Development of Lake Level Management Plans for Arrowhead and Indianhead Lakes – Community Meeting

October 9, 2023

The CITY of EDINA | 9 MILE CREEK WATERSHED DISTRICT | BARR

Purpose and goal for today

- Hear your reactions to what we've learned and potential pumping scenario
  - Share the study results, answer questions, listen to concerns
- Discuss possible next steps

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Background

Arrowhead and Indianhead lakes are landlocked – they do not have low level outlets; the only way for water to leave the lake is through evaporation, seepage, and/or pumping. This makes them prone to high water levels during wet years.

2019

- Wettest year on record in the Twin Cities metro area, breaking previous record set in 2016. Prior six years (2014-2019) were wettest six years on record in the area
- Landlocked lake levels were higher than normal, Groundwater levels were higher than average throughout the watershed
- High water and requests for pumping in 2019. Temporary pumping at Arrowhead Lake and Indianhead Lake in 2019 to alleviate high water levels

2020

- Concern about flood exposure on landlocked lakes across the watershed related to spring snowmelt and rain
- Nine Mile Creek Watershed District Board authorized screening-level analysis to understand potential for spring 2020 flooding of homes and infrastructure
  - Outcomes: Recommendation to prepare for potential need for pumping at Arrowhead Lake in 2020.
  - City secured permit but ultimately did not need to pump.
- June: City Council approved scope of work for development of lake level management plans

Landlocked level management plans are intended to;

- Define the City service.
- Increase understanding of how risk is shared/transferred to downstream Nine Mile Creek when pumping occurs.
- Enable City staff to mobilize temporary pumping installations more rapidly and proactively manage lake levels to protect homes.
- Establish a common understanding about the City's service among the City, Nine Mile Creek Watershed District, MN Department of Natural Resources, Arrowhead Lake Association, The Indianhead Lake Association, and downstream parties.

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Water Resources Management Plan policy

- Flood Risk = Climate and Physical Setting x Exposure x Vulnerability
- Service goal – reduce flood exposure for homes in 1% chance event, sometimes referred to as "100-year" event.

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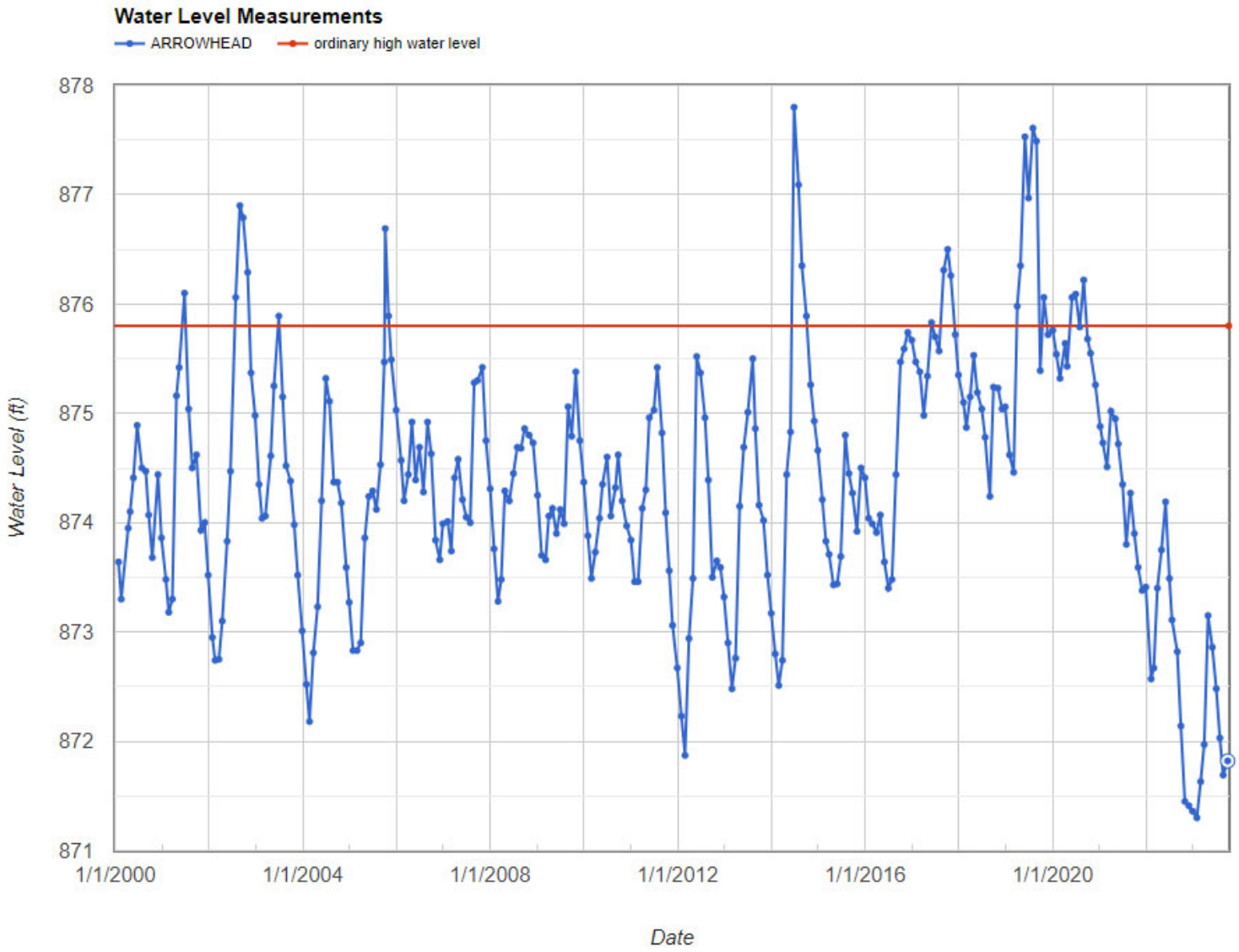
What we've learned about Arrowhead and Indianhead Lakes

- Levels typically rise in the spring and early summer, then fall during mid-summer and early fall, and generally remain stable during the winter.
  - Arrowhead Lake typically fluctuates about 2-3 feet annually. Indianhead Lake typically fluctuates about 2 feet annually. Generally stable lake levels from 2000 to approximately 2013, then rising 2015-2019.
- Lake levels are strongly influenced by groundwater elevations
  - High groundwater levels limited seepage and were a primary driver in increased annual low water levels and were a major contributor to the rising lake levels in the years leading up to 2019.
- Two main scenarios that trigger the need for pumping to protect homes from flood exposure
  - 1) high groundwater levels combined with precipitation which can cause lake levels to rise over a longer duration of time; and
  - 2) extreme precipitation events which result in a rapid risk in the lake levels

- Arrowhead Lake Levels from 2000-2023
- Most recent observed Arrowhead Lake level is elevation 871.8 ft on Sept 27, 2023



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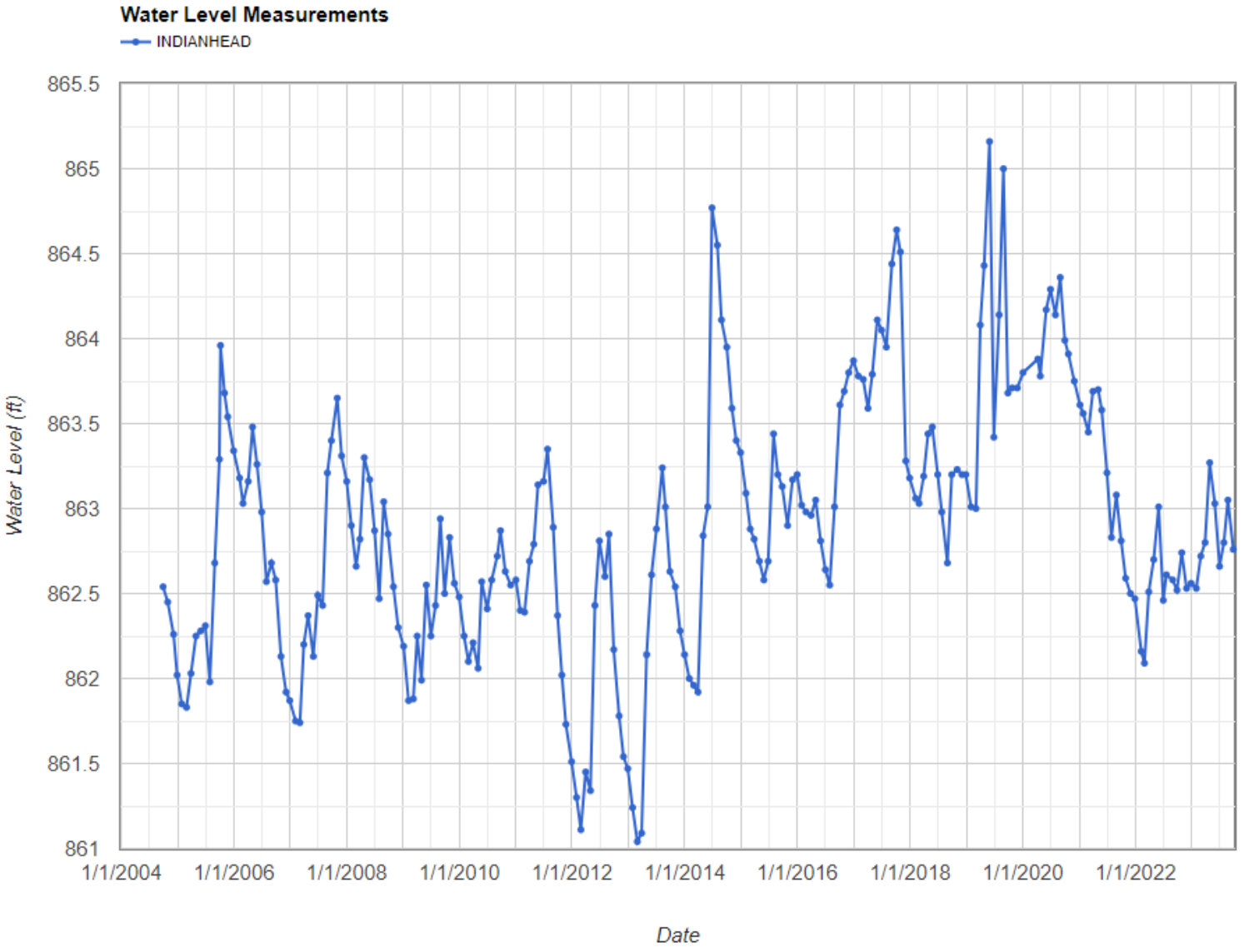
- Indianhead Lake Levels from 2004-2023
- Most recent observed Indianhead Lake level is elevation 862.8 ft on Sept 27, 2023



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Evaluation of pumping operation scenarios

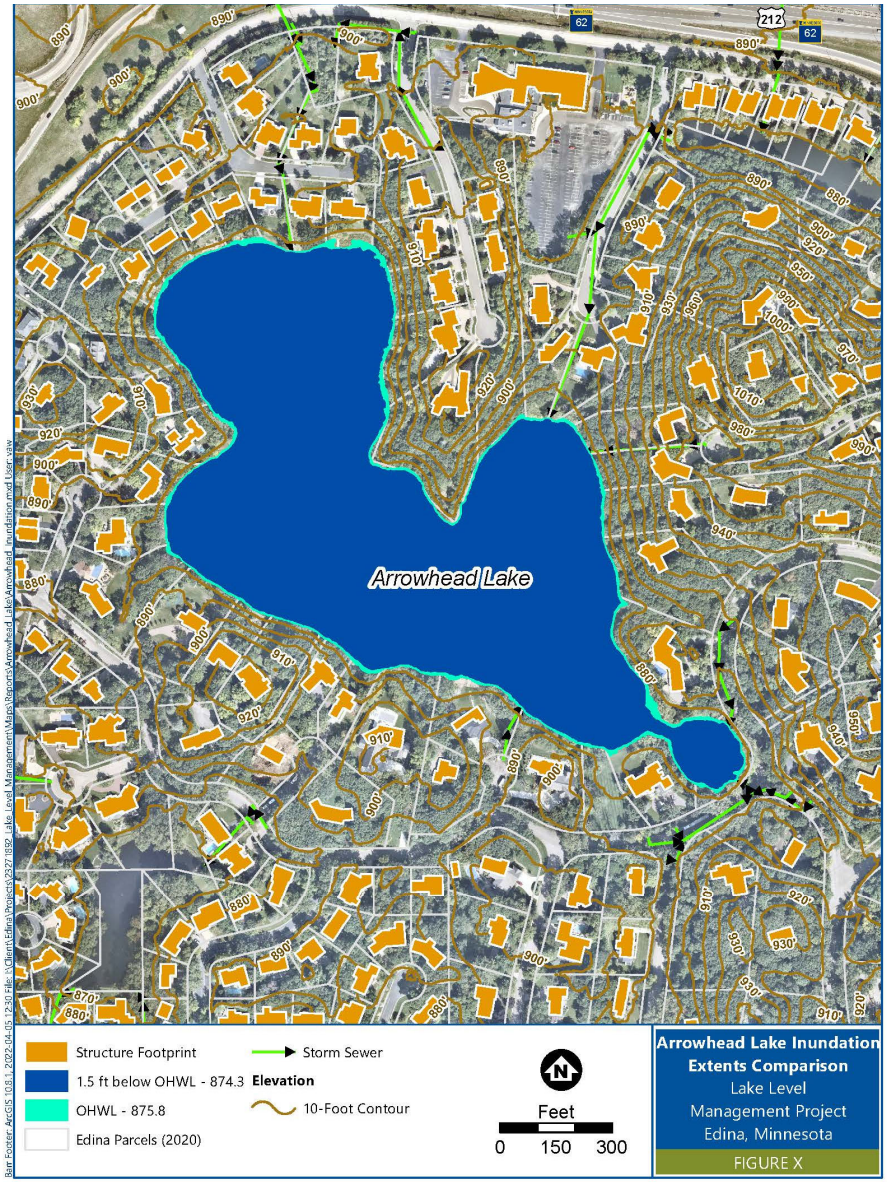
- We determined the initial lake level elevations needed to protect structures from extreme events
  - 1% annual chance rainfall (100-year, 24-hour storm event = 7.5 inches)
  - 1% annual chance snowmelt runoff (100-year, 10-day snowmelt event = 7.2 inches)
  - 0.5% annual chance rainfall (500-year, 24-hour storm event = 10.5 inches)
- We considered the frequency of pump deployments and impacts to water levels during dry weather conditions.
- We reviewed potential scenarios and potential permitting requirements with staff at the Minnesota Department of Natural Resources.
- We evaluated the flood exposure impacts of level augmentation at Indianhead Lake.
- More detail is available in the study memo.

Findings that apply to both lakes

- Higher groundwater levels tend to keep the lake levels high which increases the likelihood of flooding.
- When groundwater levels are high, pre-emptive pumping in the early fall is not expected to keep the lake level down over the winter.
  - When groundwater levels are within 1 ft of the bottom of the lake, modeling indicates the lakes will rise over the winter.
- When groundwater levels are high, recommend deployment of pumping systems early in the spring, so that pumping can begin as early as needed to preserve space in the lake for runoff from large events.

Findings for Arrowhead Lake

- Starting level needed to protect low structure (home)
  - During the critical 100-year snowmelt event is 873.3 ft (2.5 ft below the ordinary high water level (OHWL))
  - During the 100-year rainfall event is 874.3 ft (1.5 ft below OHWL)
- The pumping scenario which turns the pump on at OHWL and off 1.5 ft below OHWL produces the combination with the fewest number of deployments balanced with the greatest level of flood protection preferred for the lake. DNR staff have indicated this is within an allowable range.



Findings – Arrowhead Lake

- Arrowhead Lake Levels in recent years from 2017-2023
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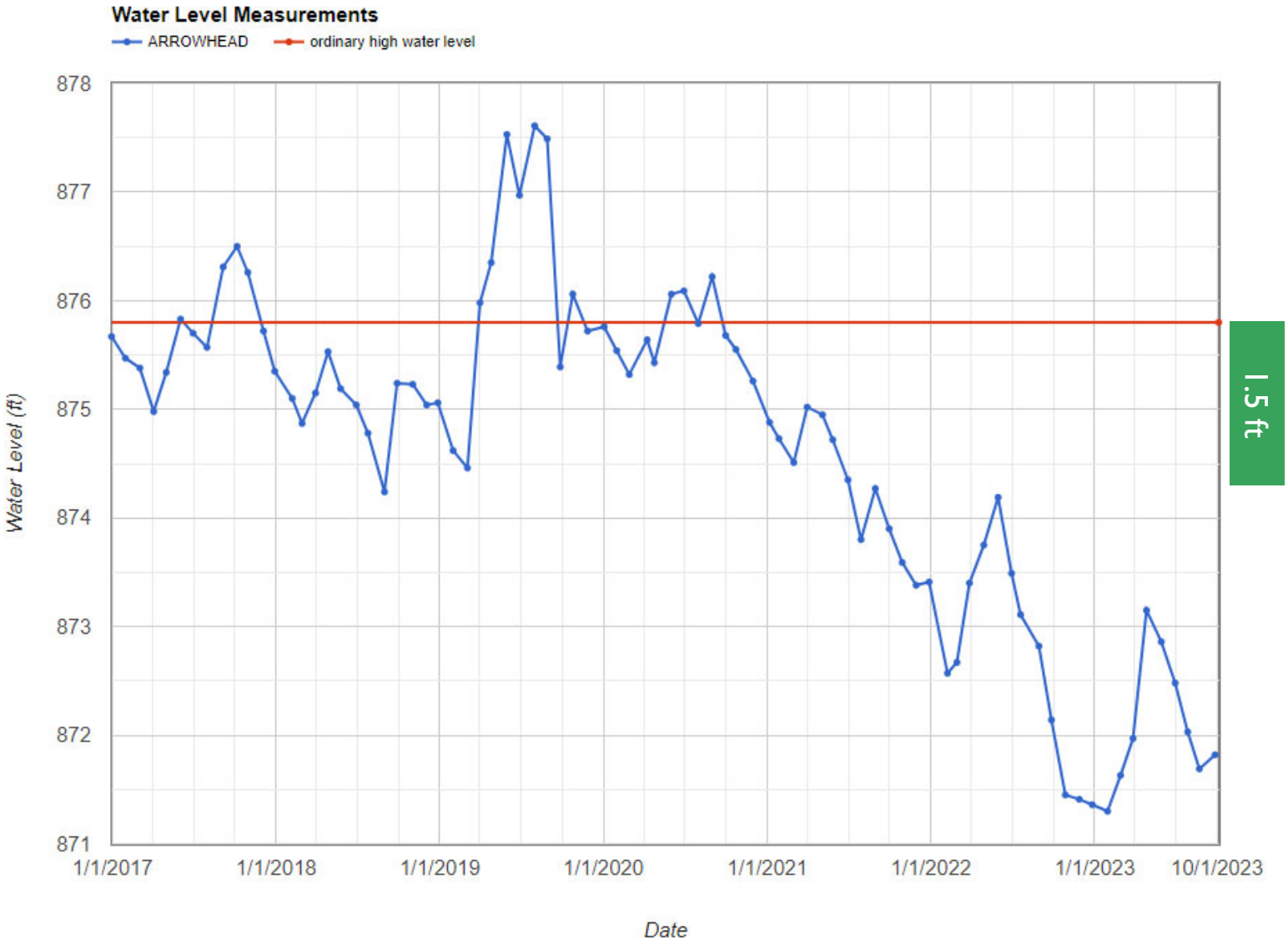

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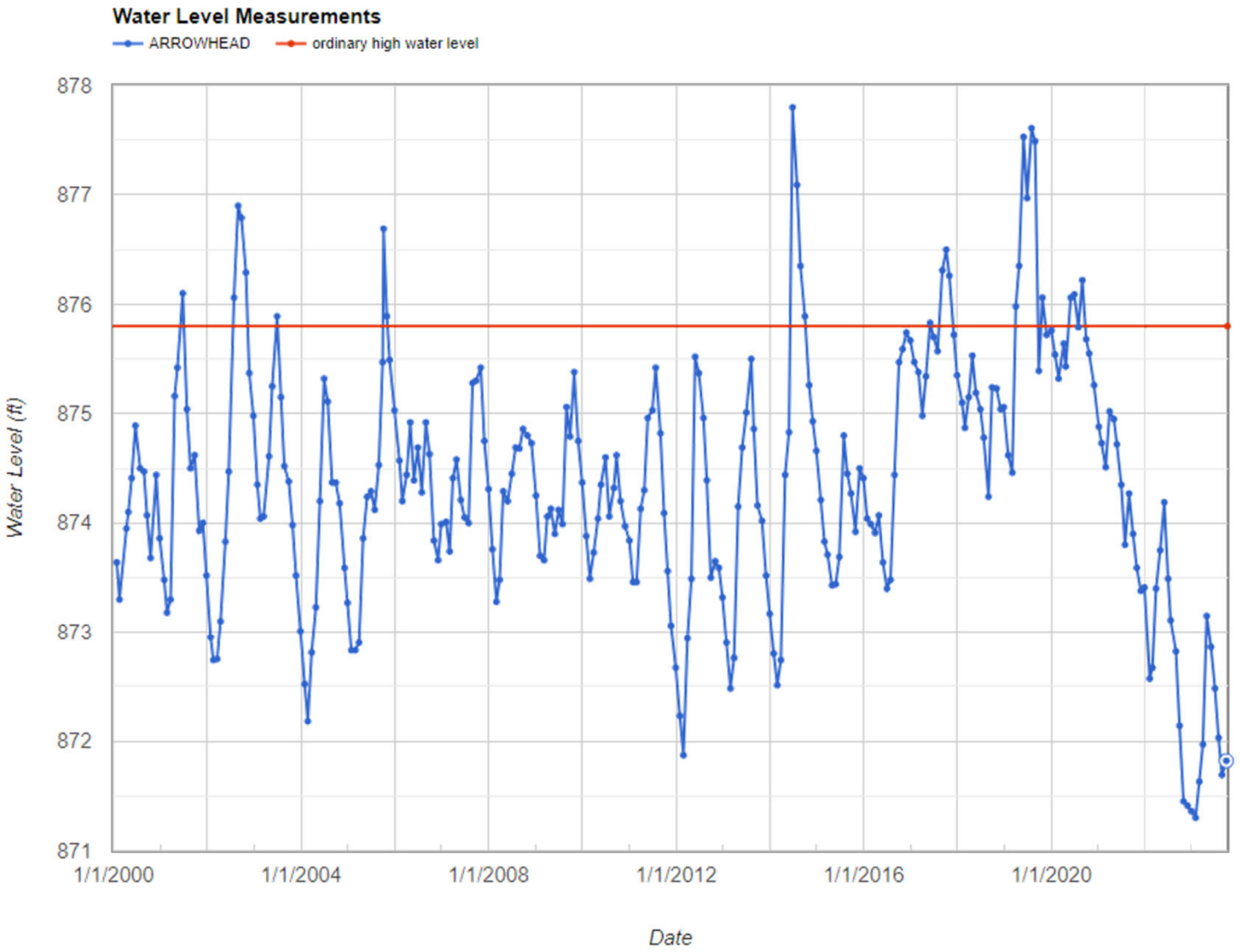

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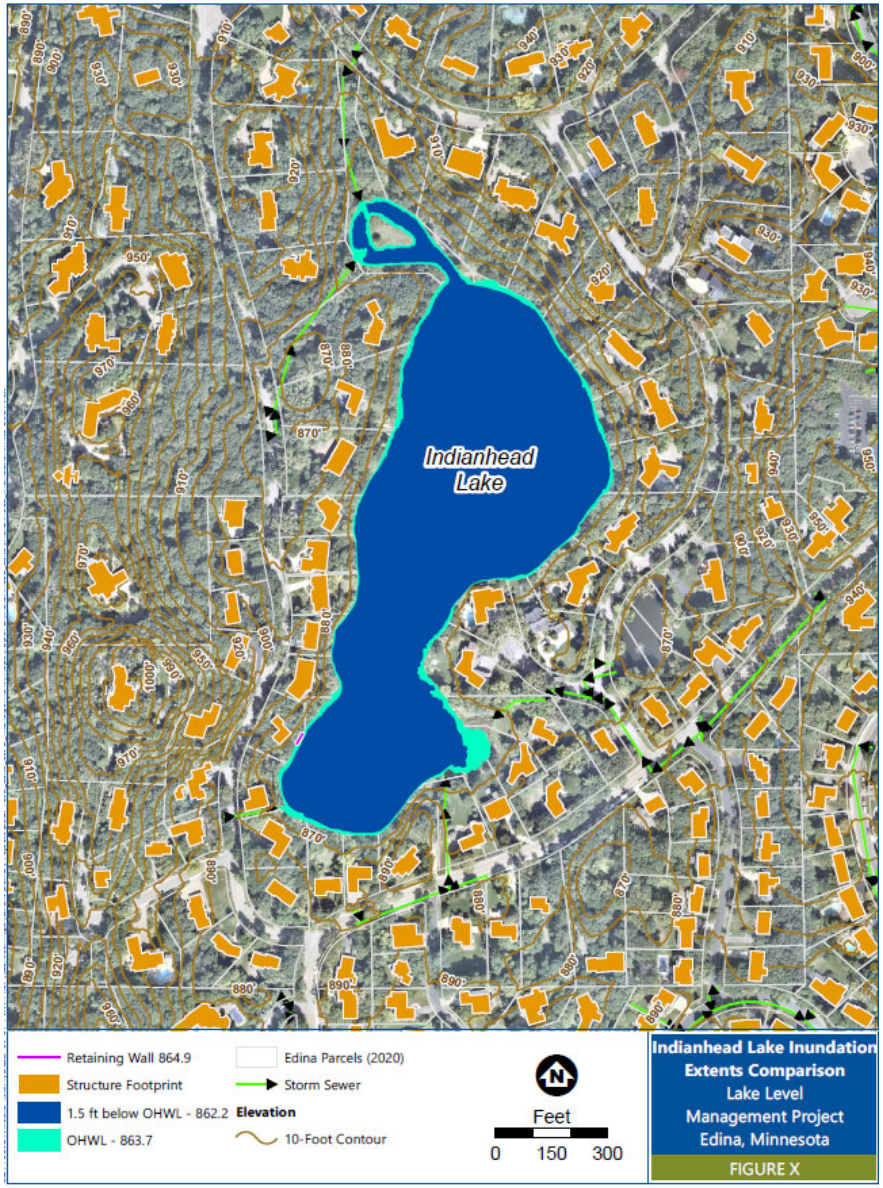
Findings for Indianhead Lake

- Starting level needed to protect low structure (structural retaining wall)
  - During the critical 100-year snowmelt event is 859.9 ft (3.8 ft below the ordinary high water level (OHWL))
  - During the 100-year rainfall is 861.8 ft (1.9 ft below OHWL)
- The pumping scenario which turns the pump on at the OHWL and off 1.5 ft below OHWL produces the combination with the fewest number of deployments balanced with the greatest level of flood protection preferred for the lake. DNR staff have indicated this is within an allowable range.
- Augmentation of lake levels above 861.8 ft during the summer months increases risk of flooding the low primary structure during large rain events.



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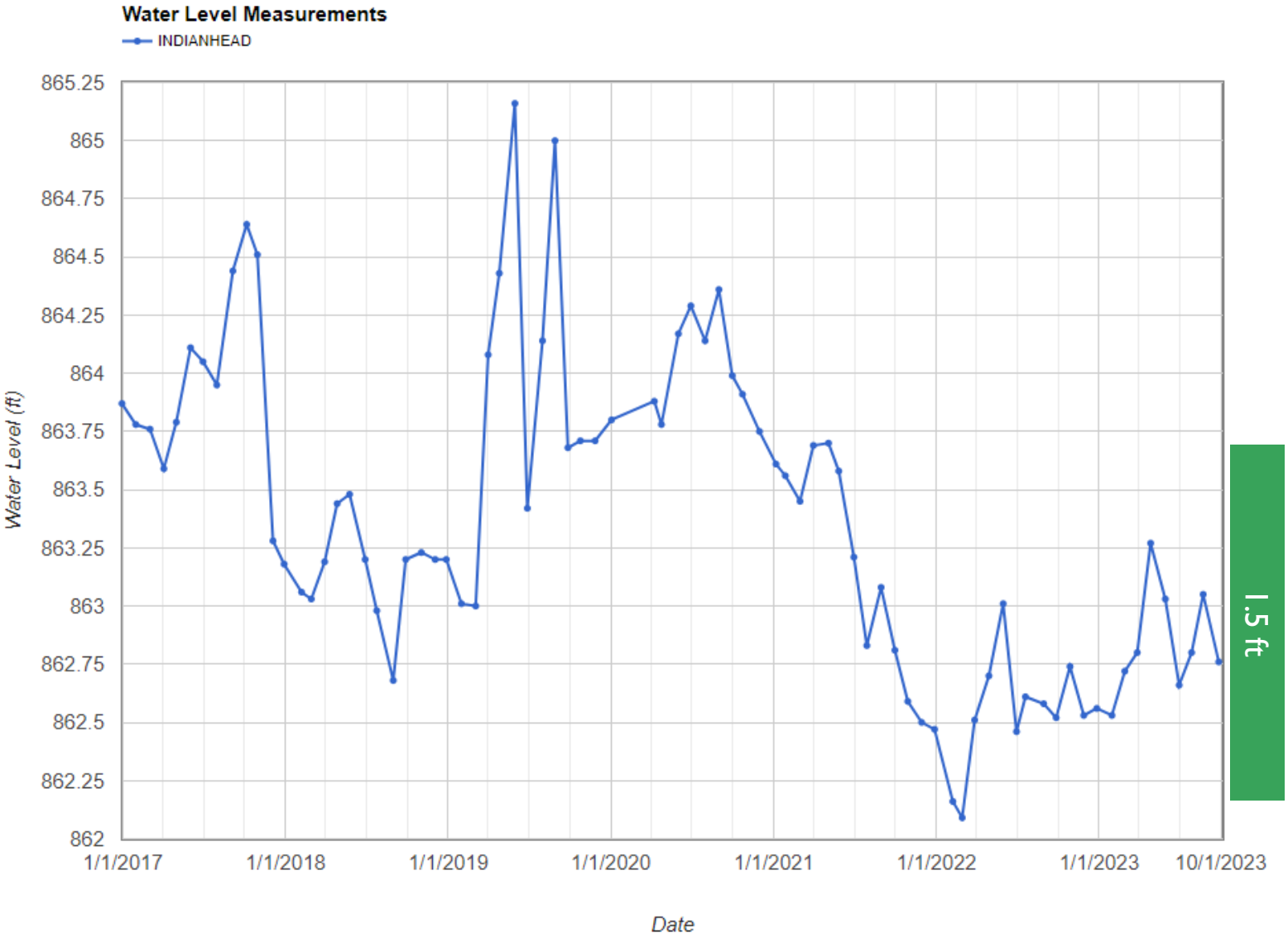

1.5 ft

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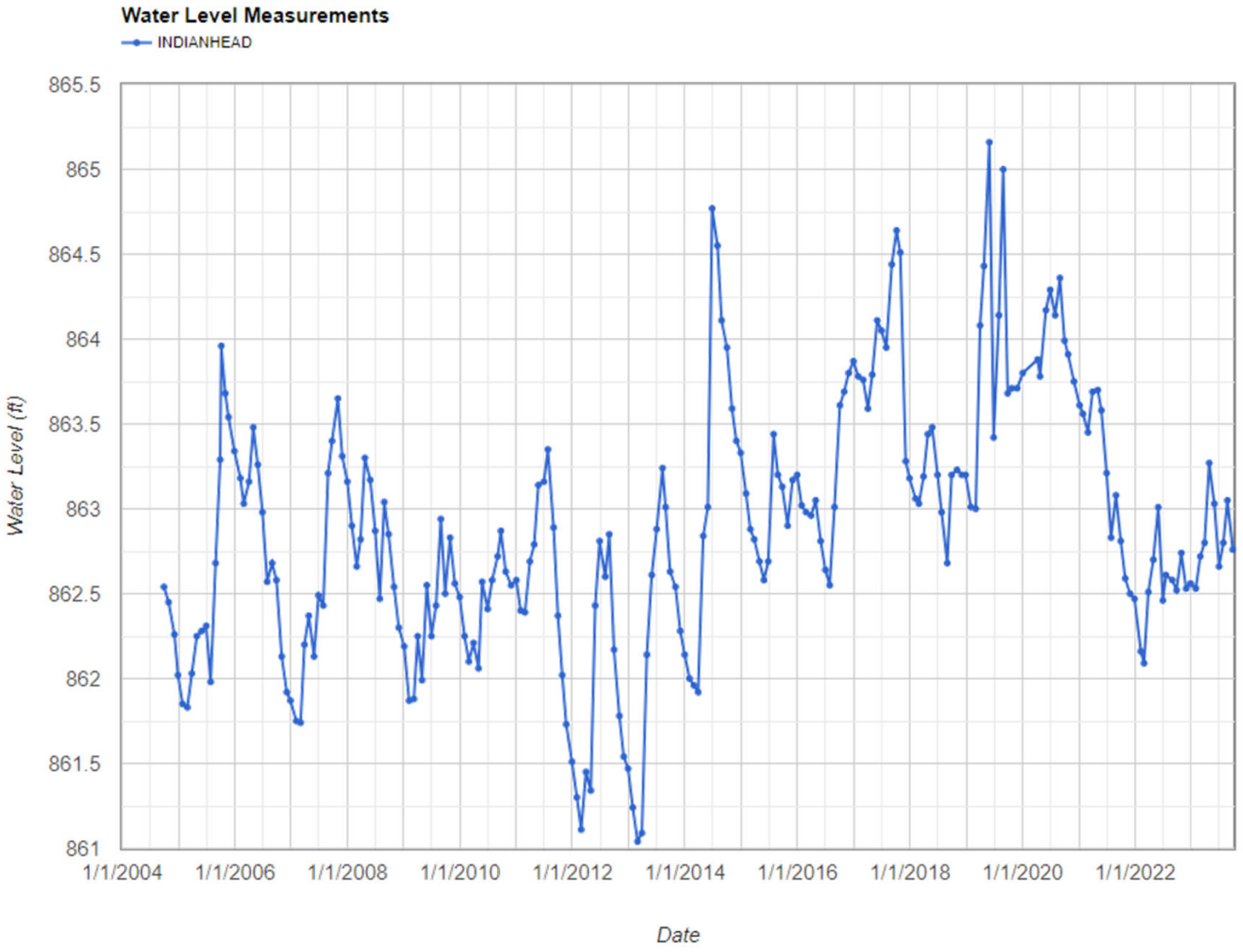

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