Barrier Island Coastal Hazard Analysis and Mapping

Chris Mack
Agenda

• Overview of the coastal study process and phases for GA-NEFL
• Overview of the Primary Frontal Dune (PFD) considerations
• Overview of the WHAFIS model (Wave Height Analysis for Flood Insurance Studies) and Erosion Treatment
• Overview of WHAFIS tests of Tybee Island, GA
• Q&A
Study Project Area

<table>
<thead>
<tr>
<th>NEFL</th>
<th>Georgia</th>
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<tbody>
<tr>
<td>Duval</td>
<td>Bryan</td>
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<td>Flagler</td>
<td>Camden</td>
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<td>Nassau</td>
<td>Chatham</td>
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<td>St. Johns</td>
<td>Glynn</td>
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<td>Volusia</td>
<td>Liberty</td>
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Basic Elements of a Coastal Study

Base Flood Elevation (BFE) on FIRM includes four components:

1. Storm surge stillwater elevation (SWEL)
2. Amount of wave setup
3. Wave height above storm surge (SWEL) elevation
4. Wave runup above storm surge elevation (where present)

Determined from storm surge model
Storm Surge Modeling – ADCIRC and JPM
Overland Wave Modeling – WHAFIS

Wave height ≥ 3 ft
3 ft > ft Wave height > 1.5 ft
1.5 ft > Wave height

BFE including wave effects
Properly elevated building

100-year stillwater elevation
Datum

Unelevated building constructed before community entered the NFIP

Shoreline  Sand beach  Buildings  Overland wind fetch  Vegetated region  Limit of SFHA
Flood Hazard Mapping
FEMA defined PFD in 44 CFR, Section 59.1 (October 1, 1988):

*Primary frontal dune* means a continuous or nearly continuous mound or ridge of sand with relatively steep seaward and landward slopes immediately landward and adjacent to the beach and subject to erosion and overtopping from high tides and waves during major coastal storms. The inland limit of the primary frontal dune occurs at the point where there is a distinct change from a relatively steep slope to a relatively mild slope.
PFD Identification

PFD “Footprint”
VE Zone
Wave Crest Profile
100-year SWEL

Heel
Toe
Dune Reservoir – The “540 Square Foot Rule”

FEMA also included a new section in Part 65 of the NFIP regulations, identifying a cross-sectional area of **540 square feet** as the basic criterion to be used in evaluating whether a PFD will act as an effective barrier during the 1-percent-annual-chance flood.

**Two Cases:**

1. Dune Retreated?
2. Dune Removed?
Dune Reservoir (cont.)

Dune Reservoir (540 sq. ft. ?)
Erosion Treatment

Dune Cases - Retreated or Removed

Dune Reservoir >540 square feet
= Dune Face Retreat

Dune Reservoir <540 square feet
= Dune Removal

1:12.5 slope
1:40 slope
1:1 slope
1:50 slope

100-year SWEL

Barrier Island Coastal Hazard Analysis and Mapping
Removal – PFD/WHAFIS

![Diagram](image-url)
Removal – Mapped Flood Zones

Zone X

Wave Attenuation
AE Zone (EL 10)

VE 11

Wave Propagation
VE Zone (EL 14)

VE 14

PFD VE Zone (EL 11)

Zone VE (EL 14)

Ocean
Retreat – PFD/Runup
Retreat – Mapped Flood Zones

Zone X

Zone VE (EL 13)

Wave Runup & PFD

VE 13

X
PFD Data Sources

• Topography (from LIDAR)
• Beach profiles (from profile/transect surveys)
• Aerial photographs
• Field notes
Tybee Island WHAFIS Tests

Wave height ≥ 3 ft
3 ft > ft Wave height > 1.5 ft
1.5 ft > Wave height

BFE including wave effects
100-year stillwater elevation
Datum

Properly elevated building
Unelevated building constructed before community entered the NFIP

Shoreline Sand beach Buildings Overland wind fetch Vegetated region Limit of SFHA
Study Data – Topography and Bathymetry

2009 LiDAR

-9 - 0
0 - 4
4.0000000001 - 6
6.0000000001 - 8
8.0000000001 - 10
10.0000000001 - 12
12.0000000001 - 14
14.0000000001 - 16
16.0000000001 - 18
18.0000000001 - 48.03699875
2008 Tybee Nourishment

- November 2007 Pre-Construction Survey by Arc Surveying and Mapping
- Between October and November 2008, 1.2 million CY of sediments placed between monitoring stations 6 and 13A
- Berm design elevations +7-ft NAVD88 (+11-ft MLW)
- No clear dune construction in profiles
Tybee Beach Topo Analysis
These Tybee Beach Analysis Transects mimic the annual monitoring transects collected by the Town and do not reflect the AECOM Modeling transects that will be used for the FEMA flood study.
*The ground profile includes only the elevations below the 1%SWEL elevation. Such profile may be truncated and may not include fully the Primary Frontal Dune area or the extent of the wave runup profile.

**AO zones are not depicted in this profile.
Test Profile Analysis – T2

Combined Profiles: Transect 2

*The ground profile includes only the elevations below the 1%SWL elevation. Such profile may be truncated and may not include fully the Primary Frontal Dune area or the extent of the wave runup profile.

**AO zones are not depicted in this profile.
Combined Profiles: Transect 3

*The ground profile includes only the elevations below the 1%SWEL elevation. Such profile may be truncated and may not include fully the Primary Frontal Dune area or the extent of the wave runup profile.

**AO zones are not depicted in this profile.
Test Profile Analysis – T4

Combined Profiles: Transect 4

The ground profile includes only the elevations below the 1% SWELElevation. Such profile may be truncated and may not include fully the Primary Frontal Dune area or the extent of the wave runup profile.

** AO zones are not depicted in this profile.**
Survey Mapping (Draft)
Comparison (Draft)
Conclusion

• At the open coast, water depths control wave sizes.

• For some barrier islands, the PFD v-zone requirement will supersede WHAFIS computed water surface elevations (and flood zones).

• Although larger berms will reduce wave energy at the open coast (due to shoaling and wave dissipation), changes to computed flood zone elevations upland of the PFD are negligible.
Thank You