

**Lake Champlain Basin Program
Technical Advisory Committee meeting
Held remotely over MS Teams
Wednesday, February 1, 2023, 8:45 AM – 12:30 PM**

Approved TAC meeting summary

TAC Members: Jennifer Callahan, Ryan Cunningham, Bryan Dore, Laurie Earley, Antony Tseng for Michele Fafette, Peter Isles, Neil Kamman, Steve Kramer, Margaret Murphy, Bridget O'Brien, Ryan Patch, Oliver Pierson, Andrew Schroth, Jamie Shanley, Lauren Townley, Daniel Tremblay, Ryan Waldron

LCBP Staff: Mae Kate Campbell, Meg Modley, Matthew Vaughan, Sarah Coleman, Sarita Croce, Erin Vennie-Vollrath, MaryJo Feuerbach

Guests: Dave Braun, Meghan Arpino, Bettina Miguez, Jon Kim, Joe Ayotte, Kristina Masterson, Janet Barclay, Don Walter, Brad Roy, Benjamin Dejong, Pamela Dugan, Marli Rupe, Amy Macrellis, Patti Casey, Edwin Romanowicz, Les Carver

1. Updates, announcements, public comments

- Sarita Croce, the new Director of Water Resource Programs at NEIWPC, introduced herself to the TAC.
- Neil: The wake boat petition previously described by Oliver is moving forward. A rulemaking procedure to limit the use of wake boats in some lakes in Vermont is in process. The effort is in the inter-agency consultation stage; there will be a public comment period in the future. The decision was made based on a scientific analysis of the impact of wake boats.
 - Peter: The rule is essentially that wake boats can't operate within 500 ft of shore and in ponds less than 20 feet deep; the polygon meeting that criteria needs to be at least 50 acres large. There will be a public info meeting on 2/15.
- Margaret: The sea lamprey wounding assessment on lake trout and Atlantic salmon documented that the number of wounds is below our management goals. This is the first time that has been achieved for lake trout, a good news story.
- Ryan P.: The Payment for Ecosystem (PES) Services Working Group has released its final report, which is a culmination of 3 years of work, 8 technical studies, and many meetings. The group has made a recommendation for a pilot program. It will be a state-federal partnership and attempt to take advantage of under-utilized federal programs and fill in the gaps of federal programs and funding streams. Farms will be required to submit their whole farm for assessment and can enroll their forest land as well. Pilot signup for farms will be happening this March or April.
 - Neil: How does the proposed pilot program link up with the existing US Department of Agriculture (USDA)-funded Pay for Performance (PFP) program?
 - Ryan: The pay for performance program is focused on phosphorus, not other ecosystem services at this time (though we are evaluating that). We hope to

have the VT PFP program expand, but that is separate from the recommendations of the PES working group.

- Sarah: The 2022 Clean Water Performance Report has been released. I urge folks to take a look at the performance dashboard.
 - Neil: There will be a public review presentation on 2/17. There are impressive statistics in the report documenting the reduction of nutrients and utilization of public funds.
- Matt: We have invited pre-proposal applicants who advanced to the next phase to submit full proposals; all have confirmed their intent to submit a full proposal. Full proposals are due 2/7. The March 8th TAC meeting will be focused on reviewing TAC scores and making a recommendation to the Steering Committee.
 - Neil: The March meeting will be in-person.

Review and approve summary of previous TAC meeting

Motion: to approve the December meeting summary

By: Jenn

Second: Margaret

Vote: All in favor

Abstentions: Ryan Patch

2. Final report review – Tile Drainage System Monitoring in the Northern and Southern Lake Champlain Basin and Comparison of Two Reactive Media Filters to Remove Phosphorus from Tile Drainage Water (Dave Braun, Stone Environmental)

- Matt: This is phase 2 of this work, and this project is part of a larger body of work that LCBP has supported to increase knowledge of tile drains and test nutrient management options. Matt reviewed previous work and the process for collecting TAC member's feedback on the report.
- Dave noted that the Stone team intends to make revisions in response to the comments already submitted by Matt. Dave shared [a presentation](#). He provided background on tile drains and previous assessment Stone completed in Jewett Brook. He then reviewed methods and results of the tile drain monitoring efforts in Jewett Brook and Addison County.

Questions/Discussion

- Ryan: I have a question on the terminology of direct vs. indirect conduit. Could tile drains be considered an indirect conduit at times since there is mediation through the soil profile?
 - Dave: I was referring to the fact that once something reaches the tile drain, there is no opportunity to remove it.
- Neil: How did you install the mag-meters?
 - Dave: We used an excavator.
- Matt: I have a question related to the way event mean concentration is being handled in the report. It seems like there is some disconnect between the way the concentration is

being calculated vs. the way it is being described in the report. Please make sure the term is being used consistently.

- Neil: In the figure comparing activated aluminum with the St. George black media, it seems to me that the figure is showing that over time different amounts of P was added to the tile treatment media. Is that correct? It seems strange to me.
 - Dave: You are correct. If we continue to load the tile drains, this is the amount of P that it took to keep it constant in the outflow. So, this is a measure of sorption.
 - Matt: The graph shows what was added and what I think Neil was questioning is the language about “maintaining” the concentration. Maybe we can flip the graph to show what is sorbed. More labeling on the graph could help also.
 - Neil: I think the y axis just needs to be modified.
 - Matt: I agree. That will make it more clear that AA performed better.
- Marli: For the cost details you shared, is that amount for the media only, or for the construction and the media?
 - Dave: \$4-10K covered the full cost of installation (the media + construction). We will have updated numbers in May when we start the installations.
- Neil: There are a couple of key questions to cover. Does your take home sentence refer to the total amount of removal, or the amount per event?
 - Dave: That refers to all removal through the 30-40 events where we collected composite samples. We would have done better if we did not have high bypass whenever the ditch flooded, which was a lot of the time. If we were not flooded and the filter system was always running, we would have seen a lot of removal in the spring that we did not see.
- Steve: I have been monitoring soil temperature and moisture, and last year we had extended periods of drying. I am wondering if that factor is affecting the soil fractions washing through the tile, as we are re-wetting soils after major storms. The clays will shrink, swell, crack, and re-shut. I use a particle size analyzer to determine if the fraction of soil size changes. You may want to consider a pre-settling basin.
 - Dave: I would be surprised if we did not see results from opening up the system, and you could transport a huge range of particle sizes vs. if you have matrix flow conditions. To your second point, we did some math on settling velocities and water and sediment control basins, and the settling rates are so slow that to achieve settling we would need a massive basin. We prefer to get a clean aggregate that will pass a lot of water.
- Neil: So to summarize TAC’s major comments, we are asking the project team to look at standardizing the periods of sampling to a fixed number of days, and report on the load with harmonized data and review the retention figure based on cumulative additions. I suggest moving forward with provisional approval of this final report, pending the incorporation of Matt’s written comments, and suggest we organize another in-person discussion so we can have more time to discuss this project.
 - Matt: TAC would also like to ensure the economic information in the report is clarified and reflects how much these systems cost.
 - Neil: I will add a recommendation to include a cartoon schematic of what a tile drain looks like in the body of the report.

- Motion: to provisionally approve the final report, pending the incorporation of edits suggested by the TAC and subject to final review and approval by Matt
- By: Ryan P.
- Second: Jenn
- Vote: All in favor
- Abstentions: Andrew Schroth

Matt: I will invite all of TAC to an optional follow-up discussion which will not involve further review of the final report. Andrew and Neil expressed interest in joining.

3. **Workplan review – Determining the bioavailable phosphorus loading avoided from implementation of restoration practices** (Bettina Miguez, Stone Environmental)

- Matt: This project was previously approved by the TAC, but the State of Vermont independently completed a study with the same objectives of the study as originally approved. The project advisory committee (PAC) for this project worked with the project partners to propose a related project.
- Bettina reviewed the original workplan, discussed why a change was necessary, and reviewed the proposed new workplan/project scope.

Questions/Discussion

- Matt: There was excitement from the PAC that in management, we treat total phosphorus (P) as equal across the board even though the fractions do differ. We talked about treating different lake basins differently since different types of sediment would react differently. That was removed from the workplan, but this project will provide information on how different sediments will react differently.
- Matt: Sharing a comment from Eric Roy. They used the phosphorus saturation ratio (PSR), which can be a better proxy of dissolved P release from sediment-bound P. We may want to consider that since it could be a better proxy.
- Neil: Do we have someone from the Clean Water Initiative program on the PAC? That team publishes the standard operating procedure (SOP).
 - Sarah: I serve on the PAC and can help create that link. My sense is that this is complex soil science and is still probably a bit upstream from being able to impact the state's prioritization procedures at this time. I want to make sure that the study is positioned to make meaningful progress towards the larger complex question. It's a compelling and important question.
 - Bettina: It does sound like a theoretical research question, but we should keep in mind what the potential for applying this in a regulatory context could be. Our goal with the project is to make some progress towards that. As mentioned, this project alone will not get us there. We want to know how this research project can inform reactions.
 - Matt: This will be a great way to learn if looking at different phosphorus phases will be significant enough to affect our management goals and if this is something we will need to look at more broadly. We know these things are impacted by soil history, texture, type, but local data and extractions will be useful.

- Antony: Will a broad range of soil types and existing data like Natural Resources Conservation Service (NRCS) coverage be used?
 - Bettina: One of the reasons we focused in on two project types is that we want to be able to take more samples and get a broader geographic range of samples. Site geology and site history will be taken into account in the site selection process.
- Andrew: The question is, is this research something we can generalize in a meaningful way that can scale up to policy implications? If you can assess that somewhere in the report, I think that would be useful.
 - Bettina: We will be working with the PAC to make sure the data we collect is most usefully communicated.
 - Sarah: I added a similar comment to Andrew's in the workplan. If this project doesn't have an output that would affect management/policy, it would be great to include a discussion of what further steps would be needed to get us to that point.

Motion: to approve the workplan as drafted

By: Jenn

Second: Andrew

Vote: All in favor

4. **Presentation: Lake Carmi groundwater study results** (Jon Kim, VTDEC)

- Jon presented the results of a collaborative study: "[How Does Groundwater from the Fractured Bedrock and Surficial Aquifers Affect Nutrient Levels \(P and Nitrate\) in Surface Waters from the Lake Carmi Watershed?](#)".
- Neil: This was a high-value project for the cost. I have a big-picture question about the conceptual diagram you shared. In the figure, you had arrows between the sediment and the lake water. Would your data paint the picture that under the most exacerbated summer conditions, groundwater is driving the delivery of nutrients through the sediments at a rate that is higher than it would be from large surface flows to the lake?
 - Jon: The hydraulic heads in the bedrock aquifer between the highlands on both sides suggest that groundwater is moving to the lake. Whether the heads are sufficient to move groundwater through the sediments to the lake is unclear. We have discussed additional sampling or additional water quality analyses to get at this question. Additionally, when surface water is flowing towards the lake, it's a combination of groundwater and surface water. We know that during droughts, the surface water component is lowest relatively. Groundwater and surface water interact so that you can have groundwater in a stream flowing to the lake, or the reverse. I would defer to Andrew's team about how to effectively integrate our work with their work and make our findings most useful for all.
- Margaret: I am curious as to how this work helps our understanding with legacy P in sediments and how that loading can change our understanding of those dynamics.

- Jon: The P has to get to the lake sediments to then be involved in internal loading. With tracers of anthropogenic activities, we are seeing that the soluble elements like nitrate and chloride have been exhausted from the system, and longer-lived constituents dominate.
- Margaret: With the NO_x, is that altering the P/N ratio which could drive cyanobacteria bloom dynamics?
 - Jon: Prefacing this response with a note that I am not a cyanobacteria expert. We were surprised in our results at how low the nitrogen levels we measured were. We would like to compare these results with other data. That raises the question of whether the N is leached out of the system, or if this is a low-N producing system.
- Ryan: Compared to the other agricultural sites and considering the lower rates of nitrate impact, it seems to me like there is less active anthropogenic contamination of groundwater happening here compared to other sites. With the geology of Lake Carmi, are there just natural conditions where the lake will not be able to meet in-lake water quality standards?
 - Jon: It seems like the soluble tracers are suggesting that the immediate impact of anthropogenic activity on groundwater is low. There is other work ongoing that is looking at phosphorus loading considering monitoring well data that we can share with this group.
- Jon: We submitted a final report in PDF format to LCBP/EPA, and it is available on the VTDEC website.

5. Line-item proposal review: US Geological Survey Lake Champlain Basin groundwater study (Joe Ayotte, Kristina Masterson, Janet Barclay, Don Walter, USGS)

- Matt introduced the proposal from the USGS Lake Champlain science team.
- Joe and Kris [presented](#).
- Matt: How does the scale and heterogeneity of the geology in the Lake Champlain basin compare to your previous studies?
 - Joe: This is a larger system, but I would expect this analysis to go smoothly still. Our team has a lot of experience with this type of work.
 - Don: On Long Island we had a complex aquifer system. In Champlain, the geology is complex but not in the same way. Every system is different, but I still expect the analysis will go smoothly.
 - Joe: There are a lot of local geologic experts that we intend to draw upon as well.
- Neil: The Lake Champlain Basin is a larger geography with some fundamental differences in bedrock geology. The micro-scale complexity of groundwater travel in small sub-basins is high. How do you take what I know is locally highly complex and expand it to the whole-basin scale?
 - Don: The modeling tool we will be using is well-developed to handle this sort of system. There are a lot of tools we can test in a robust way to see how the level of detail we include about these small complexities affects our model predictions and adapt accordingly.

- Ben: I have thought a lot about this question myself. For the bedrock, am I hearing that you will be assuming that each of our bedrock formations has a primary porosity, or will you try to incorporate the fracture network as you know it at local scales?
 - Don: If you have a mapped fracture zone, we can incorporate that into this model. These are regional models, but you can include data at the couple 100-meter scale.
 - Joe: Additionally, when you add those features, sometimes we see that they aren't that important at the regional scale. We can test those assumptions as we build this model.
- Andrew: I was curious if any of you have experience/would it be possible once the model is developed to incorporate other geospatial products where you could identify where we need to sample to learn more about groundwater dynamics like recharge areas?
 - Joe: This model could definitely inform sampling networks.
 - Kris: One thing that we'll be able to do is overlay contributing areas on the model. Results from this study could be used to direct sampling networks by overlaying the results from other studies.
- Matt: In thinking about bringing this proposal to the Steering Committee, it would be helpful to obtain a clear list of project outputs. We understand that this kind of project is a foundational step to get at some of these other questions that have been posed by TAC members and to look at management implications. It would be helpful to articulate what further steps would be needed after this modeling study to bridge those questions.
 - Joe: We are happy to provide that.
- Jamie: We are developing a complementary monitoring proposal for LCBP to consider to look at groundwater quality, using this model to identify hotspots for groundwater discharge.