The LAMP Process: Structural Inundation

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Plan Design Enable

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Introduction

Analysis and Mapping
Procedures for Non-Accredited
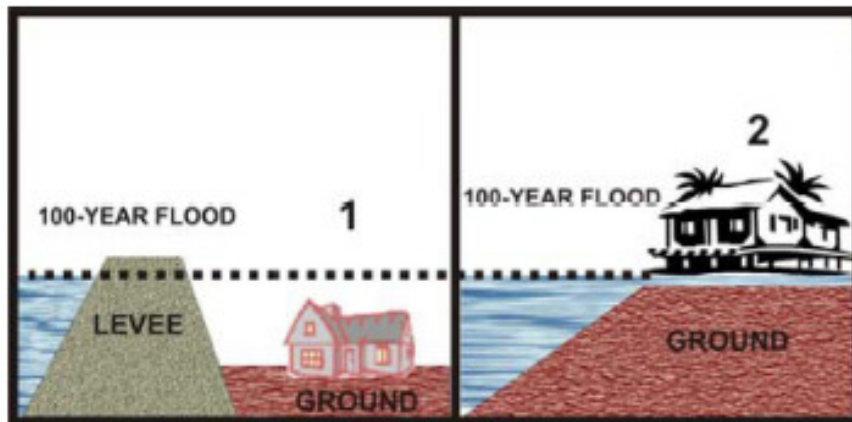Levee Systems

New Approach
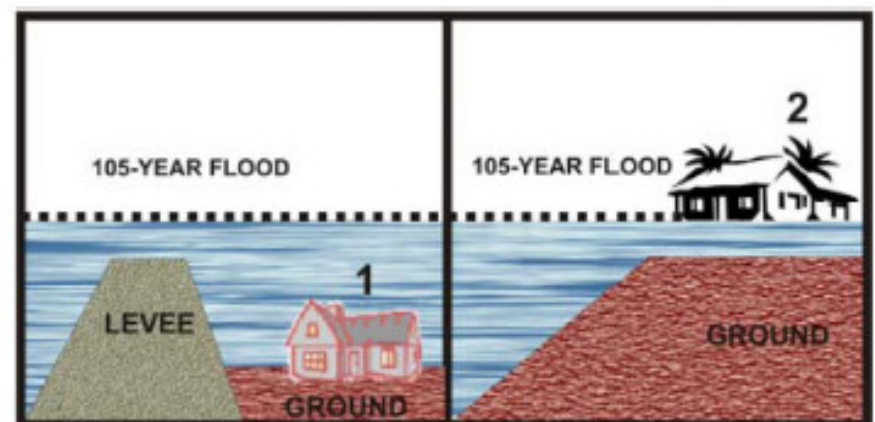
July 2013

RiskMAP
Increasing Resilience Together

www.fema.gov/plan/prevent/fhm/rm_main.shtm · 1–877–**FEMA MAP**

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Why LAMP?

Interagency Levee Policy Review Committee, 2006

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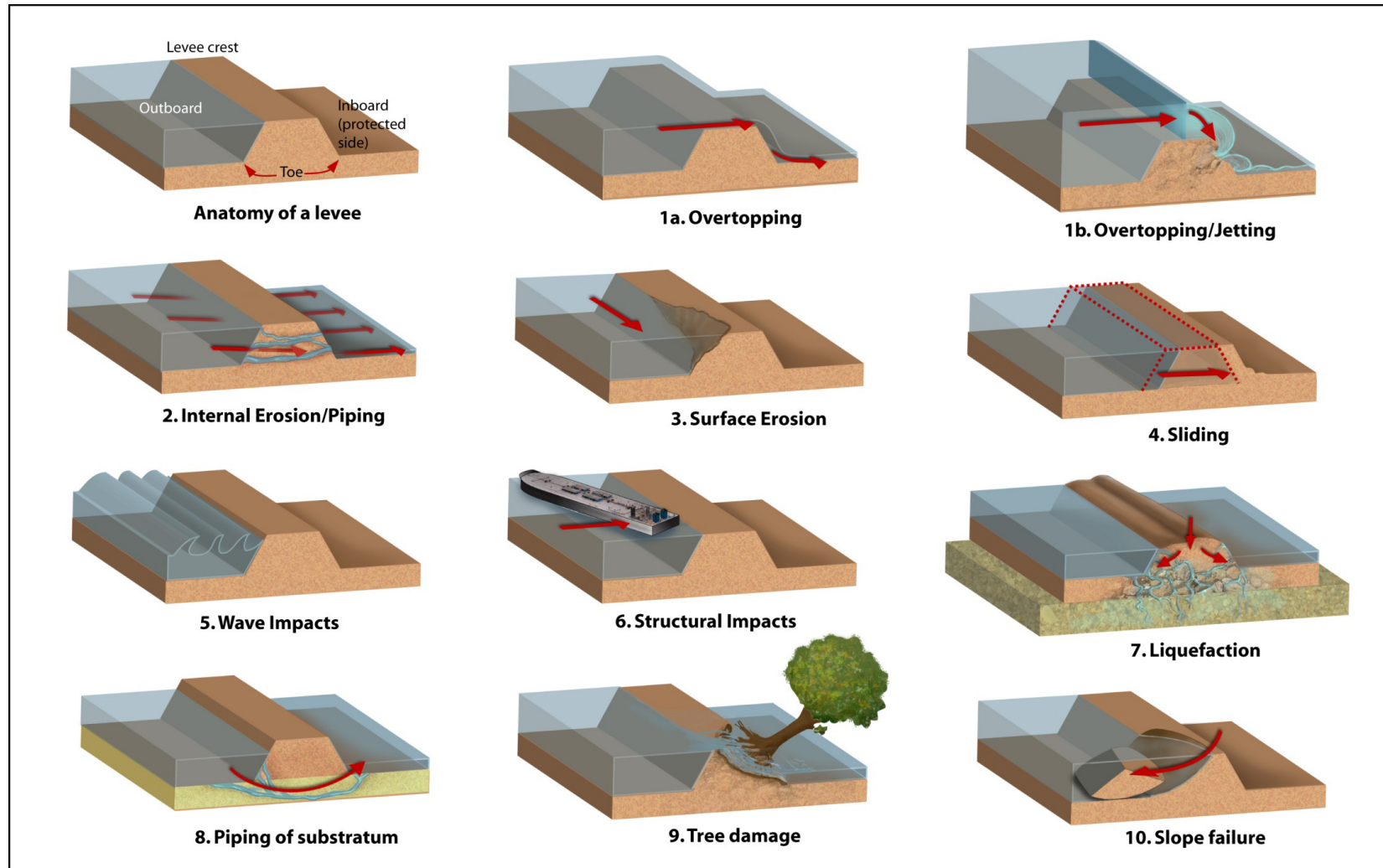# Options Under the LAMP Process

Sound Reach

Freeboard Deficient

Overtopping

Structural Based Inundation
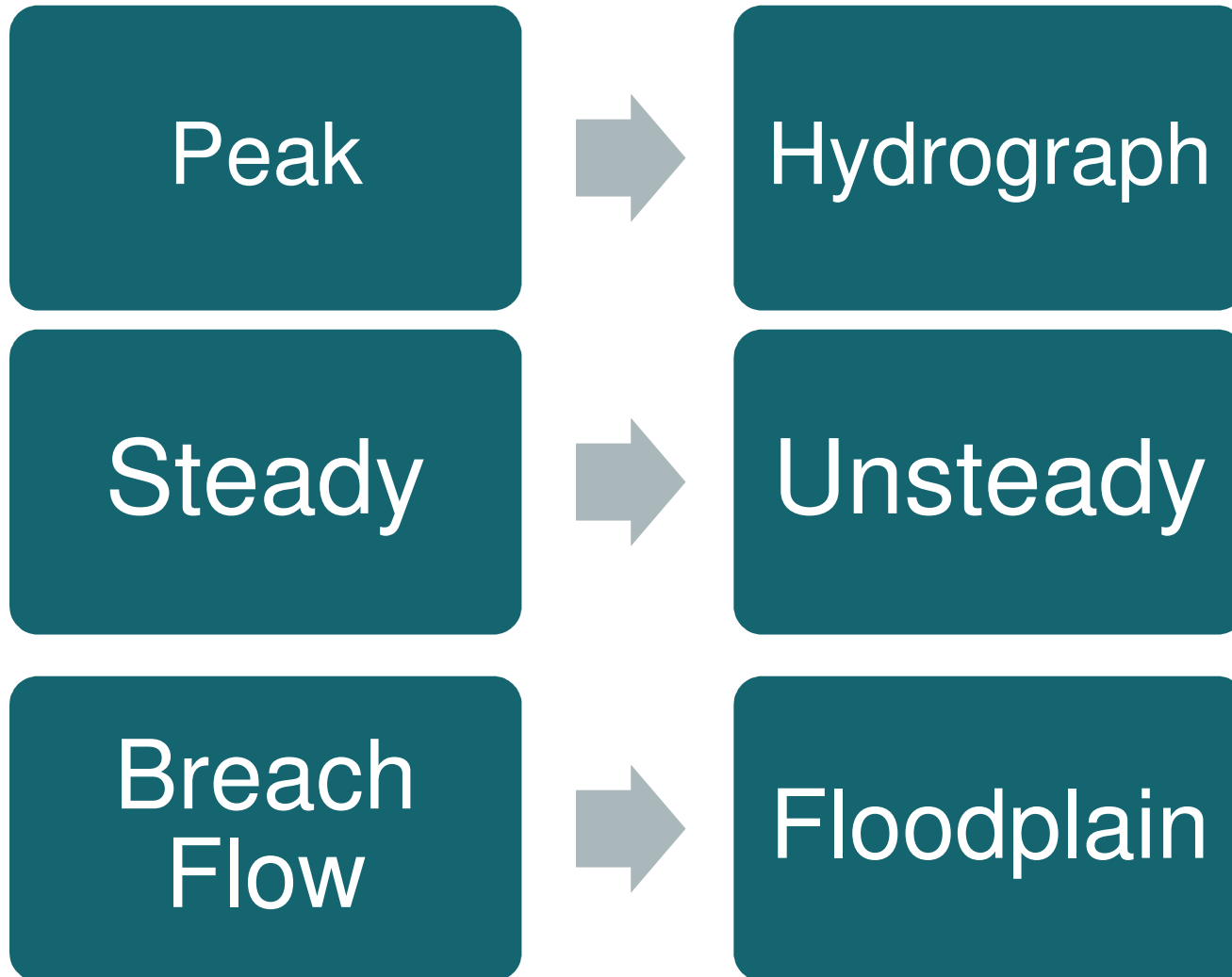
Natural Valley

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Levee Failure Types

Anatomy of a levee

1a. Overtopping

1b. Overtopping/Jetting

2. Internal Erosion/Piping

3. Surface Erosion

4. Sliding

5. Wave Impacts

6. Structural Impacts

7. Liquefaction

8. Piping of substratum

9. Tree damage

10. Slope failure

Zina Deretsky, National Science Foundation

When and where will it fail?

Patsy Lynch/FEMA, National Committee on Levee Safety

USACE

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6

Modeling Process

Peak → Hydrograph

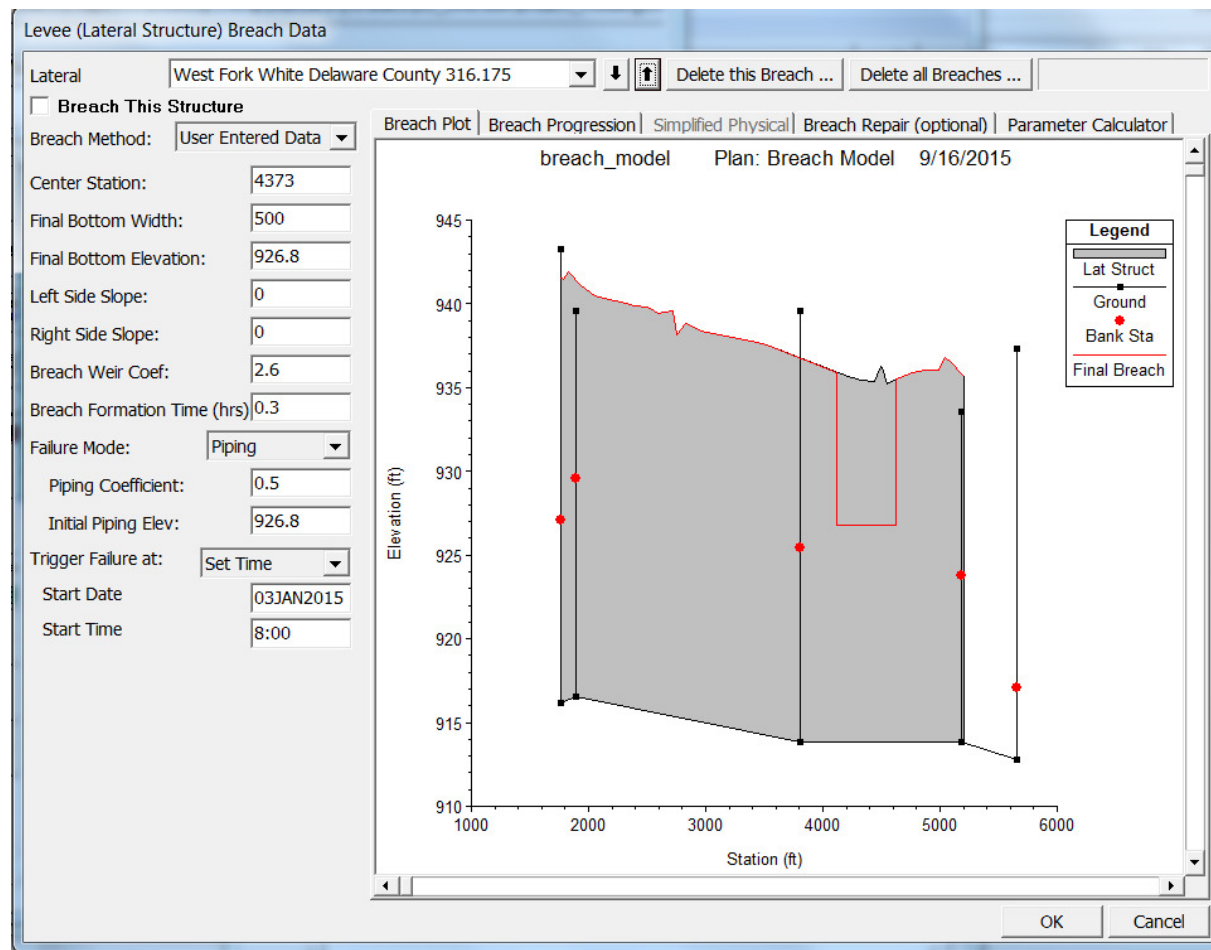Steady → Unsteady

Breach Flow → Floodplain

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Hydrograph Creation
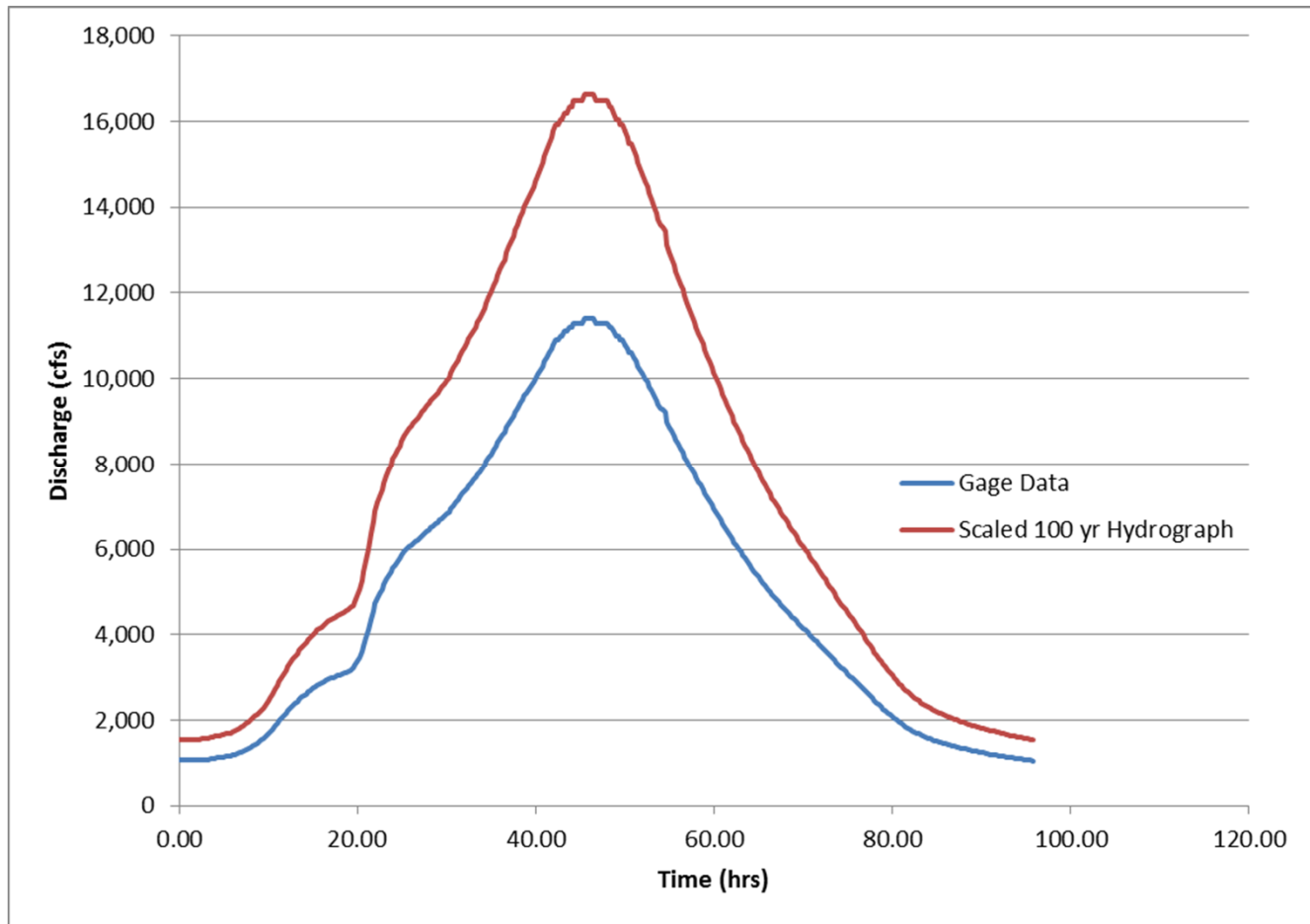
Steady to Unsteady Model
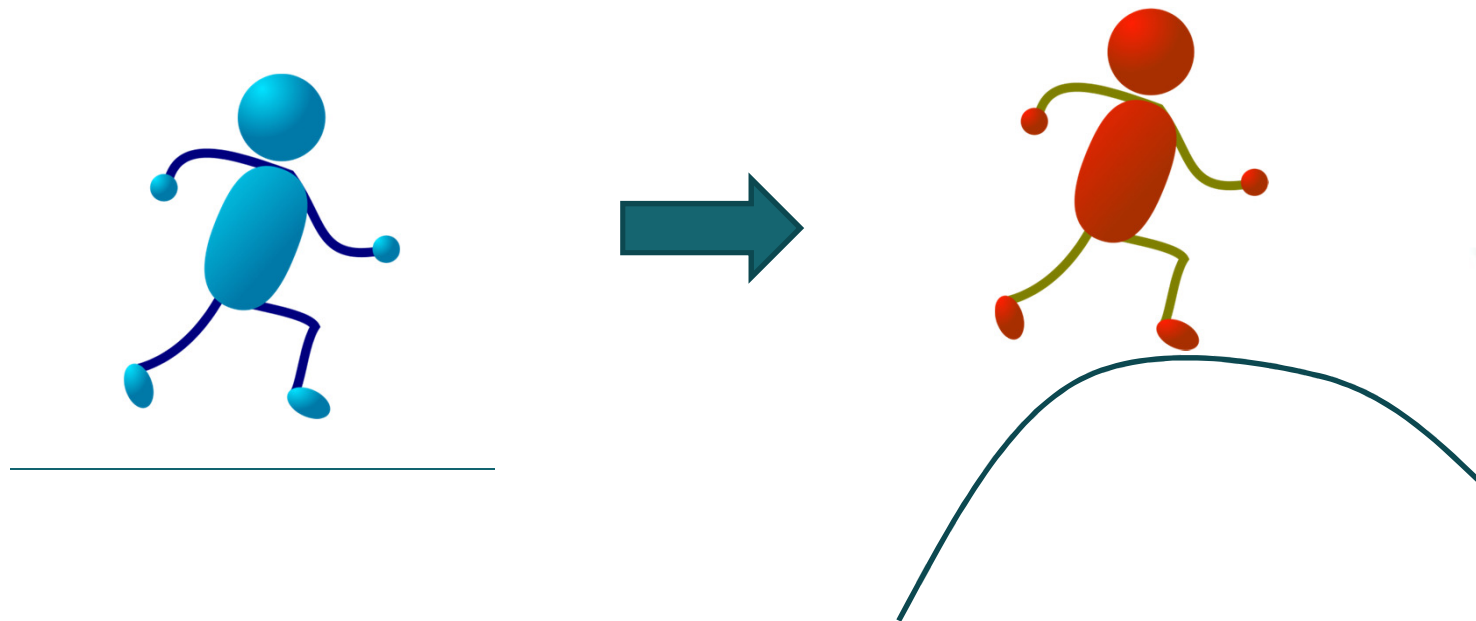
Determination of Breach Hydrograph

Breach locations

Greendale

Breach

Breach

Lawrenceburg

Breach

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Breach Parameters

Prediction of Embankment Dam Breach Parameters

A Literature Review and Needs Assessment

DSO-98-004

DSO
DAM SAFETY OFFICE

Water Resources Research Laboratory

July 1998

**US Army Corps
of Engineers**
Hydrologic Engineering Center

**Using HEC-RAS for Dam
Break Studies**

August 2014

Approved for Public Release. Distribution Unlimited.   TD-39

Breach parameters

Table 1. — Compilations of dam-failure case studies and guidance for predicting breach parameters and peak breach outflow. For explanations of symbols see the *Notation* section at the end of this report.

Reference	Case Studies	Relations Proposed	Notes
Babb and Mermel (1968)	>600 incidents		Many cases not well-documented
Kirkpatrick (1977)	16 (plus 5 hypothetical failures)	$Q_p = f(h_w)$	
SCS (1981)	13	$Q_p = f(h_w)$	
Hagen (1982)	6	$Q_p = f(h_w{*}S)$	
Reclamation (1982)	21	$Q_p = f(h_w)$	
Graham (1983)	6		dams with large storage-to-height ratios
Singh and Snorrason (1982, 1984)	20 real failures and 8 simulated failures	Guidance for B, d_{ovtop}, and t_f $Q_p = f(S)$; $Q_p = f(h_d)$	Q_p relations based on simulations
Graham (undated)	19	$Q_p = f(h_w, S)$	
MacDonald and Langridge-Monopolis (1984)	42	$V_{er} = f(V_{out}{*}h_w)$ $t_f = f(V_{er})$ $Q_p = f(V_{out}{*}h_w)$	
Costa (1985)	31 constructed dams	$Q_p = f(h_d)$ $Q_p = f(S)$ $Q_p = f(h_d{*}S)$	Includes information on natural dam failures
Evans (1986)		$Q_p = f(V_w)$	
FERC (1987)		Guidance for B, Z, t_f	
Froehlich (1987)	43	B, Z, t_f relations	
Reclamation (1988)		B, t_f guidance	
Singh and Scarlatos (1988)	52	Guidance for B, Z, t_f	
Von Thun and Gillette (1990)	57	Z guidance $B = f(h_w, S)$ $t_f = f(h_w$, erosion resistance$)$	
Froehlich (1995b)	63	B, Z, t_f relations	
Froehlich (1995a)	22	$Q_p = f(V_w, h_w)$	

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Wahl, 1998

Sensitivity analysis

Breach Width

Formation Time
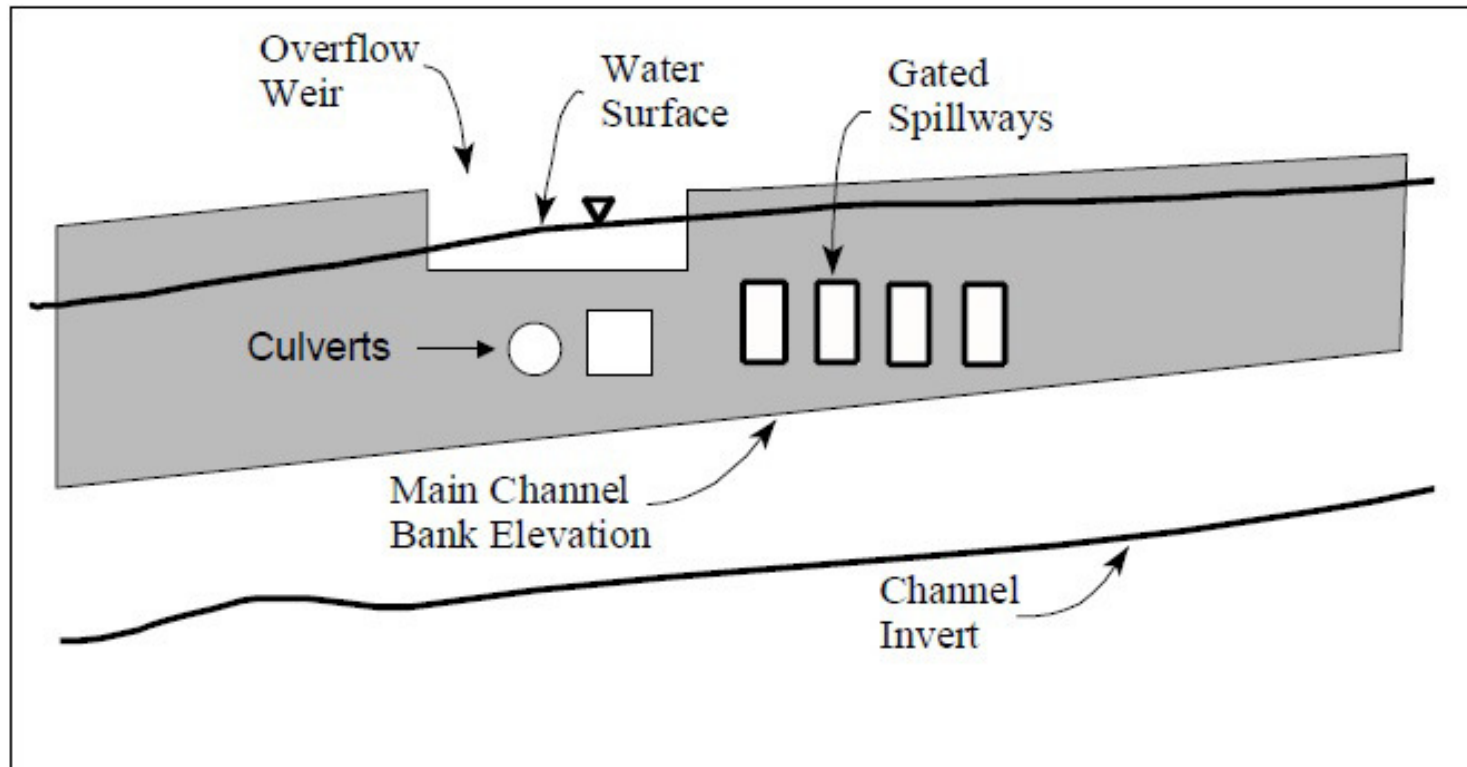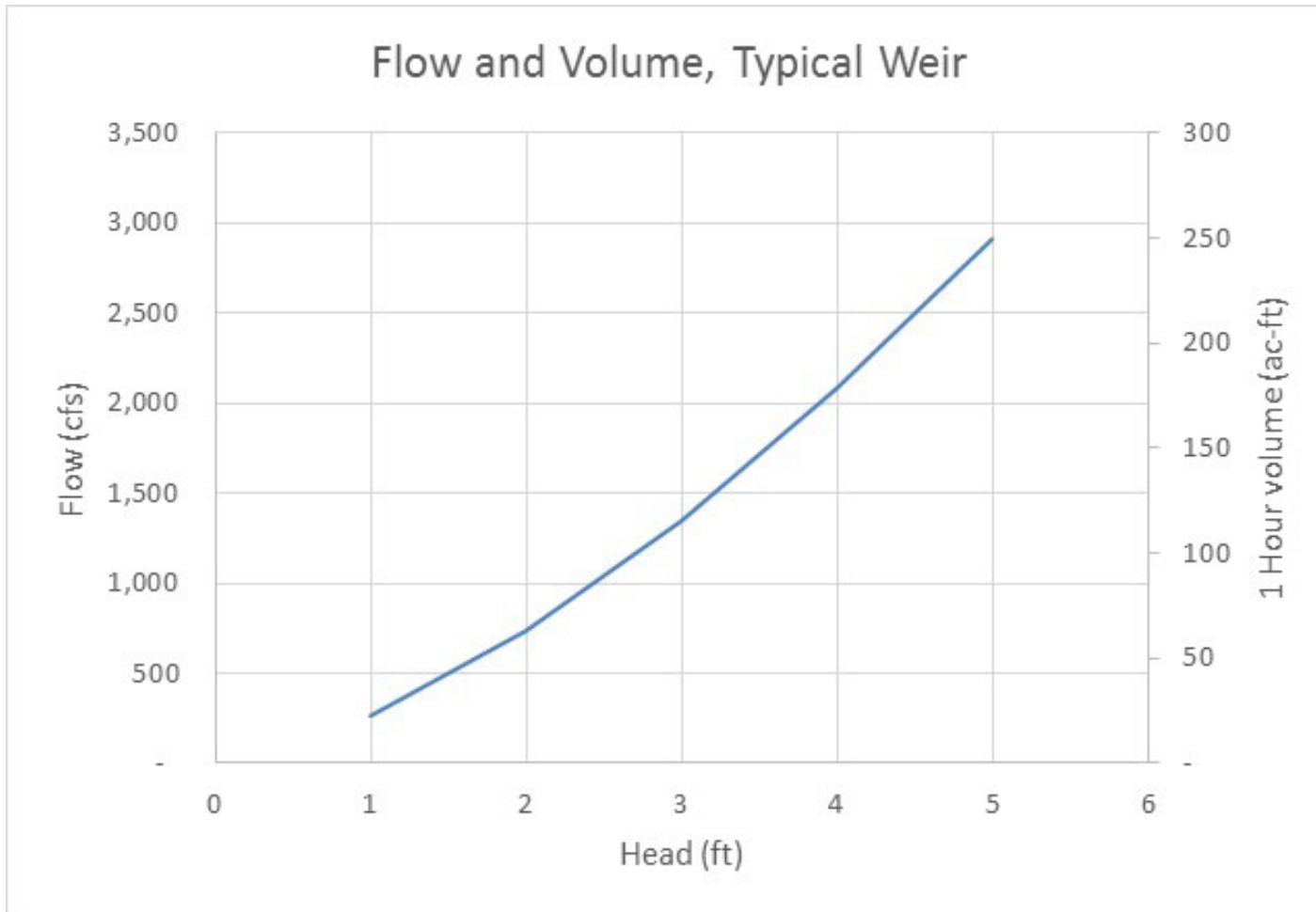
Initiation Time

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HEC-RAS Lateral Weir

Figure 8-9 Example Lateral Weir and Gated Spillway

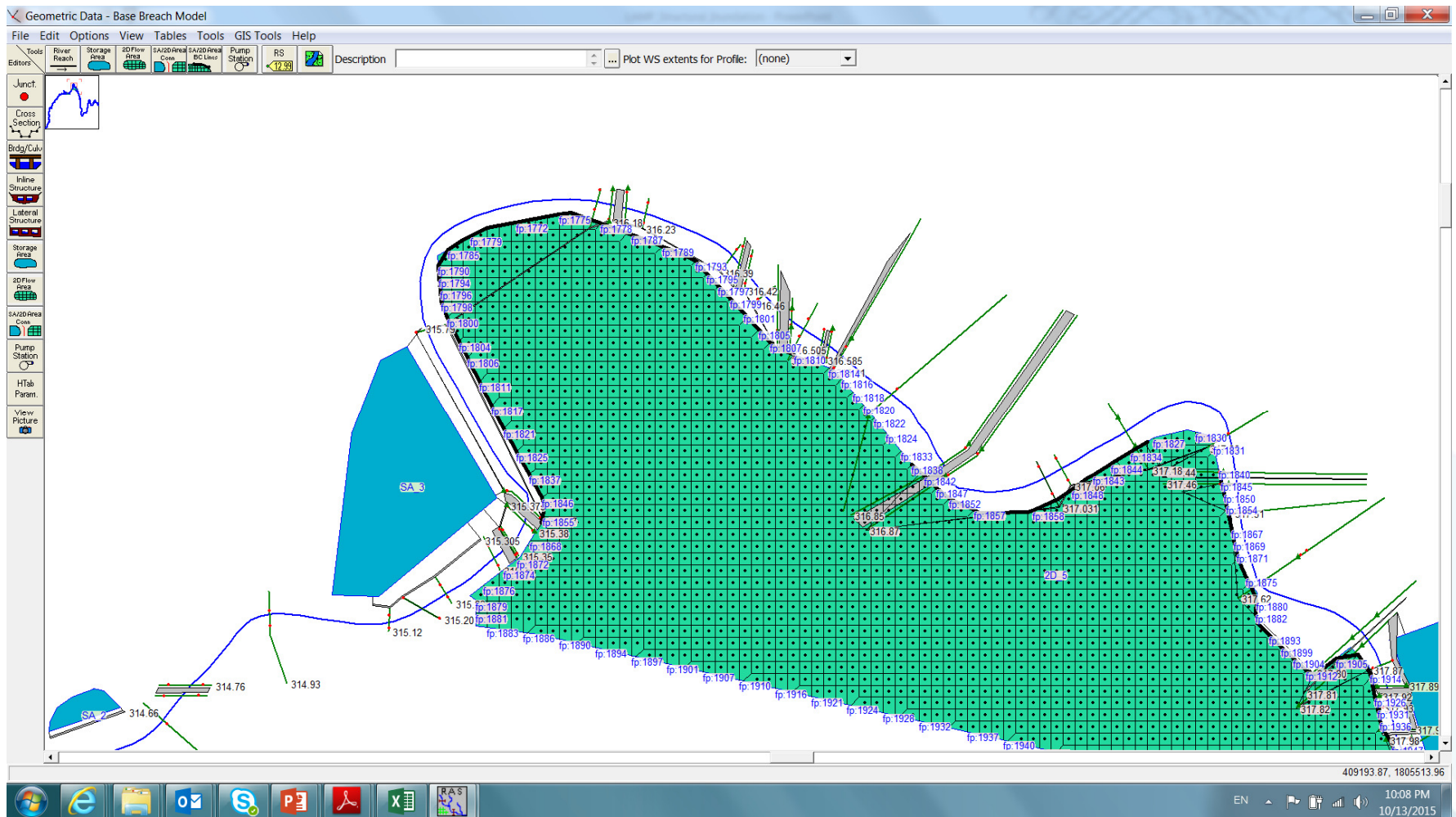USACE, HEC-RAS Manual

Boundary conditions

USACE

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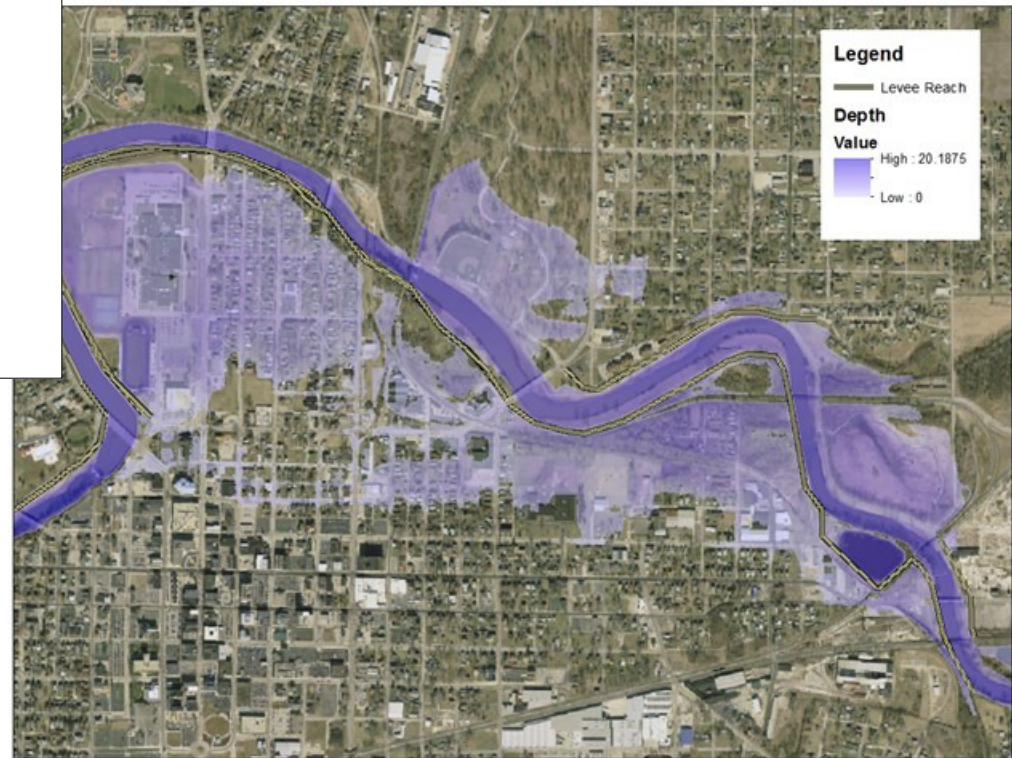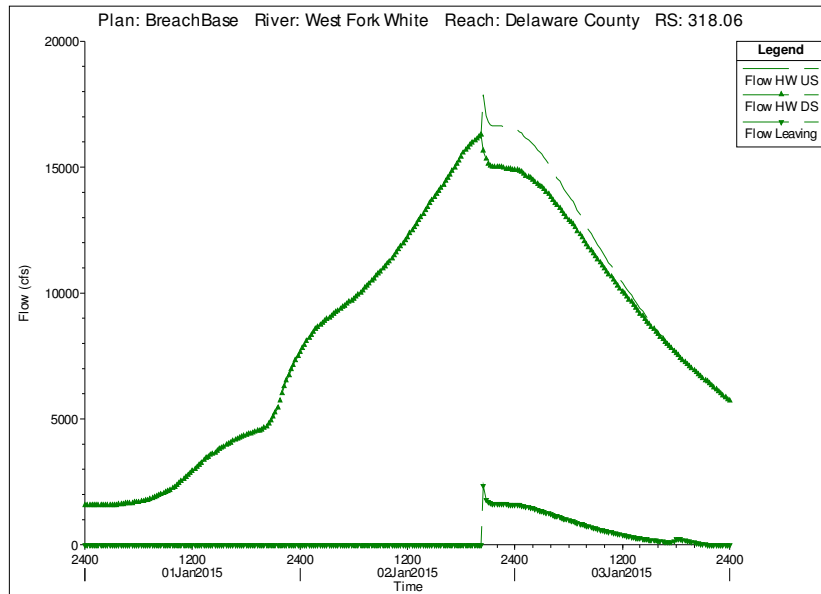
Sample Weir

Tailwater conditions

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Lesson learned

Breach Hydrograph to Floodplain

Questions?

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