

CECW-CE
CECW-CO
CECW-P

Regulation
No. 1110-2-8160

1 March 2009

Engineering and Design
POLICIES FOR REFERENCING PROJECT ELEVATION GRADES
TO NATIONWIDE VERTICAL DATUMS

1. Purpose. This regulation establishes U.S. Army Corps of Engineers (USACE) policies for referencing project elevation grades to nationwide vertical datums established and maintained by the U.S. Department of Commerce. Its purpose is to ensure that controlling elevations and local datums on USACE projects are properly and accurately referenced to nationwide spatial reference systems used by other Federal, state, and local agencies responsible for flood forecasting, inundation modeling, flood insurance rate maps, navigation charting, and topographic mapping.
2. Applicability. This regulation applies to all USACE commands having responsibility for the planning, engineering, design, construction, operation, maintenance, and regulation of flood risk management and coastal storm damage reduction, hurricane protection, multi-purpose water supply/control and hydropower, ecosystem restoration, and navigation projects. This regulation also applies to regulatory permitting activities.
3. Distribution. This regulation is approved for public release; distribution is unlimited.
4. Policy. It is the policy of the USACE that the designed, constructed, and maintained elevation grades of projects shall be reliably and accurately referenced to a consistent nationwide framework, or vertical datum—i.e., the National Spatial Reference System (NSRS) or the National Water Level Observation Network (NWLON) maintained by the U.S. Department of Commerce, National Oceanic and Atmospheric Administration (NOAA). The current orthometric vertical reference datum within the NSRS in CONUS is the North American Vertical Datum of 1988 (NAVD88). The current NWLON National Tidal Datum Epoch (NTDE) is 1983-2001. (Other NSRS/NWLON defined datums are applicable in the Great Lakes and in isolated OCONUS regions). The relationships among existing, constructed, or maintained project grades that are referenced to local or superseded datums (e.g., NGVD29, MSL), the current NSRS, and/or hydraulic/tidal datums, shall be established as outlined below.
 - a. Hurricane & Shore Protection Projects (HSPP). In coastal areas subject to tidal influence, hurricane and shore protection design or constructed grades shall be directly referenced to NWLON tidal gages and coastal hydrodynamic tidal models established and maintained by the U.S. Department of Commerce (NOAA).

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b. Coastal Navigation Projects. Designed, constructed, dredged, and maintained navigation project grades in coastal areas shall be directly referenced to a local Mean Lower Low Water (MLLW) datum modeled on the latest NTDE as defined by NOAA for the project area.

c. Inland Flood Risk Management, Navigation, and Water Control Systems (to include levees, floodwalls, multipurpose hydropower projects, locks and dams, and non-tidal inland navigation systems). Designed or constructed flood protection or navigation clearance grades, hydraulic or hydrodynamic water surface profiles, river or pool stages, and stream gages in inland flood risk and water control systems shall be accurately referenced to the NSRS (e.g., NAVD88).

d. Ecosystem Restoration and Regulatory Permitting Actions. Ecosystem restoration projects, Civil Works compensatory mitigation projects, or regulatory permitting activities that are referenced to tidal or non-tidal datums shall be defined to a current NSRS, MLLW, or MHW datum, as appropriate to local, state, and federal requirements.

5. Implementation. All newly authorized and existing projects shall be evaluated to ensure that designed and constructed grades are adequately connected and referenced to the NSRS and/or NWLON networks. The hydraulic/tidal and geodetic vertical datum relationships must be assessed, developed and/or verified during the Feasibility and Preconstruction, Engineering, and Design (PED) phases, during construction, and periodically monitored after construction to account for subsidence, settlement, NOAA reference datum redefinitions and readjustments, sea level change, and other factors. Verification of the designed or constructed reference elevation datums represents a critical evaluation and assessment factor in performing technical reviews, peer reviews, O&M project condition surveys, or periodic inspections of completed works. The frequency of required periodic assessments of project datums is project site dependent—ranging from 5 years in high subsidence areas to 20 years in stable, non-tidal project locations. NSRS/NWLON reference datum updates and readjustments must also be continuously monitored and included as assessment items in periodic inspections of completed works (ICW). Technical reviews and periodic inspections shall appropriately confirm that adequate field surveys, gage observations, and/or other verification methods were utilized to maintain datum relationships consistent with the current NSRS/NWLON networks, as applicable.

6. Projects Referenced to Local or Legacy Datums. Most existing USACE projects were designed and referenced to older, superseded datums that are no longer supported by the U.S. Department of Commerce—e.g., NGVD29, MSL, SLD 1929, MSL 1912, USGS, Cairo Datum, Mean Low Gulf, etc. These older reference datums typically have unknown origins and may have significant elevation grade errors relative to updated NSRS and NWLON datums used by other agencies. These legacy datums are, however, often critical to long-term hydrologic and hydraulic analyses, and are the baseline reference cited in FEMA flood insurance rate maps, water control manuals, emergency operation & maintenance manuals, flood profile models, stream/pool gages, inundation models, or as-built drawings. The relationship between these local (legacy) orthometric or hydraulic reference datums and the current nationwide frameworks maintained by the U.S. Department of Commerce must be accurately modeled, documented in O&M manuals, and be kept current; especially in high subsidence areas. Long-term effort should be programmed to transition from legacy reference datum grades to the NSRS.

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7. Projects Subject to High Subsidence Rates. Project datums and controlling protective elevations in high subsidence areas require special consideration during PED and must be periodically reevaluated and updated after construction. This also applies to areas subject to crustal uplift or earthquakes. Vertical elevations of permanent benchmarks, water level gages, required dredging grades, and HSPP/flood protection structures must be continuously monitored for movement, settlement, and loss of protection/clearance. In high subsidence areas, independent, time-dependent local vertical geodetic control networks and short-term (5-year) tidal epochs have been established for these purposes.

8. Risk and Reliability Models. The relative accuracies and uncertainties of reference datums relative to projected stage discharge/damage probabilities, floodwall heights, navigation datums, ecosystem restoration grades, and floodplain inundation (or first-floor) elevations must also be assessed for input into risk-based analysis studies. The uncertainty assigned to the reference datum parameter in a risk model can be complex as it may contain both systematic and random components. These datum uncertainty factors are independent of uncertainty standard error parameters established for water surface profiles and topographic surveys.

9. Proponency and Responsibility. The HQUSACE proponents for this regulation are the Engineering & Construction Community of Practice (COP) (CECW-CE), the Operations & Regulatory COP (CECW-CO), and the Planning and Policy Division (CECW-P). Program or Project Managers leading designated project delivery teams are responsible for assuring the requirements in this regulation are implemented, periodically assessed, and budgeted.

10. Technical Support. Detailed technical guidance, procedures, methods, and accuracy standards for evaluating the adequacy of existing project reference datums, including GPS survey techniques needed to connect project control with the NSRS, may be obtained from the ERDC Topographic Engineering Center's Geospatial Applications Branch (CEERD-TR-A)—or through <http://www.tec.army.mil>—Survey Engineering & Mapping Center of Expertise (National Datums & Subsidence Program—Actions for Change).

FOR THE COMMANDER:


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