



US Army Corps of Engineers
Portland District

2006 Northwest Dam Safety Regional Forum

Probable Maximum Precipitation using HMR Nr. 57

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Reasons for Dam Failures

- OVERTOPPING - 34% of all failures (nationally)
 - Inadequate Spillway Design
 - Debris Blockage of Spillway
 - Settlement of Dam Crest
- FOUNDATION DEFECTS - 30% of all failures
 - Differential Settlement
 - Sliding and Slope Instability
 - High Uplift Pressures
 - Uncontrolled Foundation Seepage
- PIPING AND SEEPAGE - 20%
 - Internal Erosion Through Dam Caused by Seepage-"Piping"
 - Seepage and Erosion Along Hydraulic Structures Such as Outlet
 - Conduits or Spillways, or Leakage Through Animal Burrows
 - Cracks in Dam
- CONDUITS AND VALVES - 10%
 - Piping of Embankment Material Into Conduit Through Joints or Cracks
- OTHER - 6%

PMP using HMR Nr. 57

- Get yourself a copy of HMR Nr. 57
 - Available from NOAA-NWS-HDSC
- Follow instructions in Chapter 15
 - Omit Step 4 if not applicable
- Questions?

Outline

- What are HMRs?
- What is the PMP?
- Why a PMP?
- HMRs and PMP.

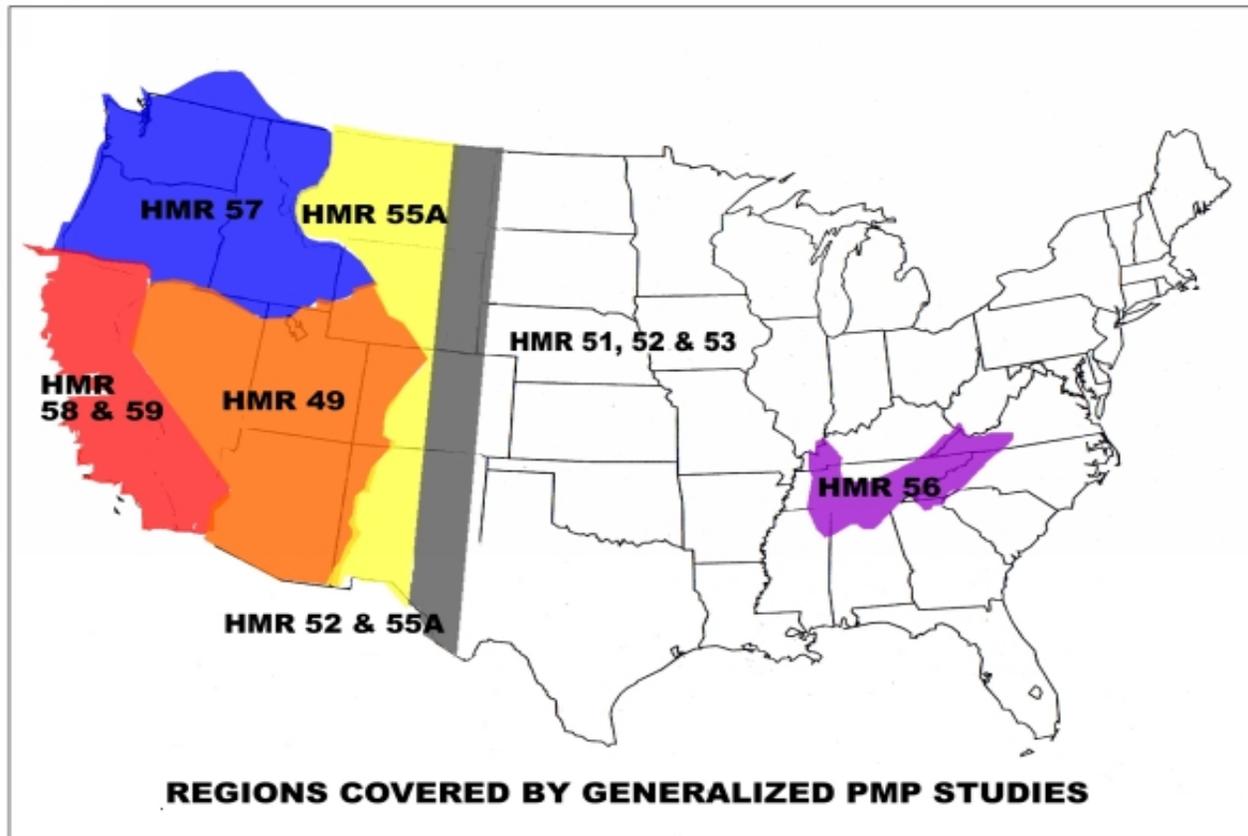
Hydrometeorological Reports (HMRs)

- Series of reports – National in scope
- Content
 - Probable Maximum Precipitation Study Documentation
 - Methods to compute PMP for an area of interest
 - Support information
 - References

HMRs



Hydrometeorological Design Studies Center



HMR Nr. 57

- HMR Nr. 57 (Supercedes HMR Nr. 43)
 - Probable Maximum Precipitation – Pacific Northwest States, Columbia River (including portions of Canada), Snake River, and Pacific Coastal Drainages
- October 1994
- NOAA, BuRec, CoE

HYDROMETEOROLOGICAL REPORT NO. 57
(SUPERCEDES HYDROMETEOROLOGICAL REPORT NO. 43)

PROBABLE MAXIMUM PRECIPITATION
PACIFIC NORTHWEST STATES
(Columbia River, including portions of Canada),
Snake River, and Pacific Coastal Drainages

U.S. DEPARTMENT OF COMMERCE
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
U.S. DEPARTMENT OF INTERIOR
BUREAU OF RECLAMATION
U.S. DEPARTMENT OF ARMY
CORPS OF ENGINEERS

Silver Spring, MD
October 1994

Probable Maximum Precipitation

- What is it?
 - "Theoretically, the greatest depth of precipitation for a given duration that is physically possible over a given size storm area at a particular geographical location at a certain time of the year."
- Why use it?
 - To develop an Inflow Design Flood to use in sizing or evaluating of outlets

Inflow Design Flood

- Could be, and are, any of a number of magnitudes depending...
- Corps of Engineers Standards for IDF
 - ER 1110-2-8(FR)
- IDFs are used for New Dams and Used Dams

Inflow Design Flood

- ER 1110-8-2(FR) - Inflow Design Floods for Dams and Reservoirs
- "It is the Corps of Engineers policy that dams designed, constructed, or operated by the Corps will not create a threat of loss of life or inordinate property damage. Departures from accepted policy or practice will not be made in the design of a dam simply to reduce cost. Every phase of the planning, design, construction, and operation of a dam will be accomplished to assure that it is safe, efficient, and reliable."
- Four Standards in ER

Why a PMF?

- There are **four standards in the ER**. The standard selected is governed by circumstances associated with the specific project [to select IDF methods.]
 - 4. Small recreational lakes, farm ponds, etc. [less than ~20 AF]
 - 3. Analysis shows that failure could be tolerated at some flood magnitude
 - 2. Typically run-of-river, hydroelectric [small head differentials]
 - 1. Capable of placing human life at risk OR causing a catastrophe should they fail [= PMF]

HMR Nr. 57

- Updated HMR Nr. 43
- Goal to use improved technology and additional information to overcome shortcomings in HMR 43
- Foundation is observation of major storms
- Contains substantial summary of study (~180 pages)

PMPs from HMR Nr. 57

- Applicability
 - for the PNW
 - Columbia Basin including Snake
 - PNW Coastal Streams (e.g. Rogue)
- General Storms
 - 1 to 72 hours
 - 10 to 10,000 mile²
- Local Storms
 - ¼ to 6 hours
 - 1 to 500 mile²

PMPs from HMR Nr. 57

- Information needed
 - Drainage basin “outline” & area (mile²)
 - General Storm or Local Storm
 - Some knowledge of snowmelt potential
 - If you need snowmelt; HMR Nr. 43 has guidance

General Storm Procedure

1. Drainage Outline
2. All-season PMP estimate (10 mi² 24 hr)
3. Seasonal adjustments if needed
4. Depth-duration (1 to 72 hr)
5. Areal reductions (from 10 mi² to actual basin)
6. Incremental estimates (6 hr, 2 hr, etc)
7. Temporal Distribution (Storm Pattern)
8. Areal Distribution
9. Temperature & wind for snowmelt (see HMR 43 or other)

Example - Cougar Lake PMF Components

- Precipitation
- Runoff from Snowmelt

Component	Design (1955) Design Docs (inches)	Review (2000) HMR 57 (inches)
Precipitation	16.10	29.31
Snowmelt	5.15	12.17

Summary

- PMP used to develop a large IDF
- PacNW PMP Guidance is HMR Nr. 57
- Based on observed storm evaluations
- Results
 - Depend on geographic location, basin size, and topography
 - PMP for local storms and general storms

Questions...



end