# Coastal Hazard Analyses and DFIRM Update For Maryland

### **FEMA Region III**

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Increasing Resilience Together





### Introduction

- State of MD Effective Coastal Studies
- Why a coastal restudy is needed?
- Elements of a Coastal Flood Insurance Study
- Ongoing FEMA Region III Storm Surge Modeling Effort
- Overland Wave Analysis Components
- Preliminary DFIRM schedules
- Outreach Efforts







### State of Effective Coastal Study

- Topographic data used for modeling and mapping date back to the Mid-1970's and mid-1980's from USGS maps
- SWELs go back to a 1978 VIMS study for the Chesapeake Bay and Tidal Gage Analysis on the Atlantic Coast.
- Coastal studies date back to late 1970's and early 1980's
- Wave height determined with NAS method.
- Erosion analysis not performed
- Wave setup not accounted for
- Limited WHAFIS and/or wave runup modeling performed







## Why a coastal restudy is needed?

- New Guidelines need to be implemented
  - Atlantic Ocean and Gulf of Mexico Guidelines Update (2007)
  - Sheltered Water Report (2008)
  - *PM* 50 *Limit of Moderate Wave Action (LiMWA) (*2008*)*
- To update base data such as topographic dataset and aerial imagery to high resolution products and seamless Digital Elevation Model (DEM)
- To utilize newer coastal hazard methodologies developed during the FEMA Mississippi Coastal Restudy
- To take advantage of higher performance numerical modeling
- To take advantage of improvement in GIS technologies to allow for more accurate FIRMs







#### Hurricane Isabel Sept 19, 2003 – MD CHWMs









## Elements of a Coastal Flood Insurance Study

- BFE on a FIRM includes 4 components:
  - 1. Storm surge stillwater elevation (SWEL)
  - 2. Wave setup (from 2D wave modeling)
  - 3. Wave height above total stillwater elevation
  - 4. Wave runup above storm surge elevation All applied to an eroded beach profile
- The above components are computed through:
  - 1. Terrain processing and profile erosion
  - 2. Storm surge study for SWELs determination
  - 3. Coastal Hazard Analyses

Floodplain boundaries, flood hazard zones and LiMWA are then









### Scope of Coastal Surge Analysis Study

• All of Region III coastal counties/cities (Atlantic Ocean Chesapeake Bay, Delaware Bay and their tributaries)









## Ongoing FEMA Region III Storm Surge Modeling Effort

- Current stillwater elevations (SWELs) on FIRMs date back to 1973-1986 (few updates made in early-1990s) and were computed using a tidal gage analysis or the VIMS model
- SWELs will be updated for 50 coastal counties covering approx. 2280 miles of shoreline
- State-of-the art modeling setup by using ADCIRC soft coupled with the 2D wave model SWAN
- Obtain updated 10%, 2%, 1% and 0.2% annual chance stillwater elevations, wave setup and wave conditions for nearshore open-coast and back-bay shorelines







### Storm Surge Project



US Army Engineer Research and Development Center



#### **Project Status – October 2010**

- ✓ Submittal 1 comments received; replies in preparation
  - Study area description
  - DEM, Mesh
  - Modeling approach
  - Storm selection
- ✓ Submittal 2 target 29 October
  - Modeling system validation
  - Hurricanes Ernesto and Isabel
  - Extratropical Storm Ida
- ✓ Production target November 2010 February 2011



oceanweather inc.

Jeff Hanson Region III Storm Surge Project Manager USACE-FRF













### **Modeling System Validation**

#### Validation Storms

- Hurricane Isabel (SEP 03)
- Hurricane Ernesto (AUG o6)
- Extratropical Storm Ida (Nov 09)

#### Validation Parameters

- Tides
- Wind speed and direction
- Wave height, period and direction
- Water levels
- High water marks





US Army Engineer Research and Development Center

### Hurricane Isabel September 2003





#### Hurricane Isabel Wind Speeds:

#### **OWI Reconstruction vs. Observations**



#### **High Water Marks:**

#### Hurricanes Isabel and Ernesto

#### Hurricane Isabel September 2003



US Army Engineer Research and Development Center



Circles depict observed high water marks to same color scale as background surge predictions





### **Coastal Hazard Analyses Components**

- Transect layout
- Field Reconnaissance (land use, obstructions, shoreline conditions, structures)
- Starting wave conditions (wave height and period) from 2D wave modeling eliminating the need for limited fetch analysis
- Wave setup from 2D wave modeling
- Primary Frontal Dune (PFD)
- Dune erosion: 540 sqft rule
- Bluffs erosion
- WHAFIS modeling for overland wave height computation
- 2% Wave Runup
- All above analyses will be performed with the Coastal GeoRAMPP tool







### **Transect Placement**





Harford County, Proposed Transect Layout for the Havre de Grace area



## Field Reconnaissance

Kent County, MD Transect No. 025 - Point No. 001 Team 001 (Jesse Hayden, Joe Faries) 4/30/2010

**Location Description :** Indiana Ave. Shoreline is a very steep slope with 2ft high riprap at the bottom of the slope. Nearby buildings are all atop the slope, but shoreline protection is not continuous.

Point Type : N/A

Latitude, Longitude (decimal degrees): 39.23345, -76.23117

Building Description : Buildings are on grade at elevation of cliff, which is 20ft+.

Vegetation Description : Mixed forest vegetation, with 6 inch diameters, 50 feet avera

Marsh Description :

Coast Description : Cliff, Rocky, Vegetated

Fetch Description : Open Fetch



Photo Type : Offshore Direction & Description : Direction: 315 degrees



Photo Type : Left Direction & Description : Direction: 20 degrees

**Photographs and Descriptions** 



Photo Type : Onshore Direction & Description : Direction: 115 degrees



Photo Type : Right Direction & Description : Direction: 200 degrees







## Development of a Seamless Digital Elevation Model (DEM)

- Topo and Bathy data collected from USACE
- Shoreline extracted from LiDAR data
- Topo, Bathy and shoreline data are merge to create a seamless DEM
- USACE DEM for surge was generated at a 10 m resolution
- DEMs for DFIRM studies are generated at 3 m resolution to allow more higher modeling and mapping detail.







Example of Kent and Queen Anne's 3m (10ft) seamless DEM





### **Erosion Analysis**

- Dunes:
  - Dune erosion based on the 540 sqft rule
  - Dune retreat
  - Dune removal
  - Primary Frontal Dune (PFD) delineation
- Bluffs, Cliffs:
  - Non-standard erosion based on historic data



### **Overland Wave Hazard Modeling**

- WHAFIS 4.0
  - Profile elevation
  - 1% SWELs
  - Starting wave conditions
  - Wave Setup
  - Obstruction cards (OF, IF, BU, VE, MG)









### Wave Runup

- FEMA G&S 2007 requires the use of the 2% runup vs. the mean runup computed prior to 2007
- Mild-sloping beaches, bluffs and cliffs
- Coastal Structures:
  - Will structure survive the 1% event?
  - Is structure certified?
  - Modeling of integral structure vs. fail structure to determine higher hazard
  - Runup on structures limited to 3 ft on top of the structure's crest w/overtopping possible AO Zone
- Methods:
  - Runup 2.0, TAW, ACES, SPM







## MD Coastal Overland Wave Height Analysis Status

- Modeling set-up
  - Transect Layout all 17 studies completed
  - Field Reconnaissance 12 studies completed, 5 to be performed 11/2010
  - Obstruction carding 12 studies completed, 5 in progress
  - Topo/bathy /shoreline development 12 studies in progress
- Wave height analysis (waiting on surge results)
  - Starting wave conditions (wave height and period)
  - Wave setup
  - Primary Frontal Dune (PFD)
  - Dune/Bluff erosion
  - WHAFIS modeling for overland wave height computation
  - 2% Wave Runup







### Mapping









## Limit of Moderate Wave Action ----LiMWA

- FEMA Procedure Memorandum No. 50, 2008
- At present not a regulatory requirement
- No Federal Insurance requirements tied to LiMWA
- CRS benefit for communities requiring VE Zone construction standards in areas defined by LiMWA or areas subject to waves greater than 1.5 ft.







## Draft MD Preliminary DFIRM Schedules

- Harford County- 10/29/2011
- Cecil and Baltimore Counties, Baltimore City 11/29/2011
- Talbot, and Caroline Counties 2/28/2012
- Dorchester, Wicomico, Somerset Counties 2/28/2012
- Prince George's County 2/1/2012
- Charles County 3/1/2012
- Worcester County 4/31/2012
- Saint Mary's County 5/15/2012
- Calvert and Queen Anne's Counties 6/1/2012
- Anne Arundel County 7/1/2012
- Kent County 8/1/2012







## **Coastal Study Outreach Efforts**

- Coastal Outreach Strategy
- Outreach meetings
  - Initial outreach (scoping) meetings for each county
  - Regional technical storm surge study meetings
  - Flood study review meetings for some counties
  - Final community meetings for each county
  - Open houses for some counties
- Website <u>www.r3coastal.com</u>







# **Questions?**





