NOTES

Phosphorus Loading Subgroup
Thursday, February 13, 2020
1:30-4:00 p.m.
Dane County Building, 5201 Fen Oak Drive, Room 208

Members: Matt Diebel, Laura Good, Dale Robertson, Dick Lathrop, Paul Dearlove, Mark Riedel, Jake Vander Zanden, Greg Fries, Todd Stuntebeck, Kyle Minks

Lead/Spokesperson: Matt Diebel

Recorder: Paul Dearlove

Charge: From 12/6/19 Steering Team Notes: *"The group [will] focus on the biophysical side of the issue, and not social impacts. It would address questions such as: How does the system work? What kind of kind of lake responses can we expect with different [phosphorus] reduction scenarios? What models and assumptions should we be using? The process will start with a system inventory and focus on the science and technical aspects of the problem. The subgroup would not get into the recommendation of specific strategies."*

Attendance: Matt Diebel, Dale Robertson, Dick Lathrop, Paul Dearlove, Mark Riedel, Greg Fries, Dave Merritt, Todd Stuntebeck, Laura Good, Jake Vander Zanden

Specific request(s) from Steering Team or Executive Committee:
Define the charge and recommended membership of the subgroup, and assign follow-up tasks as they relate to assessing phosphorus (P) loads and developing reduction targets.

Recommendations/Proposals:
Meeting objectives were to review data summaries of historic P loadings to the lakes through gaged tributaries; P-concentration trends in the lakes themselves; and the Yahara CLEAN 2.0 process for calculating practice impacts and progress. The goal was to reach a common understanding of what we know and what we need to learn going forward.

- *No decisions or recommendations made on the work components to put out for contract.*
  Context: Hiring outside consultants is under consideration but may not be needed to perform the type of work that this group can do on its own, like figuring out how the lakes might respond to changes in phosphorus load. However, the work will take time that subgroup members may not always have available to give, which could stretch completion timelines.

- *Need a better description of what public wants to see in the form of narrative goals.*

Context: There is the question of how to involve and get input from the public regarding what people want the lakes to be like and how much they're willing to spend for it. Does the technical subgroup define a range of feasible possibilities/scenarios to present to the public, or do we ask what the public wants and then determine what that will require?

- *Diebel was encouraged to continue his work on re-evaluating delivery factors to help improve the targeting of practices.*

  Context: Delivery factors were previously developed for each practice (a.k.a. Yahara CLEAN action priority) to better estmate how much of a given phosphorus diversion on the landscape would have impacted the lakes. These adjustment factors generally take into account the form and propotions of phosphorus diverted (dissolved and particulate) and the degree to which the practices would effect the lakes (based on distance, etc.).

Action items:

- Diebel will give a summary update to the Steering Team on February 14th.
- Todd agreed to share his PowerPoint presentation with the subgroup members.
- Next meeting: 9:00 a.m. on March 6th at 5201 Fen Oak Ct.

Supplementary notes:

Stuntebeck P-loading update and discussion

- Since Lathrop did his work in 2010, we have much more data on external loading from tributaries and updated SLAMM results. Sixmile and Dorn Creeks started to be measured in 2013. Used regression equations to back estimate loadings from the present to 1991. About 7.7 sq mi not modeled from Middleton area.
- Urban (SLAMM) modeling is averaged out over the entire year (not seasonalized), and was done on a 10.1 sq mi. area. Found that 60% of annual average P loading comes in over a two-month period in the fall, and it is mostly orthophosphorus from leaves. There was no accounting for snowmelt. Existing practices such as street sweeping, catch basins, and detention ponds were factored into the modeling.
- Average annual urban load is about 6,400 lbs. of P. "Other" P contributions include 7.7 sq mi of unmeasured area around Middleton. P load per acre is highest for urban areas (about 1.00). Depends on the type of weather year. Direct Lake Mendota P deposition (estimated) averages 3,100 lbs. of P per year, mostly from dust.
- Annual TP loading to Lake Mendota averages 76,846 lbs using the last 29 years of data (1990-2019). From 1976-2008, it was estimated at 73,600 lbs (Lathrop). This compares to the 1991-2008 estimate of 71,000 lbs. of average annual P loading (Stuntebeck). From 2008-2019, the average annual P load was 86,400 lbs., or an increase of 15,000 lbs. per year compared to pre-2008 loads.
- Overall, concentrations appear to be staying relatively stable while loads are increasing.
- The effect of watershed management over the recent period is best determined by factoring out the effect of flow variability, known as "flow-normalization". Flow-normalized trends in total phosphorus in the Yahara River and Pheasant Branch Creek have been relatively constant over the last decade, indicating a balance between the effects of intentional watershed management practices and other changes in the watershed.

- Total P contributions to Lake Mendota are about 8% urban, 4% direct deposition, and the rest from rural tributaries (47% dissolved and 53% particulate P). The relative amounts coming in through tributaries are fairly representative of the size of the land areas that they drain. About 51% of the annual loading occurs January-March, and 75% between January-June.
- Most snowmelt P losses are dissolved according to what is measured in the stream. Leaf control would fix a big portion of the urban contribution, but would not have a big impact overall given the size of the rural contributions. Farmand conservation practices that control erosion and improve infiltration can be effective for controlling particulate P, but may do little for dissolved P. It will be important to determine the sources of dissolved P from rural areas (manure, decaying plants, wetlands) and what practices can be applied to control those sources. We have to stop P from getting into the lakes regardless of its form, but knowing trends and whether it's particulate or dissolved can help in the identification of control strategies. Most practices today are targeting particulate P.
- Most of the water getting into the lakes comes in during baseflow, but most of the P (>80%) gets into the lakes through stormflows.
- Median stream P concentrations are currently two to three times the 0.75 mg/L TP criteria concentrations (0.17 mg/L median). There are some indications that baseflow concentrations have decreased as a result of Suck the Muck. However, it was hypothesized that unless streambed sediment is getting transferred into the lakes during storms, the total impact of "Suck the Muck" remains in question. It might only be the top 5 cm of streambed sediment that actually moves given the results of sediment-dating profiles. It would be useful to look at how much Suck the Muck is costing and what we're getting for the investment.

<u>Lathrop in-lake P concentration update and discussion</u>

- The target for lake clarity is a Secchi depth greater than 2.0 meters.
- The target total phosphorus concentration used to establish load targets in Lakes Mendota and Monona is 24 µg/L, which is considered the threshold to reach a mesotrophic (or less algae bloom-prone status). The phosphorus criteria adopted by DNR are 30 µg/L for deep drainage lakes (Mendota and Monona) and 40 µg/L for shallow lakes (Waubesa and Kegonsa). The DNR criteria are used by the Clean Lakes Alliance for the State of the Lakes reporting. It has been suggested that the criterion for Mendota should be lowered to 15 µg/L because it used to support cisco, which is a fish that requires lower phosphorus concentrations.
- Median total P concentrations in Lakes Mendota and Monona (July-Aug, 1980-2019) only drop down to 24 µg/L during droughts. The data also show the lakes recover quickly after being shocked with high P concentrations, and that they do respond to changes in external loading. Consequently, Lathrop said that if external P loads are reduced, the lakes should respond quickly without expensive alum treatment.
- A fall turnover index is a good way to evaluate conditions given the huge store of P in the bottom of the lake during the summer, and the fact that algal uptake at that time is less of an impact. Deep hypolimnetic waters can be quite high in P, and alum treatments only turn off internal loading while doing nothing for external loading. These treatments could cost $100

million for a lake the size of Mendota, and it wouldn't last long enough to make it worth the cost.

- Why not pump and treat hypolimnetic waters in a somewhat continuous way? Response: It would not be economically feasible given that a huge system would be needed to pump and treat that volume of water. High sulfide concentrations would create a big smell problem, and a huge treatment system is needed for only three months of the year. Concentrations in the hypolimnion (~450 µg/L) are actually pretty low compared to what treatment plants typically treat. Main point is that the lake will respond to reductions in P load, as demonstrated during droughts.

Diebel update on Yahara CLEAN 2.0 delivery factors and discussion

- Average P loss per acre of farmland is 2 lbs, or 1 lb. under conservation practices. Delivery factors attempt to quantify, depending on the practice, how much P gets into the lake and in what forms.
- General goals outlined in CLEAN 2.0 are probably still appropriate. However, there are many more internally drained areas within the watershed than just the bigger, more contiguous areas identified in CLEAN 2.0. In other words, it is a very complex and not very connected watershed. This should be considered when identifying hot spots and where to prioritize practices.

General discussion

- *Average* annual P loads to Lake Mendota should be around 35,000 lbs. Goal should be to squeeze the probability distribution curve of a high-load, high-algae situation. Reaching the load-reduction goal would then result in a certain number of days out of 10 when Secchi clarity is greater than 2 meters (CLEAN 2.0).
- Riedel was concerned about directly linking P-load reductions to less algae, suggesting a need to also focus on nitrogen to reduce harmful algal blooms. Lathrop: Lots of dentrification occuring in wetland areas before it gets to the lake. Also, practices positively impact N loads while they're controlling for P. Suggests not getting into the N rabbit hole.
- Public messsaging maybe shouldn't focus so heavily on phosphorus, but rather something that is more readily observable by lake users.
- Lake biology has its own impacts, but is much harder to control. Regardless, if you drop the P concentrations, there will be improvements.
- Public wants to know how much it will cost to get to a specific lake response. The idea is that the subgroup will help provide cost-benefit scenarios.
- Delevan Lake can be used as a model for how goals were set and what was needed to achieve them, and then what happens when those actions are implemented. We have to deal with fact that we have an agriculture watershed, and it's not likely that we will go back to prairie and managed grazing everywhere.