



**FEMA**

March 2, 2012

**COPY**

The Honorable Joe Adame  
Mayor, City of Corpus Christi  
1201 Leopard  
Corpus Christi, TX 78401

RE: Request for Levee System Certification Documentation - Corpus Christi Flood Protection System

Dear Mayor Adame:

The Federal Emergency Management Agency (FEMA) is currently working to prepare Preliminary Flood Insurance Rate Maps (FIRMs) for Nueces County, Texas. This study will produce Flood Insurance Rate Maps (FIRMs) and a Flood Insurance Study (FIS) for the county area. This restudy effort is part of FEMA's Risk Mapping, Assessment, and Planning (Risk MAP) program.

As part of the mapping effort, we determined the flood hazard information depicted in the county and incorporated community's current maps and FIS' are based, in some areas, on flood risk reduction structures. The Corpus Christi Flood Protection System in Nueces County reduces the flood hazard risk for communities within its vicinity. The current effective flood maps in Nueces County show the levee as accredited (reducing the flood risk) for a flood that has a one-percent-chance of being equaled or exceeded in any given year (also known as the base flood or 100-year flood).

The Corpus Christi Flood Protection System includes an earthen levee on the west side, and a small floodwall on the northeast corner and are subject to levee certification requirements. For FEMA to continue to recognize the Corpus Christi Flood Protection System on the FIRM maps that are currently in production, we will need to receive documentation which meet the requirements of the Code of Federal Regulations, Title 44, Section 65.10 (44 CFR 65.10), entitled "Mapping of Areas Protected by Levee Systems." A copy of the regulation can be found at [http://www.access.gpo.gov/nara/cfr/waisidx\\_02/44cfrv1\\_02.html](http://www.access.gpo.gov/nara/cfr/waisidx_02/44cfrv1_02.html). In accordance with 44 CFR 65.10(a), it is the responsibility of the community or other party seeking recognition of a levee system, to certify the levee system provides risk reduction from the base flood by submitting data defined and outlined in the regulation. The remainder of the Corpus Christi Flood Protection System consists of seawall which are considered to be coastal structures, not levees, and do not need to be certified to 44 CFR 65.10.



In order to comply with this request, there are three options your community may pursue:

**1. Submit all required documentation to fully comply with 44 CFR 65.10**

If your community or levee owner has all of the documentation necessary to satisfy the requirements of 44 CFR 65.10, please submit the data to the FEMA Region 6 Office within 30 days. This documentation should include an existing operation and maintenance plan, and record of an on-site inspection by a registered professional engineer. Upon receipt of your submittal, FEMA will perform a completeness review of the data received and determine the levee's accreditation status. A fact sheet with additional information on the required documentation for a complete certification package is enclosed for your reference.

**2. Submit documentation identifying your intent to NOT certify the flood control structure**

If your community or the levee owner does not intend to, or is aware of a deficiency which may preclude the levee or flood control structure from certification in compliance with 44 CFR 65.10, please submit a letter to the FEMA Region 6 Office within 30 days to document this decision.

**3. Sign a Provisionally Accredited Levee (PAL) agreement**

FEMA understands it may take time to acquire and/or assemble the documentation necessary to fully comply with 44 CFR 65.10. Therefore, FEMA developed a process to provide additional time to allow communities to collect the required documentation for certification of the levee system. This process is known as the Provisionally Accredited Levee (PAL) procedure. **The PAL approach is only available for maintained levees with no known deficiencies.** If you would like to pursue this option please contact the FEMA Region 6 Office to enter into this agreement. A fact sheet with additional information on the PAL agreement is enclosed for your reference.

Initiation of this process can take place only if you, the community/levee owner, sign and return the enclosed PAL agreement within 90 days of the date of this letter before May 29, 2012. Levees will be labeled as PALs during the 24-month period to convey to map users that levee certification verification is underway. FEMA recommends that you, the levee owner, implement outreach efforts to inform affected property owners that an assessment of the levee is underway. FEMA also encourages the purchase of flood insurance, even though coverage is not federally required for the areas landward of the levee.

If you endorse the enclosed PAL agreement but are unable to submit all the documentation necessary to meet the requirements of 44 CFR 65.10 before May 29, 2014. FEMA will de-accredit the levee and initiate a map revision to re-designate certain areas on the landward side of the levee as flood prone.



The Honorable Joe Adame  
March 2, 2012  
Page 3

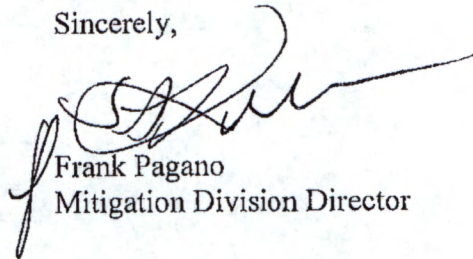
If FEMA does not receive any documentation to assist us in the determining a flood risk reduction structure's accreditation status, FEMA will proceed with the study and deem the flood risk reduction structure as de-accredited. The exact impact to the FIRM is unknown at this time, however, FEMA will analyze and model the levee system as de-accredited and determine flood hazard risk on the landward side of the levee system(s). The results of the analysis will identify the appropriate flood hazard area subject to flooding during the one-percent-annual-chance flood.

We request you notify the FEMA Region 6 office within 30 days as to which of the above options your community is planning to pursue. This notification allows FEMA to continue progress on the flood hazard analysis being performed in your county and identifies the required information for FEMA to determine how the flood risk reduction structure should be analyzed. If you have questions regarding the specific submittal requirements, please contact Larry Voice, at the FEMA Region 6 Office either by telephone at (940) 898-5419 or by e-mail at [Larry.Voice@fema.dhs.gov](mailto:Larry.Voice@fema.dhs.gov).

Once the revisions to the maps are complete, your community will receive updated flood hazard maps and are encouraged to review and engage with FEMA during the post-preliminary phase of the countywide mapping effort. Community comments should be submitted during the formal appeal and protest period. It is FEMA's objective to work with local community officials, local levee districts, county flood protection staff, and Floodplain Administrators from the beginning of this update through the issuance of the effective map.

We look forward to working with you and your community officials to address this important matter. If there is anything we can do to facilitate the submittal process, please let us know.

Sincerely,



Frank Pagano  
Mitigation Division Director

Enclosures: Levee Location Map  
PAL Certification Agreement  
Procedure Memorandum No. 34  
Procedure Memorandum No. 43  
44 CFR 65.10  
FEMA Fact Sheet-Meeting the Criteria for Accrediting Levees on Flood Maps  
FEMA Fact Sheet-The NFIP and Levees  
FEMA Fact Sheet-Provisionally Accredited Levees

cc: Ronald Olson, City Manager, City of Corpus Christi  
Dan McGinn, Floodplain Manager, City of Corpus Christi  
The Honorable Loyd Neal, County Judge, Nueces County

The Honorable Joe Adame  
March 2, 2012  
Page 4

Danielle Hale, Emergency Management Director, FPA, Nueces County

(without attachments)

Kay Bailey Hutchison, U.S. Senator

John Cornyn, U.S. Senator

Blake Farenthold, U.S. Representative

Juan "Chuy" Hinojosa, State Senator

Connie Scott, State Representative

Michael Sterling, USACE, Galveston District

Michael Segner, State NFIP Coordinator

Rigel Rucker, Study Manager, RAMPP

Surya Ravulaparthi, Michael Baker Jr., Inc.

Stephen Altman, RAMPP-RSC6



# Nueces County, Texas - Corpus Christi Flood Protection System



Texas



Nueces County

Locator Map

- Seawall
- Floodwall \*
- Earthen Levee \*
- Roads
- Nueces County (Unincorporated Areas)

\* requires certification



0.350.175 0 0.35

Miles

Map Created: February 14, 2012  
Project Location:  
R:\RSC\_06\RSC6\_Proj\TX\Nueces\Levee\Maps



**PAL AGREEMENT, SCENARIO A1: LEVEE NOT IN FEDERAL SYSTEM**

**Letter of Agreement and Request for Provisionally Accredited Levee (PAL) Designation and Agreement to Provide Adequate Compliance with the Code of Federal Regulations, Title 44, Section 65.10 (44 CFR 65.10)**

We, the undersigned, have received the letter from Federal Emergency Management Agency (FEMA) dated **March 2, 2012**, and the enclosed document entitled "Requirements of 44 CFR 65.10." We understand that FEMA is in the process of providing an updated flood map, termed a Flood Insurance Rate Map (FIRM), for **Nueces County, Texas** and that the area behind the levee known as **Corpus Christi Flood Protection System** will be remapped to reflect that the levee has been designated as a PAL.

To the best of our knowledge, the levee known as **Corpus Christi Flood Protection System** meets the requirements of 44 CFR 65.10 and has been maintained in accordance with an adopted operation and maintenance plan as evidenced by the attached plan and records of levee maintenance and operation, as well as tests of the mechanized interior drainage systems, if applicable. We hereby submit to FEMA, within 90 days (before **May 29, 2012**) our agreement to provide FEMA with necessary data and documentation to show that the levee known as **Corpus Christi Flood Protection System** complies with 44 CFR 65.10. We understand that the data and documentation will be required before **May 29, 2014**. This information will allow FEMA to move forward with the FIRM for **Nueces County, Texas**. We fully understand that if complete data and documentation to comply with 44 CFR 65.10 are not provided within the designated timeframe of 24 months, FEMA will initiate a revision to the FIRM to redesignate the areas as Special Flood Hazard Area, the area subject to inundation by the base (1-percent-annual-chance) flood.

Levee Owner Representative \_\_\_\_\_ (signature)

\_\_\_\_\_ (print)

Date: \_\_\_\_\_

Community CEO \_\_\_\_\_ (signature)

\_\_\_\_\_ (print)

Date: \_\_\_\_\_

Other (if applicable) \_\_\_\_\_ (signature)

\_\_\_\_\_ (print)

Date: \_\_\_\_\_

**Attachments -**

Operation and Maintenance Plan and Records To be provided at later date.

Test Records of Mechanized Interior Drainage System To be provided at later date.





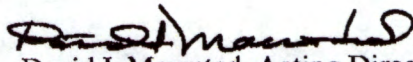
# Federal Emergency Management Agency

Washington, D.C. 20472

August 22, 2005

**MEMORANDUM FOR:** Regional Directors  
Regions I - X

**FROM:**

  
David I. Maurstad, Acting Director  
Mitigation Division

**SUBJECT:** Procedure Memorandum 34 — Interim Guidance for Studies  
Including Levees

**Background:** Throughout the United States, levees protect numerous communities and large expanses of agricultural land from floods. Their importance in mitigating flood hazards and their relevance to the National Flood Insurance Program (NFIP) are indisputable. However, riverine and coastal levees, in the aggregate, stretch for tens of thousands of miles, and information on their location, structural integrity, and certification often is outdated or missing altogether.

**Issue:** To address this challenge, a Levee Coordination Committee—including representatives from FEMA, other Federal agencies, and States—is examining current levee regulations and assisting in the development of a long-term policy that protects citizens and property, while accommodating the needs of the NFIP. This memorandum helps to clarify the entities responsible for providing information on levees identified during a mapping project.

**Action Taken:** Until the new policy is developed, this memo provides interim guidance to minimize delays in near-term mapping studies. The attached flow chart supplements FEMA's procedure memorandums 30 and 32. This information is in conformance with Section 65.10 of the NFIP regulations.

### **Supplement to Procedure Memo 30—FEMA Levee Inventory System.**

Mapping partners – CTPs, IDIQs, OFAs, etc. -- should continue providing information about levees located in or adjacent to study areas. Information should be provided via the FEMA Levee Inventory System (FLIS) according to Procedure Memorandum 30 and the instructions available on the FLIS Web site located at <http://flis.pbsjdfirm.com>. The FLIS will be accessed via the MIP after release 3.0.

Levee coordinates should be gathered at a level of detail consistent with GIS accuracy and digital Flood Insurance Rate Map (FIRM) standards. Mapping partners who do not already have access to the FLIS can contact the National Service Provider at (703) 960-8800.



**Supplement to Procedure Memo 32—Levee Review Protocol.**

The protocol for levee reviews, particularly the details provided in Table 1 of Procedure Memorandum 32, is revised according to the attached flow chart.

**Identification of Levees**

It is critical that all levees within the scope of the mapping project be identified early in the mapping project, ideally no later than the scoping meeting. The role of all mapping partners, including coordination with the State and other Federal partners (e.g., U.S. Army Corps of Engineers), related to review of levee certification should be clearly identified as part of the scoping process. When levees are identified at the scoping meeting the community must be informed of the data requirements for FEMA to recognize a levee as providing protection from the 1-percent-annual-chance flood (base flood) on the FIRM. In accordance with 44 CFR Section 65.10(a), it is the responsibility of the community or other party seeking recognition of a levee system at the time of a flood risk study or restudy to provide the data outlined in 44 CFR Section 65.10. FEMA will not be conducting detailed examinations of levees to determine how a structure or system will perform in a flood event. In addition, the community or party seeking recognition should be provided with a deadline for submitting the data and informed that if the data are not submitted by the deadline, the levee cannot be recognized as providing protection from the base flood as part of the current mapping effort. However, a revision could be initiated once data are available.

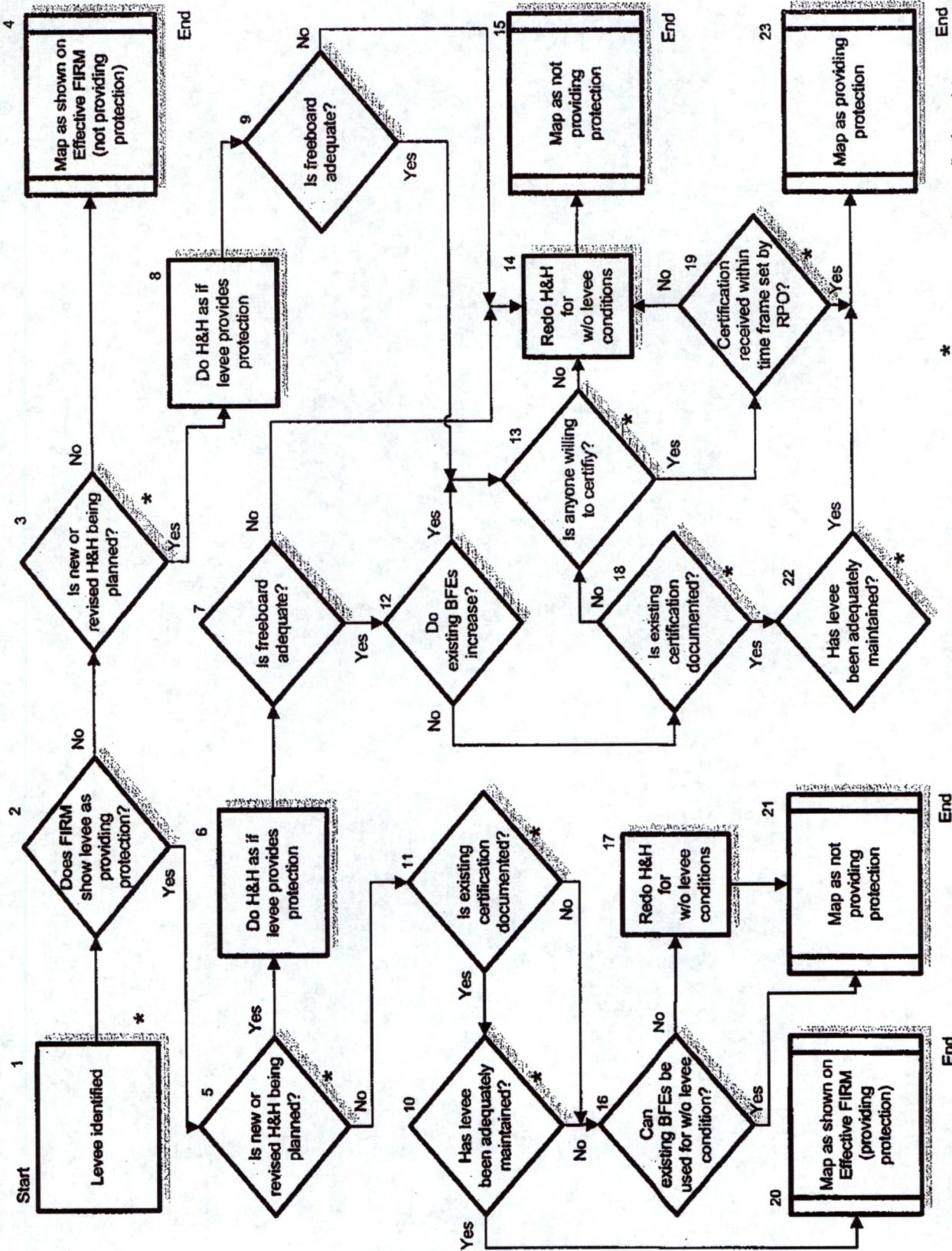
Early identification of levees allows the mapping partner to outline to the community, or party seeking recognition, their responsibilities and FEMA's expectations to minimize study delays. In order to aid our mapping partners in properly assessing how to handle levee mapping issues, we have generated the below flowchart.

cc: See Distribution List

**Distribution List (electronic distribution only):**

Office of the Mitigation Division Director  
Risk Assessment Branch  
Risk Identification Branch  
Flood Insurance and Mitigation Divisions in FEMA Regional Offices  
Office of Legislative Affairs  
Office of General Counsel  
National Service Provider  
Systems Engineering and Technical Assistance Contractor  
Map Service Center





Note: Numbers shown for reference purposes only \* Indicates community coordination point

08/22/2005

Interim Guidance for Studies Including Levees







FEMA

March 16, 2007

(Originally Issued on September 25, 2006)

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

**FROM:** David I. Maurstad  
Director *David I. Maurstad*  
Mitigation Division

**SUBJECT:** Revised Procedure Memorandum No. 43 - Guidelines for  
Identifying Provisionally Accredited Levees

**Background:** Early in the implementation of Flood Map Modernization (Map Mod), the Department of Homeland Security's Federal Emergency Management Agency (FEMA) recognized that the role of levees in flood risk reduction would be an important part of the efforts of Map Mod. Further, it was acknowledged that the condition of levees had not been assessed since they were originally mapped as providing base (1-percent-annual-chance) flood protection. Because of this, FEMA initiated a revised process to gain a better understanding of the actual flood risks for those citizens living and working behind levees nationwide.

On August 22, 2005, FEMA issued Procedure Memorandum No. 34 - Interim Guidance for Studies Including Levees. The purpose of the memorandum was to help clarify the responsibility of community officials or other parties seeking recognition of a levee by providing information identified during a study/mapping project. Often, documentation regarding levee design, accreditation, and the impacts on flood hazard mapping is outdated or missing altogether. To remedy this, Procedure Memorandum No. 34 provides interim guidance on procedures to minimize delays in near-term studies/mapping projects, to help our mapping partners properly assess how to handle levee mapping issues.

**Issue:** Levee owners or communities have the responsibility to provide documentation that a levee meets the requirements of Title 44 of the Code of Federal Regulations, Section 65.10 of the National Flood Insurance Program regulations (44 CFR Section 65.10), as part of a study/mapping project. Without the required documentation necessary to comply with 44 CFR Section 65.10, the area behind the levee will be re-delineated and mapped as Special Flood Hazard Area on the Digital Flood Insurance Rate Map (DFIRM). Procedure Memorandum No. 34 allows for the issuance of a deadline to the community for submitting the required documentation.



While 44 CFR Section 65.10 documentation is being compiled, the release of more up-to-date DFIRM panels for other parts of a community or county may be delayed. To minimize the impact on the Map Mod goals of mapping areas landward of levees, mapping partners should be provided with guidance that will allow preliminary and effective DFIRMs to be issued while the levee owner or community is given a reasonable amount of time to compile and submit data and documentation to show compliance with the requirements of 44 CFR Section 65.10. Guidance should also be provided to the mapping partners that allows, in specific situations, the preliminary DFIRM to be issued while providing the communities and levee owners with a specified timeframe to show compliance with 44 CFR Section 65.10 by correcting any maintenance deficiencies associated with the levee.

**Action Taken:** To minimize the impact of the levee recognition and certification process on Map Mod goals, guidelines have been developed that will allow mapping partners to issue preliminary and effective versions of DFIRMs while the levee owners or communities are compiling the full documentation required to show compliance with 44 CFR Section 65.10. The guidelines also explain that mapping partners can issue preliminary DFIRMs while providing the communities and levee owners with a specified timeframe to correct any maintenance deficiencies associated with a levee to and show compliance with 44 CFR Section 65.10. These guidelines are summarized in the attached document entitled "Guidelines for Identifying Provisionally Accredited Levees (PALs)."

The attached document describes the criteria for five scenarios intended to determine when a levee does or does not qualify for the PAL designation. FEMA has established a specified timeframe in which the community or levee owner may use to fulfill the remaining requirements for 44 CFR Section 65.10 before the levee is shown on the DFIRM as not providing base flood protection. The attached guidance also describes an additional process for maintenance deficient levees that do not currently qualify for the PAL designation. FEMA has established a separate specified timeframe for these levees, which allows the community or levee owner time to correct any maintenance deficiencies associated with a levee. If the levee qualifies for the PAL designation, FEMA will provide the community 90 days to sign and return an agreement indicating that the full documentation for 44 CFR Section 65.10 will be provided within 24 months of the signed agreement. If the signed agreement is not returned to FEMA within 90 days, or if the levee does not meet the PAL requirements (except for the maintenance deficient levees), the community is no longer eligible for the PAL designation, and the area landward of the levee will be remapped as Zone AE or Zone A, depending on the type of study performed for the area.

For levees that are included in the U.S. Army Corps of Engineers (USACE) Federal Program, FEMA will actively coordinate with the appropriate USACE district to determine which projects do not provide protection from the base flood. In a collaborative effort, existing data or project-specific information will be evaluated to identify and validate non-accredited levees in the USACE's inventory. As part of the USACE's recent survey of their levee inventory, levee projects have been identified to be no longer eligible for Public Law (PL) 84-99 rehabilitation assistance, based on the project's last inspection. However, many of these levee projects have been identified to



be eligible for a one-time-only "maintenance deficiency correction period," established to allow public sponsors/levee owners to correct levee maintenance deficiencies before the levee is placed in an inactive status in the USACE Rehabilitation & Inspection Program and becomes ineligible for PL 84-99 rehabilitation assistance. The USACE has developed a written notification process to inform communities or levee owners of this status after it has coordinated with FEMA. Copies of the USACE notification letter will be provided to FEMA. If a community or levee owner receives this notification letter, the area landward of the identified levee will be mapped as Zone AE or Zone A, as appropriate.

Effective on the date of this Procedure Memorandum, levees that meet the PAL requirement (levees presently shown as providing base flood protection on the effective FIRM), for which the community or levee owner cannot readily provide full documentation of 44 CFR Section 65.10, will be identified on the FIRM with a map note. This note, placed landward of the levee, will indicate that the levee is provisionally accredited and any existing Zone X (shaded) area is provisional. If there is no existing Zone X (shaded) area on the effective FIRM, then the mapping partner should define the provisional Zone X (shaded) area using the best available data. Specific procedures and guidance for evaluating and mapping levees is provided in Appendix H of *Guidelines and Specifications for Flood Hazard Mapping Partners*.

The following note must be applied at several locations, point to the levee, and be placed landward of the levee in or near the Zone X (shaded) area:

WARNING: Provisionally Accredited Levee. For explanation, see the Notes to Users.

The applicable Note to Users would read as follows:

WARNING: This levee, dike, or other structure has been provisionally accredited and mapped as providing protection from the 1-percent-annual-chance flood. To maintain accreditation, the levee owner or community is required to submit documentation necessary to comply with 44 CFR Section 65.10 by (\_\_\_\_\_, \_\_\_\_). Because of the risk of overtopping or failure of the structure, communities should take proper precautions to protect lives and minimize damages in these areas, such as issuing an evacuation plan and encouraging property owners to purchase flood insurance.

The five scenarios for determining whether the levee qualifies for the PAL designation are described in the attachment. The document also summarizes the process for coordinating with community officials and others to acquire the appropriate levee documentation, while moving forward with the production of countywide mapping for communities with levees.

#### **Attachment**

Guidelines for Identifying Provisionally Accredited Levees (PALs)



cc: See Distribution List

**Distribution List** (electronic distribution only):

Directors, Regions I - X

Office of the Mitigation Division Director

Risk Analysis Branch

Risk Reduction Branch

Risk Insurance Branch

Federal Insurance and Mitigation Divisions in FEMA Regional Offices

Office of Legislative Affairs

Office of General Counsel

National Service Provider

Independent Verification and Validation Contractor

Map Service Center

Indefinite Delivery Indefinite Quantity Contractors

Cooperating Technical Partners



## § 65.10

## 44 CFR Ch. I (10-1-02 Edition)

a reissuance or revision of the flood insurance study or maps and will be deferred until such time as a significant change occurs;

(f) An additional 90 days is required to evaluate the scientific or technical data submitted; or

(g) Additional data are required to support the revision request.

(h) The required payment has not been submitted in accordance with 44 CFR part 72, no review will be conducted and no determination will be issued until payment is received.

[51 FR 30315, Aug. 25, 1986; 61 FR 46331, Aug. 30, 1996, as amended at 62 FR 5736, Feb. 6, 1997]

### § 65.10 Mapping of areas protected by levee systems.

(a) *General.* For purposes of the NFIP, FEMA will only recognize in its flood hazard and risk mapping effort those levee systems that meet, and continue to meet, minimum design, operation, and maintenance standards that are consistent with the level of protection sought through the comprehensive flood plain management criteria established by § 60.3 of this subchapter. Accordingly, this section describes the types of information FEMA needs to recognize, on NFIP maps, that a levee system provides protection from the base flood. This information must be supplied to FEMA by the community or other party seeking recognition of such a levee system at the time a flood risk study or restudy is conducted, when a map revision under the provisions of part 65 of this subchapter is sought based on a levee system, and upon request by the Administrator during the review of previously recognized structures. The FEMA review will be for the sole purpose of establishing appropriate risk zone determinations for NFIP maps and shall not constitute a determination by FEMA as to how a structure or system will perform in a flood event.

(b) *Design criteria.* For levees to be recognized by FEMA, evidence that adequate design and operation and maintenance systems are in place to provide reasonable assurance that protection from the base flood exists must be provided. The following requirements must be met:

(1) *Freeboard.* (i) Riverine levees must provide a minimum freeboard of three feet above the water-surface level of the base flood. An additional one foot above the minimum is required within 100 feet in either side of structures (such as bridges) riverward of the levee or wherever the flow is constricted. An additional one-half foot above the minimum at the upstream end of the levee, tapering to not less than the minimum at the downstream end of the levee, is also required.

(ii) Occasionally, exceptions to the minimum riverine freeboard requirement described in paragraph (b)(1)(i) of this section, may be approved. Appropriate engineering analyses demonstrating adequate protection with a lesser freeboard must be submitted to support a request for such an exception. The material presented must evaluate the uncertainty in the estimated base flood elevation profile and include, but not necessarily be limited to an assessment of statistical confidence limits of the 100-year discharge; changes in stage-discharge relationships; and the sources, potential, and magnitude of debris, sediment, and ice accumulation. It must be also shown that the levee will remain structurally stable during the base flood when such additional loading considerations are imposed. Under no circumstances will freeboard of less than two feet be accepted.

(iii) For coastal levees, the freeboard must be established at one foot above the height of the one percent wave or the maximum wave runup (whichever is greater) associated with the 100-year stillwater surge elevation at the site.

(iv) Occasionally, exceptions to the minimum coastal levee freeboard requirement described in paragraph (b)(1)(iii) of this section, may be approved. Appropriate engineering analyses demonstrating adequate protection with a lesser freeboard must be submitted to support a request for such an exception. The material presented must evaluate the uncertainty in the estimated base flood loading conditions. Particular emphasis must be placed on the effects of wave attack and overtopping on the stability of the levee. Under no circumstances, however, will a freeboard of less than two



feet above the 100-year stillwater surge elevation be accepted.

(2) *Closures.* All openings must be provided with closure devices that are structural parts of the system during operation and design according to sound engineering practice.

(3) *Embankment protection.* Engineering analyses must be submitted that demonstrate that no appreciable erosion of the levee embankment can be expected during the base flood, as a result of either currents or waves, and that anticipated erosion will not result in failure of the levee embankment or foundation directly or indirectly through reduction of the seepage path and subsequent instability. The factors to be addressed in such analyses include, but are not limited to: Expected flow velocities (especially in constricted areas); expected wind and wave action; ice loading; impact of debris; slope protection techniques; duration of flooding at various stages and velocities; embankment and foundation materials; levee alignment, bends, and transitions; and levee side slopes.

(4) *Embankment and foundation stability.* Engineering analyses that evaluate levee embankment stability must be submitted. The analyses provided shall evaluate expected seepage during loading conditions associated with the base flood and shall demonstrate that seepage into or through the levee foundation and embankment will not jeopardize embankment or foundation stability. An alternative analysis demonstrating that the levee is designed and constructed for stability against loading conditions for Case IV as defined in the U.S. Army Corps of Engineers (COE) manual, "Design and Construction of Levees" (EM 1110-2-1913, Chapter 6, Section II), may be used. The factors that shall be addressed in the analyses include: Depth of flooding, duration of flooding, embankment geometry and length of seepage path at critical locations, embankment and foundation materials, embankment compaction, penetrations, other design factors affecting seepage (such as drainage layers), and other design factors affecting embankment and foundation stability (such as berms).

(5) *Settlement.* Engineering analyses must be submitted that assess the po-

tential and magnitude of future losses of freeboard as a result of levee settlement and demonstrate that freeboard will be maintained within the minimum standards set forth in paragraph (b)(1) of this section. This analysis must address embankment loads, compressibility of embankment soils, compressibility of foundation soils, age of the levee system, and construction compaction methods. In addition, detailed settlement analysis using procedures such as those described in the COE manual, "Soil Mechanics Design—Settlement Analysis" (EM 1100-2-1904) must be submitted.

(6) *Interior drainage.* An analysis must be submitted that identifies the source(s) of such flooding, the extent of the flooded area, and, if the average depth is greater than one foot, the water-surface elevation(s) of the base flood. This analysis must be based on the joint probability of interior and exterior flooding and the capacity of facilities (such as drainage lines and pumps) for evacuating interior floodwaters.

(7) *Other design criteria.* In unique situations, such as those where the levee system has relatively high vulnerability, FEMA may require that other design criteria and analyses be submitted to show that the levees provide adequate protection. In such situations, sound engineering practice will be the standard on which FEMA will base its determinations. FEMA will also provide the rationale for requiring this additional information.

(c) *Operation plans and criteria.* For a levee system to be recognized, the operational criteria must be as described below. All closure devices or mechanical systems for internal drainage, whether manual or automatic, must be operated in accordance with an officially adopted operation manual, a copy of which must be provided to FEMA by the operator when levee or drainage system recognition is being sought or when the manual for a previously recognized system is revised in any manner. All operations must be under the jurisdiction of a Federal or State agency, an agency created by Federal or State law, or an agency of a community participating in the NFIP.



(1) *Closures.* Operation plans for closures must include the following:

(i) Documentation of the flood warning system, under the jurisdiction of Federal, State, or community officials, that will be used to trigger emergency operation activities and demonstration that sufficient flood warning time exists for the completed operation of all closure structures, including necessary sealing, before floodwaters reach the base of the closure.

(ii) A formal plan of operation including specific actions and assignments of responsibility by individual name or title.

(iii) Provisions for periodic operation, at not less than one-year intervals, of the closure structure for testing and training purposes.

(2) *Interior drainage systems.* Interior drainage systems associated with levee systems usually include storage areas, gravity outlets, pumping stations, or a combination thereof. These drainage systems will be recognized by FEMA on NFIP maps for flood protection purposes only if the following minimum criteria are included in the operation plan:

(i) Documentation of the flood warning system, under the jurisdiction of Federal, State, or community officials, that will be used to trigger emergency operation activities and demonstration that sufficient flood warning time exists to permit activation of mechanized portions of the drainage system.

(ii) A formal plan of operation including specific actions and assignments of responsibility by individual name or title.

(iii) Provision for manual backup for the activation of automatic systems.

(iv) Provisions for periodic inspection of interior drainage systems and periodic operation of any mechanized portions for testing and training purposes. No more than one year shall elapse between either the inspections or the operations.

(3) *Other operation plans and criteria.* Other operating plans and criteria may be required by FEMA to ensure that adequate protection is provided in specific situations. In such cases, sound emergency management practice will be the standard upon which FEMA determinations will be based.

(d) *Maintenance plans and criteria.* For levee systems to be recognized as providing protection from the base flood, the maintenance criteria must be as described herein. Levee systems must be maintained in accordance with an officially adopted maintenance plan, and a copy of this plan must be provided to FEMA by the owner of the levee system when recognition is being sought or when the plan for a previously recognized system is revised in any manner. All maintenance activities must be under the jurisdiction of a Federal or State agency, an agency created by Federal or State law, or an agency of a community participating in the NFIP that must assume ultimate responsibility for maintenance. This plan must document the formal procedure that ensures that the stability, height, and overall integrity of the levee and its associated structures and systems are maintained. At a minimum, maintenance plans shall specify the maintenance activities to be performed, the frequency of their performance, and the person by name or title responsible for their performance.

(e) *Certification requirements.* Data submitted to support that a given levee system complies with the structural requirements set forth in paragraphs (b)(1) through (7) of this section must be certified by a registered professional engineer. Also, certified as-built plans of the levee must be submitted. Certifications are subject to the definition given at § 65.2 of this subchapter. In lieu of these structural requirements, a Federal agency with responsibility for levee design may certify that the levee has been adequately designed and constructed to provide protection against the base flood.

[51 FR 30316, Aug. 25, 1986]

#### § 65.11 Evaluation of sand dunes in mapping coastal flood hazard areas.

(a) *General conditions.* For purposes of the NFIP, FEMA will consider storm-induced dune erosion potential in its determination of coastal flood hazards and risk mapping efforts. The criterion to be used in the evaluation of dune erosion will apply to primary frontal dunes as defined in § 59.1, but does not



# Requirements for Mapping Levees

## Complying with Section 65.10 of the NFIP Regulations

As part of a mapping project, it is the levee owner's or community's responsibility to provide data and documentation to show that a levee meets the requirements of Section 65.10 of the National Flood Insurance Program (NFIP) regulations. Links to Section 65.10 and many other documents are available on FEMA's Web site at [www.fema.gov/plan/prevent/fhm/lv\\_fpm.shtm](http://www.fema.gov/plan/prevent/fhm/lv_fpm.shtm).

The FEMA requirements in Section 65.10 are separated into five categories:

1. General criteria;
2. Design criteria;
3. Operations plans and criteria;
4. Maintenance plans and criteria; and
5. Certification requirements.

The requirements for each of these areas are summarized below.

### **(A) GENERAL CRITERIA**

For purposes of the NFIP, FEMA will only recognize in its flood hazard and risk mapping effort those levee systems that meet, and continue to meet, minimum design, operation, and maintenance standards that are consistent with the level of protection sought through the comprehensive floodplain management criteria established by Section 60.3 of the NFIP regulations. Section 65.10 of the NFIP regulations describes the types of information FEMA needs to recognize, on NFIP maps, that a levee system provides protection from the flood that has a 1-percent chance of being equaled or exceeded in any give year (base flood). This information must be supplied to FEMA by the community or other party seeking recognition of a levee system at the time a study or restudy is conducted, when a map revision under the provisions of Part 65 of the NFIP regulations is sought based on a levee system, and upon request by the Administrator during the review of previously recognized structures. The FEMA review is for the sole purpose of establishing appropriate risk zone determinations for NFIP maps and does not constitute a determination by FEMA as to how a structure or system will perform in a flood event.

### **(B) DESIGN CRITERIA**

For the purposes of the NFIP, FEMA has established levee design criteria for freeboard, closures, embankment protection, embankment and foundation stability, settlement, interior drainage, and other design criteria. These criteria are summarized in subsections below.

#### **(B)(1) FREEBOARD**

For riverine levees:

- A minimum freeboard of 3 feet above the water-surface level of the base flood must be provided.
- An additional 1 foot above the minimum is required within 100 feet on either side of structures (e.g., bridges) riverward of the levee or wherever the flow is constricted.





- An additional 0.5 foot above the minimum at the upstream end of the levee, tapering to not less than the minimum at the downstream end of the levee, is also required.

Exceptions to the minimum riverine freeboard requirements above may be approved if the following criteria are met:

- Appropriate engineering analyses demonstrating adequate protection with a lesser freeboard must be submitted.
- The material presented must evaluate the uncertainty in the estimated base flood elevation profile and include, but not necessarily be limited to:
  - An assessment of statistical confidence limits of the 1-percent-annual-chance discharge;
  - Changes in stage-discharge relationships; and
  - Sources, potential, and magnitude of debris, sediment, and ice accumulation.
- It must be also shown that the levee will remain structurally stable during the base flood when such additional loading considerations are imposed.

Under no circumstances will freeboard of less than 2 feet be accepted.

For coastal levees, the freeboard must be established at 1 foot above the height of the 1-percent-annual-chance wave or the maximum wave runup (whichever is greater) associated with the 1-percent-annual-chance stillwater surge elevation at the site.

Exceptions to the minimum coastal freeboard requirements above may be approved if the following criteria are met:

- Appropriate engineering analyses demonstrating adequate protection with a lesser freeboard must be submitted.
- The material presented must evaluate the uncertainty in the estimated base flood loading conditions. Particular emphasis must be placed on the effects of wave attack and overtopping on the stability of the levee.

Under no circumstances will a freeboard of less than 2 feet above the 1-percent-annual-chance stillwater surge elevation be accepted.

## **(B)(2) CLOSURES**

The levee closure requirement is that all openings must be provided with closure devices that are structural parts of the system during operation and design according to sound engineering practice.

## **(B)(3) EMBANKMENT PROTECTION**

Engineering analyses must be submitted to demonstrate that no appreciable erosion of the levee embankment can be expected during the base flood, as a result of either currents or waves, and that anticipated erosion will not result in failure of the levee embankment or foundation directly or indirectly through reduction of the seepage path and subsequent instability.

The factors to be addressed in such analyses include, but are not limited to:

- Expected flow velocities (especially in constricted areas);
- Expected wind and wave action;



- Ice loading;
- Impact of debris;
- Slope protection techniques;
- Duration of flooding at various stages and velocities;
- Embankment and foundation materials;
- Levee alignment, bends, and transitions; and
- Levee side slopes.

#### **(B)(4) EMBANKMENT AND FOUNDATION STABILITY**

Engineering analyses that evaluate levee embankment stability must be submitted.

The analyses provided shall evaluate expected seepage during loading conditions associated with the base flood and shall demonstrate that seepage into or through the levee foundation and embankment will not jeopardize embankment or foundation stability.

An alternative analysis demonstrating that the levee is designed and constructed for stability against loading conditions for Case IV as defined in U.S. Army Corps of Engineers (USACE) Engineering Manual 1110-2-1913, Chapter 6, Section II, may be used.

The factors that shall be addressed in the analyses include:

- Depth of flooding;
- Duration of flooding;
- Embankment geometry and length of seepage path at critical locations;
- Embankment and foundation materials;
- Embankment compaction;
- Penetrations;
- Other design factors affecting seepage (e.g., drainage layers); and
- Other design factors affecting embankment and foundation stability (e.g., berms).

#### **(B)(5) SETTLEMENT**

Engineering analyses must be submitted that assess the potential and magnitude of future losses of freeboard as a result of levee settlement and demonstrate that freeboard will be maintained within the minimum freeboard standards set forth in B(1).

This analysis must address:

- Embankment loads,
- Compressibility of embankment soils,
- Compressibility of foundation soils,



- Age of the levee system, and
- Construction compaction methods.

A detailed settlement analysis using procedures such as those described in USACE Engineering Manual EM 1110-1-1904 must be submitted.

#### **(B)(6) INTERIOR DRAINAGE**

An analysis must be submitted that identifies the source(s) of such flooding; the extent of the flooded area; and, if the average depth is greater than 1 foot, the water-surface elevation(s) of the base flood. This analysis must be based on the joint probability of interior and exterior flooding and the capacity of facilities (such as drainage lines and pumps) for evacuating interior floodwaters. Interior drainage systems usually include storage areas, gravity outlets, pumping stations, or a combination thereof.

For areas of interior drainage that have average depths greater than 1 foot, mapping must be provided depicting the extents of the interior flooding, along with supporting documentation.

#### **(B)(7) OTHER DESIGN CRITERIA**

In unique situations, such as those where the levee system has relatively high vulnerability, FEMA may require that other design criteria and analyses be submitted to show that the levees provide adequate protection. In such situations, sound engineering practice will be the standard on which FEMA will base its determinations. FEMA also will provide the rationale for requiring this additional information.

#### **(C) OPERATIONS PLANS AND CRITERIA**

For a levee system to be recognized, the operational criteria must be as described below. All closure devices or mechanical systems for internal drainage, whether manual or automatic, must be operated in accordance with an officially adopted operation manual, a copy of which must be provided to FEMA by the operator when levee or drainage system recognition is being sought or when the manual for a previously recognized system is revised in any manner. All operations must be under the jurisdiction of a Federal or State agency, an agency created by Federal or State law, or an agency of a community participating in the NFIP.

##### **(C)(1) CLOSURES**

Operation plans for closures must include the following:

- Documentation of the flood warning system, under the jurisdiction of Federal, State, or community officials, that will be used to trigger emergency operation activities and demonstration that sufficient flood warning time exists for the completed operation of all closure structures, including necessary sealing, before floodwaters reach the base of the closure;
- A formal plan of operation, including specific actions and assignments of responsibility by individual name or title; and
- Provisions for periodic operation, at not less than 1-year intervals, of the closure structure(s) for testing and training purposes.



### **(C)(2) INTERIOR DRAINAGE SYSTEMS**

Interior drainage systems associated with levee systems usually include storage areas, gravity outlets, pumping stations, or a combination thereof. FEMA will recognize these drainage systems on NFIP maps for flood protection purposes only if the following minimum criteria are included in the operation plan:

- Documentation of the flood warning system, under the jurisdiction of Federal, State, or community officials, that will be used to trigger emergency operation activities and demonstration that sufficient flood warning time exists to permit activation of mechanized portions of the drainage system;
- A formal plan of operation, including specific actions and assignments of responsibility by individual name or title;
- Provision for manual backup for the activation of automatic systems; and
- Provisions for periodic inspection of interior drainage systems and periodic operation of any mechanized portions for testing and training purposes; no more than 1 year shall elapse between either the inspections or the operations.

### **(C)(3) OTHER OPERATION PLANS AND CRITERIA**

FEMA may require other operating plans and criteria to ensure that adequate protection is provided in specific situations. In such cases, sound emergency management practice will be the standard upon which FEMA determinations will be based.

### **(D) MAINTENANCE PLANS AND CRITERIA**

For levee systems to be recognized as providing protection from the base flood, the following maintenance criteria must be met:

- Levee systems must be maintained in accordance with an officially adopted maintenance plan, and a copy of this plan must be provided to FEMA by the owner of the levee system when recognition is being sought or when the plan for a previously recognized system is revised in any manner.
- All maintenance activities must be under the jurisdiction of a(n):
  - Federal or State agency;
  - Agency created by Federal or State law; or
  - Agency of a community participating in the NFIP that must assume ultimate responsibility for maintenance.
- The maintenance plan must document the formal procedure that ensures that the stability, height, and overall integrity of the levee and its associated structures and systems are maintained.
- At a minimum, the maintenance plan shall specify:
  - Maintenance activities to be performed;
  - Frequency of their performance; and
  - Person by name or title responsible for their performance.





***(E) CERTIFICATION REQUIREMENTS***

Data submitted to support that a given levee system complies with the structural requirements set forth in B(1) through B(7) above must be certified by a Registered Professional Engineer. Also, certified as-built plans of the levee must be submitted. Certifications are subject to the definition given in Section 65.2 of the NFIP regulations. In lieu of these structural requirements, a Federal agency with responsibility for levee design may certify that the levee has been adequately designed and constructed to provide protection against the base flood.