
Atypical Types of Flooding in the Upper Peninsula

Linda Hansen PE

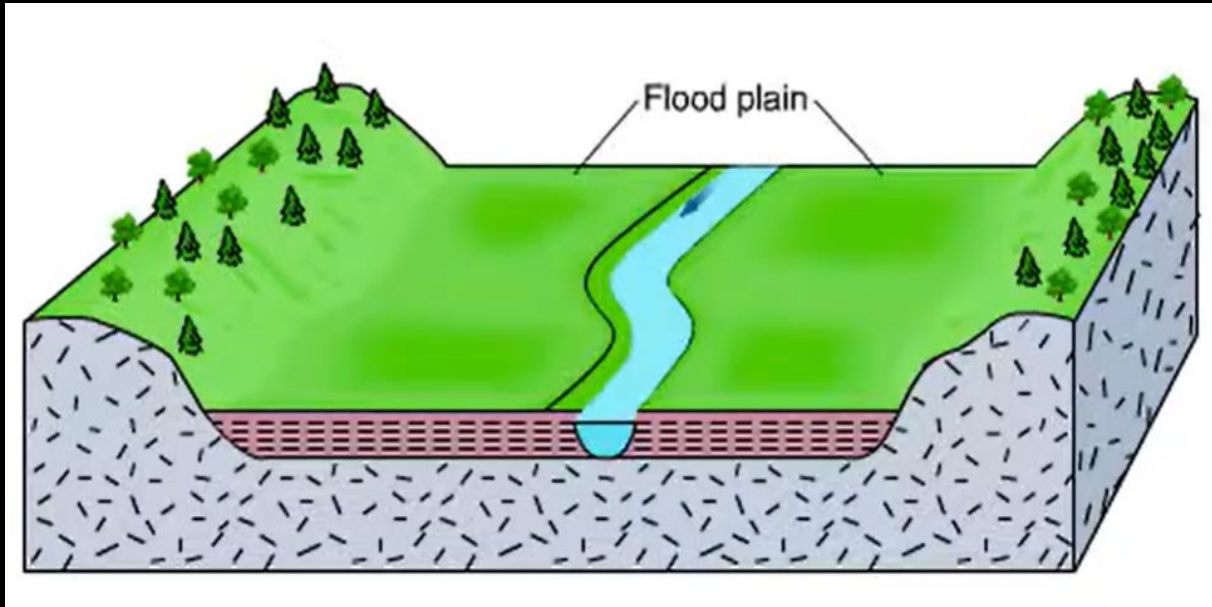
Floodplain Engineer

MI EGLE WRD – Transportation
Review Unit



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We are all familiar with a flood like this:



A Typical "Fluvial" Flood

Resulting in something like this:



Photo Credit: Phil Strong, Gogebic CRC

But what if the flood happens in a
different way?



Case in Point: The Upper Peninsula

- Flooding happens in a lot of ways that are not 'traditional'
- **Diverse landscape** = diverse flooding 'modes'
- Flood damage is flood damage
- Cannot be managed traditionally



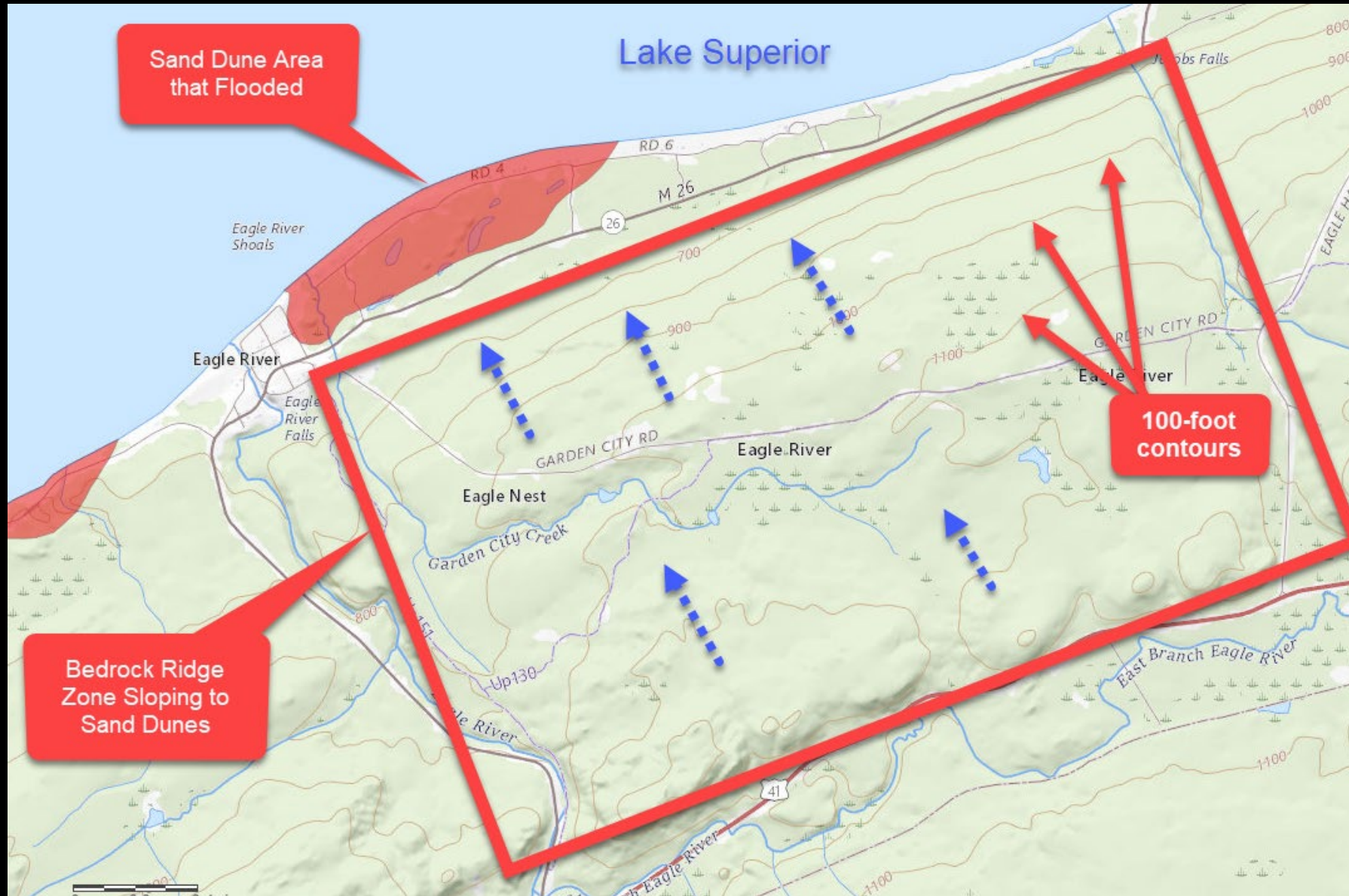
Geologic Relief Map of Upper Peninsula

“Flash Snowmelt” on Steep Bedrock (Eagle River, Keweenaw Co.)



Photo credit: coppercountrytrail.org

Physical Setting



Weather and Snowpack Set-up

- Typical high snow fall winter for the Keweenaw
- Unknown depths or snow-water equivalent (but a lot none the less)
- 70+ degree day at end of April
- Zero infiltration on very steep slopes above coastal dunes
- Dune sands are highly permeable, but still frozen (so not permeable)

= **Flooding in the Dunes**



Skier at Mount Bohemia in the Keweenaw

Flooding in the *dunes*?



Photos taken May 1, 2013

Flooding in the *dunes*?



Photos taken May 1, 2013

The (unfortunate) result... Excavation in Critical Dune Areas



Coastal River Mouth Sediment Blockage

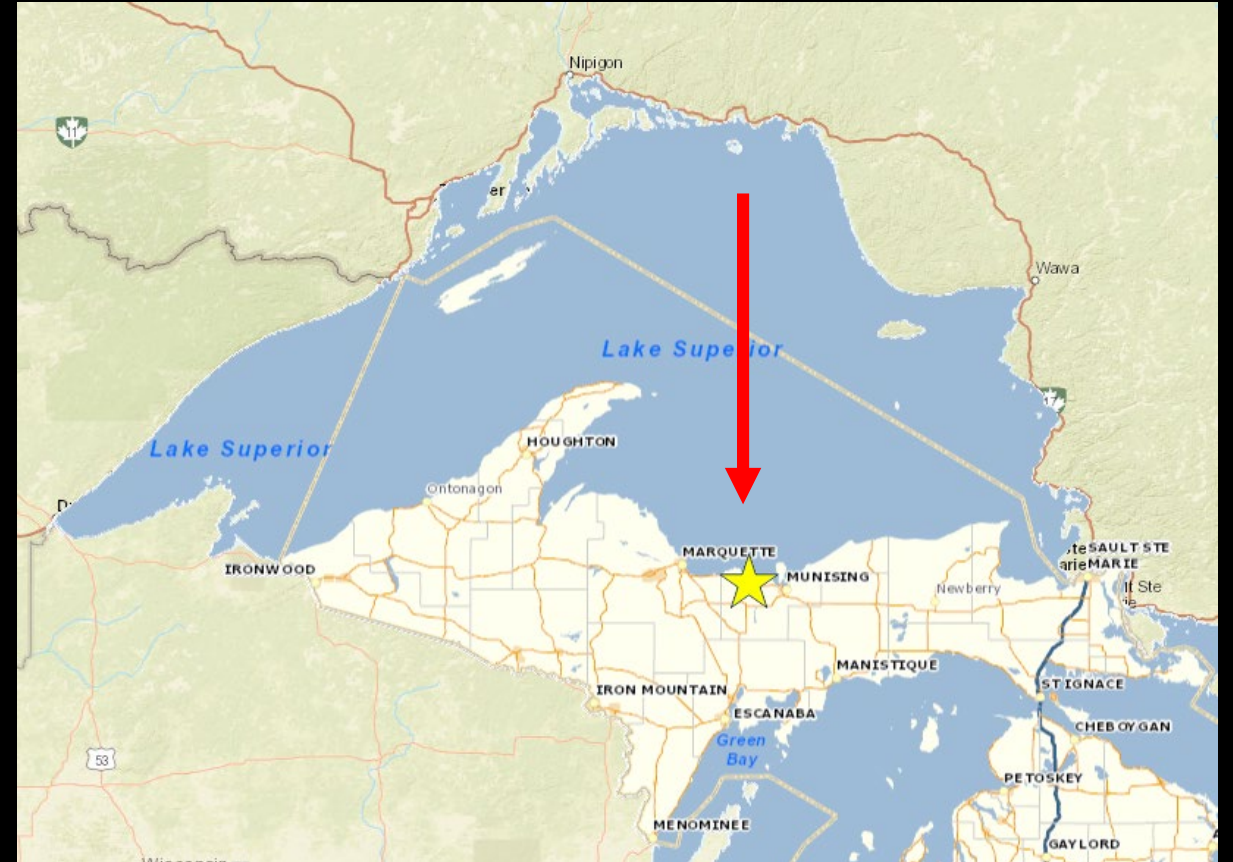
(Au Train Township, Alger
Co.)



Coastal River Mouth Sediment Blockage

(Au Train Township, Alger Co.)

- Caused by coastal sediment transport
- Large, North-facing bay on South shore of Lake Superior
- Central on lakeshore, open to long lake fetch
- Intense late fall storms with high **north winds** cause most blockages
- Subject of 2016 Coastal Storm Risk Study by NOAA and Michigan Tech



Au Train Bay is a "Pocket Beach"



Longshore drift visible

River mouth moving to east

Water backs up into town

Image USDA/FPAC/GEO

Coastal River Mouth Sediment Blockage (Au Train Township, Alger Co.)



The upstream impacts...



Coastal River Mouth Ice Blockage

(Au Train Township, Alger
Co.)



Coastal River Mouth Ice Blockage

(Au Train Township, Alger Co.)

- NOT traditional “Ice Jams” – Ice is blown in from off the lake and clogs river mouth
- Due to same north-facing condition receiving high wind and wave action, particularly in winter/spring
- Per 2016 NOAA/MTU report, sediment conditions exacerbate ice jam effect
- Cannot be modeled like a “traditional” ice jam



Crews work to restore water flow on Au Train River

River

Christmas Day, 2022

Residents still experiencing flooding in their homes and yards



ALGER COUNTY



AU TRAIN RIVER FLOODS AFTER ICE FORMS DAM

AU TRAIN TOWNSHIP



5:59 | 16°

Coastal River Mouth Ice Blockage

(Au Train Township, Alger Co.)



Photo credits: UpperMichiganSource.com

The only remedy... High costs for small towns

(almost every year)



Photo credit: UpperMichiganSource.com

Coastal River Mouth Ice Shove

(Schoolcraft Township,
Keweenaw Co.)



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The Great “Ice Tsunami” of 2014

Occurred *April 30th, 2014*



Photo credits: Paul Kitti



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Adjacency to Floodplains in Highly Permeable Soils

(City of Mackinac Island,
Mackinac Co.)



Photo credit: Cloghaun.com

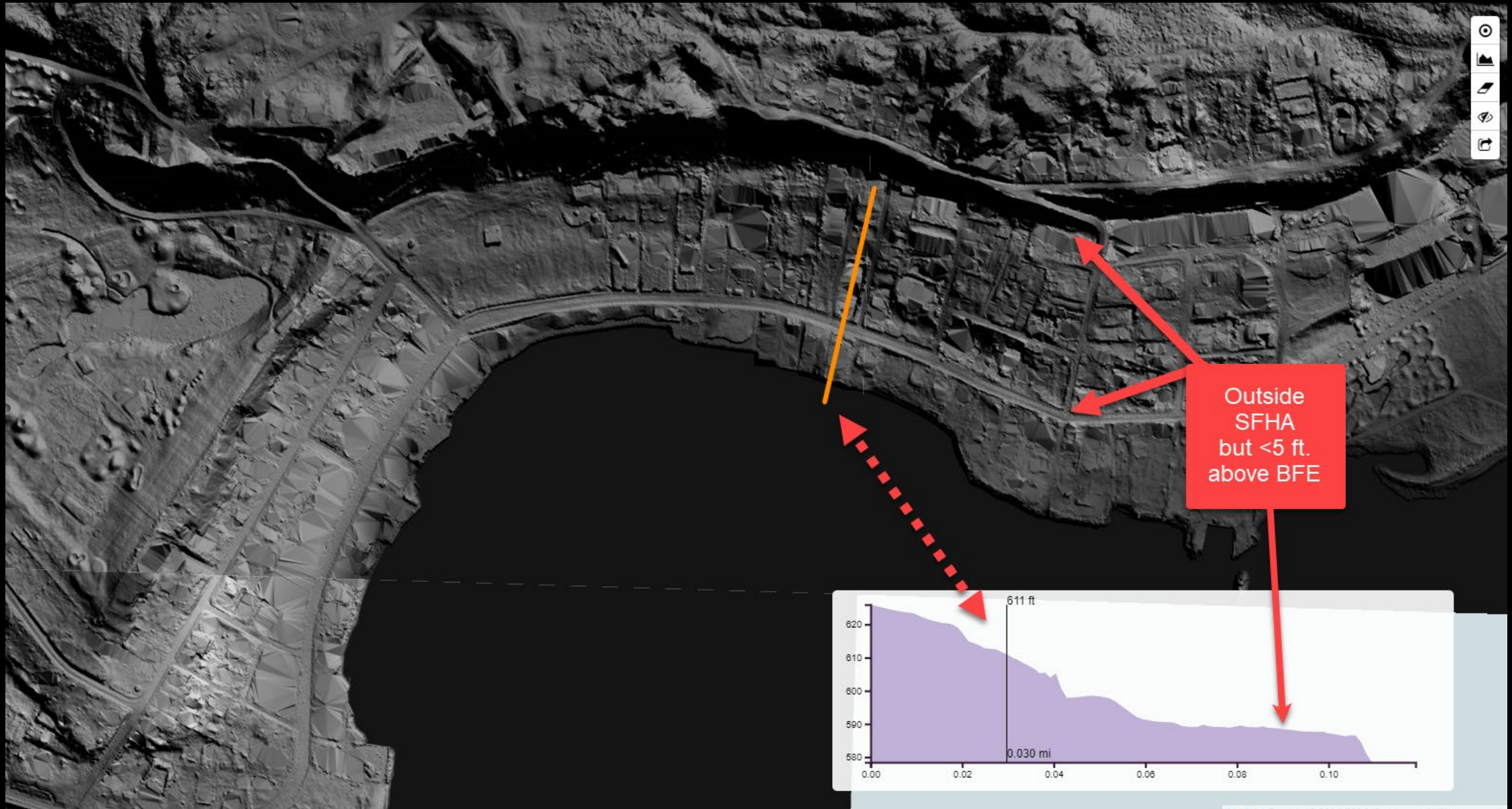


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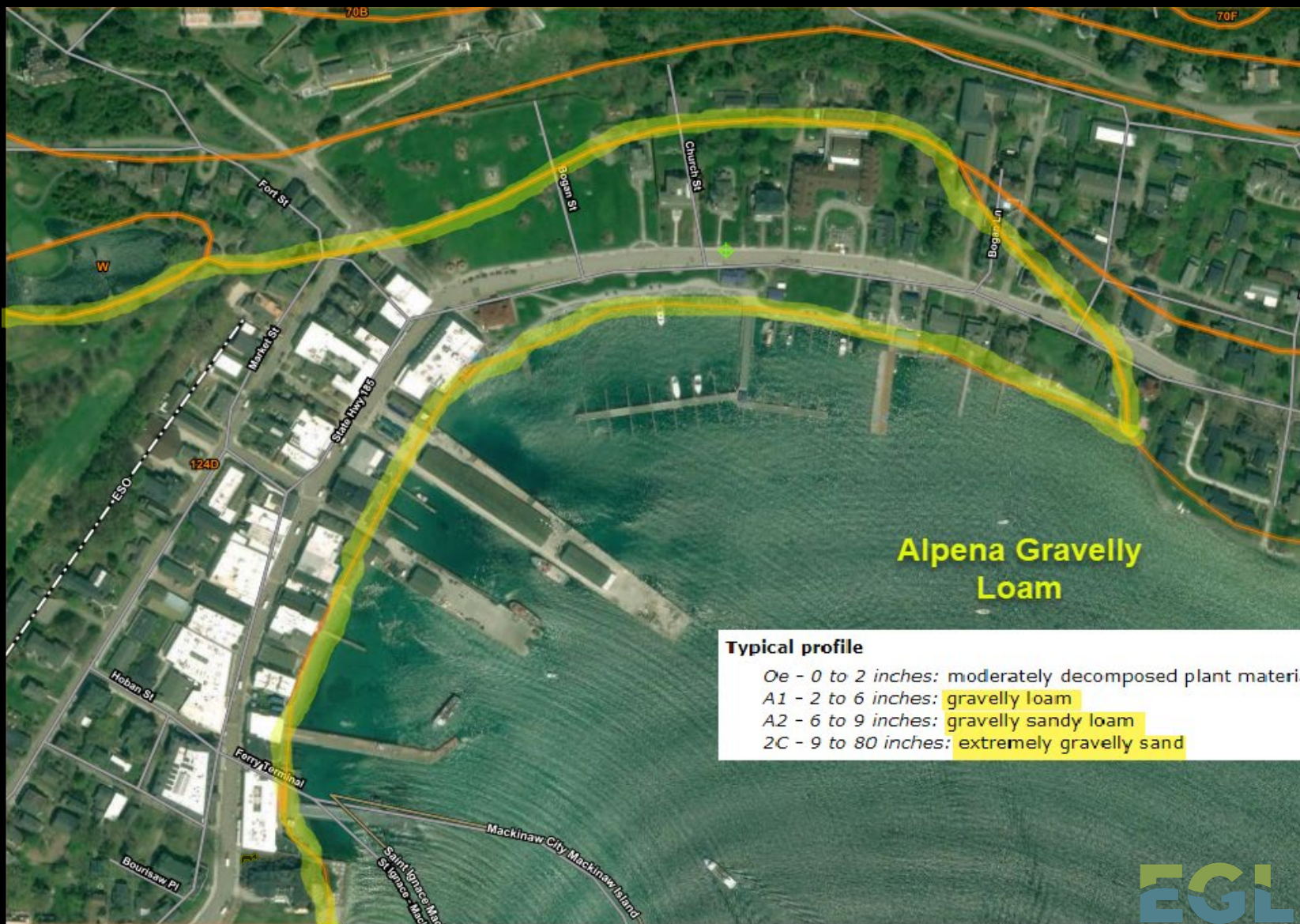
Physical Setting



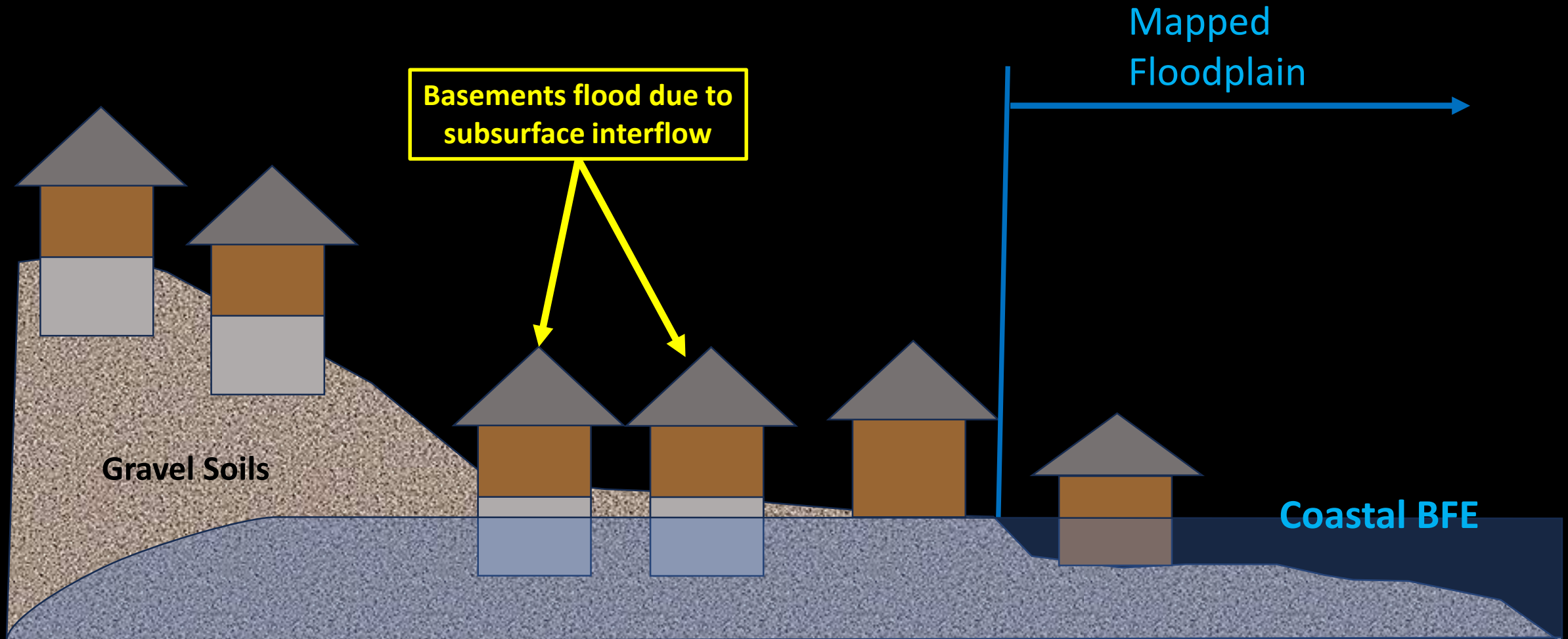
Physical Setting



Physical Setting



Adjacency to Floodplains in Highly Permeable Soils (City of Mackinac Island, Mackinac Co.)



Adjacency to Floodplains in Highly Permeable Soils (City of Mackinac Island, Mackinac Co.)

- High Water years on Lake Huron impacted the coastlines of Mackinac Island
- Road damage occurred – but also flooding of old and historic buildings inland of FEMA Flood Zone
- Those with flooded basements (*due to subsurface flow only*) reportedly had difficulties with FEMA insurance claims



Flooding from Beaver Activity

(Everywhere in the U.P.)



Flooding from Beaver Activity

- Per study by Miller from **1983** – beavers caused **\$75 to \$100 million** in losses annually to roads, dwellings, property, crops & timber in the U.S.
- In **today's** dollars: **\$240 to \$320 million / yr**
- One night of activity – clogging a culvert – can flood a homes, wash out roads.
- Debris clearing and trapping is common but hard to keep up with and costly in rural areas; Harder to find trappers.



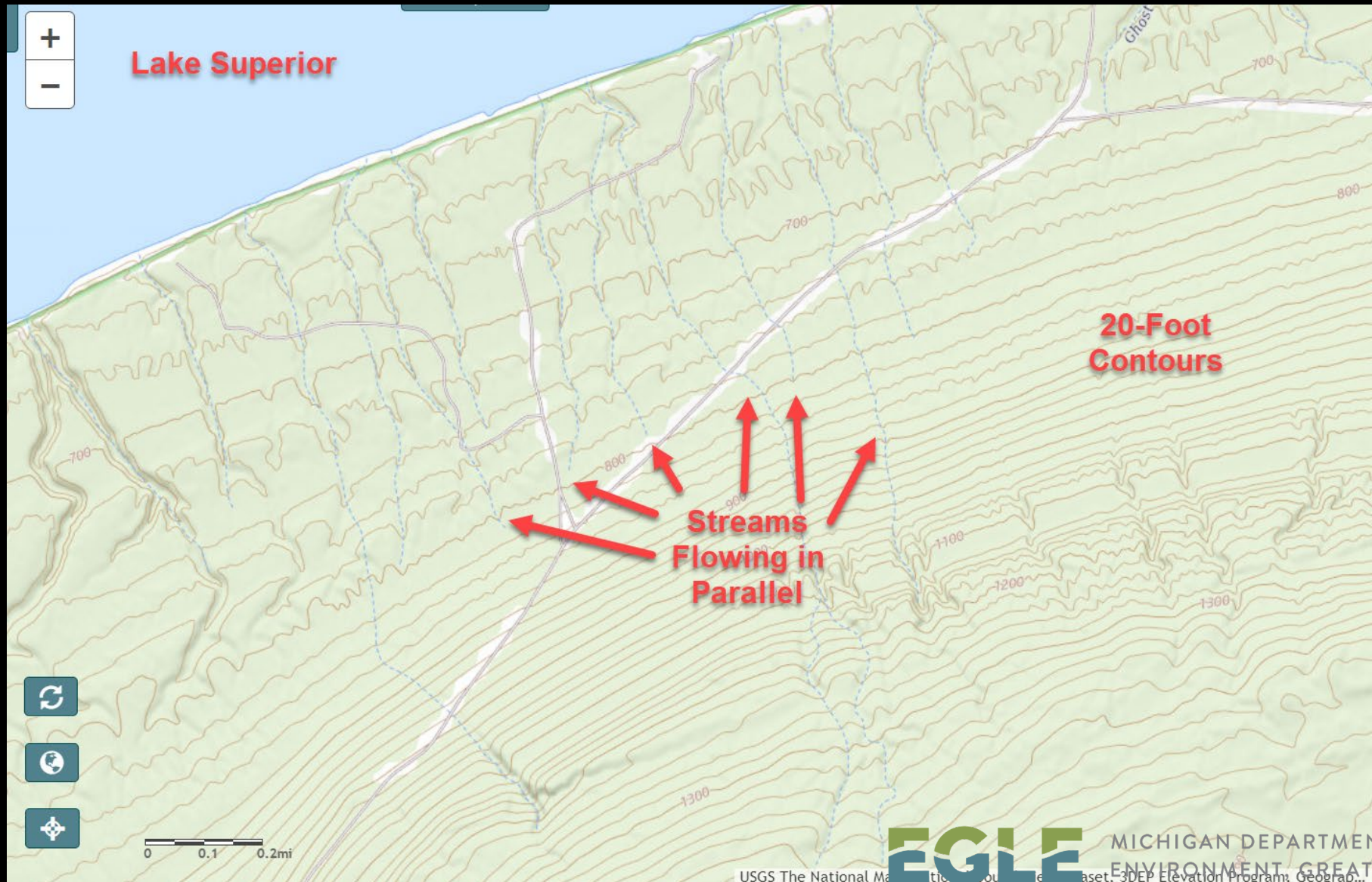
Indirect Impacts – “Fluvial Hazard Zone”

Severe Stream Channel Down- Cutting

(Ironwood Township,
Gogebic Co.)



“Saxon Harbor Flood” of 2016 – Physical Setting



Physical Setting - Soils

- Unconsolidated to consolidated clay loams with gravel, cobbles and boulders
- Prone to head cuts



“Saxon Harbor Flood” of 2016 – Severe Downcutting



“Two-track”
road surface

Approximate location of
former culvert and
stream bed

Stream
flow now

Severe Downcutting

- Extremely deep down-cuts occurred
- Surface flooding was pluvial in nature in many locations – not from streams overflowing
- Costs of restoration disproportional for type of “loss”
- Areas affected mostly non-residential



And then sometimes... just plain fluvial and coastal flooding...

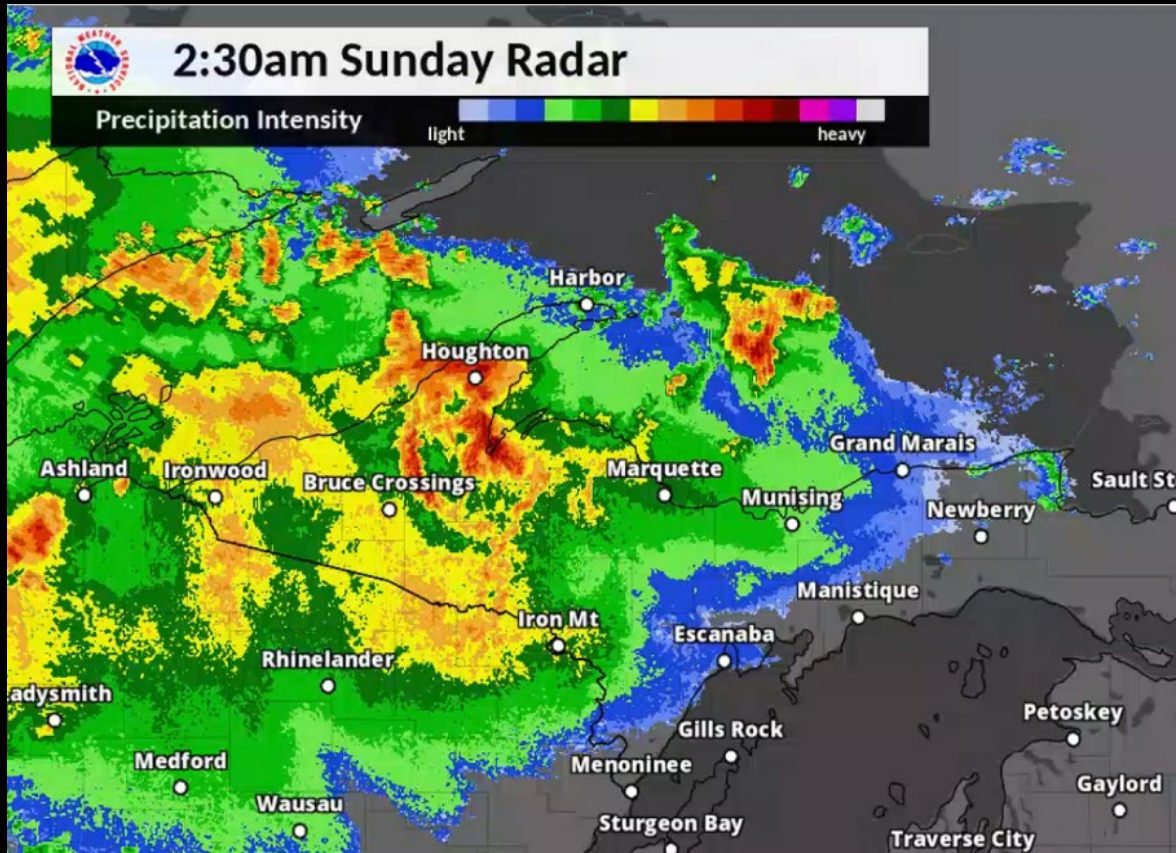


City of Wakefield, 2002
Little Black River / Sunday Lake



Menominee County, 2019; Lake Michigan

And even some **pluvial** floods:



Houghton Father's Day Flood, June 2018



Agate Street, Houghton at End of Flood

What can we learn from this?

- In the U.P. (and elsewhere) – atypical modes of flooding and flood damage can occur as frequently as “typical” scenarios.
- Current methods of flood hazard identification, quantification and management are not necessarily effective for all types of flooding and flood-related damage.
- If the goal is overall hazard and loss avoidance, there is room for growth in flood management strategies.



Questions?

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<https://www.michigan.gov/egle/about/organization/water-resources/floodplain-management>



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