

STUDY OF LAKE OKAHUMPKA WATER LEVEL CHANGES DURING RAIN EVENT 12/16-17/2023

A case for relocating the automatic Water Level measuring Instrument

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3/1/2024

Conclusions about Lake Okahumpka water level

Staff gauge at lake North side almost always indicates a higher level than the electronic and staff ones at the weir structure

- Higher by average of 5/8" during 'steady' times
- Higher by up to 3.8" after Dec 16-17, 2023 rainfall event

Weir drain flow from local basin at the weir is not immediately replaced from the lake as the marsh slows flow between structure gauge basin and the lake. This is why the lake gauge reads higher.

Lake water levels can be 5" higher than indicated at the gauge at the structure

Gauge hourly reading at structure has accuracy for lake level only after long periods of little rain. Time duration to reach this stability is in terms of months. The North side gauge is read once during each month as it is only a staff gauge requiring visual presence.

North gauge and Gazebo region in-water sign details reference show good water level agreement. An excel flow model of the lake is providing a good match during the period of mid Dec 2023 to near the end of Feb 2024.

A calibrated staff gauge in our canal would good for SWFWMD and the CCC community. Relocation of the electron gauge from the weirs to the Gazebo area is desirable.

Solar powered reporting water level sensor with accompanying staff gauge
- this is currently near the weirs which control the lake level



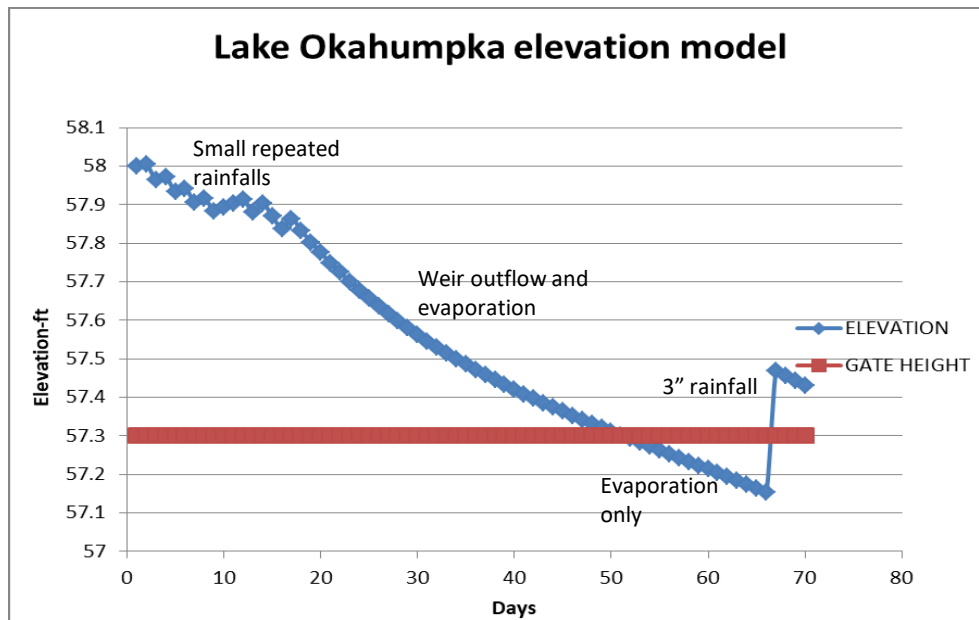
INGREDIENTS

- Electronic sending lake elevation results from gauge at weir structure
- Park Staff gauge readings (photos) provided by Richard Burr and TJ Venning (SWFWMD) and data from SWFWMD website
- Relative changes in Gazebo area canal elevation using in-water signs as reference.
- Rain accumulation data from rain gage near Hidden Lake
- Lake elevation model made for understanding effects of rainfall, weir outflow and evaporation model using excel spreadsheet

- No attempt is made here to determine proper lake level

An excel based elevation model was constructed to understanding lake level variations

- Daily iteration
- Ability to add daily rainfall, initial elevation, weir elevation
- Bernoulli equation for weir outflow calculations
- Penman Formula for evaporation calculations



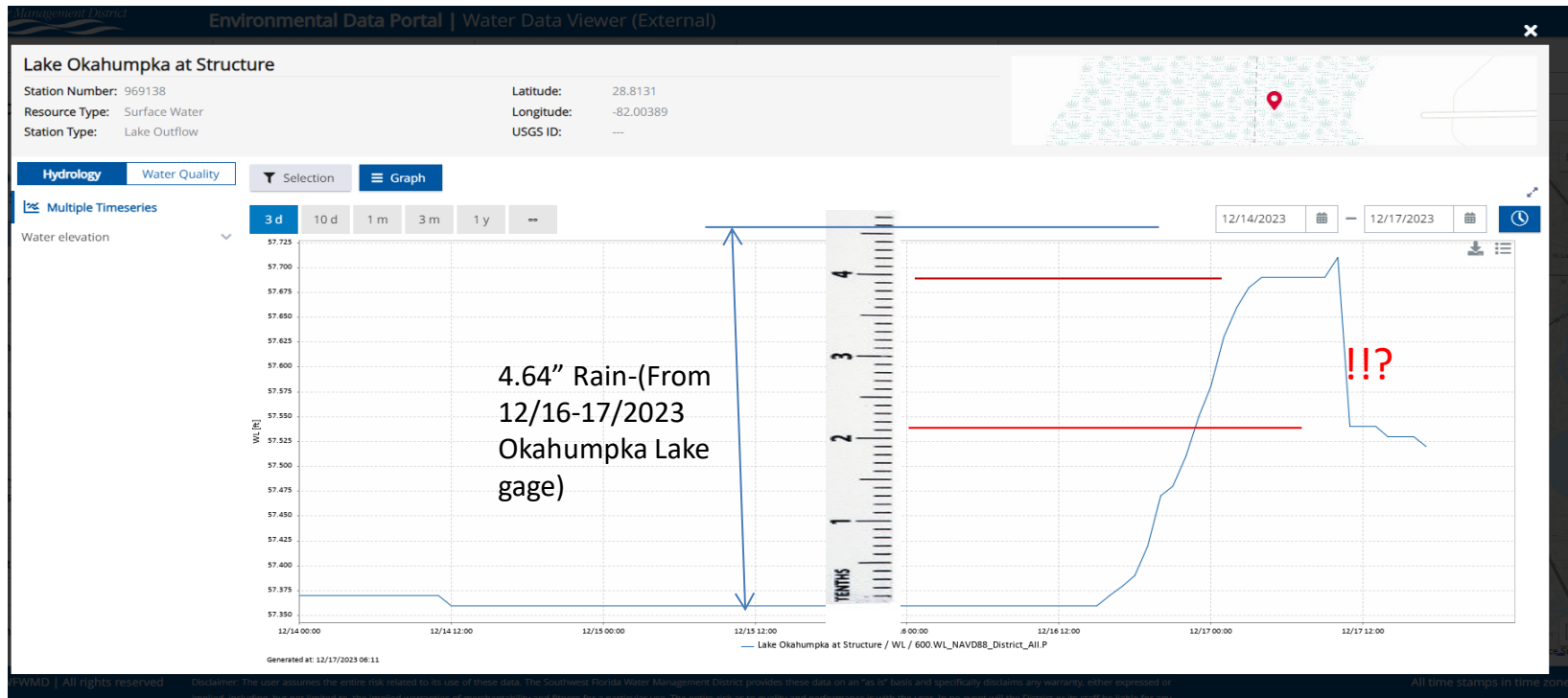
Initial elevation and Rainfall times/amounts are arbitrary variable used for illustration

Lake Okahumpka structure-located water level gage levels

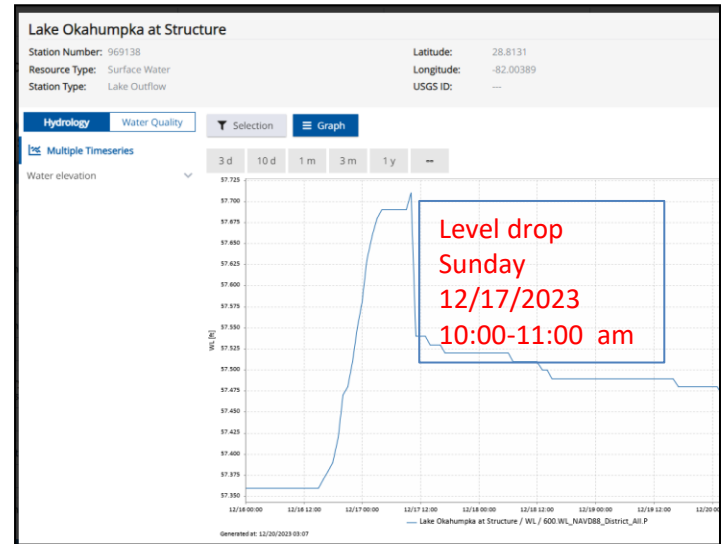
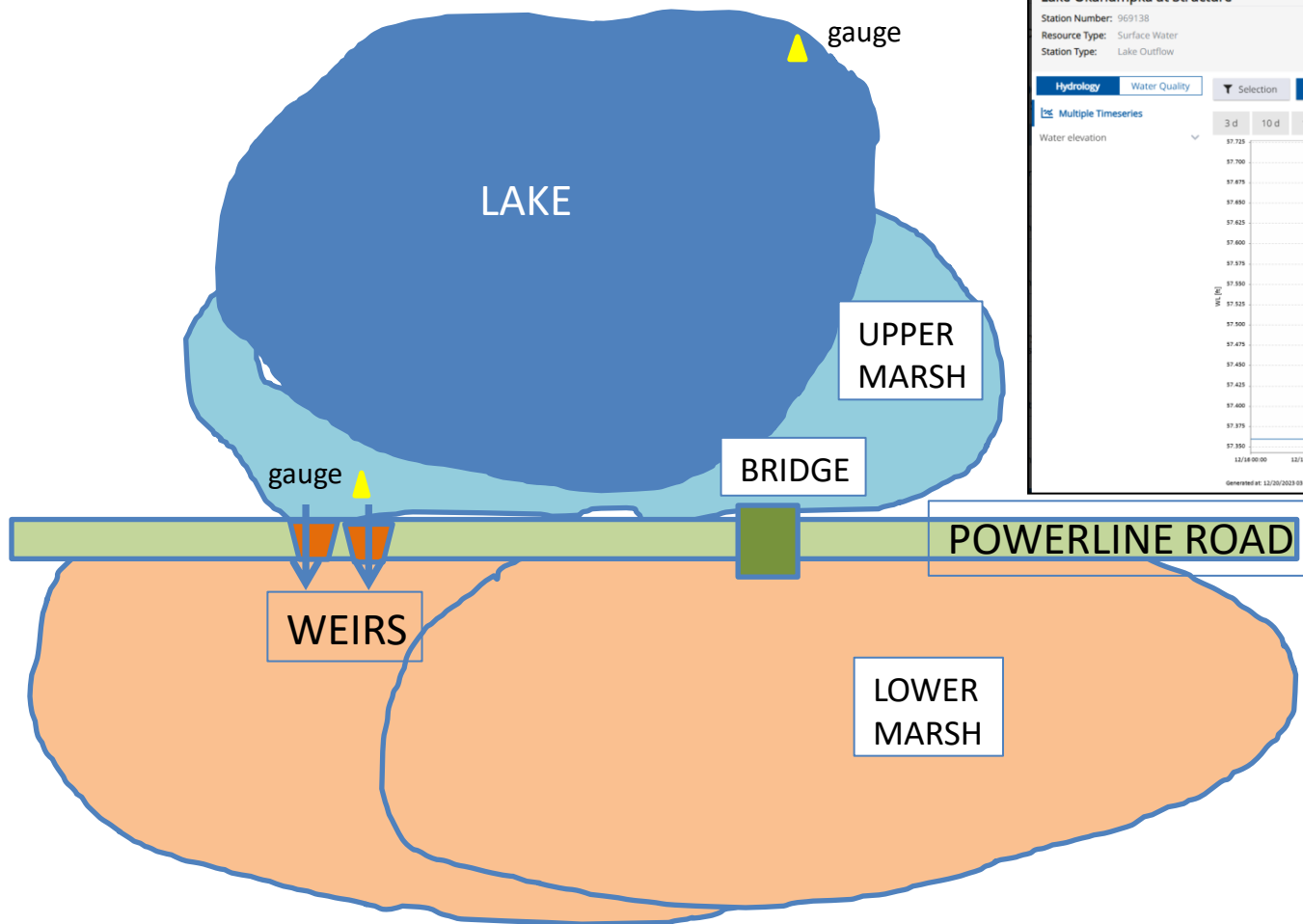
Although the water level change from the storm gage initially agreed reasonably with the rain gauge, its value precipitously dropped.

We have confidence in the Lake water level gage at the control structure based on excellent agreement between gage internet reported level and the value from the visual staff gage in photos. This from comparison of gauge report to staff gage level (photos) in the same day/hour.

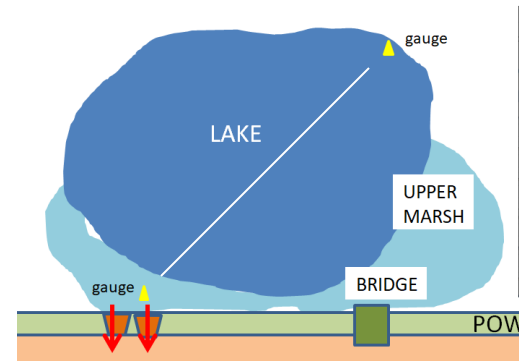
We have since learned that height boards have been removed from the weirs. The timing of the rapid drop is coincident with the boards removal.



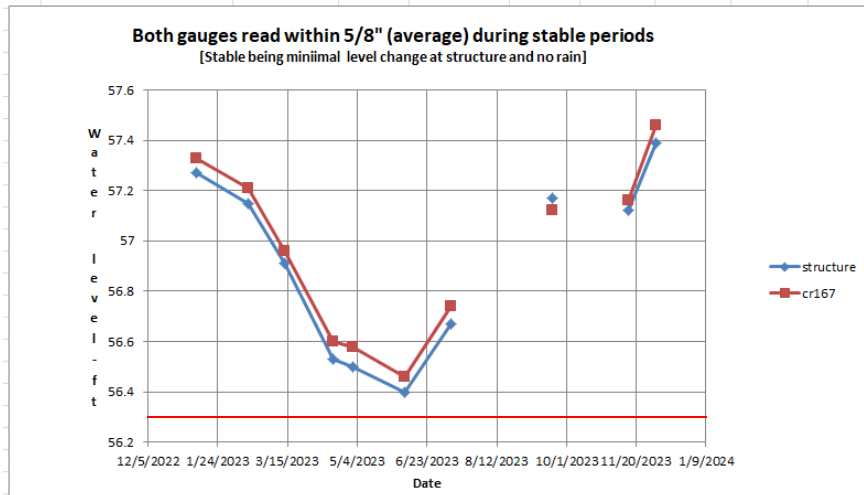
The boards were removed on Sunday morning 12/17/23, causing the rapid gage level change after that time. For that to occur without the lake dropping accordingly, the weir must be somewhat isolated from the Lake whereby there is a long lag between local weir upstream level and Lake levels. There must be restriction between the Lake and the weirs; difficult path, lake bottom ground shapes, and especially vegetation, etc.. A resulting small “basin”, in effect, near the weir might rapidly lower due to the removal of the boards. The slow movement of the water through the marsh cannot immediately replace the water gone through the weir.



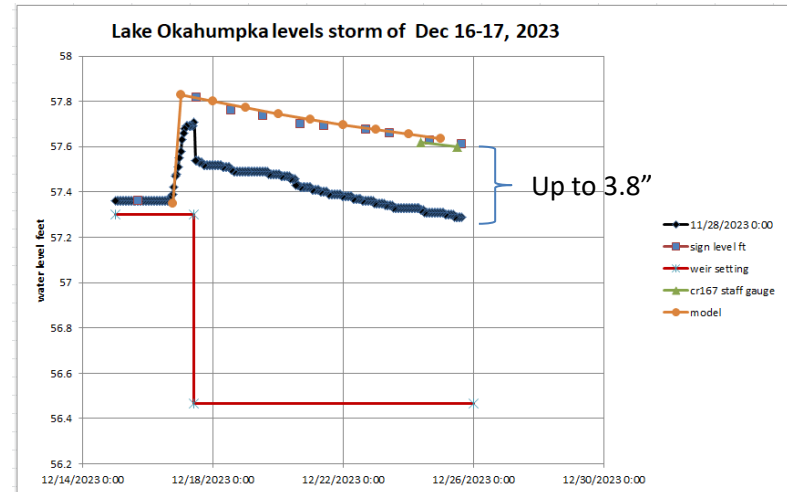
The slow movement of the water through the marsh cannot immediately replace the water gone through the weir in times of rapid level change. This can result in a large difference in gauge readings



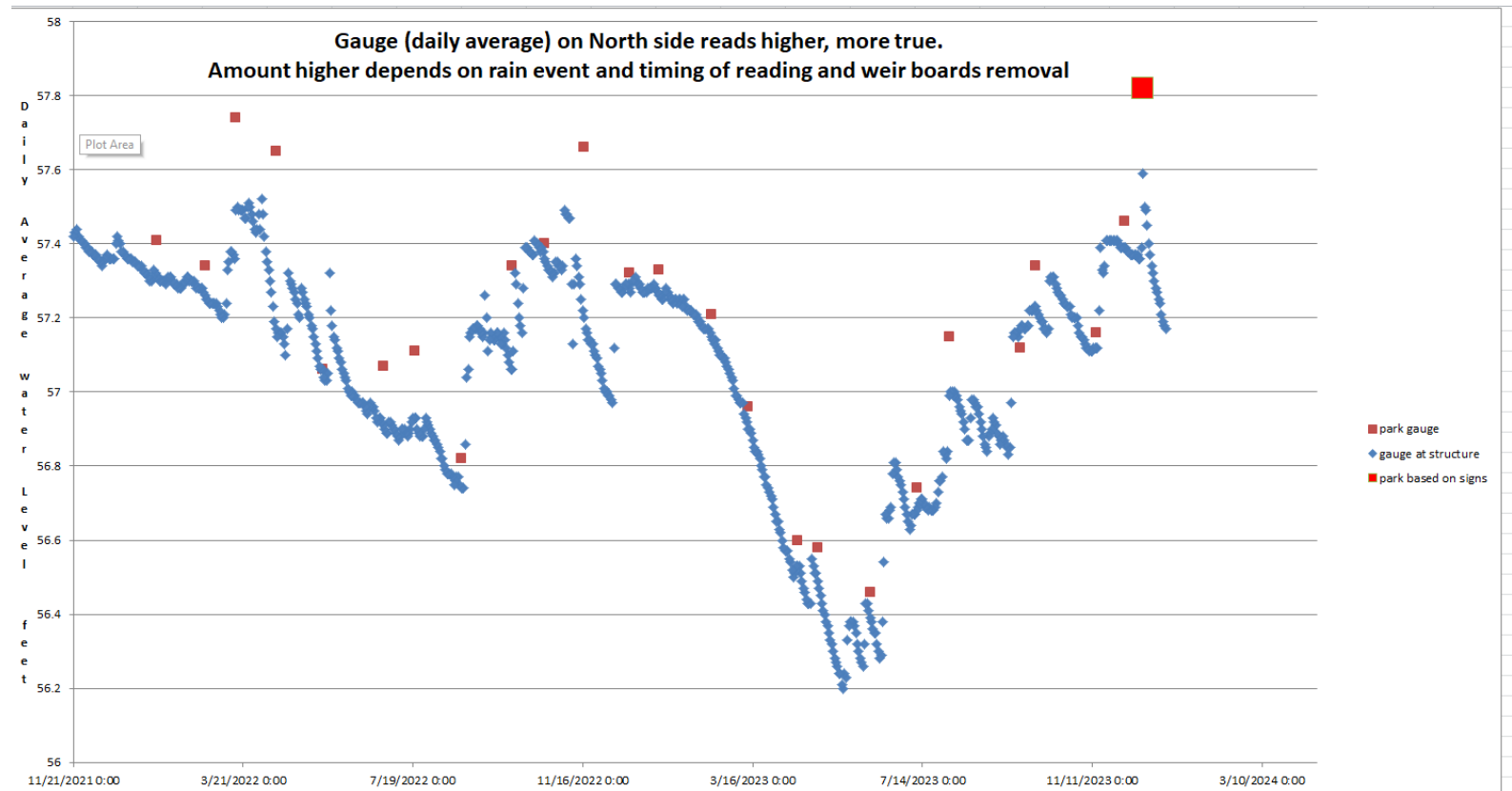
The two gauges read closely when the lake is 'settled'



The two gauges differ greatly during time of rapid level change

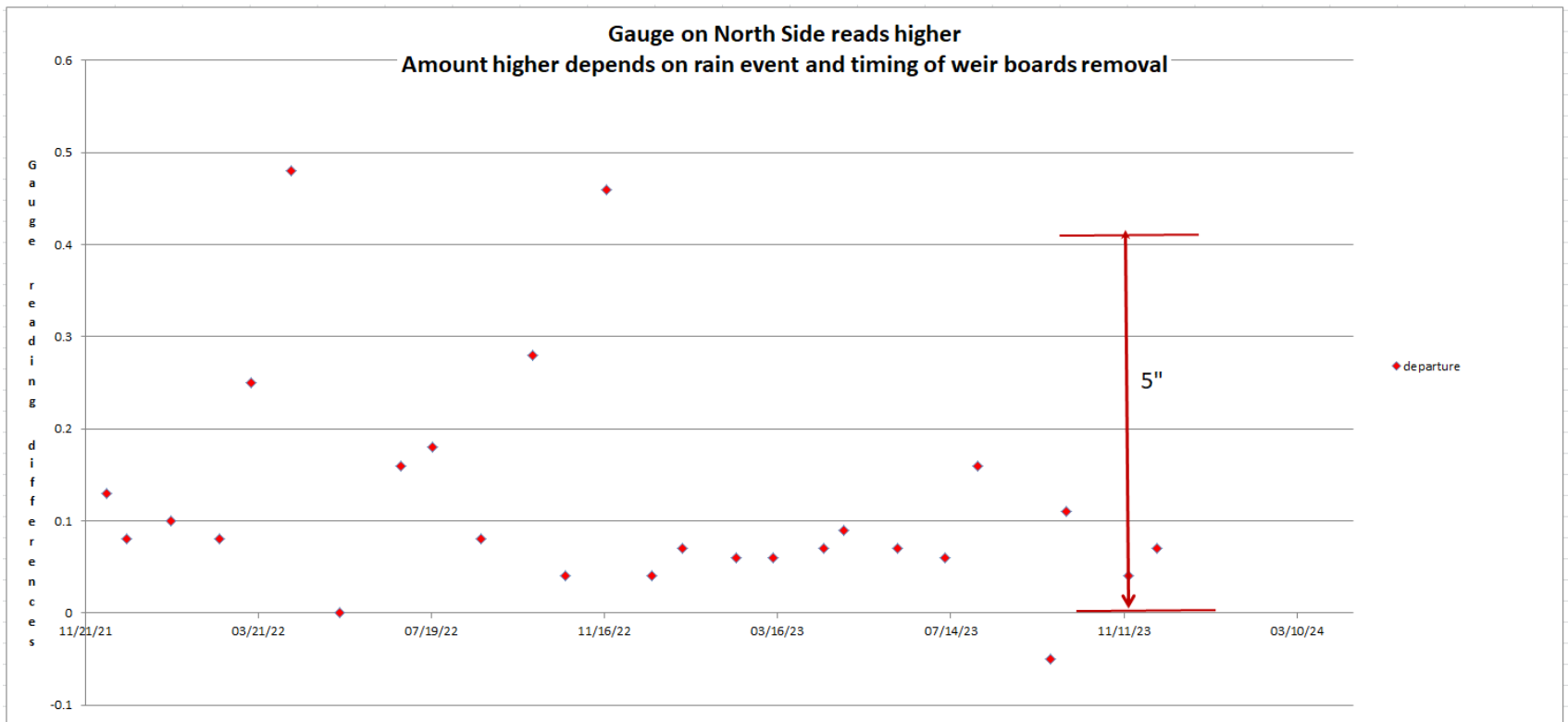


Actual Lake water level can be significantly higher than that measured at the weir structure

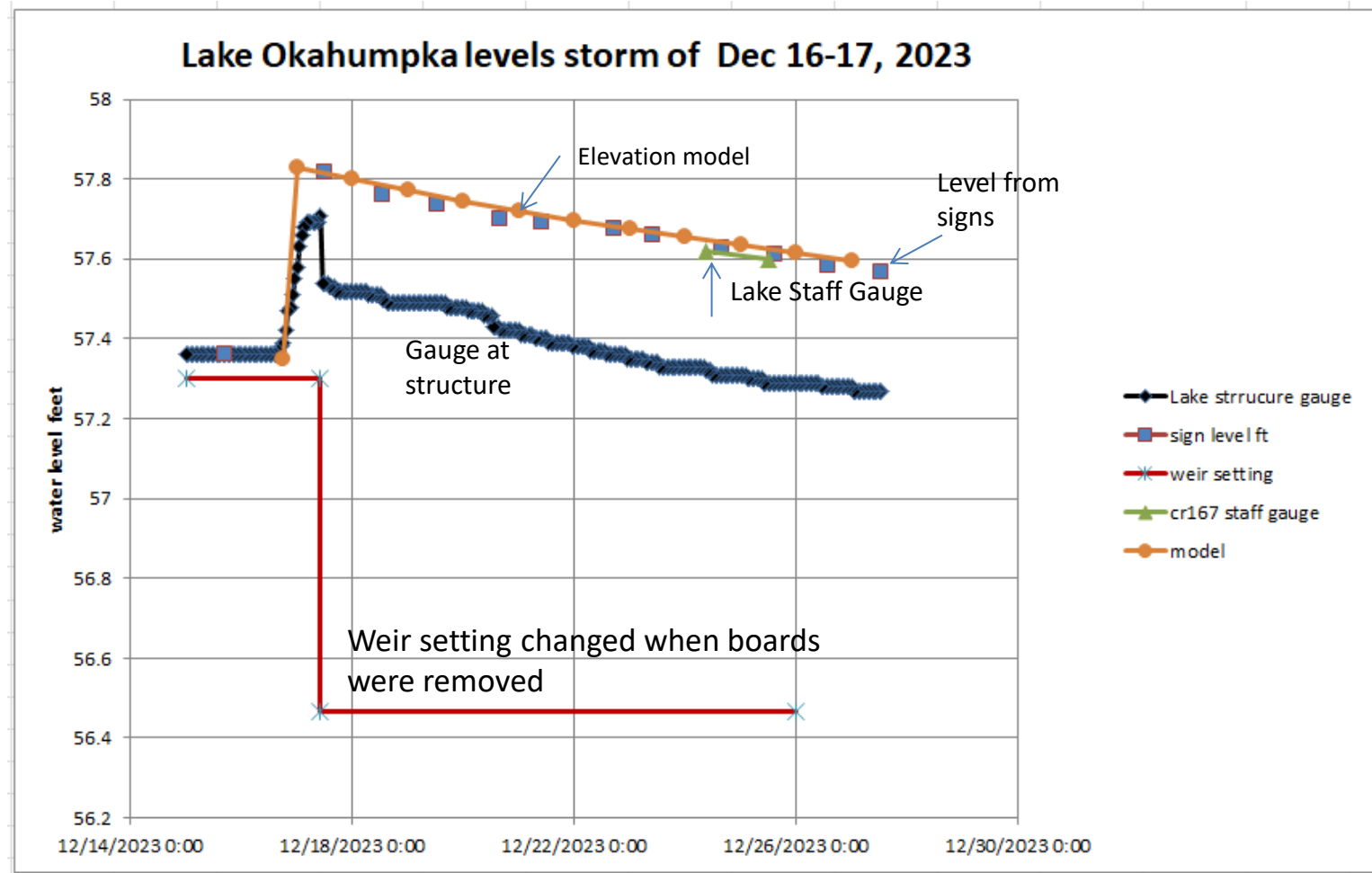


The below graph shows the difference in daily average water levels between the gauges at CR167 (lake North) and that at the structure.

A staff gauge placed near the CCC Gazebo would get far more attention than the CR167 gauge, which is seldom read (often with gaps up to 1 1/2 months)



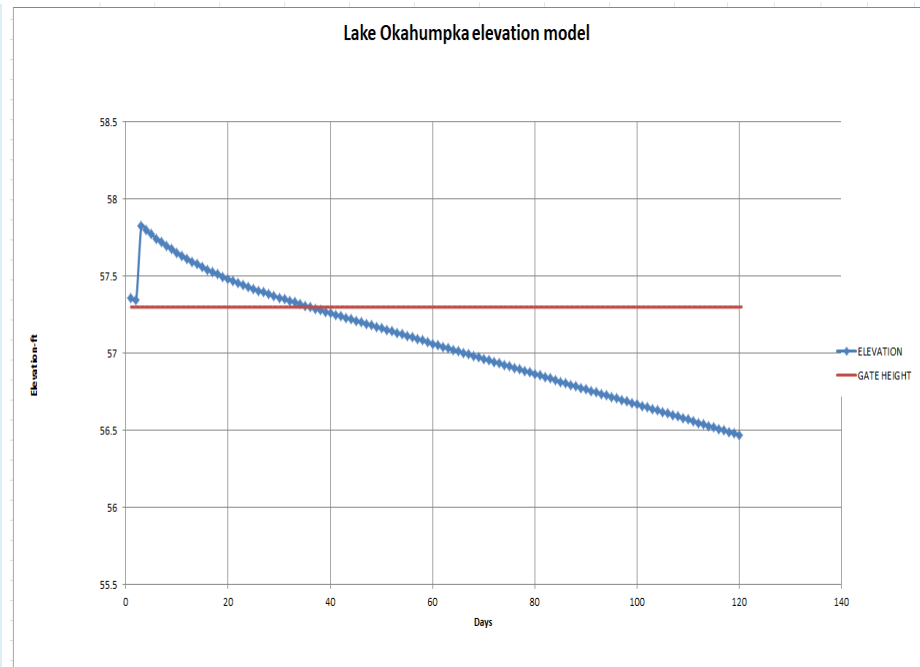
Lake Elevation Model and Gazebo sign observations provide good insight to lake level



Simple excel model provides some understanding of mechanisms affecting lake levels

- Rainfall
- Weir outflow (Bernoulli equation)
- Evaporation (Penman formula)

INPUT	
starting height	feet 57.36
gage height	feet 57.3
b, wier width each	feet 4
number of wiers in paralel	2 feet both 8
WEIR FLOW CORRECTION	0.6
RAINFALL CORR DRAINAGE FROM ENVIR	1.25
EVAPORATION CORRECTION	0.5
	RAIN DAY inches
	1 2 3 4 5 6 7 8 9 10
1	0 4.7 0 0 0 0 0 0 0 0
11	0 0 0 0 0 0 0 0 0 0
21	0 0 0 0 0 0 0 0 0 0
31	0 0 0 0 0 0 0 0 0 0
41	0 0 0 0 0 0 0 0 0 0
51	0 0 0 0 0 0 0 0 0 0
61	0 0 0 0 0 0 0 0 0 0
71	0 0 0 0 0 0 0 0 0 0
81	0 0 0 0 0 0 0 0 0 0
91	0 0 0 0 0 0 0 0 0 0
111	0 0 0 0 0 0 0 0 0 0
110	0 0 0 0 0 0 0 0 0 0

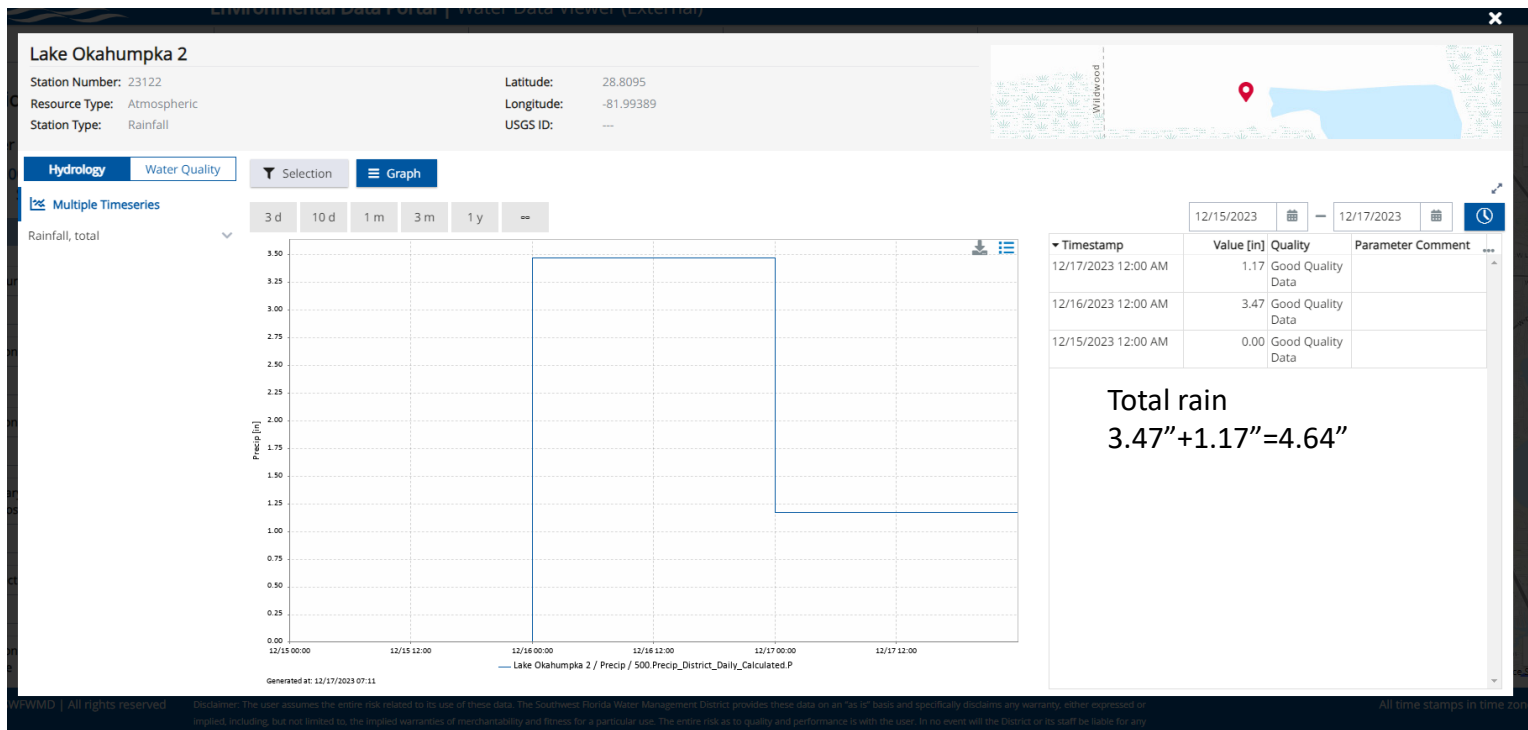


Cheapo water level gage (sign) indicates approx. 5.5" change due to 12/16-27/2023 Rain

(5.5" by counting bolt holes in the sign post-assuming standard 1" spacing between bolt holes)



Rain gage near Lake Okahumpka shows 4.64" of total rainfall during 12/16-17/2023



**It would be better to have a calibrated Staff Gauge in our canal
- better to have the electronic gauge there.**

12/15/2023



12/17/2023



12/18/2023



12/19/2023



12/20/2023



12/21/2023



12/22/2023



12/23/2023



12/24/2023



12/25/2023



12/26/2023



12/27/2023



Establishing canal sign-water level reference for our crude 'staff gauge'





12/15/2023
Before rain



12/17/2023
After rain

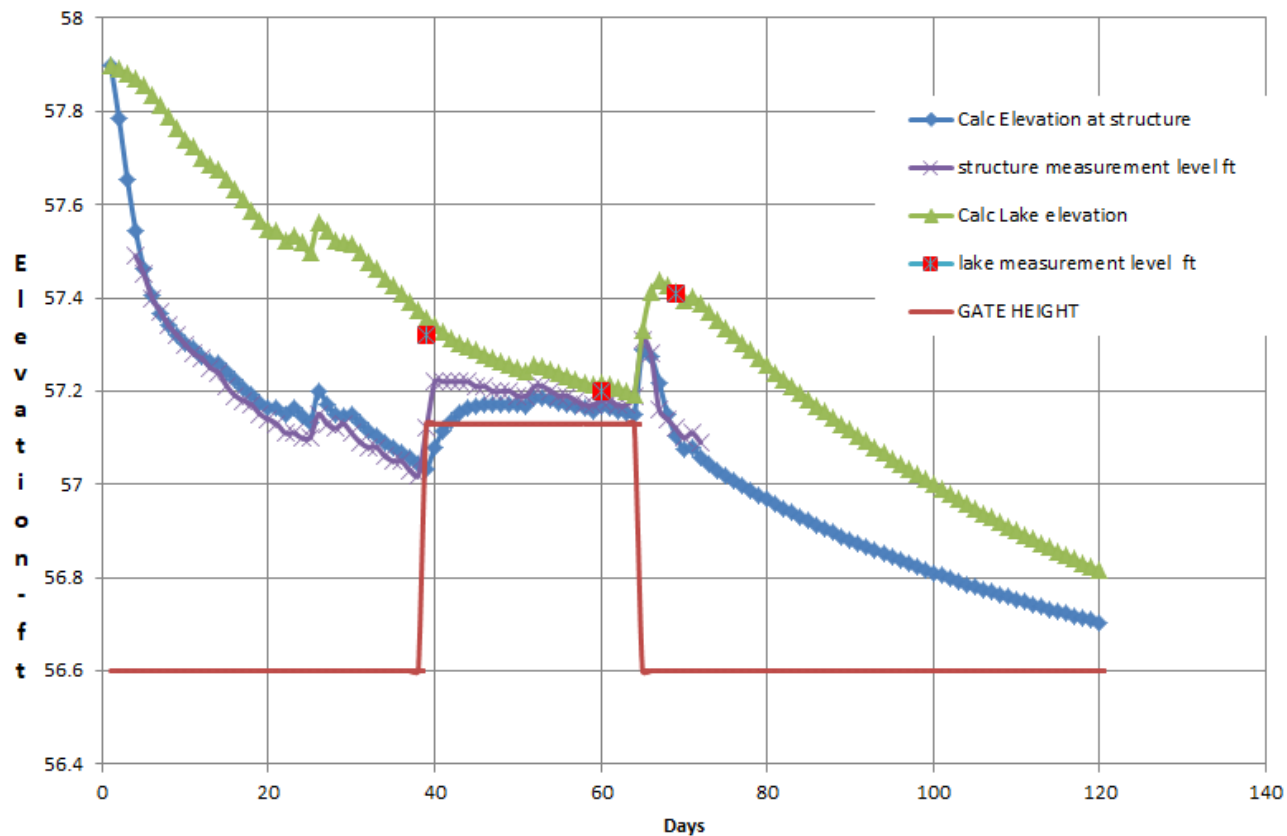


12/18/2023
After rain

The model has been advanced to predict the lake level at both measuring locations. Good agreement is seen versus actual data.

-note scarcity of data from the 'park' gauge

Lake Okahumpka elevation model starting at time of removal of boards after Dec 16/17 2023 storm



Ref: Rain gauge at Bradley Lake (Floral City) shows 5.02” of total rainfall during that same 12/16-17/2023 storm.

There was no rapid drop in level. Gauge is not at a water level control structure, and is exposed directly to its lake.

