

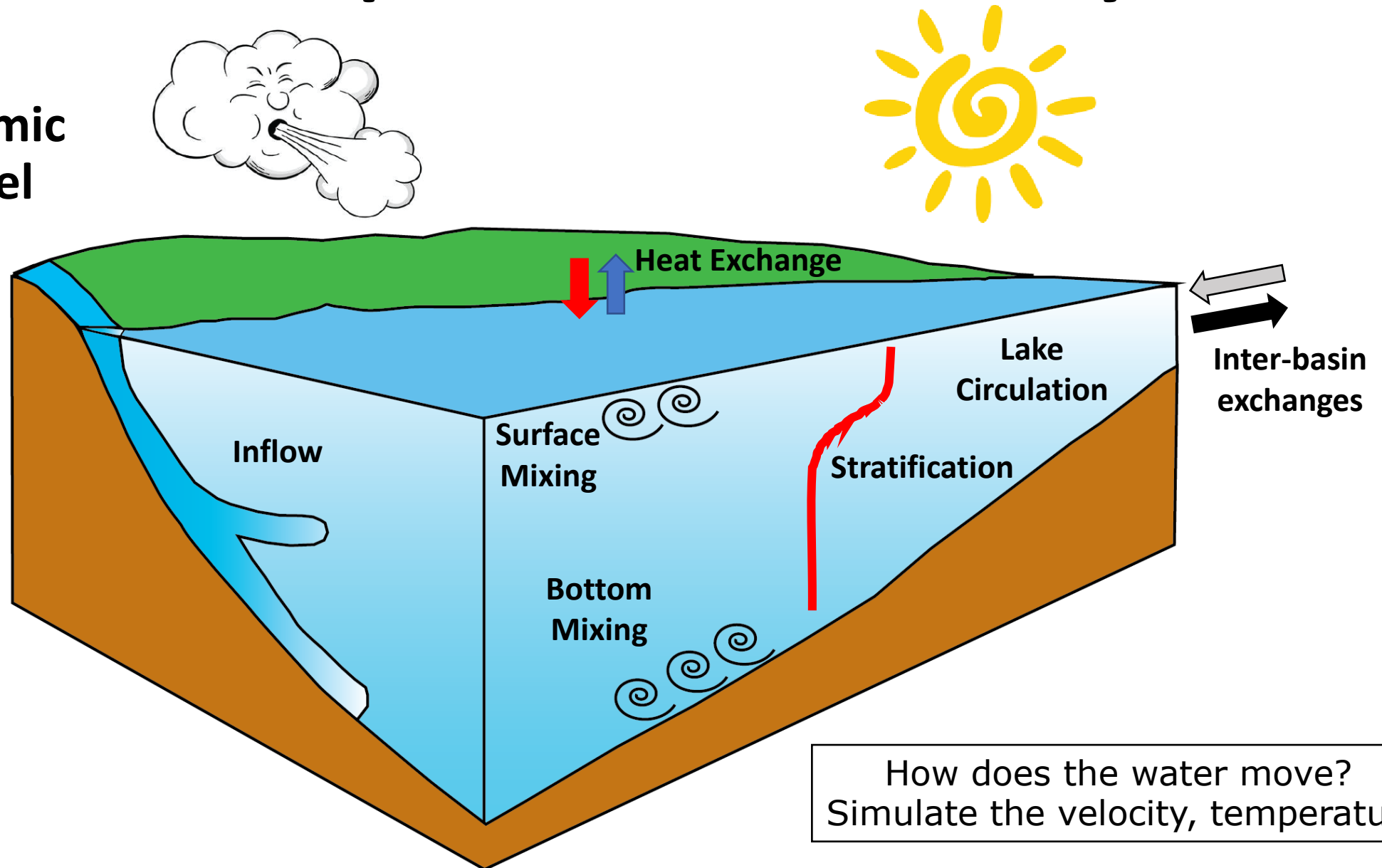
Clear Lake: Creating Predictive Tools to Evaluate Future Options

Blue Ribbon Committee Meeting #15

June 23rd, 2021

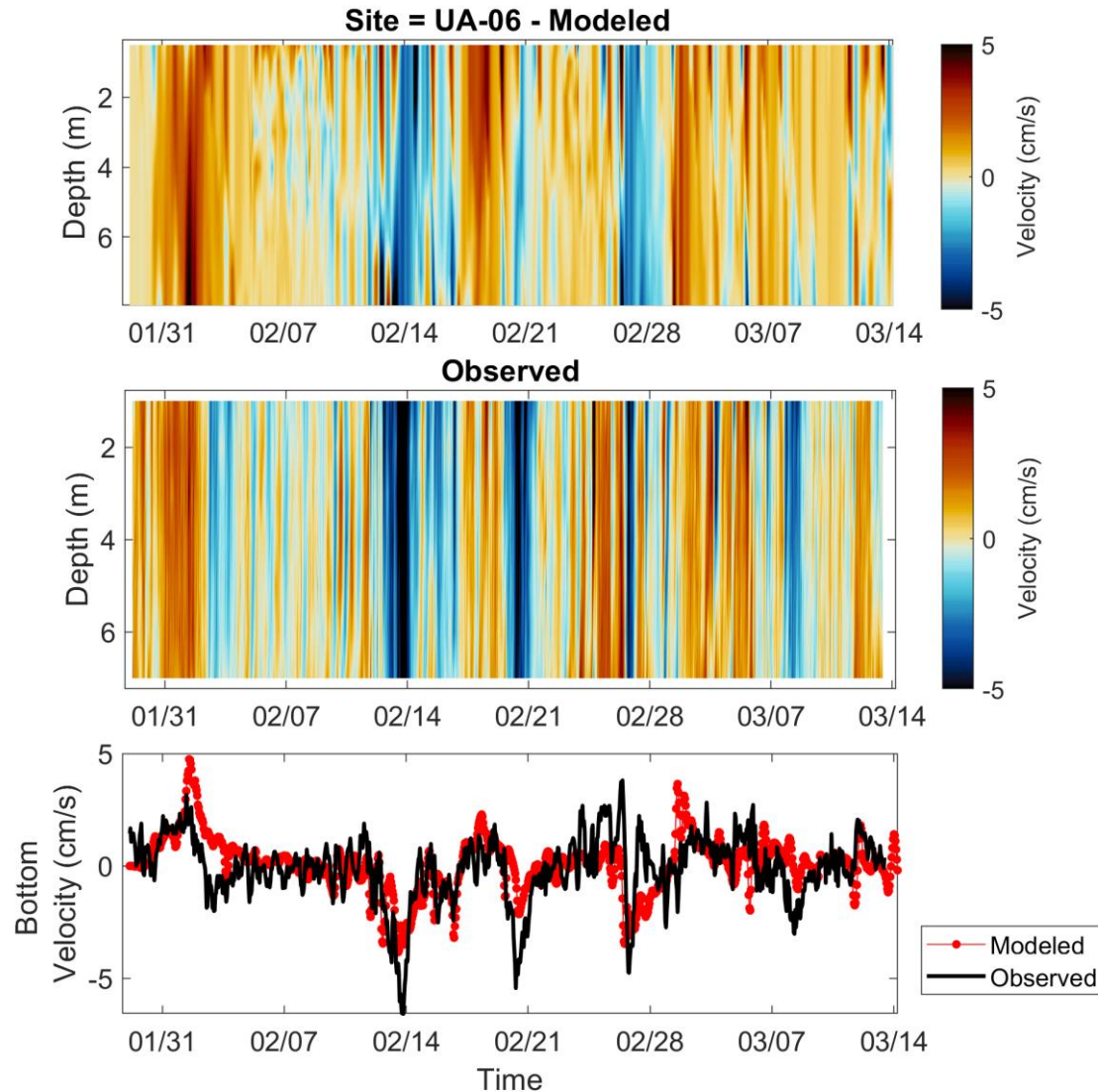
Models are simplifications of real systems

Hydrodynamic Lake Model





Milestone: Hydrodynamic Lake Model Calibration

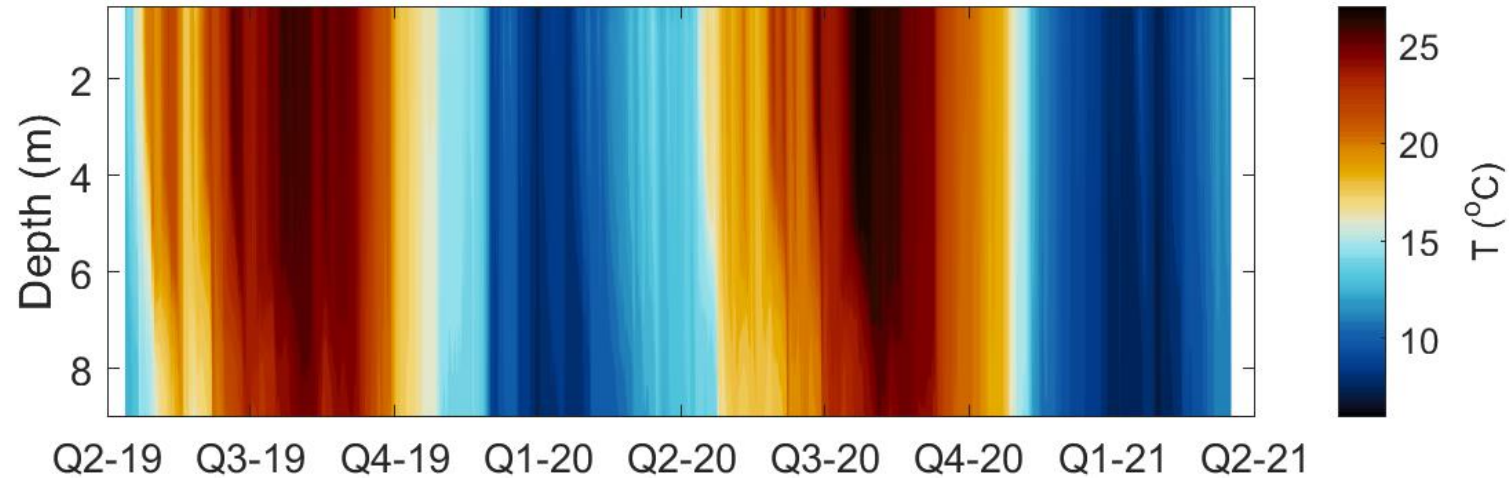


Foundation upon which
the rest of the lake
modeling will be built

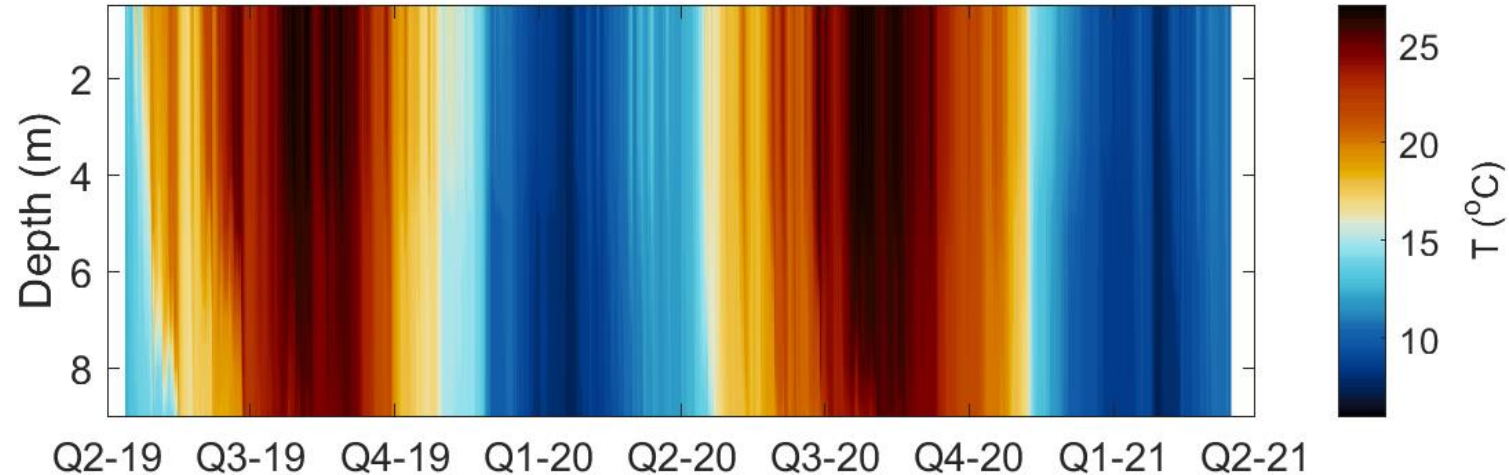
*Comparison of Modeled and Observed Lake
Water Velocities during Winter 2021*

Hydrodynamic Lake Model Validation

Site = UA-06 - Modeled



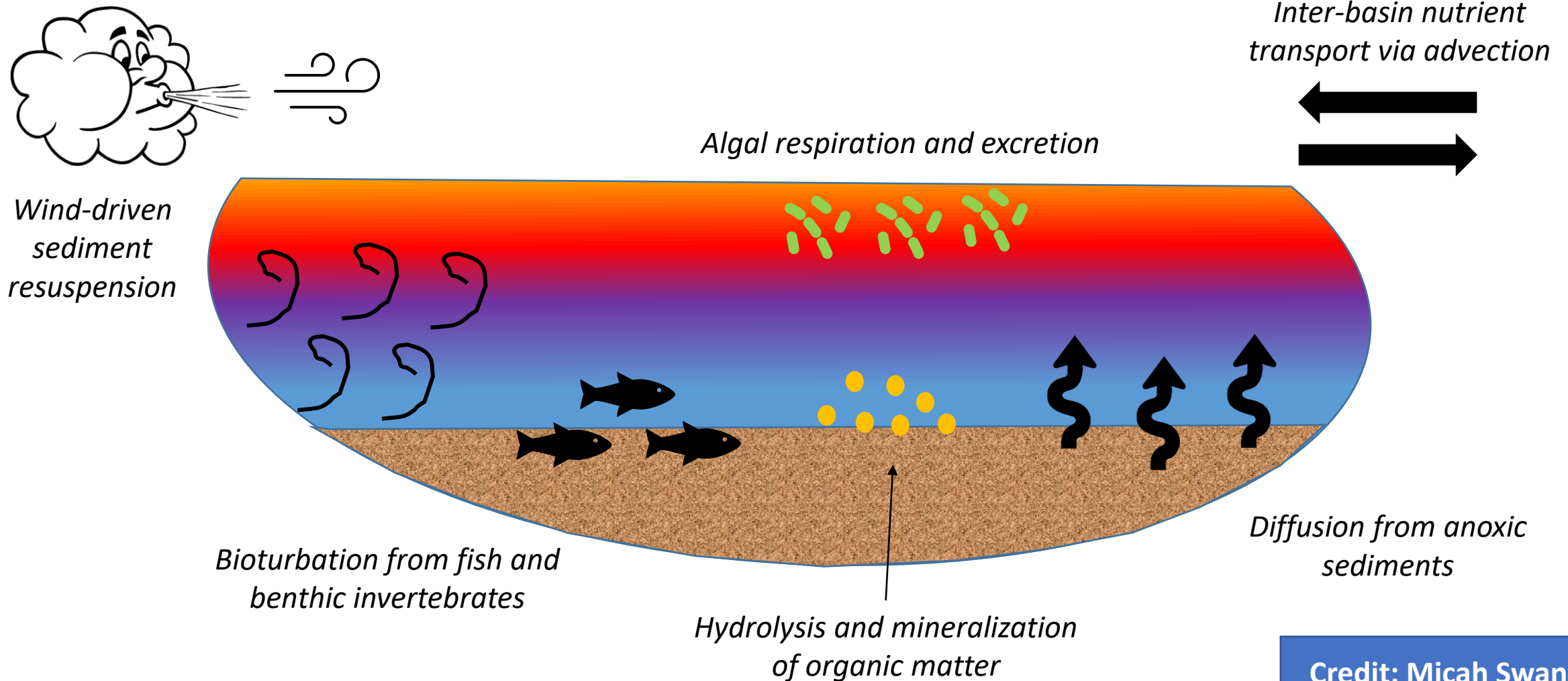
Observed



Model Performance Metrics show that our Hydrodynamic Model has an “Excellent” Performance

Comparison of Modeled and Observed Lake Water Temperatures for Two Years

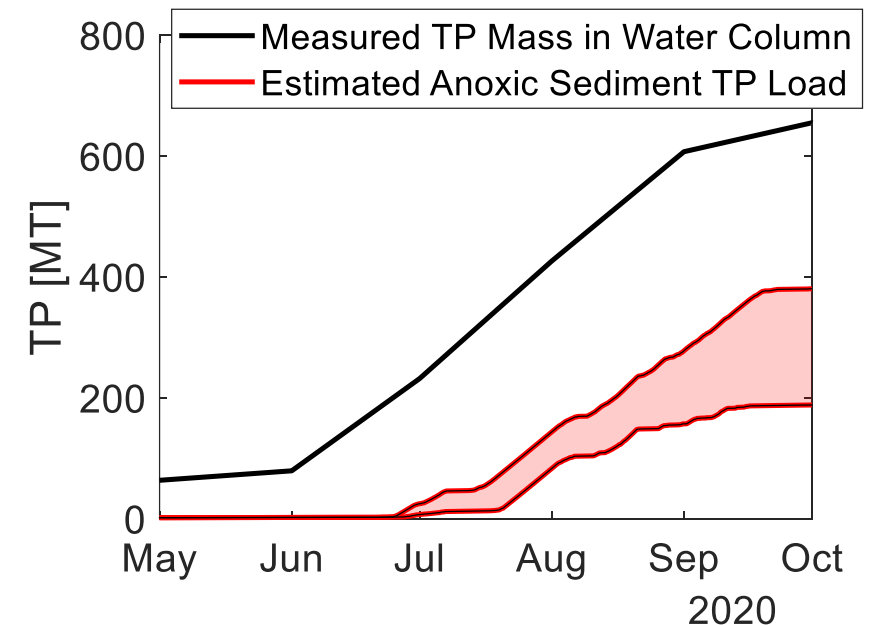
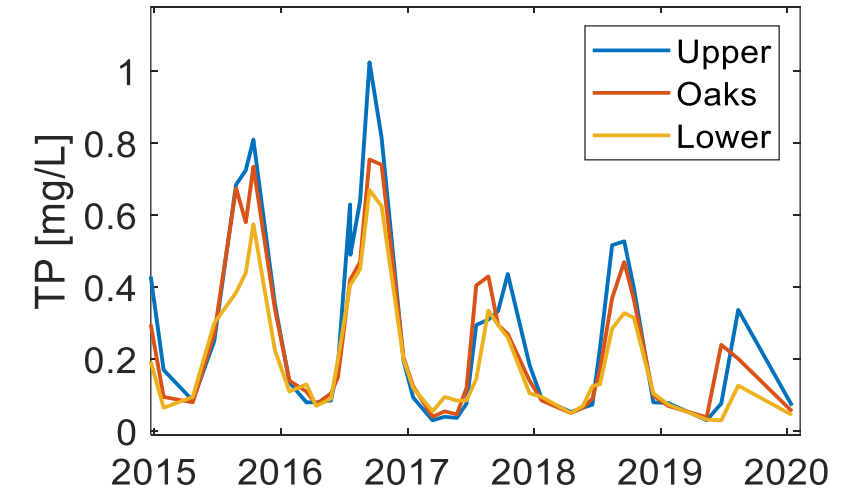
1. Reproducing the Phosphorus Cycling: Unknown Internal P Release Mechanisms



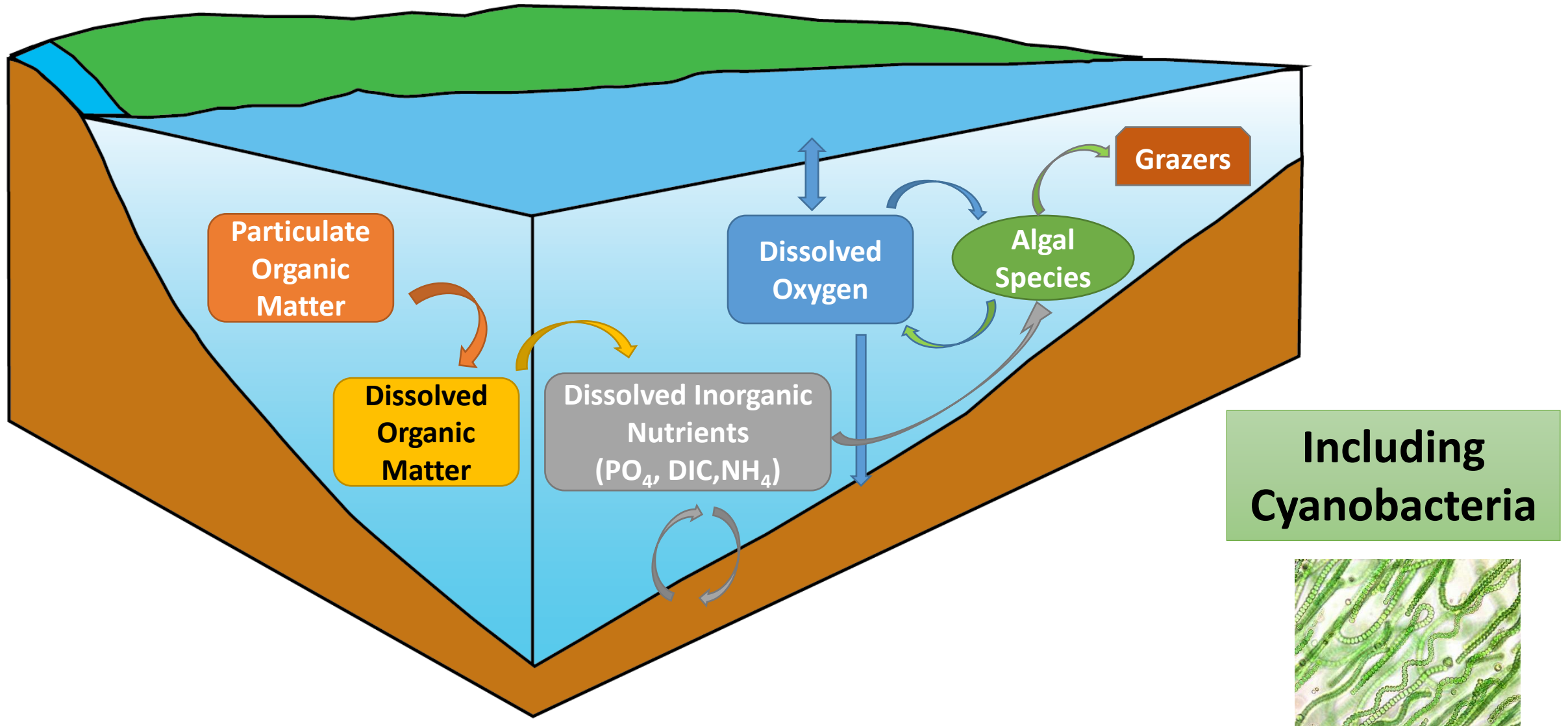
Credit: Micah Swann

What is the Phosphorus Dynamics in Clear Lake?

- Water column P fluctuate seasonally reaching a *minimum in the spring and maximum in the fall*
- Increasing P concentrations during dry season indicate internal loading
- *Fluxes from anoxic sediments* have been historically viewed as main internal P source. We have quantified them.
- **Estimated sediment P fluxes only account for ~30-60% of observed summer increase in water column**

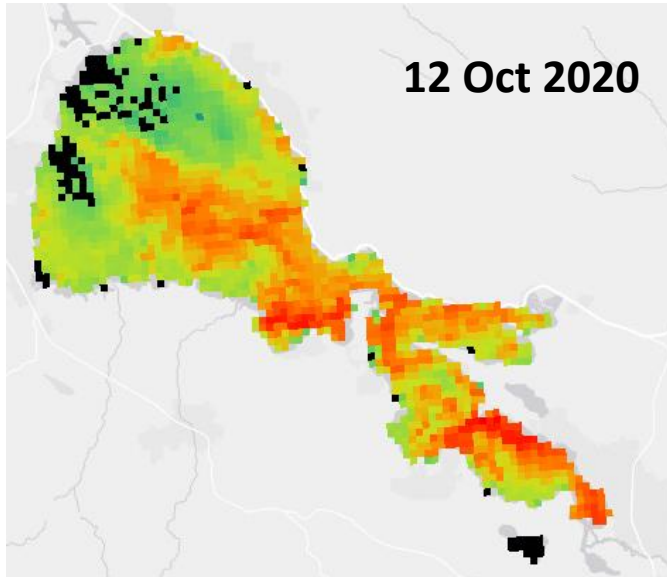
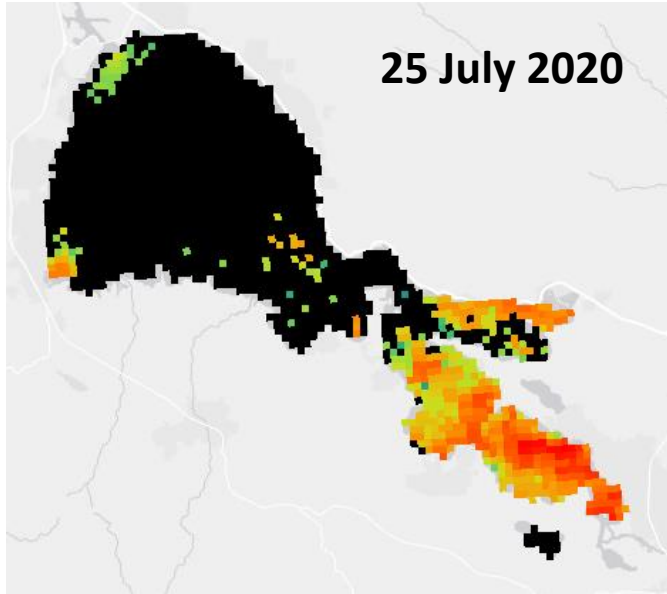


2. Developing the Phytoplankton Model

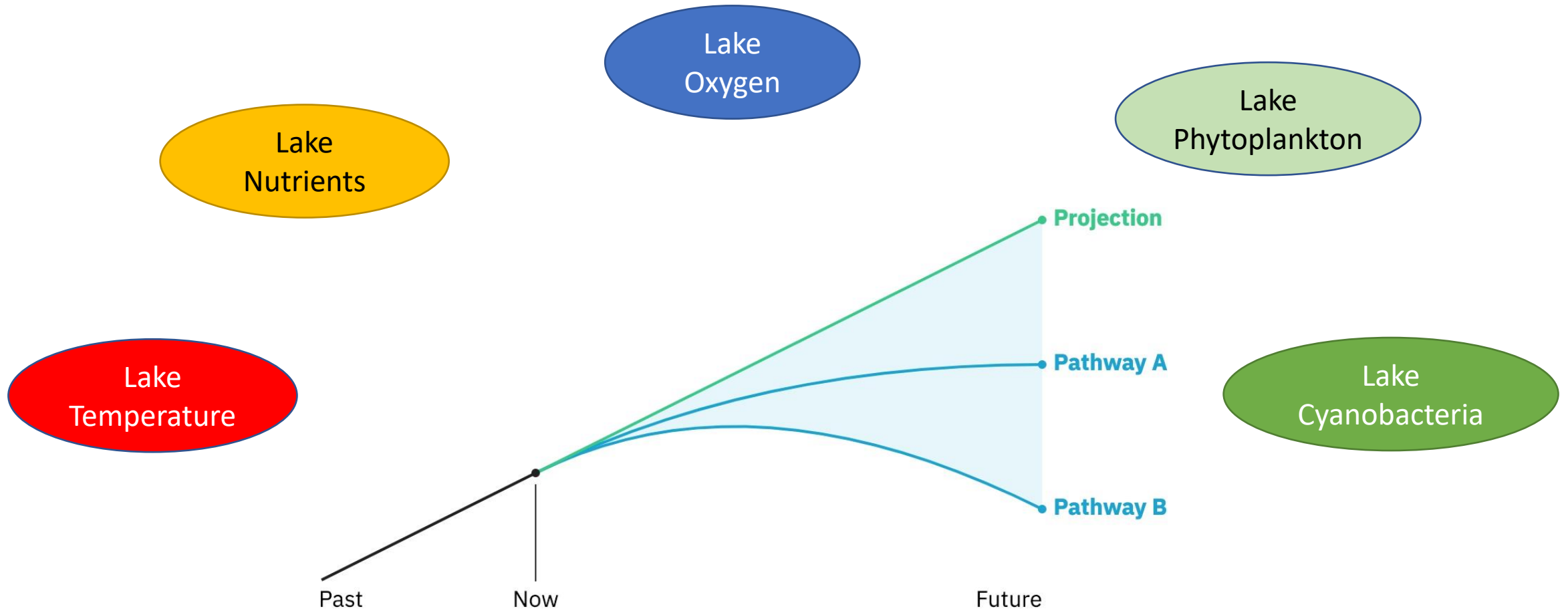


3. Potential Remediation Strategies (Hypolimnetic Oxygenation)

Mean bottom Concentration (Max 100 ppb)
Time = 7/22/2020 at 21 h



4. Simulating Climate Change Scenarios



Research Team

Name	Position
Geoff Schladow	Principal Investigator (PI)
Alex Forrest	Co-PI
Steve Sadro	Co-PI
Alicia Cortes	Project Scientist
Lidia Tanaka	Project Scientist (Phycologist)
Shohei Watanabe	Data manager & Project Scientist
Tina Hammell	Research Associate (Chemistry)
Anne Liston	Research Associate (Chemistry)
Steven Sesma	Research Associate (Chemistry)
Katie Senft	Research Associate (scuba & field)
Brandon Berry	Research Associate (scuba & field)
Micah Swann	Graduate Student
Nicholas Framsted	Graduate Student
Ruth Thirkill	Graduate Student
Samantha Sharp	Graduate Student
Kanarat Pinkanjanavee	Graduate Student
Carmen Woods	Project administration
Lindsay Vaughan	Technical Staff

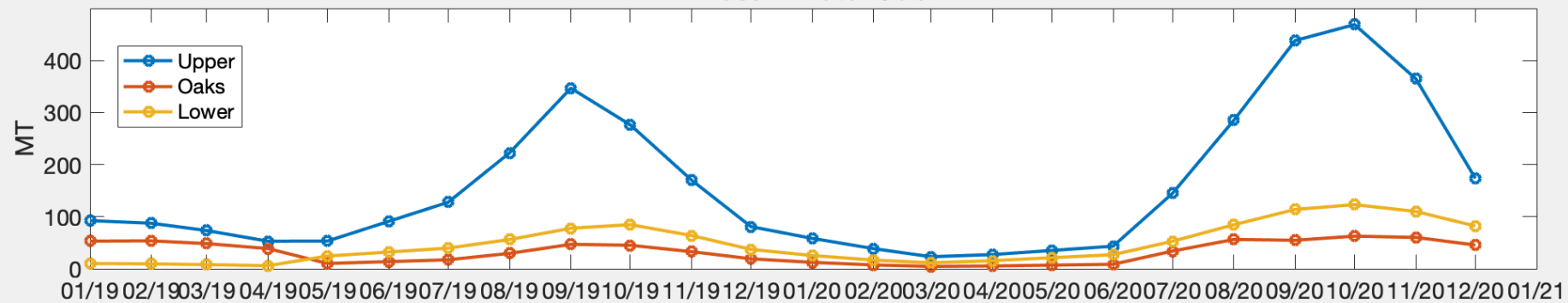
Thank you!
Questions?

<https://terc-clearlake.wixsite.com/cldashboard>

Month	L_ext (MT)	L_out (MT)	L_ext - L_out (MT)
'01-Jan-2019'	28.17	-2.71	25.46
'01-Feb-2019'	44.01	-17.88	26.13
'01-Mar-2019'	32.60	-24.21	8.39
'01-Apr-2019'	8.69	-8.02	0.67
'01-May-2019'	7.40	-2.20	5.19
'01-Jun-2019'	1.73	-3.76	-2.03
'01-Jul-2019'	0.27	-5.10	-4.83
'01-Aug-2019'	0.13	-6.62	-6.49
'01-Sep-2019'	0.12	-6.19	-6.07
'01-Oct-2019'	0.13	-4.60	-4.47
'01-Nov-2019'	0.13	-0.36	-0.23
'01-Dec-2019'	6.85	-0.91	5.94
'01-Jan-2020'	7.69	-0.59	7.10
'01-Feb-2020'	2.05	-0.24	1.81
'01-Mar-2020'	1.09	-0.35	0.74
'01-Apr-2020'	1.48	-1.58	-0.09
'01-May-2020'	0.81	-3.11	-2.30
'01-Jun-2020'	0.17	-4.50	-4.33
'01-Jul-2020'	0.07	-6.95	-6.88
'01-Aug-2020'	0.05	-8.78	-8.73
'01-Sep-2020'	0.07	-8.87	-8.80
'01-Oct-2020'	0.07	-1.20	-1.13
'01-Nov-2020'	0.08	-0.26	-0.18
'01-Dec-2020'	0.10	-0.31	-0.21

Below is a table for external inputs (L_ext) and external losses to Cache Creek (L_out) at monthly time steps. L_ext is an estimate of the entire watershed input, assuming that the three monitored streams account for 50% of the total inflows. Note that during the summer months external loading is actually *negative* because the inflows are so small and outflow concentration increases as a result of increasing ambient P concentrations in the Lower Arm due to internal loading. Thus I believe that any increase during the summer must be solely the result of in-lake processes. This is also shown graphically below. Let me know if you need further clarification on this.

TP Mass in Water Column



Clear Lake TP Budget

