


Lake Carmi, Franklin, VT Lake Monitoring Review April 2018

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VT Department of Environmental Conservation (DEC)
Watershed Management Division
Lakes and Ponds Management and Protection Program

Lake Carmi, Franklin, VT

Lake Monitoring Stations

Legend

 Station



Lake Monitoring Data and Reports

- Lay Monitoring Program

<http://dec.vermont.gov/watershed/lakes-ponds/monitor/lay-monitoring>

- Spring Phosphorus Program

<http://dec.vermont.gov/watershed/lakes-ponds/monitor/assessment>

- Lake Score Card

<http://dec.vermont.gov/watershed/lakes-ponds/data-maps/scorecard>

- Supplemental Monitoring

<http://dec.vermont.gov/watershed/cwi/restoring/carmi>

<https://anrweb.vt.gov/DEC/IWIS/>

Lay Monitoring Program

- Since 1979, VTDEC has partnered with volunteers throughout the state to track long-term nutrient enrichment of Vermont lakes through the [Lay Monitoring Program](#).
- Weekly sampling at Station 1 from Memorial Day through Labor Day (minimum of 8 samples required to calculate summer mean):
 - Secchi disk transparency (water clarity), also at Station 2/3
 - Water samples (hose @ 2X Secchi depth \approx photic zone)
 - Total phosphorus concentration (nutrient)
 - Chlorophyll-a concentration (algae and cyanobacteria)



LAKE CARMi

Franklin, VT

Lay Monitor: Peter Benevento
Former Lay Monitors: Bob Rennie
 Skyler Gauvin
 Dave Jones
 Richard Davis

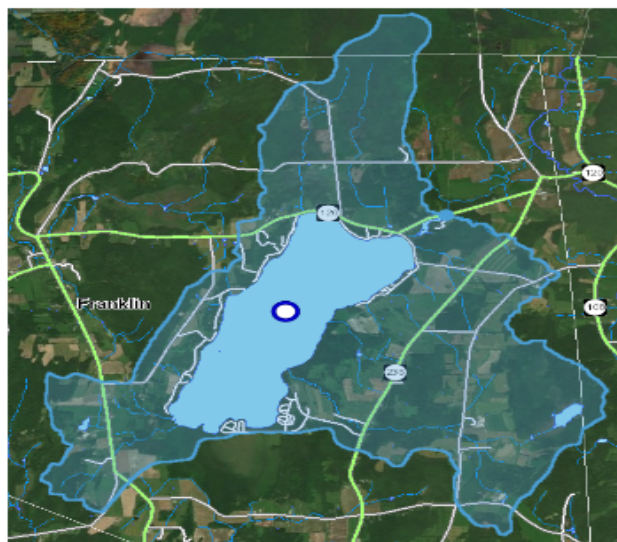
Physical

Lake Carmi is a large, shallow, warmwater lake.

Lake Surface Area: 1,402 acres
 Drainage Basin Area: 7,710 acres
 Ratio (Basin/Lake): 5:1
 Maximum Depth: 33 ft (10.1 m)
 Mean Depth: 13 ft (4.0 m)

2017 Summary (Station 1)

Parameter	Days	Min	Mean	Max
Secchi (m)	12	1.4	2.3	3.5
Chl-a (µg/L)	12	5.6	16.5	35.2
Summer TP (µg/L)	11	21.3	29.4	39.9
Spring TP (µg/L)	1		26.3	



Annual Data (Station 1)

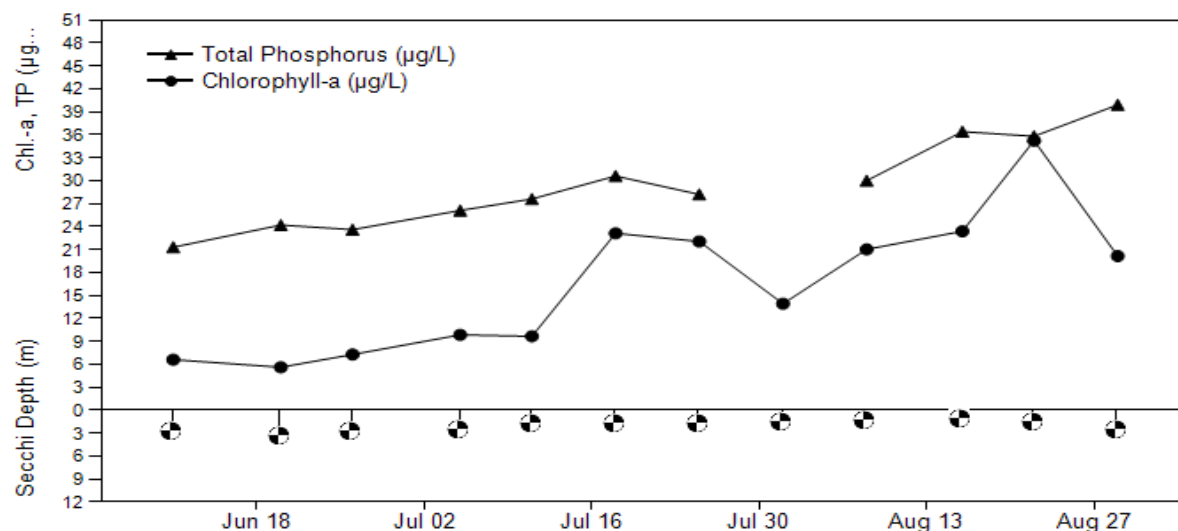
Year	Days Sampled	Secchi (m)	Chloro-a (µg/l)	Summer TP (µg/l)	Spring TP (µg/l)
1979	24	1.5	15.2		18.0
1980	16	1.7	23.7		
1981	12	1.9	19.3		21.0
1982	7				31.0
1983	11	1.9	25.5	29.6	33.0
1984	12	1.5	29.8	34.9	27.0
1985	13	1.5	30.5	38.5	28.0
1986	13	1.3	27.3	37.5	22.0
1987	10	1.8	15.0	29.9	30.0
1988	13	2.0	14.4	27.5	
1989	13	2.4	12.9	29.2	
1990	17	1.7	40.4	28.0	
1991	12	2.1	13.0	27.0	
1992	13	2.2	13.6	29.5	
1993	14	1.8	14.9	26.8	
1994	14	2.2	10.3	23.8	27.3
1995	10	2.1	14.9	25.7	23.0
1996	10	2.1	10.5	27.1	27.0
1997	9	2.5	8.4	23.7	29.0
1998	9	2.2	7.6	23.2	26.3

Annual Data (Station 1)

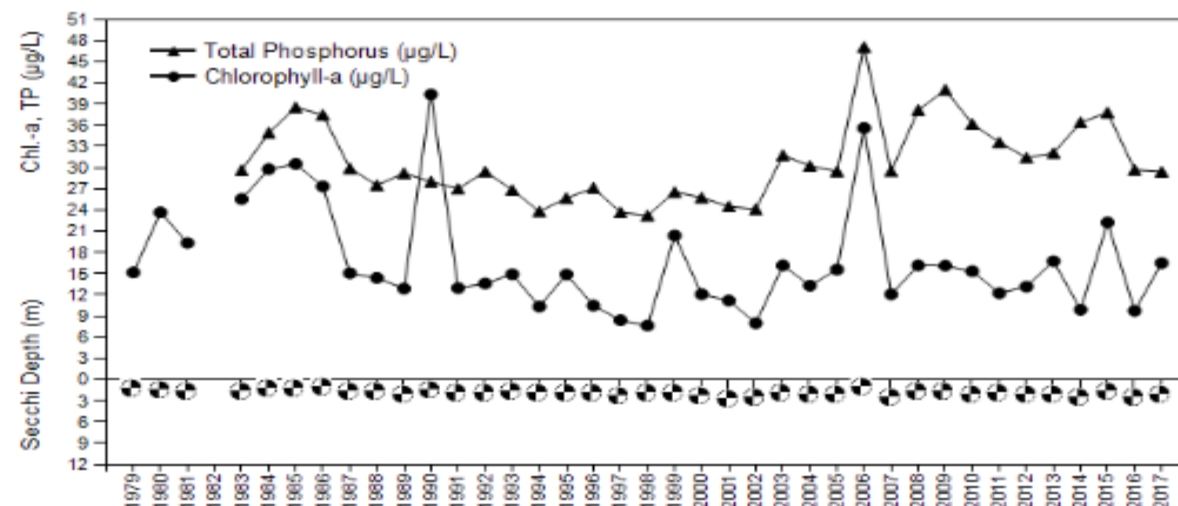
Year	Days Sampled	Secchi (m)	Chloro-a (µg/l)	Summer TP (µg/l)	Spring TP (µg/l)
1999	9	2.1	20.4	26.6	26.3
2000	8	2.5	12.1	25.8	26.3
2001	14	2.9	11.2	24.5	26.3
2002	9	2.7	8.0	24.1	22.3
2003	8	2.2	16.2	31.8	
2004	11	2.3	13.3	30.2	30.3
2005	11	2.2	15.6	29.5	
2006	10	1.2	35.6	47.1	
2007	12	2.8	12.1	29.5	22.4
2008	12	1.9	16.2	38.1	
2009	13	1.9	16.1	41.0	34.4
2010	13	2.4	15.3	36.2	
2011	12	2.1	12.2	33.6	
2012	12	2.3	13.2	31.4	27.9
2013	12	2.3	16.8	32.1	33.9
2014	12	2.8	9.9	36.4	30.9
2015	14	1.9	22.2	37.8	28.4
2016	14	2.8	9.7	29.7	23.3
2017	12	2.3	16.5	29.4	26.3

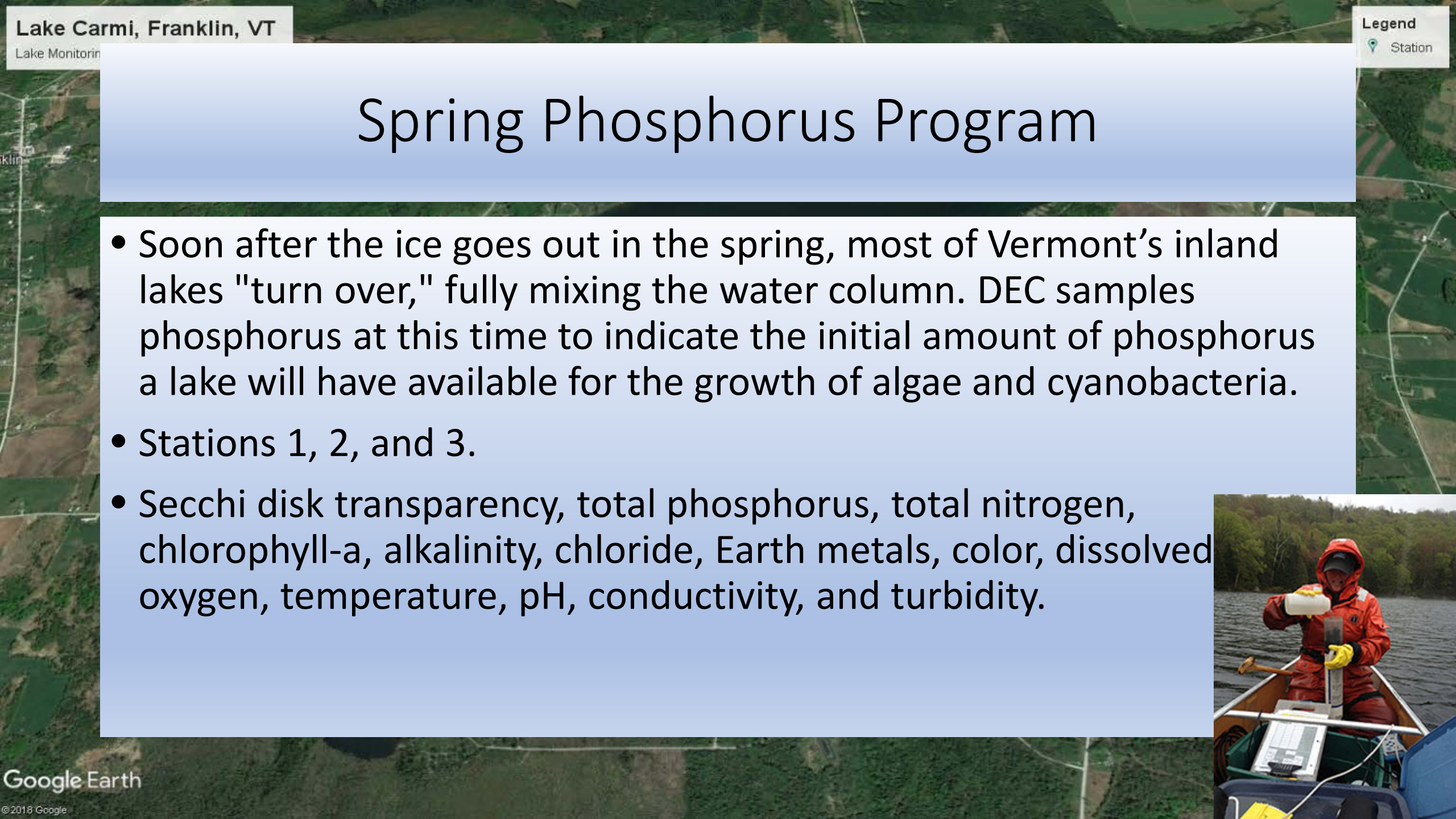
Trophic State	Mean Secchi Clarity (m)	Mean Chlorophyll-a (µg/L)	Mean Total Phosphorus (µg/L)
Oligotrophic	> 5.5	< 3.5	< 7.0
Mesotrophic	3.0 - 5.5	3.5 - 7.0	7.0 - 14
Eutrophic	< 3.0	> 7.0	>14

2017 Daily Values (Station 1): Total Phosphorus, Chlorophyll-a, and Secchi Depth



Summer Annual Means (Station 1): Total Phosphorus, Chlorophyll-a, and Secchi Depth





Spring Phosphorus Program

- Soon after the ice goes out in the spring, most of Vermont's inland lakes "turn over," fully mixing the water column. DEC samples phosphorus at this time to indicate the initial amount of phosphorus a lake will have available for the growth of algae and cyanobacteria.
- Stations 1, 2, and 3.
- Secchi disk transparency, total phosphorus, total nitrogen, chlorophyll-a, alkalinity, chloride, Earth metals, color, dissolved oxygen, temperature, pH, conductivity, and turbidity.



Lake Score Card

CARMI - data through 2017

[Learn How
Lakes Are
Scored](#)



Lake Area:
1402 acres

Basin Lake Area Ratio:
5

Max Depth:
10 meters

Mean Spring TP:
27.3 ug/L

Mean Summer TP:
31 ug/L

Mean Summer Chla:
17.1 ug/L

Mean Summer Secchi:
2.1 m

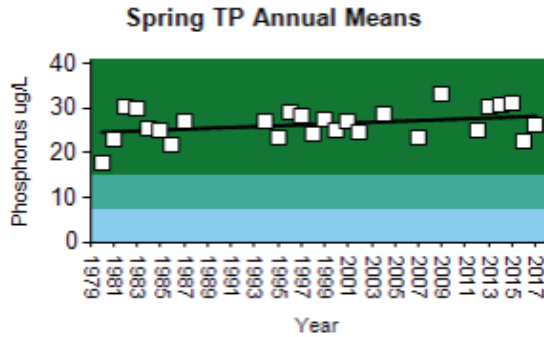
Hypereutrophic

Eutrophic

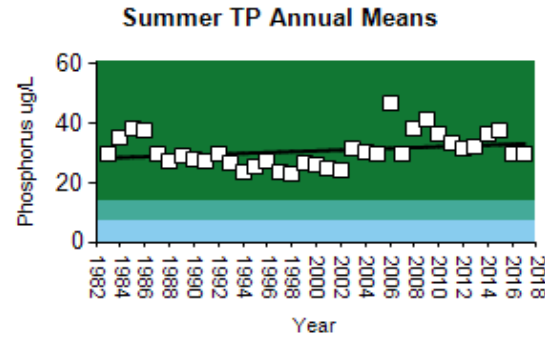
Mesotrophic

Oligotrophic

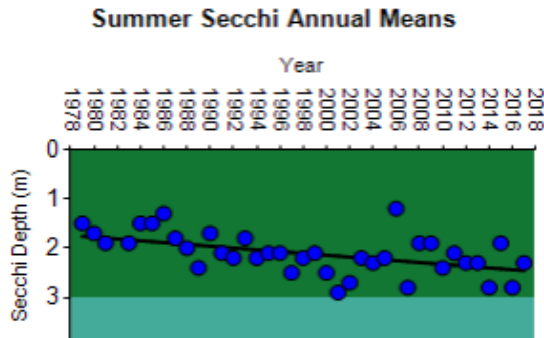
Spring TP Trend: $p = 0.2008$ | CV = 13
Stable



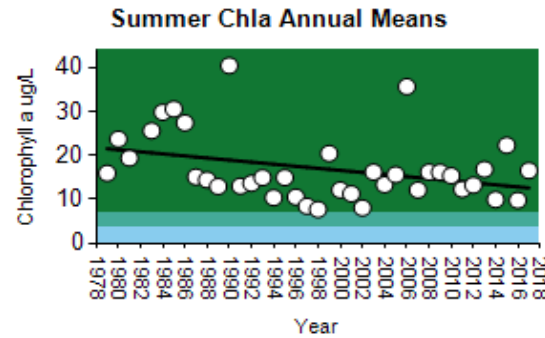
Summer TP Trend: $p = 0.2678$ | CV = 18
Stable



Summer Secchi Trend: $p = 0.0005$ | CV = 19
Highly significantly increasing



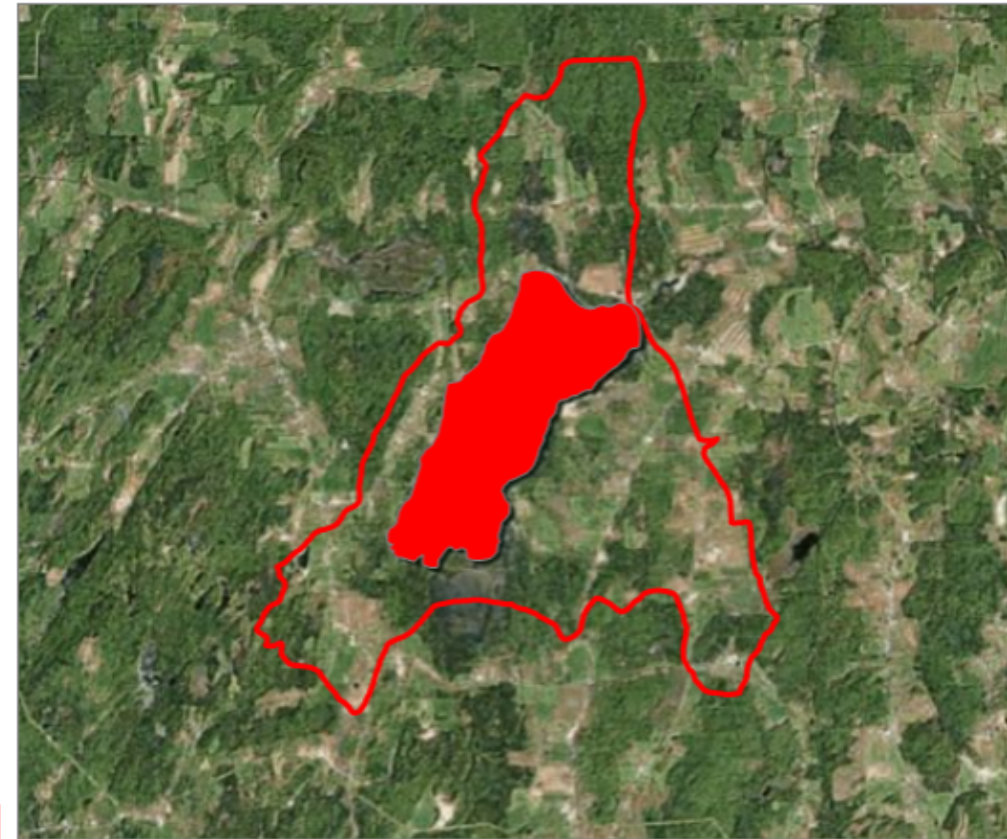
Summer Chla Trend: $p = 0.0784$ | CV = 45
Stable



Trend Score: **Good**

WQ Standards Status: **Impaired**

Watershed Score: **Highly Disturbed**



Stresses / Impairments

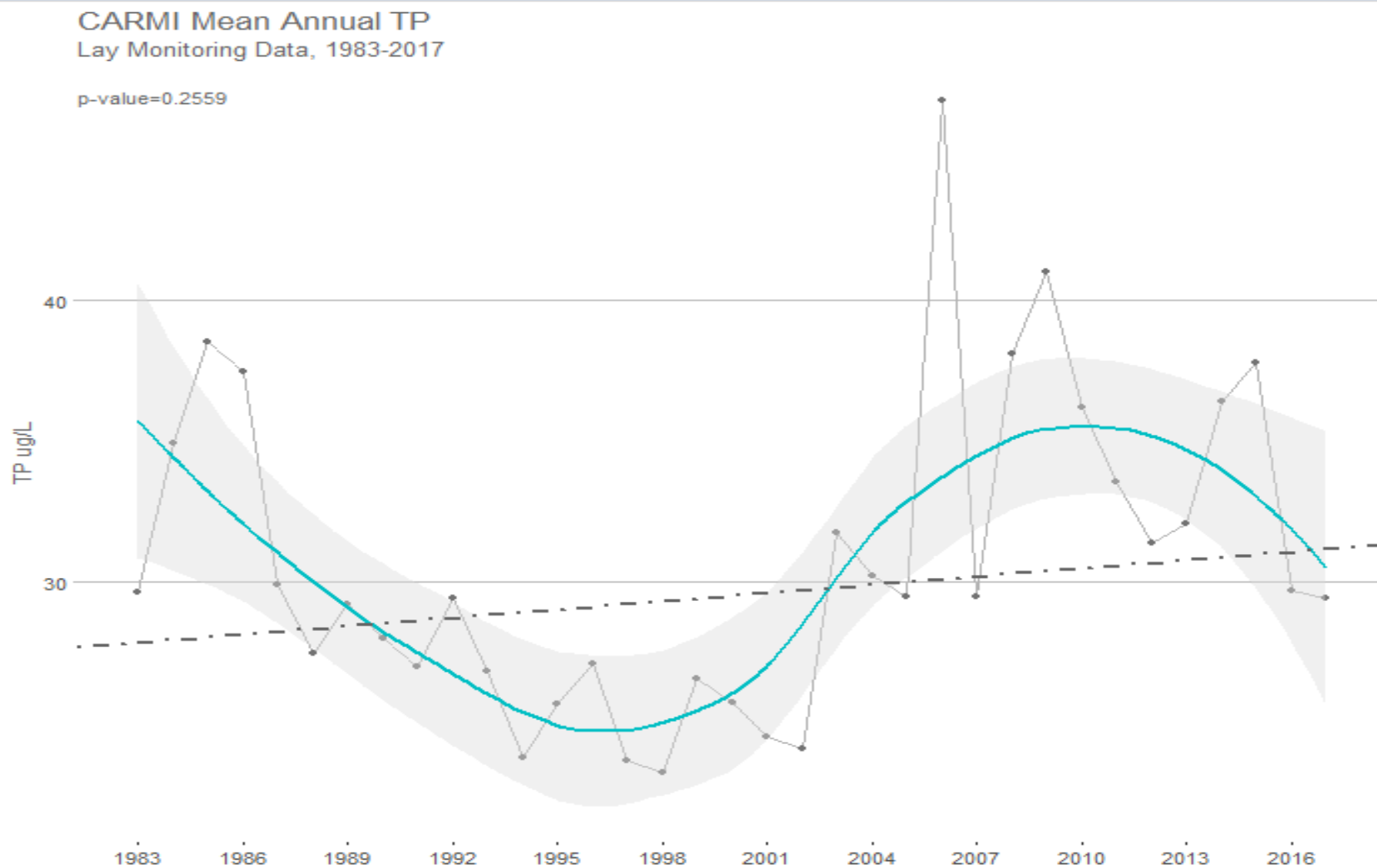
Stressed -- Escherichia coli

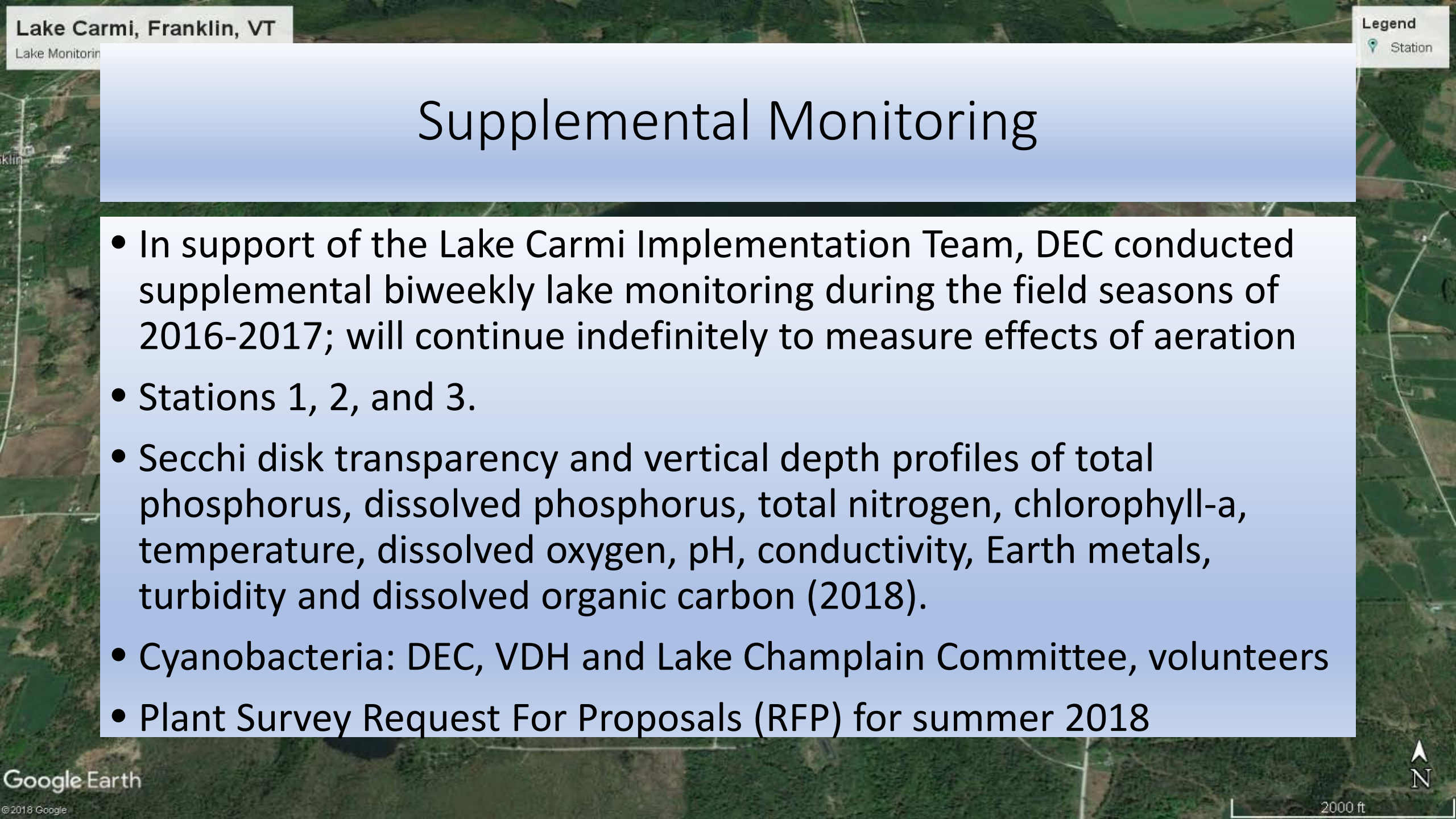
Stressed -- Flow alteration

Impaired -- Organic Enrichment - DO

Impaired -- Phosphorus

Summer total phosphorus (TP) remains consistently above the standard of 22 ug/l but shows some indication of recent improvement.



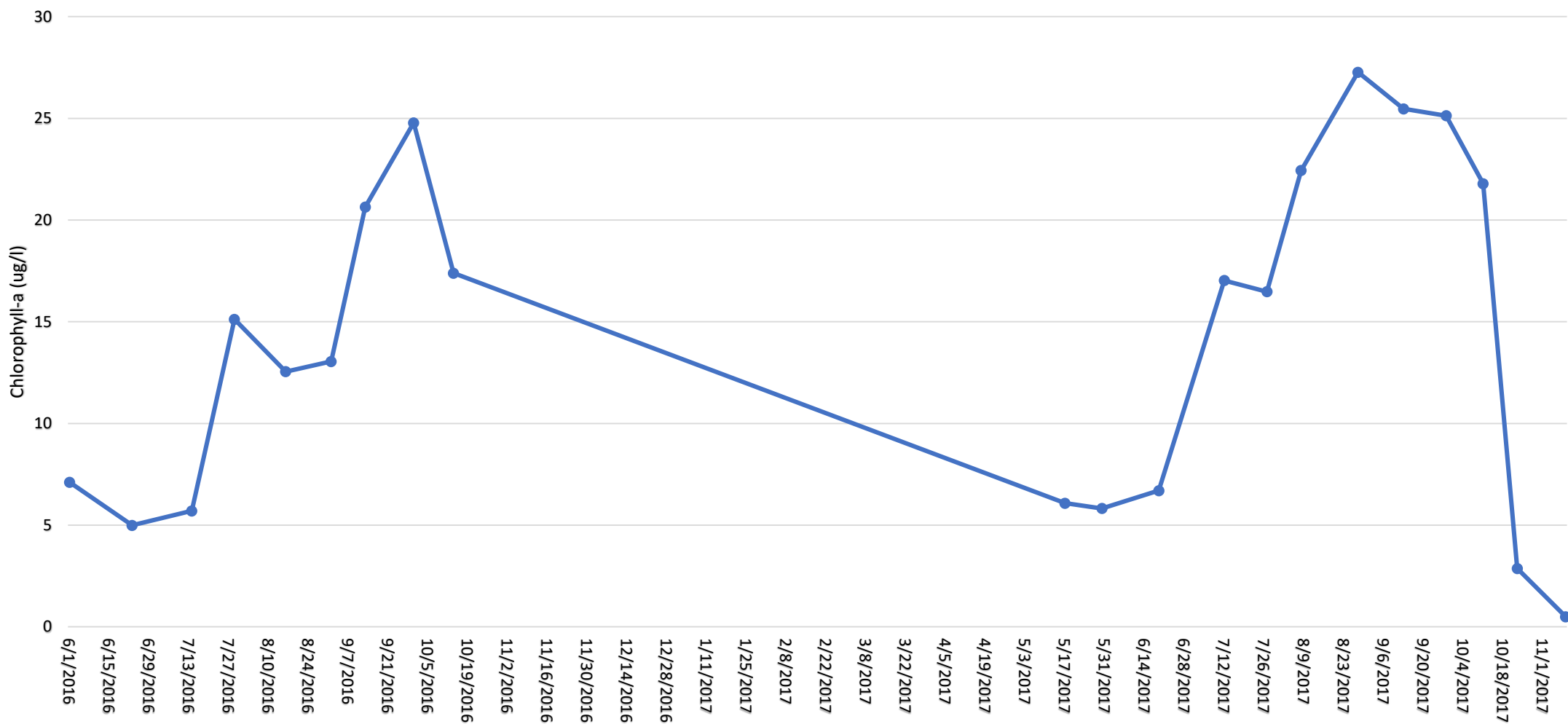


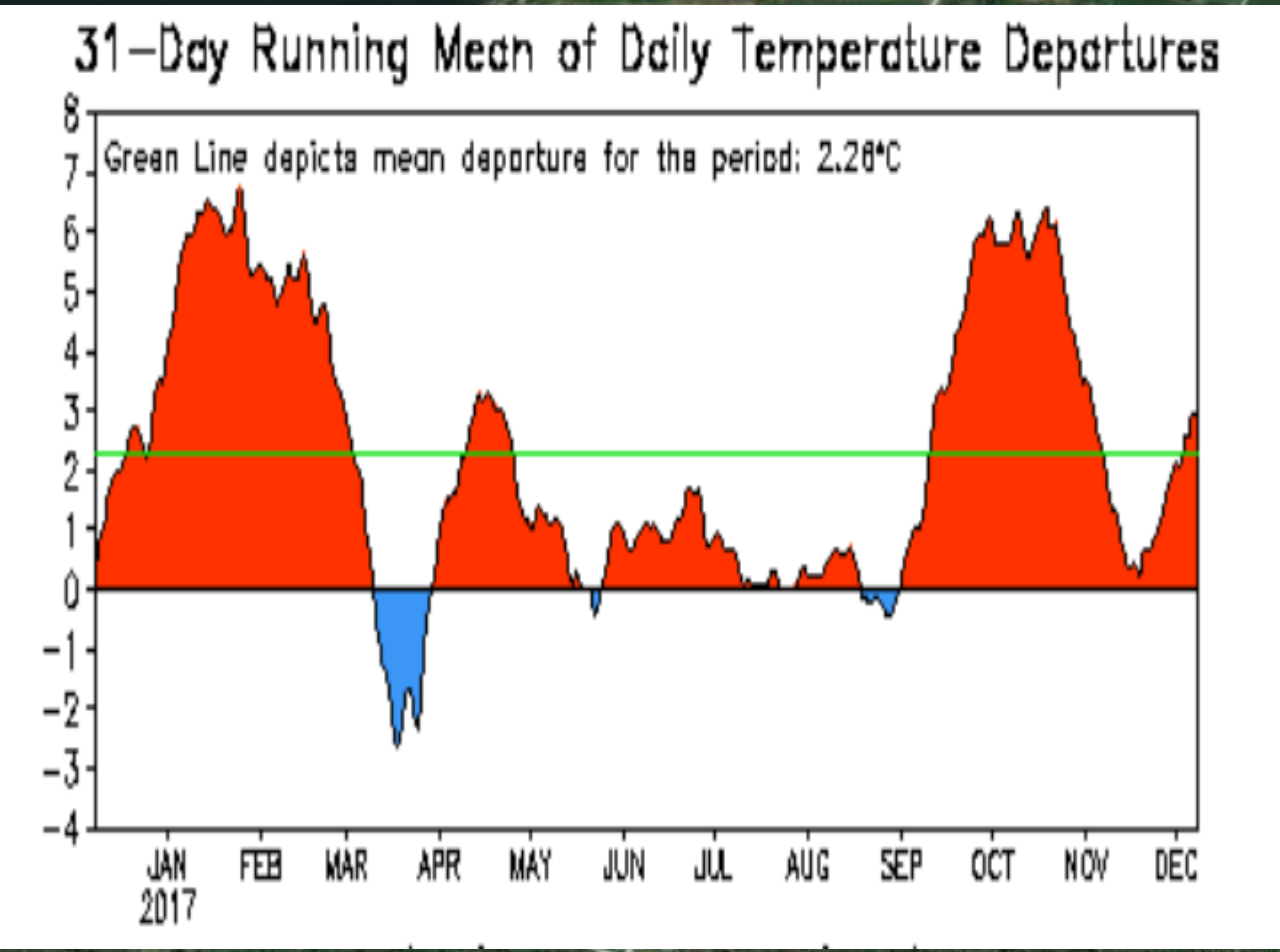
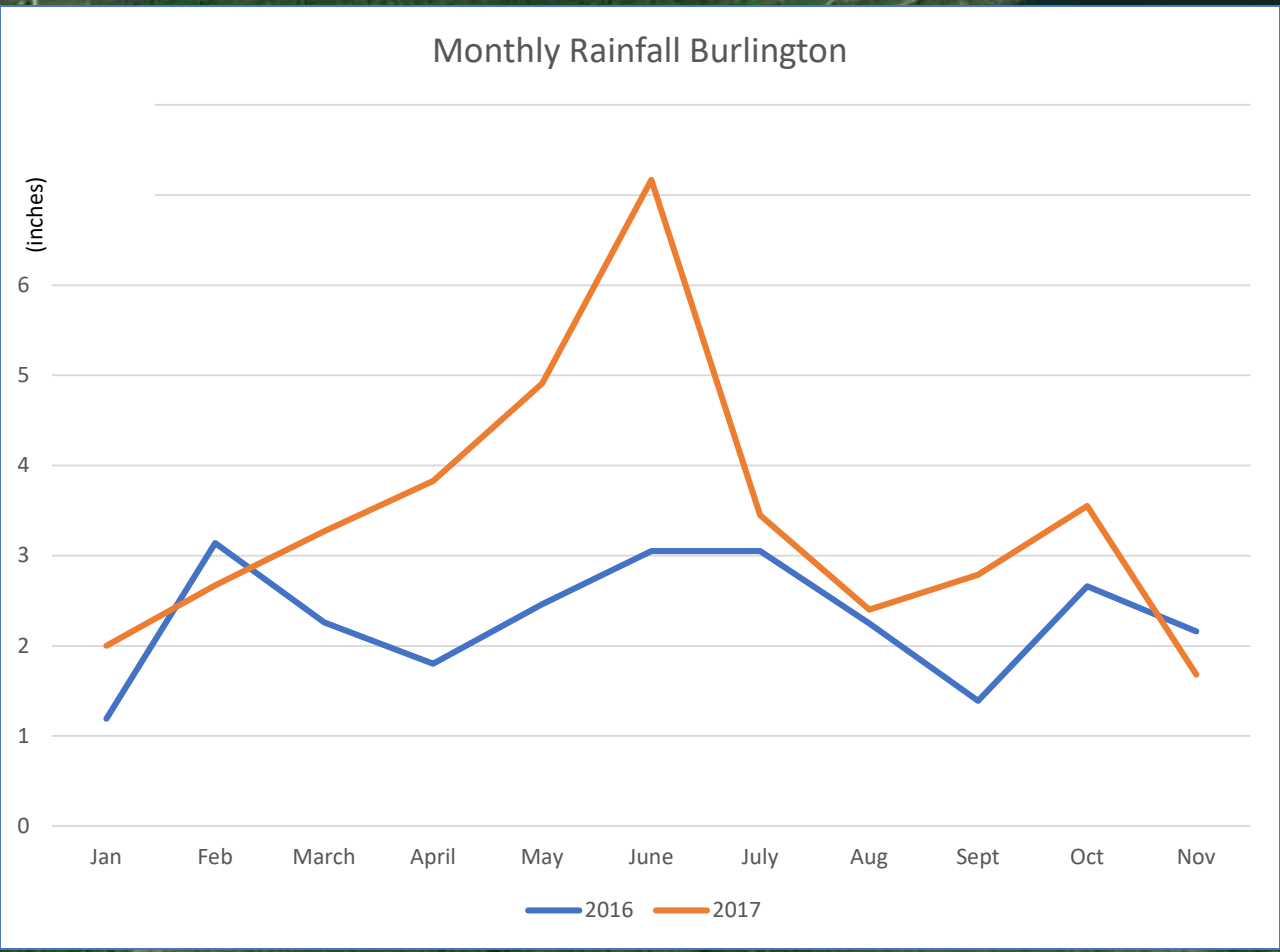
Supplemental Monitoring

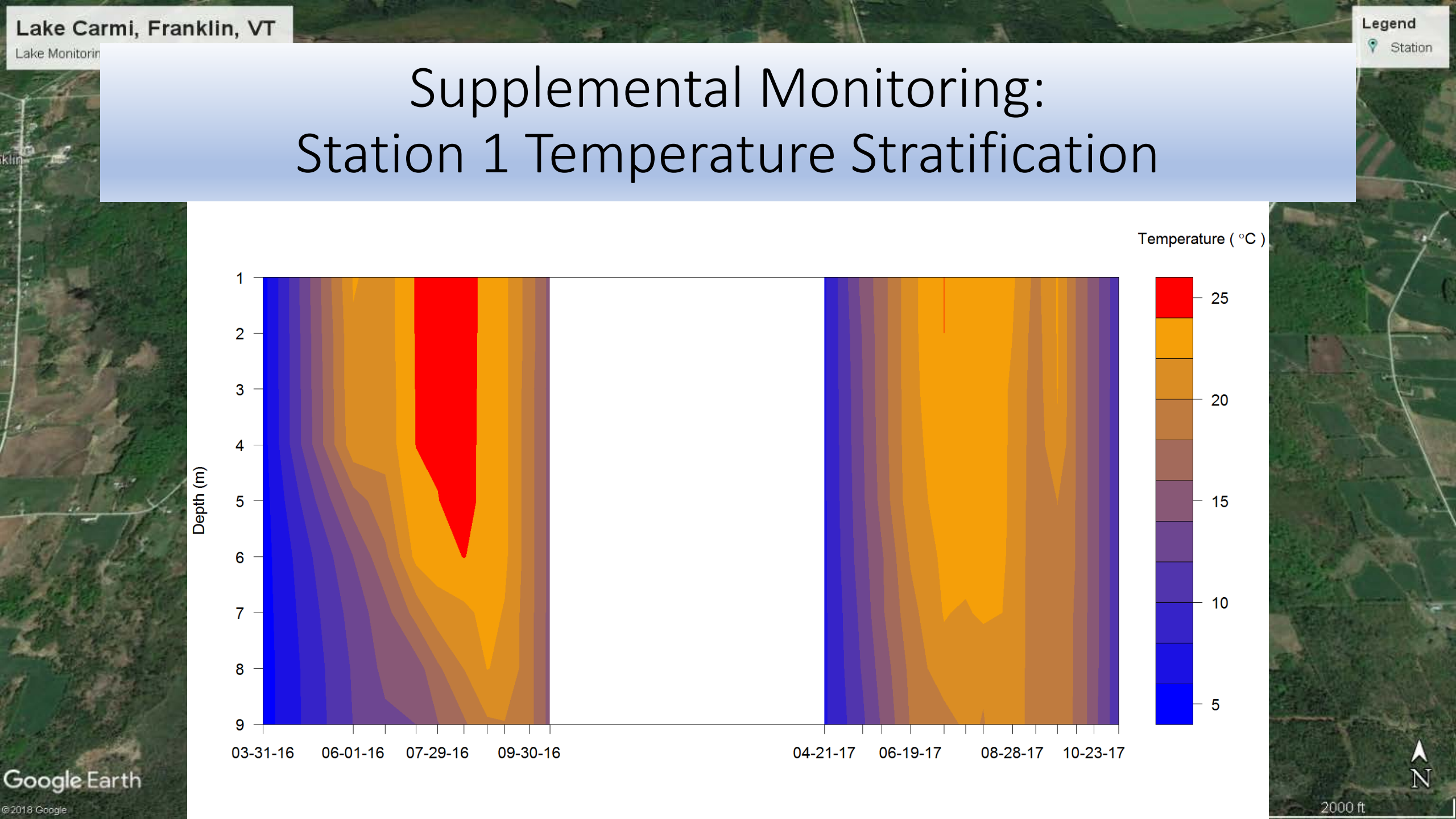
- In support of the Lake Carmi Implementation Team, DEC conducted supplemental biweekly lake monitoring during the field seasons of 2016-2017; will continue indefinitely to measure effects of aeration
- Stations 1, 2, and 3.
- Secchi disk transparency and vertical depth profiles of total phosphorus, dissolved phosphorus, total nitrogen, chlorophyll-a, temperature, dissolved oxygen, pH, conductivity, Earth metals, turbidity and dissolved organic carbon (2018).
- Cyanobacteria: DEC, VDH and Lake Champlain Committee, volunteers
- Plant Survey Request For Proposals (RFP) for summer 2018

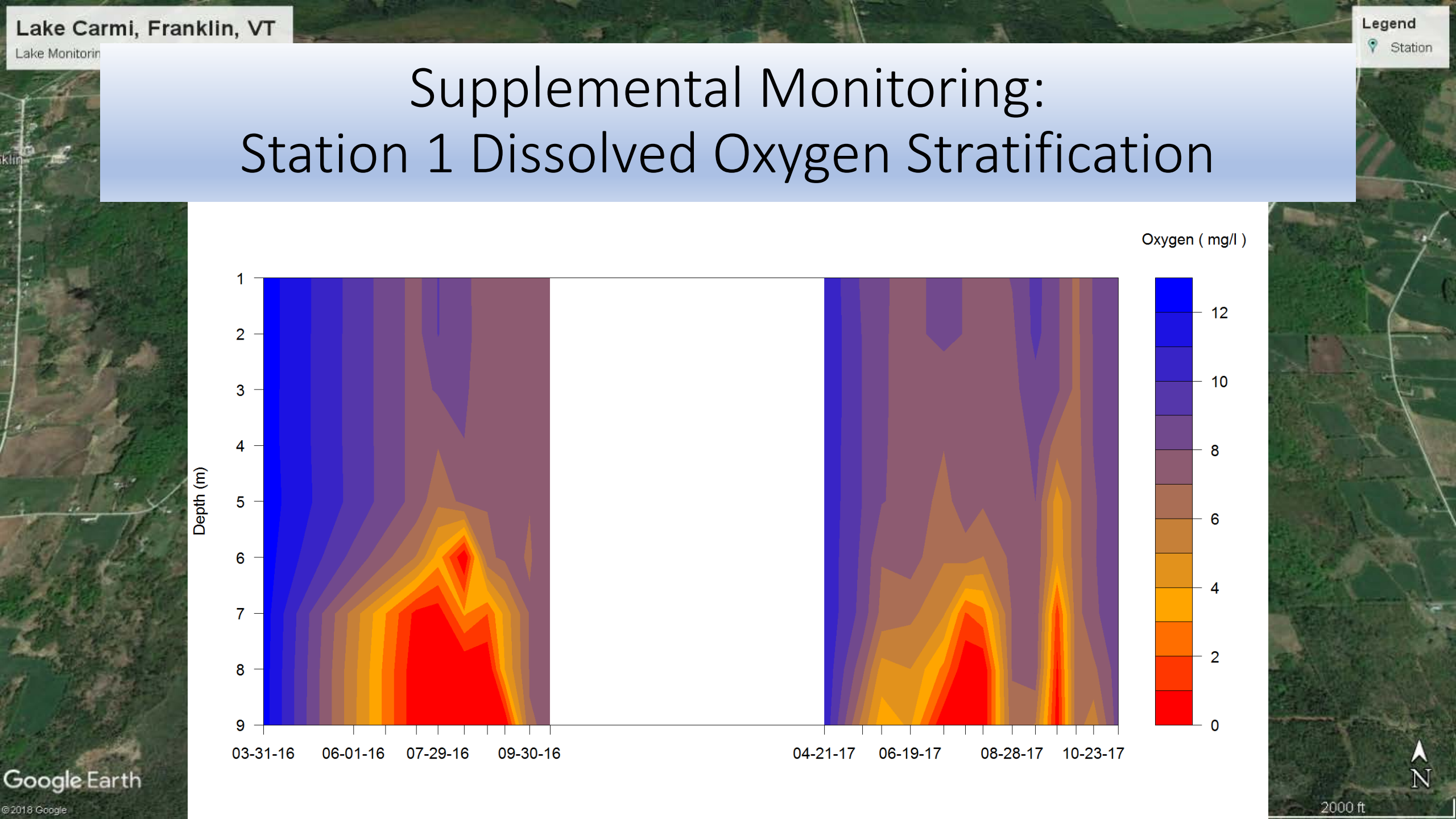
Supplemental Monitoring: Early and Late Season Cyanobacteria Blooms

Lake Carmi Station 1 Chlorophyll-a (Algae and Cyanobacteria) 2016-2017

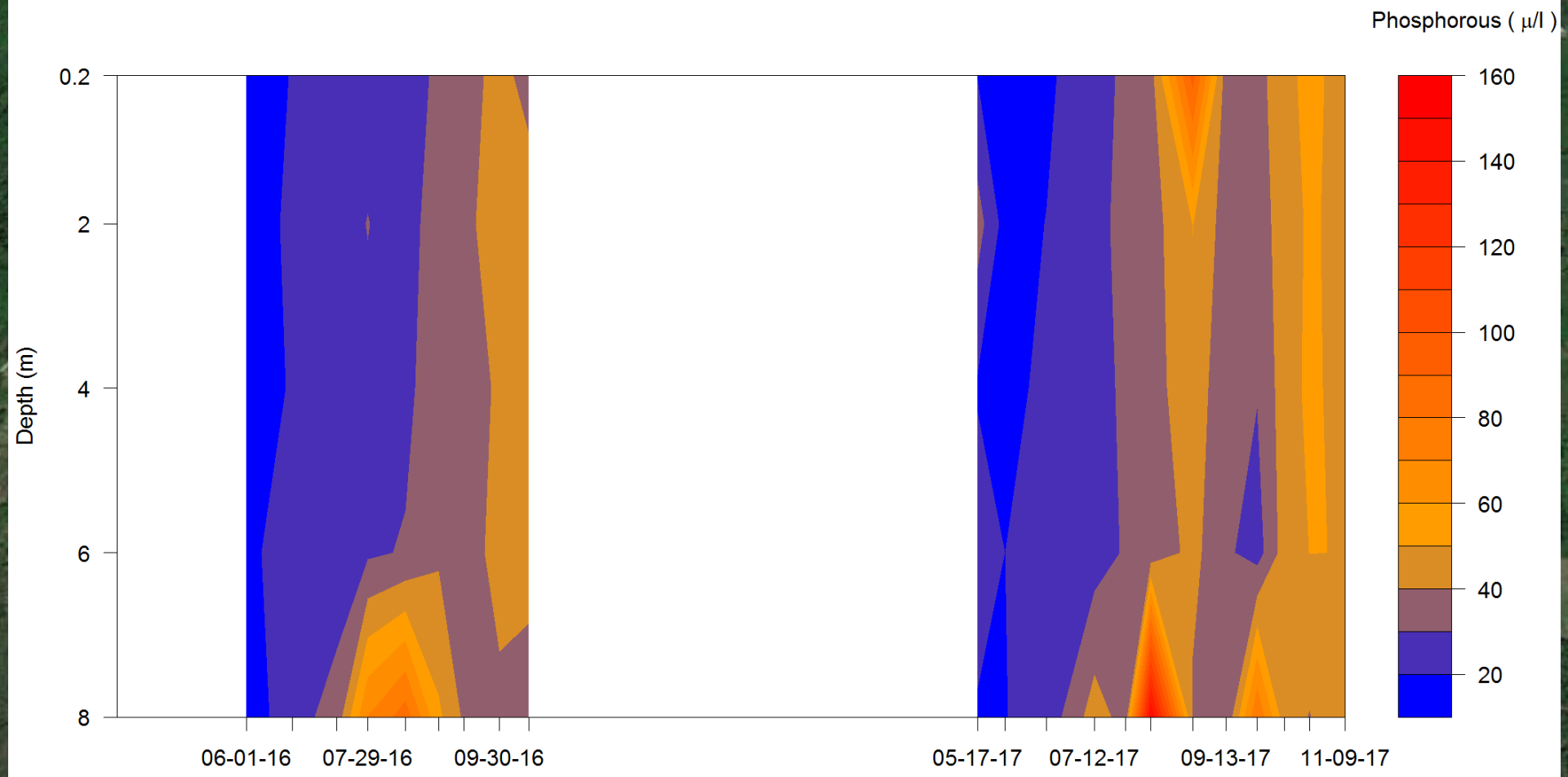








Supplemental Monitoring: Station 1 Total Phosphorus Loading





Lake Carmi, Franklin, VT

Lake Monitoring Stations

Legend

Station

Thank you!

dec.vermont.gov/watershed/cwi/restoring/carmi

Google Earth

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2000 ft