

Monitoring Lake Level Variability at White Lake

There are several common ways of reporting lake level highs: mean high water level is the average of all the high-water levels of a lake measured over a rolling 19-year period; ordinary high-water level is the highest level which has been maintained for a sufficient period to leave evidence upon the shoreline. High water level serves as a reference point for lakeshore property owners, and lake levels are often reported as values above or below this high-water point.

An easily accessible lake level gauge was installed in late 2018 on the Goldston's Motel Pier (eastern side of the lake, not far from Town Hall, installed by personnel from Lake Observations by Citizen Scientists and Satellites program at the University of North Carolina-Chapel Hill (www.locss.org), so it is now possible to collect regular lake level measurements. A second gauge, which reads as lake elevation (in feet) has been placed at the Turtle Cove outlet on the western side of the lake.

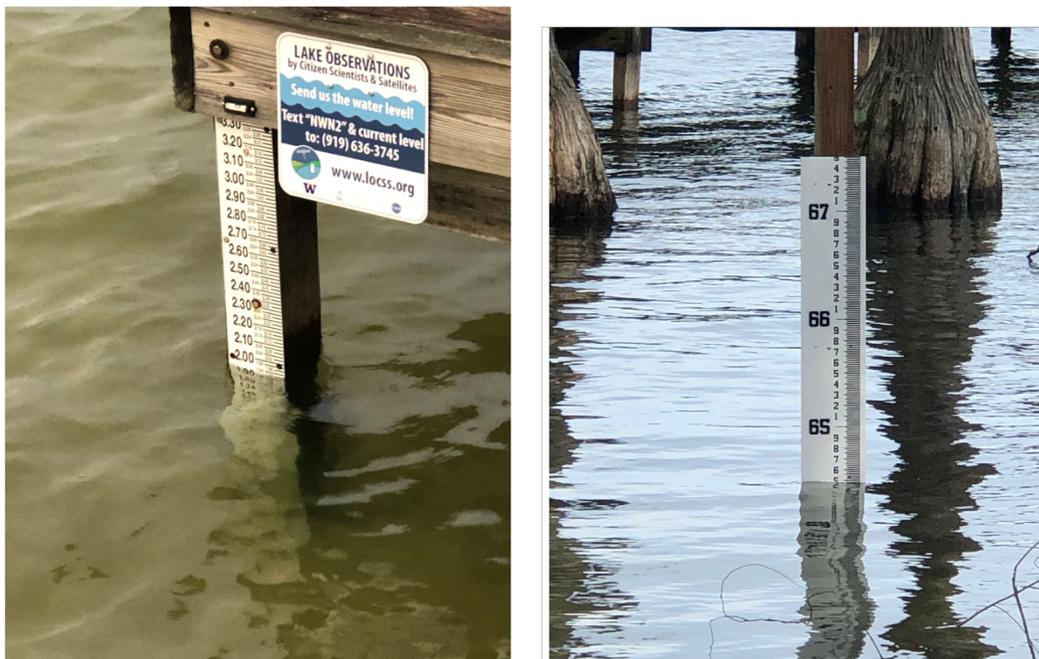


Figure LL-1. Photo on Left: Lake level gauge installed by the Lake Observations by Citizen Scientists and Satellites program, located at Goldston's Motel Pier (1608 White Lake Drive). Photo on Right: Lake elevation gauge installed by Walker Surveying Company at Turtle Cove. Elevations are given in the NAVD 88 Vertical Datum. Both photos were taken January 16, 2020.

There are different ways to measure vertical elevation; measurements taken with the commonly used Vertical Datum NAVD 88 are one foot less than measurements taken with the older NGVD 29 Datum. Walker Surveying Company measured lake elevation on December 17, 2017, at 64.5 feet (NAVD 88); a second survey measurement taken on January 16, 2020 prior to installing the elevation gauge and this elevation was also measured as 64.5 feet above sea level (NAVD 88). Total rainfall amounts in 2017 and 2019 were very similar (53.1 inches and 52.8 inches respectively) and very near the long-term average rainfall of around 50 inches (for the region and for the state), so the winter elevations of 64.5 feet reflect these relatively "normal" conditions.

Lake Stewardship Officer Steve Bunn created a table to correlate the measurements between the two gauges:

Table LL-1. Lake elevation gauge readings compared to lake level gauge readings at Goldston's Motel Pier.

Elevation Above Sea Level in Feet (NAVD 88)	Goldston's Motel Pier Gauge
66.00	3.40
65.90	3.30
65.80	3.20
65.70	3.10
65.60	3.00
65.50	2.90
65.40	2.80
65.30	2.70
65.20	2.60
65.10	2.50
65.00	2.40
64.90	2.30
64.80	2.20
64.70	2.10
64.60	2.00
64.50	1.90
64.40	1.80
64.30	1.70
64.20	1.60
64.10	1.50
64.00	1.40
63.90	1.30
63.80	1.20
63.70	1.10
63.60	1.00
63.50	0.90
63.40	0.80
63.30	0.70
63.20	0.60
63.10	0.50
63.00	0.40
62.90	0.30
62.80	0.20
62.70	0.10
62.60	
62.50	

Table LL-2. Monthly rainfall at White Lake Wastewater Treatment Plant.

Monthly Rainfall (inches) for White Lake 2012-2022

Month	2022	2021	2020	2019	2018	2017	2016	2015	2014	2013	2012	Monthly Average for Region
January	5.75	8.25	4.5	2.75	4.20	7.0	3.0	2.5	2.0	1.75	2.75	3.81
February	1.0	9.2	6.7	2.25	2.00	1.5	10.7	5.5	1.5	2.5	4.0	3.44
March	2.45	2.7	3.7	3.25	3.95	3.7	1.55	4.15	ND	1.0	7.0	3.91
April	3.75	1.75	5.1	7.25	6.75	6.75	6.75	4.55	ND	1.75	2.25	3.12
May	2.2	3.0	12.25	1.20	7.70	2.7	4.5	4.20	ND	2.25	9.25	3.67
June	6.2	7.9	7.15	5.25	10.00	4.5	3.65	8.70	3.0	17.0	2.0	4.70
July		7.5	6.85	6.00	4.75	6.75	3.75	3.0	4.65	11.25	8.6	5.75
August		6.5	7.55	5.35	6.25	5.6	4.12	9.4	9.75	8.25	9.75	5.95
September		3.2	5.95	5.00	29.45	5.2	15.0	4.7	7.0	1.0	5.0	5.29
October		0.6	3.35	3.60	2.25	2.95	14.25	9.75	1.7	1.75	2.25	3.38
November		0.4	7.5	4.90	4.25	1.0	0.50	7.25	4.15	0	2.25	3.16
December		3.4	4.25	6.00	7.5	5.45	5.1	6.5	3.7	5.75	4.25	3.14
Total		54.4	74.85	52.80	89.05	53.1	72.87	70.20		54.25	59.35	49.32
% of Lake Volume		71	97	69	116	69	95	91		70	77	64

White Lake Annual Trends in Lake Levels:

Lake Elevations in 2019

Lake level variability in 2019 was consistent with the historical pattern of winter highs and summer lows, with a rapid decline in May—5 inches—as a result of low rainfall and record-setting high temperatures at the end of that month. The total variation high (64.6 feet NAVD 88 on January 25) to low (63.54 feet NAVD 88 of July 9) was 12.7 inches, which is also consistent with historical ranges in lake levels. This variability indicates that lake depths also vary by the same magnitude, so that the summer maximum lake depth can be up to a foot less than winter depths.

Lake Elevations in 2020

Lake level trends in 2020 were the opposite of what was seen in 2019: the lowest lake levels were measured at the start of the year (64.34 feet NAVD 88), and the highest lake levels were measured in June (65.2 feet NAVD 88), after very high rainfall in May (12.25 inches). The total variation high to low was 10.3 inches, with the total variability over the two-year period 2019-2020 totaling 19.9 inches.

Lake level at the end of 2020 (64.85 feet NAVD 88) was six inches higher than at the end of 2019, with rainfall totals in 2020 1.4 times higher than 2019 rainfall levels.

Lake Elevations in 2021

Lake level at the start of 2021 was 64.85 feet NAVD 88, with the highest level, 65.3 feet, measured in February, after two rains of over 3 inches (total monthly rainfall [9.2 inches] was highest in February as well). With a total rainfall amount of one inch for October and November combined, the lake dropped to its lowest point, 63.9 feet, by the end of November. The total variation high to low was 16.8 inches.

Summary Observations:

- *Three-Year* Mean High-Water Level = 65 feet NAVD 88
- Extended periods of high rainfall are needed to sustain lake levels at or above 65 feet
- Lake levels can drop 4-5 inches in a month when the monthly rainfall amounts are very low
- The total variation in lake level (highest to lowest) over the three-year period 2019-2021 was 21.1 inches
- Monthly rainfall amounts over the three-year period 2019-2021 ranged from 0.4 inches to 12.25 inches. Total rainfall in 2020 was 1.4 times the annual average for the region, providing a volume of water equivalent to 97% of the volume of the lake.