Tuesday, April 17th		
8:00 am to 10:00 am	**1a. Water Reuse & Conservation** 8:00-8:20 TBD City of Phoenix 8:20-8:45 Ronen Barkan Fluence 8:45-9:10 Chris Wilkinson NO-DES, Inc. 9:10-9:35 Justin Nichols BioMicrobics, Inc. 9:35-10:00 Peter Cartwright Cartwright Consulting Co.	**1b. Water Treatment** 8:00-8:30 Taylor Reynolds MilliporeSigma 8:30-9:00 Rakesh Govind PRD Tech, Inc. 9:00-9:30 Bryce Hill Montana Tech of the University of Montana 9:30-10:00 Greg Campbell ProMinent Fluid Controls
10:00am to 10:30 am	**Morning break in the exhibit hall**	
10:30 am to 12:30 pm	**2a. Desalination** 10:30-11:10 Thomas Buschatzke Arizona Department of Water Resources 11:10-11:50 Randy Shaw Brackish Groundwater National Desalination Research Facility, USBR 11:50-12:30 Joe Cresko U.S. Department of Energy	**2b. Water Reuse & Irrigation** 10:30-11:00 Jeff Pringle Orenco Systems, Inc. 11:00-11:30 Eric Peterson Amiad Water Systems 11:30-12:00 Rodney Ruskin Geoflow 12:00-12:30 Brad Wardle Orbit B-hyve
12:30 pm to 1:30 pm	**Lunch in the exhibit hall**	
1:30 pm to 3:30 pm	**3a. EPA - Water Utility Resilience** Curt Baranowski US EPA Keely Brooks Southern Nevada Water Authority Laurna Kaatz	

	Denver Water Russell Clayshulte Bear Creek Water and Sanitation District	
3:30 pm to 4:00 pm	**Afternoon break in the exhibit hall**	
4:00 pm to 5:30 pm	**4a. Infrastructure I** 4:00-4:30 Daniel Gutierrez ABB 4:30-5:00 Marius Basson Aladon 5:00-5:30 Jerry Regula McWane Ductile	
5:30 pm to 7:00 pm	**Evening Reception in the exhibit hall**	

Wednesday, April 18th		
8:00 am to 10:00 am	**5a. Water Training Sessions** 8:00-9:00 Chris Jones Kupferle 9:00-10:00 Crystal Flitton GSM Arizona	**5b. Data & Safety** 8:00-8:30 Meghan Smart Arizona Dept. of Environmental Quality 8:30-9:00 Dominique Gomez WaterSmart Software 9:00-9:30 Tom McKinney HMS Industrial Networks 9:30-10:00 Ruben Mendez National Trench Safety
10:00 am to 10:30 am	**Morning break in the exhibit hall**	
10:30 am to 12:30 pm	**6a. Groundwater** 10:30-11:00 Perri Benemelis Central Arizona Groundwater Replenishment District 11:00-11:30 Rose Galbraith New Mexico Department of Health	

	11:30-12:00 Jacob Petersen-Perlman Water Resources Research Center 12:00-12:30 Michael Barden Hydro Geo Chem, Inc	
12:30 pm to 1:30 pm	**Lunch in the exhibit hall**	
1:30 pm to 4:00 pm	**7a. Infrastructure & Water Treatment II** 1:30-1:55 John Johnson McWane Ductile 1:55-2:20 Jerry Regula McWane Ductile 2:20-2:45 Peter Gabor Emerson Automation Solutions 2:45-3:10 Robert Newton MIOX 3:10-3:35 Rakesh Govind Water Warriors, LLC 3:35-4:00 Pitiporn Asvapathanagul California State University, Long Beach	

Abstracts

Tuesday, April 17th

8:00 am to 10:00 am	**1a. Water Reuse & Conservation** *City of Phoenix* **Water Service Department** *Ronen Barkan, US Sale Manager, Fluence* **MABR Wastewater Treatment: Low Energy & Effluent Reuse** Conventional aerobic wastewater treatment is an energy intensive process. A large portion of a wastewater treatment plant's operational cost is spent on energy for aeration. The second most costly operational cost component for most wastewater treatment plants is sludge disposal. Together these two components account for approximately 75% of a wastewater treatment plant's operational costs. Treatment

technologies that can reduce one or both of these components are, therefore, very attractive; and significant research and development is being conducted worldwide to develop such technologies. Membrane Aerated Biofilm Reactors (MABR) have recently been introduced to the general wastewater treatment market after decades of research and development. Fluence's MABR dramatically reduces energy consumption as well as sludge disposal costs through its unique approach to wastewater treatment. In cases where nitrogen limits are low, the Fluence MABR enables compliance with simple operation and less addition of an external carbon source.
The primary benefits of the Fluence MABR are:
• Up to 90% less energy required for aeration
• Inherent simultaneous nitrification and de-nitrification, requiring less operator attention and less external carbon addition
• Exceeds EPA standards for class 1A effluent
• Inherent bio-P removal
• Modular design, enabling shorter construction time, gradual implementation, and easier expansion
• Encapsulated design, reducing odor and noise
• Simple operation and maintenance
• Remotely controlled
The presentation will describe in detail how Fluence's MABR works to achieve the above benefits. A typical Fluence MABR plant design will be presented and discussed. In addition, the presentation will highlight several case studies where the Fluence MABR has been successfully installed, including data on treatment performance and energy savings.

Chris Wilkinson, President, NO-DES, Inc.

Water Main Cleaning With Water Conservation

For decades water utilities throughout the world have performed annual distribution system flushing to clean water mains, maintain water quality and ensure its safety. As a consequence, enormous amounts of water are flowed out of hydrants into the street where it then is lost down storm drains to waste, even during declared droughts where mandatory conservation or rationing is enacted. Additionally, the runoff raises ever tightening and restrictive National Pollution Discharge Elimination System regulation issues. With the realization that there will never be enough water to waste, is it possible for water utilities to perform distribution system flushing in a way that meets water quality goals and enables them to lead by example in water conservation? How well do conventional and uni-directional flushing methods meet these objectives? Has the time come for utilities to rethink the problem and stop viewing the waste associated with water system flushing as a short-term public relations issue that is justified as a necessary evil? More importantly, is it possible to perform water system flushing while virtually eliminating the vast waste of water associated with it? Four distribution system flushing methods will be reviewed and compared - conventional, uni-directional, pigging with ice and the NO-DES method, relative to:
1. Their effect on water conservation - actual amount of water needed, impact on water supplies, and their ability to enable the utility to lead by example in conservation by demonstrating to customers that they are practicing what they preach.
2. Their effectiveness in maintaining or improving water quality, including being able to add disinfectant to the system, and/or reforming chloramines where necessary.
3. Impacts on customers throughout the distribution system.
4. Total costs, including labor, purchased water, equipment, energy, permitting, damage claims, valve damage/replacement and chemicals.
5. NPDES issues they raise or mitigate for.
6. Ability to be performed throughout the year and during the daytime.

Justin Nichols, Regional Sales Manager, BioMicrobics, Inc.

The role of membrane in for the decentralized wastewater treatment market comprises of two types of membranes an onsite professional may run into: Reverse Osmosis (for rural drinking water) and Membrane BioReactors (onsite MBRs for ultrafiltration of wastewater).
This presentation will focus on the design and application of the MBR system in decentralized wastewater applications to help answer the following:
• Why MBR?

	• Accurate flow data is necessary for good MBR design. • Consistent nitrogen removal is possible with MBR system. • Settleability is “OUT” -- Filterability is “IN” The MBR effluent can easily be considered for reuse in various applications; irrigation, toilet flushing and laundry. An MBR system is also ideal for treating challenging conditions, such as low temperature environments and compounds that are difficult to treat. *Peter Cartwright, President, Cartwright Consulting Co.* **Membrane Technologies for Wastewater Treatment & Reuse** As global population increases, the relatively finite volume of fresh water is becoming more and more contaminated. This, combined with weather-related water shortages and depletion of groundwater supplies, indicates that wastewater can no longer be considered expendable. The crossflow, pressure-driven membrane separation technologies of microfiltration, ultrafiltration, nanofiltration and reverse osmosis are becoming standard processes for treatment of both municipal and industrial wastewater streams to condition the recovered water for specific applications. The unique properties of these technologies are defined, system design features detailed and case histories discussed. *Jeff Pringle, Senior Account Manager, Orenco Systems, Inc.* **Packed Bed Filter Treatment for Onsite Water Reuse** As the need for freshwater resources increases, water reuse has become an increasingly attractive option for conserving potable water. Wastewater can be treated onsite to levels that allow it to be used for toilet flushing, cooling towers, water features, and landscape irrigation. Packed bed filter technology provides a safe, efficient, and sustainable option for treating to reuse standards. In West Virginia, Orenco’s AdvanTex packed bed filters are being used to treat design flows of over 230,000 gallons per day from showers and reuse it for flushing toilets. Packed bed advanced treatment systems have been proven through decades of documented performance, and Platinum LEED ratings and other environmental recognitions for new homes, renovations, and low-impact developments.The importance of water in our lives is paramount, and pressures on clean water supplies are mounting everywhere. Safe reuse of what used to be called “waste” water has been proven, and can now be done cost-effectively with technology currently available.
8:00 am to 10:00 am	**1b. Water Treatment** *Taylor Renolds, Environmental Marketing Manager, MilliporeSigma* **New Test Method for the Analysis of Total Nitrogen** Currently the US EPA has not promulgated a method for the analysis of Total Nitrogen (TN). Most states that have TN regulations require permitee's to measure TN as the composite of TKN, Nitrate and Nitrite. This approach is costly, time consuming, potentially hazardous to lab technicians and also susceptible to variability based on the methods used for the individual analytes. MilliporeSigma recently concluded a multi-lab validation study in the State of Iowa to demonstrate the equivalency of a new spectrophotometric test kit that allows users to perform a single test to obtain a result for Total Nitrogen. This presentation will provide a review of the existing test methods, and why testing for Total Nitrogen is important. Provide an overview of the new method including accuracy, time to results and a status update regarding individual state approvals for the test. Comparisons will be provided on cost, time to results and ease of use. *Rakesh Govind, President, PRD Tech, Inc.* **Decentralized Treatment of Wastewater - NextGen Technology** NextGen technology is a compact, energy efficient, and modular wastewater treatment technology which can be applied to existing septic tanks, small businesses, buildings, restaurants, etc. It employs four levels of treatment in conjunction with a wireless communication system, which transmits all alarms through the power line. The four levels of treatment includes: (1) anoxic decomposition of solids; (2) aerobic biodegradation of soluble organics, nitrogen and phosphorus compounds using a microbubble aeration system and high surface area biomedia; (3) membrane separation of suspended solids and partial disinfection; and (4) solid-state UV disinfection. The effluent water has less than 10 mg/L BOD, less than 2

mg/L ammonia-nitrogen, less than 1 mg/L phosphorus and no suspended solids.

Microbubble aeration uses a liquid pump, with no blowers, and uses ambient air to create microbubbles, less than 30 microns in diameter in the water. These microbubbles are small enough that they stay in the water for hours, unlike the fine bubble aeration bubbles which only stay for a few seconds. This extended residence time of the microbubbles coupled with their high surface area, enables high rates of oxygen transfer into the wastewater. The energy consumed using this microbubble technology is about 1/2 to 1/3 of the energy used in fine bubble aeration using blowers and spargers. The high surface area biomedia is a Waving Biomedia, instead of moving biomedia, consisting of a specially coated, high surface area, open-cell foam material, which enables the liquid concentration of active biomass to acgieve levels as high as 40,000 mg/L - 8 times the concentration of biomass in suspended culture aerated bioreactors. Membrane separation has been used in Membrane Bioreactors, but these membranes requires frequent cleaning to maintain the water flux across the membrane. In the NextGen technology, a self-cleaning membrane is used, which requires no frequent cleaning, and maintains a high water flux for several years. Furthermore, the membrane surface is treated to prevent biofouling of the membranes, even after several years of use. NextGen technology is currently being sold in NextGen septic tanks, and these systems have been installed in homes, small businesses, golf clubs, etc.

Bryce Hill, Assistant Professor Electrical Engineering, Montana Tech of the University of Montana

Remote Sampling of Berkeley Pit via Semi-Autonomous Boat

Background: Butte Montana is home to the Berkeley Pit, and open pit copper mine in operation from 1955 to 1982. Since its abandonment, the pit has been filling with low pH water laden with metal. Currently it contains over 174 billion liters at a depth of 260 meters. The US Environmental Protection Agency and Montana Department of Environmental Quality require semi-annual sampling and profiling of the water within the pit. The pit is part of the Butte Mine Flooding Operable Unit, a part of the Silver Bow Creek Superfund Site. Past slope failures in 1998 and 2102-2013 caused safety concerns about those manning boats for the profiling and sampling of the pit. In 2013 manual sampling ceased. Montana Resources Inc. commission Montana Tech of the University of Montana via a grant to develop an autonomous boat to profile and sample the pit lake. Approach: The platform for the boat was an existing boat used to manually sample the pit, a 12ft fishing drift boat. Dual electric outboard trolling motors were mounted to provide a skid steer control of the boat. Communications were achieved via a 2.4GHz radio link for telemetry and network communications, and a 433MHz radio link for manual radio control. An ISCO sampler was modified to be controlled over a serial control interface. A Hydrolabs data-sonde using a 200 meter reel was mechanized and data collected over the existing serial interface. A hose reel with 229 meters of vinyl tubing was mechanized to manage the hose. The boat was designed to operate with an autopilot as well as tele-operated. Network cameras were also used for visual feedback for tele-operations. Results: Successful sampling occurred July 2017. The boat was launched and recovered. Water was profiled to the length of the data reel. Water was sampled to a depth of 38 m. The water sampled was later analyzed and compared to previous data from the sampling. Current conditions include the pH of 3.4 and a thermocline at 15 m. The boat is scheduled for an additional sampling event in Oct 2017 and subsequently every 6 months. Current improvements in design are methods to manage the cable and hose as well as increasing the pumping speed.

Greg Campbell, Regional Sales Manager, ProMinent Fluid Controls

While water treatment encompasses many facets of design and very large equipment capable of treating millions of gallons of water on an hourly basis, little is mentioned about a much smaller piece of equipment that is extremely important to the overall success of clean and purified water. That piece of equipment would be the metering pump. Often overlooked as a device on a drum of chemical or on a shelf somewhere off to the side of a chemical room, the metering pump is capable of accurately dosing precise amounts of key water treatment chemicals such as sodium hypochlorite, hydrofluosilicic acid, sodium hydroxide, sulfuric acid, ferric chloride and many more. The metering of these chemicals is critical to the overall process as adding too much or too little could shut down a water plant or alert consumers to a “Boil Water Alert”. This presentation will review what is and isn’t a metering pump, functionality of the pump, and what advances have been made to allow chemical metering to be safe, accurate, and important to the overall aspects of water treatment.

10:00am to 10:30 am	**Morning break in the exhibit hall**
10:30 am to 12:30 pm	**2a. Desalination** *Thomas Buschatzke, Director, Arizona Department of Water Resources* The State of Arizona is investigating the feasibility of enhancing its water supplies through desalination methodologies, including desalination of both in-state brackish groundwater supplies and opportunities for binational desalination projects in the Sea of Cortez in partnership with the Republic of Mexico. Efforts to date include the work of a desalination subcommittee of the Governor's Water Augmentation Council, legislative proposals to prepare statewide "desalination action plans," and negotiations undertaken in partnership with the Republic of Mexico through the recently signed Minute 323 to the Mexican Water Treaty of 1944, which establishes the rules and guidelines for sharing Colorado River water between the United States and Mexico. Binational desalination opportunities are also being explored by the Arizona Mexico Commission, a partnership between the State of Arizona and the State of Sonora. *Randy Shaw, Research Facility Manager, Brackish Groundwater National Desalination Research Facility, USBR* **Brackish Groundwater National Desalination Research Facility** The Brackish Groundwater National Desalination Research Facility (BGNDRF) is located in Alamogordo, NM and is owned and operated by the United States Bureau of Reclamation (USBR). It is a test bed facility used by universities, businesses, entrepreneurs, and other government agencies. The BGNDRF is comprised of a central research building sitting on 43 acres of land. The central research building contains 6 indoor test bays, a water laboratory, conference room and office space. The outdoor area contains 3 test pads and a large scale test area, a renewable energy test pad, a 5-acre agriculture research area, 3 evaporation ponds and other undeveloped areas. Water for testing comes from 4 brackish water wells located throughout the facility grounds. The total dissolved solids of the well water ranges from 1,200 to 5,900 mg/L. There are five focus areas of the facility: 1) Concentrate Management; 2) Renewable Energy Desalination Hybrids; 3) Produced Water Desalination Technologies; 4) Small Scale Desalination Systems; and 5) Public Outreach and Education. A wide range of technologies have been tested, developed and/or demonstrated at the facility since it's opening in 2007. A sampling of the technologies includes electrodialysis, capacitive deionization, radial deionization, electrodialysis metathesis, pressure retarded osmosis, forward osmosis, reverse osmosis and solar distillation. Gaining use of the facility is relatively easy and consists of completing 7 forms and the BGNDRF safety orientation. Facility use fees are presently being waived through September 2018. *Joe Cresko, Strategic Analysis Technology Manager, U.S. Department of Energy* Seawater can be part of a diverse water supply portfolio for meeting projected water demands. However, seawater is a far less utilized water source for potable water compared to fresh ground or surface water in the US, partly because of the energy required to treat it for potable use. Evaluating the potential to improve desalination energy intensity requires a foundational analysis of the current energy demands, and opportunities for improvement from state-of-the-art and next generation technologies. A series of manufacturing "Energy Bandwidth Studies" have been published by the U.S. Department of Energy, Advanced Manufacturing Office (DOE AMO), where energy requirements are assessed based upon a bottom-up analysis starting with the fundamental unit operations. Current typical U.S. energy requirements are then compared to state-of-the-art and R&D requirements to determine the bandwidth of savings opportunity across all U.S. facilities. This approach has been adapted to study the energy consumption and energy savings opportunity for technologies to desalinate seawater for municipal potable water. The energy consumption and implications of increasing the share of potable water in the U.S provided by seawater desalination is detailed in a "Bandwidth Study on Energy Use and Potential Energy Savings Opportunities in U.S. Seawater Desalination Systems" published by DOE in 2017; results of this analysis will be reviewed in this presentation.
10:30 am to 12:30 pm	**2b. Water Reuse & Irrigation** *Eric Peterson, VP of Business Development, Amiad Water Systems*

	Compact, Efficient and Expandable Title 22 Treatment System San Simeon, CA is a small Pacific Coast community best known as the location of the tourist attraction Hearst Castle. The community wastewater treatment plant (WWTP) was faced with a substantial state fine due to violations of their discharge permit from their secondary effluent ocean outfall. The community was given the option to direct a portion of the fine funds towards an environmental improvement project that was related to the violation cause. The decision was made to pursue reducing their effluent discharge volume by installing a water reuse system to provide California Title 22 compliant quality water for local irrigation needs. Through innovative engineering and product selection the community was able to build a very simple and effective tertiary level treatment system for their wastewater flow which was installed within a small footprint at the WWTP and with modularity to allow for easy future expansion as the community recycled water demands expand. *Rodney Ruskin, CEO, Geoflow Surface Drip* **Reuse of Wastewater using Subsurface Drip Irrigation** Direct reuse for irrigation: Risks carried with the water: Pathogens, viruses, bacteria, protozoa, helminths (nematodes and tape worms), endocrine disrupting chemicals, triclosan, trace organics and heavy metals, pharmaceutically-active compounds, salinity and nutrients. Other risks: Root intrusion, animal damage (gophers etc.). What the design engineer needs to know: Quantity and quality of wastewater by calendar time periods, climate, crops, evapotranspiration, soils, restrictive horizons, landscape position, storage and alternative disposal if needed. The map needs to show all dispersal system related pertinent data: Elevation contours with 5 ft. minimum intervals. Power lines. Fences and property boundaries. Buildings. Roadways, whether they are currently in use or abandoned road beds. Well locations. Streams (running or not). Wetland areas (If no wetland is defined but there are cat-tails growing - show them and their location. Potential reuse and/or dispersal system locations. Property rights of way. Buffer zone off-sets plus the required distance of the off-set, whatever it may be, should be written somewhere in the buffer. All locations for soil and site evaluations should show with a number or letter code referencing them to the actual report. Obstructions that may hinder any part of the installation; trees, power poles, buried waterlines, buried power cables, telephone cables etc. The map has to be to scale. A graphic scale has to be put on the drawing. Examples will include: A single family home to a multi-million gpd municipal system. Applications in farming, golf courses, median strips, an airport runway, airport approach areas, home gardens, parks, forests, a Boy Scouts campsite, shopping centers, hotels, RV parks, oil industry produced water and the Olympic Stadium Vancouver. Water quality: From septic tank effluent to tertiary treated effluent, and produced water from the oil and gas industries. Alternative technologies: Center pivots, sprinklers. Innovation: Ethanol and CO2 greenhouse gas absorption simultaneously with irrigation. Reuse of wastewater using subsurface drip irrigation. What the design engineer needs to know before beginning the design. Examples of successful installed systems from single family homes to multi-million gallon municipal systems. Discussion on water quality, alternative technologies and greenhouse gas effects. *Brad Wardle, Director of Marketing, Orbit B-hyve* **Conservation Through Innovation** We share your passion for a beautiful landscape, while protecting our most valuable resource – water. For over 40 years, our customers have installed millions of Orbit® sprinkler timers that were built with one goal in mind, "Conservation through Innovation." We are excited to continue that tradition of innovation by introducing the Orbit® Bhyve™ Smart WiFi Sprinkler Timer.
12:30 pm to 1:30 pm	**Lunch in the exhibit hall**
1:30 pm to 3:30 pm	**3a. EPA - Water Utility Resilience** *Curt Baranowski, US EPA* **Creating Resilient Water Utilities** *Keely Brooks, Southern Nevada Water Authority*

	Managing Climate Hazards and Improving Resilience in Las Vegas, NV *Laurna Kaatz, Denver Water* **Managing Climate Hazards and Improving Utility Resilience in Denver, CO** *Russell Clayshulte, Bear Creek Water and Sanitation District* **0Managing Climate Hazards and Improving Utility Resilience in Bear Creek, CO** **Managing Climate Hazards and Improving Water Utility Resilience: Lessons Learned and Tools to Assist** Climate change impacts pose an immediate and long-term threat to the continuity of water utility operations and water supplies. Elevated heat and drought conditions in the Western U.S. have caused source water levels to drop due to increased evapotranspiration and lack of recharge to aquifers. Projections from climate models indicate that these events may become more frequent or severe across the United States in the coming decades. This session will communicate the real-world challenges and successes of utilities in adapting to the impacts of climate change. Utility case studies will be presented by Southern Nevada Water Authority in Las Vegas; Bear Creek, CO; and East Bay Municipal Utilities District in Oakland, CA. To reduce the risks associated with climate-related hazards, drinking water, wastewater, stormwater utilities across the country are actively preparing for climate change impacts. The Environmental Protection Agency's (EPA) Creating Resilient Water Utilities (CRWU) initiative helps utilities develop an understanding of climate science, potential climate change impacts, and adaptation options, and helps them evaluate and implement adaptive actions to proactively manage the risks posed by climate change. EPA provides tools and training through a collaborative technical assistance community and an online portal designed to educate the water sector on climate science and the full spectrum of adaptation options. Presentations will include experiences and lessons learned by utilities at all stages in the adaptation planning process, with an emphasis on audience and panelist interaction. This session will provide an exceptional opportunity for attendees to exchange knowledge and best practice solutions with their industry peers. Attendees will leave the session equipped with knowledge, resources, and contacts to start or continue their efforts to enhance resilience across the water sector. Panelists will represent the diverse challenges that utilities encounter when managing their response to climate change, including regional variations in climate hazards and projections, resource (financial and technical) constraints, capacity and size, and steps taken to date in response to extreme events or gradual climate change impacts. Each panelist will provide a short presentation highlighting the innovative solutions that helped them overcome challenges, as well as associated lessons learned. The panelist presentations will be followed by an audience-driven question and answer session to maximize the audience's ability to gain specific insights that may be applicable to their own resilience and adaptation efforts. The moderator will also be prepared to direct a panel discussion to elicit additional information from the panelists related to lessons learned and best practices that may be broadly applicable to attendees. Attendees and panelists will benefit from the open-format question and answer portion as well as the panel discussion which comprise a large portion of the session. Utilities at every stage in the resilience and adaptation planning process will benefit from hearing how EPA's CRWU resources and growing utility network can supplement adaptation planning at every utility and any stage.
3:30 pm to 4:00 pm	**Afternoon break in the exhibit hall**
4:00 pm to 5:30 pm	**4a. Infrastructure I** *Daniel Gutierrez, Regional Sales Engineer, ABB* **ABCs of VFDs**

	Although Variable Frequency Drives (VFDs) are common in water and wastewater treatment plants for collection and distribution systems, the value they provide and how to properly select and use them are often not fully understood. This presentation will demystify VFDs, providing a better understanding as to where and why you would use them. Attendees will leave with the ability to: • Be aware of safety considerations. • Identify applications that can benefit from VFDs. • Understand the inherent value they provide. • Recognize what needs to be considered to appropriately size and select VFDs. • Be aware of proper installation considerations for a successful solution. *Marius Basson, President, Aladon* **Building Resilience into Everyday Operations** Utilities face huge challenges with aging infrastructure, shortage of funding and changing demographics and workforce. Aladon provides training and physical asset management consulting services to many large utilities around the globe to assist with building resilience to face these challenges. Delegates will learn what steps to take for operational sustainability and resilience, from design to decommissioning (full life-cycle asset management) *Jerry Regula, National Product Engineer, McWane Ductile* **Linings and Coatings for Ductile Iron Pipe and Fittings** Improving the Nation's water infrastructure by using sustainable products is vital. Provided a variety of linings and coatings for Ductile Iron pipe and fittings enables the Engineer to select the proper linings and coatings based on the specific requirements of a project. Specifications for a water / waste water system may change given a variety of factors: water quality, location and or elevation just to name a few. Discussion will include a variety of proven lining and coating methods as well as new technologies.
5:30 pm to 7:00 pm	**Evening Reception in the exhibit hall**

Wednesday, April 18th	
8:00 am to 10:00 am	**5a. Water Training Sessions** *Chris Jones, Regional Sales Manager, Kupferle* **Water Quality Flushing - The Dead-End Danger Zone - How Uncirculating Water In Distribution System Dead-Ends Can Pose A Health Threat to Consumers** Keeping water safe for consumers is the primary responsibility for metropolitan and rural water utilities. Based on the Eliminate Dead-End Water article (Opflow November 2011), this presentation will provide information to participants about the two main health threats that old, uncirculating water on dead-end water mains pose to consumers. Information on EPA guidelines for residual level and the new Stage 2 DBP rule will be shared. Additionally, tools on identifying hazardous dead-ends, as well as, solutions to address the threats will be presented. The presentation is approximately one hour in length and a four-page summary booklet will be provided to each attendee. *Crystal Flitton, Manufacturer's Sales Representative, GSM Arizona* **Air Valve Maintenance for Surge and Vacuum Protection** Pipelines can experience pressure upsurges and down surges called pressure transients. Pressure transients wreak very extensive damages to water and wastewater transmission systems. Until recent years, most of the concern related to pressure transient damages was focused on the obvious extreme events of pipe burst or collapse that result in major spills or flooding. But, there are many damages, far more widespread and often more dangerous, that are less obvious and attract less attention. Pressure transients cause

	cracks and unseen small breaks in buried pipelines, pipe fittings and accessories. They cause joints to fracture or to come apart; they damage seals and gaskets or cause them to shift out of their sealing positions. These damages result in leakage and in contaminant intrusion and their consequent economic (water loss), environmental (infiltration of sewage to soil, water and environment), and public health (intrusion of pathogens, toxins and other contaminants to drinking water systems) repercussions. These consequences of pressure transients have come into the limelight in the past few years, and great efforts are being made to control them. The advantages of air valves as efficient and cost effective tools for the control of pressure transients, and their dangerous consequences, are often overlooked or unfamiliar. Air Valve maintenance is also overlooked and in more cases than not, lack of maintenance causes the air valve to not function properly and therefore can leave the pipeline unprotected.
8:00 am to 10:00 am	**5b. Data & Safety** *Meghan Smart, Scientist III, Arizona Department of Environmental Quality* **The Art of Building a Citizen Science Program** Arizona Water Watch (AWW), a new citizen science program offered through the Arizona Department of Environmental Quality, is designed to train volunteers to collect credible scientific data on streams and lakes in Arizona. The program uses innovative ideas like visually friendly forms, hand stitched cloth streams for teaching, micro video lessons, and crowd sourcing data techniques to reach many levels of volunteers. Empowering the volunteers with the proper tools and resources allows citizen scientists to make a meaningful contribution and helps state scientists assess water quality on more of the waterbodies in the state. The pairing of scientists with volunteers enables themes of ground breaking methods and creativity to solve water quality issues. For example, Arizona Water Watch has citizen scientists sampling E. coli by drone, testing the use of time-lapse photography to meet Municipal Separate Storm Sewer System (MS4) permit requirements, and explores the unique canine scent testing "ship and sniff" to identify human sewage pollution sources. This presentation will discuss the fundamentals of building a citizen science based program, discuss lessons learned, and highlight some of the amazing work Arizona's citizen scientists are doing to aid in the protection of our waterbodies. *Dominique Gomez, COO, WaterSmart Software* **New Automated Leak Detection and Resolution Solutions** Advances in smart water meter technology are bringing a revolution in data collection capabilities along with new ways to dynamically detect leaks and gain other critical insights into customer water consumption patterns. According to the EPA, household leaks can waste up to 1 trillion gallons of water annually. Besides wasting a scare resource, household leaks diminish utility customer satisfaction and tend to burden customer services resources where leaks and high bills are typically the number one reason for customers to call into their utility. Leaks costs everybody time and money. Customers pay extra on their water bill and might suffer property damage caused by leaks. Utilities incur costs through increased customer service call volume, possible chargebacks, and field staff being dispatched to help customers find and resolve leaks. Fortunately a new generation of data analytics technologies is making it possible to create sophisticated and automated self-resolution workflows personalized to a household's water use; thereby allowing utilities to avoid costly customer service measures. The availability of interval data from advanced metering infrastructure (AMI) now allows utilities the ability to remotely monitor water use and identify both burst and continuous leaks. Even without interval data, advanced algorithms that relate consumption data with property data to infer detailed household water use can also be used to identify leaks. This new understanding provides suppliers with powerful new tools to better understand and target wasteful usage and provide customers with the resources to address it. The presentation will explore modeling methodologies and data presentment approaches that have proven successful for AMI and non-AMI suppliers in detecting leaks. The second section will discuss how these tools can aid in more effective customer communications and improved utility operational efficiency. Based on WaterSmart's alerting and resolution system, we can provide insight into how direct communications improve operational efficiency, reduce water losses, improve customer-utility interaction, and reduce utility spending on abatement. We'll share best practices on which types of messages resonate with residents so that leaks are quickly resolved on a self-service basis. This presentation will benefit staff responsible for demand management, operational efficiency and public information programs.

	Tom McKinney, Business Development, HMS Industrial Networks **Analysis of Wireless Connectivity Costs** Monitoring remote infrastructure is critical to any water waste water system. Achieving this monitoring at the lowest possible cost is valuable to any municipality. Many factors contribute to the cost of a connectivity solution. This presentation will examine in detail the different factors contributing to cost and how to optimize a communications system. Topics include cellular costs, protocol overhead impact on data usage, prepressing data to reduce data usage, adding WiFi connectivity to reduce costs, cellular vs. proprietary radio solutions. *Ruben Mendez, National Bilingual Safety Trainer, National Trench Safety* **So Much Technology and Equipment – Why are there still Fatalities?** As we enter 2018 we find ourselves in a time in age where we have so many advances for protecting our employees while they work inside an Excavation. If this is true, why is it than on an average 1 person dies in an excavation every 10 days nationwide? Why is it that in Construction in General, 1 person dies every 2 hours, 365 days a week / 24 hrs a day? We will discuss the 12 General Requirements that OSHA teaches us in Subpart P 1926.651 of the Construction Standard. We will also discuss best safety practice and review a couple Excavation Fatalities during 2016.
10:00 am to 10:30 am	**Morning break in the exhibit hall**
10:30 am to 12:30 pm	**6a. Groundwater** *Perri Benemelis, Manager, Water Supply Program, Central Arizona Groundwater Replenishment District* **Water Acquisitions: Good Business, Good Water Management** In 2012, the Central Arizona Water Conservation District ("CAWCD") authorized a program to acquire water supplies for groundwater replenishment in central Arizona. Replenishing groundwater pumping is by statute a responsibility of the Central Arizona Groundwater Replenishment District ("CAGRD") a division of the CAWCD. CAGRD membership allows entities that do not have, or do not have sufficient renewable water supplies, to subdivide and develop lands in a manner that complies with the requirements of the Assured Water Supply ("AWS") Program. Arizona's 100-year AWS Program is arguably one of the most stringent programs of its type in the country. The CAGRD Water Supply Program has been operating for several years now, and has crafted a variety of mutually beneficial water acquisitions with benefits that exceed the financial terms of the deals. For instance, CAGRD and Liberty Utilities, a private water company ("Liberty") recently entered into an agreement in which CAGRD funded construction of an effluent recharge facility for Liberty, in exchange for a 100-year effluent supply for the CAGRD. This project created value for Liberty from an underutilized water supply and provided a replenishment water supply for CAGRD. Also, the location of the facility is near where CAGRD member groundwater pumping is the greatest, benefiting the area groundwater aquifer. This project is an early example of a "P3" project, a public, private partnership. CAGRD has developed other partnership agreements with "value added" benefits, similar to the Liberty, CAWCD project. *Rose Galbraith, Private Wells Epidemiologist, New Mexico Department of Health* **New Mexico Department of Health Private Wells Program** The New Mexico Department of Health Private Wells Program (NMPWP) collaborates with well-water protection stakeholders, within and beyond public health, to reach and support unregulated drinking water (UDW) users. Developing and maintaining partnerships is essential in a geographically large (5th largest), culturally diverse, rural state with limited resources and 20% of the population utilizing UDW. Collaboration objectives include: communicating with and educating well owners, establishing public health activities to influence health behaviors of private well users, and public health surveillance of water quality through:

data access, analysis, and sharing, and identifying/addressing data gaps. Meeting objectives and supporting activities occur through sharing resources and expertise. Communication with those interested in water quality and private wells is achieved through a partnership with the New Mexico Environmental Public Health Tracking (NMEPHT) program through the NMEPHT web portal. The portal hosts 20 topic web-pages providing resources around water quality and/or private wells. Pages can be updated or created in response to an urgent event or community concern. Establishing activities to influence health behaviors of people who consume drinking water from private wells occurs through many collaborations including: the New Mexico Biomonitoring and NMEPHT programs and the New Mexico Environment Department (NMED) Well Water Testing Fairs. Recruitment of potential biomonitoring participants includes participation in NMED water fairs. Biomonitoring (testing of urine), in turn, measures contributions of metal exposure from well water to help well owners mitigate exposures. The collaboration on water fairs allows in-person education of well owners, provides free field testing, and access to private well water quality data. Data dissemination and interpretation occurs through the NMEPHT website. Surveillance of water quality through data access, analysis, and sharing is supported by the New Mexico Private Well Collaborative (PWC). The PWC serves as the technical advisory group for three NMDOH programs, as well as for many other partners. The PWC includes representation from 15 groups of well water professionals from state and local government, academia, and industry. Educating those at potential health risk from UDW use in NM is essential to protecting public health and can only occur through essential partnerships and resource sharing.

Jacob Petersen-Perlman, Research Analyst, University of Arizona Water Resources Research Center

Groundwater Governance and Management in the United States

Groundwater is vital to meeting water demands across the United States. Effective groundwater governance (making laws, policies, and regulations) and management (implementation of the governance framework) is needed with applicable strategies aimed at ensuring sustainable use of a critical resource. In the United States, groundwater governance is decentralized, resulting in considerable variability in practices across the country. We have conducted two surveys to better understand groundwater governance strategies and practices in the United States. The first survey was developed to garner information about the extent and scope of groundwater use, groundwater laws and regulations, and groundwater tools and strategies. The second survey focused on groundwater quality issues. State water professionals were recruited in each state to participate in each nationwide survey. The initial survey's responses revealed that states' legal frameworks differ widely in many areas, including needs of ecosystems dependent on groundwater, the protection of groundwater quality, and the capacity to enforce groundwater laws and regulations. Participants in both surveys identified a wide variety of groundwater issues and concerns, including water quality and quantity impairment, staffing and budget issues, vulnerabilities of private well users, and aquifer overdraft. Respondents of the second survey also indicated problems with groundwater contamination through natural and anthropogenic causes. Most respondents indicated the existence of explicit state-level groundwater quality management goals and reported that their states have undergone significant changes to groundwater quality policy. These surveys represent initial steps in a broader, continuing effort to characterize groundwater governance and management practices in the United States.

Michael Barden, Vice President & Senior Hydrologist, Hydro Geo Chem, Inc.

Mobilization of Naturally Occurring Uranium to Supply Wells

Uranium concentrations exceeding the federal MCL were encountered in water during routine sampling from two community supply wells located south of Tucson, Arizona. The wells are situated adjacent to an area of recently developed agricultural fields on the western margin of the Tucson basin. A study conducted to evaluate the situation and compliance alternatives included extensive examination of the geological and hydrogeological setting and geochemical characterization of groundwater to determine the source of elevated uranium concentrations and appropriate measures to deal with the problem. Trace metal composition of alluvial basin-fill sediments is poorly known, but various uraniferous sources are present in the area and uranium content in surficial materials is known to typically be about 5 mg/kg and range up to about 22 mg/kg. Uranium is naturally occurring in the alluvial sediments and groundwater

	underlying the area. Uranium solubility in groundwater depends strongly on the presence of potential complexing agents in solution, such as carbonate, phosphate and sulfate, as well as on the pH and oxidation-reduction conditions. Uranium is most mobile in oxic and alkaline groundwater where it forms highly soluble uranyl-carbonate complexes. The association of elevated uranium concentrations in groundwater with nitrate has been widely noted and a variety of mechanisms are known by which nitrate can directly or indirectly result in potential uranium mobilization. Evaluation of the hydrogeology and groundwater chemistry, including geochemical modeling using PHREEQC, indicate that the source of the observed uranium concentrations in the water supply wells is most likely due to increased concentrations of bicarbonate and calcium associated with irrigation return flow from the adjacent agricultural fields that has resulted in desorption of uranium from aquifer solids through formation of a highly soluble calcium-uranyl-carbonate complex. The area of elevated uranium concentrations appears to be restricted to the area impacted by irrigation return flows.
12:30 pm to 1:30 pm	**Lunch in the exhibit hall**
1:30 pm to 4:00 pm	**7a. Infrastructure II** *John Johnson, Region Engineer, McWane Ductile* **Corrosion Protection for DI Pipe/Identification of Potential** Maximizing Sustainability and Design Life via Corrosion Protection for DI Pipe/Identification of Potential External Pipeline Corrosion AWWA C-105 (DDM) and External Corrosion Prevention AWWA C-105 standards are included. From explanation and discussion of a selection matrix developed jointly by a corrosion engineering council and the ductile iron pipe research association (DIPRA) to the review of real world successes and failures in protecting buried pipelines; attendees of this session will then be able to decide for themselves what is their best option on each project they undertake. Defining the mechanisms of corrosion in simple terms, and exploring the options in protective coatings, linings, and cathodic protection systems. *Jerry Regula, National Product Engineer, McWane Ductile* **Total Cost Equation When Selecting Pipeline Materials** When Request for Proposals go out to construct a pipeline project, there are a multitude of items that eventually determine the project cost. However, when bid documents are received by the owner or engineer, many times the per foot bid for the pipeline material is all that is considered. The scope of this paper will focus upon "The Total Cost Equation" which looks at other factors which should be taken into account before the bid analysis is finalized. In order to best serve a utility in the selection of pipeline material for a specific project, several if not many factors relating to the successful installation of that pipeline should be taken into account. Beyond the initial per foot cost of the pipeline material, some other immediate costs exist such as bedding, tapping saddles, line locator wire, corrosion protection and climate mitigation. Additional longer term present worth costs such as energy and life cycle should also be accounted for prior to a final decision on the selection of pipeline material for a particular project. *Peter Gabor, Marketing Director, Emerson Automation Solutions* **Water Industry Direction and the Importance of Automation** The Water and Wastewater industry is experiencing unprecedented change. Population growth, increasingly complex regulations and aging infrastructure are straining the ability of municipalities and regional authorities to serve their communities while protecting the environment. These demands, complicated by tax base losses and the looming retirement of experienced industry personnel, are driving those in the industry to seek out creative solutions in their mission to provide these most essential of community services. During this session we'll dig deeper into the issues facing the industry, and the increasingly important role that automation will play.

Robert Newton, Senior Director of Business Development, MIOX

MIOX Mixed Oxidant Solutions (MOS) in Drinking Water Treatment

Mixed oxidants (MOS) are approved by EPA and follow the same standards of chlorine. Mixed oxidant chemistry has provided water municipalities with chlorine residual enhancement, biofilm control, taste & odor improvement, disinfection by product (DBP) reduction, and alum/polymer savings by micro-flocculation in conventional surface water treatment plants. Data and research from sites across the country has shown that MOS is able to penetrate the polysaccharide substrate of biofilm uses to attached to pipe distribution walls where standard chlorine and bleach chemicals could not. Recent evidence from laboratory research indicates that mixed oxidants include H2O+ and other reactive oxygen species. Research on the composition continues; but the evidence on the chemical and biocidal behavior continues to show, as it has for the past 20 years, that MOS is a superior oxidant compared to sodium hypochlorite alone. The presentation will discuss the onsite generation process, including mixed oxidant (MOS) chemistry used at water utilities and the evaluation of the field data collected and how it has significantly improved water quality and how it has saved municipal utilities significant costs.

Rakesh Govind, President, Water Warriors, LLC

NutrientTreatment in Bioretention Ponds

The bioretention technique was developed in 1992 by the Department of Environmental Resources, Prince George's County, Maryland. A bioretention system consists generally of an inflow structure (e.g., swales, pipes, curb openings, gutter downspouts) that collects storm water, a depressive orientation for water ponding, a thin mulch layer on the depression surface, a filter media layer to treat infiltrating storm water, water-tolerant plants growing in the filter media, and optional appurtenances for overflow (e.g., pipe, weir) and outlet (e.g., under drain - perforated pipes in a sand/gravel sump layer underneath the bioretention media).The water ponding zone, the mulch and vegetation zone, the filter zone, and the drainage zone of such a "rain garden" function in combination to reduce runoff, purify storm water, and recharge groundwater. Although bioretention is not suitable for treating a large drainage area (e.g., >1 ha) and the treatment structure takes space, this low impact development (LID) technique has become a most popular stormwater best management practice in the U.S. and is rapidly being adopted by other countries [3].The effectiveness of a bioretention system is, however, influenced by its location, size, water ponding depth, bioretention media composition and thickness, and vegetation. A natural soil infiltration (water percolation) rate greater than 6 mm hr-1 is desirable and otherwise, engineered soils by mixing on-site soil, sand, and compost are needed to construct the 90–150 cm thick bioretention layer. The water ponding depth should limit to 15–30 cm such that all runoff water is able to infiltrate into the ground within 48 hours after a storm. In this paper, open cell foam pieces will be used to treat the nutrients as the water percolates through the foam layer, which has a gravel layer at the bottom and soil layer at the top. The foam pieces, when used as a water infiltration treatment zone, can effectively treat the nutrients in the storm water. In this paper, theoretical and experimental data on the nutrient removal rates using the foam infiltration layer will be presented in this paper.

Pitiporn Asvapathanagul, Assistant Professor, California State University, Long Beach

Assessing Foaming Bacteria Abundance in a BNR Plant

Foaming incidents are frequently observed at domestic water reclamation plants in Southern California. This plant completely nitrifies and partially denitrifies wastewater. Samples from six different locations were obtained from a Southern California water reclamation plant, including primary effluent, anoxic 1 tank, aeration 1 tank, anoxic 2 tank, aeration 2-3 tanks and return activated sludge pipe, for a total of 54 week in 2016 to 2017. The biological secondary treatment of the plant is operated using a plug flow step feed configuration. Foaming bacteria were identified using DNA sequencing technique. Both foaming bacteria and total bacteria were quantified using quantitative Polymerase Chain Reaction (qPCR) and their abundances were correlated with plant operational parameters and physicochemical factors at the plant, entailing mixed liquor suspended solids, chemical oxygen demand, biochemical oxygen demand, food to mass ratio, ammonia ions, nitrite ions, nitrate ions, hydraulic retention time, solids retention time, temperature, pH and etc. The analysis results will reveal tentative causes promoting foaming incidents at the plant.