Comparing Pleasant vs. East Vadnais Lakes

Graphs of comparisons and preliminary interpretation: These graphs and explanations provide more background to complement an article submitted to North Oaks News in 2020. These graphs are not published as a part of a formal report. They may help build TMDL recommendations for Pleasant Lake in upcoming years.

This is intended as a discussion and companion document to SLMPs, the North Oaks News article, and for stakeholder discussions in the watershed.

***VLAWMO thanks SPRWS for sharing data and allowing us to build these comparisons.**

****This discussion document was prepared by Dawn Tanner, Program Development Coordinator, December, 2019**

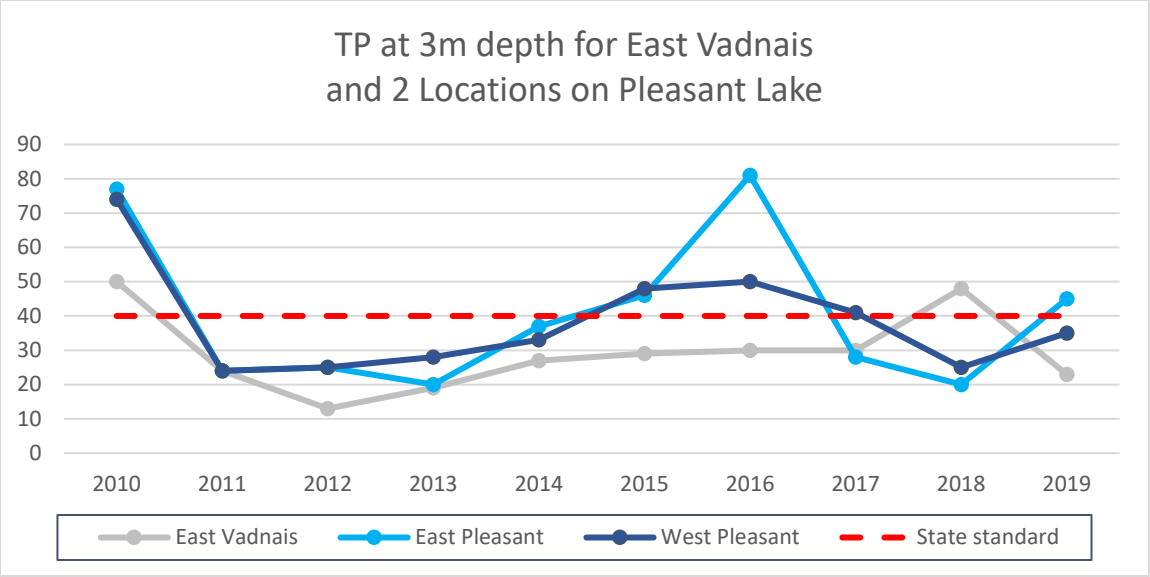
Pleasant Lake is listed as impaired by MPCA for nutrients.
East Vadnais Lake is not listed as impaired.

- Data were collected by MPCA for Pleasant Lake in 2010-2011, assessed in 2012, and the listing took effect in 2014. Seasonal means (June-Sept) are reported. TP = 56.5 µg/L and Chl-a = 19 µg/L
- Data were collected by MPCA and Ramsey County for East Vadnais Lake in 2010-2011; it was not listed as impaired. TP = 27 µg/L and Chl-a = 7 µg/L

Data have been collected by SPRWS from 2008-2019. All data for a given season may not available. More uniform sampling at varying depths (3m and 13m) was begun in 2010. Chlorophyll-a was collected at 0m.

For these graphs, 3m depths for TP are used. Results at this depth are comparable to mean results collected during 2010-2011 by MPCA (Pleasant) and by MPCA/Ramsey County (East Vadnais). MPCA also recommends using 3m depth results and maintaining the benefits of a long-term dataset.

To begin understanding trends over time, two locations on Pleasant Lake (East and West) are compared with East Vadnais Lake (North). TP measurements were collected at 3m. Chl-a measurements were collected at 0m.

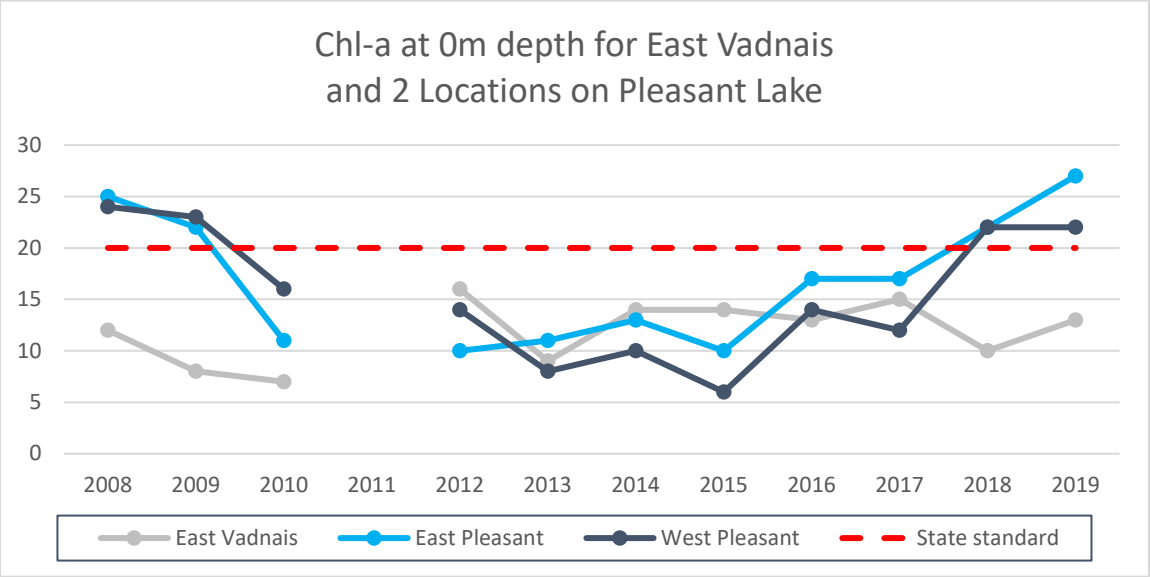


East, West Pleasant, and East Vadnais all exceeded the TP standard in 2010. In 2011, all 3 were below the standard. During 2015-2016, Pleasant Lake exceeded the standard. It was below the standard in 2017-2018, but appears to be approaching if not exceeding the standard as of 2019. East Vadnais has remained below the standard since 2010 except for 2018.

The spikes in 2016 at East Pleasant Lake and 2018 in East Vadnais are at first curious. Data are shown at 3m. Data are also available at 13m. To decide if these data points might be outliers, we checked the TP level at 13m. In both cases, that measurement was also high and provides evidence that these were not data-collection or lab-analysis errors but are accurate data points.

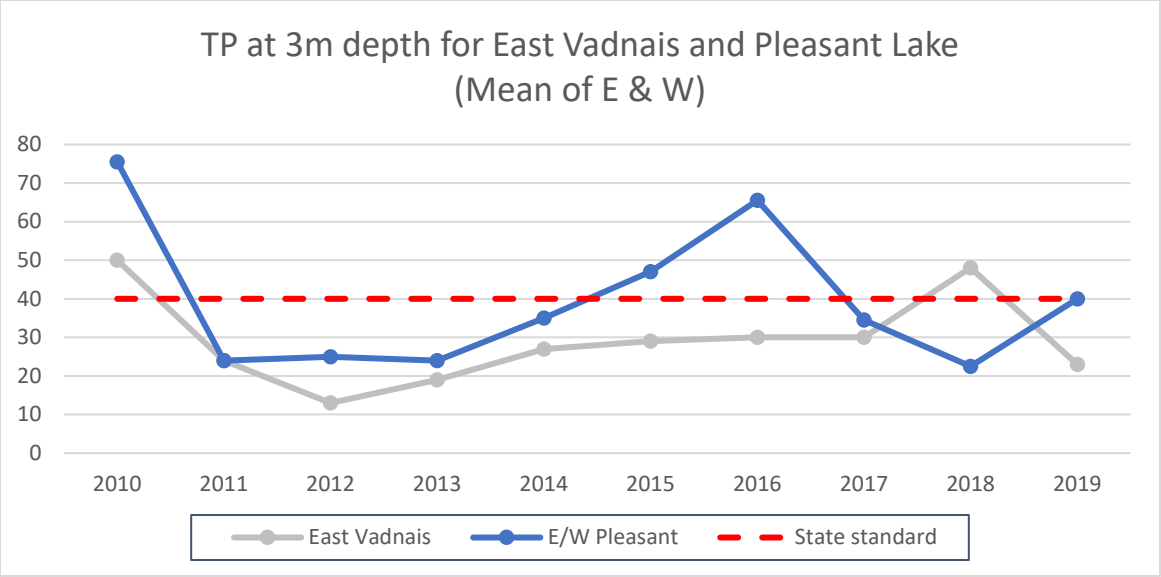
These spikes are likely due to treatment at the Fridley SPRWS facility. These show the results in the lake that occur when insufficient ferric chloride was being added to treat the Mississippi River and Vadnais Lake to maintain the permeable reactive barrier of Fe(OH)3 that keeps the nutrients in lake sediment. There was also a change in the ferric chloride feed system following the oxygenation system upgrade that likely affected this process. SPRWS lost the permeable reactive barrier of Fe(OH)3 with extended ferric chloride feed issue at Fridley pumping station in those periods; which may have impacted the iron boundary layer formation at Pleasant Lake. Sediment studies have not been done to verify the issue at Pleasant Lake.

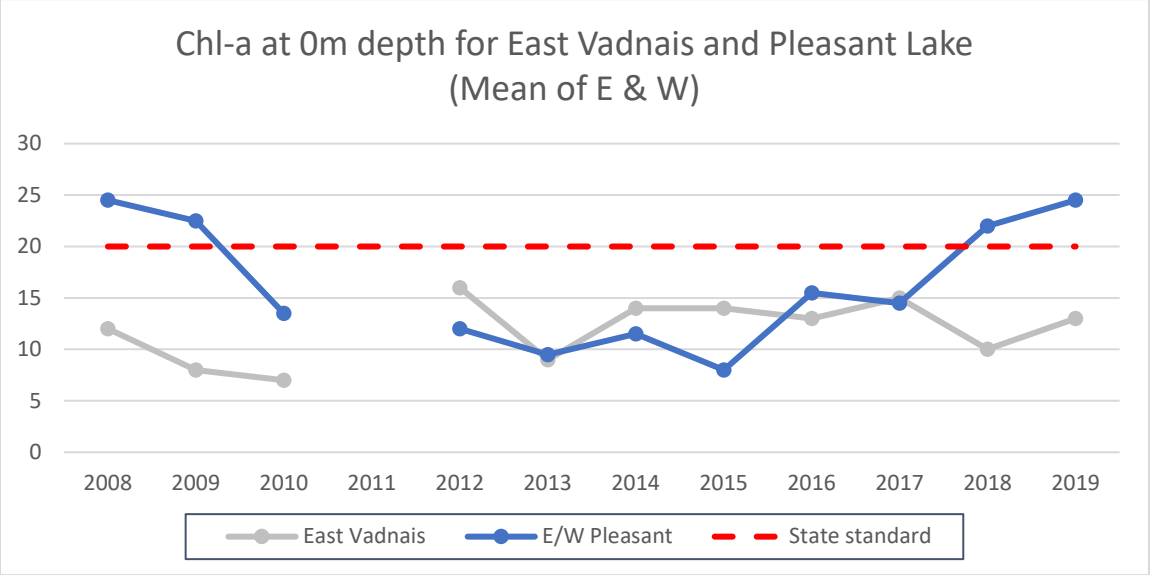
Chlorophyll-a shows the amount of algae (or “green”) in the water. Chlorophyll-a samples were collected at 0m (surface).



All 3 locations remained below the Chl-a standard since 2010, but both locations on Pleasant exceeded the standard in 2019. This was also supported by documented blue-green algae blooms that occurred late in the growing season (Aug.-Sept.). Chl-a is higher in East Pleasant. A blue-green algae bloom was documented in West Pleasant, next to the Charley Channel, and has been documented in previous years. Systematic monitoring is not conducted for blue-green algae blooms. There may have been additional blue-green algae blooms that were not reported nor documented.

To make it easier to look at trends, East and West Pleasant Lake locations are collapsed into a mean measurement for the following two graphs. These graphs otherwise show the same information as the previous two graphs.



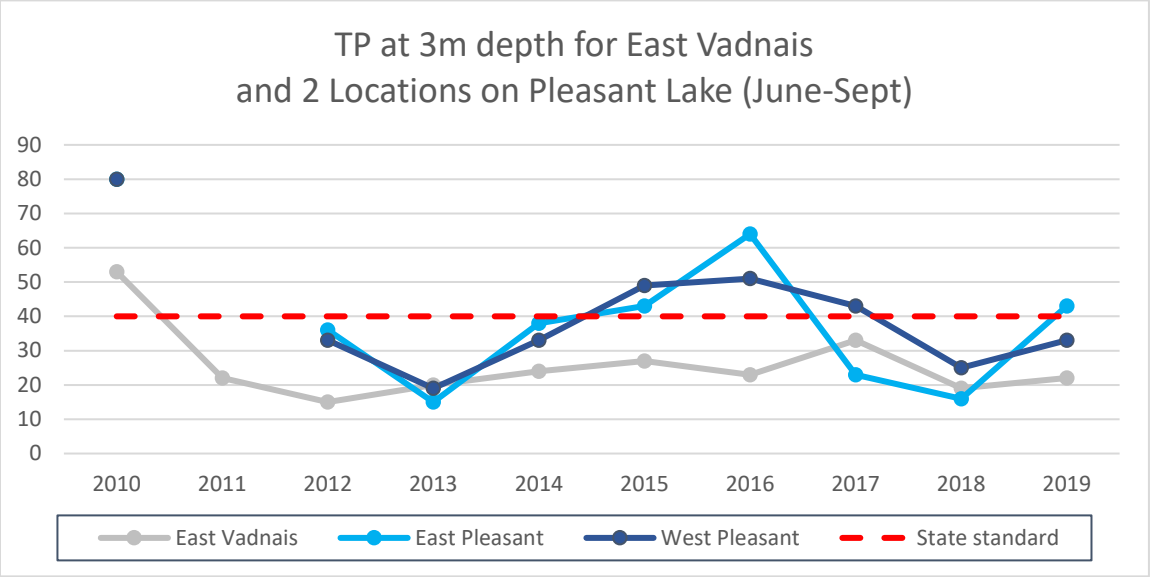


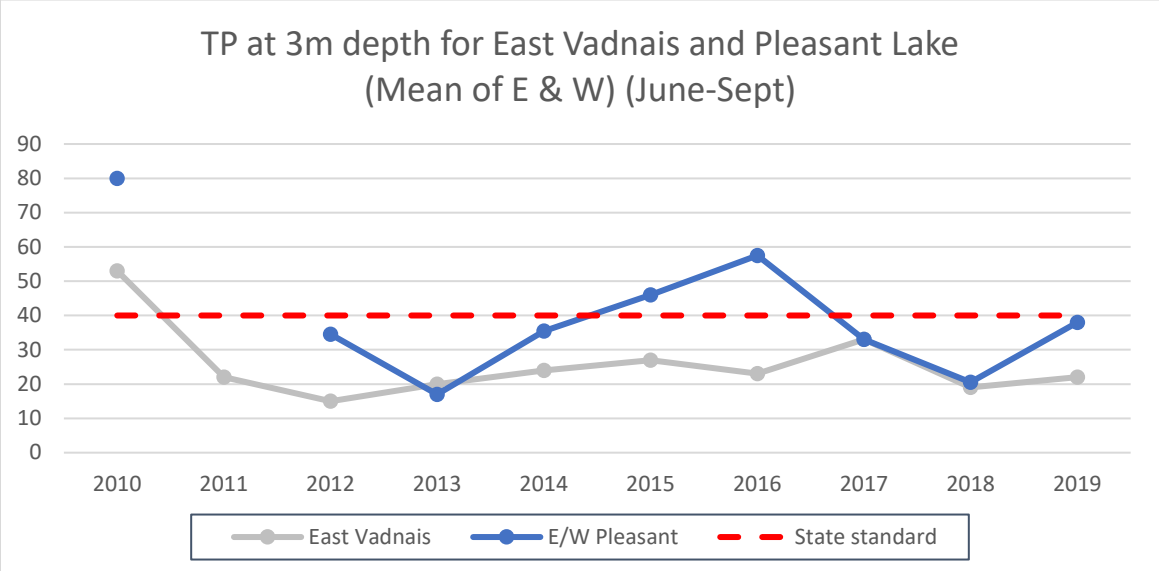
SPRWS treatment techniques changed over the course of the monitoring time period (2008-2019). Aeration systems (Hypolimnetic Aeration/HA) were in place on East Vadnais Lake from 1987-2010. There was a 1-year gap between when the HA system was stopped and the liquid oxygenation system (Hypolimnetic oxygenation/HO) began. The HO system has been running continuously at 2 locations on East Vadnais since it was installed. The 1-year gap on East Vadnais was 2010-2011. On Pleasant Lake, the gap was longer. It was 7 years, from 2006-2013. Pleasant Lake had HA in place from 1994-2006. HO began in 2 locations on the lake in 2013 and has been running continuously since, except for several days in Jan. and Feb. of 2019 when ice built up on the vaporizer.

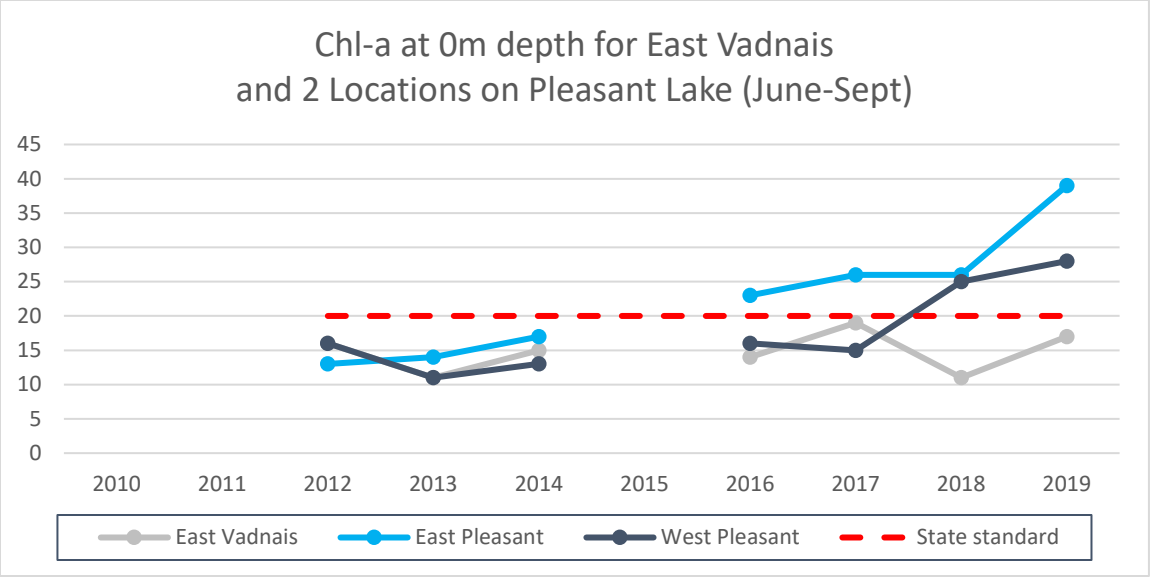
Hypolimnetic aeration (HA):
Pleasant: 1994 – 2006
Vadnais: 1987 - 2010

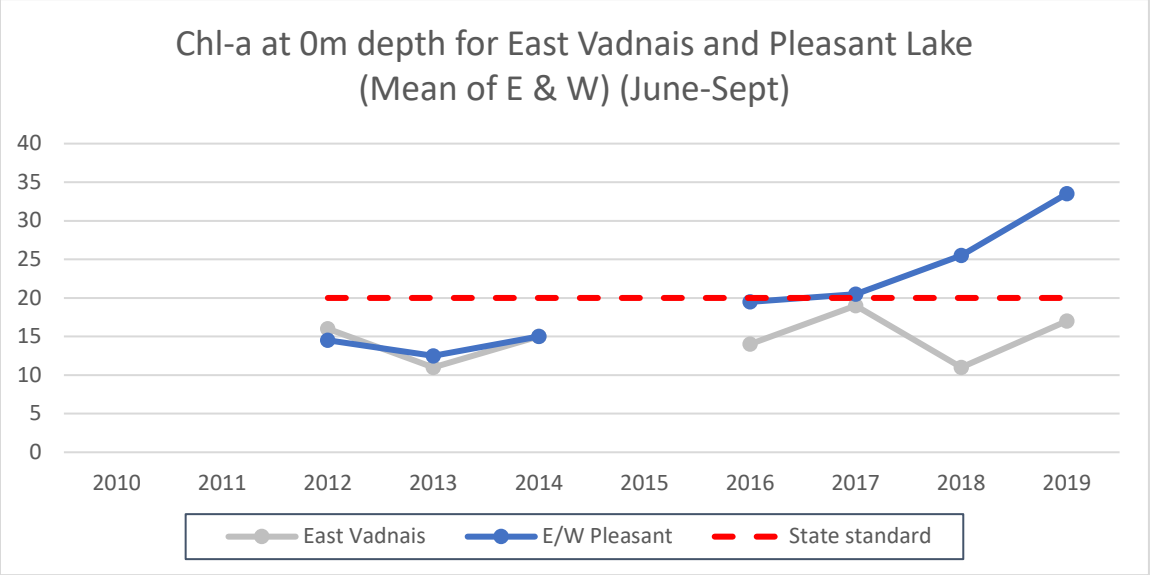
Hypolimnetic oxygenation (HO):
Pleasant: 2013 – Present
Vadnais: 2011 - Present

MPCA lists waterbodies based on measurements collected during the monitoring season (defined as June-Sept). To compare what is happening on East Vadnais and Pleasant Lake with regard to potential listing, only data collected during June-Sept are shown for East Vadnais and East and West Pleasant. Insufficient data were available during 2011 on Pleasant Lake.

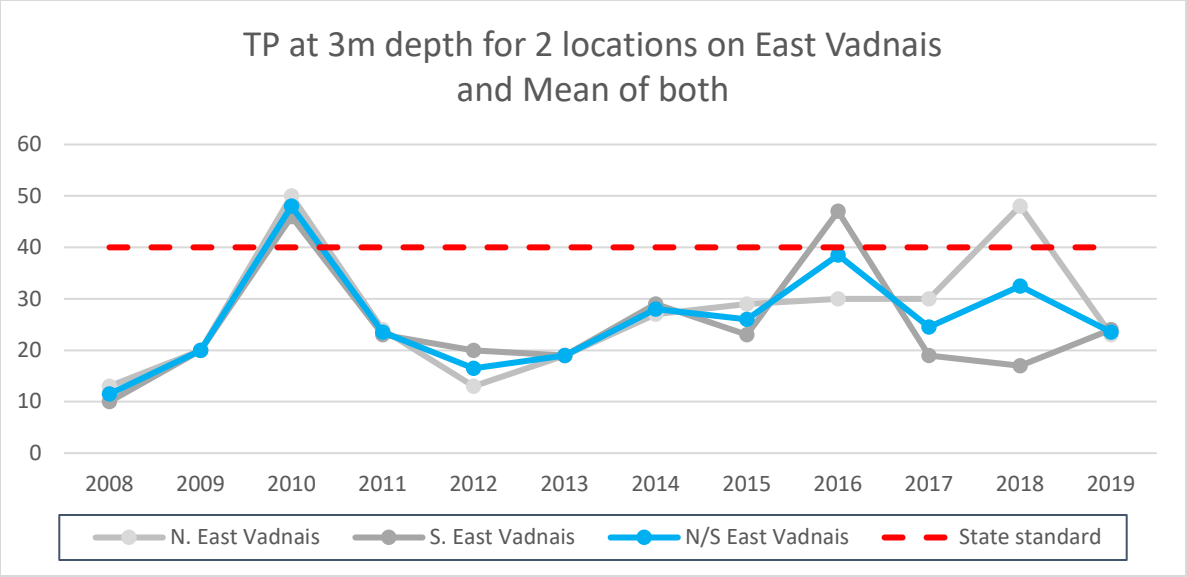


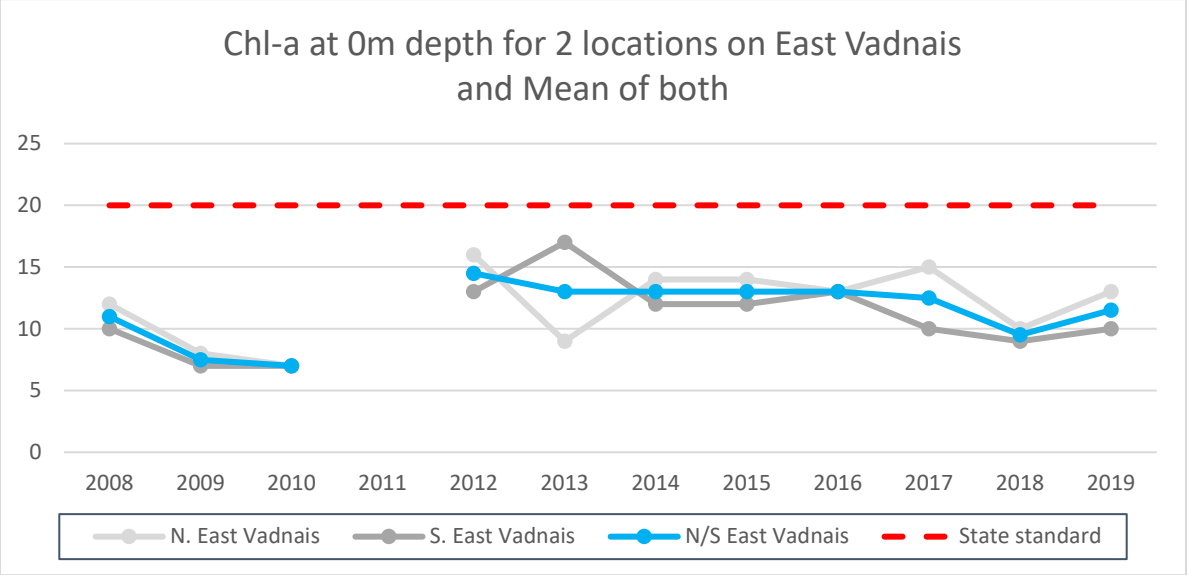






The graphs so far only used data from North East Vadnais. North and South East Vadnais are both sampled. To better understand changes through time on East Vadnais, the graphs below show comparisons between N/S East Vadnais and the mean measurement for the lake including both sampling locations.





These graphs are interesting because there is a high point in TP during 2010-2011 when the oxygenation system was switched, during the time that no system was running. There are also high points when the iron treatment was low in 2016 and 2018. The mean TP level only exceeded the State standard in 2010. Chlorophyll-a has not exceeded the State standard during the measurement period (2008-2019).