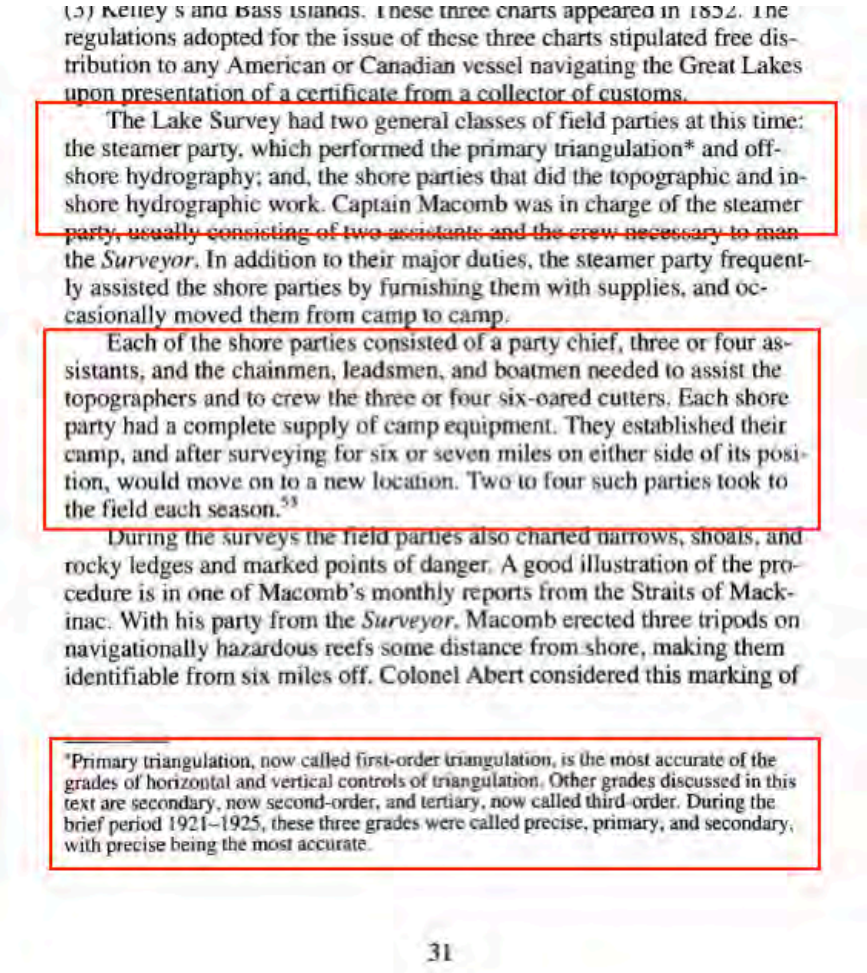
Thank you for the opportunity to speak today.

My Name is Dan Collins. I am a licensed Professional Engineer in the State of Wisconsin.

I am going to testify about the US War Department Engineers and US Army Corps of Engineers Maps for this shoreline from 1863 through 1963. I will also speak about the techniques to create these maps, and provide some background about their intended use and the quality of the data. The shorelines and sounding depths from these maps provide important information about historic shore lines and water depths that directly related to determining an Ordinary High Water Mark in the filled lakebed setting of Parcel 92. These maps nicely corroborate setting an OHWM near the shoreline indicated in the plat maps from the 1870s and 1880s, across all of Parcel 92.

According to Arthur Woodford in his 1991 book describing the history and process of the Army Engineers surveying the Great Lakes titled *"Charting the Inland Seas, A history of the US Lakes survey"*, significant rigor was applied to making these maps. There were two classes of



(3) Kelley's and Bass Islands. These three charts appeared in 1852. The regulations adopted for the issue of these three charts stipulated free distribution to any American or Canadian vessel navigating the Great Lakes upon presentation of a certificate from a collector of customs.

The Lake Survey had two general classes of field parties at this time: the steamer party, which performed the primary triangulation* and offshore hydrography; and, the shore parties that did the topographic and inshore hydrographic work. Captain Macomb was in charge of the steamer party, usually consisting of two assistants and the crew necessary to man the *Surveyor*. In addition to their major duties, the steamer party frequently assisted the shore parties by furnishing them with supplies, and occasionally moved them from camp to camp.

Each of the shore parties consisted of a party chief, three or four assistants, and the chainmen, leadsmen, and boatmen needed to assist the topographers and to crew the three or four six-oared cutters. Each shore party had a complete supply of camp equipment. They established their camp, and after surveying for six or seven miles on either side of its position, would move on to a new location. Two to four such parties took to the field each season.[53]

During the surveys the field parties also charted narrows, shoals, and rocky ledges and marked points of danger. A good illustration of the procedure is in one of Macomb's monthly reports from the Straits of Mackinac. With his party from the *Surveyor*, Macomb erected three tripods on navigationally hazardous reefs some distance from shore, making them identifiable from six miles off. Colonel Abert considered this marking of

*Primary triangulation, now called first-order triangulation, is the most accurate of the grades of horizontal and vertical controls of triangulation. Other grades discussed in this text are secondary, now second-order, and tertiary, now called third-order. During the brief period 1921–1925, these three grades were called precise, primary, and secondary, with precise being the most accurate.

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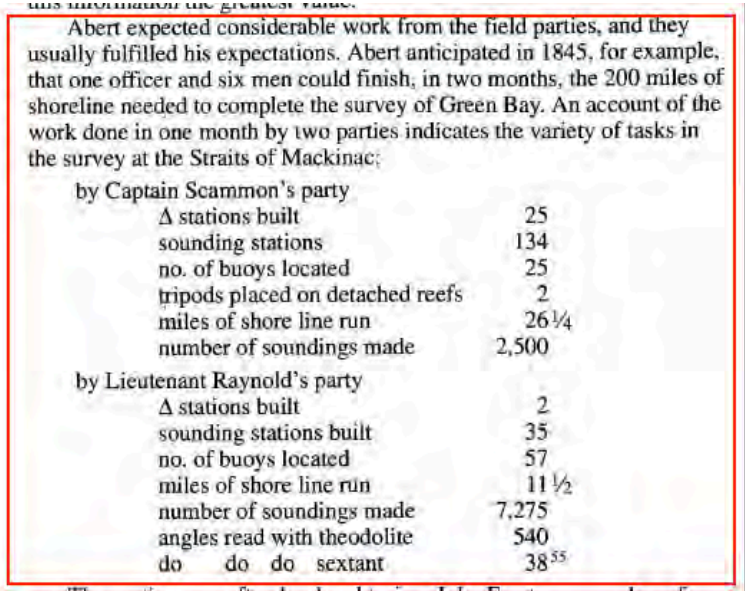
field survey parties the steamer party which performed primary triangulation and offshore hydrography. The shore parties did the topographic work.

To make the measurements needed to chart a dozen miles or so, these teams had to: build land based triangular towers as fixed theodolite survey points, set sounding stations, measure miles of shore, perform thousands of soundings and read hundreds of angles with theodolites and sextants.

A theodolite is a surveying instrument with a rotating telescope for measuring horizontal and vertical angles.



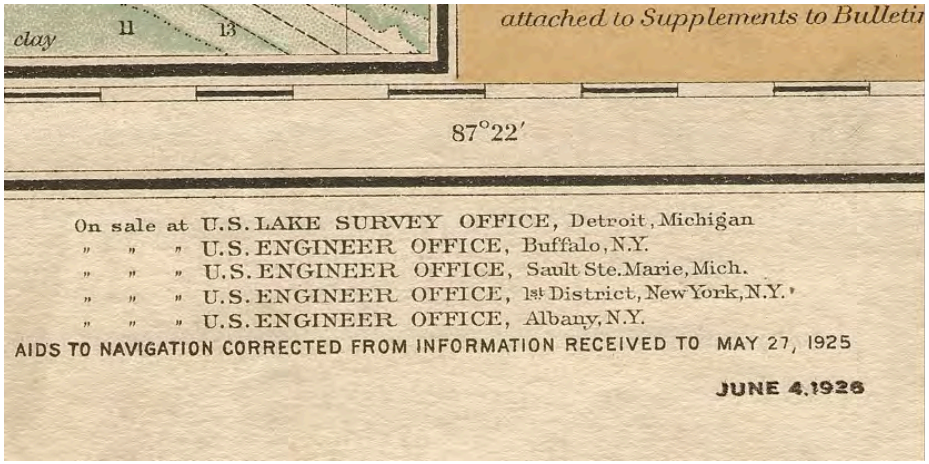
this information the greatest value.

Abert expected considerable work from the field parties, and they usually fulfilled his expectations. Abert anticipated in 1845, for example, that one officer and six men could finish, in two months, the 200 miles of shoreline needed to complete the survey of Green Bay. An account of the work done in one month by two parties indicates the variety of tasks in the survey at the Straits of Mackinac:

by Captain Scammon's party	
Δ stations built	25
sounding stations	134
no. of buoys located	25
tripods placed on detached reefs	2
miles of shore line run	26¼
number of soundings made	2,500
by Lieutenant Raynold's party	
Δ stations built	2
sounding stations built	35
no. of buoys located	57
miles of shore line run	11½
number of soundings made	7,275
angles read with theodolite	540
do do do sextant	38[55]

The Army Corps surveys are intended to be used in aid of marine navigation. This function was so important that we can see in the footnotes these maps were frequently updated between major releases with changes to aid in navigation.

Getting the shoreline and the soundings correct is central to the purpose of these maps.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" " " U.S. ENGINEER OFFICE, Sault Ste. Marie, Mich.
" " " U.S. ENGINEER OFFICE, 1st District, New York, N.Y.
" " " U.S. ENGINEER OFFICE, Albany, N.Y.

AIDS TO NAVIGATION CORRECTED FROM INFORMATION RECEIVED TO MAY 27, 1925

JUNE 4, 1926

Reading the title block, legends and notes on these maps provides important foundation so that we can understand the intention of the charts, the scales, references, projections, standards and symbology used.

To interpret the sounding numbers, the datum of reference needs to be known. What are we measuring "from" and "to". The "from" is the bottom of the lake, and the "to" is a datum called the Standard Low Water Datum. This datum is the reference used on each of the 7 ACE maps. The 1863 Army map makes note that all soundings should be adjusted up by 1.7 feet for high water and down 2.8 feet for low water.

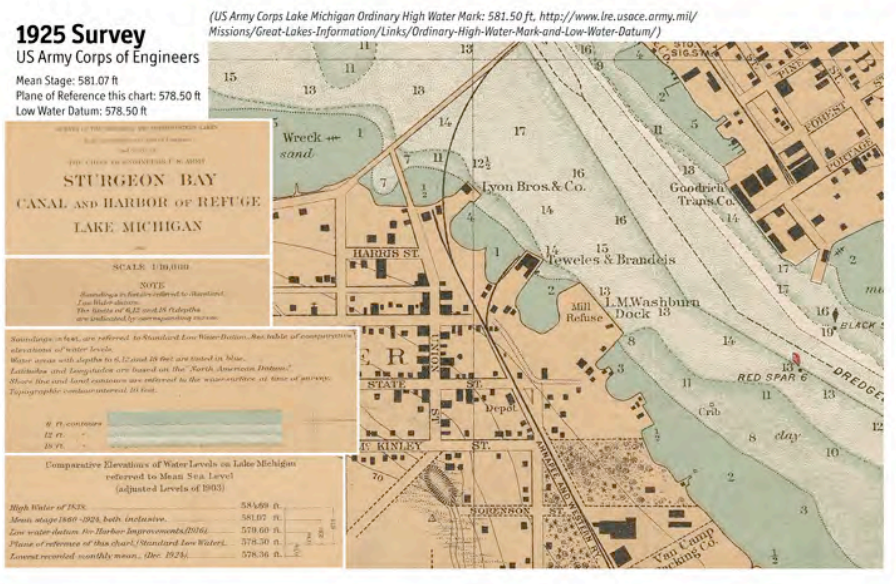
From the 1925 map:

"Plane of reference this chart (Standard Low Water) 578.50 ft."

"Mean stage 1860-1924, both inclusive, 581.07 ft"

or 2.57 feet above the reference for the chart.

Also note the 6, 12 and 18 foot sounding depth contours. These are standard marine navigation indicators measured also referenced to the Standard Low Water Datum.



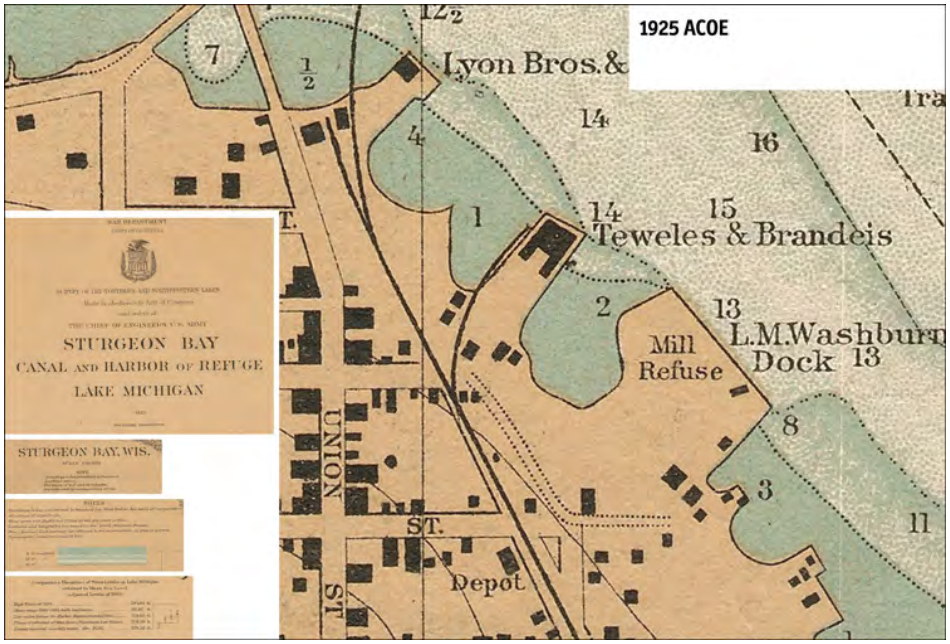
By using the legend on the 1925 chart, the "2" found near the Mill Refuse site adjacent to the Teweles and Brandeis dock provides the full range of depth of water for the conditions of; low water, mean water, and high water.

For low water: A minimum of 2 feet of water no matter how low Lake Michigan is in some year.

For mean water: in 1925, the mean water depth is 4.57 feet of water in this spot. This is based on the mean water level datum on this 1925 map, 581.07, which is 2.57 feet higher than the Standard Low Water Datum. The "2" on the map plus 2.57 equals 4.57 feet of water.

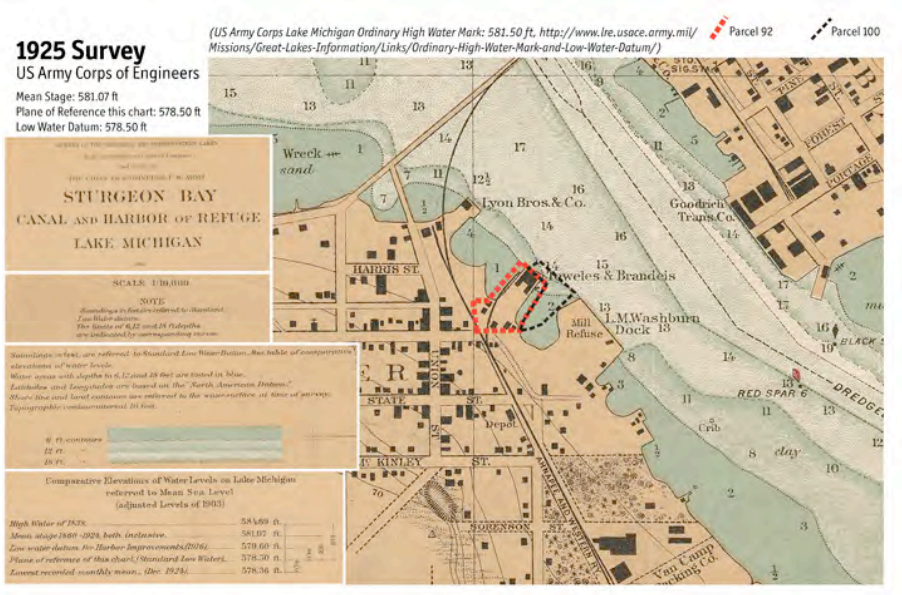
For high water: in 1925, the chart indicates 5 feet of water in this spot to the Ordinary High. This is based on the Ordinary High Water Mark datum used by the Army Corps for Lake Michigan, 581.5, which is 3 feet higher than the Standard Low Water Datum. The "2" on the map plus 3 equals 5 feet of water.

The contour shading indicating a range of 6 to12 feet depth wraps around the Teweles & Brandeis



Dock, indicating there is at least 6 feet of water to the Standard Low Water Datum, or 8.57 feet of water for the mean depth.

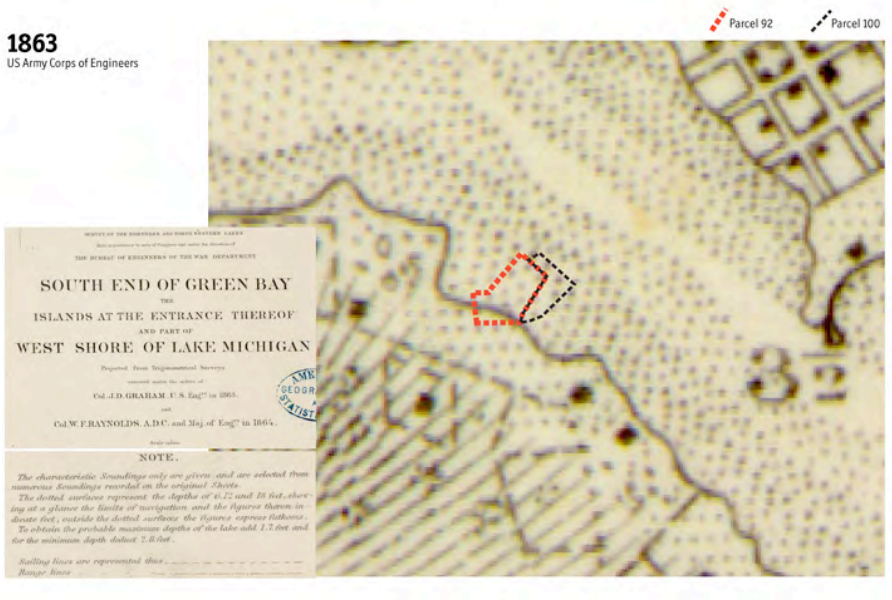
Here is the 1925 Army Corps survey with Parcel 92 overlaid.



1863 was “War Department Army Engineers” map and this shows Parcel 92 in red.

Although granularity and scale of this map are coarse for looking at this shoreline, it does conform nicely to maps that are more directly focused on Parcel 92, such as the plat maps of the 1870s and 1880s.

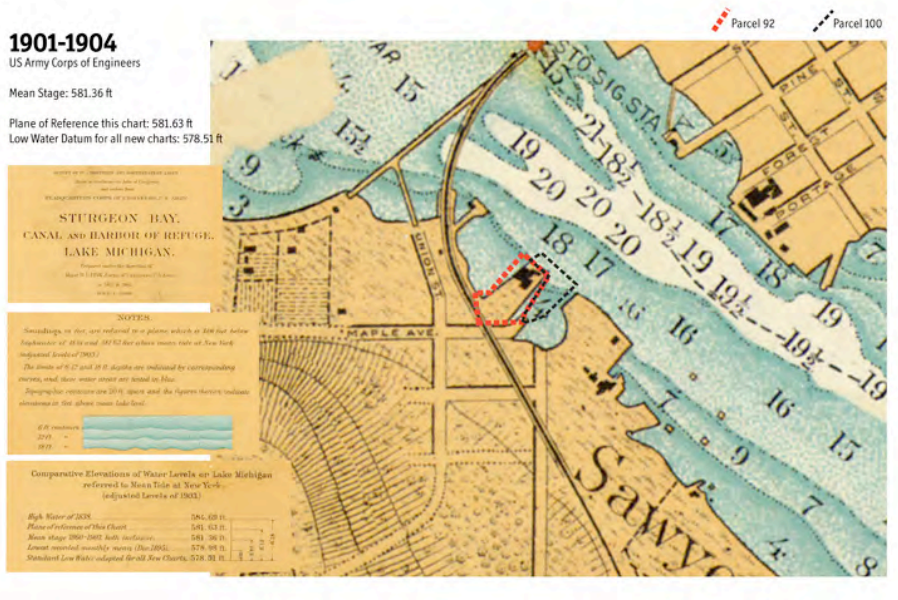
According to this chart there are no swamplands on this shore. This corroborates the findings of the 1835 GLO Survey. .



The 1901-1904 ACE chart, with Parcel 92 in red, shows a sounding depth of 4 feet to the Standard Low Water Datum at the Teweles and Brandeis Dock . The mean level of the water is 2.85 feet above the Standard Low Water Datum according to the legend. The measurement in this chart at the dock indicates 6.85 feet of water to the mean lake level.

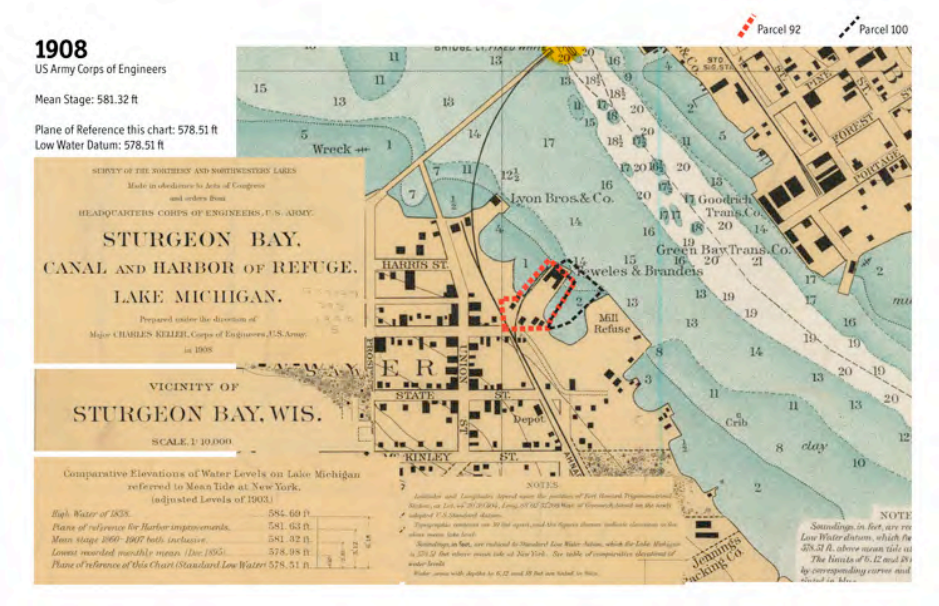
We can also see Maple Street clearly ending in the water at the foot of a small dock which later becomes the little fire dock.

The depth at the end of this dock is in the range 12 to 18 feet of depth to the Standard Low Water Datum.

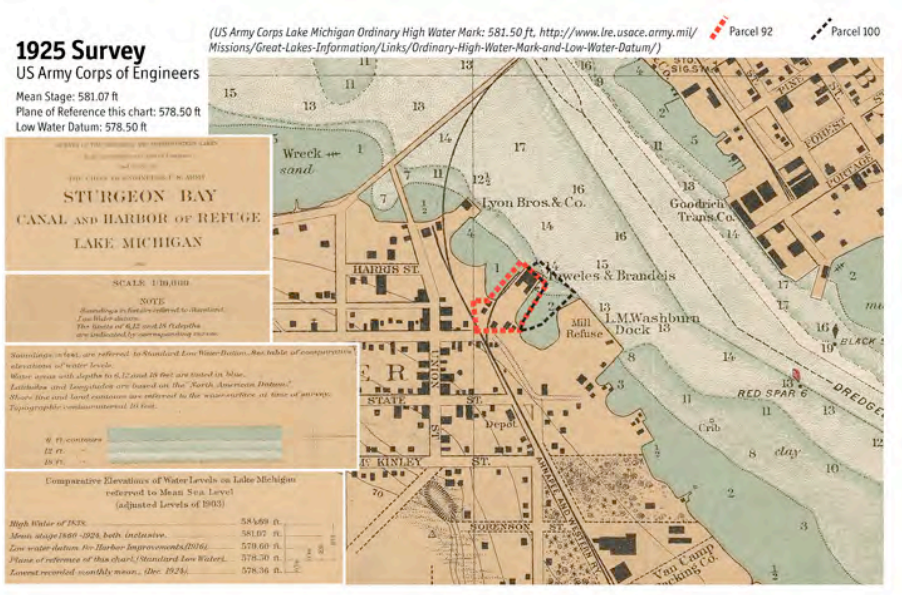


The 1908 ACE chart shows a sounding depth of 2 feet to the Standard Low Water Datum at a point near the Mill Refuse. The mean level of the water is 2.81 feet above the Standard Low Water Datum according to the legend. The measurement in this chart near the Mill Refuse is 4.81 feet of water to the mean lake level.

The depth at the end and side of the dock is in the range of 6 to 12 feet to the Standard Low Water Datum, or at least 8.81 feet, or more, to the mean lake level.



I have previously discussed the depths on the 1925 map, see the notes above for details on the 1925 Army Corps survey map.

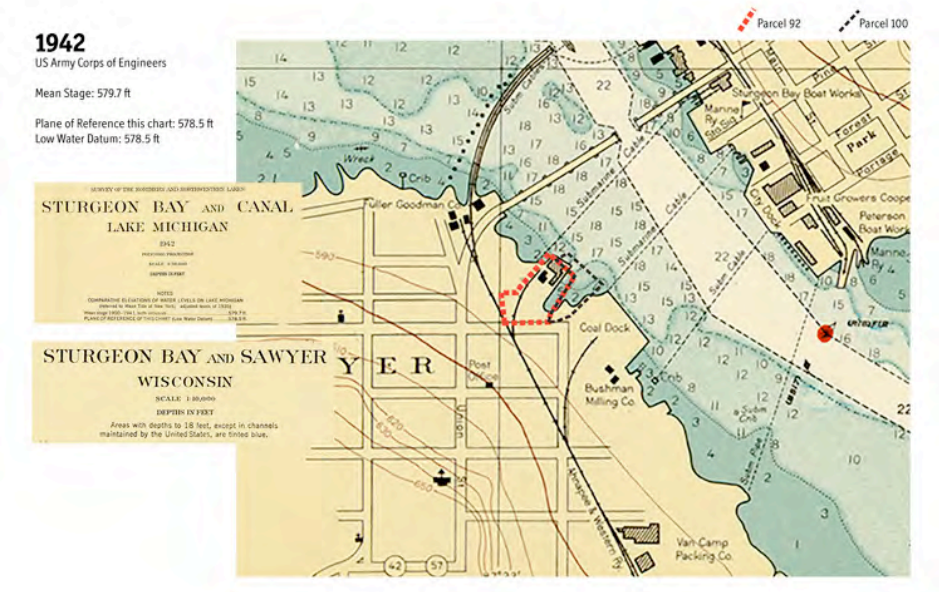


The1942 Army Corps of Engineers survey map is significantly improved by providing three soundings in the area near the Teweles and Brandeis Dock. The sounding closest to the dock indicates 5 feet of water to the Low Water Datum of 578.5.

The chart indicates a minimum of 5 feet of water at this spot no matter how low Lake Michigan is in some year.

The chart indicates there is 6.2 feet of water to the mean lake level. This is based on the mean water level datum on this 1942 map, at 579.7, which is 1.2 feet higher than the Low Water Datum. The "5" on the map plus 1.2 equals 6.2 feet of water.

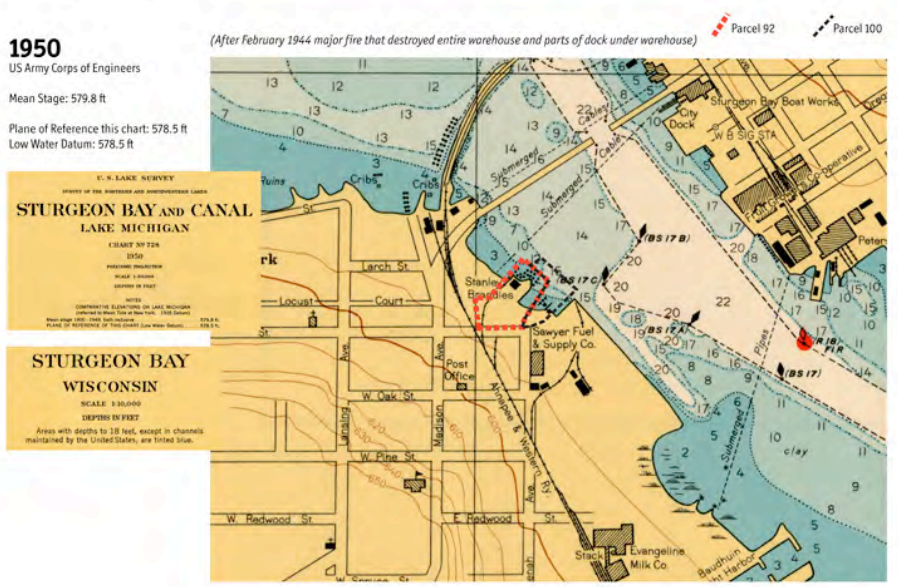
There would be 8 feet of water in this spot to the Ordinary High. This is based on the Ordinary High Water Mark Datum used by the Army Corps for Lake Michigan, 581.5, which is 3 feet higher than the Low Water Datum. The "5" on the map plus 3 equals 8 feet of water.



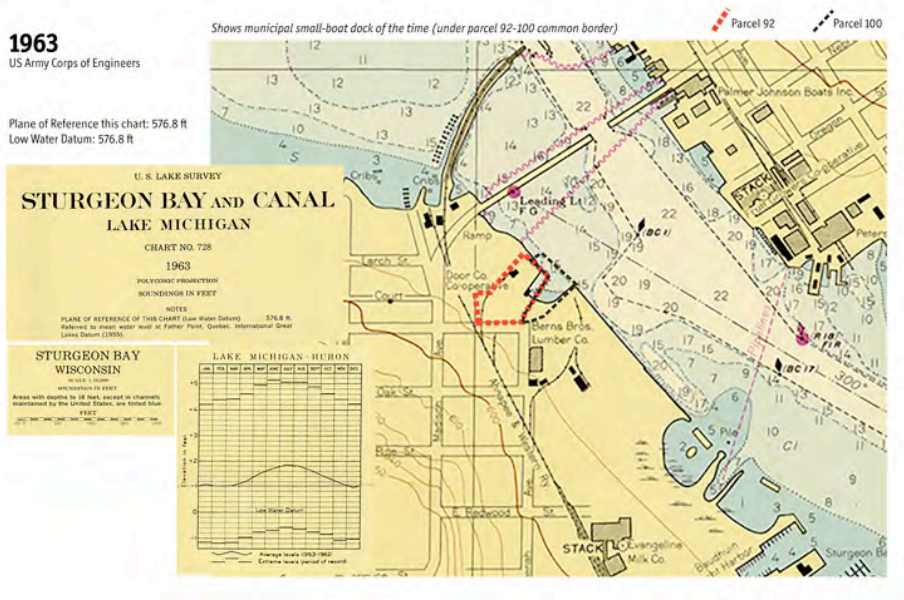
The 1942 chart proves that natural accretion could not have caused the formation of lands at this location as it requires 6 to 8 feet of sedimentation occurring in the 13 years between 1942 and the 1955 bulkhead ordinance. At Parcel 92, natural accretion is not a credible or valid explanation for the existence of land upon lakebed.

The 1950 Army Corps survey map shows a dock which is shorter due to the fire in 1944. Also shown are the many pilings installed by prior owners to form the footings of the dock.

The addition of a small boat marina and pier can be seen. There is no sounding provided at this spot, but the sounding contours indicate depths in the range of 6 to 12 feet to the Low Water Datum and 12 to 18 feet immediately adjacent to the dock.

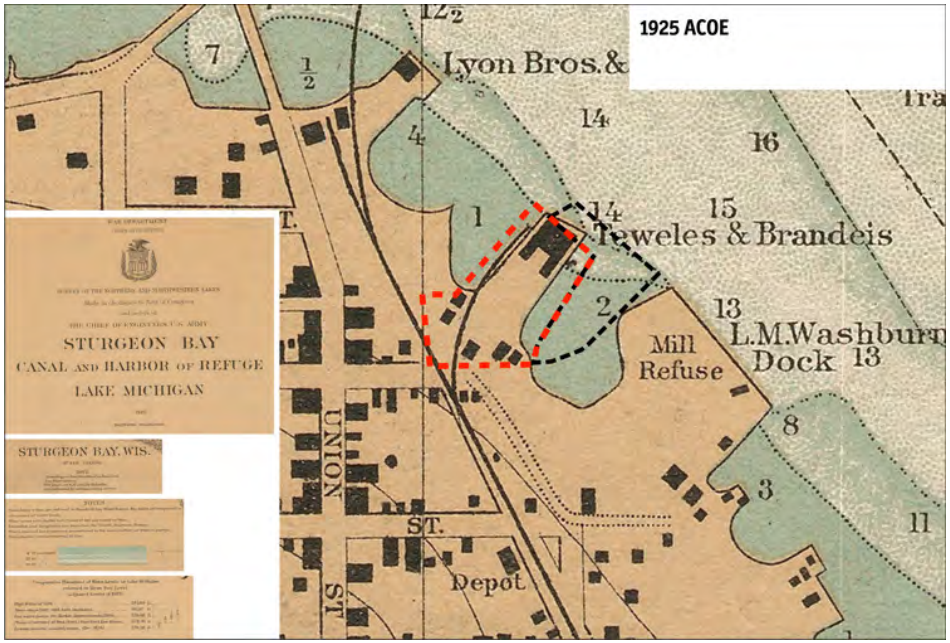


The 1962 Army Corps survey map shows some of the results of filling, under the 1955 bulkhead ordinance. It also shows some significant water near the dock at a sounding depth of 6 to 12 feet to the Standard Low Water Datum.



The Army Corps of Engineers Lake Survey maps were made to high standards for the purpose of aiding maritime navigation. They offer important information about the waters of Sturgeon Bay at the time the charts were made.

Sounding depths on these charts must be read relative to the Standard Low Water Datum. This results in depths to the mean lake level of no less than 4.57 feet when measured in the vicinity of the Mill Refuse. Soundings performed closer to the dock (for example, in 1904 and 1942) show a water level of more than 6 feet relative to the mean lake level.



There is no evidence to suggest that natural accretion occurred at this location. Overwhelming evidence of dock construction into the waters of Sturgeon Bay, dock expansion, dock filling and near shore filling exists. Independent of the aforementioned, the 1942 chart proves that accretion by natural process is not a possible explanation for dry land on lakebed at this location as it requires 6 to 8 feet of sedimentation occurring in the 13 years between 1942 and the 1955 bulkhead ordinance. At Parcel 92, natural accretion is not a credible or valid explanation for the existence of land upon lakebed. All "made lands" found water-ward of the historical shoreline in Parcel 92 are the direct result of interventions by the riparian owner.

Appendix. Added information regarding U.S. Army Corps of Engineers Lake Surveys.

vey had been reestablished, a national survey directed by the U.S. Coast and Geodetic Survey had extended its network past the Mississippi and the Detroit District office had rerun most of the old Lake Survey level lines between the Lakes, to allow for integration into the national network. The releveling provided data for computing new elevations on the Lakes known as the "1902 Observed Elevations." The Coast and Geodetic Survey, however, did incorporate the Lake Survey's first-order level lines* between the Lakes into the national network and in 1901, when all levels east of the Mississippi were adjusted, some Lake Survey water-level transfers were used.

The Lake Survey adopted the elevations resulting from this adjustment, known as Adjusted Levels of 1903. With additional instrumental leveling and water-level transfers, the Lake Survey determined elevations on the new datum** for all remaining bench marks in its network. This new leveling datum on the Great Lakes soon became known as the U.S. Lake Survey 1903 Datum or simply "1903 Datum." As a result, the elevations of standard low water reference planes above mean tide at New York were now as follows: Lake Superior, 600.5 feet; Lakes Michigan and Huron, 578.5 feet; Lake Erie, 570.0 feet; and Lake Ontario, 243.0 feet.[6]

In 1902, the Lake Survey and Coast and Geodetic Survey cooperated on another project. During that year Assistant Engineer Thomas Russell of the Lake Survey staff went to Washington to assist in converting Lake Survey triangulation positions to the *United States standard datum*, geodetic datum later renamed *North American datum*. Working with J.F. Hayford, chief of the Computing Division, Coast and Geodetic Survey, the two men accomplished the monumental task of adjusting more than 1,250 Lake Survey positions to Coast and Geodetic Survey standards.[7]

In addition to standardization of terminology and datums, those engaged in survey work continued to improve their instruments and the general public's interest grew. In 1904 the Lake Survey received an invitation to participate as an exhibitor at the Louisiana Purchase Centennial Exhibition held at St. Louis. Eugene E. Haskell, now principal assistant engineer, the senior civilian employee of the Lake Survey, oversaw the

*With leveling, as with other survey methods, acceptable minimums of accuracy are set and described by the terms first-order, second-order, third-order. These terms have changed over the years. First-order leveling has also been called precise leveling and leveling of high precision.
**Leveling datum is a level surface to which heights are referred, generally mean sea level. Geodetic datum consists of latitude and longitude of an initial point, the azimuth of a line from that point and two constants; it is the basis for computing horizontal control surveys.

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