

MINUTES

SEWRPC ADVISORY COMMITTEE ON REGIONAL WATER QUALITY MANAGEMENT PLAN UPDATE FOR THE GREATER MILWAUKEE WATERSHEDS

DATE: September 27, 2006

TIME: 9:00 a.m.

PLACE: City of Mequon City Hall
Upper Level Council Chambers
11333 N. Cedarburg Road
Mequon, Wisconsin

Committee Members Present

Daniel S. Schmidt, Chairman
Michael G. Hahn, Secretary

Julie A. Anderson
Martin A. Aquino
(for Jeffrey J. Mantes)
John R. Behrens

Thomas J. Bunker
Daniel T. Feinstein (for Charles A. Peters)
Sharon L. Gayan
(for James L. McNelly)
Shannon K. Haydin
Andrew A. Holschbach

Judy Jooss (for Diane M. Georgetta)
Kristine M. Krause
James F. Lubner

Charles S. Melching

Matthew Moroney

Paul E. Mueller
Cheryl Nenn
Stephen Poloncsik
(for Peter G. Swenson)
Kevin L. Shafer

SEWRPC Commissioner
Chief Environmental Engineer, Southeastern
Wisconsin Regional Planning Commission
Director, Racine County Division of Planning and Development
Environmental Manager, Environmental Engineering,
City of Milwaukee
Commissioner-Secretary, Silver Lake Protection and
Rehabilitation District
General Manager, City of Racine Water and Wastewater Utility
Hydrologist, U.S. Geological Survey
Basin Supervisor, Wisconsin Department of Natural Resources

Director of Planning and Resources, Sheboygan County
Director, Ozaukee County Planning, Resources,
and Land Management Department
Town and Country Resource Conservation and Development, Inc.
Vice-President, Environmental Department, We Energies
Sea Grant Advisory Services Specialist,
University of Wisconsin Sea Grant Institute
Associate Professor, Civil & Environmental
Engineering, Marquette University
Executive Director, Metropolitan Builders Association
of Greater Milwaukee
Administrator, Washington County Planning and Parks Department
Riverkeeper/Project Director, Friends of Milwaukee's Rivers
Senior Staff Engineer, U.S. Environmental Protection Agency

Executive Director, Milwaukee Metropolitan Sewerage District

Staff Members and Guests

Marsha B. Burzynski

Troy E. Deibert (for William Krill)

Regional Water Quality Planner, Wisconsin
Department of Natural Resources
Water Resources Engineer, HNTB Corporation

WELCOME AND INTRODUCTIONS

Mr. Schmidt thanked the Advisory Committee members for attending this meeting. He indicated that roll call would be accomplished with a sign-in sheet circulated by Commission staff.

APPROVAL OF MINUTES OF THE MEETING OF AUGUST 29, 2006

Mr. Schmidt asked if there were any additions or revisions to be made to the minutes of the August 29, 2006, meeting of the Committee.

Ms. Jooss noted the following typographical errors (In these revisions and subsequent revisions in these minutes, added text is indicated in bold letters): 1) in the fourth paragraph on page 3, the two occurrences of the word “nearshore” should not be capitalized, 2) the third word in the second sentence of the text to be added as indicated in the last Secretary’s Note on page 4 should be concentrations, 3) the second last sentence of the last paragraph on page 7 should be revised to read “Ms. Jooss noted that there is not a land segment..., and 4) in the sentence before the last Secretary’s Note on page 8, the word “by” should be replaced with “be.”

Regarding the third Secretary’s Note on page 4, Mr. Melching said that *E. coli*. data were only available from 2000 through 2004 and he asked that the note be revised to reflect that.

Mr. Melching referred to the last Secretary’s Note on page 5 which provided an explanation of the limitations of examining available data to detect possible correlations between increasing water temperatures in Lake Michigan and increasing air temperatures. He said that he did not think a detailed temperature analysis was warranted, but it is important to generally look at air temperature trends to see if they could be affecting water temperatures. He noted that if no correlation were found, then the increasing water temperature trend would logically be attributed to human-induced causes and actions to mitigate the human actions might be warranted. Mr. Melching said that biweekly temperatures are recorded at MMSD monitoring sites and he asked whether daily temperatures were recorded at any Lake Michigan sites. Mr. Hahn said that the air temperature data recorded at the General Mitchell International Airport National Weather Service Station would be analyzed for trends.

Mr. Melching suggested that the footnote that is to be added per the first Secretary’s Note on page 10 be revised to recognize that biochemical oxygen demand data were available for the model calibration and validation, but the model actually simulated carbonaceous biochemical oxygen demand.

[Secretary’s Note: The footnote was revised to read as follows:

“Biochemical oxygen demand data were available for the model calibration and validation, but the model actually simulated carbonaceous biochemical oxygen demand. Typically, carbonaceous biochemical oxygen demand may be assumed to approximate five-day biochemical oxygen demand values. Thus, the use of biochemical oxygen demand data for model calibration/validation is considered to be acceptable.”]

There being no further additions or revisions, the minutes were approved as revised, on a motion by Mr. Moroney, seconded by Mr. Shafer, and carried unanimously.

CONSIDERATION OF THE PRELIMINARY DRAFT OF CHAPTER XI, “GROUNDWATER QUALITY CONDITIONS AND SOURCES OF POLLUTION IN THE STUDY AREA,” OF SEWRPC TECHNICAL REPORT NO. 39, *WATER QUALITY CONDITIONS AND SOURCES OF POLLUTION IN THE GREATER MILWAUKEE WATERSHEDS*

Mr. Schmidt asked Mr. Hahn to review the preliminary draft chapter.

Mr. Lubner asked that the fourth sentence in the second paragraph on page 1 be revised to state that surface waters may lose water from outflow to groundwater.

[Secretary's Note: That sentence was revised to read as follows:

“... lose water from outflow to **groundwater**;]

Mr. Melching suggested that Figure XI-3 be redesignated as Figure XI-2 and be referenced in the sixth paragraph on page 3.

[Secretary's Note: Following the meeting, Mr. Melcher noted that the Niagara aquifer referred to in that paragraph was not previously mentioned in the text. To address that comment, along with the comment on the figure, the end of the first sentence in the paragraph was revised to read as follows:

“both the **dolomite** and sandstone aquifers (**see Figures XI-1 and XI-2**).”

All existing references to Figure XI-3 were changed to XI-2 and all existing references to Figure XI-2 were changed to XI-3.]

Mr. Melching noted that it appeared that the Galena-Platteville aquifer did not occur within the study area, and, thus, it should be removed from the legend for Map XI-2.

On Map XI-4, Mr. Lubner asked that a different color be used for the “121-180 Hard” legend item to better distinguish it from the color used to indicate Lake Michigan.

[Secretary's Note: That revision was made.]

Mr. Bunker said that the presence of magnesium in groundwater has been identified as a possible concern in the Madison, Wisconsin, area and he suggested that the Commission staff look into that situation as it relates to the discussion of groundwater quality issues in the chapter.

[Secretary's Note: The Commission staff will research this issue.]

Mr. Melching noted that the last paragraph on page 8 states that the WDNR recently tested municipal water systems for volatile organic chemicals, but the second full paragraph on that page referred to 1985 data and did not cite the more-recent data. He said that the more-recent data should be reported.

[Secretary's Note: The first sentence in the last paragraph on page 8 was moved to the end of the second full paragraph on page 8 and was revised to read as follows:

“**Subsequent to the 1985 sampling**, the WDNR tested all municipal water systems in the State and a large number of noncommunity and private wells for VOCs.”

The Commission staff is coordinating with the WDNR to obtain the test data and to present the results in this chapter. That information will be presented to the Committee at a later date.]

Referring to the identification in the second full paragraph on page 10 of “clusters of onsite sewage disposal systems” as potential sources of groundwater contamination, Mr. Mueller said that he believed that the age of an onsite system is more of a problem than the density of such systems. He noted that systems installed prior to 1980 are unregulated; are not being systematically replaced; and are not required to be evaluated, including when

properties are sold. He also said that the first full paragraph on page 10 should refer to older failing systems as a source of groundwater contamination.

Ms. Anderson noted that onsite sewage disposal systems are commonly referred to as privately owned waste treatment systems, or POWTS.

[Secretary's Note: The following footnotes were added after "clusters of onsite sewage disposal systems," in the third sentence of the second full paragraph on page 9:

"Commonly referred to as privately owned waste treatment systems, or POWTS."

"The age of an onsite system is also of concern regarding the potential for groundwater pollution because as a system ages it becomes more susceptible to failure and certain older systems may have been constructed to less stringent standards than newer systems. Systems installed prior to about 1980 are unregulated; are not systematically replaced; and are not required to be evaluated, including at the time of sale of a property. The individual watershed chapters of this report include maps that generally identify areas with systems that were installed in, or before, 1980."]

Also, the second last sentence in the first paragraph on page 10 was revised to read as follows:

"In these areas, clustered onsite systems and potentially failing systems installed around 1980 or before are a potential source of contamination to the groundwater."]

Mr. Bunker said that during the debate over promulgation of Chapter Comm 83 of the *Wisconsin Administrative Code*, it was pointed out that failure of onsite systems that are located in areas with less permeable soils could lead to surface water contamination.

[Secretary's Note: The following footnote was added after the last sentence on page 9:

"The 2000 amendments to Chapter Comm 83 permit the installation of onsite sewage disposal systems on less permeable soils than was previously allowed. Failure of systems installed on less permeable soils could lead to a greater potential for surface water contamination."]

Regarding the subsection on **Major Livestock Operations** on pages 11 and 12, Ms. Gayan noted that there are currently a total of 12 concentrated animal feeding operations (CAFOs) in the region, thus, the presence of six operations in the study area is significant. She also said that the WDNR had three pending applications for new CAFOs and that she would send information on those to the Commission staff.

Mr. Bunker questioned the use of the term "hazardous chemicals" in the fourth sentence of the first full paragraph on page 11. He noted that regulations governing industrial sludges or residual solids and municipal biosolids require that the concentrations of potentially hazardous substances be reduced to nonhazardous levels.

[Secretary's Note: The last paragraph of the **Land Application of Liquid Waste and Sewage Sludge** subsection refers to appropriate treatment of municipal residuals prior to land application and to the expectation of no impact on groundwater from current land application of wastewater biosolids. To provide further clarification the following revisions were made:

The word "hazardous" was removed from that sentence. And the following footnote was added at the end of the sentence:

“Regulations governing land application of industrial sludges or residual solids and municipal biosolids require that the concentrations of potentially hazardous substances be reduced to nonhazardous levels.”]

Mr. Lubner noted that Table XI-7 does not include places for bulk agricultural chemical storage and mixing/loading facilities in Dodge, Fond du Lac, and Sheboygan Counties. Mr. Hahn replied that data were being assembled for that table and he said that information would be provided for those counties in addition to the others in the study area.

Regarding the potential for improperly abandoned wells to cause groundwater contamination as described on pages 13 and 14, Ms. Gayan said that the WDNR requires each community to have ordinances requiring municipal oversight and monitoring of abandoned wells.

Mr. Mueller noted that the following two major considerations were missing from the **SOURCES OF GROUNDWATER CONTAMINATION** section:

1. There is a relatively low level of enforcement and inspection for potential groundwater contamination sources. Onsite sewage disposal systems and holding tanks are not periodically inspected. Septage and holding tank waste spreading are not inspected onsite and there are many abuses. The State delegated authority over well abandonment to counties on a voluntary basis, thus, some counties do enforce well abandonment requirements, while others do not. Simply listing the applicable regulations is misleading because of the problems related to enforcement. Because of budget cuts at the State level, the State is not inspecting illegal dumping and spreading of septic tank waste.
2. The report should include a subsection on illegal dumping, which is a major source of groundwater contamination. Counties have records of enforcement actions and the WDNR keeps record of waste haulers who have had their licenses revoked.

Ms. Gayan replied that 1) the WDNR investigates illegal dumping whenever they receive information on such possible activities, 2) they regulate septage hauling and monitor spreading on fields, and 3) septage hauling trucks are inspected annually.

[Secretary’s Note: The following footnote was added after the second sentence of the first paragraph of the **Improperly Abandoned Wells** subsection on page 13:

“Private well abandonment ordinance requirements for municipalities and for counties are set forth in Chapters NR 811, “Requirements for the Operation and Design of Community Water Systems,” and NR 845, “County Administration of Ch. NR 812, Private Well Code,” of the *Wisconsin Administrative Code*. Well abandonment is regulated by the WDNR unless a county voluntarily seeks, and obtains, authorization to adopt and enforce an abandonment ordinance under Chapter NR 845 or a municipality obtains such authorization under Chapter NR 811.”

(The Commission staff is working on an inventory of which cities, villages, and counties in the study area have well abandonment ordinances. The results of that inventory will be incorporated in this chapter and presented to the Committee at a later date.)

In addition the following subsection was added to the **SOURCES OF GROUNDWATER CONTAMINATION** section after the **Land Application of Liquid Waste and Sewage Sludge** subsection on page 11:

Illegal Dumping and Spreading of Septage and Holding Tank Waste

Although the WDNR 1) investigates illegal dumping whenever they receive information on such possible activities, 2) regulates septage hauling and monitors spreading on fields, and 3) inspects septage hauling trucks annually, illegal dumping was identified by the regional water quality management plan update technical advisory committee as a potentially significant source of groundwater contamination. It was noted that 1) there is a relatively low level of enforcement and inspection for potential groundwater contamination from onsite sewage disposal systems and holding tanks, 2) septage and holding tank waste spreading are not inspected onsite, and 3) the ability of the State to inspect illegal dumping and spreading of septage and holding tank waste is hampered by staff limitations resulting from budgetary restrictions.]

Mr. Melching noted that the third sentence in the second paragraph on page 14 required clarification.

[Secretary's Note: The sentence was revised to read as follows:

Unfortunately, it is not possible to match well abandonment records with the original WCRs.”]

Mr. Melching also noted that in the third sentence of the third paragraph on page 14, the word “four” should be replaced with “three.”

Mr. Lubner suggested replacement of the colon in the third sentence of the third paragraph on page 14 with a dash or parentheses.

[Secretary's Note: The sentence was revised to read as follows:

By comparing numbers from various sources, the WDNR has estimated that within the study area, **three** areas—Milwaukee County, eastern Waukesha County, and eastern Racine County—have the most abandoned wells.”]

Mr. Moroney asked that the fourth sentence of the first paragraph of the *Naturally Vulnerable Areas* subsection on page 20 be revised to clarify its meaning.

[Secretary's Note: The sentence was revised to read as follows:

The areas where these two categories overlap each other have **the greatest potential for contamination** and require special attention because certain land uses, accidents, or mishandling of hazardous materials may create serious contamination problems.”]

Ms. Nenn asked that, on Maps XI-8 and XI-9, either the surface water features be shown using a more-contrasting color or that they be eliminated from the maps since they are not essential to those particular maps.

[Secretary's Note: The Commission staff will look into making changes as suggested for Maps XI-8, XI-9, and XI-10.]

Mr. Moroney observed that Map XI-10 might more appropriately be entitled “Areas Naturally Vulnerable to Contamination of the **Shallow Aquifer** in the Portion of the Study Area within the Southeastern Wisconsin Region.” It is correct that for the portion of the study area within the Region the map depicts the vulnerability to contamination of the shallow aquifer. That is a result of the presence of the Maquoketa shale confining layer beneath all of that area. However, because this map also depicts areas outside the study area (for the purpose of

locating the critical recharge areas in the western part of the Region), there may be the potential for contamination of the deep aquifer in areas that do not include the Maquoketa shale layer.

Mr. Lubner asked that the study area boundary be highlighted on Map XI-10. There was some discussion of possible alternatives to presenting information for the entire Region on Map XI-10. Ms. Krause and Ms. Jooss supported showing information outside the study area boundary.

[Secretary's Note: In response to the comments from Mr. Moroney and Mr. Lubner, the following revisions were made:

The title of the map was changed to:

“Areas Naturally Vulnerable to Groundwater Contamination in the Southeastern Wisconsin Region”

A note was added to the map stating that:

“Within the portion of the study area within the Region this map depicts the vulnerability to contamination of the shallow aquifer.”

The regional water quality management plan update study area boundary was added as an item in the legend.]

Referring to the last sentence of the first partial paragraph on page 21, Mr. Melching asked if the Commission staff intended to map potential problem areas by correlating the map of naturally vulnerable areas with maps of identified contamination sources. Mr. Hahn replied that some contamination sources would be mapped separately, but potential problem area maps would not be prepared for this plan. He said such maps could be prepared under second level plans that would focus on specifically identifying problem areas in more-localized geographic areas. Ms. Gayan noted that the WDNR has a source water identification mapping program and she said that information is confidential and is not released to the public.

Ms. Nenn said that the first sentence in the second full paragraph on page 21, which states that, “At present, the known existing sources of contamination, as determined in the contamination source inventory, do not present a widespread threat to groundwater quality,” appears to contradict the remainder of the paragraph. Mr. Hahn replied that the implication of the paragraph when taken as a whole is that the threats to groundwater quality are manageable.

Mr. Moroney asked that the term “urban areas” be defined in the first full sentence in the first partial paragraph on page 2 of Appendix I of the chapter.

[Secretary's Note: The following footnote was added after the sentence in question:

“Urban areas were defined as those areas generally designated as urban under the Regional Planning Commission land use inventory. Those areas include residential, commercial, industrial, and governmental and institutional lands, as well as land designated in the transportation, communications, and utilities category.”]

Mr. Bunker noted that although Tables XI-2 and XI-3 provide information for the entire area of all counties contained either wholly or partially within the study area, the data could be somewhat misleading because certain counties, including Racine County, only have a portion of their area in the study area. Ms. Krause said that the information presented in those two tables should be considered together, and she asked if they could be redesignated in a manner that ties the two together.

[Secretary's Note: Footnote "a" in each table states: ^aIncludes all water use for the entire counties, including those only *partially within the study area*. To highlight that situation, footnote "a" in each table will be shown in bold type. Also, Table XI-2 and XI-3 will be formatted in the final report so that they are presented together within the text, allowing the reader to consider them together.]

A motion to approve preliminary draft Chapter XI, "Groundwater Quality Conditions and Sources of Pollution in the Study Area," of TR No. 39, as amended, was made by Mr. Bunker, seconded by Mr. Holschbach and was carried unanimously by the Committee.

REVISIONS TO CHAPTER XI, OF SEWRPC TECHNICAL REPORT NO. 39 AS SUGGESTED BY MR. MELCHING FOLLOWING THE COMMITTEE MEETING

Following the meeting, Mr. Melching provided Mr. Hahn with an annotated copy of the chapter, suggesting a number of limited editorial revisions that improved the clarity and accuracy of the text. He also pointed out an inconsistency in the citation of sources of information. In certain locations in the chapter and in Appendix I, sources were cited by noting the author and year of publication in parentheses, but there was no list of references given from which to obtain the complete citation.

[Secretary's Note: Mr. Melching's editorial revisions were made and all literature references in the chapter and Appendix I were incorporated in footnotes as is standard practice in Commission publications.]

Mr. Melching asked that the report include a discussion of how the statistical analyses were conducted in cases where pollutant concentrations were below the limits of detection.

[Secretary's Note: Such a description will be included in TR No. 39, Chapter III, "Data Sources and Methods of Analysis."]

Finally, Mr. Melching noted that the table in Appendix K contained repetitive information and he suggested that it be revised.

[Secretary's Note: The revised table is included as Exhibit A.]

COMMENTS ON CHAPTER XI, OF SEWRPC TECHNICAL REPORT NO. 39 AS PROVIDED BY WDNR STAFF FOLLOWING THE COMMITTEE MEETING

The WDNR staff intends to provide additional comments on the draft chapter. At the time that these meeting minutes were finalized in order to provide them to the Advisory committee before the next meeting, the WDNR comments had not yet been received.

MAP XI-6, "AGRICULTURAL CHEMICAL FACILITIES," TABLE XI-7, "BULK AGRICULTURAL CHEMICAL STORAGE AND MIXING/LOADING FACILITIES," MAP XI-6A, "SALT STORAGE SITES," AND TABLE XI-8, "SALT STORAGE FACILITY SITES"

The inventories to produce these maps and tables were in progress at the time of the Committee review of the chapter. They have now been completed and the maps and tables are set forth in Exhibits B, C, D, and E.

[Secretary's Note: The first sentence in the second last paragraph on page 12 was revised to read as follows:

Table XI-8 and Map XI-6a set forth an inventory of salt storage facilities in the study area.]

DETERMINATION OF NEXT MEETING DATE AND LOCATION

The next two meetings of the Advisory Committee were scheduled for Tuesday, October 31, 2006, and Wednesday, November 29, 2006, both beginning at 1:30 p.m. at the Mequon City Hall in the upstairs Council Chambers.

ADJOURNMENT

The September 27, 2006, meeting of the Advisory Committee on the regional water quality management plan update was adjourned at 10:29 a.m. on a motion by Mr. Moroney, seconded by Ms. Anderson and carried unanimously by the Committee.

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#121673 V1 - RWQMP UPDATE MINUTES 09/27/06
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MGH/pk
10/07/06, 10/18/06

Exhibit A

Technical Report No. 39

WATER QUALITY CONDITIONS AND SOURCES OF POLLUTION IN THE GREATER MILWAUKEE WATERSHEDS

Appendix K

COMPARISONS OF ARTIFICIAL RECHARGE TECHNOLOGIES

Technology	Description	Advantages	Limitations	Aquifer Suitability
Surface Infiltration (general comments apply to all technologies within this category)	--	<ul style="list-style-type: none"> • Initial low capital construction cost • Maintenance can be simple and low cost • Low operation and maintenance costs • Can use untreated surface water • Can co-exist with recreation use or wildlife habitat 	<ul style="list-style-type: none"> • Require near-surface aquifer • Require permeable soil profile/high vertical permeability • Require frequent maintenance to prevent clogging • Evaporation losses can be high • Vulnerable to surface contamination • Land availability and cost • May be incompatible with nearby land uses • Regulatory considerations 	<p>All of the technologies listed under the "Surface Infiltration" heading, except "Selected Stormwater Management Measures," have the following suitability characteristics:</p> <ul style="list-style-type: none"> • Unconfined aquifers with surface exposure • Alluvium • Semi-consolidated sediments at outcrop • Highly fractured bedrock
Infiltration Ponds and Basins Spreading Basins	Engineered off-channel structures (rectilinear)	<ul style="list-style-type: none"> • Can adapt former gravel pits and quarries 	<ul style="list-style-type: none"> • Can require large tracts of land 	See list for "Surface Infiltration"
Selected Stormwater Management Measures	Grassed swale drainage systems, including grassed roadway drainage ditches, bioretention basins, surface sand filters, and rain gardens	<ul style="list-style-type: none"> • Commonly used practices • Serve multiple purposes by reducing runoff rates and volumes and potentially reduce nonpoint source pollution 	<ul style="list-style-type: none"> • Limited in areas with poorly drained soils • Requires water quality impact evaluation 	<ul style="list-style-type: none"> • Unconfined aquifers with surface exposure • Alluvium
Leaky Ponds and Reservoirs	Allow existing structure to leak	<ul style="list-style-type: none"> • Can utilize existing structures 	<ul style="list-style-type: none"> • Very site-specific 	See list for "Surface Infiltration"
Infiltration Ditches Ditch/Furrow	Engineered off-channel structures (linear)	<ul style="list-style-type: none"> • Adapt to irregular topography 	<ul style="list-style-type: none"> • Very site-specific 	See list for "Surface Infiltration"
Leaky Ditches	Allow existing structure to leak	<ul style="list-style-type: none"> • Utilize existing structure 	<ul style="list-style-type: none"> • Very site-specific 	See list for "Surface Infiltration"
Dry Stream Channels	Divert flow into the natural channel of an ephemeral stream	<ul style="list-style-type: none"> • Utilize natural topographic feature 	<ul style="list-style-type: none"> • Very site-specific • Environmental concerns 	See list for "Surface Infiltration"

Appendix K (continued)

Technology	Description	Advantages	Limitations	Aquifer Suitability
Surface Infiltration (continued) Closed Depressions, Including Kettles	Use natural depressions that catch water in wet cycles	<ul style="list-style-type: none"> Utilize natural topographic feature 	<ul style="list-style-type: none"> Very site-specific Require soil modification to break-up/remove native low permeability soils 	See list for "Surface Infiltration"
Land Application	Surface irrigation at rates that exceed crop consumptive use	<ul style="list-style-type: none"> Combine with agricultural or recreational land use Generate revenue from crops or recreational fees 	<ul style="list-style-type: none"> Require large tracts of land 	See list for "Surface Infiltration"
Subsurface Infiltration (general comments apply to all technologies within this category)	--	<ul style="list-style-type: none"> Can be used where surface layers of low permeability preclude surface infiltration Can co-exist with other surface urban uses such as parking lots and recreation facilities Minimize evaporation losses 	All of the technologies listed under the "Subsurface Infiltration" heading have the following limitations: <ul style="list-style-type: none"> Higher initial capital costs Limited aerial extent Difficult to clean/maintain Dependent upon near-surface geology 	All of the technologies listed under the "Subsurface Infiltration" heading have the following suitability characteristics: <ul style="list-style-type: none"> Unconfined aquifers Alluvium Semi-consolidated sediments at outcrop Highly fractured bedrock
Infiltration Trenches	Perforated pipe embedded in a gravel-filled ditch	<ul style="list-style-type: none"> Compatible with urban land uses 	See list for "Subsurface Infiltration"	See list for "Subsurface Infiltration"
Infiltration Galleries	Similar to trenches, except in arrays	<ul style="list-style-type: none"> Can cover larger areas 	See list for "Subsurface Infiltration"	See list for "Subsurface Infiltration"
Dry wells	Wells completed above the water table	Can be used where space is limited	See list for "Subsurface Infiltration"	See list for "Subsurface Infiltration"
Infiltration Pits/Shafts	Large diameter bore or excavation to penetrate near-surface low-permeability soils	<ul style="list-style-type: none"> Can be used where space is limited 	See list for "Subsurface Infiltration"	See list for "Subsurface Infiltration"
Direct Injection (general comments apply to all technologies within this category)	--	<ul style="list-style-type: none"> Can be used where vertical permeability is limited Occupy small surface areas Can fit in with most land-use patterns Can utilize existing water supply infrastructure 	<ul style="list-style-type: none"> Require pre-treatment to drinking water standards Require tight control over source water quality High capital costs, when existing infrastructure is not available 	<ul style="list-style-type: none"> Unconfined aquifers with limited surface exposure Confined aquifers Deep alluvium Sedimentary bedrock aquifers

Appendix K (continued)

Technology	Description	Advantages	Limitations	Aquifer Suitability
Direct Injection (continued)			<ul style="list-style-type: none"> • High energy requirements, high operation and maintenance costs • Require frequent pumping to remove clogging • Contamination from recharge would be difficult to remediate 	
Injection Wells/Aquifer Storage and Recovery (ASR) Wells	Wells that are either used solely for injecting water (injection wells) or both injection and recovery (ASR wells)	<ul style="list-style-type: none"> • Can be used for deep aquifers • Low capital costs, when existing infrastructure is available 	<ul style="list-style-type: none"> • High capital costs • Potential reactions between injected water and native formation or groundwater 	<ul style="list-style-type: none"> • All of above • Abandoned mines • Karst, caverns
River Bank Filtration and Induced Recharge (general comments apply to all technologies within this category)	Well or well field completed near or under a surface waterbody designed to induce groundwater recharge	<ul style="list-style-type: none"> • Can increase the source of supply available • Reduces demand on groundwater • Provides significant improvement in source water quality 	<ul style="list-style-type: none"> • Requires surplus surface water • Requires permeable connection between surface water and wells • Plugging of surface waterbed reduces yield over time • Higher level of treatment required than for most groundwater sources 	<ul style="list-style-type: none"> • Shallow aquifers in direct connection with surface water
Radial Collection Wells (Raney well)	Large diameter collector well with horizontal radial bores	<ul style="list-style-type: none"> • High infiltration rates from a single point 	<ul style="list-style-type: none"> • High initial capital costs 	<ul style="list-style-type: none"> • Unconsolidated aquifers
Horizontal Wells	Small diameter well that deviates from vertical to horizontal with depth	<ul style="list-style-type: none"> • High infiltration rates from a single point 	<ul style="list-style-type: none"> • High initial capital costs • Unproven technology 	<ul style="list-style-type: none"> • All of above
Enhanced Recharge	Modification of land use or vegetation to increase recharge	<ul style="list-style-type: none"> • Low input and low maintenance 	<ul style="list-style-type: none"> • Limited potential to increase recharge 	<ul style="list-style-type: none"> • Unconfined aquifers
Other Artificial Recharge Technologies Detention Dams, Dikes and Weirs	Engineered structures in the channel of a stream to catch natural flow and enhance natural recharge	<ul style="list-style-type: none"> • Low operation and maintenance costs 	<ul style="list-style-type: none"> • Very site-specific • Environmental concerns 	<ul style="list-style-type: none"> • Unconfined aquifers with surface exposure • Alluvium • Semi-consolidated sediments at outcrop • Highly fractured bedrock

Appendix K (continued)

Technology	Description	Advantages	Limitations	Aquifer Suitability
<p>Other Artificial Recharge Technologies (continued)</p> <p>Groundwater Dams</p>	<p>Structures in the aquifer that intercept or obstruct natural groundwater flow</p>	<ul style="list-style-type: none"> • Do not necessarily require outside source of water • Low operation and maintenance costs • Low evaporation losses 	<ul style="list-style-type: none"> • Site-specific and limited to shallow aquifers with small cross-sectional areas • High construction costs for larger, deeper aquifers 	<ul style="list-style-type: none"> • Unconfined aquifers with surface exposure • Alluvium
<p>Adits/Sh shafts/Natural Openings</p>	<p>Allow water to flow into cavern or mine using open shaft</p>	<ul style="list-style-type: none"> • High recharge rates 	<ul style="list-style-type: none"> • Vulnerability to contamination • Site-specific 	<ul style="list-style-type: none"> • Abandoned coal and metal mines, caverns • Karst • Caverns

Source: Modified from Topper et. al., Colorado Geological Survey Department of Natural Resources, *Artificial Recharge of Ground Water In Colorado - A Statewide Assessment, 2004.*

Exhibit B

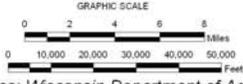
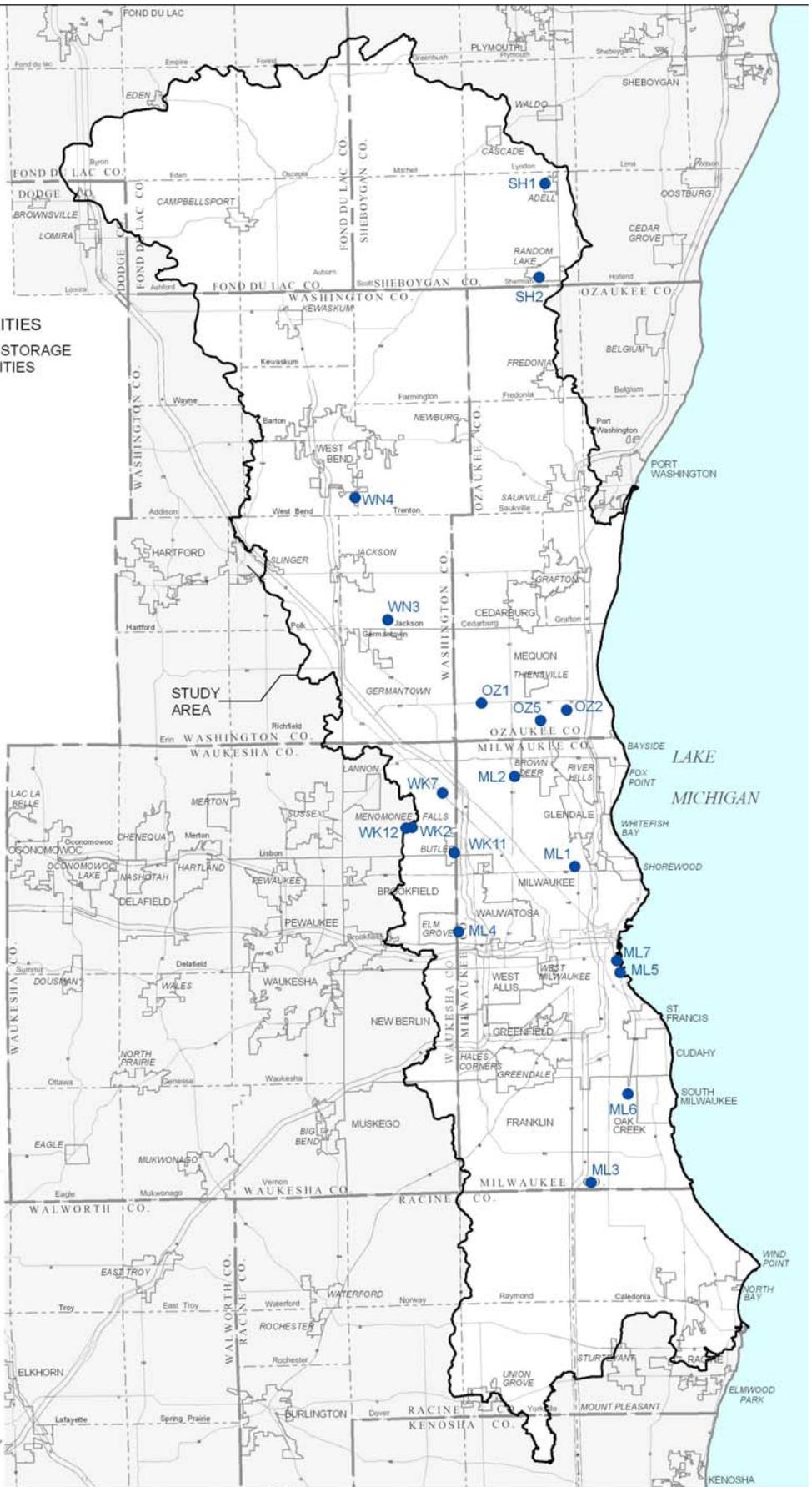
Map XI-6

AGRICULTURAL CHEMICAL FACILITIES WITHIN THE REGIONAL WATER QUALITY MANAGEMENT PLAN UPDATE STUDY AREA

AGRICULTURAL CHEMICAL FACILITIES

- BULK AGRICULTURAL CHEMICAL STORAGE AND MIXING AND LOADING FACILITIES

WK7 IDENTIFICATION NUMBER (SEE TABLE XI-7)



Source: Wisconsin Department of Agriculture, Trade, and Consumer Protection and SEWRPC.

Exhibit C

Table XI-7

BULK AGRICULTURAL CHEMICAL STORAGE AND MIXING/LOADING FACILITIES WITHIN THE REGIONAL WATER QUALITY MANAGEMENT PLAN UPDATE STUDY AREA: 2005

Identification Number ^a	Name and Site Address	Location by U.S. Public Land Survey
Milwaukee County ML1	Happy Lawns, Inc. 4220 N. Teutonia Ave. Milwaukee, WI	T7N, R22E, Section 6, NE 1/4 of the SW 1/4
ML4	Hawks Nursery Company 12217 Watertown Plank Road Wauwatosa, WI	T7N, R21E, Section 30, NW 1/4 of the NW 1/4
ML2	Hydrite Chemical Company 7300 W. Bradley Road Milwaukee, WI	T6N, R21E, Section 10, SW 1/4 of the SW 1/4
ML5	Kinder Morgan Energy Partners 1900 S. Harbor Drive Milwaukee, WI	T6N, R22E, Section 4, SW 1/4 of the NE 1/4
ML6	Kujawa Enterprises, Inc. 824 E. Rawson Ave. Oak Creek, WI	T5N, R22E, Section 3, SW 1/4 of the SW 1/4
ML7	Milwaukee Metropolitan Sewerage District 700 E. Jones Street Milwaukee, WI	T7N, R22E, Section 33, SW 1/4 of the SE 1/4
ML3	PPG Industries, Inc. 10800 13th Street Oak Creek, WI	T5N, R22E, Section 32, NW 1/4 of the SW 1/4
Ozaukee County OZ5	Buckley Tree Service, Inc. 10351 N. Cedarburg Road Mequon, WI	T9N, R21E, Section 35, NW 1/4 of the NE 1/4
OZ2	North Shore Country Club 10757 Range Line Road Mequon, WI	T9N, R21E, Section 25, NE 1/4 of the SE 1/4
OZ1	Walter Baehmann Farms 9919 W. Mequon Road Mequon, WI	T9N, R21E, Section 29, NE 1/4 of the NW 1/4
Sheboygan County SH1	Adell Cooperative Union 707 Mill Street Adell, WI	T13N, R21E, Section 2, NE 1/4 of the SW 1/4
SH2	Kettle Lakes Cooperative 403 1st Street Random Lake, WI	T13N, R21E, Section 34, NE 1/4 of the SE 1/4
Washington County WN4	Gundrum Brothers Farm Supply, Inc. 1095 Rusco Drive West Bend, WI	T11N, R19E, Section 36, NE 1/4 of the NE 1/4
WN3	Vogel Seed & Fertilizer, Inc. 1891 Spring Valley Road Jackson, WI	T10N, R20E, Section 33, NW 1/4 of the SE 1/4

Table XI-7 (continued)

Identification Number ^a	Name and Site Address	Location by U.S. Public Land Survey
Waukesha County WK2	Associated American Landscape N60 W16073 Kholer Lane Menomonee Falls, WI	T8N, R20E, Section 27, SE 1/4 of the SE 1/4
WK11	LCS Lawn Service 4908 N. 125th Street Butler, WI	T8N, R20E, Section 36, SE 1/4 of the SE 1/4
WK7	North Hills Country Club N73 W13430 Appleton Ave. Menomonee Falls, WI	T8N, R20E, Section 13, NE 1/4 of the SW 1/4
WK12	Scotts Lawn Service N59 W16600 Greenway Circle Menomonee Falls, WI	T8N, R20E, Section 27, NE 1/4 of the SW 1/4

NOTE: The inventory data in this table are subject to periodic change due to the nature of the facilities. For the most recent data, the Wisconsin Department of Agriculture, Trade and Consumer Protection should be contacted.

^aSee Map XI-6.

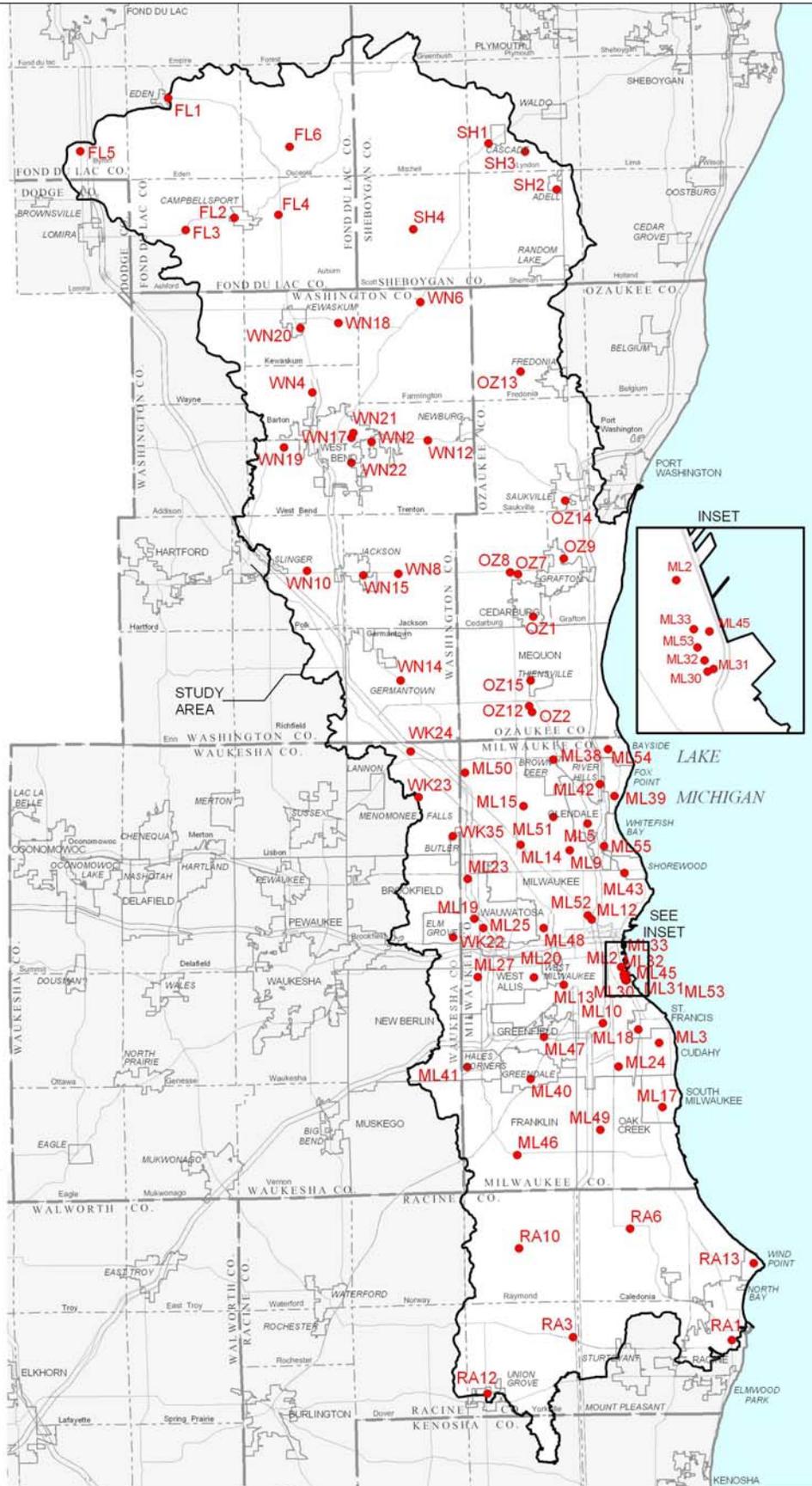
Source: Wisconsin Department of Agriculture, Trade and Consumer Protection and SEWRPC.

Exhibit D

Map XI-6a

SALT STORAGE SITES
WITHIN THE REGIONAL WATER
QUALITY MANAGEMENT PLAN
UPDATE STUDY AREA: 2006

- SALT STORAGE FACILITY SITES
- ML52 SALT STORAGE FACILITY IDENTIFICATION NUMBER (SEE TABLE XI-8)



Source: SEWRPC.

PRELIMINARY DRAFT

Table XI-8 (continued)

Identification Number ^a	Owner	Site Location
Sheboygan County SH1 SH2 SH3 SH4	Sheboygan County Sheboygan County Town of Lyndon Town of Scott	W6451 State Road 28, Lyndon, WI 234 Edgewood Street, Adell, WI W5672 County Road F, Lyndon, WI N1320 Boltonville Road, Scott, WI
Washington County WN2 WN4 WN6 WN8 WN18 WN10 WN12 WN19 WN14 WN15 WN20 WN17 WN21 WN22	City of West Bend Town of Barton Town of Farmington Town of Jackson Town of Kewaskum Town of Polk Town of Trenton Town of West Bend Village of Germantown Village of Jackson Village of Kewaskum Washington County Washington County West Bend School District	251 Municipal Drive, West Bend, WI 3482 Town Hall Road, Barton, WI 9422 State Road 144, Farmington, WI 3685 Division Road, Jackson, WI 9019 Kettle Moraine Drive, Kewaskum, WI 3680 State Road 60, Polk, WI 1071 State Road 33, Trenton, WI 6355 County Road Z, West Bend, WI W172 N12205 Fond du Lac Road, Germantown, WI W204 N16690 Jackson Drive South, Jackson, WI US Highway 45 at County Road H, Kewaskum, WI 620 E. Washington Street, West Bend, WI 900 Lang Street, West Bend, WI 1065 S. Indiana Avenue, West Bend, WI
Waukesha County WK35 WK22 WK24 WK23	Village of Butler Village of Elm Grove Village of Menomonee Falls Village of Menomonee Falls	12975 Old Silver Spring Road, Butler, WI 900 Wall Street, Elm Grove, WI W164 N9183 Water Street, Menomonee Falls, WI N72 W15920 Good Hope Road, Menomonee Falls, WI

NOTE: The inventory data on this table is subject to periodic change due to the nature of the facilities. For the most recent data, the Wisconsin Department of Transportation should be contacted.

^aSee Map XI-6a.

Source: Wisconsin Department Transportation and SEWRPC.