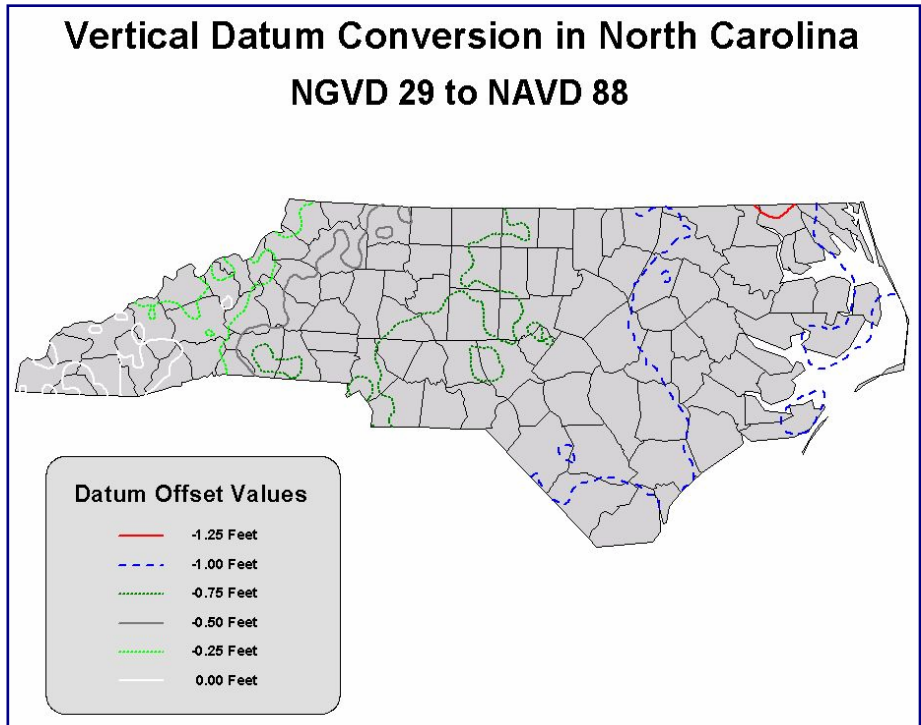# Vertical Datum Changes

In an effort to lessen the impact of flooding, Congress created the National Flood Insurance Program (NFIP) in 1968. In partnership with the NFIP, the North Carolina Floodplain Mapping Program (NCFMP) was created to update the Flood Insurance Rate Maps (FIRMs) for the entire State. One of the main goals of this effort is to more accurately identify the boundaries of flood hazard areas. The limits of these flood hazard areas are determined by comparing flood elevations with digital elevation data. To ensure that all the elevations used are based on a common reference system, a FIRM must reference a single vertical datum.

What is a Vertical Datum?

A vertical datum is a set of constants that defines a system for comparison of elevations. In the NFIP, a vertical datum is important because all elevations need to be referenced to the same system. Otherwise, surveys using different datums would have different elevations for the same point. Historically, the FIRMs have referenced the National Geodetic Vertical Datum of 1929 (NGVD 29). With FIRM updates, a more accurate vertical datum will be used — the North American Vertical Datum of 1988 (NAVD 88).

Why is the Vertical Datum Changing?

A datum needs to be updated periodically because geologic changes to the surface of the earth occur; these changes are due to subsidence and uplift or gradual changes in sea level. In addition, the older vertical datum (NGVD 29) was flawed because of erroneous assumptions that mean sea level at different tidal stations represented the same elevation (zero). With the outdated vertical datum, points at 0.0' NGVD 29 have, in fact, different elevations for a variety of reasons. We can now more accurately measure these elevation differences with an expanded geodetic network, further warranting the use of the new vertical datum. The statewide mapping effort provides an opportunity to produce new maps using NAVD 88 and to expedite the State's use of the newer vertical datum.

Vertical Datum Conversion in North Carolina
NGVD 29 to NAVD 88

Datum Offset Values

——————	-1.25 Feet
– – – –	-1.00 Feet
··············	-0.75 Feet
——————	-0.50 Feet
··············	-0.25 Feet
——————	0.00 Feet

When is the Vertical Datum Changing?

Elevations in NAVD 88 should be used for floodplain management and flood insurance purposes (e.g., elevation certificates) the day that a new FIRM becomes effective for a county. The State is still in the initial stages of map production in eastern North Carolina, but the first counties (Hyde and Beaufort) will receive new maps effective May 15, 2003.
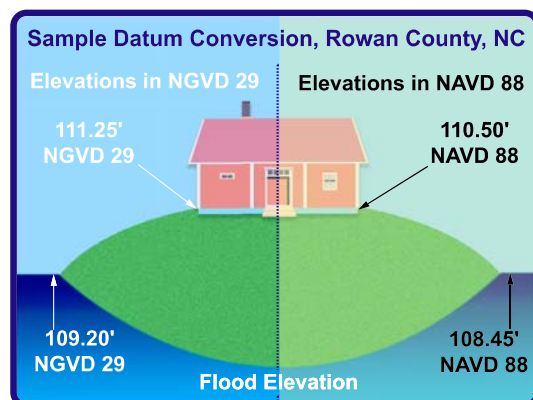
Who Will be Impacted by the Vertical Datum Change?

This change should be noted by anyone who uses a FIRM in North Carolina, particularly when comparing elevation data on a new FIRM with data from an old FIRM that was produced in NGVD 29. The vertical datum change impacts those who work with elevation data, such as engineers and surveyors, as well as community floodplain administrators across the State.

How are Unrevised NGVD 29 Flood Elevations Converted to NAVD 88?

The difference between the two datums varies from location to location. Therefore, an average offset (the difference between NAVD 88 and NGVD 29) has been computed for each county in the State. In Rowan County, NAVD 88 = NGVD 29 – 0.75', as shown in the sample datum conversion. With the exception of three counties (Burke, Haywood, and Rutherford) this offset will be applied to the NGVD 29 flood elevations that are not revised during the creation of a new FIRM. Where a county boundary and a flooding source with unrevised NGVD 29 flood elevations are coincident, an individual offset will be calculated and applied during the creation of the a FIRM. Flood Insurance Study reports that support the new FIRMs, will contain information on the conversion of elevations between NAVD 88 and NGVD 29.

Sample Datum Conversion, Rowan County, NC

Elevations in NGVD 29 | Elevations in NAVD 88

111.25' NGVD 29 | 110.50' NAVD 88

109.20' NGVD 29 | 108.45' NAVD 88

Flood Elevation

Average Conversion Offset from NGVD 29 to NAVD 88 in Feet for North Carolina Counties***

County	Offset	County	Offset	County	Offset	County	Offset	County	Offset
Alamance	-0.80	Chowan	-1.09	Guilford	-0.75	Mitchell	-0.23	Rutherford**	**
Alexander	-0.61	Clay*	0.05	Halifax	-1.04	Montgomery	-0.82	Sampson	-0.90
Alleghany	-0.41	Cleveland	-0.72	Harnett	-0.82	Moore	-0.76	Scotland	-0.89
Anson	-0.87	Columbus	-1.04	Haywood**	**	Nash	-1.02	Stanly	-0.84
Ashe	-0.26	Craven	-1.09	Henderson	-0.15	New Hanover	-0.95	Stokes	-0.58
Avery	-0.26	Cumberland	-0.87	Hertford	-1.16	Northampton	-1.09	Surry	-0.51
Beaufort	-1.07	Currituck	-0.91	Hoke	-0.85	Onslow	-1.05	Swain*	-0.09
Bertie	-1.11	Dare	-0.99	Hyde	-0.99	Orange	-0.79	Transylvania*	0.00
Bladen	-0.94	Davidson	-0.74	Iredell	-0.67	Pamlico	-1.05	Tyrrell	-1.09
Brunswick	-1.06	Davie	-0.69	Jackson*	0.04	Pasquotank	-1.00	Union	-0.78
Buncombe	-0.16	Duplin	-0.94	Johnston	-0.94	Pender	-0.93	Vance	-0.93
Burke**	**	Durham	-0.83	Jones	-1.09	Perquimans	-1.05	Wake	-0.88
Cabarrus	-0.80	Edgecombe	-1.07	Lee	-0.76	Person	-0.86	Warren	-0.95
Caldwell	-0.47	Forsyth	-0.65	Lenoir	-1.13	Pitt	-1.15	Washington	-1.09
Camden	-0.96	Franklin	-0.95	Lincoln	-0.71	Polk	-0.36	Watauga	-0.29
Carteret	-1.04	Gaston	-0.70	Macon*	0.02	Randolph	-0.76	Wayne	-1.02
Caswell	-0.77	Gates	-1.18	Madison	-0.29	Richmond	-0.86	Wilkes	-0.48
Catawba	-0.67	Graham*	-0.10	Martin	-1.09	Robeson	-0.95	Wilson	-1.05
Chatham	-0.76	Granville	-0.89	McDowell	-0.33	Rockingham	-0.72	Yadkin	-0.56
Cherokee*	-0.01	Greene	-1.11	Mecklenburg	-0.74	Rowan	-0.75	Yancey	-0.16

*   Average conversion offset for county is 0.10 foot or less (i.e., between -0.10' and 0.10'). Therefore, a simplified conversion procedure is being used by the State of North Carolina for producing the new FIRMs.

** Large variations between NGVD 29 and NAVD 88 within the county preclude the use of a single conversion offset.

*** The U.S. Army Corps of Engineers' CORPSCON software was used to determine the variable offsets between NGVD 29 and NAVD 88 throughout the State of North Carolina. Developed by the Army's Topographic Engineering Center, CORPSCON consolidates the mathematical models from the National Geodetic Survey NADCON and VERTCON models. NADCON converts horizontal coordinates (geographic, Universal Transverse Mercator (UTM), or State Plane coordinates) between North American Datum of 1927 (NAD 27) and North American Datum of 1983 (NAD 83) horizontal datums; and VERTCON converts vertical coordinates between NGVD 29 and NAVD 88, computing vertical offsets that differ as a function of horizontal location. The most accurate way of converting between NGVD 29 and NAVD 88 is to compute a different offset value for each set of horizontal coordinates, but this would yield an infinite number of different offsets in any given county. To simplify the process for converting unrevised elevation data from old flood studies into new flood studies, the Federal Emergency Management Agency (FEMA) allows a uniform offset to be applied to an entire county when the maximum error in using a standard offset value is no more than 0.25 foot (3 inches) for that county.

Is Further Information Available?

If you have any questions regarding vertical datum changes or the NFIP in general, please contact the FEMA Map Assistance Center toll free at 1-877-FEMA MAP (1-877-336-2627). Additional information about the NFIP is available at www.fema.gov/nfip. Information about the NCFMP can be found at www.ncfloodmaps.com. To obtain current elevation, description, or location information for bench marks in North Carolina, please contact the North Carolina Geodetic Survey at 121 West Jones Street, Raleigh, NC 27601 or (919) 733-3836.