



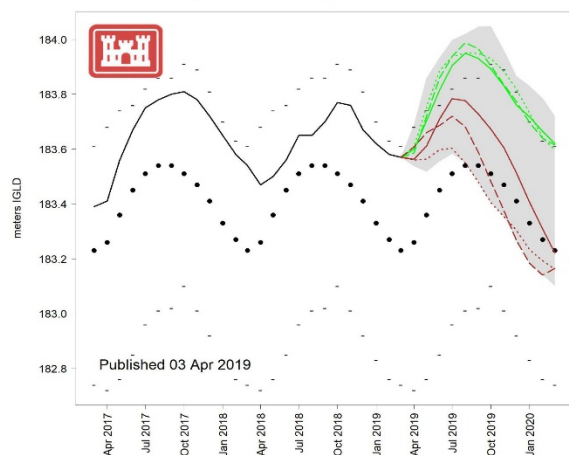
**US Army Corps
of Engineers
Detroit District**



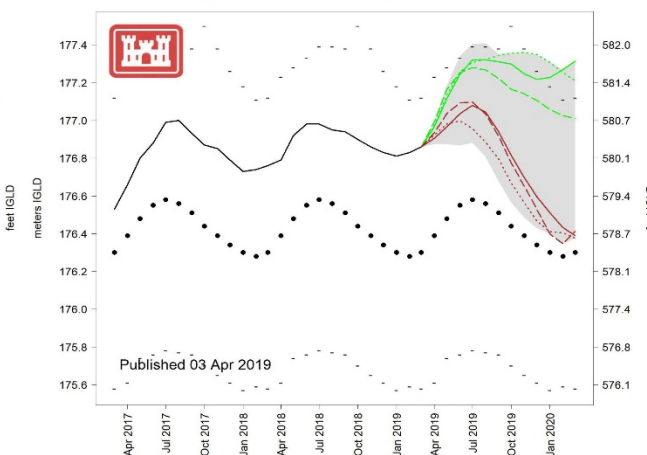
Great Lakes Water Level Outlook

Volume 15: April 2019 12-Month Outlook

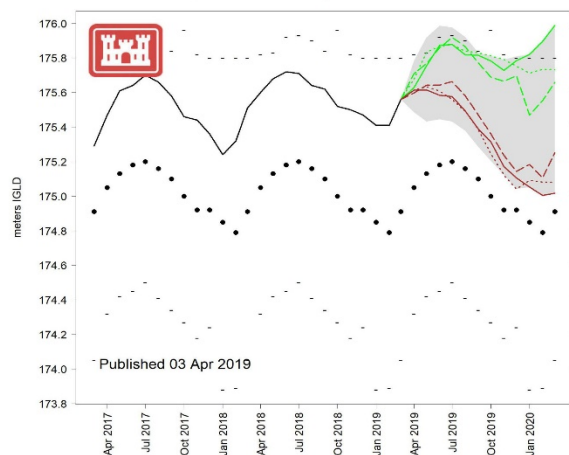
Lake Superior Monthly Mean Water Levels



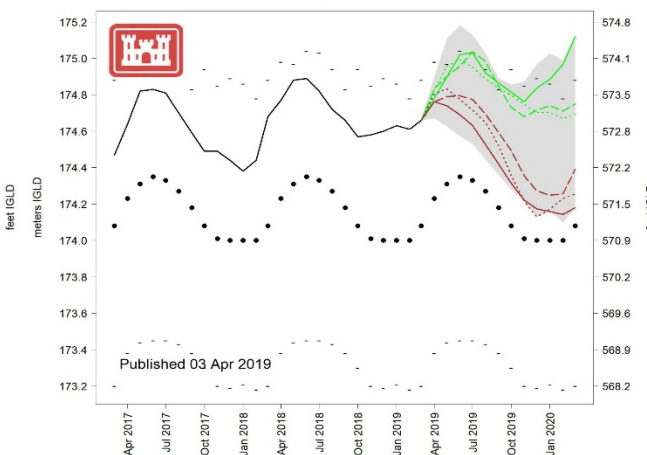
Lake Michigan-Huron Monthly Mean Water Levels



Lake St. Clair Monthly Mean Water Levels



Lake Erie Monthly Mean Water Levels



— Observed Monthly Mean ■ Range of Possible Outcomes ● Long Term Average - - Long Term Max/Min
 — 1996 - - 2013 - - 2014 - - 1930 - - 1976 - - 1998

*At this time, water level outlooks for Lake Ontario are still under development due to complexities of its weekly regulation process. For the official 6-month forecast of all lakes, including Lake Ontario, see the [Monthly Bulletin of Great Lakes Water Levels](#).

Overview

Heading into the early spring, water levels remain high across the Great Lakes. The March monthly mean water level for Lake Superior was only 2 inches below its record high water level for the month. The rest of the lakes are not as close to reaching record highs, but are still well above long-term average water levels. During the spring, the lakes tend to rise due to increased precipitation and increased runoff as result of snowmelt. In the fall, the lakes generally fall due to an increase in evaporation as temperatures cool off and the cold air moves over the relatively warm lake waters. We refer to the combined effect of precipitation over the lake, evaporation from the lake, and runoff to the lake as Net Basin Supply (NBS).

This edition of the Water Level Outlook incorporates the projection of water levels if NBS values are similar to those seen during years when water levels experienced a large spring rise or a large fall decline. The three green lines represent scenarios that are characterized by a significant spring rise. The three brown lines represent scenarios that are characterized by a steep fall decline. To see the magnitude of the rise and decline for each year view Figure 1 on page 4 that shows the full period of record of monthly mean water levels (1918-present).

1996 Scenario

1996 is a year when a large spring rise occurred on the lakes and this scenario is shown as the solid green line. In 1996, heading into the spring, snowpack was very high due to record breaking snowfall that occurred in various locations throughout the basin. Sault Ste. Marie, Michigan broke its winter snowfall record receiving 222 inches of snow. This scenario also includes high ice cover during the winter of 1996 for the Great Lakes basin, which peaked at 81% in early March. In this scenario, precipitation in April and June is well above average throughout the basin and runoff plays a large role in May NBS as it was well above average during that month. On the plot, the 1996 NBS scenario indicates water levels toward the higher end of possible outcomes with Lake Superior water levels surpassing record high levels

in June through September and Lake Erie tying record high water levels in July and surpassing record highs in September. Also to note, in the 1996 NBS scenario water levels toward the end of the period go above record high levels on all the lakes. This is likely a result of above average precipitation that occurs between December and March along with increased runoff, causing NBS to be well above average for that time of year.

2013 Scenario

The 2013 scenario also depicts a significant water level rise occurring in the spring and is shown by the dashed green line. The winter of 2012-2013 was characterized by a late start with most of the snow falling in February. Due to the late start to winter, Great Lakes basin ice cover peaked at 38.4% in mid-February 2013. Temperatures in March 2013 were below normal and significant runoff did not occur until later in the spring. Runoff was well above average for the Great Lakes basin April through July. This was coupled with generally above average precipitation during the same time period and led to sharp rises across all the lakes in the spring and early summer. The 2013 NBS scenario would lead to record high levels on Lake Superior June through September and on Lake Erie July through September.

2014 Scenario

The 2014 NBS scenario is another example of what could happen if a large spring rise in water level occurs. This is shown by the dotted green line on the diagram. The winter of 2013-2014 was characterized as very cold and very snowy. Many areas around the Great Lakes experienced a top 10 coldest winter with some areas also receiving record breaking snowfall. Detroit, MI experienced its snowiest winter on record in 2013-2014 with about 95 inches of snow. The cold temperatures throughout the winter led to significant ice cover across all the lakes, with total coverage for the Great Lakes basin peaking at 92.5% in early March, becoming the 2nd largest percentage of ice cover for the basin in the period of record (1972-2018). Heading into the spring, there was a significant snowpack to be melted, which led to increased runoff during the spring. The basin also

received above average precipitation between April and July contributing to above average NBS. On the diagram, the 2014 NBS scenario would result in record high water levels on Lake Superior for a majority of the next year, while on Lake Michigan-Huron the NBS sequence would result in record high water levels later in the period between December and March.

1930 Scenario

1930 is a year when a large decline occurred in the fall on the lakes and this scenario is shown as the solid brown line. In the 1930 scenario, a warm summer along with below average precipitation during July and August kept the basin hot and dry. Heading into the fall, the below average precipitation continued, but the temperatures turned much cooler. The colder air moving over the relatively warm lakes from the hot summer likely resulted in increased evaporation during the fall. This led to diminished NBS during the fall, resulting in sharp water level declines. In this scenario, water levels on Lake Superior would return to average by the end of the period, while on Lakes St. Clair and Erie the 1930 NBS scenario would be at the bottom of range of possible outcomes toward the end of the forecast period (gray shaded area).

1976 Scenario

The 1976 NBS scenario is also a scenario when a significant water level decline occurs in the fall and is shown by the dashed brown line. The summer of 1976 was rather cool throughout the Great Lakes basin, which caused well above average evaporation as early as July and August on Lake Superior and Lake Michigan-Huron. This was followed by near record cold temperatures in the fall season for the Great Lakes basin, which led to high evaporation rates throughout the fall and cause the lake levels to plummet. In this scenario, water levels on Lake Superior would fall below average by October, while the rest of the lakes would experience a sharp drop in water levels that lasted into the early winter.

1998 Scenario

The 1998 NBS scenario is another example of a scenario when a large fall decline in water level

occurs. This is shown by the brown dotted line on the diagram. The winter and spring of 1998 was one of the warmest on record in the Great Lakes basin, which caused reduced ice cover and water temperatures to be relatively warm heading into the summer and fall. The peak ice cover for the Great Lakes basin in 1998 only reached 14.3% during the winter due to the warmer than normal conditions. However, temperatures were closer to average in the summer, and increased evaporation began on the lakes in June. These high evaporation rates continued throughout the fall and into the early winter. On Lake St. Clair and Lake Erie, high evaporation during the fall was also coupled with below average precipitation. In this scenario, water levels would reach the bottom of the range of possible outcomes (gray shaded) in November and December. On Lake Superior and Lake Michigan-Huron the warm winter and spring of 1998 led to a small seasonal rise, which was followed by a steep decline in water levels. In this scenario, water levels on Lake Superior would fall below average by June and Lake Michigan-Huron would finish the forecast period at the bottom of the range of possible outcomes.

Climatic Outlook as of April 2019

The recent 1-month climate forecast for April updated by the Climate Prediction Center (CPC) shows a likelihood of above average temperatures across all lake basins. The 1-month precipitation outlook shows equal chances of above, below, or normal precipitation forecasted for the majority of the Great Lakes basin. The seasonal outlooks for temperatures in the early spring and summer also indicate above average temperatures throughout the majority of the Great Lakes basin. The seasonal outlooks for precipitation indicate above average precipitation for the very southern portions of the basin. One of the climatic factors that influences the outlooks are teleconnections, such as the El Niño Southern Oscillation (ENSO). Currently, a weak El Niño exists and it is expected to last through the spring and summer of 2019. In the Great Lakes region, an El Niño can be characterized by generally warmer and drier conditions, which has been reflected in the seasonal temperature outlooks.

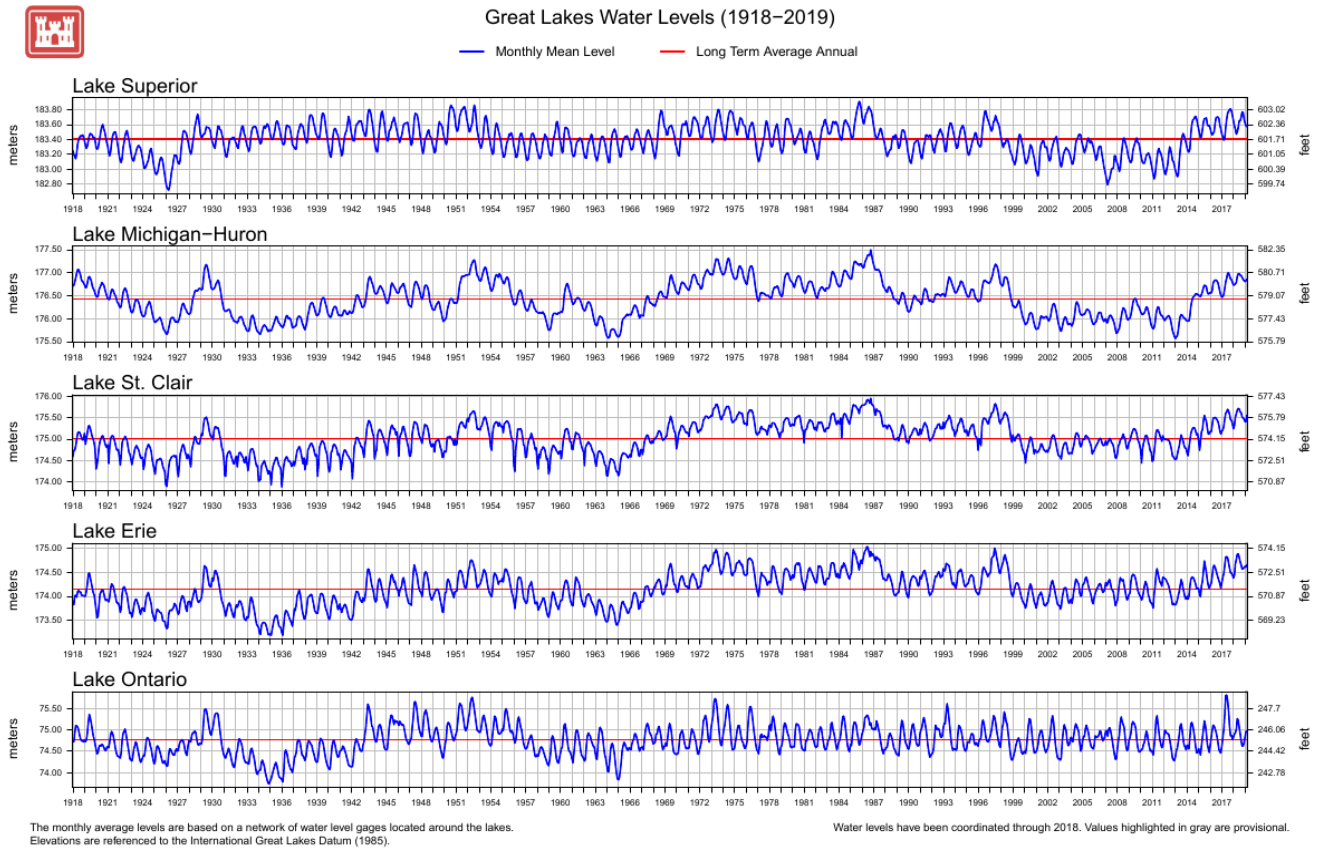


Figure 1: Monthly mean water levels for all of the Great Lakes for the period of record 1918-present.