

# Stream Restoration in a time of Systemic Change – the Story from the Great Lakes Region

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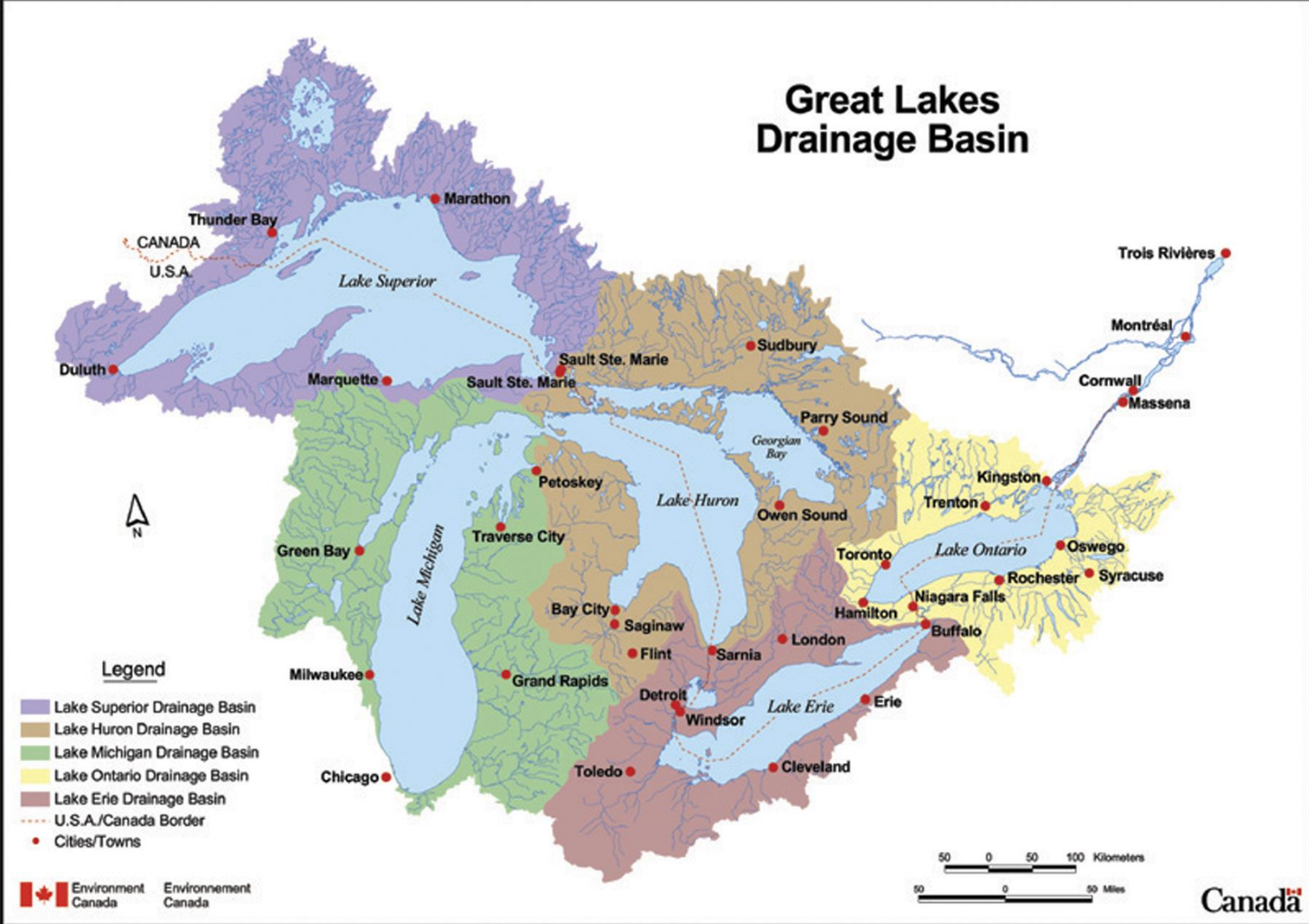
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Lake Michigan, Indiana Dunes National Lakeshore

# Great Lakes Drainage Basin



**Map Labels:**

**Cities/Towns:** Duluth, Marquette, Sault Ste. Marie, Soudby, Trois Rivières, Montréal, Cornwall, Massena, Kingston, Trenton, Oswego, Rochester, Syracuse, Toronto, Hamilton, Niagara Falls, Buffalo, London, Sarnia, Windsor, Cleveland, Erie, Toledo, Chicago, Milwaukee, Grand Rapids, Detroit, Flint, Saginaw, Bay City, Traverse City, Petoskey, Owen Sound, Parry Sound, Green Bay, Marathon, Thunder Bay.

**Lakes:** Lake Superior, Lake Huron, Lake Michigan, Lake Ontario, Lake Erie.

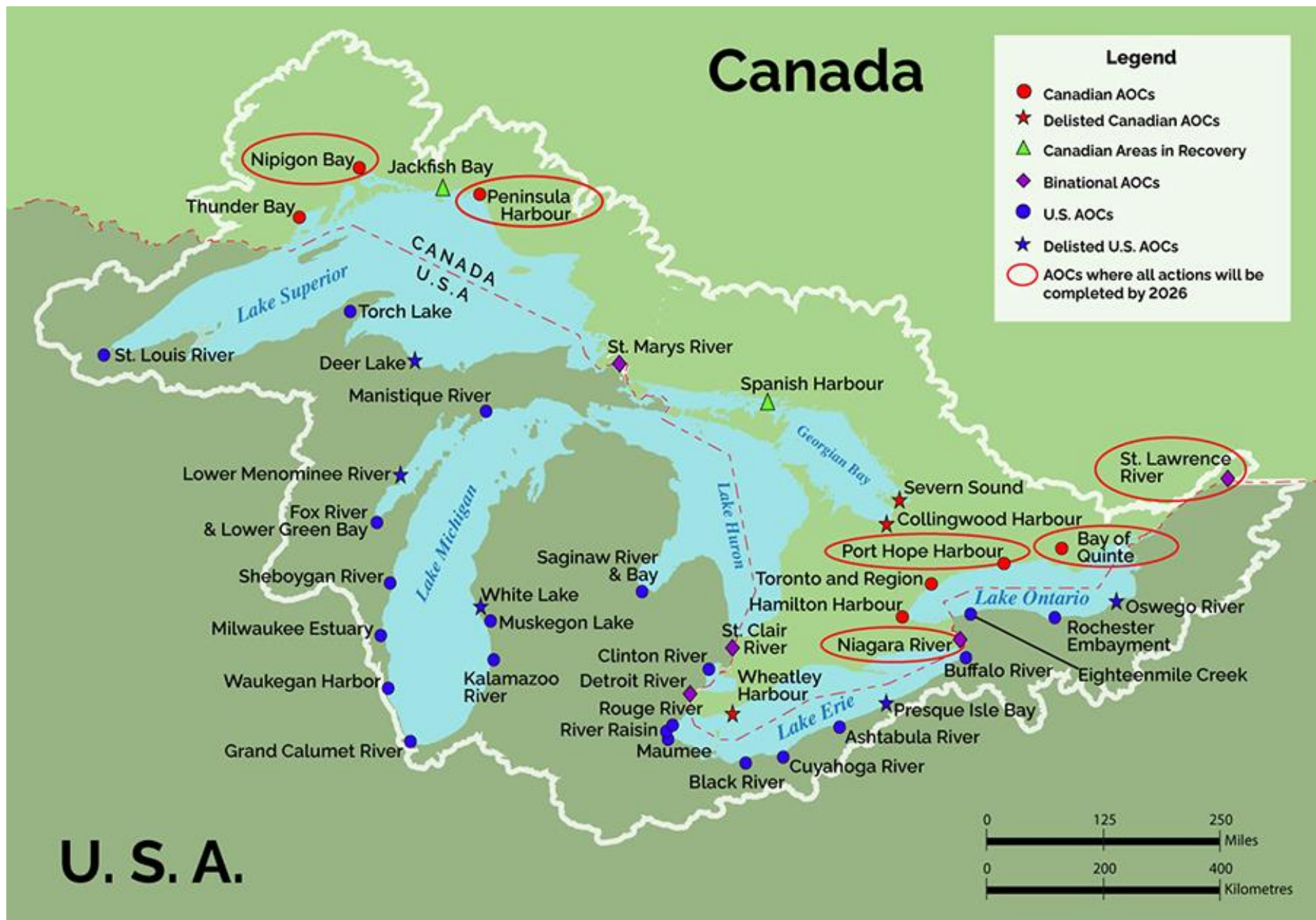
**Other Labels:** CANADA, U.S.A., Georgian Bay.

# Basin Characteristics

- Land Drainage Area: 521,830-km<sup>2</sup> (201,480 mi<sup>2</sup>)
- Total Area: 765,990-km<sup>2</sup> (295,750 mi<sup>2</sup>)
- Shoreline length 17,017-km<sup>2</sup> (10,574 mi<sup>2</sup>)
- Approx. 20% of the worlds surface fresh water
- Approx. 90% of North America's surface fresh water
- Over 500 named rivers ???

# Great Lakes Water Quality Agreement (GLWQA)

April 14, 2022 (50th Anniversary of the signing of the United States-  
Canada Great Lakes Water Quality Agreement)



Map illustrating Great Lakes areas of concern (<https://www.ontario.ca/page/summary-canada-ontario-great-lakes-agreement>)

## The Great Lakes Restoration Initiative Accelerates Great Lakes Protection and Restoration in Five Focus Areas

FY 2010 – FY 2014: GLRI Action Plan I | FY 2015 – FY 2019: GLRI Action Plan II | FY 2020 – FY 2024: GLRI Action Plan III

Toxic Substances and Areas of Concern

Invasive Species

Nonpoint Source Pollution Impacts on Nearshore Health

Habitats and Species

Foundations for Future Restoration Actions

### Long-Term Goals for the Great Lakes Ecosystem

- All Areas of Concern delisted
- Fish safe to eat
- Water safe for recreation
- Safe source of drinking water
- No new self-sustaining invasive species
- Existing invasive species controlled
- Harmful/nuisance algal blooms eliminated
- Habitat protected and restored to sustain healthy ecosystem function and native species

Through Fiscal Year (FY) 2018, the GLRI federal agencies have invested over \$2.4 billion from the GLRI for over 4,000 projects



## Interagency Task Force and Regional Working Group Agencies



**U.S. Environmental  
Protection Agency**  
Great Lakes National  
Program Office



**U.S. Department  
of State**



**U.S. Department of the  
Interior**  
Bureau of Indian Affairs  
U.S. Fish & Wildlife Service  
National Park Service  
U.S. Geological Survey



**U.S. Department  
of Housing and  
Urban Development**



**U.S. Department of  
Agriculture**  
Animal and Plant Health  
Inspection Service  
Natural Resources  
Conservation Service  
U.S. Forest Service



**U.S. Department of  
Commerce**  
National Oceanic &  
Atmospheric Administration



**U.S. Department of  
Transportation**  
Federal Highway  
Administration  
Maritime Administration



**U.S. Department of  
Homeland Security**  
U.S. Coast Guard



**U.S. Department of  
the Army**  
U.S. Army Corps of Engineers



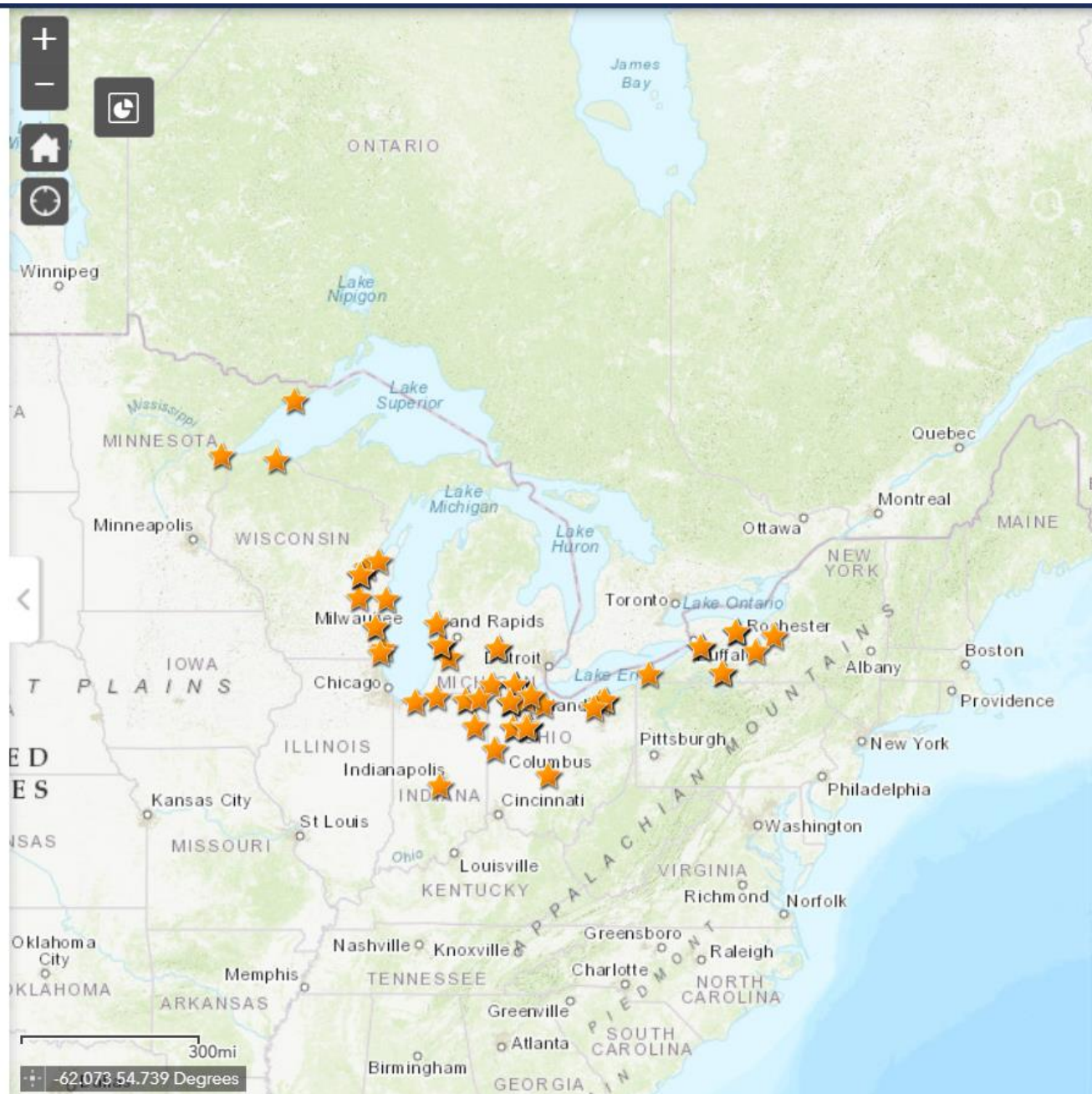
**Council on  
Environmental Quality**



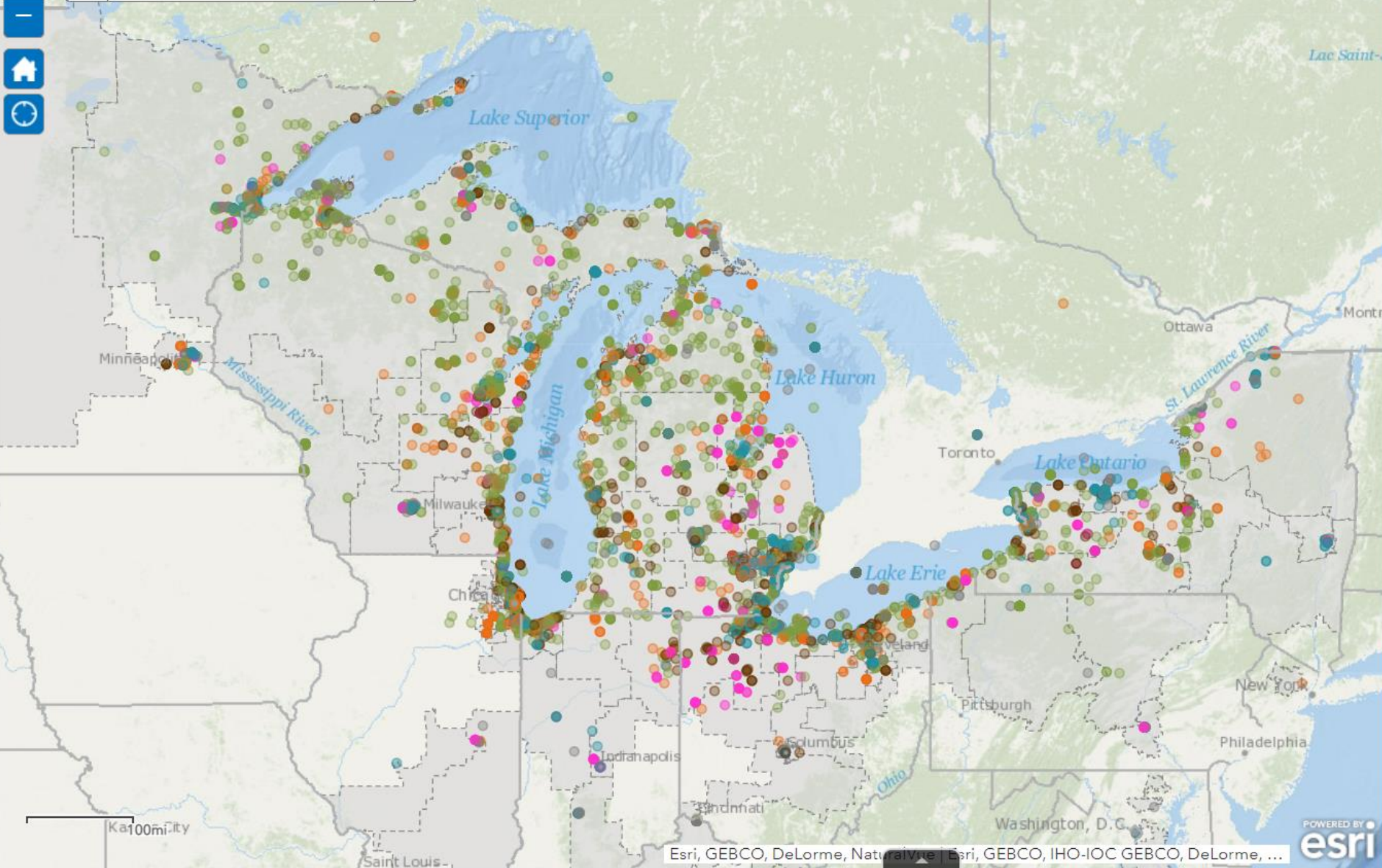
**U.S. Department  
of Health and  
Human Services**  
Agency for Toxic Substances  
and Disease Registry  
Centers for Disease Control  
and Prevention

<https://www.epa.gov/sites/default/files/2019-10/documents/glri-action-plan-3-201910-30pp.pdf>





Find address or place



### Legend

#### Great Lakes Restoration Initiative

- 1 - Toxic Substances and Areas of Concern
- 2 - Invasive Species
- 3 - Nonpoint Source Pollution Impacts on Nearshore Health
- 4 - Habitat Restoration and Wildlife Protection and Restoration
- 5 - Foundations for Future Restoration Actions
- M - Multiple Focus Areas

#### US Congressional Districts



# Great Lakes Water Quality Agreement (GLWQA)

## Annex 9: Climate change impacts and resilience

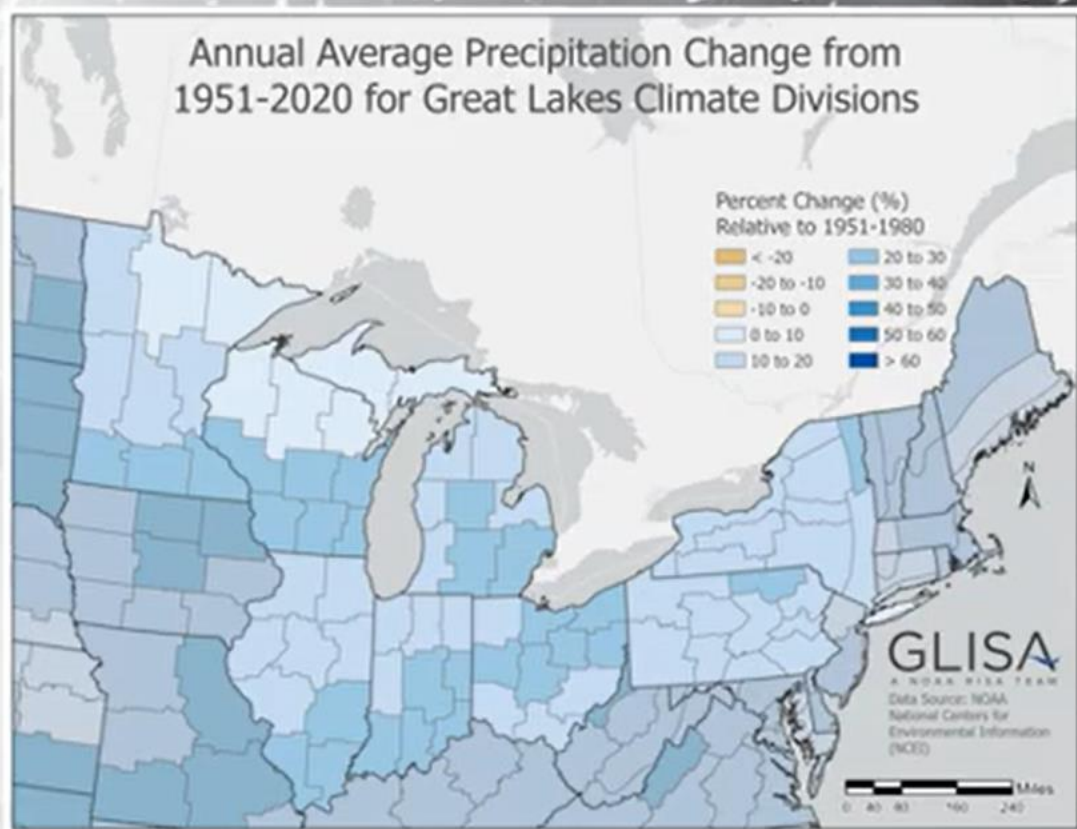
Climate change affects physical, chemical and biological processes and aquatic ecosystems. It impacts people, public health, communities and infrastructure in the Great Lakes region. Warmer water, changing precipitation patterns, extreme variability in lake levels, decreased ice coverage, increased lake evaporation and extreme weather events are among the most evident impacts.

(2012)

# More Precipitation

**Total annual precipitation in the region has increased by:**

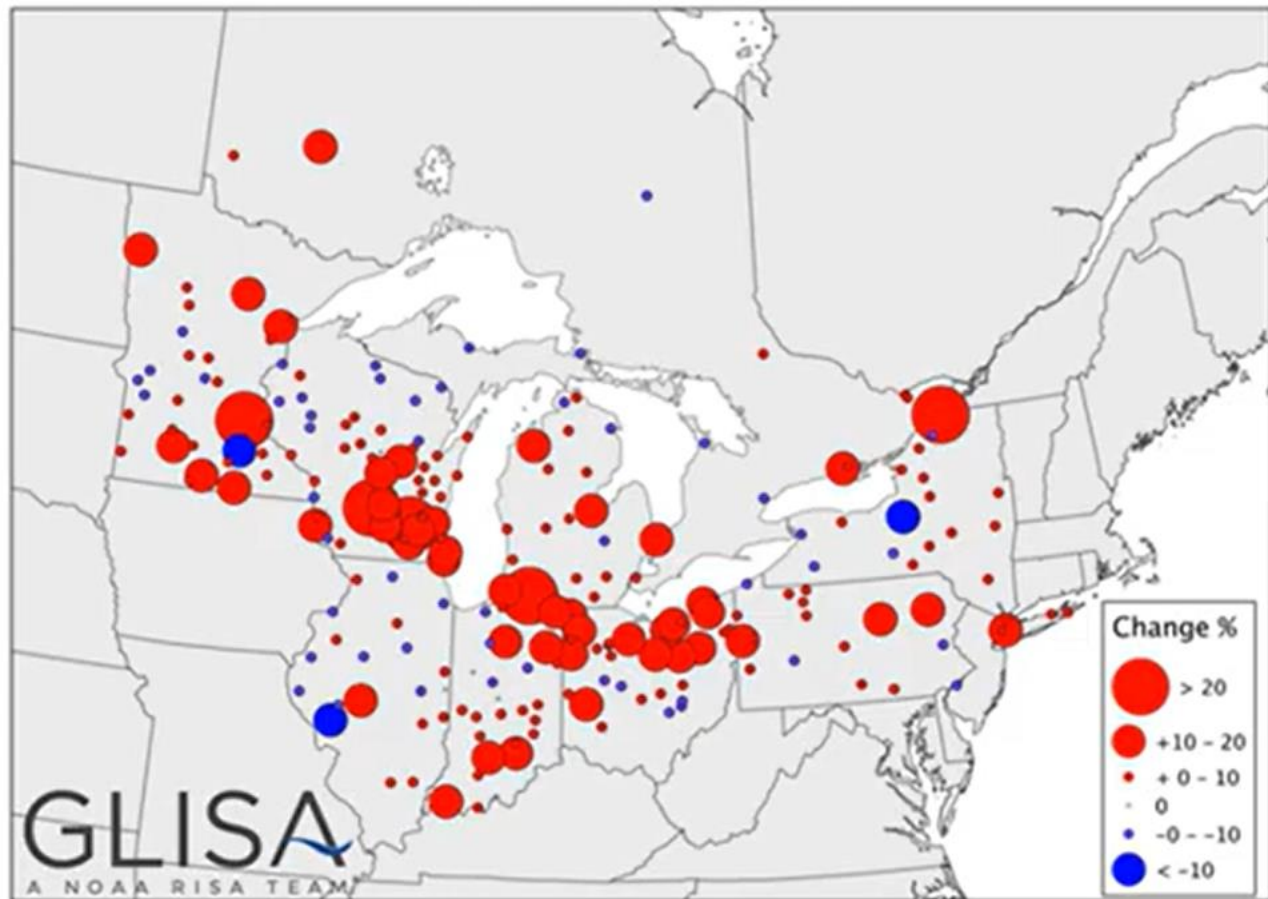
**17%**



**Uneven changes across the Region**

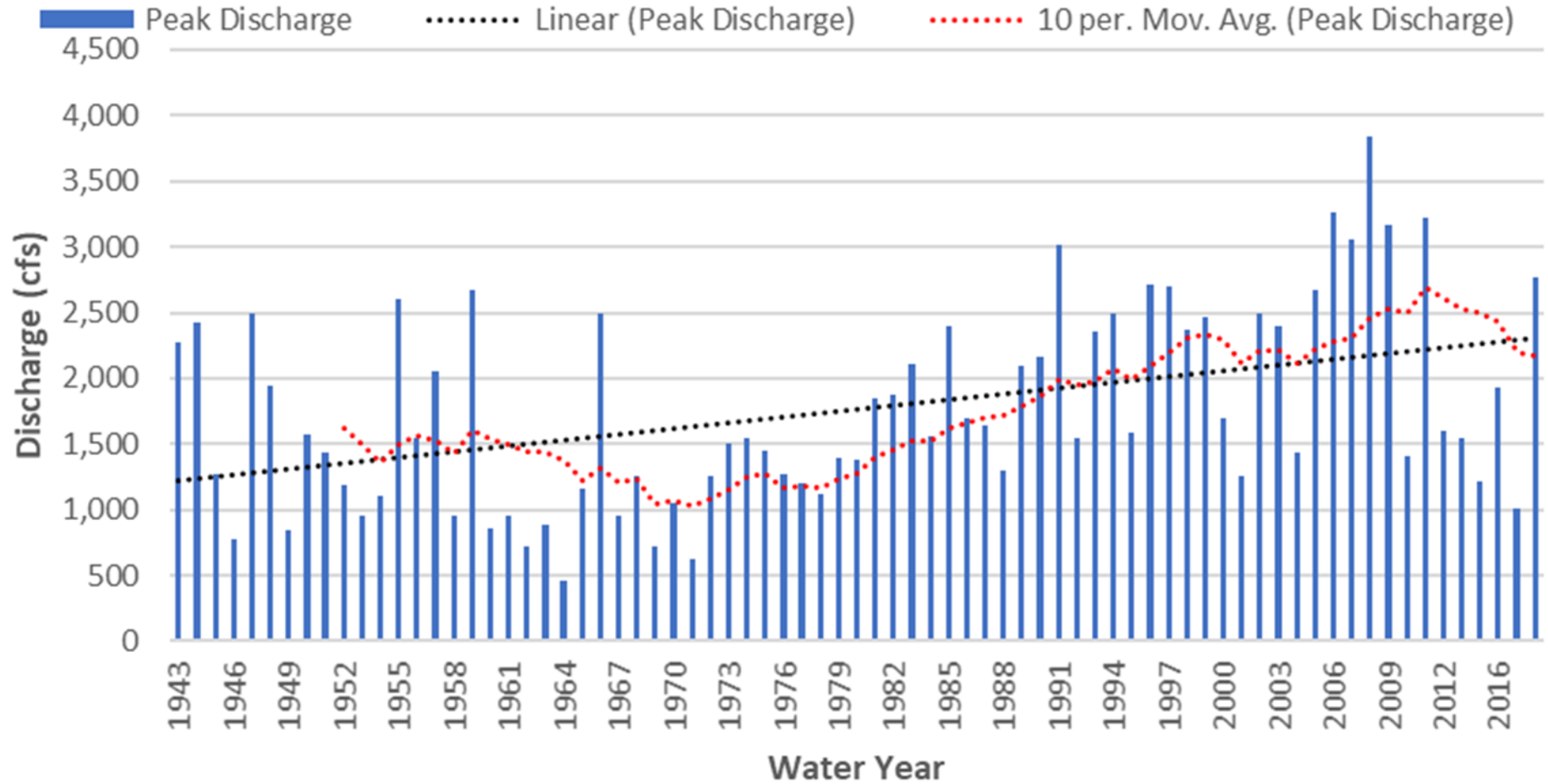
# More Extreme Precipitation

Observed Changes (%) in the Intensity of the 1% Heaviest Precipitation Days  
(1951-1980 vs. 1981-2010)

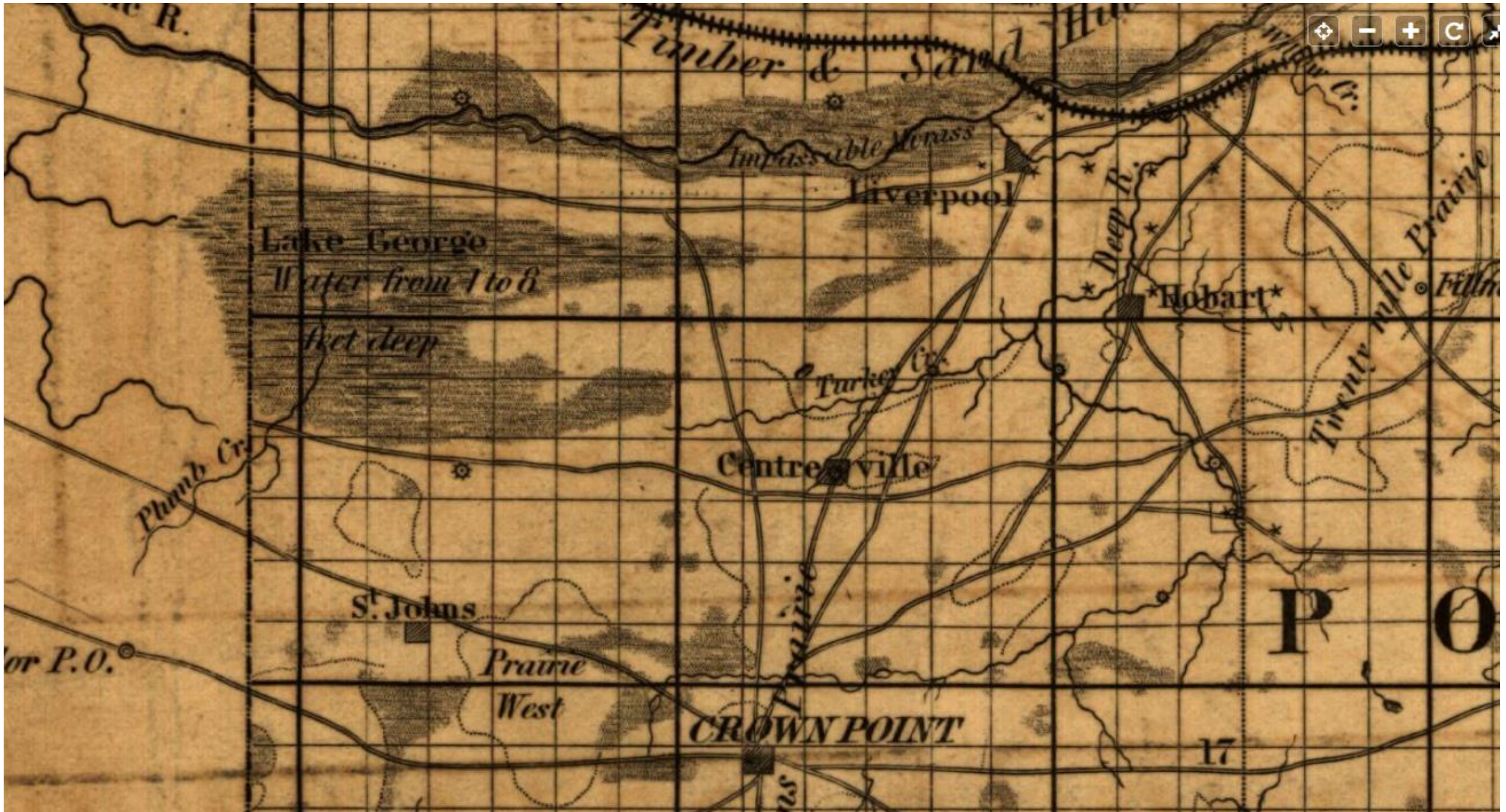


Data: GHCND (NOAA)

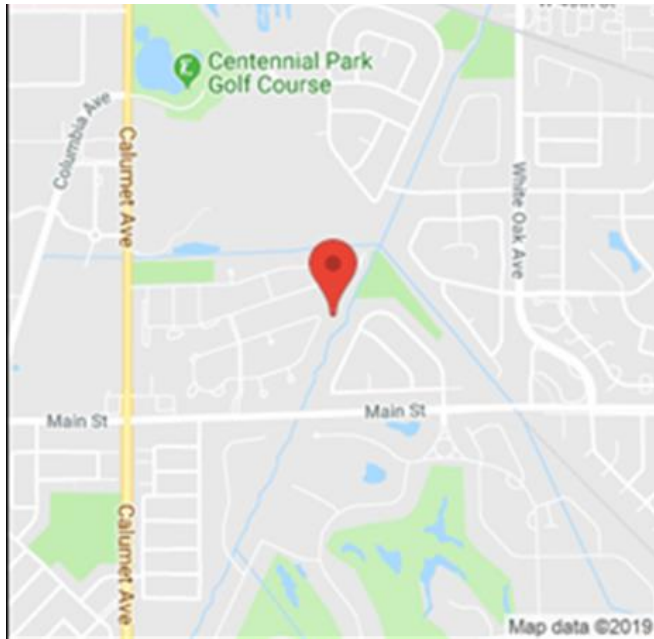
# Annual Peak Discharge Trends



Hart Ditch at Munster, Indiana, USGS Gage 05536190



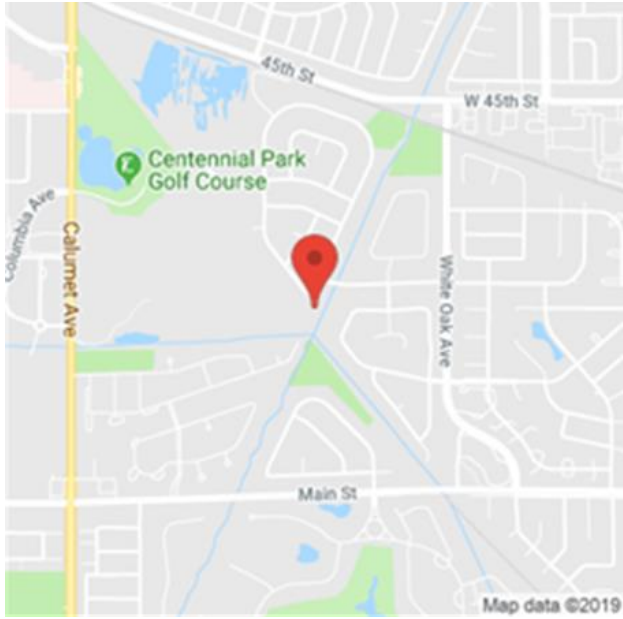
Kings Map of Indiana, 1852



Slope failure on RB. Note bkf bench forming at base of slope. Slope is primarily sand. Toe of slope is a more resistant clay.

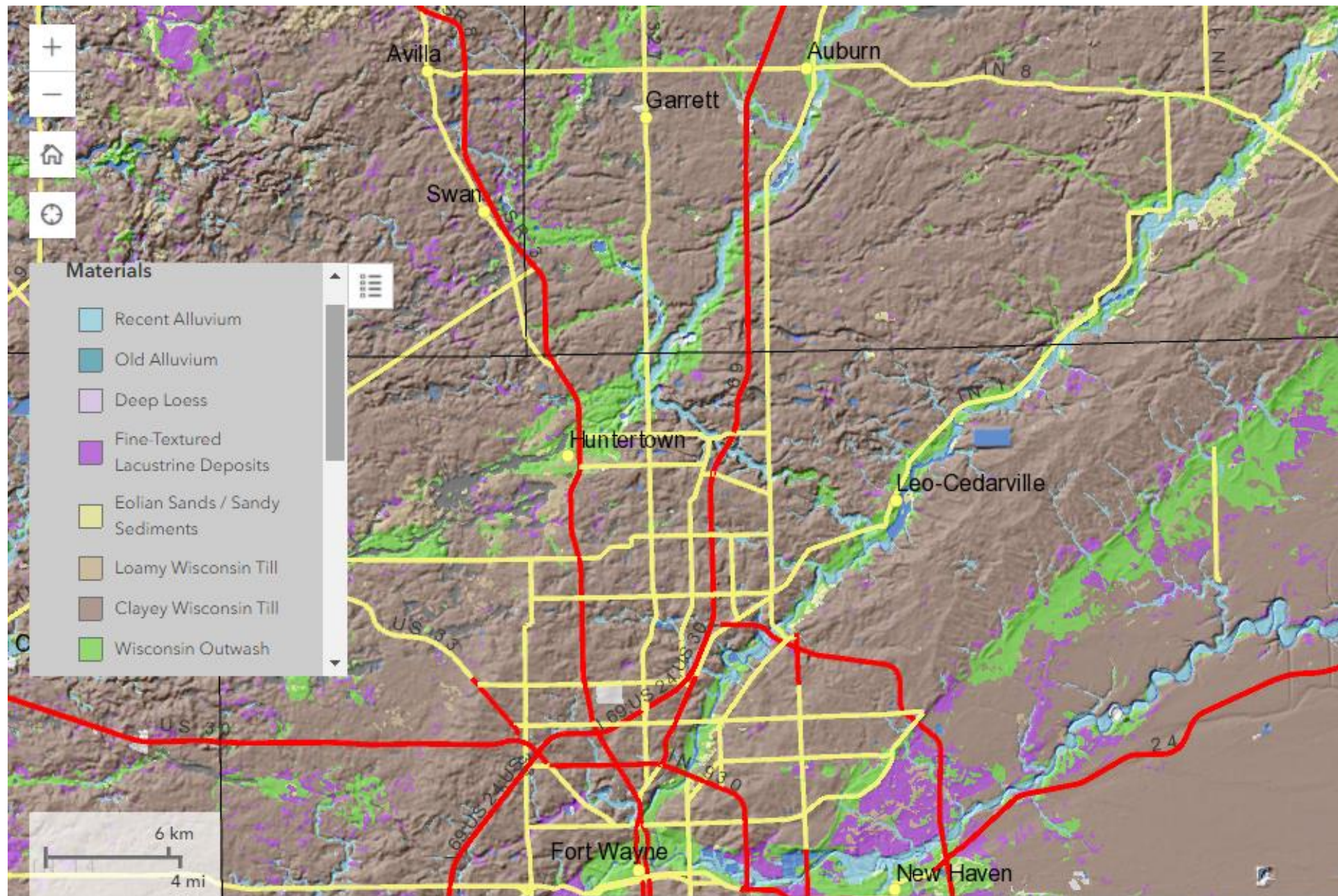






LB is migrating towards homes. Scour line approximating bkf stage is seen on LB. Extensive vegetation is stabilizing upper bank in some reaches.





Soil Explorer (<https://soilexplorer.net/>)



St Joseph River (Maumee) above Cedarville, IN



St Joseph River (Maumee) above Cedarville, IN



Lake Superior near Two Harbors, MN

# Acknowledgements:

- Bill Annable, University of Waterloo
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- The Nature Conservancy, Indiana and Michigan
- Maumee River Basin Commission, Indiana