SUMMARY NOTES OF THE OCTOBER 8, 2025, MEETING OF THE TECHNICAL ADVISORY COMMITTEE FOR *A CHLORIDE IMPACT STUDY FOR THE SOUTHEASTERN WISCONSIN REGION*

INTRODUCTION

The October 8, 2025, meeting of the Technical Advisory Committee (TAC) for *A Chloride Impact Study for the Southeastern Wisconsin Region* (Study) was convened online at 10:03 a.m. The meeting was called to order by Committee Chairman Thomas M. Grisa, Director of Public Works, City of Brookfield. Mr. Grisa welcomed the attendees to the meeting. Attendance was taken using the online software.

Members Present

Thomas M. Grisa, Chairman .... Director, Department of Public Works, City of Brookfield
Laura K. Herrick, Secretary .... Chief Environmental Engineer, SEWRPC
Cody Churchill .... Winter Maintenance Engineer, WisDOT
David J. Hart .... Hydrogeologist, Wisconsin Geological and Natural History Survey
Craig Helker .... Water Resources Biologist, Wisconsin Department of Natural Resources
Samantha J. Katt .... Urban Stormwater Specialist, Wisconsin Department of Natural Resources
Kevin J. Kirsch .... Water Resources Engineer, Wisconsin Department of Natural Resources
Max Marechal .... City Engineer, Engineering Department, City of West Bend
Cheryl Nenn .... Riverkeeper, Milwaukee Riverkeeper
Neal T. O'Reilly .... Director, Department of Conservation and Environmental Science, UWM
David Strifling .... Director, Water Law and Policy Initiative, Marquette University Law School
Mike Wieser .... Director, Engineering and Public Works, City of Cedarburg

Staff Present

Karin M. Hollister .... Principal Engineer, SEWRPC
James M. Mahoney .... Engineer, SEWRPC
Aaron W. Owens .... Principal Planner, SEWRPC
Justin P. Poinsatte .... Principal Specialist, SEWRPC
Emily E. Porter .... Planner, SEWRPC
Thomas M. Slawski .... Chief Biologist, SEWRPC

Ms. Herrick introduced the presenters and the agenda for the meeting to review SEWRPC Technical Report No. 65, *Mass Balance Analysis for Chloride in Southeastern Wisconsin.*

[Secretary's Note: The agenda for this meeting is attached herein as Exhibit A.]

REVIEW OF THE SUMMARY NOTES FROM THE AUGUST 27, 2025, TECHNICAL ADVISORY COMMITTEE MEETING

Ms. Herrick asked the TAC for any comments or edits for the Summary Notes from the August 27, 2025, TAC meeting. That meeting reviewed draft Chapters 2 (partial), 3, 4, and 6 of Technical Report No. 63, *Chloride Conditions and Trends in Southeastern Wisconsin*. TAC members offered no questions or comments on the Summary Notes.

REVIEW OF SEWRPC TECHNICAL REPORT NO. 65, *MASS BALANCE ANALYSIS FOR CHLORIDE IN SOUTHEASTERN WISCONSIN*

Background and Overview

Ms. Hollister gave an overview of Technical Report No. 65 (TR-65) and the presentation structure. She introduced the main report topics including study background information, sources of chloride to the environment, data used to develop chloride loads, calculation methods and assumptions, and the evaluation of results and conclusions. She highlighted the three primary results presented in TR-65: a Regional chloride budget identifying and quantifying the major sources of chloride in the Region during the study period; chloride source loads estimated for each stream monitoring site deployed for the Study; and mass balance analysis results for select monitoring sites. She also provided definitions of terms related to chloride loading and mass balance analysis and noted that interactions between surface water and groundwater were not quantified for the analysis.

Ms. Hollister also provided a brief review of the study area. The study area encompassed approximately 3,000 square miles and included the seven-County Region in Southeastern Wisconsin plus areas that drain into the Region. Ms. Hollister presented a map showing the 12 major watersheds included in the study area and discussed how existing land use was characterized. She showed a map identifying the waterbodies in the Region that were impaired for chloride toxicity as of 2022. Ms. Hollister described water quality data collected for the Study at 41 stream monitoring sites for the study period from October 2018 to October 2020. She also presented weather conditions during the study period, summarizing monthly precipitation and snowfall totals along with the 30-year monthly averages to provide context.

Sources of Chloride

Ms. Hollister presented the sources of chloride included in the TR-65 analyses. These included winter maintenance (deicing and anti-icing activities on public roads and private parking lots), wastewater effluent (public treatment facilities, industrial dischargers, and private residential septic systems), agricultural sources (potash fertilizer, livestock manure, and irrigation), and atmospheric deposition. She continued to discuss each chloride source individually, identifying the input data sources and describing the methodologies and assumptions used to estimate chloride loads.

Ms. Hollister introduced atmospheric deposition as the only natural source of chloride analyzed in TR-65. Using total chloride deposition data obtained from the National Atmospheric Deposition Program, the amount of chloride from atmospheric deposition was computed for each county in the Region and individual monitoring sites. Atmospheric deposition had an average annual chloride contribution over the Region of 660 tons per year, which was relatively stable over the study period as well as over the last ten years.

Ms. Hollister noted that winter maintenance operations were the largest chloride contributor in the Region, including deicing on public roads and private parking lots. She described the various jurisdictions responsible for maintaining public roadways and explained that the analysis assumed uniform distribution of deicing materials on roadways within a particular jurisdiction. Ms. Hollister acknowledged that this simplification does not account for areas that may require higher application rates such as hills, intersections, or overpasses, but the data reporting did not provide that level of detail. Deicing material usage data for state and federal highways was obtained from the Wisconsin Department of Transportation (WisDOT). To estimate the chloride load from deicing activities on state and federal roads, she described how the SEWRPC transportation network geospatial dataset was used to determine the roadway lane miles within each county and monitoring site drainage area. The estimated annual average chloride contribution from deicing activities on state and federal highways across the Region was 51,300 tons per year.

Ms. Hollister then addressed the chloride load estimates for county highways and local roads. She explained that deicing material usage data for county and local roads were obtained from the Wisconsin Department of Natural Resources (WDNR) municipal separate storm sewer system (MS4) permit data for a significant portion of the Region and showed a map highlighting where data were available. The MS4 deicing data for county highways were geographically distributed using the SEWRPC transportation network data and a similar lane mile method as described for state and federal highways. Whereas the geospatial distribution of deicing materials used by municipalities on local roadways utilized an areal proportion approach. An average annual chloride contribution of 135,141 tons per year was estimated for county and local roads.

Ms. Hollister noted that MS4 reports are due at the end of March each year and may not capture late season winter events. Mr. Grisa asked if salt applied in April or May would show up in MS4 reports the following year. Ms. Katt explained that the MS4 forms allow for entry of monthly data from October of the permit year through March of the following year, but permittees can add notes. Ms. Katt offered that the WDNR is discussing options to improve the MS4 reporting methodology. She asked for any suggestions related to reporting improvements, but none were offered by the TAC during the meeting.

Ms. Hollister discussed winter maintenance on private parking lots, which included over 25,000 acres of off-street parking within the Region. An average annual salt application rate was estimated from literature and previous studies, and chloride loads were calculated for the entire Region as well as individual monitoring site drainage areas. The average annual chloride contribution from private parking lot deicing salt was estimated to be 84,430 tons per year.

Ms. Hollister then discussed treated wastewater effluent as another chloride source evaluated in the analysis. This source included public wastewater treatment facilities (WWTF), industrial wastewater, and residential septic systems. She noted that conventional treatment processes do not remove chloride from wastewater. She presented a map showing the 49 active public WWTFs in the study area during the study period, with six facilities discharging directly to Lake Michigan. She explained that private WWTFs were not included in this analysis because their flows were very small and the available chloride data was relatively limited. The TAC did not present any objection to the omission of private WWTFs. Ms. Hollister described how monitoring data obtained from the WDNR was used to estimate chloride loads for public WWTF effluent. The average annual chloride contribution to inland rivers from public WWTF effluent was 46,276 tons per year, while 107,261 tons per year were discharged directly to Lake Michigan.

Ms. Hollister presented the industrial wastewater discharge source next. There are only 12 industrial wastewater facilities in the study area that discharge directly to streams and monitor chloride in their effluent. Ms. Hollister described how monthly chloride loads were estimated for each facility using monitoring data obtained from the WDNR. These 12 facilities had an estimated average annual chloride contribution of 636 tons per year.

Ms. Hollister then discussed the chloride load estimated for residential septic systems in the Region. She explained that data from SEWRPC Vision 2050 was used to determine the number of unsewered households and population in the Region, and all unsewered homes were assumed to be on septic systems. Based on data from the three western-most counties in the Region that represent about 75 percent of the unsewered households, over 95 percent of unsewered homes have septic systems. Septic systems collect domestic wastewater and the sources of chloride to septic systems include salt from water softeners, household products, and human excreta. Data obtained from literature review were used to estimate chloride content from the domestic wastewater sources, and an annual average chloride load of 13,478 tons per year was estimated for residential septic systems in the Region. Due to a lack of detailed location data, residential septic systems were not included as a source of chloride for individual monitoring sites.

Prior to moving onto the next section, a discussion of the sources of chloride in wastewater ensued among attendees. Mr. Grisa commented on the contribution from the combined sewer area in Milwaukee, which also conveys stormwater to the plant, may skew the chloride levels from the Jones Island WWTF in Milwaukee. Ms. Herrick commented that the chloride monitoring data was limited for the plants discharging directly to Lake Michigan, and the chloride loads from Jones Island were estimated using average chloride concentrations that would not reflect the seasonal influence of the chloride content contributed from areas with combined sewers.

Mr. Kirsch pointed out that WWTFs are different than industrial wastewater dischargers and generally do not generate chloride but rather aggregate it from other sources such as water softening, household waste, and road salt inflow and infiltration. Ms. Hollister agreed that WWTF effluent collectively represents chloride that the facility receives from a variety of sources. She mentioned that WWTFs often don’t contribute additional chloride but some treatment facilities in the Region use relatively small quantities of chloride-containing chemical additives such as ferrous chloride or ferric chloride, which are commonly used for phosphorus removal. Mr. Kirsch also asked if it would be possible to use the domestic wastewater assumptions in the analysis to evaluate the individual chloride sources to WWTFs and determine the contribution from winter road maintenance. Ms. Hollister responded that it would be possible, and the analysis would need to consider all sources of chloride to WWTFs including significant industrial users and commercial sources as well as chloride sources in the water supply. She explained that the Commission did not analyze the individual sources to each WWTF for the Regional Study, but noted that she was aware of a similar chloride source evaluation for the City of Waukesha WWTF performed by Jacobs.

Ms. Hollister next summarized the agricultural sources of chloride that were evaluated, including potash fertilizer, livestock manure, and irrigation. She described how the chloride load from potash (KCl) fertilizer was computed for agricultural fields planted with corn, soybeans, and alfalfa during the study period. Geospatial cropland data was obtained from the U.S. Department of Agriculture (USDA) Cropscape dataset and was used to determine the different crops that were planted in the study area. Fertilizer application rates were estimated using USDA resources. The average annual chloride contribution to the Region from potash fertilizer was estimated to be 17,510 tons per year during the study period.

Ms. Hollister then discussed how the chloride load from livestock manure was estimated for the Region and for individual monitoring sites. She explained that a literature review was conducted to determine the amount of chloride in manure for different types of livestock, and the number of livestock in the Region was obtained from the county inventories published in the USDA Census of Agriculture. The average annual chloride contribution from livestock manure estimated for the entire Region was 3,439 tons per year. Ms. Hollister explained that the county livestock inventories did not include a geospatial component and could not be used to estimate the chloride load from livestock for individual monitoring sites. Instead, manure generated from the subset of livestock housed at concentrated animal feeding operations (CAFO) and permit data from the WDNR were used to estimate the chloride load from livestock manure for the monitoring sites. The average annual chloride contribution estimated for all 17 CAFOs in the study area was 772 tons per year.

Ms. Hollister discussed irrigation as an agricultural source of chloride. The U.S. Geological Survey (USGS) 2015 Water Use Report was used to determine the quantity of water used for irrigation in the Region, of which 95 percent was sourced from groundwater. Using an average chloride concentration for shallow groundwater obtained from TR-63, the average annual chloride contribution was estimated to be 1,399 tons per year for agricultural irrigation. Due to a lack of detailed geospatial data, agricultural irrigation was not included as a source of chloride for individual monitoring sites.

Following the discussion of chloride sources, Ms. Hollister addressed in-stream chloride loads. She explained that in-stream chloride loads were computed for the 14 monitoring sites located near USGS stream gage stations for which reliable streamflow data could be obtained. She described how in-stream chloride concentrations were estimated from the 5-minute specific conductance data collected for the Study using regression equations developed as detailed in TR-64. She then presented the equation used to determine the in-stream chloride load for each 15-minute computational interval and described how those chloride loads were summed to determine the total instream chloride load for each month of the study period.

No additional comments or questions on the TR-65 chloride sources and chloride loads were given by the TAC.

Results and Conclusions

Ms. Hollister first discussed the Regional chloride budget, which was the annual loading rate calculated for the Region for the study period from October 2018 through 2020. The total annual chloride load estimated for all sources in the Region was 461,540 tons per year. Evaluating the results based on general chloride source categories, she noted that winter maintenance operations were the largest computed chloride source at approximately 59 percent, wastewater effluent sources were the second largest at about 36 percent, and agricultural sources were the third largest with nearly 5 percent of the total chloride load estimated for the Region. She described the detailed results of the individual chloride sources within each general source category. She noted that much of the chloride entering the environment is from anthropogenic sources or human-derived, nearly 700 times the amount of chloride from natural sources in the Region.

Ms. Hollister then presented the chloride source loads calculated for each of the 41 stream monitoring sites over the study period. The general chloride source categories were the same as previously discussed, but the individual monitoring sites did not include estimated chloride loads from residential septic systems and agricultural irrigation. She provided an example of the Appendix B maps developed for each site, highlighting land use along with drainage area characteristics. She then presented the total chloride source loads calculated for each site, showing bar charts and a companion data table. Ms. Hollister discussed which monitoring sites had the highest and lowest chloride loads for the various chloride sources. She noted that the sites with the highest chloride source loads were highly urbanized and over 99 percent of the estimated chloride load at those sites was from winter maintenance activities. She then presented additional graphs and tables summarizing the relationships between chloride source loads and various factors such as land use characteristics, chloride-impaired waterbodies, and estimated in-stream chloride concentrations.

Ms. Hollister next discussed the results of the mass balance analysis. She presented a schematic to illustrate the mass balance analysis performed at individual monitoring sites, evaluating the amount of chloride entering the system from various sources within the site drainage area compared to the amount of chloride leaving the system, represented by the in-stream chloride load computed at the monitoring site. She then presented a map showing the 14 monitoring sites that were included in the mass balance analysis along with a figure showing general land use breakouts for each site. She showed a plot that compared the total calculated source loads verses the estimated in-stream chloride loads at each site, explaining which sites had relatively close matches as well as the sites that had larger differences between chloride loads. She then presented a companion table summarizing the results for each site and highlighted the percent differences between chloride loads over the full study period.

Ms. Hollister then provided an example from Appendix C, which presents one-page summaries of the mass balance results for each monitoring site. She introduced the three plots generated for each site to compare chloride loads and described the other data summarized in Appendix C. She then showed an example of the monthly chloride load comparison plot for Site 1 Fox River at Waukesha, demonstrating that while the monthly chloride differences may be large, this site had an overall 0.2 percent difference between chloride source loads and the estimated in-stream loads for the entire study period.

Mr. O'Reilly commented that there appears to be a time lag between the source loads and in-stream loads. Ms. Hollister concurred and noted that she will address this phenomenon in forthcoming slides. Ms. Nenn noted that Milwaukee Riverkeeper has some monitoring sites that now exceed chloride standards nearly every month of the year. She cited Honey Creek in Wauwatosa as an example. Ms. Nenn questioned if chloride could be entering the stream on a time delay from groundwater or via sediment. Ms. Hollister noted that as chloride is highly soluble, it tends to stay in water and does not accumulate in stream sediment.

Ms. Hollister next presented factors that may have influenced the mass balance results. These include missing input data, potential in-stream sensor fouling, the performance of the Study regression equations used to estimate in-stream chloride concentrations, assumptions used to compute chloride sources, and the various chloride transport pathways through the environment.

Ms. Hollister then described seasonal influences and some of the seasonal patterns that emerged for chloride source loads and in-stream chloride loads at stream monitoring sites. She presented a figure showing seasonal excess chloride loads, explaining how the excess chloride source load observed during the winter months compared with the excess in-stream chloride loads observed during the subsequent non-winter months. She noted that the figure demonstrates the time lag phenomenon that Mr. O'Reilly had mentioned, suggesting that chloride applied to roadways during the winter season may potentially be retained in shallow groundwater, slowly moving through surficial soil layers and eventually released to surface water during the following non-winter months.

Ms. Hollister then introduced the flow-weighted mean chloride concentrations (FWMCC) computed for each site monthly and for the full study period, discussing the sites with the highest and lowest FWMCCs over the study period. She presented a plot demonstrating the inverse relationship between streamflow discharge and chloride concentrations. She highlighted outliers for which high chloride concentrations were paired with high streamflow discharge rates, explaining how the outliers were often observed during February and March and identify critical periods for chloride toxicity in streams. She then showed a plot illustrating the proportion of in-stream chloride load at stream monitoring sites that could be attributed to WWTF effluent for each month of the study period. Ms. Hollister brought the presentation to a close by summarizing some of the main findings and conclusions from TR-65 and asked the TAC if there were any other questions or comments to share with the group.

Mr. O'Reilly added that some older homes, by code, were plumbed to have their water softeners discharge their regeneration brine directly into storm sewers, not into sanitary sewers. He suggested that the increased chloride concentration from this should show up during dry weather water quality sampling.

No additional comments or questions on the TR-65 results or conclusions were given by the TAC.

NEXT STEPS FOR THE PLAN

Ms. Herrick stated that comments will be taken on the draft TR-65 chapters reviewed during this TAC meeting until October 31, 2025. She added that comments on the draft TR-65 text can also be submitted through the Study webpage at www.sewrpc.org/chloride-study or via email (lherrick@sewrpc.org).

Ms. Herrick reviewed the next steps for the Study. She stated that the next TAC meeting will be in November of this year and consist of a review of the final chapter of TR-63 (Chapter 5 Lakes). She indicated that meeting presentations and summary notes along with draft chapters from this meeting will be posted on the SEWRPC project website at www.sewrpc.org/chloride-study.

ADJOURNMENT

There being no further business, the meeting was adjourned by unanimous consent at 11:58 a.m.

Respectfully submitted,

Laura Herrick
Recording Secretary

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10/20/25, 10/13/25, 10/10/25

Exhibit A

Southeastern Wisconsin Regional Planning Commission

Notice of Meeting and Agenda

TECHNICAL ADVISORY COMMITTEE FOR
A CHLORIDE IMPACT STUDY FOR THE SOUTHEASTERN WISCONSIN REGION

DATE: Wednesday, October 8, 2025

TIME: 10:00 am to Noon

TEAMS LINK
Join the meeting now
Meeting ID: 267 395 782 485 6
Passcode: mz78BF3z

AGENDA:

1. Roll call

2. Review of summary notes from the August 27, 2025, TAC meeting

3. Review of draft **SEWRPC Technical Report No. 65, Mass Balance Analysis for Chloride in SE Wisconsin**
    a. Chapter 1 – Introduction
    b. Chapter 2 – Chloride Sources and Data for Chloride Loading and Mass Balance Analysis
    c. Chapter 3 – Chloride Loading and Mass Balance Analysis Methodology
    d. Chapter 4 – Chloride Loading and Mass Balance Analysis Results
    e. Appendices

4. Next steps

5. Adjourn

Laura K. Herrick
Chief Environmental Engineer