GREAT LAKES WATER LEVELS

Missy Kropfreiter, PE

Hydraulics & Hydrology Office
Detroit District, Corps of Engineers
30 June 2020

NWS-GRR

US Army Corps of Engineers®

HIGH WATER PHOTOS ACROSS THE GREAT LAKES

Canal Park
Near Duluth,
MN (NWS)

South Haven, MI
(NWS)

Stony Point, MI
Lake Erie
(Port of Monroe)

Oswego, NY
(Bill Foley)

The impacts of high water levels have been felt across the basin.

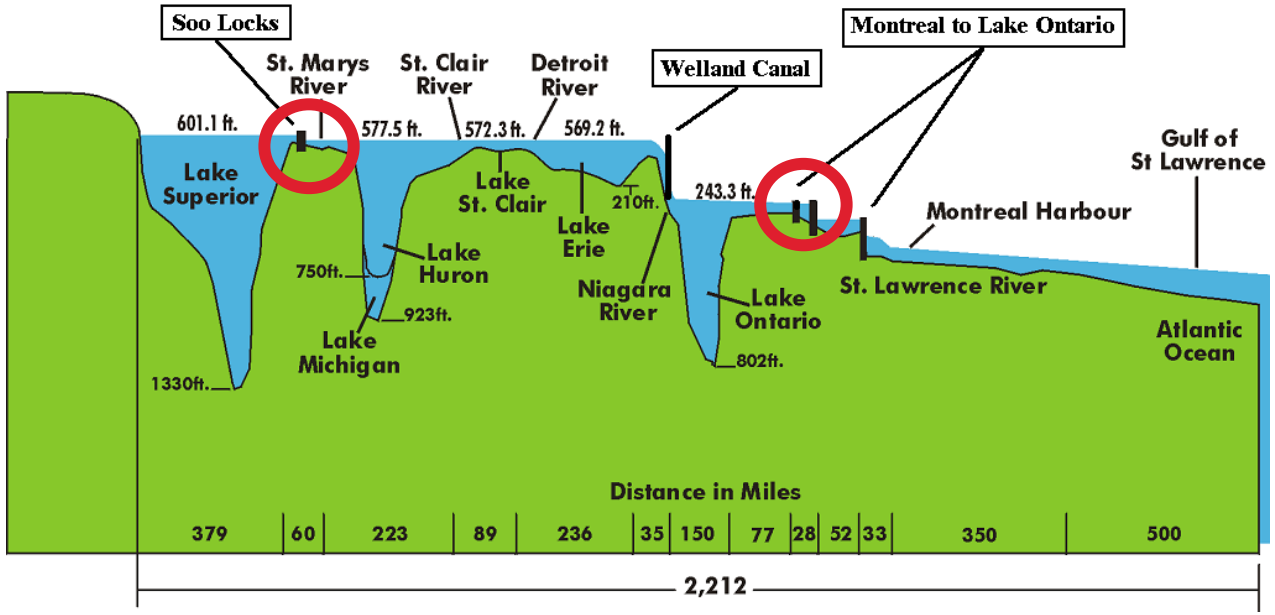
NOTES ABOUT GREAT LAKES WATER LEVELS

- Not a depth, but an **elevation** above sea level, IGLD 1985
- Michigan and Huron = One lake
- Lake-wide daily means → Lake-wide **monthly** means
- Based on still water, not influenced by meteorological forcing
- Based on a network of water level gauges
- Detroit District Corps of Engineers = keeper of official monthly water level statistics from 1918-2019
- Coordination occurs with Environment and Climate Change Canada
- **Primary drivers of water level fluctuations are changing weather patterns and resulting fluctuations in water supply**

MONITORING GREAT LAKES WATER LEVELS

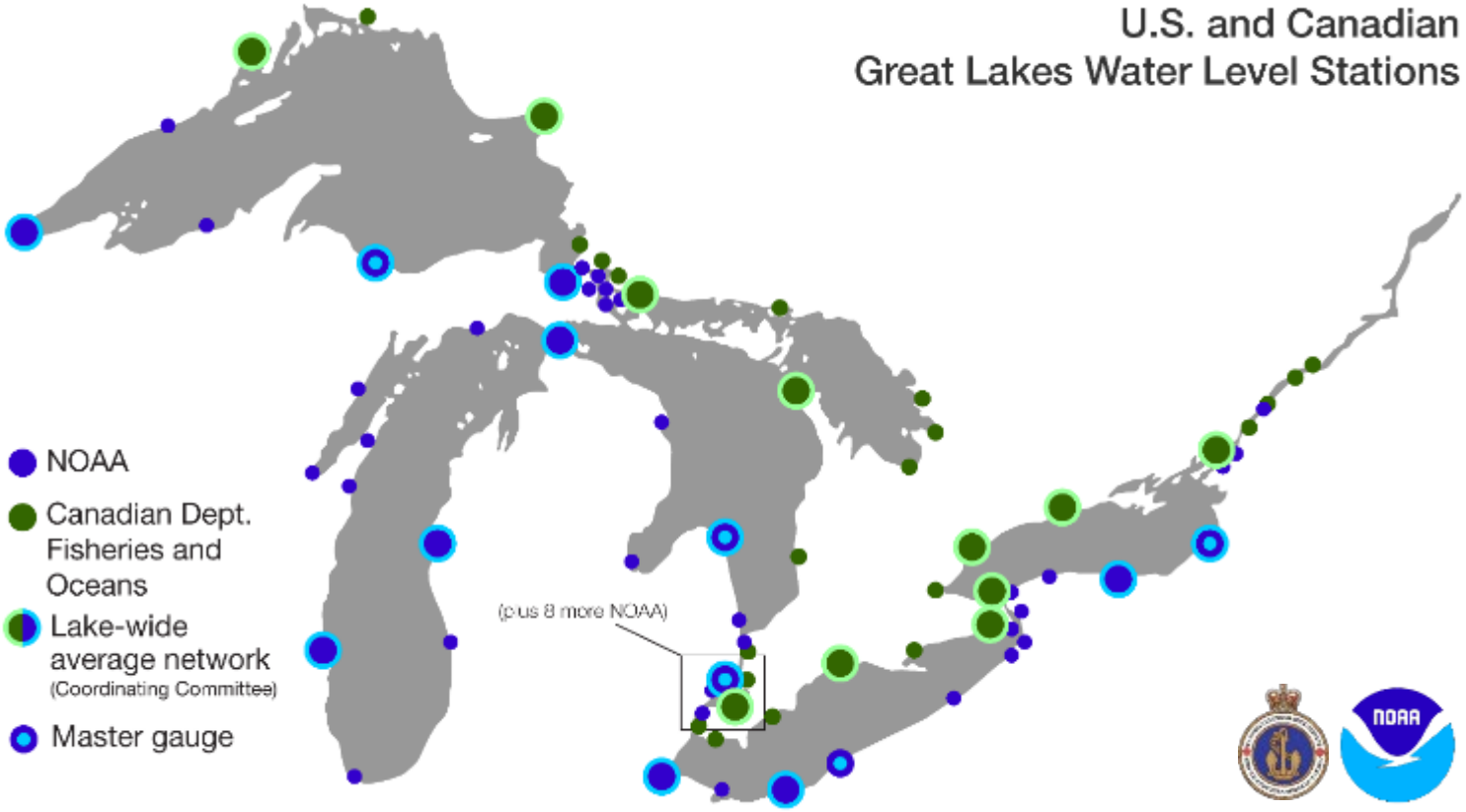
The Great Lakes Basin

- 14,000 miles of shoreline
- 95,000 square miles of water
- 200,000 square miles of land
- 8 States & 2 Provinces



Outflow regulation

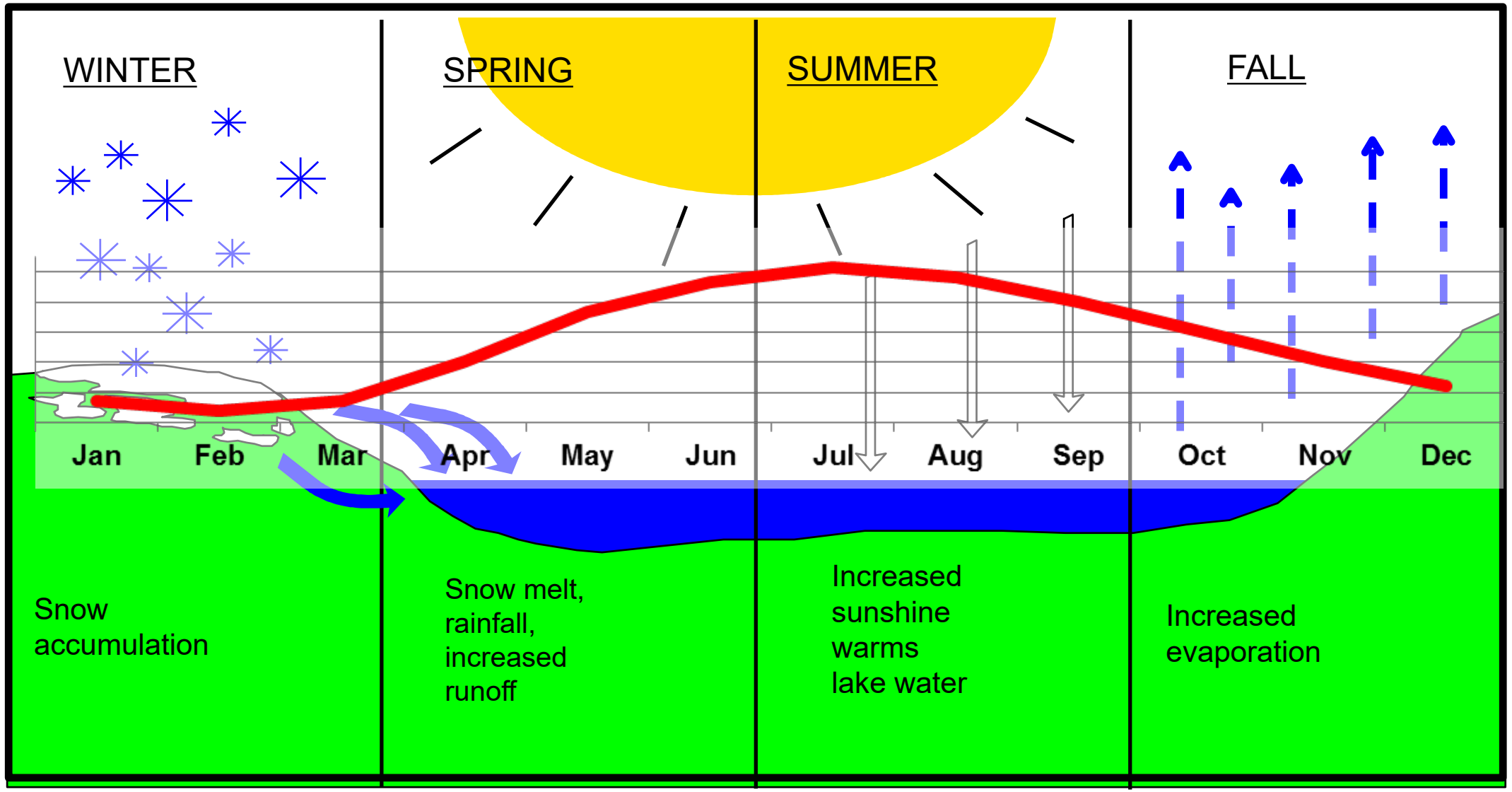
MONITORING GREAT LAKES WATER LEVELS



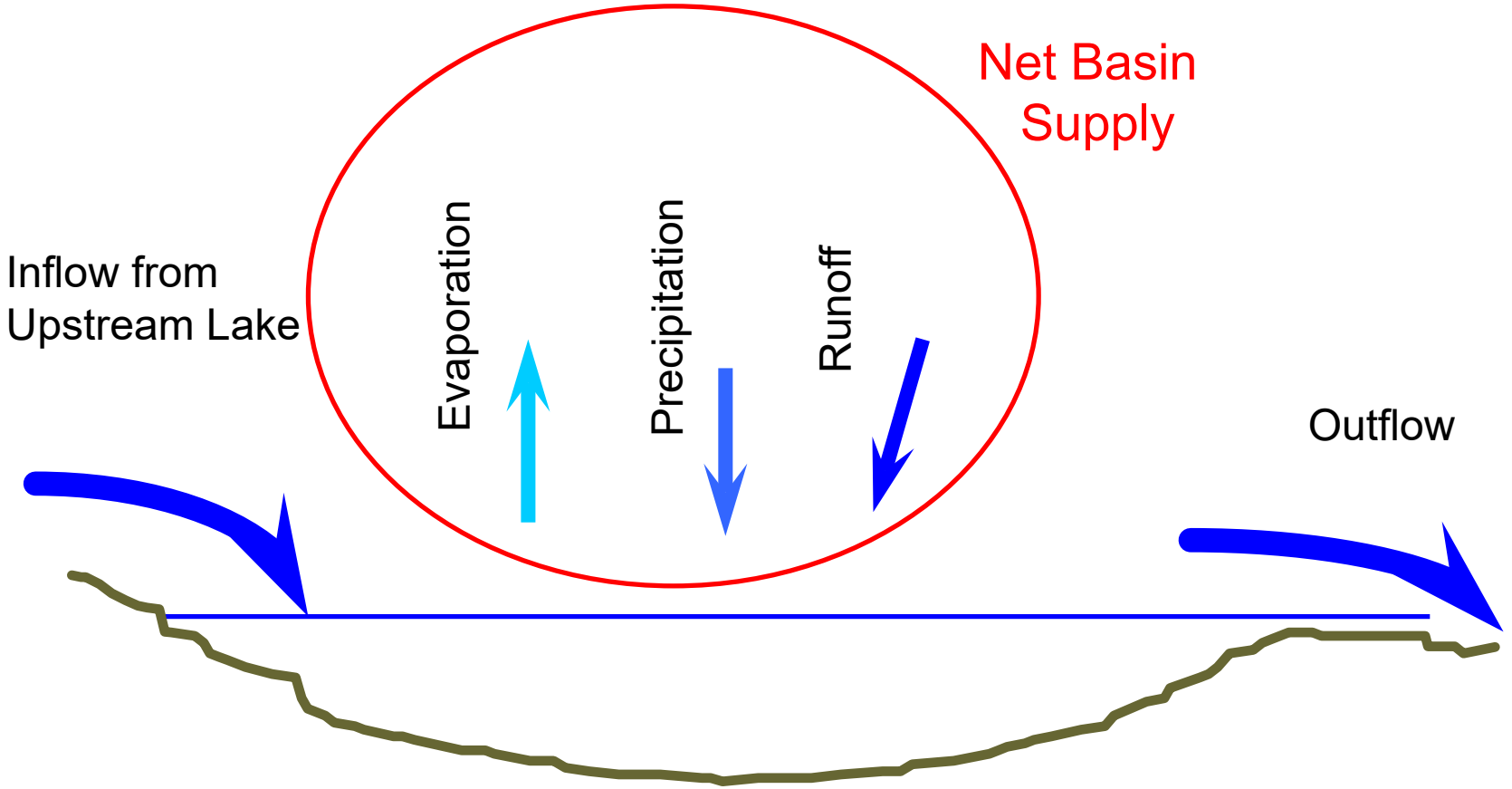
Daily Average Water Levels Based on Lake-Wide Average Network

- **Lake Superior:** Duluth, Marquette, Pt. Iroquois, Thunder Bay, Michipicoten
- **Lakes Michigan-Huron:** Harbor Beach, Ludington, Mackinaw City, Milwaukee, Tobermory, Thessalon
- **Lake St. Clair:** St. Clair Shores, Belle River
- **Lake Erie:** Toledo, Cleveland, Port Stanley, Port Colborne
- **Lake Ontario:** Oswego, Rochester, Toronto, Kingston, Port Weller, Cobourg

ANNUAL WATER LEVELS AND THE HYDROLOGIC CYCLE



FACTORS IMPACTING WATER LEVELS

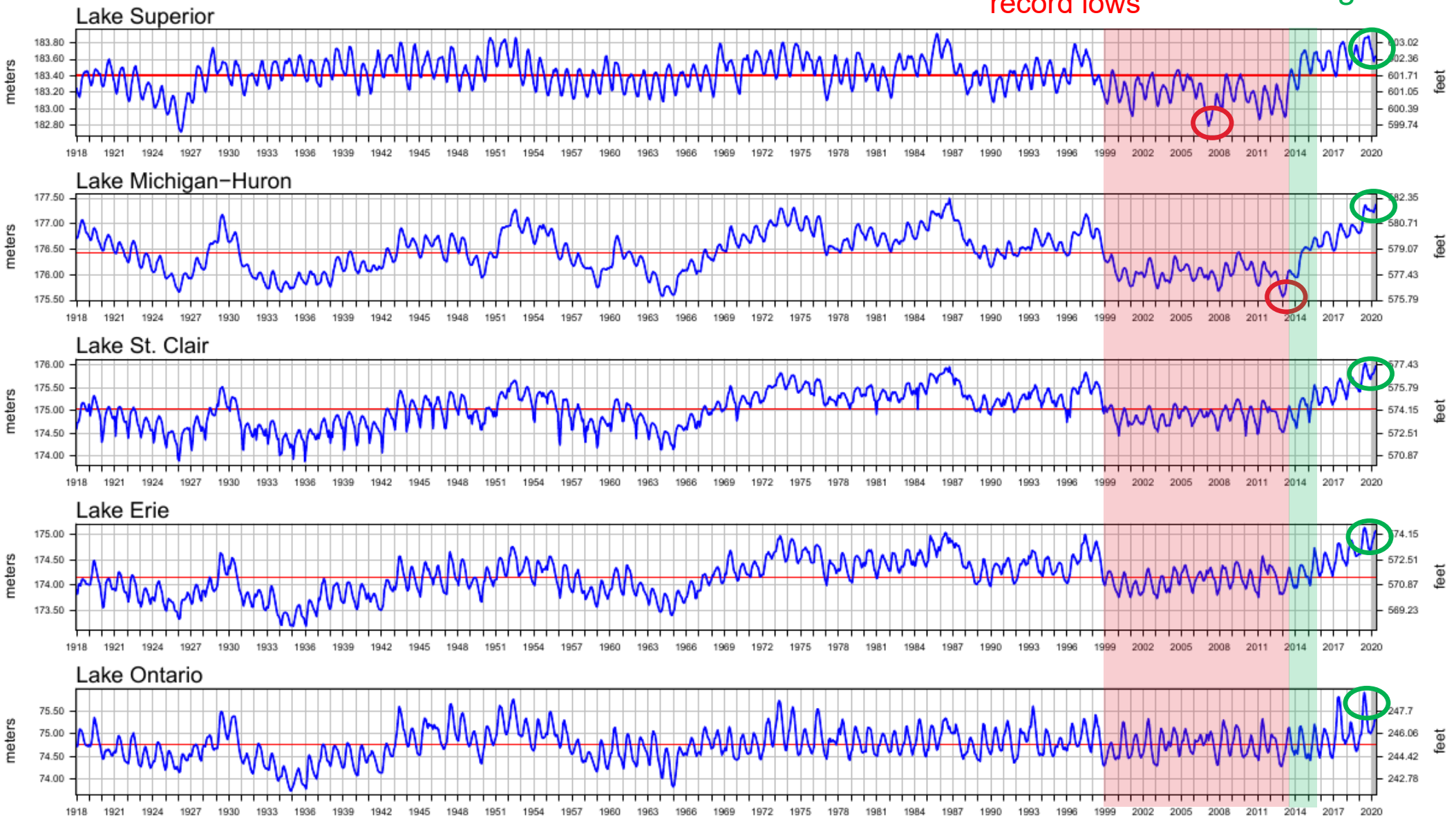


Great Lakes Water Levels (1918–2020)

Monthly Mean Level — Long Term Average Annual

Decade plus of low water with record lows

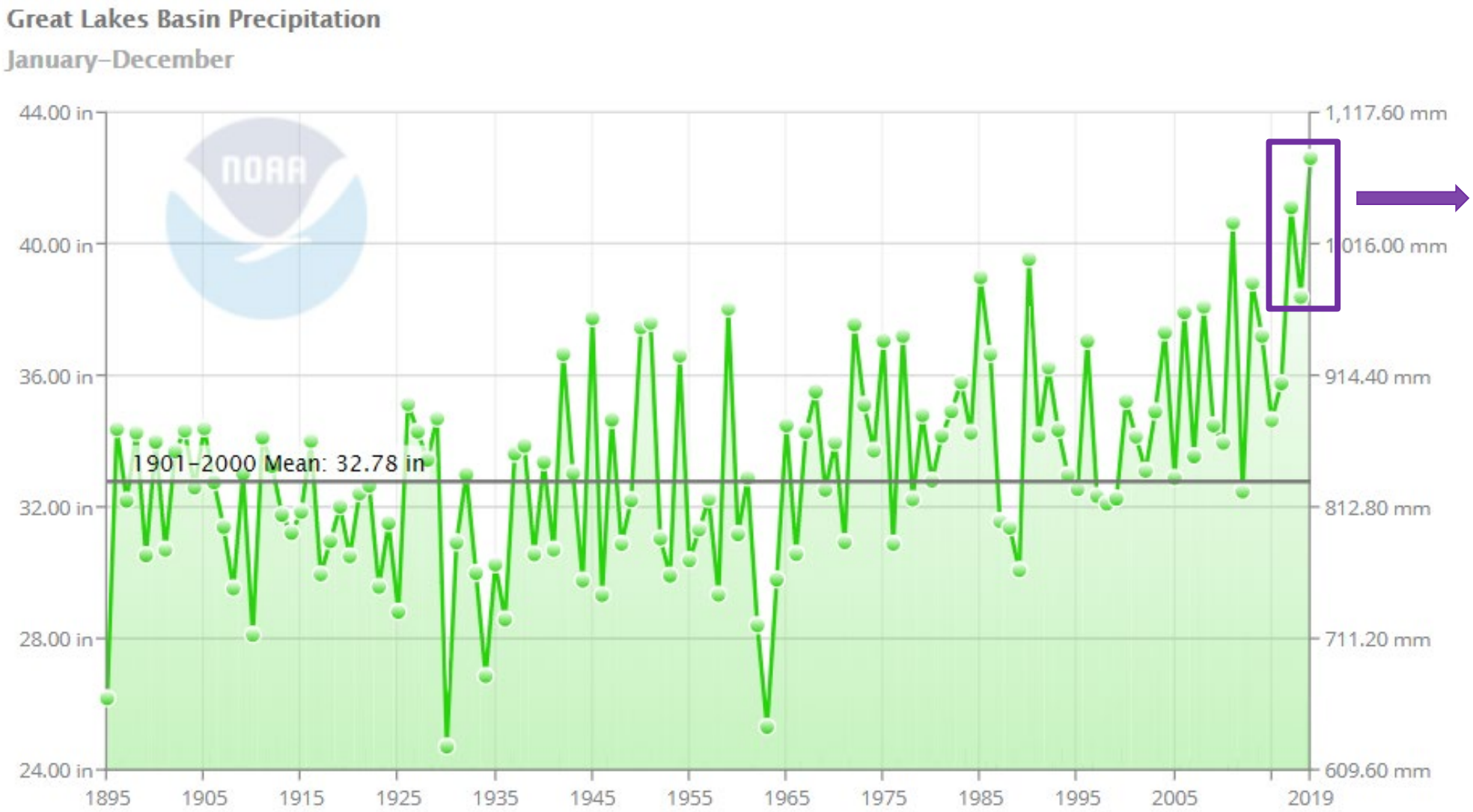
Record rise and record highs



The monthly average levels are based on a network of water level gages located around the lakes.
Elevations are referenced to the International Great Lakes Datum (1985).

Water levels have been coordinated through 2019. Values highlighted in gray are provisional.

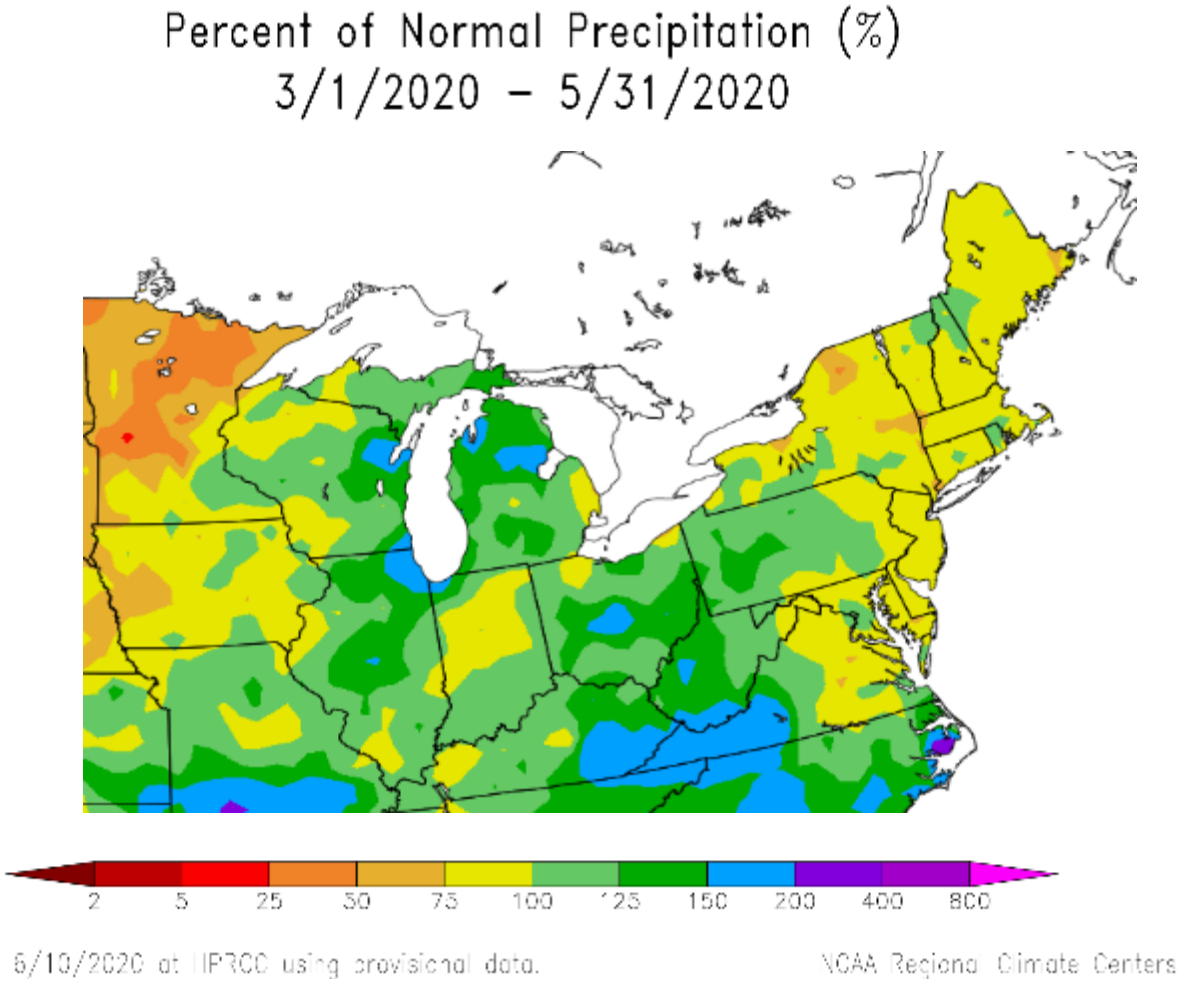
WHY ARE LEVELS SO HIGH? – WET PATTERN

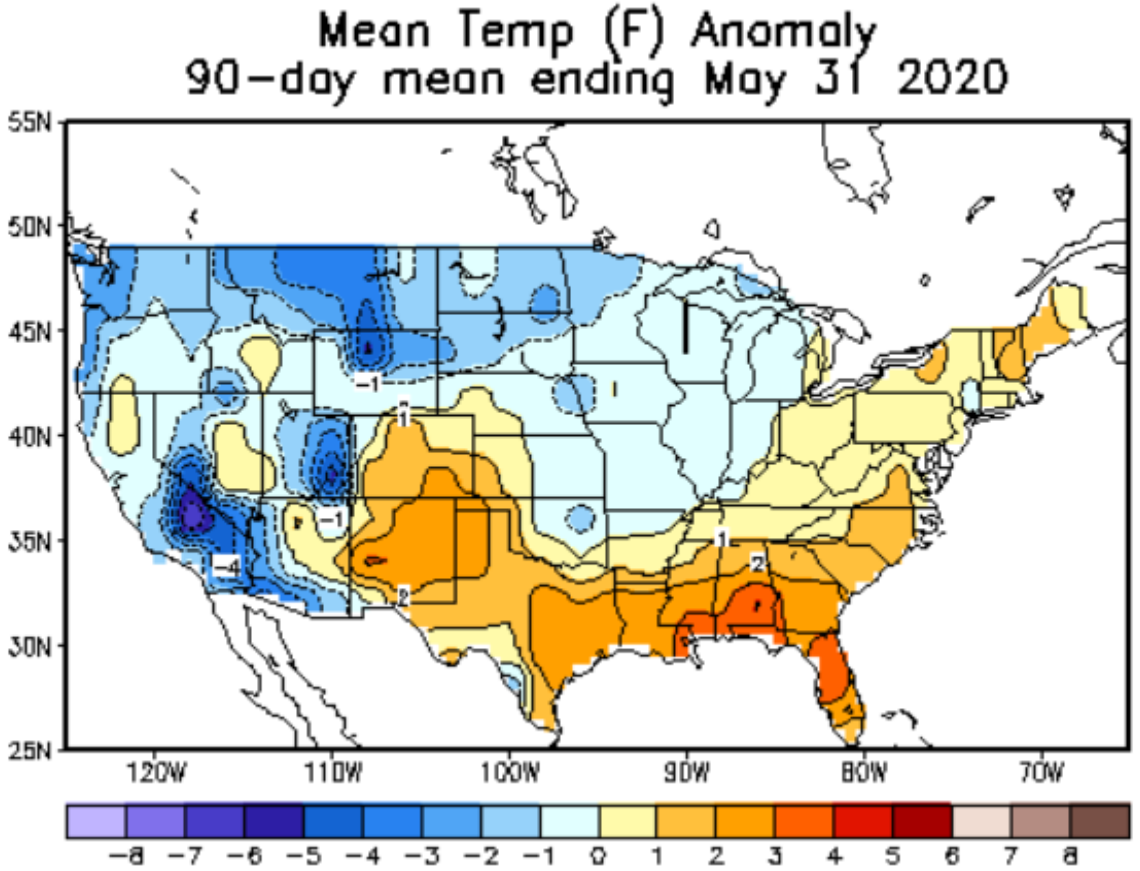


Last 3 years (2017-2019), exceptionally wet for the Great Lakes Basin.

NOAA National Centers for Environmental information, Climate at a Glance

RECENT SPRING CONDITIONS





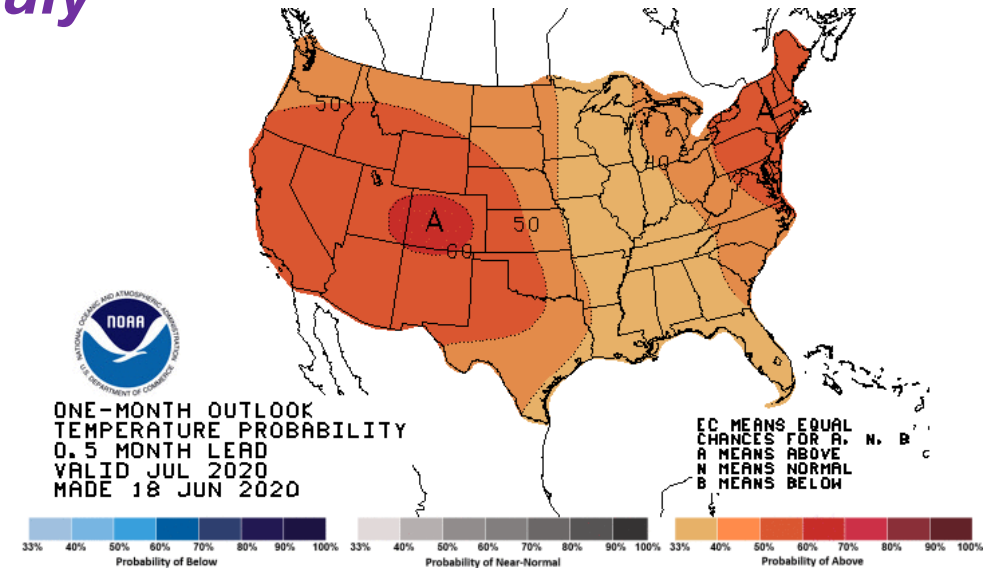
- During the spring, drier conditions were felt in the Lake Superior and Ontario basins, while the central areas of the GL basin experienced wetter conditions.
- Although March was much warmer than normal, April and May were cooler than normal, causing the overall spring mean temperature to be near normal.

MONTHLY AND SEASONAL OUTLOOKS

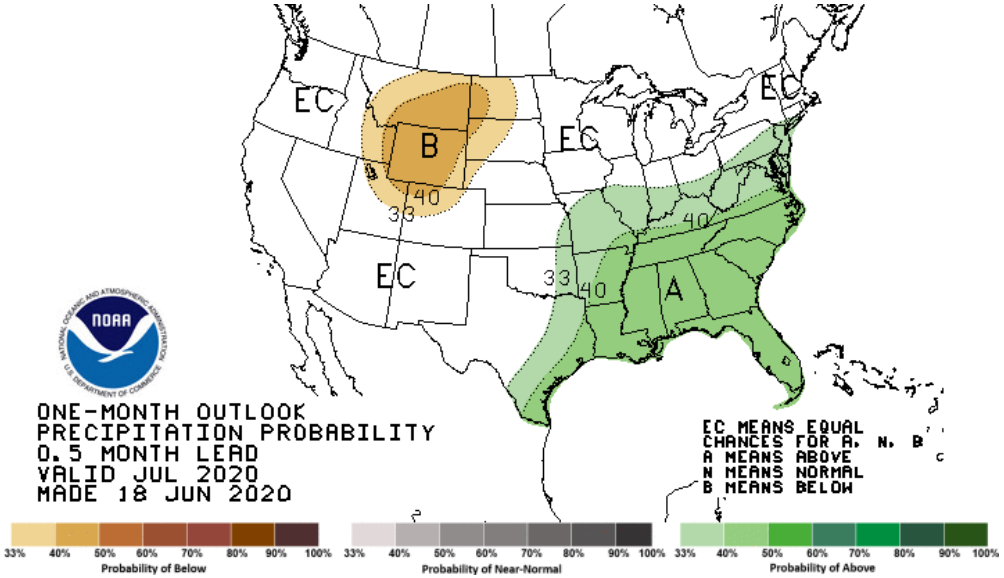
ONE MONTH OUTLOOK

July

TEMPERATURE

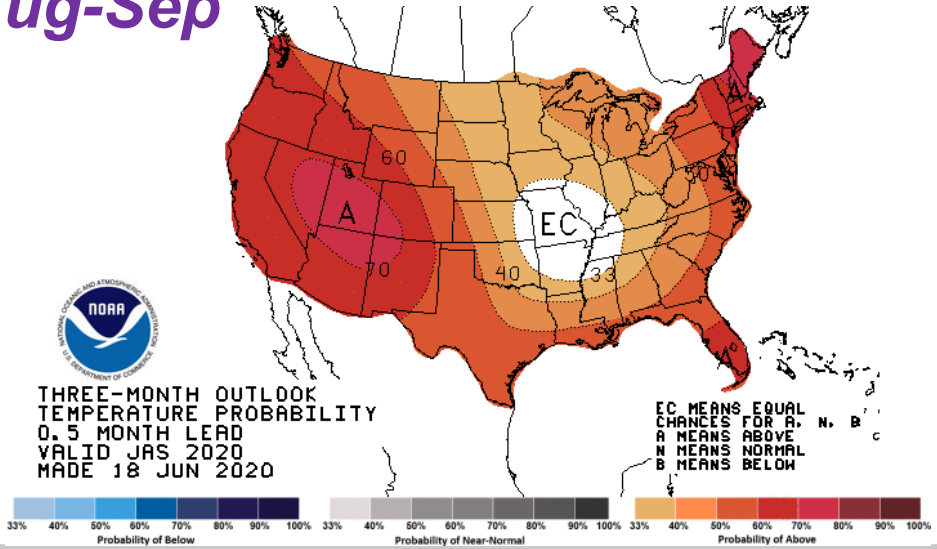


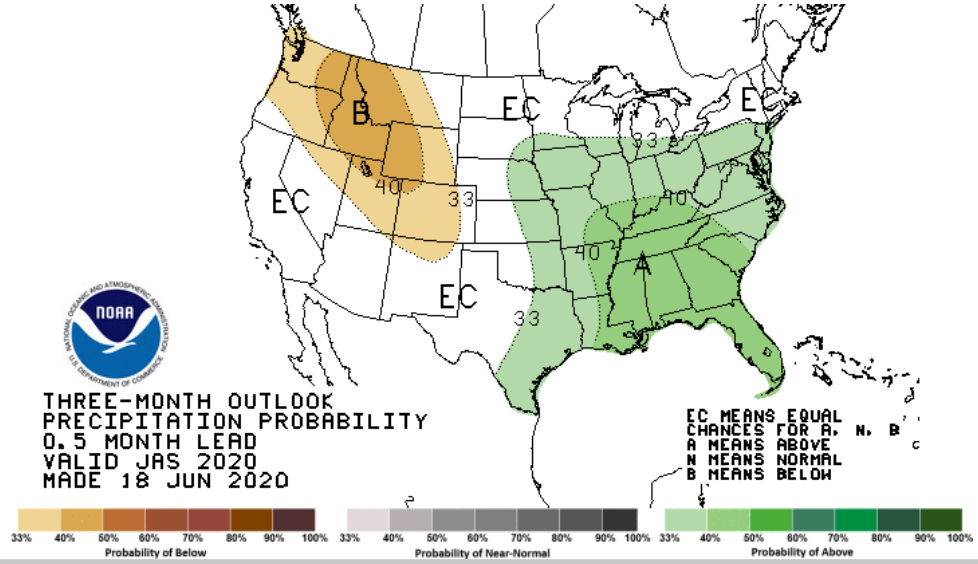
PRECIPITATION



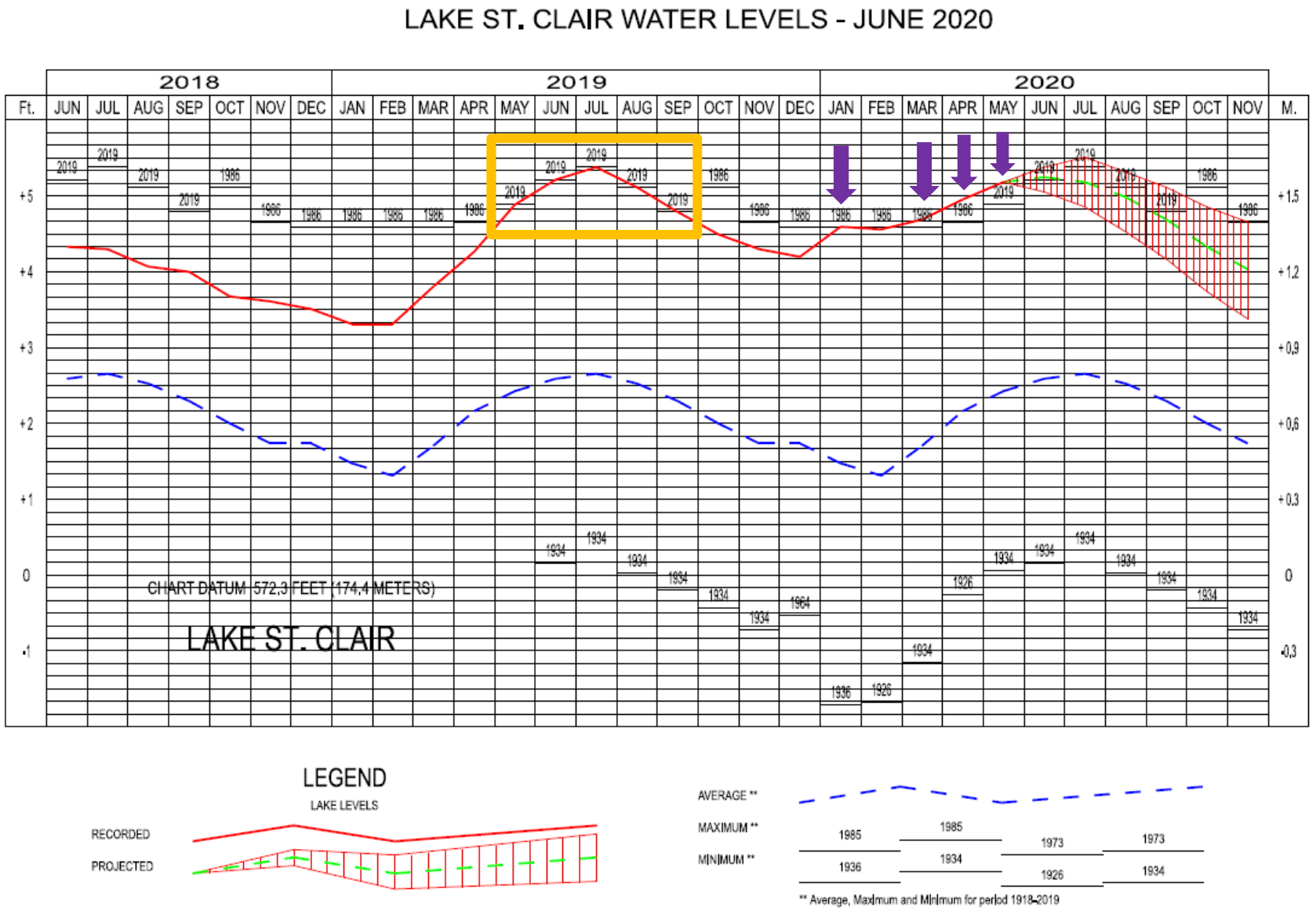
THREE MONTH OUTLOOK

Jul-Aug-Sep





6-MONTH FORECAST (JUNE-NOVEMBER)



- 2019 Records
- 2020 Provisional Record

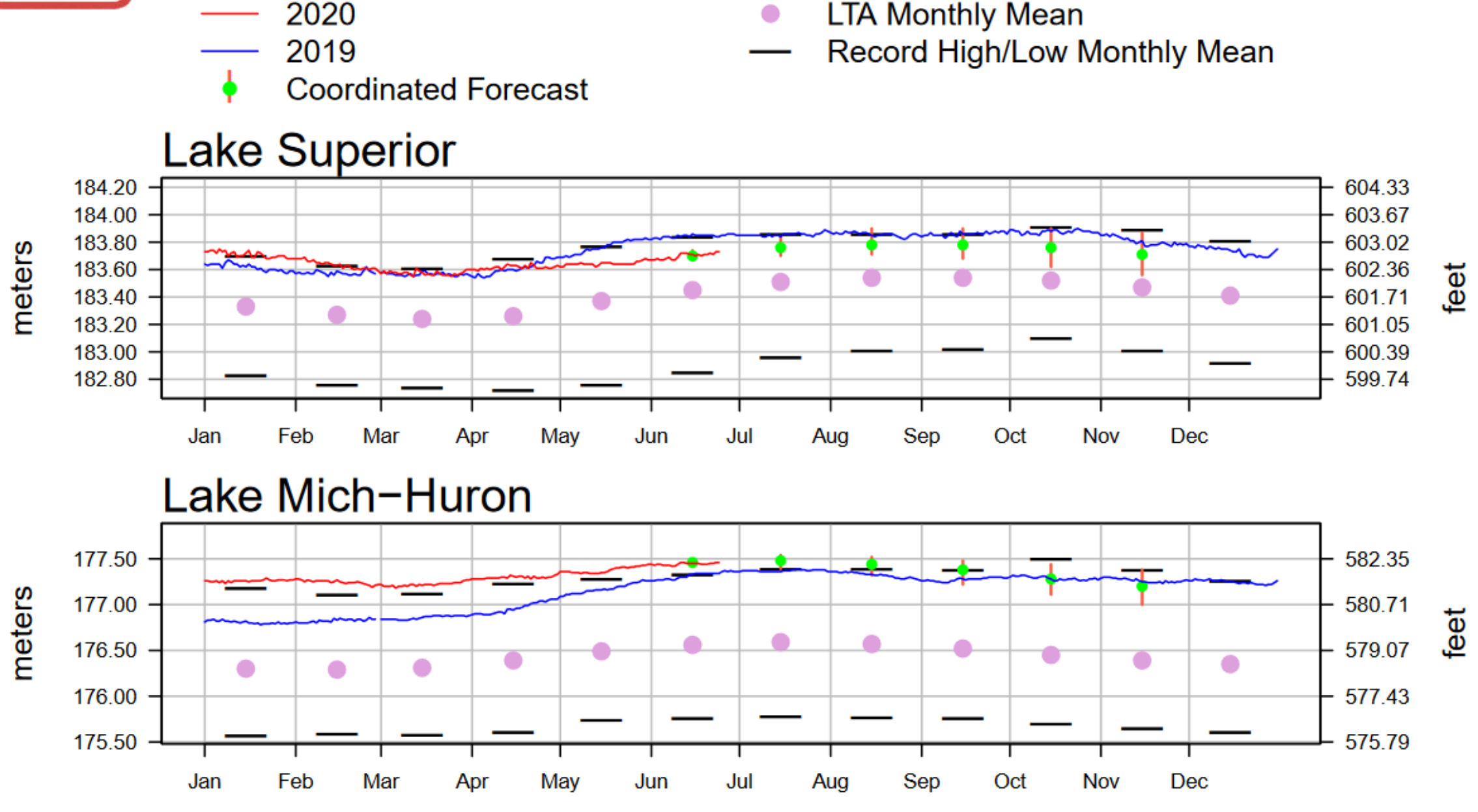
Projected Levels (dashed green line):

- In period of seasonal rise
- May 2020 level was 4 inches above the May 2019 level.
- Forecast to be less than 1 inch above record high June level, 1 to 2 inches below record highs from July to Sept., and 7 to 9 inches below record high levels in Oct. and Nov.

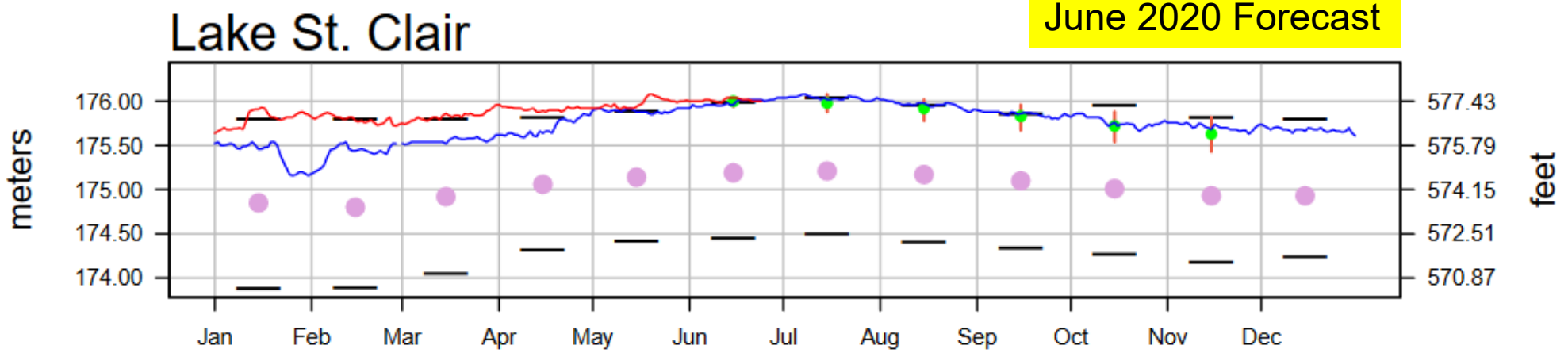
https://www.lre.usace.army.mil/Missions/Great-Lakes-Information/Great-Lakes-Water-Levels/Water-Level-Forecast/

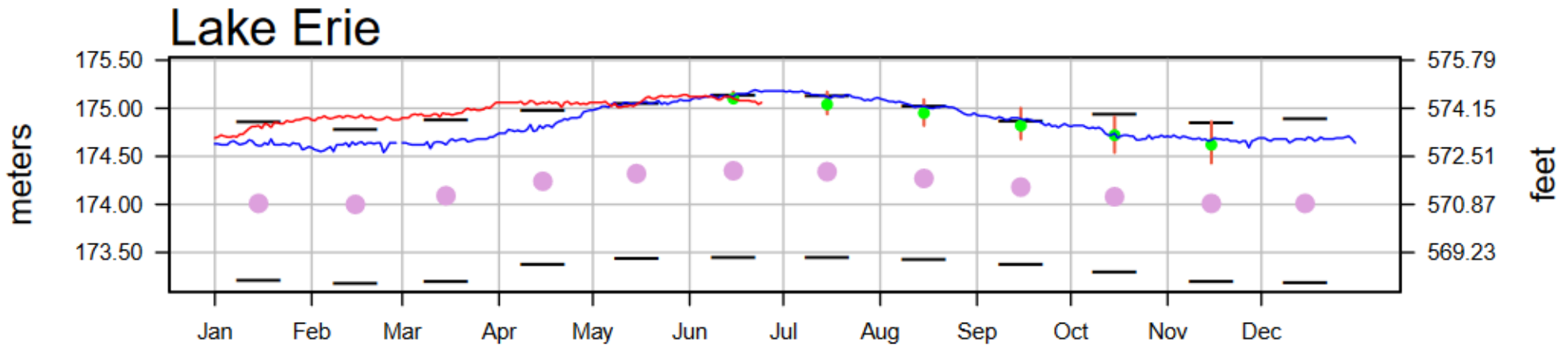
Daily Great Lakes Water Levels

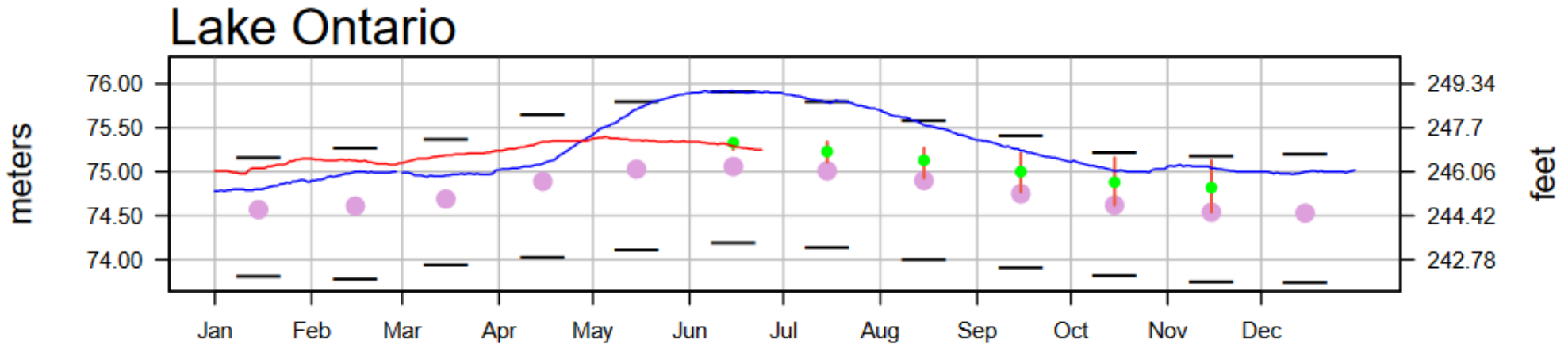
June 2020 Forecast



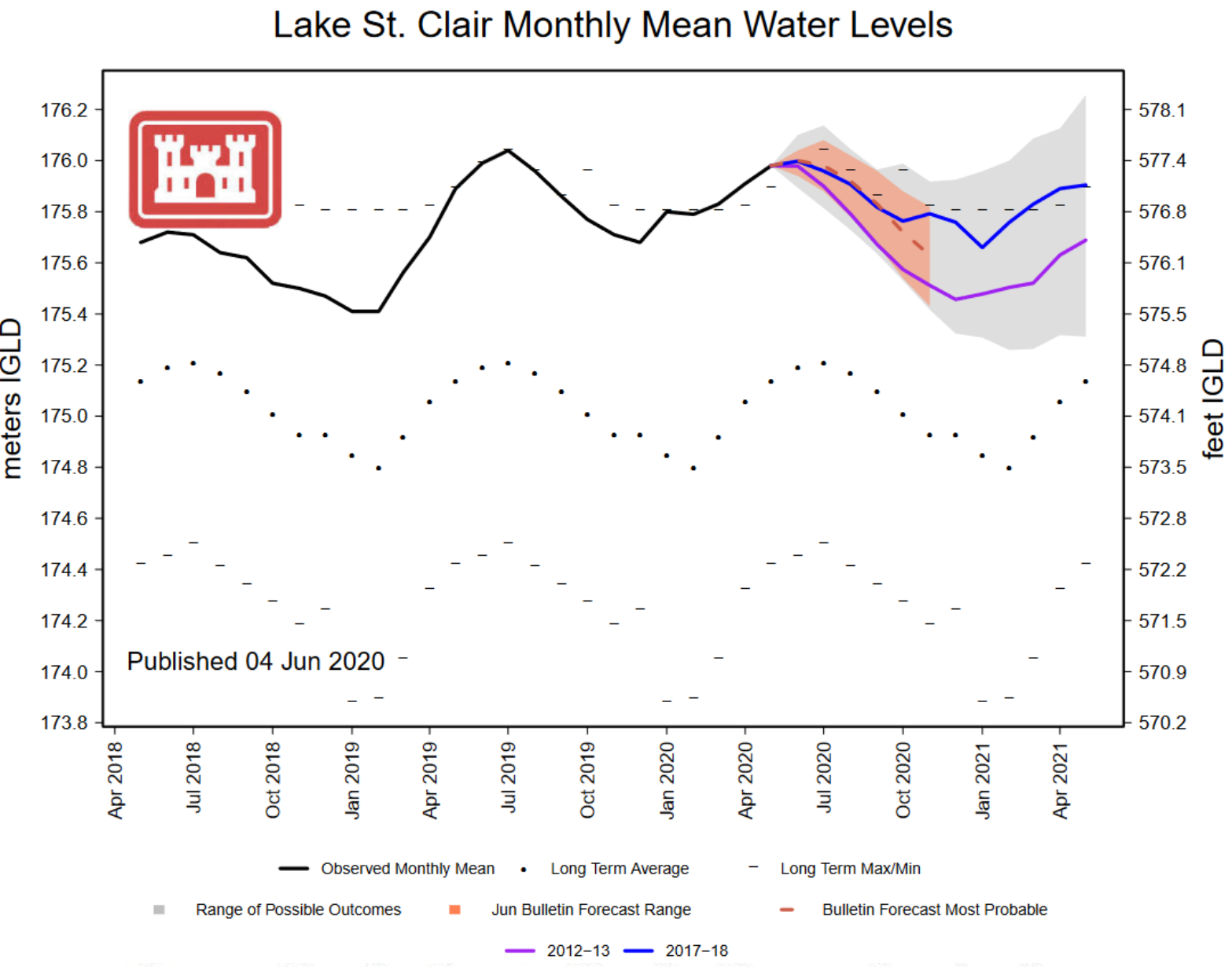
June 2020 Forecast







THE "WHAT IF" WATER LEVEL OUTLOOK



Scenarios driven based on historical supplies from 2012-2013 (dry) and 2017-2018 (wet)

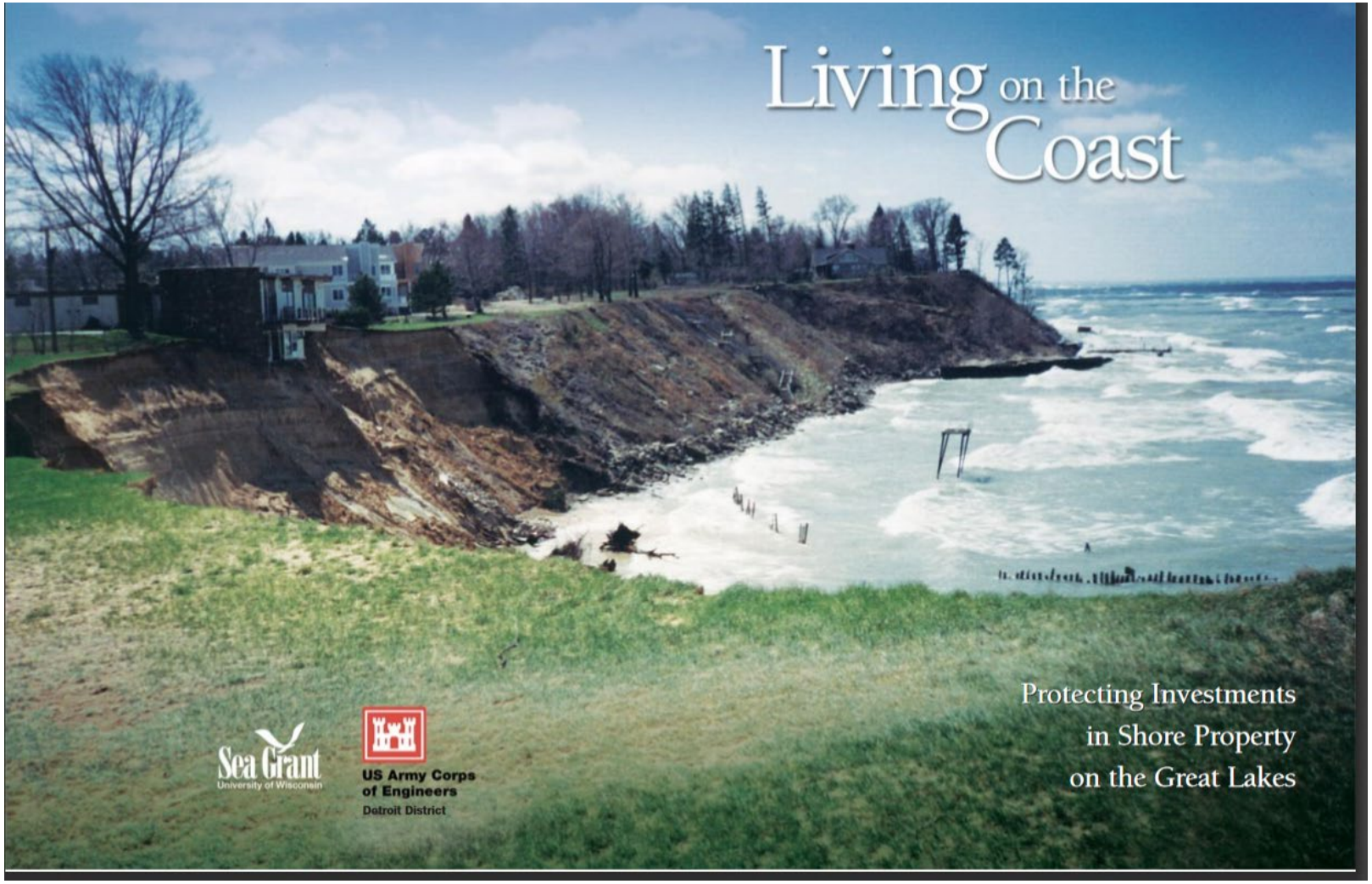
https://www.lre.usace.army.mil/Missions/Great-Lakes-Information/Great-Lakes-Water-Levels/Water-Level-Forecast/Water-Level-Outlook/

KEY POINTS

- Water level fluctuations are primarily driven by weather and hydrologic conditions.
- Except for Lake Michigan-Huron, all lakes forecast to peak below 2019 levels.
- Regulation of outflows (St. Marys and St. Lawrence) cannot prevent extreme high or low water levels nor fully control water levels
- Impacts of high water are expected to be felt throughout 2020

LIVING ON THE COAST

https://www.lre.usace.army.mil/Portals/69/docs/GreatLakesInfo/docs/CoastalProgram/Living%20on%20the%20Coast%20Booklet.pdf?ver=2016-06-06-105107-683



WATER LEVEL RESOURCES

GREAT LAKES WATER LEVEL RESOURCES AND CONTACT INFORMATION

Websites

USACE Detroit District	Link at the top of the page provides USACE resources related to high water levels	https://www.lre.usace.army.mil
Water level forecasts	Monthly Bulletin of Great Lakes Water Levels (6-month forecast) Weekly Great Lakes Water Levels (update on current conditions and forecast for next month) Great Lakes Water Level Outlook (Scenario-based 12-month outlook) Connecting Channels Forecast (channel depths for next month)	https://www.lre.usace.army.mil/Missions/Great-Lakes-Information/Great-Lakes-Water-Levels/Water-Level-Forecast/
Water level observations	Current Conditions (preliminary daily lake-wide average levels and connecting channel water levels) Historical Data (long term average, maximum, and minimum Great Lakes water levels)	https://www.lre.usace.army.mil/Missions/Great-Lakes-Information/Water-Level-Data/
Basin Conditions and Other Great Lakes Information	Water Level Summaries (lake-by-lake summaries of recent conditions) Great Lakes Update Articles (periodic publications on various Great Lakes topics)	https://www.lre.usace.army.mil/Missions/Great-Lakes-Information/Basin-Conditions/
Living on the Coast	Brochure on coastal impacts	https://www.lre.usace.army.mil/Portals/69/docs/GreatLakesInfo/docs/CoastalProgram/Living%20on%20the%20Coast%20Booklet.pdf?ver=2016-06-06-105107-683

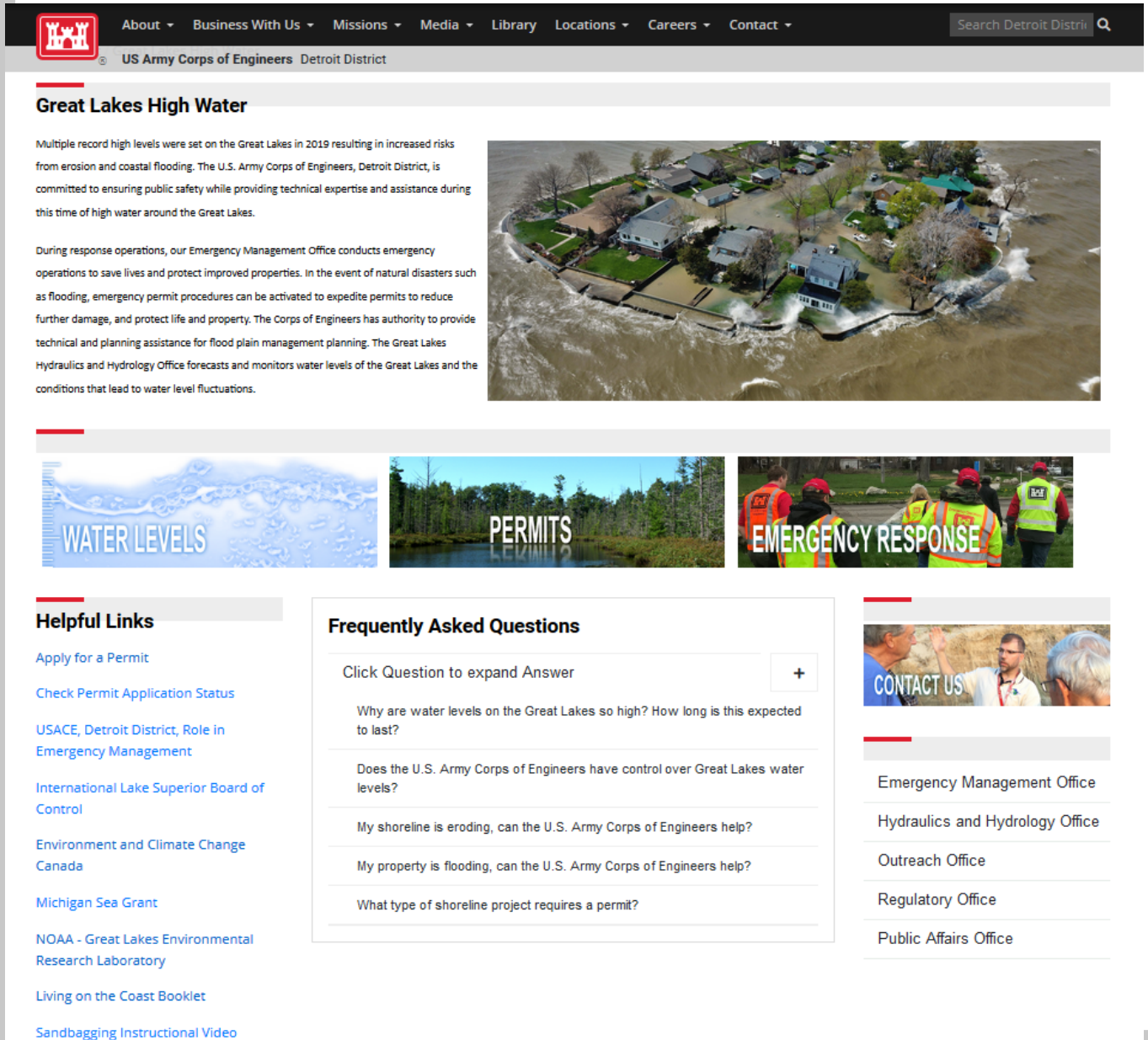
Contact Information

Water level forecasts

- John Allis, Chief Office of Great Lakes Hydraulics and Hydrology (313-226-2137)
- Deanna Apps (313-226-2979)

US Army Corps of Engineers

HTTPS://WWW.LRE.USACE.ARMY.MIL/ABOUT/GREAT-LAKES-HIGH-WATER/



Water Level Contacts

John Allis
313 226 2137
John.t.allis@usace.army.mil

Deanna Apps
313 226 2979
Deanna.Apps@usace.army.mil

2019-2020 GREAT LAKES HIGH WATER

EMERGENCY MANAGEMENT SUPPORT

U.S. ARMY CORPS OF ENGINEERS DETROIT DISTRICT

Krystle Walker
Emergency Management Specialist

U.S.ARMY

US Army Corps
of Engineers®

How can the Army Corps of Engineers help my community??

1. Immediate emergency assistance
2. Long-term solutions

USACE EMERGENCY AUTHORITIES

Authorities provided by Congress:

33 U.S.C. 701n (commonly referred to as Public Law (PL) 84-99):

Localized events

"The Chief of Engineers is authorized to undertake activities, including disaster preparedness, Advance Measures, emergency operations, rehabilitation of flood control works threatened or destroyed by flood, protection or repair of Federally authorized shore protective works threatened or damaged by coastal storms, provision of emergency water due to drought or contaminated source, emergency dredging, and flood-related rescue operations."

Robert T. Stafford Disaster Relief and Emergency Assistance Act (42 U.S.C. 5121 et seq.) (The Stafford Act):

Presidentially-declared or major disasters

FEMA may direct Federal agencies to use available personnel, supplies, facilities, and other resources to provide assistance in the event of a major disaster or emergency declaration.

PUBLIC LAW 84-99

–Authority that allows USACE to provide emergency operations support to communities

–Federal assistance is meant to SUPPLEMENT local resources just prior to or during an event.

–All resources must be exhausted, or nearly exhausted, by the City, County, and State.

–**Request is made by the State to USACE.**

PUBLIC LAW 84-99

Erosion cannot be addressed by USACE under emergency response authorities.

TYPES OF EMERGENCY ASSISTANCE – TECHNICAL

Technical assistance consists of providing review and recommendations in support of state and local efforts, and helping determine feasible solutions. Some examples of technical assistance are:

1. Providing experienced personnel to give guidance on flood fight techniques and emergency construction methods.

2. Providing personnel to inspect existing flood protection projects to identify problem areas and recommend corrective measures.

3. Providing hydraulic analysis, geotechnical evaluations, topography and stream data, maps, and historic flood or storm information.

No cost to customer

TYPES OF EMERGENCY ASSISTANCE – TECHNICAL

District Flood Fight Team

• Made up of trained and dedicated USACE employees as a collateral duty.

• Trained in principles of public communication and flood fight techniques.

• Bring other expertise such as geotechnical, structural, hydrological, and hydraulic engineering.

STATUS OF CURRENT EVENT

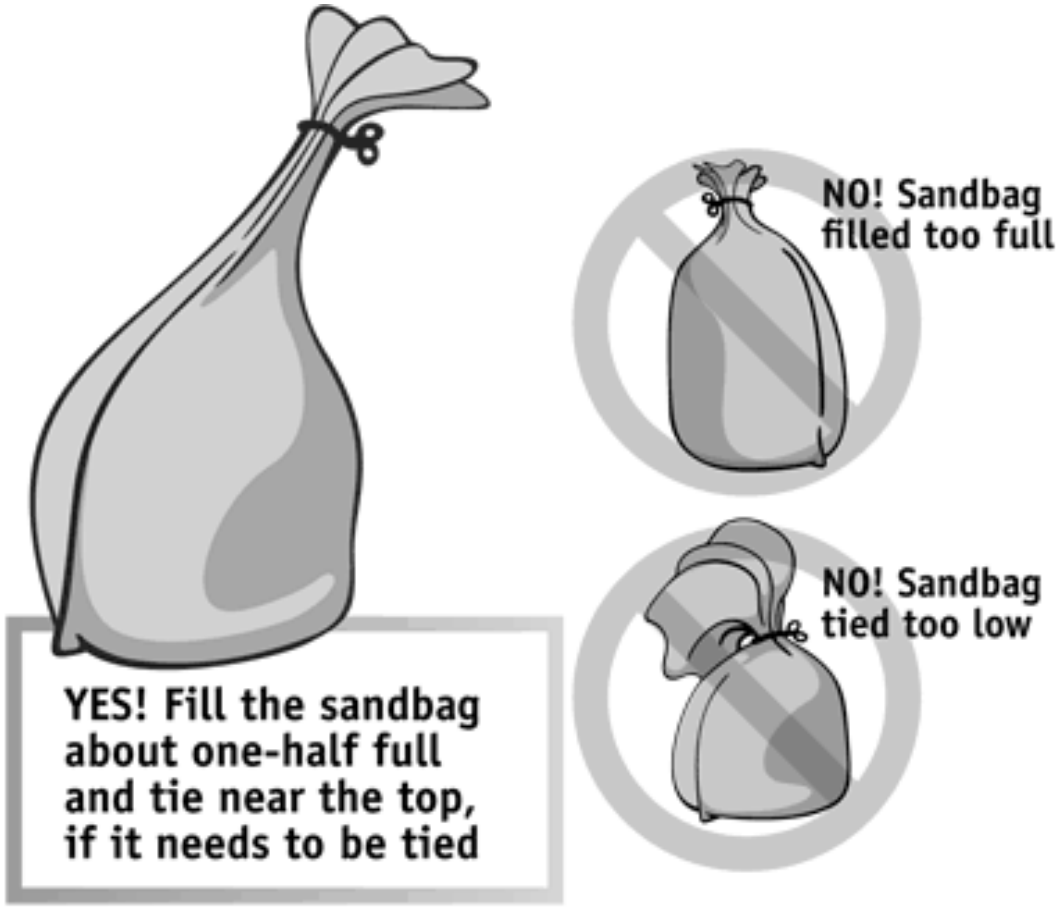
– MI counties receiving technical assistance for 2019-2020 lakeshore flooding:

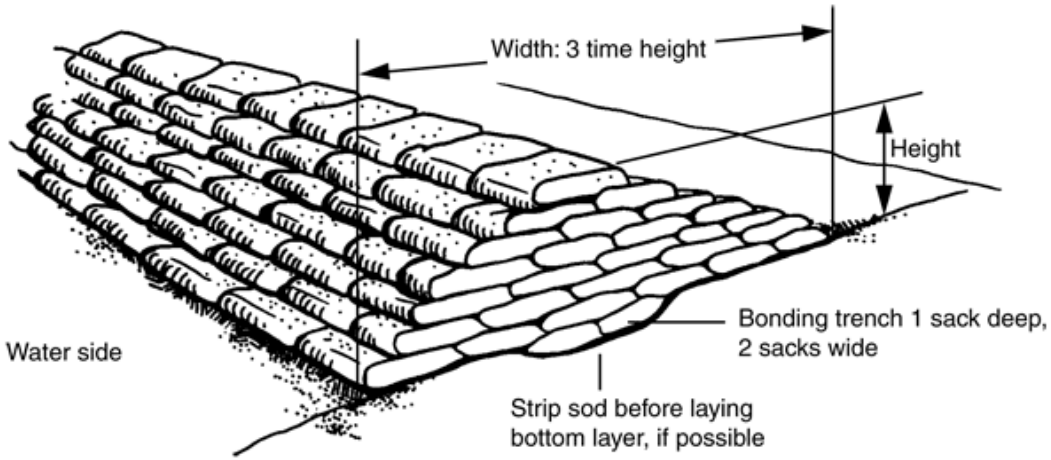
- Allegan
- Bay
- Charlevoix
- Cheboygan
- Emmet
- Macomb
- Monroe
- Muskegon
- Newaygo
- Ottawa
- St. Clair
- Van Buren
- Wayne

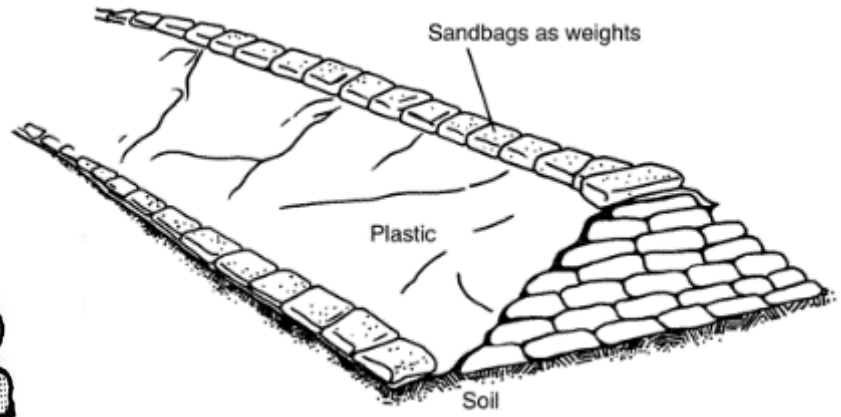
– Typical technical assistance requests

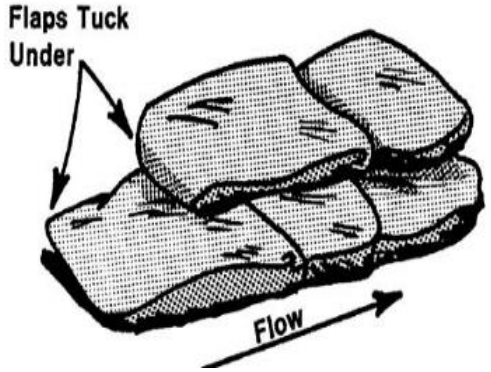
- Sandbagging technique
- Sandbag placement

FILLING SANDBAGS









2019 TECHNICAL ASSISTANCE EFFORTS

TYPES OF EMERGENCY ASSISTANCE - DIRECT

Supplies and Equipment: Sandbags, plastic sheeting, HESCO barriers

- To be used for protection of public infrastructure. Not to be used for private residences or private businesses. Ideally the supplies are used in a community planned and led effort.
- Supplies that are unused are to be returned to USACE. Supplies that are used have to be reimbursed at the USACE cost to replace.
  ***Unless the area receives a Presidential Declaration.
- All supplies need to be picked up by the requesting agency (county officials, local public works, etc.) from a USACE staging area

2020 DIRECT ASSISTANCE EFFORTS

PUBLIC LAW 84-99

Erosion cannot be addressed by USACE under emergency response authorities.

BUT…

EROSION PROTECTION PROJECT PERMITS

It's important to know that placing structures for erosion protection may require federal, state, county, and/or city permits.

USACE is a regulatory agency that has permitting authority for projects along the lakeshore.

USACE works in partnership with EGLE for permitting activities in the state of Michigan.

To apply for a permit or learn more about the process please visit: https://www.lre.usace.army.mil/Missions/Regulatory-Program-and-Permits/Apply-For-A-Permit/

LONG-TERM SOLUTIONS

USACE also has the ability to complete studies or construction to address erosion and/or other flood mitigation issues under non-emergency authorities

To learn more about the full catalog of USACE programs please visit: https://www.lre.usace.army.mil/Missions/Planning/Technical-Planning-Assistance/

CONTINUING AUTHORITIES PROGRAM (CAP) SUMMARY

Authority	Description	Per Project Federal Limit ($)	Annual Prog. Limit ($)	Cost Sharing (Fed/Non-Fed)
Sect 14	Emergency Streambank and Shore Protection	5,000,000	20,000,000	65/35
Sect 103	Coastal Storm Damage Reduction	10,000,000	30,000,000	65/35
Sect 107	Small Navigation	10,000,000	50,000,000	Varies by depth
Sect 111	Mitigation of Damages Caused by Federal Structures	10,000,000	N/A	Per original project
Sect 204	Beneficial Use of Dredged Material	10,000,000	50,000,000	65/35
Sect 205	Flood Damage Reduction	10,000,000	50,000,000	65/35
Sect 206	Aquatic Ecosystem Restoration	10,000,000	50,000,000	65/35
Sect 208	Clearing and Snagging	500,000	7,500,000	65/35
Sect 1135	Modifications for Improvement of the Environment	10,000,000	25,000,000	75/25

SECTION 205 – FLOOD RISK MANAGEMENT

Authority: Flood Control Act of 1948 (PL 80-858), as amended.

Cost Share: 65% Federal, 35% Local. $10M Federal limit.

Types of Assistance: Work under this authority provides for local protection from flooding by the construction or improvement of structural flood damage reduction features such as levees, channels, and dams. Non-structural alternatives are also to be considered, and may include measures such as installation of flood warning systems, raising and/or flood proofing of structures, and relocation of flood prone facilities.

Timeline: 2-10 years, if approved and funded

FLOOD PLAIN MANAGEMENT SERVICES PROGRAM (FPMS)

Authority: The program's authority stems from Section 206 of the 1960 Flood Control Act (PL 86-645), as amended.

Cost Share: 100% Federal, typically for smaller studies, approximately 75,000.

Purpose: People who live and work in the flood plain need to know about the flood hazard and the actions they can take to reduce property damage and prevent the loss of life caused by flooding.

Types of Assistance:
Technical Assistance - program develops or interprets site-specific data on obstructions to flood flows, flood formation and timing; and the extent, duration, and frequency of flooding. It also provides information on natural and cultural flood plain resources of note, and flood loss potentials before and after the use of flood plain management measures.

Planning Assistance - provides assistance and guidance in the form of "Special Studies" on all aspects of flood plain management planning. Typical studies include: Flood Plain Delineation/Flood Hazard Evaluation, Flood Warning/Preparedness, Flood Damage Reduction, Urbanization Impact, Stormwater Management Studies, Flood Proofing Studies, Inventory of Flood Prone Structures

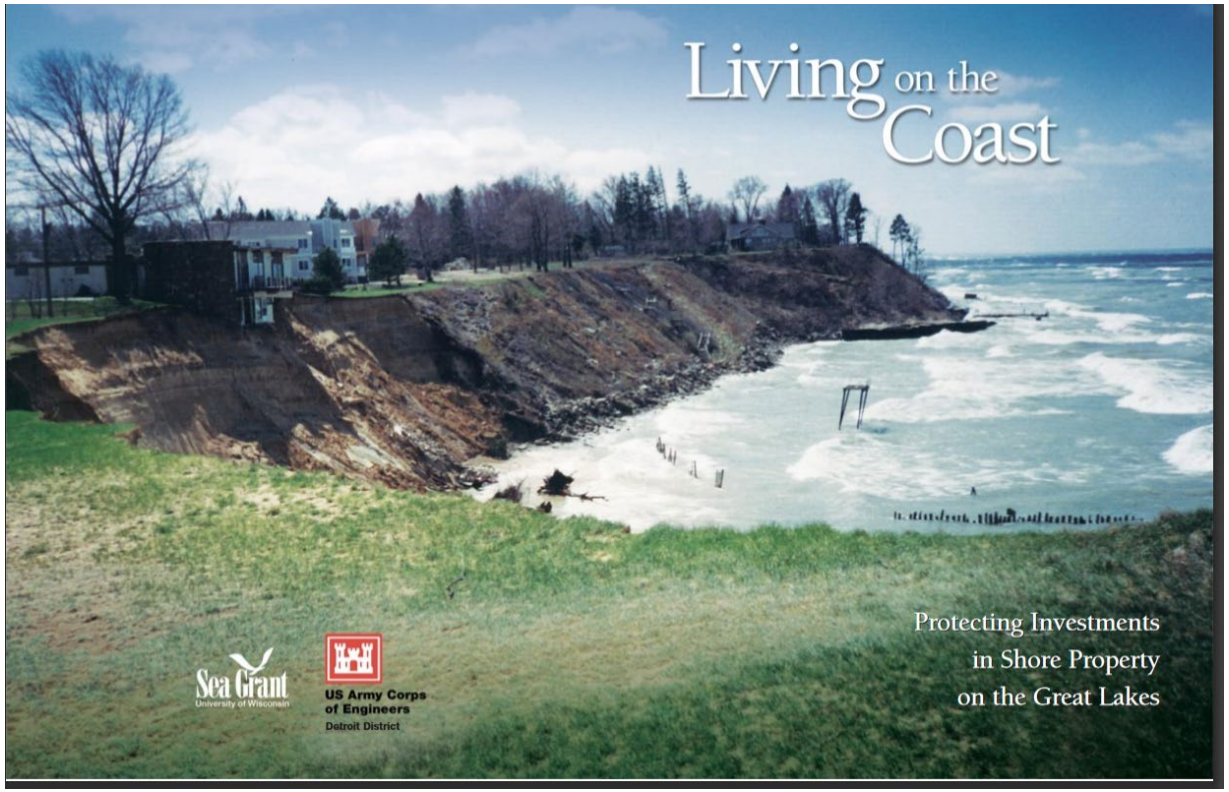
Timeline: 1-2 years, if approved and funded

KEY TAKEAWAYS

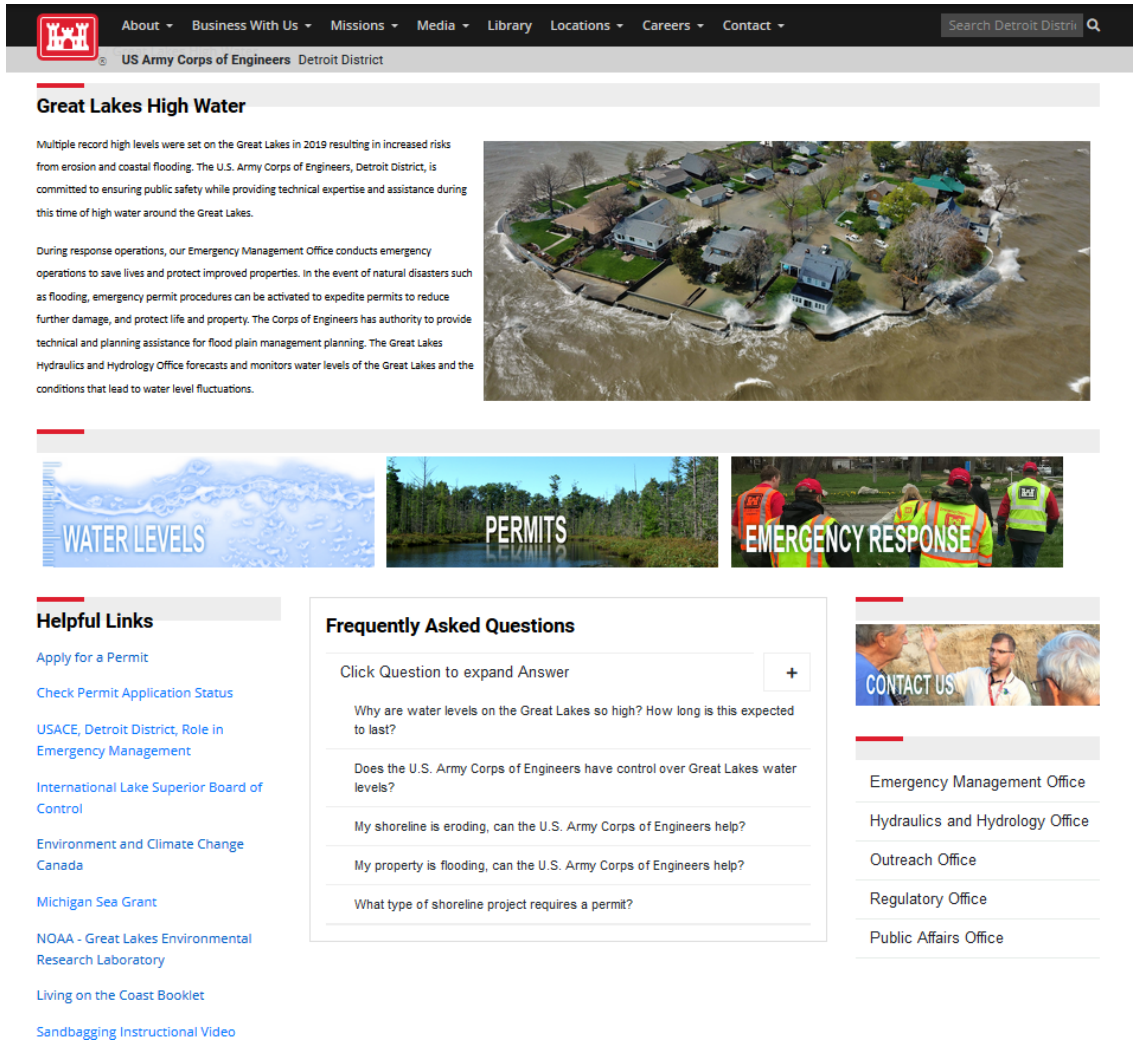
1. 2020 will see a continued pattern of record or near-record lake levels. What will 2021 bring?
2. USACE is partnered with the Michigan State Police EMHSD and your county emergency management programs. If you have any questions or concerns, be sure to contact your city or county emergency management point of contact.
3. Be sure that you are aware which permits are needed when placing erosion protection structures.
4. There are several USACE programs that can be used to address flooding and erosion issues, but these will take time to implement, *if approved*.

LIVING ON THE COAST

https://www.lre.usace.army.mil/Portals/69/docs/GreatLakesInfo/docs/CoastalProgram/Living%20on%20the%20Coast%20Booklet.pdf?ver=2016-06-06-105107-683



WHO CAN I CONTACT?



HTTPS://WWW.LRE.USACE.ARMY.MIL/ABOUT/GREAT-LAKES-HIGH-WATER/

Hint: Search Detroit District High Water *in your favorite search engine*

Questions about lake levels?

Deanna Apps
(313) 226-2979
Deanna.Apps@usace.army.mil

Questions about emergency management or technical assistance?

1. Call your local emergency management agency
2. Detroit District Emergency Management: CELRE-EOC@usace.army.mil