

Pelican Lake

From 2007 to 2021, all three lake sites (see graphic below) were monitored. Site 206 in the middle of the lake has been monitored since 1996.

Site 205 (Fairhills Bay) has the highest phosphorus concentration over the long term, which makes sense because the Pelican River is the largest contributor of phosphorus to Pelican Lake. Stream monitoring since 2001 has shown that the Pelican River contributes 64% of the total stream phosphorus loading into Pelican Lake. The Pelican River enters Pelican Lake on the east end. The best water quality in the lake was at site 206 in the middle of the lake. This makes sense because this site is the furthest from any stream inputs. At site 201 the Spring Creek and Bob Creek inlets carry nutrients and sediment into the lake from the west side, but combined, they only contribute 35% of the stream phosphorus loading into Pelican Lake.

In 2021 site 206 in the middle of the lake had the highest phosphorus concentration. Even though we would have expected the increase in total phosphorus we observed to also increase the chlorophyll-a, the sample results show the chlorophyll-a concentrations actually stayed almost the same. In 2021 all the sites on Pelican Lake had secchi measurements very close to the long term average.



Figure 1. Pelican Lake monitoring site comparisons in phosphorus concentration.

Trends: Pelican Lake (Site 206)

- Total Phosphorus: No significant trend exists.
- Chlorophyll a (algae): Chlorophyll a concentration is decreasing, which indicates improving water quality.
- Secchi Depth (clarity): Secchi depth is increasing, which indicates improving water quality.

Table 1. Pelican Lake Total Phosphorus results from 1996-2021.

Parameters	1996-2020		2007-2020		2007-2020	
	Site 206	Site 206	Site 201	Site 201	Site 205	Site 205
Total Phosphorus Mean (ug/L):	15	13.8	14.8	13.6	14.8	14.6
Chlorophyll-a Mean (ug/L):	4.2	1.2	4.2	2.2	4.2	2
Secchi Depth Mean (ft):	15.3	16.5	15.7	16	15.7	15.8

Little Pelican Lake

Little Pelican Lake has been monitored at Site 202 from 2003 to 2021, and has an average total phosphorus concentration of 23.6 ug/L. This is higher than the phosphorus levels in Big Pelican Lake. The phosphorus in Little Pelican Lake comes from the Pelican River, so any phosphorus loading upstream in Detroit Lakes eventually goes into Little Pelican Lake.



Little Pelican Lake is considered a shallow lake; therefore, it has different dynamics than Pelican, Bass and Fish lakes. Most of the lake is less than 15 feet deep, which means that the sunlight can reach the bottom and plants can grow in the entire lake. It is important to preserve the aquatic plants in Little Pelican to take up the nutrients in the lake and stabilize the lake sediments.

The 2021 lake monitoring season results were similar to historical averages. Trend analysis now shows stable phosphorus concentrations. The phosphorus in Little Pelican mostly comes from upstream, so improvements implemented at the Detroit Lakes Wastewater Treatment Plant should benefit Little Pelican Lake in future years.

Trends:

Years monitored: 2003-2021

Total Phosphorus:	No significant trend.
Chlorophyll a (algae):	Chlorophyll a (algae) is decreasing, which indicates improving water quality.
Secchi Depth (clarity):	Secchi depth is increasing, which indicates improving water quality.

Table 2. Little Pelican Lake historical data, 2003-2021.

Parameters	Historical Site 202	2021 Site 202
Total Phosphorus Mean (ug/L):	23.6	23.6
Chlorophyll-a Mean (ug/L):	8.5	4.2
Secchi Depth Mean (ft):	9	10.7

Fish Lake

Fish Lake has been monitored from 2003 to 2021 at site 201. Fish Lake has the best water quality in the Pelican Group of Lakes. One reason for this is that it does not have a direct stream inlet discharging into it. Pelican Lake is attached, but the phosphorus in that water is already filtered by the time it reaches Fish Lake.

The south bay of Fish Lake (Echo Bay) is some of the only shoreline in the Pelican Group of Lakes that is still undeveloped. It is not sandy, but is lined with reeds and cattails, which make excellent habitat for aquatic animals and fish.

Due to a proposed development project in this area a few years ago, site 202 was monitored in 2007-2008 to get a good picture of baseline water quality. Since then, this development has fallen through, but now we have baseline conditions to compare in case this area ever gets developed in the future. This site was once again monitored in 2015 and again in 2017. This is the area now proposed for a County Park.



The results from the 2021 lake monitoring season indicate that the water quality is staying fairly stable in comparison to the historical average. Considering all the data water clarity is still considered to be improving. Nutrient levels observed in 2021 in Fish Lake were the highest summer average level for the entire period of record. The drought conditions may have affected water quality observations in 2021.

Trends:

Total Phosphorus: No trend
 Chlorophyll a (algae): Chlorophyll a concentration is decreasing, which indicates improving water quality.
 Secchi Depth (clarity): Secchi depth is increasing, which indicates improving water quality.

Parameters	Historical Site 201	2021 Site 201
Total Phosphorus Mean (ug/L):	11.9	15.2
Chlorophyll-a Mean (ug/L):	3.3	2.2
Secchi Depth Mean (ft):	15.5	17.6

Bass Lake

Bass Lake total phosphorus concentration at Site 201 has been monitored from 2003 to 2021. It has an average of 16.8 ug/L. Bass Lake has nutrient levels similar to those in Big Pelican Lake and higher than the phosphorus levels in Fish Lake.

Bass Lake has no direct inlets and outlets, just a connection with Fish Lake that doesn't show much flow of water either direction. Because of its isolation and small surface area, Bass Lake is more susceptible to impacts occurring on the shoreline of the lake such as adding impervious surface, adding artificial sand beaches, and removing aquatic plants.

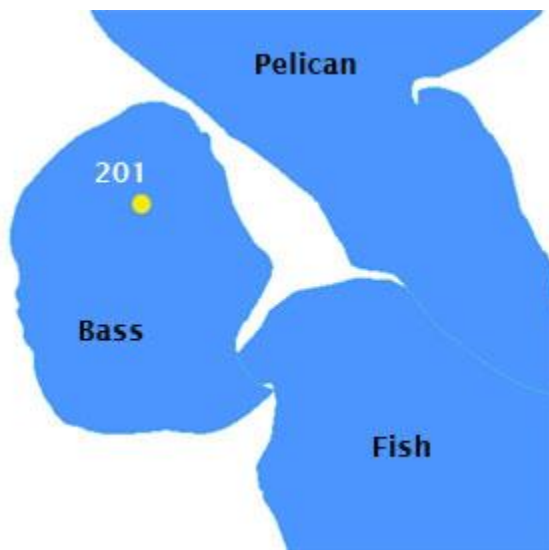
The 2021 lake monitoring season indicates stable water clarity and decreasing chlorophyll-a concentrations in comparison to the historical average. This is due to zebra mussels filtering the water, capturing the algae and other particles, and depositing them on the shallow lake bottom.

Trends:

Years monitored:2003-2021

Total Phosphorus: No trend
 Chlorophyll a (algae): Chlorophyll a concentration is decreasing, which indicates improving water quality.
 Secchi Depth (clarity): Secchi depth is increasing, which indicates improving water quality.

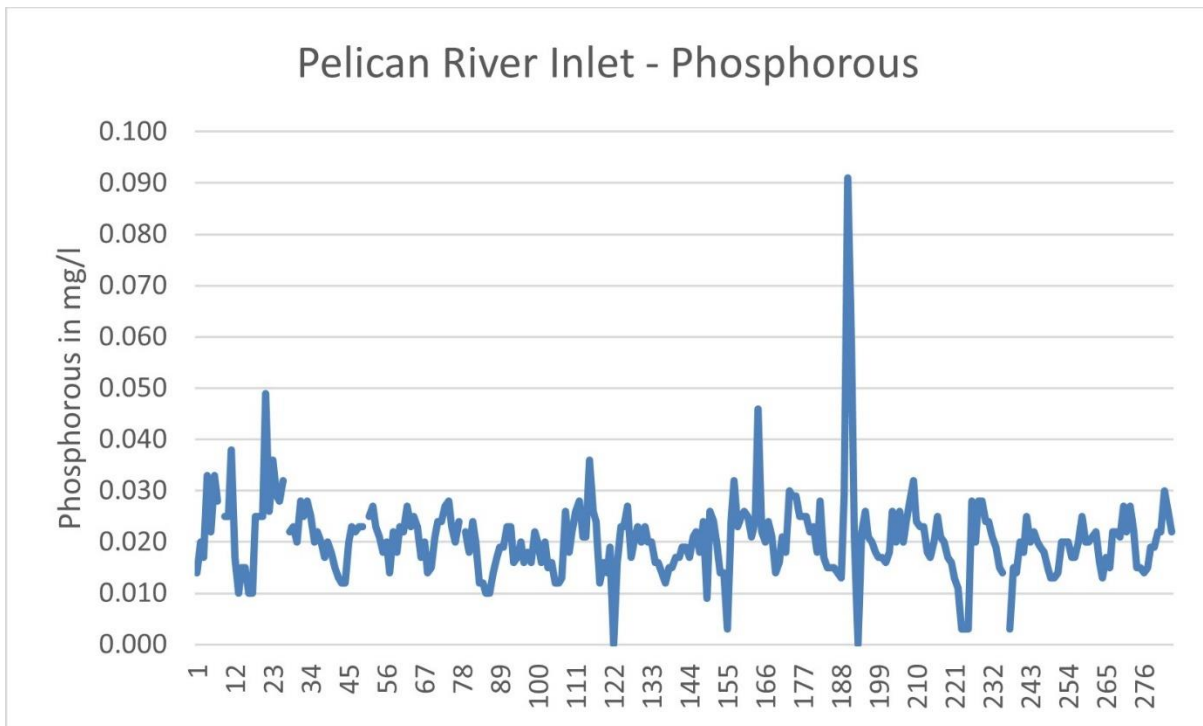
Parameters	Historical Site 201	2021 Site 201
Total Phosphorus Mean (ug/L):	16.8	16.6
Chlorophyll-a Mean (ug/L):	4.5	1.6
Secchi Depth Mean (ft):	12.7	16.4

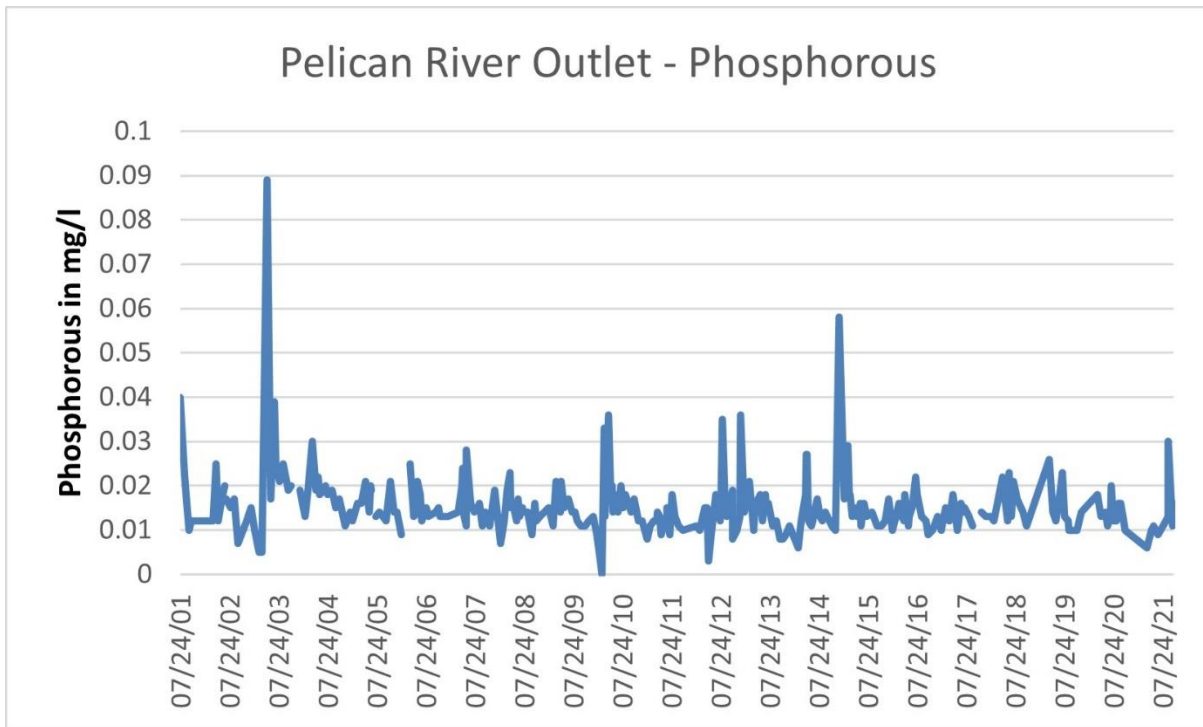


Streams

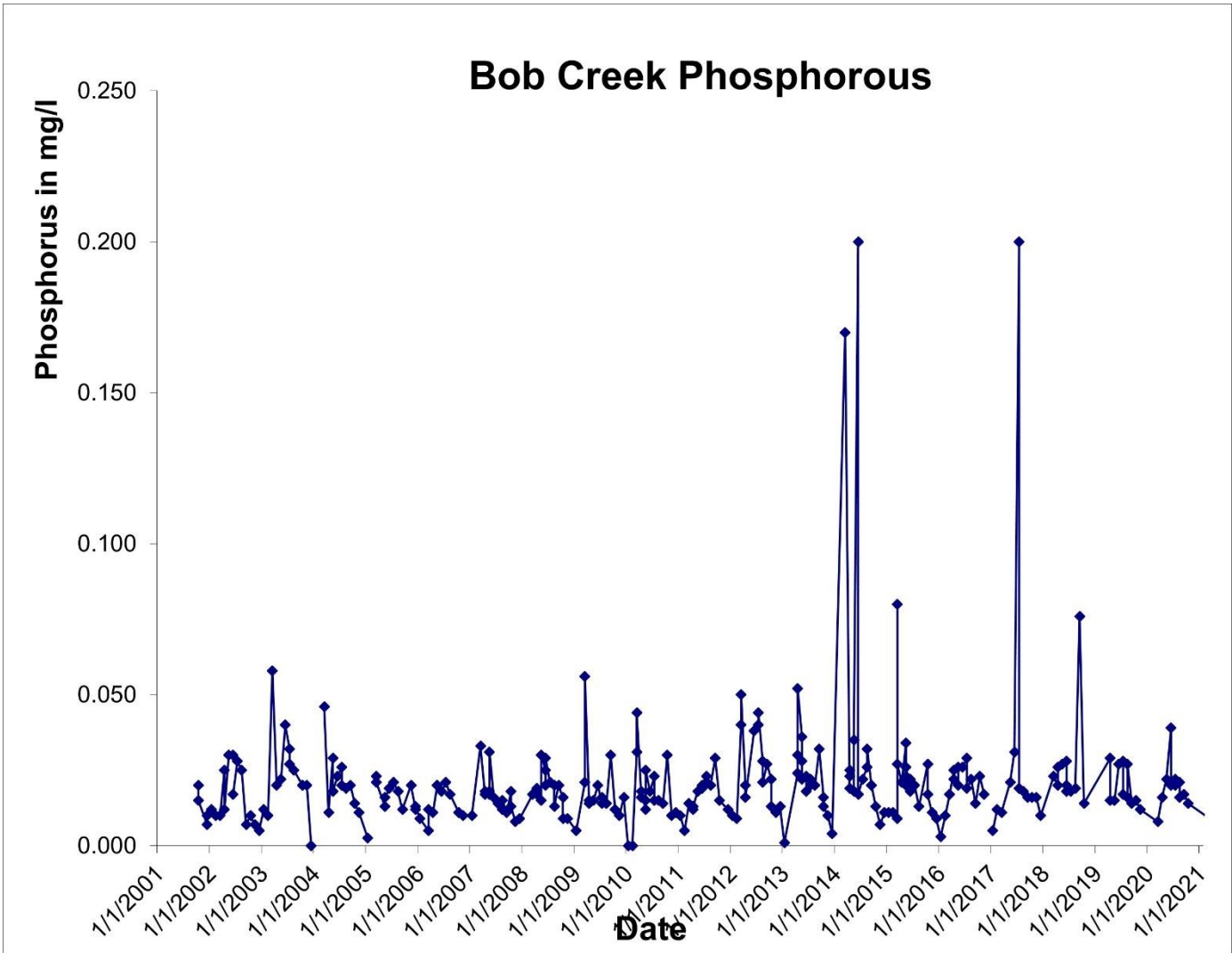
In 2021 stream flows were much below normal due to the drought conditions. At times the Pelican River was more than a foot below normal and flows were reduced to a trickle. These conditions may have impacted water quality results but all observations were within the range of those normally observed.

Nutrient and sediment levels observed in the Pelican River above the inlet to Little Pelican Lake have been very consistent over the dataset. Normally ranging from 0.015 to 0.03 which is clean river water. I was unable to get the date axis to display correctly, my apologies. Each number corresponds to a year with 1=2001 and 276=2021. The average nutrient level in the incoming Pelican River water has not declined.

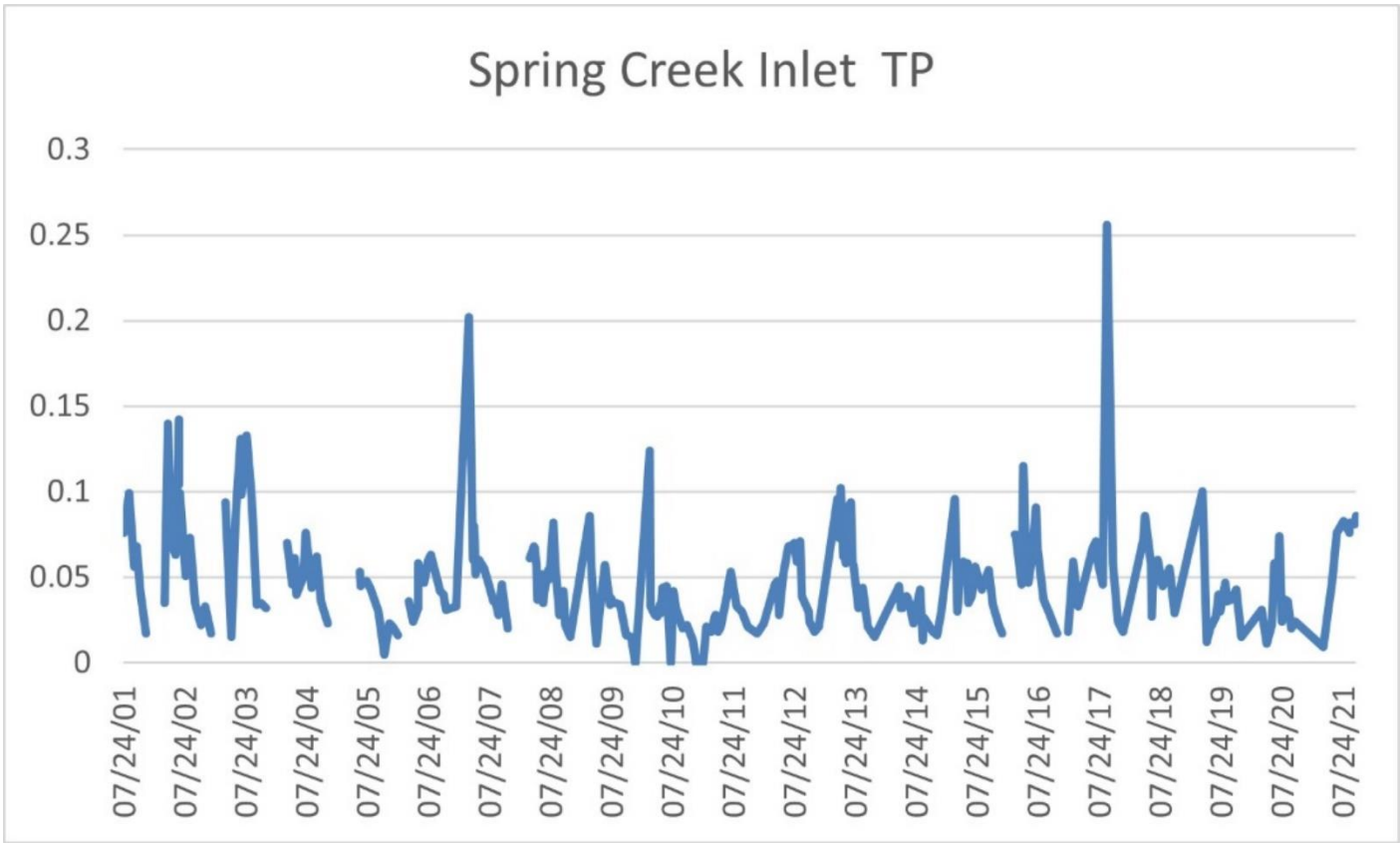




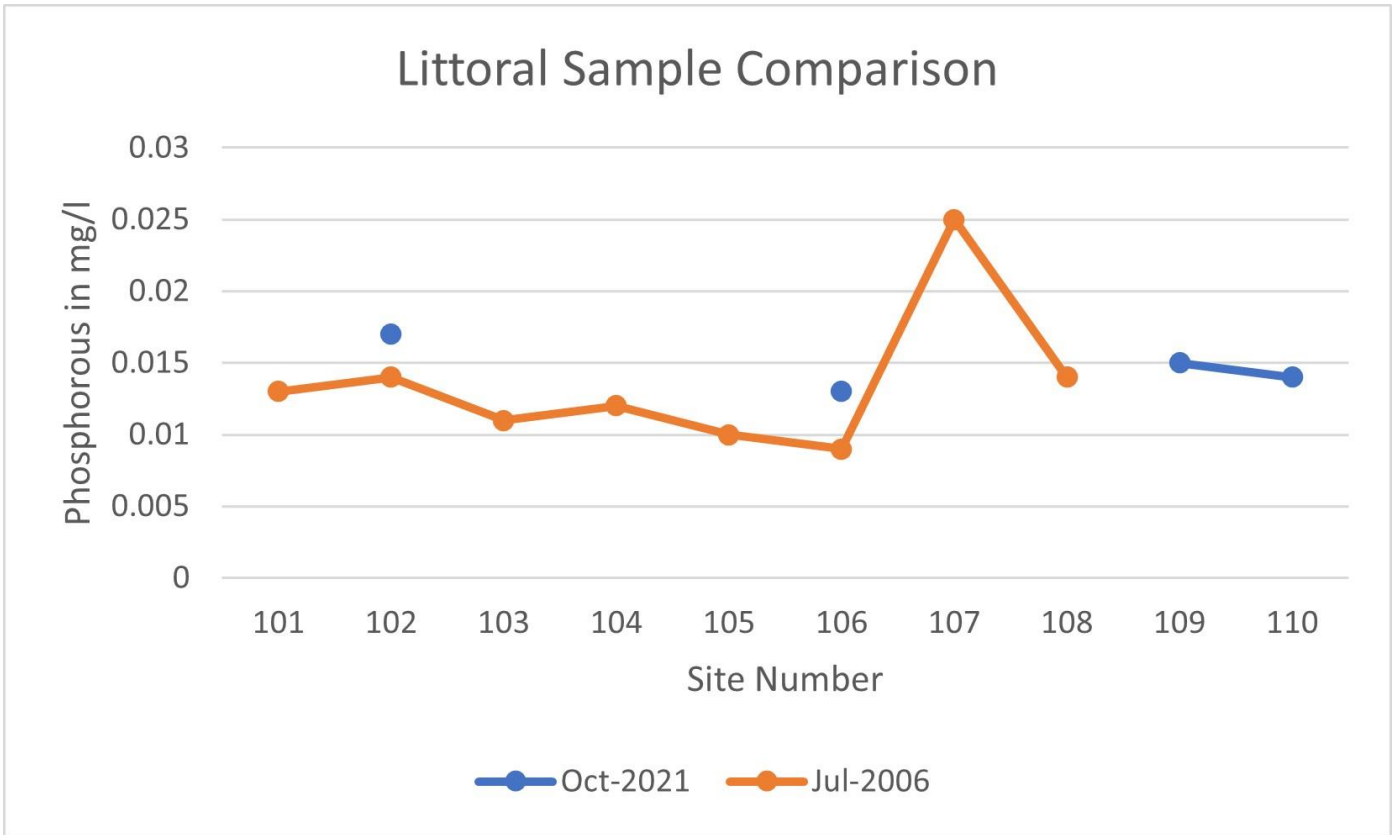
The Pelican River outlet had lower nutrient levels in 2021 compared to previous years. The very low flows likely contributed to the observed low levels of nutrients. However, since 2014 the nutrient levels in the outflowing water have been about 10% lower than levels observed between 2004 and 2010.



Bob Creek enters Pelican Lake on the west end. Nutrient levels in Bob Creek are slightly higher than the Pelican River but still almost entirely below 0.05 mg/l. Bob Creek flows quite consistently and likely carries spring water draining from the hills to the west. Bob Creek supplies less than 10% of Pelican Lake’s annual water supply.



The Spring Creek samples had higher levels of nutrients in 2021 compared to the most recent years. The observed nutrient levels were slightly above the historical average which is over 0.05 mg/l. Flow from Spring Creek declined in mid-summer but rebounded by September in contrast with the Pelican River which stayed very low. Spring Creek supplies about 20% of Pelican Lake’s annual water supply.



Littoral means that part of the lake that supports plant growth. In Minnesota samples taken from the littoral zone have shown significant variation from lake to lake, corresponding well with the observed fertility indicators. Within a lake the littoral nutrient levels are quite consistent, as can be seen above, with widely spaced sample sites returning similar results for each sample date. The observed nutrient level moves up and down within the range of levels for that particular lake. Some Minnesota lakes have seen increasing levels of nutrients in the littoral zone with levels ranging higher over time.

There is only enough littoral zone data on the Pelican Lake to make general conclusions. None of the samples had excessive levels of nutrients. One note is that near shore nutrient levels do not appear to have declined after zebra mussel infestation while off shore nutrient levels have declined.