Oceana and Mason Counties, MI Coastal Hazard Analysis Flood Risk Review Meeting

September 19, 2017

FEMA

Agenda

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

Oceana and Mason Counties, MI

COASTAL FLOOD RISK STUDY AND MAPPING PROGRAM

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

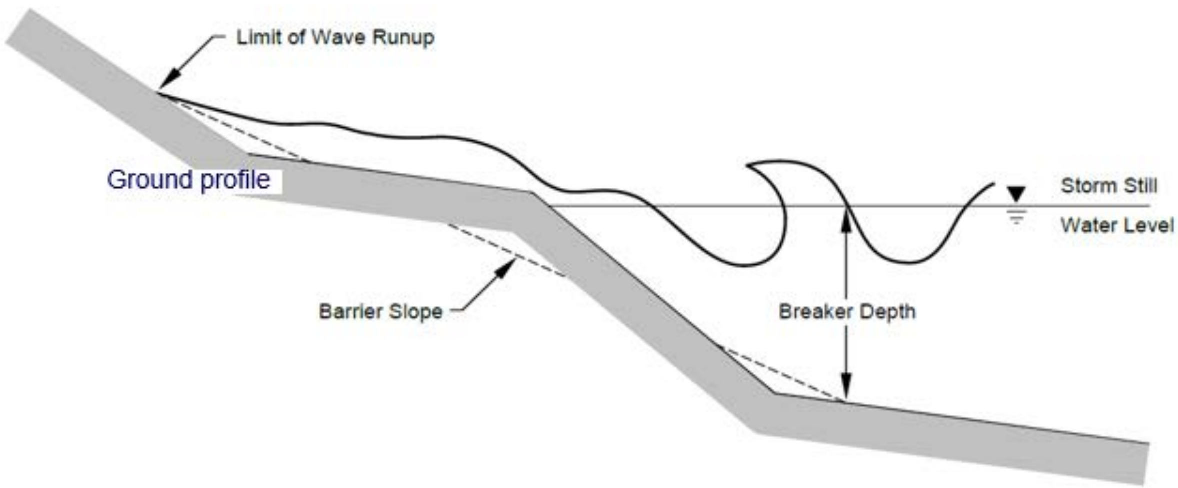
ERDC

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.



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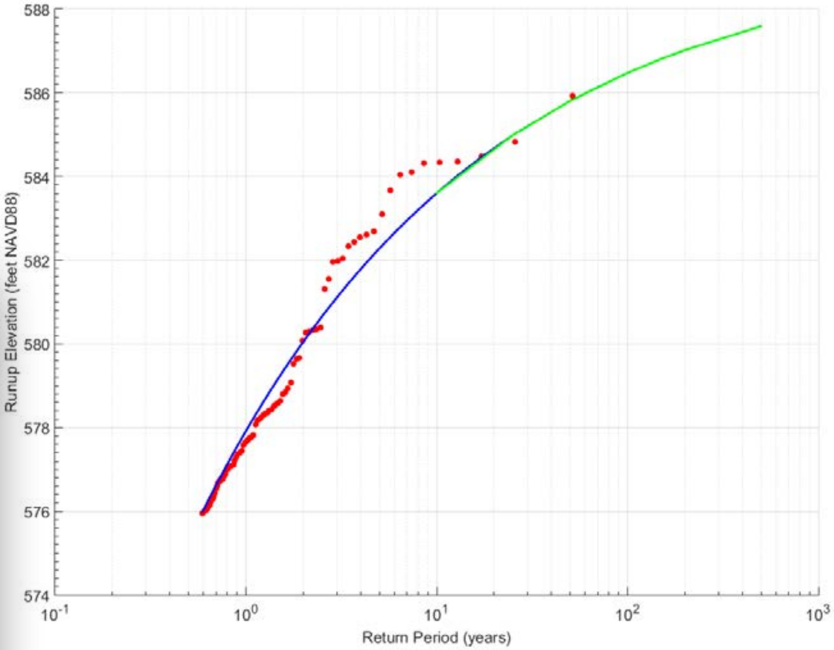
Response-Based Wave Runup



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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

Oceana and Mason Counties, MI

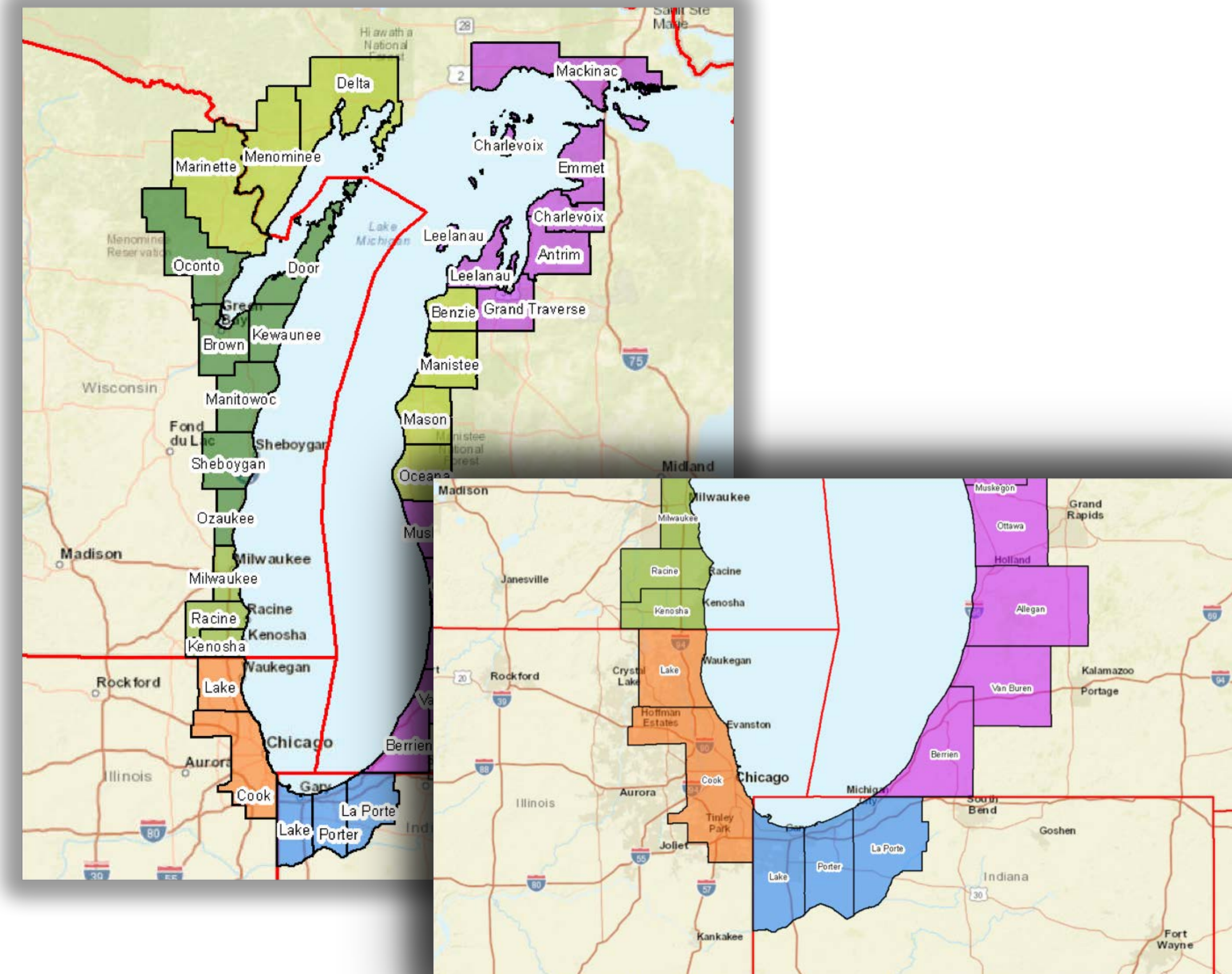
CURRENT STATUS REVIEW

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



Current Study Status

Lake-Wide Storm Surge and Waves Study

County Based Overland Analyses

Workmap Production

You are here

Comment Period

FIRM Production

FPM Workshops

Preliminary FIRM

Community Coordination Meeting

Comment and Appeal Periods

Letter of Final Determination

6 months – update ordinance

Effective FIRM

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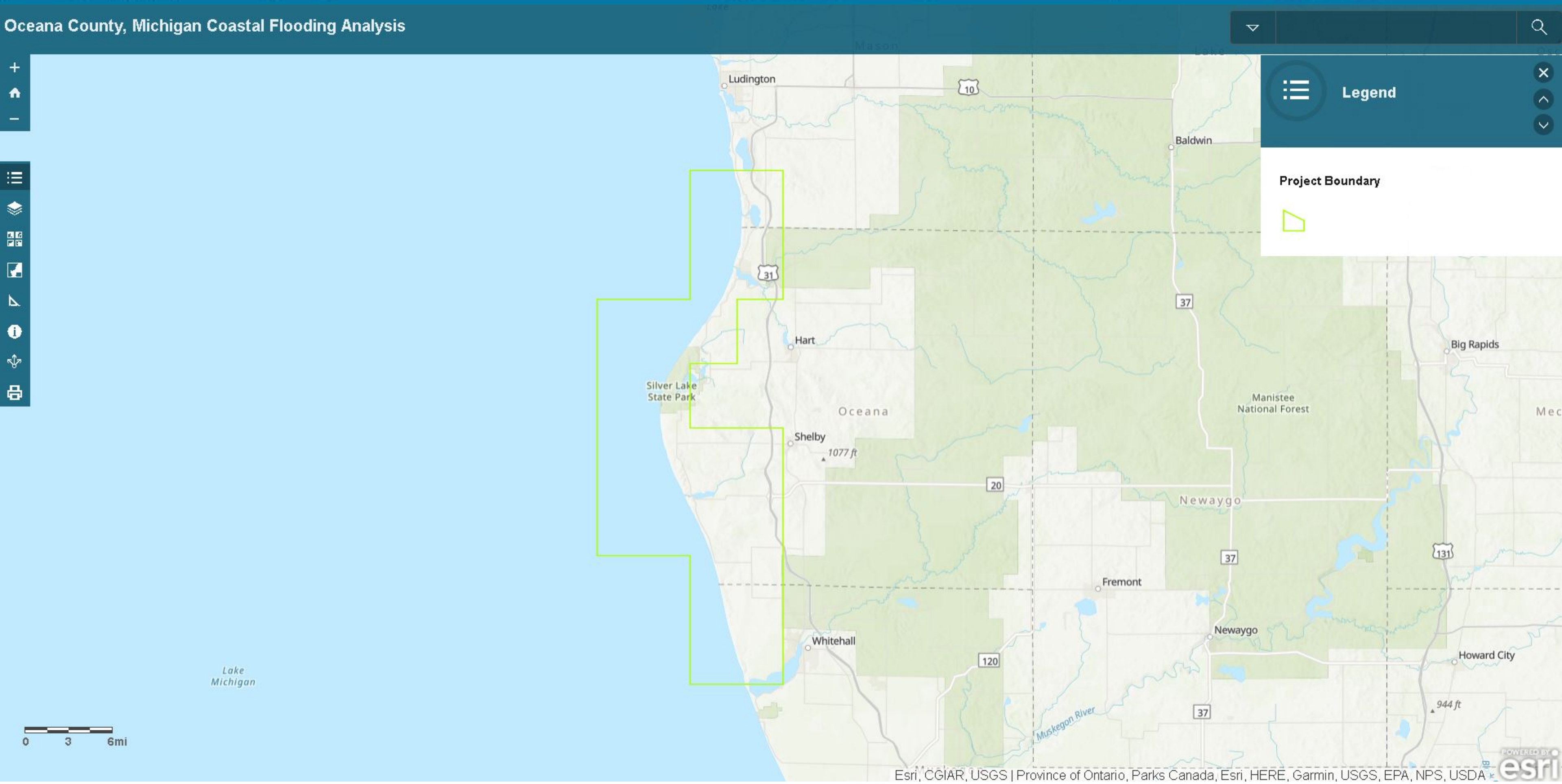
Floodplain Management Workshops

- 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 Oceana County, MI Work Map Data Viewer: http://arcg.is/uLi1m
Link to the Mason County, MI Work Map Data Viewer: http://arcg.is/1WfaTi

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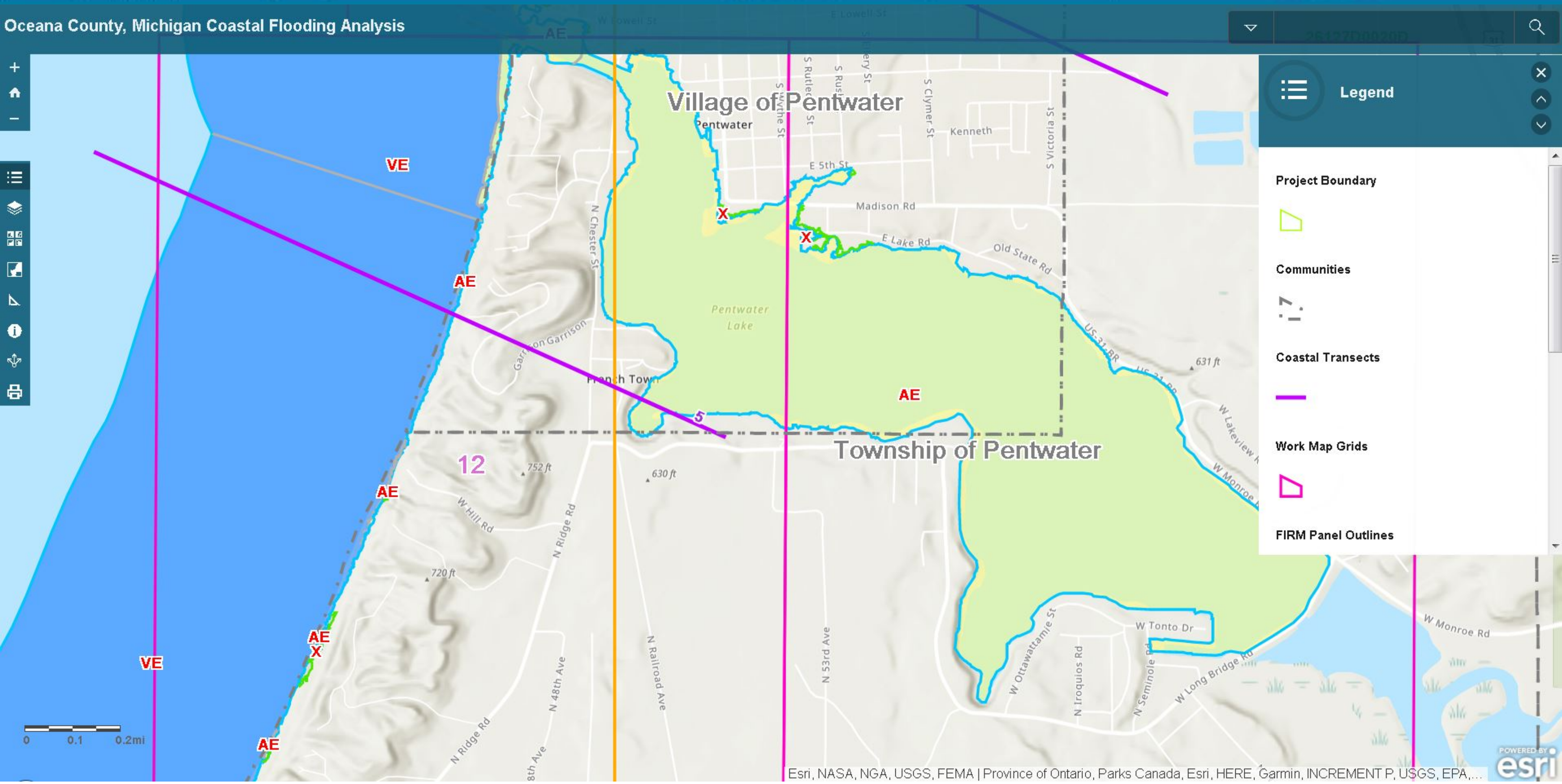
Work Map Data Viewer



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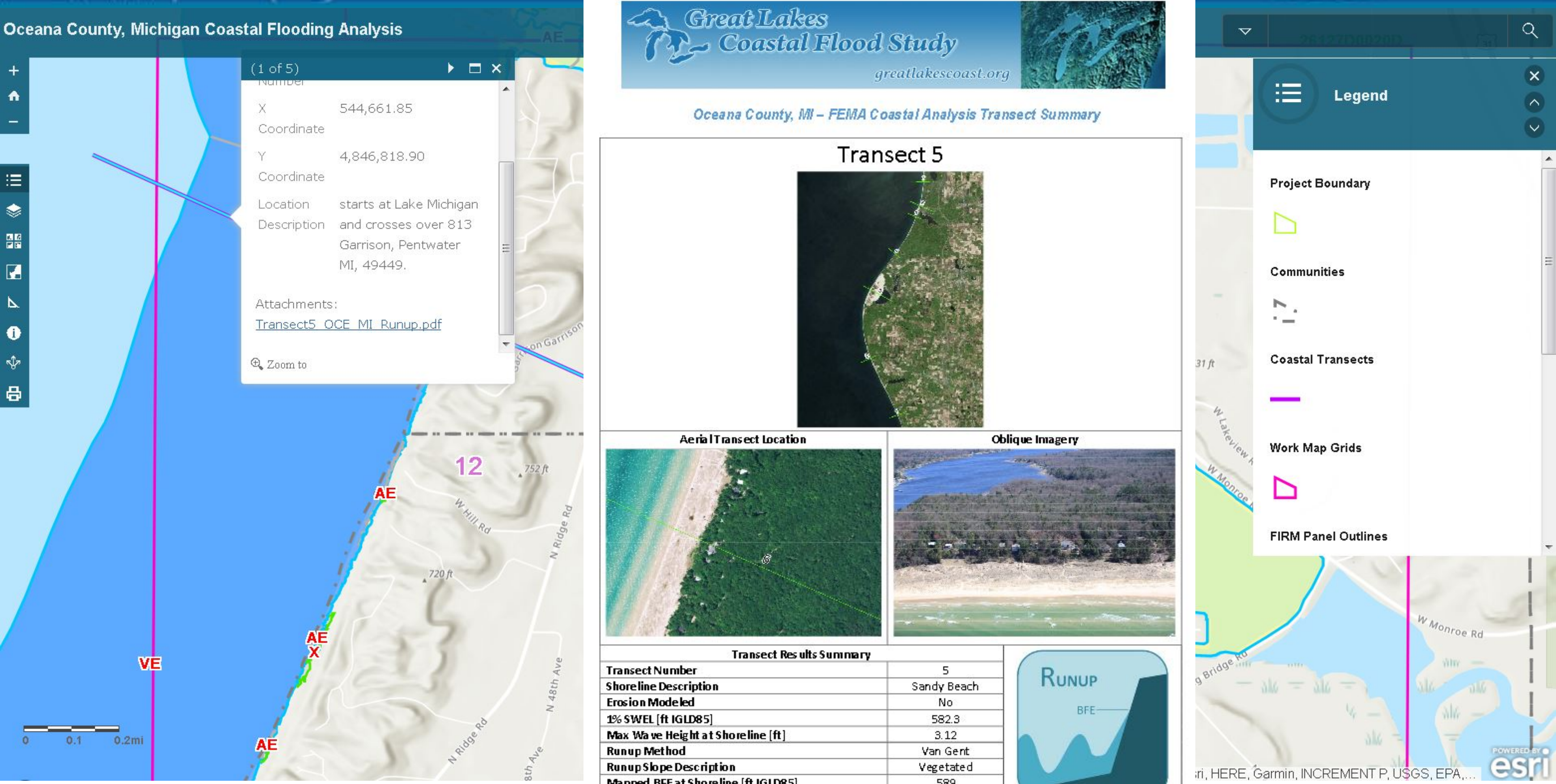
Work Map Data Viewer



Great Lakes Coastal Flood Study

greatlakescoast.org

Oceana County, MI – FEMA Coastal Analysis Transect Summary

Transect 5

Aerial Transect Location

Oblique Imagery

Transect Results Summary	
Transect Number	5
Shoreline Description	Sandy Beach
Erosion Modeled	No
1% SWEL [ft IGLD85]	582.3
Max Wave Height at Shoreline [ft]	3.12
Runup Method	Van Gent
Runup Slope Description	Vegetated
Mapped BFE at Shoreline [ft IGLD85]	589
BFE Source (Mapped Hazard)	Runup

RUNUP

BFE

August 2017

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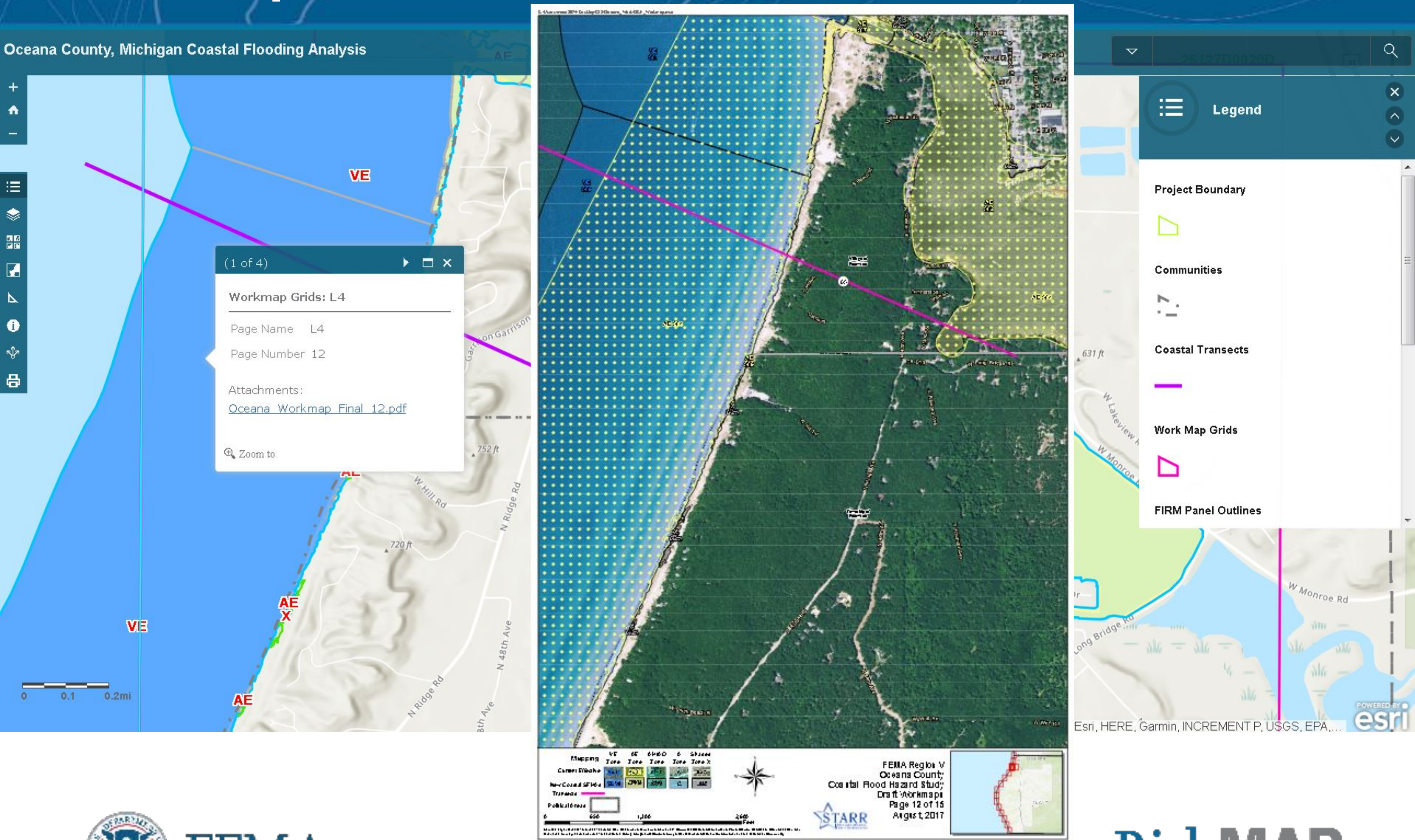
Work Map Data Viewer



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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/PCZuqc
Charlevoix	http://arcg.is/1yz0ba
Delta	https://goo.gl/aqDLpE
Emmet	http://arcg.is/0qLOTy
Grand Traverse	http://arcg.is/1Tniij
Leelanau	http://arcg.is/1qr4Hf
Mackinac	http://arcg.is/yW5OT
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

Oceana and Mason Counties, MI

TECHNICAL OVERVIEW OF STUDY AND MAPPING

Coastal Flood Hazard Modeling Overview

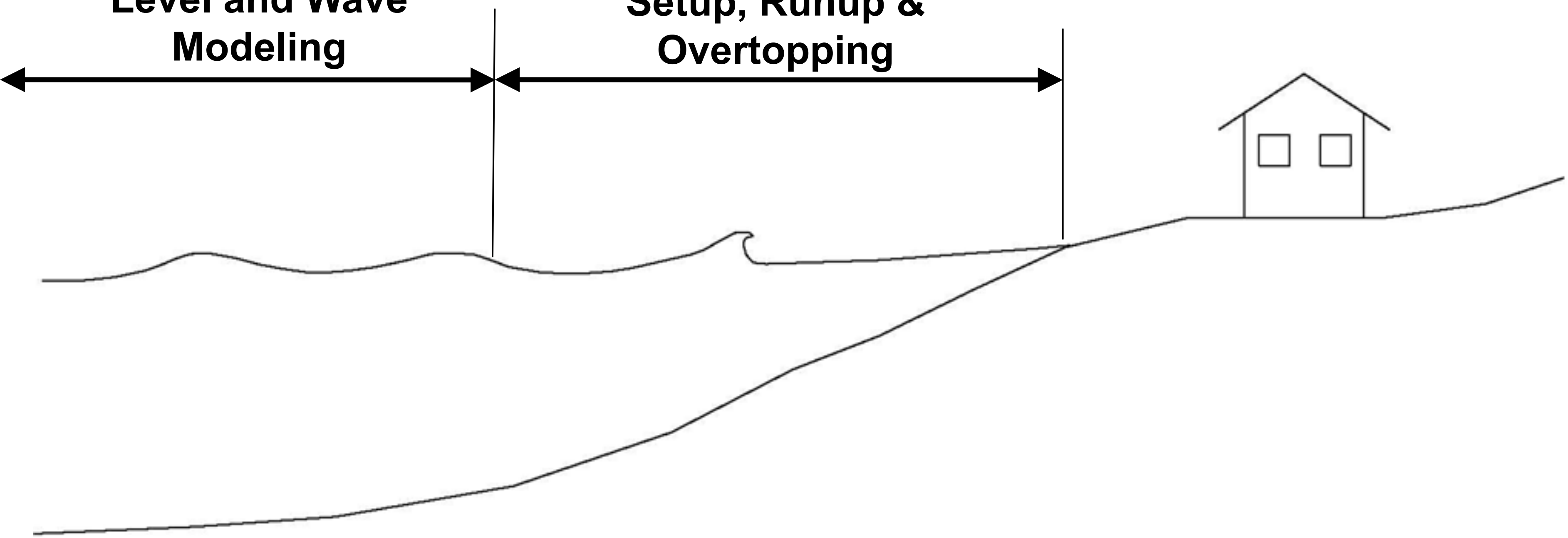
Lake-Wide Variation

Local Variation

Step 1: Offshore Water Level and Wave Modeling

Step 2: Nearshore Wave Setup, Runup & Overtopping

Step 3: Floodplain Mapping



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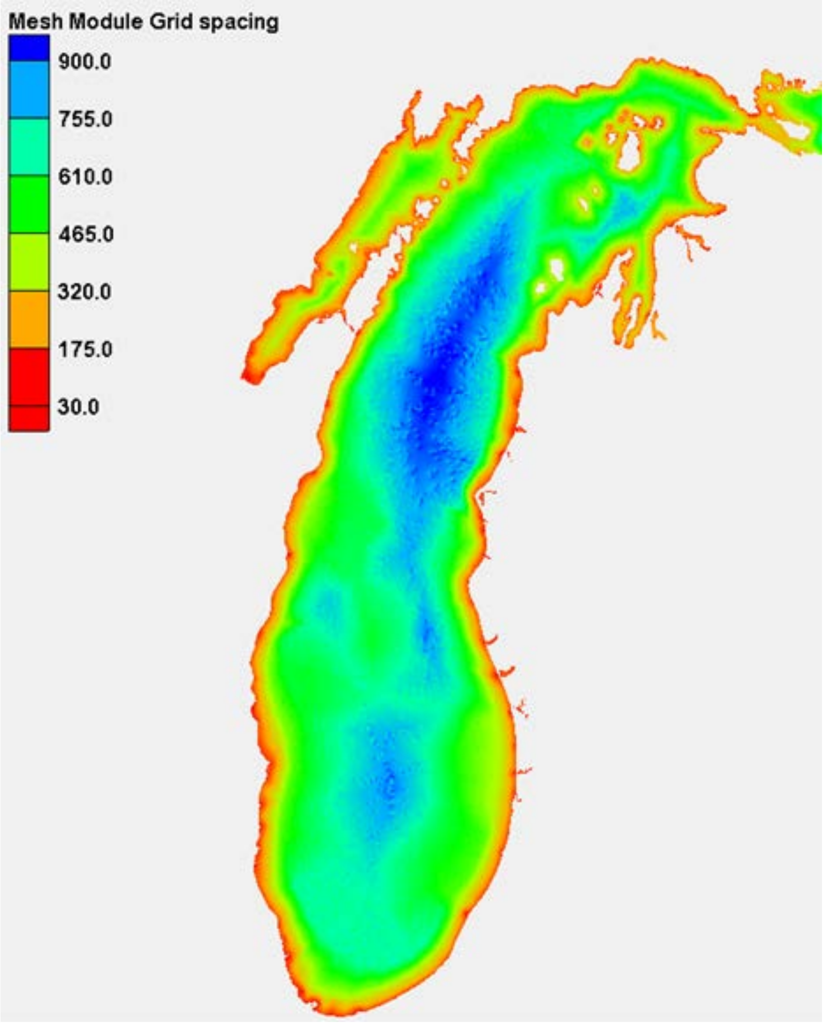
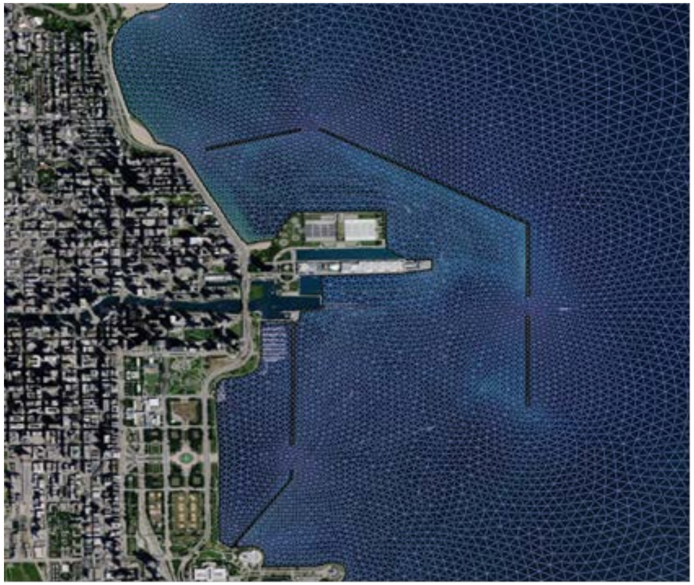
Step 1: ADCIRC+SWAN Mesh



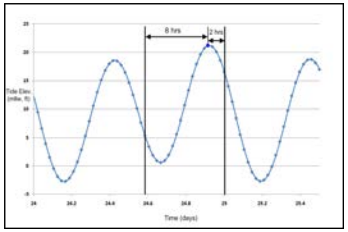
- Resolution as fine as 10 m along complex shoreline features including:
  - Jetties
  - Breakwaters
  - Inlets
  - Natural Shoals



Step 1: Run the Models

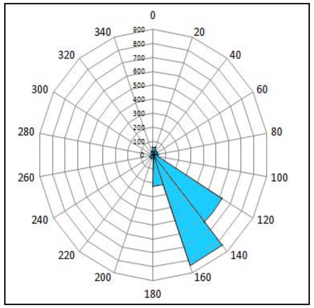
Baseline

Water Level

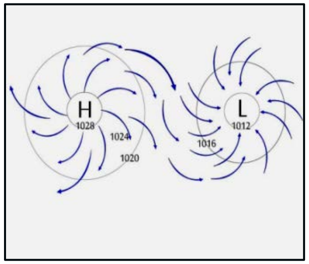


Meteorological Forcing

Wind



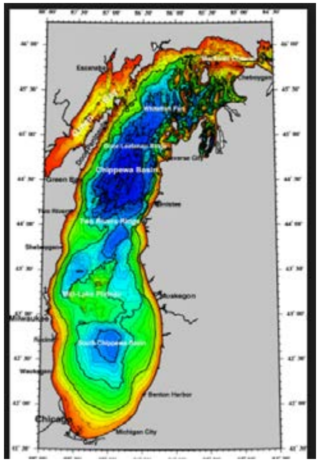
Pressure



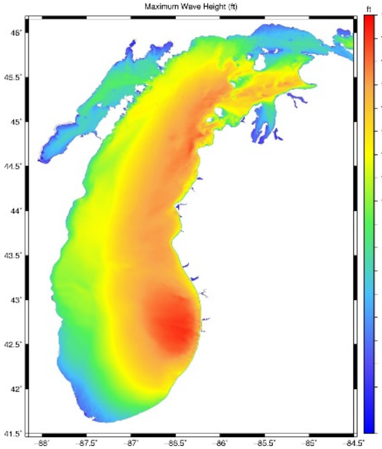
Ice

Physical Setting

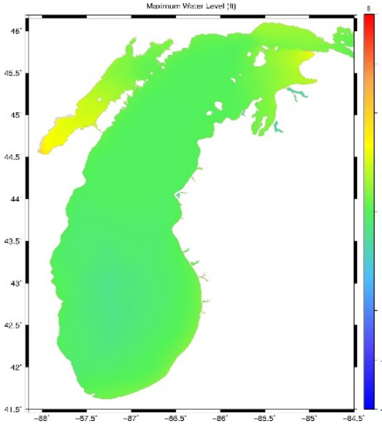
Bathymetry



Waves

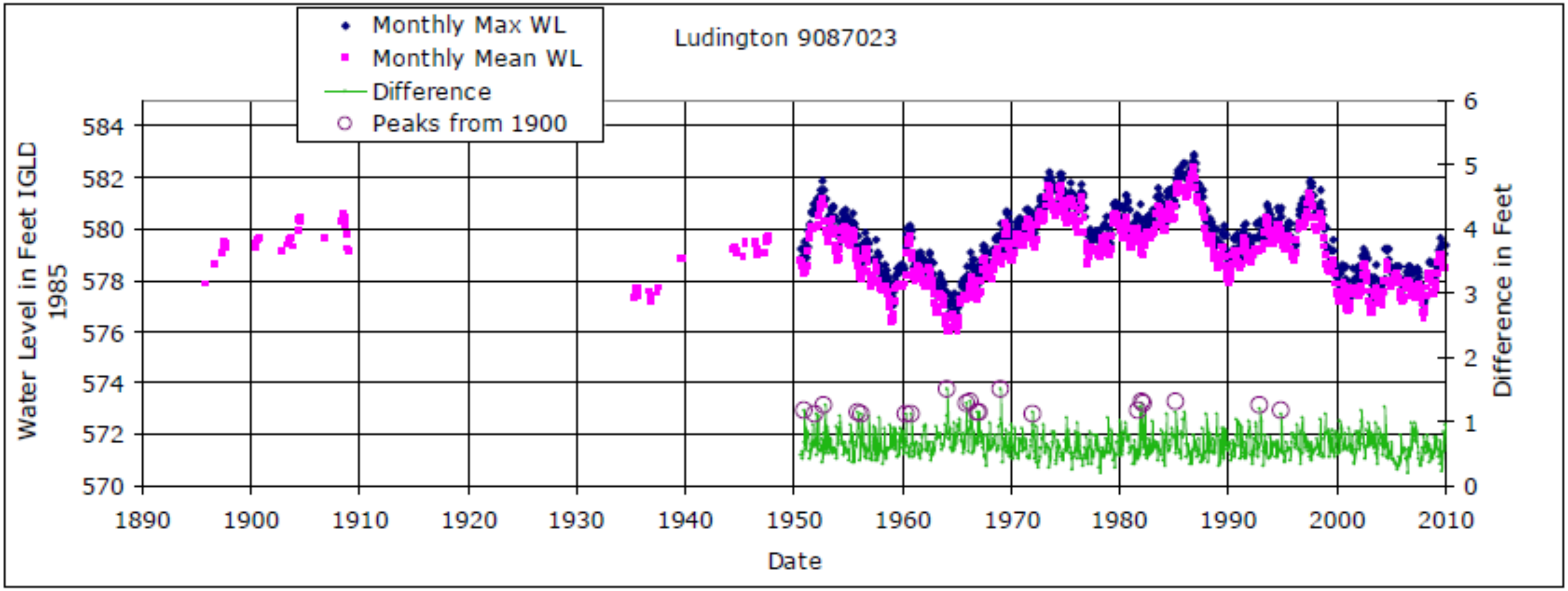


Still Water Elevations

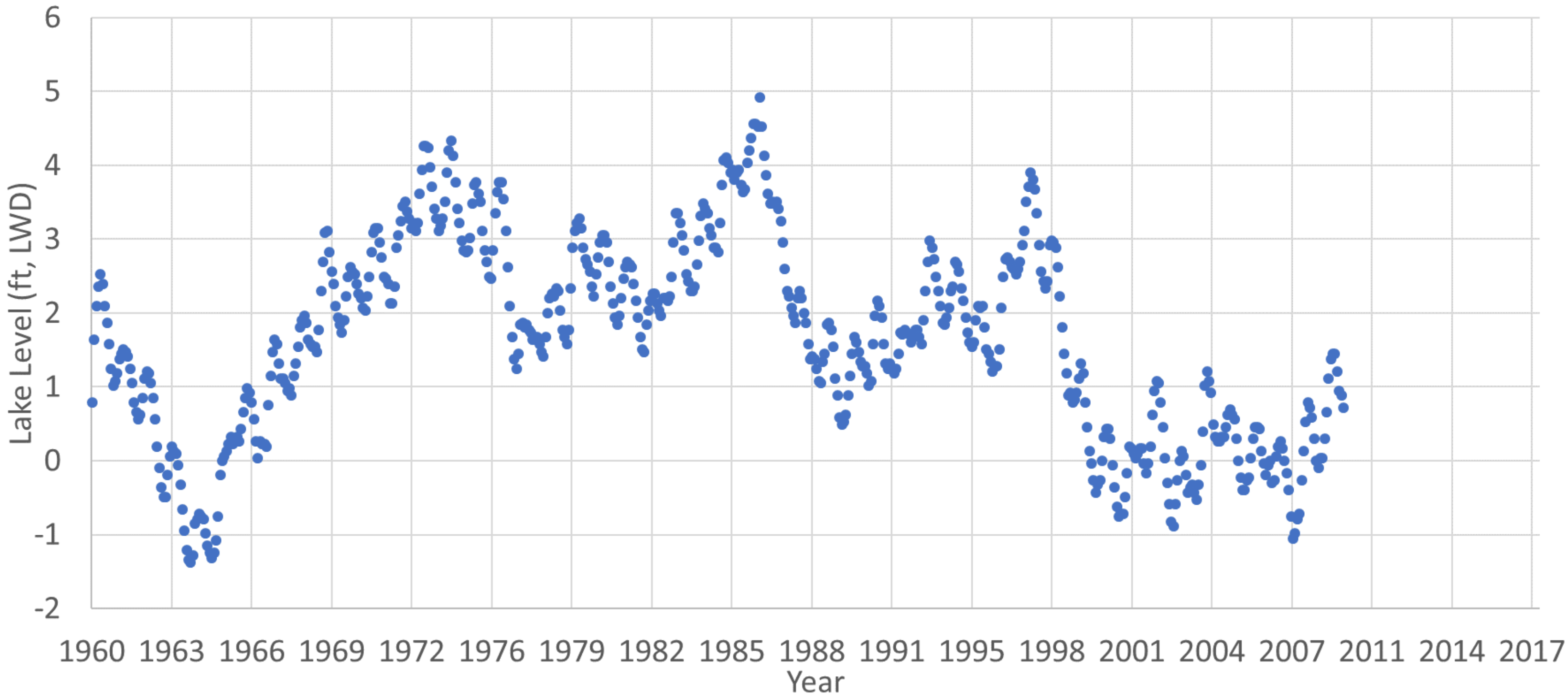


Total of 150 events between 1960-2009

Step 1: Lake Levels



Step 1: Lake Levels



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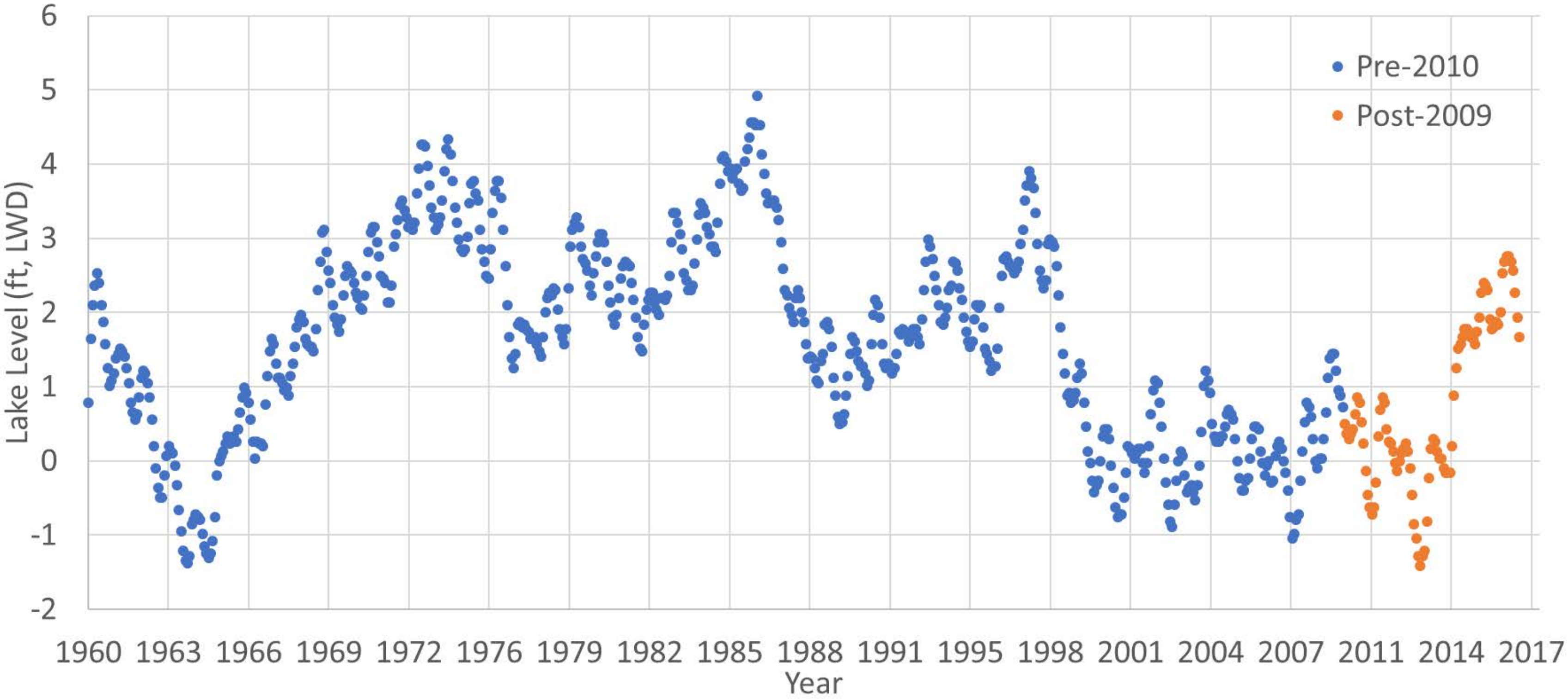
Step 1: Lake Levels



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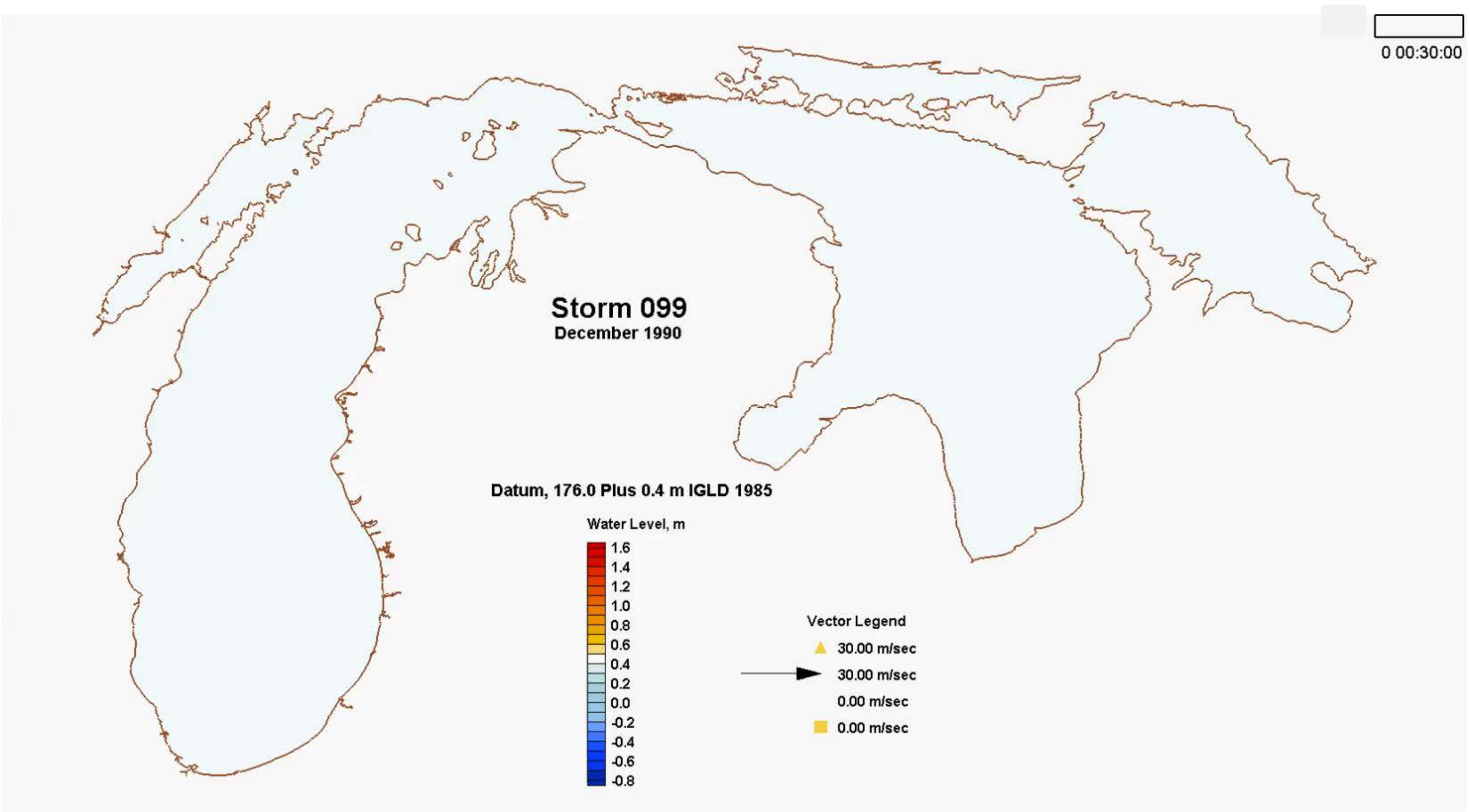
Step 1: Example Surge Behavior



Step 1: Water Level Accuracy Assessment

Station	1 percent annual chance still water level (m)	
	Measured	Simulated
NOAA 9087031	177.82	177.78
NOAA 9087044	178.10	178.02
NOAA 9087068	177.64	177.67
NOAA 9087072	177.78	177.69
NOAA 9087079	178.43	178.44
NOAA 9087080	177.80	177.71
NOAA 9087096	177.97	177.81

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

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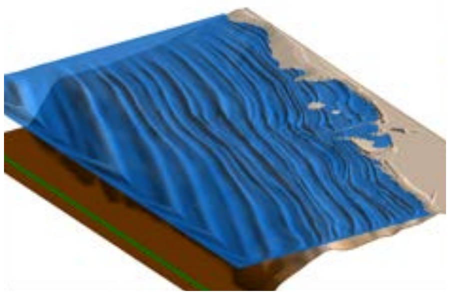
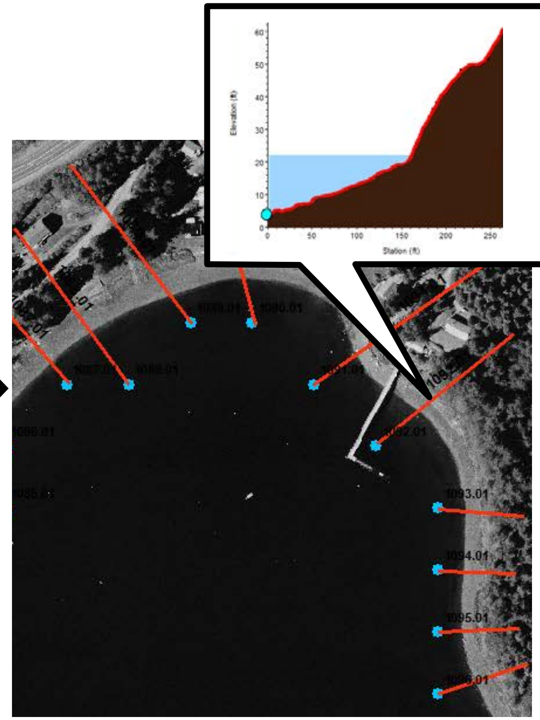
Step 2: Transect Analysis Overview

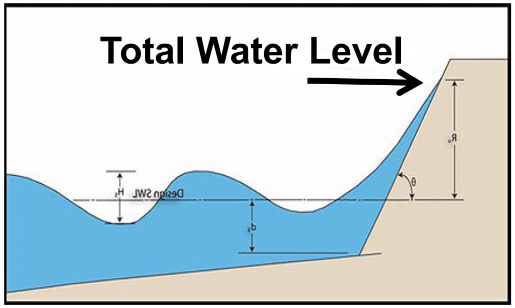
Water Level & Offshore Waves



Transect Analysis



Total Water Level

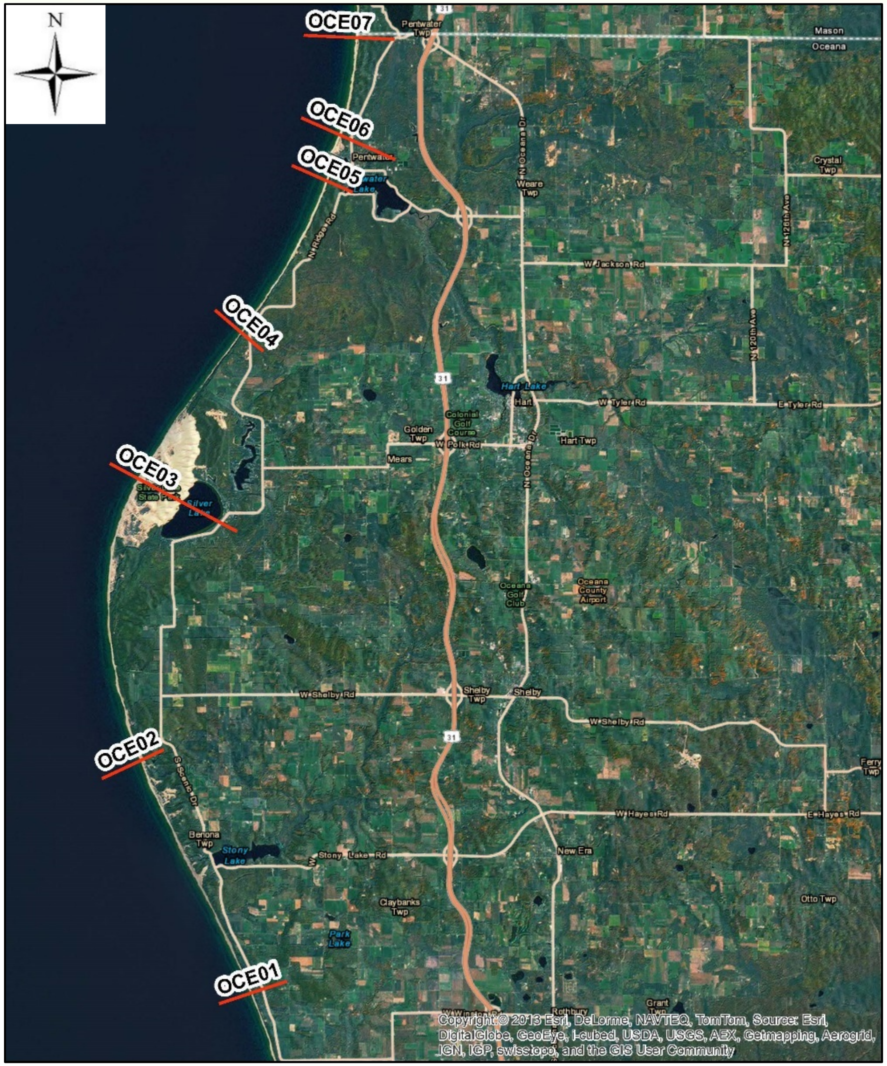


Total Water Level

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

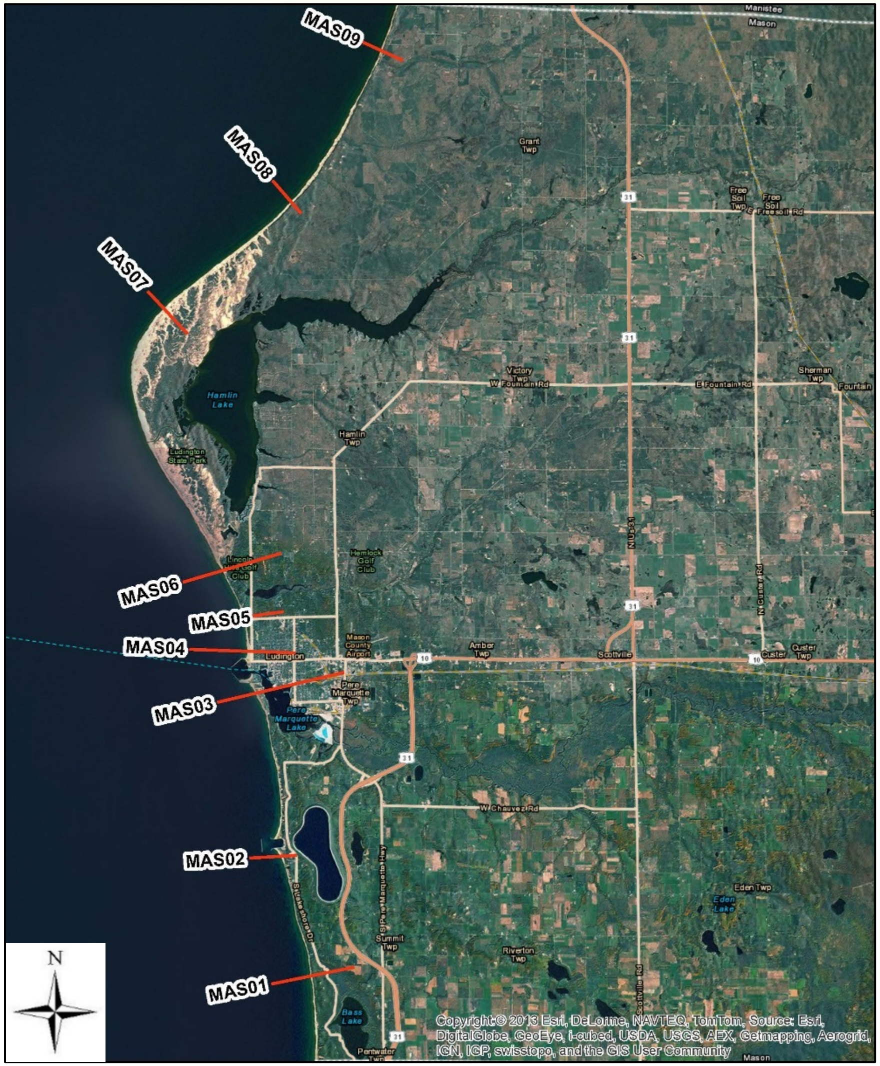
Step 2: Transect Layout

- Oceana County:
  - 7 Analysis Transects
  - 27 Shoreline Miles
- Transects placed at representative shoreline reaches based on:
  - Topography
  - Exposure
  - Shoreline Material
  - Upland Development



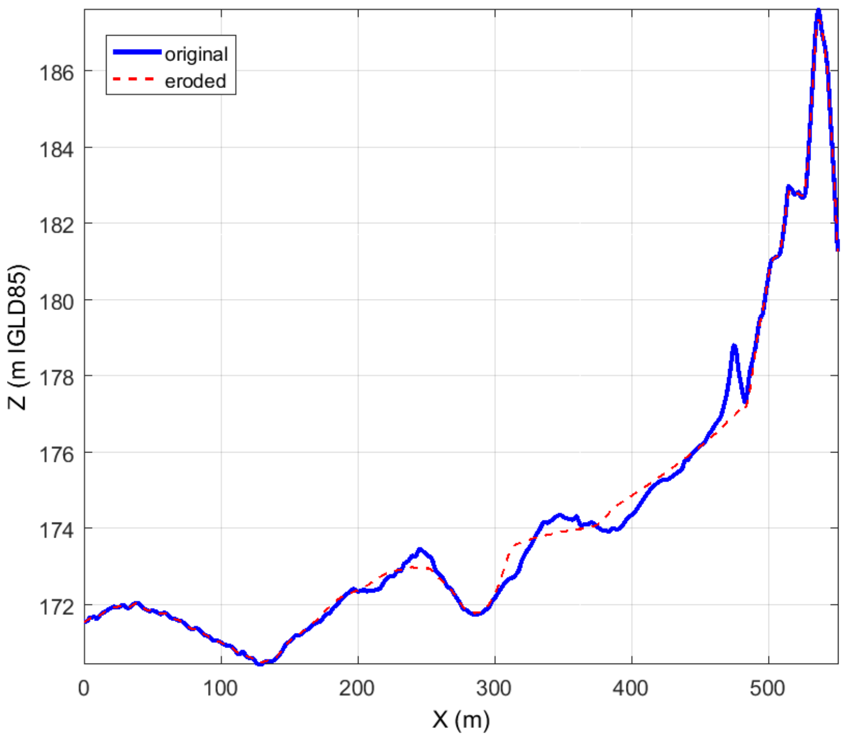
Step 2: Transect Layout

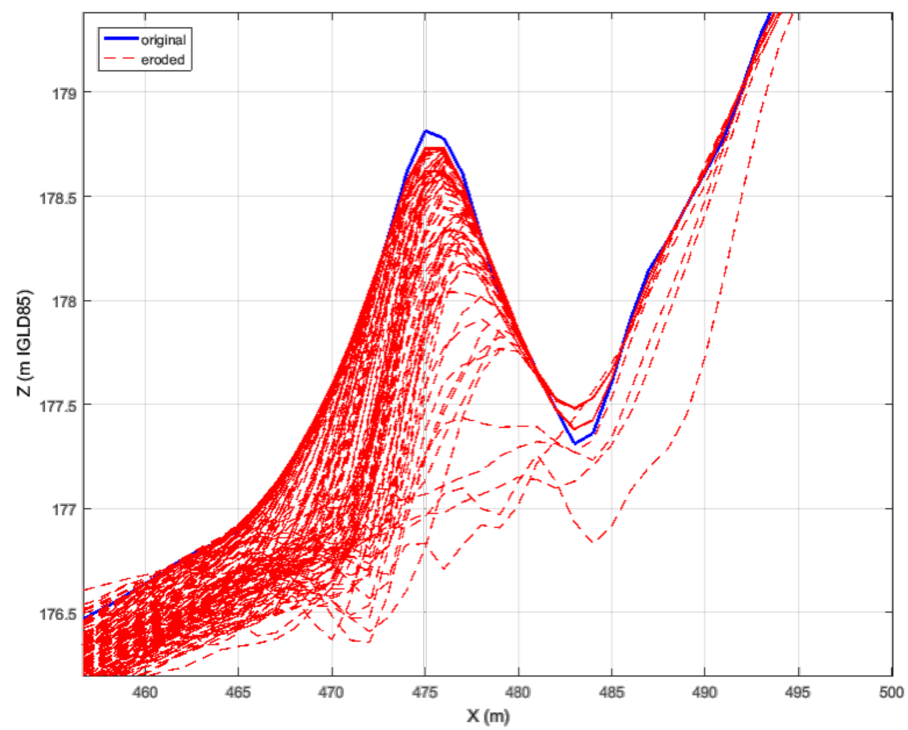
- Mason County:
  - 9 Analysis Transects
  - 32 Shoreline Miles
- Transects placed at representative shoreline reaches based on:
  - Topography
  - Exposure
  - Shoreline Material
  - Upland Development



Step 2: Erode Transect Profiles

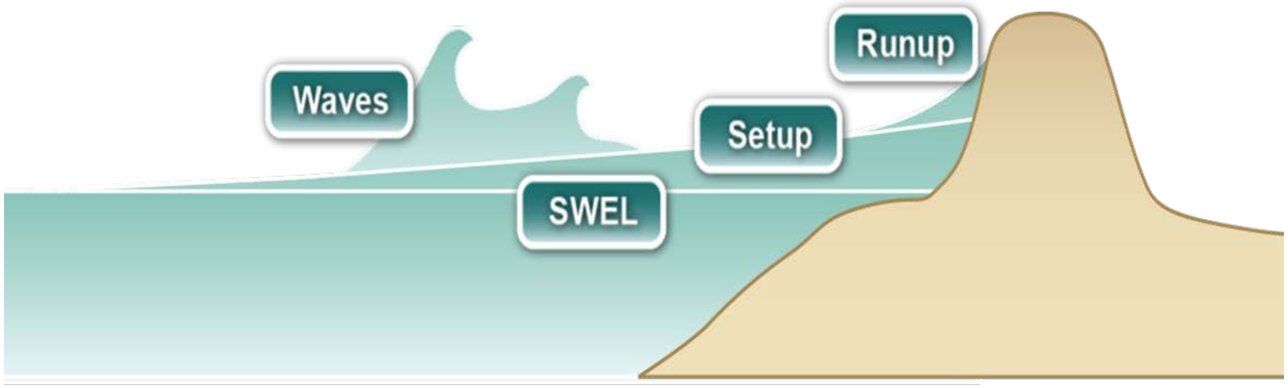
- Erosion analysis applied for sandy beach transects with gradual slopes.
- Eroded profiles are calculated using the USACE CSHORE model for each storm event.
- Influences wave setup, runup, and overtopping by affecting profile slope.





Step 2: 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

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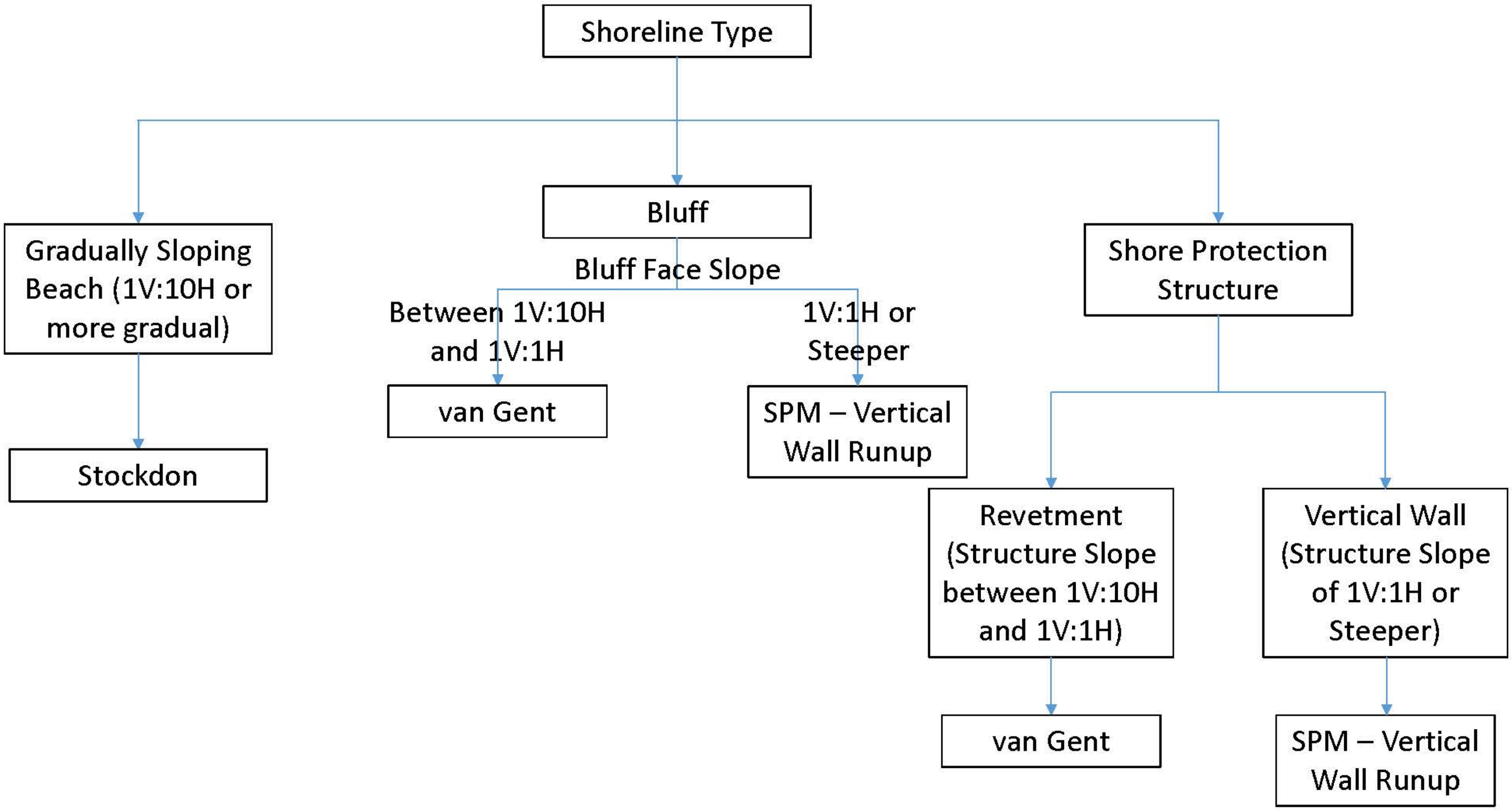
Response-Based Wave Runup

Runup Method Decision Flow Chart



Step 2: Runup

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

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Step 2: Overtopping

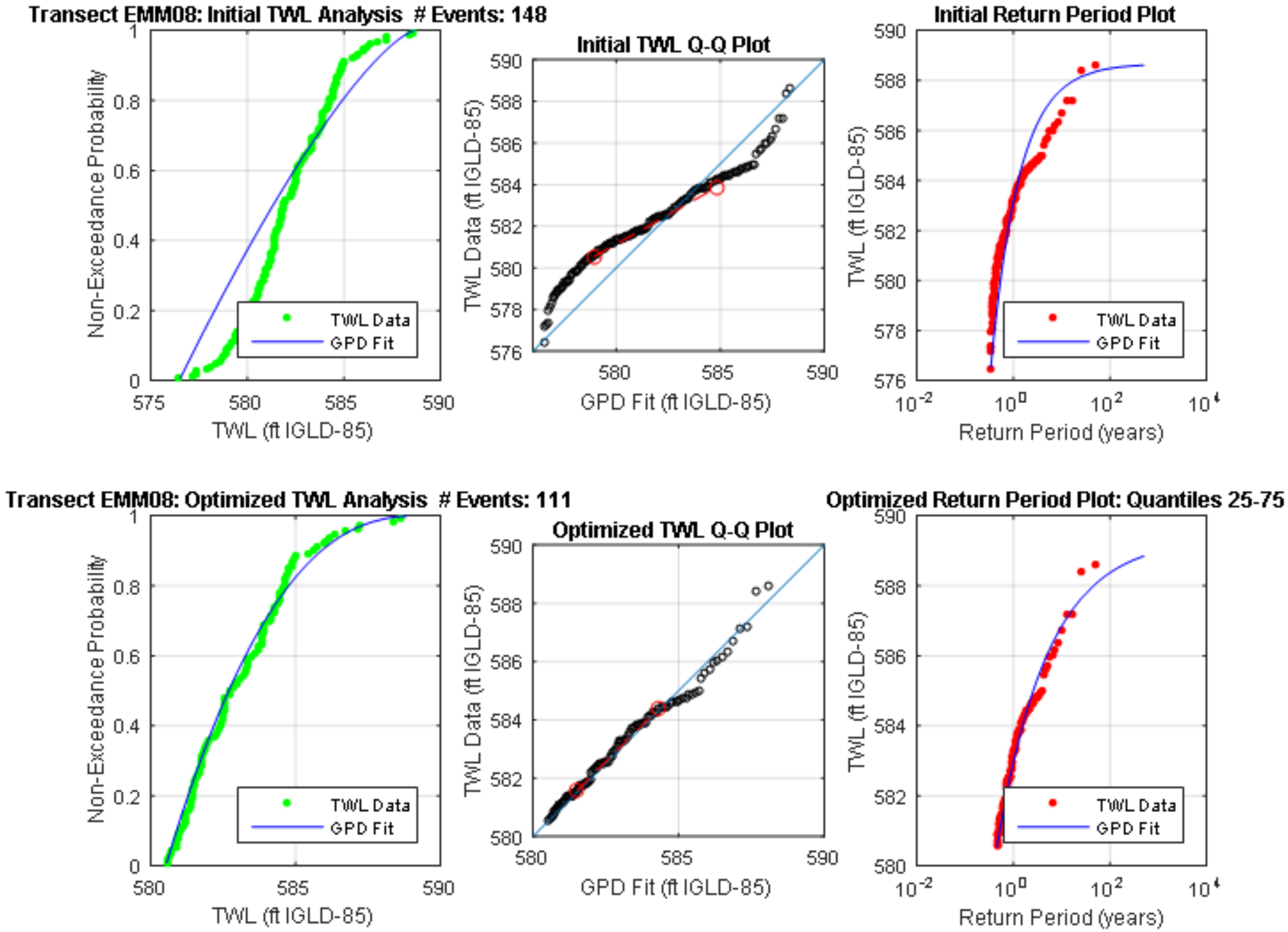
Green, M. Spencer. AP Photo. 2012. September 4,2014.

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

Step 2: 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)

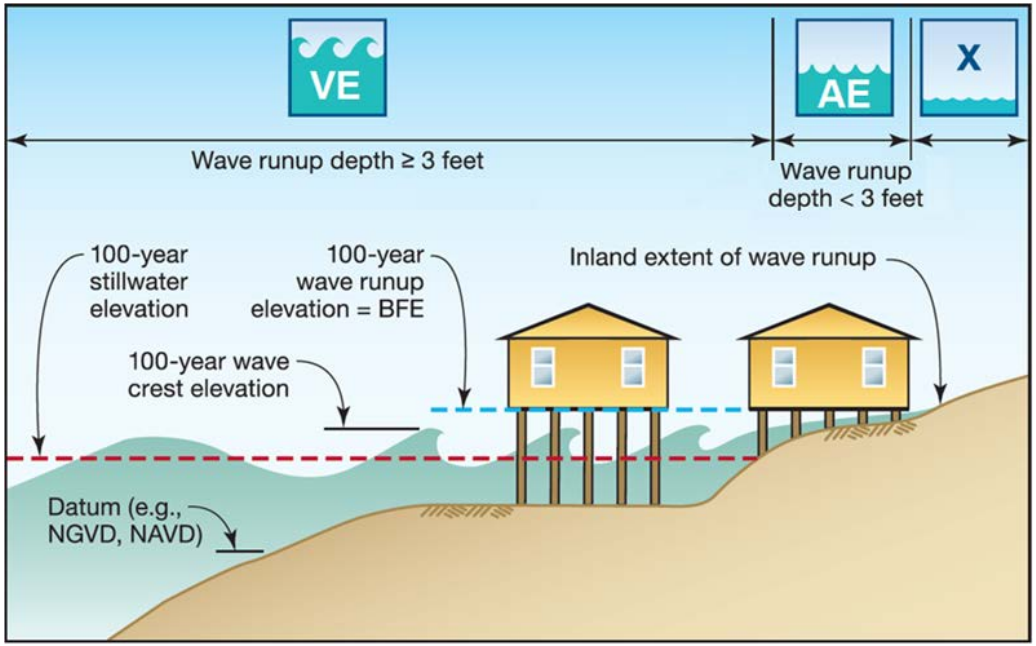
Step 2: Return Period Analysis



Step 3: Mapping

Coastal Flood Hazard Zones

- Zone VE:
  - Represents coastal high hazard areas
  - Wave heights ≥ 3ft
  - Wave runup ≥ 3ft above ground elevation
  - Overtopping splash zones
  - BFEs are assigned
- Zone AE:
  - Inundation areas
  - Wave heights < 3ft
  - Wave runup < 3ft above ground elevation
  - 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



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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

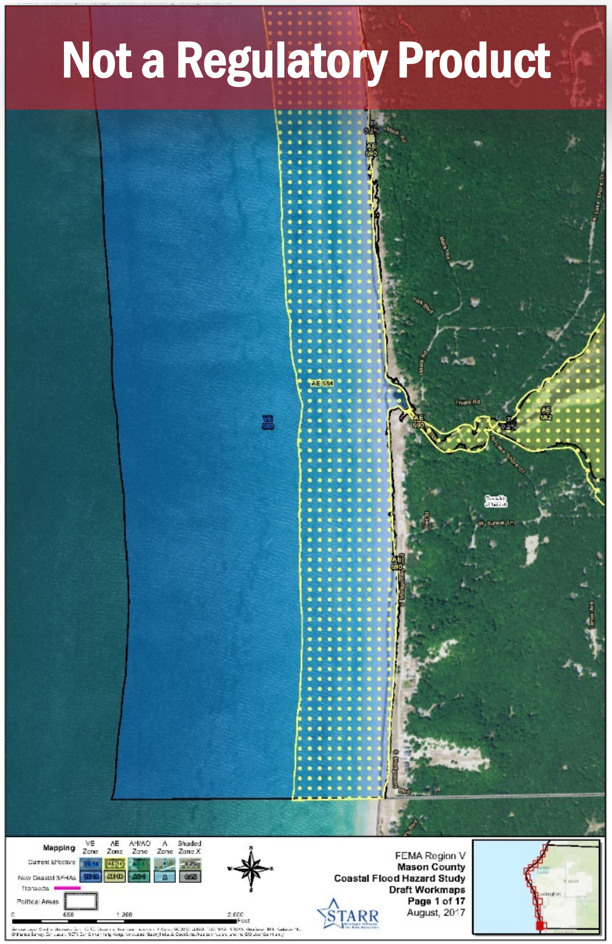
Step 3: Runup VE Zones

- Intact transects
  - VE zone mapped to elevation associated with TWL or structure crest elevation
- Failed transects (coastal structures)
  - VE zone mapped to station along the profile associated with TWL
  - Elevation may not match topography since mapping extent is associated with failed structure elevation
- Eroded profiles
  - VE zone mapped to station along the profile associated with TWL
  - Elevation may not match topography since mapping extent is associated with the eroded profile elevation

Step 3: SWEL Inundation

Draft Work Map vs FIS/FIRM

Mason County, MI Workmap



Mason County, MI Effective FIRM

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Oceana and Mason Counties, MI

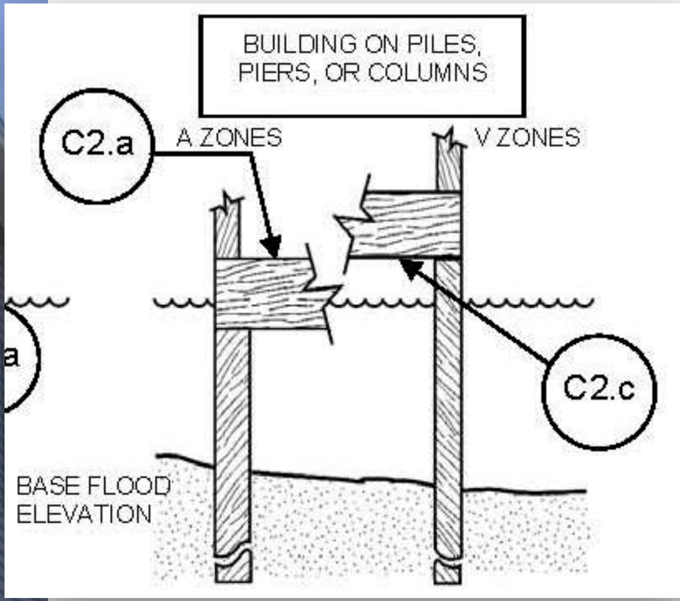
FEMA FLOODPLAIN MANAGEMENT

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



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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

SAMPLE

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

1.5: V ZONE DESIGN AND CONSTRUCTION CERTIFICATION

2 of 2 HOME BUILDER'S GUIDE TO COASTAL CONSTRUCTION

12/10

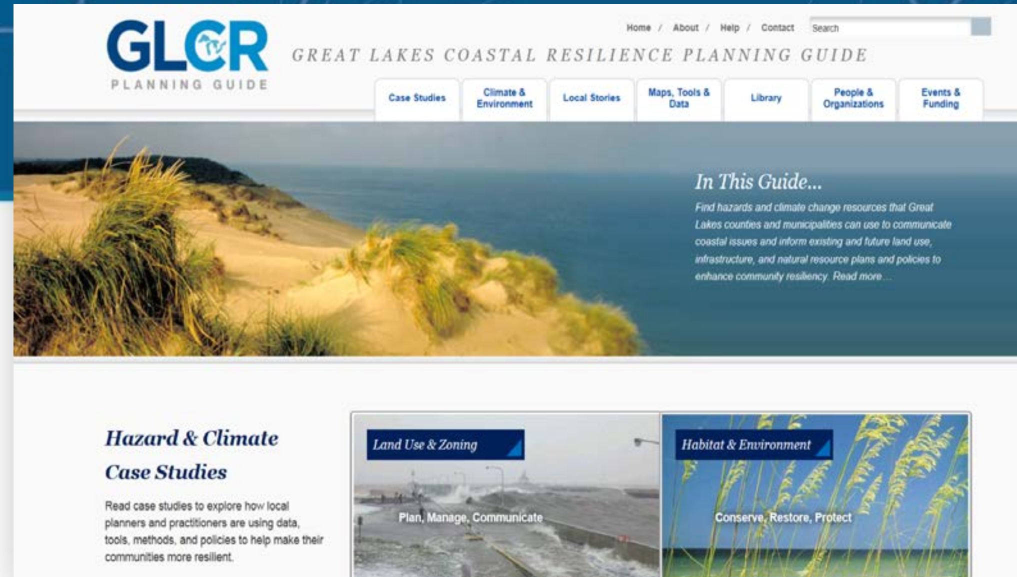
2 / 2

FEMA

RiskMAP
Increasing Resilience Together

Online Resources

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



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

FEMA

RiskMAP
Increasing Resilience Together

RiskMAP
Increasing Resilience Together

Oceana and Mason Counties, MI

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 October 28, 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

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Questions?

Thank you for your participation!