

# **World Environmental and Water Resources Congress 2010**

**Providence, Rhode Island, USA  
16-20 May 2010**

**Volume 1 of 6**

**Editor:**

**Richard N. Palmer**

**ISBN: 978-1-61738-610-7**

**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© (2010) by the American Society of Civil Engineers  
All rights reserved.

Printed by Curran Associates, Inc. (2010)

For permission requests, please contact the American Society of Civil Engineers  
at the address below.

American Society of Civil Engineers  
1801 Alexander Bell Drive  
Reston, VA 20191

Phone: (800) 548-2723  
Fax: (703) 295-6333

[www.asce.org](http://www.asce.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: 845-758-2634  
Email: [curran@proceedings.com](mailto:curran@proceedings.com)  
Web: [www.proceedings.com](http://www.proceedings.com)

# TABLE OF CONTENTS

## VOLUME 1

### 2010 EWRI TECHNICAL PAPER CONTEST WINNERS

<b>The Rivers of Madison County: Determination of Bacterial Contamination in the Flint River During Winter Flood Stage</b> .....	1
<i>Tara M. Martin</i>	
<b>Reclamation of Tile Effluent: Denitrifying Woodchip Bioreactors</b> .....	7
<i>Wendy D. Rodriguez</i>	
<b>Comparison of Water Quality Data to Determine Effects of Urbanization on the Flint River, Madison County, Alabama</b> .....	14
<i>Elizabeth A. Gilbert</i>	
<b>Suspended Sediment Transport in a Southeastern Plains Watershed</b> .....	19
<i>J. J. Ramirez-Avila</i>	
<b>Study of the Effects of Ozonation and Flow on Corrosion of Cement Mortar Lined Water Pipe</b> .....	29
<i>James R. Montgomery</i>	

### CLIMATE CHANGE

<b>River Water Pollution Modeling under Climate Change in Kura-Araks Basin for Watershed Management</b> .....	37
<i>M. A. Nalbandyan, N. A. Ajabyan</i>	
<b>Climate Change Impacts on Extreme Flow Measures in Satluj River Basin in India</b> .....	46
<i>Mohammed Sharif, Donald Burn, Azhar Hussain</i>	
<b>Transboundary Climate Change Effects on the Hydrologic Regime in the Rio Conchos Basin</b> .....	60
<i>Eusebio Ingol-Blanco, Daene C. McKinney</i>	
<b>Assessing the Impacts of Climate Variability on the Water Resources in the Rio Grande/Río Bravo Basin</b> .....	69
<i>C. Prakash Khedun, Ashok K. Mishra, Mehmet Özger, Hiroko Kato-Beaudoing, John D. Bolten, John R. Giardino, V. P. Singh</i>	
<b>Combined Effect of Global Climate Projection and Hydrologic Model Uncertainties on the Future Changes of Streamflow</b> .....	81
<i>Mohammad Reza Najafi, Hamid Moradkhani, Ilwon Jung</i>	
<b>Evaluation of Climate Change Impacts to Reservoir Operations within the Connecticut River Basin</b> .....	92
<i>Kelcy Adamec, Richard Palmer, Austin Polebitski, D. Ahlfeld, Scott Steinschneider, Brian Pitta, Casey Brown</i>	
<b>Framework for Water and Wastewater Utility Climate Change Adaptation Decision Making</b> .....	101
<i>Walter M. Grayman, Steven G. Buchberger, David C. Major, Richard M. Males, James A. Goodrich, Y. Jeffrey Yang</i>	
<b>A Framework of Hydroclimate Modeling and Decision Support Tools for Sustainable Water Resources Planning in a Changing Climate</b> .....	107
<i>Jae Ryu, Seon Ki Park, Kwangya Lee</i>	
<b>Preliminary Analysis of Trends in Australian Flood Data</b> .....	115
<i>E. H. Ishak, A. Rahman, S. Westra, A. Sharma, G. Kuczera</i>	
<b>Impacts of Climate Change and Growth on Water Demands in the Puget Sound Region</b> .....	125
<i>Austin Polebitski, Richard Palmer</i>	
<b>Water Quality Management in the Context of Climate Change: Importance for Adapting Critical Condition and Uncertainty Analysis in the Threshold or Scenario Approach</b> .....	135
<i>Harry X. Zhang</i>	
<b>Aquifer Storage and Recovery as a Viable Climate Change Adaptation Technique: Sustainable Development under the Current Regulatory Framework</b> .....	144
<i>Y. Jeffrey Yang, Angela Restivo, Young-Shin Jun, Donald Schupp, Heath Mash, E. Radha Krishnan</i>	
<b>Mechanistic Determination of Arsenic Remobilization at ASR Sites and Corresponding Adaptation Techniques</b> .....	154
<i>Angela Restivo, Young-Shin Jun, Donald Schupp, Y. Jeffrey Yang</i>	
<b>Topographic Factors in Precipitation Dynamics Affecting Water Resource Engineering in the Contiguous U.S.: Notes from Hydroclimatic Studies</b> .....	164
<i>Y. Jeffrey Yang</i>	

## **COMMUNICATIONS COUNCIL**

<b>How to be an Effective Expert Witness</b> .....	171
<i>Kenneth A. Goodwin</i>	
<b>Using Radio to Promote Water-Related Engineering</b> .....	181
<i>Deb O'Bannon</i>	

## **EDUCATION AND RESEARCH**

<b>History and Status of Women in Civil Engineering Academia</b> .....	186
<i>Kathleen M. Leonard</i>	
<b>Does Study of "Economy &amp; Risk" Alter Engineers' Views of Sustainability Issues?</b> .....	202
<i>R. A. Chadderton</i>	
<b>GPS/GIS Technology to Provide Sustainable Solutions</b> .....	208
<i>S. D. Watling, J. Connor</i>	
<b>Joseph Totten, Fort Adams, and America's Third System of Coastal Fortifications</b> .....	218
<i>Augustine J. Fredrich</i>	
<b>Gray Iron and Ductile Iron Pipe—Some Historical Benchmarks Impacting Condition Assessment</b> .....	226
<i>Ralph Carpenter</i>	
<b>Preserving Hydroelectric History in Mexico: Developing the Remate Project as an Interpretive Park</b> .....	240
<i>Mark W. Killgore</i>	
<b>Missouri S&amp;T's Global Studies Minor Development Experience</b> .....	250
<i>Andrew Elmore</i>	
<b>Interdisciplinary Graduate Education in Water and Environmental Resources in 2050</b> .....	258
<i>Laurel Saito, Fritz Fiedler, Barbara Cosens, Derek Kauneckis</i>	

## **EMERGING AND INNOVATIVE TECHNOLOGIES**

<b>Bench-Scale Evaluation of Peracetic Acid and Twin Oxide™ as Disinfectants in Drinking Water</b> .....	261
<i>Jacqueline L. Goveas, R. Sinha, E. Radha Krishnan, Craig Patterson, Vasudevan Nambodiri</i>	
<b>Laboratory and Field Evaluation of a Nanofilter Membrane to Remove Disinfection Byproduct Precursors and Microorganisms from Lake Water Sources Used for Drinking Water</b> .....	270
<i>R. Sinha, Nur Muhammad, E. Radha Krishnan, Anita Anderson, Craig Patterson, David Pearson</i>	
<b>Two-Stage Groundwater Filtration for Control of Manganese and DBPs</b> .....	279
<i>J. E. Tobiason, Minh Pham, Yesher Larsen, Gary Kaminski</i>	
<b>Evaluation of a Pour-Through Water Treatment Device for Use as Microbiological Purifier</b> .....	281
<i>Craig Patterson, Morris Waskar, Nur Muhammad, R. Sinha, E. Radha Krishnan, Nimish Shah</i>	
<b>Evaluation of Long-Term Performance of Point of Use (POU) Systems for Drinking Water Treatment</b> .....	289
<i>Nur Muhammad, R. Sinha, E. Radha Krishnan, Lee Heckman, Craig Patterson</i>	
<b>Drinking Water Distribution Systems: Theory and Application of an Urban Observatory</b> .....	300
<i>D. L. Boccelli, J. G. Uber, S. Hatchett</i>	
<b>Managing Environmental Flows Information</b> .....	307
<i>Eric S. Hersh, David R. Maidment</i>	
<b>NASA's Applied Sciences for Water Resources</b> .....	315
<i>Bradley Doorn, David Toll, Ted Engman</i>	
<b>Integrated Real Time Geospatial Sensor Web and Visual Analytics for Environmental Decision Support</b> .....	325
<i>Y. Liu, D. Hill, J. Myers, B. Minsker</i>	
<b>Forecasting Hypoxia in Corpus Christi Bay, Texas by Model Fusion</b> .....	335
<i>Indu Chinta, B. Minsker</i>	
<b>Detection of Breaking Waves Using X-band Pulse Radar in the River Mouth Region</b> .....	344
<i>H. C. Chan, J. M. Leu, M. C. Lee, Y. C. Lin, F. C. Ou</i>	
<b>Emerging Sensors and their Implications for the Future of Environmental Observatories</b> .....	353
<i>T. O. Ojo, J. S. Bonner</i>	
<b>Integrated Strategy for Public Involvement at the Paducah Gaseous Diffusion Plant</b> .....	360
<i>L. Ormsbee, Anna Hoover</i>	
<b>Use of Structured Public Involvement to Identify Community Preferences for a Superfund Site End State Vision</b> .....	370
<i>Ted Grossardt, John Ripy, Keiron Bailey</i>	

<b>Use Of Community-Based Participatory Communication to Identify Community Values at a Superfund Site</b> .....	381
<i>Chike Anyaegbunam, Anna Hoover, Michael Schwartz</i>	
<b>Casewise Visual Evaluation for High-Performance Collaborative Visioning of PGDP Nuclear Enrichment Plant End State</b> .....	391
<i>Keiron Bailey, Ted Grossardt, John Ripy, Ben Blandford</i>	
<b>Development of a Treatability Study Work Plan for Testing Nanoparticles at a US DOE Superfund Site</b> .....	401
<i>L. Ormsbee, S. Hampson, D. Bhattacharyya</i>	
<b>Nanotechnology for TCE and PCB Dechlorination from Water: Nanoparticle Synthesis and Reactivity</b> .....	411
<i>D. Bhattacharyya, J. Xu, V. Smuleac, S. Lewis, L. Ormsbee, L. Bachas</i>	
<b>Rapid Destruction of Perchlorate on Ion Exchange Resin Using Stabilized, Zero-Valent Iron Nanoparticles (nZVI)</b> .....	417
<i>Jeffrey Shoemaker, A. Kney, Steven Mylon, Andrea Merino, Dongye Zhao</i>	
<b>Criteria for Evaluating Distribution Network Early Warning Systems</b> .....	428
<i>Dan Kroll</i>	
<b>Integrating Rainwater Harvesting for Innovative Stormwater Control</b> .....	448
<i>P. C. Reidy</i>	
<b>Demonstration and Monitoring of Rainwater Harvesting Technology in North Carolina</b> .....	455
<i>K. M. DeBusk, W. Hunt, J. D. Wright</i>	
<b>The Impact of First Flush Removal on Rainwater Quality and Rainwater Harvesting Systems' Reliability in Rural Rwanda</b> .....	465
<i>Kelly Doyle, Peter Shanahan</i>	
<b>Advanced Water Budget Analysis for Rainwater and Related Harvesting Applications</b> .....	475
<i>J. F. Briggs, P. C. Reidy</i>	
<b>Rainwater Harvesting Performance in a Changing Climate</b> .....	485
<i>Lars S. Hanson</i>	
<b>Analysis and Treatment of Harvested Rainwater</b> .....	495
<i>Emmanuel U. Nzewi, Srujana Sarikonda, Eun Ju Lee</i>	
<b>Transitional Approaches to the Development of Sustainable Civil Engineering Infrastructure</b> .....	504
<i>Peter D. Binney</i>	
<b>Techniques for Nitrogen Management in Municipal Solid Waste Composting</b> .....	514
<i>M. J. Adelman, A. Kney</i>	
<b>Prospects of Using Rainwater as a Local Resource</b> .....	525
<i>Aruna Ramani Grover</i>	
<b>Evaluation and Optimization of Cooling Water Use in Nuclear Power Generation</b> .....	535
<i>Kit Ng, Stewart Taylor</i>	
<b>Use of Ceramic Pot Filters for Drinking Water Disinfection in Guatemala</b> .....	545
<i>Aaron Archer, Andrew Elmore</i>	
<b>Field Testing of a Small Water Purification for Non-PRASA Rural Communities</b> .....	559
<i>D. Concepcion, J. Falcon, S. Hwang, R. Sinha, C. Impellitteri</i>	
<b>Evaluating the Effects of Waterjet Delivered Amendment on Benthic Organism</b> .....	568
<i>Grace Harper, Gavin Risley, Andrew Elmore, Joel Burken, G. Galecki, Aaron Archer</i>	
<b>Water for All International Manual Well Drilling Method</b> .....	578
<i>Anne Marie Lassaline, Cathy Fitzgerald</i>	

**ENVIRONMENTAL COUNCIL**

<b>GHG Emissions of Livestock Manure Management Operations and the Mandatory Reporting Requirements in the USA</b> .....	584
<i>William F. Ritter, S. Rao Chitikela</i>	
<b>Spatial and Temporal Distribution of Highway-Generated Air Pollution in a Residential Urban Neighborhood: Comparison of Monitoring and Dispersion Modeling Results</b> .....	594
<i>Allison St. Vincent, Jeffrey Trull, Wig Zamore, Doug Brugge, John Durant</i>	
<b>From Problem Statement to Pilot Scale: A Hybrid Passive Treatment System for Landfill Leachate in North Bay, Ontario, Canada</b> .....	602
<i>S. Speer, P. Champagne, B. Anderson</i>	
<b>Evaluation of SWCC Model and Estimation Procedure for Soil and Fly Ash</b> .....	614
<i>C. Malaya, S. Sreedeeep</i>	

<b>A Conceptual Framework for Assessing the Success of Water Quality Trading Programs</b> .....	623
<i>Priscilla Cole, William F. Ritter</i>	
<b>Water Quality Analysis in a Residential Area of Kuwait</b> .....	634
<i>Karim N. Jallad, Cyntia Espada-Jallad</i>	

**GROUNDWATER COUNCIL—8<sup>TH</sup> SYMPOSIUM ON GROUNDWATER  
HYDROLOGY, QUALITY, AND MANAGEMENT**

<b>ASCE/EWRI KSTAT 3 Standard Guideline for K Estimation—Implementation of Example Code as an Excel Function</b> .....	642
<i>Gustavious P. Williams</i>	
<b>A Particle Tracking Model, IGSM_PT, as a Post-Processor to Finite-Element Groundwater Flow Model, IGSM</b> .....	647
<i>Mesut Cayar , Saquib Najmus, Ali Taghavi</i>	
<b>Three Dimensional Land Motion in Response to Aquifer Depressurization</b> .....	658
<i>J. Li</i>	
<b>Effect of Input Data on Predicting Plume Location Using MAROS Mode</b> .....	668
<i>Ron Erdman, Avdhesh Tyagi, Greg Wilber</i>	
<b>Automated Well Permitting via GIS Geoprocessing Tools</b> .....	678
<i>Norman L. Jones, Gil Strassberg, Alan Lemon</i>	
<b>Empirical Equation for Spacing of Ground Water Heat Pump Systems</b> .....	688
<i>M. Möderl, R. Sitzenfrey, W. Rauch</i>	
<b>Statistical Methods in Ground Water: Review and Applications</b> .....	698
<i>Jinsheng Huo, Yan Jiang</i>	
<b>Visualisation Modules for Solute Transport in Ground Water</b> .....	707
<i>Chandramouli Viswanathan, Chenn Qian Zhou, Li Jin, Madhusudhan Narayana, Vamsi Duvvuri</i>	
<b>Engineered Well Injection and Extraction to Enhance Mixing in Aquifers</b> .....	715
<i>David C. Mays, R. M. Neupauer</i>	
<b>An Industry Perspective on Water Management / Optimization Applications</b> .....	723
<i>Peter F. Andersen</i>	
<b>Treatment of Uncertainty in Groundwater Modeling: A (Limited) Research Perspective</b> .....	729
<i>P. D. Meyer, S. J. Cohen</i>	
<b>An Industry Perspective on Groundwater Flow Model Calibration</b> .....	737
<i>Angelos N. Findikakis, Matthew K. Waterman</i>	
<b>Sustainability of Gravity-Fed Water Systems in Alto Beni, Bolivia: Preparing for Change</b> .....	744
<i>Lauren Fry, D. Watkins, James Mihelcic, Nathan Reents</i>	
<b>Forecasting Salt-Water Intrusion into Coastal Aquifers Due to Climate Change</b> .....	752
<i>John Rapaglia, Athanasios Vafeidis, Henry Bokuniewicz, Tsvi Pick</i>	
<b>Climate-Groundwater-Surface Water Interrelationships Over the South Eastern US</b> .....	761
<i>Naser Almanaseer, S. Arumugam</i>	
<b>Rainwater Harvesting in an Indian Village</b> .....	768
<i>C. Bull, C. Tang, V. P. Sylas</i>	
<b>River Bank Filtration for Protection of Jordanian Surface and Groundwater</b> .....	776
<i>W. Blanford, Thomas Boving, Z. Al-Ghazawi, M. Shawaqfah, J. Al-Rashdan, I. Saadoun, Jack Schijven, Qotaiba Ababneh</i>	
<b>River Bank Filtration in North India</b> .....	782
<i>C. S. P. Ojha, A. K. Thakur</i>	
<b>Using Water Conservation and Rain Water Harvesting to Recharge Groundwater: Groundwater Protection and Cultural Understanding of Hydrogeology in Abheypur, India</b> .....	792
<i>D. S. Pines, N. S. Glucksberg</i>	
<b>Island Groundwater: A Limited and Vulnerable Resource</b> .....	795
<i>Daniel W. Urish</i>	
<b>Ceramic Water Filters Impregnated with Silver Nanoparticles for Point-of-Use Water Treatment: Results of Field Studies in Guatemala and South Africa</b> .....	806
<i>James A. Smith, Lydia Abebe, Vinka Craver, Rebecca Dillingham, Erin Kallman, Beauty Mashao, Sophia Narkiewicz, Amidou Samie</i>	
<b>Changes of Temporal Trends and Spatial Patterns of Nitrate-Nitrogen in the Farmland Groundwater Resulting from Water-Saving Irrigation in the Hetao Irrigation District of China</b> .....	808
<i>Zhongyi Qu, Xixi Wang , Zhaozhong Feng, Shaohong Guo</i>	

## VOLUME 2

<b>Water Pump Scheduling System Using Scatter Search, Tabu Search and Neural Networks—The Case of Bouregreg Water System in Morocco</b> .....	822
<i>Mustapha Hajji, Ali Fares, Fred Glover, Ouazar Driss</i>	
<b>Thermal Measurement, Analysis &amp; Interpretation of a Pilot Standing Column Well</b> .....	833
<i>Albert A. Koenig, John Goodhall</i>	
<b>Macro Scale Wetlands Restoration by Drainage Canal Removal—Challenges, Solutions, and Lessons Learned</b> .....	846
<i>David Weston, Charles Rowney, Roger Copp, Amber Fuxan, Ron Armstrong</i>	
<b>Between a Rock and a Hard Place: Improving the Modeling of Chlorinated Solvent Natural Attenuation in Bedrock Aquifers</b> .....	856
<i>S. J. Druschel, N. E. Kinner</i>	
<b>Hydrogeologic, Geologic, and Sustainable Challenges and Interpretations for the Installation of a Geothermal Well</b> .....	868
<i>Susan Cahalan-Roach, Kathleen Campbell, Yee Cho</i>	
<b>Borehole Geophysics and the Interpretation of Subsurface Conditions Contributing to the Design of a Sustainable Geothermal Well</b> .....	880
<i>M. Scott McQuown, Kathleen Campbell</i>	
<b>Phosphorus Distribution in Reservoir Sediments: Implications for Groundwater Transport</b> .....	891
<i>Gustavious P. Williams, Warren Casbeer, E. James Nelson, Brett Borup</i>	
<b>Piloting of a National Groundwater Monitoring Network: Meeting the Challenges</b> .....	899
<i>Robert P. Schreiber</i>	
<b>Bayesian Inference of Groundwater Contamination Source</b> .....	905
<i>Xin Jin, Hui Wang, Ranji Ranjithan</i>	
<b>Wavelet Analysis of Steady State Groundwater Flow in a Bounded Domain</b> .....	913
<i>M. F. Dillin, R. M. Neupauer</i>	
<b>Clean Water Everywhere: A Look at Source Water Assessment and Protection Across the United States</b> .....	922
<i>Claudia Krug Lea, Christina Petersen, Camille Sowell, Sean Ables</i>	
<b>The Effect of Atmospheric Chemical Release on the Reduction in Groundwater Pollution by CVOCs</b> .....	934
<i>W. Jang, M. L. Maslia, M. M. Aral</i>	
<b>Implementing Voluntary Source Water Protection in the State of Texas</b> .....	940
<i>Elston Johnson, Sean Ables, Camille Sowell, Tina Petersen</i>	
<b>Characterization of On-Site Wastewater Nitrogen Plumes in Shallow Coastal Aquifers, North Carolina</b> .....	949
<i>C. P. Humphrey Jr., N. E. Deal, M. A. O'Driscoll, D. L. Lindbo</i>	
<b>Use of Multi-Electrode Resistivity Profiling to Estimate Hydraulic Properties of Preferential Flow Paths in Alluvial Floodplains</b> .....	959
<i>R. B. Miller, D. M. Heeren, G. Fox, T. Halihan, D. E. Storm, A. R. Mittelstet</i>	
<b>Nutrient and Pathogen Removal in a Passive On-Site Sewage Treatment and Disposal System (OSTDS) with a Recirculation Filtration Tank</b> .....	970
<i>Ni-Bin Chang, Marty Wanielista, Fahim Hossain, Zheming Xuan, Ammarin Daranpob</i>	
<b>Using a Subsurface Upflow Wetland for Nutrient and Pathogen Removal in an On-Site Sewage Treatment and Disposal System</b> .....	983
<i>Ni-Bin Chang, Marty Wanielista, Zheming Xuan, Ammarin Daranpob</i>	
<b>Porous Pavement Hydrology</b> .....	994
<i>Christina Syrrakou, J. Fitch, Thomas Elliasen, William Ahearn, George Pinder</i>	
<b>Statistical Analysis of Flow Exchange and Salt Loading between the Rio Grande and Underlying Aquifers</b> .....	1002
<i>Z. Sheng, A. Michelsen, Y. Liu, B. Creel, T. McGuckin, R. Lacewell</i>	
<b>Adjoint Model for the Selection of Groundwater Well Locations to Minimize Stream Depletion</b> .....	1012
<i>R. M. Neupauer, M. T. Cronin</i>	
<b>A Smart Market for Ground and Surface Water with Hydropower Generation</b> .....	1021
<i>Rebecca Teasley, John Raffensperger, Mark Milke</i>	
<b>Evaluation of Alluvial Well Depletion Analytical Solutions from a Stream—Aquifer Analysis Test Along the North Canadian River in Oklahoma</b> .....	1030
<i>G. Fox, D. M. Heeren, M. A. Kizer</i>	
<b>Impact of Preferential Flow Paths on Stream and Alluvial Groundwater Interaction</b> .....	1040
<i>D. M. Heeren, R. B. Miller, G. Fox, D. E. Storm, A. K. Fox, A. R. Mittelstet</i>	

<b>Occurrence of Steroid Hormones and Antibiotics in Groundwater Impacted by Livestock Waste Control Facilities</b> .....	1052
<i>Shannon Bartelt-Hunt, Daniel D. Snow, Teyona Damon-Powell</i>	
<b>Assessment of Estrogenicity and Estrogenicity Drivers in a WWTP Mixing Zone</b> .....	1062
<i>Sheree A. Pagsuyoim, Wu-Seng Lung, Lisa M. Colosi</i>	
<b>A Microfluidic Device for Studying Contaminant Mixing in Porous Media</b> .....	1072
<i>Rajveer Singh, Mira S. Olson</i>	
<b>Historical Reconstruction of Groundwater Contamination at Contaminated Sites and Uncertainty Analysis</b> .....	1082
<i>Jiabao Guan, Wonyong Jang, M. L. Maslia, M. M. Aral</i>	
<b>Ensemble Modeling of Nonlinear Hydrologic Processes under Uncertainty Using Symmetry Methods and Its Application to 2-D Unconfined Groundwater Flow in Heterogeneous Aquifers</b> .....	1087
<i>Mesut Cayar, M. L. Kavvas</i>	
<b>Analysis of Saltwater Intrusion Driven by Areal-Recharge</b> .....	1099
<i>S.-W. Chang, T. P. Clement</i>	
<b>The Effects of Uncertainty on a Ground Water Management Problem Involving Saltwater Intrusion</b> .....	1102
<i>K. L. Ricciardi, A. E. Mulligan</i>	
<b>Submarine Groundwater Discharge and Seawater Intrusion: Two Sides of the Same Problem with Major Quantification Gaps</b> .....	1114
<i>G. Destouni, C. Prieto</i>	
<b>The Influence of River Bottom Topography on Salt Water Encroachment Along the Lamone River (Ravenna, Italy), and Implications for the Salinization of the Adjacent Coastal Aquifer</b> .....	1124
<i>Mario Laghi, Pauline Mollema, Marco Antonellini</i>	
<b>Three-Dimensional Mapping of Seawater Intrusion Using Geophysical Methods</b> .....	1136
<i>M. Sherif, A. Kacimov, A. Ebraheem, M. AlMulla</i>	
<b>Driving the Modeling of Saltwater Intrusion at the Venice Coastland (Italy) by Ground-Based, Water-, and Air-Borne Geophysical Investigations</b> .....	1146
<i>P. Teatini, L. Tosi, A. Viezzoli, R. de Franco, G. Biella, C. Tang</i>	
<b>A Study on the Influence of Unit Weight on Tensiometric Measurement</b> .....	1156
<i>C. Malaya, S. Sreedeeep</i>	
<b>Effect of Ethanol on Water Flow in the Vadose Zone</b> .....	1162
<i>Antonella Sciortino, Filomena Canora, Kreg Martin</i>	
<b>Prediction of Transport Properties in Reconstructed Unconsolidated Porous Media</b> .....	1172
<i>Riyadh Al-Raoush, Andy Ward</i>	
<b>Waterjet Placement of Remediation Amendments into Contaminated Sediments</b> .....	1181
<i>Gavin Risley, Andrew Elmore, Joel Burken, G. Galecki</i>	

## **HYDRAULICS AND WATERWAYS COUNCIL**

<b>I-90 Over Cattaraugus Creek Bridge Scour Reevaluation and Plan of Action</b> .....	1199
<i>Kenneth Avery, Craig Morris, Dean Goodison</i>	
<b>Three-Dimensional Numerical Modeling of Hydrodynamics and Transport in the Wachusett Reservoir</b> .....	1209
<i>M. A. Laverty, D. Ahlfeld, J. E. Tobiasson</i>	
<b>Lampricide Hindcast Modeling in Missisquoi Bay</b> .....	1215
<i>D. Crowley, C. Swanson, B. Chipman</i>	
<b>Three-Dimensional Numerical Modeling of Flow Circulations in Lake Pontchartrain</b> .....	1225
<i>Xiaobo Chao, Yafei Jia</i>	
<b>Computational Fluid Dynamics (CFD) Modeling of Flow into the Aerated Grit Chamber of the MWRD's North Side Water Reclamation Plant, Illinois</b> .....	1239
<i>Som Dutta, Yovanni Catano, Xiaofeng Liu, Marcelo H. Garcia</i>	
<b>Optimal Flood Control in Alluvial Channel Using Adjoint Sensitivity Analysis</b> .....	1250
<i>S. N. Kuiry, Yan Ding, Sam S. Y. Wang</i>	
<b>Air Entrainment and Sequent Depths in Horizontal Closed Conduits</b> .....	1266
<i>Nathan J. Lowe, Rollin Hotchkiss, E. James Nelson</i>	
<b>Differences Between Open-Channel and Culvert Hydraulics: Implications for Design</b> .....	1278
<i>Brett C. Singley, Rollin Hotchkiss</i>	
<b>Safe and Economical Design and Operation of Liquefied Natural Gas (LNG) Pipelines: From the Perspective of Hydraulic Transients</b> .....	1288
<i>Yong Tang, Pinar Cakir Kavcar, Zhiyong Duan</i>	

<b>Computational Modeling of Midwest Flood 2008: Levee Breaching and Flood Propagation</b> .....	1298
<i>Yafei Jia, Azad Hossain, Xiaobo Chao</i>	
<b>Numerical Modeling of Flow through a Breached Levee and During Levee Closure</b> .....	1304
<i>Yafei Jia, Tingting Zhu, Cyrus K. Riahi-Nezhad, Yaoxin Zhang</i>	
<b>2D Numerical Simulation of Breaching Process of Unlined Cohesive Earthen Dam</b> .....	1317
<i>Xinya Ying, Sam S. Y. Wang</i>	
<b>Flood Hazards from Impoundment Failure in Nuclear Power Plant Sites</b> .....	1327
<i>Yonas Kinfu, Kit-Yin Ng</i>	
<b>A Depth-Averaged 2-D Model for Coastal Levee and Barrier Island Breach Processes</b> .....	1335
<i>Weiming Wu</i>	
<b>Dam Breach Modeling with HEC-RAS Using Embankment Erosion Process Models</b> .....	1347
<i>D. Michael Gee</i>	
<b>A Finite Element Dam and Levee Break Model</b> .....	1357
<i>Gaurav Savant, Charlie Berger, Tate O. McAlpin, Jennifer N. Tate</i>	
<b>Finding Flooding Solutions Using Interfacing Tools to Aid in Model Calibration and Public Collaboration</b> .....	1371
<i>Cynthia A. Baumann</i>	
<b>Toward a 3-Dimensional Numerical Modeling of Tidal Currents in San Francisco Bay</b> .....	1385
<i>Kaveh Zamani, Fabián A. Bombardelli, Stefan Wuertz, Peter E. Smith</i>	
<b>Evaluation of Water Level Forecast Guidance from Real Time Ocean Forecast Systems</b> .....	1395
<i>Richard A. Schmalz Jr., Philip H. Richardson</i>	
<b>Numerical Modeling of the St. Clair River and Sediment Mobility Analysis</b> .....	1412
<i>Xiaofeng Liu, Gary Parker, Marcelo H. Garcia</i>	
<b>Soft Bedrock Erosion Modeling with a Two-Dimensional Model</b> .....	1421
<i>Yong G. Lai, Blair P. Greimann, Kuowei Wu</i>	
<b>Numerical Modeling of Mobile-Bed Hydrodynamics of the Lower Mississippi River</b> .....	1433
<i>E. A. Meselhe, J. F. Pereira, I. Y. Georgiou, M. A. Allison, J. A. McCorquodale, M. A. Davis</i>	
<b>Theoretical Analyses for Interaction between Vegetation Bending and Flow</b> .....	1443
<i>Li Chen, Mark Stone</i>	
<b>Relating Vegetation Composition in a Bioretention Cell to Small-Scale Hydrologic and Topographic Variability</b> .....	1451
<i>C. Bryan Young, Edward Peltier, Kelly Kindscher</i>	
<b>Environmental and Recreational Water Needs: A Colorado Case Study</b> .....	1458
<i>Nicole Rowan, Susan Morea, Jacob Bornstein</i>	
<b>Response of Riparian Evapotranspiration to Groundwater Fluctuations</b> .....	1468
<i>Lijuan Jia, Mark Stone, Gregory Pohll, David McGraw</i>	
<b>Fish Movement and Weir Drown-Out</b> .....	1477
<i>Robert Keller</i>	
<b>Forecast and Early Warning System of Water Pollution Accident</b> .....	1487
<i>Jianli Zhang, Feizhou Zhang, Xianghong Yin, June Fu</i>	
<b>Developing a System Dynamics Model for Phosphorous TMDL in Reservoir: A Case Study</b> .....	1495
<i>M. Karamouz, Masoud Taheriyoun</i>	
<b>Stormwater Phosphorus Removal Using an Innovative Filtration Media</b> .....	1503
<i>Jia Ma, James H. Lenhart, John Pedrick, Karel Tracy</i>	
<b>The Ohio River Community HEC-RAS Model</b> .....	1512
<i>Thomas Adams, Sherry Chen, Raymond Davis, Trent Schade, Deborah Lee</i>	
<b>Hydraulic Modeling of Flash Floods in Sana'a</b> .....	1524
<i>Tatiana H. Papakos, Kristi Root</i>	
<b>Optimal Cost Model for Water Systems Planning</b> .....	1534
<i>E. Mendi, C. Bayrak</i>	
<b>Reducing the Error Associated with Manning's Roughness in Culvert Design for Improved Fish Passage</b> .....	1540
<i>Steven F. Mangin, Michelle Stipetich, Hans M. Tritico</i>	
<b>Field Studies and Proposed Solutions to Facilitate Migration of the Peruvian Shrimp (Cryphiops Caementarius)</b> .....	1554
<i>J. J. Valle, J. M. Kuroiwa</i>	
<b>Lock Approach Improvements at Lock and Dam No. 22, Upper Mississippi River</b> .....	1566
<i>Thomas Gambucci</i>	
<b>Levee Evaluation and Certification under the National Flood Insurance Program (NFIP)</b> .....	1576
<i>Joseph V. Bellini</i>	

<b>Use of CFD Analysis in Designing a Channel Mixing Structure.....</b>	1586
<i>Kevin D. Nielsen</i>	
<b>Formed Suction Inlet Design for Mixed Flow Pump Applications .....</b>	1596
<i>David Werth, Yifan Zheng</i>	
<b>Analysis of Seepage through Dam Foundation Using Smoothed Particle Hydrodynamics (SPH) Meshless Method.....</b>	1604
<i>Zeinab Takbiri, Amin Rasekh, Mohammad Hadi Afshar</i>	
<b>Small and Medium Size Dam Air Vent Sizing for Low-Level Outlet Works.....</b>	1613
<i>Blake P. Tullis, Jason Larchar</i>	

## VOLUME 3

<b>Optimization of Energy Dissipation Works for Nai Gaj Dam Project .....</b>	1622
<i>M. Ashiq, A. Sattar</i>	
<b>Hydraulic and Sediment Transport Modeling for Cache Creek Settling Basin, Woodland California .....</b>	1634
<i>K. J. Carr, A. Ercan, M. L. Kavvas</i>	
<b>Can Climate Change Affect Sediment Transport in a Watershed?.....</b>	1643
<i>Jennifer M. Heglund, Brian D. Barkdoll</i>	
<b>Surface Water and Groundwater Interactions Affect New Jersey and New York Water Supply and Power Grids in 2002 .....</b>	1653
<i>Paul Schorr, Asghar Hasan</i>	
<b>Waterjet Amendment for Remediation of Contaminated Sediments Using Absorptive and Dechlorinating Compounds in Compromised Waterways .....</b>	1670
<i>Aaron Archer, Gavin Risley, Ryan Stringer, Andrew Elmore, Joel Burken</i>	
<b>Relationship between Acoustic Backscatter Strength and Suspended Sediment Concentration using a 6 MHz Nortek Vector Velocimeter.....</b>	1676
<i>M. Salehi, K. B. Strom</i>	
<b>Estimation of Water Stage over Wetlands of South Florida Using TRMM Precipitation Radar Observations .....</b>	1683
<i>Sumit Puri, S. Ahmad, Haroon Stephen</i>	
<b>Mean Flow and Turbulence around Two Series of Experimental Dikes.....</b>	1692
<i>Mary Yaeger, Jennifer Duan</i>	
<b>Turbulent Burst around Experimental Spur Dike.....</b>	1702
<i>Jennifer Duan, Li He, Guangqian Wang, Xudong Fu</i>	
<b>Failure Analysis of Gated Culvert Structure by Numerical Simulations.....</b>	1712
<i>M. M. Wilsnack, J. Zeng, H. Gao, E. Damisse, J. A. González-Castro, L. Deaton</i>	
<b>Guidelines for Assessing Sediment-Related Effects of Dam Removal .....</b>	1722
<i>Timothy J. Randle, Jennifer A. Bountry, Blair P. Greimann</i>	
<b>Dam Removal: Adaptive Management &amp; Bed Sediment Monitoring Before and After .....</b>	1734
<i>P. Woodworth, Josh Galster, J. Wyrick, Jacob Helminiak</i>	
<b>Simulating Dam Removal with a 1D Hydraulic Model: Accuracy and Techniques for Reservoir Erosion and Downstream Deposition at the Chiloquin Dam Removal .....</b>	1737
<i>Desiree Tullos, Matt Cox, Cara Walter</i>	
<b>Redefining the Dam Removal Paradigm in Formerly Glaciated Forested Headwater Systems .....</b>	1750
<i>M. D. Daniels, D. Burchsted, J. MacBroom, L. Wildman, S. Harold, M. Carabetta, P. Woodworth, G. Boardman</i>	
<b>Dams and Clams: Freshwater Mussel Surveys and Translocations in the Context of Dam Removal Projects .....</b>	1759
<i>Joe Rathbun</i>	
<b>Pre-Restoration Assessment, Big Sunflower River, Mississippi: Where to Begin? .....</b>	1777
<i>F. D. Shields Jr., Scott S. Knight</i>	
<b>The Rosgen Rosetta Stone: Translating Rosgen Terminology .....</b>	1788
<i>John E. Shelley, C. Bryan Young, Bruce M. McEnroe</i>	
<b>Restoring the River Discontinuum: Looking at the Example of Beaver Dams.....</b>	1797
<i>D. Burchsted, M. D. Daniels, R. M. Thorson</i>	
<b>An Analytical Reference-Reach Method for Natural Channel Design .....</b>	1807
<i>Bruce M. McEnroe, John E. Shelley, C. Bryan Young</i>	
<b>A Consolidated Approach to Stream Stability Analysis.....</b>	1816
<i>Alan Turner, Aaron Cook, Pieter Van Ry, David Van Dellen</i>	

<b>Integration of Restoration Education into Undergraduate Course Work and Community Group Activities through the Lost Creek Restoration Project</b> .....	1828
<i>Chelsea S. Moss, Sue L. Niezgod, Michael Robinson, Ella L. Ingram</i>	
<b>Stream Restoration Education and Professional Development: Working Toward a Consensus</b> .....	1838
<i>Sue L. Niezgod, Terre Haute, Donald Carpenter, Janine Castro, Joanna Curran, G. Fox, Rollin Hotchkiss, Peggy A. Johnson, David Rosgen, John (Jack) Schmidt, John Schwartz, Andrew Simon, Louise O. Slate, Peter Wilcock, Tess Wynn</i>	
<b>Post-Restoration Changes within Codorus Creek, South-Central Pennsylvania</b> .....	1850
<i>Christina Y. S. Siu, Shirley Clark, Katherine H. Baker</i>	
<b>A Modeling Approach to Restoring Pool-Riffle Structure in an Incised, Straightened Channel of an Urban Stream</b> .....	1854
<i>Keil J. Neff, John Schwartz, Andrew B. Dodson, Michael S. Hamrick</i>	
<b>Restoring Function to Boneyard Creek, Urbana IL</b> .....	1864
<i>Michael Schwar</i>	
<b>Streambank Erosion Assessment in Southeastern Plains Ecoregion Channels Using <i>In Situ</i> Monitoring and Submerged Jet Testing</b> .....	1873
<i>J. J. Ramirez-Avila, E. J. Langendoen, W. H. McAnally, J. L. Martin, S. L. Ortega- Achury, J. N. Díaz-Ramírez</i>	
<b>Surface Erosion and Sediment Yields on Steep-Sloped Coal Mining Reclamation Sites in the Appalachian Region</b> .....	1881
<i>Stavash Hoomehr, John Schwartz, Daniel C. Yoder, Wesley C. Wright, Eric C. Drumm</i>	
<b>A Model of Surface Fine Grained Laminae, Streambed and Streambank Processes Applicable to the Watershed Scale</b> .....	1893
<i>J. P. Russo, J. F. Fox</i>	
<b>Experiments Identifying Worst Case Scour Conditions of Gated Weir Stilling Basins</b> .....	1905
<i>Ted M. Champagne, Brian D. Barkdoll, J. A. González-Castro, L. Deaton</i>	
<b>Extending the Useful Life of Small-to-Medium Reservoirs in the United States</b> .....	1915
<i>Roger Pearson, Mike Sufliata, Rollin Hotchkiss</i>	
<b>Estimation of Particle Concentrations Using the Stochastic Particle Tracking Method in Open Channel Flows</b> .....	1926
<i>Jungsun Oh, Christina W. Tsai</i>	
<b>Flocculation Population Dynamics of Cohesive Houston Ship Channel Sediments</b> .....	1936
<i>A. Keyvani, K. B. Strom</i>	
<b>The Development of a Rouse-Type Profile for Nonequilibrium Suspended Sediment</b> .....	1942
<i>Gary L. Brown</i>	

## **INTERNATIONAL COUNCIL**

<b>Water Quality, Sedimentation, and Hydrological Changes Due to the Construction of Large Dams: A Three Gorges Dam Focus</b> .....	1954
<i>Jonathan Grace, J. Connor</i>	
<b>Risk Analysis in Development of Reconstruction and Rehabilitation Programs of Urban Water Infrastructures</b> .....	1960
<i>M. Karamouz, K. Yasari, S. Nazif</i>	
<b>Flooding Impacts and Modeling Challenges of Tropical Storms in Eastern Yemen</b> .....	1970
<i>Kristi Root, Tatiana H. Papakos</i>	
<b>An Overview of the Water Situation in Amman, Jordan</b> .....	1980
<i>P. A. Ray, P. H. Kirshen, David Rosenberg, R. E. Hagan</i>	
<b>Providing Clean Water to Communities in Need: Living Waters for the World's Sustainable Clean Water Systems</b> .....	1990
<i>Wil Howie, Ralph Young, George Plouffe, Cristiane Surbeck</i>	
<b>An Analysis of Household Rainwater Harvesting Systems in Falelima, Samoa</b> .....	2000
<i>Timothy M. Martin, David W. Watkins Jr.</i>	
<b>A New Water Treatment Product for the Urban Poor in the Developing World</b> .....	2010
<i>Paul A. Berg</i>	
<b>Integrated Water Resources Management in Ghana: Past, Present, and the Future</b> .....	2026
<i>Festus Anane Mensah</i>	
<b>Evaluation of Water Conservation Measures Implemented in the Rio Grande/Bravo Basin</b> .....	2038
<i>S. Sandoval-Solis, Daene C. McKinney</i>	

<b>Improving Lake Superior Outflow Regulation—Phase 2 of the International Upper Great Lakes Study</b> .....	2048
<i>Anthony J. Eberhardt</i>	

### **IRRIGATION AND DRAINAGE COUNCIL**

<b>Comprehensive Evaluation and New Development of Determination of Critical and Normal Depths for Different Types of Open-Channel Cross-Sections</b> .....	2058
<i>Manoj KC, Janesh Devkota, Xing Fang</i>	
<b>Regional Regression Analysis for Small Watersheds in Southwestern Utah</b> .....	2069
<i>A. J. Timpson, C. A. Pomeroy</i>	
<b>Simulation of Unsteady Flow and Soil Erosion in Irrigation Furrows</b> .....	2080
<i>Shiyan Zhang, Jennifer Duan, Theodor S. Strelkoff</i>	
<b>Surface Aerodynamic Temperature Derived from Wind/Temperature Profile Measurements over Cotton and Alfalfa in a Semi-Arid Environment</b> .....	2090
<i>J. L. Chávez, T. A. Howell, D. Straw, P. H. Gowda, L. A. Garcia, S. R. Evett, T. W. Ley, L. Simmons, M. Bartolo, P. Colaizzi, A. A. Andales</i>	
<b>Meeting Irrigation Demands in Water Deficit Counties of Texas Panhandle: Biotechnology and Other Novel Strategies</b> .....	2102
<i>Rachna Tewari, Lal K. Almas, Stephen Amosson</i>	
<b>Review of Electro Kinetic Techniques in Controlling Nitrate Contamination in Different Soils</b> .....	2112
<i>Naglaa Eid</i>	
<b>Impact of Irrigation Management Changes on Lower Chenab Canal System</b> .....	2121
<i>M. Sulman, M. Ashiq</i>	

### **LOCAL ISSUES**

<b>Challenges and Opportunities in Modelling a Regional Water System with Interchangeable Sources</b> .....	2132
<i>Yvonne Wai, Li Gu, Brent Burton</i>	

### **PLANNING AND MANAGEMENT COUNCIL**

<b>Collaborative Approaches Leading to Improved Outflow Management of the Great Lakes</b> .....	2142
<i>Anthony J. Eberhardt</i>	
<b>A New Angle on Adaptive Management—Reducing Plausible Vulnerability in the Upper Great Lakes</b> .....	2150
<i>Casey Brown, William Werick, Wendy Leger, David Fay</i>	
<b>Collaborative Modeling for Water Supply Controversies in Colorado: Technical Challenges and Lessons Learned</b> .....	2162
<i>Mark Lorie, William Werick, John Sanderson</i>	
<b>Water Planning under an Unsustainable Condition: Challenges for the Laguna Region, Mexico</b> .....	2173
<i>Sanchez Rosario, Kaiser A. Ronald, John R. Giardino</i>	
<b>Shared Vision Planning for Clean Water Act Permits: An Experiment in Colorado</b> .....	2185
<i>William Werick, Mark Lorie, John Sanderson</i>	
<b>Evaluating Water Resource Management in the Transboundary Rio Grande/Bravo using Cooperative Game Theory</b> .....	2194
<i>Rebecca Teasley, Daene C. McKinney</i>	
<b>Shared Vision Planning as Policy Analysis: Opportunities for Shared Learning and Methodological Innovation</b> .....	2204
<i>W. E. Walker, I. S. Mayer, E. R. Hagen</i>	
<b>FEMA Flood Map Modernization Program</b> .....	2223
<i>Doug Bellomo, Andrea Ryon, Fernando Pasquel</i>	
<b>Relations Between Large-Scale Atmospheric Circulation Patterns and New England River Flow</b> .....	2231
<i>Scott Steinschneider, Casey Brown, Richard Palmer</i>	
<b>Optimizing Reservoir Operations in the Connecticut River Basin</b> .....	2241
<i>Brian Pitta, Richard Palmer, Kelcy Adamec, Austin Polebitski, Scott Steinschneider</i>	
<b>Evolutionary Algorithm Memory Enhancement for Real-Time CSO Control</b> .....	2251
<i>Andrea Zimmer, B. Minsker, Arthur Schmidt, Avi Ostfeld</i>	

<b>Application of Multi-Objective Particle Swarm Optimization in Operation Management of Reservoirs with Sedimentation Problems</b> .....	2260
<i>Asgar Azadnia, Banafsheh Zahraie</i>	
<b>Impact of Climate Change Projections and Best Management Practices on River Flows and Sediment Load</b> .....	2269
<i>Prakash Kaini, John W. Nicklow, Justin T. Schoof</i>	
<b>Optimization of Nonlinear Muskingum Method with Variable Parameters Using Multi-Objective Particle Swarm Optimization</b> .....	2278
<i>Asgar Azadnia, Banafsheh Zahraie</i>	
<b>Development of an Algorithm for Risk Based Strategic Water Supply Planning: A Case Study</b> .....	2285
<i>M. Karamouz, Azadeh Ahmadi, Babak Zahraie, Ali Moridi</i>	
<b>Short Lead-Time Hydrologic Ensemble Forecasts from Numerical Weather Prediction Model Ensembles</b> .....	2294
<i>Thomas Adams, Joseph Ostrowski</i>	
<b>OHRFC and National Water Resources Outlook</b> .....	2305
<i>James Noel, Thomas Adams, Kevin Werner</i>	
<b>Uncertainty Assessment for Real-Time Stage Forecasting</b> .....	2313
<i>S. Barbetta, L. Brocca, F. Melone, T. Moramarco, V. P. Singh</i>	
<b>Improving Stochastic Rainfall Generators</b> .....	2324
<i>Dongkyun Kim, Francisco Olivera</i>	
<b>Dam Spillways Adequacy Evaluation through Bivariate Flood Frequency Analysis and Hydrological Continuous Simulation</b> .....	2328
<i>L. Giustarini, S. Camici, A. Tarpanelli, L. Brocca, F. Melone, T. Moramarco</i>	
<b>Long Range Streamflow Forecasting Based on Hydrologic and Climatic Data</b> .....	2340
<i>J. D. Salas, C. Fu, B. Rajagopalan</i>	
<b>The Impact of Stormwater Recharge Practices on Boston Groundwater Levels</b> .....	2352
<i>B. F. Thomas, R. Vogel</i>	
<b>2009-2010 El Niño: Predicted Hydrologic Response in the United States</b> .....	2362
<i>Oubedillah Aziz, Glenn A. Tootle, Thomas C. Piechota, Cody Moser</i>	
<b>Derivation of the Modified Anderson-Darling Test Statistics for the Generalized Extreme Value and Generalized Logistic Distributions</b> .....	2371
<i>Hongjoon Shin, Taesoon Kim, Sooyoung Kim, Younghun Jung, Jun-Haeng Heo</i>	
<b>Assessment of Hydrological and Physical Similarity of Southeastern Watersheds</b> .....	2379
<i>Fredline Ilorme, Veronica W. Griffis</i>	
<b>A Modified Region of Influence Approach for Flood Regionalization</b> .....	2388
<i>S. S. Eslamian, E. Z. Hosseinipour</i>	
<b>Application of Regional Frequency Analysis to Non-Stationary Rainfalls in Korea</b> .....	2415
<i>Lynn Seo, Chang-Hwan Lee, Tae-Woong Kim, Jae-Hyun Ahn</i>	

## VOLUME 4

<b>Bayesian GLS Analysis of California Regional Skew</b> .....	2422
<i>Andrea G. Veilleux, Jery R. Stedinger</i>	
<b>Trends in Heavy Rainfalls in the Observed Record in Selected Areas of the U.S.</b> .....	2432
<i>Geoffrey M. Bonnin</i>	
<b>Evaluation of Antecedent Storm Event Characteristics for Different Climatic Regions based on Interevent Time Definition (IETD)</b> .....	2441
<i>P. K. Behera, Yiping Guo, Ramesh S. Teegavarapu, Travis Branham</i>	
<b>An Example of the Impact that Filled-In Peakflow Data Can Have on Flood Frequency Analysis</b> .....	2451
<i>Steven K. Starrett, Travis Heier, Yunsheng Su, Mark Bandurraga, Denny Tuan, Shelli Starrett</i>	
<b>Comparison of the Probability Plot Correlation Coefficient Test Statistics for the General Extreme Value Distribution</b> .....	2456
<i>Sooyoung Kim, Jun-Haeng Heo</i>	
<b>Bivariate Models Constructed by the Marginal Transformation Method: With Applications in Hydrology</b> .....	2467
<i>F. Ashkar, F. Aucoin</i>	
<b>Prospects for Systems Analysis in an Age of Changing Systems: Thoughts from a Saturday Afternoon</b> .....	2478
<i>Jay R. Lund</i>	

<b>Optimization of Hydrosystem Operation—A 40-Year Retrospective</b> .....	2485
<i>William W.-G. Yeh</i>	
<b>Comparison of Model Evaluation Methods to Develop a Comprehensive Watershed Simulation Model</b> .....	2492
<i>Misgana Muleta</i>	
<b>Watershed-Based Optimal Stormwater Management: Part 1—Application of StormWISE to Little Crum Creek in Suburban Philadelphia</b> .....	2502
<i>Arthur E. McGarity</i>	
<b>The Sacramento-San Joaquin Delta Conflict: Chicken or Prisoner's Dilemma?</b> .....	2513
<i>Kaveh Madani, Jay R. Lund</i>	
<b>Watershed-Based Optimal Stormwater Management: Part 2—Hydrologic Modeling of LID/BMP Sites on Little Crum Creek in Suburban Philadelphia</b> .....	2522
<i>Zachary Eichenwald, Arthur E. McGarity</i>	
<b>Restoring the Northern Everglades: A Systematic Approach to Lake Okeechobee Watershed Management</b> .....	2531
<i>Lena Rivera, Kirk Westphal, Michael Schmidt, Mark Long</i>	
<b>A Complex Adaptive Systems Approach to Simulate Urban Water Resources Sustainability</b> .....	2543
<i>M. H. Giacomoni, Emily M. Zechman</i>	
<b>Multivariate Non-Stationary Stochastic Streamflow Models for Two Urban Watersheds</b> .....	2550
<i>M. Ng, R. Vogel</i>	
<b>System Analysis to Improve Wetland Water Allocation at the Bear River Migratory Bird Refuge, Utah</b> .....	2562
<i>Omar Alminagorta, David Rosenberg, Karin M. Kettnering</i>	
<b>Evaluating Conservation Potential in Agricultural and Municipal Water Use in South Florida</b> .....	2572
<i>Dinesh Prashar, S. Ahmad</i>	
<b>Development of Water Supply Plans Using System Dynamics Approach in the Han River Basin, South Korea</b> .....	2584
<i>Gunhui Chung, Myeonho Jeon, Joong Hoon Kim, Tae-Woong Kim</i>	
<b>Optimal Reservoir Operation Considering Downstream Water Quality and Environmental Flow Needs</b> .....	2592
<i>Jian-Ping Suen, Ruei-Hong Wang</i>	
<b>Deriving Near-Optimal Solutions to Deterministic Reservoir Operation Problems</b> .....	2602
<i>Pan Liu, Ximing Cai</i>	
<b>Optimum Management of Existing Surface Water Resources and Land of a Water Logged Area Using DP Model</b> .....	2619
<i>Debasis Deb, Bipul Talukdar</i>	
<b>Utility of Climate Forecasts in Promoting Inter-Basin Transfer in the North Carolina Triangle Area</b> .....	2630
<i>Weihua Li, S. Arumugam, Ranji Ranjithan</i>	
<b>Analyzing the Change in Trends of Rainfall- Runoff to the Reservoir Sites in Indiana Using Self Organizing Maps</b> .....	2639
<i>V. Chandramouli, Nimisha Gupta, Alfie Ningyu Song</i>	
<b>Assessment of Dam Operations for a Severe Drought in Korea</b> .....	2649
<i>Kuk-Hyun Ahan, Dae Hyun Song, Young-Oh Kim</i>	
<b>A Multi-Agent System Based Model for Water Allocation Management in the Yellow River Basin</b> .....	2656
<i>Yi-Chen E. Yang, Jianshi Zhao, Ximing Cai</i>	
<b>North Slope Decision Support System: Technological Aspects</b> .....	2664
<i>Stephen F. Bourne, James Haleblan, Amy C. Tidwell, Kelly Brumbelow</i>	
<b>Institutional Dimensions of River/Reservoir System Modeling: Lessons from Implementation of the Texas Water Availability Modeling System</b> .....	2673
<i>Ralph A. Wurbs</i>	
<b>Modeling of Flood Wave Propagation through Levee Breach Using MIKE21, A Case Study in Helleh River, Iran</b> .....	2683
<i>Masih Zolghadr, M. Reza Hashemi, E. Z. Hosseinipour</i>	
<b>Caspian Sea Negotiation Support System</b> .....	2694
<i>Omid M. Rouhani, Kaveh Madani, Sona Gholizadeh</i>	
<b>Multi-Objective Planning for Ice Road Routes on Alaska's North Slope: Algorithms and Technology Development</b> .....	2703
<i>Kelly Brumbelow, Arun K. Aryasomayaula, Stephen F. Bourne, Amy C. Tidwell</i>	
<b>A Drought Frequency Analysis for Palmer Drought Severity Index Using Boundary Kernel Function</b> .....	2708
<i>Young-Il Moon, Tae-Suk Oh, Min-Seok Kim, Seong-Sil Kim</i>	
<b>Spatial Assessment of Droughts Vulnerability Using MODIS Image in South Korea</b> .....	2717
<i>J. Y. Yoo, M. Choi, T-W. Kim, G. Chung, H. S. Kim</i>	

<b>Hydrological Drought in the Upper Nakdong River Basin</b> .....	2724
<i>S. M. Jeong , C. J. P. Rubio, J. H. Ryu, K. R. Oh , M. J. Park</i>	
<b>Robust Optimization of the Water System in Amman, Jordan</b> .....	2734
<i>P. A. Ray, P. H. Kirshen</i>	
<b>Water Resources Management Strategies for Development of a Water-Saving Society in Golmu City, Qinghai Province, China</b> .....	2744
<i>Runjie Li, Yongan Wen, Kaixiang Guo, Z. Sheng, Shaofeng Jia</i>	
<b>Developing an Integrated Drought Monitoring System Based on Socioeconomic Drought in a Transboundary River Basin: A Case Study</b> .....	2754
<i>Davoodreza Arab, Asghar Elyasi, Hamed Tavakoli Far, M. Karamouz</i>	
<b>Integrated Urban Water Management in a New Coastal Developed Area in United Arab Emirates</b> .....	2762
<i>W. E. Elshorbagy</i>	
<b>Development of Large Topographic Datasets for Hydrologic Analysis</b> .....	2772
<i>Celso Ferreira, Francisco Olivera, Dean Djokic</i>	
<b>Integration of Watershed Model AnnAGNPS and Stream Network Model CCHE1D for the Development of a New GIS-Based BMP Planning Tool</b> .....	2781
<i>M. S. Altinakar, J. Singh, V. P. Ramalingam, A. M. Sadeghi, G. W. McCarty, D. Hively, A. M. Sexton</i>	
<b>Evaluation of Hargreaves Equation for ET<sub>0</sub> Calculations at Selected Synoptic Stations in Iran</b> .....	2791
<i>Hamed Jamshidi, Davar Khalili, Mehdi Rezaeian Zadeh, E. Z. Hosseinipour</i>	
<b>Public Water Supply Adequacy: The Challenge of Changing Climates and Institutions</b> .....	2802
<i>W. Cox</i>	
<b>The Impact of Large Scale Desalination on Water Quality: An Operational Perspective</b> .....	2810
<i>Noa Avni, Moshe Eben-Chaim, Gideon Oron</i>	
<b>A 2050 Vision for Colorado's Water Supply Future</b> .....	2820
<i>Nicole Rowan, Susan Morea, Eric Hecox</i>	
<b>Regional Flood Modelling: Use of Monte Carlo Cross-Validation for the Best Model Selection</b> .....	2831
<i>Khaled Haddad, Mohammad Zaman, A. Rahman, Surendra Shrestha</i>	
<b>Design Flood Estimation for Ungauged Catchments: Application of Artificial Neural Networks for Eastern Australia</b> .....	2841
<i>Kashif Aziz, A. Rahman, Gu Fang, Khaled Haddad, Surendra Shrestha</i>	
<b>Application of Hilbert-Huang Transform Method to the Analysis of Varying Timescales in Sediment Transport</b> .....	2851
<i>Ken Z. Kuai, Christina W. Tsai</i>	
<b>Scaling Issues in Design Flood Estimation for Ungauged Catchments: A Case Study for Eastern Australia</b> .....	2860
<i>Mohammad Zaman, Ishita Rahman, Khaled Haddad, A. Rahman</i>	

**URBAN WATER RESOURCES RESEARCH COUNCIL—7<sup>TH</sup> URBAN WATERSHED MANAGEMENT SYMPOSIUM**

<b>Real Time Savings: Using High Density Real Time Monitoring and Control to Optimize South Bend, IN's CSO System</b> .....	2870
<i>Timothy Ruggaber</i>	
<b>Japan's System for Verification of Sewerage Technology</b> .....	2880
<i>Shunji Fukao</i>	
<b>Flushing Bay CSO Retention Facility—Hydraulic Performance Evaluation</b> .....	2889
<i>Chenchen Li, S. Rangarajan, Thomas Newman</i>	
<b>Large Interceptor Capacity Analysis Using a Dynamic Hydraulic Model</b> .....	2899
<i>Masatsugu Takamatsu, S. Rangarajan, Burt Curry, Sujatha Palani</i>	
<b>Permeable Pavement Monitoring at the Edison Environmental Center Demonstration Site</b> .....	2908
<i>Amy Rowe, Michael Borst, Thomas P. O'Connor, Emilie K. Stander</i>	
<b>Improving Ground Water Recharge Using Pervious Cement Concrete Made of Aggregates Recycled from Crushed Concrete Wastes</b> .....	2917
<i>Prakash Parasivamurthy, Veena Jawali, B. V. Kirankumar, Mallikarjun B. Patil</i>	
<b>Nutrient Leaching from Disturbed Soil Horizons</b> .....	2927
<i>Daniel P. Treese, Shirley Clark, Katherine H. Baker</i>	
<b>Impact of Triclosan in Greywater on Antibiotic-Resistance in Soil Microbial Communities</b> .....	2939
<i>Danielle I. Harrow, Katherine H. Baker</i>	
<b>Integrating Green Infrastructure into a Combined Sewer Service Area Model</b> .....	2950
<i>Robert Pitt, John Voorhees, Shirley Clark</i>	

<b>Integration of Site Water Chemistry and Media Characteristics to Design (Bio)(In)Filtration Systems</b> .....	2964
<i>Shirley Clark, Robert Pitt</i>	
<b>Laboratory Evaluations to Support the Design of Bioretention Systems in the Southwestern U.S.</b> .....	2977
<i>Robert Pitt, Shirley Clark, Brandon Steets</i>	
<b>Mitigating the Effects of Bridge Deck Runoff: A Case Study Using Bioretention and a Bioswale</b> .....	2994
<i>R. J. Winston, S. K. Luell, W. Hunt</i>	
<b>Impacts of Roadside Filter Strips, Dry Swales, Wet Swales, and Porous Friction Course on Stormwater Quality</b> .....	3006
<i>R. J. Winston, W. Hunt, J. D. Wright</i>	
<b>The Effects of Rain Garden Size on Hydrologic Performance</b> .....	3018
<i>Emilie K. Stander, Michael Borst, Thomas P. O'Connor, Amy Rowe</i>	
<b>Metal Sequestration and Remobilization in Bioretention Media</b> .....	3028
<i>Edward Peltier, Jamila Saadi, Xiaolu Chen, C. Bryan Young</i>	
<b>Nitrogen Retention in Bioretention Mesocosms with Outlet Controls</b> .....	3038
<i>William C. Lucas, Margaret Greenway</i>	
<b>Impact of Maintenance and (Im)Properly Sizing Bioretention on Hydrologic and Water Quality Performance</b> .....	3048
<i>Robert A. Brown, W. Hunt</i>	
<b>Bioretention Outflow: Does it Mimic Non-Urban Watershed Shallow Interflow?</b> .....	3060
<i>K. M. DeBusk, W. Hunt, D. E. Line</i>	
<b>Effectiveness and Downstream Impacts of Stormwater Detention Ponds Required for Land Development</b> .....	3071
<i>Dehui Su, Xing Fang, Zheng Fang</i>	
<b>A Low Impact Development (LID) Model Ordinance and Guidance Document</b> .....	3082
<i>Steven Trinkaus, Michael Clar</i>	
<b>The Tolland Low Impact Development Design Manual: The Changing Paradigm for Land Development</b> .....	3088
<i>Steven Trinkaus</i>	
<b>The Application of Environmental Site Design Processes to Design a LID Subdivision</b> .....	3095
<i>Steven Trinkaus</i>	
<b>LID from Rules to Reality—The Role of the Plan Reviewer</b> .....	3105
<i>Hunter C. Freeman</i>	
<b>A Process Identification Algorithm for Predicting Highway Stormwater Pollutographs</b> .....	3113
<i>A. Massoudieh, M. Kayhanian</i>	
<b>Optimizing the Placement of Low Impact Development in an Urban Watershed</b> .....	3123
<i>Chandana Damodaram, Emily M. Zechman</i>	
<b>Modeling Stormwater Basins for Potential Retrofit Designs: An Update</b> .....	3129
<i>R. R. Headley, J. Wyrick</i>	
<b>Multivariate Models of Watershed Suspended Sediment Loads for the Eastern United States</b> .....	3133
<i>David C. Roman, R. Vogel, Gregory E. Schwarz</i>	
<b>Prediction of Water Quality Parameters Using an Artificial Neural Networks Model</b> .....	3145
<i>L. Kalin, S. Isik</i>	
<b>Waitakere City Vehicle Testing Station Raingarden—Stormwater Quality Monitoring and Performance</b> .....	3154
<i>Melanie Skeen, Rajika Jayaratne, Mike Timperley, Matthew D. Davis</i>	
<b>Development and Application of Particle Separation Efficiency Model for a Hydrodynamic Separator with Cumulative Probabilistic Distribution Functions</b> .....	3165
<i>J.-Y. Kim, J. Sansalone</i>	
<b>Development and Use of Water Quality Indices (WQI) to Assess the Impact of BMP Implementation on Water Quality in the Cool Run Tributary of the White Clay Creek Watershed</b> .....	3171
<i>Alison Kiliszek, Anastasia E. M. Chirnside</i>	
<b>Significance of Using Different Particulate Matter Indices on Representing Particulate-Bound Metals Load and BMP Performance During Stormwater Events</b> .....	3181
<i>J.-Y. Kim, J. Sansalone</i>	
<b>Water Resources GIS System Applied to an Urban Watershed</b> .....	3188
<i>José Pedro Zuffo Janducci, João Luiz Boccia Brandão</i>	
<b>Characterization of Escherichia Coli for Sediment Basin Systems at Construction Sites</b> .....	3198
<i>C. B. Sawyer, J. C. Hayes, W. R. English</i>	
<b>Assessing BMP Performance Using Microtox Toxicity Analysis</b> .....	3209
<i>John Komlos, Amy Rowe, Shirley Clark, R. Traver, Mary Stinson</i>	

## VOLUME 5

<b>Indicator Bacteria Removal by Stormwater BMPs in Coastal North Carolina</b> .....	3218
<i>J. M. Hathaway, W. Hunt</i>	
<b>Development of a Laboratory Based Stormwater Sampling and Test Facility Utilizing Natural Stormwater Runoff</b> .....	3226
<i>James H. Lenhart, Jia Ma, Scott A. de Ridder</i>	
<b>Evaluation of Stormwater Management Practices for Stream Erosion</b> .....	3237
<i>James Li, Celia Fan</i>	
<b>Why We Need Improved Characterization of Solids in Wastewater, Stormwater, and Combined Sewer Flows</b> .....	3248
<i>R. Y. G. Andoh</i>	
<b>Total Water Management: The New Paradigm for Urban Water Resources Planning</b> .....	3251
<i>Thomas P. O'Connor, Dan Rodrigo, Alek Cannan</i>	
<b>Developments in LIDRA 2.0: A Planning Level Assessment of the Cost-Effectiveness of Low Impact Development</b> .....	3261
<i>Ziwen Yu, Miguel Aguayo, Franco Montalto, Michael Piasecki, Christopher Behr</i>	
<b>Current Capabilities and Planned Enhancements of SUSTAIN</b> .....	3271
<i>Fu-hsiung Lai, Leslie Shoemaker, Khalid Alvi, John Riverson, Jenny Zhen</i>	
<b>Development of a Rainfall Statistical Analysis Tool for Analytical Probabilistic Models for Urban Stormwater Management Analysis</b> .....	3281
<i>T. L. Branham, P. K. Behera</i>	
<b>Quantity and Quality of Stormwater Solids Trapped by Hydrodynamic Separators at Highway Sites</b> .....	3291
<i>Qizhong Guo, Junghoon Kim</i>	
<b>Evaluation of Rainfall-Runoff Particulate Metals Removal by Hydrodynamic Separation and Batch Settling Clarifier</b> .....	3301
<i>J.-Y. Kim, J. Sansalone</i>	
<b>Calibration of Urban Snow Process and Water Quality Model for Logan Airport</b> .....	3307
<i>Mitchell Heineman, Frances Bui, Keith Beasley</i>	
<b>Integrated Collection Systems Model for Hartford, Connecticut</b> .....	3314
<i>Mitchell Heineman, Xin Huang, Ajay Prasad, Scott Craig, Shawn Dent, Constantin Banciulescu</i>	
<b>An Experimental Study of Stage-Discharge Relationships for Thick-Walled Concrete Orifices</b> .....	3329
<i>D. Brandes, W. T. Barlow, B. Hendrickson</i>	
<b>Estimation of Rational Runoff Coefficients for Texas Watersheds</b> .....	3339
<i>Nirajan Dhakal, Xing Fang, Theodore G. Cleveland, David B. Thompson, Luke J. Marzen</i>	
<b>Roof Runoff Water Quality—A Comparison of Traditional Roofing Materials</b> .....	3349
<i>Natasha Nicholson, Shirley Clark, Brett V. Long, Christina Y. S. Siu, Julia Spicher, Kelly A. Steele</i>	
<b>Using Electronic Conductivity and Hardness Data for Rapid Assessment of Stream Water Quality</b> .....	3356
<i>Michael Y. Thompson, D. Brandes, A. Kney</i>	
<b>Characterization of First Flush Phenomenon in an Urban Stormwater Runoff: A Case Study of Flamingo Tropicana Watershed in Las Vegas Valley</b> .....	3366
<i>Anil Acharyaa, Thomas C. Piechota, Kumud Acharya</i>	
<b>Total Dissolved Solids Contribution to the Colorado River Associated with the Growth of Las Vegas Valley</b> .....	3376
<i>A. K. Venkatesan, S. Ahmad, J. R. Batista, W. S. Johnson</i>	
<b>Developing an Alternative Water Supply Strategy for the City of Plantation, Florida</b> .....	3386
<i>Courtney S. Licata, Michael Wengrenovich, Hank Breitenkam</i>	
<b>Regenerative Stormwater Conveyance: An Innovative Approach to Meet a Range of Stormwater Management and Ecological Goals</b> .....	3399
<i>Ted Brown, Joe Berg, Keith Underwood</i>	
<b>Assessment of PAH Concentrations and Toxicity of Runoff from Sealed Asphalt Surfaces</b> .....	3414
<i>Amy Rowe, Thomas P. O'Connor, Mary Stinson</i>	
<b>Preliminary Results of the Examination of Thermal Impacts from Stormwater BMPs</b> .....	3424
<i>Robert M. Roseen, Nicholas DiGennaro, Alison Watts, Thomas P. Ballester, James Houle</i>	
<b>The Potential for Green Infrastructure Practices to Reduce Combined Sewer Overflows as Examined in Nashville, Tennessee</b> .....	3452
<i>Curt Jawdy, Andrew Reese, Joseph Parker</i>	
<b>Urban Runoff and Stormwater Quality Management Using the Los Angeles County Flood Control District's Watershed Management Modeling System: A Pilot Application</b> .....	3462
<i>Youn Sim, Stephen Carter, John Riverson, Jenny Zhen</i>	

<b>Evaluation of Indicator Bacteria Export from an Urban Watershed</b> .....	3474
<i>J. M. Hathaway, W. Hunt</i>	
<b>Characterisation of Urban Stormwater Quality in the Auckland Region (New Zealand)</b> .....	3485
<i>Matthew D. Davis, Rajika Jayaratne, Judy-Ann Ansen, Mike Timperley</i>	

## **WATER, WASTEWATER, AND STORMWATER COUNCIL**

<b>EWRI Effort to Establish Monograph on Concentrate Management in Desalination Case Studies</b> .....	3502
<i>Michael Fahy, Berrin Tansel, Conrad Keyes Jr.</i>	
<b>Concentrate Volume Reduction Research In El Paso, Texas</b> .....	3507
<i>A. J. Tarquin, Michael Fahy, John E. Balliew</i>	
<b>Concentrate Management by Deep Well Injection at North County Regional Water Treatment Plant in Naples, Collier County, FL</b> .....	3519
<i>Mengshan Lee, Wei Li, Berrin Tansel, Howard Brogdon, Paul Mattausch</i>	
<b>Silica Removal from Brine by Using Ion Exchange</b> .....	3529
<i>Carlos R. Acevedo, J. L. Gardea-Torresdey, A. J. Tarquin</i>	
<b>Sea vs. Bay Water Desalination: Which One is for You?</b> .....	3542
<i>Val S. Frenkel</i>	
<b>Modeling the High Salinity Discharge from Creation of a Salt Cavern</b> .....	3552
<i>C. Swanson, C. Galagan, T. Isaji, D. Steube, Y. Kim</i>	
<b>Feasibility Evaluations for St. Johns River Membrane Water Plant Demineralization Concentrate Management</b> .....	3562
<i>Mitchell L. Griffin, Steven W. Gong, John M. Fitzgerald</i>	
<b>Treatment of a Soybean Flour Processing Plant Wastewater</b> .....	3573
<i>William F. Ritter, Anastasia E. M. Chirnside</i>	
<b>Issues Associated with Large Scale Water Recycling</b> .....	3584
<i>Michael Savage</i>	
<b>Small Scale Water Purification Projects—Determinants of Success</b> .....	3595
<i>Barrett Hazeltine</i>	
<b>Using a Mobile Pilot Plant to Evaluate Need and Protocol for a Previously Failed Coagulant Changeover</b> .....	3604
<i>J. Cochran, P. Barron, A. Nabors, W. Cox</i>	
<b>Evaluation of Ceramic Media Against GAC and Sand/Anthracite Filtration for Organics Removal</b> .....	3612
<i>J. Cochran, M. Lalor, P. Barron</i>	
<b>An Innovative Approach to Water Supply—The Groundwater Replenishment System</b> .....	3624
<i>Michael R. Markus, Shivaji S. Deshmukh</i>	
<b>Manifold Flow in Wastewater Pressure-Distribution Systems</b> .....	3640
<i>S. David Graber</i>	
<b>Surge Analysis and Design for a Wastewater Transmission System in Hernando County</b> .....	3652
<i>Jinsheng Huo</i>	
<b>Transitioning of Urban Water Distribution Systems</b> .....	3662
<i>J. Sempewo, K. Vairavamoorthy, Frank Grimshaw</i>	
<b>The Value Added to Flood Control Projects by Use of External Review Panels</b> .....	3675
<i>David T. Williams, Leslie F. Harder Jr., George L. Sills, Ray E. Martin</i>	
<b>Effects of Carbon Dioxide Stripping on Solids Settling in Pure Oxygen WWTP</b> .....	3683
<i>Ernesto Coro, Somshekar Kundral, Ratnaji Mudragada, Manny Moncholi, Nelson Mora, Shonali Laha, Berrin Tansel</i>	
<b>DCWASA's Impervious Area Information System: Designed to Allocate the Costs of the Mandated Combined Sewer Overflow Long Term Control Plan</b> .....	3693
<i>B. T. Reed, S. Kuhr, J. Qian, J. Ramsey</i>	
<b>Flow Dynamics in Combined Storm-Sewer Systems: Application of the Illinois Transient Model (ITM) to the Calumet TARP System in Chicago, Illinois</b> .....	3703
<i>Arturo S. Leon, Nam Jeong Choi, Arthur Schmidt, Marcelo H. Garcia</i>	
<b>Vortex Valves—Effective Flow Regulation for Economical Stormwater Management</b> .....	3718
<i>M. G. Faram, K. Osei, R. Y. G. Andoh</i>	
<b>Incorporating Storm Sewer Exfiltration into SWMM: Proof of Concept</b> .....	3729
<i>Matthew D. McCutcheon, Steven G. Buchberger, Y. Jeffrey Yang</i>	
<b>An Innovative and Rapid Method of Assessing Particle Shape and Size in Stormwater Runoff</b> .....	3737
<i>K. Osei, L. Brown, R. Y. G. Andoh, A. Gwinn</i>	

<b>A Modernized Biosolids Management Plan for New York City's Water Pollution Control Plants</b> .....	3745
<i>Raymond Pun, Geoffrey Baldwin, Keith Mahoney, Arthur Spangel, Pedick Lai</i>	
<b>Field Assessment of Grit Removal Systems</b> .....	3756
<i>K. Osei, A. Mody, R. Y. G. Andoh</i>	
<b>Residence Time Distribution and the Investigation of Bed Movement in a Continuously Operated Upflow Filter (COUF) for Tertiary Wastewater Treatment</b> .....	3764
<i>E. Loffill, R. M. Alkhaddar, D. A. Phipps, M. G. Faram, G. Papaefthimiou</i>	
<b>Removal of Heavy Metals Using Pervious Concrete Material</b> .....	3774
<i>Jesse Calkins, A. Kney, Muhannad T. Suleiman, Austin Weidner</i>	
<b>Two-Dimensional Modeling of Contaminant Spills to a Drinking Water Supply Reservoir</b> .....	3784
<i>C. L. Stauber, J. E. Tobiason, B. Sojkowski, D. Ahlfeld</i>	
<b>Water Quality Component Development and Integration with USACE Watershed Hydrologic Models</b> .....	3793
<i>Z. Zhang, B. E. Johnson, T. K. Gerald</i>	
<b>Evolution of Sandia's Risk Assessment Methodology for Water and Wastewater Utilities (RAM-W™)</b> .....	3804
<i>Calvin D. Jaeger, M. Michael Hightower, Teresa Torres</i>	
<b>Emergency Drinking Water Supply Challenges for Public Health</b> .....	3811
<i>Clifford L. Bowen</i>	
<b>Emergency Water Supply Planning for the National Capital Region</b> .....	3817
<i>Gregory Welter</i>	
<b>Cross Sector Emergency Planning for Water Supply Utilities and Healthcare Facilities</b> .....	3830
<i>Gregory Welter</i>	
<b>National Guidelines on Physical Security for Water, Wastewater, &amp; Stormwater Facilities—WHEN?</b> .....	3842
<i>James B. Conboy, Yakir Hasit, Conrad Keyes Jr.</i>	
<b>A Comprehensive City Wide Platform for Accessing Data and Communicating with Security and Water Quality Monitoring Systems</b> .....	3849
<i>Dan Kroll</i>	
<b>Water/Wastewater Perspectives on Chlorine Security</b> .....	3859
<i>Gregory Welter</i>	
<b>Natural Disaster Response Lessons Learned for Water and Wastewater Utilities</b> .....	3865
<i>Gregory Welter</i>	
<b>Critical Information Policies for Water Utilities—Water Research Foundation Project #3106</b> .....	3872
<i>Gregory Welter, Charles Herrick</i>	
<b>Wet Weather Rules, Regulations, and Policies: A National Survey</b> .....	3879
<i>Jonathan W. Bulkeley, Danielle LeFevre, Hilton Clark, Amy Samples, Ria Berns</i>	
<b>Systemwide Monitoring: Los Angeles County Flood Control District Automated Storm Water Monitoring Project</b> .....	3889
<i>Youn Sim, Oliver D. Galang, Lisa Skutecki</i>	
<b>Survey of Retention Basin Hydraulic Performance in Florida</b> .....	3901
<i>E. Z. Bean, M. D. Dukes</i>	
<b>Watershed Retrofit and Management Evaluation for Urban Stormwater Management Systems in North Carolina</b> .....	3911
<i>K. M. DeBusk, W. Hunt, Olha Sidorovych</i>	
<b>New Rules, Familiar Tools: Efficient Use of Stormwater Storage and Flow Control</b> .....	3921
<i>J. Fink, D. Scott</i>	
<b>Investigation of Water Quality and Quantity of Five Rainwater Tanks in Western Sydney Australia</b> .....	3933
<i>M. van der Sterren, A. Rahman, G. Ryan</i>	
<b>Evaluating Short-Circuiting Potential of Stormwater Ponds</b> .....	3942
<i>Jeffrey S. Glenn, Elizabeth M. Bartell</i>	
<b>Dissolved Oxygen Impairment and BMP Effectiveness in Mermentau River Basin</b> .....	3952
<i>Z.-Q. Deng, Z. Zhang</i>	
<b>A Randomization Process for Modeling Constructed Wetlands with an Optimization Example</b> .....	3961
<i>G. D. Jones, B. M. Wadzuk</i>	
<b>Stormwater Temperature Mitigation Beneath Porous Pavements</b> .....	3971
<i>James Barbis, Andrea L. Welker</i>	
<b>Unit Process Simulation of a BioInfiltration Stormwater Control Measure</b> .....	3980
<i>R. S. Lee, R. Traver, R. A. Chadderton</i>	
<b>Determination of Evapotranspiration in SCM's Using a Weighing Lysimeter: An Experimental Approach</b> .....	3990
<i>John Hickman, Dominik Schneider, B. M. Wadzuk, R. Traver</i>	
<b>Evaluation and Modeling of Bacteria Water Quality in an Urbanizing Stream</b> .....	4000
<i>Tina Petersen, Hanadi S. Rifai, Richard Wagner, Roger Miranda</i>	

## VOLUME 6

<b>Modeling Oxygen Mass Transfer Rate through the Air-Water Surface in Stratified Flows</b> .....	4010
<i>Zhiyong Duan, J. L. Martin, Yong Tang</i>	
<b>Predicting and Verifying Physiological Performance of Plants in a Bioretention System in an Arid Climate</b> .....	4019
<i>C. D. Houdeshel, C. A. Pomeroy</i>	
<b>Independence from Fossil Fuel Usages in Northeastern United States: Important Tasks for a Sustainable Geothermal Pilot Well Project</b> .....	4025
<i>Yee Cho, John Goodhall, Susan Cahalan-Roach</i>	
<b>Choosing Sustainable Wastewater Treatment Technologies to Enhance Integrated Watershed Management in Developing Countries</b> .....	4036
<i>William W. Clarkson, Paul D. Robillard, Rebecca W. Harjo</i>	
<b>Rainwater Tank Water Quality Testing in Western Sydney Australia</b> .....	4048
<i>M. van der Sterren, G. R. Dennis, J. Chuck, A. Rahman</i>	
<b>Sustainable Sites Initiative: Protect On-Site Water Resources and Receiving Water Quality</b> .....	4059
<i>Michael Barrett</i>	
<b>Sustainable Site Initiative—A Rating System for Green Sites</b> .....	4067
<i>Karen C. Kabbes, Steven Windhager</i>	
<b>Alternative Site-Assessment Hydrologic Metrics for Urban Development</b> .....	4076
<i>K. M. DeBusk, W. Hunt</i>	
<b>Sustainable Site Initiative—Protecting and Restoring Site Ecosystem Services</b> .....	4086
<i>Karen C. Kabbes, Steven Windhager</i>	
<b>Water Conservation and Reuse: A Case Study of the Energy-Water Nexus in Texas</b> .....	4093
<i>Ashlynn S. Stillwell, Michael E. Webber</i>	
<b>Long-Term Effects of Graywater Irrigation on Soil Quality in Arid Regions</b> .....	4109
<i>Masoud Negahban Azar, Sybil Sharvelle, Mary Stromberger, Larry Roesner</i>	
<b>Decentralized Anaerobic Blackwater Management: A Sustainable Development Technology Concept for Urban Water Management</b> .....	4118
<i>Neal T. Gallagher, Sybil Sharvelle</i>	
<b>Sustainable Water Supply Development with Use of Brackish Supplies and Carbon Neutral Energy</b> .....	4129
<i>Lyndel W. Melton, Jim Heitzman</i>	
<b>Using Life-Cycle Assessment to Evaluate the Environmental Impacts of Water Network Design and Optimization</b> .....	4138
<i>Lesley Herstein, Yves Fillion</i>	
<b>Scouring Stress for Large Solids</b> .....	4148
<i>Thomas Walski, Bryce Edwards, Emil Helfer, Brian E. Whitman</i>	
<b>Estimating Design Flows for Self Cleansing Sewers</b> .....	4158
<i>Steven G. Buchberger</i>	
<b>Making Optimal Pump Scheduling Models Work</b> .....	4168
<i>Thomas Walski, Wayne Hartell, Zheng Wu</i>	
<b>Relationship between Pump Horsepower and Energy Usage in Municipal Water Networks</b> .....	4180
<i>Santosh R. Ghimire</i>	
<b>Detection of Leaks in Water Distribution System Using Routine Water Quality Measurements</b> .....	4185
<i>Jitendra Kumar, Sarat Sreepathi, E. Downey Brill, Ranji Ranjithan, G. Mahinthakumar</i>	
<b>WDS Designer—A Tool Algorithmic Generation of Water Distribution Systems based on GIS Data</b> .....	4193
<i>R. Sitzenfrei, M. Möderl, W. Rauch</i>	
<b>How Many Network Sources are Enough?</b> .....	4205
<i>M. Möderl, R. Sitzenfrei, W. Rauch</i>	
<b>Deciding Whether to Replace or Repair a Pipe After a Break Using Advanced Analytical Tools</b> .....	4215
<i>Annie Vanrenterghem Raven, Matthew Poulton, Ingo Kropp</i>	
<b>Flexible Design of Urban Water Distribution Networks</b> .....	4225
<i>Danguang Huang, K. Vairavamoorthy, S. Tsegaye</i>	
<b>Improved Leakage Detection and Model Calibration Using Night Fire Flow Testing</b> .....	4237
<i>Paul Sage, Zheng Yi Wu, Neil Croxton</i>	
<b>An Agent-Based Modeling Approach to Evaluate the Impact of Conservation Practices on Water Resources Sustainability</b> .....	4253
<i>Lufihansa Kanta, Emily M. Zechman</i>	
<b>Alternative Formulation for DBP's Minimization by Optimal Design of Booster Chlorination Stations</b> .....	4260
<i>Ziv Ohar, Avi Ostfeld</i>	

<b>Estimating and Verifying Household Potential to Conserve Water</b> .....	4270
<i>Francisco Suero, David Rosenberg</i>	
<b>Estimating Non-Residential Water Use with Publicly Available Databases</b> .....	4283
<i>M. A. Morales, J. P. Heaney</i>	
<b>Optimal Planning of Regional Water Distribution Systems: A Case Study</b> .....	4293
<i>Baoyu Zhuang, Xinhua Zhao, Bin Gao</i>	
<b>An Energy Methodology for the Design of Water Distribution Systems</b> .....	4303
<i>J. Saldarriaga, S. Takahashi, F. Hernández, D. M. Díaz, S. Ochoa</i>	
<b>Adjoint-Based Probabilistic Characterization of Contaminant Sources in Water Distribution Systems under Transient Flow Conditions</b> .....	4314
<i>R. M. Neupauer, M. K. Records, C. J. Cichowitz</i>	
<b>Adaptive Bayesian Contaminant Source Characterization in Water Distribution Systems via a Parallel Implementation of Markov Chain Monte Carlo (MCMC)</b> .....	4323
<i>Hui Wang, Kenneth W. Harrison</i>	
<b>Cluster Analysis for Water Distribution Systems Security Enhancement</b> .....	4330
<i>Lina Perelman, Avi Ostfeld</i>	
<b>An Agent-Based Modeling Approach for Simulating Contamination Events Applied to the Mesopolis Water Distribution System</b> .....	4339
<i>Mohammadmehdi Shafiee, Emily M. Zechman</i>	
<b>Identification of Reactive Contaminant Sources in a Water Distribution System under the Conditions of Data Uncertainties</b> .....	4347
<i>Jitendra Kumar, E. Downey Brill, G. Mahinthakumar, Ranji Ranjithan</i>	
<b>WDS Vulnerability Analysis: Focusing on Random Factors, Consumer Behavior, and System Dynamics in Contamination Events</b> .....	4357
<i>Amin Rasekh, Kelly Brumbelow, Emily M. Zechman</i>	
<b>H<sub>2</sub>O Fate—A New Software for Fate and Transport Simulations in Water Distribution Systems</b> .....	4364
<i>Venkat Devarakonda, Sivakumar Manickavasagam, Vicki VanBlaricum, Mark Ginsberg</i>	
<b>Water Quality Parameter Estimation for Water Distribution Systems Considering Parameter and Measurement Uncertainties</b> .....	4374
<i>M. F. K. Pasha, K. Lansey</i>	
<b>Kinetics of Free Chlorine Decay in Water Distribution Networks</b> .....	4383
<i>Venkat Devarakonda, N. Albert Moussa, Vicki VanBlaricum, Mark Ginsberg, Vincent Hock</i>	
<b>Chlorine Bulk Decay Coefficients to Calibrate the GCWW All-Pipes Distribution System Model</b> .....	4393
<i>Jeff Stillman, Yeongho Lee, Eva Sinha, Haishan Piao, David Hartman, Cheryl Bush</i>	
<b>Chlorine Wall Decay Coefficients to Calibrate the GCWW All-Pipes Distribution System Model</b> .....	4405
<i>Yeongho Lee, Eva Sinha, Haishan Piao, Jeff Stillman, David Hartman, Cheryl Bush</i>	
<b>Vulnerability Assessment and Risk Reduction of Water Supply Systems</b> .....	4414
<i>M. Karamouz, Sara Saadati, Azadeh Ahmadi</i>	

## **WATERSHED COUNCIL**

<b>Effects of Rough Surface Slopes on Surface Depression Storage</b> .....	4427
<i>Jun Yang, Xuefeng Chu, Yaping Chi, Leif Sande</i>	
<b>Characterization of Surface Roughness and Computation of Depression Storage</b> .....	4437
<i>Yaping Chi, Jun Yang, Xuefeng Chu</i>	
<b>Quantitative Evaluation of the Relationship between Grid Spacing of DEMs and Surface Depression Storage</b> .....	4447
<i>Xuefeng Chu, Jianli Zhang, Jun Yang, Yaping Chi</i>	
<b>Scattergraph Principles and Practice: Evaluating Self-Cleansing in Existing Sewers Using the Tractive Force Method</b> .....	4458
<i>Kevin L. Enfinger, Paul S. Mitchell</i>	
<b>Calculating the Macrodispersion Coefficient in the Stochastic Transport Equation</b> .....	4468
<i>I. Haltas</i>	
<b>An Innovative Study on the Effects of Land Management Practices on Rill Erosion Using an Instantaneous Profile Laser Scanner</b> .....	4477
<i>D. C. Dermisis, A. N. (Thanos) Papanicolaou</i>	
<b>Incorporating Affects of Raised Roads into Hydrology Model to Improve Simulation of Low-Relief Watershed</b> .....	4485
<i>Xixi Wang, Zhongyi Qu, Tingxi Liu, Calvin R. Clary, Carin Wunneburger</i>	

<b>Climatology of Monthly Runoff: Causality and Relations to Seasonality in Precipitation and Temperature</b> .....	4500
<i>Naresh Devineni, S. Arumugam</i>	
<b>Climate, Streamflow, and Nutrients Variability Over the Southeastern United States</b> .....	4510
<i>Jeseung Oh, S. Arumugam</i>	
<b>Climatic and Anthropogenic Influences on Freshwater Availability in the Eastern United States</b> .....	4520
<i>Yushiou Tsai, R. Vogel</i>	
<b>Hurst Analysis of Hydrologic and Water Quality Signals</b> .....	4537
<i>Shesh R. Koirala, Randall W. Gentry</i>	
<b>Canonical Correlation Analysis for Hydroclimatic Datasets with Known Measurement Uncertainties</b> .....	4547
<i>Shivam Tripathi, Rao S. Govindaraju</i>	
<b>Climate Change Assessment on Water Resources in Sabah and Sarawak, Malaysia, Based on the Downscaled GCM Outputs Using Regional Hydroclimate Model</b> .....	4557
<i>N. Ohara, M. L. Kavvas, Z. Q. Chen, A. J. Bin Shaaban, M. Z. M. Amin</i>	
<b>Reconstruction of Hydro-Climate Data for the Watershed Modeling over Foothills Region, California</b> .....	4564
<i>S. Kure, S. Jang, N. Ohara, M. L. Kavvas</i>	
<b>Hydrologic and Environmental Modeling for Upper Putah Creek Watershed Using Reconstructed Historical Atmospheric Data by Dynamical Downscaling</b> .....	4571
<i>S. Jang, S. Kure, N. Ohara, M. L. Kavvas</i>	
<b>Rainfall Downscaling Using Statistical Downscaling Model and Canonical Correlation Analysis: A Case Study</b> .....	4579
<i>M. Karamouz, S. Nazif, M. Fallahi</i>	
<b>Quantifying Hydrological Uncertainty for Rain- and Snow-Dominated Watersheds with Adaptation Strategy</b> .....	4588
<i>Iwong Jung, Hamid Moradkhani, Heejun Chang</i>	
<b>Optimal Selection of GCM Predictors Combined with a New Procedure for Statistical Downscaling of Precipitation</b> .....	4598
<i>Mohammad Reza Najafi, Hamid Moradkhani, Susan Wherry</i>	
<b>Short Lead-Time Streamflow Forecasting by Machine Learning Methods, with Climate Variability Incorporated</b> .....	4608
<i>Kabir Rasouli, William W. Hsieh, Alex Cannon</i>	
<b>Evapotranspiration Network Design Study: Ground Sensor Network Design for Air Temperature and Relative Humidity</b> .....	4620
<i>Chandra Pathak, Bijay K. Panigrahi, Ananda V. Aduvala</i>	
<b>Seamless Integration of Weather and Climate Information in Developing Operational Streamflow Forecasts</b> .....	4633
<i>Hui Wang, S. Arumugam, Ranji Ranjithan</i>	
<b>Radar-Based Quantitative Precipitation Estimation for the Cool Season in Northern California: Case Studies from the NOAA Hydrometeorological Testbed (HMT)</b> .....	4639
<i>Jian Zhang, Youcun Qi, David Kingsmill, Kenneth Howard</i>	
<b>Prediction of Heavy Rainfall in the 0-6 Hour Time Range: Current and Evolving Approaches Utilizing Radar and Numerical Weather Prediction Forecasts</b> .....	4648
<i>David Kitzmiller, Wanru Wu, Shaorong Wu, Feng Ding</i>	
<b>Infilling Missing Precipitation Data Using NEXRAD Data: Use of Optimal Spatial Interpolation and Data-Driven Methods</b> .....	4659
<i>Ramesh S. Teegavarapu, Chandra Pathak, Singaiah Chintalapudi</i>	
<b>Estimation of Regionally Specific Z-R Relationships for Radar-Based Hydrologic Prediction</b> .....	4668
<i>Samuel Rendon, Baxter Vieux, Chandra Pathak</i>	
<b>Utility of Optimal Reflectivity-Rain Rate (Z-R) Relationships for Improved Precipitation Estimates</b> .....	4681
<i>Chandra Pathak, Ramesh S. Teegavarapu</i>	
<b>Design Flood Estimation Using Monte Carlo Simulation and RORB Model: Stochastic Nature of RORB Model Parameters</b> .....	4692
<i>Hitesh Patel, A. Rahman</i>	
<b>Global Sensitivity and Uncertainty Analysis of SLAMM for the Purpose of Habitat Vulnerability Assessment and Decision Making</b> .....	4702
<i>M. L. Chu-Agor, R. Muñoz-Carpena, G. Kiker, A. Emanuelsson, I. Linkov</i>	
<b>Robust Optimization Using a Variety of Performance Indices</b> .....	4710
<i>P. A. Ray, R. Vogel, D. Watkins</i>	
<b>Resolution and Sensitivity Analysis of a Block-Scale Urban Drainage Model</b> .....	4720
<i>Alisha Goldstein, Kim DiGiovanni, Franco Montalto</i>	

<b>Effect of Land Use Uncertainty on Watershed Modeling</b> .....	4730
<i>A. Sharifi, L. Kalin</i>	
<b>Analyzing Uncertainty and Risk in the Management of Water Resources for the Texas Water Development Board</b> .....	4740
<i>Abhishek Singh, Richard Hauffpauir, Srikanta Mishra, Marsh Lavenue, Albert Valocchi</i>	
<b>Global Sensitivity Analysis of a Distributed Hydrologic Model Using Monte Carlo Simulation</b> .....	4744
<i>Tibebe Dessalegne, Sharika U. S. Senarath, Raul J. Novoa</i>	
<b>Flood Risk Assessment of Complex Riverine Systems</b> .....	4757
<i>David (Jeff) Harris, Christopher N. Dunn, Michael K. Deering</i>	
<b>Sampling Schemes for Uncertainty Assessment of a Hydrologic Simulation Model</b> .....	4769
<i>Ramesh S. Teegavarapu, Sharika U. S. Senarath, Chandra Pathak</i>	
<b>Author Index</b>	