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Analysis and Comparison of Documented Seepage and Sand Boil Events on the Lower Mississippi River from 1937 to 2011

Volume 3: Occurrences of seepage and sand boil incidents during the 2011 flood
on photo maps

Joseph B. Dunbar, Amber L. Ensign, Nalini Torres,
and Maureen K. Corcoran

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Abstract

Volume III includes photo maps for ERDC/GSL TR-18-23; Volume 1, “Analysis and Comparison of Documented Seepage and Sand Boil Events on the Lower Mississippi River from 1937 to 2011,” which examines the occurrence of seepage incidents and sand boils observed and documented during the 2011 Mississippi River Flood in the Lower Mississippi River Valley (LMV) within the boundaries of the U.S. Army Corps of Engineers (USACE), Mississippi Valley Division (MVD), Vicksburg District. This study examines the occurrence of sand boils in relationship to the underlying floodplain geology and identifies locations where large sand boils occurred. Large sand boil areas will be the focus for additional detailed study to better understand the mechanics of underseepage and internal erosion in USACE flood-control levees. Seepage and sand boil incidents documented during the 2011 Flood are presented in this report on geologic base maps and pre-flood imagery to compile a record of their occurrence and identify geologic relationships, as well as spatial patterns associated with the underlying fluvial landforms. A review of levee evolution within the LMV is summarized here along with past research studies of seepage involving major historic floods and their control.

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Preface

This study of the 2011 Mississippi River flood was conducted under the Infrastructure Technology Program, Flood and Coastal Storm Damage Reduction Program (FCSDR), in the research focus area for Improving Flood Risk Management and Water Control Infrastructure Resiliency and Reliability (WCIRR). Dr. Julie D. Rosati, U.S. Army Engineer Research and Development Center (ERDC), Technical Director, Coastal and Hydraulics Laboratory (CHL) was the Program Manager for FCSDR.

This study was conducted by personnel of the Geotechnical and Structures Laboratory (GSL). Dr. Michael Sharp, Technical Director, and Dr. Maureen K. Corcoran, Associate Technical Director, provided general supervision for this study. Dr. Joseph B. Dunbar, Geotechnical Engineering and Geosciences Branch (GEGB) of the Geosciences and Structures Division (GSD), was the principal investigator for this study of levee seepage and sand boil occurrence in the Vicksburg Engineer District during the 2011 flood. At the time of publication, Mr. Chris Price was Acting Chief, GEGB; Mr. James L. Davis was Chief, GSD. The Deputy Director of ERDC-GSL was Dr. William P. Grogan and the Director was Mr. Bart P. Durst.

COL Ivan P. Beckman was the Commander of ERDC, and Dr. David W. Pittman was the Director.

- Legend**
★ Sand Boil, Heavy	■ Under Seepage, Heavy	— Under Seepage, Heavy	◆ Slide, Minor
★ Sand Boil, Moderate	■ Under Seepage, Moderate	— Under Seepage, Moderate	◆ Slide, Major
★ Sand Boil, Light	■ Under Seepage, Light	— Under Seepage, Light	
■ Sand Boil, Heavy	▲ Through Seepage, Light	■ Through Seepage, Light	

**2011 Mississippi River Flood
Seepage and Sand Boil Incidents
USACE Vicksburg District**

Alsatia

- Legend**
★ Sand Boil, Heavy	■ Under Seepage, Heavy	— Under Seepage, Heavy	◆ Slide, Minor
★ Sand Boil, Moderate	■ Under Seepage, Moderate	— Under Seepage, Moderate	◆ Slide, Major
★ Sand Boil, Light	■ Under Seepage, Light	— Under Seepage, Light	
■ Sand Boil, Heavy	▲ Through Seepage, Light	■ Through Seepage, Light	

**2011 Mississippi River Flood
Seepage and Sand Boil Incidents
USACE Vicksburg District**

Artonish

- Legend**
	Sand Boil, Heavy		Under Seepage, Heavy		Under Seepage, Heavy		Slide, Minor
	Sand Boil, Moderate		Under Seepage, Moderate		Under Seepage, Moderate		Slide, Major
	Sand Boil, Light		Under Seepage, Light		Under Seepage, Light		
	Sand Boil, Heavy		Through Seepage, Light		Through Seepage, Light		

**2011 Mississippi River Flood
Seepage and Sand Boil Incidents
USACE Vicksburg District**

Big Island

2011 Mississippi River Flood
Seepage and Sand Boil Incidents
USACE Vicksburg District

Davis Island

- Legend**
★ Sand Boil, Heavy	■ Under Seepage, Heavy	— Under Seepage, Heavy	◆ Slide, Minor
★ Sand Boil, Moderate	■ Under Seepage, Moderate	— Under Seepage, Moderate	◆ Slide, Major
★ Sand Boil, Light	■ Under Seepage, Light	— Under Seepage, Light	
■ Sand Boil, Heavy	▲ Through Seepage, Light	— Through Seepage, Light	

**2011 Mississippi River Flood
Seepage and Sand Boil Incidents
USACE Vicksburg District**

Ferriday

- Legend**
★ Sand Boil, Heavy	■ Under Seepage, Heavy	— Under Seepage, Heavy	◆ Slide, Minor
★ Sand Boil, Moderate	■ Under Seepage, Moderate	— Under Seepage, Moderate	◆ Slide, Major
★ Sand Boil, Light	■ Under Seepage, Light	— Under Seepage, Light	
■ Sand Boil, Heavy	▲ Through Seepage, Light	■ Through Seepage, Light	

**2011 Mississippi River Flood
Seepage and Sand Boil Incidents
USACE Vicksburg District**

Lake Village

- Legend**
★ Sand Boil, Heavy	■ Under Seepage, Heavy	— Under Seepage, Heavy	◆ Slide, Minor
★ Sand Boil, Moderate	■ Under Seepage, Moderate	— Under Seepage, Moderate	◆ Slide, Major
★ Sand Boil, Light	■ Under Seepage, Light	— Under Seepage, Light	
■ Sand Boil, Heavy	▲ Through Seepage, Light	■ Through Seepage, Light	

**2011 Mississippi River Flood
Seepage and Sand Boil Incidents
USACE Vicksburg District**

Lamont

- Legend**
Sand Boil, Heavy	Under Seepage, Heavy	Under Seepage, Heavy	Slide, Minor
Sand Boil, Moderate	Under Seepage, Moderate	Under Seepage, Moderate	Slide, Major
Sand Boil, Light	Under Seepage, Light	Under Seepage, Light	
Sand Boil, Heavy	Through Seepage, Light	Through Seepage, Light	

**2011 Mississippi River Flood
Seepage and Sand Boil Incidents
USACE Vicksburg District**

Locust Ridge

- Legend**
★ Sand Boil, Heavy	■ Under Seepage, Heavy	— Under Seepage, Heavy	◆ Slide, Minor
★ Sand Boil, Moderate	■ Under Seepage, Moderate	— Under Seepage, Moderate	◆ Slide, Major
★ Sand Boil, Light	■ Under Seepage, Light	— Under Seepage, Light	
— Sand Boil, Heavy	▲ Through Seepage, Light	— Through Seepage, Light	

**2011 Mississippi River Flood
Seepage and Sand Boil Incidents
USACE Vicksburg District**

Mayersville (Lake Providence)

- Legend**
★ Sand Boil, Heavy	■ Under Seepage, Heavy	— Under Seepage, Heavy	◆ Slide, Minor
★ Sand Boil, Moderate	■ Under Seepage, Moderate	— Under Seepage, Moderate	◆ Slide, Major
★ Sand Boil, Light	■ Under Seepage, Light	— Under Seepage, Light	
■ Sand Boil, Heavy	▲ Through Seepage, Light	■ Through Seepage, Light	

**2011 Mississippi River Flood
Seepage and Sand Boil Incidents
USACE Vicksburg District**

McGehee

- Legend**
★ Sand Boil, Heavy	■ Under Seepage, Heavy	— Under Seepage, Heavy	◆ Slide, Minor
★ Sand Boil, Moderate	■ Under Seepage, Moderate	— Under Seepage, Moderate	◆ Slide, Major
★ Sand Boil, Light	■ Under Seepage, Light	— Under Seepage, Light	
■ Sand Boil, Heavy	▲ Through Seepage, Light	■ Through Seepage, Light	

**2011 Mississippi River Flood
Seepage and Sand Boil Incidents
USACE Vicksburg District**

Mellwood

- Legend**
	Sand Boil, Heavy		Under Seepage, Heavy		Under Seepage, Heavy		Slide, Minor
	Sand Boil, Moderate		Under Seepage, Moderate		Under Seepage, Moderate		Slide, Major
	Sand Boil, Light		Under Seepage, Light		Under Seepage, Light		
	Sand Boil, Heavy		Through Seepage, Light		Through Seepage, Light		

**2011 Mississippi River Flood
Seepage and Sand Boil Incidents
USACE Vicksburg District**

Monterey

- Legend**
Sand Boil, Heavy	Under Seepage, Heavy	Under Seepage, Heavy	Slide, Minor
Sand Boil, Moderate	Under Seepage, Moderate	Under Seepage, Moderate	Slide, Major
Sand Boil, Light	Under Seepage, Light	Under Seepage, Light	
Sand Boil, Heavy	Through Seepage, Light	Through Seepage, Light	

**2011 Mississippi River Flood
Seepage and Sand Boil Incidents
USACE Vicksburg District**

Natchez

- Legend**
Sand Boil, Heavy	Under Seepage, Heavy	Under Seepage, Heavy	Slide, Minor
Sand Boil, Moderate	Under Seepage, Moderate	Under Seepage, Moderate	Slide, Major
Sand Boil, Light	Under Seepage, Light	Under Seepage, Light	
Sand Boil, Heavy	Through Seepage, Light	Through Seepage, Light	

**2011 Mississippi River Flood
Seepage and Sand Boil Incidents
USACE Vicksburg District**

Onward

Legend			
★ Sand Boil, Heavy	■ Under Seepage, Heavy	— Under Seepage, Heavy	◆ Slide, Minor
★ Sand Boil, Moderate	■ Under Seepage, Moderate	— Under Seepage, Moderate	◆ Slide, Major
★ Sand Boil, Light	■ Under Seepage, Light	— Under Seepage, Light	
■ Sand Boil, Heavy	▲ Through Seepage, Light	— Through Seepage, Light	

**2011 Mississippi River Flood
Seepage and Sand Boil Incidents
USACE Vicksburg District**

Pace

**2011 Mississippi River Flood
Seepage and Sand Boil Incidents
USACE Vicksburg District**

Readland

- Legend**
★ Sand Boil, Heavy	■ Under Seepage, Heavy	— Under Seepage, Heavy	◆ Slide, Minor
★ Sand Boil, Moderate	■ Under Seepage, Moderate	— Under Seepage, Moderate	◆ Slide, Major
★ Sand Boil, Light	■ Under Seepage, Light	— Under Seepage, Light	
■ Sand Boil, Heavy	▲ Through Seepage, Light	■ Through Seepage, Light	

**2011 Mississippi River Flood
Seepage and Sand Boil Incidents
USACE Vicksburg District**

Red Fork

- Legend**
Sand Boil, Heavy	Under Seepage, Heavy	Under Seepage, Heavy	Slide, Minor
Sand Boil, Moderate	Under Seepage, Moderate	Under Seepage, Moderate	Slide, Major
Sand Boil, Light	Under Seepage, Light	Under Seepage, Light	
Sand Boil, Heavy	Through Seepage, Light	Through Seepage, Light	

**2011 Mississippi River Flood
Seepage and Sand Boil Incidents
USACE Vicksburg District**

Refuge (Greenville)

- Legend**
★ Sand Boil, Heavy	■ Under Seepage, Heavy	— Under Seepage, Heavy	◆ Slide, Minor
★ Sand Boil, Moderate	■ Under Seepage, Moderate	— Under Seepage, Moderate	◆ Slide, Major
★ Sand Boil, Light	■ Under Seepage, Light	— Under Seepage, Light	
■ Sand Boil, Heavy	▲ Through Seepage, Light	■ Through Seepage, Light	

**2011 Mississippi River Flood
Seepage and Sand Boil Incidents
USACE Vicksburg District**

Vicksburg

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