

International Great Lakes Datum: Possible Impacts and What You Need to Know

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Overview of IGLD



- International Great Lakes Datum (IGLD) is a common height reference system to measure and relate water levels
- Official vertical datum used for water level measurements and navigation charts throughout the Great Lakes, their connecting channels and the St. Lawrence River
- Maintained by the Coordinating Committee on Great Lakes Basic Hydraulic and Hydrologic Data, a binational committee with representatives from the Governments of Canada and the United States
- IGLD is updated every 25-30 years due to Glacial Isostatic Adjustment (GIA)
- The next update will be IGLD (2020), expected for release around 2027

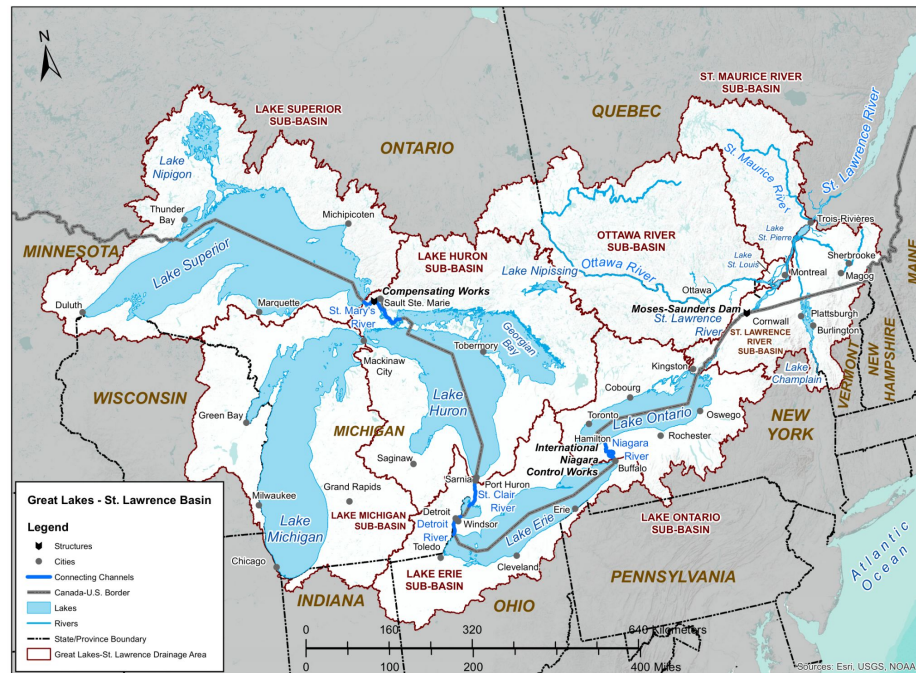
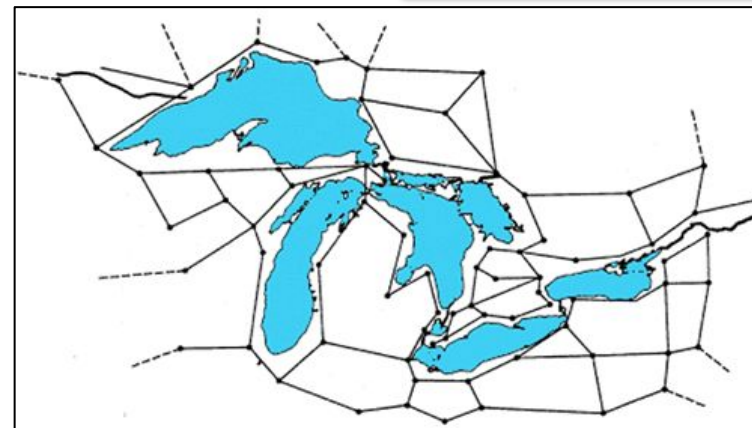


Image credit: IJC

Current IGLD

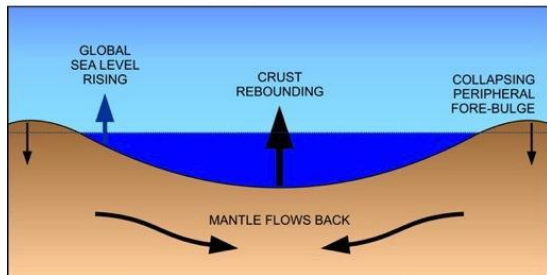
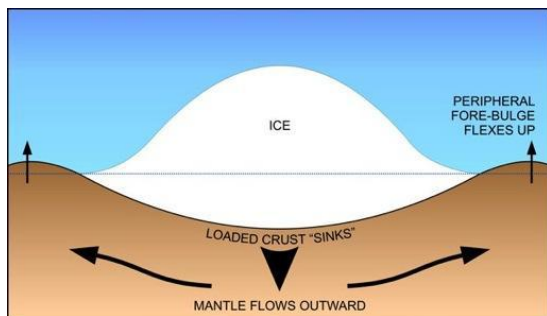
- IGLD (1985) replaced IGLD (1955) in 1992
- Same reference zero as NAVD 88 (mean sea level at Pointe au Père & Rimouski, Québec)
- Reference surface determined from leveling
 - Very time consuming & cost prohibitive
 - Datum accessible only where leveling exists (bench marks)
 - Affected by systematic errors in the leveling
- Uses dynamic heights
- Hydraulic correctors applied to water levels of the lakes to account for hydraulic effects



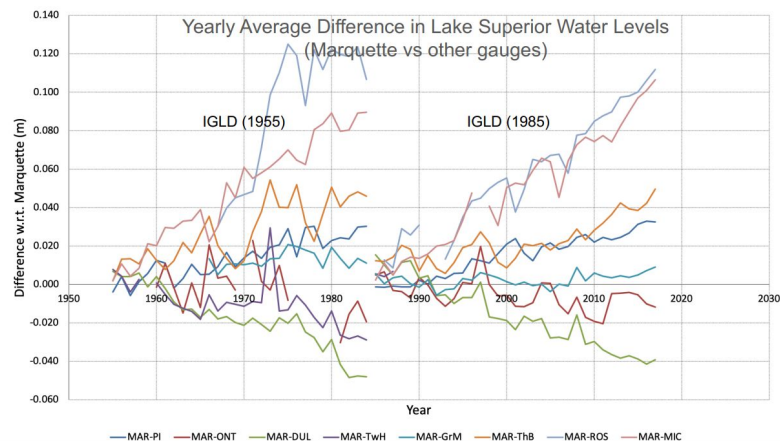
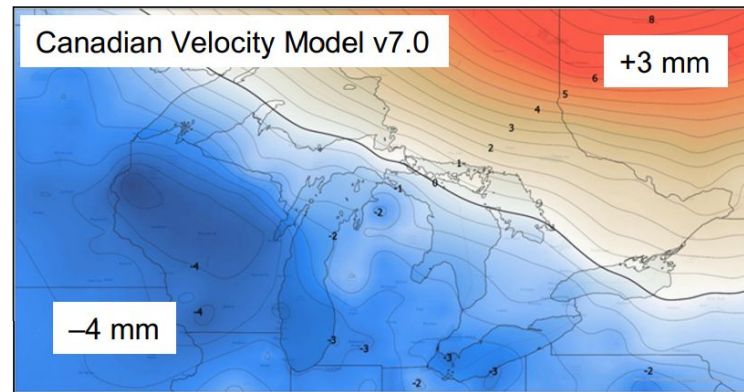
NAVD88 Network Level Loops

Why a new IGLD?

- *Uplifting in north subsiding in south*
- *Overall tilting ~ 7 mm/year (21cm or 0.7' over 30 year)*
- *Need to update IGLD every 25-30 years*



Process of glacial isostatic adjustment



Effect of GIA on Water Level Measurements

IGLD (2020) Definition

- Reference Zero

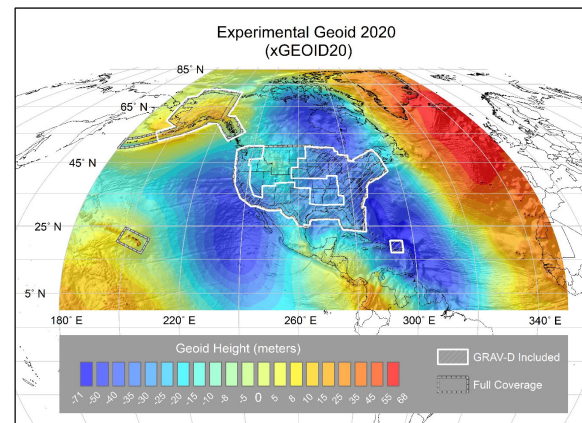
- The reference for heights where height = 0
- Represents mean sea level (MSL) around the coast of North America
- Same MSL used for North American-Pacific Geopotential Datum of 2022 (NAPGD2022) and the Canadian Geodetic Vertical Datum of 2013 (CGVD2013)

- Reference Surface

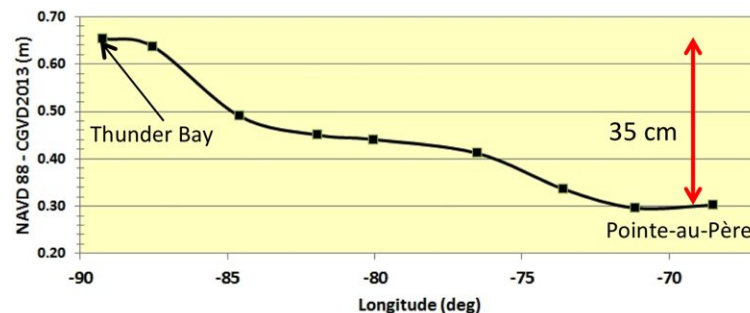
- NAPGD2022 geoid model representing the reference zero
- Defined everywhere over the Great Lakes – St. Lawrence River system, not just where leveling and bench marks exist

- Reference Epoch

- 2020.0 is the reference epoch for the heights
- Same as the central epoch of the 7-year water level observation period of 2017–2023



Expected IGLD (1985) - IGLD (2020) Difference



Determining Heights via GNSS

- ***Primary access to the datum will be via GNSS***

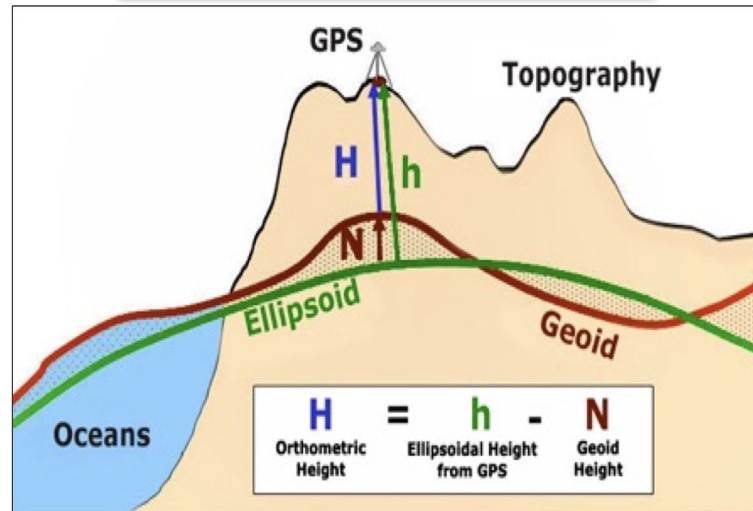
h = ellipsoidal height obtained from GNSS

N = geoid height obtained from geoid model
(provided by CGS & NGS)

H = Orthometric height

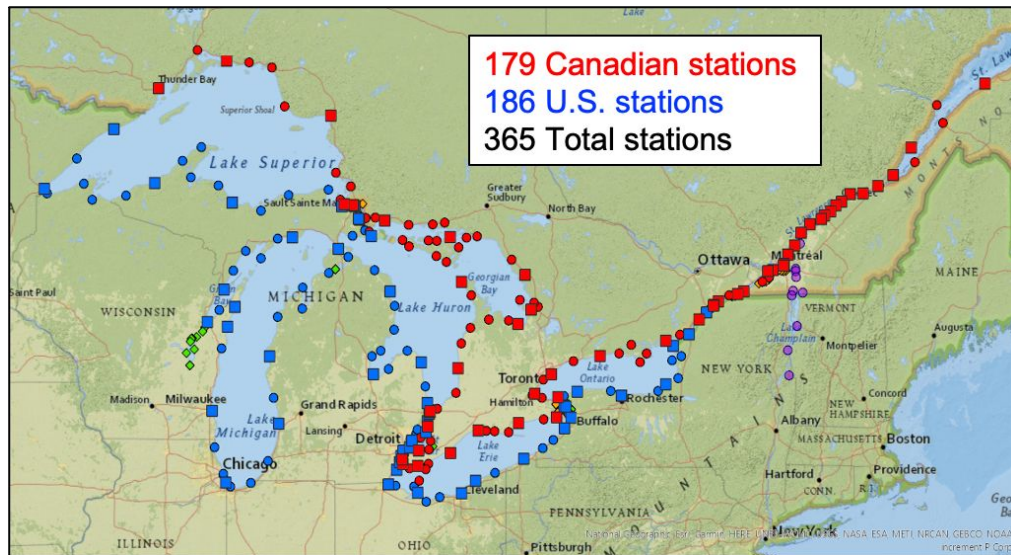
h & N must be referenced to the same reference ellipsoid (NATRF2022)

- Online conversion tools provided by CGS & NGS
- Local leveling will still be required



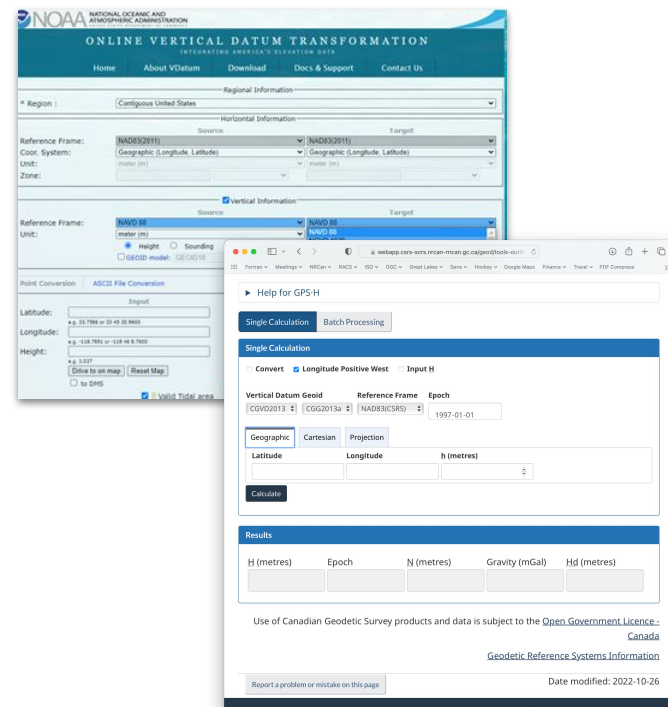
Moving Water Level Gauges to IGLD (2020)

- Need to determine IGLD (2020) heights for all water level gauges
- Previous GPS surveys in 1997, 2005, 2010, 2015
- 2022 GNSS survey completed and expanded to include:
 - Permanent gauges (CHS, ECCC, NOAA, USACE, USGS, Seaway, NYPA, OPG)
 - Seasonal gauges for determination of lake topography – may not be needed if small enough
- Presently processing GNSS data – expect to complete by end of year



Transforming from Older Datums

- Transformation grids will be provided by CGS & NGS to enable moving large data sets from IGLD (1955) & IGLD (1985) to IGLD (2020)
- CGS & NGS will provide transformation tools
 - VDatum (US) & GPS-H (Canada)
 - Desktop apps and web services will be available
 - Support batch processing of large data sets
 - Will use a common grid format based on international standards
 - Commercial GIS developers committed to incorporating into their software



Impacts of Updating IGLD

UNITED STATES - GREAT LAKES
LAKE SUPERIOR

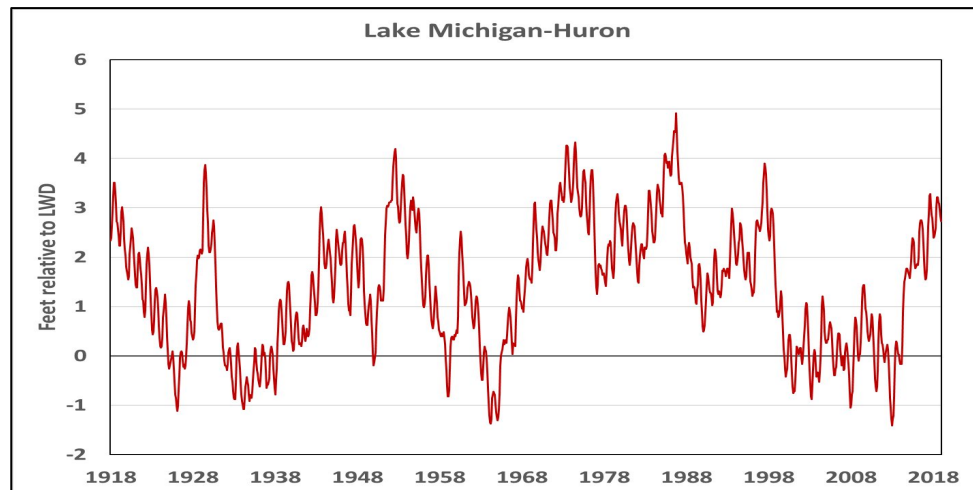
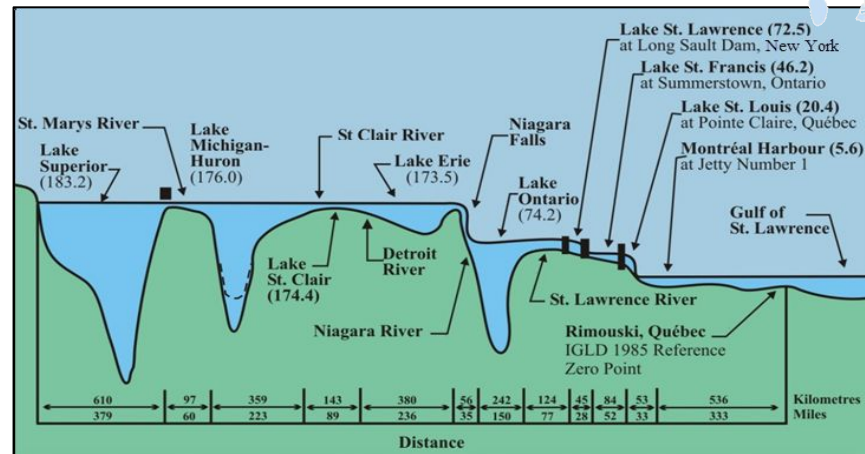
Updating water levels to a new IGLD will have significant impacts on many operations, products and services in the Great Lakes region

- Economic viability and safety of commercial and recreational navigation, including charts, ports/harbors and dredging of navigation channels
- Water level regulation and forecasting
- Coastal zone management and planning, including flood & erosion prediction and response, and coastal structure design, construction & maintenance
- Coastal habitat restoration under the Great Lakes Restoration Initiative (GLRI)
- Legislation may need to be updated to reflect IGLD (2020)

The Coordinating Committee is conducting outreach efforts like this one to inform and get feedback from stakeholders

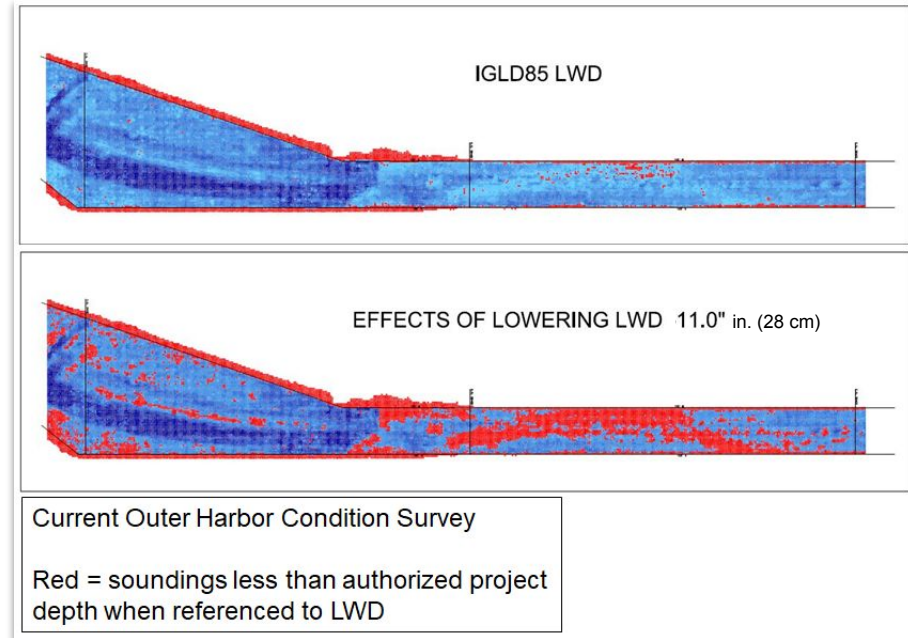
Low Water Datum (LWD)

- LWD (aka Chart Datum) is the navigational chart datum, one for each of the Great Lakes and Lake St. Clair
- Depths for harbor improvement authorizations are also referred to LWD
- Current LWD was established using data from 1933
- Water diversions, channel modification and erosion, outflow regulations, and climate change effects may all have changed current low water datum levels
- Reviewing in conjunction with the IGLD 2020 update



Impacts of the LWD Change

- Additional dredging to maintain new depths at significant costs
- A new LWD would require changes to all navigational charts for the Great Lakes, their connecting channels, and the St. Lawrence River
- Additional dredging and changes to navigation charts, documentation, and legislation would be very costly



Lake Superior

Status of IGLD Update

- Data processing of 2022 IGLD survey campaign underway
- Seasonal gauging continuing in Canada until 2024 - completed in U.S.
- Need for hydraulic correctors in IGLD (2020) being investigating
- NAPGD2022 on track for release in 2025 - basis for IGLD (2020)
- IGLD (2020) is planned for release in 2027 - dependent on NAPGD2022
- Discussing the impact of updating Low Water Datum with stakeholders

Great Lakes Commission Resolution

- GLC published a resolution in 2015
- Suggest to update with latest information:
 - U.S. and Canada to adopt the updated IGLD when released
 - Release date is now expected in 2027
 - Coordinating Committee able to help draft the update



RESOLUTION
Adopted Feb. 25, 2015

Updating the accuracy of the International Great Lakes Datum (IGLD)

Whereas, movement of the Earth's crust across the Great Lakes - St. Lawrence River system occurs on a very gradual, continuous and non-uniform basis (in some areas in the magnitude of centimeters per decade), referred to as "glacial isostatic adjustment" or rebounding of the land surface from the weight of glaciers that retreated over 10,000 years ago; and

Whereas, water levels in the Great Lakes-St. Lawrence system fluctuate on a short-term, seasonal and long-term basis, requiring careful and accurate measurements within an accurately established vertical datum; and

Whereas, the safety and economic viability of the Great Lakes commercial navigation industry, the extensive recreational boating community and ports/harbors across the region all rely heavily on accurate water level forecasts and maintenance of congressionally authorized dredging programs to provide depths in the navigation channels including waterways connecting the Great Lakes; and

Whereas, all coastal zone management, including erosion prediction, flood prediction and response, and coastal structure design, construction and maintenance, rely upon an accurate vertical elevation datum; and

Whereas, all coastal habitat restoration, rehabilitation, creation, enhancement, improvement and protection activities currently underway and expected to be implemented under the Great Lakes Restoration Initiative (GLRI) require an accurate vertical datum; and

Whereas, prediction of the magnitude, timing and duration of climate variability as it affects the Great Lakes-St. Lawrence River system, and the development of adaptive management approaches thereto, require accurate water level measurements and forecasts; and

Whereas, the vertical elevation datum for the Great Lakes, known as the International Great Lakes Datum (IGLD), first established in 1955 and last updated in 1985, needs to be updated every 25 to 35 years to reflect continuous and differential changes in land surface elevations across the region and IGLD (1985) is now due for an update.

Therefore, be it resolved, that the Great Lakes Commission urges the National Oceanic and Atmospheric Administration (NOAA) to prioritize the IGLD update, with anticipated release in 2025, and to coordinate their activities with Canadian federal and provincial partners, to ensure that this foundational vertical datum is maintained to the highest accuracy possible using the best available technologies; and

Be it resolved, that the Great Lakes Commission urges NOAA to partner with states, Canadian provinces and federal entities to extend the accuracy of the new IGLD in all ports and harbors of refuge that were not updated in 1985;

Be it finally resolved, that the Great Lakes Commission urges the U.S. Congress to provide necessary financial resources to complete the IGLD update, and further requests that the Canadian federal government provide a commensurate share to ensure timely completion of this important endeavor.

Adopted at the 2015 Semiannual Meeting of the Great Lakes Commission, February 24-25 in Washington, D.C.

For More Information

IGLD

<https://www.greatlakescc.org/en/international-great-lakes-datum-update/>

[Email: info@GreatLakesCC.org](mailto:info@GreatLakesCC.org)

NATRF2022 & NAPGD2022

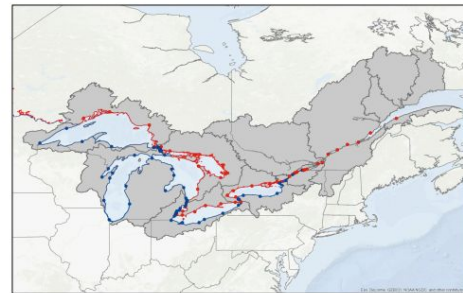
<https://geodesy.noaa.gov/datums/newdatums/index.shtml>



Coordinating Committee on Great Lakes
Basic Hydraulic & Hydrologic Data



Updating the International Great Lakes Datum (IGLD)



Prepared by the
Vertical Control – Water Levels Subcommittee
on behalf of the
Coordinating Committee on Great Lakes Basic Hydraulic and Hydrologic Data

September 2017