A Look at Levees

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Agenda

• FEMA and Levees
• Levee Accreditation Reviews
• Proposed Changes to the FEMA Levee Policy
FEMA and Levees
FEMA and Levees

• FEMA does *NOT* own or operate any levees

• Establishment of appropriate risk zones under NFIP

• Accredited levees can show protection from the 1% event on the FIRM

• For a levee to be accredited it must be under the jurisdiction of
  – Federal agency
  – State agency
  – An agency created under federal law
  – An agency of a community participating in the NFIP
Title 44 Code of Federal Regulations Section 65.10

• 44 CFR 65.10
  – Establishes the minimum standards under which a levee may offer protection under the NFIP
    1. Freeboard
    2. Closures
    3. Embankment protection
    4. Embankment and foundation stability
    5. Settlement
    6. Interior drainage
    7. Other Design Criteria

• Accreditation procedure clarified by FEMA PMs 34, 43, and 63
Procedure Memorandum 34

• Issued August 22, 2005

• Reiterates that it is the community’s responsibility to provide the data necessary for accreditation

• Establishes a clear flow chart of requirements for levee accreditation

• Allows for the issuance of a deadline to the community
Procedure Memorandum 34 Flow Chart

FEMA

Interim Guidance for Studies Including Levees
08/22/2005
Procedure Memorandum 43

• Issued March 16, 2007

• Without proper documentation, areas behind the levees will be redelineated on the new FIRMs

• Establishes the “Provisionally Accredited Levee” (PAL)

• Community has 24 months to provide full documentation of the certified levee

WARNING: This map contains levees, dikes, or other structures that have 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 August 8, 2009. 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.
Procedure Memorandum 63

• Issued September 2, 2010

• Establishes a clear, universal, review checklist for mapping partners

• Is a completeness check and NOT a technical review

• Allows the reviewer to request additional data from the submitter at three levels of the review process
**Procedure Memorandum 63 Checklist Items**

- **Tier 1**
  - All Items Signed by a P.E.
  - Freeboard Check
- **Tier 2**
  - Regulations
  - Operations and Maintenance
  - “With Levees” and “Without Levees” Analysis
- **Tier 3**
  - Levee System and Cross Reference Check
  - Interior Drainage Analysis
  - Structural Design Requirements
  - Inspection Reports
- **Final Completeness Check**
Levee Reviews
Levee Reviews

• 44 CFR 65.10 Completeness Reviews
  – Signed and Sealed by a Professional Engineer
  – Contains ALL the necessary sections
  – The sections comply with the 44 CFR 65.10 guidelines

• Show the Proof!
Levee Reviews

• Freeboard
  – Riverine 3’ above BFE
    • Additional 1’ within 100’ of inline structures
    • Additional 0.5’ at the US end of the levee
  – Coastal 1’ above the 1% wave height or maximum wave runup

• Freeboard Exceptions
  – Must provide:
    • Freeboard must be greater than 2’
    • Engineering analysis proving adequate protection
    • Statistical uncertainty analysis in the BFE and 1% discharge
    • Debris, sediment, and ice accumulation potential
Freeboard Example 1

Road with 3’ of Freeboard
Freeboard Example 1

Road with 4’ of Freeboard
Freeboard Example 2

2.88 Feet of Freeboard
Closures

• All openings must be provided with closure devices
Levee Reviews

• Containment
  – Levees must tie in to adjacent high ground within 0.1’
  – Embankment designation of high ground
    • Back slope of shallower than 6:1
    • Natural, unimproved ground that’s higher than the BFE
    • Can have the levee designation removed if the BFE does not reach the elevation on the landward toe of the levee
Containment Example 1

Flooding Source
Levee Floodwall
Highway Embankment
Levee Reviews

• Operations and maintenance
  – Must be officially adopted by the governing body
    • Must state activities to be performed and the frequency of the performance
    • Must name a responsible individual by name or title

• Typically, levee inspections are done annually and after major event

• Should document the maintenance record
Levee Reviews

• Interior Drainage
  – Often confused with “interior drainage systems”
    • Included within “Other design criteria” in 44 CFR 65.10
  – Should show what the floodplain will look like after the levee is accredited
  – Common to claim that interior drainage analysis is not necessary
Interior Drainage Example
Levee Reviews

- Structural, Geotechnical, and Seepage Calculations
  - Calculations should be well organized and “Black-Box” outputs are not desirable
    - Well organized submissions will expedite the review process
  - Should address the “as-built” levee conditions
    - As-built plans should be included
  - Calculations of seepage exit gradients should be provided
    - This is a frequent omission
Proposed Changes to FEMA Levee Policy
Current FEMA Approach for Levee Analysis

- “With Levee” and “Without Levee” Analysis
  - FEMA G&S Appendix H
  - Technically sound, yet can be conservative

- If levee accredited, landward area mapped as Zone X

- If levee isn’t accredited, landward area mapped in SFHA
Resistance to Effective Approach

- Map Mod Maps became effective
- Increased awareness of levee hazards
- Congress requested that FEMA re-evaluate methodology
Proposed Levee Analysis Guidelines

• Revised Analyses Levee Scenarios
  – Sound Reach
  – Freeboard Deficient
  – Overtopping
  – Structural-Based
  – Natural Valley
Proposed Levee Analysis Guidelines – Sound Reach

- Certified and accredited levee segment
- Requires documentation that 44 CFR 65.10 requirements are met
Proposed Levee Analysis Guidelines – Freeboard Deficient

• Levee meets all 44 CFR 65.10 requirements except freeboard
• Requires documentation that all other requirements are met
Proposed Levee Analysis Guidelines – Overtopping

- BFE is higher than levee but structurally will not fail
- Requires documentation that indicates no erosion will occur during a 1% event
Proposed Levee Analysis Guidelines – Structural-Based

- Segments are breached to determine SFHA in instances of levee failure
- Levee elevations and flooding source hydrograph required
Proposed Levee Analysis Guidelines – Natural Valley

• Without-levee type of analysis
• No documentation from community required
Mapping of a Levee with Multiple Scenarios

Legend

Reach

- Overtopping Procedure
- Structural-Based Inundation Procedure
- Sound Reach Procedure
- Natural Valley Procedure
- SFHA, Flooding Source
- Side of Levee
- Composite SFHA, Landside of Levee
Some Key Changes

• Local stakeholder engagement will be a priority
• Landward areas with levee related flood risk outside of SFHA designated as Zone D
• Ability to analyze the same levee system with different scenarios
• For non-accredited levees, analysis is scalable depending on urbanization
References

Thank You

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