WATER LOSS CONTROL PROJECTS

February 2018

Maureen Hodgins, mhodgins@waterrf.org

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WRF Project	Publication info	Project Description & Notes
AMI-Meter Data Analytics, 4741	Ongoing	A growing number of water utilities are implementing advanced metering infrastructure (AMI) to capture detailed, high-volume information from customer meters. With this expanded water usage information, utilities can better respond to customer billing questions, enforce policies for water usage and conservation, and better quantify and ultimately reduce the level of non-revenue water in their distribution systems. To realize these potential benefits, utilities need to clearly understand the improvement opportunities enabled by the AMI data, and also understand the need for new data processing and analysis tools. This project will investigate how AMI data can be used for maximum utility benefit. The research team will identify the strategies for AMI data analyses and provide case studies of utilities to demonstrate the value of using AMI data. The research will result in a meter performance index, which will allow utilities with AMI data to define their meter maintenance and replacement strategies based on actual meter performance. *Notes: Follow on to *Planning and Implementing CIS and AMR/AMI Projects* - 4583.
Assessing Water Demand Patterns to Improve Sizing of Water Meters and Service Lines - 4689	Ongoing	Oversized water meters are a common problem for utilities across North America, especially in light of the increasing implementation of water conservation and low water-using plumbing fixtures. Accurately sized water meters increase recurring utility revenue. Meter oversizing frequently results in inaccurate meter registration at low flow regimes and an underreporting of the total volume of water delivered through the meter. This problem becomes exacerbated as meters age and cumulative flow through the meter increases. This pilot-scale research study seeks to improve understanding of peak and off-peak water demand patterns of typical urban water customers (excluding single-family) for the purpose of more accurately and economically sizing water service lines and water meters.
Guidance on Implementing an Effective Water Loss Control Plan - 4695	Will be published 2018. Will be free to the public.	This project will create a peer-reviewed Guidance Manual and Decision Framework to help North American water utilities develop an actionable, cost-effective, and defensible water loss reduction and control plan. The research will allow utilities to develop plans that align with their strategic goals, water resource management concerns, financial concerns, and local circumstances.

Managing Infrastructure Risk: The Consequence of Failure for Buried Assets - 4451	For Subscribers: Raucher, R., J. et al. 2017. Managing Infrastructure Risk; The Consequence of Failure for Buried Assets, Report 4451. Denver, Colo: WRF. Free to public: Executive Summary.	This project produced a user-friendly, utility-focused guidance and a set of tools designed to pragmatically guide water utilities as they strive to integrate risk management principles into their asset management programs. The research provides an approach and methods so that utilities can develop and communicate a sound business case for appropriate levels and types of infrastructure investment. It also developed a compendium of pipe failure impacts, in a TBL framework, that will provide useful data to the whole water sector. In addition to the final report, this project developed a data collection workbook, posted below under Web Tools. Research partners: American Water, City of Los Angeles Department of Water and Power, Tarrant Regional Water District, Anchorage Water & Wastewater Utility, and Passaic Valley Water Commission. *Notes: See how to include TBL costs 2607 & Blaha and Gaweski's paper on costs of main breaks.
	For Subscribers: Web Tool, *Data Collection Workbook*.	For WRF Subscriber only. Helps users track financial/social/environmental costs of specific main breaks. One workbook per main break
Level 1 Water Audit Validation - 4639	Multiple items published.	Defines and guides water utilities and regulatory entities in understanding what makes an accurate and reliable water audit, following AWWA methodology for water audits. This project is structured to provide North American water utilities and regulatory entities with clear guidance and a standardized methodology for validation of water audit data.
	Free to public: Andrews, L., et al. 2016. Level 1 Water Audit Validation: Guidance Manual, 4639A. Denver, Colo.: WRF.	*Notes: Defines level 1 validation & minimum information needed. Discusses considerations for the 20-25 data inputs to the water audit. *Executive Summary*,
	Free to public: Andrews, L., et al. 2017. Utility Water Audit Validation: Principles and Programs, 4639B. Denver, Colo.: WRF.	*Notes: Aimed a bit more towards the regional programmatic level. The report covers background information such as information (abbreviated) on country or state water loss control programs and validation.
Water Audits and Real Loss Component Analysis - 4372	Multiple products published.	The purpose of this project is to help the North American water industry design efficient and sustainable leakage control programs. The project has been divided into two segments. In addition, articles about this project were published in the April 2016 issue of Opflow and the February 2016 issue of Journal AWWA. The articles are posted below under Project Papers.
	Free to public: Sturm, R., et al. 2015. Water Audits	Water Audits in the United States: A Review of Water Losses and Data Validity (Order #4372b) summarizes state regulations on water loss reporting and analyzes 4,575 water audits (that follow AWWA

	in the United States: A Review of Water Losses and Data Validity. 4372b. Denver, Colo.: WRF.	water audit methodology) submitted to the California Urban Water Conservation Council, Georgia EPA, Texas Water Development Board, Tennessee Comptroller of the Treasury, and the Delaware River Basin Commission from 2011-2014. The results provide a national snapshot of water loss reporting, including an assessment of water audit validity and median results for key performance indicators.
	Free to public: Sturm, R., et al. 2014. Real Loss Component Analysis: A Tool for Economic Water Loss Control. 4372a. Denver, Colo.: WRF.	Real Loss Component Analysis: A Tool for Economic Water Loss Control (Order #4372a) provides water utilities with an analysis tool to better understand the sources of their real water losses (reported, un-reported, or background) and a means of analyzing their economic intervention strategies. This project improves the quality of standard leakage component analysis and compliments the AWWA Water Audits and Loss Control Program (M36), 3rd edition. In addition to the research report, the project produced two spreadsheet tools: a *Leakage Component Analysis* (LCA) Model and the *Leak Repair Data Collection Guide*, which are available on this project page under Project Resources/Web Tools. *Notes: Includes a nice literature summary of pipe breaks research.
	Free to public: Leakage Component Analysis Model	See above
	Free to public: Leak Repair Data Collection Guide	See above
Pipe Location and Leakage Management for Small Water Systems - 4144	Free to public: Hughes, et al. 2014. Pipe Location and Leakage Management for Small Water Systems, 4144. Denver, Colo.: WRF.	This project developed guidance and other information oriented towards use by small utility system managers in locating buried pipe and managing leaks associated with those pipes. The research synthesized the project findings from case studies and other projects. *Notes: Includes template power point, under Project Resources.
Pressure Management: Industry Practices and Monitoring Procedures - 4321	For Subscribers: LeChevallier, M. et al. 2014. *Pressure Management: Industry Practices and Monitoring Procedures, 4321.* Denver, Colo.: WRF. Free to public: Executive Summary	This project provides a better understanding of pressure management practices under both baseline and optimized conditions in drinking water utilities in the United States. The research presents case studies from small, medium, and large water utilities both before and after implementing the pressure management and monitoring criteria outlined in the WRF project 4109, Criteria for Optimized Distribution Systems. The final report makes recommendations for modifications to this criteria.
Effects of Weather on Leakage and Bursts - 4392	For Subscribers only: Cunningham, A., et al. 2013. Effects of Weather on Leakage and Bursts, UKWIR report 13/WM/08/50. London, UK: UK Water	This project identifies the critical weather factors that can cause an adverse impact on leakage and pipe breaks, quantifies the weather metrics and their impacts, and identifies early warning weather indicators. The project deliverables include a set of models explaining weather and break/leakage relationships that can be used with forecast weather data to support water utility leakage management. The models are available on this project page under Project Resources/Web Tools. *Notes: This is an UKWIR project.

	Industry Research Limited. Free to public: Executive Summary	
Continuous System Leak Monitoring-From Start To Repair - 3183	For Subscribers only: Hughes, D., et al. 2011. *Continuous System Acoustic Monitoring: From Start to Repair. Project #3183*. Denver, Colo.: WRF. Free to public: Executive Summary	Evaluates the potential of a daily acoustic monitoring system to locate leaks promptly. Identifies differences in pipe, and the subsurface environment between the onset of detectable subsurface flow and the time when the leak actually surfaces. Also studies how leaks of varying types can be categorized by acoustic signature and pipe characteristics. Examines the structural characteristics of breaks captured near the time the leak starts, to gain additional insights into the dynamics of failure. *Notes: See $1.5M California Energy Commission grant for to American Water for Demonstrating innovative leakage reduction strategies – correlating acoustic monitoring, satellite images, flow sensitive pressure reducing valves, starting 2016. (No WRF funding)
Accuracy of In-Service Water Meters at Low and High Flow Rates - 4028	Free to public: Barfuss, S., M. Johnson, and M. Neilsen. 2011. Accuracy of In-Service Water Meters at Low and High Flow Rates. 4028. Denver, Colo.: WRF.	This project tested meters of various sizes (5/8-inch to 2-inch diameter) in order to understand the changes in flow measurement accuracy with time and quantified the changes in flow measurement accuracy with exposure to particles in the distribution system as well as other degradation factors. The project also compared the actual accuracy to the current AWWA standards on low and high flow accuracy to see if in-service meters generally exceeded the new meter standards and by what margin.
Leakage Management Technologies - 2928	Free to public: Fanner, P. V., R. Sturm, J. Thornton, R. Liemberger, S. E. Davis, and T. Hoogerwerf. 2007a. Leakage Management Technologies. Project #2928. Denver, Colo.: Awwa Research Foundation.	Assesses the practicality of applying U.K. proactive leakage management techniques to North American utilities. Provides guidance to water utilities on how to practically apply promising leakage management technologies. Research partner: USEPA. *Notes: Also see M36, 4th ed. and IWA/AWWA Free Water Audit Software published after this report.
Evaluating Water Loss and Planning Loss Reduction Strategies, - 2811.	For Subscribers: Fanner, Sturm et al. 2007. Evaluating Water Loss and Planning Loss Reduciton Strategies.	Evaluates the definition, measurement, and reporting methods for utility water losses. Provides guidance to water utilities on leakage identification, leakage control methods, and water loss management that can be used as a measure of best utility practices. Recommends use of the IWA/AWWA Water Audit Method as a best practice for North American water utilities. Includes a CD-ROM. *Notes: Also see M36, 4th ed. and IWA/AWWA Free Water Audit Software published after this report.

	Denver, Colo.: Awwa Research Foundation. Free to public: Executive Summary	

Related to Water Loss Control or Main Breaks

Pilot Scale Demonstration of the Systems Level Application of Water Footprinting for Sustainable Decision Making - 4652	Will be published in 2018.	Studying options to balance future supply and demand using systems or catchment-level water footprinting according to International Standard Organizations 14046. The pilot study is a water-stressed area of the United Kingdom (UK). This research will help water utility companies deliver their water services more effectively by identifying opportunities for operational savings, adding customer benefit, and reducing environmental impacts. The project will deliver a pilot study report detailing the scope, methodology, and conclusions; a refined list of value propositions on the application of water footprinting; a refined conceptual framework/toolkit; and a guidance document. *Notes: Demand options include water loss control.
Epidemiologic Study of Health Effects Associated With Low Pressure Events in Drinking Water Distribution Systems - 4390	Ongoing, expected completion in 2018.	The general scope of work to be performed by the Centers for Disease Control and Prevention (CDC) involves the following activities: (1) organize and coordinate a pilot study that will allow the study team and water utilities to become familiar with implementation and logistical aspects of the study, and (2) conduct a multi-site epidemiologic study among households that receive water from five water utilities across the United States with sufficient statistical power to evaluate human health risks associated with low pressure events in drinking water distribution systems in the United States under typical conditions. *(* *Notes: Based on work by Nygard et al. in Norway that linked main breaks to health effects. Project paper has been published on our website, "Pilot CDC Epidemiologic Study of Low Pressure Events in Drinking Water Distribution System and Request for UtilityParticipants"
Effective Microbial Control Strategies for Main Breaks and Depressurization - 4307	For Subscribers: Kirmeyer, G., et al. 2014. *Effective Microbial Control Strategies for Main Breaks and Depressurization, 4307A*. Denver, Colo.: WRF. Free to public: Executive Summary	Provides a quantitative understanding of the value of barriers, such as chorine and chloramine, along with main break repair procedures and operational practices, in preventing potential customer exposure to pathogens associated with main breaks and subsequent repairs. Identified, from a utility perspective, the primary factors that must be understood in order to manage the risk to customers from exposure to pathogens.
	For Subscribers: *Good Practices for Preventing Microbial Contamination*	Help field crews who are doing repairs to remember and implement good practices during repair of water main breaks. The Field Pocket Guide may also be useful in utility training programs for crews involved in these activities.

	of Water Mains, FIELD POCKET GUIDE, 4307B	
Criteria for Optimized Distribution Systems - 4109	For Subscribers: Friedman, M.,et al. 2010 Criteria for Optimized Distribution Systems, Project 4109.Denver, Colo.: WRF. Free to public: Executive Summary	Defines and develops a continuous improvement program based on optimization principles for water distribution system operations. Also identifies metrics to aid in determining the degree of optimization of a given system and in identifying where optimization efforts can best be focused. Research partner: Partnership for Safe Water. Published in 2010. Software tools are included with the report on CD-ROM. *Notes: helped develop the distribution system optimization portion of the Partnership for Safe Water. Focuses on chlorine residual, pressure management, and main breaks. Suggests goal of 15 breaks per 100 miles/year.
Susceptibility of Distribution Systems to Negative Pressure Transients - 3008	For Subscribers: Fleming, K., et al. 2006. *Susceptibility of Distribution Systems to Negative Pressure Transients. Project #3008*. Denver, Colo: Awwa Research Foundation. Free to public: Executive Summary	Performs hydraulic surge modeling on a variety of distribution systems. Determines the characteristics that make systems vulnerable to negative pressure transients. Tests common scenarios to develop a vulnerability ranking, evaluate mitigation approaches, and develop guidance for selecting optimum monitoring locations. Tailored Collaboration partner: American Water Works Service Company.