RiskMAP
Increasing Resilience Together

Delta County, MI
Flood Risk Review Meeting

September 21, 2017

FEMA

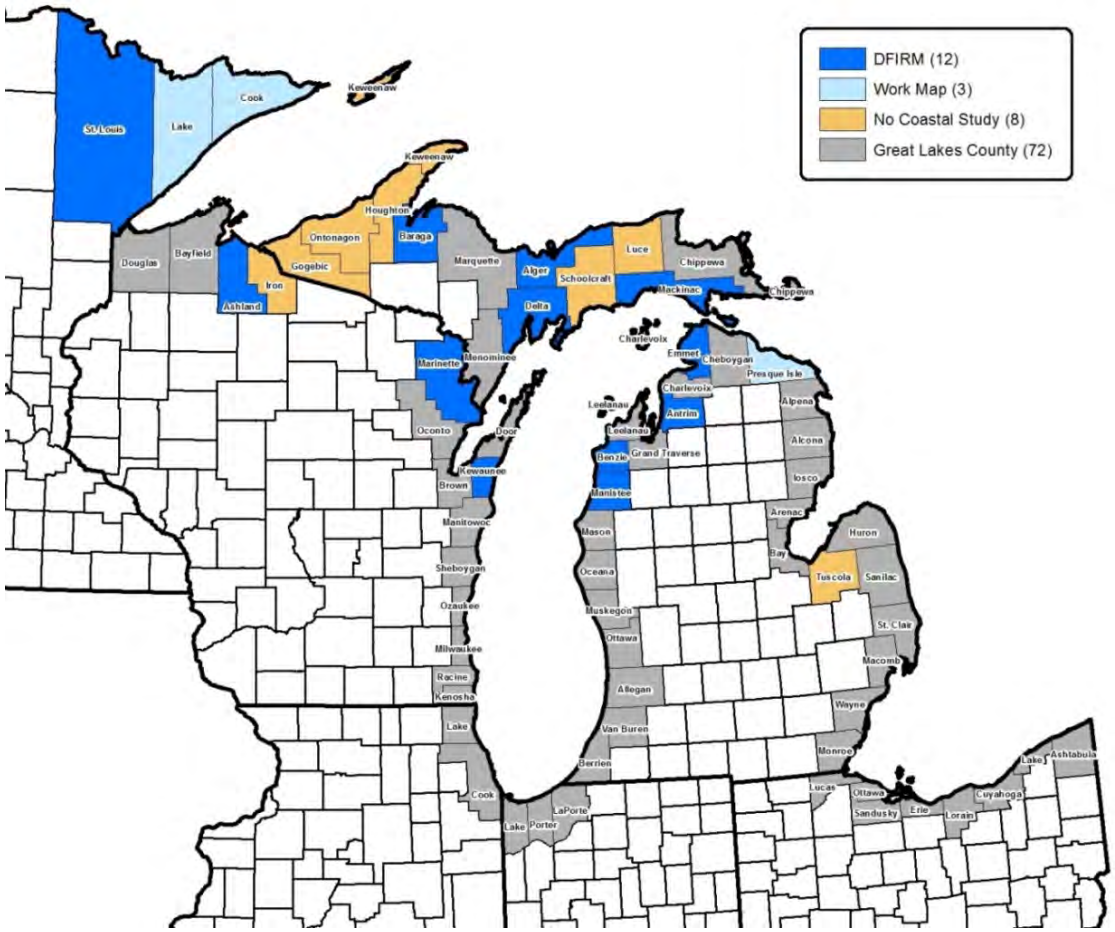
Agenda

- Introductions
- Coastal Flood Risk Study and Mapping Program
- Inland Scope and Methodology
- Current Status
- Technical Overview of Study and Mapping
- Floodplain Management
- Next Steps
- Q&A
- Workmap Review

Delta County, MI

COASTAL FLOOD RISK STUDY AND MAPPING PROGRAM

Program Goals and Status



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Great Lakes Coastal Flood Study
greatlakescoast.org

Program Goals and Status

Counties for Inland Rivers * and Lakes

Michigan U.P.

1. Alger (79 /0) **
2. Baraga (23 /4.5) **
3. Delta (162 /12.5) **
4. Mackinac (260 /0) **

Michigan L.P. Counties

5. Manistee (46 /8.3) **
6. Benzie (32 /0) **
7. Antrim (16 /34) **
8. Emmet (6 /0) **

Minnesota

9. St. Louis (1,905 /59)

Wisconsin

10. Ashland (119 /40.5) **
11. Kewaunee (53 /47)
12. Marinette (783 /101) **

* (Approx miles / AE miles) per CNMS stream threads on existing FIRMs

** fy14 LiDAR counties

Great Lakes Flood Study

- Comprehensive study of the Coastal Great Lakes flood hazards
- Latest technology, data, and models – including response based modelling concepts

Partners involved:

FEMA

US Army Corps of Engineers ®
Detroit District

ERDC

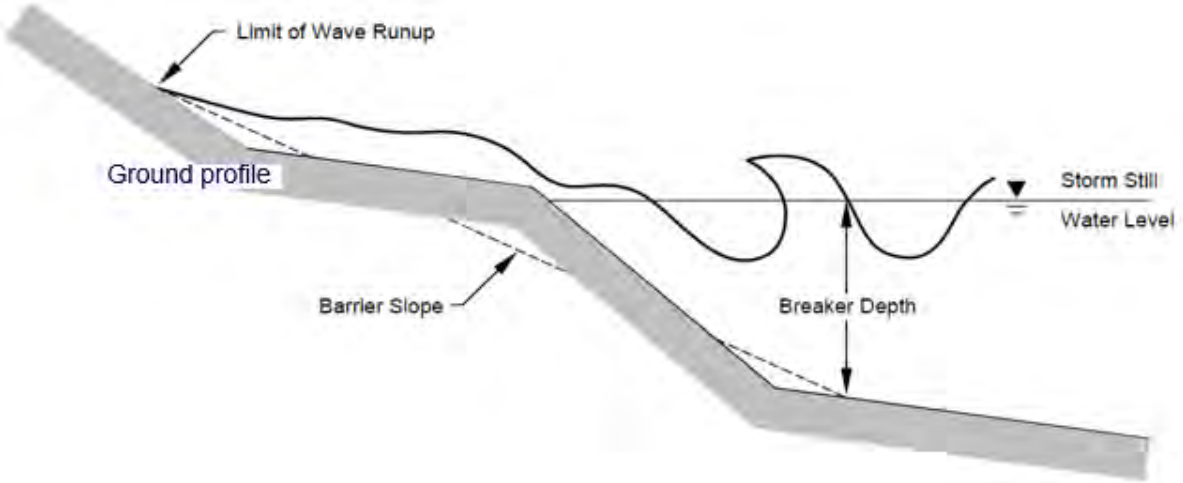
ASFPM

RAMPP

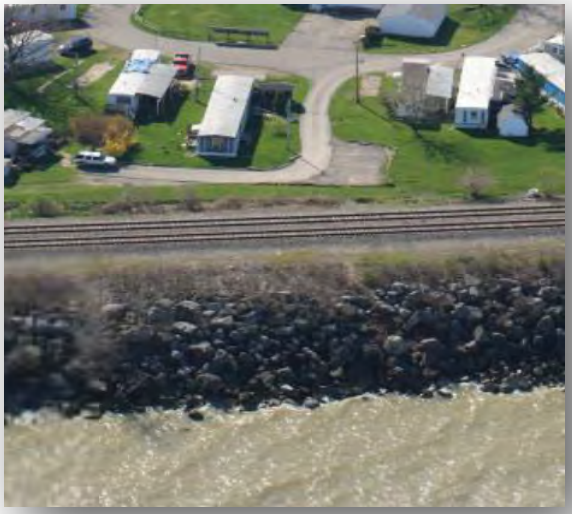
STARR
Strategic Alliance for Risk Reduction

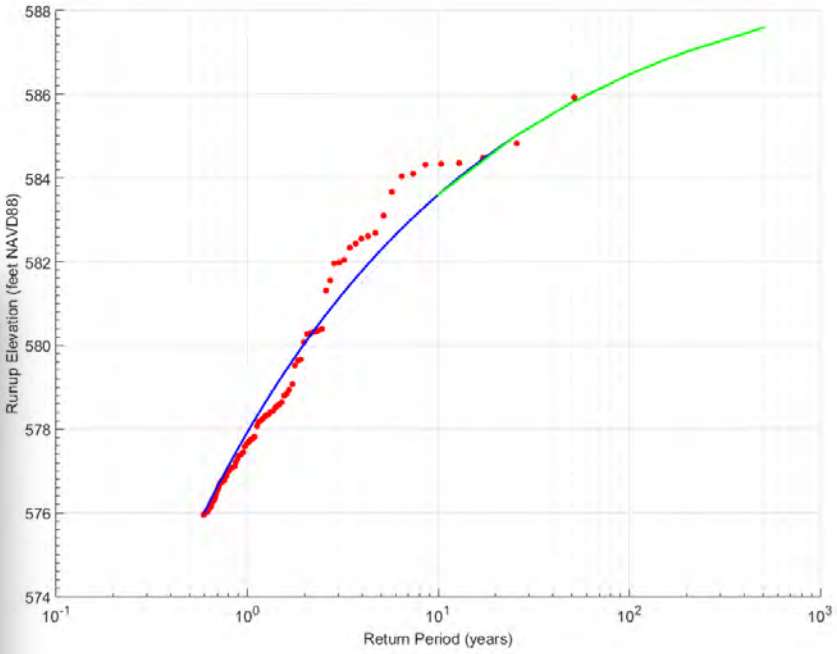
Response-Based Wave Runup

- Wave runup is the uprush of water from wave action on a beach, steep bluff or coastal structure.
- Calculated at each transect using appropriate hydrodynamic equations that simulate events for every time step captured for selected storms using lake-wide gridded record (ADCIRC-SWAN)
- Statistical analysis is performed on the maximum runup results at each transect to obtain the 1-percent-annual-chance runup elevation.



Response-Based Wave Runup





FEMA's Risk MAP Program

Risk Mapping, Assessment, and Planning …

- Will deliver quality data to increase public awareness and lead to action that reduces risk to life and property
- New non-regulatory products and datasets

Mapping Assessment Planning

Mitigation Actions: A Shared Responsibility

STRUCTURE AND INFRASTRUCTURE PROJECTS

- Acquisition
- Elevation
- Revetments and Seawalls
- Breakwater

LOCAL PLAN AND REGULATIONS

- Zoning
- Building Codes
- Open Space Plan
- Lake Front Development Master Plan

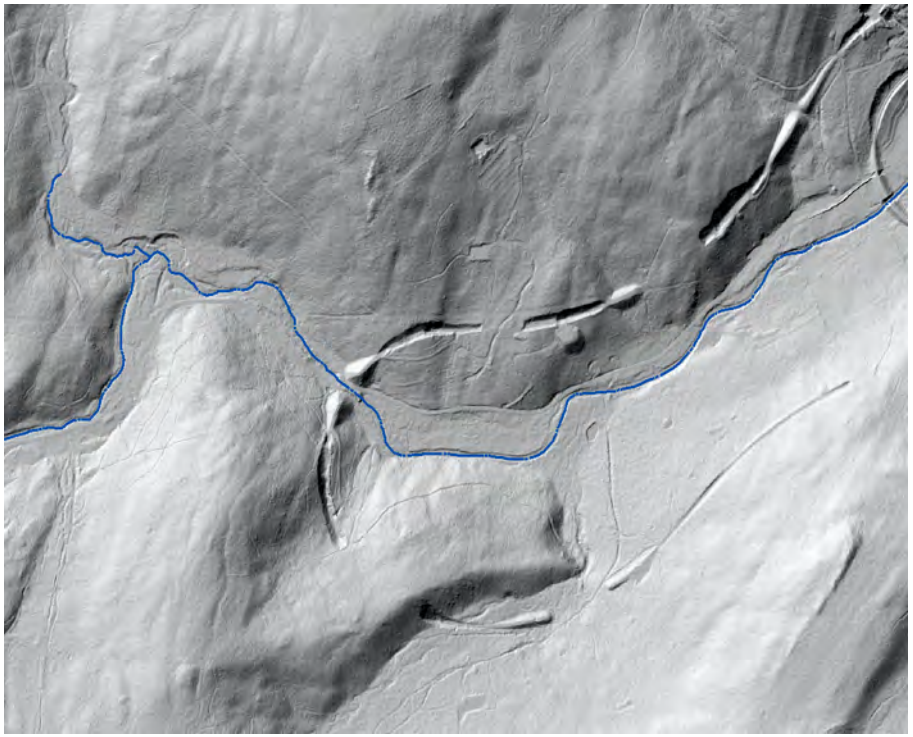
CITIZEN AND BUSINESS ENGAGEMENT

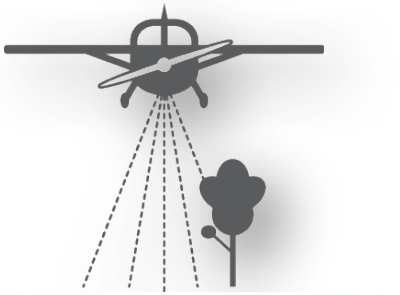
- Firewise
- StormReady
- NFIP and CRS

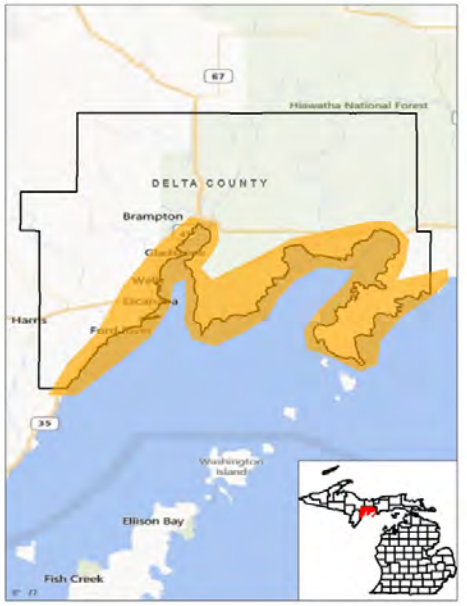
NATURAL SYSTEM PROTECTION

- Vegetation management
- Wetland restoration
- Erosion control

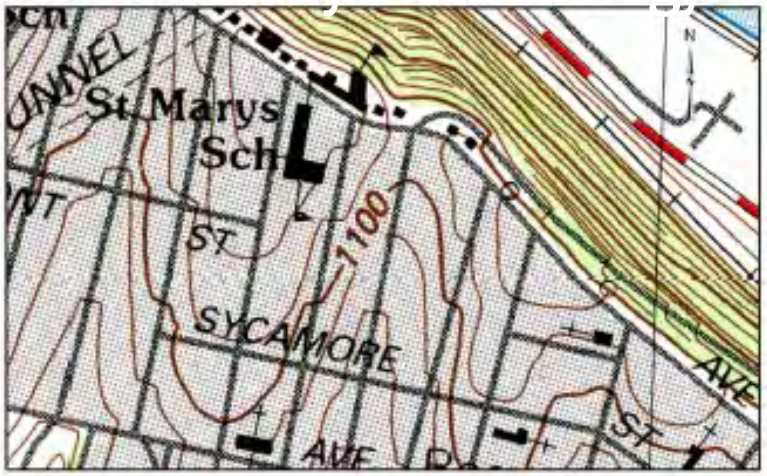
USACE LiDAR Elevation Data



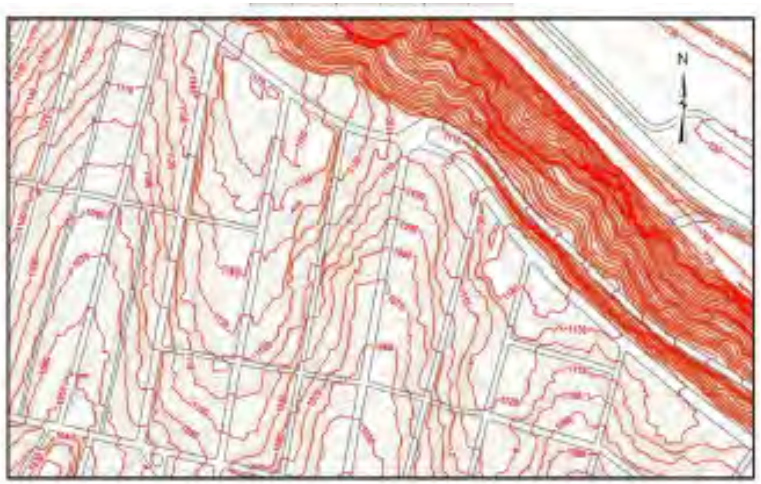




Topographic Data



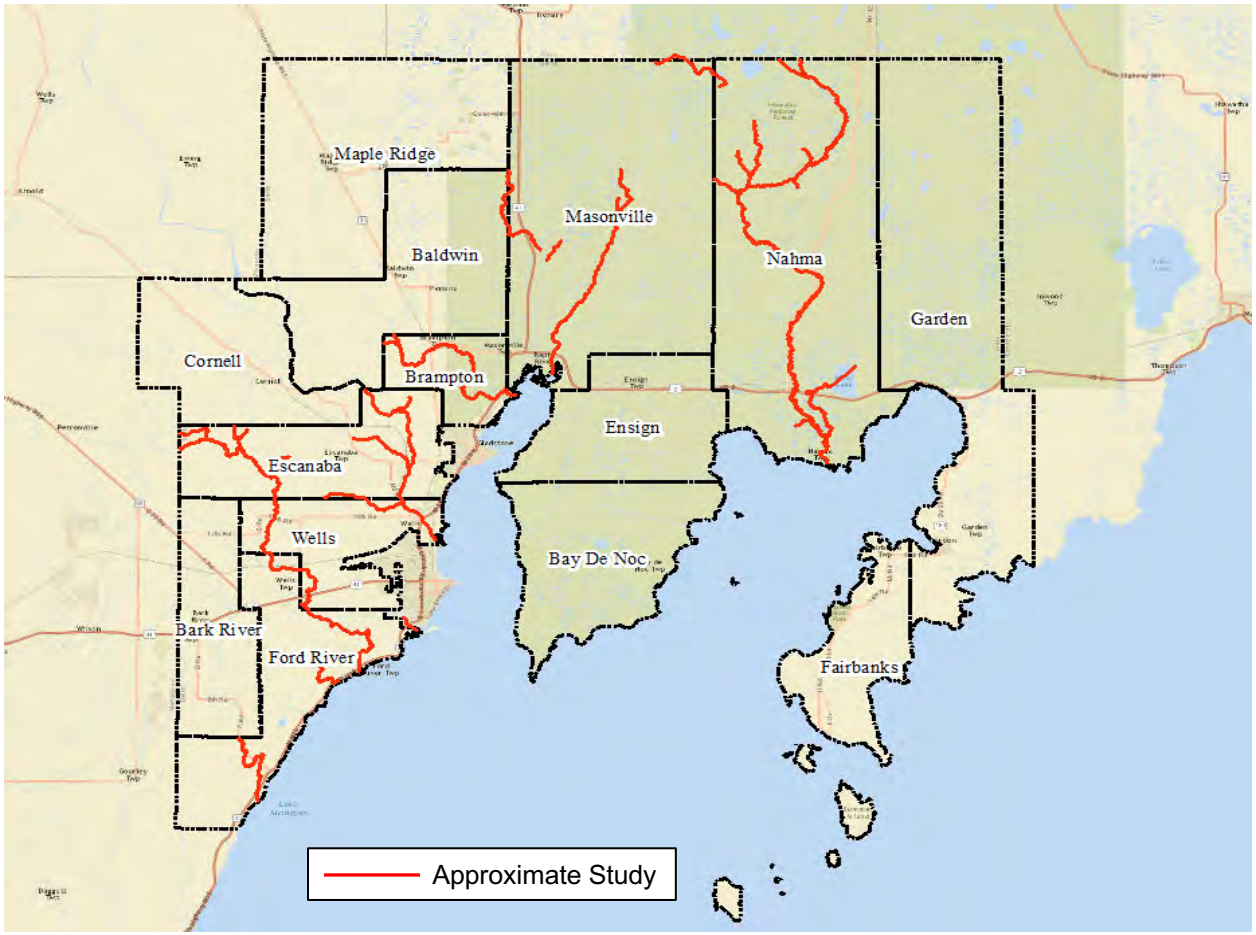
Effective maps used USGS Quadrangle (10’-20’ Contour Interval)



New Study uses USACE LiDAR (2’ Contour Accuracy)

Inland Flood Study

- Revised Approximate (Zone A) Study – 162 stream miles

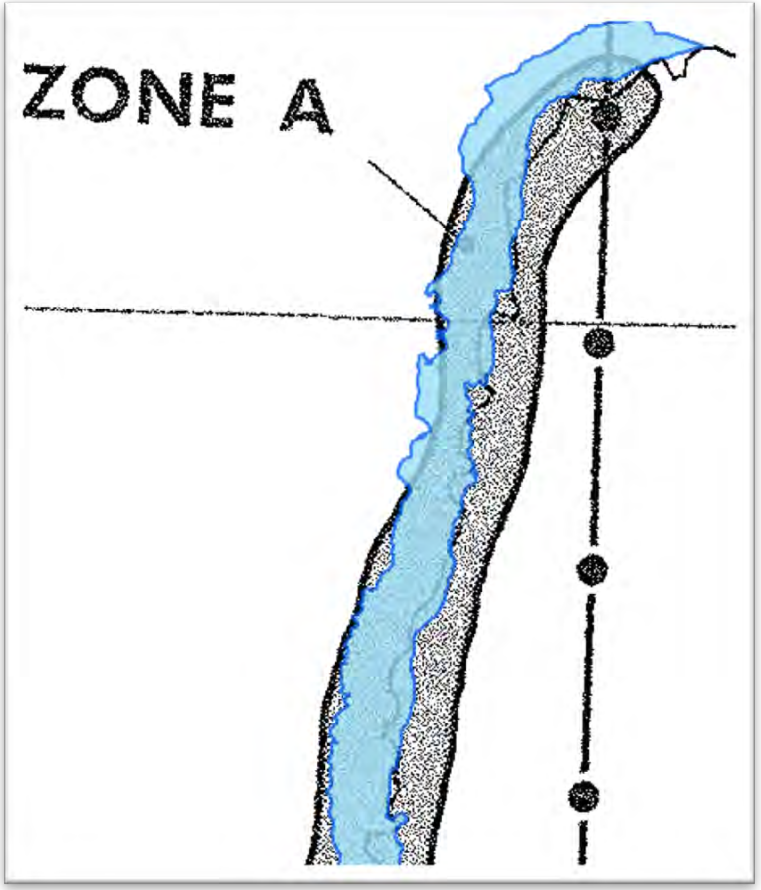


Inland Flood Study

- **Zone A:** based on approximate analysis
- Used in areas with low development or low development potential
- Old methods
  - Flood prone quads
  - Hydric soils
  - Average depth
  - Best guess???
- Modern methods
  - CADD-driven H&H

Inland Flood Study

- Revised Approximate (Zone A) Study
  - 162 stream miles
  - Hydrology: regression equations
  - Hydraulic model: HEC-RAS
  - No field survey performed
  - Hydraulic structures not modeled
  - Six events modeled: 10%, 4%, 2%, 1%,"1%-plus", and 0.2% annual-chance
  - Only 1%-annual-chance flood is mapped
  - Utilizes Digital Elevation Model derived from LiDAR collected for FEMA and the state in 2015



Delta County

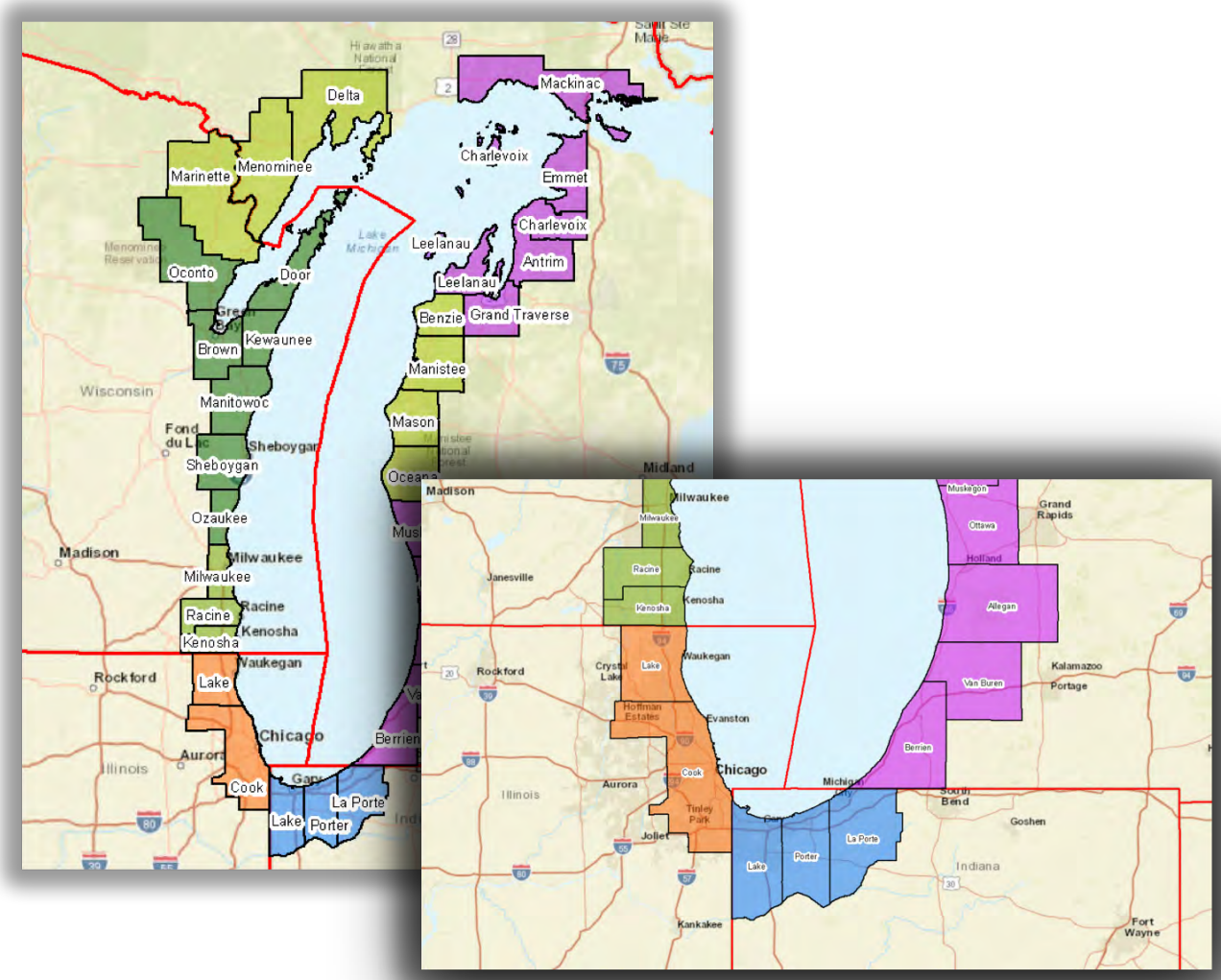
CURRENT STATUS REVIEW

Analyses/Mapping: Grouping

Orange and Blue: Phase 1

- Cook, IL
- Lake, IL
- Lake, IN
- Porter, IN
- La Porte, IN

- Remaining Counties on this map are being finalized and FRR meetings will be in August
- FRR Meetings fall at the end of a multi-year study including sophisticated modeling
- Next, the maps and data will be put into the official regulatory format



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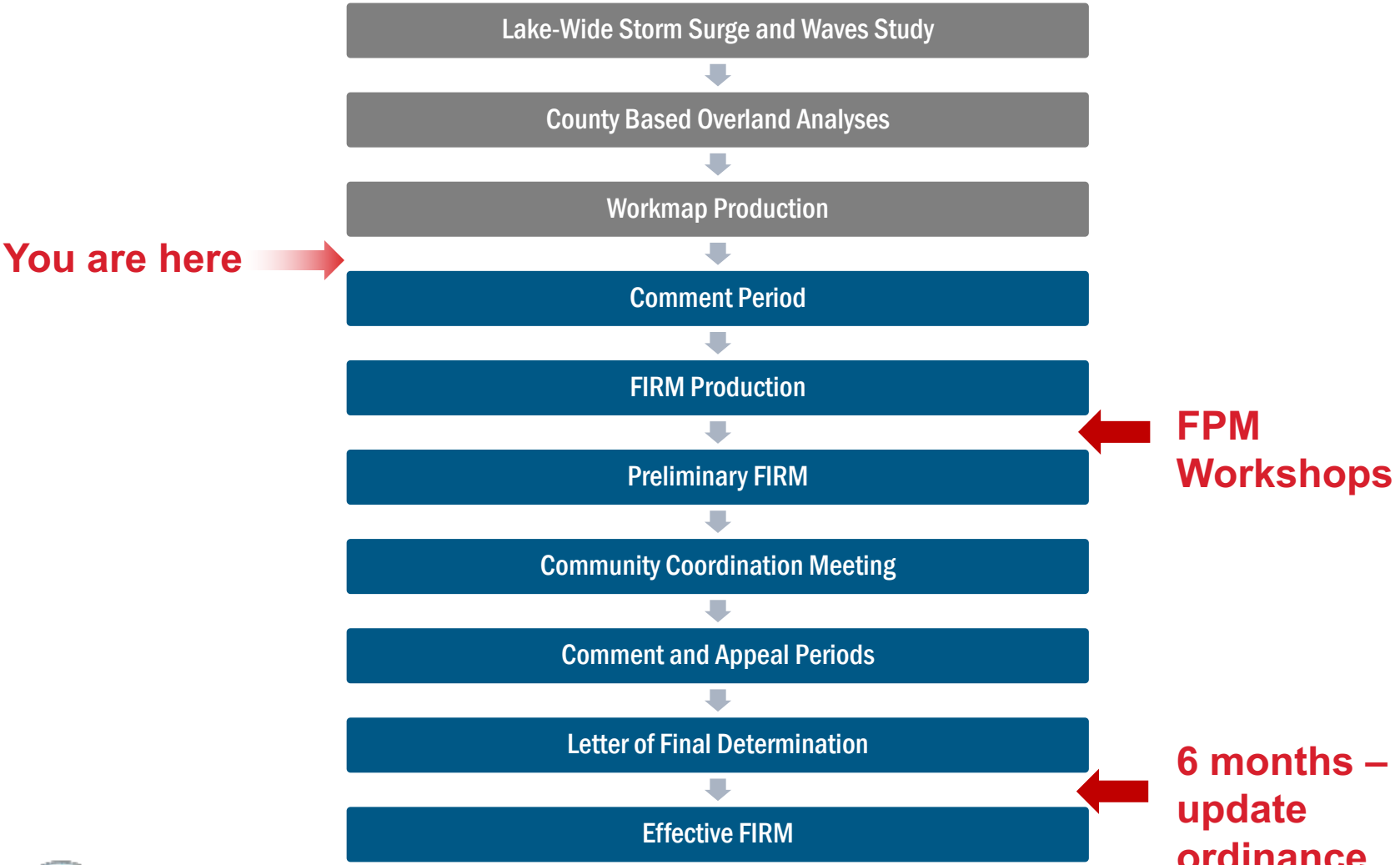
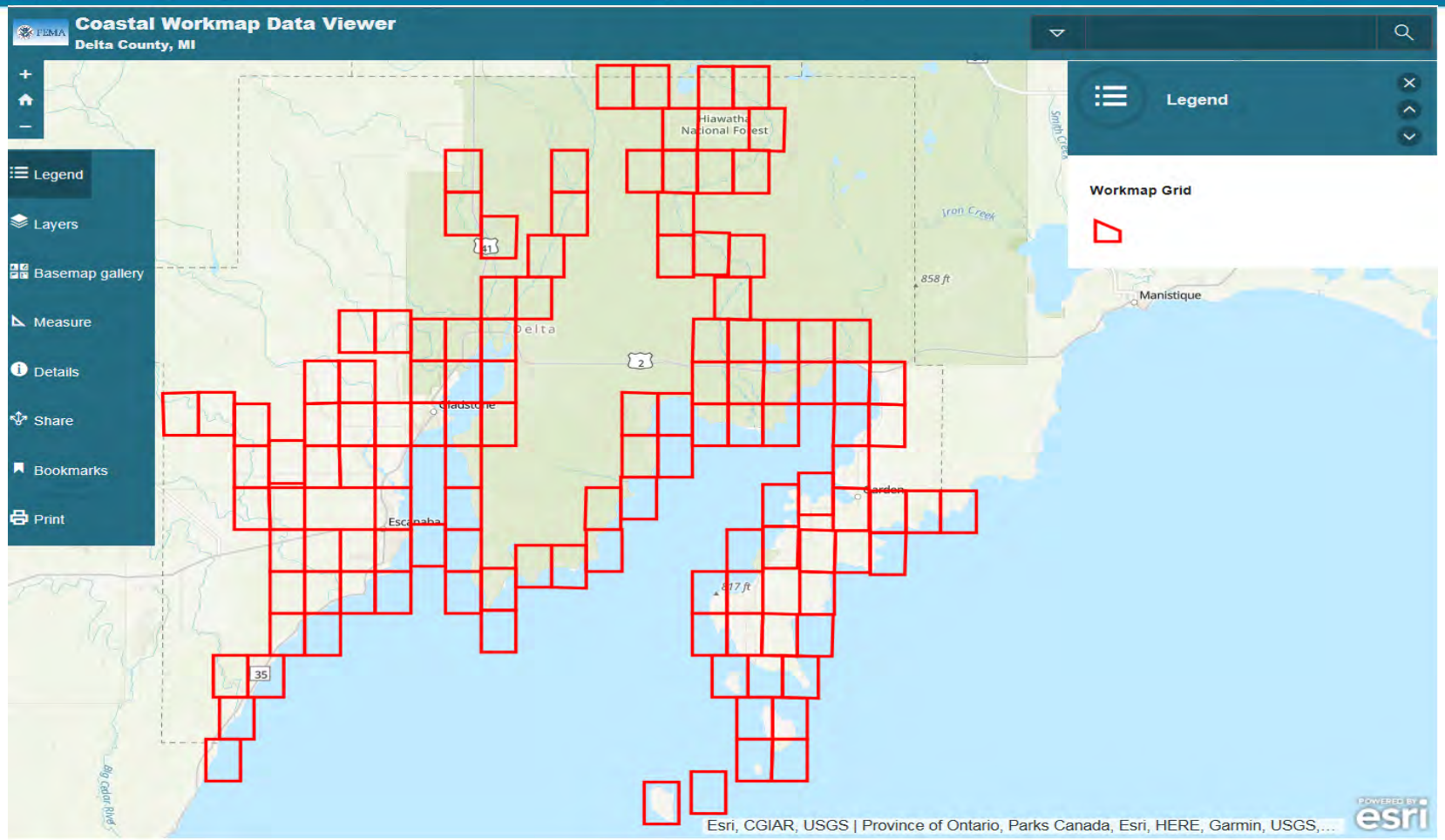
Current Study Status



Floodplain Management Workshops

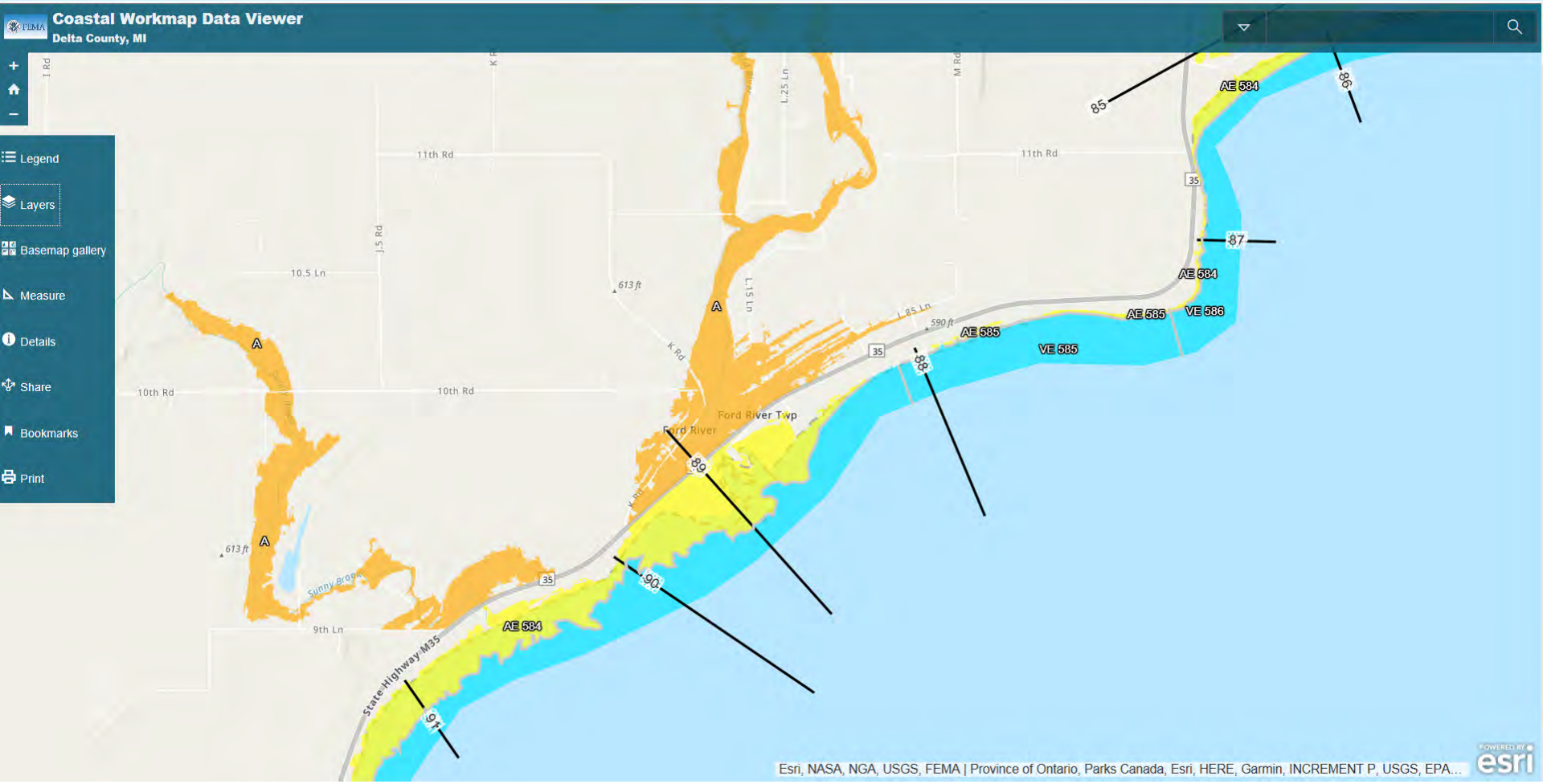
- Conducted by FEMA/DNR just before preliminary maps are released
- Workshop details:
  - Approximately 3 – 4 hours
  - Designed for floodplain administrator, zoning official, building inspectors, permit officials, etc.
  - Basics of Coastal Flooding
  - Using the Flood Insurance Study and FIRM for coastal studies
  - Floodplain Management Standards in Coastal High Hazard Areas (in depth)
  - NFIP Insurance in Coastal Zones

Work Map Data Viewer

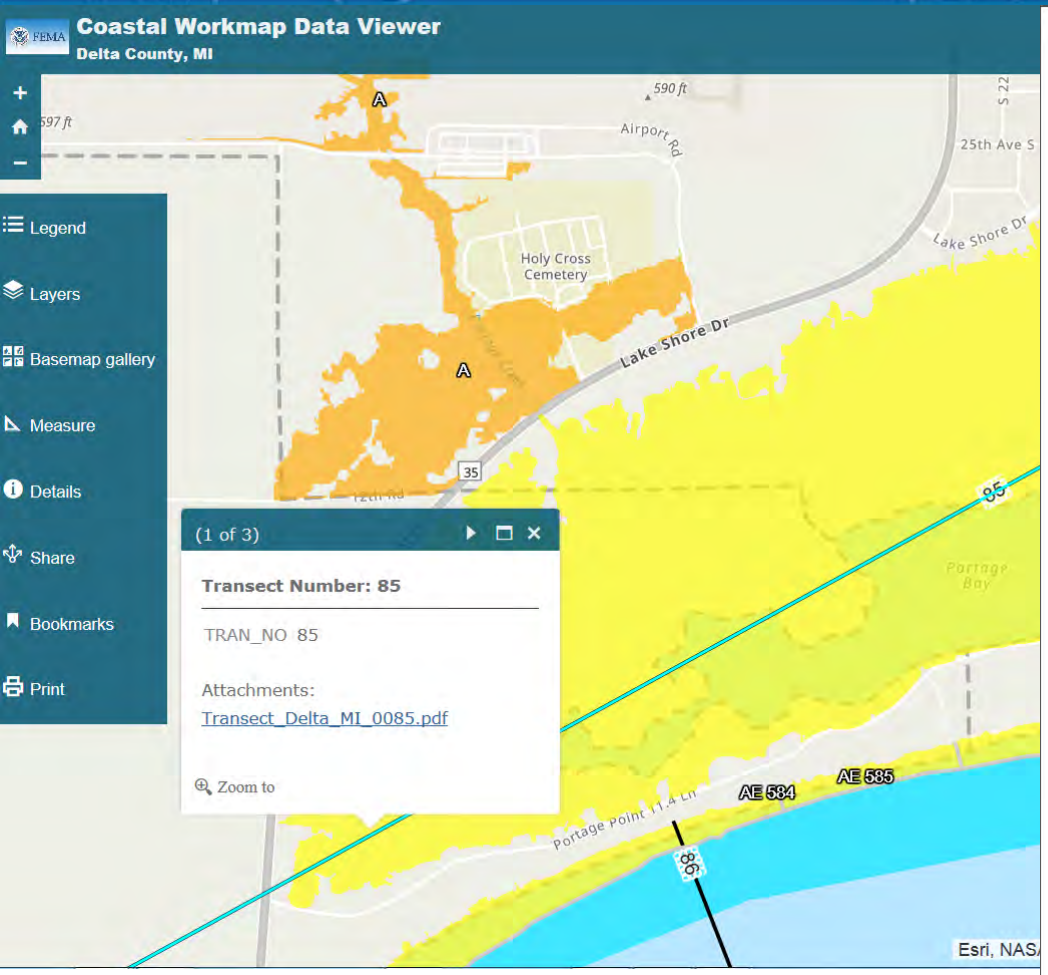


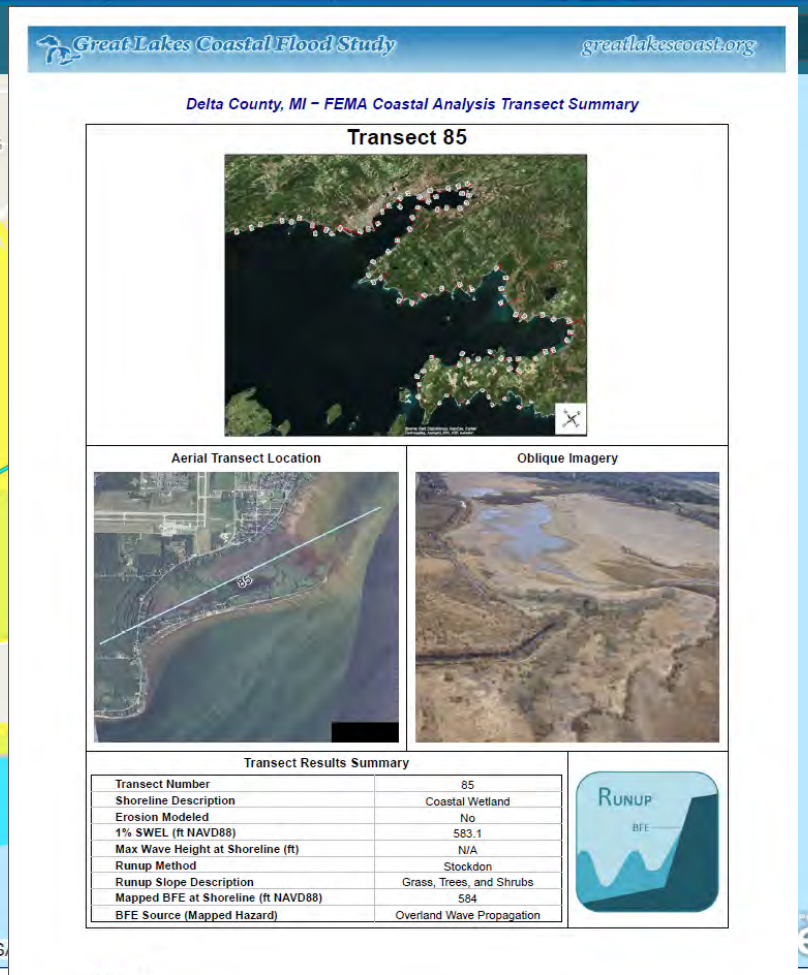
Link to the Delta County, MI Work Map Data Viewer: https://goo.gl/agDLpE

Work Map Data Viewer

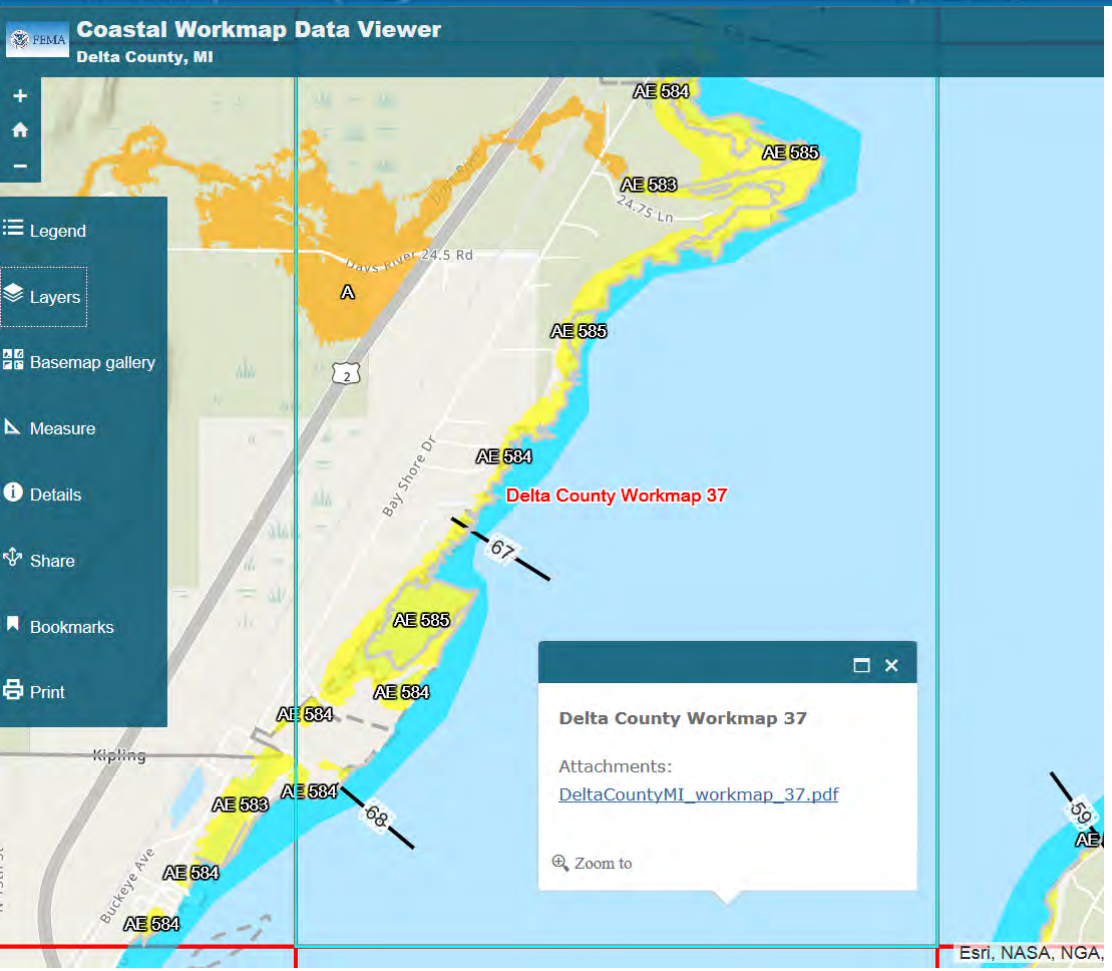


Work Map Data Viewer





Work Map Data Viewer



Work Map Data Viewer

FEMA Coastal Work Map Data Viewer User Guide:
Lake Michigan shoreline at Michigan

Project Background

The Federal Emergency Management Agency (FEMA) is releasing draft work maps for communities along Lake Michigan within coastal communities in the state of Michigan. These products display the results of FEMA's comprehensive storm and wind study of the Great Lakes basin. The intent of this release is to help community officials understand current flood risk and potential flood insurance requirements as well as provide them with an opportunity to review the findings prior to their inclusion within Preliminary Flood Insurance Rate Maps (FIRMs).

Leveraging FEMA's GeoPlatform, this information has been organized and shared with community partners through an interactive ArcGIS online web map viewer. This document provides an overview of how to navigate, visualize, and access the data and information within this tool.

Web links to Lake Michigan Great Lakes Coastal Flood Study Update – Michigan

The following table lists web location of the Lake Michigan coastal updates for the state of Michigan. The GeoPlatform link will take you to the ArcGIS web application. Please use this document to help assist you while navigating through the web application (See Table 1).

County	GeoPlatform link
Allegan	https://goo.gl/aiZpu2
Antrim	http://arcg.is/1LHTj80
Benzie	http://arcg.is/1mzfqi
Berrien	https://goo.gl/PCZugc
Charlevoix	http://arcg.is/1yz0ba
Delta	https://goo.gl/agDLpE
Emmet	http://arcg.is/0qLOTy
Grand Traverse	http://arcg.is/1Tniij
Leelanau	http://arcg.is/1qr4Hf
Mackinac	http://arcg.is/yW5QT
Manistee	http://arcg.is/0X1jDn
Mason	http://arcg.is/1WfaTi
Muskegon	https://goo.gl/kDqAVv
Oceana	http://arcg.is/uLi1m
Ottawa	https://goo.gl/pdesBj
Van Buren	https://goo.gl/j5Jomu

Table 1 – Coastal Workmap GeoPlatform entry points for Michigan

Viewing the Lake Michigan Coastal Workmap via FEMA GeoPlatform

To open the FEMA Work Map Data Viewer for a county referenced in the table above follow the GeoPlatform link in the adjacent column for that county and your screen should appear similar to Figure 1 below. If you want a general overview of the map click on the "Details" button (outlined below in Figure 1)

User guide location:

https://goo.gl/dAA1in

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TECHNICAL OVERVIEW OF STUDY AND MAPPING

Coastal Flood Hazard Modeling Overview

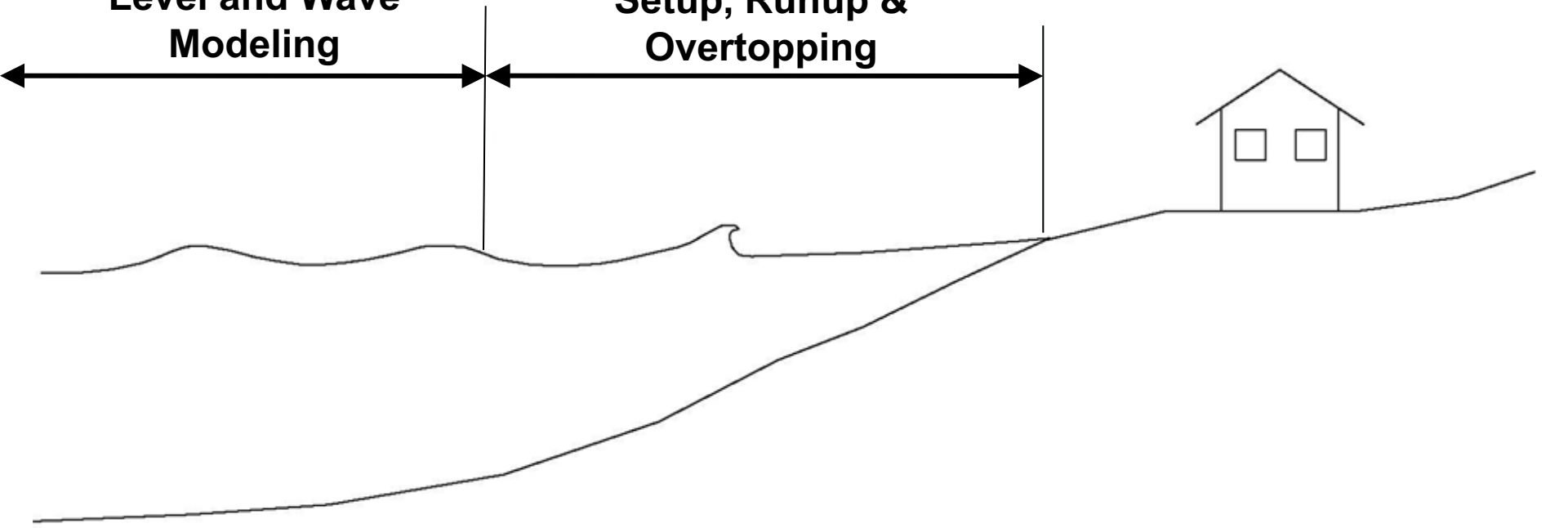
Lake-Wide Variation

Local Variation

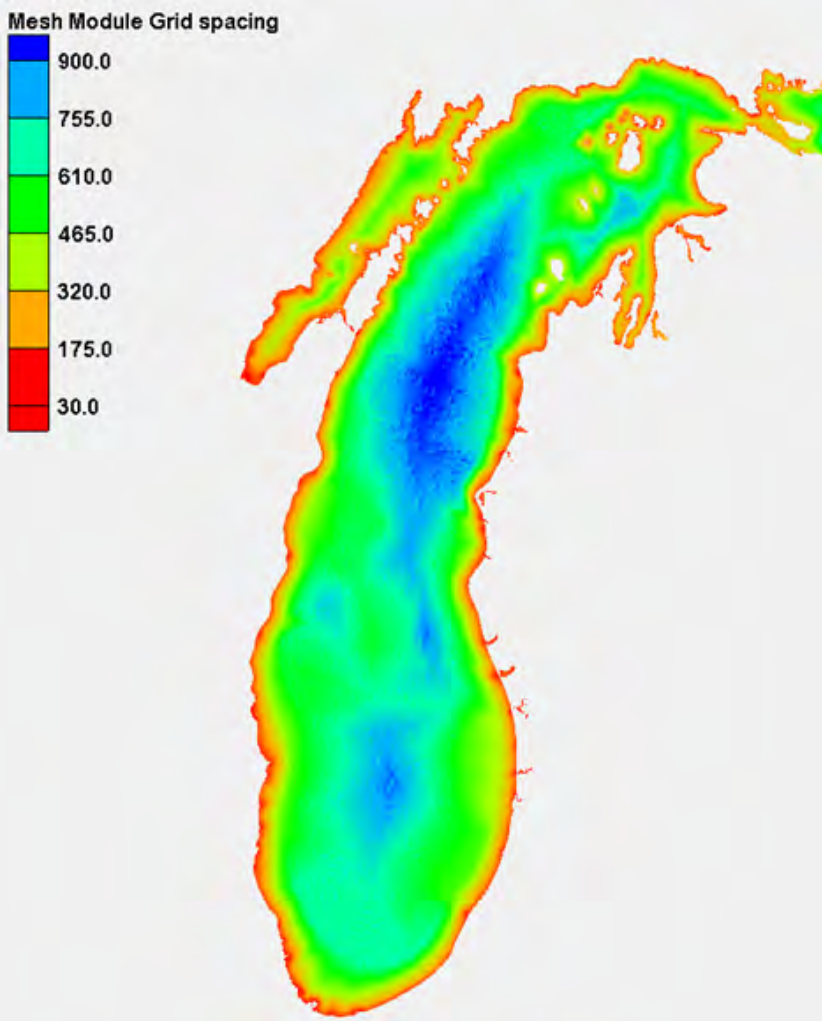
Step 1: Offshore Water Level and Wave Modeling

Step 2: Nearshore Wave Setup, Runup & Overtopping

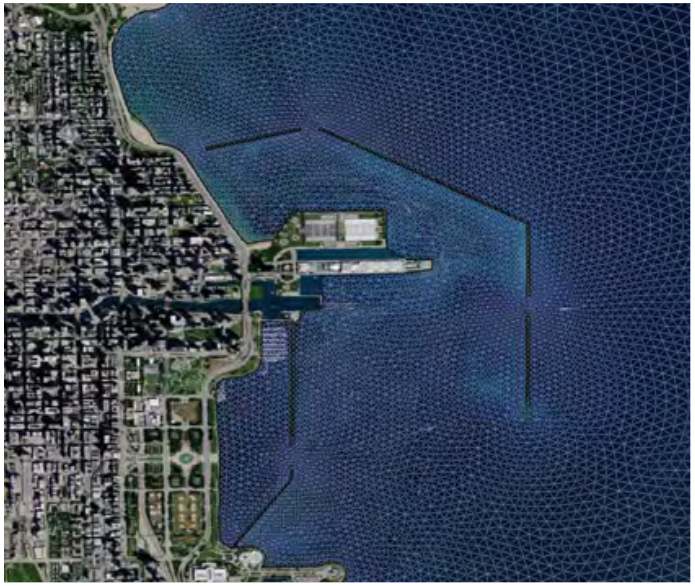
Step 3: Floodplain Mapping



Step 1: ADCIRC+SWAN Mesh



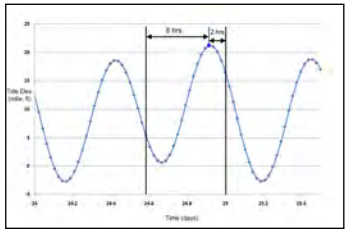
- Resolution as fine as 10 m along complex shoreline features including:
  - Jetties
  - Breakwaters
  - Inlets
  - Natural Shoals



Step 1: Run the Models

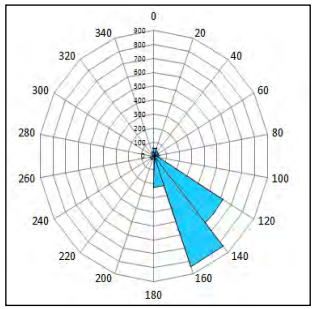
Baseline

Water Level

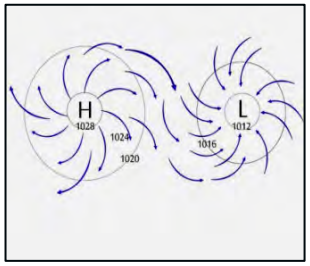


Meteorological Forcing

Wind



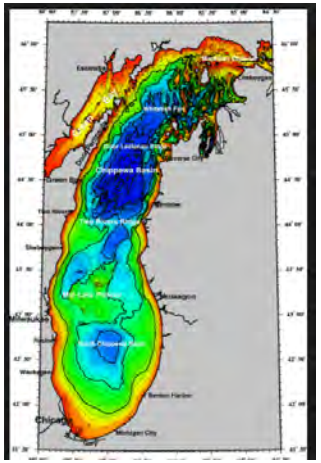
Pressure



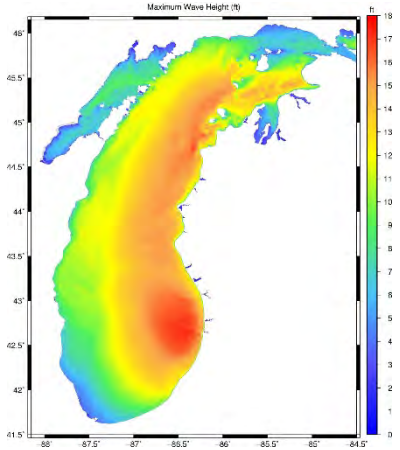
Ice

Physical Setting

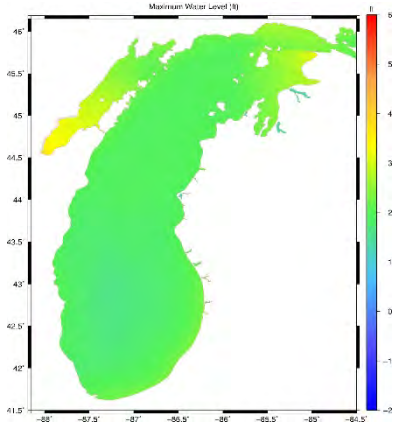
Bathymetry



Waves



Still Water Elevations



Total of 150 events between 1960-2009

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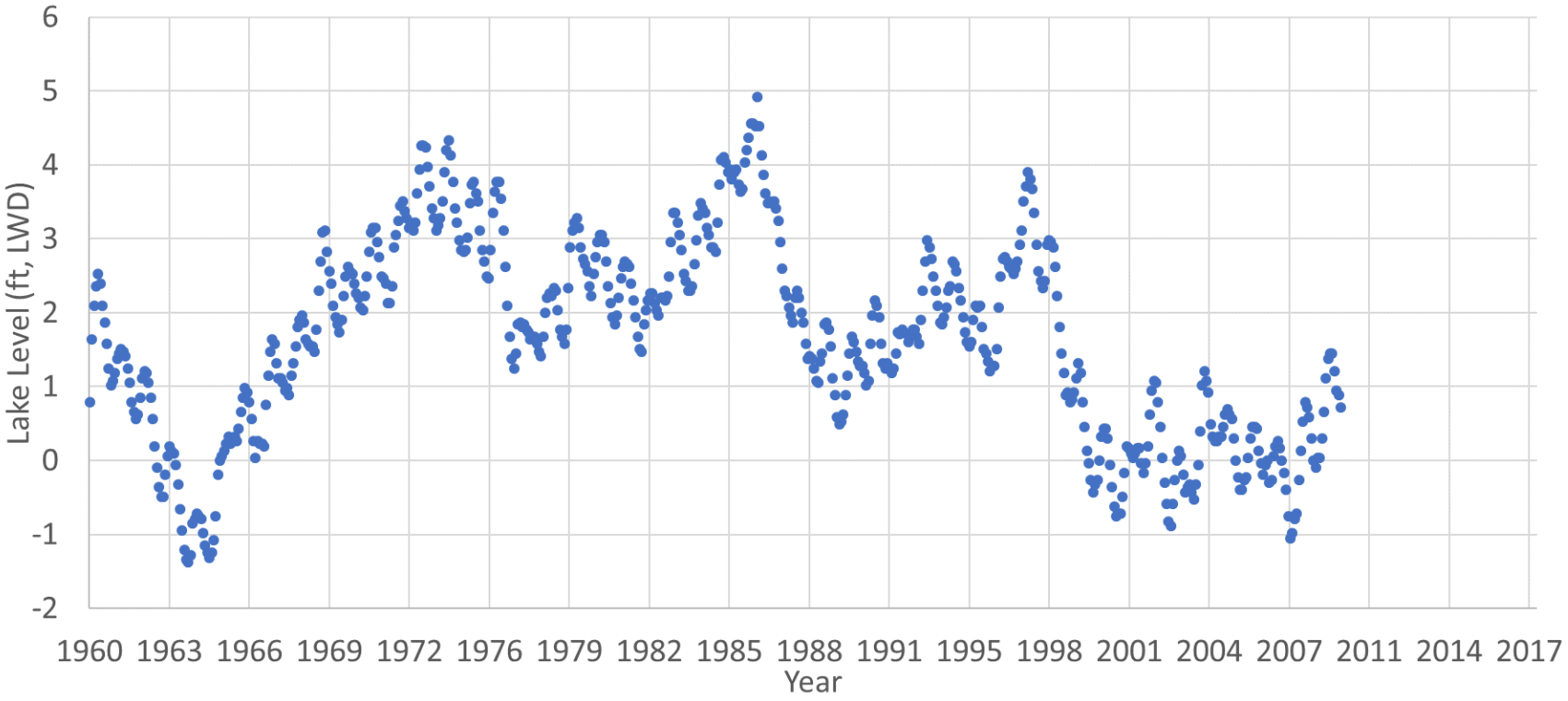
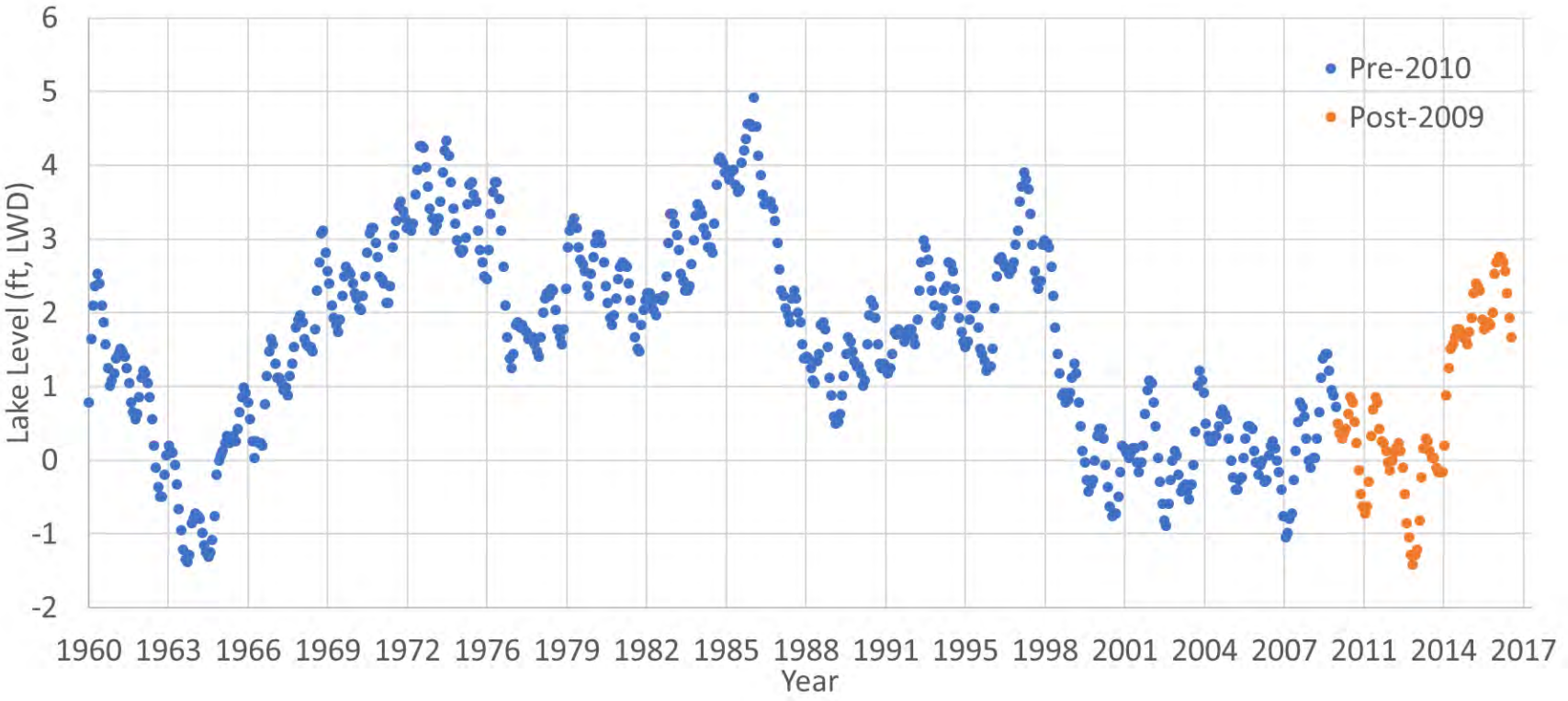
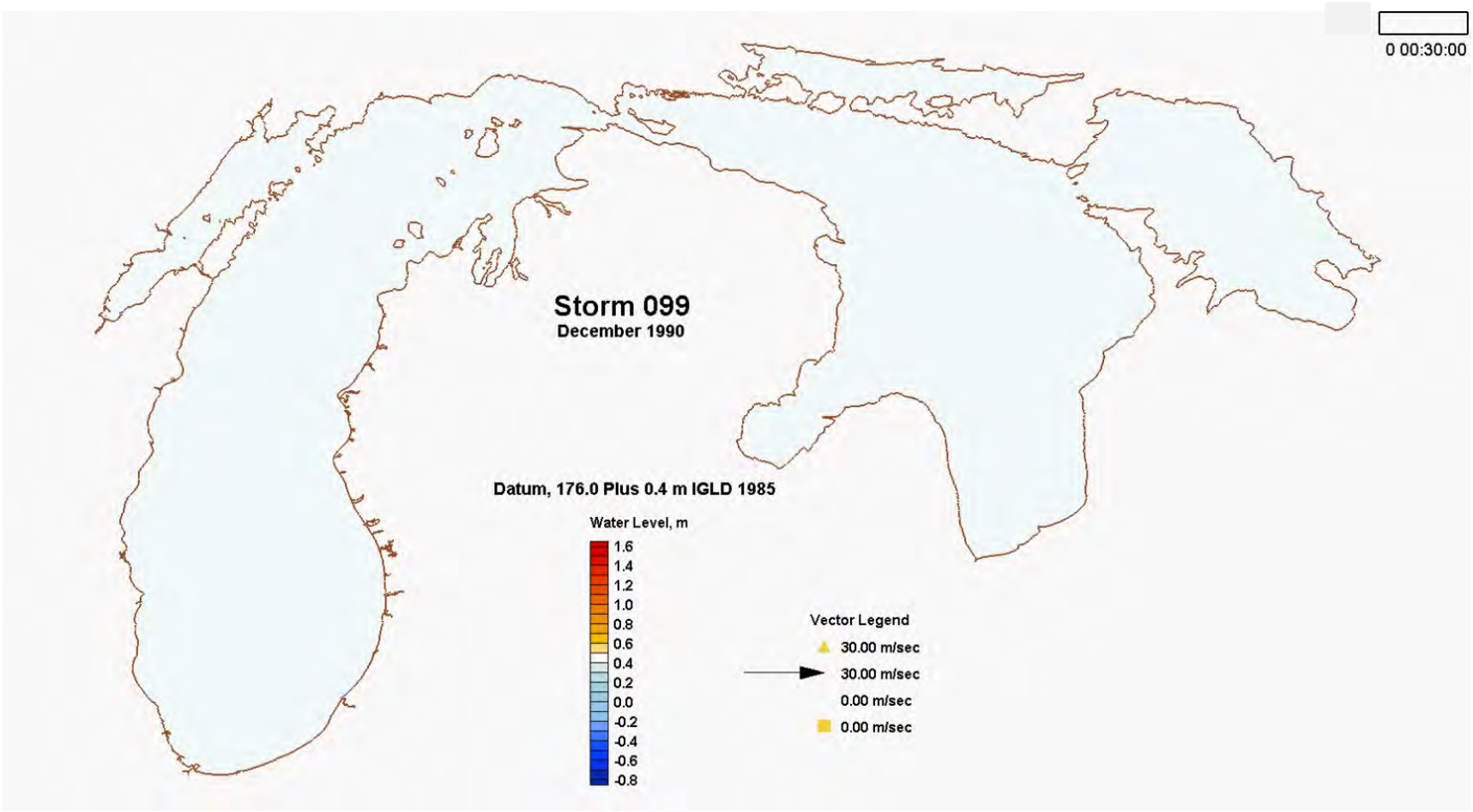
Step 1: Lake Levels



Step 1: Lake Levels



Step 1: Example Surge Behavior



Step 1: Water Level Accuracy Assessment

Stations	Locations	1-Percent-Annual-Chance SWEL (ft, IGLD85)	
		Measured	Simulated
NOAA 9087044	Calumet, Harbor, IL	584.3	584.1
NOAA 9087057	Milwaukee, WI	583.2	584.0
NOAA 9087068	Kewaunee, WI	582.8	582.9
NOAA 9087072	Sturgeon Bay Canal, WI	583.3	583.0
NOAA 9087079	Green Bay, WI	585.4	585.4
NOAA 9087031	Holland, MI	583.4	583.3
NOAA 9075080	Mackinaw City, MI	583.3	583.0
NOAA 9087096	Port Inland, MI	583.9	583.4

Step 2: Nearshore Wave-Induced Flood Hazards

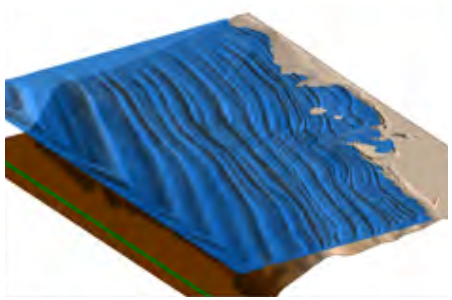
Nearshore Wave-Induced Flood Hazards Analysis includes:

- Shoreline classification
- 2-D Wave and Surge Model data extraction
- Wave setup
- Erosion
- Evaluation of coastal structures
- Wave runup
- Wave overtopping
- Overland wave propagation
- Statistical analysis

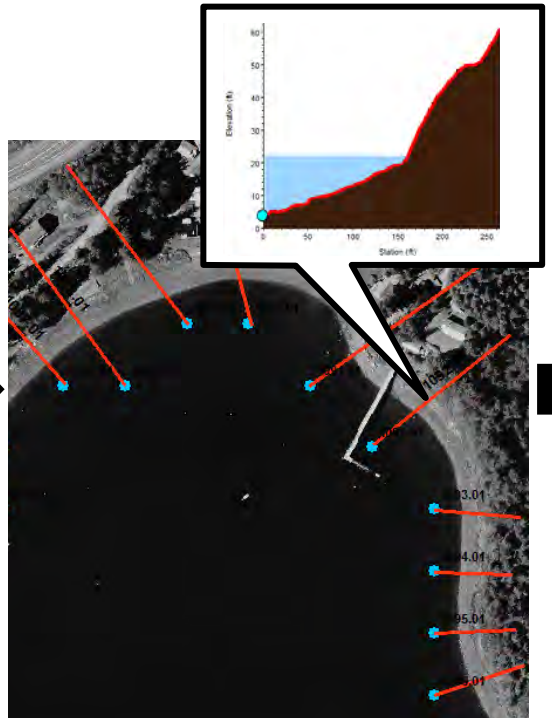
→ Along 1-D Transects

Step 2: Transect Analysis Overview

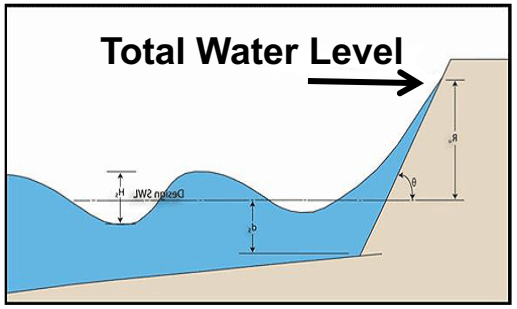
Water Level & Offshore Waves



Transect Analysis



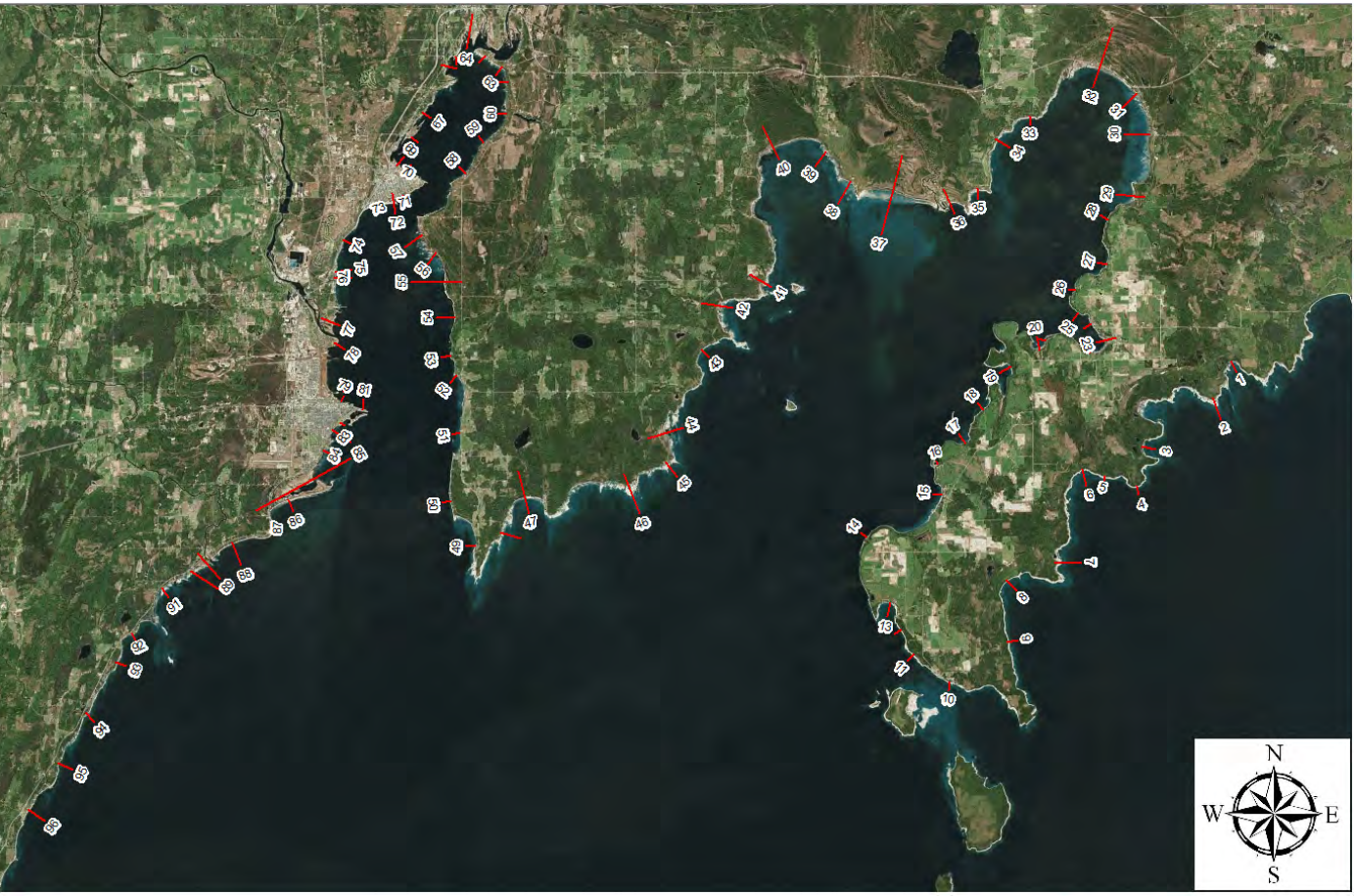
Total Water Level



Total Water Level

- Water Level (Surge)
- Waves
- Setup, Runup and Overtopping

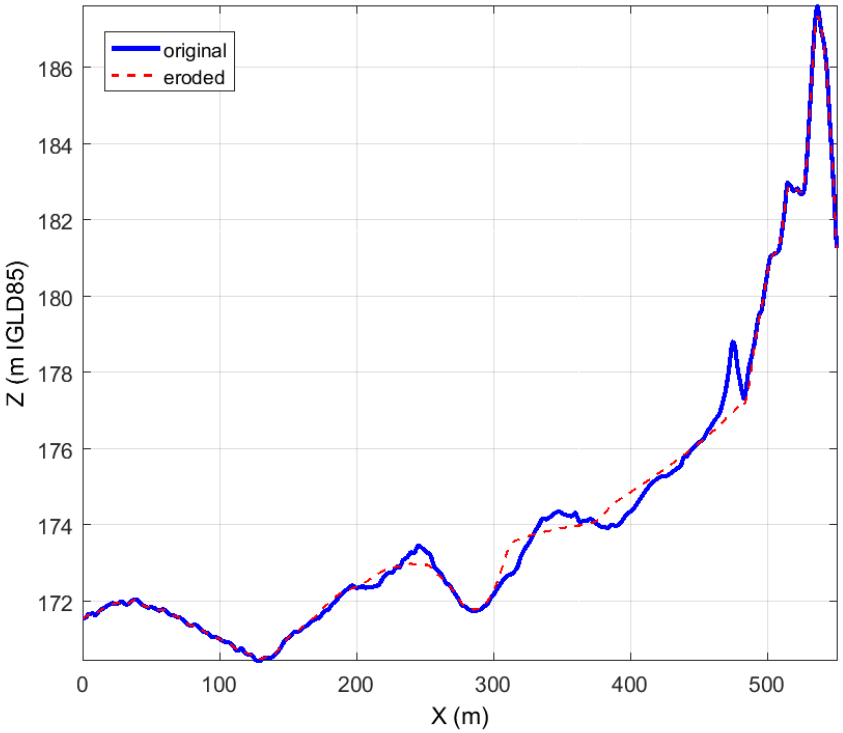
Step 2: Transect Layout

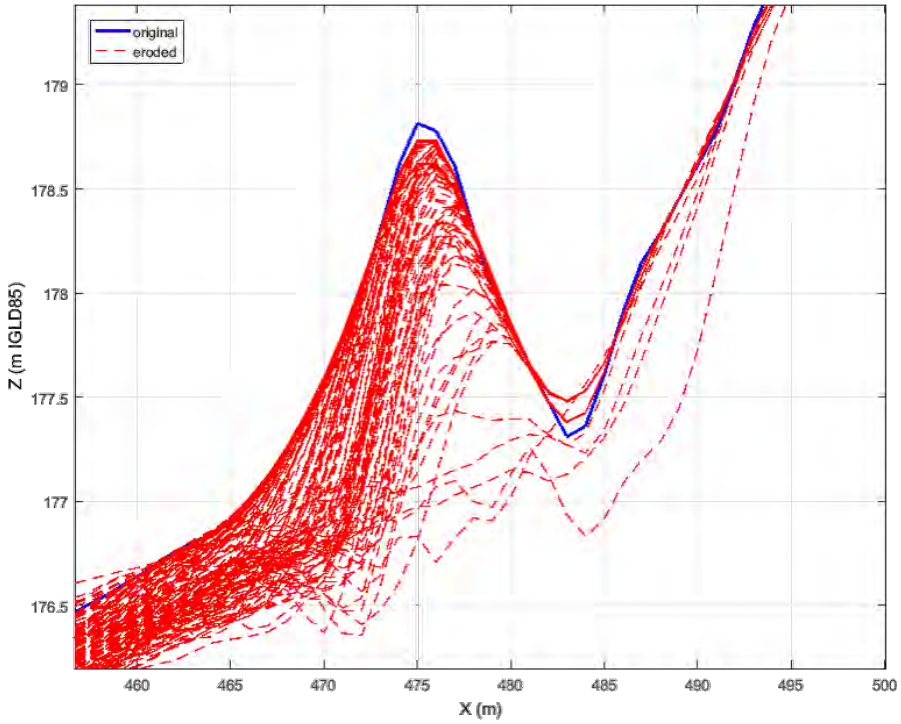


- Delta County:
  - 96 Analysis Transects
  - 176 Shoreline Miles
- Transects placed at representative shoreline reaches based on:
  - Topography
  - Exposure
  - Shoreline Material
  - Upland Development

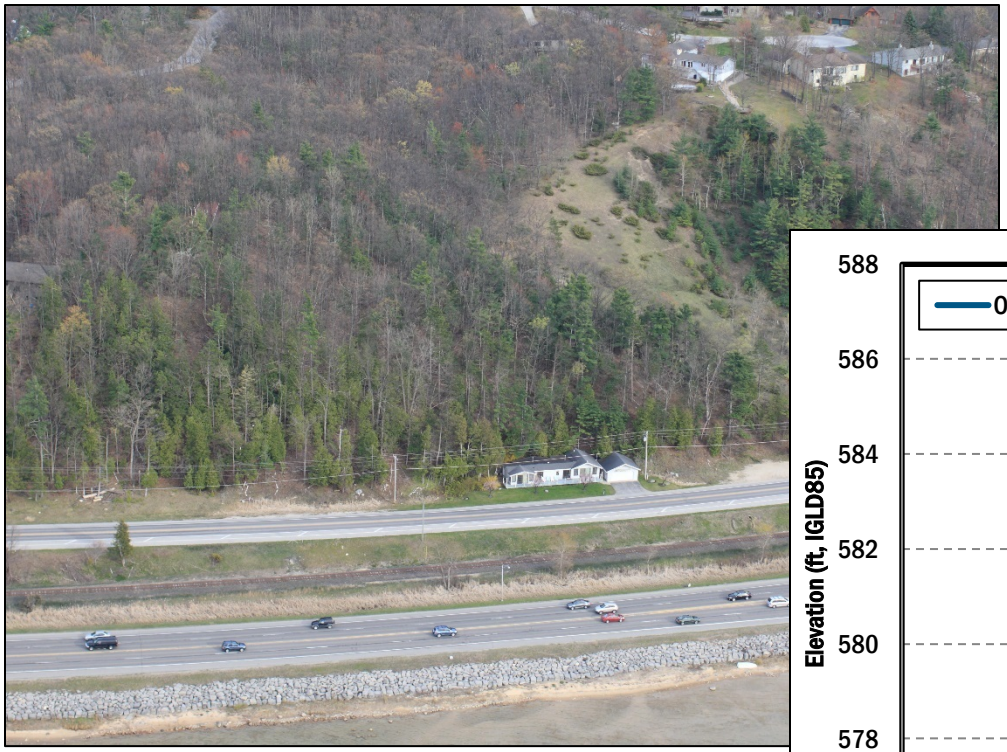
Step 2: Erode Transect Profiles

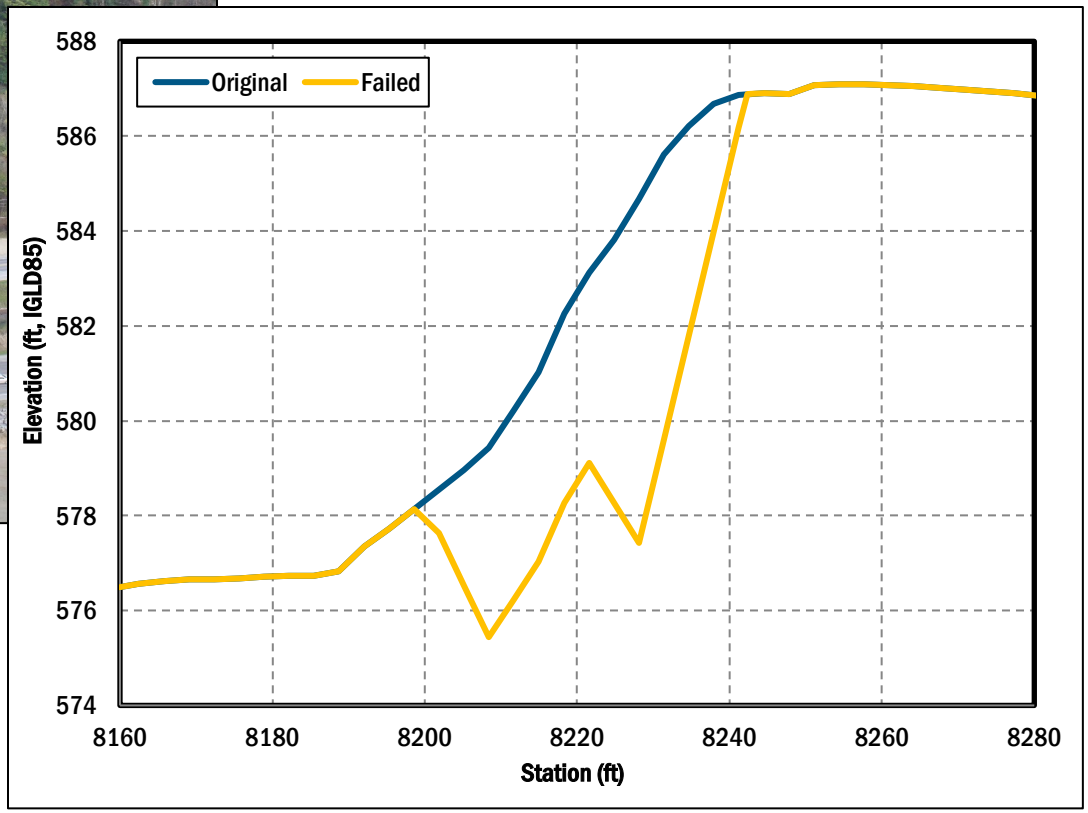
- Erosion analysis applied for sandy beach transects with gradual slopes.
- Eroded profiles are calculated using the USACE CSHORE model for each storm event.
- Influences wave setup, runup, and overtopping by affecting profile slope.





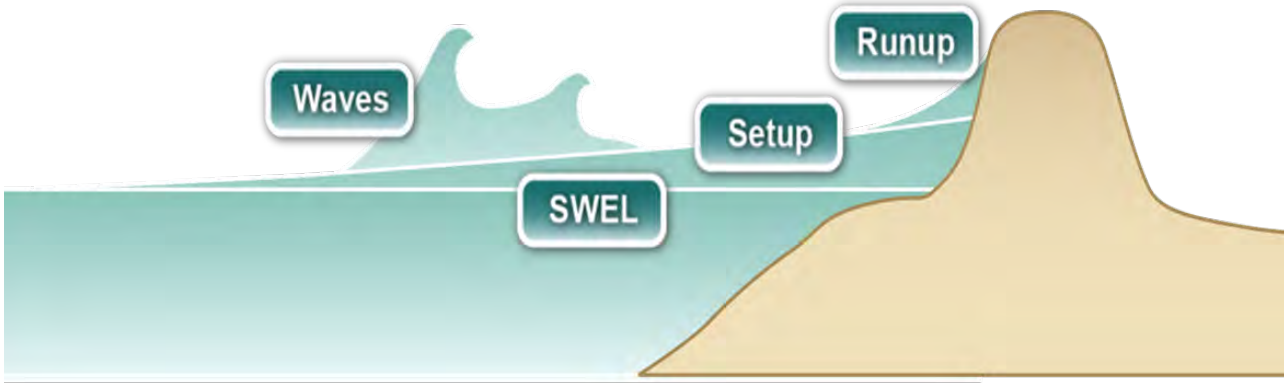
Step 2: Failed Structure Profiles





Step 2: Transect Analysis: Wave Setup and Runup

- Wave runup is the uprush of water from wave action on a beach or shore barrier such as a steep dune, bluff or coastal structure.
- Runup was calculated for every time step of each of the 150 storm events at each transect for the response-based approach.
- A statistical analysis was performed on the maximum runup results at each transect to obtain the 1-percent-annual-chance runup elevation.

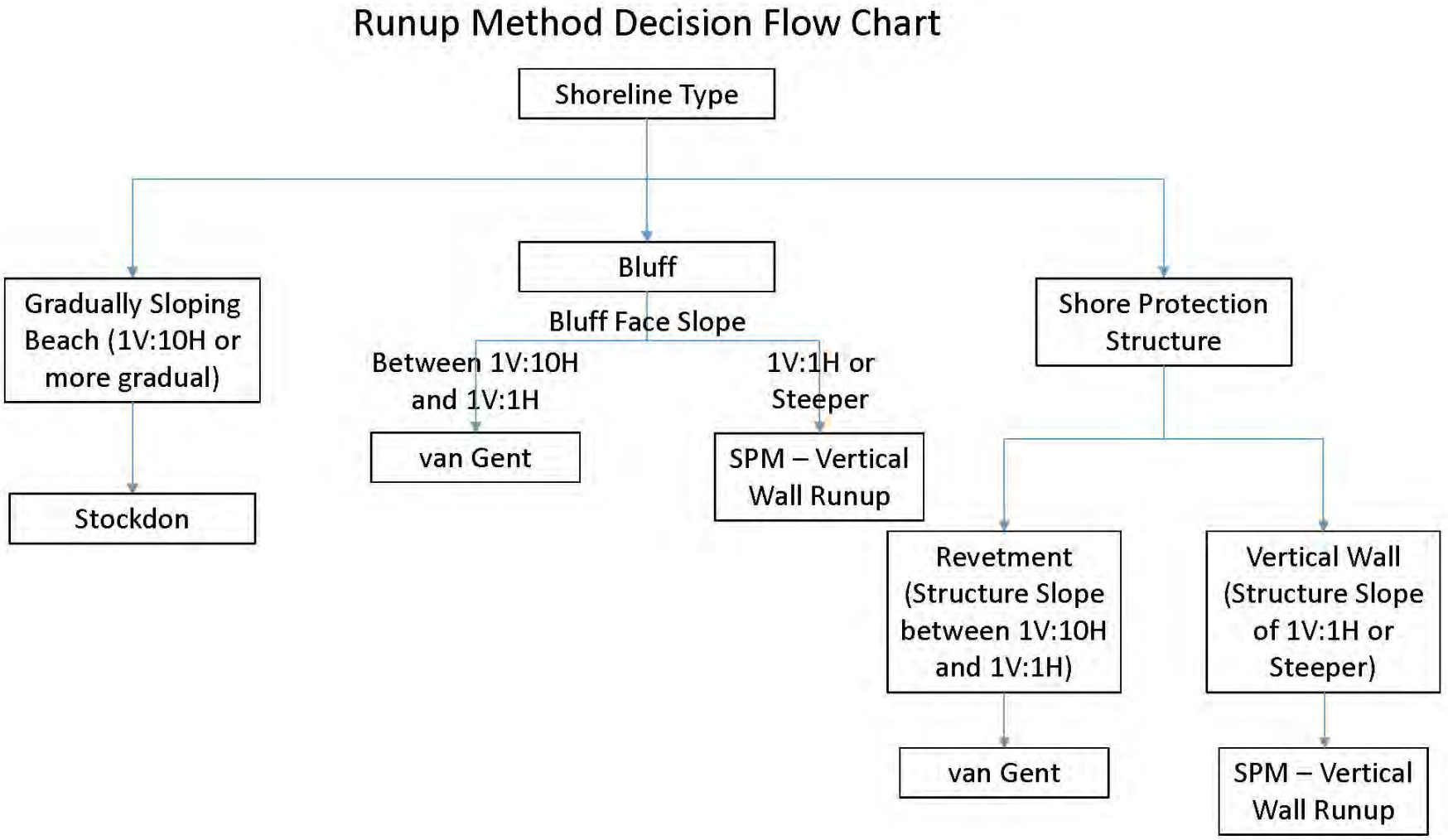


Wave Height
Wave Period
SWEL
Profile Slope

→

Wave Setup
Wave Runup

Response-Based Wave Runup

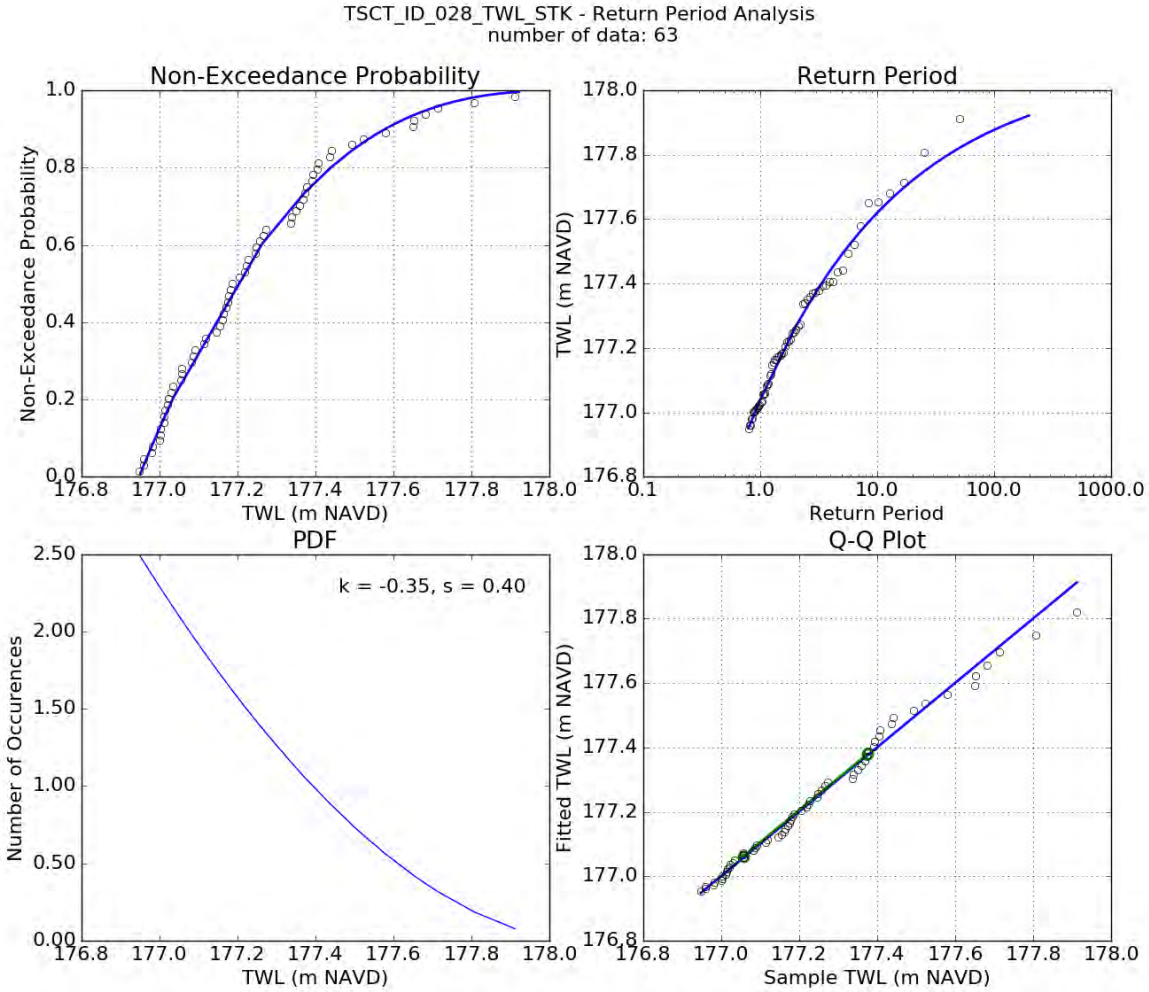


Step 2: Runup

Step 2: Compute Setup, Runup, and Overtopping

- 150 storms with hourly waves and water levels yields hourly wave setup, runup and overtopping rates
- Hourly Still Water Levels (SWELs)
- Hourly Water Levels + Setup + Runup = Hourly Total Water Levels (TWLs)
- Extract the Peak SWEL and TWL from each storm
- Perform Return Period Analysis on SWEL and TWL
- 1-percent-annual-chance TWEL is used to define the Base Flood Elevation (BFE)

Step 2: Return Period Analysis



Step 2: Transect Analysis - Wave Overtopping

- If wave runup exceeds the barrier crest elevation, overtopping occurs.
- Overtopping rates are calculated using methods described in the EurOTop Manual
- Overtopping rates determine VE splash zones and AO Zone (sheet flow) depths

Step 2: Overtopping

Green, M. Spencer. AP Photo. 2012. September 4,2014.

http://journalstar.com/ap/business/two-story-waves-on-great-lakes-halt-shipping/article_bcf2bb34-b528-52f5-8cd4-0c57e7ea8922.html

Step 2: Wave Overtopping – Plateau Method

- When overtopping occurs, the zone behind the barrier is designated as:
  - AE if landward slope is positive
  - AO or AH if landward slope is negative
- Inland extent of overtopping mapping generally follows the 1-percent-annual-chance BFE contour
- Plateau method allows for an inland limit of runup to be calculated as the AE zone extent for gradually sloping upland areas behind a steep barrier

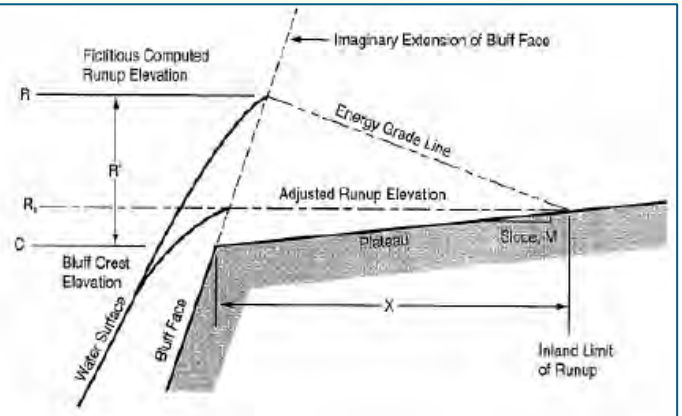


Figure D.3.5-3: Treatment of Runup onto Plateau above Low Bluff

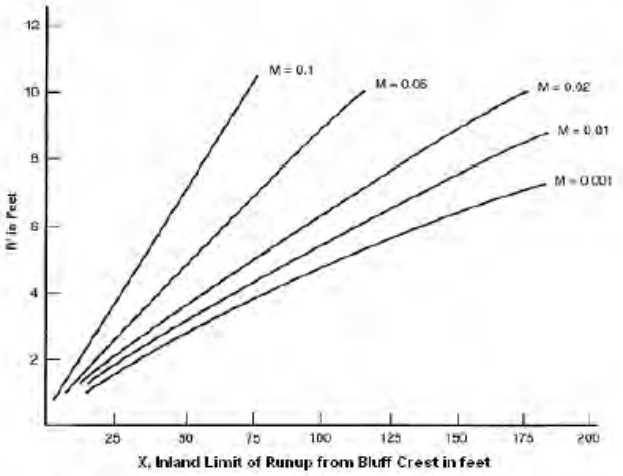


Figure D.3.5-4: Curves for Computation of Runup Inland of Low Bluffs

Step 2: Overland Wave Propagation

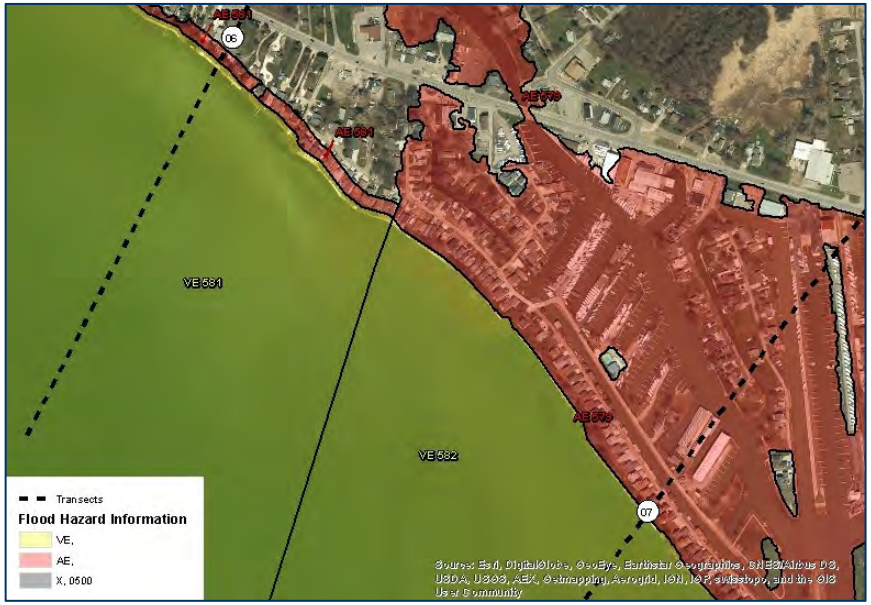
Step 2: Overland Wave Propagation

- Identify 5 pairs of water level and wave height that represent a 1% annual-chance occurrence (Joint Probability Method or JPM)
- Determine if transect is subject to erosion
  - Develop a theoretical storm event using the 5 pairs
- Determine wave setup elevations
  - Using the Direct Integration Method (DIM)
  - Wave setup + SWL = Total Stillwater Level (TSWL)
- Use Wave Height Analysis for Flood Insurance Studies (WHAFIS) to determine interaction of waves with the backshore

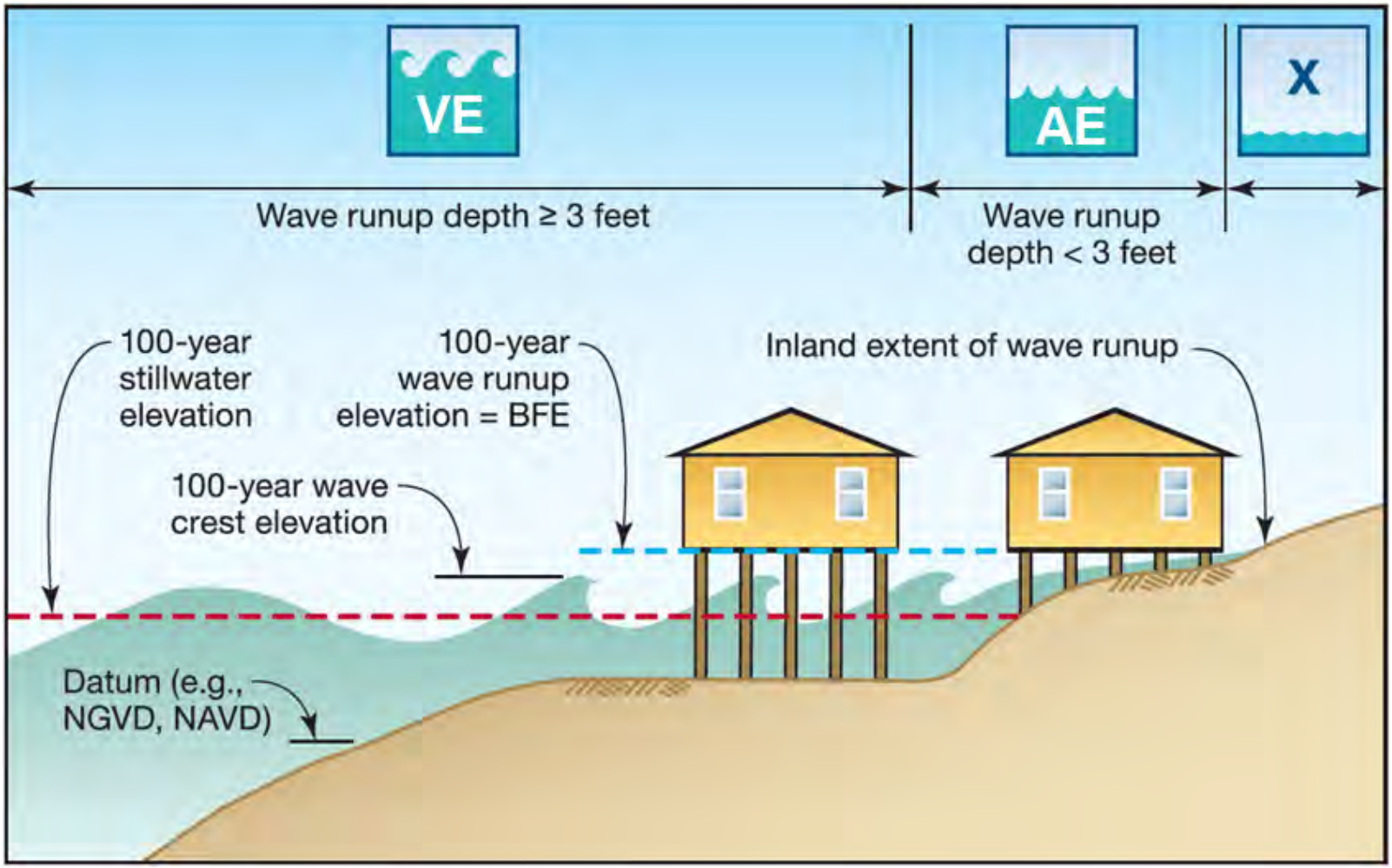
Step 3: Mapping

Coastal Flood Hazard Zones

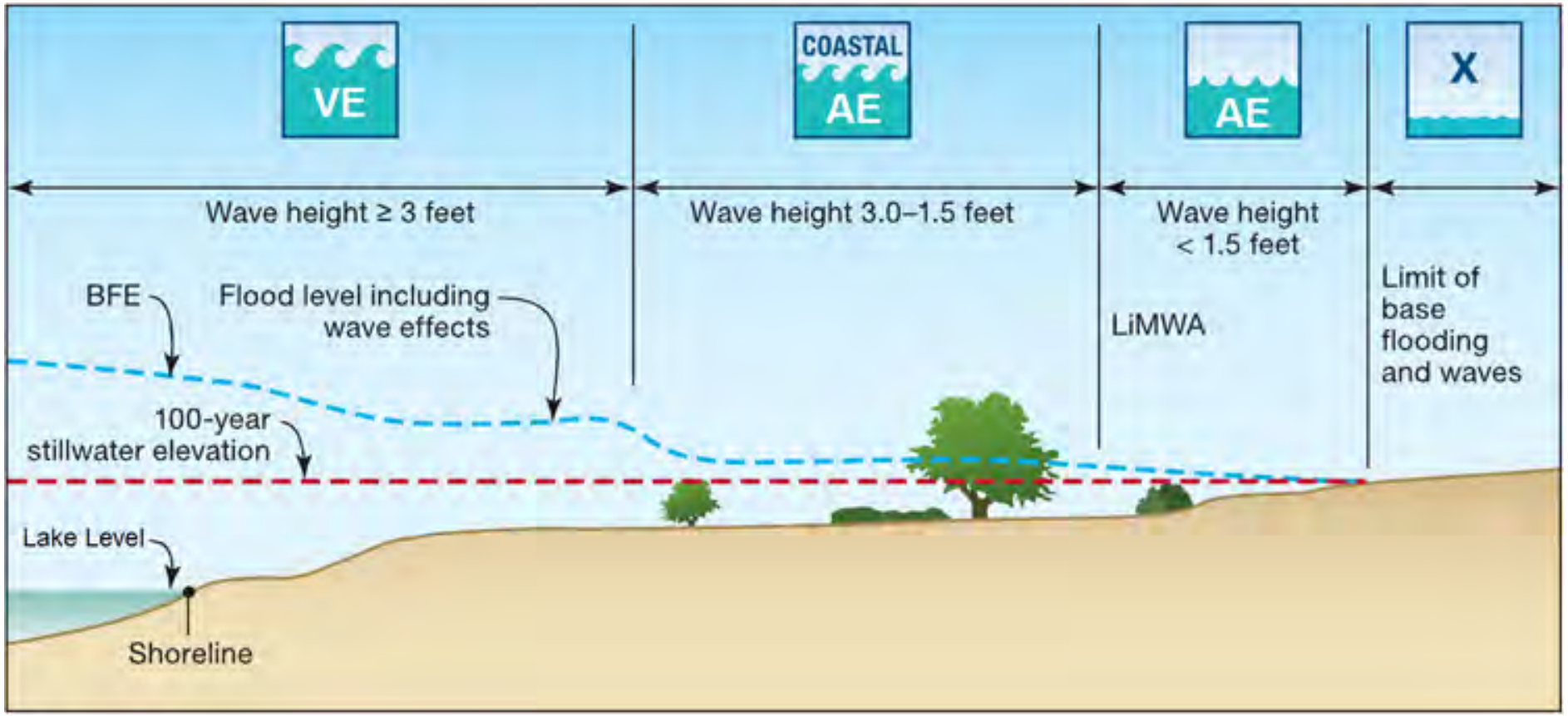
- Zone VE:
  - Represents coastal high hazard areas
  - Wave heights ≥ 3ft
  - Wave runup ≥ 3ft above ground elevation
  - BFEs are assigned
- Zone AE:
  - Inundation areas
  - Wave heights < 3ft
  - Wave runup < 3ft above ground elevation
  - BFEs are assigned
- Zone AH:
  - Ponding areas with 1-3 ft depths
  - BFEs are assigned
- Zone AO:
  - Applied in areas of sheet-flow shallow flooding
  - Designated with depths of 1-, 2-, or 3-ft
- Zone Shaded-X:
  - Areas impacted by the 0.2-percent-annual-chance event



Step 3: Runup Mapping



Step 3: Overland Wave Propagation Mapping



Step 3: Overland Wave Propagation VE Zones

- VE zone associated with the location of the 3 foot or higher breaking wave
- AE zones can exist with BFEs higher than TSWL as wave action is considered
- Most conservative of the 5 WHAFIS runs selected for mapping
- Most conservative is associated with largest extend of flooding and highest VE zone

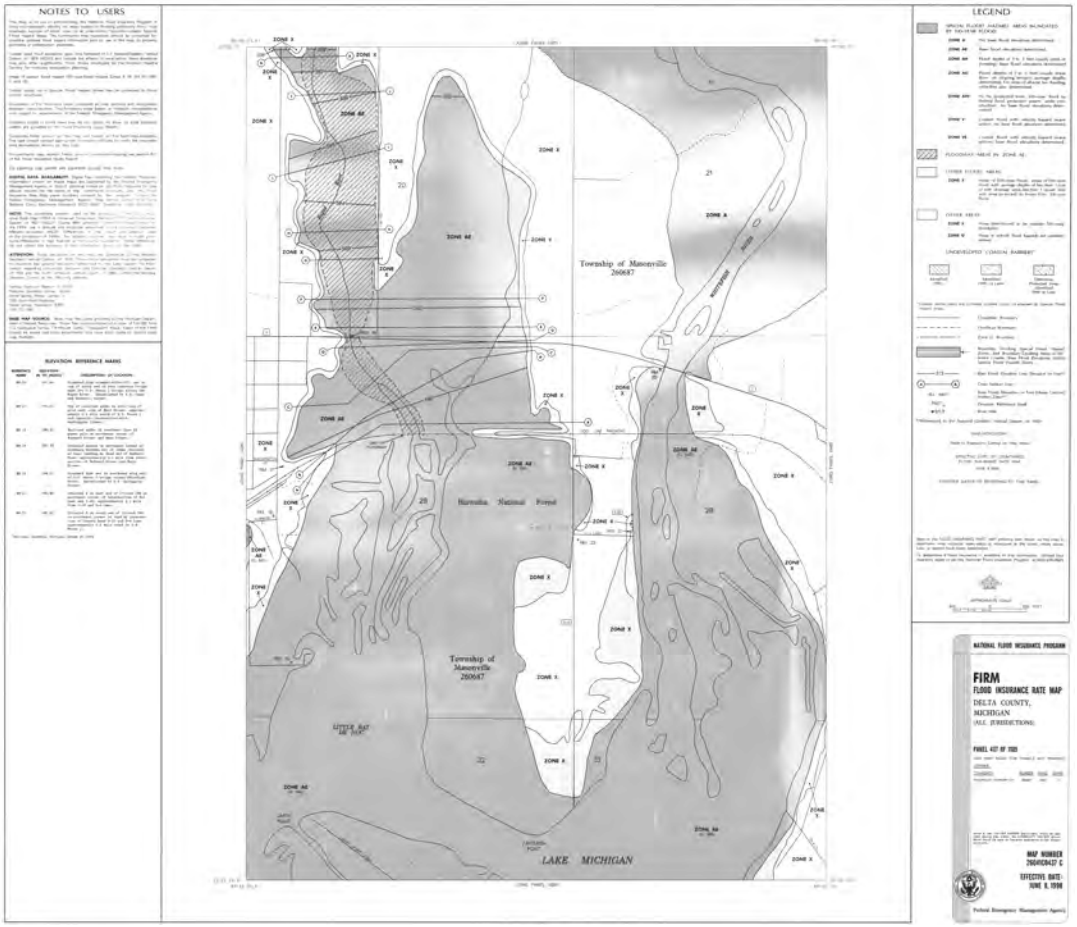
Step 3: Zone Breaks

- Zone breaks are placed along the coast where the characteristics of the shoreline transition from one shore type to another
- Define the extents of each representative shoreline reach

Draft Work Map vs FIS/FIRM

Delta County, MI Workmap

Delta County, MI Effective FIRM



Delta County

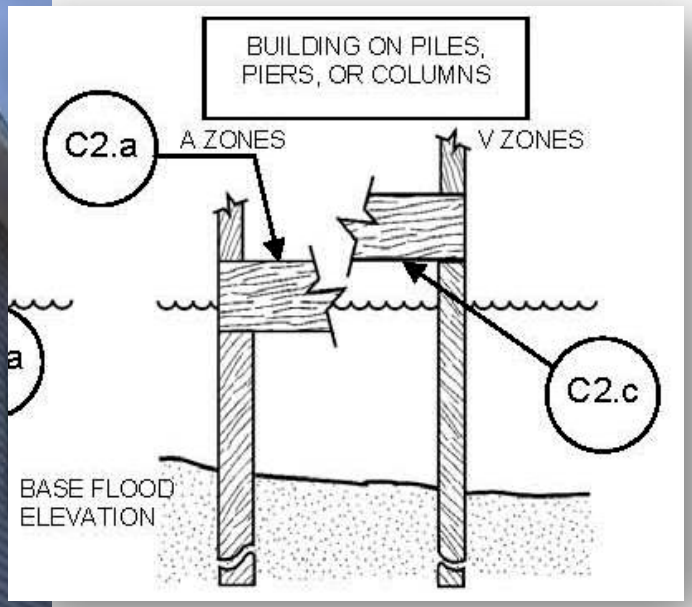
FEMA FLOODPLAIN MANAGEMENT

V-zone Floodplain management : 44 CFR 60.3(e)

The community must require that all new construction and substantial improvements have the lowest horizontal structural member of the lowest floor elevated to or above the base flood level,

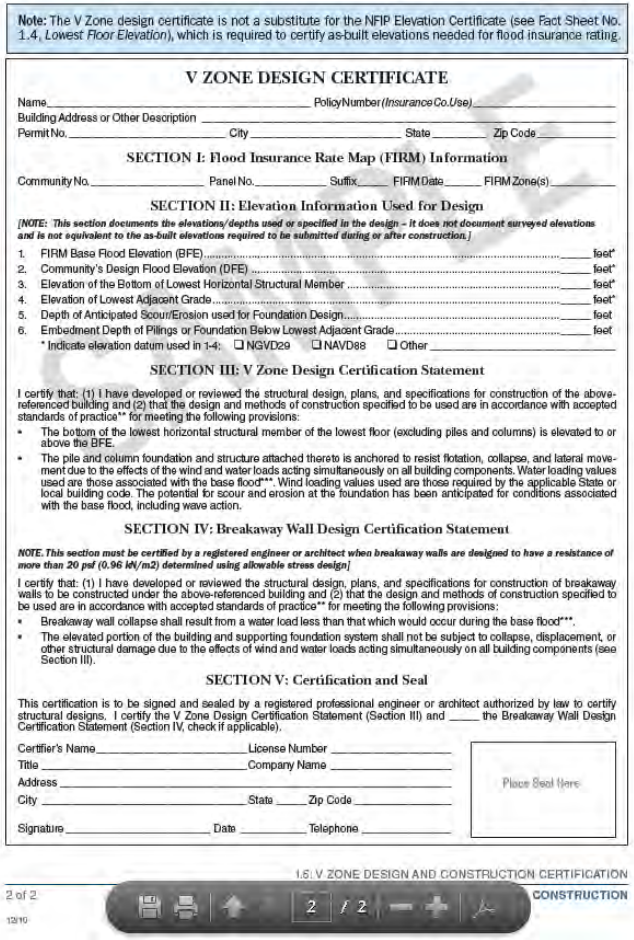
> … with the space below the lowest floor either free of obstruction or constructed with non-supporting breakaway walls …

Lowest horizontal structural member



Other key standards in Zone VE:

- Fill for structural support is prohibited
- Elevated portion of the building and piling/column foundation must be designed to withstand water and wind loads acting simultaneously under base flood conditions
- Structural design, specifications and plans for construction must be developed or reviewed and certified by a registered professional engineer or architect



Note: The V Zone design certificate is not a substitute for the NFIP Elevation Certificate (see Fact Sheet No. 1.4, *Lowest Floor Elevation*), which is required to certify as-built elevations needed for flood insurance rating.

V ZONE DESIGN CERTIFICATE

Name _____ Policy Number *(Insurance Co. Use)* _____

Building Address or Other Description _____

Permit No. _____ City _____ State _____ Zip Code _____

SECTION I: Flood Insurance Rate Map (FIRM) Information

Community No. _____ Panel No. _____ Suffix _____ FIRM Date _____ FIRM Zone(s) _____

SECTION II: Elevation Information Used for Design

[NOTE: This section documents the elevations/depths used or specified in the design – it does not document surveyed elevations and is not equivalent to the as-built elevations required to be submitted during or after construction.]

1. FIRM Base Flood Elevation (BFE) _____ feet*
2. Community's Design Flood Elevation (DFE) _____ feet*
3. Elevation of the Bottom of Lowest Horizontal Structural Member _____ feet*
4. Elevation of Lowest Adjacent Grade _____ feet*
5. Depth of Anticipated Scour/Erosion used for Foundation Design _____ feet
6. Embedment Depth of Pilings or Foundation Below Lowest Adjacent Grade _____ feet

* Indicate elevation datum used in 1-4: ❑ NGVD29 ❑ NAVD88 ❑ Other _____

SECTION III: V Zone Design Certification Statement

I certify that: (1) I have developed or reviewed the structural design, plans, and specifications for construction of the above-referenced building and (2) that the design and methods of construction specified to be used are in accordance with accepted standards of practice** for meeting the following provisions:

- The bottom of the lowest horizontal structural member of the lowest floor (excluding piles and columns) is elevated to or above the BFE.
- The pile and column foundation and structure attached thereto is anchored to resist flotation, collapse, and lateral movement due to the effects of the wind and water loads acting simultaneously on all building components. Water loading values used are those associated with the base flood***. Wind loading values used are those required by the applicable State or local building code. The potential for scour and erosion at the foundation has been anticipated for conditions associated with the base flood, including wave action.

SECTION IV: Breakaway Wall Design Certification Statement

NOTE: This section must be certified by a registered engineer or architect when breakaway walls are designed to have a resistance of more than 20 psf (0.96 kN/m2) determined using allowable stress design.]

I certify that: (1) I have developed or reviewed the structural design, plans, and specifications for construction of breakaway walls to be constructed under the above-referenced building and (2) that the design and methods of construction specified to be used are in accordance with accepted standards of practice** for meeting the following provisions:

- Breakaway wall collapse shall result from a water load less than that which would occur during the base flood***.
- The elevated portion of the building and supporting foundation system shall not be subject to collapse, displacement, or other structural damage due to the effects of wind and water loads acting simultaneously on all building components (see Section III).

SECTION V: Certification and Seal

This certification is to be signed and sealed by a registered professional engineer or architect authorized by law to certify structural designs. I certify the V Zone Design Certification Statement (Section III) and _____ the Breakaway Wall Design Certification Statement (Section IV, check if applicable).

Certifier's Name _____ License Number _____

Title _____ Company Name _____

Address _____

City _____ State _____ Zip Code _____

Signature _____ Date _____ Telephone _____

Place Seal Here

1.6: V ZONE DESIGN AND CONSTRUCTION CERTIFICATION

2 of 2

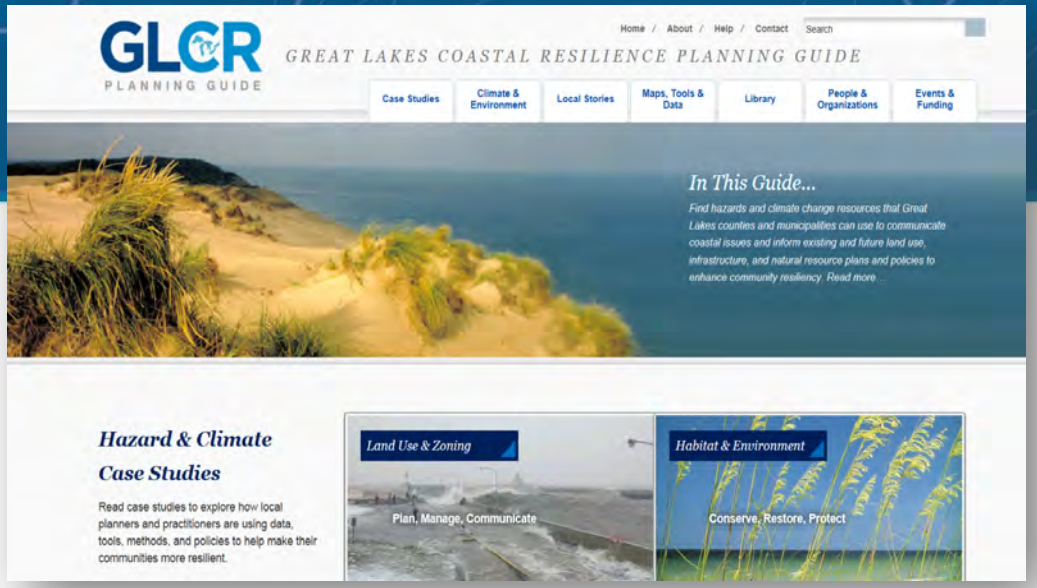
12/10

CONSTRUCTION

2 / 2

Online Resources

Great Lakes Coastal Resilience Planning:
http://www.greatlakesresilience.org/



High resolution oblique aerial images
https://greatlakes.erdc.dren.mil/

Delta County

NEXT STEPS

Comments

Send comments via email to brett.holthaus@atkinsglobal.com or mail to:

Great Lakes Coastal Flood Study
Comment Repository
c/o Atkins
Attn: Brett Holthaus
3901 Calverton Boulevard, Suite 400
Calverton, MD 20705

Include county, community, map panel number, description of area (screenshots or drawings are very helpful), detailed comment, and contact information

- You will receive acknowledgement of receipt of your comment within 3 business days
- Within 3 weeks, FEMA's response will indicate if enough technical justification was provided to necessitate a map change
- If you are not satisfied with a comment response on technical grounds, consider using the appeal process during Preliminary FIRM rollout

Next Steps

60 day review and comment period ends November 20, 2017.

FEMA's next steps:

1. Inventory all comments received
2. Evaluate and incorporate comments and data as appropriate
3. Move studies into the NFIP regulatory process (developing FIRMs)

FEMA Contacts

KEN HINTERLONG
Senior Engineer, Risk Analysis
FEMA Region 5
312-408-5529
ken.hinterlong@fema.dhs.gov

COMMENT REPOSITORY:

Send comments via email to brett.holthaus@atkinsglobal.com or mail to:

Great Lakes Coastal Flood Study
Comment Repository
c/o Atkins
Attn: Brett Holthaus
3901 Calverton Boulevard, Suite 400
Calverton, MD 20705

Questions?

FEMA

Thank you for your participation!