TCMA Chloride Project
TAC meeting #1
September 8, 2010 1-3pm
MPCA Board Room West

Agenda

- **Introductions – team**
- **Overview of the Project – Brooke Asleson & Barb Peichel**
  - **Review feasibility study results (phase I)**
  - **Vision/Goals of the project (phase II)**
  - **Stakeholder process**
  - **Project website**
- **Role of the TAC in project – Brooke Asleson**
- **Timeline & Funding of project – Brooke Asleson**
- **Monitoring Plan – Mike Walerak**
- **Work Plan review/discussion – team**
- **Next meeting (Dec./Jan.)**

TCMA Chloride Project

TAC Meeting #1

Attendees: Brooke Asleson, Barb Peichel, Jennifer Anthony, John Erdmann, Kelly O'Hara, Bob Fossum, Kevin Bigalke, Steve Albrect, Cliff Aichinger, Mark Fishbach, Barb Lioda, Wesley Saunders-Pearce, Tom Struve, Melissa Bokman, Kari Oquist, Pat Byrne

September 8, 2010, 1-3pm, MPCA Board Room West

The group went around and gave introductions including their experience related to chloride/road salt. Some of the intro comments were: Tom said they are making brine for Hennepin County and other cities and retrofitting their fleet. Steve said they have reduced their road salt usage by 35% even though they increased the roads they maintain in the winter.

Overview of the project

1. **Review feasibility study results (phase I)**
    - Meeting attendee comments/concerns:
        - Concerns over using application rates versus purchasing records. Until we have better data on actual application rates, purchasing records will be the default (see "road salt application rates" diagram). Ideally we would like to have accurate application rates. Will work in phase II on data collection.
        - There are a lot of private applicators and it is tough to collect actual application rates from them.
        - Cities vary on how precise their records are on application rates so we should be thoughtful about how to obtain/quantify that type of information.
        - We should also try to use square feet for roads in the future because if we just use lane miles or linear miles, that doesn't account for the very different width of roads (9 to 16 feet).
        - Who is doing lake chloride and conductivity profiles in the Metro?
        - Since we do not have the funding for the research needs, local partners should consider putting a proposal together for the LRRB (Local Road Research Board) and the APWA (American Public Works Association).
2. **Vision/goals of the project (phase II):** Inter-agency team met last March. Talked about results of the study and how we move forward into phase II. A workplan was created. A holistic chloride plan for the 7 county metro area, for ALL waters (inclusive list), not just wait until they are impaired. The vision is to develop goals such as: here is where we are today,

this is what we need to do to maintain WQ, and how to improve those waterbodies that are already impaired. The Plan will address protection and restoration, along with an implementation plan for cities and MS4s to use.

Concern-public expectation of having dry roads. Watersheds and operations will have to work together to help bring about behavior change and expectations. **Response**: the goal is to use this TAC to help bring WDs and WMOs on board to help spread the word about the project and educate the general public. Concern: A lot of cities/entities are willing, but not technically capable to make the changes. **Task 9: Stakeholder process:** Very large audience and entities to involve and engage in the project. This approach will coordinate the various stakeholders and their needs. Please refer to the Stakeholder diagram located on our website under "Current Activities". Notice the overlap between several of the teams. Want expertise on the teams to help advise and make educated decisions. Brooke will be giving project updates through speaking at events and conferences in the metro area to inform and educate various groups and the public on this effort. Project website-fact sheet and full feasibility report are available. The website will be used to provide up to date information and details on the project. We will be looking to all of the members of the various teams for this project to help us disseminate information about the project. **Role of the TAC in project:** The TAC is going to be used to define the work plan and the work that needs to be done to meet the goals of the project. Talk about modeling, protection vs restoration, etc. This group will help guide the project. This team will have quarterly meetings.

Timeline and funding of project-MPCA will be collecting data over the next 3 years. Anticipating 2014 for the end date of the project. Funding of $200,000 available and needs to be spent by June 30, 2013. Once we better know what we need for various tasks, Brooke can request additional funds.

Task 1: Monitoring Plan-A separate plan will be developed for monitoring. Looking at surface and depth chloride monitoring (to use along-side conductivity profiles) of the lakes 3 times during the winter season (early Nov-pre ice, late Jan-drill down through the ice, late March-ice melt). Criteria for choosing the lakes were high road density in the watershed, deep lakes with small surface area, large watershed to lake ratio, some with data suggesting they are impaired, and those with no outlets. Tried to pull in a variety of lakes, and include some of those from Phase I. The first season is a test run to test the monitoring techniques/methods to help us develop the monitoring guidance document. Met Council is also going to monitor 6-8 lakes this winter. Develop protocol for WDs and WMOs to pick up and continue the monitoring.

What will this data collection teach us? The relationship between conductivity and road salt. To build a more robust dataset for the winter months which is when chloride levels are the highest in streams. To further emphasize deep lake samples and further demonstrate that chloride is settling to the bottom of our lakes. There is still some uncertainty that chloride is being retained in our lakes at high concentrations, this data will expand our understanding of how chloride is impacting lake mixing dynamics . We also need to know which lakes are currently exceeding the chloride standard, and prioritize those that are near the standard so that we can prioritize BMP implementation. This data

collection effort will also define the baseline before more development and roads are built in outer Metro areas.

Stream monitoring sites: Monitoring will be conducted at stations where we have existing flow stations that have a good flow record which will primarily be Met Council sites. We (MCES & local partners) will be collecting grab samples during thaw events and will also be exploring how to sample under various ice conditions. For the most part flow will be calculated for the winter months using USGS protocol at locations where freezing conditions make flow measurements impossible.

Work Plan review/discussion: Work plan will be sent out once it is updated, and any final feedback will be solicited.

Task 2: Update existing data compilation with recent data. This task is to update existing data. Take Phase I data and add any chloride or conductivity data that is not routinely added to STORET (we will put a call out for this type of data to local partners). The model to be used is the empirical model developed in Phase I.

Task 3: Categorize & define waterbodies for protection and restoration- This is a separate task to define the different categories of waterbody status in the metro (impaired, not impaired, not assessed/monitored). Note that we do know a few that are impaired, but haven't been added to our 303(d) list yet.

We should either eliminate this task or make sure we really limit the budget for this activity. We use the same equipment for waterbodies that are impaired or not impaired so in the big picture this doesn't really matter.

Question- we need other stakeholders on the TAC? Possibly various teams should be weighing in on the work plan draft. Add IAT to task 3 for review of products. There are five various teams with representatives from all stakeholders that are reviewing and providing feedback to the project team. Additional meetings will also be held or attended with the larger stakeholder group to inform them of the project. We are looking to the representatives on these teams to be bringing information back to the other stakeholders.

Potential Additional Tasks that could be added to the work plan.

Because this project does not have funding to address the research recommendations from Phase I, it was suggested that someone (a local eligible entity) could apply for a 319 research grant to research groundwater and infiltration of chloride.

Prior Lake made the switch to a brine solution because it was an economic benefit to reduce road salt use. The benefit to the lakes was secondary. If we build a good pitch (compile economic data) on how reducing road salt use is cost effective, the cities will buy into the process. Add to task 8 or create a separate task for this activity (i.e. economic analysis or cost effectiveness of using less road salt). Could be a task of the work plan to create or review a cost package for cities.

Broad education/outreach effort should be included as a task to educate the general public on why these changes are necessary. Need to message/market the "why" behind this change. Target elected officials as well. Maybe this should be a separate task in the work plan since we really need a large public outreach/media campaign (i.e. people should slow down when there are poor driving conditions or we have to use more road salt and pollute the waters). It could be on the same scale as the statewide phosphorus ban.

Question-Should Department of Public Safety (DPS) be added to one of the teams?

Task 4: Develop target concentrations for non-impaired waters

Task 5: Source identification -comment-we need to improve assumptions from Phase I.

There are a lot of private applicators and it is tough to collect actual application rates from them.

Can we identify other impervious surfaces besides roads such as parking lots that are salted routinely? Create a map similar to the road surface map? Ramsey-Washington WD can provide information on the study they did. RWWD found that most folks only salt the areas where there is pedestrian traffic. There is some work on agricultural chemicals being a potential source of chloride so we should consider this too.

Task 6: Modeling and Analysis -concern that Wasteload Allocations (WLAs) will be assigned to water bodies not actually on the 303d list. MPCA response: Only waters that are impaired will be given WLAs in the project, the rest will be voluntary protection goals. The final report for this project will be very clear as to what is part of a TMDL (restoration) and what is protection and therefore a suggested goal.

Task 7: Write draft & final Restoration (TMDL) and Protection Plan

Comment: It does make sense to conduct this on a watershed-wide basis.

Task 8: Write draft & final Implementation Plan & long-term monitoring plan

It seems that much of the implementation actions could fall under the MS4 permit. Will this be a Metro-wide implementation plan? Yes.

Cities might see this as another unfunded mandate.

It will be important that we know where we should spend the funding first – on protection or restoration activities and in what areas (developing or already developed).**Question**: Are we not conducting any modeling for lakes in this project? How can we do this for lakes and reaches at the watershed scale? We are considering more of a Load Duration Curve (LDC) approach. We want to work more at the watershed/WMO/WD scale or subwatershed scale (except for listed stream reaches and lakes which will be at a smaller scale.) We are still working out the details for addressing lakes in this project

Are there any Mississippi River chloride issues? Dilution is a big factor – and the fact that chloride is transient in rivers and streams. Downstream drinking water may be a factor.

We need to add lakes in this task and flesh out the type of modeling that will be conducted for the lakes – need this information to be much more detailed in the work plan. Don't want to do that intensive of modeling for lakes – could just classify lakes – watershed: lake area – or do an analysis of lakes instead of conducting a lot of modeling. It would be a waste of funding to pay a consultant to do this.

Get comments on the work plan to Brooke by Sept 17th

Mississippi WMO Board would like a presentation about this project. When do you (Brooke) want to talk about this project? Anytime there is a need or opportunity.

We should distribute the factsheet/website to all WMOs and cities in Metro to get the message out. We should wait until the work plan is finalized before doing this more widespread dissemination.

The work plan will take a few months to revise.

Next meeting: TBD (Winter 2011)

TCMA Chloride Project
TAC meeting #2
October 12, 2011 12-2:30pm
Capitol Region WD office

Agenda

- Update on the project (Brooke, MPCA)
- Review of data analysis so far (Hans Holmberg, LimnoTech)
- Discuss source identification process & application rates (Brooke & Hans)
- Discuss the various road salt sources - how to best separate them out
- Various approaches for setting protection goals (Hans Holmberg)
- Stakeholder communications (Brooke)

Twin Cities Metro Area Chloride Management Plan

Development Project Status Report

TAC Meeting
Oct. 12, 2011

LimnoTech
Water | Environment | Scientists | Engineers

Overview

- Project overview
- Chloride criteria
- Trends
- Chloride-conductivity relationships
- Sources
- Targets
- Next steps

Project Overview

Data Compilation

Categorize Waters

Develop Targets

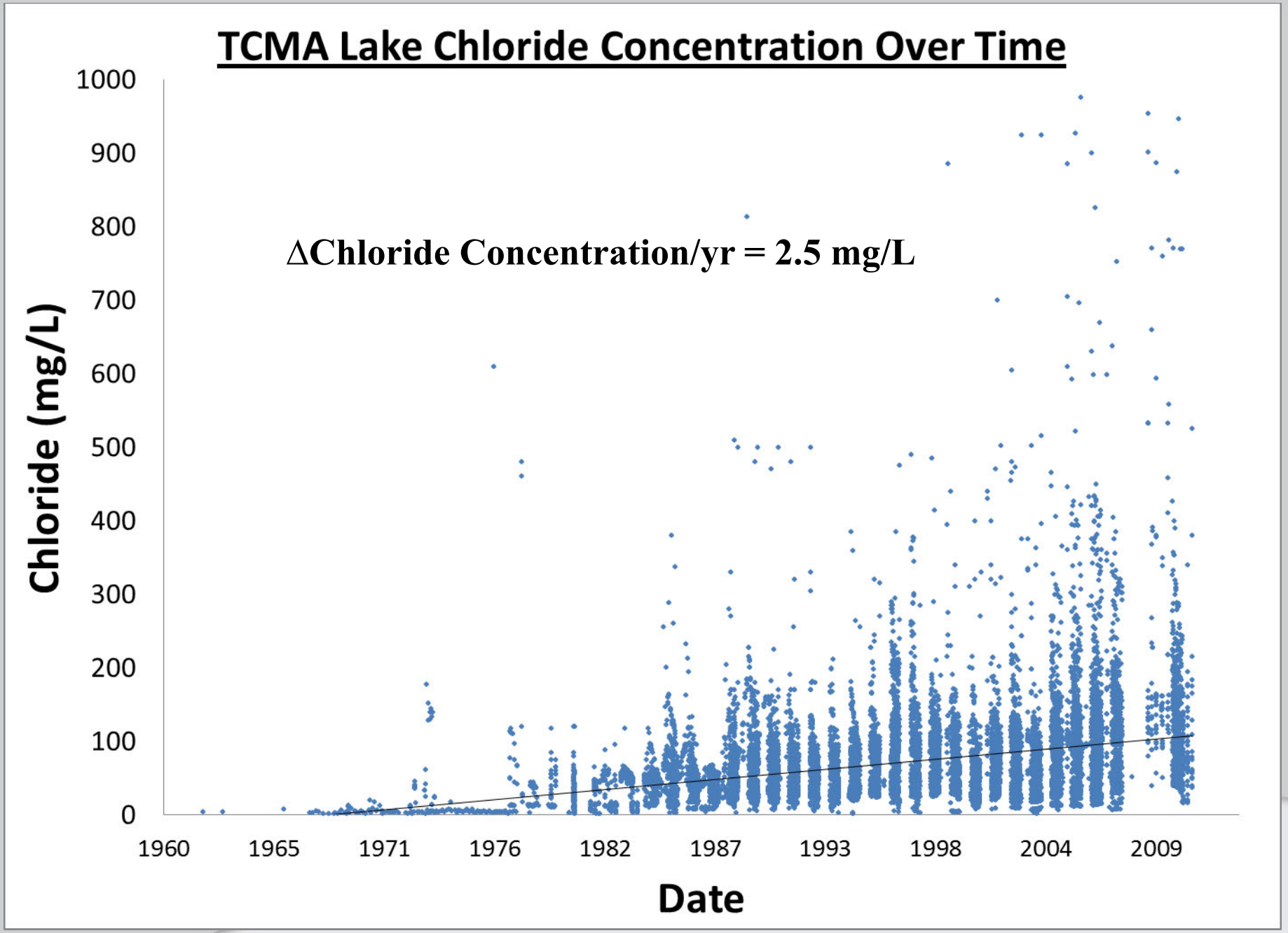
Source Identification

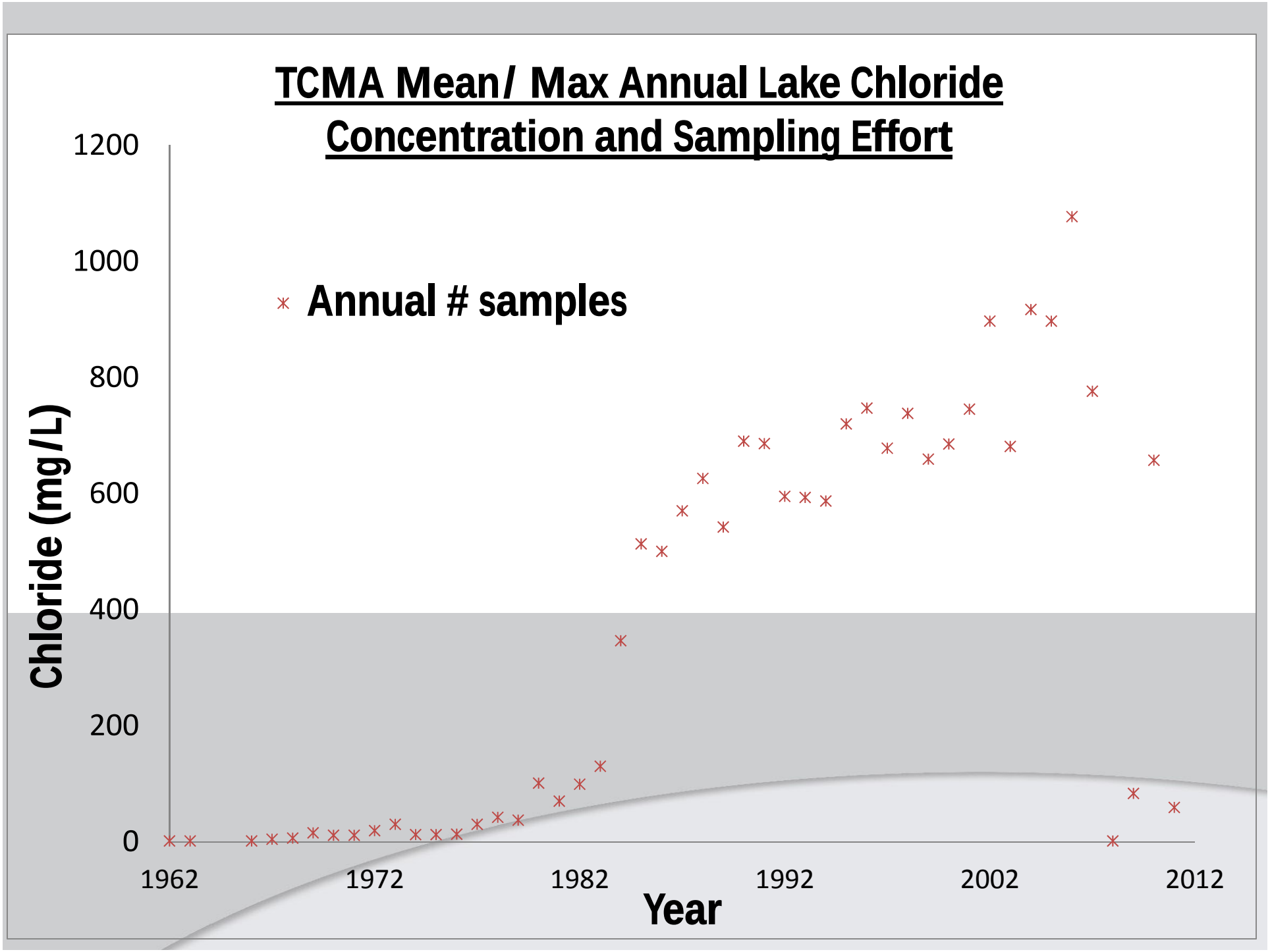
Modeling and Analysis

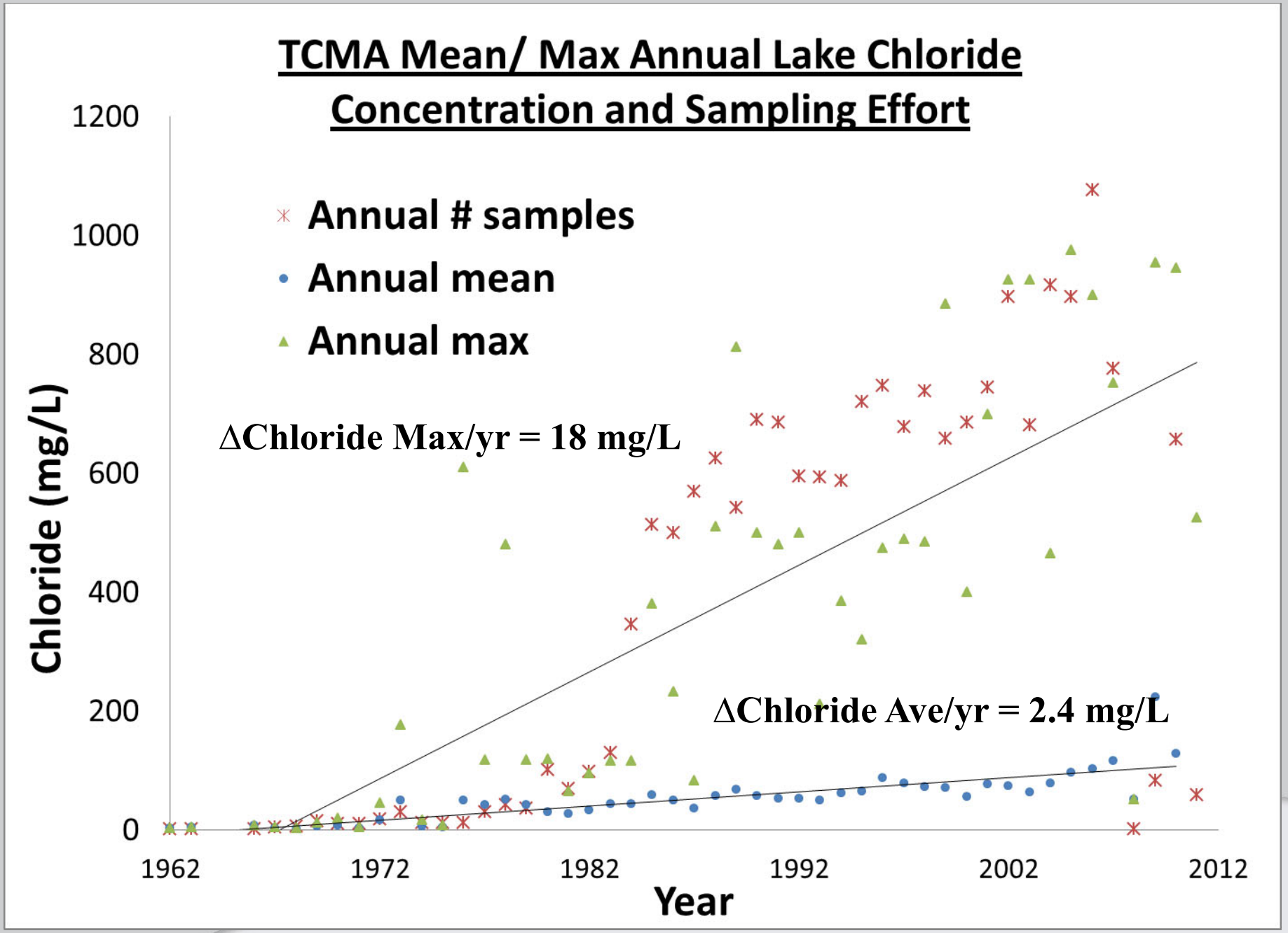
Write Management, Implementation, and Monitoring Plans
Drafts: Oct. 2013; Finals: Nov. 2014

Chloride Criteria

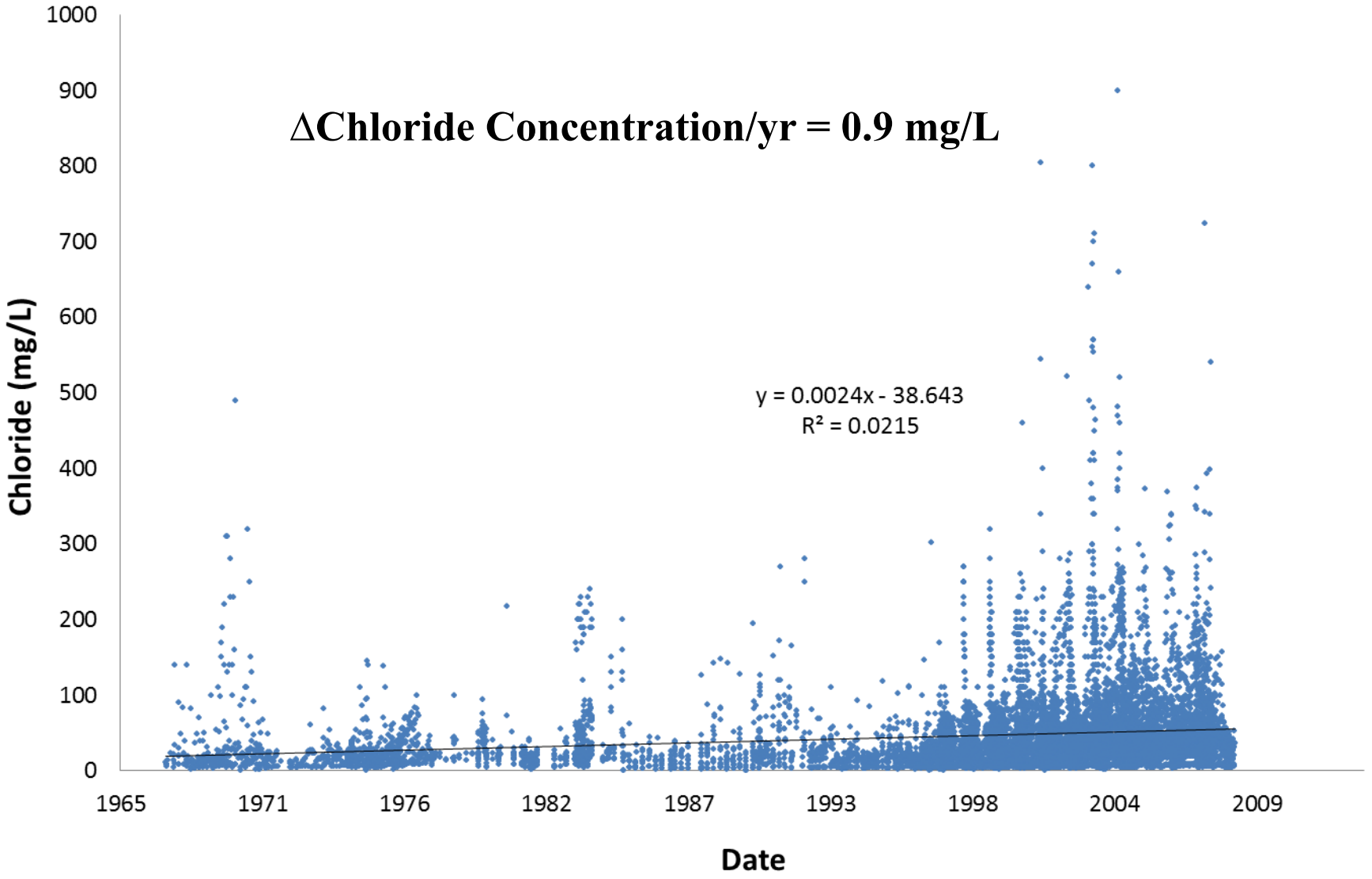
	Hardness (mg/L as CaCO3)	Sulfate (mg/L)	Acute WQC (mg/L)	Chronic WQC (mg/L)
Existing Criteria	---	---	860	230
Proposed Criteria - Lakes				
Average	121	11.2	625	397
25th % Hdns/75% Sulfate	94	11.8	539	342
Proposed Criteria - Streams				
Average	244	73	573	364
25th % Hdns/75% Sulfate	180	120	518	329


TCMA Lake Chloride Concentration Over Time
ΔChloride Concentration/yr = 2.5 mg/L
Chloride (mg/L)
1000
900
800
700
600
500
400
300
200
100
0
1960
1965
1971
1976
1982
1987
1993
1998
2004
2009
Date

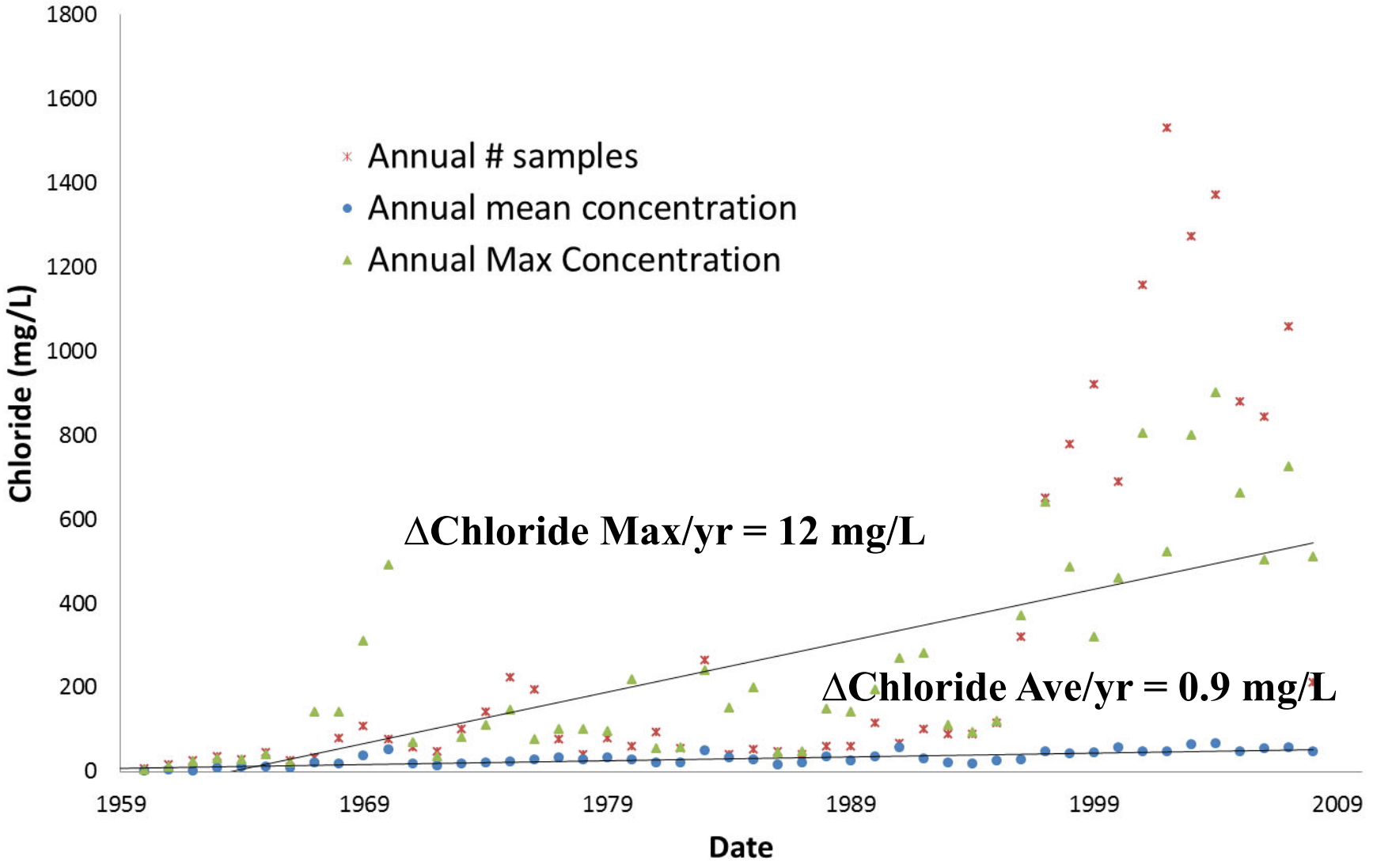

TCMA Mean/ Max Annual Lake Chloride Concentration and Sampling Effort
Annual # samples
Chloride (mg/L)
1200
1000
800
600
400
200
0
1962
1972
1982
1992
2002
2012
Year

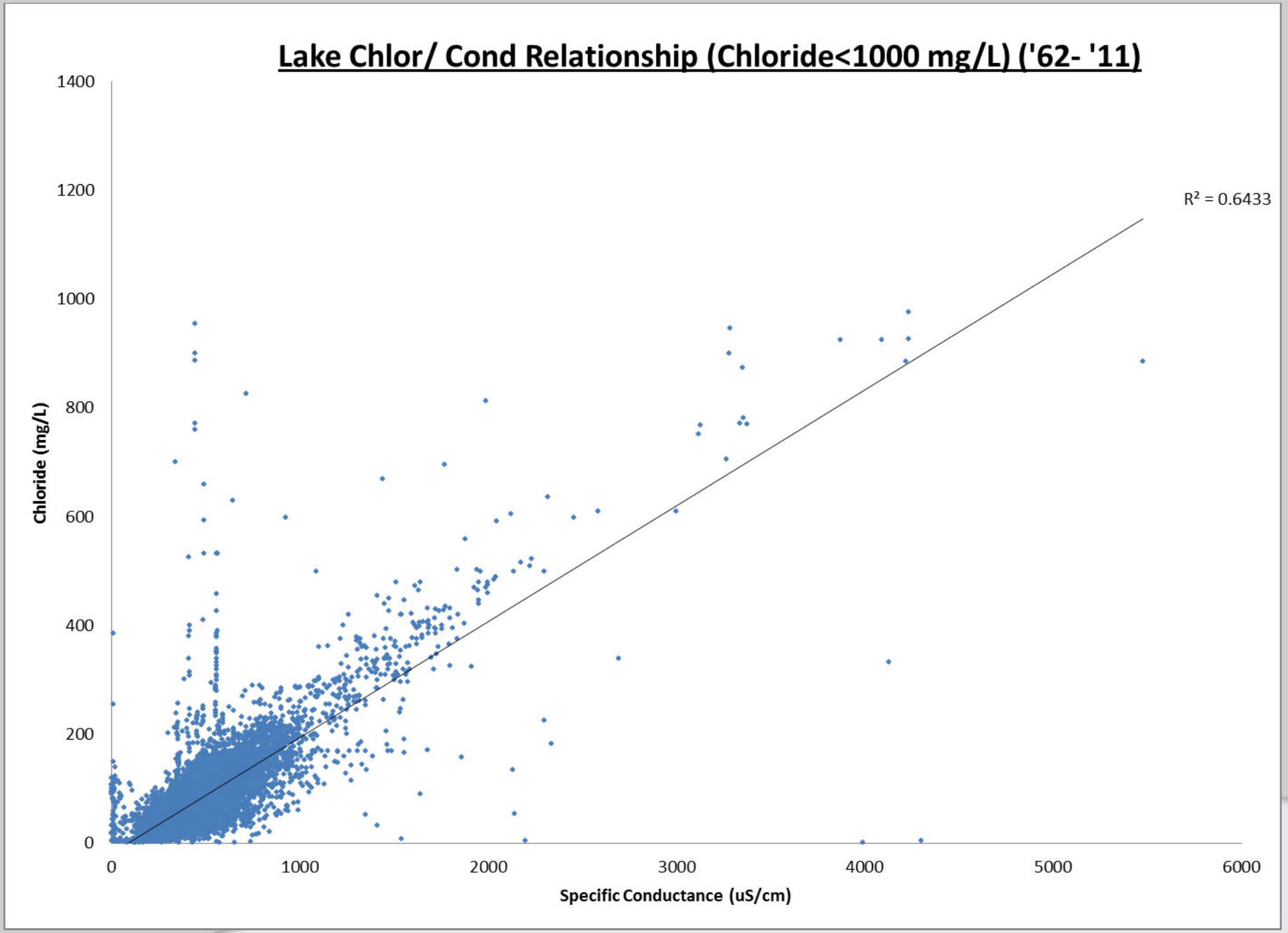

TCMA Mean/ Max Annual Lake Chloride Concentration and Sampling Effort
Annual # samples
Annual mean
Annual max
ΔChloride Max/yr = 18 mg/L
ΔChloride Ave/yr = 2.4 mg/L
Chloride (mg/L)
1200
1000
800
600
400
200
0
1962
1972
1982
1992
2002
2012
Year

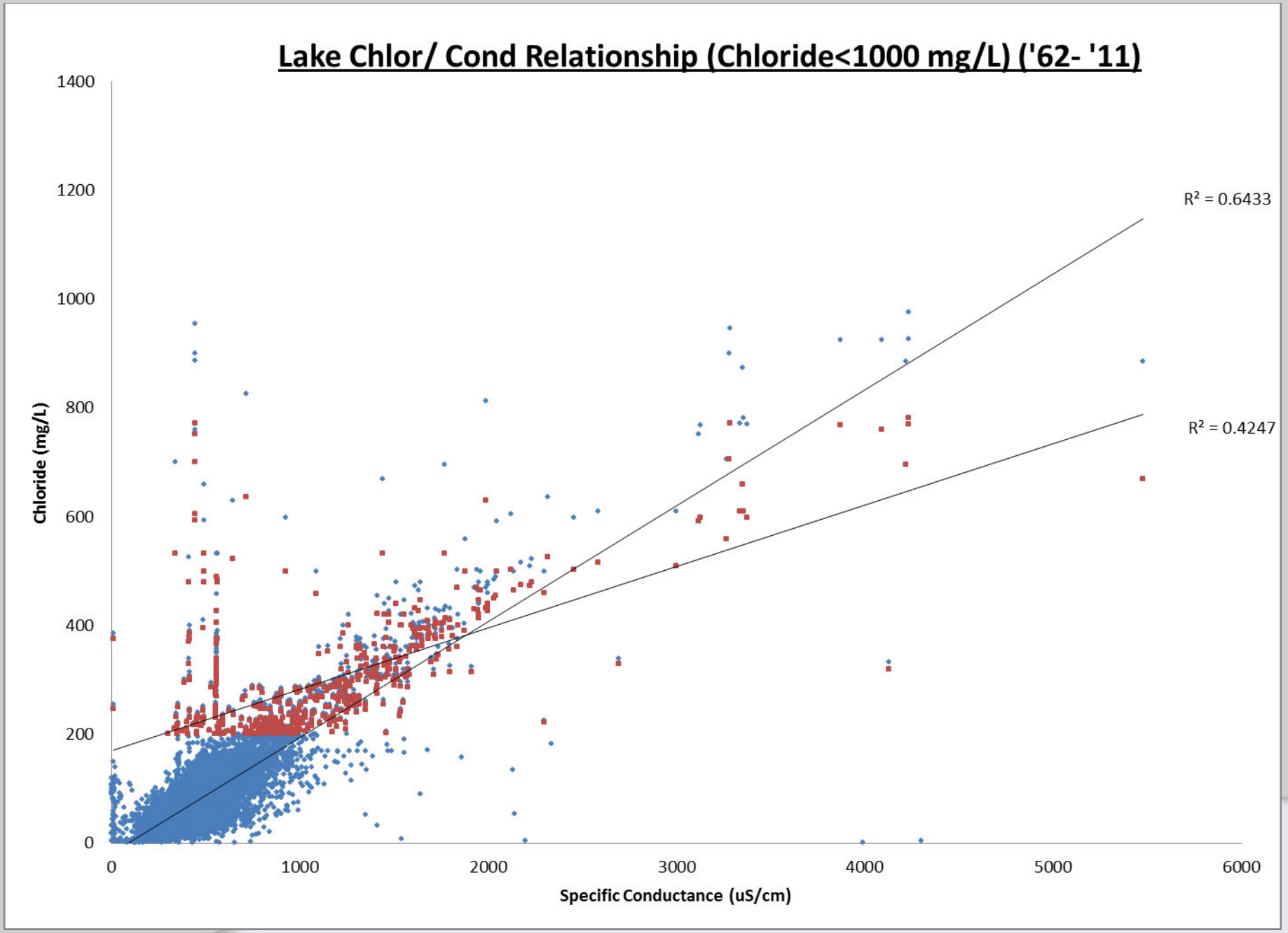
TCMA Stream Chloride Concentration Over Time (All Seasons)



Mean/ Max Annual Stream Chloride and Sampling Effort (All Seasons)




Lake Chlor/ Cond Relationship (Chloride<1000 mg/L) ('62- '11)
1400
1200
1000
800
600
400
200
0
Chloride (mg/L)
R² = 0.6433
0
1000
2000
3000
4000
5000
6000
Specific Conductance (uS/cm)


Lake Chlor/ Cond Relationship (Chloride<1000 mg/L) ('62- '11)
1400
1200
1000
800
600
400
200
0
Chloride (mg/L)
0
1000
2000
3000
4000
5000
6000
Specific Conductance (uS/cm)
R² = 0.6433
R² = 0.4247

Source Identification

- Objective
  - Quantify how much and where
- Uses
  - Link cause and effect
  - Set targets
  - Track progress
  - NOT for directly comparing one source with another

Sources

- Sources
  - MnDOT
  - Counties
  - Cities (roads AND sidewalks/parking lots)
  - Park districts
  - Private applicators
  - Homeowners
  - Others???

Source Data Collection Considerations

- What product?
- How much?
  - Purchasing
  - Usage
  - Application rates
- Where?
  - Entity
  - Route

City of Minnetonka Example

Storm #	DATE	DESCRIPTION	OPERATION DETAILS	Reported Salt TNS	Reported Trtd Slt TNS	SAND	Brine Gals	Hot Mix Gals	Precise DATA (Tons)			
									Trtd Salt City	Salt City	Trtd 9 Mile	Salt 9 Mile
1	11/13-14 / 2010	E1. 8" HEAVY WET snow- MAJOR tree damage	Full plowing oper- Sat Full plowing oper- Sun		11/13- 41T 11/14 -144T				6.25 T		1.25 T	
2	11/21/2010	E2. Frezing rain- ICE L ight snow follows	Full plowing oper @ 1am		186.00				28.6T		123 T	
21	3-23,24-10	E21. Freezing rain overnight- snow begins 3 am- heavy WET snow thru day on 2/23 6-8" total	3-23- full operation 3-24 Re-plow and clean up	158.00			0.00			no info		no info
TOTAL				684.00	1,716.00		2,584.00	5,736.90	799.14	327.45	335.45	98.60

Source Data Collection

- End result
  - Simple, standard, efficient form/process for annual reporting

Targets

- Objective
  - Set voluntary protection goals for non-impaired waters
- Options
  - Use numeric criteria or some percentage of criteria (for example, 90% of criteria)
  - Use existing concentration or some percent increase above existing (for example, 20% increase above existing, or 10% reduction)
  - Use reference or historical condition or some percentage above those conditions
- Alternative or combined with targets
  - Set performance based goals for users (for example, application rates, best practices)

Next Steps

- Continue to compile available data
- Develop and update trend analyses
- Finalize chloride-conductivity relationship and apply to available data
- Select modeling approach, identify data needs, make recommendations for monitoring plan refinement
- Develop source reporting template and circulate for review
- Characterize waters based on existing data

Twin Cities Metro Area Chloride Project

Technical Advisory Committee (TAC) Meeting #2

October 12, 2011, 12:30-2:30 pm, Capitol Region Watershed District office

Attendees: Introductions included answering the question, *what do you hope to gain from being on this TAC?*

Attendee	Representing	Answer
Brooke Asleson	MPCA	guide project outcome with stakeholders
Anne Weber	St. Paul	insight/input, compliance, WQ improvement
Barb Loida	MnDOT	achievable project outcome
Bob Fossum	Cap Reg WD	reduce chloride impacts
Cliff Aichinger	Rams-Wash Metro WD	final project findings, solutions
Derek Asche	Plymouth	stay informed
Hans Holmberg	LimnoTech / MPCA	best available data to inform plan
John Erdmann	MPCA	learn, help; today, meeting notes
Kari Oquist	Mississippi WMO	tech insight/input on data, analysis
Kevin Bigalke	Nine Mile Ck WD	integrate Nine Mile work w/this project
Lois Eberhart	Minneapolis	insight/input, compliance, WQ improvement
Mark Fischbach	MnDOT	provide practice-based technical help
Mark Maloney	Shoreview, APWA	user-friendly/public works-friendly outcomes
Ross Bintner	Prior Lake	learn about project, impacts, practices
Tom Struve	Minnetonka	improved tracking of chloride usage
Udai Singh	Mississippi WMO (alt)	provide technical help, learn more

Project update

Consultant contracts now in place:

- LimnoTech (Hans Holmberg) – technical component of project work; preparation of main reports
- Fortin Consulting (Connie Fortin) – private applicator usage data, implementation plan development

Project use of waterbody subset:

- Waterbodies in the seven-county metro area will be categorized into four categories:
    - Impaired (exceeds water quality standard, TMDL needed)
    - High Risk (not current listed as impaired but likely to become impairment within 10 years)
    - Non-impaired (sufficient data to clearly define as meeting water quality standard)
    - Insufficient data (little or no data)

Monitoring program:

- Waterbodies include 74 lakes, 27 stream stations, and 7 storm sewer stations
- Monitoring partners are also part of the project Monitoring Sub Group– 12 total, including Watershed Districts, Cities, and regional and federal governmental entities
- Monitoring protocol and quality assurance guidance has been developed and is available on the project website
- Monitoring schedule:

- Duration 3 years total; 1st year now completed, 2nd year underway
- Frequency of lake monitoring is once per season minimum; several partners' ongoing programs continue with higher frequencies during the growing season

- Monitoring results will be provided in a separate report for widespread availability

Project website: has links to Phase 1 Feasibility Study final report, Phase 2 work plan, and other items at http://www.pca.state.mn.us/index.php/water/water-types-and-programs/minnesotas-impaired-waters-and-tmdls/tmdl-projects/special-projects/twin-cities-metropolitan-area-chloride-project.html

Technical update:

Overview of technical scope:

- Current tasks:
  - Data analysis – trends
  - Chloride-conductivity relationships – to potentially support surrogate monitoring in the future
  - Source assessment
  - Chloride targets – for non-impaired waters

Project Schedule:

- Draft management, implementation, monitoring reports – Fall 2013
- Final management, implementation, monitoring reports – Fall 2014

Intervening Q & A, discussions

Assessments of waterbodies by MPCA:

- Upper Mississippi (Twin Cities) major watershed – MPCA assessing waterbodies during the winter of 2011-2012 to determine their impairment status
- Special seven-county metro area chloride water quality assessment– to be conducted during the winter of 2012-2013 (arranged especially for chloride project)

Chloride TMDLs completed and in progress:

- Completed TMDLs (Shingle Ck, Nine Mile Ck) will not be modified, but rather incorporated into TCMA Management Plan perhaps.
- In-progress TMDL (Minnehaha Ck) will be guided by chloride project "real-time" findings and will be incorporated into the TCMA Chloride Management Plan.
- Chloride project's Implementation Plan will apply to the above TMDL areas as well as the entire 7-county Metro Area.

Eagan, Minnetonka achievements:

- Eagan reduced chloride/chemical usage from 170 tons per event in 2005-06 to 88 tons per event in 2000-09.
- Minnetonka has Nine Mile Ck WD goal of 4.2 tons/lane-mile per normal winter season; essentially met last winter (180% of normal winter) with 7.0 tons/lane-mile (equivalent to ~4 tons/lane-mile in "100% normal winter").

Education/outreach:

- Kevin described Nine Mile's efforts, related to Minnetonka's achievements

- Brooke commended Nine Mile WD for their road salt program and suggested that if others are looking for an example of a very comprehensive chloride outreach program they should look to Nine Mile WD – special credit to Claire Bleser

- Chloride criteria/water quality standards review:
  - Current state chloride standards: acute toxicity 860 mg/L; chronic 230 mg/L
  - Background water quality influences chloride toxicity, particularly hardness (decreases chloride chronic toxicity, hence increases allowable Cl^-) & sulfate (increases Cl^- toxicity, hence decreases allowable Cl^-) – findings of Iowa studies
  - Based on above studies, hardness & sulfate levels typical of Minnesota lakes and streams would make the acute chloride standard lower (more stringent), roughly 520 – 620 mg/L, but the chronic standard higher (less stringent), roughly 330 – 400 mg/L.

  Remark on statewide chloride assessment:

  - Current assessment cycle (begins Feb. 2012) is first cycle in which lakes and wetlands will be assessed for chloride on statewide basis
  - Existing chloride water quality standard: *one-hour* average of maximum standard (860 mg/L); *four-day* average of chronic standard (230 mg/L). Impairment occurs if a water body experiences two or more exceedances of either standard in a three-year period containing a minimum of five data points.
  - Change to the proposed chloride standard to include sulfate and hardness consideration in calculation is part of the current triennial review process.

Data analysis:

- Both lake and stream chloride concentrations in the metro area show long-term (~30 years) increasing trends
- Chloride concentration rates of change, (from regression analyses of all available chloride–time data) are shown below:

Approximate slope of trend (mg/L-yr)		
Waterbody type	**Annual Means**	**Annual Maxima**
Lakes	2.4	18
Streams	0.9	12

- Chloride – electrical conductivity correlations yielded fair r^2 values:
  - ✓ All data: $r^2 \sim 0.64$ (very strong, considering the large number of samples)
  - ✓ Data subset (chloride > 200 mg/L): $r^2 \sim 0.43$ (also strong)

Intervening Q & A, discussions

Observed chloride levels:

- Good news: most levels are below the 230-mg/L chronic standard

Chloride-conductivity correlations:

- Suggests lab conductivity measurements be taken initially to calibrate field meter data to ensure accuracy

Chloride implementation approach:

- Chloride project's implementation approach will be "universal" across metro area including impaired, non-impaired, and not-yet-assessed waters

Chloride usage:

- Cities and counties at "opposite end of spectrum" (usage increases with driving speed)

Evolution of winter road safety "culture":

- 30 years ago: lots of sand, little salt (only to keep sand from freezing solid)
- Now: safety (saving lives) has no cost limit, but drivers want perfect road conditions conducive to high speed at all times – even during blizzards
- Desirable in future: drivers to slow down! Expect less-than-perfect road conditions in bad weather
- Must educate public, set proper expectations; and find "sweet spot" everyone supports
- Other motivations (not TMDL) should be considered such as cost savings in operations while still maintaining safety

Comment on above "future" scenario:

- Politics won't allow last scenario of "sweet spot" that everyone supports
- MnDOT is currently pursuing bill to reduce highway speed limit to 45 mph during winter storms
- Over application actually makes it more slippery and therefore more of a liability hazard

Measuring road "safety": (several)

- How is road safety measured or Level of Service (LOS)? (Lois Eberhardt)
    - Primarily by numbers of phone calls from the public
    - MnDOT reviews accident histories to measure LOS
    - Community surveys
    - It can be empirical, residents of Prior Lake notice differences in city roads versus county roads or other cities
    - Caveat: public perception makes no distinction among the many road authorities, and also uncontrollable factors such as winter conditions

Public perception is the biggest obstacle, we need a major education campaign similar to the Emerald Ash Borer campaign to allow for reduced application rates.

Source identification:

Intervening Q & A, discussions

Variability of road salt usage tracking:

- Level of road salt application rate tracking varies greatly by cities and between different types of road authorities. Private application rates vary greatly due to liability concerns, and by virtue of the way the contracts are written (many charge by the pound of product applied). Education will need to be more of a marketing approach.
- Nine Mile Ck WD has 6 cities, with road salt tracking ranging from:
    - Detailed records – including driver, usage amount, for each street/road segment and for each snow/ice event

- Gross records – usage city-wide for whole season (usage = total purchases – change in inventory)

Private applicator usage:

- Perverse incentive – private applicators are paid by quantity of chloride/chemical used; hence, use more to make more money
- New Hampshire is an example of trying to address the liability issue through a legislative bill to protect those with a snow & ice plan who are applying appropriate amounts rather than over applying to protect themselves from potential lawsuits due to slip and falls.
- "Branding" for applicators – market services by stressing employee training etc.
- Could cities or watershed districts license/permit private applicators? (Shoreview licenses tree trimmers)
- Lake County, IL, is doing this ("permit" issuance is term used there)
- Nine Mile Ck WD provides homeowners' associations with list of "private applicators who attended training" – WD cannot legally "recommend" a particular private business but can provide objective information such as this
- MPCA staff is interested in studying how to address the liability concerns

Winter street/road sweeping:

- Minneapolis sweeps up excess salt – do other cities?
- Minnetonka does not – idea is to have on-street salt ready for next snow
- MnDOT does winter sweeping
  - Aimed at contaminants such as lead (Pb), not excess road salt
    - Sweepings sampled for contaminants?
    - Yes, sweepings sampled every 3 years
  - I-35/Hwy 62 corridor to have 2 winter sweepings each year

Source identification (continued):

- Preliminary list of sources includes local, regional, and state government entities

Intervening Q & A, discussions

Additions to list suggested:

- Private applicators – contract with Fortin for this project will be to develop more accurate estimate of their application rates
- Residents/ homeowners – the Education & Outreach Committee (EOC) for this project is putting together a qualitative survey for homeowners to help inform the watersheds and cities as to an estimate of their contribution and therefore the potential reduction opportunities available. This survey will made available to all watershed organizations and any interested cities, counties.
- Commercial/ industrial buildings – contact property managers
- Agricultural/feedlot manure spreading – appears to be significant source in Prior Lake, where spring chloride peaks coincide with spreading operations

- Wastewater treatment plant solids – similar to feedlot manure: solids from Metro Plant widely applied to fields as amendment
- Wastewater treatment plant effluent used for irrigation – e.g., Mystic Lake golf course irrigation caused turf loss from high salinity
- Metropolitan Airports Commission – secondary airports
- Alternative deicing products (many/most contain some salt)
- NPDES-permitted industrial sources – such as pickle producers – MPCA staff will go through files to identify potential sources
- Groundwater – contaminated by infiltration, including intentional stormwater infiltration to meet MPCA permit requirements of watershed districts/WMOs

Communications with wider community:

- Cities on TAC are interested in participating in the voluntary homeowner survey, and others may be interested as well.
- MS4 communications could be done through Minnesota Cities Stormwater Coalition (MCSC). Anne Weber is on the steering committee and will forward the information to the steering committee to pass along. *(The MCSC has declined to coordinate with MPCA on this communication effort at this time).*

Source identification (continued):

- Chloride usage tracking by municipalities
  - ✓ Example of detailed tracking record shown; Minnetonka record will meet Nine Mile Creek WD requirements

Discussion

Data requests from metro-area municipalities for this project:

- Some cities and townships may push back on requests for application rate data
- First project year: suggest asking for method of tracking first, and put in a voluntary request for past 5 years of applications rates. Let them know that we will want this information now or within the next year to best inform the project.

Data Chloride mass balances:

- University of Minnesota/St. Anthony Falls Laboratory study – included metro-area chloride mass balance showing 78% retention
- Possibility raised that on-going accumulation in lakes, wetland and groundwater could account for such high retention. The project lake monitoring program is aimed to help understand this better, 74 lakes in the metro being monitored for 3 years. Some lakes have a much longer data record however.

Groundwater component in the chloride cycle is important to consider. MPCA does currently have groundwater chloride data available.

TCMA Chloride Project
TAC meeting #3
January 15, 2013 9:30-11:30am
MPCA St. Paul office
Room 6-3

***Desired outcome of meeting**:* TAC members to have a clear understanding of the potential modeling approaches available for the project. The TAC to provide their recommendation to the project team of their preferred modeling approach.

Agenda

- Introductions & Overview of meeting (Brooke, MPCA)
- Overview of project (Jeremy Walgrave, LimnoTech)
- Review of Modeling options (Dave Dilks, LimnoTech)
- Facilitated discussion on TAC's preferred modeling approach (Everyone)
- Wrap up & Next TAC meeting (Brooke, MPCA)

Twin Cities Metro Area Chloride Management Plan Development Project

Status Report

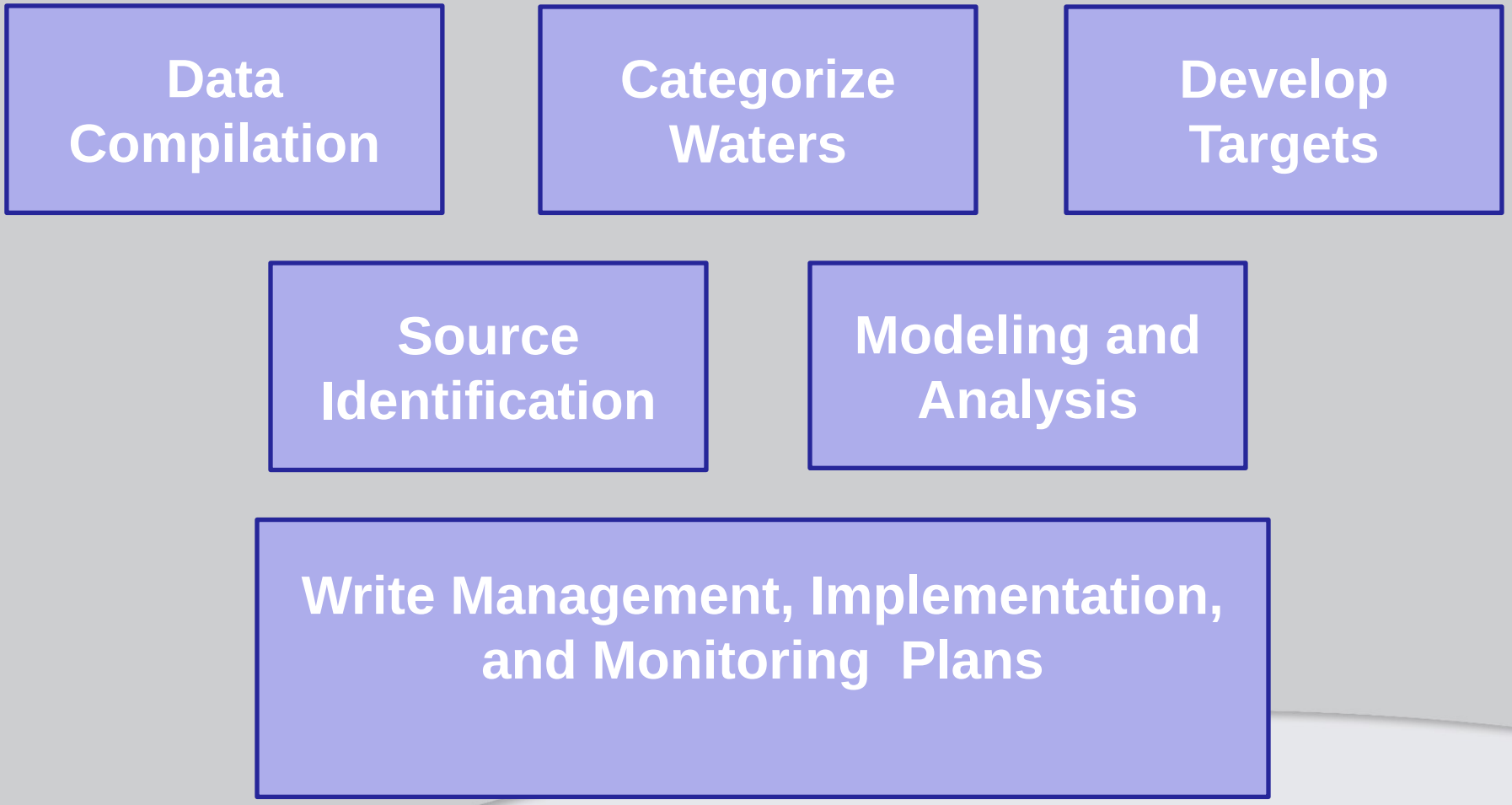
TAC Meeting
January 15, 2013

LimnoTech
Water | Environment | Scientists | Engineers

Overview

- Project overview
- Chloride criteria
- Data Compilation
- Categorize Waters
- Targets
- Sources
- Next steps

Project Overview



Chloride Criteria

- Existing Water Quality Standard
  - 230mg/L Chronic, 860 mg/L Acute
- Proposed Water Quality Standard
  - Based on Sulfate and Hardness
  - 415mg/L Chronic, 675 mg/L Acute

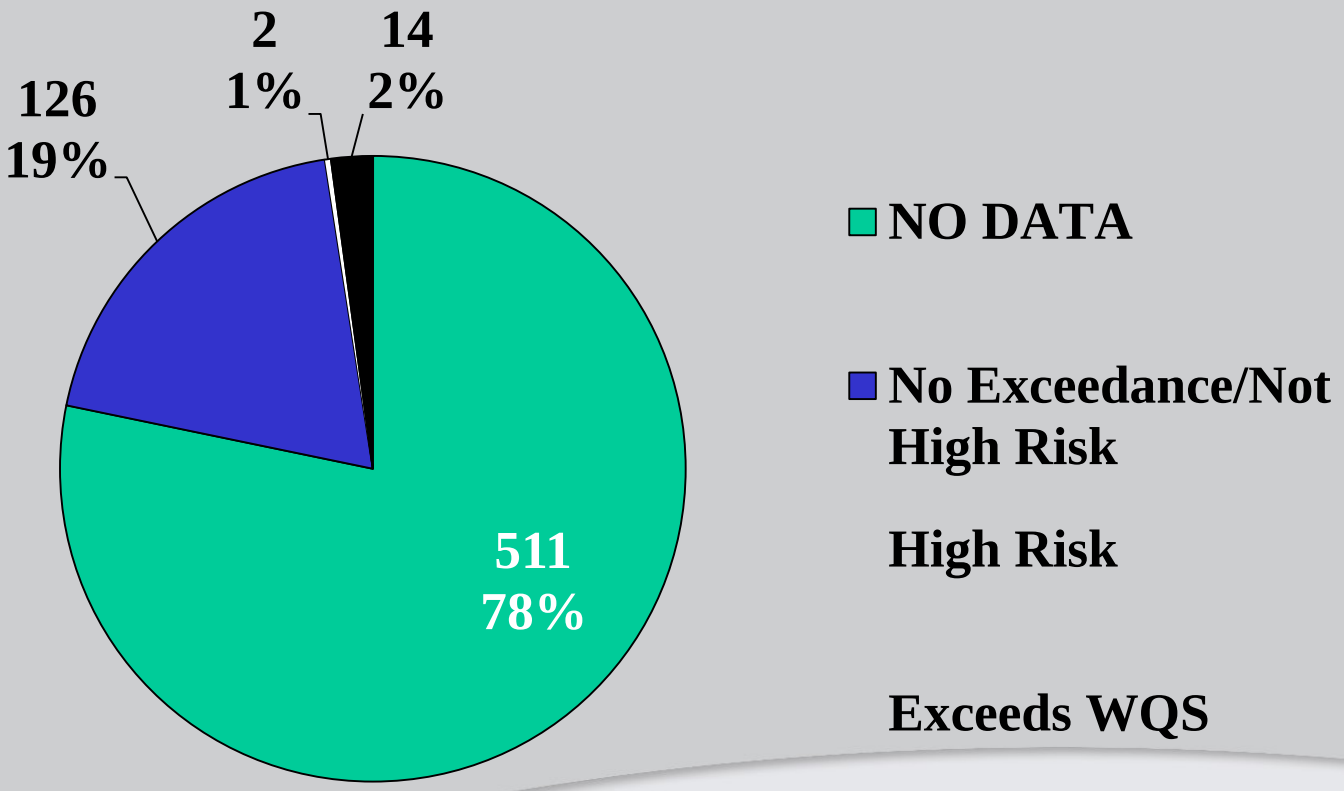
Data Compilation

- Building from the Phase I Metro Chloride Feasibility Study (2009)
- 2013 monitoring data will be the final round of data collected for the project
- Data used to categorize waters

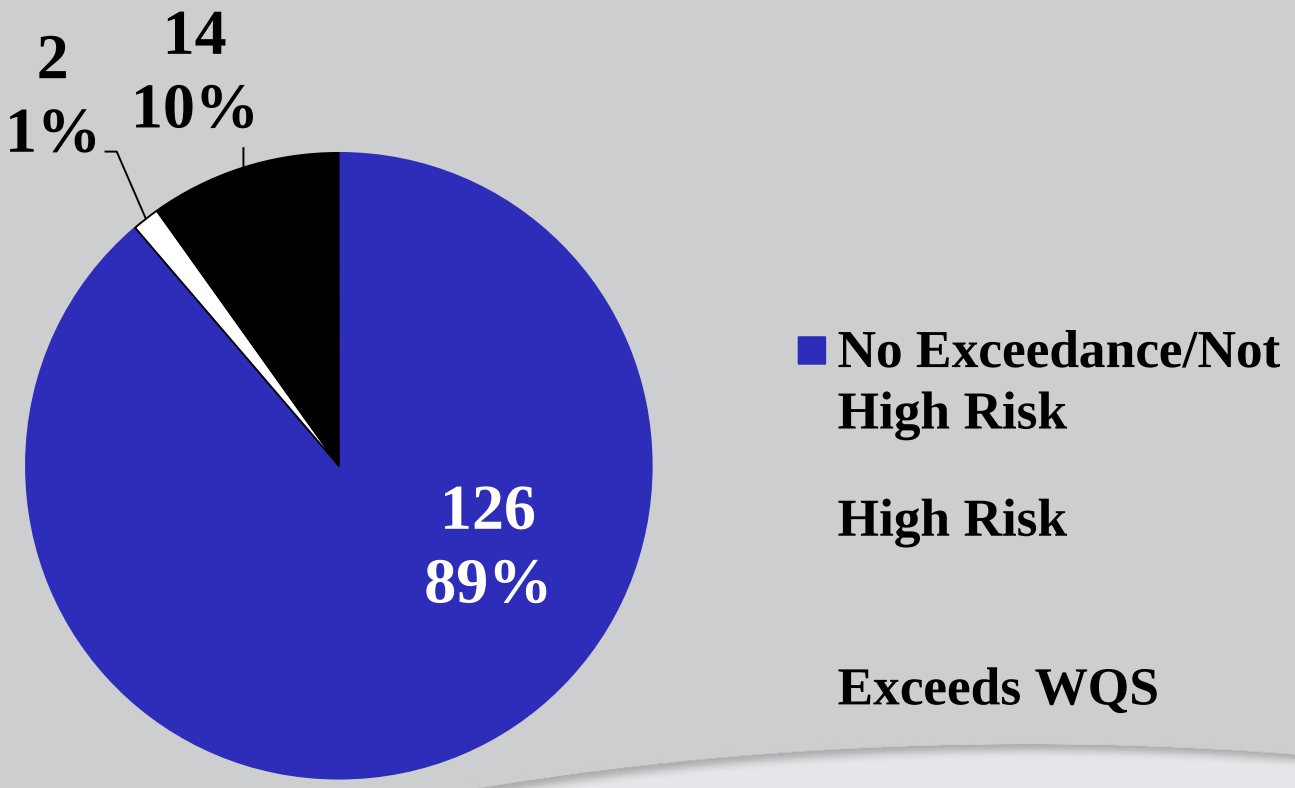
Categorize Waters

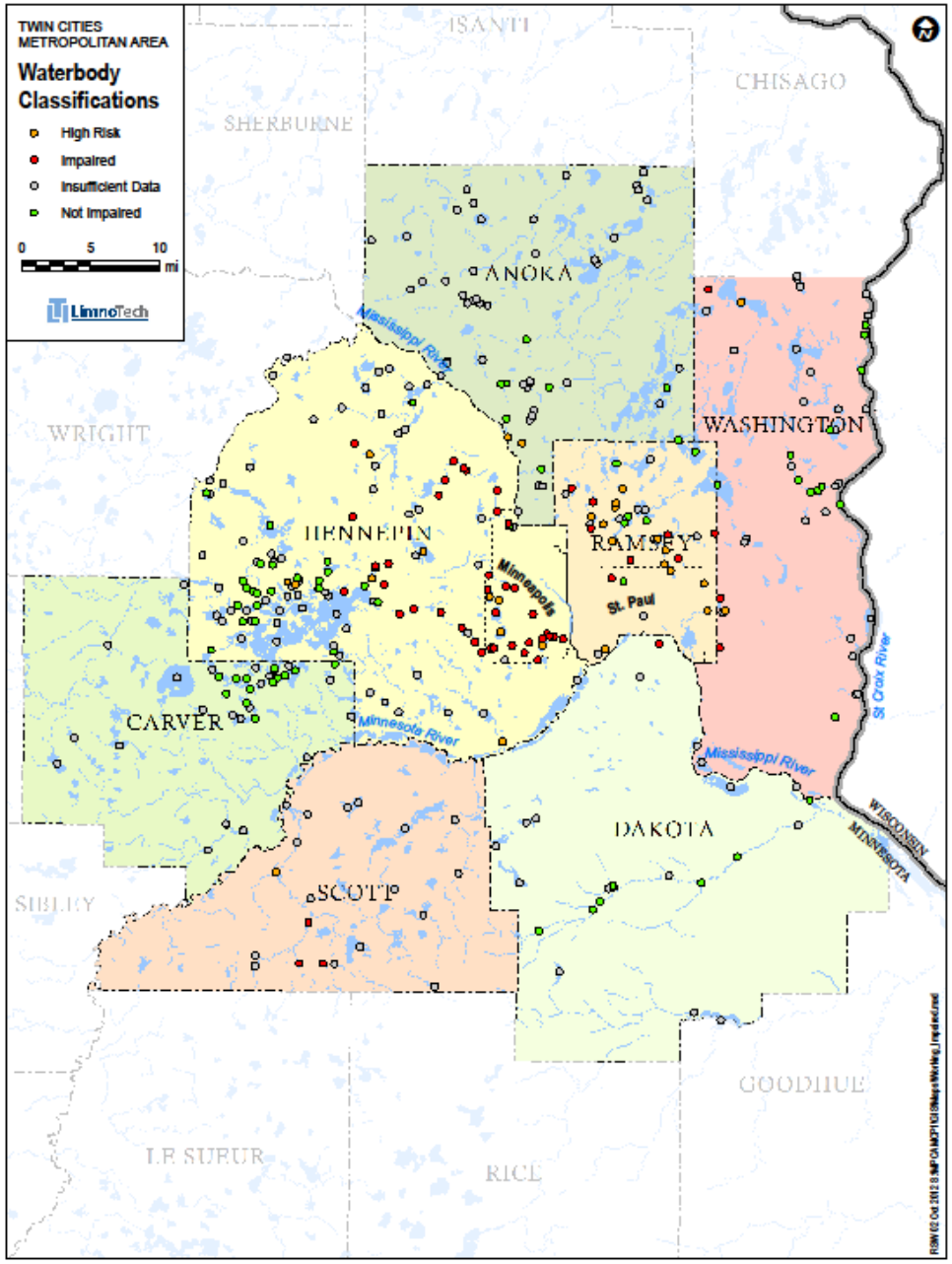
- Objective – use monitoring data to preliminarily categorize water bodies
- Exceeds Water Quality Standards (WQS)
- High Risk (within 10% of WQS)
- No WQS Exceedance (nor High Risk)
- Insufficient Data

Twin Cities Metro Area Status



Twin Cities Metro Area Status




TWIN CITIES
METROPOLITAN AREA
Waterbody
Classifications
High Risk
Impaired
Insufficient Data
Not Impaired
0
5
10
mi
LimnoTech
ISANTI
CHISAGO
SHERBURNE
ANOKA
WASHINGTON
WRIGHT
HENNEPIN
RAMSEY
Minneapolis
St. Paul
Mississippi River
St Croix River
CARVER
Minnesota River
Mississippi River
WISCONSIN
MINNESOTA
DAKOTA
SCOTT
SIBLEY
GOODHUE
LE SUEUR
RICE

Targets

- Objective
  - Set voluntary protection goals for non-impaired waters
- Options
  - Use numeric criteria or some percentage of criteria (for example, 90% of criteria)
  - Use existing concentration or some percent increase above existing (for example, 20% increase above existing, or 10% reduction)
  - Use reference or historical condition or some percentage above those conditions
- Alternative or combined with targets
  - Set performance based goals for users (for example, application rates, best practices)

Source Identification

- Objective
  - Quantify how much and where
- Uses
  - Link cause and effect
  - Set targets
  - Track progress
  - NOT for directly comparing one source with another

Sources

- Sources
  - MnDOT
  - Counties
  - Cities (roads AND sidewalks/parking lots)
  - Park districts
  - Private applicators
  - Homeowners
  - Industrial point sources
  - Others???

Source Data Collection Considerations

- What product?
- How much?
  - Purchasing
  - Usage
  - Application rates
- Where?
  - Entity
  - Route
  - Watershed
- How?
  - Technologies
- When?
  - Annual
  - Storm events

How You Can Help

- Surveys
- Provide Input to Brooke, Connie, or Jeremy
- Other Chloride Contributors
- Other Factors Affecting Chloride
- Suggestions on Source Reporting (Templates, Online System, etc.)

Next Steps

- Continue to compile available data
- Develop and update trend analyses
- Select modeling approach and identify data needs
- Develop source reporting template and circulate for review
- Develop and apply models to support TMDLs
- Write Management, Implementation, and Monitoring Plans – end of 2014

Twin Cities Metro Area Chloride Management Plan

Water Quality Model Selection

TAC Meeting
January 15, 2013

LimnoTech
Water | Environment | Scientists | Engineers

Agenda

- Overview
- Model characteristics relevant to selection
- Potentially applicable model frameworks
- Management considerations
- Discussion
- Next steps

Project Overview

- Application of road salt has caused chloride impairments in many Metro lakes
- MPCA studying the extent, magnitude, and causes of chloride contamination
- Ultimate goal is development of Chloride Management Plan
  - Define actions that local partners can use to reducing chloride loading, such that lakes are in attainment of water quality standards

Need for Water Quality Model

- Calculation of maximum allowable load requires an understanding of relationship between chloride load and resulting chloride concentration
- This relationship typically described through the application of a water quality model
  - Series of mathematical equations describing known cause-effect relationships

Project Overview

Data Compilation

Categorize Waters

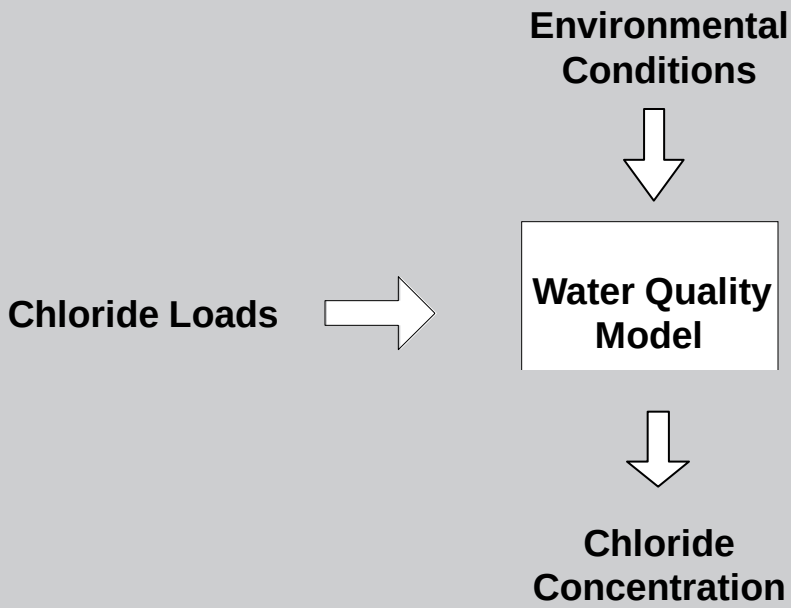
Develop Targets

Source Identification

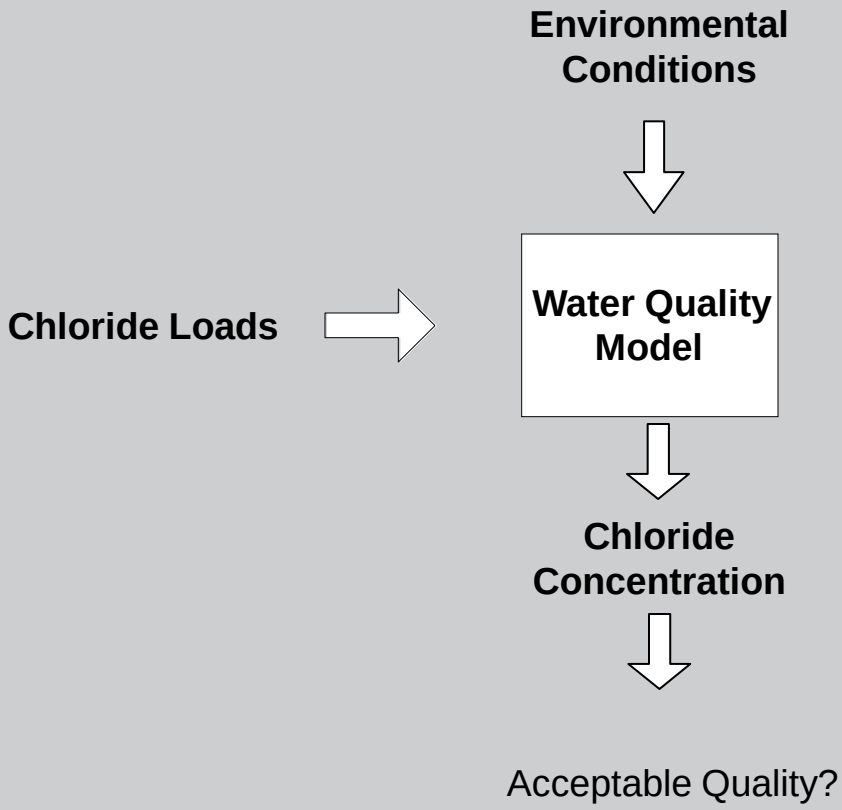
Modeling and Analysis

Write Management, Implementation, and Monitoring Plans

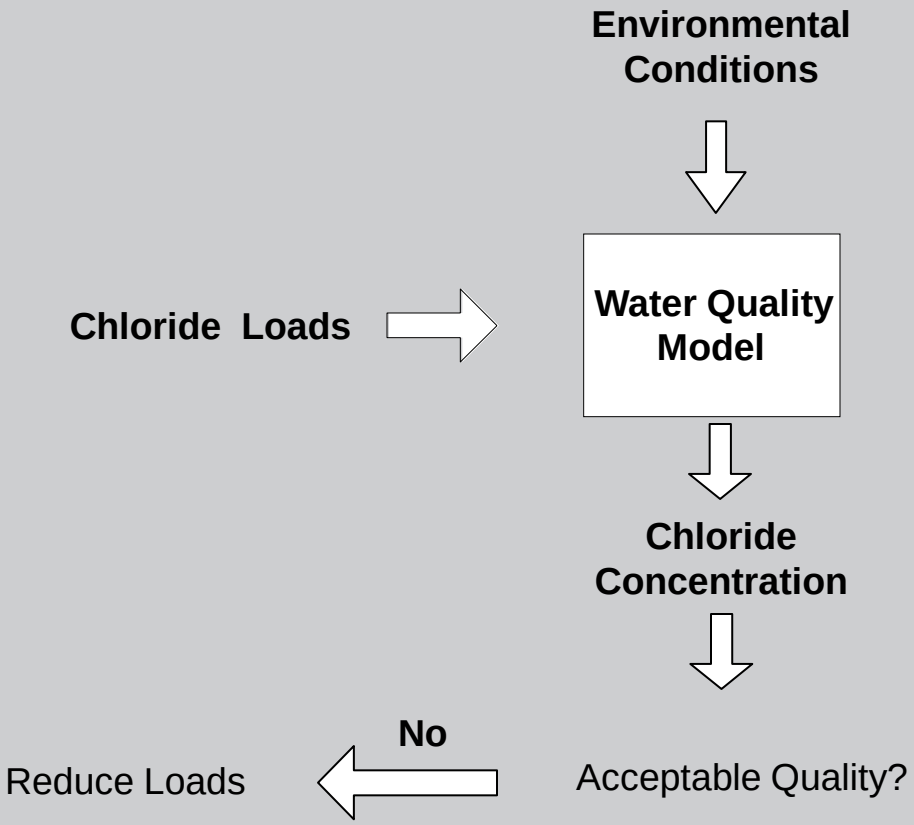
Use of Water Quality Model to Determine Maximum Allowable Load



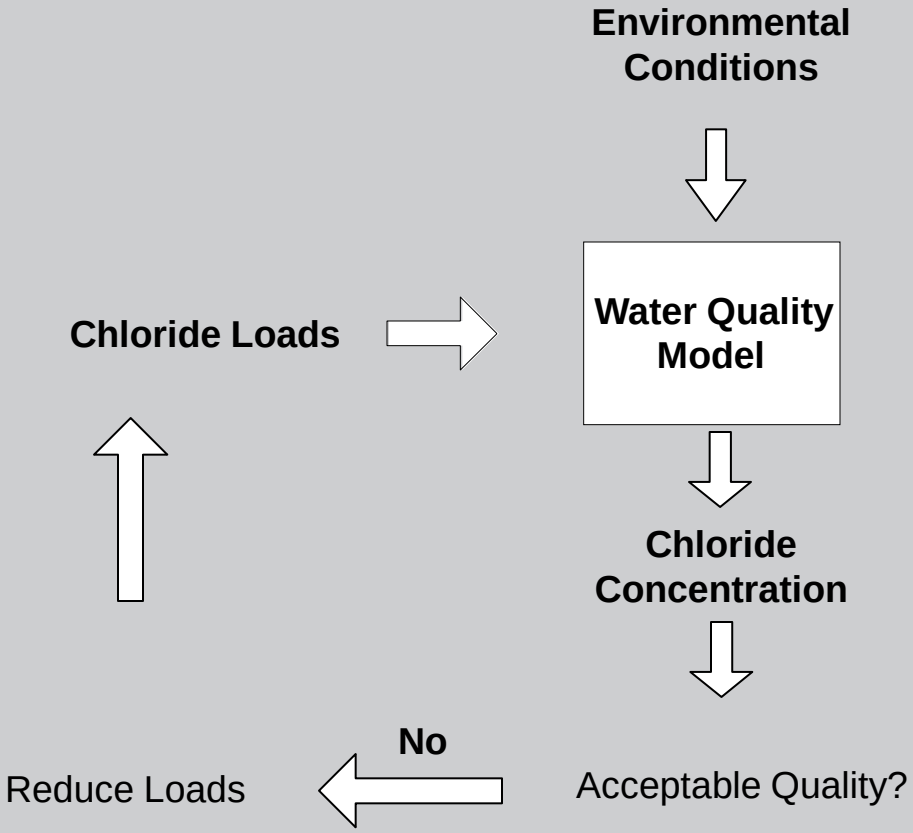
Use of Water Quality Model to Determine Maximum Allowable Load



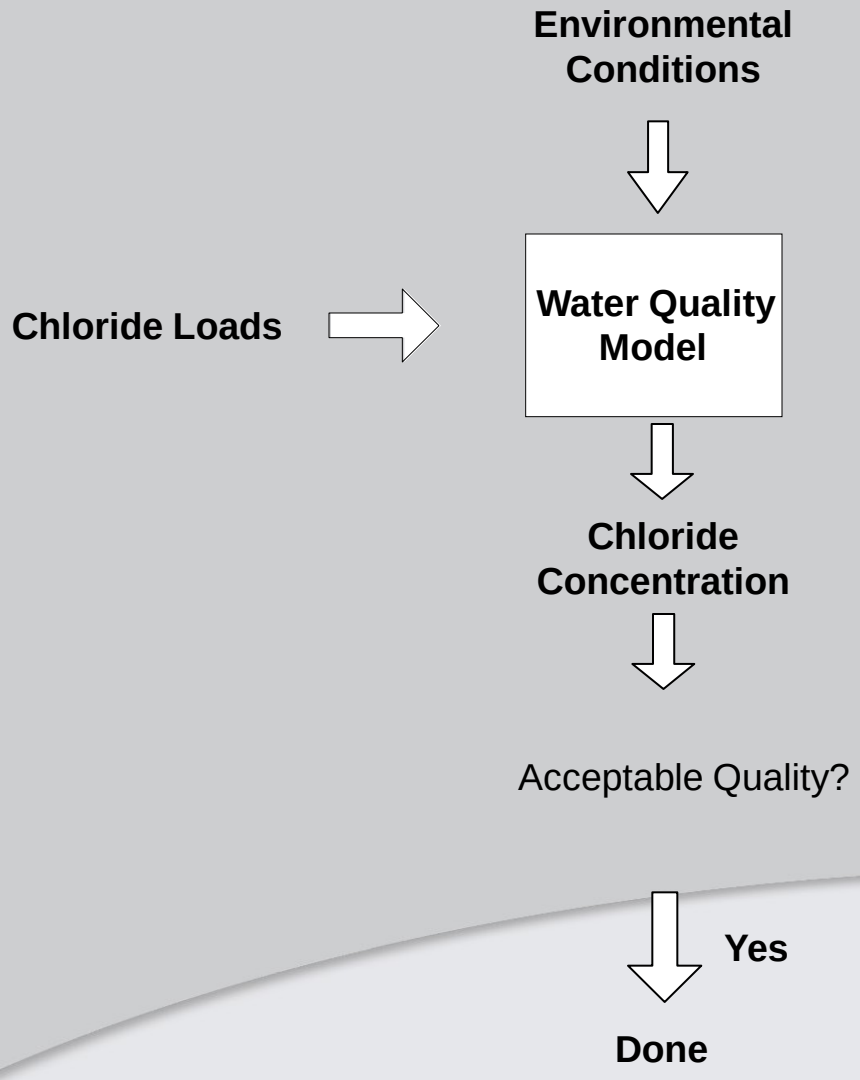
Use of Water Quality Model to Determine Maximum Allowable Load



Use of Water Quality Model to Determine Maximum Allowable Load



Use of Water Quality Model to Determine Maximum Allowable Load



Water Quality Model Selection

- Many different types of water quality model frameworks exist
- First task of modeling requires selection of appropriate framework(s)

Model Characteristics

- Selection of a water quality model requires consideration of three key characteristics
  - Temporal scale
  - Spatial scale
  - Kinetic complexity

Temporal Scale

- Does the model consider the change in concentrations over space?
- Four categories of models exist
  - Zero dimensional
    - Predicts only a single lake-wide average
  - One dimensional
    - Considers changes in a single dimension (depth)
  - Two dimensional
  - Three dimensional
    - Considers changes in all three spatial dimensions

Spatial Scale

- Does the model consider the change in concentrations over space?
- Two categories of models exist with respect to temporal scale
  - Steady state model
    - If we reduce the load to 5 kg/day, the concentration will (eventually) reach 230 mg/l
  - Dynamic model
    - If we reduce the load to 5 kg/day, this is how the concentration will change over time

Kinetic Complexity

- What reaction processes does the model simulate?
- Simple decision for chloride, as it does not undergo significant reactions

Potentially Applicable Frameworks

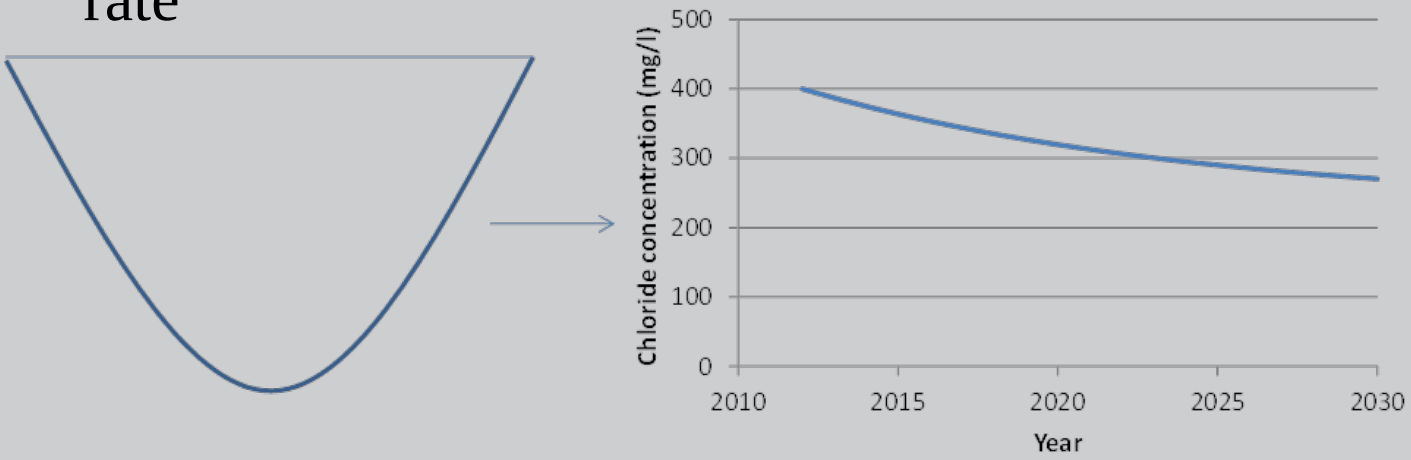
- Four options exist
  - Zero-dimensional steady state model
  - Zero-dimensional time variable model
  - One-dimensional time variable model
  - Three-dimensional time variable model

Zero-Dimensional, Steady State

- Predicts single, lake-wide average concentration expected to be achieved over the long term
- Model equation
  - $C = W \div Q$
  - Chloride concentration = Chloride load ÷ Flushing rate
- Determination of allowable load
  - $W = Q \times C$
  - Maximum load = Flushing rate x water quality target

Zero-Dimensional, Time-variable

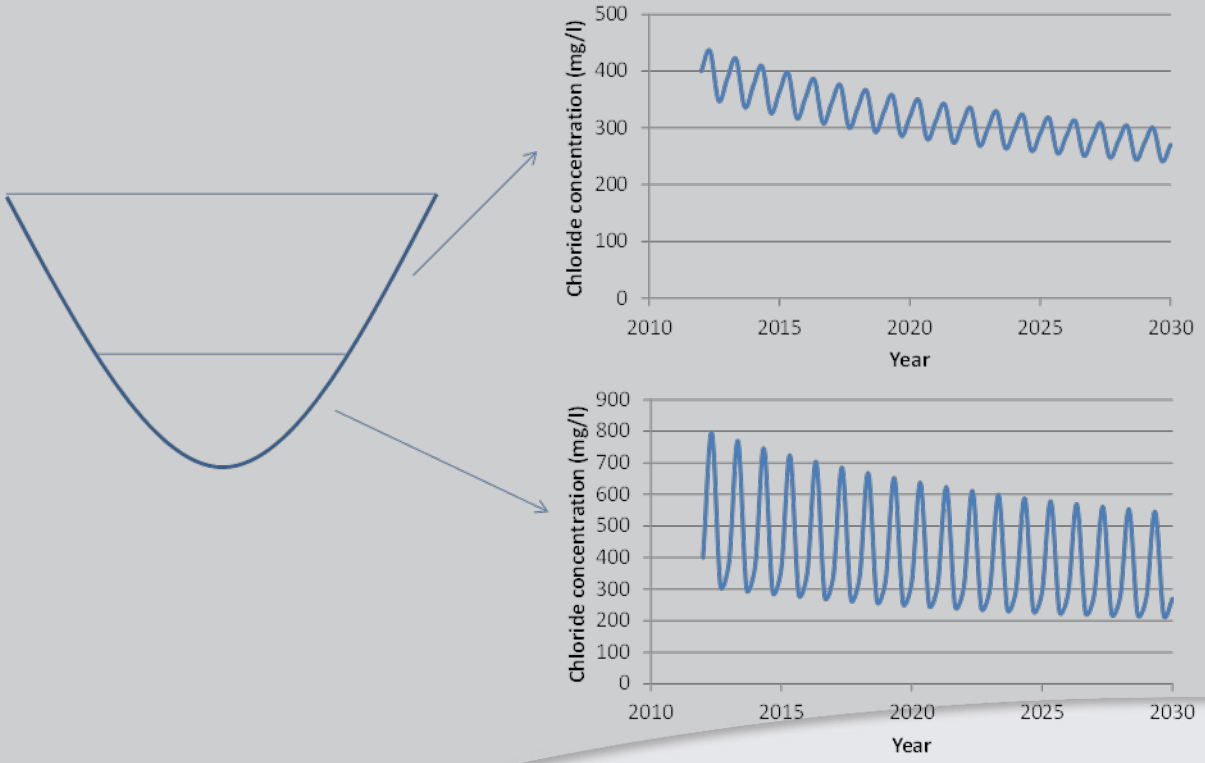
- Predicts lake-wide concentration over time
  - Inputs: Initial concentration, load, lake volume, flushing rate



- Maximum allowable load determined iteratively
  - Based upon desired year for attainment of standards

One-Dimensional, Time Variable

- Inputs: Initial concentration, load, volume, flushing rate, vertical mixing coefficient



- Allowable load determined iteratively

Three-Dimensional, Time Variable

- Required inputs increase substantially
  - Initial concentration in lake (by location)
  - Chloride load (by location)
  - Inflows (by location)
  - Climatic conditions over time
  - Vertical mixing coefficient
  - Lateral mixing coefficient
  - Longitudinal mixing coefficients

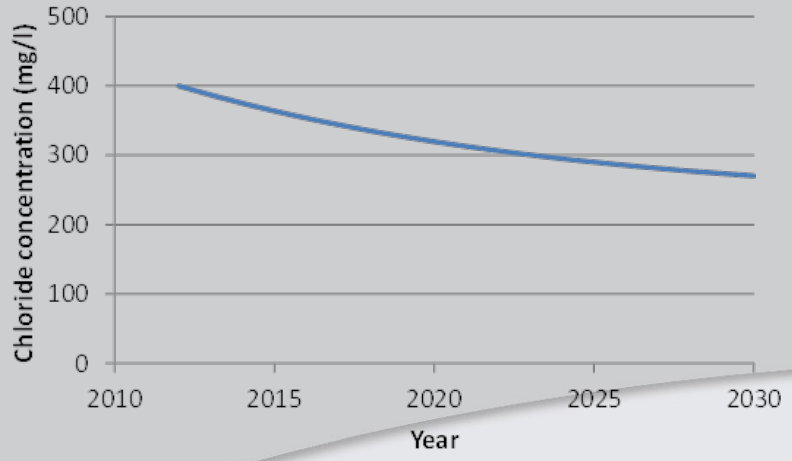
Management Considerations

- Management considerations play a primary role in model selection
- Key management questions to be addressed
  - Is it necessary to consider how quickly lake concentrations will change over time?
  - Does the difference in chloride that occur between the surface and bottom waters need to be described?
  - Does a single region-wide maximum loading rate need to be specified?
  - Do resources exist to support more complex models?

Need For Time Variability?

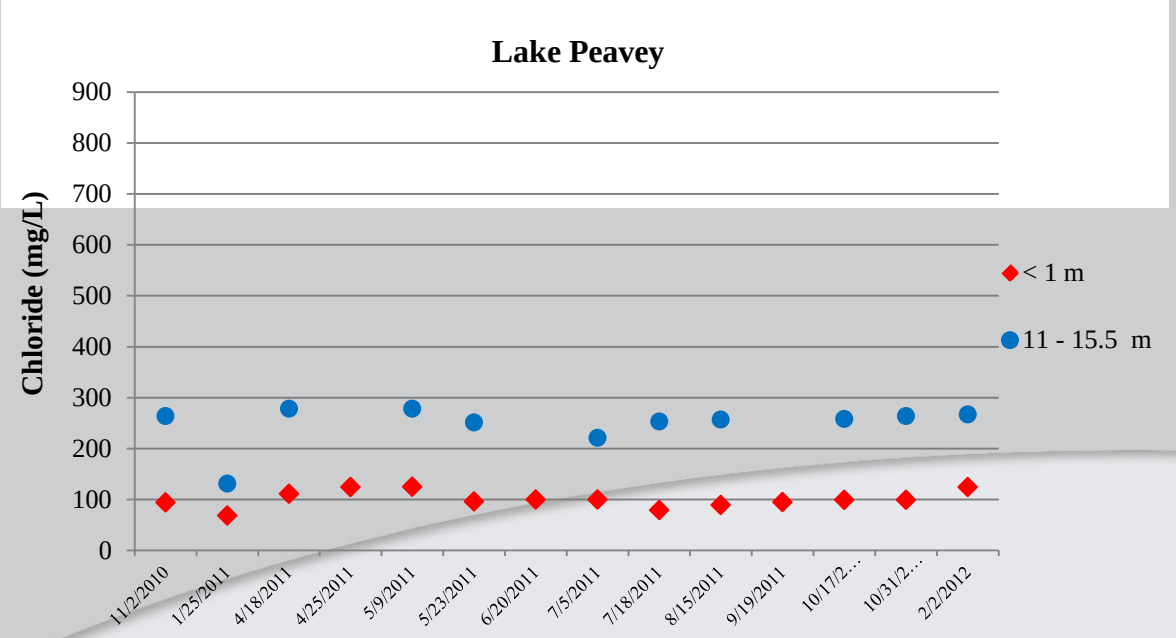
- Is it necessary to understand how long it will take impaired lakes to attain water quality standards?
  - Maximum load = Flushing rate x water quality target

vs.



Need For Spatial Variability?

- Does the difference in chloride concentration between surface and bottom need to be described?
  - Some lakes show persistent stratification



Need for Consistent Regional Allowable Loading Rates?

- Important to consider how results will translate into management actions
- Time-variable models will generate unique results for each lake
- Zero-dimensional steady state can generate a single regional maximum loading rate

Resource Availability

- Application of time-variable and spatially-variable frameworks will require an order of magnitude more resources than zero-dimensional steady state
  - Can/should resources be allocated to support more detailed analyses?

Discussion

- Is it necessary to consider how quickly lake concentrations will change over time?
- Does the difference in chloride that occur between the surface and bottom waters need to be described?
- Does a single region-wide maximum loading rate need to be specified?
- Do resources exist to support more complex models?

Potential Approach

- In the absence of external guidance on management considerations, we would recommend
  - Steady-state, zero dimensional model framework be applied to the majority of lakes
    - the time response of lakes to changes in chloride load will not be a significant management consideration,
    - the majority of lakes do not have persistent, year-round density stratification
  - Steady state, one-dimensional model framework for special cases where lakes have persistent, year-round density stratification affected by salinity

Next Steps

Twin Cities Metro Chloride Project
January 15, 2013 Technical Advisory Committee
Meeting Notes

Attendance: Tara Carson, Hans Holmberg, David Dilks, Jeremy Walgrave, Lois Eberhart, Barb Peichel, Brooke Asleson, Kevin Nelson, Kathy Schaefer, Cliff Aichinger, Anne Weber, Derek Asche, John Erdmann, Mark Maloney, Bob Fossum, Freya Rowland

What have TAC members been doing as far as winter maintenance?

- MPCA had a press release on winter maintenance, Minneapolis was dealing with a water main break, Mississippi WMO monitoring chloride in melt events, Plymouth is using GIS tracking to help more accurately monitor application rates, Shoreview conducted an in-house training on to get their whole organization (different departments) on the same page and calibrated equipment, Ramsey-Washington Metro Watershed District was thinking about providing a big incentive program for cities with impaired lakes but cities are already making good progress, MnDOT received a call every 10 minutes for many days – for snow compaction – Mark and I and participate in webinar talking nationwide EPA and partnership MnDOT and MPCA

Kevin – education and outreach – 2 trainings for MnDOT in west metro – 40-50 drivers and later this month working with SFM workers compensation and Bloomington school – training for school district employees – reduce chloride can workers comp – more proactive treatment on curbline and use a liquid brine mix – and when get closer to school not use granular is being tracked in the school – slips and falls in the school – reduce chloride and reduce slip and fall and rugs and carpets maintenance costs
Bob – making ice backyard ice skating
Kevin Nelson – St. Paul public works – rain is really hard – 16 hours to treat all the streets we have – would like goal to be treat in 4 hours…added brine this year and Como and Capital complex using it…retrofit sanders with automatic controls so can measure some salt use…we do all the MnDOT and Ramsey (took back a couple streets) in St. Paul except interstates
John Erdmann – snow shoveler

- other folks said personally they were trying to use shoveling as a workout plan, – not salt in river – hopefully not much

Mark Maloney, Shoreview – earlier this year
Agenda – overview of project (Brooke), review of modeling options (Jeremy), facilitated discussion on TAC's preferred modeling approach (David) , wrap up & next TAC meeting
Outcome of meeting – clear understanding of the potential modeling approaches available fo rhte project and provide their recommendation to the project team of their preferred modeling approach
2. Review of modeling options (Jeremy) – power point available
Standard

- Current standard 230/860 mg/L (these do apply to lakes, streams, and wetlands)
- proposed standard on sulfate and hardness – 415/675 mg/L (these are just averages but depends on hardness/sulfate in your areas and whether it is a lake or stream – these aren't hard numbers) – so likely to change and expect them to be in place by 2014

- MPCA is working on regional sulfate/hardness standards so we don't have to monitor it everywhere
- Why the change? EPA is recommending these new standards – Iowa has already adopted these (very different in waters where harder)
- About 5 or 6 lakes dropped off of exceedance; some chronic and actue (please send this to Lois)

Data compilation

- Build on 2009 feasibility study
- 2013 monitoring (fall, winter, spring – MPCA is doing 16 of 74 (local partners) and 33 streams and a few storm sewers? Lakes and they do summer too)…meet with that group in February – will meeting with monitoring group to provide some monitoring recommendations (particularly for lakes)
- Data used to categorize waters

Categories

- Exceeds, high risk (within 10% of standard), no water quality exceedance or high risk, insufficient data
- All waters (graphics) – 511 waters no data, 126 no exceedance …look at slide! just lakes …
- For lakes we have data for, roughly 10% exceed wq standard
- Scatter of data – where hot spots are map and includes creeks

Targets

- Protection goals for non-impaired waters – use numeric criteria or some percentage, use existing concentration above existing, or use reference or historical condition or some percentage…alternative or combined with targets – so set performance based goals for users (application rates/best practices)
- Joint TAC and Implementation meeting so figure out how want to set these protection goals – in the next few months (Lois – wouldn't mind meetings more often)
- Need to figure out impairments first and figure out where we are – Lois – pick a path for non-impaired waters…more later
- This is the largest chunk of waters we are dealing with
- Cliff – impairments will help protection so I don't think we need a strategy for protection and if cities BMPs – alternative strategy (performance based goals) – should see improvements in monitoring

Source Identification

- Talking to different applicators – what is typical, how vary event to event – trying to put puzzle together – link cause and effect and set targets and track progress – not for directly comparing one source with another
- Cliff – lakes with groundwater chloride inputs would be very different, some flush and some don't, landlocked – very complex and individual for each lake – good for modeling discussion
- Hans – once we see 10 lakes or 100 lakes – how much effort can we put in each waterbody and then figure out what are the most important components
- Chlorides in groundwater – not a naturally occurring source (still road salt, etc.) but how to model that – eventually groundwater could go down over time just takes longer…more areas infiltrating with BMPs now and going in at a rapid rate because of stormwater regulations

Sources

- Public and private applicators
- What product, how much using (purchasing, usage, application rates), where put it , how (technologies), when apply
- It is really, really hard to estimate application rates

How help

- Surveys, provide input to Brooke, Connie, Jeremy
- Other chloride contributors
- Other factors affecting chloride
- Suggestions on source reporting (templates, online system, etc.)
- Derek using precise software – would he recommend using this? GIS tracking in trucks and then then log on and see – 1st year using it
- Kathy – more agencies throughout MN using Precise and maybe Bloomington and Minnetonka – they can tell me down to the street and the driver (different driver on same road may be applying differently)

Next steps

- Compile available data
- Develop and update trend analyses
- Select modeling approach/data needs
- Develop source reporting template and circulating for review
- Develop apply models
- Missed last one
- Brooke – Raven Creek in rural area – so is road salt

Lois – salinity in ag. Area – lessons learned in other areas

Water Quality Modeling Selection (Dave)

- Outline - Overview, model characteristics relevant to model selection, potentially applicable model frameworks, management considerations, discussion, next steps
- Overview – development of chloride management plan
- Water quality models – max. allowable load to meet standard – need to understand relationship between chloride load and resulting chloride concentration
- Model needs – chloride loads, chloride concentration (acceptable quality – reduce loads to meet standard), environmental conditions
- Cliff – how models handle accumulation (since chloride doesn't deteriorate)
- Frameworks –
- Model characteristics – temporal scale, spatial scale, kinetic complexity (not issue of chloride)
  *note some people are looking at LimnoTech memo during this discussion
- Spatial scale – zero (don't care about differences in lakes top to bottom), one (surface and bottom depth – stratified), two (either top to bottom or longitudinal), three dimensional (changes in all three spatial dimensions)
- …most of this discussion deals with lakes since streams are pretty much one dimensional
- Temporal scale – flipped heading – steady state model (keep concentration steady – reduce load to 5 kg/day then reach 230 mg/l) versus a dynamic model – if we reduce the load to 5 kg/day, this is how the concentration will change over time (need a lot more data to drive dynamic model)

- Kinetic – not relevant for chloride
- Zero dim steady state, zero dim time variable, one dim time variable, three dim ?
- Zero dimensional at steady state (simplest)– (model equation) chloride concentration equals chloride load divided by flushing rate and then determination…allowable load (max load equals flushing rate times the water quality target)…assuming well-mixed lake (and can't consider stratification)
- Cliff – with stratified lakes – more chloride, don't get mixing – so how calculate if lake is not mixing – can't consider this…over predict on top versus under predict in bottom…
- Brooke – assessment guidance will look at either surface or deep. Lois – what does aquatic life need. If not mixing then problematic for whole ecosystem
    - Groundwater – if historically high concentrations in – tell us watershed assimilate

Zero dimensional, time-variable

- Again, assumes well mixed…is it important to know what the time response would be – 5 years, 10 years (need loading rate, volume of lake, initial concentration, flushing rate)
- How good of a predictor – depends on what the application rates and loads – and less accurate
- Assume that we have application rates per year –
- Shape of curve – has constant application rate – but could change application rate versus year – current level get here in in 10 years and then how much reduce to get there
- Uncertainty of climate

One dimensional, time variable

- Inputs –initial concentration, load, volume, flushing rate, vertical mixing coefficient….allowable load determined iteratively
- Lois – average wouldn't stratified (some lakes don't mix every year)
- Assume lakes over this depth do stratify
- Salinity driven stratification – Brownie Lake - 9 acres and 80 feet deep
- Lakes not stratified use zero dimensional, other lakes use one dimensional
- If have high chloride levels in deep parts of the lake – in

Three dimensional, time variable

- Required inputs – initial concentration, chloride, load, inflows, climatic conditions, vertical mixing and lateral mixing coefficients, etc.
- Not really feasible

14 impaired and x number of high risk

Management Considerations

Is it necessary to consider how quickly lake concentrations will change over time?

Difference in surface and bottom concentrations matter?

Does a single region-wide maximum loading rate need to be specified?

Cliff – doesn't make sense because TMDL is based on lakesheds - you could assume so an aerial loading rate and watershed size (tons/square mile)

Kevin – but there is more topography you will be having a higher loading rate (application rates)

Do resources exist for more complex models?

Cliff – how do we accurately predict what is coming from private application

John – time variable not important to MPCA

Kevin – not just implement for 3 years – has to be an ongoing practice for our partners…how long does it get from impaired to non-impaired (good for city councils)

Lois – but so climate variable year to year – more important that we are on the right track
Lois – permits say that load applications
TMDL could say long and short term loading rate
Bob – how much cost from steady state versus time variable – useful for everyone to see where we are compared to what curve is showing…time variable is more valuable – so if we use it for implementation (steady state), but if we use it for loading rate
Cliff – zero dimensional, steady state – we have really detailed information for our lakes and we could go next step – we have time variable
John – set allowable loading based on steady state but then compliance is 20 years out
Cliff – why would cities make changes but then go back (calibrated spreaders, brine mix, etc.)
Lois – CSO separation
Derek – once done here, how would monitoring be done – some have annual monitoring (Bassett Ck), have to know if going in right direction…impaired waters…
Derek – How to separate for the steady state model (parking lots versus roads)
David - that is step 2 of the TMDL (how allocate load)
Brooke – we haven't developed the monitoring plan yet – every three years or conductivity every year but we – monitoring plan recommendations from MPCA – progress for permit could be BMPs
Bob – monitoring has to happen in order to delist a waterbody
Lois – commitment from DNR and MPCA water quality monitoring – DNR does biological monitoring – for Metro MPCA is doing limited…MPCA has a delisting process
MWMO – steady state – what using input…we see difference in chloride in wetland as far as surface or bottom depth…would that be an average concentration – TMDL only uses chloride standard…need one dimensional model
John – need a volume average
Kevin – how do creeks fit in – we don't have to worry about time-variable…we would use a zero-dimensional, steady state approach for streams (what existing loads)
Spatial variability – surface versus bottom difference matter?
John – if permanently stratified…Brownie
Barb – can we do a 3-dim model on just Brownie and a couple more and a more simple model on the other ones?
Brooke – or if seeing the higher concentration in the deeper part maybe use one-dimensional…not thoroughly mixing – may become chemically stratified
Desire for consistent allowable loading rate????
Limnotech – recommends steady-state, zero to majority to lakes (only 1D on lakes with chemical stratification) – if what is more stringent for streams versus lakes
Bob – has to be regional goal versus individual…Cliff but is there a way to look at subregions – one might be 8 or 6 – difference in runoff is most important – parking lots versus streets…more densely developed…Hans that applies more to implementation rather than the TMDL
Lois – Minnehaha finding differences in different parts of the watersheds – one size fits all approach doesn't seem like it would work, but not iterative
Rivers- look at different options
David – time not for allowable loads, but for informational -

TCMA Chloride Project
TAC meeting #4
March 27, 2013 9:30-12:00pm
MPCA St. Paul office
Room 1-2

Desired outcome of meeting*:* TAC members to have a clear understanding of the potential loading approaches available for the project. The TAC to provide their recommendation to the project team of their preferred modeling approach. Begin the conversation about baseline year for the model and the TMDLs.

Agenda

- Introductions & Overview of meeting (Brooke, MPCA)
- Review Modeling options from previous meeting (Jeremy Walgrave & Hans Holmberg, LimnoTech)
- Discuss regional versus individual loading options (Jeremy Walgrave & Hans Holmberg, LimnoTech)
- Facilitated discussion on TAC's preferred approach (Everyone)
- Discuss baseline year options for model and TMDLs (Jeremy Walgrave & Hans Holmberg, LimnoTech)
- Make final modeling recommendation (TAC)
- Wrap up & Next TAC meeting (Brooke, MPCA)

Twin Cities Metro Chloride Project

TAC Meeting #4

March 27, 2013

LimnoTech

Goals – TAC Meeting

- Understand pros and cons of range of modeling approaches as related to:
  - TMDL
  - Implementation
- Build consensus on modeling approach
  - Establishing “baseline”
- Modeling recommendations, including pros and cons related to implementation, will be presented to Implementation Plan Committee

Project Overview - LimnoTech

Water Quality Data Compilation

Categorize Waters

Develop Targets

Source Identification

Modeling and Analysis

Write Management, Implementation, and Monitoring Plans

Management questions that inform modeling approach

- Is it necessary to consider how quickly lake concentrations will change over time?
- Does the difference in chloride that occurs between the surface and bottom waters need to be described?
- Does a single region-wide maximum loading rate need to be specified?
- Do resources exist to support more complex models?

Key take-aways from last meeting

- Changes over time
  - Use this only for informational purposes, not in loading capacity determination
- Surface versus depth consideration in modeling
  - Only on case by case – criteria still to be determined? (for sure those with chemical stratification, others?)
- East to west (bay to bay) information
  - Not important
- Regional versus individual loading capacity
  - Very important to have regional values (or “sub-regional”)
- Inclusion of non-impaired waters in modeling
  - Very important to include all waters in modeling effort
- Cost of the modeling
  - Not a consideration

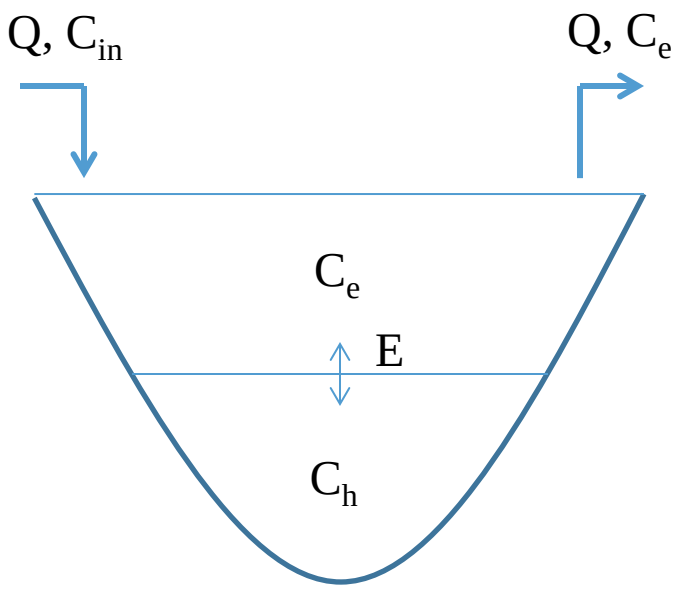
Dealing with 3 basic types of waters

- Non-stratified lakes
- Stratified lakes
- Streams

Potentially applicable lake model frameworks

- Four options exist
  - Zero-dimensional steady state model
  - Zero-dimensional time variable model
  - One-dimensional time variable model
  - Three-dimensional time variable model

One-dimensional model becomes zero-dimensional at steady state



Q = Flushing flow
C = Concentration
E = Exchange between layers
V = Volume

Mass Balance in Epilimnion

Change in mass = Inflow – Outflow +/- Exchange

$V_e dC_e/dt = QC_{in} - QC_e + E(C_h - C_e)$

Mass Balance in Hypolimnion

Change in mass = +/- Exchange

$V_h dC_h/dt = + E(C_e - C_h)$

At Steady State, dC/dt = 0

$C_e - C_h = 0$

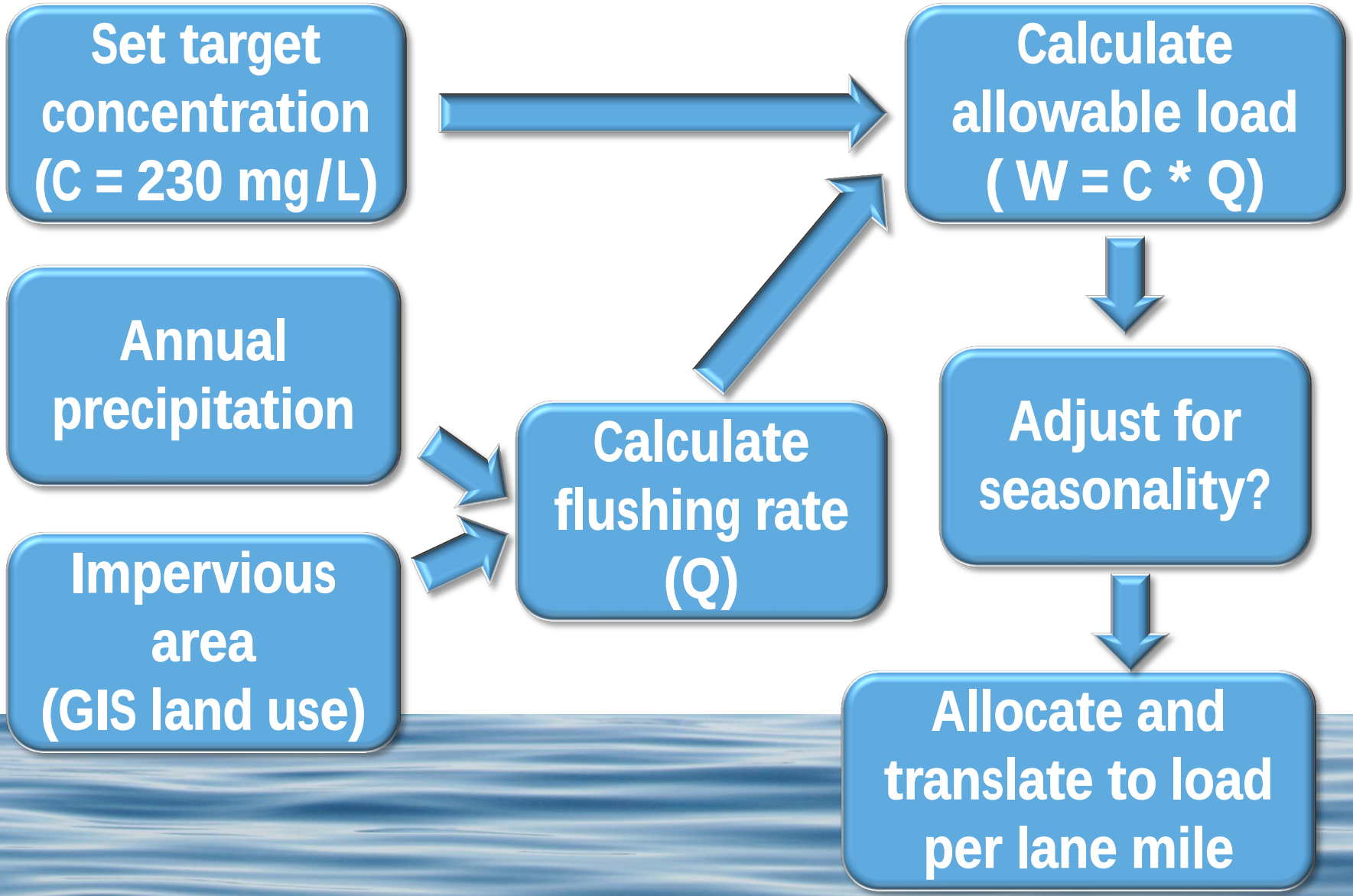
$C_e = C_h$

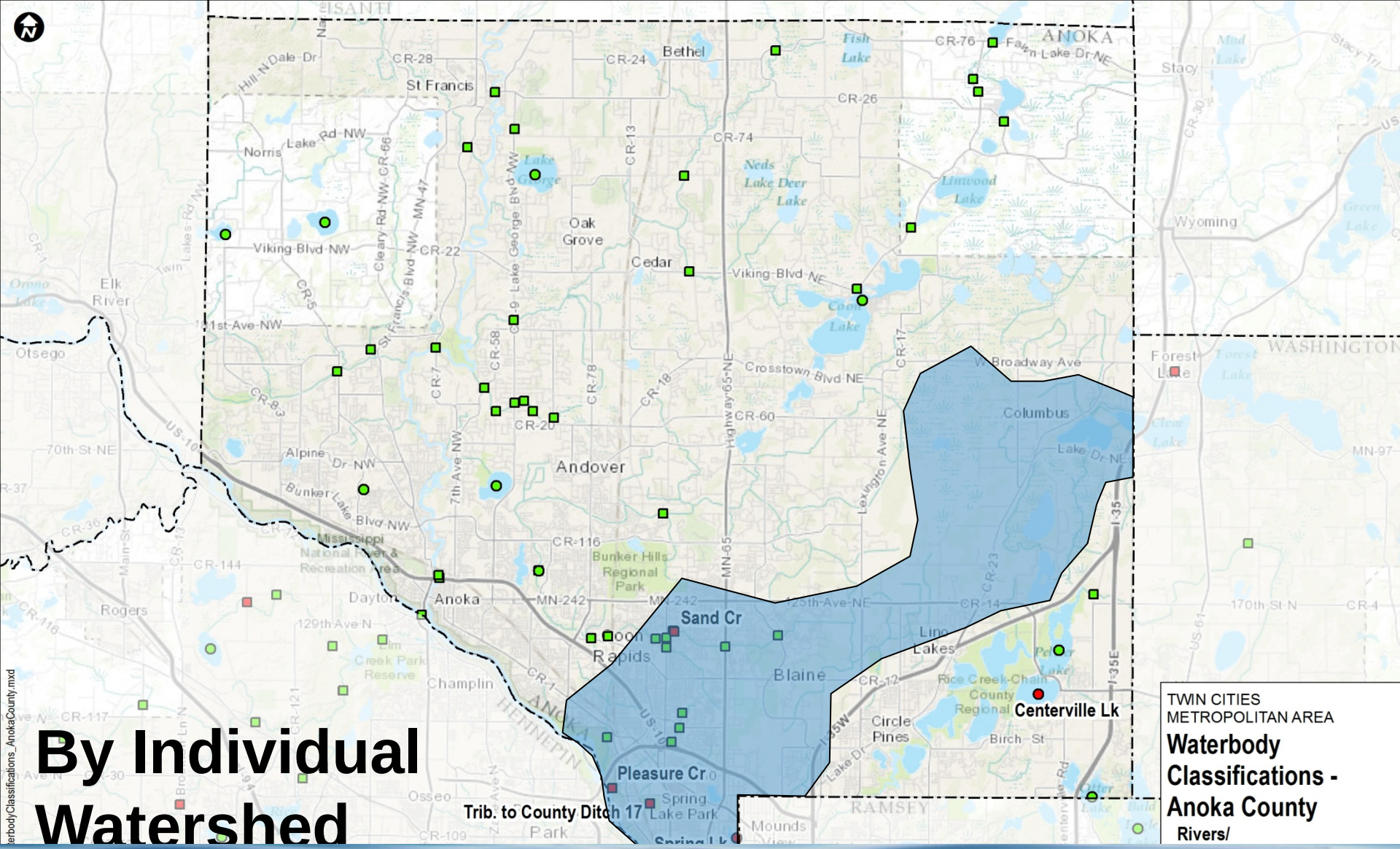
Model equations are identical to 0-D model

Proposed approach

- Set TMDL based on zero-dimensional steady state model for lakes: maximum load = flushing rate x water quality target
  - Flushing rate (annual runoff) can be determined on an individual lake basis, a metro-wide basis, or sub-regional level (county or city basis, or urban/suburban/rural)
  - Potential to apply an adjustment factor for seasonality based on observed swing in concentration
  - Time-variable model can be used to inform expectations (how long to achieve criteria?) and implementation
- Compare maximum load for lakes versus streams
  - Choose more restrictive approach and apply regionally? or
  - Individual approach for streams?

What the process looks like…





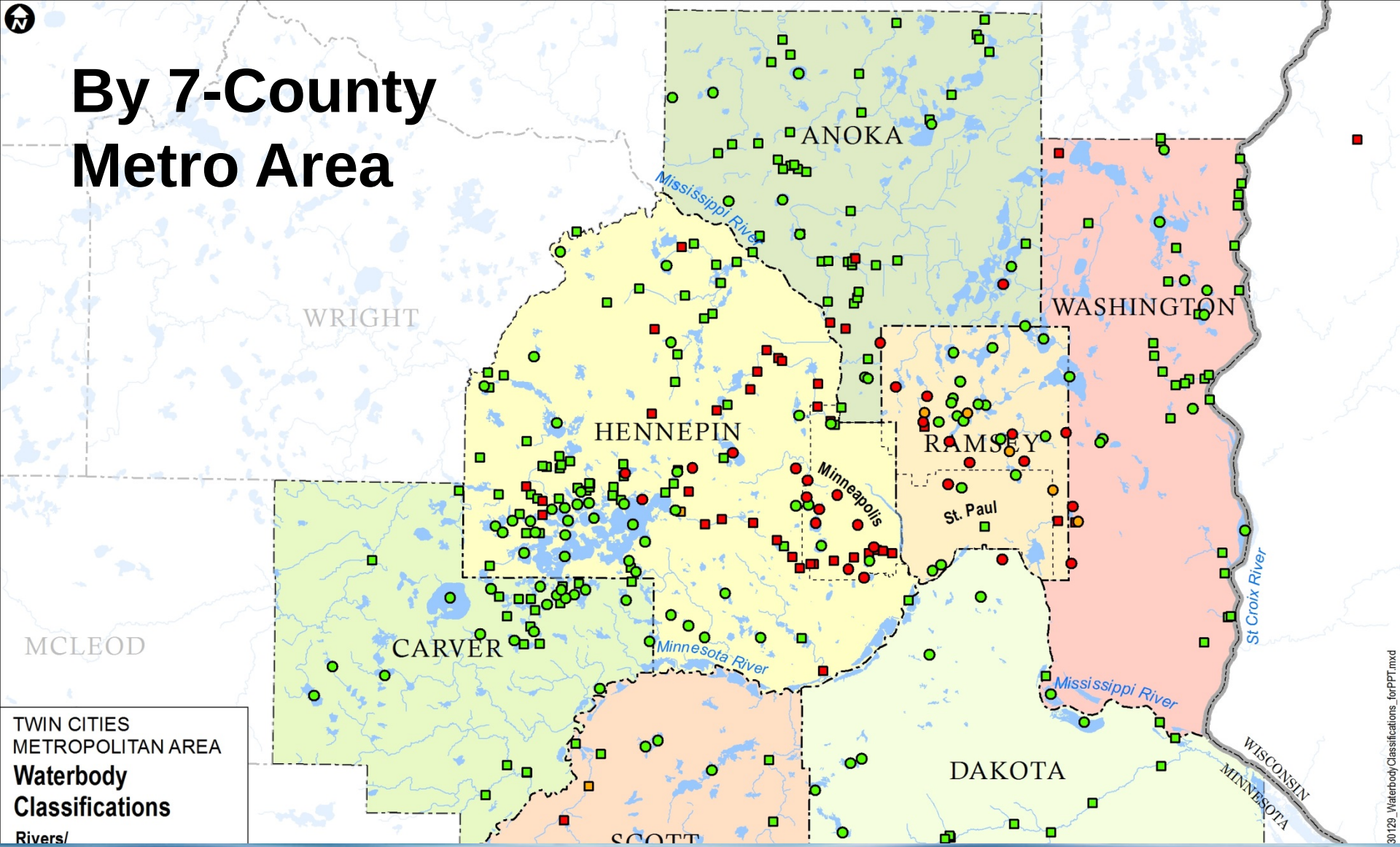
TWIN CITIES METROPOLITAN AREA

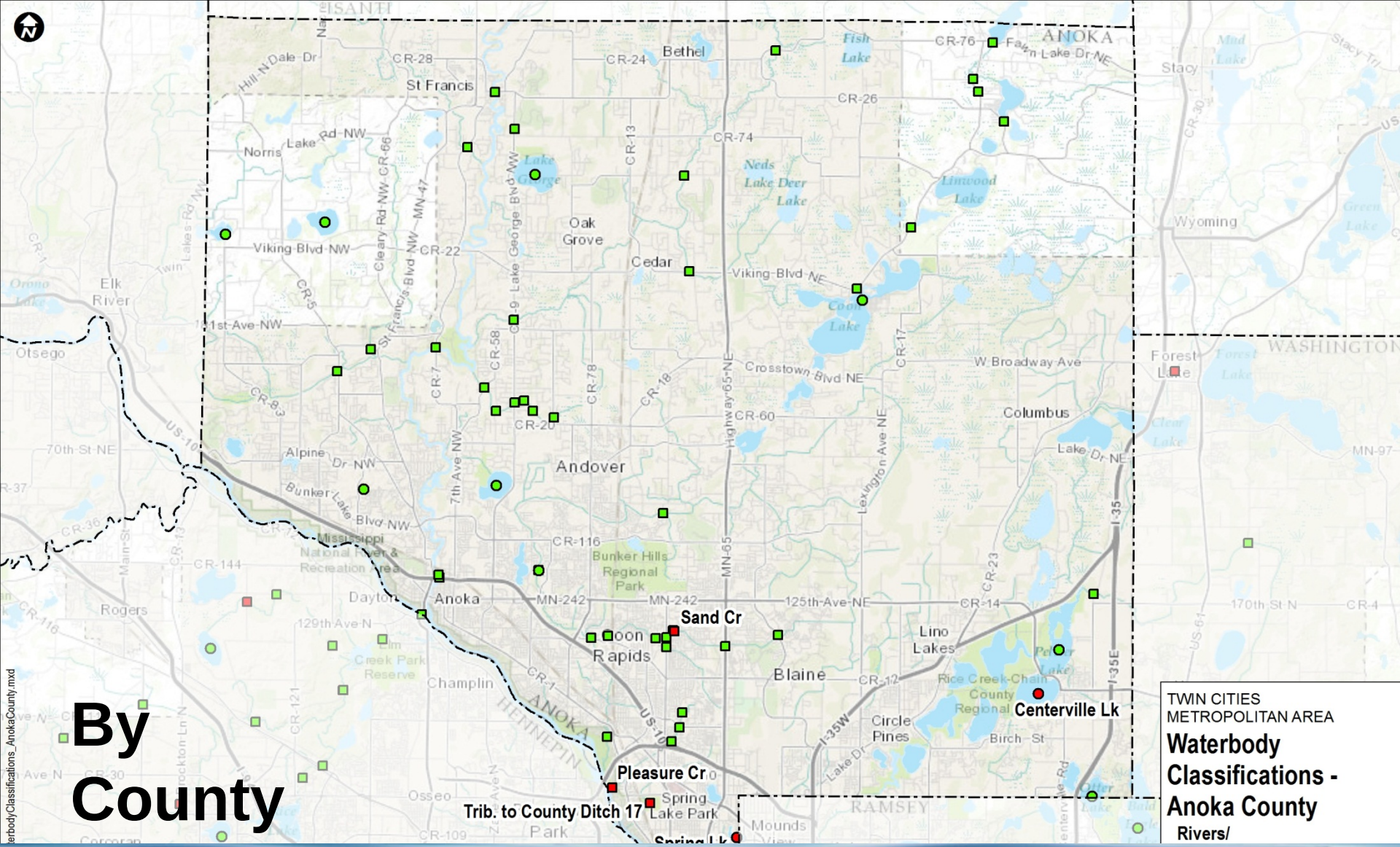
Waterbody Classifications - Anoka County

Rivers/

By Individual Watershed

By 7-County Metro Area




By County
TWIN CITIES METROPOLITAN AREA
Waterbody Classifications - Anoka County
Rivers/
Sand Cr
Centerville Lk
Pleasure Cr
Trib. to County Ditch 17
Anoka
Andover
Blaine
Coon Rapids
Oak Grove
Cedar
Columbus
Lino Lakes
Circle Pines
Spring Lake Park
Mounds View
Ramsey
Champlin
Rogers
Elk River
Otsego
St Francis
Bethel
Wyoming
Forest Lake
Stacy
Viking Blvd NW
Viking Blvd NE
Crosstown Blvd NE
W Broadway Ave
Bunker Lake Blvd NW
Alpine Dr NW
Lake Dr NE
125th Ave NE
129th Ave N
Rice Creek Chain of Lakes Regional Park
Bunker Hills Regional Park
Mississippi National River & Recreation Area
Elm Creek Park Reserve
CR-28
CR-24
CR-26
CR-74
CR-22
CR-116
CR-12
CR-14
CR-76
MN-242
MN-65
I-35
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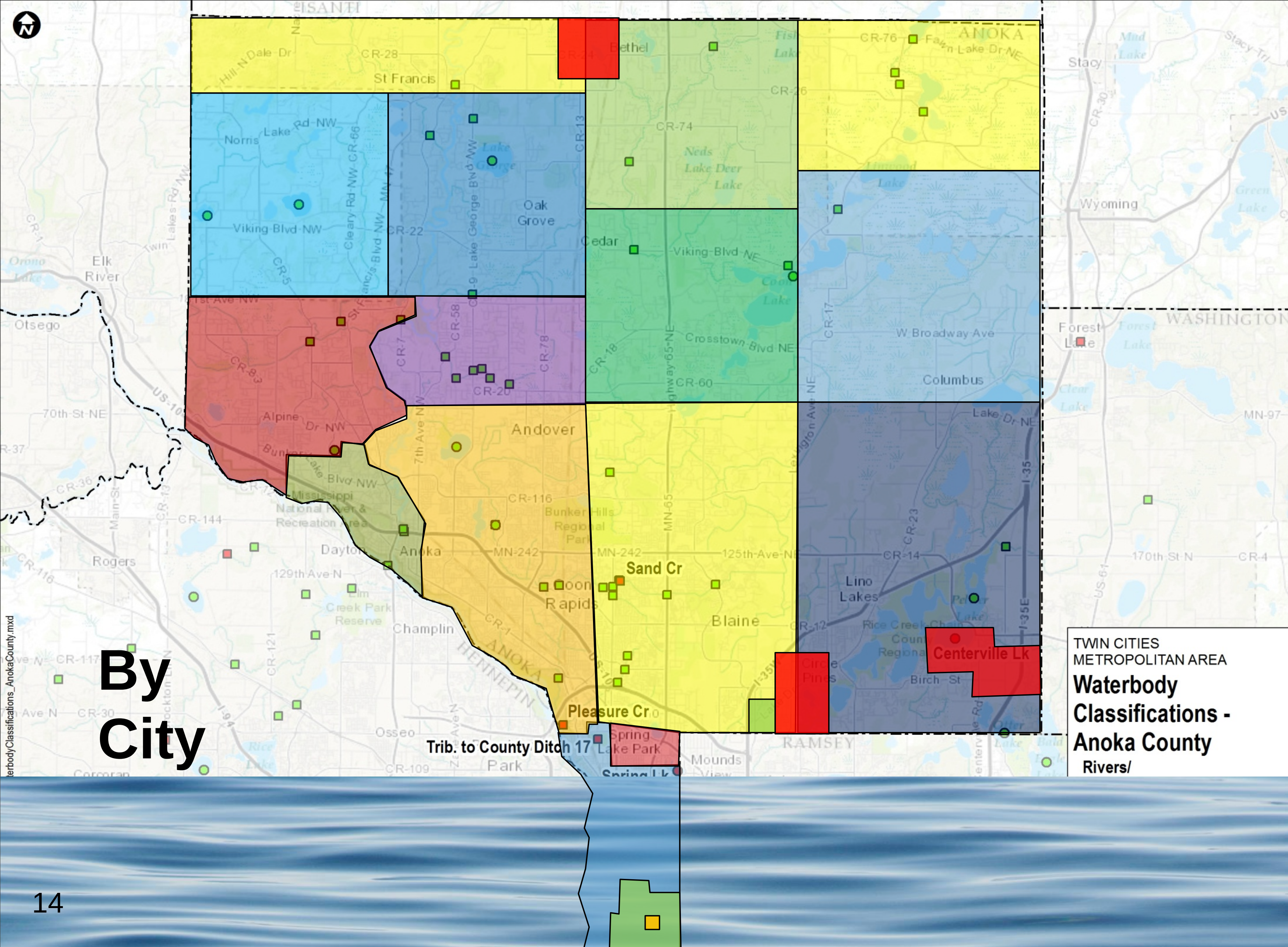
I-35E
US-10
US-61
ANOKA
HENNEPIN
WASHINGTON
RAMSEY

By City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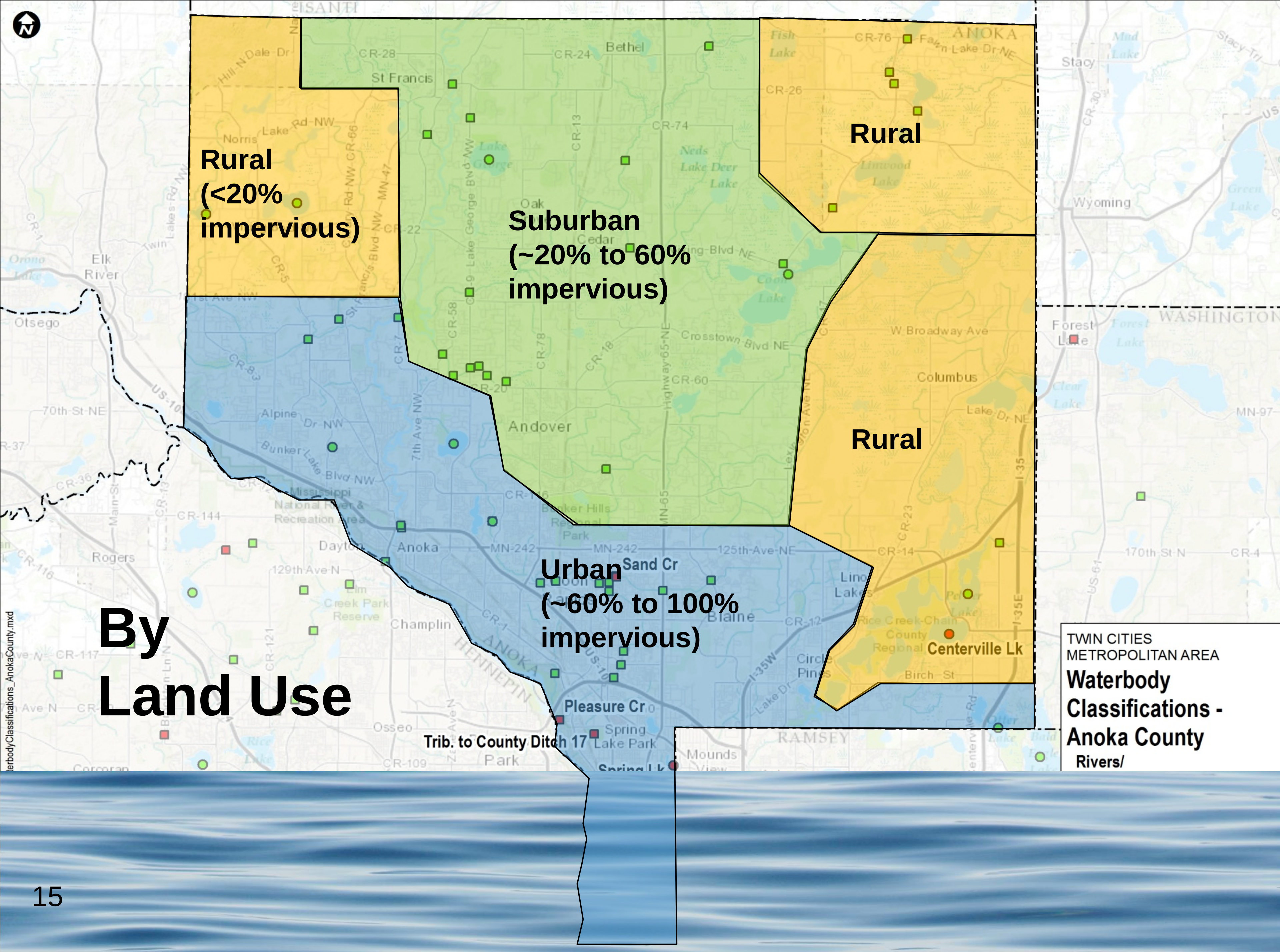
ANOKA
ISANTI
HENNEPIN
RAMSEY
WASHINGTON
Elk River
Otsego
Rogers
Dayton
Champlin
Osseo
Stacy
Wyoming
Forest Lake
Mounds View
WaterbodyClassifications_AnokaCounty.mxd


Rural
(<20%
impervious)
Suburban
(~20% to 60%
impervious)
Rural
Rural
Urban
(~60% to 100%
impervious)
TWIN CITIES
METROPOLITAN AREA
Waterbody
Classifications -
Anoka County
Rivers/
Centerville Lk
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Anoka
Andover
Blaine
Columbus
St Francis
Bethel
Oak
Champlin
Rogers
Elk
River
Otsego
Wyoming
Forest
Lake
Stacy
Circle
Pines
Lino
Lakes
Spring
Lake Park
Mounds
View
Osseo
Dayton
ANOKA
WASHINGTON
RAMSEY
HENNEPIN
ISANTI
Linwood
Lake
Coon
Lake
Bunker Hills
Regional
Park
Rice Creek Chain
County
Regional
Mississippi
National River &
Recreation Area

By Land Use

Example 0-d Steady State Model for Regional Land Use Approach

Target Concentration	230	mg/L
Annual Precipitation	30.61	inches

Land Use Type	Impervious Cover	Average Impervious Cover	Runoff Coefficient	Flushing Rate, Q ($ft^3/mi^2/yr$)	Allowable Load, W = Q * C ($tons/mi^2/yr$)	Allowable load on impervious surfaces ($tons/mi^2$ impervious/yr)
Urban	60%-100%	80%	0.77	54,757,127	393	491
Suburban	20%-60%	40%	0.5	35,556,576	255	638

Considerations for individual vs regional modeling approaches

Approach	Considerations
Individual	Site-specific - many, many allowable loading rates
	Variable reductions across region/county/city
	Handling of nested watersheds
Regional: 7-County Metro	One allowable loading across metro
	Averages land use/lane mile density
	Could under or over protect specific waters
Regional: by County	7 allowable loading rates
	Different reduction goals for MNDOT
	Could under or over protect specific waters
Regional: by City	Many allowable loading rates
	Different reduction goals for MNDOT and counties
	Could under or over protect specific waters
Regional: Urban, Suburban, Rural	Different allowable loadings across regions
	Variable reductions across region/county/city
	May need to increase reduction goals as development occurs

Considerations for individual vs regional implementation approaches

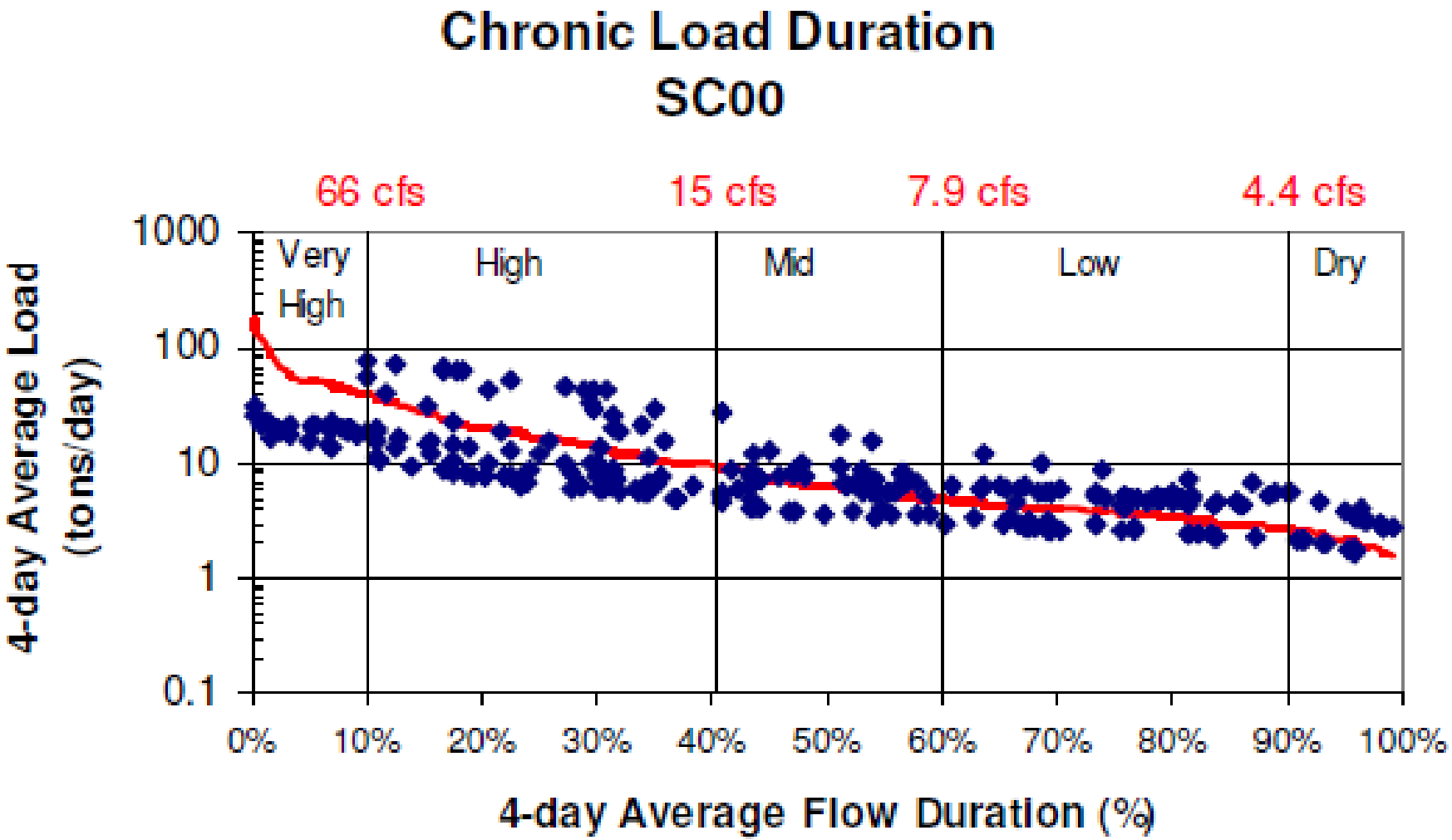
- If individual modeling approach taken, then:
  - TMDL could set specific allowable loading rates & Implementation could call for varying degrees of reductions, or
  - TMDL could set specific allowable loading rates & Implementation could call for a regional level of reduction based on selection of a “sufficiently” protective loading rate

- If regional modeling approach taken, then:
  - TMDL would set one allowable loading rate & Implementation would call for a regional level of reduction

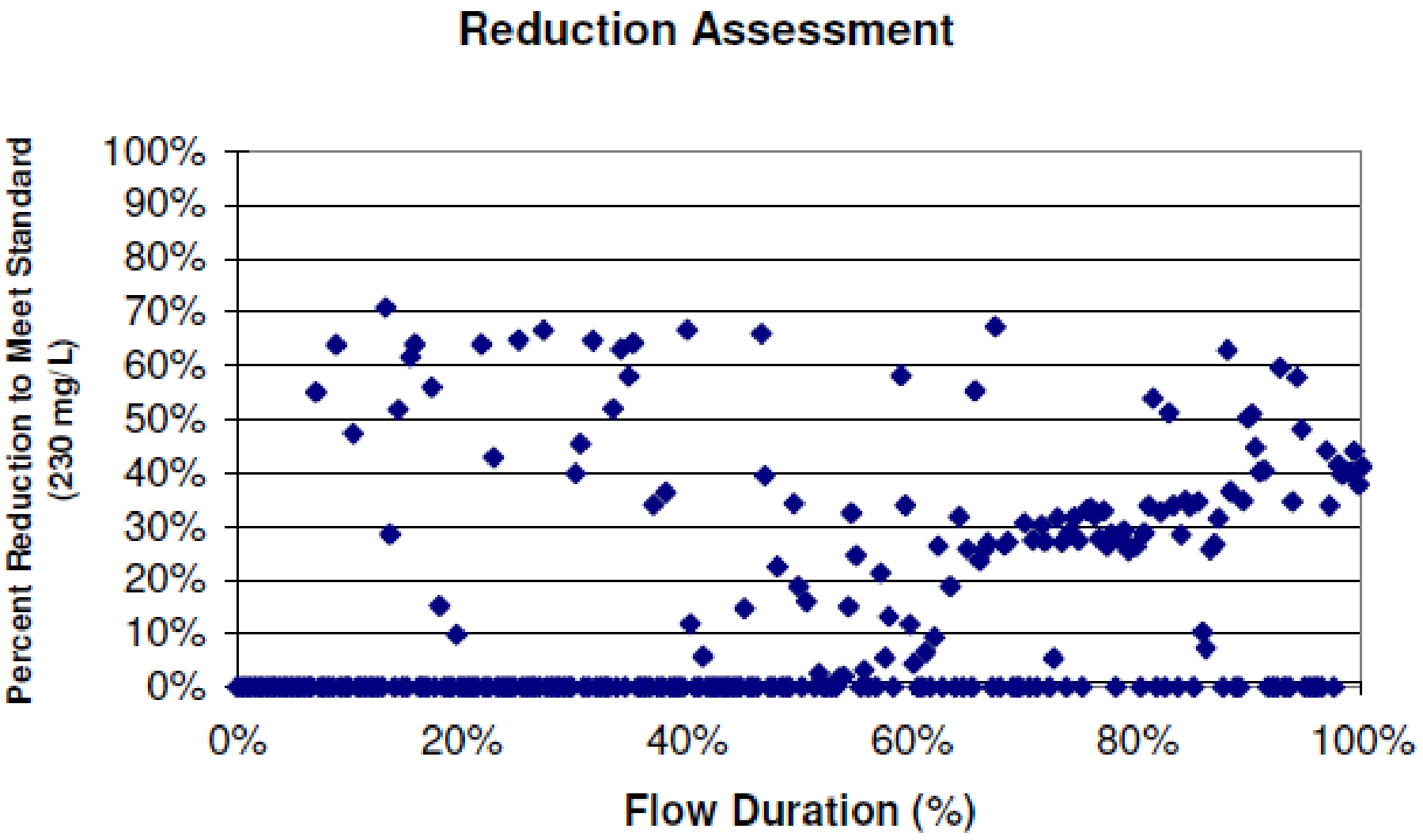
Now to consider streams…

- Streams respond on a finer temporal scale than lakes
  - Event basis rather than annual or longer
  - Likely makes streams more critical case than lakes
- Mechanistic model possible, yet complex and resource intensive
- Empirical approach more efficient if enough data exists
  - Both Shingle Creek and Nine Mile Creek TMDLs applied an empirical approach

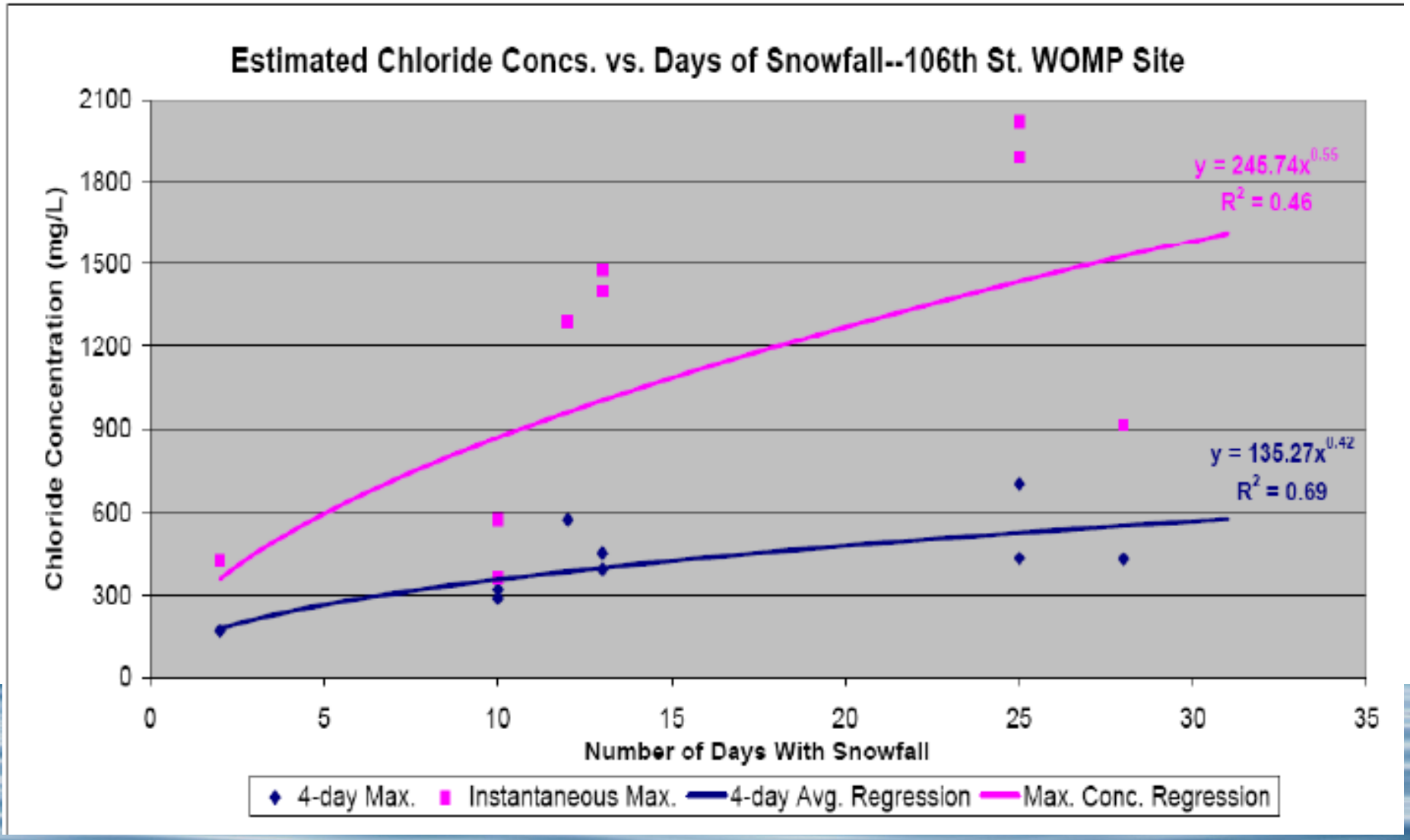
Shingle Creek Approach



Shingle Creek Approach (cont.)



Nine Mile Creek Approach



Summary of Existing Stream TMDLs

Stream	Observed Peak Cl Conc. (mg/L)	Existing tons Cl applied per yr	Watershed Area (mi^2)	Baseline Application Rate (tons/mi^2/yr)	Required % Reduction (including MOS)	Allowable Load (tons/mi^2/yr)
Nine Mile Creek	605	6,357	44.5	143	71%	41
Shingle Creek	821	6,449	44.5	145	62%	55

Baseline conditions for Modeling/TMDL

- Important to keep in mind baseline for modeling is used to set TMDL, that is the allowable loading
  - The allowable loading is then allocated (equitable)

- Suggested baseline conditions for lake modeling
  - Most recent available land use coverage for metro

- Suggested baseline conditions for stream modeling
  - Most recent period providing sufficient data to establish relationship

Baseline loadings to establish required % reduction

- Important to keep in mind % reduction from "baseline" conditions is a "relative" means of informing Implementation
  - It is not required for TMDL

- Options:
  - Historical application rates
    - Potential to show greater % reduction needed to attain WLA, but may be able to demonstrate progress already made
  - Current application rates
    - May show smaller % reduction needed to attain WLA

Recommended Approach

- Set lake TMDLs based on individual zero-dimensional steady state model: maximum load = flushing rate x water quality target
  - Assumes watershed delineations for all listed lakes are available
  - Evaluate adjustment factor for seasonality
  - Time-variable model can be used to inform expectations
    - Assumes lake volume is readily available
- Confirm Nine Mile and Shingle Creek assessments of existing loadings, required reductions, and allowable loadings are consistent with other impaired streams and set TMDLs accordingly
- Compare allowable load for lakes versus streams
  - More restrictive approach drives regional Implementation

Questions?

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LimnoTech – Twin Cities
hholmberg@limno.com
715-808-0182

Twin Cities Chloride Project
TAC meeting #4
March 27, 2013, 9:30-12:00

Attendees – John Erdmann-MPCA, Lois Eberhart-City of Minneapolis, Mike Maloney-City of Shoreview/APWA, Brooke Asleson-MPCA, Hans Holmberg-LimnoTech, Kari Oquist-Mississippi River WMO, Mark Fischbach-MnDOT, Barb Loida-MnDOT, Nick Tiedeken-MnDOT, Anna Kerr-MPCA, Becky Houdek-Minnehaha Creek WD, Jeremy Walgrave-LimnoTech, Tara Carson-MnDOT, Anne Weber-City of St. Paul, Cliff Aichinger-Ramsey Washington Metro WD, Barb Peichel-MPCA, Dereck Asche -

Introductions/Overview

Reviewing Modeling Options from previous meeting

- Which impaired waters are we talking about? How can we do a TMDL if we don't have a list of impaired waters? We don't know until the official assessment which waters are officially impaired. We likely have 28 lakes and 20-30 streams stations (not reaches). How much data was collected for each lake? How can we make these modeling decisions when we don't know the waterbodies. In general, there is information we can use for modeling. How many samples were taken at each site? We look at most recent 10 years of data – one exceedance of the acute. Is it anywhere in lake in the lake? Deepest part of the lake is our monitoring protocol. For the 74 lakes that were monitored as part of this project, we took samples at both surface and deep parts of the lake (note that the sampling station itself for lakes is at the location of the lake with the deepest bathymetry).
- Is it the issue of density part of why we are monitoring the deep part of the lakes? Brownie Lake is the one lake we know isn't turning over because of the chloride levels at the deep part of the lake – it is… There is a fear that lakes will not turnover because of elevated chloride levels – yes, we are concerned about that. We did look at the Osgood index (add parameters…lake depth, etc.) that are mixing or are most at risk for not turning over due to chloride. There is a hope that implementation will lead to delisting but for chloride that is different. We don't really have the technology to remove chloride. But is the TMDL achievable? If we reduce the chloride coming into the lake, someday the lake could flush out the salty water eventually so for most lakes it could be achievable. Landlocked lake also has groundwater so could flush out. We would have to reduce load dramatically to make progress. We will all have to apply practices for the entire city or watershed that are the same. For seven lakes near downtown Minneapolis, we could do different practices.
- Is there a new standard. How would that impact the number of lakes listed. We have been planning for new EPA proposed standard. EPA determined that some species are more tolerant/intolerant to chloride so they are going to redo testing. MPCA won't adopt new EPA guidance (that isn't ready) for at least 3-5 years. Are these species in Minnesota? EPA uses species representative of entire region. MnDOT asked MPCA to look at Iowa species and MPCA did work on that. EPA approved Iowa criteria.
- No minimum waterbody size for this assessment – that is true – the standard applies to lakes and wetlands. Mississippi River WMO has wetland data for chloride they are submitting by May for the assessment.

*Action - provide the preliminary list of waterbodies to entire TAC and assessment criteria.

- Lois – Assume we can't do TMDL until waterbody and drainage areas are identified. We need to know the assessment criteria and number of impairments.

Regional versus individual loading options and discussion on TAC's preferred approach

- What modeling might look like for setting TMDL loading
- Understand pros and cons and build consensus on modeling approach
- Limnotech has compiled the chloride data, categorized waters, developed targets, source identification, salt usage application rates across Metro, pull it all together into management, implementation, and monitoring plans.
- Questions used to discuss model selection (also discussed at the last TAC meeting)
    - Is it necessary to consider how quickly lake concentrations change over time?

    - Does the difference in chloride that occurs between surface and bottom waters need to be described?
    - Does a single region-wide maximum loading rate need to be specified?
    - Do resources exist to support more complex models?
- Entity may want 2 different standards – impaired (regulated) versus protection (good practice)
- What we heard from last meeting. We heard that changes over time – that we could use this just for informational purposes (but not in loading capacity determination). Will there be guidance in whether it will take 10 or 100 years for each waterbody? Yes, we could provide that based on residence time (flushing rate and volume if that is available). You could get there faster if cut chloride coming in by a different x factor. Surface versus depth consideration – only need to know that on case by case basis. What is assessment protocol – the depth and surface samples are analyzed separately. Example would be Lake Minnetonka. East to west (bay to bay) information not important. Regional versus individual loading capacity – very important to have regional values. Inclusion of non-impaired waters – very important. Cost of the modeling – not a consideration (can't do Cadillac version) – but with millions of dollars for implementation, we should. Hope that we will have a robust model that we will have for doing implementation. If you are spending $250K for this project, some of the projects spent that on just one impairment – is it appropriate? Chloride is fairly easy to model and we are not cutting corners on this one. But you will help choose the modeling approach that works for you.
- Non-stratified lakes, stratified lakes, streams.
- Four options – zero-dimensional steady state model, zero-dimensional variable model, one-dimensional time variable model, three-dimensional time variable model. We thought that the zero-dimensional steady state model is sufficient to set TMDL loading rate(will help us get to surface and depth and mixing questions) – this will answer the questions we are interested in. Can use a zero-dimensional like a one-dimensional.
- Proposed approach – set TMDL based on zero-dimensional steady state model for lakes: maximum (allowable) load = flushing rate x water quality target. Flushing rate (annual runoff) can be determined on individual lake basis, metro-wide basis, or sub-regional level (county or city basis, or urban/suburban/rural). Would this be annual or daily load? We need daily for EPA TMDL, but you would use annual load. Would be important to use annual loads for implementation and permitting. Potential to apply an adjustment factor for seasonality based on observed swing in concentration – instead of targeting 230 mg/L we would apply this factor to address peaks to be most protective of water quality (could be lower than 230 mg/L). Peak in late winter seems negligible since macroinvertebrates aren't active at that time. Time-variable model can be used to inform expectations (how long to achieve criteria?) and implementation. Who are the best authorities on the aquatic life? That is how EPA/MPCA sets the standard.
- How do we manage on annual basis when the winters are very different? How does this work with our permit? Just because you were over your loading rate one winter doesn't mean you are violating your permit. Useful to know what is being the approach, not the list of Best Management Practices (BMPs). Fortin is helping a tool that is web-based interface tool – here are the BMPs that you could use. If you have to model a certain year compared the baseline year – can you do that? It could be done, but that would be time variable model. For steady-state, that assumes average annual precipitation and wouldn't change it year to year. We are going to calculate the chloride load. This is not going to calculate the existing load, this will calculate the load based on the TMDL. How put it back in lanes per mile if don't know the runoff by subwatershed? Want to know what to base your operation on. Manage expectations – even if we changed our practices, it could take 10-20 years. If you want to monitor our performance, we could use a time-variable model for implementation. Streams are different because their conditions respond much more strongly to single events compared to lakes. Where do wetlands fit in? The zero-dimensional, steady state model could be used for wetlands if residence time would is more than a year. We will have to see which wetlands to see if we use more of a stream or lake modeling approach. But some areas, could have more chloride flush in (example is wetlands and groundwater). If you set a load for a stream – that would be pounds and then that depends on flow, right?
- Compare maximum load for lakes for streams – choose more restrictive approach and apply regionally. Individual approach for streams?
- Process. Set target concentration (C) at 230 mg/L then calculate allowable load (W=C*Q), then adjust for seasonality (maybe) then allocate and translate to load per lane mile. Note that the annual precipitation and impervious area (GIS land use) are used to calculate the flushing rate (Q). Atlas 14 (NOAA driven project to

update rainfall amounts in this country) is almost ready – can we use it for this project? Yes, we could use it and use north or south metro levels. What about parking lots (this just says lane mile) – they are a source too. They will be considered too.

- What model looks likes – one objective is to set TMDL for impaired water and another objective is implementation.
- Map of individual watersheds (hypothetical examples) – what if we did the model this way. If we had impaired waterbody and use GIS to get drainage area. Calculate impervious are to calculate runoff. But you can have rate controls in place so not very scientific. Need to account for frozen ground? Again, this is an annual approach. This is just a general estimation of rainfall running off. Set allowable load – 100 tons/square mile/year. Then look at what MnDOT or County or City does in this individual watershed or outside this watershed. TMDL target on water specific basis. How does this relate to implementation approaches? Not likely state operators may flip switch. Better example is Minneapolis where neighborhoods where we would apply less for those areas and encourage folks to drive slower, but wouldn't do this downtown. MnDOT wouldn't change their application – need operators to follow guidelines. Where we see the salt right now is where we over-applied because it didn't turn to liquid. Pretty much application rates are used for 40-50 years. But each individual watershed is really different – could have more highways or have industrial areas. Correlation between public safety and application rates. At local level, we don't have crash data compared to highways and people who can talk to elected officials. Need to separate out fact and fiction for safety issue. Radically different application salt application rates based on who is applying. There has been a lot of work on implementation strategies that reduce salt use and in some cases these are cut in half or more. A lot of cities have already made a lot of changes to reduce salt use. Shingle Creek did TMDL, doing work, and showing dramatic reductions. Need to move in this direction for each watershed. We need to show them we have to move them in that direction. TMDL is only one tool we are using. Modeling approach for streams and lakes – are you asking us if we need to choose and if they need to be the same – the number of regulatory entities in a lake versus stream watershed would be drastically different. TMDL is specific to waterbody and that is what makes it more scientific - would rather look at each lake individually.
- Other option is to look at it by 7-county metro area – entire area. Could give everyone in Metro the same loading rate. This would be less protective for Metro core and more protective to outside Metro. Is EPA even open to this conversation? Thought we couldn't do this (example – Lower Mississippi fecal TMDL). Seems like a different standard for different densities. State could also set site specific standards. Sand Creek seems odd – where are those impaired – doesn't seem to be due to road.
- Another option is Counties. Another option is Cities. Do you waive requirements because of urban density? Another option is by land use (urban versus rural – from 0 to 100% impervious). So urban would be allowed a higher an allowable load. But this doesn't take into consideration individual waterbody drainage area characteristics – just a broader example. But that means that an industrial user in an urban area could be higher than in a rural area. Not all property in the region has the same impervious cover. But for TMDL, it would be just the regulatory authority in that drainage area.
- Pros/cons of different modeling approach (scale) – for example, individual watershed or regional (county, city, land use). Individual would be drainage area to impaired waterbody.
- Individual – TMDL could set specific allowable loading rates & implementation could call for varying degrees of reduction. If regional – then TMDL would set one allowable loading rate & implementation would call for a regional level of reduction. But TMDL would still have individual loading so implementation would be more regionally. Tanners reduce to 10 tons/square mile/year and Calhoun reduce 150 tons/square mile/year. Would have loading rates the same Metro-wide.
- Streams are more critical. Shingle Creek Watershed Management Organization did load duration curve – and how much do we need to reduce – we set 70% reduction. Nine Mile Watershed District used a correlation with snowfall– and that was about a 60% reduction. Both Nine Mile and Shingle – baseline application rates are 143-145 tons/square mile/year and allowable loads were 41 and 55 tons/square mile/year. If we achieve stream water quality standards, then that will actually be protective of lakes too.

Recommended approach

- Use individual zero-dimensional steady state model.

- Assumes watershed delineations for all listed lakes are available.
- Evaluate need for adjustment factor for seasonality
- Time-variable model can be used to inform expectations (assumes lake volume readily available)
- Confirm Nine Mile and Shingle Creek assessments of existing loading, reductions, and allowable loadings are consistent with other impaired streams and set TMDLs accordingly
- Compare allowable load for lakes versus streams – more restrict approach drives regional implementation.
- Nested lakes – how would you model those lakes (Brownie, Isles, Calhoun and lakes not impaired)? Need more time to respond to that question. Upstream lake assumed to be at current conditions or standard. Depends on the watershed or upstream lake conditions how much water/pollutant comes in. How treat (Hiawatha) as a lake or stream because residence time is only 4 days. Minnehaha has a weir so not sure how to treat that – but don't open dam. Special modeling may be needed for these.

Make final modeling recommendation

- What modeling approach can we start with today – if we use this approach, can we still have more conversations about regional guidelines? Yes. Stakeholders are not here at the table. Barb Loida can't speak for Carver County but we just need you to speak for MnDOT. Should have 28 stakeholders to help make these decisions. There are hundreds of regulated entities in the Twin Cities Metro area. We do plan on engaging the stakeholders in these watersheds. Lois moves to accept this approach. Questions on time-variable. Streams just plug the numbers in. And what is approach on protection. Time variable model would not be used to set TMDL – just for implementation. Streams used empirical models (Shingle/Nine Mile) – suggest using this approach and if data is not available, could apply same methods (maybe apply those to streams where we don't have data). Protection is another conversation that we want to have – haven't even starting discussing if we want to have protection goals. When are we sending the draft TMDL to EPA? Fall 2014. Watersheds can't represent the cities – need these stakeholders at the table.
- Everyone present is comfortable with lake approach. But need more information on streams before comfortable with approach. Thirty streams have new data. Not comfortable if we can't do empirical approach if we don't have sufficient data. Load duration approach needs flow data (Shingle Creek example).

Discuss baseline year options for model and TMDLs

Discussion deferred until the next meeting.

Wrap up & Next TAC meeting

- Next steps – start getting started on modeling approach. TAC/Implementation meeting in next couple months to talk about baseline and approach. Assessment this summer.

TCMA Chloride Project
TAC meeting #5
Dec. 12, 2013 1:00-3:30pm
MPCA St. Paul office
Board Room West (lower level)

Desired outcome of meeting*:* Review how chloride interacts with the environment. Review the Implementation Planning Committee desire for a performance based approach for protection and the MPCAs recent chloride assessment. Discuss Waste Load and Load Allocation scheme for impaired waters. TAC members to discuss and provide recommendation to the project team of the preferred modeling approach for streams.

Agenda

- Chloride Basics (John E., MPCA) – 15 minutes
- Review chloride assessment and March IPC meeting (Barb & Brooke, MPCA) – 15 minutes
- Stream modeling – discussion and recommendation (Hans Holmberg, LimnoTech & TAC) – 45 minutes
- Discuss WLA & LA Scheme for TMDLs (Hans Holmberg, LimnoTech) – 70 minutes
- Wrap up & Next steps (Brooke, MPCA) – 5 minutes

Twin Cities Metro Area (TCMA) Chloride Project

Primer on Chloride Behavior in Inland Surface Waters

John B. Erdmann
Environmental Research Scientist
Minnesota Pollution Control Agency (MPCA)

Twin Cities Metro Area (TCMA) Chloride Project

Chloride is a "conservative" substance

Chloride is a “conservative” substance

- “conservative” means it:
  - does not react chemically or biologically
    - persists as the simple anion **Cl^-**
  - does not have a vapor phase
    - cannot escape to atmosphere

Chloride is a “conservative” substance

- “conservative” means it:
  - does not stick to soil or sediment
    - Cannot settle out
    - Cannot resuspend

Chloride is a “conservative” substance

- “conservative” means it:
  - **Goes with the flow** of the water

Twin Cities Metro Area (TCMA) Chloride Project

Chloride is a "conservative" substance

Twin Cities Metro Area (TCMA) Chloride Project

Barb Peichel & Brooke Asleson
Watershed Project Manager, Minnesota Pollution Control Agency (MPCA)

TCMA Chloride Project: Timeline

Began process in 2010

Scheduled to complete project in 2014

Final Metro Chloride Assessment (Oct. 2013)

- Assessed 335 lakes, wetlands, & stream/river reaches*
- 7-county Twin Cities Metro Area
- Impairment to aquatic life from chloride concentrations that exceed state water quality standards
  - 44 waterbodies listed as impaired
    - Shingle Creek/Nine Mile Creek
  - 250 waterbodies meet standards (note: winter/depth)
  - 39 waterbodies had some data, but insufficient for assessment
  - 2 waterbodies proposed to be delisted

Implementation Plan Committee Meeting (May 9th, 2013)

- Monitoring & Modeling – LimnoTech
  - Protection goals (performance based vs. numeric)
  - Implementation strategy – consistent is better (may not apply different amounts when crossing watershed boundaries)

- BMP Tool for Winter Maintenance – Fortin Consulting
  - Tool to ask questions about your own winter maintenance operations
    - Current vs. predicted practices (some salt savings)
    - Advanced vs. best vs. poor practices
    - IPC reviewed possible report options

For More Information – TCMA Web Pages

http://www.pca.state.mn.us/r0pgb86

Twin Cities Metro Chloride Project

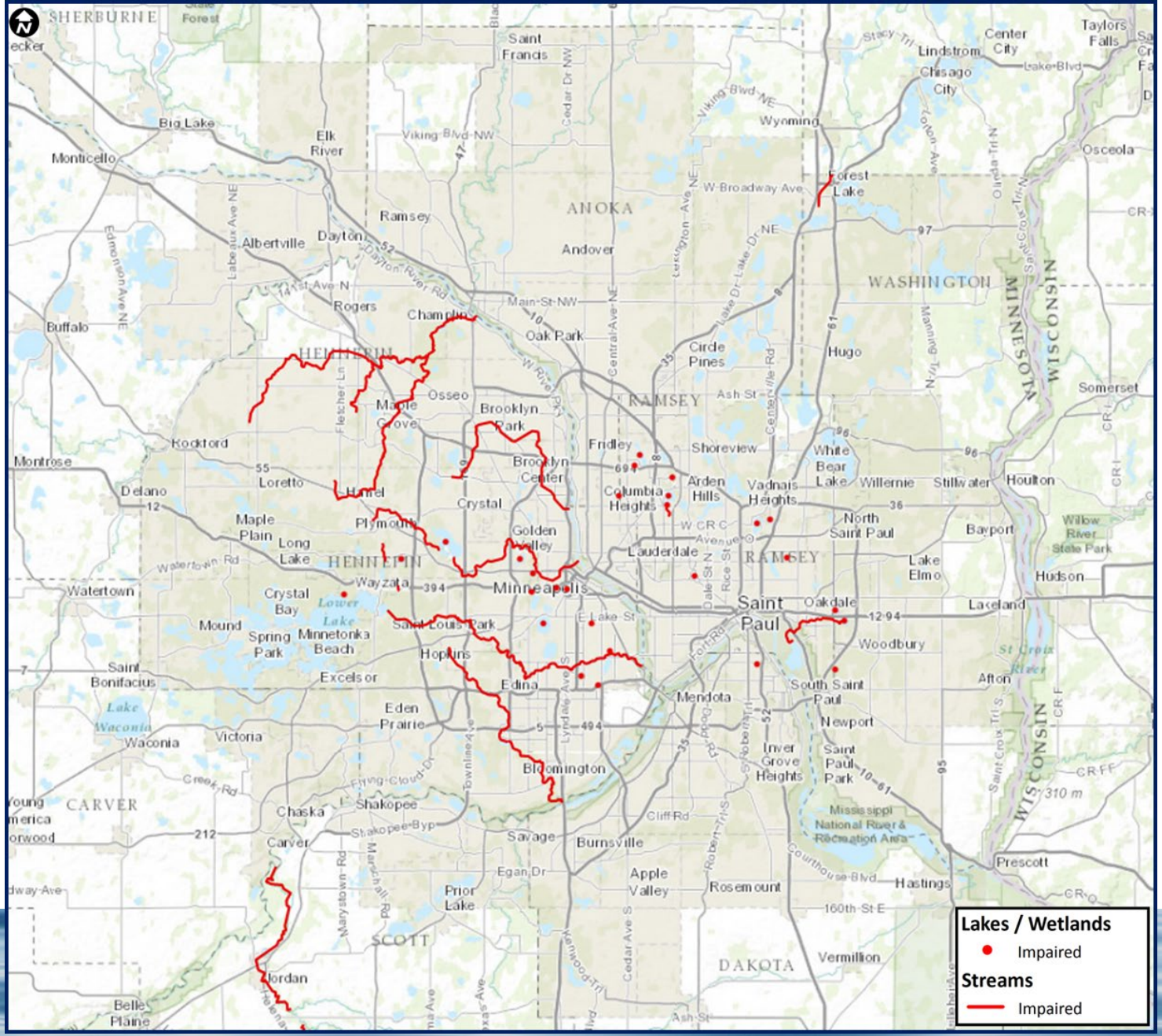
TAC Meeting #5

December 12, 2013

LimnoTech

Goals – TAC Meeting

- Build consensus on stream modeling approach for TMDLs
- Discuss allocation approach and expectations for permit requirements


Lakes / Wetlands
Impaired
Streams
Impaired
Minneapolis
Saint Paul
ANOKA
RAMSEY
HENNEPIN
WASHINGTON
SCOTT
CARVER
DAKOTA
WISCONSIN
MINNESOTA

Project Overview - LimnoTech

Water Quality Data Compilation

Categorize Waters

Develop Targets

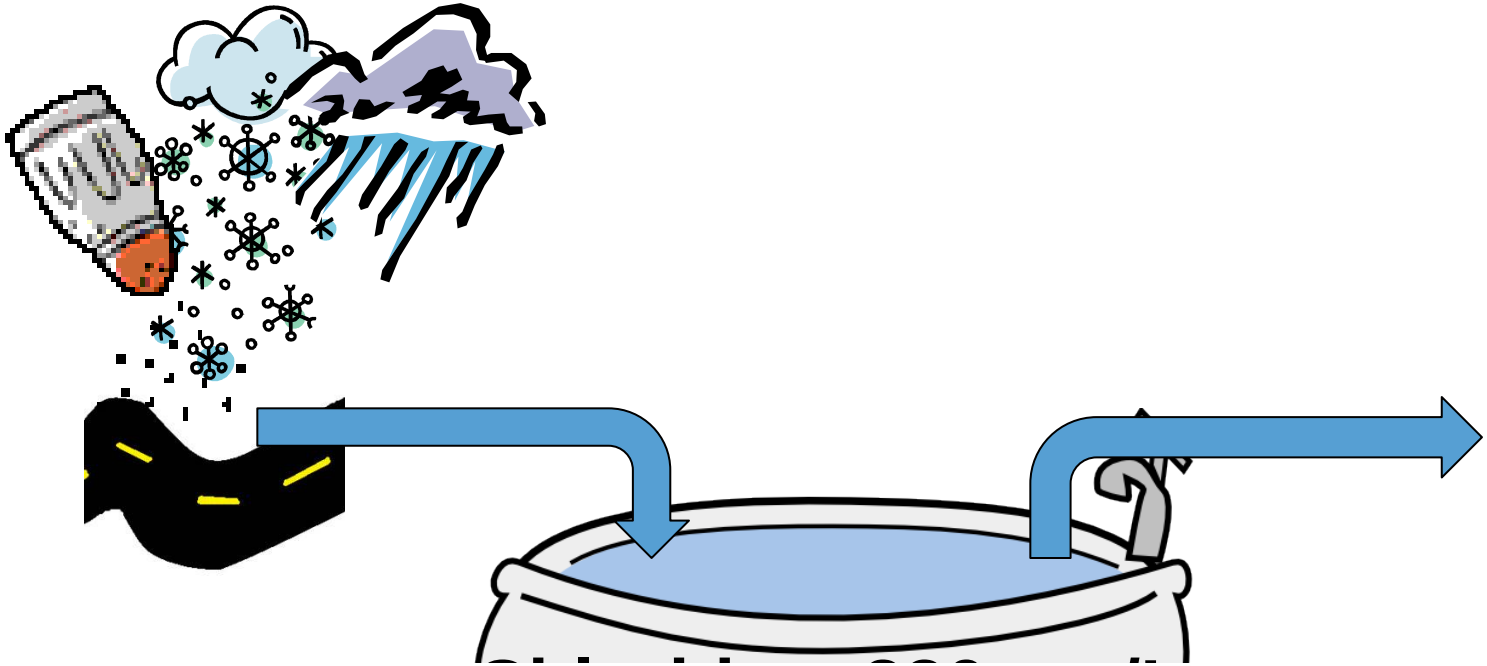
Source Identification

Modeling and Analysis

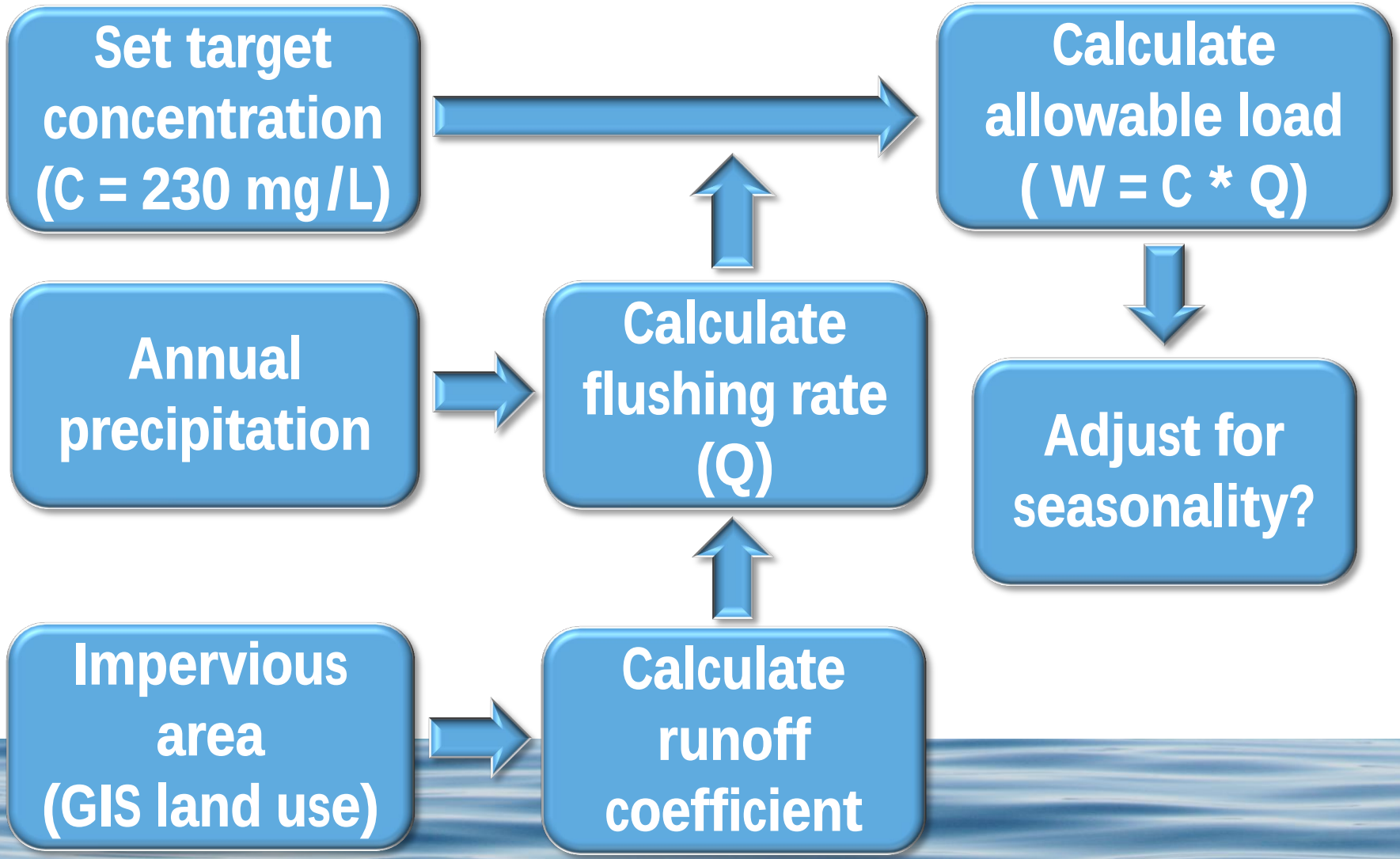
Write Management, Implementation, and Monitoring Plans

Modeling objective

- Establish the TMDL: Determine how much chloride can get into lakes and streams and still be protective of water quality standards



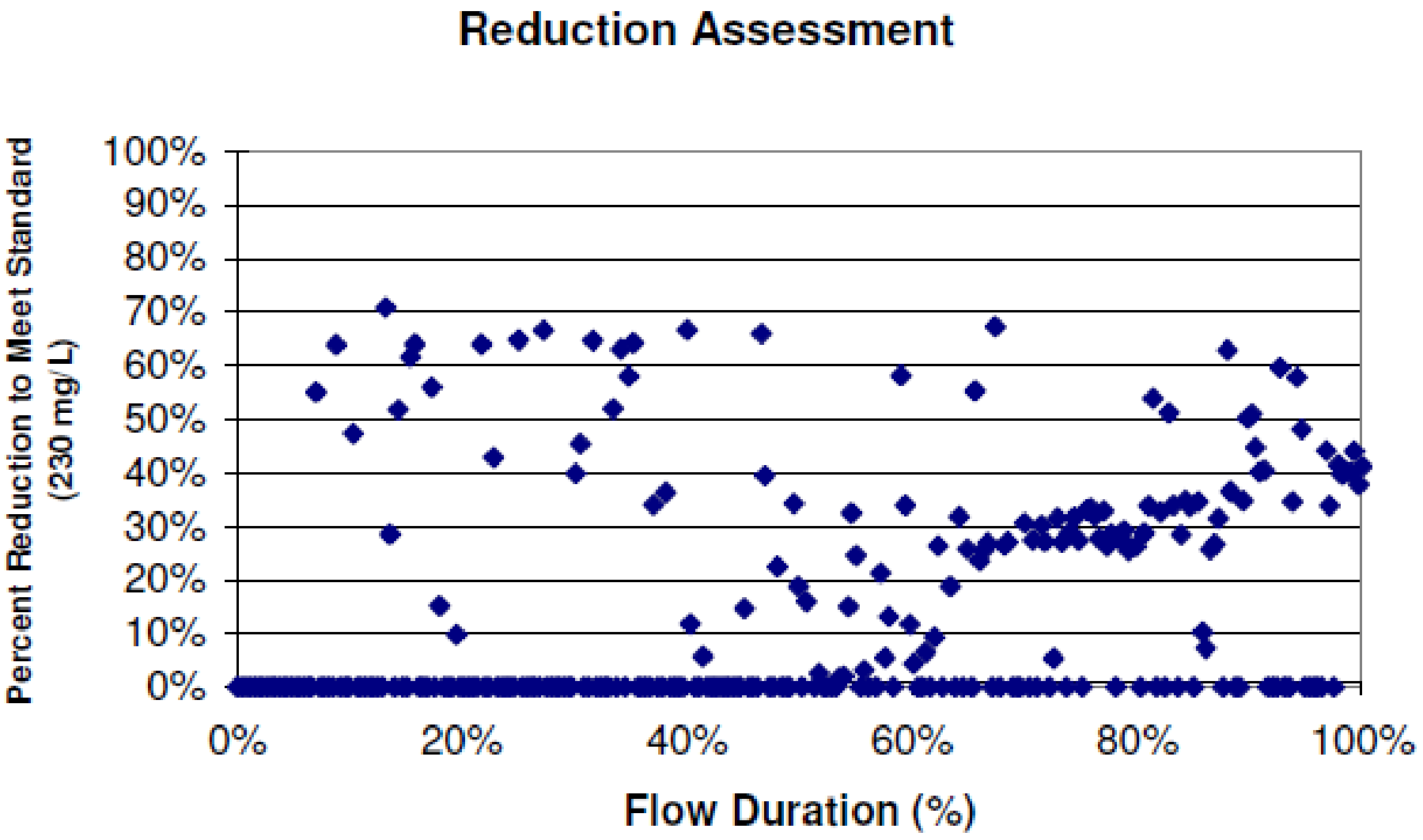
TMDL approach for lakes



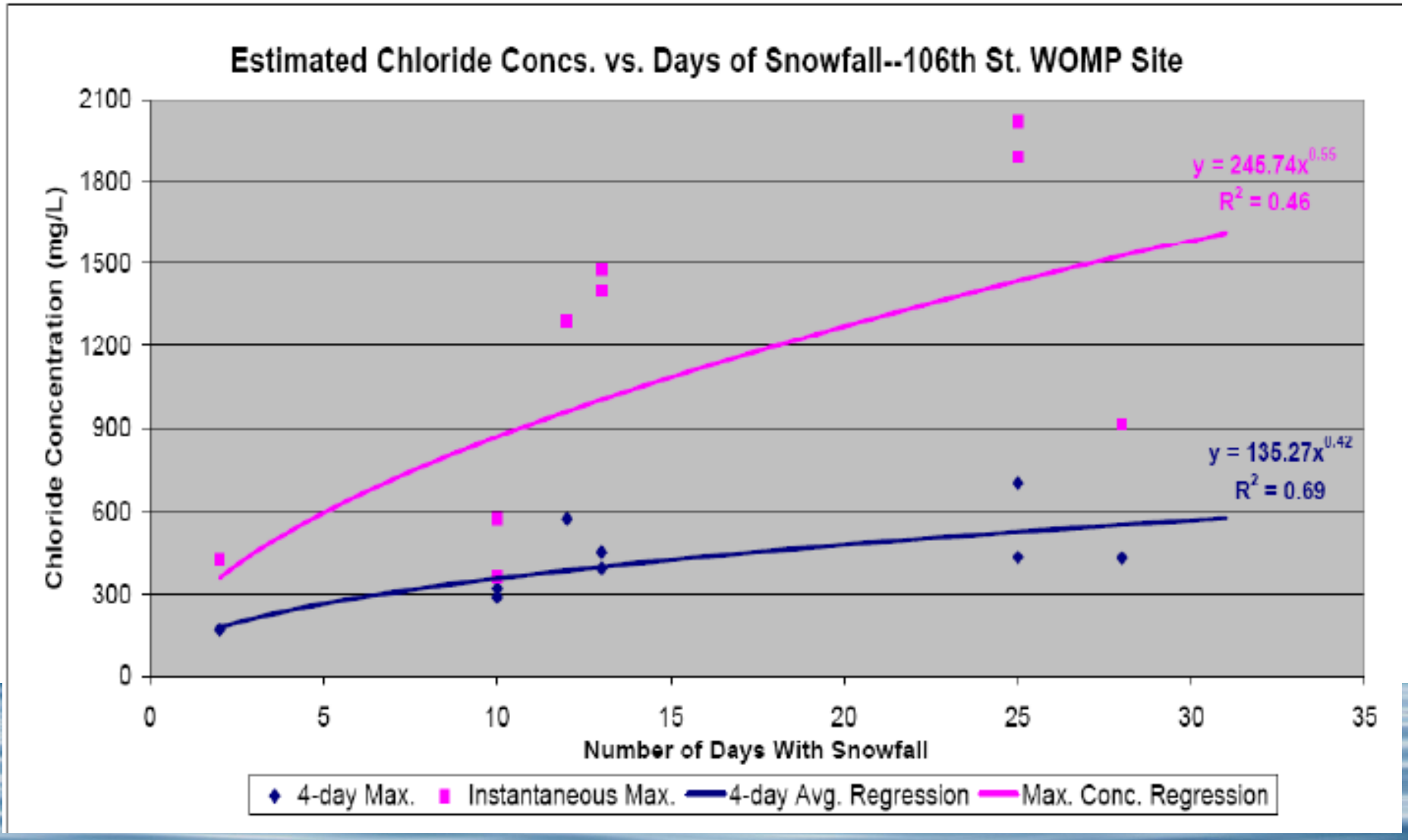
TMDL approach for streams

- Streams respond on an event basis/spring snowmelt rather than annual or longer
  - Lakes benefit from mixing/dilution outside of loading timeframe
  - Streams do not

Shingle Creek approach



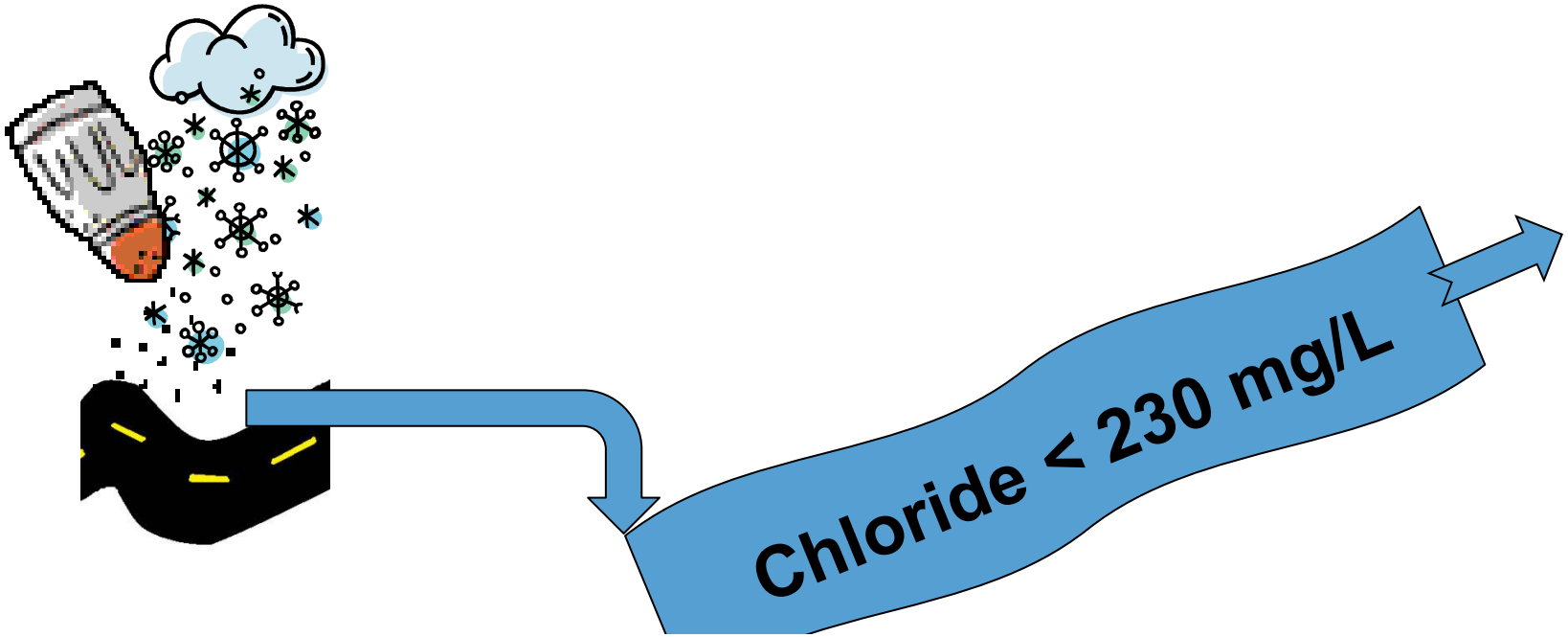
Nine Mile Creek approach



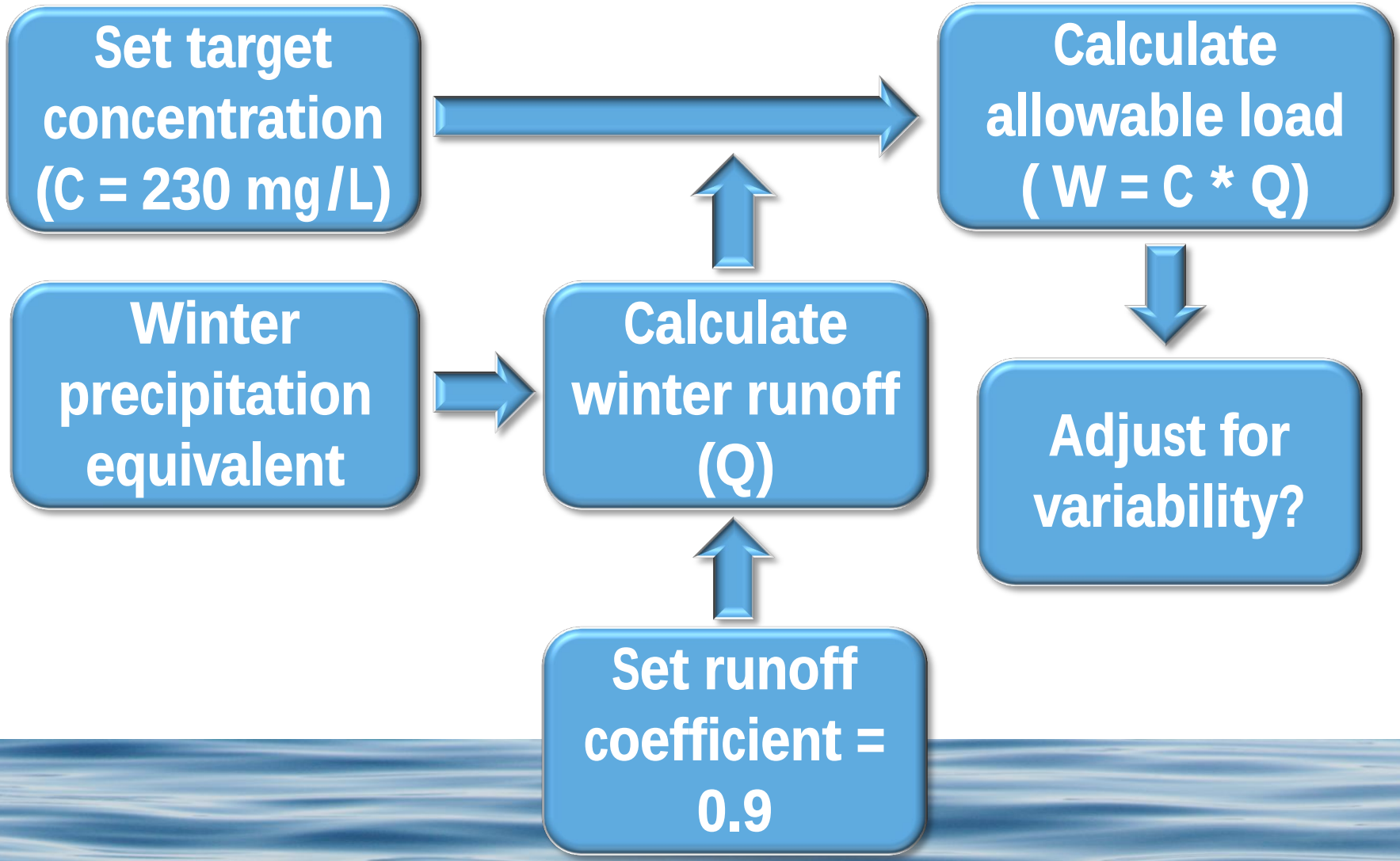
Summary of existing stream TMDLs

Stream	Existing tons Cl applied per yr	Watershed area (mi^2)	Baseline application rate (tons/mi^2/yr)	Required % reduction (including MOS)	Allowable load (tons/mi^2/yr)
Nine Mile Creek	6,357	44.5	143	62%	55
Shingle Creek	6,449	44.5	145	71%	41

Proposed stream model



Recommended TMDL approach for streams



Comparison of recommended approach to existing stream TMDLs

Stream	Existing tons Cl applied per yr	Watershed area (mi^2)	Baseline application rate (tons/mi^2/yr)	Required % reduction (including MOS)	Allowable load (tons/mi^2/yr)
Nine Mile Creek	6,357	44.5	143	62%	55
Shingle Creek	6,449	44.5	145	71%	41

Proposed approach = 45-90 tons/mi^2/yr

Additional considerations

- Situations where criteria exceedances occur in summer/non snowmelt
- Non-MS4 point sources
- Situations with potentially significant inputs from agricultural runoff or septic systems

Questions/discussion on stream modeling approach

From TMDL to Implementation

- TMDL = How much chloride can enter water body?
- Allocation = How much chloride from each source?
  - Road applicators
    - Consider high speed vs low speed roads
  - Private applicators (commercial/parking lots)
  - Homeowners
  - Non-MS4 point sources (industrial discharges)
  - Other non-point sources (agriculture, septic)
- Implementation = How can chloride be reduced to meet TMDL?

Allocation objective

- Establish equitable wasteload and load allocations
- Focus less on specific numbers to meet, more on making progress with BMPs
  - Need specific numbers to meet requirements of TMDL
  - Measure progress by degree of implementation and trends in ambient monitoring
    - Not by accounting for salt applied and comparing to individual numeric targets
- Allow flexibility in permitting and implementation
  - Recognize complexities involved with road salt

Allocation options: MS4 permit written consistent with TMDL

- WLA → # → permit as a #
- WLA → % reduction → permit as a % reduction
  - Need to estimate baseline
- WLA → # → performance based criteria
  - Develop and implement management program
    - Make progress on BMPs
      - Measure/estimate reductions
    - Track progress and report

Twin Cities Metro Area (TCMA) Chloride Project
Technical Advisory Committee (TAC) meeting #5
December 12, 2013, 1:00-3:30pm

Attendees: Josh Stock, Cliff Aichinger, Anne Weber, Paul Nelson, Kari Oquist, Tara Carson, Barb Loida, Mark Fischbach, Kevin Bigalke, Nick Tiedeken, Connie Fortin, Jeremy Walgrave, Hans Holmberg, Barb Peichel, Brooke Asleson, John Erdmann, Lois Eberhart, Becky Houdek

Desired outcome of meeting: Review how chloride interacts with the environment. Review the Implementation Planning Committee desire for a performance based approach for protection and the MPCAs recent chloride assessment. Discuss Waste Load and Load Allocation scheme for impaired waters. TAC members to discuss and provide recommendation to the project team of the preferred modeling approach for streams.

- Folks shared best winter maintenance stories.
- *Chloride Basics - John Erdmann, MN Pollution Control Agency (MPCA)*
    - Chloride is a conservative substance – does not react chemically or biologically, persists as anion Cl^-, doesn't have gas phase, doesn't stick to soil or sediment (particularly compared to phosphorus), and goes with the flow of water (doesn't evaporate)
    - Summer spikes in chloride could be coming from a pipe coming in from a source (example: brine from reserve osmosis) but that seems like it would be a rare occurrence – more common explanation would be that the summer spike would be because the lake is mixing and water with higher chloride concentrations in the hypolimnion is brought to the surface. Would you see that in August? Yes, it is common to see lake mixing and higher winds in August. Surface layer is cooler in fall so stratification is weaker and mixing could occur. Summer storms can cause mixing too.
    - Septic systems could be a source, water softeners or groundwater could also be sources – however, you likely wouldn't see a spike from these sources for a lake.
    - How are people sampling the water column? Surface sample (from the top 2 meters) and depth sample for chloride and also a conductivity profile for entire water column. Monitoring protocol is online about how sampling was conducted in most recent 3 years. Older samples for lakes are mostly surface samples only.
    - So this isn't a sediment issue? Likely not from construction (normally these are not salted areas). Only if salt was applied to nearby roads. You wouldn't see salt trapped in soils to be a huge source? No.
    - How about sodium - doesn't this stay more with soil? Yes, sodium attaches to soil particles and destroys the soil stability, decreases the soils ability to infiltrate water and can increase soil erosion.
- *Review chloride assessment and May Implementation Plan Committee (IPC) meeting – Brooke Asleson, MPCA*
    - Comprehensive stakeholder process on-going since start of project> monitoring completed Spring of 2013> evaluate waters (assessment process went through the last few months) > sources (just starting this), developing protection goals > complete Total Maximum Daily Loads (TMDLs) > develop implementation strategies
    - Project is scheduled to be completed in 2014 so you will likely see a draft TCMA Chloride Management Plan in late spring/early summer.
    - Where does the listing process fit? Impairments on both 2012 impaired waters and draft 2014 303(d) list (January 31st is the end of the public comment period).

- 335 lakes, wetlands, stream/river reaches were assessed for aquatic recreation due to chloride concentrations that exceed the state water quality standard. This was done for waters in the 7-County Twin Cities Metro Area.
    - We will be addressing 42 impairments through TCMA Chloride Project
    - 250 waterbodies met standards
    - 39 had some data, but insufficient for assessment
    - 2 waterbodies proposed to be delisted
- Which are being considered for delisting? Bevens Creek and South Fork Crow River.
- There are roughly 3,200 waters (this is our best guess, but could be double this number) in the 7 county metro area; therefore we have only assessed about 10% of the waters in the metro for chloride. We believe that our monitoring has completed a good representative of the metro however.
- IPC May meeting – 2 breakout groups
    - Monitoring and Modeling – how do we want to address protection (performance based vs. numeric) – performance based approach for protection would be preferred is what we heard from folks (look at Best Management Practices (BMPs)); implementation strategy – consistency across the city, county or other area is better (may not apply different amounts when crossing watershed boundaries)
    - BMP Tool for Winter Maintenance
        - We reviewed rough drafts of final reports – feedback was useful - good to hear from both maintenance and watershed folks to figure out what that might look like
        - What is the status of the tool? It is 176 questions – most of those are multiple choice – 1/5 of those need more in-depth knowledge and information. We made some modifications of reports – still checking tool to make sure if data is required that it is actually used in the tool.
        - What is the product? Series of questions – what is underneath your salt pile today? What you predict would be under your salt pile in 5 years? Green practice is good, yellow-okay, red-bad. Then generate report to tell you how you are doing now and in the future. For some activities – trying to get some numbers on reduction – much of it isn't published research.
- If you use a performance based approach, will be there be firm advice on what type of BMP? We don't want to dictate what people need to do, but give them choices - they can choose their own path within the reductions needed. Annual report in the MS4 permit on reductions from different BMPs (e.g. calibrating trucks could be a 5% salt saving). But how do we know we are getting there? If the waterbody is meeting standards or maybe if all your practices are green you could be meeting goals. This is still to be worked out by the project team and the TAC not that we know this is the preferred direction.
- If we are using performance based goal – are we saying 75% of your activities need to be green or that we need reductions by a certain %? We don't want to be that prescriptive. What if someone is just doing 5% more – that may not be acceptable to the state. But audits don't happen very often. We need to be able to say we need to reduce by a certain number to know we are meeting the reduction required.
- We can't do the same every year. Depends on weather. Can't put a pond in for chloride and say 20% reduction.

- Like tool idea and it is performance-based. Converting 50 practices. What is the magic number? We need a number to strive for.
- Tabled this discussion for now until later in the agenda.
- Sand Creek and Raven Creek – both have point sources and historic inputs and biosolids (neither of these have significant impervious surfaces) – fairly well convinced that this is the main source – it decreases as it goes through Scott County. Where are you in source identification? Compiling all the permitted entities right now. There will most likely be a separate approach for the TMDLs for Raven and Sand Creeks. Scott WMO has data from 2007 and 2008.
- Do we have to make reductions towards meeting protection goals? No, there are no required actions for protection waters. However, tool can be used for both, and we have the best opportunity to improve water quality conditions before the water is impaired since there is no feasible way to remove the chloride once it enters the water system.
- Created map on our website of chloride impaired waters - http://www.pca.state.mn.us/index.php?option=com_k2&Itemid=2871&id=2372&layout=item&view=item#tcma-chloride-project). Click on a waterbody to get more information. Zoom into see the waterbodies you are interested in. This uses the ESRI server. We can send a link of the map to TAC members by email. Is this different from the MS4 mapping tool? Yes, that tool uses only the EPA-approved 303d impaired waters list.
- What if chloride is not a primary stressor for the biological community? Fish IBIs scores were fine in Scott County - some sites meet the Index of Biotic Integrity (IBI) in that reach. We are still required to do TMDLs for waters impaired for chloride.
- We are seeing chloride in groundwater increasing particularly in the Metro Area – see MPCA's report on the *Condition of Minnesota's Groundwater, 2007-2011*, http://www.pca.state.mn.us/index.php/view-document.html?gid=19743.
- We need to make progress with BMPs. We can sell people on the cost savings too.

- *Stream modeling approach - Hans Holmberg, LimnoTech*
  - Source identification – we are still looking into sources.
  - Goal of modeling is to establish Total Maximum Daily Load (TMDL) – allowable load of chloride for each lake and stream to these waterbodies meet water quality standards ($\leq$230 mg/l)
  - Lake model chosen is zero steady state model – we may need to adjust model for seasonality.
  - Stream modeling approach is different because streams respond on an event basis (e.g. snow melt events); we assessed both Nine Mile and Shingle Creek TMDLs approaches.
  - Shingle Ck approach took highest numbers compared to baseline (estimated this loading) – 71% to reduce. Had more conductivity data (continuous) and developed a regression – so not practical for us since we don't have this type of data for all of our streams.
  - How many waterbodies of the 42 impairments are streams? 14.
  - Nine Mile Ck approach – estimated chloride concentrations with days of snowfall over 9 years. 62% reduction. Very data rich example.
  - Don't really have enough data for all of our impaired streams to use either of those approaches.
  - Proposed stream model – assumes salt is evenly distributed in runoff. What will you use for streamflow? Do we have 7Q10 for some of these? Probably. But we are just using

runoff so don't need streamflow. Use 6-inch snowmelt and assume it all runs off - no baseflow dilution.

- Modeling components = set target concentration (230 mg/l), winter precipitation equivalent, runoff coefficient (.9), calculate winter runoff, then calculate allowable load. May want to adjust for seasonality for spring events.
- We compared this stream modeling approach with existing Shingle Creek and Nine Mile TMDLs and estimated 45-90 tons/mi^2/yr reductions that would be needed. This is a large range – if salt was evenly distributed it would be 90 tons/mi^2/yr (assume snow melts evenly during the winter) versus 45 tons/mi^2/yr (assume snow melts in fits and bursts). 45 tons/mi^2/yr would be more conservative, but it is not as restrictive as Nine Mile and Shingle Creeks TMDLs. Don't hold on to 45 number because will depend on future work.
- Asking group to comment on stream modeling approach.
- For point source discharges and special cases (WWTFs), how do you account for boundary conditions or if facilities don't have any chloride discharge data? We are going to evaluate all potential regulated sources but haven't decided the approach yet.
- If people are softening their water – we could track it. Look at the Middle Wakotan Sioux community – they got people to eliminate their water softeners.
- We are really focusing on simplified approach on roads and sidewalks. We don't think we would consider allowing a facility to discharge more than 230 mg/l. Some facilities that may be above that but we would be surprised to see that.
- Feb 6th is the next Road Salt Symposium (http://freshwater.org/annual-road-salt-symposium-fights-chloride-pollution/) .
- We know salt doesn't come in equally in runoff.
- But we will still have storm events where we may be above 230 mg/l. Will be hard to get these off the list. Could consider use attainability analyses.
- We want to make progress where we at, have to have a TMDL number, document our progress and in 10 years we can take a harder look if most folks are doing all "green" practices.
- Management plan wasn't supposed to be individual TMDLs I thought. Thought for the TCMA Management Plan was that non-impaired waters would be included too. Need to know where we are so have to monitor/assess impaired waters.
- Is this stream model okay? Yes, the approach seems conservative. But most of these streams aren't big enough to have baseflow but would suggest including that for larger streams.
- It was calibrated with the Shingle Ck and Nine Mile Ck but did you use any other streams? Not yet, these are the only two completed chloride TMDLs in Minnesota.
- Lake model assumes land use runoff throughout the year (runoff lower in summer), but the stream model assumes the same runoff coefficient? Yes.
- Hard to understand approach because the range in chloride reduction doubles (45-90 tons/mi^2/yr) so we need a more consistent number. How can you pinpoint that number? Nine Mile sees three spikes/year and then don't see exceedances after April. Some cities are below 90 tons/mi^2/yr – but depends on how many county and state highways in those areas. How did cities calculate that? Based on the lane miles and tons applied per year that is tracked.
- Will EPA accept this? Most likely. Do we have confidence that if we meet – if you use 80 tons/mi^2/yr than that wouldn't do it for Nine Mile and Shingle Creeks. Could maybe do a sensitivity analysis on snow melt depth.

- As long as we are taking an adaptive management and performance based approach this seems like a fine modeling approach.
- What are the next steps for Nine Mile? How long is it going to take us to show improvement? Some cities have reduced application by 50% and some have used brine mixture (and sold it to schools). But the private application is really hard to figure out – not sure at all about what is being applied at malls – so we don't know baseline. Trying to educate as many people as we can. May send property manager to training, but not applicators. Looking at property management – saving money is part of it, but many companies want green (environmental) initiatives. But big selling point is cost savings. Bloomington cost savings is building maintenance too (floors/carpets/etc.). Most slips/falls at curb line and just granular at curb and then let it just track into the door. Private applicators – what are they willing to do for risk management – comes down to liability.
- Simplified runoff approach – adaptive management and performance – if streams have significant baseflow want to figure that in – need to protect for spikes – should move more towards 45 tons/mi^2/yr rather than 90 tons/mi^2/yr. Will be presenting the draft numbers to this TAC so you can have input on those in the future as the TMDLs are developed.
- Anyone strongly opposed to this modeling approach –one person is only for Raven and Sand Creeks because he is not sure what this will mean for point sources.
- Has this been used anywhere else? No. Some east coast states have TMDLs, but we are at the cutting edge.

- WLA & LA allocation scheme for setting TMDLs
  - This is the beginning of the discussion – no decision is needed today – but we just want to get the conversation started.
  - How much chloride from each source (e.g. road, private, non-MS4, homeowners)?
  - We will have to discuss categorical vs. individual wasteload allocation at a future meeting.
  - Goals for allocation (from LimnoTech) - establish equitable wasteload and load allocations; focus less on specific numbers to meet, more on making progress with BMPs
    - Need specific numbers to meet requirements of TMDL
    - Measure progress by degree of implementation and trends in ambient monitoring (not by accounting for salt applied)
    - Allow flexibility in permitting and implementation (complexities)
      - But the permit says what the permit says (it really isn't flexible)
    - What is Load Allocation (LA)? WLA is permitted source including MS4s and individually permitted facilities. LA could be agricultural or septics or city/county roads (outside the urban area). We are not including atmospheric in LA.
    - Homeowners and high speed/low speed roads are just types of sources (these would not get a separate allocation).
    - Allocation has to be reported in daily load (lbs/day). We can also have an annual average in report or permit. We can express it as both.
    - Phone off the hook from cities in Nine Mile for daily loads – they don't understand the categorical allocation.
  - We will send presentation slides out with meeting notes.
- WLA approaches –
  - Permit uses a number (not proposing this)

- Permit uses a % reduction (we are not proposing this because it would require baseline)
- We are proposing a performance based criteria – development and implement a management program – make progress on BMPs (measure/estimate reductions by BMPs) – track progress and report
  - MPCA is still discussing this internally
    - But our meetings with MPCA MS4 program, they are pushing % reductions and modeling.
    - There will have to be some guarantee from MS4 program that this is supported.
  - Percent reduction is nice because then we know when we are meeting the TMDL.
  - You would report annually (stormwater permit) on BMPs you are implementing (tool would be helpful) and estimate reductions from each BMP.
  - Then we can revisit these in 10 years to see what progress we are making.
  - Need to invite environmental groups to future meetings to see if they are onboard with this approach.
  - Need to meet with EPA on this approach. Brooke is planning on doing this soon.
  - Most people recognize MnDOT as a leader of this.
  - People will get credit for what they are already doing as far as good BMPs.
  - Is MPCA committing to monitoring same waterbodies and when? MPCA only monitored 16 of these, but locals did the rest of the 74 waterbodies. May look again in 10 years. Most of partners are going to continue to monitor these more often.
  - How about baseline? We are proposing not using/calculating a baseline.
  - Hoping this would be more prescriptive as far as best BMPs. Cities may need more direction. Watersheds could help all cities get to those levels. We could present a case study of a high performing entity as an example. Equipment upgrades may need to be highlighted more and a couple other practices – which are the biggest bang for the buck. People have different budgets. It is hard because if you don't get out early in storm doesn't matter if your equipment is calibrated. Could have baseline BMPs and break it into phases – look at equipment upgrades.
  - Establish TMDL for each waterbody. We should have these drafted in the spring. One person needs to see these TMDLs before they agree to this approach.
- Once we know all the permitted entities, we plan to at least have an all-Metro MS4 meeting.
- Individual vs. categorical – we are leaning towards categorical. MnDOT may like individual allocation because they want us to do the math. They will discuss this internally and get back to us.

TCMA Chloride Project
TAC meeting #6
April 23, 2014 1:00-3:30pm

Capitol Region Watershed District office
1410 Energy Park Drive, Suite 4, St. Paul

Desired outcome of meeting*:* To have a shared understanding of the Winter Maintenance Assessment tool and it's potential to assist with developing individual plans for improved winter maintenance practices. Receive recommendation from TAC on best approach for applying performance based approach to addressing protection and restoration (TMDL) goals.

Agenda

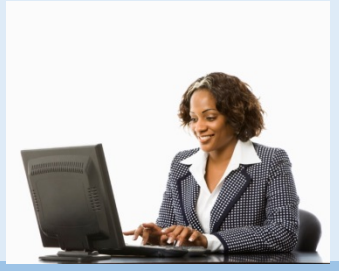
- Introductions & meeting goals (Brooke, MPCA) – 15 minutes
- Winter Maintenance Assessment tool overview (Connie, Fortin Consulting) – 20 minutes
- Discuss winter maintenance assessment tool (TAC) – 20 minutes
- Performance Based Approach overview (Hans, LimnoTech) – 20 minutes
- Discussion about performance based approach (TAC) – 45 minutes
- Modeling update (Jeremy, LimnoTech) – 15 minutes
- Wrap up & Next steps (Brooke, MPCA) – 5 minutes

Winter Maintenance Assessment Tool

Connie Fortin

FORTIN CONSULTING, INC.
serving the environment

Vision



To develop the logic for a computer based tool that help winter maintenance organizations:

- Document their current practices
- Chart a path towards salt reduction
- Develop a strategy unique to their operation

Target Audience:
Winter maintenance supervisors
Twin Cities Metro Area

How to use the tool

Enter Organizational Information

- Organization Name: City of Roundville
- Department: Public Works Department
- Contact Person: Jim Smith
- Address: 211 Main Street, Roundville MN 55444
- Email Jim@roundville.gov
- Phone 763-111-2222
- Date of Assessment 6-06-2012
- For winter operations 2011 - 2012
- Notes: We do both streets and parks

What types of maintenance do you do?

- [ ] High Speed Roads
- [x] Low Speed Roads
- [ ] Parking lots
- [ ] Sidewalks

Select the mode:

- [x] Mode 1: BMP assessment & prediction
- [ ] Mode 2: Salt use assessment & salt reduction prediction
- [ ] Mode 3: Both

Mode 1: Best Management Practice Assessment and Prediction

- Requires very little prep time and data entry, just need a good overall knowledge of your winter maintenance operation
- About 150 multiple choice questions

69. We select the appropriate material for the pavement temperature

Now?	In next 5 years ?	Practices	code	Salt savings calculation?	Citation	Comments
			★	NO		
	✓	Always	3			For example rock salt does not work well at pavement temperatures below 15 f.
✓		Most of the time	2			
		Don't adjust our product selection based on pavement temperatures	1			
		Don't know	1a			

Efficiency Section: Deicers Subsection

12. What materials do you calibrate for?

Now?	In next 5 years?	Practices	code	Salt savings calculation?	Citation	Comments
			★			
		For every product used that flows differently	3			Matt M, City of St.Paul 3/13 calibrate for one, tried some calibration for second procuct didn't see flow difference so didn't calibrate
✓	✓	For most commonly used product(s)	2			Steve S. UMD. Calibrate for 2 probably will calibrate for more in future 3/13
		Don't' calibrate	1			

66. Are you using liquids for de-icing (during or after the storm)?

Now?	In next 5 years ?	Practices	code	Salt savings calculation?	Citation	Comments
			★	NO		Pre-wetting salt before applying it, pretreated stockpile?
	✓	Yes	3			
✓		No	1			

Efficiency Section: Deicers Subsection

Wikipedia?

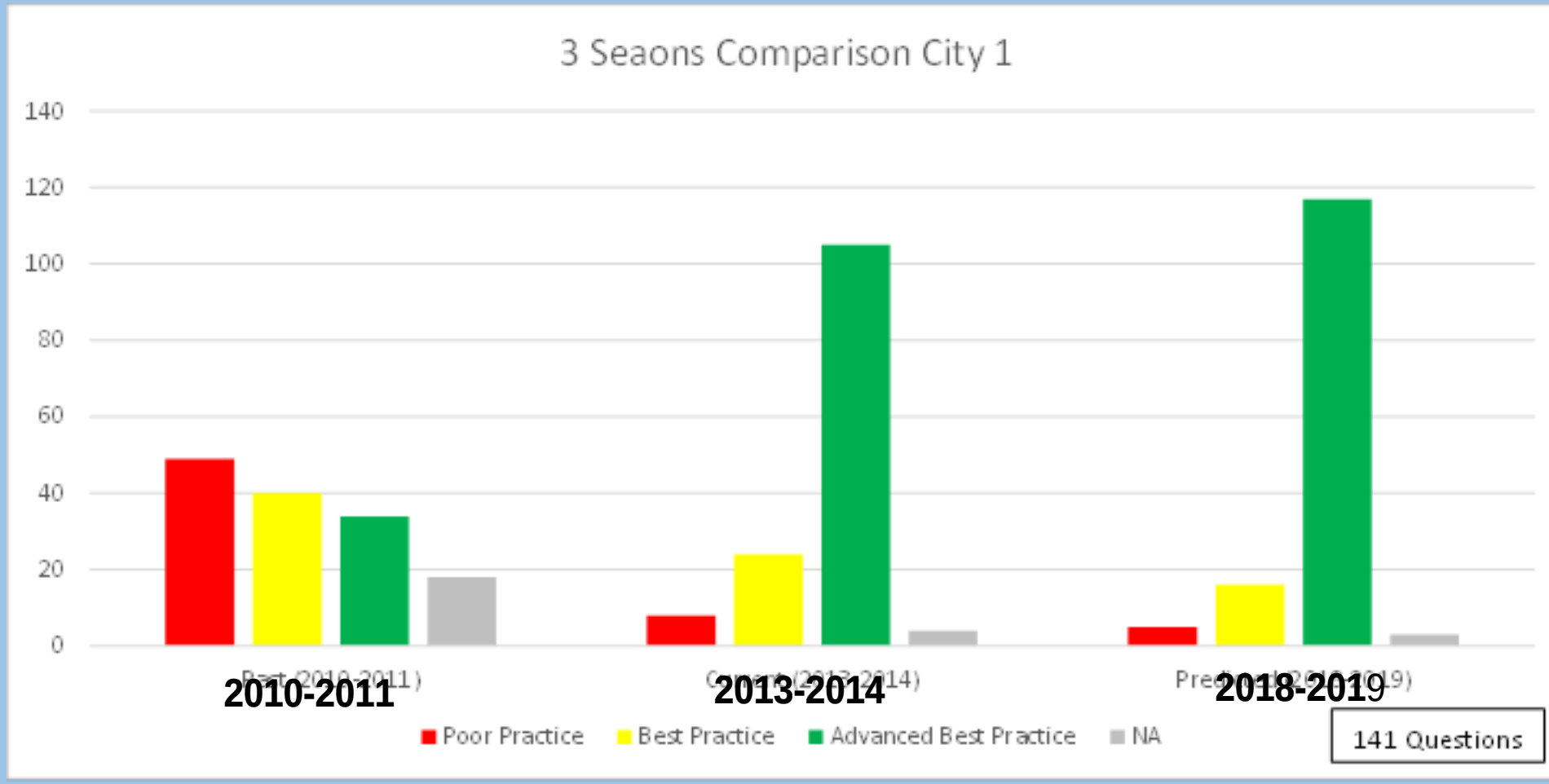
- The group has suggested that users are allowed to (but not forced to):
- look at background information, citations, rate calculations
- Add information for others to look at

Now?	In next 5 years ?	Practices	code	Salt savings calculation?	Citation	Comments
				NO		
		Always	3			For example rock salt does not work well at pavement temperatures below 15 f.
		Most of the time	2			
		Don't adjust our product selection based on pavement temperatures	1			
		Don't know	1a			

Reports

- Summary of current practices
- Summary of predicated changes

City #1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120
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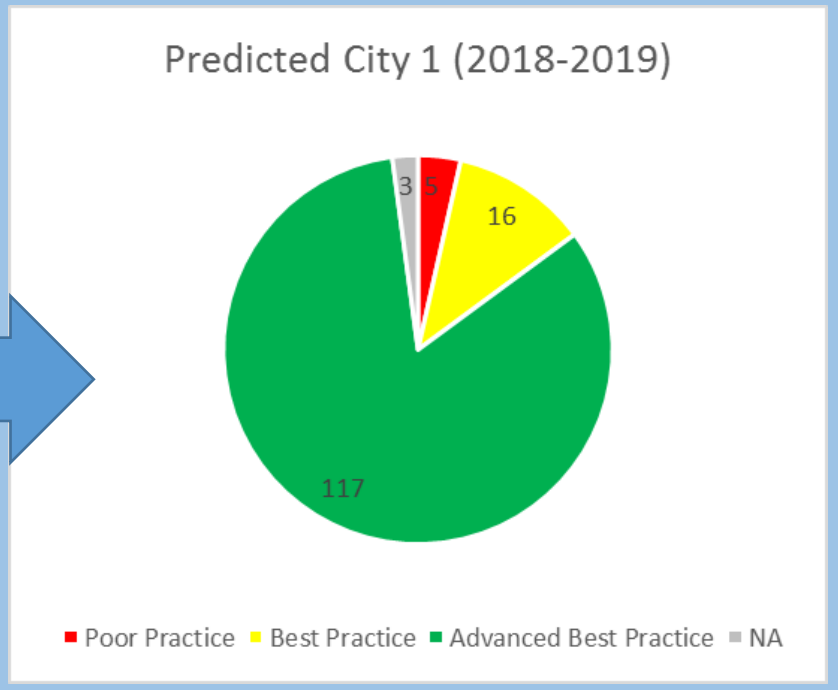
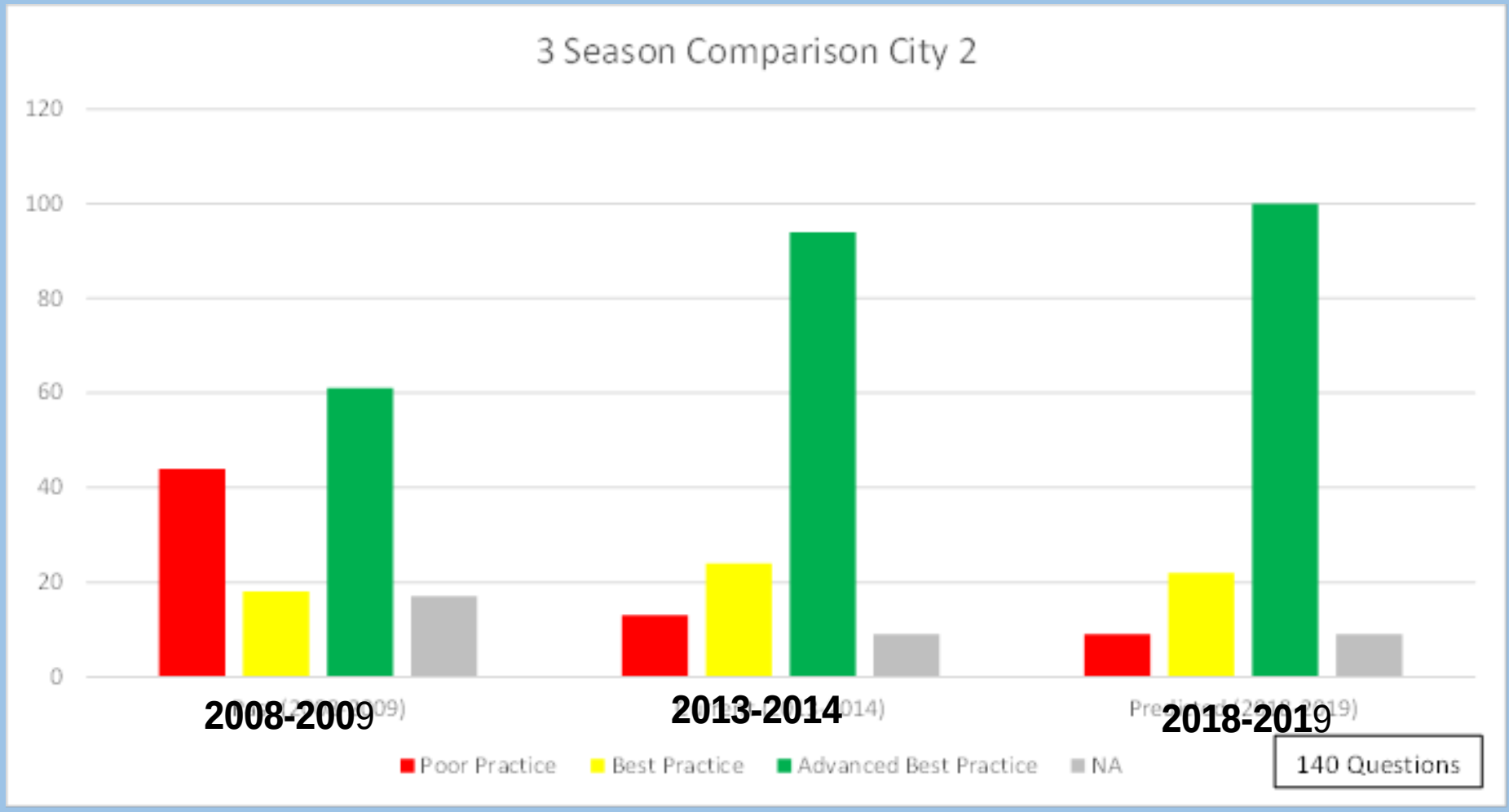
2010-2011
2013-2014
2018-2019
Poor Practice
Best Practice
Advanced Best Practice
NA
141 Questions


Past City 1 (2010-2011)
18
48
34
40
141 Questions
Poor Practice
Best Practice
Advanced Best Practice
NA

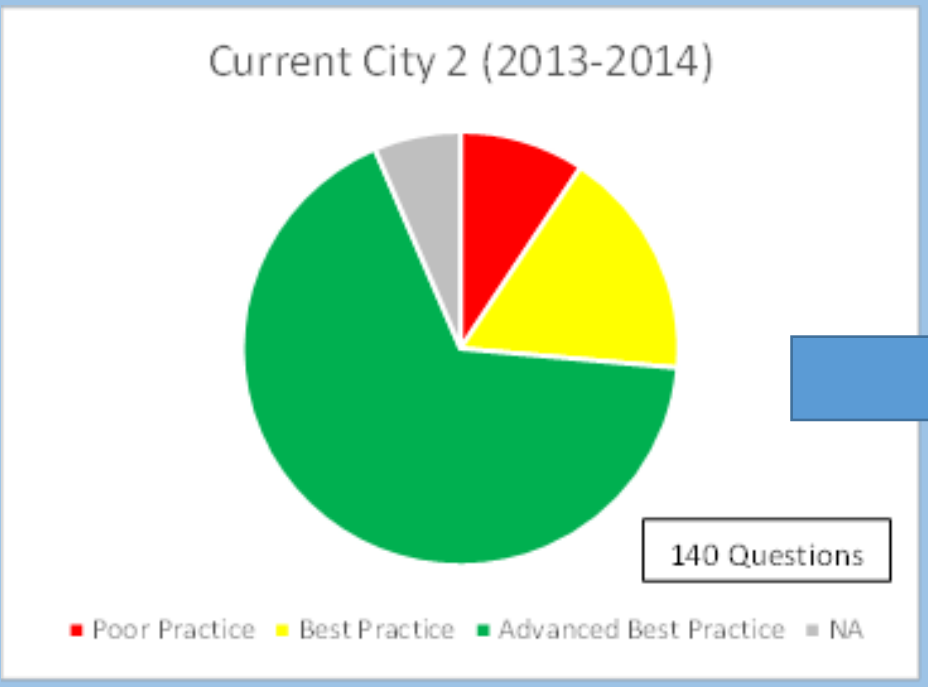

Current City 1 (2013-2014)
4
8
24
105
141 Questions
Poor Practice
Best Practice
Advanced Best Practice
NA

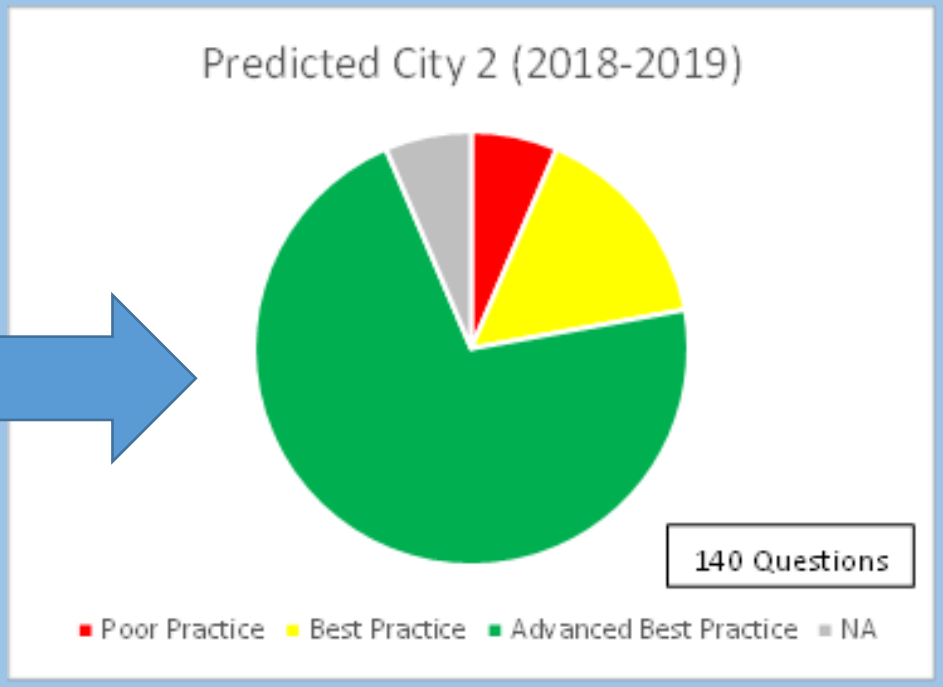

Predicted City 1 (2018-2019)
3
5
16
117
Poor Practice
Best Practice
Advanced Best Practice
NA

City #2


3 Season Comparison City 2
120
100
80
60
40
20
0
2008-2009
2013-2014
2018-2019
Poor Practice
Best Practice
Advanced Best Practice
NA
140 Questions


Past City 2 (2008-2009)
140 Questions
Poor Practice
Best Practice
Advanced Best Practice
NA


Current City 2 (2013-2014)
140 Questions
Poor Practice
Best Practice
Advanced Best Practice
NA


Predicted City 2 (2018-2019)
140 Questions
Poor Practice
Best Practice
Advanced Best Practice
NA

Past Winter Maintenance Practices

City 2 Winter of 2008-2009

For maintenance of: Low Speed Roads

Summary:
46 Poor Practices
18 Best Practices
61 Advanced Best Practices

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NOTES: We do both streets and parks.

Legend:
- Poor Practice
- Best Practice
- Advanced Best Practice

ADVANCED BEST PRACTICES

23. Who determines application rates? We make our own application rate chart. The rates are comparable to the MN field handbook for snowplow operators or the MN parking lot and sidewalk manual
36. How do you treat frost? Anti-ice to prevent frost
42. Roads: what do you do with a 2 inch snow? Remove it, salt only if necessary
47. How do you plow and apply salt? Plow 2 lanes then apply salt to middle
49. How do you manage routes that overlap? Avoid plowing or salting on other peoples routes unless requested
52. How effective are you are removing slush before salting? High
55. How effective are you at removing a 2 inch snow fall before salting? High
56. How effective are you at removing wet heavy snow before salting? High
57. Do you have good equipment for effective removal? Yes
60. Is your response to snow events the same during weekday hours and weekend/evening

62. Do you use a salt sand mix as your primary deicer? No
71. For extremely cold, below 0 pavement temperatures? We use sand
72. If ice or snow isn't melting? We switch deicers
73. We buy? A selection of deicers so we have options
74. How do you cover your salt in the winter? Bulk salt pile indoors or in container
76. Do your snow piles melt into your salt or sand/salt piles? No
77. Any leaching out of your storage area? No
78. What is under your salt pile? Salt pile stored on waterproof surface with concave base "birdbath shaped floor" and with a waterproof membrane, sloped toward containment tank
79. Do you overfill your salt sheds? No
80. How do you cover your sand/salt blended pile in the summer? Summer sand/salt pile indoors
81. What is under your sand/salt blend pile? Salt pile stored on waterproof surface with concave base "birdbath shaped floor" and with a waterproof membrane, sloped toward containment tank
83. Do you receive shipments while it is raining or snowing? Yes, we do not receive shipments in the rain/snow
84. How do you store salt in the summer? Store inside
89. Do you overfill your trucks? No
92. What is done with left over product? Brought back to the pile at end of the shift
95. Is there enough time to unload at the end of the storm? Allow ample time for unloading of trucks
97. What method is most frequently used to open frozen drains/culverts? High pressure water or steam
100. How much salt in truck is going into wash? 0 lbs of salt washed out of box and sander
101. When salting the spinner is usually? Low
103. How do you store your liquids? Single wall tank with a second container with a volume equal to or greater than tank capacity
107. What spread pattern is used when salting intersections? Same rate as you were using on the road
110. What areas do you salt on sidewalks, parking lots, and low speed roads? Strategic spots
113. How much salt per load leaves your truck thru cracks, gaps or when forget to turn off auger or conveyer? No
125. At what speed do you spread salt? 22 mph or less
126. How often do you apply salt while it is snowing? Salt continuously during event, apply ¼ or less the amount of salt during each pass as we do on the pass after the event

128. After the storm do you apply salt to areas that are both clear and icy? No
129. Who salts the overlap stretches? Only one route can apply to overlap stretch
131. Does the last pass of the day get more salt? No
132. Are my trucks easy to unload? Yes
133. Do you have a written winter maintenance policy? Yes
134. Does the crew understand the winter maintenance policy? Yes
135. Do you try to communicate your winter maintenance policy to your customers? Yes
137. How often is your policy reviewed and updated? Each year
141. Are culverts, storm drains, curb cuts, inspected and cleared of obstacles before first snow event? All of them
142. Is anti-icing equipment ready for use before first salting event? Yes
143. Are prewet systems ready for use before first salting event? Yes
144. Is your liquid salt ready for use before first salting event? Yes
145. Are spill shields installed prior to first storm? Yes
150. Do supervisors participate in or attend training with crew? Yes
152. How do you rate your managers or supervisors willingness to change? High
154. Are natural resources made visible for each operators' maintenance are lakes, rivers, wetlands, well-heads marked on route maps? Yes
157. How well do you communicate with neighboring organizations? Excellent
158. Do we use the optimal equipment for the route? Yes
159. Do most plow operators have regular routes? Yes
162. Are you changing any maintenance areas to non-salted areas? (permeable pavers, permeable asphalt, permeable concrete, gravel, heated, light rail, or traditional surfaces not salted) Yes
169. Do you provide different levels of service? Different levels of service for different areas
170. Does your crew know the level of service required for their maintenance areas? Yes
171. Do most of your crew meet their level of service targets? Meet level of service
180. How do you cover your sand/salt pile during the winter? Winter sand/salt pile stored indoors
301. DO you host low impact winter maintenance training for others? (people not in your organization) Yes
302. Do you feel you have the necessary equipment, materials, and knowledge to use less salt while maintaining safety? Yes

BEST PRACTICES

11. Do your operators know how to read your application rate charts? No, supervisors read charts and assign rates
38. Do you have any automated anti-icing systems built into your pavement surfaces? No
41. Roads: what do you do with a light snow? No plow, salt if needed
50. When we have compaction, our “primary tool” is to? Scrape it, then salt
53. How effective are you at removing compacted snow and ice before salting? Medium
58. Once snow removal is started, when does it stop? Snow removal during shifts, breaks without snow removal
70. When pavement temperatures are below 15 degrees, how often do you use granular salt? Some of the time
75. Do you prevent moisture from entering salt sheds? OK quality buildings or a mix of good and bad buildings
82. Do you receive salt shipments indoors or outdoors? Receive shipments outdoors, move them indoors with good clean up
99. How often do you wash your trucks? After the storm
105. Where do you place the salt? Spread pattern in center
115. Do you primarily use a vbox or dump truck? Dump truck
116. How do your trucks dispense salt? Auger
127. How long after the storm until you apply salt? Apply deicer immediately if we have a deicer that works for the pavement temperature
156. How well do operators work together within your organization? Ok
166. How fast do you need melted surfaces? Faster than in the past, use same amount of salt
172. How do you dispose of truck wash water? Dispose of wash water in sanitary sewer (goes to treatment plant
173. Where does your storage runoff water go? Collect runoff, bring to sanitary sewer

POOR PRACTICES

1. How often do you calibrate spreaders? Never
2. How many anti-icing systems (liquid only spreaders) do you calibrate? Don't have any
3. How many liquid prewet systems do you calibrate? Don't have any
4. How many granular salting trucks do you calibrate? None
5. Which is your primary type of spreader controls (active fleet only)? Manual

8. What % of your fleet is set up for liquids (of the trucks that apply salt)? 0-49%
9. Where are your manual spreader control calibration charts? Not with the equipment
10. for manual spreader controls: do your operators know how to read calibration card? No
12. What materials do you calibrate for? Don't calibrate
26. Are your application rates based on pavement temperatures? No
27. Do most of your operators follow application rate recommendations? No
28. How do you select your application rate? Supervisor in charge: generally disregards charts and makes own decisions.
29. Manual controllers: when salting at different speeds how often does your crew change spreader settings: Rarely
32. How accurate are our salt use numbers? Low – estimate at end of year
34. Where do you anti-ice? None of the areas we salt
35. When do you anti-ice? Never
40. What do you do with slush? Ignore it
59. Do we have the ability to do as much physical removal as needed to avoid over applying salt? No
65. What method do you primarily use for deicing (not anti-icing)? Dry salt
66. Are you using liquids for deicing? No
68. We understand the practical pavement temperature range of our deicers? No
69. We select appropriate material for pavement temperature? Don't adjust our product selection based on pavement temperatures
86. Are your trucks tarped during application? No
88. Where is the loading area for trucks? Outdoors
96. Which tools/equipment do you use to unload? None
98. How often is the outdoor loading area swept back into the pile? Rarely
117. What is the lowest application rate, most of your trucks can deliver with an even spread pattern? More than 200 lbs per lane mile (or 500 lbs per acre)

130. Are you changing any salted maintenance areas to reduced salt areas? (textured for traction, dark colored, crowned, sloped, covered, sub base influence for warmth, chip seal, pavement overlay, etc.) No
136. Do supervisors compare crew actions to salt application guidelines? No
138. Does the crew document their actions? No
146. Do you use snow fences? No
148. How often are crew and supervisors trained on conservative salt use? Crew is trained occasionally
149. Does crew and supervisors understand the long-term impacts of salt on our waters? No
151. How do you rate your operators' willingness to change? Low
153. Do you educate your customers about salt, the environment and what you are doing to be pro-active? No
155. Are trouble areas documented on each route? No
160. Do you encourage lower speed, safer customer behavior during winter? No
161. Do you actively promote proper storage in your community? (beyond your operations, i.e. private companies) No
168. Is there a change in your service area? Lane miles increasing
176. Do you desalinize (take salt out) from any ponds, lakes or rivers? No
177. Do you desalinize (take salt out) from ground water sources? No
178. Do you remove salt from discharge water at the water treatment plant? No
300. Do you require professional organizations applying salt in your city to be certified by MPCA training program (or other training/certification program that encourages low salt use)? No

Predicted Changes in Winter Maintenance Practices

City 2 Winter of 2013-2014

For maintenance of: Low speed roads

Current:
12 Poor Practices
24 Best Practices
94 Advanced Best Practices

Predicted:
8 Poor Practices
22 Best Practices
100 Advanced Best Practices

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Legend:
- Poor Practice
- Best Practice
- Advanced Best Practice

IMPROVE BEST PRACTICES

64. As you increase the amount of liquid do you decrease the amount of granular in the mix?
Current: Don't change the amount of liquid
Predicted: Yes

148. How often are crew and supervisors trained on conservative salt use?
Current: Most of the crew is trained each year
Predicted: Entire crew is trained each year

153. Do you educate your customers about salt, the environment and what you are doing to be pro-active?
Current: Some
Predicted: Yes

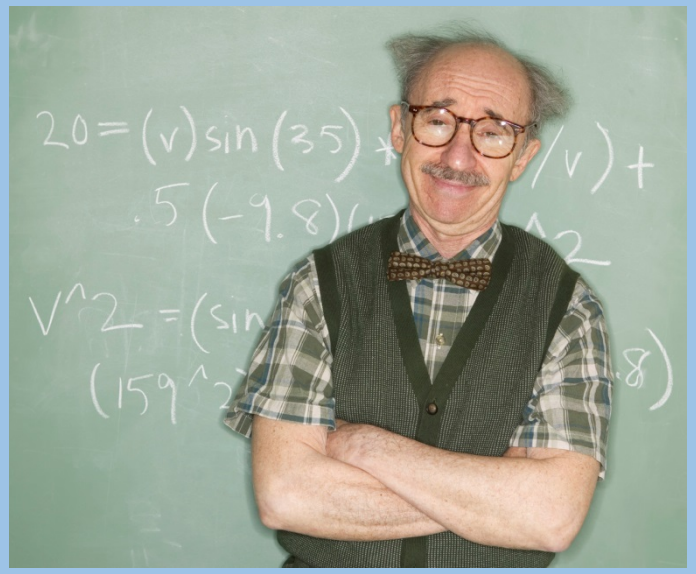
160. Do you encourage lower speed, safer customer behavior during winter?
Current: Sometimes
Predicted: Always

IMPROVE POOR PRACTICES

39. Have you made changes to reduce loss of anti-icing liquids from airflow?
Current: No
Predicted: Yes, some of our fleet has modifications
86. Are your trucks tarped during application?
Current: No
Predicted: ½ the time
147. Do you test each batch of your liquids?
Current: No
Predicted: Always
300. Do you require professional organizations applying salt in your city to be certified by MPCA training program (or other training/certification program that encourages low salt use)?
Current: No
Predicted: Yes

Mode 2: Salt Use Assessment and Salt Reduction Prediction Tool

- Requires user to supply more detailed data



The Questions

- About 25 data entry questions
- Some multiple choice questions (which will not be repeated if they have selected the “both” mode).

74. How do you store your salt in the winter?

Now ?	In next 5 years?	Practices	code	Salt savings calculation?	Citation	Comments
			★	YES calculate in winter storage		High salt savings here
✓		Bulk salt pile uncovered	1	1 to 3 = 7% 1a to 3 = 7% x tons of salt typically stored (from input screen)		.125 to 2.5% of the initial weight of an uncovered stockpile is lost per year by leaching for each inch of rainfall on that pile. From Environmental stewardship practices, procedures, and policies for highway construction and maintenance requested byAASHTO, prepared by venner consulting and parsons brinckerhoff 2004. cited in this is the hogbin research. Hogbin, L.E. “loss of salt due to rainfall on stockpiles used for winter road maintenance.” RRL report 30, road research lab, crownthorne, UK (1966), in burtwell, M. “Assessment of the performamce of prewetted salt for snow removal and ice control” Transportation research record 1741, trb , washington DC (2001)
		Pile tarped but not strictly maintained	1a			Foudray: Says tarps is not good. Too hard to keep in place. get caught in pile or equipment doesn’t work well to protect salt from elements. 12/12/12 cargo boxes can be rented for about $100 per month. Work and look much better than tarpsPut wood along sides to help prevent loader damage to container.
		pile tarped & strictly maintained	2	2 to 3 = 5%		Bob vasek mndot, says tarp is ok if done right. 12/12/12 Woody woodruff Retired mndot mankato 2/18/13 thought minimal loss during winter 5-7%. Barry underdahl city of invergrove. 5% loss from tarped to indoors
	✓	Bulk salt pile indoors or in container	3			Lee flandrich city of st.paul park 2/18/13. All of the salt in the salt sand pile that was not used during the winter and stored over the summer wouid be gone by fall. Had to start over with the mix. (3 scoop block sand, 1 scoop pea gravel, 1 scoop salt) Over the winter months the loss would be minimal 5-7% guess.

33. How many miles of your salted surfaces are being anti-iced?

Now?	In next 5 years?	Practices	code	Salt savings calculation?	Citation	Comments
10	50		h,l	YES	**use this question in rate reduction report only**	large salt savings
		Enter % amount	3	25%	Minnesota Snow and Ice Control Field Handbook for Snowplow Operators 2005	will have to calculate the % change from anti-icing today to anti-icing in near future. Using this percent change (x%) we can do the math: 25% reduction over x% of the route = Y% savings. For example if today we anti-ice 10 % and in the near future we plan to anti -ice 30% x = 20% so 25% of 20% = 5%decrease in salt use.
				50-80%	The FHWA document Planning for Snow and Ice Control states that the use of anti-icing results in a 50 to 80 percent reduction in chemical application required to achieve the same result.	this seems high…? SEE NOTES ON NEXT PAGE

City of Roundville Salt saving potential for one year based Winter of 2011-2012 and predicted changes

For maintenance of: High speed roads, low speed roads

2011-2012 Information

5000 tons salt stored
4000 tons salt/sand stored
salt/sand 30/70 mix
1000 gallons brine stored

2000 tons salt used
1500 tons salt/sand used
500 gallons brine used

$70.00 per Ton of salt
$1.00 per gallon of brine

80% salt used on low speed roads
20% salt used on high speed roads

Prediction based on changes

Total = 234.6 tons of salt likely to be saved

Reduction Potential = 11.7%

Had these changes been made for the winter of 2011-2012**, Roundville would have saved $16,422** in salt purchases and used only 1,765.4 tons of salt

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Salt Savings Potential for One Year

City of Roundville Parks Department 6-06-2011

List of predicted changes

BEFORE WINTER:

0% reduction potential

DURING WINTER:

0% reduction potential

ACCURACY DURING THE STORM:

10% Reduction Potential

*0 Ground Speed Controllers with MDSS>10 Ground speed controllers with MDSS>10% Salt Savings on salt applied salt

EFFECTIVENESS DURING THE STORM

0% reduction potential

REDUCE WASTE DURING THE STORM:

22.05% reduction potential

Bulk salt pile uncovered > Bulk salt pile indoors > Salt Savings 17% of salt in storage

Salt/sand pile uncovered> Bulk salt pile indoors > Salt Savings 17% of salt in sand pile

Receive shipments outdoor with good clean up > Receive shipments indoors > Salt savings .05% of salt ordered

Use up all salt at end of winter > give away salt at end of winter> 5% of total salt purchased

RECOVERY OF SALT:

0% reduction potential

Legend:

- Poor Practice
- Best Practice
- Advanced Best Practice

The analysis in this mode is limited by:

- Available published research
- Willingness of maintenance organizations to provide unpublished research or educated guesses of salt reductions based on changes in a particular maintenance practice
- It is incomplete
- To make it better it should be continually updated as research is done
- We can use the voids to request research or fund research projects

….But it is better than anything the industry has ever had

What can it accomplish?

- Increased awareness of current practices
- A clear list of places where the organization is doing well or could improve
- In rate reduction mode, a list of predicted practice changes and the associated salt savings

Why this is a better approach

- It looks at small areas of winter maintenance
- Provides insight into current operations
- Shows user recommended practices (learning tool)
- Allows a flexible approach
- **Allows you to chart your future!**

Stakeholder Process 2011-2014

- Road Salt Symposium survey
- Literature Searches
- Phone calls, phone interviews with members of the advisory team and industry experts
- Email correspondence with members of the advisory team and industry experts
- The implementation plan committee input
- Test of questions on industry pro’s

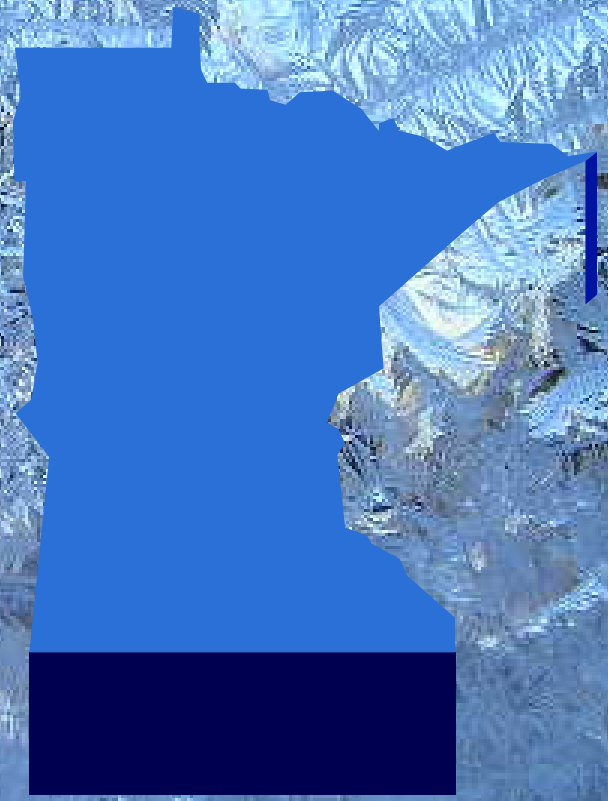
The technical expert team has been formed that reflects maintenance leaders in Minnesota. These leaders represent winter maintenance of high speed roads, low speed roads, parking lots, sidewalks, deicer sales and equipment. This team has reviewed all of the logic in the questions, input screens and reports. The members are:

- Tom Broadbent - EnviroTech Services
- Bob Vasek- MnDOT
- Mike Greten -Dakota County
- Mike Scherber-Hennepin County
- Craig Eldred -City of Waconia
- Ryan Foudray -Prescription Landscape
- Joe Wiita-Scott County
- Brian Brown-Three Rivers Park District
- Kevin Nelson-City of St. Paul
- Mike Kennedy-City of Minneapolis
- Matt Morriem-City of St.Paul
- Jeff Warner -Force America
- Mark Fischbach-MnDOT

Coming up....

APWA North American Snow Conference

May 4–7, 2014
Cincinnati, Ohio



Minnesota Initiatives for reducing road salt in Winter Maintenance

Connie Fortin – Fortin Consulting Inc. www.fortinconsulting.com

Questions? Suggestions?

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763-478-3606

Twin Cities Metro Chloride Project

TAC Meeting #6

Performance-based Approach Discussion

April 23, 2014

LimnoTech

Allocation objective

- Establish equitable wasteload and load allocations
- Focus less on specific numbers to meet, more on making progress with BMPs
  - Need specific numbers to meet requirements of TMDL
  - Measure progress by degree of implementation and trends in ambient monitoring
    - Not by accounting for salt applied and comparing to individual numeric targets
- Allow flexibility in implementation
  - Recognize complexities involved with road salt

Permit options

- WLA → # → permit as a #
- WLA → % reduction → permit as a % reduction
  - Need to estimate baseline
- WLA → # → performance based criteria
  - Develop and implement management program
    - Identify a desired level of BMP implementation
      - For example, < X% in red, > Y% in green
    - Measure/estimate usage and/or reductions
    - Track progress and report

MS4 Requirements for WLAs

- Compliance schedule for WLAs not met, including:
  - Interim milestones/dates for BMPs and strategies for continued BMP implementation
  - Target date for achieving WLA
- The BMPs in the compliance schedule "constitute a discharge requirement"
- Demonstrate continuing progress toward meeting discharge requirement
  - Assessment of progress – list of BMPs and status
  - Estimate of cumulative reductions in loading
  - Adaptive management strategies

Performance-based implementation approach

- Assess and document current practices
  - Application of BMP tool
- Set goals/schedule for improving practices
- Track progress/estimate reduced usage
  - Annual purchase records
    - Consideration given to variability in winter conditions
  - BMP tool, where applicable
- Report annually

What do we do about private applicators?

- Possible approaches
  - Cities/watershed districts offer/require:
    - Training and certification
    - Annual reporting
      - Quantity and type of product applied
      - Treated area
      - Number of treatments
      - Change/progress in BMPs
  - Legislation to limit liability

What do we do about homeowners?

- Possible approaches
  - Educational/awareness program
    - Salt application
    - Water softeners

What do we do with WWTPs?

- Individual non-MS4 permitted point sources will be identified and assessed for chloride contribution within each impaired watershed
  - Establish WLA for facilities with significant chloride contribution

Keys for successful implementation

- Accountability
  - Need a strategy to meet the protection and TMDL/goals (adaptive management included) and
  - Need regular (every year – two years) accounting and reporting on progress
  - Quantify, to the extent possible, pollutant load reductions
  - Implementation, accounting, and reporting of BMPs needs to occur so that MS4 can demonstrate progress toward goal
- 1 to 2 yr milestones/thresholds
- End date – reasonable assurance

Twin Cities Metro Area (TCMA) Chloride Project
Technical Advisory Committee (TAC) meeting #6
April 24, 2014, 1:00-3:30pm

Attendees: Josh Stock, Cliff Aichinger, Anne Weber, Tara Carson, Barb Loida, Mark Fischbach, Kevin Bigalke, Connie Fortin, Jeremy Walgrave, Hans Holmberg, Brooke Asleson, Rachel Olmanson, John Hensel, Duane Duncanson, John Erdmann, Lois Eberhart, Becky Houdek, Steve Albrecht, Derek Asche, Mark Maloney, Udai Singh, Jennifer Keville, Bob Fossom, Randy Neprash

- **Introductions**: Everyone introduced themselves and stated what they thought their role was in the goal to reduce salt usage. A common response was to balance public safety and environmental concerns regarding salt usage.

- **Presentation:** Winter Maintenance Tool – *Connie Fortin, Fortin Consulting*
  - The main goal of the winter maintenance tool is to provide information to the maintenance industry on how to reduce chloride.
  - The target audience for the tool is the leadership of organizations that perform winter maintenance, and for people within the organization.
  - The tool could be used as a training tool.
  - Users will enter information about the winter maintenance activities they do and information can be entered based on different categories: high speed roads, low speed roads, parking lots, and sidewalks. It will be most useful to enter information for the different categories separately.
  - *There are three modes to the tool:*
    - Mode 1: this mode requires little prep time, it includes about 150 questions, the user should have good overall knowledge of winter maintenance practices. The user will enter information about what they are doing today and what they plan to do in the next five years. There will also be supplemental information associated with the questions; users may also be able to eventually add information to this part of the tool (their own practices/success stories, etc.).
    - Do all the questions have same color coding system (red/yellow/green)? Connie: Yes.
    - If this tool is going to be used as a way to measure progress, how will we determine if the cities have met waste load allocations? Josh: We will do a review during the audits, we will not necessarily associate compliance with the tool; the tool will be used as supporting information: use of the tool is not an enforced requirement.
    - At what point will we say that a city has done everything they can? Hans: We will get to this topic later during the discussion. Connie: We can use water quality data as evidence that BMPs are effective, we'll know if responsible salt usage is improving the water quality.

  - *Discussion about private applicators*:
    - A 75% reduction in chloride will not happen without reducing usage by private applicators. Connie: How will we get private applicators to use the tool?
    - We need to do education/outreach to the private sector. Brooke: maybe we can develop a Level 2 training and assist salt applicators to use the tool to evaluate their current program and find opportunities to make reductions where it makes the most sense for them. We want to make sure everyone knows about the tool. The training would show people how to use the tool and may be a good way to roll out the tool to a wide audience.
    - There is also a question included in the tool addressing private applicators; the education committee suggested this, really wants to encourage training of private applicators. Are you requiring private applicators to be trained in your cities?

  - *Modes of the tool:*
    - After the questions are answered a summary report is generated that shows current performance and what your performance will be 5 years out: reports for 1st level assessment. The summary report shows what practices are poor/best/enhanced best (red/yellow/green).

- § The 2nd level assessment is a bit more time consuming to run through; this requires more detailed information to be entered and it then calculates salt savings. This assessment is limited to questions that have salt savings associated with them. The report shows what you entered and the tons of salt saved, as well as the money that was saved. These numbers are based on the assumption that conditions are static: winters consistent year-to-year. Maybe the user could add additional information/data to this.
- § The percentages that are reported in the 2nd level assessment are nested, meaning that the report does not show a cumulative percent reduction if multiple BMPs are in place.
- § This assessment is limited by the amount of research that has been done; some information is based on educated guesses, information that was gathered at the road salt symposium, and informal information on salt savings.
- § The tool could potentially be used as a way to budget accordingly for winter maintenance activities, and potentially show that the cities need more money. Good approach to help them move ahead.
- § The tool will have value to local government, it will be nice to look at individual cities path and progress without having to compare to other cities. Important to put time and energy into getting local government invested into doing this well, best conduit to reach out to locals, incentive to invest time.
- § Learned a lot looking at the questions, the tool is not threatening.
- § MPWA conference opportunity to get super intendants to buy into the tool. The tool provides a common measuring stick across cities. The results can be analyzed in-house without the need for broadcasting to a wider audience; the tool will be very useful.
- § What percent of BMPs were you able to put salt reduction values to? Connie: about 25-30 of the questions have salt reduction values associated with them.
- § It's important to prioritize practices, which ones are the most important? Each municipality can decide what is a priority based on their individual situation including budgets.
- § I like how the tool is being developed, it will be useful. Cities can quantify information that they have, address city officials and reach out through social media.

- o *Further discussion about private applicators*:
  - § How do we address where private applicators/maintenance facilities come in? Connie: There are questions in four categories, sidewalks and parking lots would be geared towards private applicators, in theory the tool should work across the industry.
  - § We could look at erosion control model. Construction sites have to be permitted; maybe we could require private applicators to register with the cities.
  - § The private applicators have to deal with liability issues, the liability falls on the vendor, some require that the parking lots have to be ice free. Brooke: In New Hampshire legislation was just passed; private applicators can volunteer to do training and if they are trained they have liability protection. SIMA is interested in pursuing legislation in Minnesota.
  - § It could be a matter of time before this goes to court in New Hampshire; maybe MN could offer certification for private applicators through stormwater U- reach out to green industries to hire certified private applicators.
  - § Connie is presenting information about the tool at the APWA conference in Cincinnati- will talk to those folks at the conference and get input from the industry- work together.

- o *Discussion about the roll-out of the tool and the expected timeline:*
  - § What is the timeline for the roll out of the tool to the industry? Brooke: The goal is to have the tool mostly developed w/in 6 months, and from there work out the bugs/any issues and have the tool finalized w/in the year. The goal is to roll out the tool to everyone in the seven county metro area and then statewide.
  - § MPWA conference is at the end of Nov., could get interest in the tool going then.
  - § City Engineers Association of MN Annual Conference (CEAM) and MN County Engineers Association (MCEA) Conferences are held 3rd/4th week of January, these would also be

opportunities to roll-out the tool, but it's important to have something ready at that point to give to them. Brooke: Also presented at the Metro Cities Engineers Meeting, talked to about 20 people and received good feedback/response.
    - Could also present at the MN Water Resources Conference and MN Transportation Research Conference. Brooke: MPCA will submit an abstract to the MN WRC and Connie is also planning to submit an abstract. Maybe Nine Mile could also present at the WRC, geared towards education/outreach.
    - Connie: How will we take tool to the next phase, implement? What is the best way to go? If we provide training to use the tool at a Level 2 training, people will need access to the tool, maybe they could download the tool. We want to make it as simple as possible to use. Maybe staff could run through the training with supervisors.
    - The tool will not be hosted on MPCA website during development due to limited IT resources. The hope is that MPCA will be able to support the tool in a year or two; however, we may need to find someone else to take ownership of the tool and make sure it is updated and maintained.
    - A state entity needs to keep the tool. Why can't the MPCA do it? Brooke: the MPCA doesn't have the IT resources right now available to maintain the tool, maybe we could hire an outside contractor, maybe it could be tied into the stormwater manual. We will be exploring possible options before the development phase is complete.

- *Discussion about what information should users enter, is historical information important?*
    - Connie: Users will answer all questions relating to their practices today, and also what they think they will be doing 5 years out, when testing the tool out the historical information was included in the report. Is this information valuable?
    - Yes, nice to go back at see that people made progress, this way the MS4 will receive credit for what they've already done, this will show evidence of past improvements.
    - Connie: The tool will be flexible, the user will be able to save each year to see if you are getting to their 5 year goals, the tool is not restricted to time periods.
    - Brooke: You will be able to go back every year, easy documentation.
    - Could the report include areas that are financially/economically advantageous (prioritize BMPs)?
    - Connie: This could be added to the tool eventually, but currently this information is not in the model.
    - In order to get people to start using the tool, it may have to start as a financial incentive.
    - Connie: We could add success stories/case studies to show the economic advantages.
    - Hope the tool doesn't just arbitrarily pick a date/time to start monitoring progress. A lot of folks have already done a lot to improve practices- they want to get credit for past improvements.
    - Could the user set the first date? Historical start point, once cities do the easy stuff- it's hard to continue making progress. Brooke: The user could pick the baseline year, focus on what can be done- what you did in the past and what you will do in the future.
    - Connie: Organizations were more willing to use the tool if they've already implemented BMPs- observed this when trying to get people to test the tool out.

- **Presentation:** *Hans Holmberg, Limnotech*
    - We are using a performance based approach for protection and the TMDLs, WWTPs will have individual WLA's , there won't be a percent reduction, relying on performance based approach, which is the implementation of BMPs with interim goals to work towards improved practices.

    - *Discussion about baseline year, reporting reductions in permit, and year-to-year variation in conditions:*
        - Other TMDLs have a baseline year and other TMDLs don't get to count previous BMPs. Will there be allowance to count previous BMPs? Brooke: Don't need to include baseline year with a performance based approach, will be able to take credit for past BMPs. Each entity will determine when they started implementing salt reduction BMPs and improving their winter maintenance practices- this was part of the motivation for taking a performance based approach to the TMDLs.

- Hans: the permitee would measure or estimate usage and reductions, this will also help the permittee understand how much they are using year-to-year. The permitee would have to report this annually. Brooke: The reporting would not start until 2019 and is not required if you are not in an impaired watershed. The majority of cities are already looking at ways to reduce salt usage, economic benefit.
- Still looking at permit holders to report usage/reduction for the performance of BMPs? Brooke: With road salt there are many data gaps, can't quantify reductions for all BMPs, but the permit will not require you to report a percent reduction. Duane: Permitees will just need to demonstrate progress, either qualitative or quantitative: some things can be quantified, some things can't. Can indicate qualitative activities too on the permit (like education), every permittee will be different.
- Every winter is different, how will that affect progress? Hans: Understanding that each year is different and each event is different. From a regulatory standpoint: can't employ BMPs in all cases: can't use deicers in all cases.
- The state doesn't intend to regulate how much salt is applied, but that information can be important for assessment to determine if progress is being made.
- What is the purpose of collecting salt usage information? A District with 8 counties has very different conditions in different areas: how will it be applied? Some point you have to say that yes you've done everything you can- can't come out during an audit, can't leave people hanging. Hans: Salt use is a good number to have to track usage trends: understood that initially there will be reductions, you will see a big reduction in the first couple of years (low hanging fruit). Want good information encourage people to make progress- challenging issue: public safety, increasing expectations of level of service, year-to-year variation.
- There is anxiety from regulated because of radically different winters the past few years: better if progress is measured on a longer time frame: too much variability (could look at averages). Hans: to look at long-term data we need usage- long-term dialogue commitment.
- I like performance based approach, usage is important to compare year-to-year, use an average approach, still would be able to show if there was reduction, the ability to compare to an average winter. Performance vs WLA: cities can reduce loads but will not meet WLA because of private applicators: how will we address this?
- Will there be a cut off threshold? How will the PCA evaluate if 40%, or whatever percent is good enough. Duane: Any reduction is good as long as they are making progress/improvement.

- *Further discussion about addressing private applicators and other sources of chloride:*
  - Brooke: Private applicators are not regulated; we need to work together to target that group: U of MN, watershed and cities.
  - Cities could require that applicators have an operating license and attend a training.
  - Need leverage to require cities to enforce private applicators to attend trainings.
  - Municipalities could mention on permit: public education, getting info out to private applicators, qualitative BMP, that could count towards reduction on permit.
  - Connie: We could continue to monitor as a way to evaluate if BMPs are effective; monitoring data will show if BMPs are working- provide evidence.
  - Many people contribute to the problem, home-owners, private applicators, but pushing MS4s to quantify.
  - Brooke: Looking at big picture: we are pulling all resources together (education materials)- will be in one place
  - Wastewater treatment plants do contribute chloride; however, in the metro most of the WWTPs discharge to the Mississippi River, where there is a large dilution factor. There are cases where the wastewater treatment plants are the primary source the chloride in the TCMA (Sand Creek).
  - Could we look at parking lot surfaces vs roads to try to determine the area that the private applicators are applying salt vs roads?
  - Steam is effective method to open up blocked stormsewers by ice in winter, don't use salt

    - Could there be something in the industrial stormwater permit addressing salt, there is nothing in there right now? Brooke: I will check with our industrial stormwater folks about that.
    - Maybe we should think about chloride the same way we think about phosphorus, but we are never going to stop salting the roads.
    - We could register private applicators; similar to pesticide applicator certification (Illinois did it at a more local level). Training not a voluntary thing.
    - More regional approach to reach private applicators. Maybe watershed districts could do it, rather than local government. There will be pushback for any city certification program. The problem is that some cities are located in multiple WDs/WMOs.
    - Private applicators need to be protected against lawsuits; we need legislation passed as a bill, legislation to limit liability. There could be a requirement that you have to be certified/tracking usage.

- TMDLs are a challenging subject; Chesapeake Bay is using a performance based approach. Each state is implementing a plan/strategy, this will lead to progress and will be able to quantify reductions, report and demonstrate with interim milestones and adaptive management.
- Could the MPCA work with attorney's to look into some of these questions? What can cities and counties do? Could we lobby for legislation? John: If the group has consensus on some of these ideas, they can make recommendations/suggestions, as long as there is a clear voice, there could be a positive outcome.
- We could bring in the League's legal staff to help. Brooke: Will form a subteam to get together and discuss ideas for "regulating" or certifying private applicators. Volunteers were Brooke, Lois E., Cliff A., and Randy N.
- How can we fund development/outreach of tool? Could we have a webinar? We need funding for training programs. Could MWMO fund training?
- Brooke: TAC will be meeting more regularly from here on out, next meeting will be in June or July.

TCMA Chloride Project
TAC meeting #7
July 1, 2014 1:00-3:30pm

Room 1-2
MPCA offices, St. Paul

***Desired outcome of meeting**:* To get feedback from the TAC regarding the overall format, approach and design of the draft TCMA chloride TMDL report. Discuss the TACs needs/vision for the Chloride Management Plan document and review the outline to provide input on the contents of the plan prior to its completion. Set clear expectations for review process and desired timeline for completion of project.

Questions to think about and come prepared to discuss:

What is the purpose (your perspective) of the Chloride Management plan?

What do need the most from the Chloride Management Plan for your organization?

How can we write this plan to provide the most benefit to your organizations needs/goals?

What is your role in implementing the Chloride Management Plan?

Agenda

- Introductions & meeting goals (Brooke, MPCA) – 15 minutes
- Modeling update & Review rough draft chloride TMDL report (Jeremy & Hans, LimnoTech) – 20 minutes
- Discussion about draft TMDL (TAC) – 40 minutes
- Discussion about your vision for the Chloride Management Plan (TAC) – 45 minutes
- Present draft Chloride Management Plan outline (Brooke, MPCA) – 15 minutes
- Review process schedule (Brooke, MPCA) – 10 minutes
- Road Salt Display State Fair sign –up (Rachel, MPCA) – 5 minutes

Next TAC/IPC meeting – August 2014
- o Review draft Chloride Management Plan

*****There will be an all MS4 meeting in August/September after TAC/IPC has reviewed draft Management Plan and provided “big picture” feedback.

*****There will be an informal stakeholder review process to get individual/specific feedback on the draft Chloride Management Plan from all stakeholders in August/September.

Attachments: Chloride Management Plan draft outline & review process schedule

Twin Cities Metro Chloride Project

TAC Meeting #7

Modeling & TMDL Discussion

July 1, 2014

LimnoTech

Water Environment | Scientists Engineers

Goals – Modeling and TMDL Discussion

- Present modeling approach
- Discuss TMDL components
- Present results for lakes and streams
- Approach answers “How much chloride can be used to meet the chronic criteria?”

Modeling Approach - General

- 0-dimensional steady-state model
- Simple runoff-dilution model to determine loading capacity of the waterbody
- Modeling considers runoff and the chronic water quality standard for chloride
- Modeling does not consider existing loading
- Modeling does not look at the amount of reduction needed to achieve standard

Modeling Approach - General

- Calculate average annual runoff volume (Qv)
  - Qv = area * runoff coefficient * average annual precipitation
  - Runoff coefficient is based on impervious surface

- Calculate loading capacity (TMDL)
  - TMDL = avg. annual runoff vol.* chronic water quality std.
  - TMDL = Qv * 230 mg/L chloride

Modeling Approach for Lakes

- Drainage area
- Impervious percentage (NLCD 2006)
- Average annual runoff coefficient (Simple Method)
- Average annual precipitation (30.6 in/yr) (TCMA 1981-2010)
- Average annual runoff volume
- TMDL Based on average annual runoff and chronic criteria of 230 mg/L

Battle Creek Lake & Tanners Lake Examples

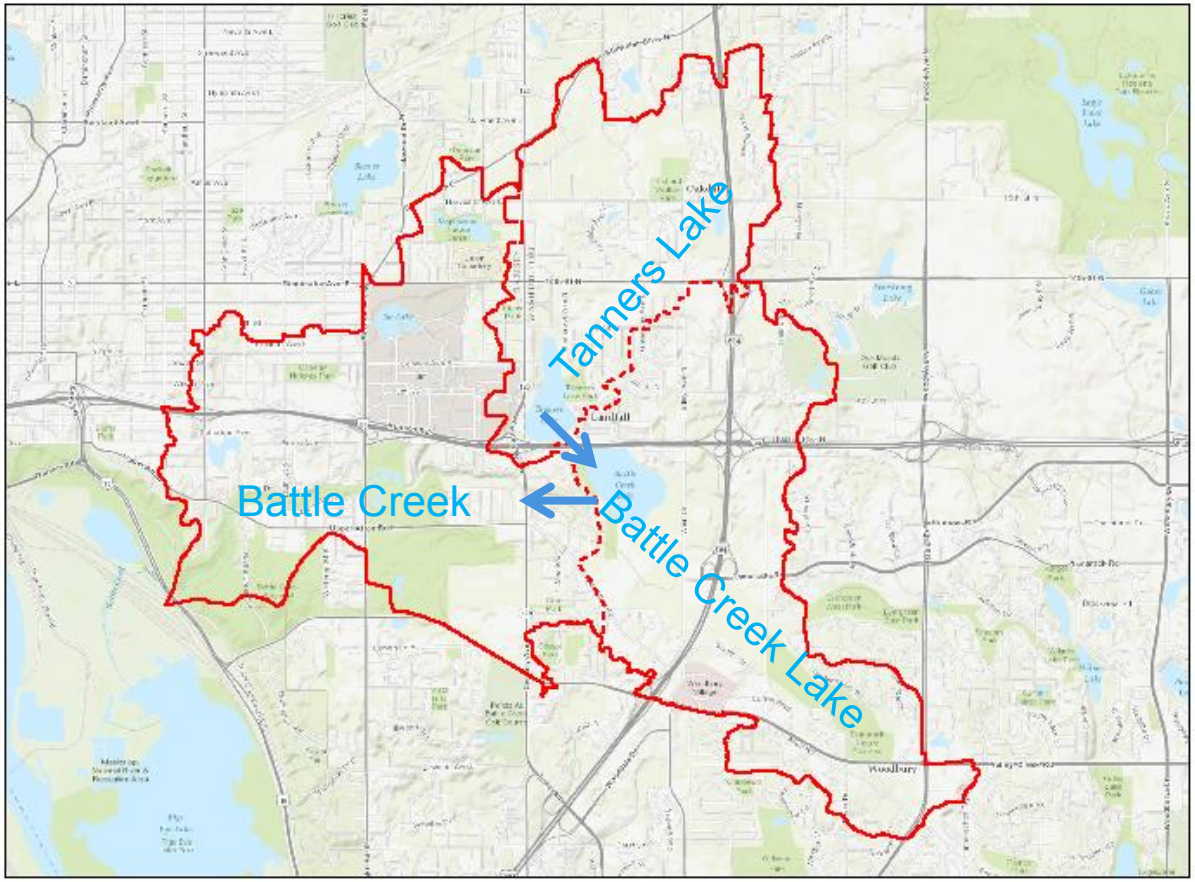
- Tanners Lake
  - Drainage area = 1,732 acres
  - Impervious surface = 29.8%

- **Tanners Lake flows into Battle Creek Lake*

- Battle Creek Lake
  - Drainage area = 4,325 acres
  - Impervious surface = 30.5%

- Loading capacity is based on runoff and does not include point source discharges.

Battle Creek Lake & Tanners Lake Watersheds



Battle Creek Lake & Tanners Lake

- Tanners Lake loading capacity =
  - 791,000 lbs of chloride/yr
  - 2,200 lbs of chloride/day

- Battle Creek Lake loading capacity =
  - 2,015,000 lbs of chloride/yr
  - 5,500 lbs of chloride/day

- Loading capacity is based on runoff and does not include point source discharges.

Modeling Approach for Streams

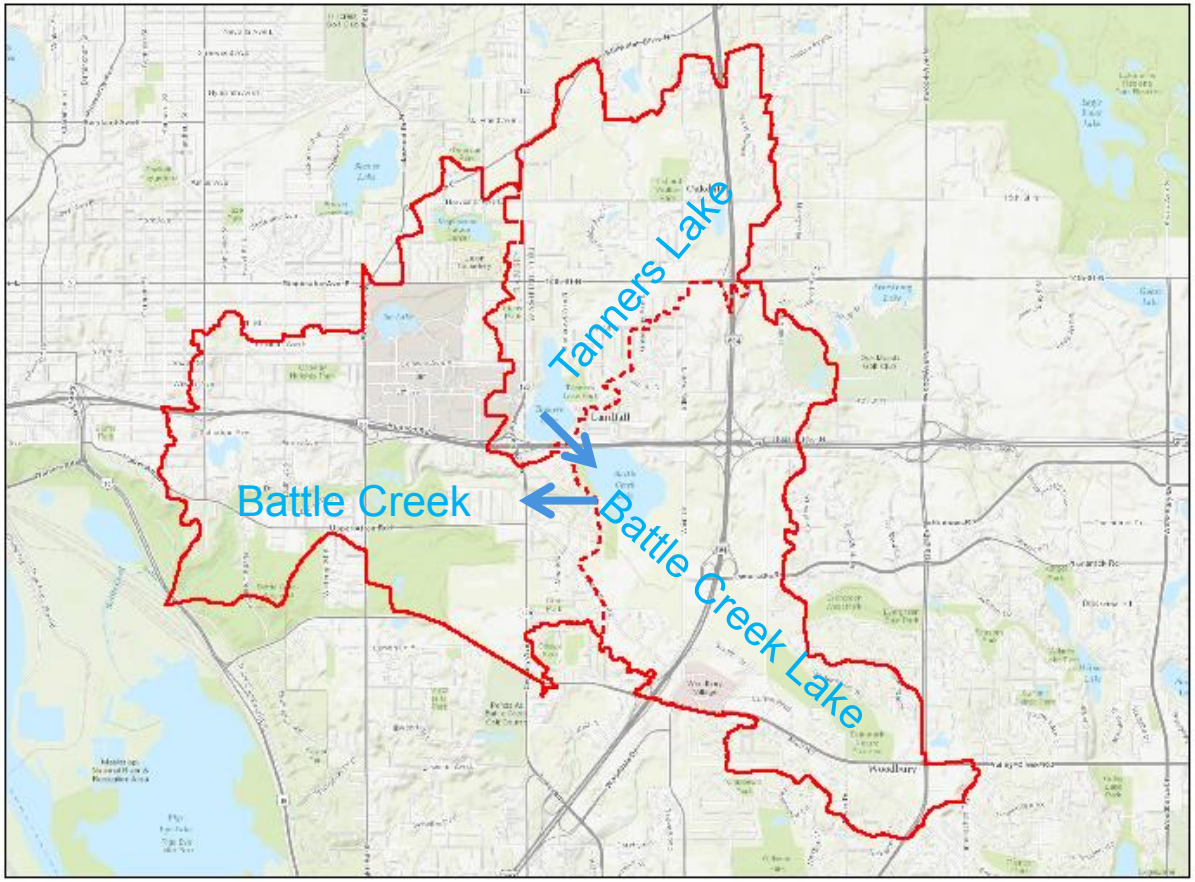
- Seasonal approach
- Drainage area
- Runoff coefficient for frozen conditions = 0.98
  - **Impervious surface does not matter**
- Seasonal – winter precipitation equivalent – Nov. 1 – March 31
  - 6.29 inches – snowmelt water equivalent
- Average seasonal runoff volume
- TMDL based on seasonal runoff & chronic criteria of 230 mg/L

Battle Creek Example

- Battle Creek
  - Drainage area = 7,246 acres
  - Impervious surface = 30.4%

- **Tanners Lake and Battle Creek Lake flow into Battle Creek*

Battle Creek Watershed



Battle Creek

- Battle Creek loading capacity =
  - 2,329,000 lbs of chloride/yr
  - 6,400 lbs of chloride/day

- Loading capacity is based on runoff and does not include point source discharges.

Additional Considerations

- Model assumes
  - Lakes are fully mixed
  - All chloride applied enters the waterbody
- Model does not consider
  - Time to achieve target – assumes steady-state
  - Year-to-year variability
- Point sources are being compiled and evaluated for inclusion in TMDLs

TMDL = WLA + LA + MOS + RC

- WLA = Wasteload Allocation
- LA = Load Allocation
- MOS = Margin of Safety
- RC = Reserve Capacity

Reserve Capacity (RC) & Margin of Safety (MOS)

- RC = 0
- BMP's will be implemented on newly added impervious surfaces
- Runoff volume increases with new impervious surface

- MOS = 10% (explicit)
- Accounts for scientific uncertainty
- New Hampshire chloride TMDLs use 10% (explicit)
- Shingle Creek and Nine Mile Creek - implicit

Wasteload Allocation (WLA)

- MS4's – Categorical
  - this includes all land area within MS4
- Point sources will be evaluated given a WLA
  - Additional WLA for Point Sources will be calculated by multiplying the design discharge volume by the chronic chloride criteria
  - In most cases, this will not reduce the WLA for MS4's since the point sources add additional discharge volume (additional dilution)

Load Allocation (LA)

- Natural Background = 18.4 mg/L (Novotny, 2008)
  - 8% of total loading capacity
  - TCMA only

Other Potential Sources

- Fertilizer (potassium chloride)
- Land applied WWTP sludge
- Land applied food waste
- Dust suppressant for gravel roads and lots
- Septic system discharge

Battle Creek Example TMDL

- Battle Creek loading capacity =
  - 2,336,000 lbs of chloride/year
  - Does not include Point Sources – YET!

Stream	Location	Watershed Area (acres)	TMDL (lbs/yr)	MOS - 10% (lbs/yr)	LA - 8% (lbs/yr)	WLA (lbs/yr)
Battle Creek	Ramsey Washington Metro Watershed District	7,246	2,336,000	233,600	186,880	1,915,520

Battle Creek Example TMDL

- Categorical WLA = 1,915,520 lbs of chloride/year

Waterbody	MS4_Name	MS4 Permit ID	MS4_Type
Battle Creek	Ramsey County Public Works MS4	MS400191	County
	St Paul Municipal Storm Water	MN0061263	City
	MNDOT Metro District MS4	MS400170	Non-trad
	Maplewood City MS4	MS400032	City
	Woodbury City MS4	MS400128	City
	Washington County MS4	MS400160	County
	Oakdale City MS4	MS400042	City
	Landfall City MS4	MS400025	City

Lake TMDLs

Lake	Watershed Area (ac)	TMDL (lbs/yr)	MOS - 10% (lbs/yr)	LA - 8% (lbs/yr)	WLA (lbs/yr)
Battle Creek Lake	4,325	2,007,500	200,750	160,600	1,646,150
Brownie Lake	391	255,500	25,550	20,440	209,510
Carver Lake	2,242	1,022,000	102,200	81,760	838,040
Como	1,850	949,000	94,900	75,920	778,180
Kohlman Lake	7,533	3,613,500	361,350	289,080	2,963,070
Little Johanna Lake	1,703	1,204,500	120,450	96,360	987,690
Long Lake (South)	114,786	24,783,500	2,478,350	1,982,680	20,322,470
Loring Pond (South Bay)	34	10,950	1,095	876	8,979
Parkers Lake	1,064	620,500	62,050	49,640	508,810
Peavey Lake	776	182,500	18,250	14,600	149,650
Pike Lake	5,735	3,467,500	346,750	277,400	2,843,350
Powderhorn Lake	332	219,000	21,900	17,520	179,580
Silver Lake	655	365,000	36,500	29,200	299,300
Spring Lake	76	36,500	3,650	2,920	29,930
Sweeney Lake	2,439	1,387,000	138,700	110,960	1,137,340
Tanners Lake	1,732	803,000	80,300	64,240	658,460
Thompson Lake	178	146,000	14,600	11,680	119,720
Valentine Lake	2,404	1,095,000	109,500	87,600	897,900

- Point sources have not been included yet.

Stream TMDLs

Stream	Watershed Area (acres)	TMDL (lbs/yr)	MOS - 10% (lbs/yr)	LA - 8% (lbs/yr)	WLA (lbs/yr)
Bass Creek	5,434	1,752,000	175,200	140,160	1,436,640
Bassett Creek	26,738	8,577,500	857,750	686,200	7,033,550
Battle Creek	7,246	2,336,000	233,600	186,880	1,915,520
Crow River, South Fork	818,091	262,909,500	26,290,950	21,032,760	215,585,790
E Branch Raven Stream	14,751	4,745,000	474,500	379,600	3,890,900
Elm Creek	66,382	21,316,000	2,131,600	1,705,280	17,479,120
Judicial Ditch 2 (Judicial Ditch 1)	1,587	511,000	51,100	40,880	419,020
Minnehaha Creek	109,151	35,076,500	3,507,650	2,806,120	28,762,730
Plymouth Creek (Unnamed 07010206-526)	6,447	2,080,500	208,050	166,440	1,706,010
Raven Stream	42,750	13,724,000	1,372,400	1,097,920	11,253,680
Sand Creek (07020012-513) (South) - includes 07020012-662	175,579	56,429,000	5,642,900	4,514,320	46,271,780
South Fork Rush Creek	13,845	4,453,000	445,300	356,240	3,651,460
Unnamed Stream 07010206-909 (County Ditch 4)	1,627	511,000	51,100	40,880	419,020
Unnamed Creek 07010206-718	793	255,500	25,550	20,440	209,510
Unnamed Creek 07010206-745	2,117	693,500	69,350	55,480	568,670

- Point sources have not been included yet.

Application events per year

- Snowfall events producing more than 0.1” of snow are assumed to be “de-icing” events.
- Data obtained from UMN Climate Data – 1891-2011

- 37.3 days – average number of days/year with snowfall >0.1”
- 14.4 days – average number of days/year with snowfall >1.0”
- 7.4 days – average number of days/year with snowfall >2.0”

- This does not account for freeze/thaw and black ice events
- NOTE – every year is different

Discussion

Twin Cities Metro Area (TCMA) Chloride Project
Technical Advisory Committee (TAC) meeting #7
July 1, 2014, 1:00-3:30pm

Attendees: Josh Stock, Cliff Aichinger, Anne Weber, Tara Carson, Barb Loida, Mark Fischbach, Jeremy Walgrave, Hans Holmberg, Brooke Asleson, Rachel Olmanson, Lois Eberhart, Becky Houdek, Steve Albrecht, Derek Asche, Mark Maloney, Kari Oquist, Bob Fossom, Randy Neprash, Melissa Bokman, Steve Albrecht, Matt Kocian

- **Introductions**
- **Meeting Goals-** *Brooke Asleson, MPCA*
  - The purpose of the meeting is to get input from the TAC on the draft TMDL and to discuss the vision for the Chloride Management Plan. Today we would like your feedback on the outline for the Chloride Management Plan. The Draft will tentatively be ready in August for your review. This meeting will not be the only time to provide input; we will have several other opportunities for review in the next few months.
  - Will there be separate meeting to focus on the modeling for the TMDL modeling? Brooke: We will discuss the modeling today and give examples first, and then go through the outline for the Chloride Management Plan.
  - Is there a revised list of proposed chloride impairments? Brooke: Yes, we have an updated list and will email it to you. The list is identical to the list that was submitted to the EPA. We will also email you the list of waters that have been identified as High Risk as part of this project. We are also planning to update the interactive map of impaired and assessed waters on the MPCA Road Salt and Water Quality website.

- **Presentation:** Modeling Update and Review Rough Draft Chloride TMDL Report- *Jeremy Walgrave and Hans Holmberg, Limnotech*
  - We will walk through the modeling approach and TMDL equations, discuss TMDL components, and present example results for lakes and streams. The question is how much chloride can be used to meet the chronic criteria?

  Discussion of lake modeling approach and assumptions:
  - For the lake modeling we used a steady-state model to calculate the TMDL. This model uses a simple runoff dilution model to determine the loading capacity for each waterbody; modeling does not consider existing loading to the waterbody. We calculated the average annual runoff volume, the runoff coefficient is based on the percent of impervious surface in the drainage area. We calculated the loading capacity using the average annual runoff volume multiplied by the chronic water quality standard. Is the average annual runoff based on 365 days? Jeremey: Yes.
  - Example- Tanners Lake and Battle Creek Lake: Tanners Lake flows into Battle Creek Lake, the loading capacity is based on average annual runoff and does not include point source discharges at this time. The percent impervious land use was determined using the 2006 National Land Cover Database (NLCD) and the overlay of the subwatershed of each waterbody. This method makes an approximation based on land use designations; we are not measuring square footage of pavement. How is the impervious designation determined? Hans: We will find out exactly how it is generated and send that information out to the TAC.
  - Is the Tanners Lake subwatershed also included in the Battle Creek Lake loading capacity? Jeremy: Yes, the Battle Creek Lake drainage area includes the drainage area for Tanners Lake.
  - Based on the average annual runoff model and the water quality criteria, we can estimate an average annual loading of chloride/yr and day. Is this based on existing conditions? Why are the numbers different for Battle Creek Lake and Tanners Lake? Jeremey: This is based on the product of drainage area and the percent impervious surface, the numbers are different since the drainage areas are different sizes, if the drainage area is larger the estimated loading of chloride/yr will also be larger. We are not considering existing conditions, we are calculating what would be allowed to meet standard.

Discussion of stream modeling approach and assumptions:

- A seasonal modeling approach is being used for streams. In streams there is typically a spike in chloride concentrations in late winter/early spring after first snowmelt event. In streams the runoff coefficient is determined based on the frozen conditions, the impervious surfaces do not matter in this case.
- For streams we are using more of a seasonal approach in terms of volume of runoff. The period we are using to determine the TMDL is from Nov. 1-March 31. We based this time period on U of MN weather records. Is the runoff coefficient the curve number? Jeremy: No, the number is 0.98, this is based on the assumptions of frozen conditions, and this is not a curve number. We can calculate the average seasonal runoff and multiply by the chronic criteria to estimate the TMDL.
- Example- Battle Creek: Battle Creek has a large drainage area and includes the drainage area of Tanners Lake and Battle Creek Lake, the calculations include the entire area. We used the seasonal runoff volume and the chronic standard to determine the loading capacity.
- Are you taking into account the difference between roof top and roadway for impervious surfaces? Jeremy: No, we are not differentiating between roofs and roads. Is this going to be a problem? Hans: No, we are looking at a long-term scale, water entering lakes comes from grass, roof tops and roads. It doesn't matter where the water comes from, because salt will eventually be diluted in the lake on a long term scale.
- For Battle Creek we assumed runoff for dilution based on seasonal snowmelt. There is a small amount of dilution water available in a creek- in streams salt flushes out. We are assuming that salt is equally mixed in stream snowmelt. Why not just treat runoff first? Hans: We need to estimate a TMDL for each waterbody for EPA requirements. We could calculate a general number across the metro, or a specific TMDL for each water body. We decided at previous TAC meetings to estimate a TMDL for each waterbody. We will estimate a TMDL for all impaired waterbodies. The allowable loading would be driven by what the loading is for each impairment.
- Why are we using a different approach for streams and lakes? Hans: Because chloride in streams is more seasonal- salt flushes out of streams, and we generally see a spike in chloride concentrations after the first snowmelt. What were the assumptions in using that period of melting? Hans: The period we used is not that important; all salt that is applied is equally distributed in melt, the time period of Nov. 1-March 31 is based on the U of MN weather data.
- Why weren't existing conditions considered? Hans: We are simply calculating the loading capacity. What about a more land locked system? Would there be a disconnect in terms of loading? Hans: We are using a steady-state model over time; in streams the salt will flush out, but lakes maintain current volume over time, volume will not increase or decrease. We assume the steady state long-term loading will be completely mixed in lakes. Brooke: The goal is to focus on the long-term conditions, this will drive implementation, this is also important in terms of meeting water quality standards. Hans: There will be outflow loss of chloride to groundwater, we assume chloride will move with groundwater in terms of outflow. Brooke: In many cases groundwater is exceeding state standards; it is likely that chloride contamination from lakes is entering groundwater.
- Jeremey: We calculated the loading capacity for Battle Creek based on seasonal runoff and the chloride standard.

Discussion on meromictic lakes and chloride standard:

- What about lakes that don't mix? When will we address this? Or will we address this in implementation? Hans: Under steady state long-term conditions it does not matter if the lake mixes, there will still be the same amount of water going into the lake.
- If we start discharging less, stratified lakes won't dilute. Hans: It will take longer to mix. Will there be enough mixing in Brownie Lake to dilute chloride over time? Hans: Yes, how long do we need to wait for waters to meet standard? Hans: We can't answer that at this point based on the information we have.
- What will happen if the chloride water quality standard changes? Will the TMDL change? Brooke: If the standard changes, we would have to look at the metro chloride TMDL again and determine if it needs to be updated. MPCA will have to wait for EPA before updating standards and go through the rule making process, it could take up to 1-2 yrs. before changes are made. Also, most MS4s will not be required to

report on their BMP progress until the 2018 MS4 permit cycle, with the exception of the Phase 1 MS4s, Minneapolis and Saint Paul.

Discussion on permit requirements and implementation:

- Will people be doing implementation as they go, even though it is not required to report until 2018 permit? Josh: Cities aren't required to do any implementation until the TMDL is approved. Brooke: But we encourage them to begin implementation anytime and recognize that many have already begun to implement BMPs to reduce their salt use.
- The fact is the implementation approach is a self checklist- check off what you are doing. We are moving towards a standard approach that everyone is using to reduce chloride over time, we have to do implement the same practices regardless of TMDL.
- Hans: The TMDL is regulatory, this number drives permit compliance for the permittee. We need to demonstrate reasonable progress toward meeting the TMDL.
- We will have a loading rate, the problem is multiple MS4s will be contributing to the loading- who is responsible? Everyone is responsible. We are still required to report progress, w/out individual WLAs for each MS4; it will be difficult to report, difficult to report for categorical WLAs. Josh: Because of the implementation strategies, the reporting for this TMDL will be different, the goal is an ultimate reduction of chloride, with improved practices to reasonably believe you are doing as much as you can to reduce chloride. You are not likely going to have to quantify an estimated reduction on the permit for this project.
- MS4s would like a definite answer; we need to have strategy in place. Brooke: There are numerous practices associated with chloride reduction, and we don't have any water quality models available for chloride, the goal is to inform the permit and provide as much information to permittees as possible. We most likely will not have enough information at this point to estimate reductions for specific BMPs.
- We should look at existing language for the Phase II MS4 permit and see how chloride fits into what is required in this enforceable document. Should there be modification to address chloride in the next permit cycle? Josh: We will look at the language, if necessary; we could make updates to the permit so it is more applicable to chloride.
- We understand the approach MPCA is taking; will this hold up legally if we are not making enough progress? The numbers are based on the volume of discharge times the chronic standard- if someone insists on moving passed the performance based approach, they could jump to the number in the TMDL, and the next step could be to monitor discharge and determine if discharge is meeting chronic standard. Has MCEA signed on to the performance based approach? Brooke: At this point we have not discussed this with MCEA, but will give them an opportunity to comment on the approach when we have a draft plan ready for review.
- Brooke: The goal for this project is to re-evaluate every 10 years and determine how are we doing? We will be using the adaptive management approach to determine if progress is being made and from there determine what changes can be made if we are not making progress at reducing chloride concentrations in our waters.
- Why is chloride different from other TMDL projects? Brooke: With chloride, all the implementation strategies are related to source control. In terms of WWTP, we do measure effluent, but we can't reasonably treat at end of pipe, the agency is taking this very seriously. We appreciate you sharing your concerns; we want to do this project as best as we can.
- We aren't concerned with the MPCA; we are concerned about other third parties. We are confident in the MPCA effort but the approach has to be defensible.

Further discussion on TMDLs and other potential sources of chloride:

- Jeremy: In the TMDL equation the Reserve Capacity (RC) is set at 0, the assumption is that the same BMPs that are in place for existing impervious surfaces will also be implemented on any new impervious surfaces. The Margin of Safety (MOS) is equal to 10%; we used an explicit MOS to account for uncertainty, similar to the Chloride TMDL completed in New Hampshire and consistent with other non-chloride TMDLs in Minnesota.

- What does it mean that BMPs will be implemented? Hans: For example, if a road is expanded, the same BMPs will be used, a reduction in chloride use will apply to the new surfaces as well. Brooke: All reduction BMPs will have same practices; you would continue using BMPs that have already been implemented. What if the total amount of new surfaces doubles? Brooke: In that case, there will be more volume of water for dilution. Do we assume a higher rate of discharge from water body to offset an increase? Brooke: The offset would be outflow to groundwater or surface water. We are looking at the long-term; this is why BMP reduction practices are so important. The focus will be on preventative BMPs- once chloride is in the lakes and streams, we will not be able to remove it.
- Jeremy: Point sources (WWTP) will be different, due to the additional water volume from the discharge. The TMDL right now is based only on runoff, once we add in point sources the TMDL number will go up. Are you talking about industrial stormwater too? Brooke: No, industrial stormwater is embedded in MS4 categorical allocation; here we are referring only to industrial dischargers, not industrial stormwater.
- Jeremy: Industrial discharges will get an individual WLA.
- How will you approach impairments in agricultural areas where there is not a lot of impervious surfaces, or impairments where natural background is a concern? Jeremy: Agricultural land will get allocated differently. Brooke: In the Sand Creek watershed there are three WWTPs, where the discharge is exceeding the chloride standard. We are planning to work with the WWTP on this issue. Areas that are not permitted will be split up in the LA. South Fork Crow River is another example where there are not any regulated MS4s, and several WWTPs and Industrial dischargers are present in the watershed.
- Hans: At this point, we have not seen that agricultural runoff is a significant contributor of chloride. Brooke: Chloride and sodium are harmful to plants, so chloride would generally not be used in agricultural areas. Land use applied food waste in another potential source of chloride, like Seneca, which is included on our list of permitted entities for the project. Natural background of chloride is minimal in the 7 county metro area and is accounted for in the TMDL as part of the LA.
- How much of the TCMA does not contain MS4s? Josh: Not sure at this point, haven't done an analysis. Brooke: In this study only Sand Creek, Raven Creek, and the S. Crow River include non-MS4s drainage in their subwatersheds.
- About 50% of the TCMA is actually urbanized. Brooke: The TMDLs will include urban and non-urbanized land. The TMDLs are based on hydrologic boundaries, the land use designations will be used to determine what goes into the WLA and LA.
- Jeremy: Other potential sources of chloride include septic system discharge, and dust suppressants. We used the MCES sewer shed coverage, and determined that most of the entire watershed is w/in sewered areas, there are very few septic's in the TCMA, Sand Creek and the S. Fork Crow River being the exception.
- Is this really the case? Many areas in the TCMA have septic's. Hans: When evaluating septic's, we haven't seen chloride impairments where we have heavy septic use. We don't expect that septic's in urban areas are significant contributors of chloride.
- What about the contribution from water softener? Hans: We haven't seen impairments in areas where the watershed is unsewered. If septic's were a significant contributor, we would expect to see impacts in those areas. At this point we haven't determined exactly how much they contribute, but they are not significantly contributing to impairments in the 7 county metro area. Brooke: If we need to collect more info on other sources for this project we can, but as of now those sources are not significant contributors to water quality problems associated with chloride.
- Brooke: I will send out a list of all the MS4s for the lakes and streams, and this will be laid out clearly in the TMDL.
- Jeremy: For application events per year we used an assumption for de-icing events of snowfall events of 0.1" or greater. Using this we determined application events were 37.3 days on average/year. This does not account for freeze/thaw or black ice events.
- Randy: There is a satellite impervious analysis that was done a few years ago, but you are not using that. Does anyone recall weather roofs and roads were distinguished in the satellite data? We don't have good LIDAR data covering the entire metro area. There may be an assigned value for pixel size in the satellite imagery. Some cities signed up for it, others didn't. RWMWD is commissioning a LIDAR flight to cover Ramsey County. Is there DNR LIDAR data available for the whole state? Zoning data may be more

typical in the future. Hans: Distinguishing roof top from pavement does not come into play when calculating TMDL.
    - The Nov. 1-March 31st window is for snowfall, does that mean that is the time frame when we look at rainfall? Jeremy: We look at rainfall for entire year for lakes, streams only using the 5 month period.

- **Discussion on vision for Chloride Management Plan-** *Brooke Asleson, MPCA*
    - Brooke: We would like your feedback on the outline for the Chloride Management Plan. What do you think the purpose is of the Chloride Management Plan? Brooke: My vision for plan is to provide resources and information that local stakeholders need to implement practices that will help to reduce salt and improve water quality, at the same time, complying with EPA rules to complete TMDLS. Are there other aspects?

    - Will the plan prioritize areas that are the biggest concern? Brooke: It will identify high risk waters and impaired waters. I will send out list of High Risk waters.
    - Is this what you are referring to in the outline for priority ranking 3(b)? Jeremy: The ranking is also by impaired waters, using the median chloride values we can determine which waterbodies are the most and least impacted.
    - Brooke: Section (b) of the outline is a summary of monitoring, we did a significant amount of monitoring for this project; we want to share what we learned from the targeted monitoring that we did for this project.

    Discussion on education effort and public expectations:
    - An education effort will have to take place; will somebody be able to use this plan to determine what they need to focus on? Brooke: Yes, the Education and Outreach Committee that were part of this project came up with a lot of ideas at previous meetings. We will be incorporating those ideas and resources into the plan.
    - We should include something in plan about public safety. We need to keep the public informed that we are still concerned about public safety. We still want to make sure the roads are safe. This is true, but is also important to work with people so they have realistic expectations. We still need to explain the public safety aspect and find an appropriate balance. Brooke: There is existing information on how to inform the public about safe conditions.
    - Public safety is also a concern for legislatures, not just stakeholders. MnDOT received complaints regarding Slow Down Ice signs on highway; some people don't trust the message that is coming from road authorities. It is important that the public hear it from other entities, like the MPCA, and local entities. There should be a state-wide coordination among departments, and come up with some sort of campaign to work together.
    - Will the management plan address these as well? Brooke: Yes, for example, MPCA has a role to play in the training; we can't rely on 319 funds from one consultant to continue the training. MPCA needs to create a sustainable program. Some examples of ideas for education and outreach will include 1) reaching out to private applicators 2) addressing public expectations 3) continue training.
    - The plan needs to touch on public expectations and the impacts of these expectations. The public expects clean water and safe roads. We need a plan that addresses the impacts of chloride on lakes/streams; we need to get elected officials and citizens on board w/ this to adjust expectations. We have to show the impacts of chloride into waterbodies, which is why this plan is being created. We hope that the state could take a lead on this for meaningful improvements. Brooke: We could include an introduction statement on the importance of chloride and why it is a big deal.
    - Are there case studies of waterbodies that have been severely impacted by chloride? Brooke: Brownie Lake.
    - There is no evidence that chloride is the only cause of the meromictic conditions in Brownie Lake. Maybe there are international case studies on the effects of chloride on biota. It is important to talk about the what if scenarios, and try and explain what will happen if we continue at this rate, otherwise we will never be able to help MnDOT explain the importance.
    - Relatively few people care more about roads compared to water quality, there is nobody that is on committees or boards that don't recognize the impacts of chloride. But this is not the general audience. Hans: Who is the right person to send the message? Is it the governor's office, billboards, similar to ag community? How do you effectively get people to think differently on their expectations?
    - Is it the typical person's expectation, or the employer's expectation? The audience may not be an individual person. People drive fast; people will complain about long commutes, nobody knows who the best person

is. We need a strategy on how to communicate that. The general public doesn't watch the news, RWMWD is engaging in marketing strategy to reach public, working with strategic communicators to help with outreach effort. Hans: Could the plan call for this type of effort? Is there an entity that champions this?

- Public needs to hear message from multiple sources, need to hear it from many different places. Easier to dismiss when message is from one source. Could there be a metro-wide watershed media campaign?
- Maybe adjustable speed limits are an option.
- Hans: Do we know anyone in the legislature who understands this issue? Brooke: There is a legislature who worked w/ MWMO who understands the road salt and water quality issues. We may be able to elevate this issue in the next session.
- With changeable speed limits we need both a carrot and stick. Incentives are important; we need to show people what chloride does to a lake. We need better law enforcement about unsafe speeds.
- There is one encouraging thing: a water commission, a small group of legislatures that care about these issues. MPCA should be talking with them immediately.
- Brooke: How we need to deal with public expectations and the importance of this topic will be included in plan. What other needs do you have from plan?

Discussion on how to best develop the plan so it can serve as a resource:

- We want the plan to be a resource for permitees and include case studies. It would be nice to see the changes in practices and cost savings. A part of the plan is to keep the plan going, to make it more robust as more information becomes available. Brooke: The Winter Maintenance Assessment tool will help to address this; we can add to the tool and build the database of knowledge.
- Is the message the same for everyone? Brooke: Yes, cost savings is the same, private applicators would use less if slip and fall lawsuits were not a concern.
- Case studies should be included that include comprehensive details of cost change. Important to not only talk about cost savings, but the overall cost including environmental costs- true cost. Brooke: In case studies there was an additional upfront cost, but in the long-term they made back the money spend in salt savings.
- Will the overall cost for the TCMA be included in this TMDL? Brooke: Not directly, we don't have enough information to incorporate the cost in a useful or helpful way, the assumptions we would have to make would not hold much weight.
- Isn't the TMDL supposed to address costs? Brooke: Yes cost must be addressed in general terms, so we will address them in a useful way. There is a wide range of BMPs that will be implemented by various entities in the metro, and we are not creating a detailed implementation plan.
- Brooke: The draft Winter Maintenance Assessment tool should be ready to review and test out by our technical expert team in January sometime.
- The plan should include information on the costs of rehabilitating lakes.
- In the outline, under 5(h), there is a list of funding opportunities; all MS4s may not be eligible for these grants. Should include information on how partners can assist with funding. Not sure how funding section should fit in to the Chloride Management Plan. Brooke: We wanted to include a comprehensive list of all the funding sources available for grants and loans.
- Under 5(h) WMO's should also be included, not just WD's
- The Winter Maintenance Assessment tool is very promising. Does the tool need to be a living document that is continuously updated? Brooke: Yes, I think it should be; we will need resources to maintain the tool. The MPCA is working on the logistics; we will hopefully find a permanent home for the tool. At this point we only have approval to create the tool. MPCA may be able to host it or possibly the U of MN, or Freshwater Society. Has the U of MN Water Resources Center been involved in the project? Brooke: Yes, we have been in contact.
- MPCA should be committed to the project, only committed to stormwater manual. Brooke: The tool could possibly be part of the stormwater manual, hopefully we can find the funds to host and maintain the tool. If the tool is in an Access Database we could make changes easily and continue to update the tool. For the implementation strategy we don't want an exhaustive list of all BMPs in the Chloride Management Plan- just enough information to send people to the Winter Maintenance Assessment tool, but this is not a requirement.

- Brooke: what level of detail should we include for implementation strategies in this plan? Our vision is to keep it high level, and think about the big picture.
- We are assuming that networking is going on among cities, don't know how this formally looks. How can we involve other cities, other than the Road Salt Symposium? How will this resource steer people in the direction towards new information? Should the City Stormwater Coalition be involved? There are different groups in the loop. Should we include them in the plan as a resource? Brooke: The Winter Maintenance training is a resource as well as the Road Salt Symposium. Are there other ideas, or networks where people would go for information? We are hoping they go to the management plan. The plan will provide them with resources they need to make changes.

Discussion on timeline of TMDL review:

- The Chloride TMDLs will be an appendix to the Chloride Management Plan, the TMDL will fulfill EPA requirements.
- May not have to put Chloride Management Plan on public notice, but we will send it out to all stakeholders for review? We may just public notice the TMDL.
- Brooke: The schedule will be to send draft TMDL to EPA for preliminary comments, incorporate changes, and put on public notice for 30 days, incorporate comments, and then we have to wait 30 days before sending it to EPA for final approval.
- Will the TAC/stakeholder review be at the same time? Brooke: the TAC/IPC will review it first, and then we will send out to all stakeholders for review. We will also host a meeting during that time, where you will be able to provide feedback. Planning to finish a draft in the next month or so. We will get this group back together in August with the Implementation Planning Committee to review, we will first give them the opportunity to see the product.