

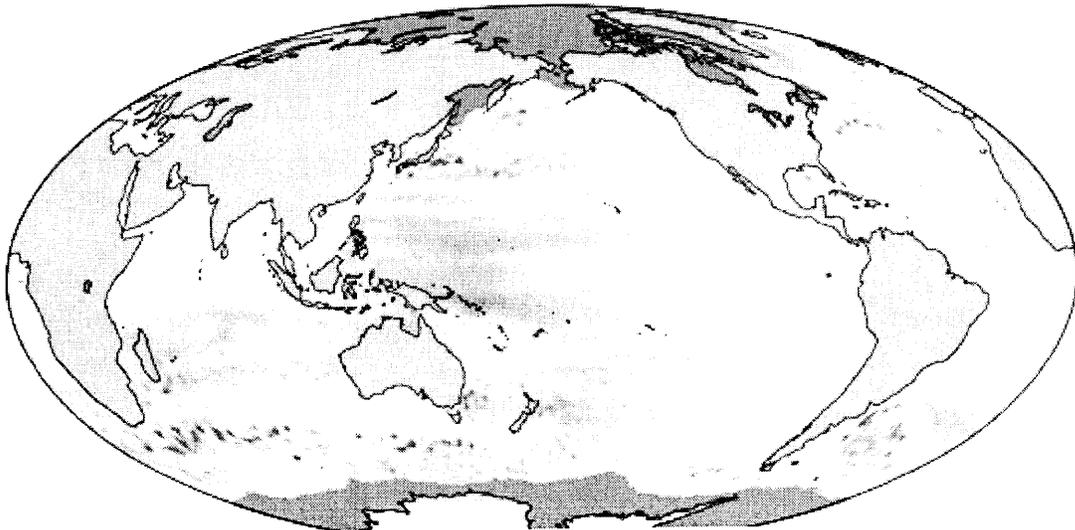
NAVD88 Explained and How It Relates to Base Flood Elevation (BFE)

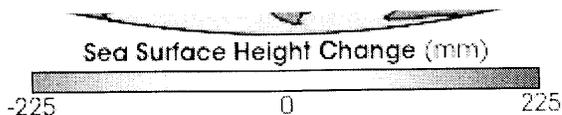
Posted on **March 2, 2014**

With all the talk of redesigning, rebuilding, and preparing for the future, a lot of people want to know what the elevation numbers on the FEMA flood hazard maps all mean. Some people think they are relative to the curb height (no), some think they are relative to the property elevation (again, no), and others think they are relative to sea level (not quite accurate).

These numbers are relative to an elevation standard called NAVD88 (North American Vertical Datum of 1988). NAVD88 replaced an earlier vertical elevation standard called NGVD29 (National Geodetic Vertical Datum of 1929); poor performance of NGVD29 in predicting flood levels and mapping flood plains demonstrated that a new vertical standard was needed to more accurately represent sea (and lake) levels and flooding risk. Improved technologies and mapping techniques yielded a much more reliable standard (NAVD88) that yields more accurate predictions.

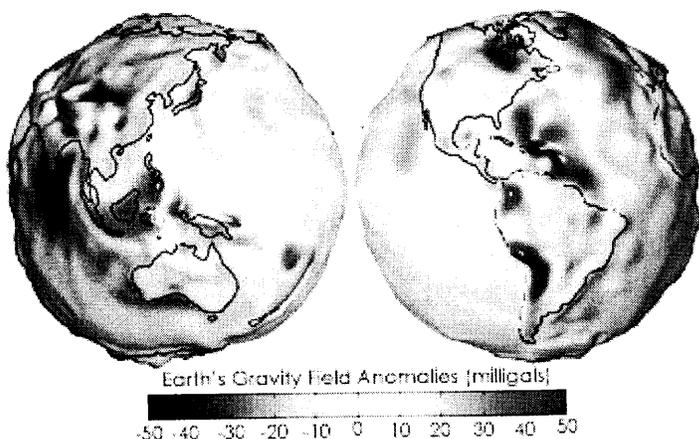
Contrary to popular belief, sea level is neither uniform nor easy to determine at all locations on the globe. The earth itself is neither spherical (it is more of an oval shape, with a greater diameter around the equator than pole-to-pole) nor smooth (there are some big humps and bumps on the surface that exert forces on water, affecting local levels). Sea level too is a tricky thing to map as many forces determine at what level waters lay; bights, embayments, continental shelves, dominant wind patterns, atmospheric pressures, rainfall, watersheds, etc. all play a role by pushing, pulling, or compressing water masses, essentially holding said water masses at varied levels depending on where on the globe you are looking. Because of the myriad of forces acting upon water, sea levels are not uniform across the globe, rising (and even, in some places, falling) at varied rates.





— Variability of sea level height/sea level rise. Credit: the Earth Observatory

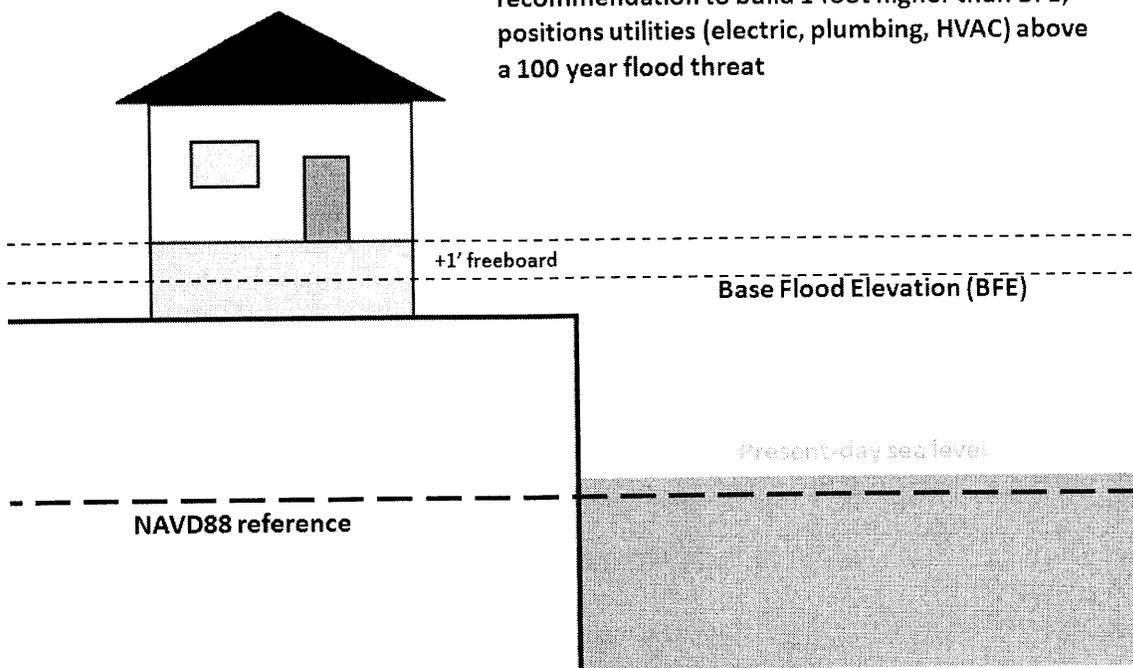
Using very sensitive sensors, satellite geopositioning technology, and complex geometric calculations, NAVD88 was calculated as the elevation at which sea level would sit at a given location if only influenced by topography and the force of gravity. Sounds simple enough, but these calculations are made difficult by the fact that, as mentioned previously, due to variations in the diameters of the planet and differences in the thicknesses and densities of the Lithosphere (crust) and Asthenosphere, gravity is not uniform in all locations.



— Global gravity field anomalies. Credit: Gravity Recovery and Climate Experiment—GRACE

So, the elevation numbers being used to survey properties, house elevations, floodplain levels, and zones (V, AE, shaded X, etc.) are all in reference to the NAVD88 standard. Let's say you are in an AE8 zone and your property is already at 5 feet, the Base Flood Elevation (BFE), which is equivalent to the 100-year/1% probability flood threat in that particular location (which considers those previously-disregarded contributing factors such as bights, embayments, continental shelves, dominant wind patterns, atmospheric pressures, rainfall, watersheds, etc.), is approximately 3 feet above your soil. When building a home, insurance agencies that provide coverage through the National Flood Insurance Program (NFIP) want to see at least one foot of freeboard above that floodplain to bring the utilities such as electric and HVAC (which usually hang approximately 1' under the floor of the home) above the flood plain and will assign the policy holder lower rates with this compliance as per their FIRMs (Flood Insurance Rate Maps), so you really want to, at minimum, put the first floor of your house 4 feet above your soil in the above scenario to locate it 9 feet over NAVD88. Some towns are allowing people to exceed this recommended +1' over the floodplain elevation, which should protect homeowners from even more severe flood events, yield lower flood insurance rates, and provide a buffer if/when the BFE is reassessed and elevated again (see next paragraph).

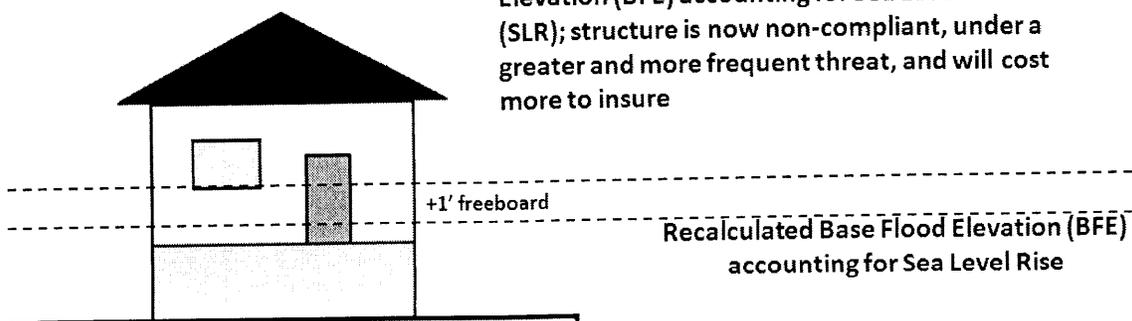
Home construction conforming to the NFIP's recommendation to build 1 foot higher than BFE; positions utilities (electric, plumbing, HVAC) above a 100 year flood threat

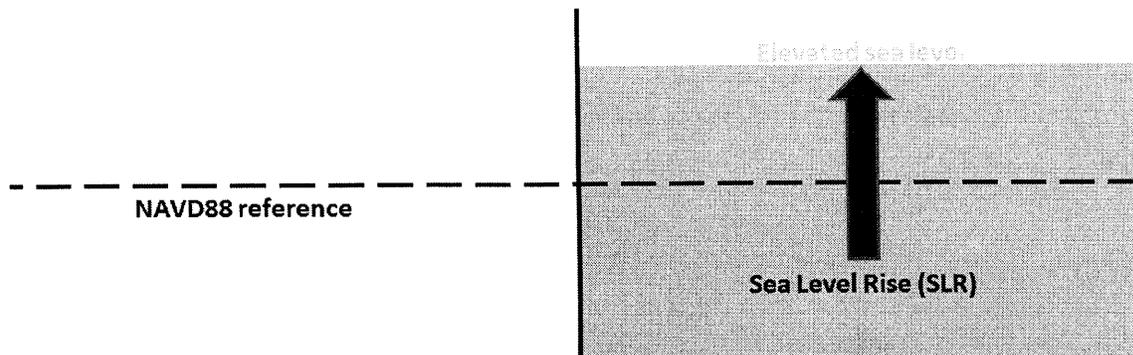


— Structure conforming to NFIP's recommendations. Image credit: Gregg P. Sakowicz

Now, here is the kicker: Bear in mind that this default "sea level" standard was calculated in 1988; as sea levels rise (which they have been doing all along; since 1911 measured sea level has risen over 1.3 feet in Atlantic City), the NAVD88 vertical standard will always remain exactly where it was determined to be in 1988. Which means that if a house today is elevated or built to the minimum recommended elevation (again, assuming the floor of the building is at +1' BFE) and Base Flood Elevations (BFE's) are recalculated and adjusted based on the increased threat posed by elevated sea levels, and this adjustment is reflected on the FEMA flood hazard maps, that AE8 zone may become an AE9 or AE10 zone (or greater), putting the structure out of compliance with the NFIP's requirements, resulting in higher fees to cover the increased calculated liability that structure poses for the company and NFIP.

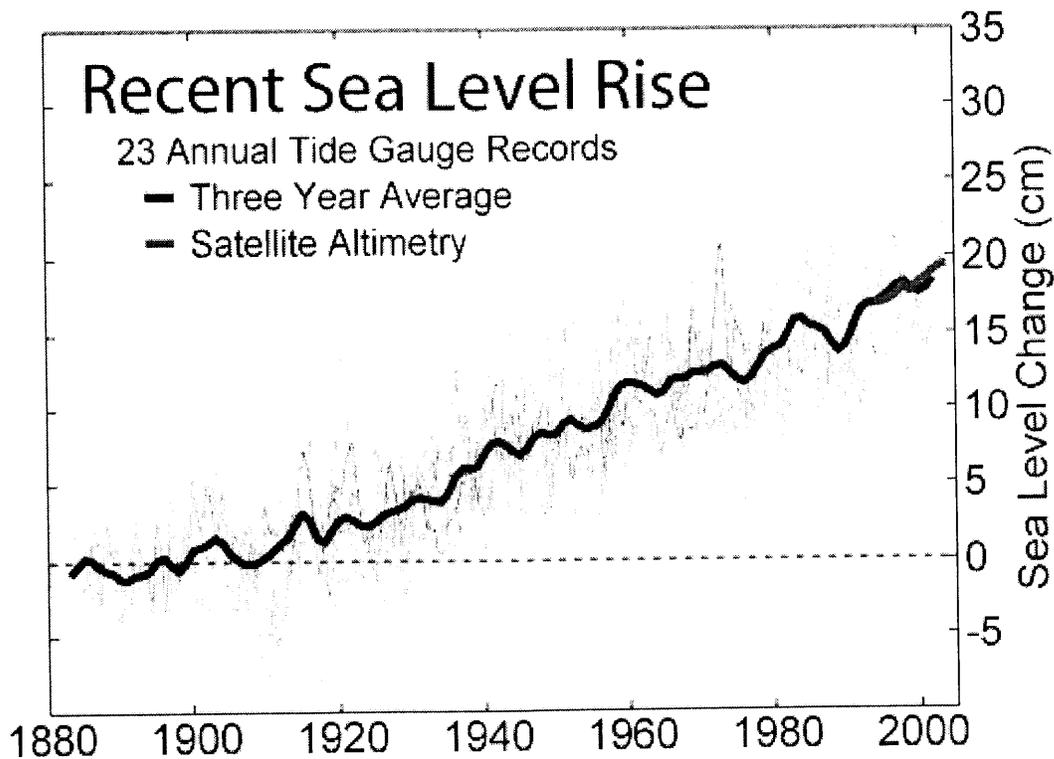
The same home under an adjusted Base Flood Elevation (BFE) accounting for Sea Level Rise (SLR); structure is now non-compliant, under a greater and more frequent threat, and will cost more to insure





- Previously-conforming structure under recalculated Base Flood Elevation accounting for Sea Level Rise. Image credit: Gregg P. Sakowicz

This is not unprecedented in the least: the FEMA flood hazard maps released post-Sandy were in the works before the storm; zones and BFE's were NOT CHANGED BECAUSE of the storm, but rather the release date of the updated maps was moved up in order to help people rebuild and redesign (so they did not rebuild to the old standards and get caught by surprise a year or two down the road by the changes), but the change to the maps was coming anyway and I suspect it will happen again as sea levels rise and the threat increases in both the height of flood waters and frequency of flood events.



- Sea Level Rise. SLR Credit: This figure was prepared from publicly available data by Robert A. Rohde.

NOTE/DISCLAIMER: This information is intended for use as an introductory educational tool to better familiarize users with the terminology and concepts addressed in the article- a "starting point", if you

will. Surveying, designs, permitting, and construction should always be performed by trained and certified/licensed professionals.

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