Water Surface Elevation Comparison

This memo explains differences in water surface elevations along the San Francisco Bay shoreline for the new Federal Emergency Management Agency (FEMA) Flood Insurance Rate Maps (FIRM) and the United States Geological Survey’s Coastal Storm Modeling System (CoSMoS) maps. FIRM maps inform flood insurance rates while CoSMoS is used for Marin Bay Waterfront Adaptation Vulnerability Evaluation (BayWAVE) and thus inform Marin County sea level rise planning efforts. Both FEMA and CoSMoS map areas at risk to the 100 year storm under baseline conditions (e.g., no sea level rise). However, modeling approaches vary as FEMA flood zones are based on historical data, while CoSMoS scenarios are based on future projections.

Vertical datums are used in modeling efforts as zero elevation surfaces to which other points are referenced for consistency in a system. Both FEMA and CoSMoS use the same datum, NAVD88, the vertical control datum of orthometric height for vertical control surveying in the United States and Canada which was established in 1991 as local mean sea level in Rimouski, Quebec, Canada. In 1993 NAVD 88 was affirmed as the official vertical datum in the National Spatial Reference System for the conterminous United States and Alaska.¹

Water Surface Elevation is defined by FEMA as: the heights, usually in relation to mean sea level, reached by flows of various magnitudes and frequencies at pertinent points in the floodplain.² For both CoSMoS and FEMA, water elevation is measure in feet NAVD. However, as the below table illustrates, water elevation varies amongst the two.

<table>
<thead>
<tr>
<th>Model</th>
<th>Water Elevation (Marin’s Bayside)</th>
<th>Datum</th>
</tr>
</thead>
<tbody>
<tr>
<td>CoSMoS</td>
<td>8.89-9.84 ft NAVD³</td>
<td>NAVD88</td>
</tr>
<tr>
<td>FEMA</td>
<td>≈11 ft NAVD</td>
<td>NAVD88</td>
</tr>
</tbody>
</table>

¹ NOAA. vertical datums. Accessed 4/15/16
² FEMA. 1986 Floodproofing Non-Residential Structures.
³ Erikson, Li (USGS). Personal Communications. 2/11/16
FIRM Maps
FEMA recently developed new FIRMs for East Marin, which delineate the Special Food Hazard Areas and risk premium zones applicable to the community and are used for regulatory purposes including general plans and building permits. SFHA (A and V Zones) are areas that will be inundated by a 1% chance of flooding (100 year storm). Special Flood Hazard Areas are delineated and Base Flood Elevations are determined based upon historical flooding trends and do not account for future Sea Level Rise which is currently not reflected in FEMA’s Flood Insurance Rate Maps.

CoSMoS Maps
CoSMoS maps, which can be viewed through the Our Coast, Our Future website, is a model which delineates areas projected to be exposed to static sea level rise at increments of 0, 25, 50, 75, 100, 125, 150, 175, 200, and 500 centimeters, plus storm events (none, annual, 20-year, and 100-year) to total 40 scenarios. The BayWAVE project uses 25-, 50-, and 150-centimeters of sea level rise to plan for the near, medium-, and long-term impacts of sea level rise on our built and natural resources.

Hazard Zones
As is evident in maps such as this one for Richardson Bay which overlays the FEMA floodzone with OCOF’s 100-year floodzone (no storm), the higher water elevation of the FEMA zone causes flooding to extend further inland. For planning purposes, this difference should be noted.

MORE INFORMATION
BCDC, USGS, and AECOM. 2016. Adapting to Rising Tides and Our Coast, Our Future – A Comparison of the Approaches

REFERENCES