly	3,526	2,140	96.00	LC50	Blasius and Merritt, 2002
Pycnopsyche lepida	Caddisfly	3,526	2,140	96.00	LC50	Blasius and Merritt, 2002
Daphnia magna	Water flea	3,054	1,853	96.00	LC50	Anderson, 1948
Rana sylvatica	Wood frog (tadpoles)	2,636	1,599	96.00	LC50	Sanzo and Hecnar, 2006
Ceriodaphnia dubia	Water flea	2,630	1,596	96.00	LC50	Wisconsin State Laboratory of Health, 1995
Daphnia pulex	Water flea	2,422	1,470	96.00	LC50	Birge, *et al.*, 1985
Hexagenia limbata	Mayfly	2,400	1,456	96.00	LC50 at 28ºC	Chadwick, 1997
Ceriodaphnia dubia	Water flea	2,308	1,400	96.00	LC50	Cowgill and Milazzo, 1990
Callibaetis coloradensis	Mayfly	700	425	96.00	LC50	Wichard, 1975

[a]*LC50 is the concentration that is lethal to 50 percent of the test organisms. A higher LC50 value means lower toxicity of the chemical to the organism.*

Source: SEWRPC.

Table A-2

CONTINUOUS SPECIFIC CONDUCTANCE DATA RECORDS AVAILABLE IN THE MENOMONEE RIVER WATERSHED

Location	Period of Record	Comments
Honey Creek at Wauwatosa (Honey Creek Parkway)	12/6/2008 – 8/26/2011	Six data gaps during winter deicing seasons totaling to 37 days without data
Little Menomonee River near Friestadt (downstream of W. Donges Bay Road)	11/8/2008 – 7/26/2011	One data gap during winter deicing season totaling four days without data
Little Menomonee River at USH 41	5/7/2010 – 9/28/2010, 5/5/2011 – 7/18/2011	No data collected during the winter deicing season
Menomonee River at N. 70th Street	11/5/2008 – 9/13/2010	Three data gaps during winter deicing seasons totaling nine days without data
Menomonee River at Pilgrim Road	11/8/2008 – 7/26/2011	- -
Underwood Creek at Wauwatosa (Gravel Sholes Park downstream of Mayfair Road)	2/12/2010 – 7/26/2011	One data gap during winter deicing season totaling two days without data

Source: Milwaukee Metropolitan Sewerage District, U.S. Geological Survey, and SEWRPC.

Table A-3

PERIODS WHEN CALCULATED CHLORIDE CONCENTRATION IN STREAMS OF THE MENOMONEE RIVER WATERSHED EXCEEDED 1,400 MILLIGRAMS PER LITER FOR FOUR DAYS OR MORE: NOVEMBER 2008 TO JULY 2011

Stream	Length (days)	Calculated Chloride Concentrations (milligrams per liter)						
		Lowest Daily Minimum	Highest Daily Minimum	Lowest Daily Maximum	Highest Daily Maximum	Lowest Daily Mean	Highest Daily Mean	Average over the Period
Honey Creek at Wauwatosa								
December 6, 2008-December 13, 2008	8	1,715	3,348	2,724	6,589	1,998	4,630	3,448
January 8, 2009-January 12, 2009	5	1,417	3,087	2,223	4,230	1,882	3,577	2,613
January 18, 2009-January 22, 2009	5	1,420	1,613	1,969	2,727	1,733	2,179	1,917
February 9, 2010-February 14, 2010	6	1,504	2,266	1,972	4,775	1,734	3,021	2,519
February 17, 2010-March 2, 2010	14	1,410	3,326	1,751	6,227	1,577	4,266	2,421
December 22, 2010-December 25, 2010	4	1,566	5,718	2,226	7,933	1,842	6,590	3,742
January 11, 2011-January 21, 2011	11	1,613	3,904	2,383	7,679	2,092	6,227	3,522
January 28, 2011-February 15, 2011	19	1,456	3,504	2,001	5,573	1,725	3,904	2,542
February 21, 2011-February 28, 2011	8	1,929	2,680	2,963	4,448	2,426	3,831	3,024
Underwood Creek at Wauwatosa[b]								
February 21, 2011-March 1, 2011	9	1,413	1,940	1,649	2,869	1,507	2,383	1,833

[a]*Chloride concentrations were calculated from specific conductance using the regression equation from Corsi* et al. *(2010). The regression equation is based on data from 17 Wisconsin streams. The regression equation is* Cl = 0.363 X Sc – 271*, where Cl is the concentration of chloride in milligrams per liter and Sc is the specific conductance in microSiemens per centimeter. This equation is considered valid for chloride concentrations greater than 230 milligrams per liter, which is equivalent to a specific conductance of 1,380 in microSiemens per centimeter.*

[b]*Period of record at this site was February 12, 2010 through July 26, 2011.*

Source: SEWRPC.

Exhibit D

specific audiences such as lawn care companies and restaurants on methods of storm water pollution prevention.

3. Promote environmentally sensitive land development designs by developers and designers.

Note: The public education and outreach program should be tailored, using a mix of locally appropriate strategies to educate the general public and target specific audiences likely to have significant storm water impacts.

(2) PUBLIC INVOLVEMENT AND PARTICIPATION. A program to notify the public of activities required by the municipal storm water discharge permit required under this subchapter and to encourage input and participation from the public regarding these activities. The implementation of this program shall comply with all applicable state and local public notice requirements.

(3) ILLICIT DISCHARGE DETECTION AND ELIMINATION. A program to detect and remove illicit discharges and improper disposal of wastes into the municipal separate storm sewer system, or require the discharger to obtain a separate WPDES permit. The program shall include all of the following:

(a) To the extent authorized by law, measures to effectively prohibit, through ordinance or other regulatory mechanism, non–storm water discharges into the storm sewer system and implement appropriate enforcement procedures and actions.

(b) A strategy to address all types of illicit discharges. In addition, non–storm water discharges or flows such as landscape irrigation, diverted stream flows, uncontaminated groundwater infiltration, uncontaminated pumped groundwater, discharges from potable water sources, foundation drains, air conditioning condensation, irrigation water, lawn watering, individual residential car washing, flows from riparian habitats and wetlands, fire fighting and discharges authorized under a WPDES permit shall be included in the strategy if identified by the municipality as significant sources of pollutants to waters of the state.

(c) Procedures to conduct on–going field screening activities during the term of the permit, including locations of storm sewers that will be evaluated.

(d) Procedures to be followed to investigate portions of the municipal separate storm sewer system that, based on the results of field screening or other information, indicate a reasonable potential for containing illicit discharges or other sources of non–storm water. Procedures may include sampling for the parameters listed within par. (i), testing with fluorometric dyes or conducting inspections inside storm sewers where safety and other considerations allow. The department shall be given advanced notice of the time and location of dye testing within an MS4.

Note: The dye may be reported to the department by concerned citizens as an illicit discharge. Prior notification will prevent false alarms.

(e) Procedures to immediately investigate reports of illicit discharges to its MS4, including cooperation with the department, in order to locate and eliminate illicit discharges.

(f) Procedures for immediate notification of the department in accordance with ch. NR 706, of a spill or release of a hazardous substance, into or from an MS4.

Note: The department shall be notified via the 24–hour toll–free spill hotline at 1–800–943–0003.

(g) Procedures to prevent, contain and respond to spills that may enter the municipal separate storm sewer system.

(h) Appropriate measures to eliminate any leakage or discharge from sanitary conveyance systems into municipal separate storm sewer systems.

(i) A field screening analysis for illicit connections and illicit discharges at all major outfalls, plus any additional selected field–screening points designated by the municipality or the department. At a minimum, a screening analysis shall include a narrative description of visual observations made during dry weather periods. If any flow is observed, field analysis shall be conducted to determine the presence of illicit discharges. All field analysis shall include a narrative description of the color, odor, turbidity, the presence of an oil sheen or surface scum, and a description of the flow rate as well as any other relevant observations regarding the potential presence of non–storm water discharges. In addition, the field analysis shall include sampling for pH, total chlorine, total copper, total phenol and detergents unless the permittee obtains concurrence from the department to perform alternative sampling that is more effective to detect illicit discharges such as with ammonia, potassium or bacteria. The field screening points shall be established using the following:

1. Field screening points shall, where possible, be located downstream of any sources of suspected illegal or illicit activity.

2. Field screening points shall be located where practicable at the farthest manhole or other accessible location downstream in the system. Safety of personnel and accessibility of the location shall be considered in making this determination.

3. Consideration shall be given to hydrological conditions, total drainage area of the site, population density of the site, traffic density, age of the structures or buildings in the area, history of the area and land use types.

(4) CONSTRUCTION SITE POLLUTANT CONTROL. Except for construction sites that are exempted under s. NR 216.42 (2) to (11), a program to implement and maintain erosion and sediment control best management practices to reduce pollutants in storm water runoff from construction sites with one acre or more of land disturbance, and sites of less than one acre if they are part of a larger common plan of development or sale. This program shall encompass any adjacent developing areas that are planned to have a minimum density of 500 people per square mile, the urbanized area and developing areas whose runoff will connect to the MS4. The program shall include all of the following:

(a) The implementation and enforcement of a legal authority to comply with ss. NR 151.11 and 151.23, as well as sanctions to ensure compliance, to the extent authorized by law.

Note: Section NR 151.11 applies to construction sites that are not transportation facilities and s. NR 151.23 applies to transportation facility construction sites.

(b) Procedures for site planning which incorporate consideration of potential water quality impacts.

(c) Requirements for erosion and sediment control best management practices.

(d) Procedures for identifying priorities for inspecting sites and enforcing control measures which consider the nature of the construction activity, topography, the characteristics of soil and receiving water quality.

(e) Requirements for construction site operators to manage waste such as discarded building materials, concrete truck washout, chemicals, litter, and sanitary waste at the construction site so as to minimize adverse impacts to water quality.

(f) Procedures for receipt and consideration of information submitted by the public.

(5) POST–CONSTRUCTION SITE STORM WATER MANAGEMENT. A program to develop, implement and enforce controls on discharges from new development and redevelopment projects that disturb one acre or more of land, including projects less than one acre that are part of a larger common plan of development or sale, that discharge into the MS4. This program shall encompass any adjacent developing areas that are planned to have a minimum density of 500 people per square mile, the urbanized area and developing areas whose runoff will connect to the MS4. The program shall include all of the following:

(a) The implementation and enforcement of a legal authority to comply with ss. NR 151.12 and 151.24.

Note: Section NR 151.12 applies to construction sites that are not transportation facilities and s. NR 151.24 applies to transportation facility construction sites.

(b) Procedures for site planning which incorporate consideration of potential water quality impacts.

(c) Requirements for source area control and regional best management practices.

(d) Procedures for inspecting and enforcing maintenance of best management practices.

Exhibit E

2010 Illicit Discharge Screening Summary for MS4-Permitted Communities within the Menomonee River Basin

MS4	Number of Outfalls in MS4	Number of Outfalls Screened, with Flow	Number of Suspected Illicit Discharges	Samples Parameters (Max, Min, Avg) mg/L						
				Ammonia	Detergent	Fluoride	Potassium	Copper	Chlorine	Phenol
Greenfield	37	37, 27	4	(3.5, 0, 0.35)	(3, 0, 0.60)	(1.28, 0.03, 0.46)	(20.1, 1.2, 7.41)			
Brookfield	48	48	2	( )	( )			( )	( )	( )
Menomonee Falls	173	173, 12	0	( )	( )				( )	( )
Germantown	23	23, 5	0		(0.25, 0, 0)			(0, 0, 0)	(0.1, 0, 0.04)	(0.05, 0, 0)
West Milwaukee	17	17, 11	2		(0, 0, 0)			(0, 0, 0)	(0.6, 0, 0.13)	(0, 0, 0)
Wauwatosa	31	31, 27	11	(1, 0, 0.05)	(10, 0, 2)			(0.58, 0.06, 0.30)	(0.52, 0.02, 0.15)	
Elm Grove	4	4, 0	0	No sampling conducted in 2010						
Butler	9	9, 5	0		(0, 0, 0)			(0, 0, 0)	(0, 0, 0)	(0, 0, 0)
Milwaukee	757	963 tested locations (including upstream follow-up), 263	67 tests above expected range, 8 cross-connections	(20, 0, 1.17)	(10, 0, 0.53)			(1.25, 0, 0.01)	(2, 0, 0.22)	(0.4, 0, 0.004)
West Allis	49	37, 23	1		(1.5, 0, 0.25)	(0.1, 0, 0.008)			(0.6, 0, 0.09)	(0.3, 0, 0,028)
TOTAL	**1148**	**373**	**95**	Range 0.00 - 20.0 mg/L	Range 0.00 - 10 mg/L	Range 0.00 - 1.28 mg/L	Range 1.2 - 20.1 mg/L	Range 0.00 - 1.25 mg/L	Range 0.00 - 2.0 mg/L	Range 0.00 - 0.40 mg/L
Expected Ranges:				< 0.1 mg/L	< 0.25 mg/L	< 0.25 mg/L	< 3.1 mg/L	< 1.0 mg/L	< 0.2 mg/L	< 0.00 mg/L

Exhibit F

TABLE 2
TEST PARAMETER RANGES AND FOLLOW-UP LEVELS (1)

Indicator Parameter	Limits of Detection	Parameter Accuracy	Follow-up Level
pH	0.0 - 14.0	+/- 0.1	≤ 6.0 or ≥ 9.0
Detergents	0.25 mg/l	0.125 – 0.5 mg/l	≥ 0.5 mg/l
Total Residual Chlorine	0.10 mg/l	0.05 – 0.25 mg/l	≥ 1.0 mg/l
Phenols	0.10 mg/l	0.05 – 1.0 mg/l	> 0.1 mg/l
Total Copper	0.10 mg/l	0.05 – 1.0 mg/l	> 0.2 mg/l

(1) Detection Limits and Accuracy (as shown and generally +/- ½ of color increment) identified is based on CHEMetrics™ CHEMets ® field screening test kit and may require modification by the Village based on test kit changes, background levels and other factors. Follow-up level is based on WDNR guidance from other monitoring programs (specifically the City of Milwaukee's IDDE program), test subjectivity, and test variances.

d. For those major outfalls identified in the field chemical analysis or identified by other information as having a reasonable potential for containing illicit discharges or other sources of unallowable non-storm water discharges, the Village will attempt to locate the source of the potential discharge. The following procedure will generally be followed:

i. The suspect outfall will be tested using the grab sample technique identified in Section B.2.d. above to confirm the presence of the suspect chemical(s). Typically, only the chemical(s) of interest will be tested for.

ii. The sampling crew will follow the storm drainage system upstream to the next accessible upstream manhole or storm sewer junction to confirm the presence of flow and chemical(s) of interest. This procedure will be continued using storm sewer system mapping until the suspect illicit discharge chemical source location is isolated to the extent practicable.

iii. Once the location is isolated (if possible), the crew will search for obvious visual signs of illicit connections and discharges by conducting a "windshield survey". The survey includes photographing the surrounding area including buildings, observing business types, and other items of interest. Other items of interest can include, but are not limited to outdoor storage areas, staining, or other potential signs of illicit discharges or dumping. Inlets and catch basins, if present may be inspected for the presence of discolored water, staining, or other indications of non-storm water discharges and may include direct chemical testing of sumps. No internal entry of any business is included in this effort. The results of the survey will be shared with Village staff at a meeting for discussion of potential sources and recommended next steps.

iv. Following the "windshield survey", building records may be researched to identify potential cross connections and discussions may be held with building owners.

v. If no immediate source is apparent after visual site inspection of sewers and buildings, the Village will consider other methods to identify the flow such as leak detection, sewer system televising, dye water testing (The WDNR will be notified in advance of the time and location of any dye water testing), smoke testing, etc., based on the general location of the chemical and other specific details such as proximity to industrial activity, water mains, and sanitary sewers.

vi. The Village will assess whether or not an identified source facility is appropriately permitted to discharge into the storm water system.

vii. When an illicit connection/discharge is located, the Village will begin procedures to work with the subject property/owner to eliminate the connection as expediently as possible.

viii. In the case of an illicit discharge that originates within the Village and that discharges directly to a neighboring municipality, the Village will notify the affected municipality within one working day of confirming the illicit discharge.

ix. In the case of an illicit discharge that appears to originate from a neighboring municipality the Village will notify that municipality as soon as practicable.

x. Prior to the actual disconnection, the Village will require the owner/operator of the illicit connection/discharge to take all reasonable measures to minimize the discharge of pollutants to the municipal separate storm sewer system.

xi. Each illicit connection/discharge discovery will be handled on a case-by-case basis. The Village has not prepared an exact remedy or timeframe for illicit discharge correction because of the wide variability of potential discharge situations. More complicated or costly remedies may take a longer period of time to correct. If it appears that more than 72 hours will be required to remedy the situation, the WDNR will be contacted and provided with additional details regarding the problem, including but not limited to interim measures to eliminate or reduce pollutant exposure, and an estimated timeline for complete elimination.

xii. The contact person for responding to reports of illicit discharges and spills shall be the Village Engineer or his designee, at (262) 250-4720.

3. The Village proposes the following program to comply with the requirements of responding to and trying to prevent spills that may, or do, discharge into the municipal separate storm sewer system:

a. The Village will respond to and investigate reported potential or known spills that discharge into and/or from the municipal separate storm sewer system including tracking the source of the spill (if possible) following the process outlined previously in this document.

b. Where appropriate, Village staff will work with first responders and within Village spill response plan guidance and follow-up.

c. The Village will prevent and contain spills (if possible) that may discharge into or are already within the municipal separate storm sewer system. Isolation of