



# Federal Emergency Management Agency

Washington, D.C. 20472

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**MEMORANDUM FOR:** Mitigation Division Directors  
FEMA Regions I-X

**FROM:**   
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Risk Identification Branch

**SUBJECT:** Procedure Memorandum No. 37 – Protocol for Atlantic and  
Gulf Coast Coastal Flood Insurance Studies in FY05

**Background:** Atlantic and Gulf Coast coastal Flood Insurance Studies (FISs) in Fiscal Year (FY) 2005 can be initiated using knowledge gained and recommendations made by the Technical Working Group for the Pacific Coast Study Guidance project conducted over the past year and a half. This project, led by Region IX, was a cooperative effort between FEMA Headquarters and Regional offices to develop new technical guidance for Pacific Coast flood studies and to review possible updates and revisions to existing flood study guidance for the Atlantic and Gulf coasts. This Procedure Memorandum presents revisions and modifications to existing protocols in *Appendix D: Guidelines for Coastal Flooding Analyses and Mapping* (April 2003) for performing detailed coastal hazard assessments for communities along the Atlantic and Gulf Coasts.

This Procedure Memorandum is considered an addendum to *Appendix D* and a component within the scope of work for coastal FISs initiated in FY 2005 by Regional Mapping Partners (Indefinite Delivery/Indefinite Quantity (IDIQ) or Cooperating Technical Partner (CTP)) in Regions I, II, III, IV, and VI. These procedural changes affect only guidance to subsections listed below and found in section D.2 of *Appendix D*, entitled "Wave Elevation Determination and V Zone Mapping: Gulf of Mexico and Atlantic Ocean" (February 2002). The basis for these procedural changes can be found in the Pacific Coast Study Guidance project final Phase 1 Summary Report and appendices, entitled *FEMA Coastal Flood Hazard Analysis and Mapping Phase 1 Summary Report*, dated February 2005. The final Phase 1 Summary Report covers topics reviewed by the Technical Working Group related to individual coastal processes or methodologies applied during coastal flood studies for the National Flood Insurance Program (NFIP). Recommendations for improving existing *Appendix D* guidance for the Atlantic and Gulf Coasts are presented in each of these appendixes. While some of the following recommendations have not been thoroughly tested, the Technical Working Group and other technical experts in the field all agreed that these are the best approaches.

For Regions IX and X, the guidance and updates to *Appendix D* presented in the Phase 2 (November 2004) draft of the Pacific Guidelines entitled “*Final Draft Guidelines for Coastal Flood Hazard Analysis and Mapping for the Pacific Coast of the United States*” are recommended for use and application for Pacific Coast flood studies. The methods and technical approaches in the draft Phase 2 Pacific Guidelines will also be considered for supplemental recommendations to applications within the Atlantic and Gulf Coast regions after any necessary refinement and testing. A review and update to the coastal guidance for the Great Lakes region is underway currently in Region V.

The following guidance is provided for each of the key technical issues of concern to ongoing or planned coastal floods studies in the Atlantic and Gulf Coasts.

**Issue 1: Stillwater Elevations (Section D.2.2.1 “Stillwater Elevations”)**

The only guidance in *Appendix D* for stillwater elevation determination using tide gage data is a requirement for at least 20 years of recorded tide gage station data. No guidance is available on the statistical methods that should be considered in developing stage-frequency analyses of long-term tide gage data. The Phase 1 Summary Report appendix on stillwater elevations, entitled “*Stillwater: FEMA Coastal Flood Hazard Analysis and Mapping Guidelines Focused Study Report,*” recommends the development of new guidance to assist Regional Mapping Partners on these types of assessments.

**Action Taken/Revised Procedure:** In section D.4.3 of the draft Pacific Guidelines on Flood Frequency Analysis Methods, basic statistical tools and methods are outlined to analyze long-term tide gage records for stage-frequency assessments. In addition, subsection D.4.4.2 of the draft Pacific Guidelines includes an outline of methods to determine water-level statistics. These approaches are all based on standard statistical techniques and represent the best available guidance to be applied to coastal FISs when stillwater elevations are revised using an analysis of long-term tide gage records.

**Issue 2: Coastal Structures (Section D.2.3, “Evaluation of Coastal Structures”)**

The principal guidance related to evaluating whether coastal structures provide protection during the 1-percent-annual-chance (base) flood can be found in *Appendix D* section 2.3. If a coastal structure can be certified and is expected to survive the 1-percent-annual-chance flood, the structure should be included in all ensuing analyses of wave effects (erosion, runup, and wave height). Otherwise, it should be considered destroyed before the 1-percent-annual-chance flood and removed from subsequent transect representations. However, *Appendix D* provides no specific guidance on how to remove failed coastal structures or how to consider their interactions with storm surge inundation, wave runup, overland wave propagation, and overtopping. Because remnants of failed coastal structures can remain in place during severe coastal flood events, the Phase 1 Summary Report appendix on coastal structures, entitled “*Coastal Structures: FEMA Coastal Flood Hazard Analysis and Mapping Guidelines Focused Study Report,*” recommends methods for treating failed coastal structures. The focused study also points out an inconsistency between the evaluation criteria for existing structures during a coastal

Flood Insurance Study (FIS) and those used for certifying existing structures in a Letter of Map Revision (LOMR).

**Action Taken/Revised Procedure:** The Phase 1 Summary Report focused study on coastal structures includes new procedures for dealing with failed coastal structures and certifying existing structures for a coastal FIS or LOMR. These procedures should be made available to and evaluated by Regional Mapping Partners during studies started in FY 2005.

**Issue 3: Storm Meteorology (Section D.2.2.6, “Storm Meteorology”)**

There is no current explicit guidance in *Appendix D* on combination of coastal storm surge and astronomical tides or on statistical combination of coastal storm surge inland profile with the riverine profile (assuming independence of the processes). However, suitable techniques for combination of surge and tide during the surge numerical modeling process are contained in the user's manuals that support particular surge models. The Phase 1 Summary Report appendix on storm meteorology, entitled “*Storm Meteorology: FEMA Coastal Flood Hazard Analysis and Mapping Guidelines Focused Study Report*,” recommends additional studies and development of new guidance.

**Action Taken/Revised Procedure:** General methods addressing these issues are included in the draft Pacific Guidelines in sections D.4.2 on Study Methodology and D.4.3 on Flood Frequency Analysis Methods. These methods should be considered the best available information and guidance for studies requiring similar storm meteorology work elements for an Atlantic or Gulf Coast study.

**Issue 4: Wave Transformation (Section D.2.2.7, “Storm Wave Characteristics”)**

*Appendix D* includes very limited existing guidance when wave transformation (wave refraction, diffraction, shoaling, and dissipation) calculations are needed or how they should be performed for an FIS. The Phase 1 Summary Report appendix on wave transformation, entitled “*Wave Transformation: FEMA Coastal Flood Hazard Analysis and Mapping Guidelines Focused Study Report*,” determined that wave transformation would be of greatest concern in a coastal FIS within sheltered waters. The focused study recommends evaluating and developing general guidance on wave transformation, including wave energy dissipation over shallow flat bottoms found in sheltered waters along the Atlantic and Gulf Coasts.

**Action Taken/Revised Procedure:** Complex wave transformation assessments and modeling are not considered necessary in the open coast environment of the Atlantic and Gulf Coast regions, where storm-driven waves and surge are generally concurrent with peak flood events along uniformly sloping beaches. However, wave transformations may be important for wave penetration into a bay or for wave generation within bays and sheltered waterways. If the Regional Mapping Partner determines that wave transformation may have a significant impact on the coastal hazards in the study area, wave transformation methods should be applied on an as-needed basis following

guidance in Chapters 2 and 3 in Volume I of the U.S. Army Corps of Engineers (USACE) 1984 Shore Protection Manual (SPM), or in Sections 2 and 4 of Chapter 3 in Part II of the 2003 Coastal Engineering Manual (CEM). These procedures should be compared to determine the most cost effective and technically accurate approach. If two-dimensional numerical models are used, they should be selected from the accepted coastal models list or meet the approval criteria specified in the NFIP regulations.

**Issue 5: Storm-Induced Erosion (Section D.2.4.1, “Basic Erosion Considerations”)**

A long-term recommendation from the Technical Working Group included in the Phase 1 Summary Report appendix on erosion, entitled “*Event-Based Erosion: FEMA Coastal Flood Hazard Analysis and Mapping Guidelines Focused Study Report*,” is that FEMA consider analyzing new pre- and post-storm profiles to update the data used to develop the 540-square-foot (sf) erosion criteria as a representative erosion area for the 100-year storm event. However, further testing will be required before this can be implemented into coastal studies.

**Action Taken/Revised Procedure:** Until the recommended erosion storm data and profiles can be assessed, the existing 540-sf criteria should continue to be used for storm-induced erosion assessments. If historical erosion data support use of a different erosion value (other than the 540-sf value), the technical supporting data should be reviewed and any revised values approved by the Regional office before a different value can be applied in a coastal FIS.

**This Document is Superseded.  
For Reference Only.**

**Issue 6: Wave Runup (Section D.2.5.1, “Wave Runup Model Description”)**

The Phase 1 Summary Report appendix on wave runup, entitled “*Wave Runup and Overtopping: FEMA Coastal Flood Hazard Analysis and Mapping Guidelines Focused Study Report*,” and draft Pacific Guidelines both provide recommendations that mean wave conditions and mean wave runup values no longer be used for coastal flood studies. In the reports, it is recommended that analyses and mapping of stillwater and wave runup elevations should reflect the 2-percent wave runup depth rather than the mean (50-percent) wave runup depth. This would require use of an interim procedure to modify RUNUP 2.0 model results until other procedures can be implemented. The interim wave runup procedure would scale the RUNUP 2.0 model results based on accepted statistical distributions of wave runup. In section D.4.5 of the draft Pacific Guidelines, alternative approaches to analyzing wave runup include both the USACE Automated Coastal Engineering Software (ACES) approach and the approach referred to as the TAW (Technical Advisory Committee for Water Retaining Structures) method (which serves as the basis for CEM runup calculations). Section D.4.5 of the draft Pacific Guidelines also recommends and provides details on an integrated approach that combines wave setup (static and dynamic) and wave runup, referred to as the Direct Integration Method (DIM).

**Action Taken/Revised Procedure:** The integrated approach to combine wave runup and setup (DIM approach) described in section D.4.5 of the draft Pacific Guidelines may eventually serve as a replacement for conventional wave setup and RUNUP 2.0 model



analyses for the Atlantic and Gulf coasts. However, this method has not been tested or applied in a coastal FIS. In the interim, it is recommended that the 2-percent wave runup value be used for Base Flood Elevation determination and hazard mapping for the Atlantic and Gulf Coasts. This can be accomplished through scaling or conversion of the RUNUP 2.0 model mean results to the 2% value, or direct computation of the 2% wave runup using the ACES or TAW methods.

**Issue 7: Wave Setup (Section D.2.5.6, “Wave Setup”)**

The recommended approach for calculating wave setup on the Pacific Coast is the DIM, through use of an equation or parametric method developed for and described in section D.4.5 of the draft Pacific Guidelines. At this time, the DIM is untested and has not been applied in a coastal FIS, so it has not been recommended for use in the Atlantic and Gulf Coasts.

**Action Taken/Revised Procedure:** As an interim method, the use of USACE guidance from the SPM as currently recommended in *Appendix D* is to be used for wave setup calculations along the Atlantic and Gulf Coasts. The Regional office should be consulted regarding any exceptions to this interim method. The Regional Mapping Partner should determine which method provides the most cost effective and technically accurate result for application in the study and coordinate with the Regional office accordingly.

**Issue 8: Wave Overtopping (Section D.2.5.7, “Wave Overtopping”)**

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The Phase 1 Summary Report appendix on wave overtopping, entitled “*Wave Runup and Overtopping: FEMA Coastal Flood Hazard Analysis and Mapping Guidelines Focused Study Report*,” recommends continued use of the mean wave overtopping rate (as contained in *Appendix D*) and also the testing of available alternate overtopping methods to select the best method. The wave overtopping approach developed in section D.4.5 of the draft Pacific Guidelines links wave runup and overtopping directly, and uses a trajectory analysis to determine the wave-overtopping water-surface profile. The new method also uses overtopping flood depth and velocity to define Zone VE using a new criterion.

**Action Taken/Revised Procedure:** The new overtopping calculation methods proposed in the draft Pacific Guidelines should not be applied to the Atlantic and Gulf Coasts until further testing in a coastal FIS has been completed. Therefore, continued use of existing *Appendix D* methods is required at this time.

**Issue 9: Wave Heights (Section D.2.6, “Analysis of Overland Wave Dimensions”)**

As part of the Phase 1 Summary Report appendix on wave transformation, entitled “*Wave Transformation: FEMA Coastal Flood Hazard Analysis and Mapping Guidelines Focused Study Report*,” a number of changes to the WHAFIS 3.0 model were proposed that would be useful in all coastal regions, but the basic methodology and approach remain unchanged. There are several proposed changes to the WHAFIS 3.0 model that

are described in the report, but the WHAFIS 3.0 model code has not yet been revised to reflect those changes. Further evaluation during the preparation of the draft Pacific Guidelines resulted in the development of a revised version of the WHAFIS 3.0 model, which allows for variable wind speed inputs for wave growth calculations other than the fixed open water and inland fetch wind speeds.

**Action Taken/Revised Procedure:** The revised version of WHAFIS 3.0 has not been tested and approved for use on the Atlantic and Gulf Coasts. When approved, it would only be appropriate in special situations, primarily in the sheltered waters of inland bays and estuaries. In the interim, the current version of the WHAFIS 3.0 model and its wind speed defaults are required for all coastal FISs with overland wave propagation analyses along the Atlantic and Gulf Coasts.

**Issue 10:** Hazard Zone Mapping (Section D.2.7.1, “Review and Evaluation of Basic Results”)

The Phase 1 Summary Report appendix on hazard zone mapping, entitled “*Flood Hazard Zones: FEMA Coastal Flood Hazard Analysis and Mapping Guidelines Focused Study Report*,” recommends only minor changes to flood hazard zone mapping procedures. A new VE zone criterion (based on flood depth and velocity) was proposed, but it has not yet been evaluated or approved.

**Action Taken/Revised Procedure:** No significant changes in the mapping of hazard zones have been recommended, so the existing *Appendix D* guidance is adequate for all Atlantic and Gulf Coast FISs in FY 2005.

**Issue 11:** Primary Frontal Dune VE Zone Mapping (Section D.2.7.2, “Identification of Flood Insurance Risk Zones”)

The recommendations in the Phase 1 Summary Report appendix on hazard zone mapping, entitled “*Flood Hazard Zones: FEMA Coastal Flood Hazard Analysis and Mapping Guidelines Focused Study Report*,” called for regulatory changes to the NFIP to revise mapping procedures for primary frontal dunes in instances where high-profile coastal ridges or plateaus back the shoreline. The report also mentions adoption of a technique for quantitative primary frontal dune mapping.

**Action Taken/Revised Procedure:** Implementing changes to primary frontal dune identification and mapping criteria will not be made at this time. Therefore, the continued use of existing *Appendix D* guidance is required for all coastal FISs along the Atlantic and Gulf Coasts.

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