Nutrient Removal and Recovery

Draft Technical Program

(Updated May 21, 2018)

June 18-21, 2018

Hilton Midtown

Raleigh, North Carolina

Pre-Conference Workshops

(Additional fees apply)

Monday, June 18
8:30 AM – 5:00 PM

WORKSHOP A

Advances in Nitrogen Removal: New processes, pathways and process control

There have been concerted efforts to overcome inefficiencies of conventional nitrogen removal processes. Which is also aligned with wastewater utilities embracing a new paradigm of recovery of resources from wastewater. To this end, minimization of chemicals, energy and footprint requirements for nitrogen removal has been benefited from the use of efficient biological pathways as well as innovative process control strategies. The main objective this workshop is to address current needs and challenges of mainstream nitrogen removing by showcasing and debating about recent advances.

Monday, June 18
1:30 PM – 5:00 PM

WORKSHOP B

Knowledge-Based Approaches for Mitigating Struvite and Vivianite Scaling at WRRFs

The overarching objective of the workshop is to enable informed decision making with respect to mitigating nuisance scaling and realize operations cost savings. The presentations and discussions will focus on the current state of knowledge of struvite and vivianite formation mechanisms; available strategies for mitigating nuisance scaling; and case studies highlighting success stories, lessons learned, and costs.

Monday, June 18
8:30 AM – 5:00 PM

WORKSHOP C

Short Course: Fundamentals of Nutrients Removal and Recovery-Theory, Technologies, Process Control, and Troubleshooting

This workshop is designed as a short course on the fundamentals of design for biological nutrient removal. It is most appropriate for young professionals and operators. The microbiology, design fundamentals, and operating controls to biological nutrient removal will be presented. Class exercises will pertain to operational responses to optimize nutrient removal or to respond to process upsets. Process simulation software will also be presented as a method to train operators or to test new design parameters.

Opening General Session

Tuesday, June 19
8:30 AM –12:15 PM

8:30 - 8:40am	**Welcome to the 2018 Conference!** Belinda Sturm, *University of Kansas, 2018 Co-Chair* Katya Bilyk, *Hazen and Sawyer*, *2018 Co-Chair*
8:40 - 8:50am	**Welcome from WEF** Peter Vanrolleghem, Université Laval, WEF Board of Trustees
8:50 - 8:55am	**Welcome from NC AWWA-WEA** TJ Lynch, City of Raleigh, NC AWWA-WEA
8:55 – 9:25 am	**WWTP Optimization at Nutrient Removal Plants and Future Direction**
9:25 – 9:50am	**How Do Small Utilities Fit into the Paradigm?** Jeanette Brown, Manhattan College
9:50 – 10:00am	**Panel and Q&A**
10:00 - 10:45am	***Networking Break in Exhibit Floor***
10:45 – 11:05am	**Lower Neuse Basin – Watershed Load Limits and how Utilities are Planning for Very Low Nitrogen Limits** TJ Lynch, Assistant Utility Director, City of Raleigh
11:05 – 11:25am	**Making a Business Case for Nutrient Removal at a Small Utility** Todd Danielsen, Avon Lake Utilities Ohio
11:25 – 11:45am	**The Value of Long-range Planning and Starting a Research Program** Jeff Prevatt, Pima County
11:45 – 12:05pm	**The Value of a Research Program and Process Challenges with Meeting Low TN and TP Limits Simultaneously** Christine Debarbadillo, DC Water
12:05 – 12:15pm	**Panel and Q&A**

12:15pm **Session Adjourns for Luncheon**

Session 01: Optimization
Tuesday, June 19, 1:30 PM – 5:15 PM

Moderators: Kumar Upendrakumar, Veolia North America; Jeanette Brown, Manhattan College

1:30 PM	**Nutrient Removal by Optimizing Conventional Wastewater Treatment** Paul Shriner, EPA; Grant Weaver, CleanWaterOps
1:50 PM	**Doing More With Less – Leveraging Existing Assets to Manage Capital and Operating Costs** Phill Yi Hazen and Sawyer; Janice Carroll, Wendell Khunjar, Ronald Taylor, Paul Pitt, Hazen and Sawyer; Sarah Lothman, Mike Latham, Michael Rumke, Rick Zaepfel, Loudoun Water
2:10 PM	**Full-Scale Testing Postpones Total Nitrogen Reduction Expansion** Don Esping, Brown and Caldwell; David Green, City of Rochester; Mark Allenwood, Weston & Sampson
2:30 PM	**Technical Brief: Limited Operating Data? Monte Carlo Based Process Simulations Allow For Optimization Of A Newly Constructed BNR Facility** Colin Fitzgerald, Jacobs - CH2M
2:35 PM	**Facilitated Panel Discussion**
3:00 PM	**Networking Break**
3:45 PM	**The Importance of Carbon Availability for SND: Improved Nitrogen Removal at Low DO Concentration is not Guaranteed** Stephanie Klaus, Virginia Tech/HRSD; Lindsey Ferguson, HRSD; Cody Campolong, Virginia Tech/HRSD; Christopher Wilson, HRSD; Sudhir Murthy, DC Water; Bernhard Wett, ARA Consut; Charles Bott, HRSD
4:05 PM	**Achieving BPR Without Nitrification – A Low SRT Dilemma** Peter Schauer, Tom Thorson, Chris Maher, Clean Water Services
4:25 PM	**Assessing Biodegradation and Exposure Effects Of Bisphenol-A With Microbial Communities Involved In Biological Nutrient Removal** Catherine Hoar, Columbia Univeristy; Sandeep Sathyamoorthy, Black & Veatch; Kartik Chandran, Columbia University
4:45 PM	**Technical Brief: The effect of excess and restricted inorganic carbon on biokinetics, performance and nitrous oxide production in a full nitrification bioreactor** Jonghun Jeon, GSIT; Youngmo Kim, Korea; Sangki Choi, Jin Gyeong Shin, Gwangju Institute of Science and Technology
4:50 PM	**Facilitated Panel Discussion**
5:15 PM	**Session Adjourns for Networking Reception in Exhibit Hall**
Poster	**Minimizing Mixing Energy in Activated Sludge Selector Basins - How Low Can You Go? - A Mixing Energy Pilot Study** James Fischer, Xylem Water Solutions; Sidharta Arora, MMSD

Session 02: Sustainability as a Driver for Planning and Decision Making
Tuesday, June 19, 1:30 PM – 5:15 PM

Moderators: Uma Vempati, ISG; Tanja Rauch-Williams, Carollo Engineers

1:30 PM **Adopting Sustainability as the Guiding Principle in Prioritizing R&D Projects at a Water Utility**
Per Nielsen, Troels Bjerre, VCS Denmark

1:50 PM **Balancing Future Growth and Nitrogen Discharge Limits in Wastewater Master Planning for the City of Raleigh**
Susan Auten, Black & Veatch; Eileen Navarrete, City of Raleigh; Christine Polo; John Brinkley, Black & Veatch; TJ Lynch, City of Raleigh; Erika Bailey, City of Raleigh Public Utilities; Steve Tedder, Tedderfarm Consulting

2:10 PM **The Role of Location in Sustainable Nitrogen Removal for Onsite Wastewater Treatment Systems**
Xiaofan Xu, Nancy Diaz-Elsayed, Qiong Zhang, University of South Florida

2:30 PM **Technical Brief: Balancing Resource Recovery and Nutrient Management – Evaluating the Sustainability of a Mature Trucked Waste Program in the Context of Impending Nutrient Regulations**
Phoebe Grow, Yun Shang, East Bay Municipal Utility District

2:35 PM **Facilitated Panel Discussion**

3:00 PM **Networking Break**

3:45 PM **Regulations Drive Nutrient Recovery and Reuse At Winnipeg's Largest Treatment Facility: The Winnipeg North End Sewage Plant Design-Build Upgrade Project**
Charles Goss, Keith Sears, James Marx, Damian Kruk, Simon Baker, Michelle Paetkau, AECOM

4:05 PM **Unforeseen Consequences: The Impact of Water Conservation on Wastewater Characteristics and the Knock-on Effect on Biological Nutrient Removal**
Andrew Shaw, Black & Veatch; Rajendra Bhattarai, Austin, TX; Ana Pena-Tijerina, City of Fort Worth; Wayne Bagg, Water Corporation; Soeren Eriksen, VCS Denmark Ltd; Per Nielsen, VCS Denmark; Allen Deur, NYCDEP; Jim McQuarrie

4:25 PM **Nutrient Removal for Madison's Utility of the Future**
Don Esping, Brown and Caldwell; Alan Grooms, Madison Metro Sewerage Dist; Lloyd Winchell; Brown and Caldwell; Nancy Andrews

4:45 PM **Technical Brief: Impact of Water Conservation on Nutrient Removal and Utilities in General**
Mario Benisch, David Clark, HDR; Werner Maier

4:50 PM **Facilitated Panel Discussion**

5:15 PM **Session Adjourns for Networking Reception in Exhibit Hall**

Session 03: Mainstream Innovations in Nitrogen Removal
Tuesday, June 19, 1:30 PM – 5:15 PM

Moderators: Belinda Sturm, University of Kansas; Tim Ware, Arcadis

1:30 PM **Achieving Low TN Effluent by Operating AvN Control Coupled With Partial Denitrification-Anammox Control**
Tri Le, Rahil Fofana, DC Water; Arash Massoudieh, Catholic University of America; Ahmed Al-Omari, Sudhir Murthy, DC Water; Bernhard Wett, ARA Consut; Kartik Chandran, Columbia University; Christine Debarbadillo, DC Water; Charles Bott, HRSD; Haydee De Clippeleir, DC Water

1:50 PM **Testing of Novel Denitratation/Deammonification Process for Mainstream Total Nitrogen Removal**
Anthony Niemiec, Hazen and Sawyer; Robert Sharp, Manhattan College/ Hazen and Sawyer; Allen Deur, NYCDEP

2:10 PM **Optimizing Carbon Addition to a Polishing Partial Denitrification/Anammox MBBR Using Online Control**
Cody Campolong, Stephanie Klaus, Virginia Tech/HRSD; Lindsey Ferguson, Christopher Wilson, HRSD; Bernhard Wett, ARA Consut; Sudhir Murthy, DC Water; Charles Bott, HRSD

2:30 PM **Facilitated Panel Discussion**

3:00 PM **Networking Break**

3:45 PM **Mainstream ANITA Mox Pilot Testing at the Joint Water Pollution Control Plant**
Michael Liu, Eric Krikorian, Thomas Knapp, Nikos Melitas, LA County Sanitation District; Hong Zhao, Mitch Johnson, Veolia Water Technology

4:05 PM **Enhancing the Decoupling of Solids Retention Times In Full-Scale Deammonification Processes Using Screens**
Tim Van Winckel, Ghent University; Ahmed Al-Omari, DC Water; Imre Takacs, Envirosim Associates Ltd; Bernhard Wett, ARA Consut; Belinda Sturm, University of Kansas; Charles Bott, HRSD; Siegfried Vlaeminck, Universiteit Antwerpen; Sudhir Murthy, Haydee De Clippeleir, DC Water

4:25 PM **Performance and Microbial Ecology of a Low Temperature (15℃) Mainstream Anammox Moving Bed Biofilm Reactor(MBBR) Process**
Minxi (Joanna) Jiang, Zheqin Li, Kartik Chandran, Columbia University

4:45 PM **Technical Brief: Membrane-Aerated Biofilm Reactor (MABR) Demonstration at Ejby Mølle WRRF**
Nerea Uri, Vandcenter Syd; Per Nielsen, VCS Denmark; Tim Constantine, Jacobs; Leon Downing, Black and Veatch

4:50 PM **Facilitated Panel Discussion**

5:15 PM **Session Adjourns for Networking Reception in Exhibit Hall**

Session 04: Phosphorus Removal: Sidestream Fermentation, Modeling, and Operations
Wednesday, June 20, 8:30 AM – 12:15 PM

Moderators: Paul Wood, Lockwood, Andrews & Newnam, Inc.; Kumar Upendrakumar, Veolia North America

8:30 AM **The Case for Side-Stream RAS Or Mixed Liquor Fermentation To Enhance EBPR**
James Barnard; Edmund Kobylinski, Black and Veatch

8:50 AM **Side-Stream EBPR Practices and Fundamentals - Rethinking and Reforming the Enhanced Biological Phosphorus Removal Process**
Nicholas Tooker, Northeastern University; James Barnard; Charles Bott, HRSD; Paul Dombrowski, Woodard & Curran; April Gu, Department of Civil and Env. Eng; Annalisa Onnis-Hayden; Peter Schauer, Clean Water Services; Varun Srinivasan, Northeastern University; Beverley Stinson, AECOM; Imre Takacs, Envirosim Associates Ltd; Guangyu Li, Northeastern University; Howard Analla, City of Henderson; Gerry Stevens, Aecom; Adrienne Menniti, CH2M; Andrew Shaw, Patrick Dunlap, Heather Phillips, Black & Veatch; James McQuarrie, Reginal District Of Central Okanagan; Isaac Avila, CH2M

9:10 AM **Sidestream RAS Fermentation for Stable Bio-P Combined with Short Cut Nitrogen Removal in an A/B Process**
Lindsey Ferguson, Old Dominion University/ HRSD; Cody Campolong, Stephanie Klaus, Virginia Tech/HRSD; Christopher Wilson, HRSD; Bernhard Wett, ARA Consut; Sudhir Murthy, DC Water; Charles Bott, HRSD

9:30 AM **Technical Brief: A Model Based Study: Revisiting Conventional BNR Configurations with Advanced Aeration Control**
Pusker Regmi, Jose Jimenez, Brown and Caldwell

9:35 AM **Facilitated Panel Discussion**

10:00 AM **Networking Break**

10:45 AM **A Full-Scale Pilot Side-By-Side Comparison Reveals Microscale Differences In The Microbial Ecology Of Conventional And Side-Stream EBPR Systems**
Varun Srinivasan, Nicholas Tooker, Guangyu Li, Northeastern University; James Barnard; Charles Bott, HRSD; Paul Dombrowski, Woodard & Curran; Peter Schauer, Clean Water Services; Adrienne Menniti, CH2M; Annalisa Onnis-Hayden; Ameet Pinto, Northeastern University; April Gu, Department of Civil and Env. Eng

11:05 AM **Performance and Microbial Population in Side-Stream Enhanced Biological Phosphorus Removal Systems**
Annalisa Onnis-Hayden; Nicholas Tooker, Varun Srinivasan, Northeastern University; James Barnard; Charles Bott, HRSD; Paul Dombrowski, Woodard & Curran; Peter Schauer, Clean Water Services; Beverley Stinson, AECOM; Imre Takacs, Envirosim Associates Ltd; April Gu, Department of Civil and Env. Eng;

11:25 AM **Application of Agent-Based Modeling to Reveal Competition between PAOs and GAOs in Side-Stream EBPR (S2EBPR) Systems**
Guangyu Li, Nicholas Tooker, Varun Srinivasan, Northeastern University; James Barnard; Peter Schauer, Clean Water Services; Charles Bott, HRSD; Imre Takacs, Envirosim Associates Ltd; Paul Dombrowski, Woodard & Curran; Annalisa Onnis-Hayden; April Gu, Department of Civil and Env. Eng

11:45 AM **Technical Brief: Turning Lemons into Lemonade: Conversion of a Conventional Activated Sludge System into an Enhanced Biological Phosphorus Removal System for High Strength Waste Management**
Kam Law, Greeley and Hansen; Thomas Meyer, Paul Keturi, Greater Peoria Sanitary District

11:50 AM **Facilitated Panel Discussion**
12:15 PM **Session Adjourns for Luncheon in Exhibit Hall**

Session 05: Control Systems for Enhanced Nitrogen Removal

Wednesday, June 20
8:30 AM – 10:00 AM

8:30 AM **Startup, Optimization, and Operational Results from a Biological Nutrient Removal Process with Ammonium Based Airflow Controls**
Thomas Johnson, Eric Redmond, CH2M-JACOBS; Leon Downing, Black and Veatch; Matthew Jalbert, Freese & Nichols; Mike Young, Trinity River Authority

8:50 AM **Understanding Simultaneous Nutrient Removal through Low Dissolved Oxygen Operation**
Jose Jimenez, Pusker Regmi, Brown and Caldwell; Kartik Chandran, Columbia University

9:10 AM **Oxygen Uptake Rate as Control Parameter for Carbon Management in High-Rate Activated Sludge**
Tim Van Winckel, Ghent University; Olajide Olagunju, Howard University; Belinda Sturm, University of Kansas; Siegfried Vlaeminck, Universiteit Antwerpen; Kimberly Jones, Howard University; Charles Bott, HRSD; Bernhard Wett, ARA Consut; Ahmed Al-Omari, Sudhir Murthy, Haydee De Clippeleir, DC Water

9:30 AM **Technical Brief: Implementation of Aeration Control Strategies and Nitrate-Based Internal Mixed Liquor Recycle Control Employing In-Situ Sensors and Feedback PID Controllers in an Integrated Fixed-Film Activated Sludge Wastewater Treatment Facility**
Amanda Ford, Hazen; Shawn Hawley, Robert Rutherford, HRSD; Kshitiz Uprety; Charles Bott, HRSD

9:35 AM **Facilitated Panel Discussion**

10:00 AM **Session Adjourns for Networking Break in Exhibit Hall**

Session 06: Alternate Electron Donors and Their Applications
Wednesday, June 20, 8:30 AM – 10:00 AM

Moderators: Sarina Ergas, Laura Rodriguez-Gonzalez, University of South Florida

8:30 AM **Making Methanol on the Backs of Nitrifying Bacteria**
Sandeep Sathyamoorthy, Black & Veatch; Yu-Chen Su, Kartik Chandran, Columbia University

8:50 AM **Sulfur-Based Autotrophic Denitrification for Nitrate Removal in Marine Recirculating Aquaculture Systems**
Qiaochong He, Zhang Cheng, Dongqing Zhang, Victoria Burnett, Sarina Ergas, University of South Florida

9:10 AM **Woodchip Bioreactors for Nitrate Removal in Wastewater : Recent Findings, Applications, and Economics**
Bryan Maxwell, Francois Birgand, NCSU

9:30 AM **Technical Brief: Characterizing Nitrogen Transformation Processes In Nitrogen Removing Biofilters For Onsite Wastewater Treatment**
Stuart Waugh, Center for Clean Water Technology; Xinwei Mao, Harold Walker, Christopher Gobler, Stony Brook University

9:35 AM **Facilitated Panel Discussion**

10:00 AM **Session Adjourns for Networking Break in Exhibit Hall**

Session 07: Nutrient Removal from the Utility and Operations Perspective
Wednesday, June 20, 10:45 AM – 12:15 PM

Moderators: Erika Bailey, City of Raleigh Public Utilities; Uma Vempati, ISG

10:45 AM **Achieving Energy Neutrality in the Face of Stringent Effluent Nutrient Requirements: Setting a Vision and Empowering Operations Staff**
Tim Constantine, Jacobs; Julian Sandino, CH2M; Per Nielsen, Mads Leth, VCS Denmark; Adrienne Willoughby, CH2M

11:05 AM **Process Model Simulation Provides Effective Hands-On Approach To BNR Operator Training**
Paul Dombrowski, Woodard & Curran

11:25 AM **Using Collaborative Efforts to Maximize Nutrient Removal Permit Compliance During Facility Upgrade Construction**
Thor Young, GHD; Ladan Holakoo; Greg Jablonski, GHD; Jerome Napora; Bernard Williams, Anne Arundel County Department of Public Works

11:45 AM **Technical Brief: Culture and organization changes unleashes nutrient removal potential in a conventional BNR facility**
Warren Barlow, Ramon Arguello, David Coad, Fort Collins Utilities; Jason Graham, City of Fort Collins Water Reclamation; Tanja Rauch-Williams, Carollo Engineers; Jacob Routzahn, Frank Wallander, Fort Collins Utilities

11:50 AM **Facilitated Panel Discussion**

12:15 PM **Session Adjourns for Luncheon in Exhibit Hall**

Session 08: Reuse and Recovery
Wednesday, June 20, 10:45 AM – 12:15 PM

Moderators: Robert Sharp, Manhattan College/ Hazen and Sawyer; Christine Radke, Water Research Foundation

10:45 AM **Nutrient recycles and other side effects of co-digestion of organic waste**
Alan Appleton, Tanja Rauch-Williams, Carollo Engineers; Mark Greene, O'Brien & Gere Engineers Inc; Stefan Grimberg, Clarkson University

11:05 AM **Advancing Nutrient Recovery through Urine-Derived Fertilizers (UDF) in the United States**
Nancy Love, University of Michigan; Abraham Noe-Hays; Krista Wigginton; Linda Macpherson; Glen Daigger, William Tarpeh, University of Michigan; Diana Aga, University of Buffalo; Stephen Hilton, University of Michigan; Rebecca Wombacher, University of Buffalo; Kim Nace; Audrey Pallmeyer; University of Michigan

11:25 AM **Wastewater Treatment Selection and Operation to Benefit Downstream Resource Recovery: An Exploration of Three Case Studies**
Stephanie Ishii, Wendell Khunjar, Phill Yi, Enrique Vadiveloo, Buddy Boysen, Chris Owen, Troy Walker, Hazen and Sawyer

11:45 AM **Technical Brief: Retrofitting a Roughing Filter/Activated Sludge Plant for Continuous Ammonia Removal (<1 mg/L)**
Matthew Kallerud, Carollo Engineers

11:50 AM **Facilitated Panel Discussion**

12:15 PM **Session Adjourns for Luncheon in Exhibit Hall**

Session 09: Innovations in Phosphorus Control and Recovery
Wednesday, June 20, 1:30 PM – 5:15 PM

Moderators: Thor Yong, GHD; Helene Kassouf, University of South Florida

1:30 PM **A Balancing Act: How to Achieve Low Level Phosphorus and Metals Limits at Upper Blackstone**
Maureen Neville, Alexandra Bowen, CDM Smith; Karla Sangrey, Upper Blackstone Water; Erik Grotton

1:50 PM **Nutrient Recovery Performance and Optimization of Biological Phosphorus Removal at the F. Wayne Hill Water Resources Center**
JC Lan, Gaya Ram Mohan, Gwinnett County Department of Water Resources; Ron Latimer, Michael Lynch, Paul Pitt, Hazen and Sawyer

2:10 PM **Nutrient Whack-a-Mole - Sidestream Nutrient Control and Assessment of the Fate of Fe, S, and P**
Colin Fitzgerald, Jacobs - CH2M; Matthew Jalbert, Freese & Nichols; Thomas Johnson, Eric Redmond, Jacobs - CH2M; Mark Reeves; Leon Downing, Black and Veatch; Mike Young, Trinity River Authority

2:30 PM **Technical Brief: There is Light at the End of the Pipe! Causes and Control of Struvite and Vivianite Scaling at WRRFs**
Samuel Jeyanayagam, CH2M; Douglas Miller, CH2M HILL O&MBG

2:35 PM **Facilitated Panel Discussion**

3:00 PM **Networking Break**

3:45 PM **Holistic Approach to Phosphorus Sequestration and Recovery at Fox River WRD**
Jack Russell, Fox River WRD; James Barnard; Beth Vogt, James Kerrigan, Fox River WRD; Bikram Sabherwal, Black & Veatch; Stephen Arant

4:05 PM **Comparison of phosphorus recovery through pre-anaerobic-digestion brushite precipitation and post-anaerobic-digestion struvite crystallization**
Zhongtian Li, Menachem Tabanpour, Gerhard Forstner, Centrisys/CNP

4:25 PM **Quantification of struvite content of biosolids is necessary to avoid bias in the assessment of phosphorus recovery benefits to digester and dewaterability performance**
Wendell Khunjar, Ron Latimer, Hazen and Sawyer; Alexandria Gagnon; Liam Cavanaugh, MWRD; Christopher Wilson, HRSD; Blair Wisdom; Isaac Avila

4:45 PM **Technical Brief: Lost Crystals– Impacts of Struvite Recovery Performance on Plant Capacity for Achieving Low-P Effluent**
Adrian Romero, Thomas Johnson, Colin Fitzgerald, Jacobs - CH2M; Leon Downing, Black and Veatch; Ron Gearhart, City of Boise; William Leaf; Adrienne Menniti, CH2M; Matt Seib, Madison Metropolitan Sewerage District

4:50 PM **Facilitated Panel Discussion**

5:15 PM **Session Adjourns**

Session 10: Operator Q&A Panel: Experiences and Lessons Learned Meeting Low TN and TP Limits in the Mid-Atlantic Region
Wednesday, June 20, 1:30 PM – 5:15 PM

Moderators: Joe Rohrbacher, Hazen and Sawyer; Erika Bailey, City of Raleigh

Many municipalities on the east coast have to meet some of the strictest nutrient standards in the country, and have been doing so for over 15 years. This session will include representatives from six municipalities in the region representing nine water reclamation facilities and they will share their stories about nutrient removal. The speakers will make 15-minute presentations and the remainder of the time will be held for a 50-minute Q&A panel with the audience. The majority of the speakers are the Wastewater Operations Director for their utility.

1:30 PM	Joe Rohrbacher, Hazen and Sawyer – Welcome
1:40 PM	Erika Bailey, City of Raleigh - 75 mgd Neuse River RRF
1:55 PM	Jeff Mahagan, Town of Hillsborough - 3 mgd Hillsborough WWTP
2:10 PM	John Dodson, City of Durham - 20 mgd North Durham WRF
2:25 PM	Charles Cocker, City of Durham - 20 mgd South Durham WRF
2:40 PM	Damon Forney, Town of Cary - 18 mgd Western Wake RWRF
2:55 PM	Jonathan Bulla, Town of Cary - 12 mgd North Cary WRF
3:10 PM	Mike Parsons, HRSD - 24 mgd Williamsburg WTP
3:25 PM	James Grandstaff, Henrico County - 75 mgd WRF
3:40 PM	Q&A panel with operators
5:00 PM	**Session Adjourns**

Session 11: Evolving World of Biofilm Systems for Nutrient Removal
Wednesday, June 20, 1:30 PM – 5:15 PM

Moderators: Pusker Regmi, Brown and Caldwell; Christine Debarbadillo, DC Water

1:30 PM **A Pilot Scale Evaluation of Membrane Aerated Biofilm Reactor (MABR) technology for Biological Nutrient Removal Process Intensification**
Sandeep Sathyamoorthy, Black & Veatch; Samik Bagchi, University of Kansas; Kelly Martin, Black & Veatch; Dwight Houweling, GE Water & Process Technologies; Daniel Coutts, Suez Treatment Solutions

1:50 PM **Partial Nitritation / Anammox Membrane Aerated Biofilm Reactor for Nitrogen Removal from Aerobic Secondary Effluent**
Glen Daigger, Brett Wagner, Nancy Love, University of Michigan

2:10 PM **Achieving Low Nutrient Effluent Quality at Lagoon Facilities using MBBR Technology: Low Temperature Performance and Bacterial Community Analysis**
Robert Delatolla, Patrick D'Aoust, Raheleh Arabgol, Warsama Ahmed, Chris Kinsley, University of Ottawa; Simon Vincent, Veolia Water Technologies Canada Inc.; Bradley Young, University of Ottawa

2:30 PM **Technical Brief: Effect of Attachment Surface Skewness on Nitrifying Biofilm Performance in Annular Bioreactors**
Philip Roveto, Andrew Schuler, University of New Mexico

2:35 PM **Facilitated Panel Discussion**

3:00 PM **Networking Break**

3:45 PM **New generation of MBBR for biological treatment of carbon, nitrogen and phosphorus**
Hugues Humbert, Tristan Germain, Veolia; Sofia Lind, AnoxKaldnes - Veolia Water & Technologies; Erin Gallimore; Romain Lemaire

4:05 PM **Comparing the Mobile Organic Biofilm (MOB™) process with K1 IFAS for nutrient removal**
Pin Hsuan Chang, Jason Calhoun, Nuvoda, LLC

4:25 PM **Dynamic Aerobic Granular Sludge Modeling**
Bruce Johnson, Jacobs/CH2M; Heather Stewart, The Catholic University of America

4:45 PM **Technical Brief: Pilot-scale evaluation of Anammox enrichment from local activated sludge in a newly started mainstream deammonification MBBR**
Sumeyye Celik, Bilge Alpaslan Kocamemi, Marmara University Environmental Engineering Department; Halil Kurt

4:50 PM **Facilitated Panel Discussion**

5:15 PM **Session Adjourns**

Session 12: Strategies for Meeting Ultra-Low Nutrient Effluent Quality Standards
Thursday, June 21, 8:30 AM – 11:45 AM

Moderators: Francis de los Reyes III, North Carolina State University; Tim Ware, Arcadis

8:30 AM	**Applying Molecular Tools for Optimizing BNR: A Discussion On Best Practices On Using DNA Of Improved Operations** Leon Downing, Black and Veatch; George Wells, Northwestern University; Autumn Fisher; Matthew Jalbert, Freese & Nichols; Mike Young, Trinity River Authority; Colin Fitzgerald, Eric Redmond, Jacobs - CH2M; John Tillotson; Ralph Wagner, Microbe Detectives LLC
8:50 AM	**Characterizing BPR Activity to Understand Overall Process Health** Peter Schauer, Clean Water Services; Adrienne Menniti, CH2M; Gavin Bushee
9:10 AM	**Quantification of Influent Non-Readily Biodegradable Dissolved Organic Nitrogen to Explore Nutrient Management via Pretreatment** Mary Sadler, Ronald Taylor, Stephanie Ishii, Hazen and Sawyer
9:30 AM	**Technical Brief: How Low Can We Go with Soluble Organic Nitrogen in a Biological Wastewater Treatment Process?** Ruchi Joshi, North Dakota State University; Sreerama Murthy Kasi Somayajula; Tanush Wadhawan; Eakalak Khan, North Dakota State University
9:35 AM	**Facilitated Panel Discussion**
10:00 AM	**Networking Break**
10:15 AM	**Lessons Learned After A Decade of Collaborative Nutrient Removal Research: What's In The Future?** J Neethling, David Clark, HDR Inc; H Stensel; Julian Sandino, CH2M; Ryujiro Tsuchihashi, AECOM; Amit Pramanik, Christine Radke, Water Research Foundation
10:35 AM	**Leveraging Research & Real World Experience to Clarify Phosphorus LOT with Ballasted Sedimentation** Patrick Dunlap, James Fitzpatrick, Mark Steichen, Michael Tache, William Walkup, Black & Veatch
10:55 AM	**Save Coagulant Dosages with Sludge Recirculation in Tertiary Chemical Phosphorus Removal Process** Hong Zhao, Bryan Fincher, Harrison Fowler, Richard DiMassimo, Veolia Water Technologies
11:15 AM	**Facilitated Panel Discussion**
11:45 AM	**Conference Adjourns**
Poster	**The Future of Nutrient and Resource Recovery is Here: Advanced Biological Nutrient Recovery - Algae is the Key to Rapid, Efficient, and Cost Effective Nutrient and Resource Recovery** Garrett Pallo, Clearas Water Recovery, Inc

Session 13: Watershed
Thursday, June 21, 8:30 AM – 10:00 AM

Moderators: Sandeep Sathyamoorthy, Black & Veatch; Victor D'Amato, Tetra Tech Engineering, P.C.

8:30 AM **Understanding Water Quality and Nutrients in a Large Watershed**
Mike Osborne, Robert Osborne, Drew Ackerman, Black and Veatch; Gina Kimble, Catawba-Wateree Water Management Group, Charlotte Water

8:50 AM **Neuse River Compliance Association: A Success Story but What Does the Future Hold?**
Haywood Phthisic; Erika Bailey, City of Raleigh Public Utilities

9:10 AM **The San Francisco Bay Area Nutrient Watershed Permit: Challenges Associated with Evaluating 37 Different WRRFs**
Michael Falk, J Neethling, HDR Inc; Linda Sawyer, Brown and Caldwell; Holly Kennedy, HDR Inc

9:30 AM **Technical Brief: Exciting New Nutrient Discharge Permitting Frameworks Protect Water Quality and Provide Compliance Flexibilities**
David Clark, Thomas Dupuis, HDR Inc.; Mike Falk; Michael Kasch, J Neethling, HDR Inc.

9:35 AM **Facilitated Panel Discussion**

10:00 AM **Session Adjourns for Networking Break**

Session 14: Latest Concepts in Sidestream Nitrogen Removal and Recovery
Thursday, June 21, 8:30 AM – 10:00 AM

Moderators: Katya Bilyk, Hazen and Sawyer; Phil Ackman, Sanitation Districts of Los Angeles County

8:30 AM	**Is PAD Worth It? Costs, Benefits, and Lessons Learned from the First PAD Retrofit in the US** Cole Sigmon, Conor Tyler, Brad Janoka, Donald Colgate, Emanuel Watson, JR Finley, City of Boulder
8:50 AM	**Post Aerobic Digestion: Operational Experience from the Northern Treatment Plant** Alex Haeger, Orren West, Metro Wastewater Reclamation District; Leon Downing, Black and Veatch; Liam Cavanaugh, MWRD
9:10 AM	**A Tale of Two Cities: Operation of ANITA Mox MBBR for Sidestream Treatment** Margaret Hollowed, Kruger/Veolia; Glenn Thesing, Kruger Products; Samuel Liang, Kruger/Veolia
9:30 AM	**Technical Brief: Impact of Ozonation and Electrocoagulation on Refractory Nutrients Generated from Thermal Hydrolysis Processes** Gregory Pace, Wendell Khunjar, Stephanie Ishii, Phill Yi, Eric Dole, Hazen and Sawyer; Marc Santos; Robert Sharp, Manhattan College/ Hazen and Sawyer; Eakalak Khan, Ruchi Joshi, North Dakota State University
9:35 AM	**Facilitated Panel Discussion**
10:00 AM	**Session Adjourns for Networking Break**
Poster	**Recovery of ammonium from sludge dewatering processes for the production of ammonium sulfate solution** Stephan Wasielewski, Eduard Rott, Ralf Minke, University of Stuttgart; Heidrun Steinmetz, University of Kaiserslautern

Session 15: US EPA National Priorities Nutrient Management Centers: Practical Outcomes from Five Years of Water Research Nationwide
Thursday, June 21, 10:15 AM – 11:45 AM

Moderators: Amit Pramanik, Water RF; Ben Packard, USEPA

The U.S. Environmental Protection Agency (EPA) as part of its Science to Achieve Results (STAR) program established four Centers to conduct water research and demonstration projects that are innovative and sustainable using a systems approach for nutrient management in the Nation's waters. These Centers were required to take a systems view of nutrient management that considered societal and technological factors in the breadth of possibilities that may influence water quality. An overview of the each Center's key accomplishments will be presented along with more detailed presentations of Center products that attendees can integrate into their nutrient management strategies.

10.15 AM **Overview of EPA Centers for Water Research on National Priorities Related to a Systems View of Nutrient Management**
Ben Packard, USEPA

10:20 AM **Smart Nonwater Urinals for Improved Water Conservation and Enhanced Nutrient Recovery**
Treavor Boyer, Daniella Saetta, Hannah Ray, Arizona State University

10:40 AM **Management of Diffuse Nutrients from Stormwater and On-Site Wastewater: New Science and Community Engagement Informing Field Demonstrations of New Technologies**
Sarina Ergas, Maya Trotz, Qiong Zhang, James Mihelcic, Kebreab Ghebremichael, Laura Rodriguez-Gonzalez, Karl Payne, Michelle Henderson, Amulya Miriyala, Justine Stocks, Emma Lopez-Ponnada, University of South Florida, Damann Anderson, Hazen and Sawyer, Thomas Lynn, Texas A&M University-Kingsville

11:05 AM **Assessing Efficacy of Nutrient Removal and Recovery Technologies at Wastewater Treatment Facilities**
Brock Hodgson, Sybil Sharvelle, Colorado State University

11:25 AM **Questions and Discussion**
Ben Packard, USEPA; Amit Pramanik, The Water Research Foundation

Session 16: Carbon Redirection
Thursday, June 21, 10:15 AM – 11:45 AM

Moderators: Mehran Andalib, Stantec; Christine Radke, Water Research Foundation

10:15 AM **Detailed assessment of primary sludge fermentation for phosphorus removal at the Central Valley Water Reclamation Facility**
Adam Klein, Henryk Melcer, Bryan Mansell, Brown and Caldwell; Phillip Heck; Sharon Burton, Central Valley Water Reclamation Facility

10:35 AM **High-rate aerobic and anaerobic technologies for carbon management and achieving energy neutrality**
Mark Miller, Jose Jimenez, Brown and Caldwell; Damien Batstone, University of Queensland

10:55 AM **Westside Process Replaces TF/AS at Central Valley WRF To Meet New Utah State Phosphorus Regulation**
Henryk Melcer, Brown and Caldwell; Phillip Heck, Sharon Burton, Central Valley Water Reclamation Facility; Adam Klein, Trevor Lindley, Bryan Mansell, Brown and Caldwell

11:05 AM **Technical Brief: Road Map to Achieving Effluent Total Phosphorus Limit of 0.043 mg/L**
Timur Deniz, John Bratby, CDM Smith

11:10 AM **Facilitated Panel Discussion**

11:45 AM **Conference Adjourns**