



**US Army Corps  
of Engineers  
Detroit District**



# Great Lakes Update

## Ice Jams on the St. Clair River

The winter season brings a number of hydrologic changes to the Great Lakes. Water levels on all of the lakes are into their periods of seasonal decline due to reduced water supply and ice forms with the arrival of colder temperatures.

Ice formation varies by year and is largely dependant on winter air temperatures. When warmer air arrives in the spring, ice flows and jams can cause significant fluctuations in water levels of the lakes and flows in the connecting channels. Lake St. Clair and the St. Clair River often see the largest impacts including flooding, structural damage and river closures. This article will explain some of the characteristics of ice jams in the St. Clair River and examine two of the larger ice jam events, the record event during April 1984 and the recent event in February 2010.

Much of the historical information on the 1984 event comes from the report titled *Record St. Clair River Ice Jam of 1984* by Jan A. Derecki and Frank H. Quinn. Direct quotes from the article are noted in italics.

### **Formation of Ice Jams in the St. Clair River**

Winter temperatures across the Great Lakes basin typically average below the freezing mark. As the water temperatures decline, ice begins to form in protected bays and inlets first, then if temperatures remain cold enough, in the open waters of the lake.

Historically ice forms near the foot of Lake Huron, north of the Blue Water Bridge. Ice rarely forms in the upper St. Clair River due to high flow velocity. When solid ice cover at this location reaches clear across the lake, it is known as an ice bridge (Figure 1). The ice bridge acts as a natural barrier keeping the river free of large ice floes. During the course of the winter, the ice bridge can deteriorate and reform itself many times depending on meteorological conditions.



**Figure 1: Ice Bridge on Lake Huron (USCG)**

The break up of this ice bridge is a large contributor to the formation of ice jams in the St. Clair River. As temperatures warm or navigation commences, the ice bridge breaks and large amounts of ice can flow into the St. Clair River (Figure 2). Northerly winds can also accelerate ice movement into the river.

Since the delta of the St. Clair River is made up of many smaller channels and Lake St. Clair almost always develops a solid ice cover during the winter, ice often piles up in North, South and Middle Channels, rather than being pushed into the open lake. The delta of the river is commonly known as the St. Clair Flats because of its relatively flat topography. In this reach of the river, the fall is less than 10 inches. The total fall of the 39 mile St. Clair River is about 5 feet.

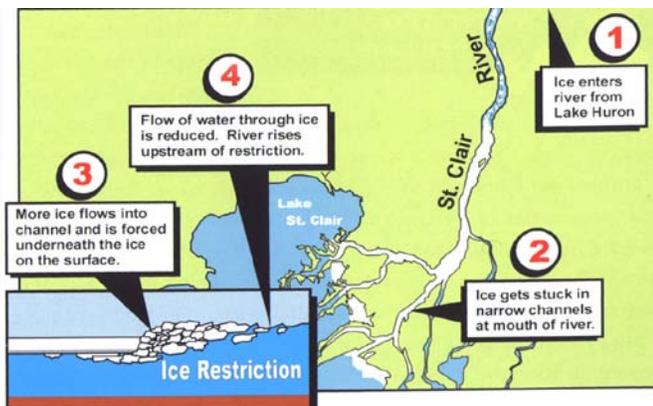


Figure 2: Ice Jam Formation

As ice continues to pile up in the channels, the natural flow of water can be impeded and cause large drops in water level downstream of the jam and significant rises upstream. It is not uncommon to see short-term fluctuations of Lake St. Clair's water level at many times during the winter as ice conditions change.

When possible, ice breaking vessels from the United States and Canadian Coast Guards will operate throughout the St. Clair River with the goal of clearing ice and restoring the natural flow of water (Figure 3). The Detroit District of the Corps of Engineers continuously monitors the ice and water levels in the river and maintains constant communication with the Coast Guard during ice jam events. If flooding becomes a concern upstream of any ice jam, warnings will be issued by the National Weather Service. Other impacts of ice jams include:

- ferry closings
- dock, pier and seawall damage
- navigation delays due to low and high water
- erosion



Figure 3: USCG Ice Breaker in the St. Clair River

### Examining the April 1984 Ice Jam

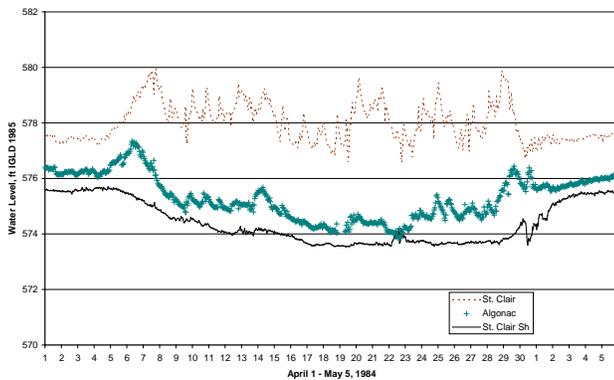
The ice jam of 1984 is considered to be the record event on the St. Clair River. The jam formed on April 5 and broke on April 29, a total duration of 24 days.

The winter of 1983 – 1984 experienced very cold temperatures in December and early January, which helped form a large ice field on Lake Huron. February was warmer than average, which led to some melting, with refreezing occurring during a cold March. April temperatures were near average and a large amount of ice was present in Lake Huron.

*The navigation season on the Great Lakes officially opened on March 26<sup>th</sup>, 1984 and continuous attempts by the shipping industry to use the waterway contributed to the ice jam problems on the St. Clair River. The ships kept breaking up the accumulated ice floes at the head of the river, preventing establishment of an ice bridge, which would have kept additional ice*

floes from entering the river. The large amounts of accumulated lake ice were being forced downstream through the St. Clair River by predominantly northerly winds, producing a record ice jam. Throughout the ice jam period, the Detroit River and Lake St. Clair were free of ice, serving as holding areas for many ships awaiting passage through the St. Clair River.

Lake St. Clair's water level dropped nearly 2 feet as a result of the jam (Figure 4). A sharp decline also occurred at Algonac, MI, while a sharp rise occurred at St. Clair, MI. The graph indicates the jam occurred south of St. Clair and north of Algonac.



**Figure 4: Water Levels During the 1984 Event**

The transit of ships through the river was very slow, very slow, with several stranded vessels, despite continuous assistance from all available ice breakers. The Lake Carriers' Association in Cleveland, Ohio (Waymire 1984), reported estimated losses of \$1,700,000 a day due to shipping delays during the ice jam, which established a record for both magnitude and lateness of occurrence.

Flooding was reported in many communities along the St. Clair River as water levels rose quickly behind the jam. At the jam's peak, the river had a packed ice cover extending from Algonac to Marysville, a reach of approximately 20 miles. Once the jam broke on April 29, Lake

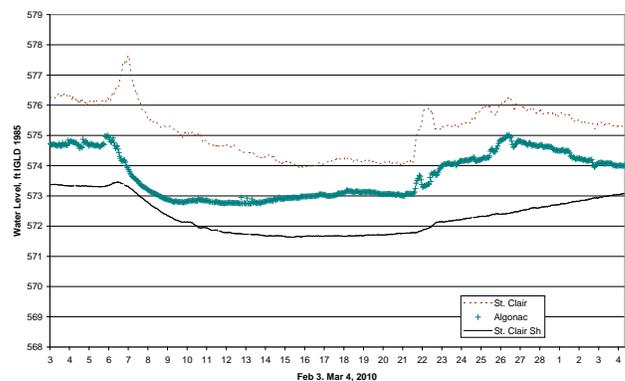
St. Clair rose dramatically, recovering most of the decline in 4 days.

**Examining the 2010 Event**

The ice jam event of February 2010 was also a long duration event. The jam formed February 6 and broke February 22, a duration of 16 days. Impacts to navigation were limited as most carriers were laid up for the winter.

The winter of 2010 was much milder across the board than the winter of 1984. Still there were long stretches of consecutive days with temperatures below the freezing mark. At Port Huron, MI temperatures were below freezing during most of January. A slight warm up near the end of January caused some deterioration of the ice bridge in Lake Huron, contributing to large amounts of ice flowing down the river.

Large fluctuations in water levels were again seen during this event. Lake St. Clair dropped close to a foot and a half, while the river level at Algonac also dropped (Figure 5).



**Figure 5: Water Levels During the 2010 Event**

No instances of significant flooding were reported during the February 2010 event, but there were some reports of dock and pier damage. At the jam's peak, solid ice cover was observed at Algonac, Marine City and St. Clair. Lake levels as a whole were approximately 2 feet lower in 2010 than 1984.

Ice reconnaissance flights made by the US Coast Guard on March 10 confirmed the presence of a deteriorating ice bridge in Lake Huron (Figure 6) and satellite imagery from March 11 shows the ice bridge and deteriorating ice fields in Lake St. Clair (Figure 7).



**Figure 6: Ice Bridge on Mar 10, with the Blue Water Bridge in the Distance**



**Figure 7: March 11 Satellite Image of the St. Clair River**

Images from the webcam located at the Fort Gratiot Light confirmed break-up of the ice bridge on March 12 (Figure 8). Note the large amount of ice flowing past the camera. For orientation, the Fort Gratiot Light is located one half mile north of the Blue Water Bridge.



**Figure 8: Ice Floe moving past Ft. Gratiot Light**

The large amount of ice entering the St. Clair River after March 12 led to the formation of second ice jam on March 20. This jam caused navigation delays in the St. Clair River as ice breaker escorts were needed to assist a number of ships. Ice remained in the river through the weekend of March 26.

The webcam at the Fort Gratiot Light and cameras at Algonac, MI can be accessed here:

<https://webcam.crrel.usace.army.mil/stclair/>

Other ice data can be found at the National Ice Center's website and can be accessed here:

<http://www.natice.noaa.gov/>

Information on water levels of the Great Lakes and Connecting Channels can be found on the Detroit District Corps of Engineers' website here:

<http://www.lre.usace.army.mil/glhh>

or from NOAA's Great Lakes Online website here:

<http://glakesonline.nos.noaa.gov>