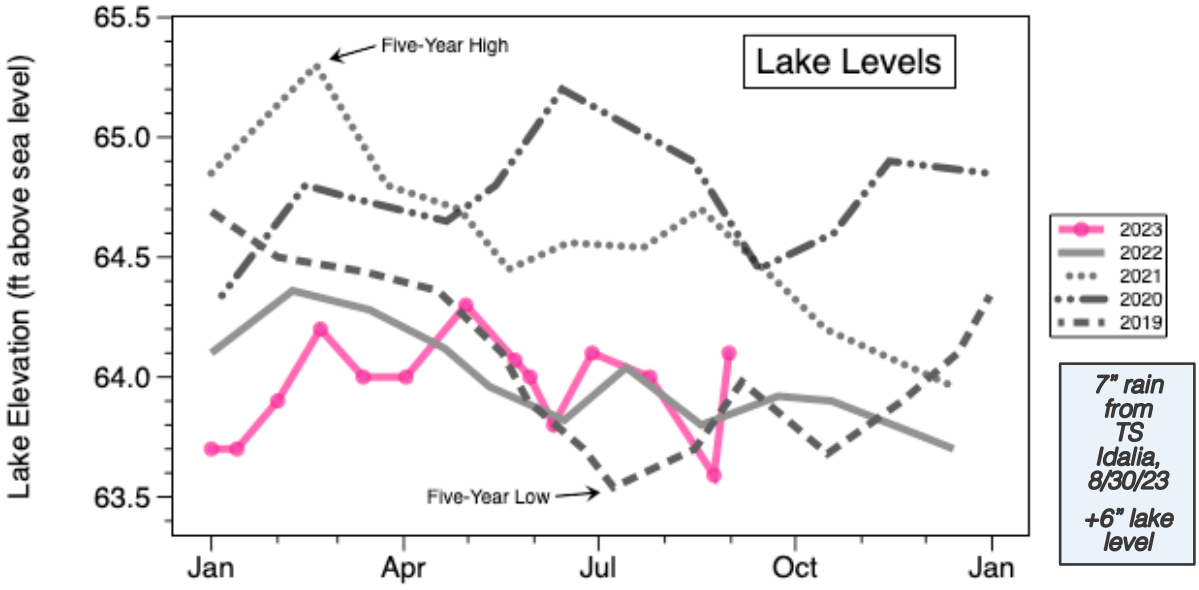
Report to White Lake Town Board
September 2023

Diane Lauritsen, Ph.D.
LIMNOSCIENCES



Annual Lake Elevations, High, Low, and Mean High-Water Level

2019 High (January 25): 64.6 Ft NAVD 88
2020 High (June 16): 65.2 Ft NAVD 88
2021 High (February 19): 65.3 Ft NAVD 88
2022 High (January 17): 64.3 Ft NAVD 88
2023 High (April 24): 64.3 Ft NAVD 88*

2019 Low (July 9): 63.5 Ft NAVD 88
2020 Low (January 1): 64.3 Ft NAVD 88
2021 Low (November 29): 63.9 Ft NAVD 88
2022 Low (May, Oct-Dec.): 63.7 Ft NAVD 88
2023 Low (August 28): 63.6 Ft NAVD 88*

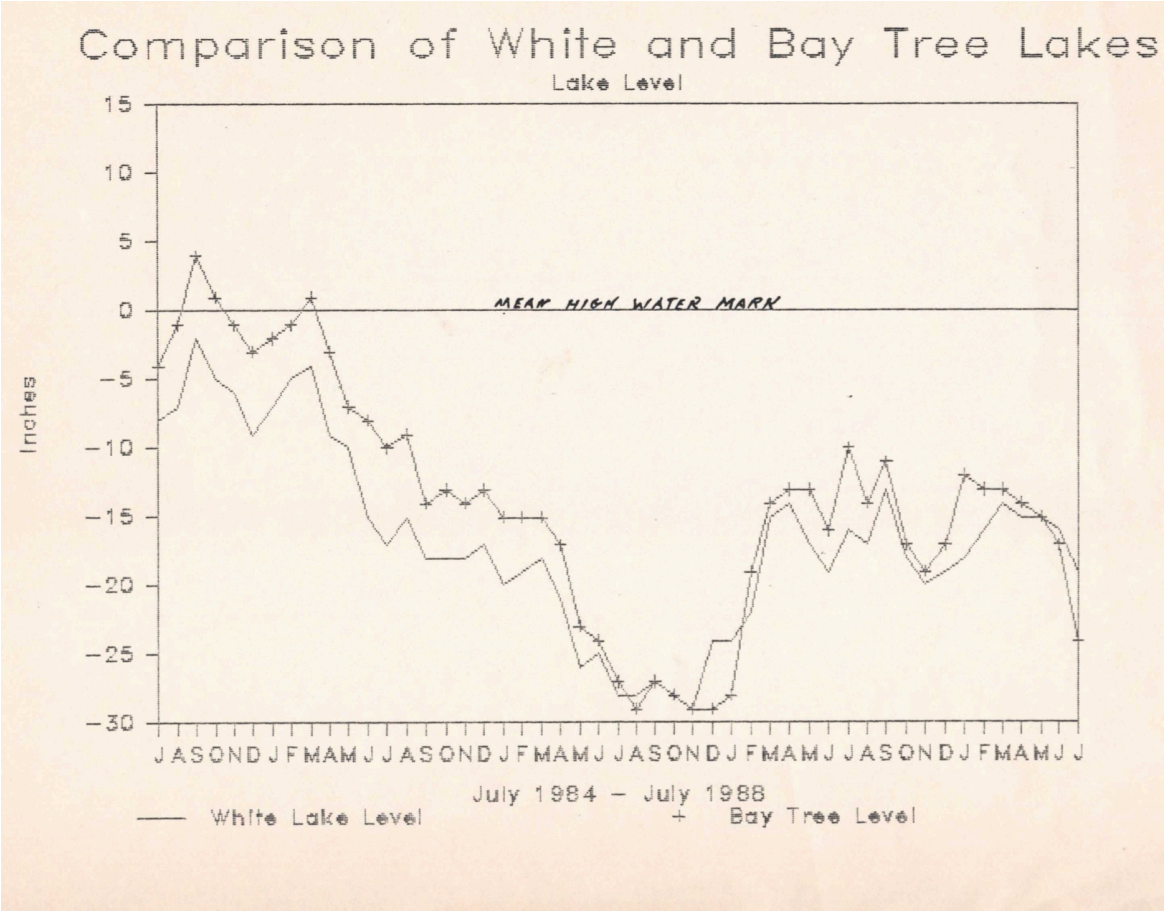
2019 Lake Level Variation (High to Low): 12.7 Inches
2020 Lake Level Variation (High to Low): 10.3 Inches
2021 Lake Level Variation (High to Low): 16.8 Inches
2022 Lake Level Variation (High to Low): 7.2 Inches
2023 Lake Level Variation (High to Low): 8.4 inches*

Variation (Highest-Lowest) Over the Five-Year Period 2019-2023: 21.1 Inches
Five-Year Mean High-Water Level: 64.74 Feet NAVD 88*

**2023 data through August 31, 2023*

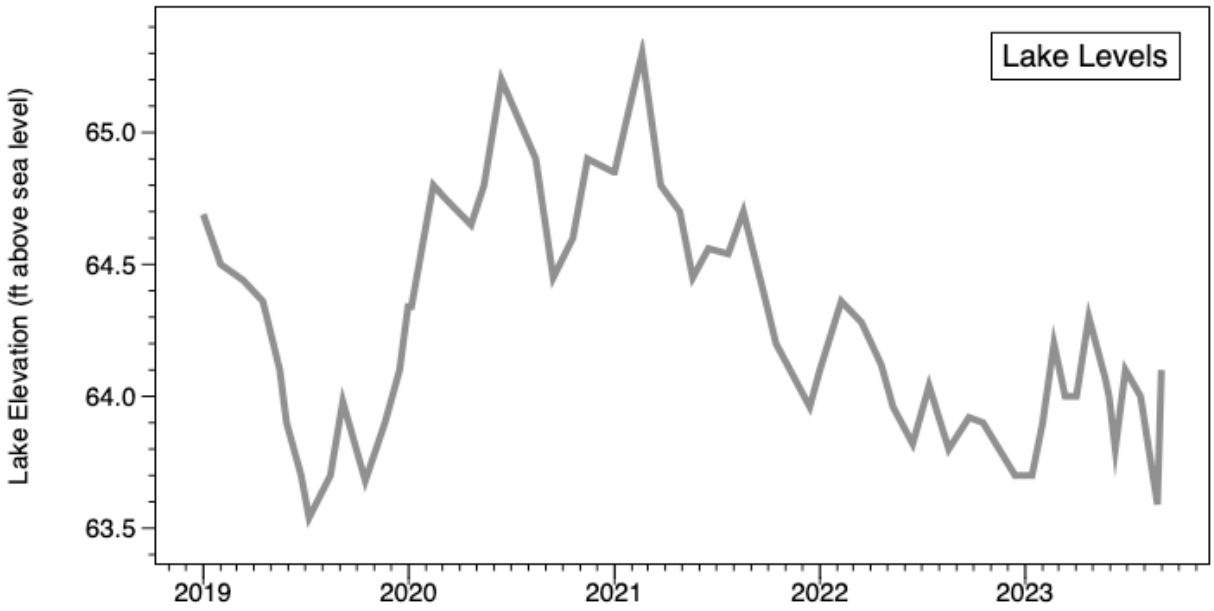
Lake Level Changes in White Lake and Bay Tree Lake, July 1984 to July 1988

Total Variation in White Lake ≈ 25 inches



Lake Level Changes in White Lake, December 2019 to August 2023

Total Variation = 21.1 inches



The following memo was sent out last year:

MEMO

TO: Sean Martin, Town Administrator, Goldston Womble, Mayor
CC: Lane Garner, Singletary Lake Superintendent, NCDPR
FROM: Diane Lauritsen, LIMNOSCIENCES

DATE: September 24, 2022

It would be most helpful if the town could provide the manpower to rake up and remove the organic material and sediments that have accumulated in places around the lake. The town has in the past provided the manpower to remove accumulations of decomposing vegetation, and this is an item that could be budgeted for on an annual basis. As you know, the need for this will be ongoing, and if the town assumes responsibility for removal, it could avoid situations where property owners are trying to do things in the lake that are not permitted.

If it would be possible to coordinate with volunteers and the lake clean up on October 8, all the better. Raking up the material before picking it up would allow it to dry out so that the volume and weight is reduced. This could be an answer to the question of "what is being done".

If a Stewardship Committee has been created, it would be good to report on what it is doing, as that is something that is lacking at the White Lake Watch web site.

During low water levels in August of this year the "mess" on the beach at Lake Place/Nathan's Cove was drying out nicely, making it easy to pick up and remove, so it bears repeating that it would be helpful to do this routinely. An inflatable berm was placed in the water at Nathan's Cove, but it appears to have little benefit.

Comparing Historical and Recent Water Quality Data from White Lake

A survey of lakes and reservoirs in North Carolina was conducted in 1974-75, providing a snapshot of nutrient levels and lake productivity at that time (Weiss and Kuenzler [1976] includes White Lake data from February and June 1974). What has changed over time at White Lake is the pH (which is higher due to the change in rainfall pH), nitrogen levels (which are higher due primarily to atmospheric deposition of nitrogen), and the change in the dominant form of phosphorus (the acidic Bay lakes had relatively high ratios of soluble phosphorus to total phosphorus, which is no longer the case at White Lake).

White Lake Monitoring Data Collected in June, From 1974 to 2023

	1974	2003	2013	2017	2018	2019	2020	2021	2022	2023
Mean Temperature (C)	26.1	27.6	27.5	28.6	30.2	29.0	27.5	28	29.6	28.3
Mean Secchi Depth (m)	>3.0	2.6	2.8	1.2	1.75	>3.0	1.25	1.25	1.25	1.6
Mean Chlorophyll a (µg/L)	13*	5	2.5	10.7	8	5.5	6.4	9.4 (7.5)	3.4 (6.2)	8.3(13)
pH Range (std. units)	4.6	4.2	6.0-6.8	6.5-7.4	6.6-7.3	6.2-6.7	7.1-7.3	6.8-7.0	6.7-6.9	6.7-7.2
Mean Dissolved Oxygen (mg/L)	8.6	8.0	7.0	7.3	7.6	7.9	8.6	7.8	8.1	8.8
Mean Total Nitrogen (mg/L)	0.211	0.11	0.39	0.68	0.50	0.481	0.757	0.870	0.745	0.768
Mean NO3-NO2 (mg/L)	0.011			<0.02	<0.02	<0.010	0.013	<0.010	<0.010	<0.010
Mean NH3-NH4 (mg/L)	0.038			<0.02			0.006	0.014	0.010	<0.010
Mean Total Phosphorus (mg/L)	0.017	<0.02	<0.02	0.02	0.02	0.014	0.025	0.031	0.029	0.023
Mean SRP (mg/L)	0.016					<0.001	<0.001	<0.001	<0.001	0.003
TN/TP (mass)	12.4			34	25	34.4	30.3	28.1	26.0	33.4
# of Samples		3	3	7	7	6	6	6	6	6

1974 data from Weiss and Kuenzler (1976), 2003-2017 data from NC DEQ, 2018-2023 data from LIMNOSCIENCES (2018 Total Phosphorus data from NC DEQ). The 1974 chlorophyll *a* data was reported as Turner units, which is not directly comparable with the other chlorophyll *a* data; field measurements of chlorophyll *a* are included in parenthesis alongside the lab results.

A water column phosphorus-stripping alum treatment was applied to the lake May 3-16, 2018 (the green line in the table). Both nitrogen and phosphorus levels declined after the treatment, and in subsequent years the levels of total nitrogen and total phosphorus have returned to levels seen before the cyanobacterial bloom developed.

Inorganic nitrogen levels vary from month to month, and soluble reactive phosphorus increases (from non-detect to 10% of total phosphorus) during times of higher algal productivity.

Recent sampling at acidic Singletary Lake shows higher SRP/TP ratios (47% in June 2023, for example) and higher total phosphorus compared to White Lake, while total nitrogen levels are similar. Chlorophyll *a* (a measure of algal biomass) levels can be higher in Singletary Lake than in White Lake (which was the case in June 2023) although the algal community is much less diverse in Singletary. The notion that a return to acidic conditions in White Lake is possible or beneficial for clarity, has no merit.

The past six years' worth of data indicates that White Lake is on an even keel with respect to nutrient levels and phytoplankton productivity, with the same types of algae that were abundant before the cyanobacterial bloom and treatment. The alum treatment was a one-time management tool for extreme conditions, which we have not seen repeated. The floc was created by the flash mixing of two chemicals—one acidic and one basic—and this bound up much of the algae and phosphorus in the water column. This material is long gone, so the notion that stirring up the lake bottom is equivalent to another alum treatment has no merit. Boating activity that stirs up the lake bottom is suspending muddy sediments and algae, which washes ashore to create an unsightly and smelly mess.

Water clarity varies from month to month, and sometimes week to week, with the best conditions found when there is no detectable inorganic nitrogen in the water column, and little boating activity.