

Lake Champlain Basin Program
Technical Advisory Committee meeting
Wednesday, September 6, 10 AM – 3 PM
Held In-person at LCBP office with remote sign-in option

Approved TAC meeting summary

TAC Members: Jennifer Callahan, Ryan Cunningham, Laura DiPietro, Bryan Dore, Laurie Earley, Michele Fafette, Curt Gervich, Peter Isles, Neil Kamman, Oliver Pierson, Andrew Schroth, Jamie Shanley, Daniel Tremblay

LCBP Staff: Mae Kate Campbell, Eric Howe, Meg Modley, Matthew Vaughan, Sarah Coleman, Sarita Croce, Erin Vennie-Vollrath, Theresa Vander Woode

Guests: Dave Braun, Clelia Marti, Ken Wagner, Jason Stockwell

1. Final report review: Evaluating Performance of Media Filters to Remove Phosphorus in Stormwater Pond Outflow (Dave Braun, Stone Environmental)

- Dave introduced the project and shared [a presentation](#). This is the third project in a series Stone has undertaken on phosphorus (P) filters; previous work focused on agriculture, and this project extended the technology to stormwater ponds. The objectives of this project were to design a cost-effective filter that can be used in retrofitting existing stormwater ponds to remove P from pond outflow and to compare four types of filter media relative to their cost and capacity to remove P from stormwater pond outflow. The work involved evaluation of 11 existing stormwater ponds in South Burlington, the design of filters with 4 different media, constructing the filters, installing monitoring systems, and monitoring outflow. Dorset Park stormwater pond was selected as the implementation and testing site. Filter construction occurred in December 2021, and weekly sampling took place between March - December 2022. All filter media depressed the pH of the outflow; the pH of filter A (activated alumina) was often unacceptably low relative to Vermont standards. Flow rates and cumulative volumes corresponded with the position of the filters. Filters C (drinking water treatment residuals) and D (iron) were the only filters with statistically significant reductions in total phosphorus (TP) and total dissolved phosphorus (TDP).
- Matt: Do we have pH data from the drainage tile filters?
 - Dave: No.
 - Matt: Seems like activated alumina is falling out of favor?
 - Dave: Correct. And it's more expensive.
- Matt: The individual paired events are aggregate samples between sampling periods?
 - Dave: Those are weekly grab samples. The method is described in the report. These are grab samples that we then averaged those concentrations. Between event 1 and 2, we averaged the samples and multiplied them by the intervening flow. These are not flow-paced like in the agricultural samples. We wanted to focus our resources on design and sampling.

- Matt: If you're using a constant concentration for a sample period and you're seeing a significant decrease in TP, but then you're not seeing a significant decrease in TP load, wouldn't the difference be solely due to flow? And since construction was not a good comparison?
 - Dave: Right, but for each filter it should be completely valid. It's hard to compare filters to each other.
 - Peter: I'd expect it's just flow introducing variance in the data.
- Matt: With this graph [46] you have autocorrelation here. Did you look at just reduction (values, difference, not %)?
 - Dave: I did not, but we could.
 - Matt: If absolute difference were constant, we'd see this decreasing. Absolute difference could be useful too.
- Sarita: Great presentation. After the filter media is used, how would you dispose of it? Would you leave it in place, or would we be transferring the problem to somewhere else?
 - Dave: My preferred solution would be to leave it in place and count on the P being irreversibly sorbed. Structurally, there won't be a problem with the bank. It will just work less well, but it makes a good pond bank.
- Sarita: As the material works less well, how do you expand it to add more?
 - Dave: If you wanted to replace it, I think we are talking a 10-year lifespan. You would have to dig it up and do it again. There are ways to use this in technology in stormwater pond construction that would be easier as new ponds are constructed rather than a retrofit. Circling the whole pond, we'd have higher removal rates.
- Matt: So to summarize, you should revise the final report to address the autocorrelation and consistency of filter naming to make it easier to interpret.
- Sarah: You mentioned engineering constraints as the reason for choosing Dorset Park. Were those constraints more related to the monitoring infrastructure or to installation for retrofits in general?
 - Dave: The latter. This was quite a construction job. It would have raised feathers at homeowner's associations and access would have been a concern.
 - Neil: Address that question in feedback.

Motion: to approve the final report

By: Laurie

Second: Jenn

Vote: All in favor.

2. Final report review: Evaluating Alternatives to Control Internal Phosphorus Loading in Missisquoi Bay Using a 3-Dimensional Coupled Hydrodynamic-Aquatic Ecosystem Model (Dave Braun, Stone Environmental; Andrew Schroth, University of Vermont; Clelia Marti, University of Western Australia; Ken Wagner, Water Resources Services)

- Dave introduced the project and shared [a presentation](#). This project was a collaboration between Stone Environmental, UVM, the University of Western Australia, and Water Resources Services. The project objectives were to:
 - Design and implement a robust sampling campaign to further spatially identify and map P distribution in Missisquoi Bay, with particular focus on hot spots of accumulation and release from the sediments.
 - Establish the physical and chemical drivers of P distribution.
 - Assess the capacity of different intervention strategies to control internal P loading and achieve bloom suppression goals.
 - Predict the efficacy and appropriate timing of potential interventions over multiple decades in the context of EPA-mandated watershed nutrient reductions.
- The team assessed internal P loading through a high-frequency monitoring platform, collection of over 100 sediment cores, and the collection of bottom water samples. Sample analysis showed high quantities of legacy P across the bay. The team then used a series of hydrodynamic models to forecast future P concentrations in Missisquoi Bay under different internal P loading scenarios:
 - Scenario 1: No in-lake management.
 - Scenario 2: Constant 90% internal load reduction in contributing area (ideal case).
 - Scenario 3A: 1 full rate treatment of area w/ most freq. low dissolved oxygen (DO) (~1,650 ha).
 - Scenario 3B: 1 full rate treatment of area w/ most/moderate freq. low DO (~3,800 ha).
 - Scenario 3C: 1 full rate treatment of all areas w/ freq. low DO (~5,580 ha).
 - Scenario 4: Annual low dose treatments by quadrant (1,395 ha/year, 3 rotations).
- Model results showed that 1%, 2%, 3%, and 4% annual external P load reductions provide cumulative reductions of 23%, 38%, 53%, and 68% by 2036 (only the 4% scenario meets the total maximum daily load (TMDL) target). The team evaluated actions for reducing internal P loading, including selective withdrawal, dredging, oxygenation, and P inactivation. They suggest that P inactivation would be the most practical solution for Missisquoi Bay. The team provided cost estimates and discussed permitting considerations associated with pursuing this management strategy.
- Peter: This is a fantastic study, and it is well received. In the model estimating internal loading there is no P mass balance going on in this model, correct? This could underestimate the impacts of external load reductions. I don't know how this will impact model results. It is an important consideration in section 4.2 in the report. To what extent does this underestimate watershed load reductions?
 - Clelia: The model does include resuspension of P that will impact mass balance. The suppression of flux coming up from sediment is the best guess that we can do with this model. This technique has been applied widely. David Covington developed the model.

- Peter: You could tweak down the load coefficient each year to approximate reductions in external loads.
- Neil: The model that is being presented is conservative. It is predicting the worst-case scenario. We can include that in the report, that there is a layer of conservatism. That is a good way to handle this in a cost/time efficient approach.
- Dave noted there will be a follow-up with VTDEC to discuss the permitting requirements and how to optimize investments.
- Sarah: Is there an ability to factor in extreme events?
 - Andrew: There is also climate change to consider. Big storms will blow out any investments that we make in the watershed.

Motion: to approve the final report

By: Jenn

Second: Laurie

Discussion: Daniel noted that this will be a big deal for Québec eventually

Vote: All in favor

Abstentions: Andrew

3. Brief workplan presentation: Zooplankton Response to Environmental Change Within Lake Champlain and Across a Global Context (Dr. Jason Stockwell, UVM Rubenstein Ecosystem Science Lab)

- Jason introduced the project and shared [a presentation](#). This project will complete processing of archived zooplankton samples from the Lake Champlain Long-Term Monitoring Program (LTMP) that were collected between 1995-1999, and then use these data to better understand systems change in Lake Champlain over time. The study aims to answer questions including:
 - How has the zooplankton community responded to changing conditions (e.g., nutrients, eutrophication, water temperature)?
 - Community response to invasions (alewife, predatory cladocerans)?
 - Are relationships related to gradient in environmental conditions?
- The 2nd goal of the project is to place Lake Champlain in a global context of climate change impacts on zooplankton dynamics and biodiversity.
- Peter: The general project outline from the workplan looks good. I would be happy to provide input on methods once those details are developed.
- Neil: I remember that taxonomic harmonization can be a bear with different parties working on it. Have you thought about that in terms of how this work will integrate with the ZINC project?
 - Jason: I have a lot of experience with this in phytoplankton in a past synthesis group. We will be going through all the names of the taxa and checking them against standardized databases through the harmonization effort. We will update old naming conventions as needed.

- Sarah: If the idea is to do an analysis over time compared to trends in Lake Champlain and to divide up the data by subbasins, I am thinking about how some of the trends might be more pronounced in some basins than others.
 - Jason: I think we can expect different responses of zooplankton to aquatic invasive species invasions depending on the subbasin.

4. Updates, announcements, public comments

- Laurie: US Fish and Wildlife (USFWS) lamprey treatments will be starting in NY at the end of this month and will include Putnam and Poultney Creeks. Treatments will then transition to 2 VT rivers in the fall. Our focus this year is on the southern end of the lake.
- Sarah: The Vermont Department of Environmental Conservation (VTDEC) Clean Water Initiative program has developed and released a flood response verification tool. DEC is asking partners who have visited DEC-funded Clean Water projects to share information on the status and condition of the project in a standard format.
- Oliver: in Vermont, the flood has been the big issue we've been focusing on. In addition, we are getting ready to submit the wakeboat regulation recommendation to Sec. Moore. We held 2 public meetings and a written comment period, and received 750 comments (I believe that is a record for DEC). We will make recommendations to change the draft rule based on input received. We are working on summarizing comments and then we will report to the legislature. The Lakes and Ponds Division is recruiting for several positions (Lake Wise, AIS, and LCBP-funded AIS specialist). LCBP was key in this strengthening, as well as Friends of VT Lakes.
- Matt: We have a few staff transitions and milestones to highlight. Meg just celebrated her 20-year anniversary with LCBP! Lauren Townley has accepted a new role within the New York State Department of Environmental Conservation (NYSDEC) so will be transitioning out of her role on TAC.
 - Neil: We wish her well.
- Matt: Oliver is transitioning to Director of Forests for the Department of Forests, Parks, and Recreation. The Lake Champlain Steering Committee meeting will be held in Québec on 9/2, and we will present TAC's recommendations on research priorities. I will be presenting on my preliminary analyses from July flooding in coordination with Peter Isles. We are working on *State of the Lake 2024*. TAC will revisit SOL in January. In response to the July flooding, LCBP released a flood relief grant opportunity for grants up to \$7,500 to support organizations affected by flooding. The Clean Water and Healthy Ecosystems Planning and Implementation request for proposals opened 8/18.
- Meg: The boat launch steward field season is winding down. Labor Day was very busy on the lake, and a boat launch steward intercepted hydrilla! Partners are in response mode to round goby. We are working on relationship building with Parks Canada to start discussions on inter-basin transfer between the Chambly Canal and Lake Champlain. Reports and sampling show round goby remain south of lock C1 in Champlain Canal and by the St. Ours dam in Québec. Québec officials discovered two grass carp during their investigations and launched a 5-day intensive response. They did not identify

additional specimens. We are working with USFWS to extend their eDNA sampling campaign to assess for grass carp.

- Curt: I am getting lots of emails from McGill about a partnership they are working on to reimagine the Champlain Canal... has anyone else gone to these meetings?
 - Eric: Katie Darr did attend a meeting they held in August in Montreal. They worked on networking and brainstorming related to submitting a proposal to a Canadian grant opportunity. We partnered with them on their last grant through the same opportunity.
- Jamie: The US Geological Survey (USGS) has a Lake Champlain working group which has submitted a proposal to include temperature and conductivity at some gauges around basin. EPA has submitted a proposal on our behalf to improve the P model that informs TMDL modeling. On flooding, the water level in our office was 4 feet up on the 1st floor. We've been informed it may be 2 years until we can re-occupy the building. We are using Dewey as temporary lab space. At our research watershed in the Northeast Kingdom we had 4 out of 5 highest peak flows over 30-year period (not in basin).
 - Neil: Do you think this is the highest base flow we've seen in years?
 - Jamie: I believe so, but I will be doing that analysis.
- Matt: Thanks to the USGS survey team, I've been in touch with gauging folks and working to verify gauge data based on fieldwork conducted during flood.
- Andrew: Was that just the Winooski gauge that went out?
 - Matt: I don't know. All the data are provisional currently. The gauge at Otter Creek cut out, the Lamoille was continuous, and I haven't heard about corrections there. I was looking at the Winooski data and realized it had been reduced based on measurements. As far as I know, Winooski is the only major revision expected. Data will be finalized in the spring.

TAC season overview, fall workplan review scheduling

- Matt reviewed the TAC scheduling doc.

Review and approve summary of previous TAC meeting

Motion: to approve the June 2023 TAC meeting summary

By: Jenn

Second: Laurie

Vote: All in favor

5. Discussion: FY24 Clean Water and Healthy Ecosystems research priorities

- Matt reviewed the changes that were made this year to the research RFP and to the process of developing the priorities for the RFP. TAC then reviewed the suggestion research priorities that were submitted, categorized and summarized below. Priorities highlighted in green were recommended to the Steering Committee for inclusion in the FY24 research requests for pre-proposals.

Native Species and Aquatic Invasive Species

- Examining the efficacy of aquatic invasive species control/eradication and opportunities to expand such programs.
 - General Eurasian watermilfoil recurrence rates following hand/suction harvesting efforts under different conditions (substrates, density of surrounding plant communities, harvest techniques, etc)?
 - What is the long-term effectiveness of AIS management efforts using different control techniques?
- eDNA work on microbes, viruses, and invertebrates, particularly insects, to see changes due to climate change.
 - Difficult to see changes due to climate on short timescale. Relevance to management seem limited. **Could consider eDNA into LTMP. Develop a framework to incorporate into LTMP?**
- Implications of the spongy moth infestation on water quality, runoff, sedimentation, tree health, effects on the forest floor biotic community to inform if/where management actions should be taken.
 - Spongy moth is off cycle. Other pests to consider. Effects on water quality are expected, though are secondary and may be difficult to measure. Consider in 8 years?
- Aquatic Invasive Species with focus on impact and effectiveness of management techniques. Specific questions in this category:
 - What are the long-term impacts to lake ecology from the use of aquatic herbicides in a given body of water?
 - Requires long-term study. Heavily studied by EPA, etc. Wouldn't be a good fit for LCBP
 - What parameters indicate AIS management efforts are at the rate of diminishing return?
 - Covered well by permitting process
 - Research on Atlantic salmon stream habitat and effectiveness of restoration by various techniques (culvert removal culvert removal to tree planting type of things to improve streams for spawning and juvenile fish) in the Boquet and Saranac Rivers.
 - Focus of USFWS. Trying to conduct this research to the best of their ability, limited resources. USFWS would benefit from more personnel resources.

Phosphorus

- Calculate nutrient loads from direct drainages to Northeast Arm, possibly other direct drainages.
 - Current unknown, popular idea
- How much phosphorus is attenuated in wetlands located outside of the floodplain? How can we calculate an estimate by wetland?
 - Current unknown, popular idea
- Assessment of how buffers in Vermont are doing, are they saturated and acting as sinks (if so are there conditions that seem to be consistent where this occurs), or are they full of capacity to keep retaining nutrients? Check forest and grassed buffers and document adjacent land uses.
 - VT-LCBP TMDL project looking at this, USFW habitat team looked at this, perhaps not to nutrient retention level. What size buffer is the minimum that contributes to conservation?

- Quantifying streambank phosphorus contributions to the basin from the various subwatersheds (particularly actual sampling, not just models)
 - FFI, Sediment phosphorus project w Stone. Could be a science blog opportunity for improved communication. Specific study on this 10 years ago, Andrew Simon. Covered by Kristen Underwood and Scott Hamshaw PhD work. We rely on models because it's difficult and expensive to sample on an event-scale basis.

Monitoring + Emerging Contaminants

- Addition of specific conductance and temperature sensors at 9 USGS gauges to provide year-round high-frequency data; analysis of chloride fluxes, loads, and aquatic life impacts after 5 years of data collection
 - Chloride, temperature would be really valuable. Turbidity would also be very useful. Have made investments in chloride projects. Can ground-truth with high quality data. Depends on cost of installation and maintenance.
- A guide to PFAS and the multitude of chemicals that exist and what their parent compounds and likely sources are.
 - Outreach opportunity. EPA and states engaged in FPAS. How to look at data, how to analyze, etc. How breakdowns occur, what triggers breakdowns, etc.
- Finding a set method for microplastic assessment in non-aqueous materials such as food wastes, soils, and manures.
 - Important and beneficial but might not be a fit for LCBP / water related research.
- Expanded tributary monitoring, with particular interest in temperature, bacteria, metals and other water quality trends in the face of climate change, expanded upstream monitoring. Monitoring to inform areas that may require water quality interventions or to identify areas where monitoring should be increased to support public use and economic development.
 - Contaminant study is just getting underway. Multiple monitoring partners are actively monitoring. States conduct targeted monitoring, Lake Champlain Sea grant, NY lakes assessment project, etc. We have monitoring and tools to target interventions from existing program. Not enough specific info to act on here.
- A continued focus on emerging contaminants, including chloride.
 - Covered with ongoing work
- Do PFAS concentrations in fish warrant waterbody-specific or statewide safe eating guidelines?
 - Other work in the region will likely cover this in the next few years.

Conservation, Developed Lands, Public Access

- Identification of areas to expand public access to the lake, tributaries, and outdoor recreation opportunities.
 - Popular idea. Malletts Bay a good example of where this could be useful.
- Research to inform where priority conservation and development areas should be located, particularly in the face of climate change/climate migration.
 - Ongoing conservation study in NY, TNC has done this in Boquet. Relevant in 30x30 initiative. A lot of investment happening. Could make more specific (e.g., maintain aquatic biodiversity, flood resilience).
- Improved data on the number of properties with septic systems. Development of a database for VT similar to the existing one in NY, with a focus on lakeshore properties.
 - States have an onsite residential program ongoing. Knows when systems need to be inspected. Compliance issues. VT database is currently internal to DEC.

Cyanobacteria

- **Developing protocols for monitoring benthic species, determining the risk of cyanotoxins from benthic blooms.**
 - Might not get enough benthic blooms to study. When they do come up, would be good to quantify. Benthic blooms may be increasing.
- Increased research on cyanobacteria, including:
 - **Using temperature profiles to identify patterns associated with blooms, particularly in areas with frequent blooms.**
 - Focus of ongoing work at UVM.
 - **Examining changes in cyanobacteria species present.**
 - Mindy has done good work on this in Carmi, associated with aeration.
 - **Using available water quality data, can we predict blooms in the Main Lake, Missisquoi Bay, and St. Albans Bay, and if so, with what degree of confidence?**
 - Covered by ongoing work at UVM. Ciroh grant, Asim Zia is lead.

Clean Water Project Design / Maintenance

- **What are recommended design standards for clean water projects to be resilient to flood impacts? What are the flood resilience co-benefits of Clean Water Project and how do they vary by type?**
 - Evaluation of Project performance --> design standards
 - What are "resilient" CW projects, what are design vulnerabilities?
 - Where should they be targeted to have the biggest impact?
- **What is the relationship between O&M and design life for different clean water projects?**
 - What O&M is critical to extend effective life.
 - Which projects improve over time, degrade over time.
 - Difficult to quantify. Expectation that these are maintained over time. Set up process to get data collection started?
- **Are the strategies currently being used to address stormwater impairments sufficient?**
 - Jenn likes it and thinks it's important, but thinks it is not appropriate for LCBP. Most are flow TMDLs. What's the best indicator to address stormwater impairment?
- **Identifying impacts from / resilience to extreme events**
 - Need more specifics to use. A lot of this work will / is happening at the state level.

Agriculture

- **Optimizing species mix of grassed waterways and filter strips for nutrient uptake, climate and soil resiliency. Basically, review the various options of seed mixes and provide guidance to the various entities that implement these kinds of programs (VAAF, NRCS, districts, UVM, etc.) to provide the best information available for Vermont.**
 - Previous work with grassed waterways faced difficulties. Would be another edge of field study, confounding results.
- **What is the right cutting height for hay to get the most out of water quality and nutrition for Vermont dairies?**
 - Whole-farm nutrient study did a good job at answering some of this question. Made recommendations on height, timing, storage, etc.