



US Army Corps  
of Engineers  
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# Great Lakes Update



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## Great Lakes Water Levels Rise in 1996

Great Lakes levels have been above average for much of 1996. These higher levels are expected to continue into 1997. Above normal snowmelt, from the heavy winter snowfall, and precipitation in the spring triggered the rise in levels starting in April. Several months of above normal precipitation since April over the Great Lakes basin has resulted in a continuation of high levels. A brief discussion of factors affecting lake levels, and of weather trends that have affected the lakes during 1996 and are projected for 1997 is presented below.

### Factors Affecting Lake Levels

The levels of the Great lakes are the result of the interaction of natural and artificial factors which affect the water supply and discharge to and from the system. These natural factors include the inflows from the upper lakes, runoff from the land draining into the particular lake, groundwater, precipitation falling directly on the water surface, evaporation from the lake surface and outflow to the next lower lake. The enclosed insert shows the average contribution of each of these factors to each lake. Other natural phenomena which affect the water levels of the Great Lakes are ice in the connecting channels and the St. Lawrence River, aquatic weed growth in these rivers, changes in barometric pressure, wind-

induced waves, minor tides on the lakes and crustal movement. Artificial factors which affect Great Lakes levels include the regulation of the outflows of Lakes Superior and Ontario, the diversion of water into, out of and between the Great Lakes basins, dredging in the connecting channels and consumptive use.

### Future Weather Conditions in the Great Lakes Region

The fall and winter months of the year generally find water levels on all of the Great Lakes experiencing a seasonal decline as the warmer lake water evaporates into the cooler autumn air. These seasonal fluctuations are very dependent on "normal" temperature and precipitation patterns; drought or an early cold snap may hasten these decreases while a rainy season may stabilize levels. Last winter and spring, a northern storm track through Lake Superior and a southern track through the Ohio Valley resulted in the flooding that occurred in these areas, while the central and southern Lakes experienced one of the dryer December through March periods on record.

The National Weather Service's "Long Lead Forecast" for this coming December through February calls for warmer than normal temperatures across all of the Great Lakes basin, while a lower than normal

precipitation pattern is forecast to develop across the northern lakes by late winter. This indicates an average storm track from the southern Rockies to north of Lake Superior, carrying more of the precipitation to the west and north of the Great Lakes. Lake levels in those basins hardest hit by rainfall and snowmelt last winter are expected to move toward their long-term averages if the predictions are on target. However, the lakes produce climatic variations throughout the Midwest that are not necessarily reflected in the outlook models.

### Lake Superior

Lake Superior started 1996 near its January long-term average (LTA). From February to April, the lake continued to rise following its seasonal pattern. However, it remained only about 1 inch above the average. From April to August lake levels rose to a monthly mean level of 602.95 feet or, about 9 inches above the LTA. This was about 3 inches below the 1952 record high and 30 inches above the 1926 record low levels. Runoff from the above normal winter snowfall and rainfall are the major contributing factors to the high lake levels.

Lake Superior's October monthly mean was about 7 inches above its LTA level for the month. Precipitation has been above normal for 7 of the last 10 months, January

through October, with March, May and August being below normal. Precipitation over the basin during October was about 44% above normal for the month. Consequently, water levels on Lake Superior continue to be above average. Levels peaked during the August - September period and are now in the seasonal decline. The October monthly mean of 602.72 feet is about 8 inches below and about 24 inches above the respective 1985 record high of 603.38 feet and 1925 record low of 600.72 feet for the month.

Water from Lake Superior flows through several structures that stretch across the St. Marys River at Sault Ste. Marie, Michigan and Ontario. These include three hydropower

plants, five navigation locks and a gated dam at the head of the St. Marys Rapids called the Compensating Works. Outflows from Lake Superior are determined by the International Lake Superior Board of control (ILSBC) and sanctioned by the International Joint Commission (IJC) by using the current Regulation Plan 1977-A as a guide.

Between May and September of this year, the U.S. Army Corps of Engineers and Great Lakes Power Limited of Canada carried out repairs to this control dam. To ensure worker safety the number of gates used to pass water through the dam was limited, with the approval of the International Joint Commission, to 3 gates for much of the repair period,

resulting in outflows being less than specified by the regulation plan. This resulted in Lake Superior levels rising about 2-1/2 inches higher than would have occurred with strict application of the regulation plan.

With completion of repairs to the Canadian side in August it was possible to increase the gate opening to 5 gates resulting in an outflow near that called for by the regulation plan. After completion of repairs to the U.S. side in September, all 16 gates were opened with the approval of the ILSBC and IJC. This action continued through October and will continue into November. The resultant outflows are in excess of amounts specified by the regulation plan and are expected to bring Lake

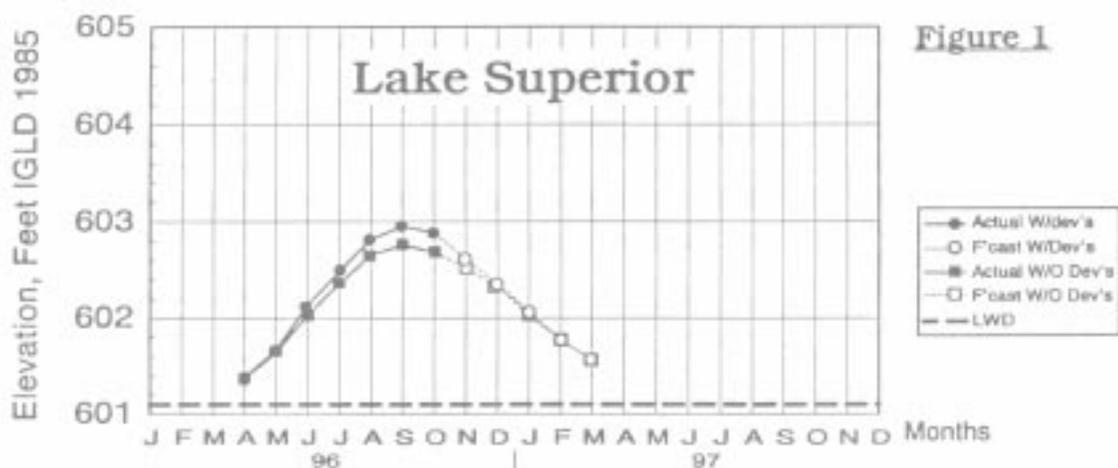


Figure 1

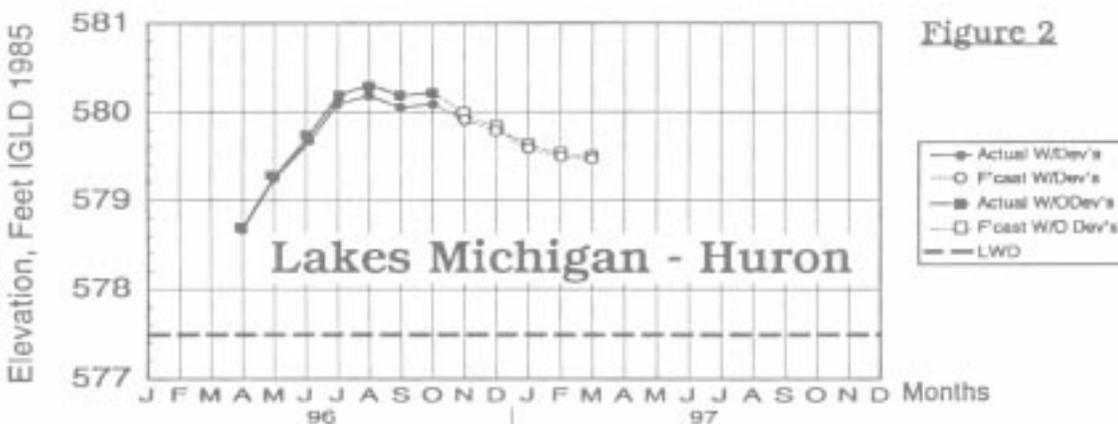


Figure 2

Figure 1 and 2. Lake Superior levels were about 2-1/2 inches higher and Lake Michigan-Huron levels were about 1-1/2 inches lower than they would have been if the regulation plan had been followed strictly. By December levels are expected to be where they would have been if the regulation plan had been followed.

Superior levels back to where they would have been by December if the regulation plan had been followed with no deviations. At that time an equivalent gate setting of one gate open will be maintained until the end of April 1997.

While Lake Superior levels rose an additional 2-1/2 inches, Lakes Michigan-Huron levels were about 1-1/2 inches lower than they would have been had the repair work not been ongoing, and the Lake Superior regulation plan been followed normally. As the result of the increased Lake Superior outflows, Lake Michigan-Huron levels are expected to be where they would have been by December had the regulation plan been followed normally.

Figures 1 and 2 opposite compare Lakes Superior and Michigan-Huron levels with deviations from the plan due to the repair work to levels which would have occurred had the regulation plan been followed normally. The figures show that actual Lake Superior levels were higher than they would have been if the regulation plan had been followed strictly. The maximum difference of about 2-1/2 inches occurred in September. Conversely, Lakes Michigan-Huron levels were lower than they would have been, with the maximum difference being about 1-1/2 inches during the period August to October.

### Lakes Michigan - Huron

Lakes Michigan-Huron started 1996 near the January LTA. From February to April levels continued to rise, following their seasonal pattern. The April mean was about 1 inch above the monthly LTA. From April lake levels rose steadily, peaking in August at a monthly mean level of 580.18 feet or, about 9 inches above the LTA. This was about 22 inches below the 1986 record high and 42 inches above the 1964 record low levels. Above normal rainfall and snowmelt on the Lakes Superior and

Michigan-Huron watersheds were the major contributor to the high levels. Since peaking in August levels have been in their seasonal decline.

The Lakes Michigan-Huron October monthly mean was about 19 inches above its LTA level for the month. Precipitation has been above normal for 5 of the last 10 months, January through October, with March, May, June, August and October being below normal. Precipitation over the basin during October was about 7% above normal for the month. Water levels on Lakes Michigan-Huron continue to be above average. The October monthly mean of 580.05 feet is about 28 inches below the 1986 record high of 582.35 feet and about 43 inches above the 1964 record low of 576.44 feet for the month.

As indicated above, Lakes Michigan-Huron levels were about 1-1/2 inches lower, while repair work was ongoing at the Compensating Works located at the head of the St. Marys Rapids, than they would have been had the repair work not been done, and the Lake Superior regulation plan had been followed normally. As previously noted Lake Superior outflows have been increased to remove that additional water, and will result in December Lake Michigan-Huron levels being where they would have been had the regulation plan been followed strictly.

### Lake St. Clair

Lake St. Clair started 1996 near the January LTA. Lake levels peaked in July at a monthly mean level of 575.79 feet. This was about 12 inches above the July LTA and about 17 inches below the 1986 record high level and about 39 inches above the 1934 record low level for the month. Since July the lake has been in its seasonal decline.

January and April monthly mean levels of 578.64 feet and 578.94 feet respectively were significantly below expected levels, as indicated in the

accompanying *Monthly Bulletin of Lake Levels for the Great Lakes* for October. The low January and April mean levels were due to ice jams which occurred in the lower St. Clair River. Ice build-up in the St. Clair River is a natural occurrence every winter, and varies in degree by the severity of the winter. These ice jams can significantly affect water levels on Lake St. Clair and on the river itself. When ice jams occur both U.S. and Canadian Coast Guard icebreakers have been deployed to reduce flood risks and to maintain an open channel for navigation.

The Lake St. Clair October monthly mean was about 17 inches above its LTA level for the month. Water levels on Lake St. Clair continue to be above average. Levels peaked in July and are now in the seasonal decline. The October monthly mean of 575.52 feet is about 21 inches below the 1986 record high of 577.30 feet and about 45 inches above the 1934 record low of 571.75 ft for the month.

### Lake Erie

Lake Erie started 1996 at about 2 inches above the January LTA. By April the level was about 1 inch above the monthly LTA. Levels continued to rise, peaking in July at a monthly mean of 572.90 feet. This was about 12 inches above the July LTA and was about 16 inches below the record 1986 high and about 46 inches above the 1934 record low levels. After peaking in July the lake entered its seasonal decline. Above normal precipitation over the Lake Erie basin, as well as above normal rainfall and snowmelt on the watersheds of the upper lakes were the major contributors to the high levels.

The Lake Erie October monthly mean was about 17 inches above its LTA level for the month. Precipitation has been above normal for 6 of the last 10 months, January through October, with February, March, August and October being below normal. Precipitation over the basin during

October was about 18% above normal for the month. Water levels on Lake Erie continue to be above average. The October monthly mean of 572.44 feet is about 18 inches below the 1986 record high of 573.95 feet and about 46 inches above the 1934 record low of 568.57 feet for the month.

### Lake Ontario

Lake Ontario started 1996 at about 3 inches above the January LTA. By April the level was about 2 inches below the monthly LTA. Levels continued to rise, peaking in June at a monthly mean of 246.82 feet. This was about 8 inches above its June LTA and was about 21 inches below

the record 1952 high and about 41 inches above the 1935 record low levels. After peaking in June the lake entered its seasonal decline. Above normal precipitation over the Lake Ontario basin as well as above normal rainfall and snowmelt on the watersheds of the upper lakes were the major contributors to the high levels.

The Lake Ontario October monthly mean was about 4 inches above its LTA level for the month. Precipitation has been above normal for 7 of the last 10 months, January through October, with February, March, and August being below normal. Precipitation over the basin

during October was about 20% above normal for the month. While water levels on Lake Ontario continue to be above average they appear to be approaching the LTA. The October monthly mean of 245.21 ft is about 19 inches below the 1945 record high of 246.78 ft and about 36 inches above the 1934 record low of 242.29 ft for the month.

\* Note that all elevations referred to in this newsletter are in IGLD datum.