World Environmental and Water Resources Congress 2019

Emerging and Innovative Technologies and International Perspectives

Selected Papers from the Proceedings of the World Environmental and Water Resources Congress 2019

Pittsburgh, Pennsylvania May 19-23, 2019







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> May 19–23, 2019 Pittsburgh, Pennsylvania

SPONSORED BY Environmental and Water Resources Institute of the American Society of Civil Engineers

> EDITED BY Gregory F. Scott, P.E. William Hamilton, Ph.D., P.E.





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Preface

We are excited to offer the proceedings of the 2019 World Environmental and Water Resources Congress. The proceedings include published papers from an engaging and challenging array of technical sessions, posters, and workshops at the Environmental and Water Resources Institute's (EWRI) 19th Annual Congress, held in Pittsburgh, Pennsylvania, May 19-23, 2019. This conference is a leading venue for professional interaction among engineers and scientists, covering disciplines related to water and environmental resources and infrastructure.

America's infrastructure is in urgent need of attention. The 2017 American Society of Civil Engineers' Report Card for America's Infrastructure estimates that an investment of over \$4.5 trillion is needed to return the nation's infrastructure to a state of good repair. Of critical importance to the public's health and safety are the needs of water focused infrastructure. The Environmental Protection Agency (EPA) estimates that wastewater and stormwater collection and treatment needs are \$271 billion as of January 2012 and drinking water utilities needs are \$472.6 billion as of March 2018. While significant, the needs are not limited to the United States alone. According to the World Health Organization (WHO), contaminated drinking water is estimated to cause 502,000 diarrheal deaths each year, and by 2025, half of the world's population will be living in water-stressed areas. Compounding the state of water infrastructure are on-going changes to the climate. Scientific evidence unequivocally indicates these changes are accelerating. While debate remains as to the causes and how best to slow, stop and/or reverse these changes, it falls to professionals in the water fields to address the challenges to rebuilding the world's water infrastructure to be more resilient and reducing direct impacts such as flooding and indirect impacts such as disruption of critical economical services.

The 2019 EWRI Congress covers a wide range of topics that attempt to provide innovative and sustainable solutions to ensure that our water and environmental infrastructure and resources will be improved and built to secure and protect them for the future. We proudly host the Congress under the auspices of the American Society of Civil Engineers (ASCE).

Within the six (6) volumes of the proceedings, more than 150 written scientific and technical papers from nearly 800 oral and poster presentations focusing on the subject areas of various EWRI Councils are included. A list of subject area tracks is included in the acknowledgements below. We hope these proceedings serve to enhance your knowledge and encourage you to follow up with more detailed publications by the same authors, and related papers, typically found in ASCE technical journals.

This collection contains papers organized by the following EWRI Councils:

- <u>Emerging and Innovative Technologies Committee (Interdisciplinary Council)</u>
 - whose purpose is to develop and apply emerging and innovative technologies to support the functioning of EWRI, to advance the development, knowledge, and application of emerging and innovative technologies for the planning and management of water resources and the protection and enhancement of the environment; to encourage the reporting, discussion of technical and social issues, and information transfer of applications of emerging and innovative technologies; and to foster the multidisciplinary use of these technologies.
- <u>International Council</u> whose purpose is to undertake and facilitate a variety of technical and liaison activities in support of international collaboration and international promotion of the role of the Institute.
- <u>Standards Development Council</u> coordinates all activities of EWRI related to the establishment, use, or discontinuance of standards or other regulatory tools in the area of water and the environment.

Acknowledgments

Preparation and planning for this Congress strongly depends on the dedication of those individuals who plan session topics, solicit abstracts and papers, oversee reviews of all submissions. We are deeply grateful to all who have provided this considerable effort, especially the track chairs listed below:

17th Groundwater Symposium	Paul Mathisen & Amy Chan-Hilton
Emerging & Innovative Technologies	Barak Fishbain
Environmental	Wendy Cohen & Lisa Hayes
History & Heritage	Larry Magura & Jerry Rogers
Hydraulics & Waterways	Fabian Bombardelli
Hydro-climate/Climate Change Symposium	Levent Kavvas
International Issues	Erfan Goharian & Ali Mirchi
Irrigation & Drainage	Stuart Styles
Planning and Management	Mashor Housh & Debora Piemnonti
Standards	Dr. Kathlie S. Jeng-Bulloch
Stormwater Symposium	Bill Hunt & Sarah Waickowski
Student Competition	Wes Lauer
Sustainability	Joshua Peschel
Watershed	Levent Kavvas & Don Frevert
WDSA	Terra Haxton
New Professionals	Erfaneh Sharifi
Desalination Symposium	Luzma Nava
Water, Wastewater and Stormwater	Bridget Wadzuk & Arnie Strasser
Professional Practice	Kristin White
Education	Angelica Huerta

We also acknowledge the members of the Congress Organizing Committee, without whose time and efforts the event would not be possible.

General Chair Kemal Niksic, P.E.

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Finally, we acknowledge and thank EWRI staff who, in the end, makes this conference a reality.

Director, EWRI Brian K. Parsons, M.ASCE

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Leave the Clipboard Behind—Smart, Digital Solutions for Field Data

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ABSTRACT

In response to two consent decrees with the Ohio EPA, the city of Columbus created the Blueprint Columbus Program in 2015. The Blueprint Columbus approach targets to reduce water-in-basement (WIB), sanitary sewer overflows (SSO), and combined sewer overflows (CSO) by implementing lateral lining, downspout redirection, sump pump installation, and green infrastructure (GI) projects. Columbus is currently constructing a GI asset consisting of pervious pavers, regional rain gardens, bio basins, and bumpouts in the urban neighborhood of Clintonville. Monthly maintenance inspections are performed on each GI during the 2-year establishment period to identify areas with repetitive maintenance concerns. To streamline the inspections and quickly disseminate monitoring data, Arcadis developed a mobile survey workflow using available software applications to complete inspections in the field and track GI assets. This paper will provide an overview of the software applications, survey usability, and process for generating GI reports and summary tables.

BACKGROUND

The City of Columbus (Columbus) is located in central Ohio and consists of residential, commercial, and industrial land uses. A map showing the location of Columbus is provided in **Figure 1.** The Columbus area serves a population of roughly 879,170 and covers an area of 225 square miles. The existing stormwater collection system is made up of 2,537 miles of pipe and discharges to the Scioto River while 167 miles of combined sewer and 2,782 miles of sanitary sewer convey wastewater to one of two treatment plants (City of Columbus 2019). The sewer infrastructure in Columbus dates to 1841 which has created susceptibilities for cracks in pipes, joint failures, and faulty connections to arise in the sewer infrastructure. These failures, along with excessive rain water, snow melt, and improperly connected sump pumps can overload the existing sewer system (City of Columbus 2019). Overloading the system has led to numerous other issues, including WIB, SSOs, and CSOs.

In 2005, Columbus submitted the *Wet Weather Management Plan* (WWMP) to the Ohio EPA in accordance with consent decrees called into order to reduce the number of overflows and basement backups. This management plan recommended constructing two large, underground tunnels to take all flows in the sewers to the wastewater treatment plants. Although increasing the system's capacity may alleviate some of the overload repercussions, the City recognized that limiting the amount of stormwater able to enter the system will more effectively limit the amount of overflow events. The desire for a more effective, affordable, and greener solution led to the creation of the Blueprint Columbus project in December 2015 (City of Columbus 2019).