



**US Army Corps
of Engineers
Detroit District**



Great Lakes Update

Lake Winnebago Regulation

The Lake Winnebago-Fox/Wolf system is located in east-central Wisconsin and has an area of 6,340 square miles. The basin is comprised of the Wolf River, the Upper Fox River, the Lake Winnebago pool and the Lower Fox River. The Lake Winnebago pool consists of Lakes Winnebago, Poygan, Winneconne and Butte des Morts (Figure 1). This article will acquaint readers with basic information on the Lake Winnebago –Fox/Wolf River system and inform them about the U.S. Army Corps of Engineers' regulation activities.

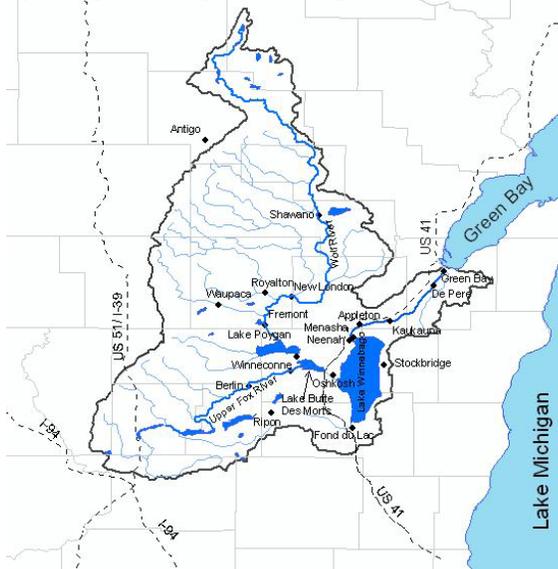


Figure 1: Lake Winnebago-Fox/Wolf River Watershed

Basin Profile

The Wolf River originates in the central part of Forest County, Wisconsin, and flows in a mostly southerly direction through several small lakes,

Lake Poygan, Lake Winneconne and Lake Butte des Morts. The Wolf River joins the Upper Fox River in Lake Butte des Morts.

The Upper Fox River flows through many flat marshy areas, many with poor drainage. The higher grounds surrounding the flood plain are generally good quality agricultural lands, chiefly devoted to dairy farming.

Lake Winnebago, located between the Upper and Lower Fox Rivers, is the largest inland lake in the state of Wisconsin and one of the largest freshwater inland lakes in the United States. A federally owned dam at Menasha and a privately owned dam at Neenah control the outflows from Lake Winnebago into the Lower Fox River. At the elevation of the crest of the Menasha Dam, Lake Winnebago has surface area of about 206 square miles, a length of about 28 miles, a width of about 10 miles and a depth of about 21 feet.

The Lower Fox River, connecting Lake Winnebago and Green Bay, is 39 miles long and the vertical drop from Lake Winnebago to Green Bay is about 168 feet. The river generally flows between high clay banks with frequent areas of exposed limestone. Most of the properties adjacent to the Lower Fox River consist of either municipal buildings or industrial facilities such as hydroelectric power plants, paper mills or other factories. Recently there has been increased residential development along the Lower Fox River. The remainder of the drainage basin

below Lake Winnebago is primarily used for agricultural needs.

Water Level Regulation on Lake Winnebago

The Corps has regulated the levels of Lake Winnebago since 1959. On a daily basis, Corps staff reviews a suite of information including current water levels, weather forecasts, flow rates and winds in order to balance the basin’s many water resource needs.

An important objective of lake operations is to reduce downstream flooding during spring rains and snowmelt. The lake is drawn down in the winter in anticipation of spring rainfall and increased runoff from snowmelt. The lake’s storage capacity allows it to be used to reduce incidents of downstream flooding. After the threat of spring flooding has passed, the lake level is gradually raised to its summer target for navigation and recreational boating.

All regulation strategies are based on limits under the Marshall Order. The Marshall Order was established in 1886 to “maintain the level of Lake Winnebago at or below” flood stage, which is 3.45 feet Oshkosh Datum. Oshkosh Datum is a local datum and all Lake Winnebago elevations are referenced to it.

Navigation interests led to the modification of the Marshall Plan in 1920. The new order instituted a lower limit for Lake Winnebago during the navigation season equal to the crest of the Menasha Dam, or 1.68 feet Oshkosh Datum.

During the years the Corps has regulated the lake, water levels have remained predominantly within the limits of the Marshall order. The Great Lakes Hydraulics and Hydrology Office (H&H) of the Corps’ Detroit District oversees the water control activities for the Fox-Wolf River basin. H&H staff works closely with local personnel at the Corps’ field office in Kaukauna, Wisconsin in

making daily regulation decisions. Staff from the Kaukauna office adjust the flow control gates at the Menasha Dam (Figure 2), make downstream pool adjustments at the other federally owned dams along the Lower Fox and monitor many gauges. Kaukauna personnel do not make adjustments at the Neenah Dam since it is privately owned by Neenah Paper. All adjustments at the Neenah Dam are handled by private contractors of Neenah Paper in coordination with Corps staff.



Figure 2: The Menasha Dam

Current Regulation Strategies

The Current regulation strategy for Lake Winnebago is divided into five periods (Figure 3), each detailed in the next series of paragraphs.

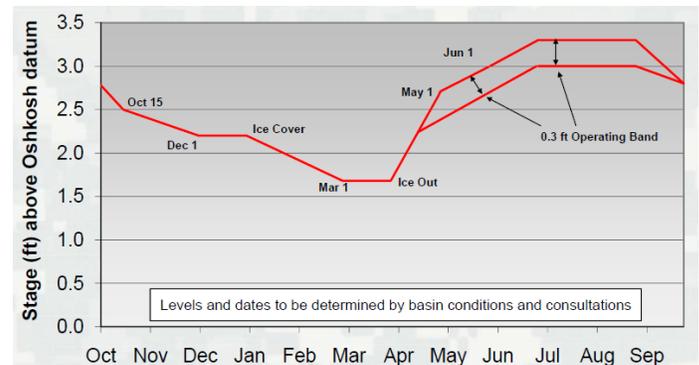


Figure 3: Regulation Strategy

(1) Winter Drawdown

After a solid ice cover forms, the lake level is slowly drawn down. The upper pool regions of Lake Poygan, Lake Winneconne and Lake Butte des Morts contain the majority of the sensitive wildlife habitat, which is susceptible to ice damage. A sudden increase in water level during the winter may damage rooted aquatic plants locked in the ice. For the sake of fish and other aquatic life, the water level should not be drawn down before a solid ice cover develops. Close contact with the Wisconsin Department of Natural Resources (WDNR) is maintained during this time for advice on ice conditions. If no solid ice cover forms by early January, drawdown must begin regardless.

The drawdown provides capacity to contain spring flooding. Flooding in the Lake Winnebago pool and/or the Lower Fox River is likely to occur when the ice cover on Lake Winnebago and the existing snowpack melts and the Lake Winnebago pool capacity is not sufficient to contain the additional runoff. If the lake level is reduced too far, spring outflows may have to be severely restricted in order to achieve the required navigation stage when the pool is refilled. The drawdown target level is determined during an annual Drawdown Conference Call between the Corps and interested parties in early January. Typically, a target level of 1.68 feet by March 1 is selected, but the target level and date is flexible depending on conditions that develop during the spring. As the winter progresses, the District Office consults the National Weather Service (NWS) and field personnel to develop an outlook for the spring runoff. For example, if below average snow is recorded, little spring runoff will occur and it could be difficult to achieve the summer target by June 1. In this situation, it would be best to increase the March 1 target level to ensure we achieve 3.0 feet by June 1. Since 1990, the drawdown has averaged about 1.45 feet which is 0.5 feet above the average historical drawdown level.

(2) Between Drawdown and Ice-out

Once the drawdown target is achieved, basin conditions are evaluated to determine how quickly the lake level can be allowed to rise before the ice cover in the Winnebago upper pool region breaks up and starts moving out. This period can vary greatly from year to year depending on how much snow remains in the basin and the spring weather conditions. As stated before, large water level increases can cause considerable ice damage to wetlands and shoreline structures. Close contact with the WDNR and Kaukauna Utilities is maintained in late March or early April for input on when the ice cover has broken up. During normal conditions the water level is raised very slowly and gradually through the early spring as the snow melts, but no major increases in level are allowed at this point.

(3) Spring Refill

When the upper pool ice cover is in such a deteriorated state that a lake level rise would not adversely affect adjacent shoreline, the lake can be refilled. The start of the refill changes each year but typically occurs near the start of April. It is important to wait until any ice is almost completely melted before raising the level substantially. This delay helps minimize the risk of shoreline damage. A conference call is scheduled before the refill begins, much like the drawdown conference call, to discuss the possible strategies for refilling the lake.

If there was a dry winter with very little snowpack and the basin remains dry throughout the spring, the level may be increased more quickly to ensure the summer navigational target is hit. If there is a lot of snow remaining in the basin and a very wet outlook for the spring, a slower rise may be used to reduce the potential for flooding and minimize negative impacts on the aquatic vegetation throughout the basin. The summer target of 3.0 feet is usually hit between June 1 and July 1. The magnitude of the outflows

varies significantly from year to year, depending on inflow and extent of the drawdown. The hydropower generators on the Lower Fox River operate best when flows are about 4,000 to 4,500 cubic feet per second (cfs). Hydropower production, protection of the ecosystem, navigation and flood control are all important issues to consider during spring refill.

(4) Summer Season

During the summer portion of the navigation season, the level of Lake Winnebago will be held as close as possible to a target level of 3.0 feet above Oshkosh Datum. Water levels above 3.0 feet result in high water levels in the upstream lakes and can result in substantial environmental damage over time. While water levels will rise above 3.0 feet at various times during the late spring and summer, the Corps attempts to keep the level from spending sustained periods of time over 3.0 feet. Since the year's lowest inflows occur during the summer, it is not always possible to maintain Lake Winnebago's level at 3.0 feet. Stream flow into the Winnebago pool will often fall below 2,000 cfs. Evaporation losses, combined with lack of precipitation, sometimes result in negative net inflows. Consequently, the water level may fall three or four tenths below target by the time of the fall regulation meeting, even with all gates at the Menasha and Neenah Dams remaining closed.

(5) Between Navigation Season and Freeze-up

As the navigation season draws to a close, the level of Lake Winnebago will be gradually reduced to a freeze-up level determined at the fall regulation meeting. During this time period it is important from an environmental standpoint to avoid large changes in water level from around Oct. 1 through freeze-up of the lake. Large changes in the water level during this time can impact over-wintering habits of animals around the lake. For this reason the lake level is lowered as gradually as possible starting in mid September all the way through freeze-up. Ice formation

varies greatly from year to year but can start as early as mid-November or as late as the end of December. The date of the freeze-up target will shift each year based on the temperatures throughout the region.

Regulation Meetings and Conference Calls

A Regulation meeting is held on an annual basis, usually in October, to adjust regulation strategies in accordance with the Marshall Order directives and to address local issues. Since circumstances change from year to year, the meeting is necessary in order to set the target stages and dates for the upcoming regulation season. Representatives from the Corps, WDNR, hydropower users and other interested parties participate and discuss issues that arose during the year and provide feedback on a specific regulation strategy for the next year. The meeting allows local interests, authorities and members of the general public to have a say in how the lake is regulated. Cooperation between all parties is important because Lake Winnebago and the Lower Fox River are integrally related.

Several public conference calls are also held throughout the year to discuss current conditions and provide system users another avenue to voice concerns and discuss regulation strategies.

Lake Winnebago Info on the Web

For much more information on Lake Winnebago, including current and historical lake levels, precipitation information, and meeting and conference call announcements please visit the Detroit District's Lake Winnebago webpage at:

<http://www.lre.usace.army.mil/greatlakes/hh/lakewinnebago/>