# Association of State Dam Safety Officials Annual Conference (Dam Safety 2019)

Orlando, Florida 8-12 September 2019

ISBN: 978-1-5108-9475-4

# Printed from e-media with permission by:

Curran Associates, Inc. 57 Morehouse Lane Red Hook, NY 12571



Some format issues inherent in the e-media version may also appear in this print version.

Copyright© (2019) by Association of State Dam Safety Officials All rights reserved.

Printed with permission by Curran Associates, Inc. (2019)

For permission requests, please contact Association of State Dam Safety Officials at the address below.

Association of State Dam Safety Officials 239 S. Limestone Lexington, Kentucky 40508 USA

Phone: 859/550-2788

info@damsafety.org

# Additional copies of this publication are available from:

Curran Associates, Inc. 57 Morehouse Lane Red Hook, NY 12571 USA

Phone: 845-758-0400 Fax: 845-758-2633

Email: curran@proceedings.com Web: www.proceedings.com

# **Table of Contents**

# Monday, September 9

# Opening General Session - Adapting to Climate Change: Challenging Ourselves to Get Ahead of the Risk

Welcome and ASDSO Update (presentation only) N/A Roger Adams, P.E., President, Association of State Dam Safety Officials

Welcome to Florida (presentation only) N/A

Alex Reed, Director, Division of Water Resource Management, Florida Department of Environmental Protection

Let's Hear From the Climatologists: A Review of the Observed Data (presentation only) N/A
Kenneth E. Kunkel, Research Professor, Dept. of Marine, Earth, and Atmospheric Sciences, Lead
Scientist for Assessments, North Carolina Institute for Climate Studies North Carolina State University

Hurricanes Harvey and Florence, Are Storms Changing and How Does This Effect PMP Depths? 1
Bill Kappel, Doug Hultstrand, Jake Rodel, and Kristi Steinhilber, Applied Weather Associates

Let's Apply This Knowledge to Dam Safety and Be Creative (presentation only) N/A Bill McCormick, P.E., CO Division of Natural Resources

#### Concurrent Session 1: Spillway Modeling 2D - 3D

Beyond Floodplain Analysis: A Modeler's Experience Using HEC-RAS 2D for Spillway Assessments and Designs 2

Yan Wang, Hydrologic and Hydraulic Engineer; Amanda J. Hess, H&H Group Manager; and Gregory L. Richards, Project Engineer, Gannett Fleming, Inc.

Improving the Geometry of Fixed-Crest Control Sections to Increase Spillway Discharge Capacity 3 Benjamin Israel Devadason, Senior Hydraulic and Hydrologic Engineer; and Paul Schweiger, Vice President, Gannett Fleming, Inc.

Spillway Modeling: Comparing 1D, 2D and Physical Scale Model Results 4
Nicholas Miller, P.E., Senior Project Manager, GEI Consultants, Inc.; and Maryam Bral, Ph.D., P.E., Chief Engineer, United Water Conservation District

#### **Concurrent Session 2: Smart Application of Risk Principles**

Availability Bias in Dam Safety 16 Matthew S. Balven; and Alex Brekke, Gannett Fleming, Inc. Using Qualitative Screening-Level Risk Assessment Approach for Regulatory Management of a Large Inventory of Dams 23

Eric J Gross, P.E., Senior Civil Engineer, Federal Energy Regulatory Commission

Applying Risk Analyses to Early Design Phases of Dam and Levee Projects 33

Jennifer Williams, P.E., Dams Sector Leader, Central Region; and Julie Heitland, P.E., Geotechnical Engineer, AECOM; and Greg Werncke, P.E., Senior Risk Advisor, US Army Corps of Engineers

#### **Concurrent Session 3: Cutoff Walls**

The Application of the Deep Mixing Method to Dam and Levee Remediation 50 Donald A. Bruce, President, Geosystems L.P.

Composite Cutoff Wall Construction for the Diavik Diamond Mine in Northern Territories Canada 51 Bob Faulhaber, Business Development Manager; and Harald Heinzlemann, Bauer Foundation Corp.

Assessment of the Feasibility of a Plastic Concrete Cutoff Wall in Dams Built on Landslides 52 Jennifer Ostrowski, Graduate Student; Dr. John Rice, Academic Advisor; and Dr. James Bay, Academic Advisor, Utah State University

#### **Concurrent Session 4: Dead Beat Dams**

Natural River Alignment Reclaimed through Dam Removal 60

Daniel Priest, P.E., General Manager, Contech Engineered Solutions LLC; and Daniel DeVaun, Senior Water Resource Engineer, AECOM

Blood from a Stone: Lessons Learned Removing an Unsafe Dam 67
John Roche, P.E., Senior Engineer, MD Department of the Environment, Dam Safety Division; Kirk Mantay, PWS, Director of Operations, GreenTrust Alliance, Inc.; and Geoffrey Goll, P.E., President, Princeton Hydro

The Tallest Dam Removal in Massachusetts (Psst...the regulators allowed us to release 10,000 CY of sediment downstream) 74

Matthew A. Taylor, Principal; and Laurie A. Gibeau, Project Manager, GZA GeoEnvironmental, Inc.

#### Concurrent Session 5: Decade Dam Failure Series Part I

"The Dam is Becoming Dangerous and May Possibly Go!" The South Fork Dam Failure 92 Clint Brown, P.E., Project Engineer; and Dylan Hoehn, Engineering Analytics

The Failure of Quail Creek Dike: Lessons Learned and Relearned 94

Everett Taylor, Dam Safety Engineer, Utah Division of Water Rights; and Nathaniel Gee, Regional Engineer, Bureau of Reclamation

Averting Failure Due to Spring Runoff – North Dakota's Historic Flood of 2009 100 Karen Goff, P.E., Dam Safety Program Manager; and Jonathan Kelsch, P.E., Engineer/Manager, ND State Water Commission; Chad Engels, P.E., CFM, Senior Project Manager, Moore Engineering; and Gregory Richards, P.E., CFM, Hydraulic and Hydrologic Engineer, Gannett Fleming, Inc.

#### Concurrent Session 6: Step Right Up for Steps and Blocks

Stepped Chute Design: Does Step Shape Really Matter? 101 Sherry L. Hunt, Supervisory Civil Engineer; and Kem C. Kadavy, Agricultural Engineer, USDA - ARS

Verification of CFD Predictions of Self-aeration Onset on Stepped Chute Spillways 104 John Wendelbo, Director, Flow Science

Hydraulic Jump Stability of Articulating Concrete Block Systems 105 James Nadeau, ACB Product Manager, ACF Environmental

# **Concurrent Session 7: Addressing Seepage Issues**

Filters - Can You Trust Them? 116
Benjamin C. Doerge, P.E., G.E., Geotechnical Engineer, M&E Consultants LLC

Use of a Geosynthetic Clay Liner to Rehabilitate the Lower Chinns Dam, Clear Creek County, Colorado 124 Steve Kuehr, P.E., Principal, Brierley Associates; and Ryan Schoolmeesters, Dam Safety Engineer, CO Division of Water Resources

Discovery and Remediation of Internal Erosion/Piping Voids between Incompatible Materials 125
Brian Tri, Senior Civil/Structural Engineer, Vice President; Bill Kussmann, Senior Geotechnical Engineer; and Robb Roy, Geotechnical Engineer, Barr Engineering Co.; and Dean Steines, Principal Plant Engineer, Hydro Operations, Xcel Energy

#### **Concurrent Session 8: Global Perspectives on Tailings Issues**

Two-dimensional runout evaluation of the Brumadinho Tailings dam failure in Brazil 140 Reinaldo Garcia, Hydronia LLC; and Adolfo Tribst-Correa, Brazil Hydro

Calculating Tailings Dam Breach Volumes for Flood Hazard Delineation 141

Noemi Gonzalez Ramirez, Senior Hydraulic Engineer; and Jimmy O'Brien, President, FLO-2D Software INC

The Increasing Number of Tailings Facility Failures: Navigating the Decade 2020-2029 151

David M. Chambers, President, Center for Science in Public Participation; and Lindsay Newland Bowker,

President, Bowker Associates Science & Research In The Public Interest

# Tuesday, September 10

General Session - Today and Yesterday: Recent Dam Safety Failures/Incidents and the 1979 Machhu Dam II Disaster

Today and Yesterday: Recent Dam Safety Failures/Incidents and the 1979 Machhu Dam II Disaster 152

Speakers: Utpal Sandesara, MD, Ph.D., Internal Medicine Resident, UCLA; Tom Wooten, Ph.D. Candidate in Sociology, Harvard; Lee Wooten, P.E., Principal, GEI Consultants, Inc.; and Mark Baker, P.E., Principal, DamCrest Consulting

#### **Concurrent Session 9: Learning from Successful Rehabs**

Prestwood Lake Dam Rehabilitation 153
Kurt Feairheller, Senior Estimator & Project Manager, Crofton Industries

Consolidation Grouting Program to Strengthen Windsor Upper Dam 163

James Myers, Project Manager; and Andrew Plucinsky, Field Engineer, Moretrench American Corporation; and Jacob Wimett, Senior Project Engineer, GeoDesign, Inc.

The Long Road to Dam Rehabilitation 174
Christopher W. Marx, P.E., Project Manager, French & Parrello Associates; and Clint J. Oman, P.E.,
Principal Civil Engineer, NJ Department of Environmental Protection

# Concurrent Session 10: Breaches, Levees, and Dam Breaks

Dam Breach Modeling for Five Dams in Glendale California, Challenges and Lessons Learned 193 Martha Elena Cardona, Associate; Jeffery G. Powers, Senior Associate; and Adam Drozek, Principal Engineer, Hazen and Sawyer

Risk Informed 2D Breach Analyses for Vermont's Flood Control Dams 194
Kevin J. Ruswick, Senior Associate; and Elizabeth Isenstein, Staff Engineer, Schnabel Engineering; and Benjamin Green, Chief Dam Safety Engineer, VT Department of Environmental Conservation

Development of Standard Procedure for Simulating Breach Formation of a Levee Failure 195 Chris Bahner, WEST Consultants, Inc.

# **Concurrent Session 11: Focus on Stability**

Shear Strength of Shale Below a High Hazard Dam – How Low Can You Go? 196 Kessi Zicko, Principal Geotechnical Engineer; and Christopher Bailey, Vice President, Gannett Fleming, Inc.; and Jon Jamison, Superintendent Maintenance Operations & Resident Engineer, Mahoning Valley Sanitary District

Three-Dimensional Stability Analyses – How do We Integrate it For Dam Safety? 206
Tiffany Adams, Ph.D., P.E., BGC Engineering, Inc.; Masood Kafash, Ph.D., P.E., Geotechnical, AECOM; and John France, P.E., Managing Member, JWF Consulting LLC

Evaluating the Stability of Existing Dry-stacked Stone Masonry Faced Earthen Embankment Dams 207 Andrea C. Judge, P.E., Senior Project Engineer, Fuss & O'Neill, Inc.

# **Concurrent Session 12: Spillway Construction**

Lake Ogletree Spillway - Rehabilitation in the "Holey" Land 208

J. Tyler Coats, P.E., Senior Engineer; and James R. Crowder, P.E., Principal, Schnabel Engineering; and Tim Johnson, P.E., Principal Utility Engineer, City of Auburn Water Resource Management

Hybrid Cofferdam and Piano Key Weir Design and Construction - A Rehabilitation Case Study 209 Mathew Moses, P.E., Project Manager, Water Resources; Hande Gerkus-Harris, Ph.D., P.E., Geotechnical Engineer; and Jesse Madden, EIT, Freese and Nichols

# Concurrent Session 13: The Latest Tools for Mitigating Security Threats and Improving Resiliency

Cybersecurity and Infrastructure Security Agency Vulnerability Assessment Programs 226
Daniel Genua, Protective Security Coordination Deputy Director (A), US Department of Homeland Security

Infrastructure Visualization Platform Demo 227

Jaysen Goodwin, Infrastructure Visualization Platform Program Manager, US Department of Homeland Security

Shut the Dam Road Down! AVERT Barrier System for Hostile Vehicle Mitigation 228

Justin M. Roberts, US Army Engineer Research and Development Center

### Concurrent Session 14: Don't Drown at Dams: Best Practices for Public Safety

CFD Modeling to Evaluate and Improve Public Safety Around Dams 229

Benjamin Israel-Devadason, P.E., CFM., Senior Hydraulic and Hydrologic Engineer; and Paul G. Schweiger, P.E., CFM, Vice President, Gannett Fleming, Inc.

Taking Action on Low-Head Dams: A National Inventory. 230
Rollin H. Hotchkiss, Ph.D., P.E., D.WRE, F.ASCE, Professor, Dept. of Civil and Env. Engineering, BYU

Fine Tuning Your Dam Talks to Responders and other Non-engineers 231

Manuela Johnson, Lead/Administrator, Indiana Department of Homeland Security; and Kenneth Smith,
Assistant Director, IN Department of Natural Resources

#### Concurrent Session 15: Out with the Old & In with the New

You Wouldn't Believe What They Put (And Didn't Put) In This Dam: The Deconstruction and Breach of Gunter Valley Dam 232

Christopher M. Hallahan, Senior Geotechnical Engineer; and Steve M. Davidheiser, Senior Project Engineer and Project Manager, Gannett Fleming, Inc.

Eureka! There is Mica in Them Thar Hills! Understanding Complex Site Geology and the Impacts on Embankment Construction 233

Anthony Nokovich, Practice Lead of Engineering, American Water Company; and Edward Barben, Geotechnical Engineer, Gannett Fleming Inc.

Restoring Gunter Valley 243

Steven Davidheiser, Project Manager and Senior Project Engineer; and Matt Leisses, Senior Environmental Scientist, Gannett Fleming, Inc.

#### **Concurrent Session 16: Spillway Modeling**

Upstream modeling to reduce risk and uncertainty during construction 253

Adéle L. Braun, Project Manager / Senior Structural Engineer; Jed Greenwood, Senior Geotechnical Engineer / Vice President; and Cory Anderson, Water Resources Engineer, Barr Engineering Co.

Importance of Site-Specific Design for Labyrinth Spillways – Lessons Learned from Upper Brushy Creek Dam 7 Modernization Design and Construction 268

Victor Vasquez, P.E., Water Resources Group Manager; and Tina Stanard, Water Resources Engineer, Freese and Nichols, Inc.; Blake Tullis, Ph.D., Professor, Utah State University; and Bruce Savage, Ph.D., Associate Professor and Chair, Idaho State University

Arced Labyrinth Weirs in Reservoirs 281

Seth D. Thompson, Hydraulic and Hydrologic Designer, Gannett Fleming; and Blake P. Tullis, PhD, Professor, Utah State University

#### Concurrent Session 17: Fast-n-Furious Grab-n-Go's

Spinney Mountain Dam Seepage Mitigation Project How Aurora Water of the City of Aurora, Colorado evaluated and dealt with a persistent seepage issue 294

John Bruneau, Project Manager, City of Aurora; and P. Paul Perri, P.E., Dam & Civil Works Production Lead, HDR

Application of DSS-Wise for Review and Approval of Dam Inundation Maps 306
Blake J. Dolve, P.E., Senior Engineer; Murari Paudel, Ph.D., P.E., Supervising Engineer; and Ariya Balakrishnan, Ph.D., P.E., G.E., Principal Engineer, CA Division of Safety of Dams

Developing a semi-automated Probable Maximum Precipitation hyetograph using Python programming language 318

Trevor Grout, P.E., CFM, Water Resources Engineer; and Natalie Rogers P.E., CFM, Water Resources Engineer, FTN Associates

My dam is failing; who is going to remove it? 319

Kelly Renee Flint, Senior Engineer; and Anna Sobilo-Ryzner, Regulatory and Compliance Engineer III, MD Department of the Environment

Using New Technology to Safely Perform a Condition Inspection of the Lock Wall at St. Anthony Falls during Run of the River Conditions 320

Christopher Marr, Senior Structural Engineer; Derek Schluessler, Engineering Technician; and Brian Tri, Vice President / Senior Civil/Structural Engineer, Barr Engineering Co.; and Dean Steines, Principal Plant Engineer, Hydro Operations, Xcel Energy

Innovative Geophysical Visualization Technology of Sinkholes Potential Application for Dams? 321 David B. Harro, Geophysicist, G3 Group

# Concurrent Session 18: Implementing Security within State Dam Safety Programs

Applying Emerging Technologies to Critical Infrastructure 322 Katherine Osborne, Stantec; Glen Alexander, Environmental Engineer Supervisor, KY Division of Water How Are State Dam Safety Programs Integrating Security Policies and Practices into Dam Safety Program Management? A Panel Discussion with Q&A (presentation only) N/A
Roger Adams, P.E., PA Department of Environmental Protection; Jonathan Garton, P.E., IA Department of Natural Resources; John Moyle, P.E., NJ Department of Environmental Protection; James Gallagher, P.E., NH Department of Environmental Services; William E. Vinson, P.E., CPESC, CPM, NC Department of Environmental & Natural Resources; Sharon Tapia, P.E., CA Department of Water Resources

### **Concurrent Session 19: Learning from Past Failures**

Clear Branch Dam: A Case Study in the Physical and Human Factors of a Spillway Failure 323 Meghan Walter, P.E., State Hydraulic Engineer; John Gillilan, P.E., State Design Engineer; John Markov, R.G., State Geologist, USDA - NRCS

What Failed Murdock Lake Dam? A Guessing Game of Failure Modes 334

Andrew Cummings, Environmental Administrator/Compliance Manager, MS Department of Environmental Quality

Risk Analysis Perspectives on the Camará Dam Failure 335
Cassandra Wagner, P.G., Engineering Geologist; Dom Galic, P.E., Geotechnical Engineer, Bureau of Reclamation

#### **Concurrent Session 20: Studies in CFD**

Lake Wackena Dam Emergency Spillway Modifications 351
Russell A. Bendel, P.E., Senior Associate, Terracon Consultants, Inc.; John T. Grimes, P.E., President, Grimes Engineering, PC; Steven L. Barfuss, P.E., Research Professor; and Zachary B. Sharp, P.E., Research Assistant Professor, Utah Water Research Laboratory

There and Back Again: A Cedar Cliff Modeling Story 364
Adrian Strain, Water Resource Engineer; Joel Bilodeau, Senior Hydrologist; and Chris Ey, Senior Professional Associate, HDR; and Brad Keaton, Duke Energy

Best practices for simulating hydraulic structures with CFD 365 Brian Fox, Senior Applications Engineer, Flow Science, Inc.

# **Concurrent Session 21: Investigative Methods**

Large-Scale Sonic Drilling To Determine Supporting Fill Parameters 366
Ingvar Ekström, Dam Safety Consultant; and Magnus Ljunggren, Dam Safety Consultant, Sweco Energy AB, Sweden; and Peter Viklander, Dam Engineering Specialist and Adjunct Professor, Vattenfall Vattenkraft AB and Luleå University

Geohazard Monitoring of the Ituango Dam, Colombia Using Radar Satellite Based InSAR Technology 380 Brian Dracup, Senior Director; Molly Zebker, InSAR Analyst; and David Holden, Senior InSAR Analyst, 3vGeomatics; and Juan David Herrera Caicedo, Engineering Specialist - Geotechnical, Ituango Dam, Integral

Dynamic Cone Penetrometer Low Cost Testing Applications in Geotechnical Investigations 400 Rick Scott, Senior Managing Engineer, McMillen Jacobs Associates

#### **Concurrent Session 22: Transforming Owner Programs**

Results of a Cost-effective, Innovative, Screening Level Dam Hazard Assessment Tool for the U.S. Fish and Wildlife Service 411

Danielle T. Hannes, Associate Engineer; Andrea D. Fasen, Assistant Engineer; and Steve Jamieson, President, W. W. Wheeler and Associates, Inc.; Brad Iarossi, Chief of Dam, Bridge, and Seismic Safety Branch; and Constantine Pappas, Civil Engineer, US Fish & Wildlife Service

Right-Sizing a Dam Safety Program for Local Governments 422 George Kelley, P.E., F. ASCE, Senior Water Resources Engineer, Freese and Nichols, Inc.

Improving Understanding of Denver Water's Dams 423

Erin Gleason, Senior Engineer, P.E.; Darren Brinker, Dam Safety Manager; and Ashley Hase, Dam Safety Engineer, Denver Water; John Hunyadi, Dam Safety Engineer; and Ryan Schoolmeesters, Dam Safety Engineer, CO Division of Water Resources

#### **Concurrent Session 23: Raising the Bar for State Programs**

If This Presentation Is Cancelled, We're Probably Dealing with Another Hurricane: The South Carolina Dam Safety Program's Strategic Approach to Intense Rainfall Estimation and Response 431 Shawn Steven Frazer, Engineer Associate II; and Jill C. Stewart, P.E., Director of Dam Safety & Stormwater Permitting, SC Department of Health & Environmental Control

"Cookbook" for State Dam Safety Programs Emergency Response to Earthquakes 432 Chadrick Hill, Civil Engineering Specialist, MT Department of Natural Resources & Conservation

Inundation Mapping and Emergency Action Plan – a California Dam Safety Initiative 447
Rajat Saha, Senior Engineer, Water Resources; and David Panec, Supervising Engineer, Water Resources, CA Department of Water Resources; Paul Risher, Senior Water Resources Engineer; and Abbas Dorostkar, Senior Water Resources Engineer, HDR

# Wednesday, September 11

#### Concurrent Session 24: Decade Dam Failure Series Part II

Harrison Park Detention Pond Failure (2009) 448
Anthony Comerio; Dan Whalen; and Brian Wozniak, Hanson Professional Services Inc.

The 1979 Martin Power Plant Dam Failure (presentation only) N/A R. Lee Wooten, P.E., GEI Consultants, Inc.

Breach of Situ Gintung Dam, Jakarta, Indonesia 449
Paul Risher, P.E., Senior Water Resources Engineer, HDR

20th Anniversary of El Guapo Dam Failure 450 Jonathan Pittman, P.E., Associate, Schnabel Engineering; and Johnathon Atkins, MS Department of Environmental Quality

#### **Concurrent Session 25: Technological Advancements in Inspections**

Remote Sensing Inventory of Dams in the Amite River Basin, Louisiana 451

Dan Schmutz, MS, Chief Environmental Scientist/Vice President; Danny Goodding, MS, Environmental Scientist; and Stephanie K. Garvis, MS, Environmental Scientist, Greenman-Pedersen, Inc.; Ed Knight, P.E., Dam Safety Program Manager; and Doug Taylor, P.E., Director, Dams, Levees and Reservoir Development, LA Department of Transportation and Development

Beam Me up Scotty: Documenting Dam Inspections Using Your Phone or Tablet 461

Joseph Scannell, CEO, USEngineering Solutions Corp.; Stephen Durgin, National Design Engineer; and Larry Caldwell, Earth Team Volunteer, USDA - NRCS

*Upstream Riprap Slope Inspection by Drone – A Case Study 462*Travis A. Shoemaker, Staff Professional, Schnabel Engineering; and Michael P. McGuire, Assistant Professor, Lafayette College

### **Concurrent Session 26: Dam Break Applications**

Dam Breach Arrival Time Delineation Using SimRAS 2D Monte-Carlo Simulation Software 473 Chris Bahner; Gyan Basyal, Staff Engineer; Brian Wahlin, Vice President; and Brent Travis, Ph.D., P.E., D.WRE, Director of Applied Research, WEST Consultants, Inc.

Following the Advice of Albert Einstein for a Dam Break Study 474 Christine Suhonen, Water Resources Engineer, GZA

Dam Breach Modeling Derivatives for Rapid PAR, IDA, and Loss of Life Estimates 475 Larry Sample, Associate Engineer, Wood

# **Concurrent Session 27: Anchors Aweigh**

Investigation and Instrumentation of Embedded Passive Anchors for Large Tainter Gates 476 Mark Schultz, Senior Structural Engineer; and Travis Adams, Structural Engineer, US Army Corps of Engineers; and Kevin Gerst, Senior Hydraulic Structures Engineer, HDR

High Capacity Bar Anchors - All Bars are Not Created Equal 485
Mark Rothbauer, P.E., Regional Manager; and Andrew Moran, P.E., Design Engineer, Nicholson Construction Company

Re-Anchoring of Bagnell Dam 486

Paul C. Rizzo, Ph.D., P.E., Chief Technical Officer, RIZZO International, Inc.; James Gagliardi, P.E., Quality Control Manager, Brayman Construction Corporation; and Jeff Greer, P.E., PMP, Manager of Dam Safety & Hydro Licensing, Ameren Missouri

#### Concurrent Session 28: Lights, Camera, Action! Set the Scene for Your Career.

Advancing your Dam Safety Career- A panel of veteran Dam Safety Professionals (Geezers) discuss careers, what they did right, wrong and lessons learned from both. 499

Nathaniel Gee, P.E., Regional Engineer, Lower Colorado Region of the Bureau of Reclamation; Roger Adams, Director of Bureau of Waterways Engineering and Wetlands, PA Department of Environmental Protection; Mark Baker, P.E., DamCrest Consulting; John France, P.E., D.GE, D.WRE, JWF Consulting; and Paul Schweiger, P.E., CFM, Vice President and Manager of Dams and Hydraulics, Gannett Fleming, Inc.

Educating the Dam and Hydro Engineer of Tomorrow 515

Mark W. Killgore, P.E., D.WRE, F.ASCE, Regional Dam Safety Engineer, VA Department of Conservation and Recreation

#### Concurrent Session 29: Levee Issues for Geo Techs

The Impact of the Wood River Lower Cutoff Wall Phase 2 Project on the Permeability of the Levee Foundation Soils and the Levee Safety 525

Wesley Schmutzler, Senior Project Manager; and Matteo Bertoni, Quality Control Manager, TREVIICOS; and Gene Bryant, Barr Engineering Co.

Relief Well Assessment and Design – Southwestern Illinois Levees 535

Jo Tucker, P.E., Principal Engineer; Mary Knopf, P.E., Project Engineer; and Randy Cook Jr., P.E.,
Senior Civil Engineer, Wood

Laboratory Evaluation of Lightweight Sand Boil Filters 546

Axel M. Montalvo-Bartolomei, Research Geotechnical Engineer; and Bryant A. Robbins, US Army Engineer Research and Development Center (ERDC)

#### Concurrent Session 30: O'Gee! Outlets & Gates

Upgrading Low Level Outlets to Modern Day Standards 559

Kenneth Avery, Water Resources Practice Leader; and Greg Johnson, Waterway Structures Practice Leader, Bergmann

Repair or Replace? Considerations for Dam Rehabilitation 560

Joseph Kudritz, P.E., Civil Engineer; Brian Afek, P.E., Project Manager; Jared Deible, P.E., Technical Manager; and Ed Kaminski, P.E., Project Manager, Michael Baker International, Inc.

A CFD Modeling Analysis of Total Downpull Force acting on Bulkhead Gate for Unbalanced Flow Condition 561

Cheegwan Lee, Lead Hydraulic Engineer; Ethan Thomson; and Raziul Mollah, Supervisor, Hydraulic Design, US Army Corps of Engineers

#### **Concurrent Session 31: Perspectives on GeoTech Topics**

Not your Grandmother's Spillway Concrete, Use of New Technology in Concrete (cancelled) N/A David W. Harris, Ph.D., P.E., F.SEI, F.ASCE, Principal Engineer; Mallory A. Westbrooke, Staff Engineer; WhitneyLe B. Belkowitz, President and CEO; and Jonathan S. Belkowitz, Ph.D., Chief Technical Officer, Intelligent Concrete, LLC

85 Years of Change: The Lower Guard Wall at Charleroi Locks and Dam 586 Timothy A. Hampshire, P.E., Director of Water Resources and Dam Safety, DLZ National, Inc.

Priest Rapids Spillway Performance and Stability Assessment 587
Rebecca Simpson, Dam Safety Engineer; and Ian Hunter, P.E., Chief Dam Safety Engineer, Grant Public Utility District

# **Concurrent Session 32: Coming to Terms with Drones**

Unmanned Aircraft Systems in the Homeland Security Environment 588
William "Tom" Hewitt, Chief, UAS Threat Integration Cell, US Department of Homeland Security

Drones Friend or Foe (presentation only) N/A Randy White, Southern California Edison

### Concurrent Session 33: Tools and Resources for State Dam Safety Officials

Speakers: Michele Lemieux, Dam Safety Section Supervisor, MT Department of Natural Resources & Conservation; Greg Paxson, Principal, National Practice Leader for Dams, Schnabel Engineering; and Mark Baker, DamCrest Consulting, LLC.

# **Concurrent Session 34: 2D Hydrology**

A Designer's Perspective on Potential Changes to the USDA NRCS National Engineering Handbook Hydrology Chapters 660

Amanda J. Hess, P.E., CFM, H&H Group Manager, Gannett Fleming; and Arthur C. Miller, Ph.D., P.E., CFM, Science Practice Leader, AECOM

Two-Dimensional (2D) Approach to Hydrologic Modeling 661

Joseph Vincent Bellini, Vice President; and Petr Masopust, Senior Water Resources Engineer, Aterra Solutions, LLC

Using HEC-RAS 2D Rain-on-Grid for Dam H & H 662
Ben Rufenacht, Senior Water Resource Engineer; and Larry Sample, Senior Project Manager, Wood

# **Concurrent Session 35: Mitigating Construction Risks**

Design of Temporary Cofferdams to Facilitate Dam Rehabilitation Projects 663 Helen Robinson, Senior Project Manager, GEI Consultants Cooper Lake Dam: Benefits of a Safe Yield Model for Understanding Water Supply Risk during Dam Rehabilitation Construction 664

Kevin J. Ruswick, Senior Associate; David Railsback, Project Engineer; and Gregory J. Daviero, Principal, Schnabel Engineering; and Judith Hansen, Superintendent, Kingston Water Department

Are You Comfortable Leaving the Safety of your Dam in the Hands of the Contractor? 665
Anthony Nokovich, Practice Lead of Engineering, American Water Company; Robert Saber, Chief Geotechnical Engineer; and David Snyder, Senior Geotechnical Engineer, Gannett Fleming Inc.

#### Concurrent Session 36: Decade Dam Failure Series Part III

The 2018 Near-Overtopping Incident of a Tribal High Hazard Dam 680 Matthew Young, P.E., CFM, Safety of Dams Engineer, Dam Inspector, Flood Hydrology Coordinator; Rinda Tisdale, MEP, CEM, CFM, Emergency Management Coordinator; William Shuter P.E., Safety of Dams Engineer, Construction Specialist; and Chad Krofta P.E., CFM, Safety of Dams Engineer; Contractor to the Bureau of Indian Affairs; and Paul Mesa, Emergency Management Administrator, Tohono O'odham Nation Department of Public Safety

The Devastation of Hurricane Camille, Schuyler Dam Incident, August 1969, Nelson County, VA 681 Jonathan Pittman, P.E., Associate, Schnabel Engineering

60th Anniversary of the Montana Yellowstone Earthquake: Quake Lake and the Hebgen Dam Incident 682 Daniel W. Osmun, P.E., Senior Technical Advisor, HDR; Lee Mauney, P.E., CFM, Acting Chief of Dam Safety, Bureau of Indian Affairs; Dave Sykora, Ph.D., P.E., G.E., D.GE, Principal Engineer; and Kathryn Murdock, Ph.D., Senior Scientist, Exponent; and Benjamin J, Cope, P.E., Principal Engineer, NorthWestern Energy

#### **Concurrent Session 37: The Best of the Rest**

Halt the Headcut – A Discussion on Earthen Spillway Erosion Cutoff Walls 684 Gregg Hudock, P.E., Golder Associates, Ltd., Canada

Success and Failure of Instrumentation Programs for Dams 692
Paul Schweiger, P.E., CFM, Vice President and Practice Leader for Dams and Hydraulics, Gannett Fleming, Inc.

Continuity of Risk Informed Decision Making from Design Through Construction for the Isabella Lake Dam Safety Project 693

David Serafini, Geotechnical Engineer, US Army Corps of Engineers

# Concurrent Session 38: The future of PMP. What's the End Game?

Statewide Probable Maximum Precipitation Studies, Where We've Been and What's Next 694
Bill Kappel, President/Chief Meteorologist; Doug Hultstrand, Senior Hydrometeorologist; Geoff
Muhlestein, Senior GIS Analyst; Jake Rodel, GIS Analyst; and Kristi Steinhilber, Staff Meteorologist,
Applied Weather Associates

What can dynamical weather modeling offer 21st Century PMP? 709 Kelly Mahoney, Research Meteorologist, NOAA/ESRL/Physical Sciences Division Dust Off Your PMP Studies! Simplified Methods of Screening and Verifying Aging Site Specific PMP Studies 710

Matthew Lehrer, P.E., CFM, Senior Civil Engineer; and Nicholas Agnoli, P.E., Branch Chief, Federal Energy Regulatory Commission

# Poster & Lightning Talks

Agricultural Engineer, USDA - NRCS

Fish Ladder in Nebraska? A Successful Case Study 711
John G. Petersen, Project Manager; and Jake Miriovsky, Project Manager, JEO Consulting Group, Inc.

Regional Semi-Empirical Site Response Model for Sacramento San-Joaquin Delta Levees 712 Tristan E Buckreis, Ph.D. Student, University of California, Los Angeles

Monitoring of Dams for safety purposes: why remote sensing and contact measurements must work together 717

Tony Simmonds, Director, Geokon; and Paolo Mazzanti, CEO, NHAZCA S.r.l., spin-off "Sapienza" Università di Roma

Regional Calibration of the Peak Rate Factor for the NRCS Dimensionless Unit Hydrograph Equation for the State of New Jersey 718

Michael Horst, Associate Professor, The College of New Jersey

Experimental Investigations of Flood Management by an Engineered Levee Breach 733

Ibrahim Adil Ibrahim, Ph.D. Candidate; Melih Calamak, Research Assistant Professor; Lindsey LaRocque, Research Assistant Professor; and Jasim Imran, Professor, University Of South Carolina

2018 Breach of Five Dams in Wisconsin - What Happened? 742
Karl Visser, Hydraulic Engineer; Mark McCurdy, Civil Engineer; Michel O. Dreischmeier, Agricultural Engineer; Tim P. Weisbrod, State Geologist; Matt Blohowiak, Civil Engineer; and Janet Vosberg, P.E.,

Loose Ended Levees? Levee Certification Process and Emergency Action Plan - A Case Study in Phoenix. Arizona 761

Hasan Mushtaq, Planning Branch Manager; and Frank Brown, Levee Safety Program Manager, Flood Control District of Maricopa County

Challenges Associated with the Development of an Emergency Action Plan in an Urban Setting 762 Natalie S. Rogers, Water Resources Engineer; and Trevor Grout, Water Resources Engineer, FTN Associates, Ltd.

Preparing and Exercising Emergency Action Plans to Minimize Dam Safety Risk 763
Benjamin D. Claggett, Training and Exercise Coordinator/Emergency Management Specialist, Bureau of Reclamation

A New Tool for Summarizing Complex Results of Incremental Flooding Analysis 769 Carmen Soller, Staff Engineer, Schnabel Engineering

Emergency Preparedness of Select Dams during Hurricane Florence in North Carolina 770

Laura Shearin-Feimster, Senior Engineer; Mark Landis, Principal; Loring Crowley, Senior Engineer; and Scarlett Kitts, Schnabel Engineering

A 'How To' Construction Administration Guide: keeping the Project Engineer on task from End of Design to Start of Construction 778

Janelle S. Skoyen, P.E., Water Resources Engineer, Ayres Associates

Risk informed assessment and prioritization of twenty-three high hazard dams to develop and implement a watershed-wide risk reduction program 779

Sunit Deo, Senior Water Resources Engineer; Kelley Rich, Water Resources Engineer; and Cris Parker, HDR; and Alysha Girard, General Manager, Upper Brushy Creek WCID

The Story of a Crawfish Boil 780

Julie Eaton, EIT, Project Engineer; and Tulin Fuselier, P.E., Geotechnical Practice Leader, Weston & Sampson Engineers, Inc.

Performing Dam Safety Inspections with Mobile Data Collection Tools 781
Patrick W. Allen, Geotechnical Engineer; Molly O'Connor, Project Manager; and Megan Puncke, Project Manager, Black & Veatch

Numerical Simulation of Big Bay Lake Dam Breach 782

Mohammad Sadik Khan, Assistant Professor; Masoud Nobahar; and Patrick Stanley, Jackson State University; and Dusty Myers, MS Department of Environmental Quality

Evaluation of Penstock Tunnel Leakage with Instrumentation 794

Tim Newton, P.G., Project Engineer, ARCADIS; and David Tanner, Senior Civil Engineer, Canary Systems

Investigation of the Causes of Uncertainty in Dam Breach Parameters Using a Numerical Model 795 Mustafa S. Altinakar, NCCHE, Director and Research Professor, The University of Mississippi; and Dusty Myers, Chief, Dam Safety Division, MS Department of Environmental Quality

Innovative and Conventional Methods of Characterizing and Evaluating Soil Liquefaction in Silty and Gravelly Deposits 796

Gregory Rollins; and Hannah Maas, Stantec; Michael Beaty, Beaty Engineering; and Ian Hunter, Grant Count Public Utility District

Gauging Consequences of Dam Failure Across Newfoundland and Labrador, Canada 797

Andrew Peach, P. Geo., EP; and Hua Zhang, Ph.D., P.Eng., Golder Associates, Ltd., Canada; and Paula Dawe, P. Eng., Government of Newfoundland and Labrador, Canada

Erosion Reduction near Spillway Foundation using Bio-Cementation 798

Jinung Do, Student; Brina Montoya, Professor; and Mohammed Gabr, North Carolina State University

# **Additional Papers**

ASDSO - Dam Design and Consturction Committee Design Review Process Guidance 589 N/A

Montana Dam Safety Program - Design Review Process Manual For Dam Projects 618 N/A