



2020 Summer Lake & Tributary Monitoring Data – Preliminary Results

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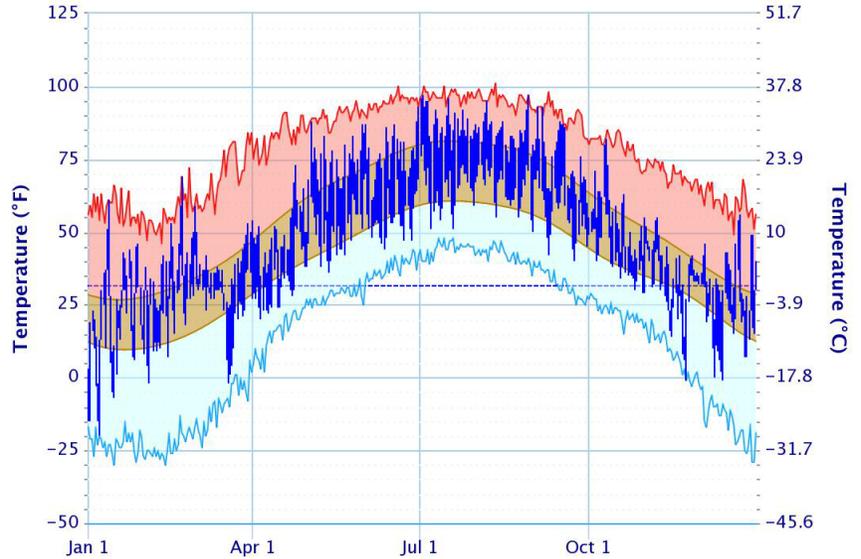
February 24, 2021

Air Temperature (2018, 2019, 2020)

2018

Daily Temperature Data – Burlington Area, VT (ThreadEx)

Period of Record – Max temperature: 1883-12-01 to 2021-01-13; Min temperature: 1884-01-01 to 2021-01-13. Normals period: 1981-2010. Click and drag to zoom chart.



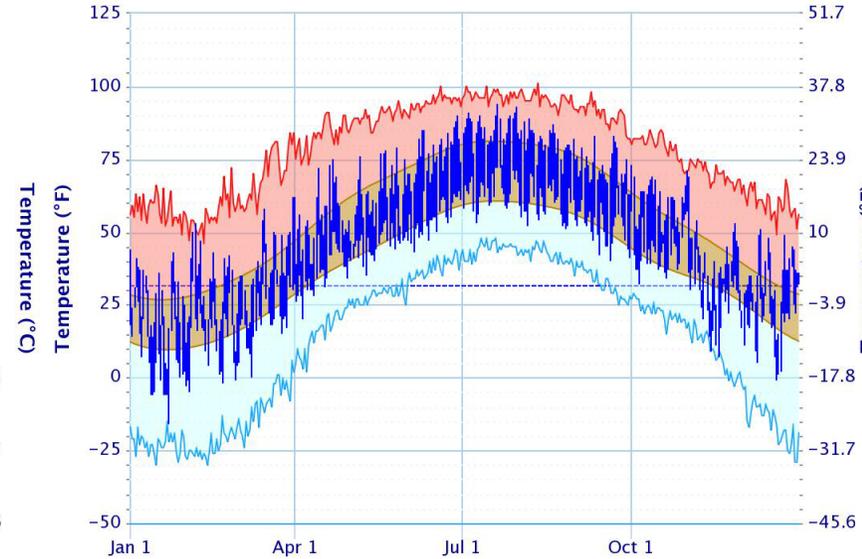
● Observed temperature range (2018) ● Normal temperature range — Record Max — Record Min

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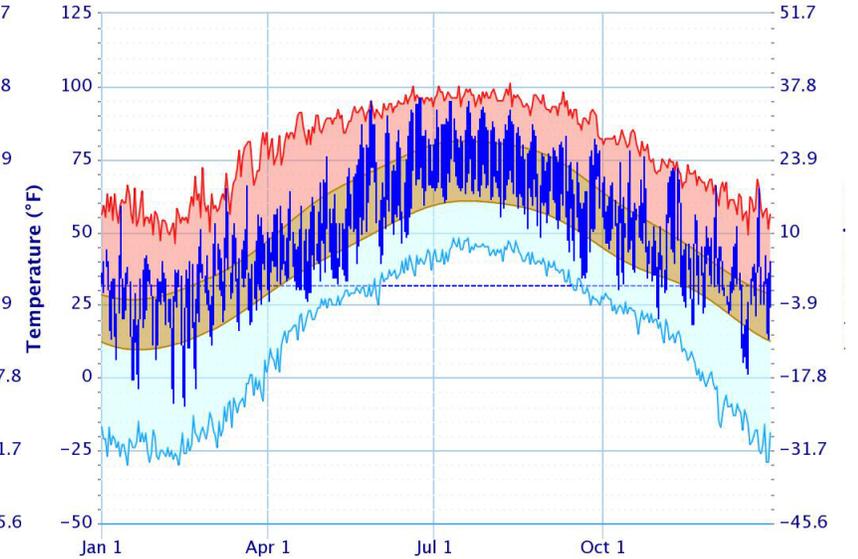
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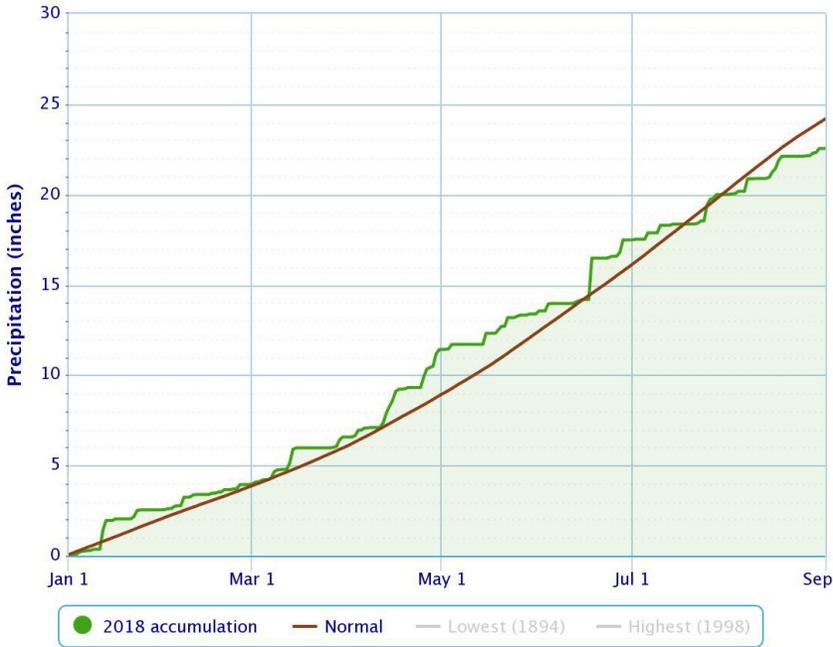
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Precipitation (BTV)

2018

Accumulated Precipitation – Burlington Area, VT (ThreadEx)

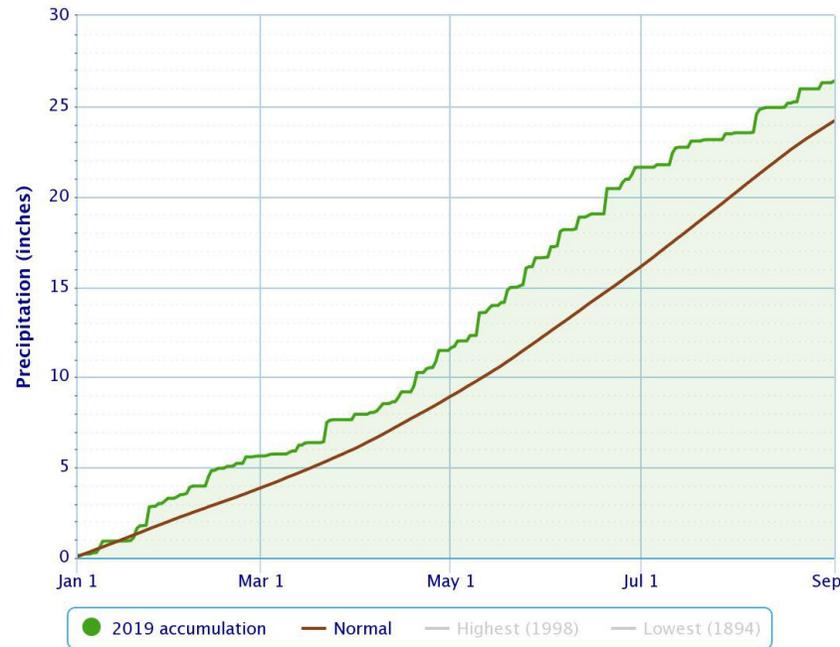
Click and drag to zoom to a shorter time interval; green/black diamonds represent subsequent/missing values



2019

Accumulated Precipitation – Burlington Area, VT (ThreadEx)

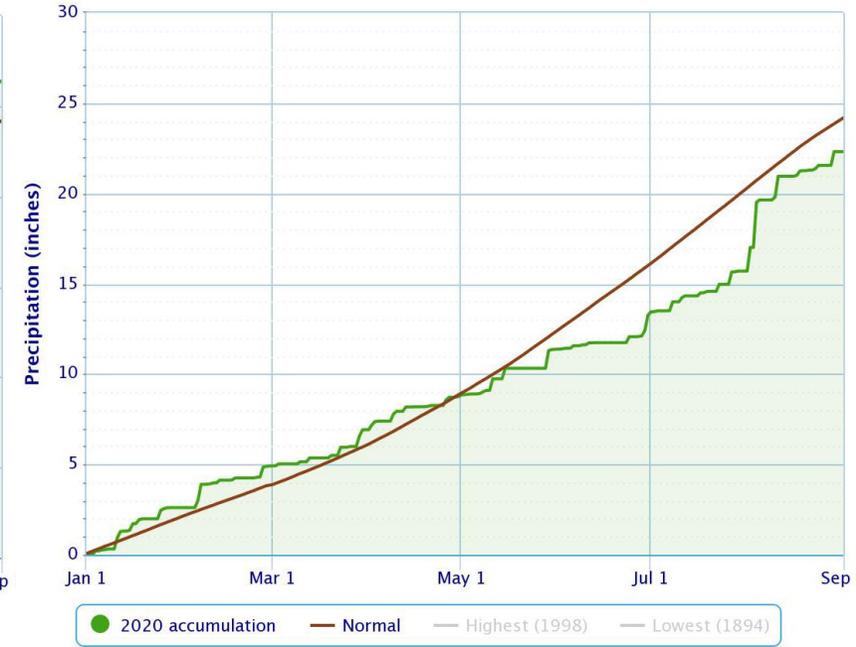
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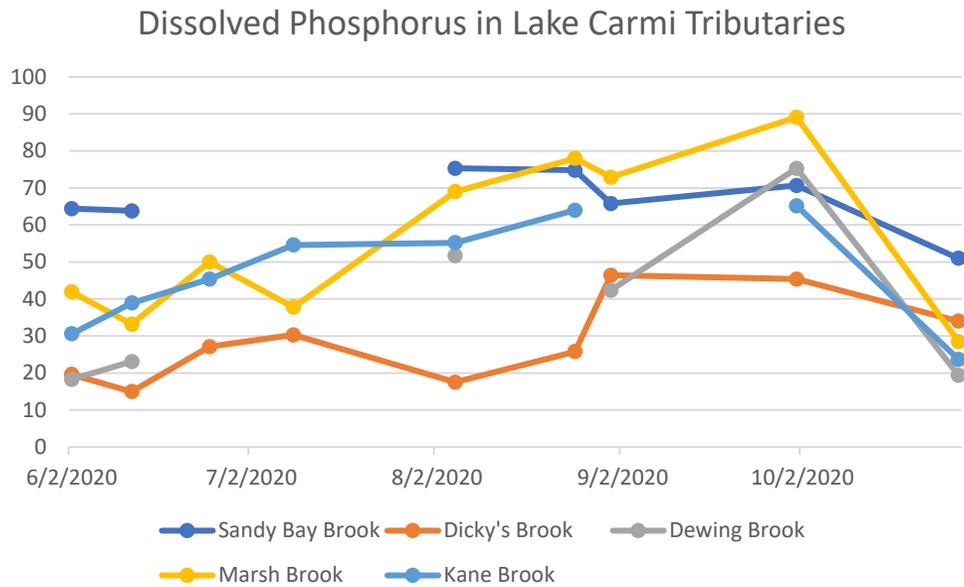
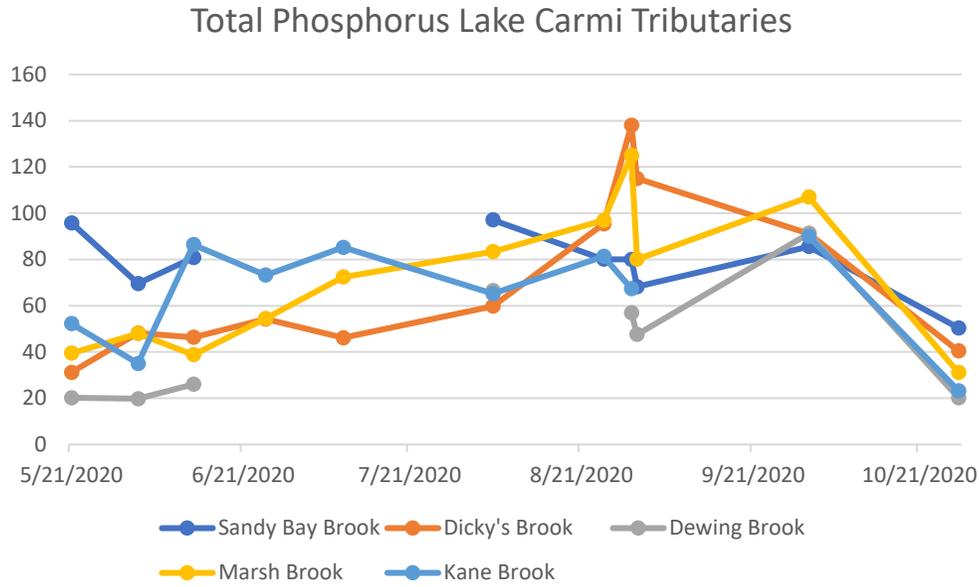
2020

Accumulated Precipitation – Burlington Area, VT (ThreadEx)

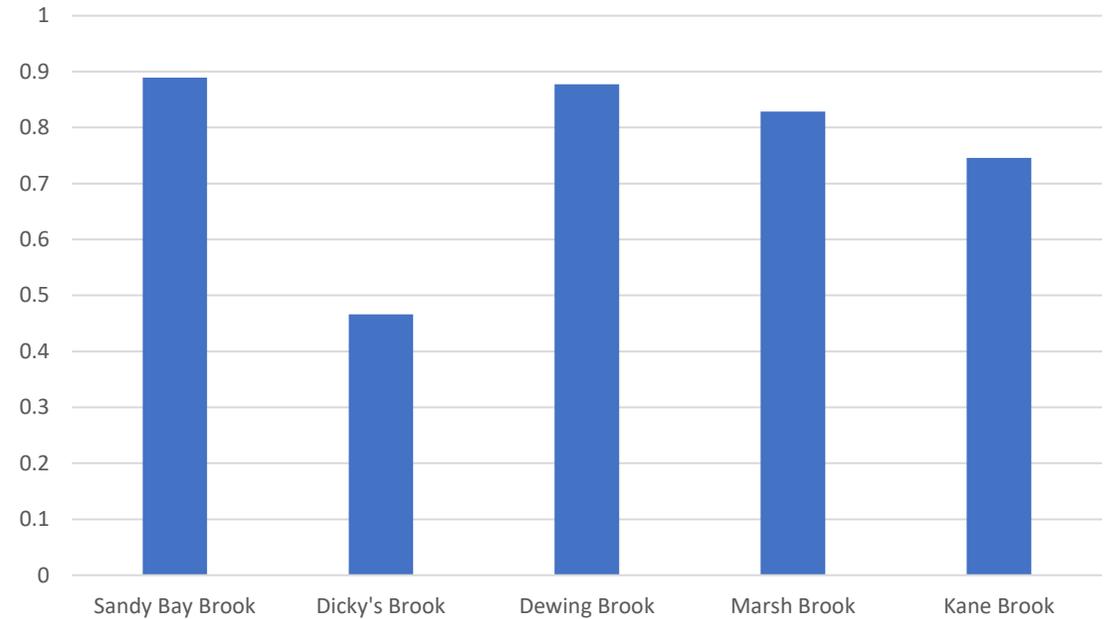
Click and drag to zoom to a shorter time interval; green/black diamonds represent subsequent/missing values



Lake Carmi 2020 Tributary Total Phosphorus Data



TP to DP Ratio

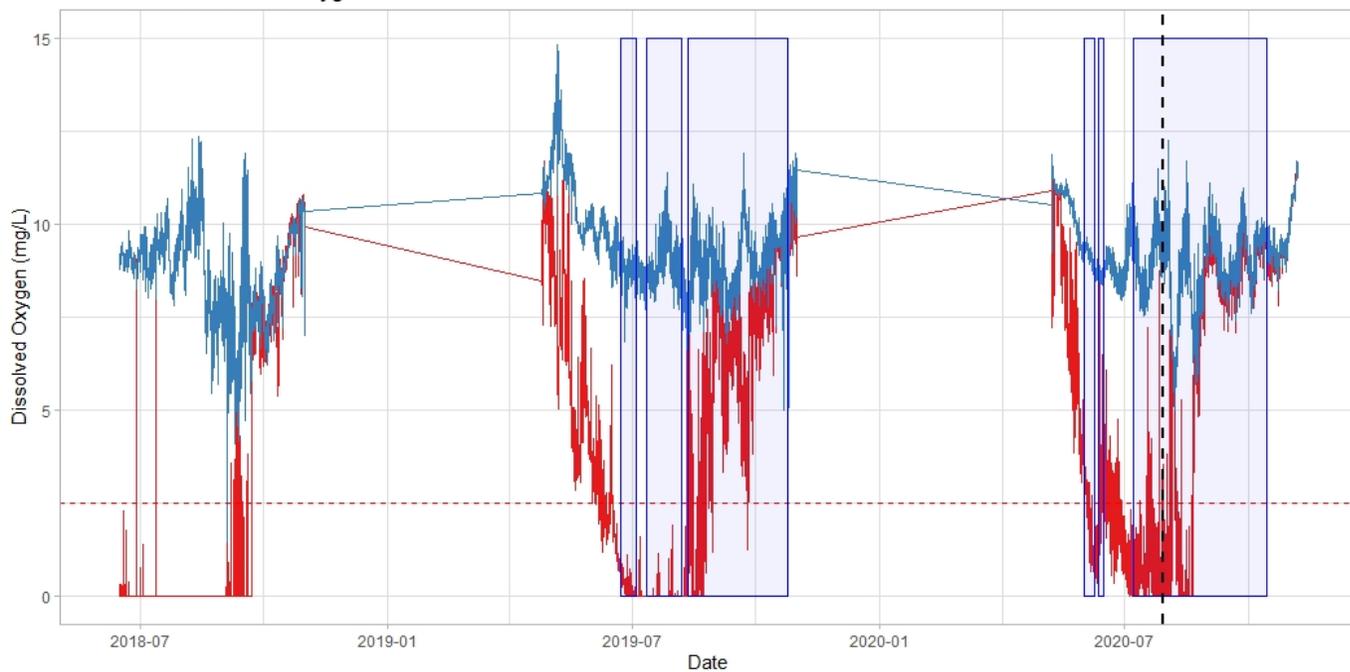


Lake Carmi Water Temperature



Depth
 — Bottom
 — Surface

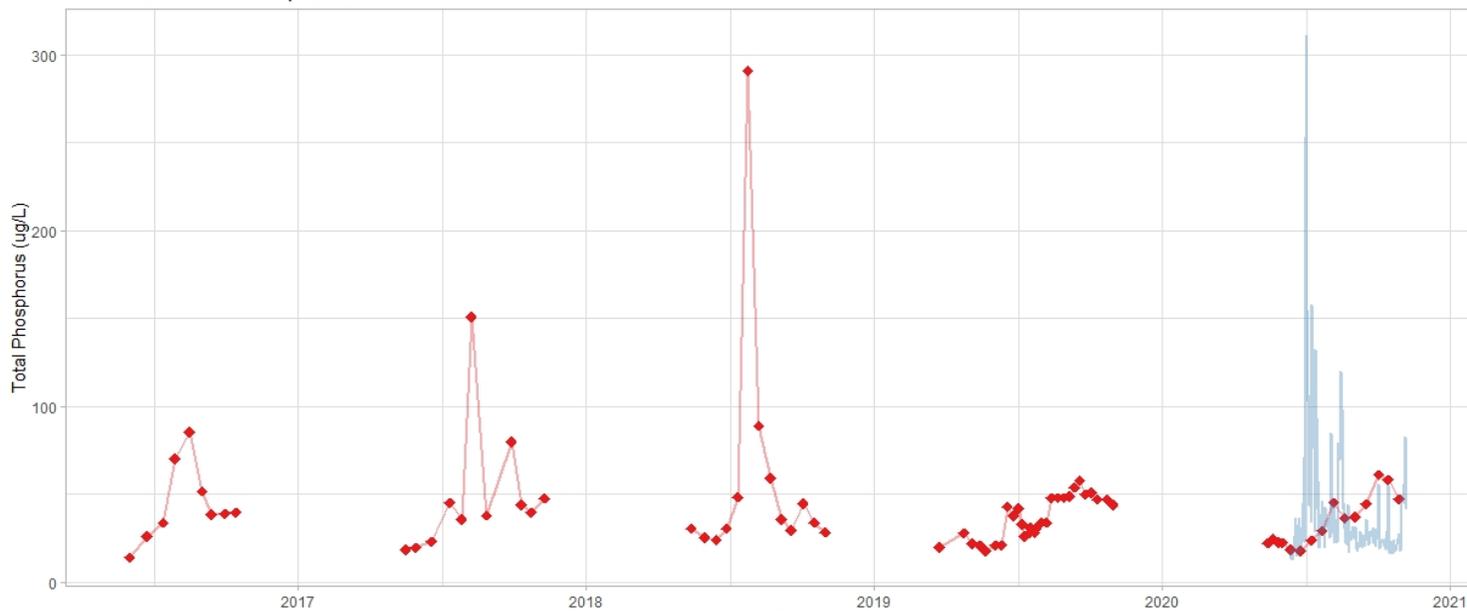
Lake Carmi Dissolved Oxygen



Depth
 — Bottom
 — Surface

- Blue shade is when aerator is functioning
- 2018 sustained stratification and anoxia until fall turnover (natural system)
- 2019 DO readings near zero when aeration was initiated, DO stratification was hard to break down.
- 2020 sustained zero DO was never attained. System mixed rapidly (with assist from wind event) in June, but then system failed and stratification and low DO set-up for early summer. As surface water temps warm and then provide warm water to bottom with aeration, low bottom water DO is resilient.
- Take home points: starting earlier in 2020 was the right move, ideally would have done this 1-2 weeks earlier with less thermal stratification.
- Lag between temperature and DO stratification is pronounced when stratification is established in summer when the mixing of warm surface water likely enhances sediment oxygen demand.

Lake Carmi Total Phosphorus



Reading

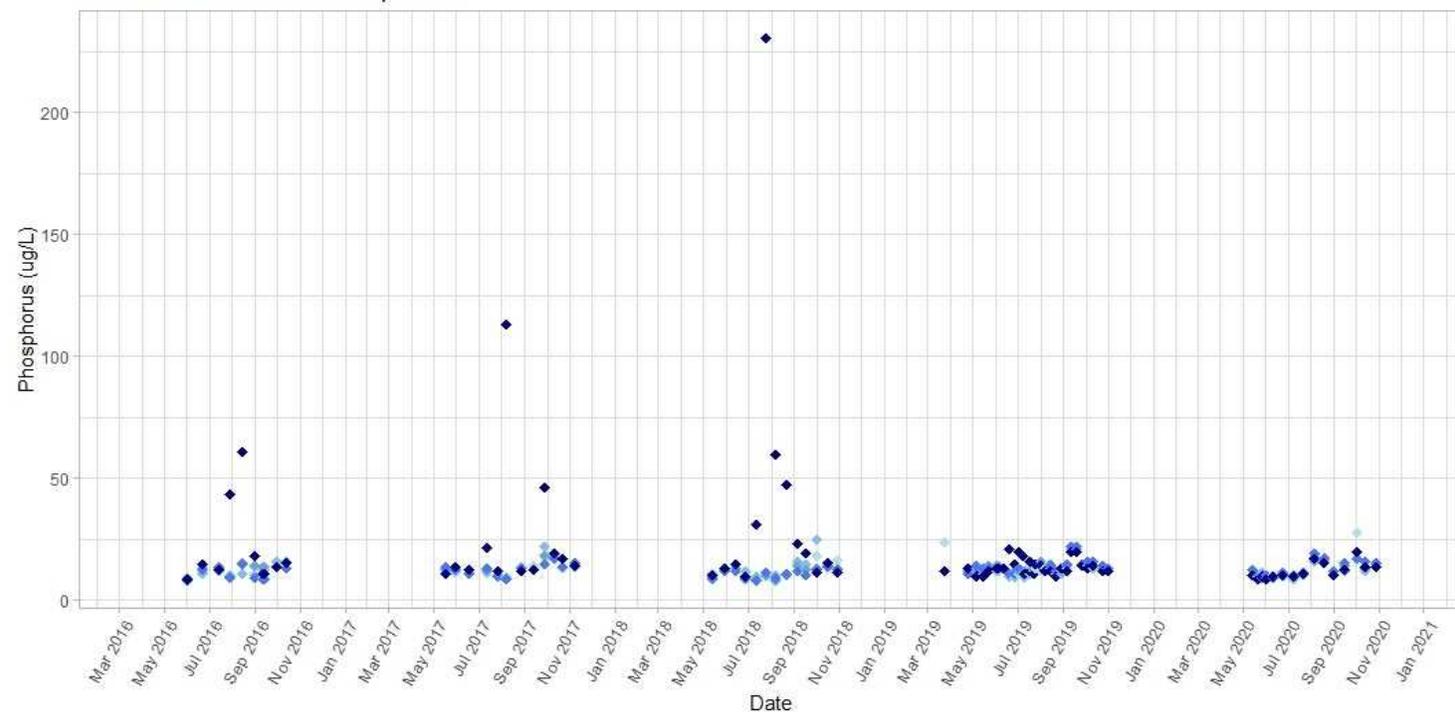
- DEC
- UVM

Dissolved P plots nicely illustrate how internal loading was suppressed by the system (high summer loading through 2018, minimal DP stratification in 2019, 2020).

2019 and 2020 TP concentrations at 8 meters (red) were very similar in range and timing.

Clearly there was internal loading in 2020 near the sediment when the aeration system failed (UVM 2020 time series), but DEC bottom sample does not show this because it is at 8m

Lake Carmi Dissolved Phosphorus



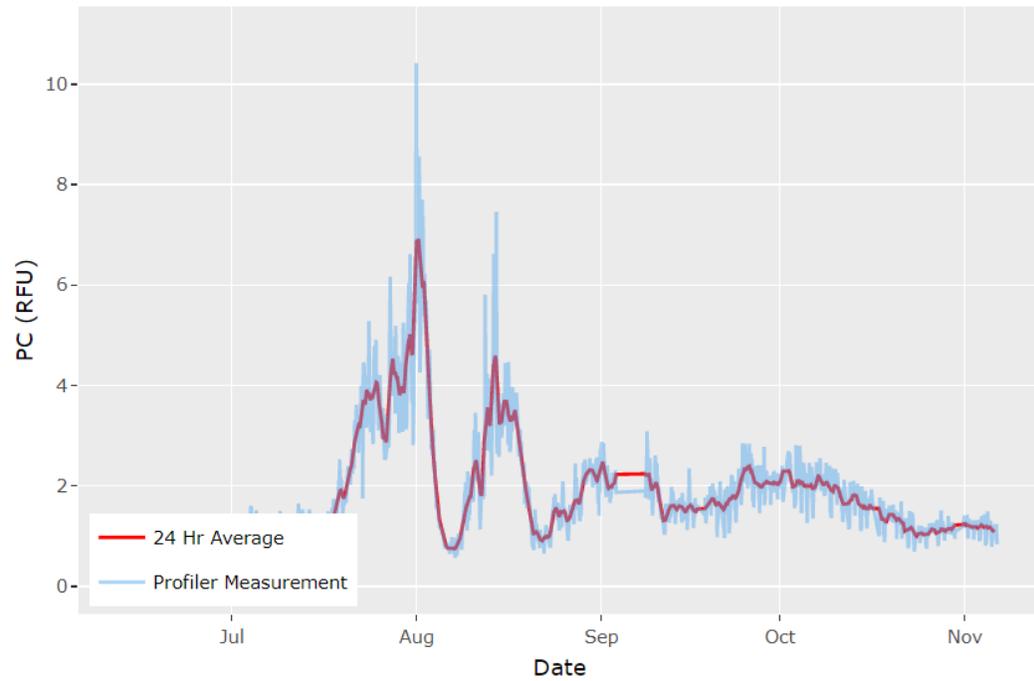
Depth

- 0.2
- 2
- 4
- 6
- 8

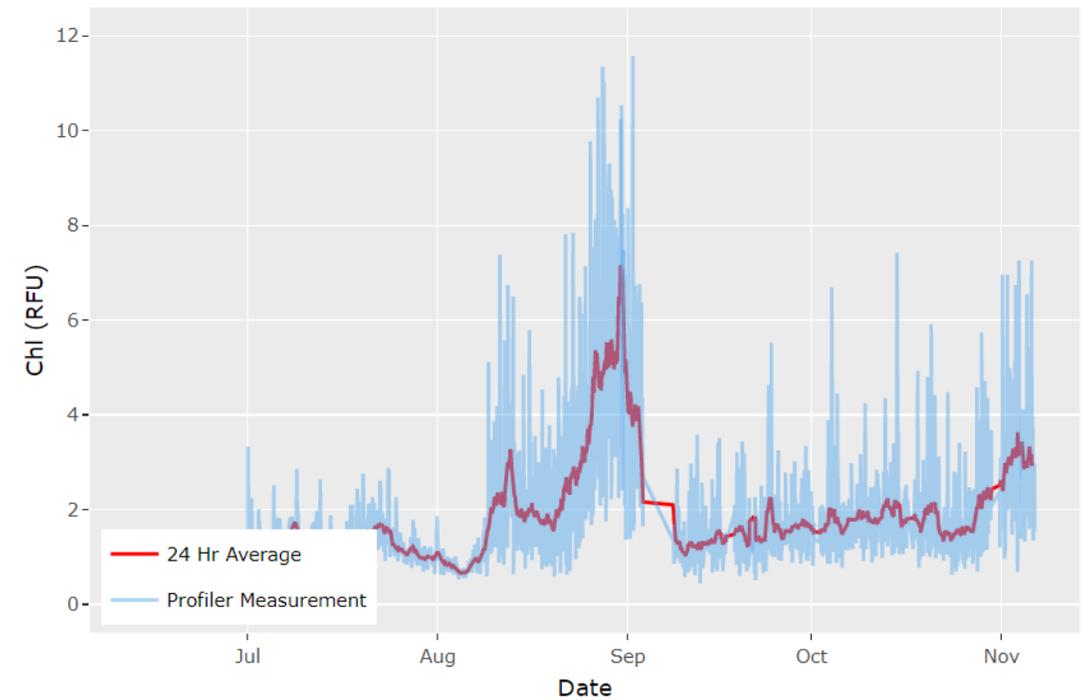
Internal loading driven nutrient enrichment is evident in DEC time series for 2019 and 2020 once mixing occurs (bump up in dissolved and total P that is not associated w/ watershed load)

Question: if the system is turned on in late May when bottom water concentrations are ~25 ppb total P, can the water column avoid the bounce up to ~50 ppb/20 ppb dissolved that we have seen in both summers? (and if that happens, can we for the most part avoid prolonged bloom?)

Lake Carmi Blue Green Algae Phycocyanin (~0.5 meters)



Lake Carmi Chlorophyll (~0.5 meters)



Lake Carmi Chlorophyll (~0.5 meters)

- Big initial peak (triggered by system being down for a while and then a mixing event), another storm/mixing event shuts the bloom down, but then stratification re-established with the aeration system on and a relatively warm nutrient rich water column-bloom persists through mid August with more cyanos.
- Shut down by another event that fully mixes the water column and systems maintains full mixing/oxygenation afterwards. This could be considered low level bloom condition under full aeration (after a failure enriches the water column in nutrients), but it is important to note that even though our sensor suggested low bloom activity, there were many reports from camp owners suggesting pronounced shore-specific concentration of the bloom-likely driven by water/wind movement concentrating cells on particular shoreline regions of the lake.

Thanks for your attention!
Questions?

