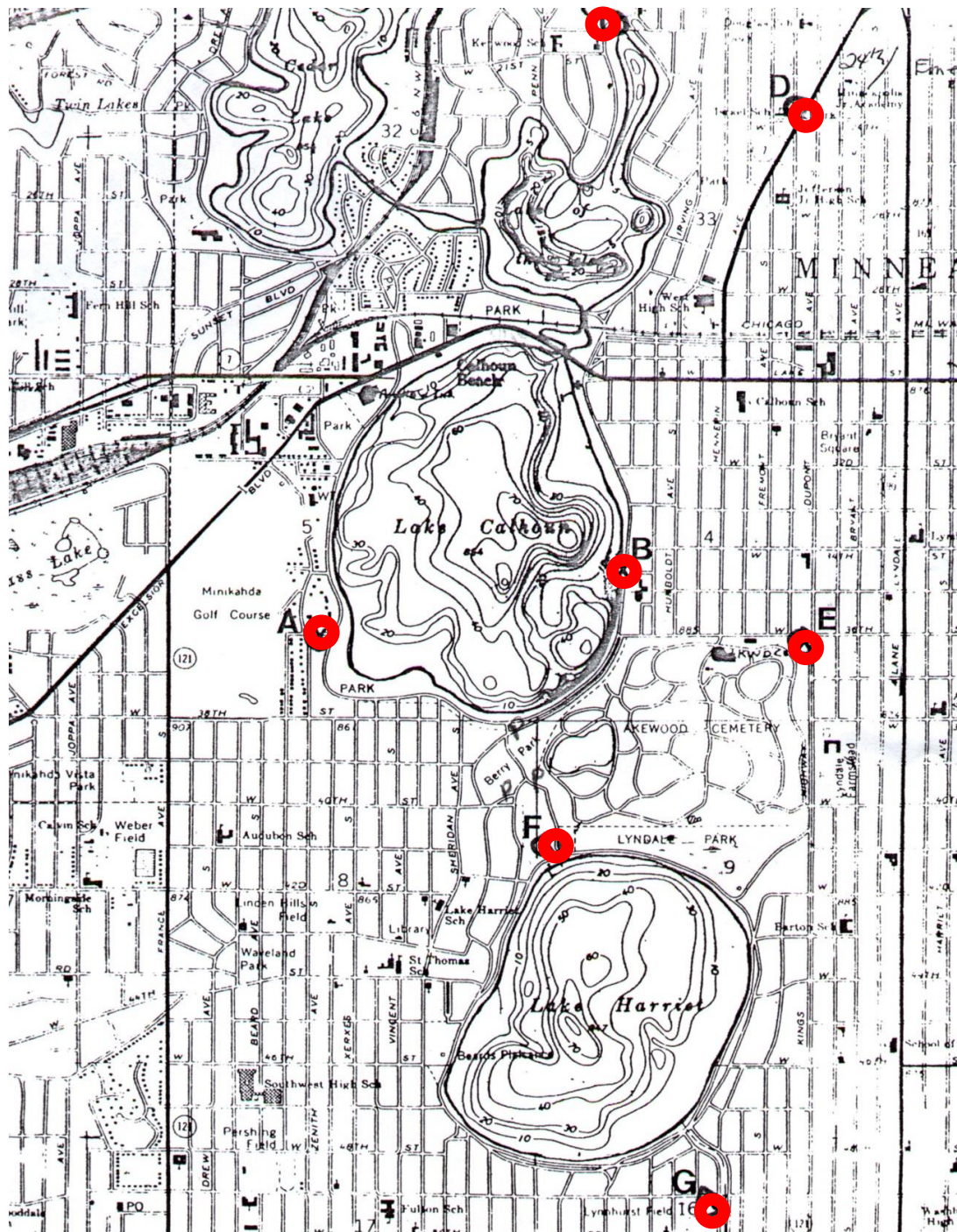




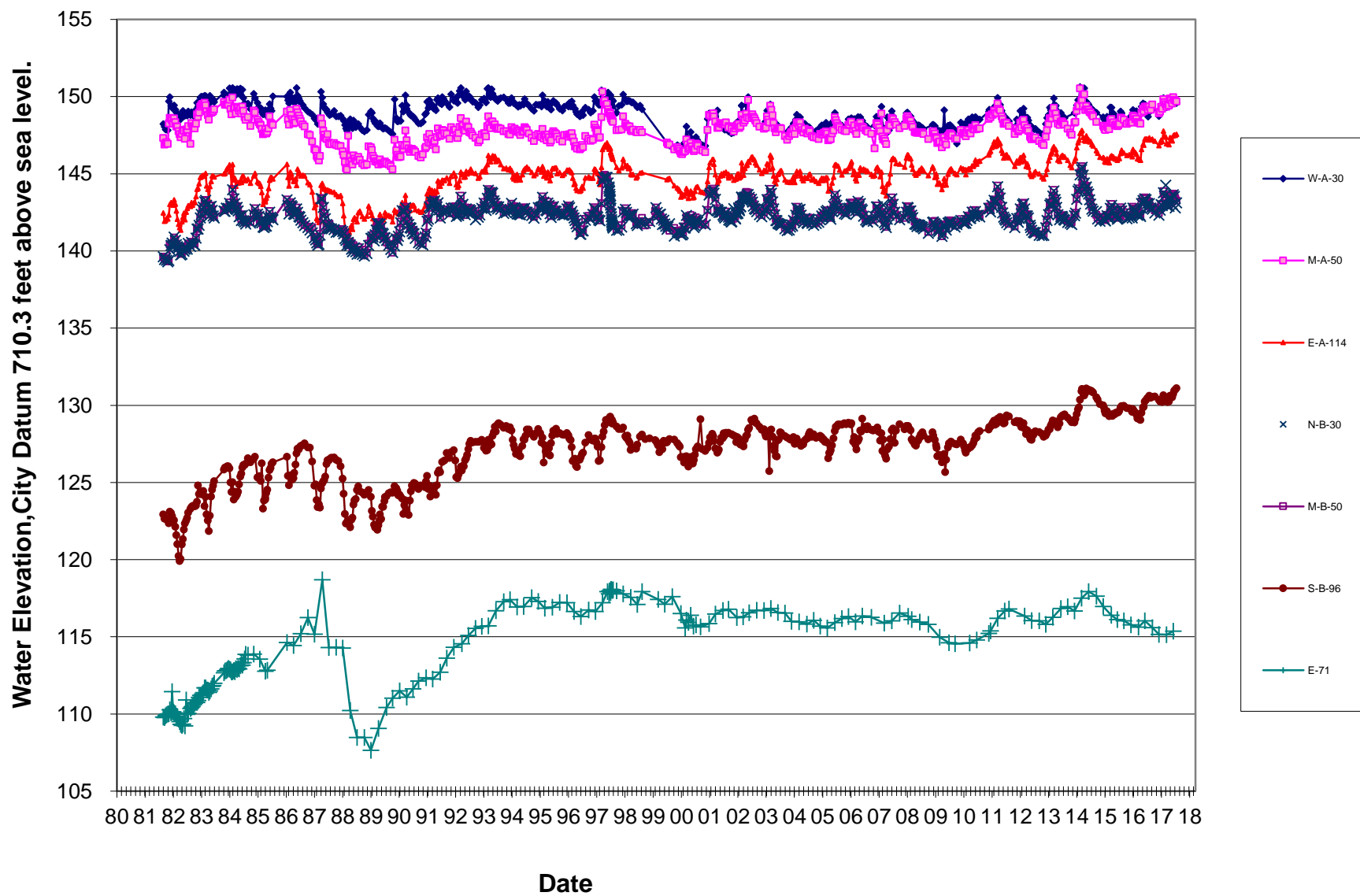
MPRB Surface and Groundwater Information

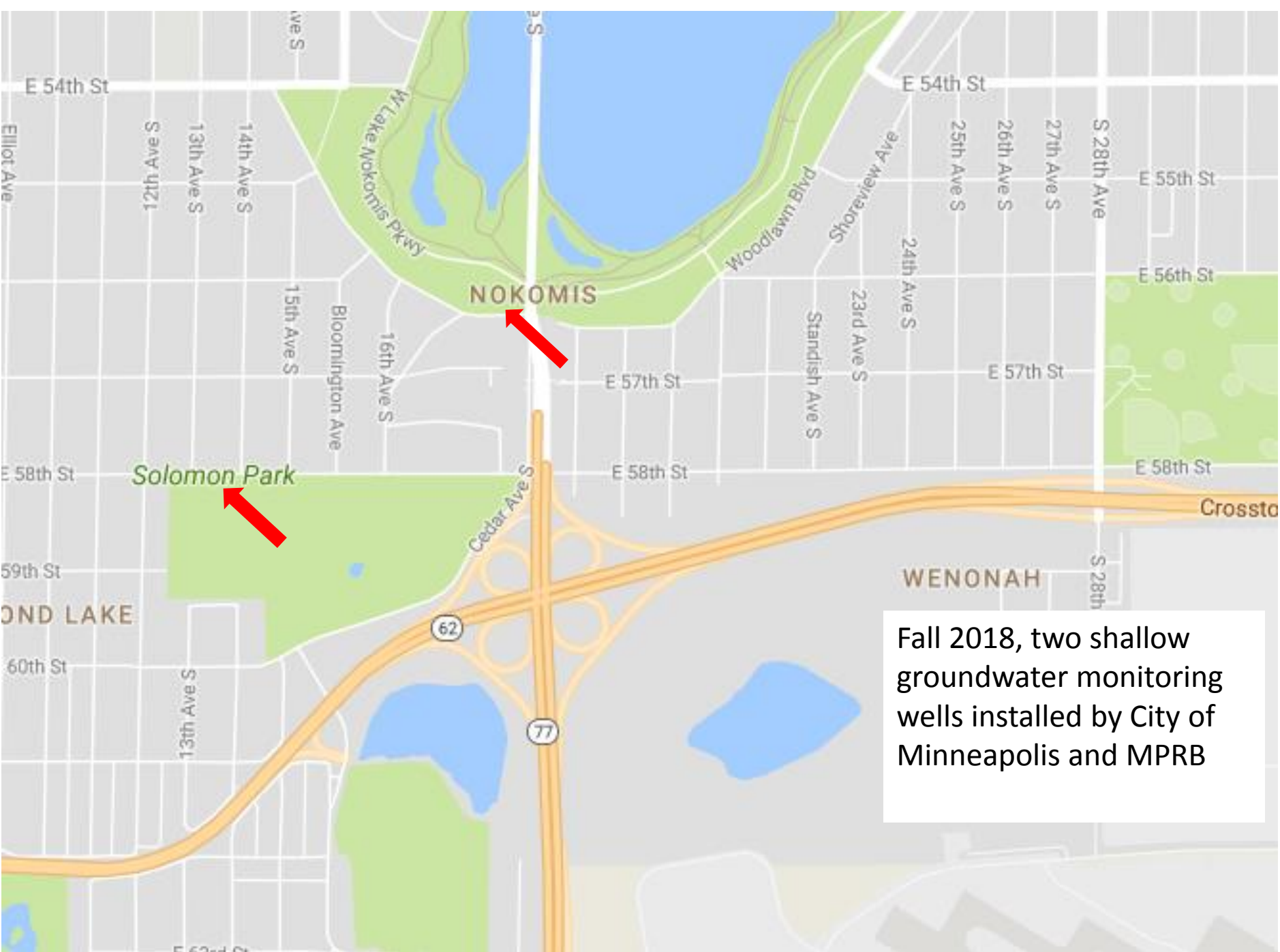
- Groundwater Monitoring
- Lake Level Monitoring
 - Trends at Nokomis and other lakes
- Lake Nokomis Outlet Management
- Hiawatha Golf Project



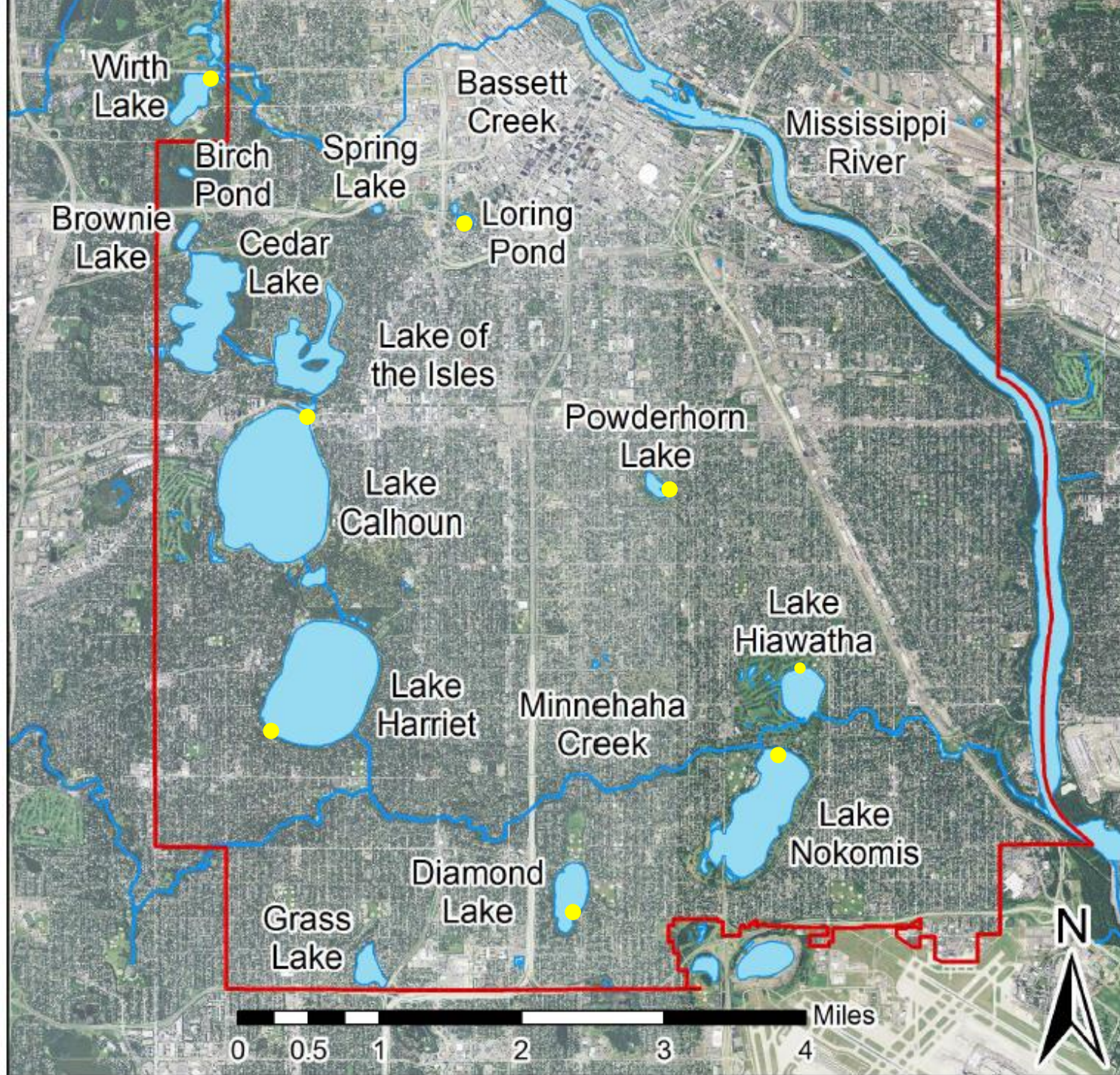
Groundwater Monitoring

- Chain of Lakes wells
- 1980's to present
- 30-100 feet deep
- 2 readings/month
- OR, quarterly

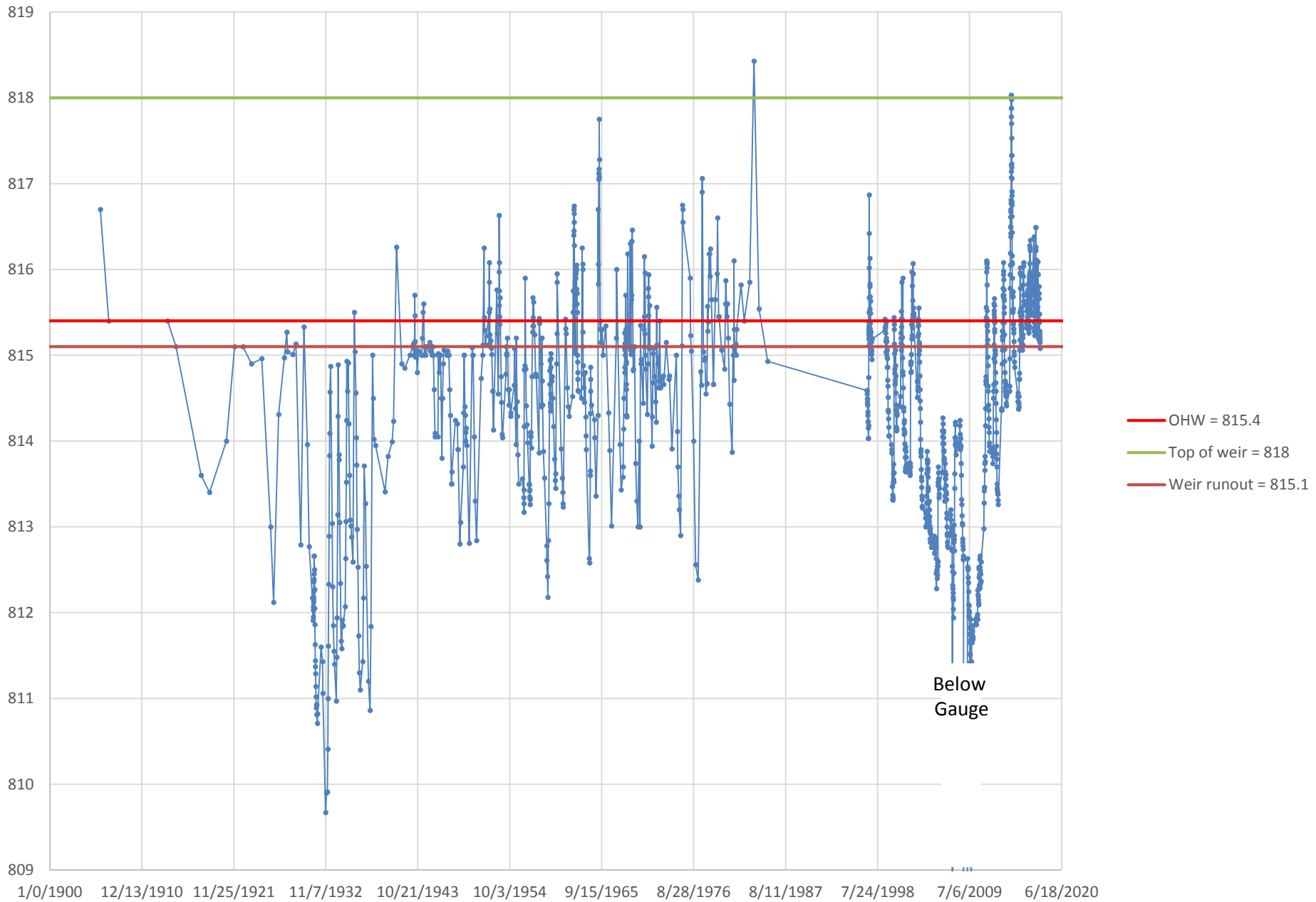




Fall 2018, two shallow groundwater monitoring wells installed by City of Minneapolis and MPRB



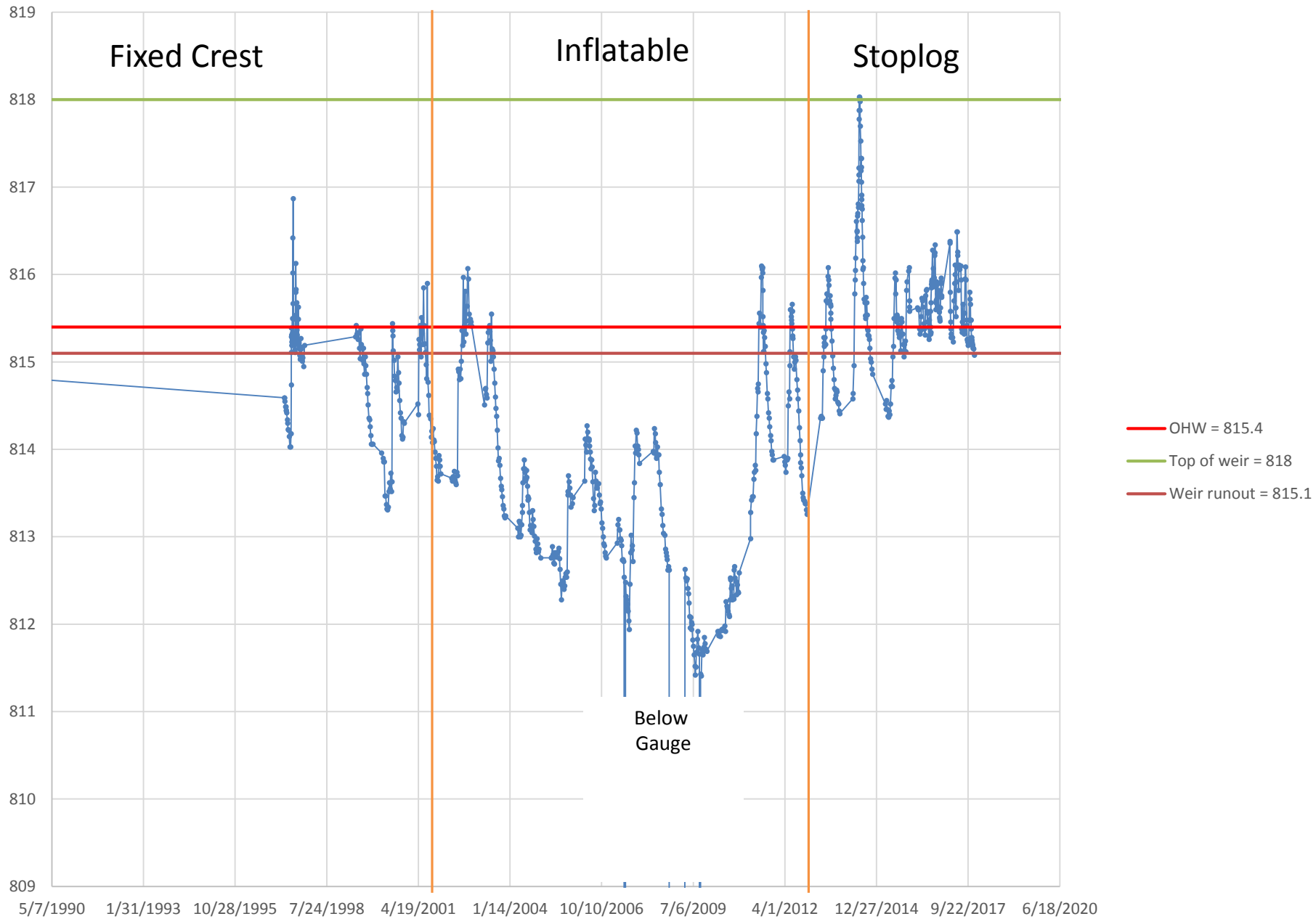
Nokomis elevation (msl)



Nokomis elevation (msl)



Nokomis elevation (msl)





1931 to August 2001 – Fixed Crest weir outlet

- Additional stoplog weir DS in creek, likely built to force water into Nokomis.
- Used for unknown period of time, DS weir fully decommissioned 1996 because it was unused and a navigation hazard



2001 – Nov 2012 Inflatable weir (C of Minneapolis and MCWD operation)

- Goal: prevent water from Creek from backing up into lake. Blue Water Commish.
- Post 2010 – operated in protective mode to keep zebra mussels out of Nokomis.
- Was not effective in all conditions, and could not operate continuously



2012 – present: Stoplog weir. MPRB operates in consultation with MCWD, per DNR-approved operating plan



Stoplog Weir Goals

(from the operation plan)

- To simplify operation and significantly reduce operational costs to the public.
- To increase protection of Lake Nokomis from polluted storm sewer discharges and from movement of zebra mussels from Minnehaha Creek to the lake.
- To increase the operational reliability of protection by having a structure that is normally in a protective mode rather than the existing inflatable weir that is normally not protective, until the weir is manually raised.
- To maintain the existing management levels for Lake Nokomis including:
 - The runout elevation of 815.1 does not change
 - The Ordinary High Water level of 815.4 has not been achieved for many years.
 - The top of weir elevation of 818.0 is the same on the inflatable weir and on the new fixed weir.
 - The predicted 10-year and 100-year water levels of the lake (819 and 819.7, respectively) are not expected to change.

The stop logs shall be removed and the Nokomis Weir shall be opened:

- **IF** the Lake Nokomis level is at or above elevation 815.4 (the OHW) for two weeks **AND/OR IF** there are high-water related problems effecting MPRB infrastructure **AND**;
- The Minnehaha Creek level is measured using the survey gauge and is found to be below 815 and is at least 1 foot below the measured level of the Lake Nokomis survey gauge (*example: If the Lake Nokomis level is at 815.82, than the Minnehaha Creek level must be at or below 814.82*) **AND**;
- There is no precipitation predicted for at least 48 hours **AND**;
- MPRB staff has notified MCWD (Project Manager, or Natural Resource Technician) of the proposed stop log removal **AND**;
- The MCWD has agreed to not change the discharge rate at Gray's Bay Dam until the stop logs have been reinstalled.

The stop logs shall be reinstalled and the Nokomis Weir shall be closed:

- When Lake Nokomis reaches the runout elevation of 815.1; **AND**
- MPRB has notified MCWD (Project Manager, or Natural Resource Technician) of the proposed stop log reinstallation.

-OR-

- Precipitation is predicted within 24 hours; **AND**
- MPRB has notified MCWD (Project Manager, or Natural Resource Technician) of the proposed stop log reinstallation.



Weir Operations Log

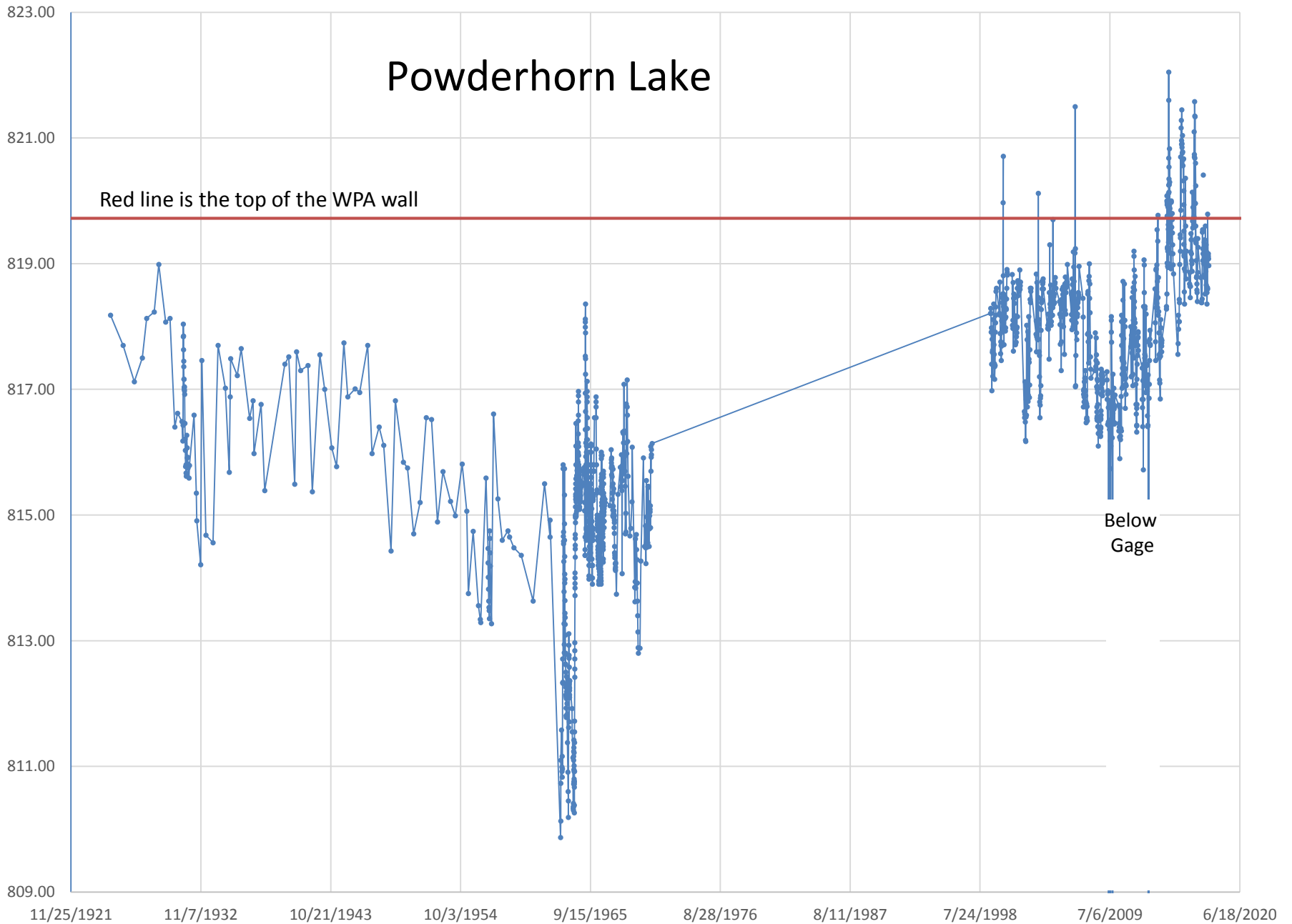
2013 – No data

Year	# of Operations	Days Open	Season Length
2014	8	30	5/22 – 9/29 (130 days)
2015	7	19	7/21 – 12/23 (155 days)
2016	12	62	3/31 – 12/5 (249 days)
2017	13	115+	3/7 – ? (266 +)

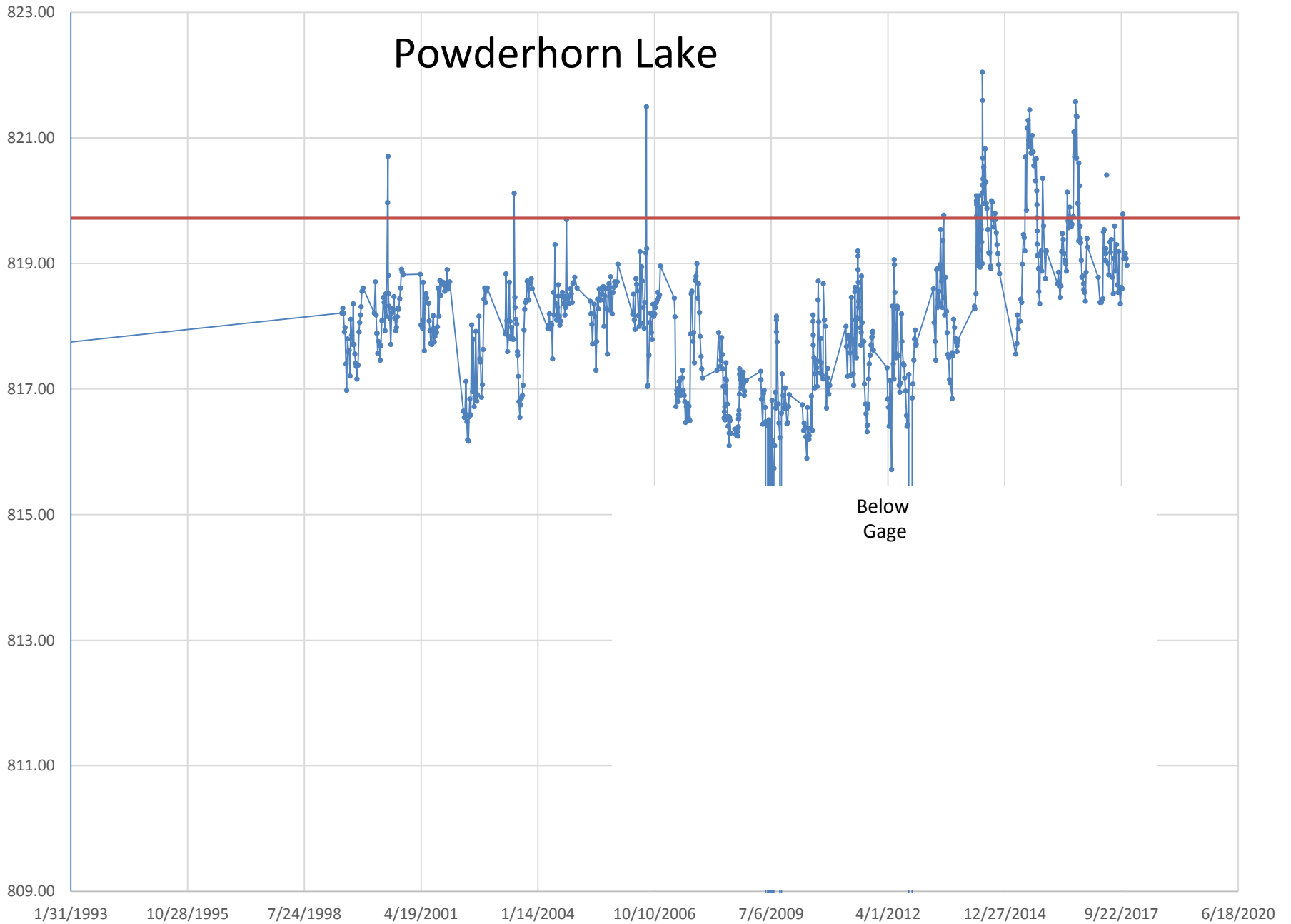
Powderhorn Lake

Red line is the top of the WPA wall

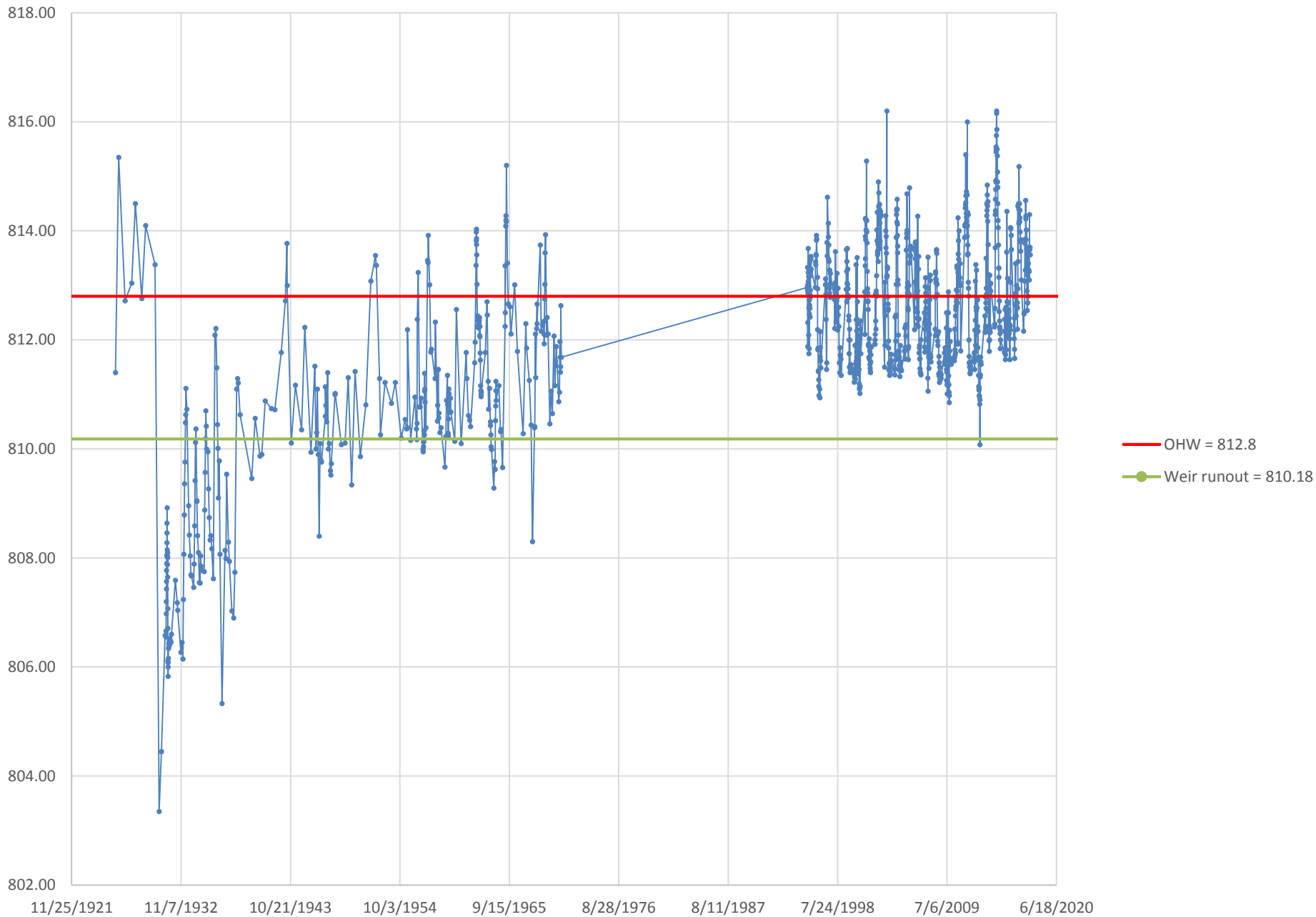
Below
Gage



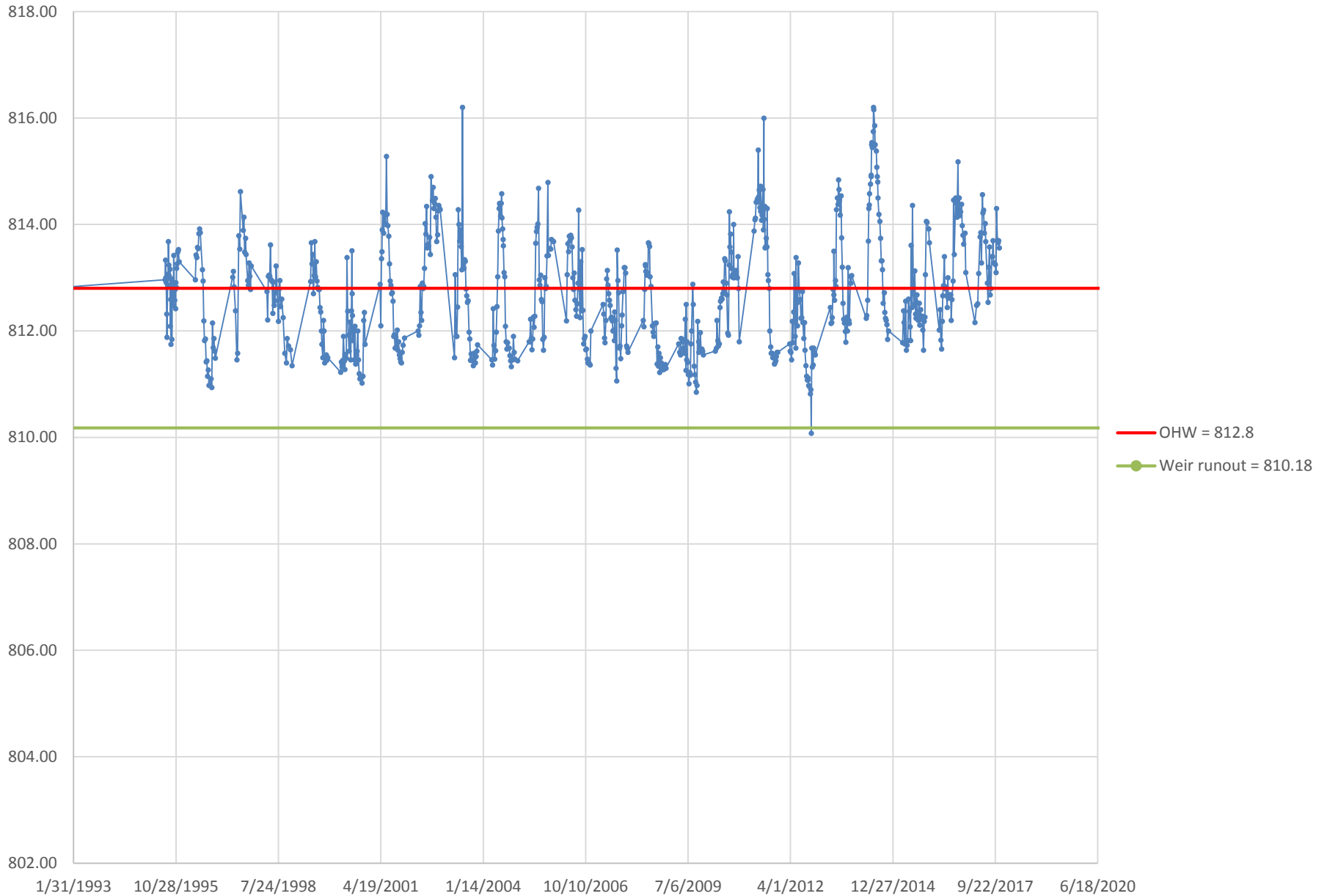
Powderhorn Lake



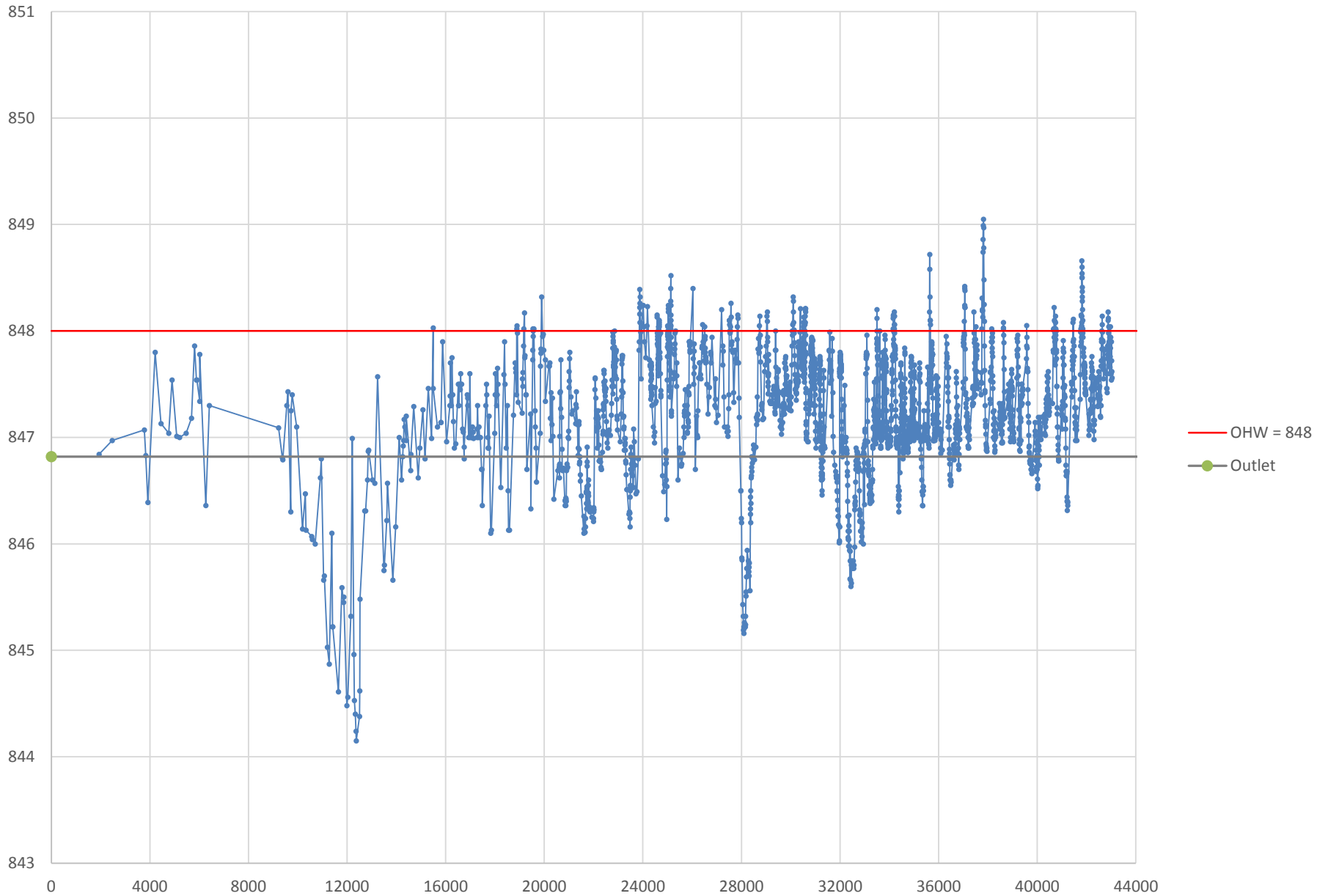
Hiawatha elevation (msl)



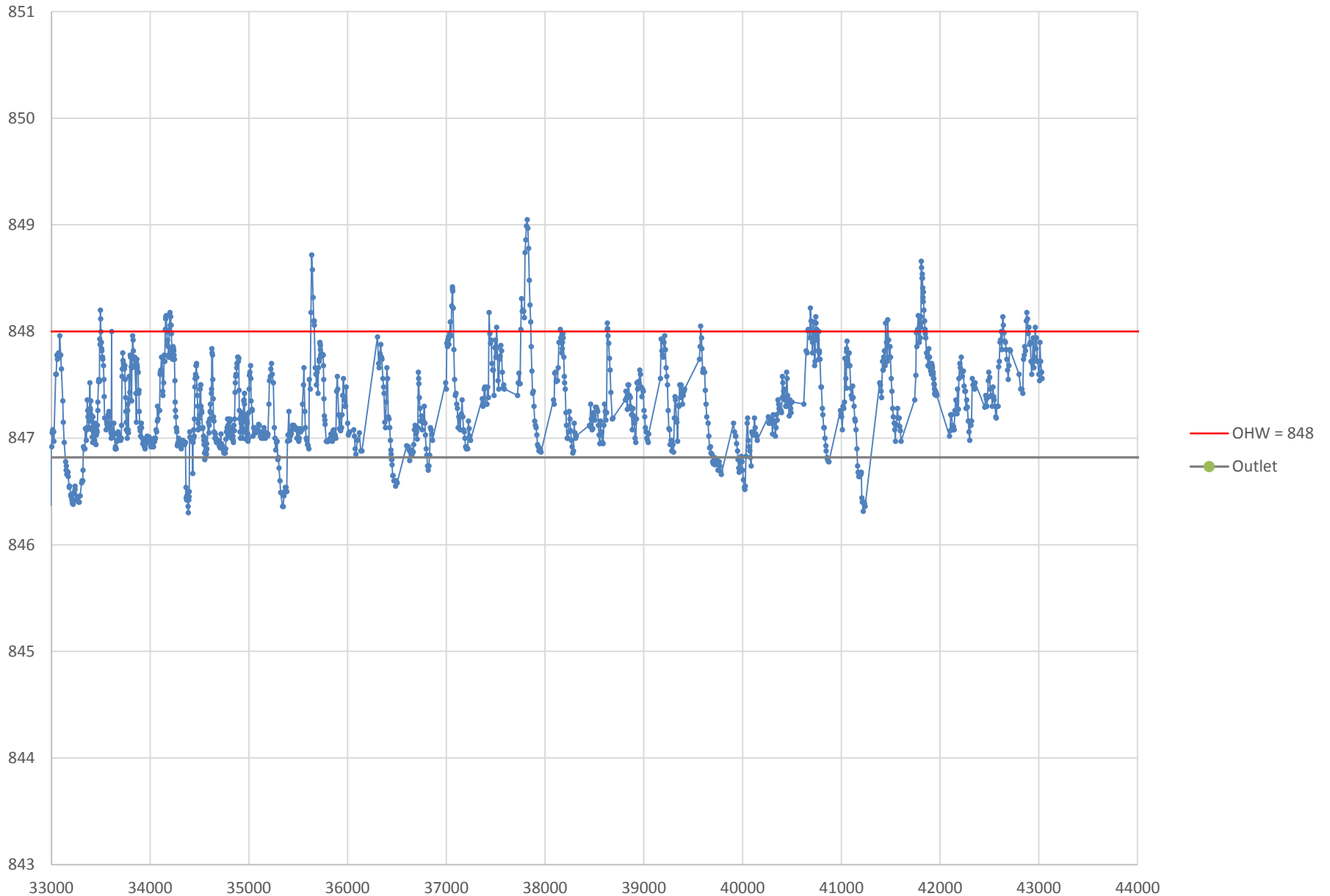
Hiawatha elevation (msl)



Harriet elevation (msl)



Harriet elevation (msl)





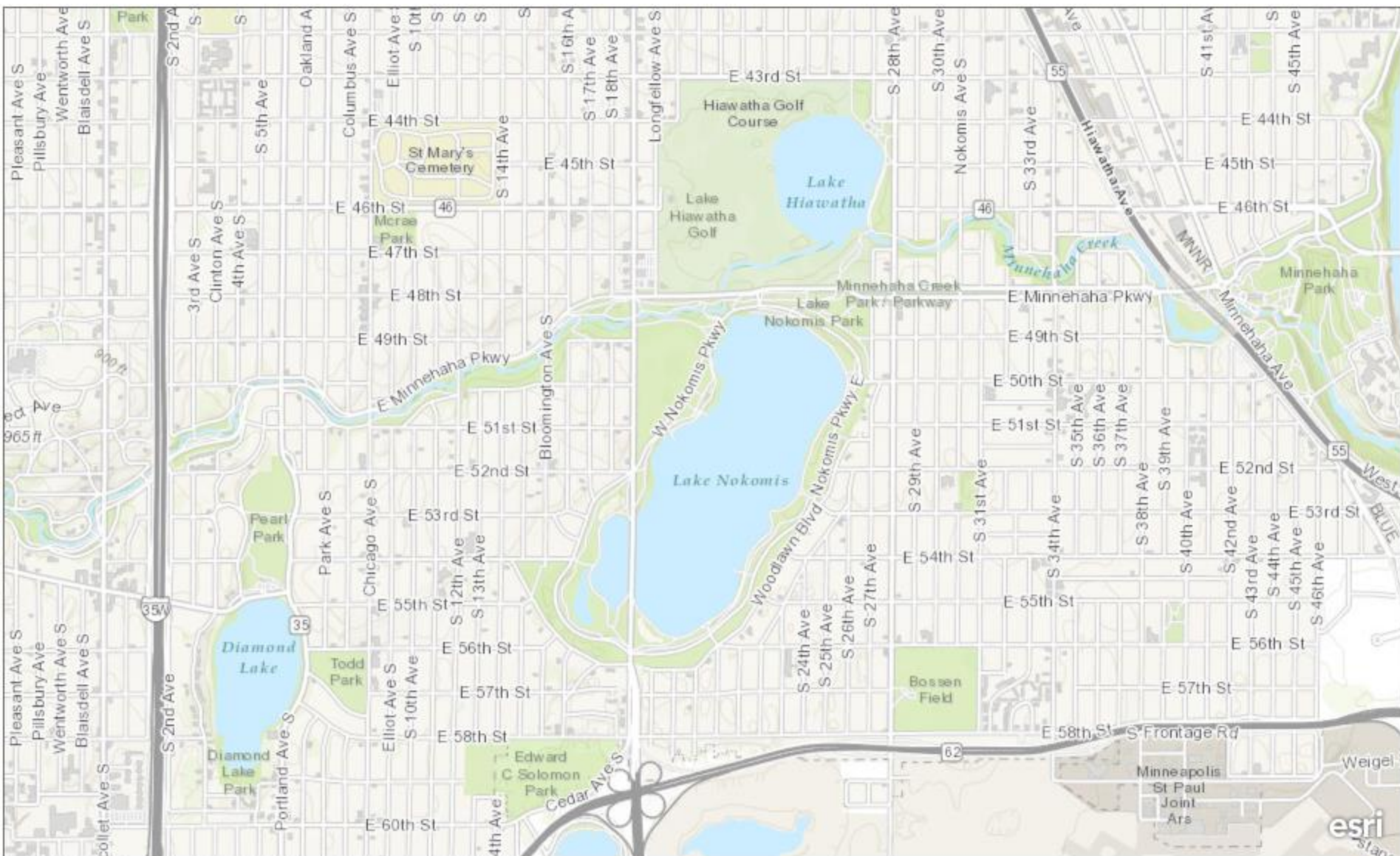
Hiawatha Golf Course Stormwater, Surface Water and Groundwater Study

- Minneapolis Park and Recreation Board
- City of Minneapolis
- Minnehaha Creek Watershed District



Study Focused On:

- (1) Reducing pumping into Lake Hiawatha
- (2) Improving water quality in Lake Hiawatha
- (3) Protecting homes from flooding



City of Minneapolis, County of Dakota, Esri, HERE, Garmin, INCREMENT P, USGS, METI/NASA, EPA, USDA



Pump Location and Information

Identified by Robert Porter, September 24, 2015

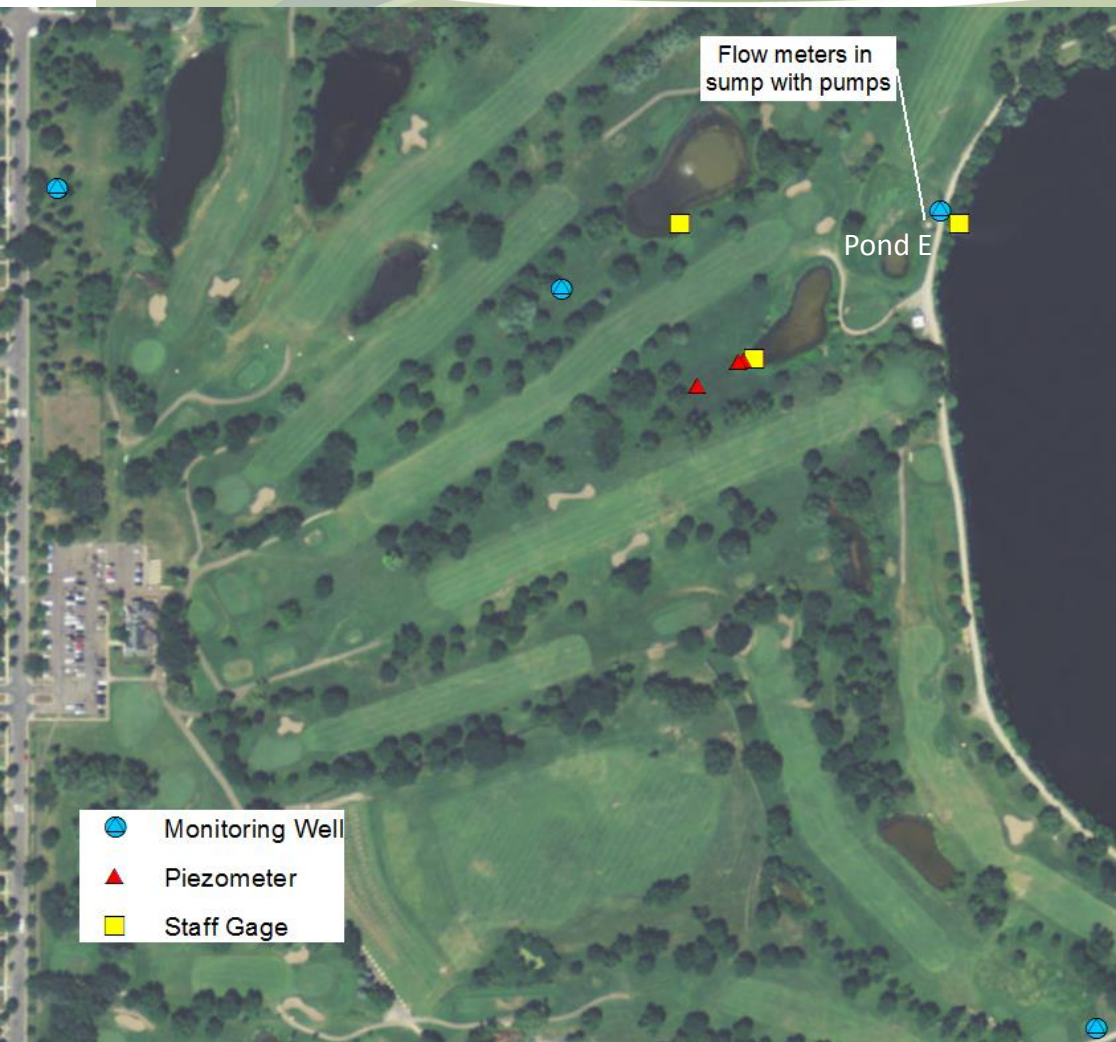


Investigations

Understanding the amount of water pumped from the golf course required that we:

- Gather existing groundwater data and develop a groundwater model
- Develop a stormwater model to understand non-groundwater inflows to the ponds
- Understand the interaction of groundwater and stormwater under a variety of high water and flooding scenarios

Measuring devices

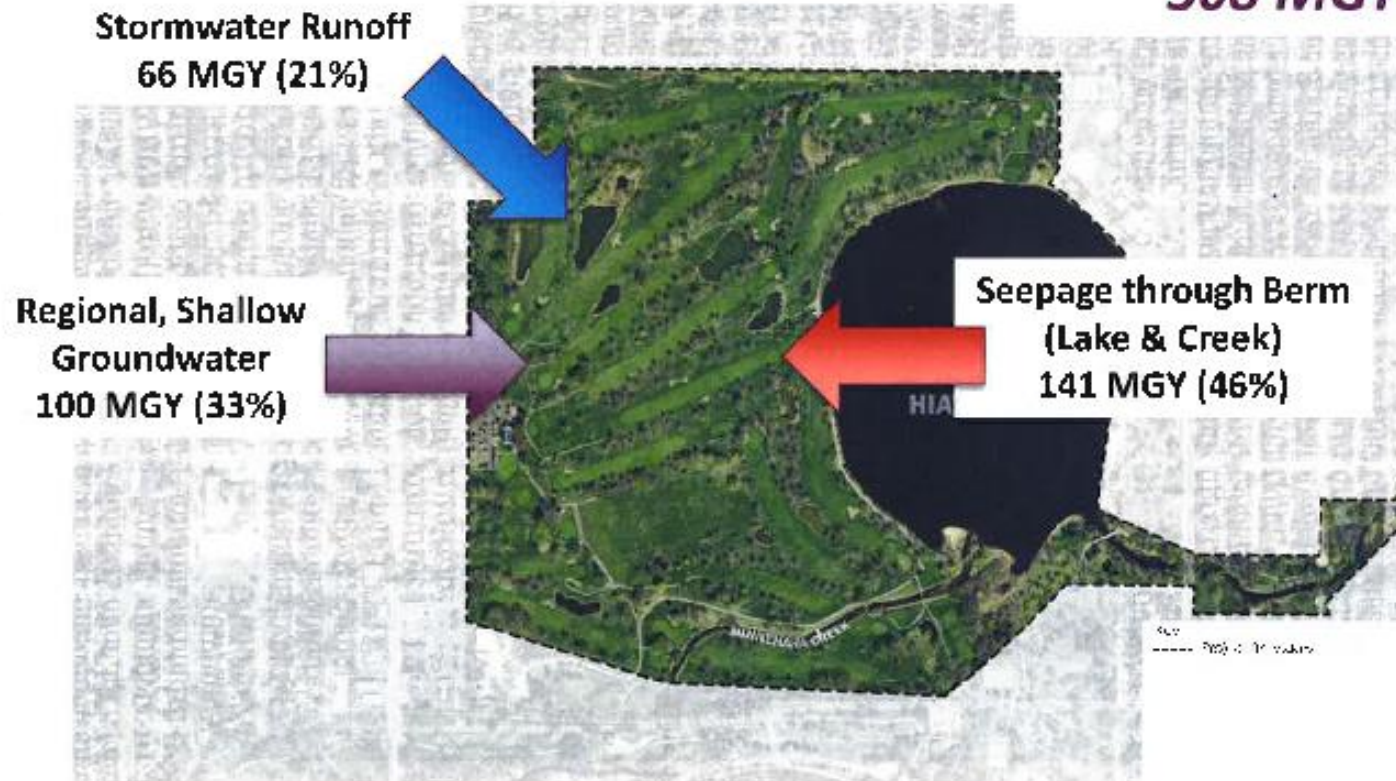


- Monitoring wells
- Piezometers
- Staff gauges
- Flow meters



Background - *Sources of Water*

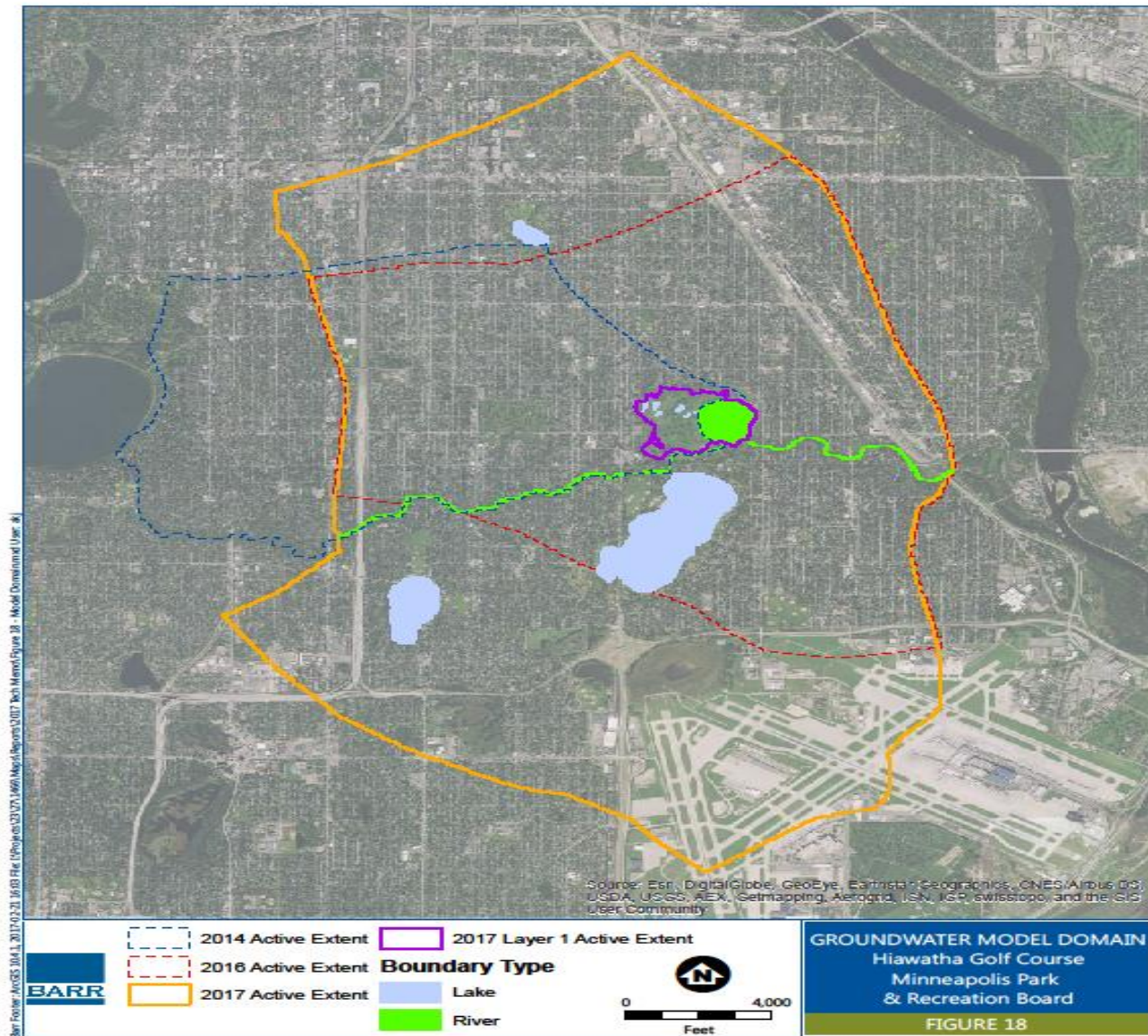
Total Annual Inflow
308 MGY





Groundwater Model

- Looked at impacts to golf course and nearby homes for different pumping regimes
- Focus was to protect nearby homes from wet basements while reducing pumping
- Determined that needed to minimum maintain pumping level of 94 MGY to protect homes
- Also looked at impacts near Nokomis and found no change in groundwater levels if pumping were reduced to 94 MGY





Hiawatha Current Project Status

- Pumping regime has not changed
- MPRB Board direction = Convene a Citizen Advisory Committee to inform land use changes consistent with the need to reduce pumping to 94 MGY with strong consideration for keeping golf at Hiawatha