Chloride Impact Study for the Southeastern Wisconsin Region

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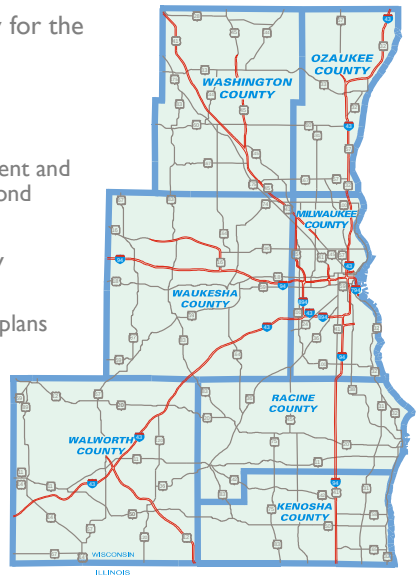
#241628

Outline

- SEWRPC Background
- Regional Chloride Impact Study Scope
- Pilot Testing
- Potential Monitoring Locations – Fox River Watershed
- Study Data Needs
- Collaboration Opportunities

Southeastern Wisconsin Regional Planning Commission (SEWRPC)

- Official Areawide Public Planning Agency for the Seven County Region
- Created in 1960 under State Legislation
- Purpose:
  - Consider and address physical development and infrastructure problems that extend beyond municipal and county boundaries
  - State designated Areawide Water Quality Management Planning Agency
  - Prepare regionwide advisory long-range plans
    - Land Use
    - Transportation
    - Water Quality Management
    - Flooding Management
    - Parks and Open Space
    - Environmental Corridors
    - Natural Areas
    - Water Supply



3

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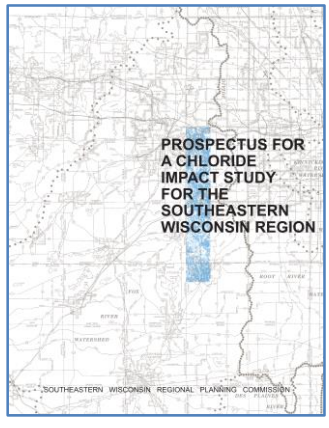
Focus of Chloride Study

Examine potentially significant sources of chloride to the environment:

- Road salt
- Wastewater treatment plants
- Private onsite wastewater treatment systems (e.g., septic systems)
- Water softening (groundwater and surface water source)
- Salt storage areas
- Large agricultural feed lots
- Fertilizers
- Landfills
- Chemical manufacturing
- Food processing



4

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Timeline, TAC and Funding Partners

- Four Year study
- Two Year monitoring (2018-2020)
- Technical Advisory Committee

U.S. Department of Transportation
Federal Highway Administration

SEWRPC
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MMSD
PARTNERS FOR A CLEANER ENVIRONMENT

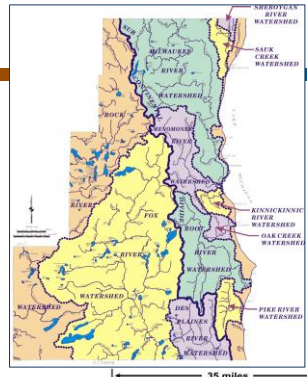
Fund for Lake Michigan
Clearly making a deep impact.

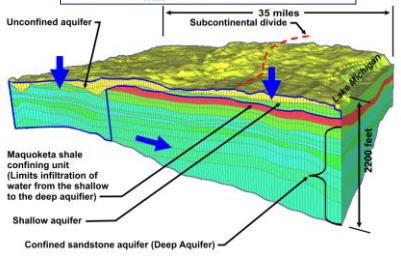
WISCONSIN DEPT. OF NATURAL RESOURCES

5

Impacts of Chloride

- Study would primarily address impacts on surface and groundwater resources
  - Streams, rivers, and lakes (effects on water quality and aquatic life)
  - Shallow groundwater aquifer, source of potable water for many communities and private wells in the Region and baseflow to streams, rivers, lakes, and wetlands
- Study would also consider potentially-affected elements of the terrestrial natural resources base (trees and plants)





Private residential wells are generally in the shallow aquifer and 100 to 300 feet deep. Most municipal wells are 200 to 800 feet deep with some up to 2,200 feet deep, and are in both the shallow and deep aquifer.

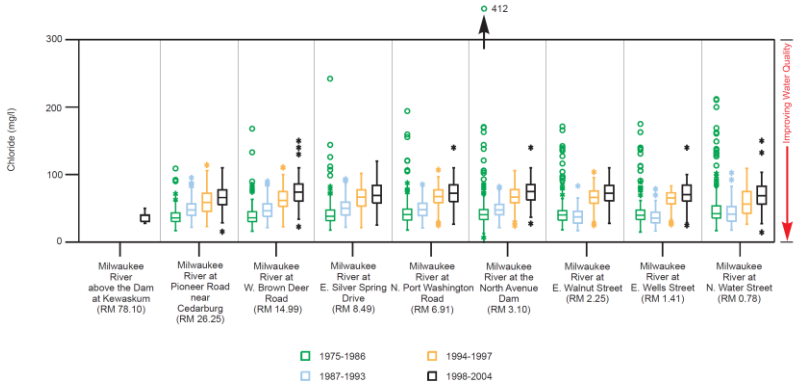
Source: USGS.

6

Need for the Study

Figure 2

CHLORIDE CONCENTRATIONS AT SITES ALONG THE MAINSTEM OF THE MILWAUKEE RIVER: 1975-2004

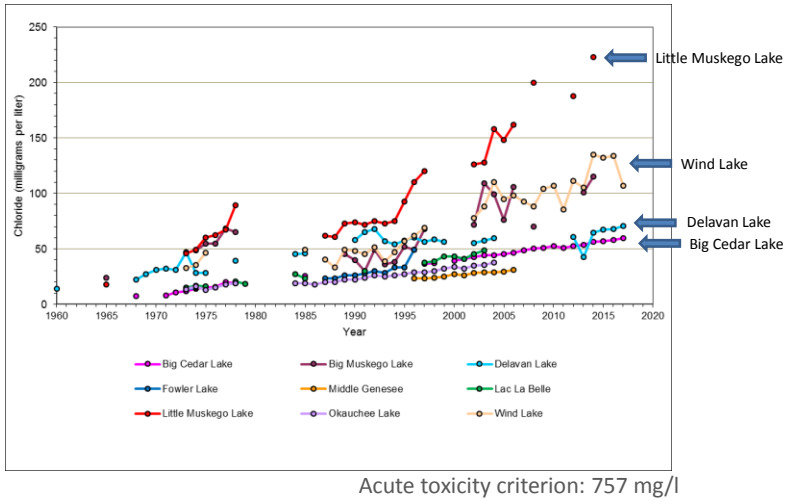


Water Samples Collected from Spring Through Fall

Acute toxicity criterion: 757 mg/l
Chronic toxicity criterion: 395 mg/l

Need for the Study

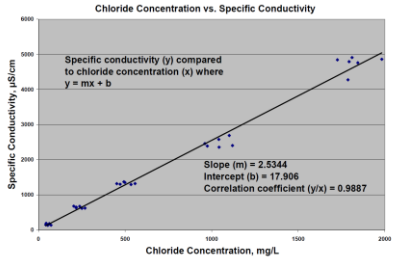
CHLORIDE CONCENTRATION TRENDS FOR ASSORTED LAKES IN SOUTHEASTERN WISCONSIN: 1960-2017



Acute toxicity criterion: 757 mg/l
Chronic toxicity criterion: 395 mg/l

Analyses and Forecasts

- Compile existing data on chloride concentrations, specific conductance (surrogate for chloride), and streamflow
- Over a two-year surface water quality sampling period:
  - Deploy continuous recording data loggers to measure water temperature and specific conductance at 30 to 40 stream, river, and lake locations
  - At data logger locations, collect 10 to 20 individual water samples to be analyzed for concentrations of chloride, total hardness, sodium, potassium, and sulfate
  - Establish relationships between specific conductance and chloride concentration
- Groundwater
  - WDNR chloride concentration data
  - Information from SEWRPC regional water supply plan
  - USGS observation wells
  - UW-Stevens Point private well water chemistry data
  - Municipal well data



Source: In-Situ Inc.

Analyses and Forecasts

- Estimate chloride loads from all sources
- Compare applied loads to measured stream and river loads
- Develop chloride loads and concentrations for existing and planned year 2050 conditions
- Identify geographic areas with existing and/or planned high chloride loads
- Evaluate effects of climate change on planned year 2050 road salt use

EarthSky

State-of-the-Art Activities Affecting Chloride

- Evaluate
  - Toxicity of anti-icing and deicing substances
  - Identify and evaluate best practices and technologies for:
    - Anti-icing and deicing
    - Water softening
    - Fertilizer application
  - Effects of chloride on transportation infrastructure
- Explore legal and policy aspects related to mitigating the effects of chloride on the environment
- Develop performance and cost information for practices and management approaches

11

Alternative Chloride Management Scenarios

- Alternative anti-icing and deicing materials
- Alternative anti-icing and deicing practices
- Legal and policy aspects related to mitigating the effects of chloride
- Meet public safety objectives
- Minimize harm to environment
- Cost-effective

Public Works Magazine

12

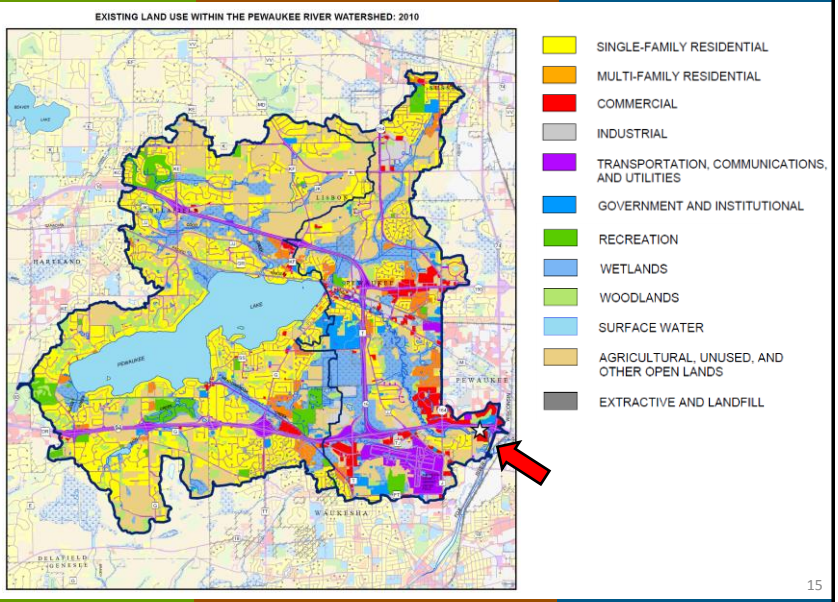
Current Effort: Pilot Testing

- Deploy several types of conductance sensors and data loggers at a common location to:
  - Compare how they perform relative to one another
  - Confirm deployment strategy for winter
  - See how the telemetry performs

Current Effort: Pilot Testing

- Collect water samples
  - Test sampling technique during winter
  - Lab analysis for chloride and other major ions
  - Used to develop correlation to chloride

Pilot Site – Drainage Area



15

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Pilot Site – Monitoring Data

16

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Pilot Site – Monitoring Data

17

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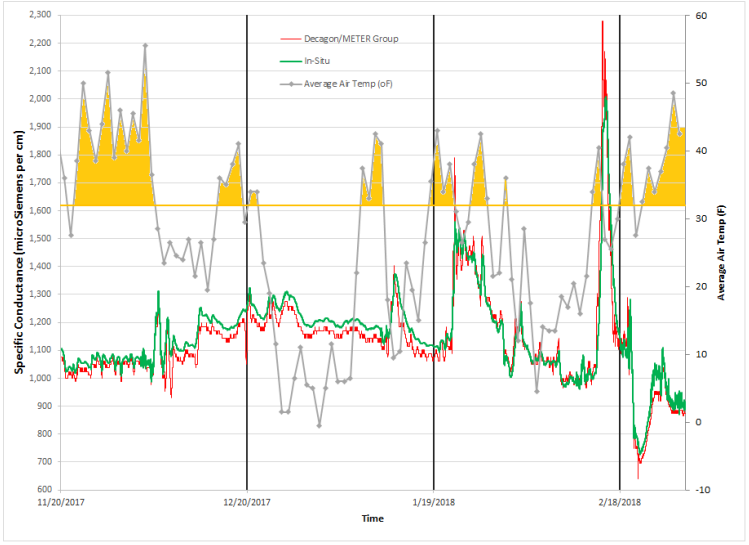
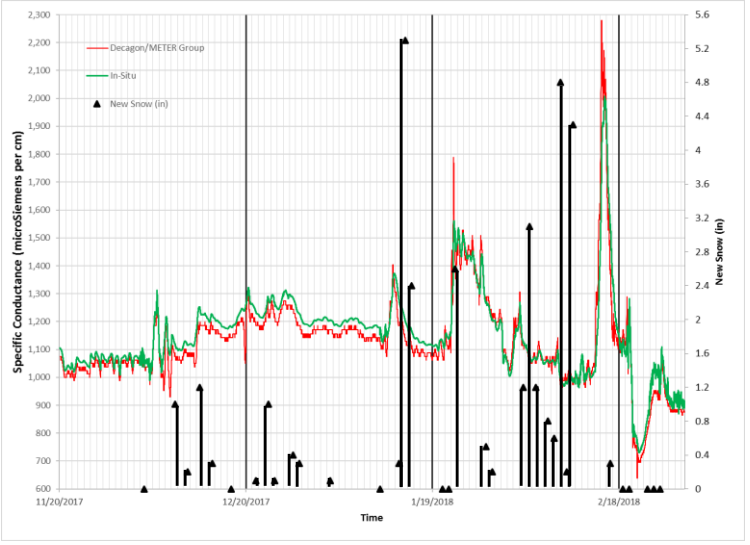


18

Pilot Site – Monitoring Data



19

Current Effort: Pilot Testing

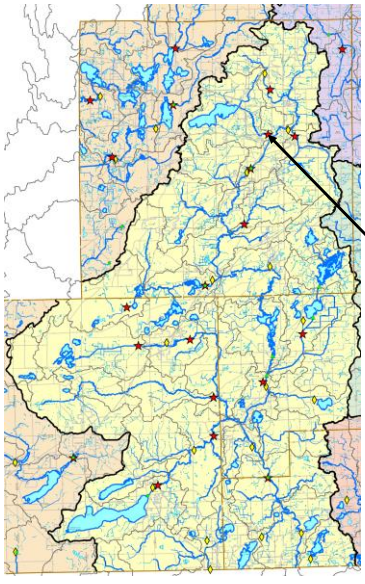
- March 2018 field visit after 4 months operation:
  - Sediment and biofilm accumulation

20

Potential Monitoring Locations – Methodology

- Numerous factors were considered in selecting the Chloride Study monitoring locations
  - Distribution throughout the Region
  - Distribution among the major watersheds
  - Contributing land use
  - Existing streamflow and conductance/chloride monitoring locations
  - Wastewater treatment plant discharges
  - Public ROW and ease of access
  - Sufficient water depth (~3-ft)

Potential Monitoring Locations – Fox River Watershed



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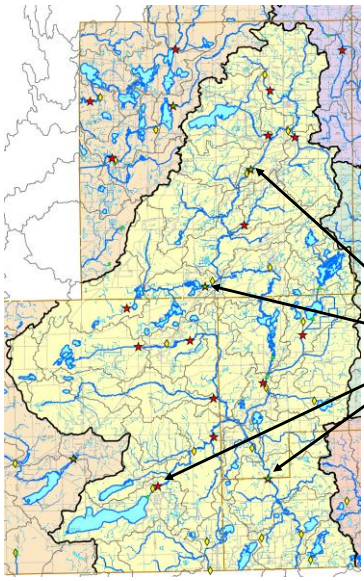
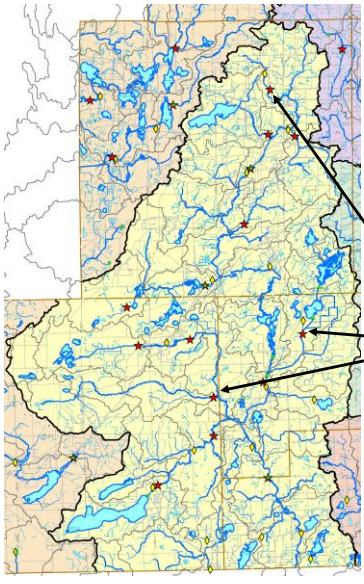


LEGEND
- New Site - Preliminary
- Wastewater Treatment Plant
- USGS Continuous Streamgage
- USGS Continuous Stage Recorder
- SEWRPC Watershed Boundary
- HUC-12 Subwatershed Boundary

Stream Gage Locations
- Fox River at Waukesha and near New Munster
- Mukwonago River at Mukwonago
- White River near Center St

Potential Monitoring Locations – Fox River Watershed



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Different Contributors
- Sussex Creek near CTH F – WWTP and quarries
- Wind Lake Drainage Canal near Hwy K – WWTP and lakes
- Sugar Creek near Hwy DD – rural land use and good stream buffer

Draft Monitoring Costs

- Specific Conductance Sensor for continuous monitoring in streams
  - Three devices range from $750 - $2,300 each
  - Telemetry for two of the devices $600 & $2,000 each
  - Additional supplies for each site are about $100 (cable conduit, PVC pipe housing, stakes, zip ties, concrete block, rope)
  - Total cost per site for equipment $850 - $4,400
- Chloride ISE Sensor for spot sampling and lake profiles
  - Device and cable total cost of approximately $5,000

25

Draft Monitoring Costs

- Lab Costs
  - Approximately $25 per sample for chloride only
  - Approximately $150 per sample for chloride, hardness, sulfate, sodium, potassium, calcium, and magnesium to correlate conductance and chloride
  - Additional costs not included
    - Drive time and expense to lab
    - Ice and cooler for full sampling regimen

26

Study Data Needs

- We will be seeking deicing data from winter maintenance providers (public and private) for both historical (20 yrs) and winter 2018 – 2020:
  - Quantity of deicers used (event and season)
  - Application rates
  - Application practices

27

Opportunity for Collaboration

- Lake Monitoring Support
  - We plan to visit 4-6 lakes in the Region chosen for the Study approximately quarterly to collect a chloride profile
  - For other interested lakes, the following data would be helpful to the Study (in order of complexity) *
    1) One sample collected at outlet at Spring turnover, sent to lab for chloride analysis
    2) Two samples collected at outlet and sent to lab for chloride analysis, one each at Spring and Fall turnover
    3) Purchase conductance meter to develop profiles in lake, and collect samples at depths to correlate with chloride
    4) Purchase conductance meter and continuously monitor at outlet of lake, maintain site, and collect samples periodically to correlate with chloride

* Requires waiver of subrogation to SEWRPC or additional insured added for SEWRPC to insurance of participating organization

28

Opportunity for Collaboration

- Stream Sampling Support
  - We plan to visit each sampling site about once a month to take a sample, calibrate the equipment, and de-foul the sensor as necessary
  - In order to establish a good relationship between conductivity and chloride, we will need to also do targeted sampling during periods of high conductivity
  - We will watch the sensors via telemetry, and may have a day or less to get out for sampling during spiking conductivity
  - Would require the ability to get to the sampling site on short notice, sample the stream near the monitoring location at approximately 6-inches below the surface, and drive the sample to SEWRPC. *

* Requires waiver of subrogation to SEWRPC or additional insured added for SEWRPC to insurance of participating organization

For More Information

- Website for the project
  - http://www.sewrpc.org/SEWRPC/Environment/ChlorideImpactStudy.htm

- Contacts

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