AMERICAN WATER RESOURCES ASSOCIATION

2017 Spring Specialty Conference

CONNECTING THE DOTS: THE EMERGING SCIENCE OF AQUATIC SYSTEM CONNECTIVITY

FINAL PROGRAM

May 1-May 3, 2017

Snowbird Resort
Snowbird, Utah

AWRA
Community, Conversation, Connections
AMERICAN WATER RESOURCES ASSOCIATION

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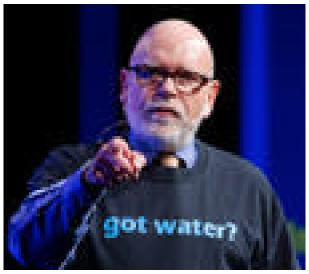
CONFERENCE OPENING PLENARY SESSION

MONDAY • MAY 1 • 8:00 A.M.-10:00 A.M. • SUPERIOR ROOM

WELCOME AND OPENING REMARKS

RAFAEL E. FRIAS III
President
American Water Resources Association
Black & Veatch Corporation
Coral Springs, Florida



MICHAEL E. CAMPANA
Conference Chair
Oregon State University
Corvallis, Oregon

SCOTT G. LEIBOWITZ
Conference Technical Program Chair
U.S. Environmental Protection Agency
Corvallis, Oregon

KEYNOTE SPEAKERS

CHARLES HAWKINS • Utah State University • Department of Watershed Sciences • Logan, Utah
Connectivity and Habitat Suitability Jointly Influence the Ecological Intactness of Aquatic Ecosystems

CATHERINE PRINGLE • University of Georgia • Odum School of Ecology • Atlanta, Georgia
Hydrologic Connectivity and Ecological Interactions in Aquatic Ecosystems

JEFFREY McDONNELL • University of Saskatchewan, School of Environment and Sustainability, Saskatoon, Saskatchewan, Canada
Hydrological Connectivity: From Hillslopes to Watersheds

10:00 A.M.-10:30 A.M. • MORNING NETWORKING BREAK • GOLDEN CLIFF ROOM

POSTER TECHNICAL SESSION ~ GOLDEN CLIFF ROOM

MONDAY ~ MAY 1 ~ 8:30 A.M.-6:30 P.M. / TUESDAY ~ MAY 2 ~ 8:30 A.M.-3:30 P.M.

POSTER PRESENTERS WILL BE AT THEIR POSTERS DURING THE OPENING NETWORKING RECEPTION FROM 5:00 TO 6:30 P.M. ON MONDAY, MAY 1. THEY WILL ALSO BE AT THEIR POSTERS DURING THE MORNING AND AFTERNOON NETWORKING BREAKS ON MONDAY, MAY 1, AND TUESDAY, MAY 2. Please note that the Presenter of each paper is in BOLD type immediately following the paper title. Co-authorsare then listed in parentheses and posters are listed in alphabetical order by Presenter's last name. Abstracts can be accessed by Presenter's last name.

1 **Using Functional Connectivity Networks to Understand the Effects of Disturbance on Ecosystem Function - Saalem Adera,** UC Berkeley, Berkeley, CA (co-authors: L. Larsen, M. Levy, S. Thompson)

2 **Land Use and Stream Water Quality in Bangladesh and Bhutan: Utilizing Macroinvertebrates as Biological Indicators - Bryan Currinder,** University of Pennsylvania, Philadelphia, PA (co-authors: N. Islam, B. Sweeney, S. Willig)

3 **Potential Effects of Climate Change on Aquatic-Terrestrial Linkages and Characterization of Wetland Water Temperature for Future Experiments - Julia Earl,** Oklahoma State University, Stillwater, OK (co-authors: S. Paudel, S.D. Fuhlendorf, C. Davis)

4 **Spatiotemporal Variability of Inorganic Nutrients During Wastewater Effluent Dominated Streamflow Conditions in Indian Creek, Johnson County, Kansas - Guy Foster,** U.S. Geological Survey, Lawrence, KS (co-authors: J.L. Graham, T.J. Williams, L.R. King)

5 **Cyanobacteria and Associated Toxins and Taste-and-Odor Compounds in the Kansas River, Kansas - Jennifer Graham,** U.S. Geological Survey, Lawrence, KS (co-authors: G.M. Foster, T.J. Williams, K.A. Loftin)

6 **Event-Based Analysis of Wetland Hydrologic Response to Infer the Mechanisms That Promote Hydrologic Connectivity in Prairie Pothole Region - Aminul Haque,** University of Manitoba, Winnipeg, MB Canada (co-authors: C. Ross, A. Schmall, S. Bansah, G. Ali)

7 **Development of an Earthen Dam Break Data Base - Karoline Hood,** U.S. Military Academy, West Point, NY (co-authors: T.V. Hromadka II, H.D. McInvale, R. Boucer, B. Wilkins)

8 **Data Driven Method Reveals Feedbacks Between Aquatic Vegetation Growth and Topography Change in Lake Delta Ecosystem - Hongxu Ma,** UC Berkeley, Berkeley, CA (co-author: L.G. Larsen)

9 **Evaluating the Hydrological Impact of Removing Woody Biomass for Biofuel Production Through Unsaturated Zone Modeling - Constance Smith,** University of Utah, Salt Lake City, UT

ORAL PRESENTATIONS

CONCURRENT SESSIONS 1, 2, 3

10:30 A.M.-12:00 NOON **MONDAY ~ MAY 1**

SESSION 1: S10.1 • MAYBIRD ROOM

NAVIGATING THE CLEAN WATER ACT: THE ROLE OF CONNECTIVITY IN POLICYMAKING

MODERATORS

DONNA DOWNING • US EPA • OFFICE OF WATER • WASHINGTON, D.C.
ROSE KWOK • US EPA • OFFICE OF WATER • WASHINGTON, D.C.

10:30 A.M. **Navigating the Clean Water Act: The Critical Role of Connectivity Among Waters - Donna Downing,** US EPA, Washington, DC

10:50 A.M. **Navigating the Clean Water Act: Science and Policy - Rose Kwok,** US EPA, Washington, DC

11:10 A.M. **Navigating the Clean Water Act: Applying the Principles of Connectivity in the Real World - Mark Ryan,** Ryan & Kuehler PLLC, Winthrop, WA

11:30 A.M. **Identification of State Waters and the Importance of Science - Jeanne Christie,** Association of State Wetland Managers, Windham, ME

SESSION 2: S11.1 • SUPERIOR A ROOM

STREAM NETWORKS: CLIMATE AND BIOLOGICAL CONNECTIVITY IN FOUR DIMENSIONS

MODERATORS

JOE EBERSOLE • US EPA • NATIONAL HEALTH & ENVIRONMENTAL EFFECTS RESEARCH LABORATORY • CORVALLIS, OREGON
AIMEE FULLERTON • NOAA NORTHWEST FISHERIES SCIENCE CENTER • SEATTLE, WASHINGTON
JASON DUNHAM • USGS FOREST & RANGELAND ECOSYSTEM SCIENCE CENTER • CORVALLIS, OREGON
MARK WIPFLI • USGS ALASKA COOPERATIVE FISH & WILDLIFE RESEARCH UNIT • FAIRBANKS, ALASKA

10:30 A.M. **Connectivity: The Key to Meeting the Challenges of Climate Change - Gordon Reeves,** PNW Research Station, Corvallis, OR (co-author: L. Benda)

10:50 A.M. **Large-Scale Degradation of Amazonian Freshwater Ecosystems - Leandro Castello,** Virginia Tech, Blacksburg, VA USA (co-author: M. Macedo)

11:10 A.M. **River Networks Dampen Long-Term Hydrological Signals of Climate Change - Kyle Chezik,** Simon Fraser University, Burnaby, BC Canada (co-authors: S.C. Anderson, J.W. Moore)

11:30 A.M. **Climate Change, Wildfire and a Message of Connectivity and Resilience From the 'River of No Return' - Colden Baxter,** Idaho State University, Pocatello, ID

SESSION 3: S13.1 • SUPERIOR B ROOM

TACKLING CONNECTIVITY THROUGH CROSS-SCALE INTEGRATION: LESSONS LEARNED IN THE PRAIRIE POTHOLE REGION

MODERATORS

LAURIE ALEXANDER • US EPA • NATIONAL CENTER FOR ENVIRONMENTAL ASSESSMENT • WASHINGTON, D.C.
RENEE BROOKS • US EPA • NATIONAL HEALTH & ENVIRONMENTAL EFFECTS RESEARCH LABORABORY • CORVALLIS, OREGON
JAY CHRISTENSEN • US EPA • NATIONAL EXPOSURE RESEARCH LABORATORY • LAS VEGAS, NEVADA

10:30 A.M. **Intermittent Surface Water Connectivity: Fill and Spill vs. Fill and Merge Dynamics - Scott Leibowitz,** US EPA, Corvallis, OR (co-authors: D.M. Mushet, W.E. Newton)

10:50 A.M. **Morphological Characterization of Isolated Wetland Depressions in the Des Moines Lobe of Iowa and Their Potential Influence on Downstream Waters - David Green,** Iowa State University, Ames, IA (co-authors: S. McDeid, W.G. Crumpton)

11:10 A.M. **How Well Do Simple Metrics of Hydrologic Connectivity Explain Limnological Conditions in Backwaters of the Upper Mississippi River? - Kathi Jo Jankowski,** USGS, La Crosse, WI (co-authors: J.T. Rogala, J.N. Houser, N.R. De Jager)

11:30 A.M. **Groundwater Connectivity of Prairie Potholes in Diverse Landscapes - Brian P. Neff,** USGS, Denver, CO (co-authors: D.O. Rosenberry)

12:00 NOON-1:30 P.M. • LUNCH BREAK • ON YOUR OWN

DEVELOPMENT OF AN EARTHEN DAM BREAK DATA BASE

Karoline Hood[1]
T.V. Hromadka[2], R.A. Perez[3], H.D. McInvale[4]

Introduction

Earthen dams and reservoirs are frequently used for flood control purposes and for storage of water supply, sediment and debris traps and storage, among other purposes. The United States Committee on Large Dams (USCOLD) estimates 79% of all operational major dams in the United States are earthen embankment dams. A topic of high interest is the assessment of possible failure of these earthen dams and the possible range of inundation areas, peak flow rates, and peak flow velocities, among other factors that are relevant in the assessment of flood inundation damages and risk assessment due to earthen dam failure.

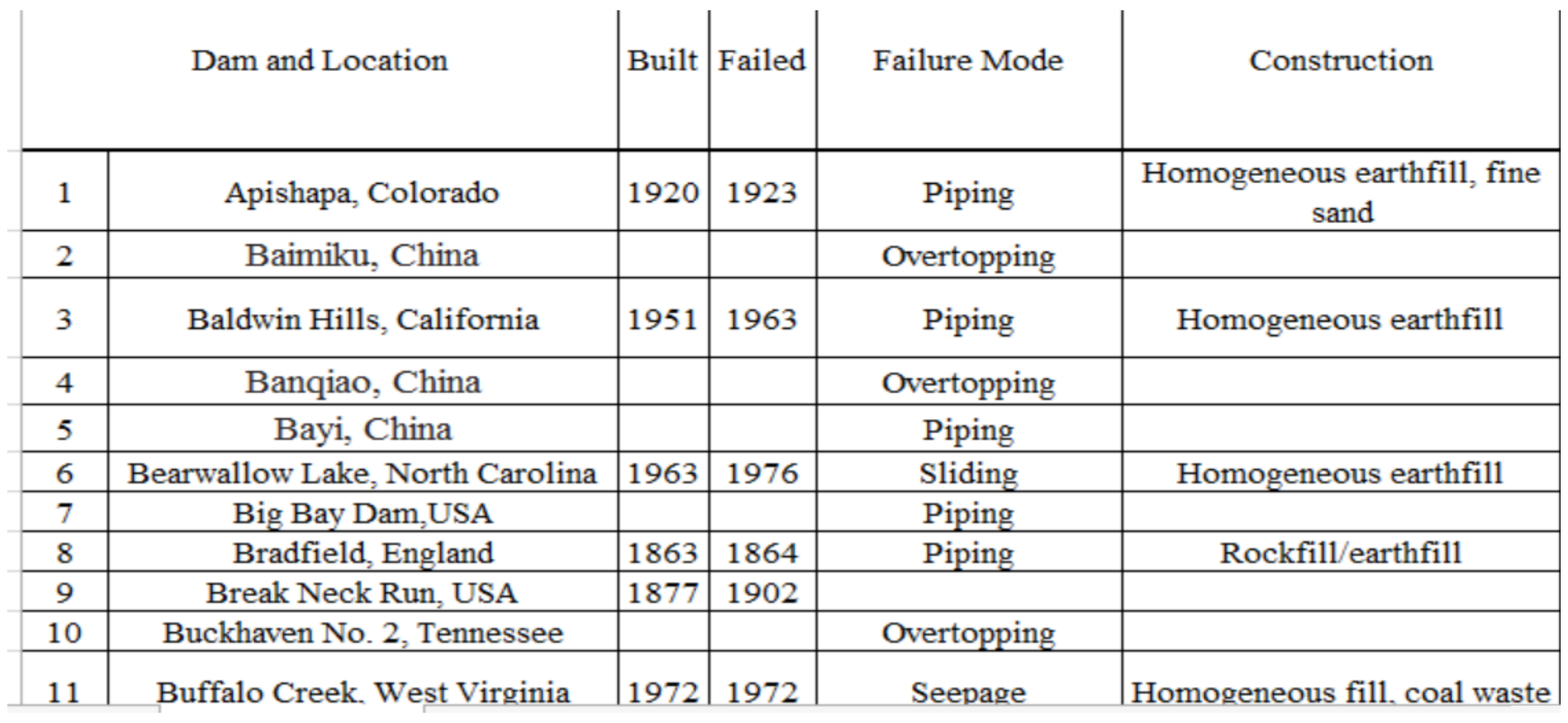
Problems With Modeling Dam Breaks

Regression equations are often used to estimate some of the key outcome variables of the dam breach process. These regression equations are based upon case studies of earthen dam breach occurrences using measured data. Few equations exist that consider a significant proportion of the available earthen dam breach cases reported in the literature. These regression equations differ in their predicted outcome variable values. An explanation for these differences are the differences in assembled data sets used to develop the equations.

We assembled a database for convenient reference, and plan to present a web application that will help to assess the "goodness of fit" of the test case situation within the population of the case study data that form the underpinnings of the selected regression equation.

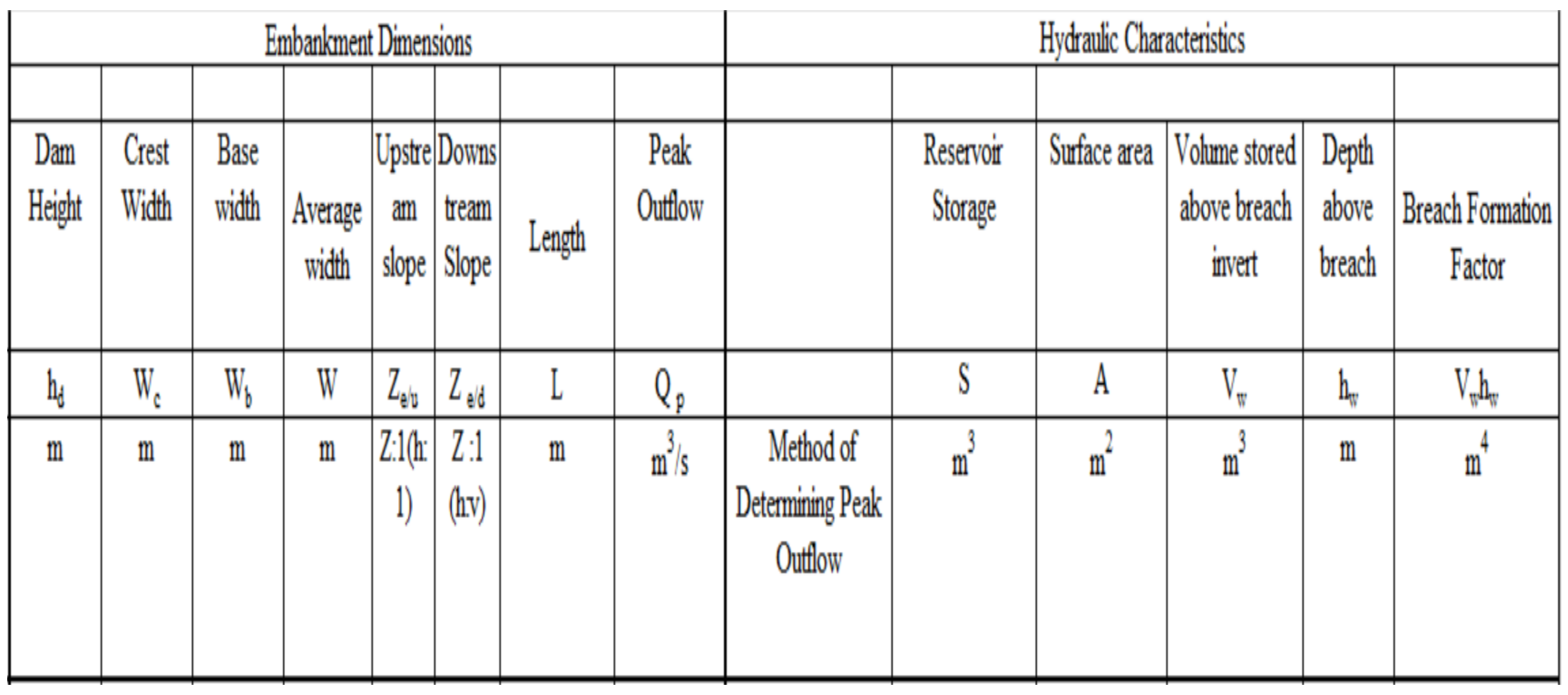
Assembled Data Base

Several sources of earthen dam break data were examined in the current study. These sources include reports from the U.S. Department of the Interior Bureau of Reclamation Dam Safety Office, articles published in the Journal of Geotechnical and Geoenvironmental Engineering and the Journal of Hydraulic Engineering, among other journals and texts, and reports submitted to the National Dam Safety Review Board. In our integrated data base, we identified 25 parameters while only 4 parameters are observed being used in the published regression equations for estimating released peak flow rates. Our database considers over 150 earthen dams.



	Dam and Location	Built	Failed	Failure Mode	Construction
1	Apishapa, Colorado	1920	1923	Piping	Homogeneous earthfill, fine sand
2	Baimiku, China			Overtopping	
3	Baldwin Hills, California	1951	1963	Piping	Homogeneous earthfill
4	Banqiao, China			Overtopping	
5	Bayi, China			Piping	
6	Bearwallow Lake, North Carolina	1963	1976	Sliding	Homogeneous earthfill
7	Big Bay Dam,USA			Piping	
8	Bradfield, England	1863	1864	Piping	Rockfill/earthfill
9	Break Neck Run, USA	1877	1902		
10	Buckhaven No. 2, Tennessee			Overtopping	
11	Buffalo Creek, West Virginia	1972	1972	Seepage	Homogeneous fill, coal waste

Figure 1. Illustration of the data base



Embankment Dimensions								Hydraulic Characteristics					
Dam Height	Crest Width	Base width	Average width	Upstream slope	Downstream Slope	Length	Peak Outflow		Reservoir Storage	Surface area	Volume stored above breach invert	Depth above breach	Breach Formation Factor
h_d	W_c	W_b	W	$Z_{e/u}$	$Z_{e/d}$	L	Q_p		S	A	V_w	h_w	$V_w h_w$
m	m	m	m	Z:1(h:1)	Z:1 (h:v)	m	m^3/s	Method of Determining Peak Outflow	m^3	m^2	m^3	m	m^4

Figure 2: Part of the database showing the assembled embankment dimensions and hydraulic characteristics used in database

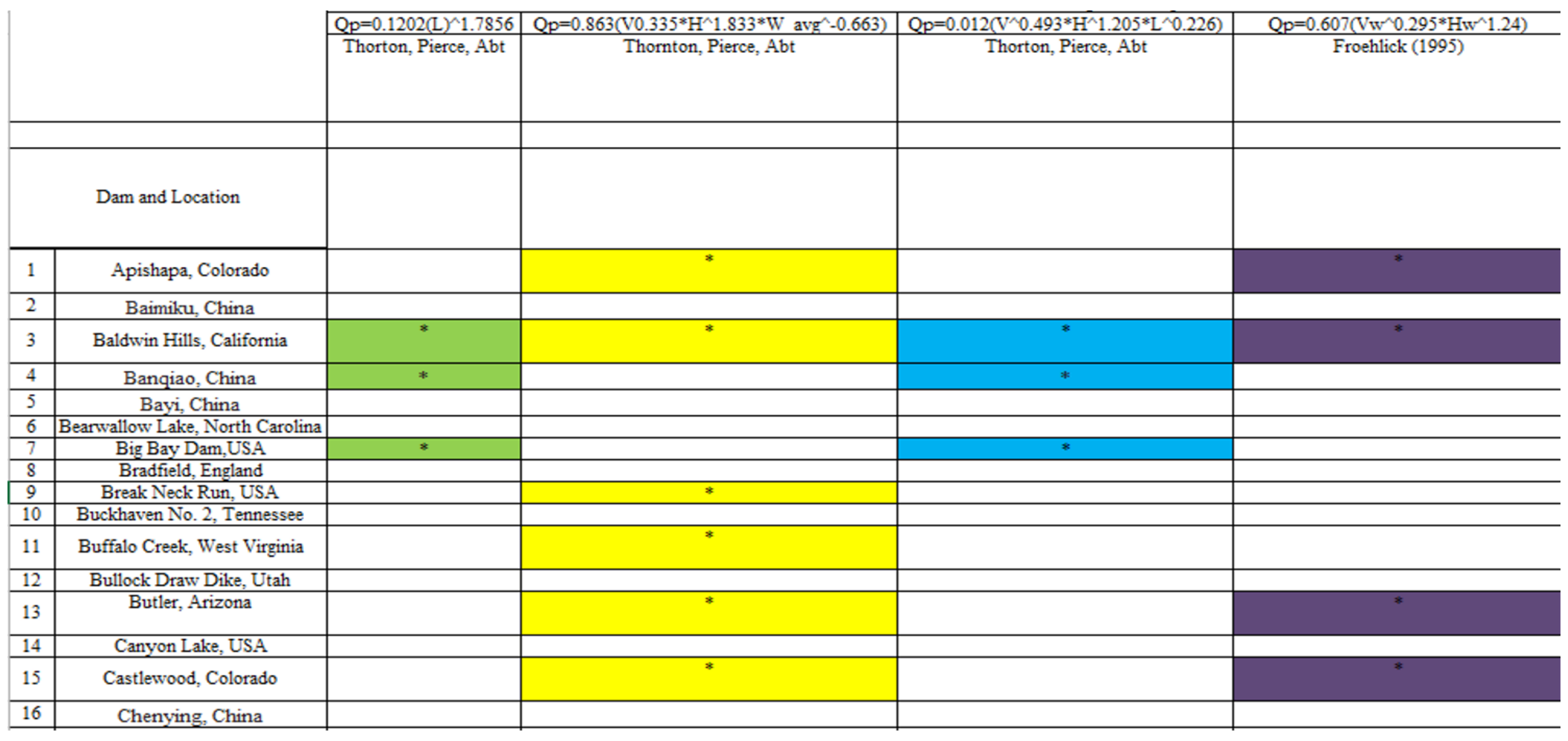
Published Regression Equations Examined

The regression equations we analyzed are all associated with peak flow rate estimation. Future work will analyze failure time equations and breach width equations. The regression equations examined include equations from Froehlich 1995 peak flow equation and three regression equations from Pierce et al. 2010. Below are the regression equations:

- $Q_p = 0.607(V_w^{0.295} \cdot H_w^{1.24})$
- $Q_p = 0.1202(L)^{1.7856}$
- $Q_p = 0.863(V^{0.335} \cdot H^{1.833} \cdot W_{ave}^{-0.663})$
- $Q_p = 0.012(V^{0.493} \cdot H^{1.205} \cdot L^{0.226})$

The “Goodness of Fit” Web Application

The online web application under development provides a graphical display of the actual data reported in the literature that is used in the selected regression equation. The entered case study data for the test situation under study is then entered into the application which then inserts the test data point into the graphical display in order to visualize the appropriateness of the selected regression equation for the considered case study. At issue is whether or not the data population (that the selected regression is based upon) is representative of the test case under study.



		Qp=0.1202(L)^1.7856	Qp=0.863(V0.335*H^1.833*W_avg^-0.663)	Qp=0.012(V^0.493*H^1.205*L^0.226)	Qp=0.607(Vw^0.295*Hw^1.24)
		Thorton, Pierce, Abt	Thornton, Pierce, Abt	Thorton, Pierce, Abt	Froehlick (1995)
Dam and Location					
1	Apishapa, Colorado		*		*
2	Baimiku, China				
3	Baldwin Hills, California	*	*	*	*
4	Banqiao, China	*		*	
5	Bayi, China				
6	Bearwallow Lake, North Carolina				
7	Big Bay Dam,USA	*		*	
8	Bradfield, England				
9	Break Neck Run, USA		*		
10	Buckhaven No. 2, Tennessee				
11	Buffalo Creek, West Virginia		*		
12	Bullock Draw Dike, Utah				
13	Butler, Arizona		*		*
14	Canyon Lake, USA				
15	Castlewood, Colorado		*		*
16	Chenying, China				

Figure 3: Database with associated regression equations

Conclusion and Future Work

The discussed web application is still under development and testing, and is anticipated to be online in BETA version in the summer of 2017.

References

Froehlich, D. C. (1995). “Peak outflow from breached embankment dam.” Journal of Water Resources Planning and Management, 121(1), 90-97.

Pierce, M.W., Thornton, C.I. and Abt, S.R. (2010). "Predicting Peak Outflow from Breached Embankment Dams." J. of Hydrologic Engineering, ASCE, Vol. 15(5).

Wahl, T. L. (1998). *“Prediction of embankment dam breach parameters” — a literature review and needs assessment. Dam Safety Rep No*. DSO-98-004, US Dept. of the Interior, Bureau of Reclamation, Denver, CO.

Xu, Y., and Zhang, L. M. (2009). "Breaching parameters for earth and rockfill dams." *Journal of Geotechnical and Geoenvironmental Engineering,* 135(12), 1957-1970.

**See the complete list of references in the full manuscript*

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