

2013 Flood Fight Training

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US Army Corps of Engineers
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Discussion Topics

- **Common Failure Modes**
- **Surveillance/Inspection**
 - **Flood Fighting**

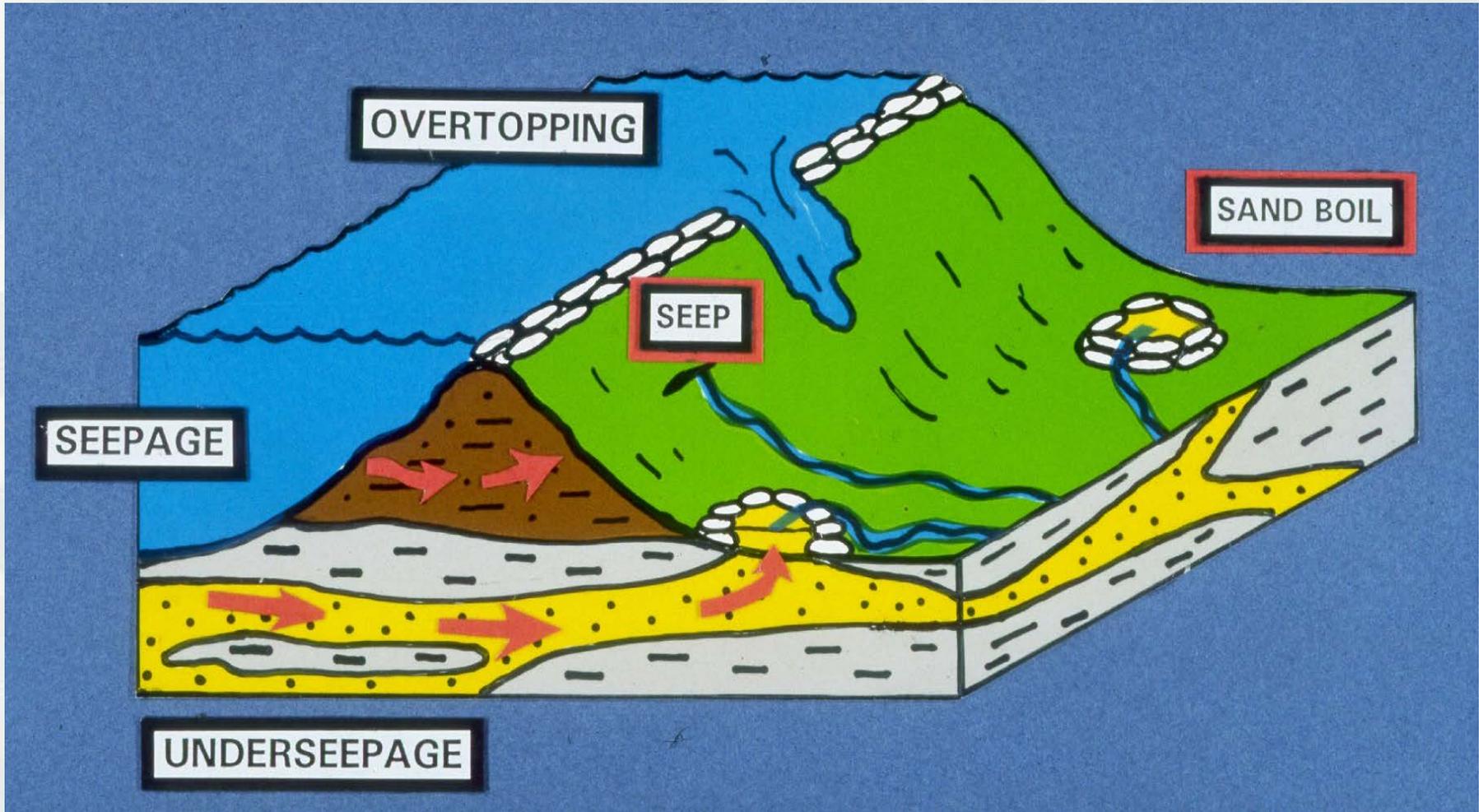




Common Failure Modes

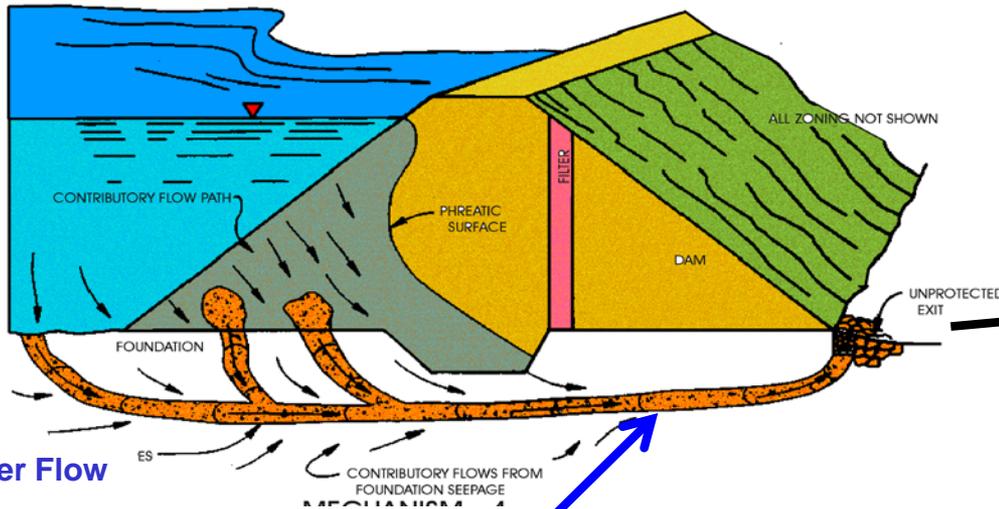


- Underseepage/Piping
- Through Seepage/Piping
- Slope Failure



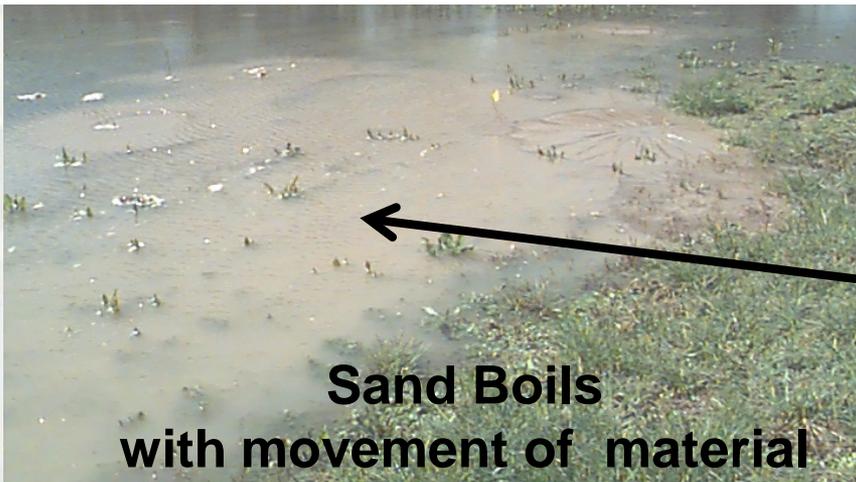
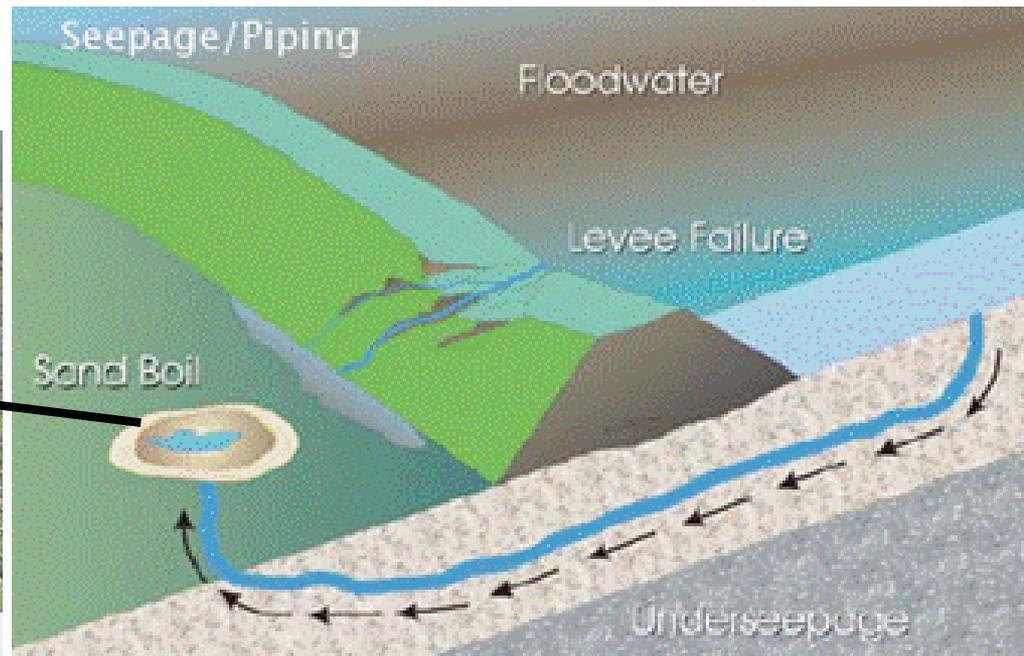
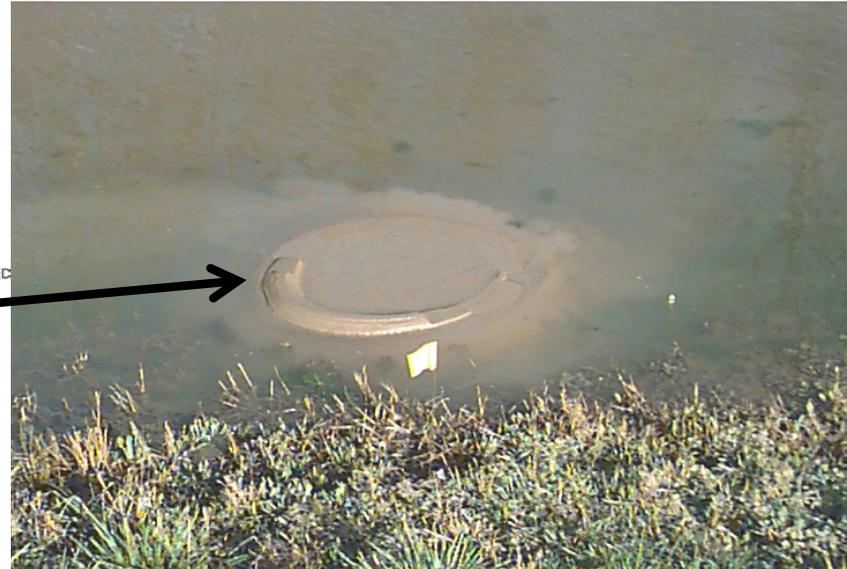


Failure Mode – Underseepage/Piping



Water Flow

Pipe Development (Movement of Material)



Sand Boils with movement of material



Failure Mode – Underseepage/Piping

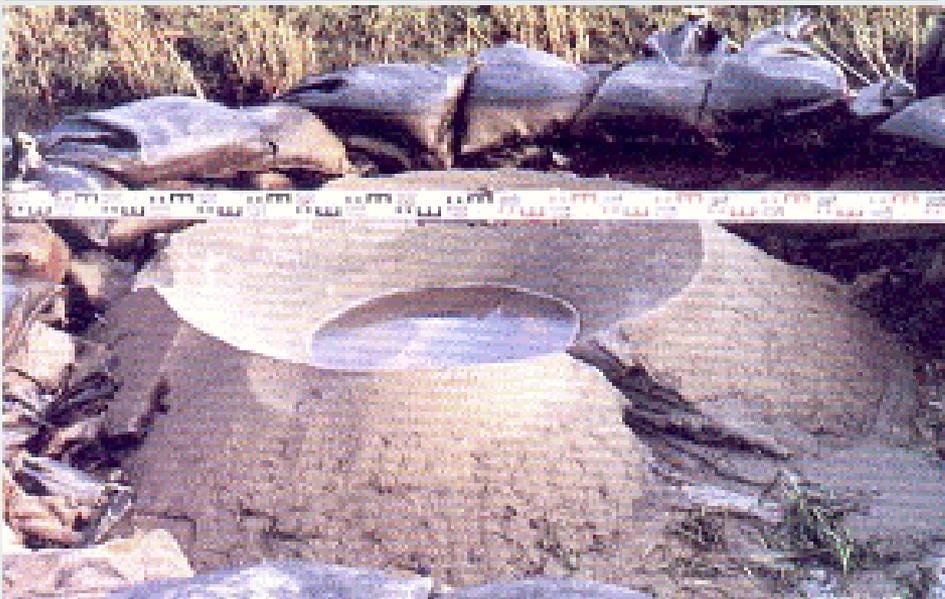


Levee Photograph – note seepage occurring at landward toe



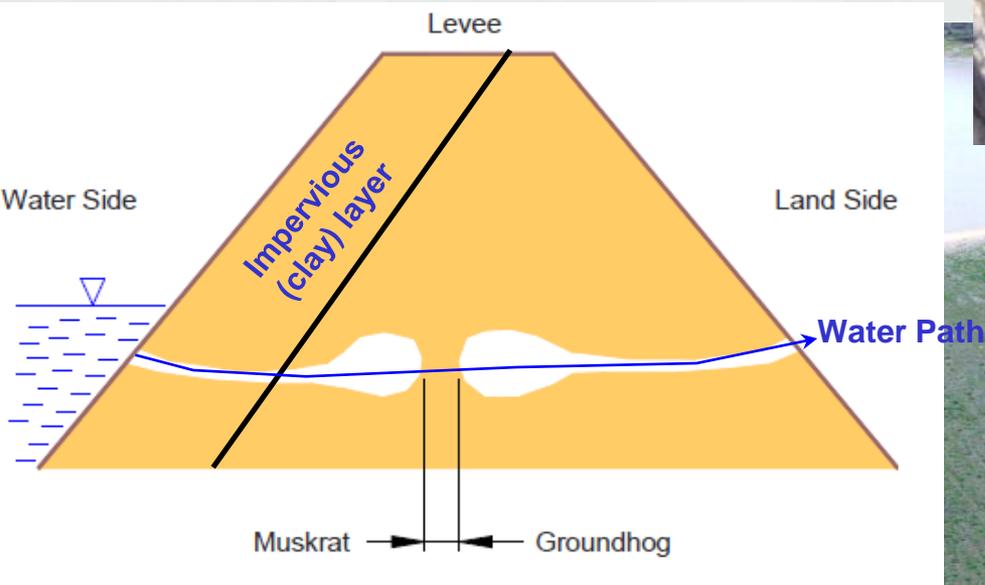
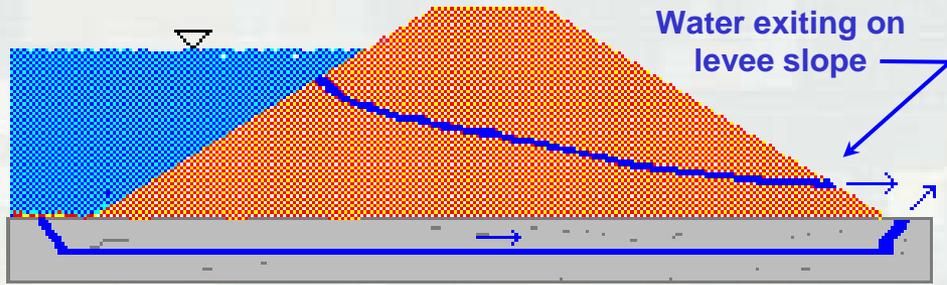


Failure Mode – Underseepage/Piping





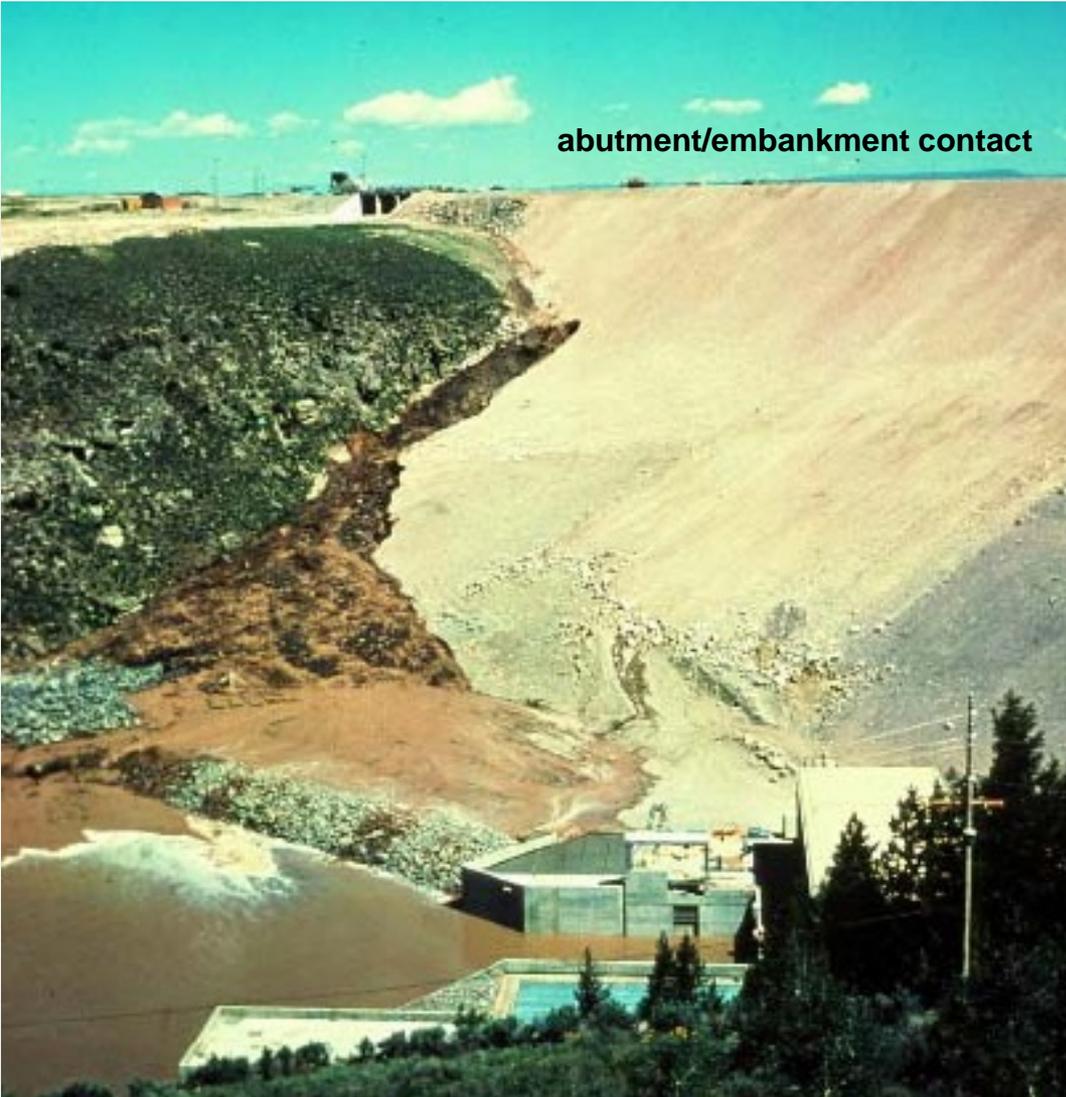
Failure Mode – Through Seepage/Piping





Failure Mode – Through Seepage/Piping

abutment/embankment contact



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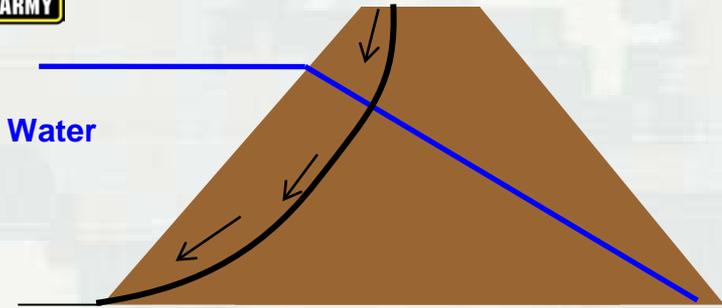
Failure Mode – Through Seepage/Piping

Drainage structures and other changes or transition areas (e.g., levee to floodwall) are potential weak points

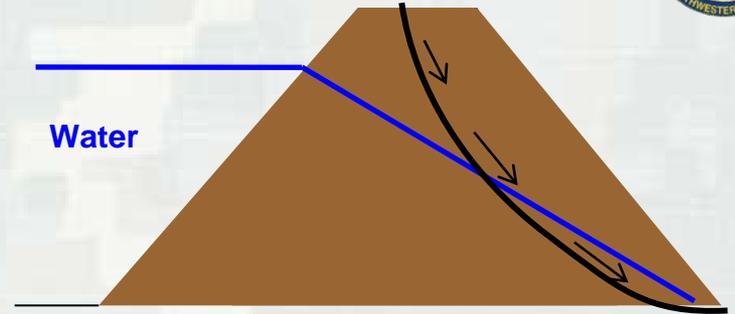




Failure Mode – Slope Failure



Riverside Slope Failure
***Most Common**



Landside Slope Failure



...ING BANKS
...ARRIED AWAY BY CAVING BANKS



Note stakes and flagging



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Failure Mode – Slope Failure



SLOUGHING

THE SOFTENED SECTION SLIDES OUT



Failure Mode – Slope Failure



Levee and Bank Erosion

**(Can lead to slope failure
and/or seepage issues)**



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Overtopping





Surveillance/ Inspections



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Flood Surveillance/Inspections



- **SAFETY FIRST!!**
 - ▶ Don't put yourself in an unsafe situation
 - ▶ Know your evacuation routes

- **Know the situation!!**
 - ▶ Who owns and operates the structure?
 - ▶ What is your role and responsibility?
 - ▶ What is the current & forecasted flood situation?

- **Know the organizational structure**
 - ▶ Frequently a multi-agency approach
 - (Owner, local authorities, Corps, National Guard, volunteers)
 - ▶ Who is in charge and making decisions?
 - ▶ Who do you contact in the case of an emergency (e.g., failing levee)?
 - ▶ How do you contact them or they contact you?????

- **Be prepared – have the right equipment**

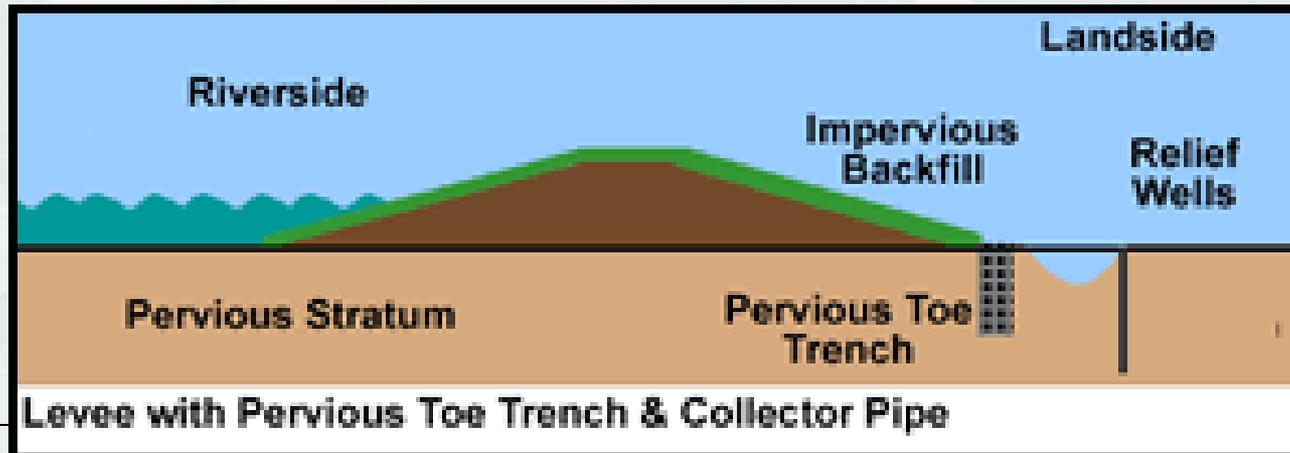




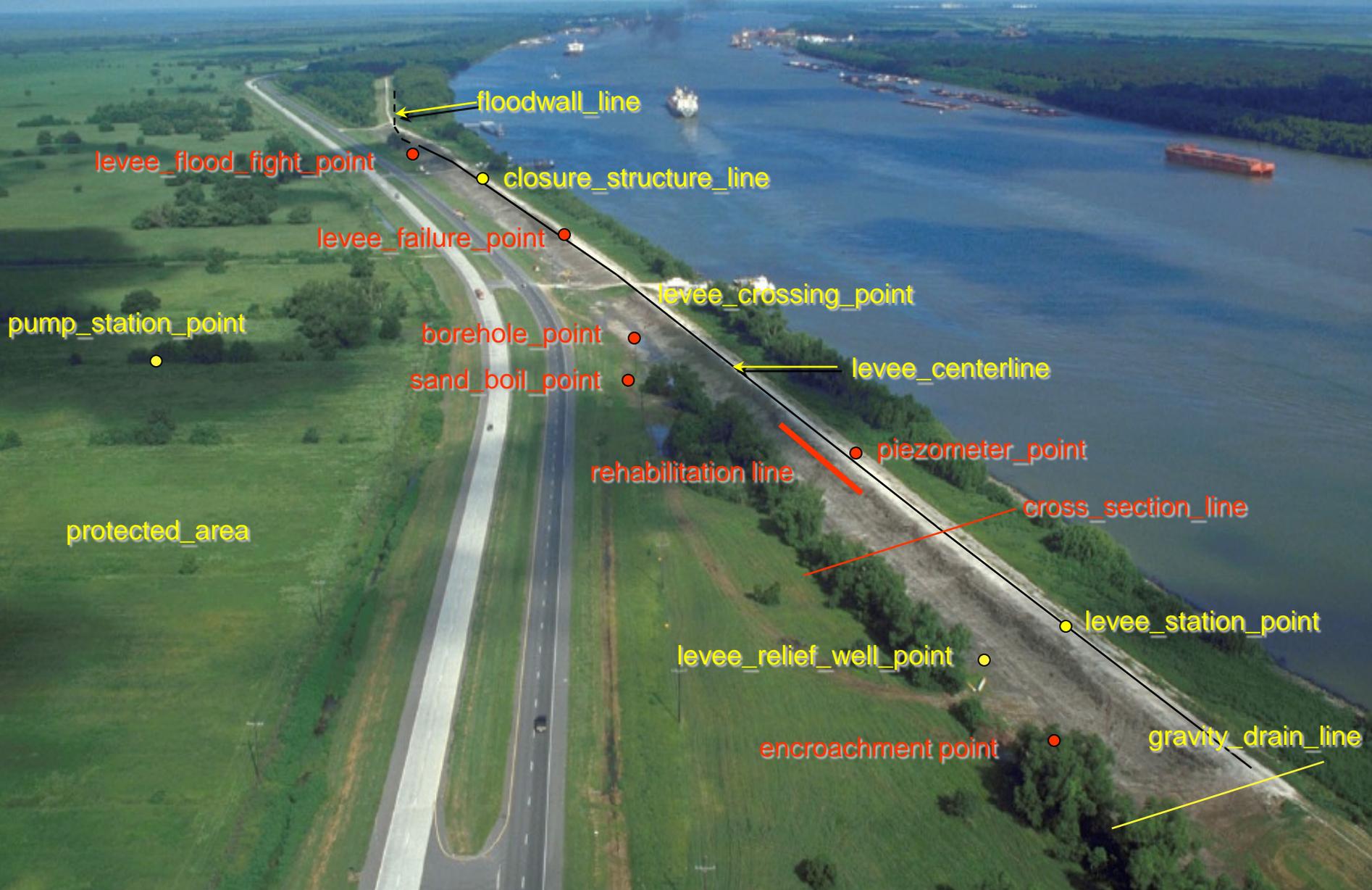
Flood Surveillance/Inspections



- Know the levee/dam features, performance history, & current issues
 - ▶ O & M Manual (relief wells, toe drains, seepage berms, penetrations, closure structures....)
 - ▶ Previous inspection reports
 - ▶ Historic seepage areas, low spots or other problem areas
 - ▶ Levee/dam owners and maintenance personnel
 - ▶ Reports from other inspection teams/personnel



Flood Surveillance/Inspections





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Flood Surveillance/Inspections



- Know failure modes and indications of distress
EARLY IDENTIFICATION OF DISTRESS IS CRITICAL TO EMERGENCY RESPONSE (Repairs or Evacuations)
 - ▶ Cracks, boils, wet areas, slides

- Walk the landside levee toe and crest
 - ▶ Not easy, you have to look to find early evidence of distress
 - ▶ Conditions are typically poor (wet, overgrown, dark)
 - ▶ Can't do an adequate inspection driving down the crest

- Document conditions in the field
 - ▶ Flagging, stakes, paint
 - ▶ Photos, videos, reports & checklists

- Proper handoff to next inspection team and upward reporting





Flood Surveillance/Inspections



- **Be diligent** – if you aren't who will be???
- Ask for assistance
- Document conditions!
 - ▶ Where
 - ▶ When
 - ▶ What
- Be prepared, bring the proper equipment

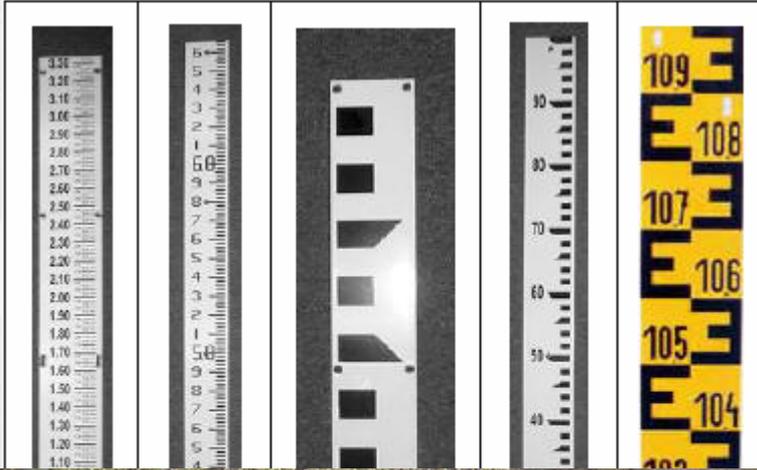




Staff Gages



Is the water level going up or down?



Gage 1 - Just Downstream of Highway 1 Bridge		
Date	Time	Reading
1-Apr	8:00	84.3
1-Apr	12:00	84.8
1-Apr	16:00	85.3
1-Apr	20:00	85.7
2-Apr	0:00	86.0
2-Apr	4:00	86.1
2-Apr	8:00	86.0
2-Apr	12:00	85.9
2-Apr	16:00	85.6
2-Apr	20:00	85.2

Water level

Increasing

Decreasing

Top of water at this location is at a gage reading of 85.7





Flood Surveillance/Inspections



Underseepage-Boils (Landside toe area primarily)



**Flowing clear or moving
material?**



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2010 / 7 / 9



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Flood Surveillance/Inspections



Slope Instability – Cracking (Levee Crest Primarily)



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Flood Surveillance/Inspections



Embankment Erosion



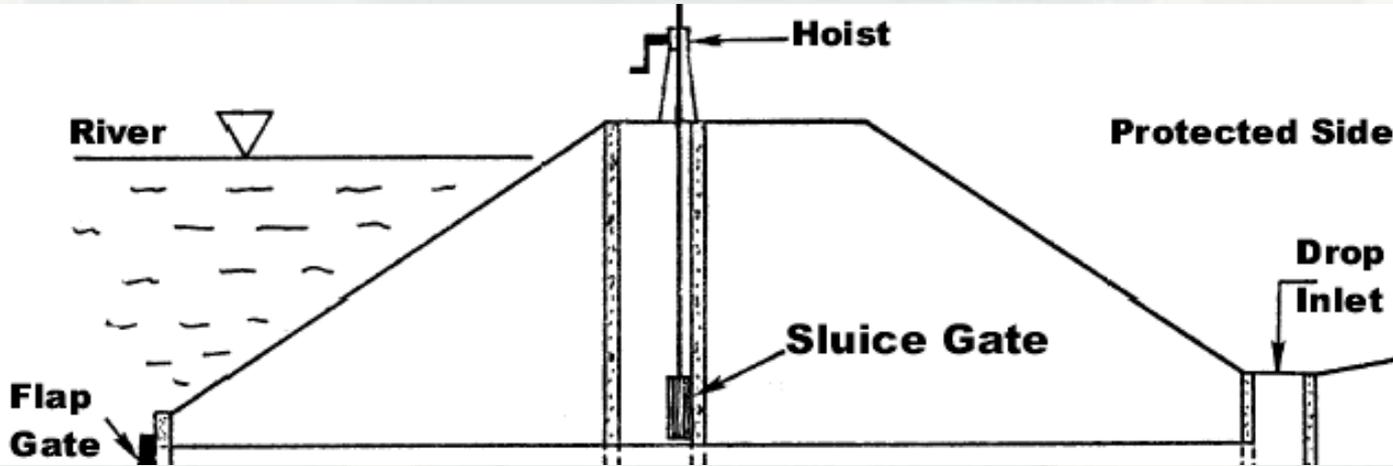


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Flood Surveillance/Inspections



Drainage structure, sewers, & other penetrations





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Flood Surveillance/Inspections



Drainage structure, sewers, & other penetrations



Emergency closure of culvert





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Flood Surveillance/Inspections



Closure Structures

When do you erect the closure?
How long will it take?
Is it functioning properly?



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Flood Surveillance/Inspections



Relief Wells

Are the functioning?



Irrigation Well





Flood Fighting

What is the need and what are the options?

Need

- Sand Boils/Seepage
- Closure Structures
- Levee Raise
- New levee segments

Options

- Sand bags
- Earthen levees
- Innovative flood fight products
 - Hesco Bastions
 - RDFW
 - Portadam

Time and place each?

How much lead time and available resources?



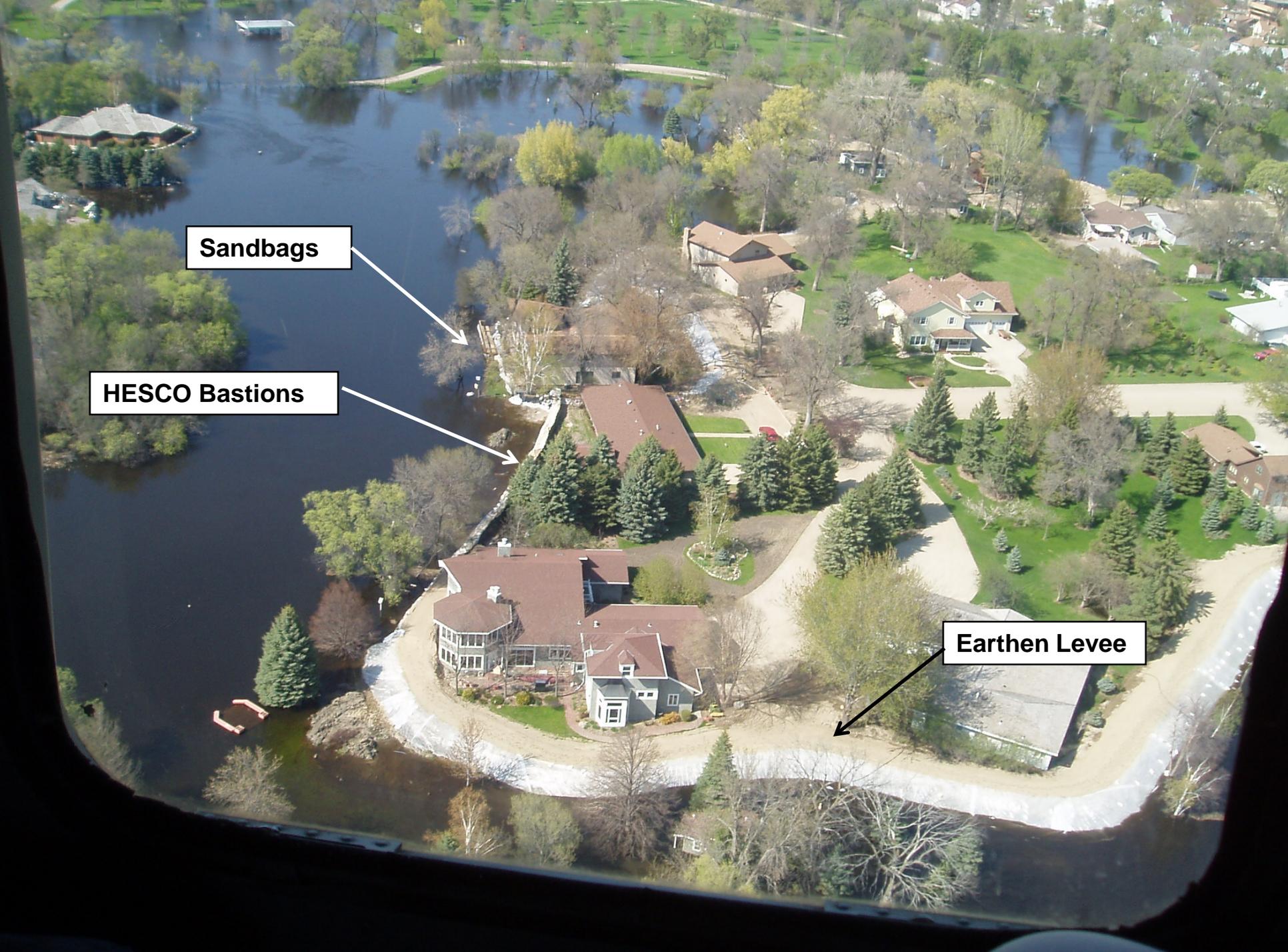
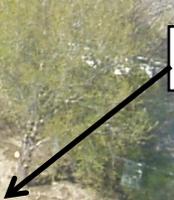
Sandbags



HESCO Bastions



Earthen Levee





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TREATMENT OF ISOLATED BOILS



- Ring boils if they are moving material
- Do not stop the water flow, it can cause the seepage path/boil to move

Notice anything?



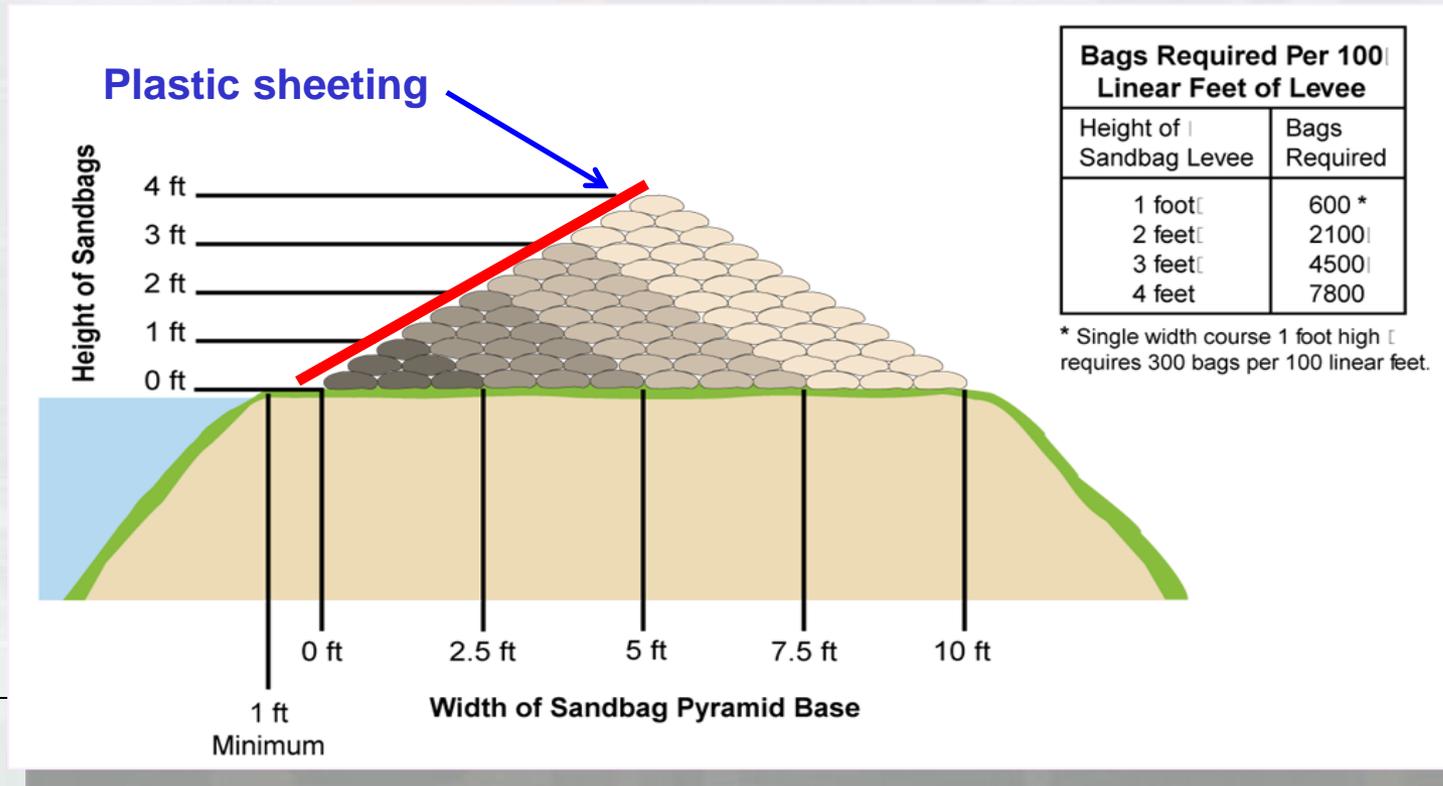
2010/7/9



Sandbag Flood Structure

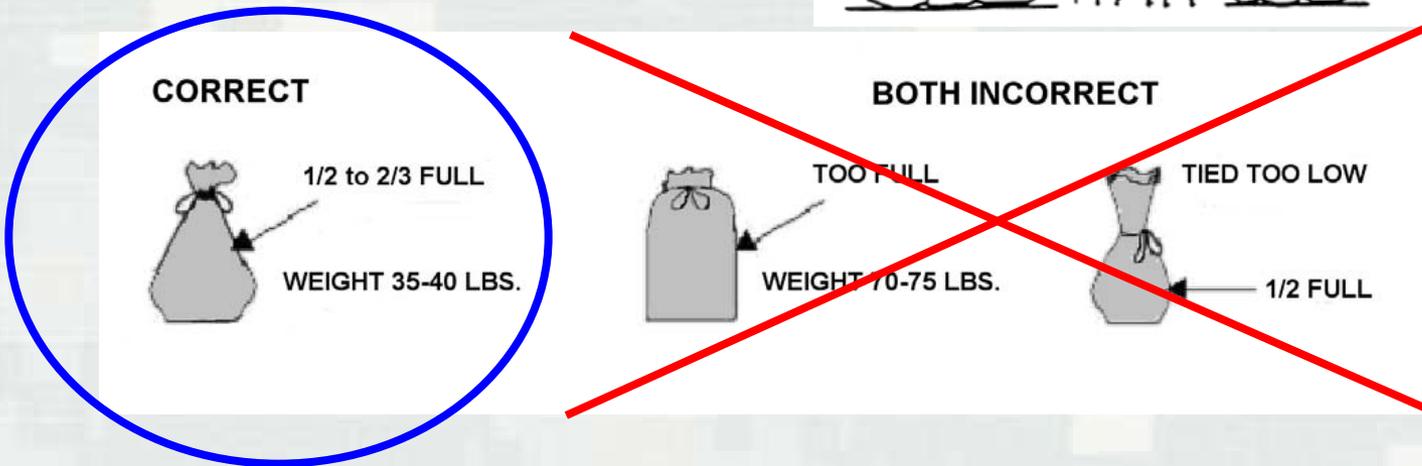
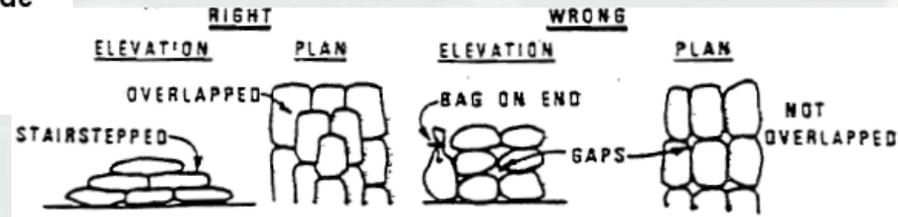
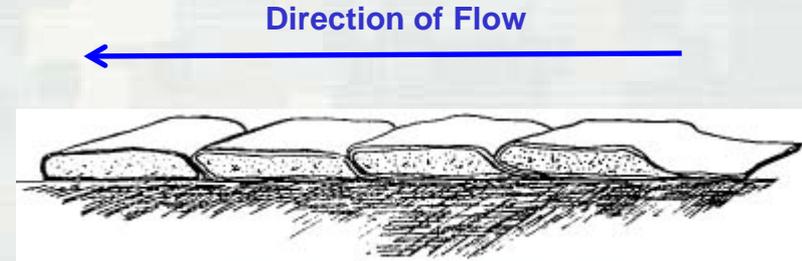
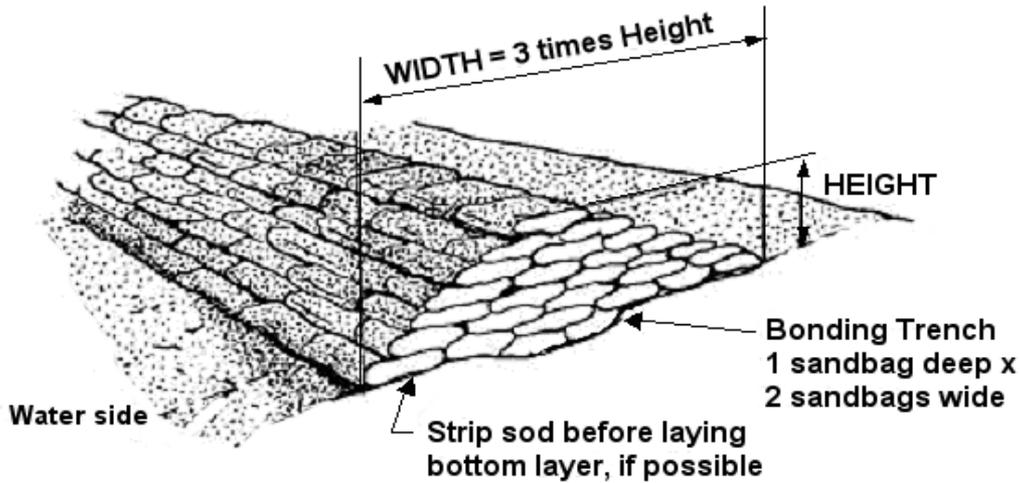


- USACE Recommendations
 - ▶ 1V:3H (1 foot high for 3 foot width)
 - ▶ 5 foot max (3 foot or less preferred)
- Typical used for low/short barrier, transitions, constricted areas, closures & around sand boils





Sandbag Flood Structure



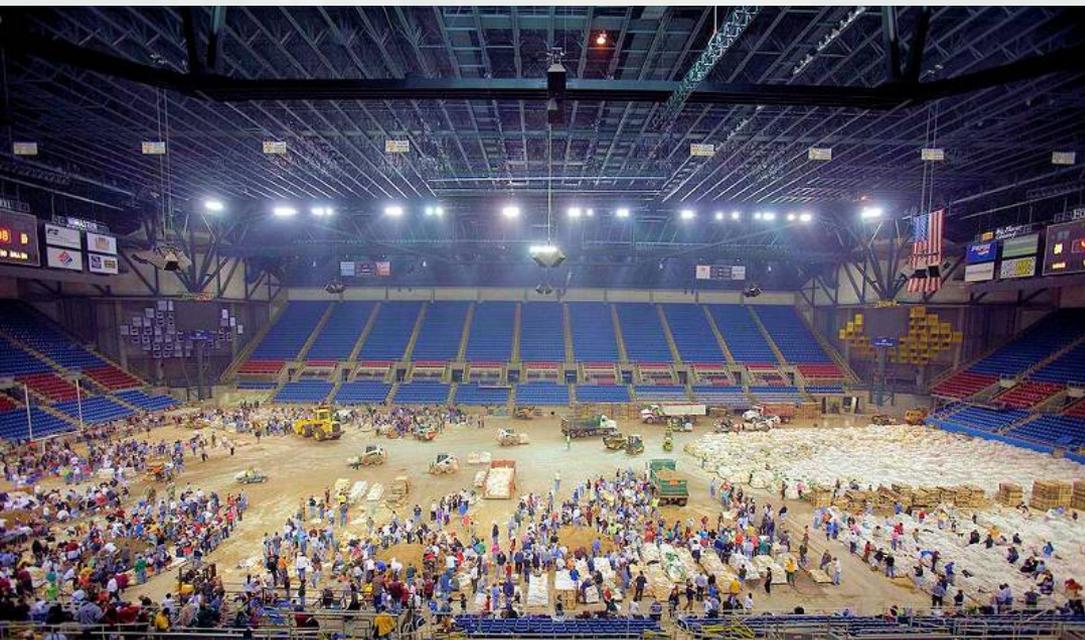


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Sandbag Flood Structure



- Very labor intensive
- Filled sandbags must be kept from freezing prior to placement





Sandbag Flood Structure





Earthen Levees





Earthen Levees





Hesco Bastion Structure





Hesco Bastion Structure





RDFW Structure



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RDFW Structure



Not Correct



Correct





Portadam Structure





TrapBag Structure



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TrapBag Structure



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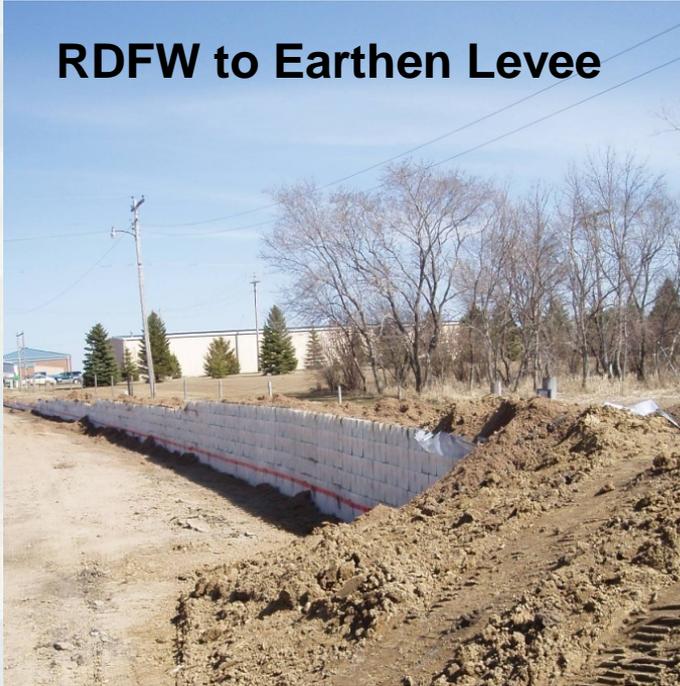


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Combinations/Transitions



RDFW to Earthen Levee



RDFW & Sandbags



HESCO, RDFW & Sandbags



Transition Concerns??



Sandbags to Earthen Levee



FLOOD FIGHT SUPPLIES



- 5.54 million Sandbags throughout the District
- 5300 Super Sandbags
- 1350 LF of Portadam
- 1200 LF of RDFW
- 33,720 LF of Hesco
- 2,424 Rolls of Poly
- 3 Sandbag filling machines
- 25 Trailer-mounted pumps





QUESTIONS

Phone: 402-995-2448

<http://www.nwo.usace.army.mil/Missions/EmergencyManagement.aspx>

