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## ABSTRACT

## FEMA's New Coastal Zone Flood Maps for Cumberland County

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This past summer FEMA released new flood zoning maps (FIRMS) for the coastal municipalities of Cumberland County. These maps were released for municipal review prior to a formal start of a 90-day appeal period, which now appears as though it will not begin before the end of 2009. There are several "new" things about these maps: 1) the use of LIDAR and ArcGIS to establish a fairly accurate (± 6 inches) topographic map base on to which to place calculated flood levels; 2) the use of a new set of methods and procedures promulgated by FEMA for determining coastal flood zone hazard—particularly the V-zone extent; 3) the vertical reference datum has changed from NGVD29 to NAVD88 (0.7' difference); 4) elevations were increased 0.05' for a change in sea level from the 1980's to now. Residential flood insurance will cost over $7000 per year. No new calculations were made on inland freshwater bodies but the position of the flood lines on the map were moved to adjust previously-calculated elevations to the new LIDAR-determined contour lines. Further, FEMA did not perform new transect calculations on some of the inner Casco Bay towns such as Falmouth, but rather adjusted previously-calculated V-zone lines to conform to new LIDAR-determined contour lines.

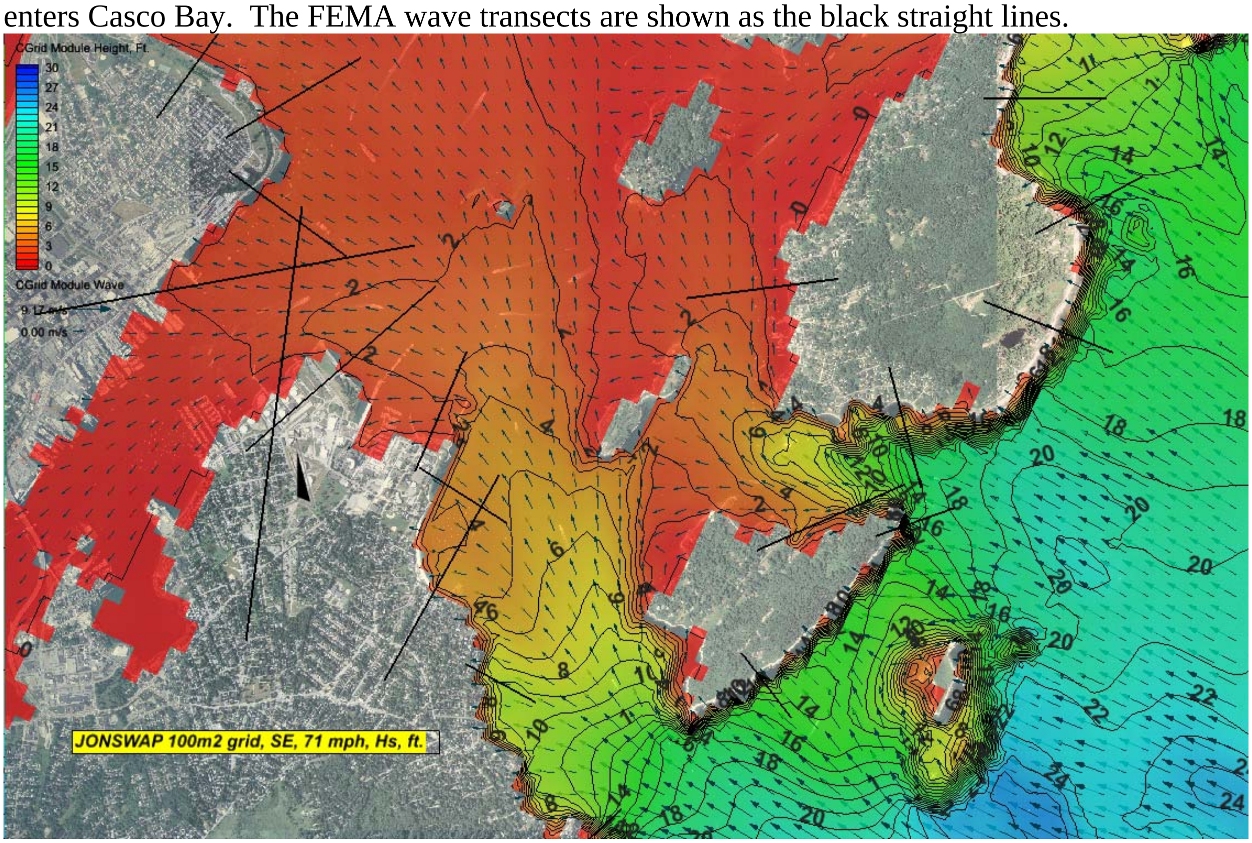
For those municipalities in which FEMA performed new wave transect calculations according to the new guidelines, most of the V-zones have migrated higher and landward from their previously-calculated positions from the 1980's. There has been significant media attention around the fact that almost all of the Portland waterfront would be placed in a V-zone, whereas it is not currently in a V-zone. The City is very concerned that the "working waterfront" concept is dead if this V-zone determination becomes final. In other areas, such as along the South Portland shoreline just north of the Cape Elizabeth boundary, the V-zone elevation has increased, for example, from elevation 18 to 41 feet NAVD88. Most previously granted LOMAs and LOMRs will be superseded by the new maps. Shoreline structures are assumed to fail unless "certified" by a P.E. to be able to withstand the 100-year storm.

Portland, South Portland, Cape Elizabeth and Falmouth have each retained Sebago Technics to do a critical evaluation of the FEMA calculations. Although our work is not yet complete, we have found several issues that seem to result, for the most part, in higher elevations of V-zones than should rationally be the case:

- Use of 71 mph wind (from a structural engineering wind chart of the United States) to generate fetch-derived waves;
- Use of simple 2-D models that over-estimate wave height compared with 3-D wave models;
- Lack of comparison of historical wave runup with predicted wave runup on transects (particularly for the Patriot's Day storm, which is close to the 100-year storm parameters)

- Extrapolation from worst case transect locations to long lengths of shoreline that have different runup characteristics (e.g., there is only one transect for the north side of Portland Harbor).

We are currently evaluating Casco Bay area wind data from the Jetport weather station (data from 1930 to present) and the NOAA offshore weather buoy (1980-present) to determine the 1% annual chance, one-hour duration wind to replace the "handbook" curves. Preliminary data suggests the local value will be more like 55 to 60 mph. The FEMA "critical" wave height (equivalent to the average of the 1% highest waves during the 2 hours of the peak of the 100-year storm) is estimated from local fetch-generated waves within the Bay or from the 1% annual chance wave calculated from the statistics of the NOAA offshore buoy, depending on the particular shoreline exposure. Smaller wind velocities will produce smaller initial wave heights at the beginning of the wave transects along which FEMA uses a 2-D wave model called WHAFIS to propagate a fetch-limited wave to the shore. The problem with the use of the offshore 1% wave is that this height of wave (26.6 feet for the average of the one-third highest waves, Hs) rarely reaches the shore because of shoaling and refraction in shallower waters as it approaches the shore. Wave setup and other characteristics used in determining the V-zone are based on the "deepwater" wave height and this height is more likely in the 10' to 20' range, for example, along the Cape Elizabeth shoreline. This determination is based on our use of the 3-D wave model STWAVE which starts the 1% wave in very deep water offshore and brings it toward shore from various compass directions in combination with the 100-year wind velocity. The small excerpt of one wave contour map below illustrates the way a wave attenuates as it enters Casco Bay. The FEMA wave transects are shown as the black straight lines.




Finally, wave runup is based on another set of models and calculations. Here, the most sensitive parameter is slope roughness. The FEMA models assume slopes equivalent to smooth plane concrete, and very few slopes have that degree of smoothness.  Although the FEMA guidelines require a review of historical runup data to temper the calculations, there is no evidence this was done here.

In a meeting we had with FEMA and the City of Portland recently, FEMA agreed to accept locally-derived wind data, and to accept the use of STWAVE to generate the initial waves for the WHAFIS transect models for municipalities where we can show the proposed maps have significant errors.